Active Experiment Working Group

Meeting

September 23, 1980

Atmospheric Emission Photometric Imaging on Spacelab (AEPI)

Presented by

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ATMOSPHERIC EMISSIONS PHOTOMETRIC IMAGING ON SPACELAB

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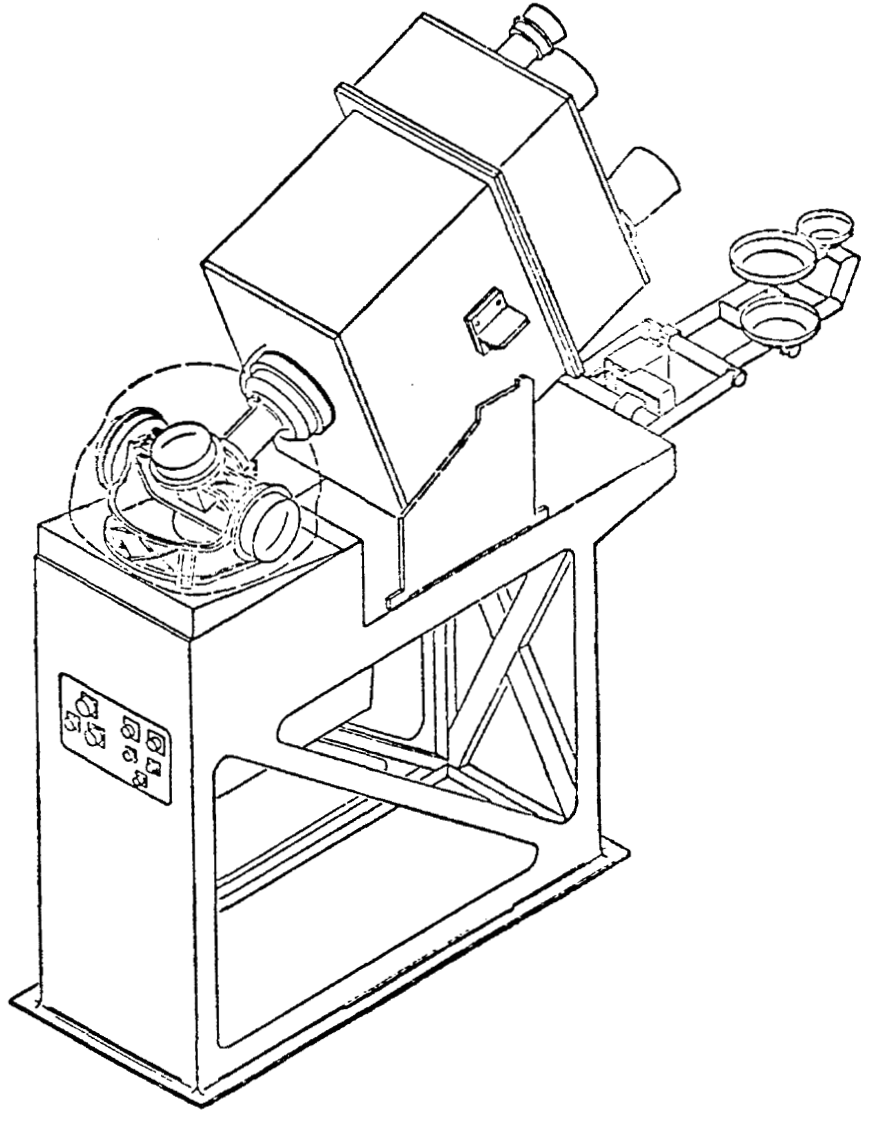
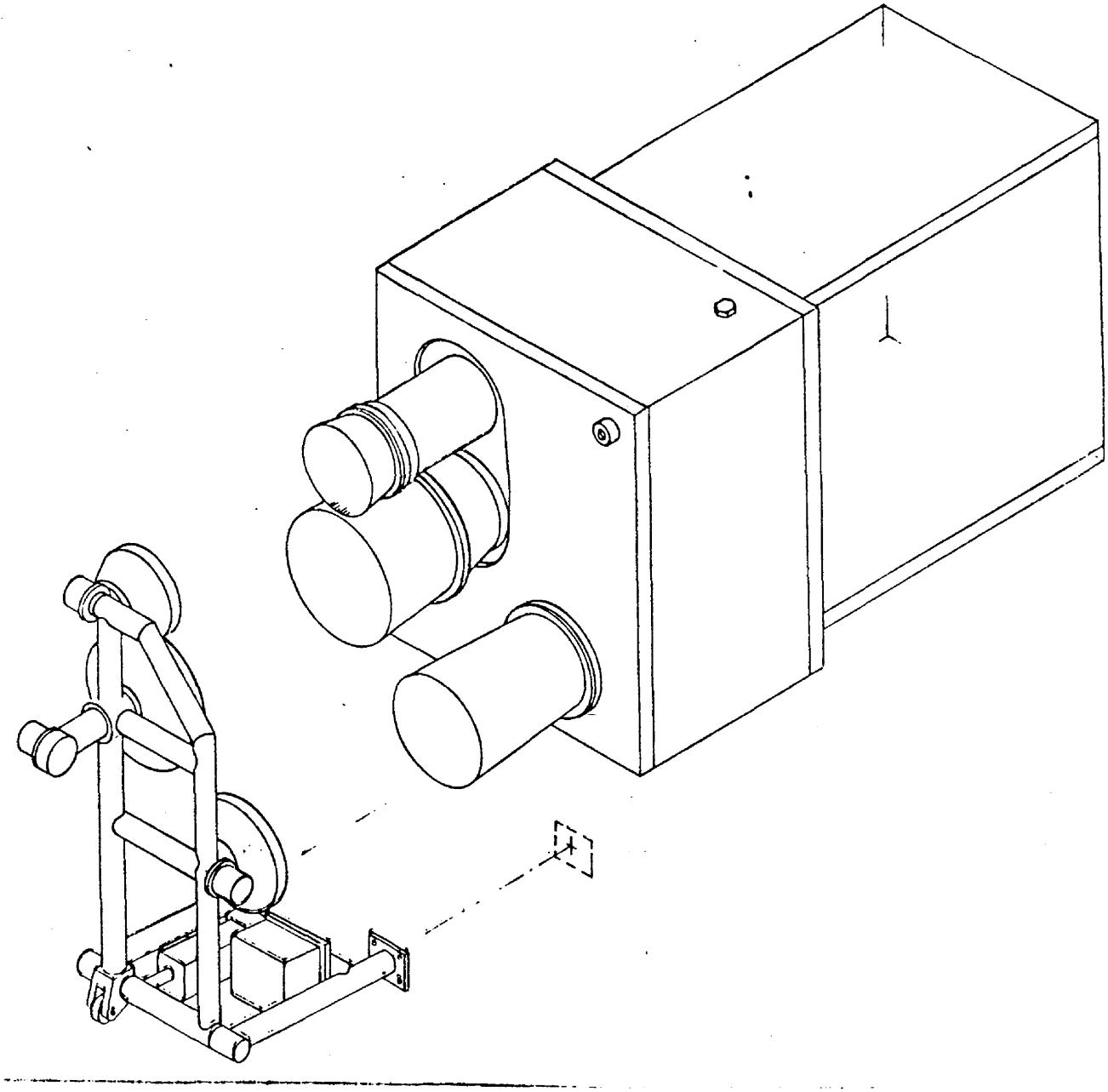
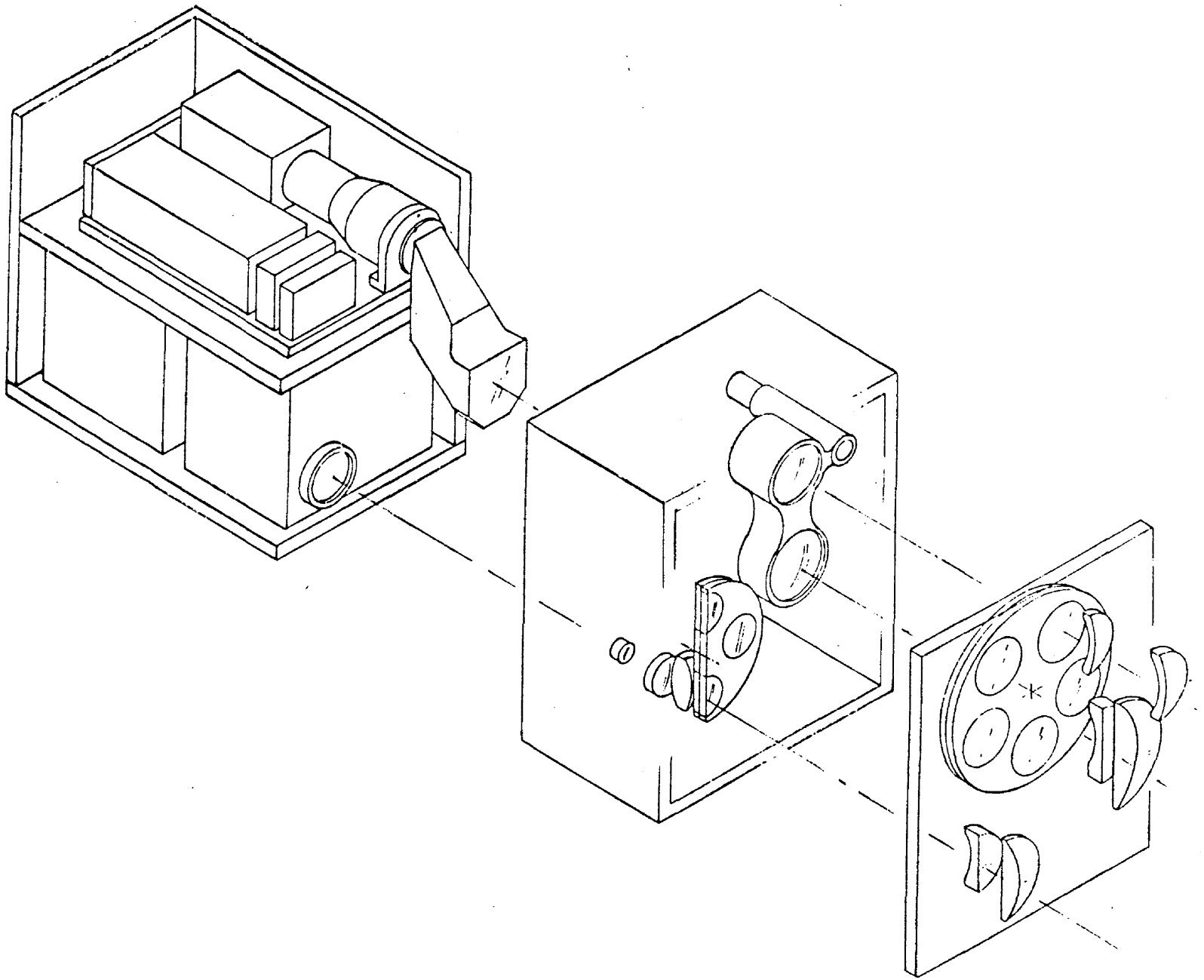
AEPI Experiment

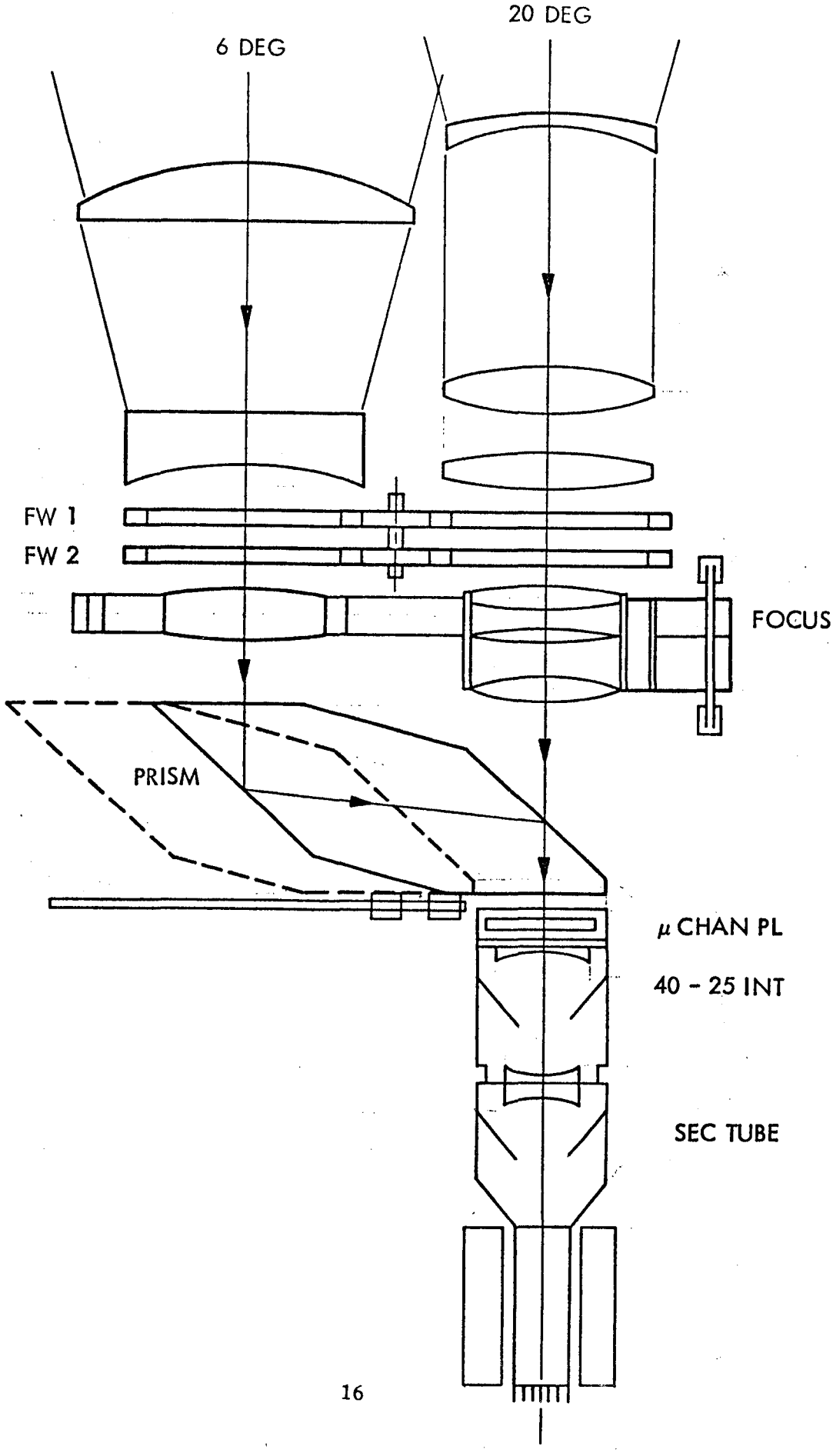


AEPI Detector Assembly

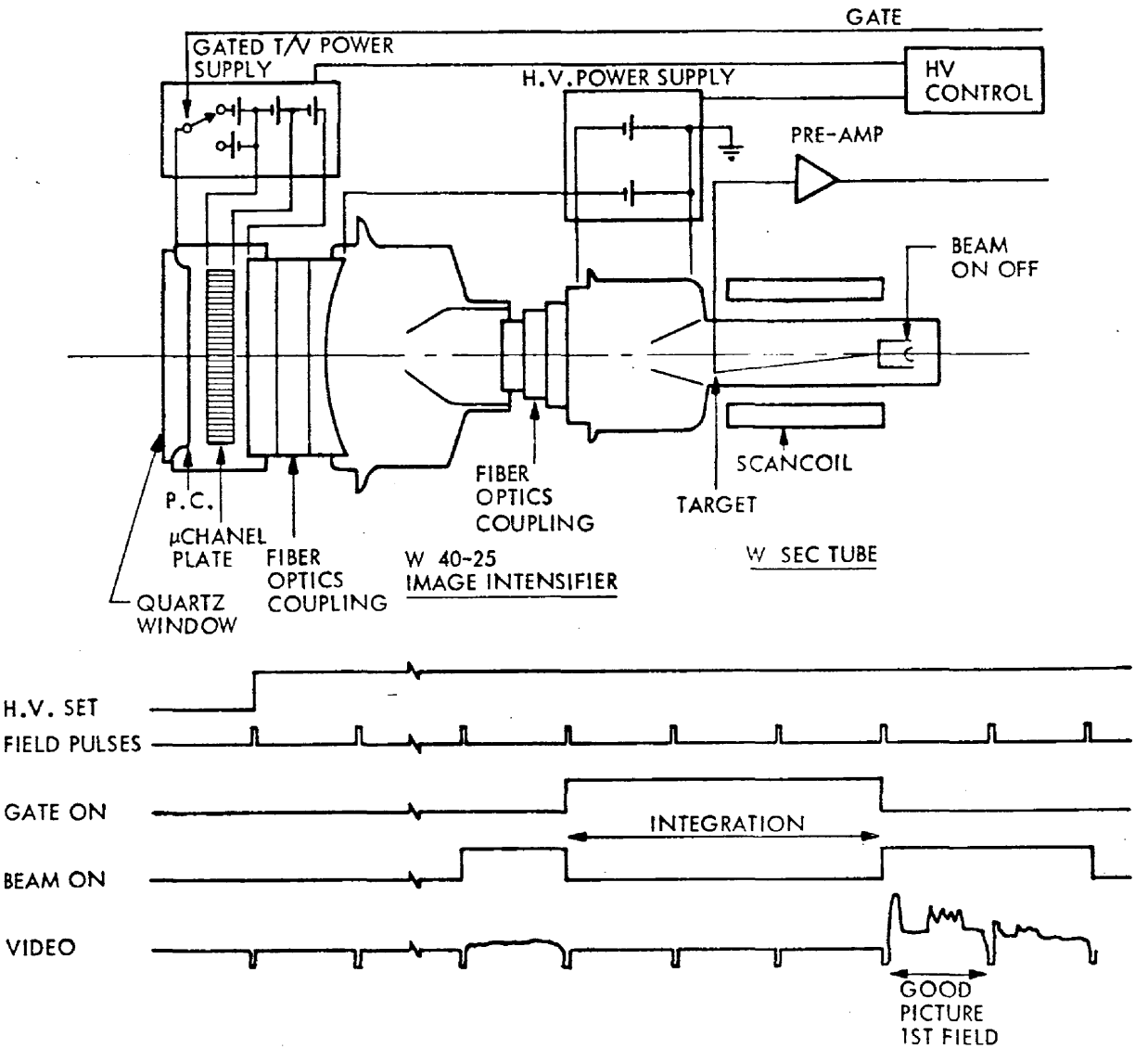


AEPI DETECTOR ASSEMBLY

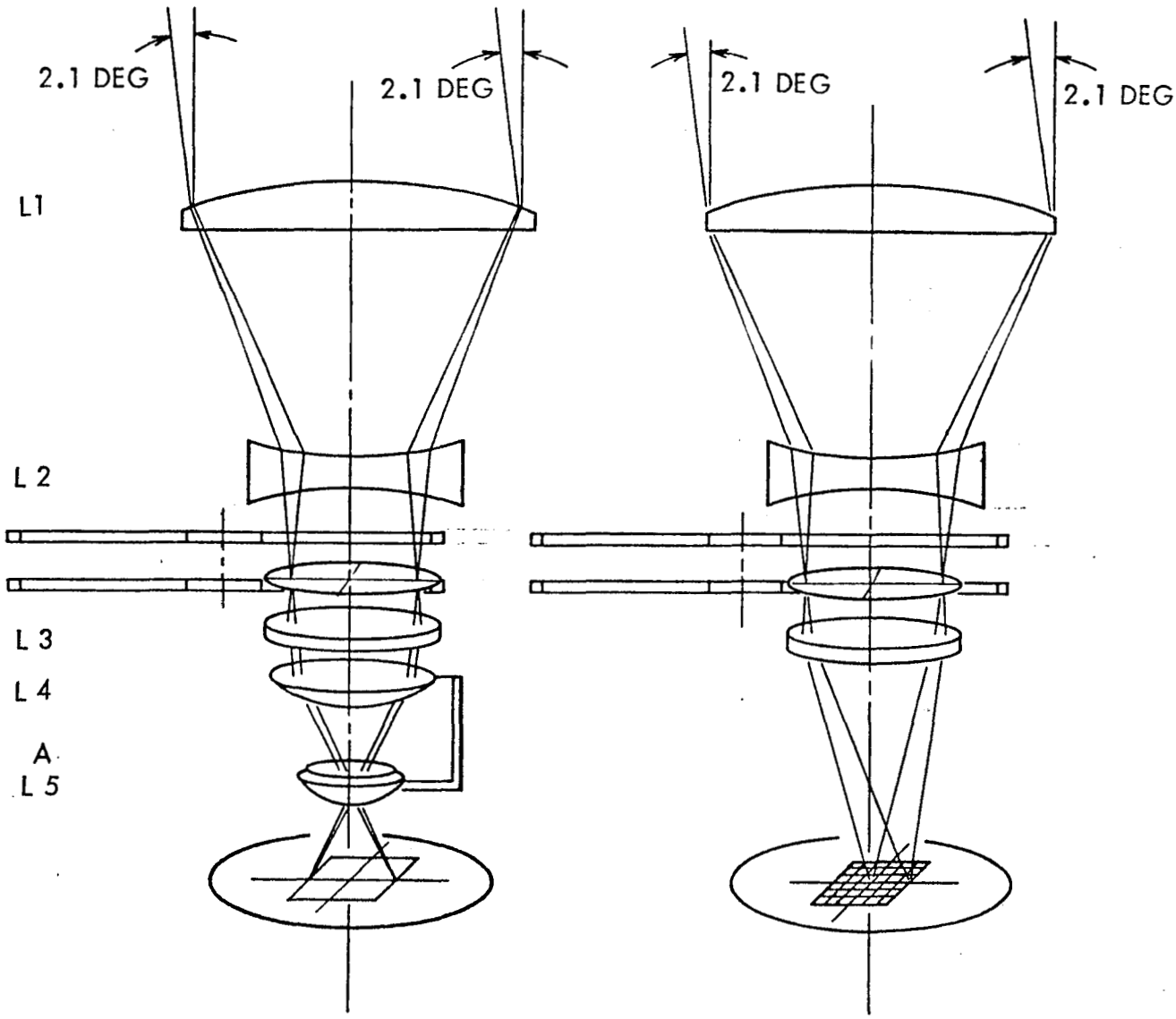



20 DEG
6 DEG
FW 1
FW 2
FOCUS
PRISM
μ CHAN PL
40 - 25 INT
SEC TUBE

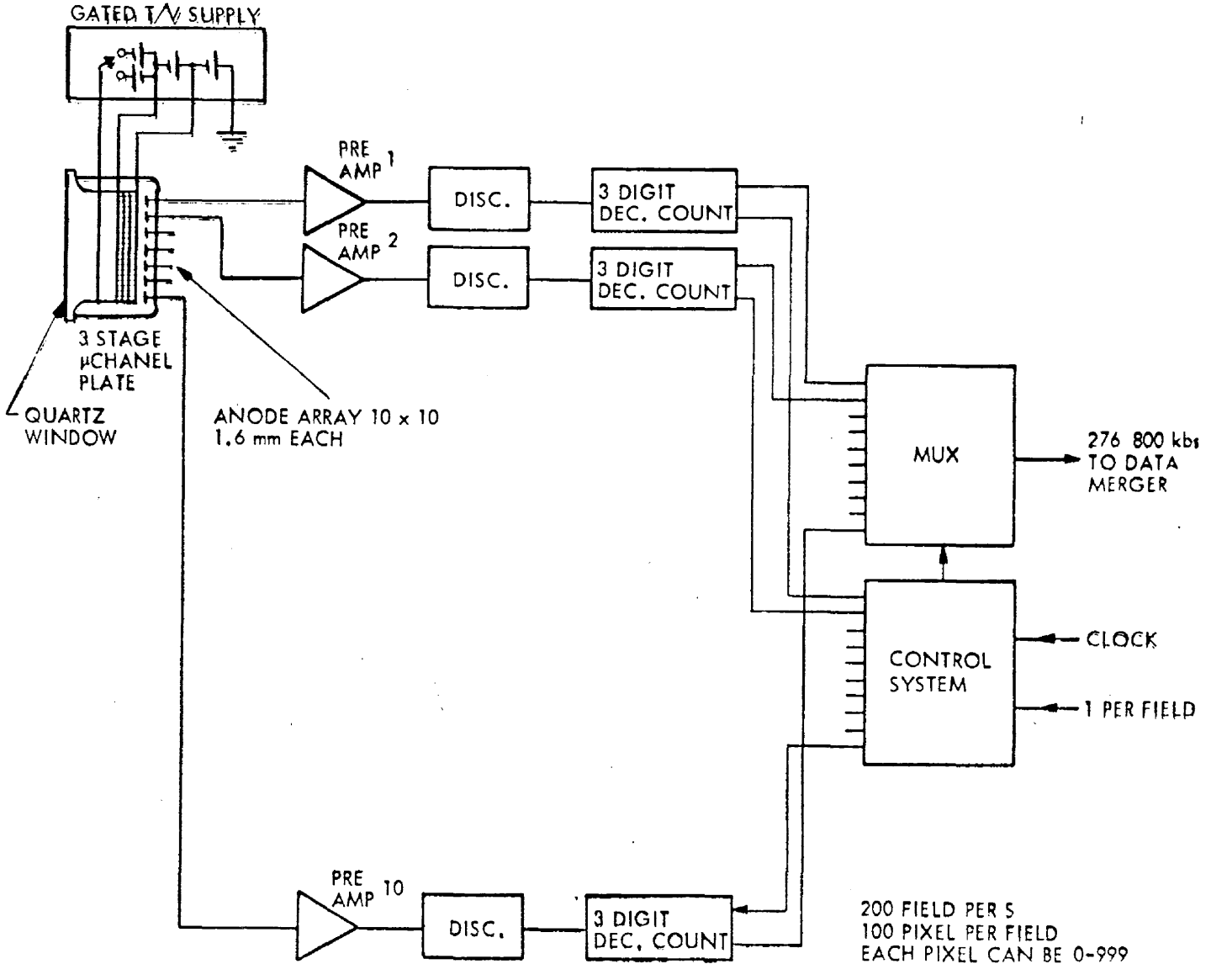
AEPI LLL-TV

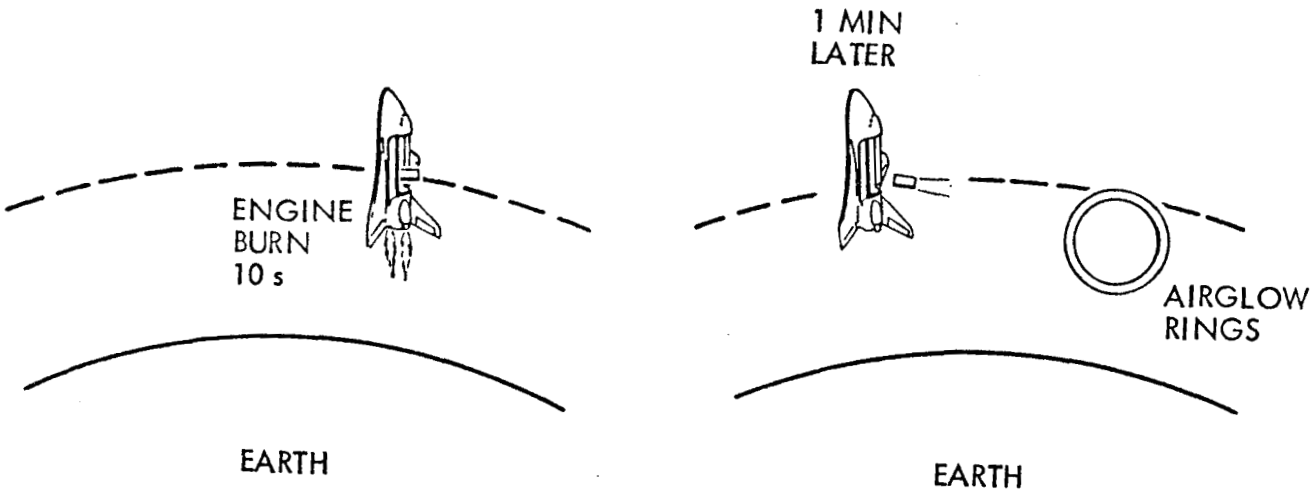

GATE
GATED T/V POWER SUPPLY
H.V. POWER SUPPLY
HV CONTROL
PRE-AMP
BEAM ON OFF
SCANCOIL
TARGET
FIBER OPTICS COUPLING
P.C.
μCHANEL PLATE
FIBER OPTICS COUPLING
QUARTZ WINDOW
W 40-25 IMAGE INTENSIFIER
W SEC TUBE
H.V. SET
FIELD PULSES
GATE ON
INTEGRATION
BEAM ON
VIDEO
GOOD PICTURE 1ST FIELD

AEPI Photon Counting Array



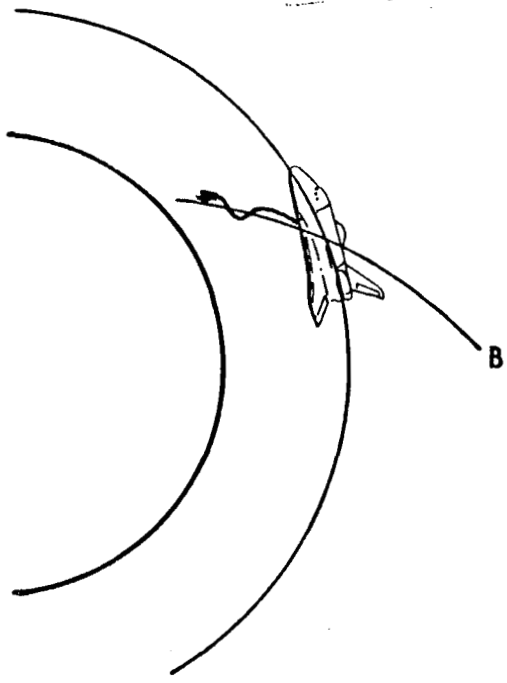
AEPI PHOTON COUNTING ARRAY



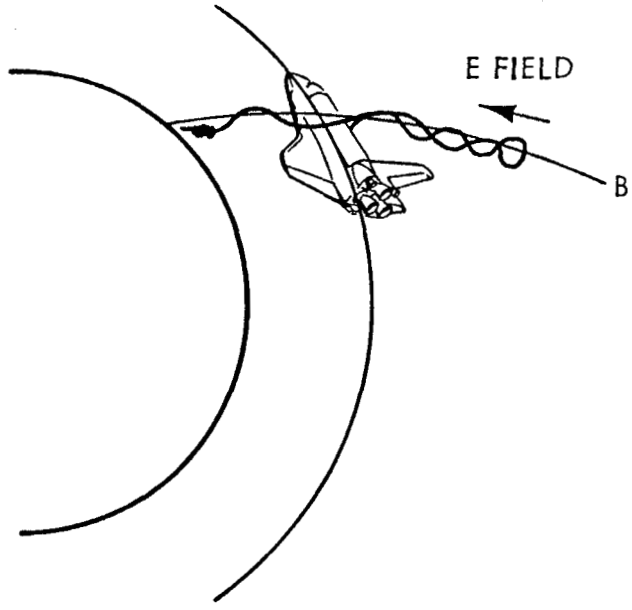


IONOSPHERIC AIRGLOW MODIFICATIONS

Joint experiments with the electron beam accelerator.

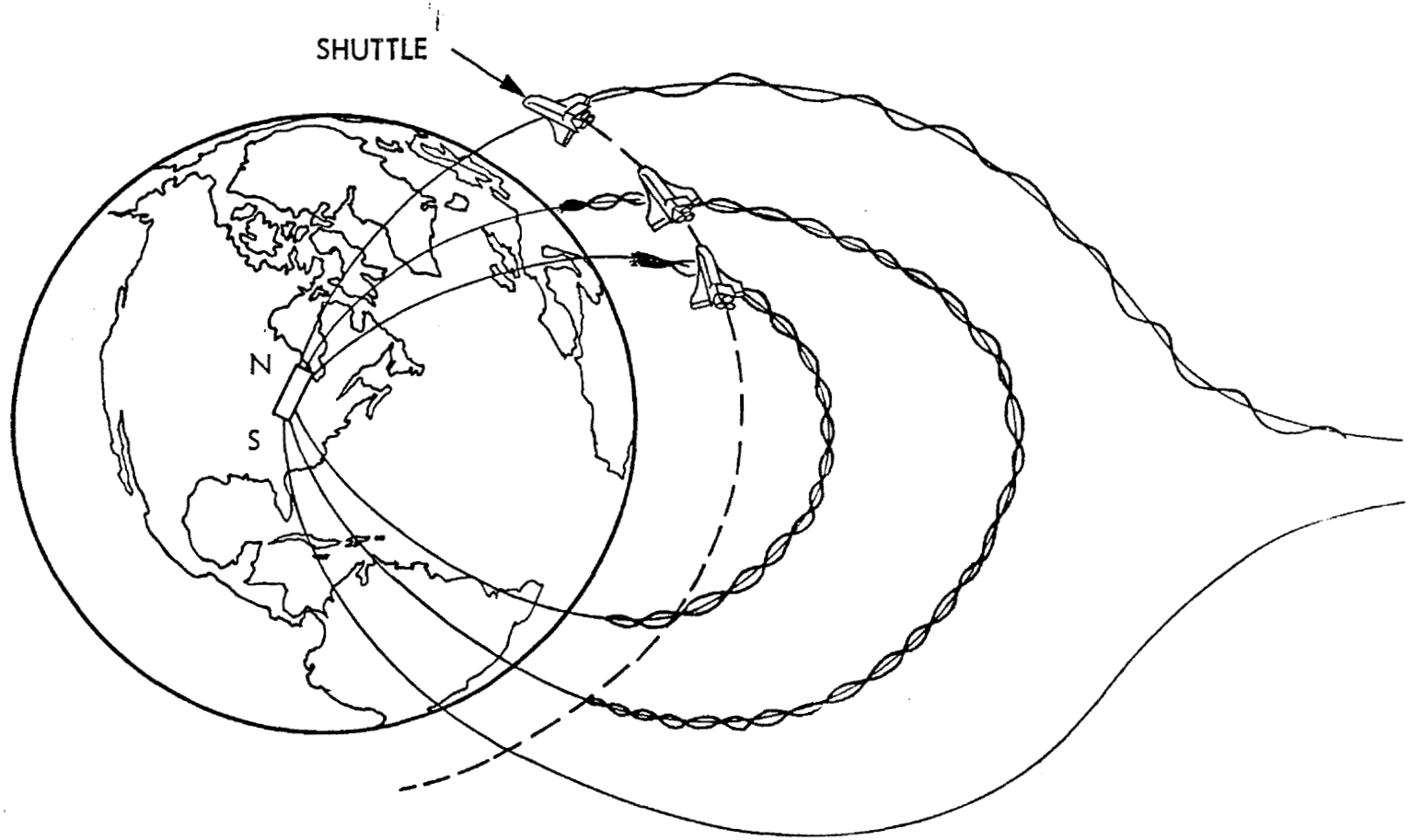


ARTIFICIAL AURORA

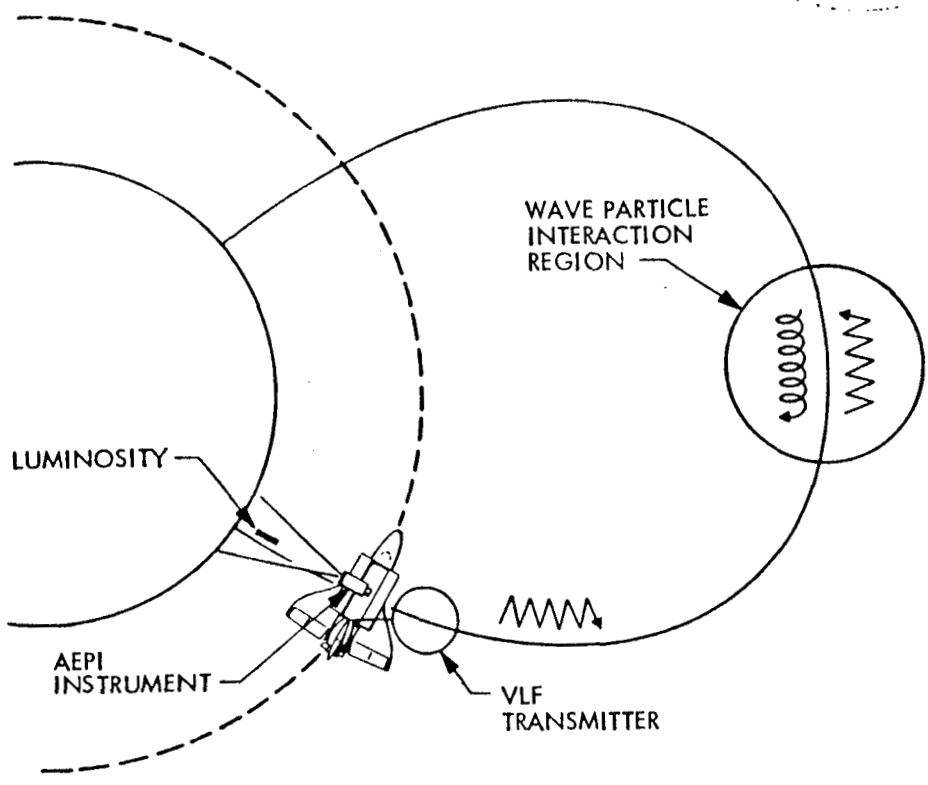


PARALLEL ELECTRIC FIELD

ECHO Experiment



The experiment aimed at the observation of the on-board VLF transmitter-induced precipitation.



DESCRIPTION OF THE INSTRUMENT

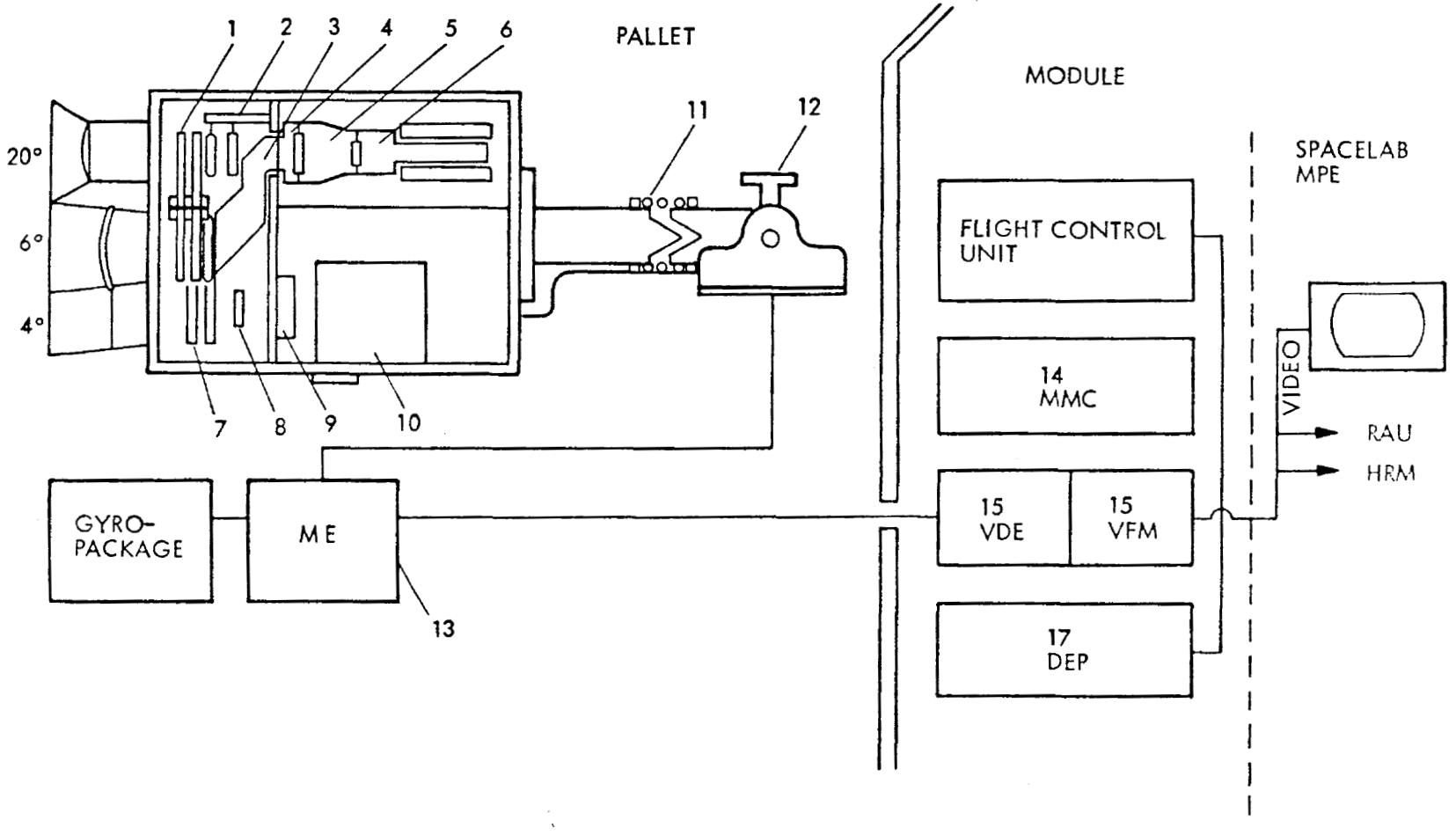
The AEPI system is illustrated in Fig. 6 . There are two parallel detector systems. The top system is a TV system using the image intensified S.E.C. tube as the detector. The bottom system, the photon counting array (P.C.A.), uses a microchannel plate intensified anode array tube and is equivalent to a 100 channel photomultiplier. For the television, the filters are selected by means of a filter-wheel set (1). For the selected waveband, an appropriate focus is chosen by focussing system (2). The field of view of the TV system is interchangeable between 20 and 6 degrees, by means of a moveable prism (3). The quartz window μ-channel plate intensifier (4) is fiber optically coupled to a 40-25 demagnifying tube (5) which is in turn coupled to the S.E.C. tube (6). The PCA channel has a fixed field of view of 4^{o}. The waveband selection is achieved by means of the filter wheel (7). The PCA has a remote control interchangeable photometric converter optics (8) which converts the imaging array into a multichannel photometer. The μ-channel plate array tube (9) amplifies the photons into detectable counts for the PCA electronics (10). The entire system is pointed by a two-axis gimbal, the (MAST) mount (12). The load isolator (11) is a decoupling device for launch to save the mount from excessive launch loads. The mount electronics package (13) will provide the appropriate signal conditioning between the mount servos the dedicated experiment processor (DEP) (17) and the mount manual control (MMC) (14). The video data encoder (15) annotates the video with housekeeping information, both in readable alphanumeric characters and in decodable signal bars. The video field memory (16) is a single frame digital store which freezes the picture for inspection. The VDE and VFM electronics include an adjustable cursor which is displayed on the video frame in the TV. This can be used by the payload or mission specialist for manually controlling the pointing mount. The data output is fed to the Spacelab furnished video monitor, the high-rate multiplexer HRM, and the remote acquisition unit RAU of the Spacelab computer. The properties of the AEPI detector system is tabulated in Table I-1.

The flight equipment which will be acquired during this program consist of the gyro-package and the Interactive flight control unit panel. The gyro package is necessary because of the inadequate attitude reference supplied by the current Spacelab systems. The interactive flight control unit panel enables the payload/mission specialist to issue direct commands to the experiment DEP to manually set up camera parameters. The instrument as it is currently flown on Spacelab relies very highly on pre-programming of the DEP with very limited flexibility on the part of the mission/payload specialist to make changes to the operating programs. Much of the experimental objectives require the man in the loop to update the system operation after each detection trial.

TABLE I-1. THE PROPERTIES OF THE AEPI DETECTOR SYSTEM.

	TV SYSTEMS	
TV Standard:	525 TV lines maximum	
Field of View:	6^{o}	20^{o}
F/Number	2.5	2.0
Resolution (300 lines)	$.02^{o}(3.5 \times 10^{-4})$	$.07^{o}(1.16 \times 10^{-3}$ rad)
Range 150 Km	5.2 m	170 m
300 Km	105 m	340 m
500 Km	175 m	580 m
Minimum Sensitivity (1 sec exposure)	60 R	40 Rayleigh

FIGURE 6
AEPI SYSTEMS CONFIGURATION



1. TV FILTER WHEEL
2. DYNAMIC CHROMATIC CORRECTOR
3. FIELD-OF-VIEW CHANGE PRISM
4. μ-CHANNEL PLATE INTENSIFIER
5. DE-MAGNIFYING TUBE
6. S.E.C. TUBE
7. FILTER WHEEL (PCA)
8. PHOTOMETER CONVERTER
9. PHOTON COUNTING ARRAY (PCA)
10. ELECTRONICS PCA
11. LOAD ISOLATION
12. MAST TWO-AXIS GIMBAL
13. MAST ELECTRONICS
14. MOUNT MANUAL CONTROL
15. VIDEO DATA ENCODER
16. VIDEO FIELD MEMORY
17. DEDICATED EXPERIMENT PROCESSOR

PHOTON COUNTING ARRAY

Mode	10 x 10 Image array	Quadrant Photometer
Field of View:	4.25^{o} x 4.25^{o}	6^{o} diameter circular
F Number	2.5	2.5
Resolution	$.42^{o}$ (0.073 rad)	6^{o} (0.1 rad) diameter circular
Range 150 Km	1.1 Km	15 Km
300 Km	2.2 Km	30 Km
500 Km	3.6 Km	50 Km
Sensitivity	12.0 counts per Rayleigh per second	320 counts per Rayleigh per second per quadrant
Maximum counts rate (2×10^{5} per sec per anode)	2.4 M Rayleighs	2.4 M Rayleighs

SECTION III. IMAGING SPECTROMETRIC OBSERVATORY (ISO)