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AN EXPERIMENTAL AND ANALYTICAL STUDY OF VISUAL DETECTION IN A SPACECRAFT ENVIRONMENT

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Prepared by
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St. Paul, Minn.
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FOREWORD

This report documents the results of a Star Vision Study performed for the National Aeronautics and Space Administration under Ames Research Center direction on Contract NAS 2-5051, Mr. Bedford A. Lampkin, technical monitor.

Honeywell Inc., Systems and Research Division, performed this study under the direction of Mr. Roger N. Schmidt during the period 1 July 1968 through 1 July 1969. Dr. Roger P. Heinisch and Mr. Clinton L. Jolliffe were co-principal investigators. Assistance of Mr. Tien Chow in preparing computer codes and Mr. Immanuel Bursch for apparatus fabrication is greatfully acknowledged.

NOMENCLATURE

A	area
A_1	area on body 1
A_2	area on body 2
A_{2a}	projected area of A_2 on unit sphere
A_{2b}	projected area of A_{2a} on unit sphere base
AU	astronomical unit (sun to earth mean distance)
BP	angular position of photometer when blackbody is in transmitted beam
$B_{s\lambda}$	solar spectral radiance
BR	angular position of photometer when specular reflex from window is incident on blackbody
b	semiminor axis of area A_{2b}
c	albedo
D	distance between dA_1 and dA_2
dA	differential area element
dA_1	differential area element on surface 1
dA_2	differential area element on surface 2
dA_p	differential area element on planet
dA_{2a}	projection of differential area element dA_2 on unit sphere
dA_{2b}	projection of differential area element dA_{2a} on unit sphere base
$d\lambda$	differential waveband
E	illuminance
E_o	illuminance incident on surface perpendicular to light beam
E_s	solar illuminance
F	configuration

$F_{dA_1-dA_2}$	configuration factor from differential area element dA_1 to differential area element dA_2.
$F_{dA_1-A_2}$	configuration factor from differential area element dA_1 to area 2
F_{p-w}	configuration factor from planet to windows
f	lens focal number
H	ratio of distance from window to planet to the planet radius
L	luminance
L_B	ambient luminance (experimental background)
L_d	luminance of diffuser
L_o	background luminance
L_s	stimulus luminance
L_w	luminance measured from window
L'	total luminance of stimulus
ℓ_λ	spectral absolute luminosity
M	optical magnification
m	star magnitude
N	total number of parts to a summation
n	reference number in a summation
$\vec{n}$	surface normal
p	point on planet representing individual node
R	radius of unit sphere
r	radius of planet
S	distance from window to planet center
$S(\theta)$	scatter coefficient
TB	angular position of photometer when photometer is in the transmitted beam
V_λ	spectral sensitivity

WR angular position of photometer when specular reflex from window is incident on photometer

WE angular position of photometer when photometer views window edge

w point representing window

α angle between window normal and line joining window with planet center or between dA_1 and planet center

β angle between lines joining the window with center of planet and outer rims of planet

γ angle between lines joining the center of the planet with the window and node on the planet

δ angle in x-y plane defining nodal point p on sphere

$\Delta\lambda$ waveband

ϵ contrast limen

ζ stimulus angle

ω solid angle

ρ reflectance

τ transmittance

θ angle between window normal and viewing line of sight

Ψ angle between window normal and incident light beam

μ micron

λ wavelength

ϕ zenith angle

ϕ_1 angle between surface 1 normal and line joining element dA_1 to dA_2

ϕ_2 angle between surface 2 normal and line joining element dA_2 to dA_1

Γ angle between lines joining window with planet center and nodal point p

Subscripts

a	projection on unit sphere
B	experimental background
b	projection on unit sphere base
d	diffusion standard
max	maximum
n	reference number
o	background or veiling
p	planet
s	stimulus
t	threshold
w	window
λ	spectral
1	body 1
2	body 2

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SUMMARY

Astronauts have experienced difficulty in seeing navigational stars through spacecraft windows on the illuminated side of the spacecraft. The objective of this investigation was to predict the star magnitude which can be seen with the naked eye or a sextant telescope through a spacecraft window. The effects of geometry and window coating on that objective were studied.

An apparatus was built, instrumented, and used for measuring the scattering luminance of typical spacecraft windows. Window illumination from the sun, moon, and earth were computed for typical orbit conditions. Star magnitude thresholds were predicted from the scattering data and window illuminations by applying the classical Tiffany visual threshold data. The star thresholds were computed for both unaided vision and a monocular telescope. The measurements indicate that window cleanliness is of paramount importance in reducing light scattering. When considering the light transport through the spacecraft windows, light reflected off the windows from inside the spacecraft cabin was found to dominate the scattered light caused by the externally incident flux.

The results of the scattering measurement reveal that quality of the anti-reflection coating on windows have more influence on the scattering level than the type of coating *per se*. The better windows had as low a scattering level as a highly-polished optical flat. Painting the edges of the window black reduced the light scattering. Light scattering created by multiple-window configurations was found to be equivalent to the sum of individual windows (superposition can be used). The star magnitude thresholds were obtained and presented for the telescope and the naked eye at the location of maximum, minimum, and average scatter for each window configuration. In general, using a telescope, an astronaut in a spacecraft that is distant from the earth or moon will be able to see stars less bright than a magnitude of 2.00. On the other hand, with the naked eye, an astronaut will have difficulty seeing the usual navigational stars under background conditions created by the light scattered from windows used in this program.

INTRODUCTION

Three probable causes for difficulties experienced by astronauts in seeing stars through spacecraft windows have been suggested:

- That a cloud of debris (dumped waste, spacecraft outgassants, and reaction jets exhausts) surrounds the craft
- That the windows become contaminated with condensates and vehicle outgassants which both reduce transmission and cause increased energy scattering in the field of view
- That the clean window itself scatters and reflects energy from other sources, such as the sun, which creates a luminance veil.

The purpose of this program was to study the latter effect.

The effect of spacecraft window configuration and surface coating on the ability of an astronaut to visually detect stars is predicted as a function of six parameters. These parameters are the characteristics of the human eye, the effect of the optical system used to view the star, angular position with respect to the sun, moon, and earth, distance from the sun, moon and earth, viewing angle, window coating and number of windows. The ability of an astronaut to see stars is defined as the minimum star magnitude that can be detected through a window for various specified values of the above parameters. The above objective was accomplished by completing the following four tasks:

- Measuring the light-scattering of various window orientations
- Calculating the light incident on the window for each specified "source" (sun, moon, and earth)
- Generating a stellar threshold model from the existing vision literature
- Calculating star magnitudes

The light scattering distribution of six window configurations was measured for visible light with approximately the solar spectrum incident at specified angles. The window configurations contain various combinations of MgF_2-coated, HEA-coated, and uncoated Vycor window panes. These data were used to compute the minimum star intensity that can be seen with the naked eye and a monocular telescope through the window for various viewing angles and incident light angles. Window specimens were kept clean during the experimental measurement so as not to confuse the effect of contaminants with the effect of the window itself.

In addition, a precision polished Supracil optical flat was prepared and scattering measurements were made for various viewing angles. Data from this flat provided a low-scattering standard for comparison with the window data.

EXPERIMENTAL MEASUREMENT APPARATUS AND PROCEDURES

To predict star magnitudes visible through spacecraft windows on the illuminated side of space vehicles, it is necessary to determine the scattering luminance from the windows. Because such data was not available, it was necessary to measure the magnitude and distribution of light scattered from typical spacecraft windows. A unique apparatus was required because the scattering values were small and very dependent on several parameters.

This section discusses the experimental apparatus and the concepts on which the experimental procedure is based. Scattering data obtained with the apparatus is used in this report to determine star magnitude thresholds that can be detected with unaided binocular vision and with a monocular telescope.

Design

The main components of the experimental facility include the following:

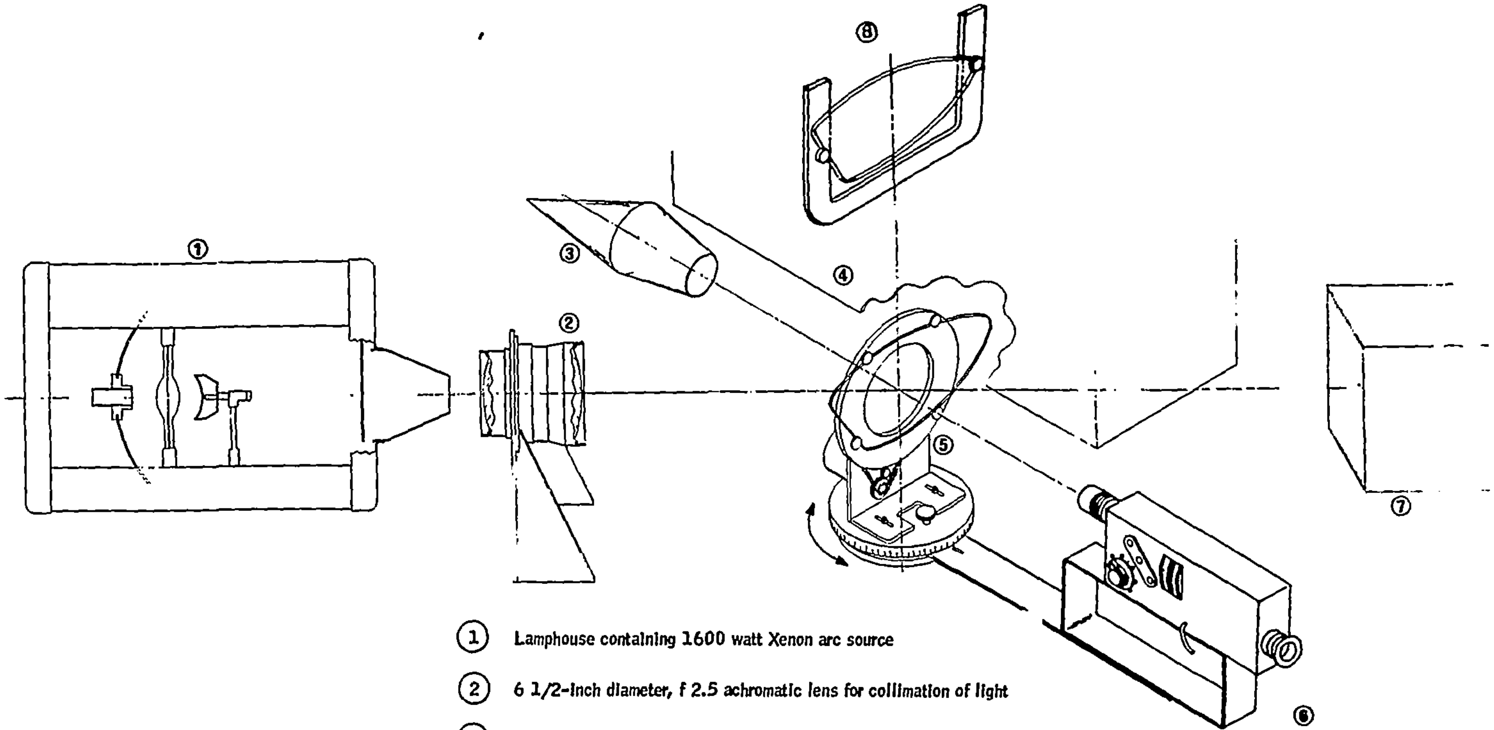
- A fixed high-temperature light source that approximates the spectral distribution in the visible portion of the solar spectrum
- A collimating lens to provide a 6-inch diameter light beam with divergence less than or equal to the sun's rays
- A fixture to hold and position the spacecraft windows with respect to the light beam
- A detector with the same spectral response as the human eye to record light scattering in various directions (0 to 360 degrees in the horizontal plane about the window)
- Blackbodies to absorb light and thus reduce the background level for the experiment
- A filter hood to continuously blow filtered air over the window during the measurements.

A schematic view of the test apparatus is shown in Figure 1. Light from the lamphouse (1) originates from a defining aperture which is located at the focal point of a 6-inch diameter collimating lens (2). Because of the characteristics of the lens, a (nominally) 6-inch-diameter light beam is incident on the window (5). Light scattered in various directions in a horizontal plane is recorded by a photometer (6). The background specifically in the field of view of the photometer is maintained dark by placing a blackbody (3) on the optical axis of the photometer as shown. Light that is not reflected or scattered from the window is transmitted. The transmitted light is absorbed by a blackbody baffle system (7) which is located on the optical axis of the lamphouse-lens-window system. A filter unit (4) is used to blow filtered air over the window during the experiment to keep the window relatively free of dust.

Light Source. - The sun's spectrum was simulated with a Xenon arc lamp, blue filter and achromatic collimating lens. Specifically, the light source was a 1600-watt Xenon arc lamp which produced a flux of 75, 000 lumens. The energy distribution of the lamp in the visible was corrected with a Corning C5900 filter. To produce accurate collimation, a 0.125-inch aperture at the lamphouse exit was used to approximate a point source. With the f 2.5, 6-inch diameter, and achromated collimating lens, 1/2-degree collimation was easily achieved. The lens, a multi-element Schneider lens, was purchased specifically for this project.

The visual spectrum of the light beam exiting the lens (incident on the window) is shown in Figure 2 in relationship to published data on the sun spectrum. In the spectral interval of 400 to 475 millimicrons, the sensitivity of the eye is so small that the source variance from the sun in that region is negligible. To illustrate, Figure 3 shows the spectral distribution of the source and sun weighted with the response of the eye. Only small deviations are evident between the two weighted distributions.

The uniformity of the light beam was quantitatively measured with a Gamma Scientific photometer positioned in the plane of the window. The active portion of the photometer detector head was masked down to a 3-mm diameter



1. Lamphouse containing 1600 watt Xenon arc source
2. 6 1/2-inch diameter, f 2.5 achromatic lens for collimation of light
3. Black body for absorption of light in line of sight of photometer
4. Filter unit from clean bench to maintain clean windows
5. Rotational apparatus to hold windows
6. Photometer
7. Black body baffle system used to absorb transmitted energy from light source
8. Low interference window bracket

Figure 1. Schematic of Experimental Apparatus

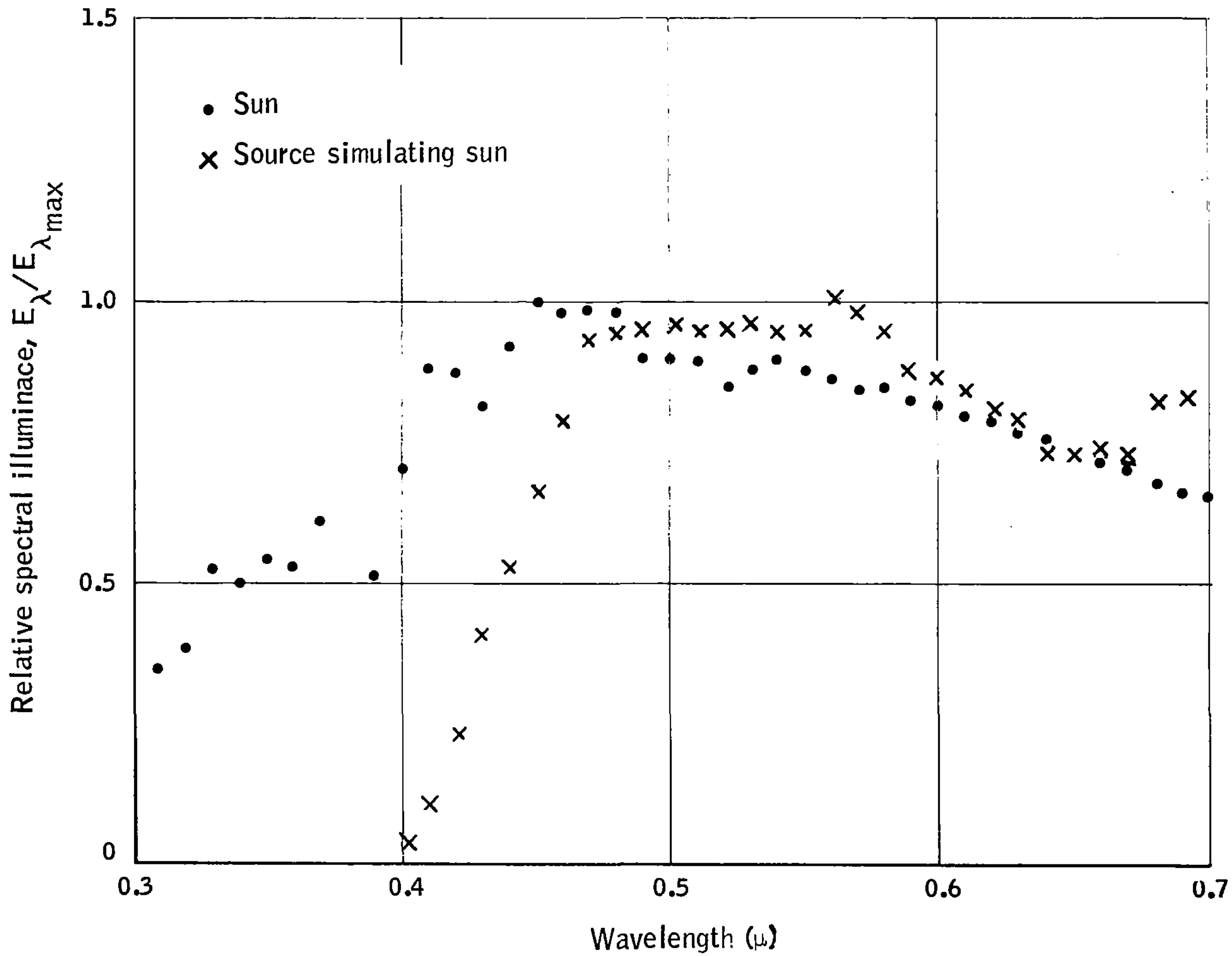


Figure 2. Comparison of Lamp and Sun Spectra

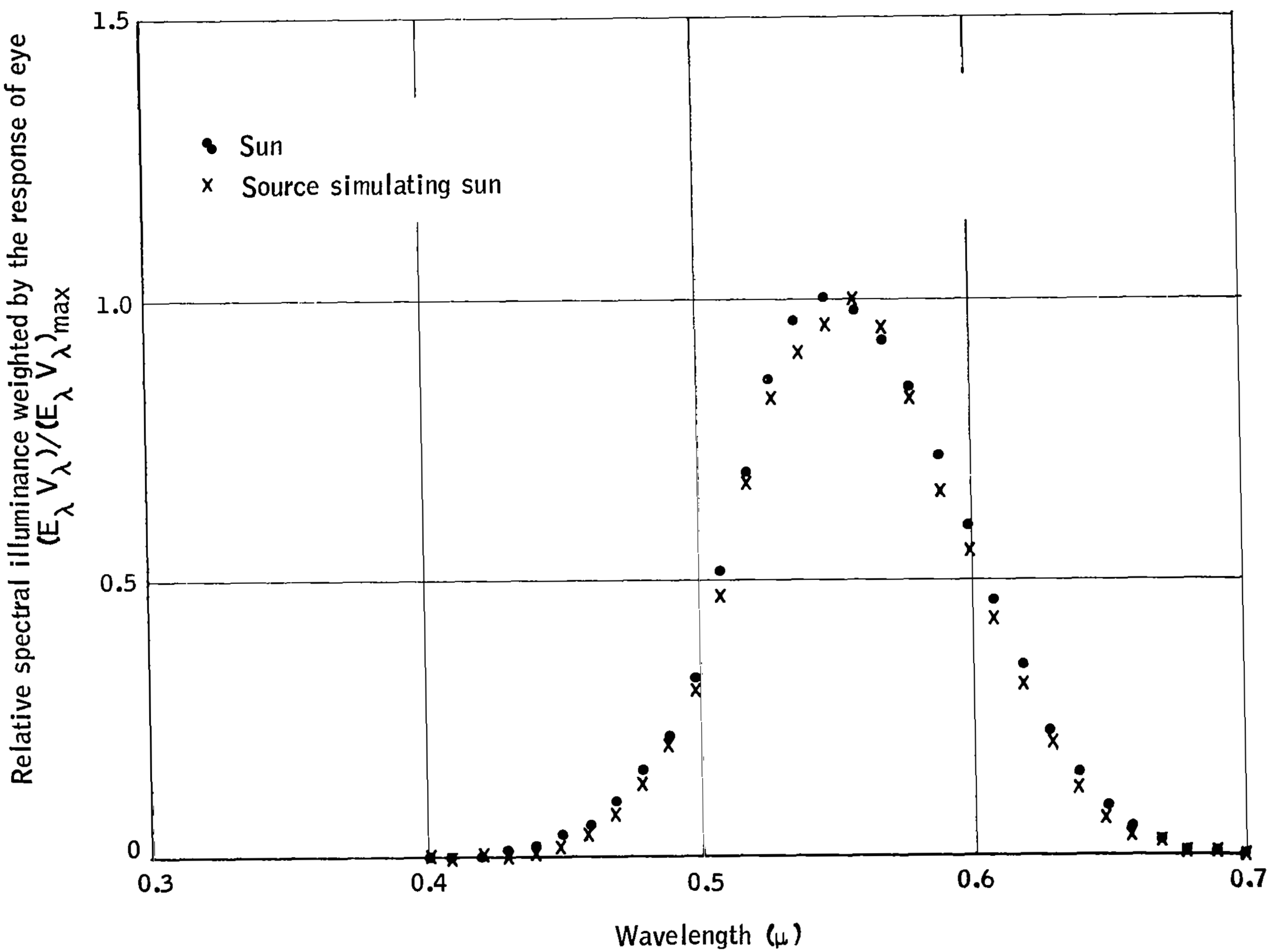


Figure 3. Comparison of Lamp and Sun Spectra Weighted by Eye Response

aperture and moved transversely across the collimated beam. A transverse lathe mount provided accurate positioning of the detector in the beam.

The uniformity of the beam shown in Figure 4 is within a 10-percent deviation across the 4-inch horizontal plane corresponding to the scattering measurement plane. The beam did not have as large a zone of uniform illumination along the vertical axis, but this did not affect the prescribed horizontal measurements because the two-dimensional measurements were taken in the horizontal plane only.

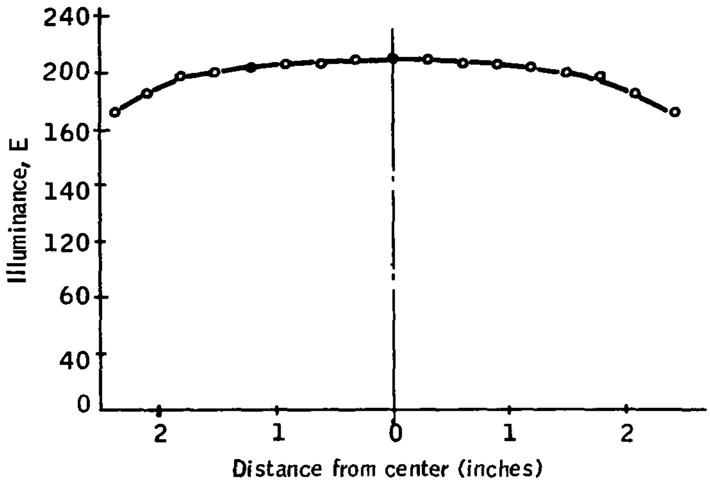


Figure 4. Horizontal Uniformity of Beam

Rotation Holder. - The window was mounted to allow angular motion about two axes. The first was about the window normal to study light scattering uniformity and the second about a perpendicular to the window normal to vary the incident light angle. Two window mounts were used, one to provide rotation about the window normal and the second to provide minimum obstruction of the incident light beam and photometer view. Both devices are shown in Figure 1.

Both window holders were mounted on a rotational platform which accurately rotated about the same center as the photometer. Degree marks on this platform provided for positioning of the window with respect to the incident light beam (the second window mount was used for the bulk of the measurements).

Detector. - A Pritchard photometer was used to make the scattering measurements and to determine incident illuminance. This particular instrument was chosen because (1) the manufacturers stated accuracy is ±13 percent of full scale reading over 13 orders of magnitude sensitivity, (2) the acceptance angle of the photometer could be varied, (3) it has internal calibration, (4) the instrument has a built-in filter so that the spectral response of the "standard eye" is modeled as shown in Figure 5, and (5) it has an optical system which permits a visual check of the field of view.

The photometer was mounted on a movable arm so it could be rotated about the window while focused on the same spot on the window.

Window Alignment. - The window was initially aligned with an autocollimator to ensure that, at $\Psi = 0$ (see Figure 6), the front surface of the window was perpendicular to the incident light beam. This alignment was easily reestablished during the course of the experiment in the following manner: two bright images are visible on the aperture of the lamphouse in Figure 7. The off-center bright spot is the reflection from the front surface of the window as imaged by the lens. For true normal incidence, this reflected spot must superimpose on the aperture. A check on the alignment of the lens is accomplished in the same manner by using the larger-diameter spot shown centered around the aperture. This spot is a reflection of the front surface of the lens and is used to align the lamphouse with the axis of the lens.

Background Light Suppression. - The light-scattering levels measured in the experiment were quite small, necessitating reducing the background to as low a level as reasonably possible. The lamphouse was enclosed with a 20-mil-thick black mylar curtain to isolate stray light originating from that source. The room housing the experiment was painted black, and all apparent light leaks were sealed with black tape. Blackbodies were used to absorb the

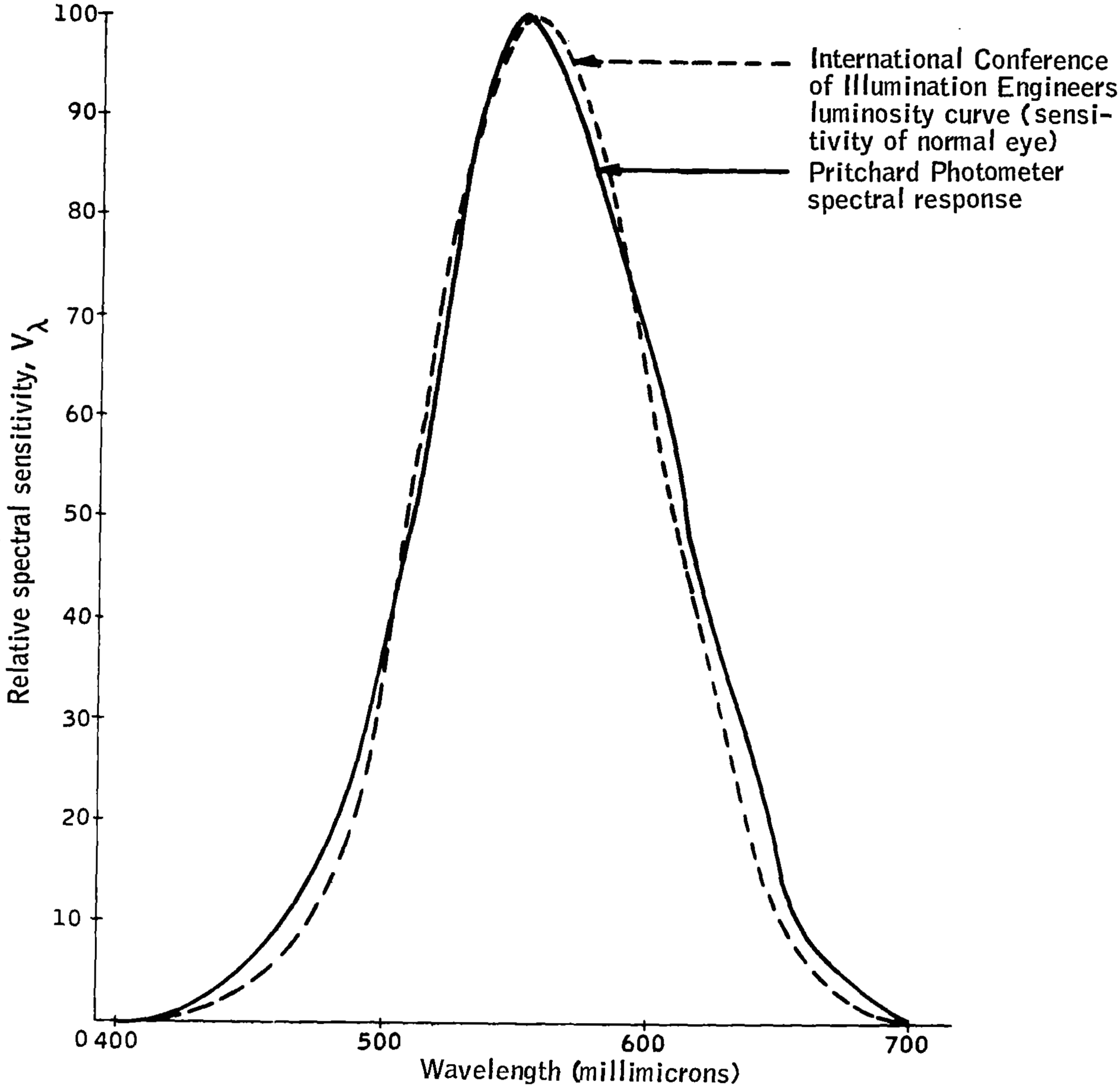


Figure 5. Comparison of Spectral Response of Eye and Filter Used on Photometer

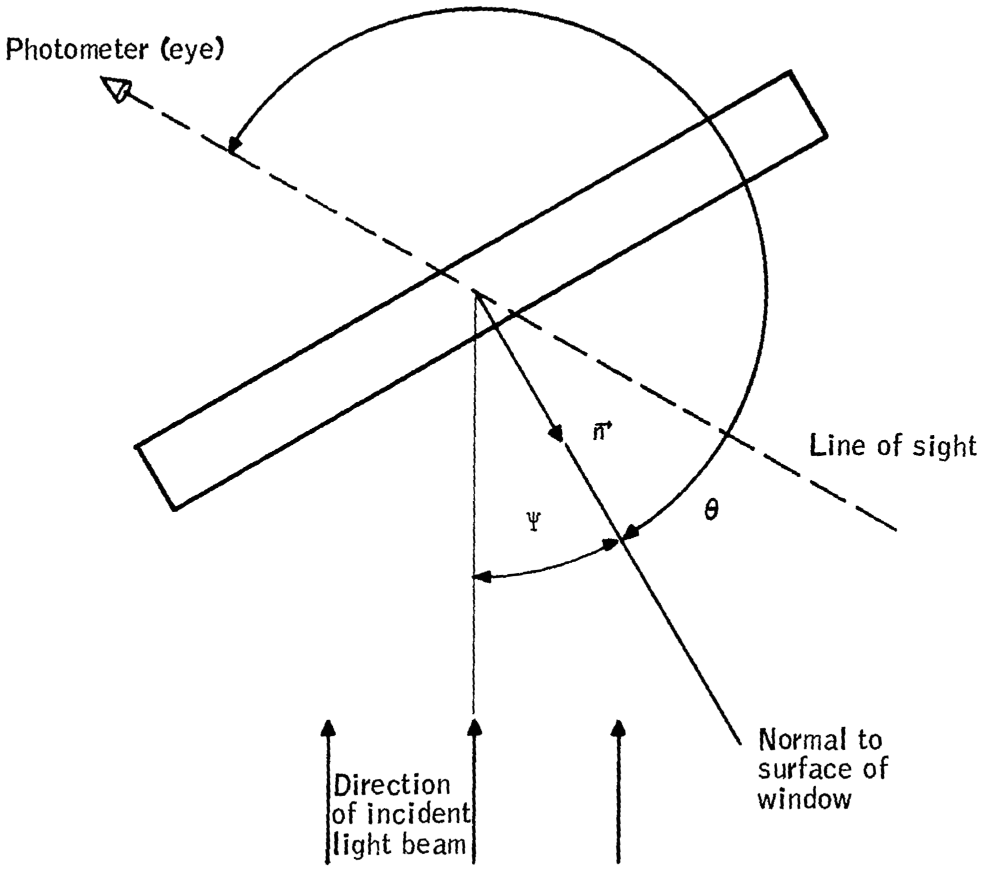


Figure 6. Definition of Angle Used

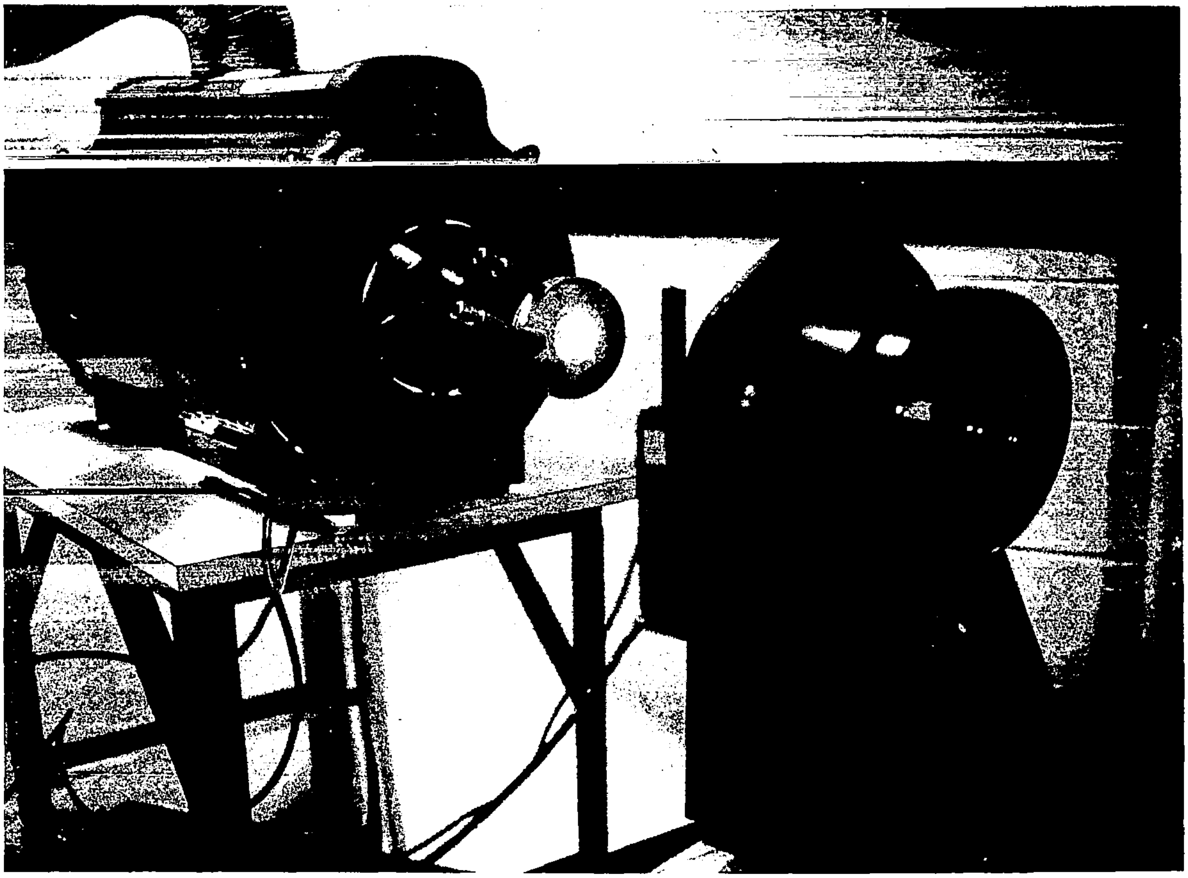


Figure 7. Image of Window Reflected on the Aperture Plate

main beam transmitted through the window and to reduce the background in the field of view of the photometer. These light suppression devices are shown in Figure 8, a photograph of the experimental apparatus.

A large blackbody baffle system (14 inches high by 10 inches deep) was placed in the beam path as shown in Figure 1 to absorb the light transmitted through the window. The blackbody design was basically an array of 18 parallel plates mounted 3/4 inch on center in a large box. The interior of the box as well as the plates was painted with 3M Black Velvet paint which has an absorptivity in the visible of about 0.97 (i.e., 97 percent of energy incident on a flat plate painted with this paint is absorbed). Thus, when including the effect of geometry, the baffle system had a high effective absorption.

A blackbody was used to prevent excess background light from scattering or reflecting into the photometer field of view. It was placed on the side of the window opposite the detector to provide an absorbing background in the photometer field of view. This blackbody was an off-axis cone (as shown in Figure 8) with a blackness of about 0.99. This aperture was 3 inches in diameter, and the total length was 16 inches.

Because the window specimens were of finite size, the window edges were exposed to the incident light beam at incidence angles greater than 40 degrees. The window edge, when illuminated, became a diffuse-like source of illumination that exceeded the luminance level of the measured field by about 2 orders of magnitude, necessitating further buffering of the photometer. To reduce stray light pickup by the photometer, a commercial light baffle with a 1-1/4-inch-diameter aperture was attached to the Pritchard photometer.

Calibration with the Pritchard photometer viewing the Gamma 100-foot-lambert standard source indicated that this light baffle with aperture did not occlude light from the photometer's viewing area, but it did reduce the background light effects.

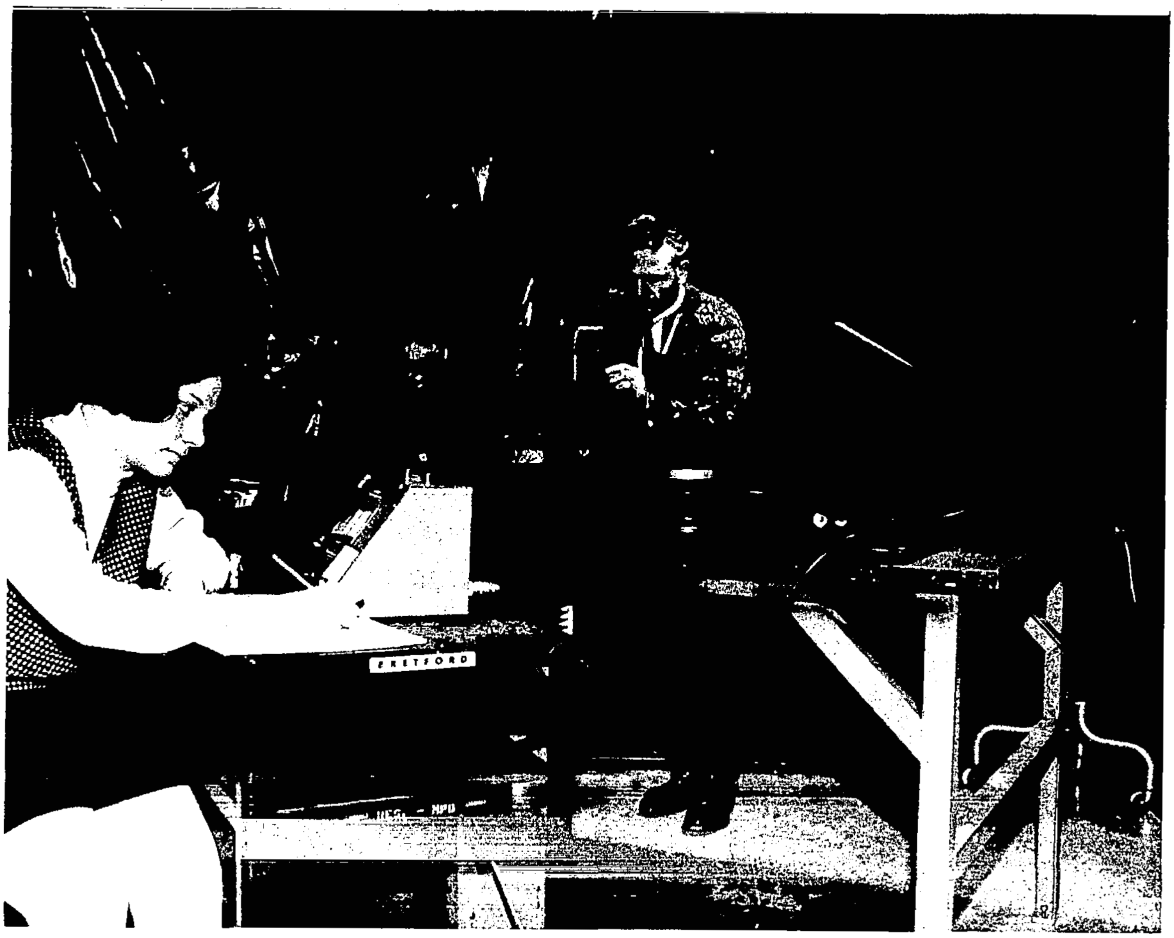


Figure 8. Photo of Laboratory, Operator and Recorder

Figure 9 shows relatively good agreement between the measurements with and without the baffle where the window edge was not exposed to the intense collimated beam, that is, at incident angles of less than 40 degrees, but at angles where the edge was illuminated (>40 degrees) some stray light was measured by the photometer. The data in Figure 9 is a plot of the window light scattering luminance (L_W) in foot lamberts divided by the window incident light flux $E_o \cos \Psi$ in foot candles. This value can also be considered a dimensionless parameter; i.e., the ratio of the scattered luminance of the window to the luminance of a perfect diffuse reflector placed at the same incidence angle in the solar beam.

A set of light scattering measurements were made with the edges of the windows painted black to absorb light scattered from the unpolished edge surface. This data is included in Appendix D for comparison with the primary data taken with unpainted window edges.

Window Samples. - The window samples used in this investigation were supplied by NASA. They were space vehicle windows which were repolished and recoated by OCLI. The glass was Corning Vycor, and it was either uncoated, magnesium-fluoride (MgF_2) coated or high-efficiency, antireflection (HEA) coated. The windows were assigned a numerical designation as follows:

Number	Coating
208	MgF_2
240	Uncoated
244	HEA
246	HEA

This numerical identification is used throughout this report.

In addition, an uncoated 6-inch-diameter by 1/4-inch-thick Supracil plate was used as a test standard. It was highly polished using optimal techniques developed at Honeywell for low-scattering laser mirrors.

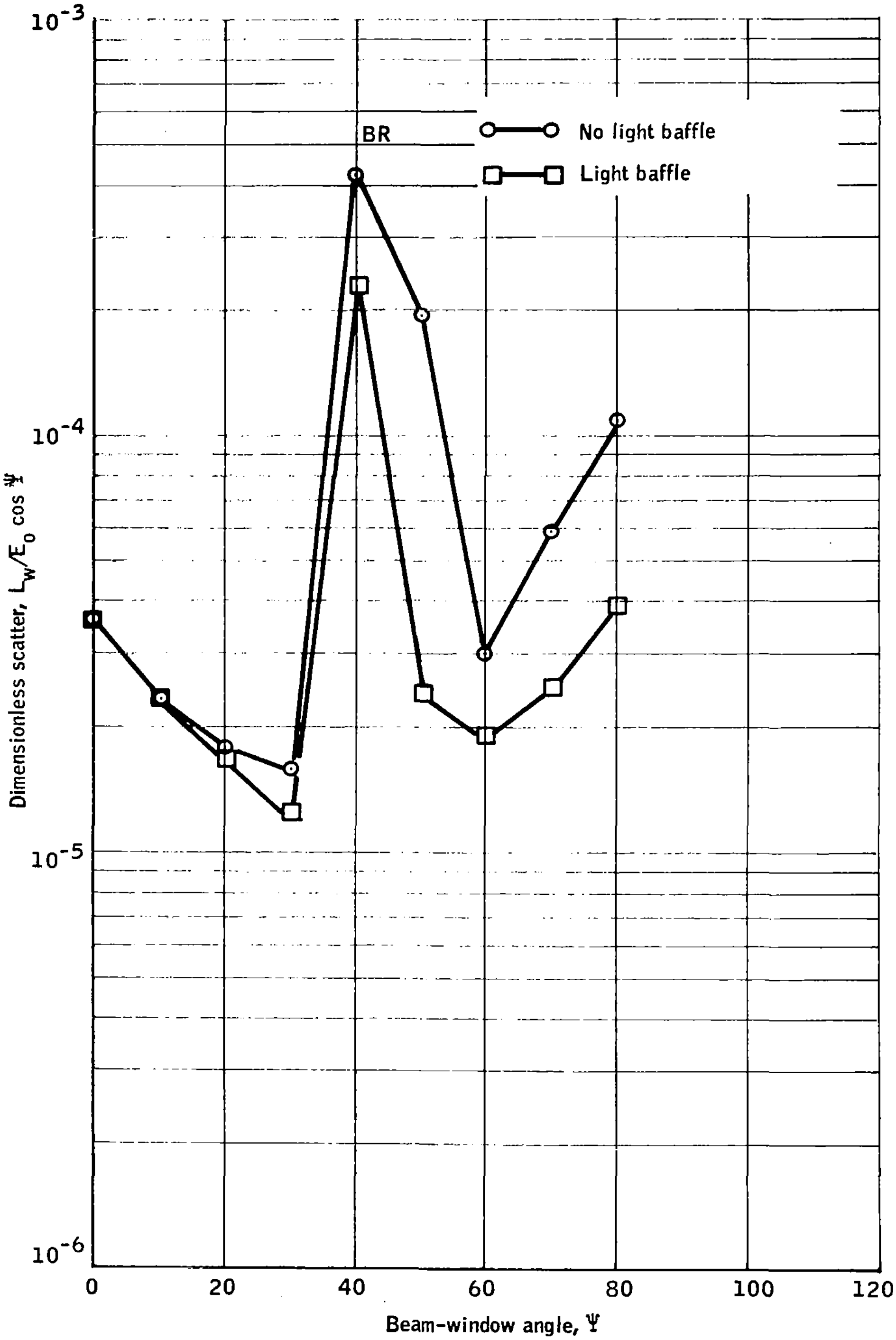


Figure 9. Photometer Measurements with and without Light Baffle, Window 244 (θ = 220 degrees)

Measurement Procedure

This subsection describes in some detail the methods used in obtaining the experimental scatter data. Included is a discussion of important observations recorded during the experiment.

Alignment. - Beam-window-photometer alignment was attained by use of an alignment plate of 3/16-inch-thick aluminum of the same shape as the windows. The alignment plate was positioned in the window mount attached to the rotating platform base. Degree marks were inscribed on the edge of the base for indexing the alignment.

Alignment of the window with respect to the light beam was accomplished by placing a front-surface plane mirror against the alignment plate. The collimated beam of light was then specularly reflected back through the large objective lens and focused at the lamphouse aperture which served as the illumination source. Adjustments were made until the source image location coincided with the aperture. This ensured that the alignment plate was perpendicular ($\Psi = 0$) to the collimated light beam and also permitted a collimation check by observing if a sharply focused aperture image was located in the plane of the aperture.

Alignment of the photometer with respect to the window was accomplished by focusing the photometer on scribe marks on the alignment plate. The alignment plate was half the thickness of the windows, so focusing onto the alignment plate surface was equivalent to focusing onto the window center plane. Focus was easily achieved with the telescope incorporated in the Pritchard photometer. The objective of this alignment task was to position the photometer such that the window measuring focus coincided with the common vertical axis of the platform base and the rotating arm upon which the photometer was mounted. Thus, as the photometer was rotated around the window and as the window was rotated in the light beam, the photometer always remained centered on the same window measuring area. Centering was checked as the photometer was rotated from 15 to 90 degrees and from 270 to 345 degrees.

Failure of the photometer focus to remain centered on the measuring field of the alignment plate meant the photometer and window were misaligned. If misalignment was indicated, the window mount was moved forward or backward on the rotating platform base, and the beam window alignment was rechecked. This alignment procedure was followed until the photometer's measuring field coincided with the centering index on the alignment plate for all angles. Thus, upon replacing the alignment plate of 3/16-inch thickness with the sample window of 3/8-inch thickness, the measuring field, which corresponded to a 7-mm-diameter circle, was centered between the two window surfaces and coincided with the common geometric axis of the photometer and window.

Throughout the series of measurements, a blackbody with a cavity diameter of 100 mm was positioned opposite the photometer. The purpose of the blackbody was not only to reduce the background luminance level behind the window but to provide a background constancy not attainable without it.

Upon completion of the beam-window-photometer alignment procedure, the alignment plate was removed, and the blackbody was positioned behind the window-mount plane and diametrically opposite the photometer. A white target with a centering index was placed over the blackbody cavity, and the photometer's telescope was focused to permit viewing of the centering disc. The blackbody was then positioned such that the measuring field viewed through the telescope was superimposed upon the centering index of the target. The blackbody was then located in place. The alignment plate was once again positioned in the window mount, and the photometer was refocused on the centering index of the alignment plate.

The Pritchard photometer with a 1-degree acceptance angle was focused in the window plane for the scattering measurements. Hence, the acceptance area in the plane of the blackbody must be exceeded by the blackbody cavity area. This acceptance area must include the measuring condition where the photometer window angle is ± 80 degrees with two windows in place. The acceptance area is effectively expanded due to displacement of the blackbody as a result of refraction at the window surfaces. These two angular extremes (±80 degrees) thus define the limiting case in terms of necessary cavity dimension.

Determination of Illumination on Windows. - The illumination incident on the windows was determined by two independent measurements. A Gamma Scientific photometer was used in the path of the light beam, while the Pritchard photometer was used to measure the light reflected from a diffuse disk placed in the light beam. The Gamma measurement was more direct but necessitated removing the window to make a measurement close to the window position. The Pritchard photometer, on the other hand, was used for the scattering measurements and a small diffuser disc could be placed directly in front of the window for routine illumination checks.

With the sample window removed, the Gamma detector unit was positioned such that the front surface of the 1-inch diameter cosine head (the light-receiving surface) fell in the same plane that the sample window occupied during measurements. In addition, the cosine receptor head was centered about the 7-mm diameter measuring locus* that the Pritchard photometer measures. Both of these positions were easily ascertained with the aid of the Pritchard photometer telescope.

The Gamma photometer was calibrated with the Gamma standard light source. A series of five individual measurements was made of the incident illumination with photometer calibrations before each measurement. Table 1 is a sample of these individual measurements.

Immediately following this set of measurements, a small $BaSO_4$ disc was positioned just in front of the Gamma cosine receptor head. (Because our incident illumination is a collimated beam (±0.25 degree) a small displacement (2-3 cm) along the beam axis results in no significant illumination change.)

*Defined measuring area when the photometer axis is perpendicular to the window (θ = 0).

TABLE 1. - INCIDENT ILLUMINATION VALUES AS MEASURED IN THE PLANE OF THE SAMPLE WINDOW

Measurement	Individual Measurement (foot candles)
(1)	178
(2)	181
(3)	175
(4)	177
(5)	180
$\bar{E}_o = 178.2$	

The Pritchard photometer was then calibrated, and, with the photometer at a 15-degree window-photometer angle (θ), a set of luminance measurements of the $BaSO_4$ disc was made. Photometer calibrations were made between each individual measurement (refer to Table 2). A calculation of the ratio of the reflected light to that incident which equals the reflectance $\bar{L}_d/\bar{E}_o = \rho$ gives a numerical value of 0.957.

TABLE 2.— LUMINANCE MEASUREMENTS OF STANDARD BARIUM SULFATE DISC

Measurement	L_d (foot lamberts)
(1)	171
(2)	170
(3)	171
$\bar{L}_d = 170.67$	

The reflectance of the barium sulfate disk was independently measured by Gardner Laboratory Inc. using a technique recommended by the National Bureau of Standards. They found the reflectance of the disk to be 0.97. The agreement between the independent measurement and our in situ evaluation of the reflectance establishes confidence in the accuracy of the illuminance determination.

Measurement of the reflectance of the standard $BaSO_4$ disc nearly simultaneously with the scattering measurements permitted monitoring of incident illumination throughout the scattering measurements without removal of the sample window or use of the Gamma photometer. An absolute calibration of the photometer was performed in Honeywell's standards calibration laboratory according to National Bureau of Standards (NBS) procedures. An NBS standard lamp was used to illuminate a magnesium oxide target. The luminance was measured and compared to the NBS value. The internal standard was recalibrated to provide an accurate accessible calibration of the instrument during the experiments.

Window Cleaning. - The last premeasuring task was reserved for cleaning of the sample windows. Normally, the windows were cleaned while mounted in the platform window mount with the intense collimated beam flooding the entire window. Under these illumination conditions, window surfaces frequently revealed surface film or particles that were unnoticed when they were cleaned and inspected under diffuse room illumination. Consequently, all windows received a final cleaning and visual inspection while positioned in the collimated beam.

Experience at Honeywell has shown that ultra-low-scattering optical elements can be realized only if good cleaning practices are combined with a means of evaluating the effectiveness of cleaning.

The windows were cleaned using the following procedure:

(1) Soak the element for several hours in hot "MICRO" detergent solution.

(2) Rinse and rub with cotton swab, using deionized filtered water. Repeat this several times.

(3) In a final step, the optical surface is covered with deionized water which is blown off with a jet of dry nitrogen. The removal of the water should be complete. Also care should be taken not to permit water droplets from the edge to flow across the optical surface after it is dry.

(4) Inspect the cleaned surface by directing a bright collimated beam of light on the surface and viewing the surface against a black background in a darkened room.

(5) If step (4) shows the optical element to be clean, proceed to measure scattering levels.

It is a general observation that a carefully cleaned optical surface usually does not become contaminated as readily as a poorly cleaned surface when exposed to normal laboratory environment.

An air filter was positioned directly above the window platform and operated continuously in an effort to reduce the collection of dust particles on the window surfaces.

Measurement Method. - Premeasurement tasks involving alignment checks, calibration checks and window cleaning took about one hour. The Xenon arc lamp was started first, allowing the lamp to stabilize before the incident illumination and scatter measurements began. The power supply to the Xenon lamp was adjusted to, and maintained at, 80 amperes.

The Pritchard photometer was calibrated with its internal calibration source and moved to the 15-degree photometer-window (ϵ) angle. With the sample window in the zero window-beam (Ψ) position, the standard barium sulfate disc was introduced into the photometer's viewing field in front (2-3 cm) of the sample window. A luminance measurement was then read and recorded as L_d. The disc was then removed, and scatter measurements were made by rotating the photometer about the window and recording luminance measurements at each 10-degree station. Exceptions to this occurred when the photometer was in the direct path of the collimated beam or when the photometer looked directly at the window edge. Upon completion of this set of measurements, the photometer was again calibrated, and a luminance measure of the standard barius sulfate disc was recorded. The window was then rotated such that the beam was incident 10 degrees off normal and the scatter measurements were repeated by rotating the photometer about the window. Upon completion of the data set, the window was returned to the zero Ψ position. The photometer was calibrated and the luminance measurement of the barium sulfate disc recorded. This procedure was repeated for all beam-window-angles at 10°intervals from 0 to 80 degrees and for all windows.

Measurement Schedule. - The windows were measured in the following order:

(1) The scatter luminance in the horizontal plane (bulk of measurements were made only in horizontal plane) was measured for individual windows 208, 244, 246 and 240, in that order.

(2) The scatter luminance at an angle of 22. 5, 45, and 67. 5 degrees from the horizontal (3-D angles) were measured on windows 240 and 244 . These measurements were made only as an exploratory measure to evaluate the validity of using only horizontal measurements (3-D angle = 0) to describe the window light scattering.

(3) The double window combinations 244 - 208 and 244 - 246 were measured in order to evaluate the effect of multiple windows.

(4) The Supracil standard was measured to provide comparison data from a low-scattering standard.

Background lighting conditions for all measurements in a horizontal plane (3-D angle = 0) were identical. The three-dimensional background light levels were reduced as the angle increased.

The photometer was calibrated, using the internal standard, at the beginning of each day and before and after the data taken for a particular window configuration. The lamp current was monitored and recorded before each data run. The air filter unit was operated at all times that a clean window was in position for measurement.

COMPUTATION OF ILLUMINATION ON WINDOW

Introduction

To predict window veiling luminance and, thus, star vision magnitude, it was necessary to calculate the luminance incident on the spacecraft window under specified orbit positions. The conditions of interest to this contract were:

(a) The sun at a distance of 1 AU
(b) The sunlit full earth at a distance of 200,000 km
(c) The sunlit full earth at a distance of 100,000 km
(d) The sunlit full earth at a distance of 200 km
(e) The sunlit full moon at a distance of 380,000 km
(f) The sunlit full moon at a distance of 130 km

In the above specified positions, two separate physical situations become apparent: first, the window is so far from the source that it receives essentially collimated light [i.e., the angle is less than 10 degrees-(a), (b), (c), and (e) above] or, second, the window is quite close to the planet and receives contributions from a three-dimensional diffuse spherical source. These two situations lend themselves to two different methods of computing the geometric relationship between the two bodies for correlation with experimental scatter data.

Before those computations are described, pertinent definitions are presented. In this report, luminous flux is referenced as the time rate of flow, emission or incidence of light. Light is defined as the aspect of radiant energy of which the human observer is aware through the visual sensations which evolve from stimulation of the retina of the eye; hence luminance is a psychophysical concept.

Therefore, to compute luminous flux from solar spectral data, it is necessary to weight the spectra by the response of the human eye. The luminosity curve of the International Commission on Illumination (Figure 5) shows on the ordinate the capability of energy of the various wavelengths to cause visual sensations of equal brightness. These values represent the mean spectral sensitivity for observers whose ages do not exceed 30 and who are observing at angles of not less than 5 degrees from the fovea under conditions of dark adaptation. Values for individuals will show small deviations from this standard response. The importance of the standard luminosity data is that these particular values have been internationally accepted and thus can be used to establish the photometric quantities by definition. Thus the standardization of the relative luminosity data permits calculation of the most probable value of the maximum luminous efficiency of radiant flux: 680 lumens/watt of radiant flux at 555 mμ.

Multiplying the ordinate values of the standard luminosity curve by 680 yields the absolute luminosity curve of radiative flux representative of the ICI standard eye with the units of lumens/watt versus wavelength.

To calculate the illuminance from the sun on a window in free space at the earth's mean distance from the sun, the spectral distribution of energy of the sun is required. This data has been compiled by Johnson (ref. 1) with a probable error of ±2 percent. With that data one can then compute the illuminance on a window perpendicular to the sun using

$$E_s = \int_0^\infty \ell_\lambda B_{s\lambda} \, d\lambda \tag{1}$$

Because the available data is discrete, the above integral is approximate. Accordingly,

$$E_s = \int_{0.38\mu}^{0.77\mu} \ell_\lambda B_{s\lambda} \, d\lambda \cong \sum_{n=1}^{N} \ell_{\lambda n} B_{s\lambda_n} \Delta\lambda_n \tag{2}$$

where $\Delta\lambda_n$ is 0.005 micron because the available data on the spectral distribution of the sun is given with these minimum increments. Assuming the visible portion of the spectrum to be from $0.38\,\mu$ to $0.77\,\mu$, N = 79. When Equation (2) is carried out on a WANG calculator

$$E_s(\text{at } 1\text{AU}) = 13.695 \text{ lumens/cm}^2 \tag{3}$$

The above calculation converts the dimensions of the flux units from watts to lumens; that is it changes the total energy of the sun's spectrum to that energy which will be detected by the human eye. Basically the luminance flux can be considered a transport phenomena in the same fashion as is radiation heat transfer. It remains to specify the fraction of the luminance flux incident on the window due to variations in position of the window with respect to the sun. This problem is a purely geometric one and completely divorced from the energy per se. The solution of this problem is normally accomplished by use of a dimensionless geometric parameter called a variety of names -- the view, angle, shape, interchange, exchange or configuration factor. The latter seems more specific, implying a dependence on both orientation and shape and will be used in this report.

Briefly, the configuration factor, $F_{dA_1-A_2}$, is the ratio of the flux originating from area dA_1 on body 1 that is incident on body 2 to the total flux originating at area dA_1. Mathematically, if the emission of a surface is assumed to be diffuse, that is according to Lambert's Cosine Law, the fraction of emitted energy from a small area dA_1 on body 1 intercepted by a differential area dA_2 on body 2 is given by

$$F_{dA_1 - dA_2} = \frac{\cos\phi_1 \cos\phi_2 \; dA_2}{\pi D^2}$$

where the geometrical notation is indicated in Figure 10. For the case where area dA_1 is very small compared to area A_2, the configuration factor becomes

$$F_{dA_1 - A_2} = \int_{A_2} \frac{\cos \phi_1 \cos \phi_2 \, dA_2}{\pi D^2} \tag{5}$$

This equation serves as the basis for the calculations presented here.

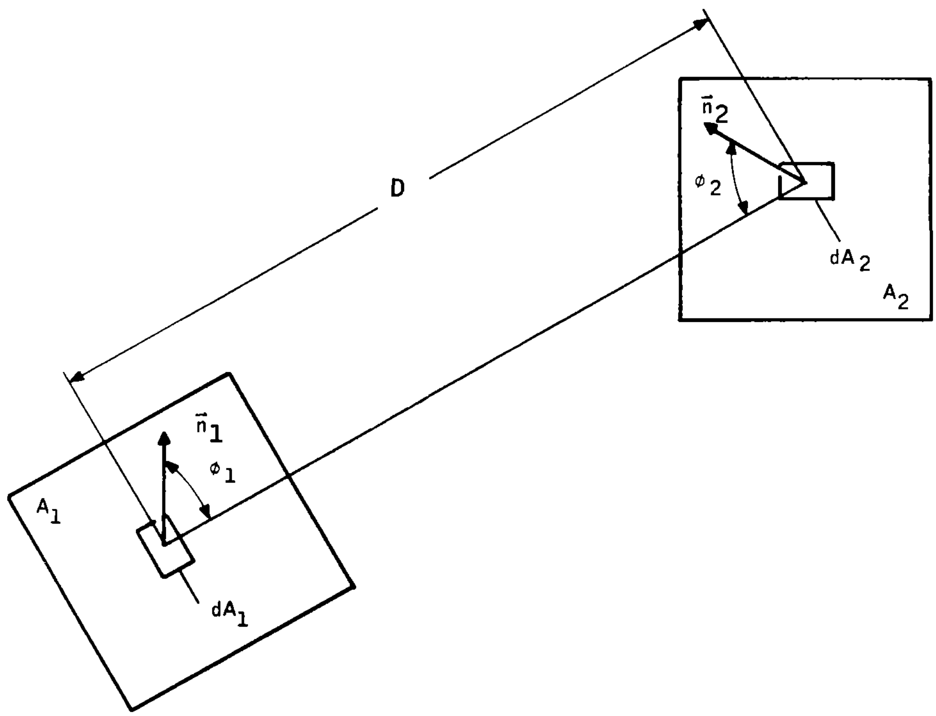


Figure 10. Coordinate System

For the purposes of this discussion computations are divided into two separate phases: the situation where the window is close to the sphere (moon or earth) and the situation where the window is quite distant from the sphere (moon, earth and sun). The description of the computation for the configuration factor for the latter situation is given in the following subsection. For the former situation, a different approach is necessary, and it is discussed subsequently.

Far-Distant Source

Integration of Equation (5) in some instances can best be accomplished by means of the so-called unit sphere method. The basis for the theory of the unit sphere method is presented in Appendix B.

The configuration factor is given by

$$F_{dA_1 - A_2} = \frac{A_{2b}}{\pi R^2} \tag{6}$$

where A_{2b} is the projected area of A_{2a} on base of unit sphere and A_{2a} is the projected area of A_2 on unit sphere.

For the special case where the surface A_2 is the surface of a sphere, the geometry is relatively simple. This body will always project on the hemispherical dome as a shadow bounded by a circle which lies in a plane normal to the radial line connecting dA_1 with the center of the spherical model. The projection A_{2b} must, therefore, be an ellipse for all cases in which the whole of the spherical model lies above the plane of dA_1. When the plane of dA_1 intersects the sphere, the shadow on the hemispherical dome is still bounded by a plane circle. However, this circle crosses the equatorial line so the shadow projects on the plane of dA_1. In this case, A_{2b} consists of an ellipse and part of a circle. When the zenith angle α is > 90 degrees, A_{2b} is the area between the ellipse and the base circle.

The area A_{2b} was determined using the notation in Figure 11.

$$A_{2b} = \pi R^2 \left(\frac{r}{S}\right) \cos \alpha$$

With the above relationship we have

$$F_{dA_1 - A_2} = \left(\frac{r}{S}\right)^2 \cos \alpha \tag{7}$$

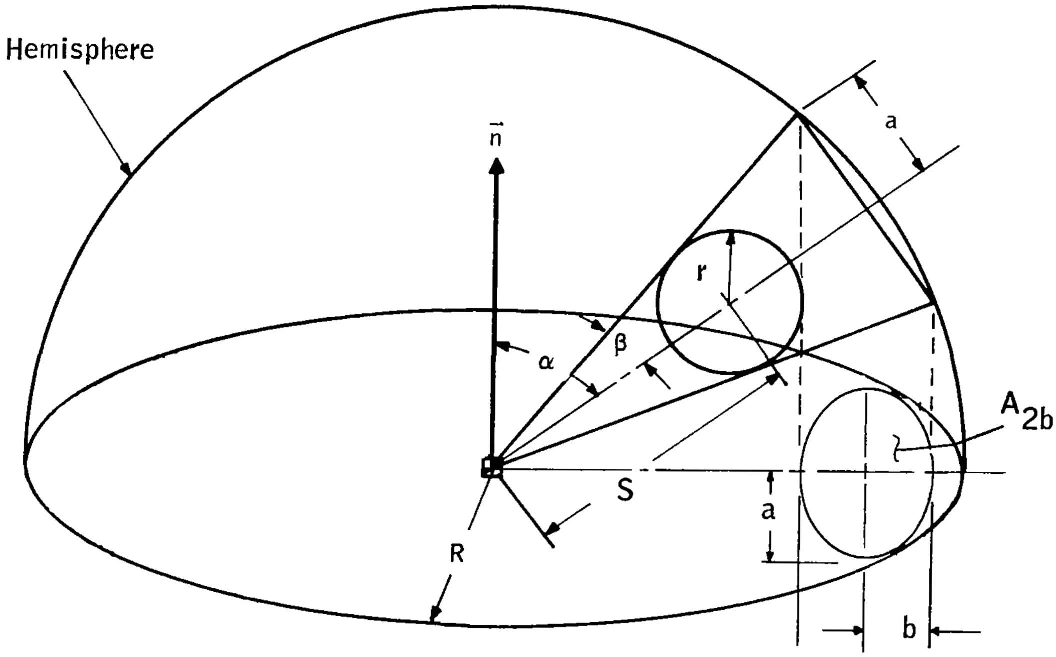


Figure 11. Application of Unit Sphere Method to Luminance from a Large Sphere (Planet) to a Small Plane (Window)

valid for $\alpha + \beta \leq \pi / 2$

where

$$\beta = \sin^{-1} (r / S) \tag{8}$$

The following limiting cases are of interest:

(1) α = 90 degrees. Here A_{2b} is a segment of the base circle.

$$A_{2b} = R^2 \left(\beta - \frac{\sin 2\beta}{2}\right) \tag{9}$$

and

$$F_{dA_1-A_2} = \frac{\beta - \frac{\sin 2\beta}{2}}{\pi} \tag{10}$$

(2) lim $F_{dA_1-A_2}$ for values of α between 0 and 90 degrees as $S/r \rightarrow \infty$

$$F_{dA_1-A_2} \rightarrow 0 \text{ as } S/r \rightarrow \infty$$

For values of $\alpha > 90$ degrees there is a limiting value of S/r beyond which $F_{dA_1-A_2} = 0$. This limiting value can be calculated by:

$$\text{limiting } r/S = \sin(\alpha - \pi/2) = -\cos\alpha,$$

therefore limiting $S/r = -1/\cos\alpha$.

These values of S/r at which $F_{dA_1-A_2}$ becomes zero are presented in Table 3.

TABLE 3.– LIMITING VALUES FOR CONFIGURATION FACTOR

$F_{dA_1-A_2} = 0$	
α (degree)	S/r
90	∞
100	5.76036
110	2.923976
120	2.00
130	1.55569
150	1.15473
165	1.035303
180	1.000

(3) Finally, the special situation when $S/r = 1$ can be easily handled:

$$F_{dA_1-A_2} = (1 + \cos\alpha) / 2 \text{ valid for } 0 \leq \alpha \leq 180 \text{ degrees} \qquad (11)$$

The configuration factors for the special situations unable to be obtained analytically were numerically computed using a Honeywell 1800 digital computer. The results of these computations are presented in Figure 12.

Close-in Source

The conditions where the spacecraft is relatively close to the planet is of interest to this study. Light in this situation is incident on the spacecraft window from many directions rather than a single direction. In reality light is reflected from a planet in a diffuse-like fashion but because our experimental data was taken with collimated light from discrete directions an integration or summation approach is needed. Because the major portion of the experimental data was taken in the horizontal plane and because this data was at discrete angles, an approximate computational scheme was developed.

The use of two-dimensional data to describe the three-dimensional physics is admittedly a gross simplification but within the scope of this program it was necessary. The primary difference between the sun and the earth's and the moon's albedo radiation is the assumption that the sun's rays are parallel while those from the planet are diffuse when the window is in a position relatively close to the sphere. Our experimental measurements deal only with a parallel-beam source. However, these results may be adapted by computing the incident flux in discrete solid-angle elements from the diffusely reflecting planet in the following manner.

Figure 13 illustrates the geometry for determining three-dimensional earth-reflected light that is incident on a surface in space. The illumination incident on a flat plate of unit area is given by

$$E = c\, E_s \int_0^{\gamma\, max} \int_0^{2\pi} \frac{\cos\phi_1 \cos\phi_2\, dA_p}{D^2} \qquad (12)$$

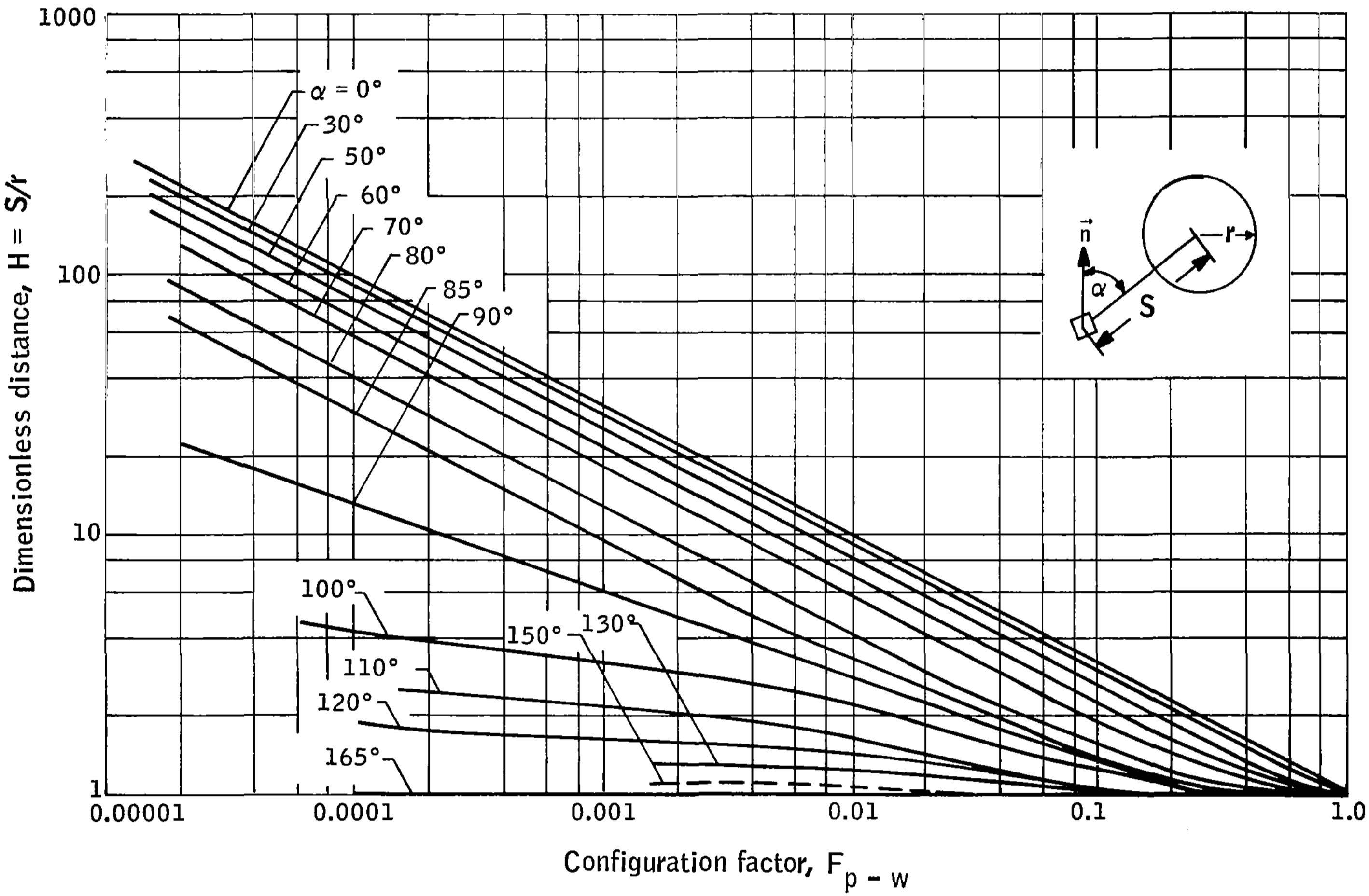


Figure 12a. Configuration Factor from Planet to Window versus Dimensionless Distance as a Function of Window-Planet Angle

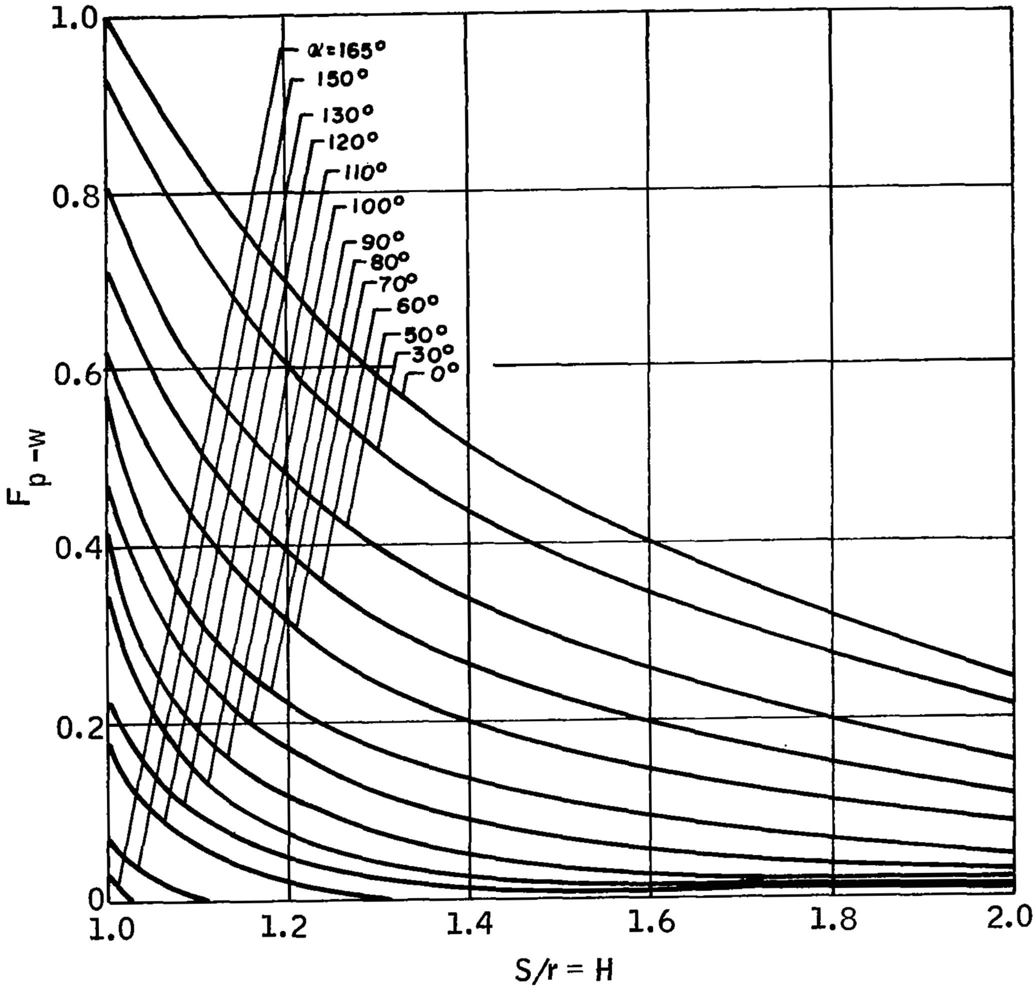


Figure 12b. Supplementary Configuration Factor from Planet to Window for Values of H from 1 to 2

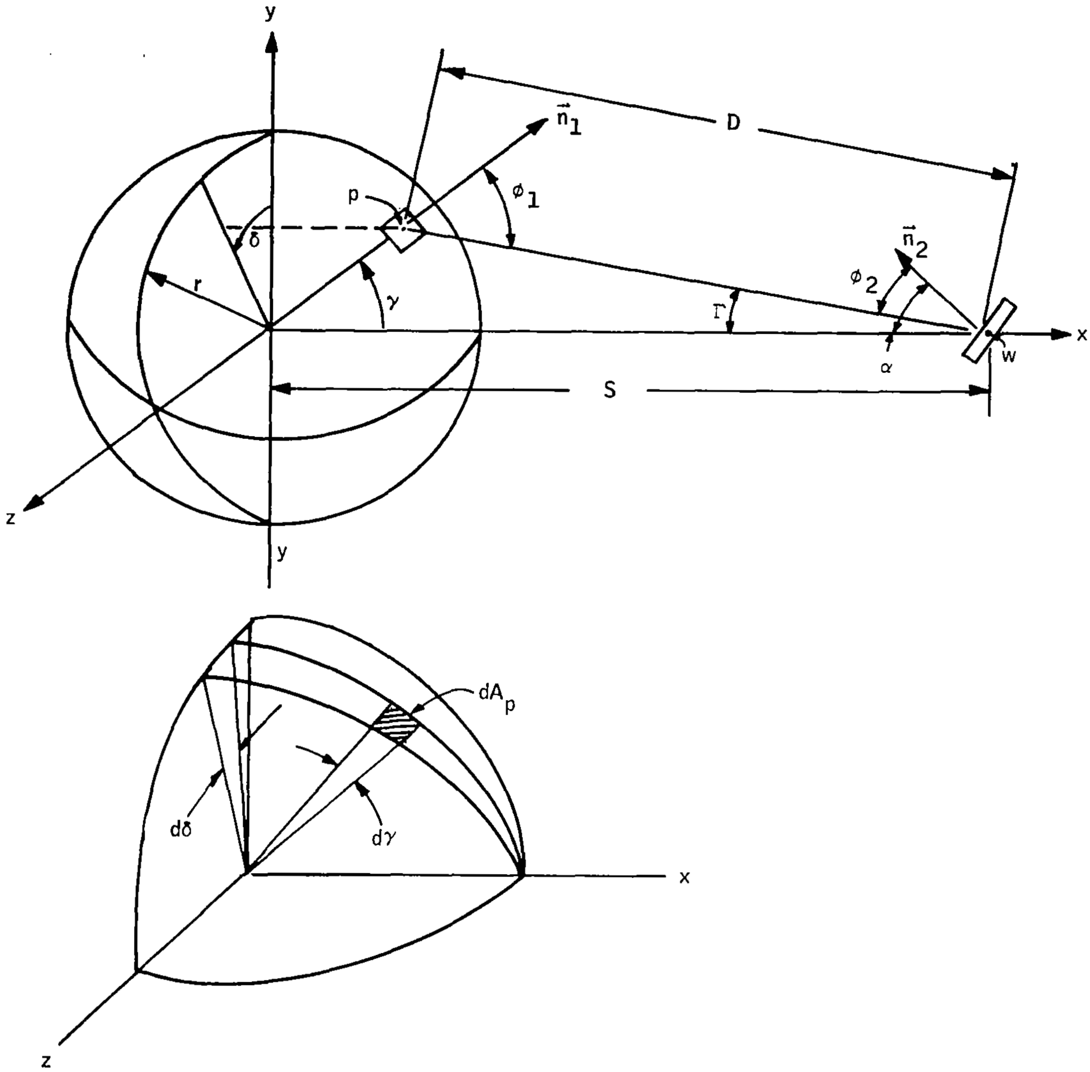


Figure 13. Three-Dimensional Computation of Luminous Flux from a Sphere to a Window

The general procedure was to divide the visible planet cap into a number of "nodes" dA_p and perform a numerical integration of Equation (12). Since the altitude of the satellite is large compared with the satellite dimensions, the solid angle subtended by the satellite at dA_p is small and hence the local flux at dA_p can be assumed parallel. Then essentially one sums up all of the contributions of collimated light from each of the "elementary" sources dA_p and obtains the final illumination incident on the window.

This computation is performed as follows. Consider the point p defined by the angles γ and δ (Figure 13) and the shaded area of the sphere surface bounded by the infinitesimal angles $d\gamma$ and $d\delta$ as shown in Figure 13, the area is

$$dA_p = (r\, d\gamma)\ (r \sin\gamma\, d\delta)$$

Also we have

$$\phi_1 = \gamma + \Gamma$$

From vector analysis

$$\cos\ \phi_2 = \frac{\vec{wp}\ \cdot\ \vec{n_2}}{|\vec{wp}|}$$

$$= \frac{-(r\cos\gamma - S)\ \cos\alpha + r\sin\gamma\cos\delta\sin\alpha}{D} \tag{15}$$

and

$$D^2 = (r\cos\gamma - S)^2 + (r\sin\gamma\cos\delta)^2 + (r\sin\gamma\sin\delta)^2 \tag{16}$$

Similarly for the angle Γ

$$\cos\Gamma = \frac{-(r\cos\gamma - S)}{D} \tag{17}$$

Substituting the above relationships into Equation (12) one is able to calculate the illumination incident on the window under the various required conditions. A Honeywell DDP 24 digital computer was used to numerically evaluate

Equation (12). The absolute accuracy is directly dependent on the number of areas used. For the planet under consideration, divided into more than 150 by 150 areas, the results are within 5 percent of 100 x 100 area computations for distances from the planet on the order of 100 km.

For the sunlit full earth at 200 km, we assume that the earth is a sphere of radius 6378 km, albedo of 0.35, and a solar illumination of 13.695 lumens/cm^2. When the illumination on the window is divided into conical segments as shown in Figure 14 we have:

Group 1	$0^o \le \phi_W < 5^o$
Group 2	$5^o \le \phi_W < 15^o$
Group 3	$15^o \le \phi_W < 25^o$
Group 4	$25^o \le \phi_W < 35^o$
Group 5	$35^o \le \phi_W < 45^o$
Group 6	$45^o \le \phi_W < 55^o$
Group 7	$55^o \le \phi_W < 65^o$
Group 8	$65^o \le \phi_W < 75^o$
Group 9	$75^o \le \phi_W < 90^o$

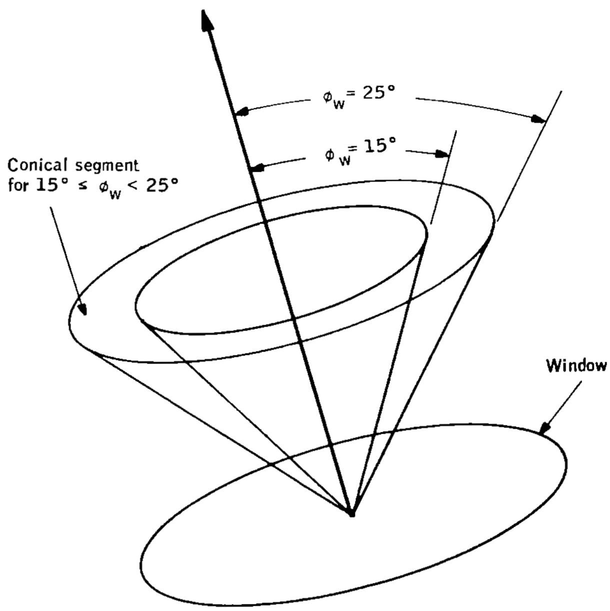


Figure 14. Method of Nodal Breakdown for Close-in Situation

The portion of the sphere that can be seen from the window is divided into a 200 x 200 area. The results are listed in Table 4.

For the sunlit full moon at 130 km, we assume that the moon is a sphere of radius 1740 km, albedo of 0.07, and receives an illumination of 13.695 lumens/cm^2. Again 200 x 200 areas are considered. The results are presented in Table 5.

TABLE 4. - INCIDENT RADIANT FLUX ON SPACECRAFT WINDOW (LUMENS/M^2) FROM THE SUNLIT FULL EARTH AT A DISTANCE OF 200 KM

α \ ϕ_w	0 ~ 5	5 ~ 15	15 ~ 25	25 ~ 35	35 ~ 45	45 ~ 55	55 ~ 65	65 ~ 75	75 ~ 90	Total
0	296.2	3089.9	5332.3	7168.9	8275.8	7739.2	7436.5	5329.7	339.3	45015.8
10	386.6	2846.9	5358.7	7191.5	8162.6	8218.2	7186.6	3894.2	1079.5	44323.8
20	376.3	2849.2	5370.3	7185.3	8188.2	8195.6	5735.6	3111.4	1345.9	42356.8
30	373.8	2871.2	5295.9	7213.2	8212.1	6702.8	4673.0	2869.9	1403.8	39615.0
40	368.4	2817.6	5343.0	7220.3	6753.8	5518.3	4169.1	2750.5	1410.4	36350.9
50	345.9	2829.3	5375.5	5856.5	5525.5	4846.0	3886.0	2598.9	1427.4	32690.8
60	372.3	2817.1	4254.5	4593.3	4792.3	4379.3	3605.5	2533.3	1405.7	28753.3
70	340.8	1981.7	3087.1	3815.7	4237.8	3976.7	3410.0	2418.8	1394.7	24662.9
80	15.0	1007.5	2224.8	3151.6	3662.0	3628.1	3177.7	2298.7	1380.3	20545.6
90	0	23.8	1277.1	2410.0	3059.1	3241.3	2956.0	2221.0	1337.2	16525.3
100	0	0	29.3	1413.1	2402.3	2807.7	2665.8	2098.2	1313.6	12730.1
110	0	0	0	31.4	1433.4	2236.8	2371.7	1935.9	1260.3	9269.5
120	0	0	0	0	30.9	1355.9	1921.3	1740.7	1200.8	6249.6
130	0	0	0	0	0	29.2	1182.6	1449.5	1098.8	3760.0
140	0	0	0	0	0	0	24.8	905.6	942.8	1873.1
150	0	0	0	0	0	0	0	18.0	619.2	637.2
160	0	0	0	0	0	0	0	0	63.7	63.7
170	0	0	0	0	0	0	0	0	0	0

TABLE 5. - INCIDENT RADIANT FLUX ON SPACECRAFT WINDOW (LUMENS/M^2) FROM THE SUNLIT FULL MOON AT A DISTANCE OF 130 KM

α \ ϕ_w	0 ~ 5	5 ~ 15	15 ~ 25	25 ~ 35	35 ~ 45	45 ~ 55	55 ~ 65	65 ~ 75	75 ~ 90	Total
0	54.0	621.5	1075.8	1338.1	1646.3	1672.6	1438.7	409.7	0	8256.6
10	73.5	570.3	1068.1	1436.9	1639.2	1630.0	1193.2	474.0	45.7	8131.0
20	73.8	568.3	1066.5	1440.6	1634.6	1424.6	883.7	487.1	179.5	7758.6
30	71.3	571.4	1063.2	1441.3	1443.8	1088.3	789.3	484.1	223.6	7176.2
40	73.2	570.2	1056.5	1269.9	1114.0	947.7	733.6	477.3	240.6	6483.0
50	72.3	559.7	929.5	945.9	959.1	855.2	689.9	463.0	249.1	5723.6
60	74.1	455.4	655.6	780.4	834.4	778.9	646.6	451.5	250.9	4927.7
70	21.2	246.7	478.0	643.3	731.5	704.8	611.9	434.4	250.3	4122.1
80	0	38.9	306.4	504.1	616.3	636.8	567.4	413.7	249.1	3332.7
90	0	0	47.6	332.7	494.6	553.9	516.2	395.9	242.9	2583.8
100	0	0	0	50.6	332.7	454.5	457.7	370.5	232.9	1899.0
110	0	0	0	0	50.6	310.6	381.5	334.1	221.9	1298.3
120	0	0	0	0	0	46.4	265.7	282.4	205.0	799.5
130	0	0	0	0	0	0	39.0	199.1	178.3	416.5
140	0	0	0	0	0	0	0	28.0	130.1	158.2
150	0	0	0	0	0	0	0	0	25.9	25.9

PREDICTION OF STAR MAGNITUDE VISUAL THRESHOLDS

Stellar Threshold Model Premises

People with normal vision observing under normally clear atmospheric conditions are able to detect stars up to about the 6th magnitude. This three-hold range may be extended to the 7th magnitude when viewing where haze and extraneous light factors are significantly reduced. Though many factors are related to optimal viewing conditions, we can define four general factors that play a large role in the detection of a specific star: (1) the viewer's adaptation level, (2) the star's illuminance level in the plane of the viewer's eye, (3) background luminance level and (4) the viewer's knowledge of star location. For our purpuse, we have made two assumptions regarding these four factors: (1) the viewer's adaptation level corresponds to the existing luminance level and (2) the viewer is knowledgeable concerning the star's location. The acceptance of these two assumptions greatly simplifies our star threshold prediction task and, in addition, permits us to draw on some available probability-of-detection data to supplement out detection threshold values.

Stellar magnitude, as established, is based on sea level illuminance levels. Consequently, to predict star magnitude threshold values from spacecraft, it is necessary to correct stellar magnitude values for light losses due to atmospheric absorption and scatter. Baker (ref. 2) has equated this factor to a 30 percent increase in illumination at the edge of the atmosphere. This value converted to star magnitude extends the magnitude range by a factor of 0.22.

For our own star prediction model we have adopted C. W. Allen's (ref. 3) illuminance value of 2.65×10^{-6} lumens/m^2 (2.46×10^{-7} foot candles) for a stellar magnitude of zero value in space. All star prediction thresholds are based on this zero magnitude illumination value.

Our approach to viewing with the prescribed monocular telescope is to consider the telescope a perfect optical instrument. Thus, optical aberrations which may reduce image quality and illumination to some degree are ignored. We have only considered the transmittance and light amplification factors which correspond to the characteristics of a typical telescope.

Selection of Model Base

We have chosen Blackwell's Tiffany study (ref. 4) and Hardy's treatment of this data (ref. 5) as a basis for a visual star detection prediction model. Our reasons for this selection are:

- The Tiffany data results are founded on a large data base. Approximately 90, 000 observations were recorded and processed for Part III which serves as the portion of the study we have drawn from.
- Blackwell has provided a convenient means of stating contrast limens for a wide range of probability detection levels.
- Hardy has presented star magnitude thresholds (based on the Tiffany data) for the case of background luminance levels being superimposed on the stimulus. This has significance for our model for this case corresponds to that where the astronaut must detect stars beyond the veiling luminance created by incident light on the spacecraft window.
- Hardy has extrapolated the Tiffany results to include a stimulus of 0. 01 minute of arc. Thus, we can safely assume that all of Hardy's 0. 01-minute threshold values pertain to a visual point source stimulus for all background luminance levels and viewing conditions. This then permits us to relate this set of threshold values to star detection magnitude while being assured that our results will not differ due to non-point source considerations.

Blackwell selected five contrast stimuli on the basis of preliminary observations. These five contrast stimuli resulted in about a 95-percent detection probability for the largest stimulus contrast and about a 10-percent detection probability for the smallest contrast stimulus. These contrast stimuli were then presented in random sequence an equal number of times for each experimental session. Blackwell determined the contrast necessary to result in a 50-percent probability by the statistical treatment referred to as Urban's Constant process.

From the results of 450,000 observations Blackwell constructed the average probability curve (Figure 15). To utilize this curve in arriving at a probability detection level other than 50 percent, one must read the value on the abscissa corresponding to the desired probability and multiply the contrast limen (ϵ) by this constant. Thus, to arrive at a probability detection level of 90 percent, one must multiply the contrast limen associated with a set of data by the constant 1.62 (ref. 4).

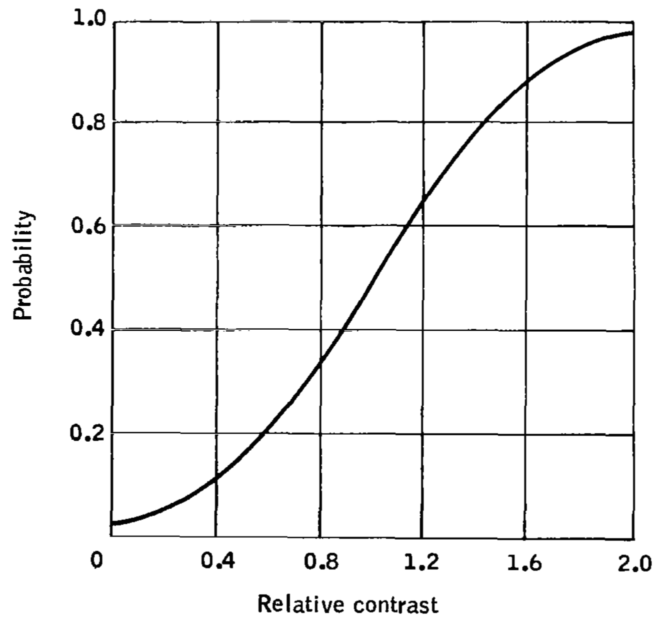


Figure 15. Average Probability Curve

Part III of this study is particularly relevant to our interests because Blackwell used achromatic steady stimuli with a wide range of background luminance levels and stimulus sizes.

Figures 16 and 17 are graphs of Blackwell's Part III data (ref. 4) which are results of a total of 90,000 observations from seven observers. The threshold values are determined for the 50-percent probability of detection level. Blackwell constructed a 10-degree background field and a stimulus projection system for the light stimulus. The one exception to the projected stimuli was the smallest stimulus (0.595') used. This smallest stimulus was provided by transilluminating a glass rod imbedded in a viewing background. Four small orientation lights at 2 degrees from the stimulus served to assist the subject in determining stimulus location. Blackwell used a 15-second stimulus duration which, he stated, proved to be adequate in eliciting the minimal threshold.

Hardy (ref. 5) has expanded Part III of the Tiffany study by extrapolating Blackwell's contrast limen curves to include stimulus angles of 0.01 minute. In addition, Hardy converted Blackwell's contrast limens to illuminance values which may easily be converted to star magnitude values. We have drawn from Hardy's Case 1 treatment where he considered the viewing condition of the background luminance as being superimposed on the stimulus. In this case $L' = L_s + L_o$ where L' is total luminance of the stimulus, L_s = luminance of stimulus separate from background luminance and L_o = background luminance. Contrast then becomes equal to

$$\epsilon = \frac{L' - L_o}{L_o} = \frac{L_s + L_o - L_o}{L_o} = \frac{L_s}{L_o}$$

where ϵ = contrast (Hardy used the symbol c). Thus,

$$L_s = \epsilon L_o$$

From the expression $E = \pi L \sin^2 \zeta$ used to define illumination at some point on the normal to a luminous field, Hardy has arrived at the expression $E = \epsilon L_o \zeta^2$ which he uses to convert Blackwell's contrast limens to illumination values. (See reference 5 for Hardy's treatment.) The symbol ϵ corresponds to contrast limen, L_o is in foot lamberts and corresponds to Blackwell's adopted symbol B (foot lamberts), and ζ is the radian value as determined by the arc subtended by the radius of the luminous field.

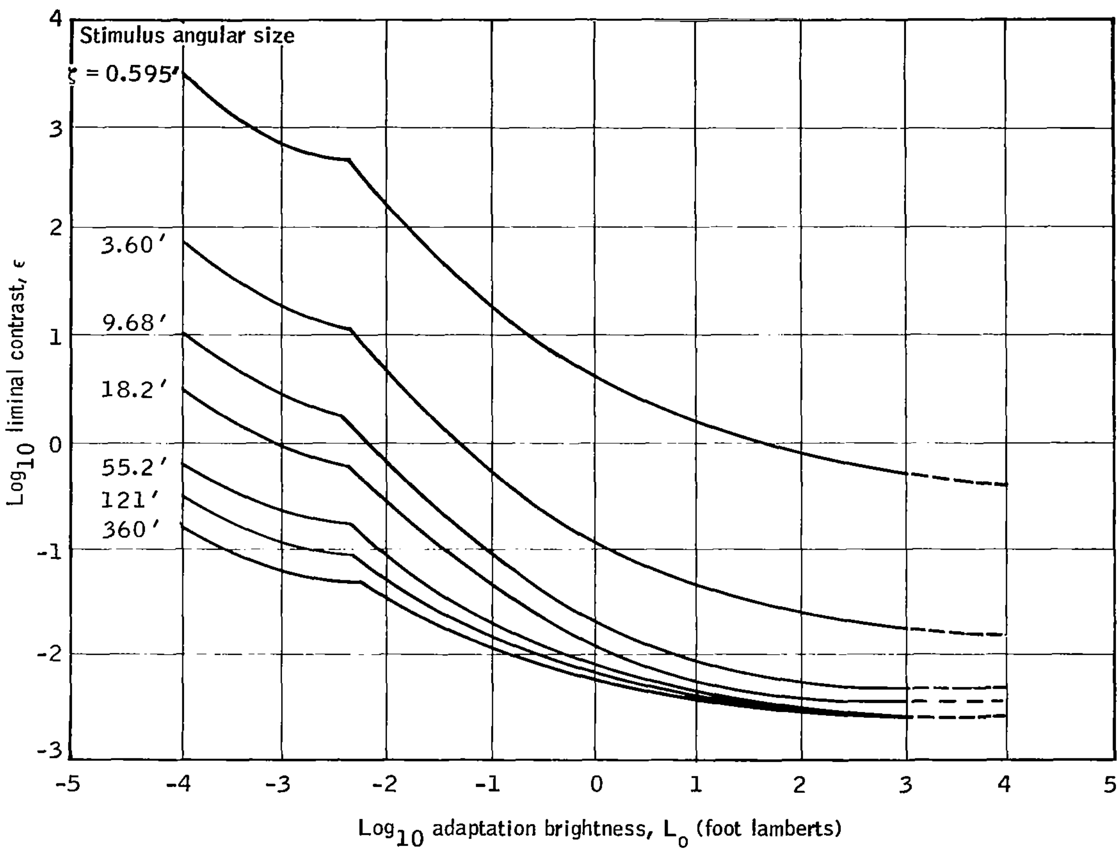


Figure 16. Thresholds of Brightness

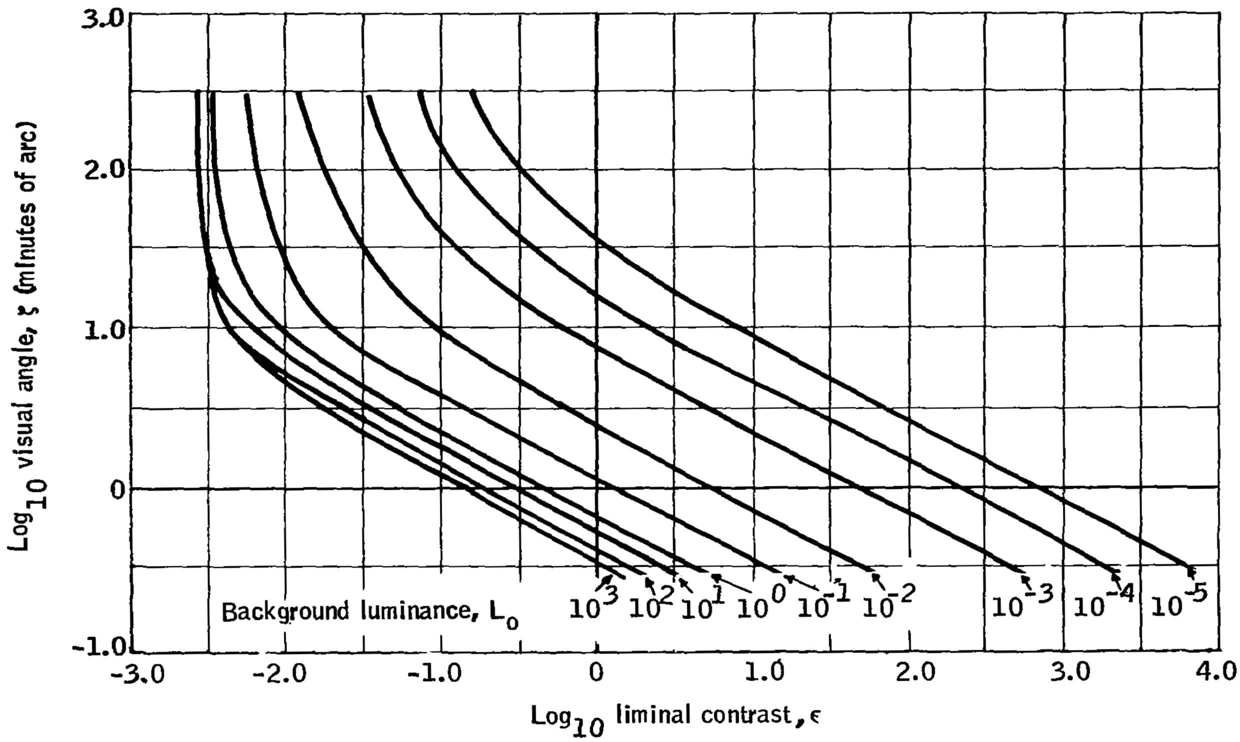


Figure 17. Interpolations from Figure 16 (Each curve shows the relationship between threshold contrast and stimulus area for a set of background luminance levels. Each curve is identified by its accordance with its background luminance level)

In applying this equation ($E = \epsilon L_o \zeta^2$) to Part III of the Tiffany study, Hardy determined illumination and corresponding star magnitude thresholds over a range of eight orders of background luminance levels.

Hardy's values are for the 50-percent probability of detection level and therefore must be converted to the 90-percent detection level for our purposes. This can be done by either multiplying Blackwell's contrast limens by 1.62 (Blackwell) or by subtracting 0.52 from Hardy's 50-percent star detection level (Table 6). In addition, Hardy has assigned an illuminance value of 1.94×10^{-7} foot candles for a star of zero magnitude. To convert this to Allen's illuminance value of 2.46×10^{-7} foot candles for a star of zero magnitude in space, we have added 0.255 to Hardy's stellar magnitude threshold values. It is this set of values that we have used as our stellar threshold magnitudes for the unaided eye.

Figure 18 was plotted to serve as our stellar prediction threshold model. The abscissa corresponds to the background luminance level which is superimposed upon the star luminance. On the right hand ordinate or margin an illumination scale has been included which permits the reader to relate a threshold value to a corresponding illumination value (E_t). The illumination scale is a logarithmic scale with values expressed in positive form in accordance with mathematical convention. Thus, a characteristic of (-8.00) would have an equivalent form of (4.00 - 12.00).

TABLE 6. - STELLAR THRESHOLD MAGNITUDES FOR UNAIDED BINOCULAR VISION
(stimulus size equals 0.01 arc min)

Background Luminance, L_o	(Hardy) m_t Probability = 50%	m_t Probability =90%	Star Visual Magnitude Corrected for Space (Probability = 90%)
10^3	-2.80	-3.32	-3.065
10^2	-0.79	-1.31	-1.055
10^1	1.23	0.71	0.965
10^0	3.09	2.57	2.825
10^{-1}	4.56	4.04	4.295
10^{-2}	5.45	4.93	5.185
10^{-3}	5.63	5.11	5.365
10^{-4}	6.55	6.03	6.285
10^{-5}	7.58	7.06	7.315

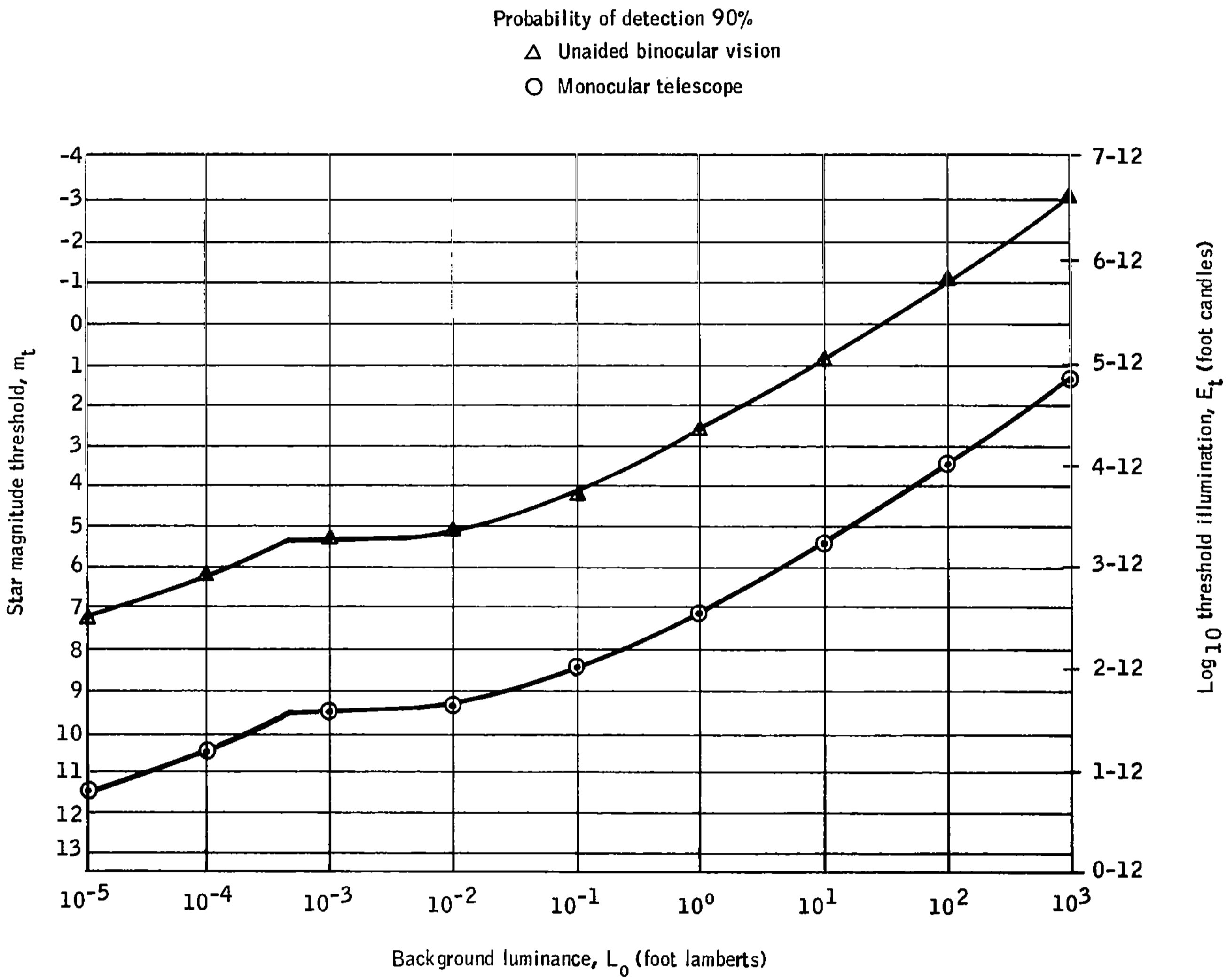


Figure 18. Star Magnitude Detection Threshold versus Background Luminance (in space)

Discussion of Star Threshold Model for Sextant Telescope

The star threshold model is simply a two-curve plot with two scales that permit relating thresholds either in terms of stellar magnitude or illumination in units of foot candles. All values have been corrected to read star magnitude thresholds for the 90-percent probability of detection level and for exo-atmospheric viewing conditions.

We have generated a stellar magnitude threshold curve that corresponds to a sextant telescope with a 32-mm objective lens, a 4-mm exit pupil, a magnification factor (M) of 8X and a light transmittance factor (τ) of 0.65. We have based our set of telescope threshold values on the premise that illumination from the background is decreased by the transmittance factor 0.65 and that illumination from a star is increased by the numerical factor 41.6. The factor 41.6 is arrived at by calculating the product of $M^2\tau$ or by the more accepted method of multiplying the transmittance factor times the square of the ratio of the objective lens to the exit pupil.

To correct for the expected change in star magnitude threshold values when viewing through a telescope of these characteristics, we have first corrected for the threshold change resulting in a background luminance level reduction and then considered the stellar illumination increase. Star magnitude has not been altered for the window transmittance factor because the nominal transmittance was near 1.0 and thus its effect is second order.

This correction may be made by a number of methods. One method would be to refer to the star magnitude curve for the unaided eye. Using each decade interval (10^{-5}, 10^{-4}) on the abscissa as reference points and, from points on the abscissa corresponding to 0.65 x these reference points, construct vertical lines to the above unaided eye detection curve. At these junctions draw horizontal lines back to the vertical grid line corresponding to each of their respective reference values. These junctions would then serve as loci to construct a curve which would correct star magnitude threshold for the background luminance reduction occurring with a prescribed telescope.

Though this method is fairly straightforward, we believe a measure of accuracy can be gained by constructing a plot of contrast threshold versus background luminance based on Hardy's star magnitude thresholds for a 0.01-minute stimulus size. We use the set of star magnitude values (Probability = 90%) from Table 6 (third column) for the basis of this curve. Hardy's star magnitude values are converted to corresponding illumination values and stated in footcandles. We then solved the equation $\varepsilon = E_t/\zeta^2 L_o$ for each decade (10^{-5}, 10^{-4}, etc.) background luminance value (Table 7). From this table of values we have plotted contrast as a function of background luminance (Figure 19).

TABLE 7. - CALCULATION OF CONTRAST USING $E = \zeta^2 L_o \varepsilon$ FOR ζ OF 0.01 MINUTE (PROBABILITY = 90%)

L_o	$\log_{10}E_t$	E_t	ζ^2	ε
10^{-5}	0.4649-10	2.917×10^{-10}	2.115×10^{-12}	1.379×10^{7}
10^{-4}	0.8769-10	7.532×10^{-10}	2.115×10^{-12}	3.561×10^{6}
10^{-3}	1.2449-10	17.58×10^{-10}	2.115×10^{-12}	8.312×10^{5}
10^{-2}	1.3209-10	20.93×10^{-10}	2.115×10^{-12}	9.896×10^{4}
10^{-1}	1.6729-10	47.09×10^{-10}	2.115×10^{-12}	2.226×10^{4}
10^{0}	2.2609-10	182.4×11^{-10}	2.115×10^{-12}	8.624×10^{3}
10^{1}	3.0049-10	1011×10^{-10}	2.115×10^{-12}	4.780×10^{3}
10^{2}	3.8129-10	6550×10^{-10}	2.115×10^{-12}	3.073×10^{3}
10^{3}	4.6169-10	41390×10^{-10}	2.115×10^{-12}	1.956×10^{3}

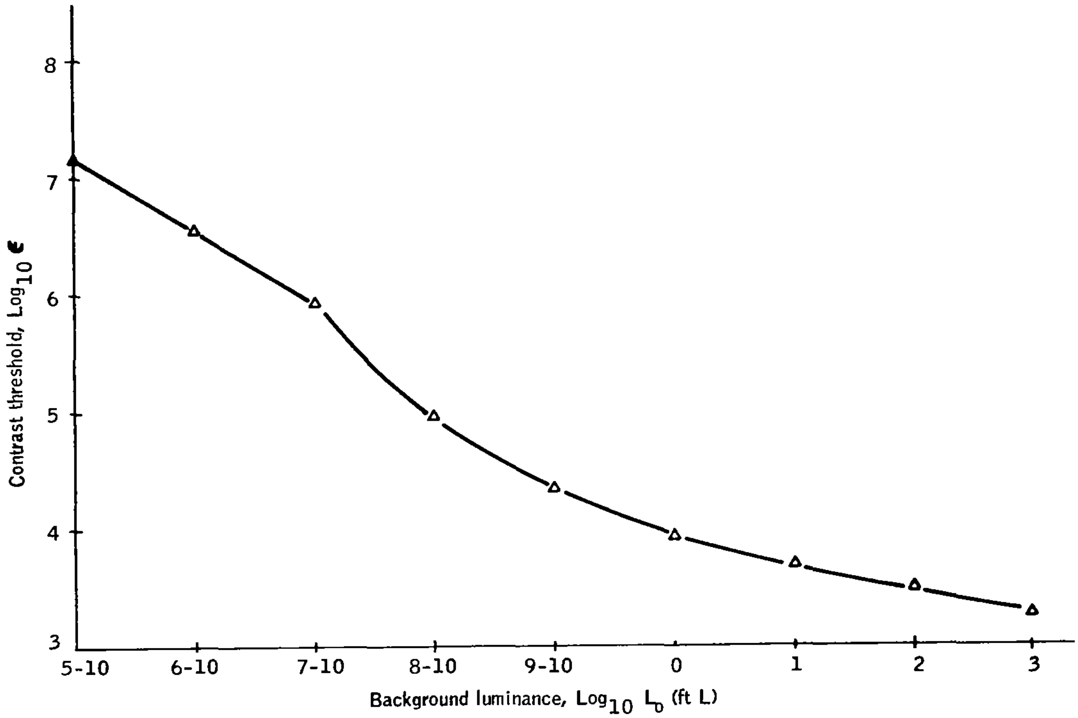


Figure 19. Contrast Threshold as a Function of Background Luminance for Stimulus Size of 0.01 arc minute

From an enlarged plot of Figure 19 we then determine contrast thresholds for a set of values corresponding to 0.65 x each decade value (Table 8, column 3). These contrast threshold values were then used in the expression $E_t = \zeta^2 L_o \epsilon$ to determine the illumination threshold (E_t) in foot candles. These illumination threshold values thus correspond to stellar magnitude thresholds while viewing with our prescribed telescope with consideration given only to the background luminance change that would result due to the transmittance factor.

The second step necessary is to consider the increase in stellar illumination realized while viewing with the telescope. As stated previously, we have assumed a 41.6 x increase in stellar illumination when viewing with the sextant telescope. Hence, we have subtracted 1.619 ($\log_{10}$ 41.6) from the $\log_{10} E_t$ values arrived at after considering the background luminance correction (Table 8, column 6). This set of values then serves as the numerical

TABLE 8. - LIMINAL STAR MAGNITUDE DETECTION WITH A SEXTANT TELESCOPE (Stimulus Size = 0.01 arc minute, $\zeta^2 = 2.115 \times 10^{-12}$)

L_o (ft L) (unaided eye)	L_o (ft L) (aided eye)	ϵ	$E_t = (\zeta^2 L_o \epsilon)$	$\log_{10} E_t$	$\log_{10} E_t - 1.6191$ *
10^{-5}	0.65×10^{-5}	1.7×10^{7}	2.337×10^{-10}	2.3687-12	0.7496-12
10^{-4}	0.65×10^{-4}	4.4×10^{6}	6.049×10^{-10}	2.7817-12	1.1626-12
10^{-3}	0.65×10^{-3}	1.1×10^{6}	1.512×10^{-9}	3.1796-12	1.5605-12
10^{-2}	0.65×10^{-2}	1.3×10^{5}	1.787×10^{-9}	3.2521-12	1.6330-12
10^{-1}	0.65×10^{-1}	2.7×10^{4}	3.712×10^{-9}	3.5696-12	1.9505-12
10^{0}	0.65×10^{0}	1.0×10^{4}	1.375×10^{-8}	4.1383-12	2.5192-12
10^{1}	0.65×10^{1}	5.0×10^{3}	6.874×10^{-8}	4.8371-12	3.2181-12
10^{2}	0.65×10^{2}	3.2×10^{3}	4.399×10^{-7}	5.6434-12	4.0243-12
10^{3}	0.65×10^{3}	2.1×10^{3}	2.887×10^{-6}	6.4605-12	4.8414-12

*The set of values in this column are the star illumination threshold values while viewing with the prescribed telescope, for 90 percent probability of detection, and for the exo-atmospheric viewing condition.

base for the stellar magnitude threshold curve as a function of background luminance for the aided eye.

In practice, our model has some evident shortcomings. Regarding the reduction in background luminance level when viewing with or without the telescope, it is not likely that the viewing field will be devoid of other stars. Stars especially in close proximity to the viewing star will obviously contribute some to light adaptation and then raise the visual threshold. In addition, we have assumed instant dark adaptation when in reality it is a rather slow process and therefore the assumption of complete adaptation is only partially correct for this case.

STAR THRESHOLD CALCULATIONS

This section describes the calculation techniques used in making the star threshold predictions. Three different calculation procedures were used, one for each of the following conditions: the window distant from the planet, the window near the planet, and the back reflections inside the spacecraft.

The condition where the window is distant from a planet is the easiest and will be discussed first. The illumination incident (foot candles) on the window can be assumed collimated and incident from a single direction so the two-dimensional experimental scatter data is directly applicable. That incident illumination is then multiplied by the percent of scattering to give the scattered contribution to the background luminance. This background value is used to obtain the star magnitude threshold. A numerical example of this particular calculation is presented in Appendix C.

The technique describing the close-in situation follows: The two-dimensional experimental scattering data could not be applied directly to this three-dimensional physical condition, so a somewhat realistic but highly simplified calculation scheme was devised. The illumination incident on the spacecraft window was calculated for conical segments symmetric about the window normal. This calculation is described in a previous section.

There are two experimental two-dimensional angles which fall in the conical segment. All the energy was assumed to be contained in the first quadrant. For the conditions where the illumination was contained in more than one conical section, the total scatter luminance was computed by summing of the individual contributions.

Back reflection inside the spacecraft was considered in two separate ways. First, the transmitted light beam was assumed to reflect from an 85-percent diffusely reflecting space suit that was one foot from the window. Because the entire 6-inch diameter beam was assumed to be reflected from the suit, the suit was approximated by a semi-infinite diffuse plane. Reflections off the window (See Appendix E for experimental data) as well as scattering was included in the computation.

The interior of the spacecraft was also modeled by a 9-foot diameter sphere that diffusely reflected 85 percent of the illumination. Again, the specular reflection measured in the laboratory (Appendix E) was included in the computational scheme. To simplify the numerical effort, a computer program was written to accomplish the computations. Results for each of the above models is presented in the next section along with the data which assumed no internal reflections.

RESULTS AND DISCUSSION

Introduction

Scatter measurements were performed on four window specimens as well as on a specially-prepared Supracil standard. The windows were uncoated, HEA-coated and MgF_2-coated Corning Vycor glass. Using the scatter distributions for each respective window, threshold conditions were computed under which an astronaut could detect a star through such background luminance as was afforded by the scattered light (or reflected light from the spacecraft interior).

Before discussing the threshold values in detail, mention need be made of the scattering distributions obtained in the experimental phase of the program. All of the experimental data obtained during the course of the experiment is presented in Appendix D. However, the objective of this contract was to obtain the maximum, the minimum and the arithmetic average values of star magnitude that could be detected.

The maximum and minimum scattering values were selected from the data taken for each window configuration. By maximum and minimum are meant the locations where the scattering has a maximum and a minimum value for the particular window under consideration. All of the available data is not presented in graphical form to eliminate the bulk required. Sufficient understanding of the trends of the available data can be obtained from a study of the graphical data encompassing selected maximum and minimum scatter values.

Scatter Measurements

Figures 20 through 25 illustrate the scattering distributions at the particular window incident orientation (Ψ angles) where the maximum and the minimum scattering occur for windows 208, 240, and 246. The discontinuous

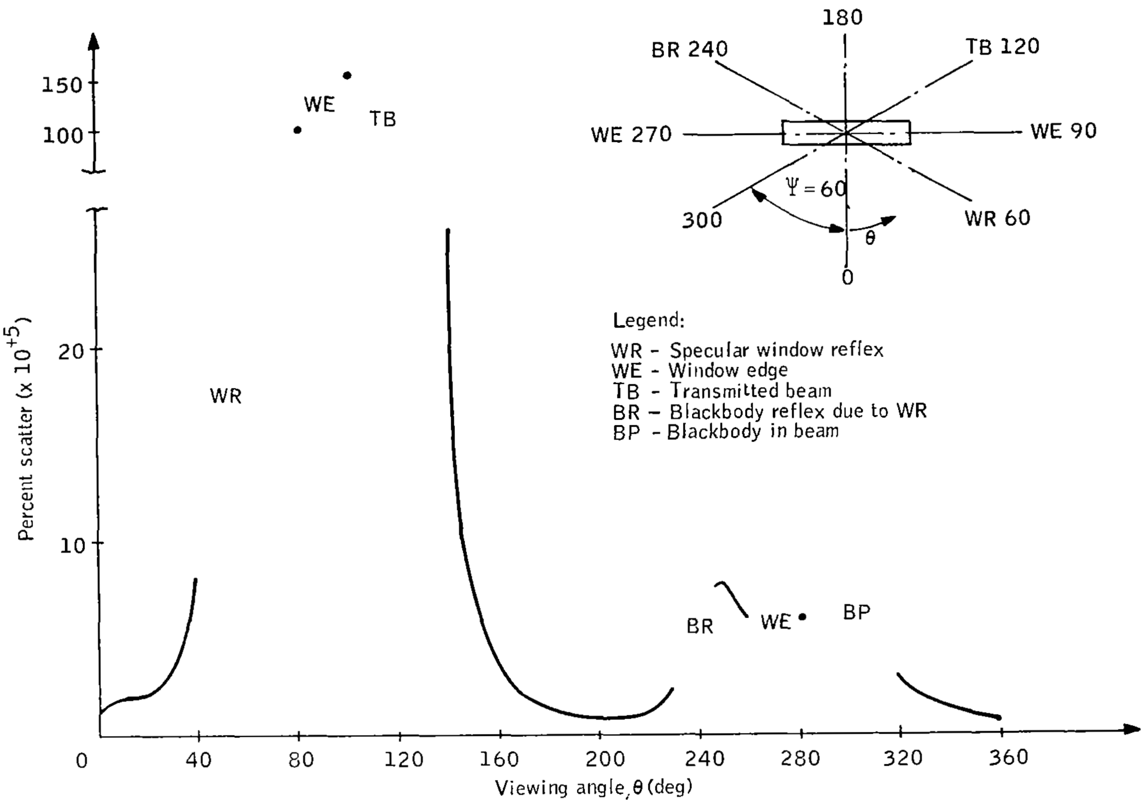


Figure 20. Scatter Distributions for Window No. 208 (ψ = 60 degrees)

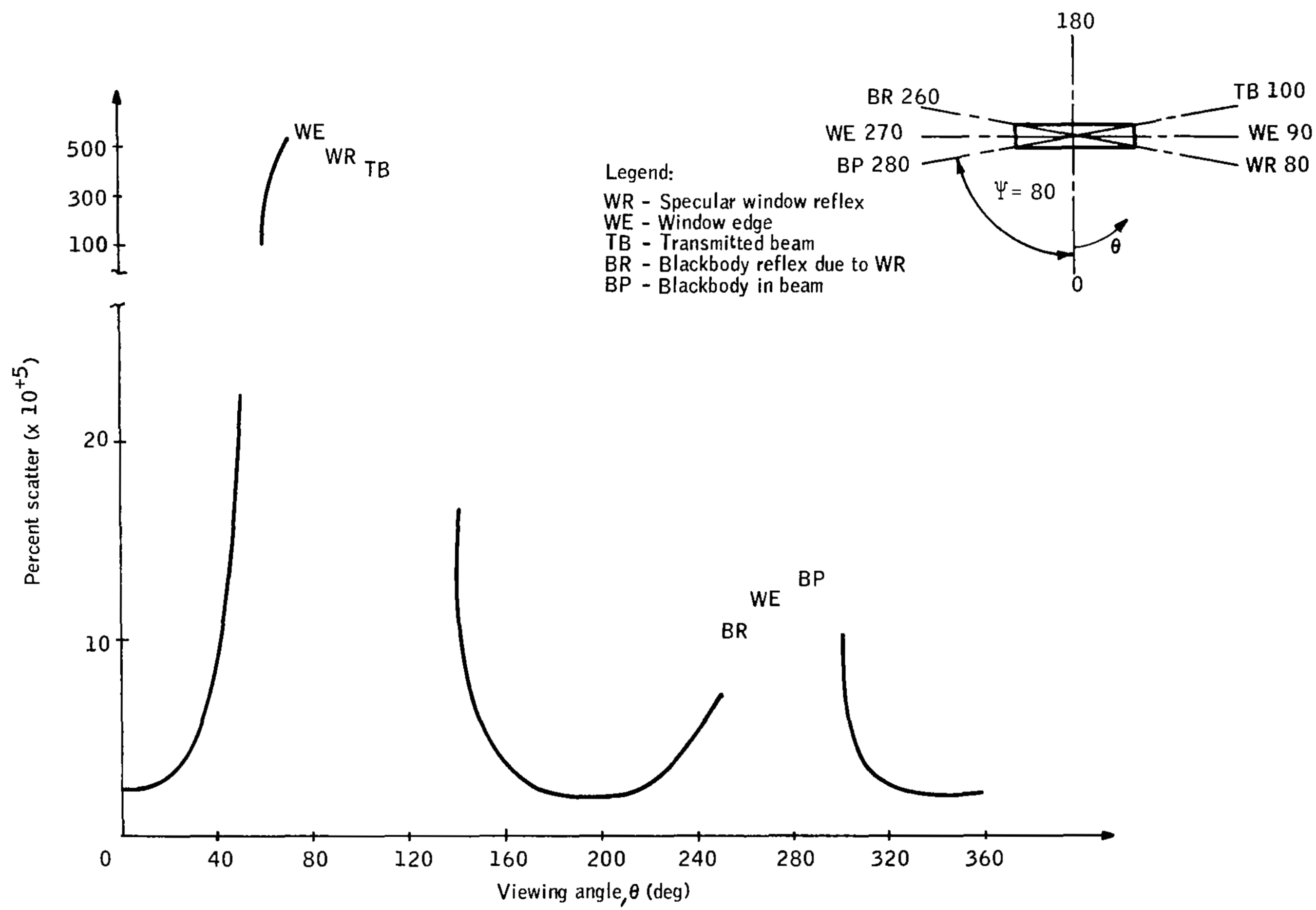


Figure 21. Scatter Distributions for Window No. 208 (Ψ = 80 Degrees)

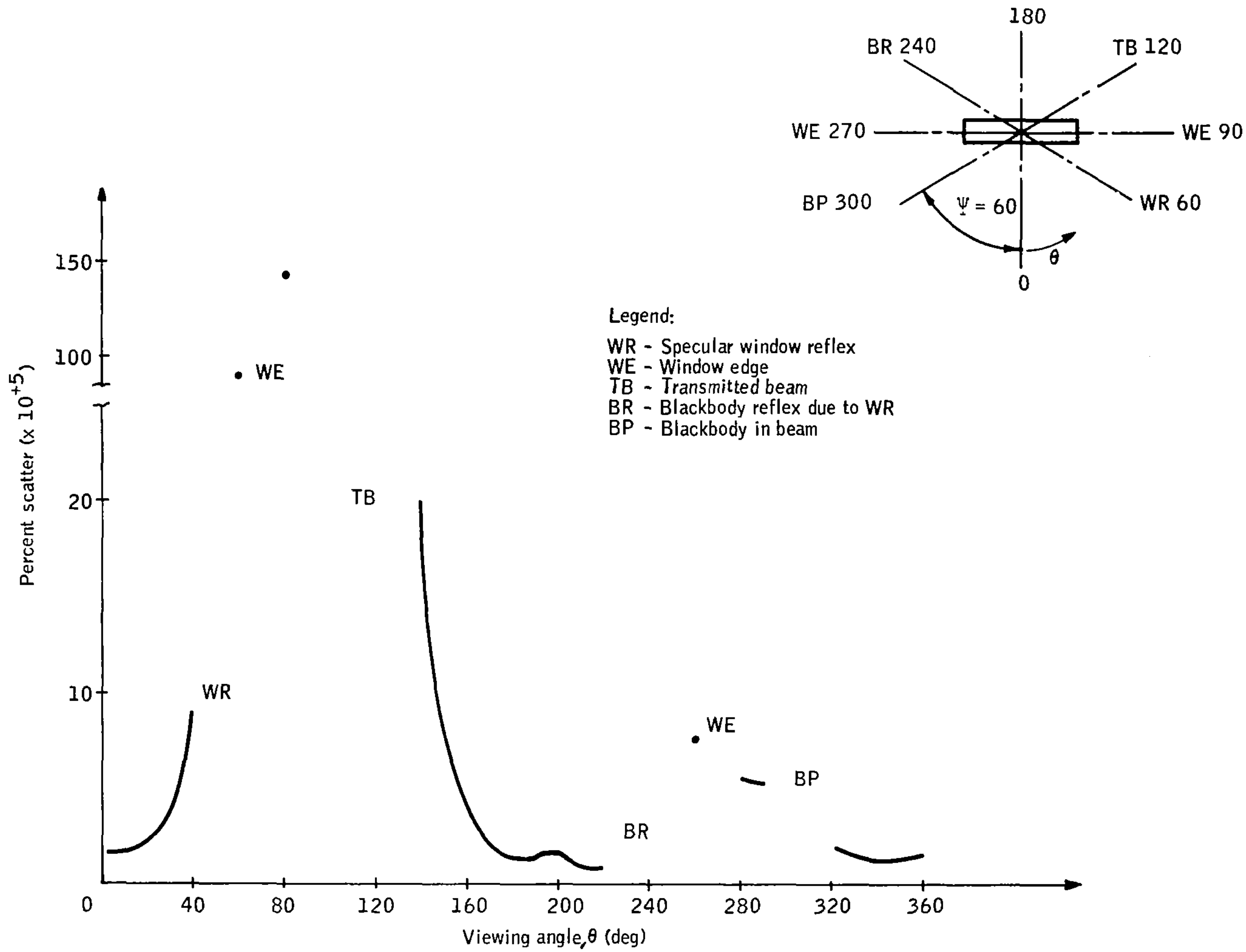


Figure 22. Scatter Distributions for Window No. 240 (ψ = 60 degrees)

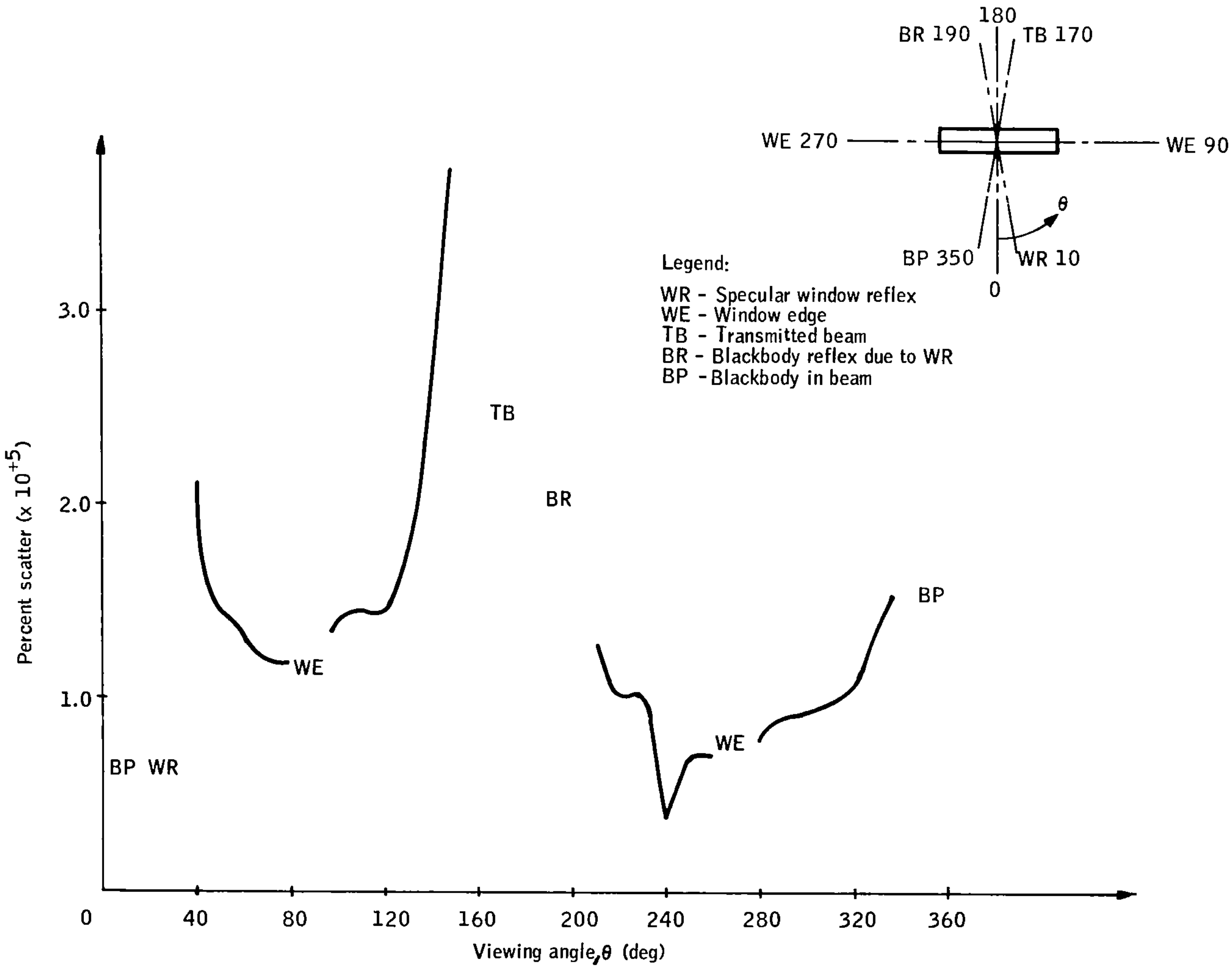


Figure 23. Scatter Distributions for Window No. 240 (ψ = 10 degrees)

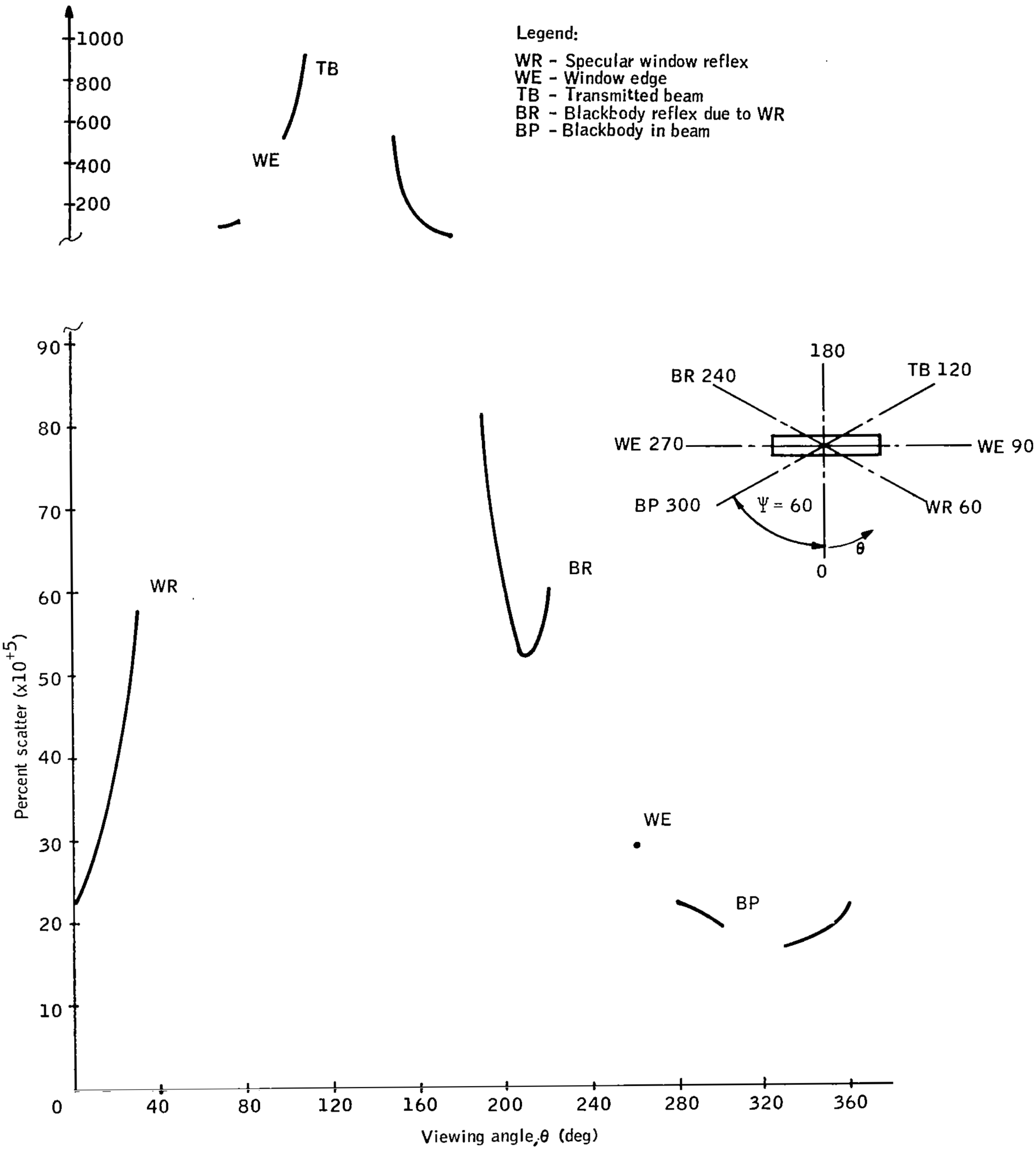


Figure 24. Scatter Distributions for Window No. 246 (Ψ = 60 degrees)

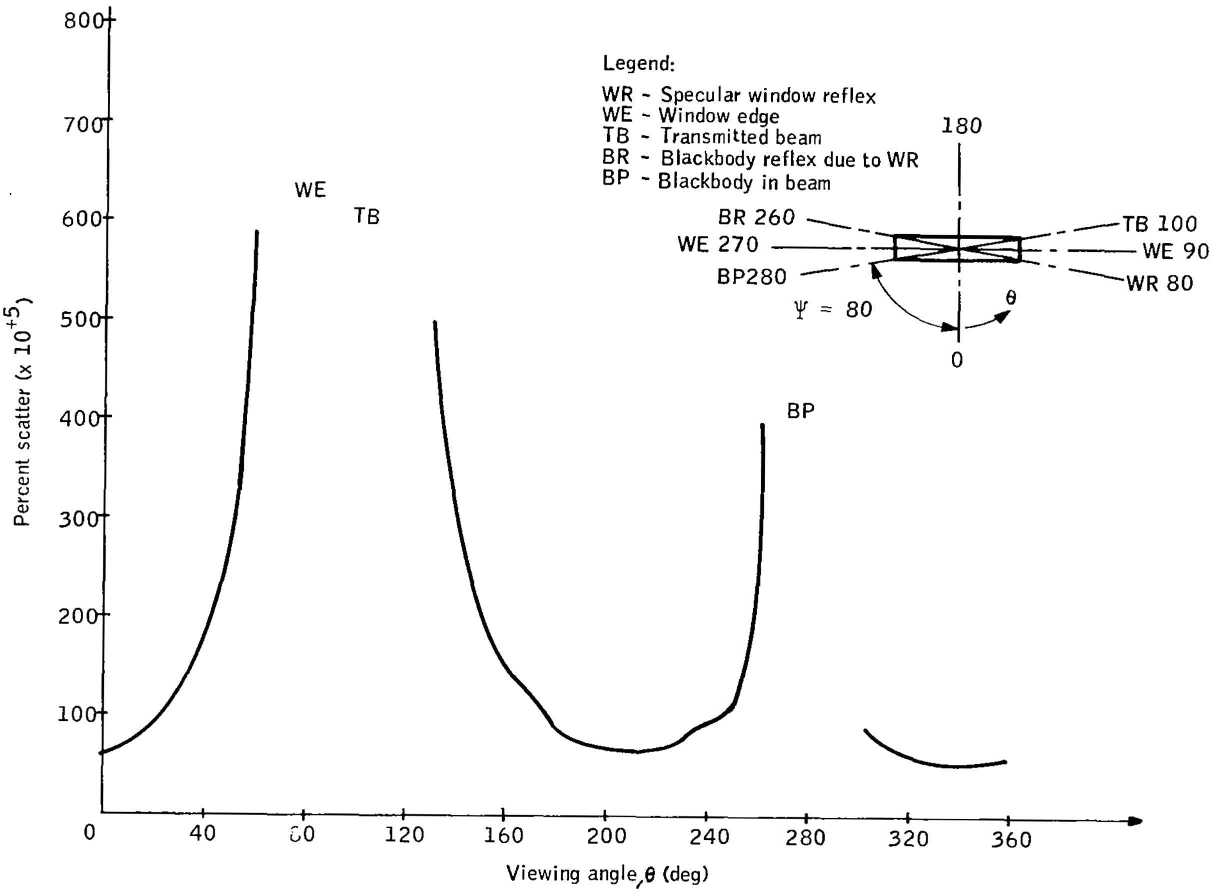


Figure 25. Scatter Distribution of Window No. 246 (Ψ = 80 degrees)

character of the data would indicate few anomalous inputs during the course of the experiment.

The discontinuities evident in Figures 20 through 25 are due to physical constraints inherent in the measurement apparatus and the physics of the problem. In particular, referring to Figure 20, WR denotes the specular reflection from the window. As the window-sun angle increases (i. e., $\Psi > 0°$) the specular reflection from the window is incident on the photometer at larger θ values. Although a valid measurement can (and was) be made at this position, the data from a scattering standpoint is anomalous. Also when the photometer is rotated to $\theta = 90$ degrees or 250 degrees WE, the line of sight is parallel with the front and back surfaces of the window. In effect, the measurement is of the background only. The notation TB refers to the transmitted beam. The intense 6-inch diameter beam is, to a large extent, transmitted by the window (s). Again, measurements could have been made but they would have indicated the transmittance of the window and not the scattering in a particular direction. When the photometer is rotated such that the blackbody is flooded by the transmitted beam, the photometer views a background (the illuminated blackbody) that is of higher intensity than the scattering per se. Consequently measurements could not be made at this position. In like manner, the blackbody can not be placed directly in the path of the light beam which is specularly reflected from the window. This instance is denoted BR.

Of particular interest is a direct comparison of Figures 20 and 22. These curves include the locations where the lowest scattering value occurs for windows 208 (MgF_2) and 240 (uncoated). The two scattering distributions are quite similar. This likeness is remarkable in light of the differences in the two windows. Equally surprising is the fact that the maximum values for scattering occur at the same viewing angle (θ) as well as the same angle of incidence (Ψ). By referring to Appendix D, other similarities are evident in the bulk of the scattering data.

Figures 21 and 23 contain the values of minimum scattering for windows 208 and 240. It is difficult to make a significant comparison because the minimums occur at different viewing angles. The data is included in graphical form for purposes of illustration only.

The scattering distribution for window 246 (HEA) is presented in Figures 24 and 25. These distributions have particular significance in light of the discussion on surface imperfections in the section entitled "Experimental Method." As was noted, scattering values are obtained that are an order of magnitude greater than for all other windows. This increased scattering appears to be due to the surface coating. The mechanism in the surface coating causing the light scatter is unknown.

The scattering distribution from a specially polished 6-inch diameter Supracil test sample was measured. The data is presented in Appendix D. The general scattering levels from the Supracil standard were of the same order as the scattering from the windows (except of course the one poorer quality HEA). It is sufficient to state that the polish provided on the windows is of high quality for reduced light scatter.

The three-dimensional data were taken on windows 240 and 244 to obtain representative scattering values. This three-dimensional data is seen to be roughly the same as the horizontal plane data. For an exact numerical comparison, the interested reader is referred to Appendix D where all data is tabulated. It should be noted that the background levels were reduced in the three-dimensional configurations; therefore, no corrections were made to the data experimental background illumination.

Detection Thresholds

The data from the four windows and the two window combinations (244 and 208, 244 and 246) was used to make star magnitude threshold predictions based on the vision theory proposed earlier in this report for a specific source of luminance.

The star magnitude threshold predictions are presented in tabular form in Tables 9 through 14. These star threshold values are presented for each window studied, illuminated by an external source of light and for window 208 and a 208 and 246 combination illuminated by the internal reflection of the transmitted light beam. It should be noted that experimental scattering measurements were not made on the 246 and 208 combination. Instead, the individual scattering contributions were numerically added. This procedure is justified in the next subsection.

The tables contain star threshold values for the maximum, the minimum, and the average scattering values measured for the windows specified. Specific values of ψ and θ are given for the maximum and minimum. The star threshold computations are based on two modes of observations, i.e., the naked eye and the telescope. Maximum means the largest valid scattering value measured. Obviously measurements made of the transmitted beam, the specular reflection, or of the blackbody in the transmitted beam would be greatest in magnitude. However, such measurements are not herein considered valid scattering measurements. For example, when ψ = 0 deg, the transmitted beam extends from θ of 165 degrees to 195 degrees. Therefore, the valid data points adjoining this segment are θ of 160 degrees and 200 degrees (See Appendix D). Other anomalous data points are self evident in the raw data sheets presented in Appendix D. The minimum data point refers to the lowest valid scattering value measured; the average refers to an arithmetic average of the maximum and the minimum scattering for the window considered.

In general, Tables 9 through 14 indicate that, using a telescope, an astronaut in a spacecraft that is distant from the earth or moon will be able to see stars less bright than a magnitude of 2.00. On the other hand, with the naked eye, an astronaut would have difficulty detecting the usual navigational stars under background conditions produced by the light scatter from windows studied in this program.

TABLE 9.- STAR MAGNITUDE PREDICTIONS, SUN AT 1 AU

Window Scatter	Mode of Observation	Veiling Luminance									
		No Internal Reflection						With Internal Reflection			
		Window 208	Window 240	Window 244	Window 246	Window 244&208	Window 244&246	Window 208		Window 208&246	
Maximum		$\Psi = 60^\circ$ $\theta = 100^\circ$	$\Psi = 60^\circ$ $\theta = 100^\circ$	$\Psi = 60^\circ$ $\theta = 100^\circ$	$\Psi = 50^\circ$ $\theta = 100^\circ$	$\Psi = 50^\circ$ $\theta = 100^\circ$	$\Psi = 60^\circ$ $\theta = 100^\circ$	$\Psi = 80^\circ$ $\theta = 0^\circ$		$\Psi = 80^\circ$ $\theta = 0^\circ$	
								a*	b*	a*	b*
	Telescope	5.50	5.50	5.50	3.70	3.50	3.30	3.60	2.75	2.75	2.00
	Eye	1.00	1.00	1.00	-0.75	-1.00	-1.15	-0.95	-1.75	-1.75	-3.20
Minimum		$\Psi = 80^\circ$ $\theta = 200^\circ$	$\Psi = 10^\circ$ $\theta = 100^\circ$	$\Psi = 80^\circ$ $\theta = 220^\circ$	$\Psi = 80^\circ$ $\theta = 210^\circ$	$\Psi = 80^\circ$ $\theta = 210^\circ$	$\Psi = 60^\circ$ $\theta = 220^\circ$	$\Psi = 0^\circ$ $\theta = 100^\circ$		$\Psi = 0^\circ$ $\theta = 100^\circ$	
	Telescope	8.75	8.05	9.50	6.50	8.25	6.75	5.65	4.75	4.75	5.50
	Eye	4.50	3.80	5.25	2.25	4.00	2.35	1.10	0.35	0.35	1.10
Average	Telescope	6.00	6.00	6.00	4.25	4.00	3.80	4.25	3.05	3.00	3.45
	Eye	1.50	1.70	1.50	-0.25	-0.25	-0.45	-0.25	-1.40	-1.50	-0.65

*a – Reflection off astronaut helmet

b – Spacecraft internal reflection (9 ft dia)

TABLE 10. - STAR MAGNITUDE PREDICTIONS, EARTH AT 2 x 10^5 KM

Window Scatter	Mode of Observation	Veiling Luminance									
		No Internal Reflection						With Internal Reflection			
		Window 208	Window 240	Window 244	Window 246	Window 244& 208	Window 244& 246	Window 208		Window 208& 246	
Maximum		$\Psi = 60^o$ $\theta = 100^o$	$\Psi = 60^o$ $\theta = 100^o$	$\Psi = 60^o$ $\theta = 100^o$	$\Psi = 50^o$ $\theta = 110^o$	$\Psi = 50^o$ $\theta = 100^o$	$\Psi = 60^o$ $\theta = 100^o$	$\Psi = 80^o$ $\theta = 0^o$		$\Psi = 80^o$ $\theta = 0^o$	
								a*	b*	a*	b*
	Telescope	6.60	6.80	4.90	5.10	4.95	5.10	3.75	3.50	3.50	2.75
	Eye	2.30	2.50	0.15	0.60	0.35	0.50	-0.75	-1.00	-1.00	-1.75
Minimum		$\Psi = 80^o$ $\theta = 200^o$	$\Psi = 10^o$ $\theta = 100^o$	$\Psi = 80^o$ $\theta = 220^o$	$\Psi = 80^o$ $\theta = 210^o$	$\Psi = 80^o$ $\theta = 210^o$	$\Psi = 60^o$ $\theta = 220^o$	$\Psi = 0^o$ $\theta = 100^o$		$\Psi = 0^o$ $\theta = 100^o$	
	Telescope	9.50	9.08	9.60	8.00	9.25	8.00	-1.00	6.30	6.25	4.75
	Eye	5.20	4.80	5.65	3.75	5.00	3.75	2.50	1.85	1.75	0.35
Average	Telescope	7.35	7.30	7.35	5.80	5.60	5.80	5.00	4.00	4.00	3.15
	Eye	3.00	3.10	3.00	1.25	1.10	1.30	0.50	-0.50	-0.50	-1.35

*a – Reflection off astronaut helmet

b – Spacecraft internal reflection (9 ft dia)

TABLE 11. - STAR MAGNITUDE PREDICTIONS, EARTH AT 1 x 10^5 KM

Window Scatter	Mode of Observation	Veiling Luminance									
		No Internal Reflection						With Internal Reflection			
		Window 208	Window 240	Window 244	Window 246	Window 244&208	Window 244&246	Window 208		Window 208&246	
Maximum		$\Psi = 60^\circ$ $\theta = 100^\circ$	$\Psi = 60^\circ$ $\theta = 100^\circ$	$\Psi = 60^\circ$ $\theta = 100^\circ$	$\Psi = 50^\circ$ $\theta = 110^\circ$	$\Psi = 50^\circ$ $\theta = 100^\circ$	$\Psi = 60^\circ$ $\theta = 100^\circ$	$\Psi = 80^\circ$ $\theta = 0^\circ$		$\Psi = 80^\circ$ $\theta = 0^\circ$	
								a*	b*	a*	b*
	Telescope	6.00	6.00	4.00	4.10	3.90	3.75	4.00	2.90	3.00	2.75
	Eye	1.40	1.50	-0.50	0.30	-0.50	-0.75	-0.50	-1.60	1-.50	-1.25
Minimum		$\Psi = 80^\circ$ $\theta = 200^\circ$	$\Psi = 10^\circ$ $\theta = 100^\circ$	$\Psi = 80^\circ$ $\theta = 220^\circ$	$\Psi = 80^\circ$ $\theta = 210^\circ$	$\Psi = 80^\circ$ $\theta = 210^\circ$	$\Psi = 60^\circ$ $\theta = 220^\circ$	$\Psi = 0^\circ$ $\theta = 100^\circ$		$\Psi = 0^\circ$ $\theta = 100^\circ$	
	Telescope	9.30	8.90	9.60	7.50	9.00	7.75	7.25	6.65	6.75	8.50
	Eye	5.10	4.65	5.40	3.20	4.75	3.40	3.00	2.20	2.10	4.05
Average	Telescope	6.40	6.50	6.40	5.70	4.50	5.40	4.00	3.25	3.40	4.10
	Eye	2.00	2.10	2.00	1.20	0.00	1.00	0.50	-1.15	-1.20	-0.05

*a – Reflection off astronaut helmet

b – Spacecraft internal reflection (9 ft dia)

TABLE 12. - STAR MAGNITUDE PREDICTIONS, MOON AT 3.8 x 10^5 KM

Window Scatter	Mode of Observation	Veiling Luminance									
		No Internal Reflection						With Internal Reflection			
		Window 208	Window 240	Window 244	Window 246	Window 244&208	Window 244&246	Window 208		Window 208&246	
Maximum		$\Psi = 60^o$ $\theta = 100^o$	$\Psi = 60^o$ $\theta = 100^o$	$\Psi = 60^o$ $\theta = 100^o$	$\Psi = 50^o$ $\theta = 110^o$	$\Psi = 50^o$ $\theta = 100^o$	$\Psi = 60^o$ $\theta = 100^o$	$\Psi = 80^o$ $\theta = 0^o$		$\Psi = 80^o$ $\theta = 0^o$	
								a*	b*	a*	b*
	Telescope	7.30	7.25	5.80	5.95	5.70	5.60	4.50	3.75	3.60	2.85
	Eye	3.10	3.25	1.30	1.40	1.25	1.10	0.00	-0.75	-0.90	-1.65
Minimum		$\Psi = 80^o$ $\theta = 200^o$	$\Psi = 10^o$ $\theta = 100^o$	$\Psi = 80^o$ $\theta = 220^o$	$\Psi = 80^o$ $\theta = 210^o$	$\Psi = 80^o$ $\theta = 210^o$	$\Psi = 60^o$ $\theta = 220^o$	$\Psi = 0^o$ $\theta = 100^o$		$\Psi = 0^o$ $\theta = 100^o$	
	Telescope	9.70	9.25	9.90	8.35	9.30	8.10	7.50	6.50	6.50	4.90
	Eye	5.25	5.00	5.55	4.15	5.05	3.90	3.20	2.25	2.25	0.50
Average	Telescope	7.75	7.90	7.75	6.30	6.30	6.10	5.25	4.25	4.40	3.50
	Eye	3.45	3.60	3.45	2.00	1.80	1.60	0.75	-0.25	-0.25	-0.30

*a – Reflection off astronaut helmet

b – Spacecraft internal reflection (9 ft dia)

TABLE 13. - STAR MAGNITUDE PREDICTIONS, EARTH AT 200 KM

Window Scatter	Mode of Observation	Veiling Luminance									
		No Internal Reflection						With Internal Reflection			
		Window 208	Window 240	Window 244	Window 246	Window 244&208	Window 244&246	Window 208		Window 208&246	
Maximum		$\theta = 0^{o}$	$\theta = 0^{o}$	$\theta = 0^{o}$	$\theta = 0^{o}$	$\Psi = 50^{o}$, $\theta = 100^{o}$	$\Psi = 60^{o}$, $\theta = 100^{o}$	$\Psi = 80^{o}$, $\theta = 0^{o}$		$\Psi = 80^{o}$, $\theta = 0^{o}$	
								a*	b*	a*	b*
	Telescope	2.50	2.50	2.40	1.00	0.75	0.50	1.00	0.00	0.00	-0.50
	Eye	-2.00	-2.00	-2.10	-3.75	-4.25	-4.60	-3.75	-4.95	-4.75	-5.25
Minimum		$\theta = 160^{o}$	$\theta = 160^{o}$	$\theta = 160^{o}$	$\theta = 160^{o}$	$\Psi = 80^{o}$, $\theta = 210^{o}$	$\Psi = 80^{o}$, $\theta = 220^{o}$	$\Psi = 0^{o}$, $\theta = 160^{o}$		$\Psi = 0^{o}$, $\theta = 160^{o}$	
	Telescope	6.60	6.70	6.70	3.75	3.50	3.25	3.50	2.75	2.75	2.25
	Eye	2.20	2.30	2.30	-1.30	-1.05	-0.80	-1.20	-1.40	-1.50	-2.10
Average	Telescope	3.10	3.05	2.50	1.25	1.00	0.75	1.00	0.25	0.25	-0.25
	Eye	-1.40	-1.30	-2.05	-3.25	-3.50	-3.75	-3.75	-4.25	-4.30	-4.75

*a – Reflection off astronaut helmet

b – Spacecraft internal reflection (9 ft dia)

TABLE 14. - STAR MAGNITUDE PREDICTIONS, MOON AT 130 KM

Window Scatter	Mode of Observation	Veiling Luminance									
			No Internal Reflection					With Internal Reflection			
		Window 208	Window 240	Window 244	Window 246	Window 244&208	Window 244&246	Window 208		Window 208&246	
Maximum		$\theta = 0^{\circ}$	$\theta = 0^{\circ}$	$\theta = 0^{\circ}$	$\theta = 0^{\circ}$	$\Psi = 50^{\circ}$ $\theta = 100^{\circ}$	$\Psi = 60^{\circ}$ $\theta = 100^{\circ}$	$\Psi = 80^{\circ}$ $\theta = 0^{\circ}$		$\Psi = 80^{\circ}$ $\theta = 0^{\circ}$	
								a*	b*	a*	b*
	Telescope	4.10	6.15	4.10	2.25	1.90	1.70	1.85	0.75	0.95	0.00
	Eye	0.25	1.75	-0.30	-2.20	-2.55	-2.75	-1.75	-3.75	-3.35	-4.50
Minimum		$\theta = 160^{\circ}$	$\theta = 160^{\circ}$	$\theta = 160^{\circ}$	$\theta = 160^{\circ}$	$\Psi = 80^{\circ}$ $\theta = 210^{\circ}$	$\Psi = 80^{\circ}$ $\theta = 220^{\circ}$	$\Psi = 0^{\circ}$ $\theta = 160^{\circ}$		$\Psi = 0^{\circ}$ $\theta = 160^{\circ}$	
	Telescope	7.25	7.30	7.30	6.50	6.15	5.90	5.30	4.75	4.50	4.00
	Eye	3.10	3.15	3.15	2.10	1.75	1.50	0.80	0.35	0.00	-0.50
Average	Telescope	4.50	4.90	4.60	2.50	2.15	1.90	2.25	1.50	1.25	0.50
	Eye	0.10	0.45	0.20	-2.30	-1.95	-2.10	-2.25	-3.05	-3.25	-4.00

*a – Reflection off astronaut helmet

b – Spacecraft internal reflection (9 ft dia)

Multiple-pane data. - Table 15 contains the four-window data (HEA244, $MgF_2$208, HEA244, $MgF_2$208) which was computed from experimental data on two window configurations (HEA244 and $MgF_2$208). Based on the results of the two-window study (i.e., that superposition is a valid approach), the four-window predictions in Table 15 are the result of superposing the two-window experimental scatter levels and then making the star magnitude threshold predictions.

Data in Appendix D indicate that, when the window edge is painted black, the scatter levels are reduced at certain angular positions over the unpainted windows. This would indicate that painting or even polishing the edge would reduce the scattering levels of spacecraft windows. All edges of windows used were frosted (unpolished) and, when illuminated, represented a large luminance source.

Scattering coefficients for two-pane configuration. - Tables 16 through 19 are comparisons of reduced scattering data for two-pane window configurations. In particular, scattering values are presented for various viewing angles (θ) that are obtained in three separate ways. First, the data is obtained experimentally, that is, by measuring the scatter levels of the two windows configurations. Secondly, the data is obtained using the theory proposed in Appendix F. This calculation is based on the assumption that both windows are composed of the same material. This assumption was satisfied when the scattering from the individual windows was comparable, as in the case of windows 208 and 244. Scattering from windows 244 and 246 differed by about one order of magnitude, so the computation of Appendix F was not applied to that window combination. Finally, the scatter levels are also obtained by superposing (adding) the individual scattering levels from the respective windows that comprise the two-window system. It is immediately evident that the superposition gives quite accurate predictions for the two-window systems. This result was not expected in light of the complexity of the light-scattering process, but it is extremely useful for application of this data to a practical spacecraft where five or six windows may be utilized in series.

TABLE 15.- STAR MAGNITUDES DETECTED VIEWED THROUGH A FOUR-PANE WINDOW CONFIGURATION* -- NO BACK REFLECTIONS FROM WITHIN THE SPACECRAFT

Source	Mode of Observation	Star Magnitude Threshold Values		
		Maximum (Ψ = 50°; θ = 100°)	Minimum (Ψ = 80°; θ = 210°)	Midrange of Scatter Luminance
Sun at 1 AU	Telescope	2.90	7.95	5.50
	Eye	-1.60	3.65	1.00
Earth at 2×10^5 km	Telescope	4.30	9.00	5.00
	Eye	-0.15	4.75	-0.50
Earth at 1×10^5 km	Telescope	3.30	8.75	3.75
	Eye	-1.10	4.65	-0.15
Moon at 3.8×10^5 km	Telescope	5.25	9.00	5.75
	Eye	0.80	4.75	1.25
Earth at 200 km	Telescope	0.50	3.00	0.85
	Eye	-4.80	-1.60	-4.00
Moon at 130 km	Telescope	1.40	5.55	1.85
	Eye	-3.10	1.00	-2.75

* Data computed from two-window configuration of windows 244 and 208.

TABLE 16. - ADDITIVE SCATTERING OF WINDOWS 208 +244 COMPARED WITH ACTUAL EXPERIMENTAL DATA AND THEORY, Ψ = 0 DEGREES

$\frac{L_W - L_B}{E_o \cos\Psi} \times 10^{-5}$			
θ	Superposition Summation	Theory	Experiment
20	5.74	7.86	4.10
30	3.03	3.42	2.54
40	2.24	2.28	2.01
50	1.98	1.82	1.82
60	1.89	1.53	1.73
70	1.97	1.54	1.74
80	2.19	1.63	1.64
100	2.81	1.83	1.54
110	2.86	1.92	3.79
120	3.12	2.11	4.72
130	3.69	2.48	4.56
140	5.19	3.13	5.48
150	8.99	5.08	7.81
160	18.92	12.93	17.29
200	21.74	14.68	18.28
210	12.57	5.50	8.25
220	5.45	3.52	4.90
230	3.97	2.38	4.03
240	3.50	2.09	3.62
250	3.31	1.71	3.15
260	3.29	2.11	1.64
280	2.13	1.55	1.42
290	2.34	1.51	1.84
300	2.17	1.53	1.83
310	2.35	1.74	1.98
320	2.94	2.01	2.18
330	3.05	2.79	2.61
340	4.49	5.06	3.97

* Theory used data for two 208 windows.

TABLE 17. - ADDITIVE SCATTERING OF WINDOWS 244+246 COMPARED WITH ACTUAL EXPERIMENTAL DATA, Ψ = 0 DEGREES

	$\frac{L_W - L_B}{E_0 \cos \Psi} \times 10^{-5}$	
θ	Superposition Summation	Experiment
20	23.58	25.43
30	18.50	19.50
40	16.96	18.08
50	16.95	18.59
60	19.30	15.66
70	25.30	23.52
80	36.33	24.01
100	81.59	56.40
110	102.09	127.56
120	113.64	157.00
130	134.52	186.44
140	176.67	230.59
150	232.09	299.27
160	376.32	460.83
200	341.66	441.14
210	223.78	274.71
220	172.16	201.14
230	130.18	156.99
240	11.64	127.55
250	88.96	117.74
260	65.96	51.49
280	30.93	27.44
290	22.48	25.96
300	18.66	23.01
310	16.01	21.06
320	18.27	20.54
330	20.24	22.46
340	27.85	26.30

TABLE 18. - ADDITIVE SCATTERING OF WINDOWS 244 +246 COMPARED WITH ACTUAL EXPERIMENTAL DATA, Ψ = 80 DEGREES

	$\frac{L_W - L_B}{E_o \cos \Psi} \times 10^{-5}$	
θ	Superposition Summation	Experiment
0	65.31	59.15
10	77.39	70.46
20	99.89	90.25
30	133.06	118.48
40	187.75	163.70
50	305.79	282.72
60	677.12	577.86
70	-----	-----
80	-----	-----
120	-----	-----
130	507.89	508.00
140	334.57	296.32
150	205.84	214.42
160	152.45	152.36
170	117.61	112.81
180	92.53	84.59
190	78.42	73.28
200	70.25	64.75
210	67.44	56.21
220	74.41	56.18
230	83.01	61.78
240	103.67	75.52
250	118.59	116.77
260	-----	-----
300	102.40	101.05
310	77.27	66.99
320	65.32	64.49
330	58.30	56.18
340	55.46	50.61
350	58.17	53.45

TABLE 19. - ADDITIVE SCATTERING OF WINDOWS 208 +244 COMPARED WITH ACTUAL EXPERIMENTAL DATA AND THEORY, Ψ = 60 DEGREES

$\frac{L_W - L_B}{E_o \cos\Psi} \times 10^{-5}$			
θ	Superposition Summation	Theory	Experiment
0	3.29	2.47	2.82
10	3.72	3.13	3.24
20	4.92	4.34	3.98
40	15.34	20.31	13.99
50	345.64	366.08	205.39
100	296.36	304.70	1083.47
140	76.70	48.50	7.19
150	15.98	13.45	18.44
160	12.29	6.55	9.60
170	6.84	3.95	6.09
180	4.68	2.91	4.68
190	3.63	2.55	3.66
200	2.99	2.19	3.24
210	1.89	2.21	2.83
220	3.05	2.44	2.60
260	13.58	11.95	218.65
280	12.94	12.10	87.81
320	3.95	3.38	3.15
330	2.95	2.29	2.75
340	2.92	2.27	2.53
350	2.93	2.21	2.59

Data was also obtained at large angles of incidence using a reduced beam diameter to eliminate interference effects of the light beam with the window holder. This data differed slightly from the large beam data and is included in Appendix D for comparison purposes.

Surface imperfections. - It was observed that a window which may appear clean and free of imperfections in normal room light may become very luminous when viewed by intense collimated light (Figure 26). Comparison of the two HEA windows indicated that the scattering level is about one order of magnitude higher in one than in the other. The increased levels were evident by visual inspection under intense light. All windows were thoroughly cleaned prior to each measuring session, yet each window exhibited a punctate appearance due to a multitude of minute imperfections and scratches which did not yield to cleaning efforts. It was speculated that some of these scattering particles might be dust particles that acquired an electrostatic charge and became attached to the surface of the window after cleaning. In addition, window coating and material imperfections were evident.

Some of the imperfections were of such a magnitude as to affect the scattering measurements by a factor of two. Attempts to remove the larger scattering centers usually resulted in a further increase in the scattering level.

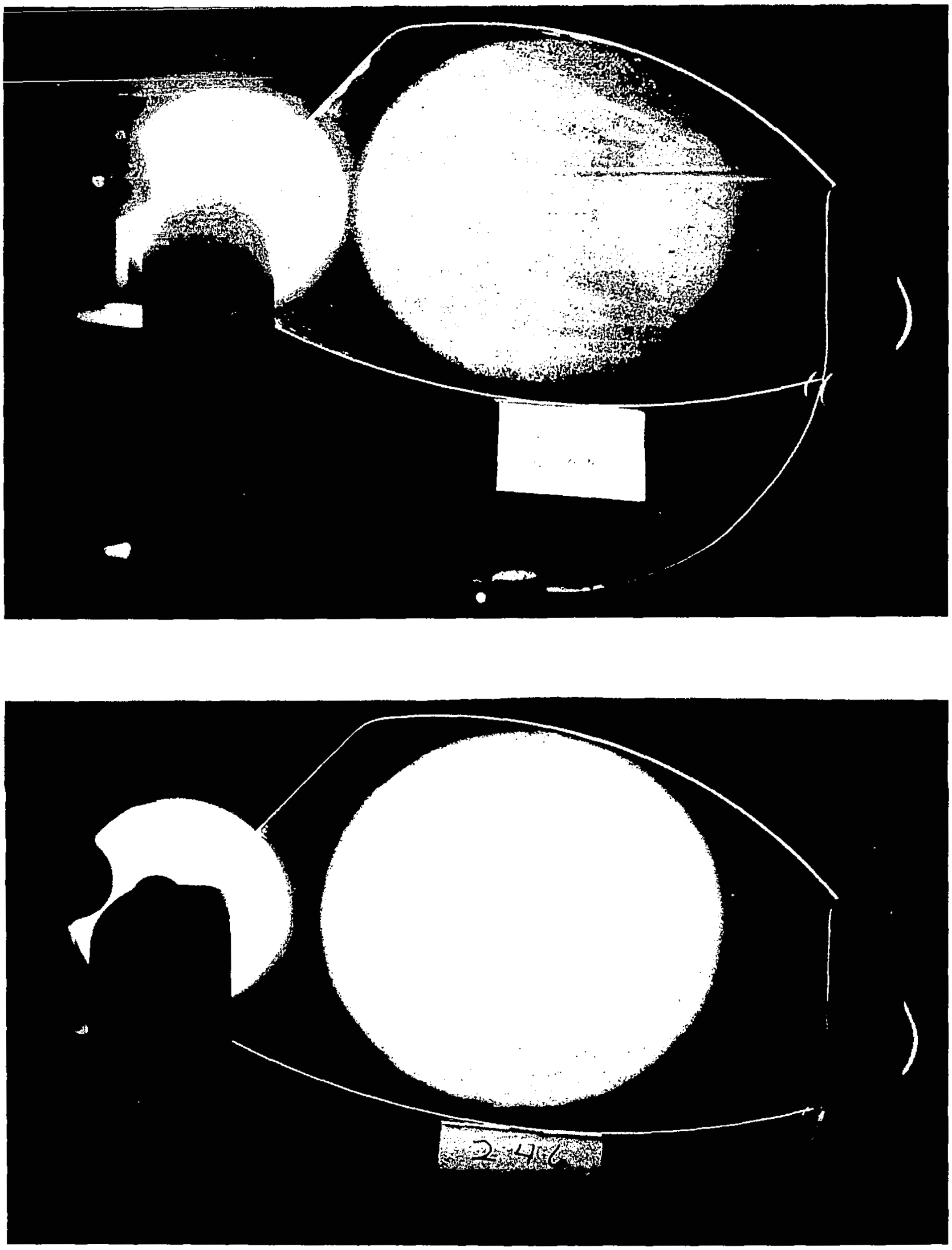


Figure 26. Comparison of Windows 244 (top, clean f8, 90 seconds exposure) and 246 (bottom, clean f8, 2 seconds exposure). (Scatter level differences are masked because of the marked difference in time exposures.)

CONCLUSIONS

An experimental apparatus was fabricated so that the light scattered from spacecraft windows in various directions could be accurately determined. Star threshold predictions were made using the light scatter information, and calculated illumination incident on spacecraft at various orbit positions.

The results of this investigation produced several significant conclusions:

- By preferentially orientating the spacecraft to obtain optimum viewing conditions, the astronauts may be able to see navigational stars that otherwise would be undetectable.
- For practical navigational purposes, a telescope would be required to detect stars consistently.
- Star detection could be appreciably enhanced if the effects of internal cabin light could be minimized. Back reflections of internal light off the window greatly increase the star magnitude required for visual detection.
- Using a monocular telescope a star with a magnitude of 9.9 can be seen through a single window under best conditions.
- With the naked eye under the worst viewing conditions considered, only a star of magnitude -5.25 can be detected.
- The quality of the surface coating is of primary importance, while the type of coating appears to have little influence on the light scatter levels.
- The effects of contamination are perhaps the most significant in influencing the light-scatter levels. Elimination of contamination reduces the scatter levels more than any other overt mechanism.
- Superposition of scatter levels (adding) is valid to obtain scatter of multiple window arrays.
- The window edges should perhaps be polished. Painting of the window edge also reduces the light-scatter levels.
- Three-dimensional scatter data is of the same order as two-dimensional scatter data for the windows measured.

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APPENDIX A
LITERATURE REVIEW

Little information is available in the open literature describing scattering coefficients from ordinary glass, spacecraft windows or coated glass. This sparsity of available information motivated the work presented in this report.

One experimental investigation (ref. A1) that parallels the present study was performed on Irtran materials in the infrared. Those authors also concluded that no extensive experimental investigation of the scattering phenomenon for highly transmitting samples has been reported.

Energy Distribution

This portion of the appendix is concerned with a detailed review of the available literature regarding the distribution of solar energy with wavelength, the distribution of reflected energy from the earth and the moon, and the amount of reflected energy that is reflected from each of these bodies (albedo).

The most often referred to and widely recognized source for the distribution of solar energy with wavelength is Johnson (ref. A2). He took the data compiled by the Smithsonian Institute and the Naval Research Laboratory during the period from 1923 to 1953 and corrected it for atmospheric attenuation. His method is generally regarded as the best to date and thus his spectral values are used in this study.

Albedo is light from the sun reflected from terrain, vegetation, water, clouds, etc. Some light in the blue end of the spectrum is generally recognized to be backscattered from the atmosphere by dust and haze. The reflection varies from about 80 to 90 percent from clouds and snow to 10 percent or less from water and certain types of vegetation.

Various analyses have been developed to treat the reflectance of the atmosphere of the earth based on scattering theory. Perhaps the best to date is that of Coulson (ref. A3) for a clear atmosphere. His calculated values compare very well with the data of OSO-III at all wavelengths except at the shorter wavelength band. This comparison was made by Neel, et al (ref. A4) who noted that Coulson neglected ozone absorption in his analysis.

Pearson and Neel (ref. A5) analyzed data from an in-flight experiment on OSO-II and presented the albedo of the earth as a function of latitude, as a function of angle with the sun and as a function of the time of day. The albedo measurements at 673 locations during 4-8 March 1965 varied from 0.10 to 0.62. A comparison with other available studies (refs. A6, A7, A8) showed that considerable variation in the average albedo values used for spacecraft thermal design existed in the literature.

About the same time Linton (ref. A9) presented the results of an experiment aboard the spacecraft Pegasus I. He compared his findings with that of Fitz, et al (ref. A10)and finds a correlation between the two. Similar to other investigations, the earth's albedo was a quantity that varied from 0.10 to 0.64.

Raschke (ref, A11) by means of an inflight experiment aboard the meteorological satellite NIMBUS II, performed a radiation balance on the earth atmosphere system during the time period 16 May 1966 to 28 July 1966. He obtained values of the albedo from 0.1 to 0.8.

Realizing that large variations in earth's albedo exist, one can still compute averages of each of the more recent experiments. These averages yield an albedo of from 0.29 to 0.40. The value most often quoted as a representative number for spacecraft thermal design is 0.35. Thus, for purposes of this study, this number is used for the calculations.

The data on the moon is considerably more sparse and uncertain than that of earth. Perhaps the first to look at the physics and astronomy of the moon was

Herschel (ref. A12)in 1847. He studied the relative brightness of the moon by producing a reduced lunar image in an astrometer. Zoellner (ref. A13), Pickering (ref. A14), and King (ref. A15) made other measurements of the moon. It should be noted that the observational methods were crude and the correction for atmospheric extinction lacked precision.

The most significant measurements thereafter were made by Rougier (refs. A16, A17, A18) who designed a photometer to make direct measurements of both the sun and the moon and hence directly compute the albedo. In this manner he obtained

$$c = 0.073$$

Comparing his results with the experimental measurements of Pettit and Nicholson (ref. A20) showed good agreement. Pettit and Nicholson used a vacuum thermocouple attached to a 100-inch telescope to measure stellar radiation. A special glass filter was used to separate the reflected energy from the emitted energy. They obtained a radiometric albedo of 0.093 which is remarkably close to that of Rougier.

Sytinska (ref. A21), using the work of an obscure reference only denoted Schröter (assumed to be German), indicated the relative brightness of 19 objects on the moon. The Floor of Grimaldi and Riccioli has an albedo of 0.061 while at the other extreme The Central Mountain of Aristarchus has an albedo of 0.183. Thus, apparently, much the same as with the earth, variations in the moon albedo occur, depending on the specific location.

Evans (ref. A22) quotes a value for the albedo of the moon of 0.07 and calculates from electromagnetic wave theory a value of 0.146. After this calculation, he recognizes the failing of electromagnetic theory and settles on a value of 0.1 for the reflection of radio waves. However, he determined that a constant error appears in his data which could be reconciled if a value for the albedo were taken to be 0.06. More recently, Lucas, et al (ref. A23) obtained data from Surveyor 1 which showed the albedo to be between 0.05 and 0.2.

Finally, the experimental work of Saari and Shorthill (ref. A24) should be cited. A comparison between the data of Saari and Shorthill and that of Lucas, et al (ref. A23) demonstrated qualitative agreement.

On the basis of the preceding discussion, a best value for the moon's albedo of 0.07 has been chosen for use in this investigation. It is felt that this number is quite representative of the visible region in particular, but the entire spectrum in general.

Configuration Factors

In this portion of the appendix the literature dealing with the computation of the geometrical relationships usually referred to as the configuration or form factors between spacecraft and spherical planets is reviewed.

One of the first efforts expended toward the geometrical determination of the amount of energy incident on a surface of a satellite in orbit was that of Katz (ref. A25). The governing geometrical relationships were formulated in exact fashion using vector analysis. However, the solutions were for specific problems and hence are in dimensional form restricting their applicability.

A rigorous evaluation of the radiation originating from the earth that is incident on a satellite was also formulated by Goetze and Grosch (ref. A26). A few brief numerical results were presented for specific orientations.

Similarly, Cunningham (ref. A27) has presented a general derivation for the geometric relationship between a small flat plate and a sphere. He recognizes the separate situations that must be considered for the plate at various vertical positions with respect to the earth and he does obtain expressions in which integrands must be numerically integrated from which the power input to the plate can be calculated. However, the graphical results are incomplete, several limiting cases are omitted, and the equations are extremely complex.

In an attempt to solve these three problems, Hauptmann (ref. A28) used the unit sphere method and published his work shortly after the authors solved the problem using the same approach. Heinisch, et al (ref. A29) have obtained numerical results and demonstrated in detail the limiting situations and expressions for them.

A numerical solution to the problem of thermal radiation to a flat plate rotating about an arbitrary axis in an elliptical earth orbit was presented by Powers (ref. A30). Skladany and Rochkind (ref.A31) have improved that program to include blockage effects.

Recently Harrison (ref. A32) has calculated the geometric relationship for both diffuse and nondiffuse radiation from the lunar surface onto a small element above the moon. A comparison is made between the results of the two computations. Unfortunately for this work, the analysis includes the directional emission effects which we obviously neglect in the visible portion of the spectrum.

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APPENDIX B
THE UNIT SPHERE METHOD

An elegant technique for the evaluation of the configuration factors from differential element to a finite area is known as the unit sphere or solid-angle projection method. The development of this method is as follows.

Consider the geometry of Figure B1.

It is clear that the configuration factor given by the defining equation in the text is

$$F_{dA_1 - dA_2} = \frac{1}{\pi} \cos \phi_1 \left(\cos \phi_2 \frac{dA_2}{D^2} \right) \tag{B1}$$

The term in parantheses on the far right-hand side of Equation (B1) is the unit solid angle $d\omega$ that is observed from Figure B1 to be also equal to the solid angle defined by the area dA_{2a} cut on the unit hemisphere constructed around the small area dA_1.

$$d\omega = \frac{\cos \phi_2 \, dA_2}{D^2} = \frac{dA_{2a}}{R^2} \tag{B2}$$

The configuration factor $F_{dA_1 - dA_2}$ is obtained by combining Equations (B1) and (B2) and integrating dA_{2a} over A_{2a}.

$$F_{dA_1 - A_2} = \frac{1}{\pi} \int_{A_{2a}} \frac{\cos \phi_1 \, dA_{2a}}{R^2} \tag{B3}$$

Referring to Figure B1, we see that

$$\cos \phi_1 \, dA_{2a} = dA_{2b} \tag{B4}$$

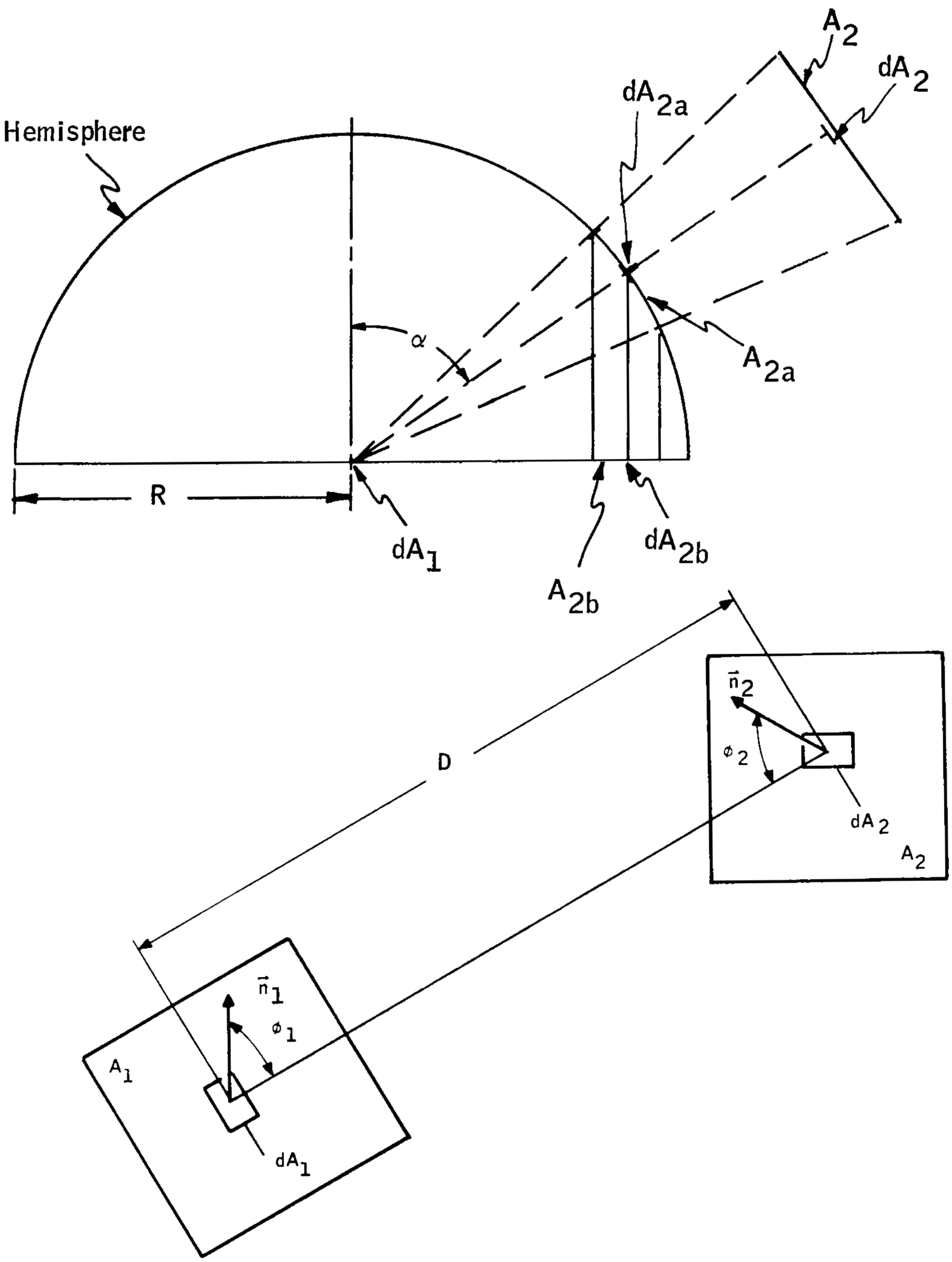

Figure B1. Configuration Factor by Unit Sphere Method

The differential area dA_{2b} of Equation (B4) is the projection of dA_{2a} on the base of the unit hemisphere. Substituting Equation (B4) into Equation (B3), a new expression for the configuration factor is obtained as

$$F_{dA_1 - A_2} = \frac{1}{\pi} \int_{A_{2b}} \frac{dA_{2b}}{R^2} = \frac{A_{2b}}{\pi R^2} \tag{B5}$$

For a sphere of unit radius (unit sphere)

$$F_{dA_1 - A_2} = \frac{A_{2b}}{\pi} \tag{B6}$$

Equation (B6) indicates that the configuration factor $F_{dA_1 - A_2}$ is equal to the ratio of the area projection on the hemisphere base of the area cut by the solid angle on the unit sphere surface to the total area of the hemisphere base.

APPENDIX C
SAMPLE THRESHOLD CALCULATION

Our star magnitude threshold determinations were made by essentially referring to our raw data in the laboratory-determined scattering value and relating this value to the scattering level that would exist in space for the specified external source condition and eye-window-source configuration.

We have chosen a sample threshold calculation to illustrate the step procedure followed.

Window:	No. 208 (MgF_2 coating)
External light source:	Sun at 1 AU distance(E_S=12,723 ft candles)
Beam-window angle:	$\Psi = 50°$
Photometer (eye) - window angle:	$\theta = 250°$
$BaSO_4$ disc luminance:	$\overline{L}_d = 190$ foot lamberts
Disc reflectance factor:	$\rho_d = 0.957$
Scattering luminance:	$L_w = 1.6 \times 10^{-3}$ foot lamberts
Experimental ambient luminance:	$L_B = 1.4 \times 10^{-4}$ foot lamberts

(1) Incident illumination on window surface in laboratory:

$$E_o \cos \Psi \text{ (lab)} = \left(\frac{\overline{L}_d}{\rho_d}\right) \cos \Psi = \left(\frac{190}{0.957}\right) 0.6428 = 127.62 \text{ foot candles}$$

(2) Incident illumination from sun at 1 Au

$$E_s \cos \Psi = (12,723^{*})\ 0.6428 = 8,178 \text{ foot candles}$$

(3) Scattering at measured window surface in laboratory:

$$\frac{L_w - L_B}{E_o \cos \Psi \text{ (lab)}} = \frac{0.0016 - 0.00014}{127.62}$$

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*Allen lists 12,723 foot candles as illumination in space from sun.
Allen, C.W. Astrophysical Quantities 2nd ed. Atheline Press, London (1955).

(4) Window luminance level equated to scattering in space:

$$\left[\frac{L_W - L_B}{E_o \cos \Psi} \text{ (lab)}\right] \left[E_s \cos \Psi \text{ (space)}\right]$$

$$= (1.14 \times 10^{-5})\ 8,178 \ = \ 9,323 \times 10^{-5} \ = \ 0.09323 \text{ foot lamberts}$$

(5) Referring to the stellar threshold model (Figure 18) we can determine that an astronaut viewing against a background of 0.09323 foot lamberts would be able to detect a star of magnitude 4.5 with unaided binocular vision and a star of magnitude 8.6 with the prescribed monocular telescope.

APPENDIX D
MEASURED DATA

This appendix includes all data obtained during the course of the experiment. As such, both raw and reduced data are presented for the interested reader. Portions of the data require explanation:

There are several gaps in the data due to physical considerations. The 6-inch diameter light beam prohibits one from performing scatter measurements ±15 degrees from Ψ = 0 and Ψ = 90 degrees. This range is denoted by the letter TB on the data sheets. As the photometer is rotated 360 degrees about the window, at two positions (i. e., say Ψ = 0, then θ = 90 and 270 degrees) the photometer will view parallel to the window surfaces. This data again is invalid for scatter purposes and it is denoted WE on the data sheets. At non-zero values of Ψ (the window inclined with respect to the incident light), the window reflection has a large specular component. For example if Ψ = 10 degrees, then, at Ψ = 20 degrees, the beam is reflected and instead of measuring a relatively small component of light, a large value is recorded. This specular reflection off the window is seen not only when the photometer points directly at the specular reflection but also at the conjugate position, that is when the off-axis cone blackbody is flooded by the specular reflection and the photometer looks through the window and records an invalid luminance reflected from the inefficient blackbody. The situation where the photometer views directly the specular reflection is denoted WR, and, where the photometer views the blackbody, it is denoted BR on the data sheets on the following pages.

The raw and reduced data is presented in the manner in which it was recorded. For clarity the data is given in the following order.

Window	3D Angle	Comments	Page
240	22.5°		D3
240	45°		D12
240	67.5°		D21
244	22.5°		D30
244	45°		D39
244	67.5°		D48
208	0		D57
240	0		D66
244	0		D75
246	0		D84
Supracil	0		D93
208 + 244	0		D102
244 + 246	0		D111
244	0	Small-dia beam and blackened edges	D120
240	0	Small-dia beam and blackened edges	D123
208	0	Small-dia beam and blackened edges	D124
246	0	Small-dia beam and blackened edges	D125

S-D Angle = 22.5

ψ = 0

Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 214
End L_d 207
Mean L_d 210.5
$E_o \cos\psi$ 219.96

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)	B P			230		2.6	1.18
5				240		2.6	1.18
10	B P			250		2.4	1.09
15		7.9	3.59	260		2.3	1.04
20		6.6	3.00	270	WE		
30		5.1	2.31	275			
40		3.5	1.59	280		2.8	1.27
50		2.6	1.18	285			-
60		2.4	1.09	290		2.6	1.18
70		2.2	1.00	295			
80		2.1	0.95	300		2.5	1.13
90	WE			305			
100		3.2	1.45	310		2.6	1.18
110		2.6	1.18	315			
120		2.7	1.22	320		3.1	1.40
130		2.8	1.27	325			
140		3.8	1.72	330		4.4	2.00
150		6.1	2.77	335			
160		11.0	5.00	340		6.4	2.90
170	TB	18.5	8.41	345		8.0	3.63
180	TB	25.0	11.36	350	BP		
190	TB	15.5	7.04	355			
200		9.0	4.09	360	BP		
210		4.9	2.22				
220		3.2	1.45				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

D4

3-D Angle = 22.5

ψ = 10

Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 207
End L_d 210
Mean L_d 208.5
$E_o \cos\psi$ 214.556

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)	BP			230		2.0	0.93
5	WR	8.9	4.14	240		1.9	0.88
10	WR	7.8	3.63	250		2.1	0.97
15				260		2.1	0.97
20	WR	6.4	2.98	270	WE		
30		4.9	2.28	275			
40		3.8	1.77	280		2.3	1.07
50		3.0	1.39	285			
60		2.6	1.21	290		2.2	1.02
70		2.3	1.07	295			
80		2.1	0.97	300		2.2	1.02
90	WE			305			
100		4.0	1.86	310		2.4	1.11
110		3.4	1.58	315			
120		3.4	1.58	320		3.2	1.49
130		4.2	1.95	325			
140		6.1	2.84	330		4.5	2.09
150		10.1	4.70	335		4.6	2.14
160	TB	16.5	7.69	340	BP		
170	TB	19.9	9.27	345			
180	TB	15.5	7.22	350	BP		
190		8.2	3.82	355			
200		4.5	2.09	360	BP		
210		3.0	1.39				
220		2.4	1.11				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

3-D Angle = 22.5

ψ = 20

Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 210
End L_d 210
Mean L_d 210
$E_o \cos\psi$ 206.203

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.6	0.77
5				240		1.6	0.77
10	WR	6.6	3.20	250		1.6	0.77
15				260		2.0	0.96
20	WR	6.2	3.00	270	WE		
30	WR	5.2	2.52	275			
40		4.3	2.85	280		2.4	1.16
50		3.7	1.79	285			
60		3.3	1.60	290		2.1	1.01
70		2.9	1.40	295			
80		2.8	1.35	300		2.3	1.11
90	WE			305			
100		6.4	3.10	310		2.9	1.40
110		5.9	2.86	315			
120		5.3	2.57	320		4.0	1.93
130		6.4	3.10	325		5.5	2.66
140		10.2	4.94	330	BP		
150	TB	TB 18.6	9.02	335			
160	TB	TB 25.0	12.12	340	BP		
170	TB	TB 14.7	7.12	345			
180		9.6	4.65	350	BP		
190		4.9	2.37	355		6.6	3.20
200		3.2	1.55	360		6.2	3.00
210		2.4	1.16				
220		2.0	0.96				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

3-D Angle = 22.5
ψ = 30
Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 210
End L_d 207
Mean L_d 208.5
$E_o \text{Cos}\psi$ 188.673

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \text{Cos}\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \text{Cos}\psi} \times 10^{-5}$
0(360)				230		1.4	0.74
5				240		1.3	0.64
10		4.6	2.43	250		1.4	0.74
15				260		1.6	0.84
20	WR	5.2	2.75	270	WE		
30	WR	5.1	2.70	275			
40	WR	4.8	2.54	280		2.2	1.16
50		4.2	2.22	285			
60		3.6	1.90	290		2.1	1.11
70		3.4	1.80	295			
80		3.6	1.90	300		2.3	1.21
90	WE			305			
100		9.6	5.08	310		4.3	2.27
110		6.7	3.55	315		4.7	2.49
120		7.2	3.81	320	BP		
130		9.8	5.19	325			
140	TB	17.3	9.16	330	BP		
150	TB	21.0	11.13	335			
160	TB	16.5	8.74	340	BP		
170		7.0	3.71	345		6.5	3.44
180		4.3	2.27	350		5.2	2.75
190		2.9	1.53	355			
200		2.4	1.27	360		5.0	2.65
210		2.0	1.06				
220		1.6	0.84				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

3-D Angle = 22.5

ψ = 40

Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 207
End L_d 206
Mean L_d 206.5
$E_o Cos\psi$ 165.286

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)				230		1.3	0.78
5				240		1.4	0.84
10		2.9	1.75	250		1.5	0.90
15				260		1.6	0.96
20		3.4	2.05	270	WE		
30	WR	4.7	2.84	275			
40	WR	4.4	2.66	280		2.3	1.39
50	WR	4.4	2.66	285			
60		4.3	2.60	290		3.0	1.81
70		4.2	2.54	295			
80		4.6	2.70	300		3.4	2.05
90	WE			305		3.6	2.17
100		14.0	8.46	310	BP		
110		9.3	5.62	315			
120		11.0	6.65	320	BP		
130	TB	18.0	10.88	325			
140	TB	22.0	13.30	330	BP		
150	TB	15.2	9.19	335		3.6	2.17
160		6.7	4.05	340		3.1	1.87
170		3.8	2.29	345			
180		2.8	1.69	350		2.5	1.51
190		2.1	1.27	355			
200		1.8	1.08	360		2.4	1.45
210		1.6	0.96				
220		1.4	0.84				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

3-D Angle = 22.5

ψ = 50

Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 206
End L_d 206
Mean L_d 206
$E_o \cos\psi$ 138.366

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		2.0	1.44
5				240		2.3	1.66
10		2.3	1.66	250		2.6	1.87
15				260		4.0	2.89
20		2.8	2.02	270	WE		
30		3.4	2.45	275			
40	WR	4.3	3.10	280		4.3	3.10
50	WR	4.7	3.39	285			
60	WR	5.1	3.68	290		4.3	3.10
70		5.4	3.90	295		4.4	3.17
80		6.5	4.69	300	BP		
90	WE			305			
100		18.1	13.08	310	BP		
110		14.9	10.76	315			
120	TB	20.0	14.45	320	BP		
130	TB	22.4	16.18	325		3.8	2.74
140	TB	13.5	9.75	330		3.1	2.24
150		7.6	5.49	335			
160		4.0	2.89	340		2.4	1.73
170		2.6	1.87	345			
180		2.3	1.66	350		2.1	1.51
190		1.9	1.37	355			
200		1.7	1.22	360		2.2	1.58
210		1.8	1.30				
220		1.7	1.22				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

3-D Angle = 22.5

ψ = 60

Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240

Start L_d 206

End L_d 209

Mean L_d 207.5

$E_o \cos\psi$ 108.41

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		4.4	4.05
5				240		6.0	5.53
10		2.9	2.67	250		8.0	7.37
15				260		16.5	15.21
20		3.2	2.95	270	WE	[illegible]	
30		3.8	3.50	275			
40		4.9	4.51	280		13.0	11.99
50	WR	6.3	5.81	285		9.7	8.94
60	WR	7.5	6.91	290	BP		
70	WR	8.4	7.74	295			
80		10.8	9.96	300	BP		
90	WE			305			
100		27.0	24.90	310	BP		
110	TB	22.0	20.29	315		6.0	5.53
120	TB	27.0	24.90	320		5.2	4.79
130	TB	15.0	13.83	325			
140		9.5	8.76	330		3.6	3.32
150		5.5	5.07	335			
160		3.6	3.32	340		3.2	2.95
170		2.7	2.49	345			
180		2.6	2.39	350		2.9	2.67
190		2.4	2.21	355			
200		2.4	2.21	360		2.8	2.58
210		2.7	2.49				
220		3.4	3.13				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

D10

3-D Angle = 22.5

ψ = 70

Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 209
End L_d 210
Mean L_d 209.5
$E_o \cos\psi$ 74.87

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		5.8	7.74
5				240		8.0	10.68
10		2.9	3.87	250		13.0	17.36
15				260		24.4	32.58
20		3.4	4.54	270	WE		
30		4.0	5.34	275			
40		5.1	6.81	280	BP		
50		6.6	8.81	285			
60	WR	8.5	11.35	290	BP		
70	WR	11.6	15.49	295			
80		16.1	21.50	300	BP		
90	WE			305		7.7	10.28
100	TB	36.0	48.08	310		6.8	9.08
110	TB	28.0	37.39	315			
120	TB	17.0	22.70	320		5.2	6.94
130		11.0	14.69	325			
140		7.0	9.34	330		4.2	5.60
150		4.6	6.14	335			
160		3.3	4.40	340		3.2	4.27
170		2.6	3.47	345			
180		2.6	3.47	350		3.0	4.00
190		2.5	3.33	355			
200		2.7	3.60	360		3.0	4.00
210		3.3	4.40				
220		4.2	5.60				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1^o
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

3-D Angle = 22.5

ψ = 80

Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 210
End L_d 210
Mean L_d 210
$E_o \cos\psi$ 38.09

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		5.2	13.65
5				240		7.4	19.42
10		2.5	6.56	250		12.1	31.76
15				260		29.0	76.13
20		3.0	7.87	270	WE		
30		3.4	8.92	275			
40		4.3	11.28	280	BP		
50		6.0	15.75	285			
60		8.0	21.00	290	BP		
70	WR	12.1	31.76	295		9.0	23.62
80	WR	24.4	64.05	300		7.7	20.21
90	WE			305			
100	TB	43.0	112.89	310		5.8	15.22
110	TB	19.0	49.88	315			
120		11.0	28.87	320		4.5	11.81
130		6.6	17.32	325			
140		4.5	11.81	330		3.3	8.66
150		3.5	9.18	335			
160		2.5	6.56	340		2.8	7.35
170		2.2	5.77	345			
180		2.2	5.77	350		2.4	6.30
190		2.2	5.77	355			
200		2.6	6.82	360		2.4	6.30
210		3.0	7.87				
220		4.0	10.50				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
BP = Beam blocked by photometer

D12

3-D Angle = 45°
ψ = 0°
Date 3/27/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 185
End L_d 185
Mean L_d 185
$E_o Cos\psi$ 193.31

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)	BP			230		2.7	1.39
5				240		2.6	1.34
10	BP			250		3.1	1.60
15		3.3	1.71	260		4.3	2.22
20		4.1	2.12	270	WE		
30		4.0	2.07	275			
40		2.8	1.45	280		5.8	3.00
50		2.5	1.29	285			
60		2.4	1.24	290		6.6	3.41
70		2.4	1.24	295			
80		2.5	1.29	300		3.0	1.55
90	WE			305			
100		2.5	1.29	310		2.6	1.34
110		2.6	1.34	315			
120		2.8	1.44	320		2.6	1.34
130		2.9	1.50	325			
140		3.4	1.75	330		3.0	1.55
150		3.9	2.01	335			
160		4.6	2.37	340		3.5	1.81
170	TB	5.3	2.74	345		3.7	1.91
180	TB	6.8	3.51	350	BP		
190	TB	4.0	2.06	355			
200	TB	3.6	1.86	360	BP		
210		2.7	1.39				
220		3.1	1.60				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 45°
ψ = 10°
Date 3-27-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 185
End L_d 185
Mean L_d 185
$E_o \cos\psi$ 190.37

θ	Remarks	(ft-L) $L_W \times 10^{-3}$ *	$\frac{L_W}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_W \times 10^{-3}$ *	$\frac{L_W}{E_o \cos\psi} \times 10^{-5}$
0(360)	BP			230		2.2	1.15
5	WR	4.7	2.46	240		2.1	1.10
10	WR	5.8	3.04	250		2.6	1.36
15				260		3.2	1.68
20	WR	3.0	1.57	270	WE		
30		2.6	1.36	275			
40		2.5	1.31	280		5.9	3.09
50		2.5	1.31	285			
60		2.4	1.26	290		5.8	3.04
70		2.4	1.26	295			
80		2.3	1.20	300		2.4	1.26
90	WE			305			
100		2.6	1.36	310		2.3	1.20
110		2.8	1.47	315			
120		3.0	1.57	320		2.5	1.31
130		3.2	1.68	325			
140		4.4	2.31	330		2.7	1.41
150		5.3	2.78	335		2.8	1.47
160	TB	5.5	2.88	340	BP		
170	TB	4.1	2.15	345			
180	TB	3.1	1.62	350	BP		
190	TB	3.1	1.62	355			
200		2.7	1.41	360	BP		
210		3.5	1.83				
220		3.3	1.73				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_W = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D14

[illegible] Angle = 45°
ψ = 20°
Date 3-27-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 185
End L_d 185
Mean L_d 185
$E_o \cos\psi$ 181.66

θ	Remarks	(ft-L)* $L_w \times 10^{-3}$	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L)* $L_w \times 10^{-3}$	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		2.0	1.10
5				240		1.7	0.93
10	WR	3.4	1.87	250		2.35	1.29
15				260		5.6	3.08
20	WR	5.6	3.08	270	WE		
30	WR	3.1	1.70	275			
40		2.7	1.48	280		6.8	3.74
50		2.6	1.43	285			
60		2.7	1.48	290		5.2	2.86
70		2.8	1.54	295			
80		2.9	1.59	300		2.2	1.21
90	WE			305			
100		3.2	1.76	310		2.4	1.32
110		3.4	1.87	315			
120		3.8	2.09	320		2.5	1.37
130		4.2	2.31	325		2.7	1.48
140	TB	5.2	2.86	330	BP		
150	TB	6.4	3.52	335			
160	TB	6.3	3.46	340	BP		
170	TB	3.7	2.03	345			
180	TB	3.0	1.65	350	BP		
190		2.7	1.48	355		2.5	1.37
200		4.6	2.53	360	WR	2.9	1.59
210		2.4	1.32				
220		2.2	1.21				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

B-L Angle = 45°

ψ = 30°

Date 3-27-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 185
End L_d 185
Mean L_d 185
$E_o \cos\psi$ 186.74

θ	Remarks	(ft-L) $L_W \times 10^{-3}$ *	$\frac{L_W}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_W \times 10^{-3}$ *	$\frac{L_W}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.6	0.85
5				240		1.55	0.83
10	WR	2.4	1.28	250		1.75	0.93
15				260		3.0	1.60
20	WR	3.0	1.60	270	WE		
30	WR	5.2	2.78	275			
40	WR	2.9	1.55	280		6.6	3.53
50		2.7	1.44	285			
60		2.6	1.39	290		4.6	2.46
70		2.9	1.55	295			
80		3.1	1.66	300		2.4	1.28
90	WE			305			
100		3.5	1.87	310		2.5	1.33
110		4.8	2.57	315		2.4	1.28
120		3.3	1.76	320	BP		
130		5.6	2.99	325			
140	TB	7.0	3.74	330	BP		
150	TB	8.5	4.55	335			
160	TB	3.7	1.98	340	BP		
170	TB	2.9	1.55	345		2.5	1.33
180		2.5	1.33	350		2.4	1.28
190		3.4	1.82	355			
200		2.0	1.07	360		2.3	1.23
210		2.1	1.12				
220		1.8	0.96				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_W = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D16

3-D Angle = 45°
ψ = 40°
Date 3-27-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d - 185
End L_d - 185
Mean L_d 185
$E_o \cos\psi$ 148.08

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.5	1.01
5				240		1.5	1.01
10		2.1	1.41	250		1.7	1.14
15				260		5.4	3.64
20	WR	2.5	1.68	270	WE		
30	WR	2.6	1.75	275			
40	WR	4.5	3.03	280		9.5	6.41
50	WR	3.0	2.02	285			
60		2.7	1.82	290		4.1	2.76
70		3.0	2.02	295			
80		3.7	2.49	300		2.3	1.55
90				305		2.2	1.48
100		4.0	2.70	310	BP		
110		4.6	3.10	315			
120		5.9	3.98	320	BP		
130	TB	8.7	5.87	325			
140	TB	8.4	5.67	330	BP		
150	TB	3.7	2.49	335		2.2	1.48
160	TB	3.3	2.22	340		2.3	1.55
170		2.6	1.75	345			
180		2.0	1.35	350		2.1	1.41
190		1.65	1.11	355			
200		1.6	1.08	360		1.9	1.28
210		1.6	1.08				
220		1.5	1.01				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 45°
ψ = 50°
Date 3-27-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 185
End L_d 185
Mean L_d 185
$E_o \cos\psi$ 124.26

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		2.6	2.09
5				240		3.0	2.41
10		2.3	1.85	250		3.9	3.13
15				260		4.5	3.62
20		2.4	1.93	270	WE		
30	WR	2.5	2.01	275			
40	WR	2.8	2.25	280		6.0	4.82
50	WR	4.7	3.78	285			
60	WR	4.0	3.21	290		6.6	5.31
70		4.9	3.94	295		4.7	3.78
80		5.4	4.34	300	BP		
90	WE			305			
100		5.6	4.50	310	BP		
110		7.3	5.87	315			
120	TB	9.2	7.40	320	BP		
130	TB	1.05	0.84	325		2.9	2.33
140	TB	0.55	0.44	330		2.8	2.25
150	TB	0.65	0.52	335			
160		5.6	4.50	340		2.4	1.93
170		4.1	3.29	345			
180		2.9	2.33	350		2.2	1.77
190		2.5	2.01	355			
200		2.4	1.93	360		2.1	1.69
210		2.3	1.85				
220		2.4	1.93				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D18

?-D Angle = 45°
ψ = 60°
Date 3-27-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 185
End L_d 185
Mean L_d 185
$E_o \cos\psi$ 96.66

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		5.7	5.89
5				240		5.4	5.58
10		3.2	3.31	250		7.3	7.55
15				260		46	47.58
20		3.3	3.41	270	WE		
30		3.4	3.51	275			
40	WR	3.6	3.72	280		90	93.10
50	WR	4.2	4.34	285		11.5	11.89
60	WR	7.2	7.44	290	BP		
70	WR	6.1	6.31	295			
80		8.8	9.10	300	BP		
90	WE			305			
100		10.0	10.34	310	BP		
110	TB	12.5	12.93	315		4.8	4.96
120	TB	18.0	18.62	320		5.1	5.27
130	TB	9.5	9.82	325			
140	TB	8.5	8.79	330		4.2	4.34
150		6.1	6.31	335			
160		4.9	5.06	340		3.8	3.93
170		4.1	4.24	345			
180		3.6	3.72	350		3.5	3.62
190		5.1	5.27	355			
200		4.6	4.75	360		3.3	3.41
210		5.1	5.27				
220		5.9	6.10				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

5-D Angle = 45°

ψ = 70°

Date ___ / · / ___

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d - 185
End L_d - 185
Mean L_d 185
$E_o \cos\psi$ 66.11

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		7.8	11.79
5				240		8.1	12.25
10		4.0	6.05	250		3.6	5.44
15				260		86.0	130.08
20		4.1	6.20	270	WE		
30		4.4	6.65	275			
40		4.9	7.41	280	BP		
50		5.6	8.47	285			
60	WR	6.6	9.98	290	BP		
70	WR	12.5	18.90	295			
80	WR	19.5	29.49	300	BP		
90	WE			305		9.2	13.91
100	TB	17.0	25.17	310		7.6	11.49
110	TB	20.5	31.06	315			
120	TB	13.5	20.42	320		6.3	9.52
130		8.5	12.85	325			
140		6.8	10.28	330		5.5	8.31
150		5.7	8.62	335			
160		4.7	7.10	340		4.9	7.41
170		4.4	6.65	345			
180		4.2	6.35	350		4.4	6.65
190		4.3	6.50	355			
200		5.1	7.71	360		4.1	6.20
210		6.4	9.68				
220		7.2	10.89				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D20

B-D Angle = 45°

ψ = 80°

Date 3-27-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 185
End L_d 185
Mean L_d 185
$E_o Cos\psi$ 33.56

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)				230		10.0	29.79
5				240		12.5	37.24
10		3.7	11.25	250		13.0	38.73
15				260.			
20		4.0	11.91	270	WE		
30		4.4	13.11	275			
40		4.9	14.60	280	BP		
50		5.7	16.98	285			
60		7.1	21.56	290	BP		
70	WR	10.0	29.79	295		10.5	31.28
80	WR	26.5	78.96	300		8.5	25.32
90	WE			305			
100	TB	25.0	74.49	310		8.5	25.32
110	TB	14.0	41.71	315			
120	TB	9.0	26.81	320		6.0	17.87
130		7.0	20.85	325			
140		5.7	16.98	330		4.9	14.60
150		5.0	14.89	335			
160		4.4	13.11	340		4.4	13.11
170		3.9	11.62	345			
180		4.0	11.91	350		3.9	11.62
190		4.2	12.51	355			
200		5.2	15.49	360		3.8	11.32
210		6.3	18.77				
220		7.9	23.53				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°

ψ = 0°

Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o Cos\psi$ 109.72

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)	BP			230		1.7	1.54
5				240		2.5	2.27
10	BP			250		4.9	4.46
15		1.6	1.45	260		5.0	4.55
20		1.6	1.45	270	WE		
30		1.7	1.54	275			
40		1.8	1.64	280		3,400	3,098.79
50		2.0	1.82	285			
60		1.8	1.64	290		5.2	4.73
70		2.1	1.91	295			
80		3.5	3.18	300		2.0	1.82
90	WE			305			
100		2,300	2,096.24	310		1.7	1.54
110		5.0	4.55	315			
120		2.9	2.64	320		2.2	2.00
130		2.0	1.82	325			
140		1.7	1.54	330		2.9	2.64
150		1.8	1.64	335			
160	TB			340		3.6	3.28
170	TB			345		3.4	3.09
180	TB			350	BP		
190	TB			355			
200	TB			360	BP		
210		2.2	2.00				
220		1.8	1.64				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D22

3-D Angle = 67.5°
ψ = 10°
Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o \cos\psi$ 108.05

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)	BP			230		2.4	2.22
5		1.6	1.48	240		4.1	3.79
10		1.6	1.48	250		2.1	1.94
15				260		4.1	3.79
20		1.6	1.48	270	WE		
30		1.5	1.38	275			
40		1.6	1.48	280		2,800	2,591.39
50		1.7	1.57	285			
60		1.8	1.66	290		5.5	5.09
70		1.9	1.75	295			
80		3.8	3.51	300		2.0	1.85
90	WE			305			
100		2,100	1,943.54	310		1.8	1.66
110		5.5	5.09	315			
120		3.1	2.86	320		2.2	2.03
130		2.1	1.94	325			
140		1.7	1.57	330		3.0	2.77
150	TB			335		3.1	2.86
160	TB			340	BP		
170	TB			345			
180	TB			350	BP		
190	TB			355			
200		2,5	2.31	360	BP		
210		1.7	1.57				
220		1.6	1.48				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°
ψ = 20°
Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o Cos\psi$ 103.1

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)				230		4.6	4.46
5				240		1.5	1.45
10	WR			250		2.1	2.03
15				260		4.3	4.17
20	WR			270	WE		
30	WR			275			
40	WR			280		2,600	2,521.82
50		1.9	1.84	285			
60		1.8	1.74	290		5.1	4.94
70		2.1	2.03	295			
80		4.5	4.36	300		1.8	1.74
90	WE			305			
100		2,900	2,812.80	310		1.7	1.64
110		6.1	5.91	315			
120		3.5	3.39	320		2.0	1.93
130		2.3	2.23	325		2.5	2.42
140	TB			330	BP		
150	TB			335			
160	TB			340	BP		
170	TB			345			
180	TB			350	BP		
190		2.6	2.52	355		2.6	2.52
200		3.4	3.29	360		2.2	2.13
210		1.8	1.74				
220		2.4	2.32				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°
ψ = 30°
Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o \cos\psi$ 95.02

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.4	1.47
5				240		1.2	1.26
10		1.4	1.47	250		2.0	2.10
15				260		4.6	4.84
20	WR			270	WE		
30	WR			275			
40	WR			280		2,700	2,841.50
50	WR			285			
60		1.7	1.78	290		4.5	4.73
70		2.0	2.10	295			
80		4.7	4.94	300		1.7	1.78
90	WE			305			
100		3,800	3,999.15	310		1.8	1.89
110		6.0	6.31	315		1.6	1.68
120		2.5	2.63	320	BP		
130	TB			325			
140	TB			330	BP		
150	TB			335			
160	TB			340	BP		
170	TB			345		2.5	2.63
180		1.4	1.47	350		2.6	2.73
190		2.3	2.42	355			
200		3.1	3.26	360		1.9	1.99
210		2.6	2.73				
220		4.3	4.52				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°

ψ = 40°

Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o \cos\psi$ 84.04

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.0	1.18
5				240		1.2	1.42
10		1.2	1.42	250		1.8	2.14
15				260		5.9	7.02
20	WR			270	WE		
30	WR			275			
40	WR			280		2,900	3,450.73
50	WR			285			
60	WR			290		5.9	7.02
70		1.8	2.14	295			
80		4.3	5.11	300		1.6	1.90
90	WE			305		1.5	1.78
100		4,500	5,354.59	310	BP		
110		6.0	7.13	315			
120	TB			320	BP		
130	TB			325			
140	TB			330	BP		
150	TB			335		4.0	4.75
160	TB			340		3.2	3.80
170		1.3	1.54	345			
180		1.3	1.54	350		2.3	2.73
190		2.5	2.97	355			
200		3.3		360		1.6	1.90
210		4.1	4.87				
220		1.3	1.54				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°

ψ = 50°

Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o \cos\psi$ 70.53

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.3	1.84
5				240		1.5	2.12
10		1.6	2.26	250		2.9	4.11
15				260		1,000	1,417.83
20		1.4	1.98	270	WE		
30	WR			275			
40	WR			280		7,100	10,066.63
50	WR			285			
60	WR			290		9.8	13.89
70	WR			295		1.9	2.69
80		6.2	8.79	300	BP		
90	WE			305			
100		6,100	8,648.80	310	BP		
110	TB			315			
120	TB			320	BP		
130	TB			325		4.0	5.67
140	TB			330		5.6	7.93
150	TB			335			
160		1.7	2.41	340		2,300	3,261.02
170		1.7	2.41	345			
180		1.6	2.26	350		4.5	6.38
190		5.0	7.08	355			
200		8.7	12.33	360		2.2	3.11
210		2.1	2.97				
220		1.5	2.12				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°

ψ = 60°

Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o \cos\psi$ 54.86

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		3.3	6.01
5				240		4.9	8.93
10		2.6	4.73	250		1,900	3,463.36
15				260		9,800	17,863.65
20		2.6	4.73	270	WE		
30		2.7	4.92	275			
40	WR			280		650	1,184.83
50	WR			285		250	455.70
60	WR			290	BP		
70	WR			295			
80	WR			300	BP		
90	WE			305			
100	TB			310	BP		
110	TB			315		2.9	5.28
120	TB			320		2.7	4.92
130	TB			325			
140	TB			330		8.3	15.12
150		3.5	6.37	335			
160		3.6	6.56	340		5.8	10.57
170		3.6	6.56	345			
180		5.1	9.29	350		5.8	10.57
190		14.0	25.51	355			
200		20.0	36.45	360		5.3	9.66
210		4.0	7.29				
220		3.2	5.83				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D28

3-D Angle = 67.5°
ψ = 70°
Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o \cos\psi$ 37.52

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		4.5	11.99
5				240		6.5	17.32
10		3.3	8.79	250		2,800	7,462.68
15				260		15,000	39,978.67
20		3.4	9.06	270	WE	-	
30		3.5	9.32	275		81,000	215,884.86
40		3.7	9.86	280	BP		
50	WR			285			
60	WR			290	BP		
70	WR			295			
80	WR			300	BP		
90	WE			305		3.3	87.95
100	TB			310		3.9	10.39
110	TB			315			
120	TB			320		4.9	13.05
130	TB			325			
140		4.9	13.05	330		9.7	25.85
150		4.8	12.79	335			
160		4.7	12.52	340		7.8	20.78
170		6.5	17.32	345			
180		1,000	2,665.24	350		4.9	13.05
190		1,400	3,731.34	355			
200		3,000	7,995.73	360		4.0	10.66
210		5.3	14.12				
220		4.3	11.46				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°

ψ = 80°

Date 3/21/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 105
End L_d 105
Mean L_d 105
$E_o \cos\psi$ 19.05

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		4.6	29.39
5				240		6.6	34.64
10		3.5	18.37	250		2,900	15,223.09
15				260		15,000	78,740.15
20		3.6	18.89	270	WE		
30		3.7	19.42	275			
40		4.0	20.99	280	BP		
50		4.2	22.04	285			
60		5.0	26.24	290	BP		
70	WR			295		5.1	26.77
80	WR			300		4.9	25.72
90	WE			305			
100	TB			310		4.2	22.04
110	TB			315			
120	TB			320		4.9	25.72
130		5.5	28.87	325			
140		5.0	26.24	330		9.7	50.91
150		4.7	24.67	335			
160		6.6	34.64	340		6.9	36.22
170		1,100	5,774.27	345			
180		4.7	24.67	350		5.0	26.24
190		1,300	6,824.14	355			
200		3,200	16,797.90	360		3.9	20.47
210		5.0	26.24				
220		4.4	23.09				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D30

3-D Angle = 22.5°

ψ = 0°

Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 45
End L_d 45
Mean L_d 45
$E_o \cos\psi$ 47.02

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)	BP			230		1.00	2.13
5				240		0.85	1.81
10	BP			250		1.00	2.13
15		0.89	1.89	260		1.10	2.34
20		0.78	1.66	270	WE		
30		0.72	1.53	275			
40		0.50	1.06	280		0.65	1.38
50		0.43	0.91	285			
60		0.46	0.98	290		0.55	1.17
70		0.52	1.11	295			
80		0.63	1.34	300		0.45	0.96
90	WE			305			
100		1.90	4.04	310		0.40	0.85
110		1.60	3.40	315			
120		1.70	3.62	320		0.45	0.96
130		1.50	3.19	325			
140		1.70	3.62	330		0.60	1.28
150		3.20	6.81	335			
160		3.00	6.38	340		0.75	1.60
170	TB	4.80	10.21	345		0.85	1.81
180	TB	6.50	13.82	350	BP		
190	TB	5.40	11.48	355			
200		2.60	5.53	360	BP		
210		1.60	3.40				
220		1.20	2.55				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 22.5°

ψ = 10°

Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 45
End L_d 45
Mean L_d 45
$E_o \cos\psi$ 46.31

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)	BP			230		0.70	1.51
5		1.05	2.27	240		0.68	1.47
10		0.90	1.94	250		2.50	5.40
15				260		8.80	19.00
20		0.67	1.45	270	WE		
30		0.55	1.19	275			
40		0.70	1.51	280		1.40	3.02
50		0.50	1.08	285			
60		0.53	1.14	290		1.10	2.38
70		0.61	1.32	295			
80		0.90	1.94	300		0.50	1.08
90	WE			305			
100		4.20	9.07	310		0.44	0.95
110		2.50	5.40	315			
120		1.90	4.10	320		0.55	1.19
130		2.20	4.75	325			
140		3.70	7.99	330		0.68	1.47
150		3.10	6.68	335		0.71	1.53
160	TB	5.00	10.80	340	BP		
170	TB	7.20	15.55	345			
180	TB	5.20	11.23	350	BP		
190		2.40	5.18	355			
200		1.40	3.02	360	BP		
210		2.90	6.26				
220		0.76	1.64				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 22.5°

ψ = 20°

Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 45
End L_d 45
Mean L_d 45
$E_o Cos\psi$ 44.19

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)				230		0.54	1.22
5				240		0.50	1.13
10		0.78	1.77	250		0.53	1.20
15	WR			260		4.40	9.96
20	WR	0.75	1.70	270	WE		
30	WR	0.51	1.15	275			
40		0.50	1.13	280		1.40	3.17
50		0.72	1.63	285			
60		0.73	1.65	290		0.55	1.24
70		0.76	1.72	295			
80		0.94	2.13	300		0.50	1.13
90	WE			305			
100		3.80	8.60	310		0.55	1.24
110		2.40	5.43	315			
120		4.60	10.41	320		0.71	1.61
130		3.20	7.24	325		0.73	1.65
140		3.50	7.92	330	BP		
150	TB	5.50	12.45	335			
160	TB	8.20	18.56	340	BP		
170	TB	4.80	9.50	345			
180		2.10	4.75	350	BP		
190		1.30	2.94	355		0.82	1.86
200		0.90	2.04	360		0.70	1.58
210		0.90	1.58				
220		0.61	1.38				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 22.5°

ψ = 30°

Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 45
End L_d 45
Mean L_d 45
$E_o \cos\psi$ 40.72

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		0.43	1.06
5				240		0.42	1.03
10		0.52	1.28	250		0.50	1.23
15				260		0.58	1.42
20	WR	0.62	1.52	270	WE		
30	WR	0.75	1.84	275			
40	WR	0.55	1.38	280		7.70	18.91
50		0.54	1.33	285			
60		0.69	1.69	290		0.56	1.38
70		1.50	3.68	295			
80		1.90	4.67	300		0.56	1.38
90	WE			305			
100		3.00	7.37	310		0.72	1.77
110		2.90	7.12	315		0.63	1.55
120		3.60	8.84	320	BP		
130		4.20	10.31	325			
140	TB	5.60	13.75	330	BP		
150	TB	8.60	21.12	335			
160	TB	4.70	11.54	340	BP		
170		2.20	5.40	345		0.84	2.06
180		1.40	3.44	350		0.73	1.79
190		0.90	2.21	355			
200		0.65	1.60	360		0.61	1.50
210		0.52	1.28				
220		0.48	1.18				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 22.5°

ψ = 40°

Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 45
End L_d 45
Mean L_d 45
$E_o \cos\psi$ 36.02

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		0.38	1.05
5				240		0.40	1.11
10		0.36	1.00	250		0.45	1.25
15				260		0.51	1.42
20		0.42	1.17	270	WE		
30	WR	0.67	1.86	275			
40	WR	0.85	2.36	280		4.40	12.22
50	WR	0.62	1.72	285			
60		0.72	2.00	290		3.60	9.99
70		0.33	0.92	295			
80		0.48	1.33	300		0.70	1.94
90	WE			305		0.70	1.94
100		3.60	9.99	310	BP		
110		4.00	11.10	315			
120		4.80	13.33	320	BP		
130	TB	6.00	16.66	325			
140	TB	8.90	24.71	330	BP		
150	TB	4.40	12.22	335		0.80	2.22
160		2.00	5.55	340		0.70	1.94
170		1.40	3.89	345			
180		0.85	2.36	350		0.53	1.47
190		0.65	1.80	355			
200		0.55	1.53	360		0.40	1.11
210		0.48	1.33				
220		0.37	1.03				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 22.5°

ψ = 50°

Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 45
End L_d 45
Mean L_d 45
$E_o \cos\psi$ 30.23

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		0.34	1.12
5				240		0.41	1.36
10		0.46	1.52	250		0.42	1.39
15				260		0.53	1.75
20		0.37	1.22	270	WE		
30		0.44	1.46	275			
40	WR	0.88	2.91	280		0.70	2.32
50	WR	1.15	3.80	285			
60	WR	1.00	3.31	290		0.68	2.25
70		1.25	4.13	295		0.57	1.89
80		1.90	6.29	300	BP		
90	WE			305			
100		4.80	15.88	310	BP		
110		4.60	15.22	315			
120	TB	6.20	20.51	320	BP		
130	TB	8.90	29.44	325		0.85	2.81
140	TB	4.60	15.22	330		0.71	2.35
150		2.30	7.61	335			
160		1.40	4.63	340		0.51	1.69
170		0.84	2.78	345			
180		0.61	2.02	350		0.34	1.12
190		0.48	1.59	355			
200		0.43	1.42	360		0.35	1.16
210		0.42	1.39				
220		0.41	1.36				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 22.5°
ψ = 60°
Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 45
End L_d 45
Mean L_d 45
$E_o \cos\psi$ 23.51

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.45	6.17
5				240		1.30	5.53
10		0.68	2.89	250		1.80	7.66
15				260		10.50	44.66
20		0.78	3.32	270	WE		
30		0.72	3.06	275			
40		0.88	3.74	280		12.50	53.17
50	WR	1.70	7.23	285		4.90	20.84
60	WR	2.50	10.63	290	BP		
70	WR	2.65	11.27	295			
80		3.50	14.89	300	BP		
90	WE			305			
100		6.00	25.52	310	BP		
110	TB	6.90	29.35	315		2.65	11.27
120	TB	9.40	39.98	320		1.40	5.95
130	TB	5.30	22.54	325			
140		2.60	11.06	330		1.20	5.10
150		1.80	7.66	335			
160		1.25	5.32	340		0.95	4.04
170		1.00	4.25	345			
180		0.79	3.36	350		0.75	3.19
190		0.80	3.40	355			
200		1.05	4.47	360		0.65	2.76
210		0.77	3.28				
220		1.10	4.68				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

S-D Angle = 22.5°

ψ = 70°

Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244

Start L_d 45

End L_d 45

Mean L_d 45

$E_c \cos\psi$ 16.08

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_c \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_c \cos\psi} \times 10^{-5}$
0(360)				230		1.40	8.71
5				240		2.15	13.37
10		0.64	3.98	250		2.40	14.93
15				260		24.0	149.25
20		0.67	4.17	270	WE		
30		0.76	4.73	275			
40		0.96	5.97	280	BP		
50		1.60	9.95	285			
60	WR	2.65	16.48	290	BP		
70	WR	4.30	26.74	295			
80	WR	4.50	27.99	300	BP		
90	WE			305		1.95	12.13
100	TB	7.60	47.26	310		1.75	10.88
110	TB	7.70	47.89	315			
120	TB	5.50	34.20	320		1.85	11.50
130		3.30	20.52	325			
140		2.00	12.44	330		1.25	7.77
150		1.40	8.71	335			
160		1.20	7.46	340		0.90	5.59
170		0.95	5.91	345			
180		0.81	5.04	350		0.75	4.66
190		0.88	5.47	355			
200		1.05	6.53	360		0.70	4.35
210		0.90	5.60				
220		1.35	8.39				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

L_w* = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D38

3-D Angle = 22.5°

ψ = 80°

Date 3-26-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244

Start L_d 45

End L_d 45

Mean L_d 45

$E_o \cos\psi$ 8.16

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.90	23.28
5				240		1.80	22.06
10		0.56	6.86	250		3.30	40.44
15				260		16.50	202.21
20		0.59	7.23	~~270~~ 265		250.0	3063.72
30		0.75	9.19	~~275~~ 270	WE		
40		0.82	10.05	280	BP		
50		1.15	14.09	285			
60		1.75	21.45	290	BP		
70	WR	3.30	40.44	295		2.25	27.57
80	WR	5.20	63.73	300		1.85	22.67
90	WE			305			
100	TB	6.00	73.53	310		1.55	19.00
110	TB	3.90	47.79	315			
120		2.90	35.54	320		1.20	14.71
130		1.80	22.06	325			
140		1.20	14.71	330		1.05	12.87
150		1.00	12.25	335			
160		0.80	9.80	340		0.80	9.80
170		0.74	9.07	345			
180		0.66	8.09	350		0.76	9.31
190		0.68	8.33	355			
200		0.89	10.91	360		0.58	7.11
210		0.84	10.29				
220		0.87	10.66				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

B-D Angle = 45^0

$\psi = 0^0$

Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 125
End L_d 125
Mean L_d 125
$E_o Cos\psi$ 130.62

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)	BP			230		3.0	2.29
5	BP			240		2.9	2.22
10	BP			250		2.9	2.22
15		1.8	1.37	260		3.8	2.90
20		1.8	1.37	270	WE		
30		1.7	1.30	275			
40		1.7	1.30	280		7.4	5.66
50		1.7	1.30	285		2.6	1.99
60		1.9	1.45	290		2.4	1.83
70		2.2	1.68	295			
80		2.8	2.14	300		2.0	1.53
90	WE			305			
100		3.7	2.83	310		1.8	1.37
110		3.4	2.60	315			
120		3.1	2.37	320		1.8	1.37
130		3.0	2.29	325			
140		3.1	2.37	330		1.9	1.45
150		3.4	2.60	335			
160		3.4	2.60	340		2.0	1.53
170		3.9	2.98	345		2.2	1.68
180		4.8	3.67	350	BP		
190	TB			355	BP		
200		4.2	3.21	360	BP		
210		4.7	3.59				
220		3.4	2.60				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1^o
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D40

3-D Angle = 45°
ψ = 10°
Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 125
End L_d 126
Mean L_d 125.5
$E_o Cos\psi$ 129.15

θ	Remarks	(ft-L) $L_W \times 10^{-3}$ *	$\frac{L_W}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_W \times 10^{-3}$ *	$\frac{L_W}{E_o Cos\psi} \times 10^{-5}$
0(360)	BP			230		2.2	1.70
5		2.2	1.70	240		2.3	1.78
10	WR	2.0	1.54	250		2.3	1.78
15				260		2.9	2.24
20	WR	1.9	1.47	270	WE		
30		1.7	1.31	275			
40		1.7	1.31	280			
50		1.8	1.39	285		2.2	1.70
60		1.9	1.47	290		2.2	1.70
70		2.2	1.70	295			
80		2.9	2.24	300		1.7	1.31
90	WE			305			
100		3.6	2.78	310		1.6	1.23
110		3.9	3.01	315			
120		3.8	2.94	320		1.6	1.23
130		4.1	3.17	325			
140		3.8	2.94	330		1.7	1.31
150		3.8	2.94	335		1.7	1.31
160	TB			340	BP		
170	TB			345	BP		
180	TB			350	BP		
190		4.9	3.79	355	BP		
200		3.4	2.63	360	BP		
210		2.6	2.01				
220		2.4	1.85				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_W = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 45°

ψ = 20°

Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 126
End L_d 126
Mean L_d 123.72
$E_o \cos\psi$

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.8	1.45
5				240		1.8	1.45
10	WR	1.9	1.53	250		2.0	1.61
15				260		2.6	2.10
20	WR	2.2	1.77	270	WE		
30	WR	1.8	1.45	275			
40		1.8	1.45	280		2.1	1.69
50		1.8	1.45	285			
60		2.0	1.61	290		2.0	1.61
70		2.4	1.93	295			
80		3.3	2.66	300		1.6	1.29
90	WE			305			
100		4.4	3.55	310		1.5	1.21
110		4.5	3.63	315			
120		4.2	3.39	320		1.5	1.21
130		4.0	3.23	325		1.5	1.21
140		4.4	3.55	330	BP		
150	TB			335	BP		
160	TB			340	BP		
170	TB			345	BP		
180		4.0	3.23	350	BP		
190		2.9	2.34	355		1.9	1.53
200		2.4	1.93	360		2.0	1.61
210		2.1	1.69				
220		1.9	1.53				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 30
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D42

S-D Angle = 45°

ψ = 30°

Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 126
End L_d 130
Mean L_d 128
$E_o \cos\psi$ 115.83

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.5	1.29 1.29
5				240		1.5	1.29 1.29
10		1.8	1.55	250		1.6	1.38 1.38
15				260		2.3	1.98
20	WR	1.7	1.46	270	WE		
30	WR	1.8	1.55	275			
40	WR	2.0	1.72	280		2.0	1.72
50		1.9	1.64	285			
60		2.2	1.89	290		1.9	1.64
70		2.6	2.24	295			
80		3.7	3.19	300		1.5	1.29
90	WE			305			
100		4.9	4.23	310		1.5	1.29
110		5.2	4.48	315		1.4	1.20
120		4.9	4.23	320	BP		
130		4.3	3.71	325	BP		
140	TB			330	BP		
150	TB			335	BP		
160	TB			340	BP		
170		3.9	3.36	345		1.7	1.46
180		2.4	2.07	350		1.7	1.46
190		2.1	1.81	355			
200		1.8	1.55	360		1.7	1.46
210		1.7	1.46				
220		1.6	1.38				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 45°

ψ = 40°

Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 130
End L_d 127
Mean L_d 128.5
$E_o \cos\psi$ 102.85

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.3	1.26
5				240		1.3	1.26
10		1.5	1.45	250		1.4	1.36
15				260		2.0	1.94
20		1.6	1.55	270	WE		
30	WR	1.6	1.55	275			
40	WR	2.0	1.94	280		2.1	2.04
50	WR	2.3	2.23	285			
60		2.6	2.52	290		1.8	1.75
70		2.8	2.72	295			
80		4.1	3.98	300		1.4	1.36
90	WE			305		1.4	1.36
100		6.1	5.93	310	BP		
110		5.6	5.44	315	BP		
120		6.1	5.93	320	BP		
130	TB			325	BP		
140	TB			330	BP		
150	TB			335		1.6	1.55
160		3.3	3.20	340		1.6	1.55
170		2.2	2.13	345			
180		1.9	1.84	350		1.6	1.55
190		1.6	1.55	355			
200		1.4	1.36	360		1.6	1.55
210		1.4	1.36				
220		1.3	1.26				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D44

D-D Angle = 45°
Ψ = 50°
Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 127
End L_d 128
Mean L_d 127.5
$E_o \cos\psi$ 85.64

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		1.2	1.40
5				240		1.3	1.51
10		1.3	1.51	250		1.5	1.75
15				260		2.1	2.45
20		1.3	1.51	270	WE		
30		1.5	1.75	275			
40	WR	1.8	2.10	280			
50	WR	2.0	2.33	285		2.3	2.68
60	WR	2.7	3.15	290		2.0	2.33
70		3.7	4.32	295		1.8	2.10
80		4.9	5.72	300	BP		
90	WE			305	BP		
100		8.2	9.57	310	BP		
110		7.3	8.52	315	BP		
120	TB			320	BP		
130	TB			325		1.5	1.75
140	TB			330		1.6	1.86
150		3.5	4.08	335			
160		2.5	2.91	340		1.6	1.86
170		2.0	2.33	345			
180		1.6	1.86	350		1.4	1.63
190		1.4	1.63	355			
200		1.2	1.40	360		1.4	1.63
210		1.2	1.40				
220		1.2	1.40				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 45°

ψ = 60°

Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 128
End L_d 128
Mean L_d 128
$E_o \cos\psi$ 66.88

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		3.6	5.38
5				240		4.2	6.27
10		2.5	3.73	250		5.2	7.77
15				260		7.2	10.76
20		2.6	3.88	270	WE		
30		2.9	4.33	275			
40		3.2	4.78	280			
50	WR	3.5	5.23	285		5.9	8.82
60	WR	4.0	5.98	290	BP		
70	WR	5.0	7.47	295	BP		
80		7.6	11.36	300	BP		
90	WE			305	BP		
100		25.0	37.38	310	BP		
110	TB			315		3.0	4.48
120	TB			320		4.2	6.27
130	TB			325			
140		7.7	11.51	330		3.7	5.53
150		5.7	8.52	335			
160		4.4	6.57	340		3.1	4.63
170		3.6	5.38	345			
180		3.2	4.78	350		2.7	4.03
190		2.9	4.33	355			
200		2.8	4.18	360		2.5	3.73
210		2.9	4.33				
220		3.2	4.78				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

S-D Angle = 45°
ψ = 70°
Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 128
End L_d 129
Mean L_d 128.5
$E_o \cos\psi$ 45.92

θ	Remarks	(ft-L) $L_w^* \times 10^{-3}$	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w^* \times 10^{-3}$	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		5.6	12.19
5				240		6.7	14.59
10		3.5	7.62	250		8.3	18.07
15				260		12.5	27.22
20		3.6	7.83	270	WE		
30		3.9	8.49	275	BP		
40		4.3	9.36	280	BP		
50		5.0	10.88	285	BP		
60	WR	5.6	12.19	290	BP		
70	WR	7.4	16.11	295	BP		
80	TB WE			300	BP		
90	WE			305		6.0	13.06
100	TB			310		6.4	13.93
110	TB			315			
120	TB			320		5.6	12.19
130		8.4	18.29	325			
140		6.3	13.71	330		4.7	10.23
150		5.2	11.32	335			
160		4.5	9.79	340		4.2	9.14
170		4.0	8.71	345			
180		3.7	8.05	350		3.8	8.27
190		3.6	7.83	355			
200		3.8	8.27	360		3.6	7.83
210		4.1	8.92				
220		4.7	10.23				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

$^*L_w$ = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 45°

ψ = 80°

Date 3-13-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 129
End L_d 127
Mean L_d 128
$E_o \cos\psi$ 23.22

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		5.8	24.97
5				240		7.1	30.57
10		3.3	14.21	250		8.8	37.89
15				260		12.7	54.69
20		3.4	14.64	270	WE		
30		3.8	16.36	275	BP		
40		4.2	18.08	280	BP		
50		4.9	21.10	285	BP		
60		6.0	25.83	290	BP		
70	WR	7.8	33.59	295		8.6	37.03
80	TB			300		7.8	33.59
90	WE			305			
100	TB			310		6.3	27.13
110	TB			315			
120		7.8	33.59	320		5.3	22.82
130		6.0	25.83	325			
140		4.9	21.10	330		4.5	19.37
150		4.3	18.51	335			
160		3.8	16.36	340		3.8	16.36
170		3.6	15.50	345			
180		3.4	14.64	350		3.5	15.07
190		3.5	15.07	355			
200		3.8	16.36	360		3.2	13.78
210		4.2	18.08				
220		4.9	21.10				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D48

3-D Angle = 67.5°

ψ = 0°

Date 3/20/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 106
End L_d 105
Mean L_d 105.5
$E_o Cos\psi$ 110.24

θ	Remarks	(ft-L) L_w x 10^{-3} *	$\frac{L_w}{E_o Cos\psi}$ x 10^{-5}	θ	Remarks	(ft-L) L_w x 10^{-3} *	$\frac{L_w}{E_o Cos\psi}$ x 10^{-5}
0(360)				230		6.3	5.71
5				240		7.6	6.89
10		2.8	2.53	250		7.2	6.53
15				260		8.1	7.34
20		2.9	2.63	270			
30		2.8	2.53	275			
40		2.7	2.44	280		15.5	14.06
50		2.7	2.44	285			
60		2.4	2.17	290		6.7	6.07
70		2.5	2.26	295			
80		2.8	2.53	300		3.3	2.99
90				305			
100			9.07	310		3.0	2.72
110		3.8	3.44	315			
120		3.3	2.99	320		3.2	2.90
130		3.2	2.90	325			
140		3.2	2.90	330		3.0	2.72
150		3.9	3.53	335			
160		3.6	3.26	340		3.1	2.81
170	TB	4.6	4.17	345		2.8	2.53
180	TB	8.2	7.43	350			
190	TB	7.6	6.89	355			
200	TB	6.3	5.71	360			
210		4.0	3.62				
220		4.1	3.71				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 67.5^{o}

ψ = 10^{o}

Date 3-20-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 105
End L_d 105
Mean L_d 105.5
$E_o Cos\psi$ 108-05

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)				230		4.6	4.25
5		2.8	2.59	240		5.2	4.81
10		2.8	2.59	250		6.3	5.83
15				260		7.2	6.66
20		3.5	3.23	270			
30		3.1	2.86	275			
40		2.8	2.59	280		4.0	12.95
50		2.8	2.59	285			
60		2.6	2.40	290		5.6	5.18
70		2.7	2.49	295			
80			2.77	300		3.0	2.77
90				305			
100		10.5	9.71	310		2.7	2.49
110		4.1	3.79	315			
120		3.8	3.51	320		2.8	2.59
130		3.6	3.33	325			
140		3.5	3.23	330		3.1	2.86
150		TB		335			
160		TB		340		2.8	2.59
170		TB		345			
180		TB		350			
190		TB		355			
200		4.6	4.25	360			
210		4.3	3.97				
220		3.2	2.96				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1^{o}
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

D50

3-D Angle = 67.5°

ψ = 20°

Date 3-20-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 105
End L_d 105
Mean L_d 105.5
$E_o \cos\psi$ 103.10

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		2.8	2.72
5				240		5.2	5.04
10		2.9	2.81	250		6.9	6.69
15				260		1.0	10.67
20		2.9	2.81	270		-	-
30		3.1	3.01	275			
40		3.1	3.01	280		4.0	13.58
50		3.9	3.78	285			
60		3.6	3.49	290		5.2	5.04
70		3.2	3.10	295			
80		4.2	4.07	300		2.5	2.42
90		-		305			
100		4.0	13.58	310		2.3	2.23
110		4.6	4.46	315			
120		4.2	4.07	320		2.5	2.42
130		4.5	4.36	325		2.6	2.52
140		TB		330			
150		TB		335			
160		TB		340			
170		TB		345			
180		TB		350			
190			2.91	355		2.8	2.72
200			2.72	360		2.9	2.81
210			2.72				
220			2.62				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 67.5°

ψ = 30°

Date 3-20-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 105
End L_d 105
Mean L_d 105.5
$E_o \cos\psi$ 95.01

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		4.1	4.31
5				240		6.3	6.63
10		2.6	2.73	250		5.8	6.10
15				260		7.6	7.99
20		3.1	3.26	270		-	-
30		3.2	3.36	275			
40		3.1	3.26	280		5.0	15.78
50		3.0	3.15	285			
60		3.1	3.26	290		5.1	5.36
70		3.2	3.36	295			
80		5.2	5.47	300		2.4	2.52
90		-	-	305			
100		16.5	17.36	310		2.1	2.21
110		5.4	5.68	315			
120		4.6	4.84	320		2.1	2.21
130		TB		325			
140		TB		330			
150		TB		335			
160		TB		340		2.2	2.31
170		TB		345			
180		2.6	2.73	350			
190		2.3	2.42	355		2.3	2.42
200		2.2	2.31	360		2.5	2.63
210		2.3	2.42				
220		2.6	2.73				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

D52

3-D Angle = 67.5°

ψ = 40°

Date 3-20-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244

Start L_d 1.05 X 10^3

End L_d 1.05 X 10^3

Mean L_d 105.5

$E_o Cos\psi$ 84.04

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)				230		3.1	3.68
5				240		4.1	4.87
10		2.4	2.85	250		5.2	6.18
15				260		8.0	9.51
20		2.6	3.09	270		-	
30		2.7	3.21	275			
40		3.0	3.56	280		8.0	21.41
50		4.1	4.87	285			
60		3.8	4.52	290		5.4	6.42
70		4.9	5.83	295			
80		5.2	6.18	300		2.4	2.85
90		-		305		2.0	2.37
100		20.5	24.39	310			
110		4.8	5.71	315			
120		4.2	4.99	320		-	
130		4.5	5.35	325			
140		TB		330			
150		TB		335		2.0	2.31
160		TB		340		2.1	2.49
170		TB		345			
180		TB		350		2.2	2.61
190		2.1	2.49	355			
200		2.0	2.37	360		2.2	2.61
210		2.2	2.61				
220		2.2	2.61				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photomete mount

3-D Angle = 67.5^{o}

ψ = 50^{o}

Date 3-20-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244

Start L_d 1.05 X 10^3

End L_d 1.05 X 10^3

Mean L_d 105.5

$E_o Cos\psi$ 70.54

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)				230		3.3	4.67
5				240		4.3	6.09
10		2.4	3.40	250		6.6	9.35
15				260		8.0	25.52
20		2.6	3.68	270		-	
30		2.8	3.97	275			
40		3.0	4.25	280		2.0	59.55
50		3.1	4.39	285			
60		2.9	4.11	290		7.0	9.92
70		3.7	5.24	295		2.5	3354
80		6.1	8.65	300			
90		-		305			
100		1.05	148.89	310			
110		5.0	7.09	315			
120		4.5	6.38	320			
130		TB		325		2.0	2.83
140		TB		330			
150		TB		335		1.8	2.55
160		TB		340		1.9	2.69
170		2.4	3.40	345			
180		2.2	3.11	350		2.0	2.83
190		2.2	3.11	355			
200		2.3	3.26	360		2.2	3.11
210		2.0	2.83				
220		2.0	2.83				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1^{o}
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°

ψ = 60°

Date 3-20-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 1.05 x 10^3
End L_d 1.05 x 10^3
Mean L_d 105.5
$E_o \cos\psi$ 54.85

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		6.6	12.03
5				240		7.0	12.76
10		4.1	7.47	250		15.5	28.25
15				260		8.8	160.43
20		3.9	7.11	270		-	
30		4.0	7.29	275			
40		4.2	7.65	280		4.3	780.95
50		4.4	8.02	285		1.9	346.39
60		4.6	8.38	290			
70		5.7	10.39	295			
80		5.0	45.57	300			
90		-		305			
100		TB		310			
110		TB		315		3.1	5.65
120		TB		320		3.3	6.01
130		TB		325			
140		TB		330		3.9	7.11
150		5.7	10.39	335			
160		5.9	10.75	340		4.0	7.29
170		5.8	10.57	345			
180		6.1	11.12	350		4.2	7.65
190		6.1	11.12	355			
200		5.8	10.57	360		4.2	7.65
210		5.9	10.75				
220		6.3	11.48				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 67.5°
ψ = 70°
Date 3-20-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 1.05 X 10^3
End L_d 1.05 X 10^3
Mean L_d 105.5
$E_o Cos\psi$ 37.52

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o Cos\psi} \times 10^{-5}$
0(360)				230		7.6	20.25
5				240		9.4	25.05
10		4.7	12.52	250		24.5	65.29
15				260		1.3	346.48
20		4.7	12.52	270		-	
30		5.0	13.32	275			
40		5.0	13.32	280		5.7	1 519.18
50		WR		285			
60		WR		290			
70		WR		295			
80		WR		300		4.3	11.46
90		-		305			
100		TB		310			
110		TB		315		5.2	13.85
120		TB		320		5.2	13.85
130		TB		325			
140		7.3	19.45	330		5.1	13.59
150		7.4	19.72	335			
160		7.0	18.65	340		4.8	12.79
170		6.9	18.39	345			
180		7.9	21.05	350		4.8	12.79
190		7.6	20.25	355			
200		7.3	19.45	360		4.8	12.79
210		7.0	18.65				
220		7.0	18.65				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

D56

3-D Angle = 67.5°
ψ = 80°
Date 3-20-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 1.05×10^3
End L_d 1.05×10^3
Mean L_d 105.5
$E_o \cos\psi$. 19.04

θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$	θ	Remarks	(ft-L) $L_w \times 10^{-3}$ *	$\frac{L_w}{E_o \cos\psi} \times 10^{-5}$
0(360)				230		7.2	37.81
5				240		8.2	43.06
10		4.8	25.21	250		2.0	115.54
15				260		1.3	682.77
20		5.0	26.26	~~270~~265		1.7	892.85
30		5.4	28.36	275			
40		5.8	30.46	280			
50		6.4	33.61	285			
60		6.6	34.66	~~290~~295		6.2	32.56
70		WR		295			
80		WR		300		5.8	30.46
90		TB		305			
100		TB		310		5.8	30.46
110		TB		315			
120		TB		320		5.6	29.41
130		7.4	38.86	325			
140		6.6	34.66	330		5.4	28.36
150		6.1	32.03	335			
160		6.1	32.03	340		5.1	26.78
170		6.2	32.56	345			
180		5.8	30.46	350		4.9	25.73
190		6.0	31.51	355			
200		6.4	33.61	360		4.8	25.21
210		7.3	38.34				
220		7.3	38.34				

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam incident on Photometer mount
WE = Window Edge
BP = Beam blocked by photometer mount
WR = Window reflex (specular) incident on Photometer mount

3-D Angle = 0°

$\gamma = 0^\circ$

Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208

Start L_d 185

End L_d 185

Mean L_d 185

$E_o \cos\gamma$ 193.31

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\gamma} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\gamma} \times 10^{-5}$
0(360)	BP						230	1	0.1	0.25	2.5	1.2	1.23
5							240	1	0.1	0.22	2.2	1.0	1.08
10	BP						250	1	0.1	0.18	1.8	0.9	0.88
15							260	1	0.1	0.22	2.2	0.8	1.09
20	1	0.1	0.78	7.8	1.9	3.93	270	WE	-	-		0.8	
30	1	0.1	0.36	3.6	2.6	1.72	275						
40	1	0.1	0.24	2.4	1.6	1.15	280	1	0.1	0.16	1.60	0.9	0.78
50	1	0.1	0.19	1.9	1.2	0.92	285						
60	1	0.1	0.16	1.6	1.0	0.77	290	1	0.1	0.16	1.60	1.0	0.77
70	1	0.1	0.16	1.6	0.8	0.78	295						
80	1	0.1	0.17	1.7	0.8	0.83	300	1	0.1	0.16	1.60	1.1	0.77
90	WE	-	-		0.8		305						
100	1	0.1	0.19	1.9	0.7	0.94	310	1	0.1	0.18	1.80	0.9	0.88
110	1	0.1	0.20	2.0	0.8	0.99	315						
120	1	0.1	0.22	2.2	0.9	1.09	320	1	0.1	0.21	2.10	1.5	1.00
130	1	0.1	0.26	2.6	1.1	1.28	325						
140	1	0.1	0.33	3.3	1.5	1.62	330	1	0.1	0.29	2.90	2.3	1.38
150	1	0.1	0.53	5.3	2.1	2.63	335						
160	1	1.0	0.14	14.0	10.2	6.71	340	1	0.1	0.51	5.10	4.2	2.42
170	TB						345	1	0.1	0.84	8.40	8.4	3.91
180	TB						350	BP					
190	TB						355						
200	1	1.0	0.16	16.0	11.4	7.68	360	BP					
210	1	0.1	0.58	5.8	2.6	2.86							
220	1	0.1	0.37	3.7	1.6	1.83							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D58

3-D Angle = 0°

$\Psi = 10°$

Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208

Start L_d 185

End L_d 190

Mean L_d 187.5

$E_o \cos\Psi$ 192.95

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	BP					
5						
10	WR 100,000	1.0	0.51	5,100,000	1.9	26431717.96
15						
20	WR 1	10.	0.23	230.0	2.6	11.90
30	WR 1	0.1	0.67	6.7	1.7	3.38
40	1	0.1	0.34	3.4	1.2	1.69
50	1	0.1	0.25	2.5	1.0	1.24
60	1	0.1	0.20	2.0	0.8	0.99
70	1	0.1	0.18	1.8	0.75	0.89
80	1	0.1	0.20	2.0	0.7	1.00
90	WE	-	-		0.8	
100	1	0.1	0.26	2.6	0.8	1.30
110	1	0.1	0.27	2.7	0.95	1.35
120	1	0.1	0.31	3.1	1.1	1.54
130	1	0.1	0.40	4.0	1.4	2.00
140	1	0.1	0.63	6.3	2.2	3.15
150	1	1.0	0.15	15.0	10.2	7.24
160	TB					
170	TB					
180	TB					
190	BR 1	10.0	0.13	130.0	11.2	66.79
200	BR 1	0.1	0.80	8.0	3.1	3.98
210	1	0.1	0.33	3.30	1.8	1.61
220	1	0.1	0.22	2.20	1.4	1.06

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
230	1	0.1	0.18	1.80	1.0	0.88
240	1	0.1	0.16	1.60	0.9	0.78
250	1	0.1	0.15	1.50	0.8	0.73
260	1	0.1	0.15	1.50	0.8	0.73
270	WE	-	-		0.9	
275						
280	1	0.1	0.14	1.40	1.1	0.66
285						
290	1	0.1	0.14	1.40	1.1	0.66
295						
300	1	0.1	0.14	1.40	0.9	0.67
305						
310	1	0.1	0.16	1.60	1.5	0.75
315						
320	1	0.1	0.19	1.90	2.3	0.86
325						
330	1	0.1	0.24	2.40	4.2	1.02
335	1	0.1	0.33	3.30	8.5	1.26
340	BP					
345						
350	BP					
355						
360	BP					

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 20°

Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208
Start L_d 190
End L_d 190
Mean L_d 190
$E_o \cos\Psi$ 186.57

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	0.54	5.4	1.9	2.79
5						
10	WR 10	0.1	0.56	56.0	2.6	29.87
15						
20	WR 100,000	1.0	0.62	6,200,000	1.7	3,323,149.39
30	WR 10	1.0	0.29	290.0	1.2	155.37
40	1	0.1	0.72	7.2	1.0	3.80
50	1	0.1	0.39	3.9	0.8	2.04
60	1	0.1	0.28	2.8	0.75	1.46
70	1	0.1	0.25	2.5	0.7	1.30
80	1	0.1	0.27	2.7	0.7	1.40
90	WE	-	-		0.8	
100	1	0.1	0.38	3.8	1.0	1.98
110	1	0.1	0.43	4.3	1.2	2.24
120	1	0.1	0.52	5.2	1.5	2.70
130	1	0.1	0.84	8.4	2.2	4.38
140	1	1.0	0.20	20.00	10.2	10.17
150	TB					
160	TB					
170	TB					
180	1	1.0	0.14	14.0	11.2	6.90
190	BR 1	0.1	0.66	6.6	3.2	3.36
200	BR 1	10	0.12	12.0	1.8	6.33
210	BR 1	0.1	0.82	8.2	1.5	4.31
220	1	0.1	0.17	1.7	1.0	0.85

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
230	1	0.1	0.14	1.40	0.9	0.70
240	1	0.1	0.14	1.40	0.8	0.70
250	1	0.1	0.13	1.30	0.8	0.65
260	1	0.1	0.14	1.40	1.0	0.69
270	WE	-	-		1.1	
275						
280	1	0.1	0.14	1.40	1.2	0.68
285						
290	1	0.1	0.14	1.40	0.9	0.70
295						
300	1	0.1	0.14	1.40	1.5	0.66
305						
310	1	0.1	0.16	1.60	2.4	0.72
315						
320	1	0.1	0.20	2.0	4.1	0.85
325	1	0.1	0.24	2.4	8.4	0.83
330	BP					
335						
340	BP					
345						
350	BP					
355						
360	1	0.1	0.54	5.4	1.9	

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D60

3-D Angle = 0°
$\Psi = 30^{\circ}$
Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208
Start L_d 187
End L_d 187
Mean L_d 187
$E_o \cos\Psi$ 169.22

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_w* $x10^{-3}$	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi}$ $x10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_w* $x10^{-3}$	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi}$ $x10^{-}$
0(360)	1	0.1	0.28	2.54	2.6	1.34	230	1	0.1	0.11	1.10	0.8	0.60
5							240	1	0.1	0.10	1.00	0.8	0.54
10	1	0.1	0.50	5.0	1.6	2.86	250	1	0.1	0.10	1.00	1.0	0.53
15							260	1	0.1	0.12	1.20	1.1	0.64
20	WR 10	0.1	0.69	69.0	1.2	40.70	270					1.2	
30	WR 1,000,000	0.1	0.56	5,600,000	1.0	3,309,301.44	275	WE					
40	WR 10	1.0	0.20	200	0.8	118.14	280	1	0.1	0.12	1.20	1.0	0.65
50	1	0.1	0.84	8.4	0.75	4.91	285						
60	1	0.1	0.48	4.8	0.6	2.80	290	1	0.1	0.16	1.60	1.5	0.85
70	1	0.1	0.40	4.0	0.7	2.32	295						
80	1	0.1	0.43	4.3	0.8	2.49	300	1	0.1	0.14	1.40	2.4	0.68
90	WE	-	-		1.0		305						
100	1	0.1	0.65	6.5	1.1	3.77	310	1	0.1	0.17	1.70	4.0	0.76
110	1	0.1	0.74	7.4	1.5	4.28	315	1	0.1	0.26	2.60	8.2	1.05
120	1	1.0	0.11	11.0	2.2	6.37	320	BP					
130	1	1.0	0.28	28.0	10.2	15.94	325						
140	TB						330	BP					
150	TB						335						
160	TB						340	BP					
170	1	1.0	0.14	14.0	11.2	7.61	345						
180	1	0.1	0.54	5.4	3.1	3.00	350	1	0.1	0.23	2.30	1.8	1.25
190	1	0.1	0.27	2.70	1.9	1.48	355						
200	BR 1	0.1	0.32	3.2	1.5	1.80	360	1	0.1	0.28	2.54	2.6	1.34
210	BR 1	10.0	0.12	120.0	1.0	70.85							
220	BR 1	0.1	0.42	4.2	0.8	2.43							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 40°

Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208
Start L_d 187
End L_d 187
Mean L_d 187
$E_o \cos\Psi$ 149.68

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_b \times 10^{-4}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	0.17	1.6	1.2	0.92
5						
10	1	0.1	0.24	1.2	1.0	1.52
15						
20	1	0.1	0.49	1.0	0.85	3.20
30	WR 10	0.1	0.71	0.8	0.8	47.38
40	WR 1,000,000	0.1	0.57	0.8	0.7	3,808,123.94
50	WR 100	0.1	0.38	0.6	0.7	253.83
60	1	1.0	0.12	0.7	0.8	7.97
70	1	0.1	0.79	0.8	0.9	5.22
80	1	0.1	0.81	1.0	1.3	5.34
90	WE	-	-	1.2	1.6	
100	1	1.0	0.14	1.5	2.2	9.25
110	1	1.0	0.19	2.2	9.4	12.54
120	1	1.0	0.46	10.2		30.05
130	TB					
140	TB					
150	TB				11.2	
160	1	1.0	0.18	11.2	3.1	11.27
170	1	0.1	0.56	3.1	1.8	3.53
180	1	0.1	0.29	1.8	1.5	1.81
190	1	0.1	0.18	1.6	1.0	1.09
200	1	0.1	0.14	1.0	0.8	0.86
210	BR 1	0.1	0.30	0.8	0.8	1.95
220	BR 1	10.0	0.12	0.8	0.8	80.11

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
230	BR 1	0.1	0.66	6.6	0.8	4.35
240	1	0.03	0.89	0.89	1.0	0.52
250	1	0.03	0.88	0.88	1.0	0.52
260	1	0.03	1.00	1.00	1.0	0.60
270	WE	-	-		0.9	
275						
280	1	0.1	0.14	1.40	1.5	0.83
285						
290	1	0.1	0.13	1.30	2.5	0.70
295						
300	1	0.1	0.16	1.60	4.1	0.79
305	1	0.1	0.26	2.60	8.0	1.20
310	BP					
315						
320	BP					
325						
330	BP					
335						
340	1	0.1	0.18	1.80	1.8	1.08
345						
350	1	0.1	0.16	1.60	2.6	0.89
355						
360	1	0.1	0.17	1.54	1.6	0.92

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

$^*L_w$ = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D62

3-D Angle = 0°
Ψ = 50°
Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208
Start L_d 190
End L_d 190
Mean L_d 190
$E_o \cos\Psi$ 127.62

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	0.14	1.40	1.2	1.00
5						
10	1	0.1	0.17	1.70	1.0	1.25
15						
20	1	0.1	0.26	2.6	0.85	1.97
30	1	0.1	0.57	5.7	0.8	4.40
40	WR 10	0.1	0.94	94.0	0.7	73.60
50	WR 1,000,000	0.1	0.79	7900000.	0.7	6,190,252.25
60	WR 100	0.1	0.58	580.0	0.8	454.41
70	WR 10	0.1	0.36	36.0	0.9	28.13
80	1	1.0	0.24	24.0	1.3	18.70
90	WE	-	-		1.6	
100	1	1.0	0.39	39.0	2.2	30.38
110	1	1.0	0.80	80.0	9.4	61.94
120	TB					
130	TB					
140	TB					
150	1	1.0	0.26	26.0	11.2	19.49
160	1	0.1	0.66	6.6	3.1	4.92
170	1	0.1	0.33	3.3	1.8	2.44
180	1	0.1	0.21	2.1	1.5	1.52
190	1	0.1	0.14	1.4	1.0	1.01
200	1	0.1	0.12	1.2	0.8	0.87
210	1	0.1	0.11	1.1	0.8	0.79
220	BR 1	0.1	0.35	3.5	0.8	2.67

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
230	BR 1	10	0.17	17.0	1.1	13.23
240	BR 1	0.1	0.64	6.4	1.2	4.92
250	1	0.1	0.16	1.6	1.4	1.14
260	1	0.1	0.25	2.5	1.1	1.87
270	WE	-	-		2.7	
275						
280	1	0.1	0.29	2.90	4.0	1.95
285						
290	1	0.1	0.24	2.40	4.7	1.51
295	1	0.1	0.23	2.30	8.5	1.13
300	BP					
305						
310	BP					
315						
320	BP					
325						
330	1	0.1	0.16	1.60	1.8	1.11
335						
340	1	0.1	0.13	1.30	2.6	0.81
345						
350	1	0.1	0.12	1.20	1.6	0.81
355						
360	1	0.1	0.14	1.40	1.2	1.00

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 60°

Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208
Start L_d 190
End L_d 190
Mean L_d 190
$E_o Cos^{\Psi}$ 99.27

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3} *	(ft-L) L_bx10^{-4}	$\frac{L_w-L_b}{E_o Cos\Psi}$ x10^{-5}	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3} *	(ft-L) L_bx10^{-4}	$\frac{L_w-L_b}{E_o Cos\Psi}$ x10^{-5}
0(360)	1	0.1	0.13	1.30	1.0	1.20	230	BR 1	0.1	0.28	2.80	1.5	2.66
5							240	BR 1	10.0	0.28	280.0	1.8	281.87
10	1	0.1	0.16	1.60	0.95	1.51	250	BR 1	0.1	0.81	8.1	2.0	7.95
15							260	1	0.1	0.64	6.40	3.8	6.06
20	1	0.1	0.21	2.1	0.8	2.03	270	WE	-	-		9.2	
30	1	0.1	0.35	3.5	0.8	3.44	275						
40	1	0.1	0.85	8.5	0.8	8.48	280	1	0.1	0.68	6.8	8.2	6.02
50	WR 10	1.0	0.19	190.0	0.9	191.30	285	1	0.1	0.68	6.0	10.6	4.97
60	WR 1,000,000	1.0	0.17	17,000,000	2.0	17,125,012.39	290	BP					
70	WR 10	10.	0.16	1600	3.9	161,176.19	295						
80	1	1	0.96	96.0	8.2	95.87	300	BP					
90	WE	-	-		9.8		305						
100	1	10	0.16	160.0	12.8	159.88	310	BP					
110	TB						315						
120	TB						320	1	0.1	0.19	1.9	1.8	1.73
130	TB						325						
140	1	1.0	0.27	27.0	11.1	26.08	330	1	0.1	0.14	1.4	2.6	1.14
150	1	0.1	0.74	7.4	3.2	7.13	335						
160	1	0.1	0.36	3.60	1.8	3.44	340	1	0.1	0.13	1.3	1.7	1.13
170	1	0.1	0.22	2.2	1.6	2.05	345						
180	1	0.1	0.16	1.6	1.1	1.50	350	1	0.1	0.12	1.2	1.2	1.08
190	1	0.1	0.14	1.4	0.9	1.31	355						
200	1	0.1	0.12	1.2	0.9	1.11	360	1	0.1	0.13	1.30	1.0	1.20
210	1	0.1	0.12	1.2	0.9	1.12							
220	1	0.1	0.13	1.3	1.1	1.19							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D64

3-D Angle = 0°

Ψ = 70°

Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208
Start L_d 190
End L_d 192
Mean L_d 191
$E_o \cos\Psi$ 68.26

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	0.12	1.2	.95	1.61	230	1	0.1	0.16	1.6	1.8	2.08
5							240	BR1	0.1	0.28	2.8	2.0	3.80
10	1	0.1	0.13	1.3	0.8	1.78	250	BR1	10.0	0.51	510.0	4.0	746.55
15							260	BR1	1.0	0.12	12.0	10.0	16.11
20	1	0.1	0.18	1.8	0.8	2.51	270	WE	-	-		24.0	
30	1	0.1	0.25	2.5	0.8	3.54	275	1	1.0	0.48	48.0	15.5	68.04
40	1	0.1	0.52	5.2	0.95	7.47	280	BP					
50	1	1.0	0.17	17.0	1.3	24.71	285						
60	WR 10	1.0	0.12	120.0	5.0	175.06	290	BP					
70	WR 1,000,000	1.0	0.38	38000000	14.5	55,669,496.85	295						
80	WR 10	1.0	0.78	780.0	42.0	1,136.53	300	BP					
90	WE	-	-		47.0		305						
100	TB						310	1	0.1	0.21	2.10	2.2	2.75
110	TB						315						
120	TB						320	1	0.1	0.16	1.60	2.9	1.91
130	10	0.1	0.56	56.0	10.9	80.44	325						
140	10	0.1	0.13	13.0	3.1	18.59	330	1	0.1	0.12	1.20	1.7	1.50
150	10	0.03	0.5	5.0	1.8	7.06	335						
160	1	0.1	0.23	2.3	1.6	3.13	340	1	0.1	0.11	1.1	1.2	1.43
170	1	0.1	0.16	1.6	1.1	2.18	345						
180	1	0.1	0.13	1.3	0.9	1.77	350	1.	0.1	0.10	1.0	1.0	1.31
190	1	0.1	0.12	1.2	0.8	1.64	355						
200	1	0.1	0.10	1.0	0.9	1.33	360	1	0.1	0.12	1.2	0.95	1.61
210	1	0.1	0.11	1.1	1.1	1.45							
220	1	0.1	0.13	1.3	1.3	1.71							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0^{o}
Ψ = 80°
Date 4-29-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208
Start L_G 192
End L_G 192
Mean L 192
$E_o Cos\Psi$ 34.83

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w x10^{-3}$	(ft-L) $L_b x10^{-4}$	$\frac{L_w-L_b}{E_o Cos\Psi}$ $x10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w x10^{-3}$	(ft-L) $L_b x10^{-4}$	$\frac{L_w-L_b}{E_o Cos\Psi}$ $x10^{-5}$
0(360)	1	0.03	0.89	.89	0.8	2.32	230	1	0.03	1.42	1.42	1.5	3.64
5							240	1	0.03	2.20	2.20	2.9	5.48
10	1	0.03	0.90	.90	0.8	2.35	250	1	0.1	0.42	4.20	17.0	7.17
15							260	BR1	10	0.82	820.0	19.5	2,348.69
20	1	0.03	1.14	1.14	0.8	3.04	270	WE					
30	1	0.03	1.76	1.76	0.95	4.78	275						
40	1	0.1	0.31	3.1	1.00	8.61	280	BP					
50	1	0.1	0.79	7.9	1.60	22.22	285						
60	1	1.0	0.32	32.0	6.10	90.12	290	BP					
70	1	10.0	0.20	200.0	26.00	566.75	295						
80	WR 1,000,000	1.0	0.81	81000000	139.00	232,558,099-62	300	1	0.1	0.39	3.90	2.6	10.45
90	WE						305						
100	TB						310	1	0.1	0.16	1.6	3.2	3.67
110	TB						315						
120	1	1.0	0.52	52.0	8.5	146.85	320	1	0.1	0.12	1.2	1.9	2.89
130	1	1.0	0.12	12.0	3.2	33.53	325						
140	1	0.1	0.39	3.9	1.9	10.65	330	1	0.1	0.09	009	1.3	2.21
150	1	0.1	0.20	2.0	1.6	5.38	335						
160	1	0.1	0.13	1.3	1.1	3.41	340	1	0.03	0.81	0.81	1.0	2.03
170	1	0.1	0.10	1.0	1.0	2.58	345						
180	1	0.03	0.90	0.90	0.8	2.35	350	1	0.03	0.90	0.90	0.95	2.31
190	1	0.03	0.85	0.85	0.8	2.21	355						
200	1	0.03	0.81	0.81	1.0	2.03	360	1	0.03	0.89	0.89	0.8	2.32
210	1	0.03	0.87	0.87	1.2	2.15							
220	1	0.03	1.05	1.05	1.3	2.71							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D66

3-D Angle = 0°
$\Psi = 0°$
Date ~~April 28,~~ 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 180
End L_d 183
Mean L_d 181.5
$E_o \cos\Psi$ 189.655

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
1(360)	BP						230	1	.1	.22	2.2	1.2	1.0967
5	BP						240	1	.1	.20	2.0	1.0	1.0018
10	BP						250	1	.1	.18	1.8	0.9	.9016
15	BP						260	1	.1	.20	2.0	0.8	1.0123
20	1	0.1	0.80	8.0	1.9	4.1180	270	WE				0.8	
30	1	0.1	0.41	4.1	2.6	2.0247	275	1					
40	1	.1	0.28	2.8	1.6	1.3920	280	1	.1	.18	1.8	0.9	.9016
50	1	.1	0.23	2.3	1.2	1.1494	285						
60	1	.1	0.20	2.0	1.0	1.0018	290	1	.1	.20	2.0	1.0	1.0018
70	1	.1	0.18	1.8	0.8	.9069	295						
80	1	.1	0.18	1.8	0.8	.9069	300	1	.1	.20	2.0	1.1	.9965
90	WE				0.8		305						
100	1	.1	0.19	1.9	0.7	.9649	310	1	.1	.22	2.2	0.9	1.1125
110	1	.1	0.20	2.0	0.8	1.0123	315						
120	1	.1	0.22	2.2	0.9	1.1125	320	1	.1	.28	2.8	1.5	1.3972
130	1	.1	0.23	2.3	1.1	1.1547	325						
140	1	.1	0.29	2.9	1.5	1.4500	330	1	.1	.38	3.8	2.3	1.8823
150	1	.1	0.45	4.5	2.1	2.2620	335						
160	1	0.3	1.10	11.0	10.2	5.2621	340	1	.1	.74	7.4	4.2	3.6803
170	TB						345	1	.3	1.20	12.0	8.4	5.8843
180	TB						350	BP					
190	TB						355	BP					
200	1	0.3	1.00	10.0	11.4	4.6716	360	BP					
210	1	.1	.44	4.4	2.6	2.1829							
220	1	.1	.29	2.9	1.6	1.4447							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 10°

Date April 28, 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 183
End L_d 177
Mean L_d 180
$E_o \cos\Psi$ 185.229

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3}	*(ft-L) L_bx10^{-4}	$\frac{L_w-L_b}{E_o \cos\Psi}$ x10^{-5}	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3}	*(ft-L) L_bx10^{-4}	$\frac{L_w-L_b}{E_o \cos\Psi}$ x10^{-5}
0(360)	BP						230	1	0.1	0.20	2.0	1.0	1.0257
5							240	1	.1	0.16	1.6	0.9	.3779
10	10^6(WR)	0.1	.94	9400000.	1.9	5,074,799.2	250	1	.1	0.14	1.4	0.8	.7126
15							260	1	.1	0.14	1.4	0.8	.7126
20	100(WR)	0.3	1.68	1680.	2.6	906.8450	270	WE				0.9	
30	.1	0.1	0.74	7.4	1.7	3.9032	275						
40	1	0.1	0.40	4.0	1.2	2.0947	280	1	.1	0.16	1.6	1.1	.8044
50	1	0.1	0.28	2.8	1.0	1.4576	285						
60	1	0.1	0.25	2.5	0.8	1.3064	290	1	.1	0.18	1.8	1.1	.9123
70	1	0.1	0.22	2.2	0.75	1.1472	295						
80	1	0.1	0.22	2.2	0.7	1.1499	300	1	.1	0.18	1.8	0.9	.9231
90	WE				0.8		305						
100	1	0.1	0.26	2.6	0.8	1.3604	310	1	.1	0.20	2.0	1.5	.9987
110	1	0.1	0.28	2.8	0.95	1.4603	315						
120	1	0.1	0.28	2.8	1.1	1.4522	320	1	.1	0.22	2.2	2.3	1.0635
130	1	0.1	0.35	3.5	1.4	1.8139	325						
140	1	0.1	0.52	5.2	2.2	2.6885	330	1	.1	0.30	3.0	4.2	1.3928
150	1	0.3	1.20	12.0	10.2	5.9277	335	1	.1	0.37	3.7	8.5	1.5386
160	TB						340						
170	TB						345	BP					
180	TB						350	BP					
190	1(BR)	3.0	2.15	215.0	11.2	115.4678	355	BP					
200	1(BR)	0.1	0.66	0.66	3.1	3.3957	360	BP					
210	1	0.1	0.26	0.26	1.8	1.3064							
220	1	0.1	0.20	0.20	1.4	1.0041							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D68

3-D Angle = 0^{o}

$\Psi = 20^{o}$

Date April 28, 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 176
End L_d 176
Mean L_d 176
$E_o \cos\Psi$ 172.818

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	1	0.1	0.68	6.8	1.9	3.8248	230	1	0.1	0.10	1.0	0.9	.5265
5							240	1	.1	0.10	1.0	0.8	.5323
10	1(WR)	1.0	0.70	70.0	2.6	40.3545	250	1	.1	0.12	1.2	0.8	.6480
15							260	1	.1	0.12	1.2	1.0	.6365
20	100K(WR)	3.0	1.15	1150000	1.7	665,439.8	270	WE	.1	0.12	1.2	1.1	.6307
30	1(WR)	10.0	0.16	1600	1.2	925.7600	275						
40	1	0.1	0.75	7.5	1.0	4.2819	280	1	0.03	1.4	1.4	1.2	.7406
50	1	0.1	0.41	4.1	0.8	2.3261	285						
60	1	0.1	0.29	2.9	0.75	1.6346	290	1	0.03	1.5	1.5	0.9	.8158
70	1	0.1	0.27	2.7	0.7	1.5218	295						
80	1	0.1	0.29	2.9	0.7	1.6375	300	1	0.03	1.5	1.5	1.5	.7811
90	WE				0.8		305						
100	1	.1	0.37	3.7	1.0	2.0831	310	1	0.03	1.7	1.7	2.4	.8448
110	1	.1	0.42	4.2	1.2	2.3608	315						
120	1	.1	0.47	4.7	1.5	2.6328	320	1	0.03	2.0	2.0	4.1	.9200
130	1	0.1	0.69	6.9	2.2	3.8653	325	1	0.03	2.5	2.5	8.4	.9605
140		.3	1.40	14.0	10.2	.2198	330	BP					
150	TB						335	BP					
160	TB						340	BP					
170	TB						345	BP					
180	1	0.3	1.40	14.0	11.2	7.4529	350	BP					
190	1(BR)	0.1	0.66	6.6	3.2	3.6338	355	BP					
200	1(BR)	3.0	1.80	18.0	1.8	10.3114	360	BP				1.9	
210	1(BR)	0.1	0.44	4.4	1.5	2.4592							
220	1	0.1	0.14	1.4	1.0	.7522							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1^{o}
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 30°

Date April 28, 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 176
End L_d 180
Mean L_d 178
$E_o \cos\Psi$ 161.074

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $^*L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	.33	3.3	2.6	1.8873	230	1	0.03	1.05	1.05	0.8	.6022
5							240	1	0.03	1.05	1.05	0.8	.6022
10	1	0.1	0.61	6.1	1.6	3.6877	250	1	0.03	1.00	1.00	1.0	.5587
15							260	1	0.03	1.15	1.15	1.1	.6456
20	100(WR)	0.1	0.15	150.0	1.2	93.0503	270	WE				1.2	
30	100K(WR)	0.1	0.96	960000.	1.0	595,999.3	275						
40	1(WR)	1.0	1.00	100.	0.8	62.0335	280	1	0.03	1.35	1.35	1.0	.7760
50	1(WR)	0.1	0.80	8.	0.75	4.9200	285						
60	1	0.1	0.46	4.6	0.6	2.8145	290	1	0.03	1.50	1.50	1.5	.8381
70	1	0.1	0.38	3.8	0.7	2.3157	295						
80	1	.1	.43	4.3	0.8	2.6199	300	1	0.03	1.60	1.60	2.4	.8443
90	WE				1.0		305						
100	1	.1	.61	6.1	1.1	3.7187	310	1	.03	1.75	1.75	4.0	.8381
110	1	.1	.78	7.8	1.5	4.7493	315	1	.03	2.00	2.00	8.2	.7325
120	1	1.0	.10	10.0	2.2	6.0717	320	BP					
130	1	1.0	.205	20.5	10.2	12.0938	325	BP					
140	TB						330	BP					
150	TB						335	BP					
160	TB						340	BP					
170	1	0.3	1.35	13.5	11.2	7.6859	345	BP					
180	1	.1	.44	4.4	3.1	2.5392	350	1	0.1	0.26	2.60	1.8	1.5024
190		.1	.24	2.4	1.9	1.3720	355						
200	1(BR)	.1	.48	4.8	1.5	2.8868	360	1	0.1	0.33	3.30	2.6	1.8873
210	1(BR)	10.	.19	19.0	1.0	11.7337							
220	1(BR)	.1	0.43	4.3	0.8	2.6199							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

$^*L_w$ = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D70

3-D Angle = 0°
Ψ = 40°

Da: April 28, 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 180
End L_d 180
Mean L_d 180
$E_o \cos\Psi$ 144.075

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10
0(360)	1	0.1	0.20	2.0	1.6	1.2771	230	1	0.03	0.85	0,85	0.8	.5344
5							240	1	0.03	.85	0.85	1.0	.5205
10	1	0.1	0.29	2.9	1.2	1.9295	250	1	.1	.9	9.0	1.0	6.1773
15							260	1	0.03	1.10	1.10	1.0	.6940
20		.1	0.56	5.6	1.0	3.8174	270	WE				0.9	
30	10(WR)	1.0	0.23	230.	0.8	159.5835	275	1					
40	100K (WR)	1.0	0.105	1050000.	0.8	728,787	280	1	0.03	1.30	1.30	1.5	.7981
50	1 (WR)	3.0	1.68	168.	0.6	116.5642	285						
60	1(WR)	0.3	1.02	10.2	0.7	7.0310	290	1	.03	1.40	1.40	2.5	.7981
70	1	0.1	0.69	6.9	0.8	4.7336	295						
80	1	0.1	0.78	7.8	1.0	5.3444	300	1	.03	1.70	1.70	4.1	.8953
90	WE				1.2		305	1	.03	1.80	1.80	8.0	.6940
100	1	0.3	0.405	4.05	1.5	2.7069	310	BP					
110	1	0.3	0.56	5.60	2.2	3.7341	315	BP					
120	1	1.0	0.32	32.0	10.2	1.5131	320	BP					
130	TB						325	BP					
140	T[illegible]						330	BP					
150	TB						335	BP					
160	1	1.0	0.14	14.0	11.2	8.9397	340	1	.01	0.18	1.8	1.8	1.1244
170	1.0	0.1	0.46	4.6	3.1	2.9776	345						
180	1.0	0.1	0.22	0.22	1.8	1.4020	350	1	.01	0.17	1.7	2.6	.9994
190	1.0	0.1	0.14	1.4	1.6	.8606	355						
200	1.0(BR)	0.1	0.50	5.0	1.0	3.4010	360	1	.01	0.20	2.0	1.6	1.2771
210	1.0(BR)	10.0	0.20	200.	0.8	13 8.7610							
220	1.0(BR)	0.1	0.38	3.80	0.8	2.5819							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 50°

Date April 28, 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d ______
End L_d ______
Mean L_d ______
$E_o \cos\Psi$ ______

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	1	0.1	0.16	1.6	1.2	1.2378	230	BR	10	.21	210	1.1	175.5534
5							240	1	.1	.44	4.4	1.2	3.5798
10	1	0.1	0.20	2.0	1.0	1.5891	250	1	.1	.18	1.8	1.4	1.3884
15							260	1	.1	.32	3.2	1.1	2.5844
20	1	0.1	0.30	3.0	0.85	2.4381	270	WE				2.7	
30	1	.1	0.64	6.4	0.8	5.2860	275	1					
40	100(WR)	.1	0.17	170.0	0.7	142.1306	280	1	.1	.32	3.2	4.0	2.3419
50	10^6(WR)	1.0	0.14	1400000	0.7	11,709,699.8	285	1					
60	1 (WR)	10.0	0.32	320	0.8	267.5833	290	1	.1	.21	2.1	4.7	1.3633
70	1	0.3	0.68	6.8	0.9	5.6122	295	1	.1	.21	2.1	8.5	1.0455
80	1	0.3	0.65	6.5	1.3	5.3279	300	BP					
90	WE				1.6		305	BP					
100	1	1.0	0.42	42.0	2.2	34.9450	310	BP					
110	1	1.0	0.57	57.0	9.4	46.8889	315	BP					
120	TB						320	BP					
130	TB						325	BP					
140	TB						330	1	0.1	0.17	1.7	1.8	1.2713
150	1	0.3	1.6	16.0	11.2	12.4457	335						
160	1	.1	0.6	6.0	3.1	4.7591	340	1	.1	0.15	1.5	2.6	1.0371
170	1	.1	.26	2.6	1.8	2.0241	345						
180	1	.1	0.18	1.8	1.5	1.3800	350	1	.1	0.15	1.5	1.6	1.1207
190	1	.1	0.13	1.3	1.0	1.0036	355						
200	1	.03	1.00	1.0	0.8	.7694	360	1	.1	0.16	1.6	1.2	1.2378
210	1	.03	1.10	1.0	0.8	.8531							
220	BR	.1	0.4	4.0	0.8	3.2787							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D71

3-D Angle = 0°
$\Psi = 60^\circ$
Date April 28, 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 176
End L_d 178
Mean L_d 177
$E_o \cos\Psi$ 92.476

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	1	.1	.16	1.6	1.0	1.6220	230	1(BR)	.1	.44	4.4	1.5	4.5957
5							240	1(BR)	10	.30	300	1.8	324.2138
10	1	.1	.16	1.6	0.95	1.6274	250	1(BR)	.1	.58	5.8	2.0	6.0556
15	1						260		.1	.76	7.6	3.8	7.8074
20	1	.1	.21	2.1	0.8	2.1843	270	WE				9.2	
30	1	.1	.35	3.5	0.8	3.6982	275						
40	1.0	.1	.83	8.3	0.8	8.8887	280	1	.1	.60	6.0	8.2	5.6014
50	10(WR)	10.0	.32	320.	0.9	345.9384	285	1	.1	.60	6.0	10.6	5.3419
60	100K (WR)	10.	.25	25000000	2.0	27,034,041	290	BP					
70	1(WR)	10.	.31	310.	3.9	334.8003	295	BP					
80	1	1.0	.84	84	8.2	89.9479	300	BP					
90		WE			9.8		305	BP					
100	1	3.0	1.34	134	12.8	143.5183	310	BP					
110	TB						315	BP					
120	TB						320	1	0.1	.20	2.0	1.8	1.9680
130	TB						325						
140	1	1.0	.2	20	11.1	20.4269	330	1	.1	0.17	1.7	2.6	1.5571
150	1	0.1	.7	7.0	3.2	7.2234	335						
160	1	0.1	.38	3.8	1.8	3.9145	340	1	.1	.14	1.4	1.7	1.3300
170	1	0.1	.20	2.0	1.6	1.9897	345						
180	1	0.1	.16	1.6	1.1	1.6 112	350	1	.1	.14	1.4	1.2	1.3841
190	1	0.03	1.2	1.2	0.9	1.2003	355						
200	1	0.03	1.9	1.9	0.9	1.9572	360	1	.1	.16	1.6	1.0	1.6220
210	1	0.1	0.10	1.0	0.9	.9840							
220	1	0.1	0.10	1.0	1.1	.9624							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 70°

Date April 28, 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 178
End L_d 182
Mean L_d 180
$E_o \cos\Psi$ 64.326

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	.1	.13	1.3	.95	1.8732
5						
10	1	.1	.13	1.3	0.8	1.8965
15						
20	1	.1	.16	1.6	0.8	2.3629
30		.1	.22	2.2	0.8	3.2957
40	1	.1	.40	4.0	0.95	6.0706
50	1	1.0	.13	.13	1.3	20.0074
60	1(WR)	10.	.14	140.	5.0	216.8640
70	100K (WR)	10.	.45	45,000,000	14.5	69,956,158.6
80	1 (WR)	10.	.44	440.	42.0	677.4865
90	WE	EDGE			47.0	
100	TB					
110	TB					
120	TB					
130	1	1.0	0.30	30.	10.9	44.9429
140	1	.1	0.82	8.2	3.1	12.2656
150	1	.1	.42	4.2	1.8	6.2494
160	1	.1	.34	3.4	1.6	5.0368
170	1	.1	.20	2.0	1.1	2.9381
180	1	.03	1.20	1.2	0.9	1.7255
190	1	.03	1.00	1.0	0.8	1.4302
200	1	.03	1.00	1.0	0.9	1.4146
210	1	.03	1.00	1.0	1.1	1.3835
220	1	.03	1.20	1.2	1.3	1.6634

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
230	1	.03	1.4	1.4	1.8	1.8965
240	1 (BR)	.03	2.3	2.3	2.0	3.2646
250	1 (BR)	10	.50	500	4.0	776.6688
260	1 (BR)	.30	1.20	12.	10.0	17.1003
270	WE				24.0	
275	1	3.0	1.00	10.	15.5	13.1362
280	BP					
285	BP					
290	BP					
295	BP					
300	BP					
305	BP					
310	1	.1	.19	1.9	2.2	2.6116
315						
320	1	.1	.16	1.6	2.9	2.0365
325						
330	1	.1	.13	1.3	1.7	1.7566
335						
340	1	.1	.11	1.1	1.2	1.5234
345						
350	1	.1	.11	1.1	1.0	1.5545
355						
360	1	.1	.13	1.3	0.95	1.8732

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
$\psi = 80^{\circ}$
Date April 28, 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 181
End L_d 181
Mean L_d 181
$E_o \cos\psi$ 32.833

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\psi} \times 10^{-}$
0(360)	1	.1	.10	1.0	0.8	2.8020	230	~~1~~	~~0.03~~	~~1.30~~	~~1.30~~	1.5	3.5025
5							240	1	.03	1.90	1.90	2.9	4.9036
10	1	.1	.10	1.0	0.8	2.8020	250	1 (BR)	.1	3.80	3.80	17.0	6.3960
15							260	BR	10	.72	720	19.5	2,187.0678
20	1	.1	.11	1.1	0.8	3.1066	270	WE					
30	1.	.1	.15	1.5	0.95	4.2792	275	BP					
40	1	.1	.24	2.4	1.00	7.0051	280	BP					
50	1	.1	.57	5.7	1.60	16.8732	285	BP					
60	1(WR)	1.0	.22	22.	6.10	65.1478	290	BP					
70	1 (WR)	10.0	.20	200	26.00	601.2243	295	BP					
80	100K(WR)	10	.95	95000000	139.00	289,342,996.7	300	1	0.1	.48	4.8	2.6	13.8275
90	TB						305						
100	TB						310	1	0.1	.16	1.6	3.2	3.8985
110	TB						315						
120	1	1.0	.39	39.0	8.5	116.1940	320	1	.1	.12	1.2	1.9	3.0761
130	1	.1	.92	9.2	3.2	27.0459	325						
140	1	.1	.38	3.8	1.9	10.9950	330	1	.1	.10	1.0	1.3	2.6497
150	1	.1	.20	2.0	1.6	5.6041	335						
160	1	.1	.20	2.0	1.1	5.7564	340	1	.1	0.09	0.9	1.0	2.4365
170	1	.1	.13	1.3	1.0	3.6548	345						
180	1	.03	.85	0.85	0.8	2.3452	350	1	.1	0.08	0.8	0.95	2.1472
190	1	.03	.80	0.80	0.8	2.3452	355						
200	1	.03	1.00	1.00	1.0	2.7411	360	1	.1	0.10	1.0	0.8	2.8020
210	1	.03	.80	0.80	1.2	2.0710							
220	1	.03	1.00	1.00	1.3	2.6497							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

$\gamma = 0°$

Date 24 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244

Start L_d 175

End L_d 170

Mean L_d 172.5

$E_o \cos\gamma$ 177.5

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\gamma} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\gamma} \times 10^{-}$
0(360	BP						230	1	.1	.50	5.0	1.2	2.7491
5							240	1	.1	.44	4.4	1.0	2.4223
10	BP						250	1	.1	.44	4.4	0.9	2.4280
15							260	1	.1	.40	4.0	0.8	2.2083
20	1	0.1	0.34	3.4	1.9	1.8083	270	WE	.1	-		0.8	
30	1	0.1	0.26	2.6	2.6	1.3182	275						
40	1	0.1	0.21	2.1	1.6	1.0928	280	1	.1	.25	2.5	0.9	1.3576
50	1	0.1	0.20	2.0	1.2	1.0590	285	1					
60	1	0.1	0.21	2.1	1.0	1.1266	290	1	.1	.29	2.9	1.0	1.5773
70	1	0.1	0.22	2.2	0.8	1.1942	295						
80	1	0.1	0.25	2.5	0.8	1.3632	300	1	.1	.26	2.6	1.1	1.4027
90	WE				0.8		305						
100	1	0.1	0.34	3.4	0.7	1.8759	310	1	.1	.27	2.7	0.9	1.4703
110	1	0.1	0.34	3.4	0.8	1.8703	315						
120	1	0.1	0.37	3.7	0.9	2.0336	320	1	.1	.36	3.6	1.5	1.9438
130	1	0.1	0.44	4.4	1.1	2.4167	325						
140	1	0.1	0.65	6.5	1.5	3.5772	330	1	.1	.32	3.2	2.3	1.6731
150	1	0.3	1.15	11.5	2.1	6.3601	335						
160	1	.3	2.27	22.7	10.2	12.2133	340	1	.1	.41	4.1	4.2	2.0731
170	TB						345					8.4	
180	TB						350	BP					
190	TB						355						
200	1	0.3	2.61	26.1	11.4	14.0611	360	BP					
210	1	0.3	1.75	17.5	2.6	9.7120							
220	1	0.1	.66	6.0	1.6	3.6279							

Photo Research Pritchard Photometer

Photometer Aperture Factor 0.10

Xenon Lamp Amperage 80

Photometer Field of View 1°

Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor

TB = Transmitted Beam

WE = Window Edge

WR = Window Reflex (specular)

BR = Blackbody Reflex (due to WR)

BP = Beam blocked by photometer

D75

D76

3-D Angle = 0°

Ψ = 10°

Date 24 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244

Start L_d 170

End L_d 170

Mean L_d 170

$E_o \cos\Psi$ 174.9

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	BP					
5						
10	1000(WR)	10	0.290	290000	1.9	165772.908
15	1(WR)	0.3	1.10	11.0		6.2879
20	1	0.1	0.32	3.2	2.6	1.6805
30	1	0.1	0.26	2.6	1.7	1.3890
40	1	0.1	0.24	2.4	1.2	1.3033
50	1	0.1	0.25	2.5	1.0	1.3719
60	1	0.1	0.24	2.4	0.8	1.3261
70	1	0.1	0.26	2.6	0.75	1.4433
80	1	0.1	0.31	3.1	0.7	1.7320
90	WE	-	-	-	0.8	
100	1	0.1	0.48	4.8	0.8	2.6980
110	1	0.1	0.50	5.0	0.95	2.8038
120	1	0.1	0.58	5.8	1.1	3.2525
130	1	0.1	0.70	7.0	1.4	3.9213
140	1	1.0	0.10	10.0	2.2	5.5905
150	1	1.0	0.25	25.0	10.2	13.7077
160	TB					
170	TB					
180	TB					
190	1(BR)	1.0	0.44	44.0	11.2	24.4658
200	1(BR)	1.0	0.12	12.0	3.1	6.6823
210	1	0.1	0.67	6.7	1.8	3.7270
220	1	0.1	0.42	4.2	1.4	2.3208

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
230	1	.1	.34	3.4	1.0	1.8863
240	1	.1	.31	3.1	0.9	1.7206
250	1	.1	.32	3.2	0.8	1.7834
260	1	.1	.30	3.0	0.8	1.6691
270	WE	-	-		0.9	
275						
280	1	.1	.24	2.4	1.1	1.3090
285						
290	1	.1	.23	2.3	1.1	1.2518
295						
300	1	.1	.23	2.3	0.9	1.2633
305						
310	1	.1	.23	2.3	1.5	1.2290
315						
320	1	.1	.27	2.7	2.3	1.4119
325						
330	1	.1	.28	2.8	4.2	1.3604
335					8.5	
340	BP					
345						
350	BP					
355						
360	BP					

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 20°
Date 24 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 163
End L_d 163
Mean L_d 163
$E_o \cos\Psi$ 160.053

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	0.33	3.3	1.9	1.9431	230	1	.1	.24	2.4	0.9	1.4432
5			0.10				240	1	.1	.23	2.3	0.8	1.3870
10	10(WR)	0.1		10.0	2.6	6.0854	250	1	.1	.24	2.4	0.8	1.4495
15							260	1	.1	.24	2.4	1.0	1.4370
20	1000(WR)	10	0.42	4.20000	1.7	262412.913	270	WE				1.1	
30	1(WR)	0.3	1.02	10.2	1.2	6.2979	275						
40	1	0.1	0.35	3.5	1.0	2.1242	280	1	.1	.20	2.0	1.2	1.1746
50	1	0.1	0.30	3.0	0.8	1.8243	285						
60	1	0.1	0.29	2.9	0.75	1.7650	290	1	.1	.21	2.1	0.9	1.2558
70	1	0.1	0.36	3.6	0.7	2.2055	295						
80	1	0.1	0.41	4.1	0.7	2.5179	300	1	.1	.20	2.0	1.5	1.1558
90	WE				0.8		305						
100	1	0.1	0.72	7.2	1.0	4.4360	310	1	.1	.21	2.1	2.4	1.1621
110	1	0.1	0.76	7.6	1.2	4.6734	315						
120	1	0.1	0.90	9.0	1.5	5.5294	320	1	.1	.25	2.5	4.1	1.3058
130	1	0.3	1.30	13.0	2.2	7.9848	325					8.4	
140	1	0.3	2.75	27.5	10.2	16.5445	330	BP					
150	TB						335						
160	TB						340	BP					
170	TB						345						
180	1	1.0	0.46	46.0	11.2	28.0407	350	BP					
190	1(BR)	1.0	0.14	14.0	3.2	8.5471	355						
200	1(BR)	1.0	0.13	13.0	1.8	8.0098	360	BP				1.9	
210	1	0.1	0.42	4.2	1.5	2.5304							
220	1	0.1	0.28	2.8	1.0	1.6869							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D78

3-D Angle = 0°

Ψ = 30°

Date 25 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 175
End L_d 175
Mean L_d 175
$E_o \cos\Psi$ 158.4

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	0.23	2.3	2.6	1.2882	230	1	0.1	0.18	1.8	0.8	1.0861
5							240	1	0.1	0.18	1.8	0.8	1.0861
10		0.1	0.27	2.7	1.6	1.6039	250	1	0.1	0.19	1.8	1.0	1.0735
15							260	1	0.1	0.21	2.1	1.1	1.2566
20	WR	1.0	0.10	10.0	1.2	6.2389	270	WE				1.2	
30	1000(WR)	10	0.77	770000	1.0	486236.904	275						
40	1(WR)	1.0	0.24	24.00	0.8	15.1049	280	1	0.1	0.18	1.8	1.0	1.0735
50	1	0.1	0.44	4.4	0.75	2.7311	285						
60	1	0.1	0.42	4.2	0.6	2.6143	290	1	0.1	0.20	2.0	1.5	1.1682
70	1	0.1	0.48	4.8	0.7	2.9868	295						
80	1	0.1	0.60	6.0	0.8	3.7383	300	1	0.1	0.20	2.0	2.4	1.1113
90	WE				1.0		305						
100	1	0.3	1.10	11.0	1.1	6.8767	310	1	0.1	0.21	2.1	4.0	1.0735
110	1	0.3	1.25	12.5	1.5	7.7987	315					8.2	
120	1	0.3	1.70	17.0	2.2	10.5961	320	BP					
130	1	1.0	0.32	32.0	10.2	19.5631	325						
140	TB						330	BP					
150	TB						335						
160	TB						340	BP					
170	1	1.0	0.54	54.0	11.2	33.3924	345						
180	1	1.0	0.16	16.0	3.1	9.9078	350	1	0.1	0.24	2.4	1.8	1.4018
190	1	0.1	0.64	6.4	1.9	3.9214	355						
200	1(BR)	0.1	0.38	3.8	1.5	2.3048	360	1	0.1	0.23	2.3	2.6	1.2882
210	1(BR)	1.0	0.16	16.0	1.0	10.0404							
220	1(BR)	0.1	0.22	2.0	0.8	1.2124							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 40°
Date 25 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 175
End L_d 175
Mean L_d 175
$E_o \cos\Psi$ 140.1

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	1	0.1	0.19	1.9	1.6	1.2422	230	1(BR)	0.1	0.19	1.9	0.8	1.2993
5							240	1	0.1	0.16	1.6	1.0	1.0708
10	1	0.1	0.22	2.2	1.2	1.4849	250	1	0.1	0.17	1.7	1.0	1.1422
15							260	1	0.1	0.20	2.0	1.0	1.3564
20	1	0.1	0.30	3.0	1.0	2.0703	270	WE				0.9	
30	1(WR)	1.0	0.31	31.0	0.8	22.0742	275						
40	10000(WR)	10.0	0.25	2500000	0.8	1784783.6	280	1	0.1	0.19	1.9	1.5	1.2493
50	1(WR)	1.0	0.30	30.0	0.6	21.3745	285						
60	1	0.1	0.76	7.6	0.7	5.3757	290	1	0.1	0.20	2.0	2.5	1.2493
70	1	0.1	0.82	8.2	0.8	5.7969	295						
80	1	0.3	1.04	10.4	1.0	7.3533	300	1	0.1	0.21	2.1	4.1	1.2065
90	WE				1.2		305					8.0	
100	1	1.0	0.20	20.0	1.5	14.1711	310	BP					
110	1	1.0	0.26	26.0	2.2	18.4046	315						
120	1	1.0	0.47	47.0	10.2	32.8257	320	BP					
130	TB						325						
140	TB						330	BP					
150	TB						335						
160	1	1.0	0.56	56.0	11.2	39.1795	340	1	0.1	0.20	2.0	1.8	1.2993
170	1	1.0	0.18	18.0	3.1	12.6291	345						
180	1	0.1	0.67	6.7	1.8	4.6547	350	1	0.1	0.19	1.9	2.6	1.1708
190	1	0.1	0.36	3.6	1.6	2.4558	355						
200	1	0.1	0.26	2.6	1.0	1.7847	360	1	0.1	0.19	1.9	1.6	1.2422
210	1(BR)	0.1	0.26	2.2	0.8	1.5134							
220	1(BR)	1.0	0.33	33.0	0.8	23.5020							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D80

3-D Angle = 0°
Ψ = 50°
Date 25 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 175
End L_d 175
Mean L_d 175
$E_o \cos\Psi$ 117.5

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3} *	(ft-L) L_bx10^{-4}	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10^{-5}	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3}	(ft-L) L_bx10^{-4}	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10^{-}
0(360)	1	0.1	0.22	2.2	1.2	1.7695	230	1(BR)	1.0	0.75	75.0	1.1	63.7123
5							240	1(BR)	0.1	0.26	2.6	1.2	2.1098
10	1	0.1	0.28	2.8	1.0	2.2970	250	1	0.1	0.28	2.8	1.4	2.2629
15							260	1	0.1	0.40	4.0	1.1	3.3049
20	1	0.1	0.42	4.2	0.85	3.5008	270	WE				2.7	
30	1(WR)	1.0	0.43	43.0	0.8	36.5139	275						
40	10000(WR)	10.0	0.59	5900000	0.7	5,019,397	280	1	0.1	0.39	3.9	4.0	2.9776
50	1(WR)	1.0	0.84	84.0	0.7	71.4030	285						
60	1(WR)	0.3	2.25	22.5	0.8	19.0737	290	1	0.1	0.33	3.3	4.7	2.4076
70	1	0.3	2.68	26.8	0.9	22.7234	295					8.5	
80	1	1.0	0.28	28.0	1.3	23.7102	300	BP					
90	WE				1.6		305						
100	1	1.0	0.50	50.0	2.2	42.3500	310	BP					
110	1	1.0	0.70	70.0	9.4	58.7524	315						
120	TB						320	BP					
130	TB						325						
140	TB						330	1	0.1	0.22	2.2	1.8	1.7185
150	1	1.0	0.54	54.0	11.2	44.9874	335						
160	1	1.0	0.20	20.0	3.1	16.7511	340	1	0.1	0.19	1.9	2.6	1.3952
170	1	0.1	0.78	7.8	1.8	6.4826	345						
180	1	0.1	0.42	4.2	1.5	3.4455	350	1	0.1	0.19	1.9	1.6	1.4802
190	1	0.1	0.29	2.9	1.0	2.3820	355						
200	1	0.1	0.22	2.2	0.8	1.8035	360	1	0.1	0.19	1.9	1.2	1.5143
210	1	0.1	0.19	1.9	0.8	1.5483							
220	1(BR)	0.1	0.29	2.9	0.8	2.3991							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 60°
Date 25 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 175
End L_d 172
Mean L_d 173.5
$E_o \cos\Psi$ 90.6

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_w x10^{-3} *	(ft-L) L_b x10^{-4}	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10^{-5}
0(360)	1	0.1	0.20	2.0	1.0	2.0960
5						
10	1	0.1	0.21	2.1	0.95	2.2118
15						
20	1	0.1	0.27	2.7	0.8	2.8903
30	1	0.1	0.34	3.4	0.8	3.6625
40	1	0.1	0.63	6.3	0.8	6.8617
50	10(WR)	1.0	0.14	140.0	0.9	154.3442
60	100,000(WR)	3.0	1.23	12300000	2.0	13,568,969.8
70	1(WR)	3.0	2.45	245.0	3.9	269.8459
80	1	1.0	2.16	216.0	8.2	237.3797
90	WE				9.8	
100	1	3.0	1.25	125.0	12.8	136.4839
110	TB					
120	TB					
130	TB					
140	1	1.0	0.47	47.0	11.1	50.6243
150	1	1.0	0.26	26.0	3.2	28.3293
160	1	0.1	0.82	8.2	1.8	8.8474
170	1	0.1	0.44	4.4	1.6	4.7877
180	1	0.1	0.30	3.0	1.1	3.1881
190	1	0.1	0.22	2.2	0.9	2.3276
200	1	0.1	0.18	1.8	0.9	1.8864
210	1	0.1	0.17	1.7	0.9	1.7761
220	1	0.1	0.18	1.8	1.1	1.8643

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_w x10^{-3} *	(ft-L) L_b x10^{-4}	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10^{-}
230	1(BR)	0.1	0.41	4.1	1.5	4.3575
240	1(BR)	3.0	1.8	188.0	1.8	207.1970
250	1(BR)	0.1	0.48	4.8	2.0	5.0745
260	1	0.1	0.72	7.2	3.8	7.5236
270	WE				9.2	
275						
280	1	0.1	0.71	7.1	8.2	6.9278
285					10.6	
290	BP					
295						
300	BP					
305						
310	BP					
315						
320	1	0.1	0.22	2.2	1.8	2.2283
325						
330	1	0.1	0.19	1.9	2.6	1.8091
335						
340	1	0.1	0.18	1.8	1.7	1.7981
345						
350	1	0.1	0.18	1.8	1.2	1.8533
355						
360	1	0.1	0.20	2.0	1.0	2.0960

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D82

3-D Angle = 0°
$\Psi = 70^{\circ}$
Date 24 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 172
End L_d 165
Mean L_d 168.5
$E_o \cos\Psi$ 60.2

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	0.18	1.8	.95	2.8314	230	1	0.1	0.21	2.1	1.8	3.1885
5							240	1(BR)	0.1	0.38	3.8	2.0	5.9784
10	1	0.1	0.20	2.0	0.8	3.1885	250	1(BR)	10.0	0.40	400.0	4.0	663.6110
15							260	1	0.3	1.0	10.0	10.0	14.9461
20	1	0.1	0.25	2.5	0.8	4.0188	270	WE				24.0	
30	1	0.1	0.29	2.9	0.8	4.6831	275					15.5	
40	1	0.1	0.48	4.8	0.95	7.8135	280	BP					
50	1	1.0	0.11	11.0	1.3	18.0516	285						
60	1(WR)	1.0	0.70	70.0	5.0	115.4178	290	BP					
70	100,000(WR)	10.0	0.34	34000000	14.5	56,463,396	295						
80	1(WR)	10.0	0.85	850.0	42.0	1,404.61	300	BP					
90	WE				47.0		305						
100	TB						310	1	0.1	0.24	2.4	2.2	3.6203
110	TB						315						
120	TB						320	1	0.1	0.18	1.8	2.9	2.5076
130	1	3.0	0.41	41.0	10.9	66.2780	325						
140	1	1.0	0.28	28.0	3.1	45.9844	330	1	0.1	0.16	1.6	1.7	2.3747
150	1	1.0	0.11	11.0	1.8	17.9686	335						
160	1	0.1	0.47	4.7	1.6	7.5395	340	1	0.1	0.14	1.4	1.2	2.1256
170	1	0.1	0.29	2.9	1.1	4.6333	345						
180	1	0.1	0.21	2.1	0.9	3.3379	350	1	0.1	0.15	1.5	1.0	2.3249
190	1	0.1	0.17	1.7	0.8	2.6903	355						
200	1	0.1	0.15	1.5	0.9	2.3415	360	1	0.1	0.18	1.8	0.95	2.8314
210	1	0.1	0.15	1.5	1.1	2.3083							
220	1	0.1	0.16	1.6	1.3	2.4412							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

$\Psi = 80^{\circ}$

Date 25 April 1969

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 165
End L_d 168
Mean L_d 167
$E_o \cos\Psi$ 30.3

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_W \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_W - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_W \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_W - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	0.1	0.12	1.2	0.8	3.6971	230	1	0.1	0.18	1.8	1.5	5.4466
5	1						240	1	0.1	0.26	2.6	2.9	7.6552
10	1	0.1	0.16	1.6	0.8	5.0174	250	1	0.1	0.48	4.8	17.0	10.2330
15							260	1(BR)	10.0	0.66	660.0	19.5	2172.3113
20	1	0.1	0.19	1.9	0.8	6.0077	270	WE					
30	1	0.1	0.22	2.2	0.95	6.9485	275						
40	1	0.1	0.33	3.3	1.00	10.5631	280	BP					
50	1	0.1	0.74	7.4	1.60	23.8991	285						
60	1	1.0	0.24	24.0	6.10	77.2100	290	BP					
70	1	10.0	0.19	190.0	26.00	618.6043	295						
80	100,000(WR)	10.0	0.79	79000000	139.00	260,777,666	300	1	0.1	0.52	5.2	2.6	16.3068
90	WE						305						
100	TB						310	1	0.1	0.20	2.0	3.2	5.5456
110	TB						315						
120	1	3.0	0.45	45.0	8.5	145.7384	320	1	0.1	0.14	1.4	1.9	3.9941
130	1	0.3	1.48	14.8	3.2	47.7982	325						
140	1	0.3	1.21	12.1	1.9	39.3147	330	1	0.1	0.12	1.2	1.3	3.5320
150	1	0.3	0.40	4.0	1.6	12.6757	335						
160	1	0.1	0.24	2.4	1.1	7.5592	340	1	0.1	0.11	1.1	1.0	3.3009
170	1	0.1	0.16	1.6	1.0	4.9514	345						
180	1	0.1	0.13	1.3	0.8	4.0272	350	1	0.1	0.11	1.1	0.95	3.3174
190	1	0.1	0.11	1.1	0.8	3.3670	355						
200	1	0.1	0.11	1.1	1.0	3.3009	360	1	0.1	0.12	1.2	0.8	3.6971
210	1	0.1	0.11	1.1	1.2	3.2349							
220	1	0.1	0.13	1.3	1.3	3.8621							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_W = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D84

3-D Angle = 0°
Ψ = 0°
Date [illegible]

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 215
End L_d 205
Mean L_d 210
$E_o \cos\Psi$ 219.43

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_w x10^{-3} *	(ft-L) L_b x10^{-4}	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10^{-5}	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_w x10^{-3} *	(ft-L) L_b x10^{-4}	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10^{-}
0(360)	BP						230	1	10	.28	280	1.2	127.54
5							240	1	10	.24	240	1.0	109.32
10	BP						250	1	10	.19	190	0.9	86.54
15	1 BR	3	1.1	110.0		50.12	260	1	3	1.4	140	0.8	63.76
20	1	1	.48	48.0	1.9	21.78	270	WE				0.8	
30	1	1	.38	38.0	2.6	17.19	275						
40	1	1	.35	35.0	1.6	15.87	280	1	3	.65	65.	0.9	29.58
50	1	1	.35	35.0	1.2	15.89	285						
60	1	1	.4	40.0	1.0	18.18	290	1	1	.46	46.	1.0	20.91
70	1	1	.53	53.0	0.8	24.11	295						
80	1	1	.79	79.0	0.8	35.97	300	1	1	.38	38.	1.1	17.26
90	WE				0.8		305						
100	1	3	1.75	175.0	0.7	79.72	310	1	1	.32	32.	0.9	14.54
110	1	3	2.2	220.0	0.8	100.22	315						
120	1	3	2.45	245.0	0.9	111.61	320	1	1	.36	36.	1.5	16.33
130	1	3	2.9	290.0	1.1	132.11	325						
140	1	10	.38	380.0	1.5	173.10	330	1	1	.41	41.	2.3	18.57
150	1	10	.5	500.0	2.1	227.76	335						
160	1	10	.8	800.0	10.2	364.11	340	1	1	.57	57.	4.2	25.78
170	TB						345	1	1	.62	62.	8.4	27.87
180	TB						350	BP					
190	TB						355						
200	1	10	.72	720.0	11.4	327.60	360	BP					
210	1	10	.47	470.0	2.6	214.07							
220	1	10	.37	370.0	1.6	168.54							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 10°

Date 3/31/69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 205
End L_d 210
Mean L_d 207.5
$E_o \cos\Psi$ 213.53

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)							230	1	3	1.8	180	1.0	84.25
5	1000WR	.1	.3	3000		1.404.95	240	1	3	1.5	150	0.9	70.20
10	1000WR	10	.66	660000	1.9	309,089.96	250	1	3	1.25	125	0.8	58.50
15							260	1	3	.9	90	0.8	42.11
20	1 WR	1	.74	74	2.6	34.53	270	WE				0.9	
30	1	1	.47	47.	1.7	21.93	275						
40	1	1	.39	39.	1.2	18.20	280	1	1	.48	48	1.1	22.42
50	1	1	.38	38.	1.0	17.74	285						
60	1	1	.44	44.	0.8	20.56	290	1	1	.33	33	1.1	15.40
70	1	1	.6	60.	0.75	28.06	295						
80	1	1	.9	90.	0.7	42.11	300	1	1	.28	28	0.9	13.07
90	WE				0.8		305						
100	1	3	2.05	205.	0.8	95.96	310	1	1	.26	26	1.5	12.10
110	1	3	2.5	250.	0.95	117.03	315						
120	1	10	.3	300.	1.1	140.44	320	1	1	.27	27	2.3	12.53
130	1	10	.38	380	1.4	177.89	325						
140	1	10	.5	500.	2.2	234.05	330	1	1	.31	31	4.2	14.32
150	1	10	.56	560.	10.2	261.78	335	1	1	.32	32	8.5	14.58
160	TB						340	BP					
170	TB						345						
180	TB						350	BP					
190	1 BR	10	.62	620	11.2	289.83	355						
200	1 BR	10	.38	380	3.1	177.81	360	BP					
210	1	10	.28	280	1.8	131.04							
220	1	10	.22	220	1.4	102.96							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 20°
Date 3-31-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 210
End L_d 205
Mean L_d 207.5
$E_o \cos\Psi$ 203.75

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)					1.9		230	1	3	1.25	125.	0.9	61.30
5							240	1	3	1.05	105.	0.8	51.49
10	1 WR	10	.58	580	2.6	284.53	250	1	3	.9	90.	0.8	44.13
15							260	1	1	.67	67.	1.0	32.83
20	1000 WR	10	.49	490000	1.7	240,490.71	270	WE				1.1	
30	10 WR	1	.77	770	1.2	377.85	275						
40	1	1	.5	50.	1.0	24.49	280	1	1	.38	38.	1.2	18.59
50	1	1	.46	46.	0.8	22.53	285						
60	1	1	.51	51.	0.75	24.99	290	1	1	.29	29.	0.9	14.18
70	1	1	.68	68.	0.7	33.33	295						
80	1	3	1.05	105.	0.7	51.49	300	1	1	.25	25.	1.5	12.19
90	WE				0.8		305						
100	1	3	2.5	250	1.0	122.65	310	1	1	.23	23.	2.4	11.17
110	1	10	.32	320	1.2	156.99	315						
120	1	10	2.5	390	1.5	191.33	320	1	1	.24	24.	4.1	11.57
130	1	10	.51	510	2.2	250.19	325	1	1	.25	25.	8.4	11.85
140	1	10	.76	760	10.2	372.50	330	BP					
150	TB						335						
160	TB						340	BP					
170	TB						345						
180	1 BR	10	.58	580	11.2	284.11	350	BP					
190	1 BR	10	.36	360	3.2	176.53	355	1 BR	3	1.2	120.		58.89
200	1 BR	10	.28	280	1.8	137.33	360	1	1	.5	50.	1.9	24.44
210	1 BR	10	.2	200	1.5	98.08							
220	1	3	1.5	150	1.0	73.57							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 30°

Date 3-31-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 205
End L_d 205
Mean L_d 205.
$E_o \cos\Psi$ 185.51

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)					2.6		230	1	3	.9	90.	0.8	48.47
5							240	1	1	.74	74.	0.8	39.84
10	1	1	.46	46.0	1.6	24.71	250	1	1	.67	67.	1.0	36.06
15							260	1	1	.5	50.	1.1	26.89
20	10 WR	.3	2.85	285.0	1.2	153.56	270	WE				1.2	
30	Pegged				1.0		275						
40	1 WR	1	.92	92.0	0.8	49.54	280	1	1	.31	31.	1.0	16.65
50	1	1	.61	61.0	0.75	32.84	285						
60	1	1	.64	64.0	0.6	34.46	290	1	1	.25	25.	1.5	13.39
70	1	1	.85	85.0	0.7	45.78	295						
80	1	3	1.4	140.0	0.8	65.42	300	1	1	.22	22.	2.4	11.72
90	WE				1.0		305						
100	1	10	.35	350.0	1.1	188.60	310	1	1	.22	22.	4.0	11.64
110	1	10	.42	420.0	1.5	226.32	315	1	1	.22	22.	8.2	11.41
120	1	10	.56	560.0	2.2	301.75	320	BP					
130	1	10	.85	850.0	10.2	457.64	325						
140	TB						330	BP					
150	TB						335						
160	TB						340	BP					
170	1	10	.54	540.0	11.2	290.48	345	1 BR	1	.92	92.		49.59
180	1	10	.33	330.0	3.1	177.72	350	1	1	.26	26.	1.8	13.91
190	1	10	.23	230.0	1.9	123.88	355						
200	1 BR	3	1.75	175.0	1.5	94.25	360	1	1	.32	32.	2.6	17.10
210	1 BR	3	1.7	170.0	1.0	91.58							
220	1 BR	3	1.1	110.0	0.8	59.25							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D88

3-D Angle = 0°

Ψ = 40°

Date 3-31-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 205
End L_d 205
Mean L_d 205.
$E_o \cos\Psi$ 164.09

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)					1.6		230	1 BR	1	.68	68.0	0.8	41.39
5							240	1	1	.56	56.0	1.0	34.06
10	1	1	.33	33.	1.2	20.03	250	1	1	.49	49.0	1.0	29.80
15							260	1	1	.39	39.0	1.0	23.70
20	1	1	.5	55.	1.0	33.45	270	WE				0.9	
30	10 WR	1	.66	660.	0.8	402.16	275						
40	1000WR	10	.99	990000	0.8	603327.39	280	1	1	.26	26.	1.5	15.75
50	1 WR	3	1.2	120.	0.6	73.09	285						
60	1	3	.95	95.	0.7	57.85	290	1	1	.22	22.	2.5	13.25
70	1	3	1.25	125.	0.8	76.12	295						
80	1	3	1.8	180.	1.0	109.63	300	1	1	.21	21.	4.1	12.54
90	WE				1.2		305	1	1	.22	22.	8.0	12.91
100	1	10	.47	470	1.5	286.33	310	BP					
110	1	10	.61	610	2.2	371.61	315						
120	1	10	.89	890	10.2	541.76	320	BP					
130	TB						325						
140	TB						330	BP					
150	TB						335	1 BR	3	.38	38.		23.15
160	1	10	.52	520	11.2	316.21	340	1	.3	2.0	20.	1.8	12.07
170	1	10	.32	320	3.1	194.82	345						
180	1	10	.21	210	1.8	127.86	350	1	.3	2.2	22.	2.6	13.24
190	1	3	1.55	155	1.6	94.36	355						
200	1	3	1.25	125	1.0	76.11	360	1	.3	2.5	25.	1.6	15.13
210	1 BR	3	1.0	100	0.8	60.89							
220	1 BR	3	1.4	140	0.8	85.27							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

$\Psi = 50^{\circ}$

Date 3-31-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 205
End L_d 205
Mean L_d 205.
$E_o Cos\Psi$ 137.69

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w x10^{-3}$ *	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi} x10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w x10^{-3}$ *	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi} x10^{-}$
0(360)	1	1	.31	31.0	1.2	22.42	230	1 BR	3	1.95	195	1.1	141.54
5							240	1 BR	3	.55	55	1.2	39.85
10	1	1	.39	39.	1.0	28.25	250	1 BR	1	.44	44	1.4	31.85
15							260	1	1	.4	40	1.1	28.97
20	1	1	.52	52.	0.85	37.70	270	WE				2.7	
30	1	1	.78	78.	0.8	56.59	275						
40	1 WR	10	.72	720.	0.7	522.86	280	1	1	.31	31	4.0	22.22
50	Pegged				0.7		285						
60	1 WR	3	2.55	255	0.8	185.14	290	1	1	.29	29	4.7	20.72
70	1	3	2.35	235	0.9	170.60	295	1	1	.28	28	8.5	19.71
80	1	3	2.9	290	1.3	210.52	300	BP					
90	WE				1.6		305	BP					
100	1	10	.69	690	2.2	500.96	310	BP					
110	10	3	.25	1250	9.4	907.15	315						
120	TB						320	BP					
130	TB						325	1 BR	3	1.0	100		72.62
140	TB						330	1	.3	2.35	23.5	1.8	16.93
150	10	3	.7	700.	11.2	507.57	335						
160	1	10	.31	310.	3.1	224.91	340	1	.3	2.4	24.0	2.6	17.24
170	1	10	.21	210.	1.8	152.38	345						
180	1	3	1.5	150.	1.5	108.83	350	1	.3	2.6	26.0	1.6	18.76
190	1	3	1.1	110.	1.0	79.81	355						
200	1	3	.85	85.	0.8	61.67	360	1	1	.31	31.0	1.2	22.42
210	1	1	.7	70.	0.8	50.78							
220	1 BR	1	.82	82.	0.8	59.49							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D90

3-D Angle = 0°
$\Psi = 60^{\circ}$
Date 3-31-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 205
End L_d 205
Mean L_d 205.
$E_o \cos\Psi$ 107.10

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)					1.0		230	1 BR	3	1.0	100	1.5	93.23
5							240	1 BR	10	.36	360	1.8	335.96
10	1	1	.4	40.	0.95	37.25	250	1	1	.46	46	2.0	42.76
15							260	1	1	.48	48	3.8	44.46
20	1	1	.51	51.	0.8	47.54	270	WE				9.2	
30	1	1	.6	60.	0.8	55.94	275						
40	1	3	1.1	110.	0.8	102.63	280	1	1	.43	43	8.2	39.38
50	10 WR	3	1.75	1750.	0.9	1633.90	285	1 BR	1	.47	47	10.6	42.89
60	Pegged				2.0		290	BP					
70	10	1	.66	660	3.9	615.88	295						
80	10	1	.59	590	8.2	550.12	300	BP					
90	WE				9.8		305						
100	10	1	.44	440	12.8	409.63	310	BP					
110	TB						315	1 BR	3	1.3	130		121.38
120	TB						320	1	.3	2.6	26	1.8	24.10
130	TB						325						
140	10	3	.7	700	11.1	652.55	330	1	.3	2.55	25.5	2.6	23.56
150	1	10	.31	310	3.2	289.15	335						
160	1	10	.2	200	1.8	186.57	340	1	.3	2.6	26.6	1.7	24.67
170	1	3	1.4	140	1.6	130.56	345						
180	1	3	1.05	105	1.1	97.93	350	1	.3	2.8	28.0	1.2	26.03
190	1	3	.8	80	0.9	74.61	355						
200	1	1	.65	65	0.9	60.60	360	1	1	.33	33.0	1.0	30.71
210	1	1	.55	55	0.9	51.26							
220	1	1	.49	49	1.1	45.64							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 70°

Date 3-31-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 205
End L_d 205
Mean L_d 205.
$E_o \cos\Psi$ 73.26

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)					.95		230	1	1	.4	40	1.8	54.35
5							240	1 BR	1	.92	92	2.0	125.30
10	1	1	.36	36.	0.8	49.03	250	1 BR	3	1.3	1300	4.0	1773.95
15							260	10	.3	1.55	155	10.0	210.21
20	1	1	.45	45.	0.8	61.31	270	WE				24.0	
30	1	1	.6	60.	0.8	81.79	275					15.5	
40	1	1	.89	89.	0.95	121.35	280	BP					
50	1	3	1.6	160	1.3	218.22	285						
60	10 WR	10	.36	3600	5.0	4913.32	290	BP					
70	Pegged				14.5		295						
80	10	10	.14	1400	42.0	1905.26	300	BP					
90	WE				47.0		305	1 BR	3	1.05	105		143.32
100	TB						310	1	1	.33	33	2.2	44.74
110	TB						315						
120	TB						320	1	1	.28	28	2.9	37.82
130	10	3	.6	600	10.9	817.51	325						
140	10	1	.34	340	3.1	463.67	330	1	1	.26	26	1.7	35.25
150	10	1	.22	220	1.8	300.05	335						
160	1	3	1.2	120	1.6	163.58	340	1	.3	2.5	25	1.2	33.96
170	1	3	.85	85	1.1	115.87	345						
180	1	1	.66	66	0.9	89.96	350	1	.3	2.65	26.5	1.0	36.03
190	1	1	.53	53	0.8	72.23	355						
200	1	1	.45	45	0.9	61.30	360	1	.3	2.9	29.	0.95	39.45
210	1	1	.41	41	1.1	55.81							
220	1	1	.39	39	1.3	53.05							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 80°
Date 3-31-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 205
End L_d 205
Mean L_d 205.
$E_o \cos\Psi$ 37.19

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
(360)	1	.3	2.3	23.0	0.8	61.62	230	1	1	.29	29.	1.5	77.57
5							240	1	1	.36	36.	2.9	96.02
10	1	.3	2.7	27.0	0.8	72.38	250	1 BR	1	.42	42.	17.0	108.36
15							260	10	3	1.5	150	19.5	398.09
20	1	1	.35	35.0	0.8	93.89	270	BP					
30	1	1	.47	47.0	0.95	126.12	275						
40	1	1	.66	66.0	1.00	177.19	280	BP					
50	1	3	1.05	105.0	1.60	281.90	285						
60	1	3	2.2	220.0	6.10	589.91	290	BP					
70	10	3	2.0	2000.	26.00	5370.79	295	1 BR	3	1.05	105.		282.33
80	Pegged				139.00		300	1	1	.36	36.	2.6	96.10
90	WE						305						
100	TB						310	1	1	.27	27.	3.2	71.73
110	TB						315						
120	1	10	.32	320.0	8.5	858.16	320	1	1	.23	23.	1.9	61.33
130	1	3	1.75	175.0	3.2	469.69	325						
140	1	3	1.1	110.0	1.9	295.26	330	1	.2	2.05	20.5	1.3	54.77
150	1	1	.72	72.0	1.6	193.17	335						
160	1	1	.54	54.0	1.1	144.90	340	1	.3	1.95	19.5	1.0	52.16
170	1	1	.42	42.0	1.0	112.66	345						
180	1	1	.33	33.0	0.8	88.51	350	1	.3	2.05	20.5	0.95	54.86
190	1	1	.28	28.0	0.8	75.07	355						
200	1	1	.25	25.0	1.0	66.95	360	1	.3	2.3	23.0	0.8	61.62
210	1	1	.24	24.0	1.2	64.21							
220	1	1	.26	26.0	1.3	69.56							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

$\Psi = 0°$

Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Supracil

Start L_d 190

End L_d 190

Mean L_d 190

$E_o \cos\Psi$ 198.54

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)							230	10	.01	.46	4.6	1.2	2.26
5							240	10	.01	.38	3.8	1.0	1.86
10							250	10	.01	.35	3.5	0.9	1.72
15	10 BR	.1	.33	33		16.62	260	10	.01	.76	7.6	0.8	3.79
20	10	.1	.18	18	1.9	9.97	270	WE				0.8	
30	10	.01	.61	6.1	2.6	2.94	275						
40	10	.01	.4	4.0	1.6	1.93	280	10	.1	.26	26.0	0.9	13.05
50	10	.01	.32	3.2	1.2	1.55	285						
60	10	.01	.29	2.9	1.0	1.41	290	10	.01	.36	3.6	1.0	1.76
70	10	.01	.33	3.3	0.8	1.62	295						
80	10	.01	.63	6.3	0.8	3.13	300	10	.01	.32	3.2	1.1	1.56
90	WE				0.8		305						
100	10	.01	.8	8.0	0.7	3.99	310	10	.01	.33	3.3	0.9	1.62
110	10	.01	.34	3.4	0.8	1.67	315						
120	10	.01	.32	3.2	0.9	1.57	320	10	.01	.37	3.7	1.5	1.79
130	10	.01	.35	3.5	1.1	1.71	325						
140	10	.01	.44	4.4	1.5	2.14	330	10	.01	.53	5.3	2.3	2.55
150	10	.01	.64	6.4	2.1	3.12	335						
160	10 TB	.03	1.35	13.5	10.2	6.29	340	10	.03	1.05	10.5	4.2	5.08
170	TB						345	10	.03	1.6	16.0	8.4	7.64
180	TB						350						
190	10 TB	.3	2.0	200		100.74	355						
200	10 TB	.1	.72	72	11.4	35.69	360						
210	10	.03	1.15	11.5	2.6	5.66							
220	10	.01	.58	5.8	1.6	2.84							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D94

3-D Angle = 0°
Ψ = 10°
Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Supracil
Start L_d 190
End L_d 190
Mean L_d 190
$E_o \cos\Psi$ 195.52

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)							230	10	.01	.48	4.8	1.0	2.40
5	100 WR	3	.9	90000		46031.	240	10	.01	.6	6.0	0.9	3.02
10	10^6 WR	.1	.68	6800000	1.9	3477904.98	250	10	.01	.8	8.0	0.8	4.05
15							260	10	1	.3	300	0.8	153.40
20	10 WR	10	.29	2900	2.6	148.09	270	WE				0.9	
30	10	.03	1.35	13.5	1.7	6.82	275						
40	10	.03	.8	8.0	1.2	4.03	280	10	.3	1.4	140	1.1	71.55
50	10	.01	.71	7.1	1.0	3.58	285						
60	10	.03	1.0	10.0	0.8	5.07	290	10	.03	1.3	13.0	1.1	6.59
70	10	.03	1.95	19.5	0.75	9.94	295						
80	10	.1	.42	42.0	0.7	21.45	300	10	.01	.62	6.2	0.9	3.13
90	WE				0.8		305						
100	10	.1	.59	59.0	0.8	30.14	310	10	.01	.46	4.6	1.5	2.28
110	10	.1	.27	27.0	0.95	13.76	315						
120	10	.03	1.55	15.5	1.1	7.87	320	10	.01	.42	4.2	2.3	2.03
130	10	.03	1.0	10.0	1.4	5.04	325						
140	10	.03	.95	9.5	2.2	4.75	330	10	.01	.47	4.7	4.2	2.19
150	10 TB	.03	1.55	15.5	10.2	7.41	335	10	.01	.51	5.1	8.5	2.17
160	TB						340						
170	TB						345						
180	10 TB/BR	1	.66	660		337.56	350						
190	10 TB/BR	1	.25	250	11.2	127.29	355						
200	10 BR	.1	.16	16.0	3.1	8.02	360						
210	10	.1	.2	20.0	1.8	10.14							
220	10	.01	.62	6.2	1.4	3.10							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 20°
Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Suprace1
Start L_d 190
End L_d 190
Mean L_d 190
$E_o \cos\Psi$ 186.57

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	10 WR	.01	.54	5.4	1.9	2.79
5						
10	100 WR	.03	1.2	120.0	2.6	64.18
15						
20	10^4 WR	10	.82	8200000	1.7	4395133.10
30	10	3	1.35	1350	1.2	723.52
40	10	.03	1.7	17.0	1.0	9.06
50	10	.03	1.5	15.0	0.8	8.00
60	10	.03	2.55	25.5	0.75	13.63
70	10	.1	.39	39.0	0.7	20.87
80	10	.1	.88	88.0	0.7	47.13
90	WE				0.8	
100	10	.3	1.05	105.0	1.0	56.22
110	10	.1	.56	56.0	1.2	29.95
120	10	.1	.24	24.0	1.5	12.78
130	10	.1	.19	19.0	2.2	10.07
140	10 TB	.1	.26	26.0	10.2	13.39
150	TB					
160	TB					
170	10TB	.3	1.15	115.0		61.64
180	10TB	.1	.48	48.0	11.2	25.13
190	10BR	.03	1.25	12.5	3.2	6.53
200	10BR	.3	1.95	195.0	1.8	104.42
210	10BR	.03	1.0	10.0	1.5	5.28
220	10	.03	2.15	21.5	1.0	11.47

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
230	10	.01	.79	7.9	0.9	4.19
240	10	.01	.8	8.0	0.8	4.24
250	10	.03	1.4	14.0	0.8	7.46
260	10	.1	1.75	17.5	1.0	9.33
270	WE				1.1	
275						
280	10	.3	1.9	190	1.2	101.77
285						
290	10	.03	1.95	19.5	0.9	104.03
295						
300	10	.03	1.0	10.0	1.5	5.28
305						
310	10	.01	.62	6.2	2.4	3.19
315						
320	10	.01	.48	4.8	4.1	2.35
325	10 BR	.01	.43	4.3	8.4	1.85
330						
335						
340						
345						
350						
355	10 BR	.1	.15	15.0		8.04
360					1.9	

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D96

3-D Angle = 0°

Ψ = 30°

Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Supracil

Start L_d 190

End L_d 190

Mean L_d 190

$E_o Cos\Psi$ 171.93

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w x10^{-3}$	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi}$ $x10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w x10^{-3}$	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi}$ $x10^{-5}$
0(360)					2.6		230	10	.01	.76	7.6	0.8	4.37
5							240	10	.01	.96	9.6	0.8	5.54
10	10 WR	.03	1.05	10.5	1.6	6.01	250	10	.03	1.45	14.5	1.0	8.38
15							260	10	.1	.58	58.	1.1	33.67
20	10 WR	.3	1.4	140.0	1.2	81.36	270	WE				1.2	
30	10^5 WR	.1	.77	7700000	1.0	4478566.8	275						
40	10 WR	3	.95	950.	0.8	552.50	280	10	1	.32	320	1.0	186.06
50	10	.1	.32	32.	0.75	18.57	285						
60	10	.1	.5	50.	0.6	29.05	290	10	.03	2.0	20.	1.5	11.55
70	10	.1	.37	37.	0.7	21.48	295						
80	10	.1	.74	74.	0.8	42.99	300	10	.03	1.05	10.5	2.4	5.97
90	WE				1.0		305						
100	10	.3	.9	90.	1.1	52.28	310	10	.03	.9	9.0	4.0	5.00
110	10	.1	.49	49.	1.5	28.41	315	10 BR	.01	.48	4.8	8.2	2.31
120	10	.1	.42	42.	2.2	24.30	320						
130	10 TB	.1	.84	84.	10.2	48.26	325						
140	TB						330						
150	TB						335						
160	10 TB	.3	1.35	135		78.52	340						
170	10 TB	.1	.31	31	11.2	17.38	345	10 BR	.03	1.35	13.5		7.85
180	10	.03	1.3	13	3.1	7.38	350	10	.03	1.0	10.0	1.8	5.71
190	10	.01	.68	6.8	1.9	3.84	355						
200	10 BR	.01	.93	9.3	1.5	5.32	360	10	.01	.68	6.8	2.6	3.80
210	10 BR	.3	1.95	195	1.0	113.36							
220	10 BR	.01	.8	8.0	0.8	4.61							

Photo Research Pritchard Photometer

Photometer Aperture Factor 0.10

Xenon Lamp Amperage 80

Photometer Field of View 1°

Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor

TB = Transmitted Beam

WE = Window Edge

WR = Window Reflex (specular)

BR = Blackbody Reflex (due to WR)

BP = Beam blocked by photometer

3-D Angle = 0°
$\gamma = 40^{\circ}$
Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Supracil
Start L_d 190
End L_d 190
Mean L_d 190
$E_o \cos\gamma$ 152.08

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\gamma} \times 10^{-5}$
0(360)					1.6	
5						
10	10	.01	.47	4.7	1.2	3.01
15						
20	10 WR	.01	.91	9.1	1.0	5.92
30	10 WR	.1	.71	71.	0.8	46.63
40	10^5 WR	3	1.0	100000000	0.8	6575486.53
50	10 WR	10	.3	300	0.6	197.23
60	10	.1	.36	36.	0.7	23.63
70	10	.1	.56	56.	0.8	36.77
80	10	1	.22	220.	1.0	144.59
90	WE				1.2	
100	10	1	.52	520	1.5	341.83
110	10	.3	1.25	125.	2.2	82.05
120	10 TB	.1	.74	74.	10.2	47.99
130	TB					
140	TB					
150	10 TB	.3	2.15	215.		141.37
160	10 TB	.1	.53	53.	11.2	34.11
170	10	.01	.76	7.6	3.1	4.79
180	10	.01	.53	5.3	1.8	3.37
190	10	.01	.35	3.5	1.6	2.20
200	10	.01	.51	5.1	1.0	3.29
210	10 BR	.01	.85	8.5	0.8	5.54
220	10 BR	.3	2.15	215.	0.8	141.32

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\gamma} \times 10^{-}$
230	10 BR	.03	1.2	12.0	0.8	7.84
240	10	.03	1.0	10.0	1.0	6.51
250	10	.03	1.6	16.0	1.0	10.46
260	10	.3	.9	90.0	1.0	59.11
270	WE				0.9	
275						
280	10	1	.56	560.0	1.5	368.13
285						
290	10	.03	2.25	22.5	2.5	14.68
295						
300	10	.03	1.15	11.5	4.1	7.29
305	10	.01	.63	6.3	8.0	3.62
310						
315						
320						
325						
330						
335	10 BR	.03	1.1	11.0		7.23
340	10	.03	1.0	10.0	1.8	6.46
345						
350	10	.01	.34	3.4	2.6	2.06
355						
360	10	.01	.38	3.8	1.6	2.39

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 50°
Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Supracil
Start L_d 190
End L_d 190
Mean L_d 190
$E_o \cos\Psi$ 127.62

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3} *	(ft-L) L_bx10^{-4}	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10^{-5}
0(360)					1.2	
5						
10	10	.01	.27	2.7	1.0	2.04
15						
20	10	.01	.48	4.8	0.85	3.69
30	10 WR	.03	1.3	13.0	0.8	10.12
40	10 WR	.1	.45	45.	0.7	35.21
50	10^5 WR	1	.52	52000000	0.7	40745964.53
60	10 WR	3	2.05	2050	0.8	1606.27
70	10	.1	.74	74.	0.9	57.91
80	10	.3	1.55	155.	1.3	121.35
90	WE				1.6	
100	10	.3	1.5	150.	2.2	117.36
110	10 TB	.3	1.35	135.	9.4	105.05
120	TB					
130	TB					
140	10 TB	.3	2.05	205.		160.63
150	10 TB	.1	.78	78.	11.2	60.24
160	10	.03	.95	9.5	3.1	7.20
170	10	.01	.41	4.1	1.8	3.07
180	10	.01	.38	3.8	1.5	2.86
190	10	.01	.24	2.4	1.0	1.80
200	10	.01	.28	2.8	0.8	2.13
210	10	.01	.5	5.0	0.8	3.86
220	10 BR	.01	.81	8.1	0.8	6.28

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3} *	(ft-L) L_bx10^{-4}	$\frac{L_w - L_b}{E_o \cos\Psi}$ x10^{-}
230	10 BR	.3	2.65	265	1.1	207.56
240	10 BR	.03	2.75	27.5	1.2	21.45
250	10	.03	2.05	20.5	1.4	15.95
260	10	.3	1.3	130.0	1.1	101.78
270	WE				2.7	
275						
280	10	1	.76	760	4.0	595.20
285						
290	10	.03	2.65	26.5	4.7	20.39
295	10	.03	1.7	17.0	8.5	12.65
300						
305						
310						
315						
320						
325	10 BR	.03	1.05	10.5		8.23
330	10	.01	.76	7.6	1.8	5.81
335						
340	10	.01	.31	3.1	2.6	2.23
345						
350	10	.01	.23	2.3	1.6	1.68
355						
360	10	.01	.24	2.4	1.2	1.79

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
$\Psi = 60^\circ$
Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Supracil
Start L_d 190
End L_d 190
Mean L_d 190
$E_o \cos\Psi$ 99.27

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)					1.0		230	10 BR	.03	1.0	10.0	1.5	9.92
5							240	10 BR	.1	.33	330.	1.8	332.24
10	10	.01	.24	2.4	0.95	2.32	250	10 BR	.1	.42	42.	2.0	42.11
15							260	10	.1	.45	45.	3.8	44.95
20	10	.01	.33	3.3	0.8	3.24	270	WE				9.2	
30	10	.01	.58	5.8	0.8	5.76	275						
40	10	.1	.32	32.0	0.8	32.15	280	10	10	.4	4000	8.2	4028.59
50	10 WR	.1	.62	62.0	0.9	62.37	285	10 BR	3	.9	900	10.6	905.55
60	10^5 WR	3	1.5	15000000	2.0	15110305.03	290						
70	100 WR	3	1.55	15500	3.9	1561.59	295						
80	10	.1	.42	42.	8.2	41.48	300						
90	WE				9.8		305						
100	10 TB	.1	.24	24	12.8	22.89	310						
110	TB						315	10 BR	.03	1.15	11.5		11.58
120	TB						320	10	.01	.6	6.0	1.8	5.86
130	10 TB	.3	1.5	150		151.10	325						
140	10 TB	.3	2.35	235	11.1	235.61	330	10	.01	.42	4.2	2.6	3.97
150	10	.03	1.4	14.0	3.2	13.78	335						
160	10	.01	.61	6.1	1.8	5.96	340	10	.01	.31	3.1	1.7	2.95
170	10	.01	.32	3.2	1.6	3.06	345						
180	10	.01	.27	2.7	1.1	2.61	350	10	.01	.26	2.6	1.2	2.50
190	10	.01	.34	3.4	0.9	3.33	355						
200	10	.01	.27	2.7	0.9	2.63	360	10	.01	.24	2.4	1.0	2.32
210	10	.01	.38	3.8	0.9	3.74							
220	10	.01	.55	5.5	1.1	5.43							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D100

3-D Angle = 0°

Ψ = 70°

Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Supracil

Start L_d 190

End L_d 190

Mean L_d 190

$E_o \cos\Psi$ 64.33

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $^*L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $^*L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)					.95		230	10	.01	.66	6.6	1.8	9.98
5							240	10	.03	1.5	15.0	2.0	23.01
10	10	.01	.19	1.9	0.8	2.83	250	10 BR	1	.54	540	4.0	838.80
15							260	10 BR	1	.2	200	10.0	309.34
20	10	.01	.23	2.3	0.8	3.45	270	WE				24.0	
30	10	.01	.34	3.4	0.8	5.16	275	WE				15.5	
40	10	.01	.75	7.5	0.95	11.51	280						
50	10	.1	.38	38.0	1.3	58.87	285						
60	10 WR	.3	1.0	100.0	5.0	154.67	290						
70	100 WR	.1	1.5	150000	14.5	233170.45	295						
80	100 WR	10	.37	37000	42.0	57509.40	300						
90	WE				47.0		305	10 BR	.03	1.65	16.5		25.65
100	TB						310	10	.03	.95	9.5	2.2	14.43
110	TB						315						
120	10 TB	1	.31	310		481.89	320	10	.01	.67	6.7	2.9	9.96
130	10 TB	.1	.53	53	10.9	80.69	325						
140	10	.1	.72	72	3.1	111.44	330	10	.01	.28	2.8	1.7	4.09
150	10	.01	.81	8.1	1.8	12.31	335						
160	10	.01	.44	4.4	1.6	6.59	340	10	.01	.24	2.4	1.2	3.54
170	10	.01	.23	2.3	1.1	3.40	345						
180	10	.01	.09	1.9	0.9	2.81	350	10	.01	.24	2.4	1.0	3.58
190	10	.01	.28	2.8	0.8	4.23	355						
200	10	.01	.22	2.2	0.9	3.28	360	10	.01	.2	2.0	0.95	2.96
210	10	.01	.26	2.6	1.1	3.87							
220	10	.01	.42	4.2	1.3	6.33							

Photo Research Pritchard Photometer

Photometer Aperture Factor 0.10

Xenon Lamp Amperage 80

Photometer Field of View 1°

Photometer - Window Distance 20"

$^*L_w$ = Footlamberts corrected for photometer aperture factor

TB = Transmitted Beam

WE = Window Edge

WR = Window Reflex (specular)

BR = Blackbody Reflex (due to WR)

BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 80°
Date 5-8-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # Supracil
Start L_d 190
End L_d 190
Mean L_d 190
$E_o \cos\Psi$ 34.47

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$*	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)					0.8		230	10	.01	.43	4.3	1.5	12.04
5							240	10	.01	.9	9.0	2.9	25.27
10	10	.01	.12	1.2	0.8	3.25	250	10 BR	.1	.26	26.0	17.0	70.50
15							260	10 BR	3	1.05	1050.	19.5	3040.47
20	10	.01	.16	1.6	0.8	4.41	270	WE					
30	10	.01	.22	2.2	0.95	6.17	275						
40	10	.01	.44	4.4	1.00	12.47	280						
50	10	.1	.56	56.0	1.60	162.00	285						
60	10	.1	.37	37.0	6.10	105.57	290						
70	10	.3	1.9	190.0	26.00	543.66	295	10 BR	.03	2.1	21.0		60.92
80	10^5 WR	1	.48	48000000	139.00	139251482.74	300	10	.03	1.4	14.0	2.6	39.86
90	WE						305						
100	TB						310	10	.01	.57	5.7	3.2	15.61
110	10^3 TB	.01	.16	1600		4641.72	315						
120	100 TB	.01	.88	880	8.5	2550.49	320	10	.01	.34	3.4	1.9	9.31
130	10	.03	1.85	18.5	3.2	52.74	325						
140	10	.03	.8	8.0	1.9	22.66	330	10	.01	.2	2.0	1.3	5.43
150	10	.01	.45	4.5	1.6	12.59	335						
160	10	.01	.26	2.6	1.1	7.22	340	10	.01	.16	1.6	1.0	4.35
170	10	.01	.16	1.6	1.0	4.23	345						
180	10	.01	.15	1.5	0.8	4.12	350	10	.01	.13	1.3	0.95	3.50
190	10	.01	.18	1.8	0.8	4.99	355						
200	10	.01	.16	1.6	1.0	4.35	360	10	.01	.22	2.2	0.8	6.15
210	10	.01	.17	1.7	1.2	4.58							
220	10	.01	.26	2.6	1.3	7.17							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D102

3-D Angle = 0^{o}

$\Psi = 0^{o}$

Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 208 & 244
Start L_d 182
End L_d 183
Mean L_d 182.5
$E_o Cos\Psi$ 190.70

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w x10^{-3}$ *	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi}$ $x10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w x10^{-3}$ *	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi}$ $x10^{-}$
0(360)	BP						230	1	.1	0.78	7.8	1.2	4.03
5							240	1	.1	0.70	7.0	1.0	3.62
10	BP						250	1	.1	0.61	6.1	0.9	3.15
15							260	1	.1	0.32	3.2	0.8	1.64
20	1	0.1	0.80	8.0	1.9	4.10	270	WE	-	-		0.8	
30	1	.1	0.51	5.1	2.6	2.54	275						
40	1	.1	0.40	4.0	1.6	2.01	280	1	.1	0.28	2.8	0.9	1.42
50	1	.1	0.36	3.6	1.2	1.82	285						
60	1	.1	0.34	3.4	1.0	1.73	290	1	.1	0.36	3.6	1.0	1.84
70	1	.1	0.34	3.4	0.8	1.74	295						
80	1	.1	0.32	3.2	0.8	1.64	300	1	.1	0.36	3.6	1.1	1.83
90	WE				0.8		305						
100	1	.1	0.30	3.0	0.7	1.54	310	1	.1	0.38	3.8	0.9	1.94
110	1	.1	0.76	7.6	0.8	3.79	315						
120	1	.3	0.91	9.1	0.9	4.72	320	1	.1	0.43	4.3	1.5	2.18
130	1	.3	0.88	8.8	1.1	4.56	325						
140	1	.3	1.06	10.6	1.5	5.48	330	1	.1	0.52	5.2	2.3	2.61
150	1	.3	1.51	15.1	2.1	7.81	335						
160	1	1.0	34.0	34.0	10.2	17.29	340	1	.1	0.80	8.0	4.2	3.97
170	TB						345	1	.3	1.30	13.0	8.4	6.38
180	TB						350	BP					
190	TB						355						
200	1	1.0	0.36	36.0	11.4	18.28	360	BP	* Window 208 on outside, 244 on inside				
210	1	.3	1.60	16.0	2.6	8.25							
220	1	.3	0.95	9.5	1.6	4.90							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1^{o}
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 10°

Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 208
Start L_d 183
End L_d 185
Mean L_d 184
$E_o \cos \Psi$ 189.34

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3} *	(ft-L) L_bx10^{-4}	$\frac{L_w-L_b}{E_o \cos\Psi}$ x10^{-5}	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3} *	(ft-L) L_bx10^{-4}	$\frac{L_w-L_b}{E_o \cos\Psi}$ x10^{-5}
0(360)	BP						230	1	0.1	0.51	5.1	1.0	2.64
5							240	1	0.1	0.48	4.8	0.9	2.49
10	10^6 WR	0.1	0.54	5400,000	1.9	2852012.	250	1	.1	0.48	4.8	0.8	2.49
15							260	1	.1	0.32	3.2	0.8	1.65
20	100 WR	0.1	0.26	2600	2.6	1373.05	270	WE	-	-		0.9	
30	1	0.3	0.82	8.2	1.7	4.24	275						
40	1	.3	0.50	5.0	1.2	2.58	280	1	.1	0.26	2.6	1.1	1.32
50	1	.1	0.42	4.2	1.0	2.17	285						
60	1	.1	0.39	3.9	0.8	2.02	290	1	.1	0.30	3.0	1.1	1.53
70	1	.1	0.40	4.0	0.75	2.07	295						
80	1	.1	0.38	3.8	0.7	1.97	300	1	.1	0.30	3.0	0.9	1.54
90	WR	-	-		0.8		305						
100	1	.1	0.37	3.7	0.8	1.91	310	1	.1	0.32	3.2	1.5	1.61
110	1	.3	1.22	12.2	0.95	6.39	315						
120	1	.3	1.50	15.0	1.1	7.86	320	1	.1	0.38	3.8	2.3	1.89
130	1	.3	1.50	15.0	1.4	7.85	325						
140	1	.3	2.02	20.2	2.2	10.55	330	1	.1	0.44	4.4	4.2	2.10
150	1	1.0	0.38	38.0	10.2	19.53	335	1	.1	0.50	5.0	8.5	2.19
160	TB						340	BP					
170	TB						345						
180	TB						350	BP					
190	1 BR	10.0	0.16	160.0	11.2	83.91	355						
200	1 BR	0.3	1.70	17.0	3.1	8.81	360	BP					
210	1	0.1	0.82	8.2	1.8	4.23							
220	1	0.1	0.61	6.1	1.4	3.15							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D104

3-D Angle = 0°

$\gamma = 20^{\circ}$

Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 208
Start L_d 185
End L_d 185
Mean L_d 185
$E_o \cos\gamma$ 181.66

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\gamma} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\gamma} \times 10^{-}$
0(360)	1	0.1	0.69	6.9	1.9	3.69	230	1	.1	0.38	3.8	0.9	2.04
5							240	1	.1	.38	3.8	0.8	2.05
10	10 WR	0.1	0.59	59.0	2.6	32.33	250	1	.1	.38	3.8	0.8	2.05
15							260	1	.1	.54	5.4	1.0	2.92
20	10^6 WR	0.1	0.50	5000000	1.7	2752394.49	270	WE	-	-		1.1	
30	100 WR	0.1	0.52	520	1.2	286.18	275						
40	1	0.1	0.94	9.4	1.0	5.12	280	1	.1	.30	3.0	1.2	1.59
50	1	.1	0.61	6.1	0.8	3.31	285						
60	1	.1	0.53	5.3	0.75	2.88	290	1	.1	.30	3.0	0.9	1.60
70	1	.1	0.54	5.4	0.7	2.93	295						
80	1	.1	0.56	5.6	0.7	3.04	300	1	.1	.30	3.0	1.5	1.57
90	WE	-	-		0.8		305						
100	1	.1	0.73	7.3	1.0	3.96	310	1	.1	.32	3.2	2.4	1.63
110	1	.3	2.15	21.5	1.2	11.77	315						
120	1	.3	2.68	26.8	1.5	14.67	320	1	.1	.38	3.8	4.1	1.32
130	1	1.0	0.41	41.0	2.2	22.45	325	1	.1	.40	4.0	8.4	1.74
140	1	1.0	0.64	64.0	10.2	34.67	330	BP					
150	TB						335						
160	TB						340	BP					
170	TB						345						
180	1	1.0	0.26	26.0	11.2	13.70	350	BP					
190	1 BR	0.3	1.40	14.0	3.2	7.53	355						
200	1 BR	3.0	1.10	110.0	1.8	60.45	360					1.9	
210	1 BR	0.1	0.80	8.0	1.5	4.32							
220		0.1	0.43	4.3	1.0	2.31							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 30°

Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 208
Start L_d 185
End L_d 186
Mean L_d 185/5
$E_o Cos\Psi$ 167.86

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3}*	(ft-L) L_bx10^{-4}	$\frac{L_w - L_b}{E_o Cos\Psi}$ x10^{-5}	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) L_wx10^{-3}*	(ft-L) L_bx10^{-4}	$\frac{L_w - L_b}{E_o Cos\Psi}$ x10^{-5}
0(360)	1	0.1	0.42	4.2	2.6	2.35	230	1	.1	.3	3.0	0.8	1.74
5							240	1	.1	.3	3.0	0.8	1.74
10	1	.1	0.68	6.8	1.6	3.96	250	1	.1	.36	3.6	1.0	2.08
15							260	1	.3	1.05	10.5	1.1	6.19
20	10	.1	0.64	64.0	1.2	38.06	270	WE	-	-		1.2	
30	WR 10^6	.1	0.62	6200000	1.0	3693554	275						
40	WR 100	.1	.38	380.	0.8	226.33	280	1	.1	0.46	4.6	1.0	2.68
50	1	.3	1.16	11.6	0.75	6.87	285						
60	1	.1	0.86	8.6	0.6	5.09	290	1	.1	0.34	3.4	1.5	1.94
70	WE	.1	0.85	8.5	0.7	5.02	295						
80	1	.3	1.12	11.2	0.8	6.62	300	1	.1	0.30	3.0	2.4	1.58
90					1.0		305						
100	1	.3	1.78	17.8	1.1	10.54	310	1	.1	0.34	3.4	4.0	1.79
110	1	1.0	0.42	42.0	1.5	24.93	315	1	.1	0.38	3.8	8.2	1.78
120	1	1.0	0.88	88.0	2.2	52.29	320	BR					
130	1	3.0	0.78	78.0	10.2	45.86	325						
140	TB						330	BP					
150	TB						335						
160	TB						340	BP					
170	1	1.0	0.28	28.0	11.2	16.01	345						
180	1	.3	1.30	13.0	3.1	7.56	350	1	0.1	.39	3.9	1.8	2.22
190	1	.1	0.80	8.0	1.9	4.65	355						
200	BR 1	.1	0.72	7.2	1.5	4.20	360	1	0.1	.42	4.2	2.6	2.35
210	BR 1	3.0	1.25	12.50	1.0	74.41							
220	BR 1	0.1	0.80	8.0	0.8	4.72							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D106

3-D Angle = 0°
$\Psi = 40°$
Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 208
Start L_d 186
End L_d 184
Mean L_d 185
$E_o \cos\Psi$ 148.08

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	1	0.1	0.33	3.3	1.6	2.12	230	1 BR	.1	0.64	6.4	0.8	4.27
5							240	1	.1	0.28	2.8	1.0	1.82
10	1	.1	0.44	4.4	1.2	2.89	250	1	.1	0.36	3.6	1.0	2.36
15							260	1	.3	2.50	25.0	1.0	16.80
20	1	.1	0.74	7.4	1.0	4.93	270	WE				0.9	
30	10	.1	0.72	72.0	0.8	48.57	275						
40	10^6 WR	.1	0.85	8500000	0.8	5740140.41	280	1	.3	0.85	8.5	1.5	5.64
50	100 WR	.1	0.30	300.	0.6	202.55	285						
60	10	.1	0.26	26.	0.7	17.51	290	1	.1	0.52	5.2	2.5	3.34
70	1	.3	1.85	18.	0.8	12.10	295						
80	1	1.0	0.35	35.	1.0	23.57	300	1	.1	0.34	3.4	4.1	2.02
90	WE				1.2		305	1	.1	0.38	3.8	8.0	2.03
100	1	1.0	0.53	53.	1.5	35.69	310	BP					
110	1	3.0	1.15	115.	2.2	77.51	315						
120	1	3.0	1.65	165.	10.2	110.74	320	BP					
130	TB						325						
140	TB						330	BP					
150	TB						335						
160	1	1.0	0.34	34.	11.2	22.20	340	1	0.1	0.32	3.2	1.8	2.04
170	1	0.3	1.40	14.	3.1	9.25	345						
180	1	0.1	0.86	8.6	1.8	5.69	350	1	.1	0.30	3.0	2.6	1.85
190	1	0.1	0.58	5.8	1.6	3.81	355						
200	1	0.1	0.42	4.2	1.0	2.77	360	1	0.1	0.33	3.3	1.6	2.12
210	1 BR	0.1	0.56	5.6	0.8	3.73							
220	1 BR	10.0	0.16	160.0	0.8	108.00							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

$\Psi = 50^{\circ}$

Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 208
Start L_d 184
End L_d 182
Mean L_d 183
$E_o \cos\Psi$ 122.92

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	1	.1	0.30	3.0	1.2	2.34	230	1	1.0	0.22	220	1.1	178.89
5							240	1	.1	0.72	7.2	1.2	5.76
10	1	.1	0.36	3.6	1.0	2.85	250	1	.1	0.54	5.4	1.4	4.28
15	1						260	1	1.0	0.90	90.0	1.1	73.13
20	1	.1	0.48	4.8	0.85	3.84	270	1	1.0	0.70	70.0	2.7	56.73
30	1	.3	0.89	8.9	0.8	7.18	275						
40	10	.3	1.10	110.0	0.7	89.43	280	1	1.0	0.22	22.0	4.0	17.57
50	10^6 WR	.3	1.34	13400000	0.7	10901399.23	285						
60	100 WR	.3	0.70	700	0.8	569.41	290	1	0.1	0.90	9.0	4.7	6.94
70	10 WR	.3	1.75	175	0.9	142.30	295	1	0.1	0.43	4.3	8.5	2.81
80	10 edge	.3	1.30	1300	1.3	1057.49	300	BP					
90	WE				1.6		305						
100	10	3.0	1.40	1400	2.2	1138.77	310	BP					
110	10	3.0	0.45	450	9.4	365.33	315						
120	TB						320	BP					
130	TB						325						
140	TB						330	1	0.1	0.31	3.1	1.8	2.38
150	1.0	1.0	0.42	42.0	11.2	33.26	335						
160	1.0	0.3	1.65	16.5	3.1	13.17	340	1	.1	0.28	2.8	2.6	2.07
170	1.0	0.3	0.85	8.5	1.8	6.77	345						
180	1.0	0.1	0.60	6.0	1.5	4.76	350	1	.1	0.27	2.7	1.6	2.07
190	1.0	0.1	0.43	4.3	1.0	3.42	355						
200	1.0	0.1	0.38	3.8	0.8	3.03	360	1	.1	0.30	3.0	1.2	2.34
210	1.0	0.1	0.30	3.0	0.8	2.38							
220	BR 1.0	0.1	0.56	5.6	0.8	4.49							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D108

3-D Angle = 0°
Ψ = 60°
Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 208
Start L_d 182
End L_d 185
Mean L_d 183.5
$E_o \cos\Psi$ 95.87

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	1	0.1	0.28	2.8	1.0	2.82	230	1 BR	.1	0.60	6.0	1.5	6.10
5							240	1 BR	10.0	0.32	320.0	1.8	333.60
10	1	.1	0.32	3.2	0.95	3.24	250	1 BR	1.0	0.22	22.0	2.0	22.74
15							260	1	10.	0.21	210.0	3.8	218.65
20	1	.1	0.39	3.9	0.8	3.98	270	WE				9.2	
30					0.8		275						
40	1	0.3	1.35	13.5	0.8	13.99	280	1.0	3.0	0.85	85.0	8.2	87.81
50	10	0.3	1.97	197.0	0.9	205.39	285	1.0	3.0	0.50	50.0	10.6	51.05
60	WR 10^6	0.3	2.42	24200000	2.0	2524251.70	290	BP					
70	WR 100	.3	2.20	2200	3.9	2294.37	295						
80	WR 100	.3	1.02	1020	8.2	1063.09	300	BP					
90	WE				9.8		305						
100	100	.3	1.04	1040	12.8	1083.47	310	BP					
110	TB						315						
120	TB						320	1	0.1	0.32	3.2	1.8	3.15
130	TB						325						
140	1.0	1.0	0.70	70.0	11.1	7.19	330	1	0.1	0.29	2.9	2.6	2.75
150	1.0	.3	1.80	18.0	3.2	18.44	335						
160	1.0	.3	1.10	11.0	1.8	9.60	340	1	0.1	0.26	2.6	1.7	2.53
170	1.0	.3	0.60	6.0	1.6	6.09	345						
180	1.0	.1	0.46	4.6	1.1	4.68	350	1	0.1	0.26	2.6	1.2	2.59
190	1	.1	0.36	3.6	0.9	3.66	355						
200	1	.1	0.32	3.2	0.9	3.24	360	1	0.1	0.28	2.8	1.0	2.82
210	1	.1	0.28	2.8	0.9	2.83							
220	1	.1	0.26	2.6	1.1	2.60							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 70°

Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 208
Start L_d 185
End L_d 185
Mean L_d 185
$E_o \cos\Psi$ 66.11

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	1	0.1	0.24	2.4	.95	3.49	230	1	.1	0.30	3.0	1.8	4.27
5							240	1	.1	0.50	5.0	2.0	7.26
10	1	.1	0.27	2.7	0.8	3.96	250	BR	10.	0.57	57.0	4.0	85.61
15							260	BR	10	0.38	38.0	10.0	55.97
20	1	.1	0.33	3.3	0.8	4.87	270	WE				24.0	
30	1	.1	0.48	4.8	0.8	7.14	275					15.5	
40	1	.1	0.89	8.9	0.95	13.32	280	BP					
50	1	.3	2.65	26.5	1.3	39.89	285						
60	1	3.0	2.22	222.0	5.0	355.05	290	BP					
70	10^6 WR	1.0	0.53	53000000	4.5	8016939.27	295						
80	100 WR	1.0	0.55	5500	42.0	8313.11	300	BP					
90	WE				47.0		305						
100	TB						310	1	0.1	0.36	3.6	2.2	5.11
110	TB						315						
120	TB						320	1	0.1	0.29	2.9	2.9	3.95
130	1.0	1.0	0.88	88.0	10.9	131.46	325						
140	1.0	1.0	0.26	26.0	3.1	38.86	330	1	0.1	0.25	2.5	1.7	3.52
150	1.0	.3	1.05	10.5	1.8	15.61	335						
160	1.0	.1	0.64	6.4	1.6	9.44	340	1	0.1	0.22	2.2	1.2	3.15
170	1.0	.1	0.42	4.2	1.1	6.19	345						
180	1.0	.1	0.36	3.6	0.9	5.31	350	1	0.1	.22	2.2	1.0	3.18
190	1.0	.1	0.28	2.8	0.8	4.11	355						
200	1	.1	0.24	2.4	0.9	3.49	360	1	0.1	.24	2.4	0.95	3.49
210	1	.1	0.24	2.4	1.1	3.46							
220	1	.1	0.24	2.4	1.3	3.43							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D110

3-D Angle = 0°

Ψ = 80°

Date 4-30-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 208
Start L_d 185
End L_d 185
Mean L_d 185.0
$E_o Cos\Psi$ 33.56

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w x10^{-3}$ *	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi}$ $x10^{-5}$
0(360)	1	0.1	0.19	1.9	0.8	5.42
5						
10	1	.1	0.21	2.1	0.8	6.02
15						
20	1	.1	.26	2.6	0.8	7.51
30	1	.1	.36	3.6	0.95	10.44
40	1	.1	.61	6.1	1.00	17.88
50	1	.3	1.45	14.5	1.60	42.73
60	1	1.0	0.59	59.0	6.10	173.99
70	100 WR	1.0	0.11	1100	26.00	3269.96
80	10^6 WR	1.0	0.98	98000000	139.00	292014261.32
90	WE					
100	TB					
110	TB					
120	1	3.0	1.6	160.0	8.5	474.23
130	1	0.3	2.4	24.0	3.2	70.56
140	1	.1	1.0	10.0	1.9	29.23
150	1	.1	0.48	4.8	1.6	13.83
160	1	.1	.30	3.0	1.1	8.61
170	1	.1	.24	2.4	1.0	6.85
180	1	.1	.20	2.0	0.8	5.72
190	1	.1	.20	2.0	0.8	5.72
200	1	.1	.22	2.2	1.0	6.26
210	1	.1	.18	1.8	1.2	5.01
220	1	.1	.20	2.0	1.3	5.57

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w x10^{-3}$ *	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi}$ $x10^{-5}$
230	1	.1	.24	2.4	1.5	6.70
240	1	.1	.42	4.2	2.9	11.65
250	1	.3	1.60	16.0	17.0	42.61
260	BR	10.	.92	920.0	19.5	2735.55
270	WE					
275						
280	BP					
285						
290	BP					
295						
300	1.0	.3	1.03	10.3	2.6	29.92
305						
310	1.0	.1	0.27	2.7	3.2	7.09
315						
320	1.0	.1	0.22	2.2	1.9	5.99
325						
330	1	.1	0.19	1.9	1.3	5.27
335						
340	1	.1	0.18	1.8	1.0	5.06
345						
350	1	.1	0.17	1.7	0.95	4.78
355						
360	1	.1	0.19	1.9	0.8	5.42

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

* L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

$\Psi = 0^{\circ}$

Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 246
Start L_d 195
End L_d 195
Mean L_d 195
$E_o \cos\Psi$ 203.76

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	BP						230	10	1	.32	320.0	1.2	156.99
5							240	10	1	.26	260.0	1.0	127.55
10	BP						250	10	1	.24	240.0	0.9	117.74
15	10BR	.1	.65	65.0		31.90	260	10	.3	1.05	105.0	0.8	51.49
20	10	.1	.52	52.0	1.9	25.43	270	WE				0.8	
30	10	.1	.4	40.0	2.6	19.50	275						
40	10	.1	.37	37.0	1.6	18.08	280	10	.1	.56	56.0	0.9	27.44
50	10	.1	.38	38.0	1.2	18.59	285						
60	10	.1	.32	32:0	1.0	15.66	290	10	.1	.53	53.0	1.0	25.96
70	10	.1	.48	48.0	0.8	23.52	295						
80	10	.1	.49	49.0	0.8	24.01	300	10	.1	.47	47.0	1.1	23.01
90	WE				0.8		305						
100	10	.3	1.15	115.0	0.7	56.40	310	10	.1	.43	43.0	0.9	21.06
110	10	.3	2.6	260.0	0.8	127.56	315						
120	10	1	.32	320.0	0.9	157.00	320	10	.1	.42	42.0	1.5	20.54
130	10	1	.38	380.0	1.1	186.44	325						
140	10	1	.47	470.0	1.5	230.59	330	10	.1	.46	46.0	2.3	22.46
150	10	1	.61	610.0	2.1	299.27	335						
160	10TB	1	.94	940.0	10.2	460.83	340	10	.1	.54	54.0	4.2	26.30
170	TB						345	10BR	.1	.64	64.0	8.4	31.00
180	TB						350	BP					
190	TB						355						
200	10TB	3	.9	900.0	11.4	441.14	360	BP					
210	10	1	.56	560.0	2.6	274.71							
220	10	1	.41	410.0	1.6	201.14							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D112

3-D Angle = 0°
$\Psi = 10^\circ$
Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 246
Start L_d 195
End L_d 195
Mean L_d 195
$E_o \mathrm{Cos}\Psi$ 200.66

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \mathrm{Cos}\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \mathrm{Cos}\Psi} \times 10^{-5}$
0(360)	BP						230	10	.3	2.2	220	1.0	109.59
5	1000BR	.03	.95	9500		4734.38	240	10	.3	1.85	185	0.9	92.15
10	10^4WR	3	1.65	1650000	1.9	822286.36	250	10	.3	1.6	160	0.8	79.70
15							260	10	.1	.46	46	0.8	22.88
20	1WR	1	.8	80.	2.6	39.74	270	WE				0.9	
30	1WR	1	.41	41.	1.7	20.35	275						
40	1	1	.34	34.	1.2	16.88	280	10	.1	.41	41	1.1	20.38
50	1	1	.35	35.	1.0	17.39	285						
60	1	1	.38	38.	0.8	18.90	290	10	.1	.43	43	1.1	21.37
70	1	1	.45	45.	0.75	22.39	295						
80	1	1	.48	48.	0.7	23.89	300	10	.1	.38	38	0.9	~~18.89~~
90	WE				0.8		305						
100	1	3	1.25	125.	0.8	62.25	310	10	.1	.34	34	1.5	16.87
110	1	3	1.27	127.	0.95	63.24	315						
120	1	10	.32	320.	1.1	159.42	320	10	.1	.35	35	2.3	17.33
130	1	10	.41	410.	1.4	204.26	325						
140	1	10	.53	530.	2.2	264.02	330	10	.1	.36	36	4.2	17.73
150	1TB	10	.77	770.	10.2	383.23	335	10BR	.1	.39	39	8.5	19.01
160	TB						340	BP					
170	TB						345						
180	TB						350	BP					
190	10TB	3	.9	900.	11.2	447.96	355						
200	10BR	1	.54	540.	3.1	268.96	360	BP					
210	10	1	.37	370.	1.8	184.30							
220	10	1	.28	280.	1.4	139.47							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 20°
Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 246
Start L_d 195
End L_d 195
Mean L_d 195
$E_o \cos\Psi$ 191.47

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	10WR	.1	.45	45.	1.9	23.40
5						
10	10WR	.1	.89	89.	2.6	46.35
15						
20	10^5WR	.3	1.7	1700000	1.7	887867.46
30	10WR	.3	1.15	115.	1.2	60.00
40	10WR	.1	.56	56.	1.0	29.20
50	10	.1	.52	52.	0.8	27.12
60	10	.1	.58	58.	0.75	30.25
70	10	.1	.7	70.	0.7	36.52
80	10	.1	.72	72.	0.7	37.57
90	WE				0.8	
100	10	.3	1.5	150	1.0	78.29
110	10	1	.46	46.	1.2	23.96
120	10	1	.53	53.	1.5	27.60
130	10	1	.7	70.	2.2	36.44
140	10TB	3	1.0	1000	10.2	521.74
150	TB					
160	TB					
170	TB					
180	10TB	1	.79	790	11.2	412.01
190	10BR	1	.5	500	3.2	260.97
200	10BR	1	.38	380	1.8	198.37
210	10BR	1	.25	250	1.5	130.49
220	10	.3	1.9	190	1.0	99.18

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
230	10	.3	1.5	150	0.9	78.29
240	10	.3	1.3	130	0.8	67.85
250	10	.1	.5	50	0.8	65.24
260	10	.1	.5	50	1.0	26.06
270	WE				1.1	
275						
280	10	.1	.38	38	1.2	19.78
285						
290	10	.1	.36	36	0.9	18.75
295						
300	10	.1	.32	32.	1.5	16.63
305						
310	10	.1	.3	30	2.4	15.54
315						
320	10	.1	.31	31	4.1	15.98
325	10BR	.1	.32	32	8.4	16.27
330	BP					
335						
340	BP					
345						
350	BP					
355	10BR	.1	.44	44		22.98
360					1.9	

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D114

3-D Angle = 0°
$\Psi = 30^{\circ}$
Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 246
Start L_d 195
End L_d 195
Mean L_d 195
$E_o \cos\Psi$ 176.46

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	10	.1	.36	36	2.6	20.25	230	10	.3	1.1	110	0.8	62.29
5							240	10	.3	.95	95	0.8	53.79
10	10WR	.1	.48	48.	1.6	27.11	250	10	.3	.9	90	1.0	50.95
15							260	10	.1	.62	62.	1.1	35.07
20	10WR	.1	.9	90.	1.2	50.94	270	WE				1.2	
30	10^4WR	10	.34	3400000	1.0	1926782.22	275						
40	10WR	.3	1.8	180.	0.8	101.96	280	10	.1	.36	36.	1.0	20.34
50	10WR	.1	.78	78.	0.75	44.16	285						
60	10	.1	.8	80.	0.6	45.30	290	10	.1	.32	32.	1.5	18.05
70	10	.3	.95	95.	0.7	53.80	295						
80	10	.3	1.05	105.	0.8	59.46	300	10	.1	.3	30.	2.4	16.87
90	WE				1.0		305						
100	10	1	.38	380.	1.1	215.28	310	10	.1	.28	28.	4.0	15.64
110	10	1	.64	640.	1.5	362.60	315	10	.1	.29	29.	8.2	15.97
120	10	1	.8	800.	2.2	453.24	320	BP					
130	10TB	3	1.15	1150.	10.2	651.13	325						
140	TB						330	BP					
150	TB						335						
160	TB						340	BP					
170	10TB	1	.78	780.	11.2	441.39	345	10BP	.1	.34	34.		19.27
180	10	1	.48	480	3.1	271.84	350	10	.1	.32	32.	1.8	18.03
190	10	1	.34	340	1.9	192.57	355						
200	10BR	1	.24	240	1.5	135.92	360					2.6	
210	10BR	1	.23	230	1.0	130.28							
220	10BR	.3	1.4	140	0.8	79.29							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

Ψ = 40°

Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 246

Start L_d 195

End L_d 195

Mean L_d 195

$E_o \cos\Psi$ 156.08

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	10	.1	.31	31.0	1.6	19.76
5						
10	10	.1	.38	380	1.2	24.27
15						
20	10	.1	.53	53.0	1.0	37.10
30	10WR	.3	1.5	150.0	0.8	96.05
40	10^4WR	10	.59	5900000	0.8	3780112.71
50	10WR	1	.28	2800	0.6	1793.91
60	10WR	.3	1.3	130	0.7	83.24
70	10	.3	1.45	145	0.8	92.85
80	10	.3	1.5	150	1.0	96.04
90	WE				1.2	
100	10	1	.6	600	1.5	384.32
110	10	1	.9	900	2.2	576.49
120	10TB	3	1.2	1200	10.2	786.18
130	TB					
140	TB					
150	TB					
160	10TB	1	.77	770	11.2	492.62
170	10	1	.46	460	3.1	294.52
180	10	1	.32	320	1.8	204.91
190	10	1	.32	230	1.6	147.26
200	10	.3	1.6	160	1.0	102.45
210	10BR	.3	1.25	125	0.8	80.04
220	10BR	.3	2.15	215	0.8	137.70

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	*(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
230	10BR	.1	.86	86	0.8	55.05
240	10	.1	.74	74	1.0	47.35
250	10	.1	.71	71	1.0	45.43
260	10	.3	.95	95	1.0	60.80
270	WE				0.9	
275						
280	10	.1	.39	39	1.5	24.89
285						
290	10	.1	.32	32	2.5	20.34
295						
300	10	.1	.29	29	4.1	18.32
305	10BR	.1	.28	28	8.0	17.43
310	BP					
315						
320	BP					
325						
330	BP					
335	10BR	.1	.3	30		19.22
340	10	.1	.27	27	1.8	17.18
345						
350	10	.1	.28	28	2.6	17.77
355						
360					1.6	

Photo Research Pritchard Photometer

Photometer Aperture Factor 0.10

Xenon Lamp Amperage 80

Photometer Field of View 1°

Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor

TB = Transmitted Beam

WE = Window Edge

WR = Window Reflex (specular)

BR = Blackbody Reflex (due to WR)

BP = Beam blocked by photometer

D116

3-D Angle = 0°
Ψ = 50°
Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 246
Start L_d 195
End L_d 195
Mean L_d 195
$E_o Cos\Psi$ 130.98

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w x10^{-3}$ *	(ft-L) $L_b x10^{-4}$	$\frac{L_w-L_b}{E_o Cos\Psi}$ $x10^{-5}$
0(360)	10	.1	.37	37	1.2	28.16
5						
10	10	.1	.44	44	1.0	33.52
15						
20	10	.1	.58	58	0.85	44.22
30	10WR	.1	.83	83	0.8	63.31
40	10WR	.3	2.1	210	0.7	160.28
50	10^5WR	.3	1.2	120	0.7	91.56
60	10WR	.3	2.0	200	0.8	152.63
70	10WR	1	.4	400	0.9	305.32
80	10	1	.53	530	1.3	404.54
90	WE				1.6	
100	10	3	1.5	1500	2.2	1145.04
110	10	3	1.55	1550	9.4	1182.67
120	TB					
130	TB					
140	TB					
150	10TB	1	.8	800	11.2	609.92
160	10	1	.46	460	3.1	350.96
170	10	1	.3	300	1.8	228.91
180	10	1	.22	220	1.5	167.85
190	10	.3	1.55	155	1.0	118.26
200	10	.3	1.15	115	0.8	87.74
210	10	.1	.87	87	0.8	66.36
220	10BR	.1	.75	75	0.8	57.20

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w x10^{-3}$ *	(ft-L) $L_b x10^{-4}$	$\frac{L_w-L_b}{E_o Cos\Psi}$ x10
230	10BR	1	.28	280	1.1	213.69
240	10BR	.1	.72	72	1.2	54.88
250	10	.1	.62	62	1.4	47.23
260	10	.3	1.7	170	1.1	129.71
270	WE				2.7	
275						
280	10	.1	.66	66	4.0	50.08
285						
290	10	.1	.41	41	4.7	31.27
295	10	.1	.32	32	8.5	23.78
300	BP					
305						
310	BP					
315						
320	BP					
325	10BR	.1	.32	32		24.43
330	10	.1	.29	29	1.8	22.00
335						
340	10	.1	.3	30	2.6	22.71
345						
350	10	.1	.32	32	1.6	24.31
355						
360					1.2	

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°

$\Psi = 60^\circ$

Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 246

Start L_d 195

End L_d 195

Mean L_d 195

$E_o \cos\Psi$ 101.88

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)	10	.1	.38	38	1.0	37.20	230	10BR	.1	.57	57	1.5	55.80
5							240	10BR	1	.52	52	1.8	50.86
10	10	.1	.46	46	0.95	45.06	250	10BR	.1	.85	85	2.0	83.23
15							260	10	.1	.38	380	3.8	372.61
20	10	.1	.58	58	0.8	56.85	270	WE				9.2	
30	10	.1	.78	78	0.8	76.48	275						
40	10WR	.3	1.15	115	0.8	112.80	280	10	.3	1.9	190	8.2	185.69
50	10WR	1	.38	380	0.9	372.90	285	10	.3	1.4	140	10.6	136.38
60	10^5WR	10	.39	39000000	2.0	38280329.60	290	BP					
70	10WR	10	.35	3500	3.9	3435.03	295						
80	10WR	3	.85	850	8.2	833.51	300	BP					
90	WE				9.8		305						
100	10TB	3	1.8	1800	12.8	1765.53	310	BP					
110	TB						315	10BR	.1	.33	33		32.39
120	TB						320	10	.1	.32	32	1.8	31.23
130	TB						325						
140	10TB	1	.84	840	11.1	823.41	330	10	.1	.31	31	2.6	30.17
150	10	1	.46	460	3.2	451.20	335						
160	10	1	.3	300	1.8	294.29	340	10	.1	.32	32	1.7	31.24
170	10	1	.2	200	1.6	196.15	345						
180	10	.3	1.45	145	1.1	142.22	350	10	.1	.34	34	1.2	33.25
190	10	.3	1.05	105	0.9	102.97	355						
200	10	.1	.83	83	0.9	81.38	360					1.0	
210	10	.1	.68	68	0.9	66.66							
220	10	.1	.58	58	1.1	56.82							

Photo Research Pritchard Photometer

Photometer Aperture Factor 0.10

Xenon Lamp Amperage 80

Photometer Field of View 1°

Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor

TB = Transmitted Beam

WE = Window Edge

WR = Window Reflex (specular)

BR = Blackbody Reflex (due to WR)

BP = Beam blocked by photometer

D118

3-D Angle = 0°
Ψ = 70°
Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 & 246
Start L_d 195
End L_d 195
Mean L_d 195
$E_o \cos\Psi$ 69.69

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* L_wx10^{-3}	(ft-L) L_bx10^{-4}	$\frac{L_w-L_b}{E_o \cos\Psi}$ x10^{-5}	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* L_wx10^{-3}	(ft-L) L_bx10^{-4}	$\frac{L_w-L_b}{E_o \cos\Psi}$ x10^{-5}
0(360)	10	.1	.32	32	.95	45.78	230	10	.1	.37	37	1.8	52.83
5							240	10BR	.1	.42	42	2.0	59.98
10	10	.1	.39	39	0.8	55.85	250	10BR	1.	.74	740	4.0	1061.27
15							260	10BR	1	.5	500	10.0	716.03
20	10	.1	.49	49	0.8	70.20	270	WE				24.0	
30	10	.1	.64	64	0.8	91.72	275	WE				15.5	
40	10	.1	.92	92	0.95	131.88	280	BP					
50	10	.3	1.65	165	1.3	236.58	285						
60	10WR	1	.54	540	5.0	774.14	290	BP					
70	10^5WR	3	2.35	23500000	14.5	33720761.30	295						
80	10^4WR	.03	2.55	255000	42.0	365900.13	300	BP					
90	WE				47.0		305	10BR	.1	.35	35		50.22
100	TB						310	10	.1	.31	31	2.2	44.17
110	TB						315						
120	TB						320	10	.1	.29	29	2.9	41.20
130	10TB	1	.64	640	10.9	916.79	325						
140	10	1	.34	340	3.1	487.43	330	10	.1	.27	27	1.7	38.50
150	10	1	.22	220	1.8	315.43	335						
160	10	.3	1.4	140	1.6	200.66	340	10	.1	.26	26	1.2	37.14
170	10	.3	1.05	105	1.1	150.51	345						
180	10	.3	.8	80	0.9	114.66	350	10	.1	.29	29	1.0	41.47
190	10	.1	.6	60	0.8	85.98	355						
200	10	.1	.48	48	0.9	68.75	360					0.95	
210	10	.1	.41	41	1.1	58.67							
220	10	.1	.38	38	1.3	54.34							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 80°
Date 5-6-69

RAW DATA SHEET

WINDOW SCATTER MEASUREMENTS

Window # 244 246
Start L_d 195
End L_d 195
Mean L_d 195
$E_o \cos\Psi$ 35.37

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)	10	.03	2.1	21	0.8	59.15	230	1.0	.03	2.2	22	1.5	61.78
5							240	10	.03	2.7	27	2.9	75.52
10	10	.03	2.5	25	0.8	70.46	250	10	.1	.43	43	17.0	116.77
15							260	10BR	3	1.25	1250	19.5	3528.55
20	10	.1	.32	32	0.8	90.25	270	WE					
30	10	.1	.42	42	0.95	118.48	275						
40	10	.1	.58	58	1.00	163.70	280						
50	10	.3	1.0	100	1.60	282.72	285						
60	10	.3	2.05	205	6.10	577.86	290						
70	10 WR	13	1.0	1000	26.00	2819.90	295	10 WR	.1	.34	34		96.13
80	10^6 WR	.1	.84	84000000	139.00	237489358.50	300	10	.1	.36	36	2.6	101.05
90	WE						305						
100	TB						310	10	.1	.24	24	3.2	66.99
110	10 TB	1	.72	720			315						
120	10 TB	1	.38	380	8.5	1071.95	320	10	.1	.22	22	1.9	64.49
130	10	.3	1.8	180	3.2	508.00	325						
140	10	.3	1.05	105	1.9	296.32	330	10	.1	.2	20	1.3	56.18
150	10	.1	.76	76	1.6	214.42	335						
160	10	.1	.54	54	1.1	152.36	340	10	.03	1.8	18	1.0	50.61
170	10	.1	.4	40	1.0	112.81	345						
180	10	c .1	.3	30	0.8	84.59	350	10	.03	1.9	19	0.95	53.45
190	10	.1	.26	26	0.8	73.28	355						
200	10	.1	.23	23	1.0	64.75	360					0.8	
210	10	.1	.2	20	1.2	56.21							
220	10	.03	2.0	20	1.3	56.18							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D120

3-D Angle = 0°
Ψ = 0°
Date__________

BLACK EDGE DATA

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 190
End L_d 192
Mean L_d 191
$E_o \cos\Psi$ 199.58

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-}$
0(360)							230	1	.1	.80	8.0	1.2	3.94
5	BP						240	1	.1	.66	6.6	1.0	3.25
10	BP						250	1	.1	.62	6.2	0.9	3.06
15	BP						260	1	.1	.58	5.8	0.8	2.86
20	1	.1	.49	4.9	1.9	2.35	270	WE				0.8	
30	1	.1	.35	3.5	2.6	1.62	275						
40	1	.1	.31	3.1	1.6	1.47	280	1	.1	.42	4.2	0.9	2.05
50	1	.1	.29	2.9	1.2	1.39	285						
60	1	.1	.33	3.3	1.0	1.60	290	1	.1	.34	3.4	1.0	1.65
70	1	.1	.38	3.8	0.8	1.86	295						
80	1	.1	.46	4.6	0.8	2.26	300	1	.1	.30	3.0	1.1	1.44
90	WE				0.8		305						
100	1	.1	.67	6.7	0.7	3.32	310	1	.1	.28	2.8	0.9	1.35
110	1	.1	.72	7.2	0.8	3.56	315						
120	1	.1	.72	7.2	0.9	3.56	320	1	.1	.28	2.8	1.5	1.32
130	1	.1	.83	8.3	1.1	4.10	325						
140	1	.3	1.04	10.4	1.5	5.13	330	1	.1	.32	3.2	2.3	1.48
150	1	.3	1.50	15.0	2.1	7.41	335						
160	1	.3	2.76	27.6	10.2	13.31	340	1	.1	.44	4.4	4.2	1.99
170	TB						345	1	.1	.56	5.6	8.4	2.38
180	TB						350	BP					
190	TB						355	BP					
200	1	.3	2.85	28.5	11.4	13.70	360	BP					
210	1	.3	1.50	15.0	2.6	7.38							
220	1	.3	1.10	11.0	1.6	5.43							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 40°
Date__________

BLACK EDGE DATA

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 92
End L_d 192
Mean L_d 192
$E_o Cos\Psi$ 153.68

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi} \times 10^{-5}$
0(360)					1.6	
5	1					
10	1	.1	.26	2.6	1.2	1.61
15	1					
20	1	.1	.37	3.7	1.0	2.34
30	1 WR	.3	1.48	14.8	0.8	9.58
40	10^4 WR	3.0	2.12	2120000	0.8	1379489.80
50	1 WR	1.0	0.40	40.0	0.6	25.99
60	1	0.3	1.15	11.5	0.7	7.44
70	1	.3	1.28	12.8	0.8	8.29
80	1	.3	1.78	17.8	1.0	11.52
90	WE				1.2	
100	1	1.0	.360	36.0	1.5	23.33
110	1	1.0	.480	48.0	2.2	31.09
120	1	1.0	.630	63.0	10.2	40.33
130	TB					
140	TB					
150	TB					
160	1	1.0	.32	32.0	11.2	20.09
170	1	0.3	1.50	15.0	3.1	9.56
180	1	.1	.80	8.0	1.8	5.09
190	1	.1	.54	5.4	1.6	3.41
200	1	.1	.38	3.8	1.0	2.41
210	1	.1	.38	3.8	0.8	2.42
220	BR	1.0	.48	48.0	0.8	31.18

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi} \times 10^{-}$
230	1	.1	.28	2.8	0.8	1.77
240	1	.03	2.05	2.05	1.0	1.27
250	1	.03	2.20	2.20	1.0	1.37
260	1	.03	2.60	2.60	1.0	1.63
270	WE				0.9	
275						
280	1	.03	2.50	2.50	1.5	1.53
285						
290	1	0.03	2.30	2.30	2.5	1.33
295						
300	1	0.03	2.40	2.40	4.1	1.29
305	1	0.03	2.70	2.70	8.0	1.24
310	BP					
315						
320	BP					
325						
330	BP					
335						
340	1	.1	.25	2.5	1.8	1.51
345						
350	1	.1	.22	2.2	2.6	1.26
355						
360	1	.1	.22	1.6	1.6	1.33

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D122

3-D Angle = 0°
$\Psi = 80^\circ$
Date__________

BLACK EDGE DATA

WINDOW SCATTER MEASUREMENTS

Window # 244
Start L_d 192
End L_d 188
Mean L_d 190
$E_o \cos\Psi$ 34.47

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
(360)					0.8		230	1	0.01	.80	0.80	1.5	1.89
5							240	1	0.03	1.20	1.20	2.9	2.64
10	1	.01	.95	.95	0.8	2.52	250	1 BR	0.03	2.00	2.00	17.0	0.87
15							260	1 BR	10	0.78	780.0	19.5	2257.18
20	1	.03	1.42	1.42	0.8	3.89	270	WE					
30	1	.03	2.10	2.10	0.95	5.82	275	BP					
40	1	0.1	0.39	3.90	1.00	11.02	280	BP					
50	1	0.1	0.91	9.10	1.60	25.94	285	BP					
60	1	1.0	.36	36.0	6.10	102.67	290	BP					
70	1	3.0	2.07	26.0	26.00	592.98	295	BP					
80	10^6	3.0	0.66	66000000	139.00	191470803.89	300	1	.1	.27	2.7	2.6	7.08
90	WE						305						
100	TB						310	1	.03	1.00	1.0	3.2	1.97
110	TB						315						
120	1	1.0	.60	60.0	8.5	171.60	320	1	.01	.74	0.74	1.9	1.60
130	1	.3	1.80	18.0	3.2	51.29	325						
140	1	.1	0.74	7.4	1.9	20.92	330	1	.01	.66	0.66	1.3	1.54
150	1	.1	0.42	4.2	1.6	11.72	335						
160	1	.03	2.35	2.35	1.1	6.50	340	1	.01	.68	0.68	1.0	1.68
170	1	.03	1.65	1.65	1.0	4.50	345						
180	1	.03	1.20	1.20	0.8	3.25	350	1	.01	.70	0.70	0.95	1.76
190	1	.03	0.85	0.85	0.8	2.23	355						
200	1	.03	0.80	0.80	1.0	2.03	360	1	.01	.76	0.76	0.8	1.97
210	1	.01	0.76	0.76	1.2	1.86							
220	1	.01	0.72	0.72	1.3	1.71							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 80°
Date 6-18

BLACK EDGE DATA

WINDOW SCATTER MEASUREMENTS

Window # 240
Start L_d 175
End L_d 171
Mean L_d 173
$E_o \cos\Psi$ 31.45

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L) $L_w \times 10^{-3}$ *	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)					0.8		230	1	.01	.60	0.60	1.5	1.43
5							240	1	.01	.90	0.90	2.9	1.94
10	1	.01	.71	0.71	0.8	2.0	250	1 BR	.03	1.60	1.60	17.0	.32
15							260	BR				19.5	
20	1	.03	1.01	1.01	0.8	2.95	270	WE					
30	1	.03	1.60	1.60	0.95	4.79	275	BP					
40	1	.1	.31	3.10	1.00	9.54	280	BP					
50	1	.1	.78	7.80	1.60	24.29	285	BP					
60	1	.3	3.05	30.50	6.10	95.04	290	BP					
70	1	3.0	2.10	210.0	26.00	659.46	295	BP					
80	10^6	3.0	0.70	70000000	139.00	222575472.	300	1	0.1	.41	.41	2.6	12.21
90	TB						305						
100	TB						310	1	.03	.81	0.81	3.2	1.56
110	TB						315						
120	1.0	1.0	.54	54.0	8.5	169.00	320	1	.01	0.62	0.62	1.9	1.37
130	1.0	3	1.60	16.0	3.2	49.86	325						
140	1	.1	.56	5.6	1.9	17.20	330	1	.01	.57	0.57	1.3	1.40
150	1	.03	2.6	2.6	1.6	7.76	335						
160	1	.03	1.50	1.5	1.1	4.42	340	1	.01	.51	0.51	1.0	1.30
170	1	.03	1.00	1.0	1.0	2.86	345						
180	1	.03	.75	0.75	0.8	2.13	350	1	.01	.54	0.54	0.95	1.41
190	1	.01	.54	0.54	0.8	1.46	355						
200	1	.01	.44	0.44	1.0	1.08	360	1	.01	.61	0.61	0.8	1.69
210	1	.01	.44	0.44	1.2	1.02							
220	1	.01	.46	0.46	1.3	1.05							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

D124

3-D Angle = 0°
Ψ = 80°
Date 6-18

BLACK EDGE DATA

WINDOW SCATTER MEASUREMENTS

Window # 208
Start L_d 85
End L_d 186
Mean L_d 185/5
$E_o Cos\Psi$ 33.64

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w x10^{-3}$	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi}$ $x10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w x10^{-3}$	(ft-L) $L_b x10^{-4}$	$\frac{L_w - L_b}{E_o Cos\Psi}$ x10
0(360)					0.8		230	1	.01	.48	0.48	1.5	0.98
5							240	1	.01	.74	0.74	2.9	1.34
10	1	.01	0.60	.6	0.8	1.54	250	1 BR	.03	1.50	1.50	17.0	0.59
15							260	1 BR	10	.77	770.0	19.5	2283.14
20	1	.01	.77	.77	0.8	2.05	270	WE					
30	1	.03	1.40	1.40	0.95	3.88	275	BP					
40	1	.1	0.34	3.40	1.00	9.81	280	BP					
50	1	.3	1.00	10.0	1.60	29.25	285	BP					
60	1	1.0	0.32	32.0	6.10	93.31	290	BP					
70	1	3.0	2.15	215.0	26.00	631.39	295	BP					
80	10^6	3.0	0.69	69000000	139.00	205112919.	300	1	.1	.24	2.4	2.6	6.36
90	WE						305						
100	TB						310	1	0.01	0.72	0.72	3.2	1.19
110	TB						315						
120	1	1.0	.56	56.0	8.5	163.94	320	1	.01	0.54	0.54	1.9	1.04
130	1	.3	1.70	17.0	3.2	49.58	325						
140	1	.3	1.00	10.0	1.9	29.16	330	1	.01	0.43	0.43	1.3	0.89
150	1	.03	2.35	2.35	1.6	6.51	335						
160	1	.03	1.30	1.30	1.1	3.54	340	1	.01	0.42	0.42	1.0	0.95
170	1	.01	0.78	0.78	1.0	2.02	345						
180	1	.01	.58	0.58	0.8	1.49	350	1	.01	0.43	0.43	0.95	1.00
190	1	.01	50	0.50	0.8	1.25	355						
200	1	.01	.48	0.48	1.0	1.13	360	1	.01	0.53	0.53	0.8	1.34
210	1	.01	.48	0.48	1.2	1.07							
220	1	.01	.40	0.40	1.3	0.80							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

*L_w = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

3-D Angle = 0°
Ψ = 80°
Date 6-18-69

BLACK EDGE DATA

WINDOW SCATTER MEASUREMENTS

Window # 246
Start L_d 188
End L_d 193
Mean L_d 190.5
$E_o \cos\Psi$ 34.57

θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$	θ	Photometer Filter Factor	Full Scale Setting	Meter Reading	(ft-L)* $L_w \times 10^{-3}$	(ft-L) $L_b \times 10^{-4}$	$\frac{L_w - L_b}{E_o \cos\Psi} \times 10^{-5}$
0(360)					0.8		230	1	.3	.90	9.0	1.5	25.60
5							240	1	.3	.90	9.0	2.9	25.20
10	1	.3	1.30	13.0	0.8	37.37	250	1	.3	1.00	10.0	17.0	24.01
15							260	1 BR	10	0.78	780.0	19.5	2250.65
20	1	.3	1.76	17.6	0.8	50.68	270	WE					
30	1	.3	2.41	24.1	0.95	69.44	275	BP					
40	1	1.0	0.37	37.0	1.00	106.74	280	BP					
50	1	1.0	0.64	64.0	1.60	184.67	285	BP					
60	1	3.0	1.50	150.0	6.10	432.14	290	BP					
70	1	10.0	0.70	700.0	26.00	2017.36	295	BP					
80	10^6	3.0	0.68	68000000	139.00	196702302.86	300	1	.1	.82	8.2	2.6	22.97
90	WE						305						
100	TB						310	1	.1	.65	6.5	3.2	17.88
110	TB						315						
120	1	10.0	.32	320.0	8.5	92.32	320	1	.1	.62	6.2	1.9	17.39
130	1	3.0	1.60	160.0	3.2	461.90	325						
140	1	1.0	0.98	98.0	1.9	282.93	330	1	.1	.64	6.4	1.3	18.14
150	1	1.0	0.62	62.0	1.6	178.88	335						
160	1	1.0	0.44	44.0	1.1	126.96	340	1	.1	.7	7.0	1.0	19.96
170	1	1.0	0.30	30.0	1.0	86.49	345						
180	1	.3	2.30	23.0	0.8	66.30	350	1	.1	.82	8.2	0.95	23.45
190	1	.3	1.70	17.0	0.8	48.94	355						
200	1	.3	1.40	14.0	1.0	40.21	360	1	.3	1.02	0.8	0.8	29.27
210	1	.3	1.20	12.0	1.2	34.37							
220	1	.3	1.00	10.0	1.3	28.55							

Photo Research Pritchard Photometer
Photometer Aperture Factor 0.10
Xenon Lamp Amperage 80
Photometer Field of View 1°
Photometer - Window Distance 20"

$^*L_w$ = Footlamberts corrected for photometer aperture factor
TB = Transmitted Beam
WE = Window Edge
WR = Window Reflex (specular)
BR = Blackbody Reflex (due to WR)
BP = Beam blocked by photometer

APPENDIX E

WINDOW TRANSMITTANCE AND SPECULAR REFLECTANCE MEASUREMENTS

A Gamma Scientific photometer (model number 2020-1) was used to measure window transmittance and specular reflectance factors. The photometer was positioned in the collimated beam at the θ = 180 degree position. An illumination measurement was obtained with no window in place. A window was then interposed in the beam and positioned for the Ψ = 0 setting. An illumination measurement was made and recorded for this zero position. The window was then rotated from the Ψ = 0 to the 80-degree setting with illumination measurements made and recorded at every 10-degree increment. Transmittance factors were calculated by dividing the illumination values measured with a window in place by that measured with the window removed.

The specular reflectance measurements were begun with the window in the Ψ = 10-degree position. The photometer was positioned in the θ = 10-degree position (specular reflection angle) and an illumination measurement was recorded. The window was then rotated to the Ψ = 20-degree position and the photometer was positioned at the θ = 20-degree position, and an illumination measurement was again taken. This procedure was repeated at each 10-degree (Ψ) increment until a set of measurements from 0 to 80-degrees was completed. The specular reflectance factor was computed by dividing the specular reflection illuminance measurement by the incident illuminance measured with the window removed.

Results of these measurements are given in Table E1.

TABLE E1. TRANSMITTANCE AND SPECULAR REFLECTANCE OF WINDOWS

Window Angle, Ψ (deg)	208		240		244		246	
	τ	ρ	τ	ρ	τ	ρ	τ	ρ
0	0.946		0.925		1.000		0.970	
10	0.946	0.032	0.917	0.057	1.000	0.0002	0.966	0.005
20	0.946	0.032	0.921	0.058	1.000	0.003	0.963	0.007
30	0.946	0.034	0.921	0.060	1.000	0.006	0.963	0.011
40	0.946	0.038	0.917	0.068	1.000	0.013	0.959	0.019
50	0.939	0.056	0.906	0.086	0.985	0.032	0.940	0.038
60	0.893	0.103	0.849	0.092	0.932	0.080	0.896	0.085
70	0.770	0.226	0.725	0.253	0.787	0.205	0.772	0.414
80	0.433	0.513	0.415	0.532	0.449	0.456	0.440	0.414

APPENDIX F
MULTIPLE WINDOW ANALYSIS

Consider, in two dimensions, a pencil of luminant flux incident upon a flat window where it is either transmitted, specularly reflected, or scattered. In Figures F1 and F2 we show a unit amount of radient energy incident from the direction where it makes an angle Ψ with the outward normal of the window. The fraction of energy τ is transmitted straight through; the fraction ρ is reflected, and a small fraction, $S(\theta)$, is scattered in all directions. By photometric measurements, the quantities τ, ρ, and $S(\theta)$ are determined (Appendixes D and E). For our calculation, we assume that no absorption occurs in the plates, that the plates are close together, and that $S(\theta)$ is small compared with τ. From the principle of conservation of energy, we have

$$\tau + \rho + \int_{0}^{2\pi} S(\theta)\, d\theta = 1$$

Since $S(\theta)$ is a small quantity, we can neglected all the beams that are scattered twice, or more and concentrated on the transmitted and the reflected beams as shown in Figure F3. The series of beams on the same direction can be combined into single beams in each direction.

Shown in Figure F4 are the combined beams so obtained. We thus obtain for the total transmittance and the total specular reflectance respectively

$$T = \frac{\tau^2}{1-\rho^2} \qquad \text{(F1)}$$

and

$$P = \rho \left(1 + \frac{\tau^2}{1-\rho^2}\right) \qquad \text{(F2)}$$

What remain to be considered are the three groups of scattering beams as shown in the figure.

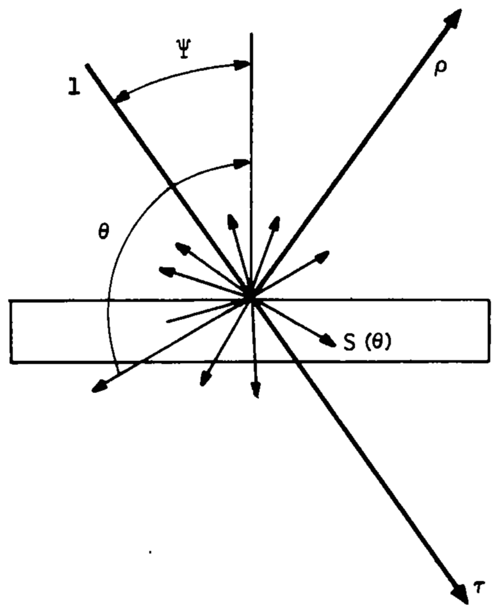

Figure F1. Geometrical Situation

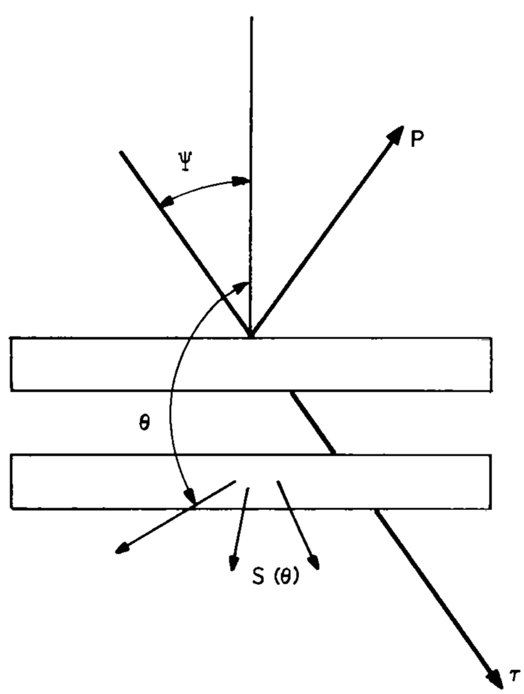

Figure F2. Two-Plate Configuration

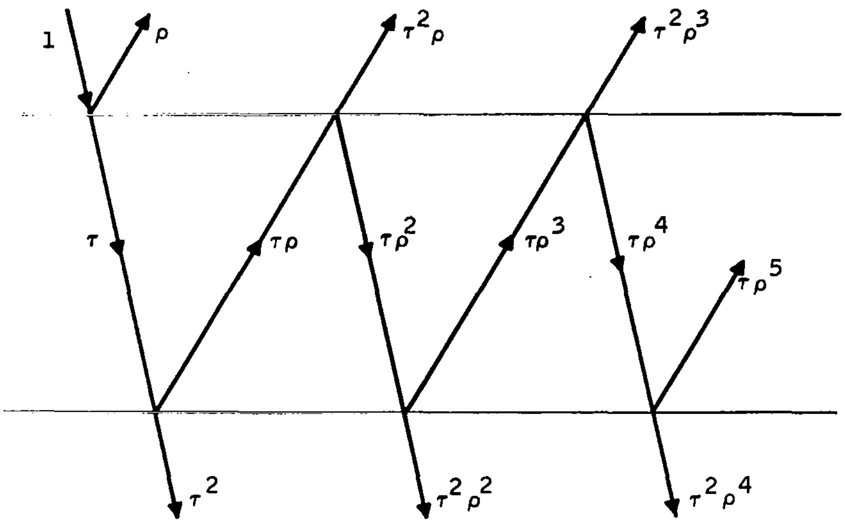

Figure F3. Internal Physics Considered

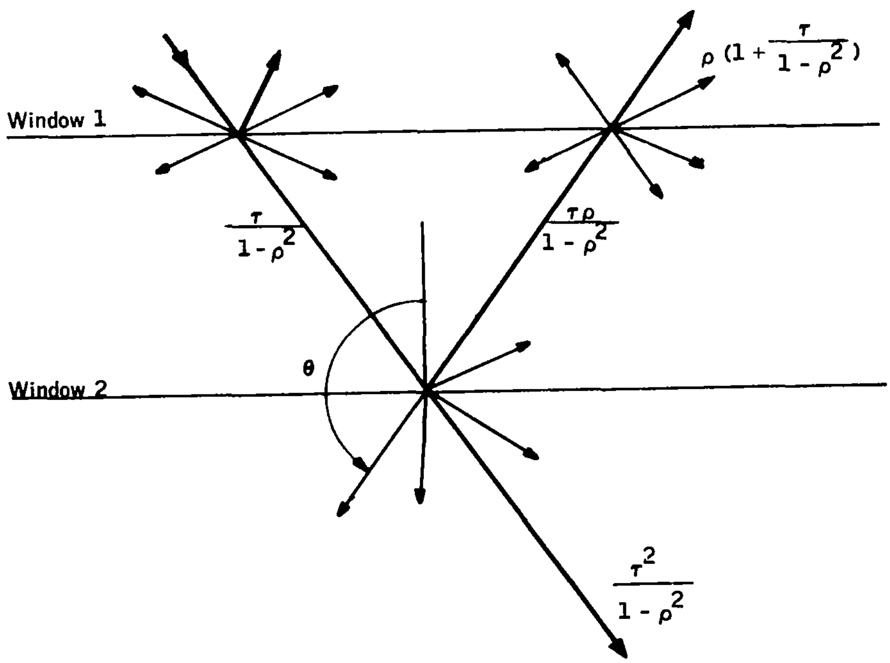

Figure F4. Resultant Mathematical Expressions

Consider first the lower group. Here the orientation is same as originally defined. The fluxes were $\frac{\pi}{2} \le \theta \le \frac{3\pi}{2}$ will constitute part of the resultant scattering, but the fluxes where either $\theta < \frac{\pi}{2}$ or $\theta > \frac{3\pi}{2}$ will hit window 1 and be either transmitted or reflected. As we mentioned earlier, we are going to neglect all the beams that are scattered twice or more, we can here neglect the scattered beams and consider only the transmitted and the reflected portions. Referring to Figure F5, we obtain for the transmitted portion

$$\tau + \rho^2 \tau + \rho^4 \tau + \ldots = \frac{\tau}{1-\rho^2}$$

and for the reflected portion

$$\rho \tau + \rho^3 \tau + \rho^5 \tau + \ldots = \frac{\rho \tau}{1-\rho^2}$$

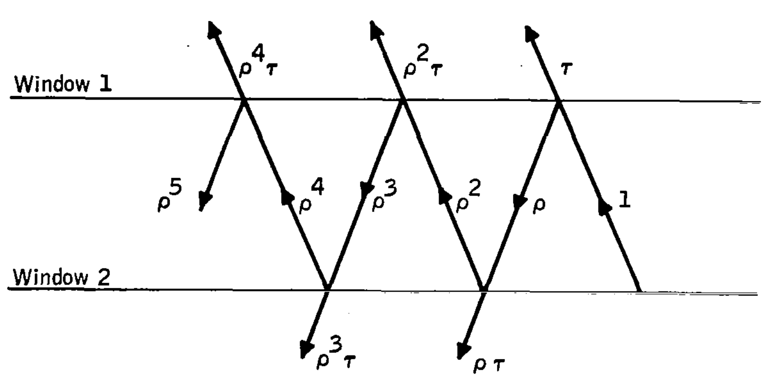

Figure F5. Transmission Results

The transmitted beams will be in the direction θ while the reflected beams will be in the direction $\pi - \theta$. This accounts for all the beams scattered from window 2. Similar consideration is given to the groups of beams scattered from window 1, and finally we arrive at the total scattering coefficients as follows:

$$S(\theta) = \frac{2\tau}{1-\rho^2} S(\theta) + \frac{2\tau^2\rho}{(1-\rho^2)^2} S(\pi-\theta), \quad \frac{\pi}{2} \le \theta \le \frac{3\pi}{2}$$

$$S(\theta) = \frac{2\tau\rho}{1-\rho^2} S(\pi-\theta) + \frac{\tau^2(1+\rho^2)}{(1-\rho^2)^2} S(\theta), \quad \frac{\pi}{2} > \theta \text{ and } \theta > \frac{3\pi}{2} \tag{F3}$$

Equations (F1), (F2) and (F3) enable the calculation of the transmittance, the specular reflectance and the scattering coefficients for two layers of identical windows based on data taken for one window. It should be pointed out that the method can easily be modified to accommodate the case where the upper and the lower windows are not identical. Also, for four windows we applied the same procedure twice. This procedure has been incorporated into a computer program and solved on a Honeywell DDP-24 machine. Examples of the computer program are reproduced on the following pages.

These pages present lists of the measured and the calculated values for window 208. There are nine tables each of which corresponds to an incident angle, Ψ, shown in degrees in the upper left corner. Each table has three parts. The first part contains the measured values of the transmittance, speculator reflectance, and scattering coefficients listed in the sequence of the scattering angle, θ. The first value is for θ = 10 degrees, the second one for θ = 20 degrees, and so on. Similarly, the calculated values for two and four windows are listed in the remaining two parts.

WINDOW NO 2Ø8

ONE WINDOW

PSI	TAU	RHO
Ø.ØØØØØØØE ØØ	Ø.946ØØØØE ØØ	Ø.32ØØØØØE-Ø1

SCATTERING COEFFICIENTS

Ø.3919999E-Ø4	Ø.3929999E-Ø4	Ø.172ØØØØE-Ø4	Ø.115ØØØØE-Ø4	Ø.9199999E-Ø5
Ø.77ØØØØØE-Ø5	Ø.7799999E-Ø5	Ø.83ØØØØØE-Ø5	Ø.88ØØØØØE-Ø5	Ø.9399999E-Ø5
Ø.9899999E-Ø5	Ø.1Ø9ØØØØE-Ø4	Ø.128ØØØØE-Ø4	Ø.162ØØØØE-Ø4	Ø.263ØØØØE-Ø4
Ø.67Ø9999E-Ø4	Ø.72ØØØØØE-Ø4	Ø.72ØØØØØE-Ø4	Ø.72ØØØØØE-Ø4	Ø.7679999E-Ø4
Ø.286ØØØØE-Ø4	Ø.183ØØØØE-Ø4	Ø.123ØØØØE-Ø4	Ø.1Ø8ØØØØE-Ø4	Ø.88ØØØØØE-Ø5
Ø.1Ø9ØØØØE-Ø4	Ø.9399999E-Ø5	Ø.7799999E-Ø5	Ø.77ØØØØØE-Ø5	Ø.77ØØØØØE-Ø5
Ø.88ØØØØØE-Ø5	Ø.1ØØØØØØE-Ø4	Ø.138ØØØØE-Ø4	Ø.242ØØØØE-Ø4	Ø.3919999E-Ø4
Ø.3919999E-Ø4				

TWO WINDOWS

TAU	RHO
Ø.8958333E ØØ	Ø.6Ø66666E-Ø1

SCATTERING COEFFICIENTS

Ø.7875229E-Ø4	Ø.78645Ø7E-Ø4	Ø.3423385E-Ø4	Ø.228Ø5Ø2E-Ø4	Ø.1823432E-Ø4
Ø.1527266E-Ø4	Ø.154Ø182E-Ø4	Ø.1632Ø35E-Ø4	Ø.1723283E-Ø4	Ø.1827938E-Ø4
Ø.1919766E-Ø4	Ø.21Ø8586E-Ø4	Ø.2477Ø43E-Ø4	Ø.3134183E-Ø4	Ø.5Ø79775E-Ø4
Ø.1293388E-Ø3	Ø.1386134E-Ø3	Ø.1386134E-Ø3	Ø.1386134E-Ø3	Ø.1468434E-Ø3
Ø.5495867E-Ø4	Ø.35233Ø1E-Ø4	Ø.238ØØ5ØE-Ø4	Ø.2Ø89646E-Ø4	Ø.171Ø859E-Ø4
Ø.21Ø916ØE-Ø4	Ø.1834251E-Ø4	Ø.1546243E-Ø4	Ø.1514539E-Ø4	Ø.152666ØE-Ø4
Ø.1744495E-Ø4	Ø.2ØØ8579E-Ø4	Ø.2792117E-Ø4	Ø.5Ø57815E-Ø4	Ø.7875229E-Ø4
Ø.7875229E-Ø4				

FOUR WINDOWS

TAU	RHO
Ø.8Ø54817E ØØ	Ø.1Ø95325E ØØ

SCATTERING COEFFICIENTS

Ø.1577766E-Ø3	Ø.15657Ø6E-Ø3	Ø.6755414E-Ø4	Ø.44729Ø2E-Ø4	Ø.3573259E-Ø4
Ø.2996579E-Ø4	Ø.2999375E-Ø4	Ø.3155743E-Ø4	Ø.33Ø9613E-Ø4	Ø.3447245E-Ø4
Ø.36Ø3367E-Ø4	Ø.3941652E-Ø4	Ø.4633295E-Ø4	Ø.5859855E-Ø4	Ø.947Ø691E-Ø4
Ø.24Ø3Ø25E-Ø3	Ø.2569914E-Ø3	Ø.2569914E-Ø3	Ø.2569914E-Ø3	Ø.269Ø277E-Ø3
Ø.1Ø157Ø2E-Ø3	Ø.6532927E-Ø4	Ø.4451131E-Ø4	Ø.39Ø7534E-Ø4	Ø.3225177E-Ø4
Ø.3944545E-Ø4	Ø.3478432E-Ø4	Ø.3Ø31Ø16E-Ø4	Ø.293Ø134E-Ø4	Ø.2993414E-Ø4
Ø.3419688E-Ø4	Ø.4Ø22783E-Ø4	Ø.565731ØE-Ø4	Ø.1Ø76389E-Ø3	Ø.1577766E-Ø3
Ø.1577766E-Ø3				

WINDOW NO 2Ø8

ONE WINDOW

PSI	TAU	RHO
Ø.1ØØØØØØE Ø2	Ø.9439999E ØØ	Ø.32ØØØØØE-Ø1

SCATTERING COEFFICIENTS

Ø.7179599E-Ø2	Ø.119ØØØØE-Ø3	Ø.338ØØØØE-Ø4	Ø.169ØØØØE-Ø4	Ø.124ØØØØE-Ø4
Ø.9899999E-Ø5	Ø.89ØØØØØE-Ø5	Ø.1ØØØØØØE-Ø4	Ø.115ØØØØE-Ø4	Ø.13ØØØØØE-Ø4
Ø.135ØØØØE-Ø4	Ø.154ØØØØE-Ø4	Ø.2ØØØØØØE-Ø4	Ø.3149999E-Ø4	Ø.724ØØØØE-Ø4
Ø.37Ø2ØØØE-Ø3	Ø.37Ø2ØØØE-Ø3	Ø.37Ø2ØØØE-Ø3	Ø.6679ØØØE-Ø3	Ø.398ØØØØE-Ø4
Ø.161ØØØØE-Ø4	Ø.1Ø6ØØØØE-Ø4	Ø.88ØØØØØE-Ø5	Ø.7799999E-Ø5	Ø.7299999E-Ø5
Ø.7299999E-Ø5	Ø.6999999E-Ø5	Ø.6599999E-Ø5	Ø.6599999E-Ø5	Ø.6699999E-Ø5
Ø.75ØØØØØE-Ø5	Ø.8599998E-Ø5	Ø.1Ø2ØØØØE-Ø4	Ø.35961ØØE-Ø2	Ø.35961ØØE-Ø2
Ø.35961ØØE-Ø2				

TWO WINDOWS

TAU	RHO
Ø.892Ø493E ØØ	Ø.6Ø54557E-Ø1

SCATTERING COEFFICIENTS

Ø.1361967E-Ø1	Ø.24776Ø4E-Ø3	Ø.6839166E-Ø4	Ø.3391159E-Ø4	Ø.2469364E-Ø4
Ø.1968Ø75E-Ø4	Ø.1767197E-Ø4	Ø.1972499E-Ø4	Ø.22475Ø9E-Ø4	Ø.2514Ø65E-Ø4
Ø.26Ø2275E-Ø4	Ø.2967Ø78E-Ø4	Ø.385Ø736E-Ø4	Ø.6Ø49877E-Ø4	Ø.1387629E-Ø3
Ø.7Ø64546E-Ø3	Ø.11Ø9966E-Ø2	Ø.9Ø51699E-Ø3	Ø.14678Ø3E-Ø2	Ø.28Ø7353E-Ø3
Ø.31Ø1Ø87E-Ø4	Ø.2Ø5248ØE-Ø4	Ø.17Ø6ØØ5E-Ø4	Ø.1512439E-Ø4	Ø.1417371E-Ø4
Ø.1417371E-Ø4	Ø.1362959E-Ø4	Ø.12941Ø8E-Ø4	Ø.12941Ø8E-Ø4	Ø.1316Ø71E-Ø4
Ø.1473629E-Ø4	Ø.1692841E-Ø4	Ø.2Ø29125E-Ø4	Ø.681298ØE-Ø2	Ø.685Ø967E-Ø2
Ø.6832963E-Ø2				

FOUR WINDOWS

TAU	RHO
Ø.7986796E ØØ	Ø.1Ø89Ø21E ØØ

SCATTERING COEFFICIENTS

Ø.2469781E-Ø1	Ø.5236891E-Ø3	Ø.13846Ø8E-Ø3	Ø.6775446E-Ø4	Ø.4873591E-Ø4
Ø.3873184E-Ø4	Ø.3471137E-Ø4	Ø.3832Ø53E-Ø4	Ø.4299424E-Ø4	Ø.4693311E-Ø4
Ø.4831336E-Ø4	Ø.55Ø4Ø76E-Ø4	Ø.7135Ø67E-Ø4	Ø.1116247E-Ø3	Ø.2551163E-Ø3
Ø.1289Ø72E-Ø2	Ø.33Ø9621E-Ø2	Ø.2284122E-Ø2	Ø.3293357E-Ø2	Ø.1164Ø31E-Ø2
Ø.5749966E-Ø4	Ø.383962ØE-Ø4	Ø.3197923E-Ø4	Ø.2836Ø18E-Ø4	Ø.2663651E-Ø4
Ø.2663651E-Ø4	Ø.25729Ø1E-Ø4	Ø.2488958E-Ø4	Ø.2488958E-Ø4	Ø.2538898E-Ø4
Ø.28442Ø6E-Ø4	Ø.3277351E-Ø4	Ø.399788ØE-Ø4	Ø.1232485E-Ø1	Ø.12522Ø9E-Ø1
Ø.124286ØE-Ø1				

WINDOW NO 2Ø8

ONE WINDOW

PSI	TAU	RHO
Ø.2ØØØØØØE Ø2	Ø.946ØØØØE ØØ	Ø.32ØØØØØE-Ø1

SCATTERING COEFFICIENTS

Ø.2987ØØØE-Ø3	Ø.9262ØØØE-Ø3	Ø.15537ØØE-Ø2	Ø.38ØØØØØE-Ø4	Ø.2Ø4ØØØØE-Ø4
Ø.146ØØØØE-Ø4	Ø.13ØØØØØE-Ø4	Ø.14ØØØØØE-Ø4	Ø.169ØØØØE-Ø4	Ø.198ØØØØE-Ø4
Ø.224ØØØØE-Ø4	Ø.27ØØØØØE-Ø4	Ø.4379999E-Ø4	Ø.1Ø17ØØØE-Ø3	Ø.8539998E-Ø4
Ø.8539998E-Ø4	Ø.8539998E-Ø4	Ø.69ØØØØØE-Ø4	Ø.3359999E-Ø4	Ø.633ØØØØE-Ø4
Ø.43Ø9999E-Ø4	Ø.8499999E-Ø5	Ø.6999999E-Ø5	Ø.6999999E-Ø5	Ø.6499999E-Ø5
Ø.6899999E-Ø5	Ø.6799999E-Ø5	Ø.6799999E-Ø5	Ø.6999999E-Ø5	Ø.6599999E-Ø5
Ø.7199999E-Ø5	Ø.8499999E-Ø5	Ø.181ØØØØE-Ø4	Ø.181ØØØØE-Ø4	Ø.181ØØØØE-Ø4
Ø.279ØØØØE-Ø4				

TWO WINDOWS

TAU	RHO
Ø.8958333E ØØ	Ø.6Ø66666E-Ø1

SCATTERING COEFFICIENTS

Ø.572ØØ97E-Ø3	Ø.1762797E-Ø2	Ø.2953585E-Ø2	Ø.78275Ø9E-Ø4	Ø.41367Ø1E-Ø4
Ø.2934234E-Ø4	Ø.26Ø2728E-Ø4	Ø.2776737E-Ø4	Ø.33Ø9485E-Ø4	Ø.383Ø349E-Ø4
Ø.4317Ø34E-Ø4	Ø.5197428E-Ø4	Ø.8412532E-Ø4	Ø.1947945E-Ø3	Ø.25Ø9124E-Ø3
Ø.214899ØE-Ø3	Ø.1788854E-Ø3	Ø.1322831E-Ø3	Ø.6467514E-Ø4	Ø.12Ø9252E-Ø3
Ø.8266757E-Ø4	Ø.1658632E-Ø4	Ø.1367Ø8ØE-Ø4	Ø.1363636E-Ø4	Ø.1271235E-Ø4
Ø.1345845E-Ø4	Ø.13269Ø5E-Ø4	Ø.1332233E-Ø4	Ø.1367763E-Ø4	Ø.1294886E-Ø4
Ø.14Ø8746E-Ø4	Ø.1664534E-Ø4	Ø.3695994E-Ø4	Ø.3818419E-Ø4	Ø.3638418E-Ø4
Ø.571268ØE-Ø4				

FOUR WINDOWS

TAU	RHO
Ø.8Ø54817E ØØ	Ø.1Ø95325E ØØ

SCATTERING COEFFICIENTS

Ø.1Ø55673E-Ø2	Ø.3216634E-Ø2	Ø.5377594E-Ø2	Ø.163Ø413E-Ø3	Ø.8411128E-Ø4
Ø.5882185E-Ø4	Ø.5185638E-Ø4	Ø.5447748E-Ø4	Ø.6355961E-Ø4	Ø.716Ø436E-Ø4
Ø.8Ø18567E-Ø4	Ø.9634285E-Ø4	Ø.1553391E-Ø3	Ø.3579743E-Ø3	Ø.74Ø9375E-Ø3
Ø.5593672E-Ø3	Ø.377797ØE-Ø3	Ø.2434864E-Ø3	Ø.1198734E-Ø3	Ø.2212Ø35E-Ø3
Ø.1522853E-Ø3	Ø.3145971E-Ø4	Ø.2596587E-Ø4	Ø.2579225E-Ø4	Ø.242Ø21ØE-Ø4
Ø.255Ø895E-Ø4	Ø.2516314E-Ø4	Ø.256ØØ77E-Ø4	Ø.2616296E-Ø4	Ø.2494366E-Ø4
Ø.27ØØ992E-Ø4	Ø.3196142E-Ø4	Ø.7596915E-Ø4	Ø.8236Ø54E-Ø4	Ø.7296329E-Ø4
Ø.1179129E-Ø3				

WINDOW NO 208

ONE WINDOW

PSI	TAU	RHO
0.3000000E 02	0.9460000E 00	0.3399999E-01

SCATTERING COEFFICIENTS

0.2860000E-04	0.4070000E-03	0.7942000E-03	0.1181400E-02	0.4910000E-04
0.2799999E-04	0.2319999E-04	0.2490000E-04	0.3130000E-04	0.3770000E-04
0.4280000E-04	0.6369999E-04	0.1594000E-03	0.1178000E-03	0.1178000E-03
0.1178000E-03	0.7610000E-04	0.3000000E-04	0.1480000E-04	0.1800000E-04
0.7084999E-03	0.2430000E-04	0.5999999E-05	0.5399999E-05	0.5299999E-05
0.6400000E-05	0.6400000E-05	0.6499999E-05	0.8499999E-05	0.6799999E-05
0.7600000E-05	0.1150000E-04	0.1150000E-04	0.1150000E-04	0.1250000E-04
0.1340000E-04				

TWO WINDOWS

TAU	RHO
0.8959517E 00	0.6446235E-01

SCATTERING COEFFICIENTS

0.5918456E-04	0.7800830E-03	0.1514998E-02	0.2249914E-02	0.1034588E-03
0.5724715E-04	0.4679061E-04	0.4968880E-04	0.6142400E-04	0.7292973E-04
0.8248641E-04	0.1223677E-03	0.3049287E-03	0.2951953E-03	0.2715779E-03
0.2479606E-03	0.1458923E-03	0.5764303E-04	0.2879645E-04	0.3479686E-04
0.1342735E-02	0.4673025E-04	0.1182870E-04	0.1064339E-04	0.1055766E-04
0.1251928E-04	0.1251318E-04	0.1274934E-04	0.1647455E-04	0.1325435E-04
0.1481141E-04	0.2339227E-04	0.6745642E-04	0.2298654E-04	0.2467848E-04
0.2736562E-04				

FOUR WINDOWS

TAU	RHO
0.8060791E 00	0.1164241E 00

SCATTERING COEFFICIENTS

0.1242125E-03	0.1442901E-02	0.2777900E-02	0.4112898E-02	0.2229202E-03
0.1179717E-03	0.9439010E-04	0.9853547E-04	0.1184745E-03	0.1364137E-03
0.1533074E-03	0.2261603E-03	0.5594795E-03	0.7659632E-03	0.6467730E-03
0.5275827E-03	0.2686921E-03	0.1065776E-03	0.5439115E-04	0.6501161E-04
0.2423130E-02	0.8652666E-04	0.2283002E-04	0.2053470E-04	0.2071649E-04
0.2385744E-04	0.2382182E-04	0.2456423E-04	0.3108977E-04	0.2526211E-04
0.2822225E-04	0.4782600E-04	0.2780323E-03	0.4570631E-04	0.4807746E-04
0.5629471E-04				

WINDOW NO 2Ø8

ONE WINDOW

PSI	TAU	RHO
Ø.4ØØØØØØE Ø2	Ø.946ØØØØE ØØ	Ø.38ØØØØØE-Ø1

SCATTERING COEFFICIENTS

Ø.152ØØØØE-Ø4	Ø.32ØØØØØE-Ø4	Ø.4737999E-Ø3	Ø.15Ø6ØØØE-Ø2	Ø.25383ØØE-Ø2
Ø.797ØØØØE-Ø4	Ø.5219999E-Ø4	Ø.5339999E-Ø4	Ø.7299999E-Ø4	Ø.9249999E-Ø4
Ø.1254ØØØE-Ø3	Ø.3ØØ5ØØØE-Ø3	Ø.2Ø66ØØØE-Ø3	Ø.2Ø66ØØØE-Ø3	Ø.2Ø66ØØØE-Ø3
Ø.1127ØØØE-Ø3	Ø.353ØØØØE-Ø4	Ø.181ØØØØE-Ø4	Ø.1Ø9ØØØØE-Ø4	Ø.8599998E-Ø5
Ø.195ØØØØE-Ø4	Ø.8Ø1Ø998E-Ø3	Ø.435ØØØØE-Ø4	Ø.52ØØØØØE-Ø5	Ø.52ØØØØØE-Ø5
Ø.5999999E-Ø5	Ø.7199999E-Ø5	Ø.83ØØØØØE-Ø5	Ø.6999999E-Ø5	Ø.79ØØØØØE-Ø5
Ø.114ØØØØE-Ø4	Ø.114ØØØØE-Ø4	Ø.114ØØØØE-Ø4	Ø.1Ø8ØØØØE-Ø4	Ø.89ØØØØØE-Ø5
Ø.9199999E-Ø5				

TWO WINDOWS

TAU	RHO
Ø.89621Ø2E ØØ	Ø.72Ø5598E-Ø1

SCATTERING COEFFICIENTS

Ø.314Ø339E-Ø4	Ø.68876Ø6E-Ø4	Ø.9145277E-Ø3	Ø.2874471E-Ø2	Ø.48346Ø4E-Ø2
Ø.17297Ø5E-Ø3	Ø.1Ø81463E-Ø3	Ø.1Ø8Ø56ØE-Ø3	Ø.1438685E-Ø3	Ø.1789Ø55E-Ø3
Ø.24116Ø5E-Ø3	Ø.5748Ø45E-Ø3	Ø.5645911E-Ø3	Ø.4941775E-Ø3	Ø.42377Ø6E-Ø3
Ø.2157195E-Ø3	Ø.6792Ø99E-Ø4	Ø.3492226E-Ø4	Ø.212597ØE-Ø4	Ø.17Ø314ØE-Ø4
Ø.3772495E-Ø4	Ø.151865ØE-Ø2	Ø.8319863E-Ø4	Ø.1Ø39149E-Ø4	Ø.1Ø33Ø1ØE-Ø4
Ø.1193456E-Ø4	Ø.1413321E-Ø4	Ø.16192Ø6E-Ø4	Ø.13666Ø1E-Ø4	Ø.1537494E-Ø4
Ø.2477834E-Ø4	Ø.793255ØE-Ø4	Ø.23Ø5Ø34E-Ø4	Ø.2112626E-Ø4	Ø.1768414E-Ø4
Ø.1877218E-Ø4				

FOUR WINDOWS

TAU	RHO
Ø.8Ø73847E ØØ	Ø.13Ø2329E ØØ

SCATTERING COEFFICIENTS

Ø.6584Ø75E-Ø4	Ø.153Ø726E-Ø3	Ø.1715628E-Ø2	Ø.5283658E-Ø2	Ø.8852Ø35E-Ø2
Ø.3887Ø81E-Ø3	Ø.2276829E-Ø3	Ø.2194366E-Ø3	Ø.2799165E-Ø3	Ø.3349859E-Ø3
Ø.447166ØE-Ø3	Ø.1Ø55899E-Ø2	Ø.1582727E-Ø2	Ø.1226598E-Ø2	Ø.87Ø5Ø37E-Ø3
Ø.3967339E-Ø3	Ø.126Ø513E-Ø3	Ø.6511768E-Ø4	Ø.4Ø37356E-Ø4	Ø.3315771E-Ø4
Ø.7Ø66788E-Ø4	Ø.2745545E-Ø2	Ø.1528Ø33E-Ø3	Ø.2Ø5214ØE-Ø4	Ø.2Ø21Ø91E-Ø4
Ø.2339724E-Ø4	Ø.2711792E-Ø4	Ø.3Ø95119E-Ø4	Ø.26156Ø6E-Ø4	Ø.2926712E-Ø4
Ø.5579439E-Ø4	Ø.3412Ø46E-Ø3	Ø.4675288E-Ø4	Ø.4Ø57249E-Ø4	Ø.348712ØE-Ø4
Ø.3862Ø67E-Ø4				

WINDOW NO 208

ONE WINDOW

PSI	TAU	RHO
0.5000000E 02	0.9389999E 00	0.5599999E-01

SCATTERING COEFFICIENTS

0.1250000E-04	0.1970000E-04	0.4399999E-04	0.7359999E-03	0.2640000E-02
0.4544100E-02	0.2813000E-03	0.1870000E-03	0.2453999E-03	0.3038000E-03
0.6193999E-03	0.4071999E-03	0.4071999E-03	0.4071999E-03	0.1949000E-03
0.4919999E-04	0.2440000E-04	0.1520000E-04	0.1010000E-04	0.8699999E-05
0.7900000E-05	0.2670000E-04	0.1323000E-03	0.4919999E-04	0.1140000E-04
0.1870000E-04	0.1910000E-04	0.1950000E-04	0.1510000E-04	0.1120000E-04
0.1120000E-04	0.1120000E-04	0.1110000E-04	0.8100000E-05	0.8100000E-05
0.1000000E-04				

TWO WINDOWS

TAU	RHO
0.8844945E 00	0.1055317E 00

SCATTERING COEFFICIENTS

0.2619992E-04	0.4242470E-04	0.1037243E-03	0.1434043E-02	0.5032716E-02
0.8631578E-02	0.5970197E-03	0.3854916E-03	0.4897099E-03	0.5909143E-03
0.1194847E-02	0.1218697E-02	0.1029477E-02	0.8402671E-03	0.3715461E-03
0.9464593E-04	0.4720953E-04	0.2962915E-04	0.1983241E-04	0.1719493E-04
0.1598593E-04	0.5141333E-04	0.2503539E-03	0.9380125E-04	0.2297711E-04
0.3716688E-04	0.3788069E-04	0.3882898E-04	0.2974259E-04	0.2635920E-04
0.3512616E-04	0.2398548E-04	0.2181310E-04	0.1622732E-04	0.1637502E-04
0.2050418E-04				

FOUR WINDOWS

TAU	RHO
0.7911415E 00	0.1890222E 00

SCATTERING COEFFICIENTS

0.5630720E-04	0.9461259E-04	0.2577764E-03	0.2752760E-02	0.9298345E-02
0.1584427E-01	0.1305557E-02	0.8088965E-03	0.9783173E-03	0.1122189E-02
0.2238289E-02	0.3637685E-02	0.2691477E-02	0.1745319E-02	0.6821784E-03
0.1764772E-03	0.8887787E-04	0.5646631E-04	0.3824355E-04	0.3350039E-04
0.3228083E-04	0.9602416E-04	0.4537927E-03	0.1722533E-03	0.4612641E-04
0.7304501E-04	0.7416183E-04	0.7725677E-04	0.5814098E-04	0.6539124E-04
0.1108054E-03	0.5309498E-04	0.4247700E-04	0.3260079E-04	0.3336588E-04
0.4268487E-04				

WINDOW NO 2Ø8

ONE WINDOW

PSI	TAU	RHO
Ø.6ØØØØØØE Ø2	Ø.8929999E ØØ	Ø.1Ø3ØØØØE ØØ

SCATTERING COEFFICIENTS

Ø.151ØØØØE-Ø4	Ø.2Ø3ØØØØE-Ø4	Ø.3439999E-Ø4	Ø.8479999E-Ø4	Ø.1913ØØØE-Ø2
Ø.14358ØØE-Ø2	Ø.14358ØØE-Ø2	Ø.95870ØØE-Ø3	Ø.12788ØØE-Ø2	Ø.15988ØØE-Ø2
Ø.9298ØØØE-Ø3	Ø.9298ØØØE-Ø3	Ø.9298ØØØE-Ø3	Ø.26Ø7999E-Ø3	Ø.7129999E-Ø4
Ø.3439999E-Ø4	Ø.2Ø5ØØØØE-Ø4	Ø.15ØØØØØE-Ø4	Ø.131ØØØØE-Ø4	Ø.111ØØØØE-Ø4
Ø.112ØØØØE-Ø4	Ø.119ØØØØE-Ø4	Ø.266ØØØØE-Ø4	Ø.28187ØØE-Ø2	Ø.7949999E-Ø4
Ø.6Ø6ØØØØE-Ø4	Ø.6Ø4ØØØØE-Ø4	Ø.6Ø19999E-Ø4	Ø.32ØØØØØE-Ø4	Ø.32ØØØØØE-Ø4
Ø.32ØØØØØE-Ø4	Ø.173ØØØØE-Ø4	Ø.114ØØØØE-Ø4	Ø.113ØØØØE-Ø4	Ø.1Ø8ØØØØE-Ø4
Ø.12ØØØØØE-Ø4				

TWO WINDOWS

TAU	RHO
Ø.8Ø59995E ØØ	Ø.186Ø179E ØØ

SCATTERING COEFFICIENTS

Ø.3134317E-Ø4	Ø.434Ø868E-Ø4	Ø.7597782E-Ø4	Ø.2Ø31Ø52E-Ø3	Ø.366Ø821E-Ø2
Ø.279Ø75ØE-Ø2	Ø.279Ø75ØE-Ø2	Ø.2Ø45248E-Ø2	Ø.2569384E-Ø2	Ø.3Ø4696ØE-Ø2
Ø.1919379E-Ø2	Ø.1919379E-Ø2	Ø.1999461E-Ø2	Ø.485Ø14ØE-Ø3	Ø.13448Ø1E-Ø3
Ø.655Ø383E-Ø4	Ø.3953961E-Ø4	Ø.29Ø91Ø5E-Ø4	Ø.2545989E-Ø4	Ø.2193349E-Ø4
Ø.2213Ø79E-Ø4	Ø.2438451E-Ø4	Ø.5338711E-Ø4	Ø.5Ø93548E-Ø2	Ø.1488796E-Ø3
Ø.1194947E-Ø3	Ø.1191672E-Ø3	Ø.121Ø291E-Ø3	Ø.7312658E-Ø4	Ø.5824274E-Ø3
Ø.6329Ø85E-Ø4	Ø.3375539E-Ø4	Ø.2286786E-Ø4	Ø.2266694E-Ø4	Ø.2212716E-Ø4
Ø.2466837E-Ø4				

FOUR WINDOWS

TAU	RHO
Ø.67292ØØE ØØ	Ø.3111931E ØØ

SCATTERING COEFFICIENTS

Ø.6622792E-Ø4	Ø.95Ø5929E-Ø4	Ø.17254Ø6E-Ø3	Ø.5ØØ2258E-Ø3	Ø.69219Ø5E-Ø2
Ø.5399499E-Ø2	Ø.5399499E-Ø2	Ø.44666Ø9E-Ø2	Ø.522Ø391E-Ø2	Ø.5618126E-Ø2
Ø.3928645E-Ø2	Ø.3928645E-Ø2	Ø.4287994E-Ø2	Ø.8625357E-Ø3	Ø.2442547E-Ø3
Ø.12Ø6337E-Ø3	Ø.7415Ø39E-Ø4	Ø.5497269E-Ø4	Ø.4825Ø45E-Ø4	Ø.425Ø213E-Ø4
Ø.4288367E-Ø4	Ø.4947Ø28E-Ø4	Ø.1Ø55574E-Ø3	Ø.8656129E-Ø2	Ø.2675592E-Ø3
Ø.23Ø9152E-Ø3	Ø.2298856E-Ø3	Ø.2454264E-Ø3	Ø.1721Ø57E-Ø3	Ø.258455ØE-Ø2
Ø.1255161E-Ø3	Ø.6567242E-Ø4	Ø.4623324E-Ø4	Ø.4582614E-Ø4	Ø.4599242E-Ø4
Ø.5149412E-Ø4				

WINDOW NO 208

ONE WINDOW

PSI	TAU	RHO
0.7000000E 02	0.7700000E 00	0.2260000E 00

SCATTERING COEFFICIENTS

0.1780000E-04	0.2510000E-04	0.3540000E-04	0.7469999E-04	0.2471000E-03
0.1750600E-02	0.6537999E-02	0.1136530E-01	0.6089800E-02	0.6089800E-02
0.6089800E-02	0.6089800E-02	0.8043998E-03	0.1859000E-03	0.7060000E-04
0.3130000E-04	0.2180000E-04	0.1770000E-04	0.1640000E-04	0.1330000E-04
0.1450000E-04	0.1710000E-04	0.2080000E-04	0.3800000E-04	0.7465499E-02
0.1611000E-03	0.4207999E-03	0.3539999E-03	0.3539999E-03	0.3539999E-03
0.2750000E-04	0.1910000E-04	0.1500000E-04	0.1430000E-04	0.1310000E-04
0.1610000E-04				

TWO WINDOWS

TAU	RHO
0.6248128E 00	0.3672076E 00

SCATTERING COEFFICIENTS

0.3811457E-04	0.5395106E-04	0.8579361E-04	0.1945810E-03	0.7131437E-03
0.5195720E-02	0.1329635E-01	0.2146450E-01	0.1253797E-01	0.1326558E-01
0.1182889E-01	0.1040408E-01	0.1378994E-02	0.3239272E-03	0.1251117E-03
0.5826664E-04	0.4067658E-04	0.3351678E-04	0.3051417E-04	0.2584035E-04
0.2799615E-04	0.3343589E-04	0.4194057E-04	0.1670260E-03	0.1222104E-01
0.3668038E-03	0.8081491E-03	0.6580811E-03	0.3337139E-02	0.6129313E-03
0.5416091E-04	0.3859043E-04	0.3069932E-04	0.2907474E-04	0.2818125E-04
0.3373427E-04				

FOUR WINDOWS

TAU	RHO
0.4512365E 00	0.5329051E 00

SCATTERING COEFFICIENTS

0.8224884E-04	0.1167884E-03	0.2029324E-03	0.4815604E-03	0.1866655E-02
0.1378926E-01	0.2744032E-01	0.4120515E-01	0.2660913E-01	0.2738254E-01
0.2217864E-01	0.1701774E-01	0.2264970E-02	0.5424103E-03	0.2135728E-03
0.1048254E-03	0.7335242E-04	0.6133303E-04	0.5486904E-04	0.4846048E-04
0.5219658E-04	0.6307632E-04	0.8132460E-04	0.4760312E-03	0.1893022E-01
0.7818824E-03	0.1476840E-02	0.1242144E-02	0.1179430E-01	0.1064311E-02
0.1084633E-03	0.7916595E-04	0.6371895E-04	0.5998938E-04	0.6104600E-04
0.7147837E-04				

WINDOW NO 2Ø8

ONE WINDOW

PSI	TAU	RHO
Ø.8ØØØØØØE Ø2	Ø.433ØØØØE ØØ	Ø.5129999E ØØ

SCATTERING COEFFICIENTS

Ø.235ØØØØE-Ø4	Ø.3Ø4ØØØØE-Ø4	Ø.4779999E-Ø4	Ø.86Ø9999E-Ø4	Ø.2222ØØØE-Ø3
Ø.9Ø11999E-Ø3	Ø.56675ØØE-Ø2	Ø.3568ØØØE-Ø2	Ø.3568ØØØE-Ø2	Ø.3568ØØØE-Ø2
Ø.3568ØØØE-Ø2	Ø.14685ØØE-Ø2	Ø.3353ØØØE-Ø3	Ø.1Ø65ØØØE-Ø3	Ø.5279999E-Ø4
Ø.341ØØØØE-Ø4	Ø.258ØØØØE-Ø4	Ø.235ØØØØE-Ø4	Ø.22Ø9999E-Ø4	Ø.2Ø3ØØØØE-Ø4
Ø.215ØØØØE-Ø4	Ø.271ØØØØE-Ø4	Ø.364ØØØØE-Ø4	Ø.548ØØØØE-Ø4	Ø.7169999E-Ø4
Ø.234869ØE-Ø1	Ø.117957ØE-Ø1	Ø.117957ØE-Ø1	Ø.117957ØE-Ø1	Ø.1Ø45ØØØE-Ø3
Ø.367ØØØØE-Ø4	Ø.289ØØØØE-Ø4	Ø.22Ø9999E-Ø4	Ø.2Ø3ØØØØE-Ø4	Ø.231ØØØØE-Ø4
Ø.2319999E-Ø4				

TWO WINDOWS

TAU	RHO
Ø.2544531E ØØ	Ø.6435343E ØØ

SCATTERING COEFFICIENTS

Ø.493Ø666E-Ø4	Ø.6422Ø86E-Ø4	Ø.1ØØ4858E-Ø3	Ø.18787Ø2E-Ø3	Ø.5212895E-Ø3
Ø.217972ØE-Ø2	Ø.1Ø291Ø1E-Ø1	Ø.7275672E-Ø2	Ø.7275672E-Ø2	Ø.5457669E-Ø2
Ø.62Ø1549E-Ø2	Ø.2Ø45239E-Ø2	Ø.4728Ø74E-Ø3	Ø.1556761E-Ø3	Ø.7899215E-Ø4
Ø.5Ø84895E-Ø4	Ø.3864917E-Ø4	Ø.3583967E-Ø4	Ø.3415882E-Ø4	Ø.31Ø512ØE-Ø4
Ø.33Ø9932E-Ø4	Ø.42Ø9Ø35E-Ø4	Ø.5578431E-Ø4	Ø.1Ø14323E-Ø3	Ø.4263638E-Ø2
Ø.3178359E-Ø1	Ø.18Ø4288E-Ø1	Ø.311Ø213E-Ø1	Ø.1698439E-Ø1	Ø.1831251E-Ø3
Ø.7465576E-Ø4	Ø.57846Ø3E-Ø4	Ø.447Ø335E-Ø4	Ø.4139465E-Ø4	Ø.465Ø133E-Ø4
Ø.47489Ø5E-Ø4				

FOUR WINDOWS

TAU	RHO
Ø.11Ø5144E ØØ	Ø.7146541E ØØ

SCATTERING COEFFICIENTS

Ø.84Ø6444E-Ø4	Ø.1Ø97768E-Ø3	Ø.1714477E-Ø3	Ø.325ØØ88E-Ø3	Ø.9246466E-Ø3
Ø.39Ø4465E-Ø2	Ø.165Ø286E-Ø1	Ø.1226734E-Ø1	Ø.1328361E-Ø1	Ø.65Ø7198E-Ø2
Ø.7885447E-Ø2	Ø.23Ø5788E-Ø2	Ø.5372628E-Ø3	Ø.18Ø8392E-Ø3	Ø.93Ø1254E-Ø4
Ø.5976151E-Ø4	Ø.455433ØE-Ø4	Ø.4266156E-Ø4	Ø.4Ø96169E-Ø4	Ø.37Ø2245E-Ø4
Ø.396Ø485E-Ø4	Ø.5Ø6Ø57ØE-Ø4	Ø.66582Ø3E-Ø4	Ø.1325687E-Ø3	Ø.7827155E-Ø2
Ø.3515975E-Ø1	Ø.2ØØ5339E-Ø1	Ø.5716587E-Ø1	Ø.2389846E-Ø1	Ø.2886755E-Ø3
Ø.1257541E-Ø3	Ø.968Ø535E-Ø4	Ø.7513Ø78E-Ø4	Ø.6979458E-Ø4	Ø.78ØØØ65E-Ø4
Ø.8Ø19144E-Ø4				