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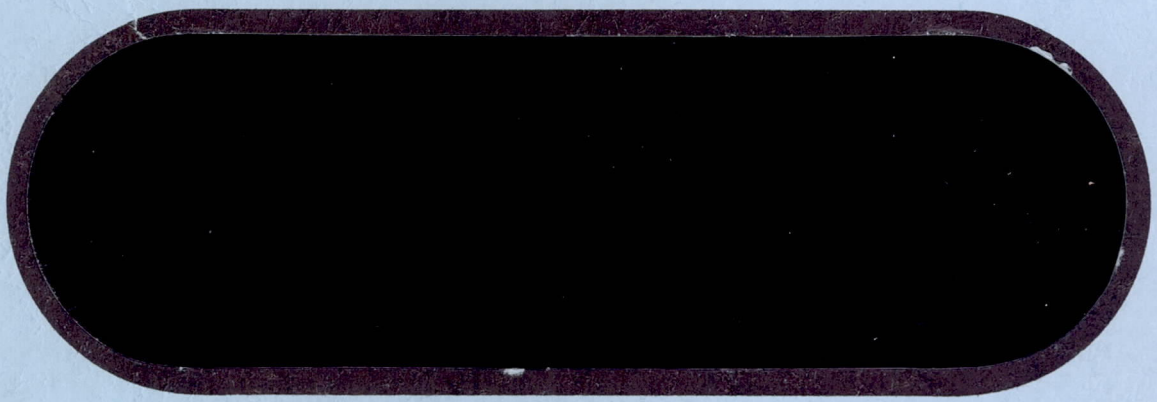

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LUNAR ORBITER SIMPLE MOON RESIDUALS

(D2-100816-1)

By T. J. Hansen

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- Final Report

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T. J. Hansen

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L. B. Aldrenkamp

APPROVED BY J. C. Graves 10/16/68
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REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL

PHOTO SITE ACCURACY ANALYSIS FINAL REPORT DOCUMENTS

TASK A - Photo Support Data

D2-100814-1 - Lunar Orbiter Photo Site Accuracy Analysis - Final Report - Photo Site Analysis

D2-100814-2 - Lunar Orbiter Photo Site Accuracy Analysis - Final Report - Supporting Data

D2-100814-3 - Lunar Orbiter Photo Site Accuracy Analysis - Final Report - Error Analysis

D2-100815-1 - Lunar Orbiter Improved Photo Supporting Data - Final Report - Lunar Orbiter I

D2-100815-2 - Lunar Orbiter Improved Photo Support Data - Final Report - Lunar Orbiter II

D2-100815-3 - Lunar Orbiter Improved Photo Supporting Data - Final Report - Lunar Orbiter III

D2-100815-4 - Lunar Orbiter Improved Photo Supporting Data - Final Report - Lunar Orbiter IV

D2-100815-5 - Lunar Orbiter Improved Photo Supporting Data - Final Report - Lunar Orbiter V

D2-100816-1 - Lunar Orbiter Simple Moon Residuals - Final Report

TASK B - Residual Feedback Study

D2-100818-1 - Application of Residual Feedback to Lunar Orbiter Residual Analysis - Final Report

TASK C - Tracking Data Residuals

D2-100817-1 - Lunar Orbiter Doppler Residual Study - Final Report

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ABSTRACT AND KEY WORDS LIST

ABSTRACT

The improved Lunar Orbiter state vector solutions, when projected ahead using a simplified lunar gravitational model, show characteristic residual (calculated minus observed) doppler patterns. These patterns are presented as plots of residuals vs. time for all data arcs processed in the photo site accuracy analysis contract.

KEY WORDS

Lunar Orbiter

Orbit Determination

Residuals

Doppler

Lunar Gravitational Model

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to present plots of doppler residuals from the L.O. photo phase data arcs, obtained by using the production state vectors and projecting forward with a simplified lunar gravitational model.

1.2 SCOPE

This document is part of the final report documentation for the"Lunar Orbiter Photo Site Accuracy Analysis" contract, NAS1-7954, Task A. The entire report follows the document numbering system indicated on page v.

2.0 DISCUSSION

The state vectors obtained for improved photo support data were generated using orbit determination procedures which included solutions for a set of higher-order spherical harmonics. This was done to obtain a superior fit to the tracking data, thereby getting small residuals (actual minus calculated doppler). To demonstrate the variation of residuals on a simpler basis, residuals were later calculated based on projection of the solved state vectors, but using a simplified triaxial lunar gravitational model:

$$J20 = 2.073 \times 10^{-4}$$

$$C22 = 0.203 \times 10^{-4}$$

The residuals, plotted vs. time, are presented in the following pages.

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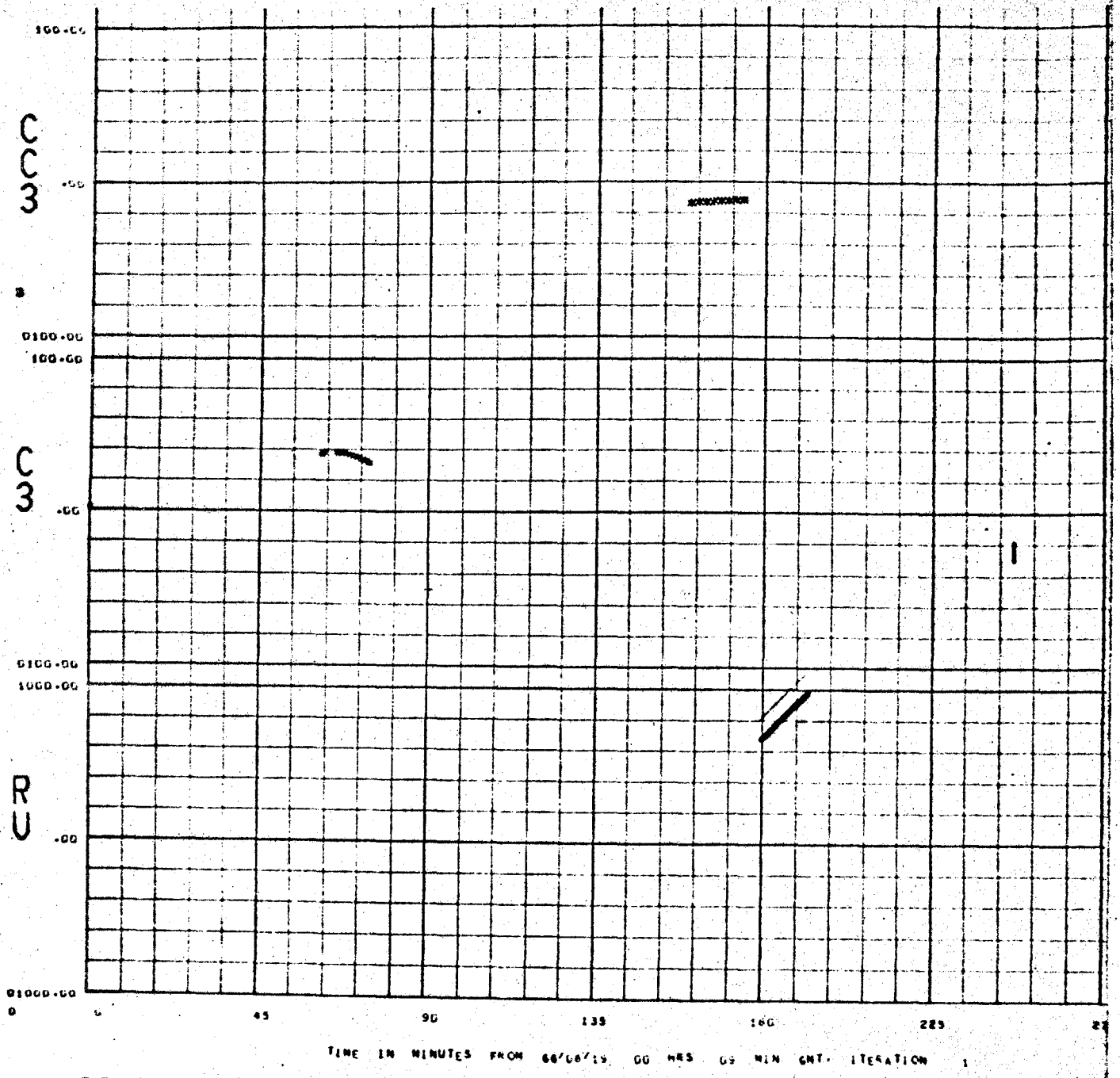
ODPL 1A0

SIMPLE MOON



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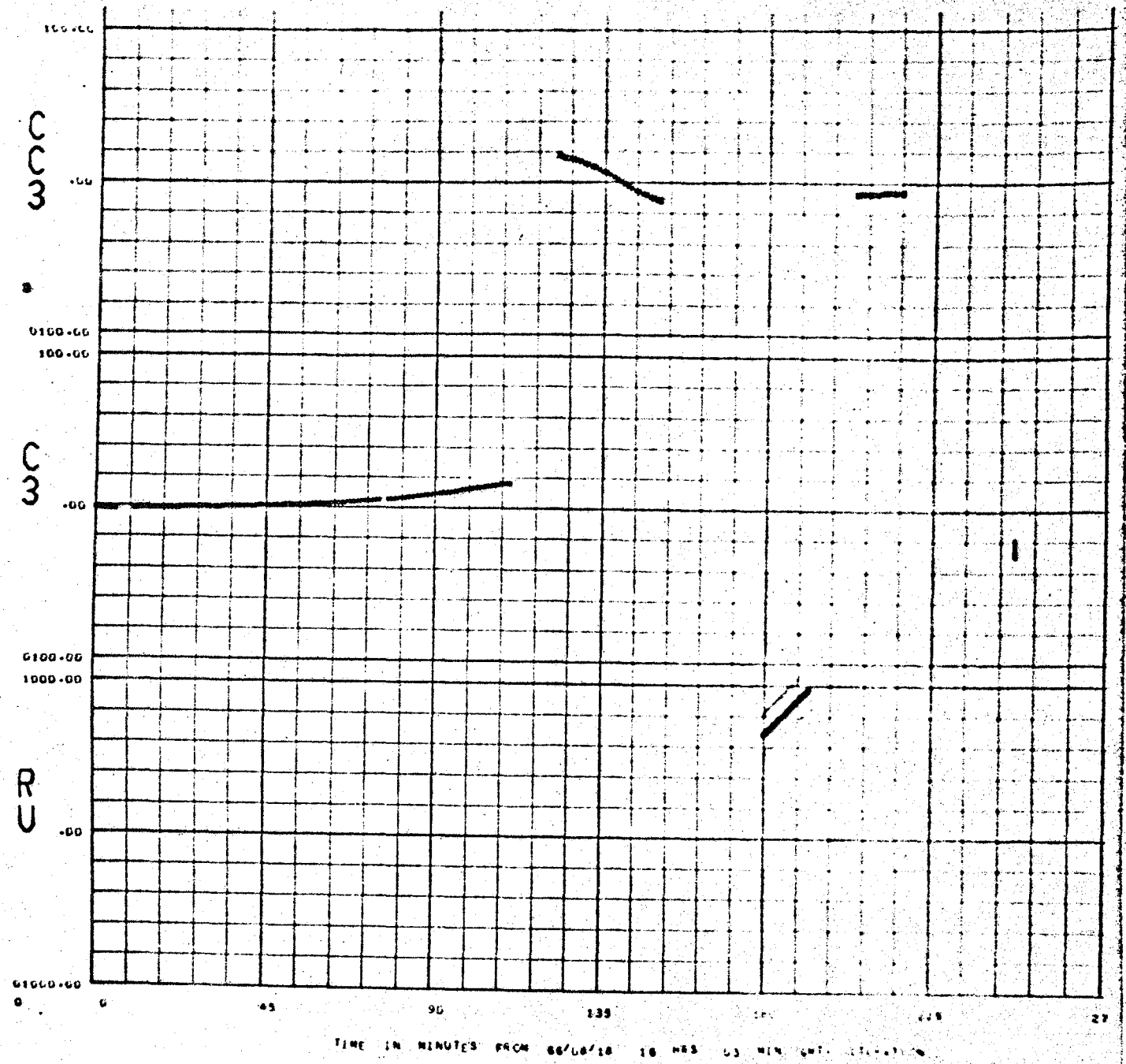

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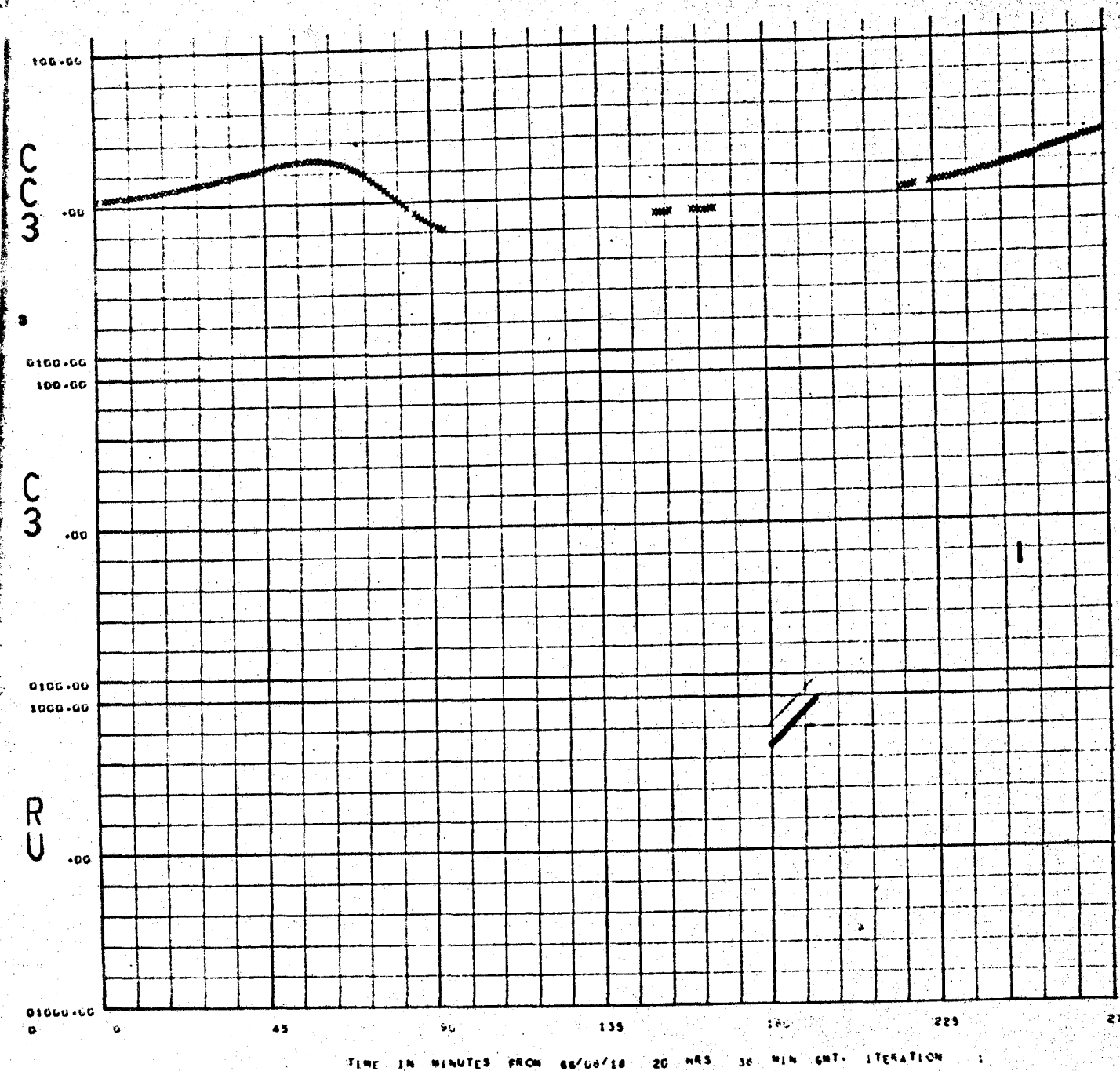

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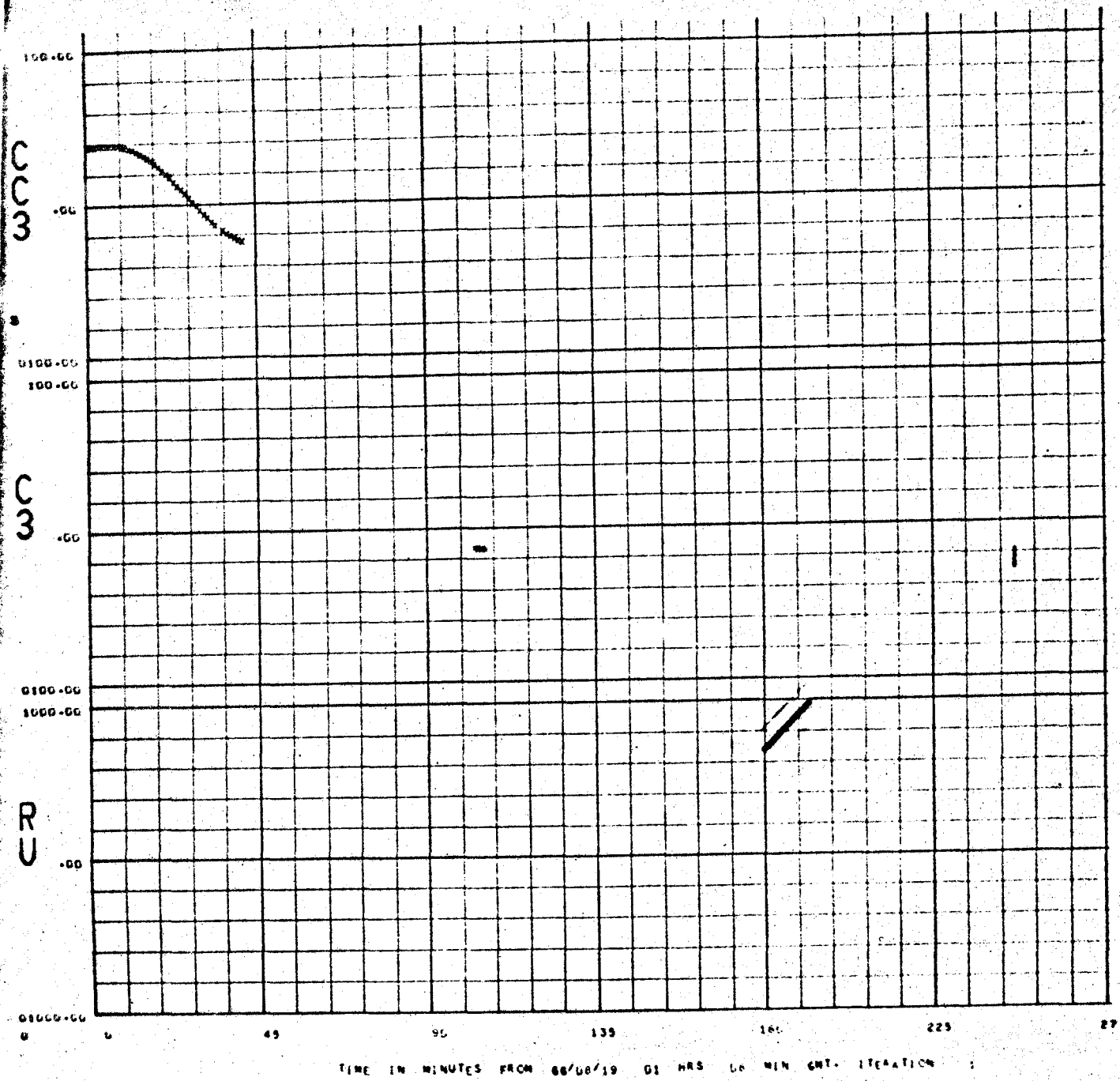

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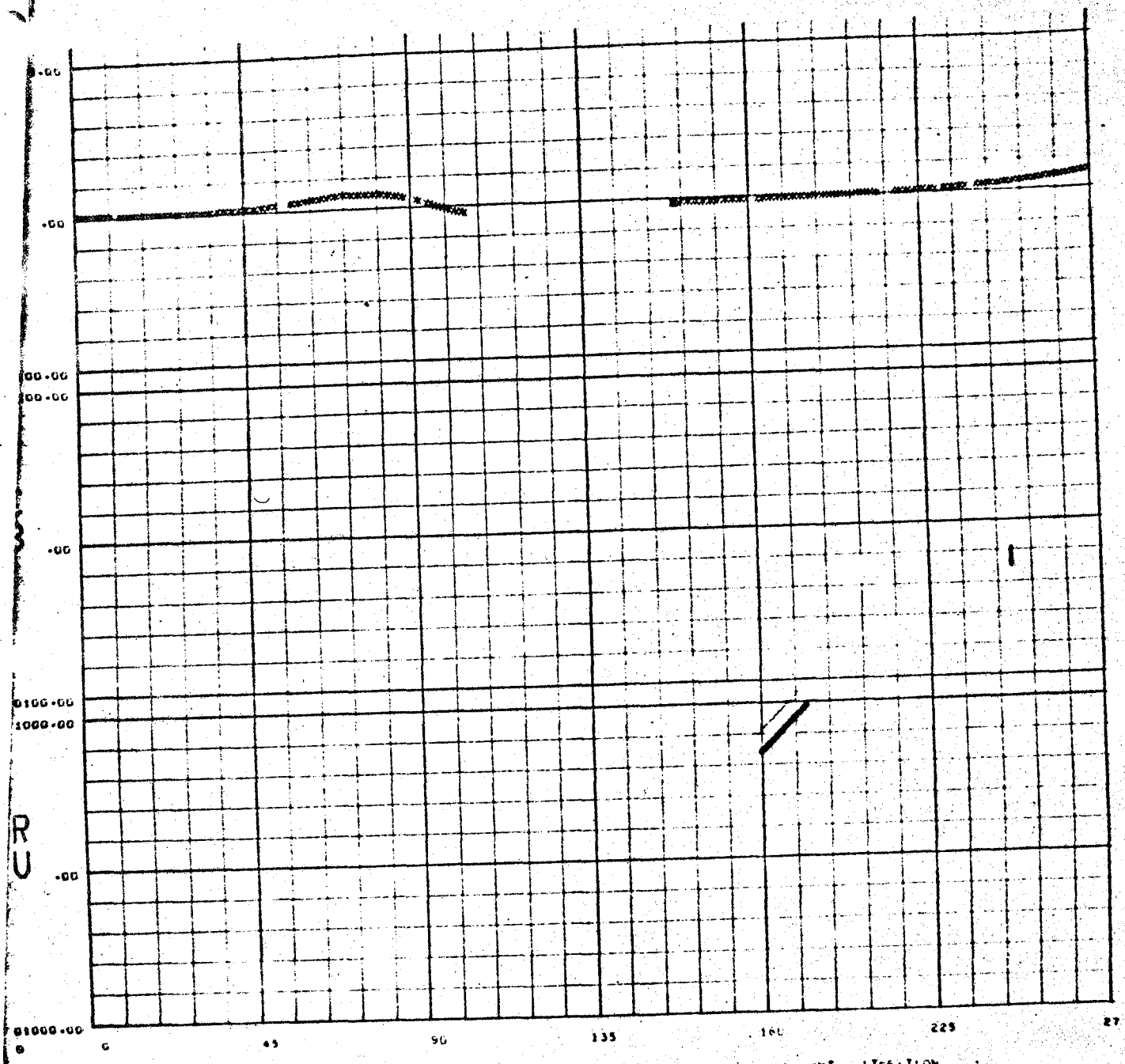

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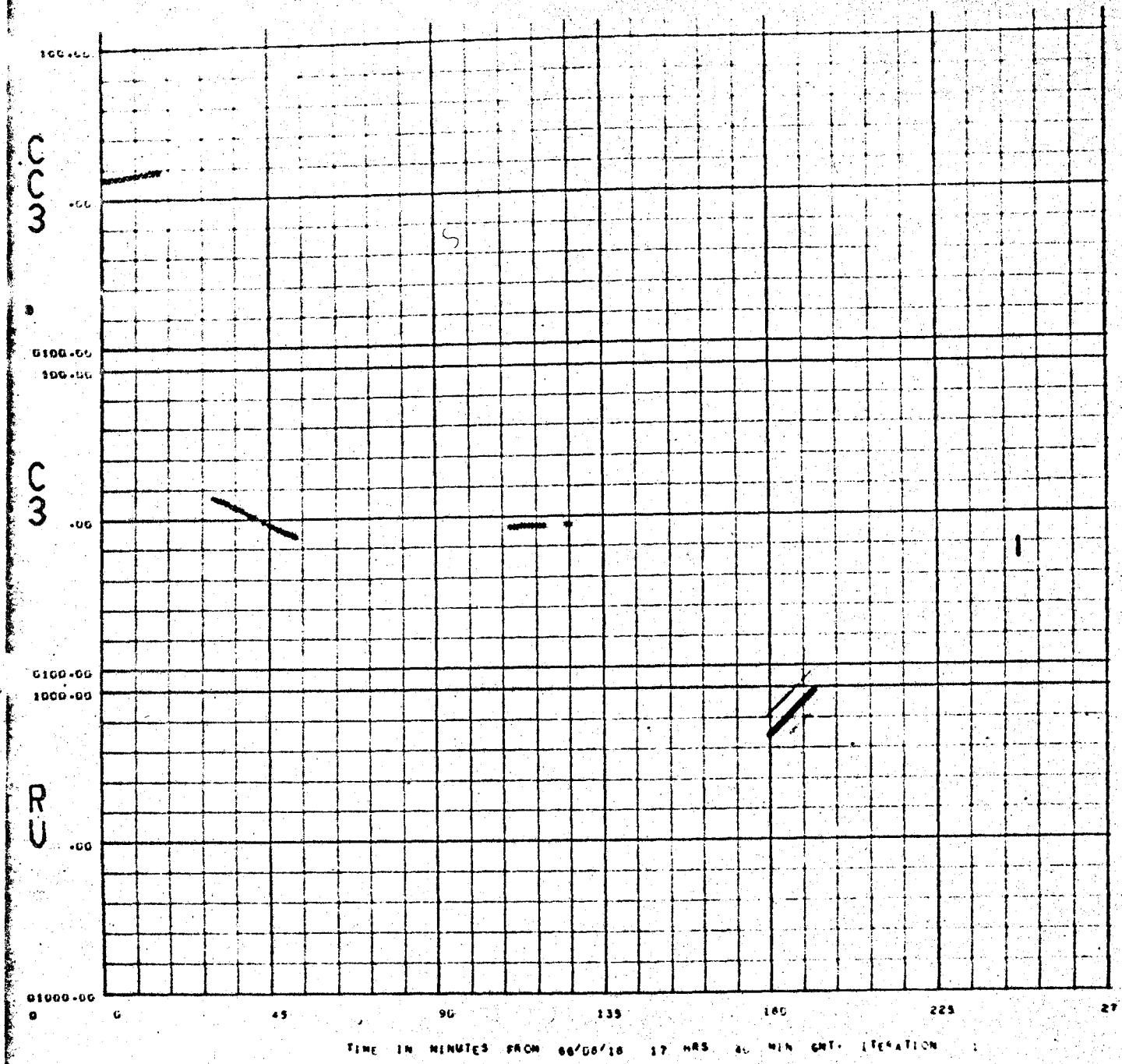

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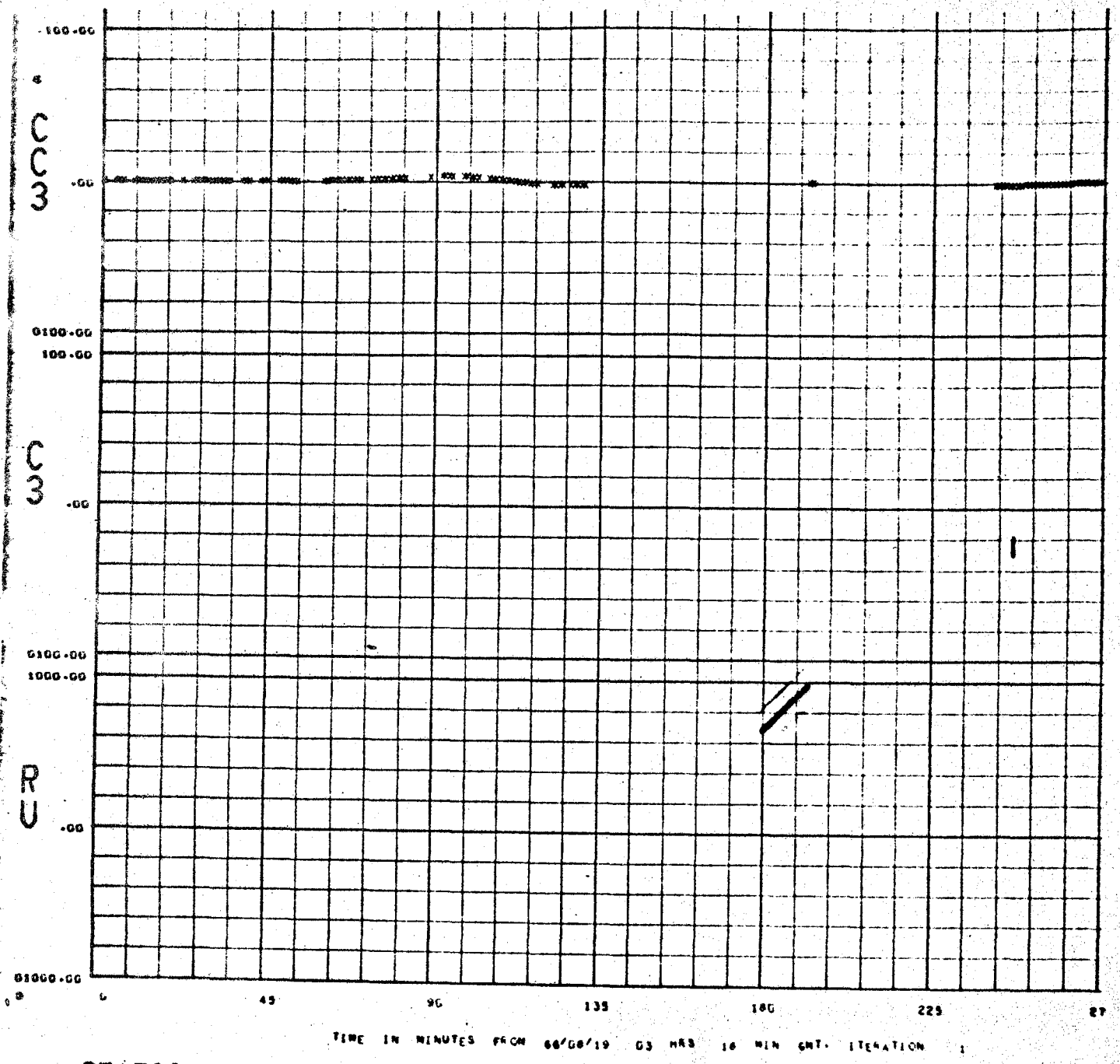

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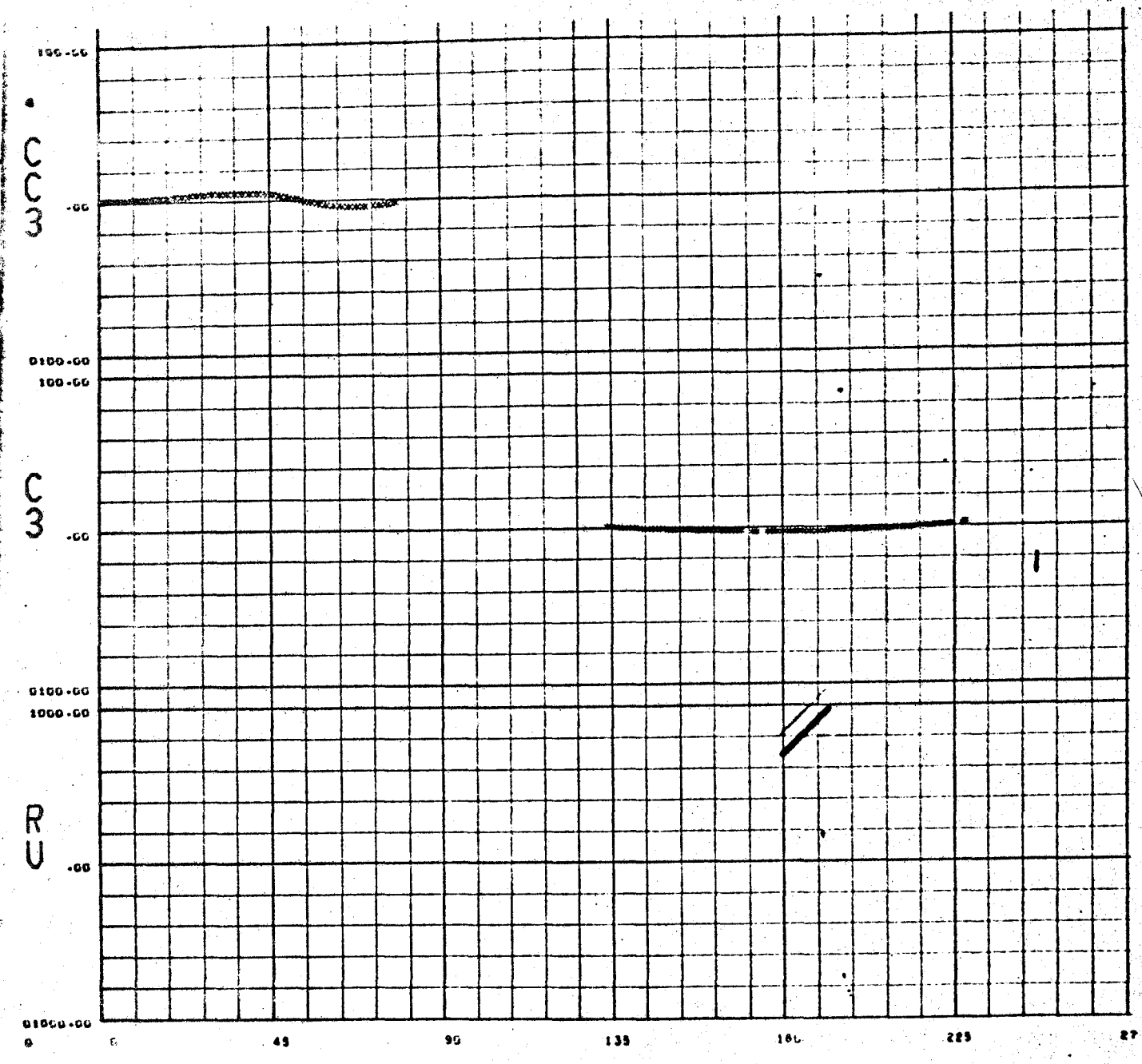

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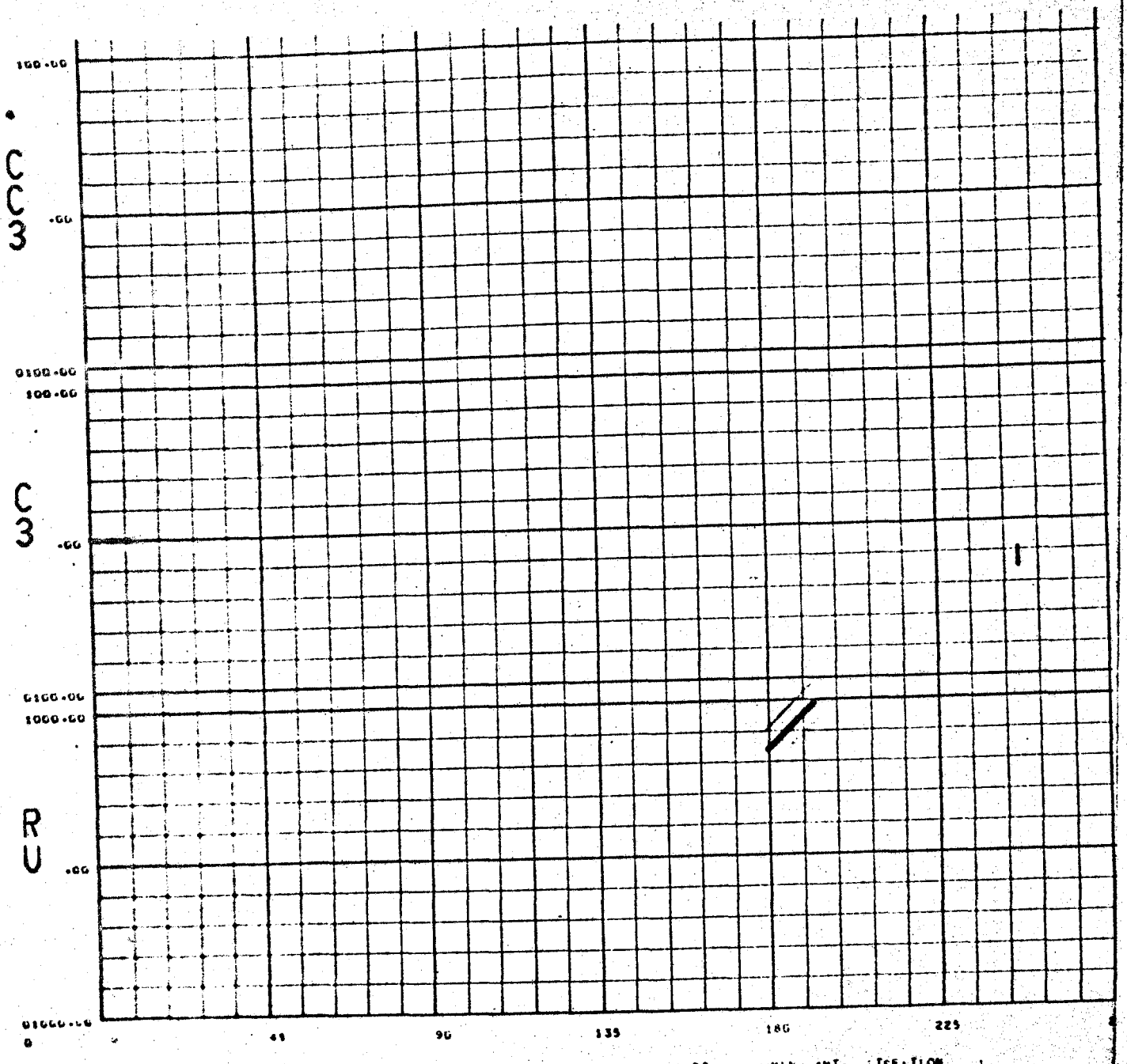

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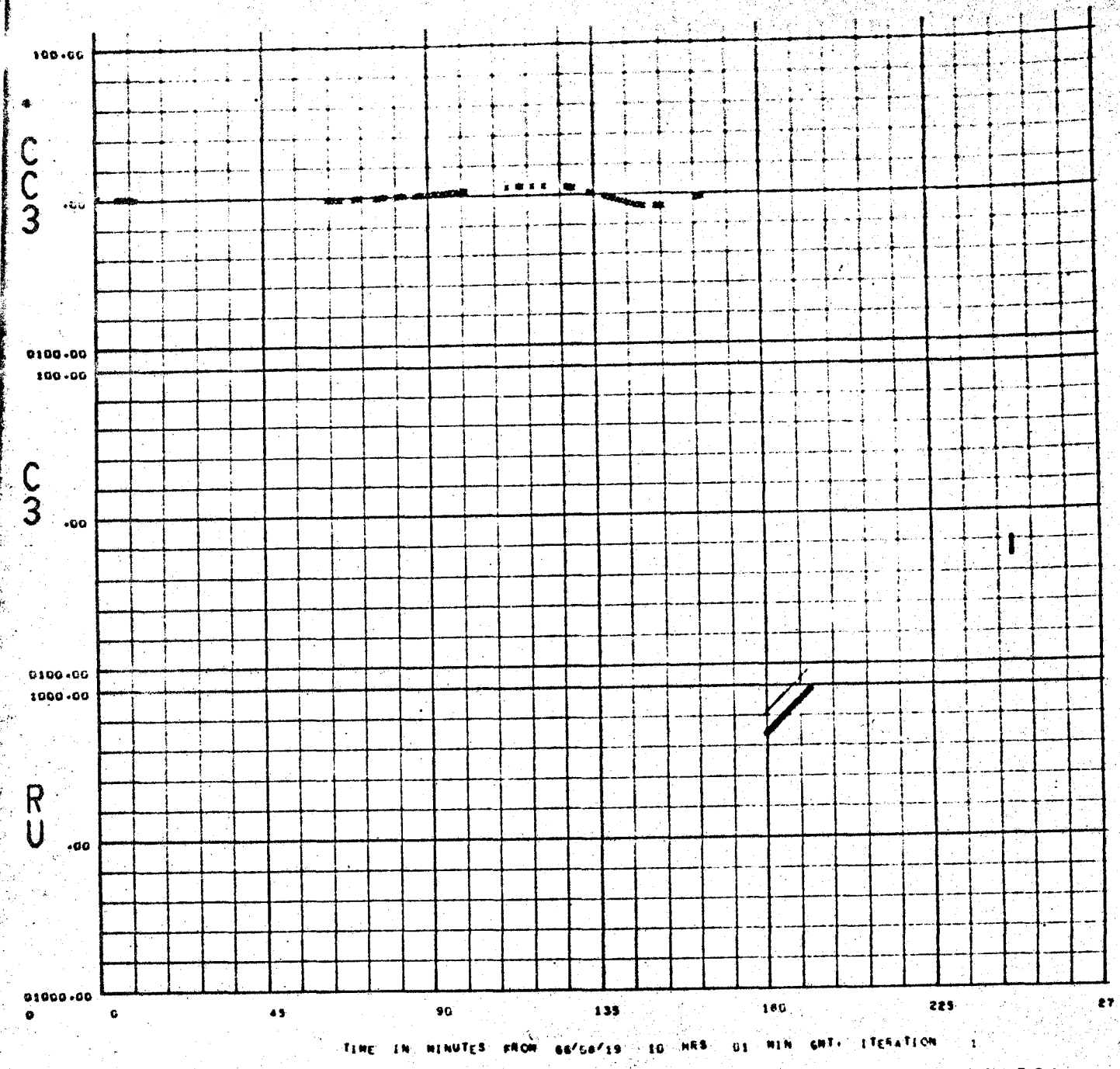

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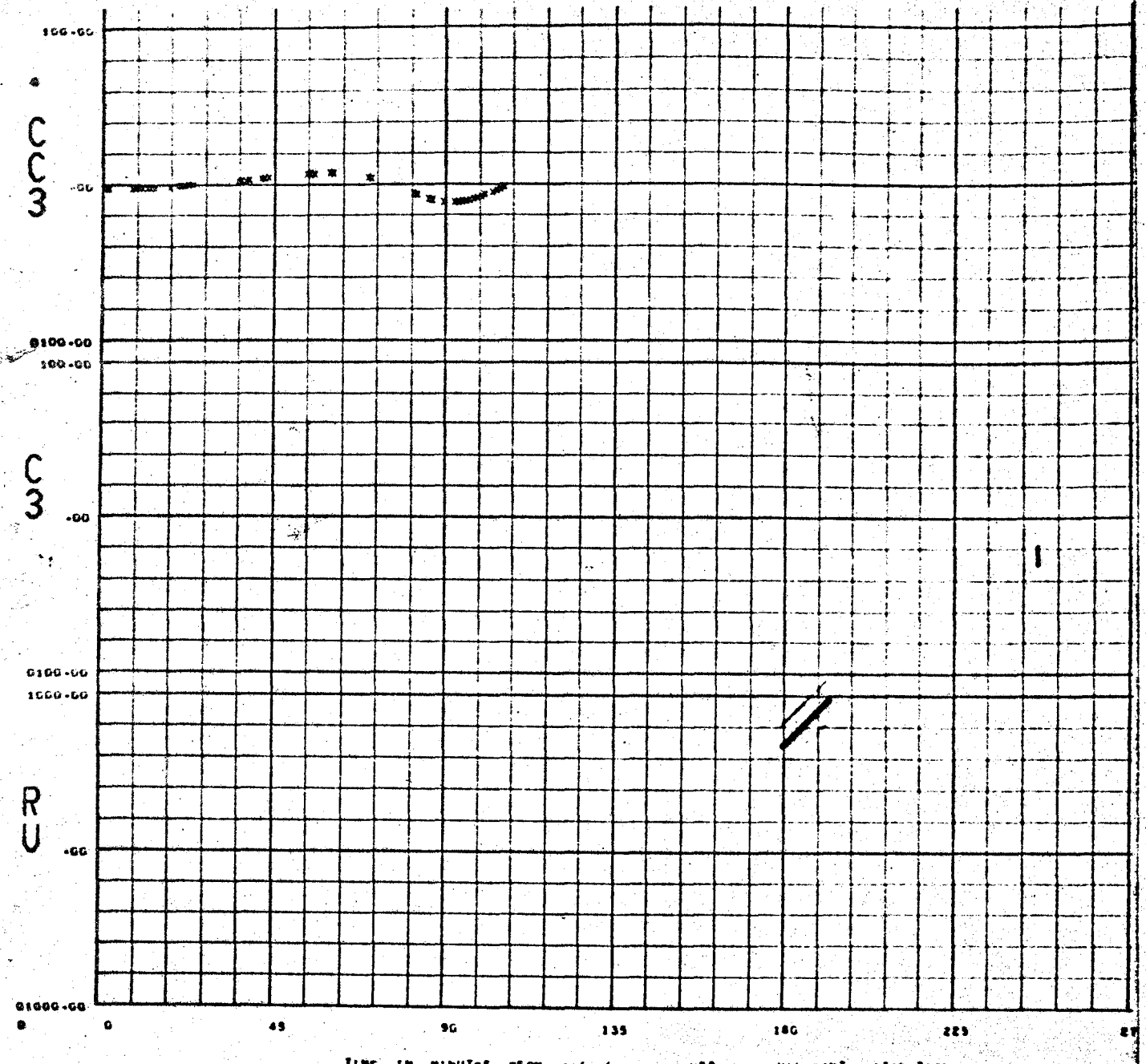

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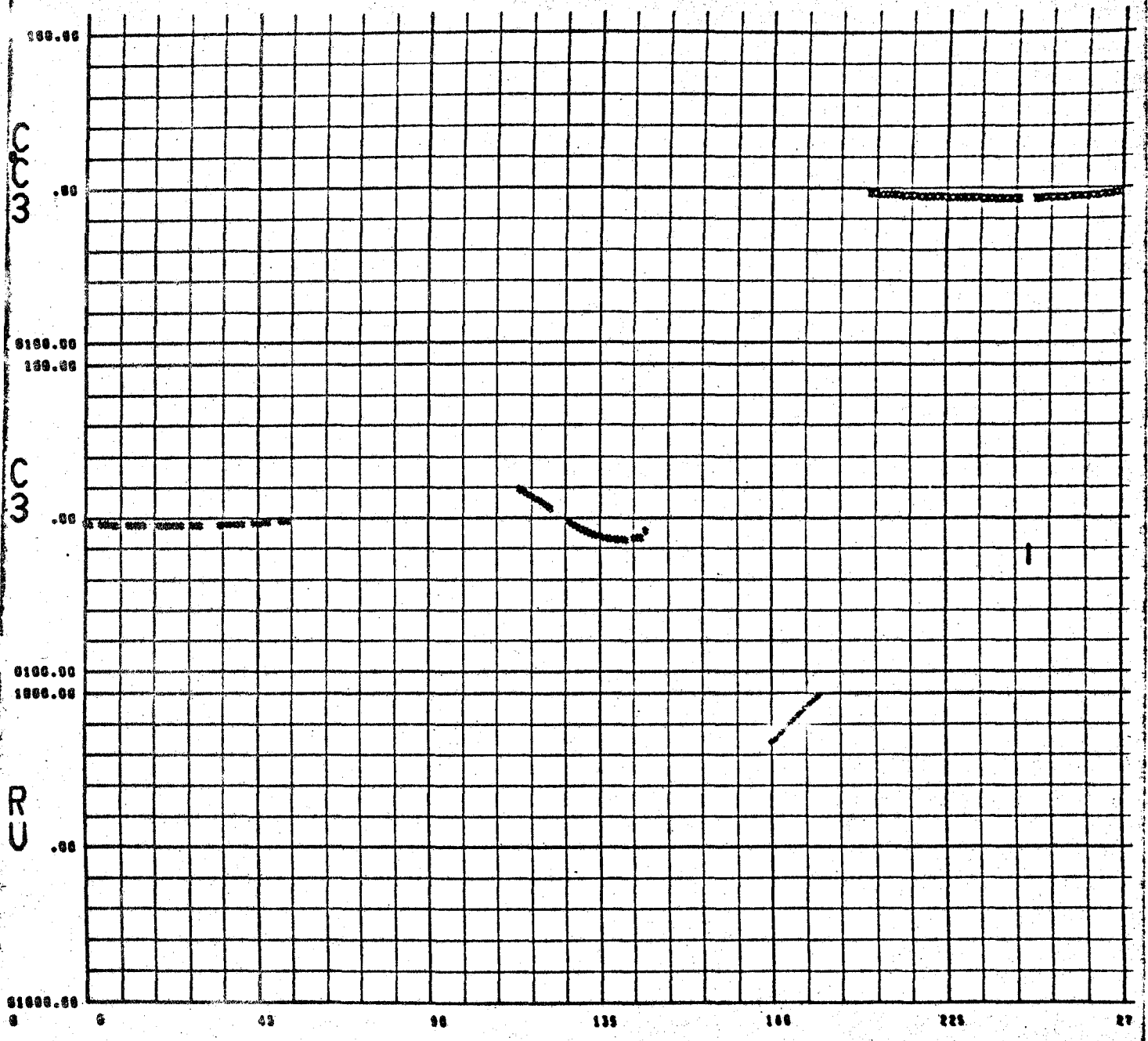

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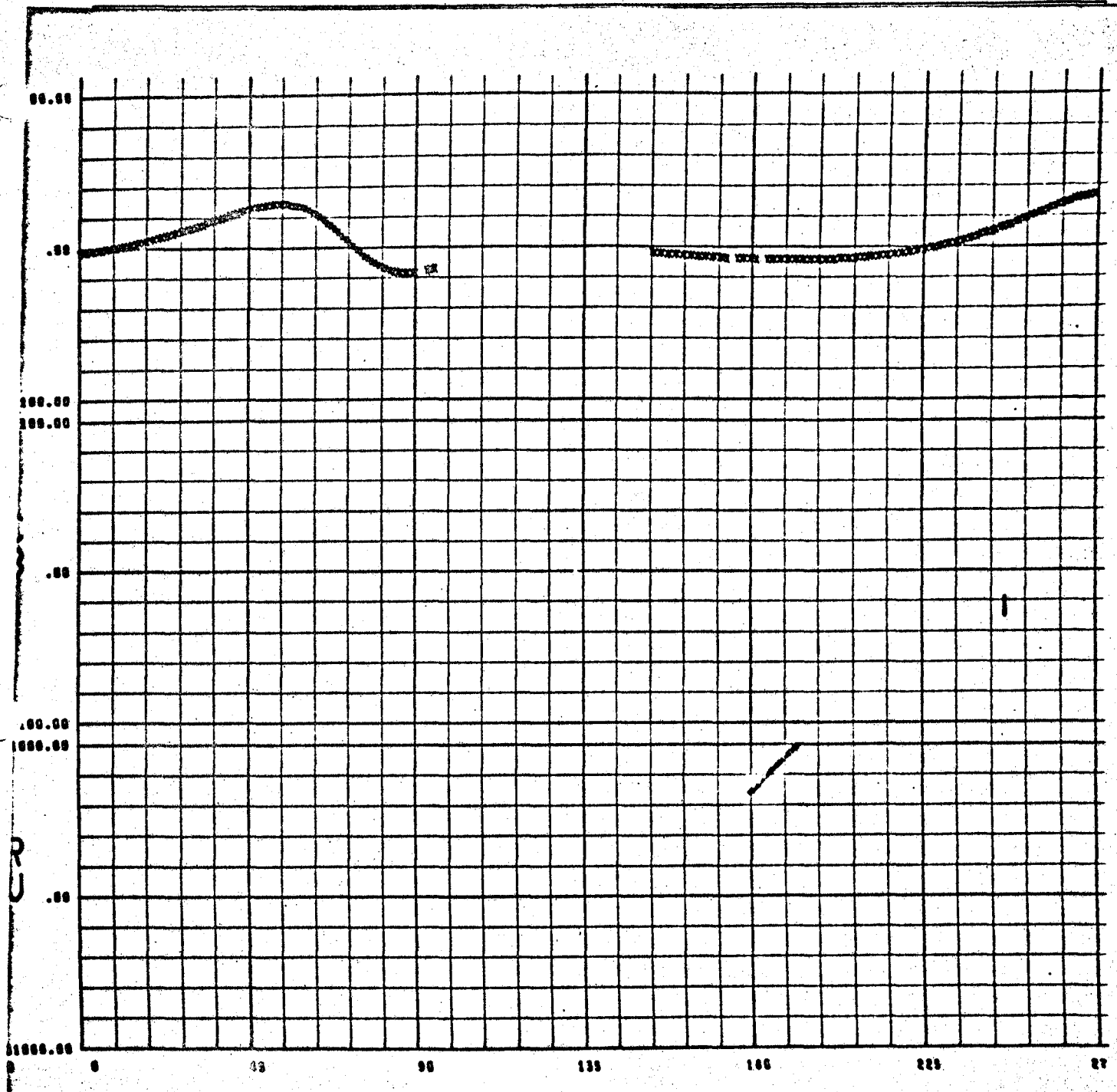

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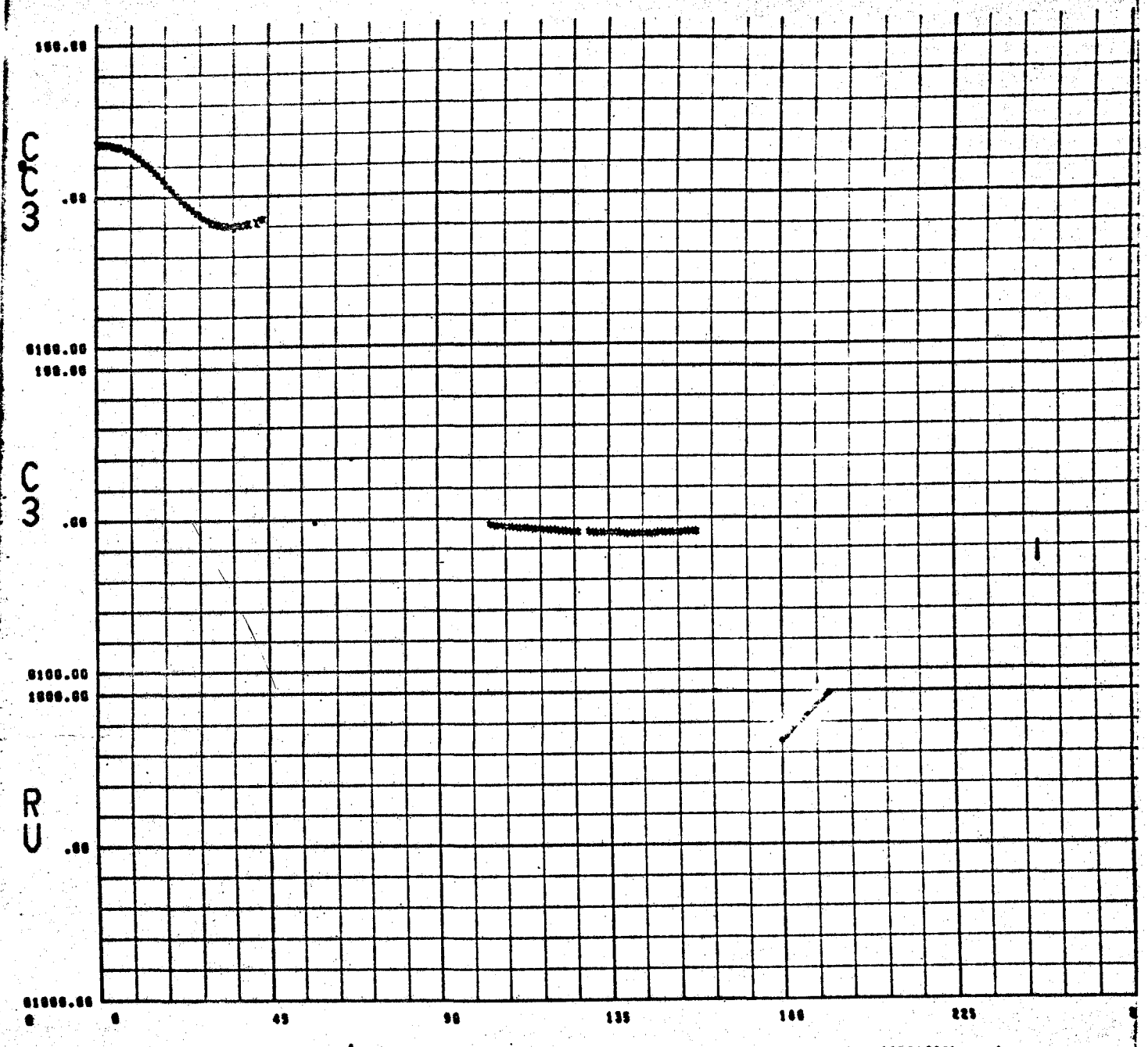

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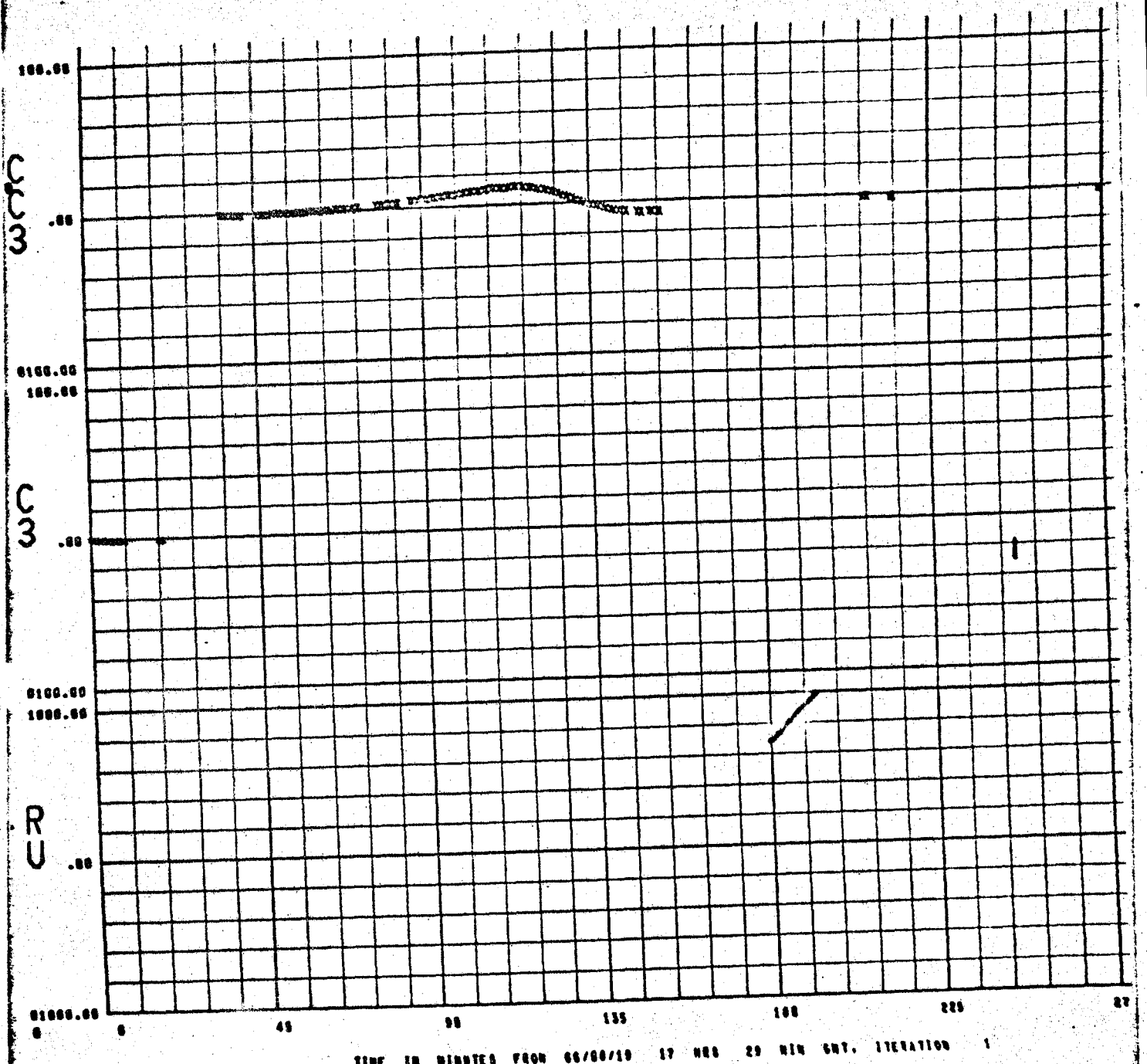

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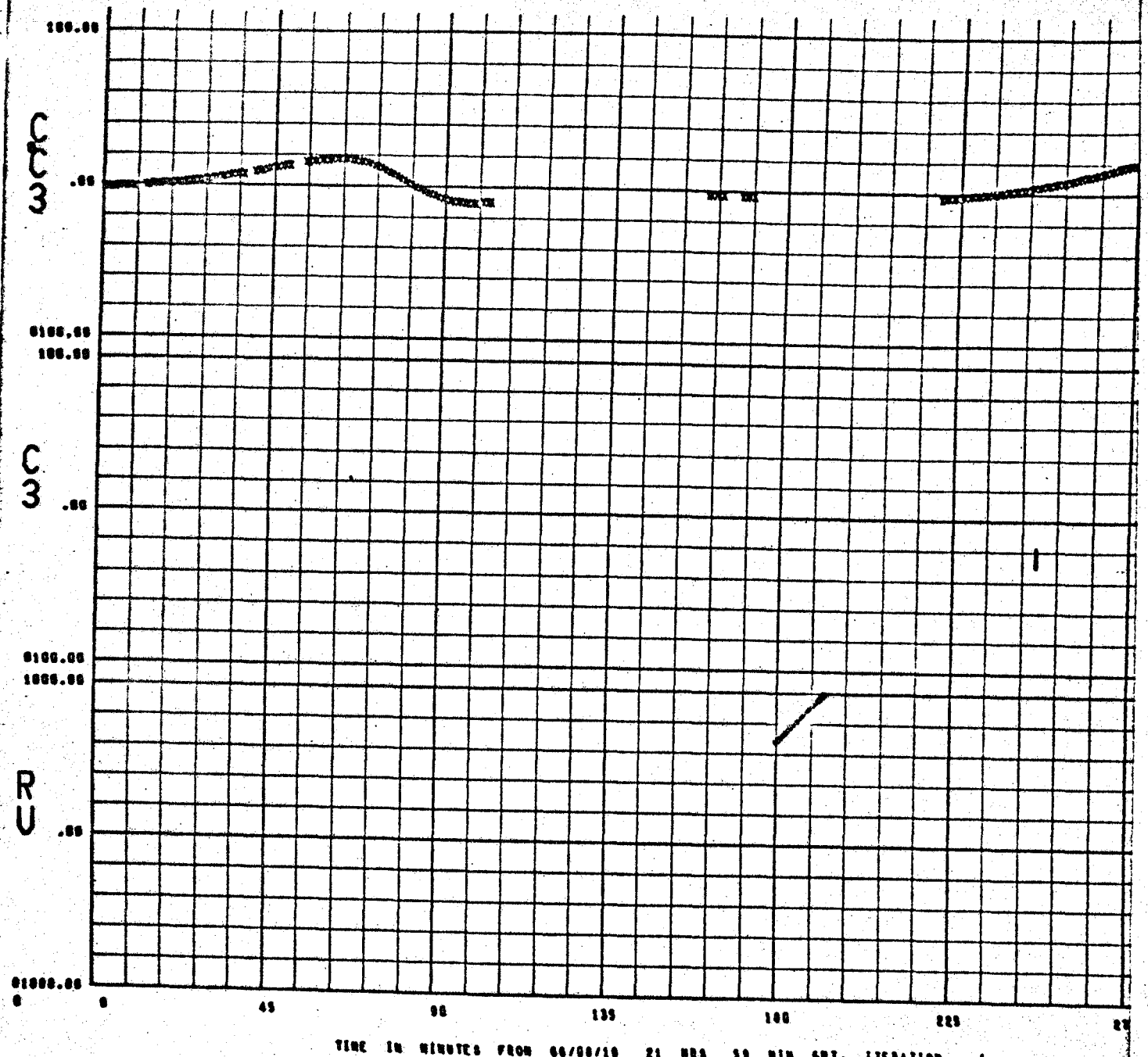

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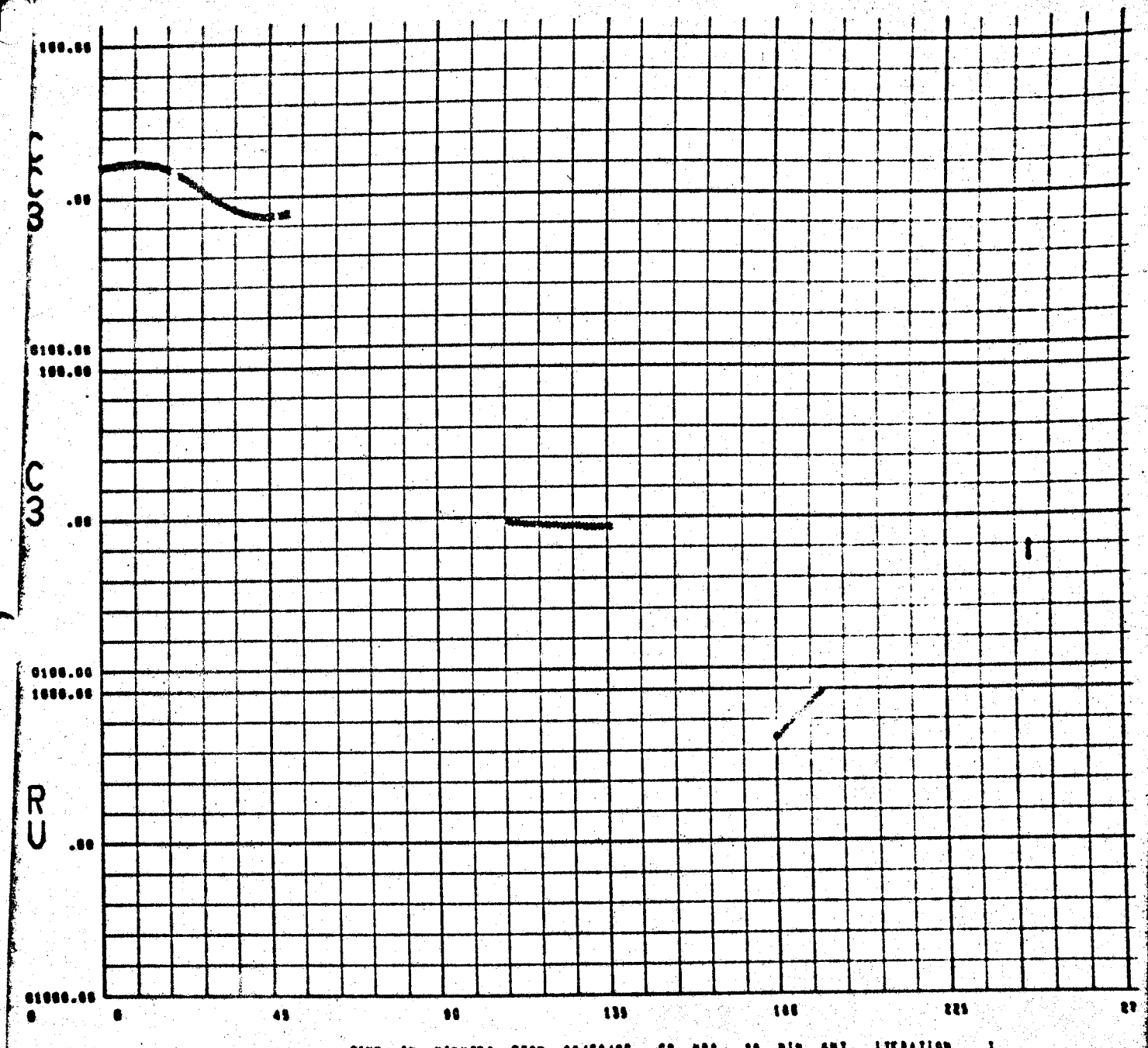

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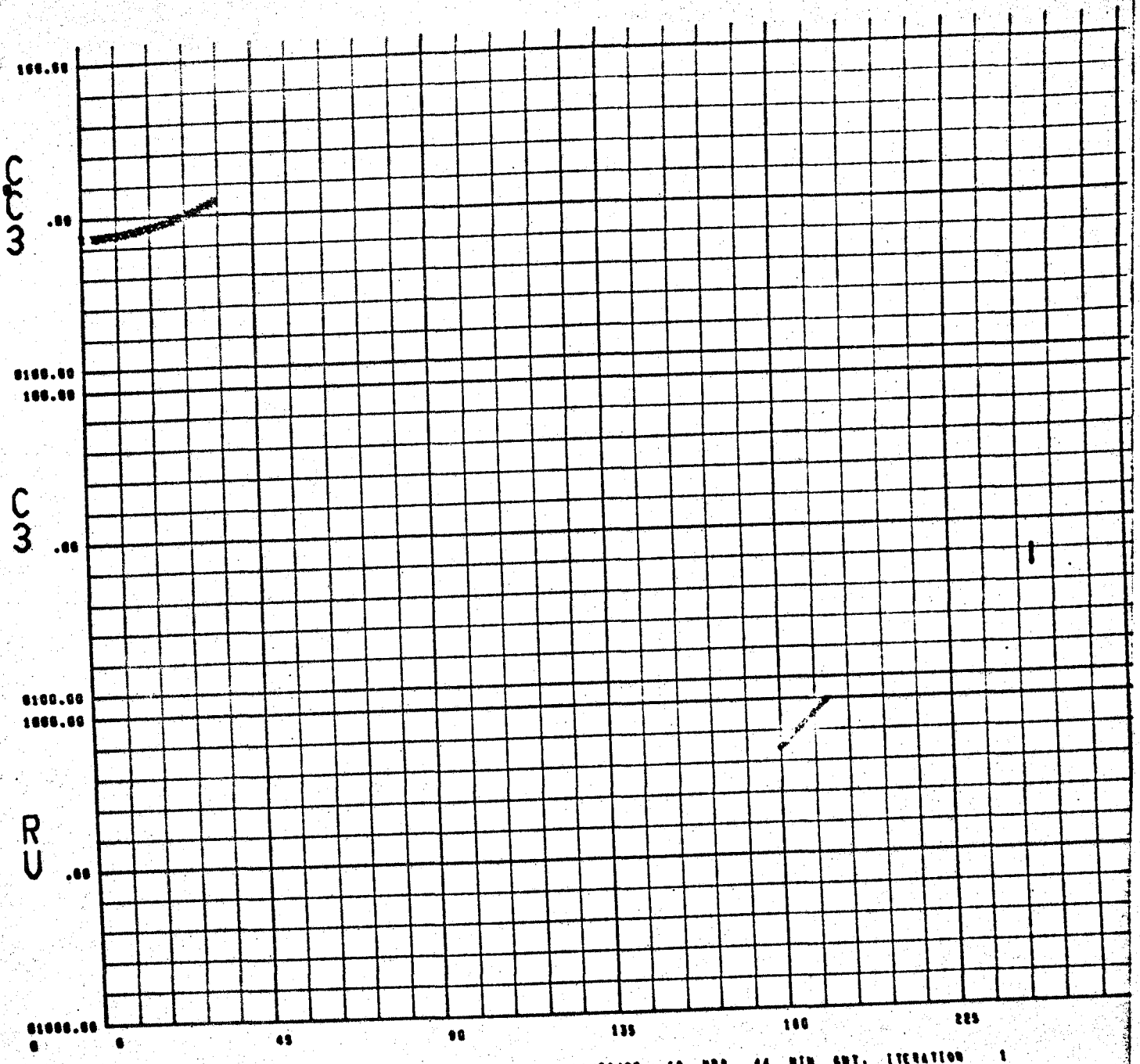

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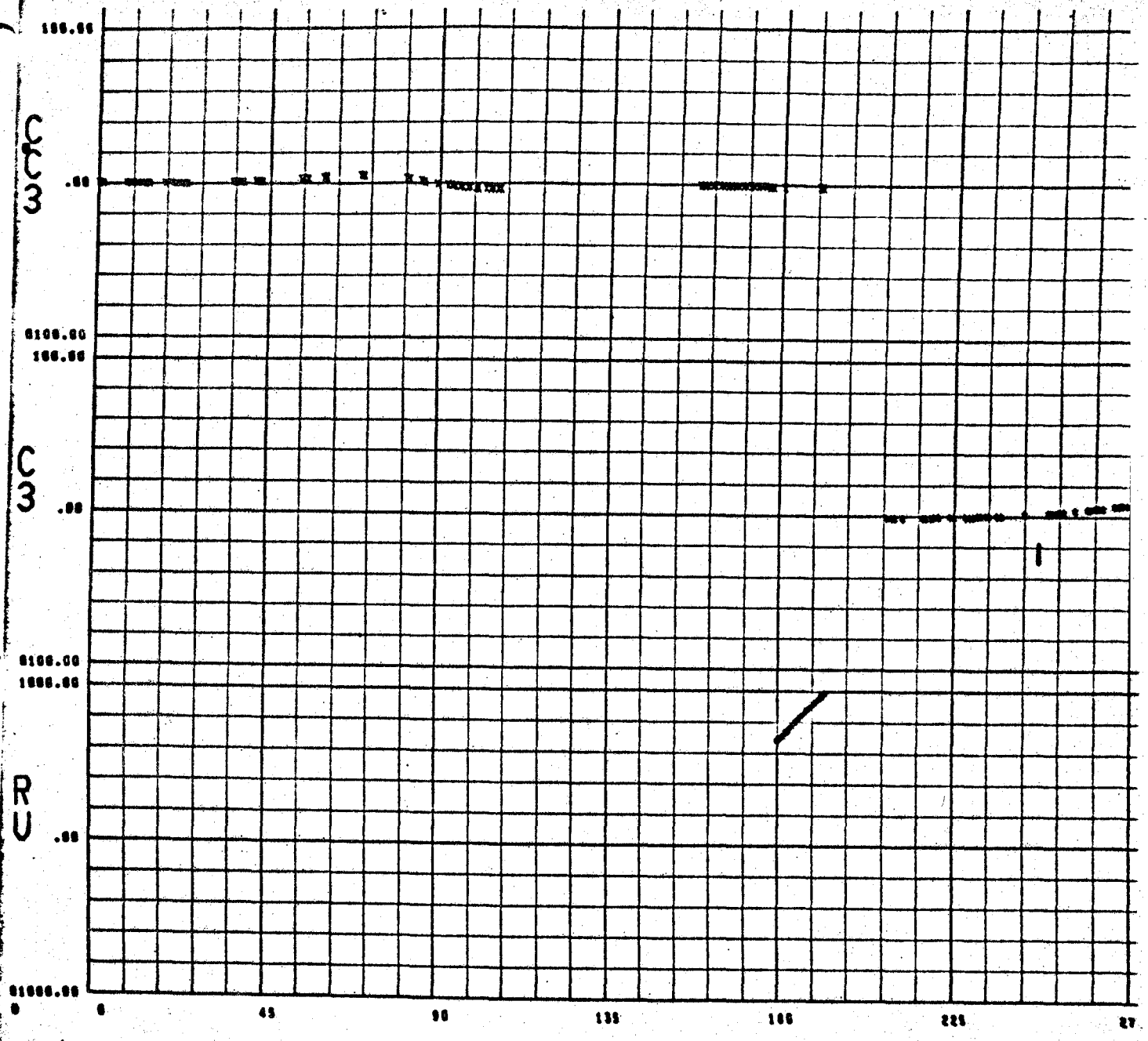

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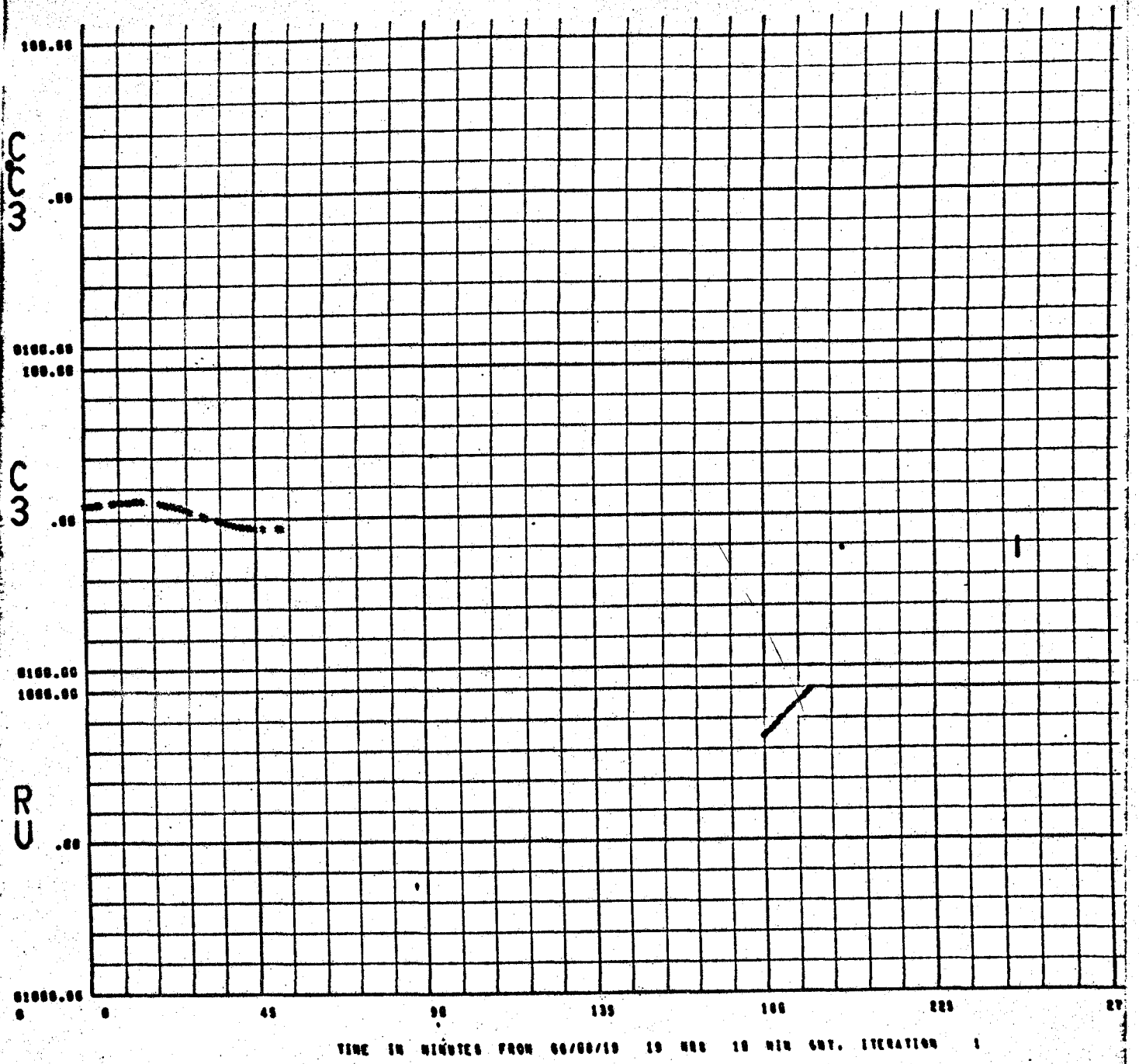

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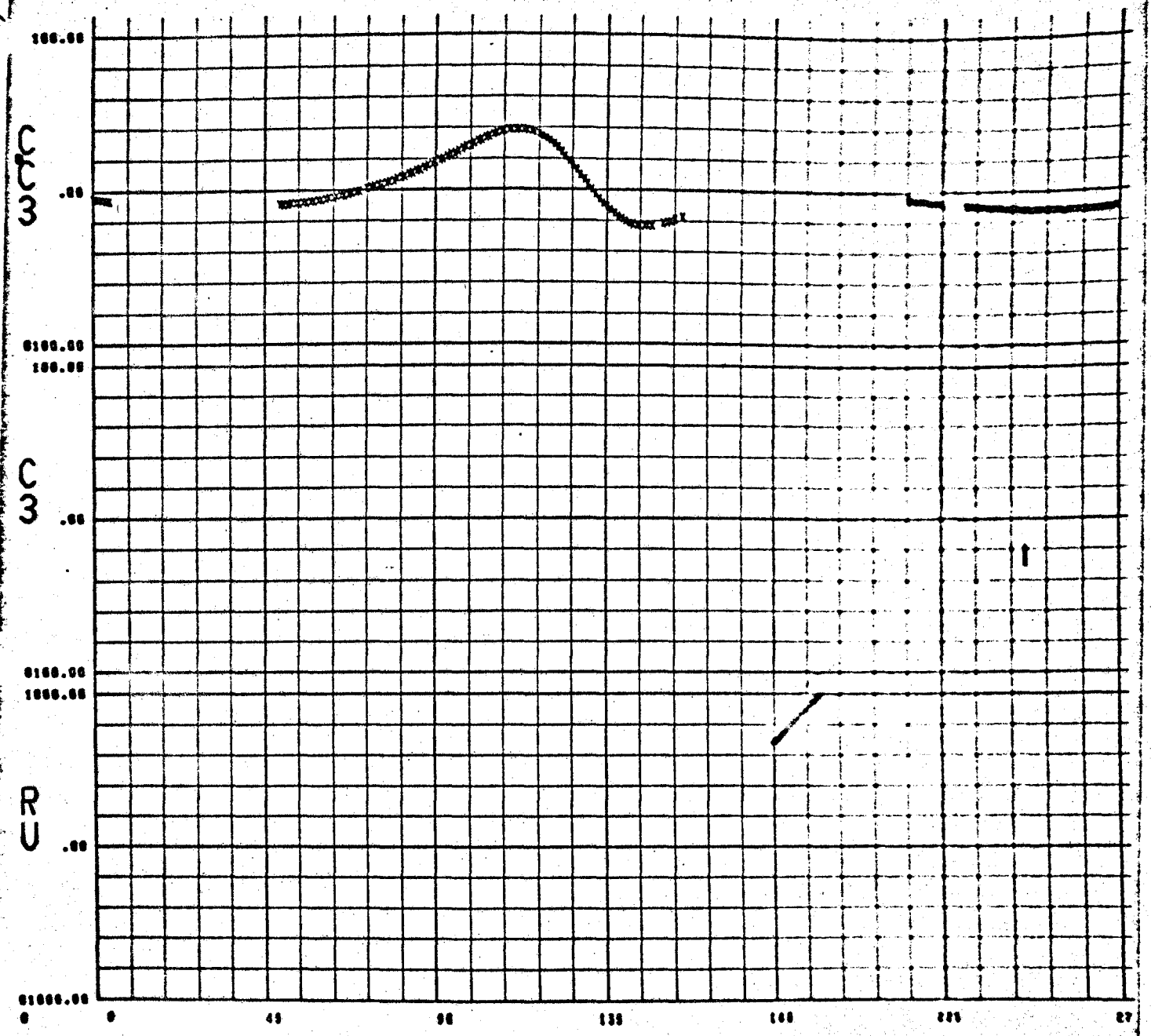

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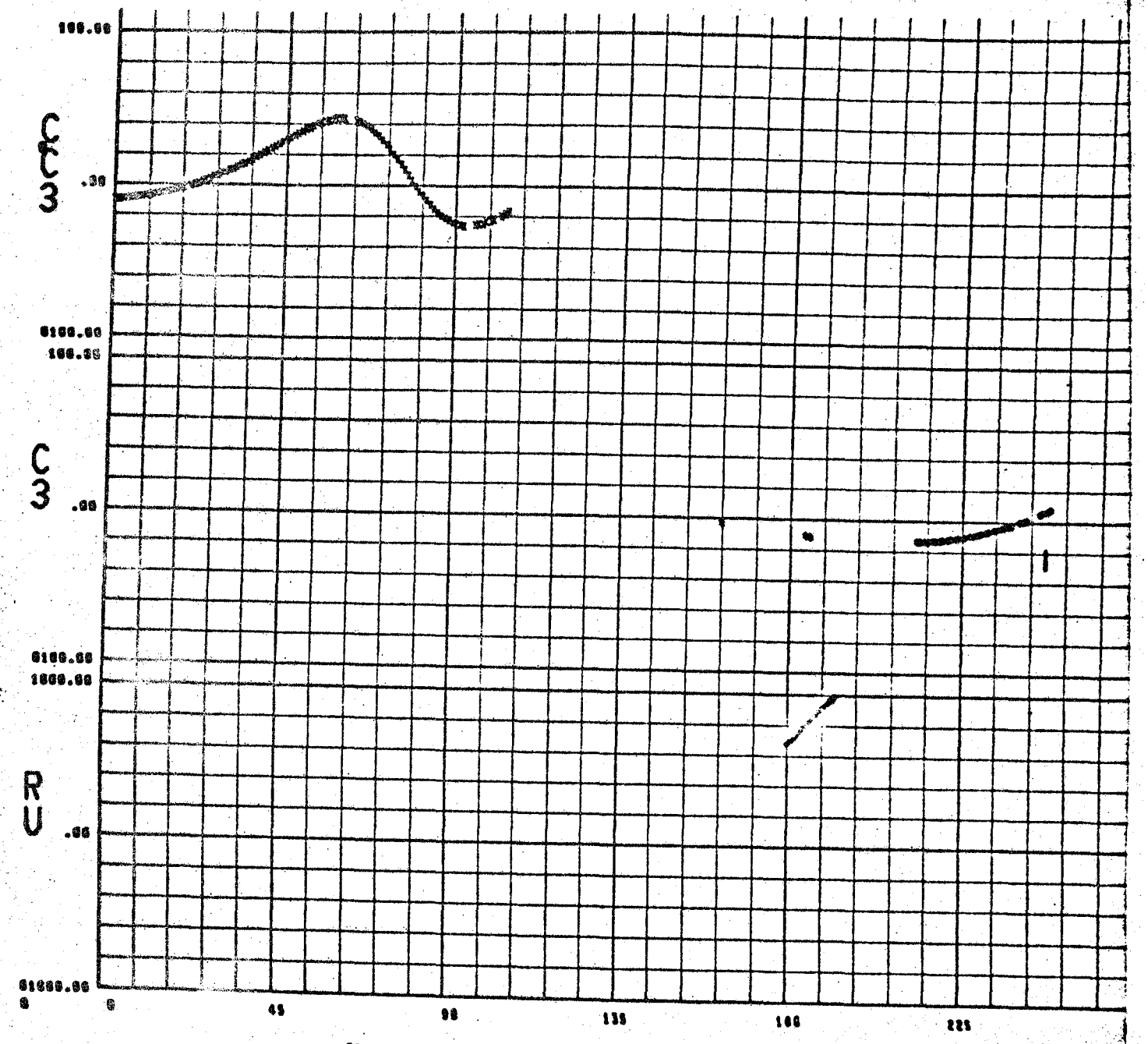

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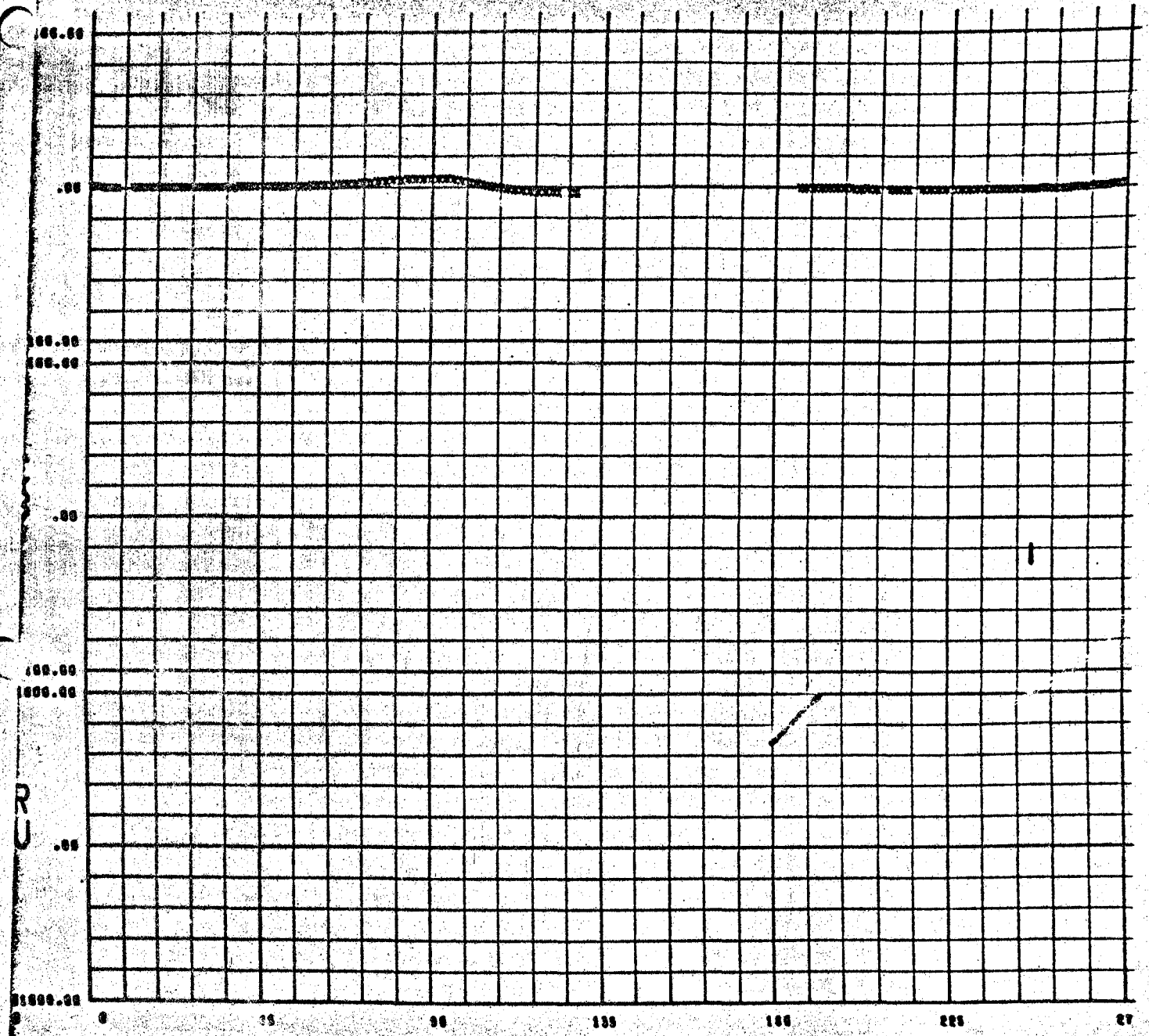

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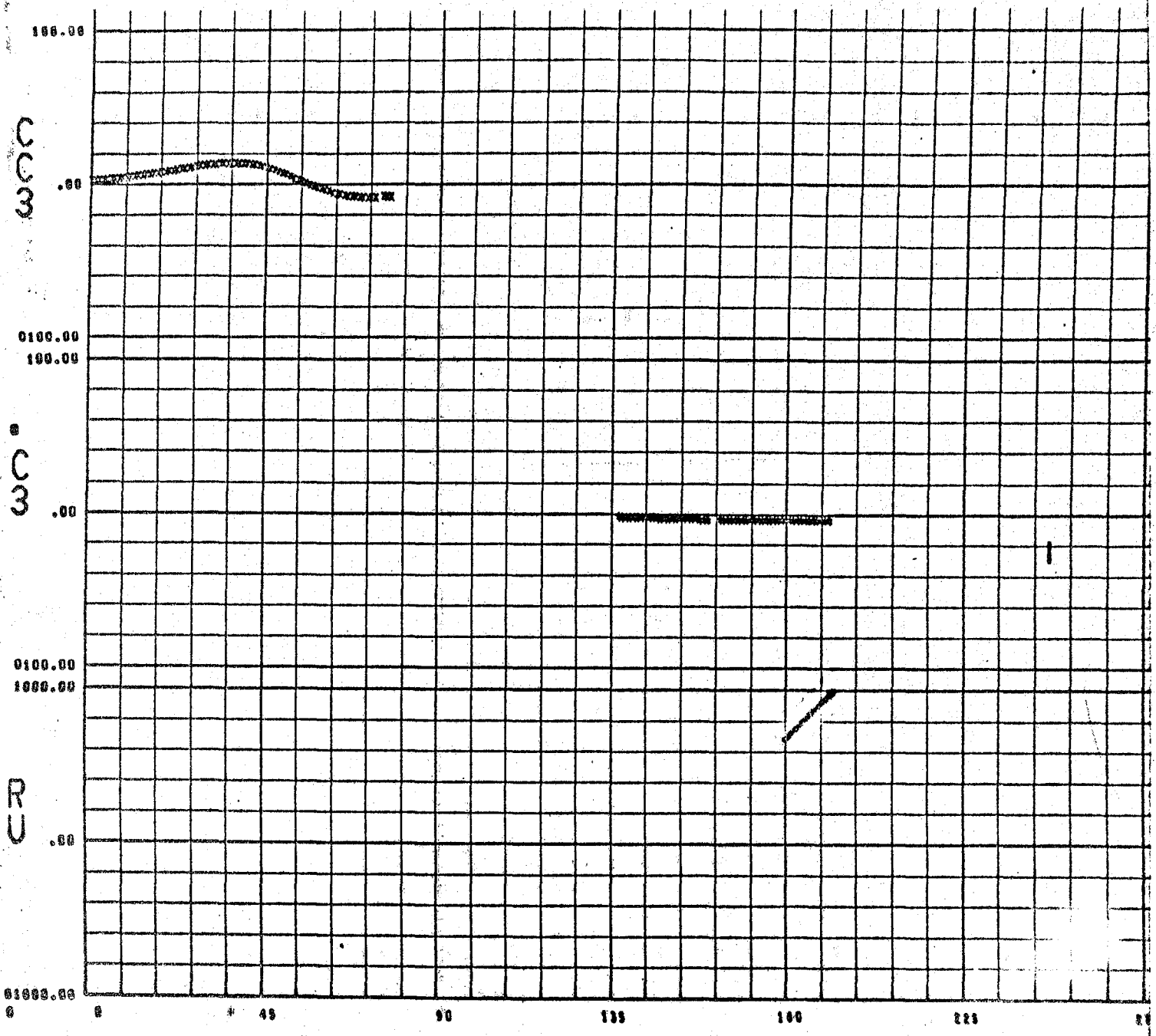

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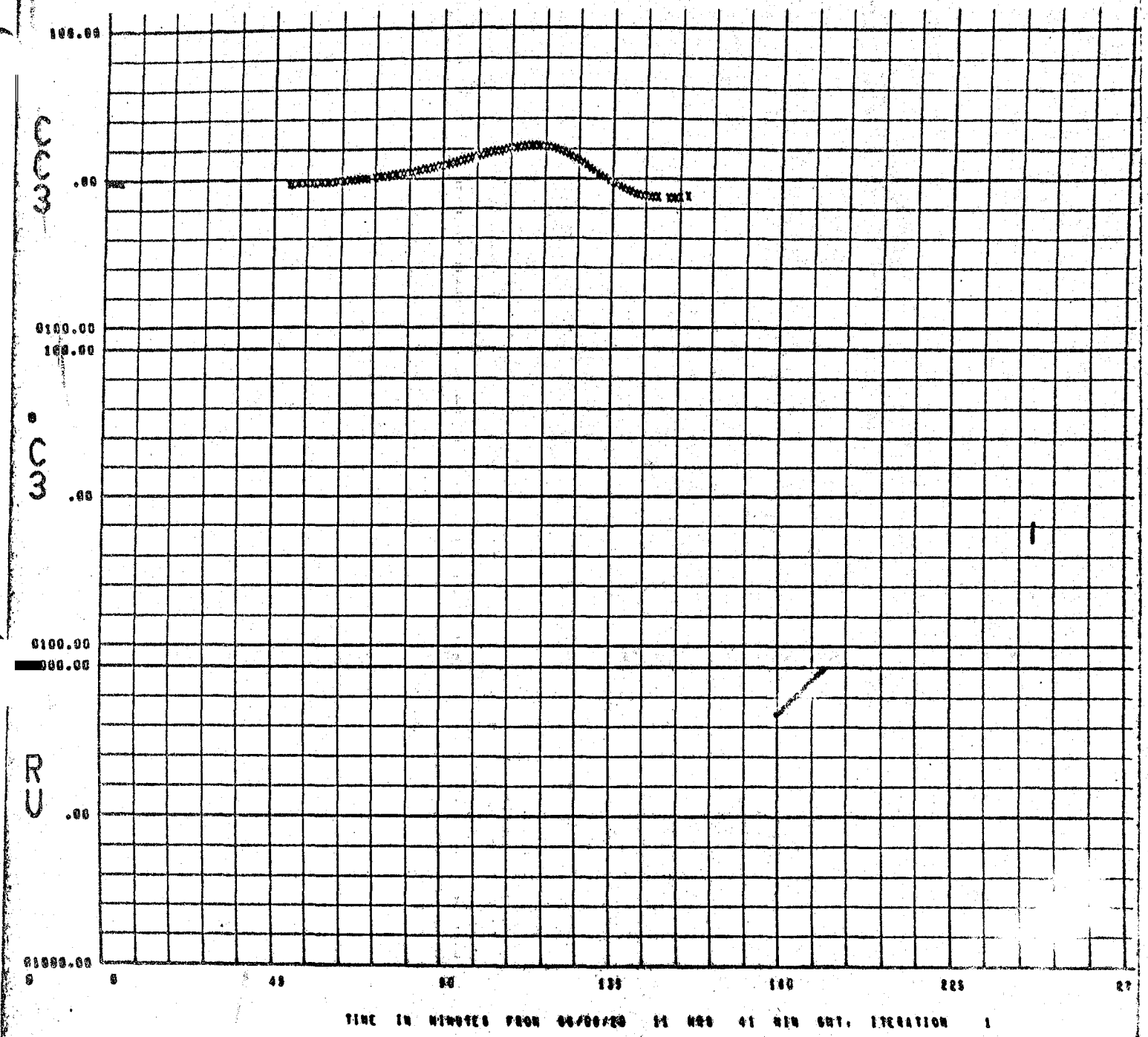

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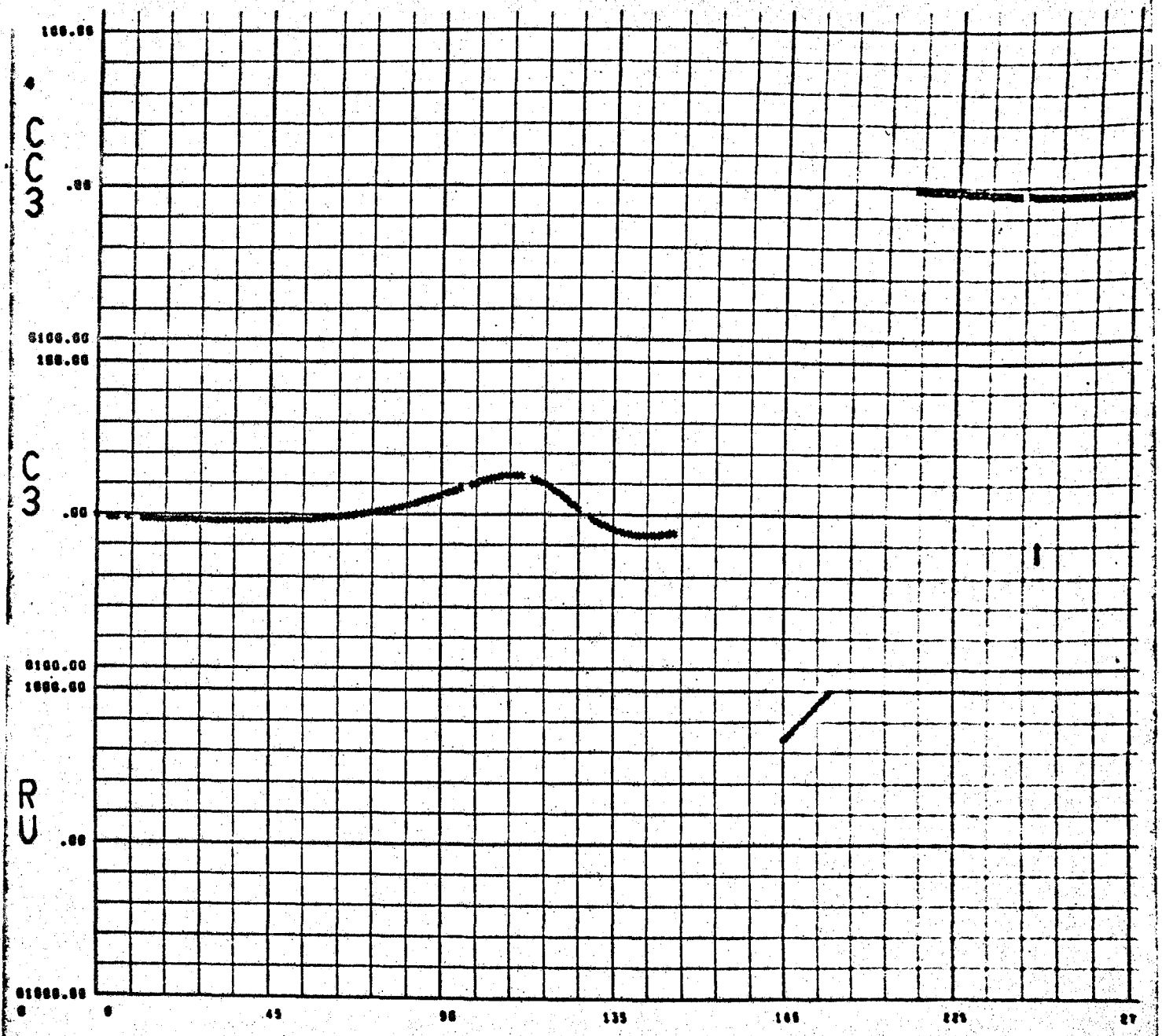

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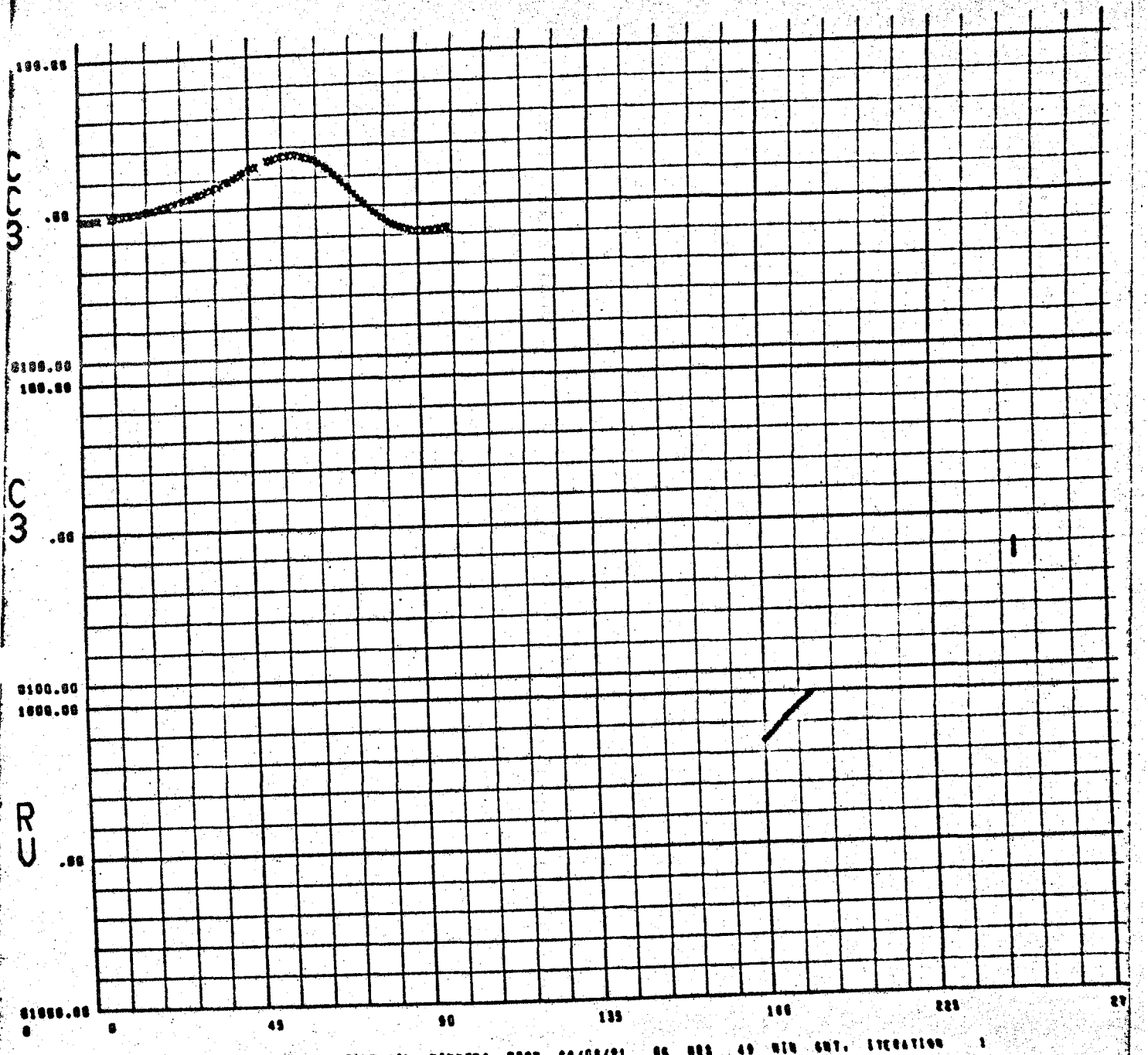

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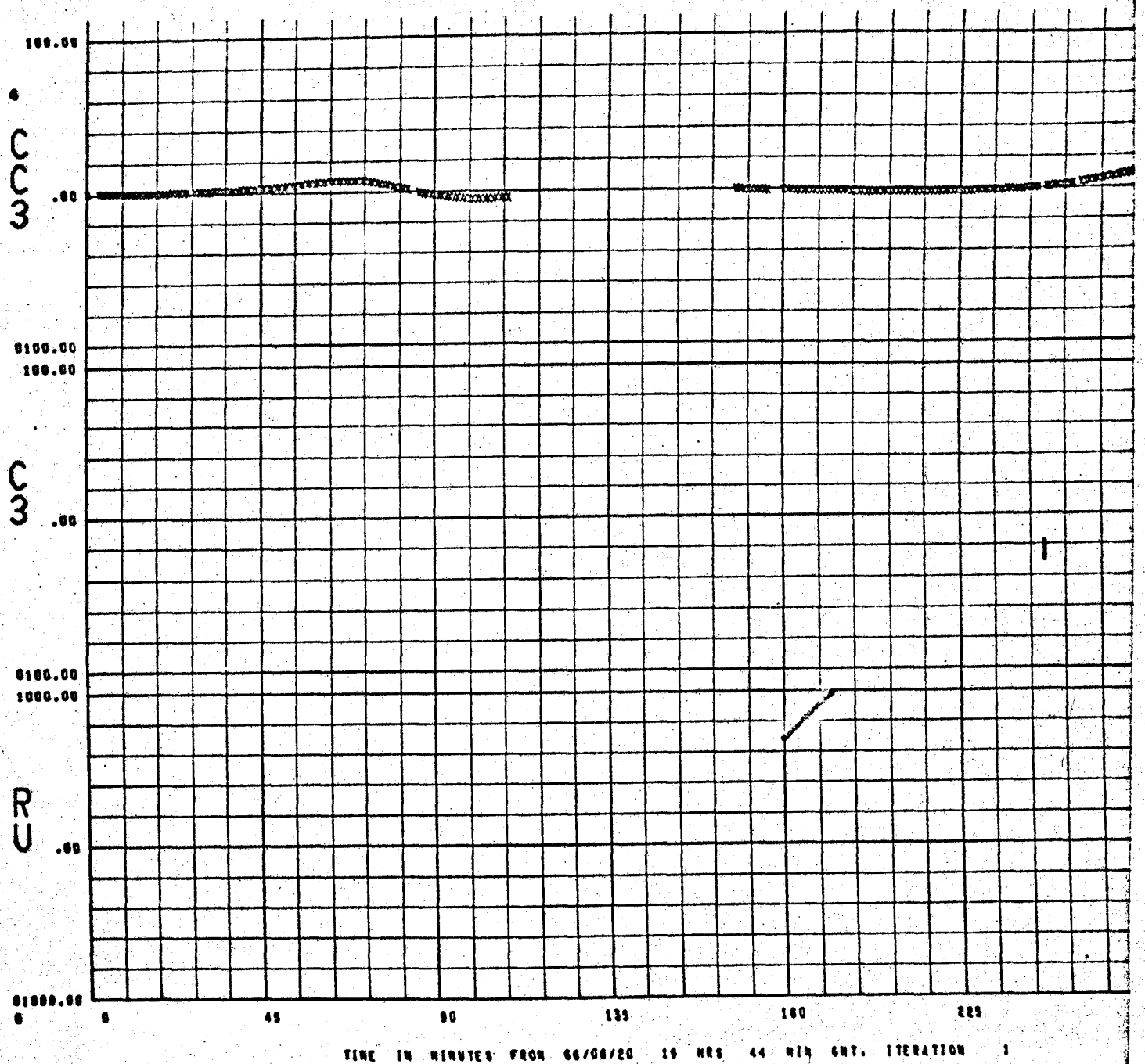

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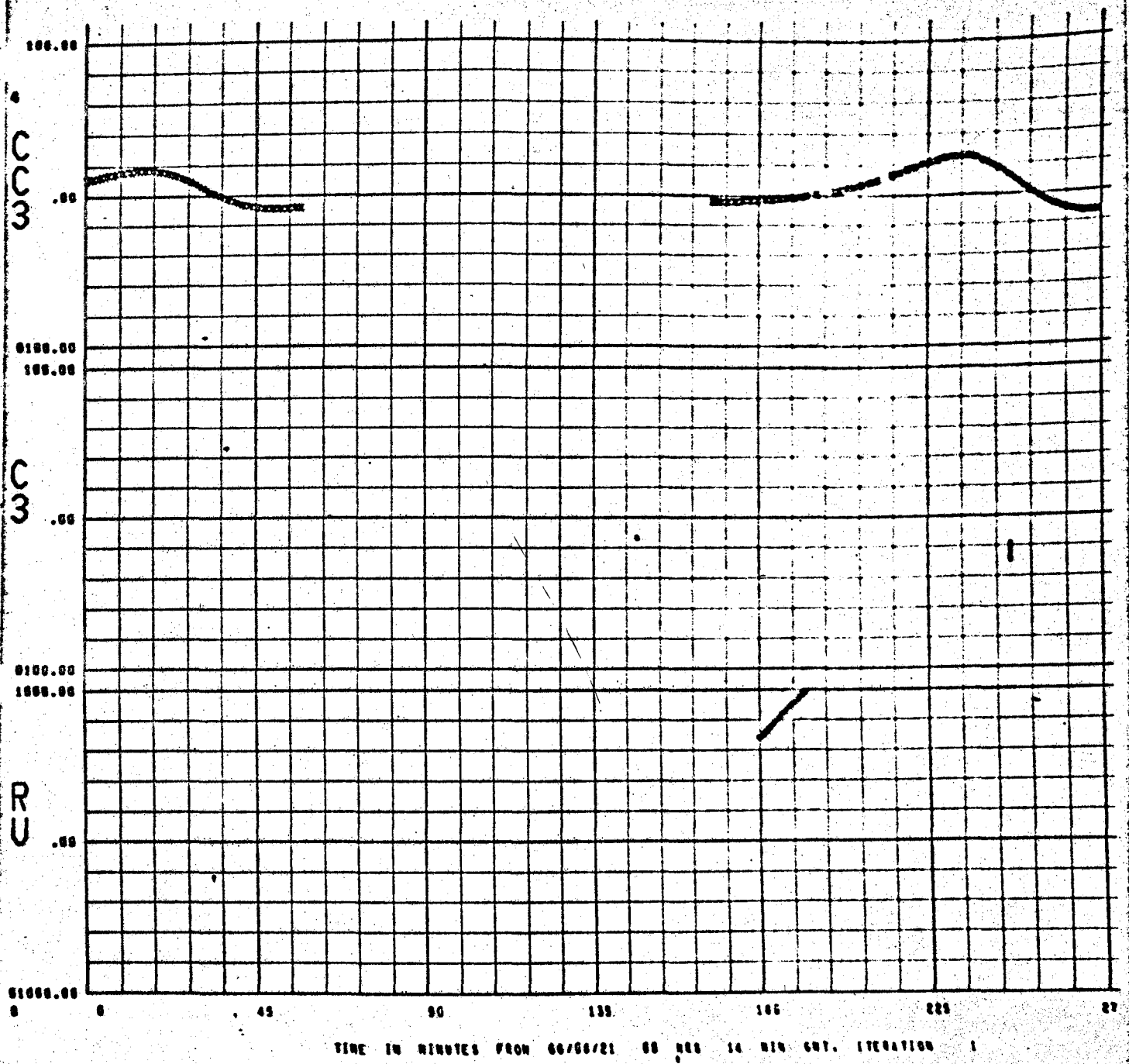

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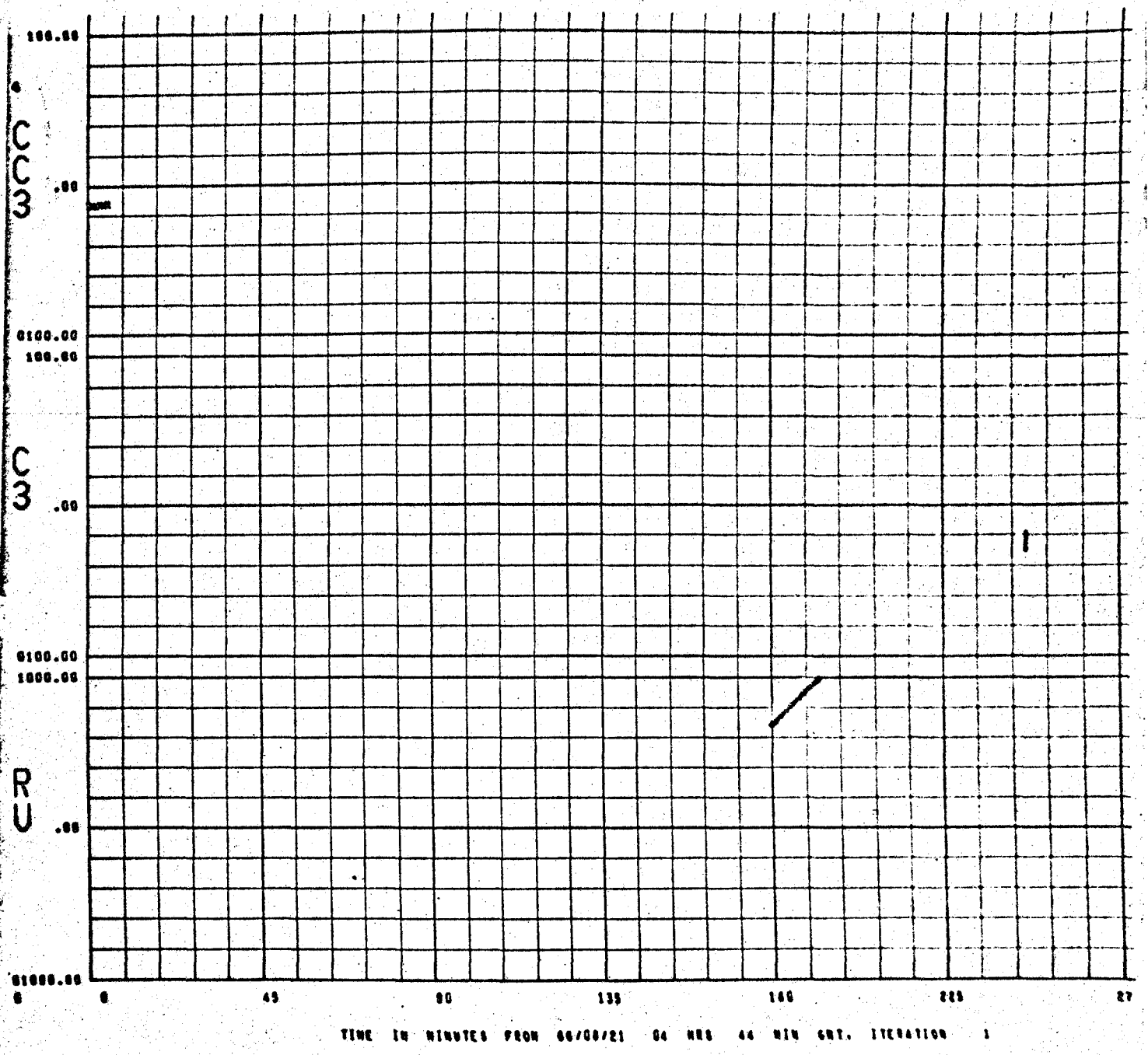

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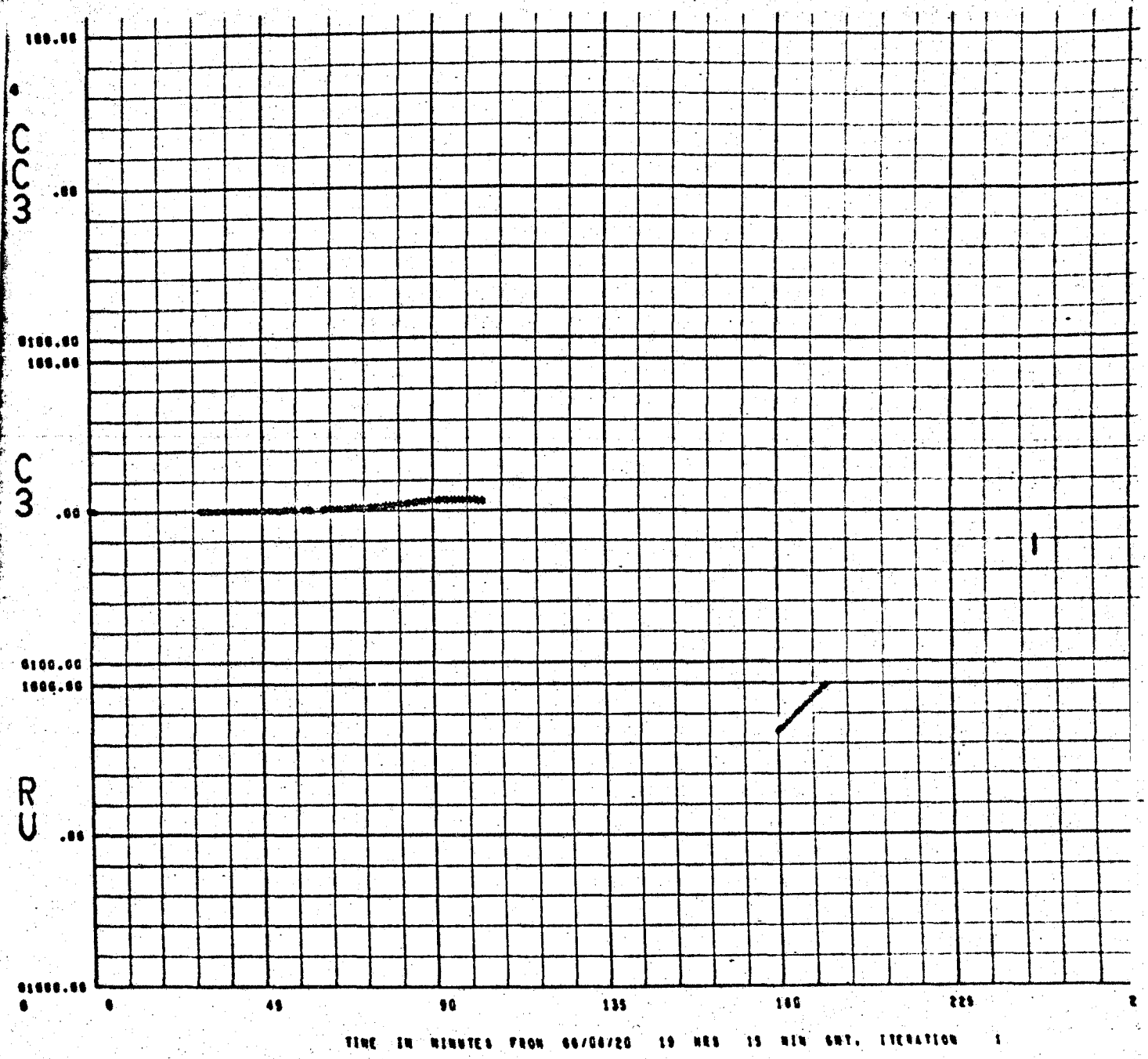

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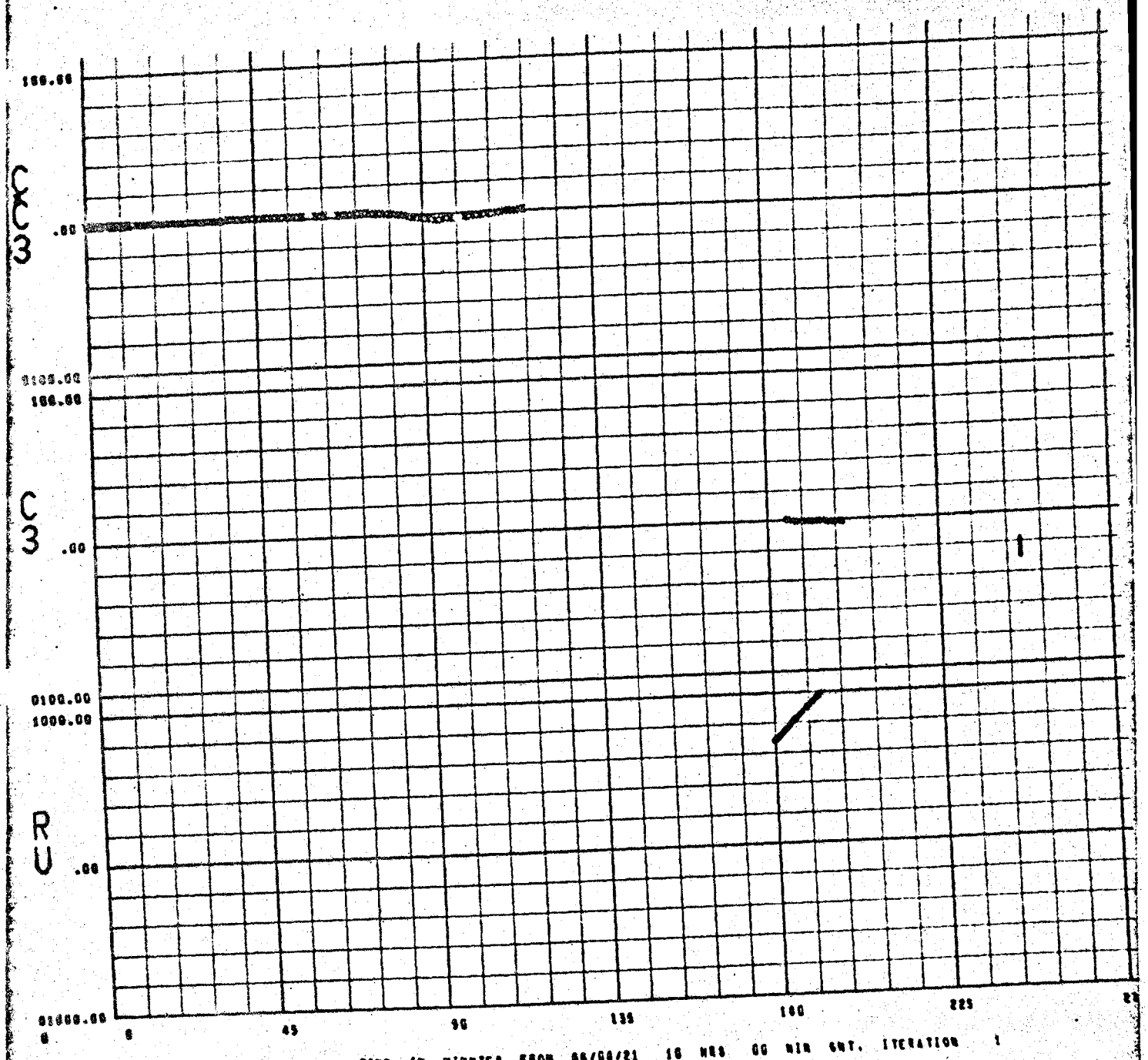

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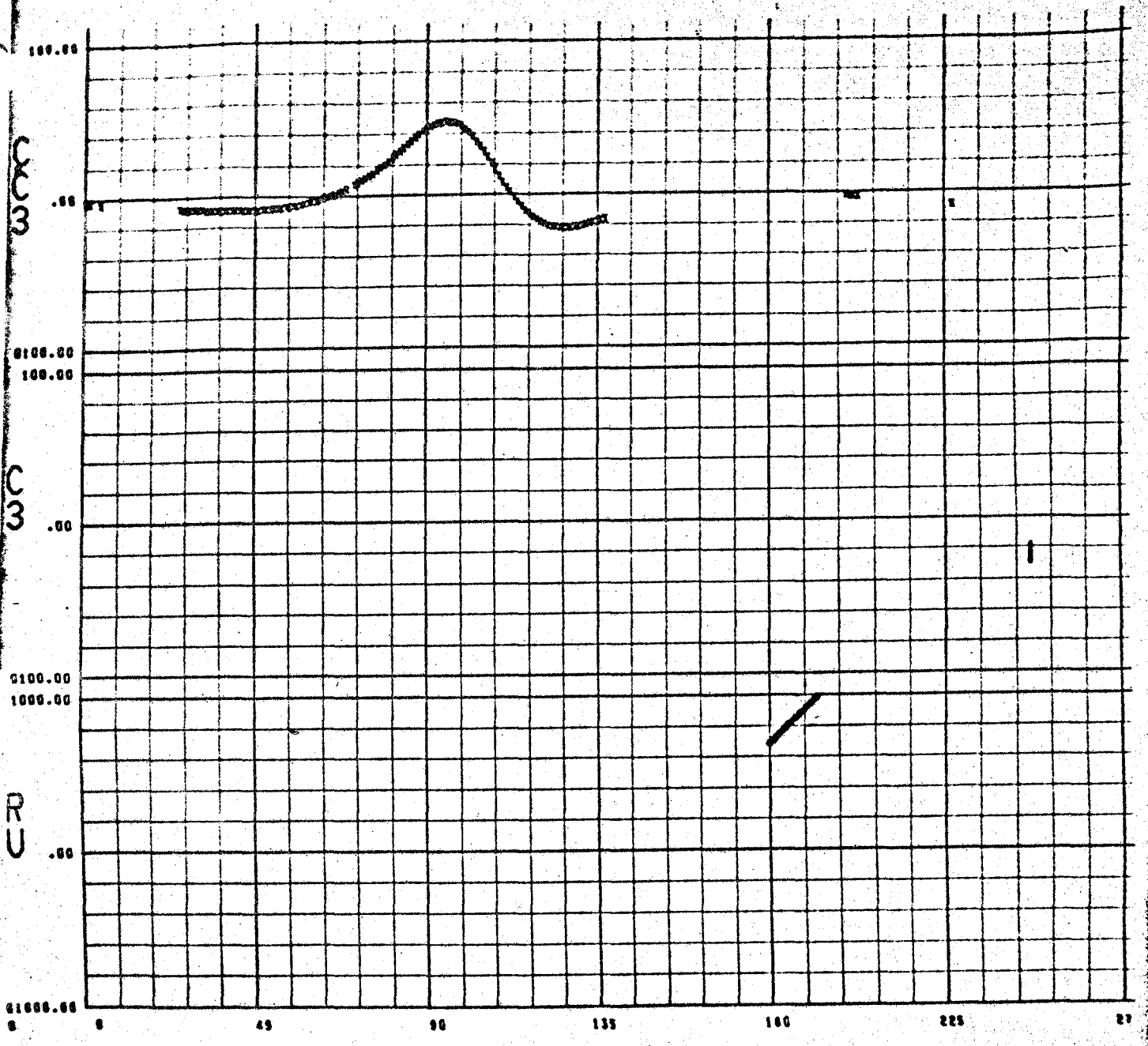

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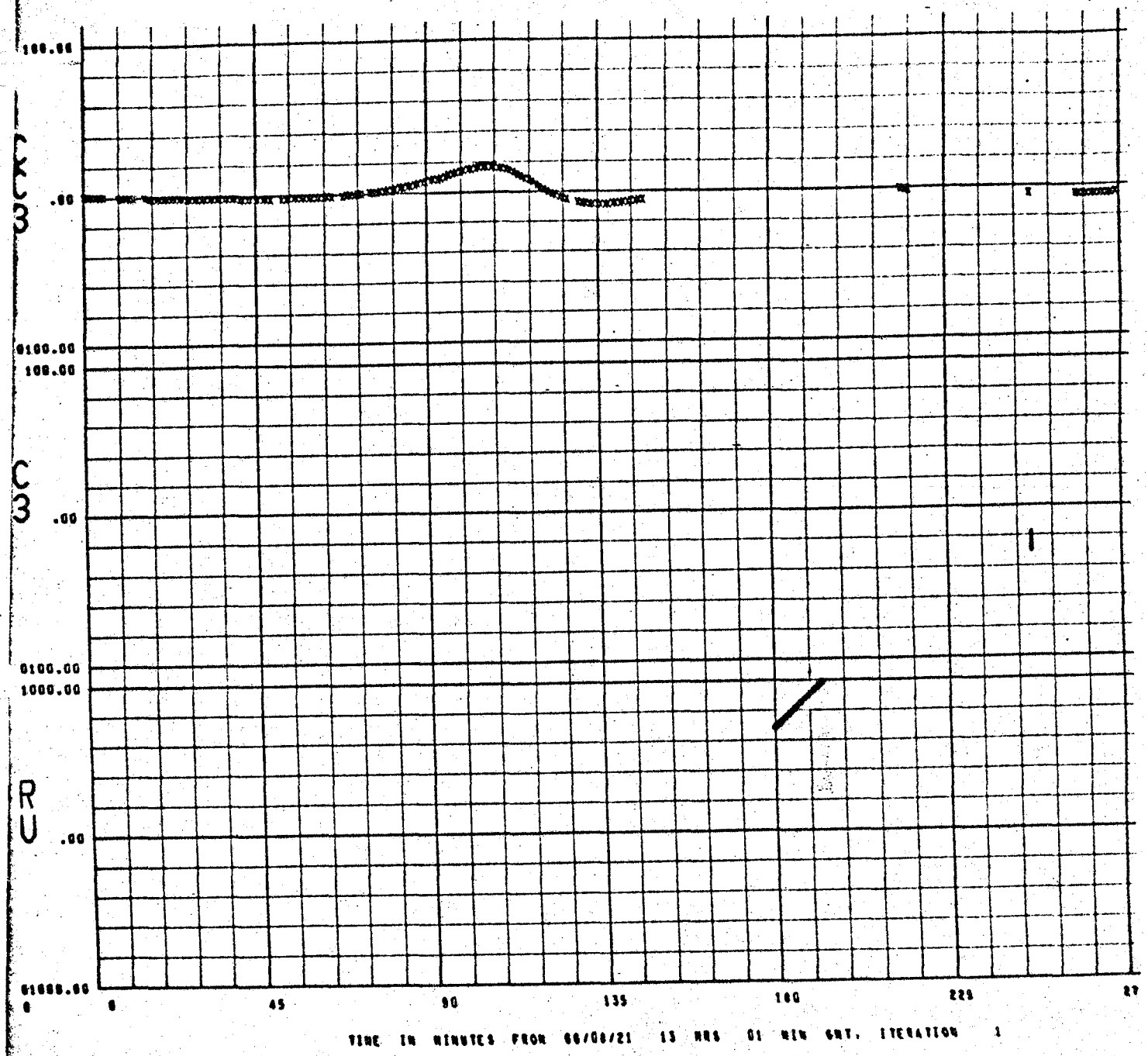

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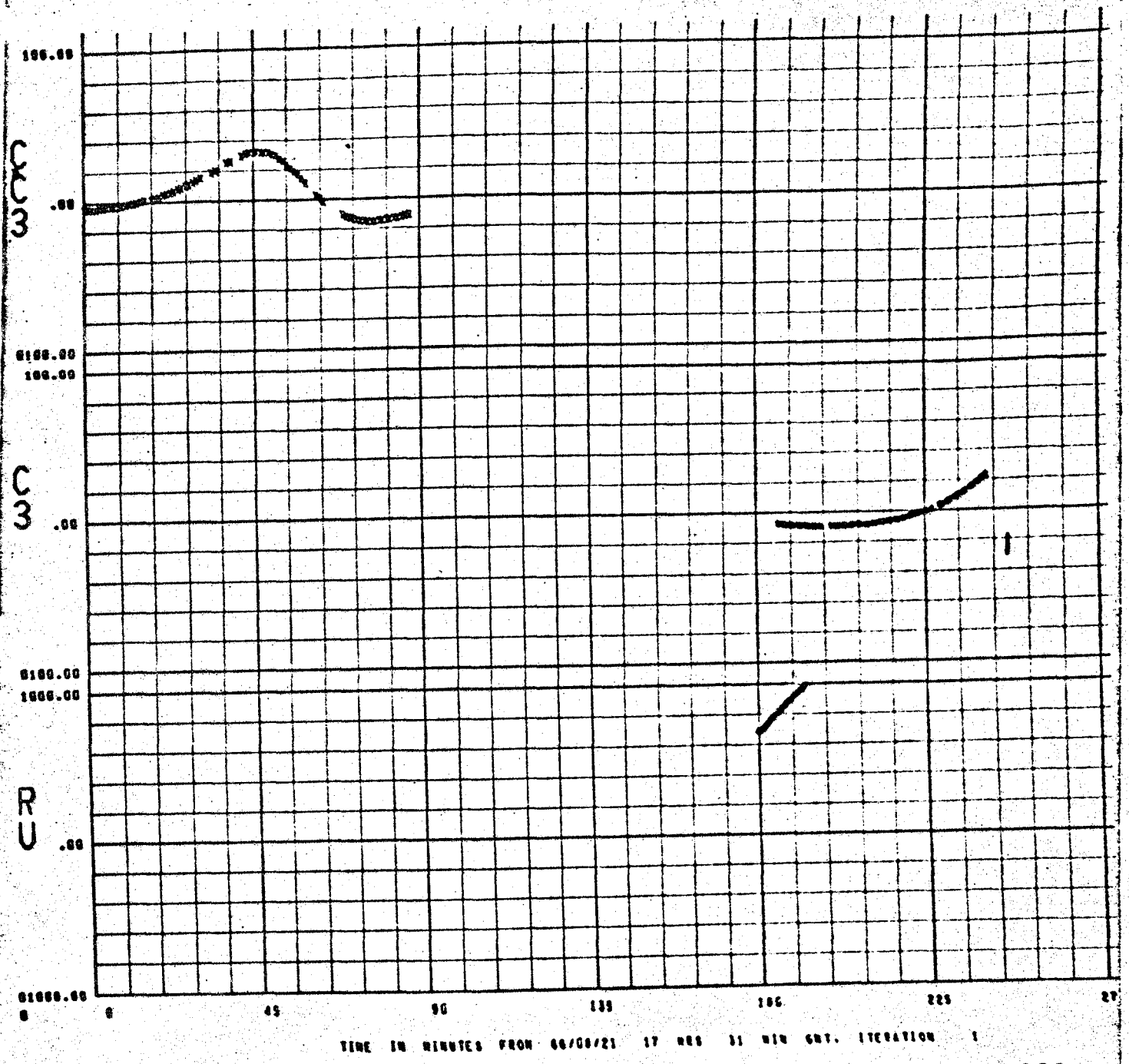

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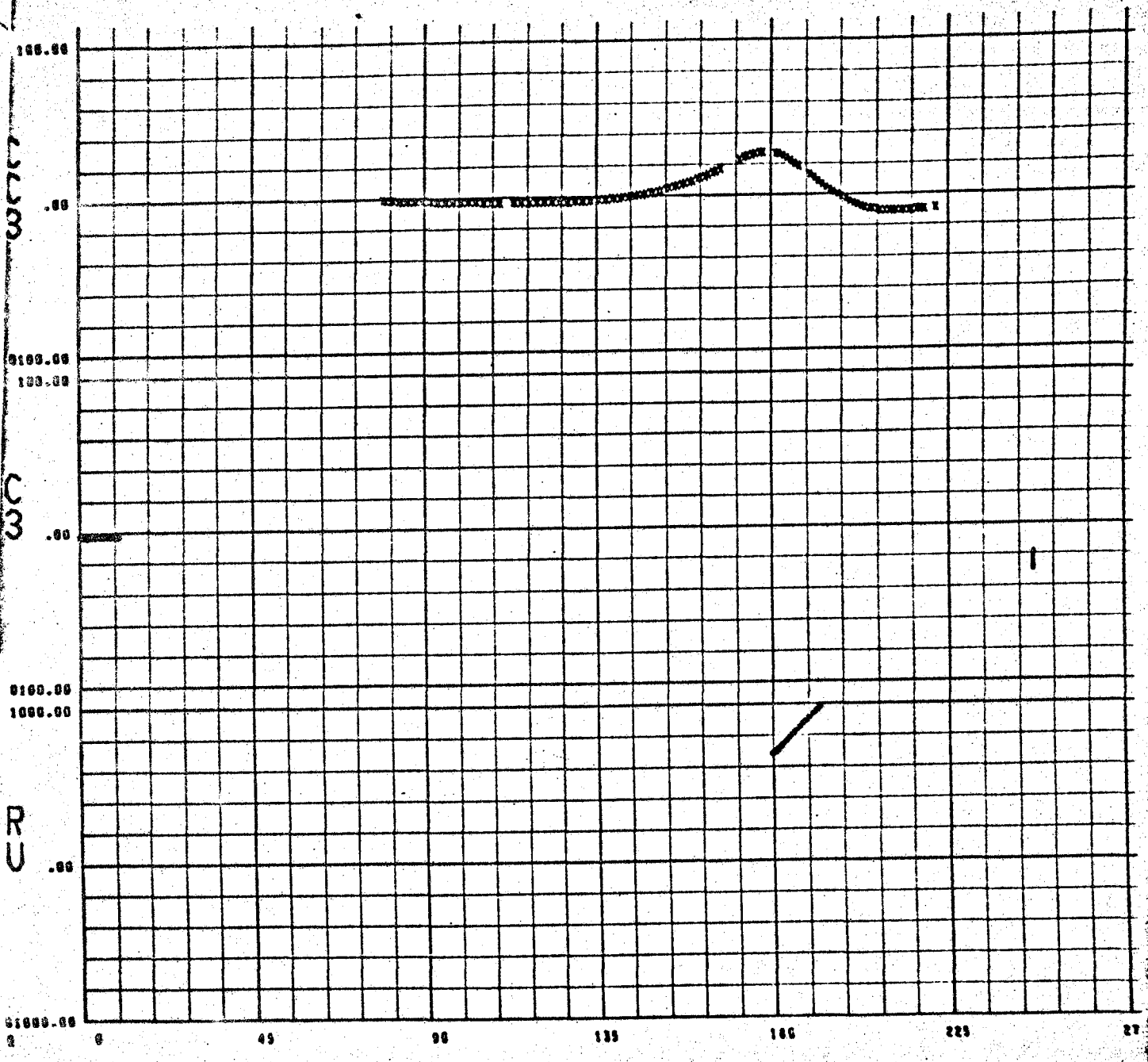

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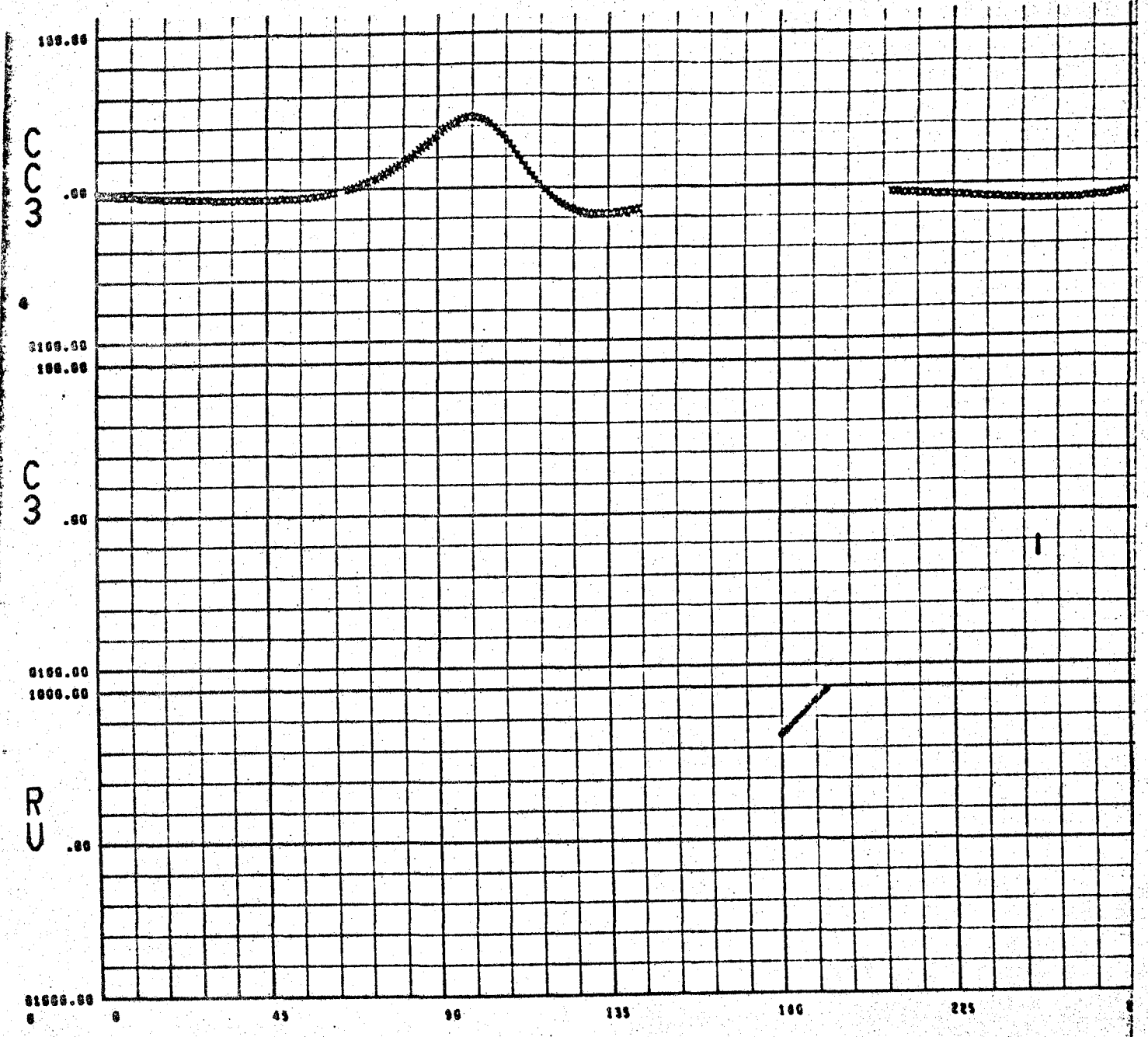

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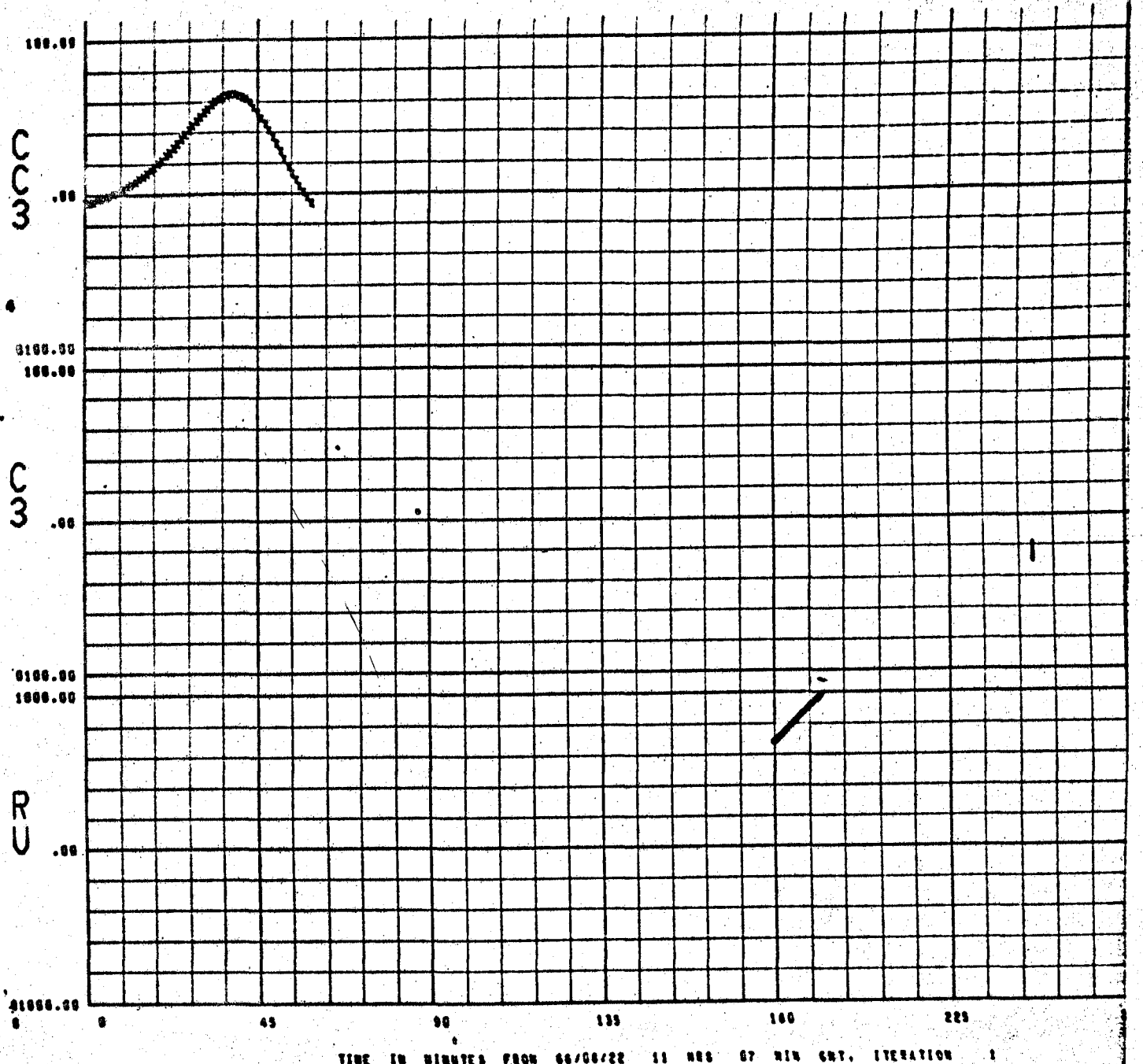

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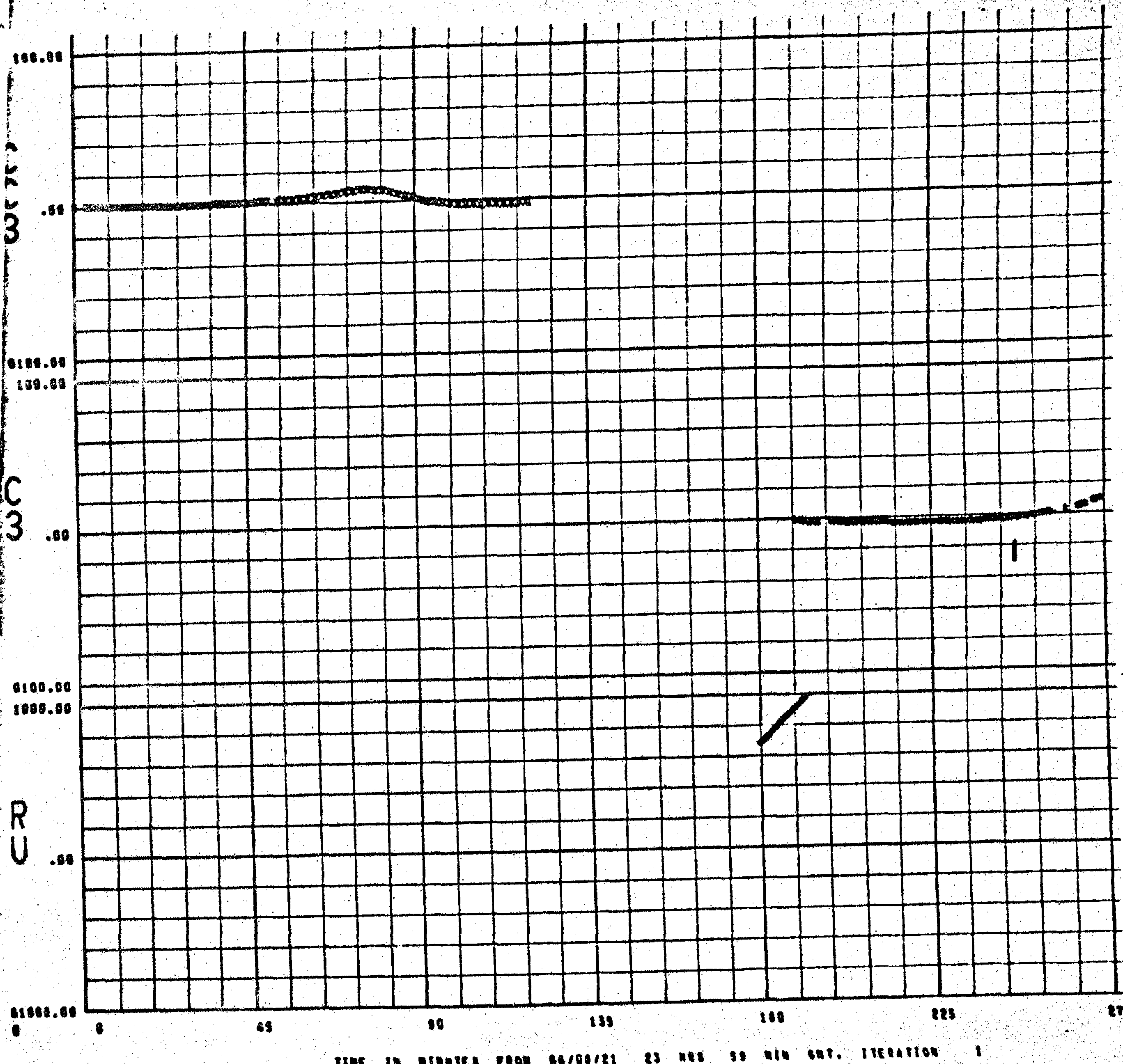

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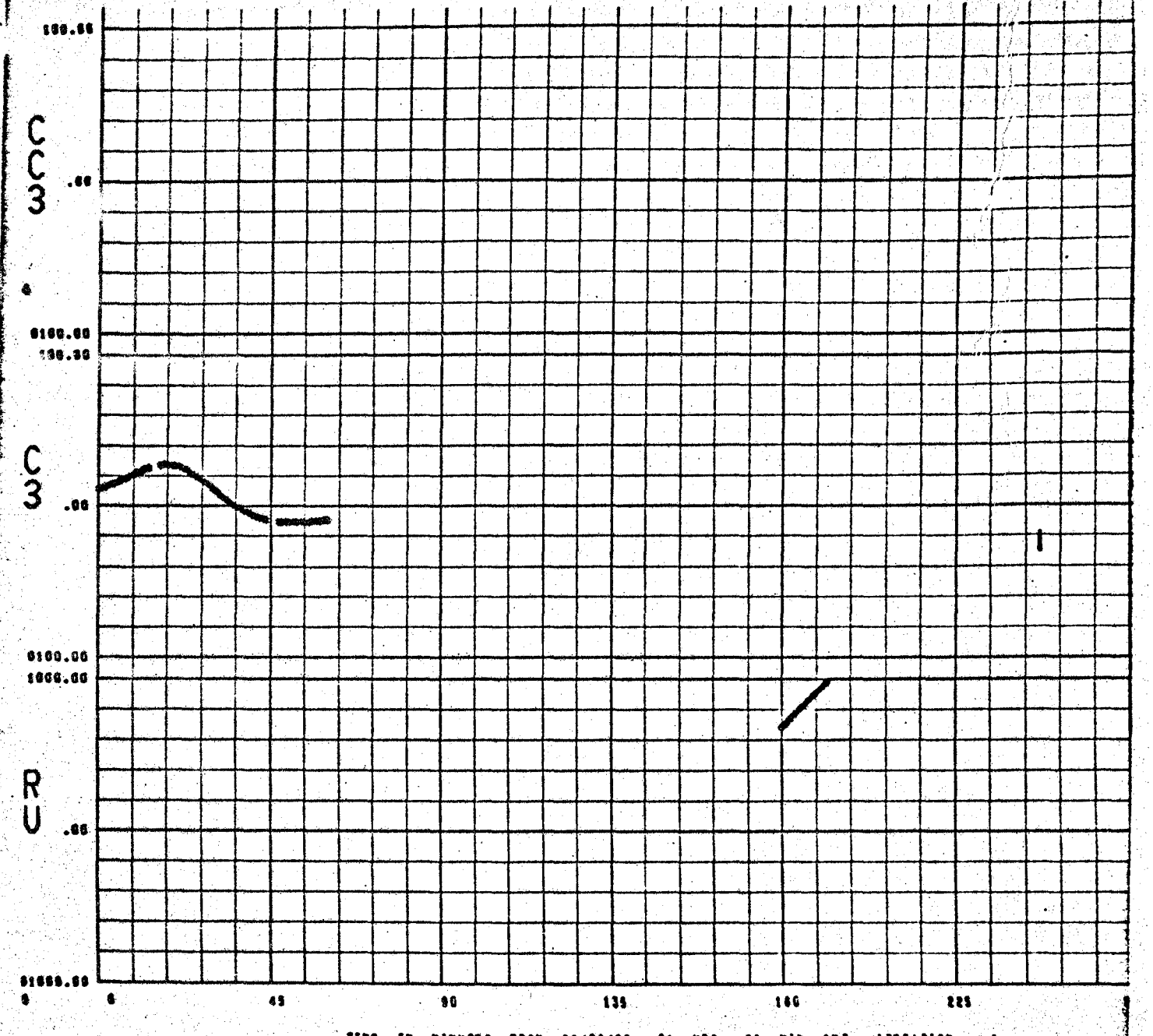

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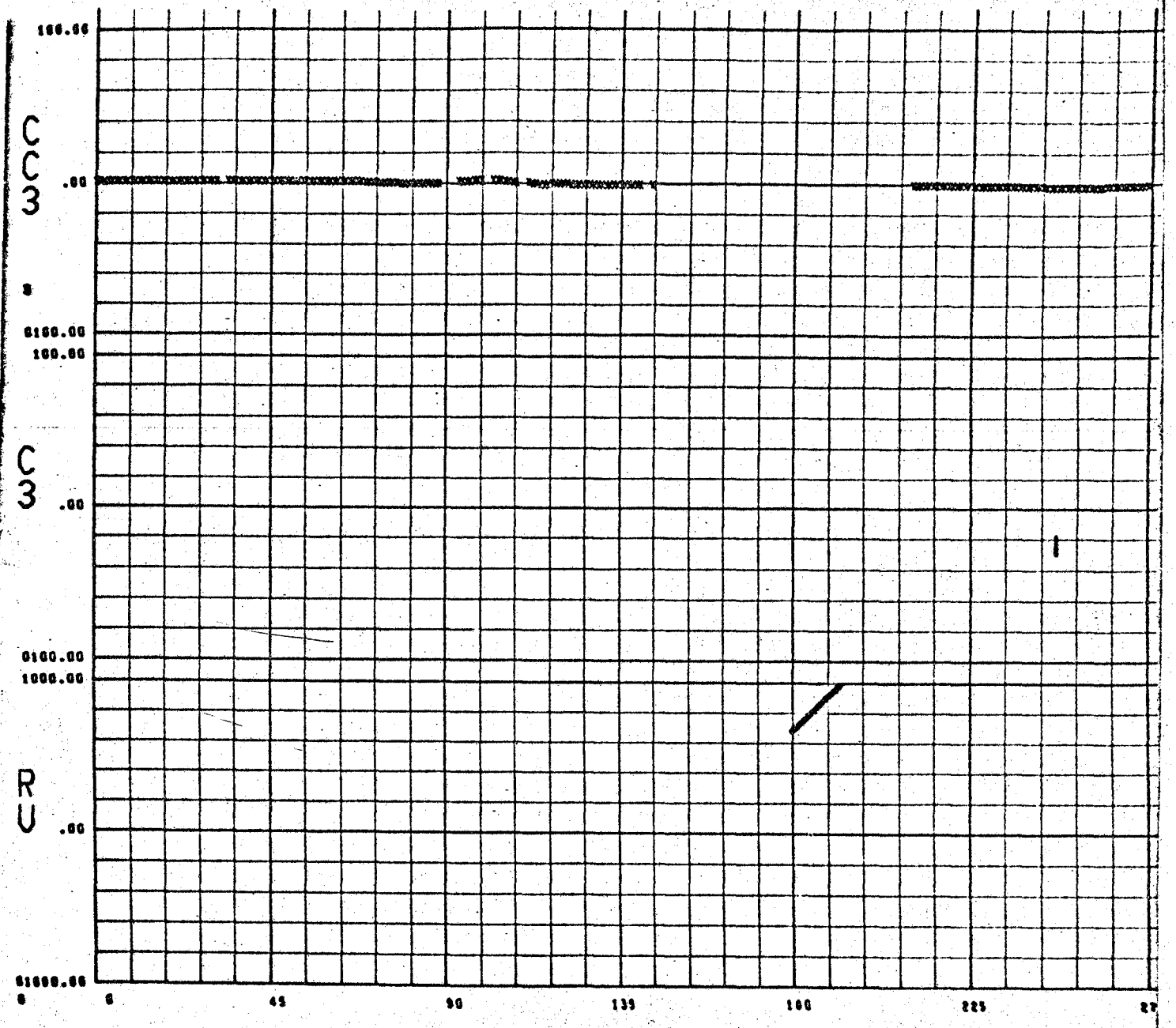
SIMPLE MOON



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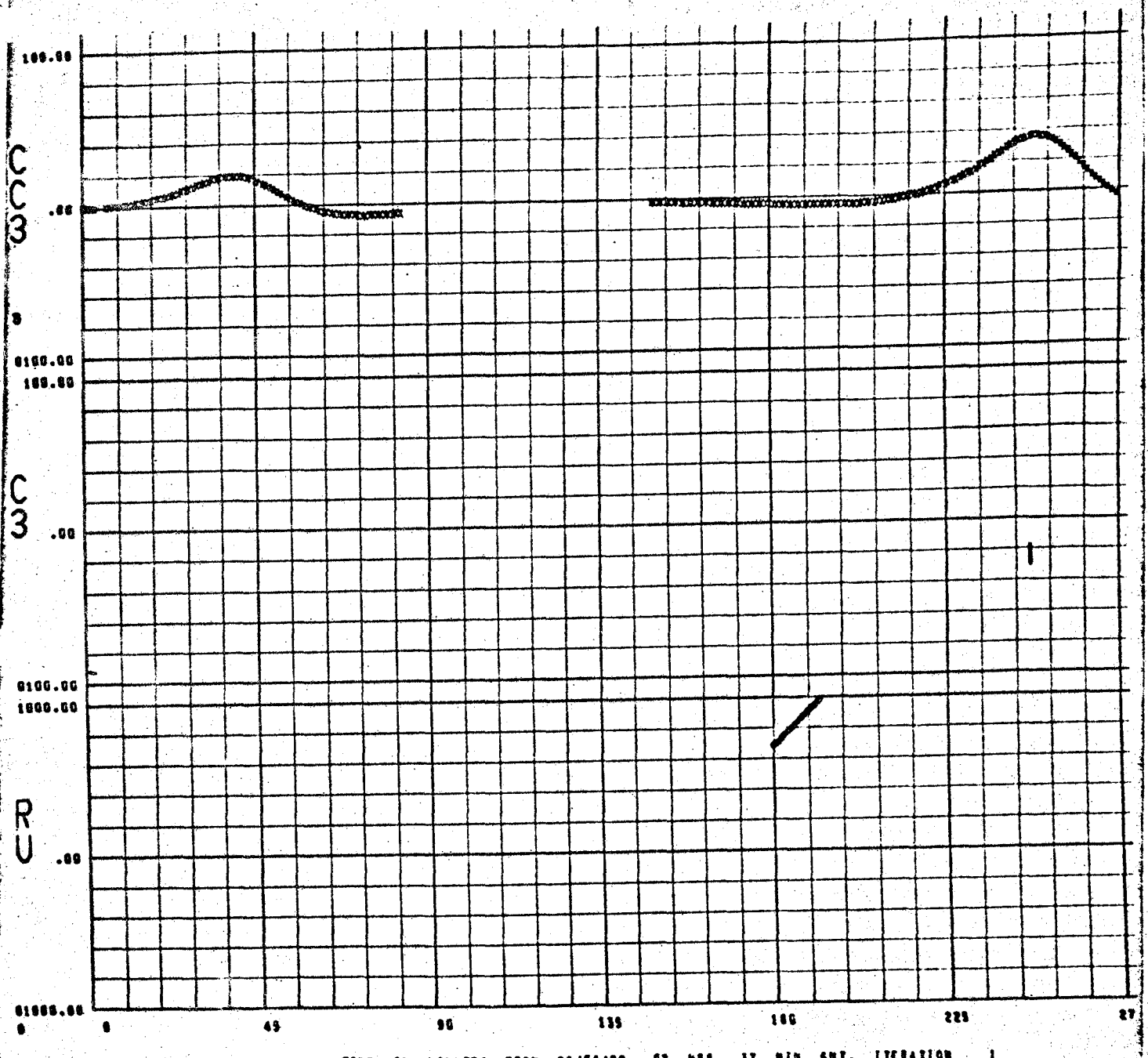
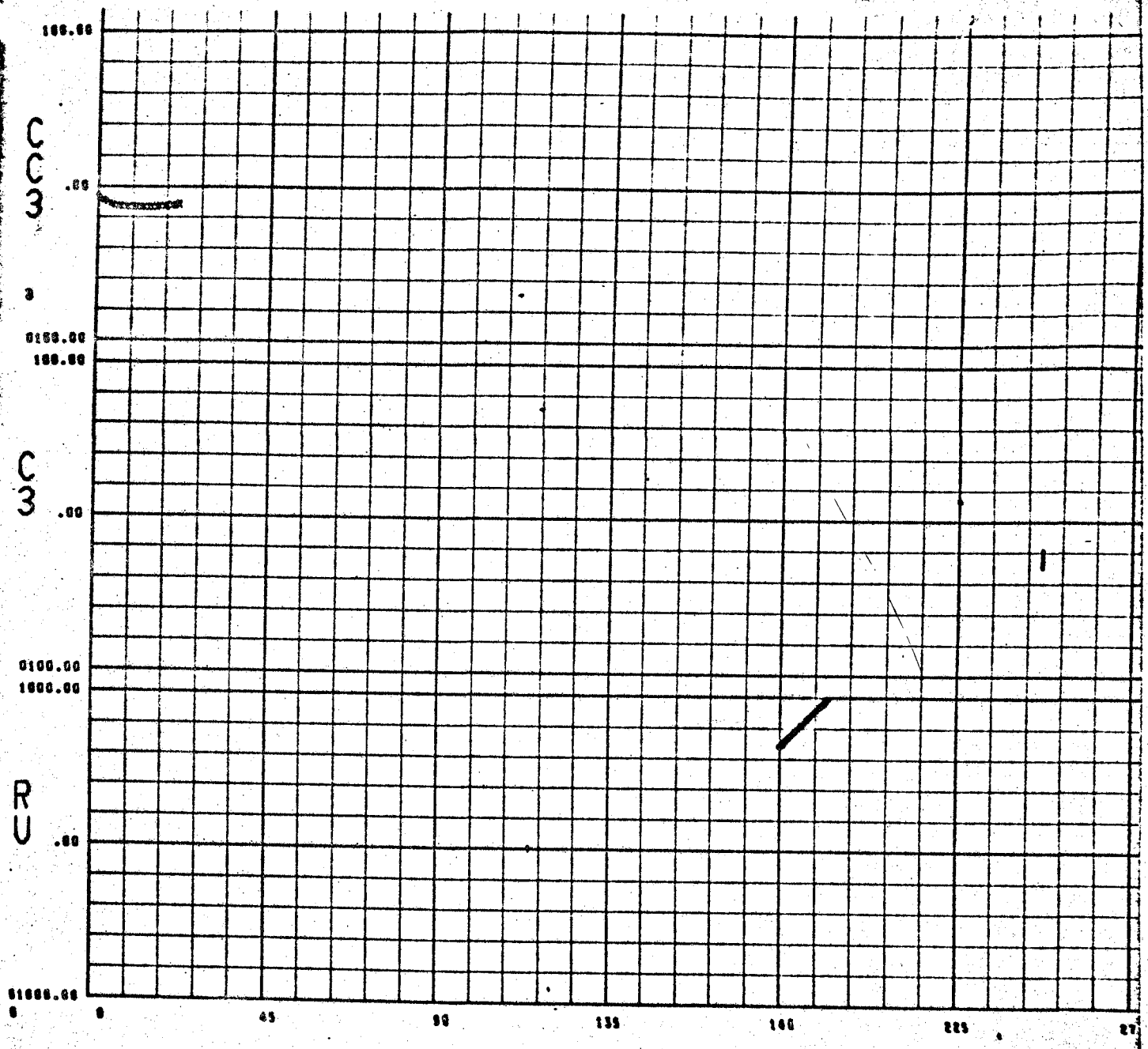
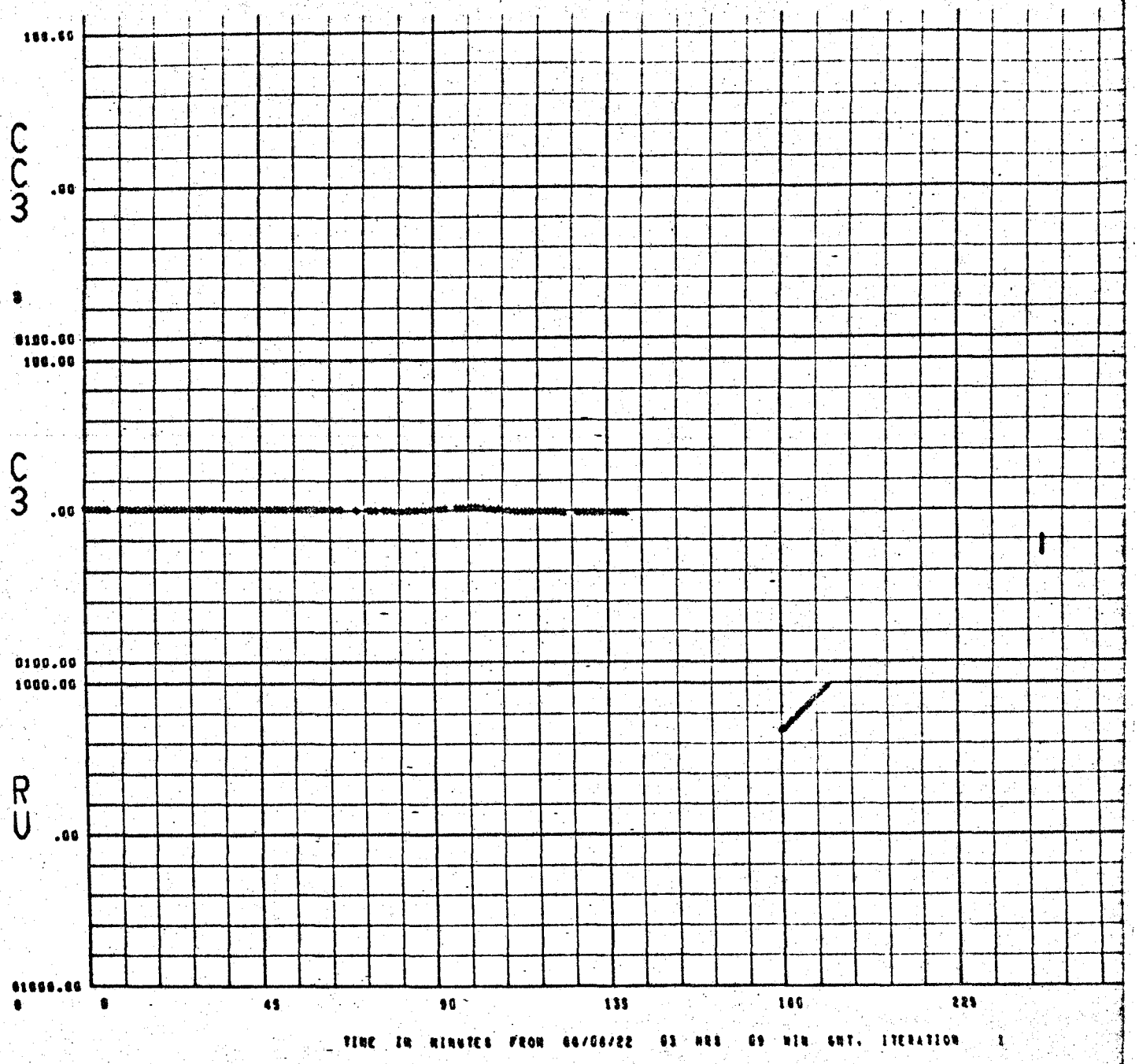


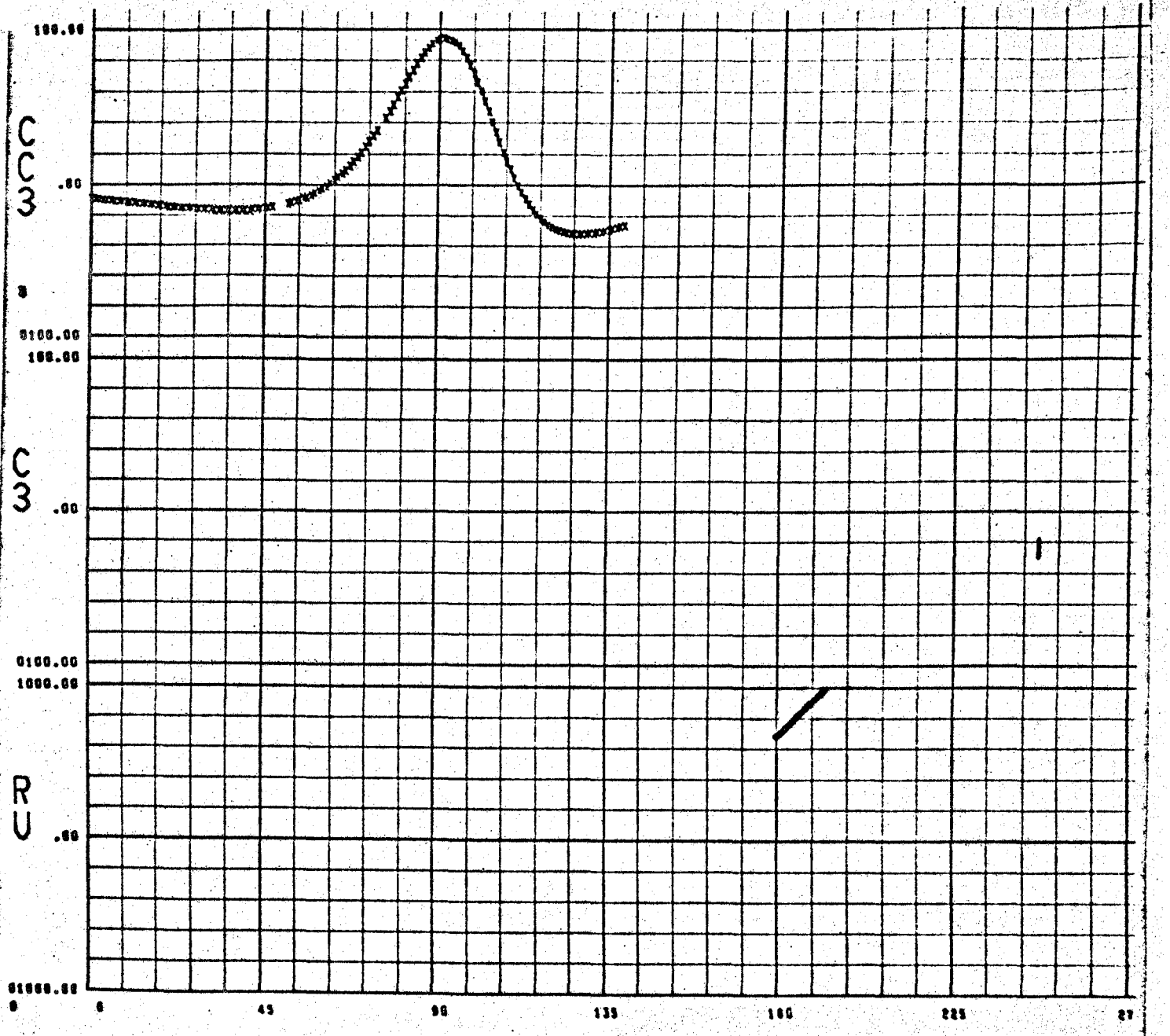
STATION 41 RESIDUALS PASS NUMBER 12/234



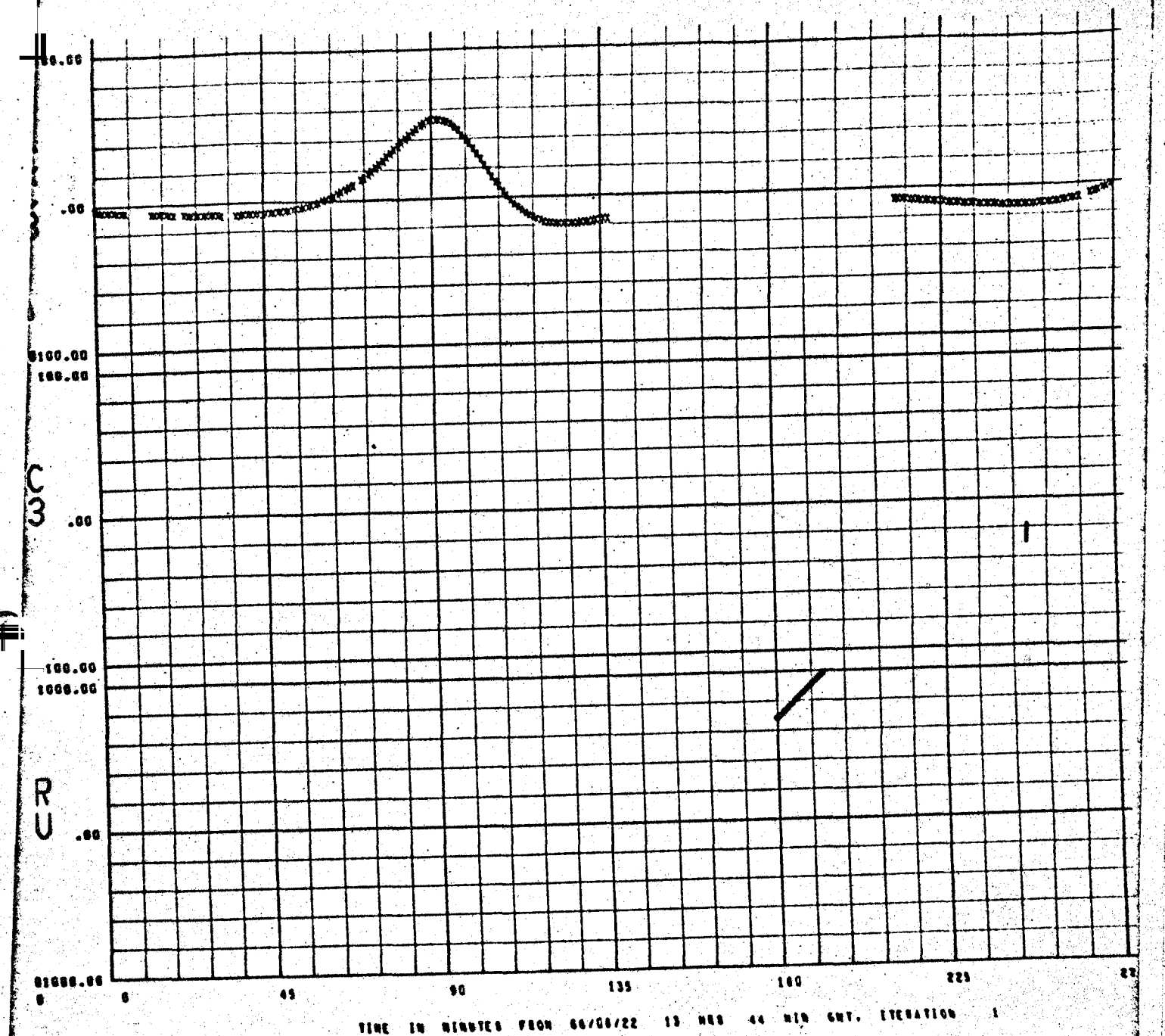
STATION 41 RESIDUALS PASS NUMBER 12/234



STATION 12 RESIDUALS PASS NUMBER 11/233

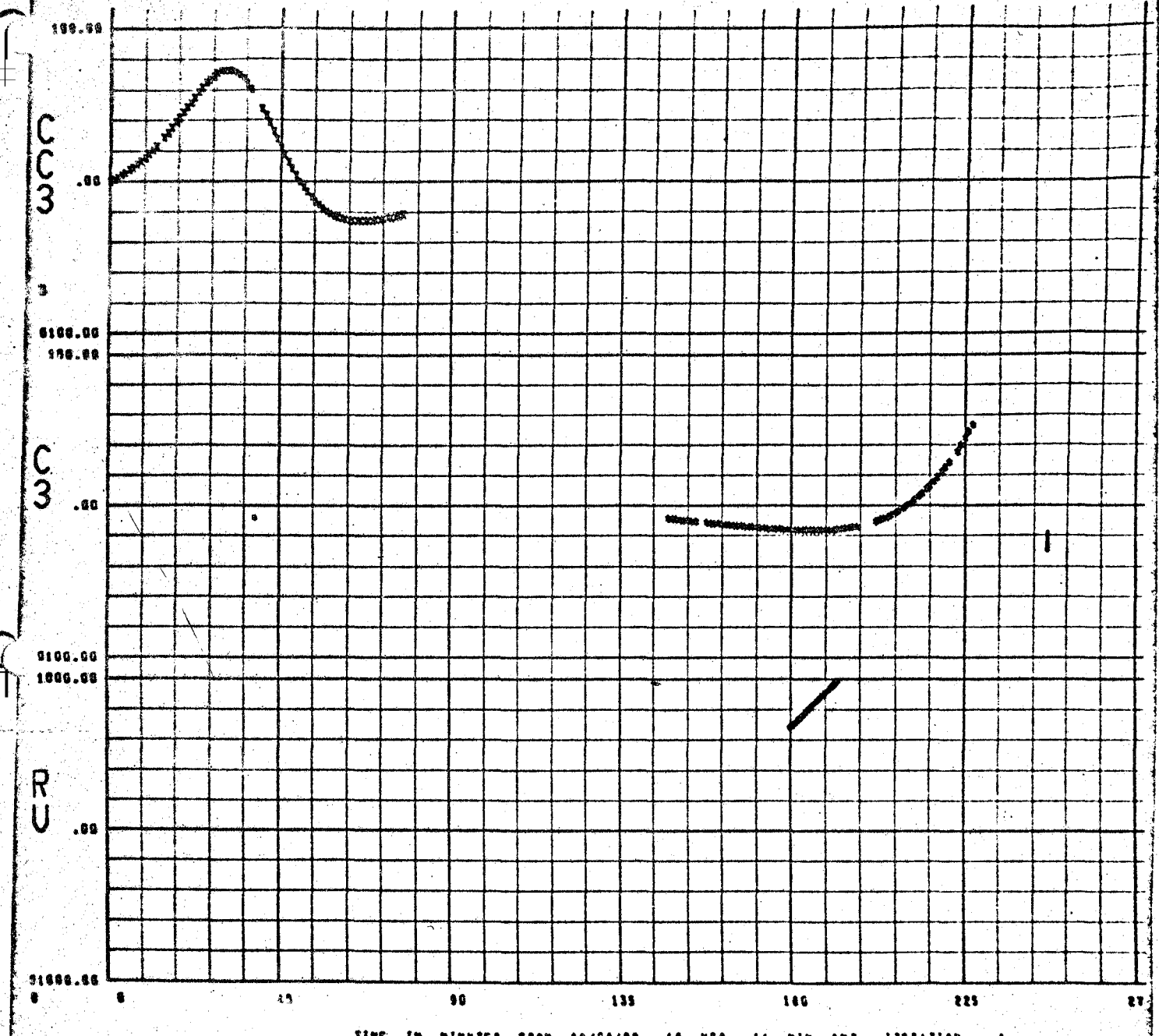


STATION 12 RESIDUALS PASS NUMBER 12/234



STATION 61 RESIDUALS

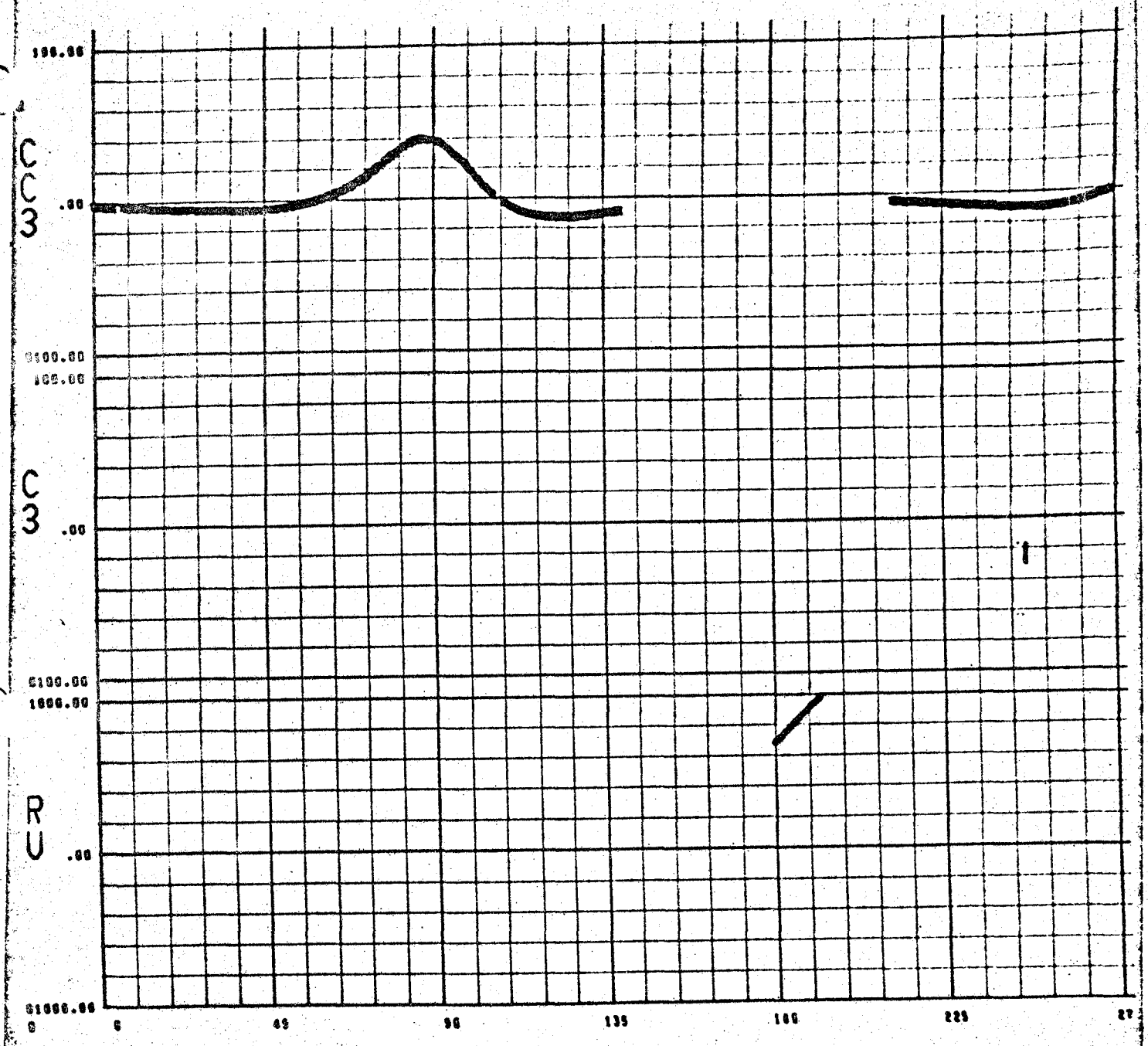
PASS NUMBER 12/234



STATION 61 RESIDUALS PASS NUMBER 12/234

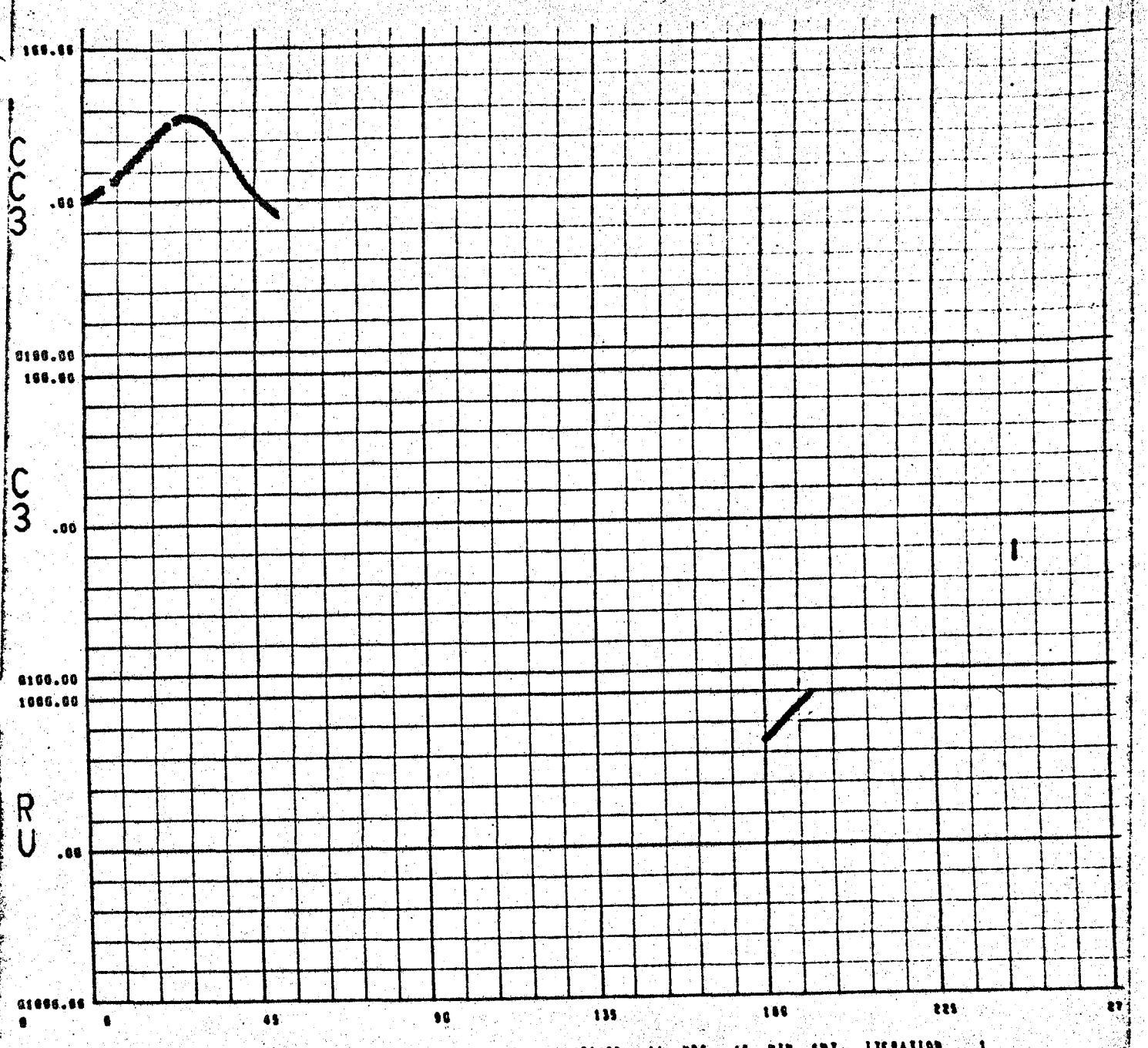
ODPL 1F84

SIMPLE MOON

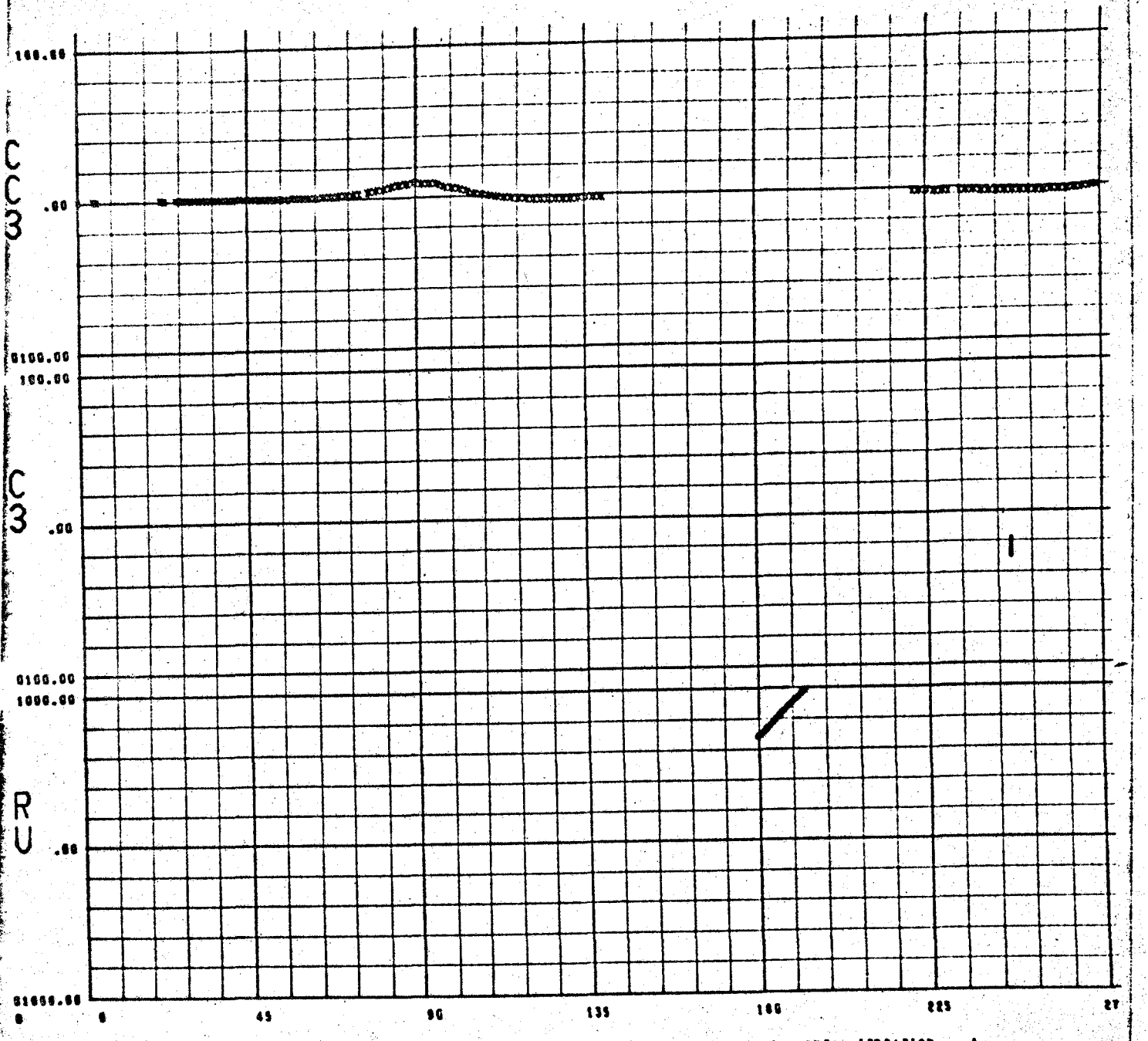


TIME IN MINUTES FROM 66/68/23 07 HRS 15 MIN GMT. ITERATION 1

STATION 41 RESIDUALS PASS NUMBER 13/235

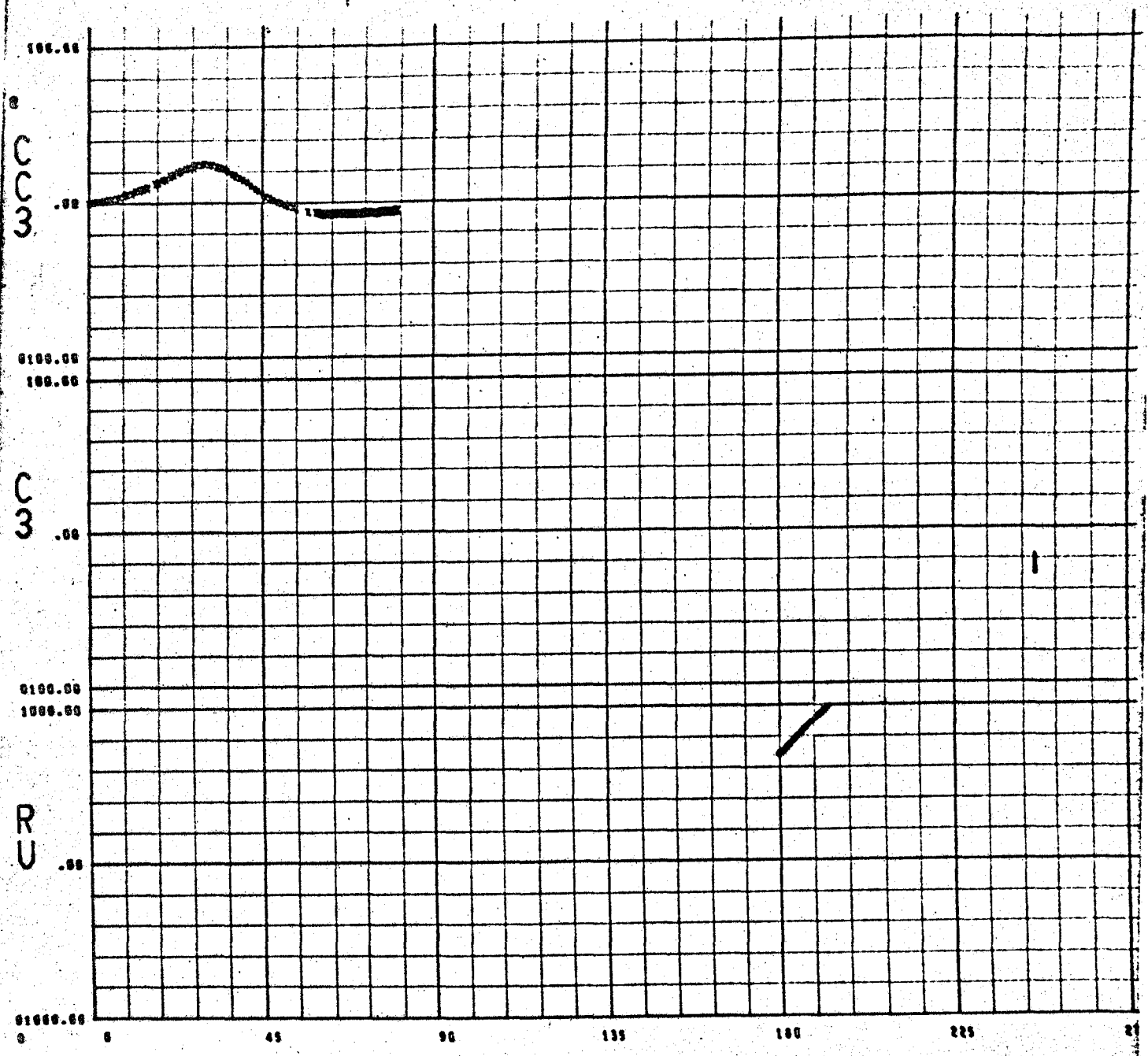


STATION 41 RESIDUALS PASS NUMBER 13/235



TIME IN MINUTES FROM 00/00/23 00 HRS 13 MIN GMT. ITERATION 1

STATION 12 RESIDUALS PASS NUMBER 12/234

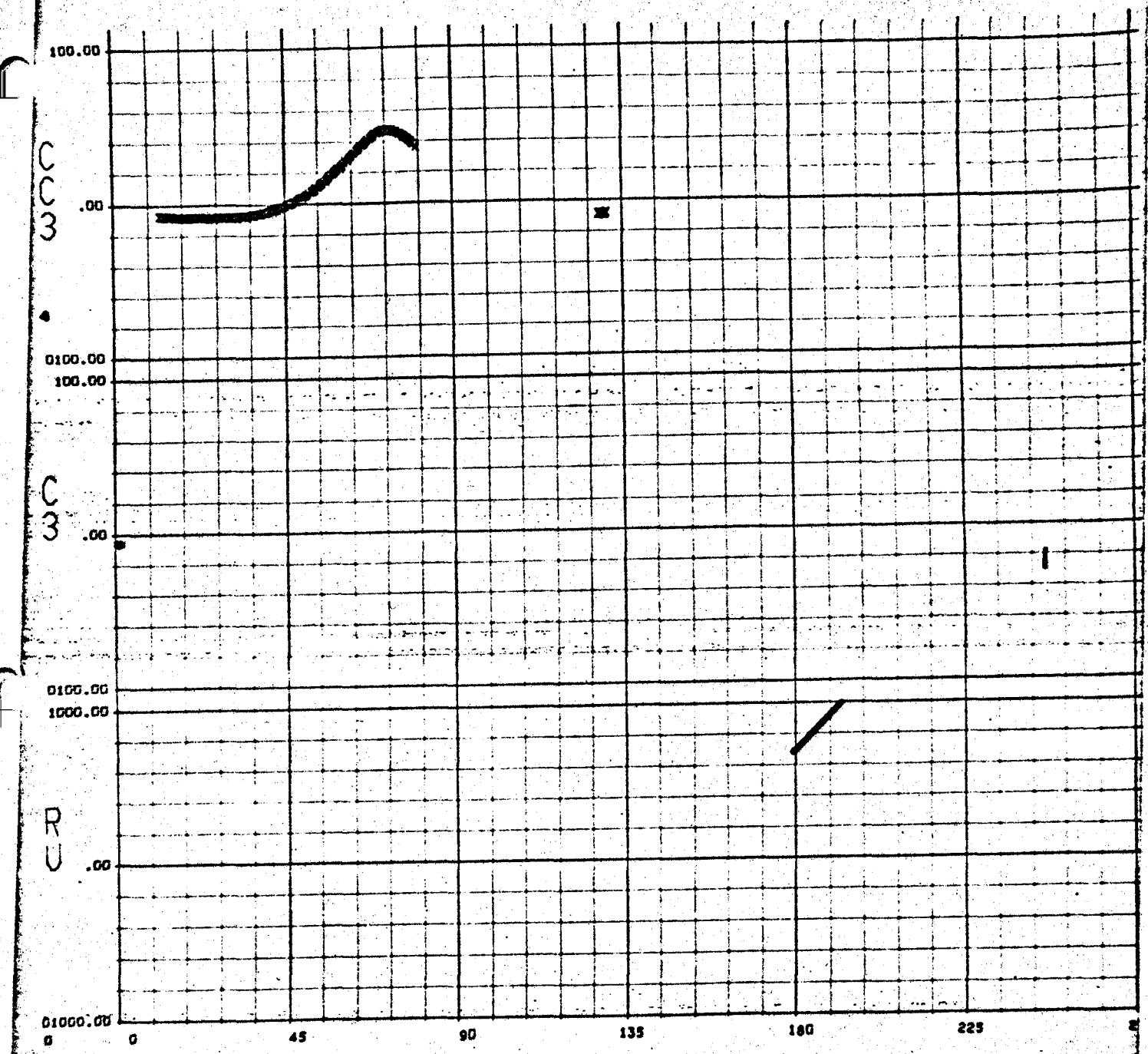


STATION 12 RESIDUALS PASS NUMBER 12/234

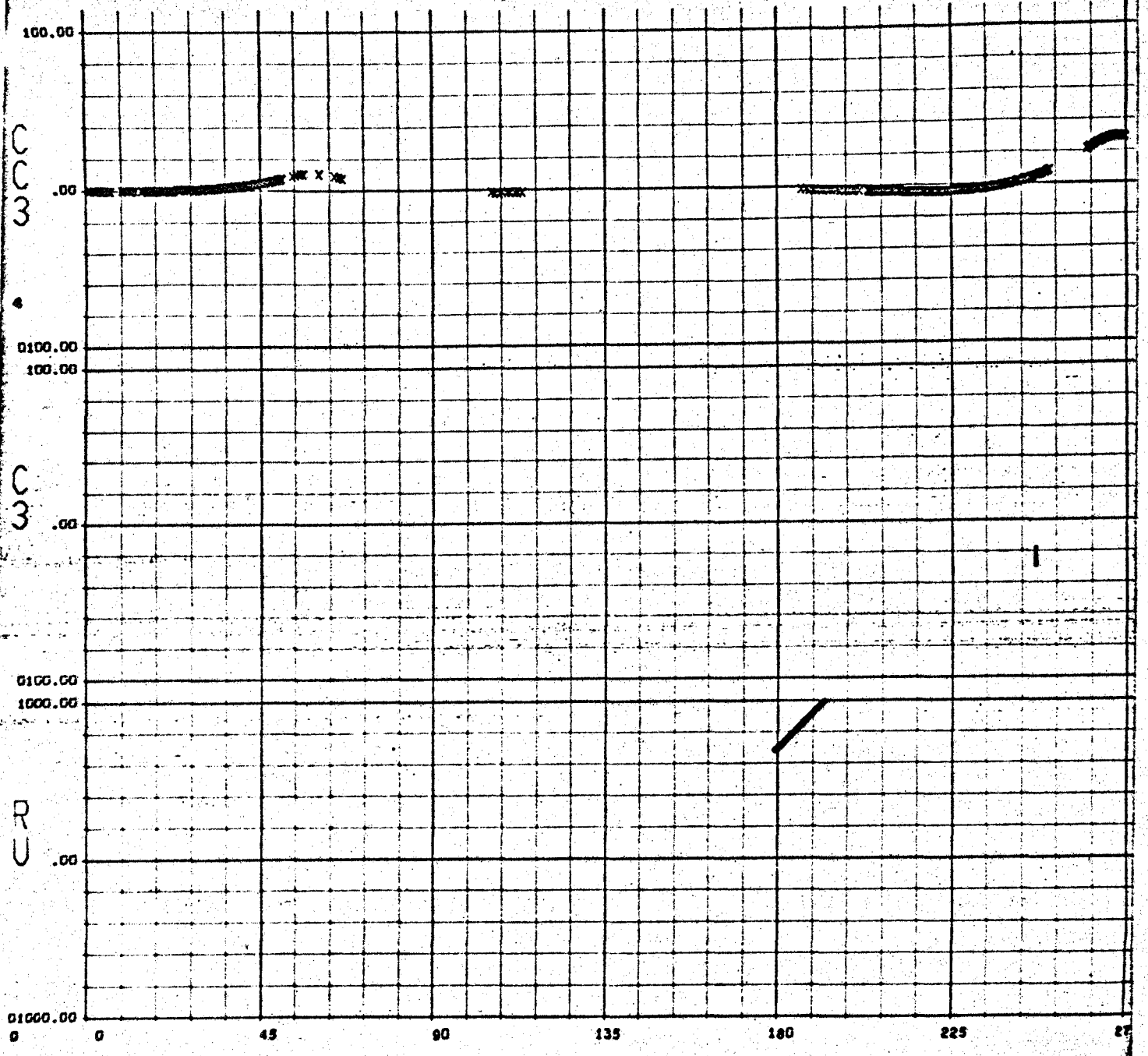
ODPL 1F102

SIMPLE MOON

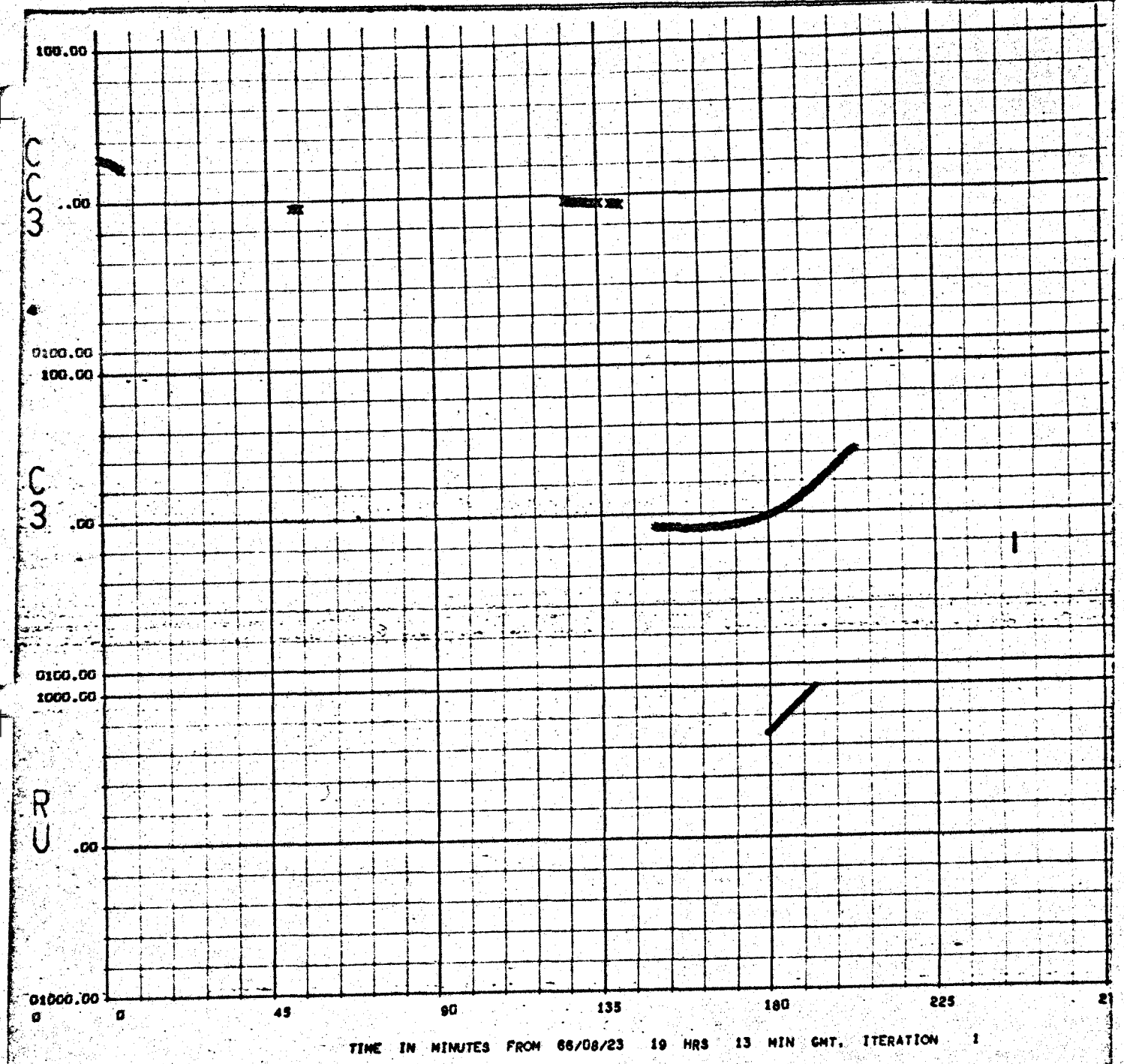
STATION 41 RESIDUALS PASS NUMBER 13/235



STATION 12 RESIDUALS PASS NUMBER 13/235



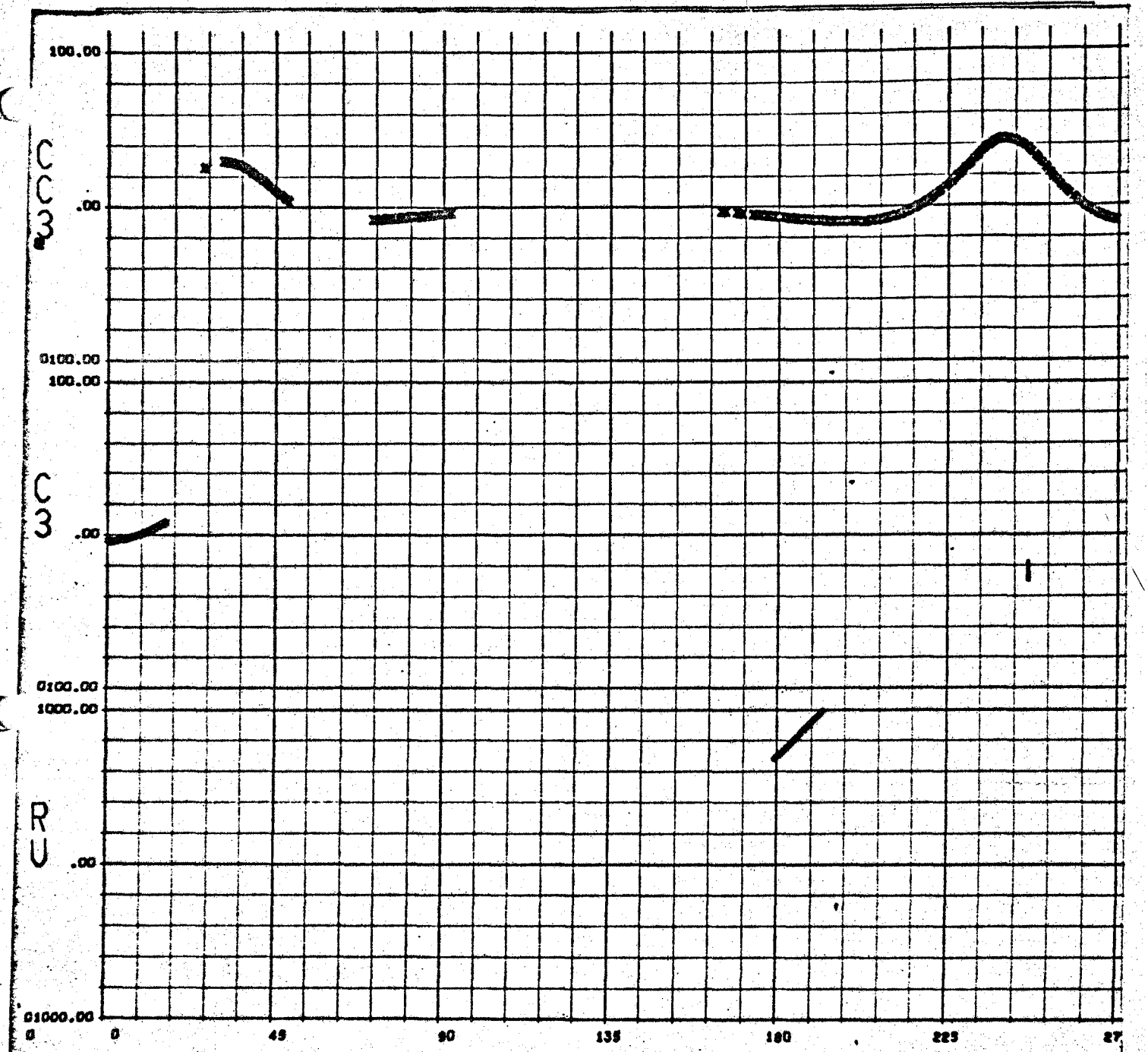
STATION 61 RESIDUALS PASS NUMBER 13/235



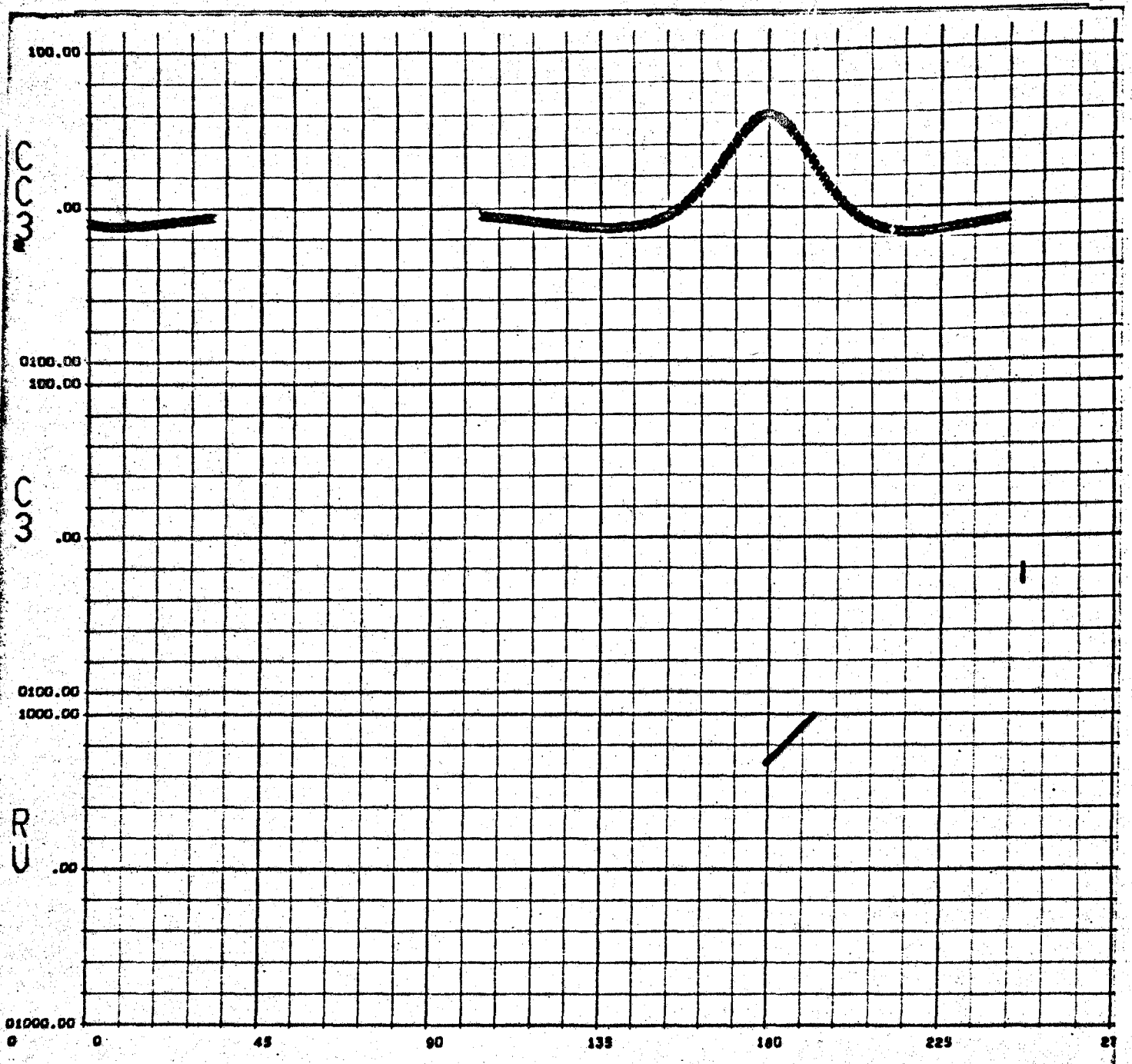
STATION 61 RESIDUALS PASS NUMBER 13/235

ODPL 1A4

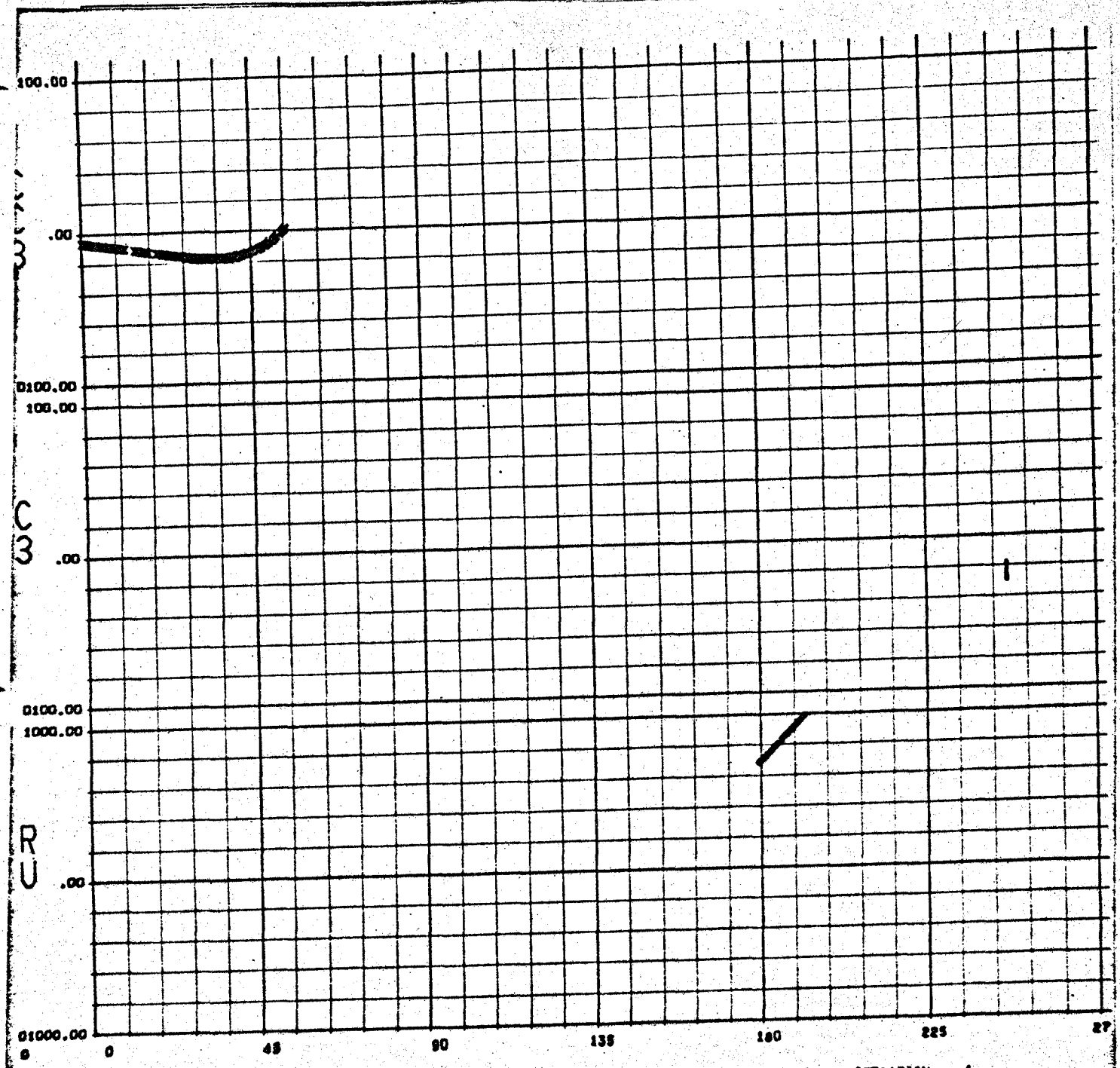
SIMPLE MOON



STATION 41 RESIDUALS PASS NUMBER 14/236

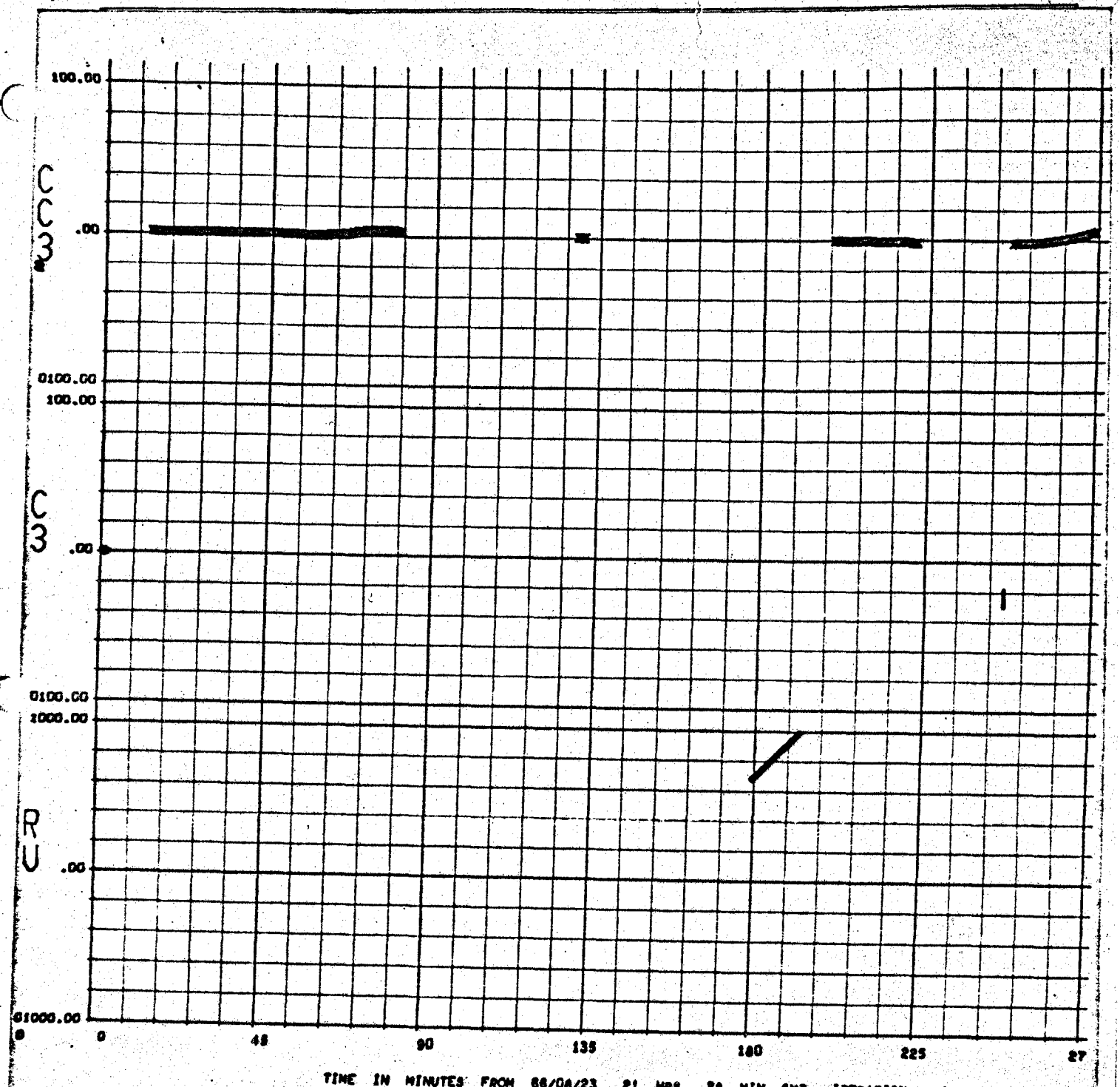


STATION 41 RESIDUALS PASS NUMBER 14/236

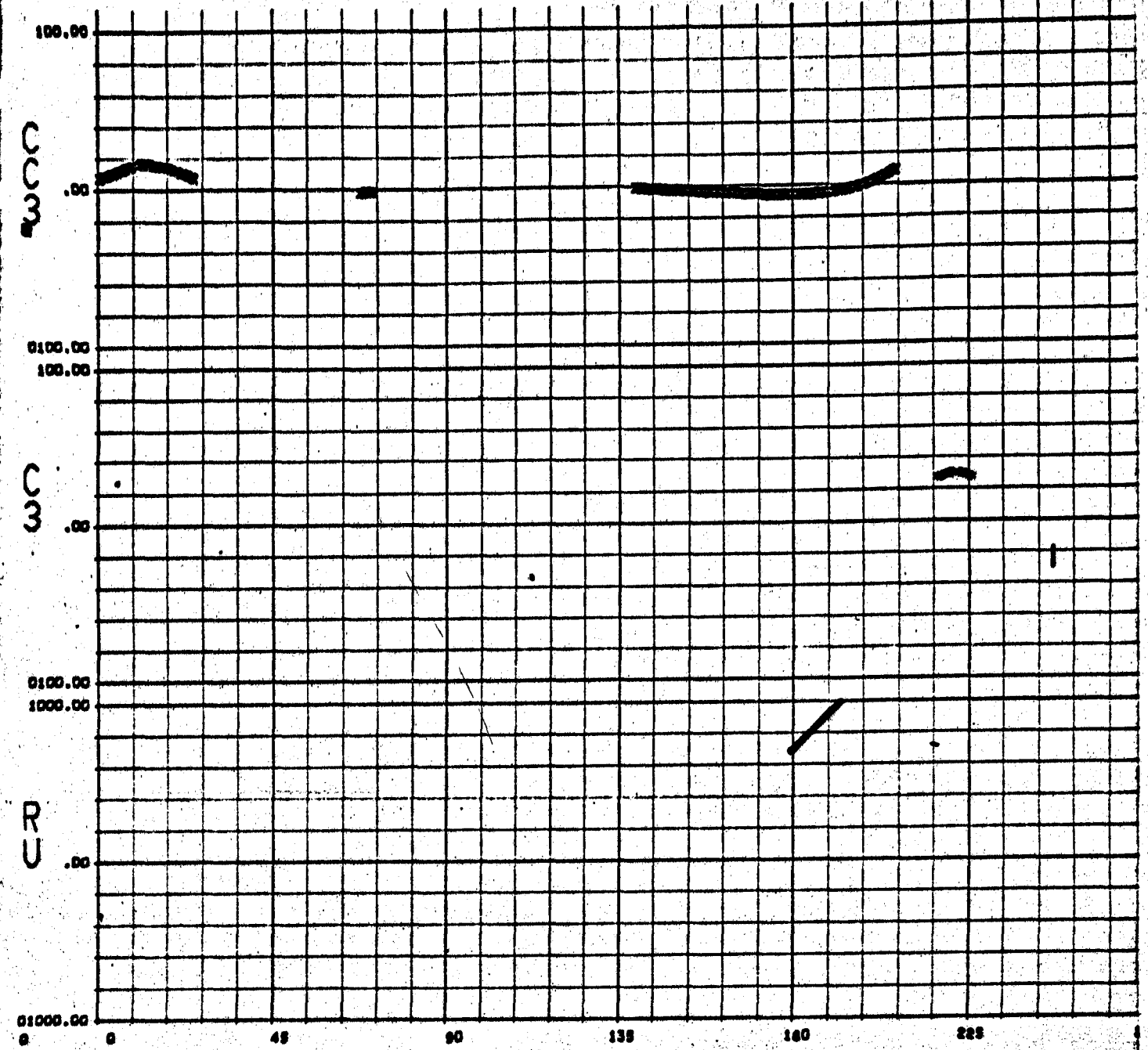


TIME IN MINUTES FROM 66/08/24 14 HRS . 51 MIN GMT, ITERATION 1

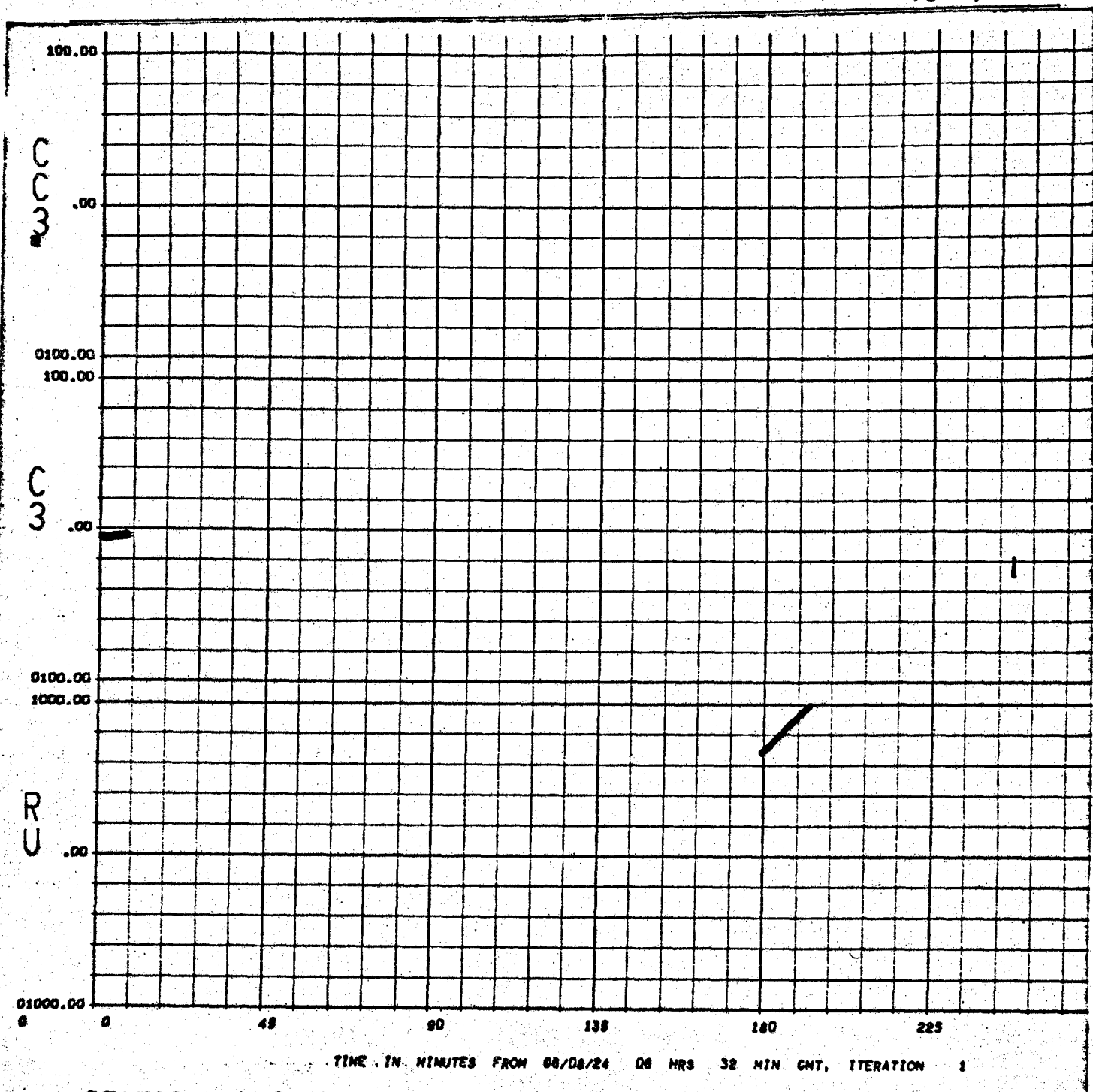
STATION 41 RESIDUALS PASS NUMBER 14/236



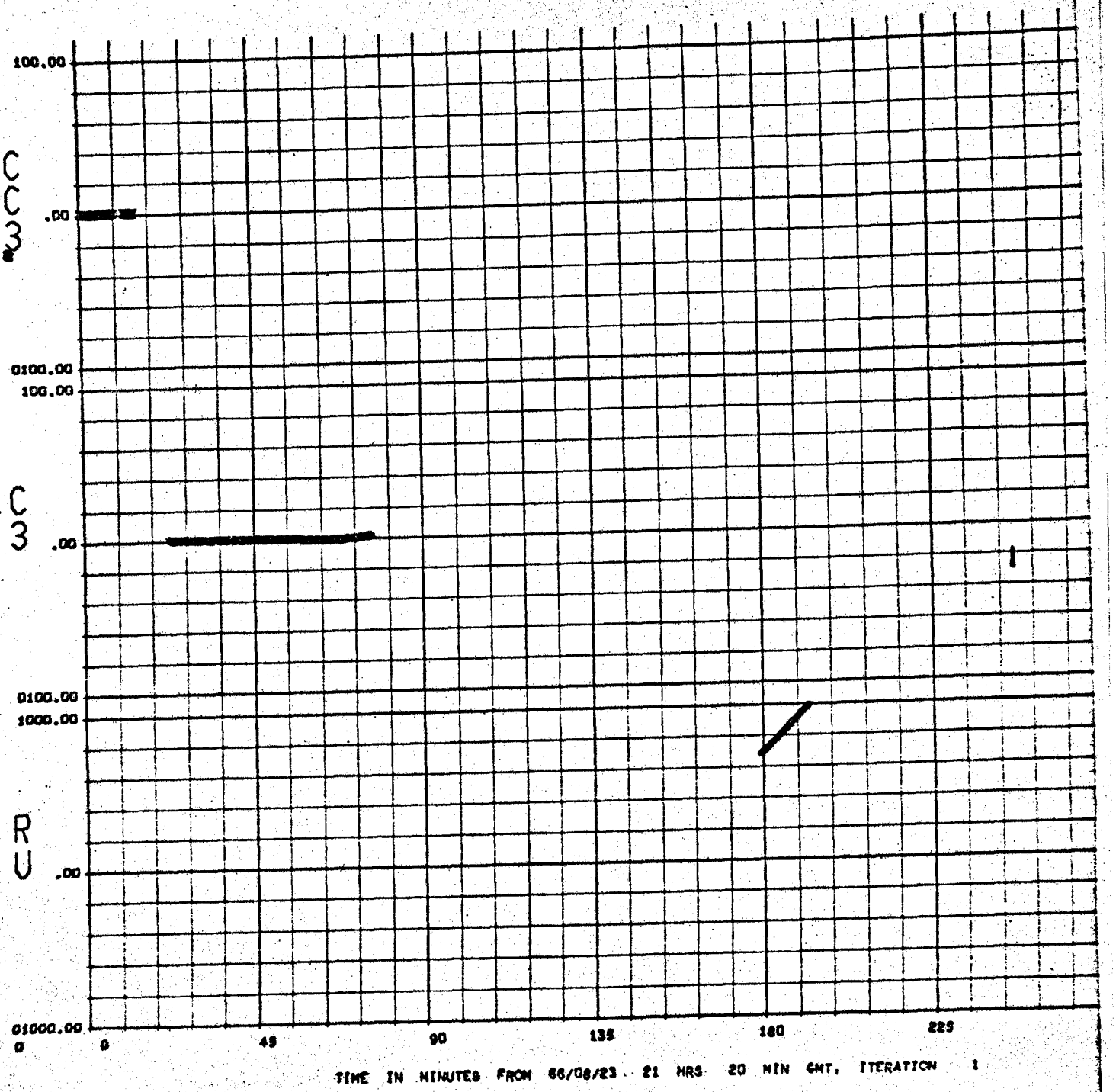
STATION 12 RESIDUALS PASS NUMBER 13/235



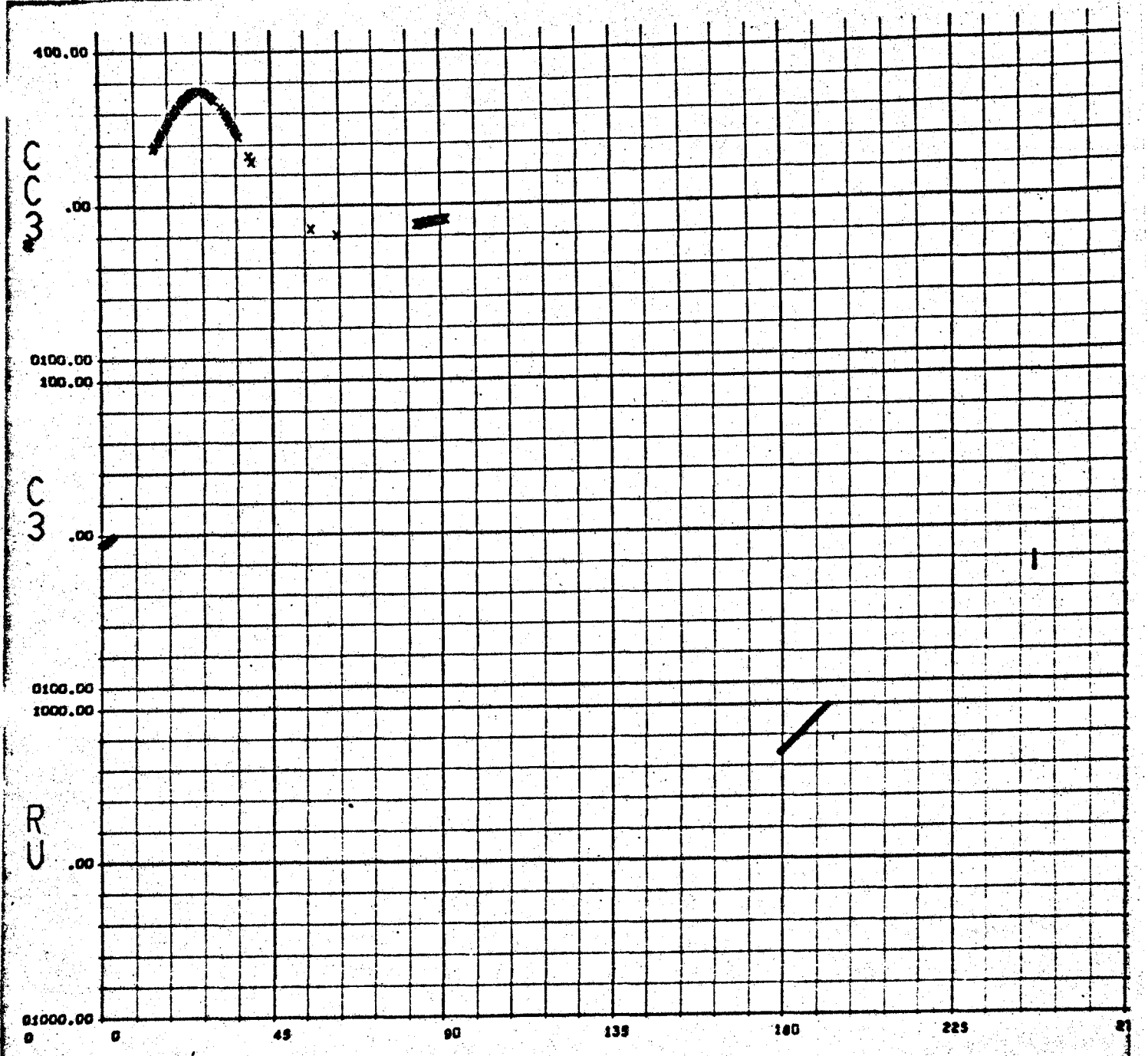
STATION 12 RESIDUALS PASS NUMBER 13/235



STATION 12 RESIDUALS PASS NUMBER 13/235



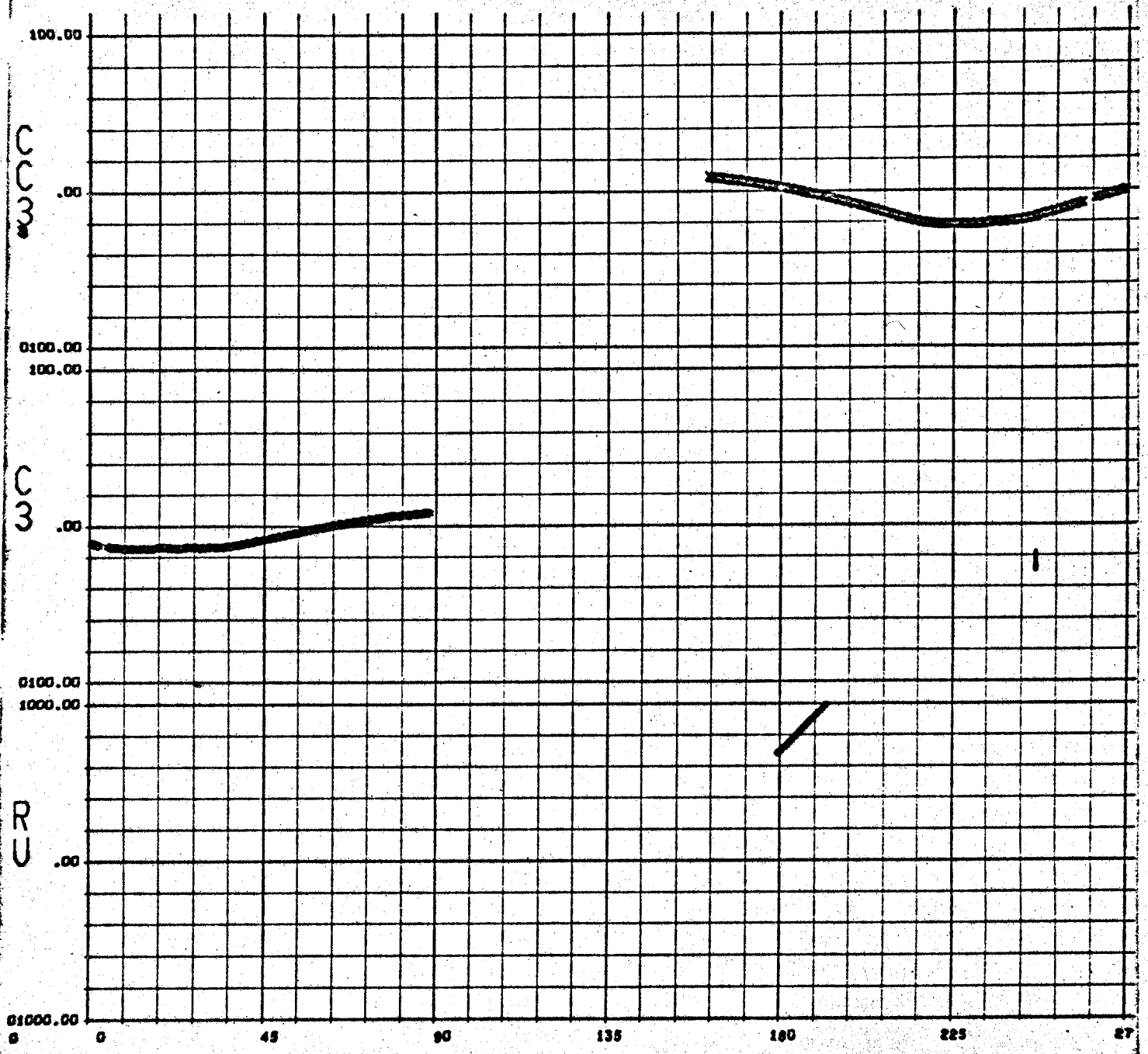
STATION 61 RESIDUALS PASS NUMBER 13/235



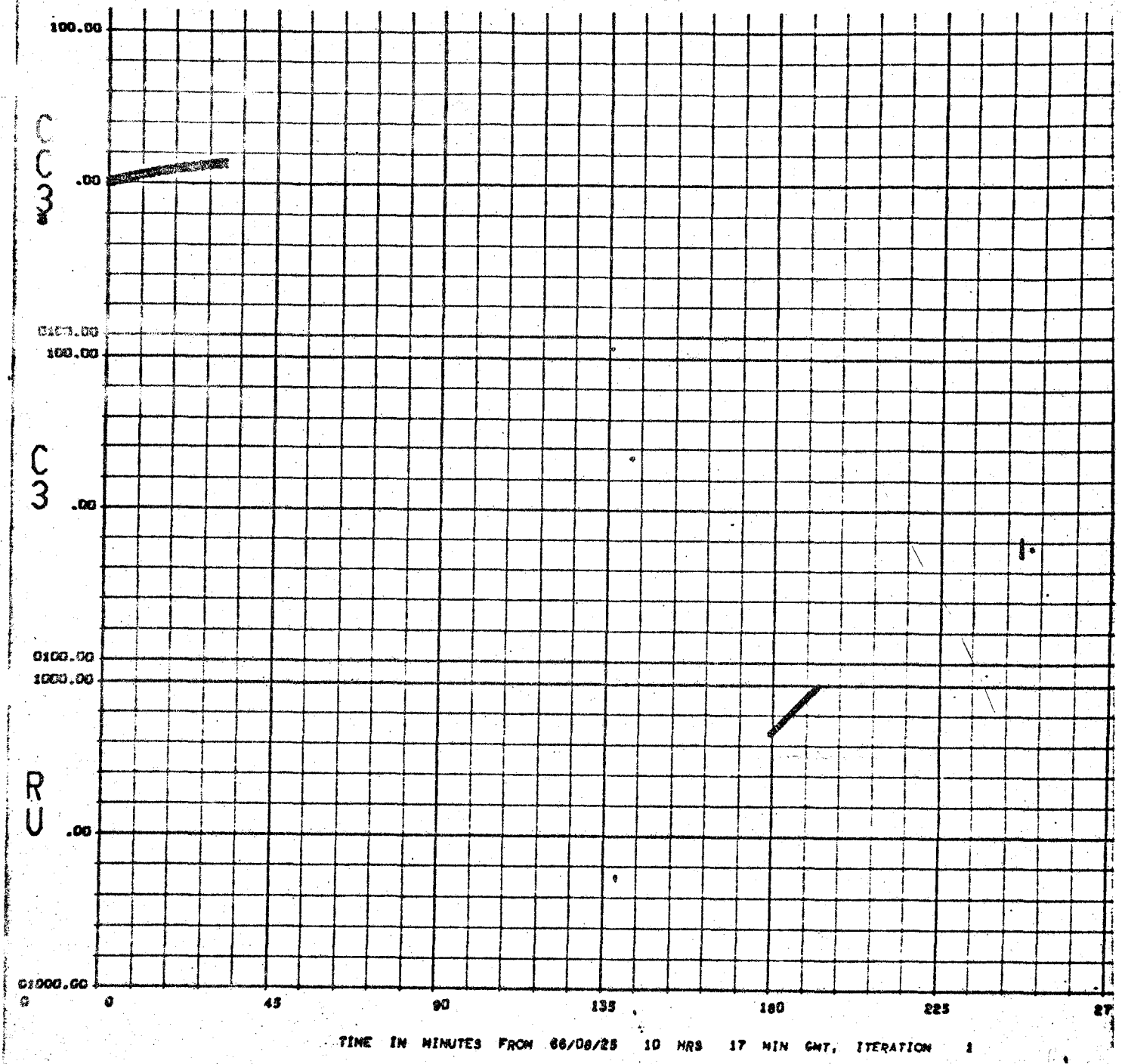
STATION 61 RESIDUALS PASS NUMBER 14/236

ODPL 1F115

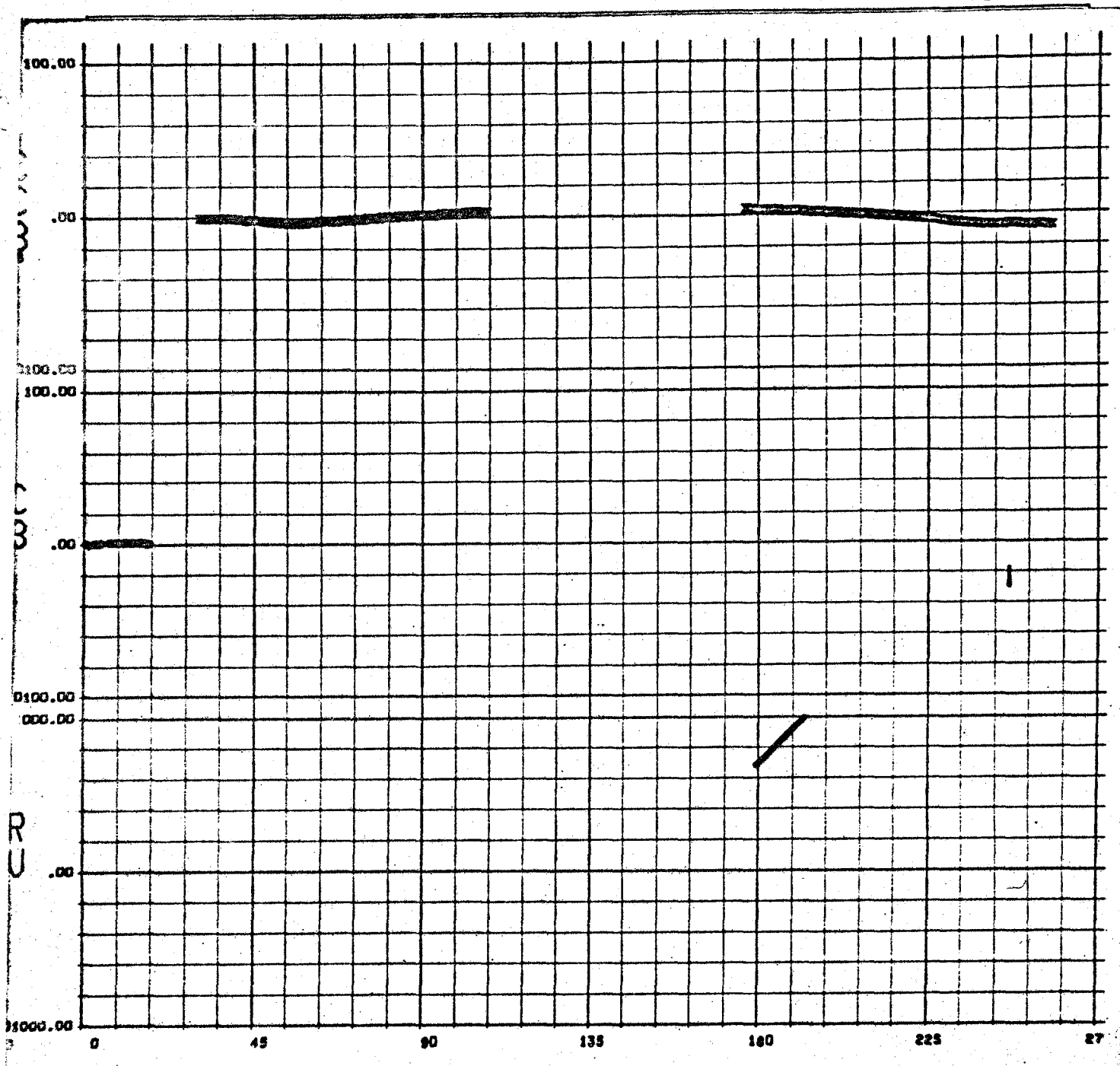
SIMPLE MOON



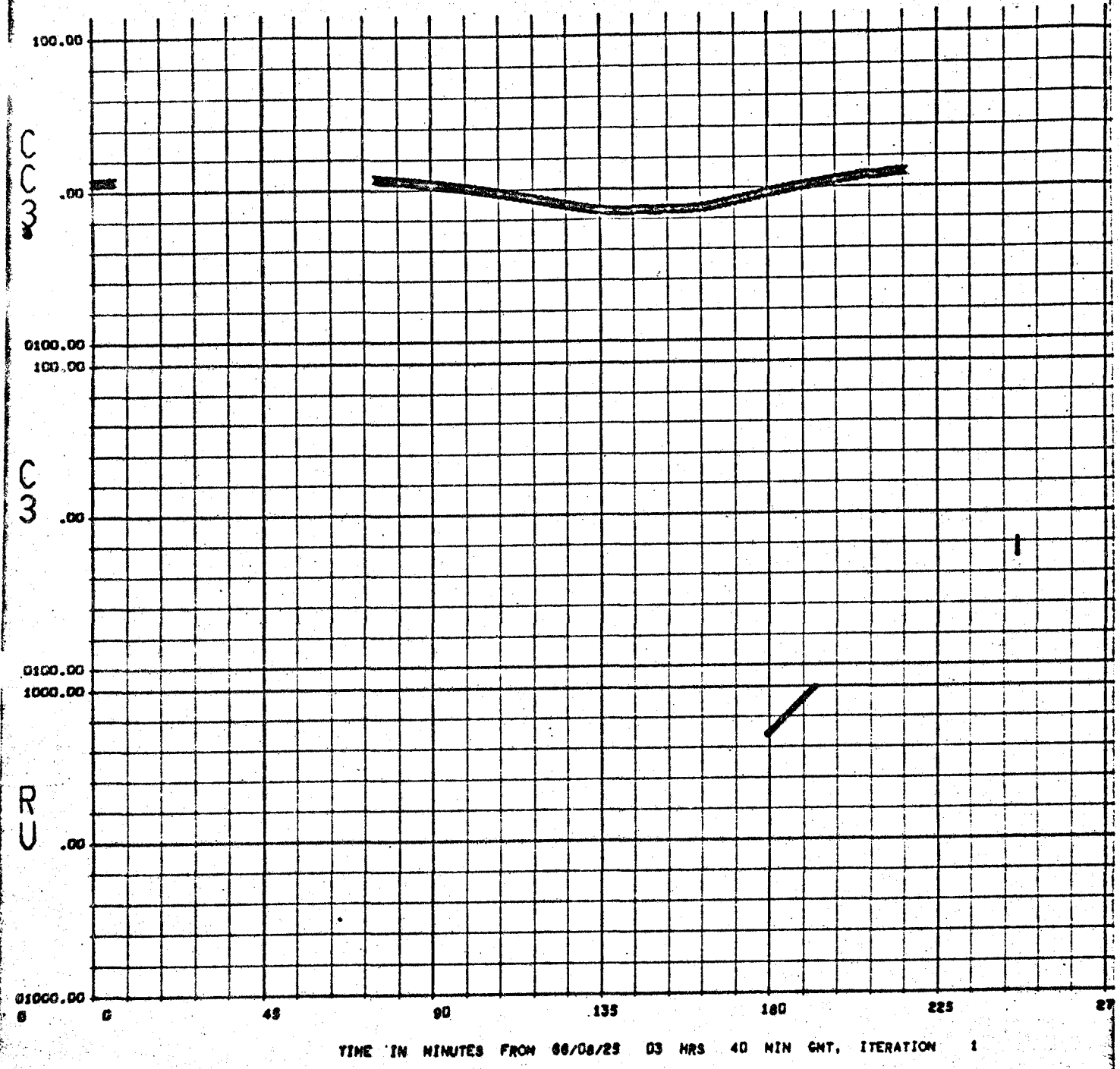
STATION 41 RESIDUALS PASS NUMBER 15/237



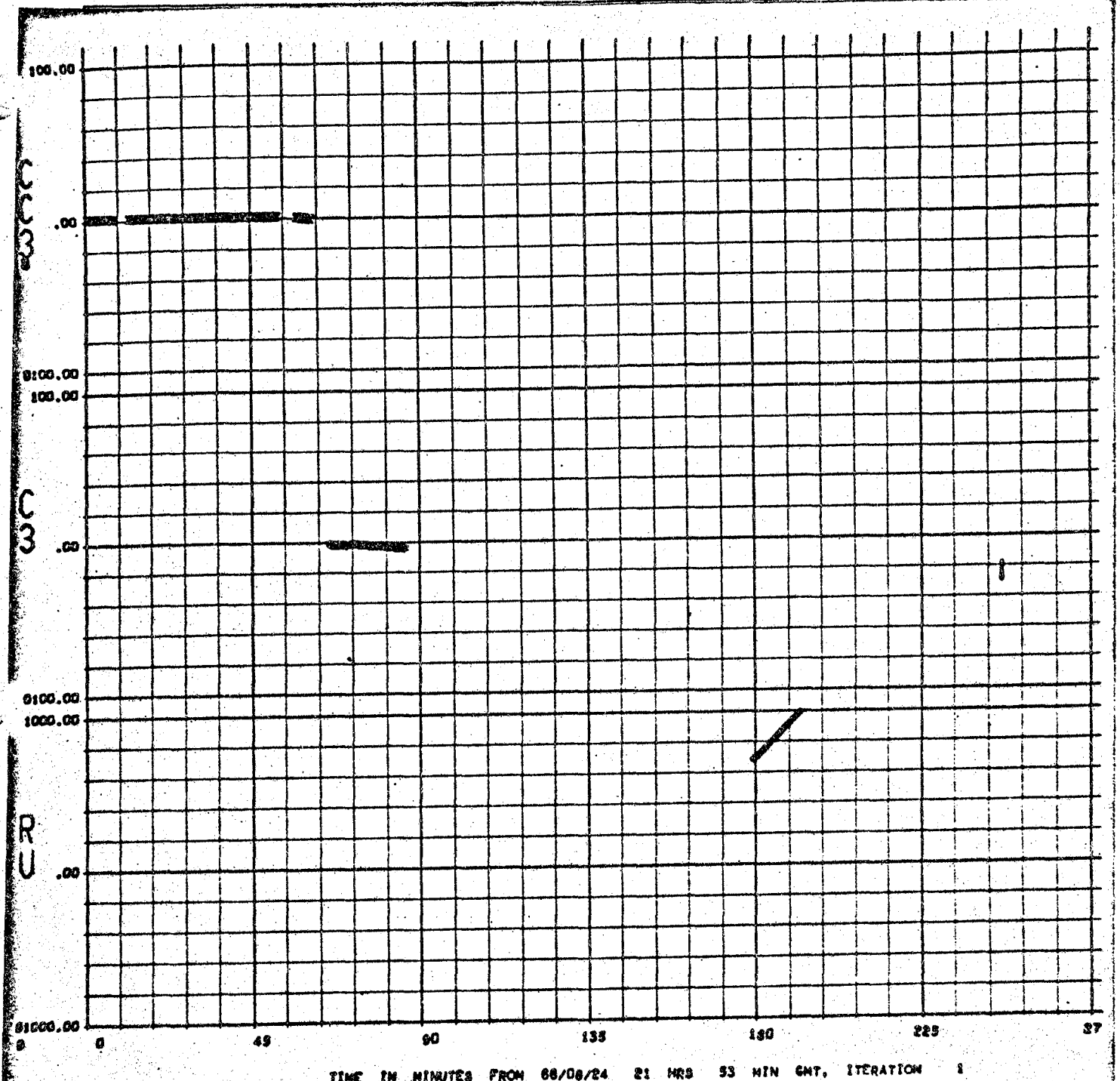
STATION 41 RESIDUALS PASS NUMBER 15/237



STATION 12 RESIDUALS PASS NUMBER 14/236



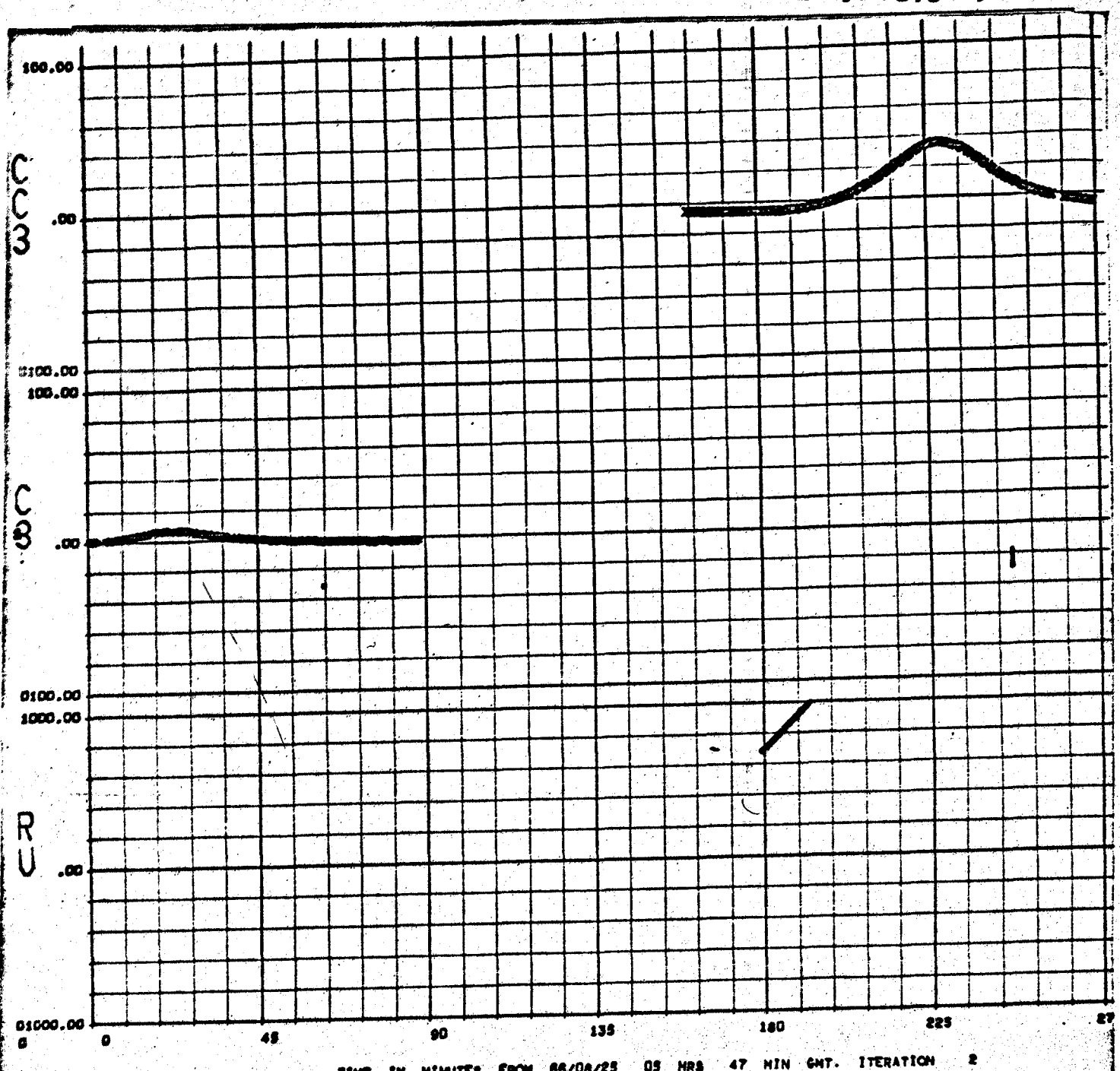
STATION 12 RESIDUALS PASS NUMBER 14/236



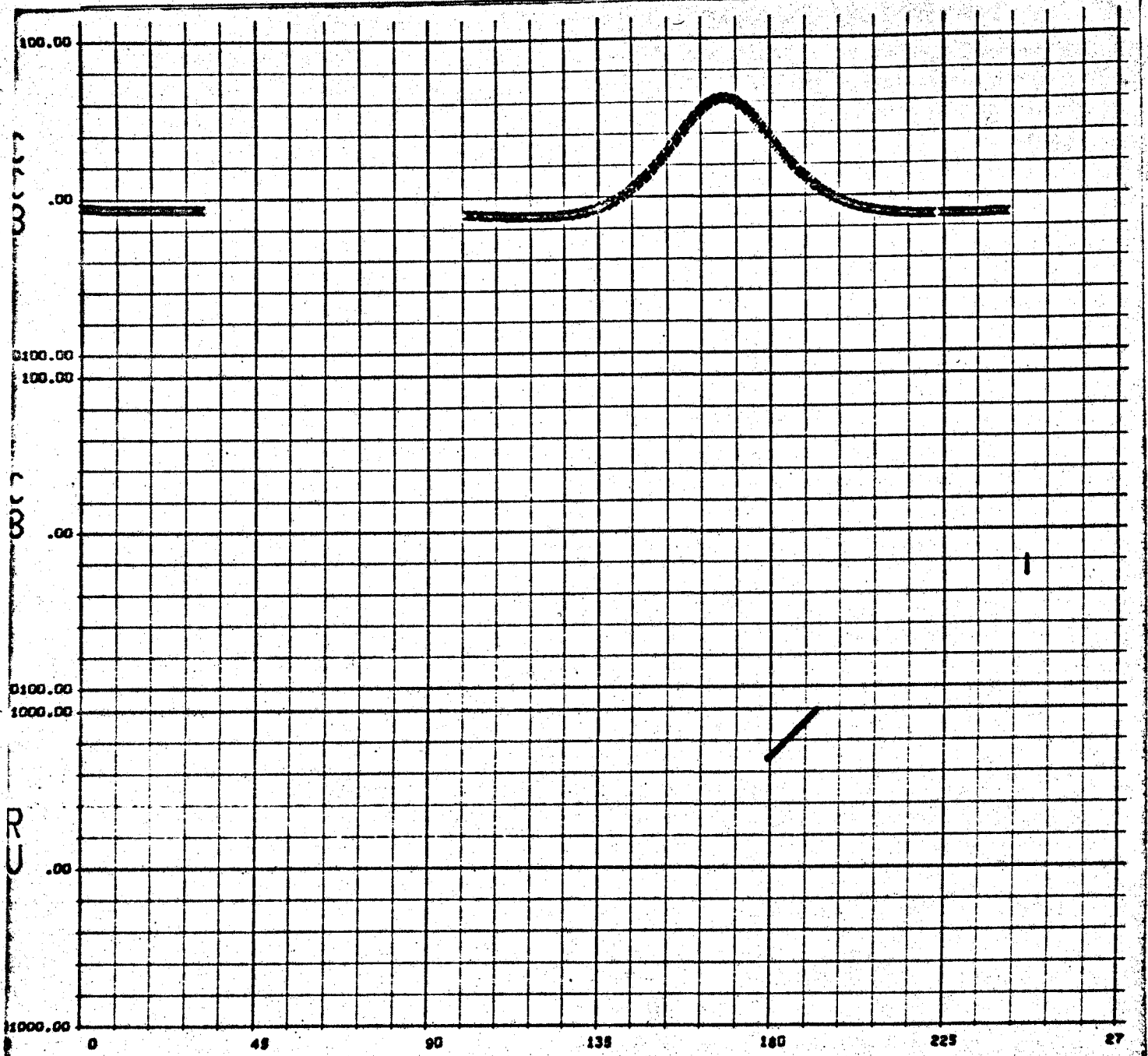
STATION 61 RESIDUALS PASS NUMBER 14/236

ODPL 1A5

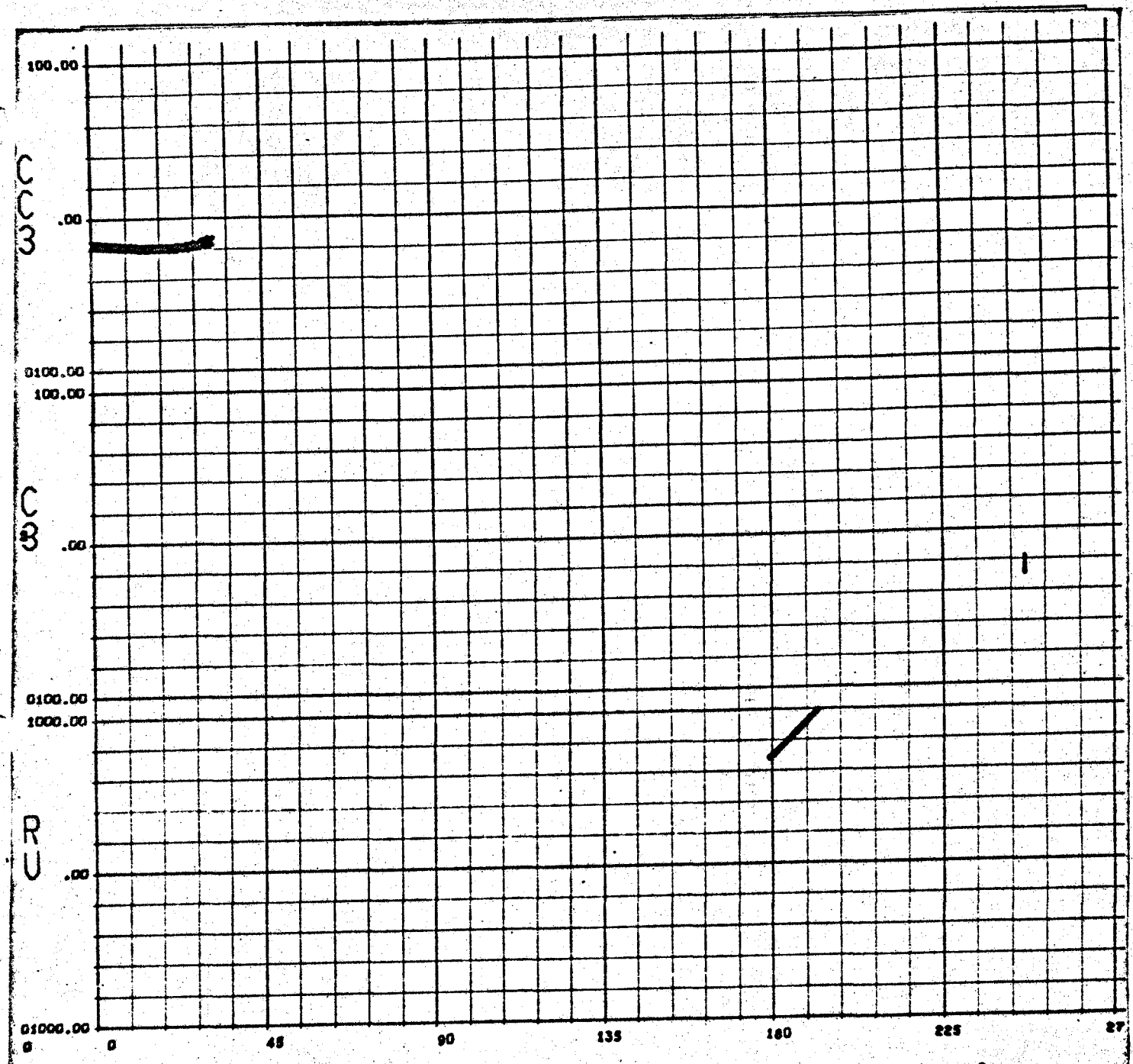
SIMPLE



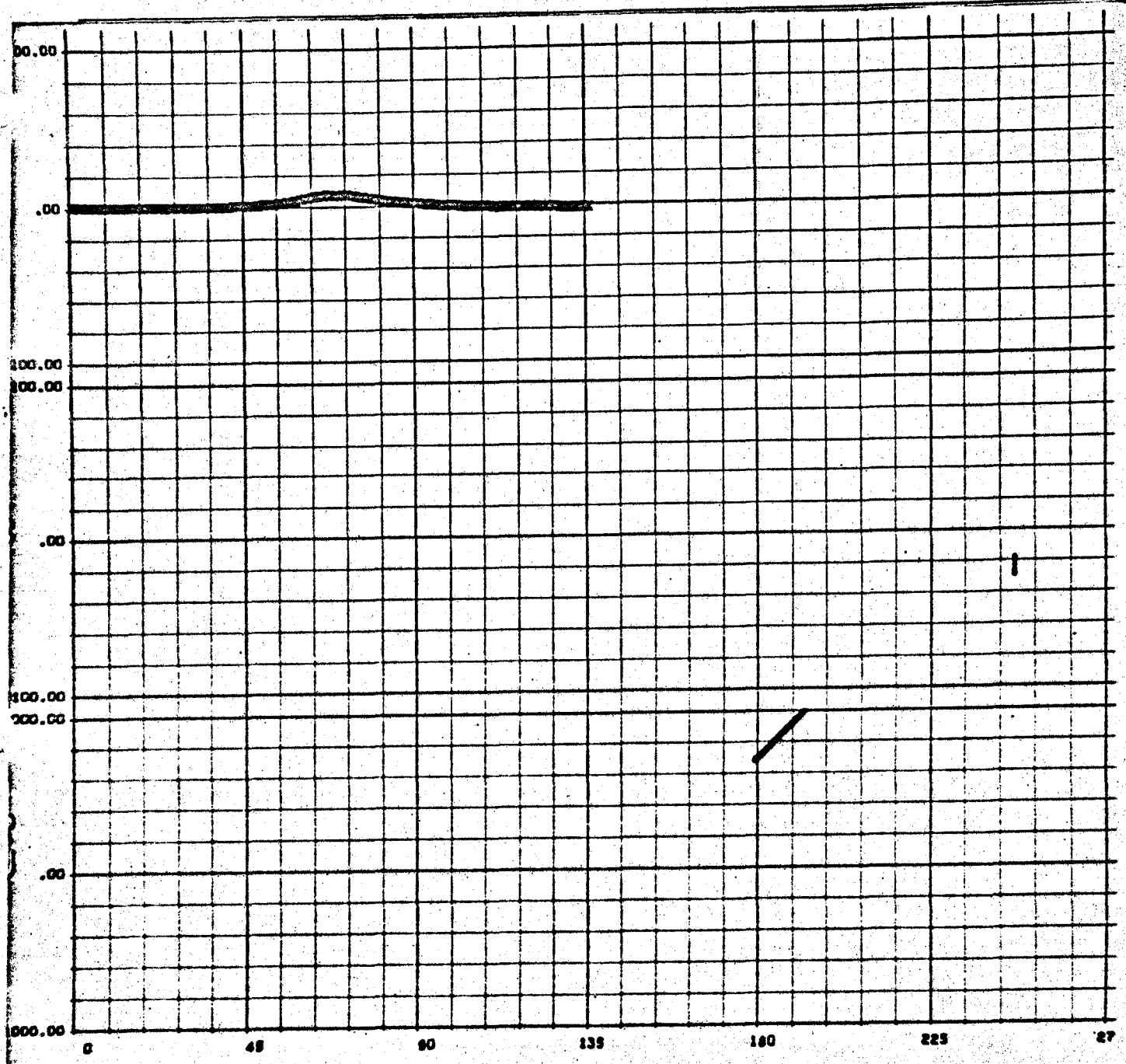
STATION 41 RESIDUALS PASS NUMBER 15/237



STATION 41 RESIDUALS PASS NUMBER 15/237



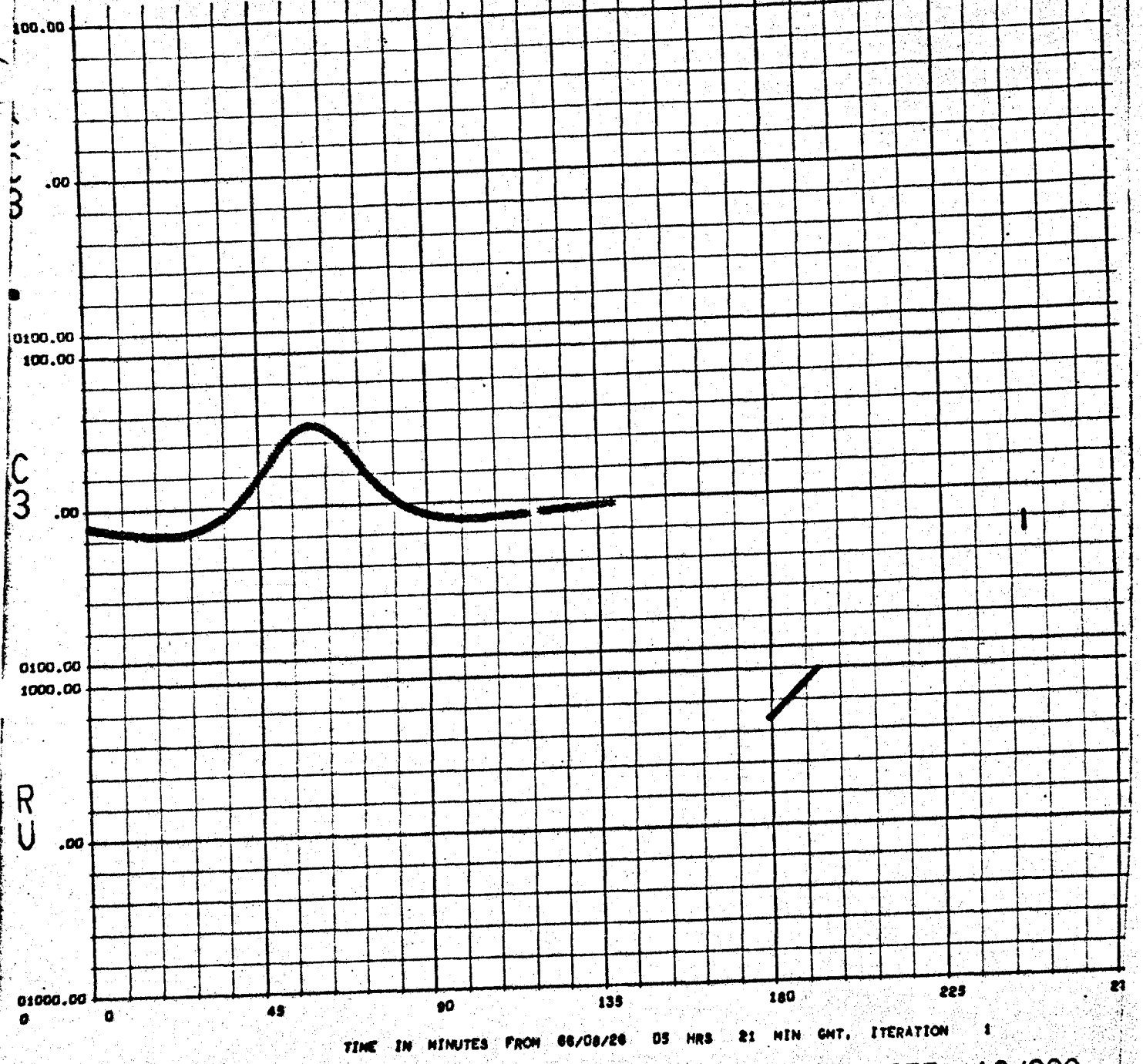
STATION 41 RESIDUALS PASS NUMBER 15/237



STATION 12 RESIDUALS PASS NUMBER 14/236

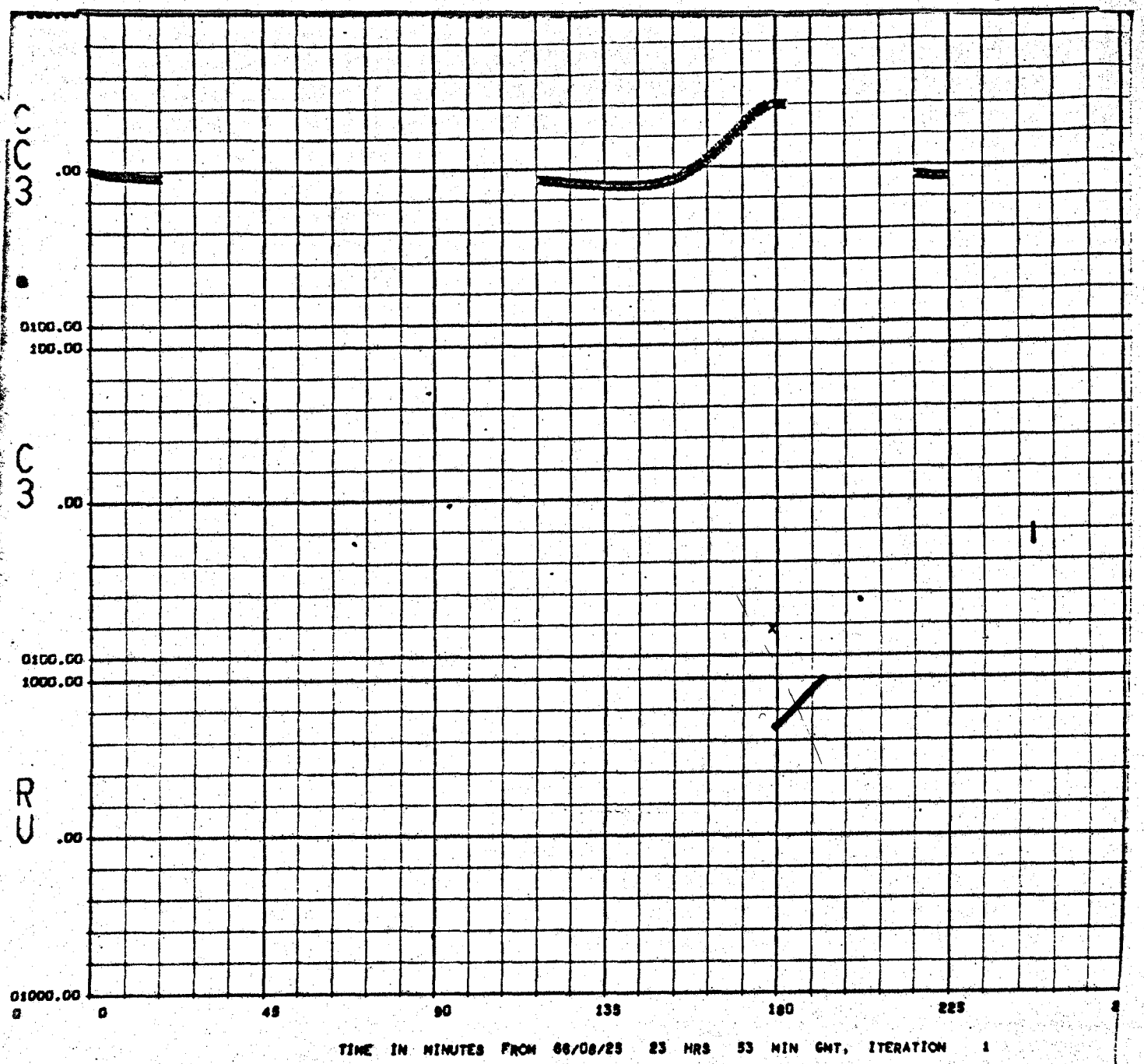
ODPL 1F134

SIMPLE MOON

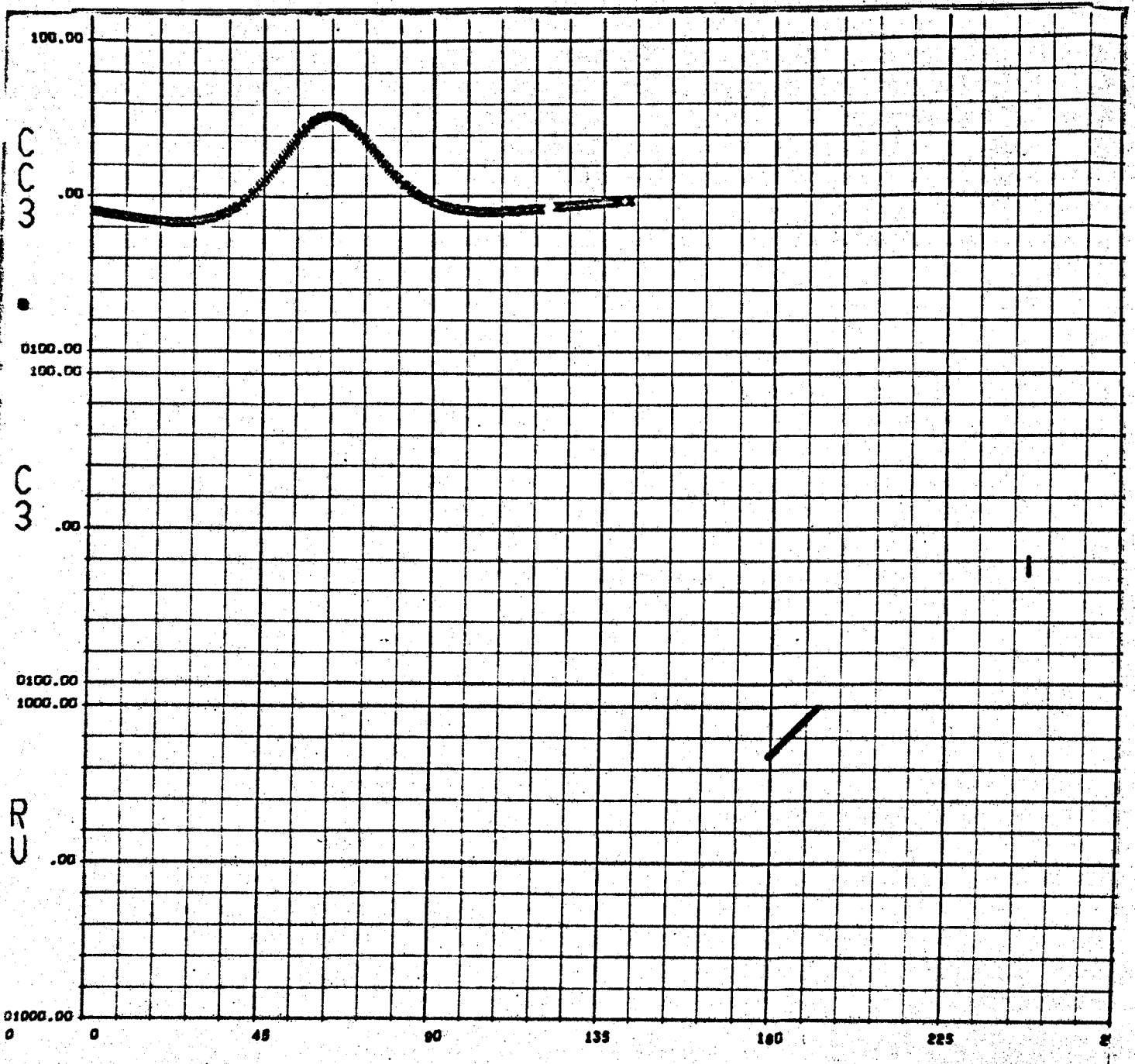


STATION 41 RESIDUALS

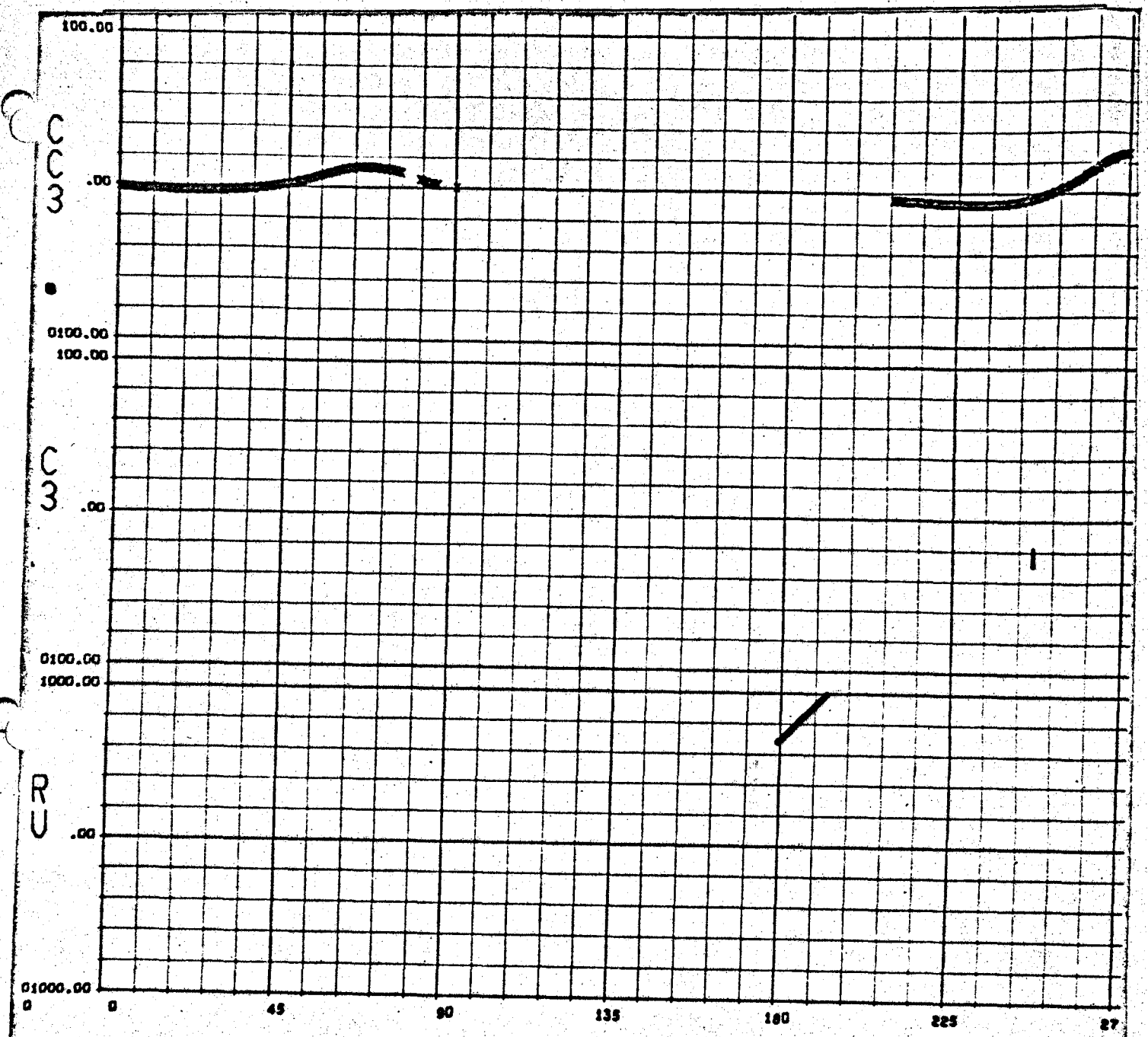
PASS NUMBER 16/238



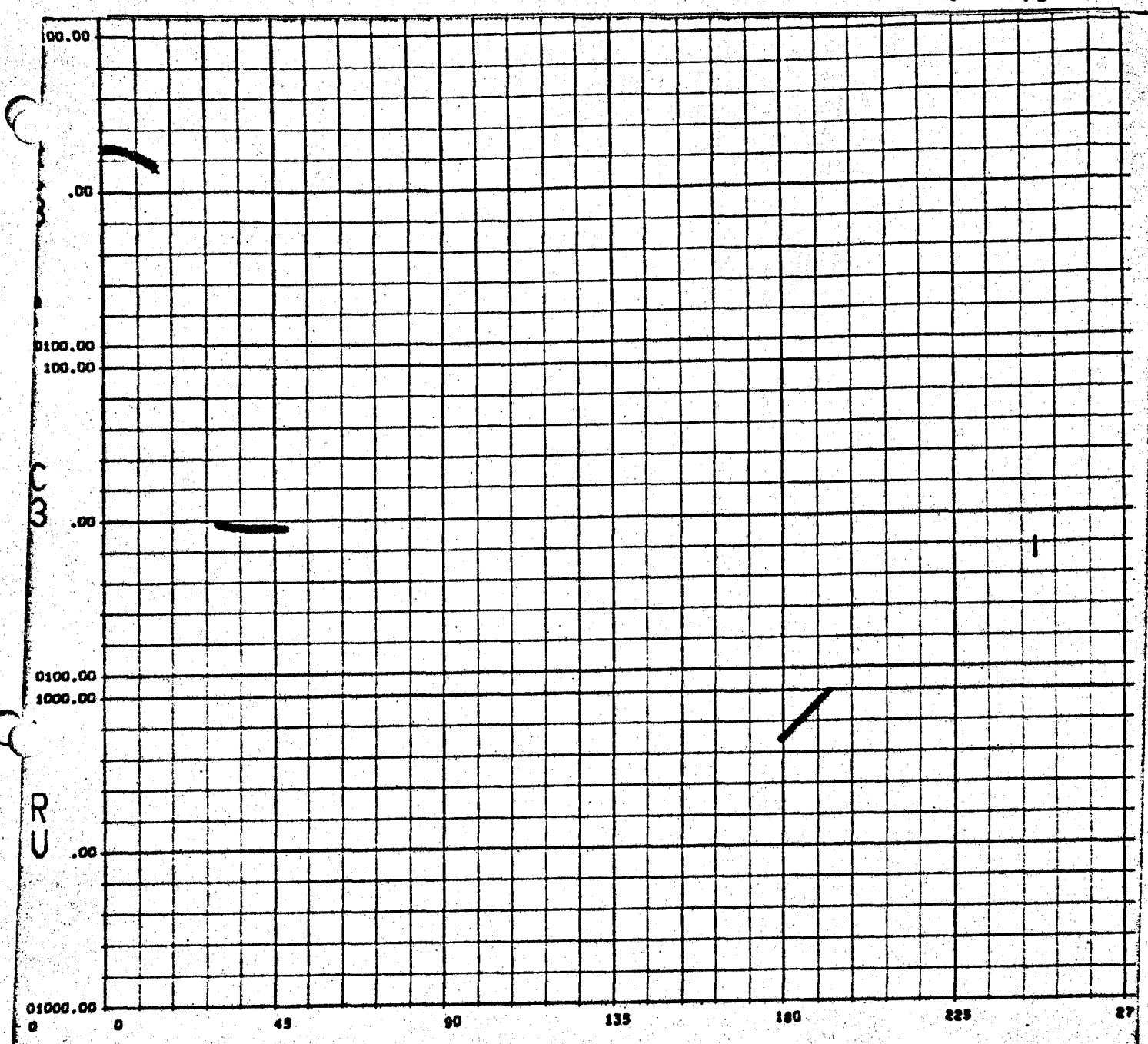
STATION 12 RESIDUALS PASS NUMBER 15/237



STATION 12 RESIDUALS PASS NUMBER 15/237



STATION 61 RESIDUALS PASS NUMBER 15/237


100.00
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100.00
C3
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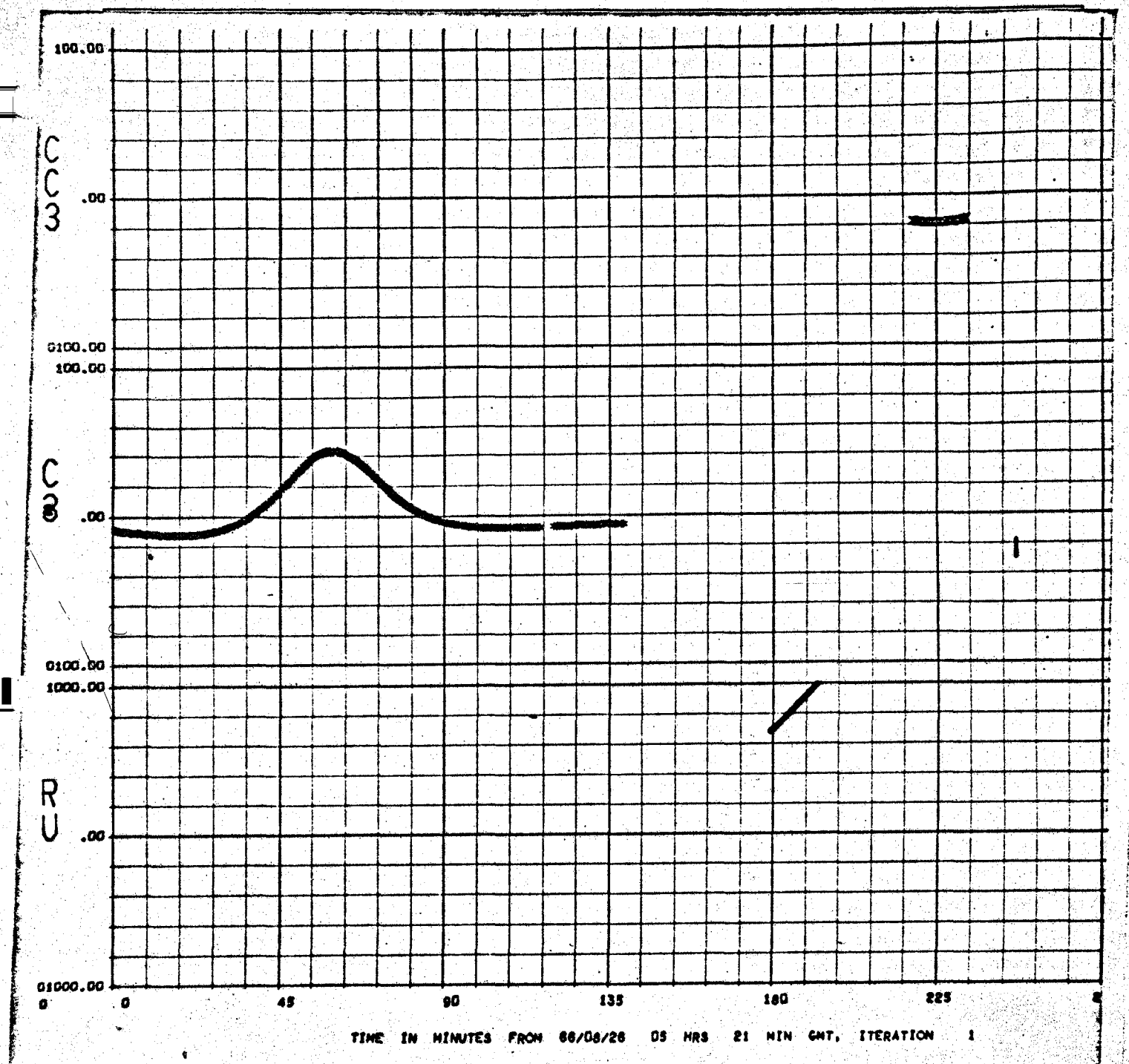
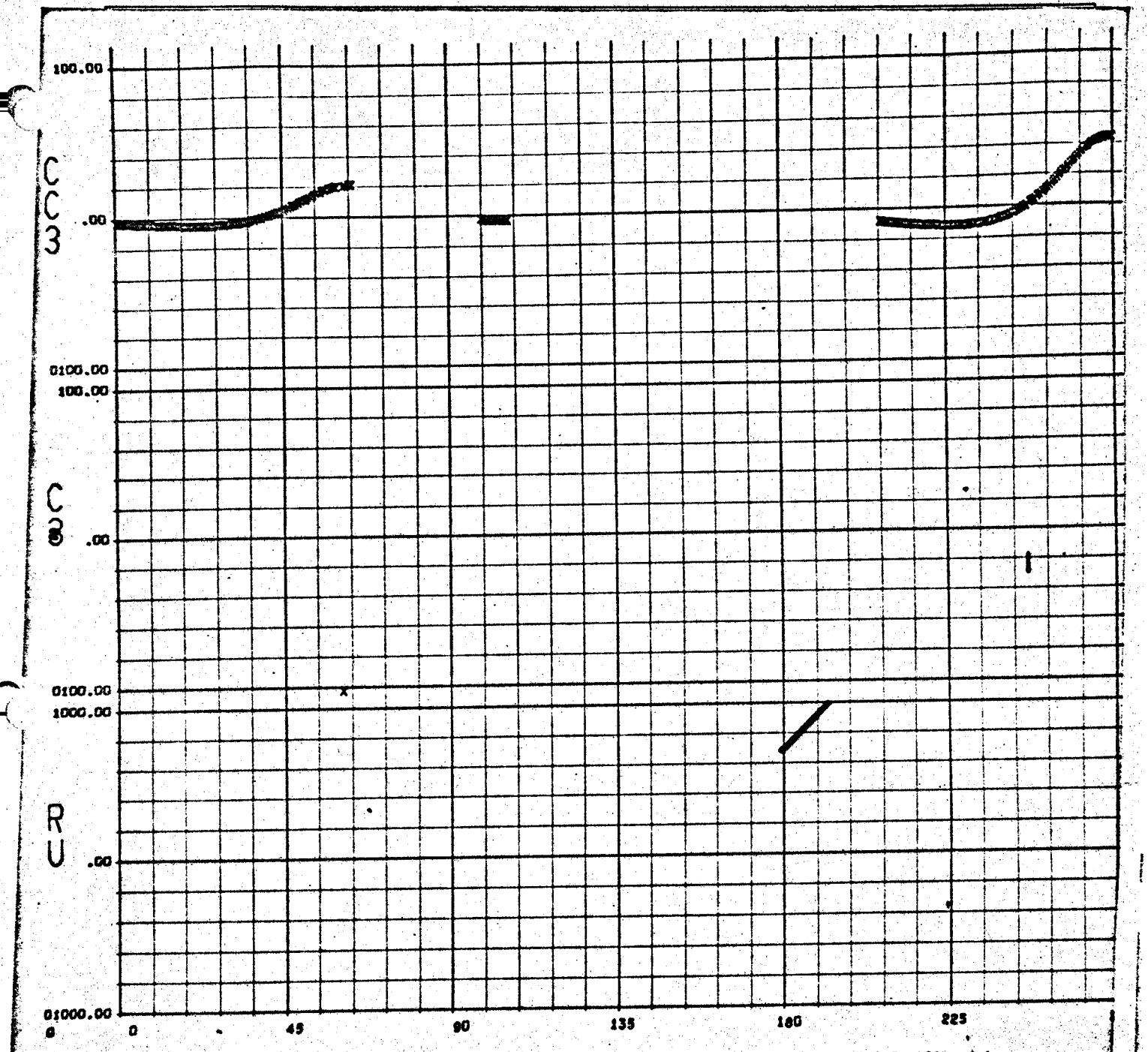
0100.00
1000.00
RU
.00
01000.00
0
0
45
90
135
180
225
27
TIME IN MINUTES FROM 66/08/25 23 HRS 25 MIN GMT, ITERATION 1
STATION 61 RESIDUALS
PASS NUMBER 15/237

ODPL 1F138

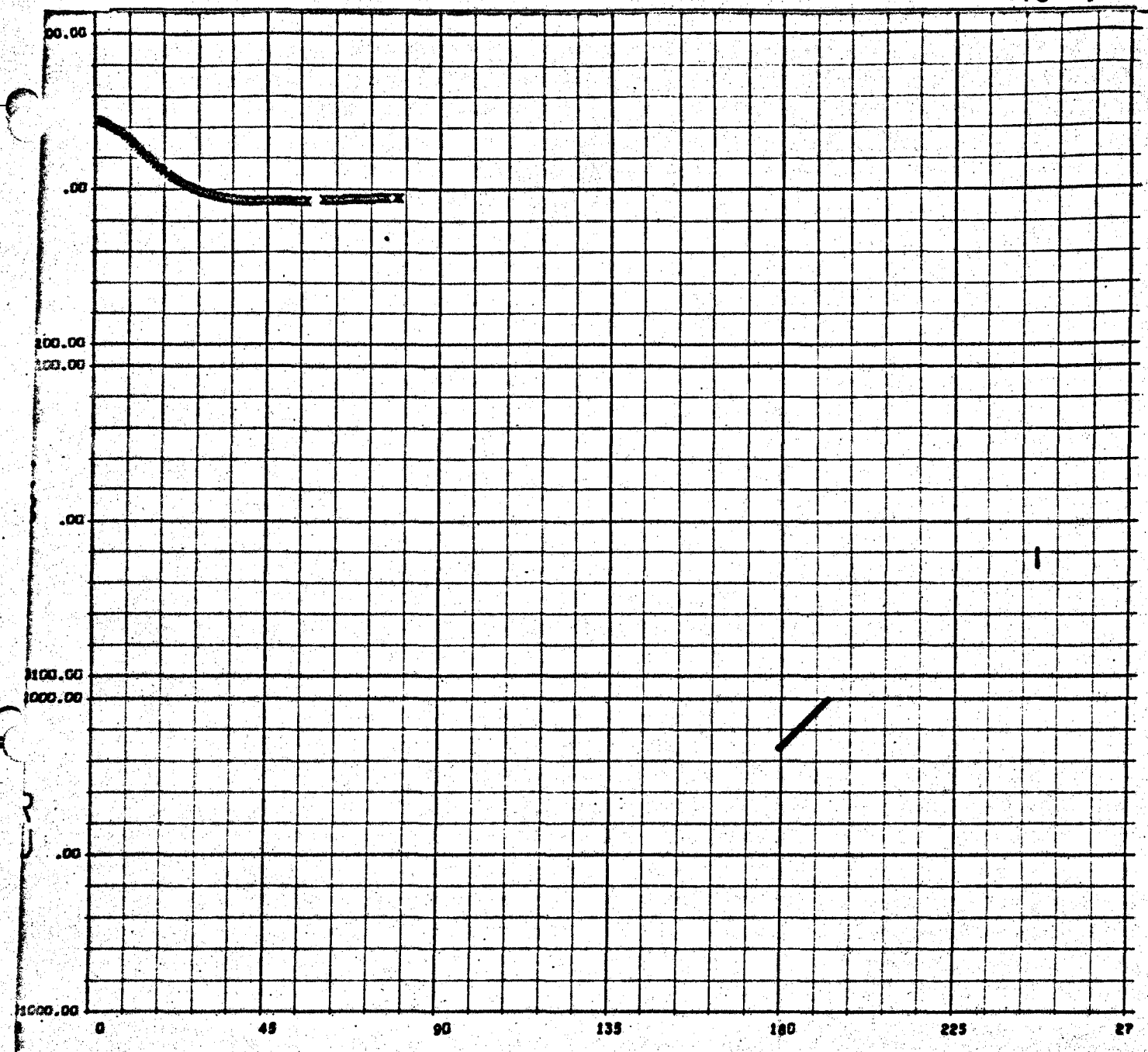
SIMPLE MOON



STATION 41 RESIDUALS PASS NUMBER 16/238



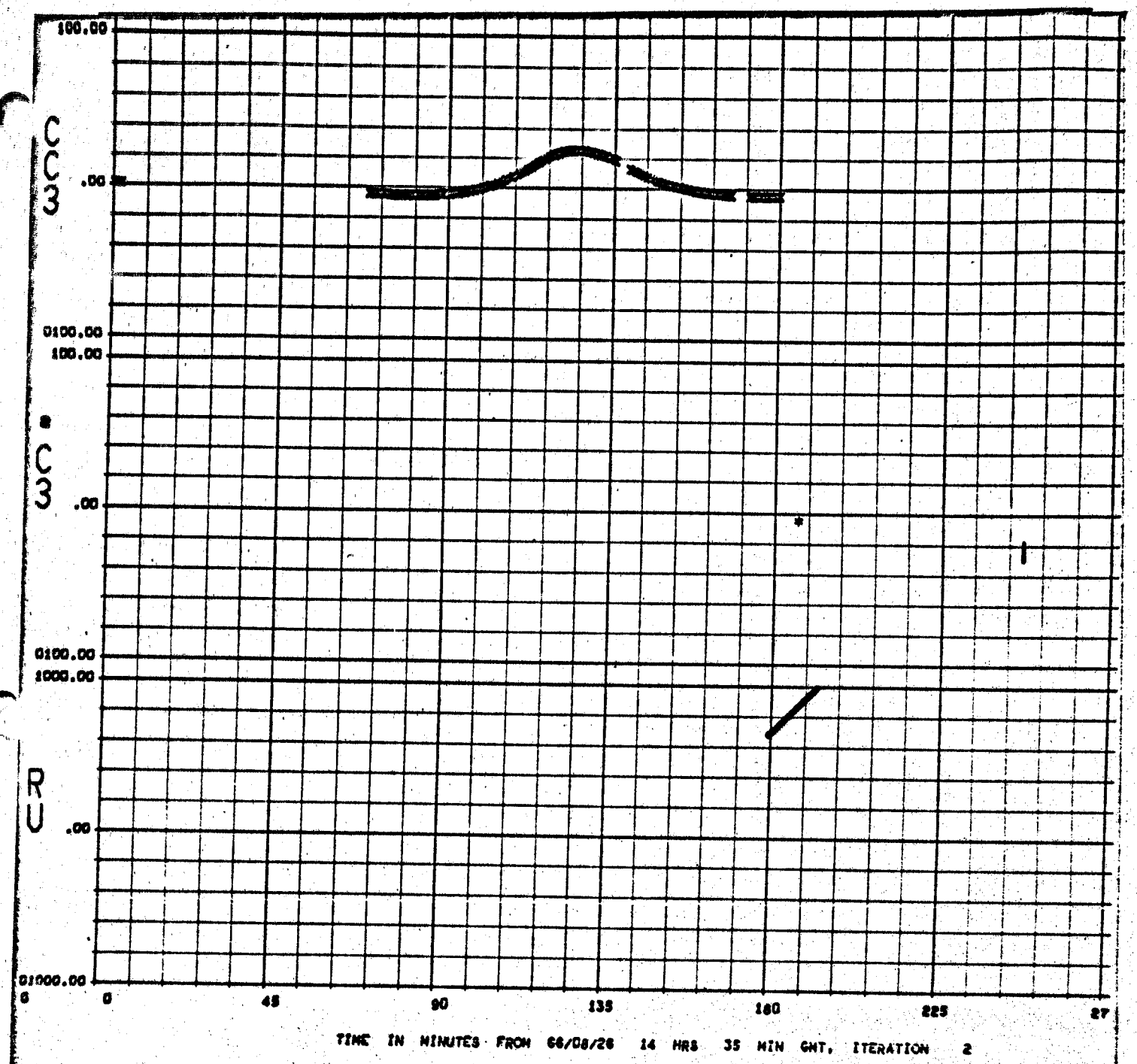
STATION 12 RESIDUALS PASS NUMBER 15/237



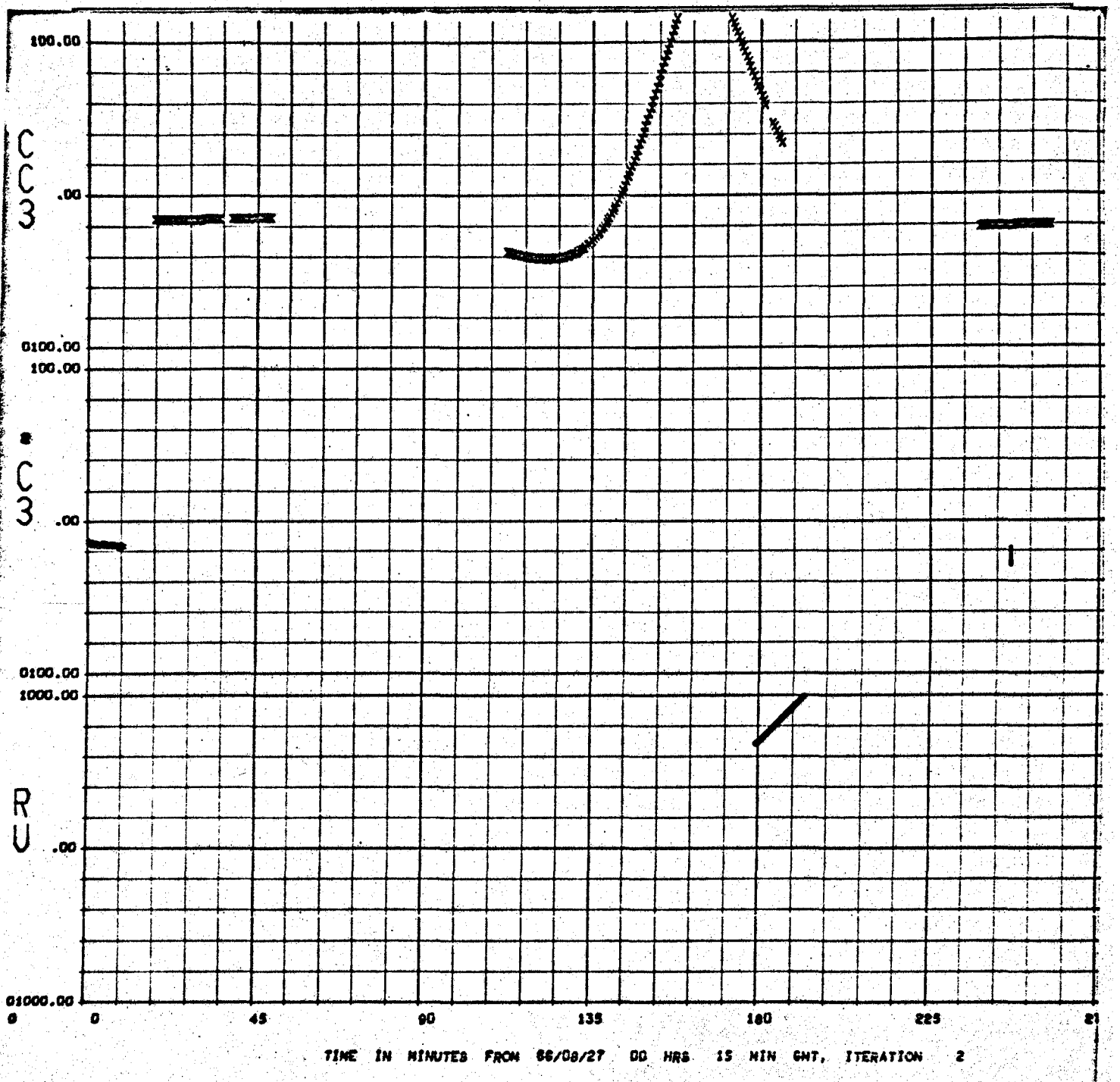
STATION 12 RESIDUALS PASS NUMBER 15/237

ODPL 1F139

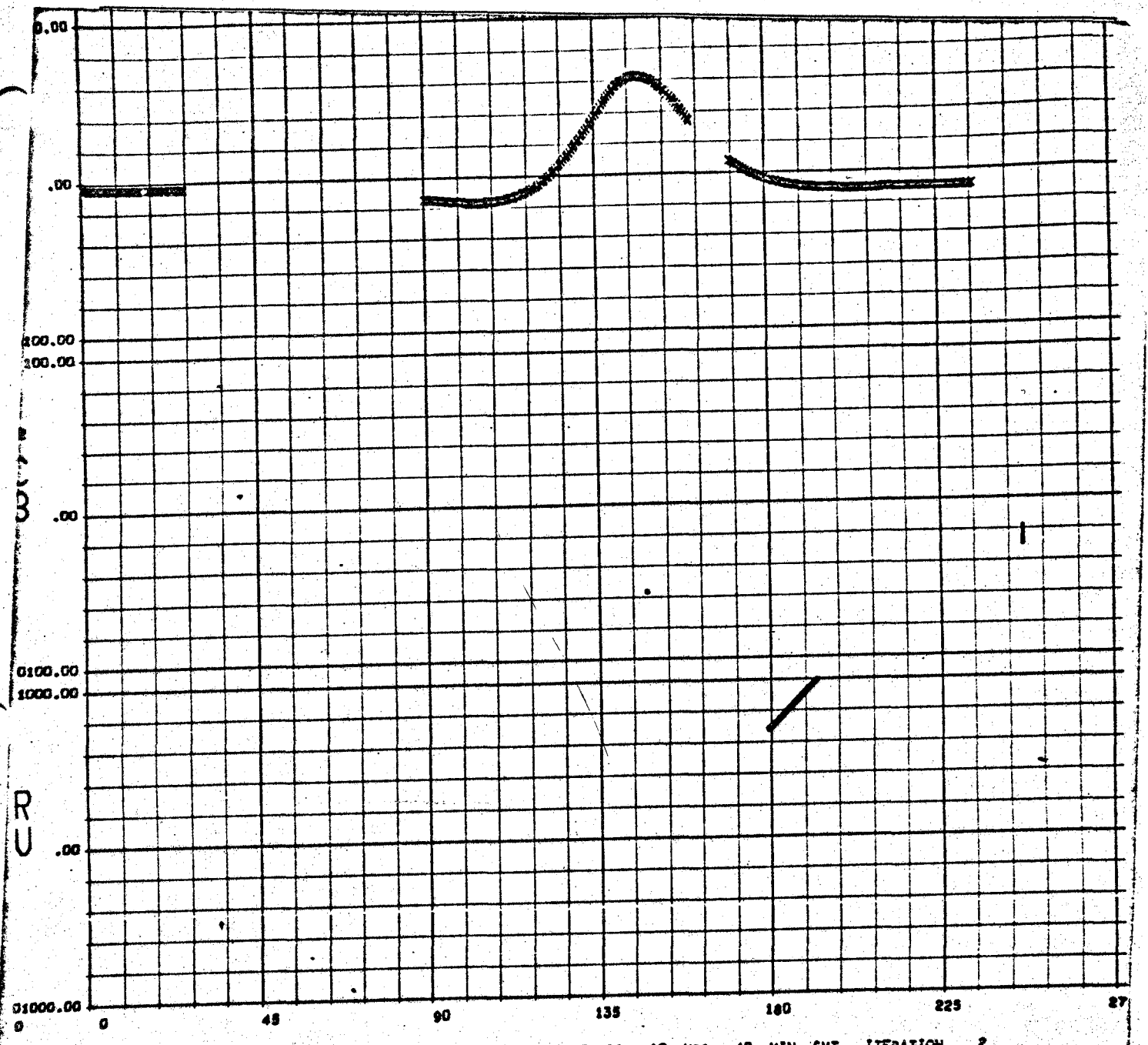
SIMPLE MOON



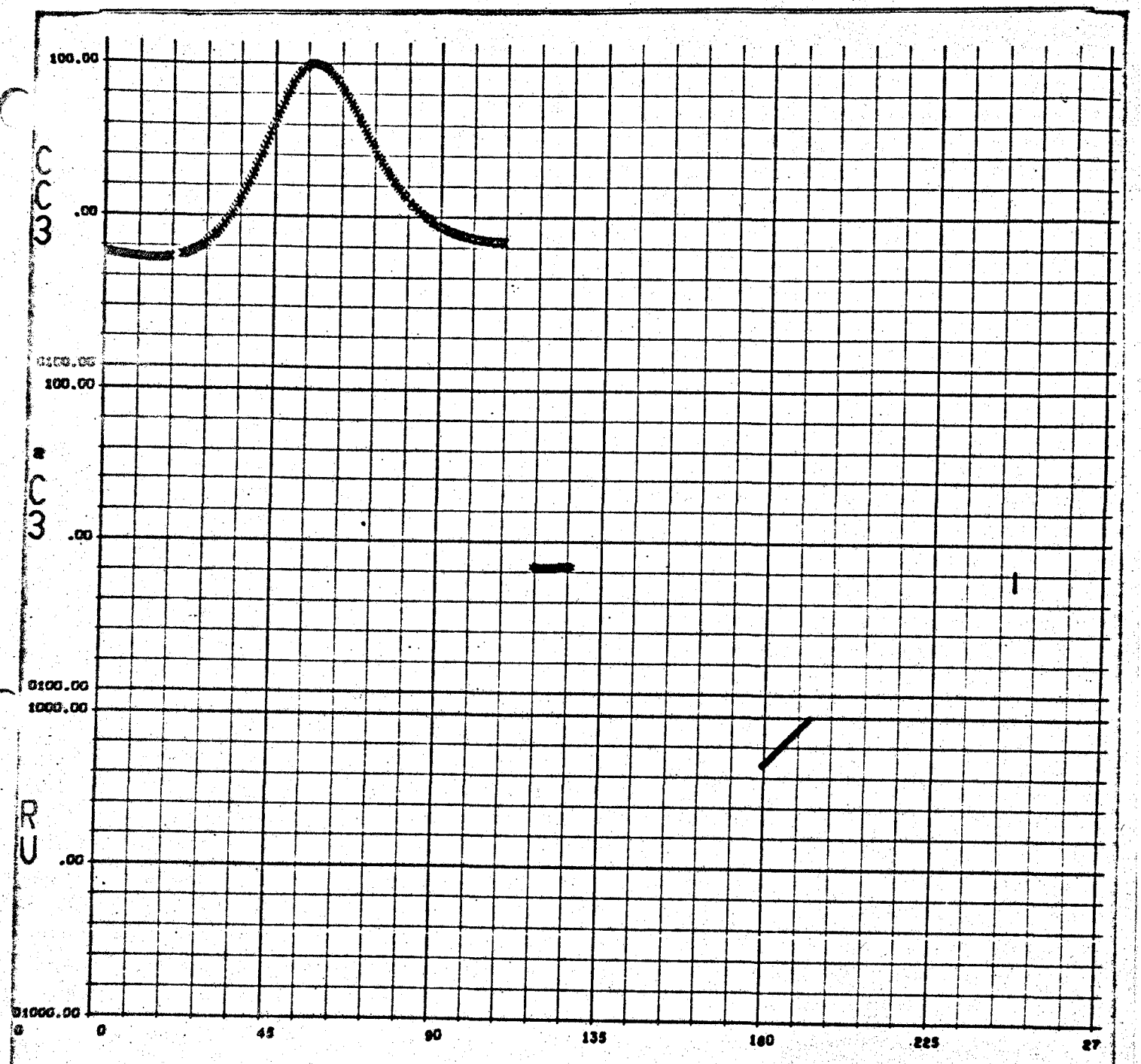
STATION 41 RESIDUALS PASS NUMBER 16/238



STATION 12 RESIDUALS PASS NUMBER 16/239



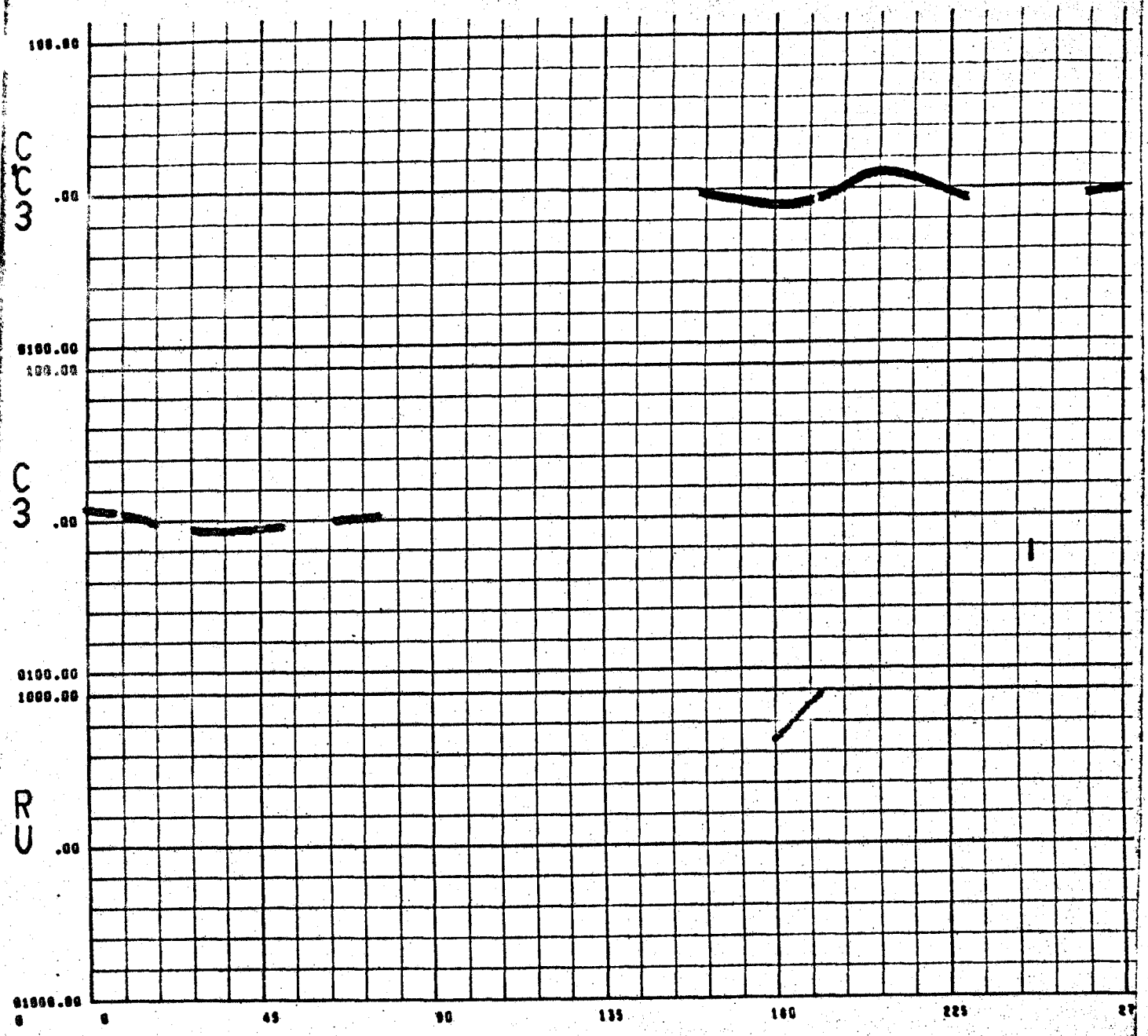
STATION 61 RESIDUALS PASS NUMBER 16/238



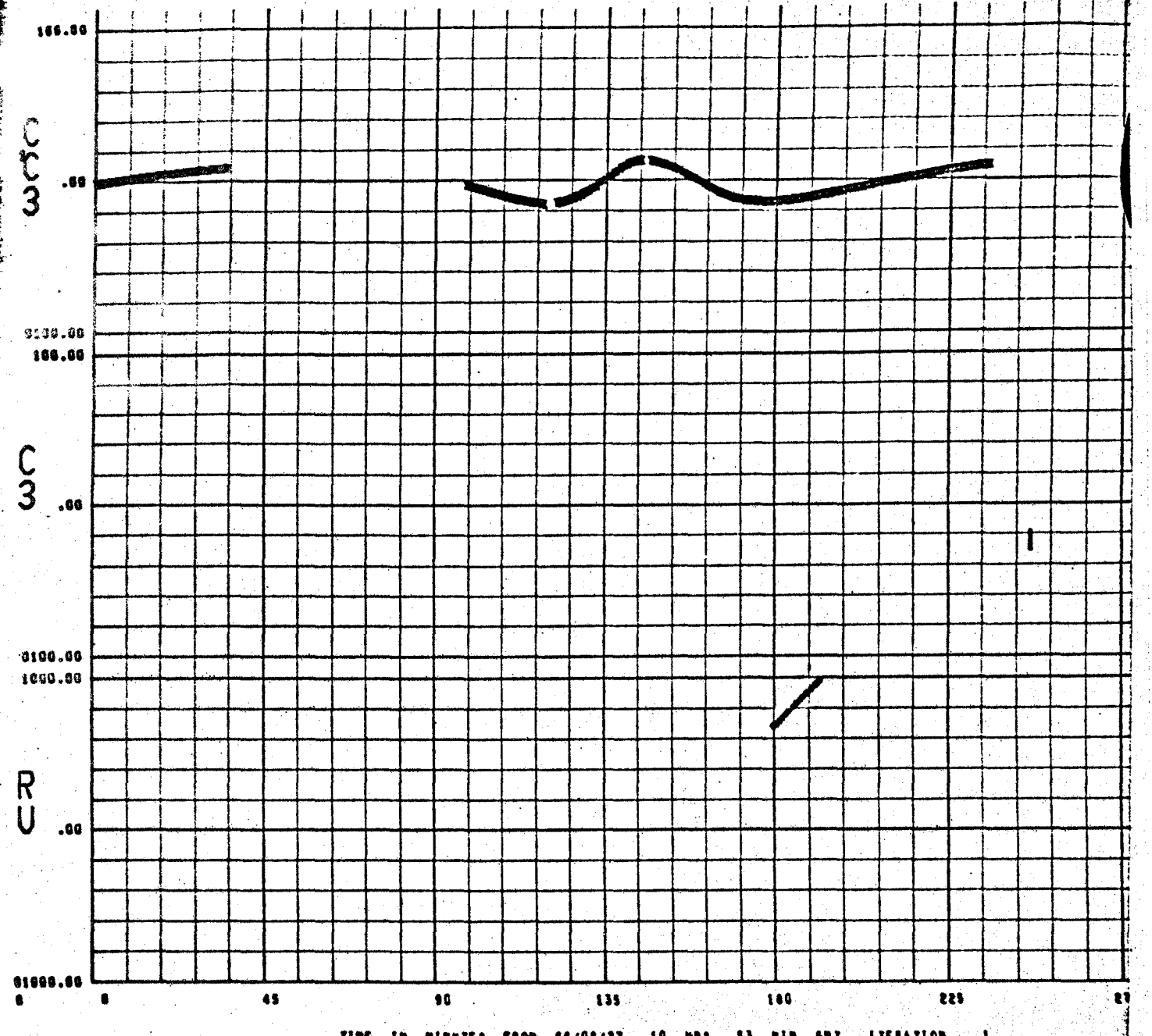
STATION 61 RESIDUALS PASS NUMBER 16/238

ODPL 1F150

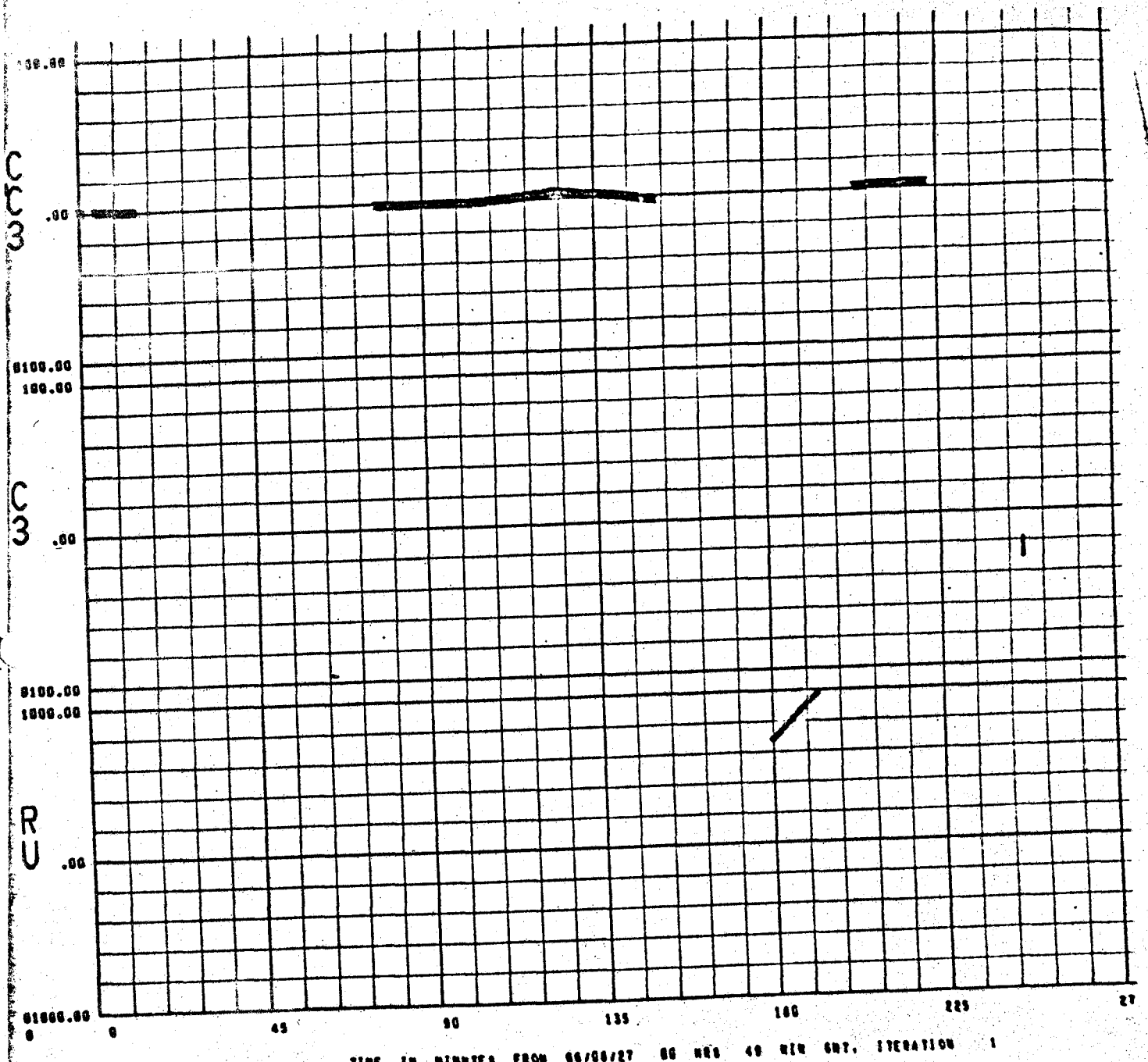
SIMPLE MOON



STATION 41 RESIDUALS PASS NUMBER 17/239

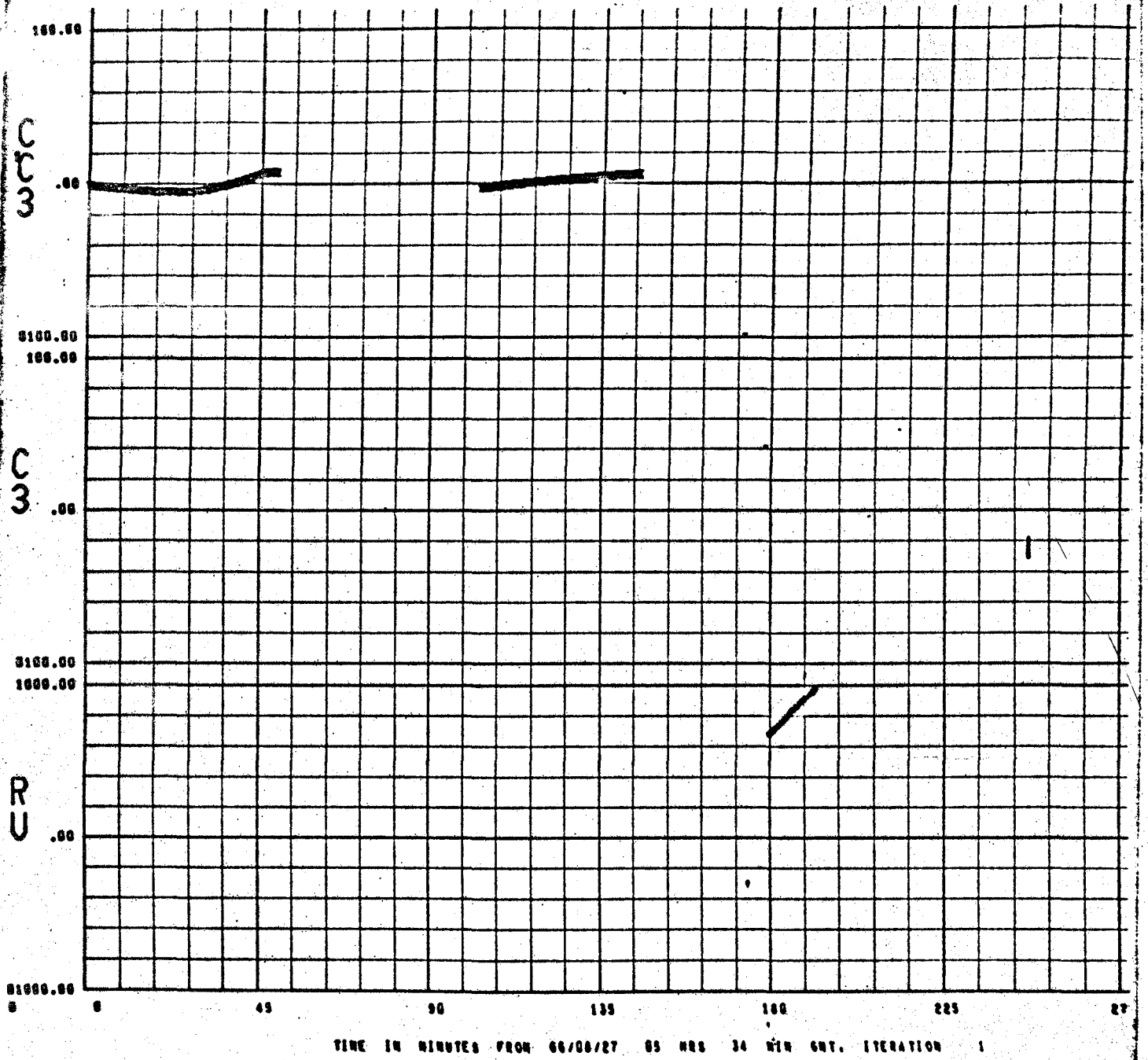


STATION 41 RESIDUALS PASS NUMBER 17/239



STATION 12 RESIDUALS

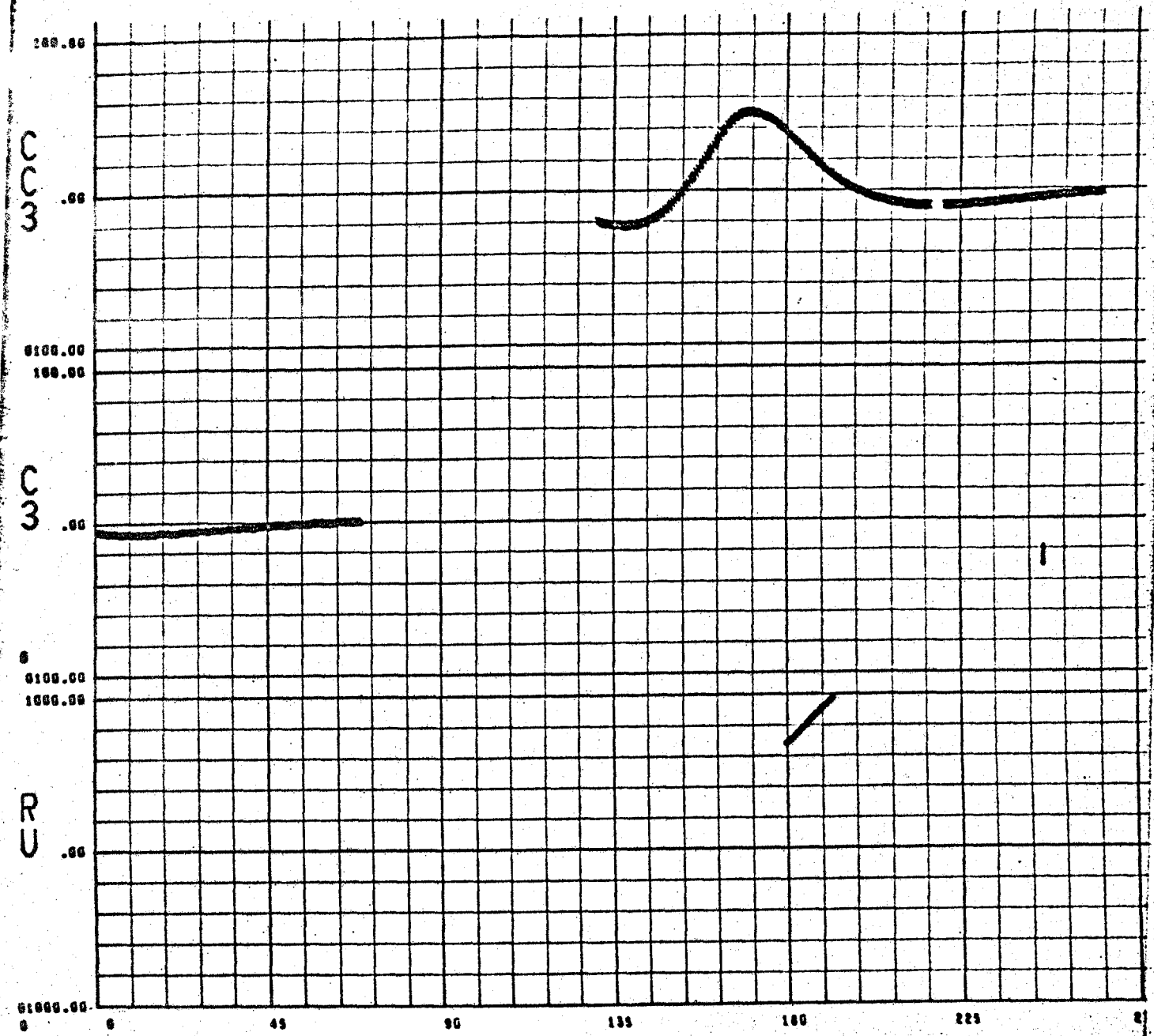
PASS NUMBER 16/239



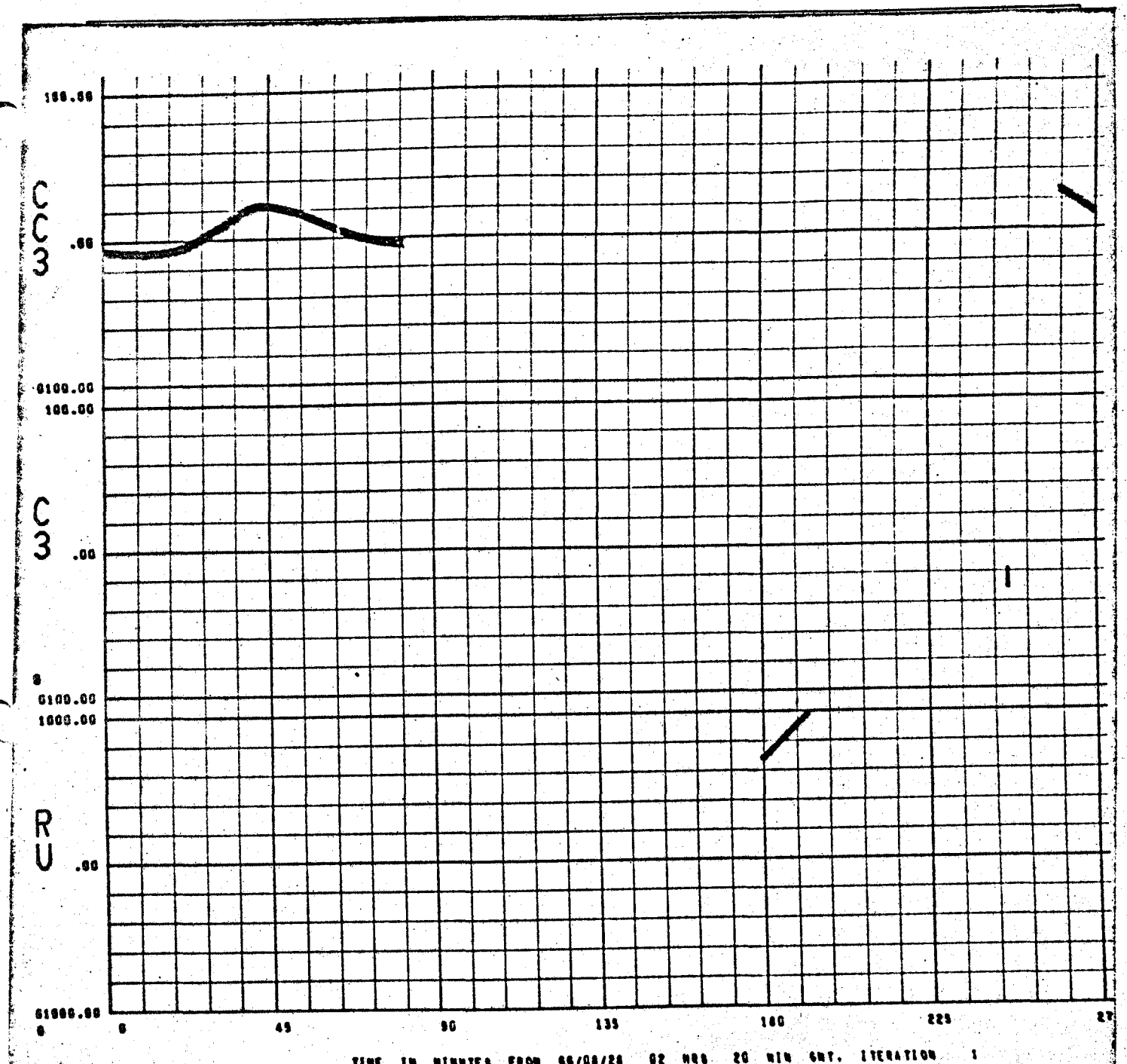
STATION 12 RESIDUALS PASS NUMBER 16/239

ODPL 1F153

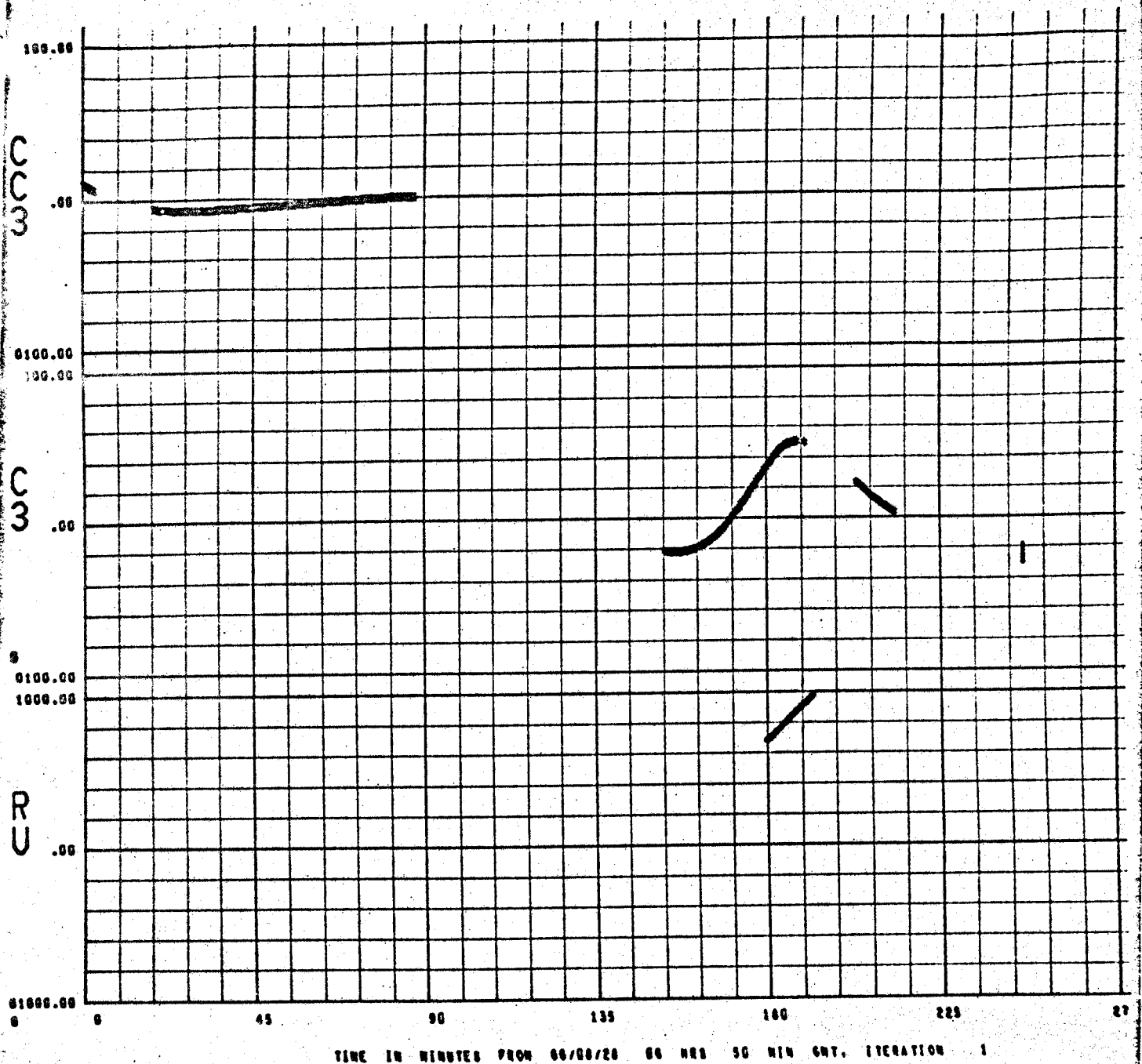
SIMPLE MOON



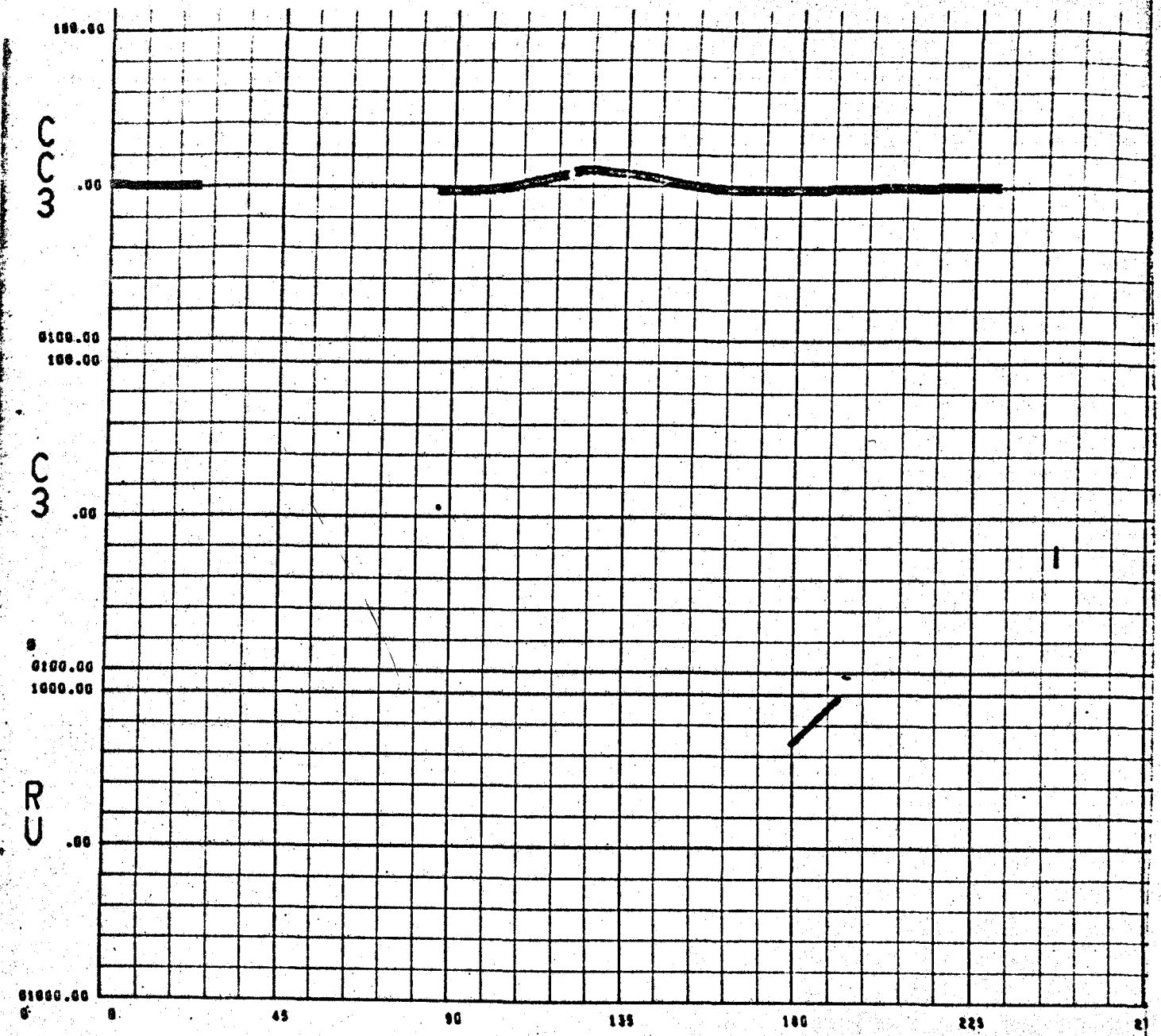
STATION 41 RESIDUALS PASS NUMBER 18/240



STATION 12 RESIDUALS PASS NUMBER 17/240



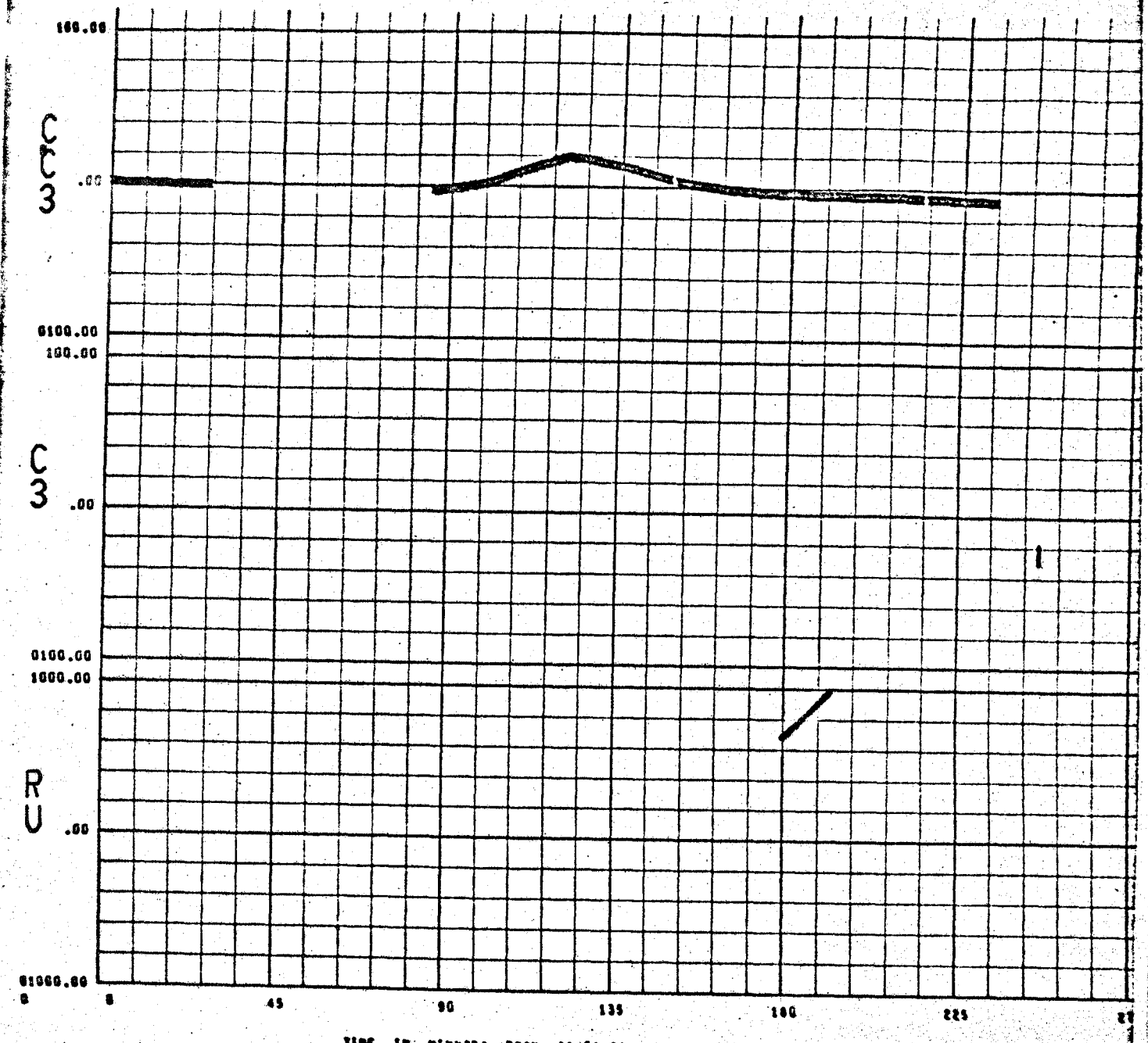
STATION 12 RESIDUALS PASS NUMBER 17/240



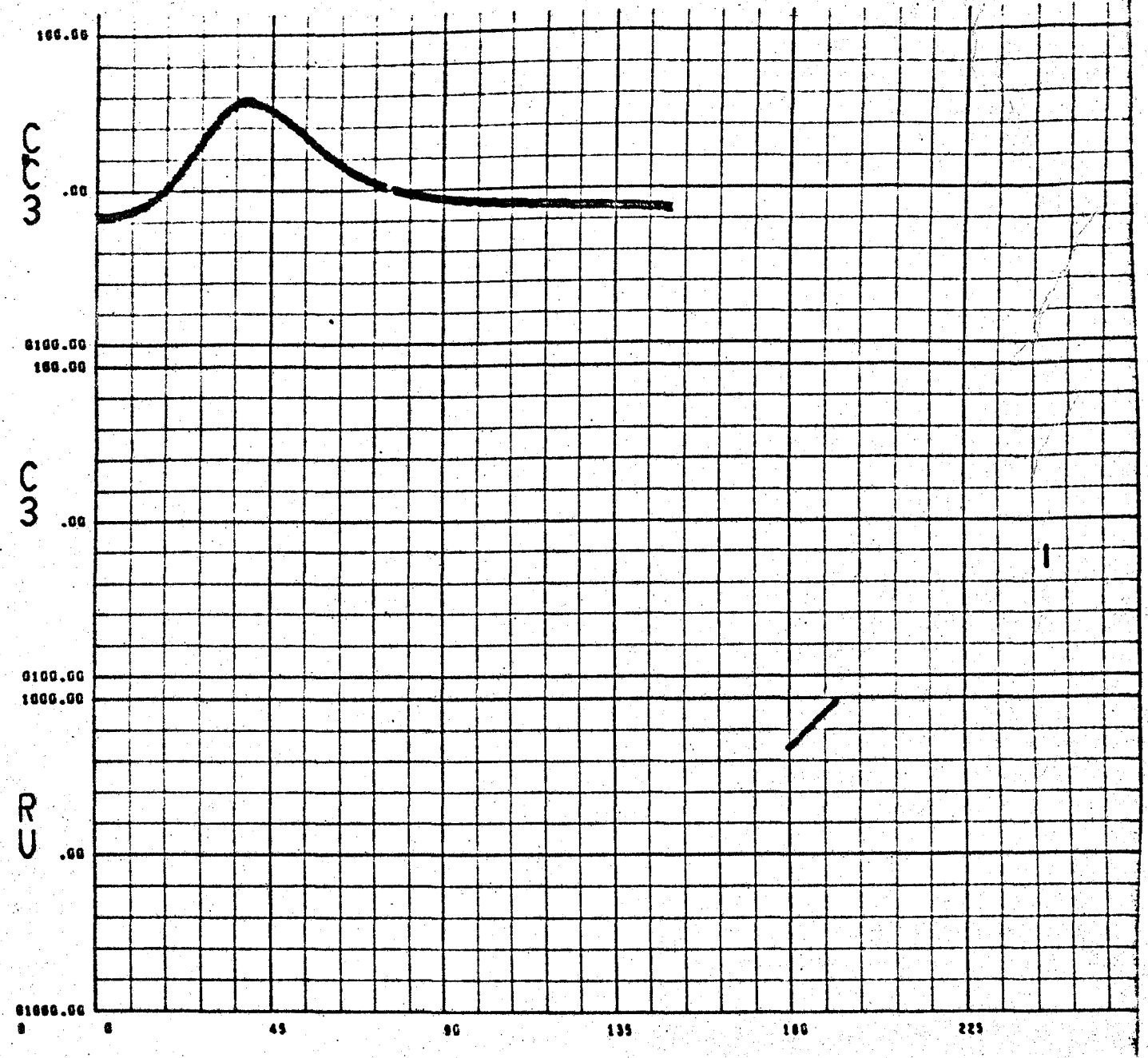
STATION 61 RESIDUALS PASS NUMBER 17/239

ODPL 1F173

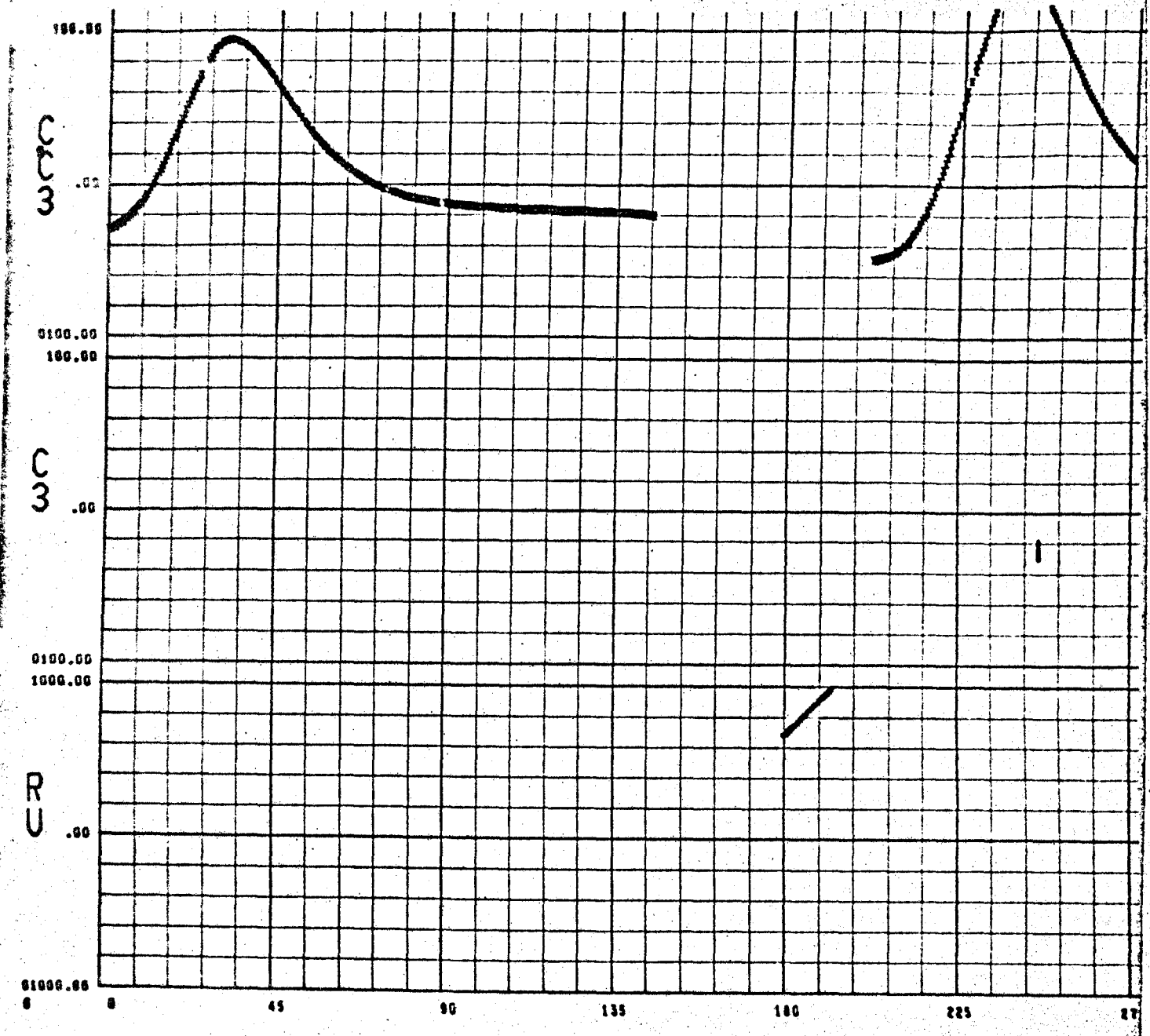
SIMPLE MOON



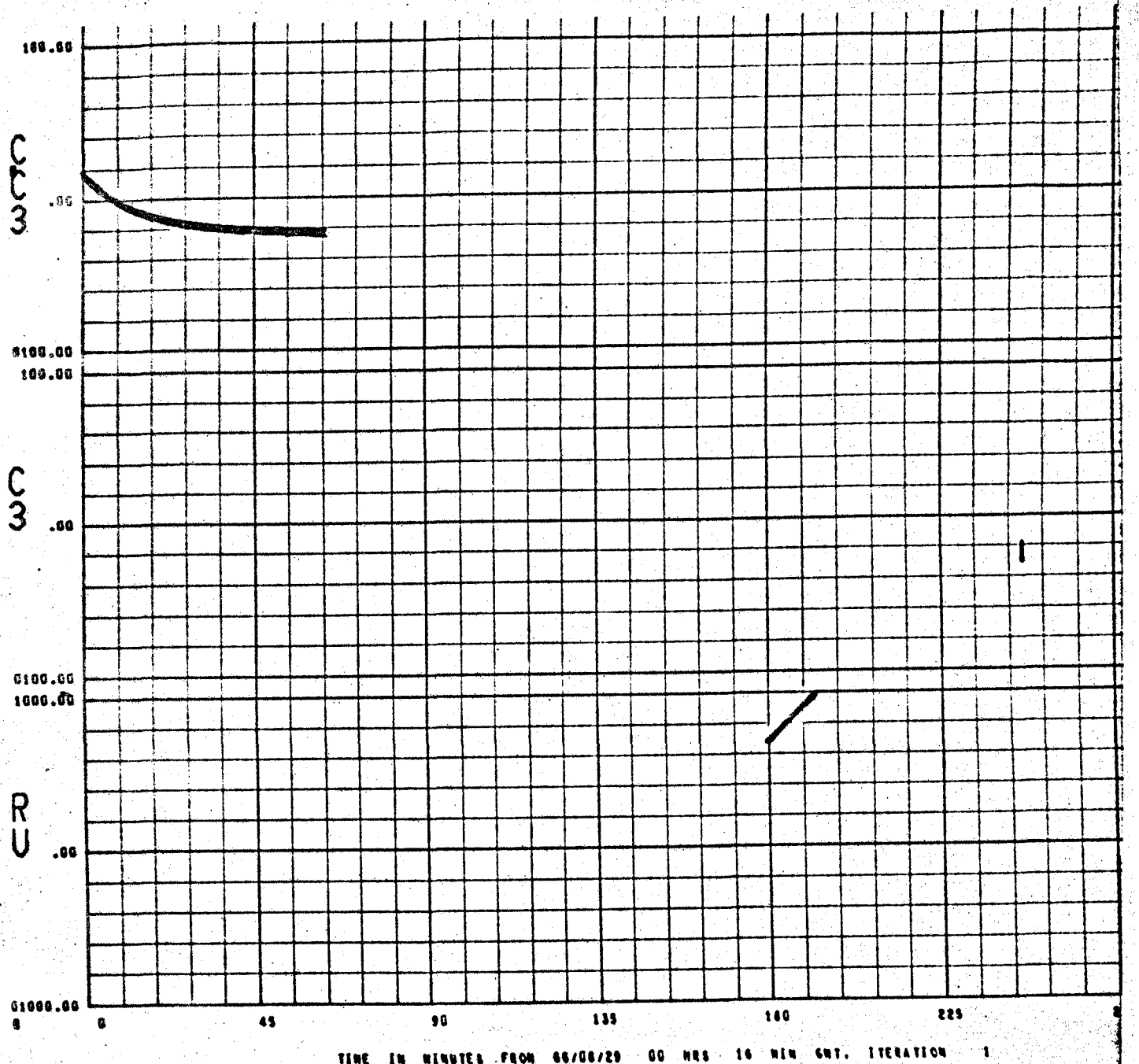
STATION 41 RESIDUALS PASS NUMBER 18/240



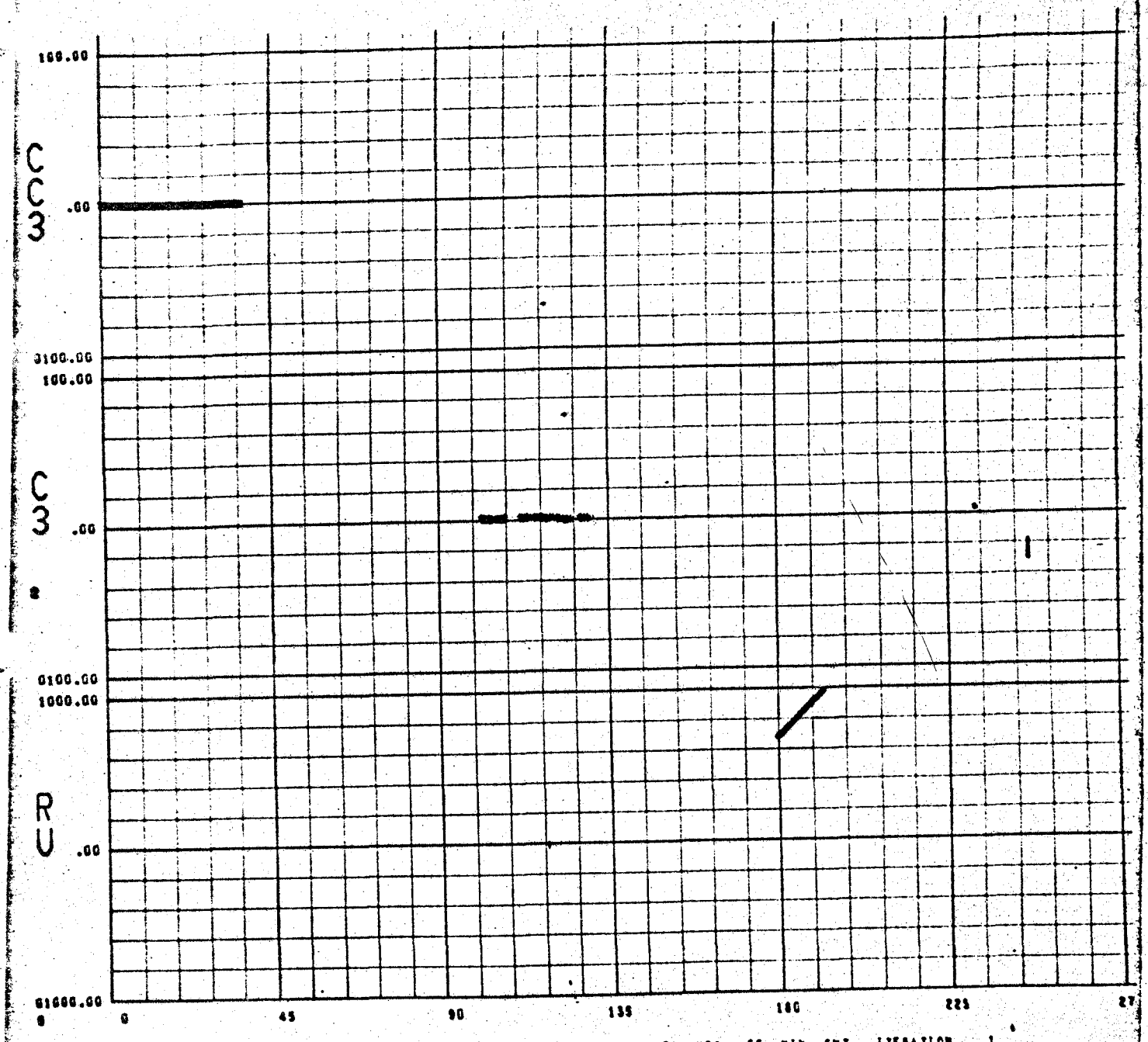
STATION 41 RESIDUALS PASS NUMBER 18/240



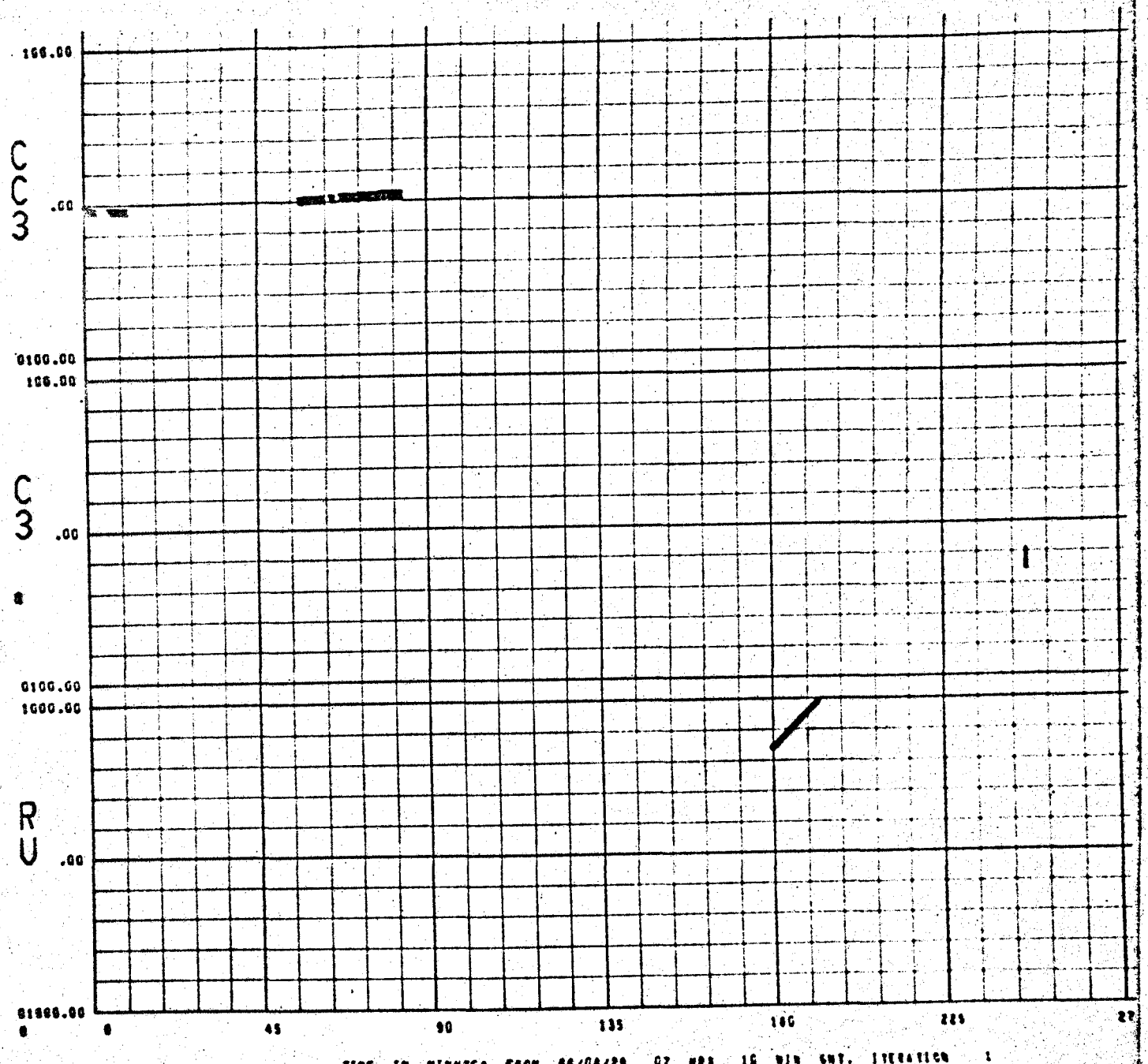
STATION 61 RESIDUALS PASS NUMBER 18/240



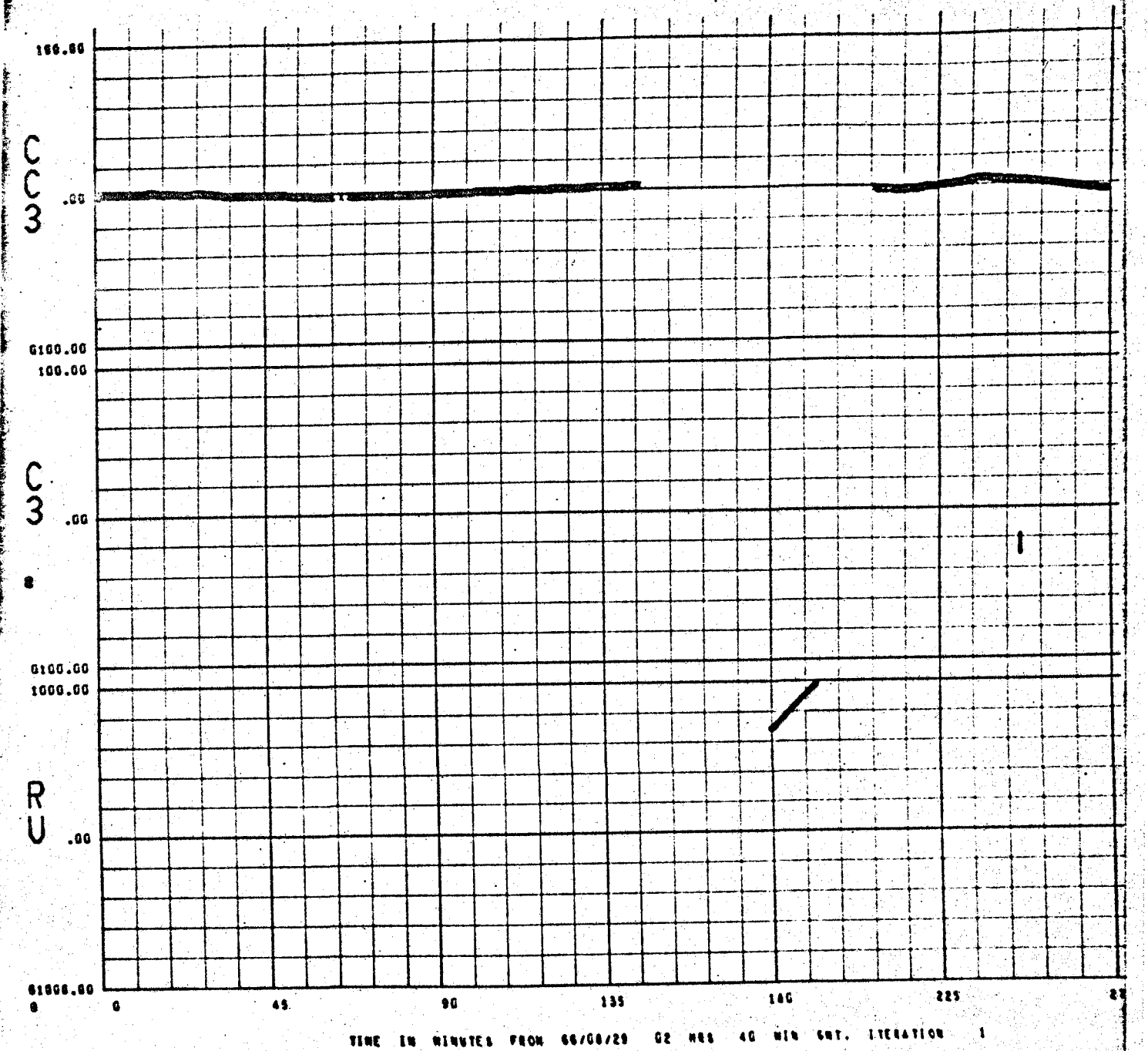
STATION 61 RESIDUALS PASS NUMBER 18/240



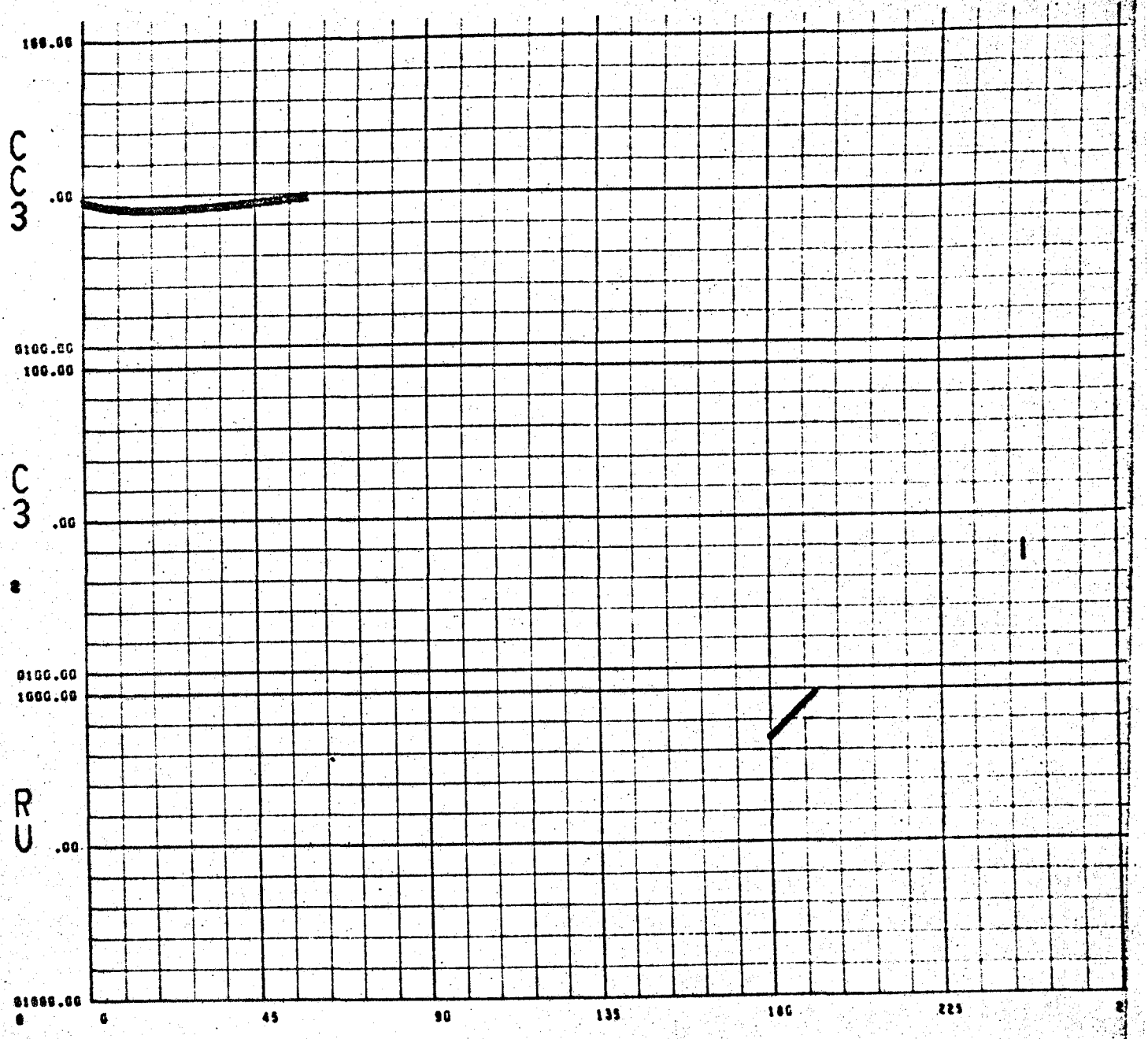
STATION 61 RESIDUALS PASS NUMBER 18/240



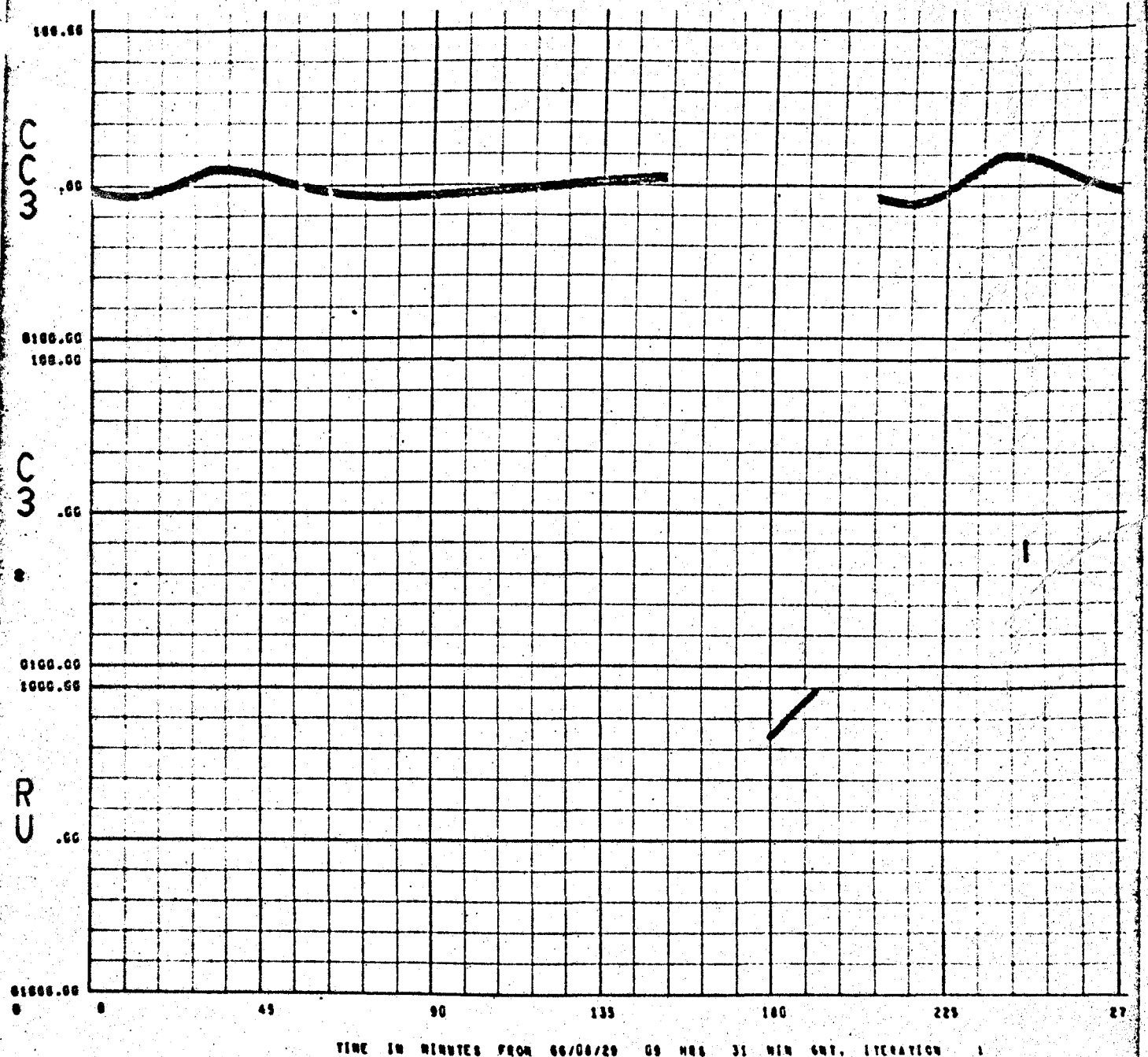
STATION 12 RESIDUALS PASS NUMBER 18/241



STATION 12 RESIDUALS PASS NUMBER 18/241



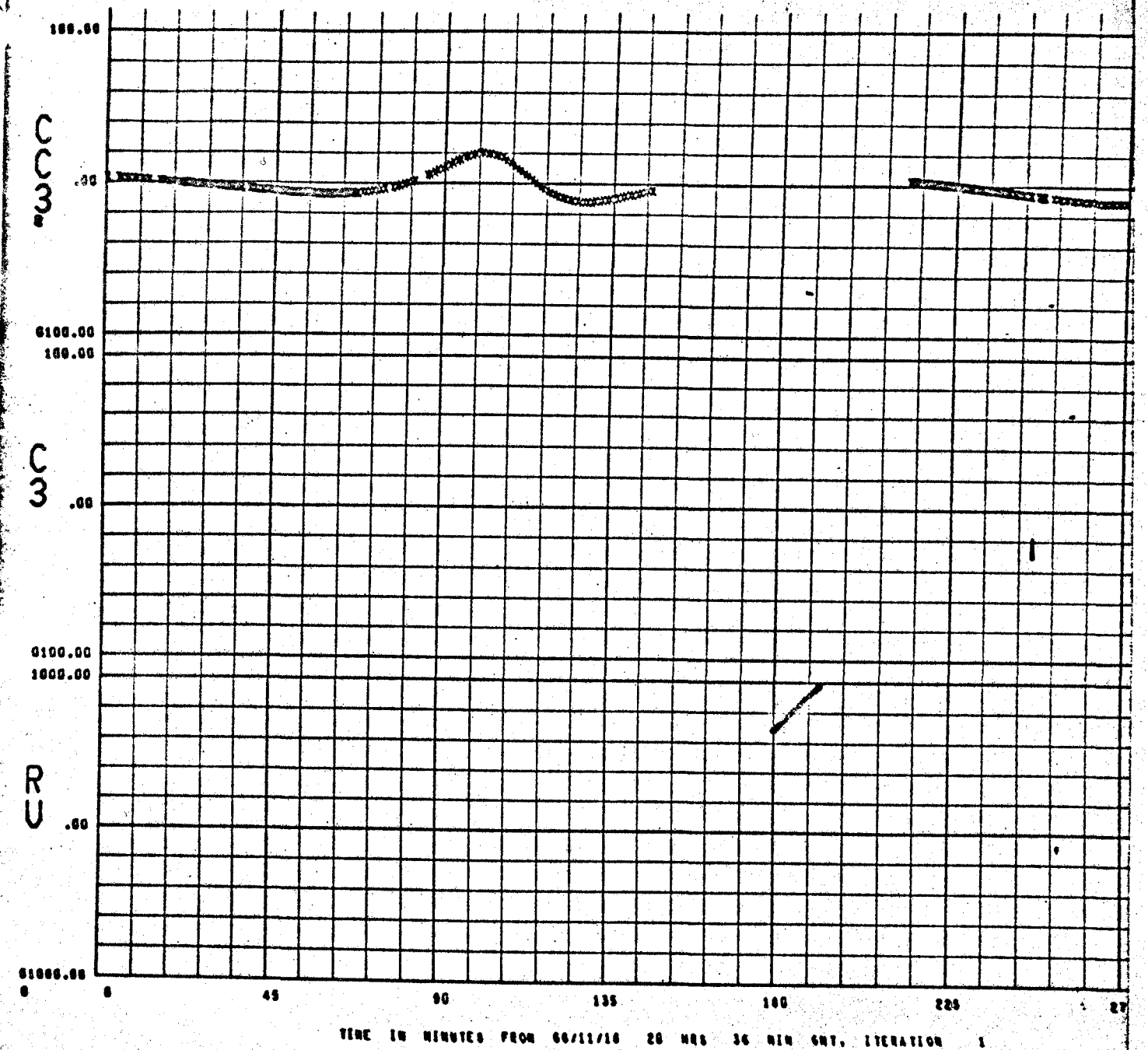
STATION 41 RESIDUALS PASS NUMBER 19/241



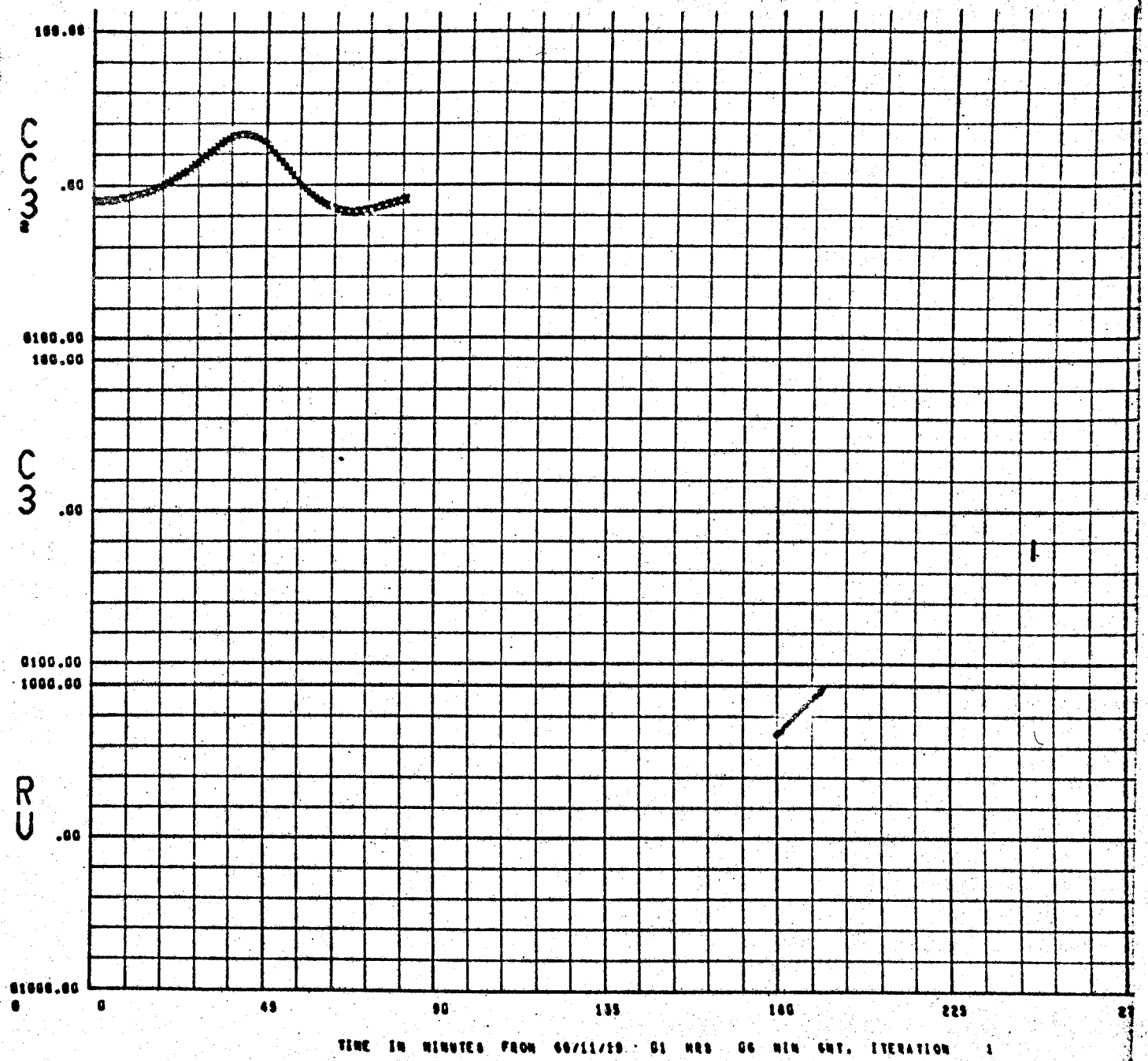
STATION 41 RESIDUALS PASS NUMBER 19/241

ODPL 2P1

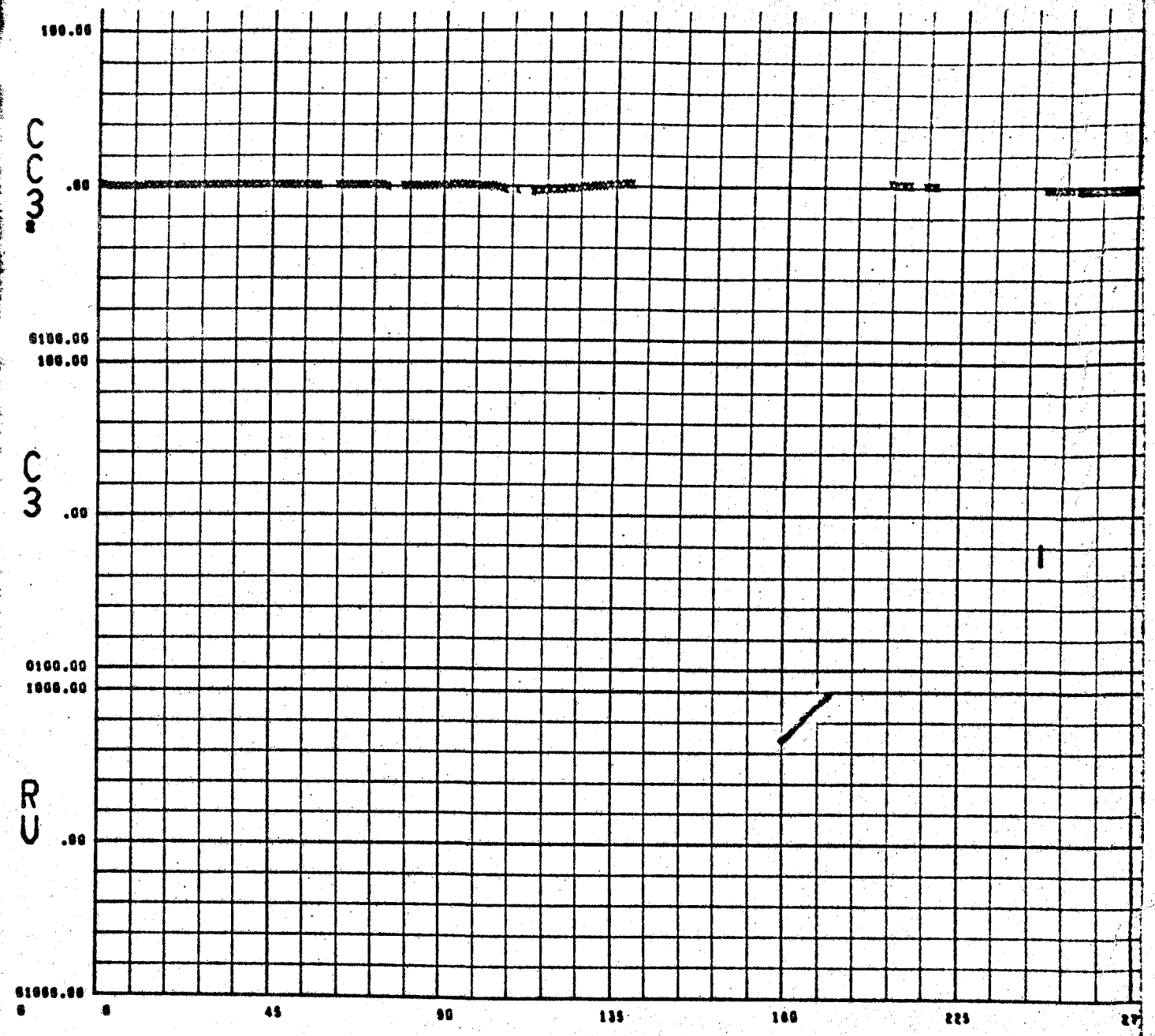
SIMPLE MOON



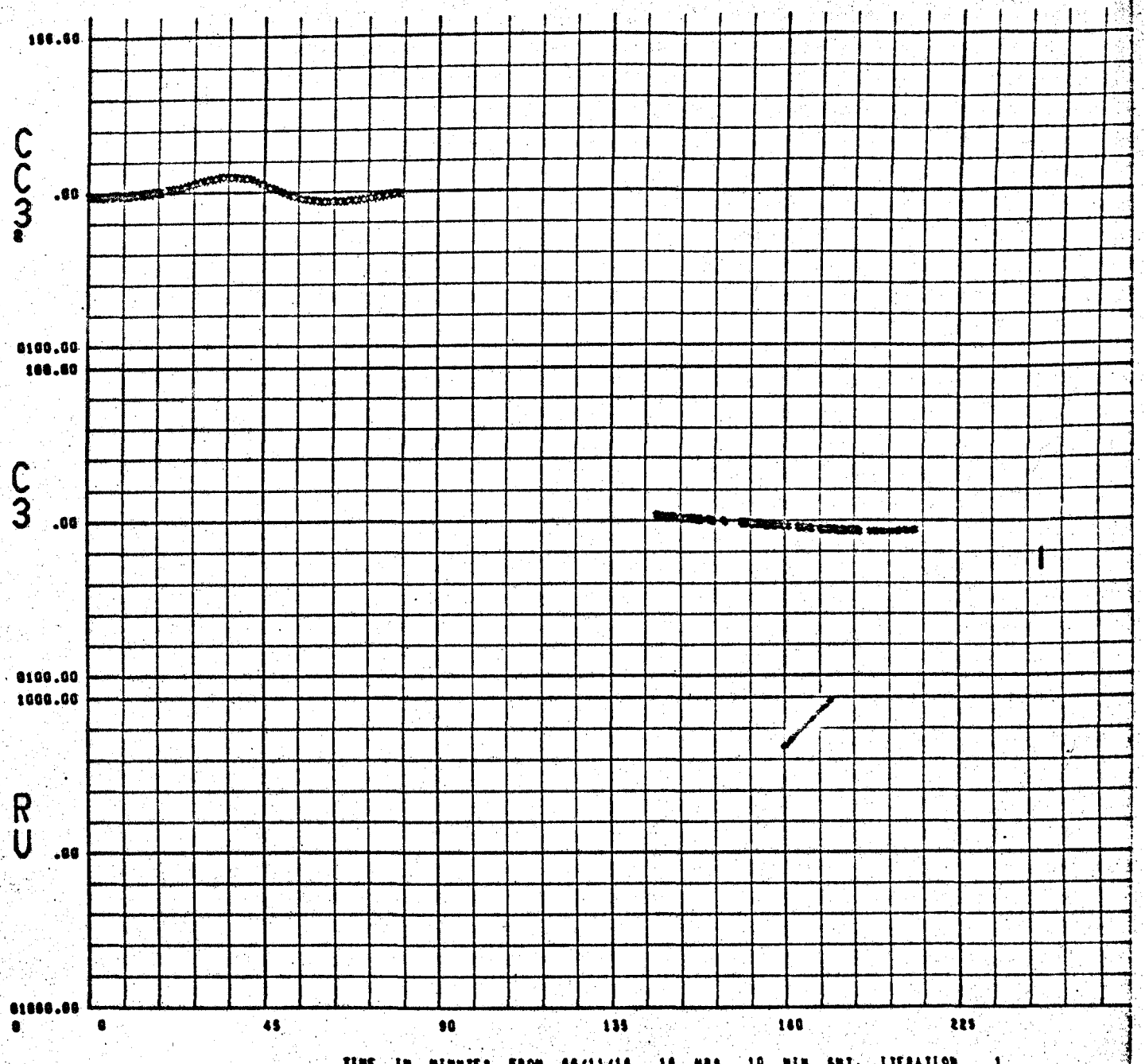
STATION 12 RESIDUALS PASS NUMBER 12/322



STATION 12 RESIDUALS PASS NUMBER 12/322



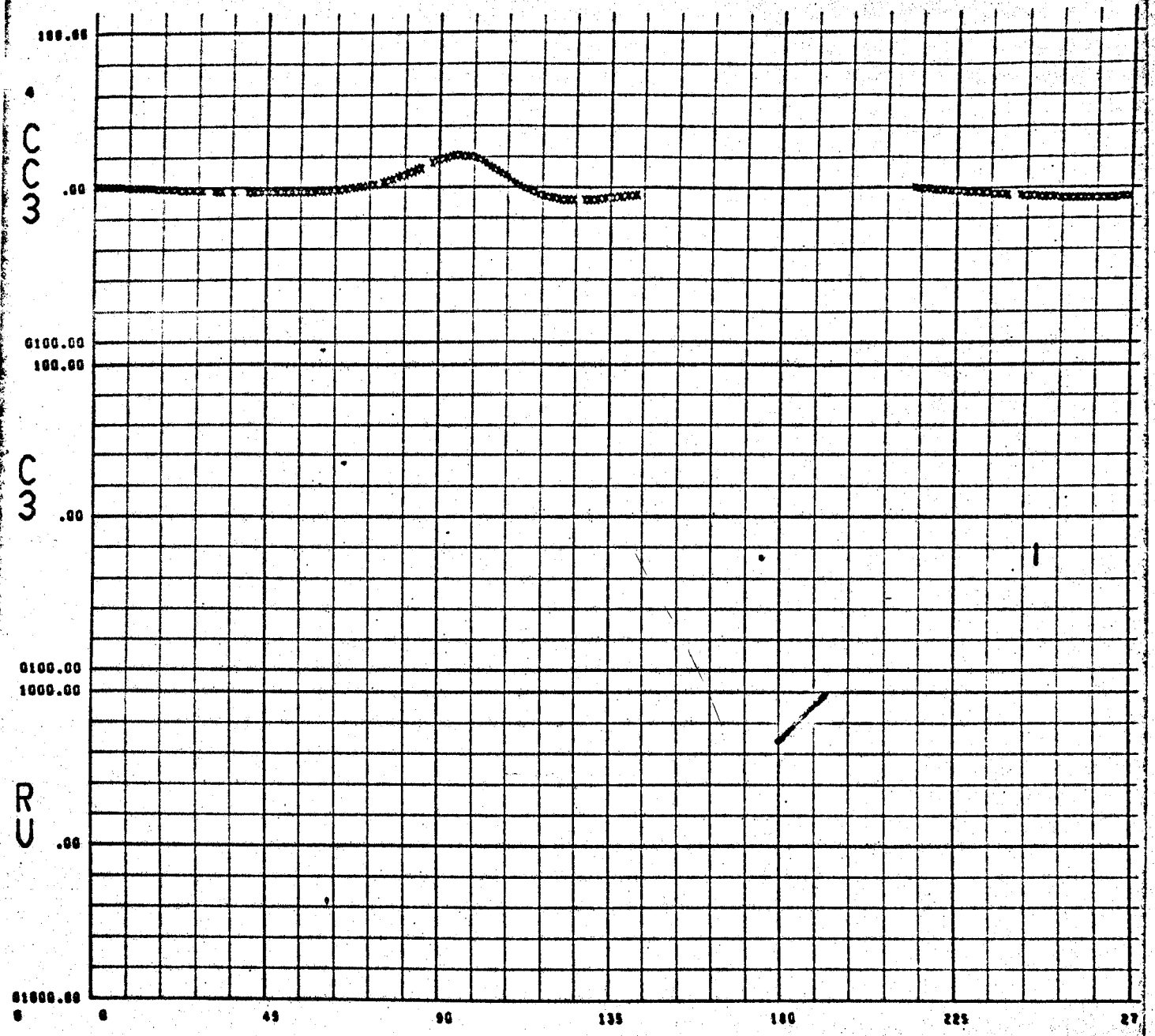
STATION 61 RESIDUALS PASS NUMBER 12/322



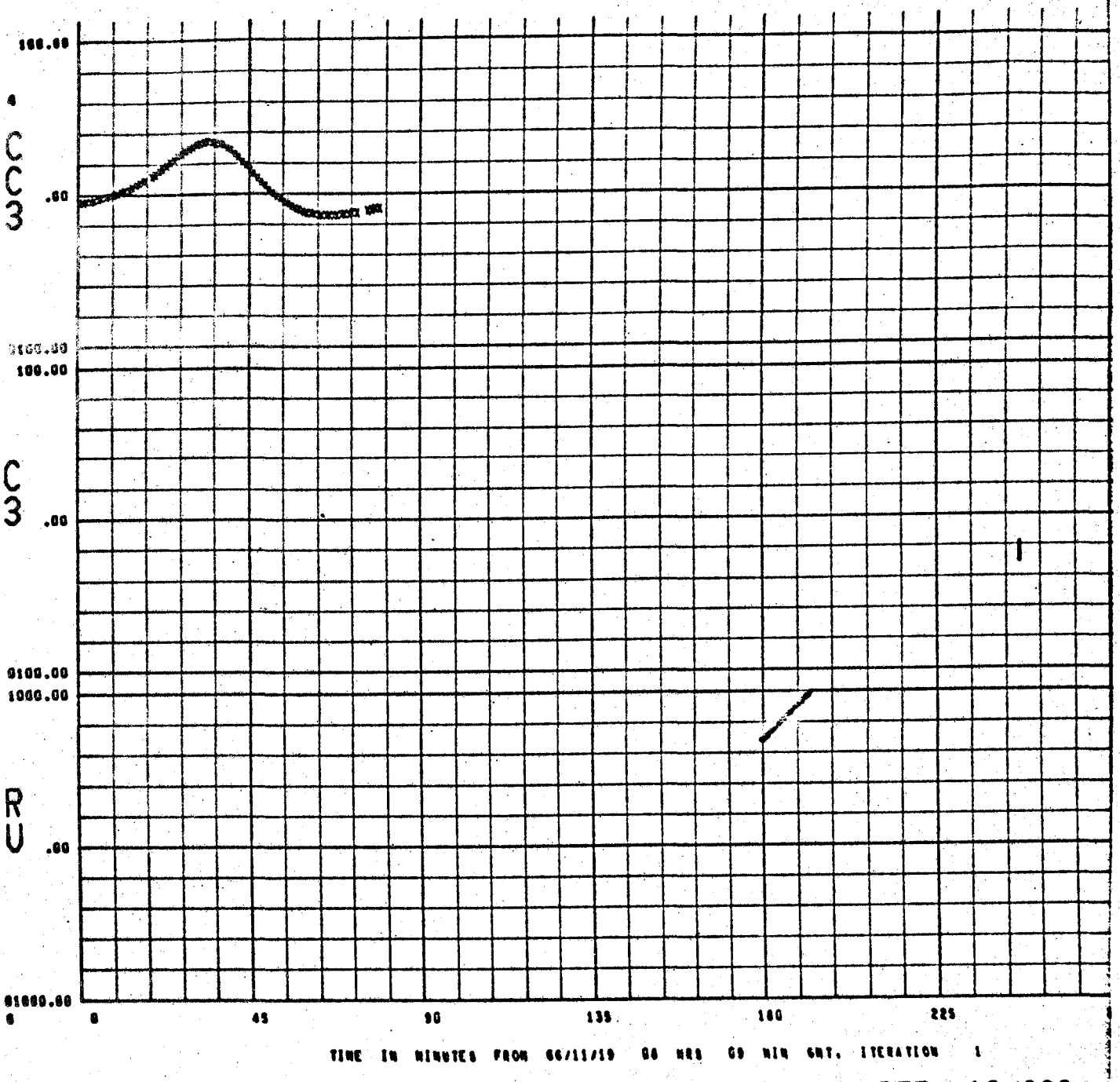
STATION 61 RESIDUALS PASS NUMBER 12/322

ODPL 2S3

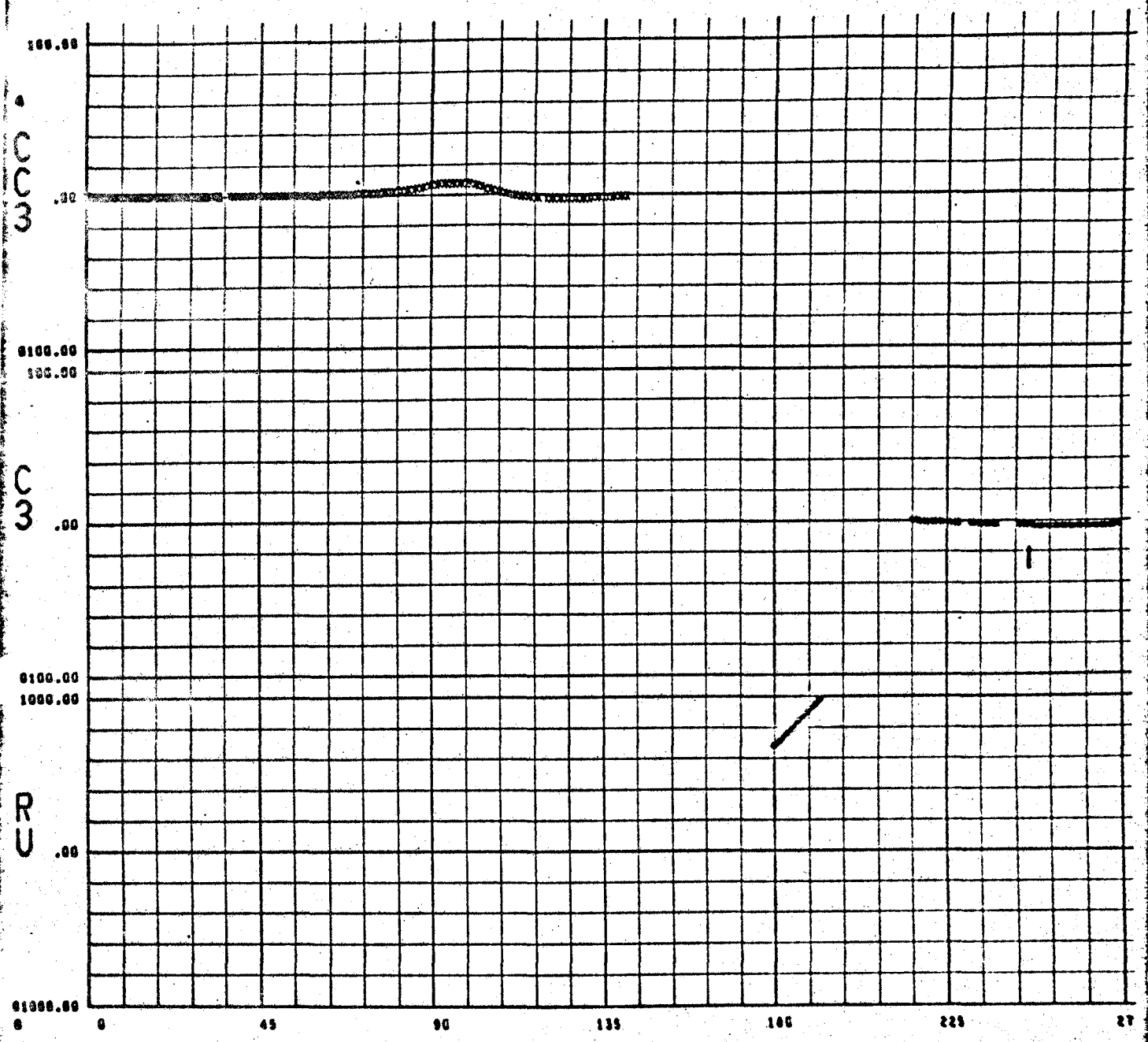
SIMPLE MOON



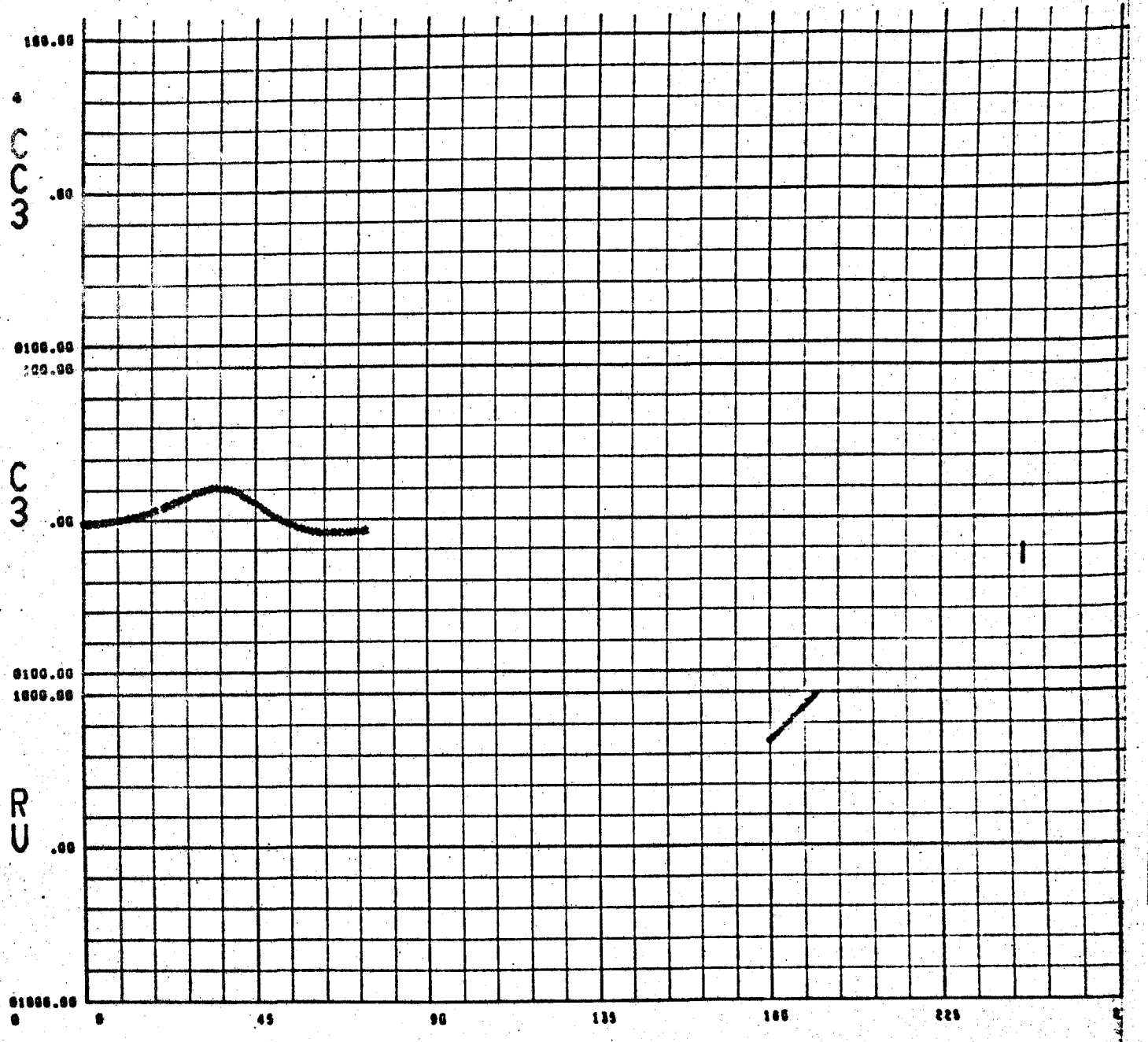
STATION 41 RESIDUALS PASS NUMBER 13/323



STATION 41 RESIDUALS PASS NUMBER 13/323



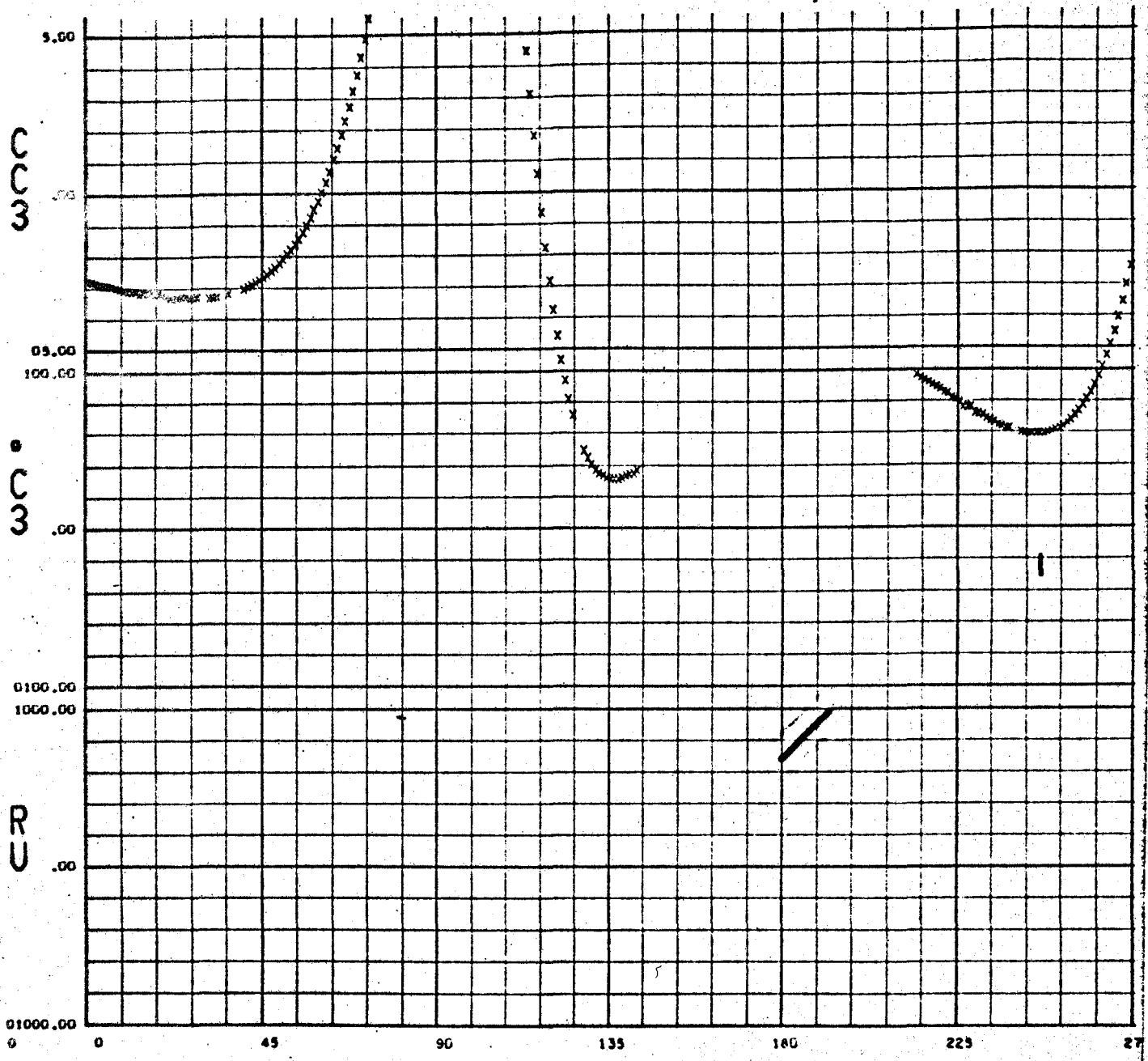
STATION 12 RESIDUALS PASS NUMBER 12/322



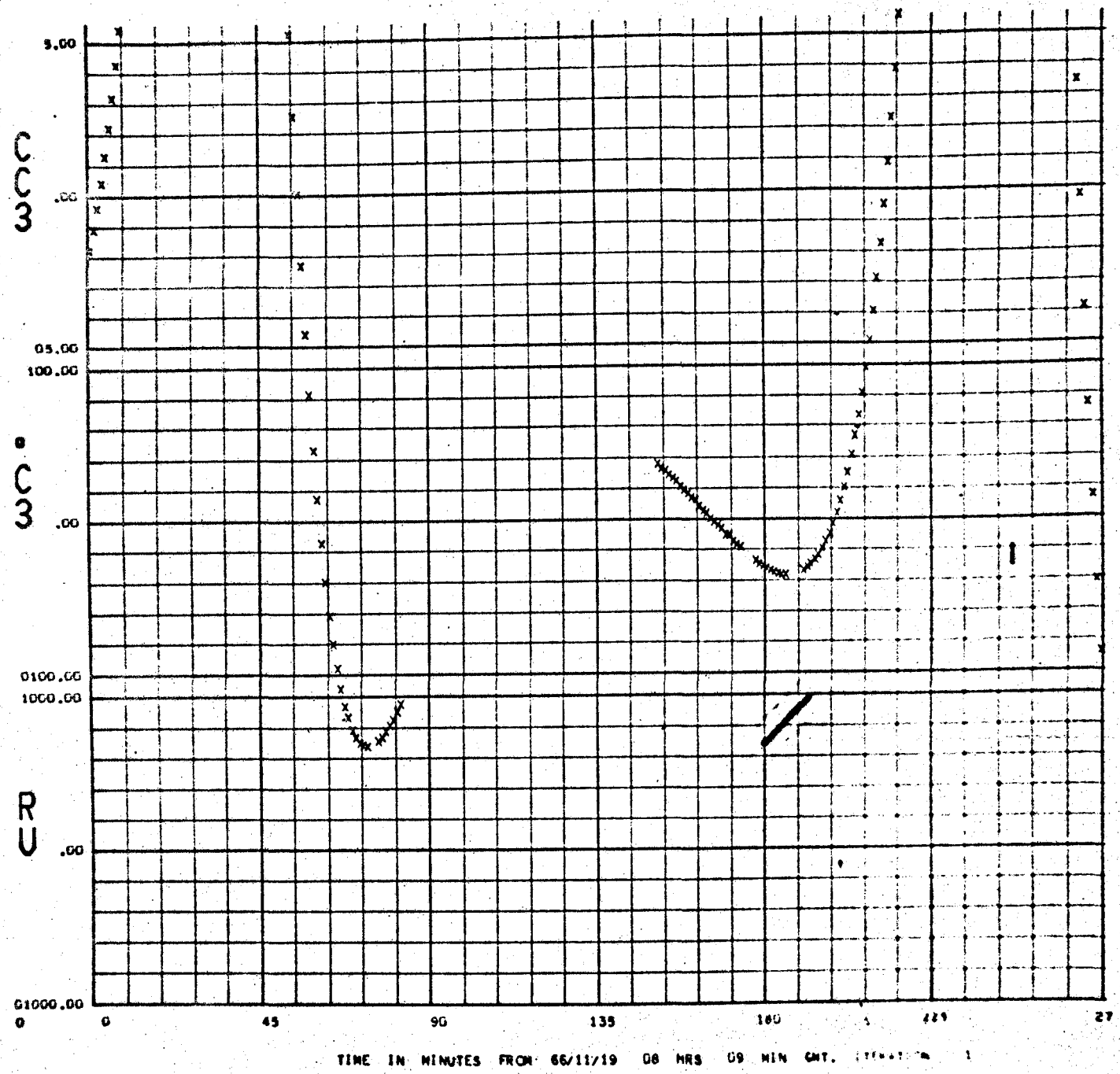
STATION 12 RESIDUALS PASS NUMBER 12/322

ODPL 2P2

SIMPLIFIED L



STATION 41 RESIDUALS PASS NUMBER 13/323



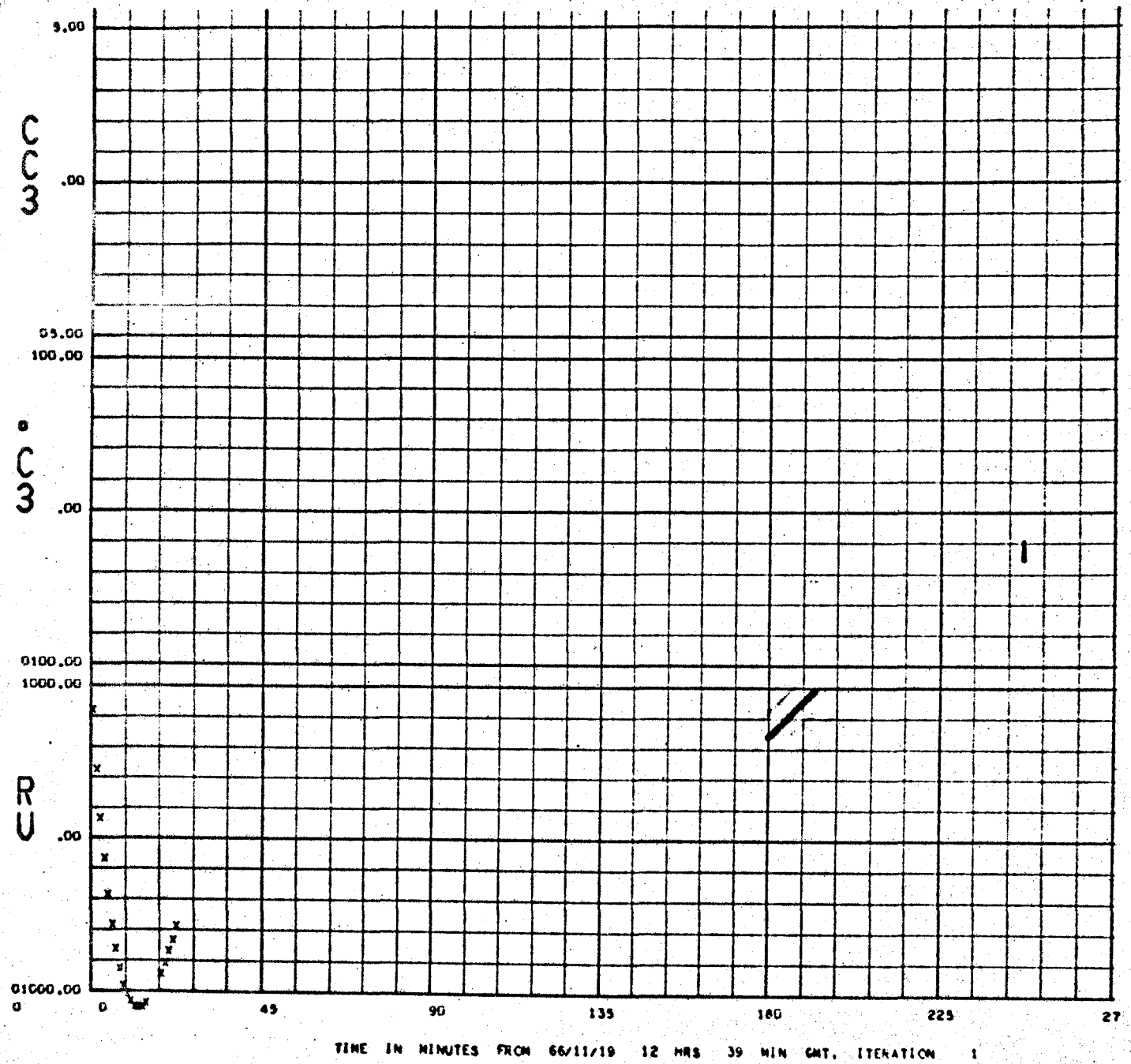
STATION 41 RESIDUALS PASS NUMBER 13/323

REV LTR

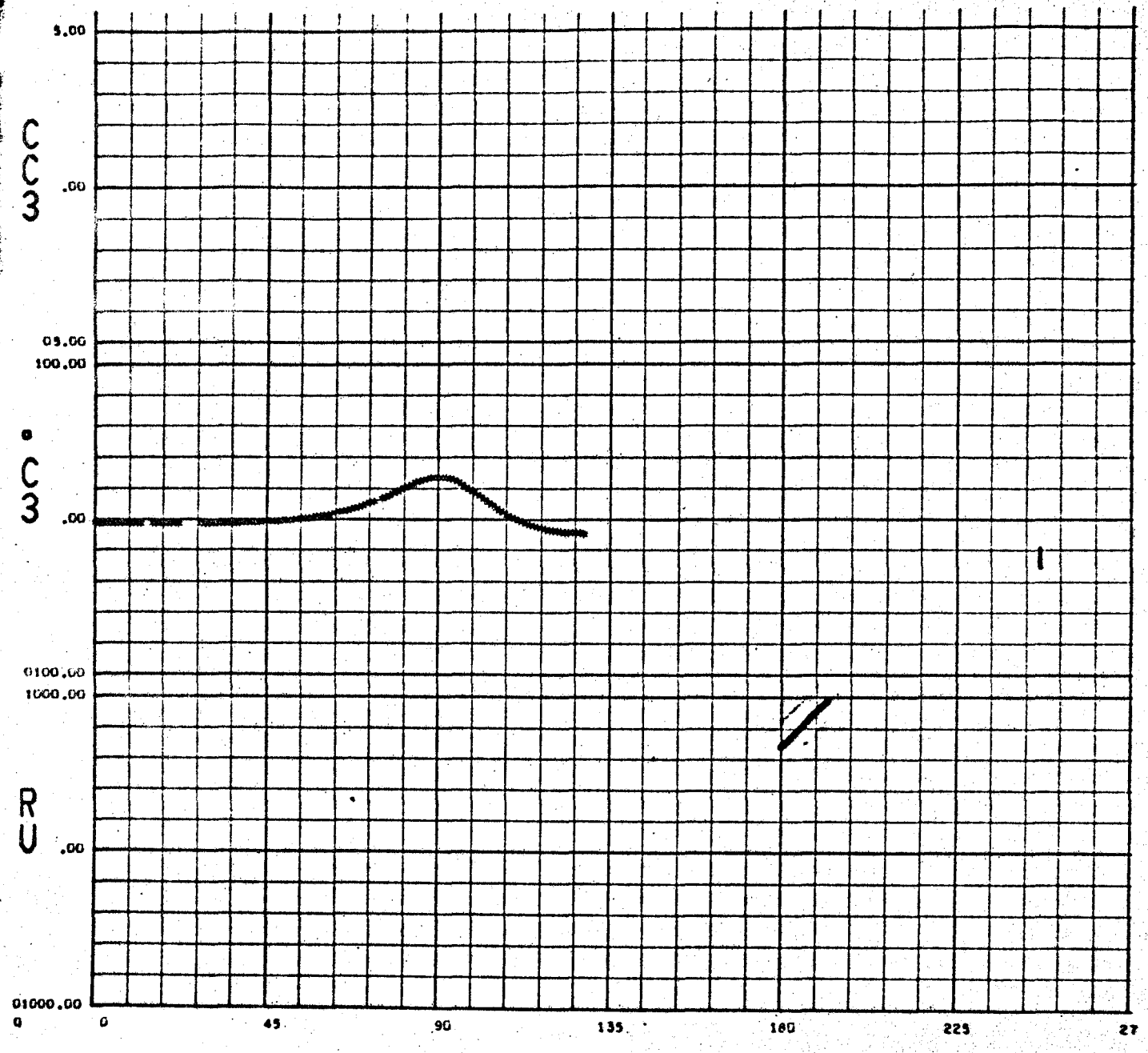
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 134

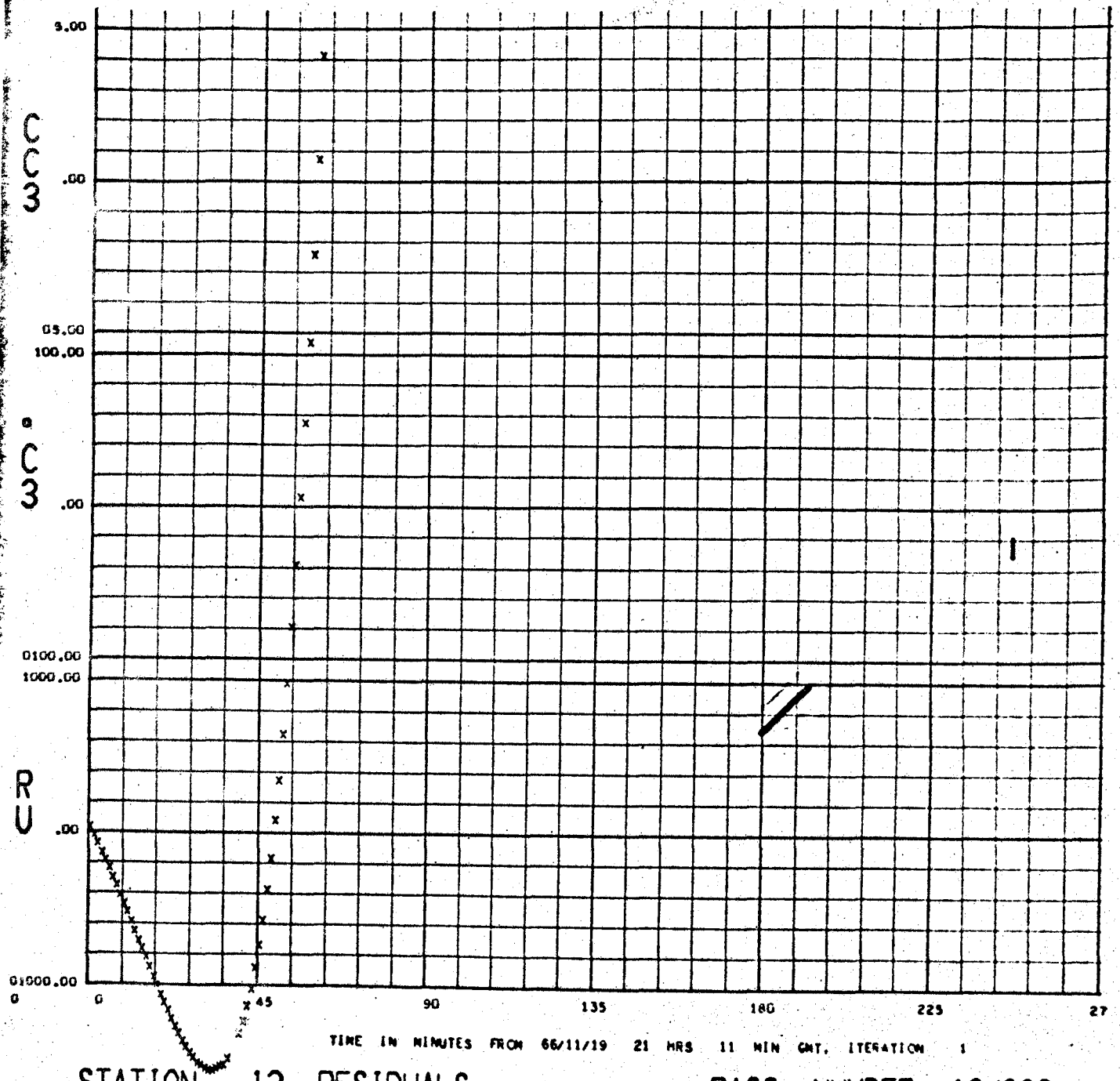


STATION 41 RESIDUALS PASS NUMBER 13/323

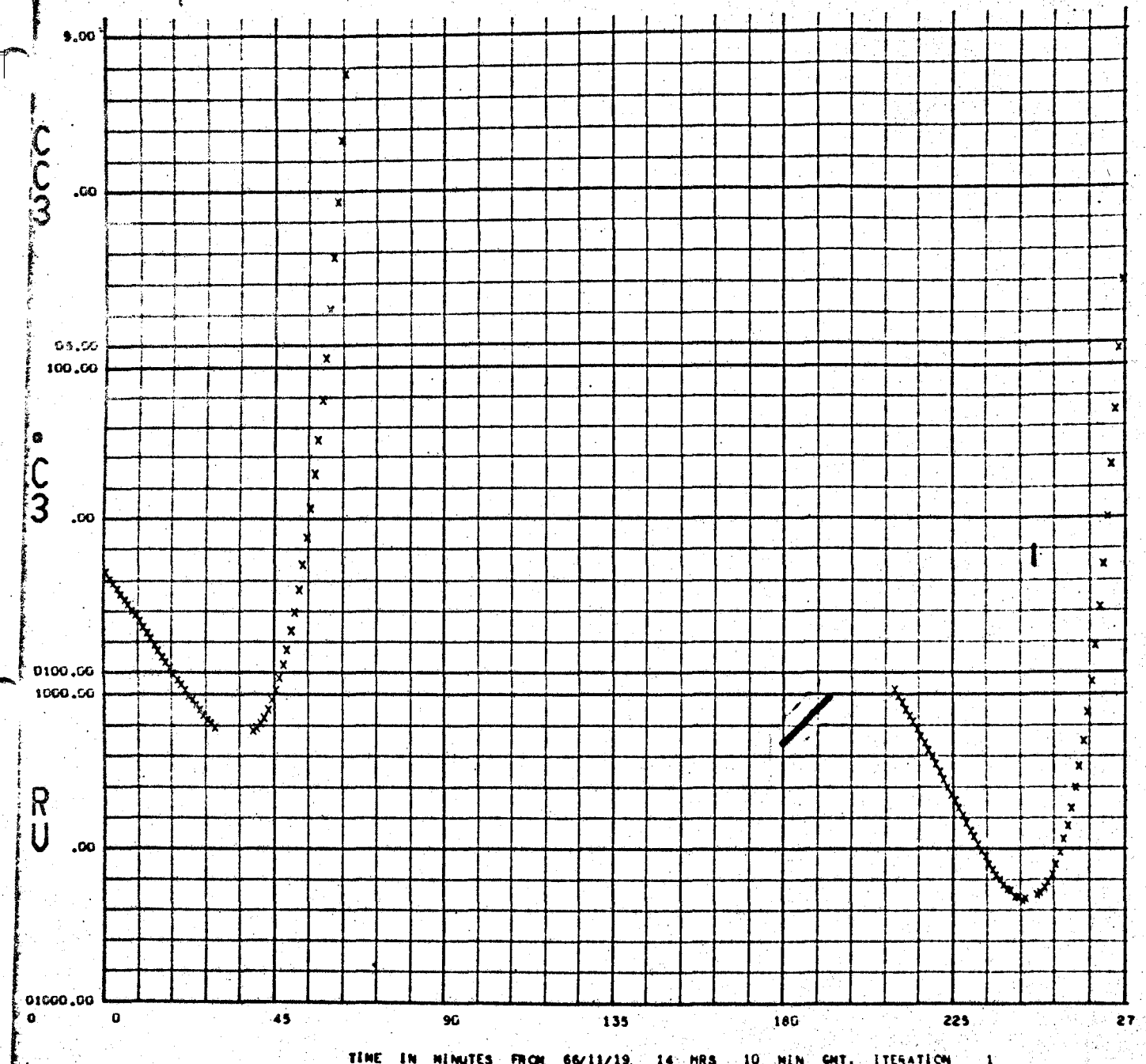


TIME IN MINUTES FROM 66/11/19 03 HRS 45 MIN GMT, ITERATION 1

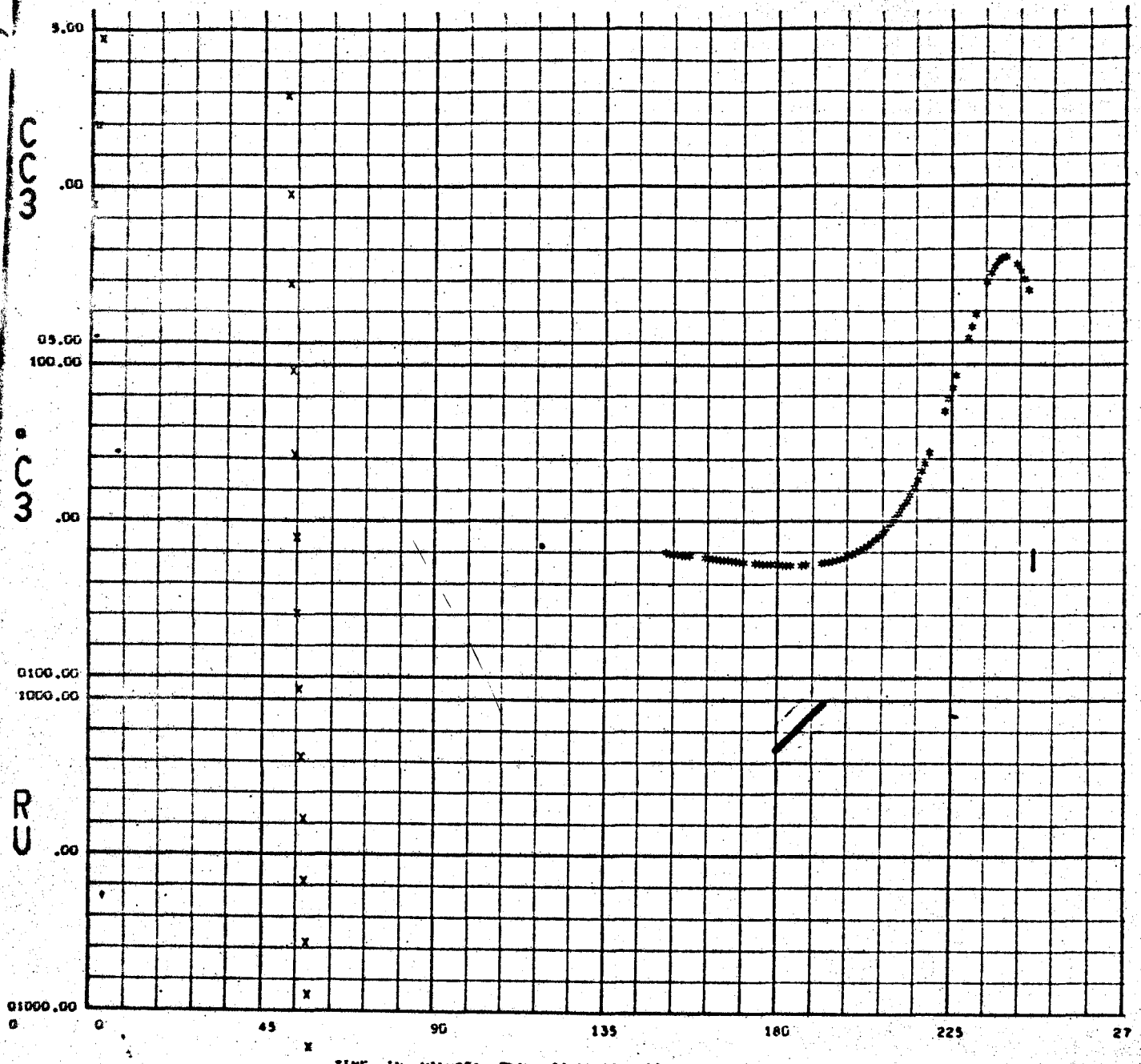
STATION 12 RESIDUALS PASS NUMBER 12/322



STATION 12 RESIDUALS PASS NUMBER 13/323



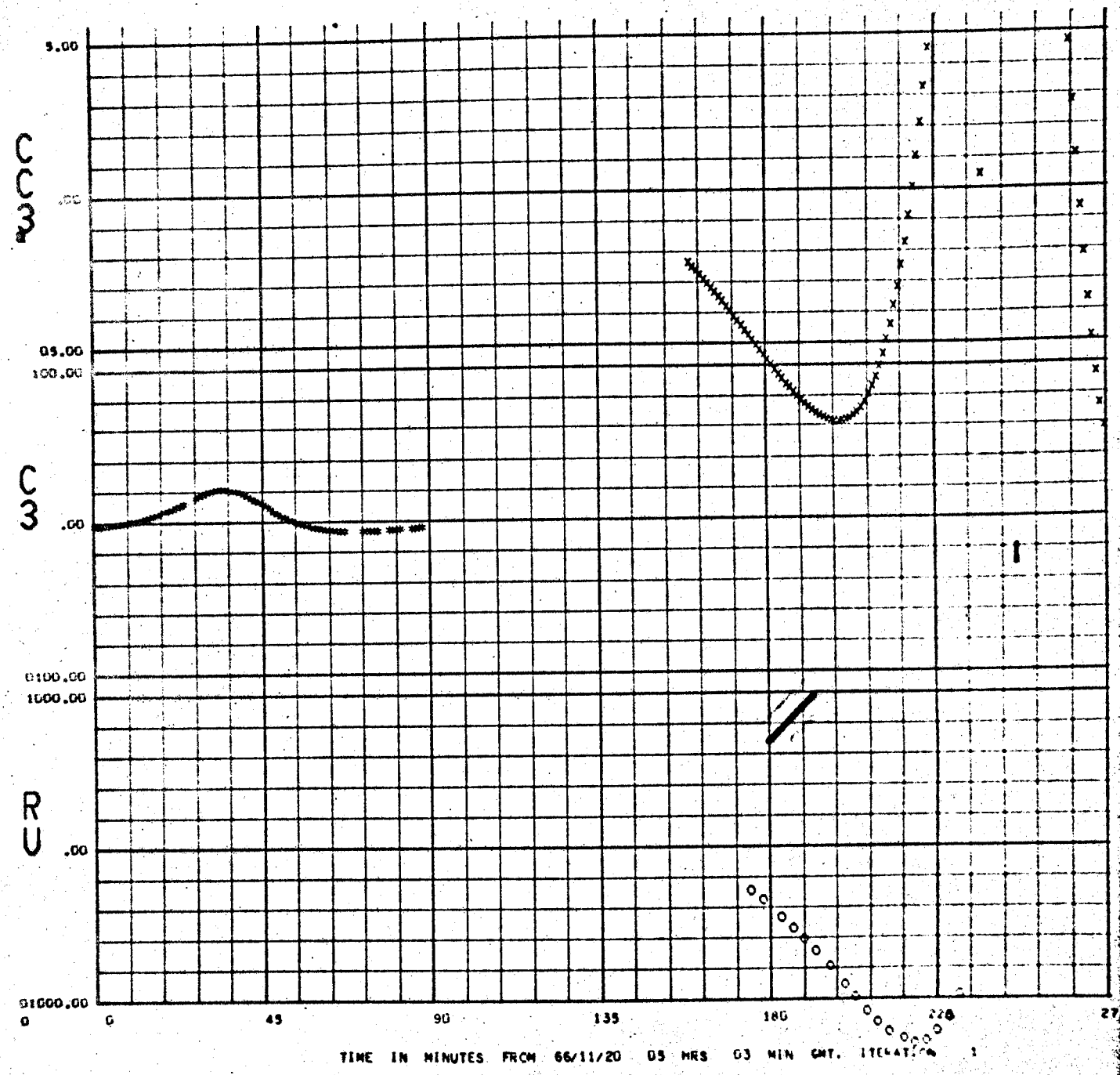
STATION 61 RESIDUALS PASS NUMBER 13/323



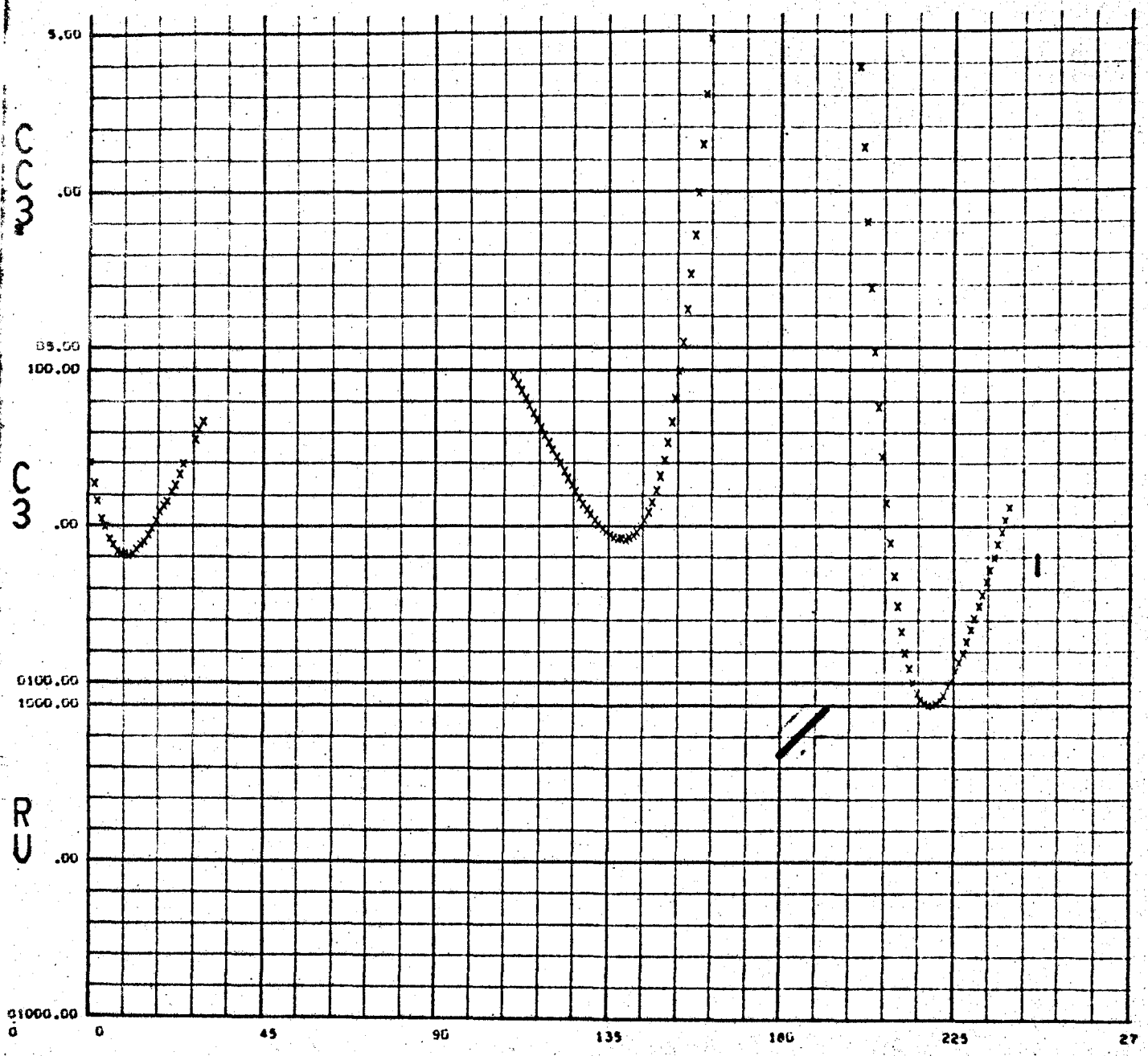
STATION 61 RESIDUALS PASS NUMBER 13/323

SIMPLIFIED L

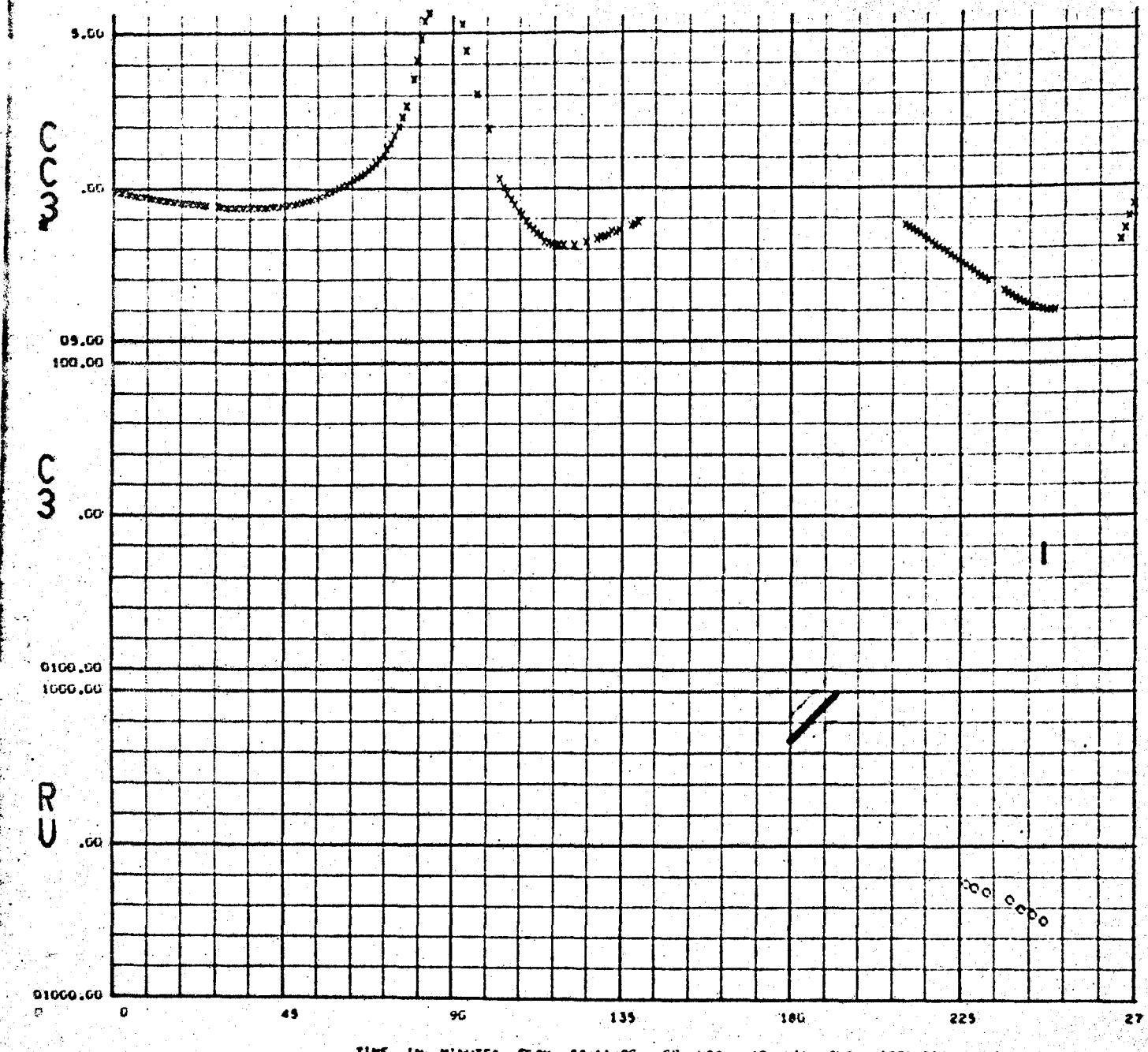
UNAR MODEL



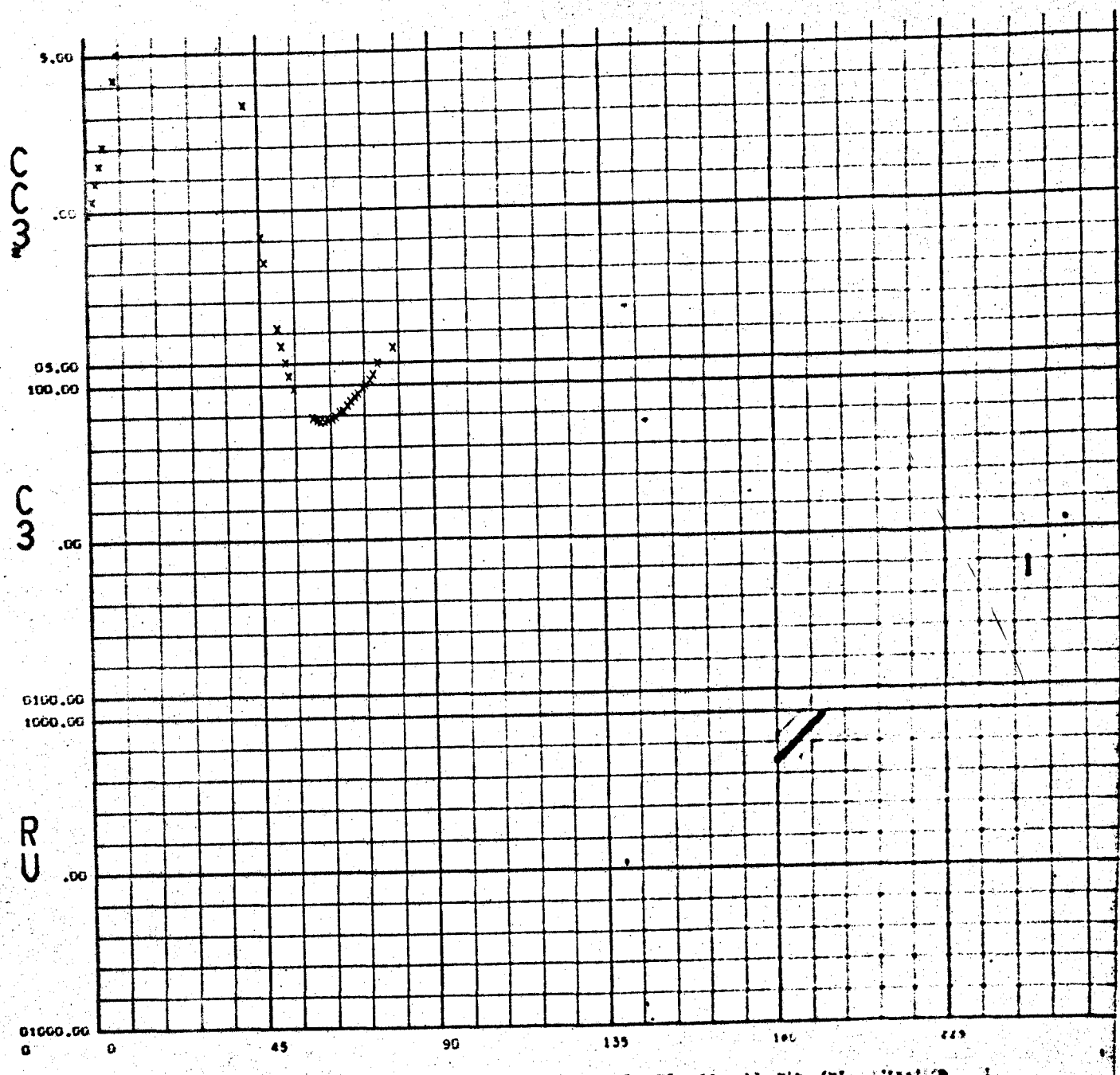
STATION 41 RESIDUALS PASS NUMBER 14/324



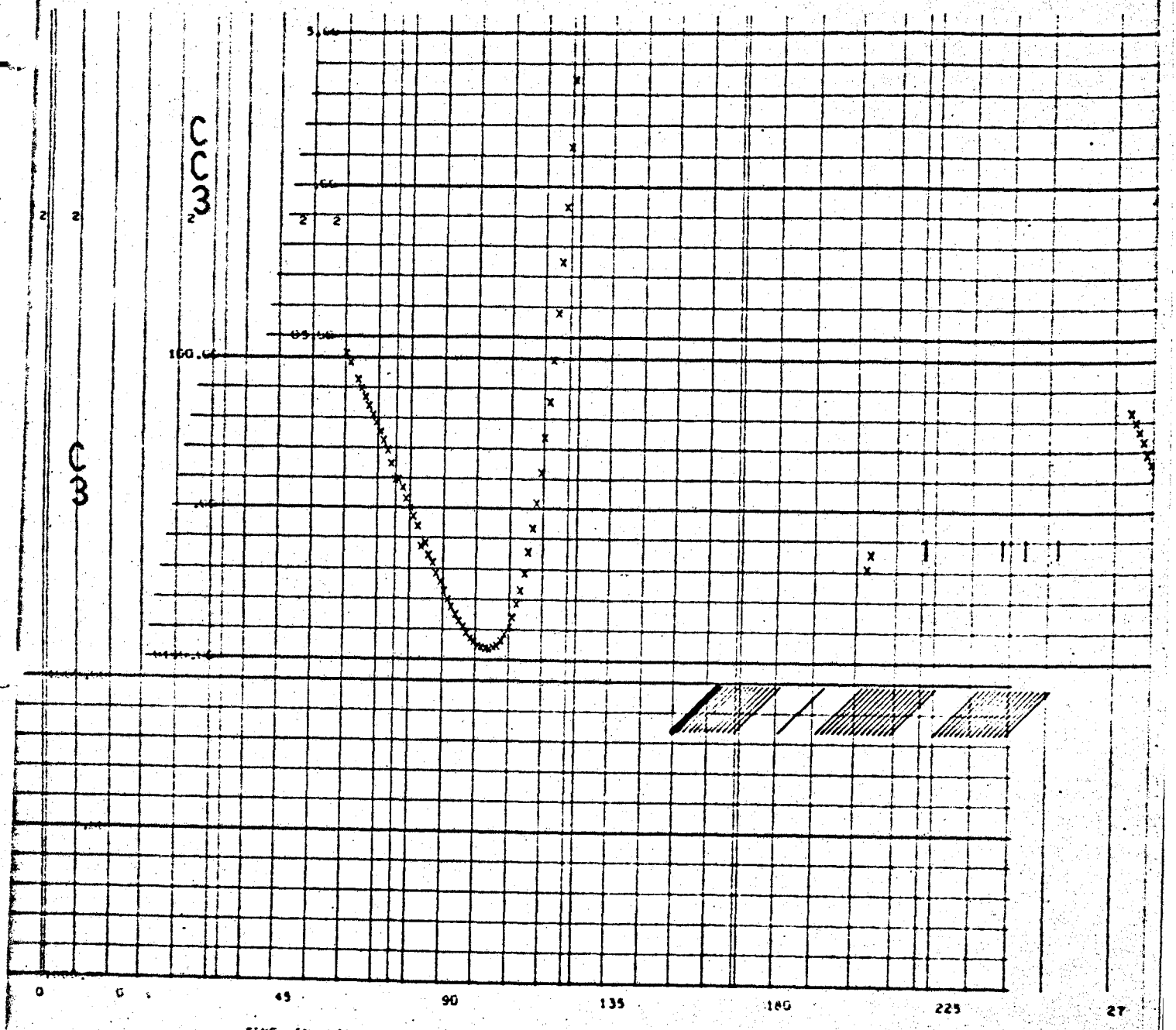
STATION 41 RESIDUALS PASS NUMBER 14/324



STATION 12 RESIDUALS PASS NUMBER 13/323

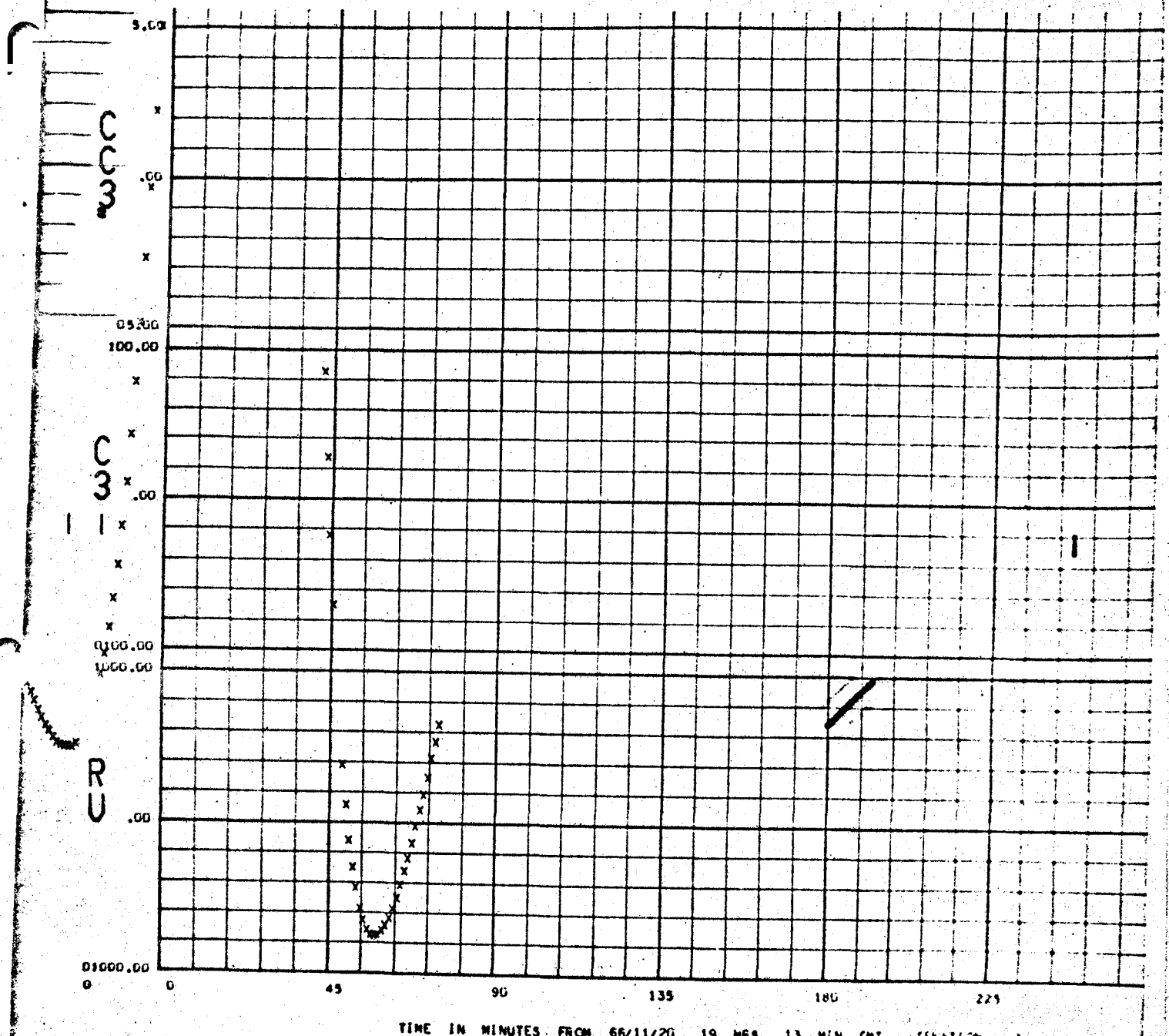


STATION 12 RESIDUALS PASS NUMBER 13/323



TIME IN MINUTES FROM 66/11/20 14 HRS 43 MIN GMT. ITERATION 1

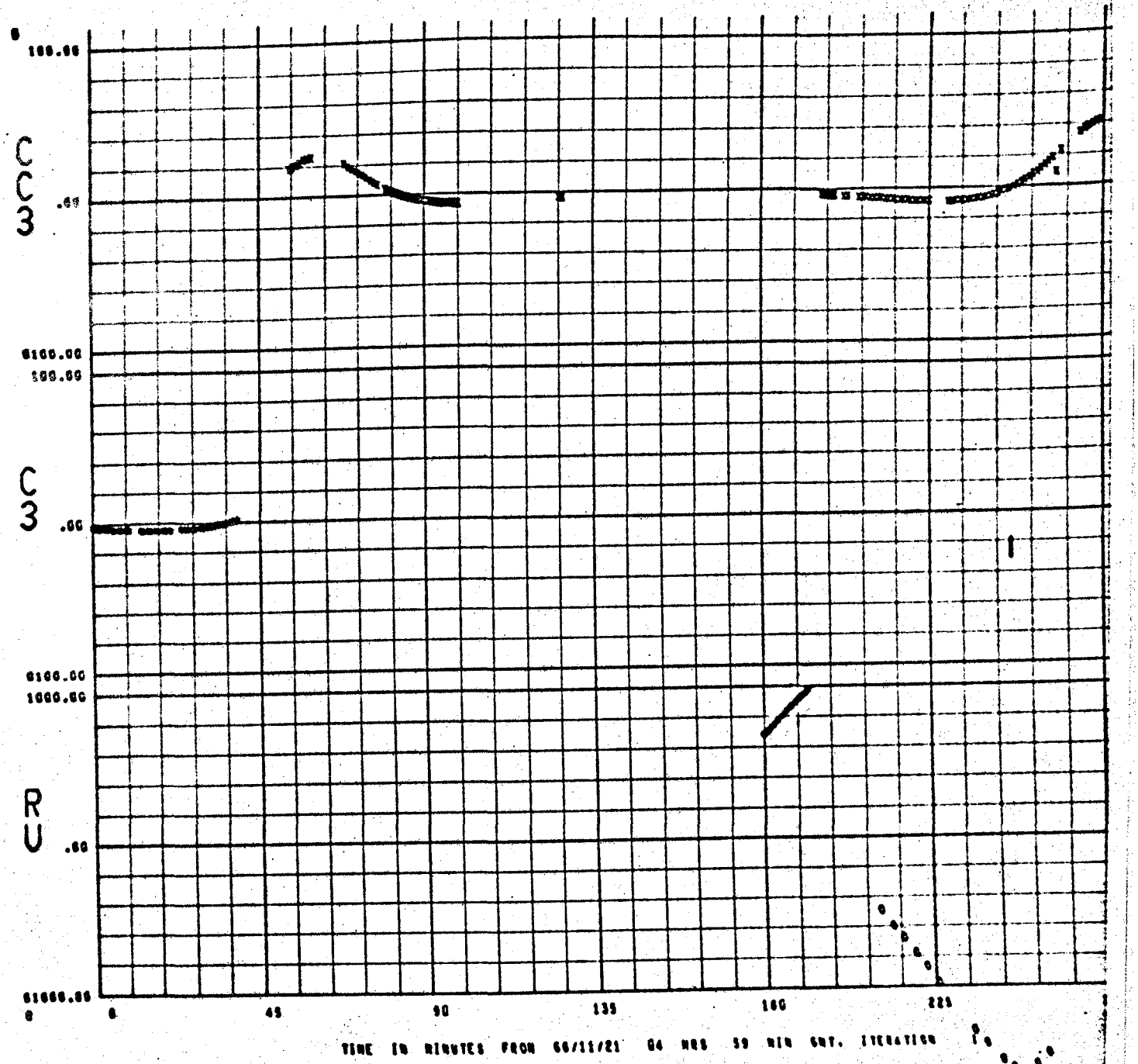
STATION 61 RESIDUALS PASS NUMBER 14/324



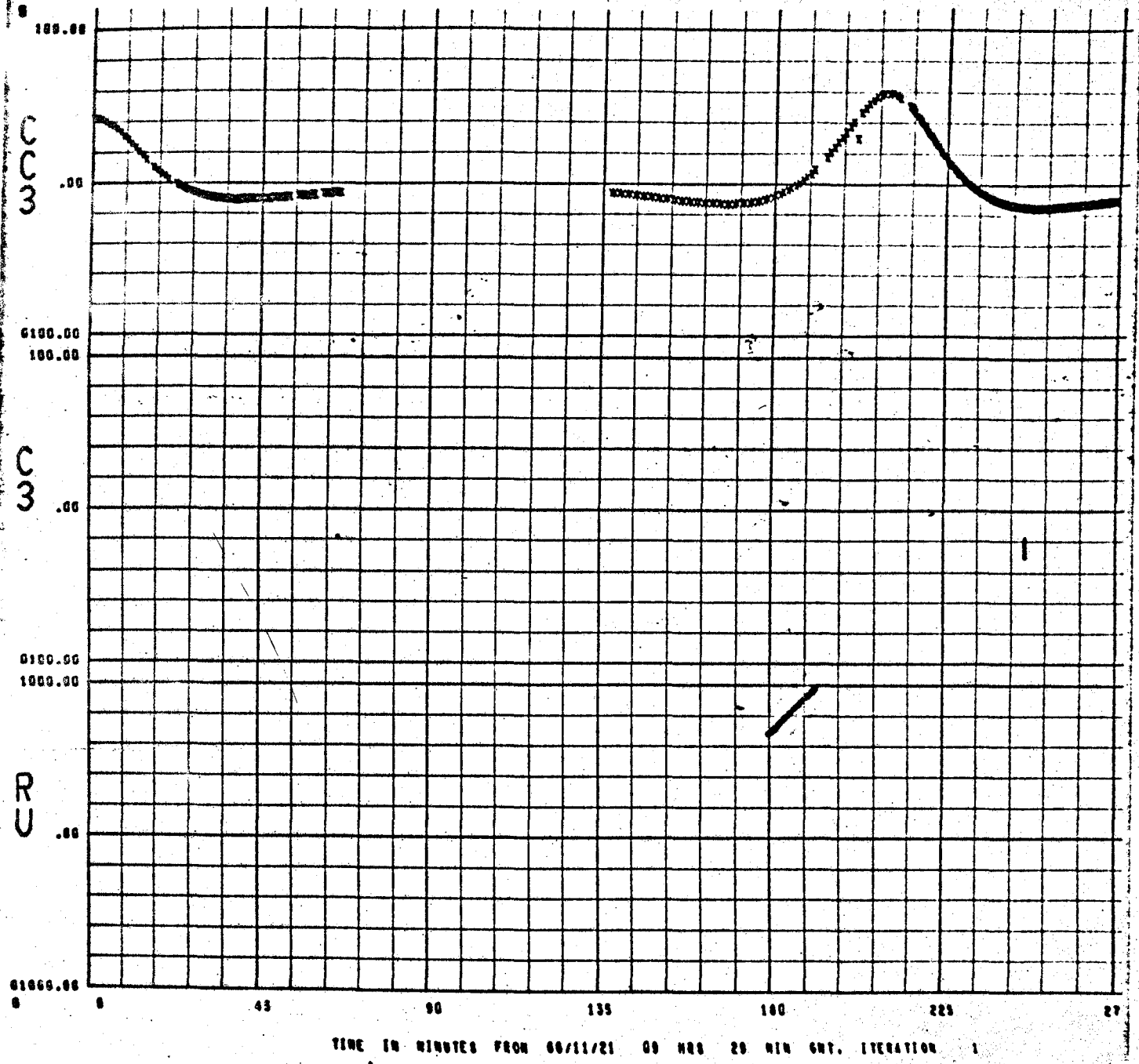
STATION 61 RESIDUALS PASS NUMBER 14/324

ODPL 2S6

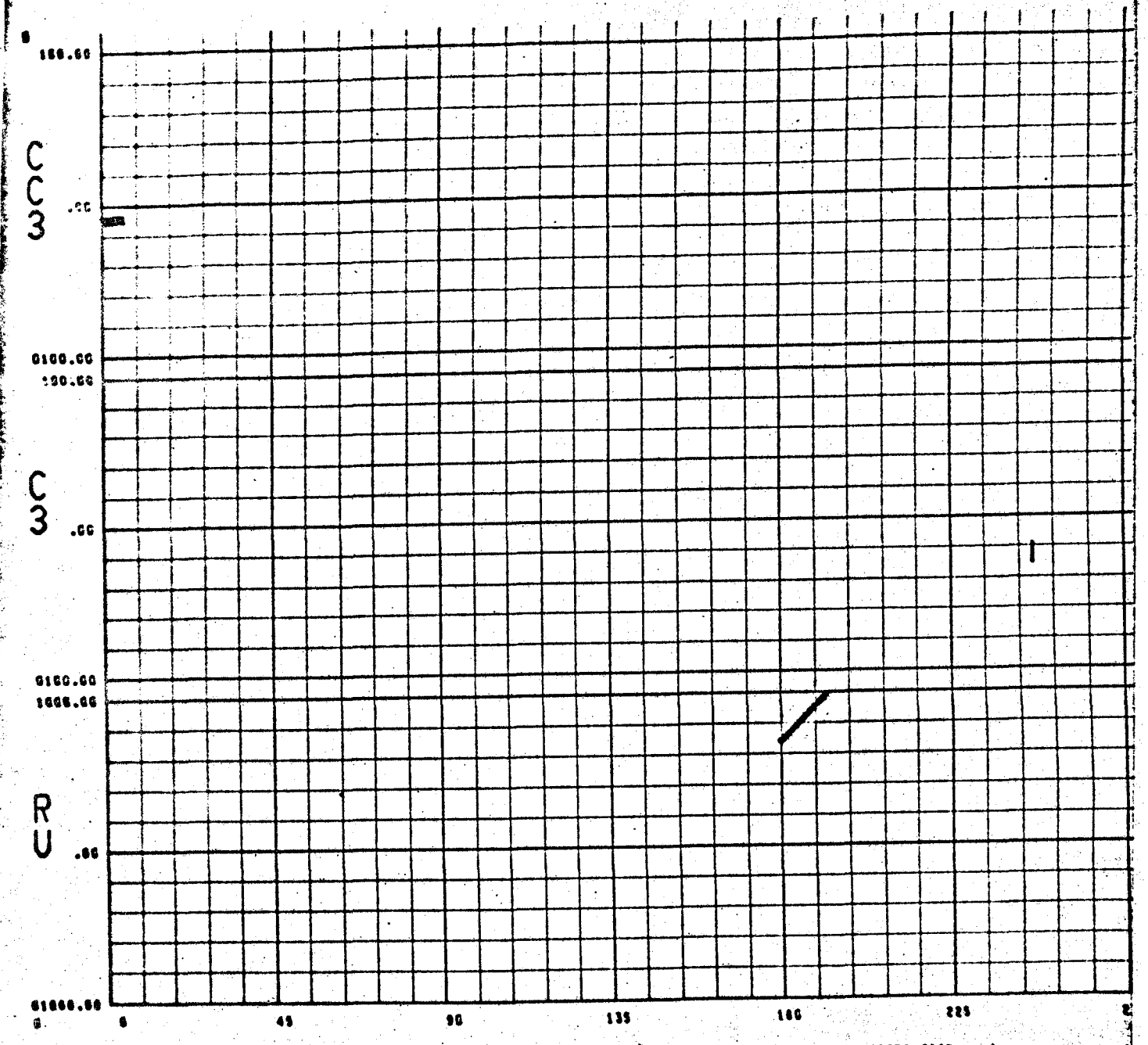
SIMPLE MOON



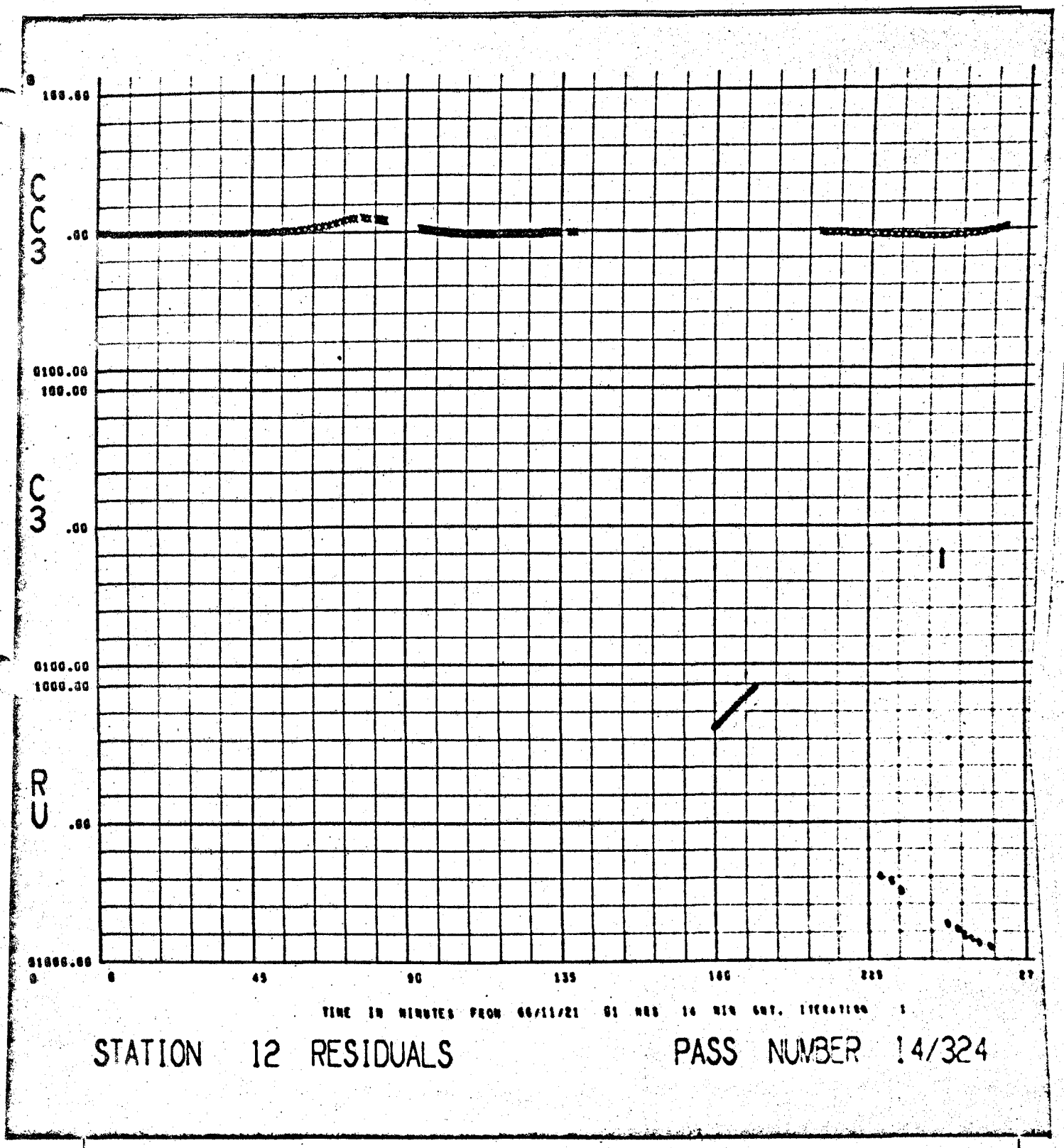
STATION 41 RESIDUALS PASS NUMBER 15/325



STATION 41 RESIDUALS PASS NUMBER 15/325



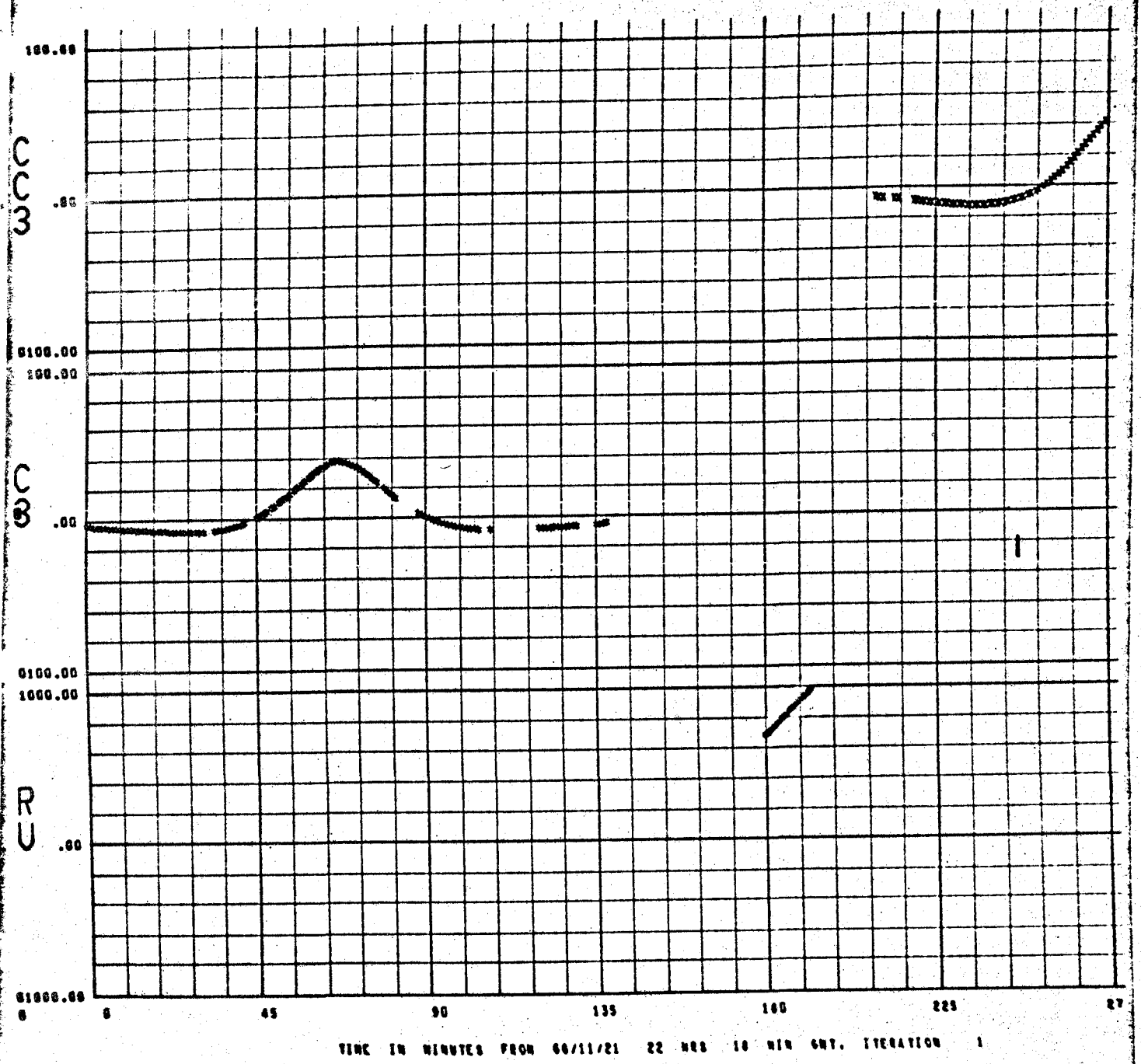
STATION 41 RESIDUALS PASS NUMBER 15/325



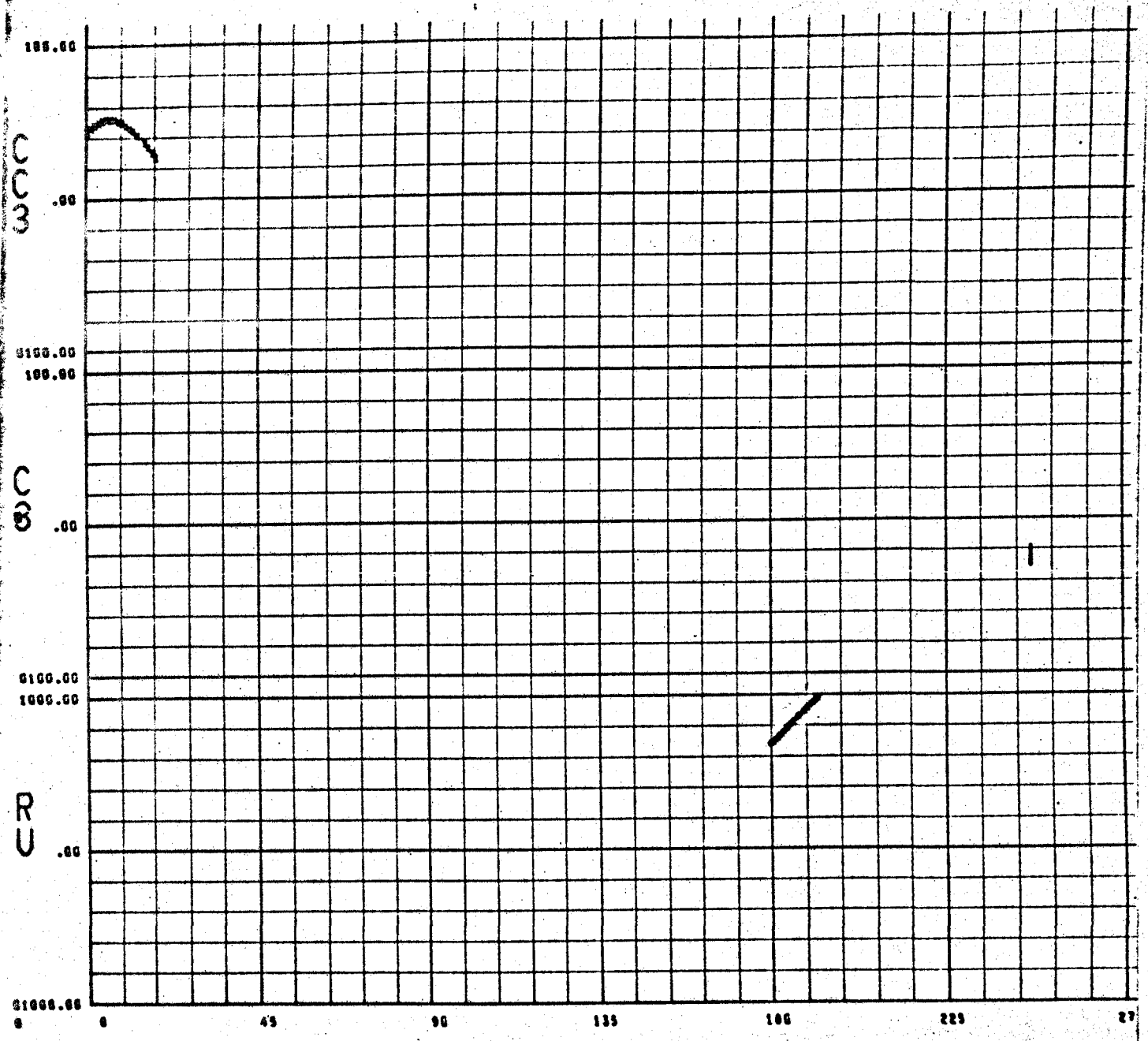
STATION 12 RESIDUALS PASS NUMBER 14/324

ODPL 258

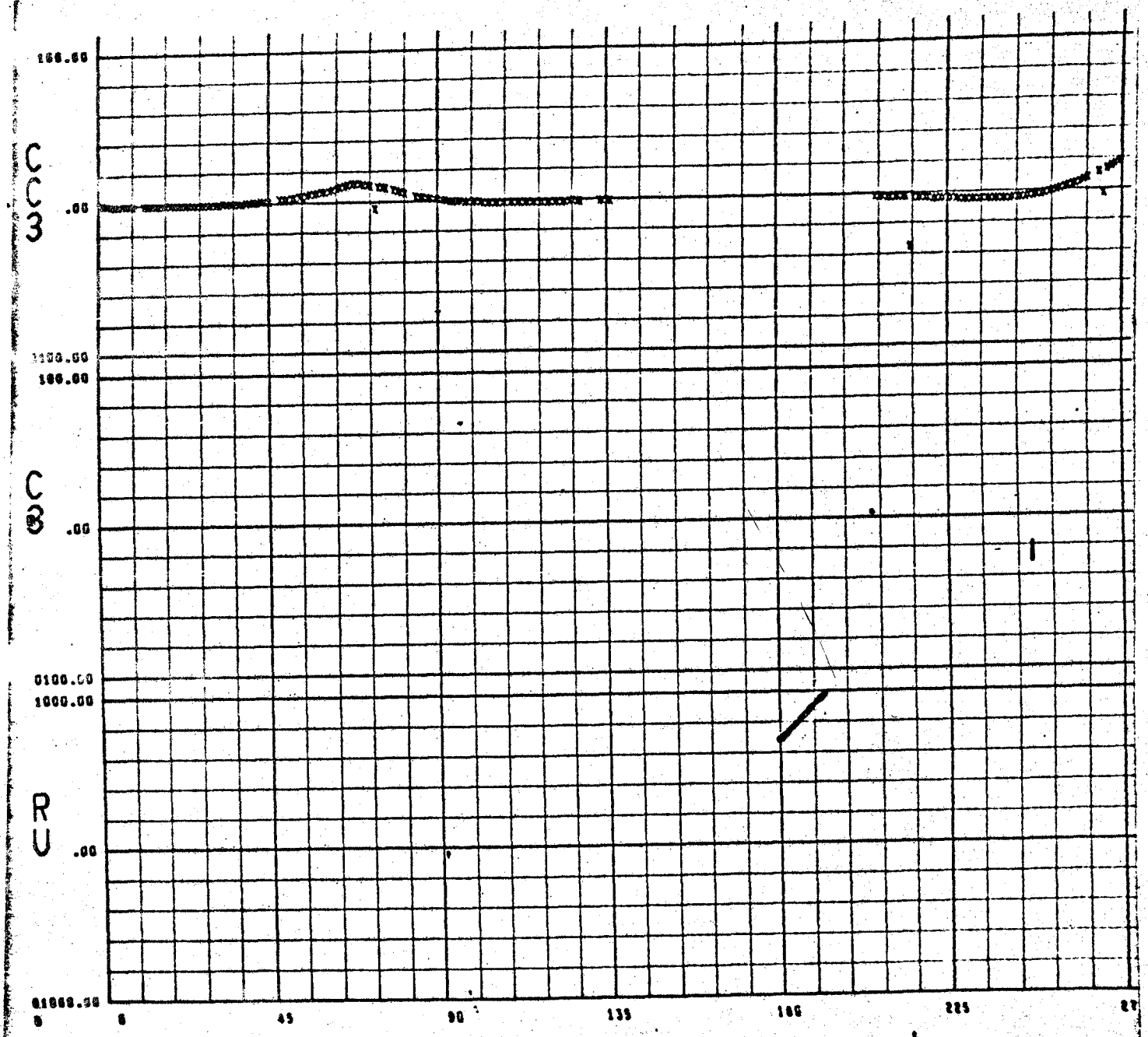
SIMPLE MOON



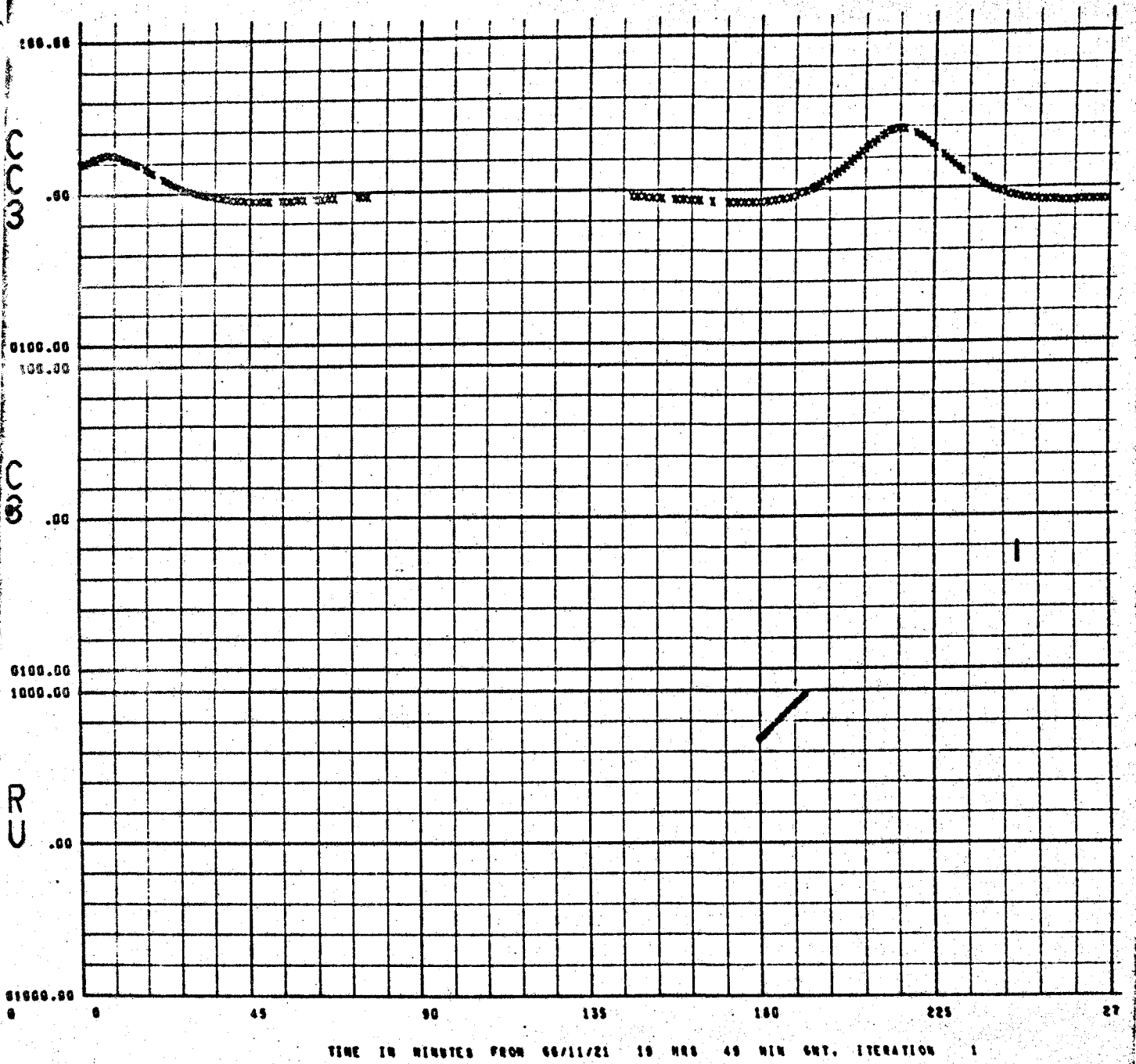
STATION 12 RESIDUALS PASS NUMBER 15/325



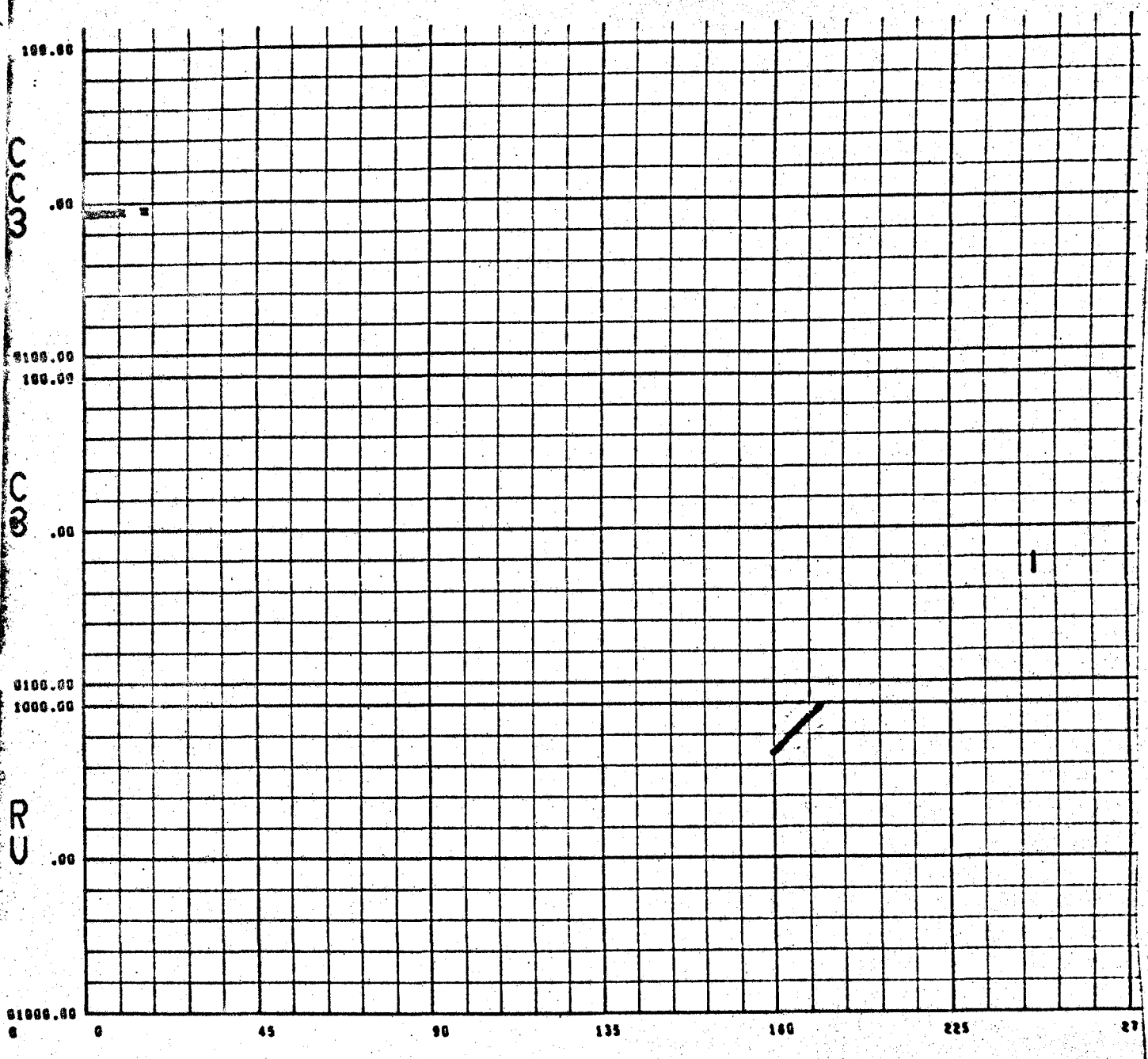
STATION 12 RESIDUALS PASS NUMBER 15/325



STATION 61 RESIDUALS PASS NUMBER 15/325



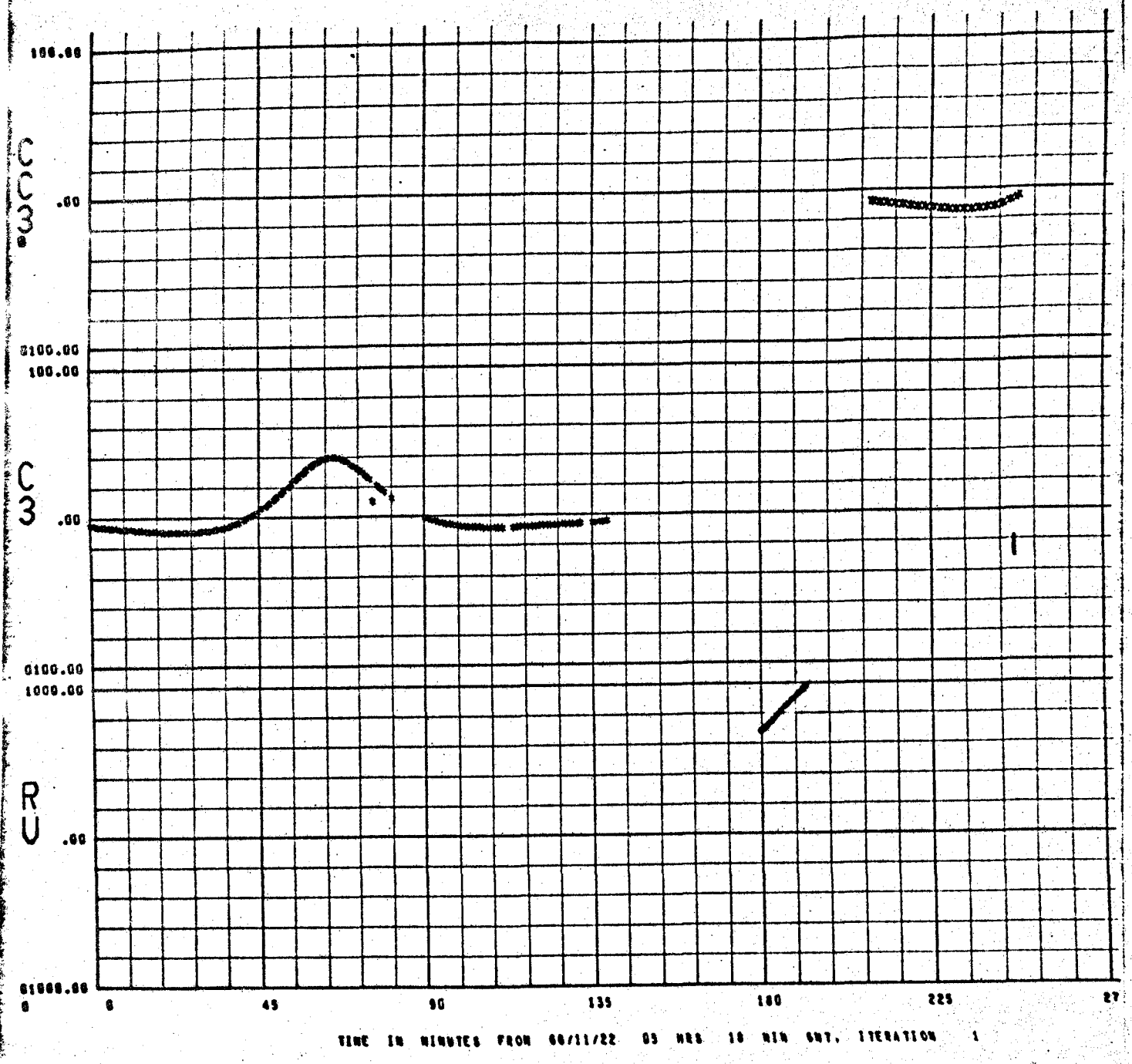
STATION 61 RESIDUALS PASS NUMBER 15/325



STATION 61 RESIDUALS PASS NUMBER 15/325

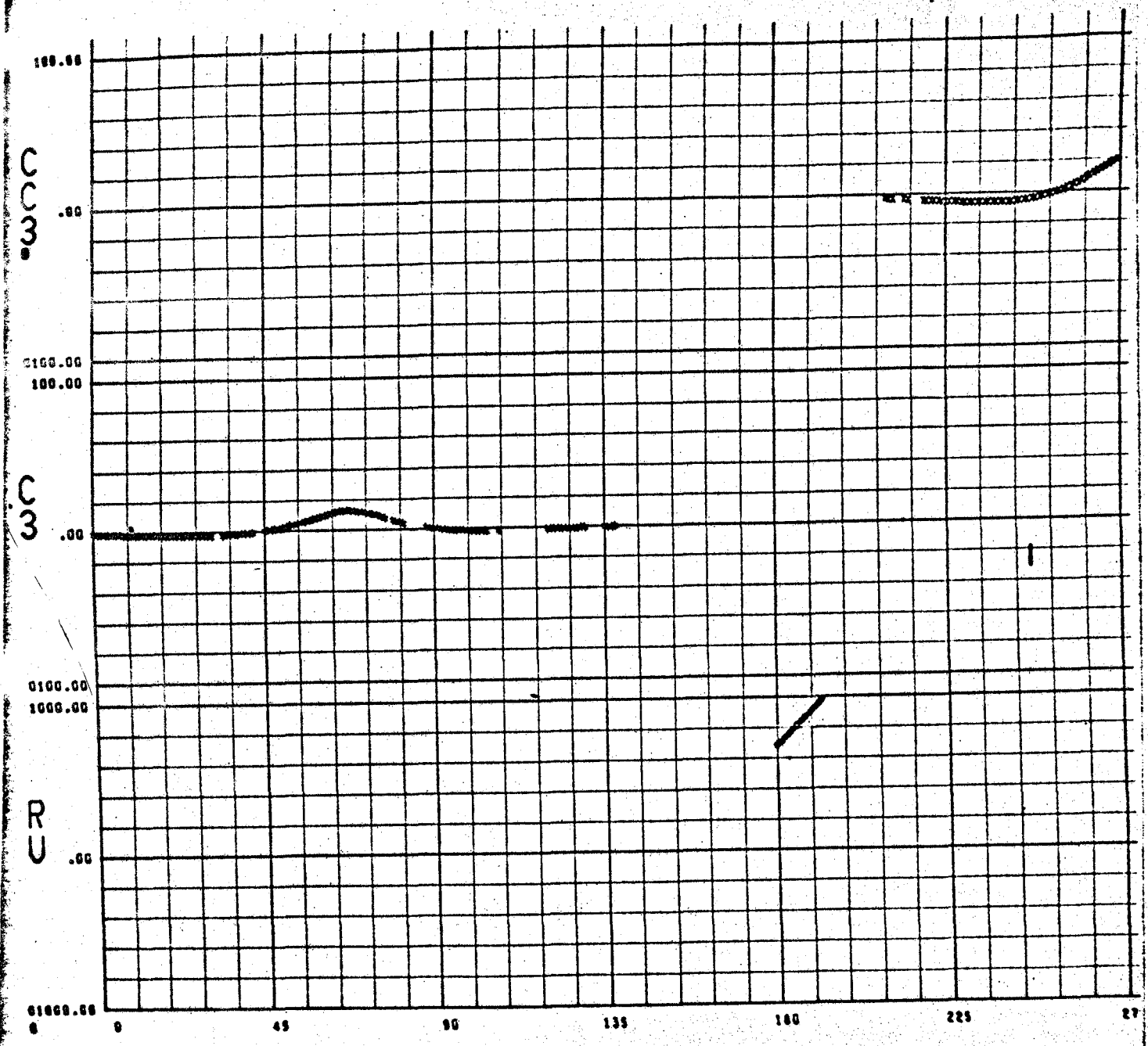
ODPL 2P7A

SIMPLE MOON

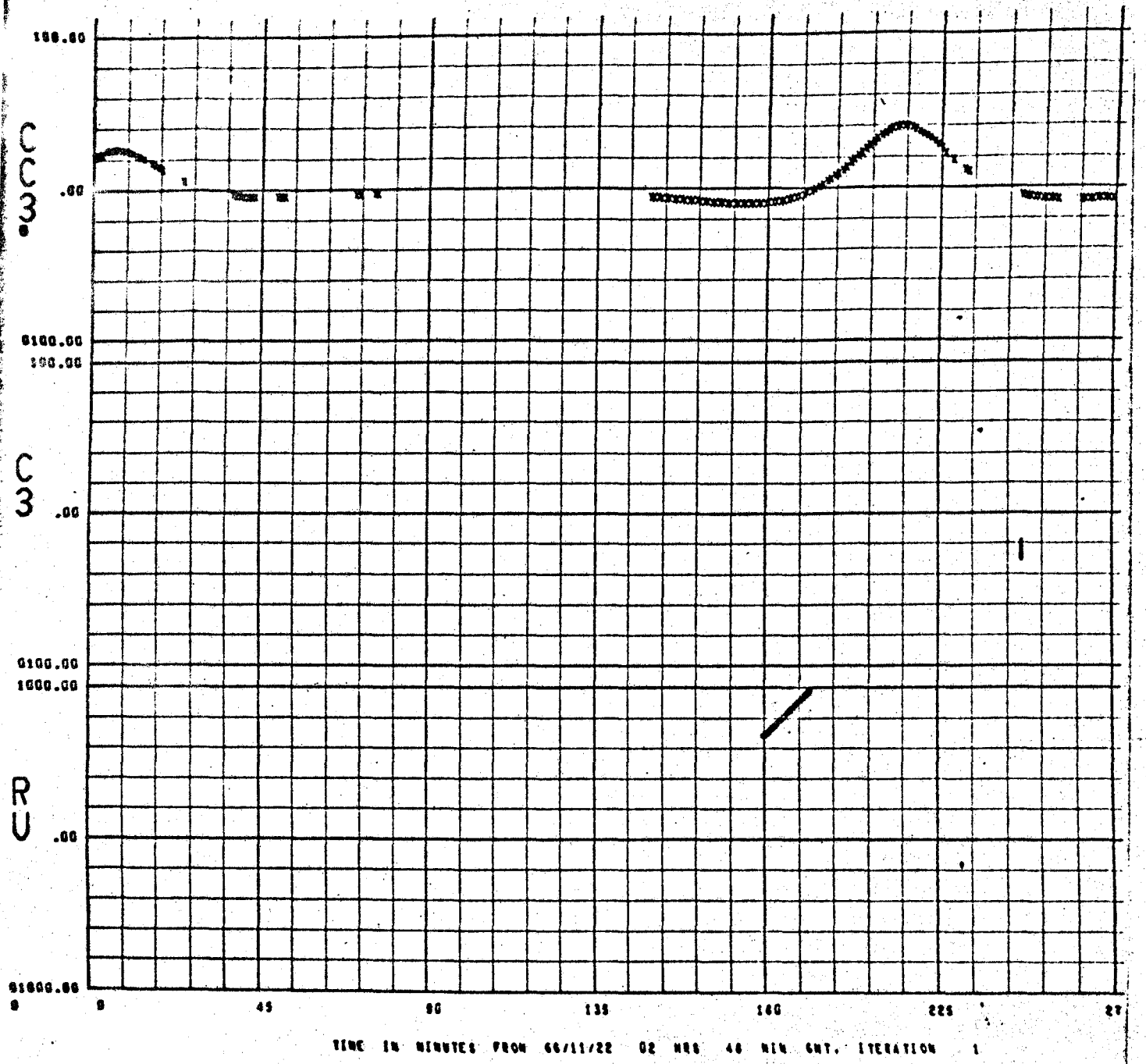


STATION 41 RESIDUALS PASS NUMBER 16/326

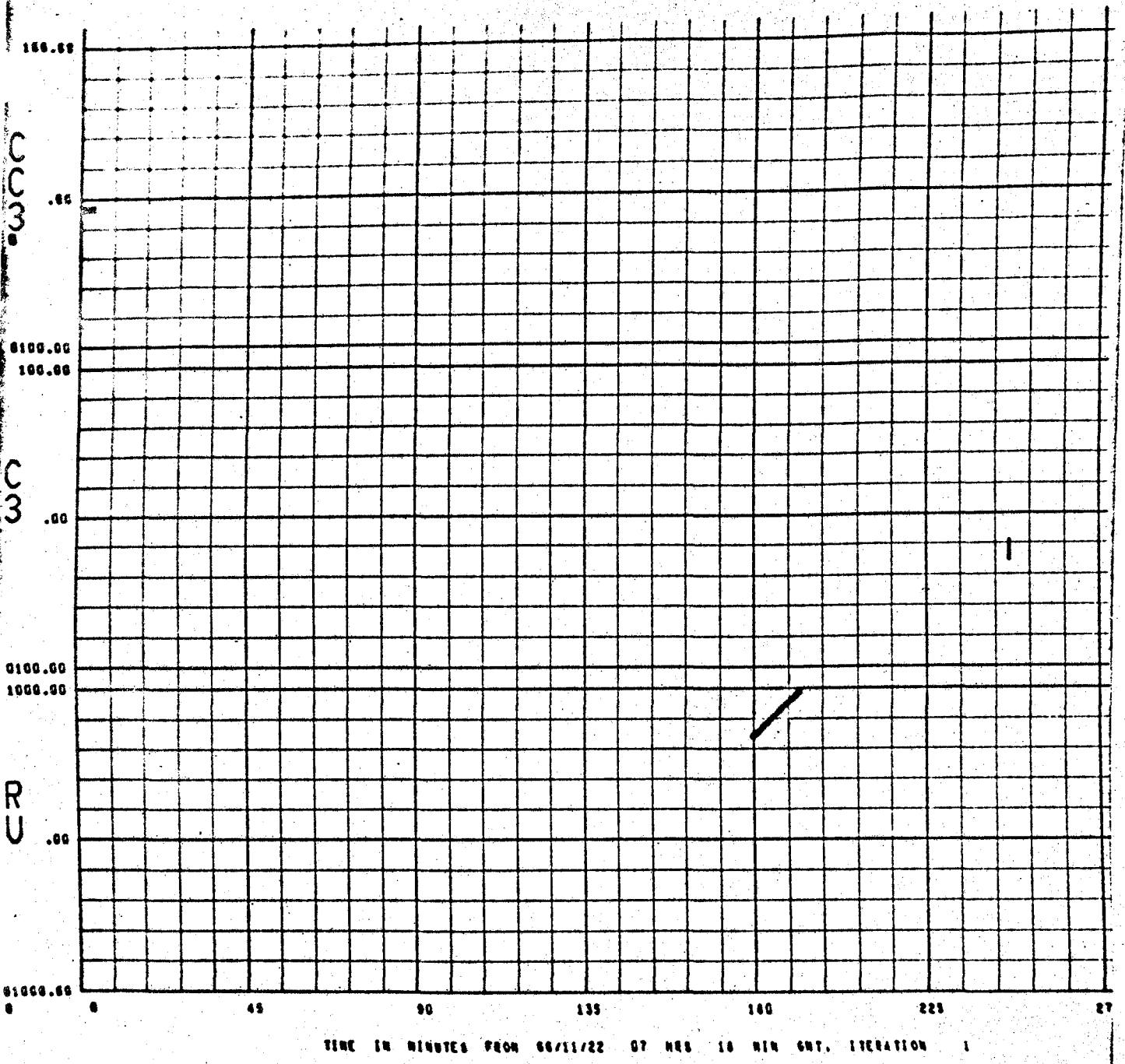
REV LTR



STATION 12 RESIDUALS PASS NUMBER 15/325

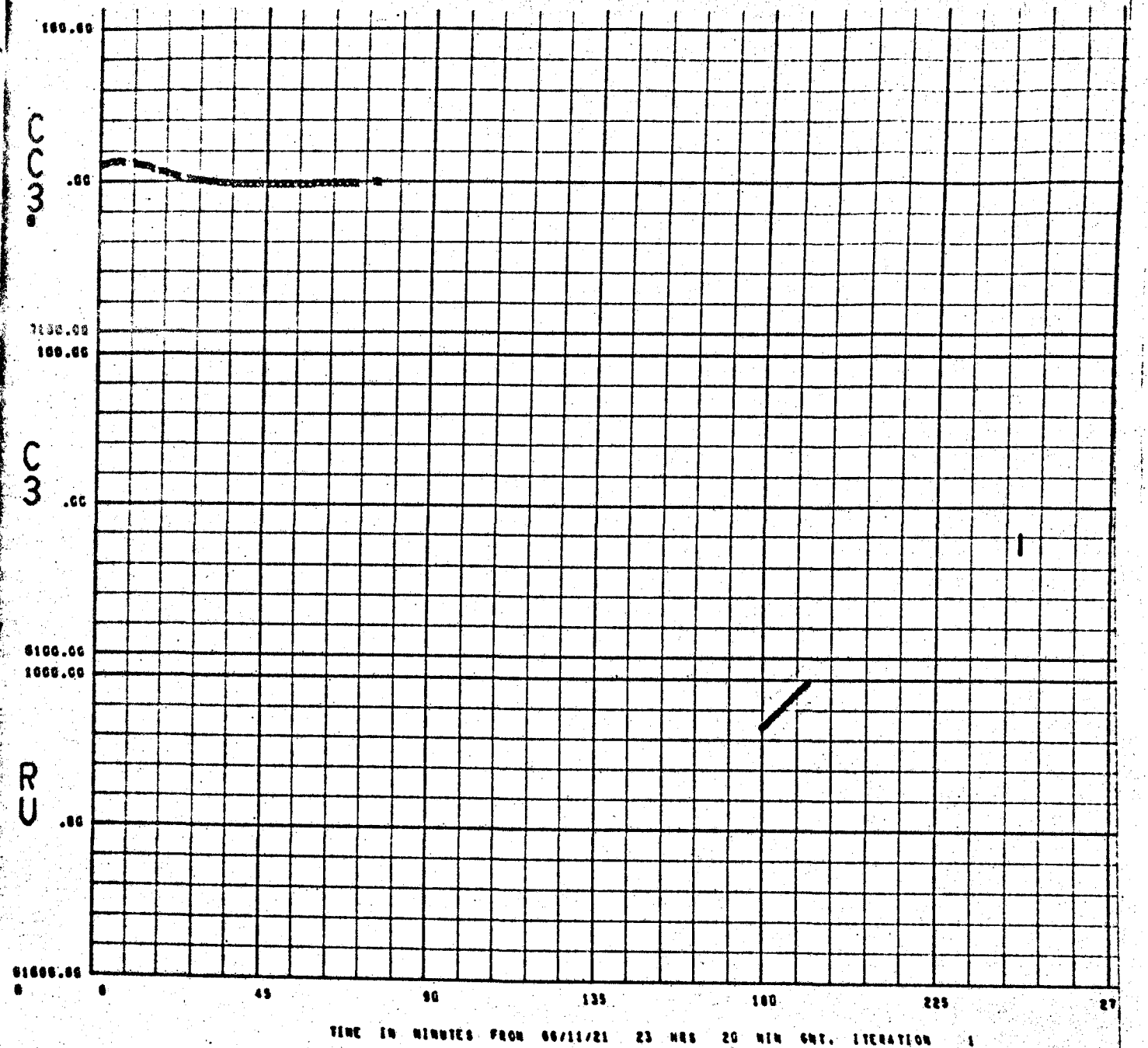


STATION 12 RESIDUALS PASS NUMBER 15/325



STATION 12 RESIDUALS PASS NUMBER 15/325

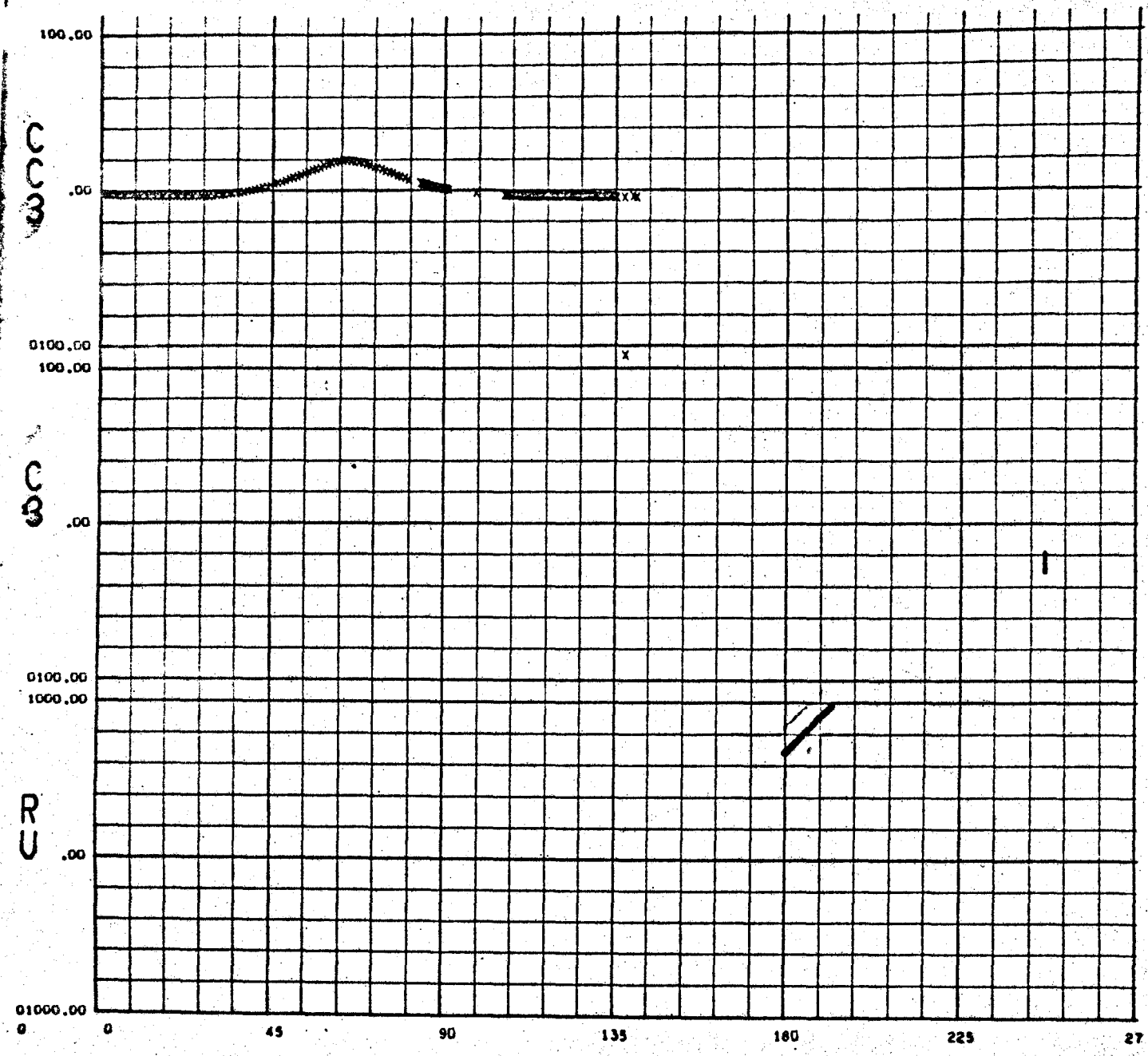
STATION 61 RESIDUALS PASS NUMBER 15/325



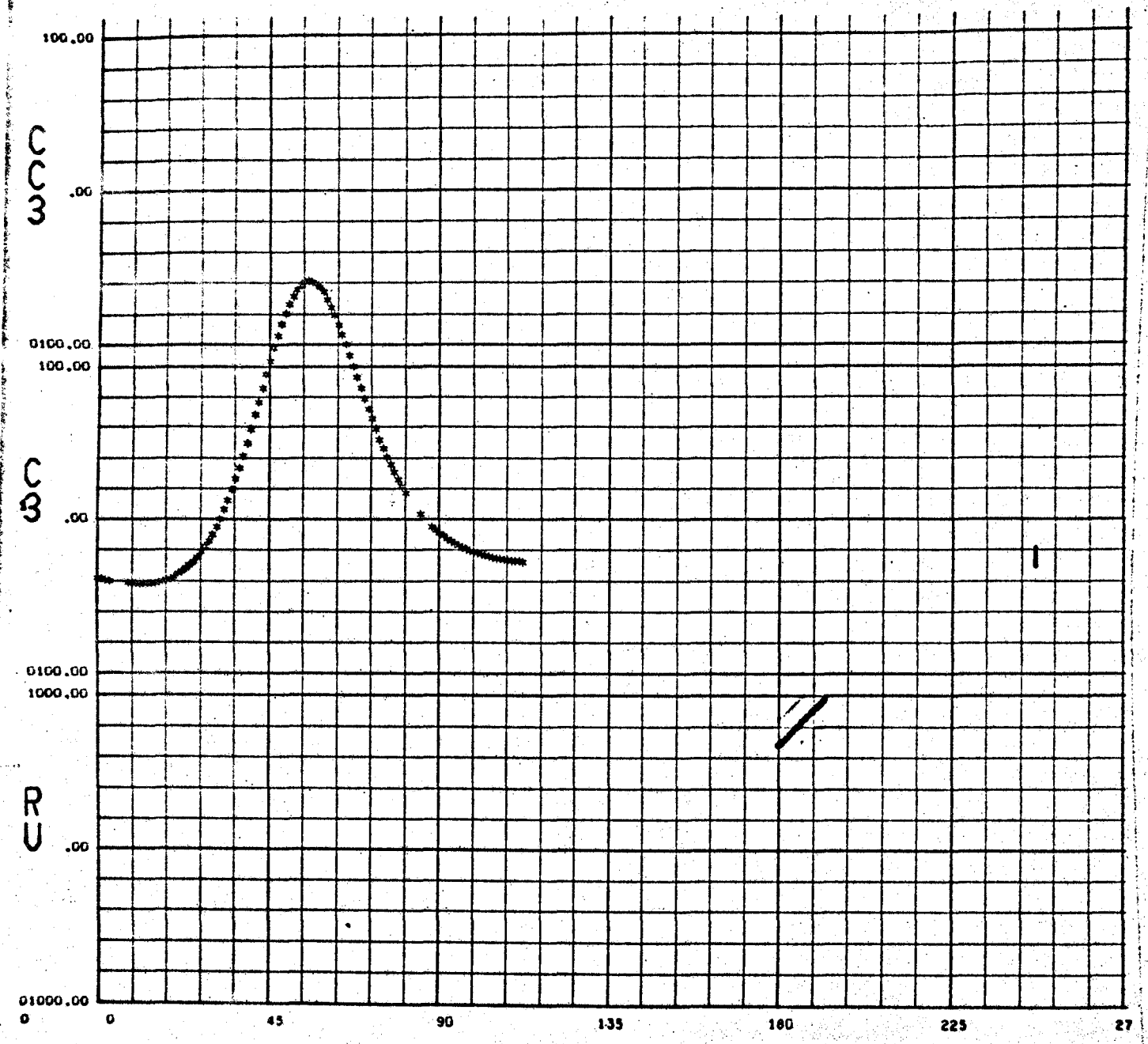
STATION 61 RESIDUALS PASS NUMBER 15/325

ODPL 2S10.2

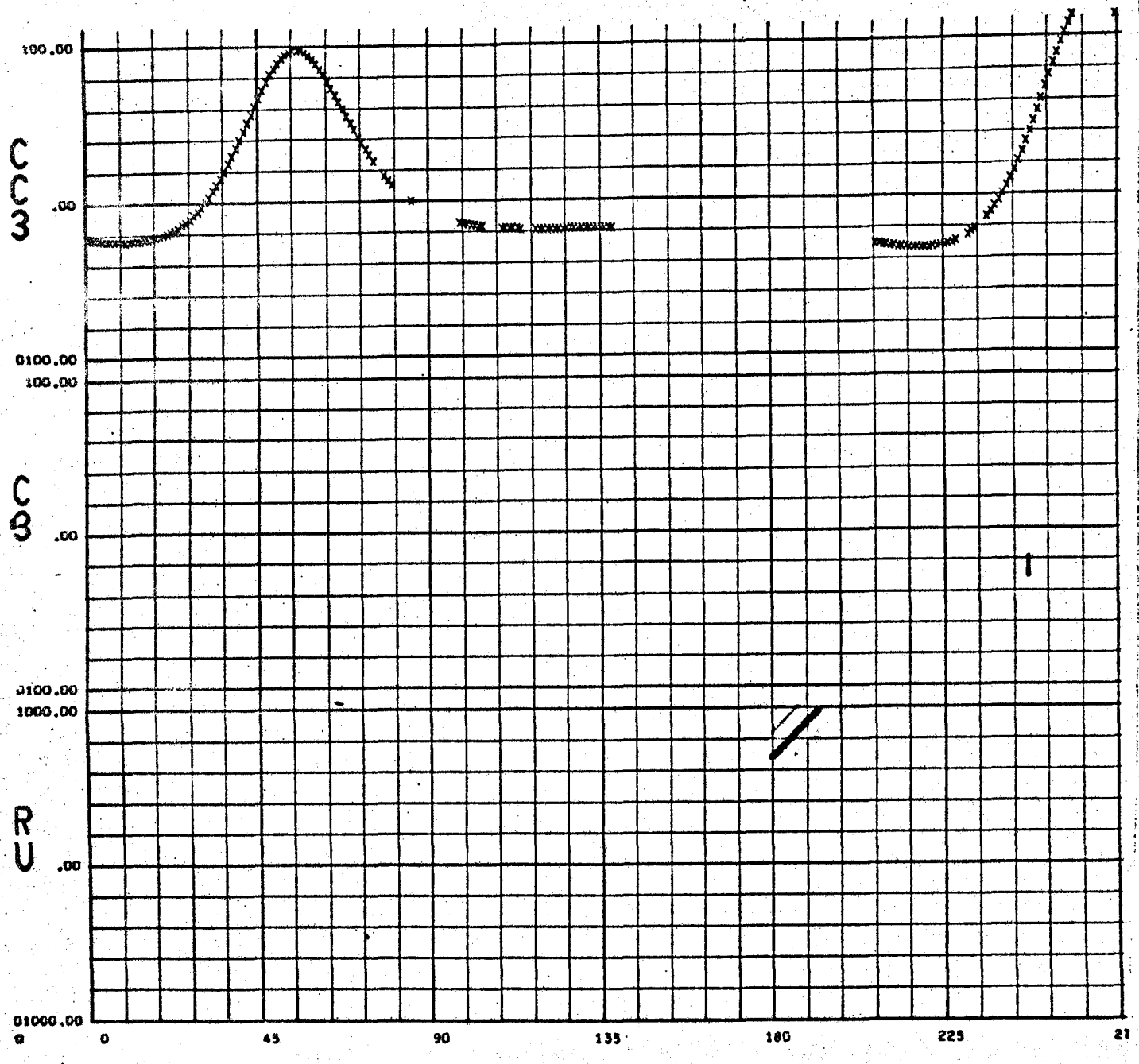
SIMPLIFIED L



STATION 41 RESIDUALS PASS NUMBER 16/326

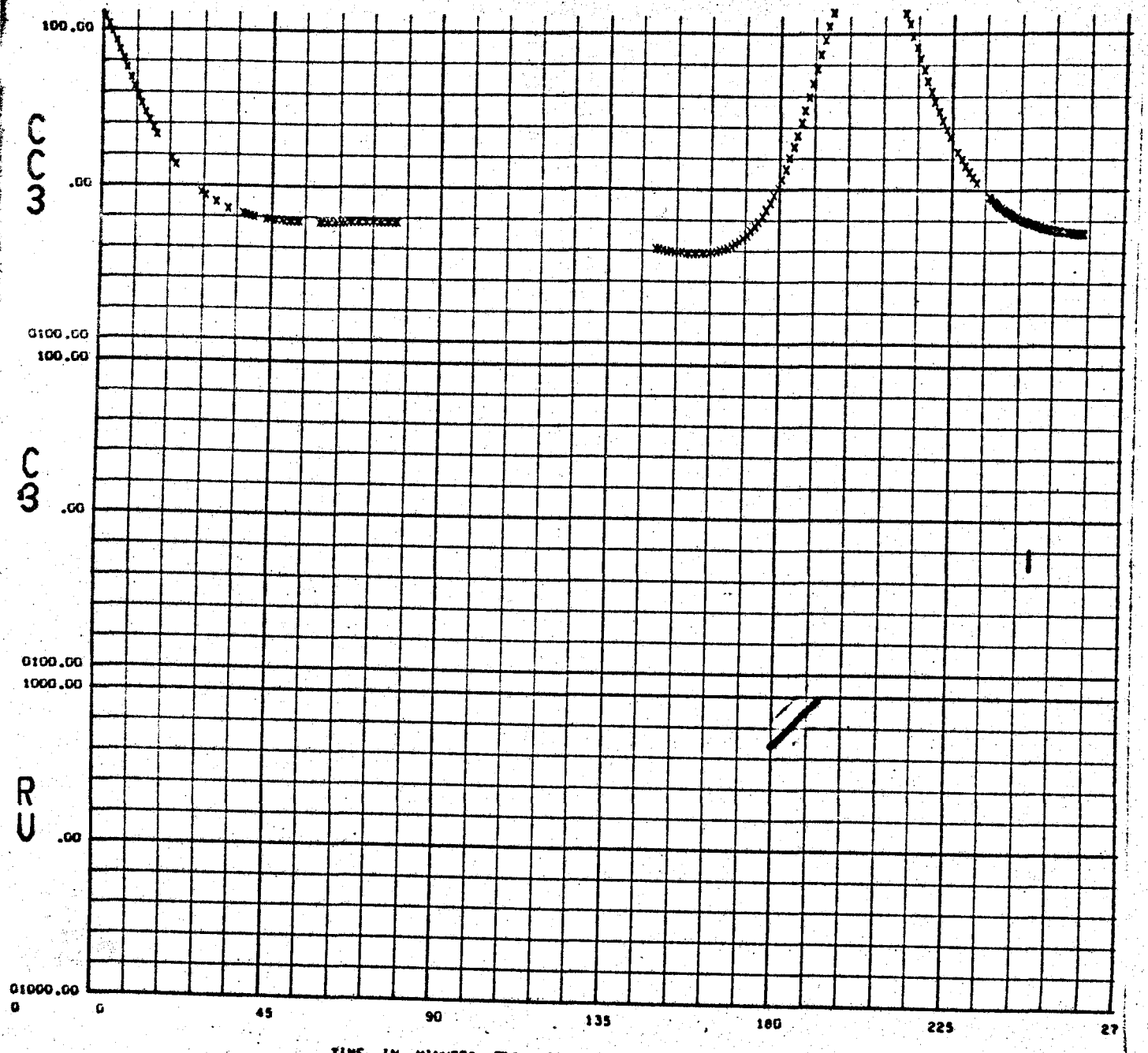


STATION 41 RESIDUALS PASS NUMBER 17/327

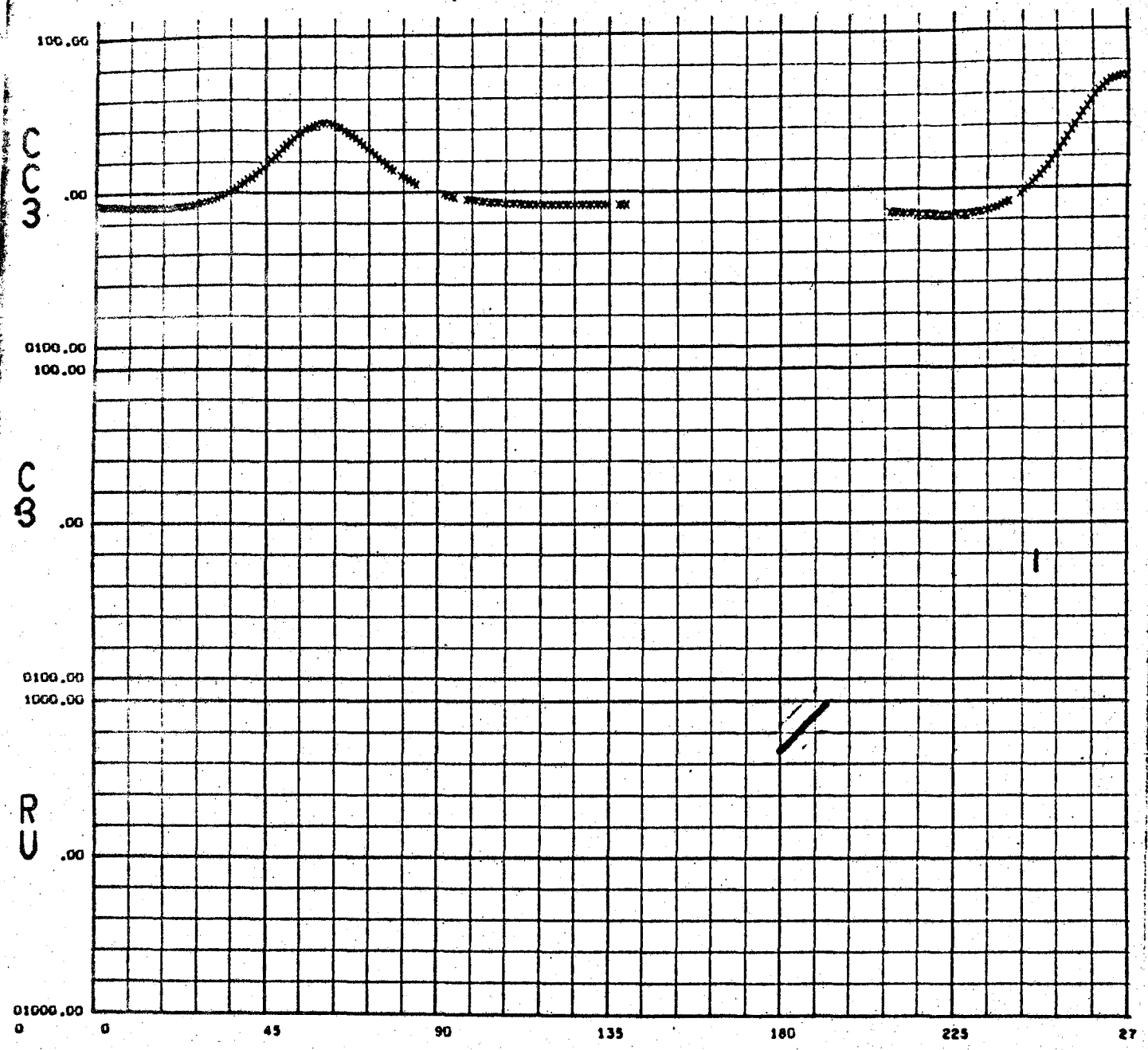


TIME IN MINUTES FROM 66/11/22 22 HRS 52 MIN GMT, ITERATION 1

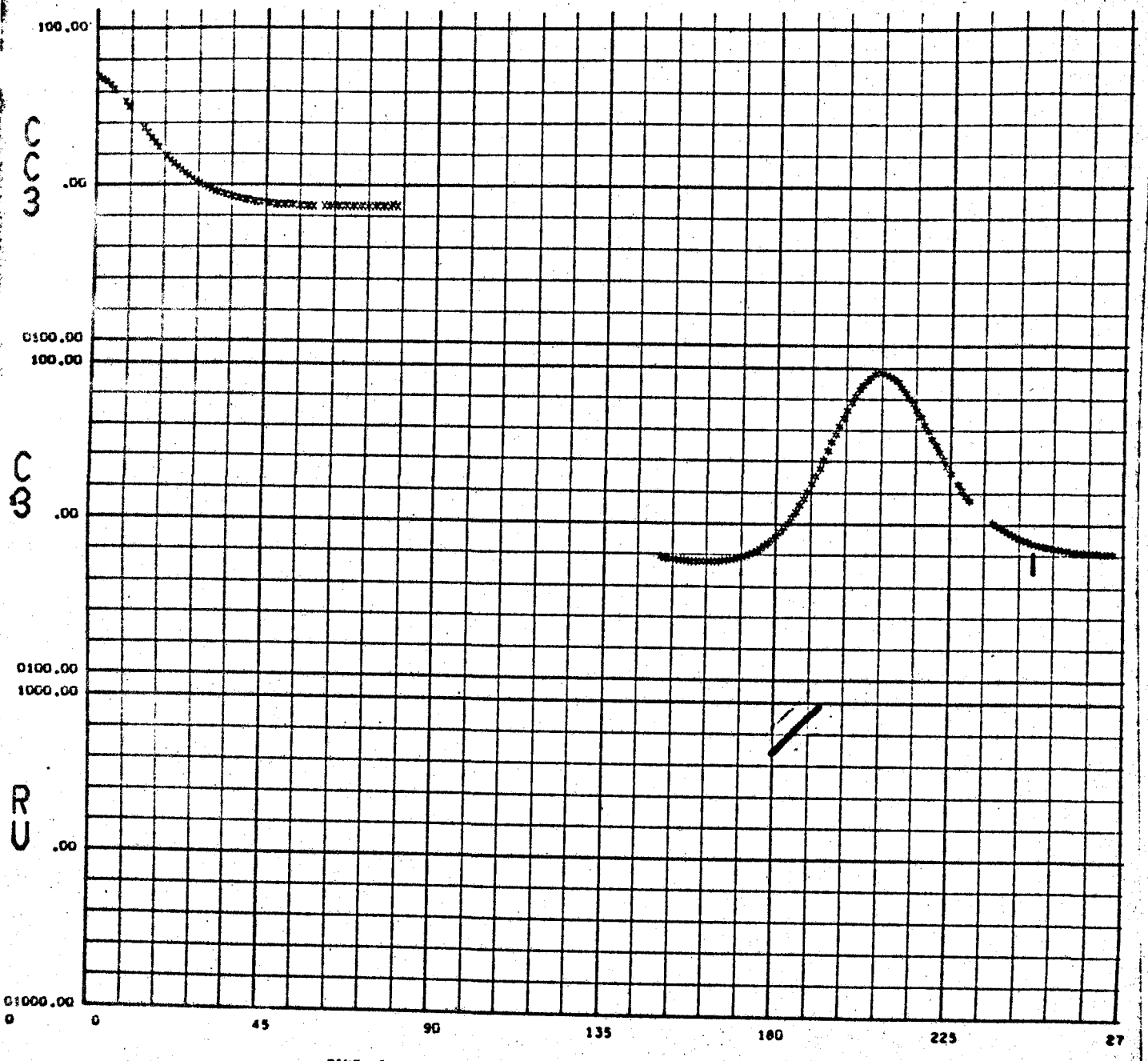
STATION 12 RESIDUALS PASS NUMBER 16/326



STATION 12 RESIDUALS PASS NUMBER 16/326

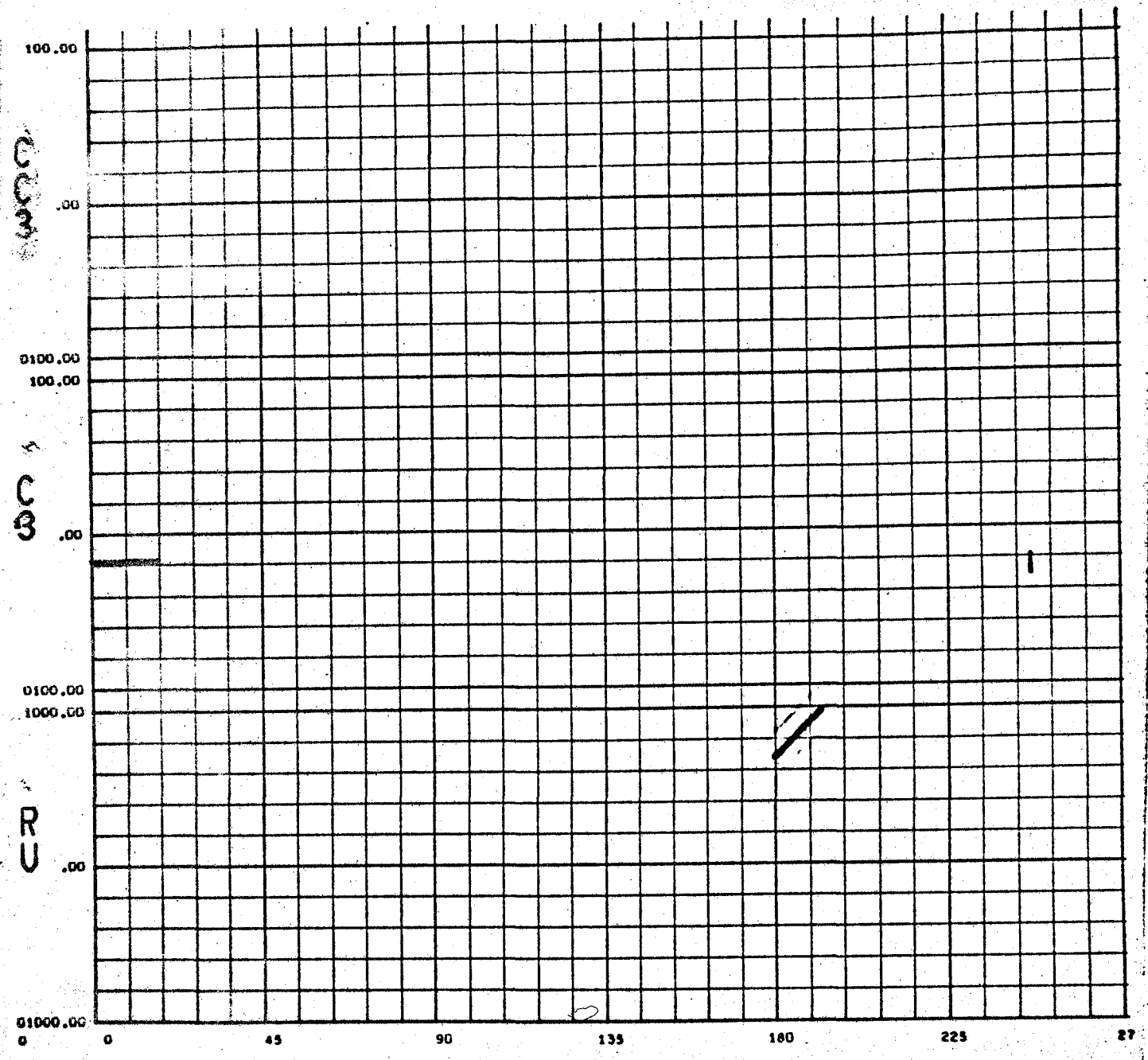


STATION 61 RESIDUALS PASS NUMBER 16/326



TIME IN MINUTES FROM 66/11/22 20 HRS 20 MIN GMT. ITERATION 1

STATION 61 RESIDUALS PASS NUMBER 16/326

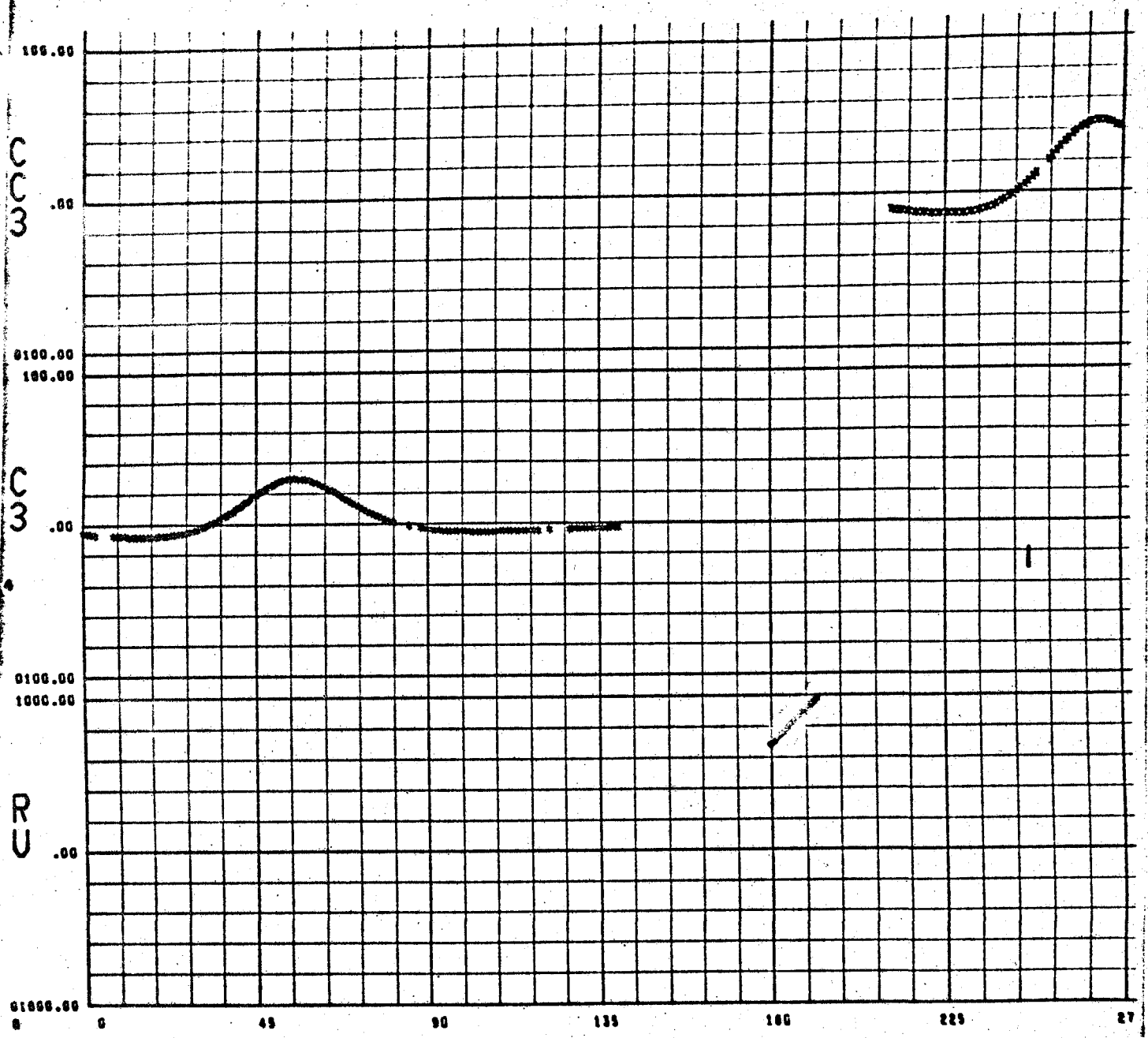


TIME IN MINUTES FROM 66/11/23 00 HRS 52 MIN GMT, ITERATION 1

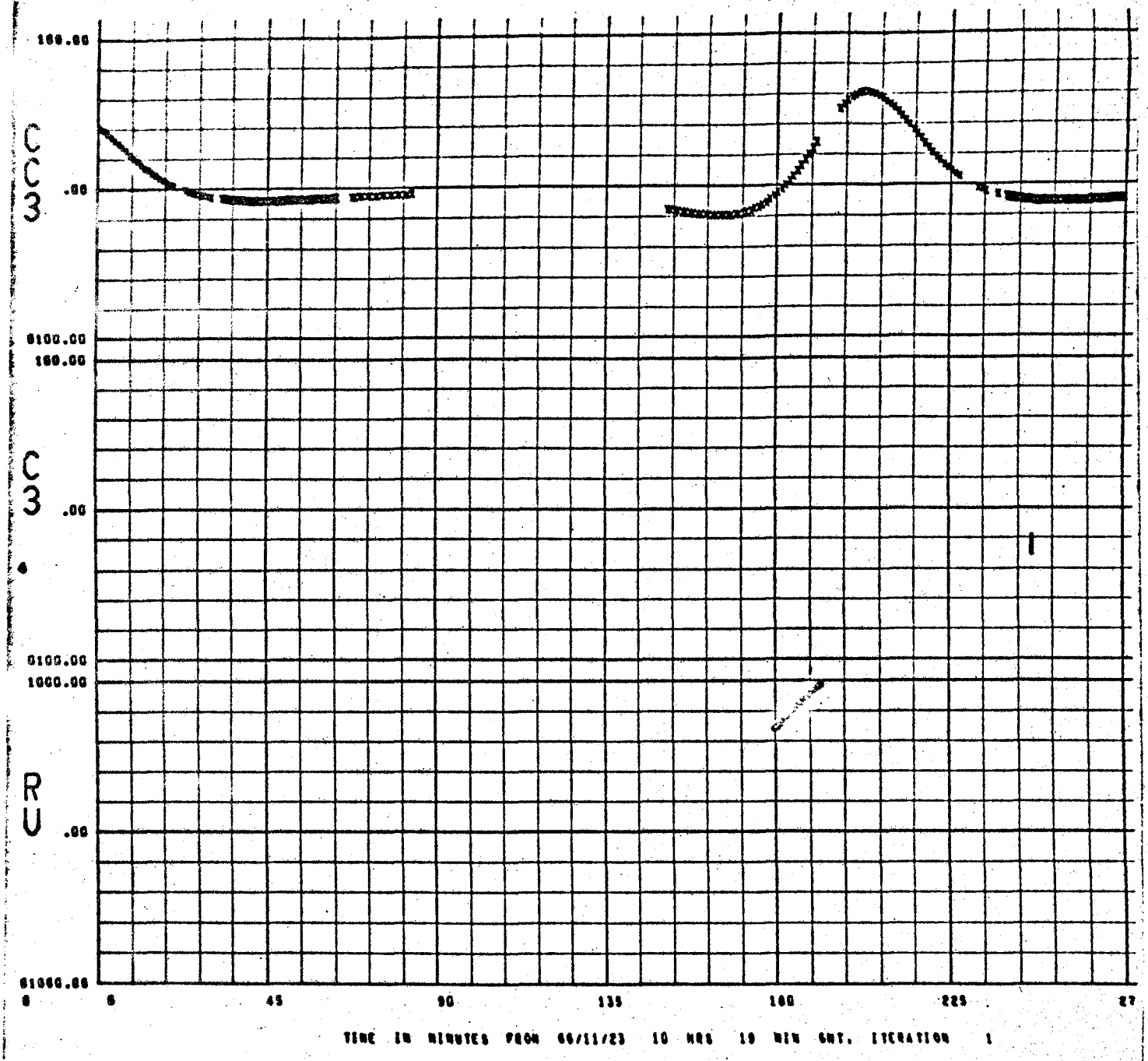
STATION 61 RESIDUALS PASS NUMBER 16/326

ODPL 2S11

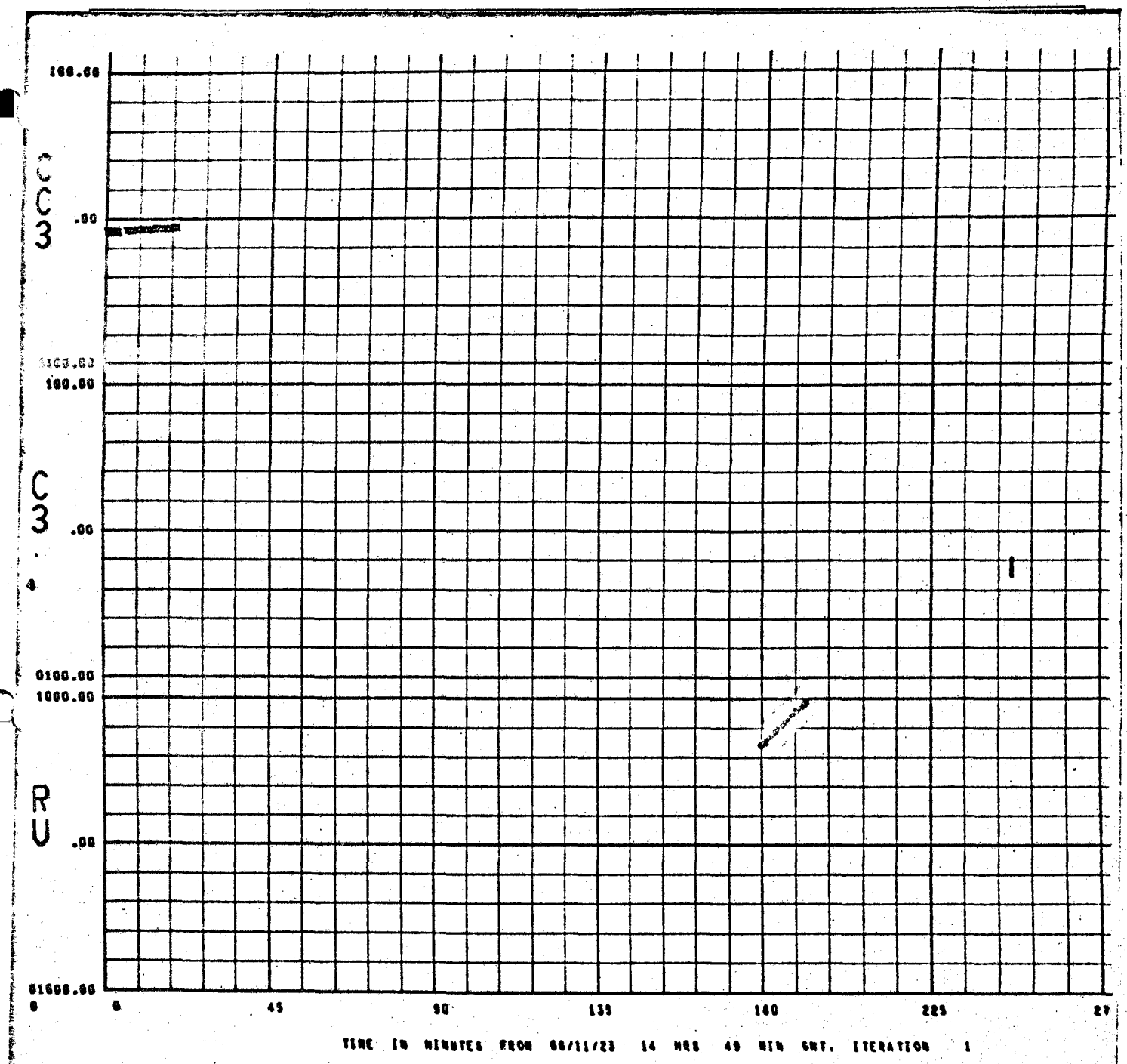
SIMPLE MOON



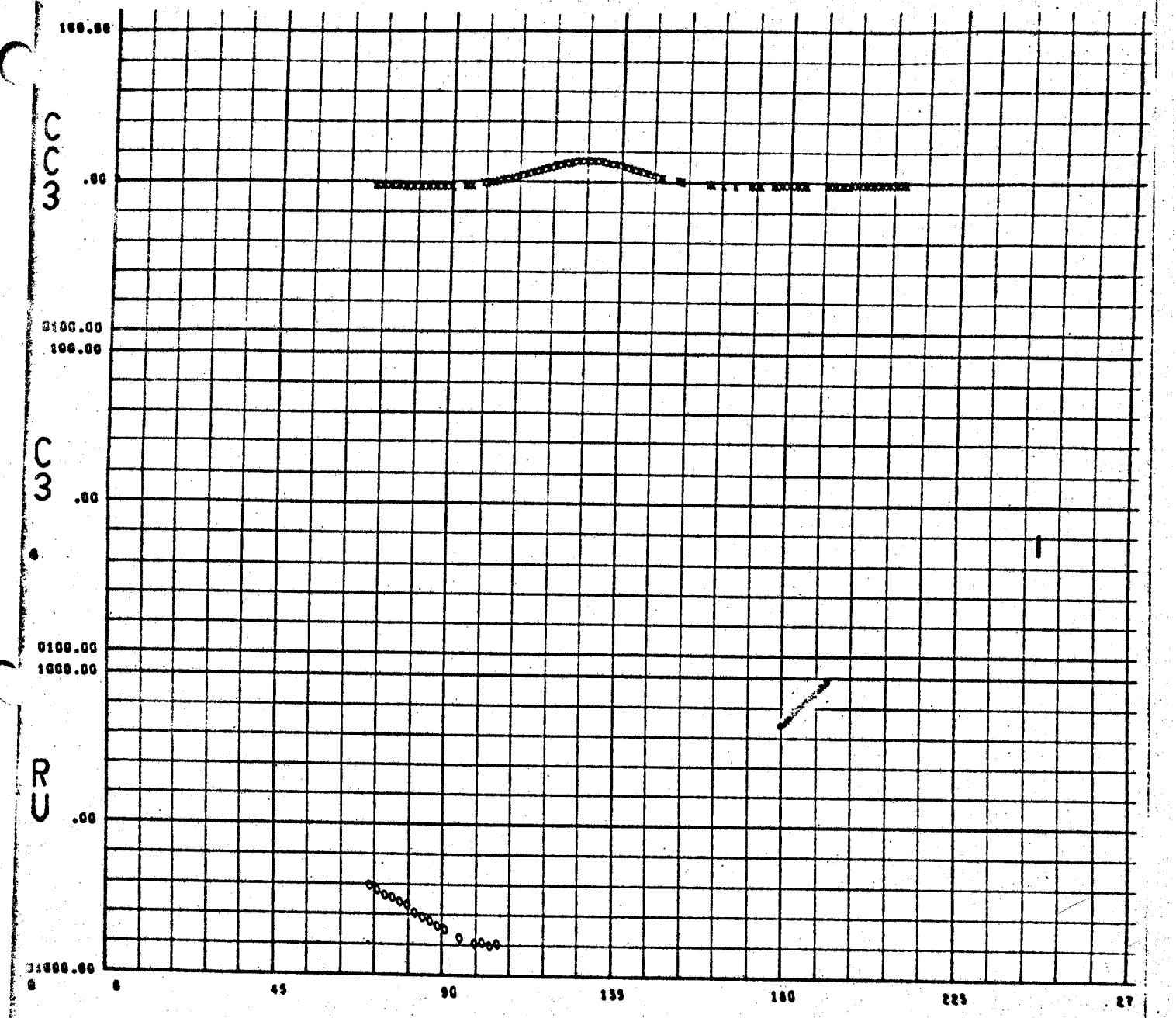
STATION 41 RESIDUALS PASS NUMBER 17/327



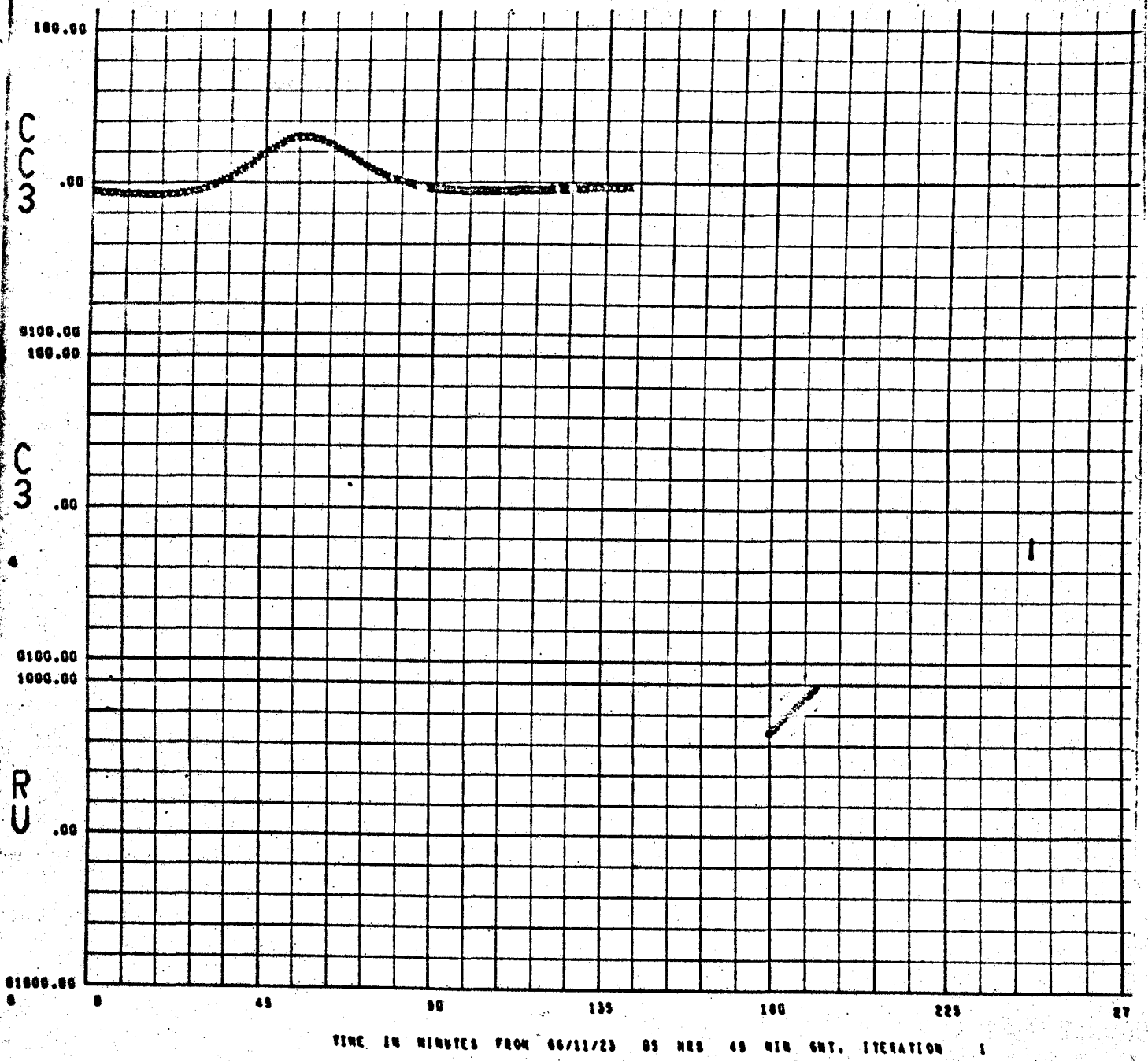
STATION 41 RESIDUALS PASS NUMBER 17/327



STATION 41 RESIDUALS PASS NUMBER 17/327



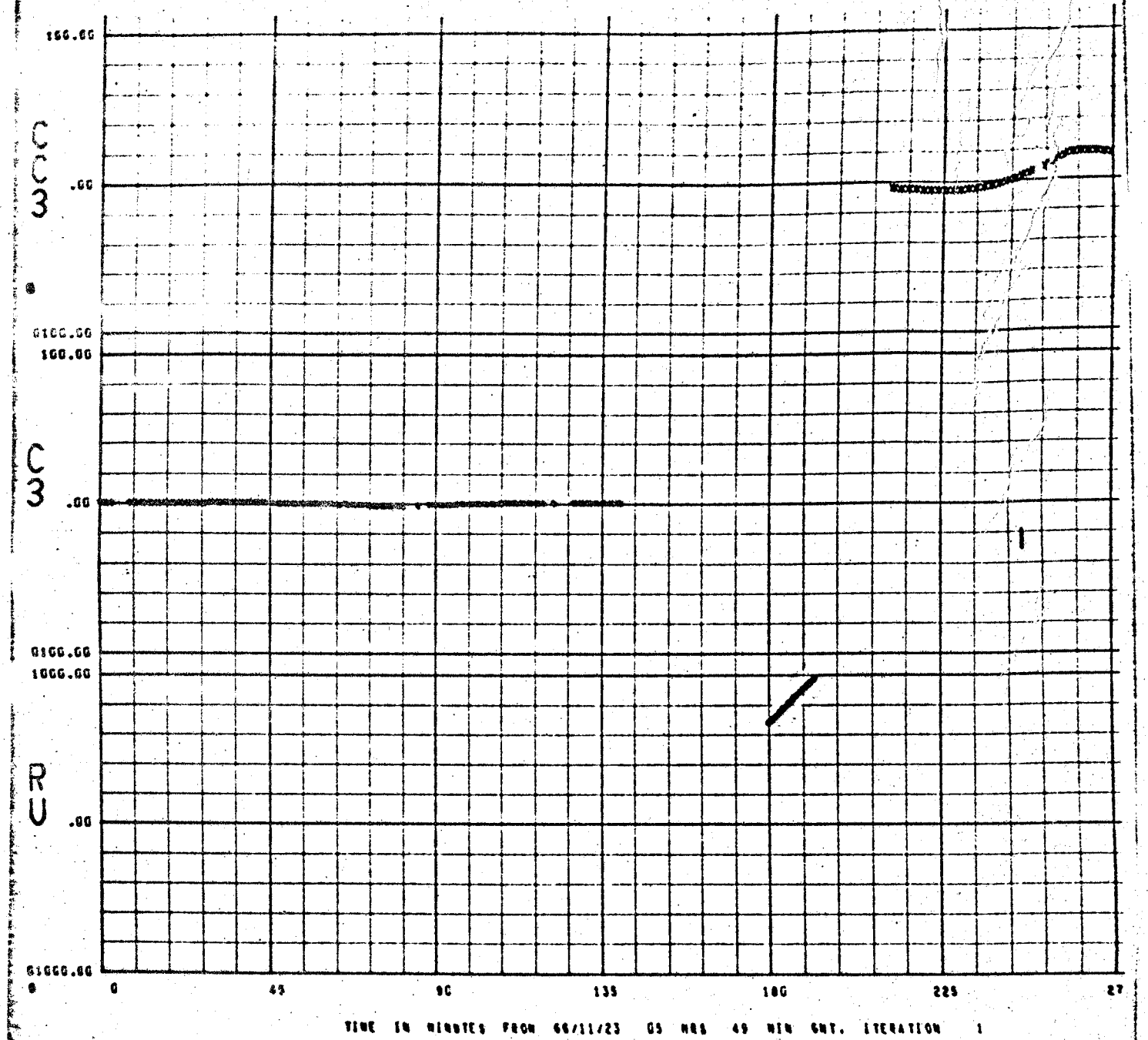
STATION 12 RESIDUALS PASS NUMBER 16/326



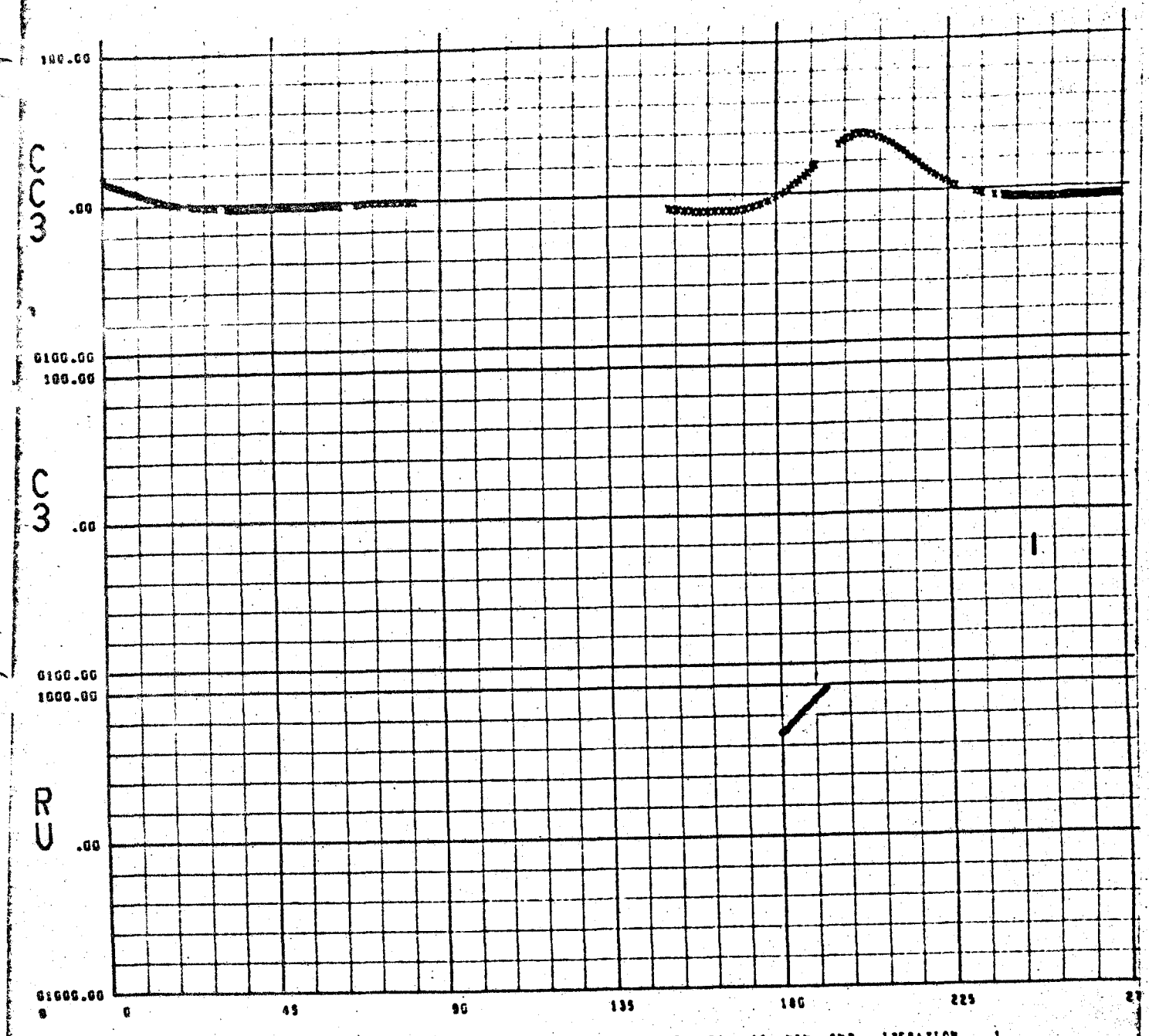
STATION 12 RESIDUALS PASS NUMBER 16/326

ODPL 2P10A

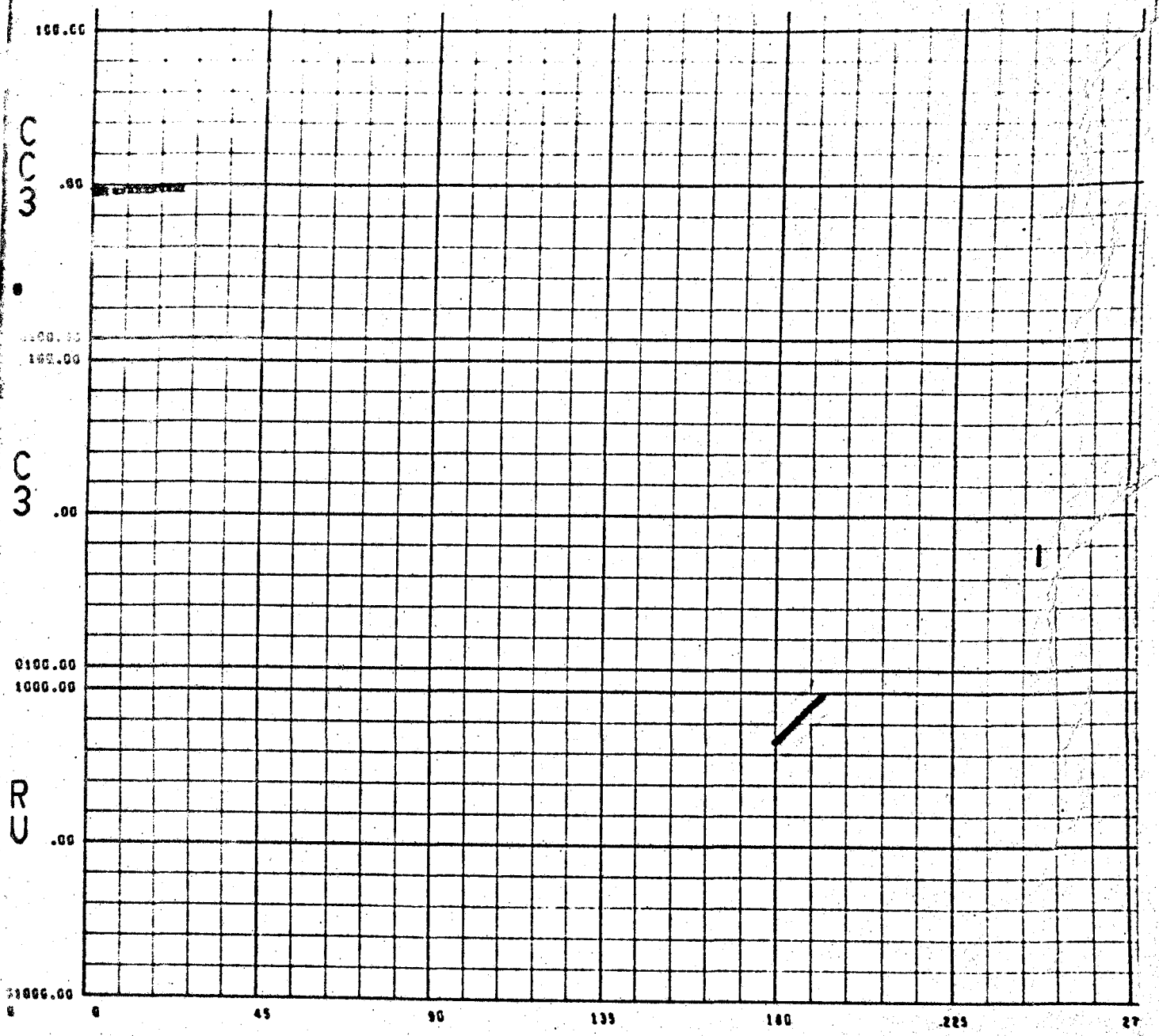
SIMPLE MOON



STATION 41 RESIDUALS PASS NUMBER 17/327

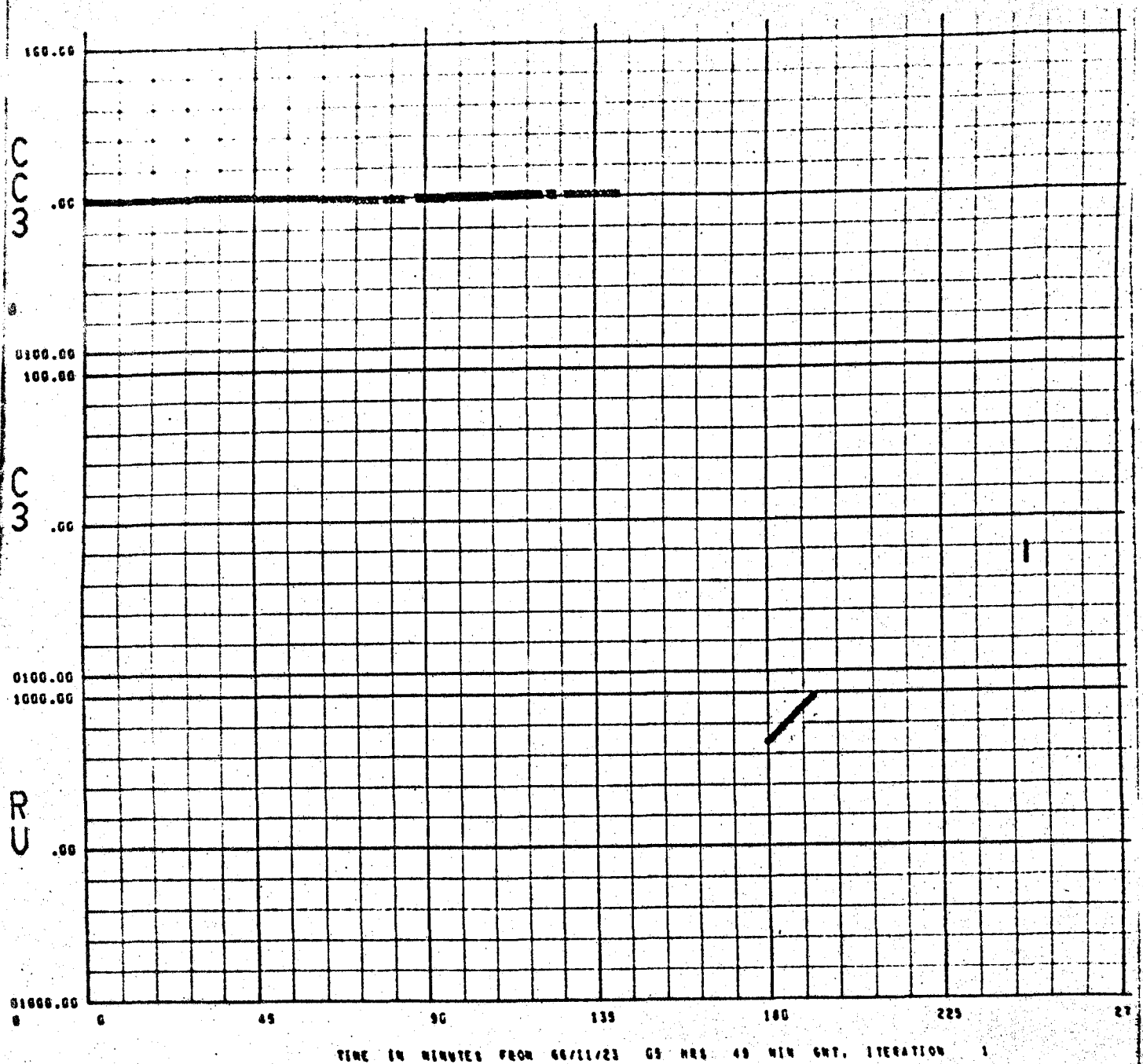


STATION 41 RESIDUALS PASS NUMBER 17/327

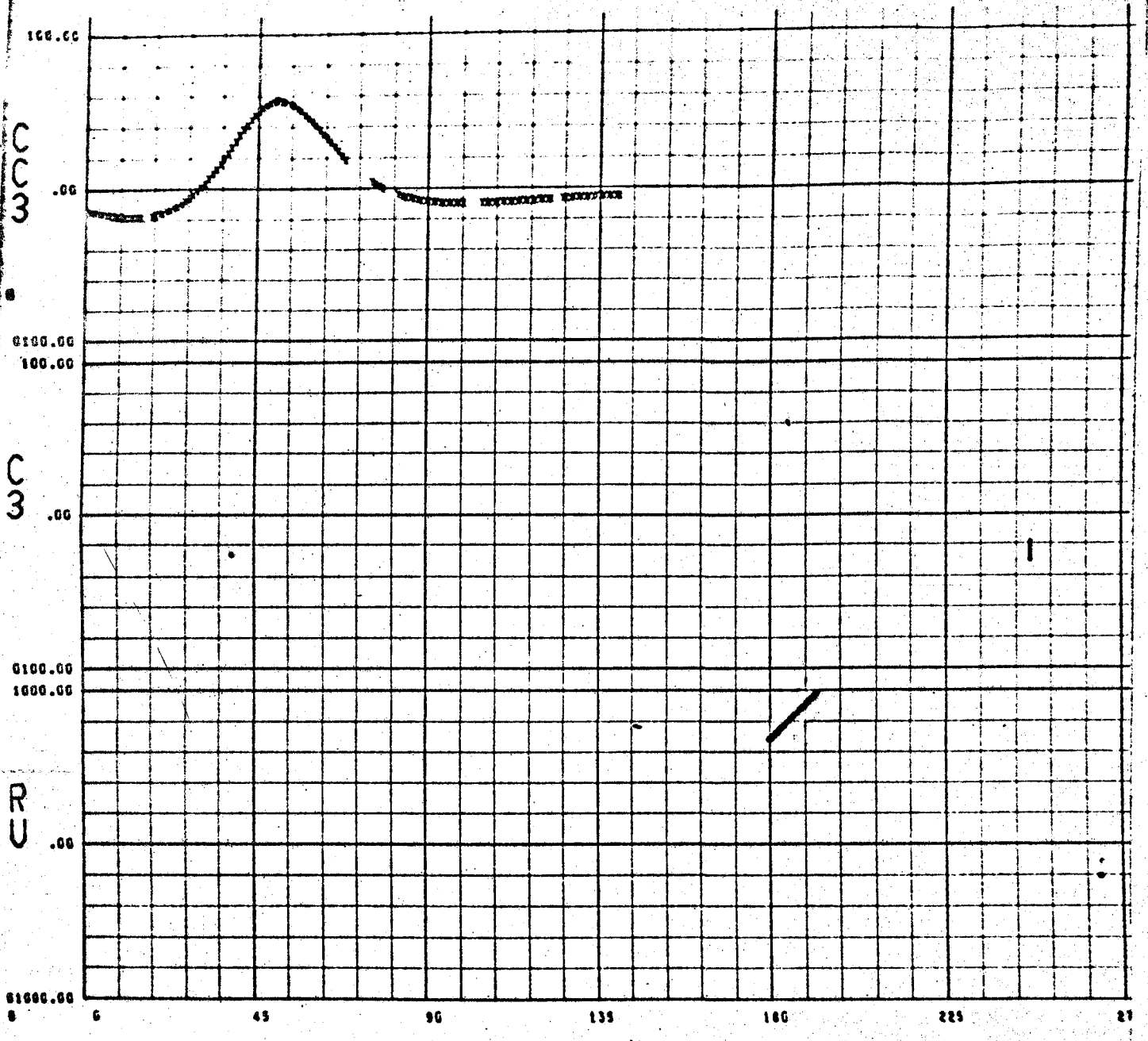


TIME IN MINUTES FROM 66/11/23 14 HRS 49 MIN GMT. ITERATION 1

STATION 41 RESIDUALS PASS NUMBER 17/327



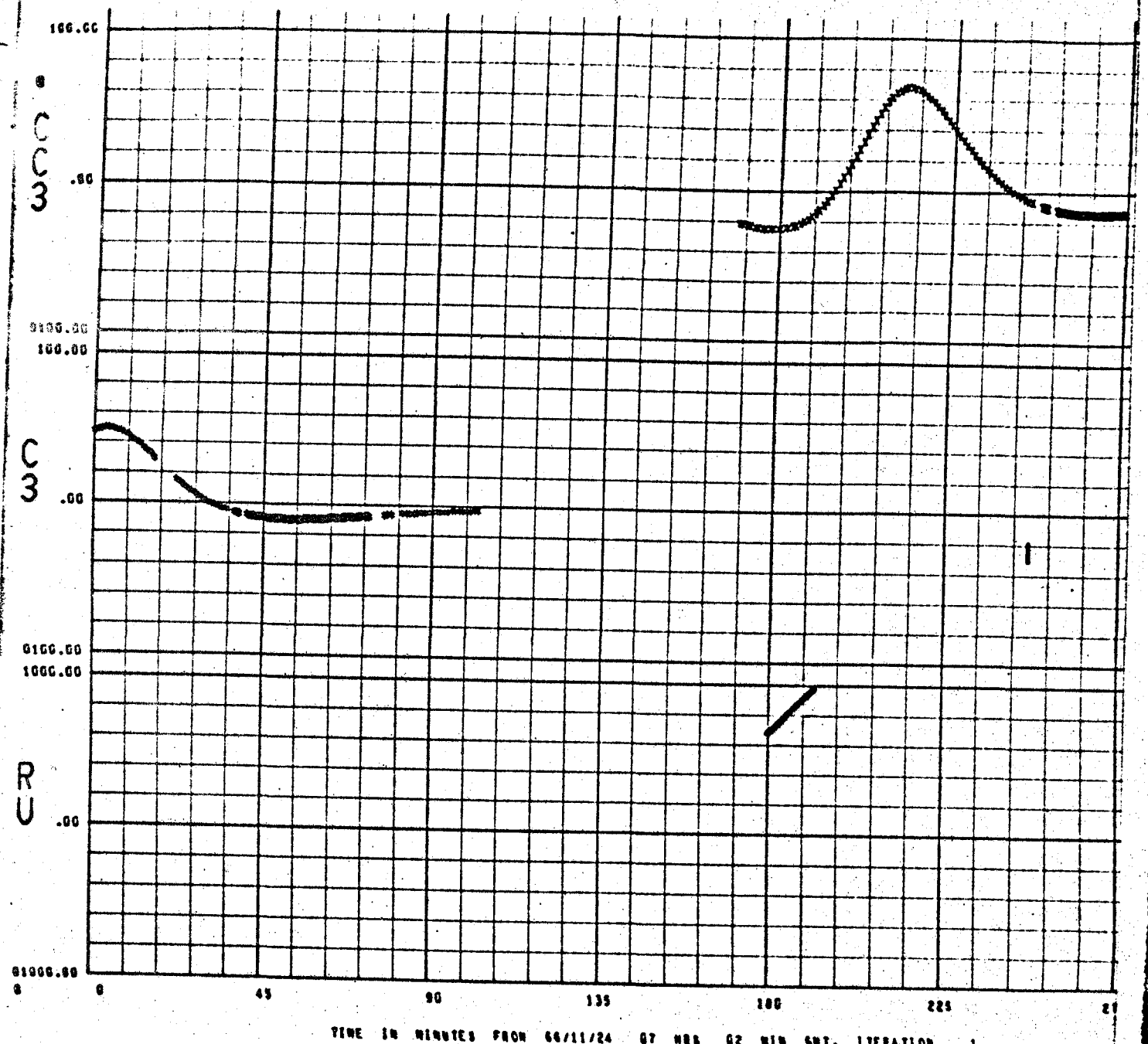
STATION 12 RESIDUALS PASS NUMBER 16/326



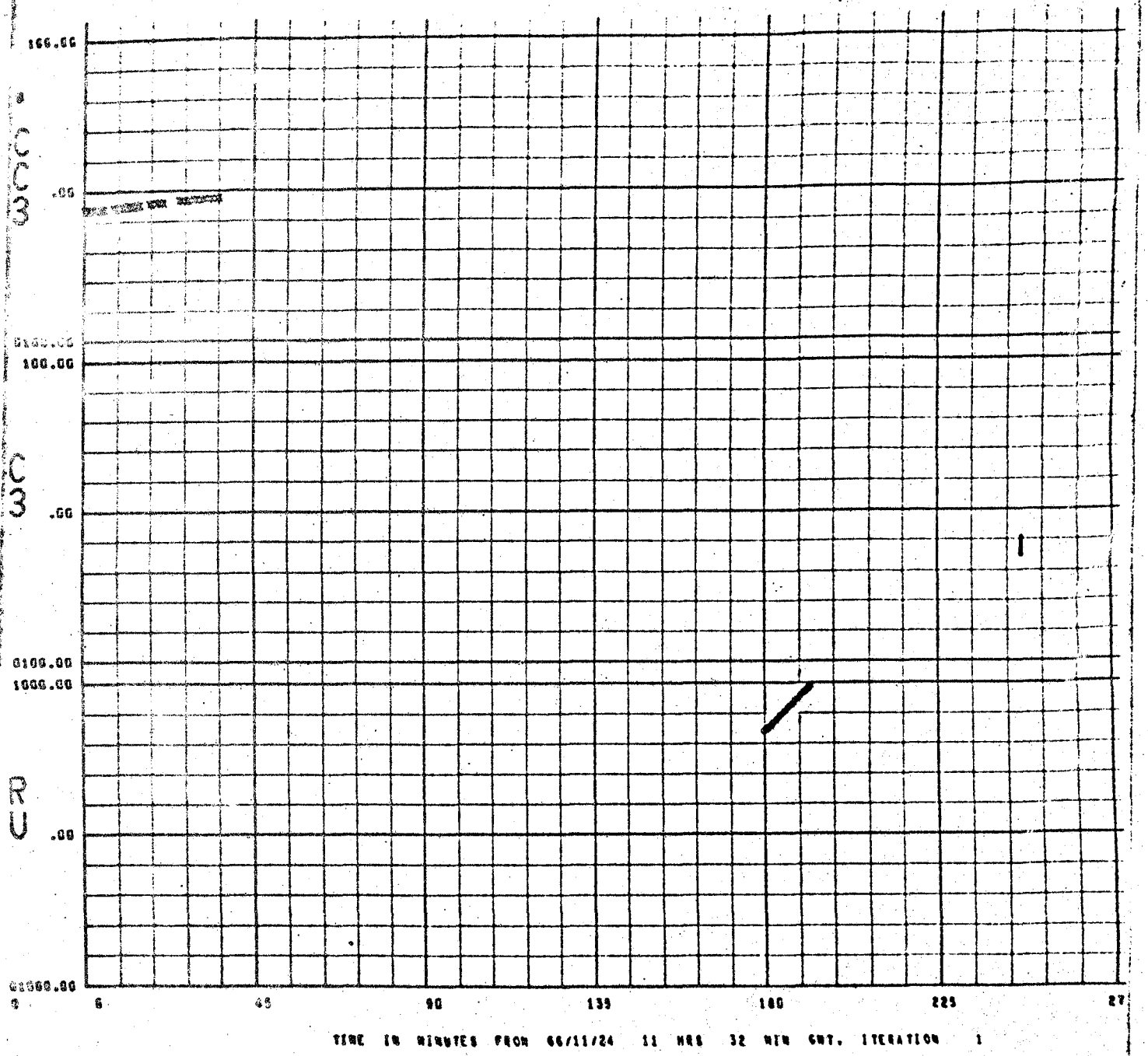
STATION 61 RESIDUALS PASS NUMBER 17/327

ODPL 2S12

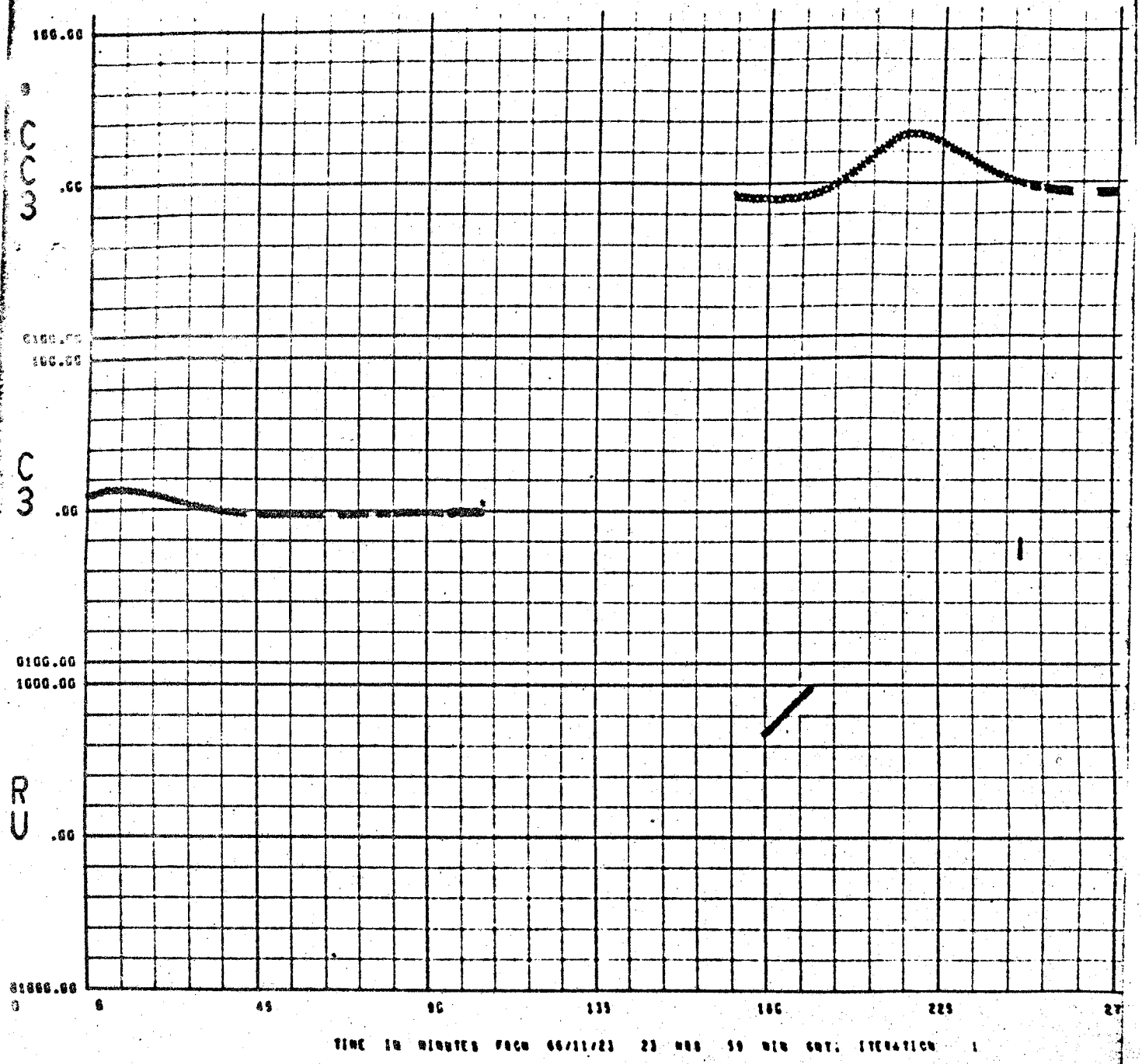
SIMPLE MOON



STATION 41 RESIDUALS PASS NUMBER 18/328



STATION 41 RESIDUALS PASS NUMBER 18/328

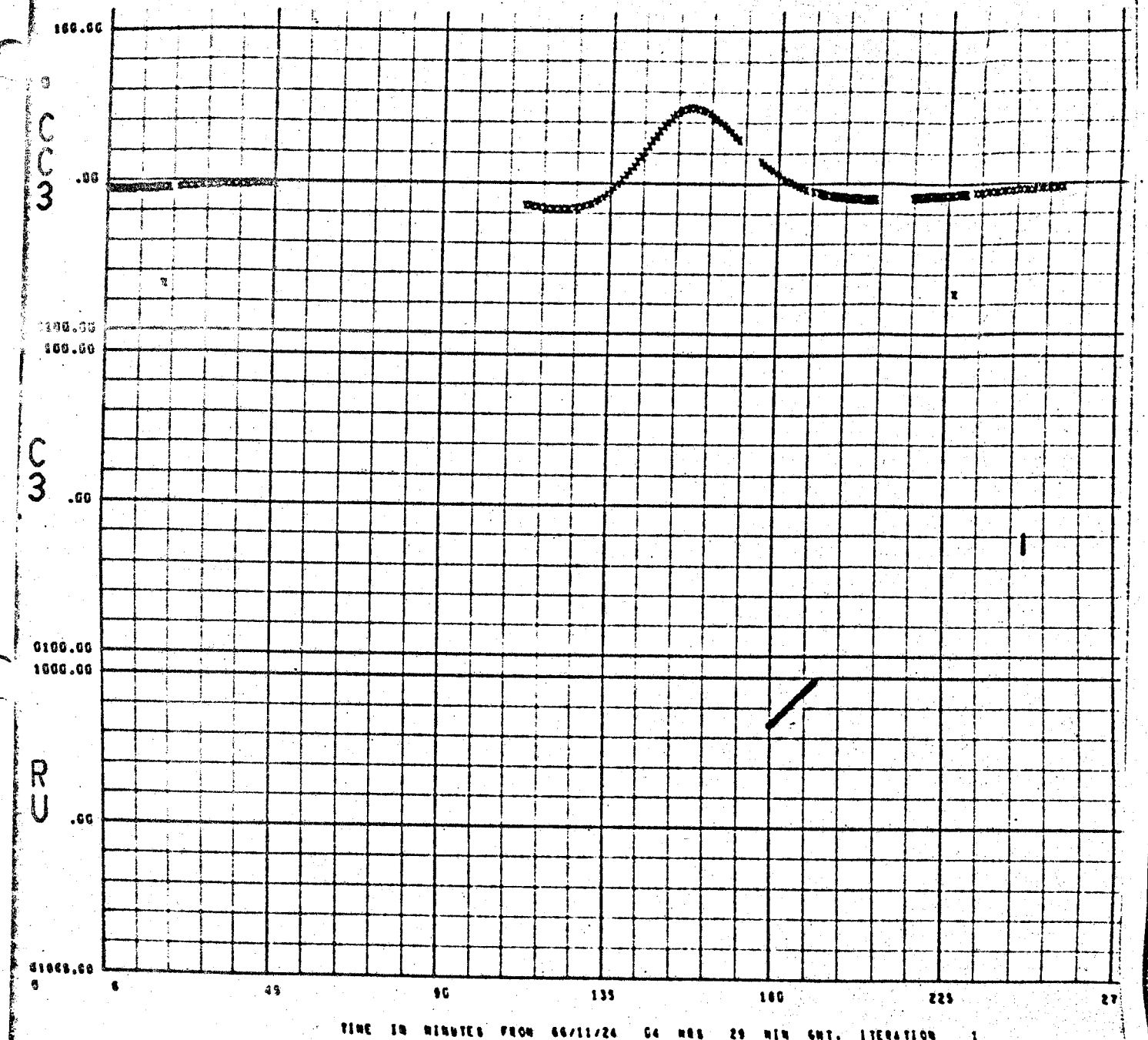


STATION 12 RESIDUALS PASS NUMBER 17/327

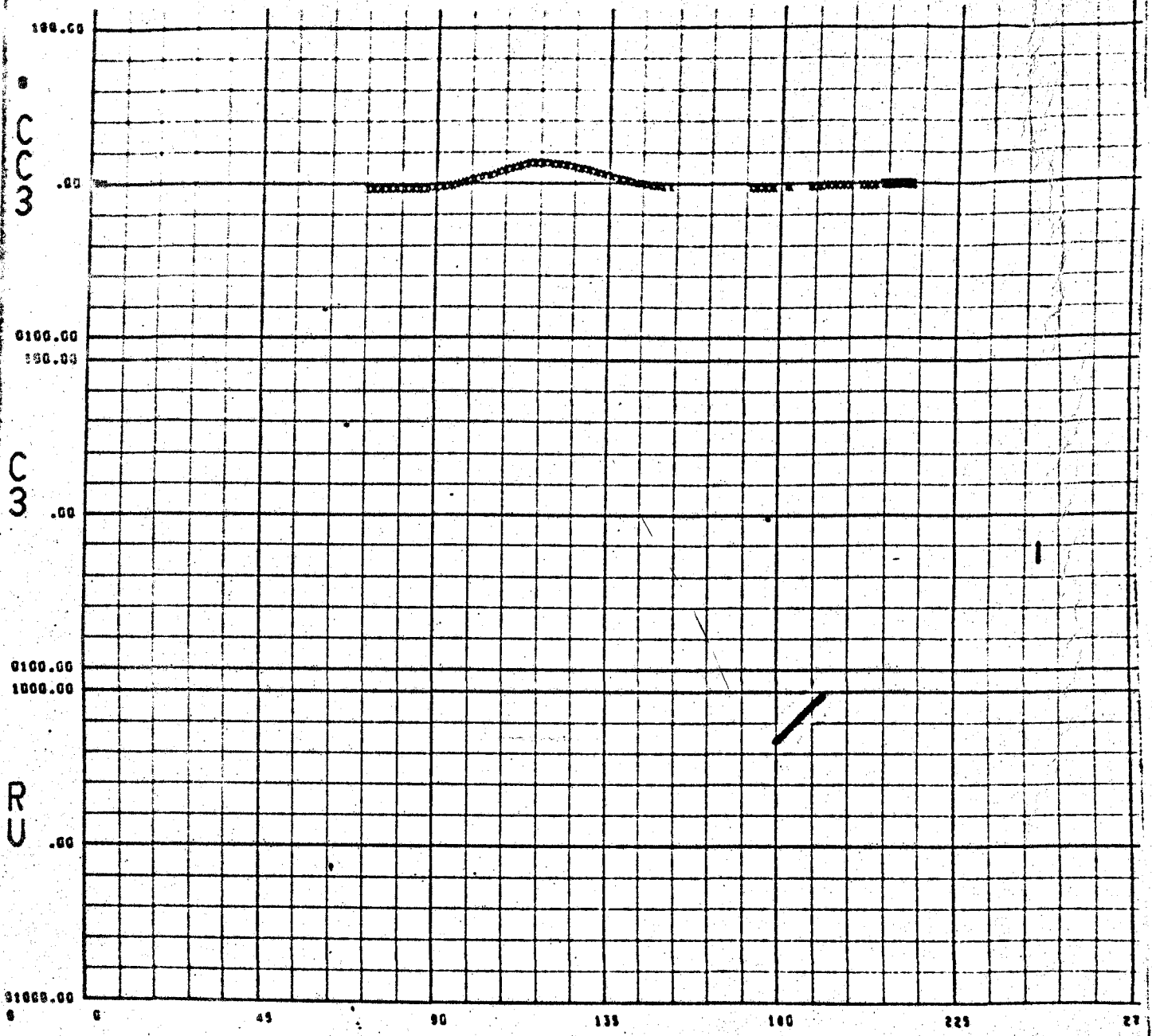
REV LTR

BOEING NO. D2-100816-1

SH. 188



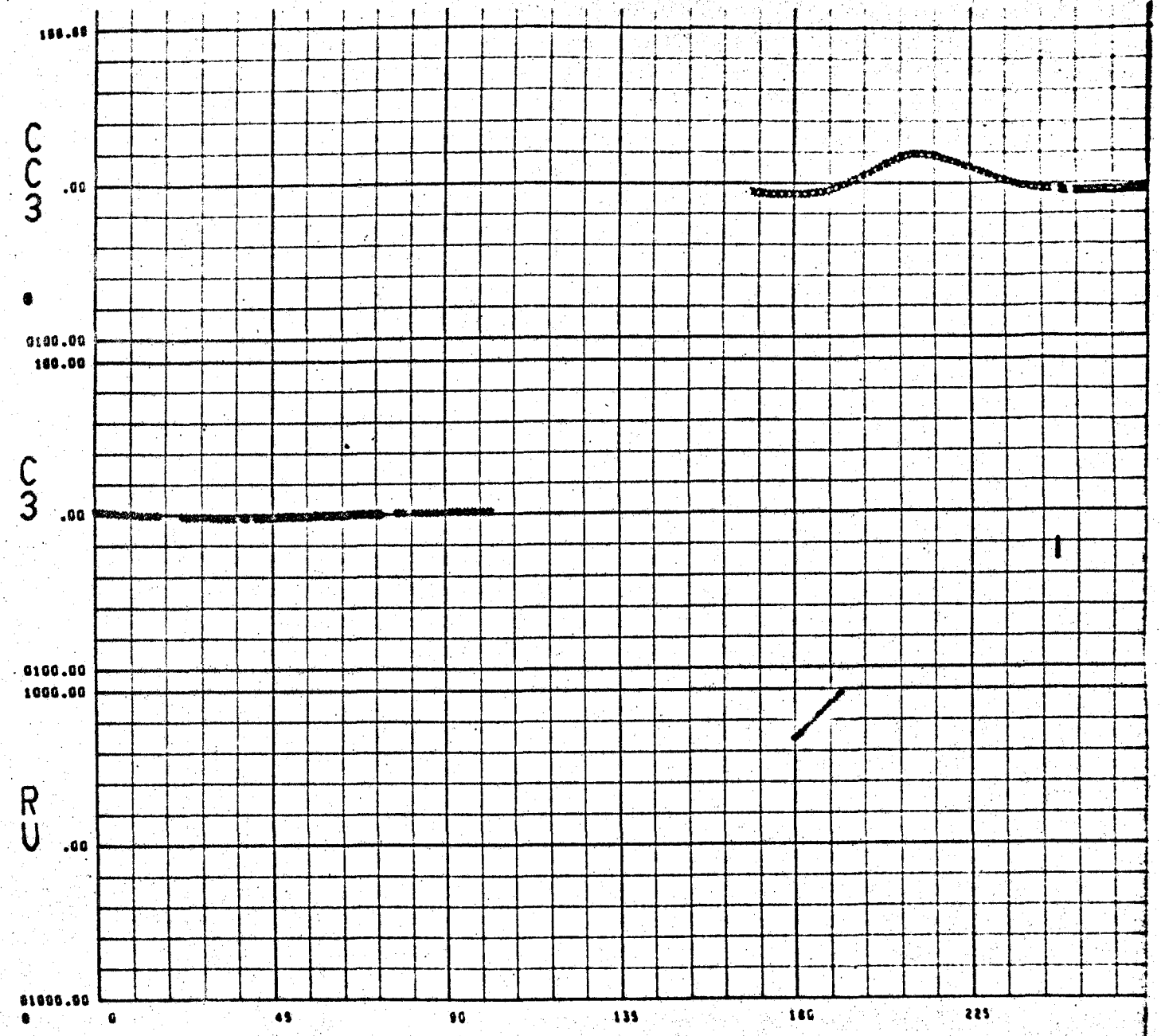
STATION 12 RESIDUALS PASS NUMBER 17/327



STATION 61 RESIDUALS PASS NUMBER 17/327

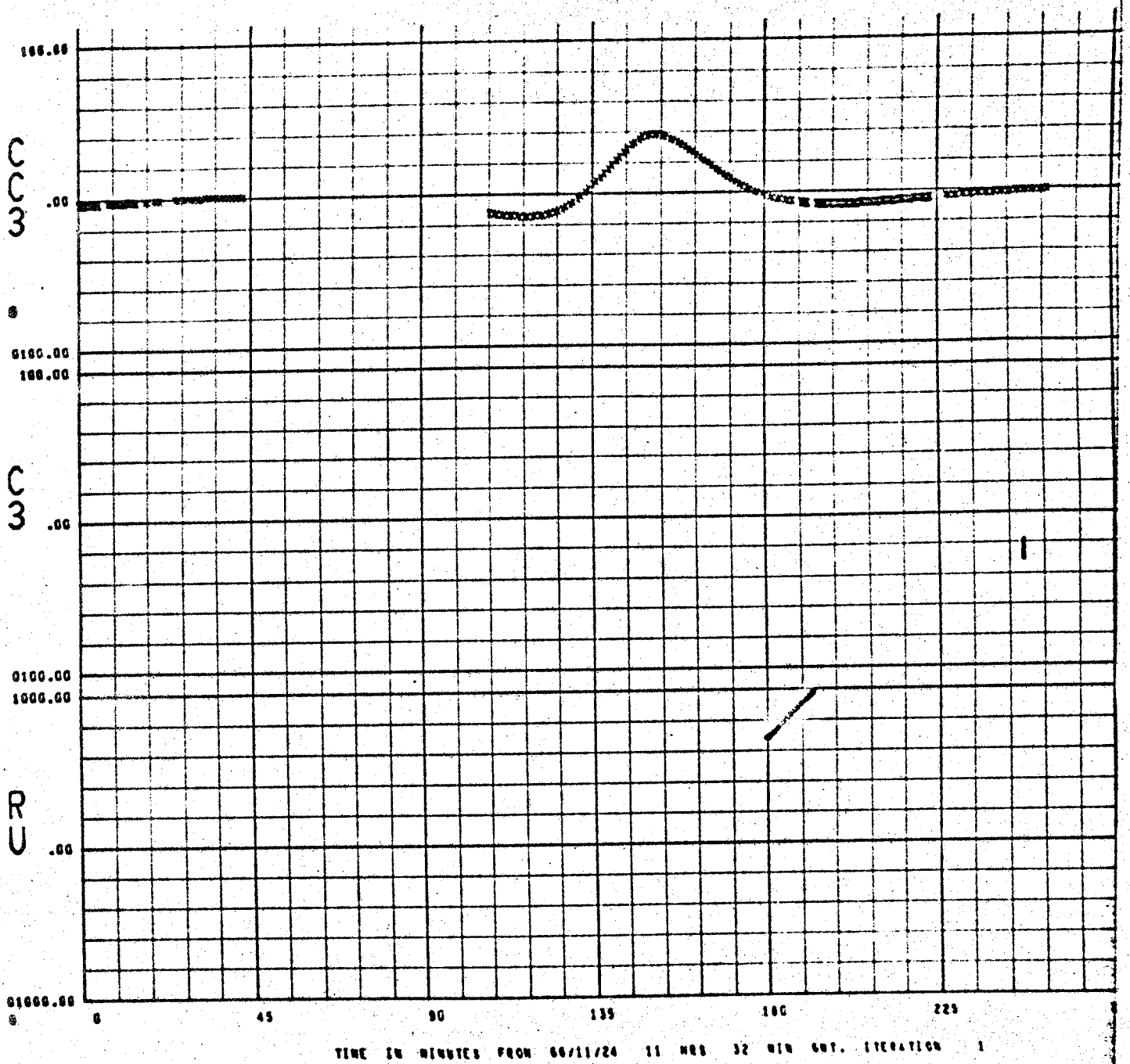
ODPL 2P12A

SIMPLE MOON

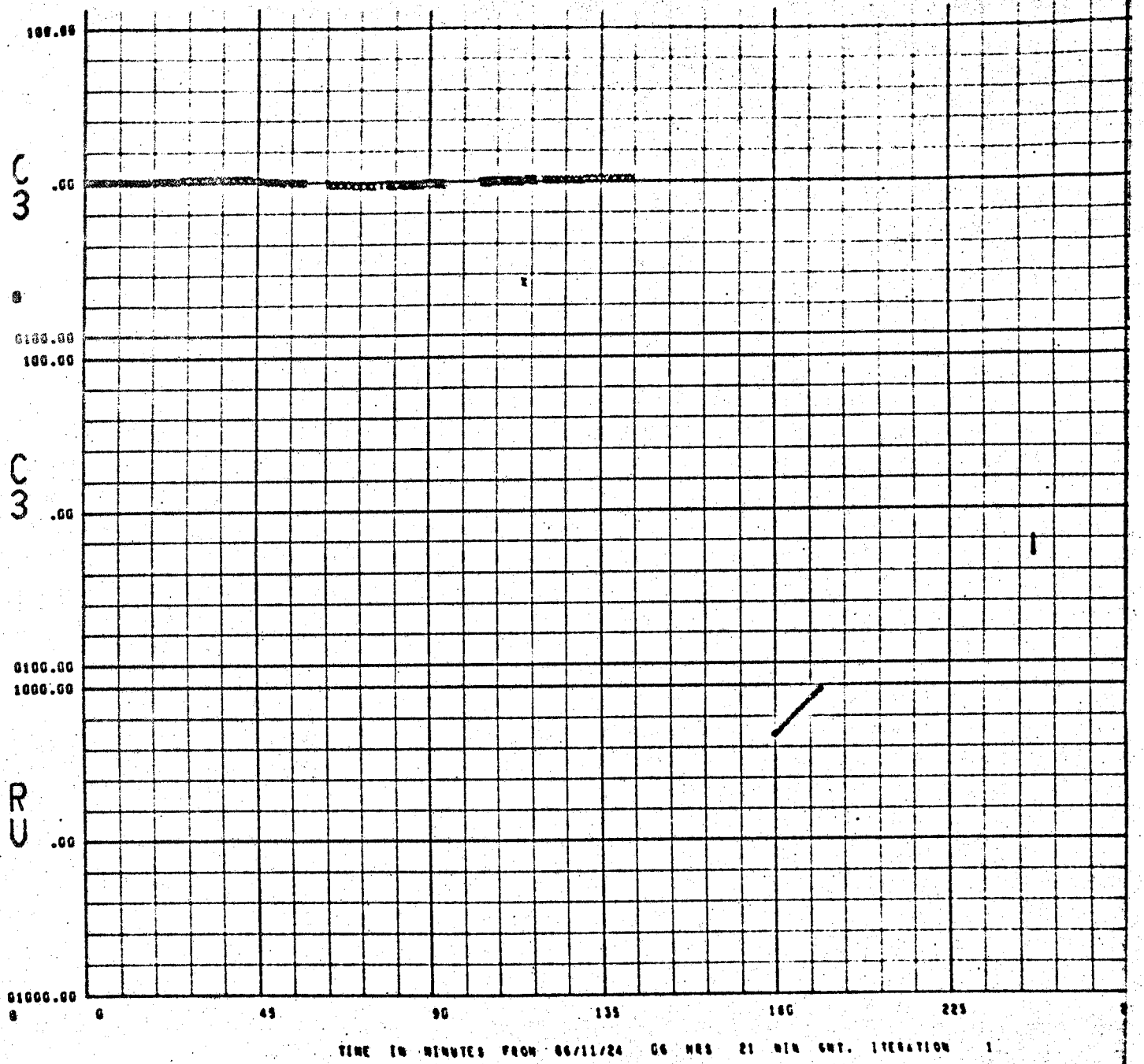


TIME IN MINUTES FROM 66/11/24 07 HRS 02 MIN GMT. ITERATION 1

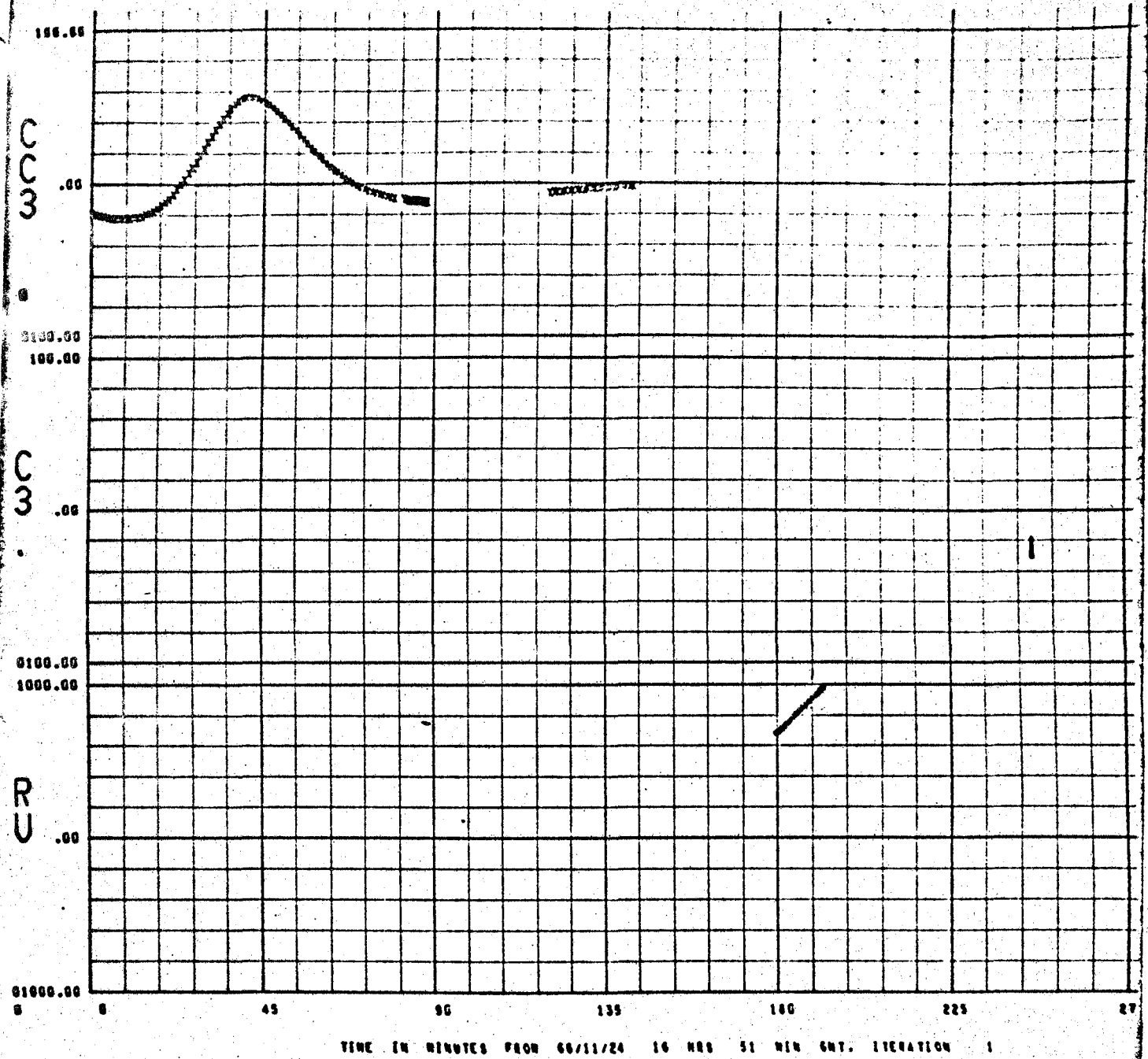
STATION 41 RESIDUALS PASS NUMBER 18/328



STATION 41 RESIDUALS PASS NUMBER 18/328



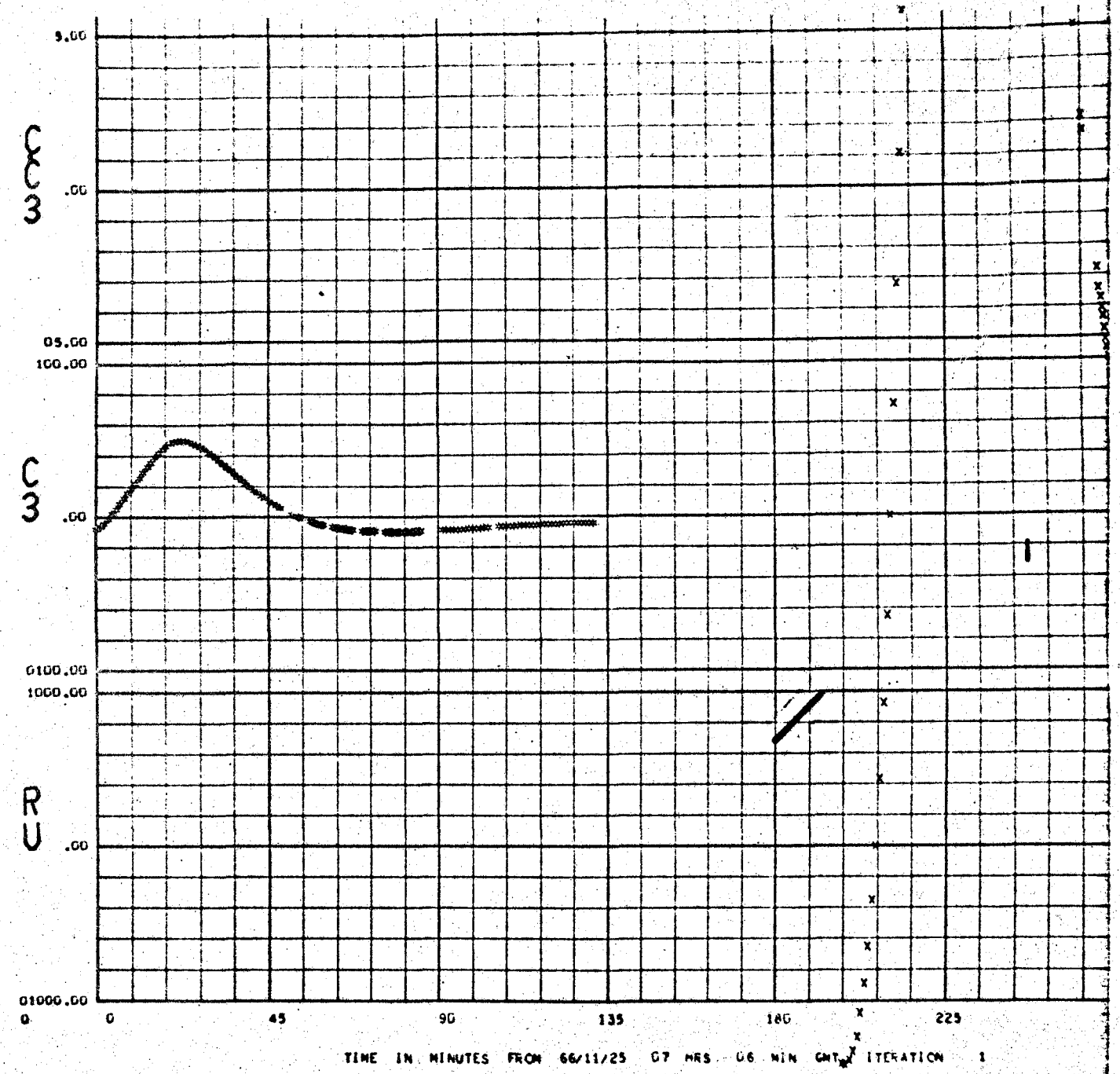
STATION 12 RESIDUALS PASS NUMBER 17/327



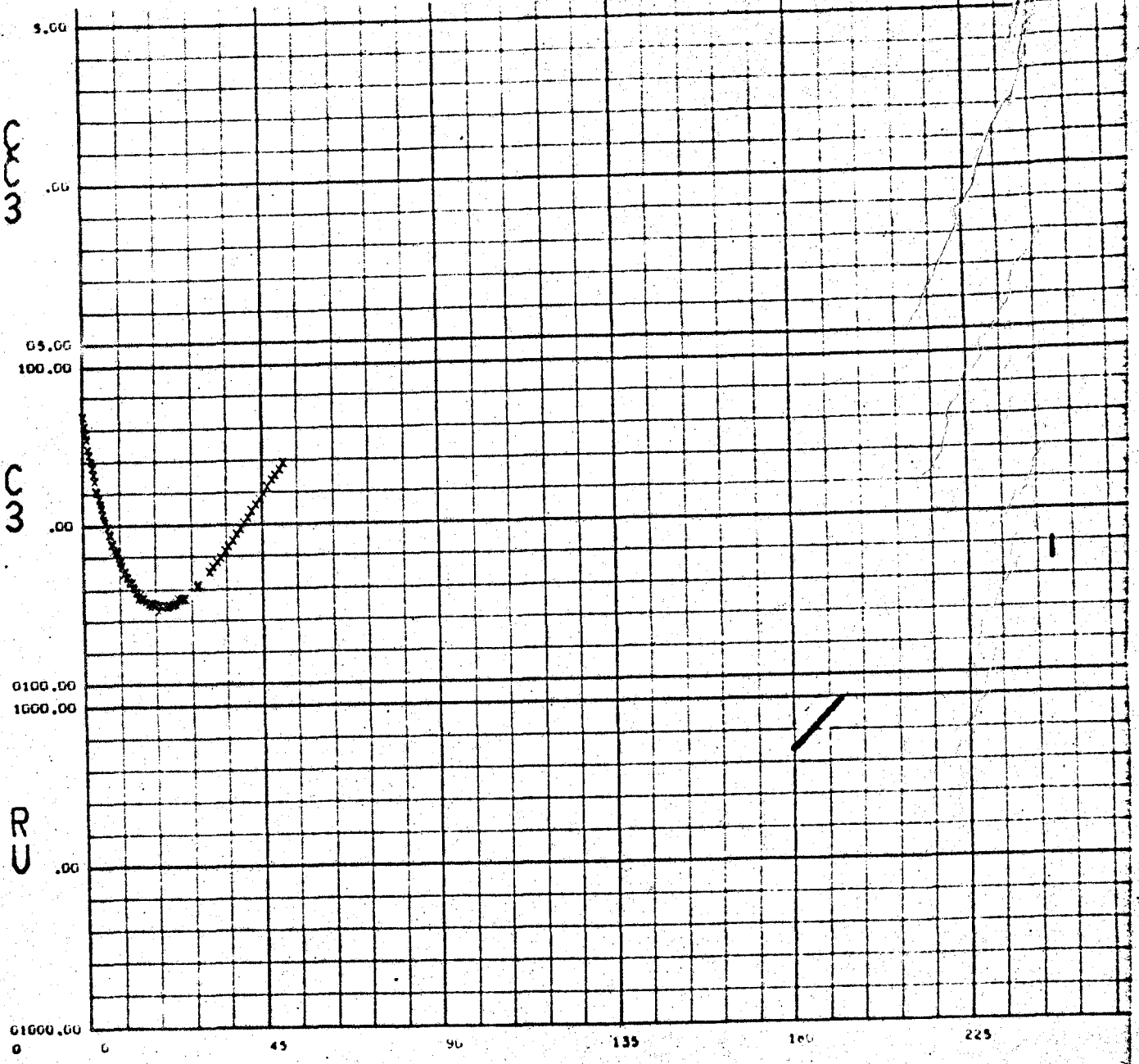
STATION 61 RESIDUALS PASS NUMBER 18/328

ODPL 2P2

SIMPLIFIED L

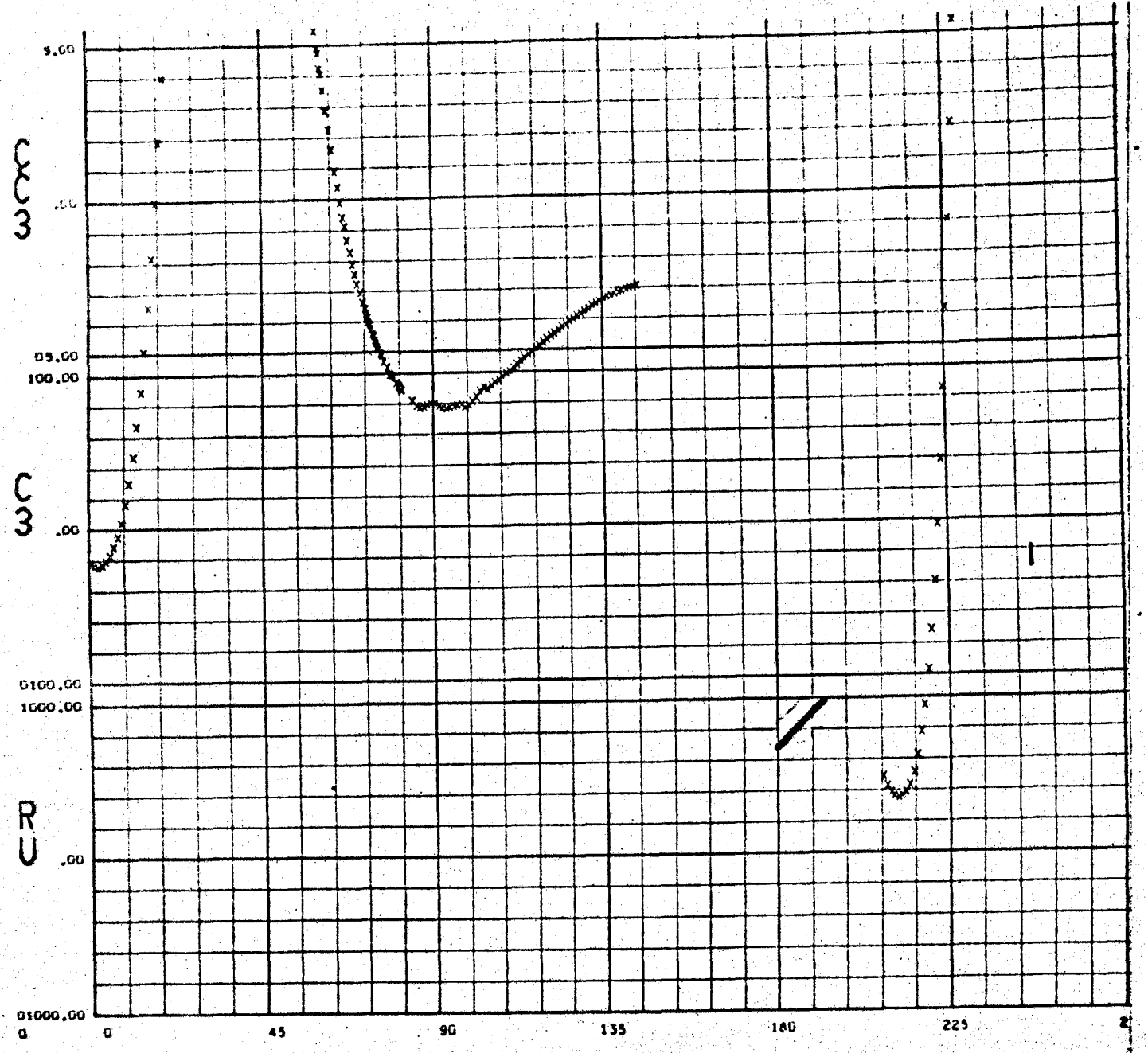


STATION 41 RESIDUALS PASS NUMBER 19/329

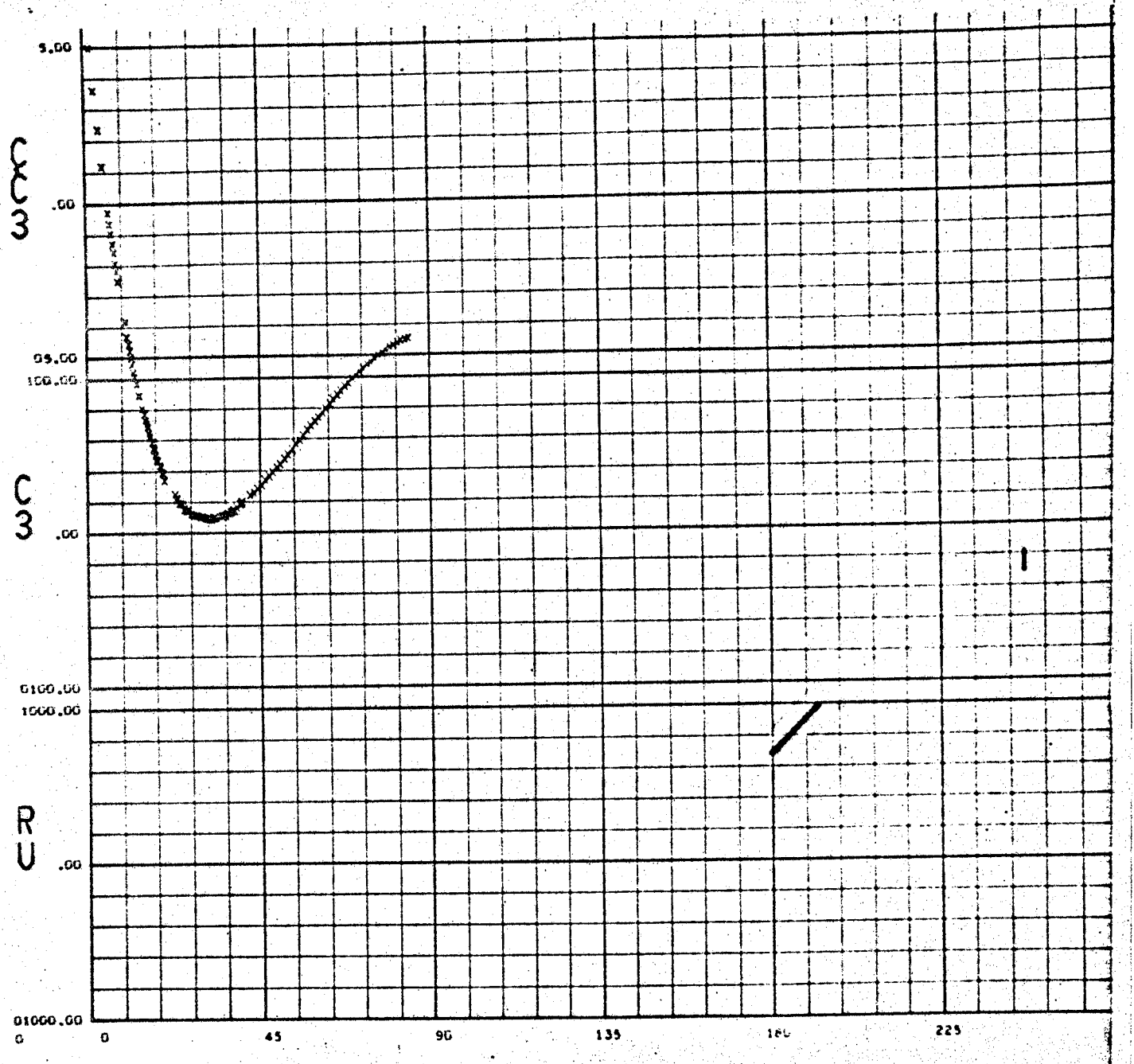


TIME IN MINUTES FROM 66/11/25 11 HRS 36 MIN GMT. ITERATION 1

STATION 41 RESIDUALS PASS NUMBER 19/329



STATION 12 RESIDUALS PASS NUMBER 18/328

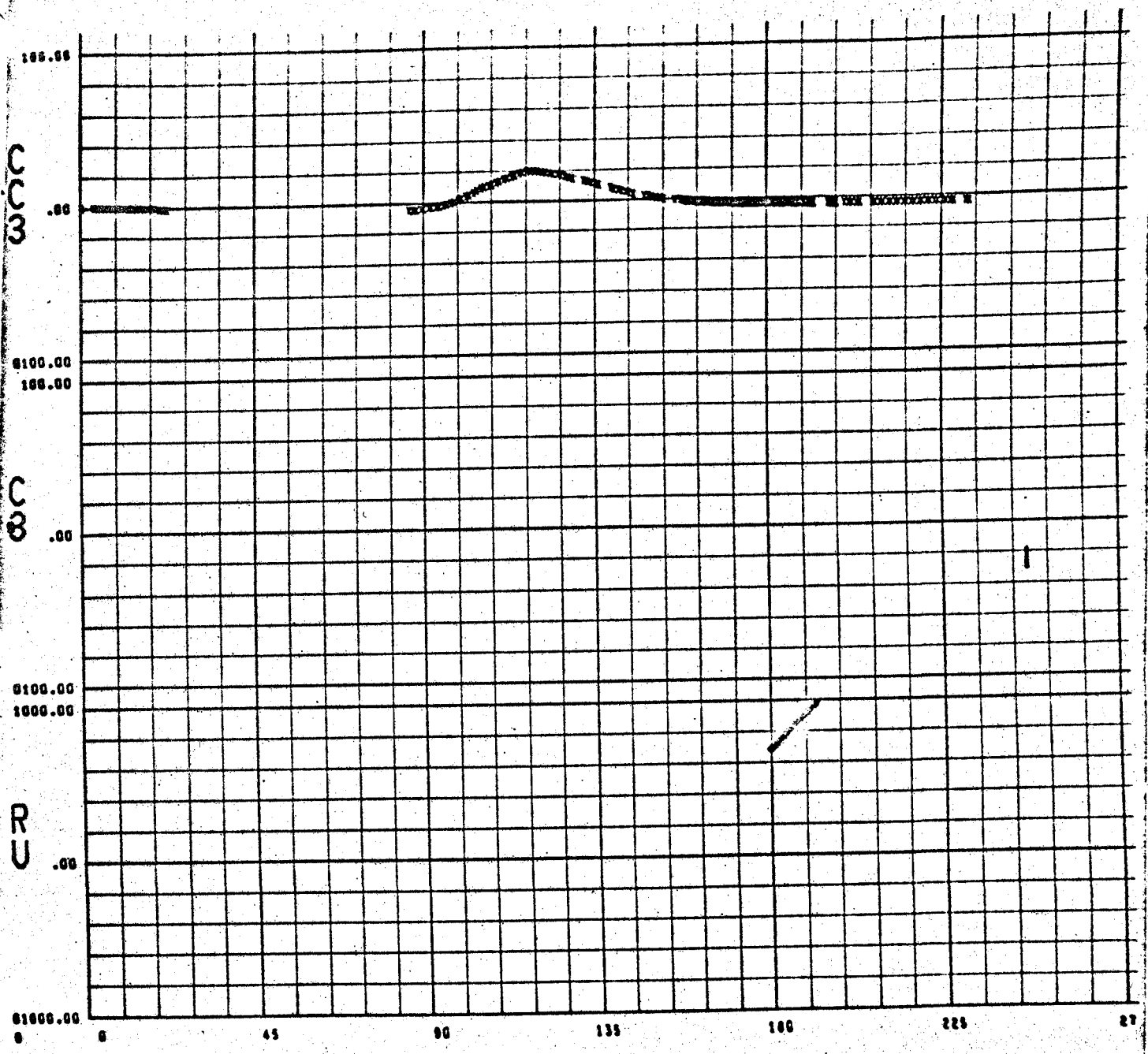


STATION 12 RESIDUALS PASS NUMBER 18/328

STATION 61 RESIDUALS PASS NUMBER 18/328

ODPL 2S15

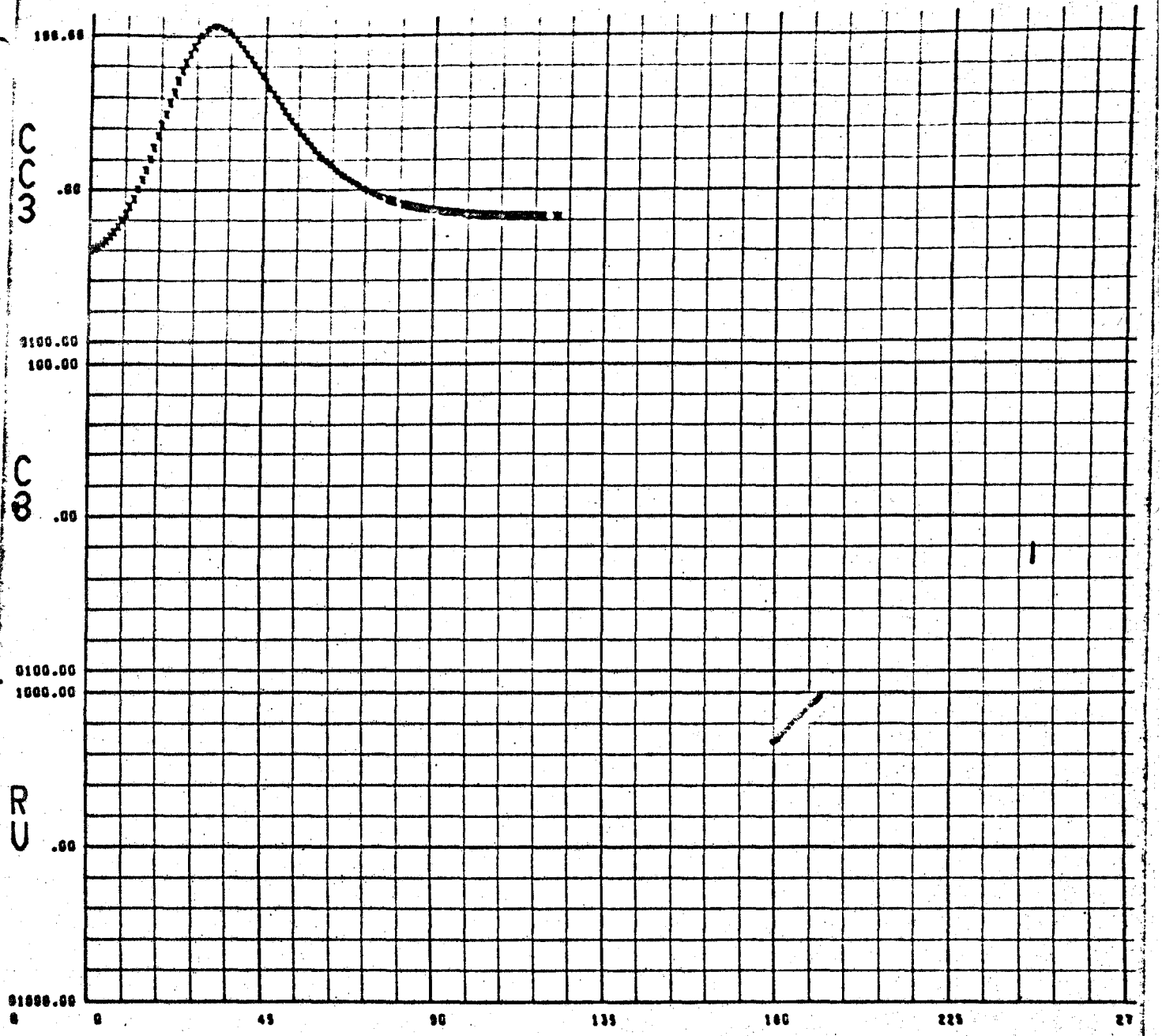
SIMPLE MOON



STATION 41 RESIDUALS PASS NUMBER 19/329

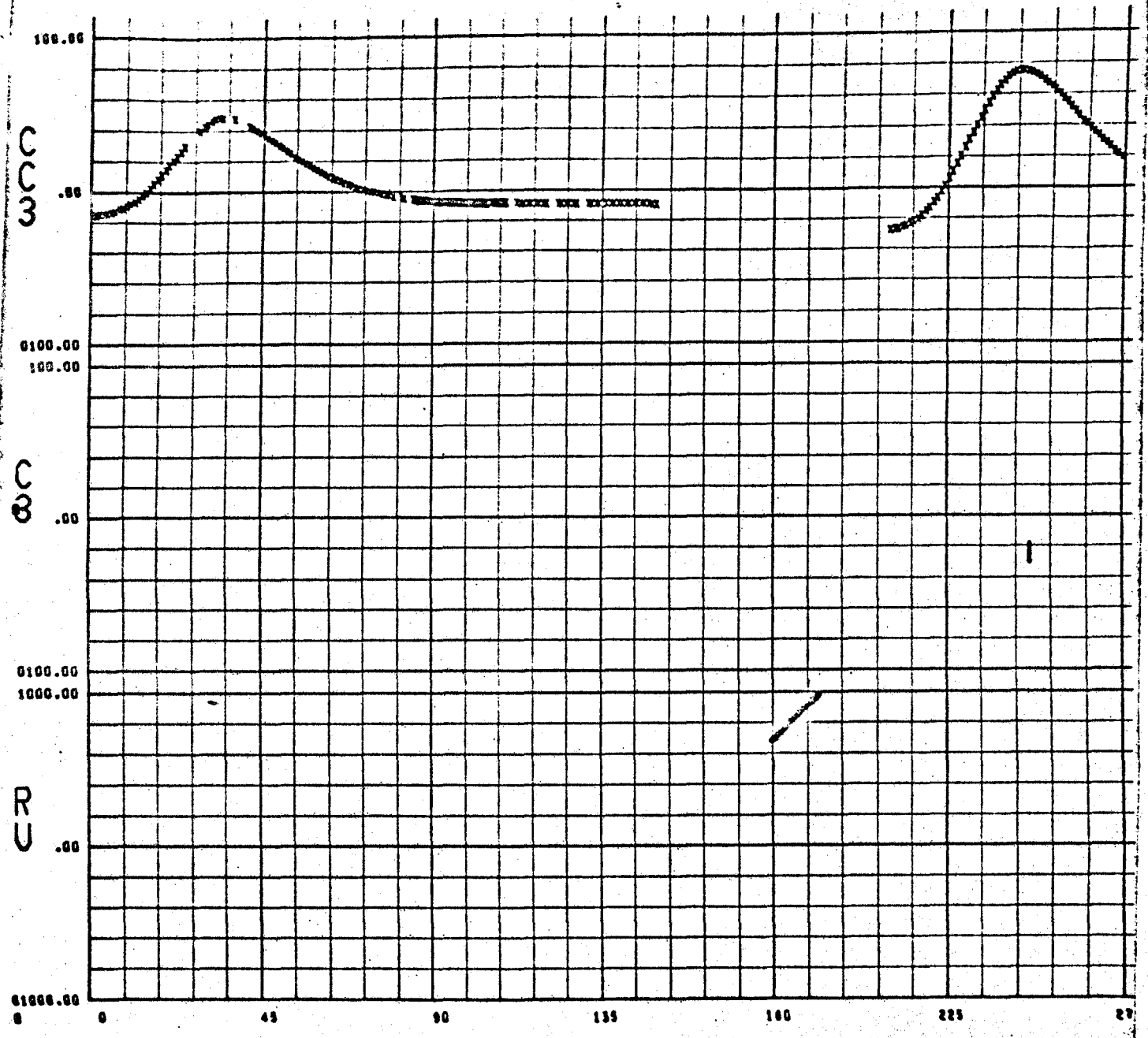
REV LTR

U3 4288-2000 REV. 6/64

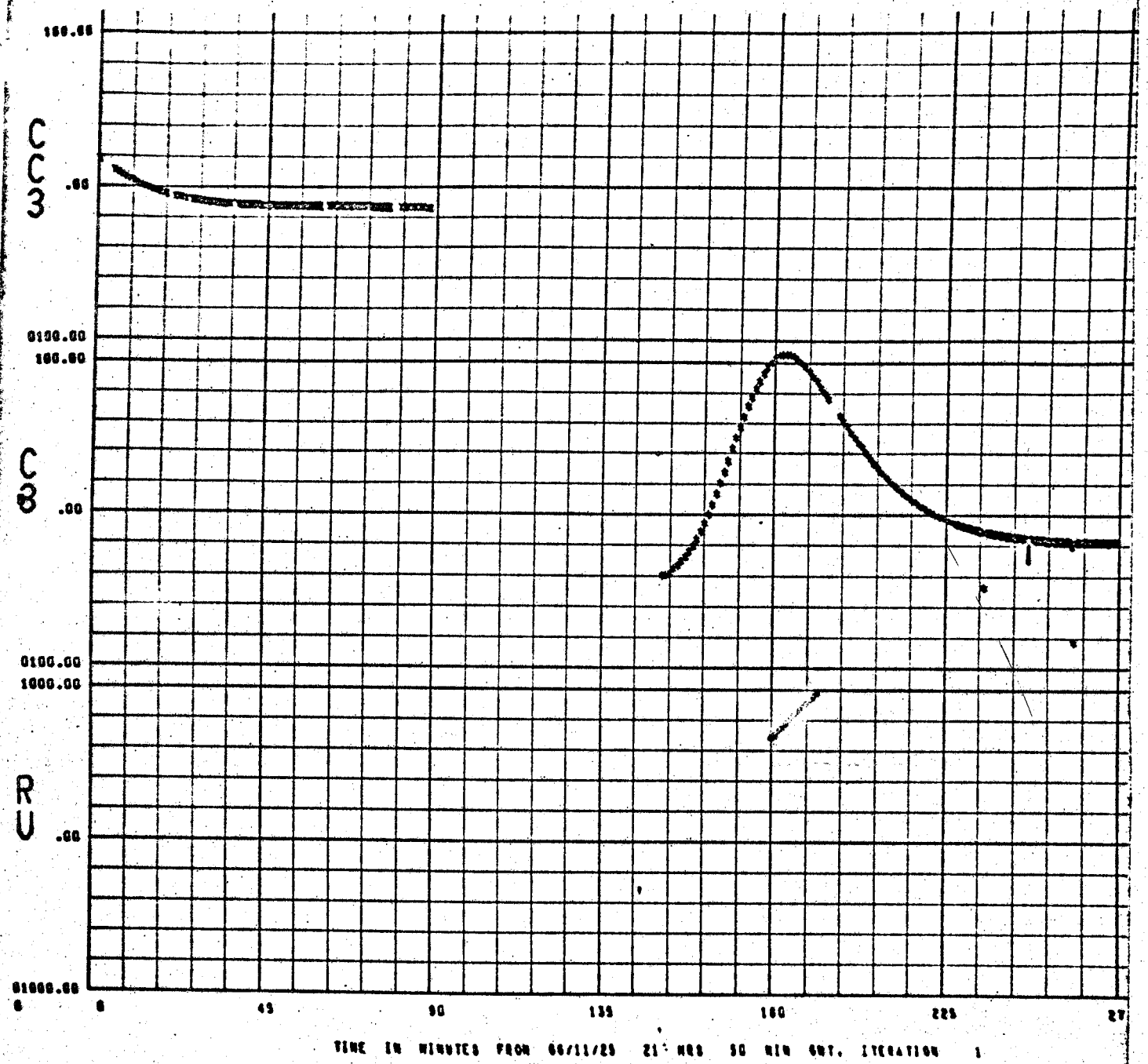


TIME IN MINUTES FROM 66/11/26 00 HRS 21 MIN GMT. ITERATION 1

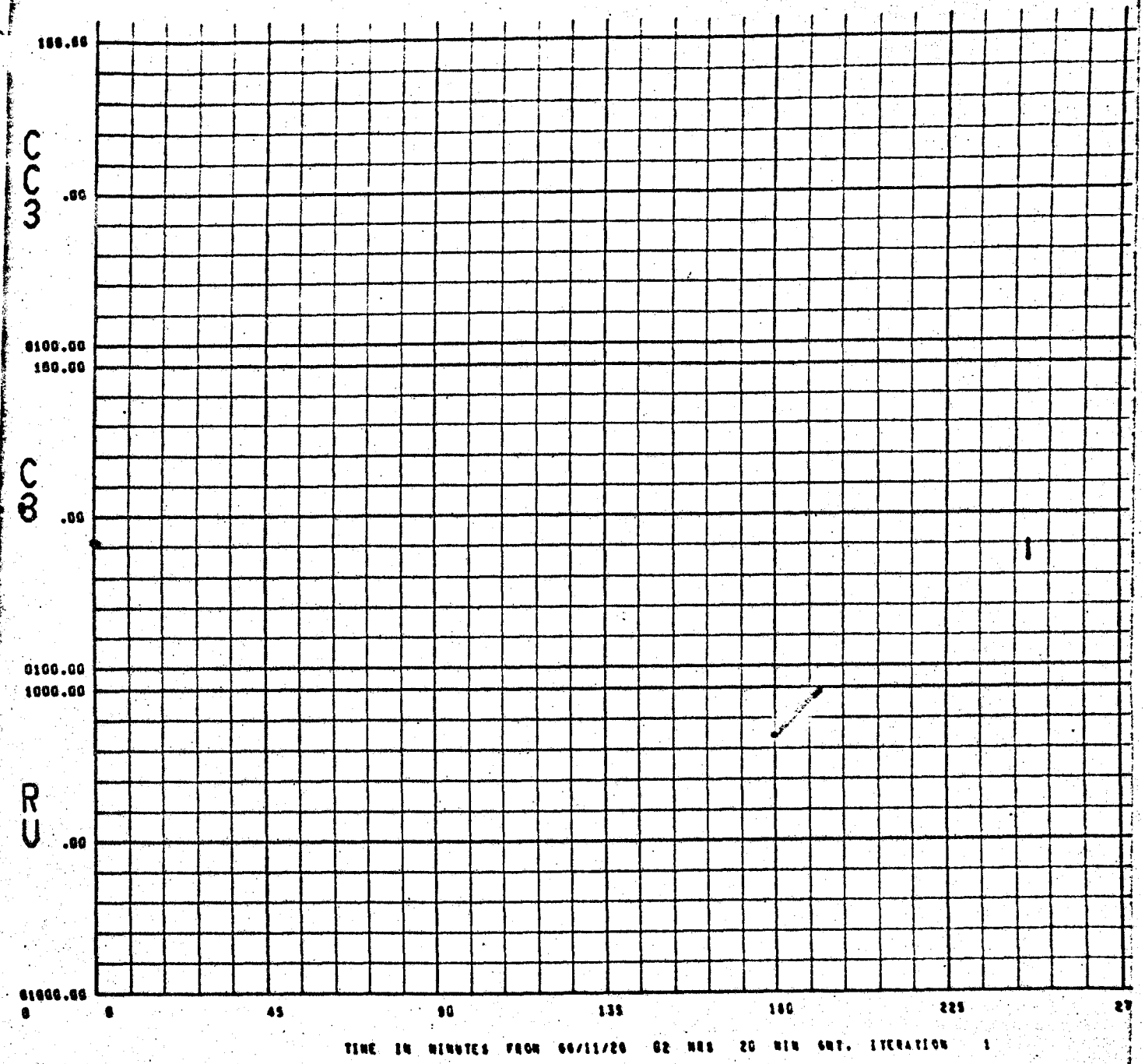
STATION 12 RESIDUALS PASS NUMBER 19/330



STATION 61 RESIDUALS PASS NUMBER 19/329



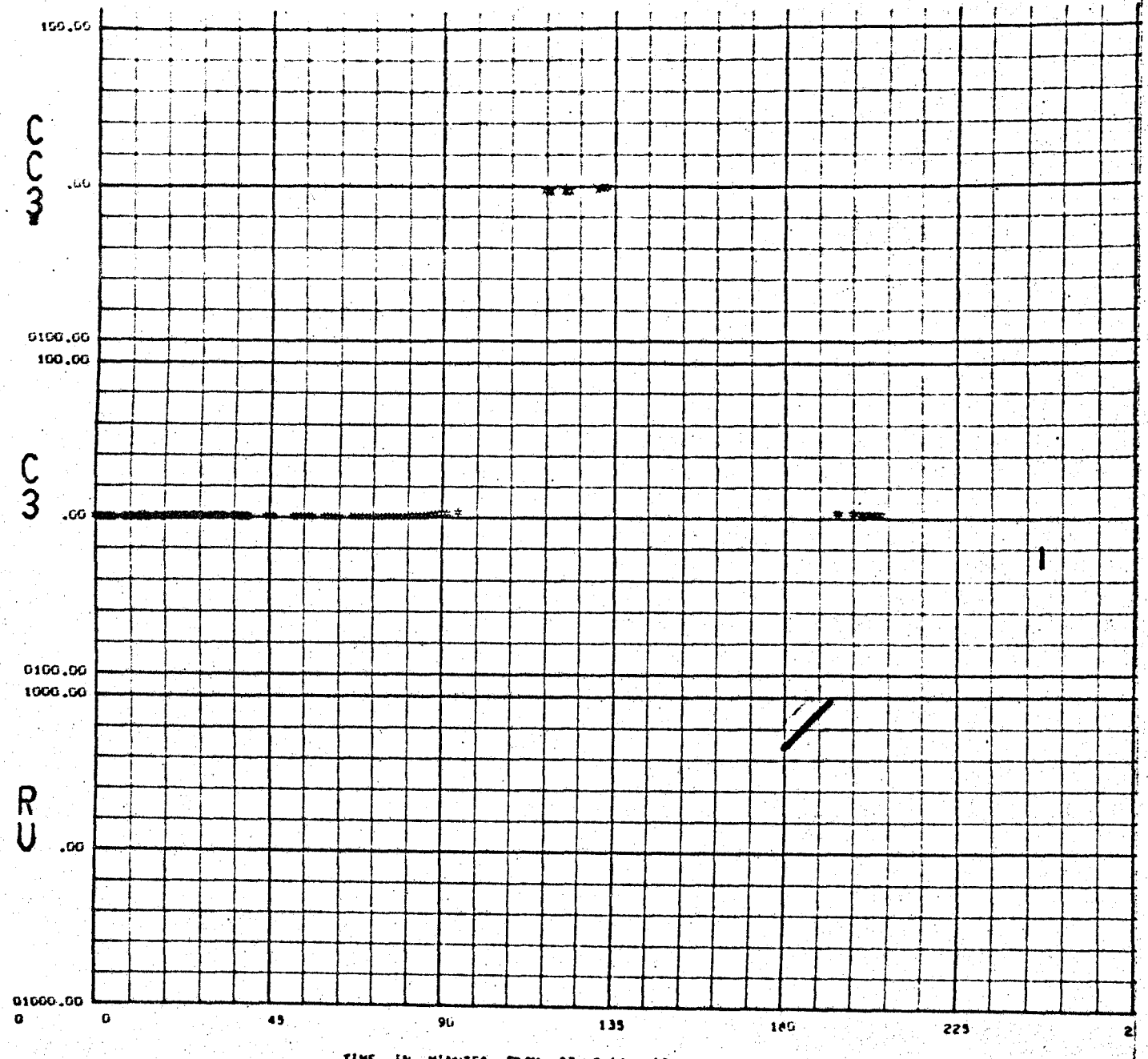
STATION 61 RESIDUALS PASS NUMBER 19/329



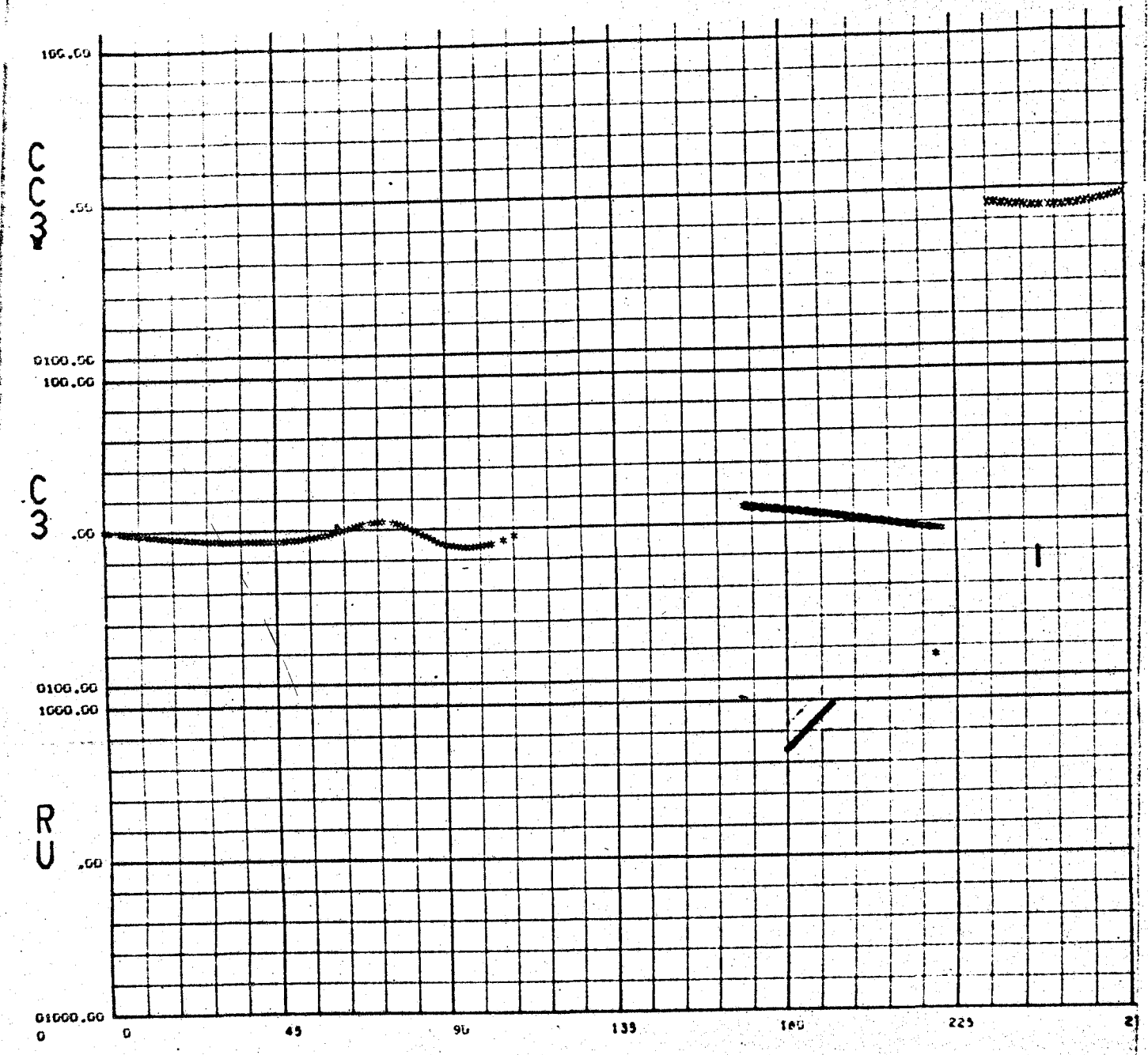
STATION 61 RESIDUALS PASS NUMBER 19/329

ODPL 3P1

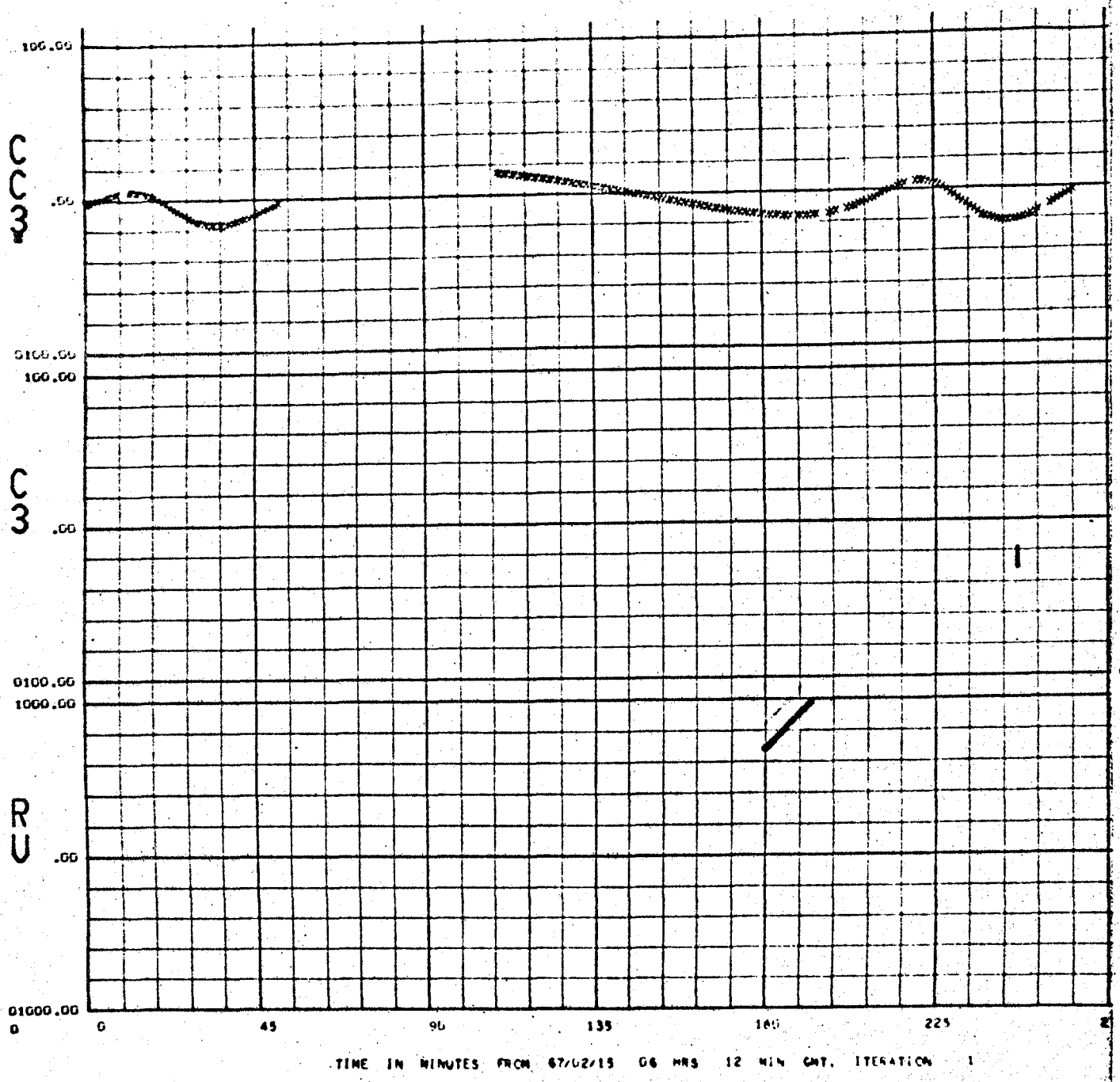
SIMPLIFIED L



STATION 62 RESIDUALS PASS NUMBER 10/045

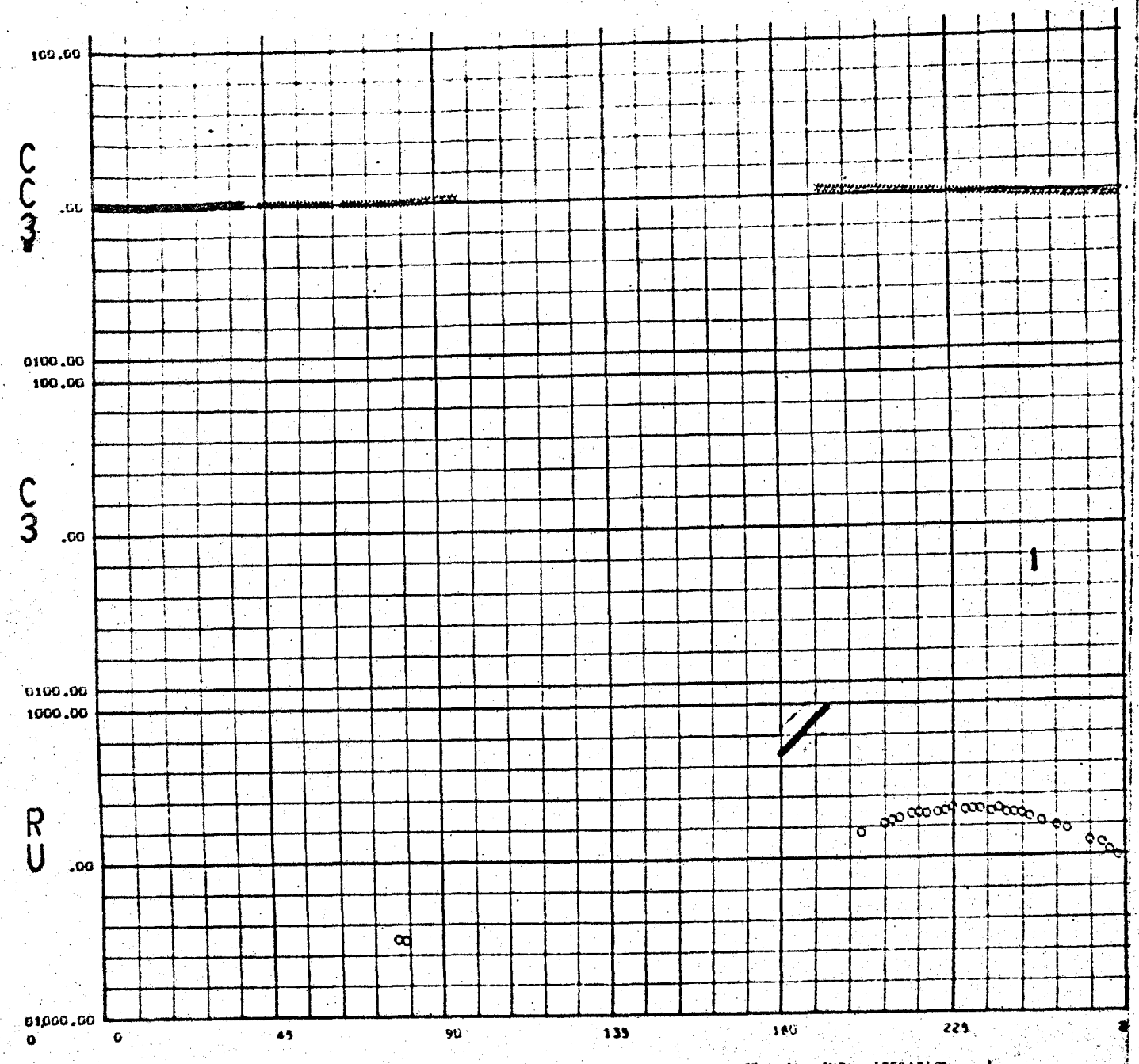


STATION 41 RESIDUALS PASS NUMBER 11/046



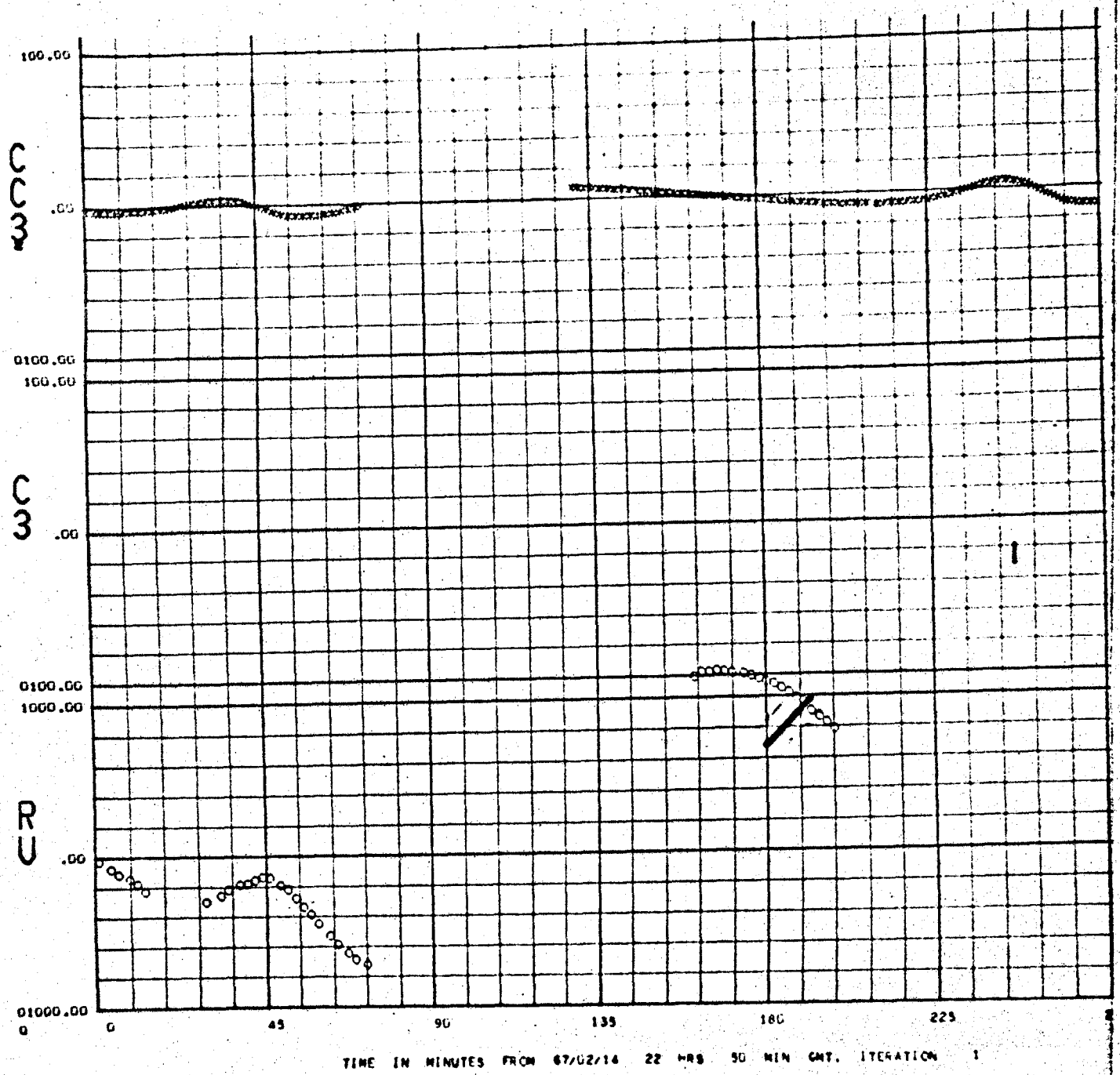
STATION 41 RESIDUALS

PASS NUMBER 11/046



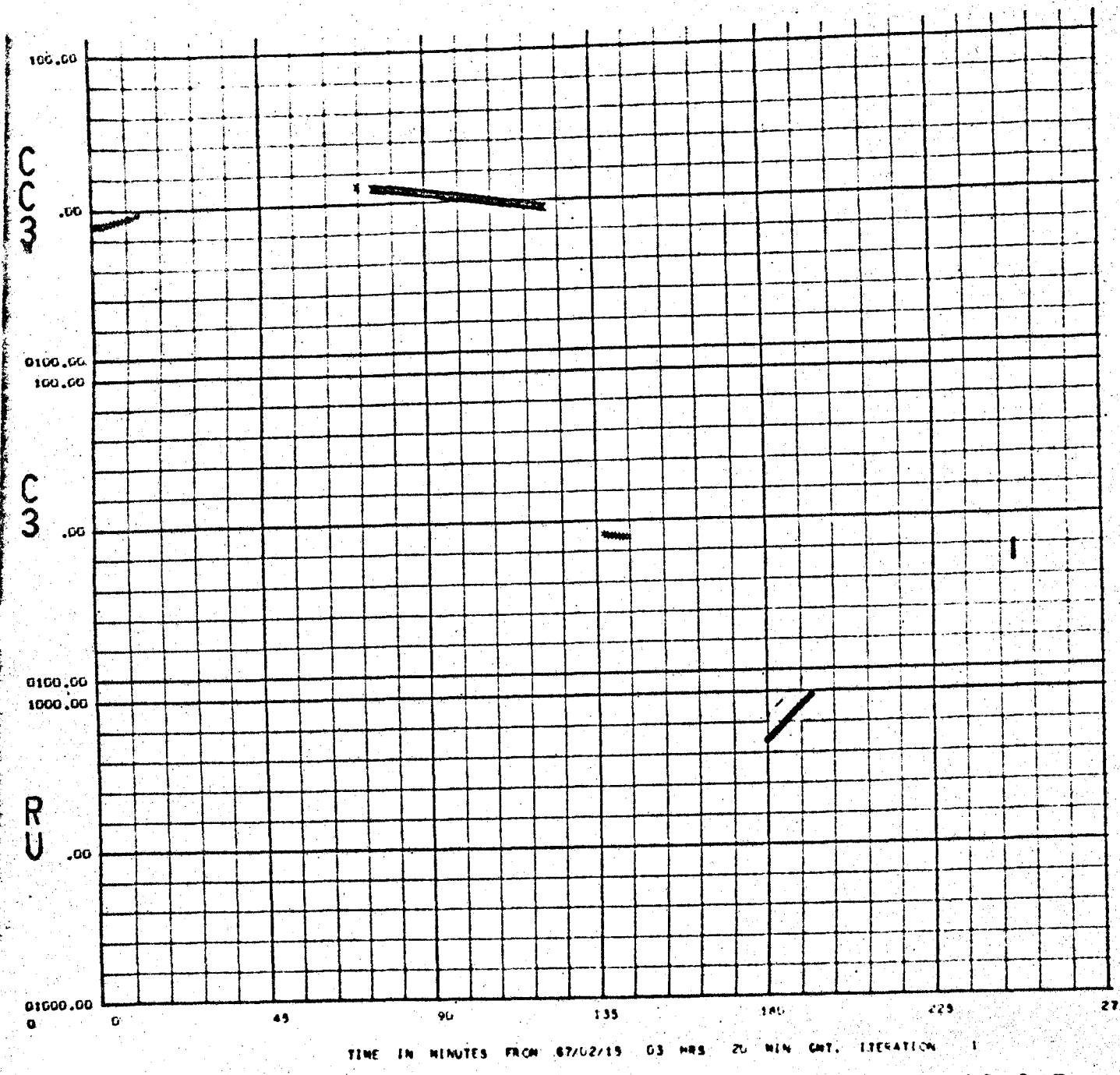
STATION 12 RESIDUALS

PASS NUMBER 10/045



STATION 12 RESIDUALS

PASS NUMBER 10/045

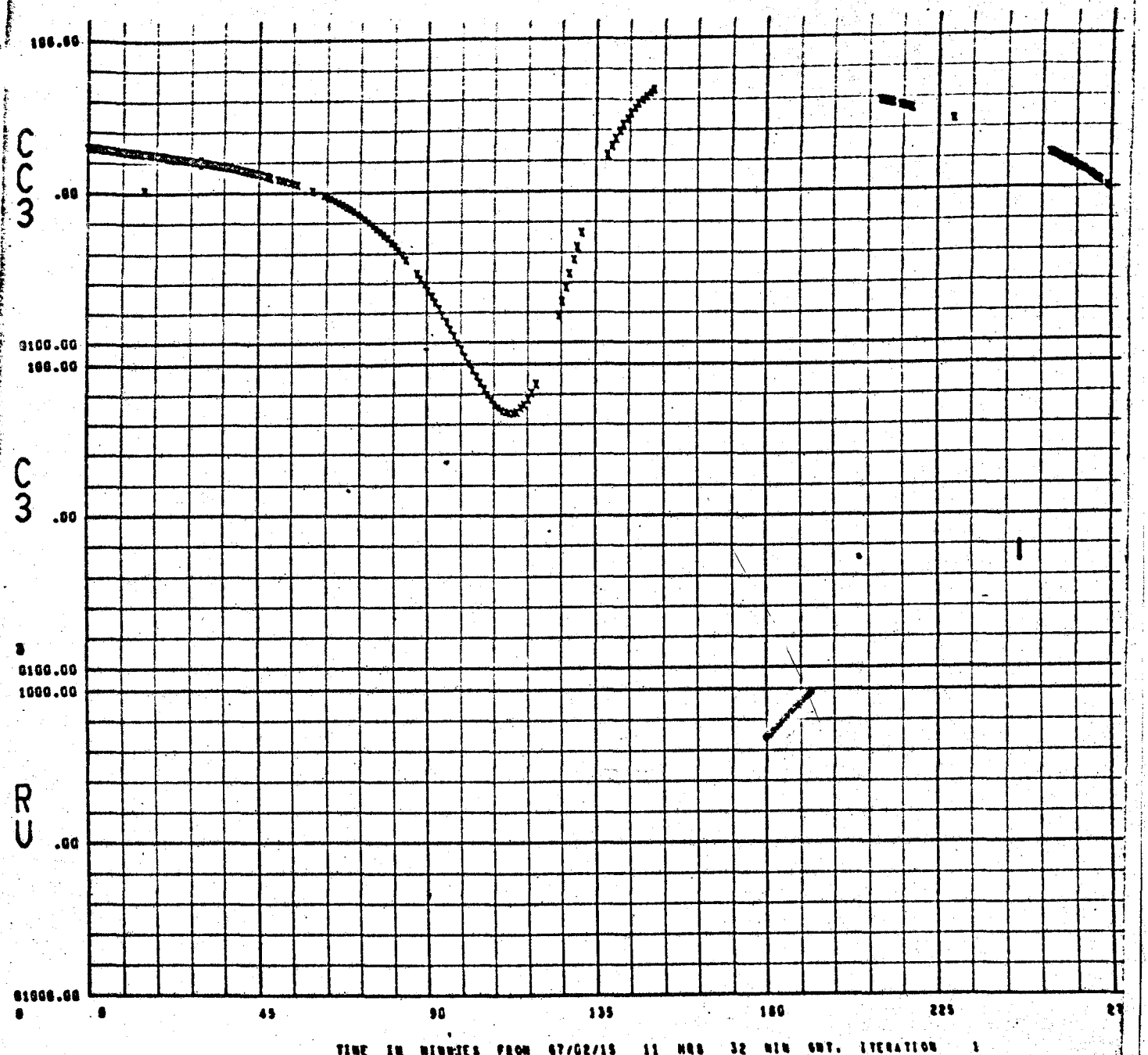


STATION 12 RESIDUALS

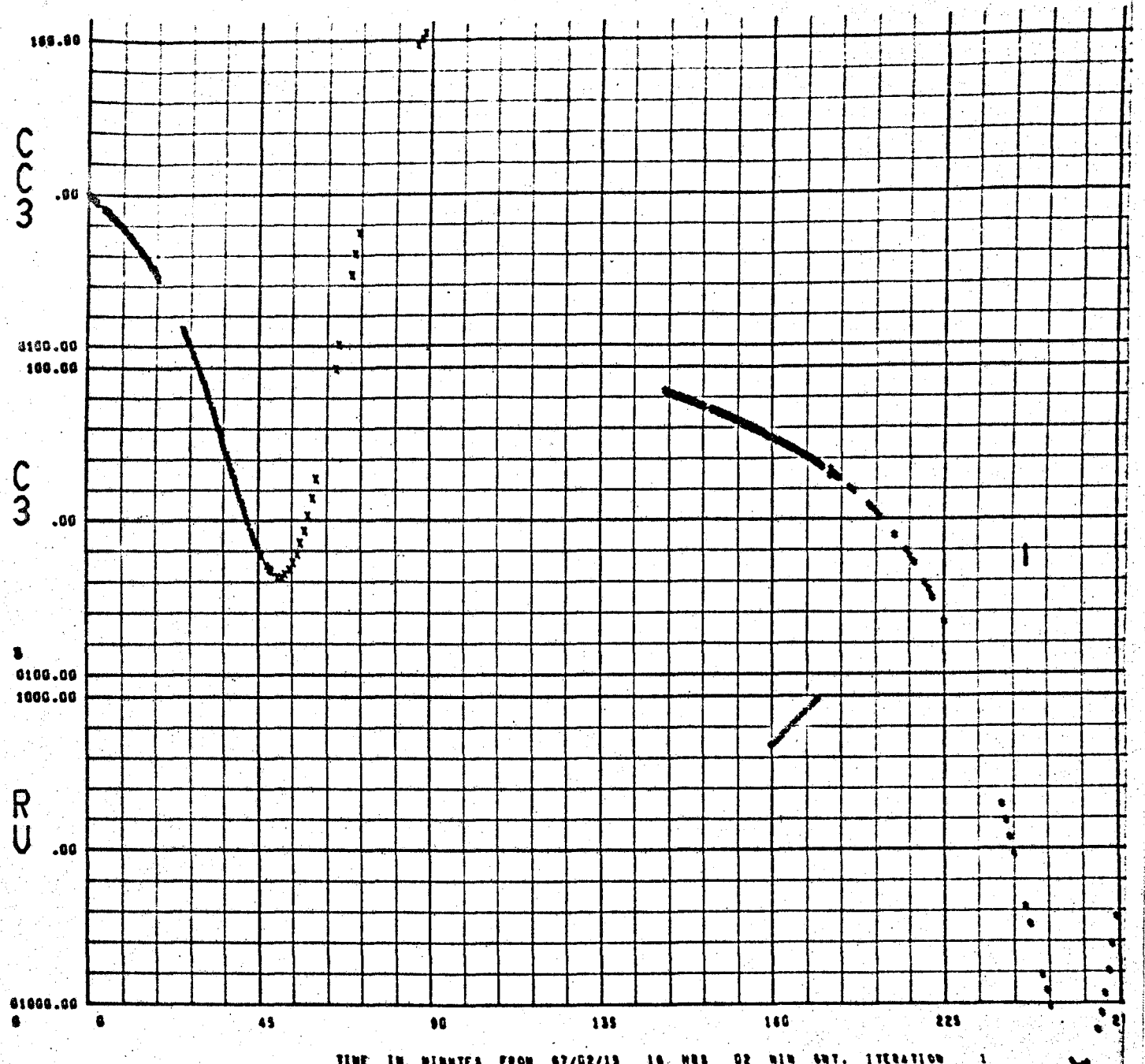
PASS NUMBER 10/045

ODPL 3P2A

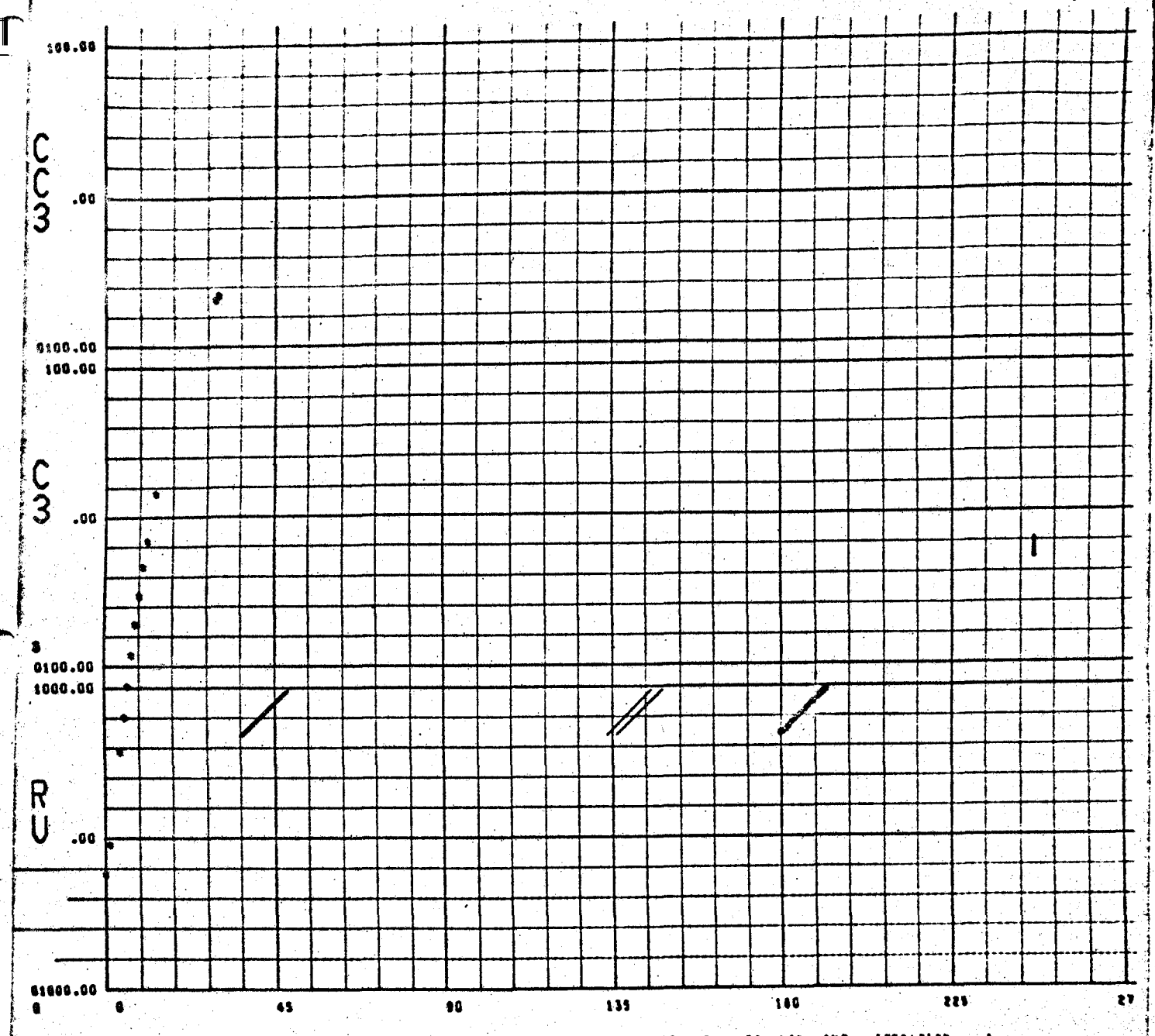
SIMPLE MOON



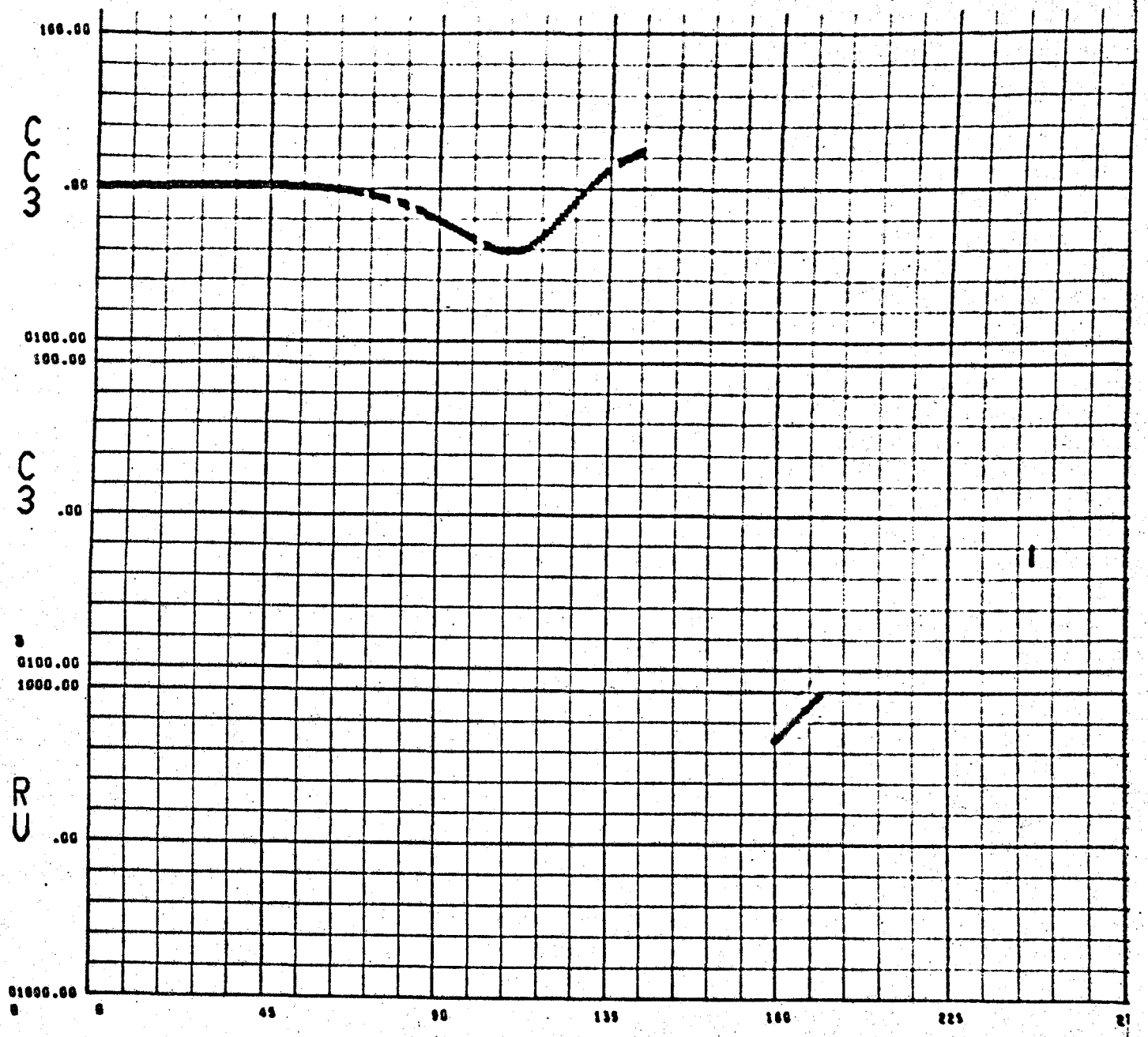
STATION 62 RESIDUALS PASS NUMBER 11/046



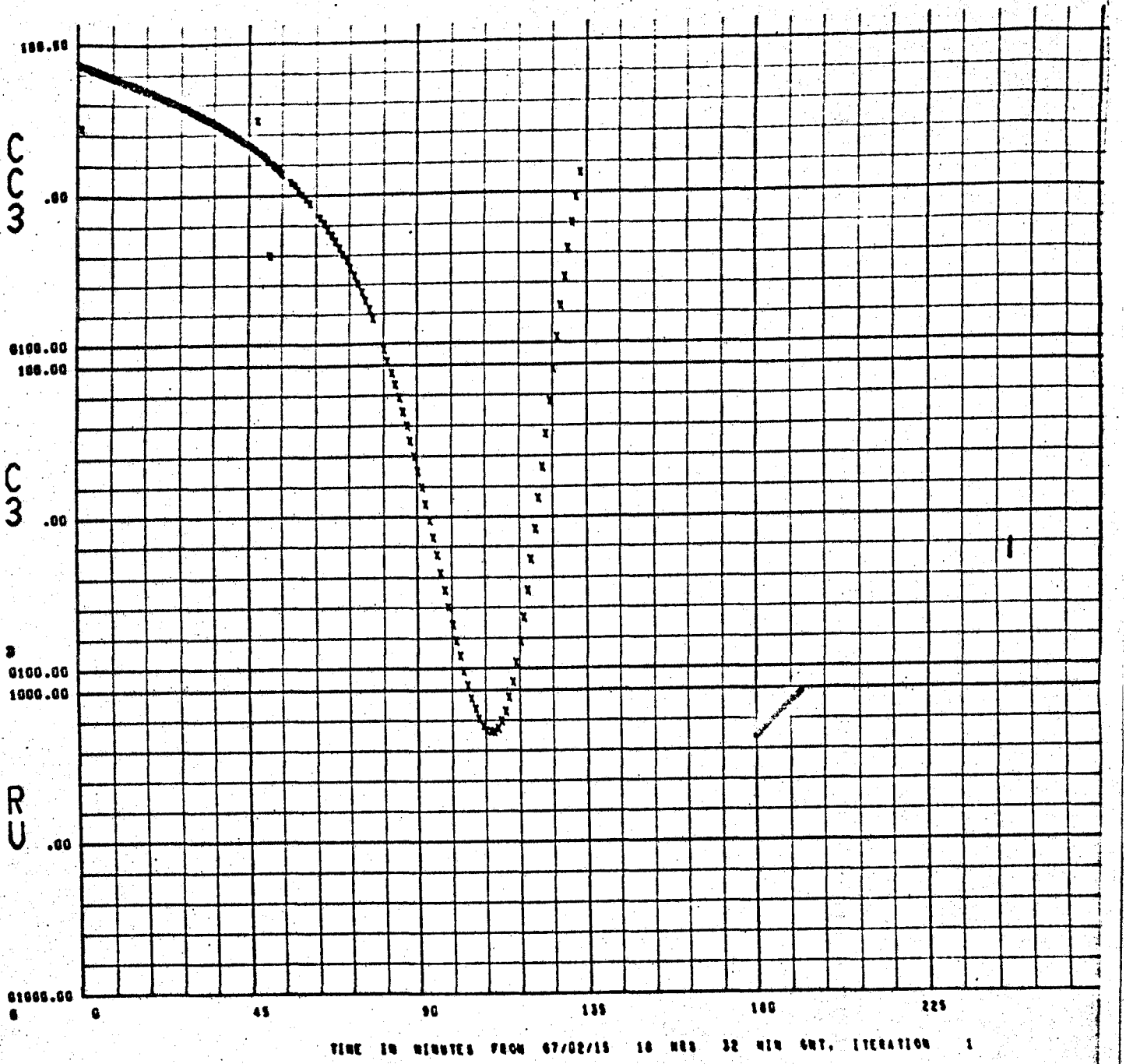
STATION 62 RESIDUALS PASS NUMBER 11/046



STATION 62 RESIDUALS PASS NUMBER 11/046



STATION 41 RESIDUALS PASS NUMBER 11/046

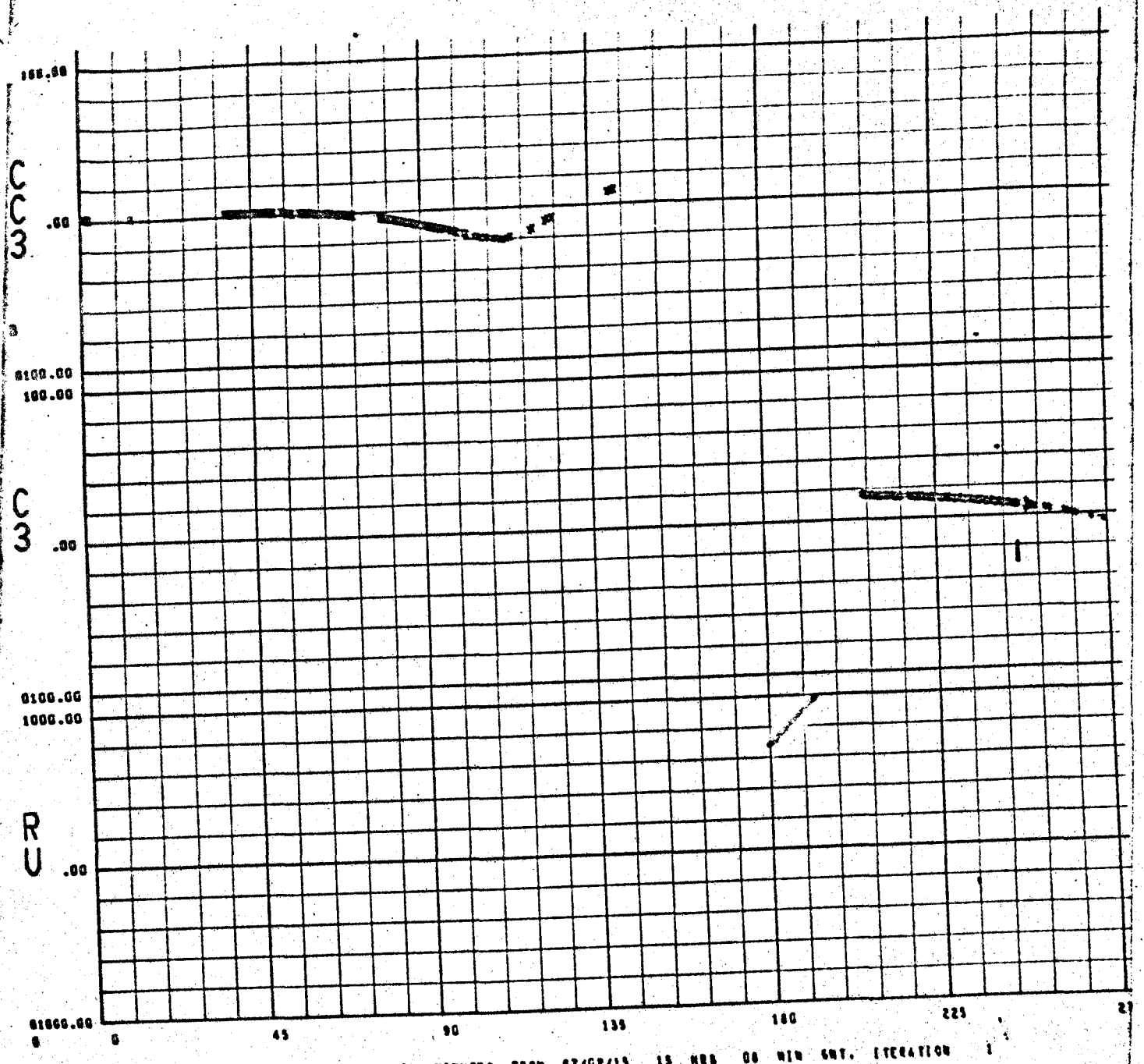


TIME IN MINUTES FROM 67/02/15 18 HRS 32 MIN GMT, ITERATION 1

STATION 12 RESIDUALS PASS NUMBER 11/046

ODPL 3S2

SIMPLE MOON



STATION 62 RESIDUALS

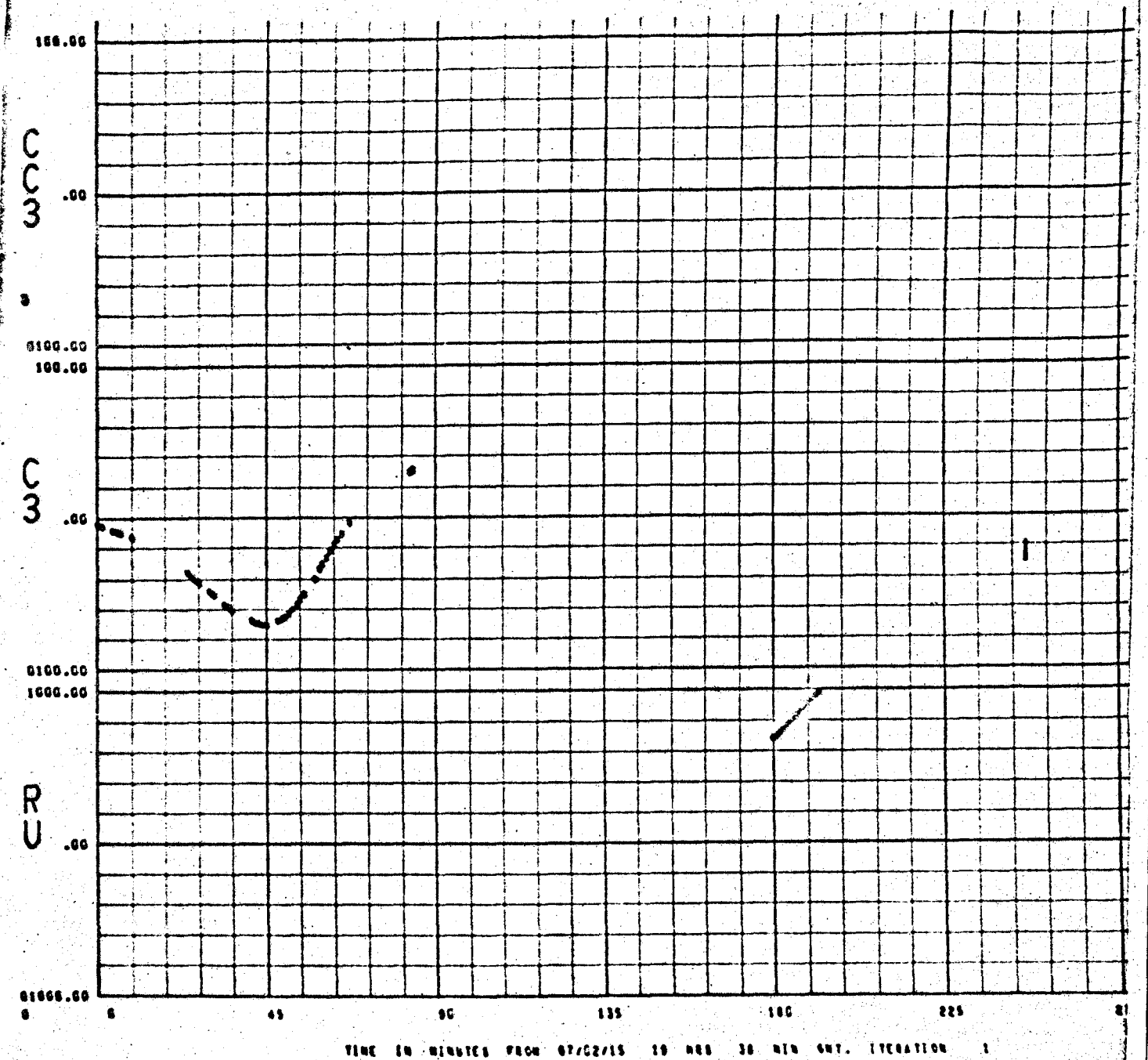
PASS NUMBER 11/046

REV LTR

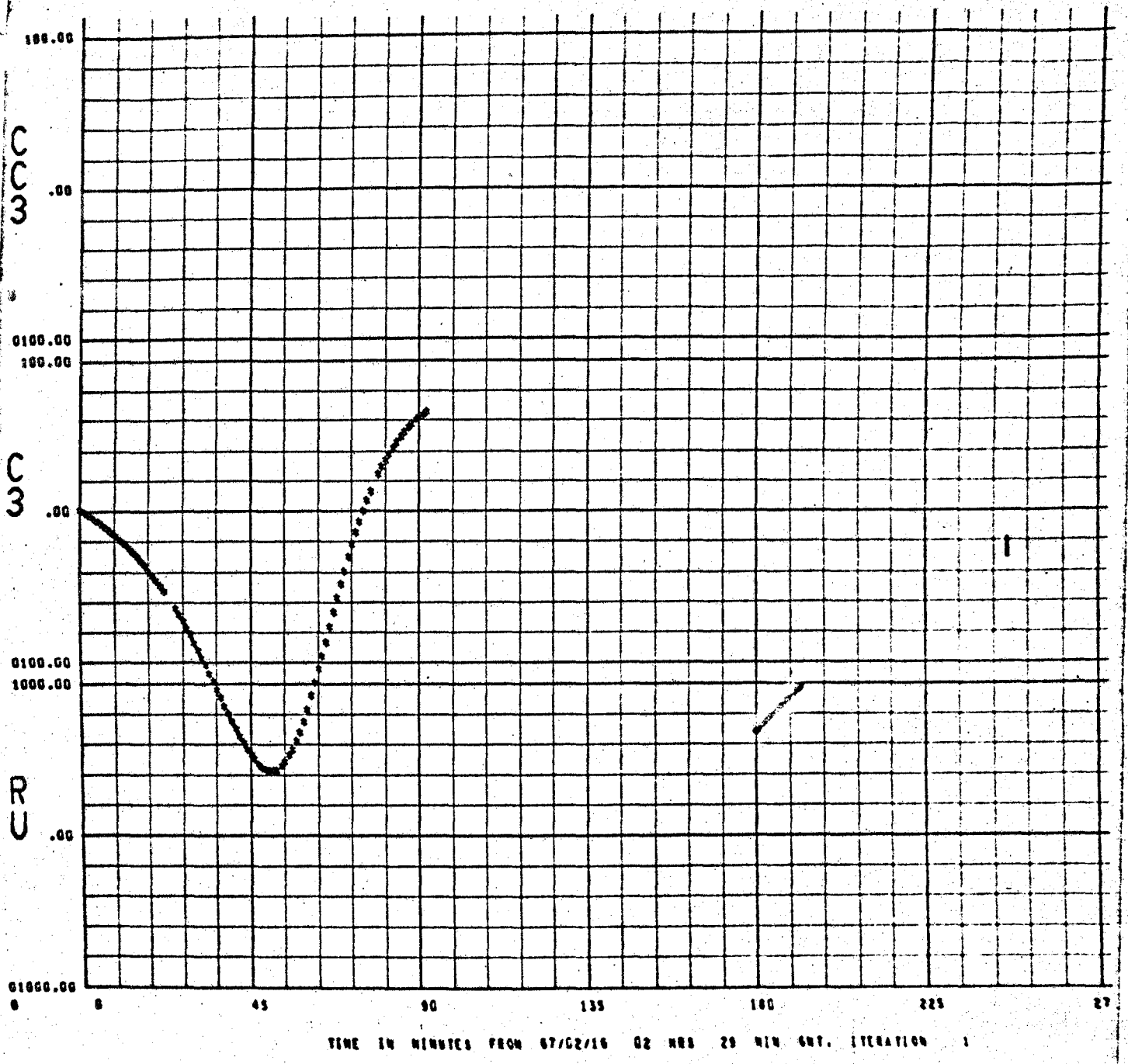
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

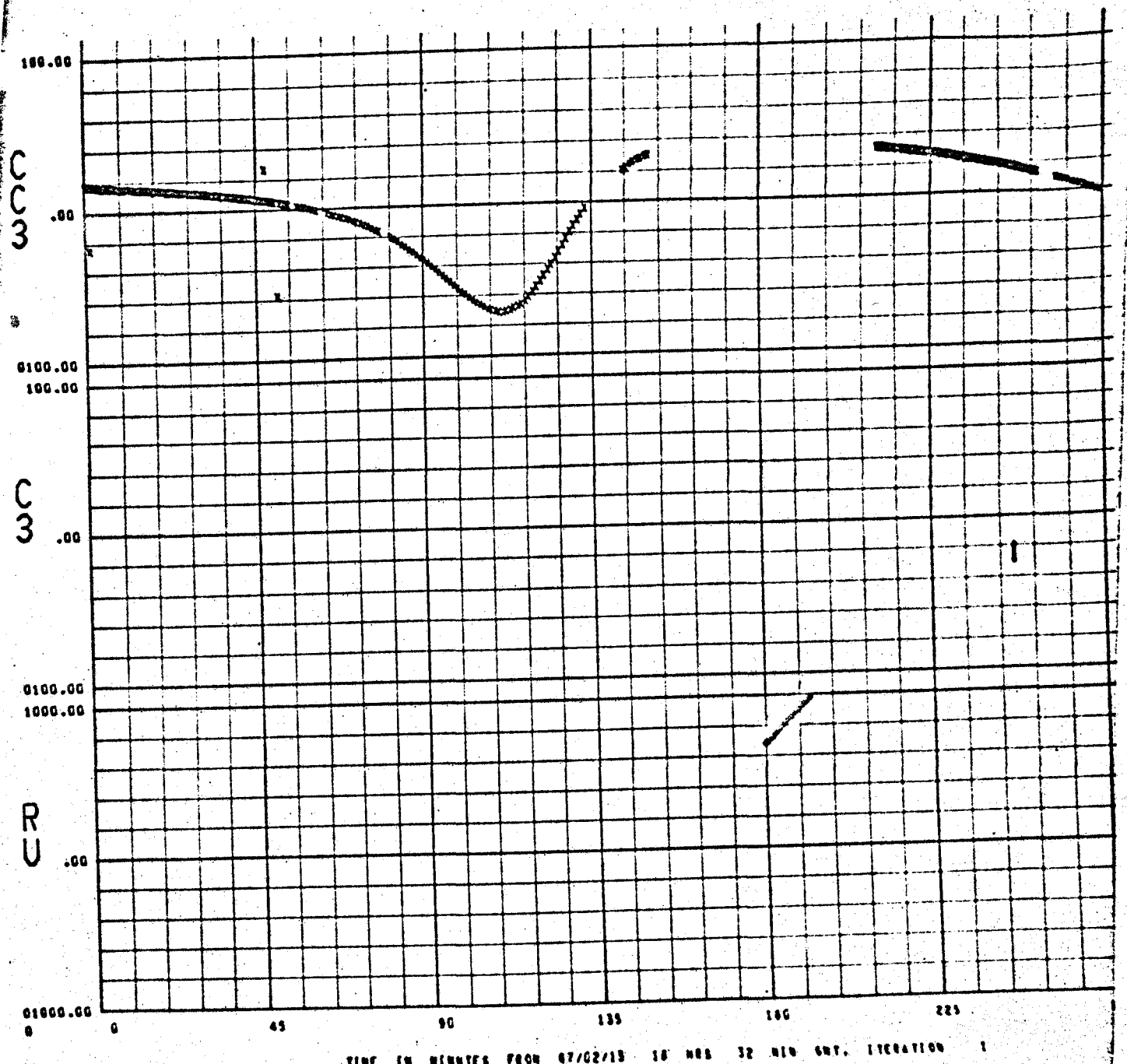
SH. 222



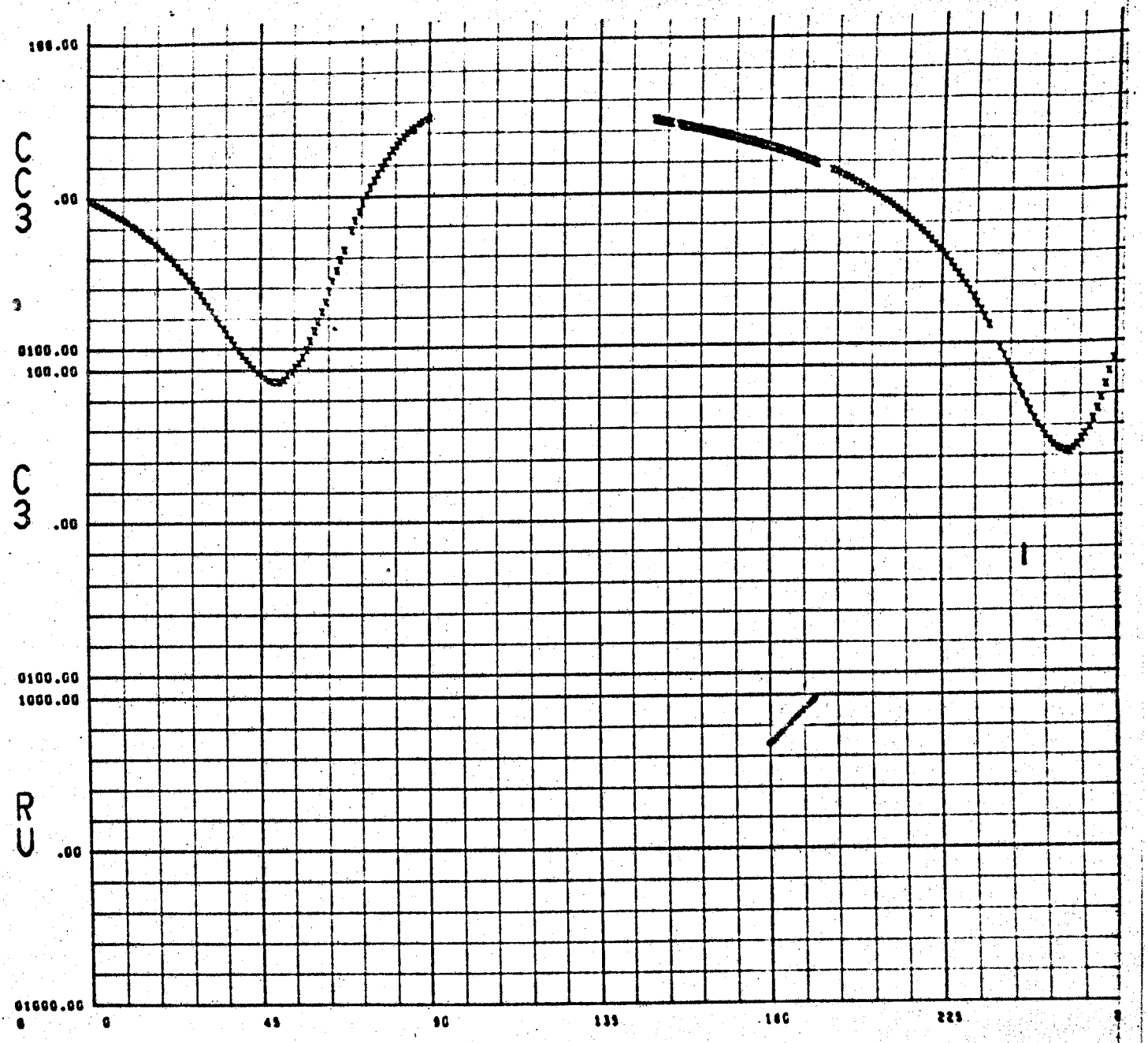
STATION 62 RESIDUALS PASS NUMBER 11/046



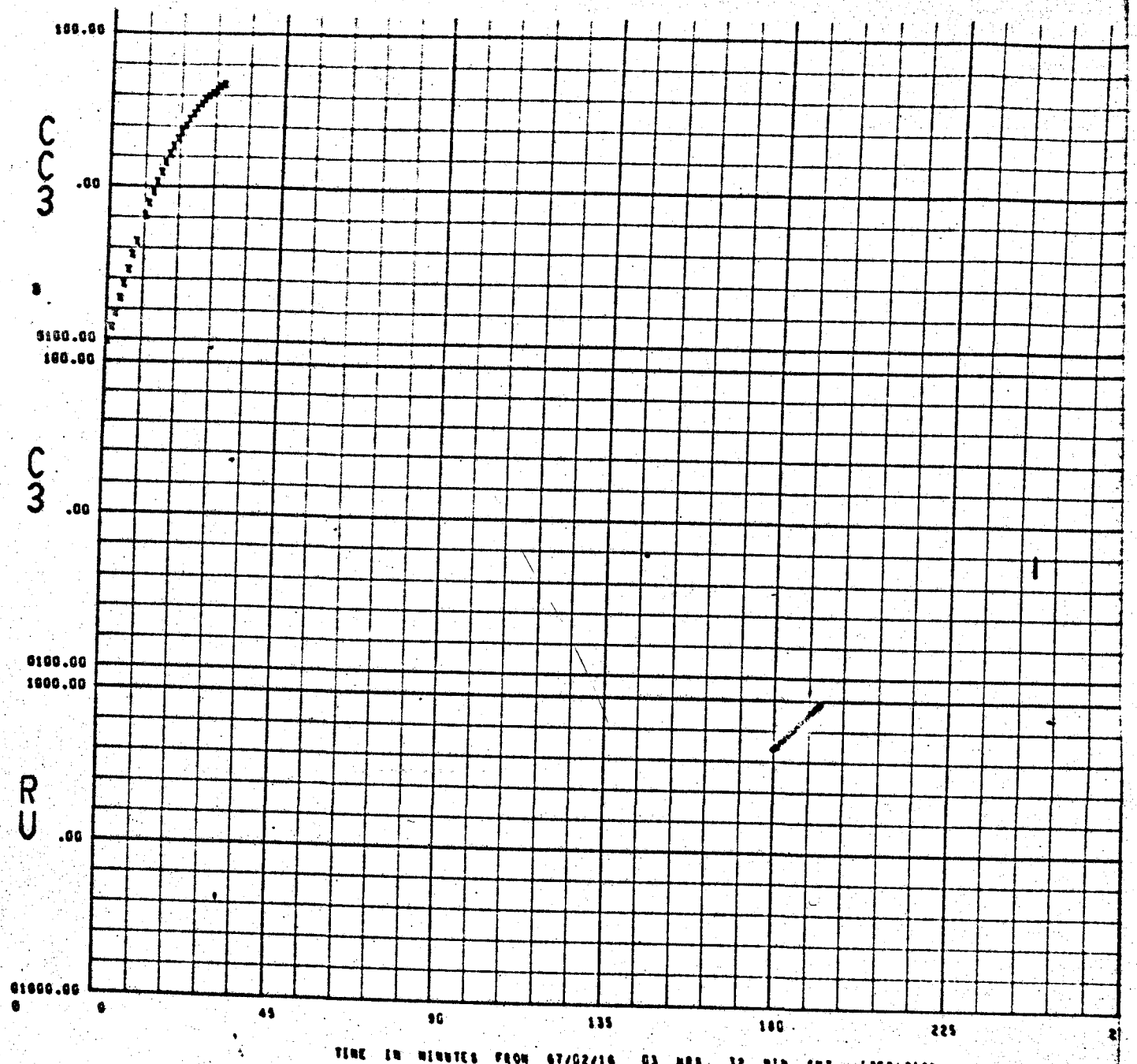
STATION 41 RESIDUALS PASS NUMBER 12/047



STATION 12 RESIDUALS PASS NUMBER 11/046



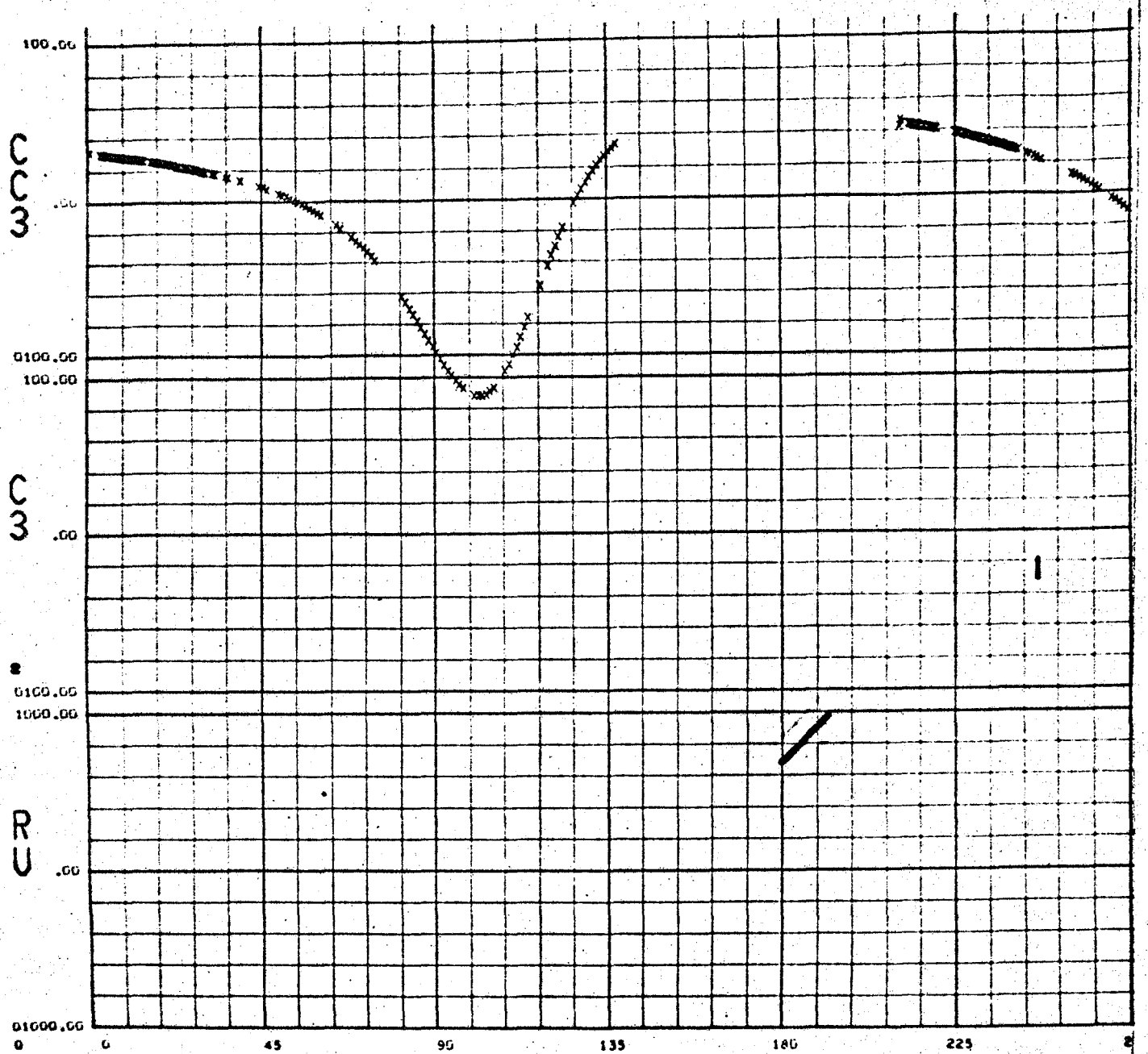
STATION 12 RESIDUALS PASS NUMBER 11/046



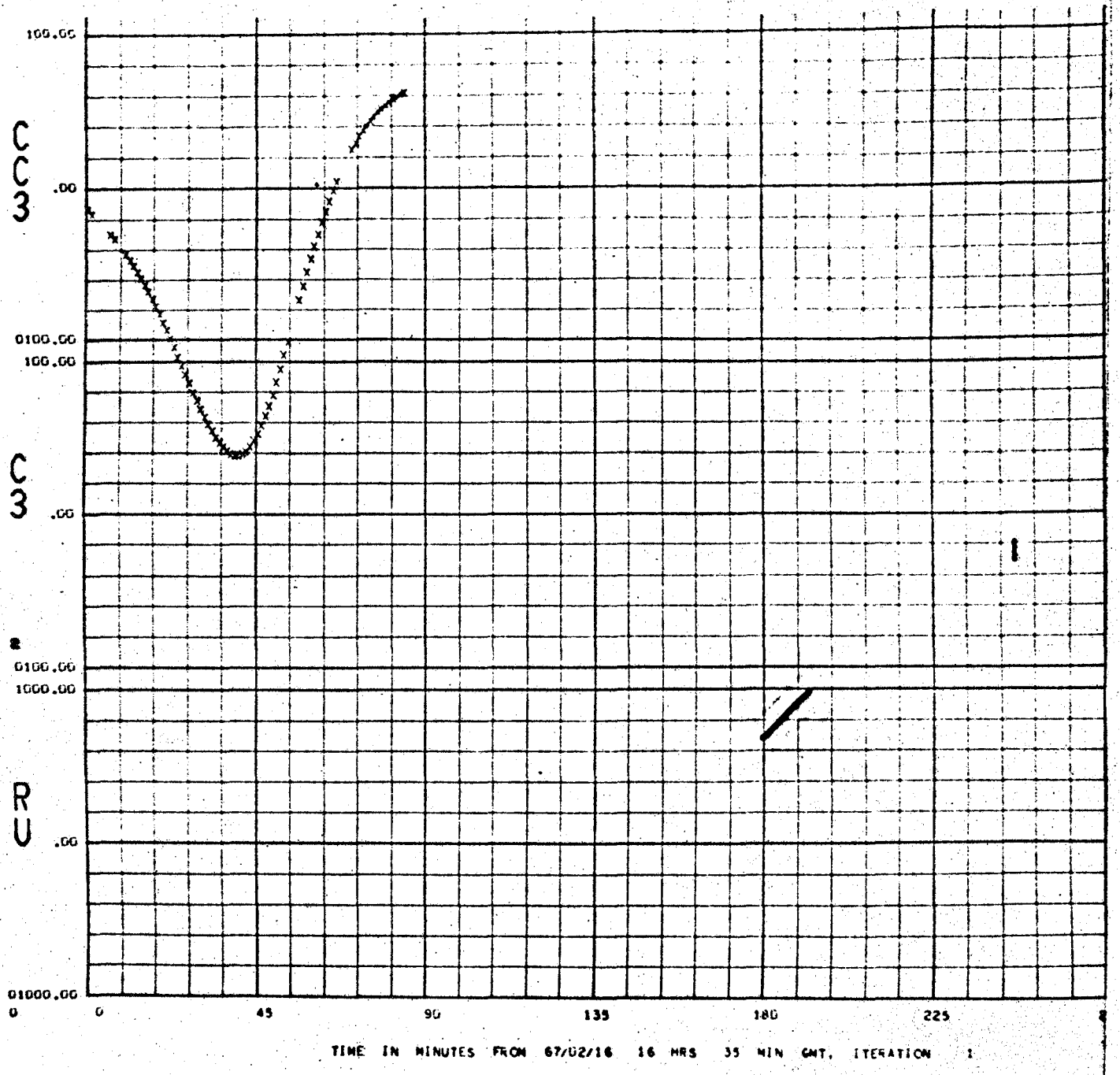
STATION 12 RESIDUALS PASS NUMBER 11/046

ODPL ITEM 50

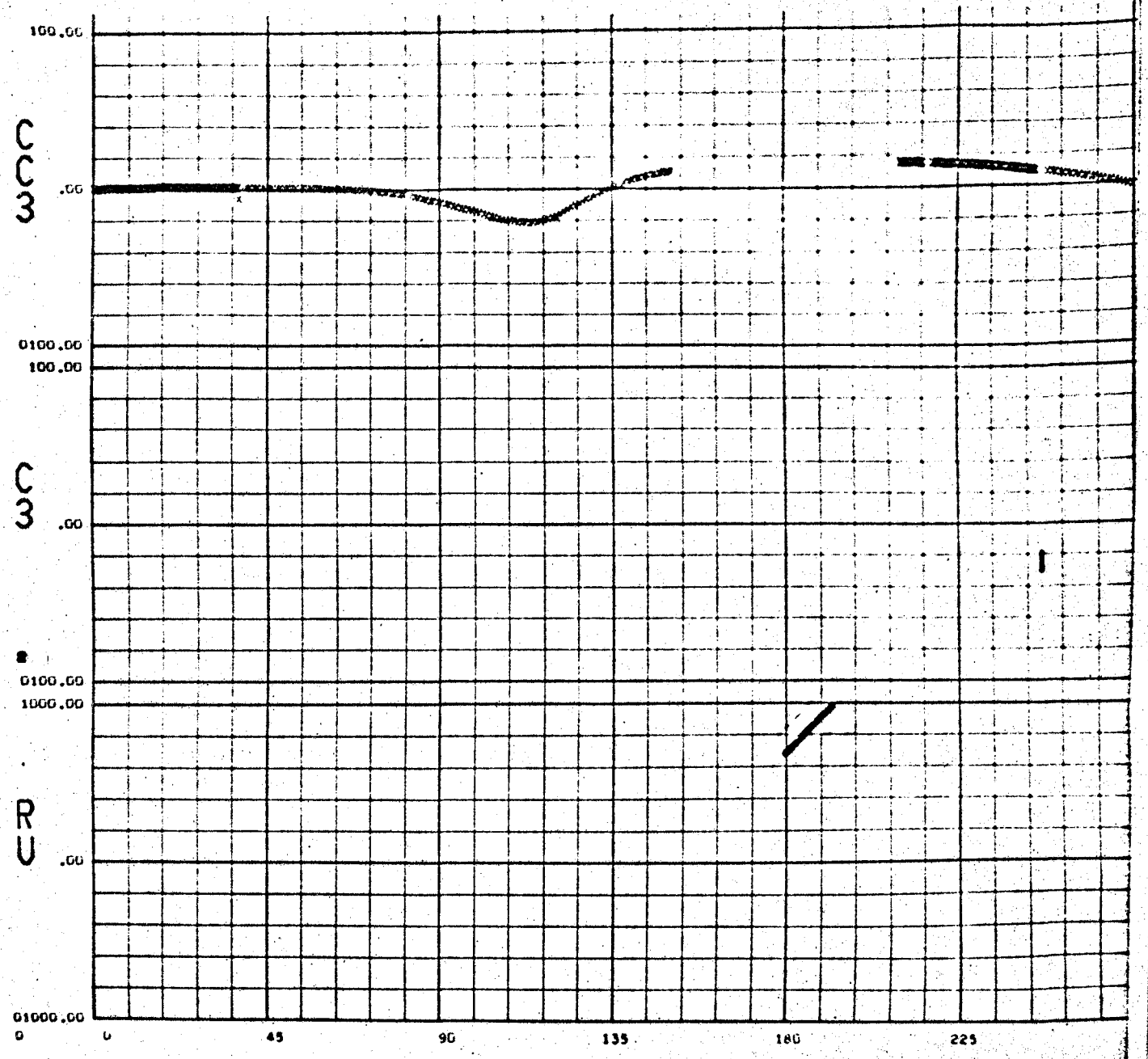
SIMPLE MOO



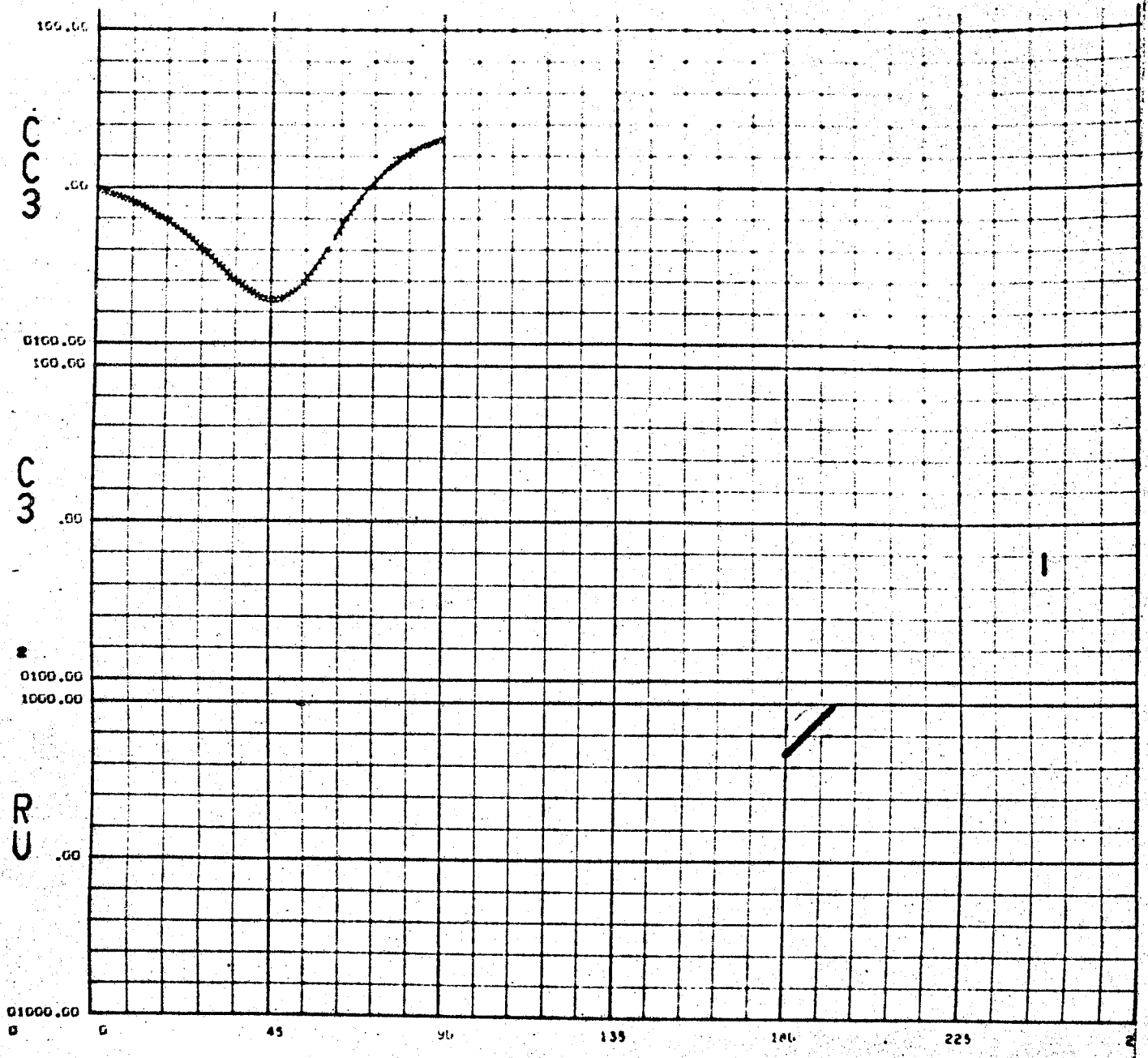
STATION 62 RESIDUALS PASS NUMBER 12/047



STATION 62 RESIDUALS PASS NUMBER 12/047



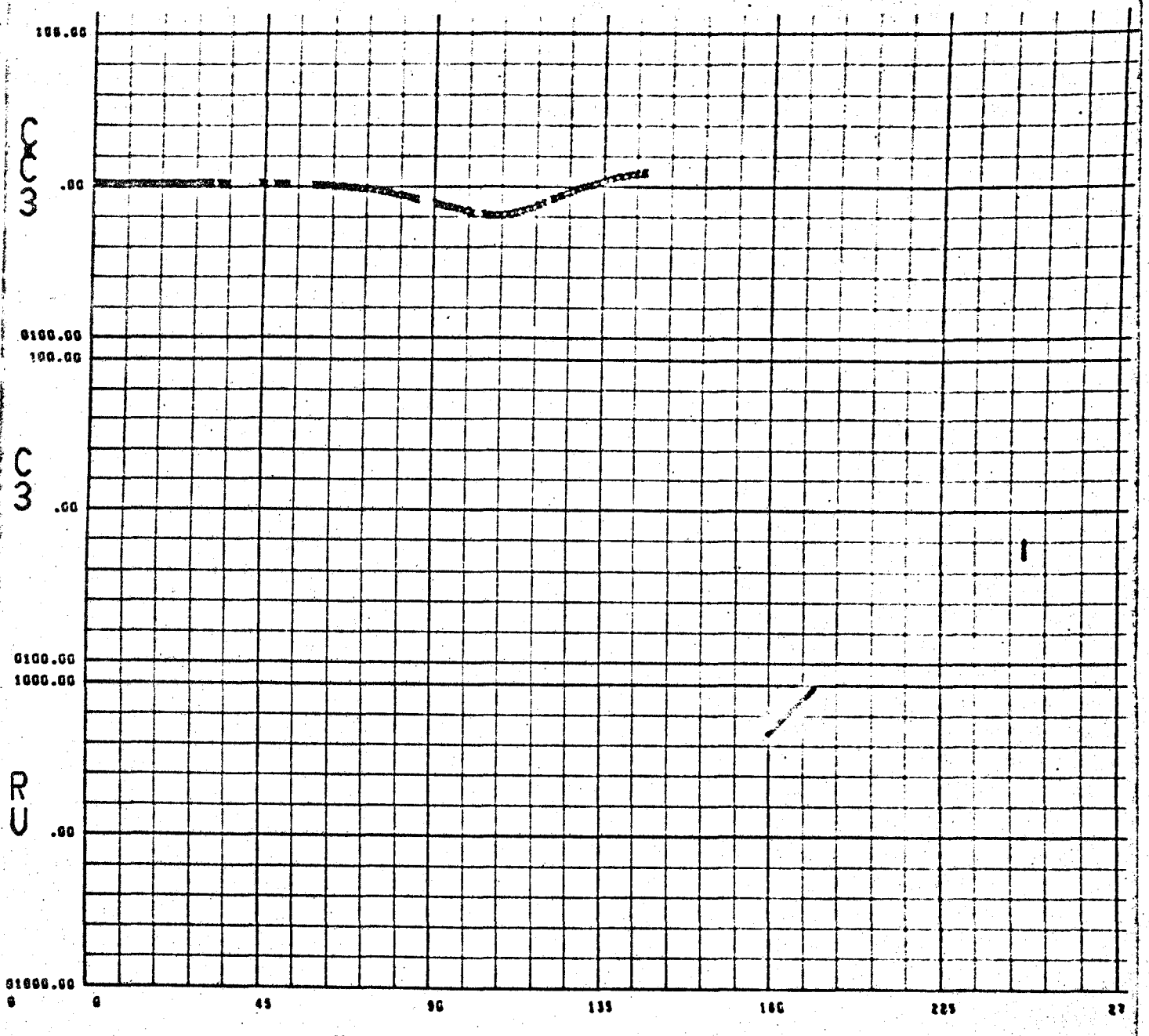
STATION 41 RESIDUALS PASS NUMBER 12/047



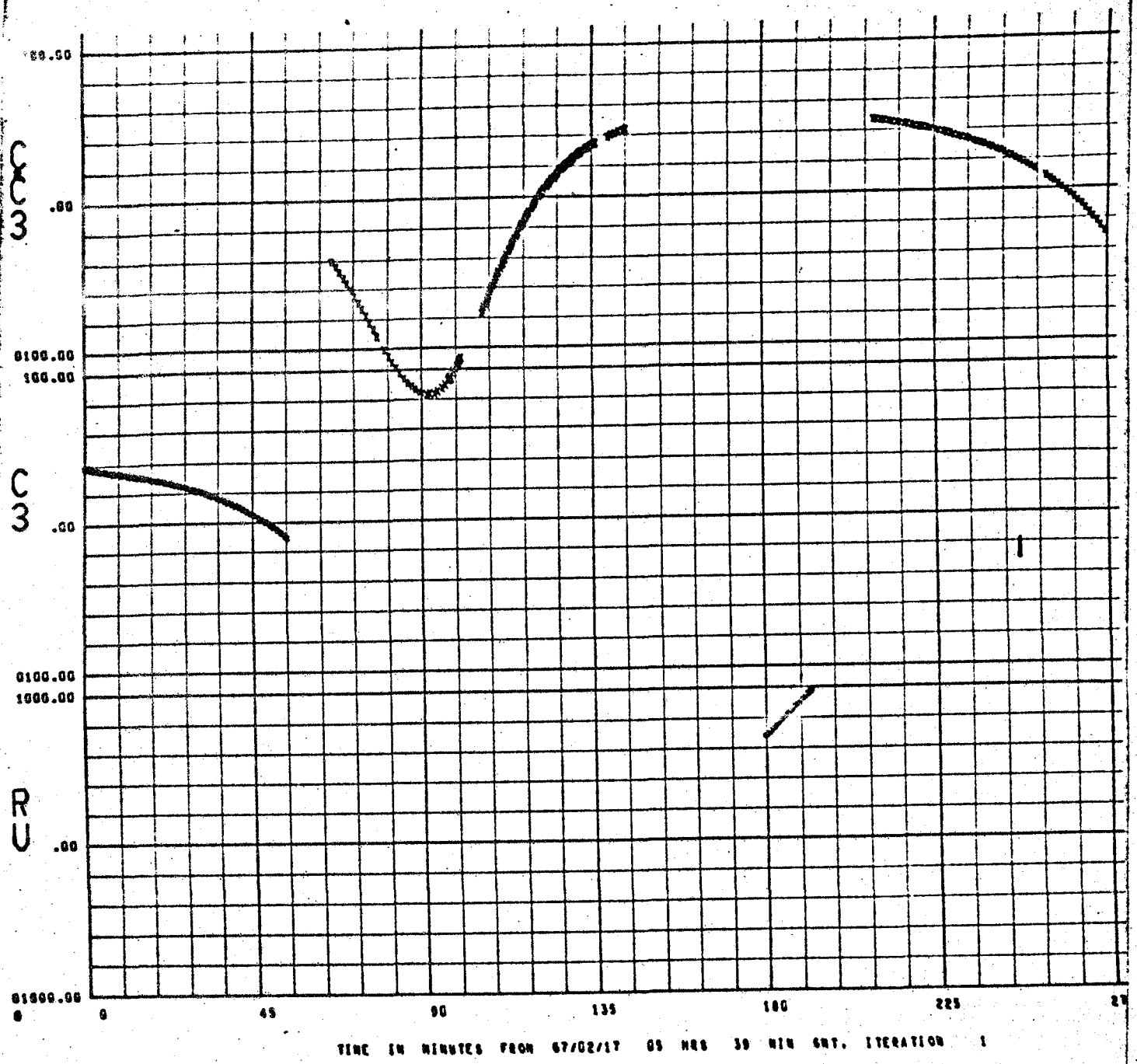
STATION 41 RESIDUALS PASS NUMBER 12/047

ODPL 3P6

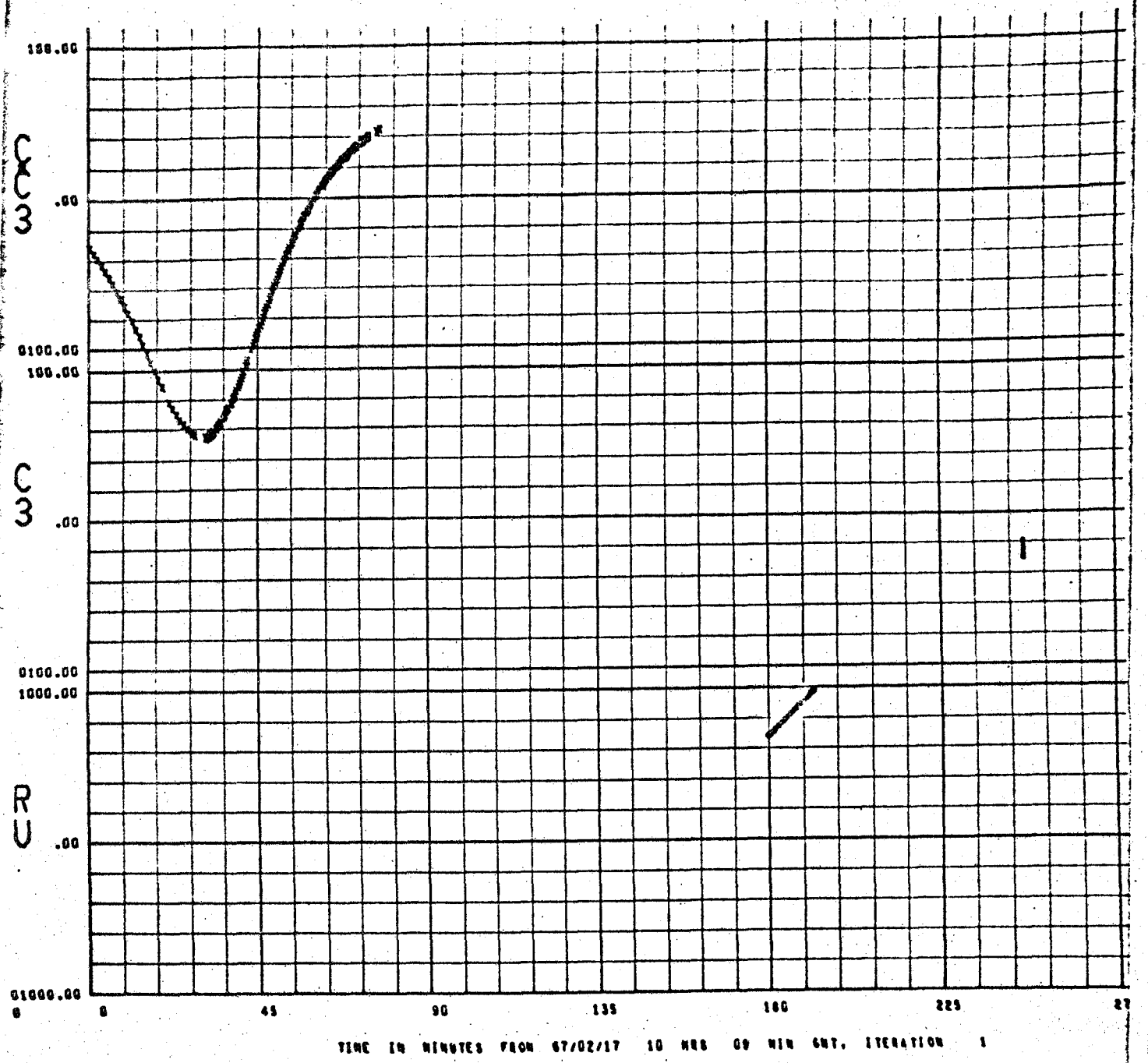
SIMPLE MOON



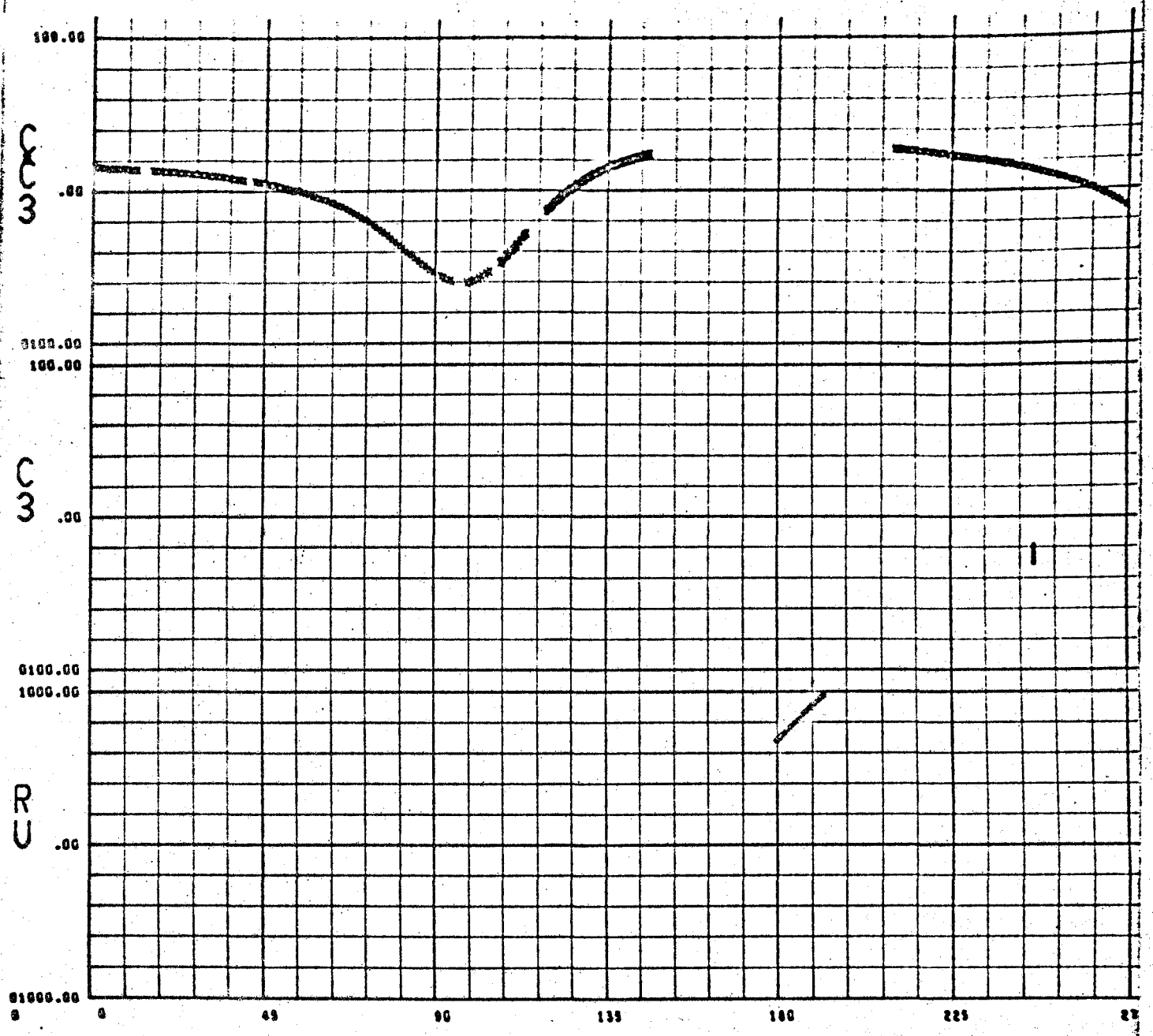
STATION 62 RESIDUALS PASS NUMBER 12/047



STATION 41 RESIDUALS PASS NUMBER 13/048

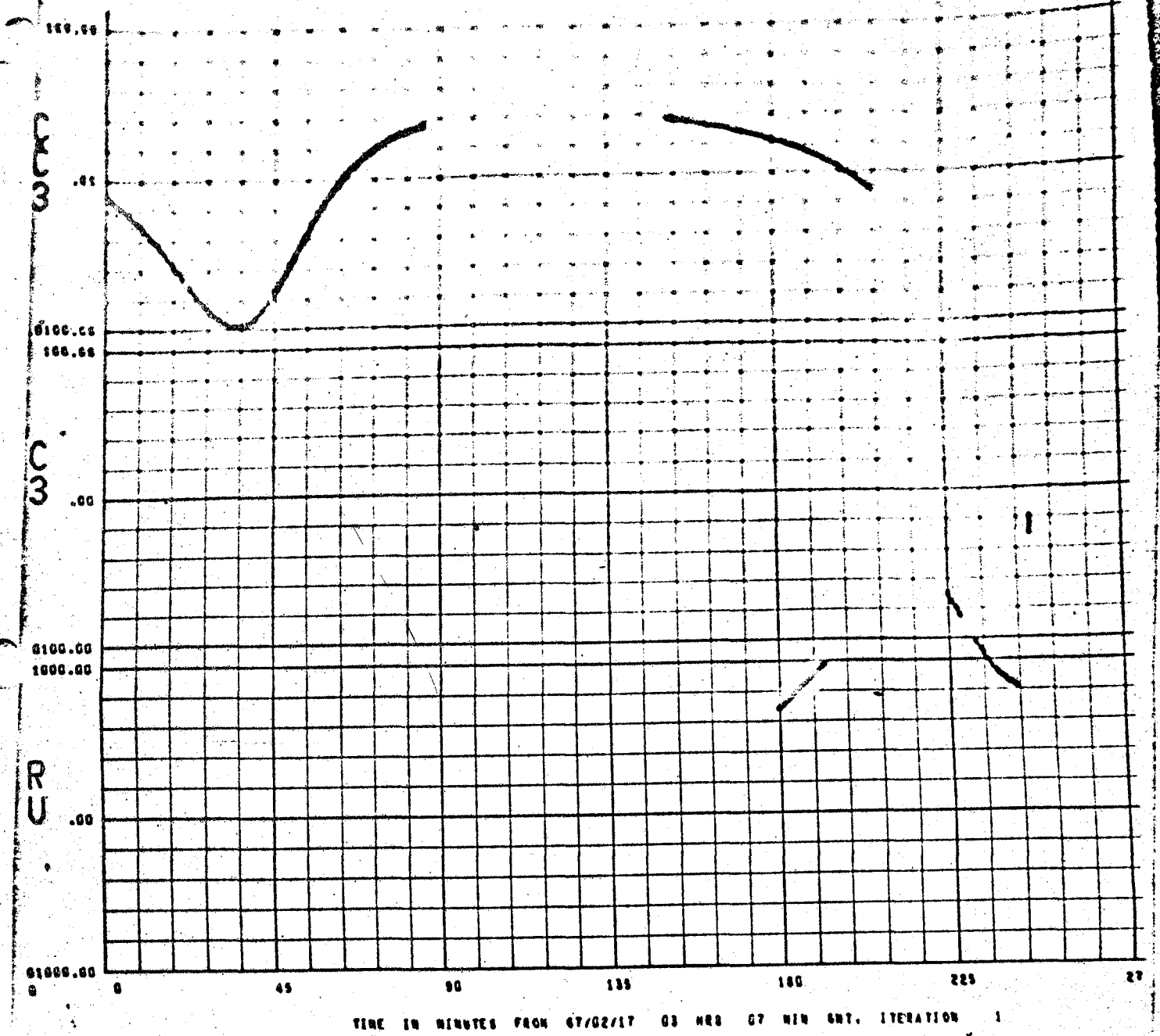


STATION 41 RESIDUALS PASS NUMBER 13/048



TIME IN MINUTES FROM 67/02/16 22 HRS 37 MIN GMT, ITERATION 1

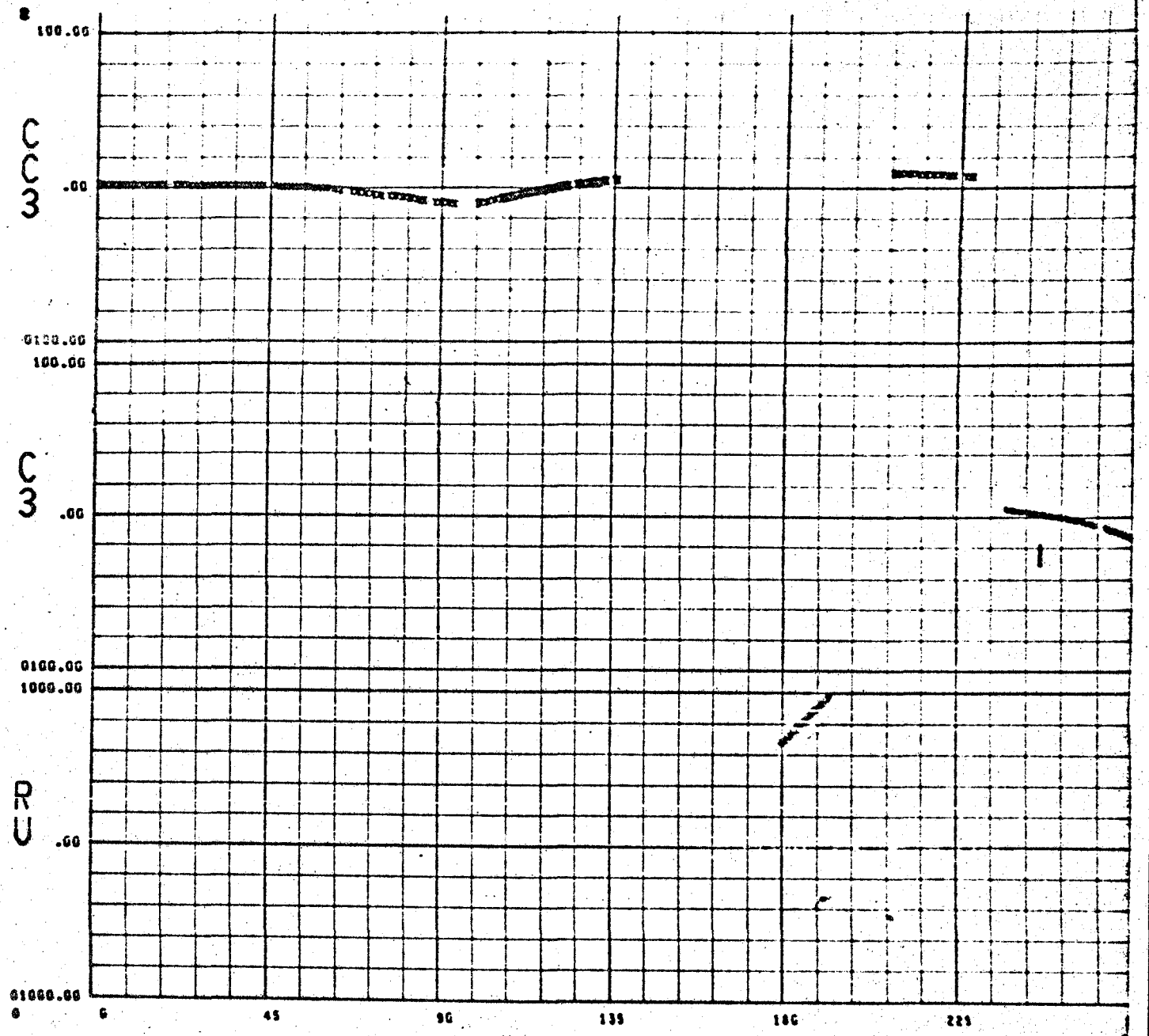
STATION 12 RESIDUALS PASS NUMBER 12/047



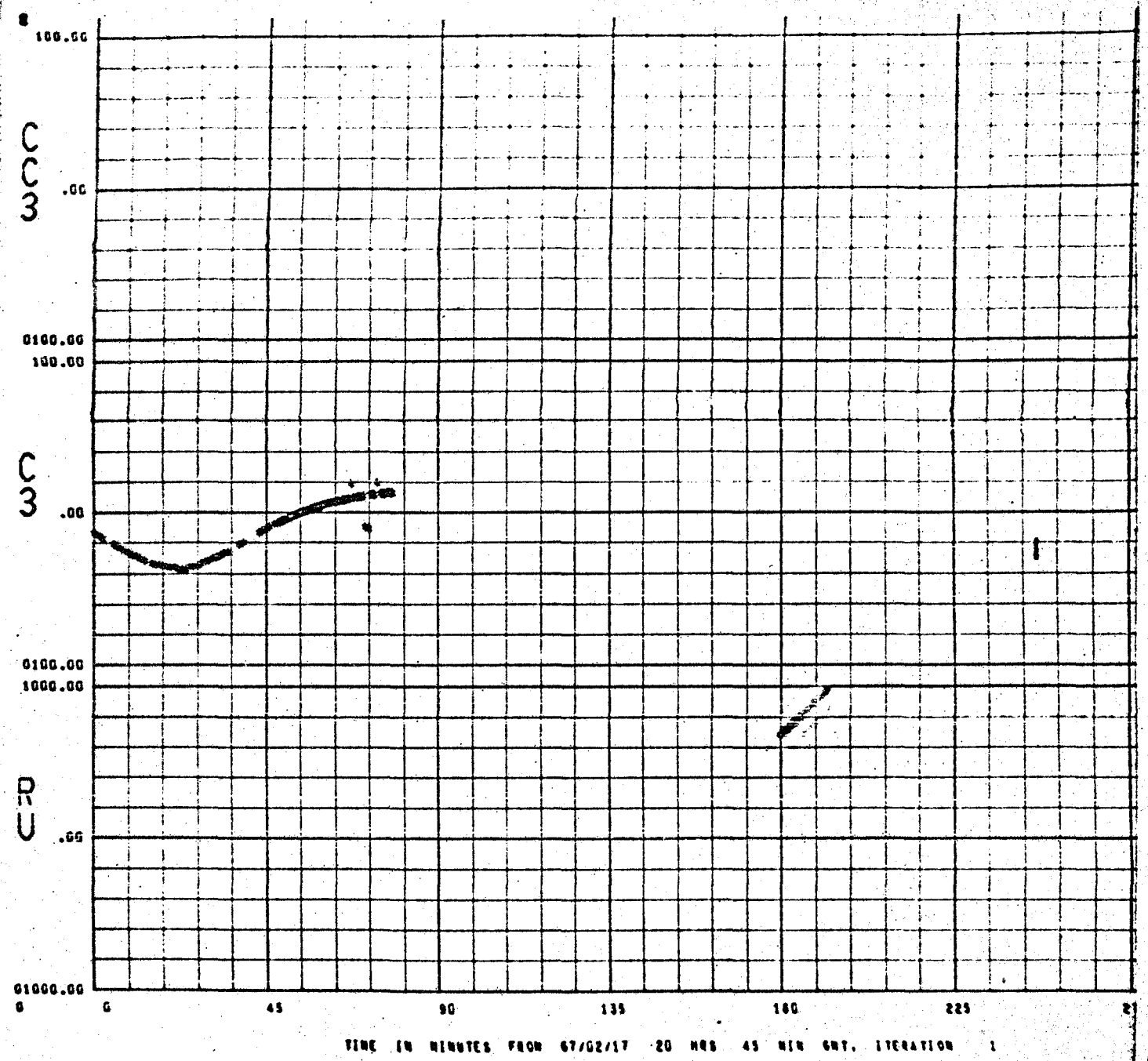
STATION 12 RESIDUALS PASS NUMBER 12/047

ODPL 3S10

SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 13/048



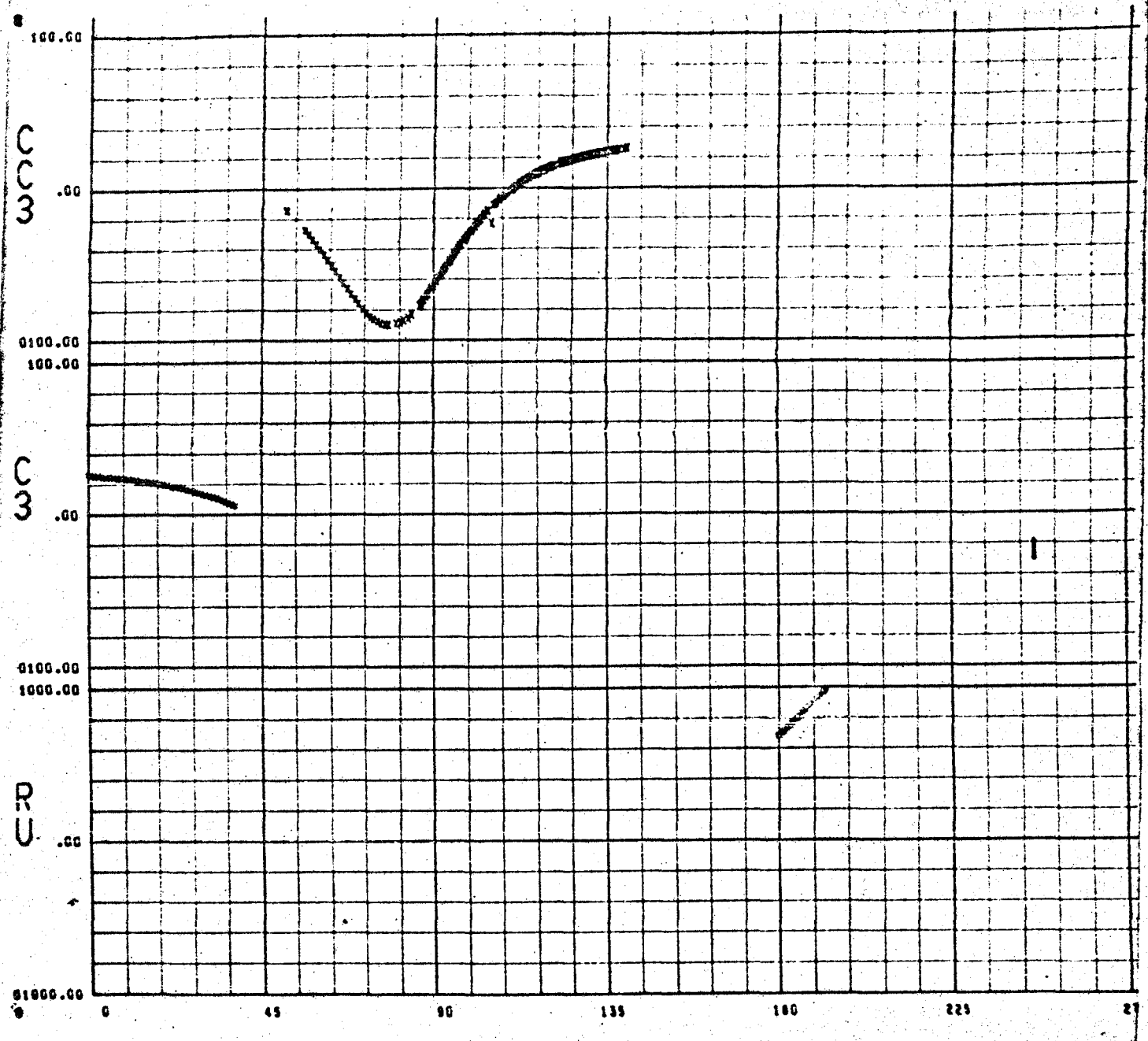
STATION 62 RESIDUALS PASS NUMBER 13/048

REV LTR

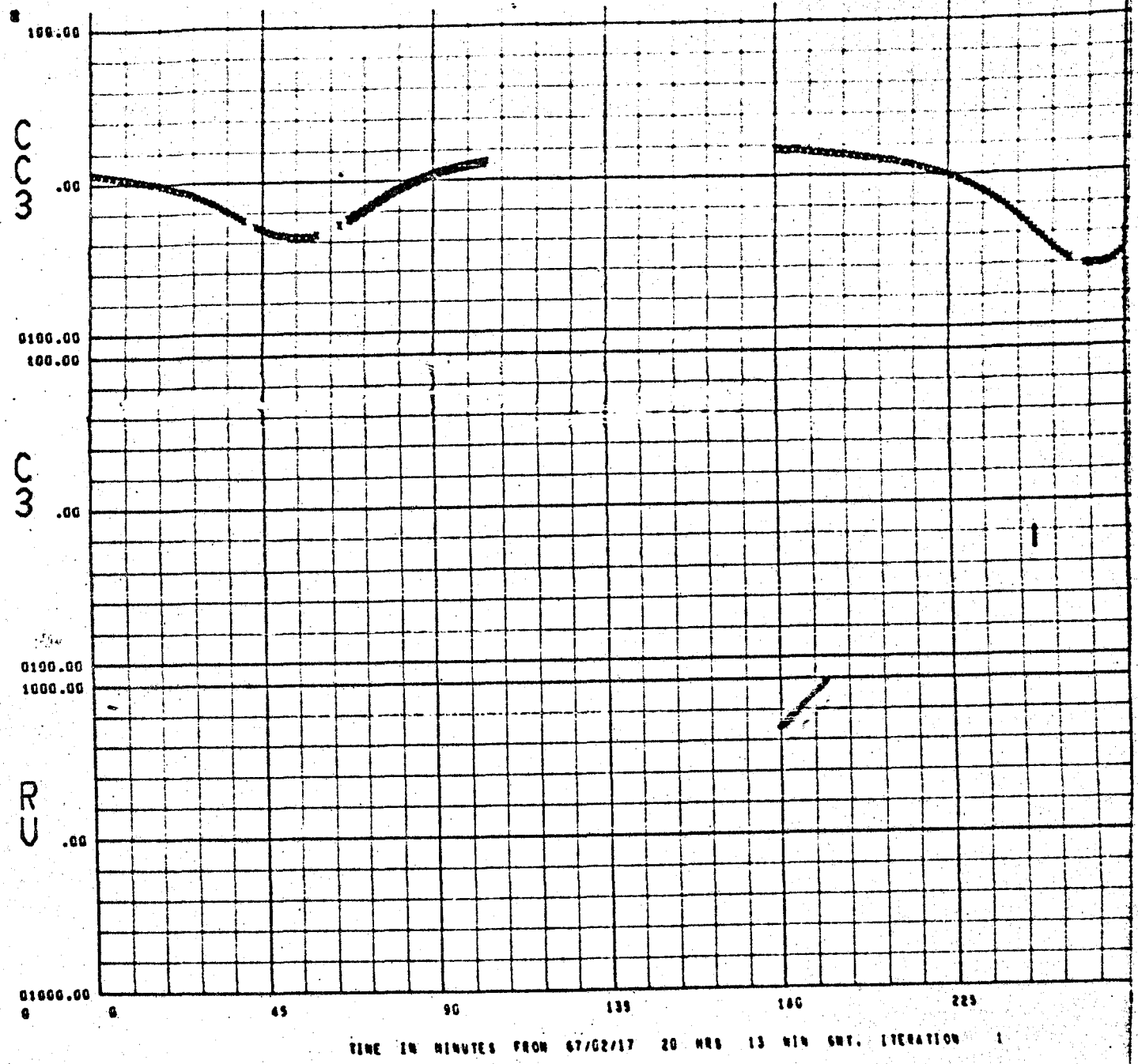
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

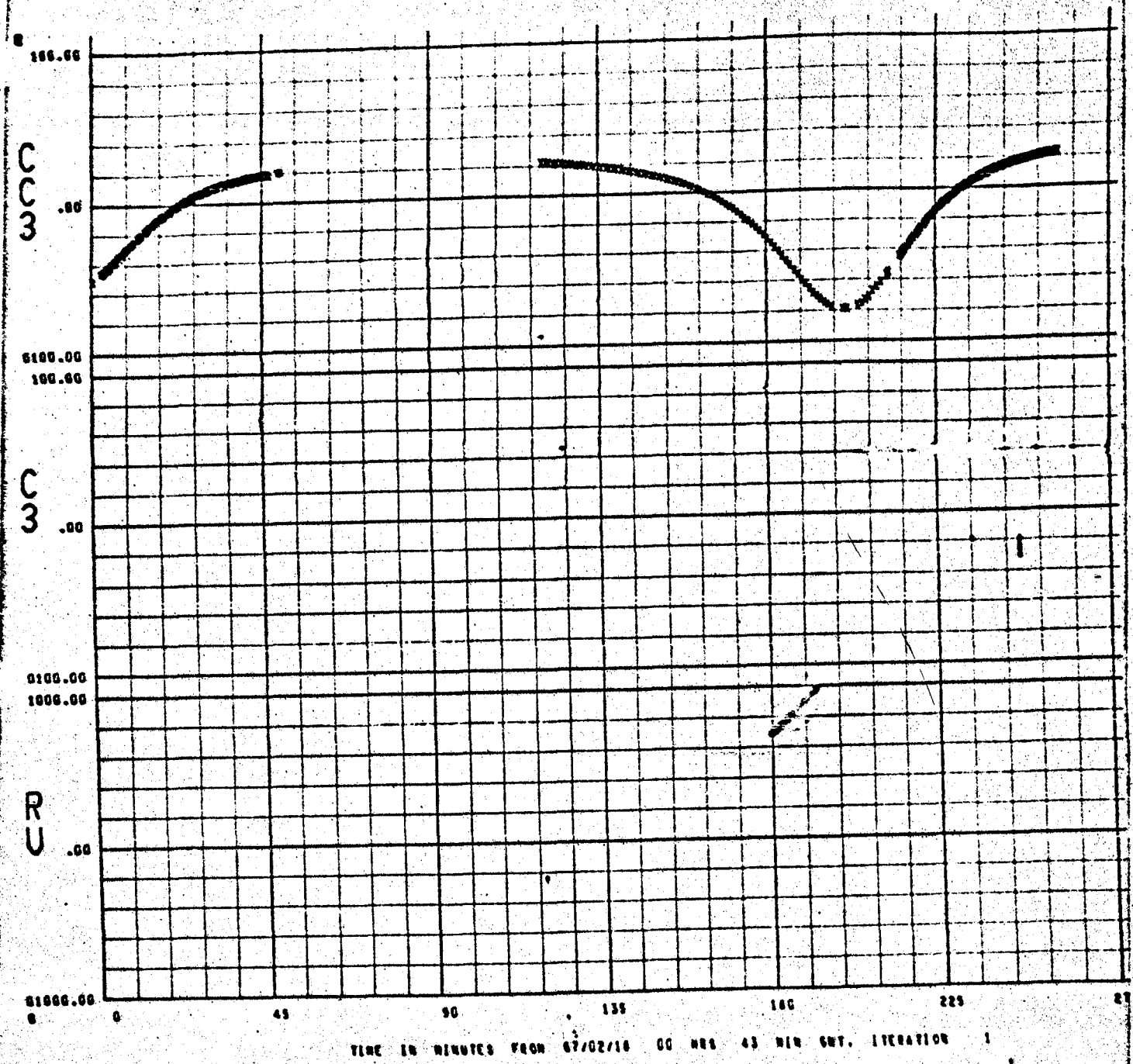
SH.



STATION 41 RESIDUALS PASS NUMBER 14/049



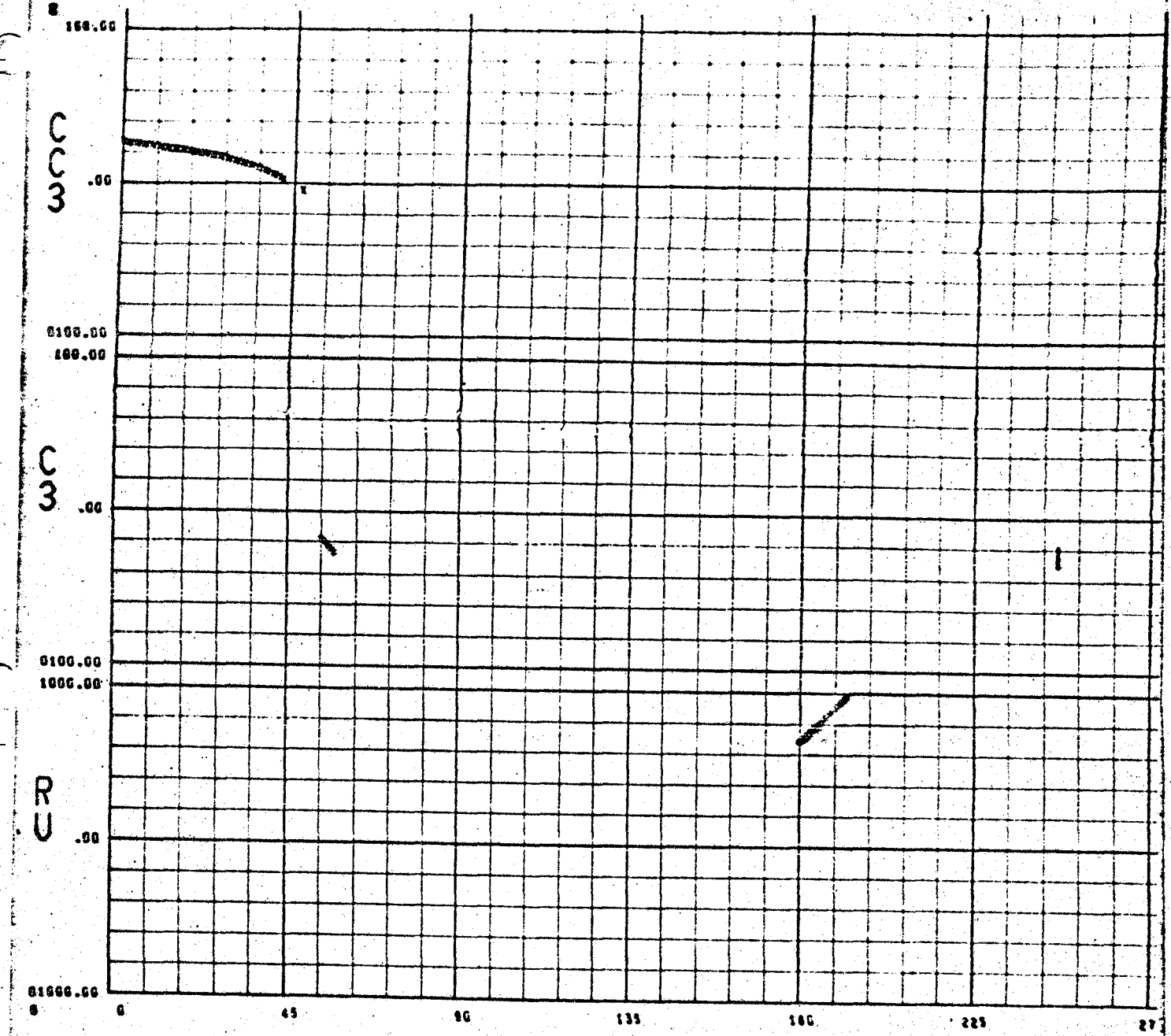
STATION 12 RESIDUALS PASS NUMBER 13/048



STATION 12 RESIDUALS PASS NUMBER 13/048

REV LTR

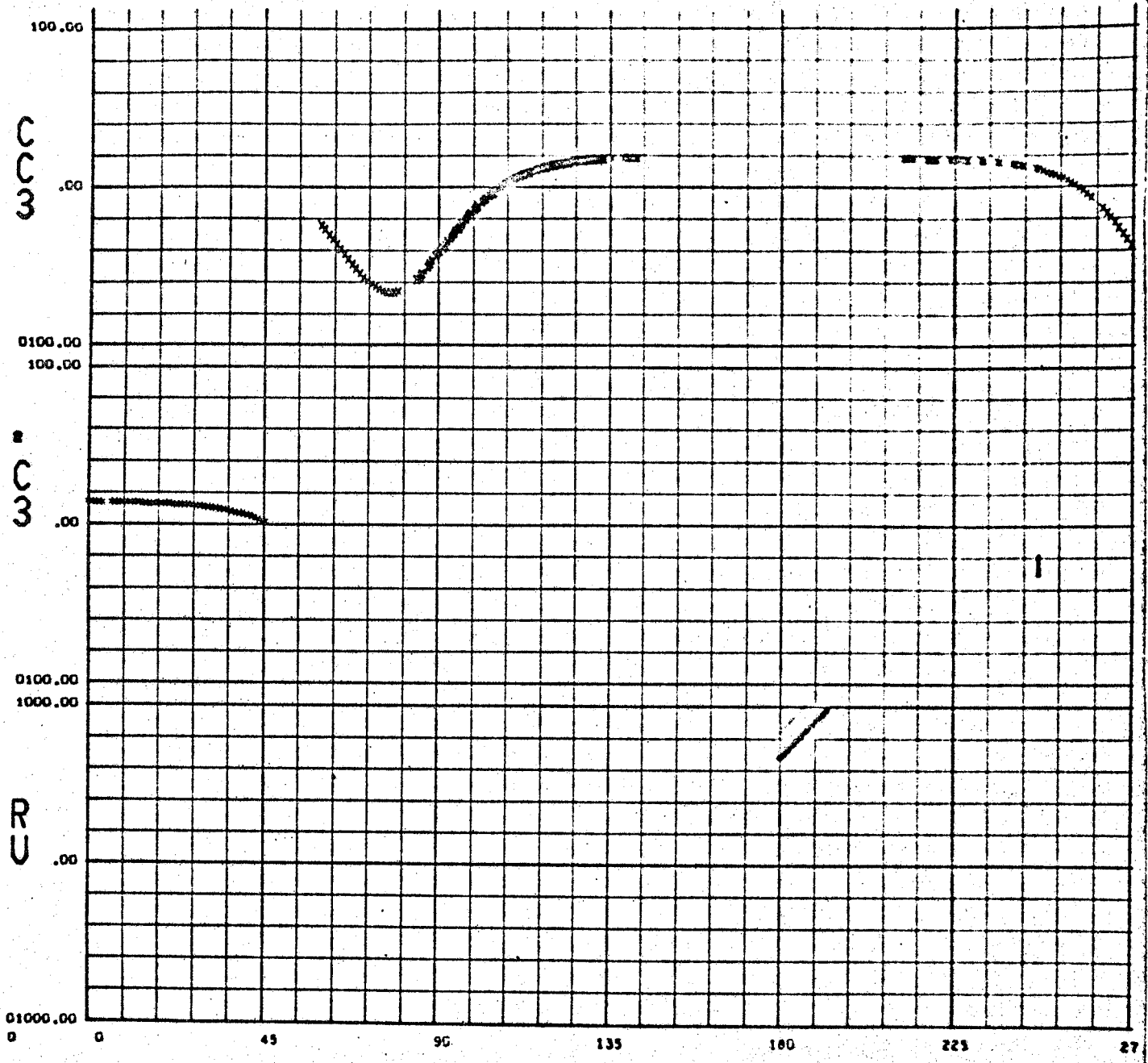
U3 4288-2000 REV. 6/64



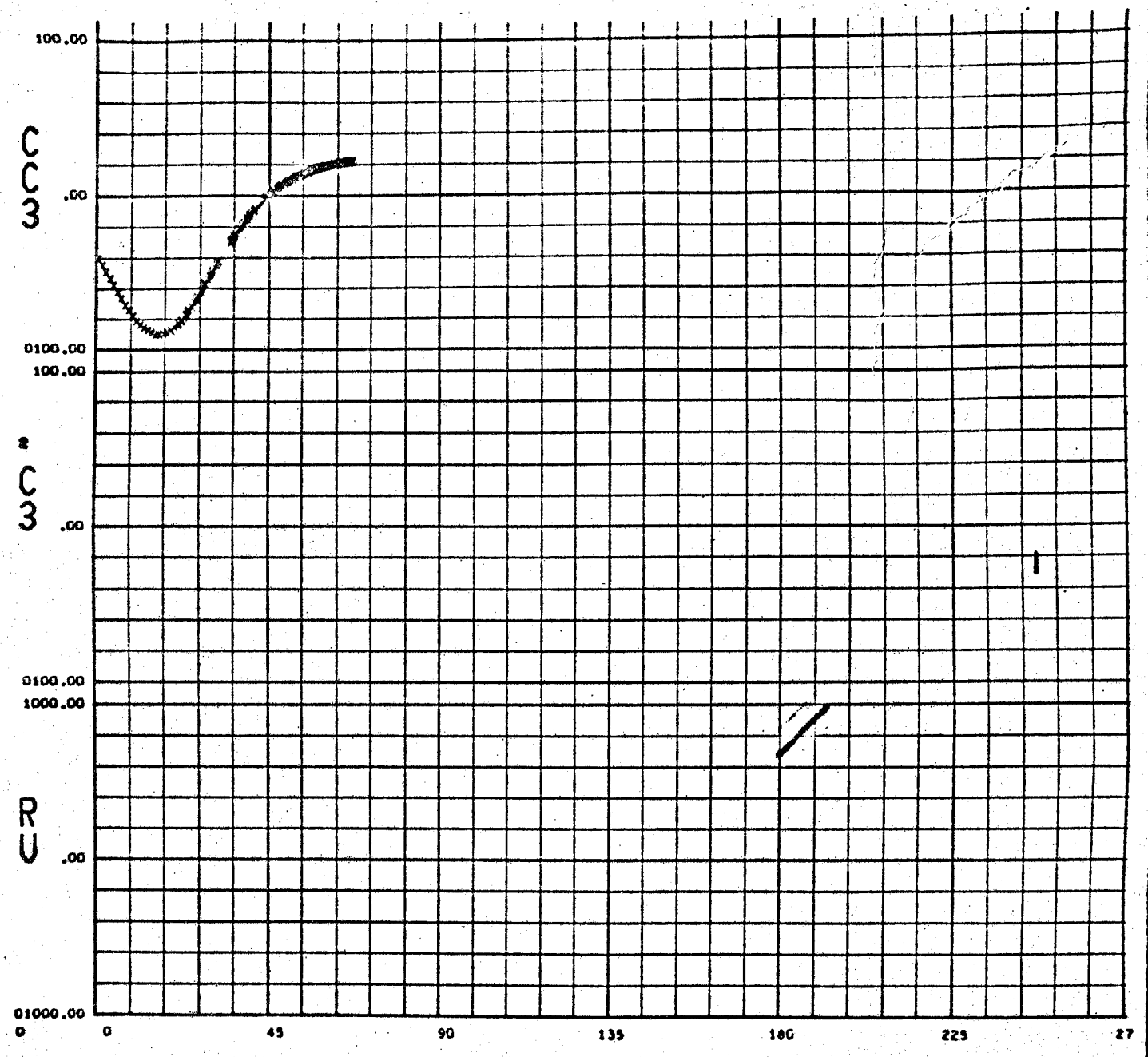
STATION 12 RESIDUALS PASS NUMBER 13/048

ODPL 3P7A

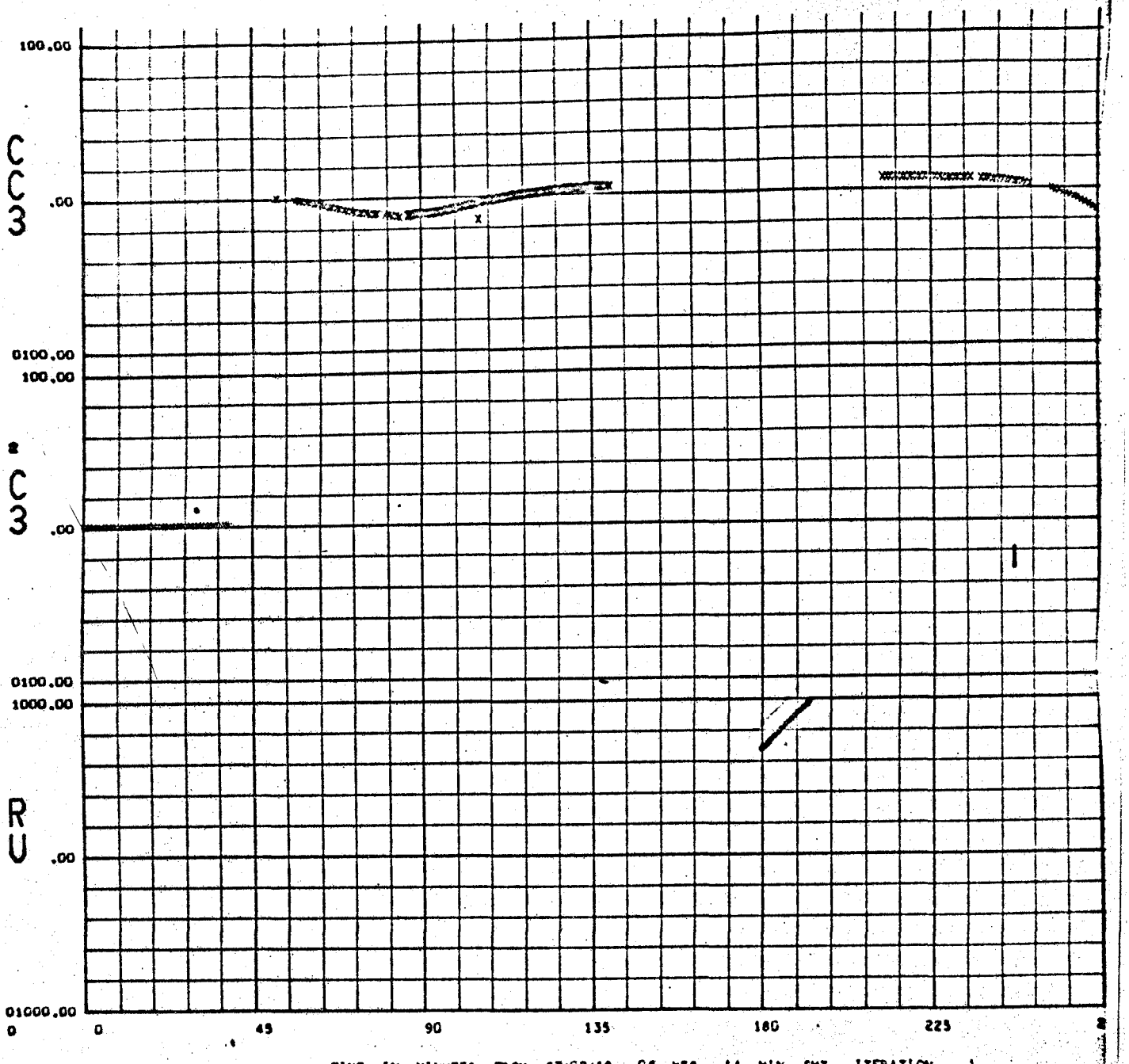
SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 14/049



STATION 62 RESIDUALS PASS NUMBER 14/049



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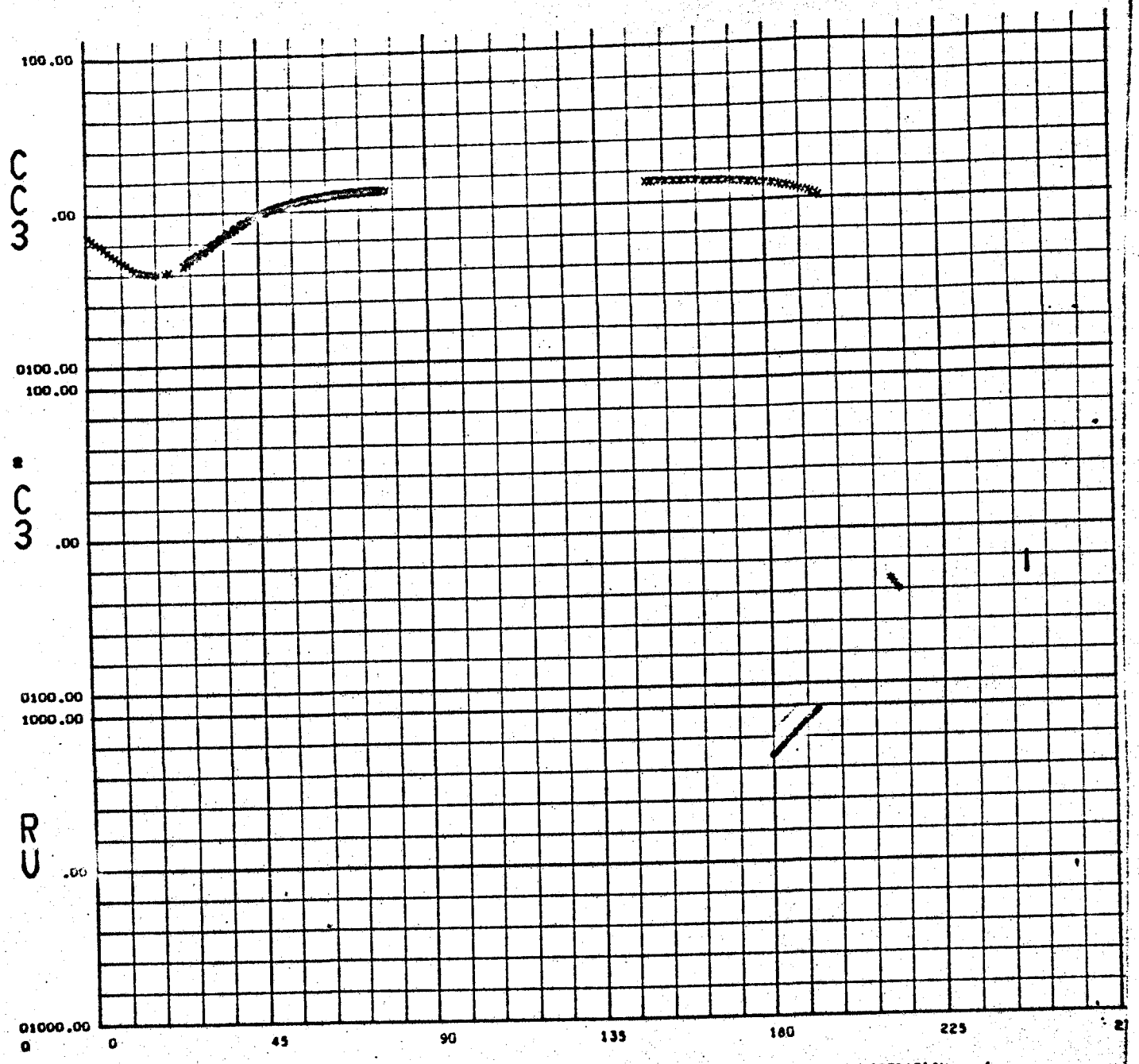
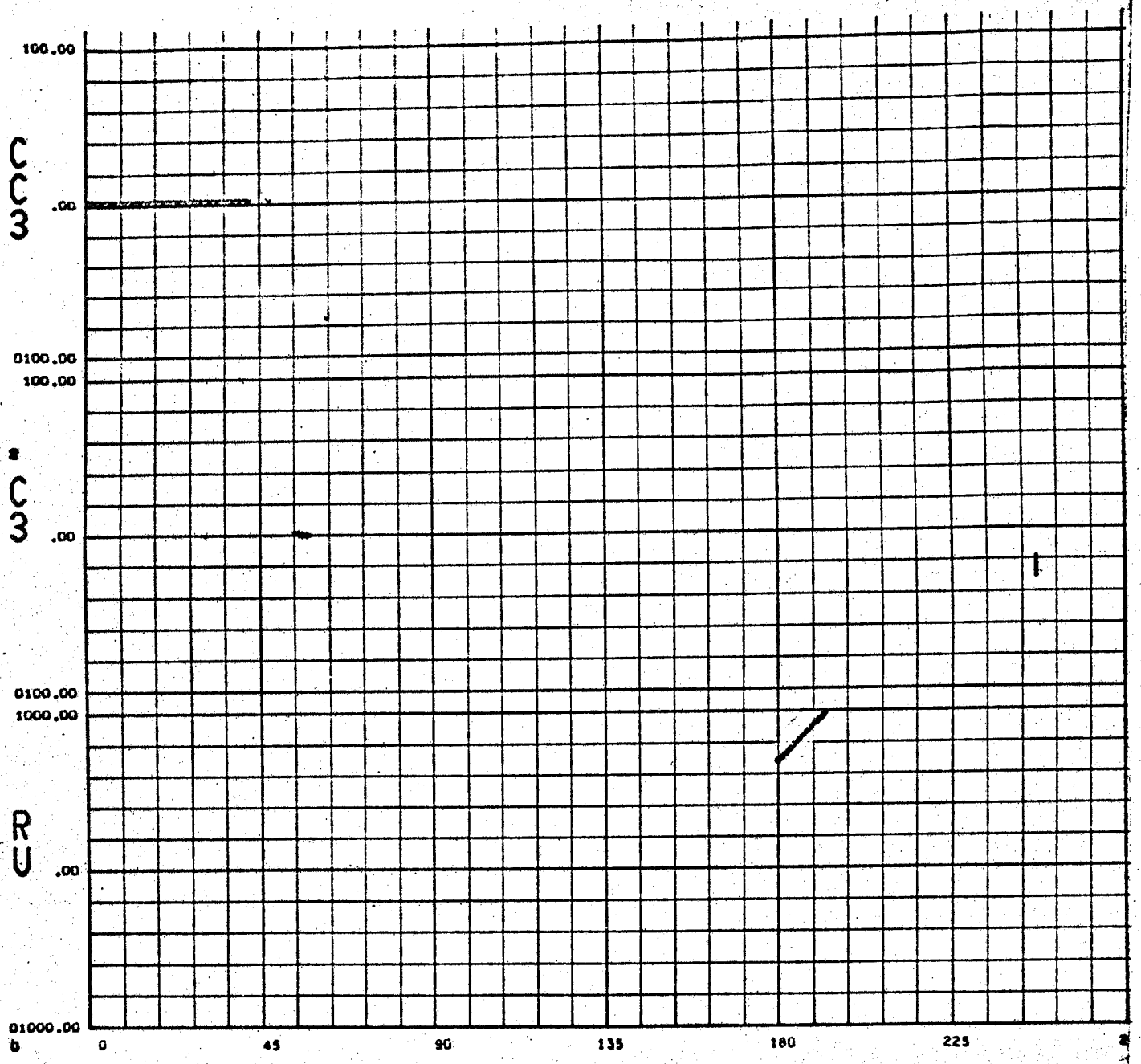


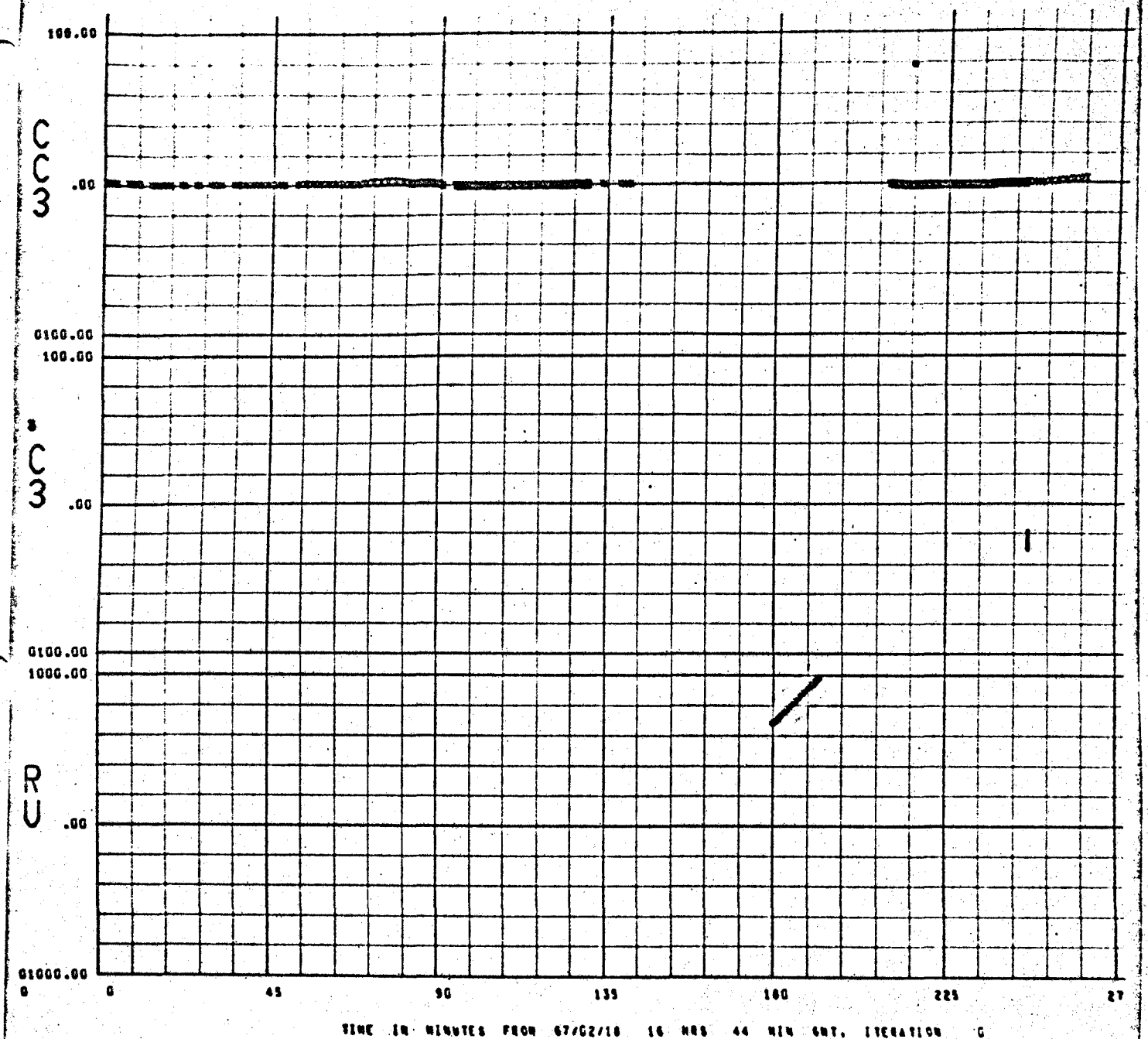
STATION 41 RESIDUALS PASS NUMBER 14/049



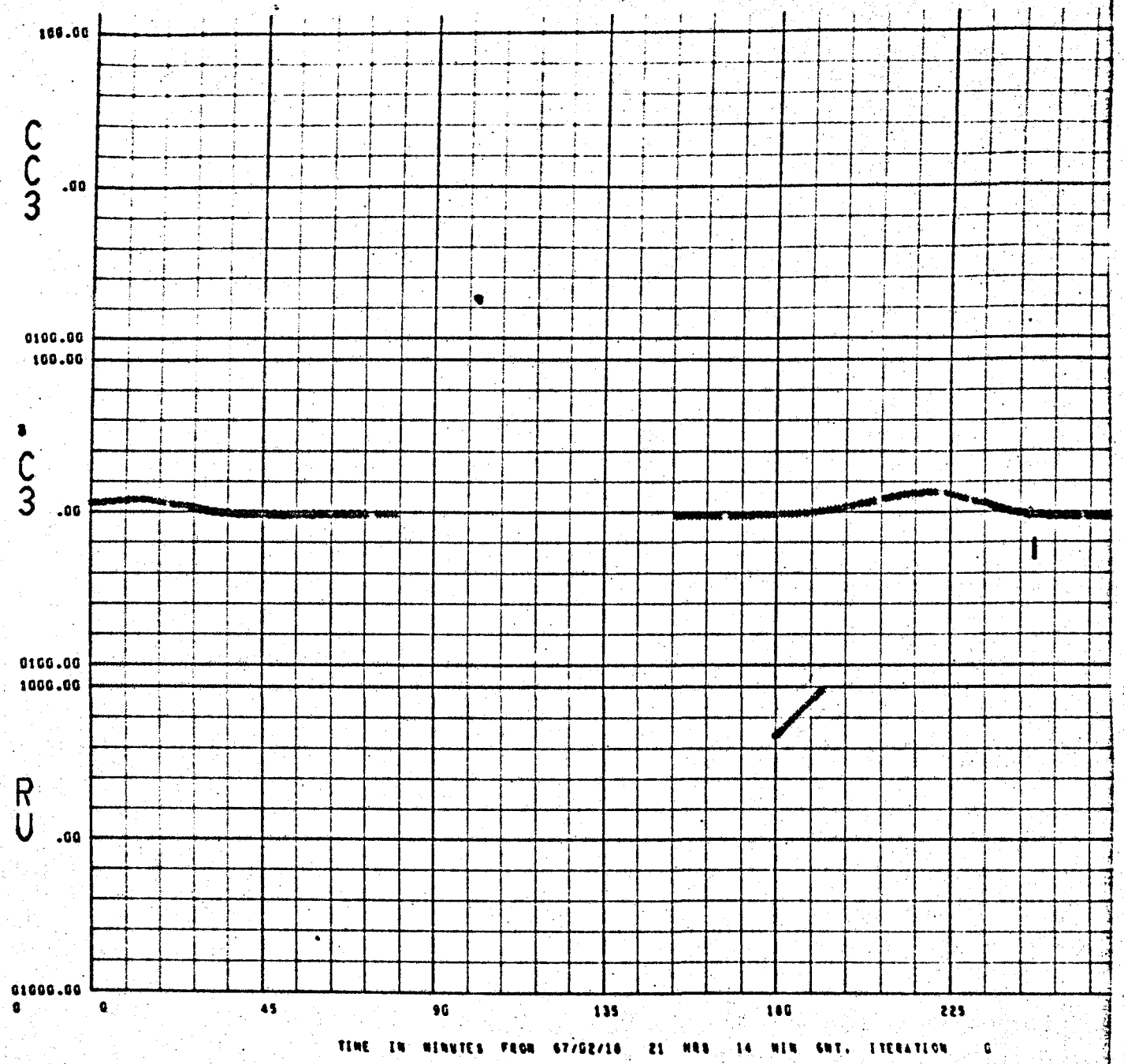
STATION 12 RESIDUALS PASS NUMBER 13/048

ODPL 3S16

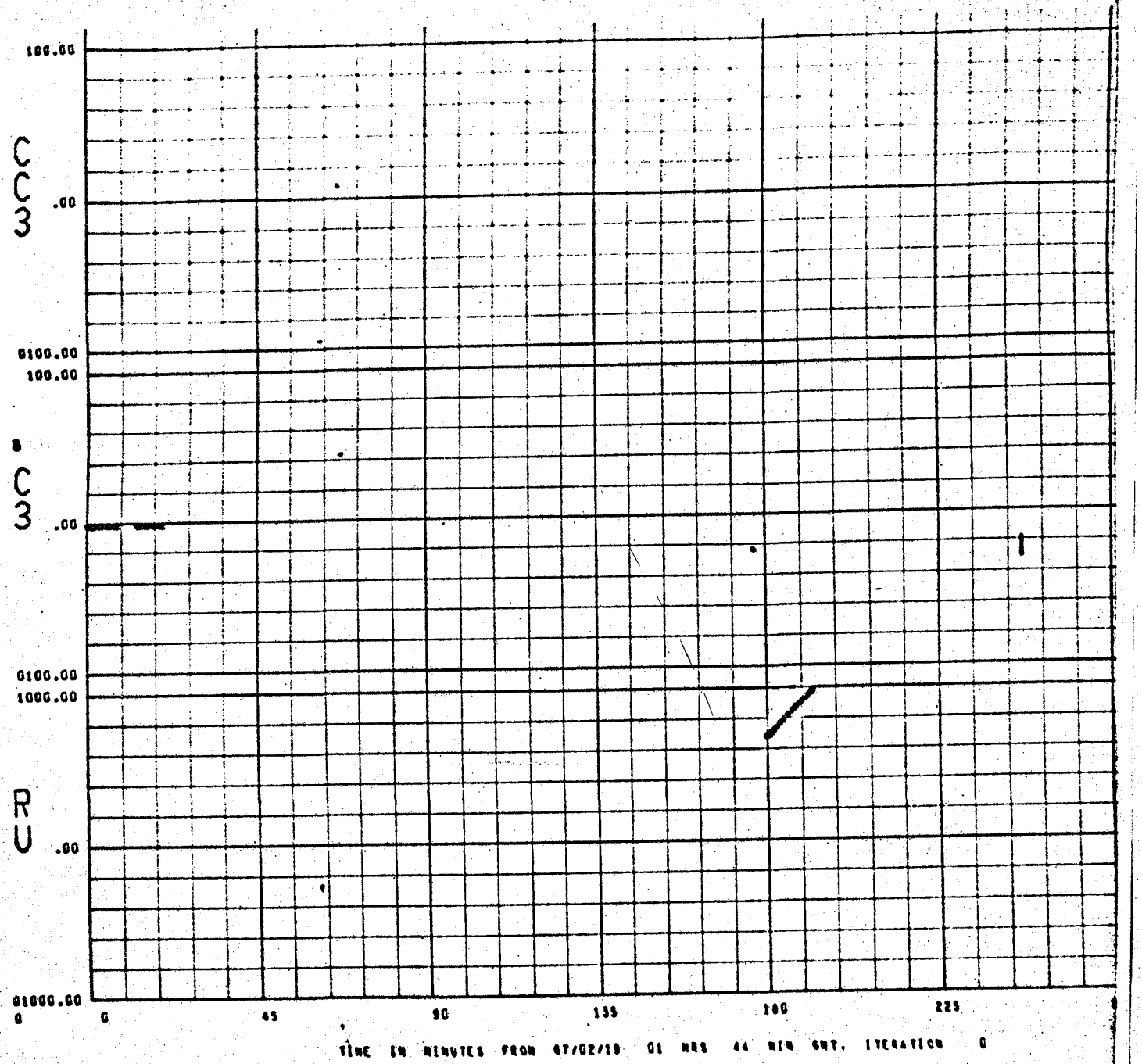
SIMPLE MOON



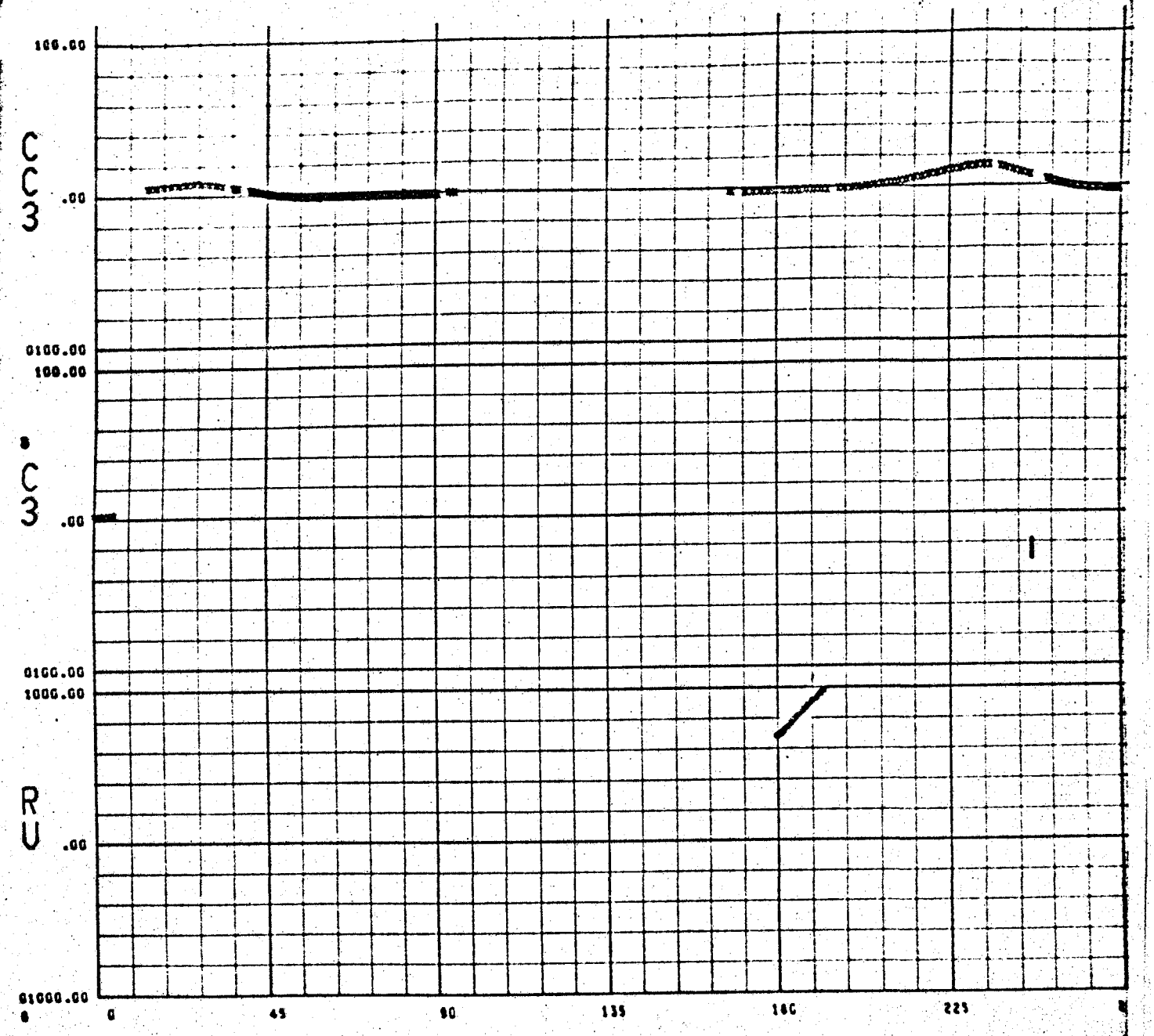
STATION 62 RESIDUALS PASS NUMBER 14/049



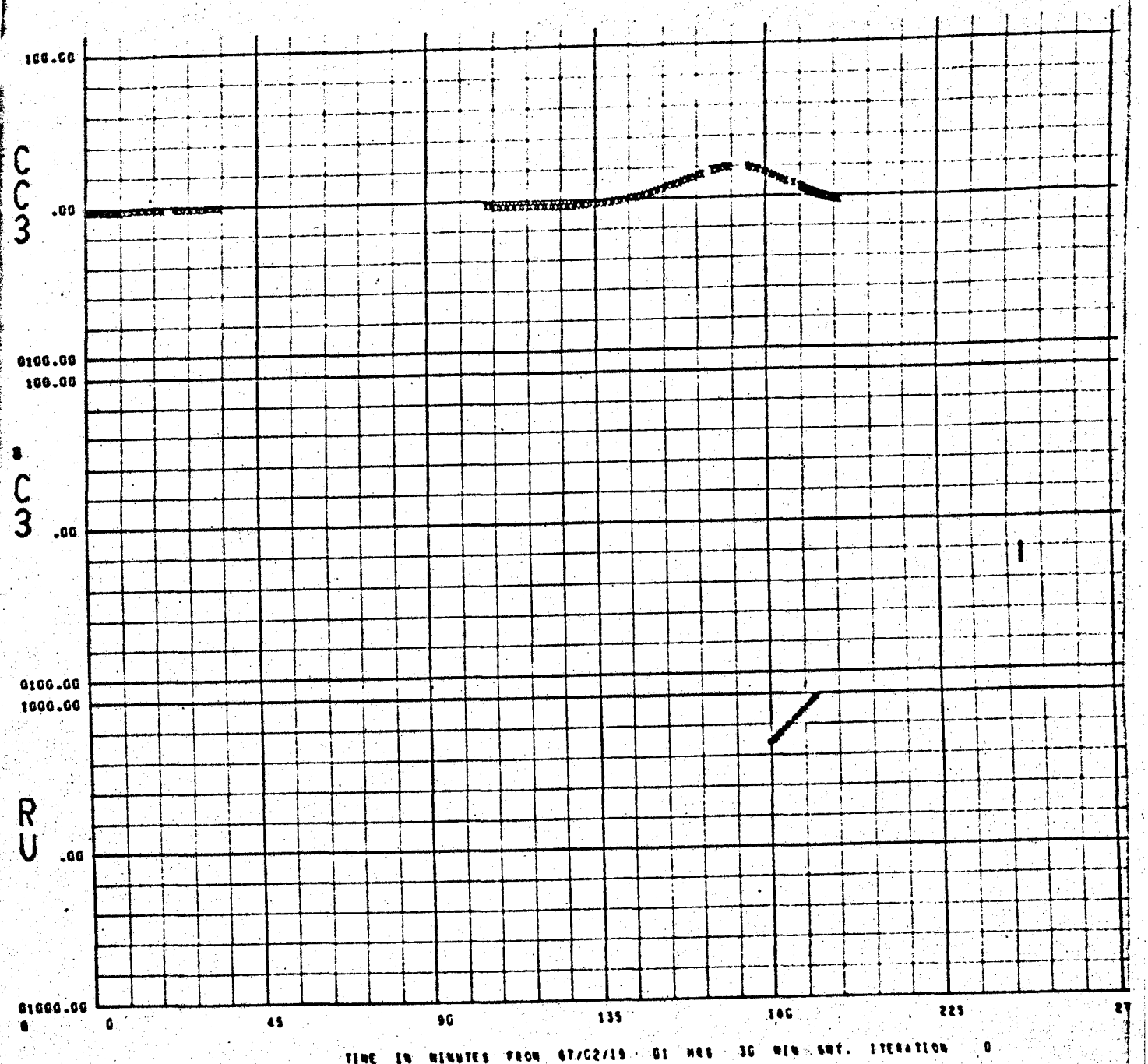
STATION 62 RESIDUALS PASS NUMBER 14/049



STATION 62 RESIDUALS PASS NUMBER 14/049



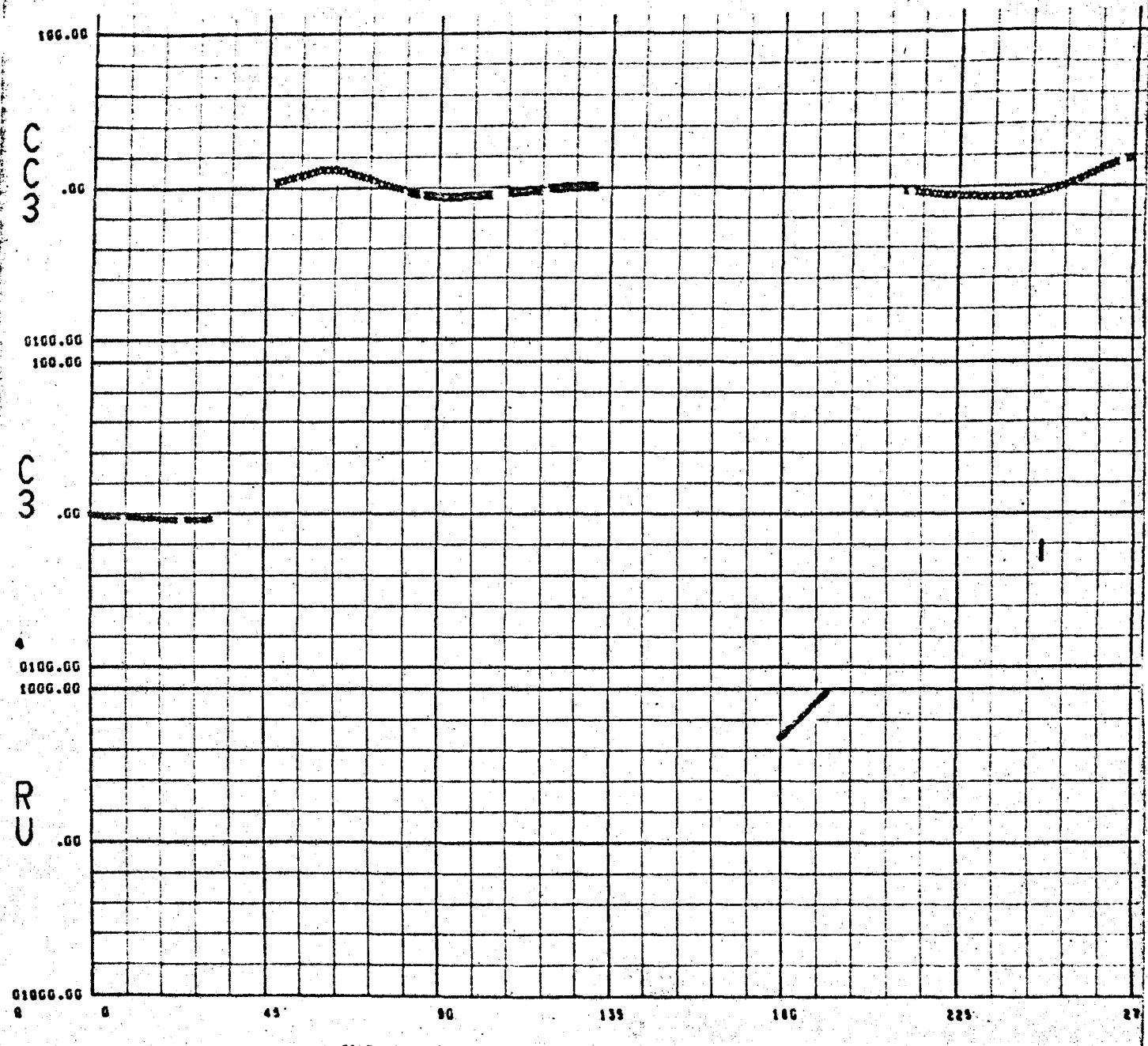
STATION 12 RESIDUALS PASS NUMBER 14/049



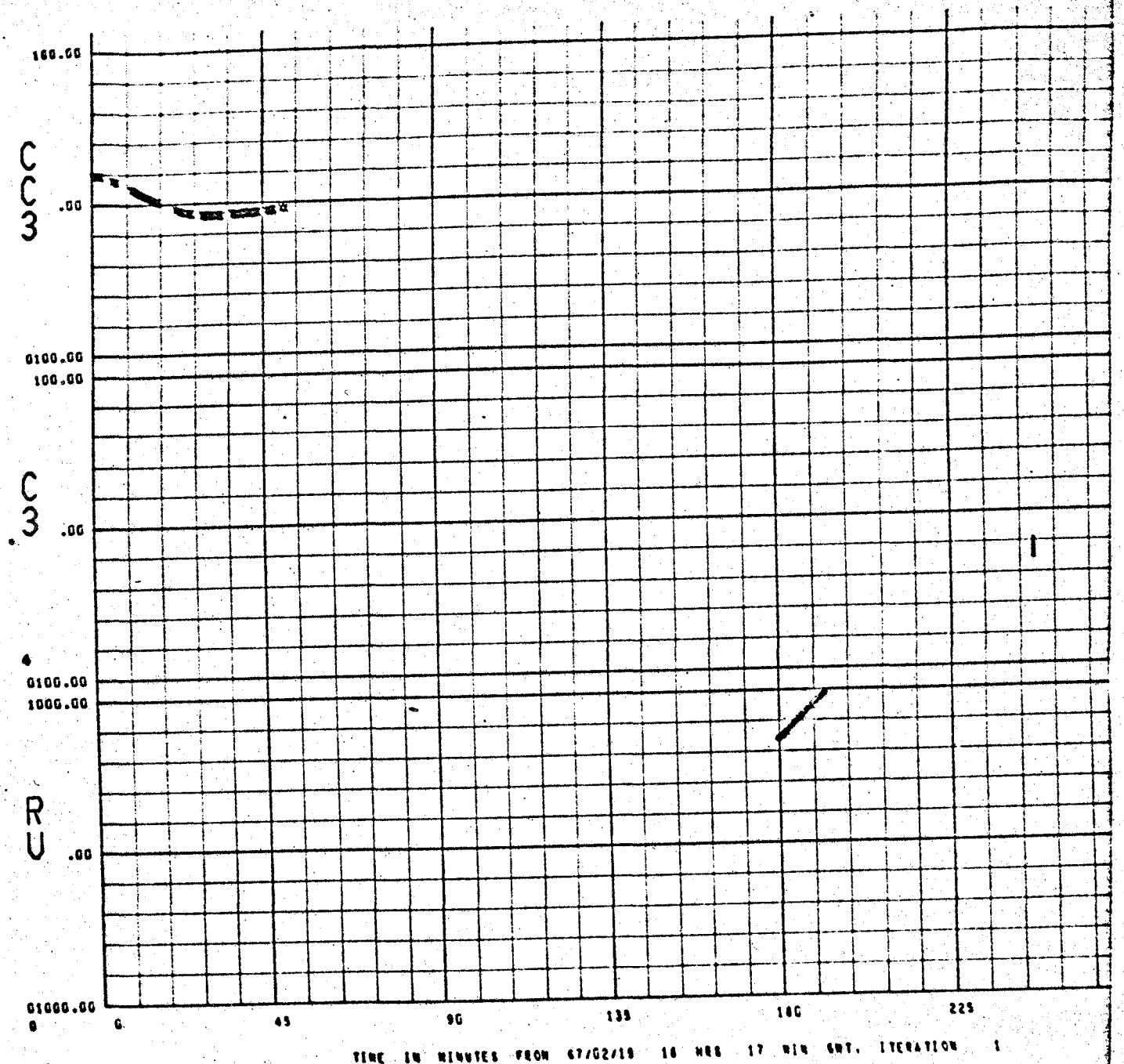
STATION 12 RESIDUALS PASS NUMBER 14/049

ODPL 3S18

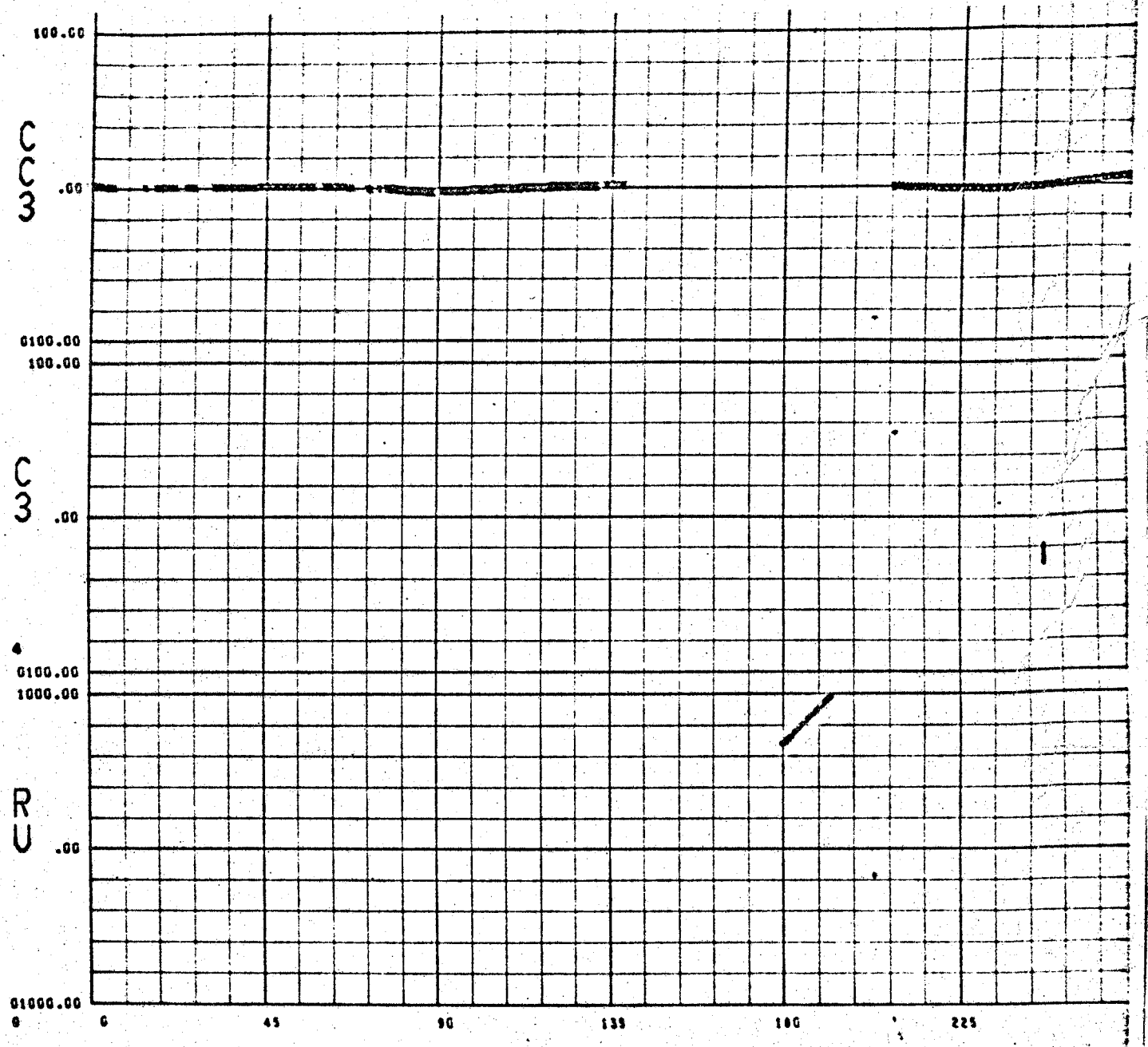
SIMPLE MOON



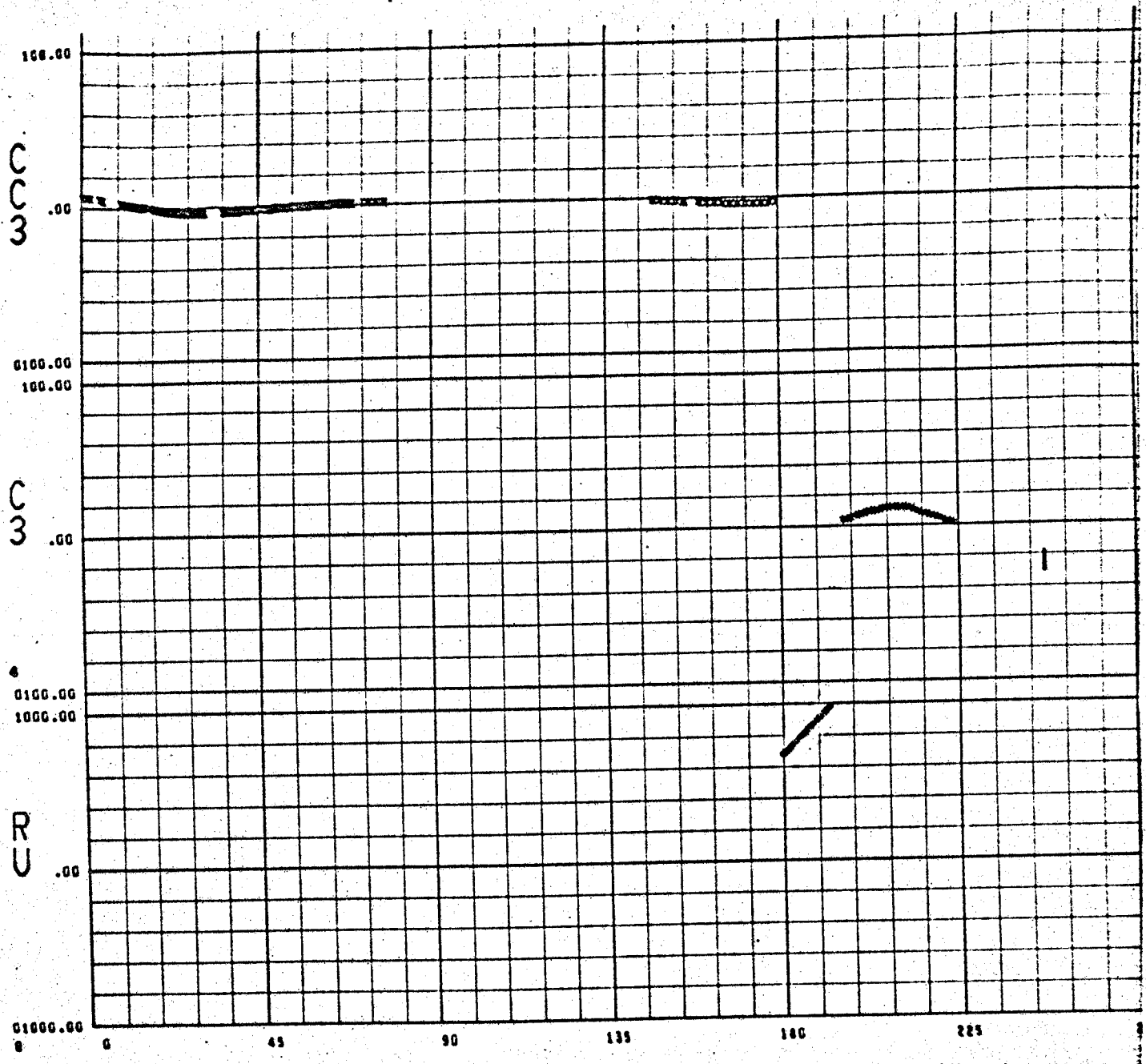
STATION 62 RESIDUALS PASS NUMBER 15/050



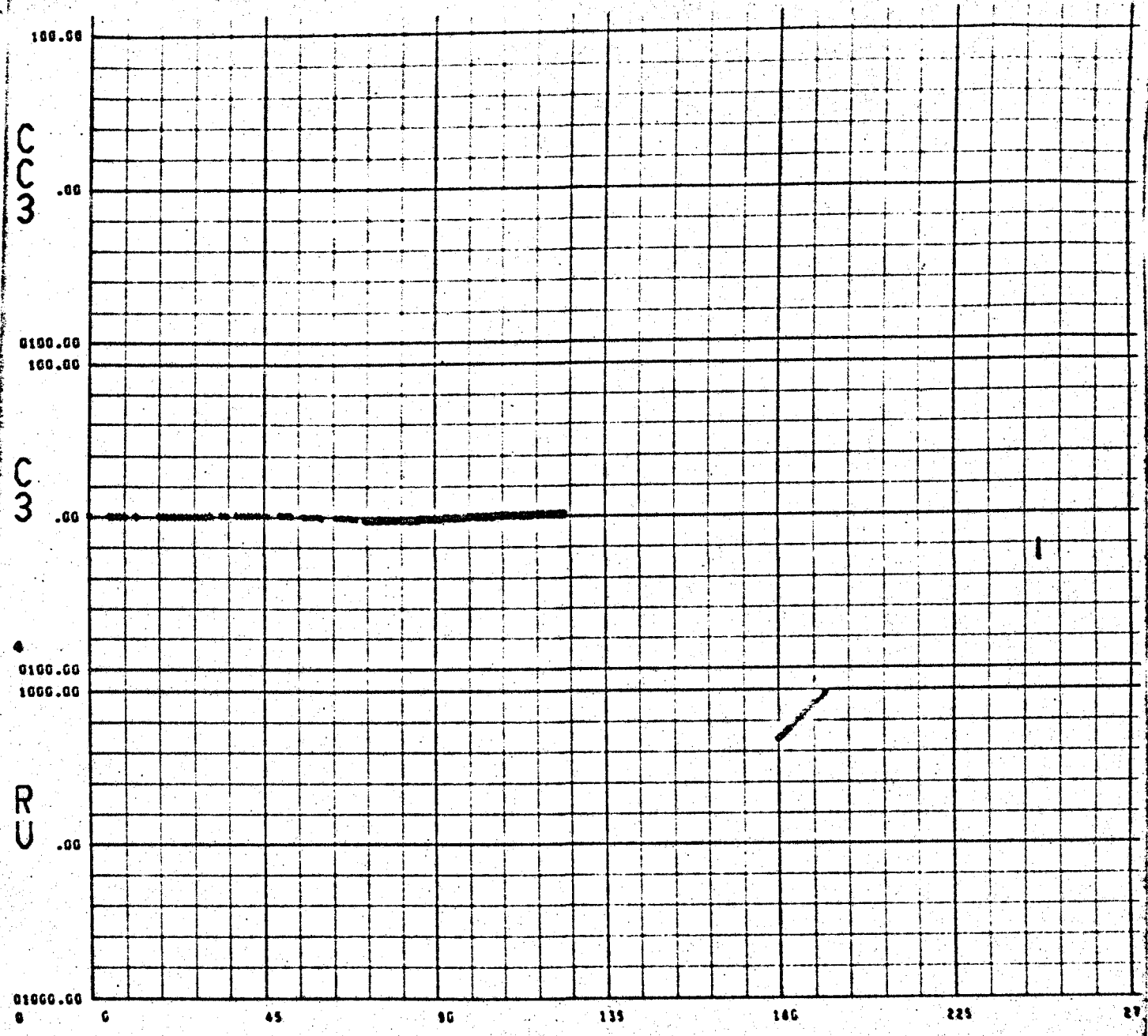
STATION 62 RESIDUALS PASS NUMBER 15/050



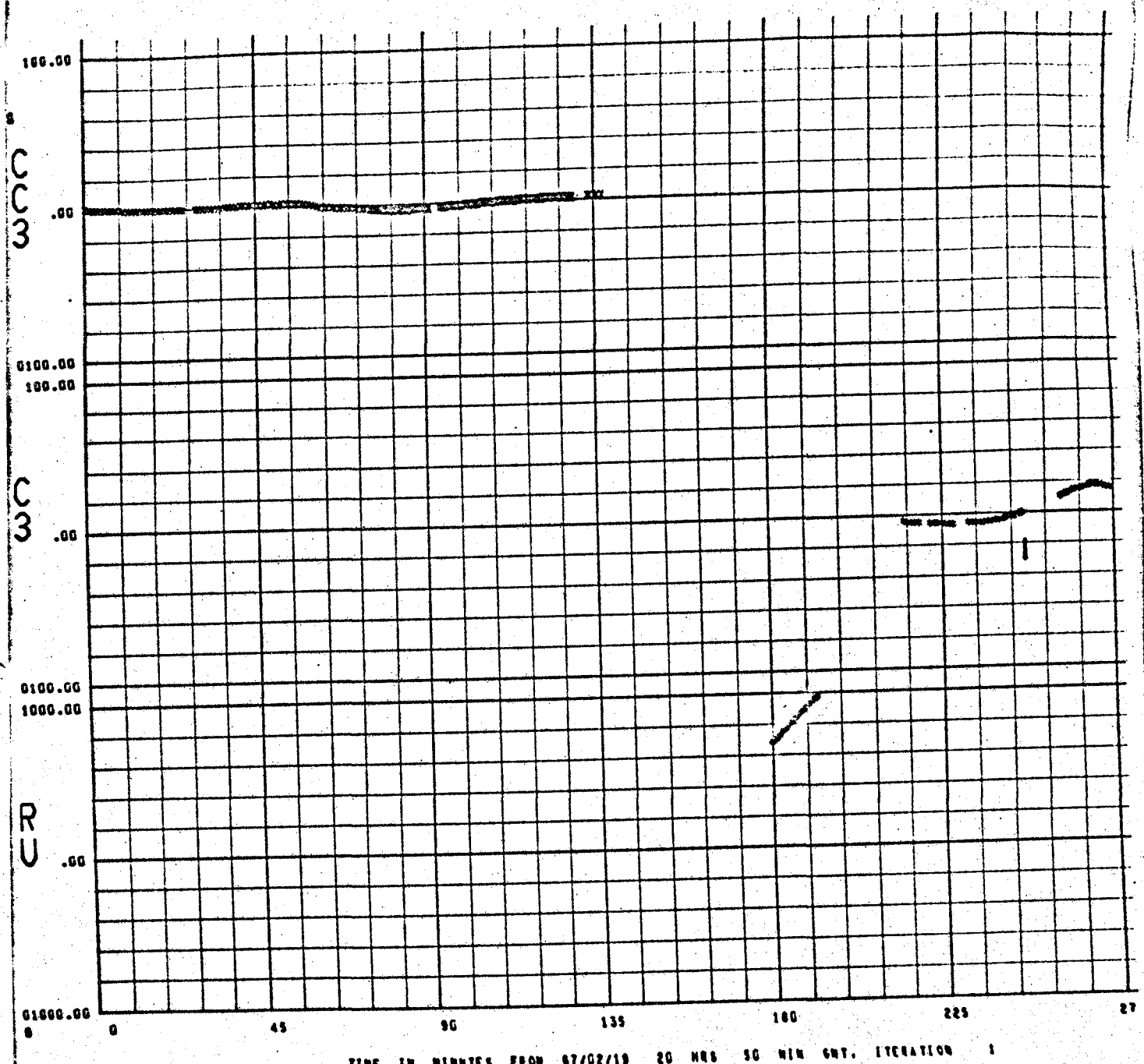
STATION 41 RESIDUALS PASS NUMBER 15/050



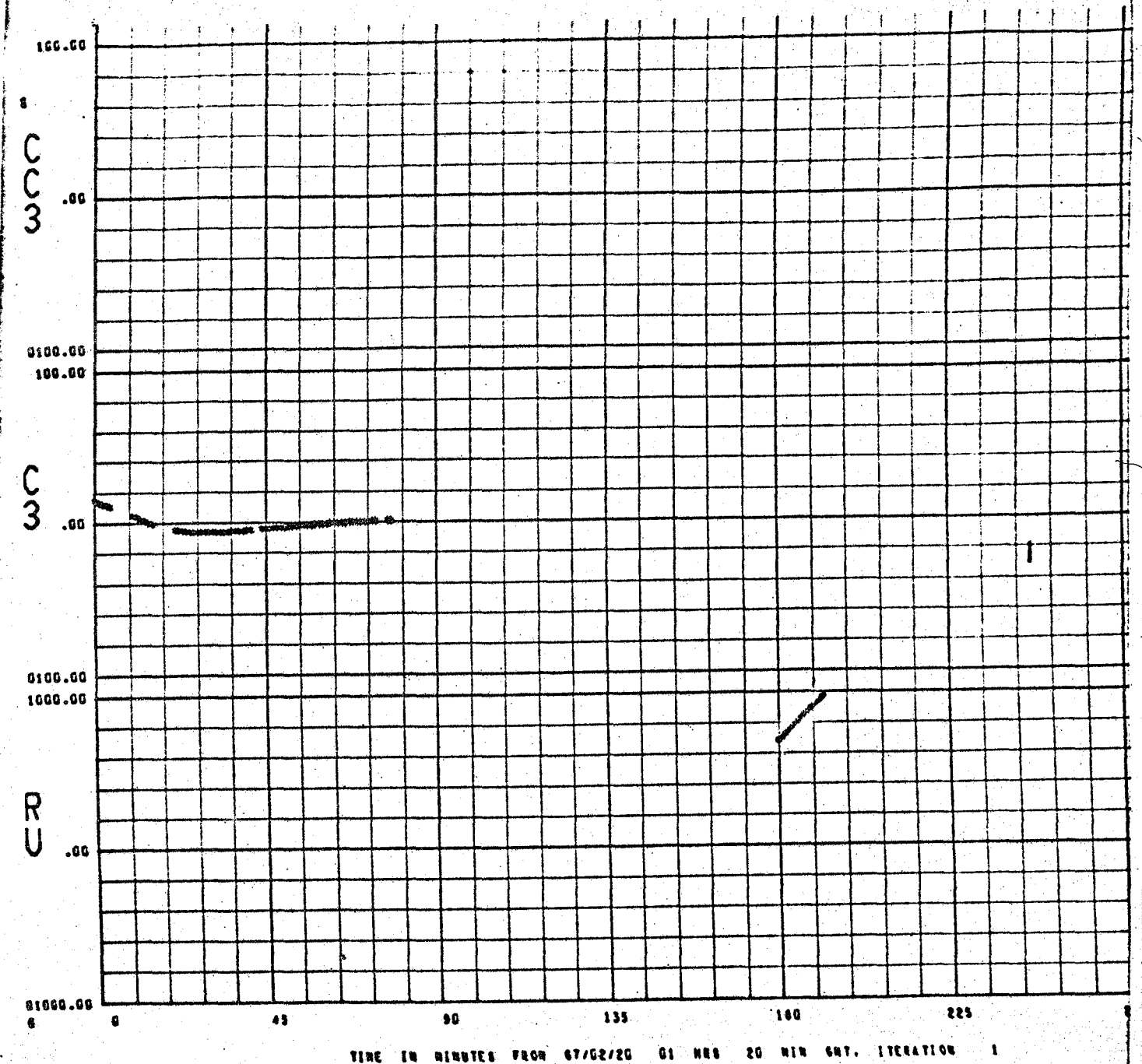
STATION 41 RESIDUALS PASS NUMBER 15/050



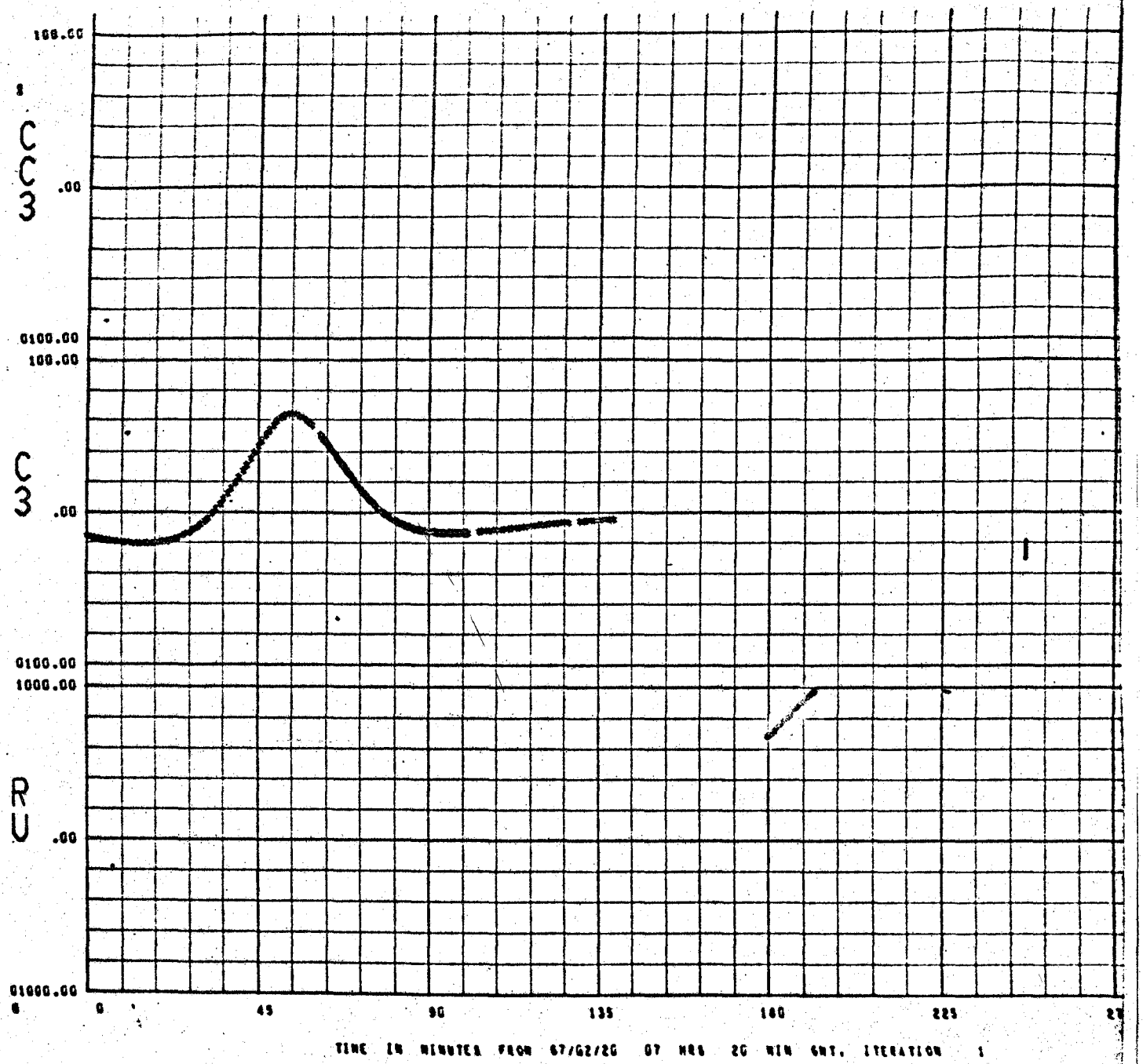
STATION 12 RESIDUALS PASS NUMBER 14/049



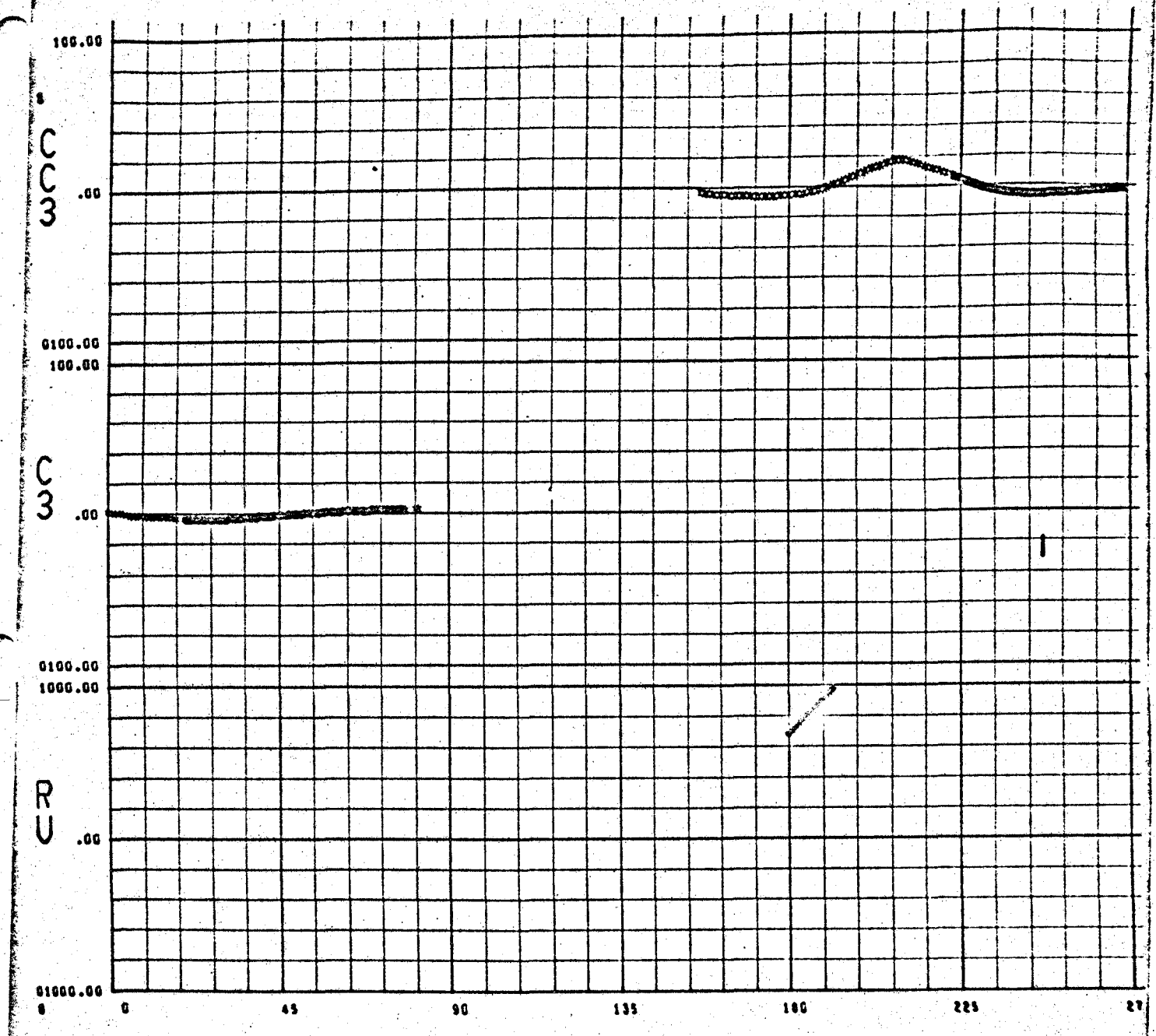
STATION 62 RESIDUALS PASS NUMBER 15/050



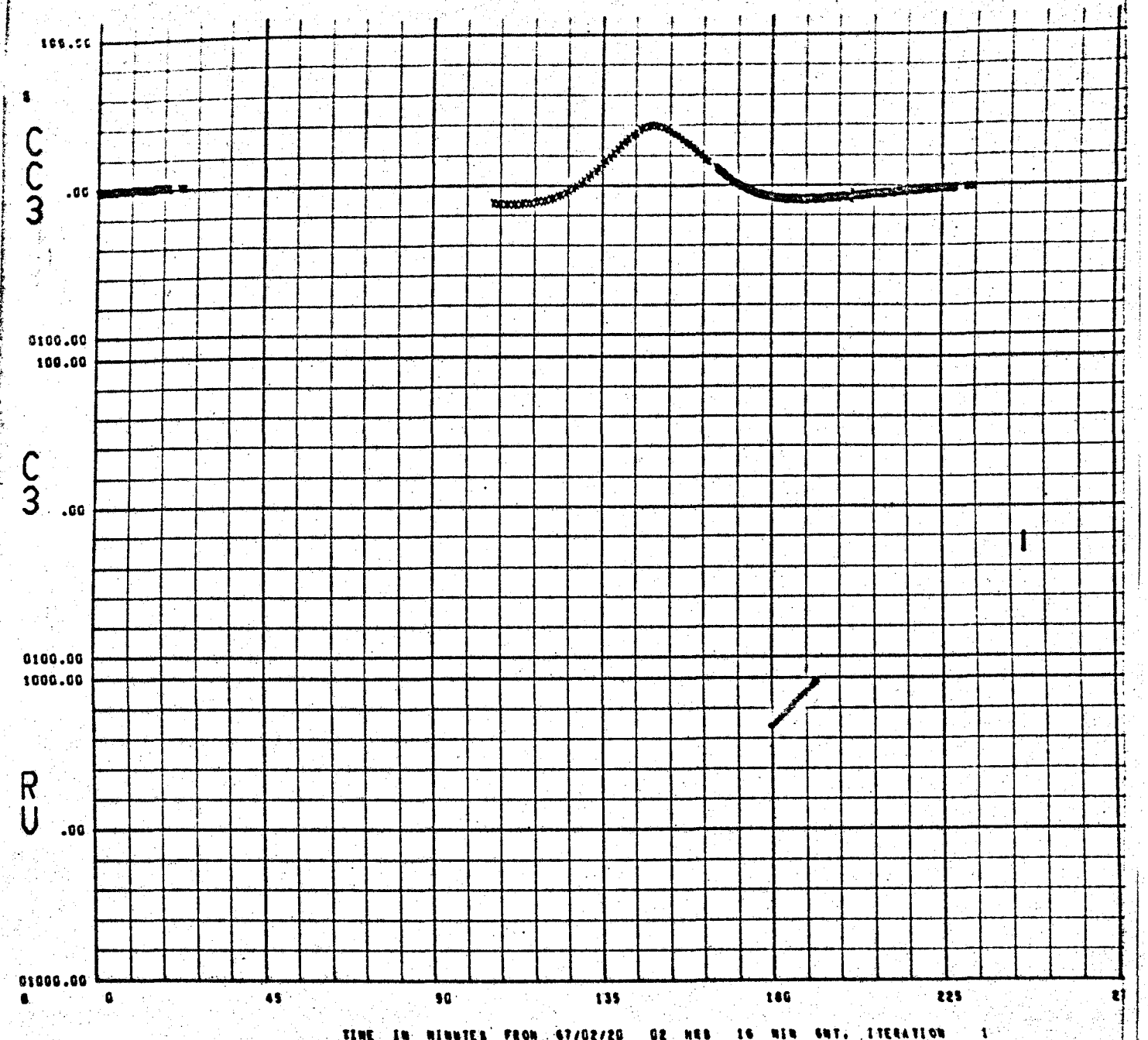
STATION 62 RESIDUALS PASS NUMBER 15/050



STATION 41 RESIDUALS PASS NUMBER 16/051



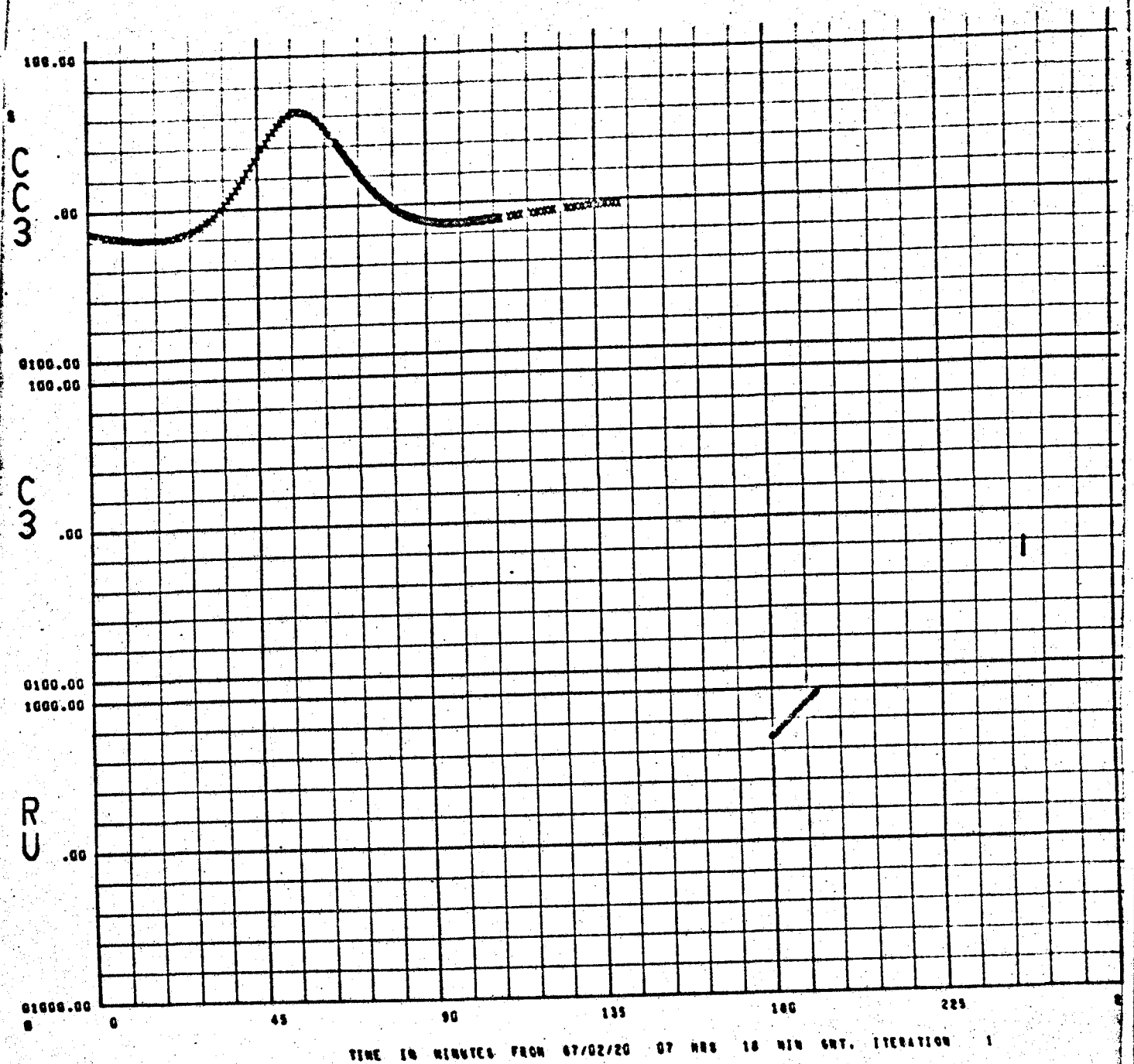
STATION 12 RESIDUALS PASS NUMBER 15/050



STATION 12 RESIDUALS PASS NUMBER 15/050

REV LTR

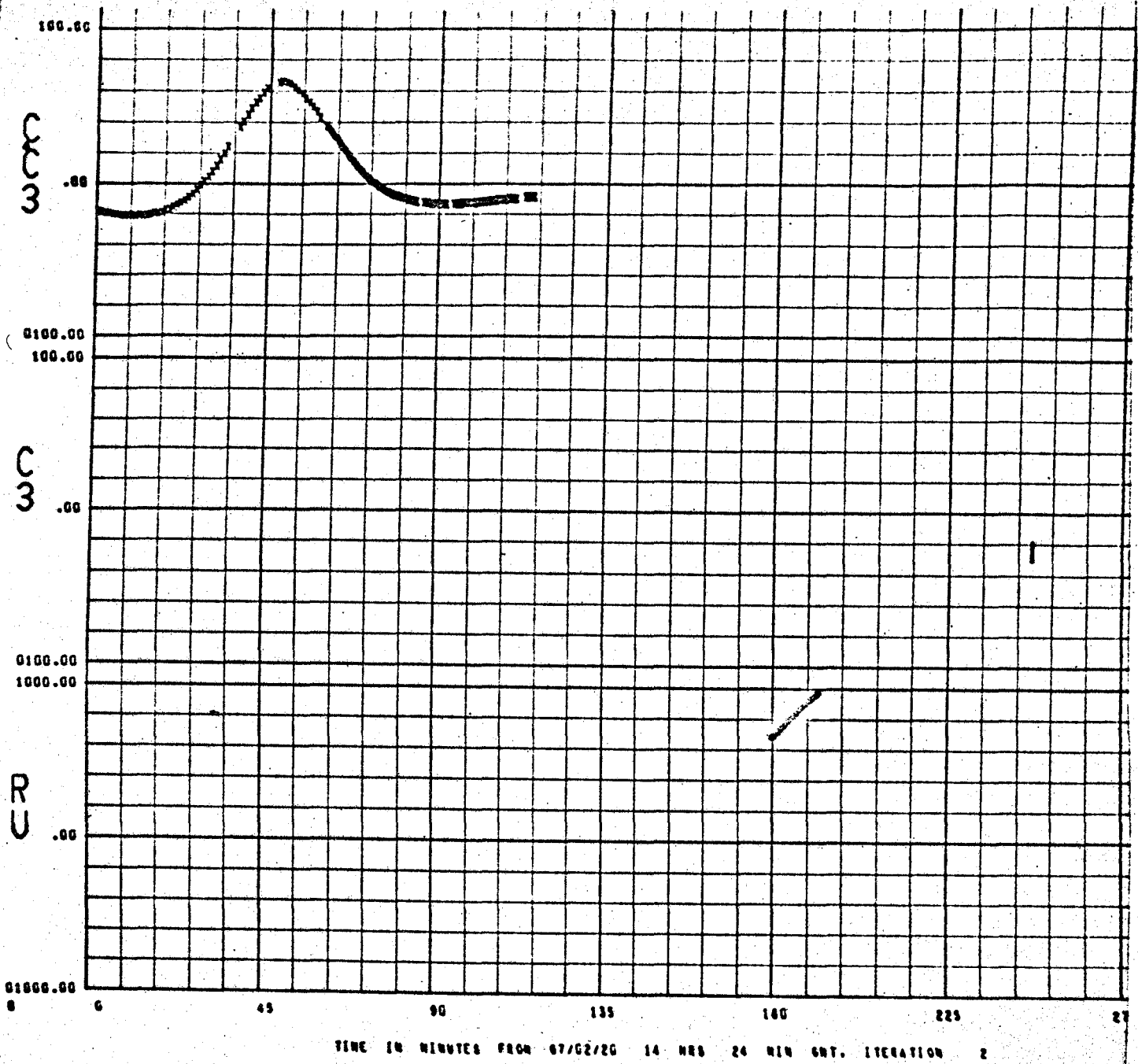
U3 4288-2000 REV. 6/64



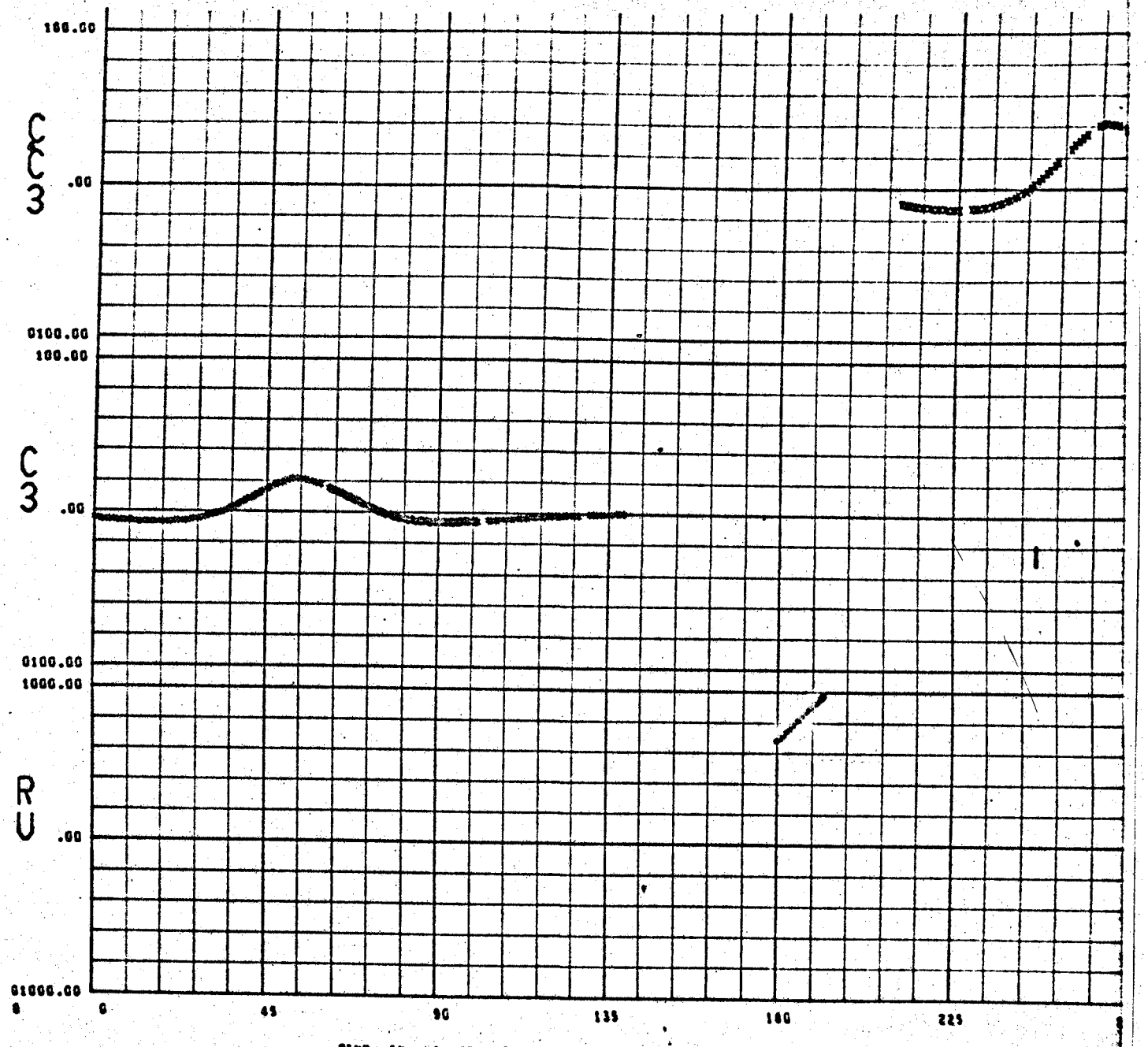
STATION 12 RESIDUALS PASS NUMBER 15/050

ODPL 3S23

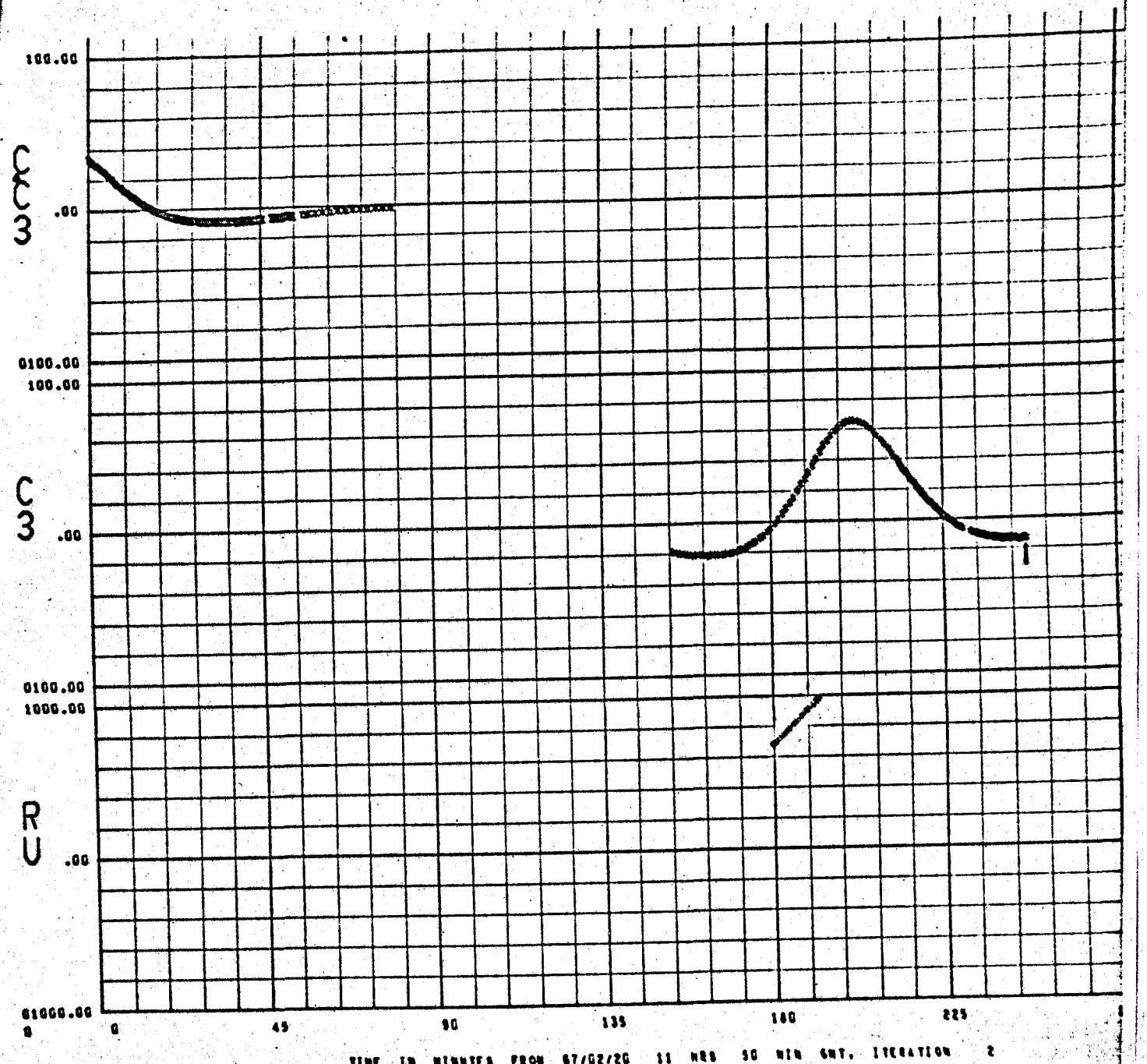
SIMPLE MOON



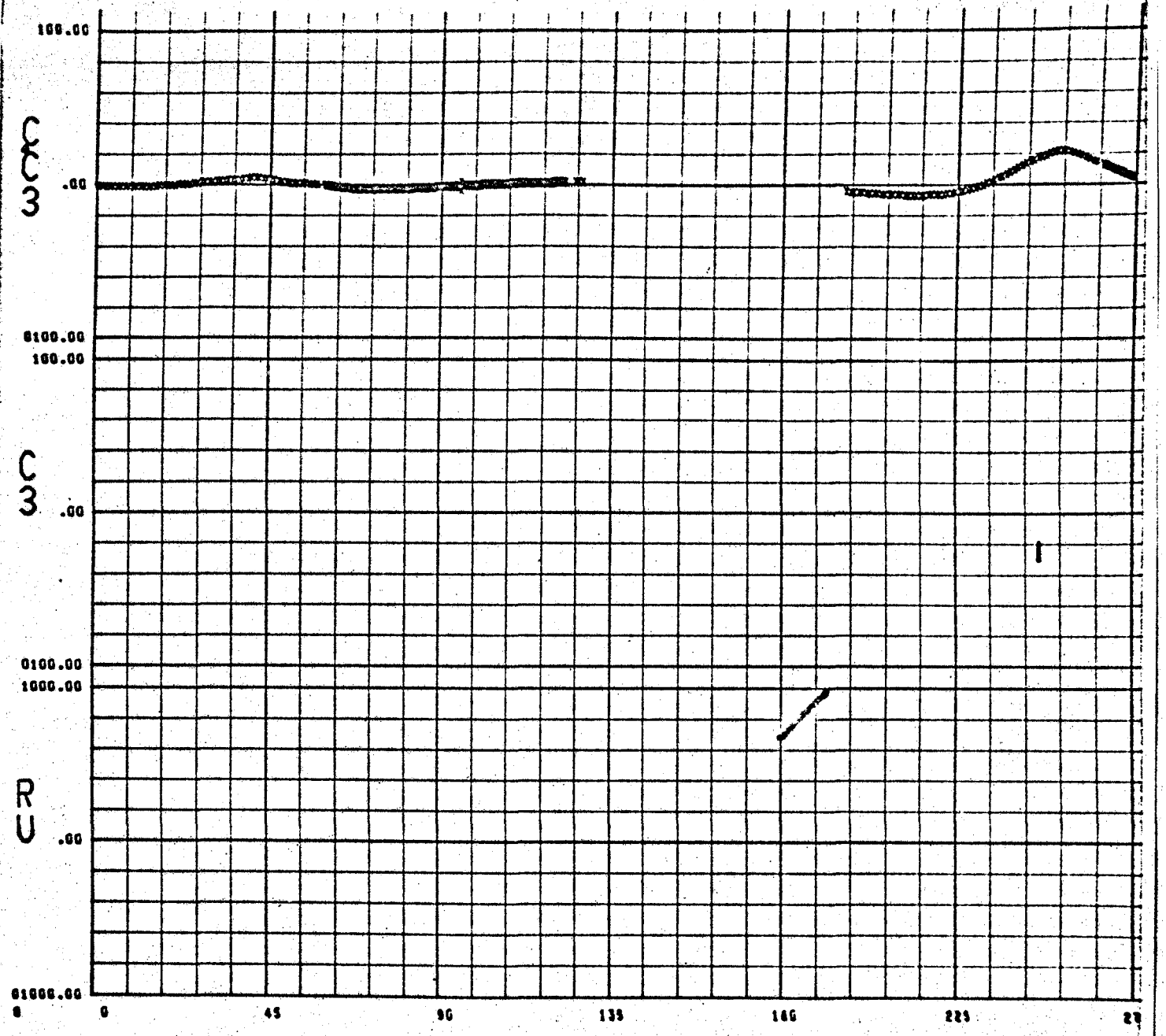
STATION 62 RESIDUALS PASS NUMBER 16/051



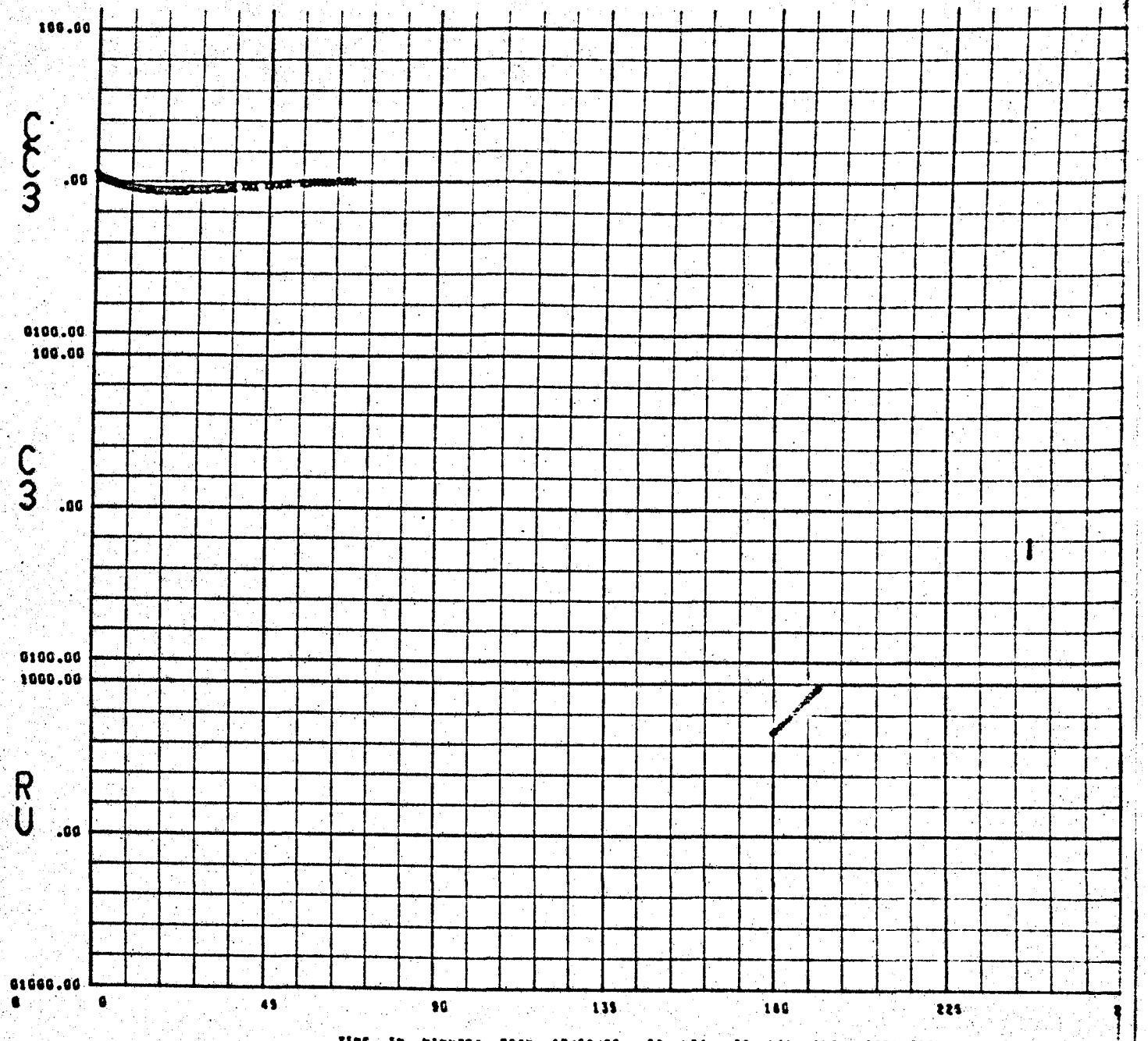
STATION 41 RESIDUALS PASS NUMBER 16/051



STATION 41 RESIDUALS PASS NUMBER 16/051



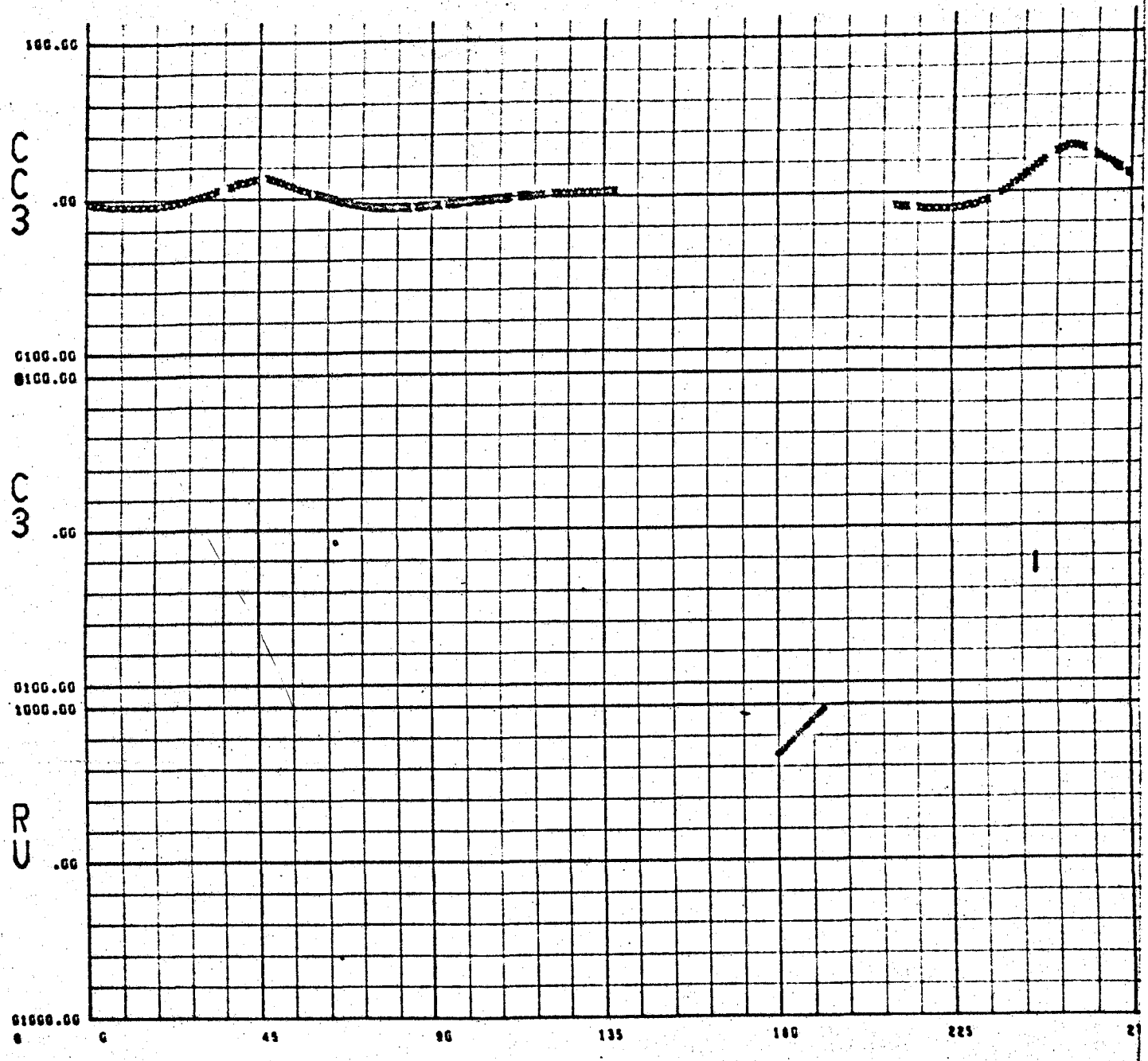
STATION 12 RESIDUALS PASS NUMBER 15/050



STATION 12 RESIDUALS PASS NUMBER 15/050

ODPL 3P9A

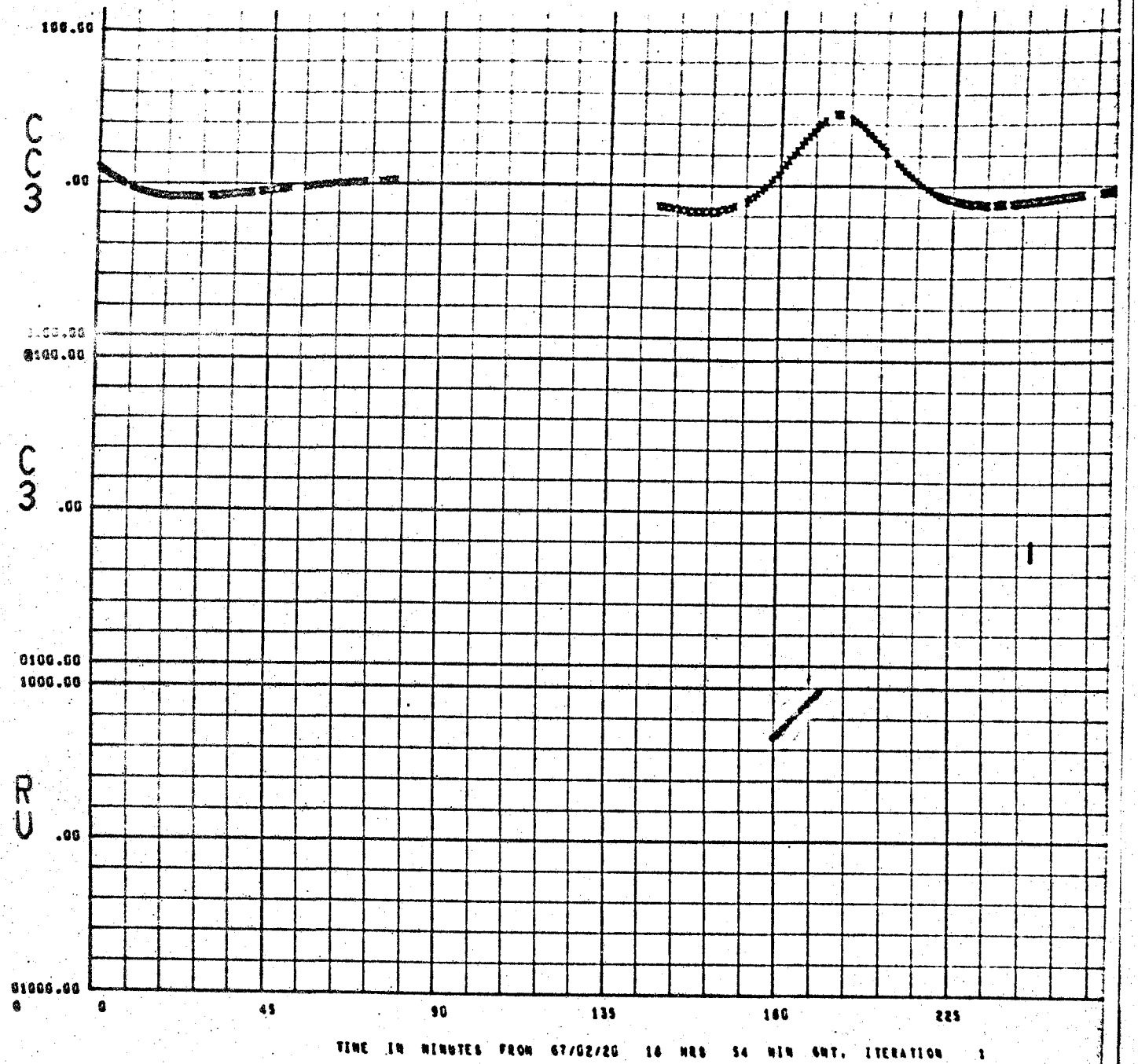
SIMPLE MOON



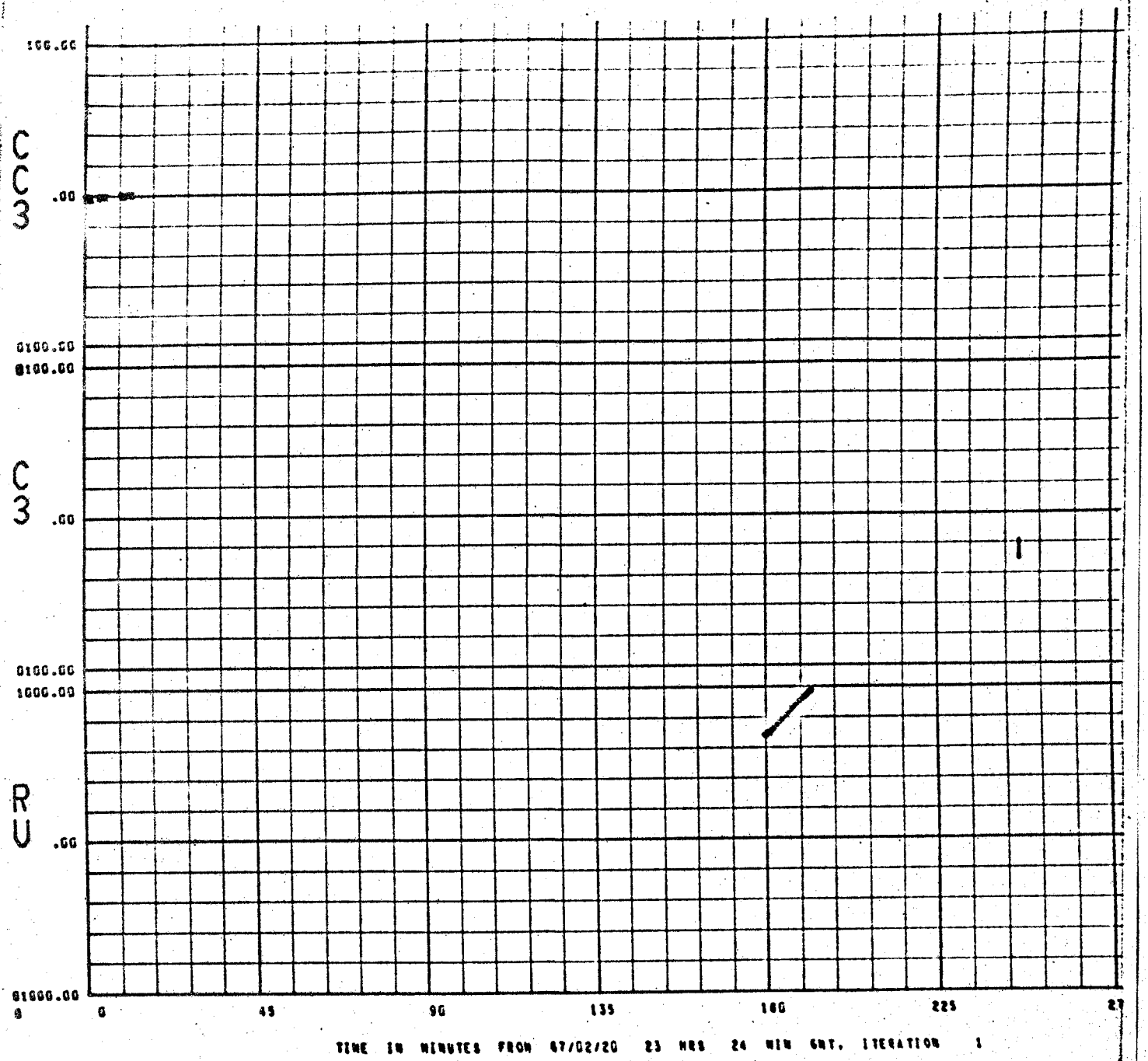
STATION 62 RESIDUALS PASS NUMBER 16/051

REV LTR

UB 4288-2000 REV. 6/64

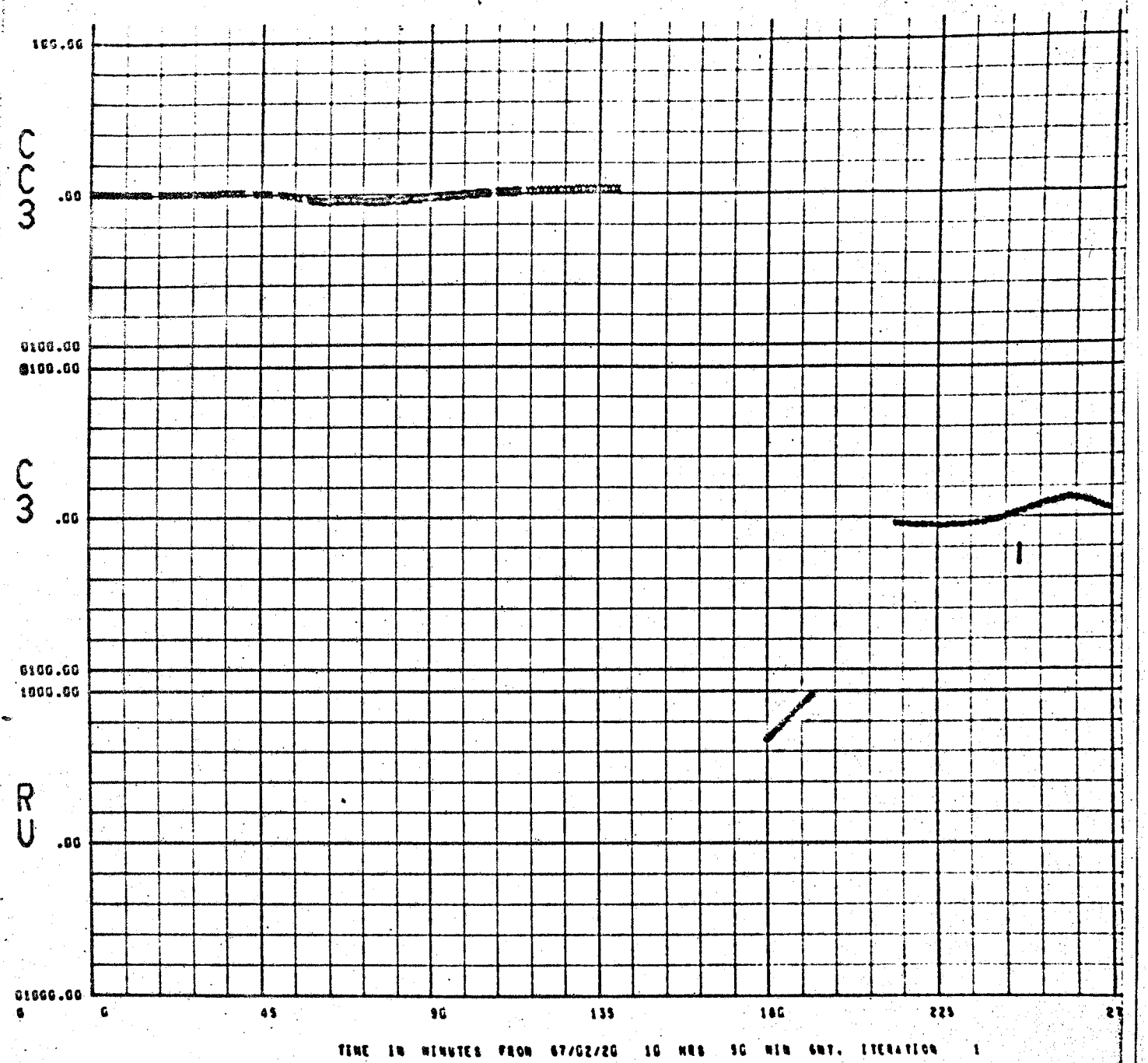


STATION 62 RESIDUALS PASS NUMBER 16/051

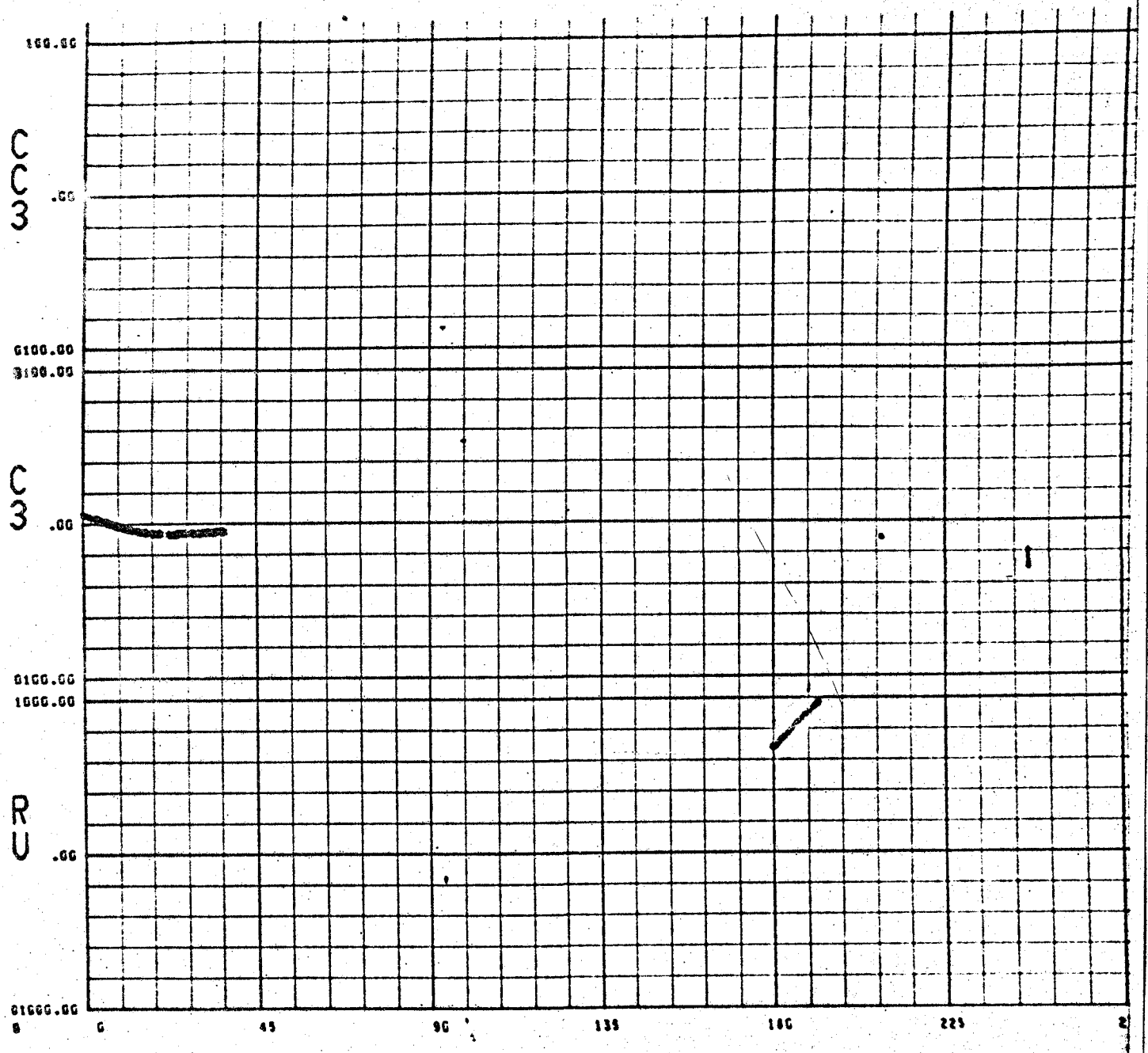


STATION 62 RESIDUALS PASS NUMBER 16/051

REV LTR



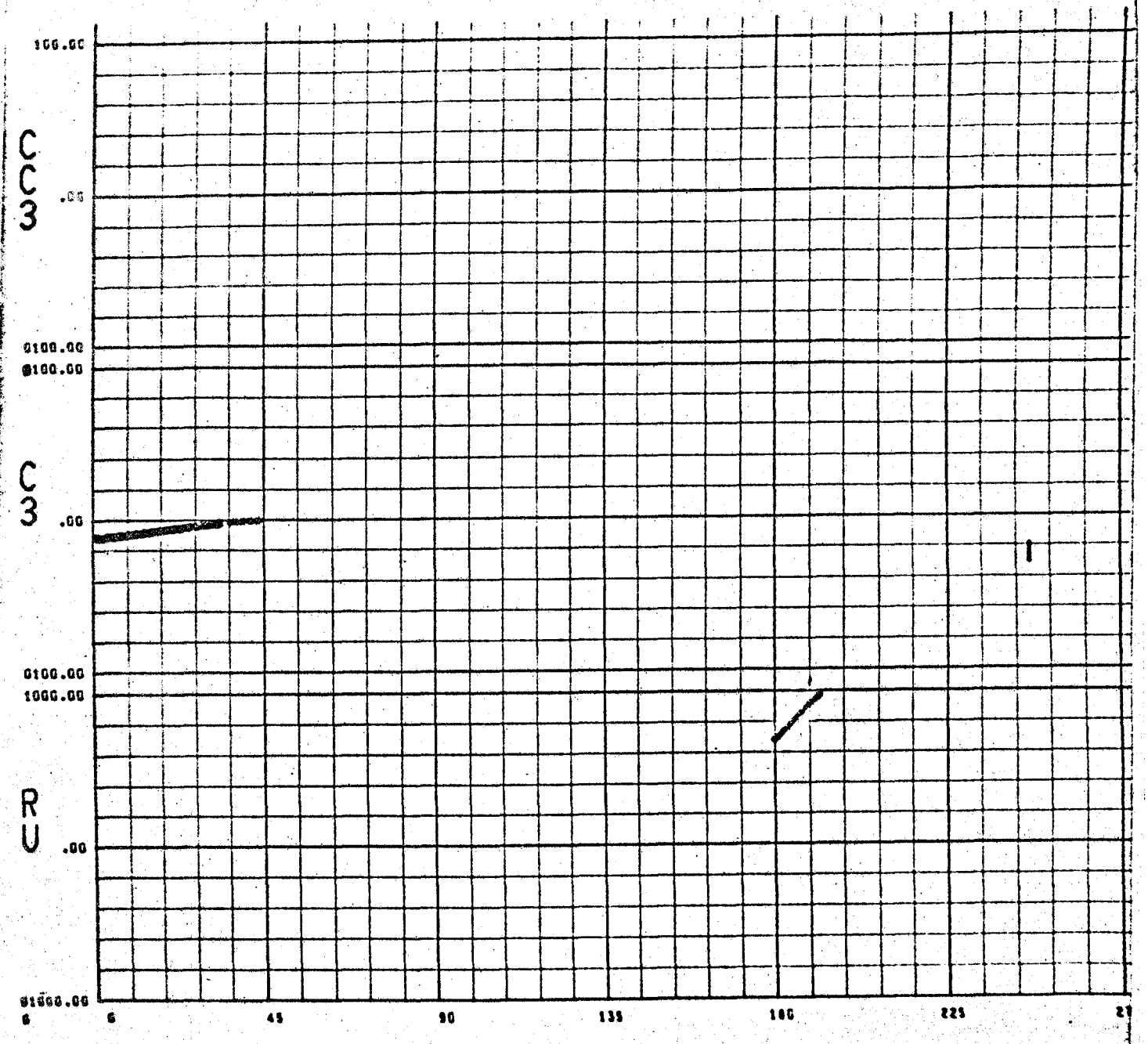
STATION 41 RESIDUALS PASS NUMBER 16/051



STATION 41 RESIDUALS PASS NUMBER 16/051

REV LTR

U3 4288-2000 REV. 6/64



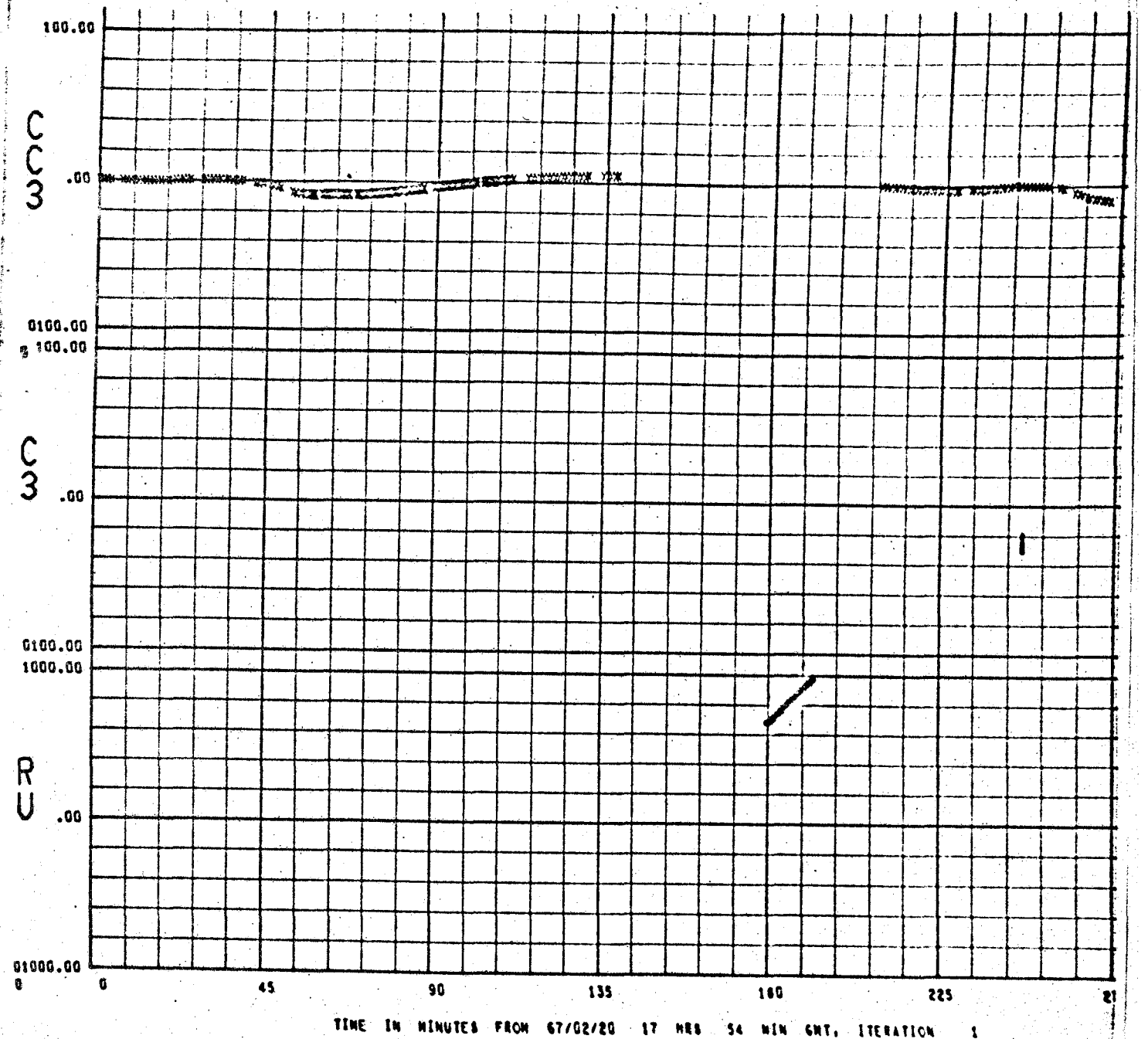
STATION 12 RESIDUALS PASS NUMBER 16/051

REV LTR

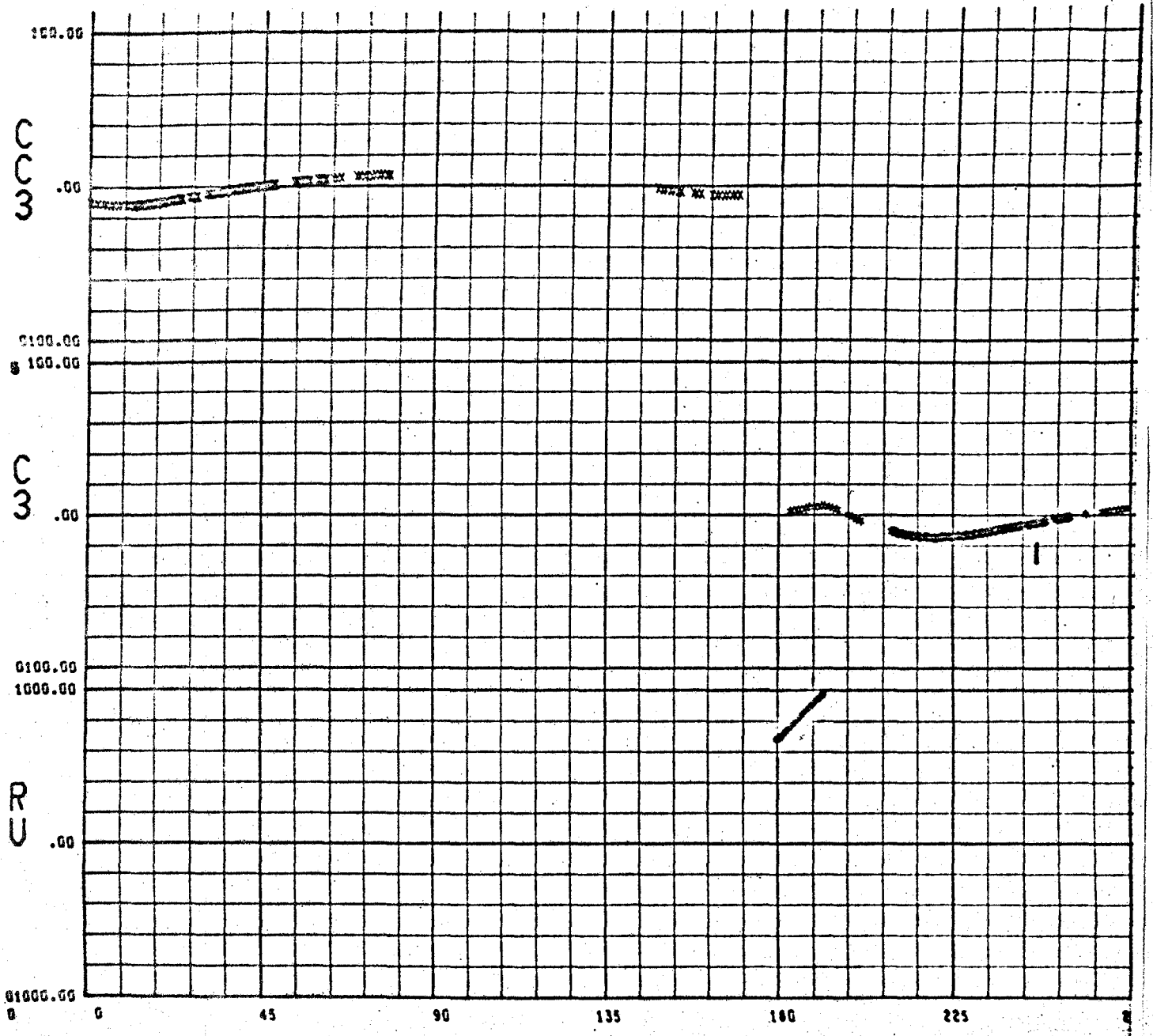
U3 4288-2000 REV. 6/64

ODPL 3S25

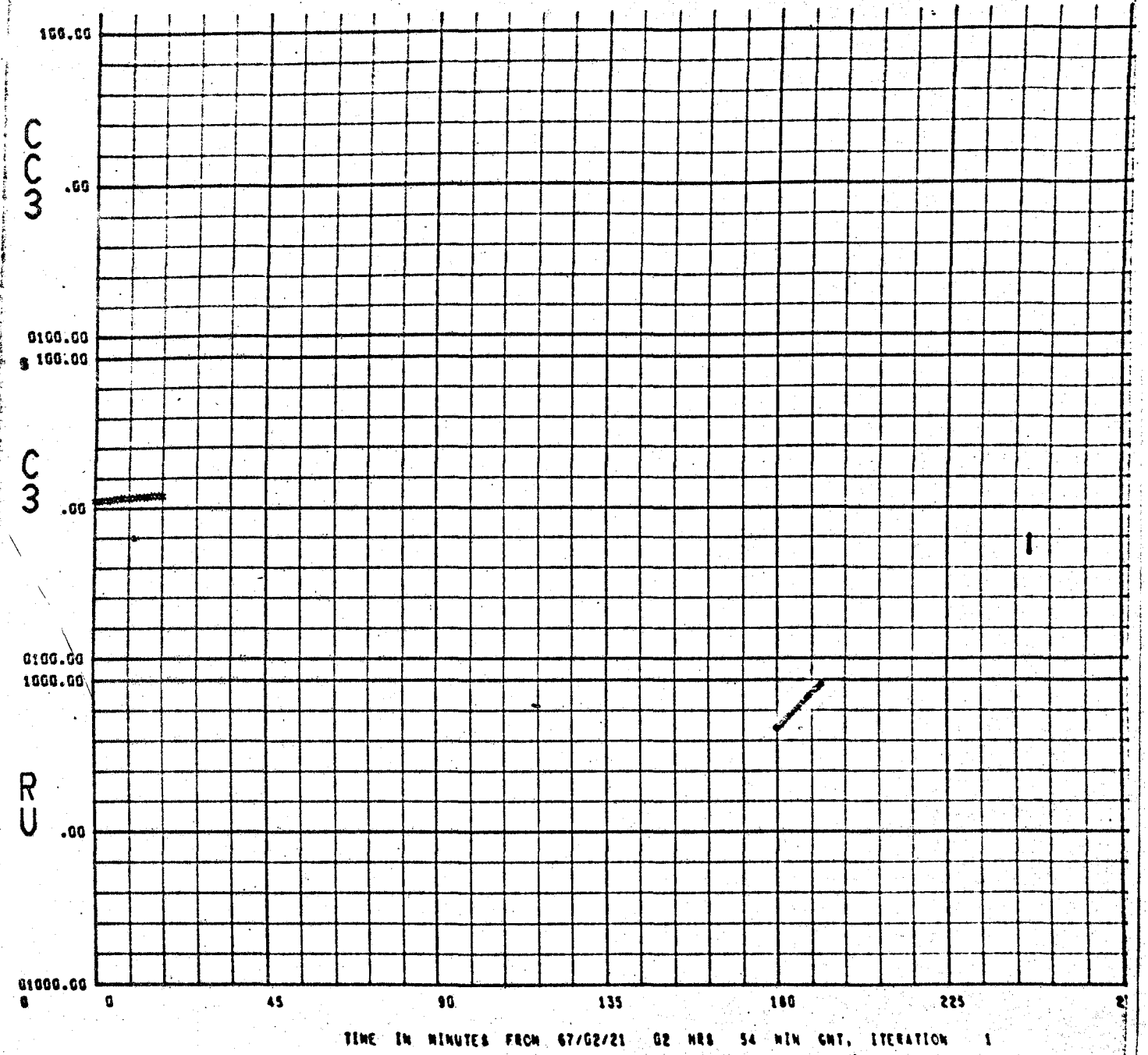
SIMPLE MOON



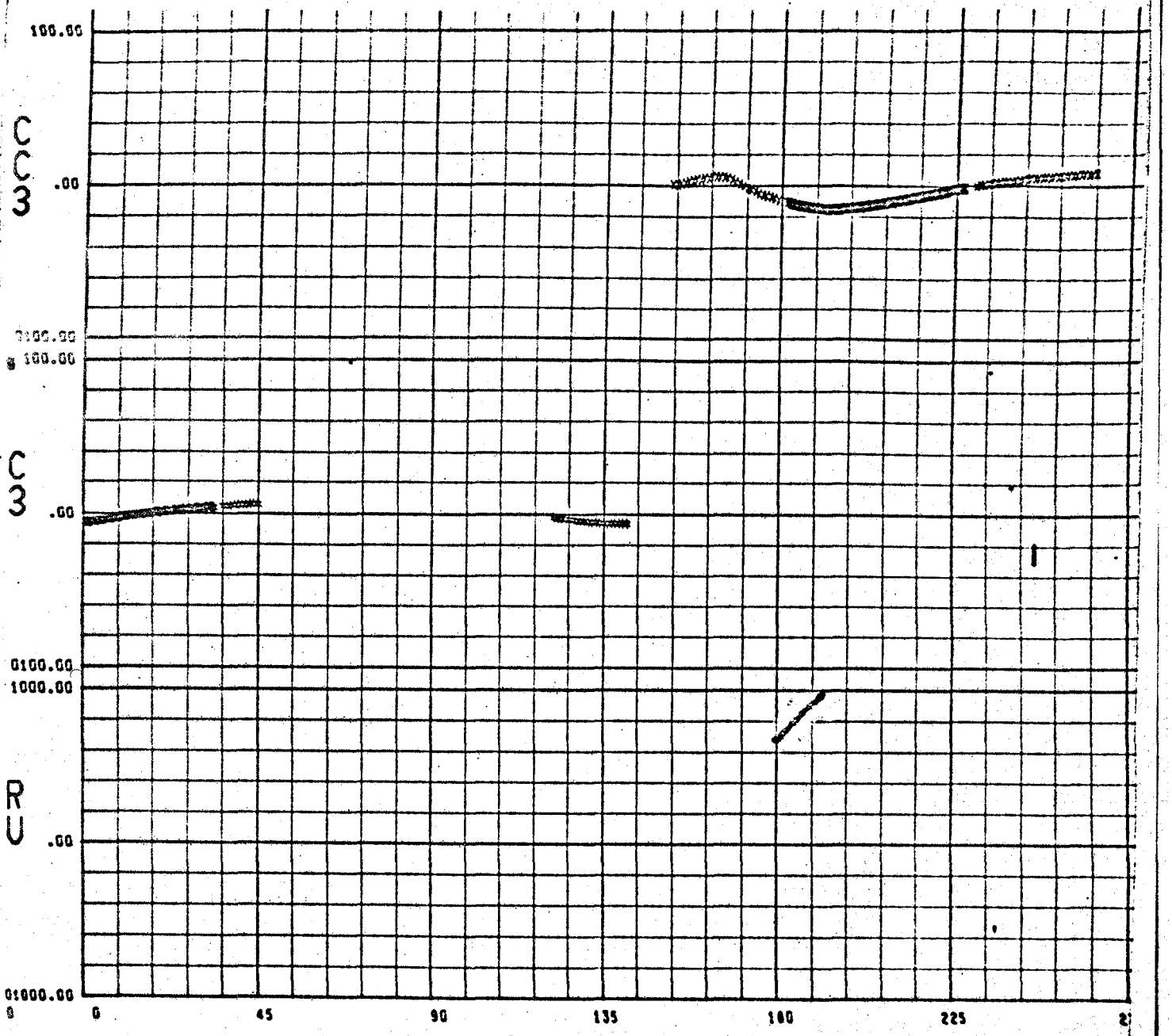
STATION 62 RESIDUALS PASS NUMBER 16/051



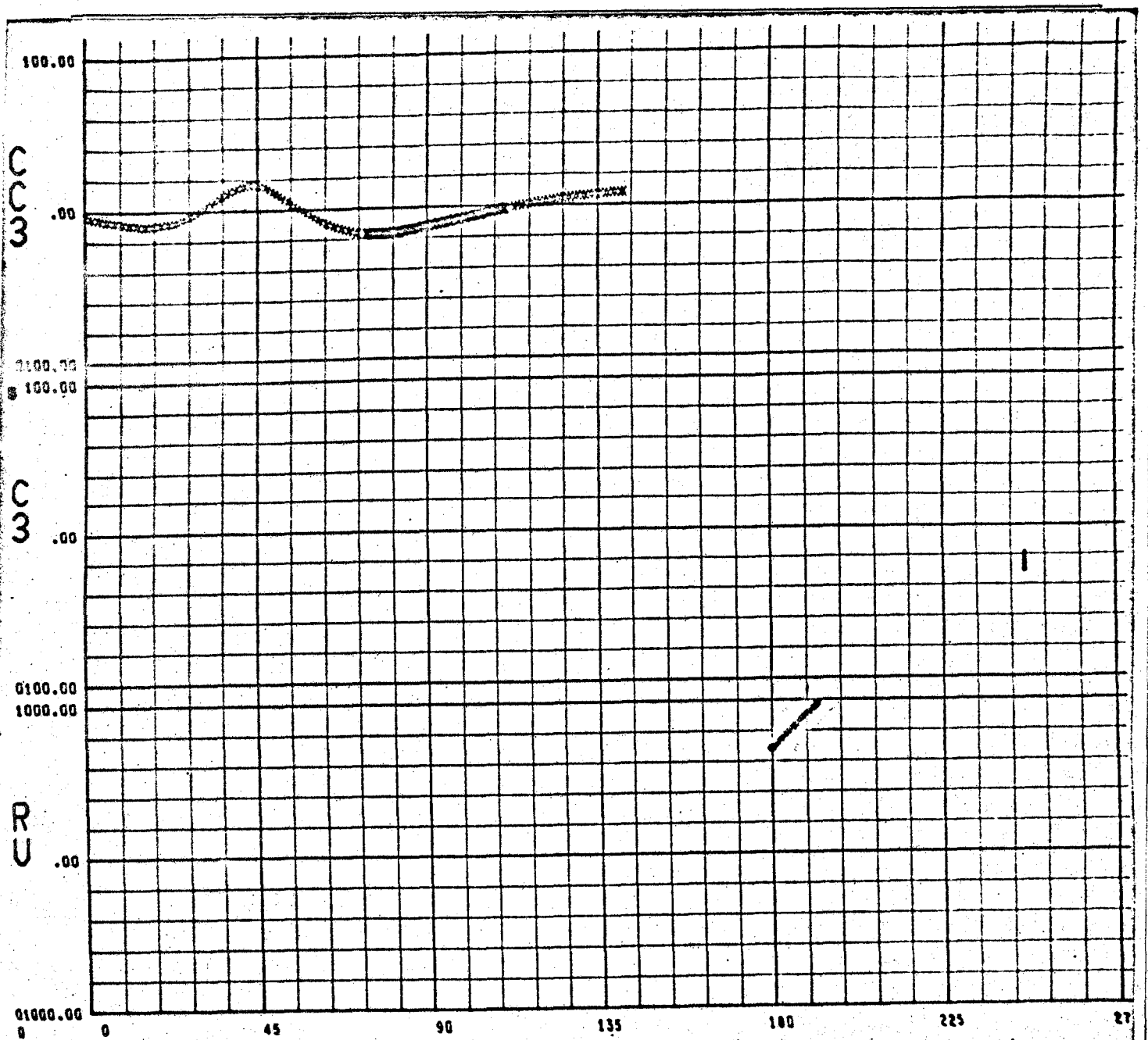
STATION 62 RESIDUALS PASS NUMBER 16/051



STATION 62 RESIDUALS PASS NUMBER 16/051



STATION 12 RESIDUALS PASS NUMBER 16/051

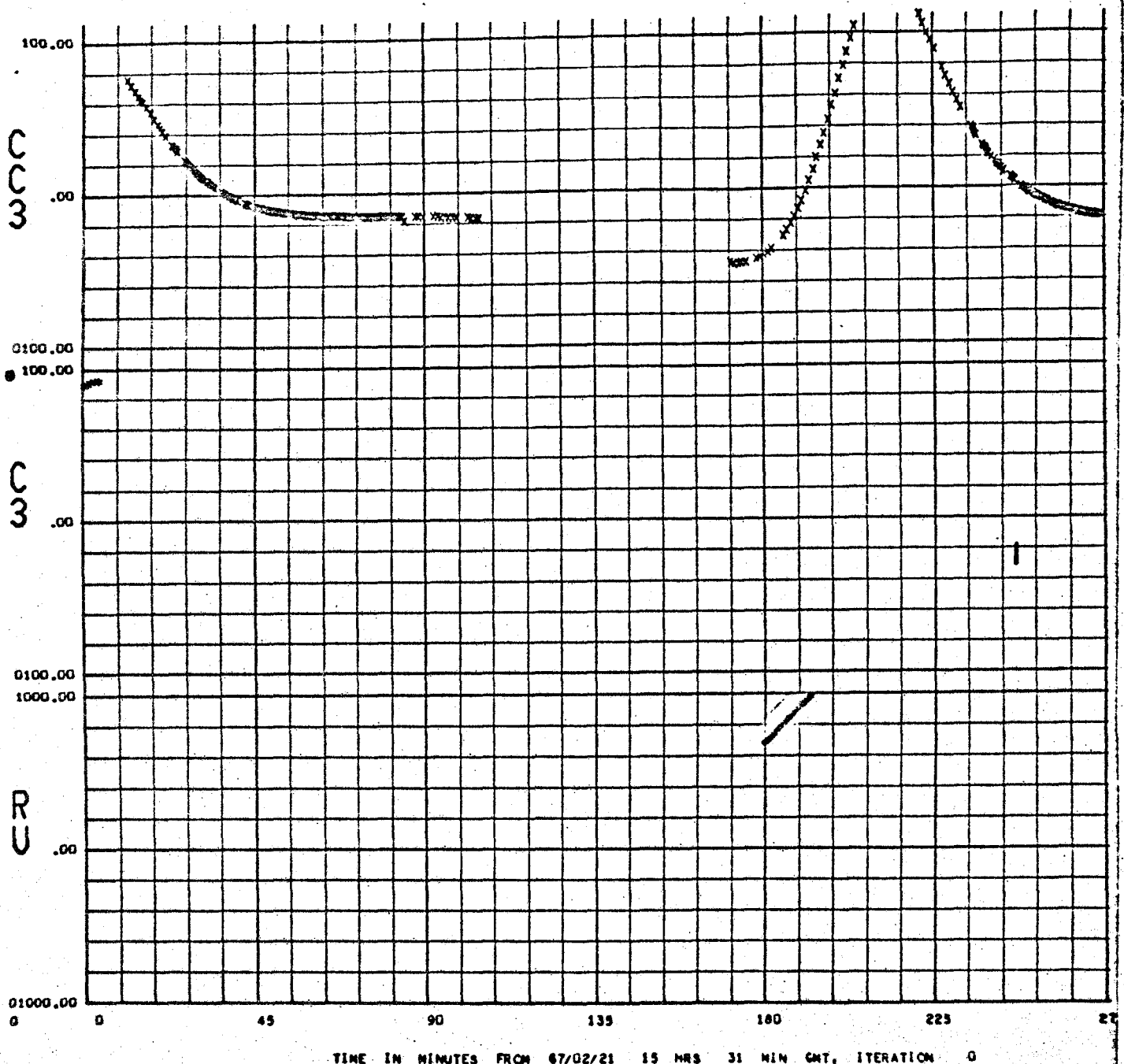


STATION 12 RESIDUALS PASS NUMBER 16/051

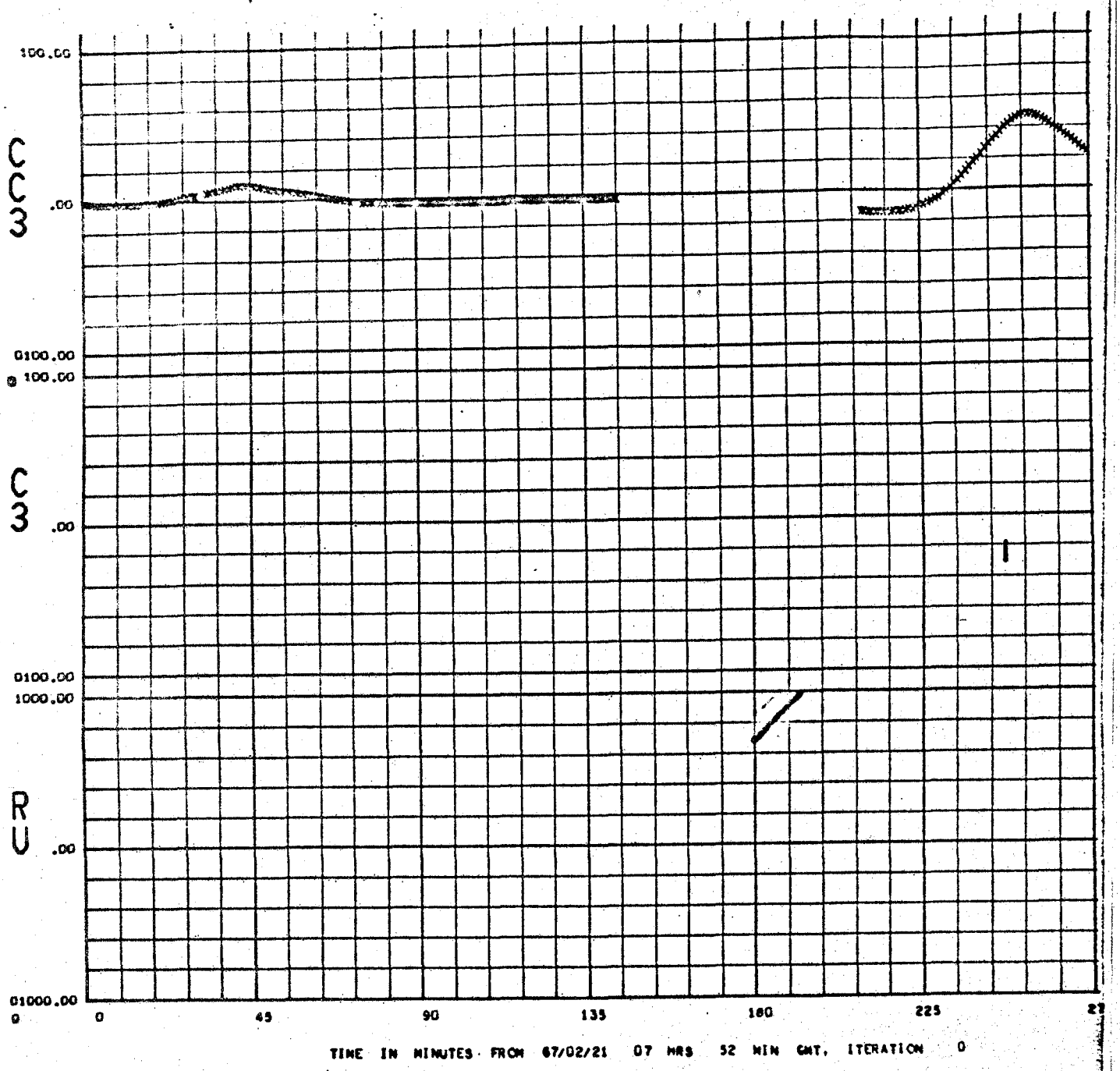
REV LTR

ODPL 3P10 I

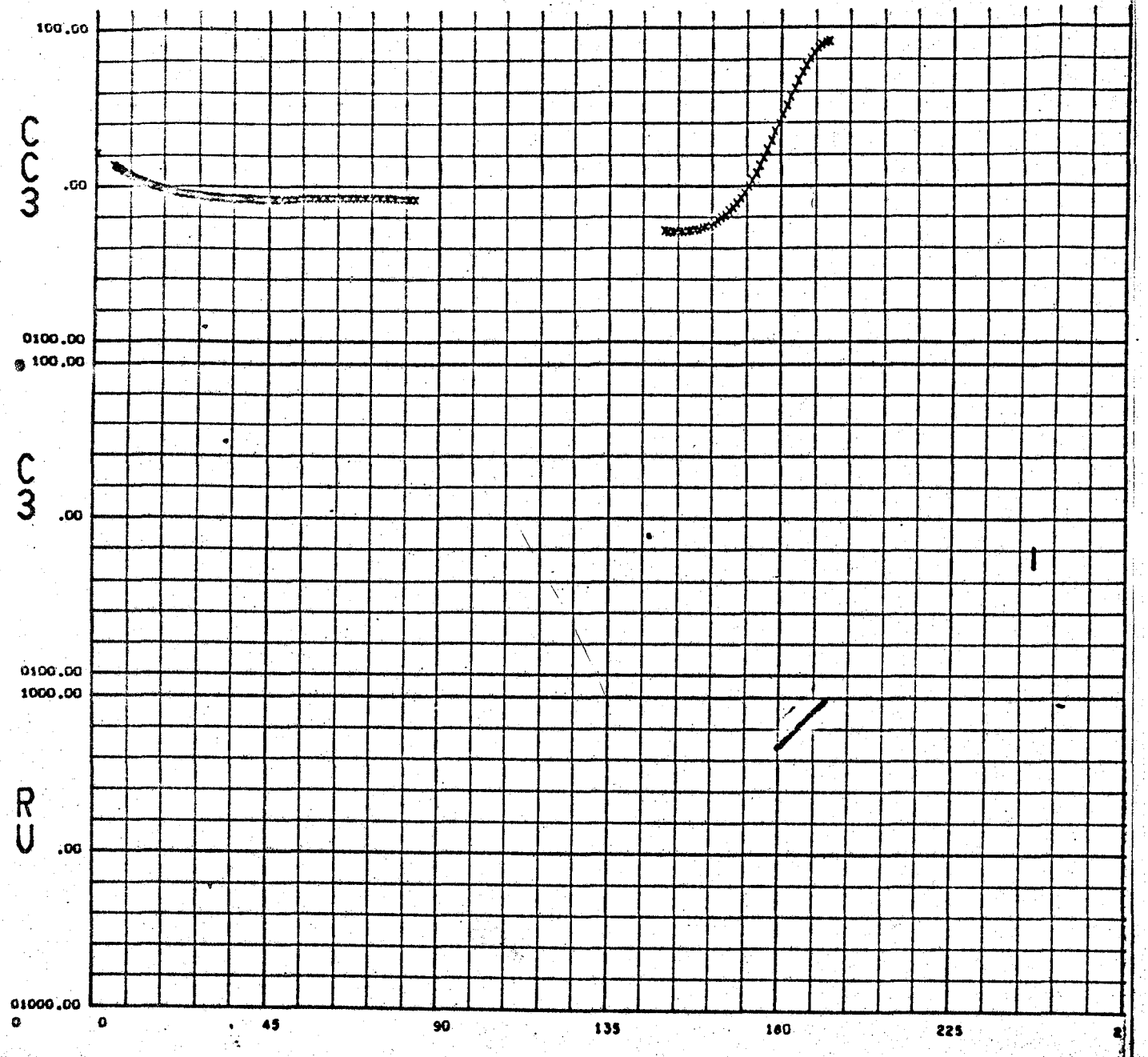
TEM 60SIMPL I



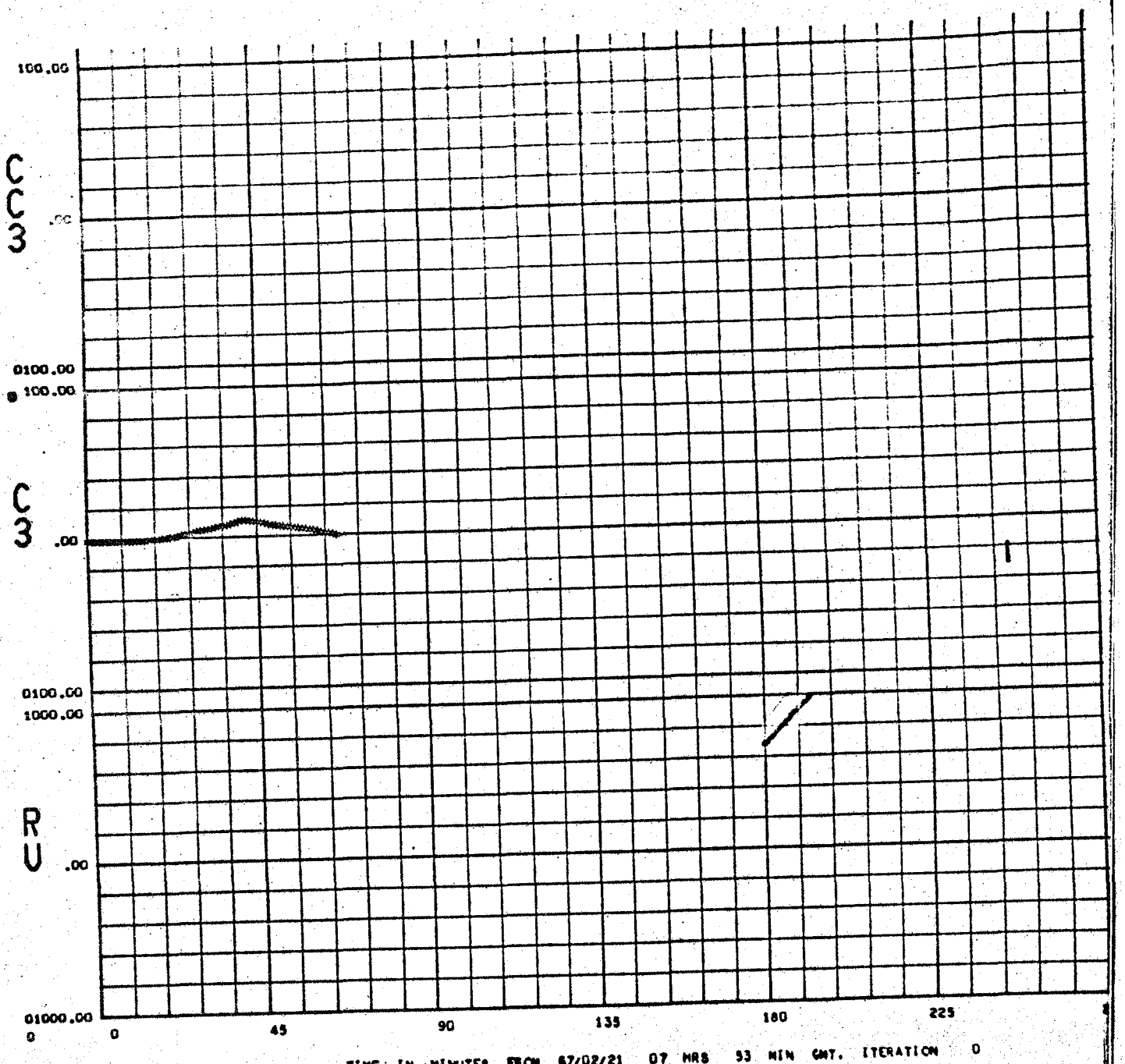
STATION 62 RESIDUALS PASS NUMBER 17/052



STATION 41 RESIDUALS PASS NUMBER 17/052



STATION 41 RESIDUALS PASS NUMBER 17/052

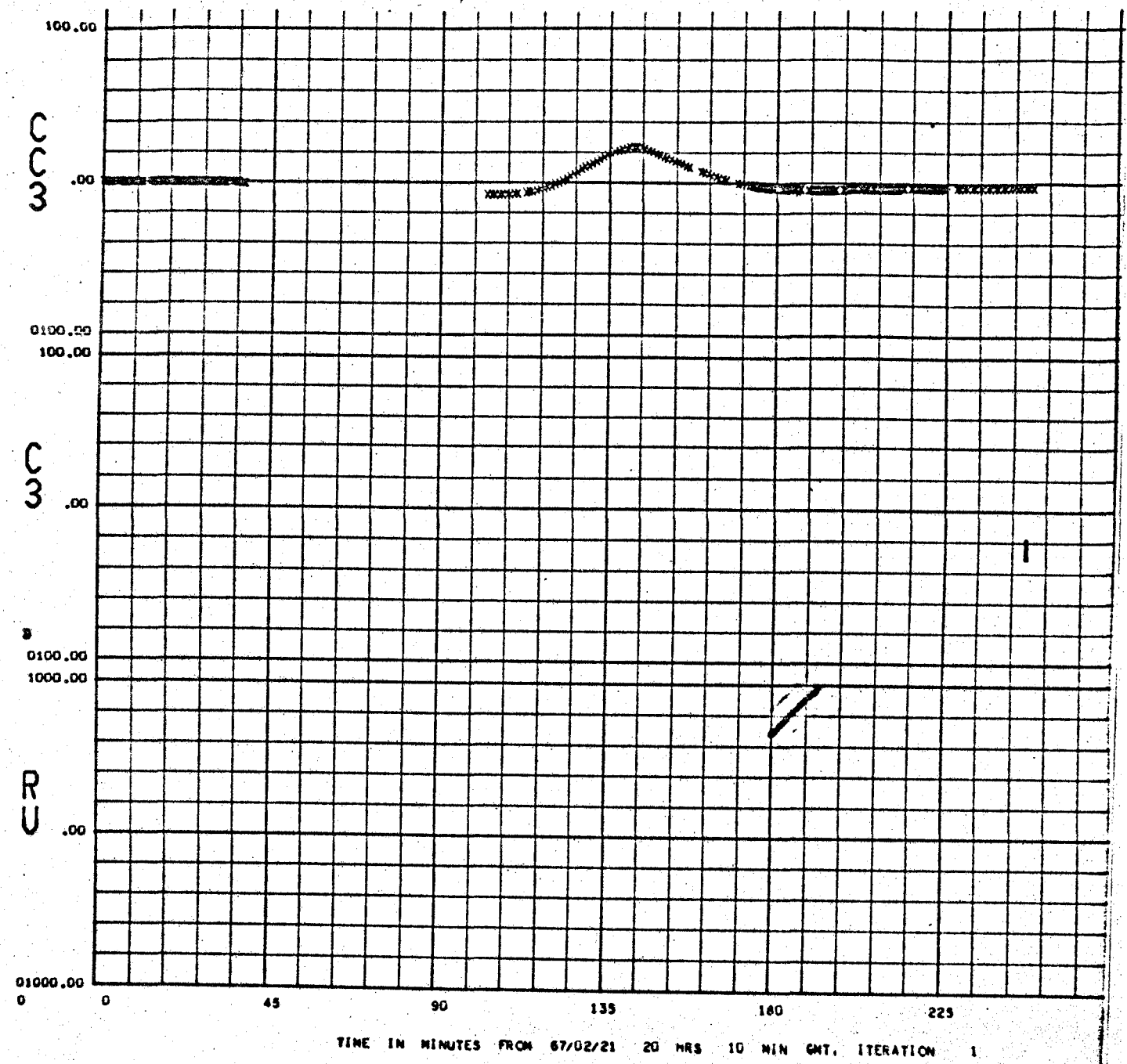


STATION 12 RESIDUALS

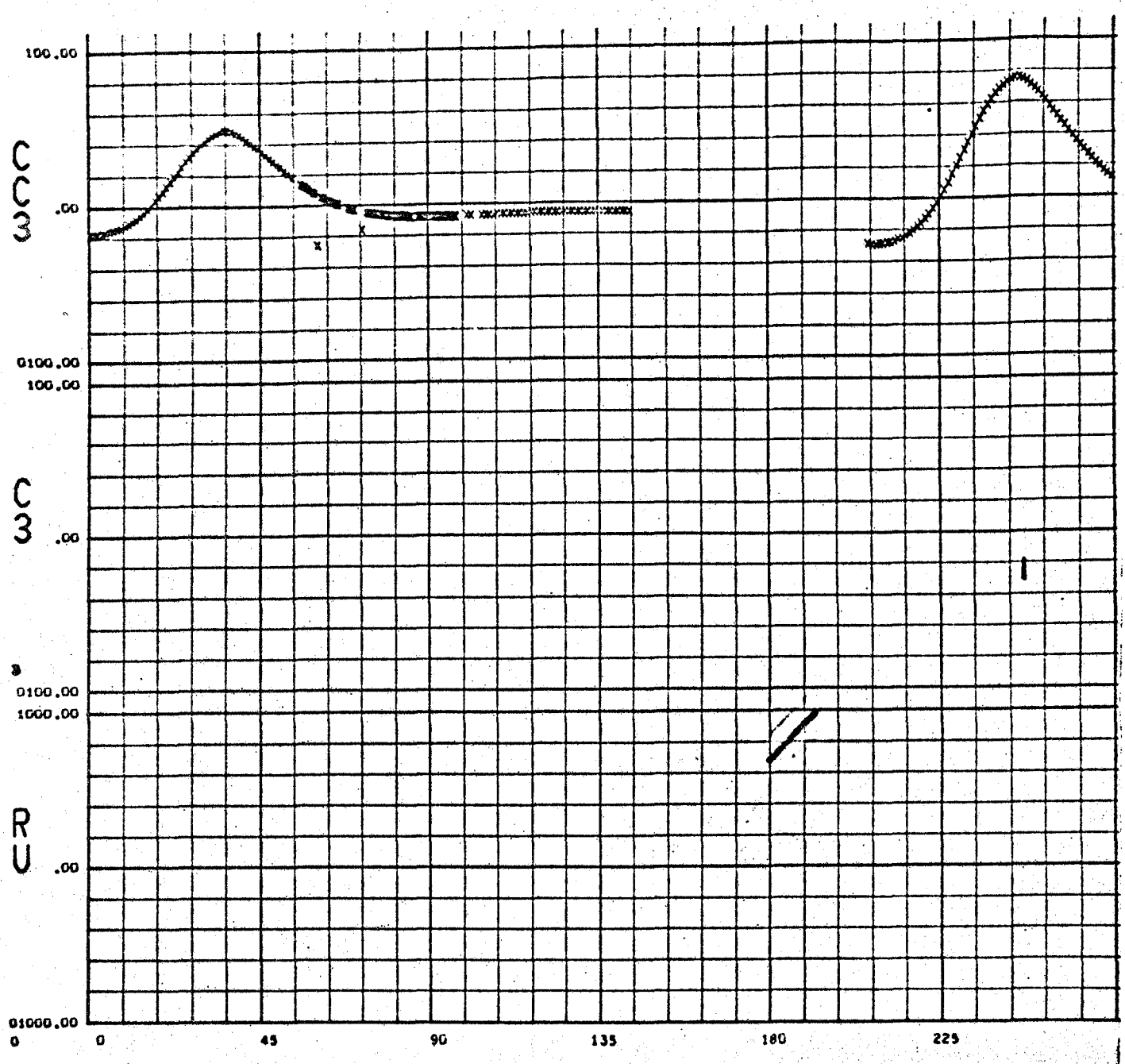
PASS NUMBER 16/051

ODPL 3P11

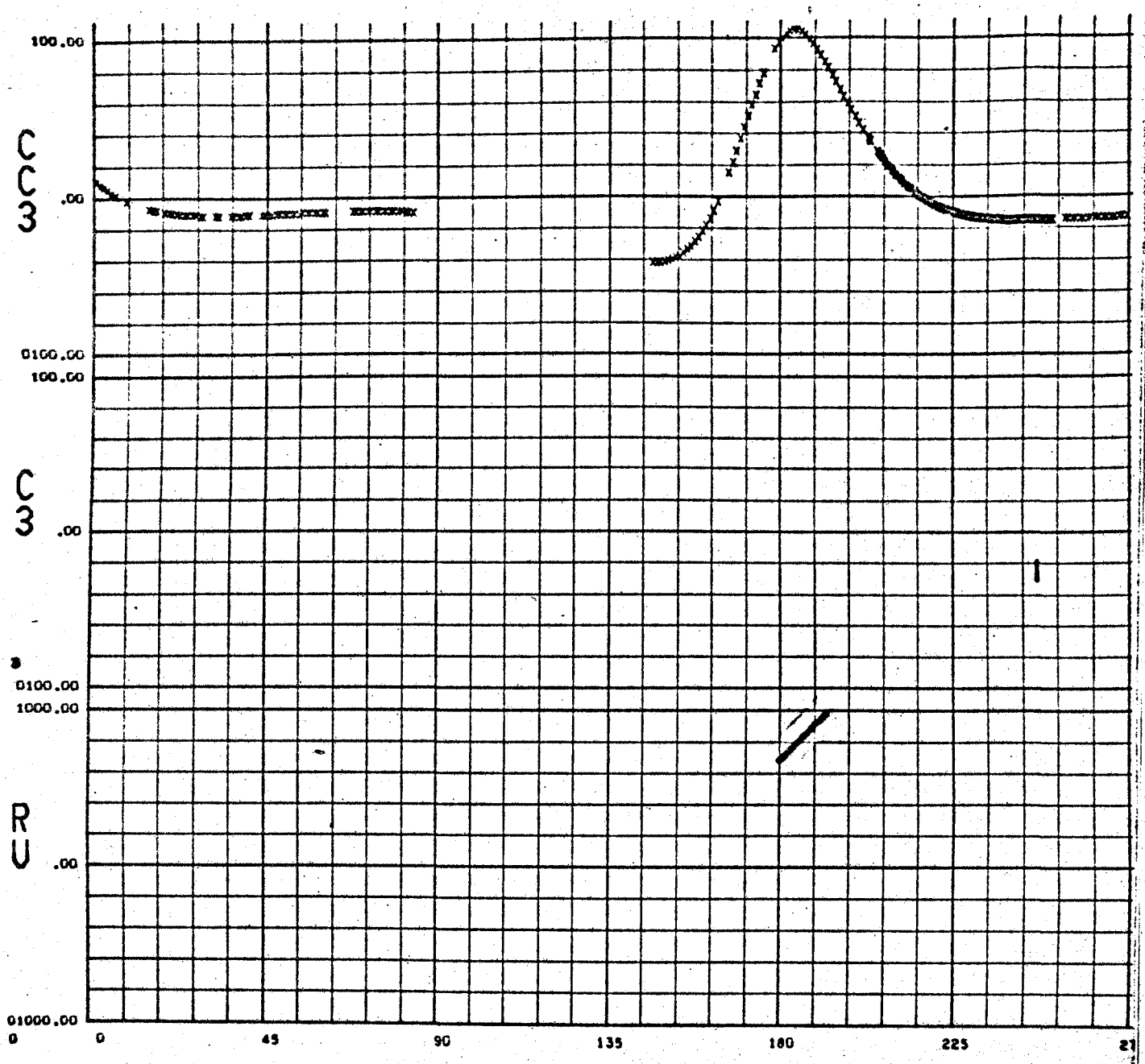
SIMPLE MOON



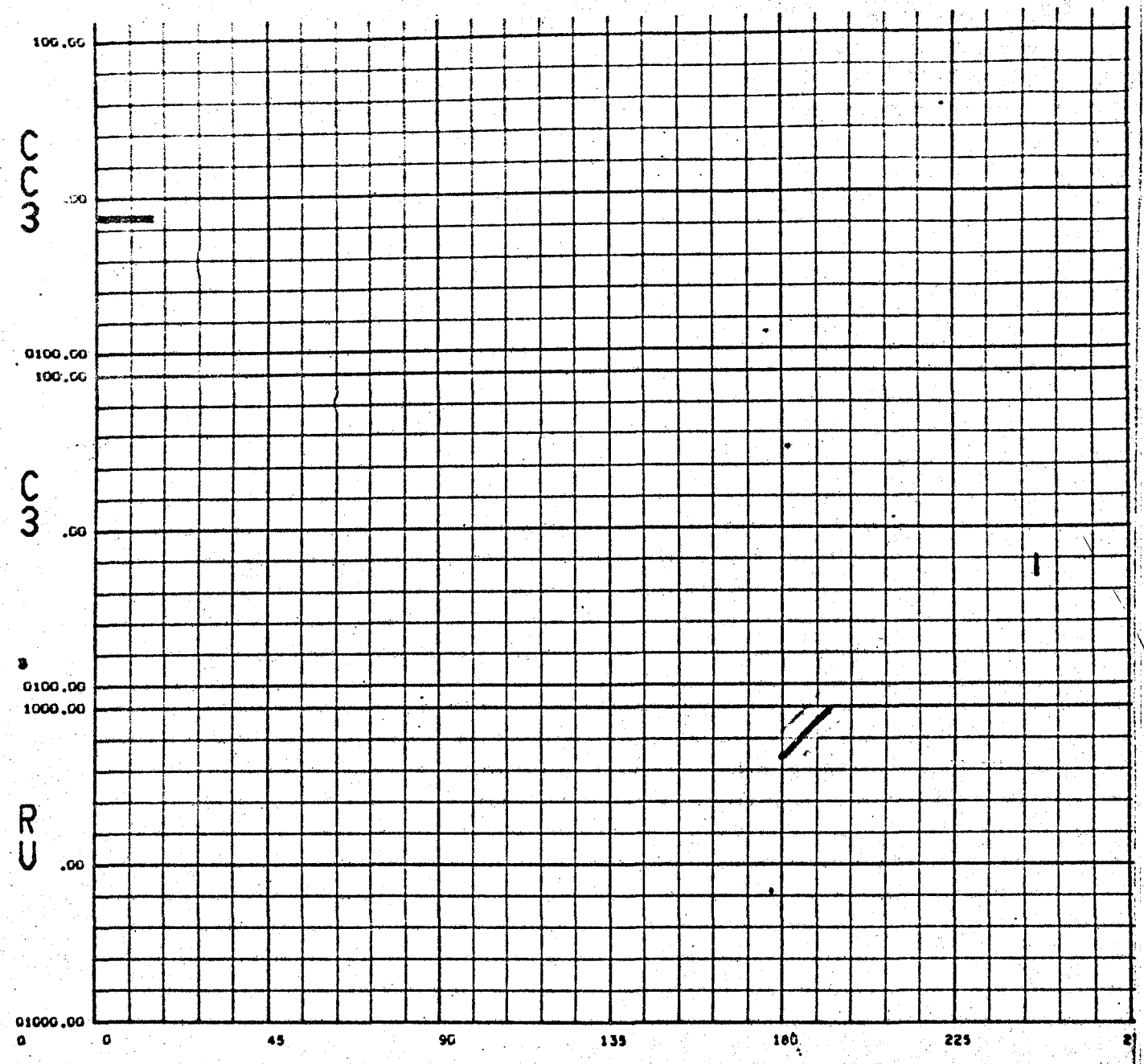
STATION 62 RESIDUALS PASS NUMBER 17/052



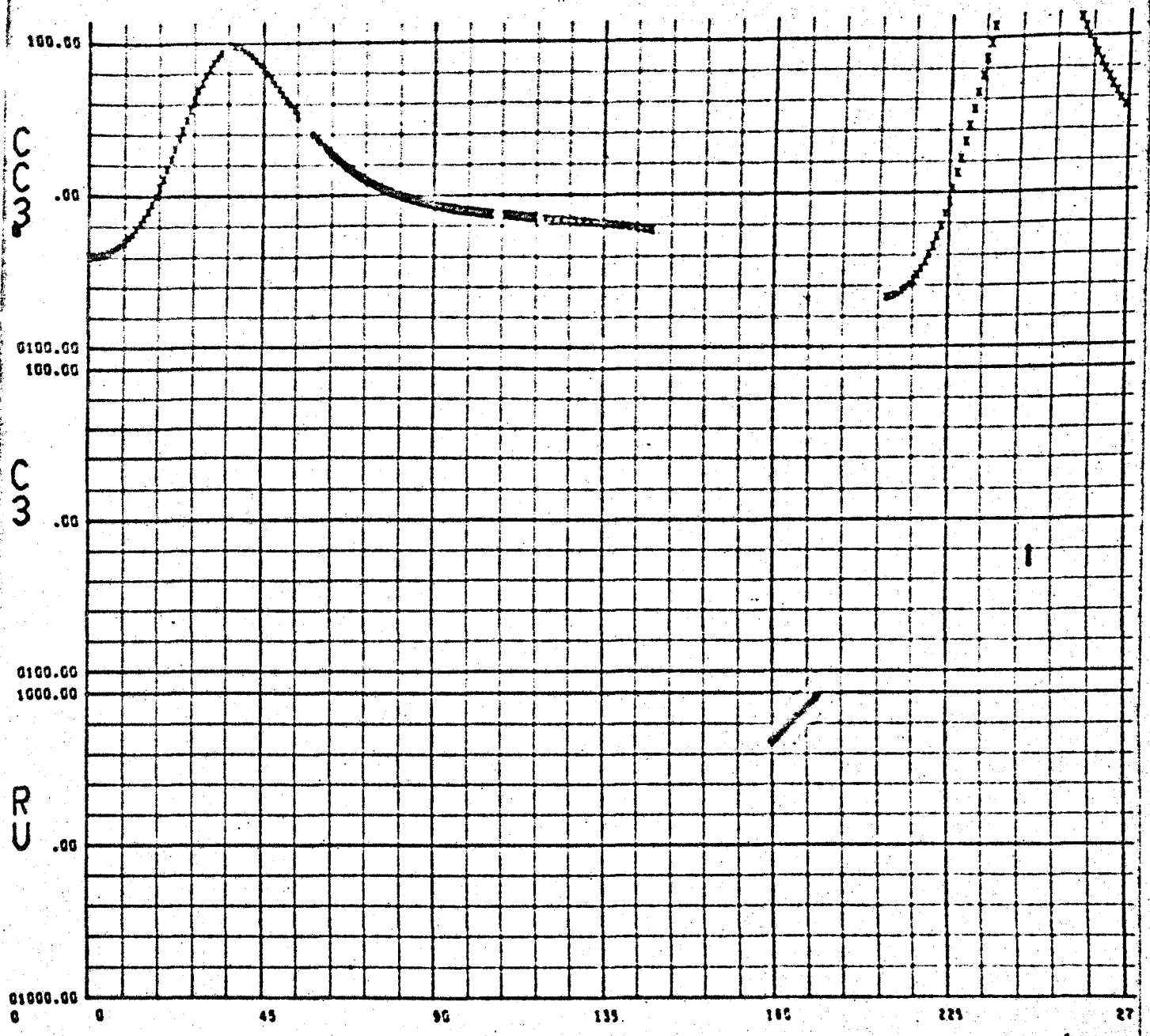
STATION 12 RESIDUALS PASS NUMBER 17/053



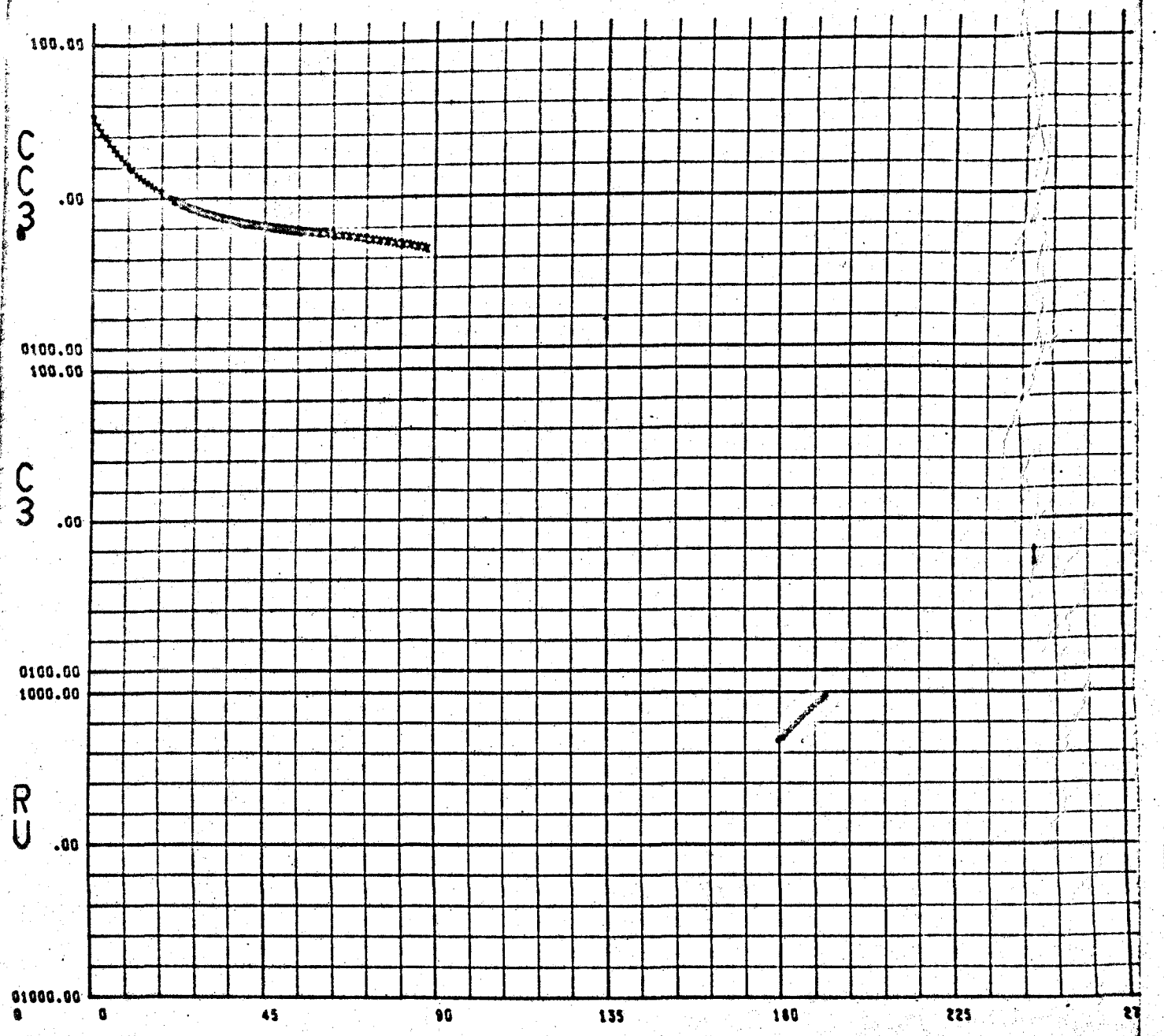
STATION 12 RESIDUALS PASS NUMBER 17/053



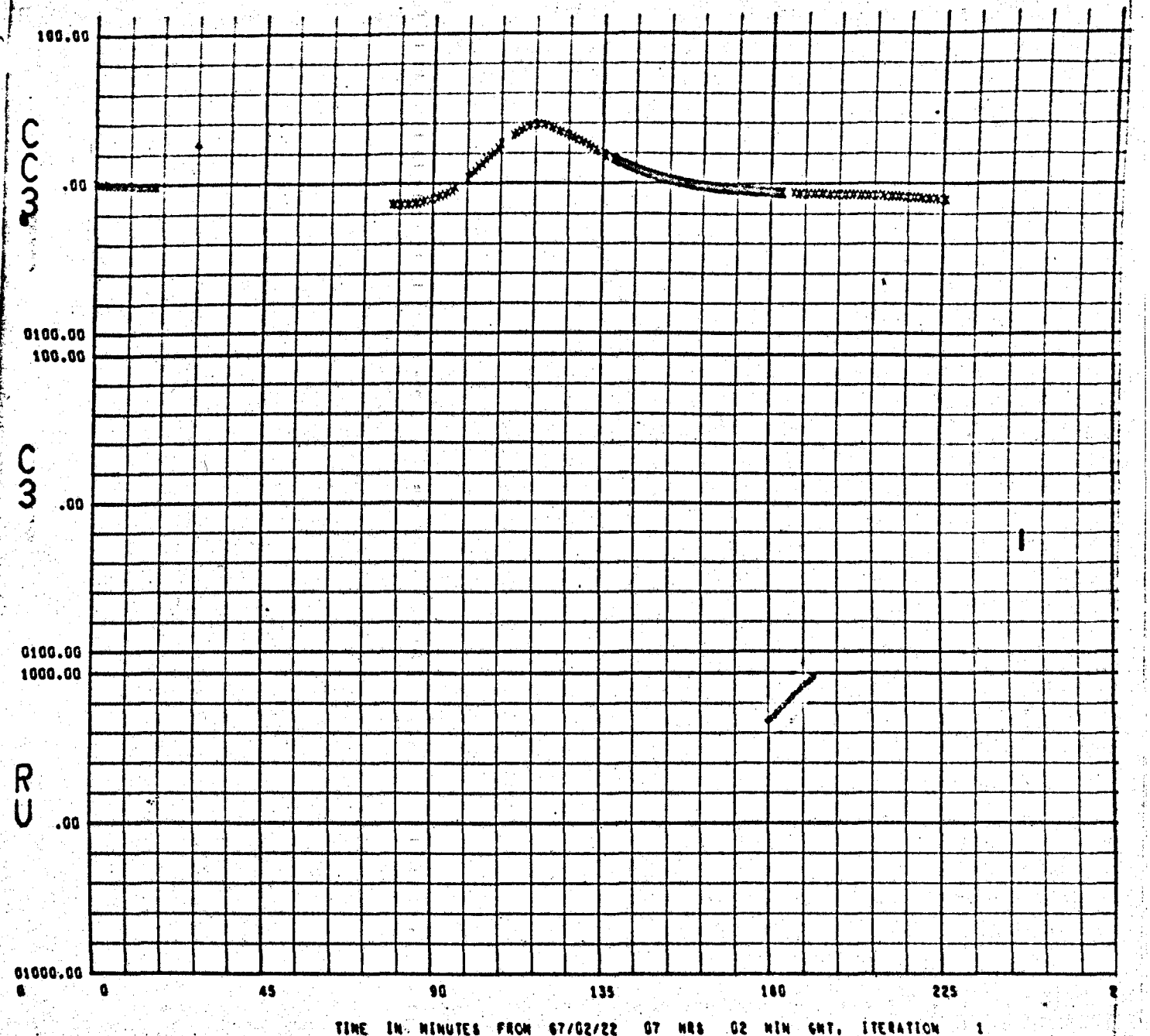
STATION 12 RESIDUALS PASS NUMBER 17/053



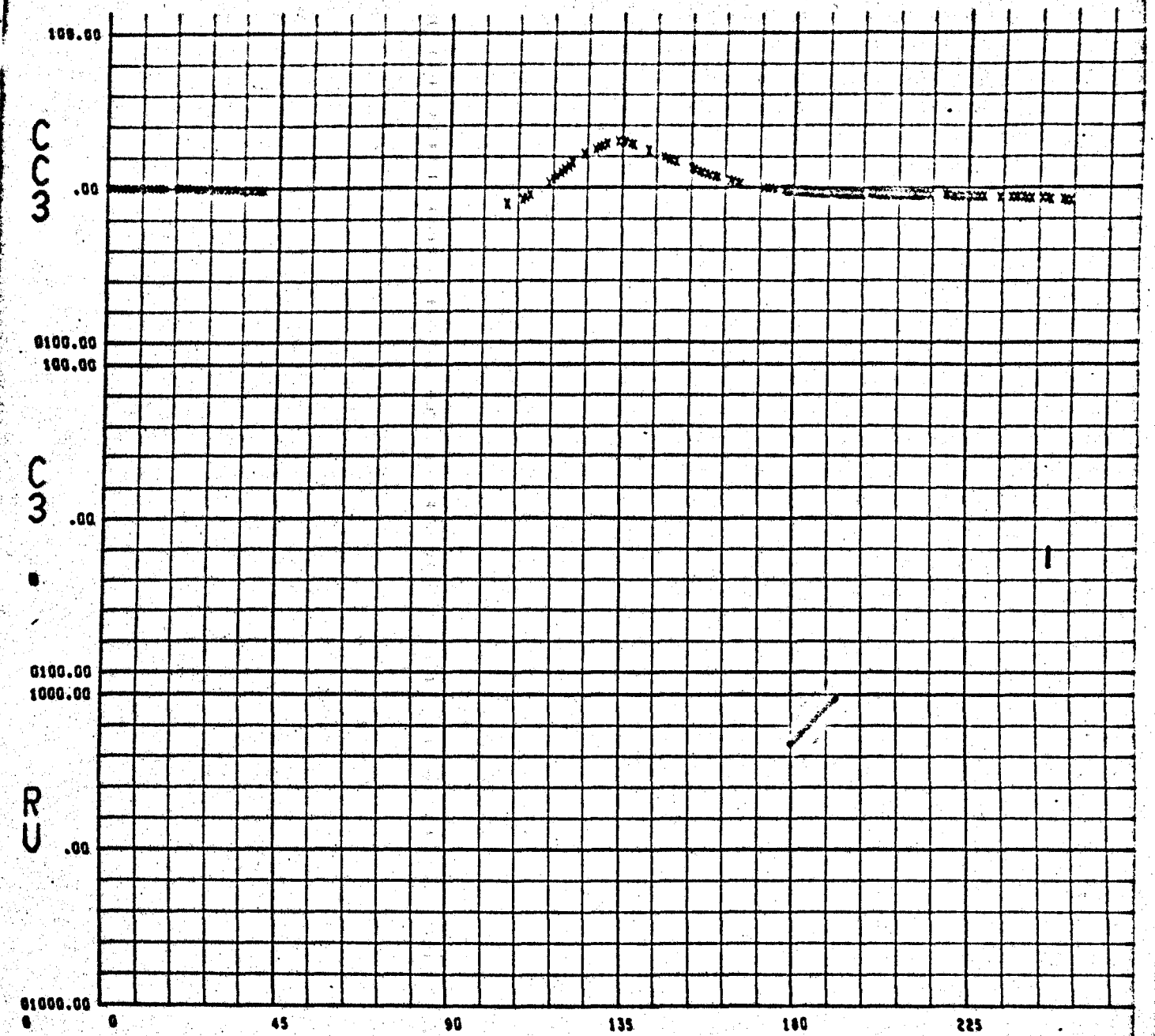
STATION 41 RESIDUALS PASS NUMBER 18/053



STATION 41 RESIDUALS PASS NUMBER 18/053



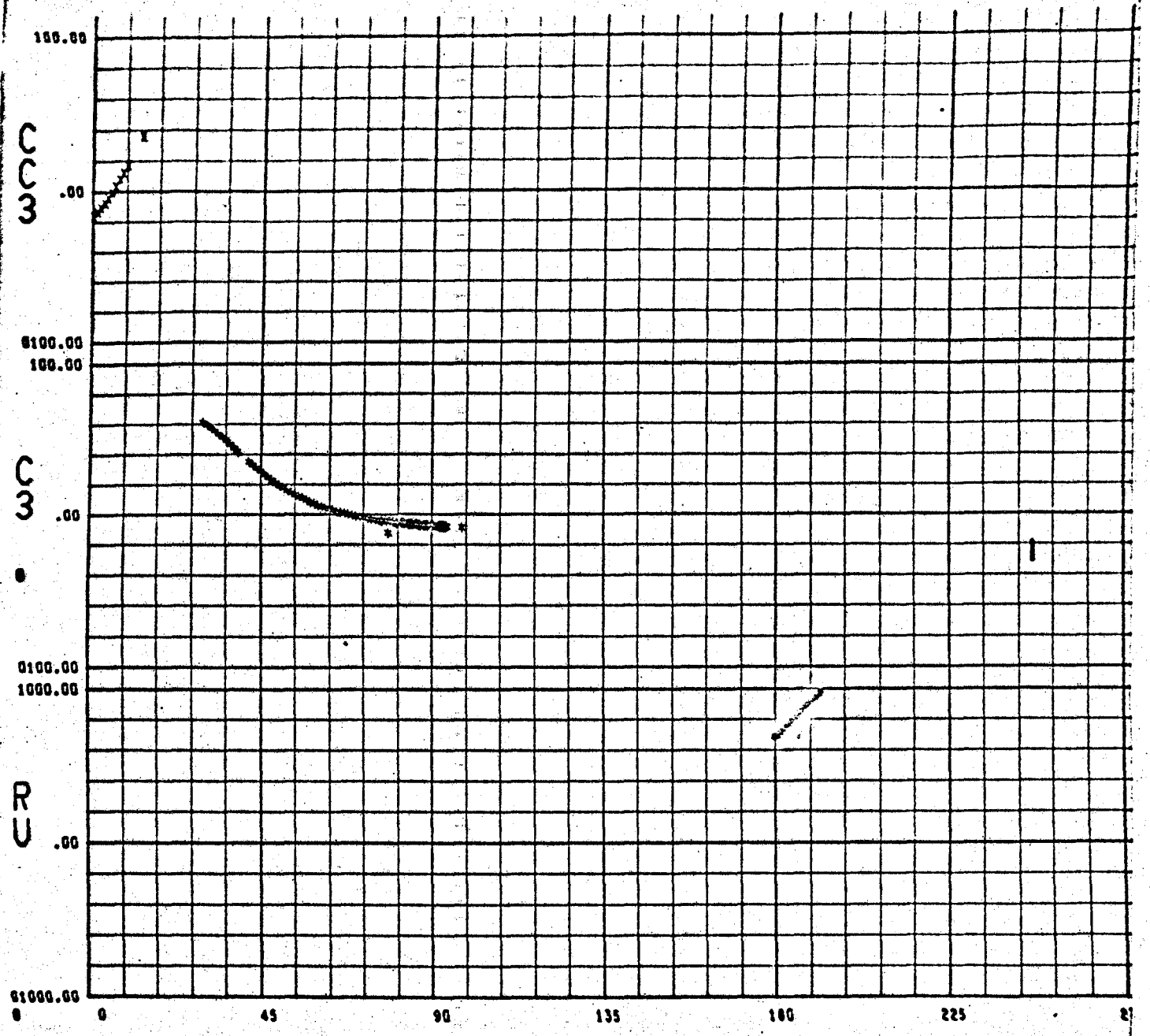
STATION 12 RESIDUALS PASS NUMBER 17/053

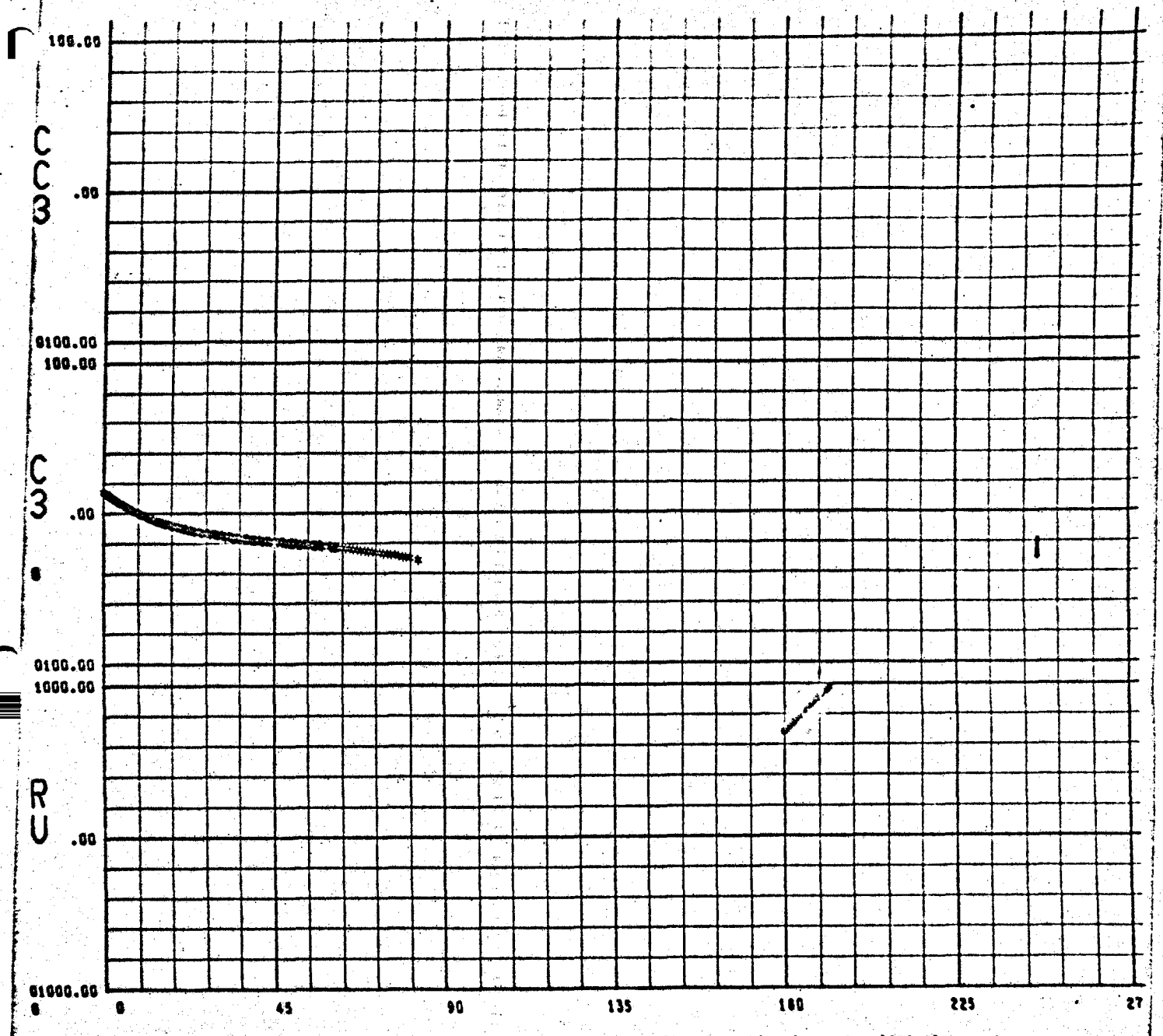


STATION 62 RESIDUALS PASS NUMBER 18/053

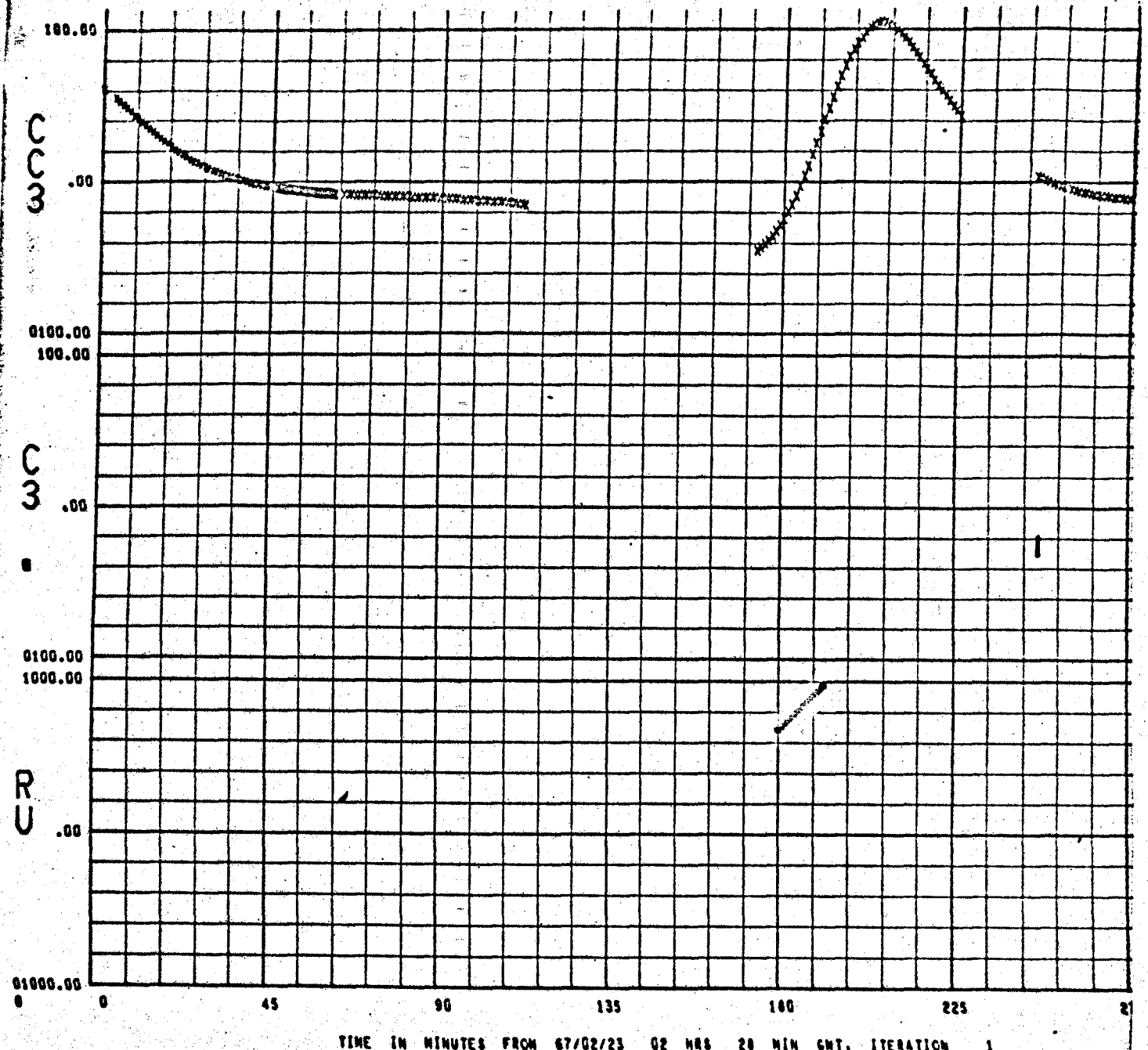
ODPL 3S30

SIMPLE MOON

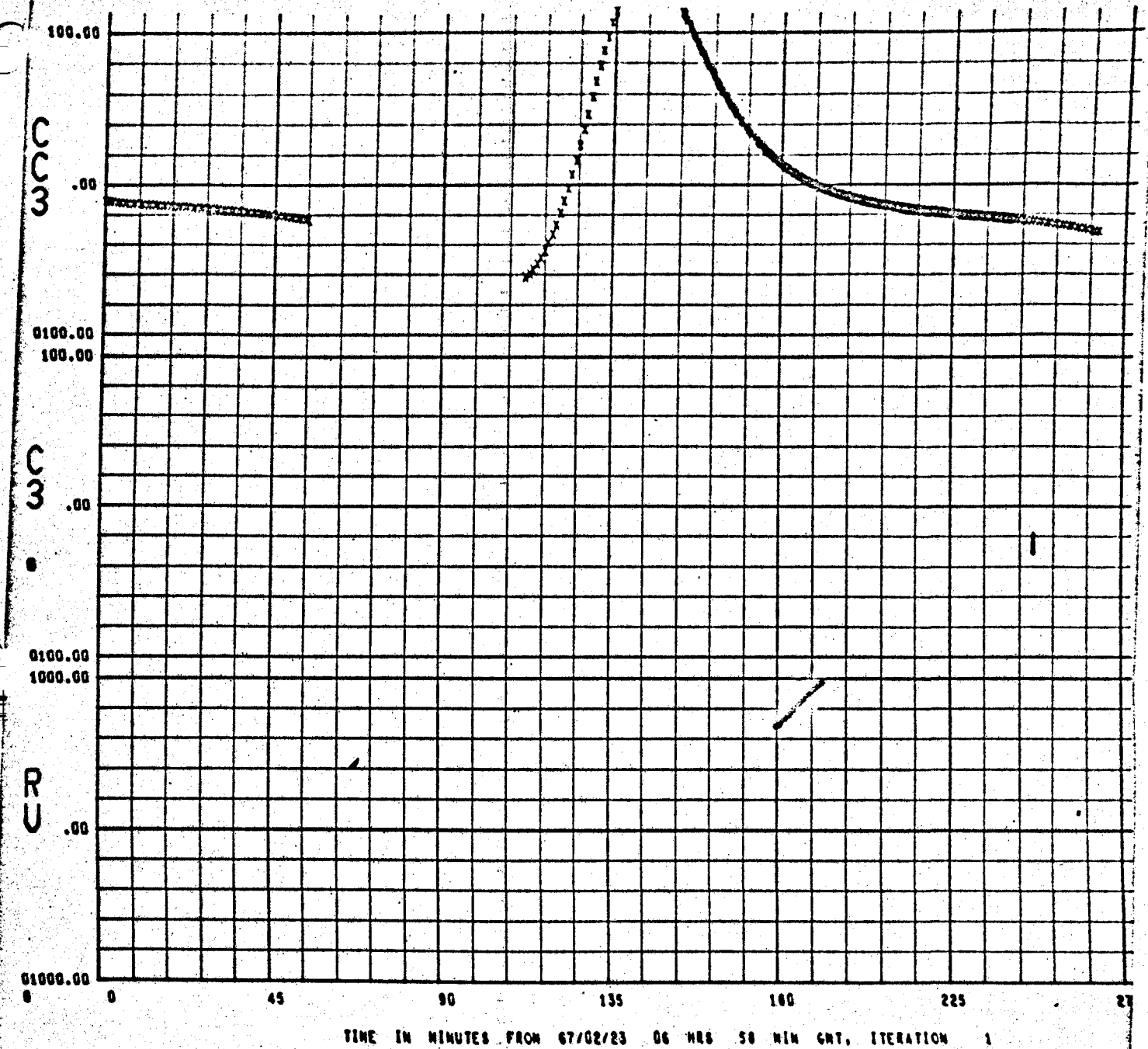

100.00
CC3
.00
-100.00
100.00
C3
.00
-100.00
1000.00
RU
.00
-1000.00
0
45
90
135
180
225
TIME IN MINUTES FROM 67/02/23 01 HRS 58 MIN GMT, ITERATION 1
STATION 62 RESIDUALS
PASS NUMBER 18/053



STATION 41 RESIDUALS PASS NUMBER 19/054



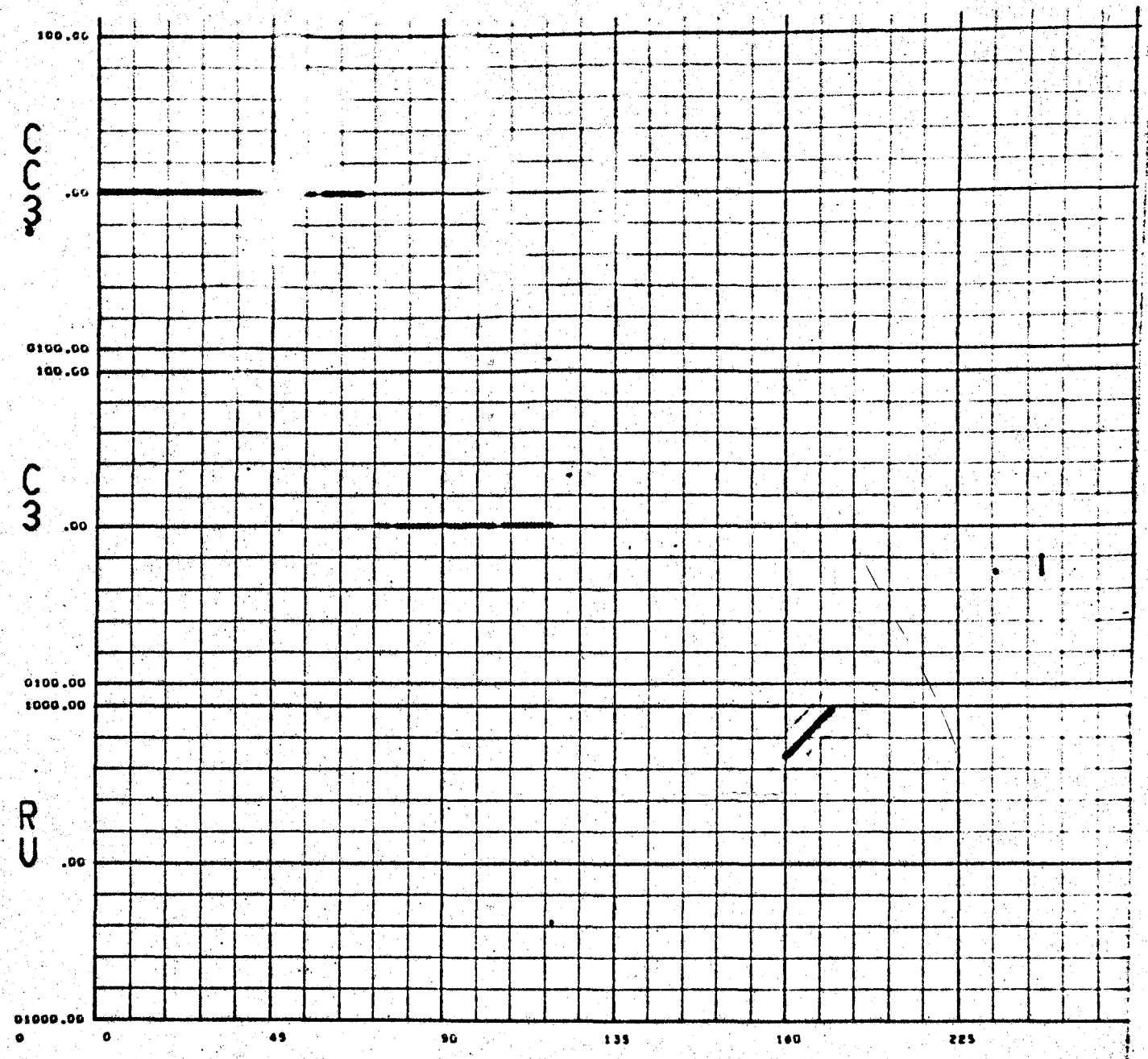
STATION 12 RESIDUALS PASS NUMBER 18/054



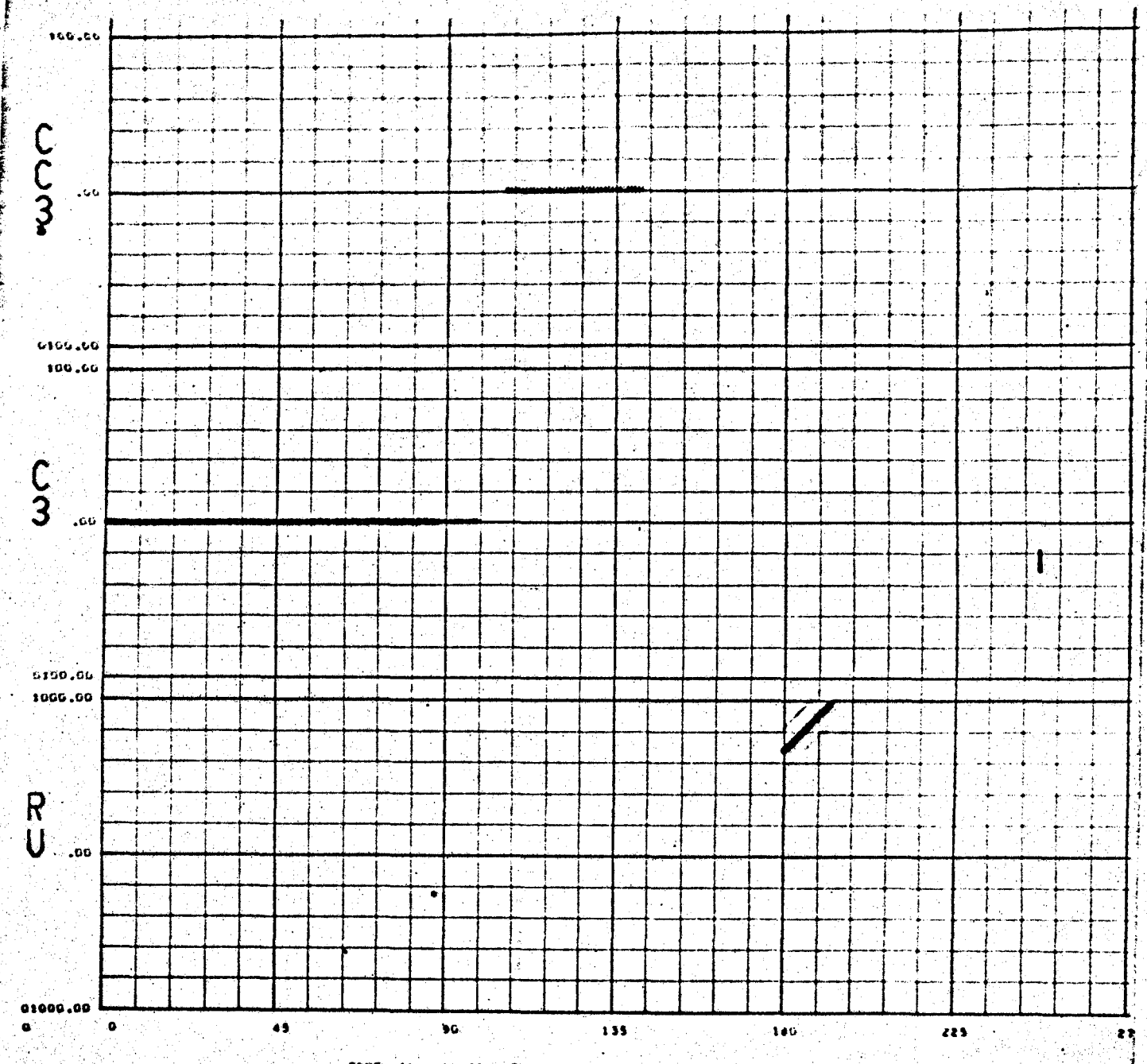
STATION 12 RESIDUALS PASS NUMBER 18/054

ODPL 40RB6

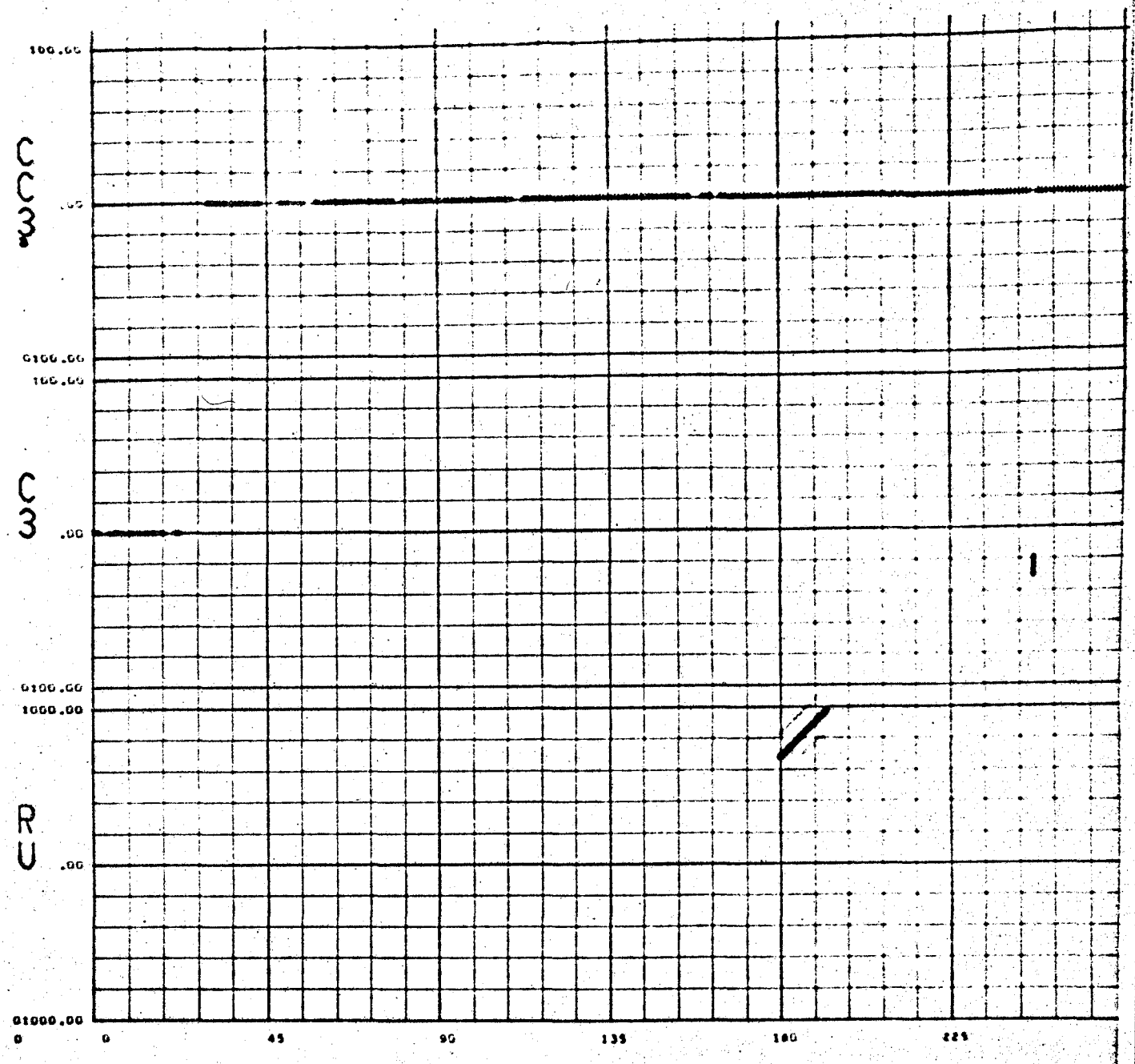
SIMPLE MOON



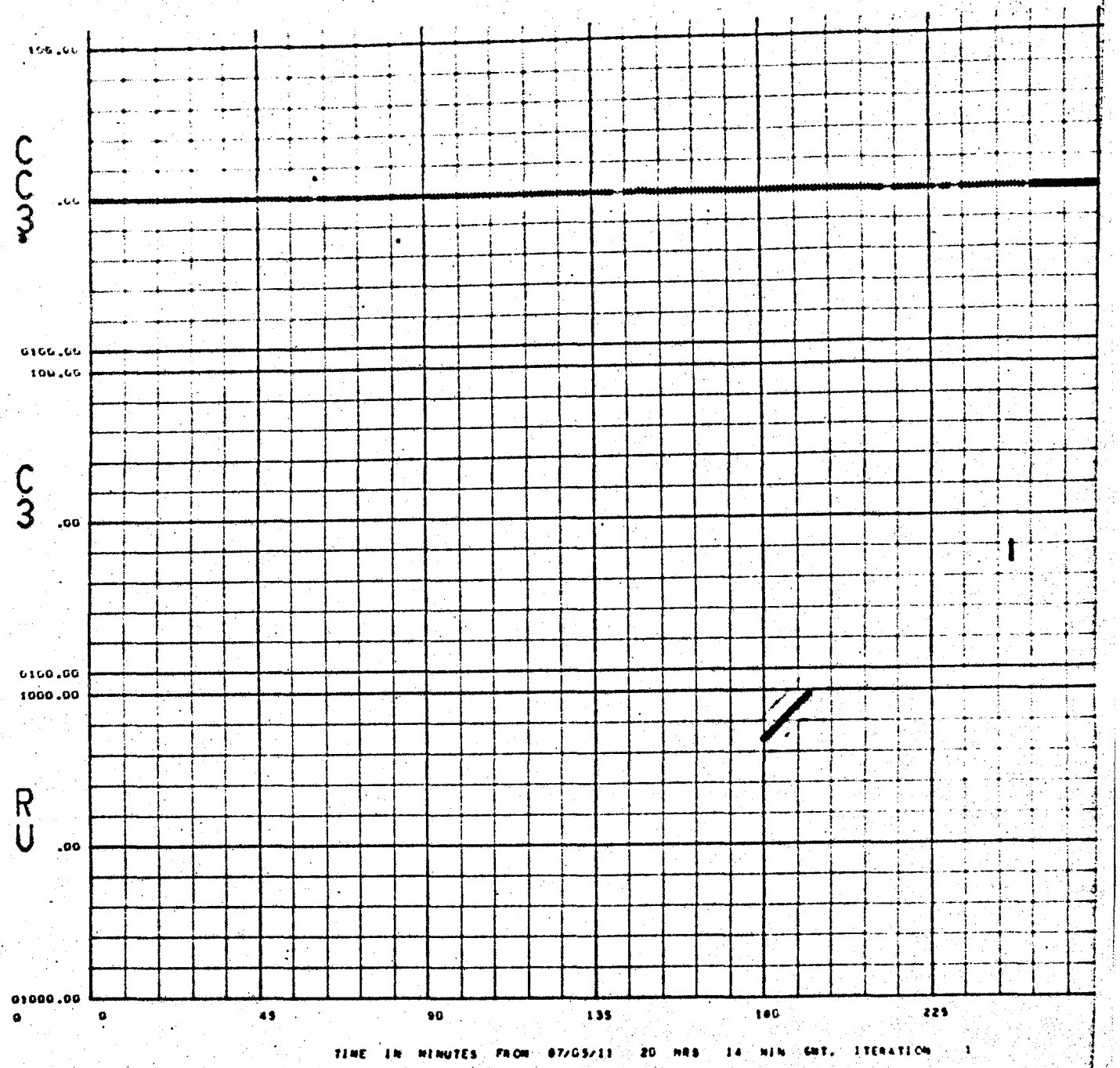
STATION 62 RESIDUALS PASS NUMBER 07/131



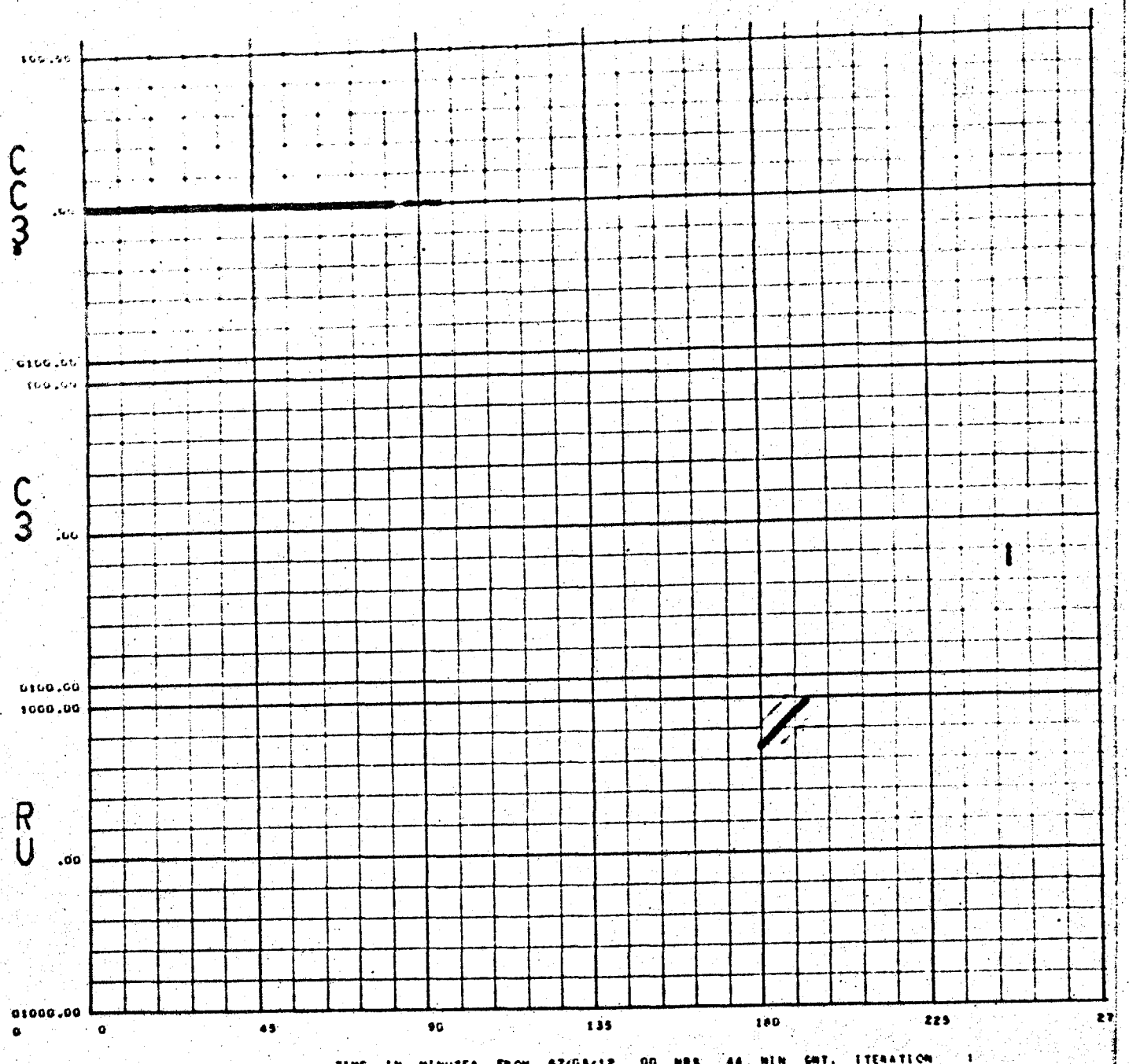
STATION 41 RESIDUALS PASS NUMBER 08/132



STATION 12 RESIDUALS PASS NUMBER 07/131



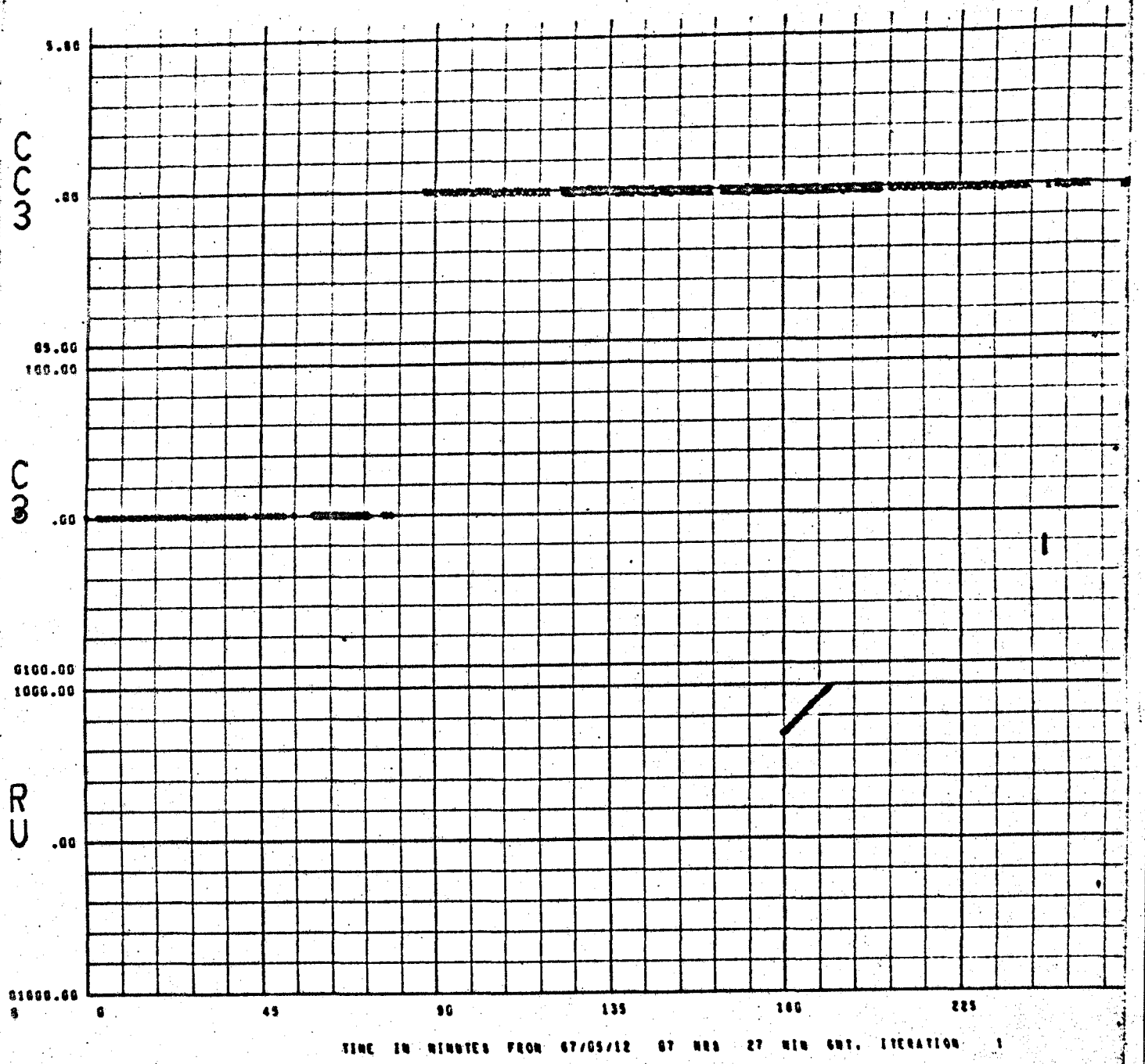
STATION 12 RESIDUALS PASS NUMBER 07/131



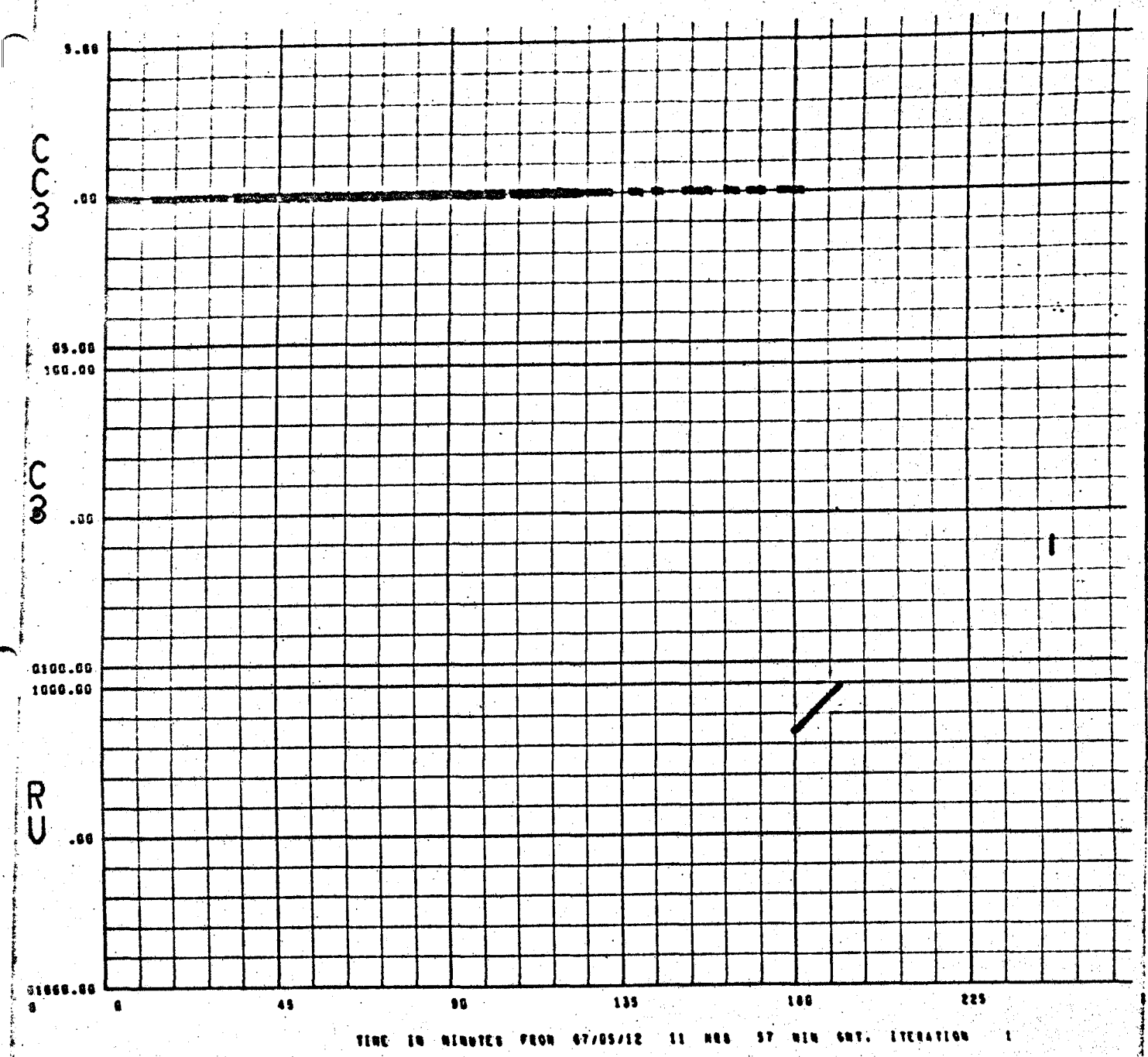
STATION 12 RESIDUALS PASS NUMBER 07/131

ODPL 40RB7

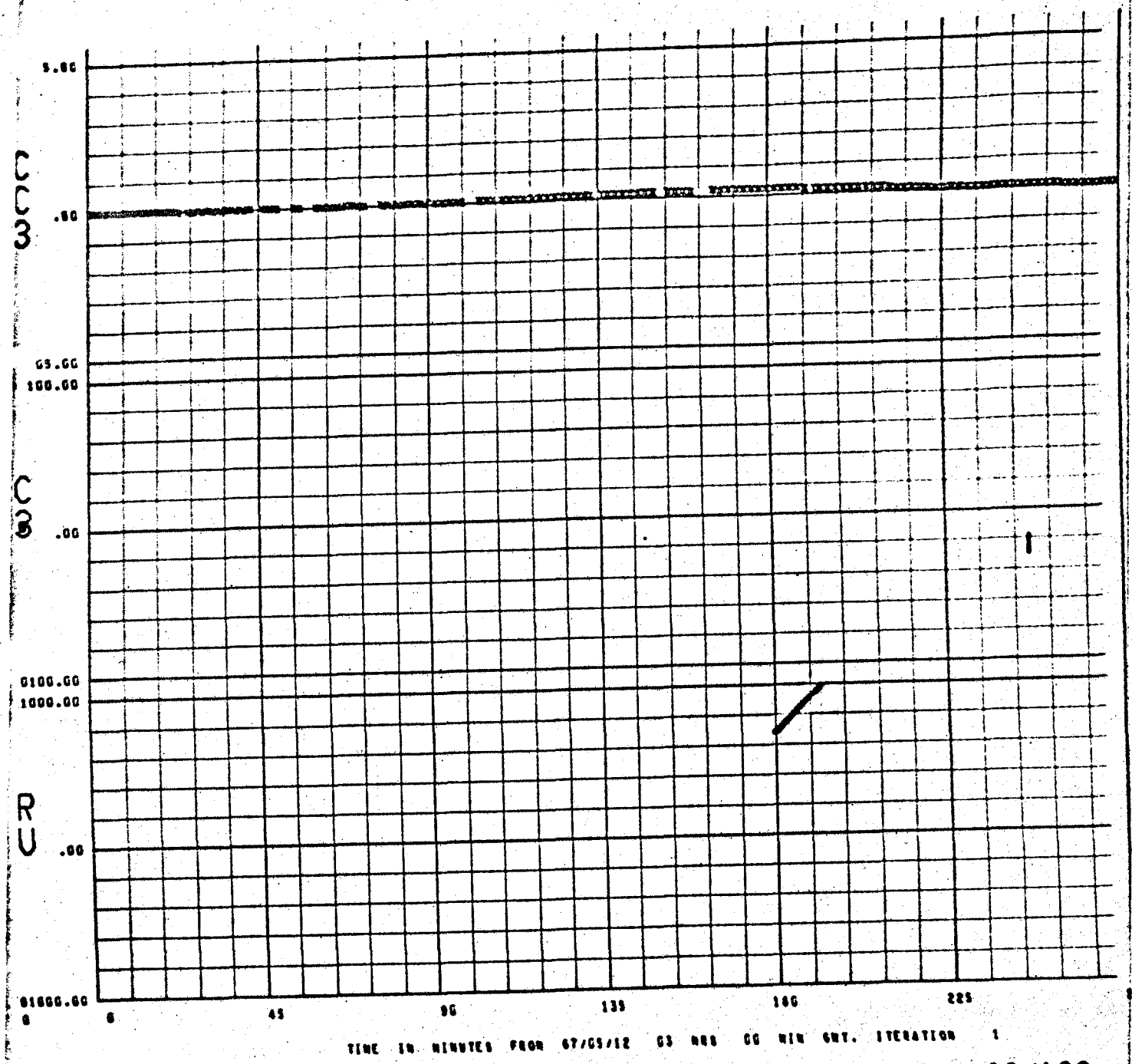
SIMPLE MOON



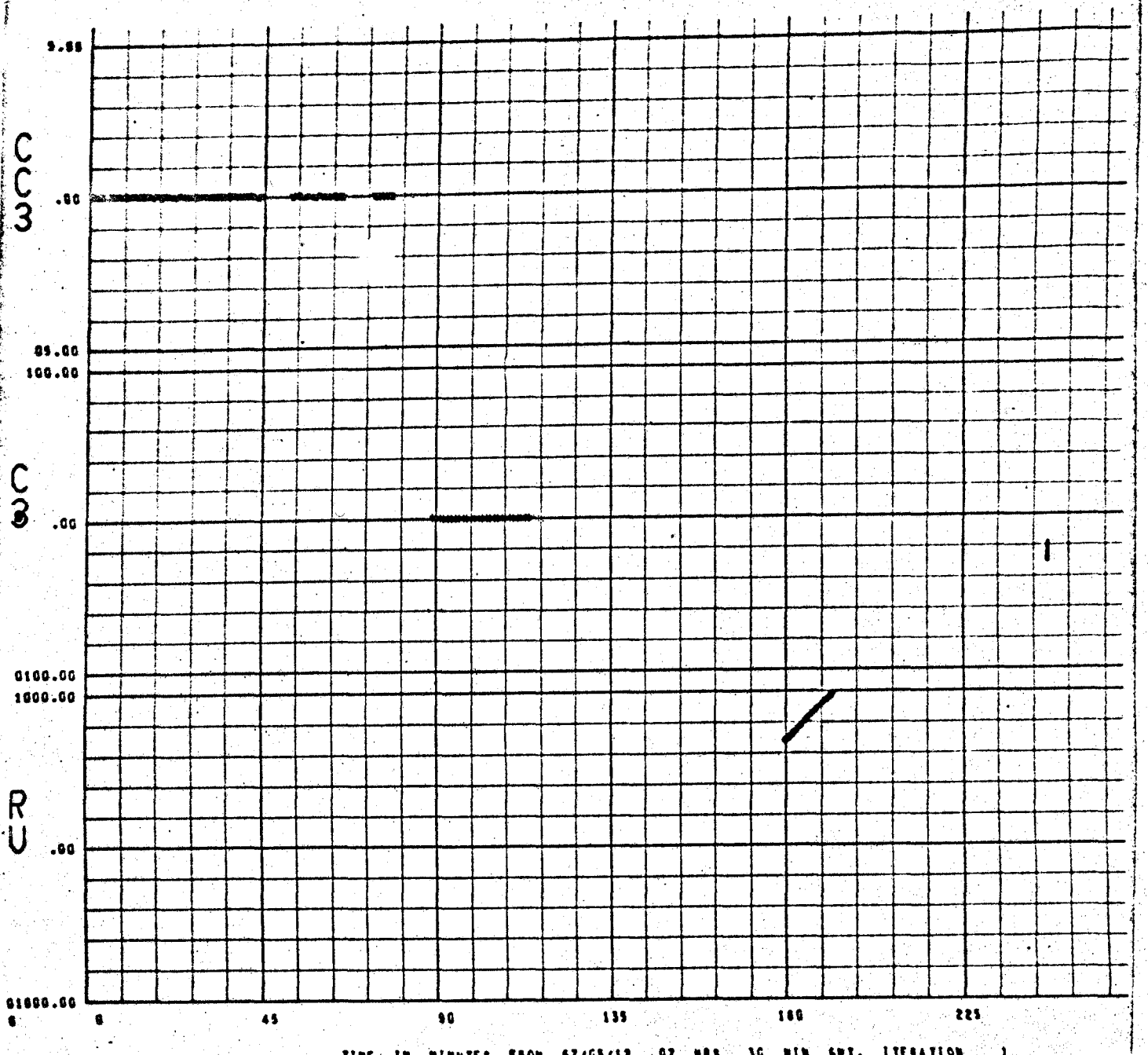
STATION 62 RESIDUALS PASS NUMBER 08/132



STATION 62 RESIDUALS PASS NUMBER 08/132



STATION 41 RESIDUALS PASS NUMBER 08/132

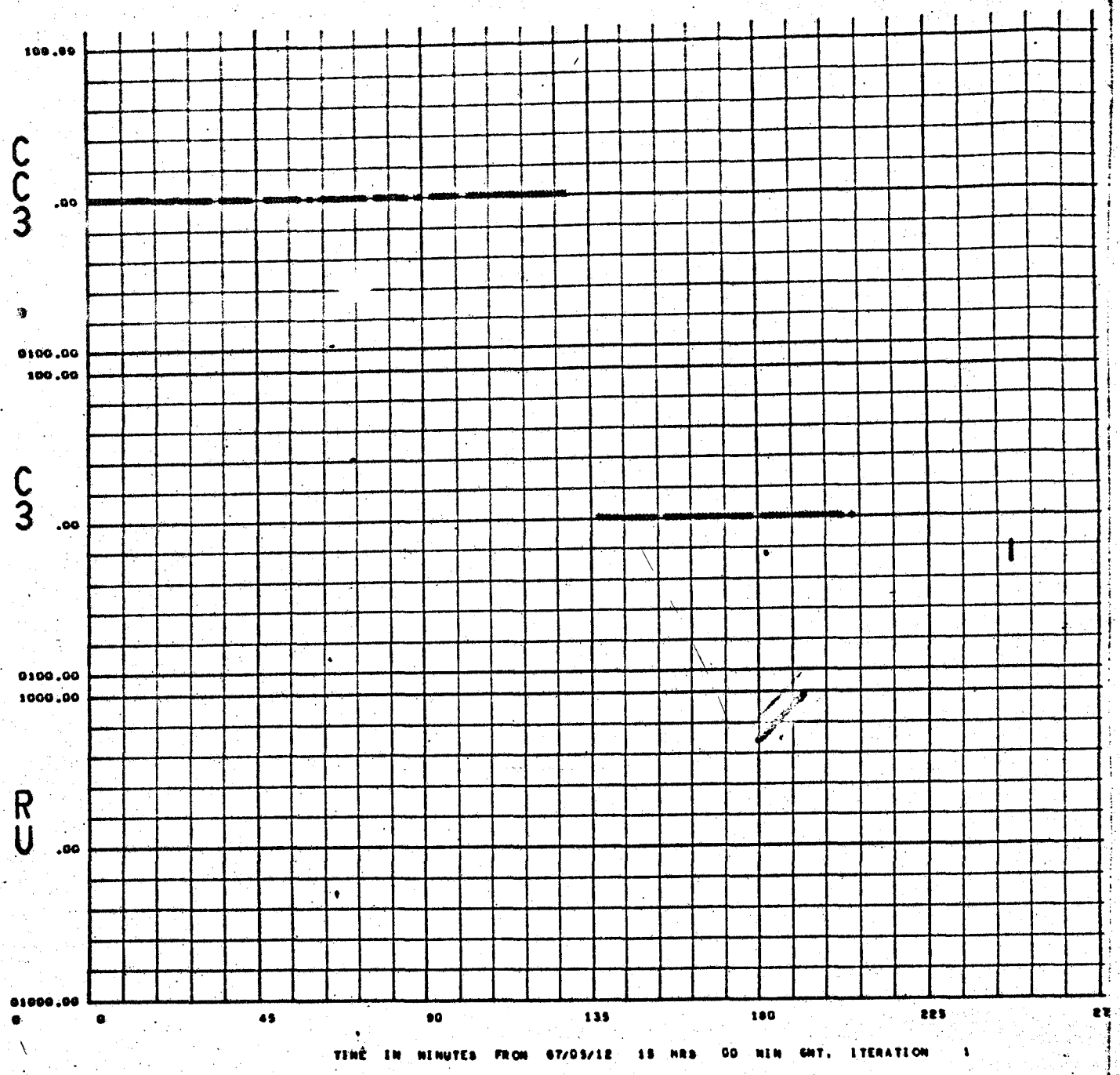


STATION 41 RESIDUALS PASS NUMBER 08/132

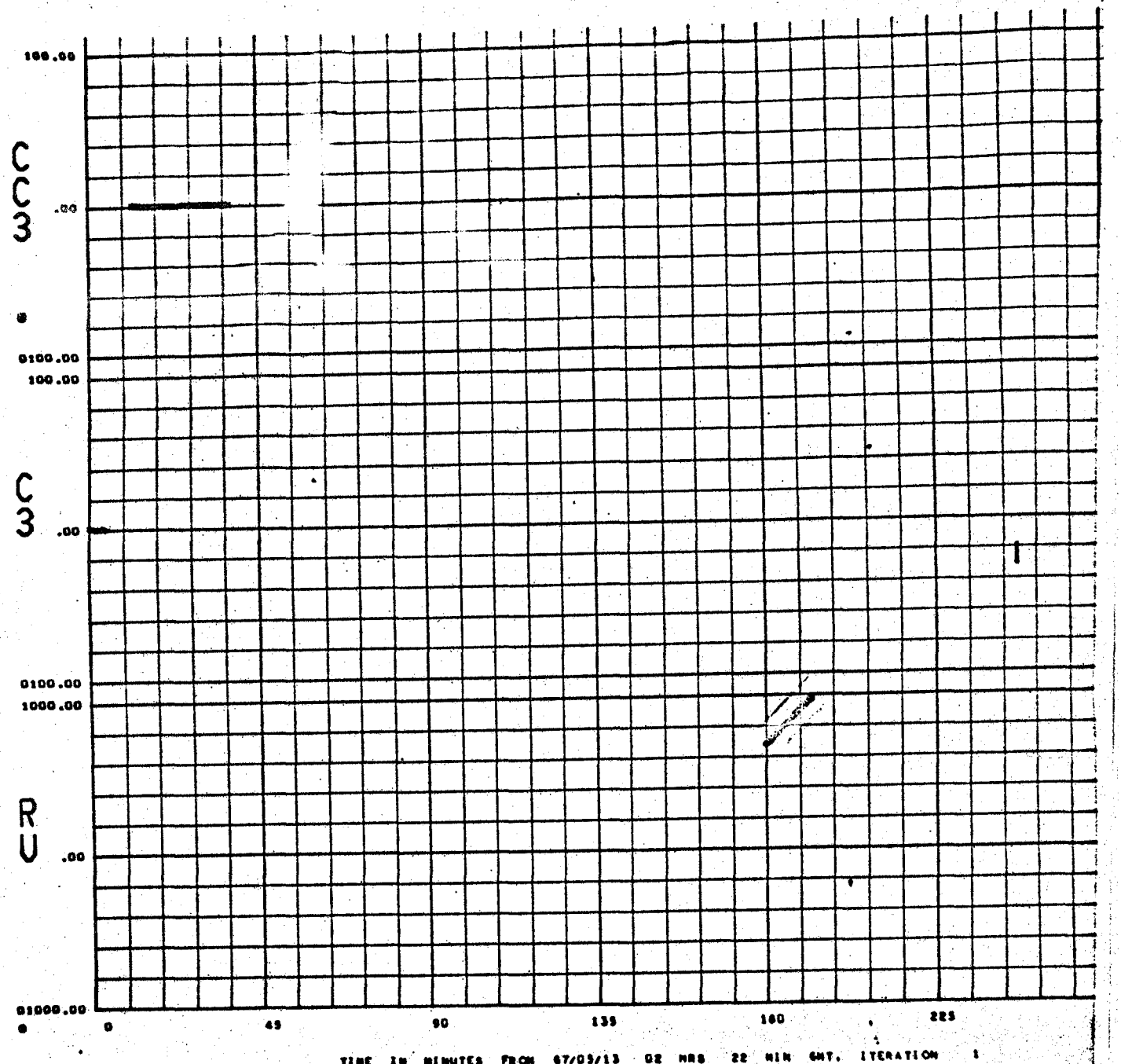
U3 4288-2000 REV. 6/64

ODPL 40RB8

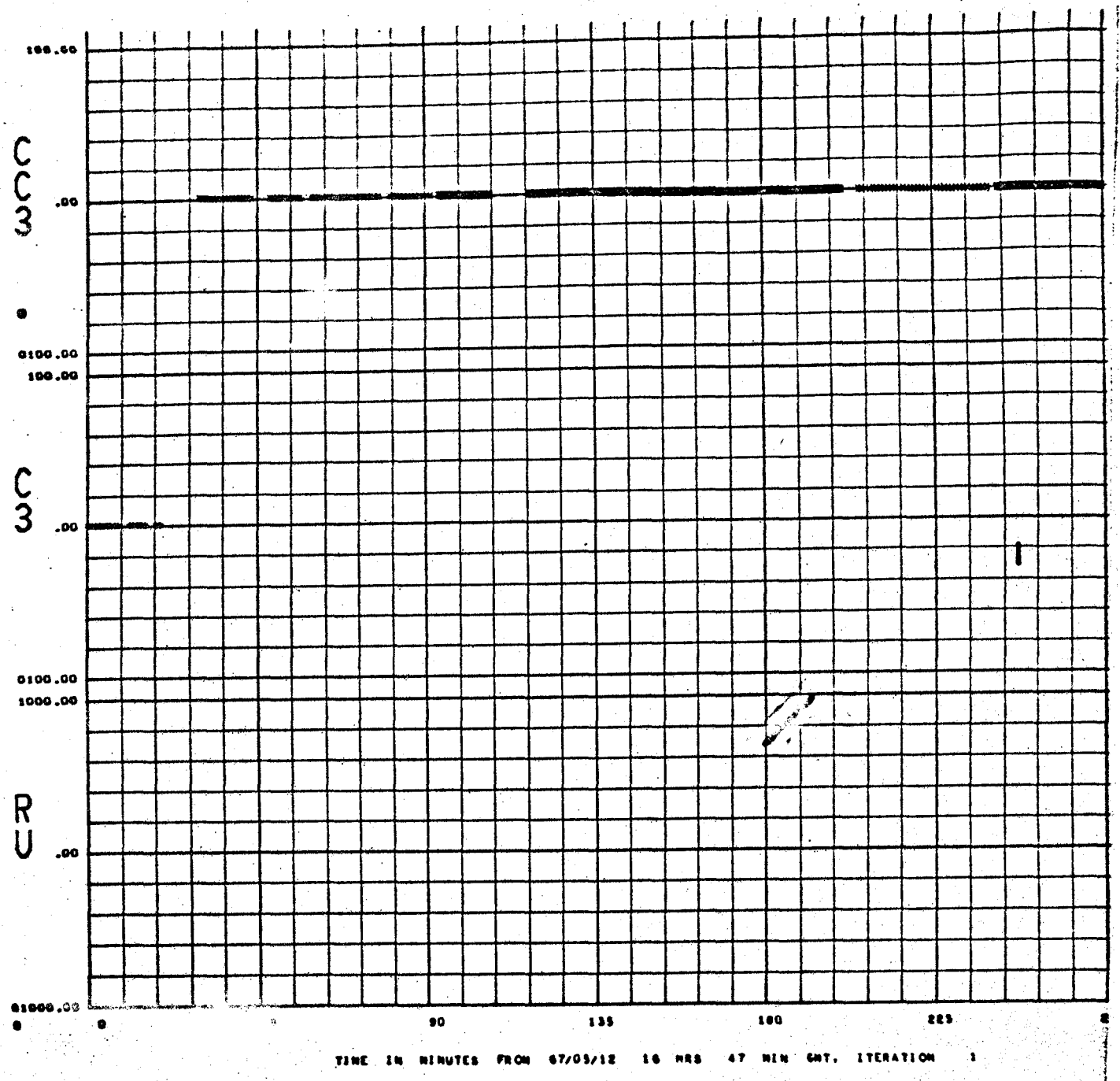
SIMPLE MOON



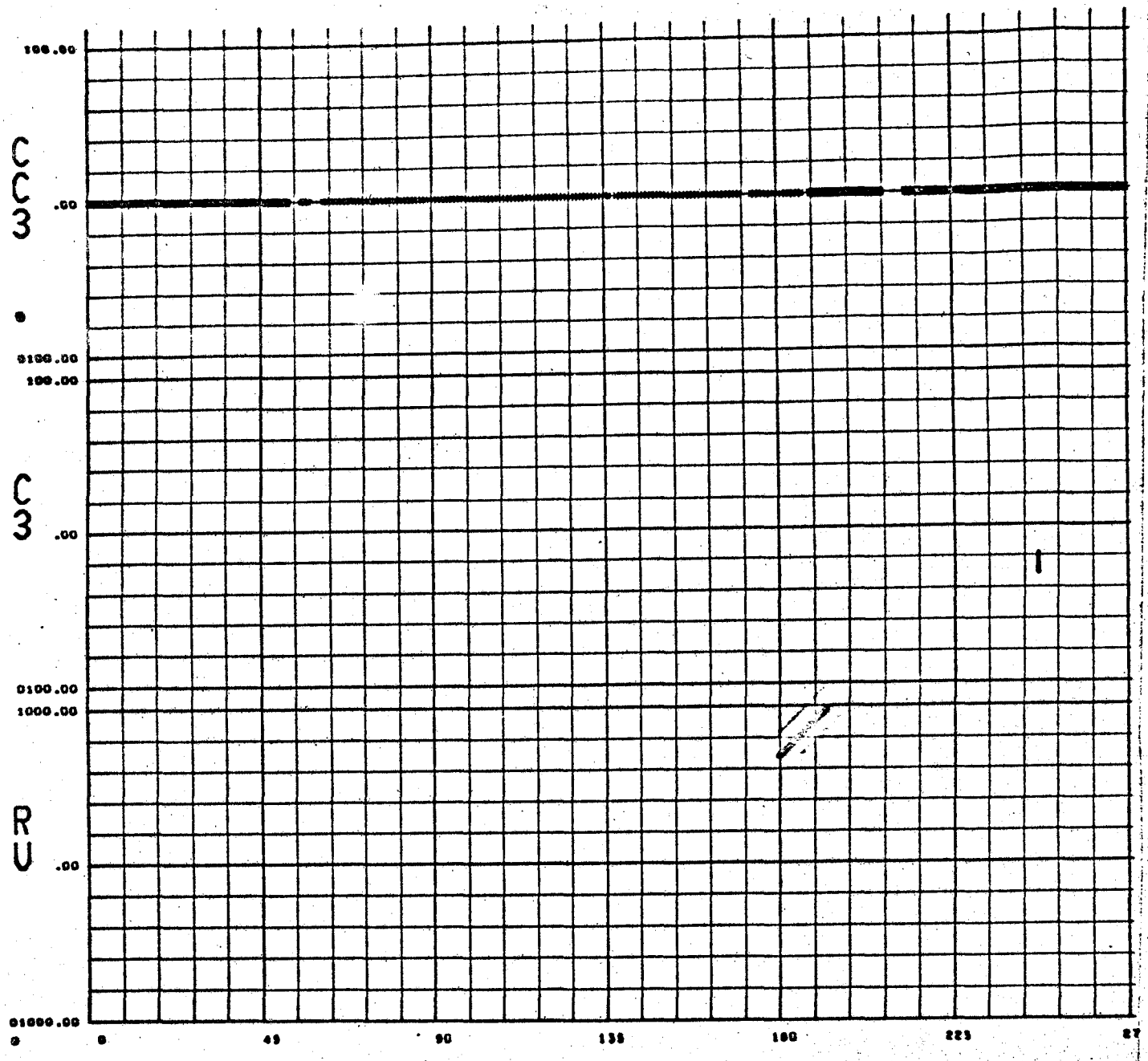
STATION 62 RESIDUALS PASS NUMBER 08/132



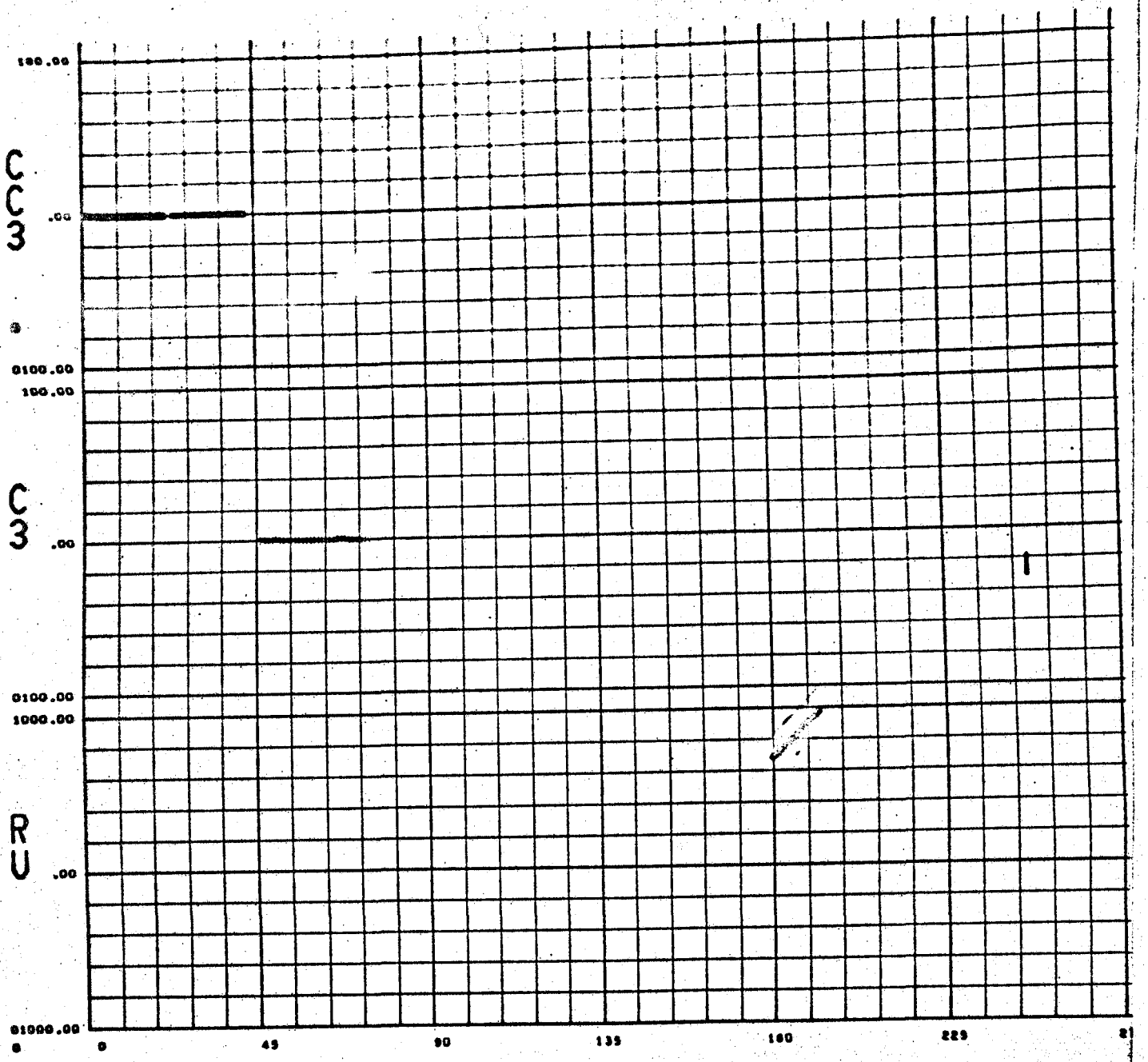
STATION 41 RESIDUALS PASS NUMBER 09/133



STATION 12 RESIDUALS PASS NUMBER 08/132



STATION 12 RESIDUALS PASS NUMBER 08/132



STATION 12 RESIDUALS PASS NUMBER 08/132

REV LTR

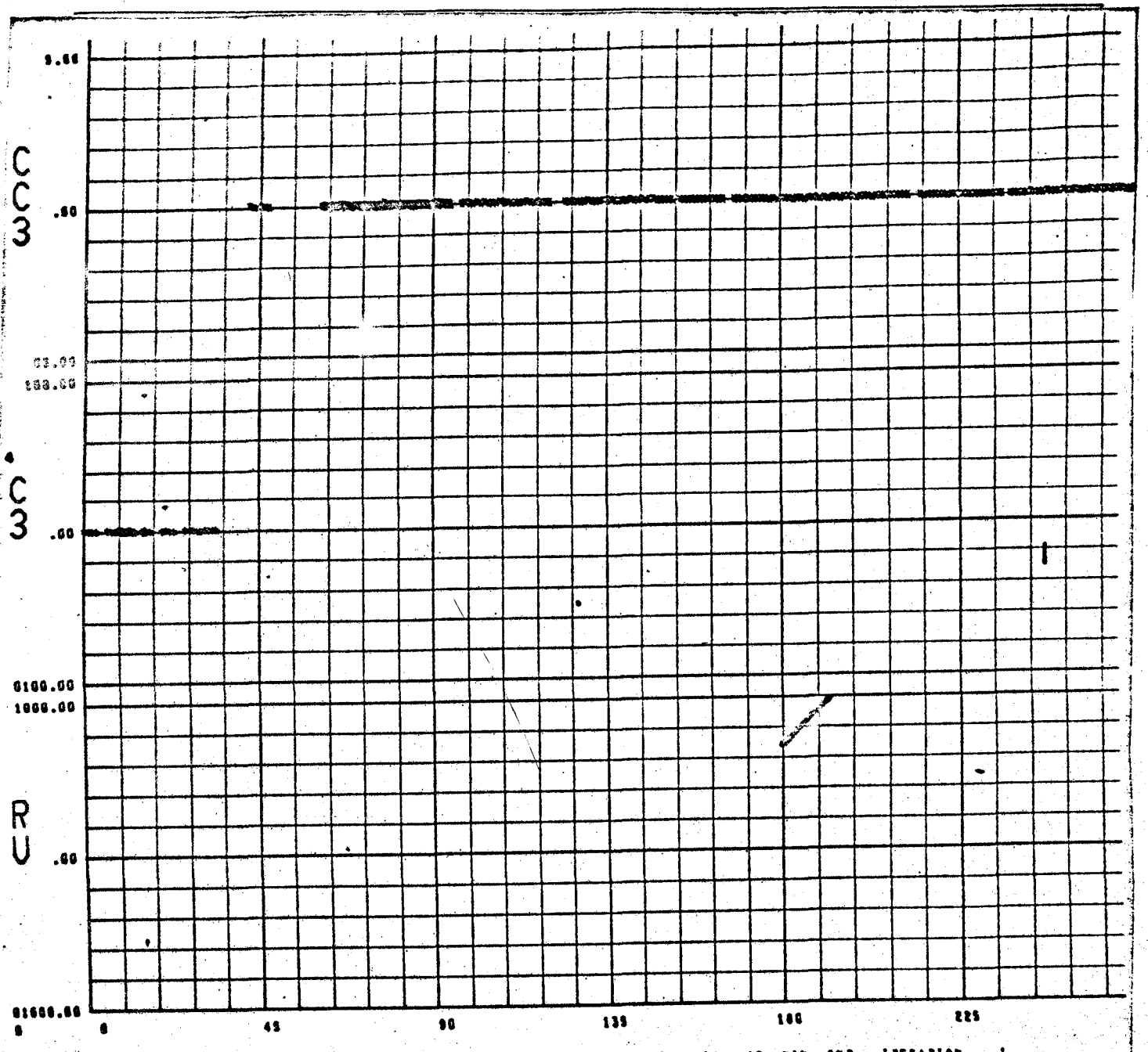
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

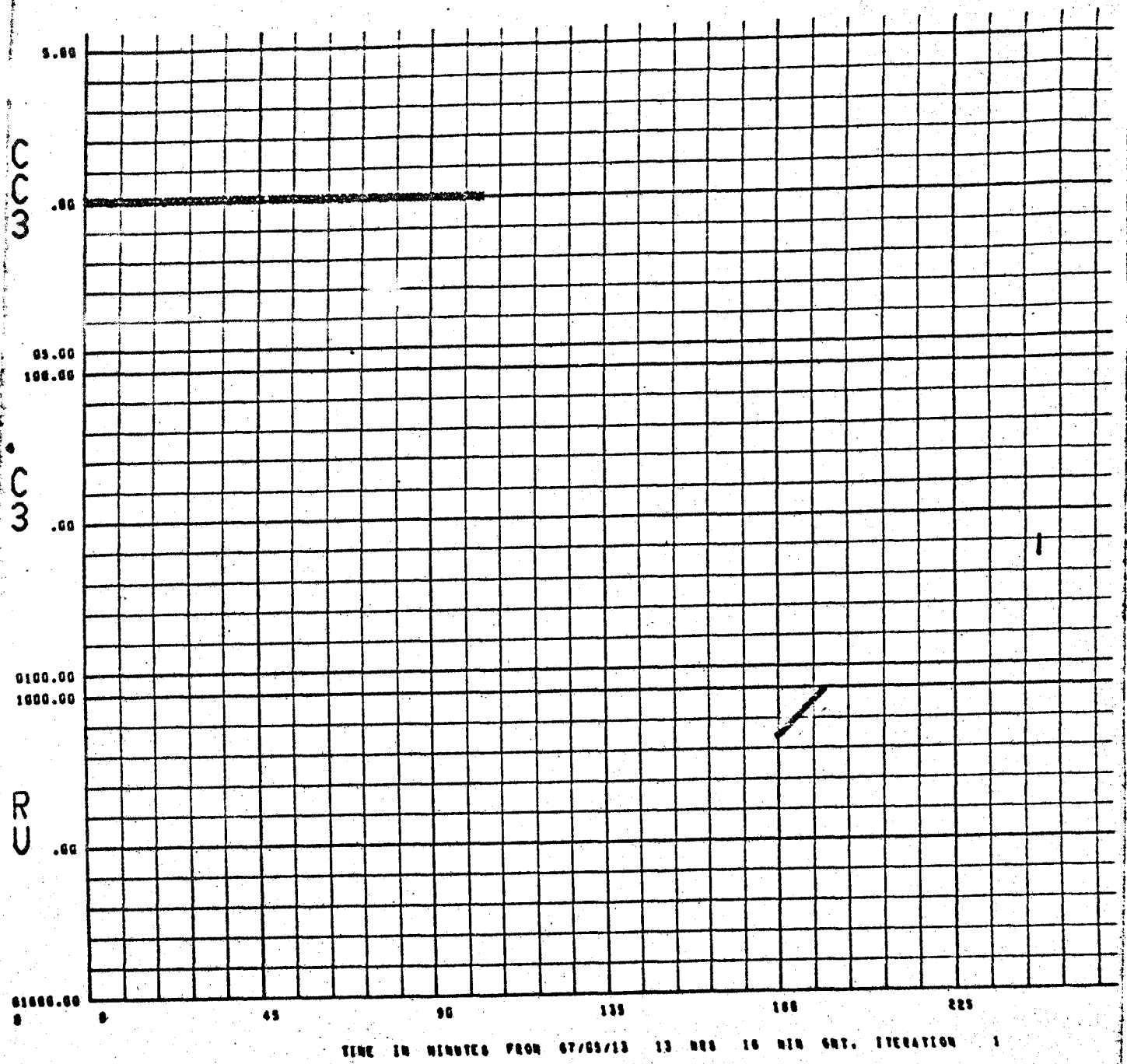
SH. 3.3-1

ODPL 40RB9

SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 09/133

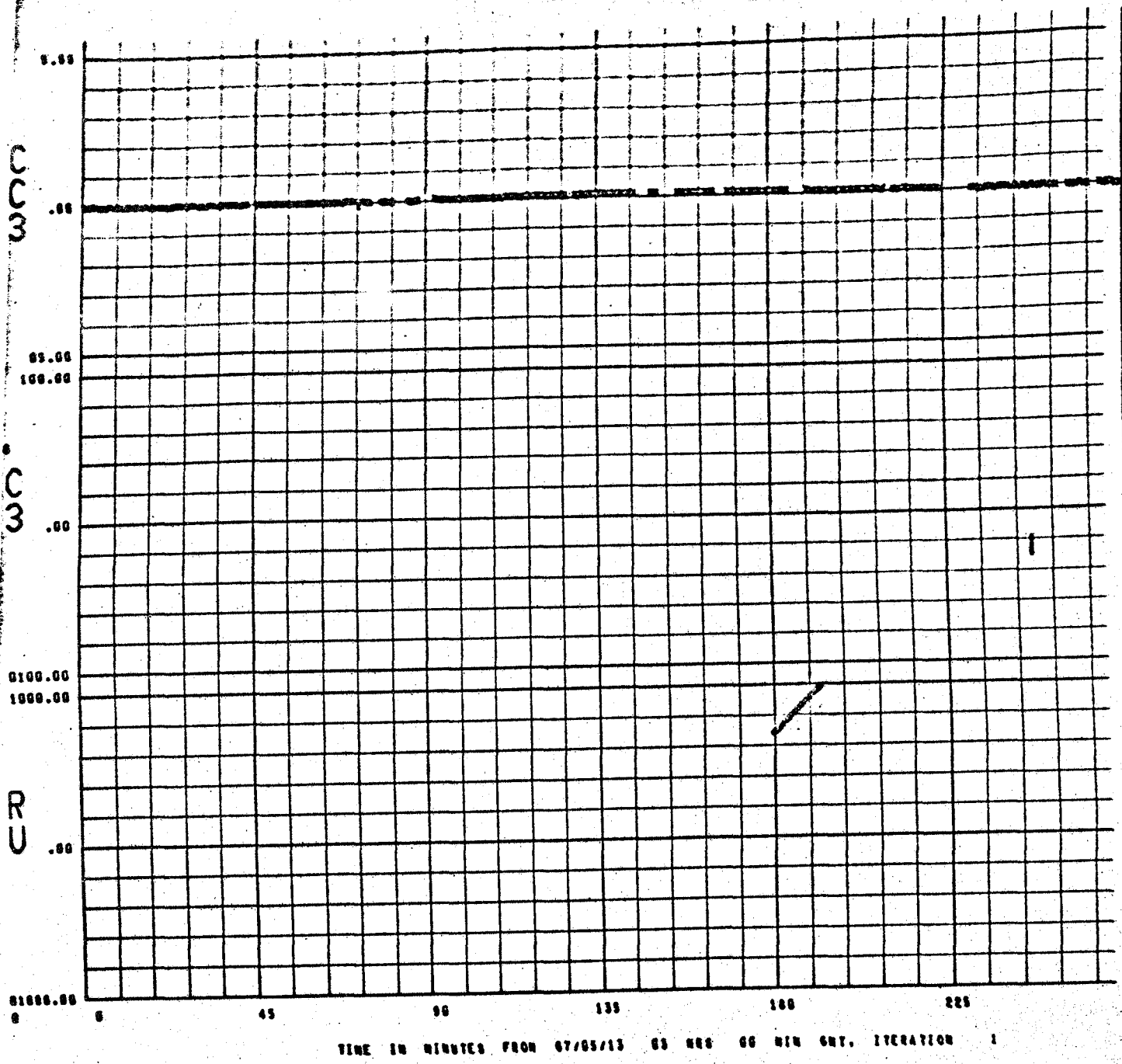


STATION 62 RESIDUALS

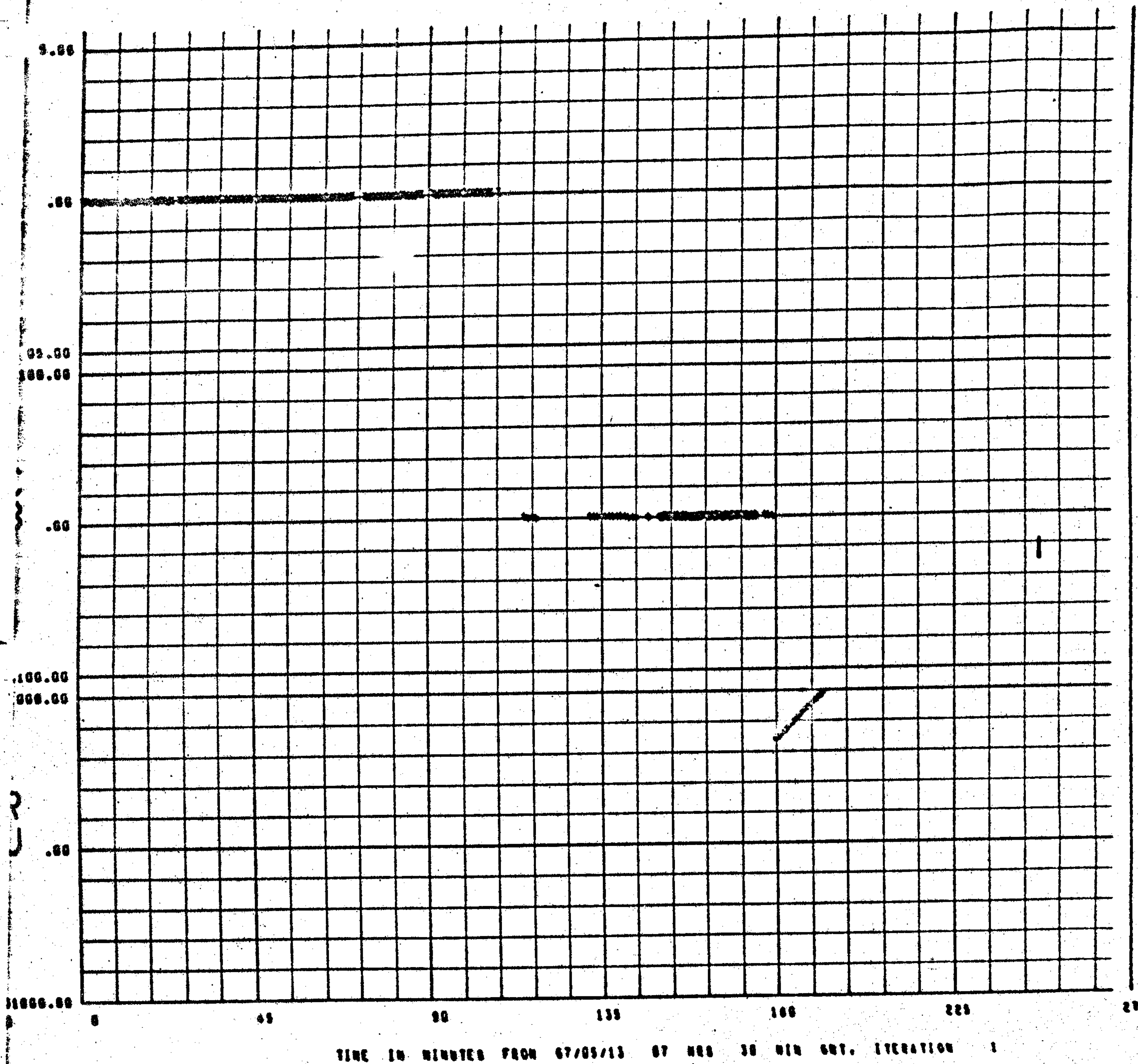
PASS NUMBER 09/133

REV LTR

U3 4288-2000 REV. 6/64



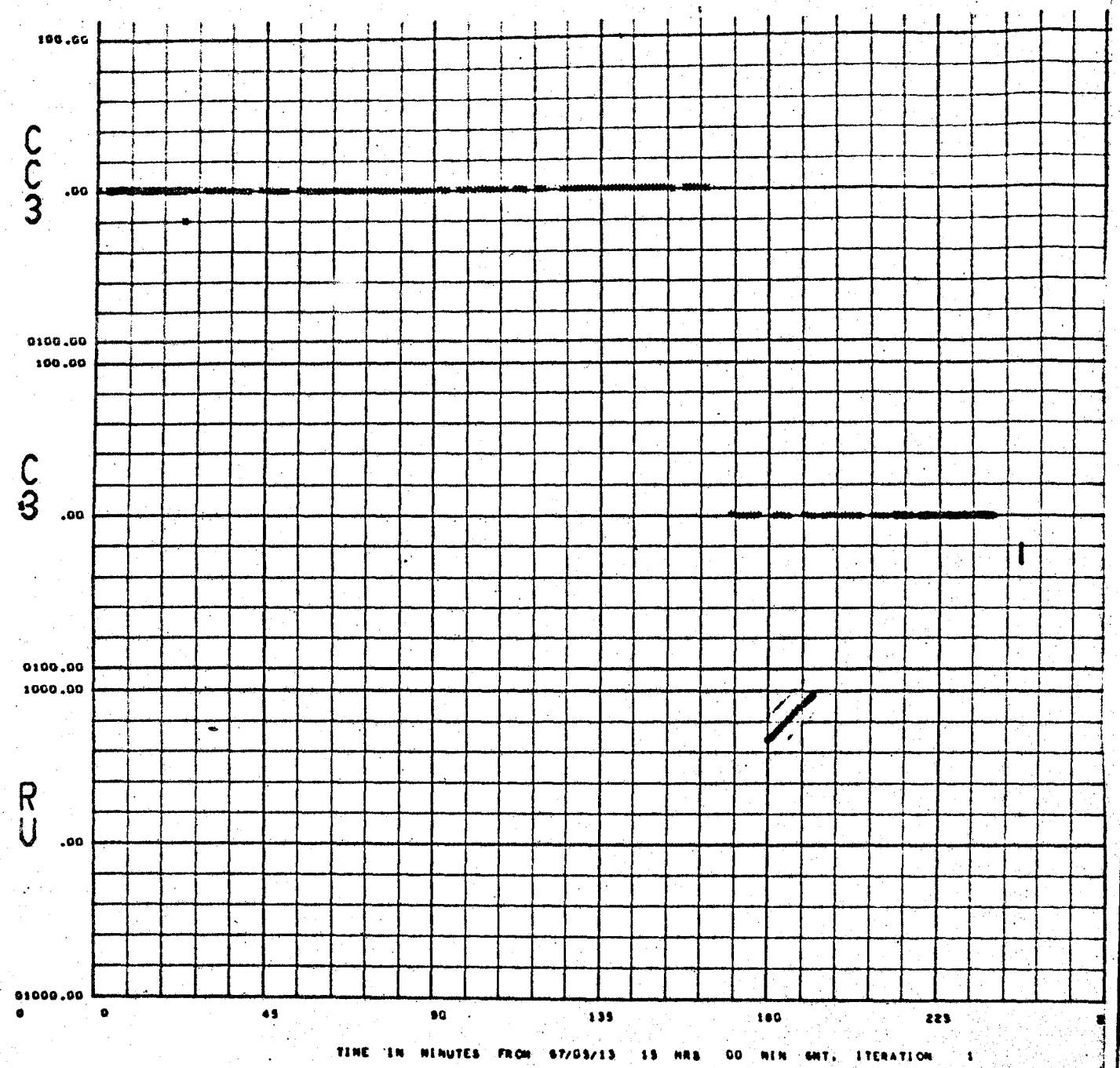
STATION 41 RESIDUALS PASS NUMBER 09/133



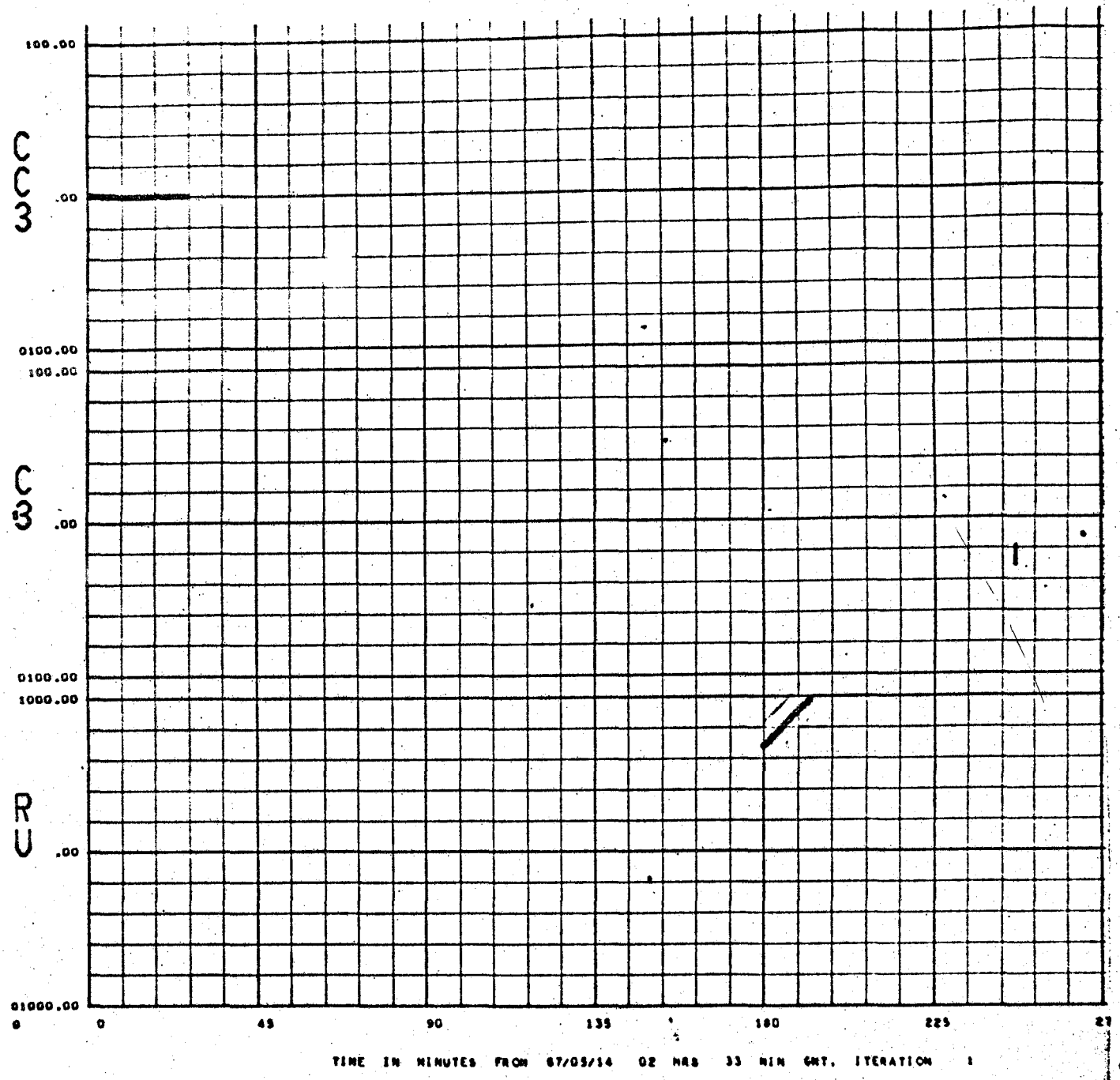
STATION 41 RESIDUALS PASS NUMBER 09/133

ODPL 40RB10

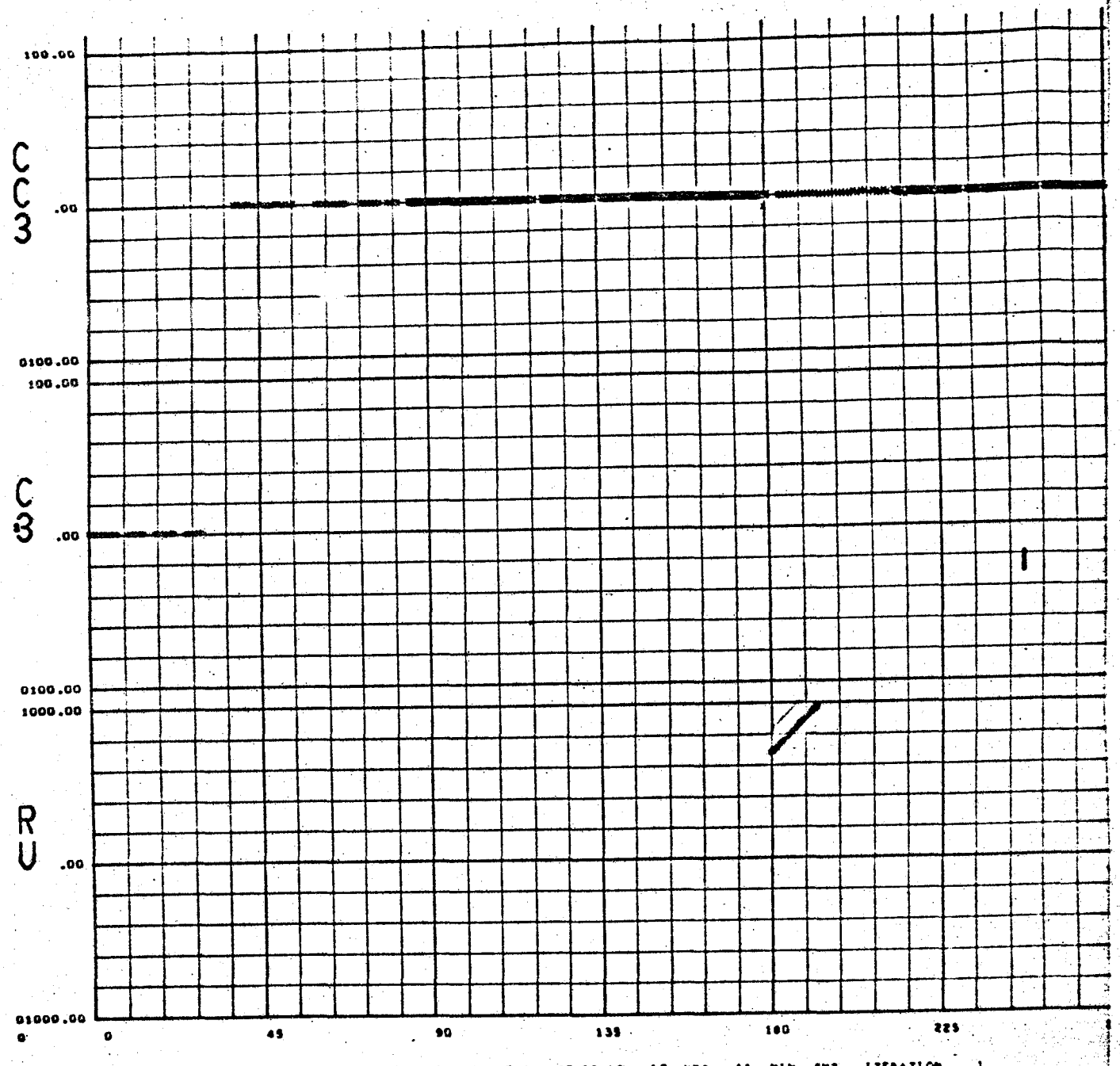
SIMPLE MOON



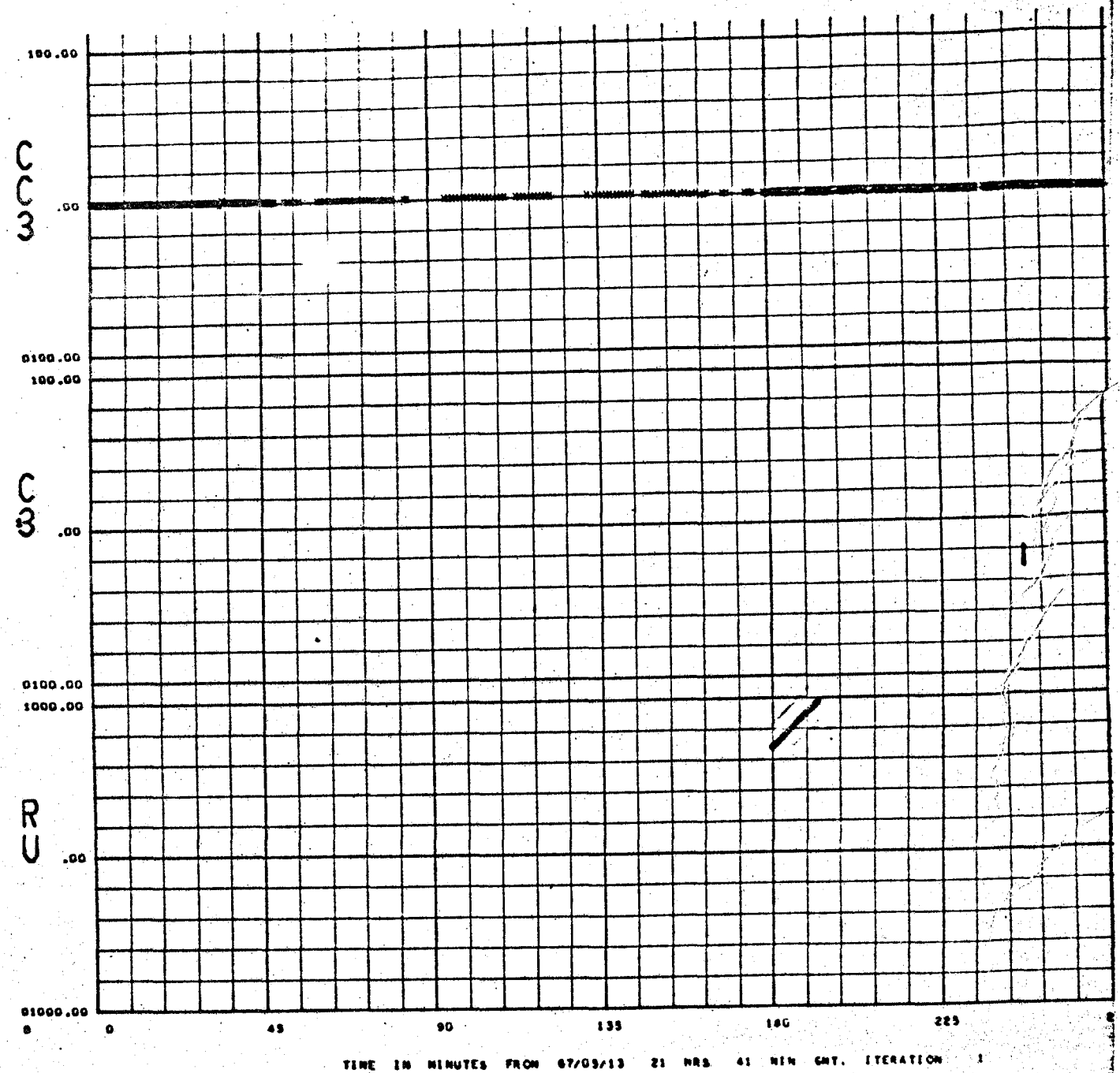
STATION 62 RESIDUALS PASS NUMBER 09/133



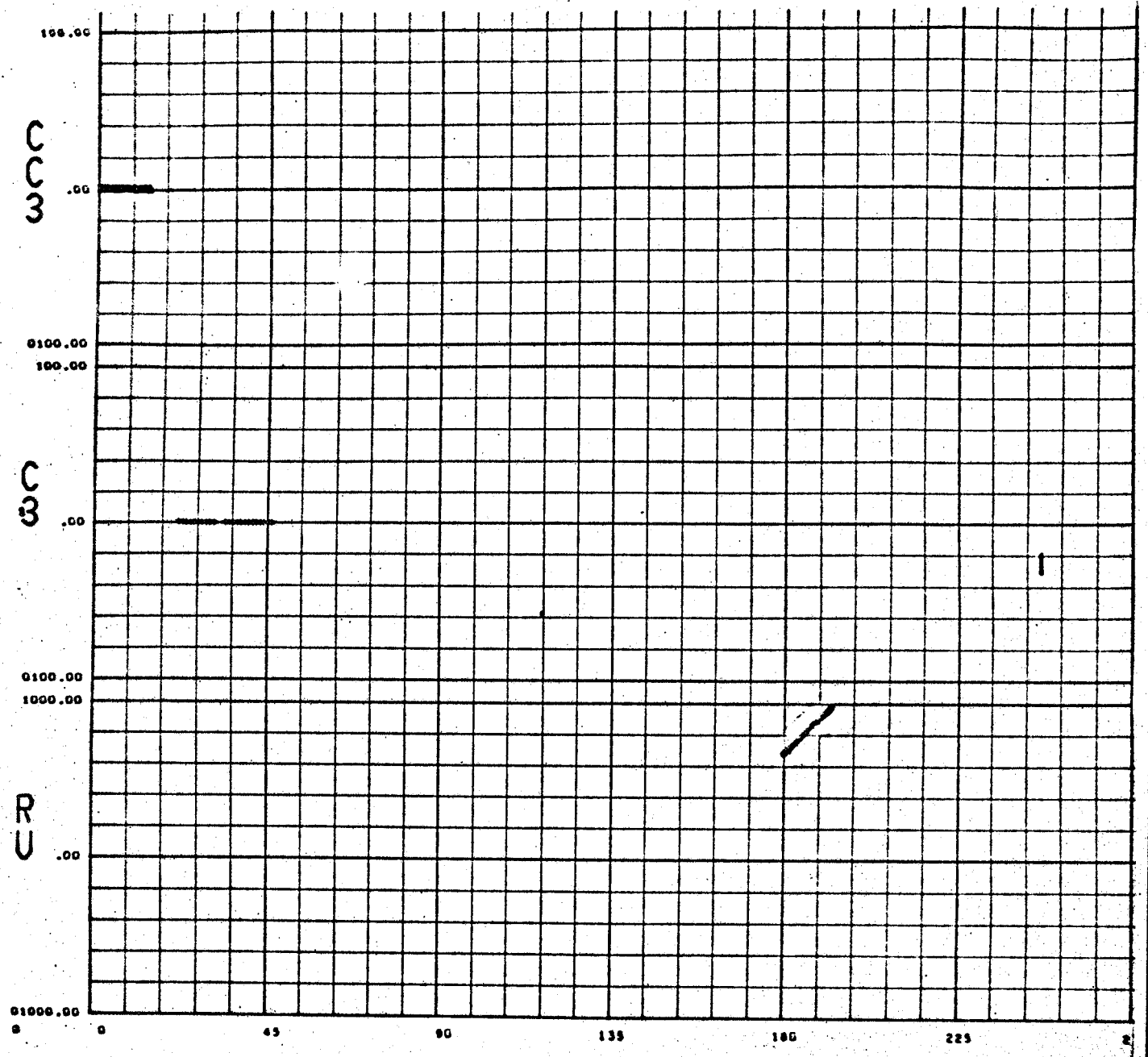
STATION 41 RESIDUALS PASS NUMBER 10/134



STATION 12 RESIDUALS PASS NUMBER 09/133



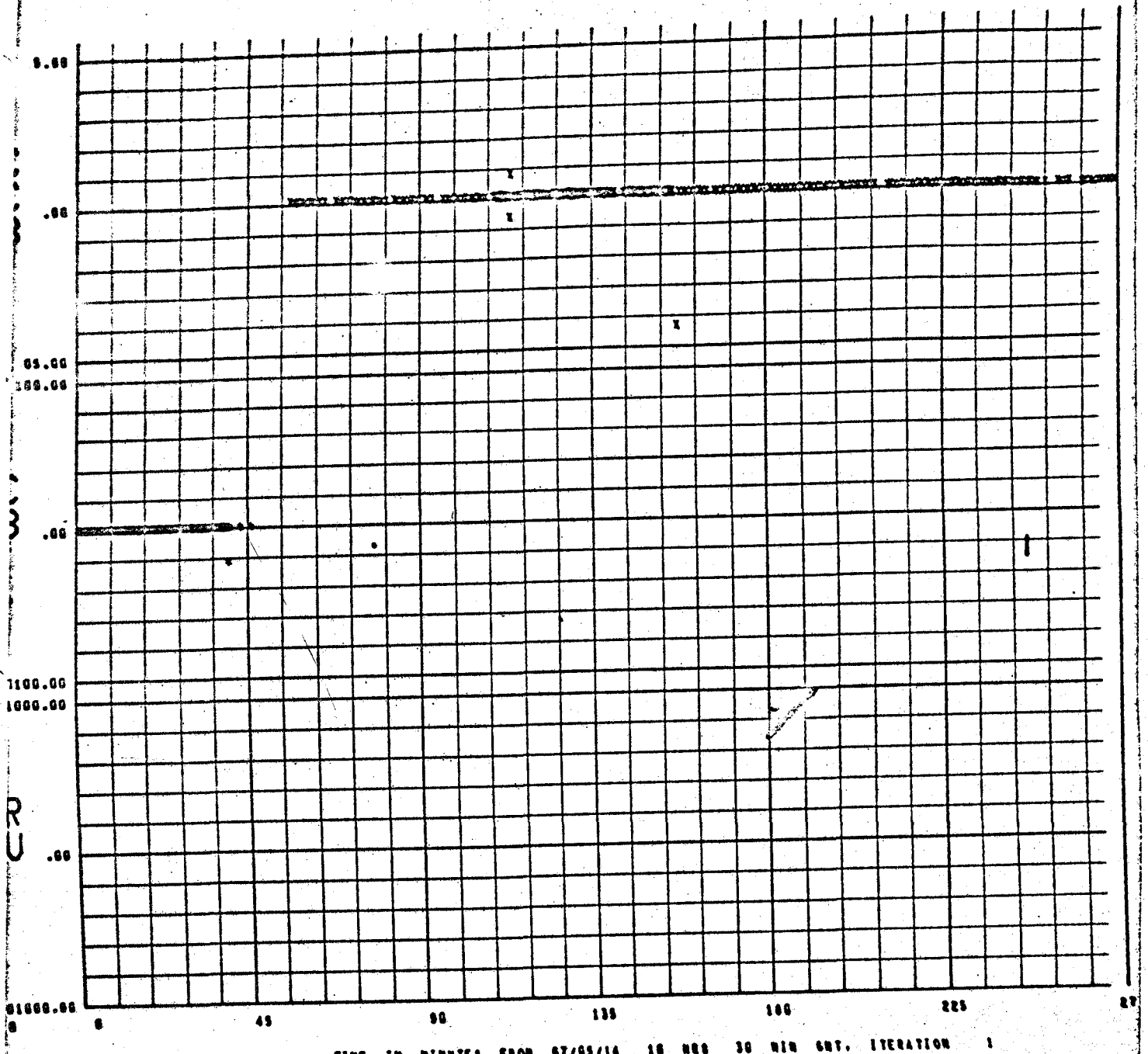
STATION 12 RESIDUALS PASS NUMBER 09/133



STATION 12 RESIDUALS PASS NUMBER 09/133

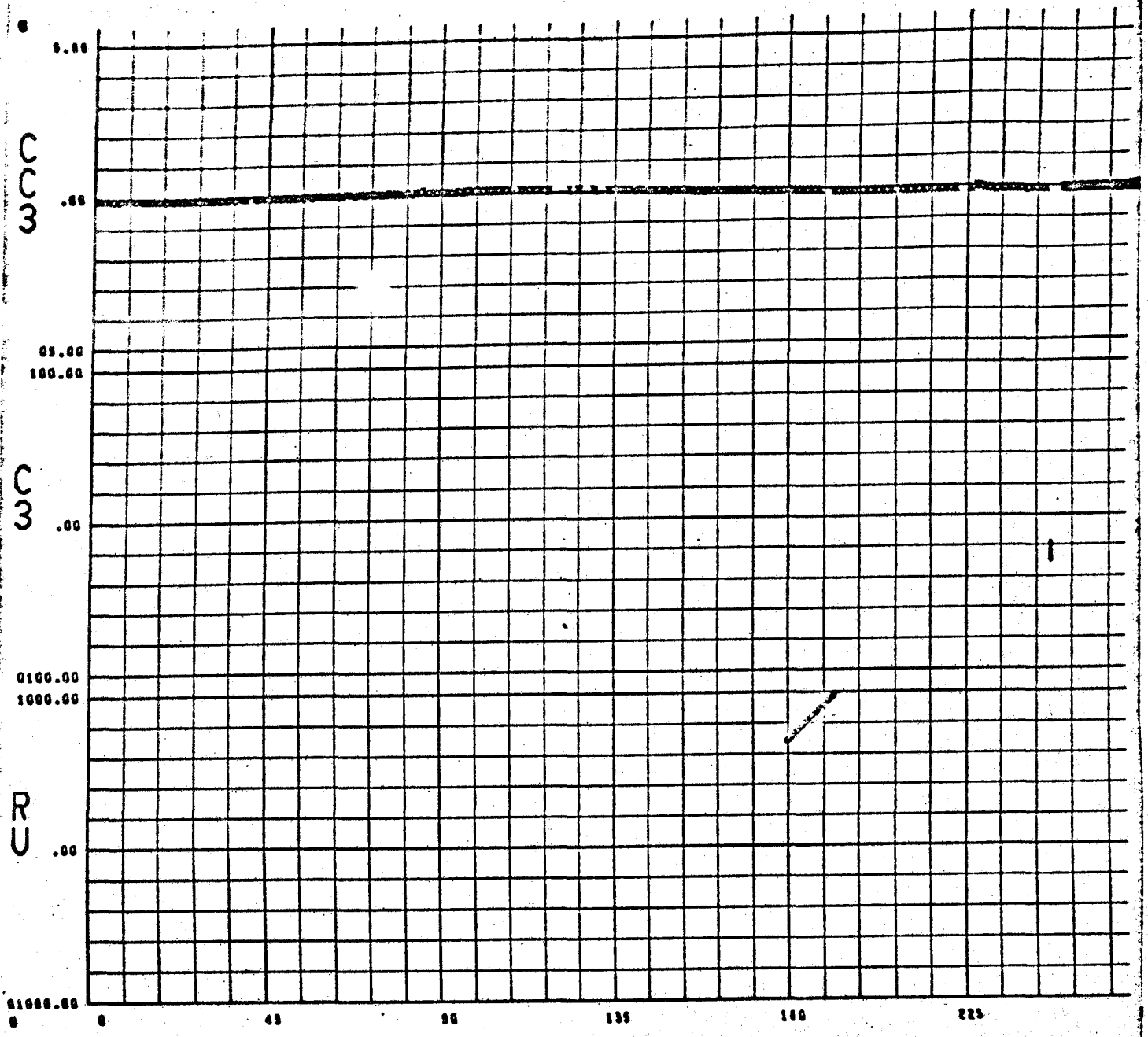
ODPL 40RB11

SIMPLE MOON

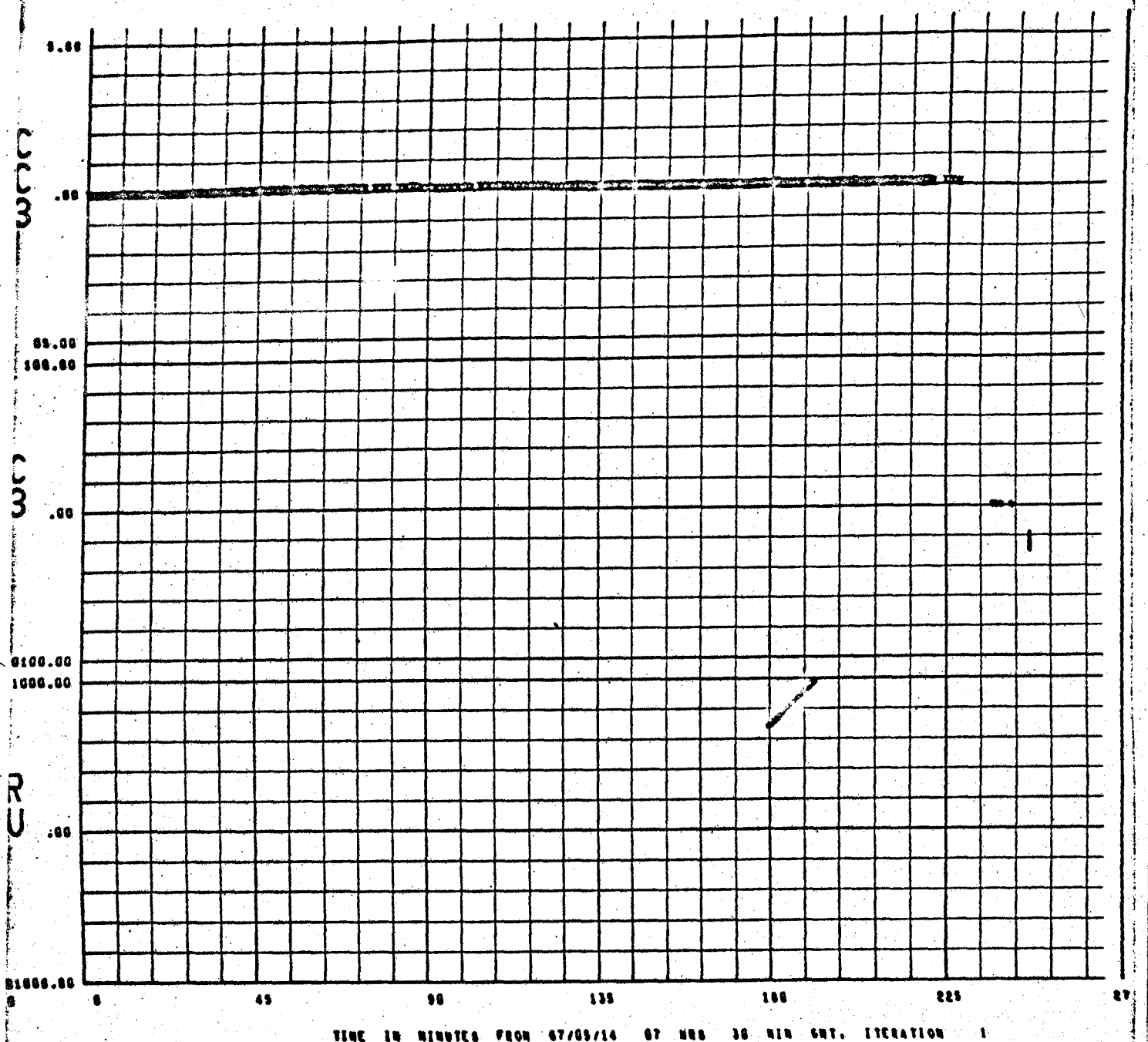


STATION 62 RESIDUALS PASS NUMBER 10/134

REV LTR



STATION 41 RESIDUALS PASS NUMBER 10/134

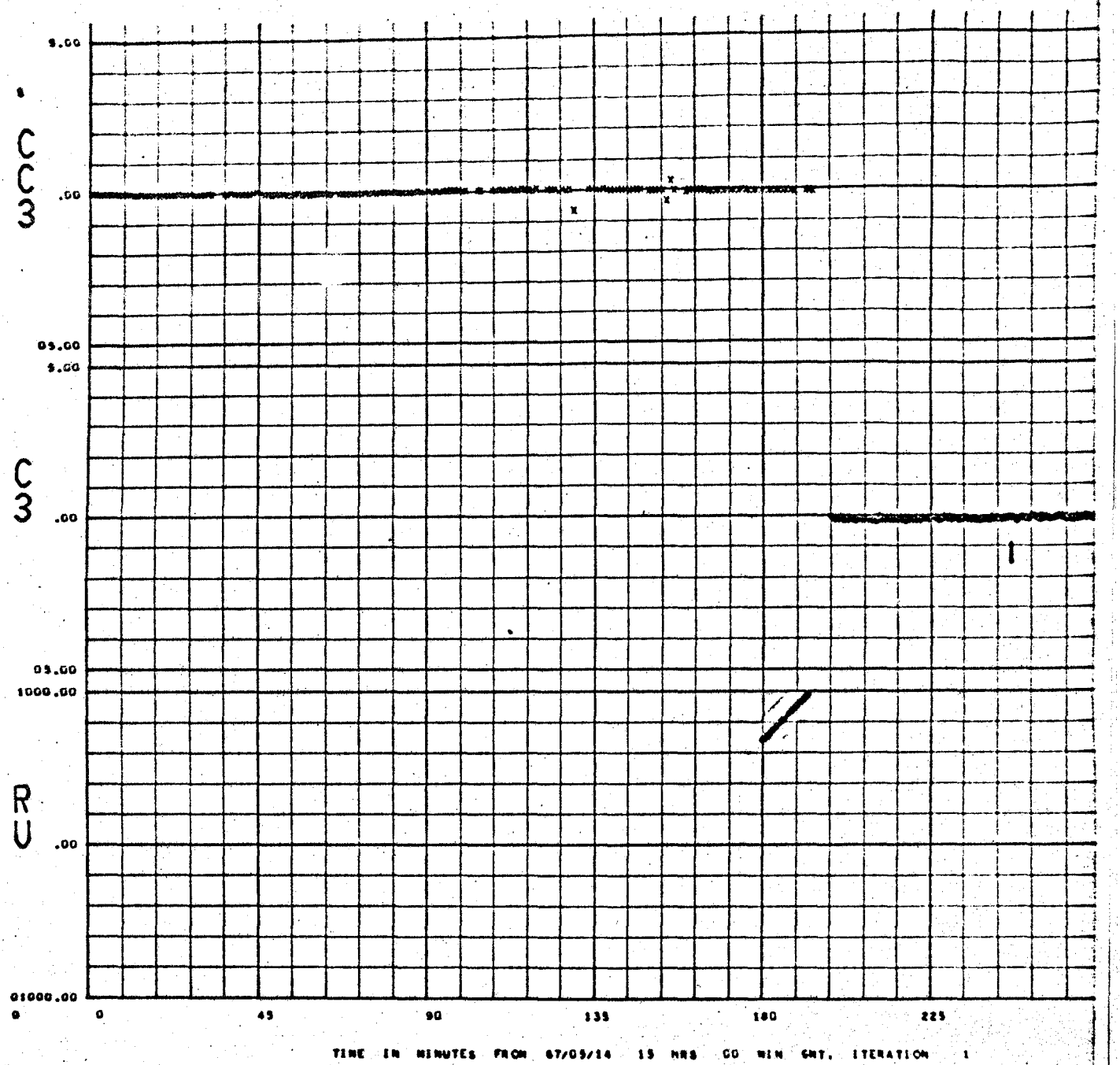


TIME IN MINUTES FROM 67/05/14 07 HRS 30 MIN GMT. ITERATION 1

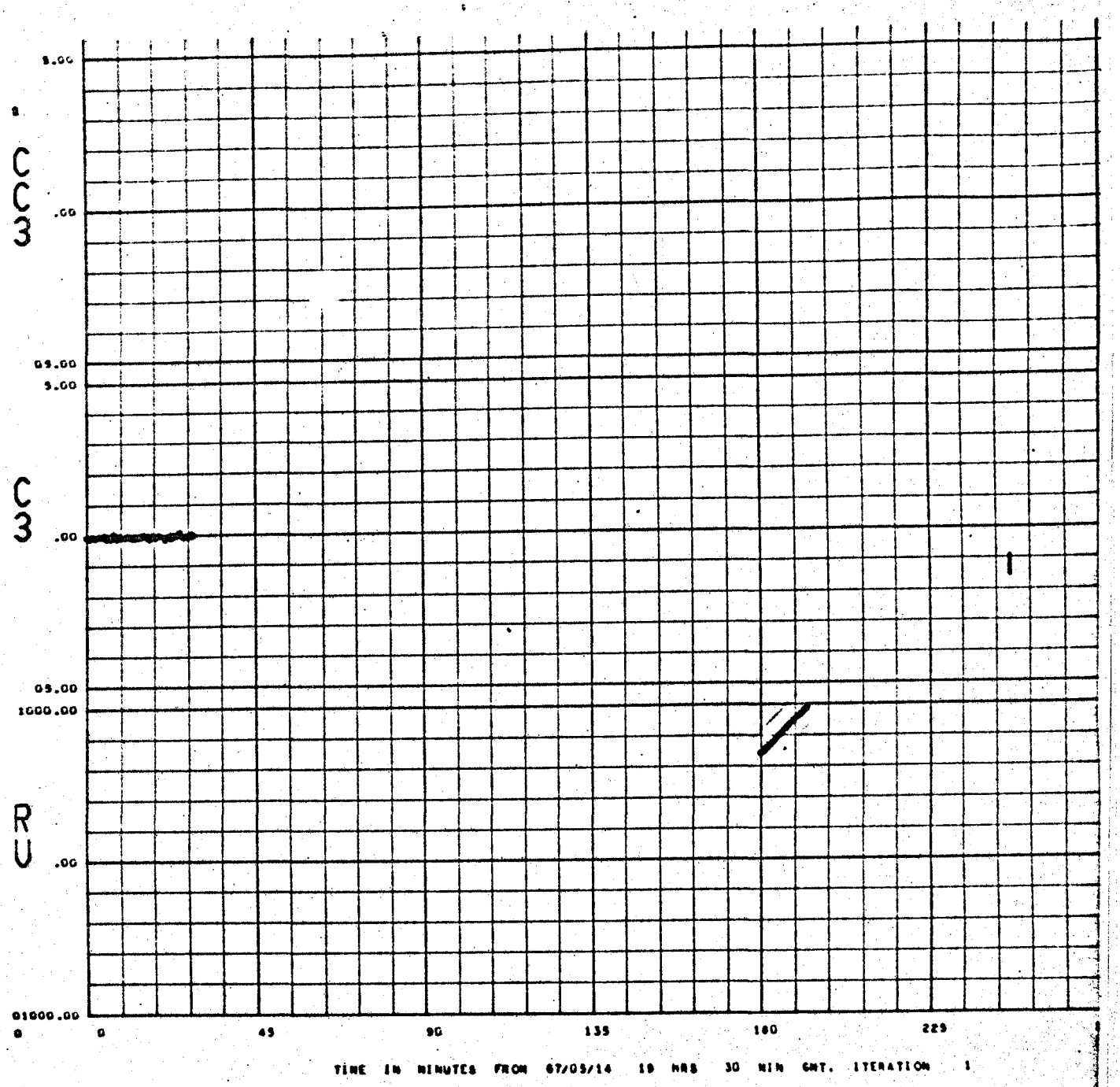
STATION 41 RESIDUALS PASS NUMBER 10/134

ODPL 40RB12

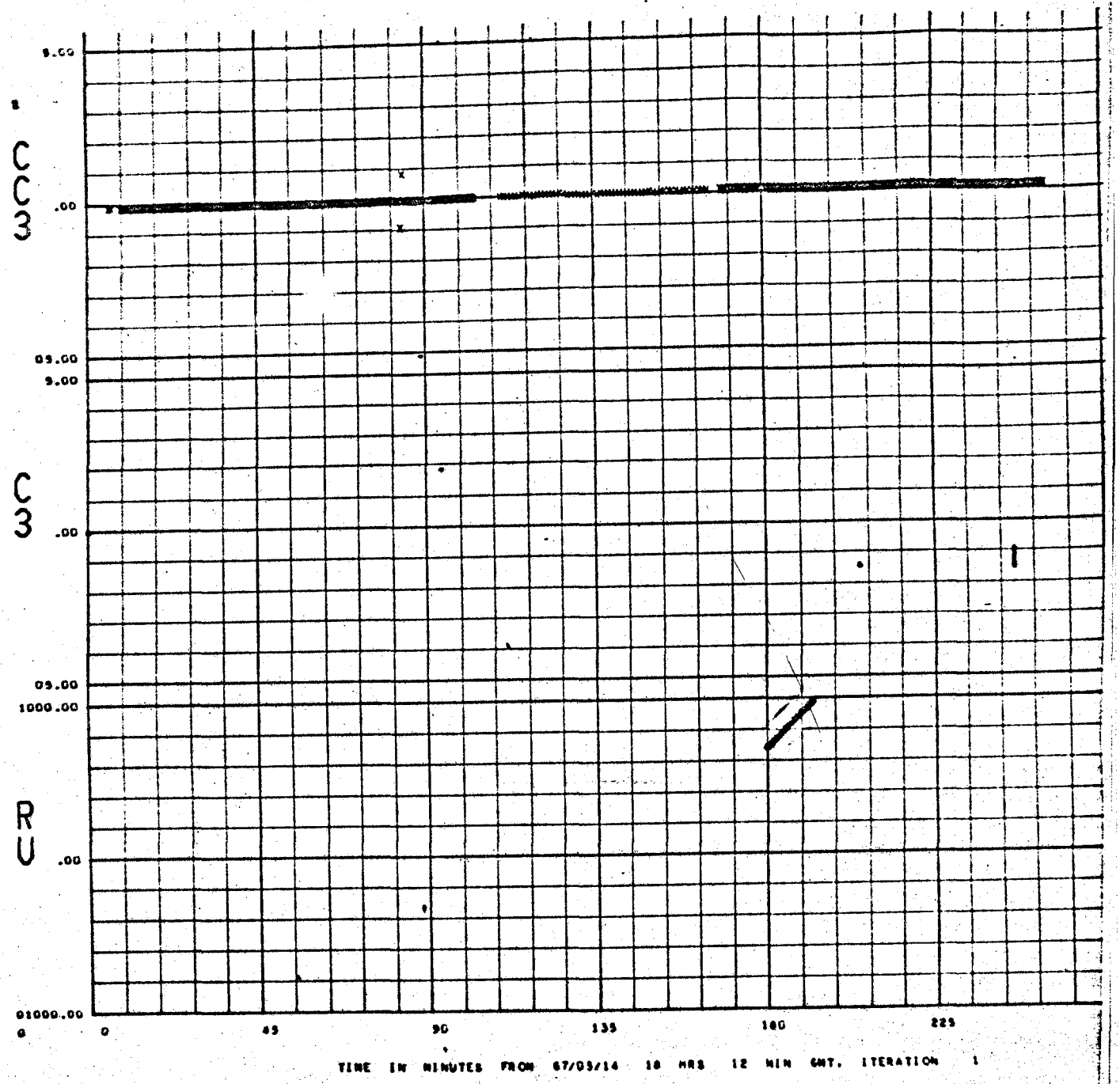
SIMPLE MOON



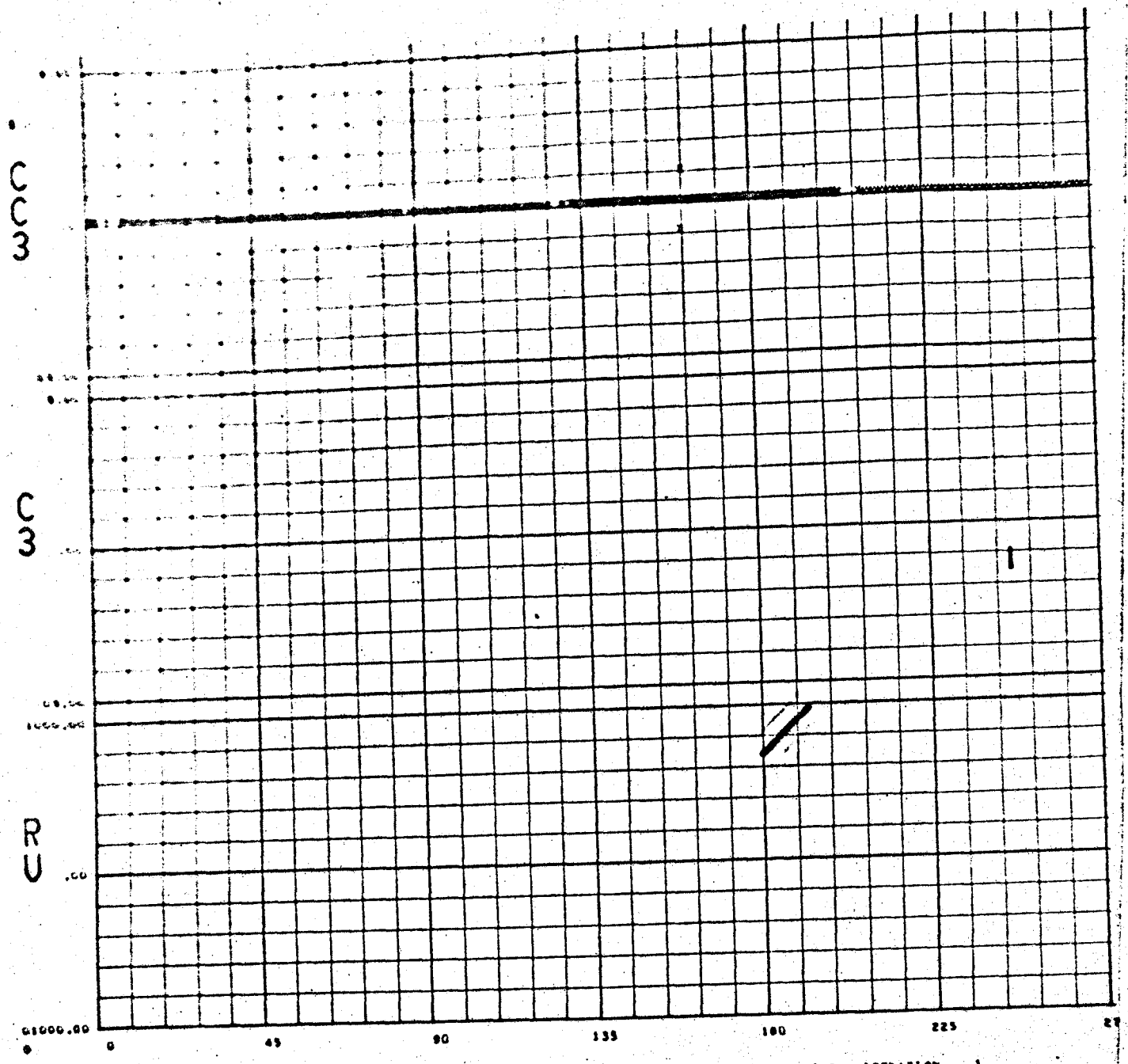
STATION 62 RESIDUALS PASS NUMBER 10/134



STATION 62 RESIDUALS PASS NUMBER 10/134

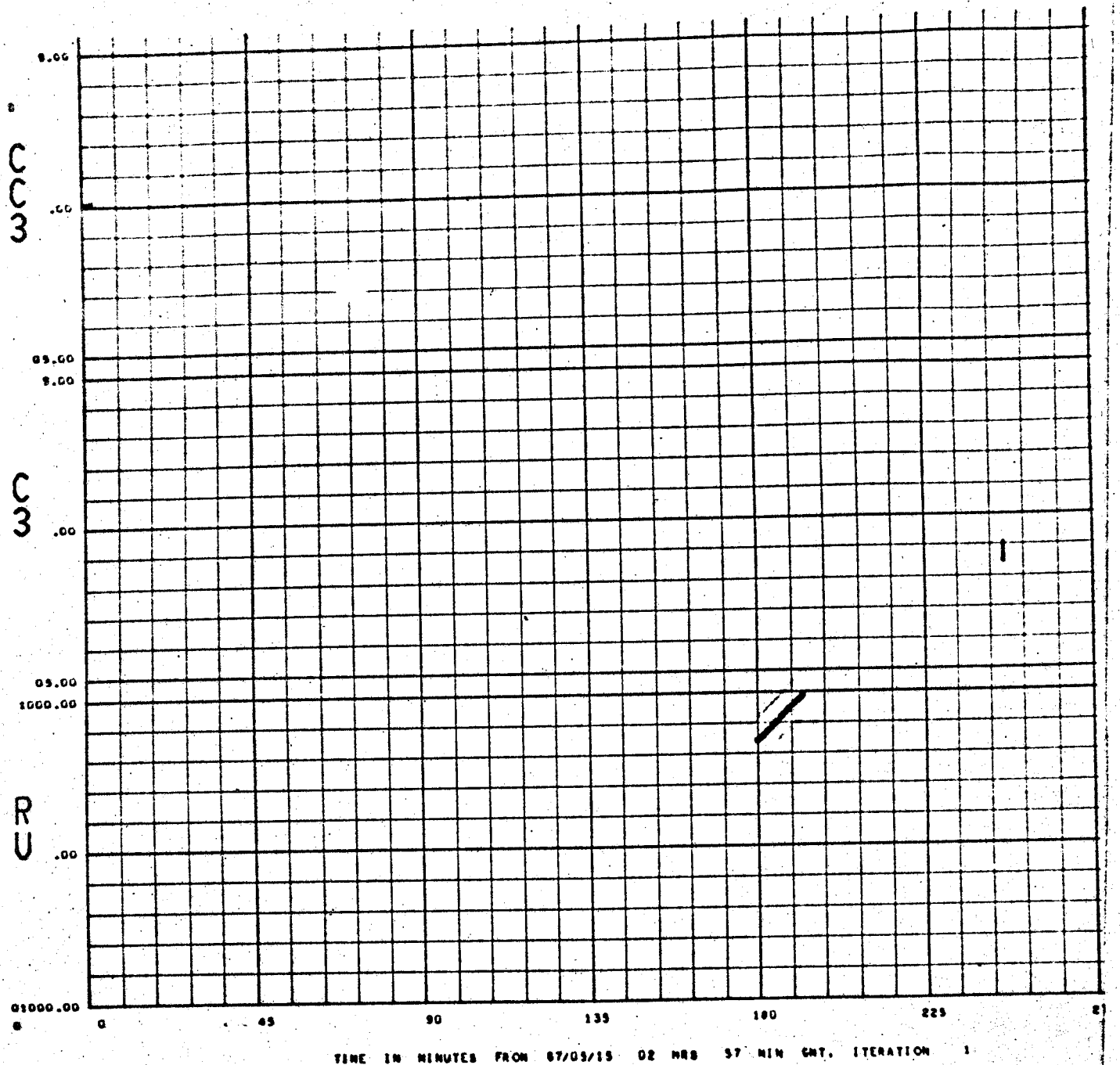


STATION 12 RESIDUALS PASS NUMBER 10/134



STATION 12 RESIDUALS

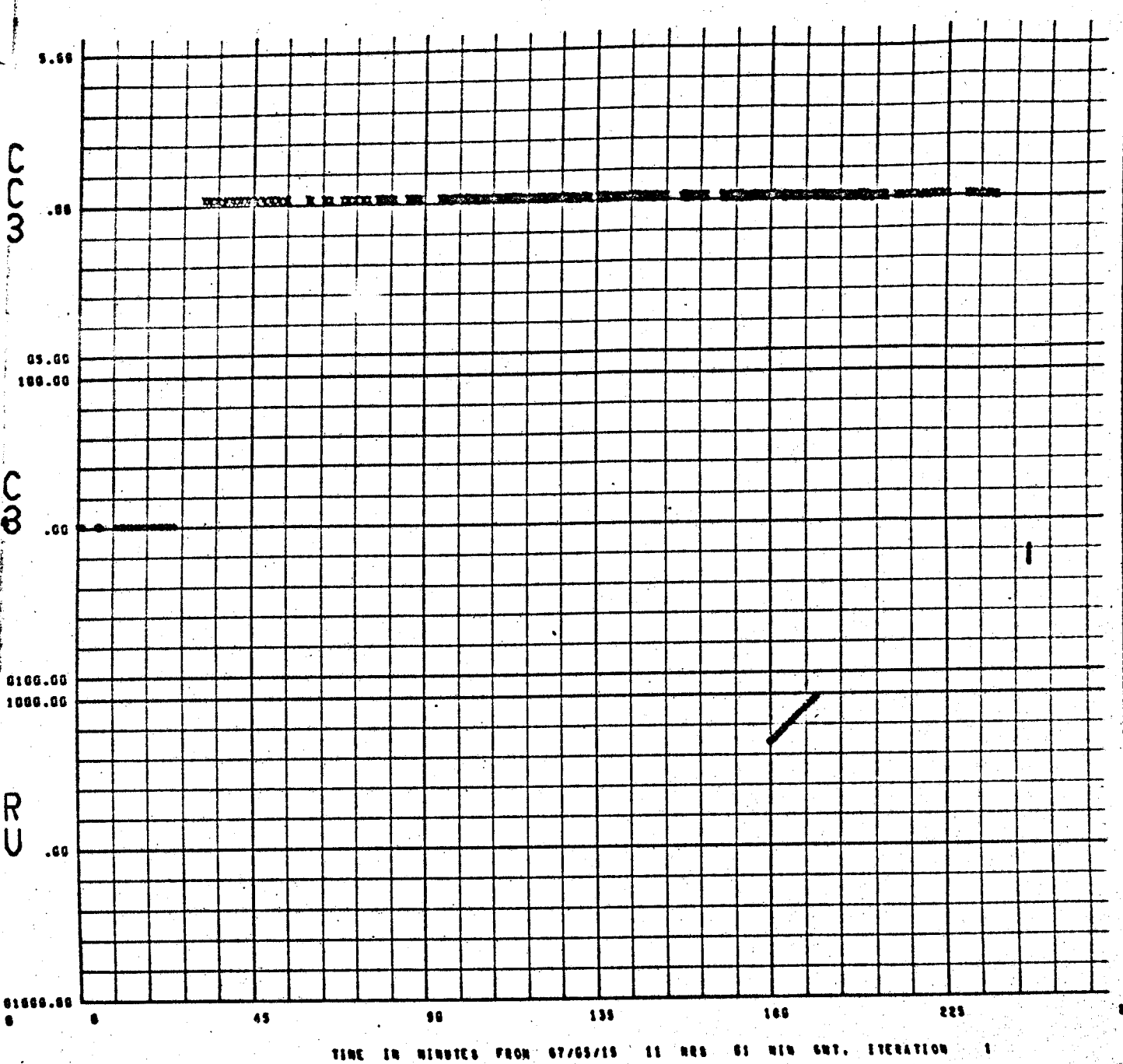
PASS NUMBER 10/134



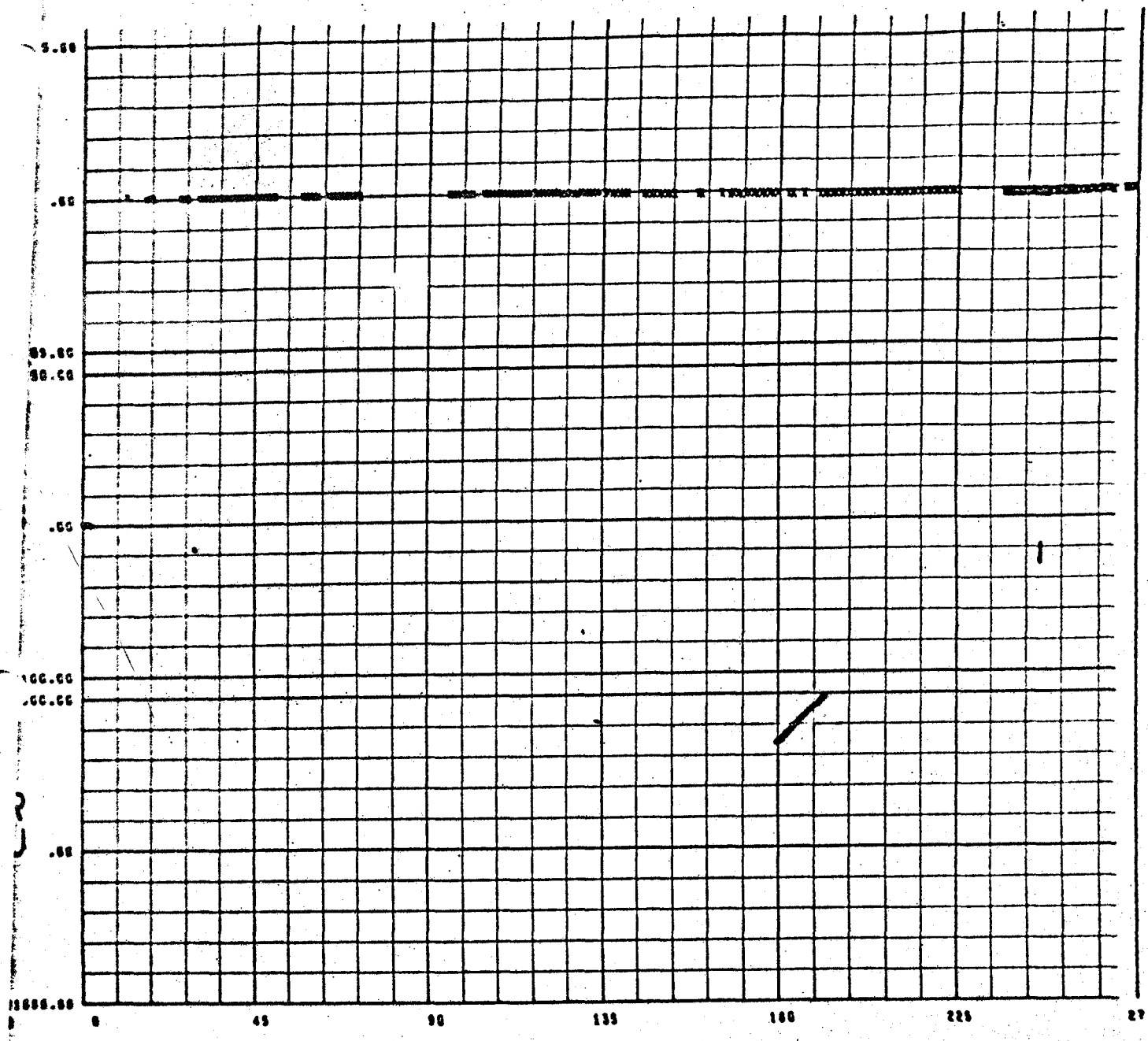
STATION 12 RESIDUALS PASS NUMBER 10/134

ODPL 40RB13

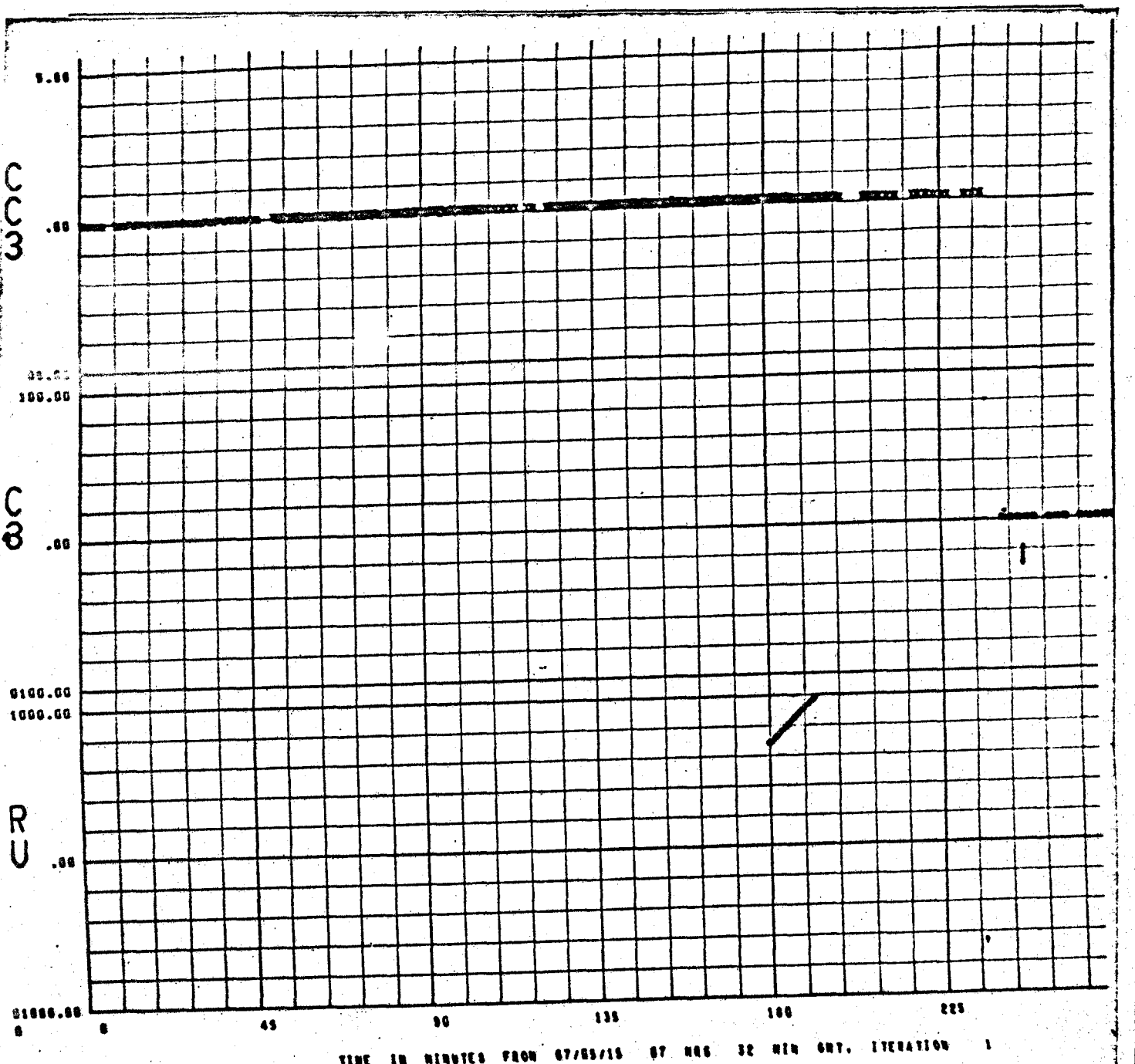
SIMPLE MOON



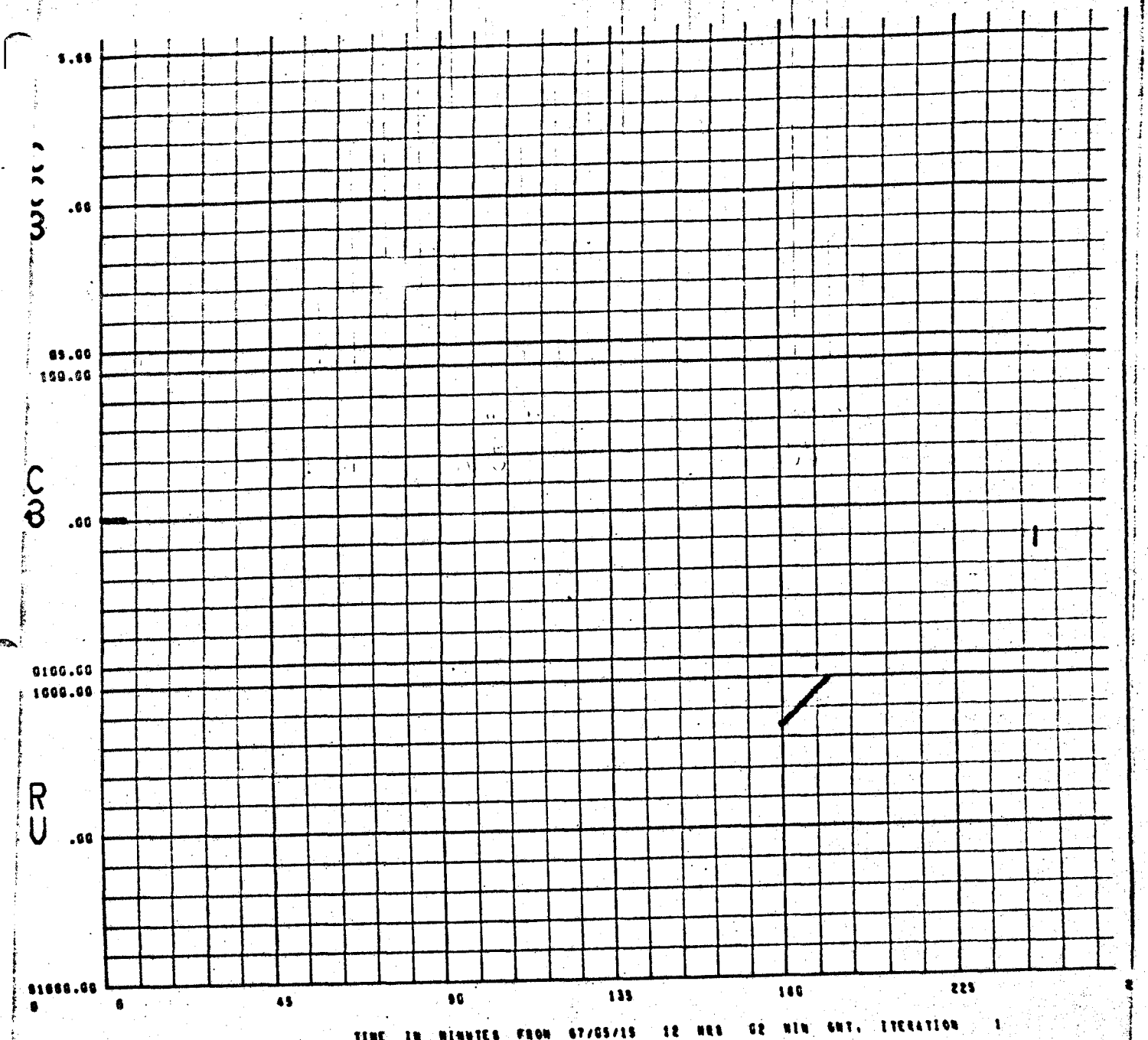
STATION 62 RESIDUALS PASS NUMBER 11/135



STATION 41 RESIDUALS PASS NUMBER 11/135

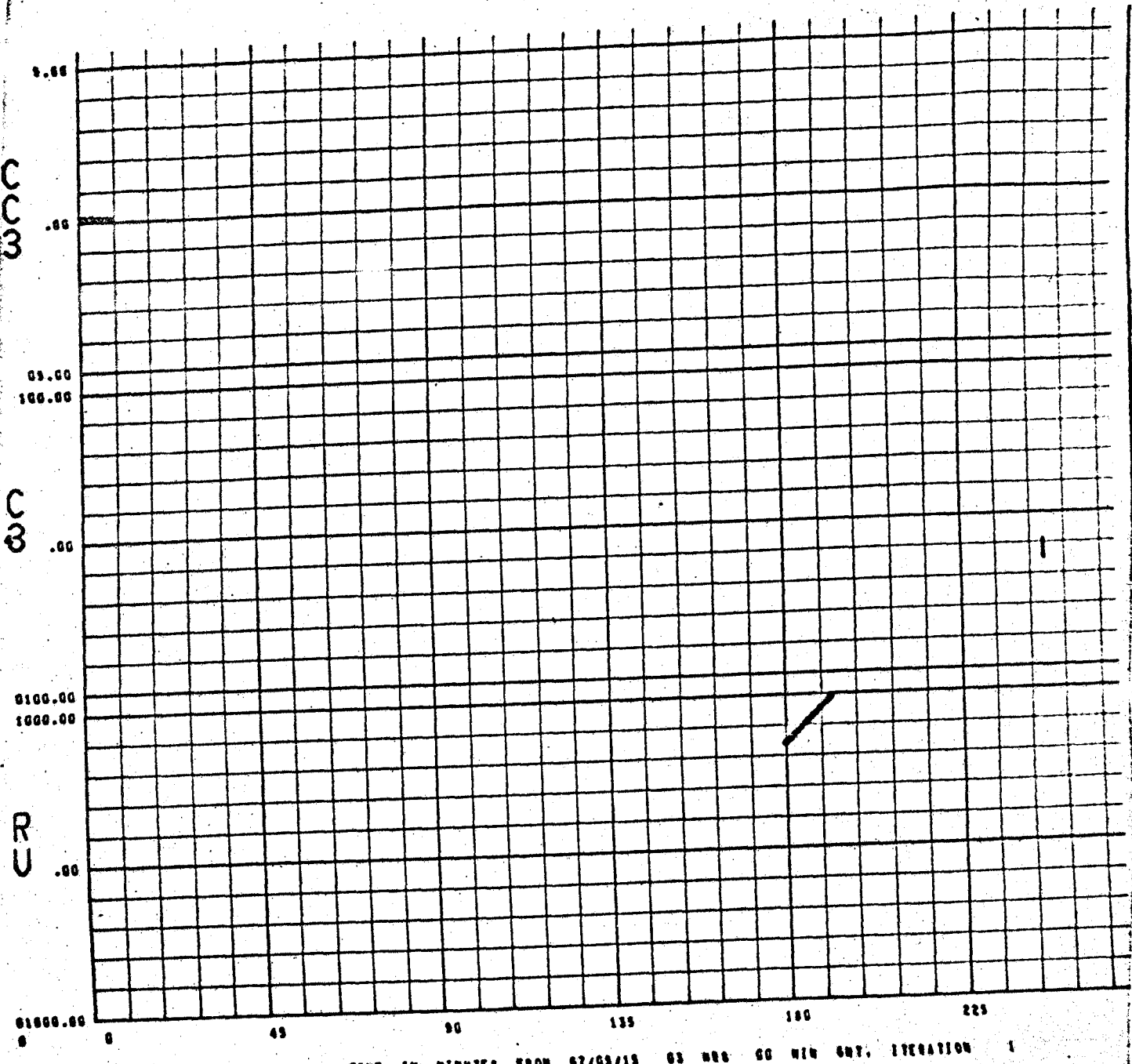


STATION 41 RESIDUALS PASS NUMBER 11/135



TIME IN MINUTES FROM 67/05/15 12 HRS 02 MIN GMT, ITERATION 1

STATION 41 RESIDUALS PASS NUMBER 11/135

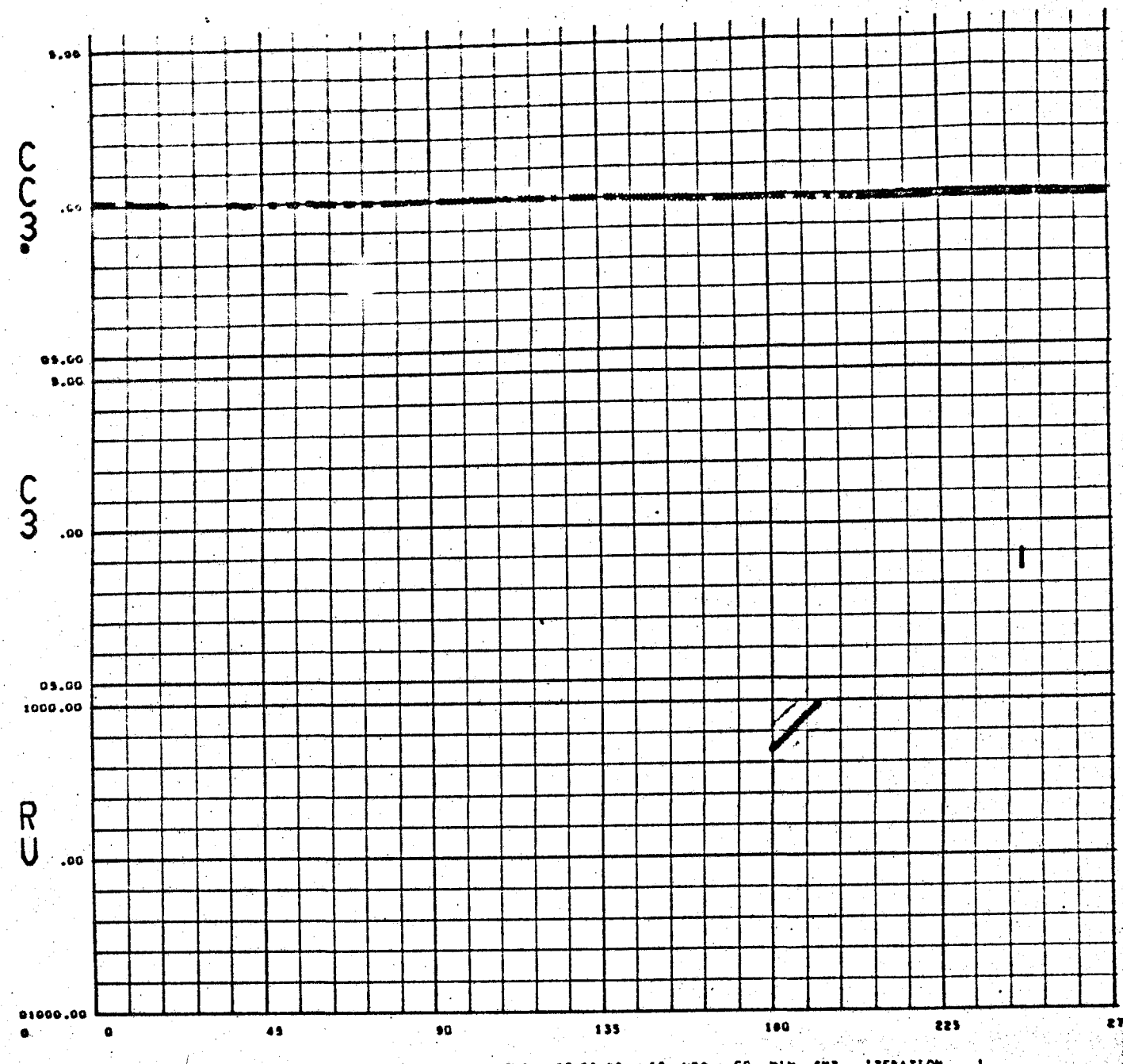


STATION 12 RESIDUALS

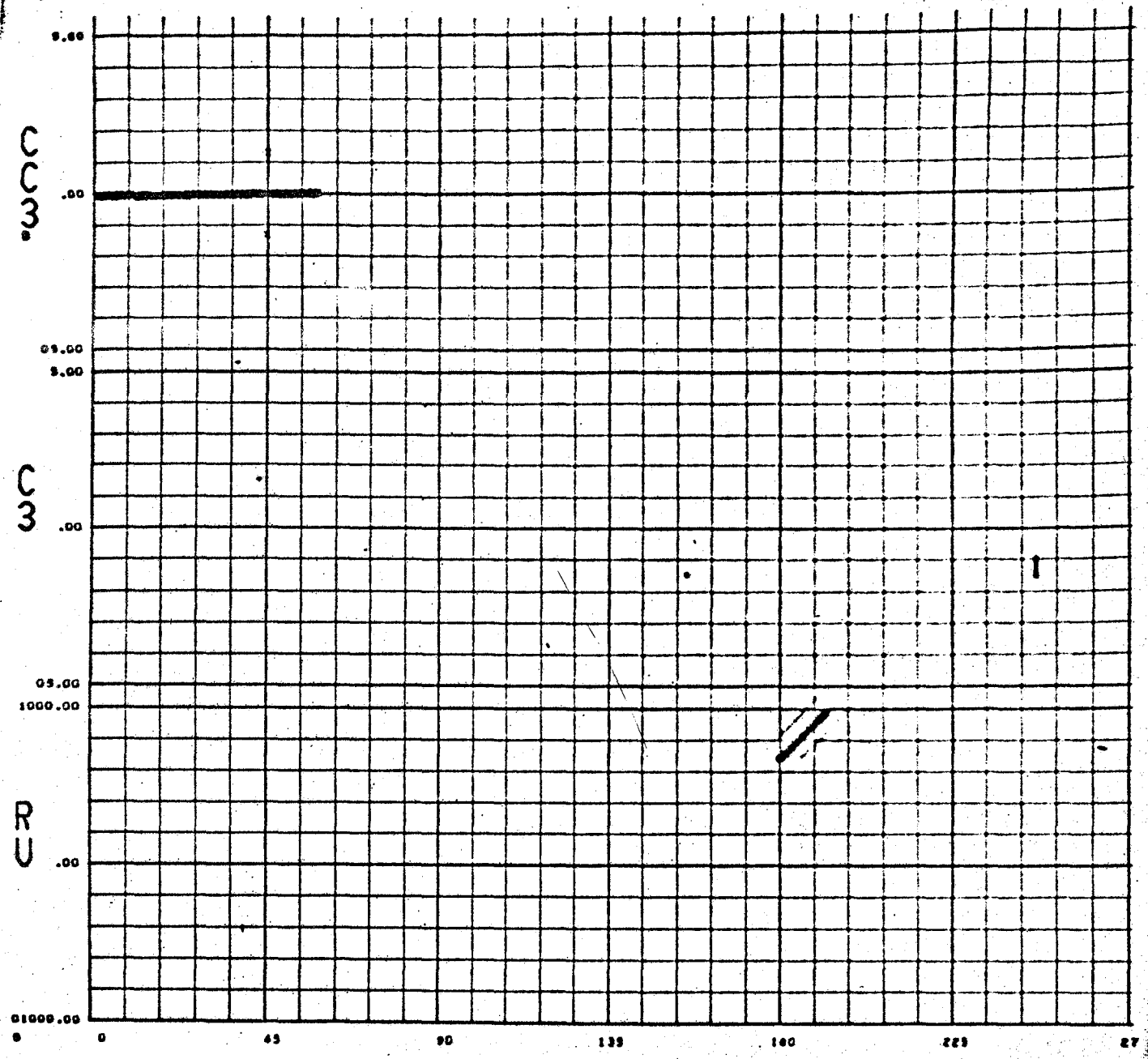
PASS NUMBER 10/134

ODPL 40RB14

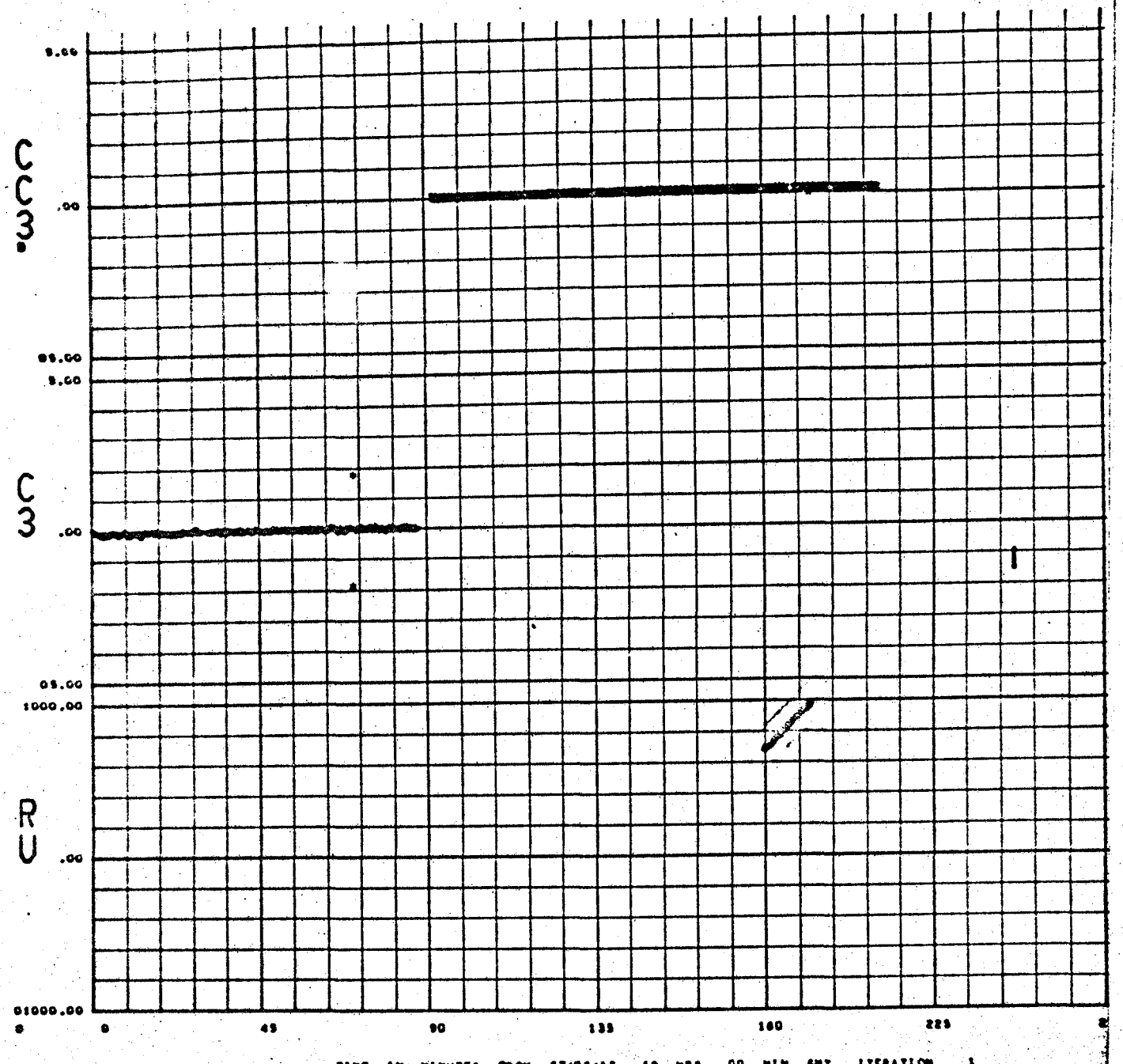
SIMPLE MOON



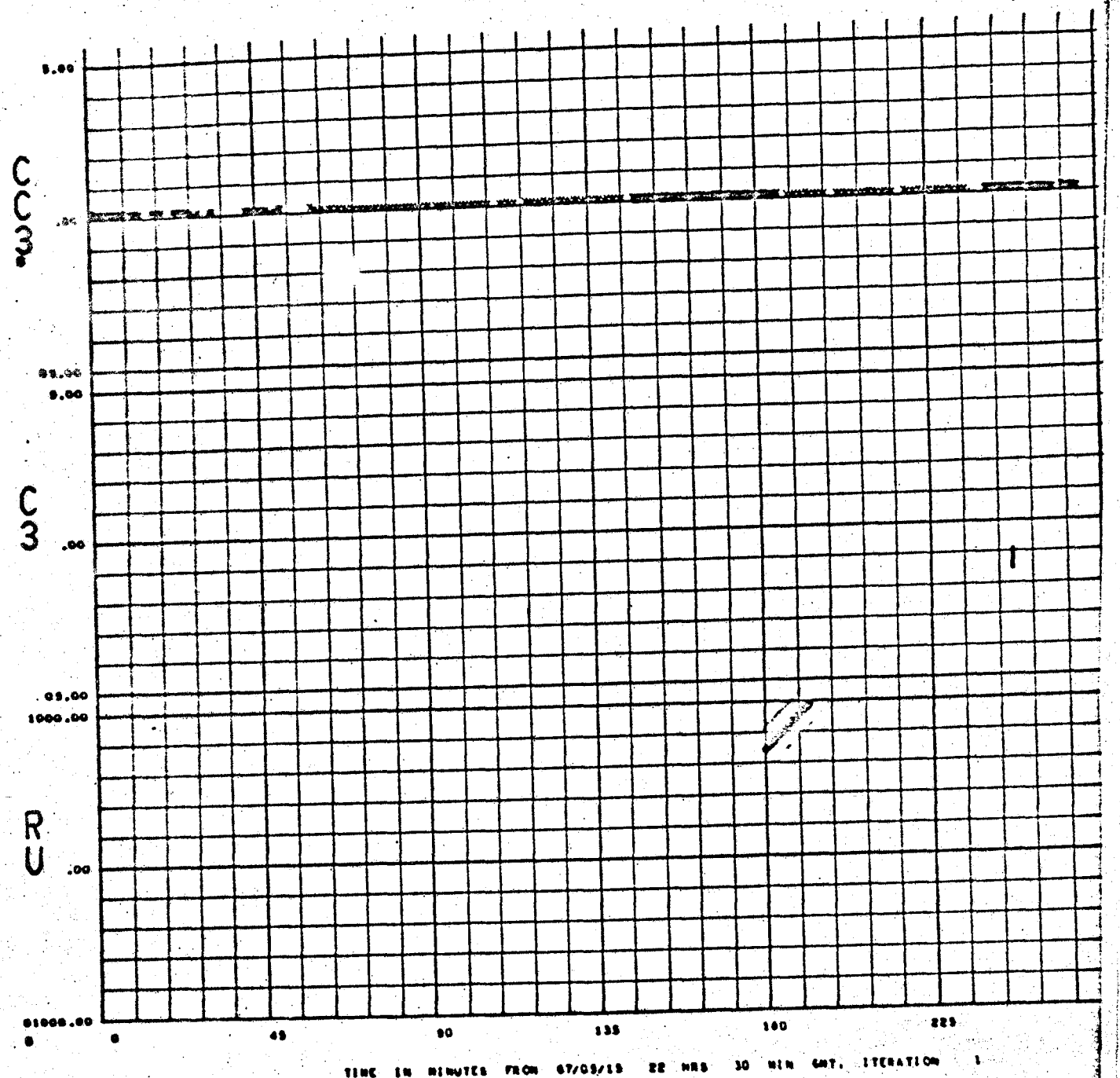
STATION 62 RESIDUALS PASS NUMBER 11/135



STATION 62 RESIDUALS 'PASS NUMBER 11/135



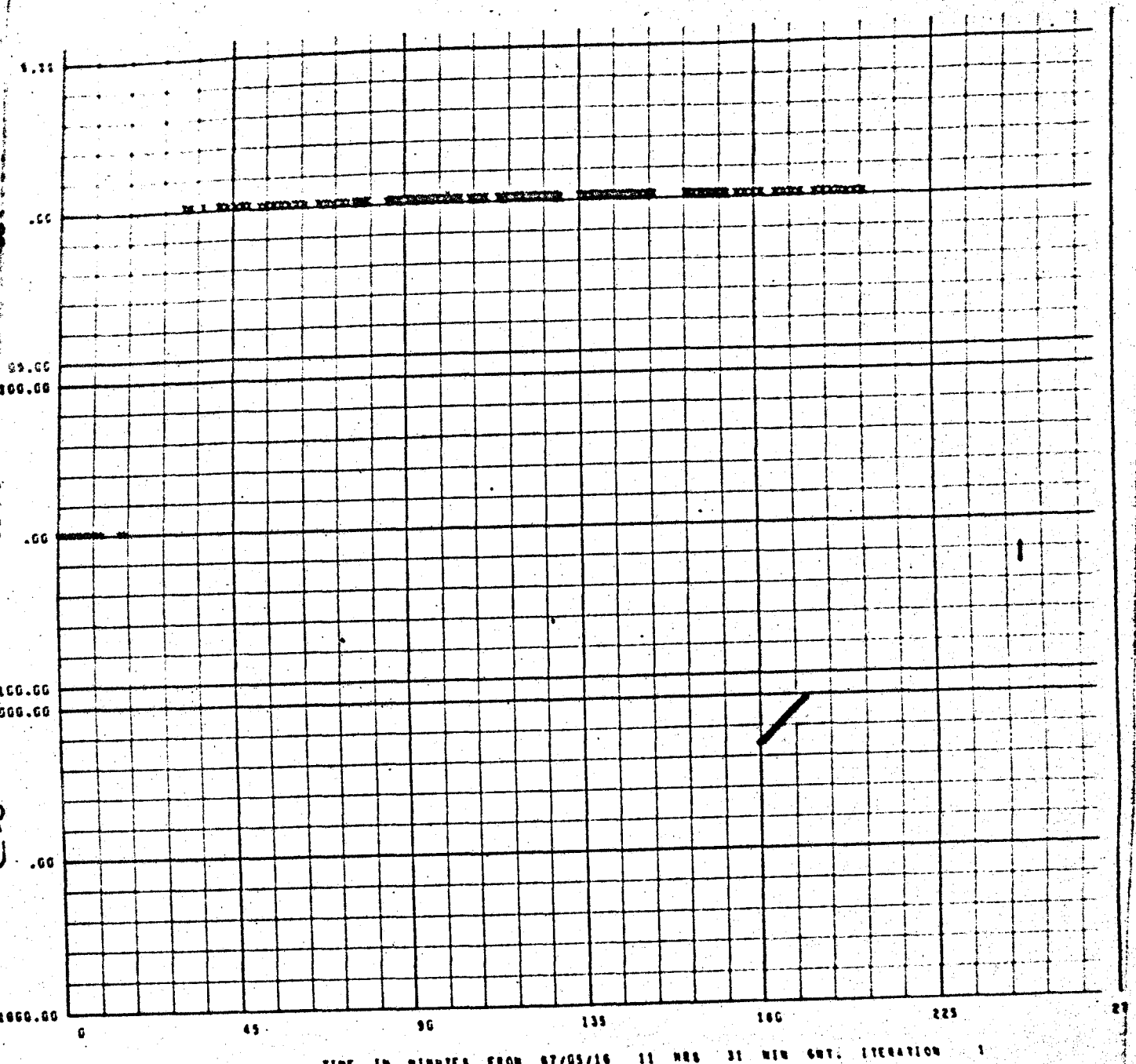
STATION 12 RESIDUALS PASS NUMBER 11/135



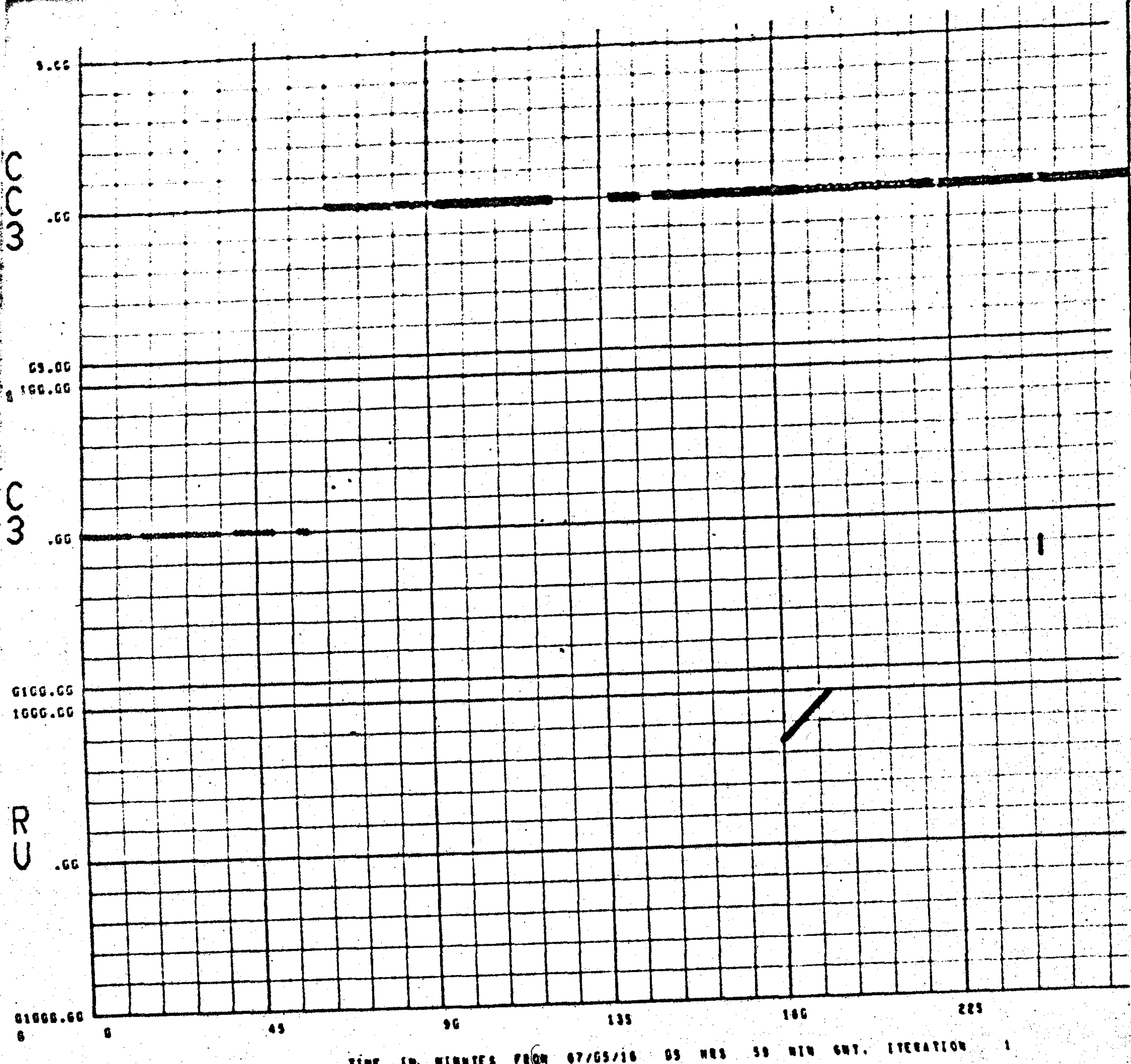
STATION 12 RESIDUALS PASS NUMBER 11/135

ODPL 40RB15

SIMPLE MOON



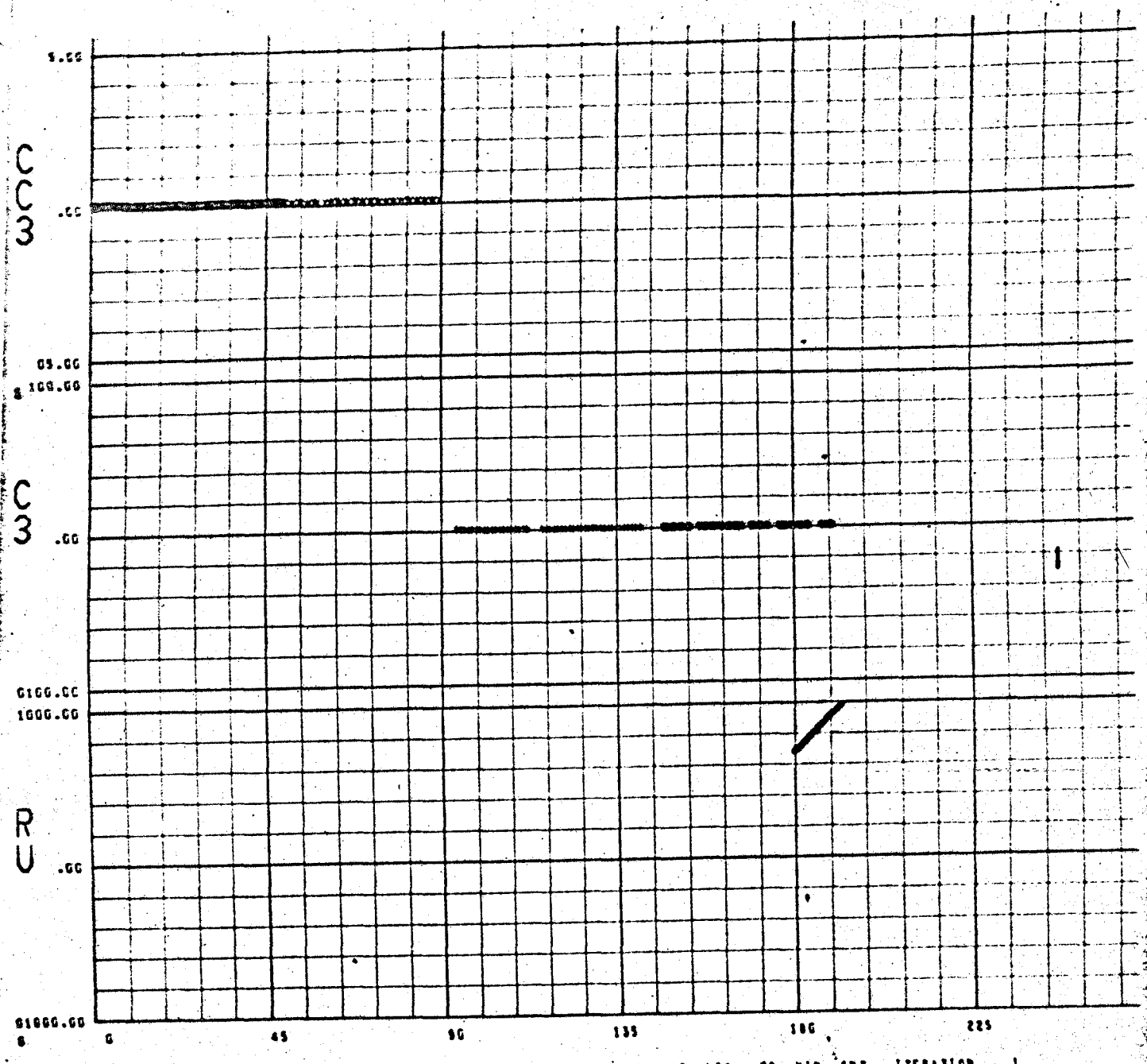
STATION 62 RESIDUALS PASS NUMBER 12/136



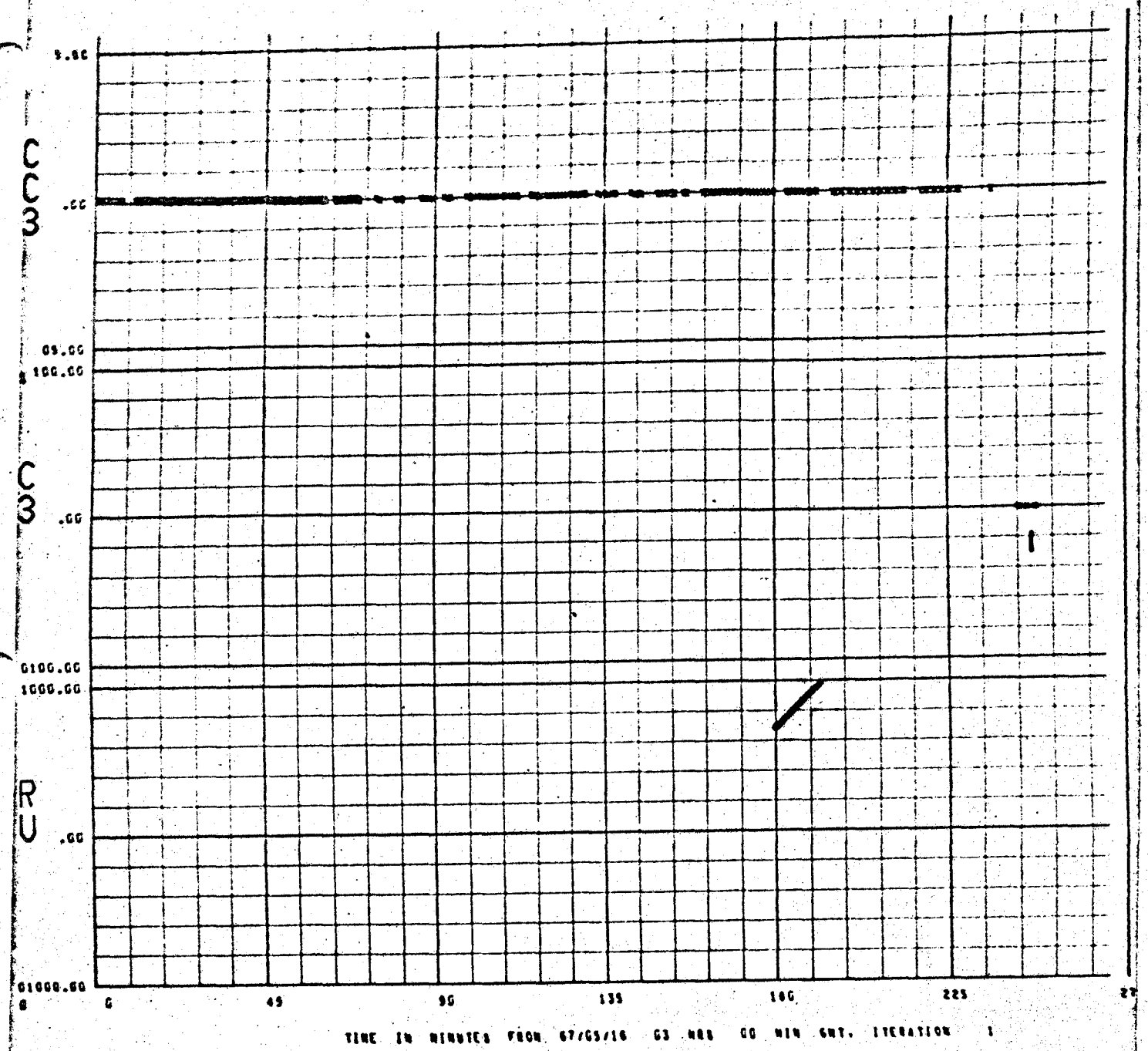
STATION 41 RESIDUALS

PASS NUMBER 12/136

REV LTR



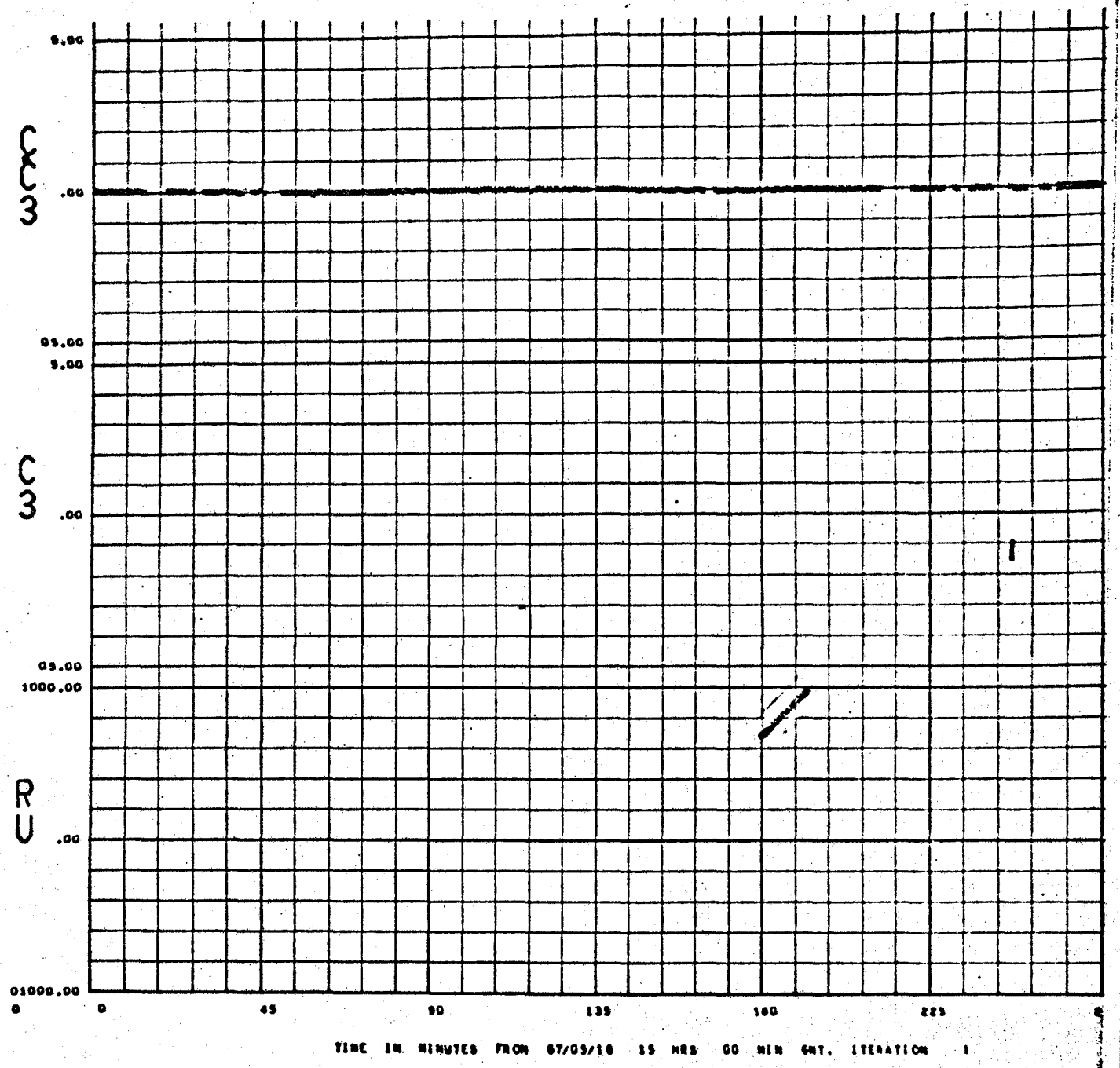
STATION 41 RESIDUALS PASS NUMBER 12/136



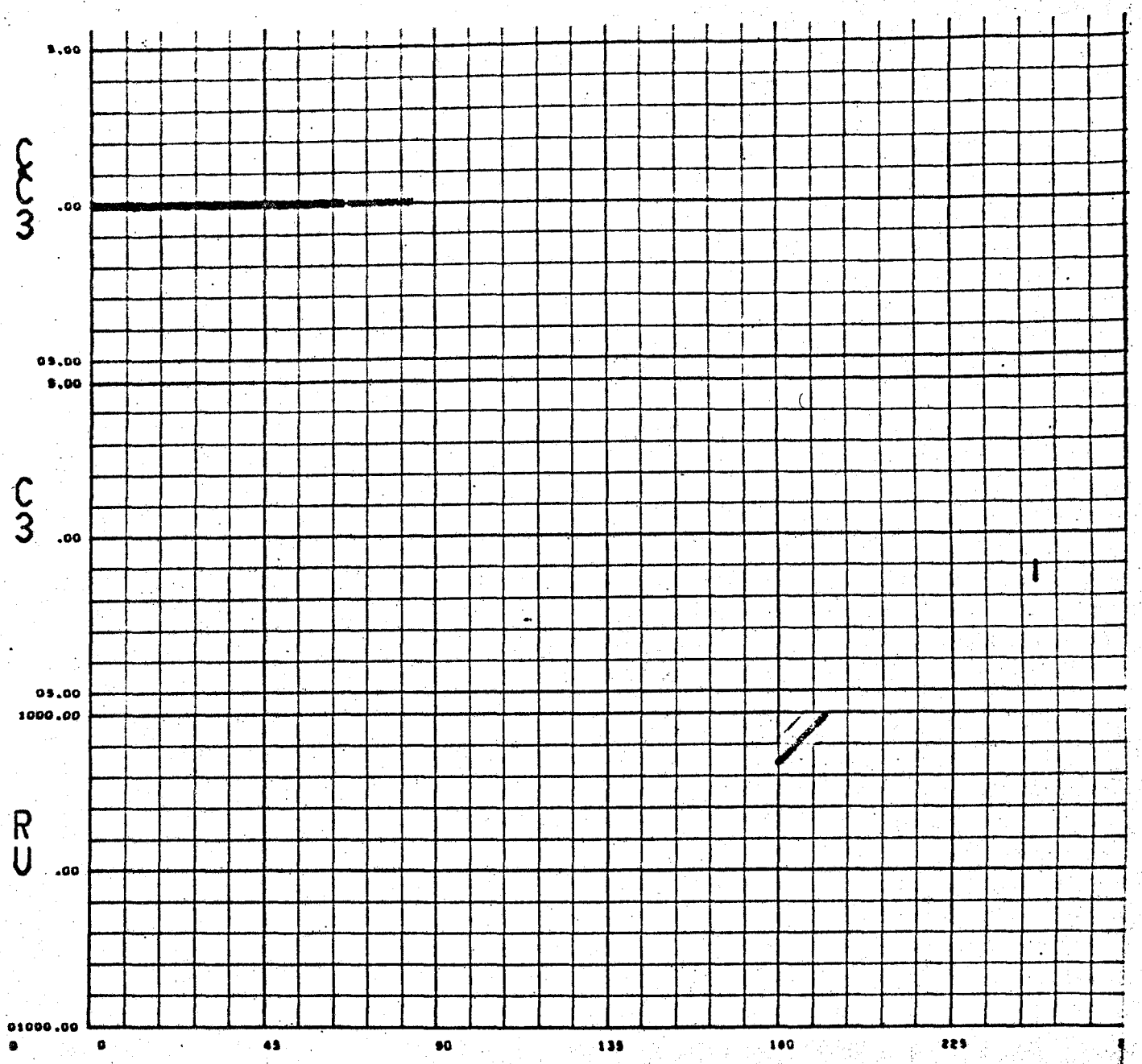
STATION 12 RESIDUALS PASS NUMBER 11/135

SIMPLE MOON

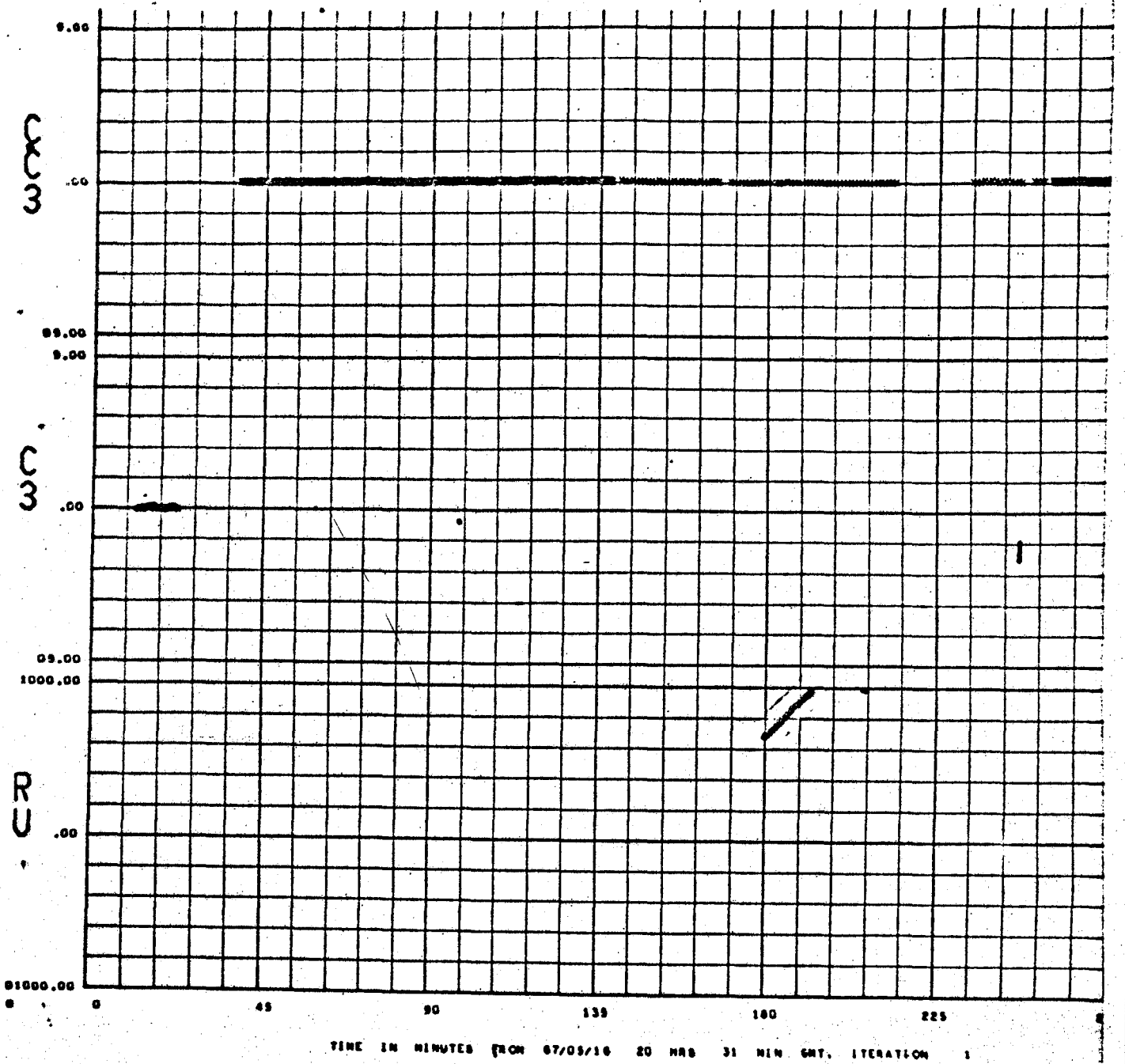
ODPL 40RB16



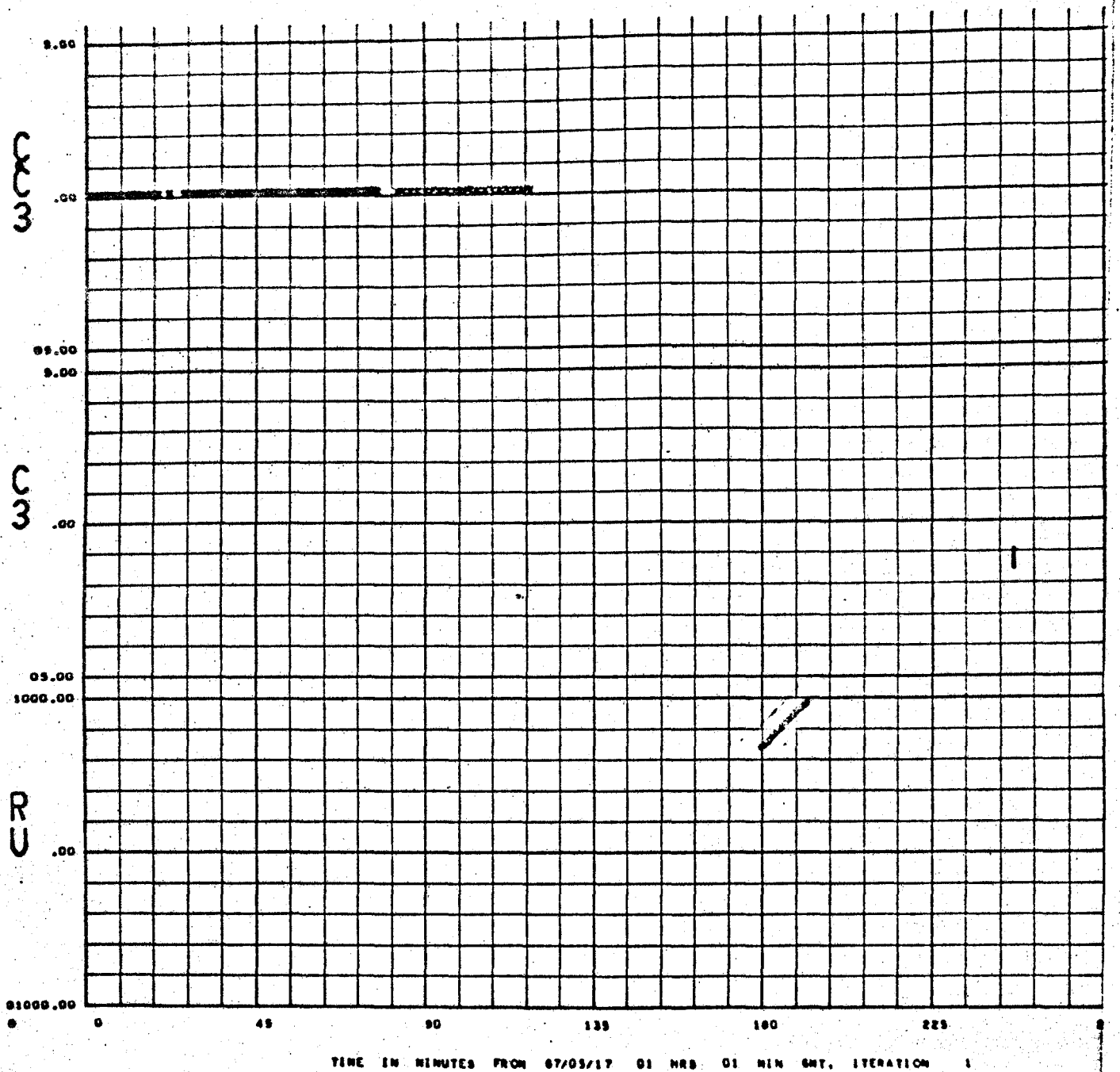
STATION 62 RESIDUALS . PASS NUMBER 12/136



STATION 62 RESIDUALS PASS NUMBER 12/136



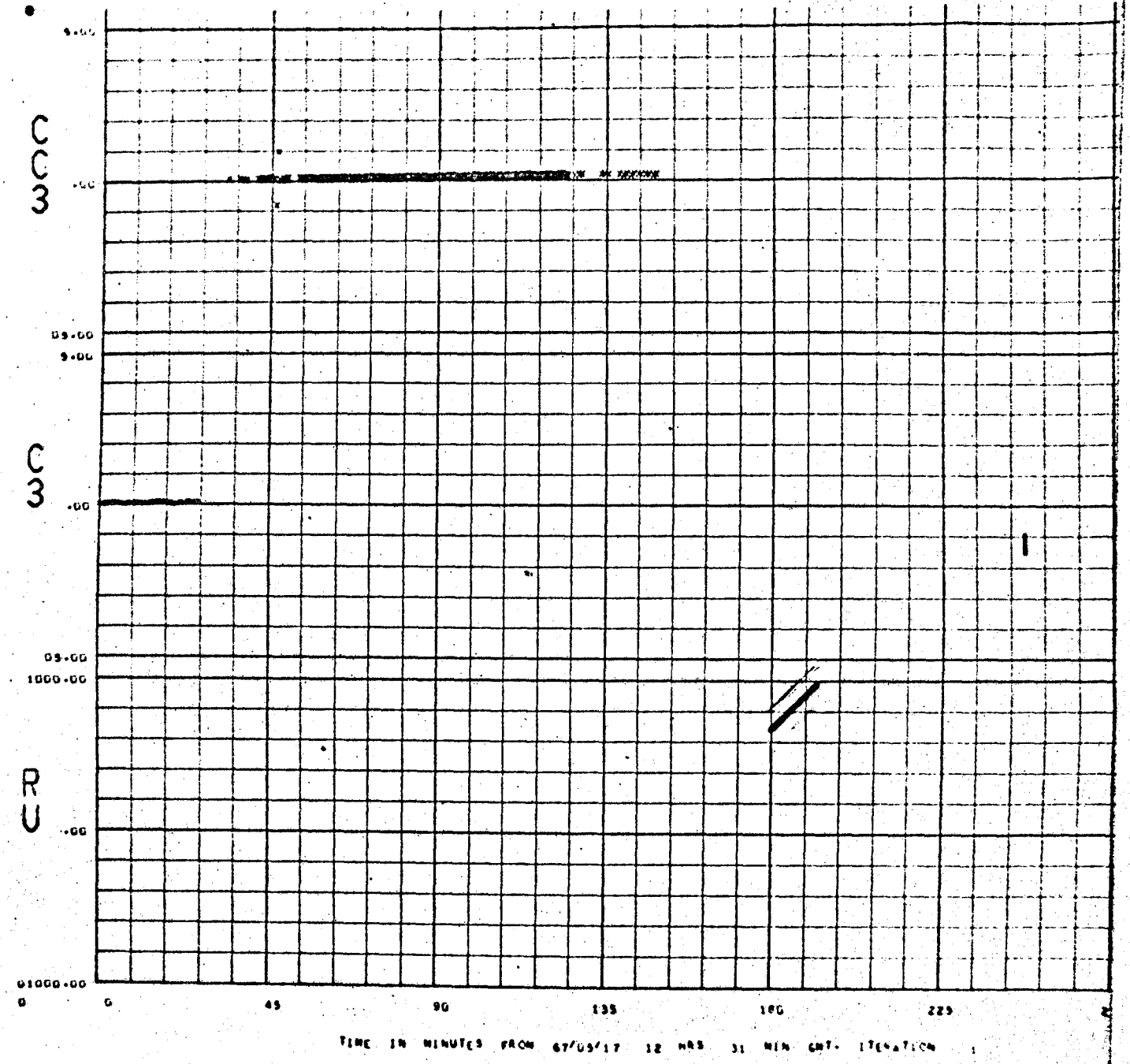
STATION 12 RESIDUALS PASS NUMBER 12/136



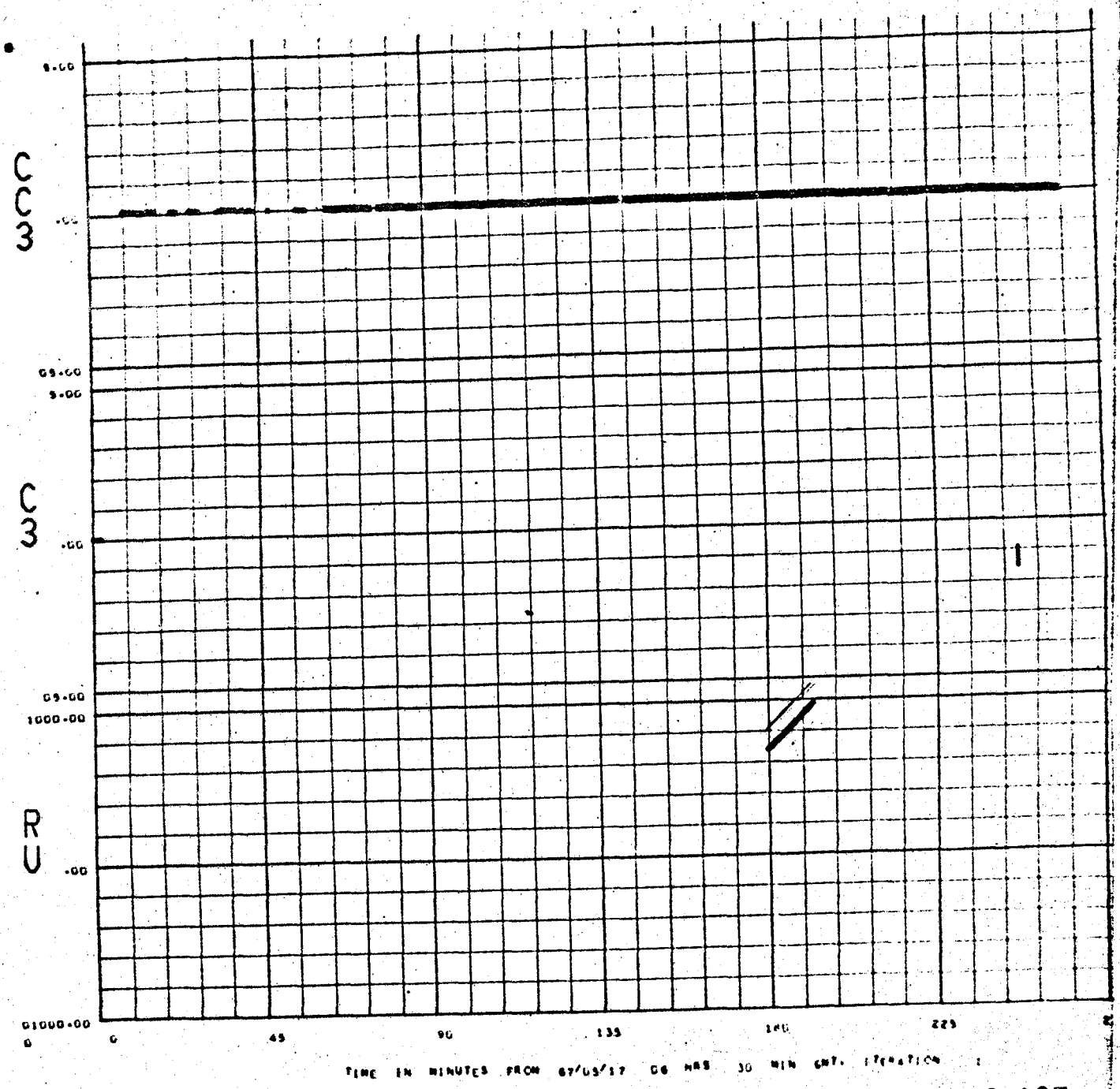
STATION 12 RESIDUALS PASS NUMBER 12/136

ODPL 40RB17

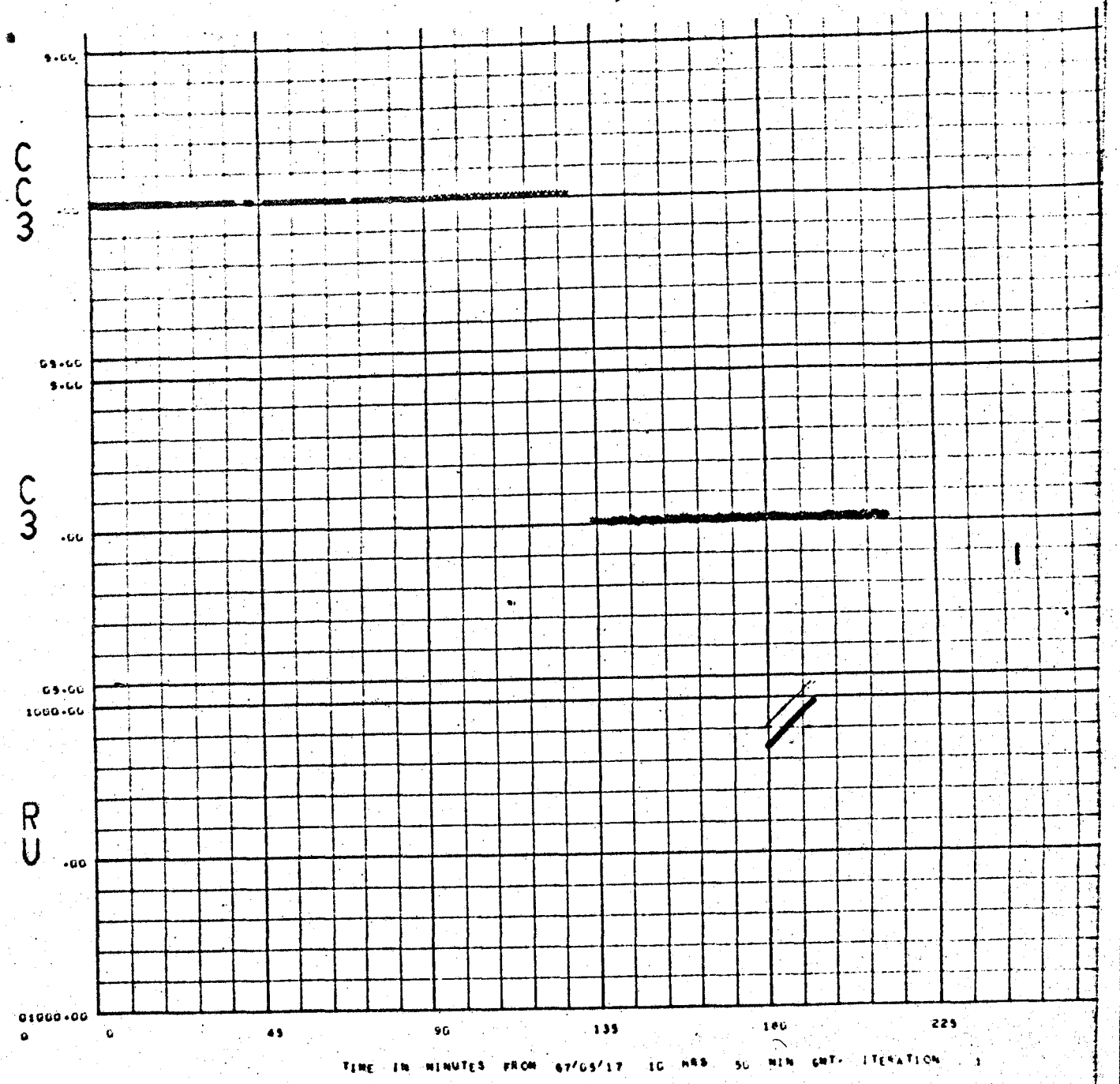
SIMPLE MOON



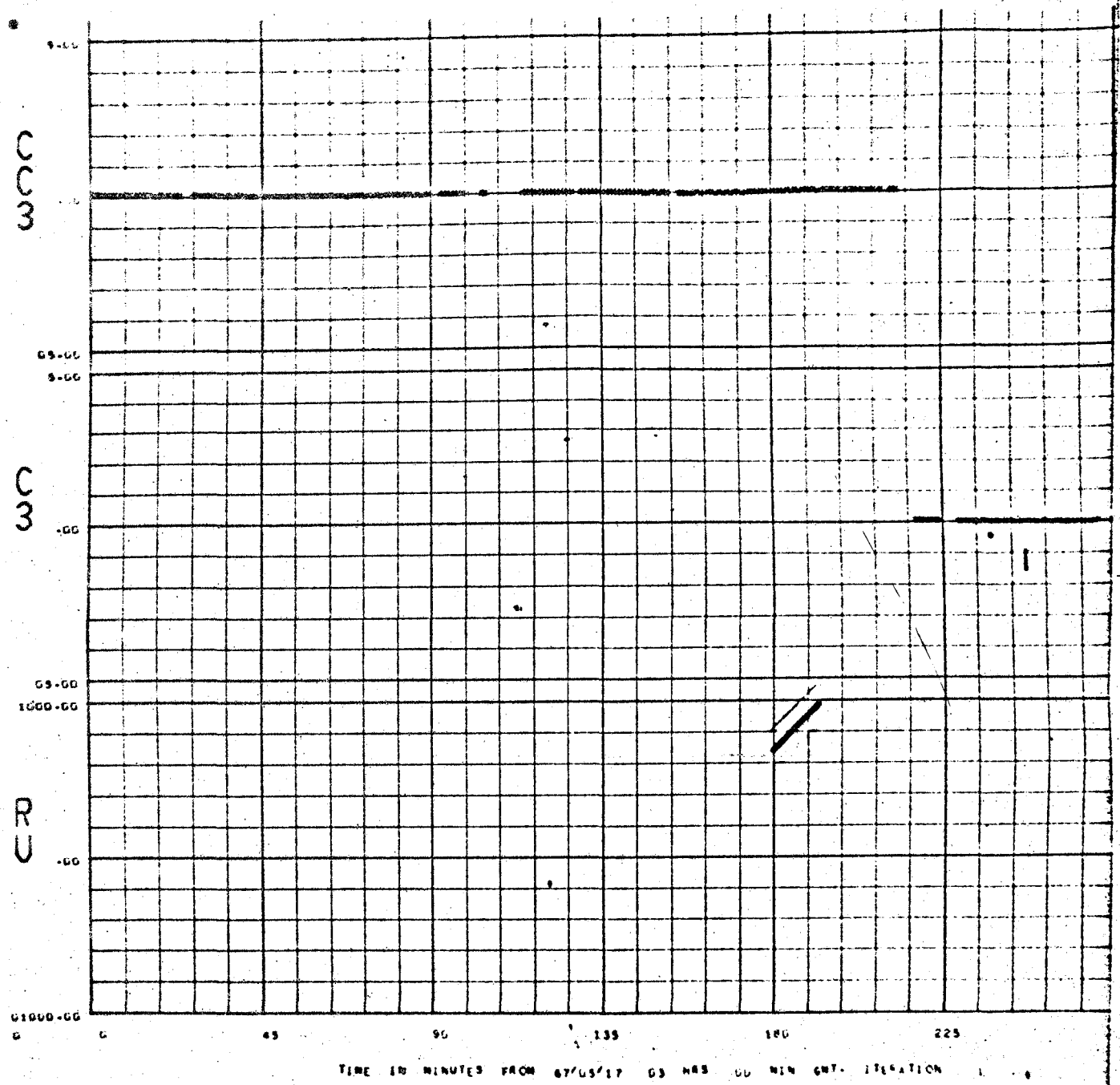
STATION 62 RESIDUALS PASS NUMBER 13/137



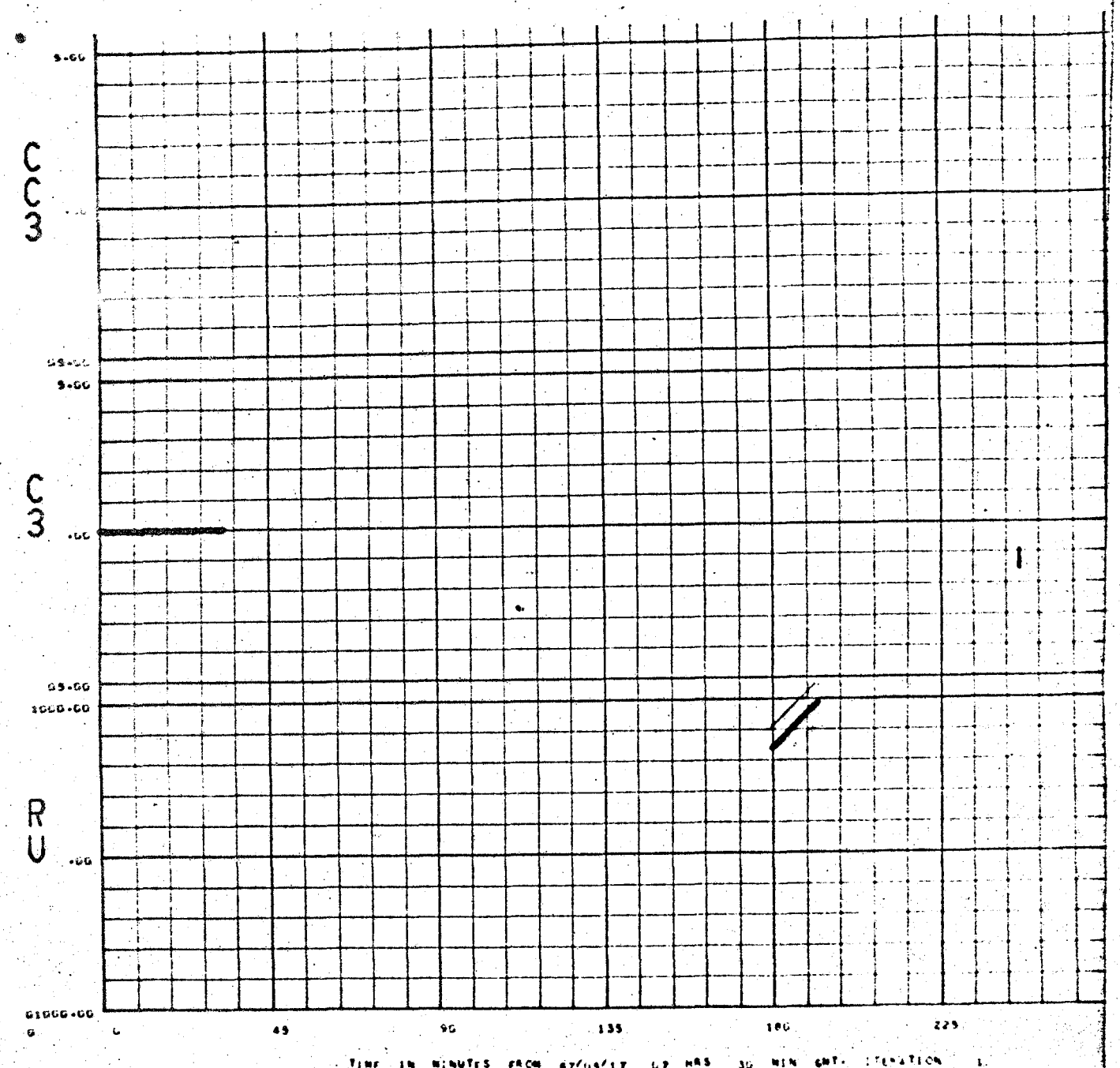
STATION 41 RESIDUALS PASS NUMBER 13/137



STATION 41 RESIDUALS PASS NUMBER 13/137



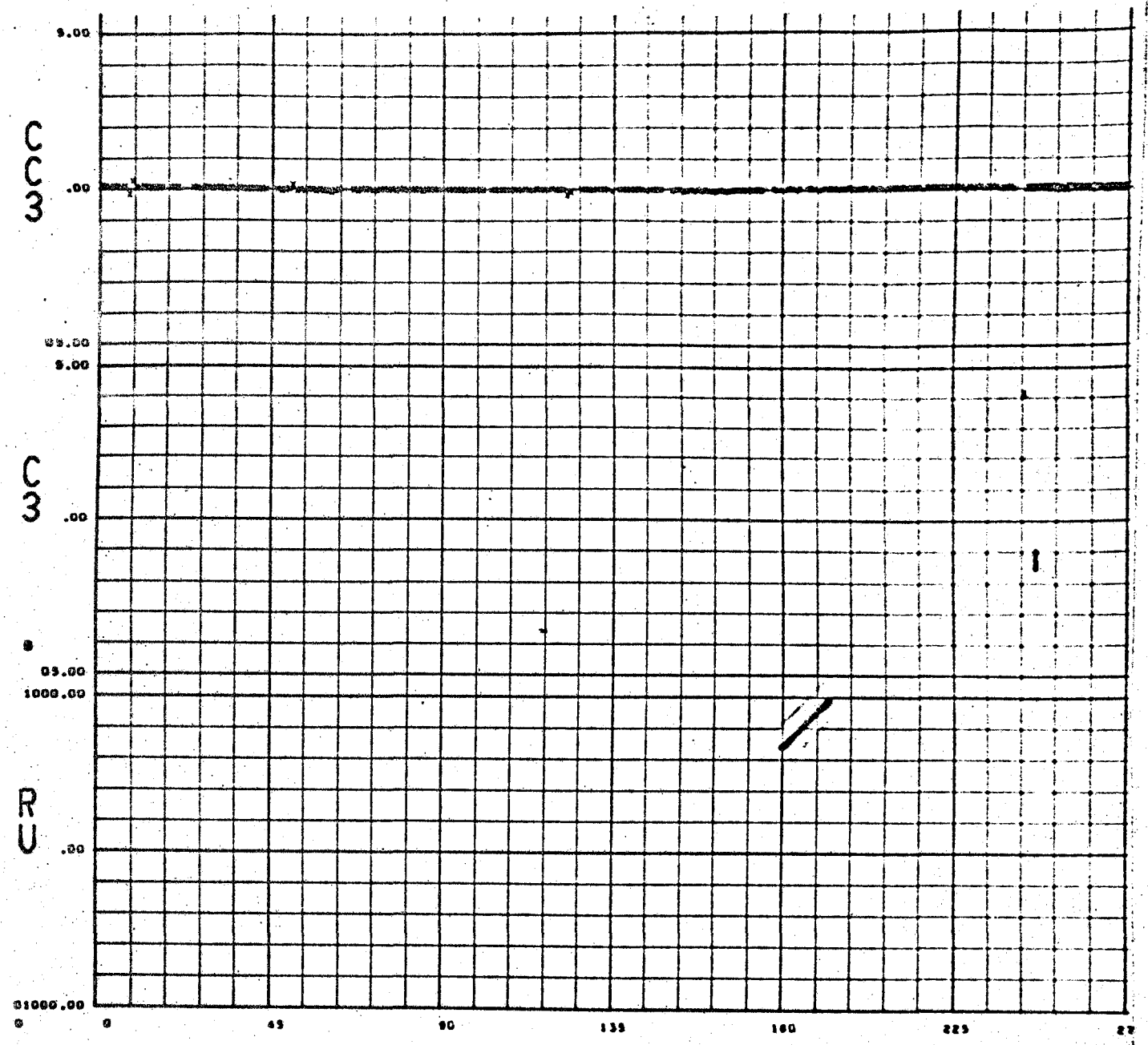
STATION 12 RESIDUALS PASS NUMBER 12/136



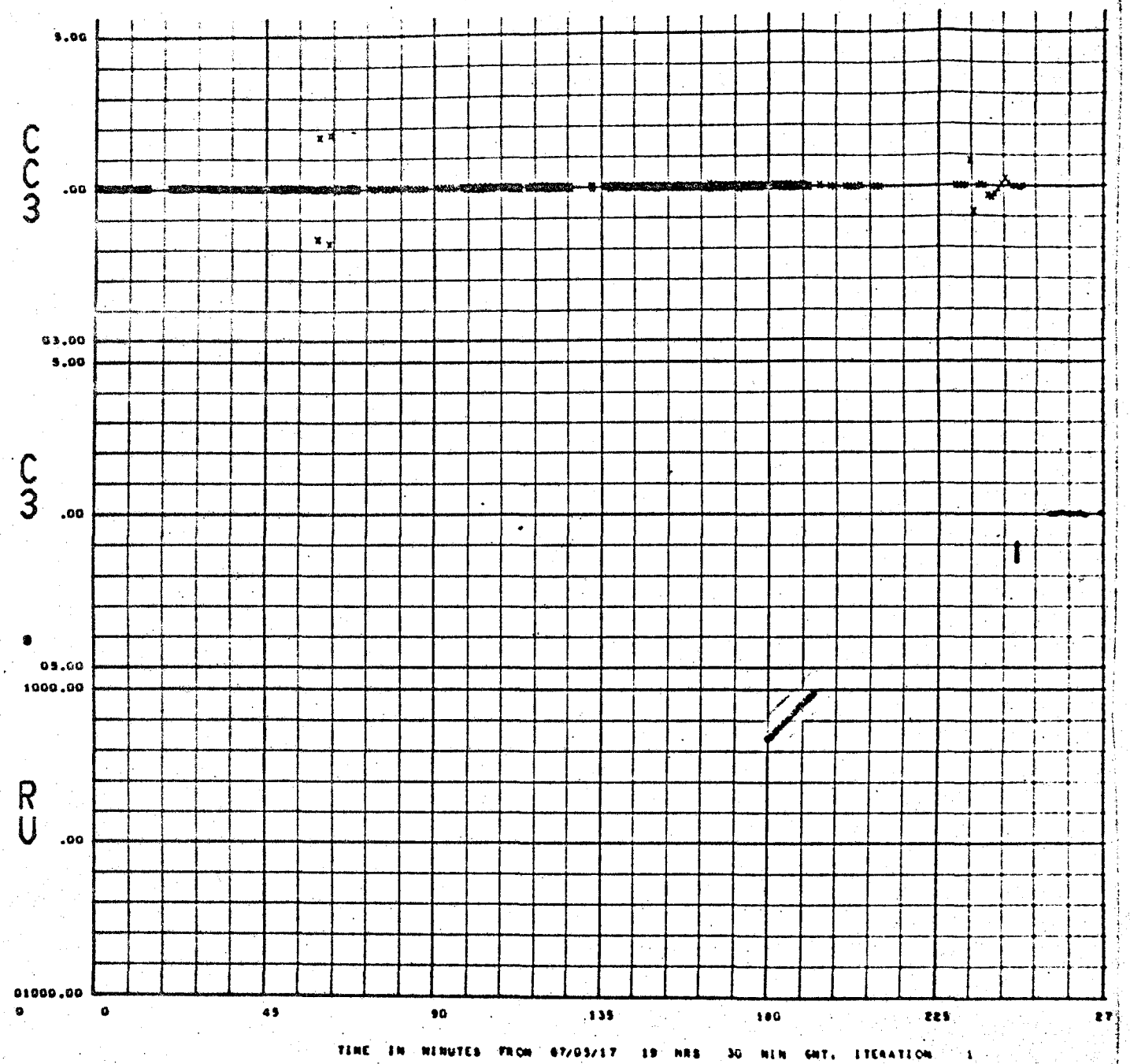
STATION 12 RESIDUALS PASS NUMBER 12/136

ODPL 40RB18

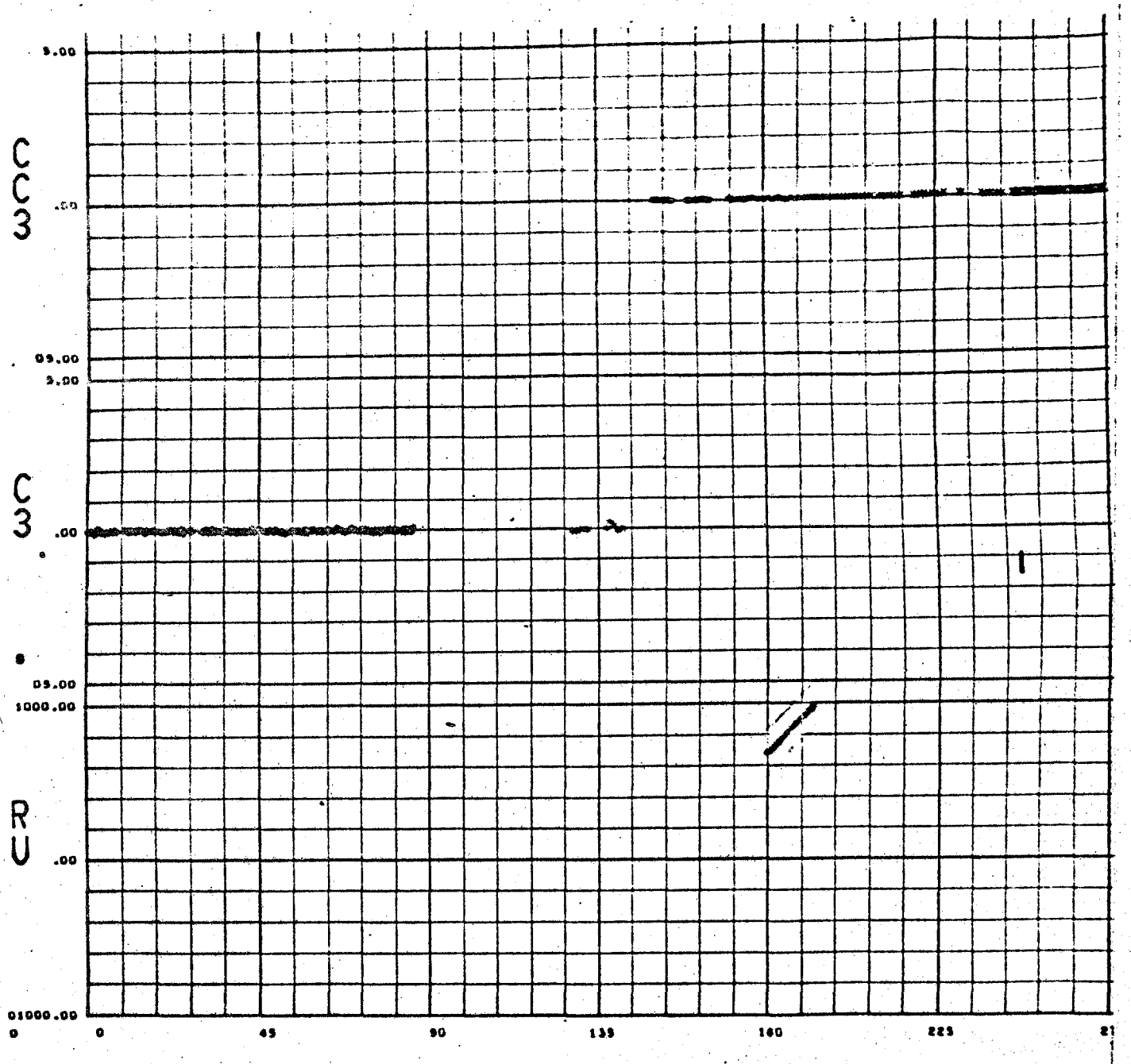
SIMPLE MOON



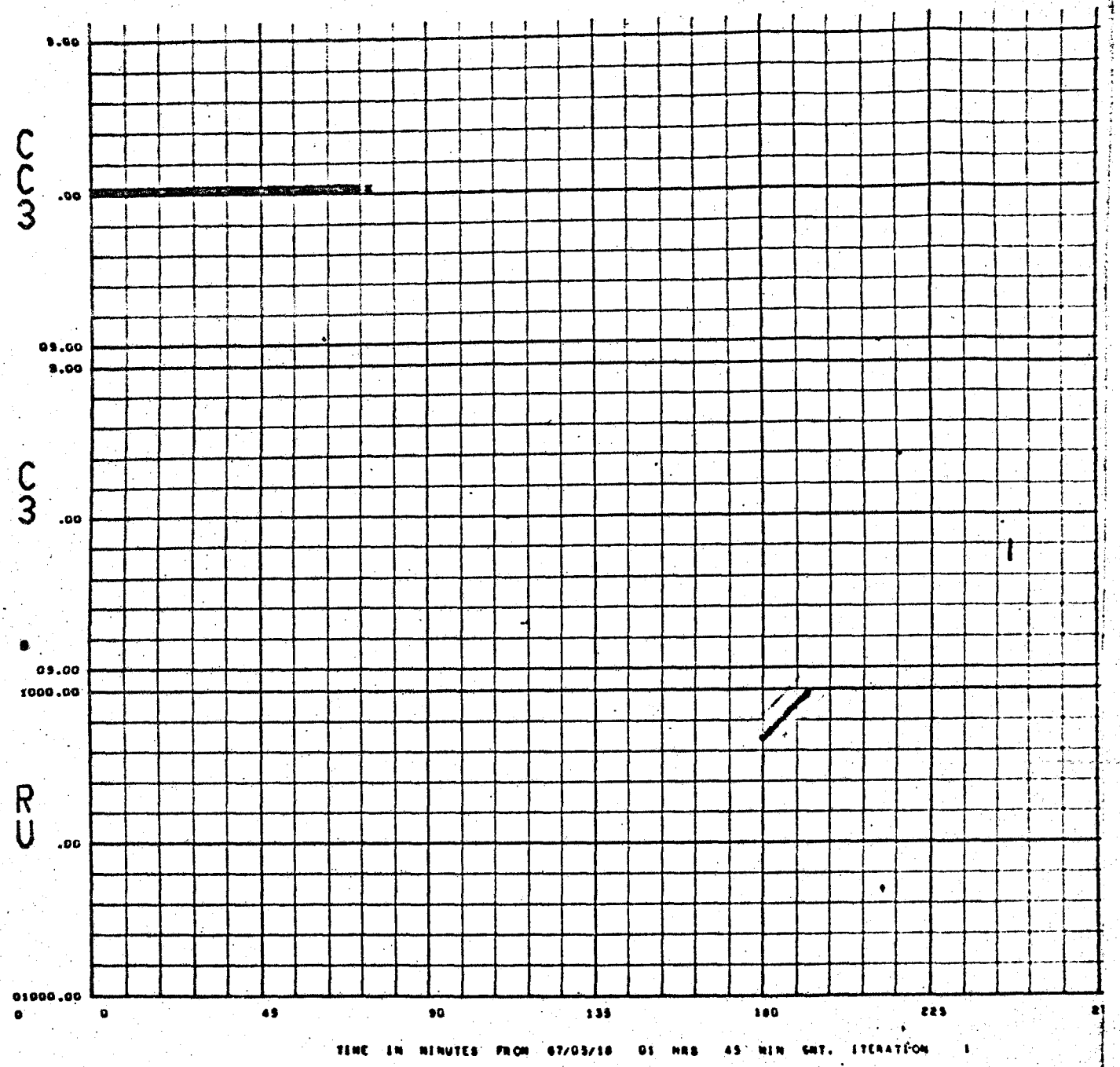
STATION 62 RESIDUALS PASS NUMBER 13/137



STATION 62 RESIDUALS PASS NUMBER 13/137



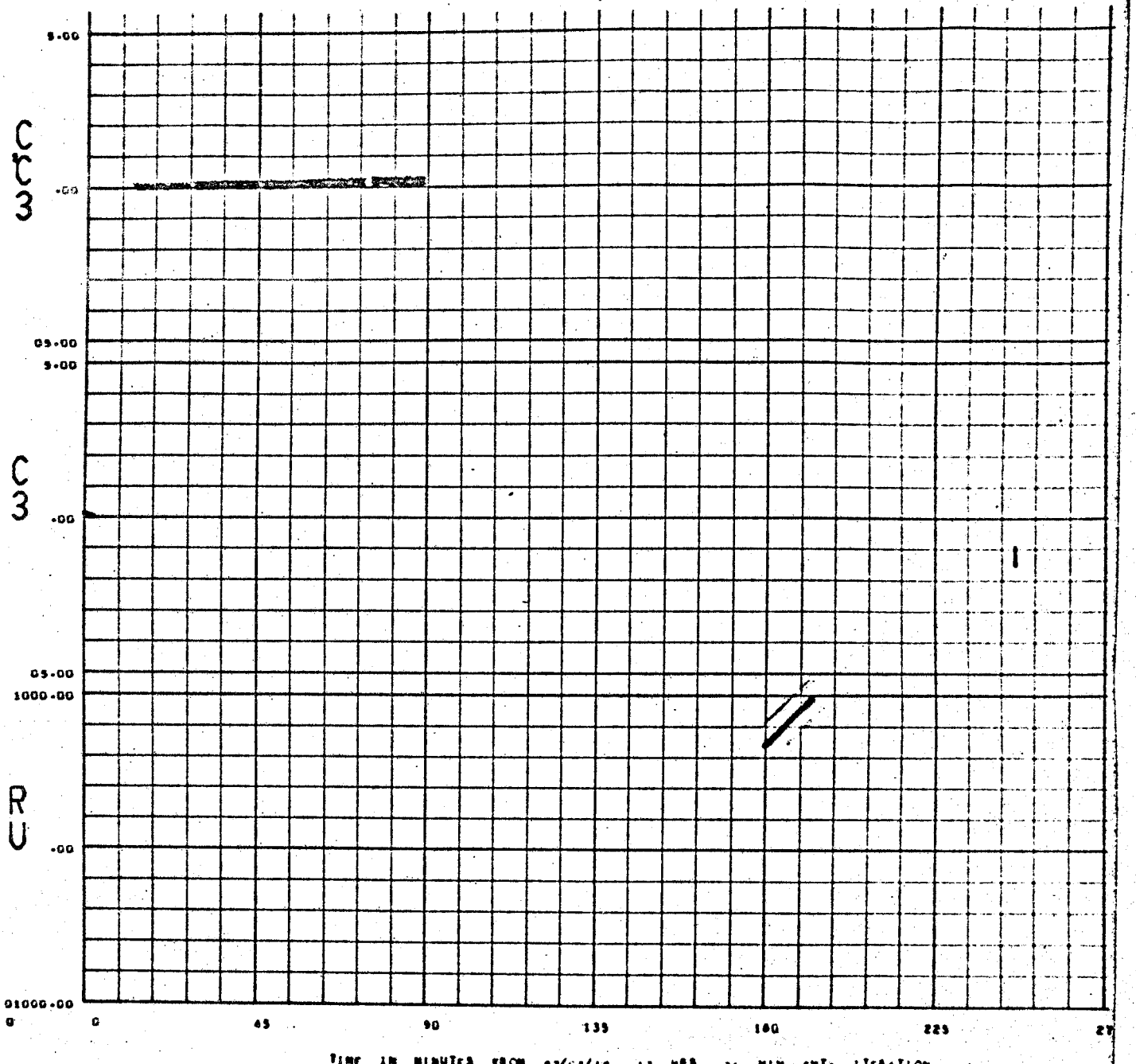
STATION 12 RESIDUALS PASS NUMBER 13/137



STATION 12 RESIDUALS PASS NUMBER 13/137

ODPL 40RB19

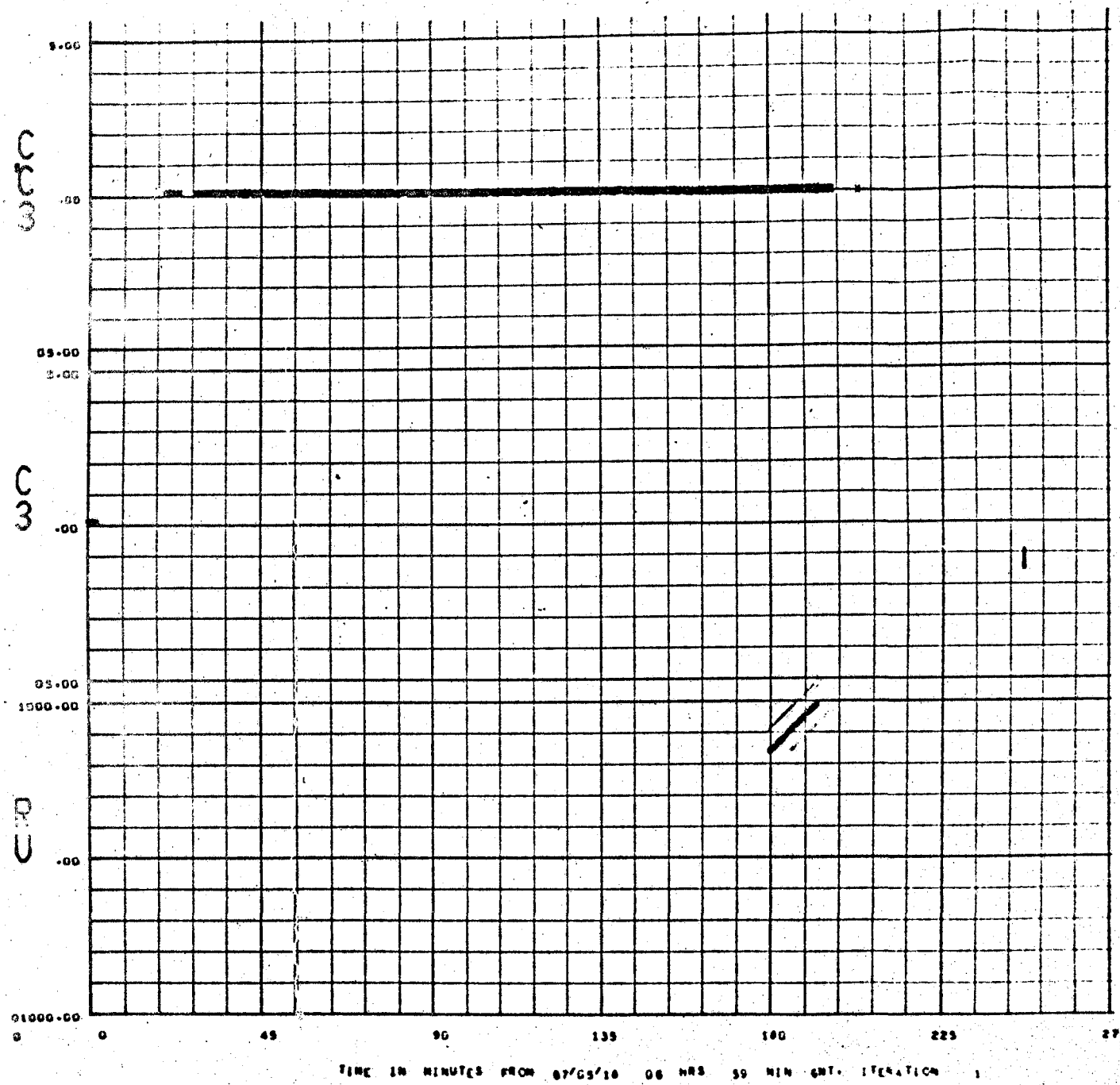
SIMPLE MOON



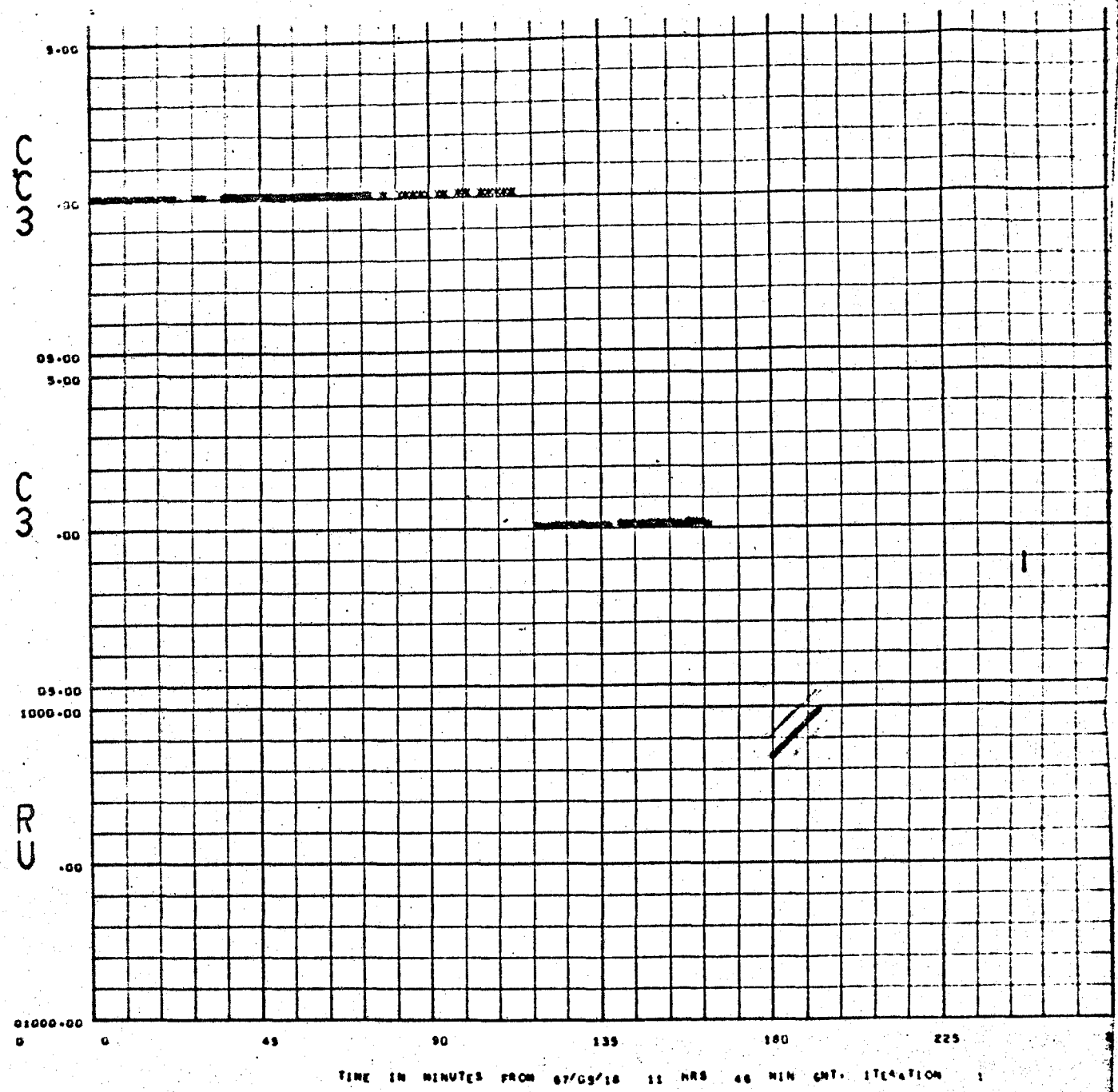
STATION 62 RESIDUALS PASS NUMBER 14/138

REV LTR

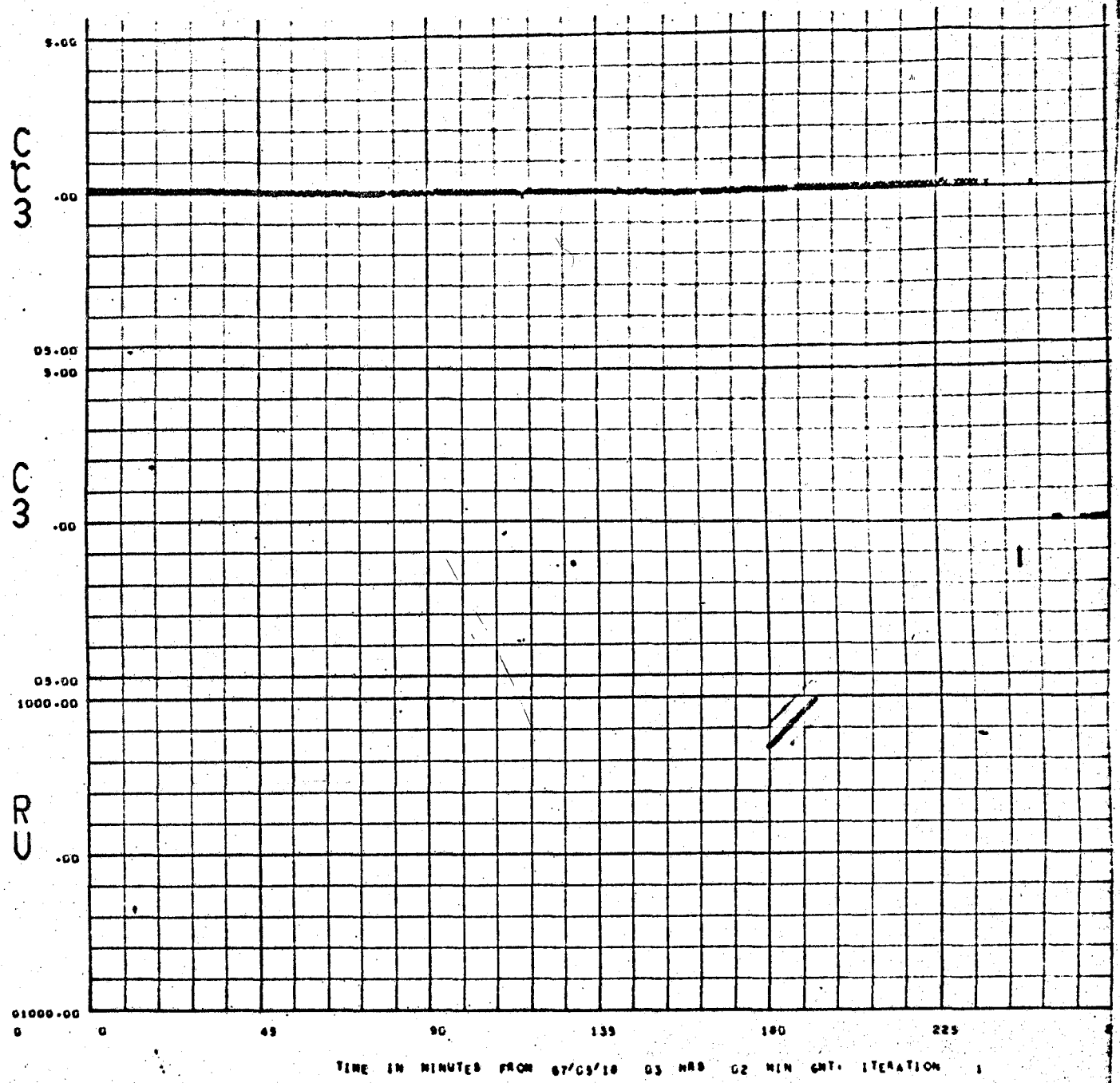
U3 4288-2000 REV. 6/64



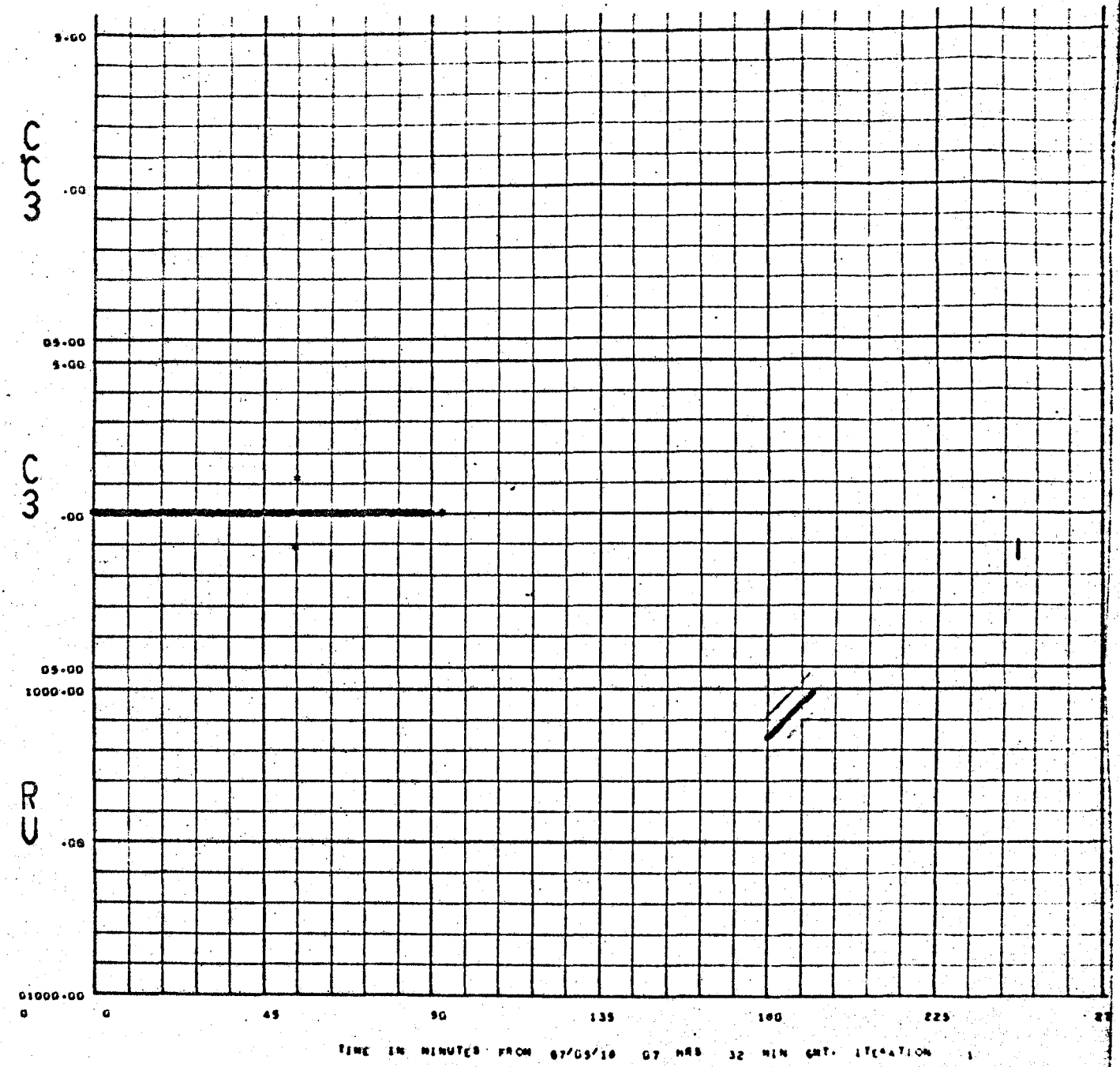
STATION 41 RESIDUALS PASS NUMBER 14/138



STATION 41 RESIDUALS PASS NUMBER 14/138



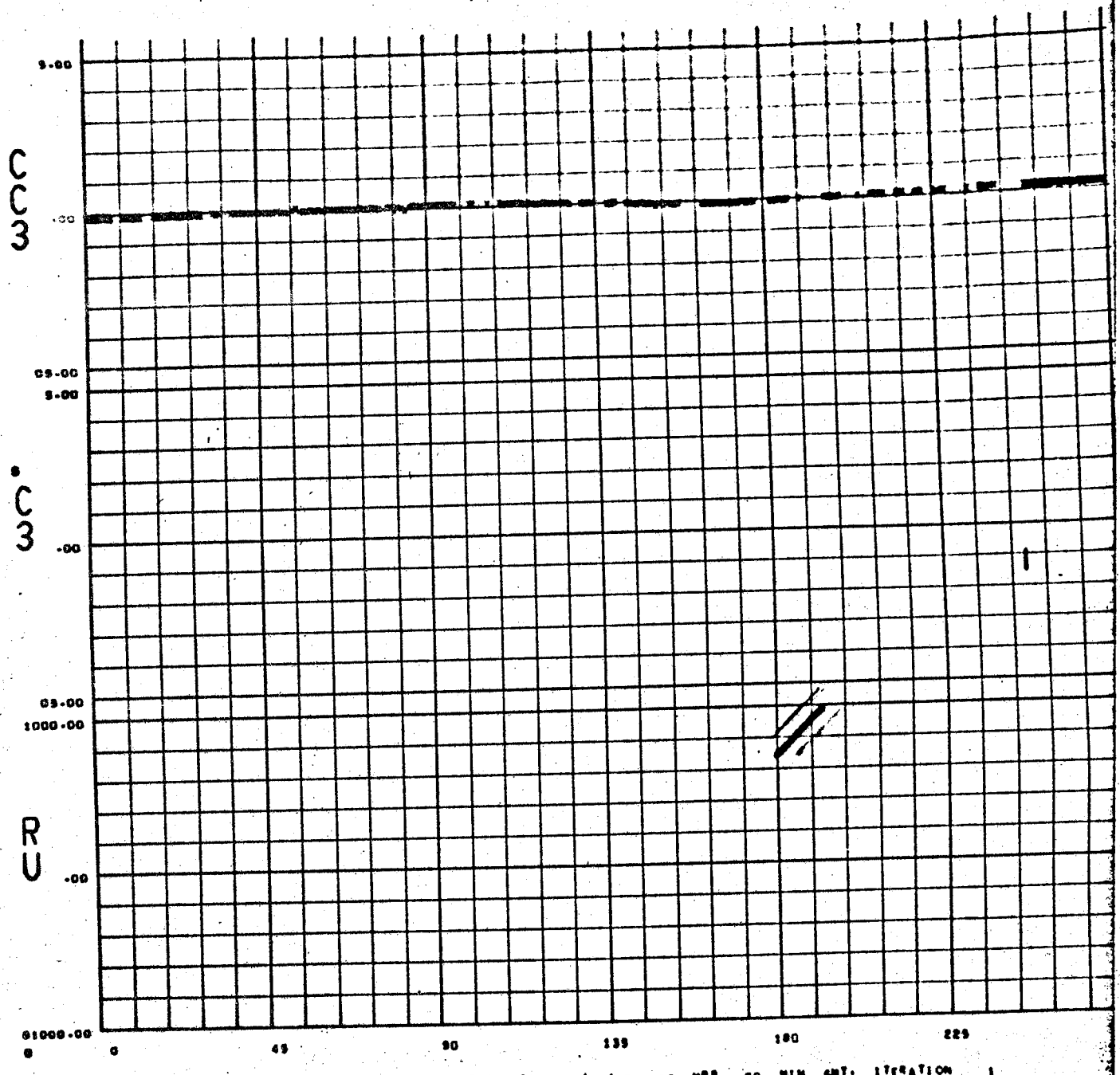
STATION 12 RESIDUALS PASS NUMBER 13/137



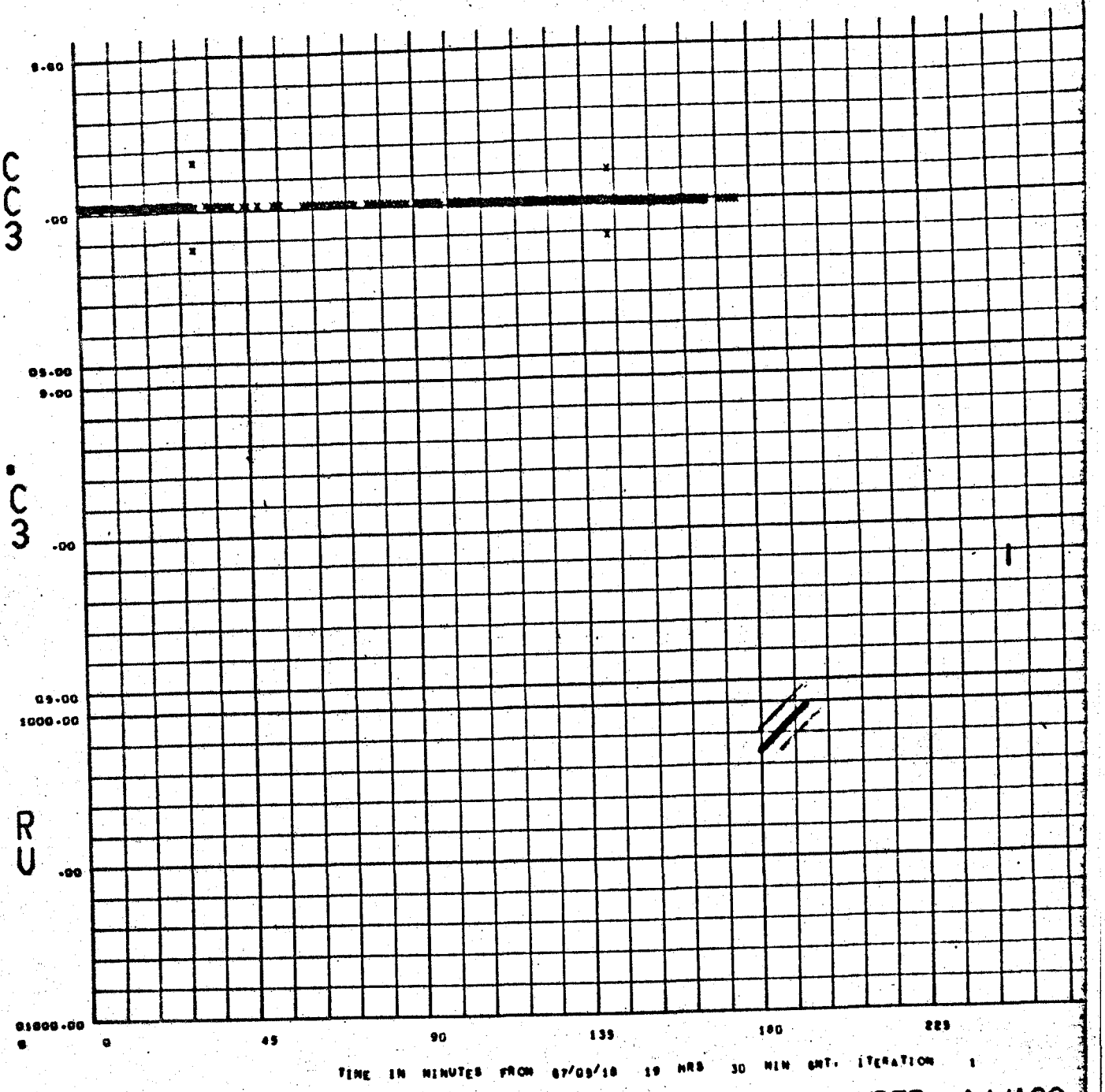
STATION 12 RESIDUALS PASS NUMBER 13/137

ODPL 40RB20

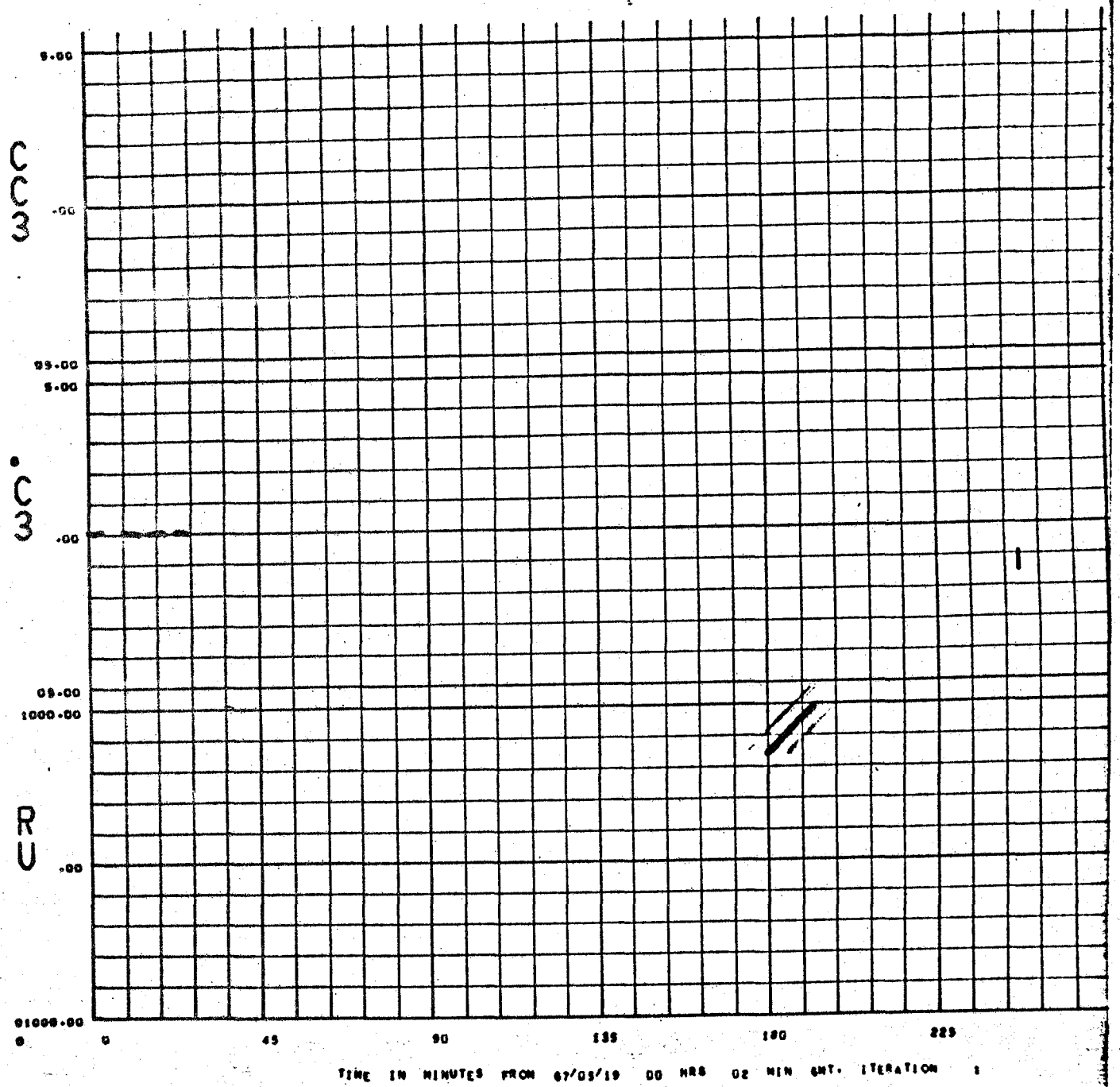
SIMPLE MOON



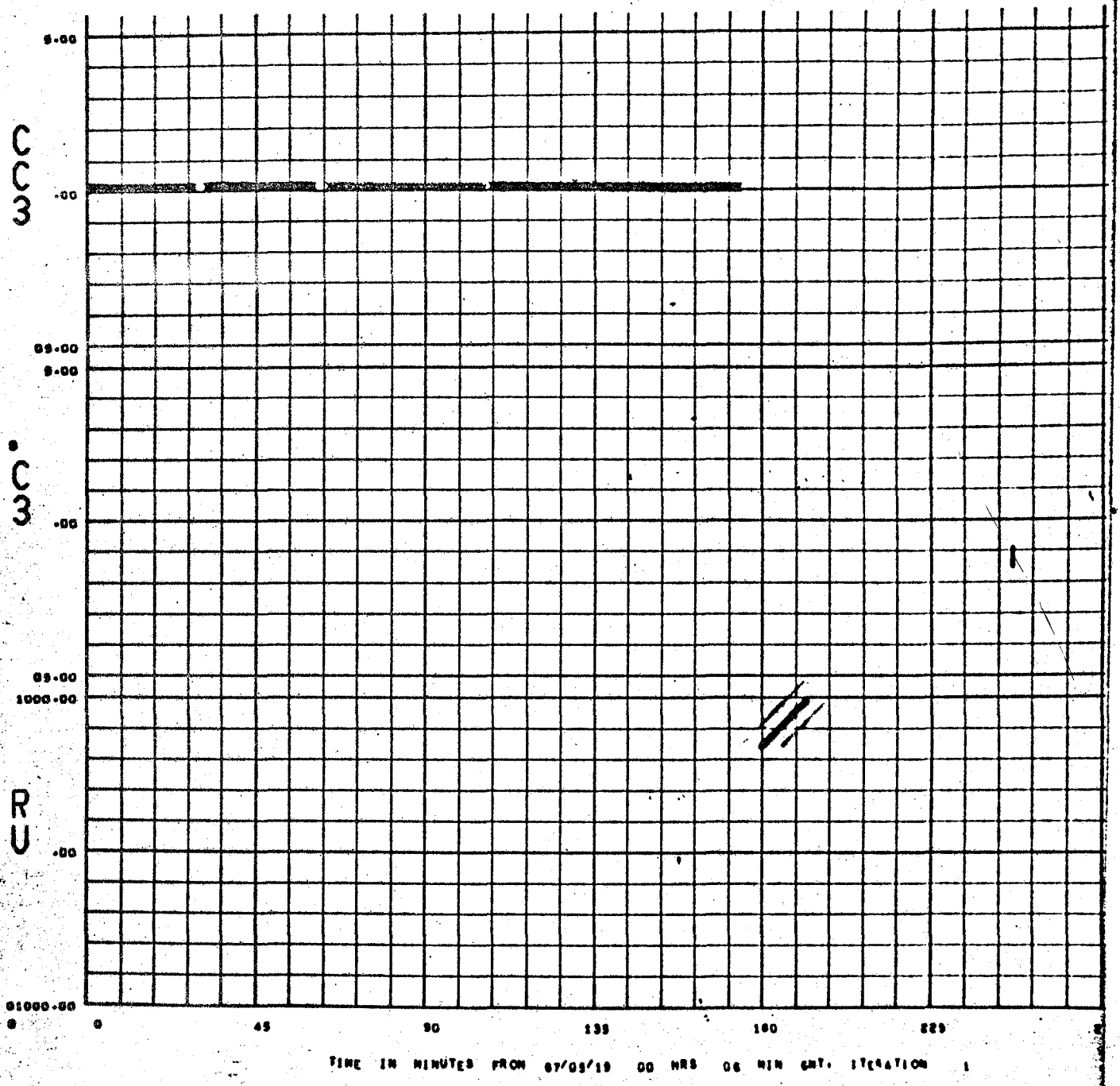
STATION 62 RESIDUALS PASS NUMBER 14/138



STATION 62 RESIDUALS PASS NUMBER 14/138



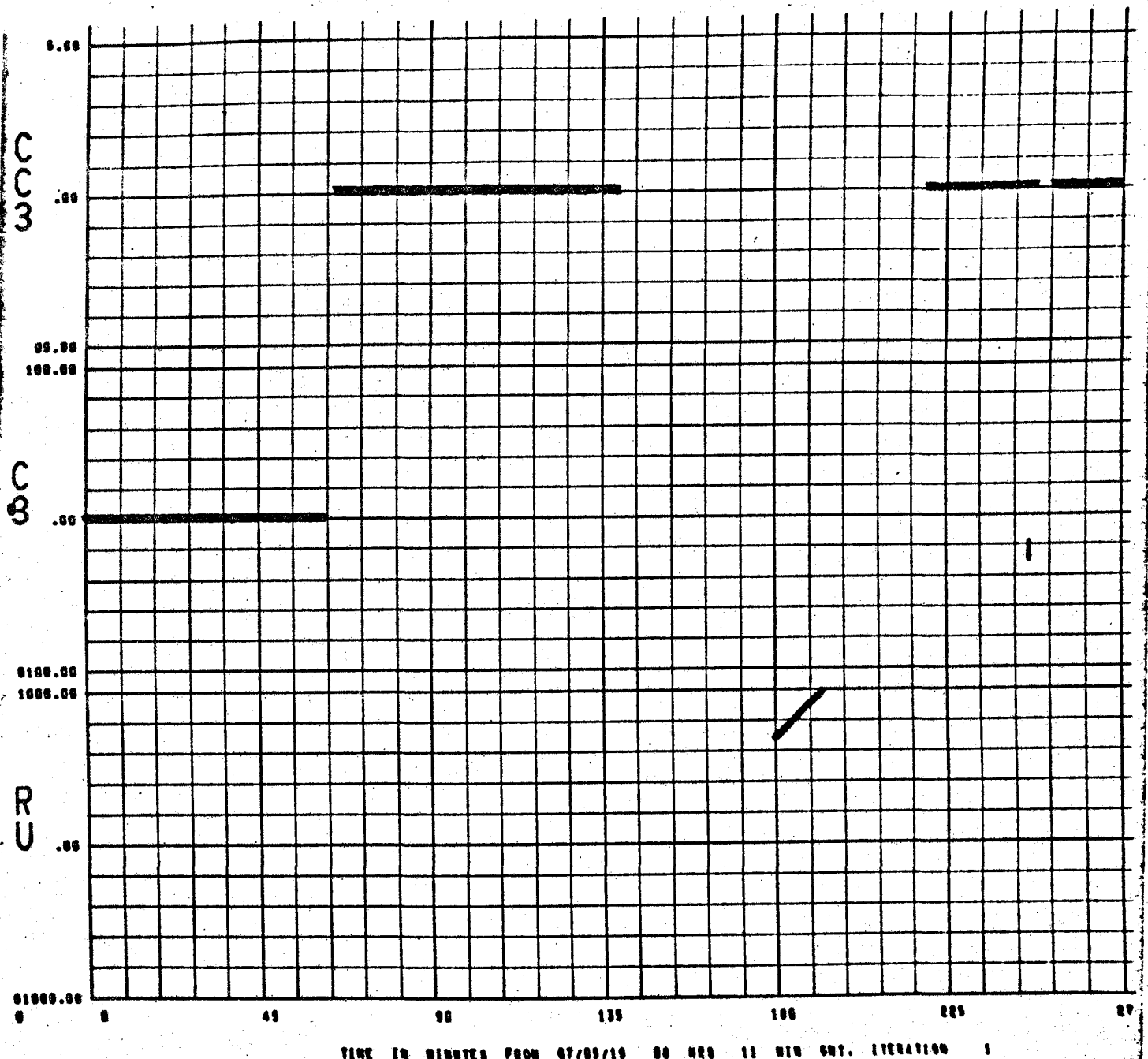
STATION 62 RESIDUALS PASS NUMBER 14/138



STATION 12 RESIDUALS PASS NUMBER 14/138

ODPL 40RB21

SIMPLE MOON



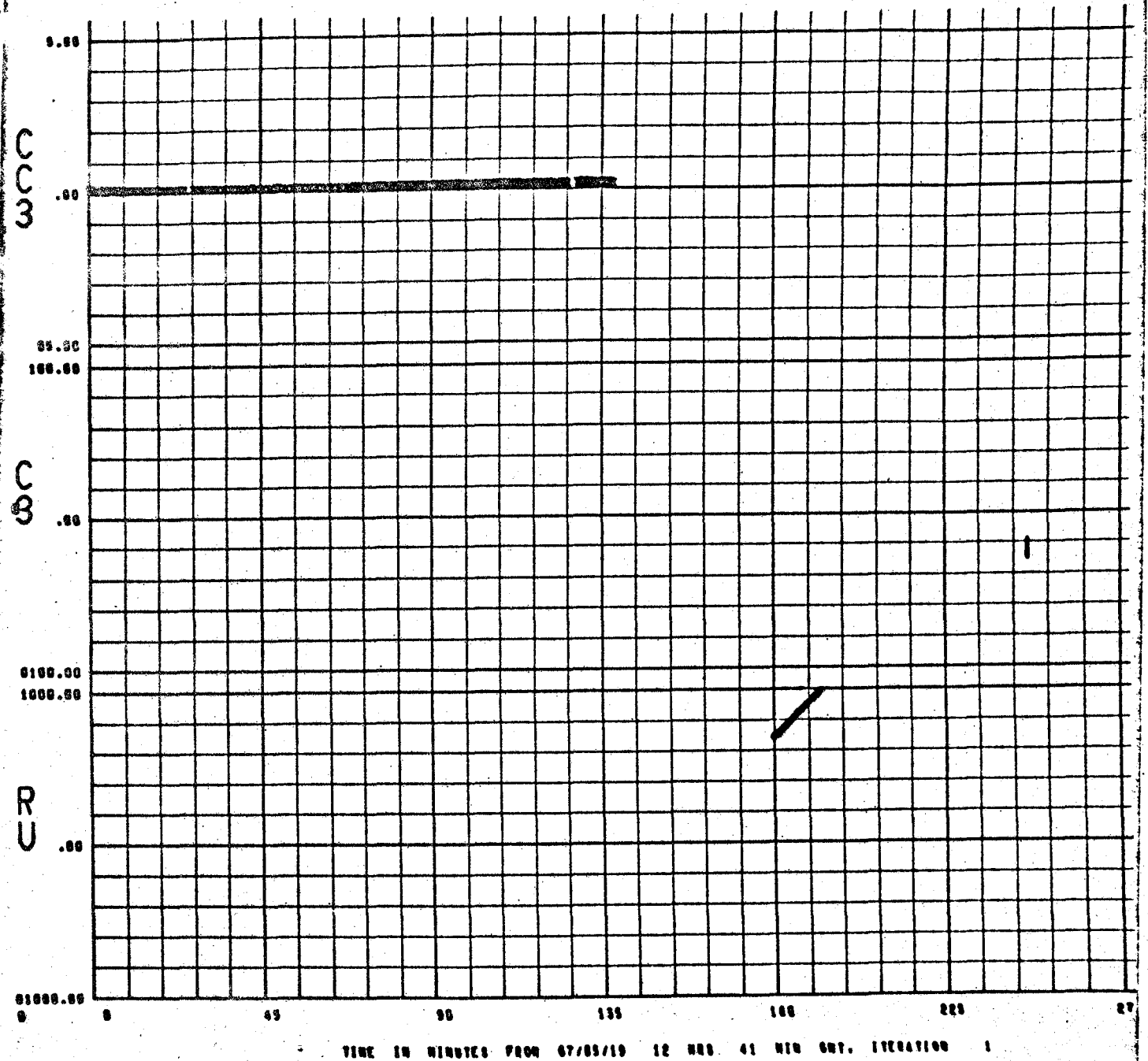
STATION 41 RESIDUALS PASS NUMBER 15/139

REV LTR

U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 390



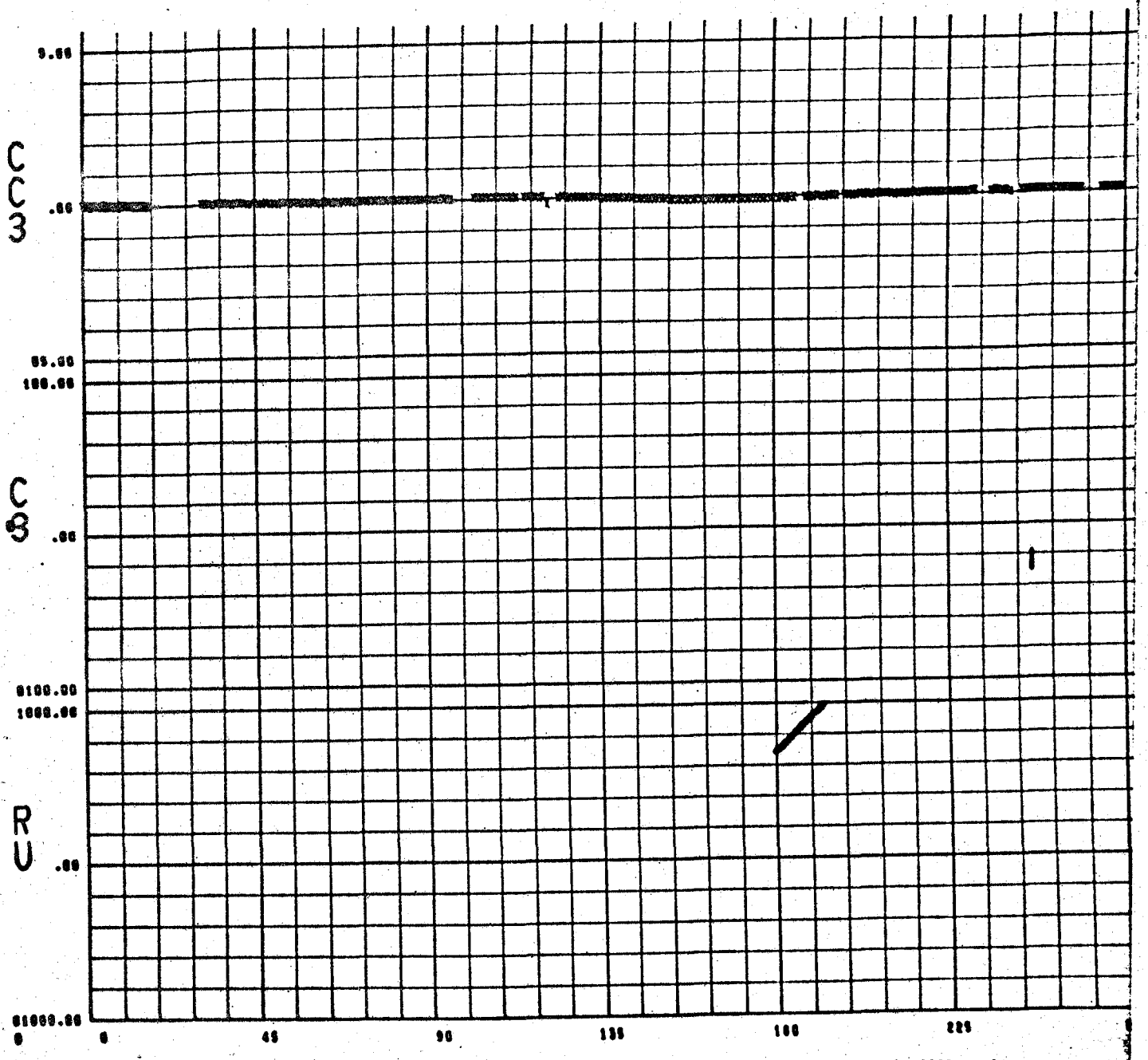
STATION 41 RESIDUALS PASS NUMBER 15/139

REV LTR

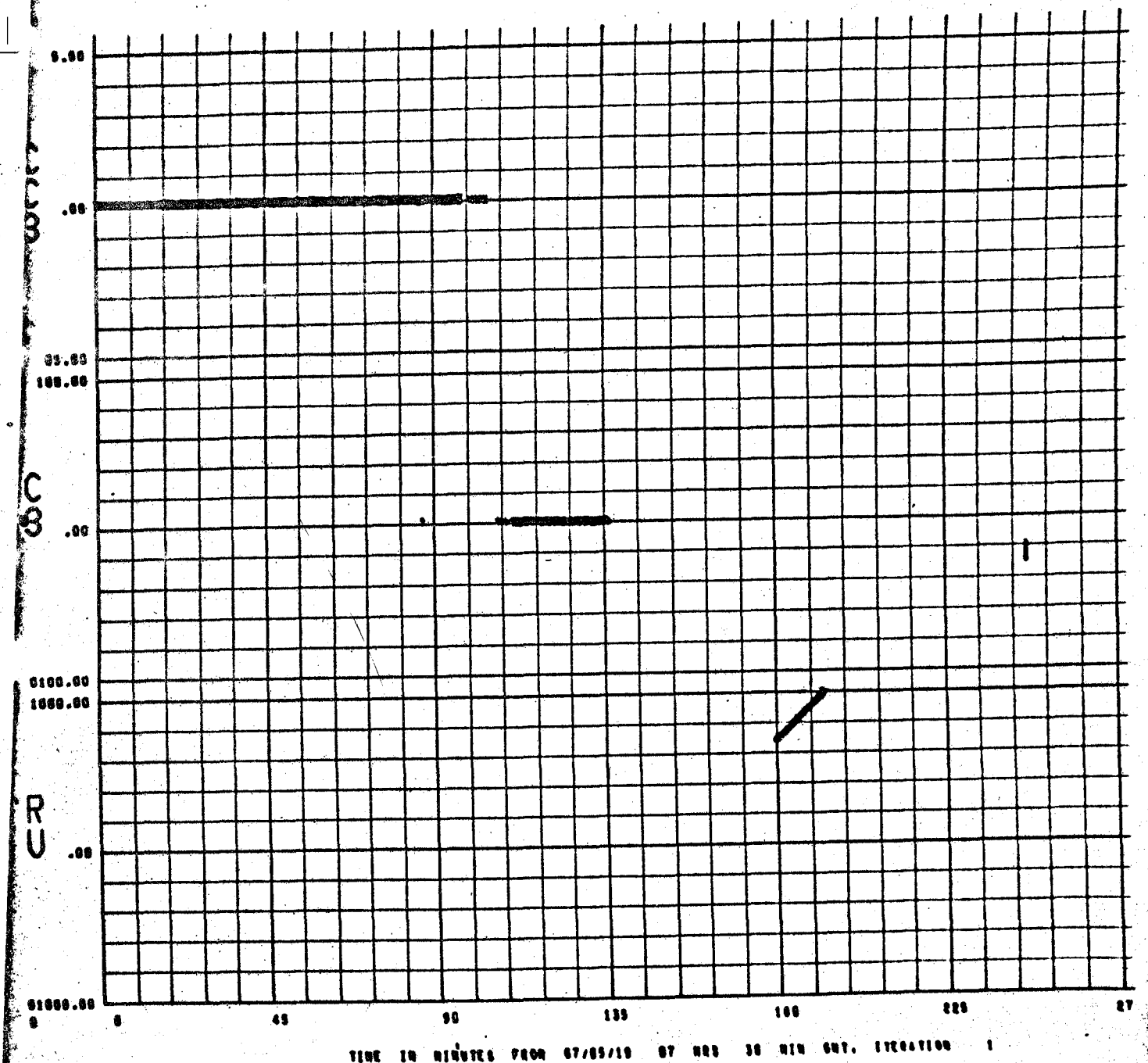
U3 428-2000 REV. 6/68

BOEING NO. D2-100816-1

SH. 351



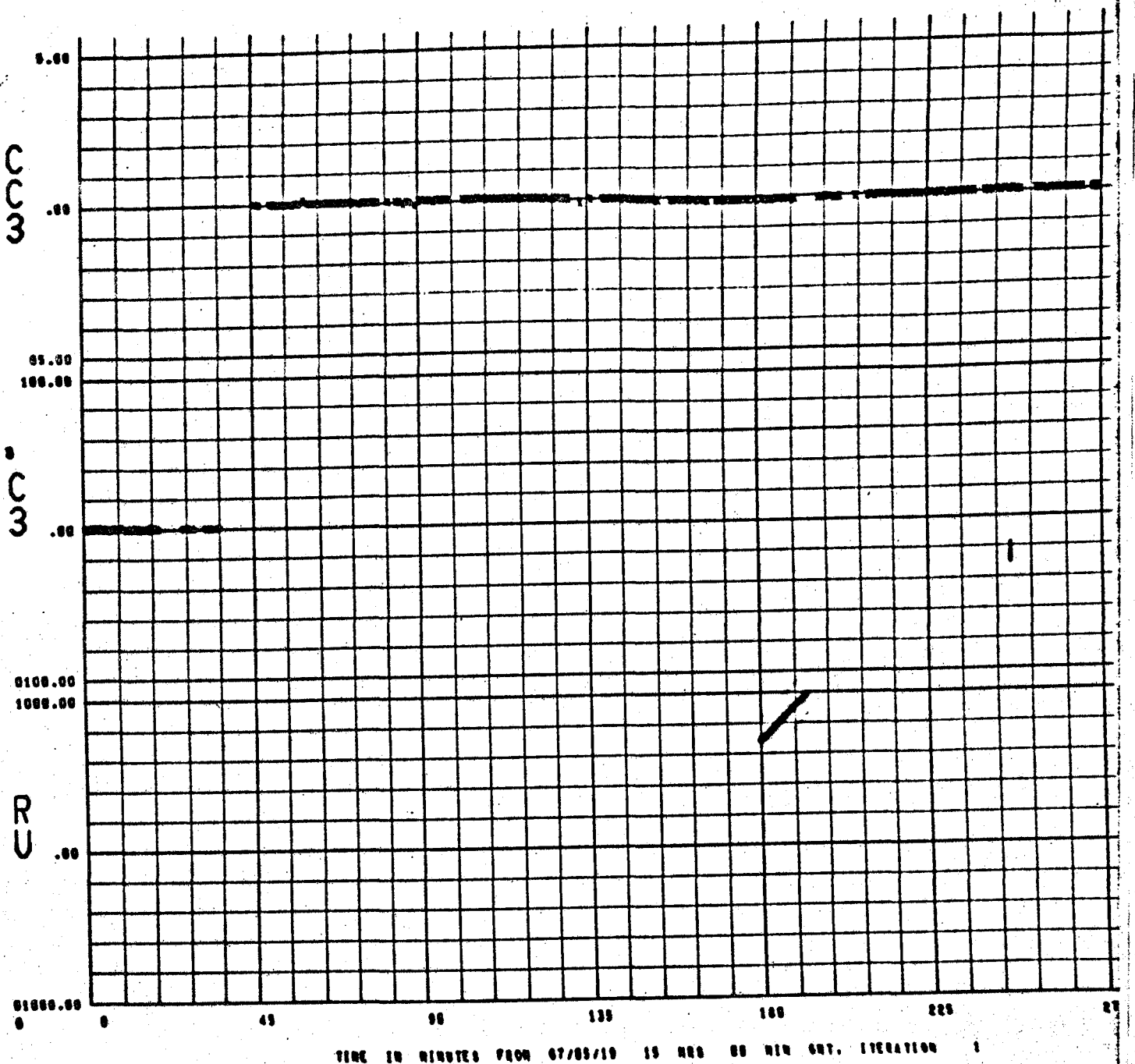
STATION 12 RESIDUALS PASS NUMBER 14/138



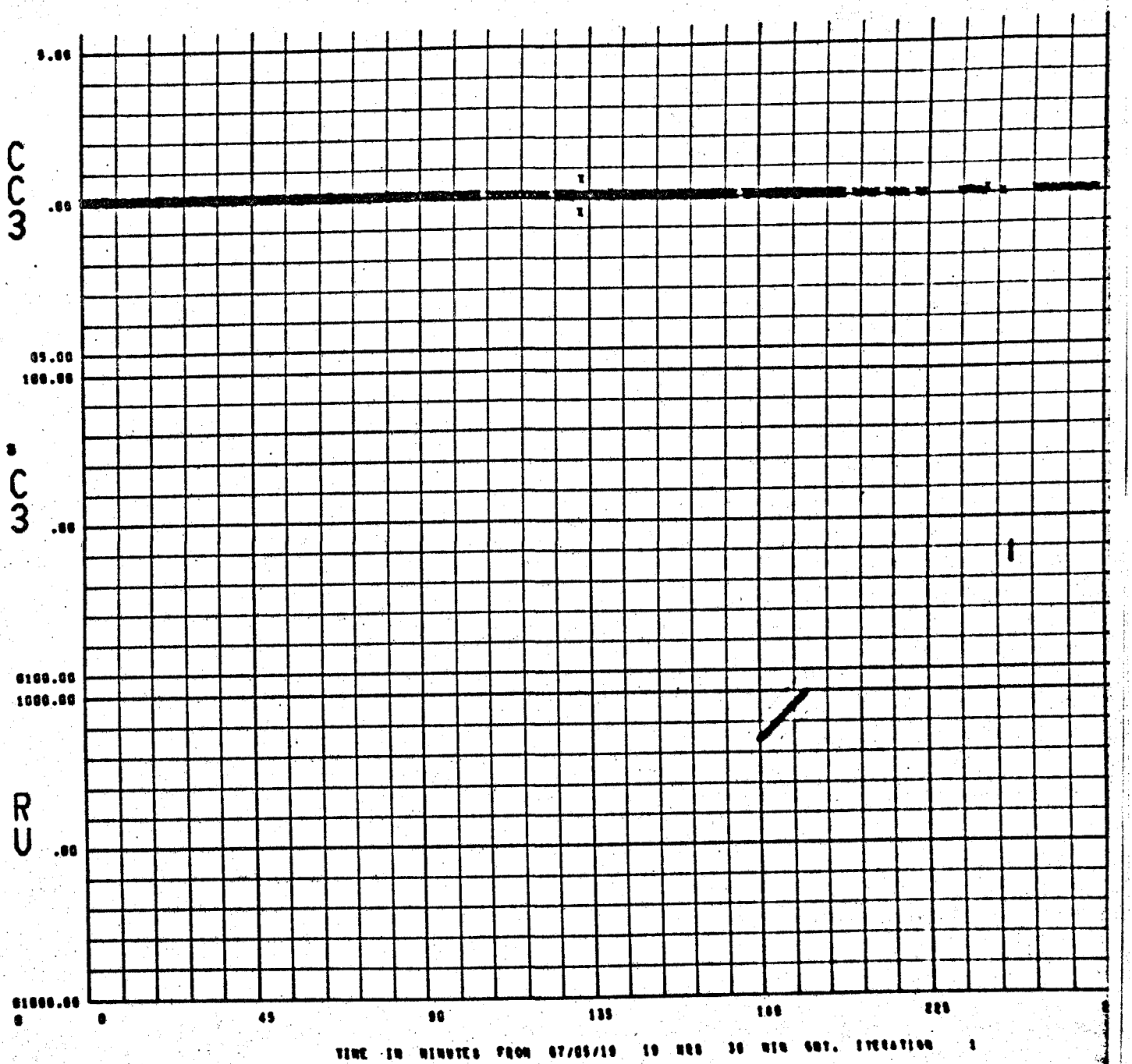
STATION 12 RESIDUALS PASS NUMBER 14/138

ODPL 40RB22

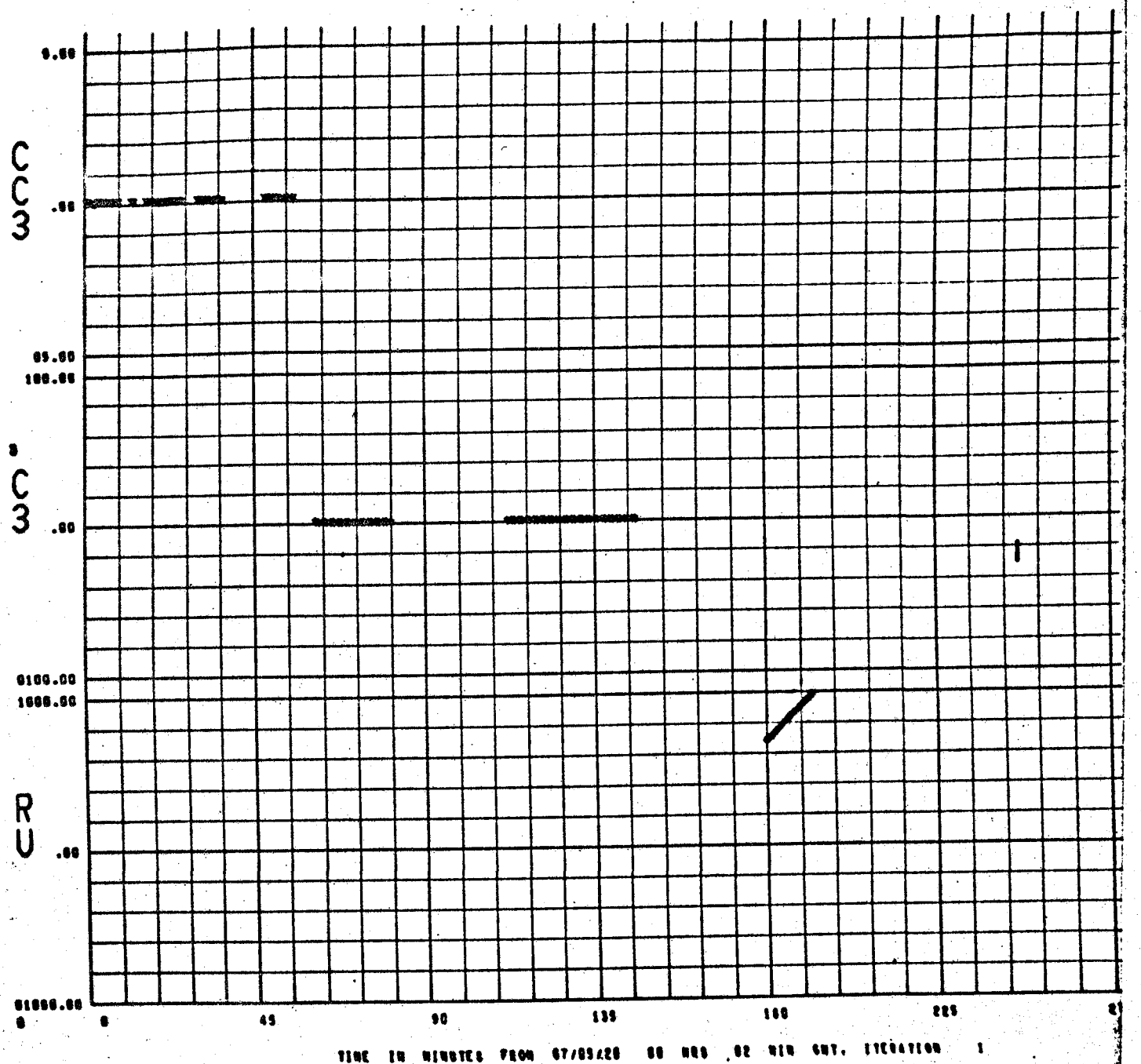
SIMPLE MOON



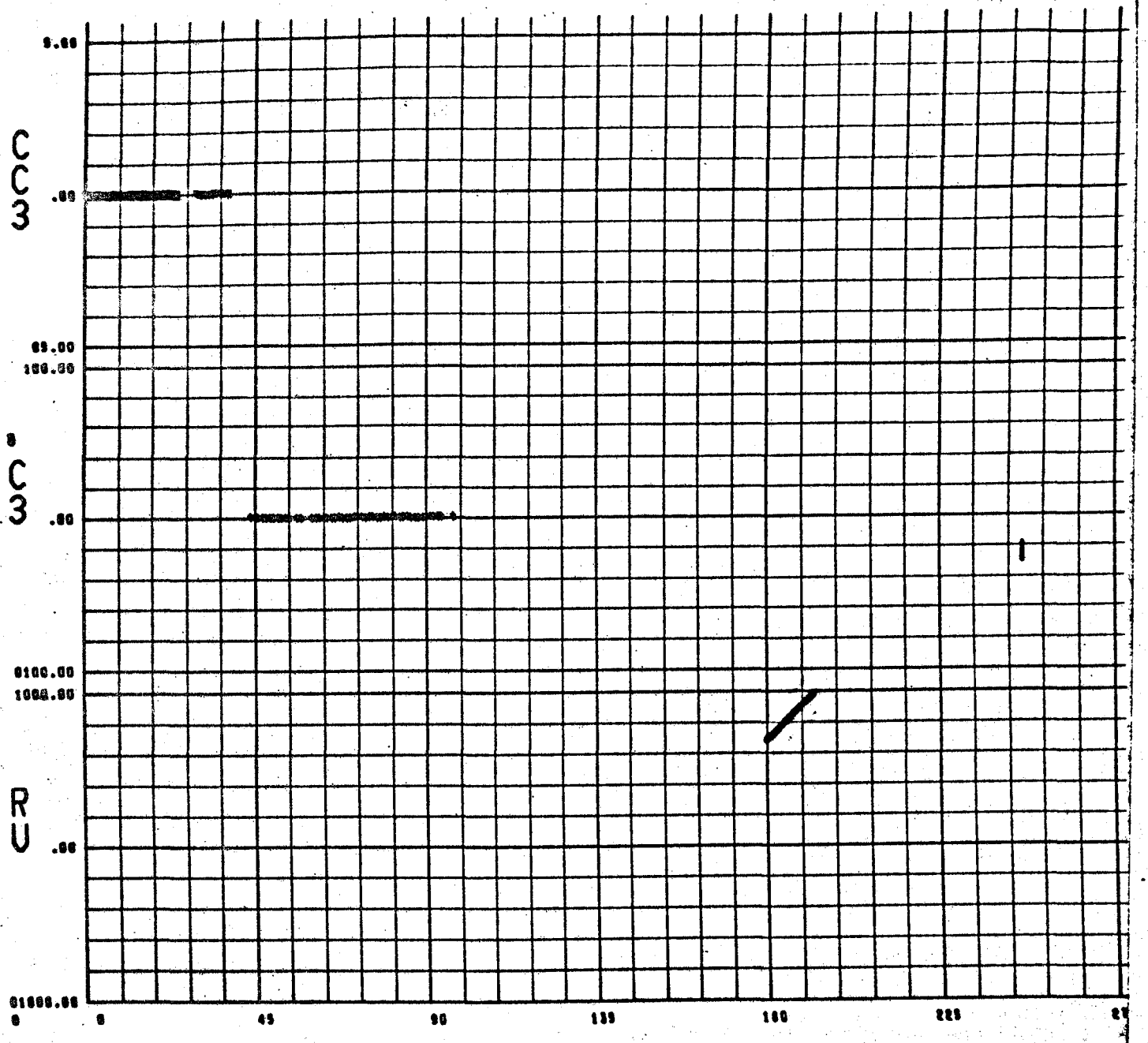
STATION 62 RESIDUALS PASS NUMBER 15/139



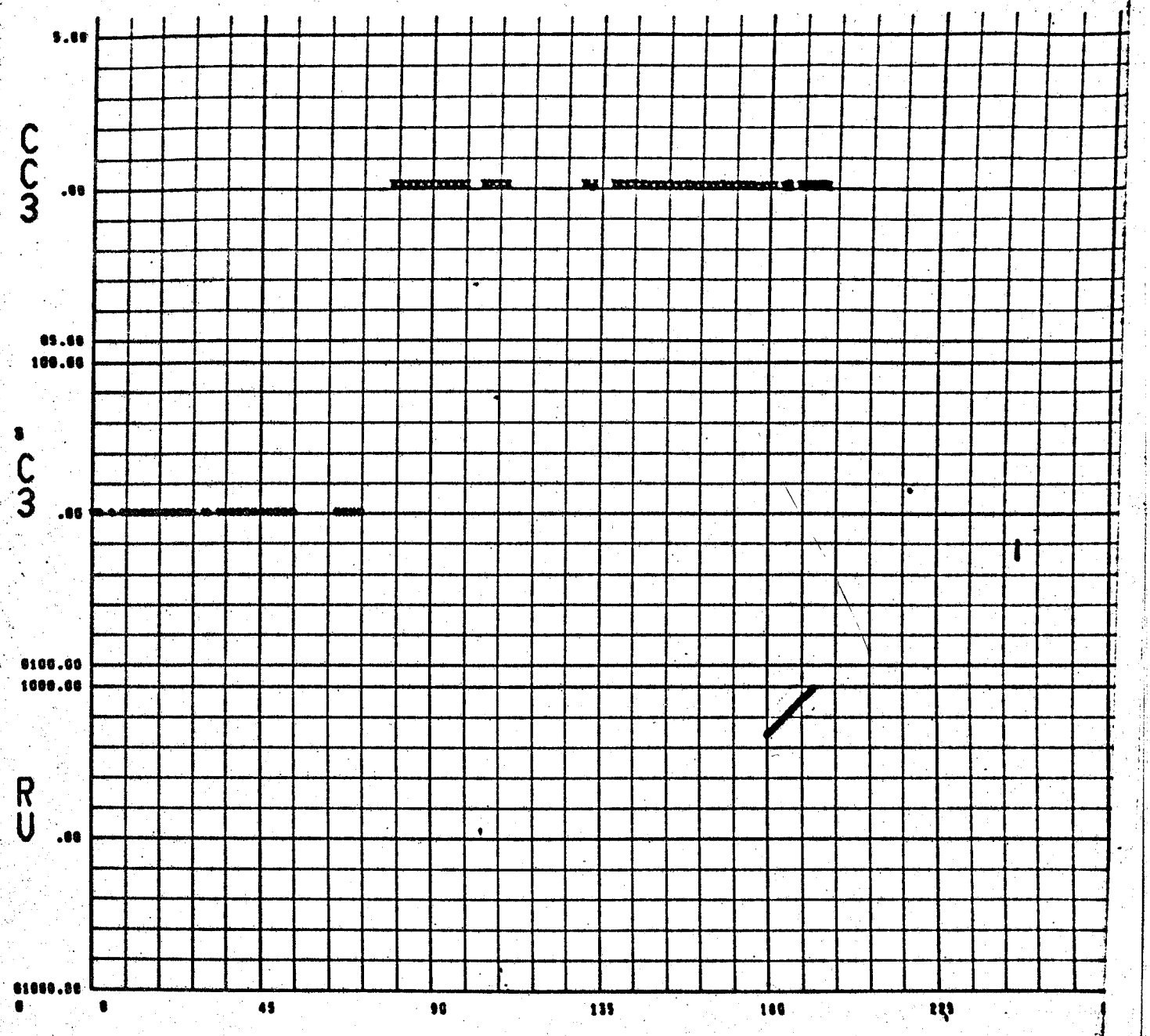
STATION 62 RESIDUALS PASS NUMBER 15/139



STATION 62 RESIDUALS PASS NUMBER 15/139



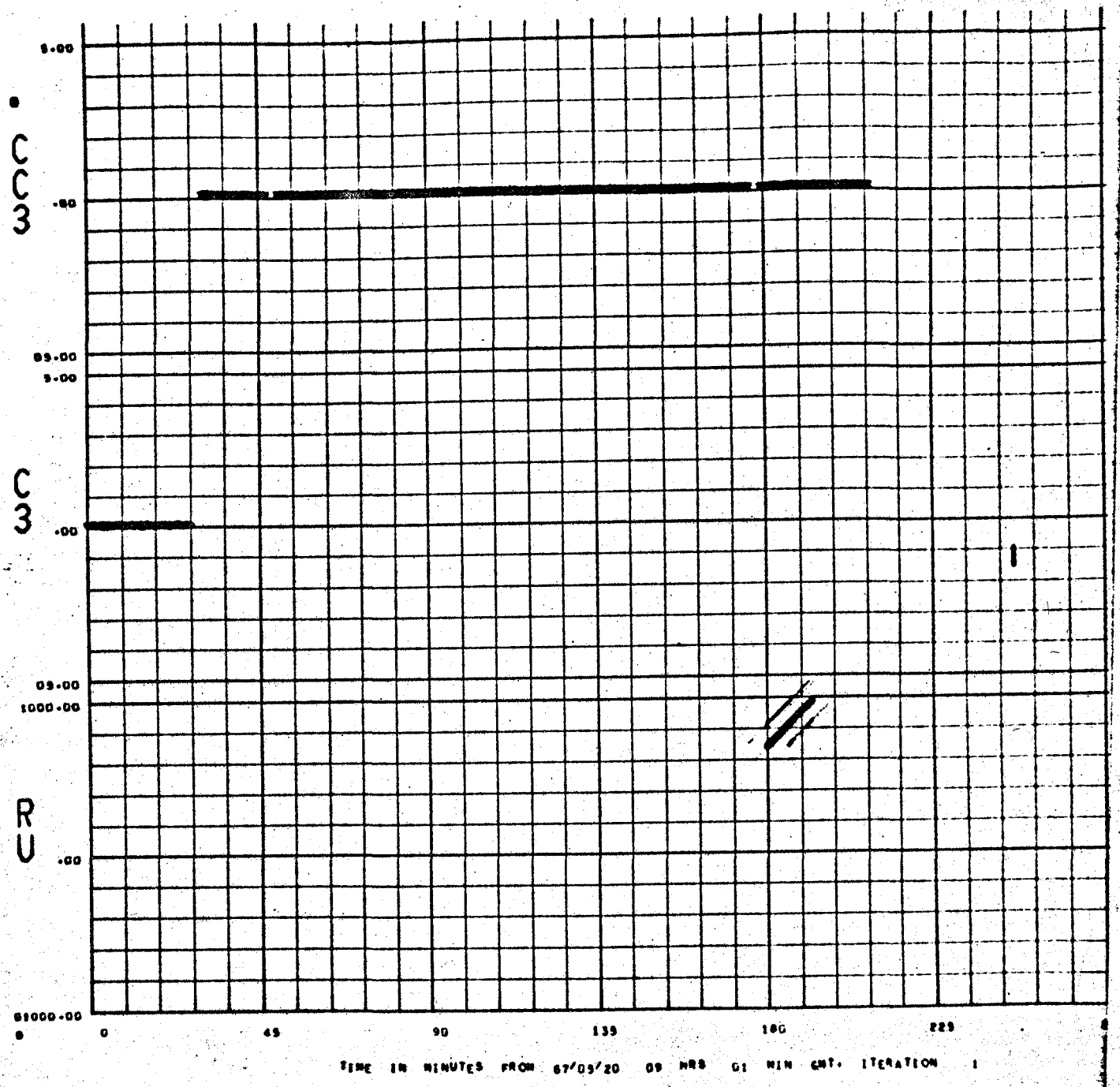
STATION 41 RESIDUALS PASS NUMBER 15/139



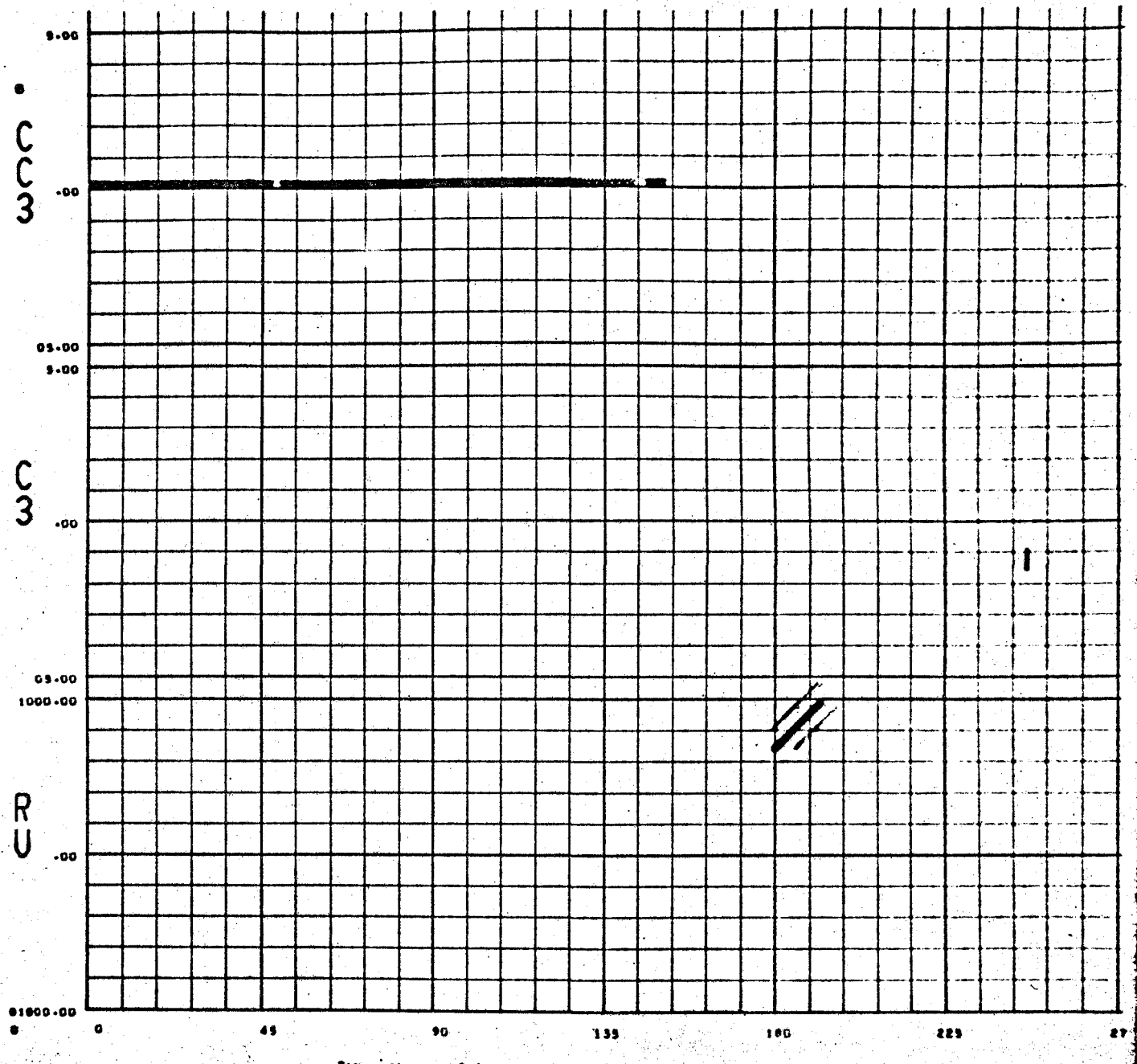
STATION 12 RESIDUALS PASS NUMBER 15/139

ODPL 40RB23

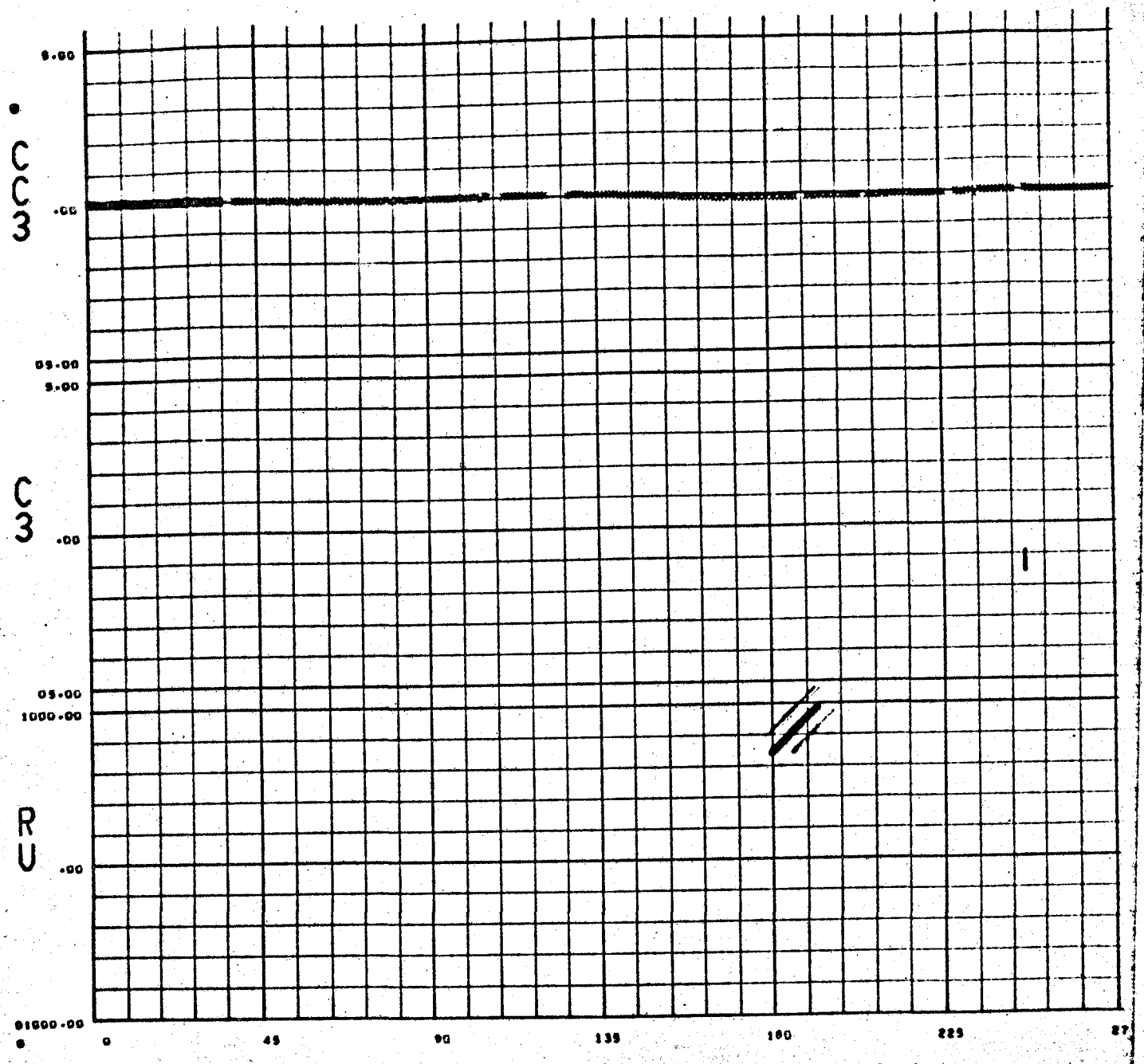
SIMPLE MOON



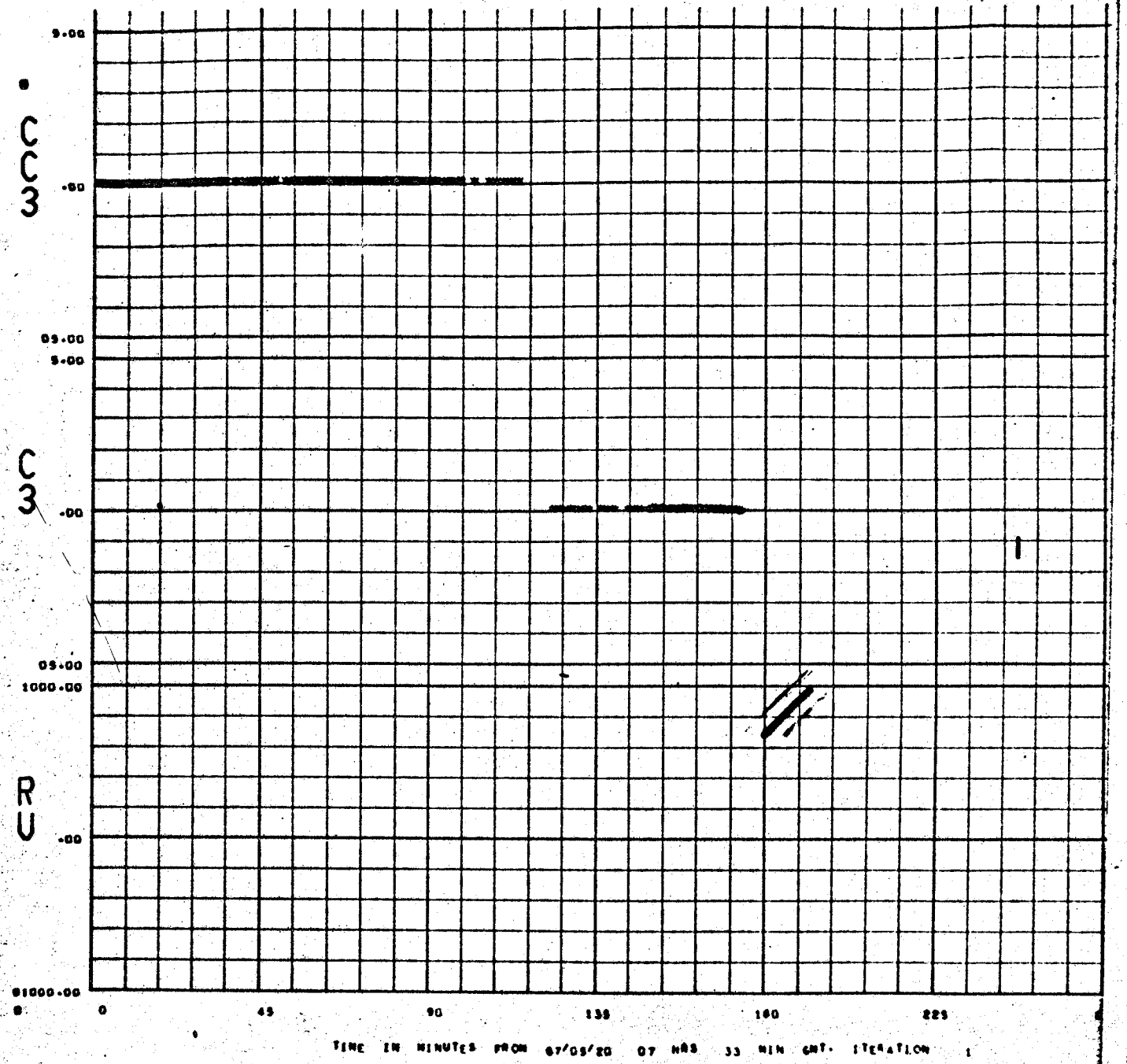
STATION 41 RESIDUALS PASS NUMBER 16/140



STATION 41 RESIDUALS PASS NUMBER 16/140



STATION 12 RESIDUALS PASS NUMBER 15/139



STATION 12 RESIDUALS PASS NUMBER 15/139

ODPL 40RB24

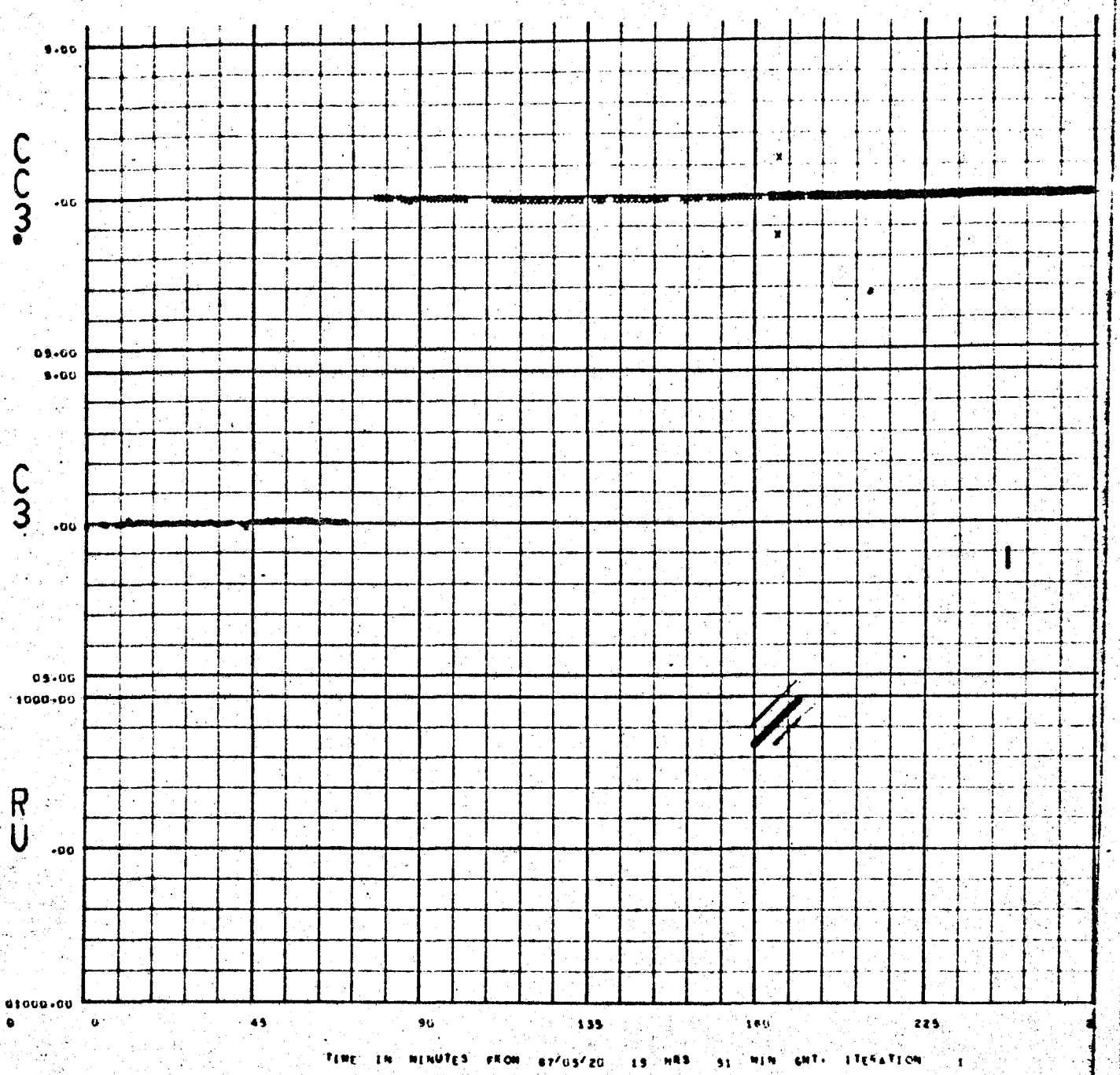
SIMPLE MOON

REV LTR

U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 405



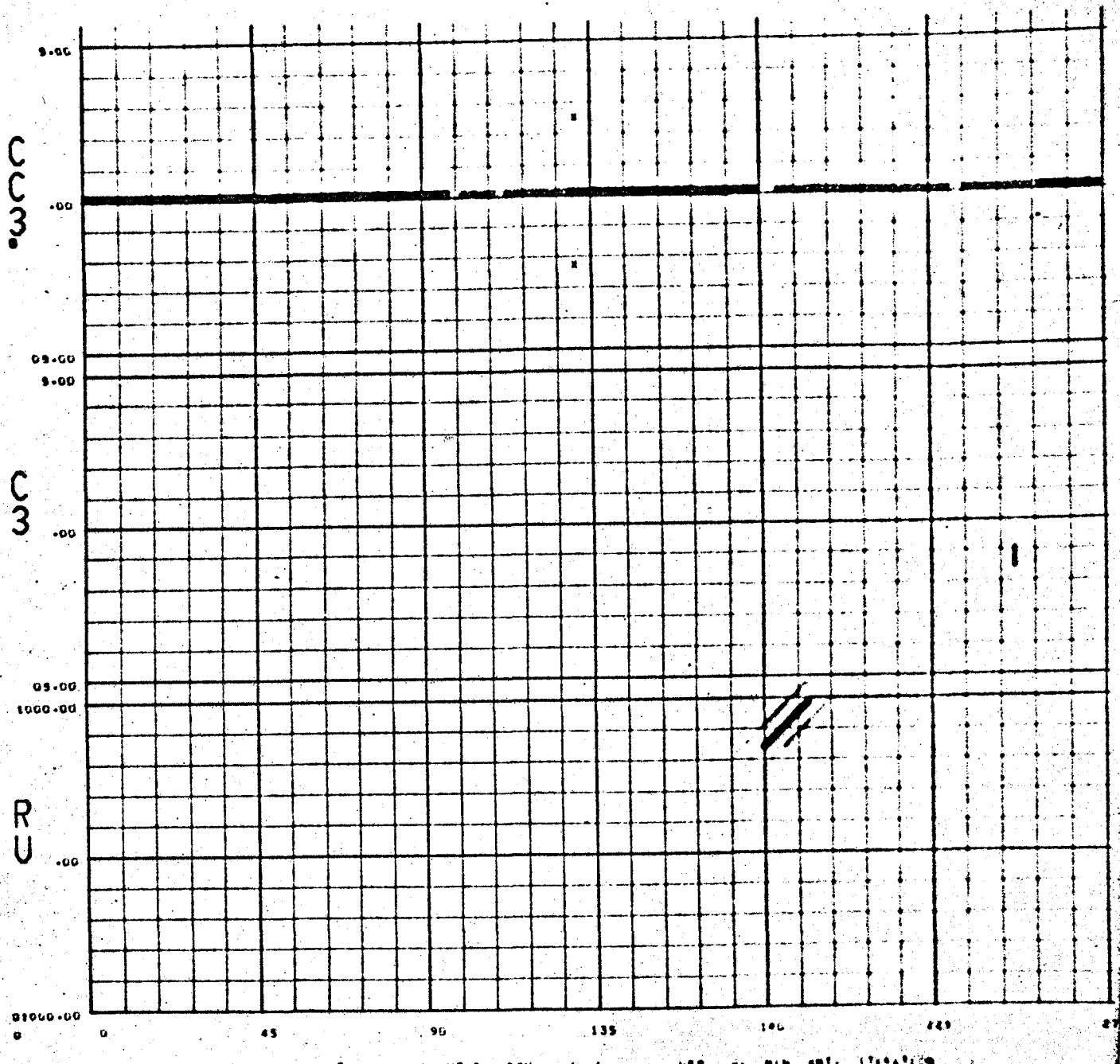
STATION 62 RESIDUALS PASS NUMBER 16/140

REV LTR

U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 406



TIME IN MINUTES FROM 67/09/20 20 HRS 21 MIN GMT. ITERATION

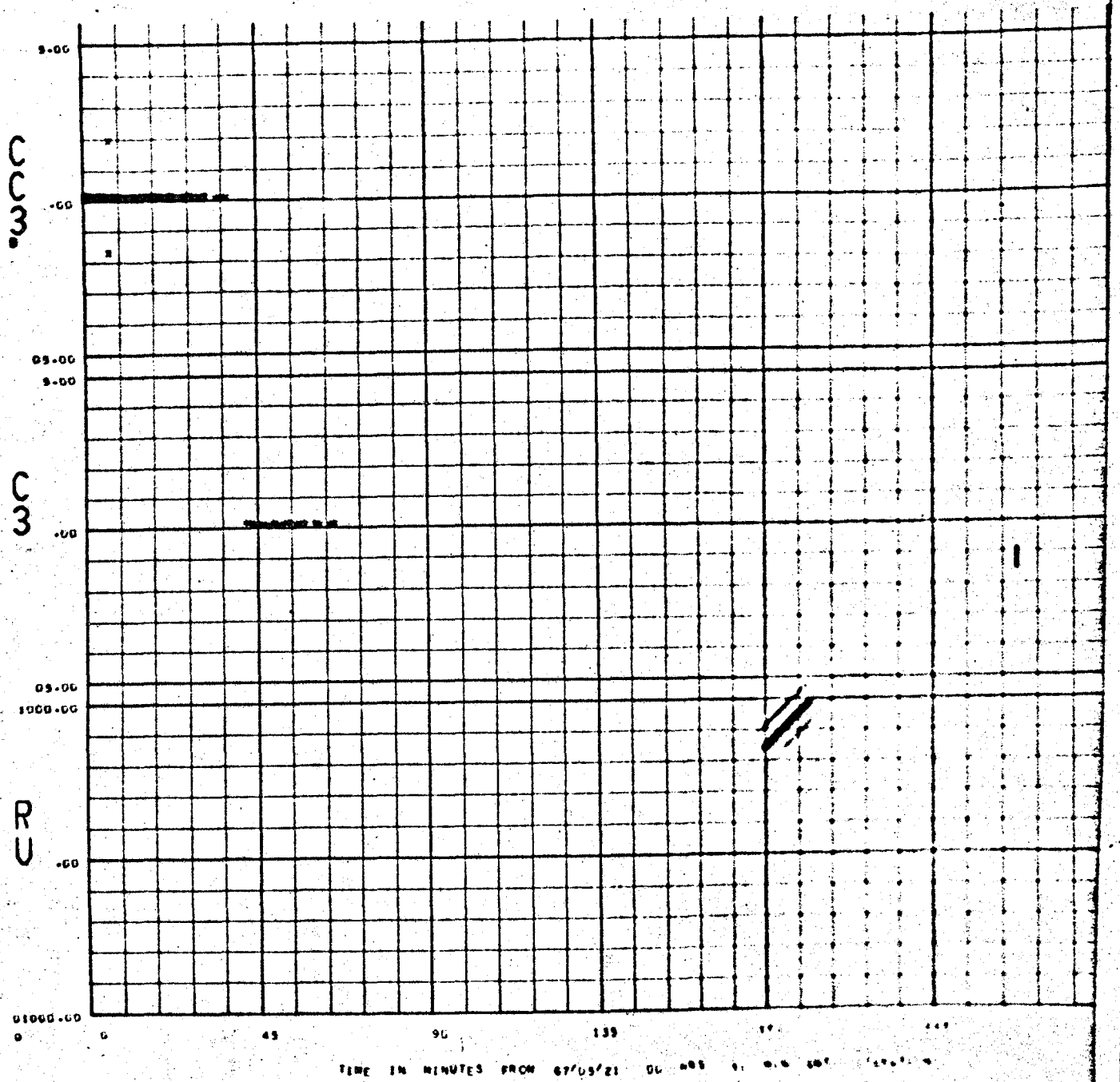
STATION 62 RESIDUALS PASS NUMBER 16/140

REV LTR

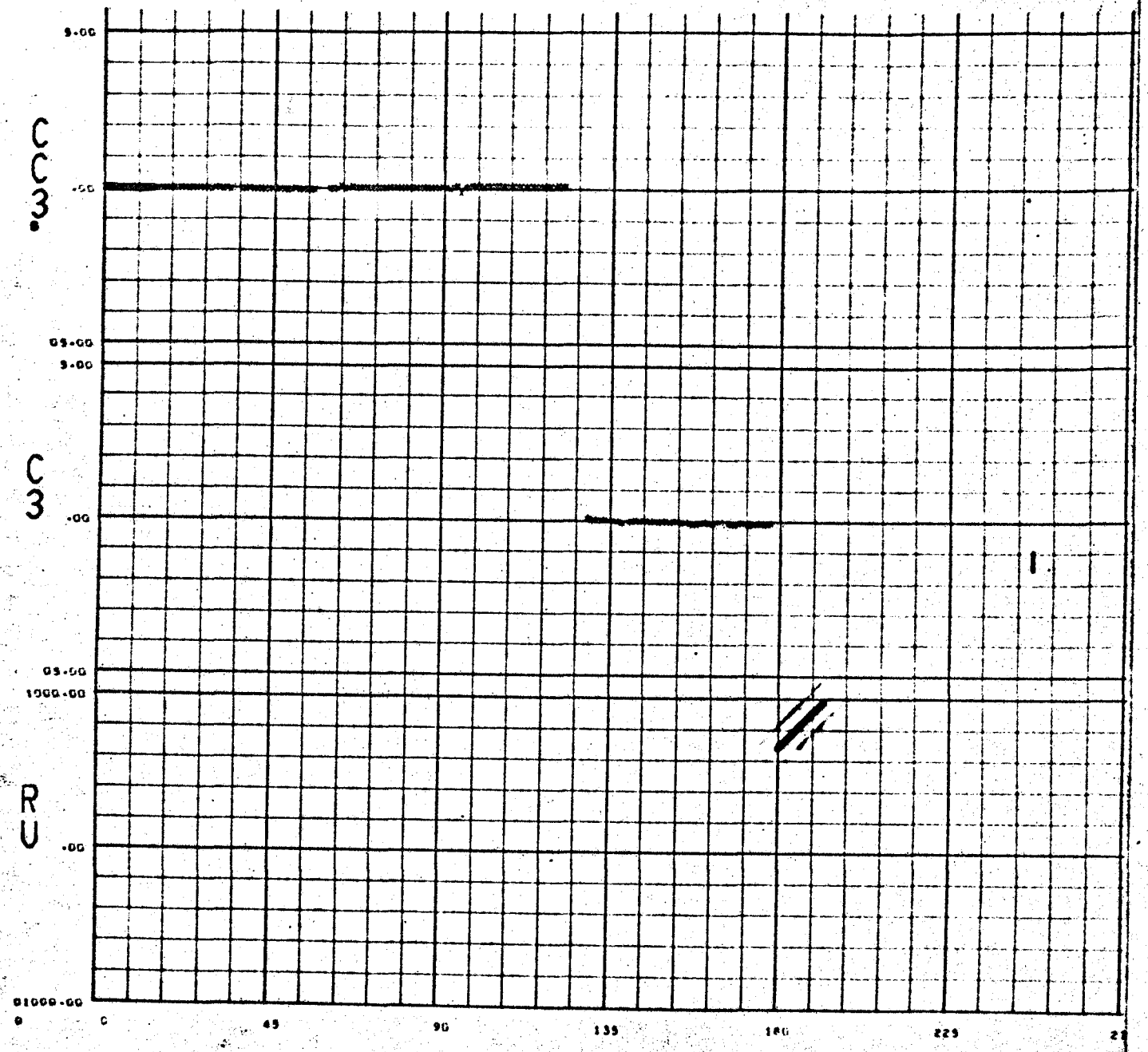
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

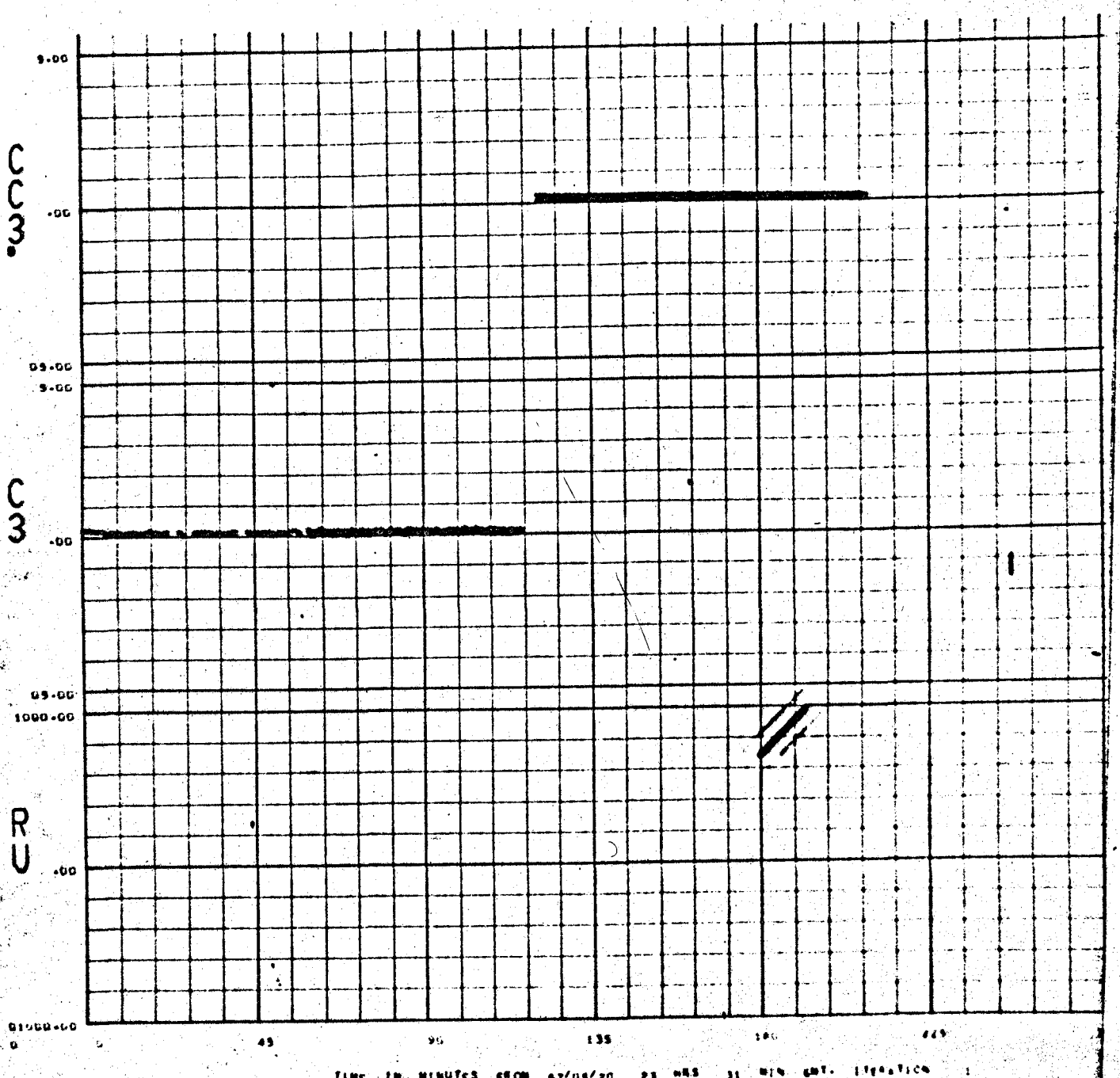
SH. 107



STATION 62 RESIDUALS PASS NUMBER 16/140



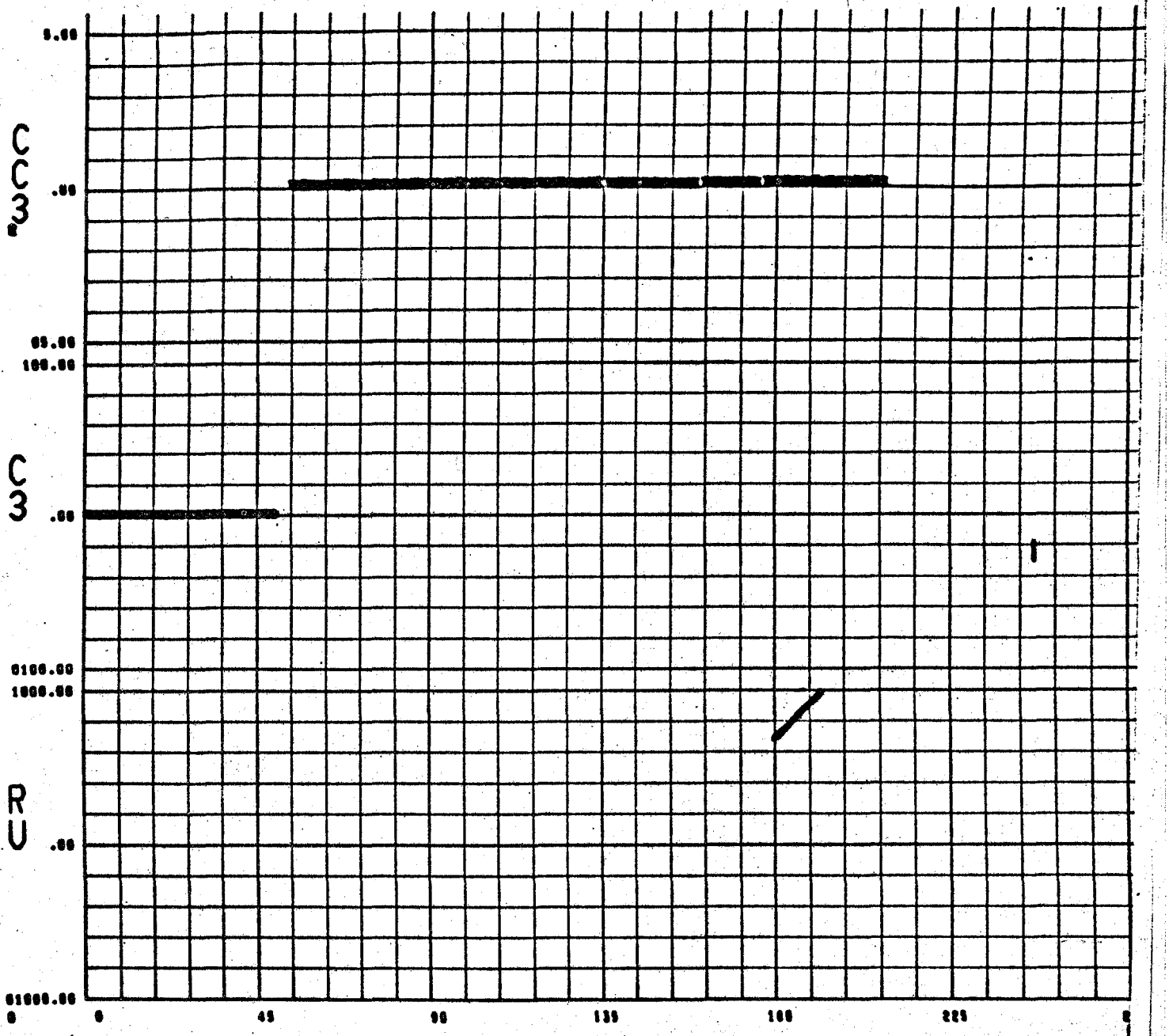
STATION 41 RESIDUALS PASS NUMBER 16/140



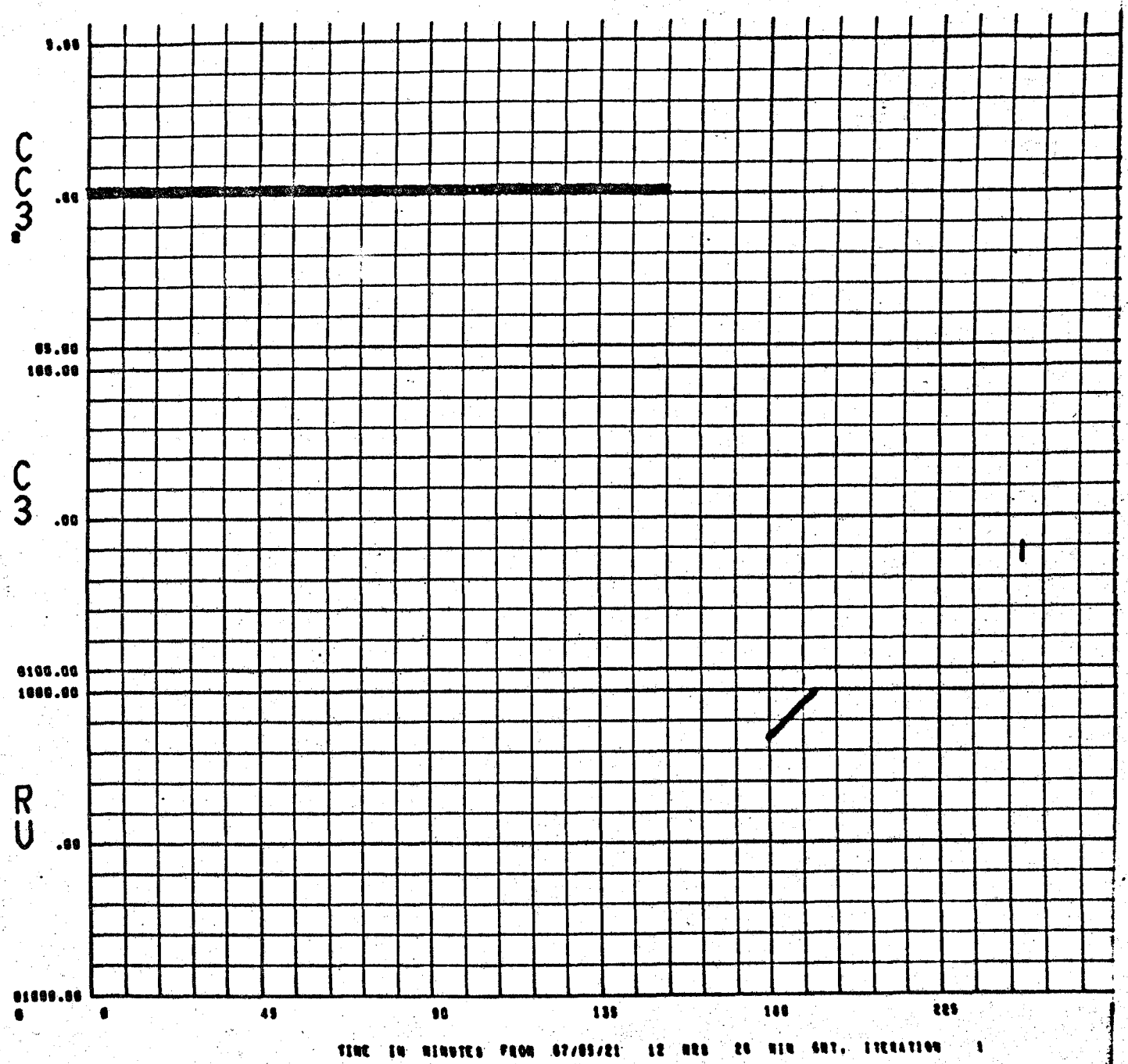
STATION 12° RESIDUALS PASS NUMBER 16/140

ODPL 40RB25

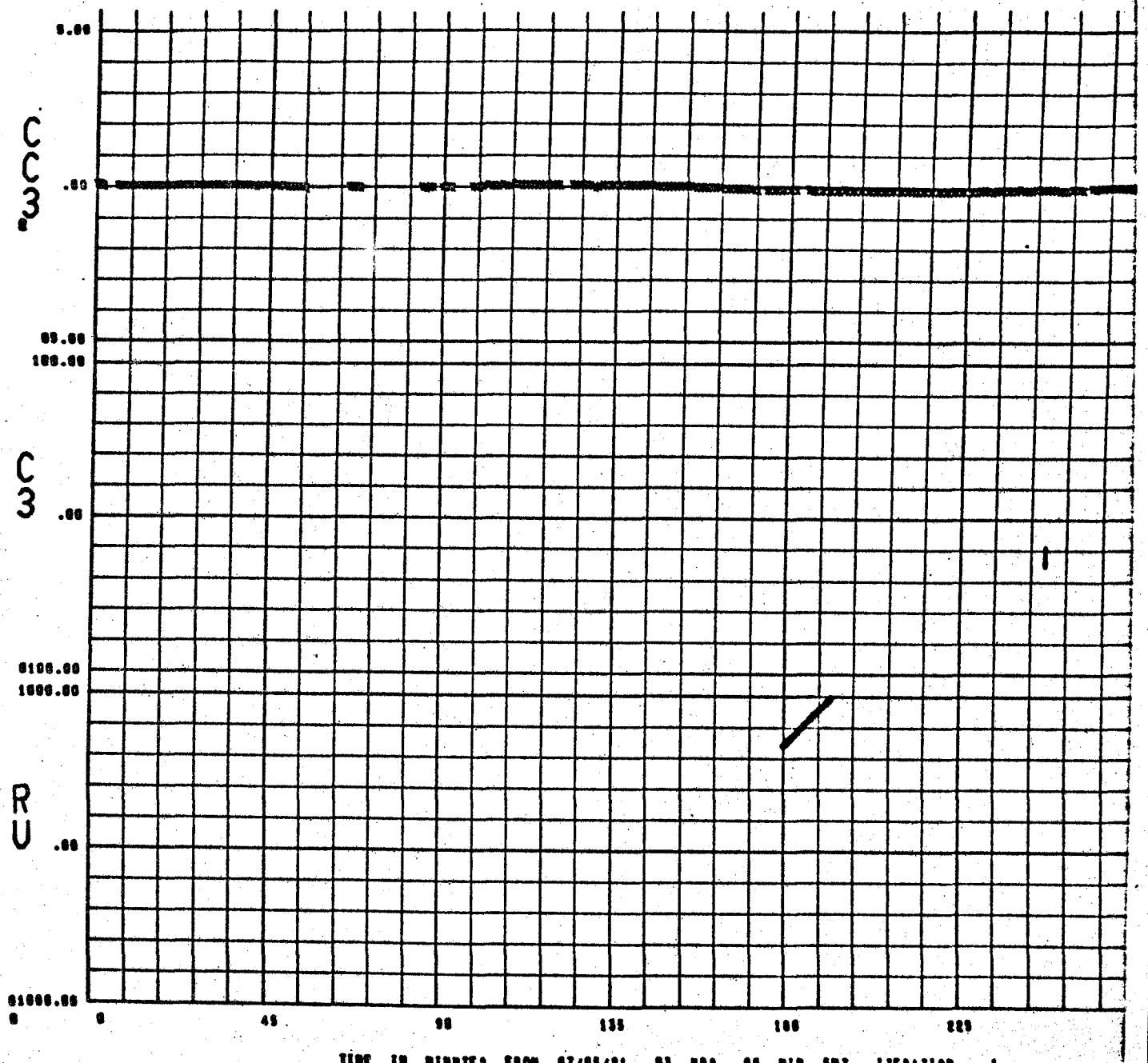
SIMPLE MOON



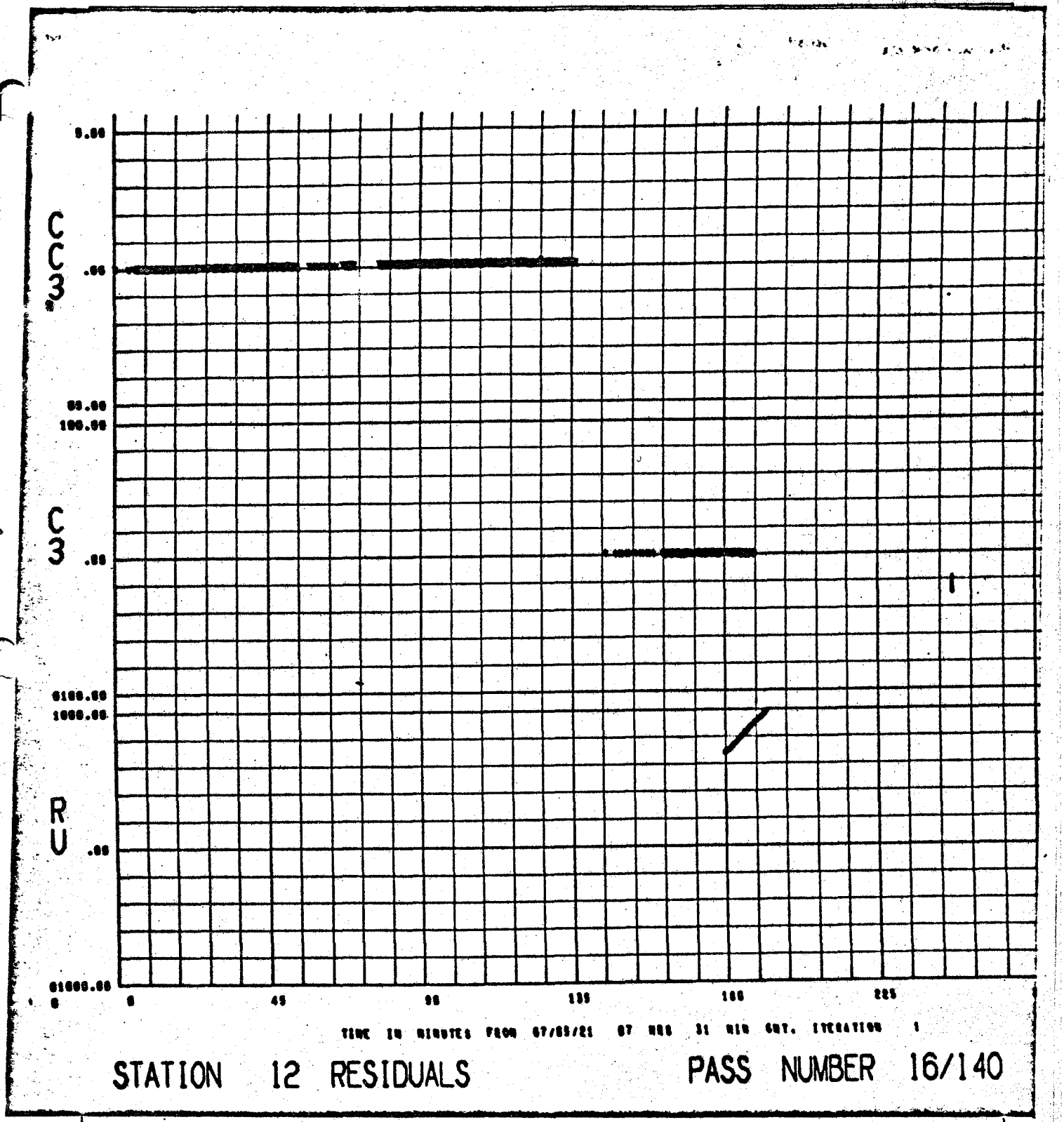
STATION 41 RESIDUALS PASS NUMBER 17/141



STATION 41 RESIDUALS PASS NUMBER 17/141



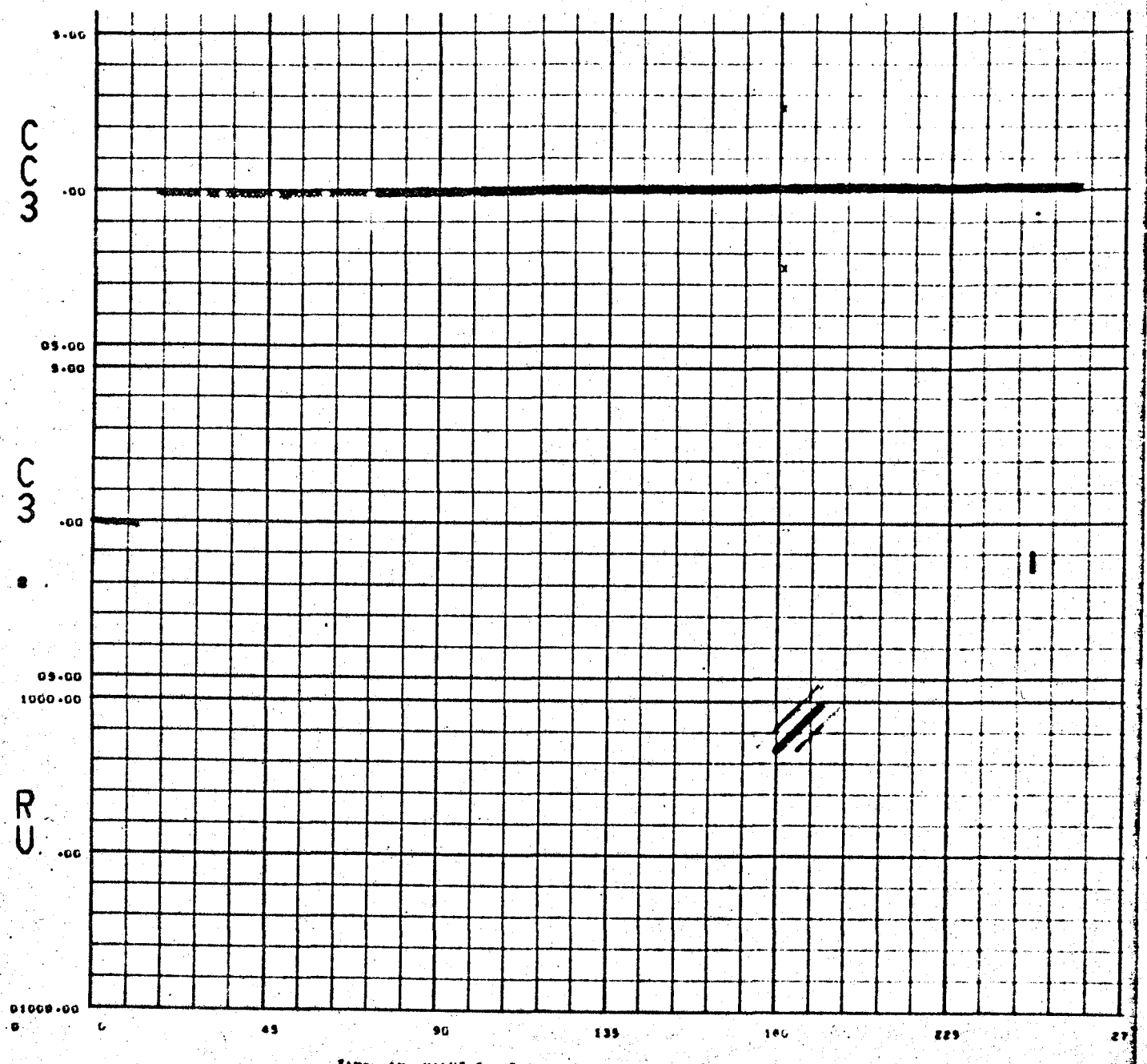
STATION 12 RESIDUALS PASS NUMBER 16/140



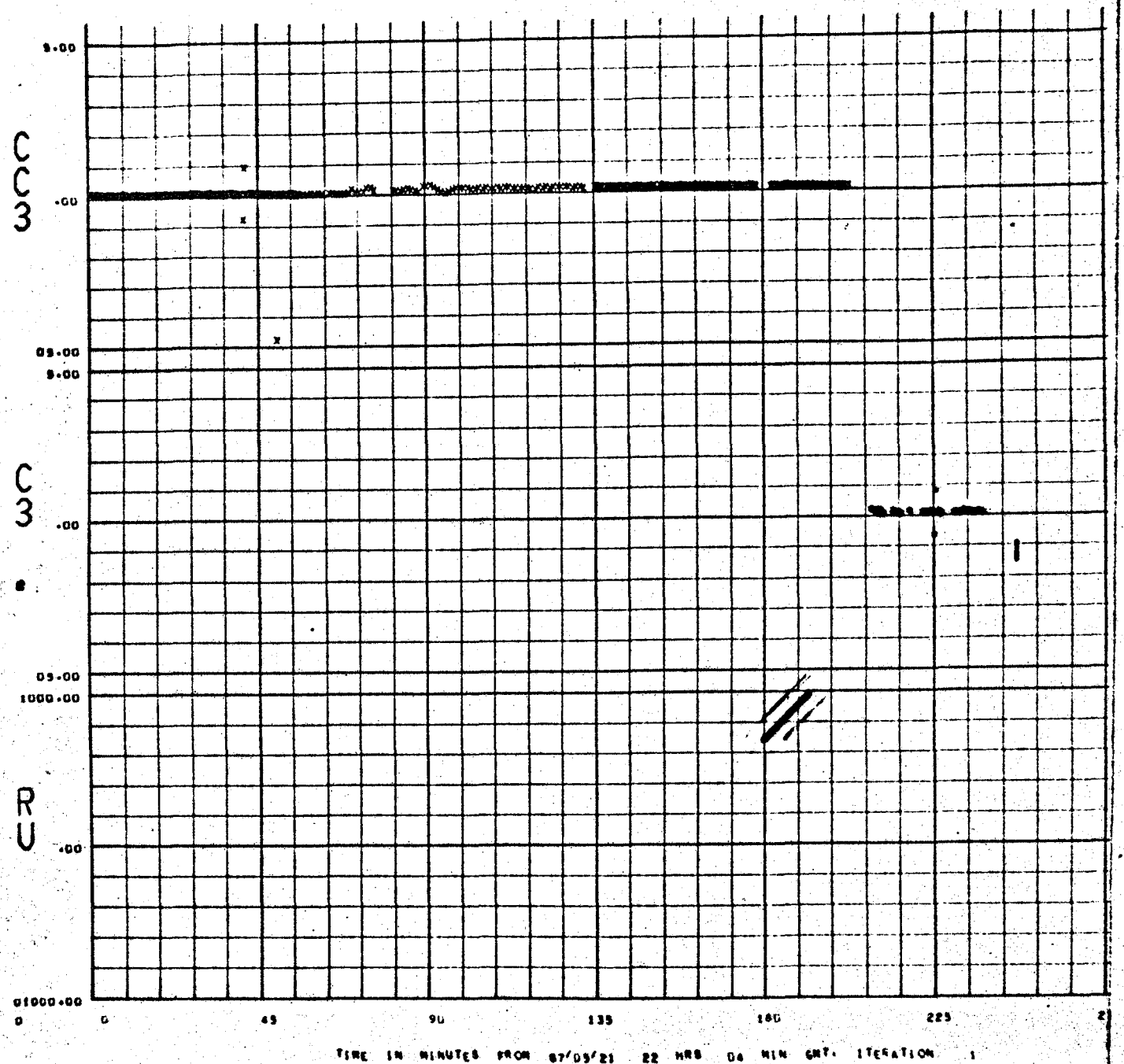
STATION 12 RESIDUALS PASS NUMBER 16/140

ODPL 40RB26

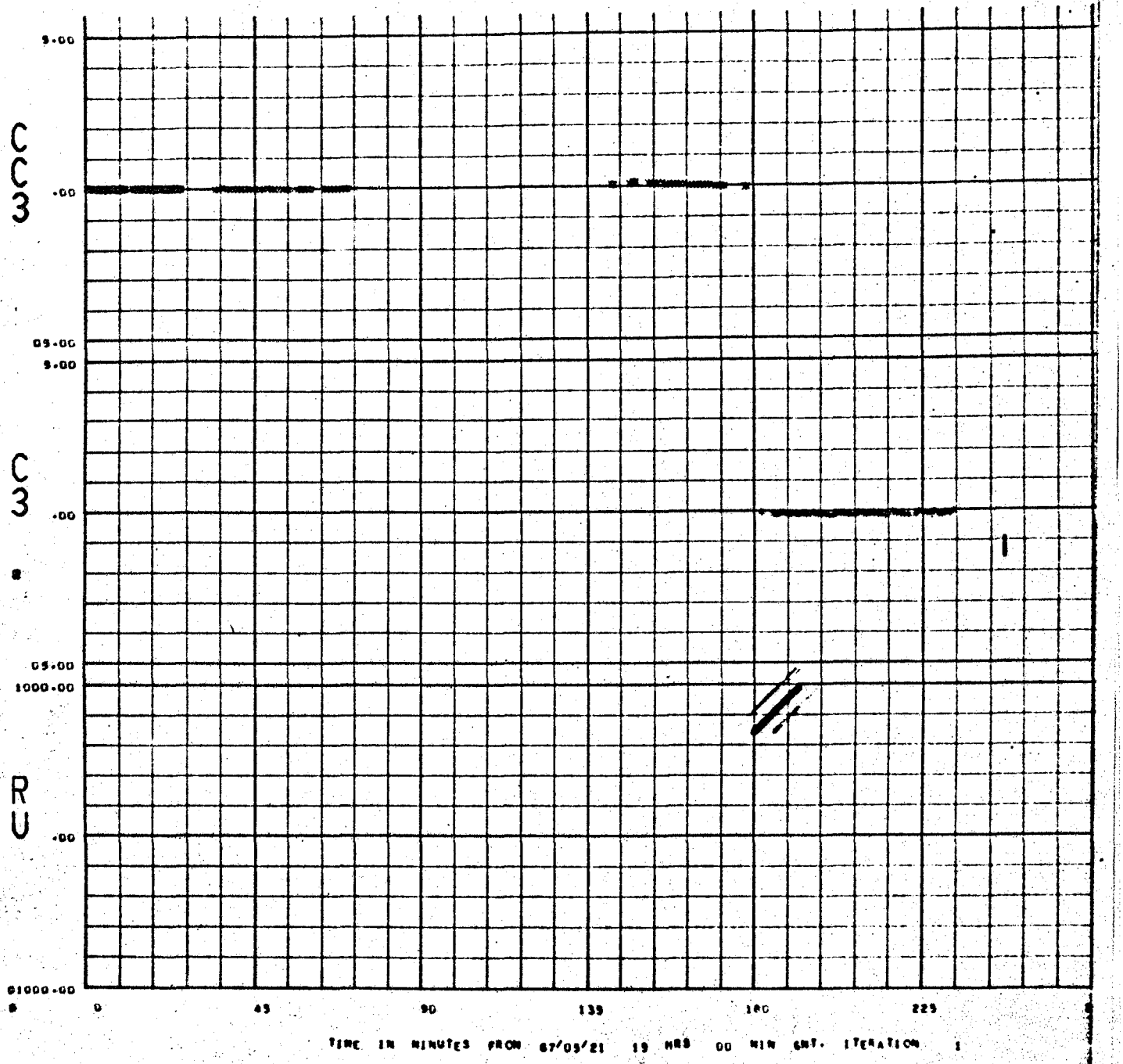
SIMPLE MOON



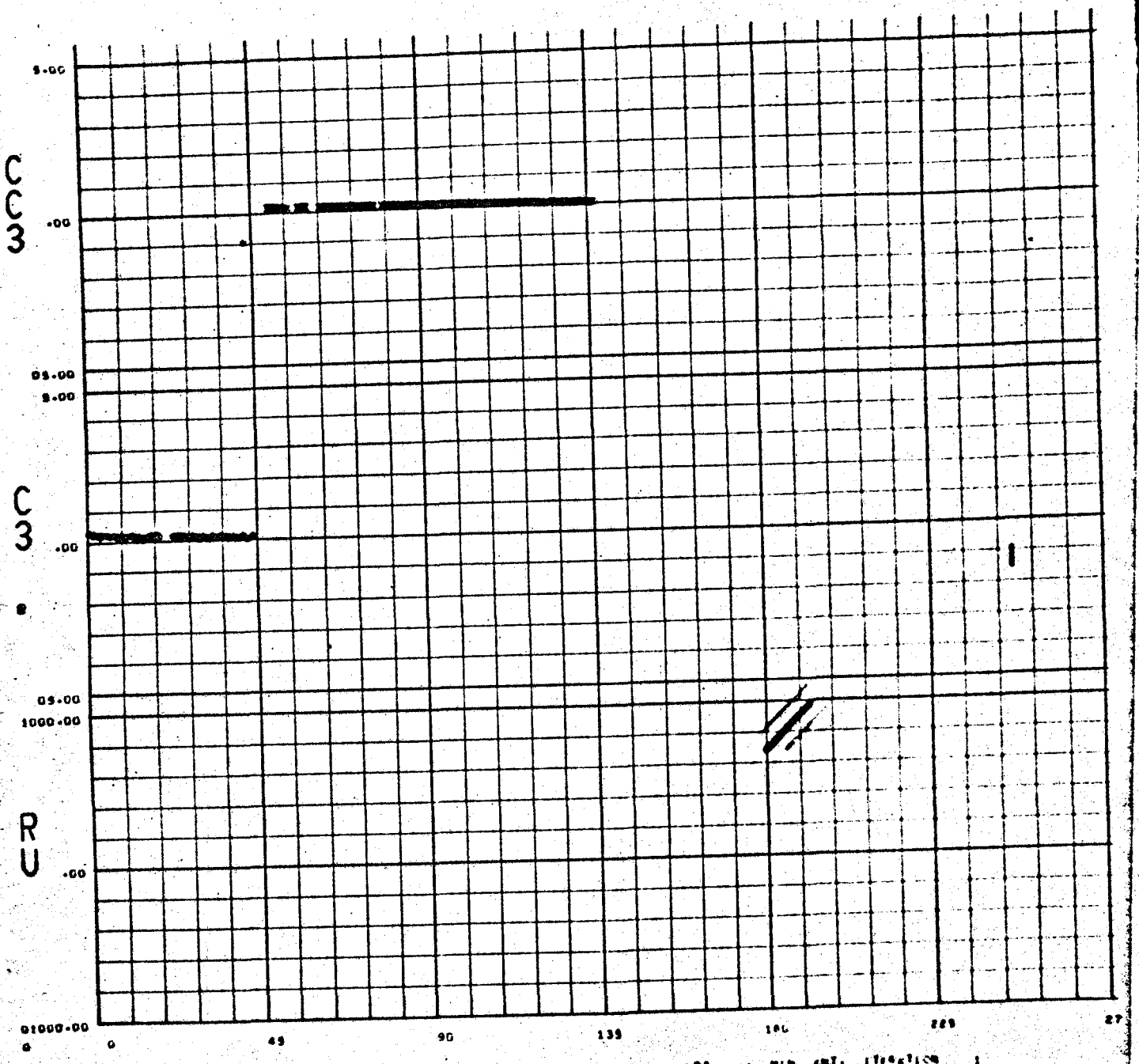
STATION 62 RESIDUALS PASS NUMBER 17/141



STATION 62 RESIDUALS PASS NUMBER 17/141



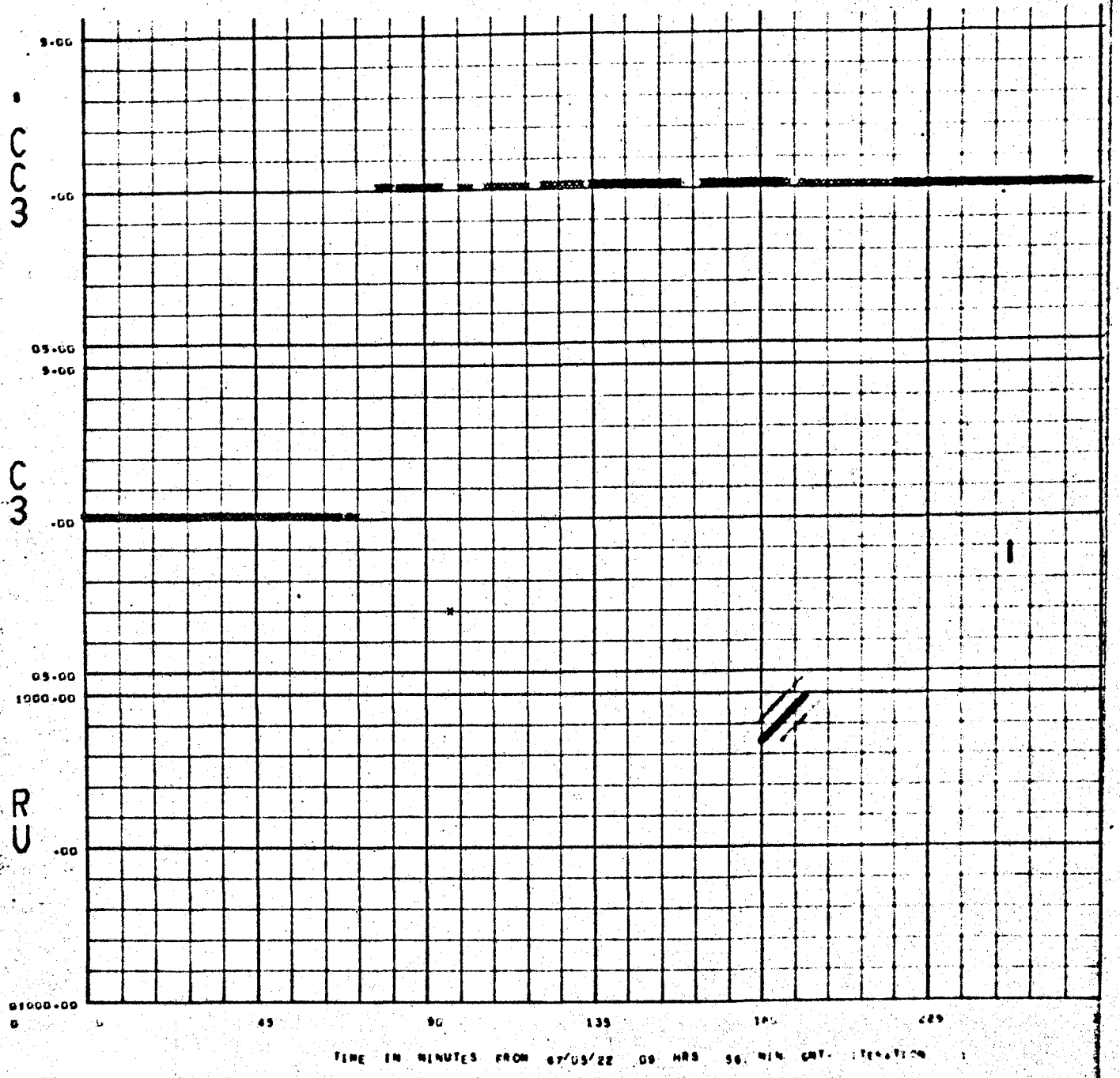
STATION 41 RESIDUALS PASS NUMBER 17/141



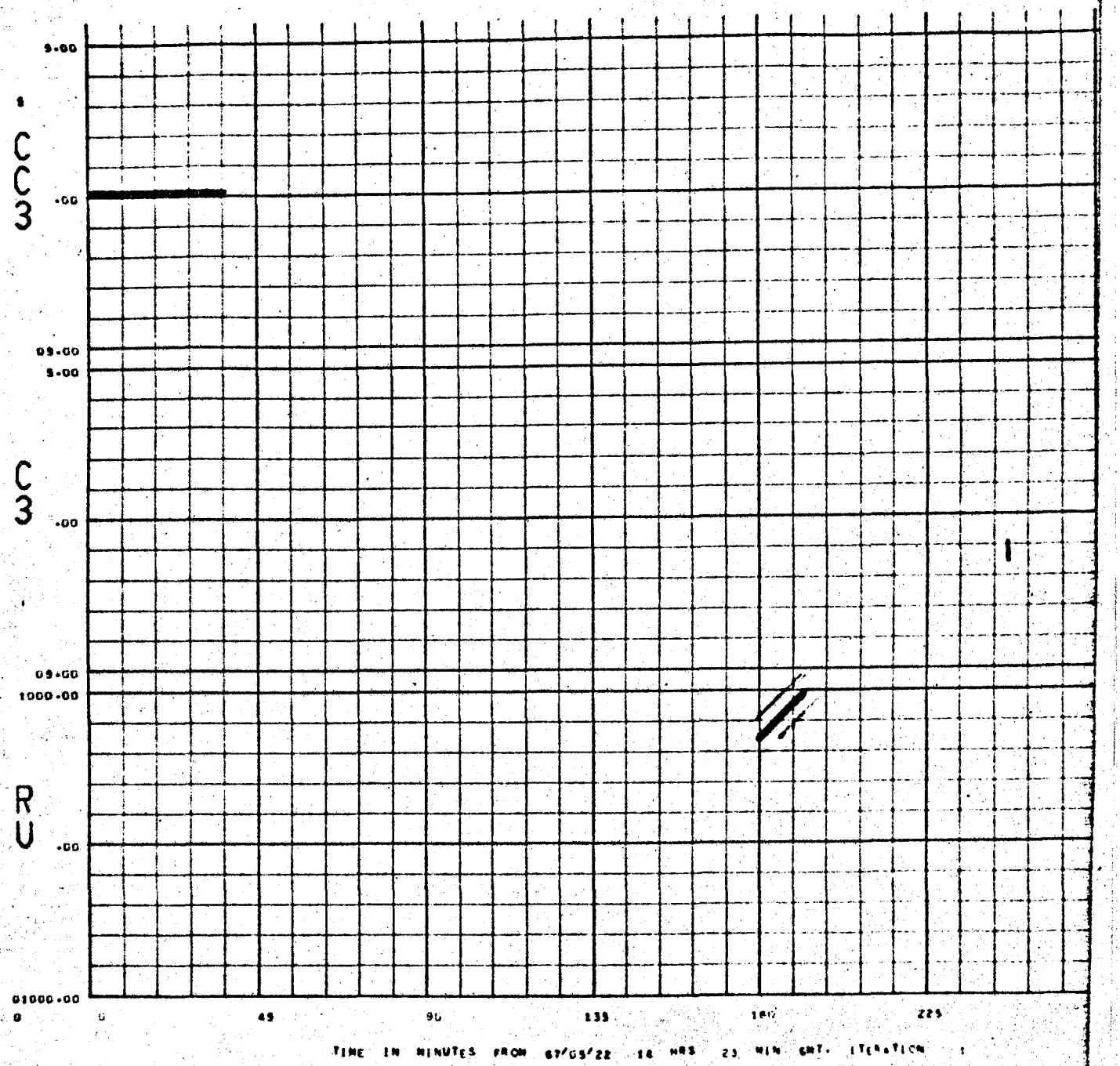
STATION 12 RESIDUALS PASS NUMBER 17/142

ODPL 40RB27

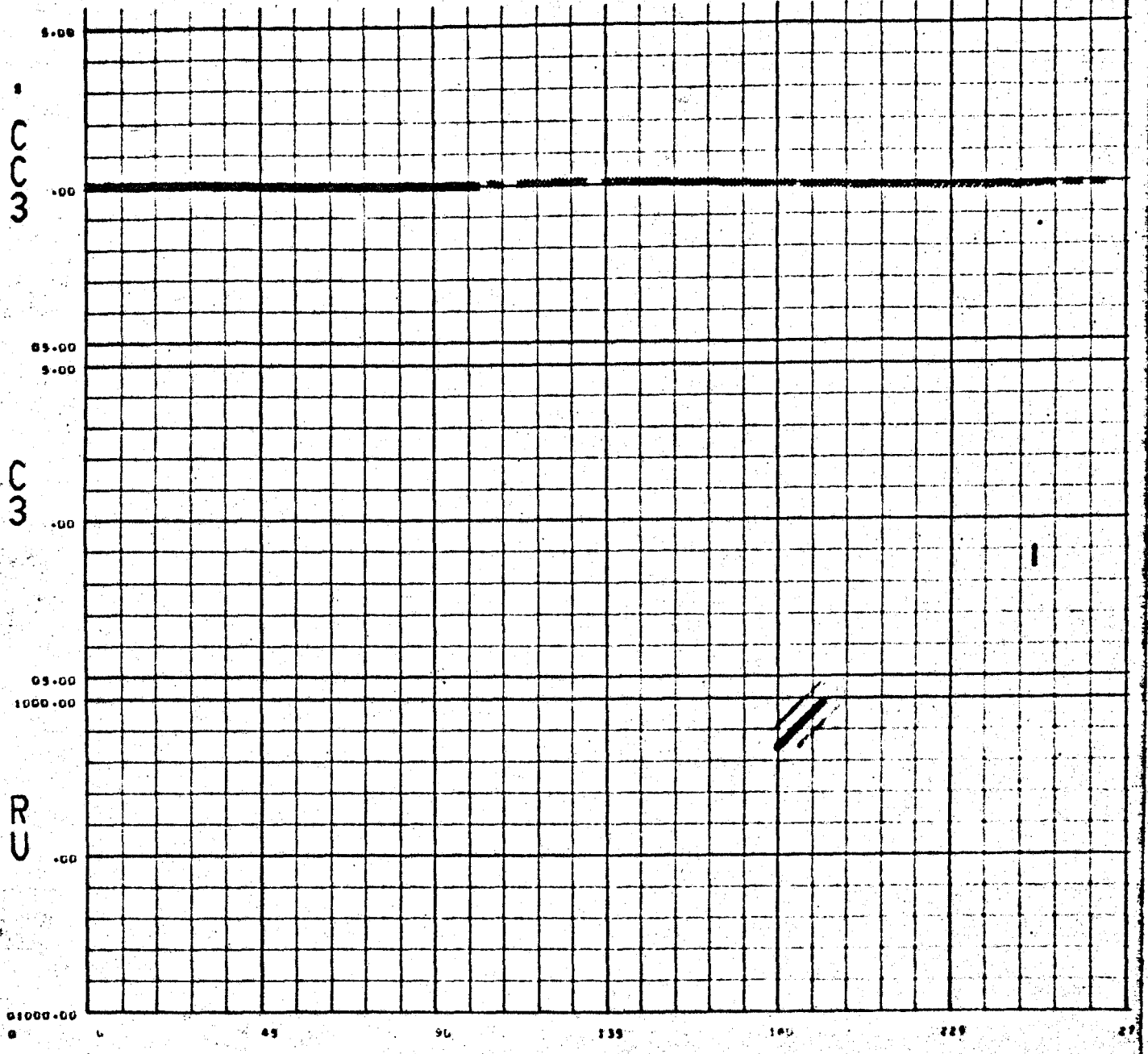
SIMPLE MOON



STATION 41 RESIDUALS PASS NUMBER 18/142

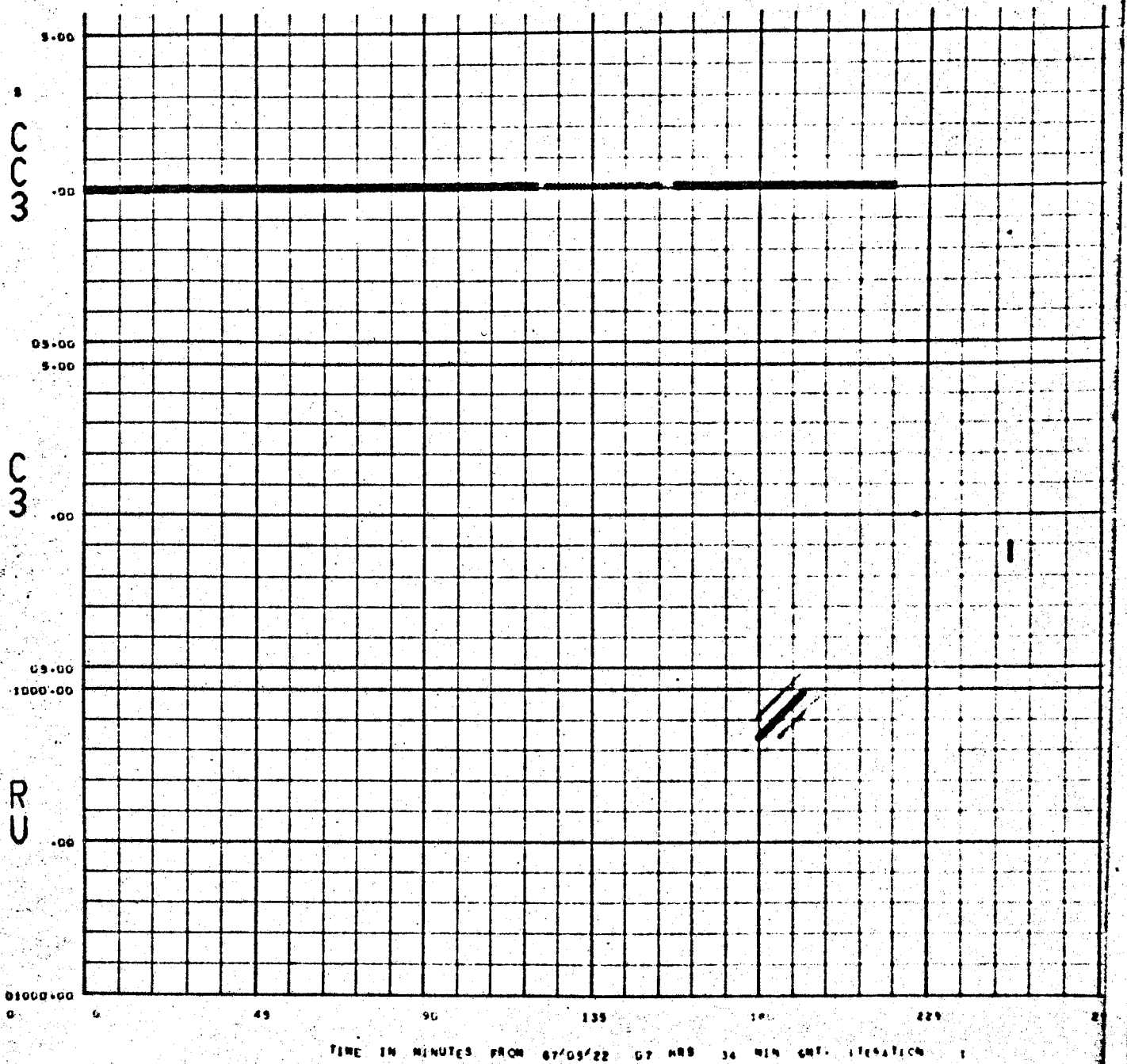


STATION 41 RESIDUALS PASS NUMBER 18/142



TIME IN MINUTES FROM 67/05/22. 03 HRS 00 MIN GMT. ITERATION 1

STATION 12 RESIDUALS PASS NUMBER 17/142

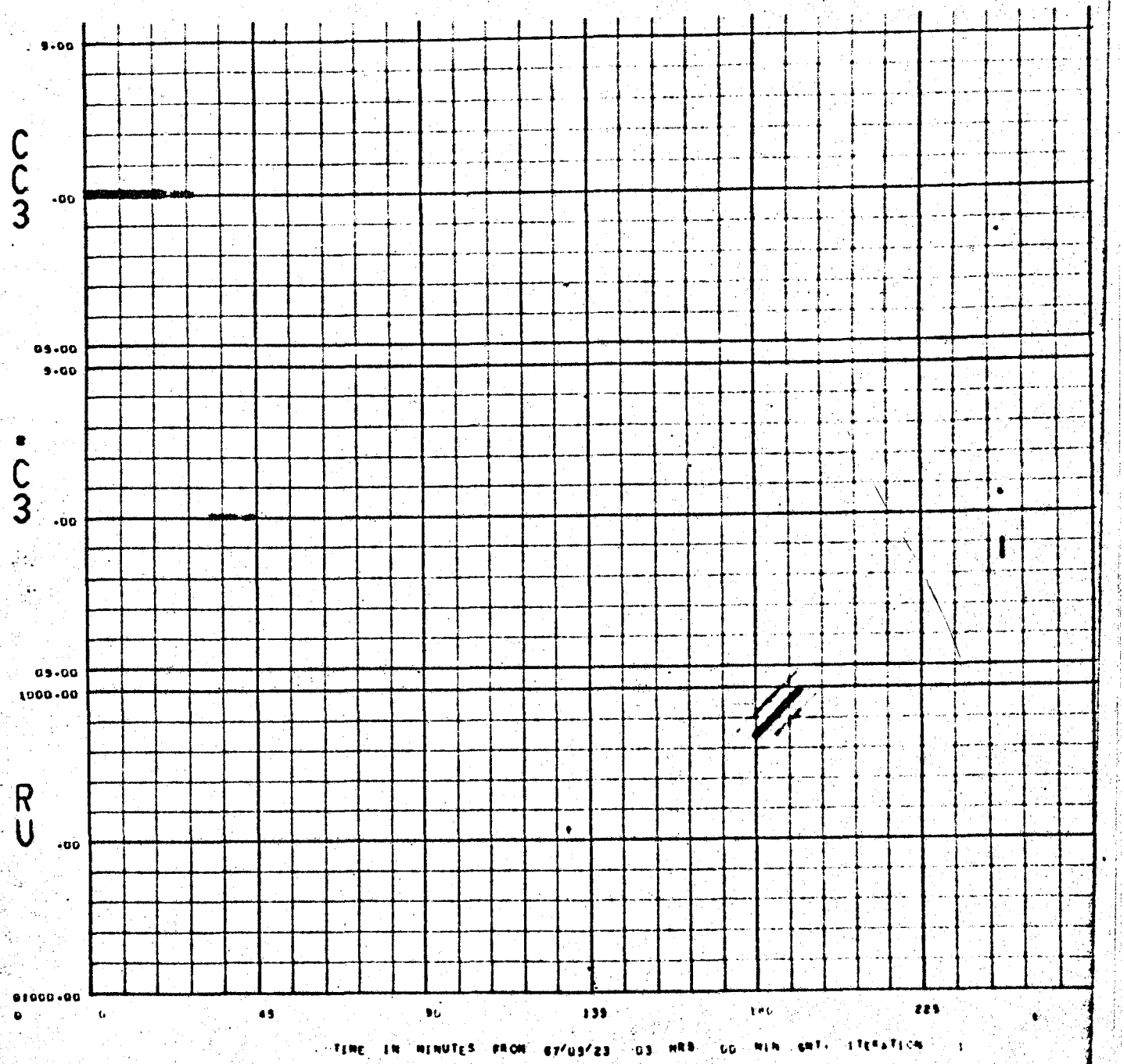


STATION 12 RESIDUALS PASS NUMBER 17/142

REV LTR

ODPL 40RB29

SIMPLE MOON



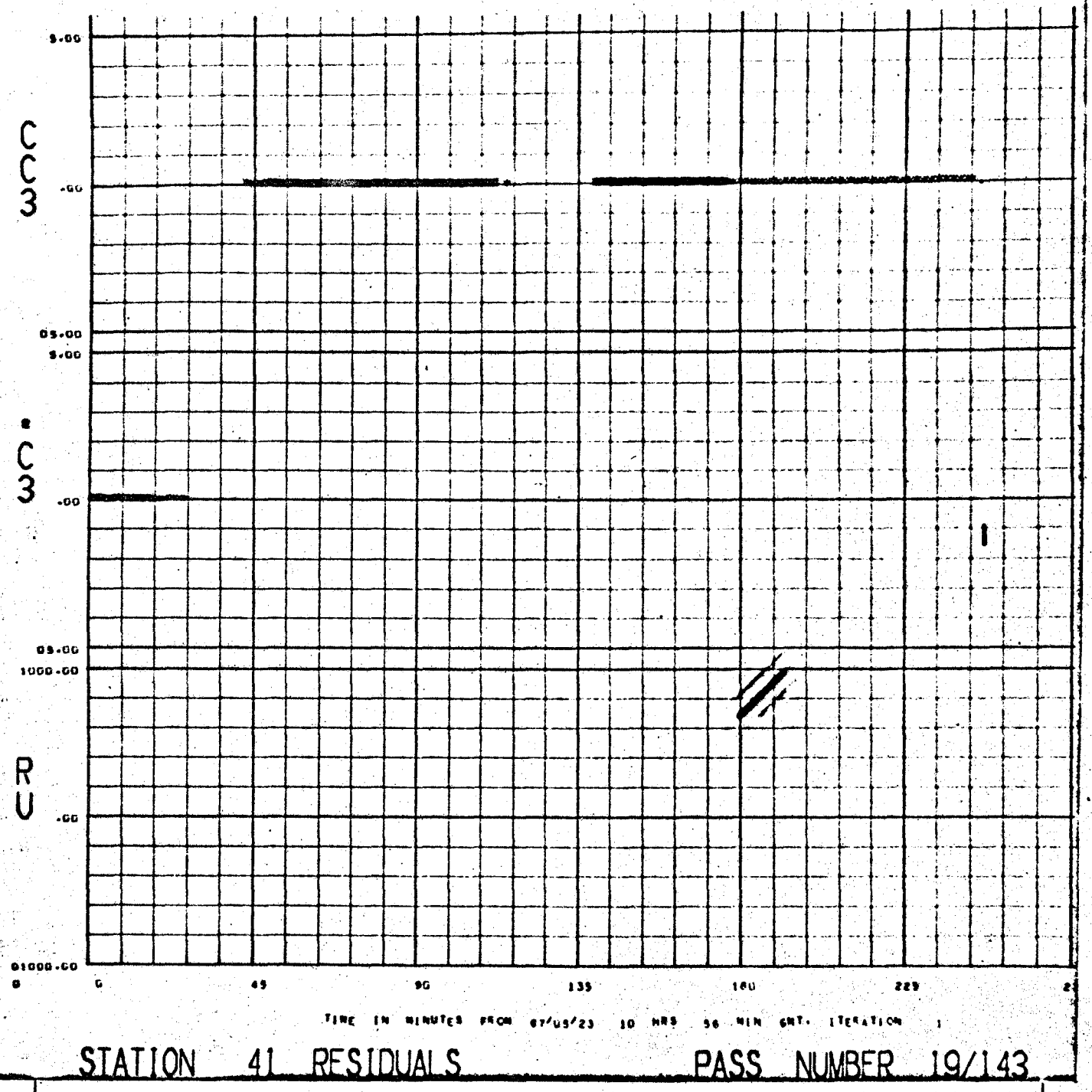
STATION 62 RESIDUALS PASS NUMBER 18/142

REV LTR

BOEING NO. D2-100816-1

SH. 127

113 4289-2000 REV. 6/64



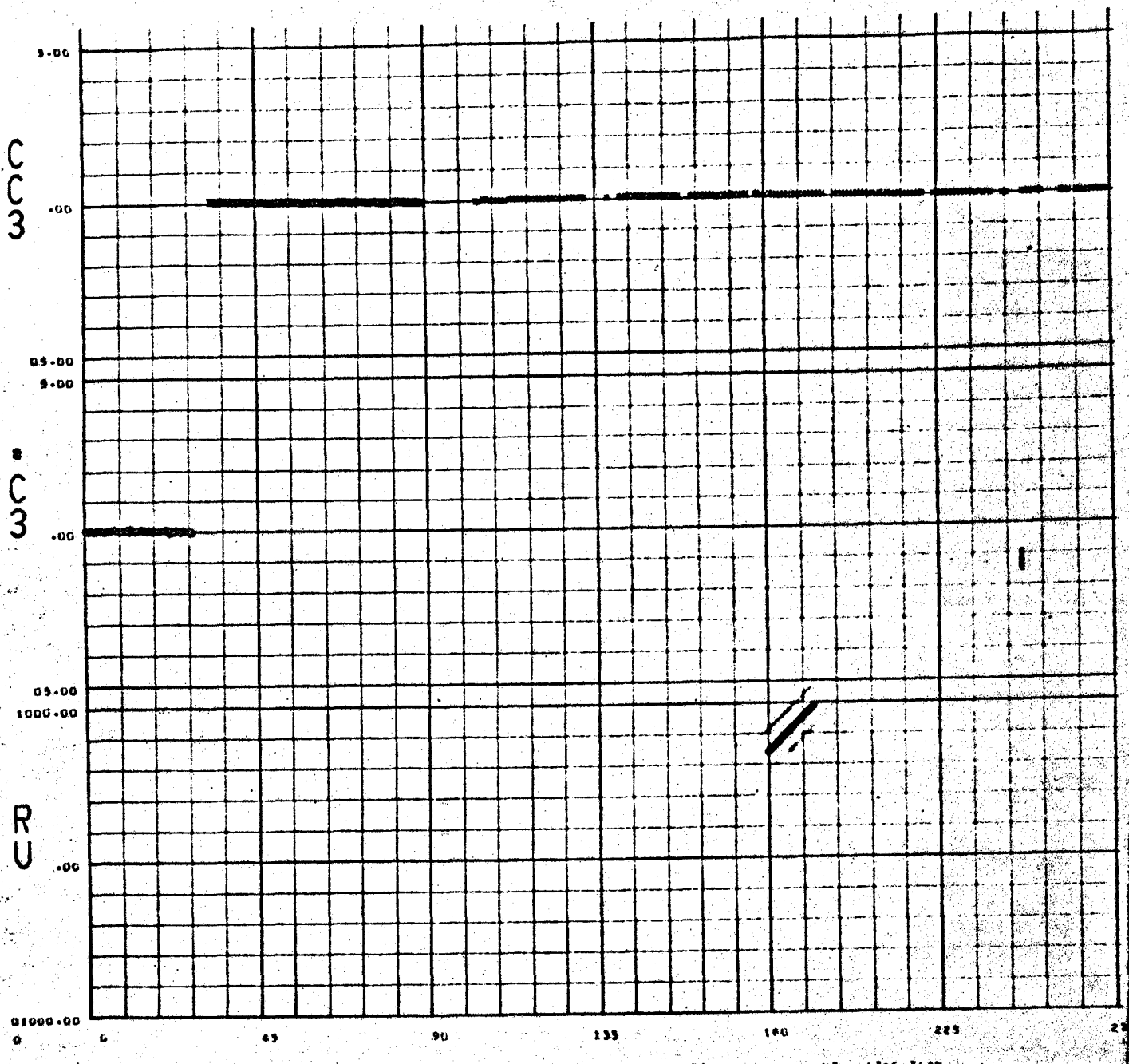
STATION 41 RESIDUALS PASS NUMBER 19/143

REV LTR

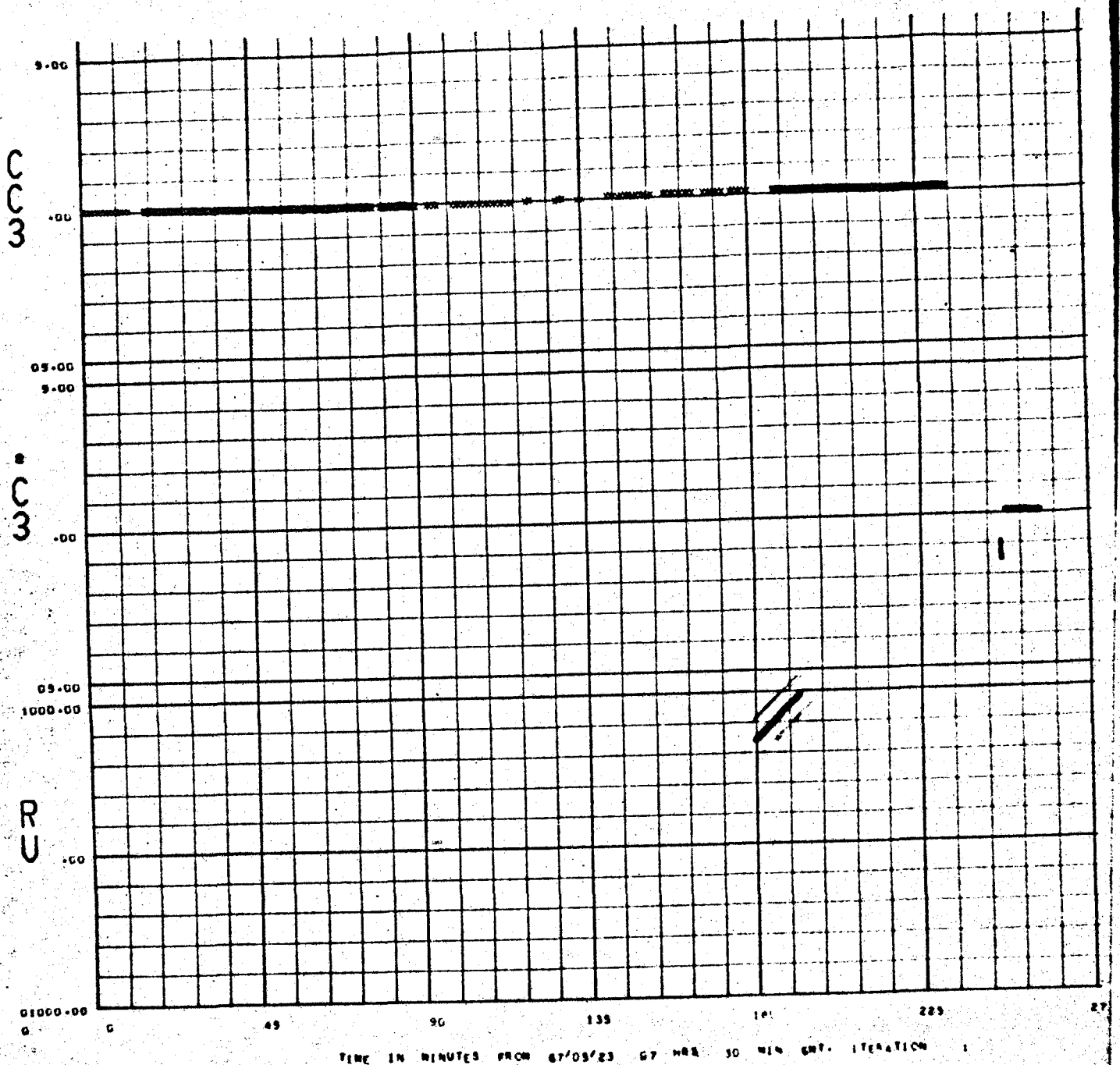
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 428



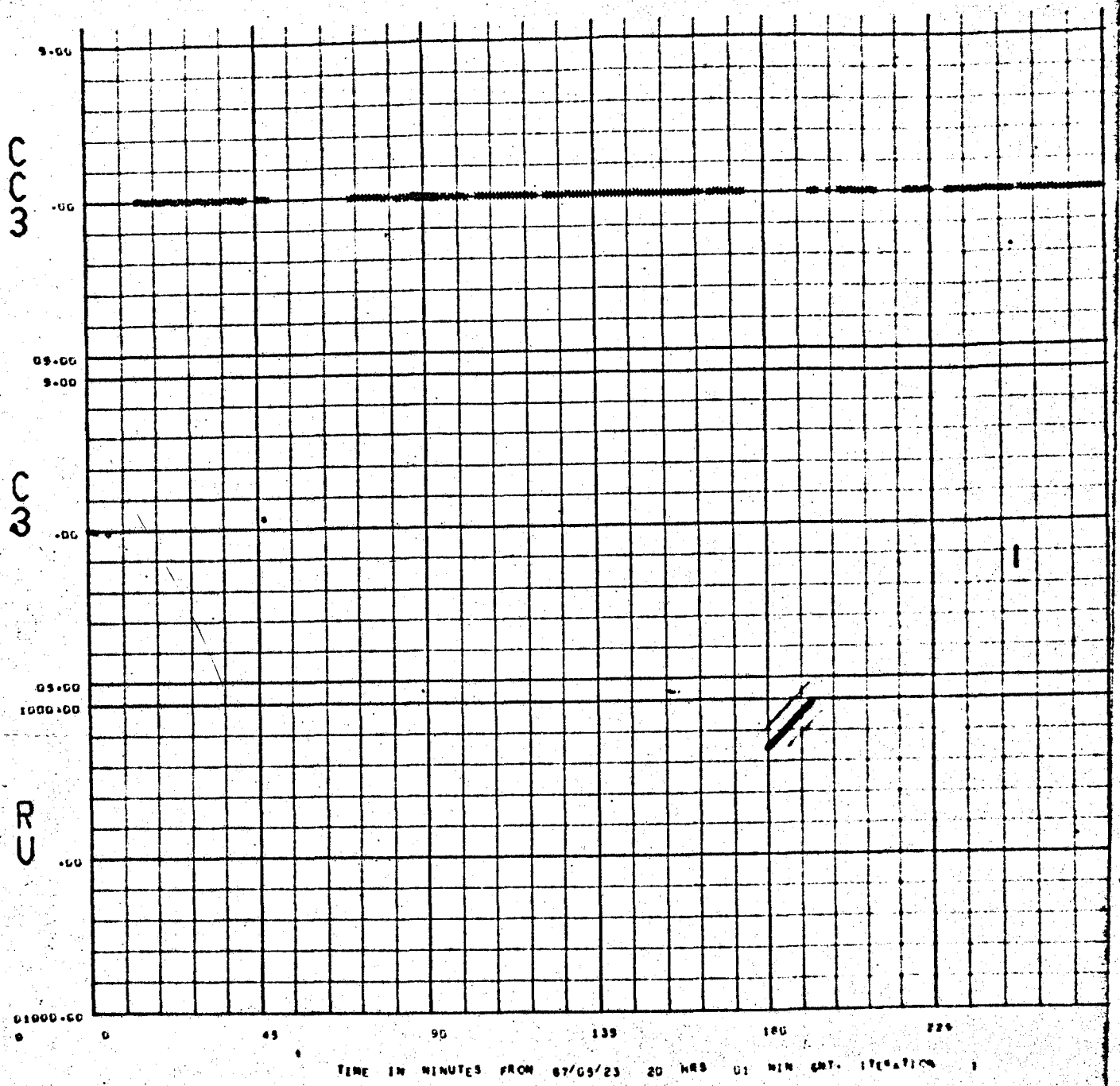
STATION 12 RESIDUALS PASS NUMBER 18/143



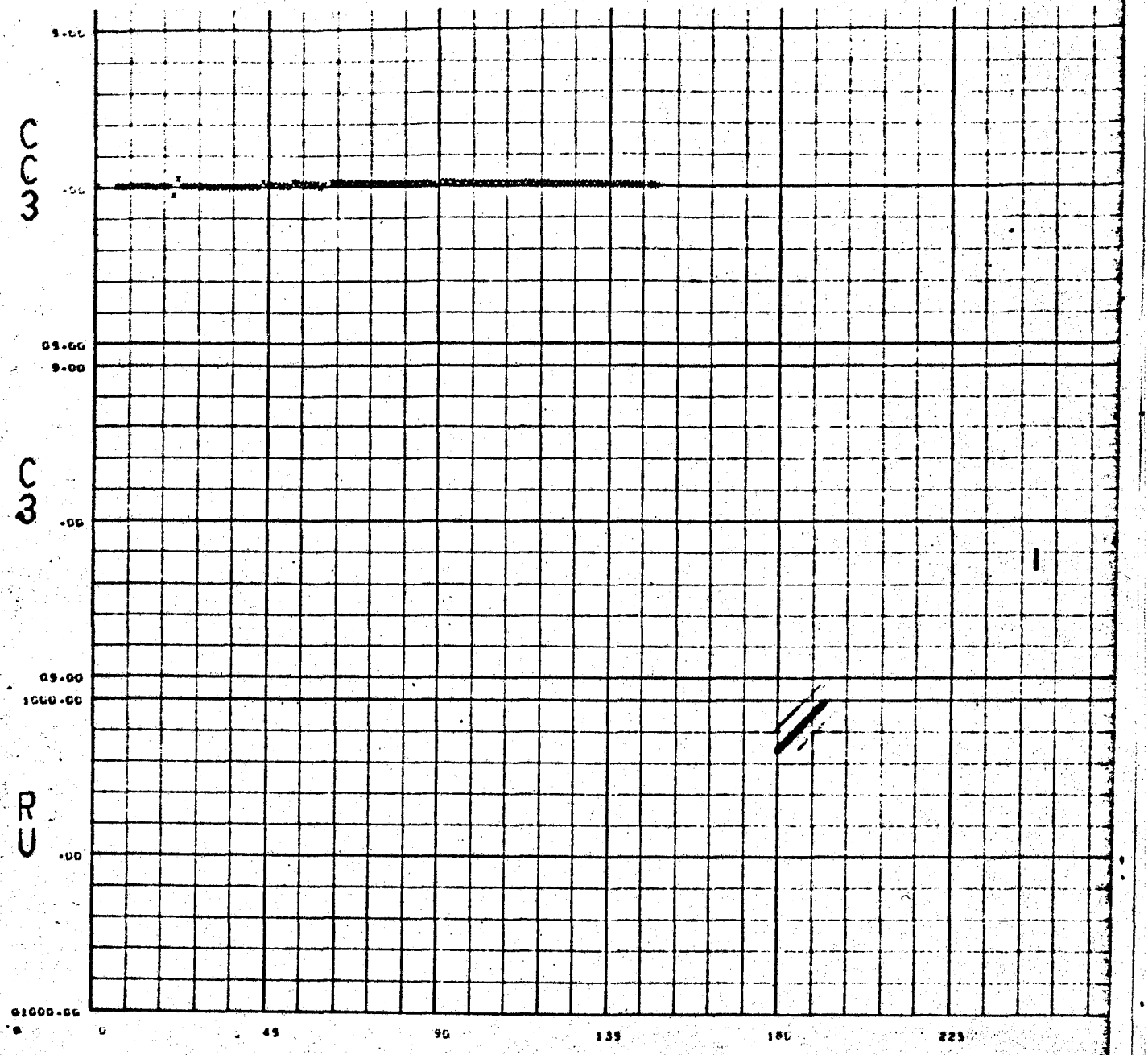
STATION 12 RESIDUALS PASS NUMBER 18/143

ODPL 40RB30

SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 19/143



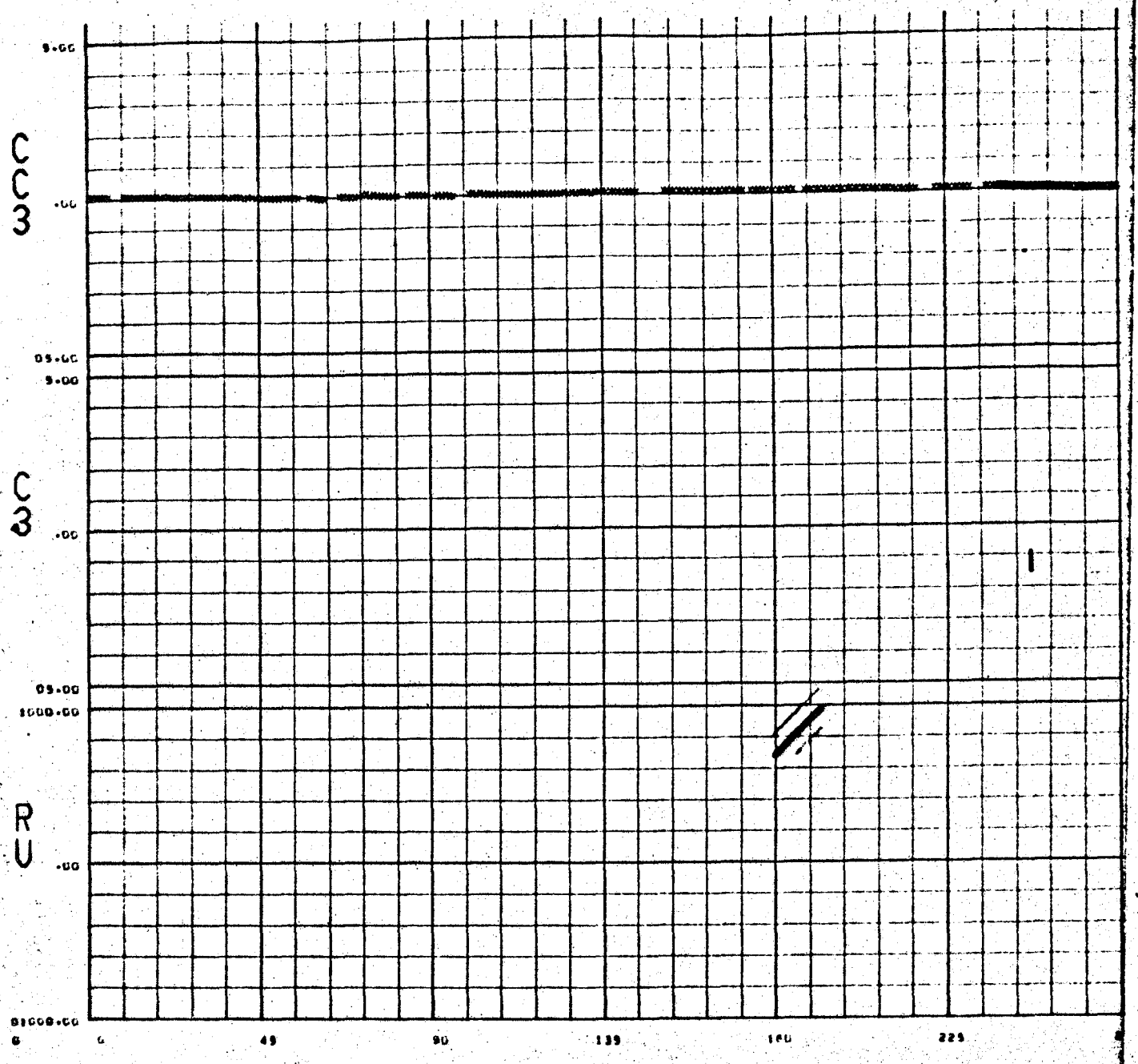
STATION 62 RESIDUALS PASS NUMBER 19/143

REV LTR

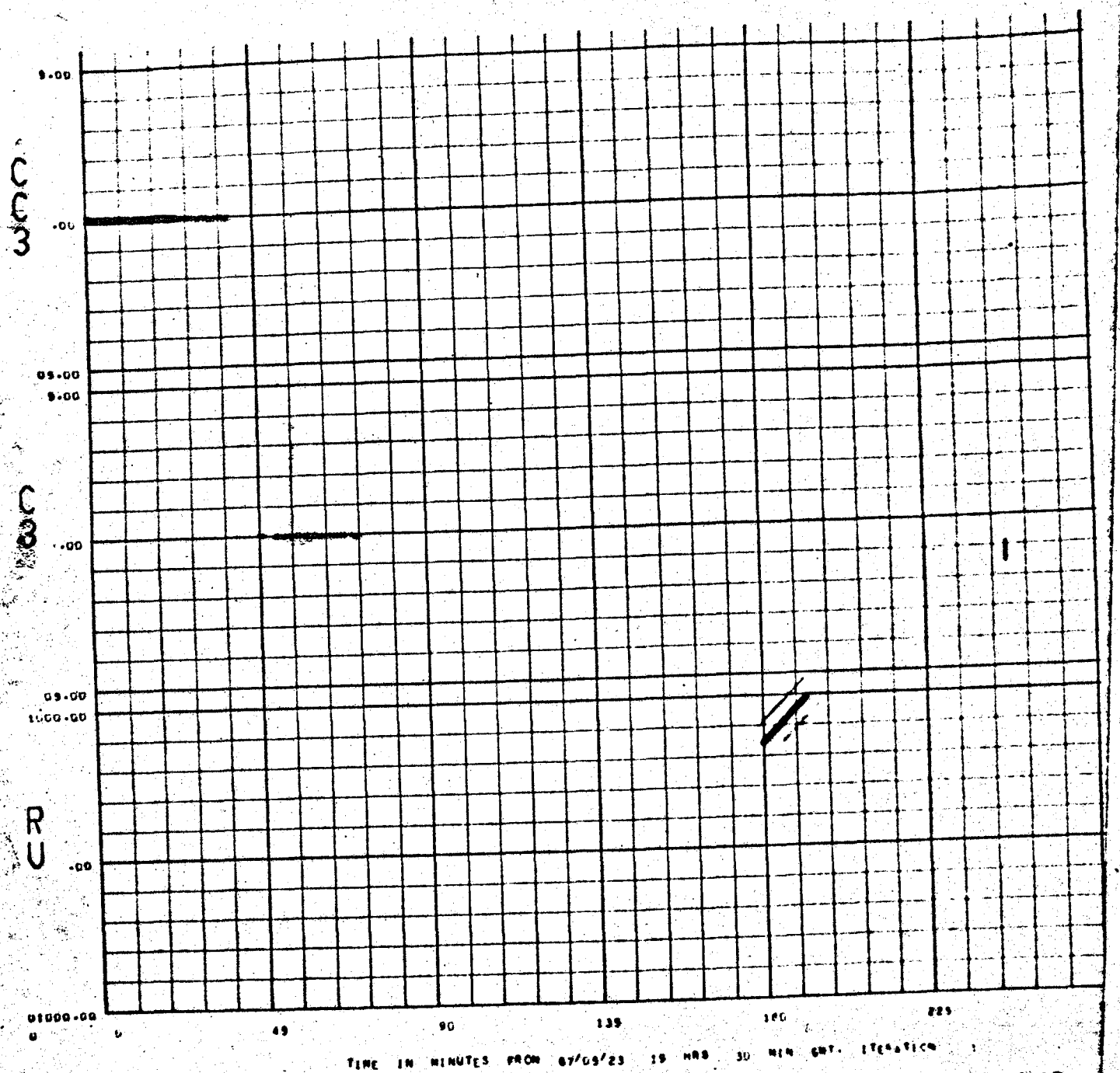
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 433



STATION 41 RESIDUALS PASS NUMBER 19/143



STATION 41 RESIDUALS PASS NUMBER 19/143

ODPL 40RB31

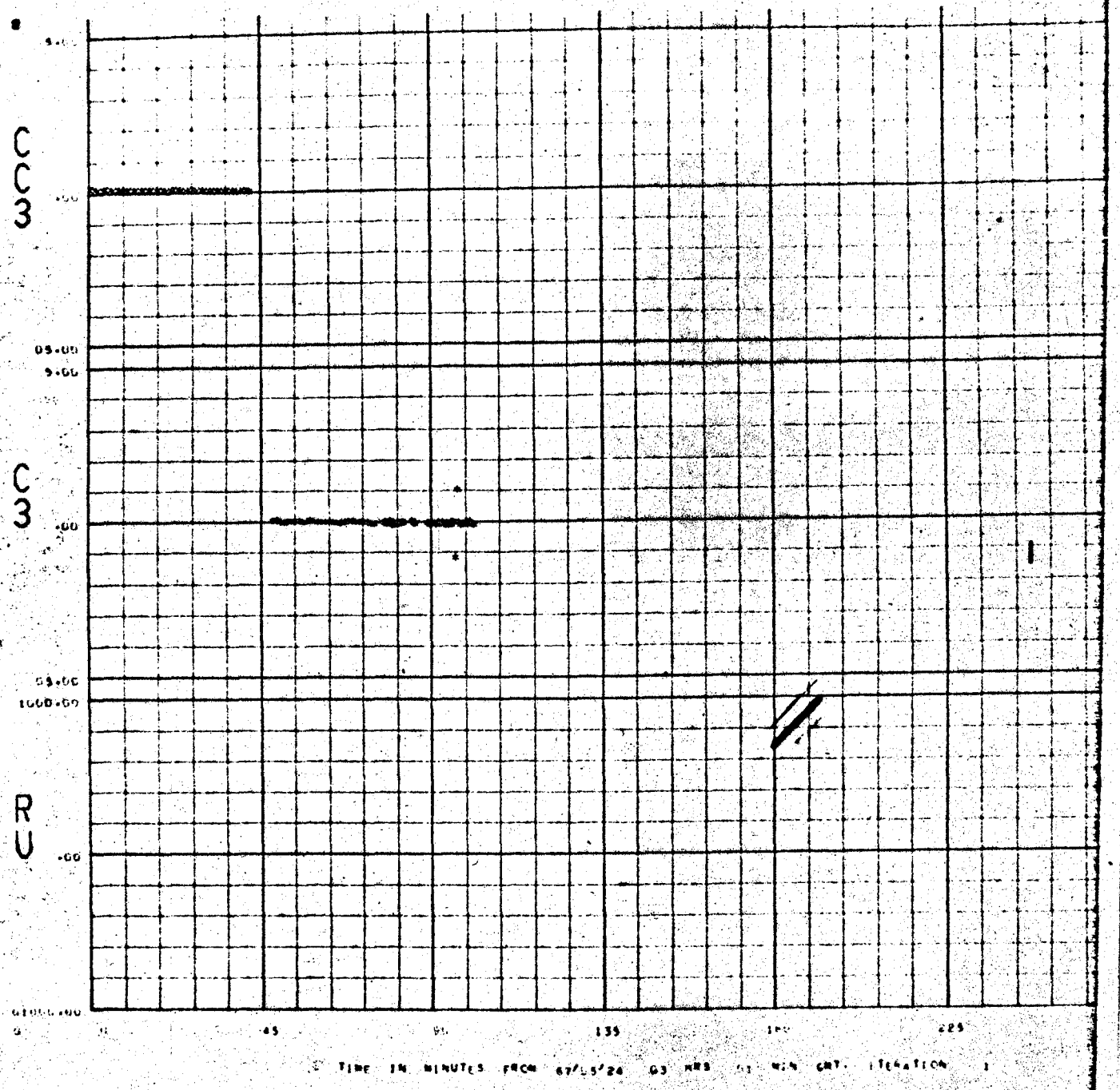
SIMPLE MOON

REV LTR

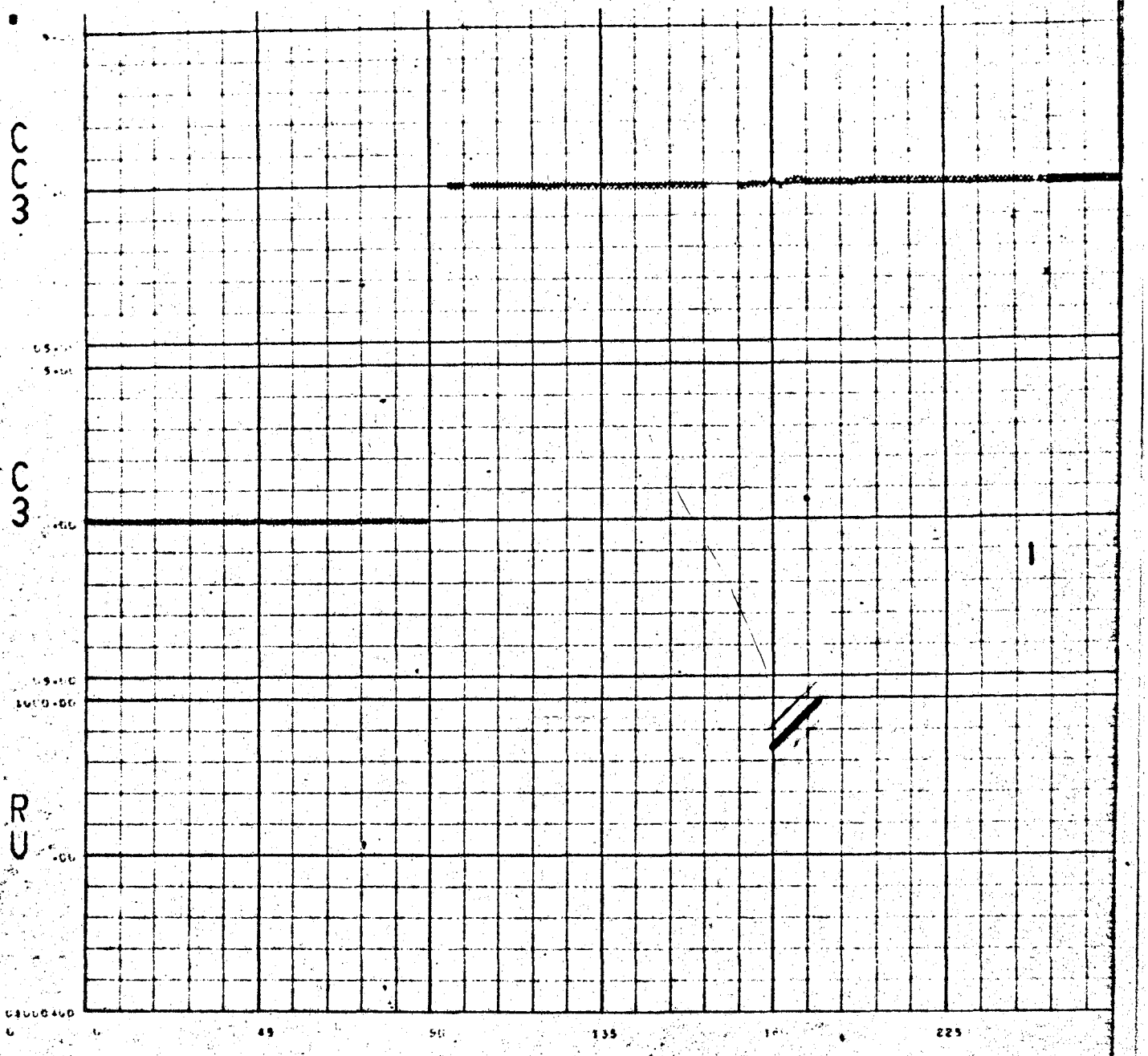
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 436

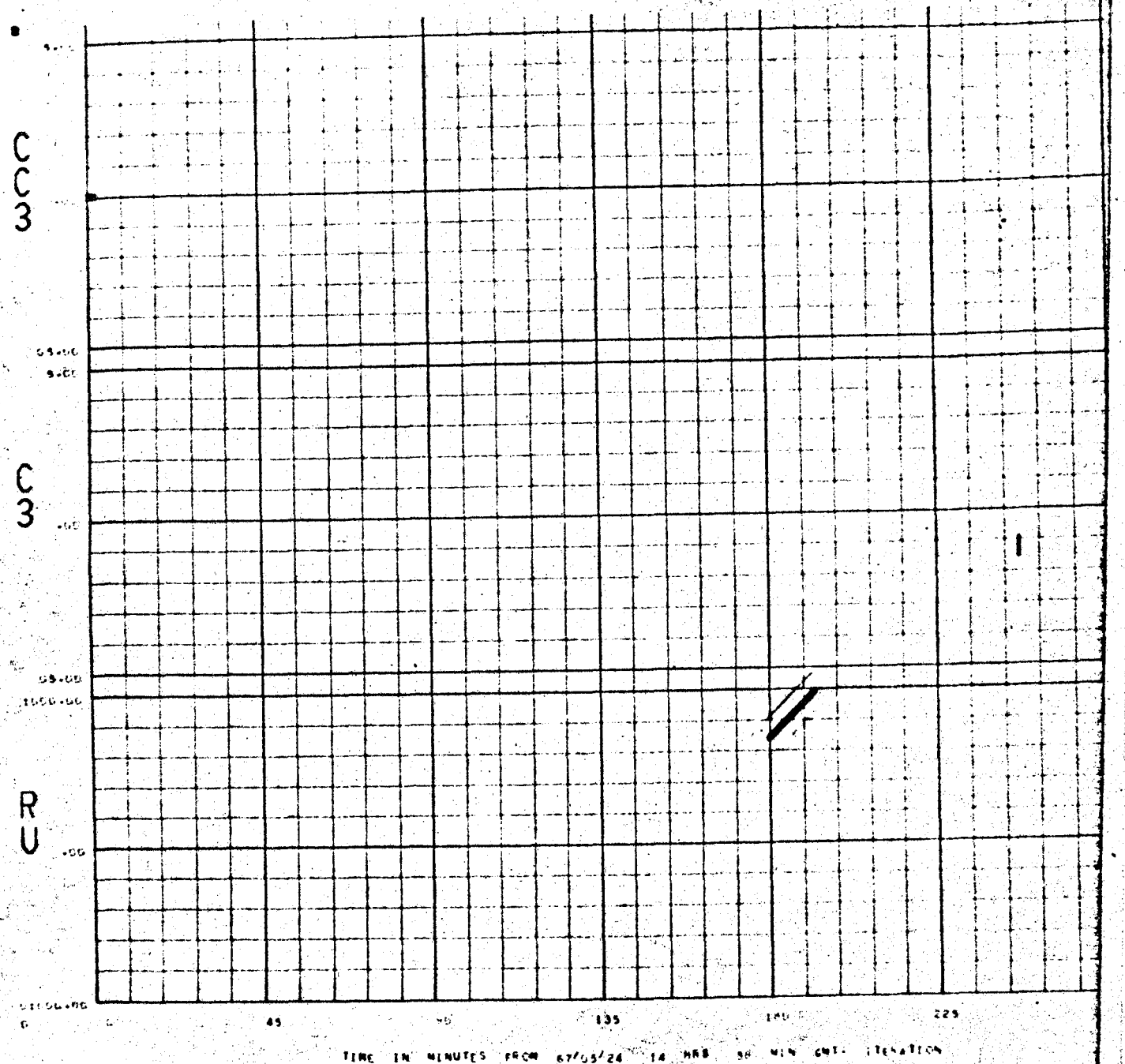


STATION 62 RESIDUALS PASS NUMBER 19/143

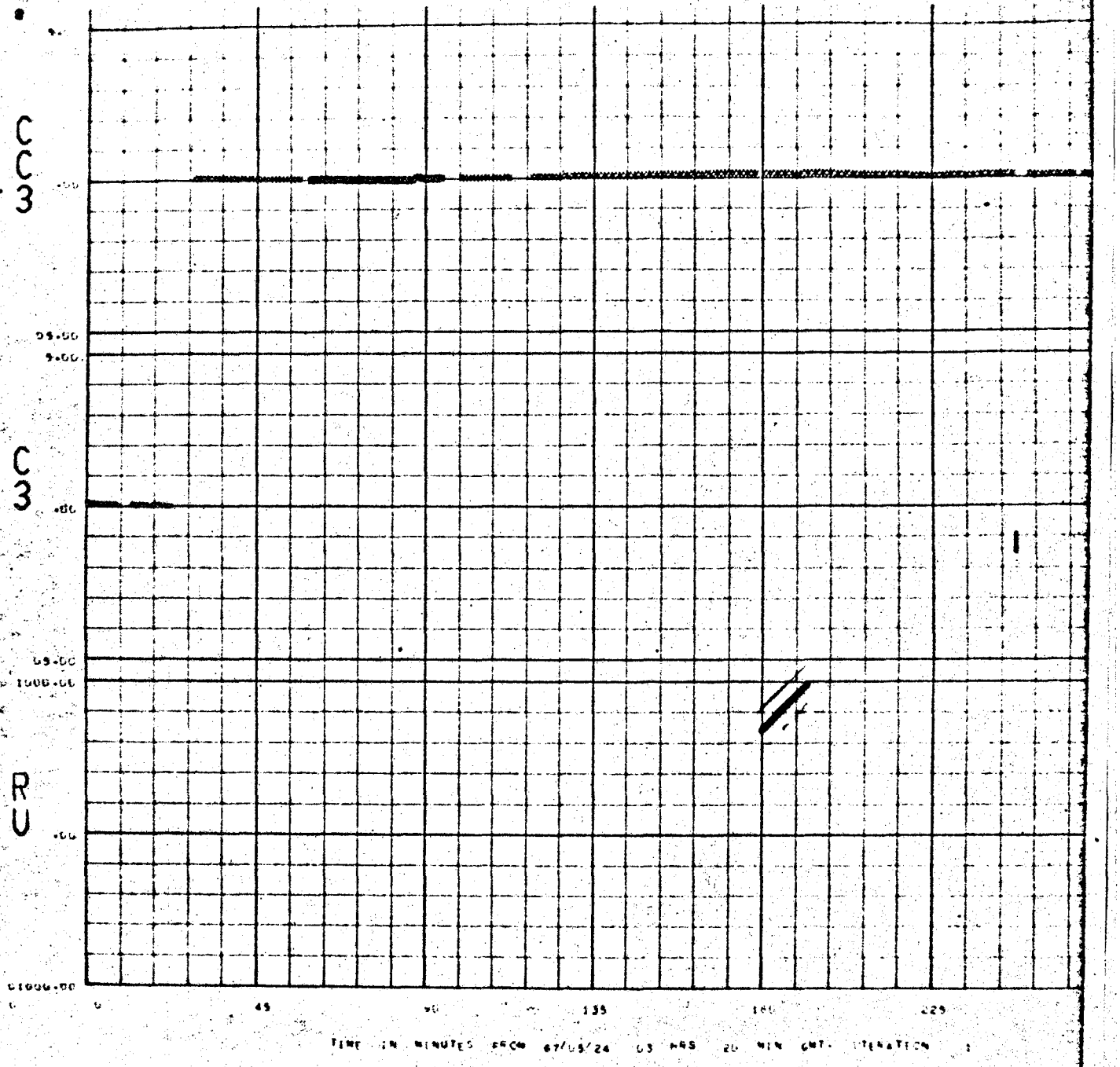


TIME IN MINUTES FROM 67/09/24 [illegible] HRS [illegible] MIN GMT. ITERATION 1

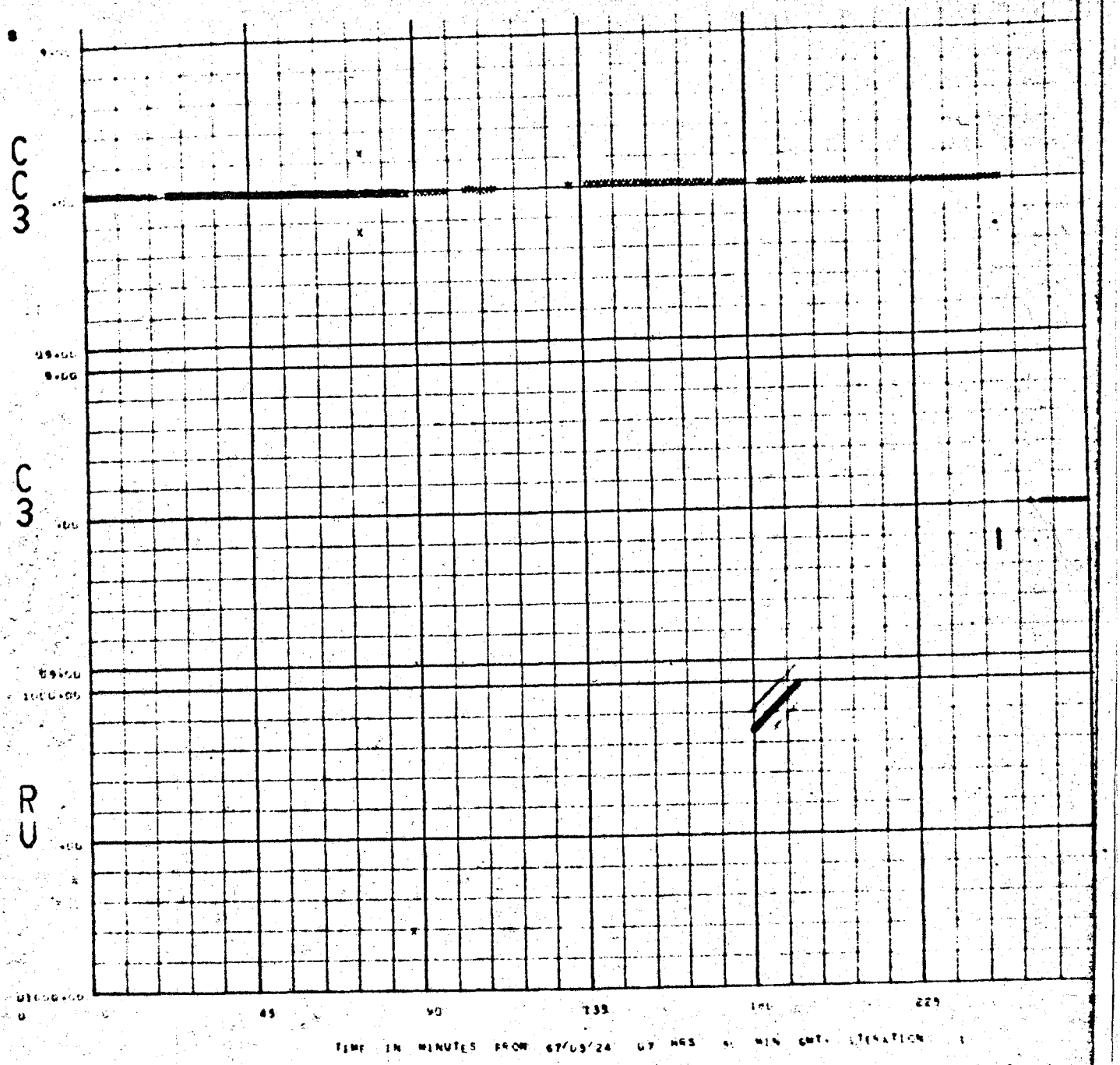
STATION 41 RESIDUALS PASS NUMBER 20/144



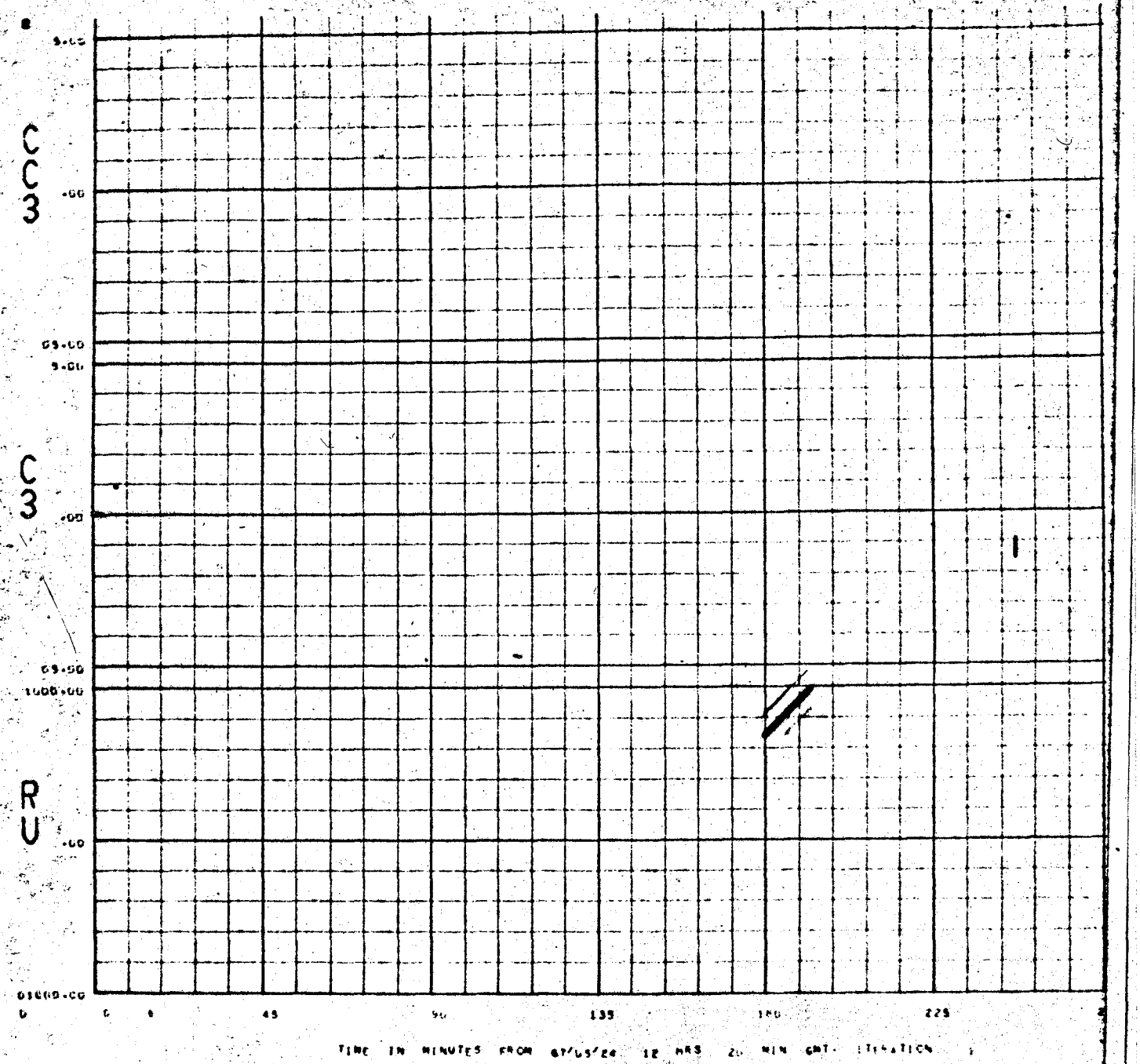
STATION 41 RESIDUALS PASS NUMBER 20/144



STATION 12 RESIDUALS PASS NUMBER 19/144



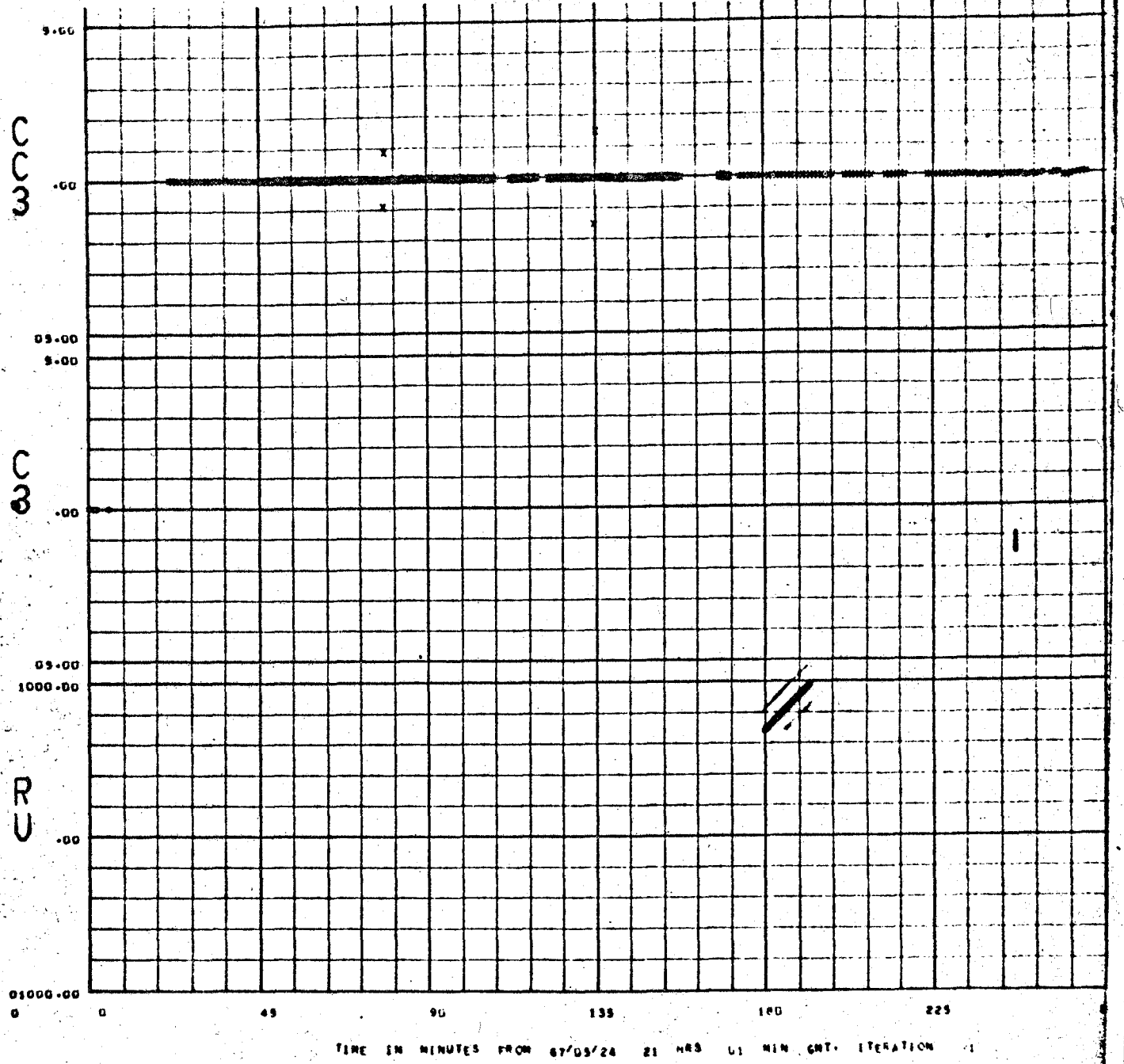
STATION 12 RESIDUALS PASS NUMBER 19/144



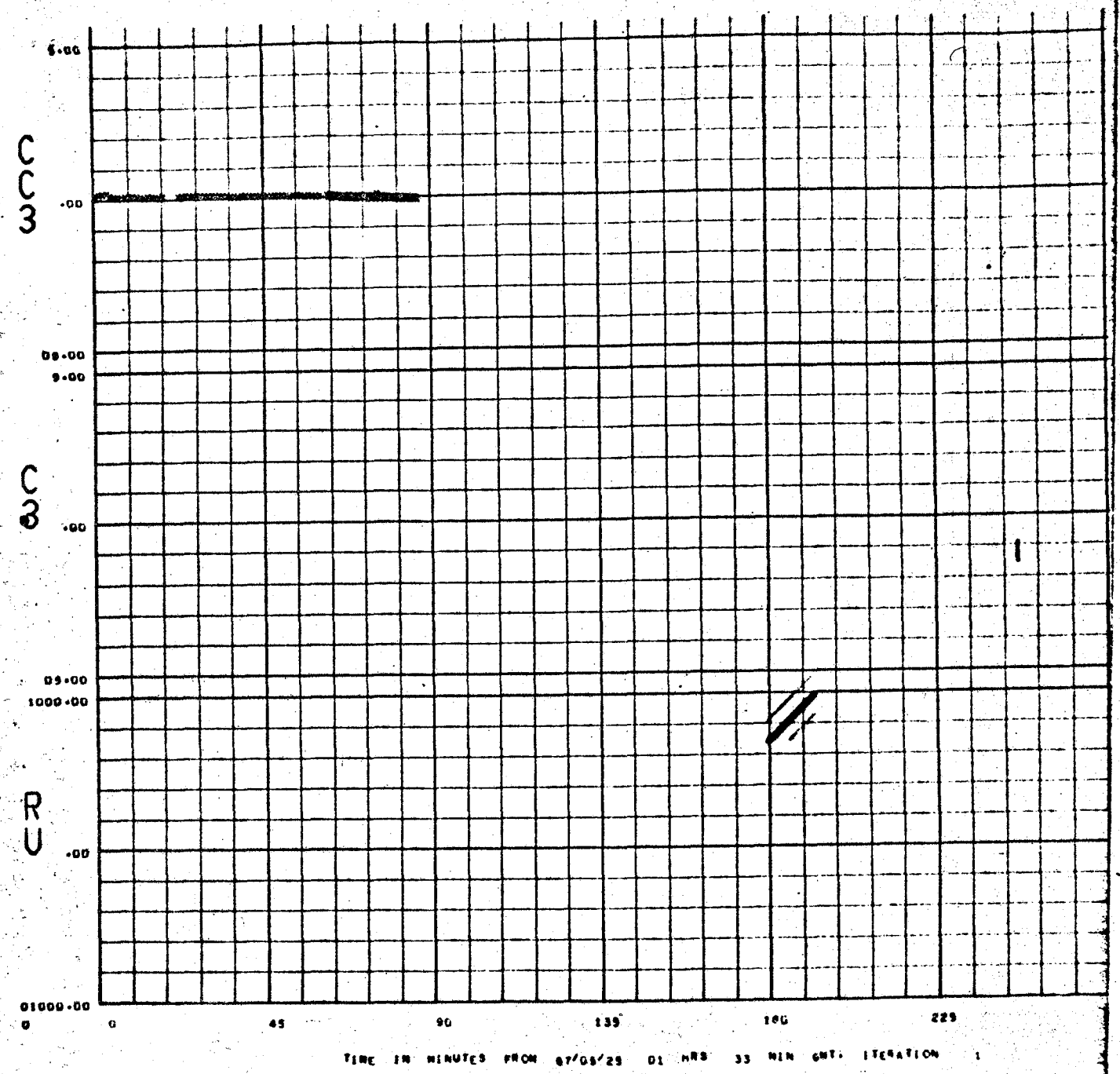
STATION 12 RESIDUALS PASS NUMBER 19/144

ODPL 40RB32

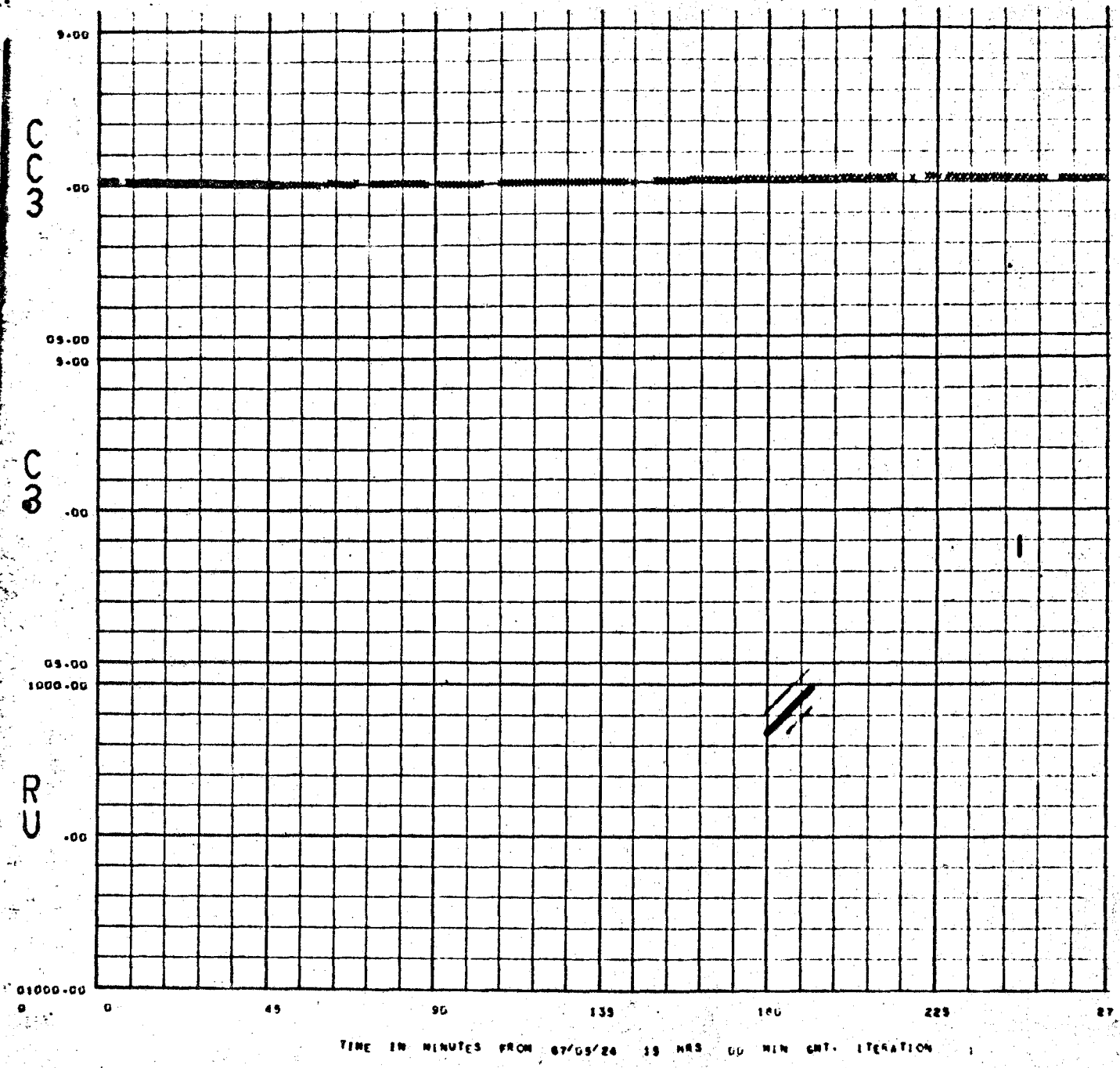
SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 20/144



STATION 62 RESIDUALS PASS NUMBER 20/144



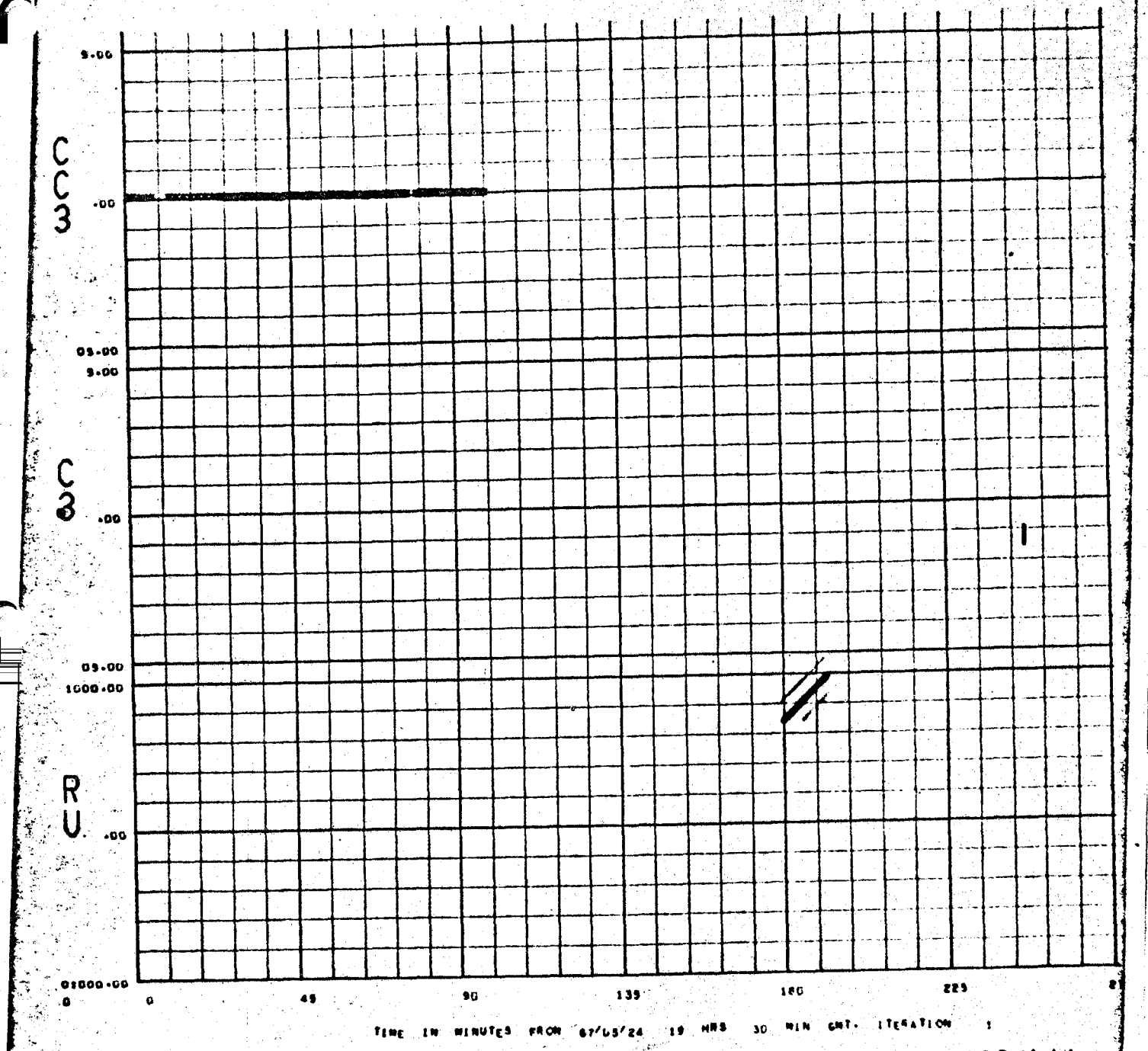
STATION 41 RESIDUALS PASS NUMBER 20/144

REV LTR

U3 4289-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 446

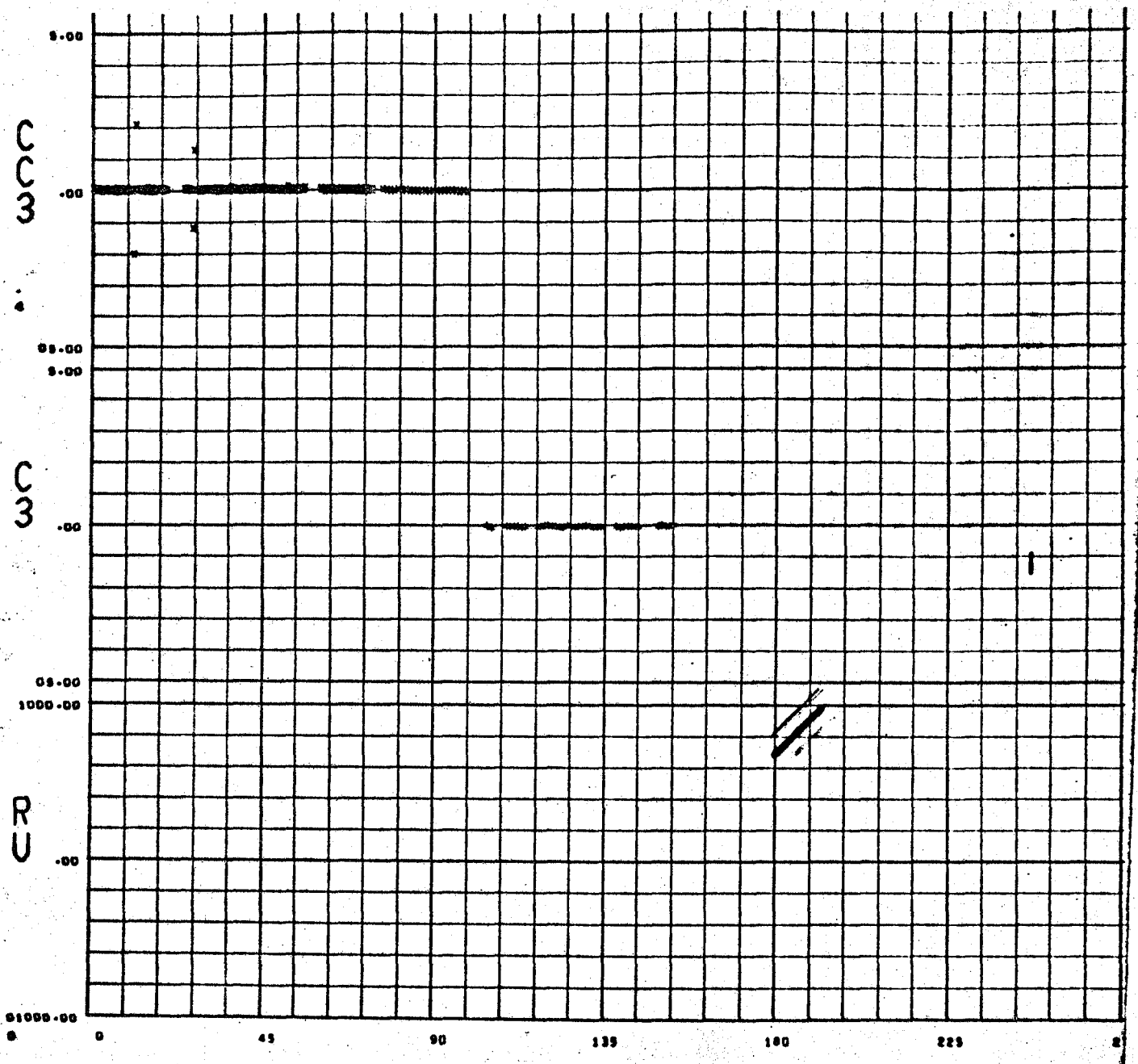


STATION 41 RESIDUALS PASS NUMBER 20/144

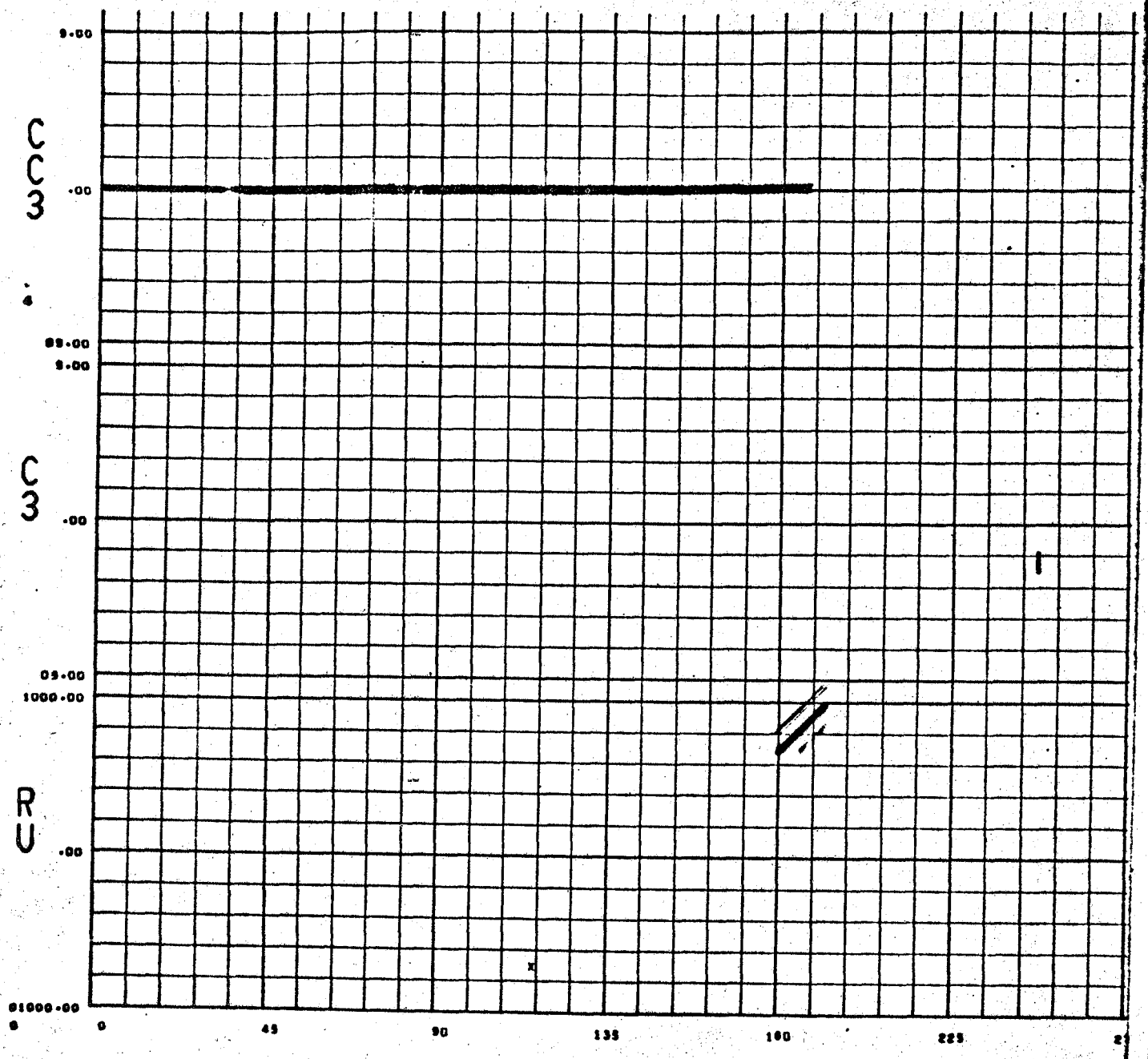
REV LTR

ODPL 40RB33

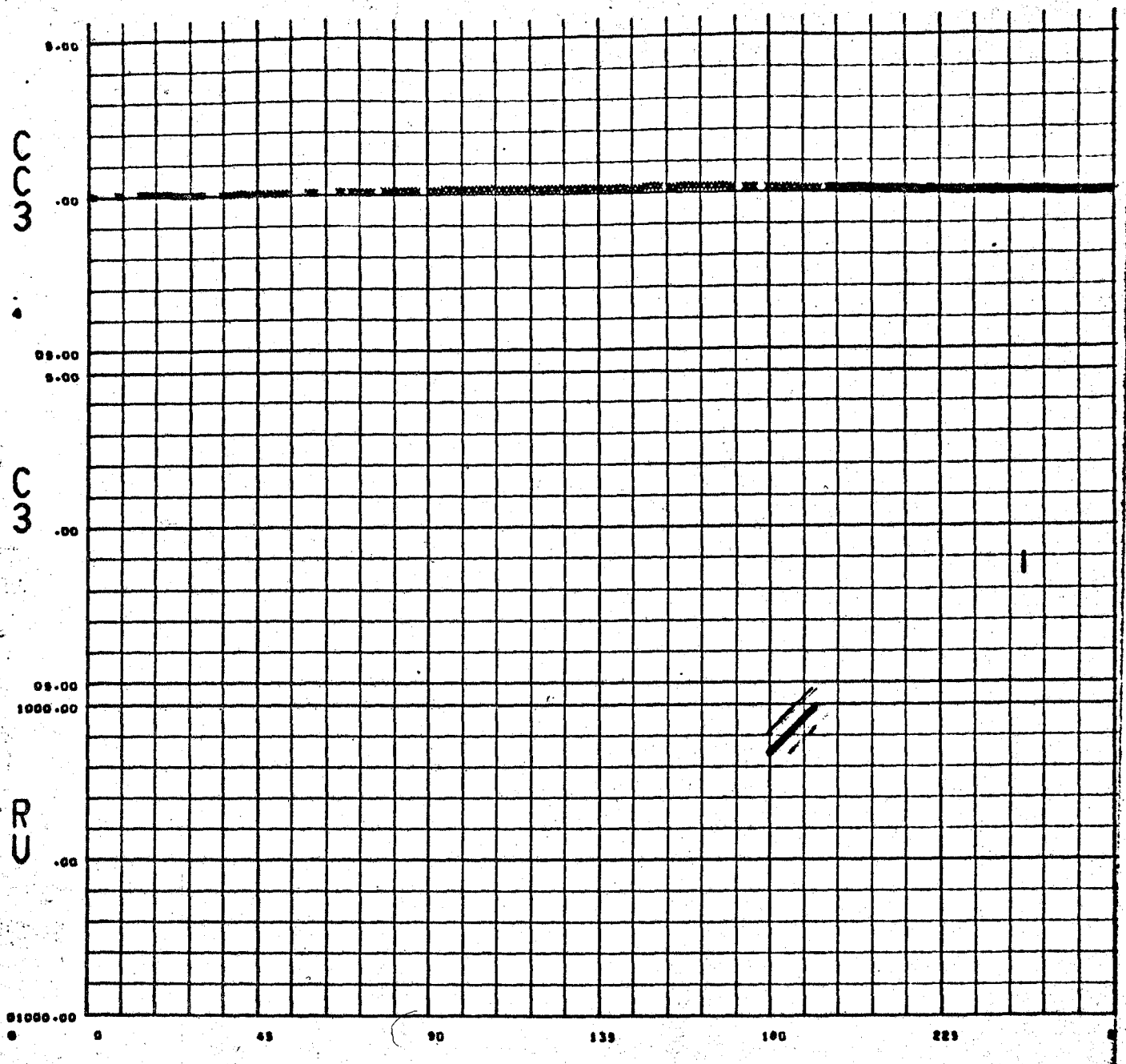
SIMPLE MOON



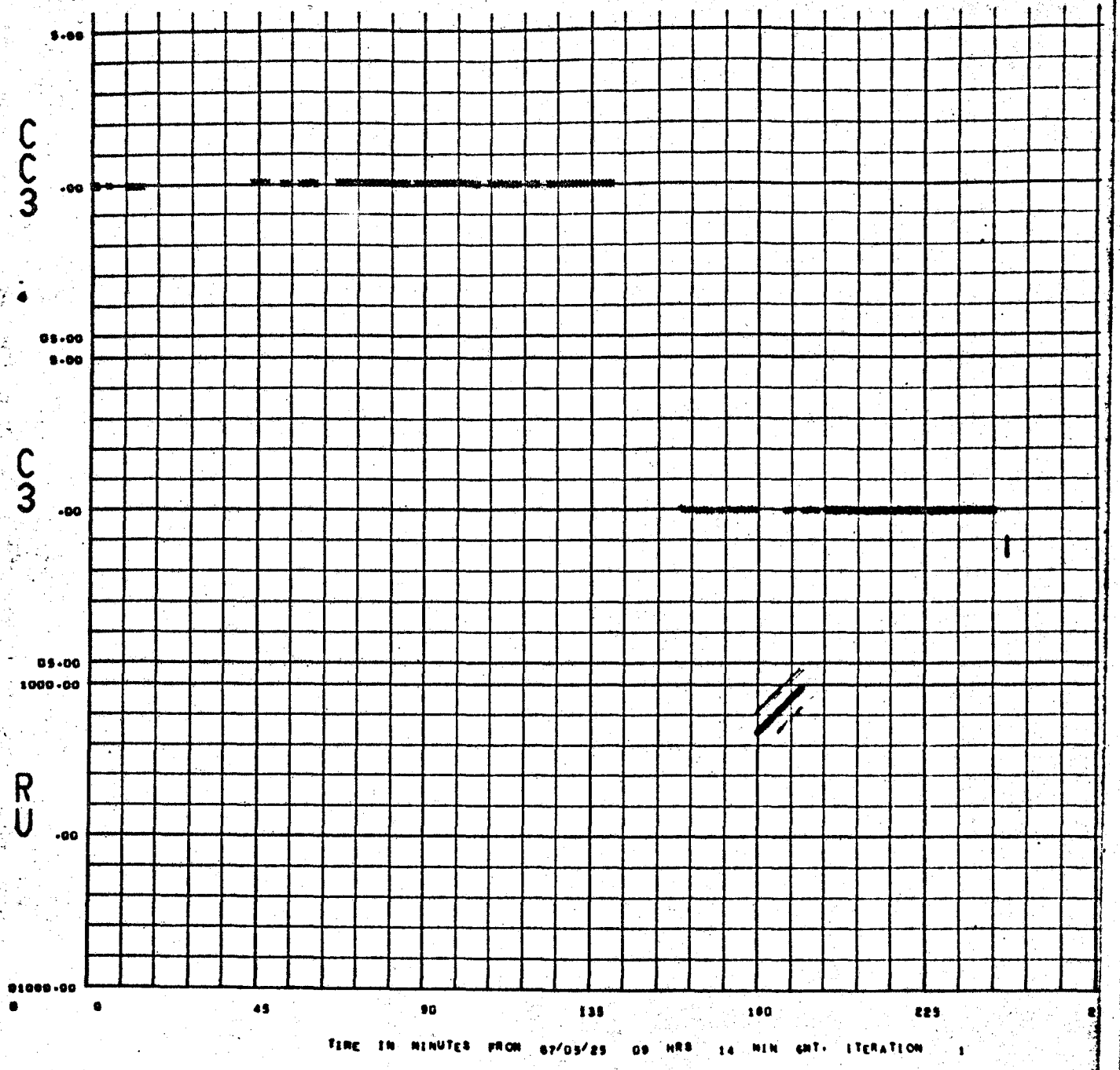
STATION 62 RESIDUALS PASS NUMBER 20/144



STATION 41 RESIDUALS PASS NUMBER 21/145



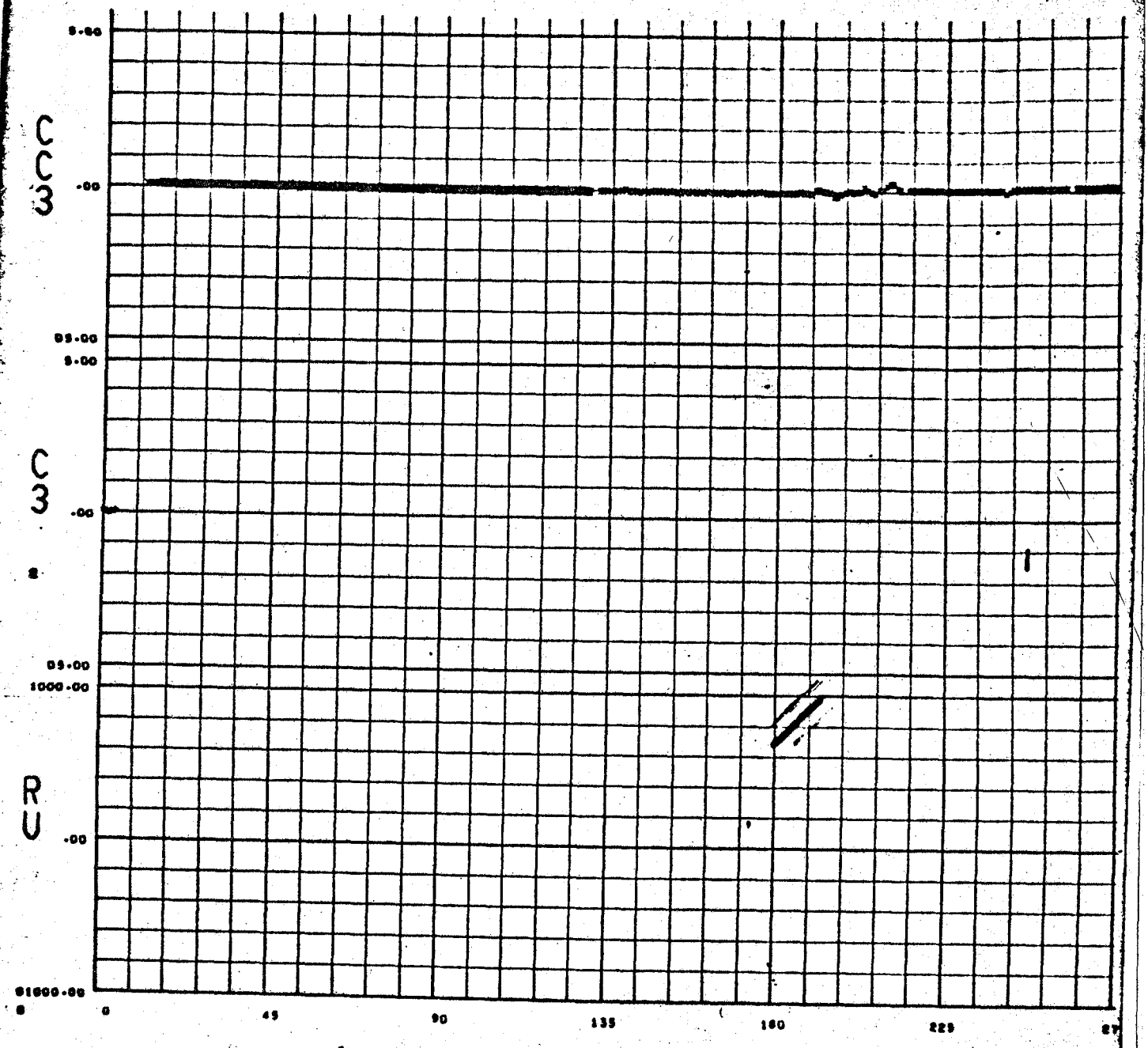
STATION 12 RESIDUALS PASS NUMBER 20/145



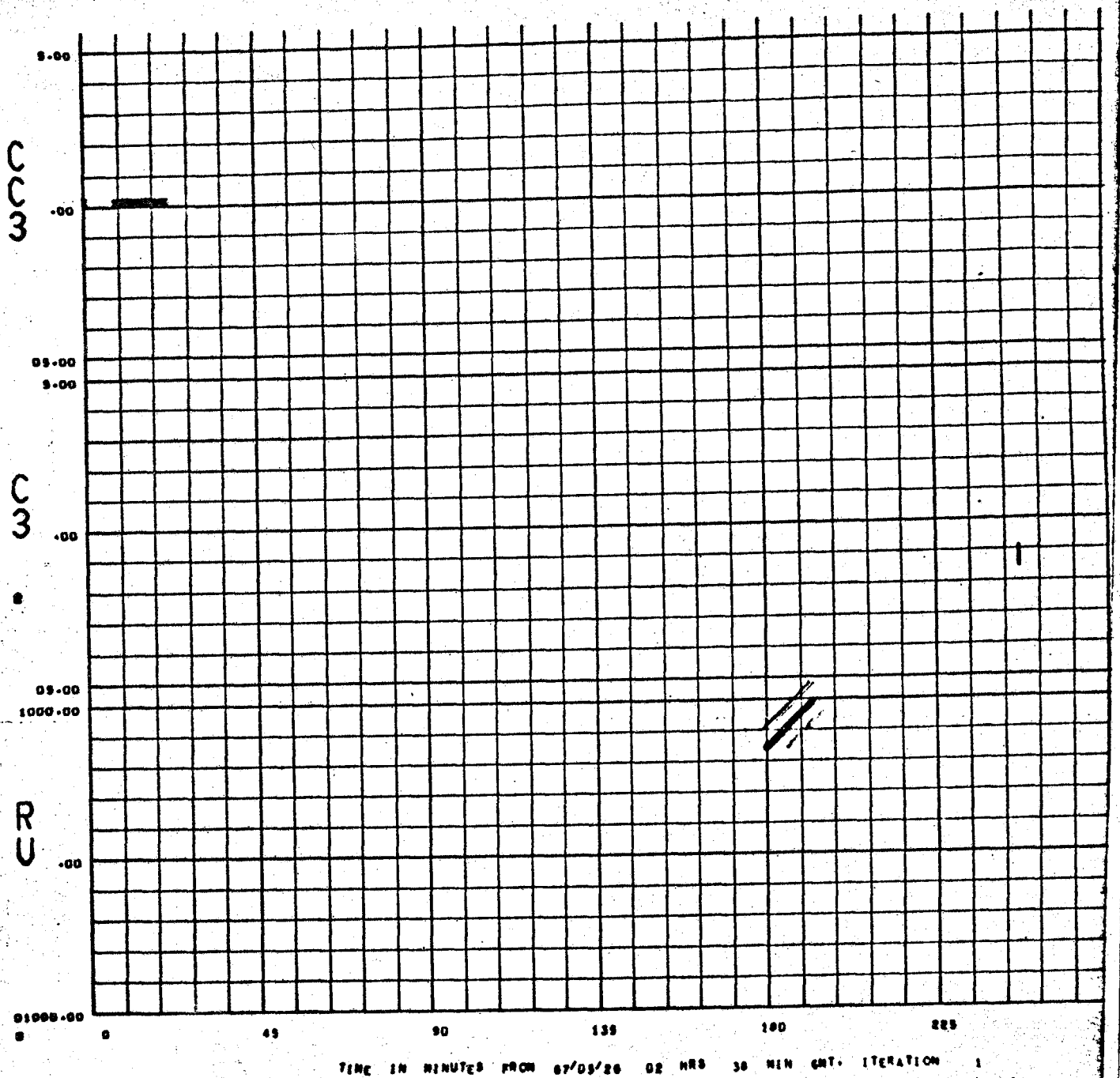
STATION 12 RESIDUALS PASS NUMBER 20/145

ODPL 40RB34

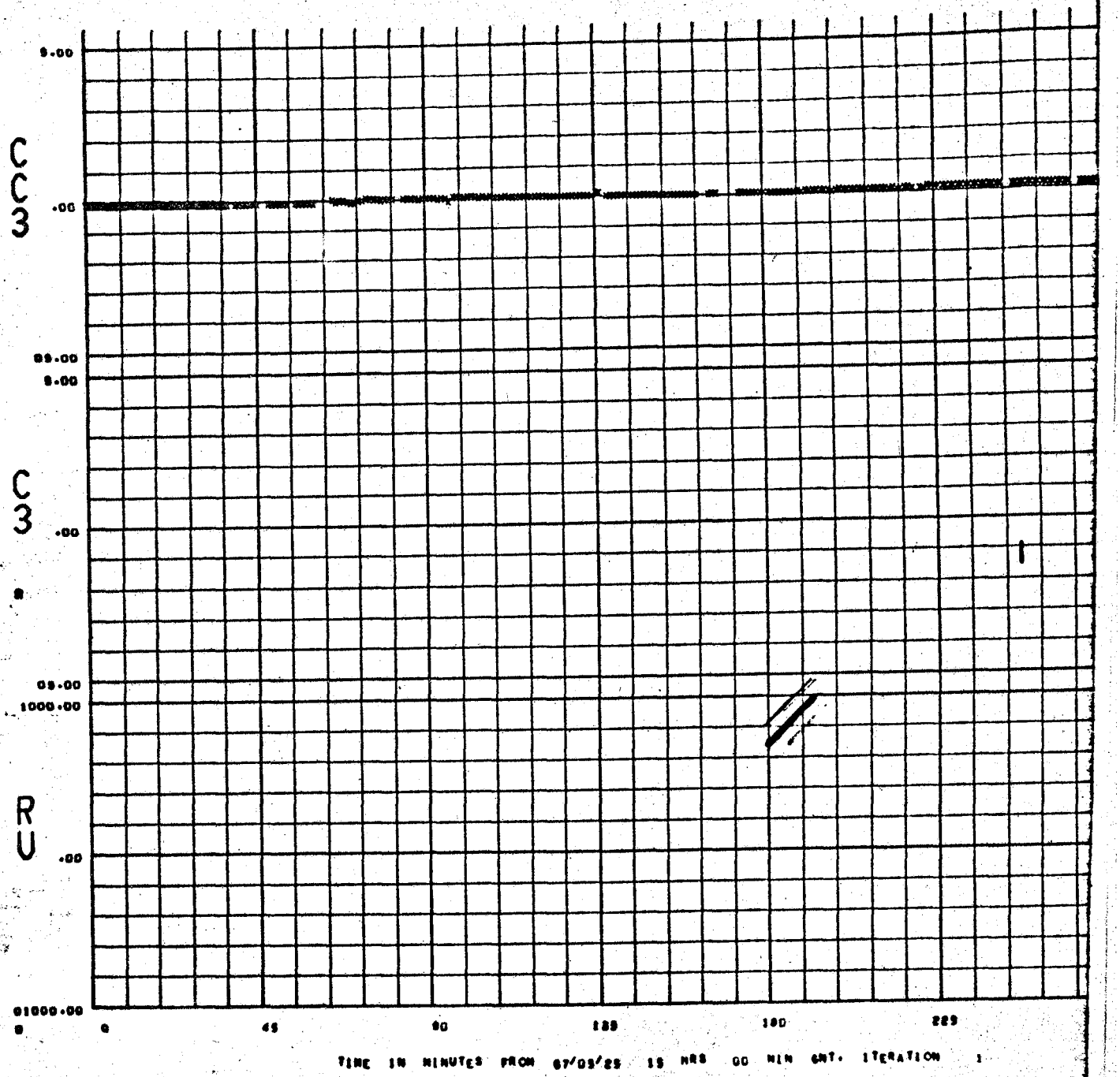
SIMPLE MOON



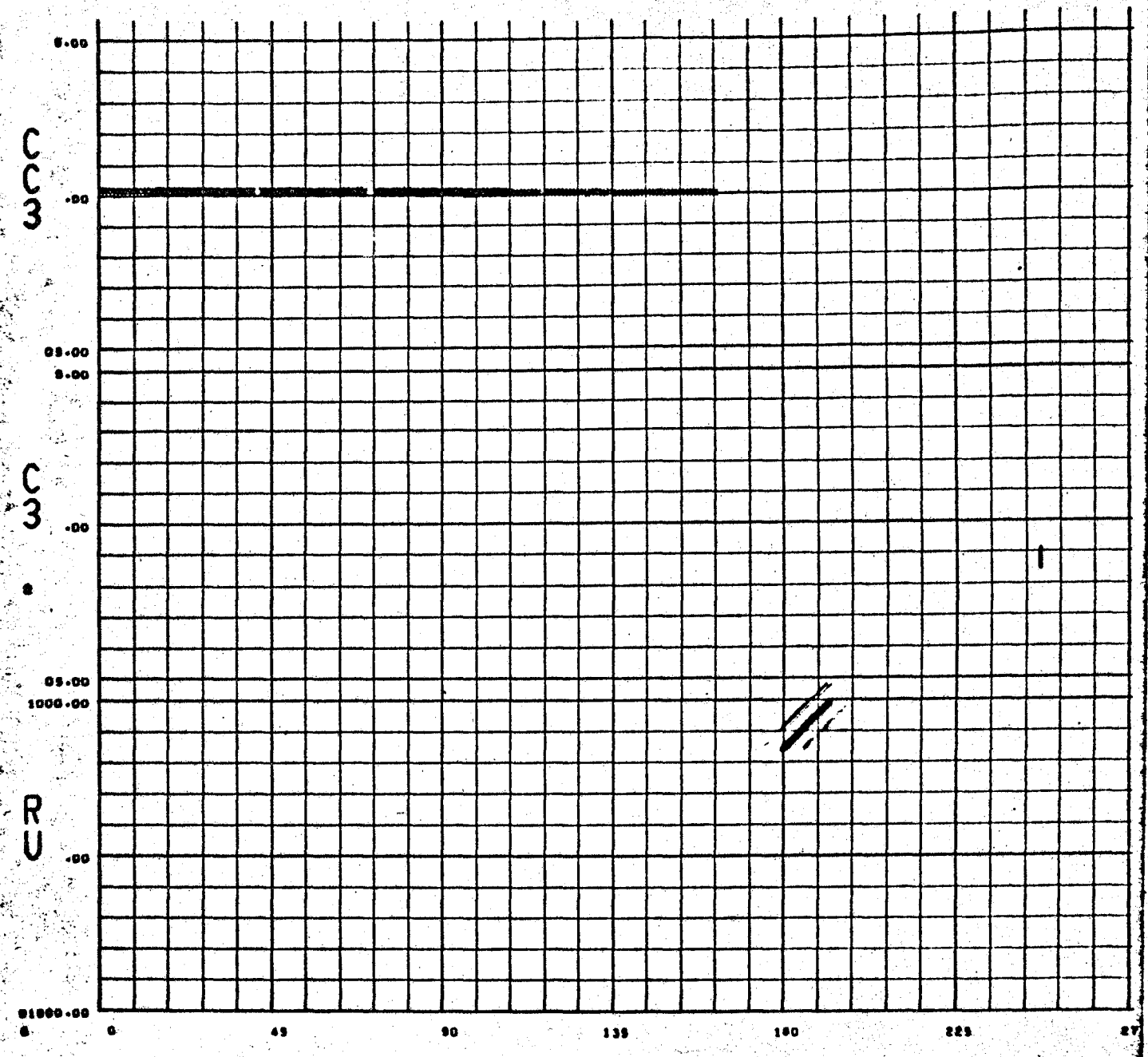
STATION 62 RESIDUALS PASS. NUMBER 21/145



STATION 62 RESIDUALS PASS NUMBER 21/145



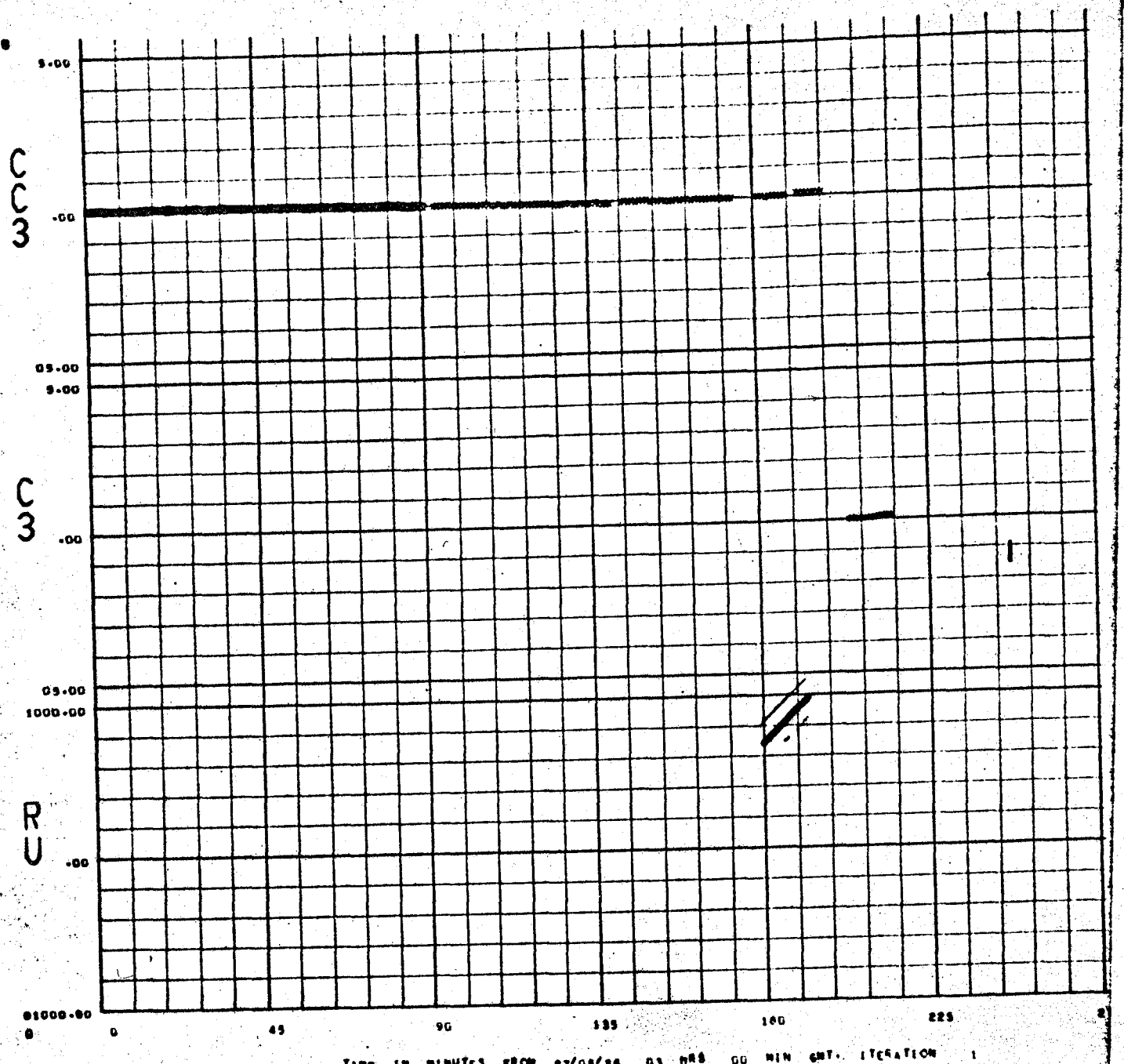
STATION 41 RESIDUALS PASS NUMBER 21/145



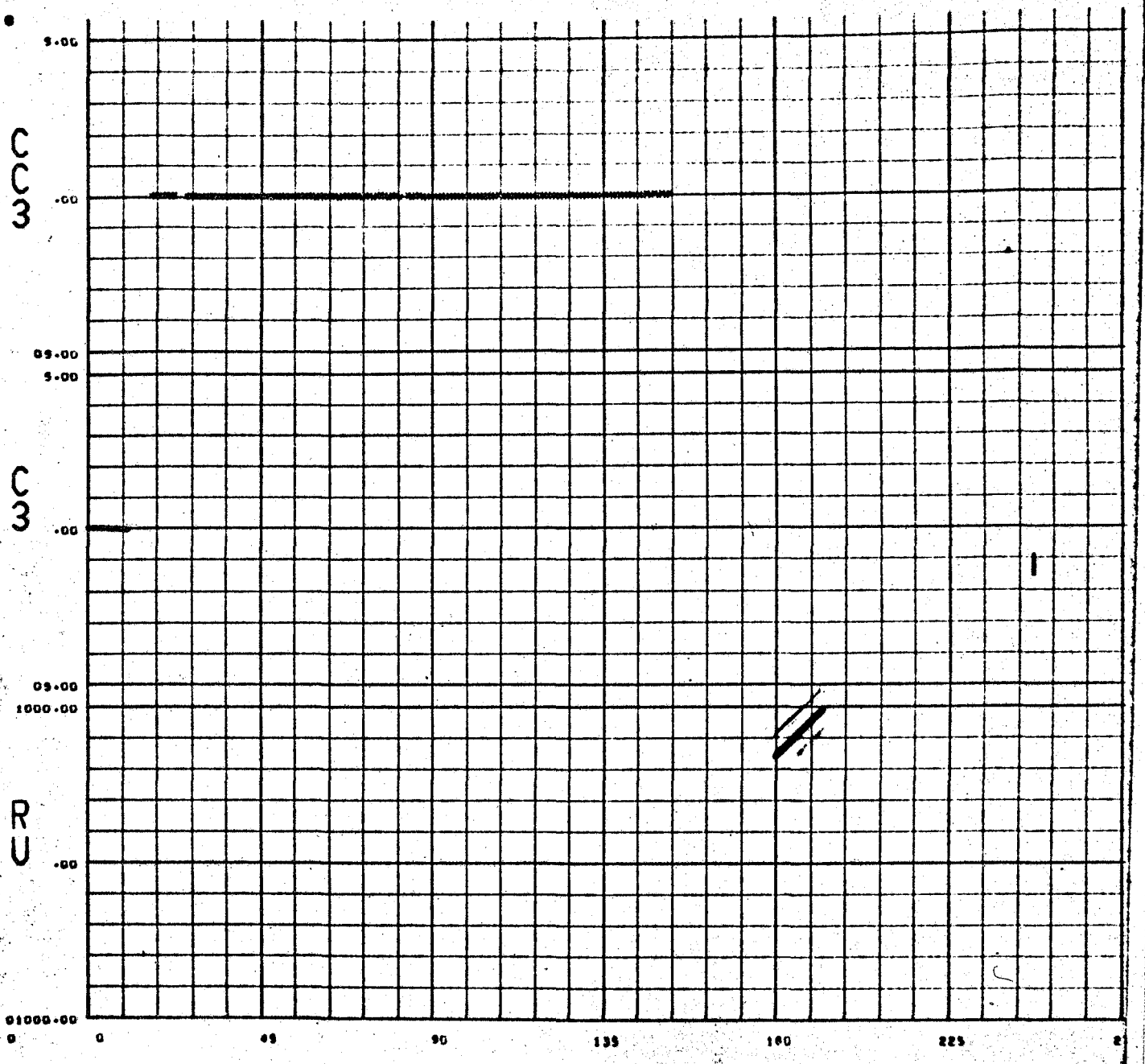
STATION 41 RESIDUALS PASS NUMBER 21/145

ODPL 40RB35

SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 21/145



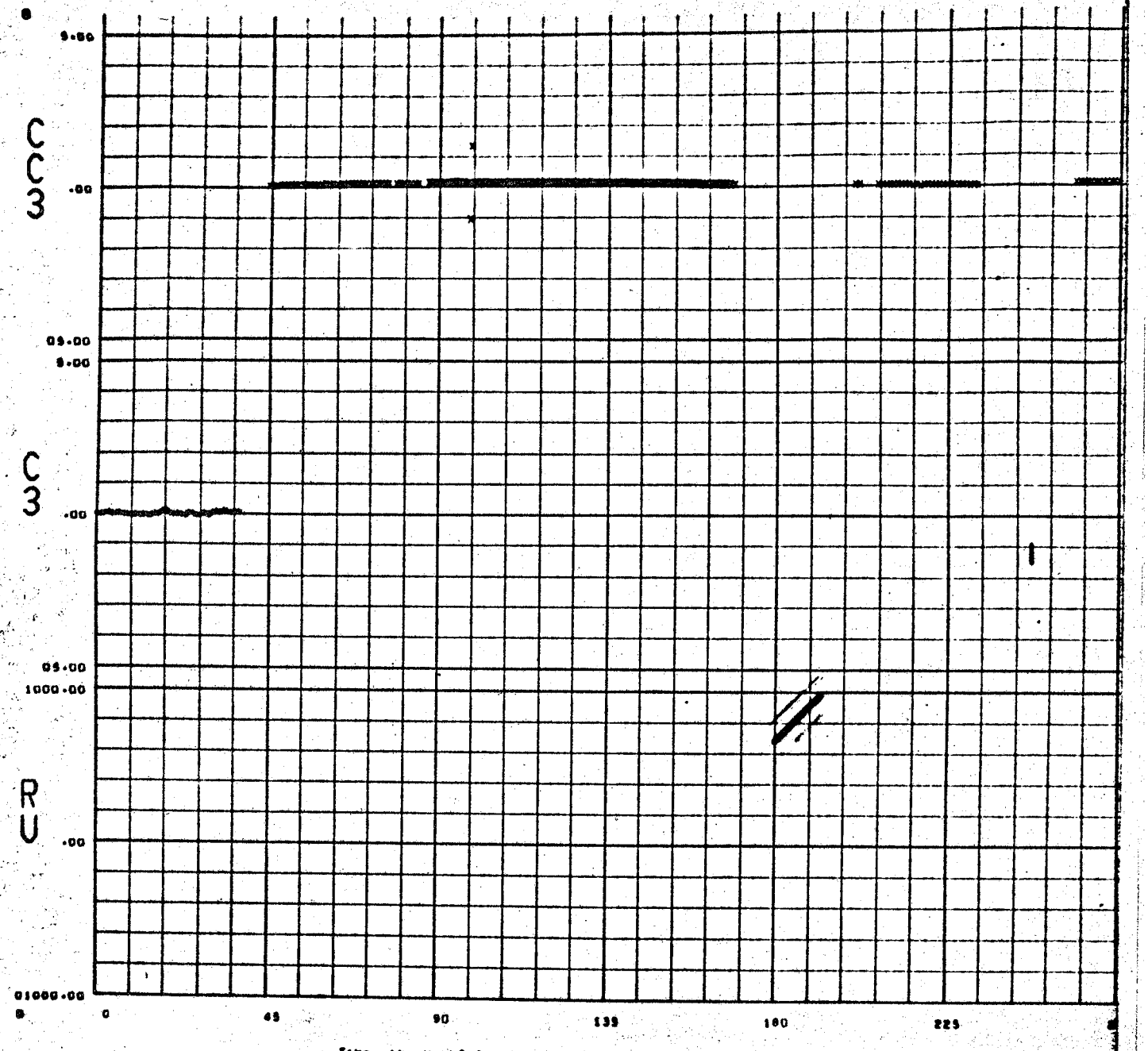
STATION 41 RESIDUALS PASS NUMBER 22/146

REV LTR

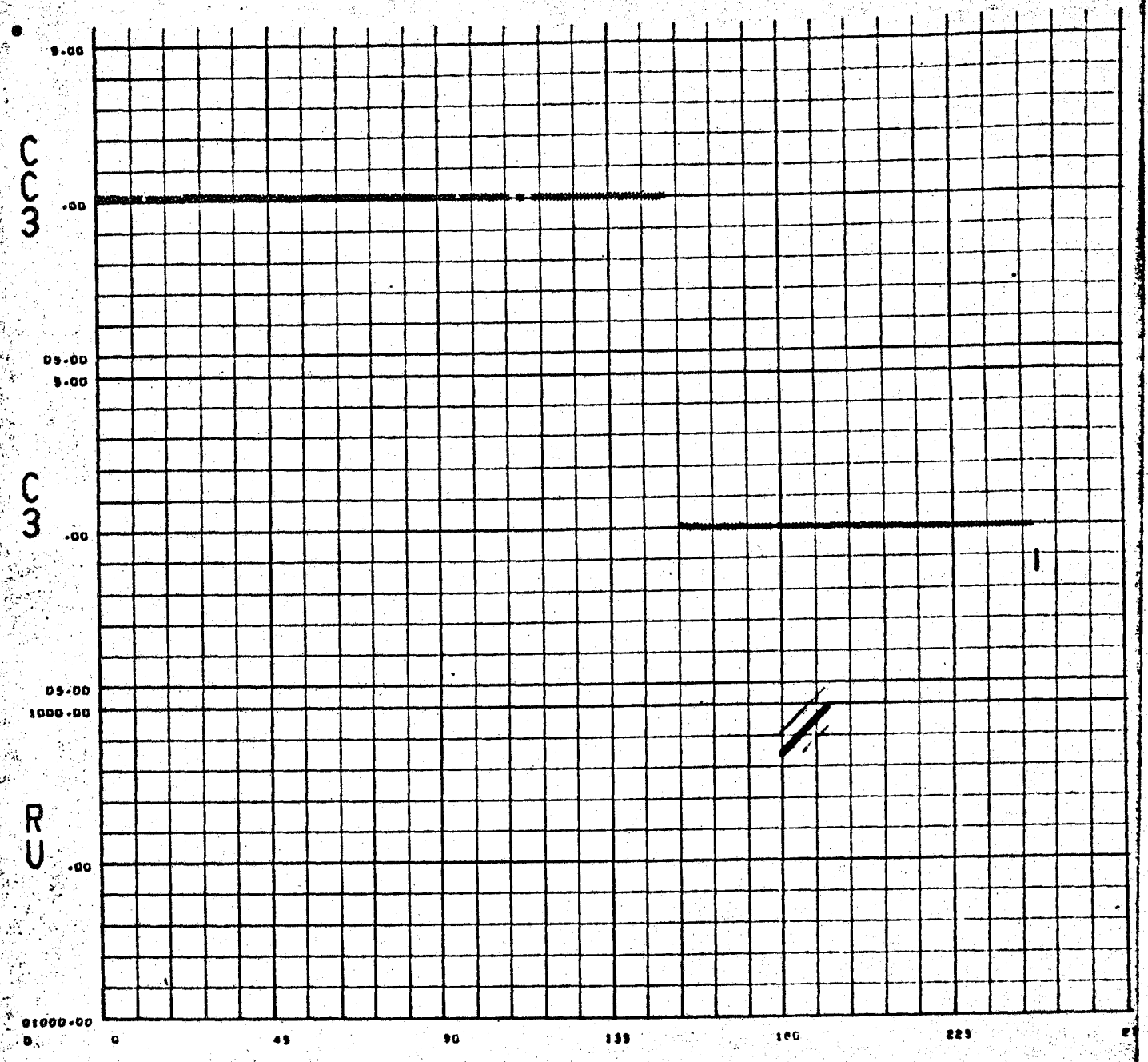
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH.



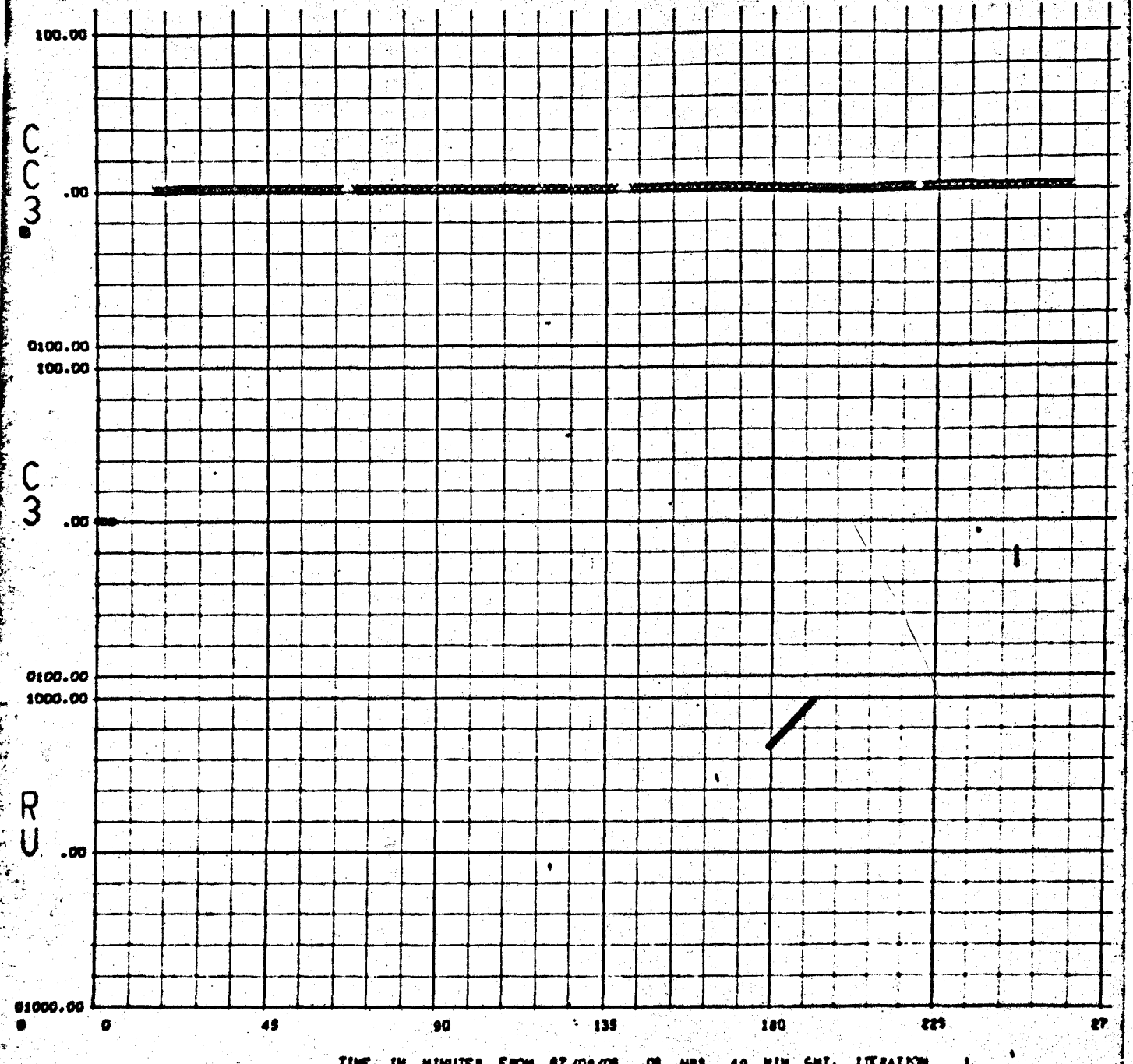
STATION 12 RESIDUALS PASS NUMBER 21/146



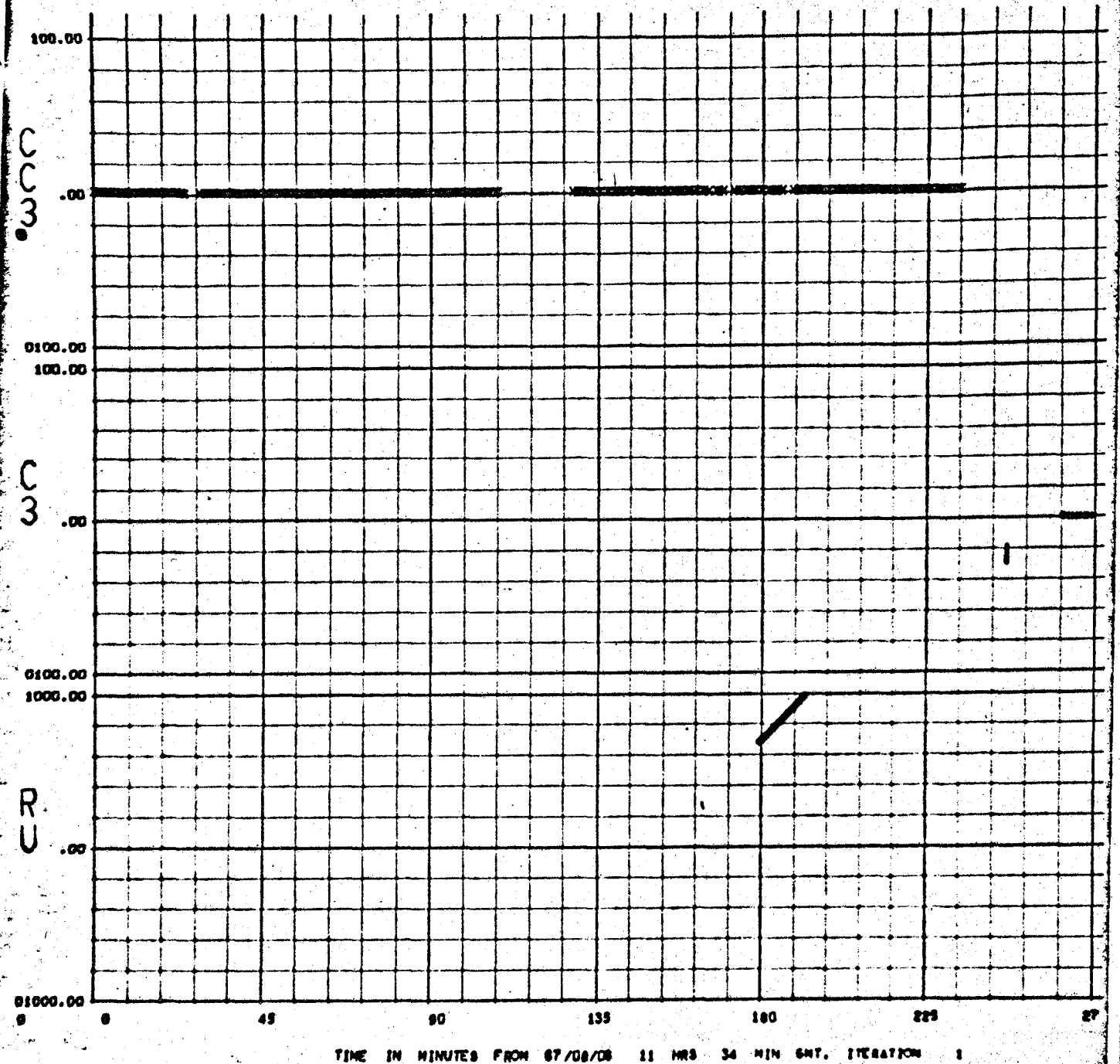
STATION 12 RESIDUALS PASS NUMBER 21/146

ODPL 5A1

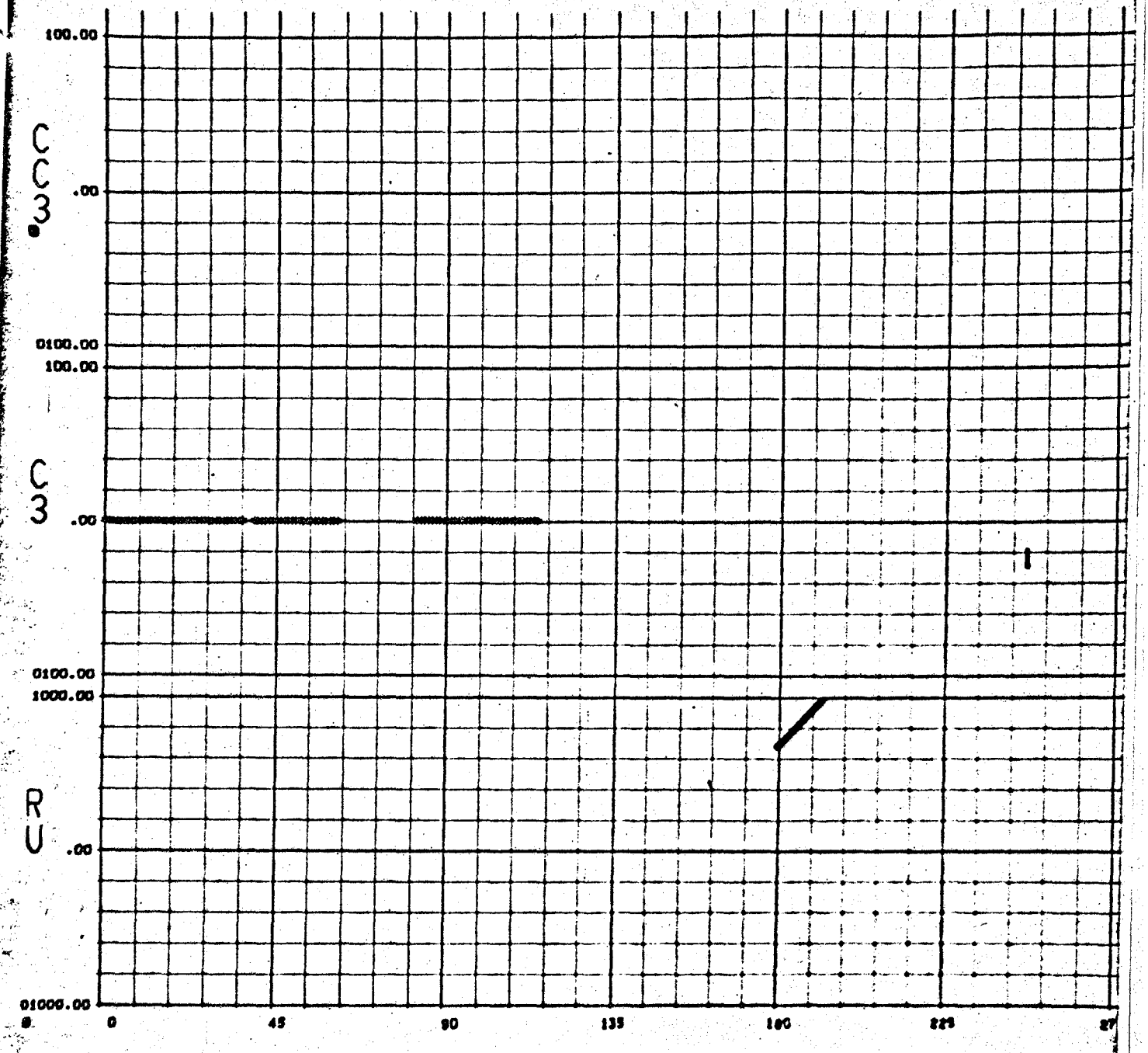
SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 05/218


100.00
CC3 .00
0100.00
100.00
C3 .00
0100.00
1000.00
RU .00
01000.00
0
0
45
90
135
180
225
27
TIME IN MINUTES FROM 67/08/08 11 HRS 34 MIN GMT. ITERATION 1
STATION 62 RESIDUALS
PASS NUMBER 05/218

REV LTR



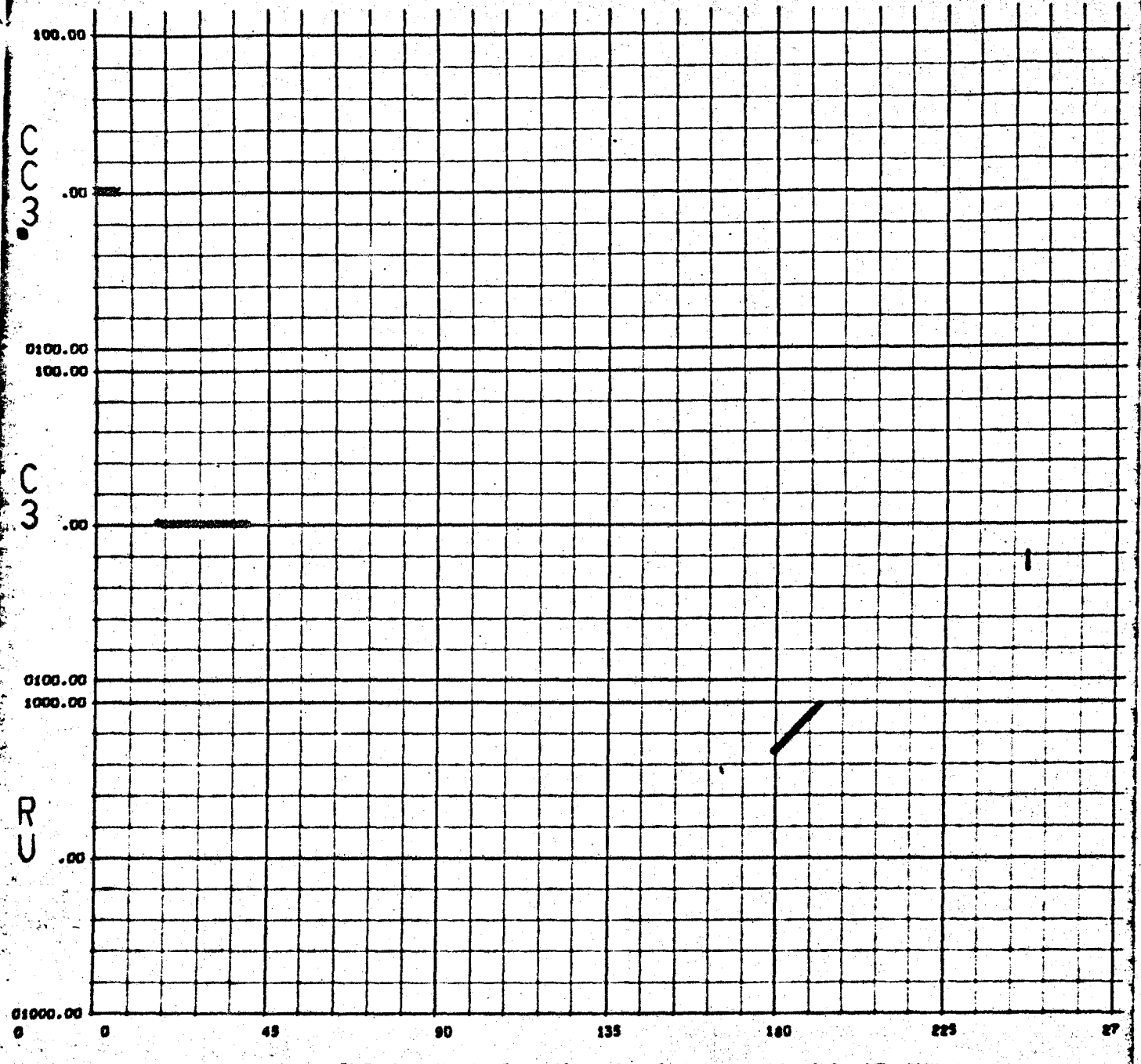
STATION 62 RESIDUALS PASS NUMBER 05/218

REV LTR

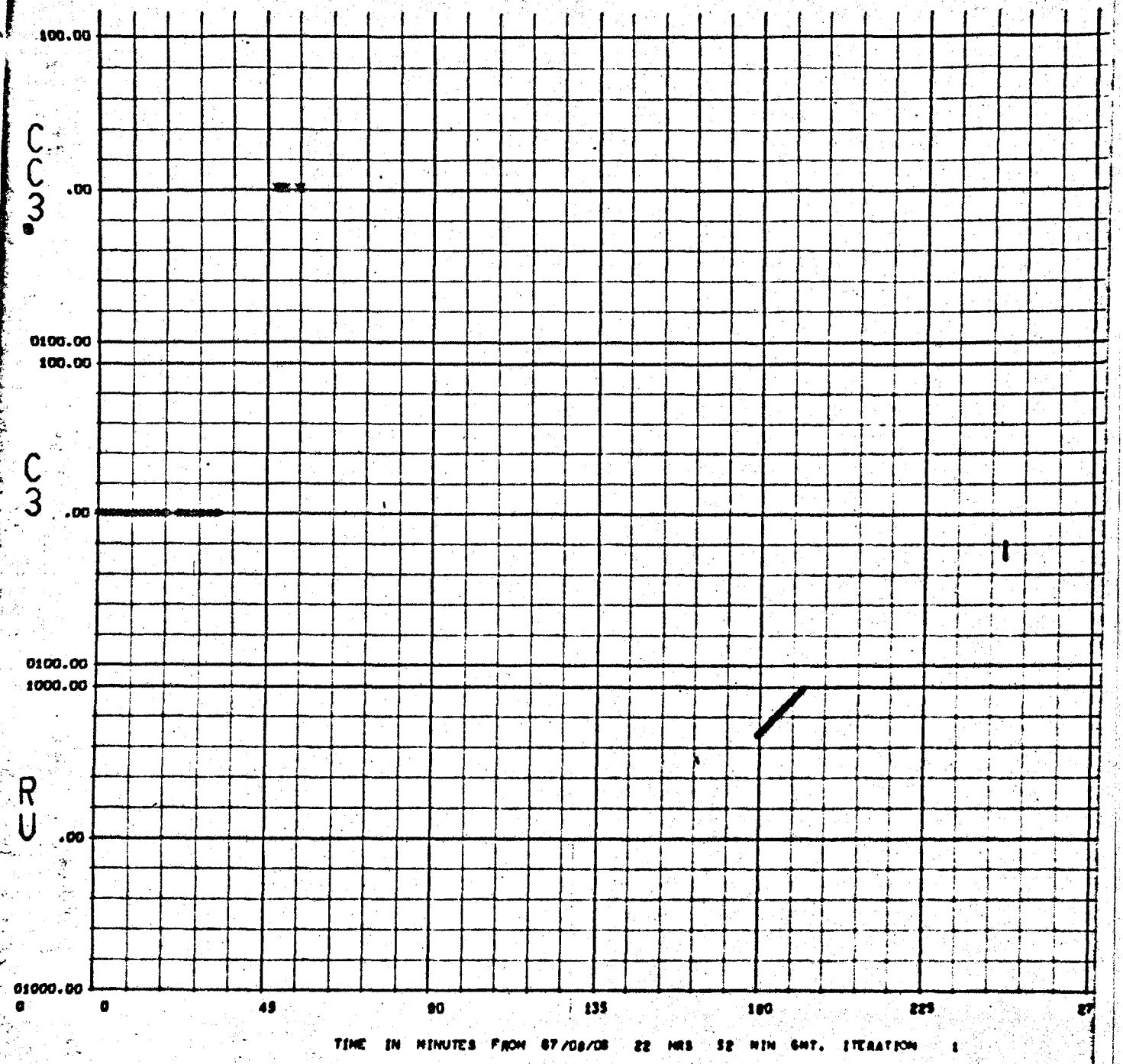
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

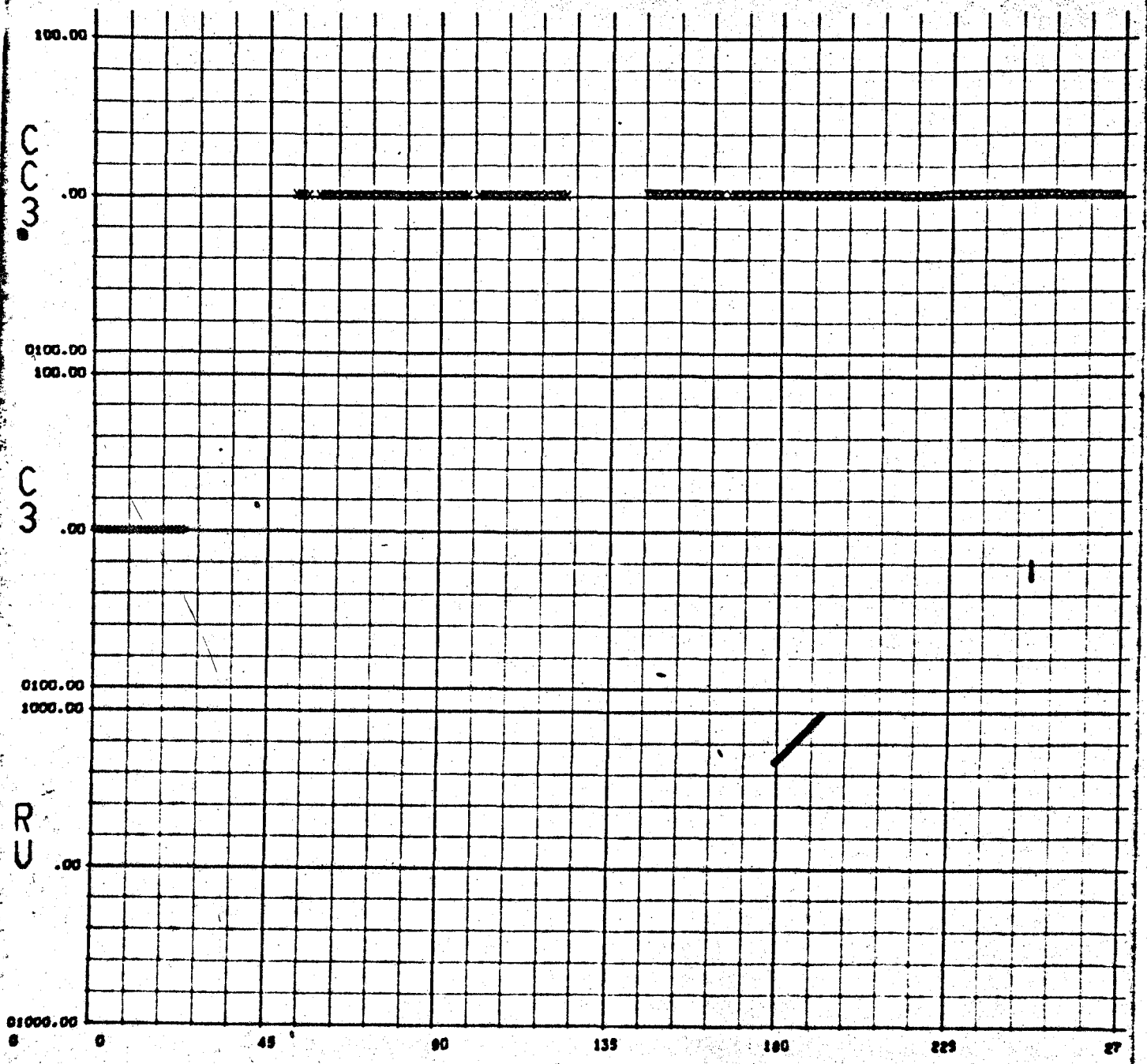
SH. 165



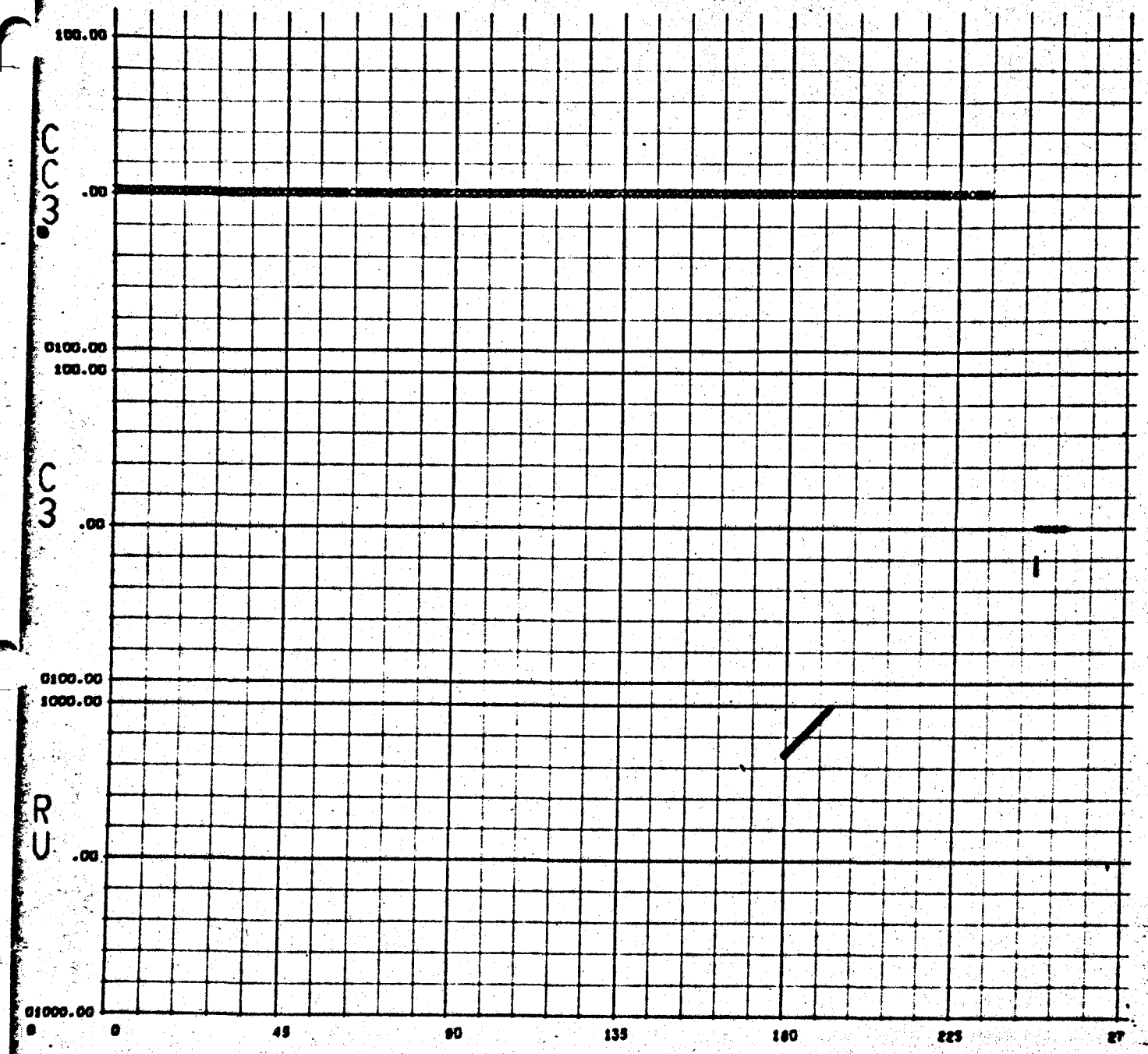
STATION 41 RESIDUALS PASS NUMBER 05/217



STATION 41 RESIDUALS PASS NUMBER 06/218



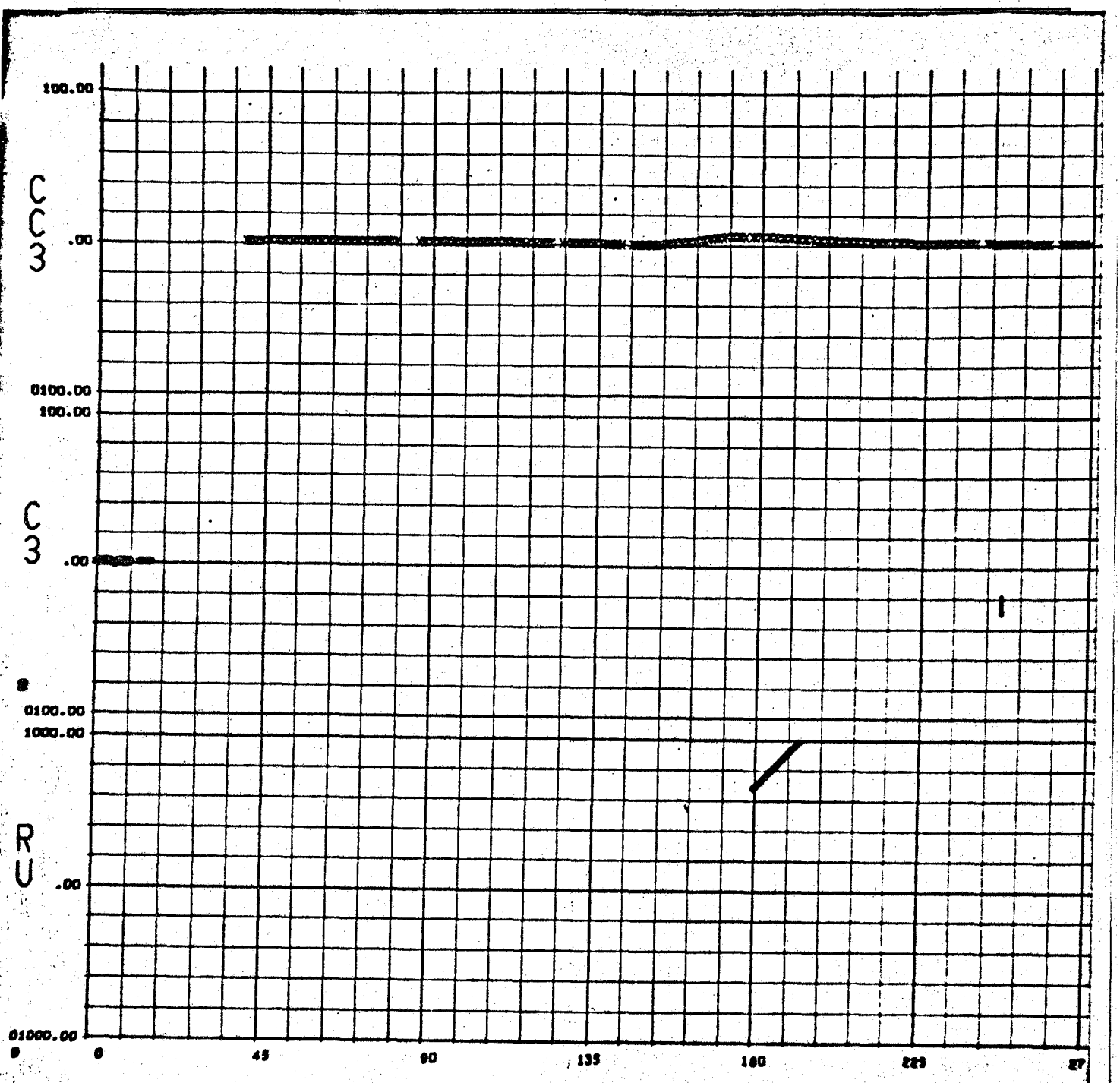
STATION 12 RESIDUALS PASS NUMBER 05/218



STATION 12 RESIDUALS PASS NUMBER 05/218

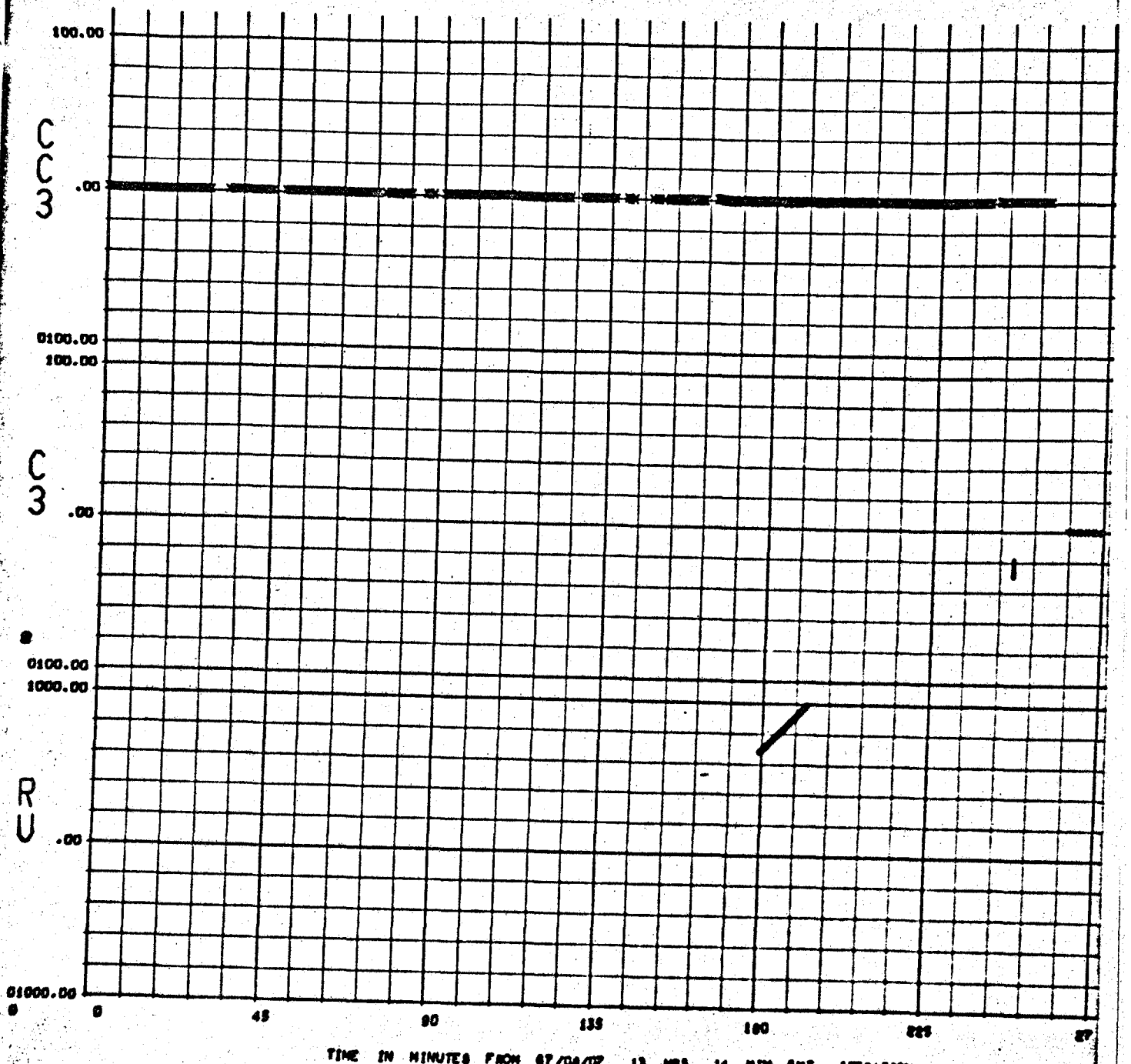
ODPL 5A6

SIMPLE MOON

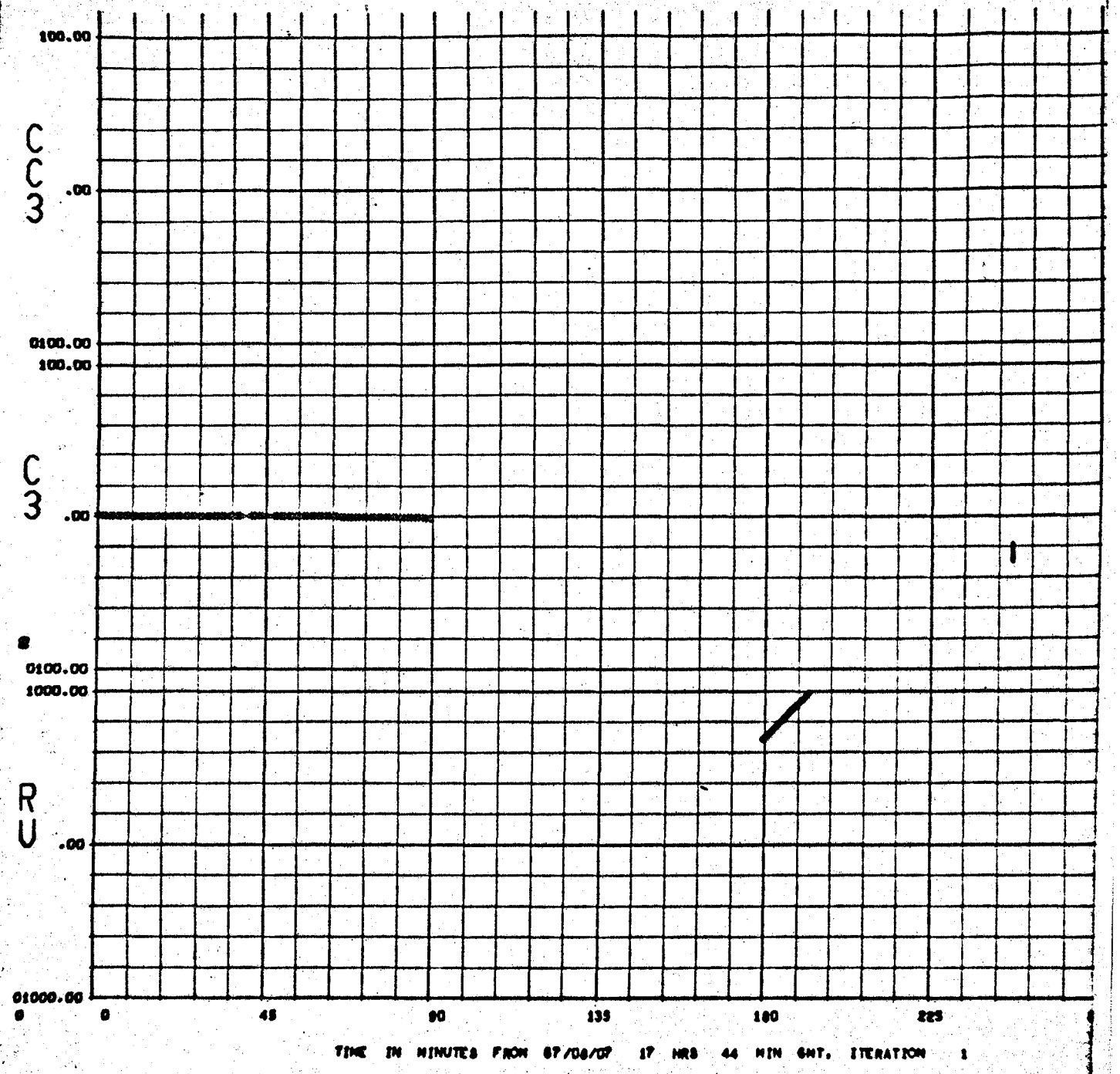


STATION 62 RESIDUALS PASS NUMBER 06/219

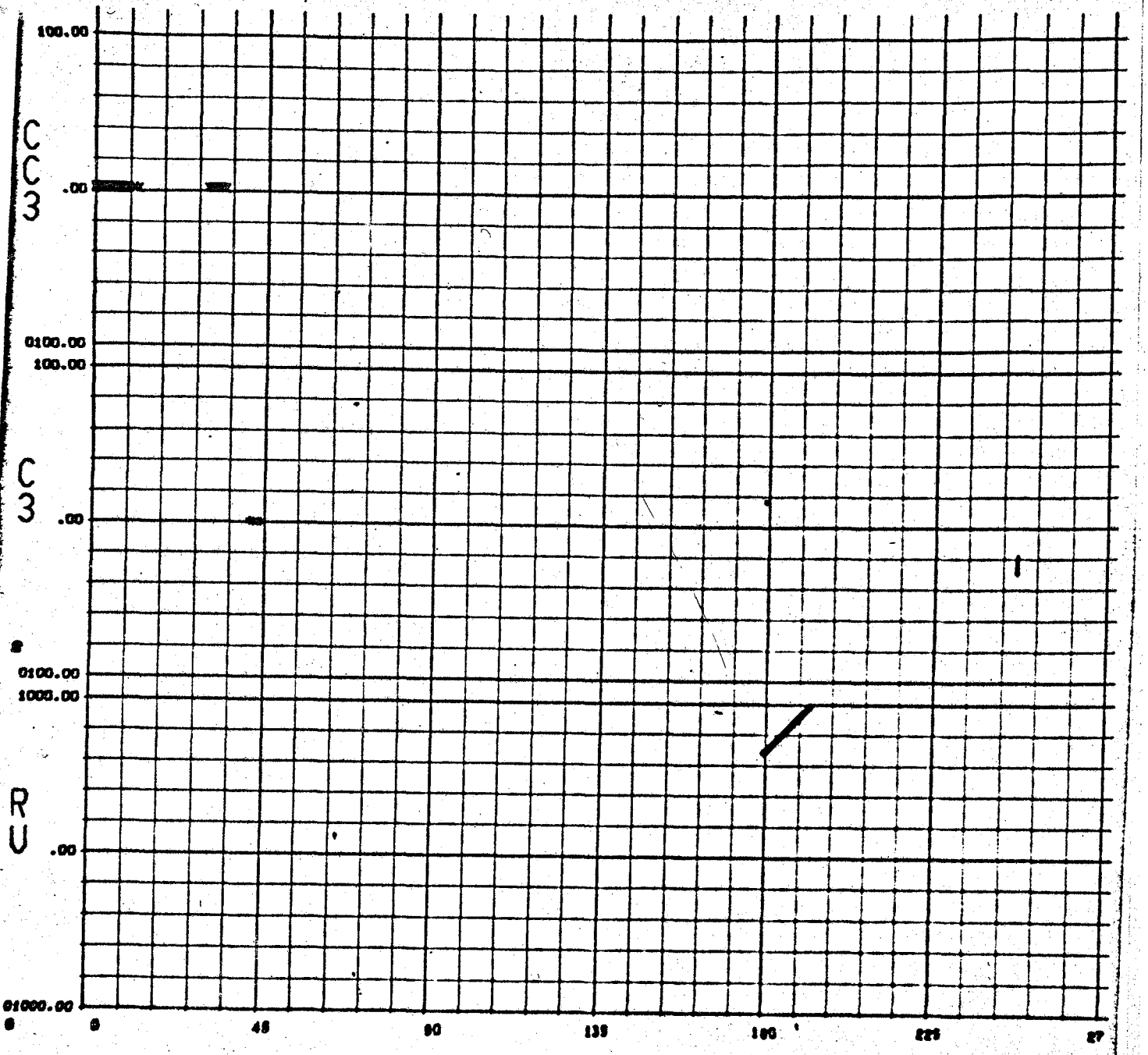
REV LTR



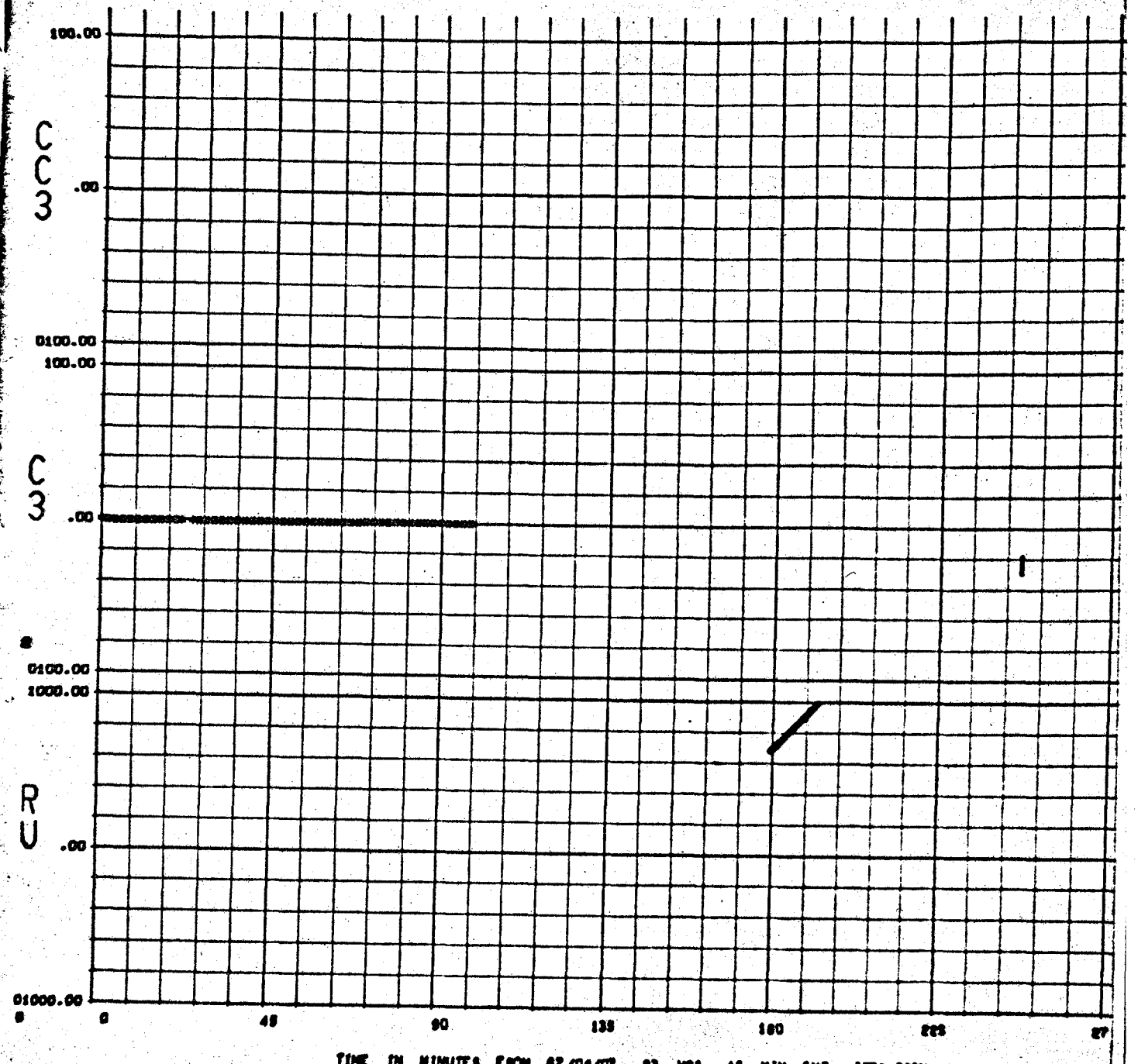
STATION 62 RESIDUALS PASS NUMBER 06/219



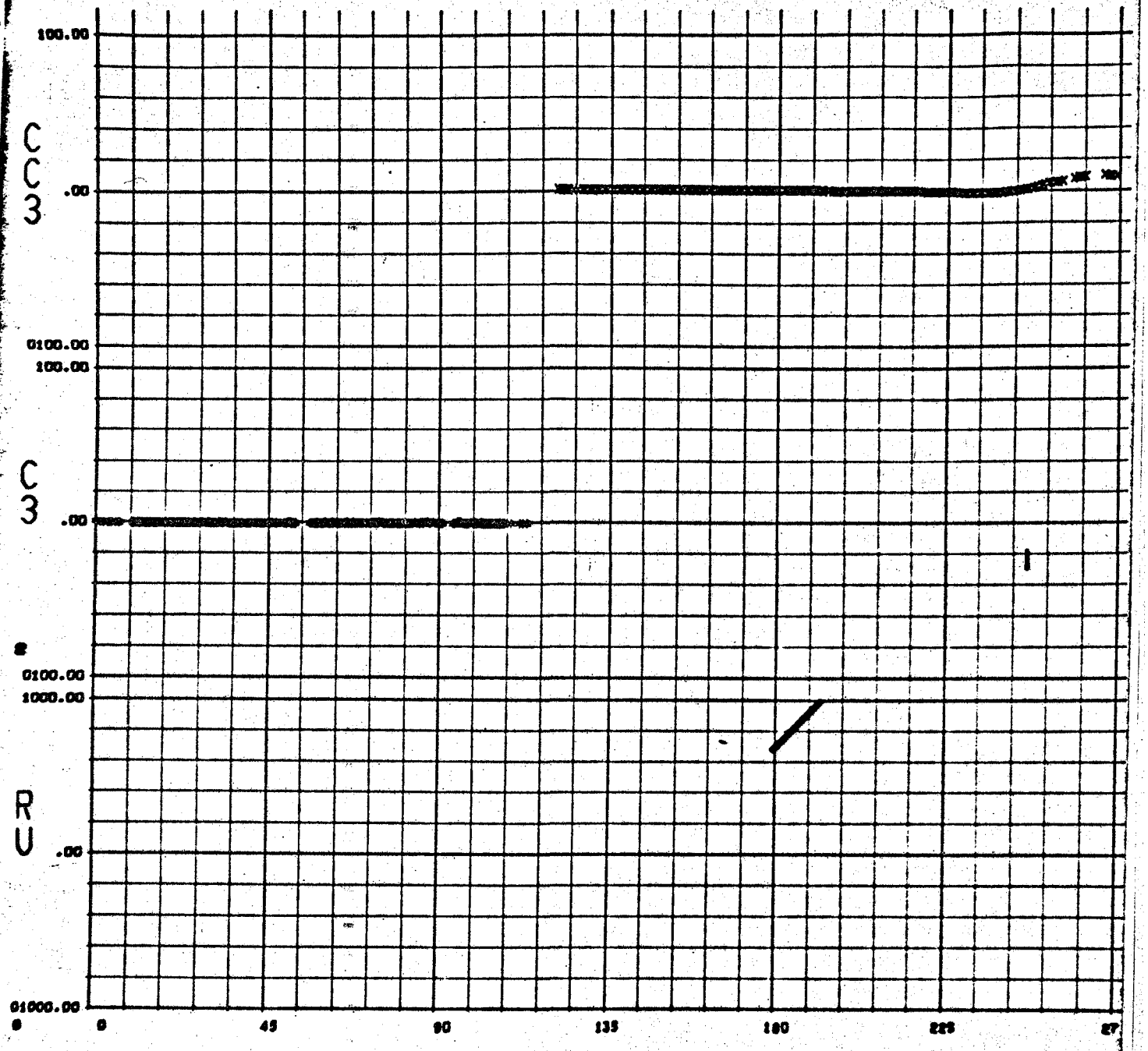
STATION 62 RESIDUALS PASS NUMBER 06/219



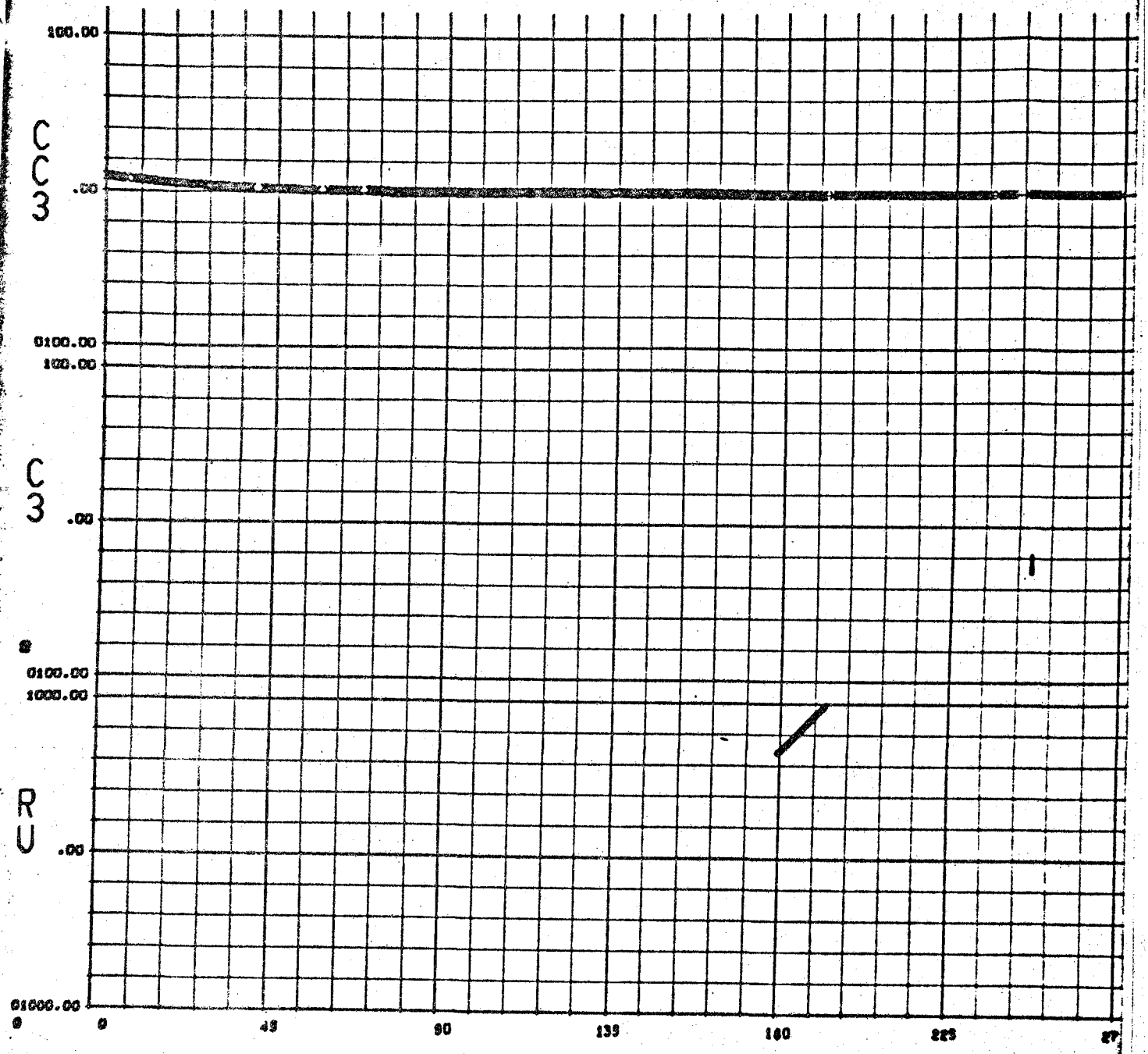
STATION 41 RESIDUALS PASS NUMBER 06/218



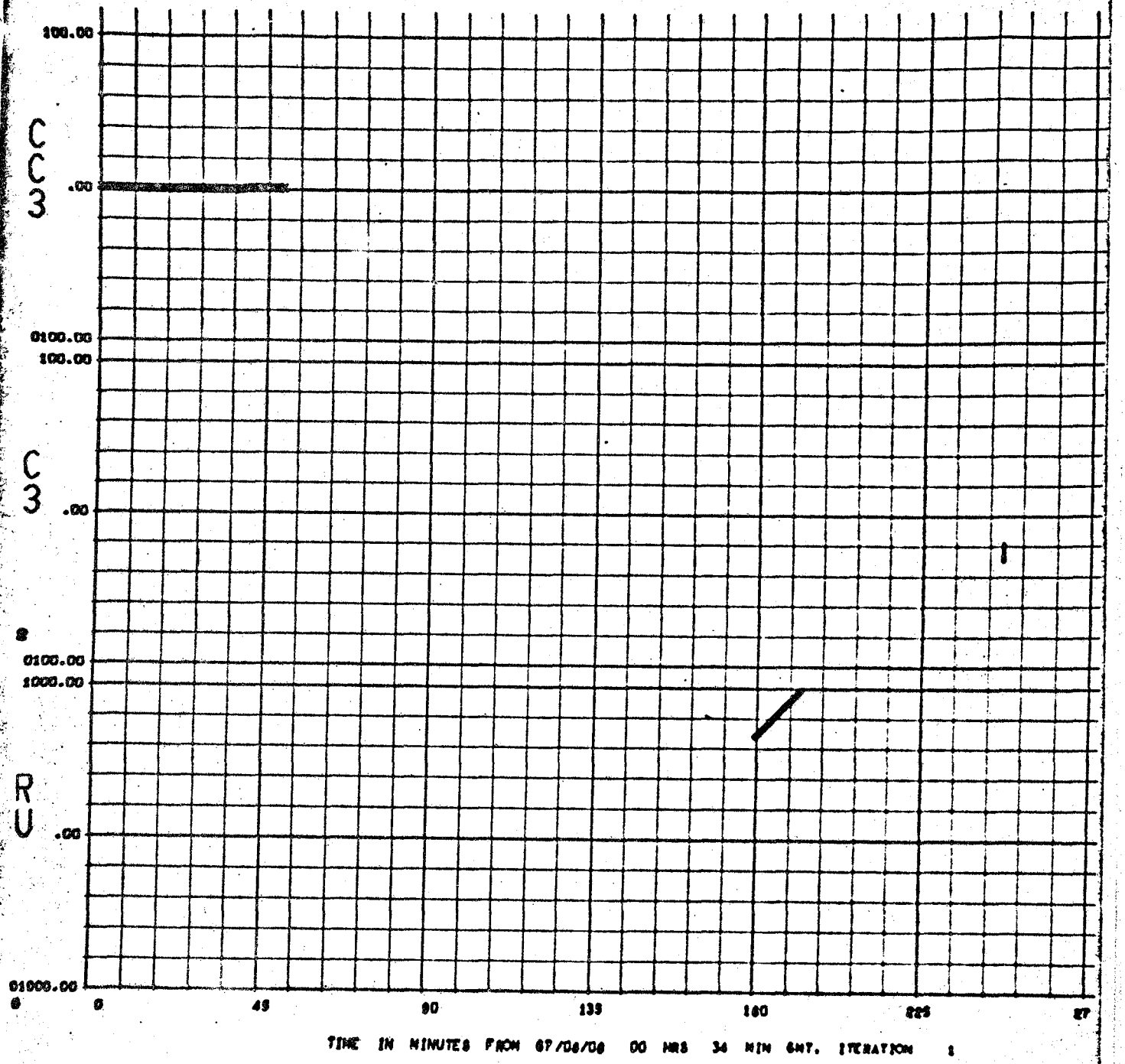
STATION 41 RESIDUALS PASS NUMBER 07/219



STATION 12 RESIDUALS PASS NUMBER 06/219



STATION 12 RESIDUALS PASS NUMBER 06/219



TIME IN MINUTES FROM 67/08/08 00 HRS 34 MIN GMT. ITERATION 1

STATION 12 RESIDUALS PASS NUMBER 06/219

ODPL 5A8

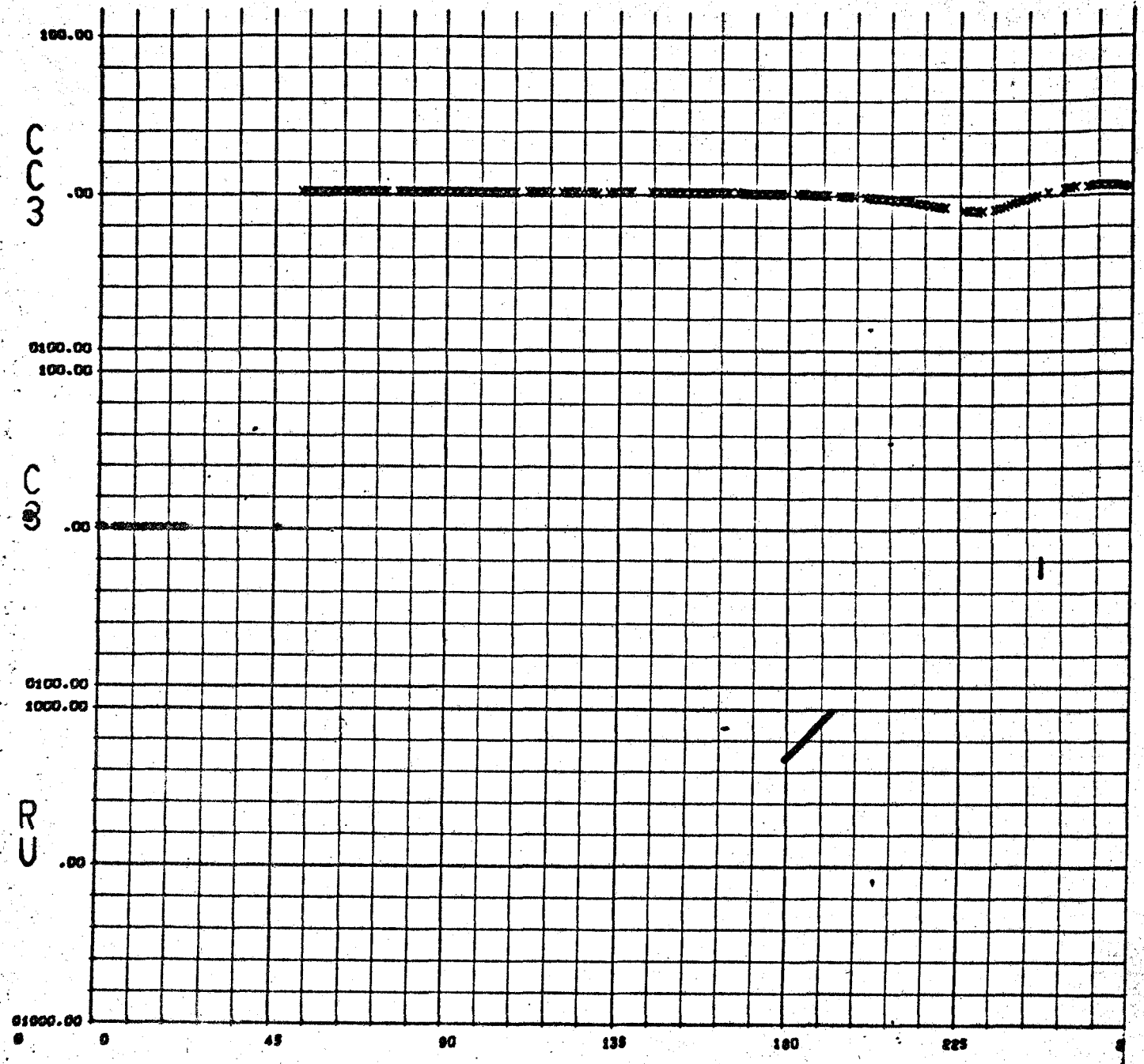
SIMPLE MOON

REV LTR

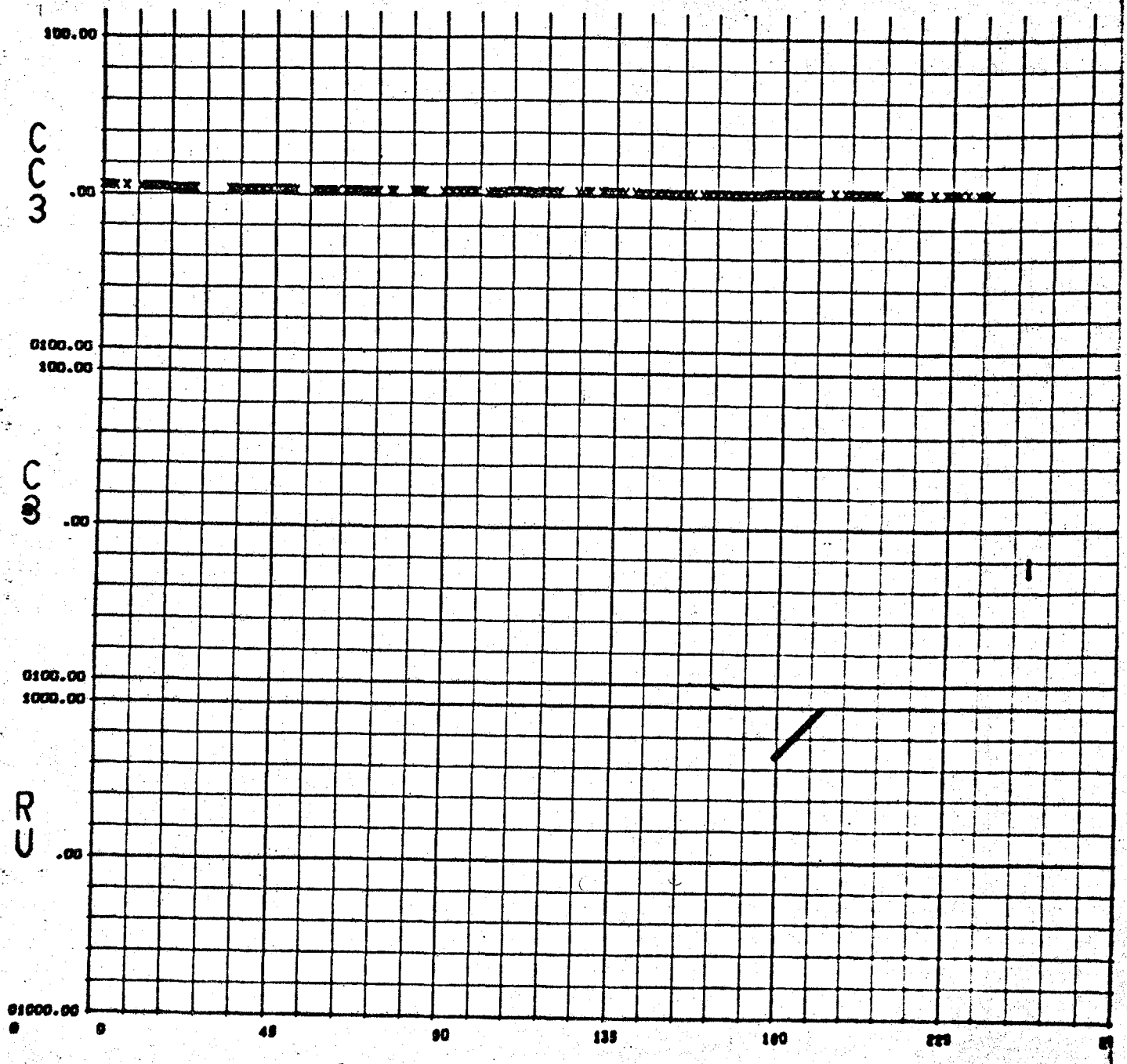
U3 4289-2000 REV. 6/64

BOEING NO. D2-100816-1

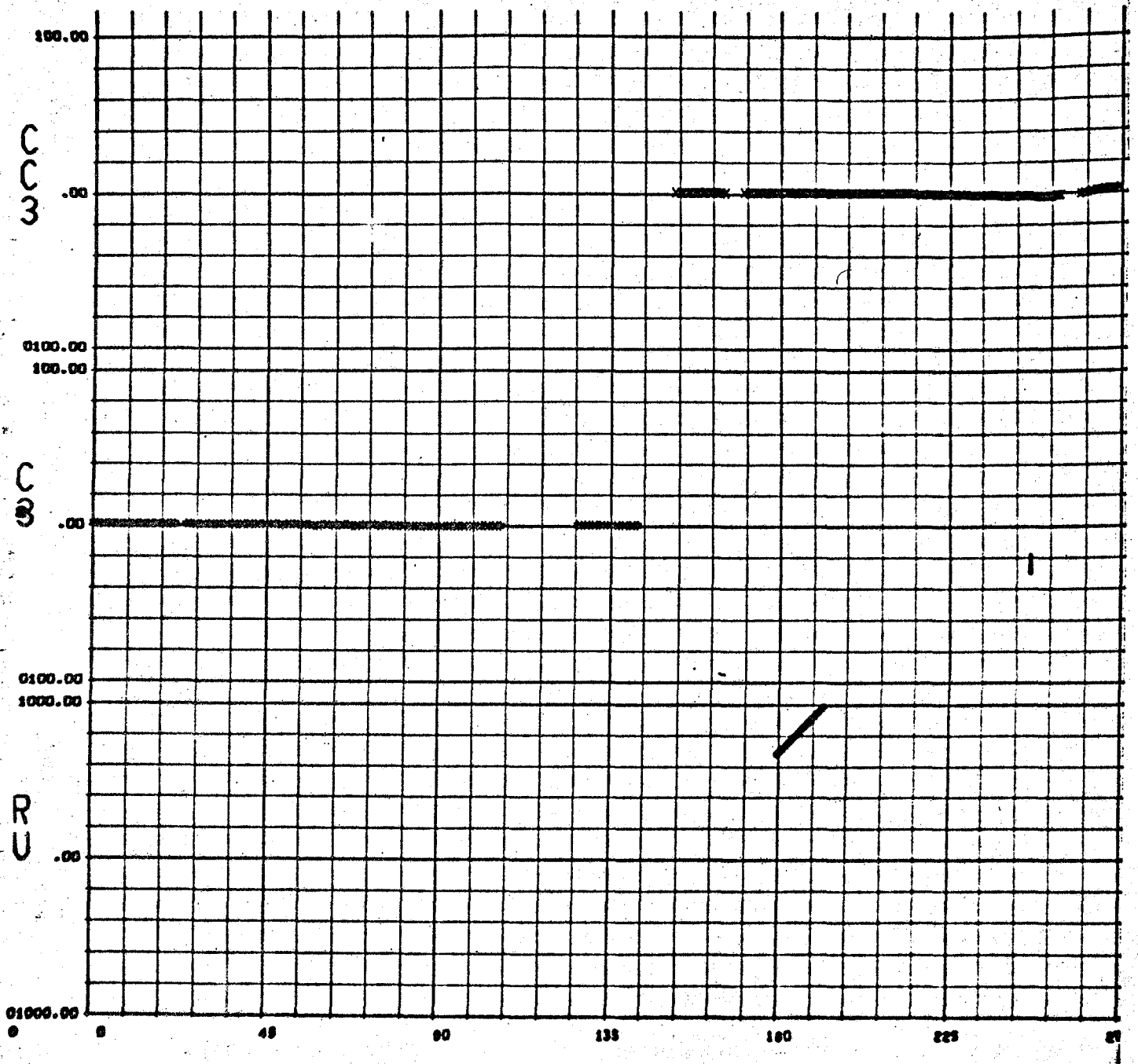
SH. 480



STATION 62 RESIDUALS PASS NUMBER 07/220



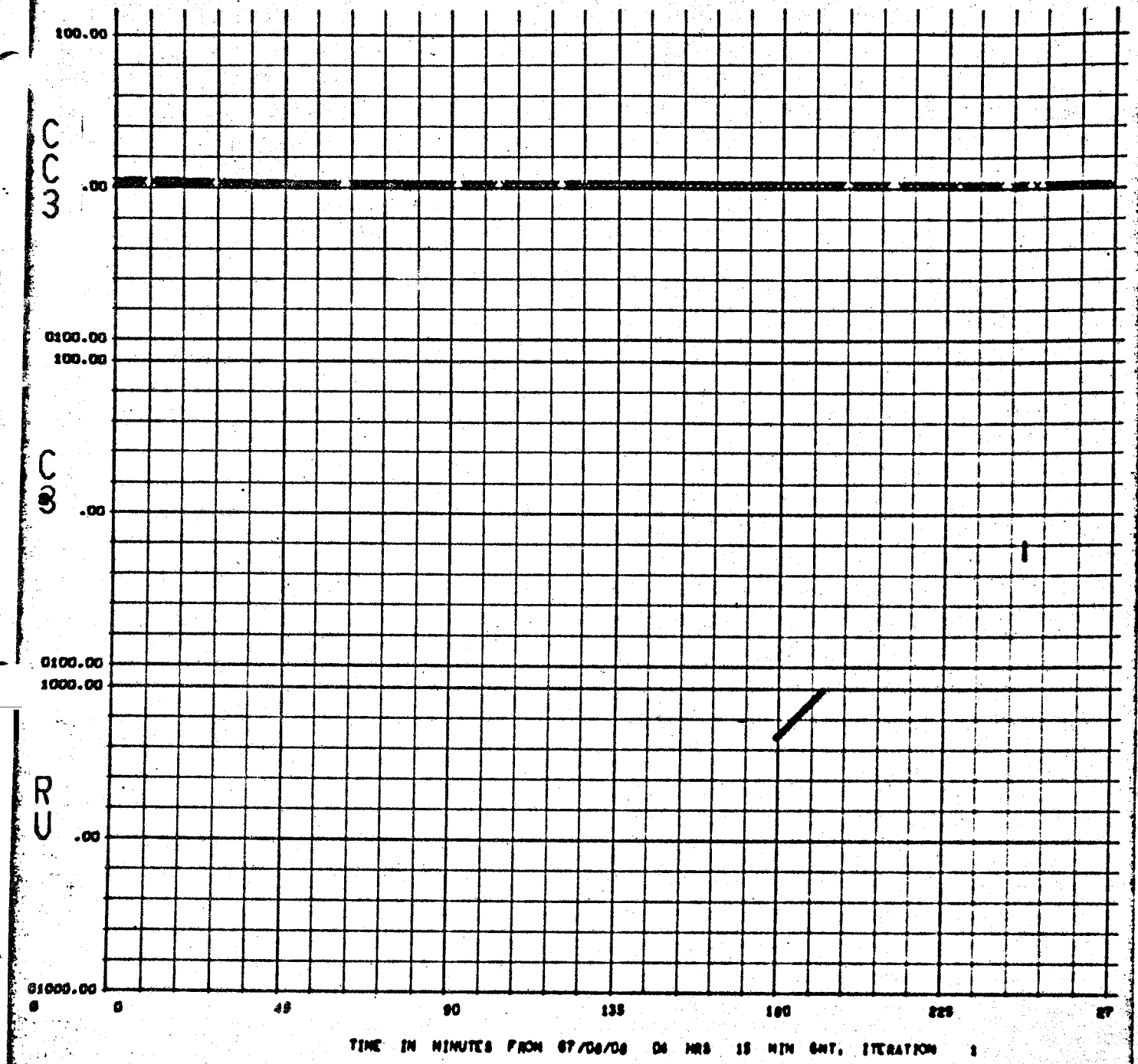
STATION 62 RESIDUALS PASS NUMBER 07/220



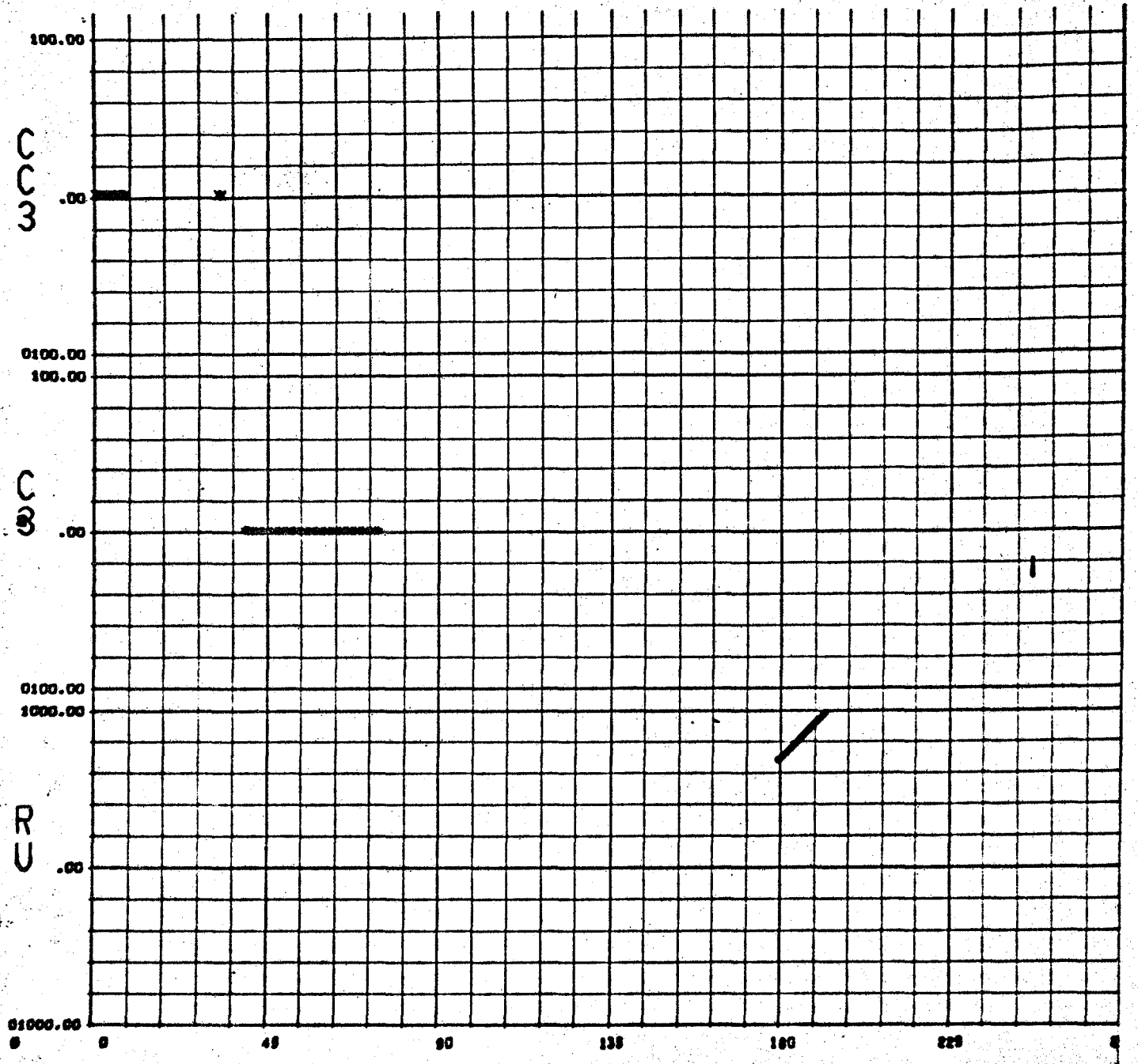
STATION 41 RESIDUALS PASS NUMBER 07/219

REV LTR

US 4288-20[illegible] REV. 8/64



STATION 41 RESIDUALS PASS NUMBER 07/219



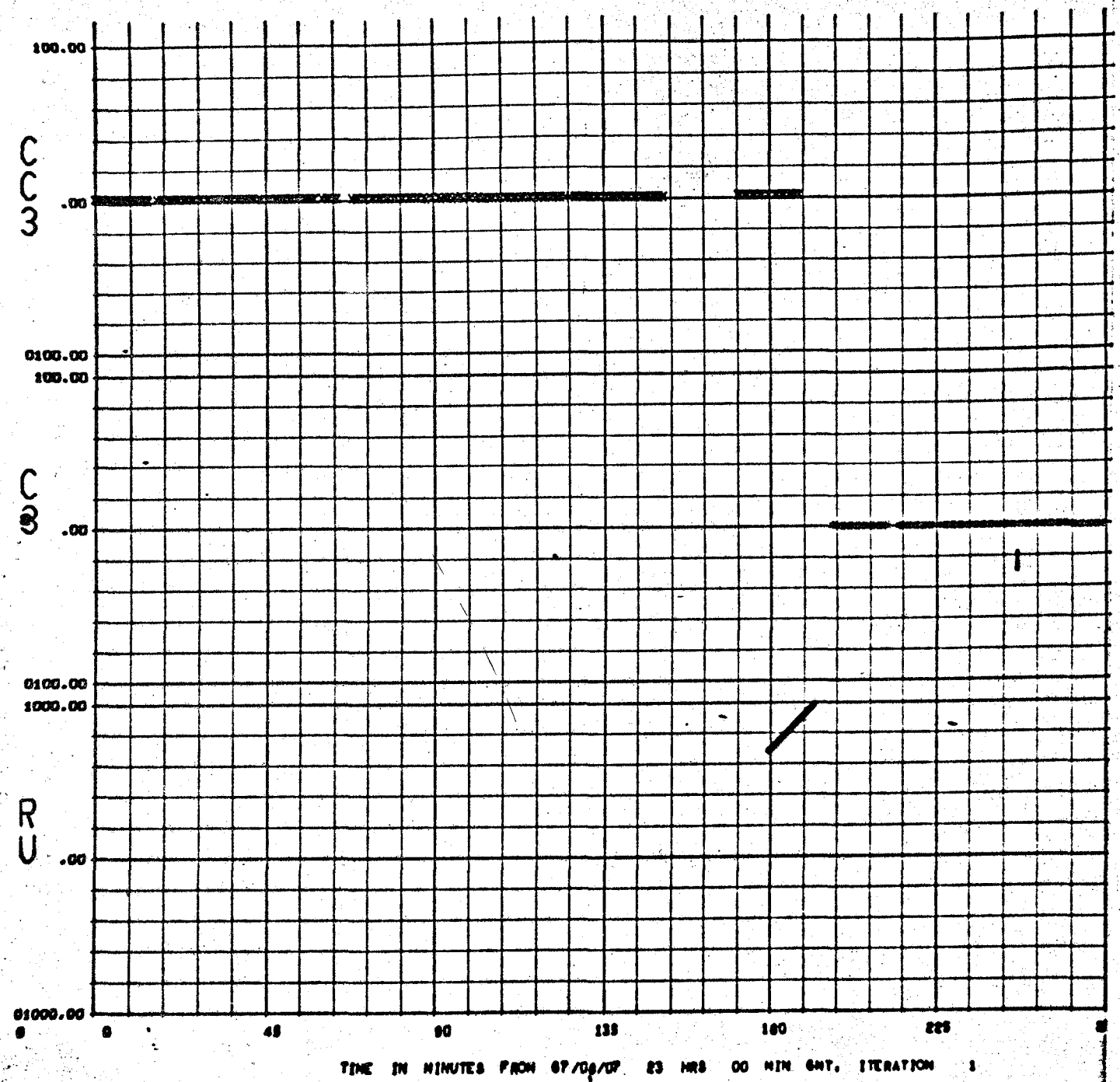
STATION 41 RESIDUALS PASS NUMBER 07/219

REV LTR

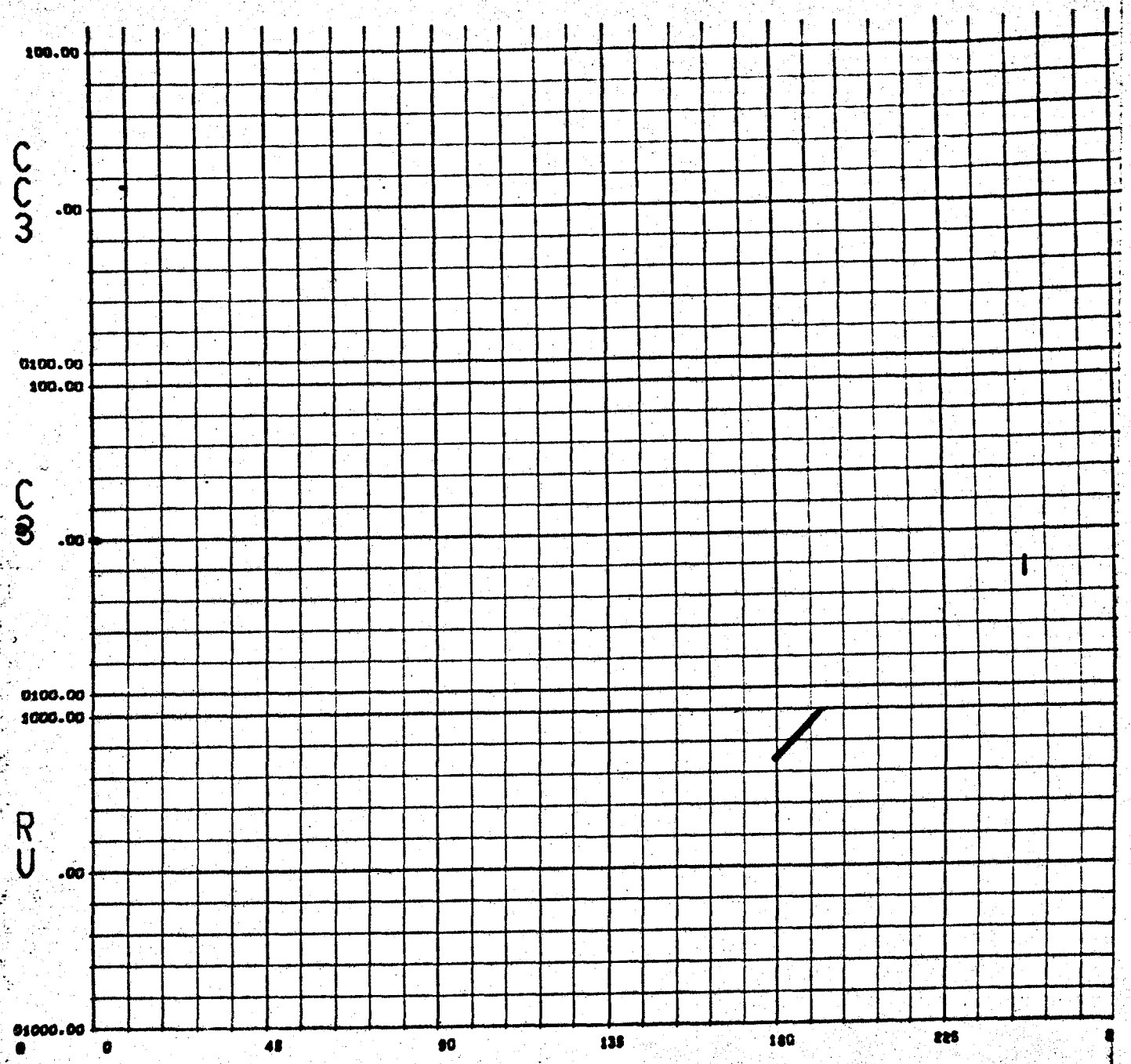
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 485



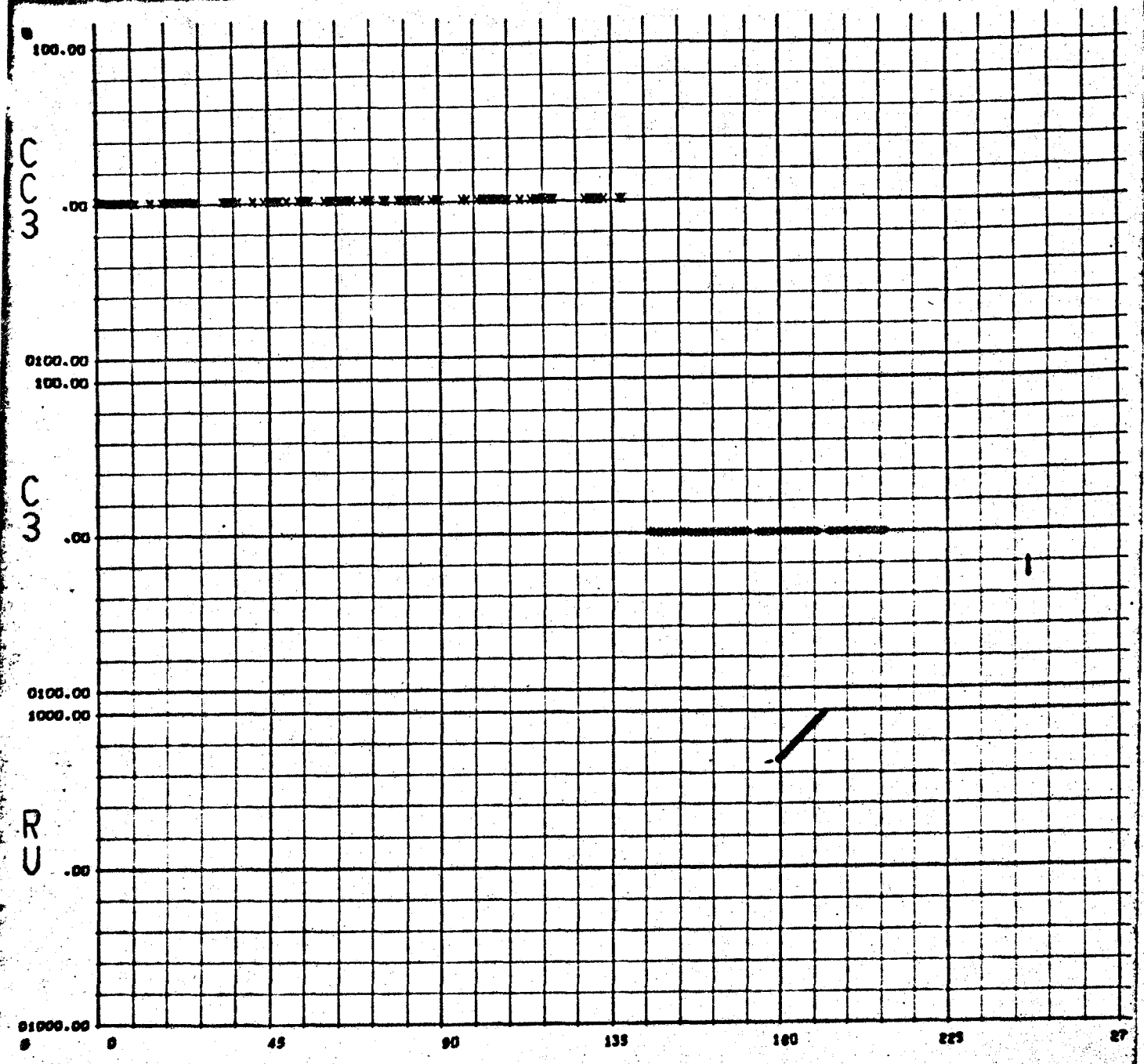
STATION 12 RESIDUALS PASS NUMBER 06/219



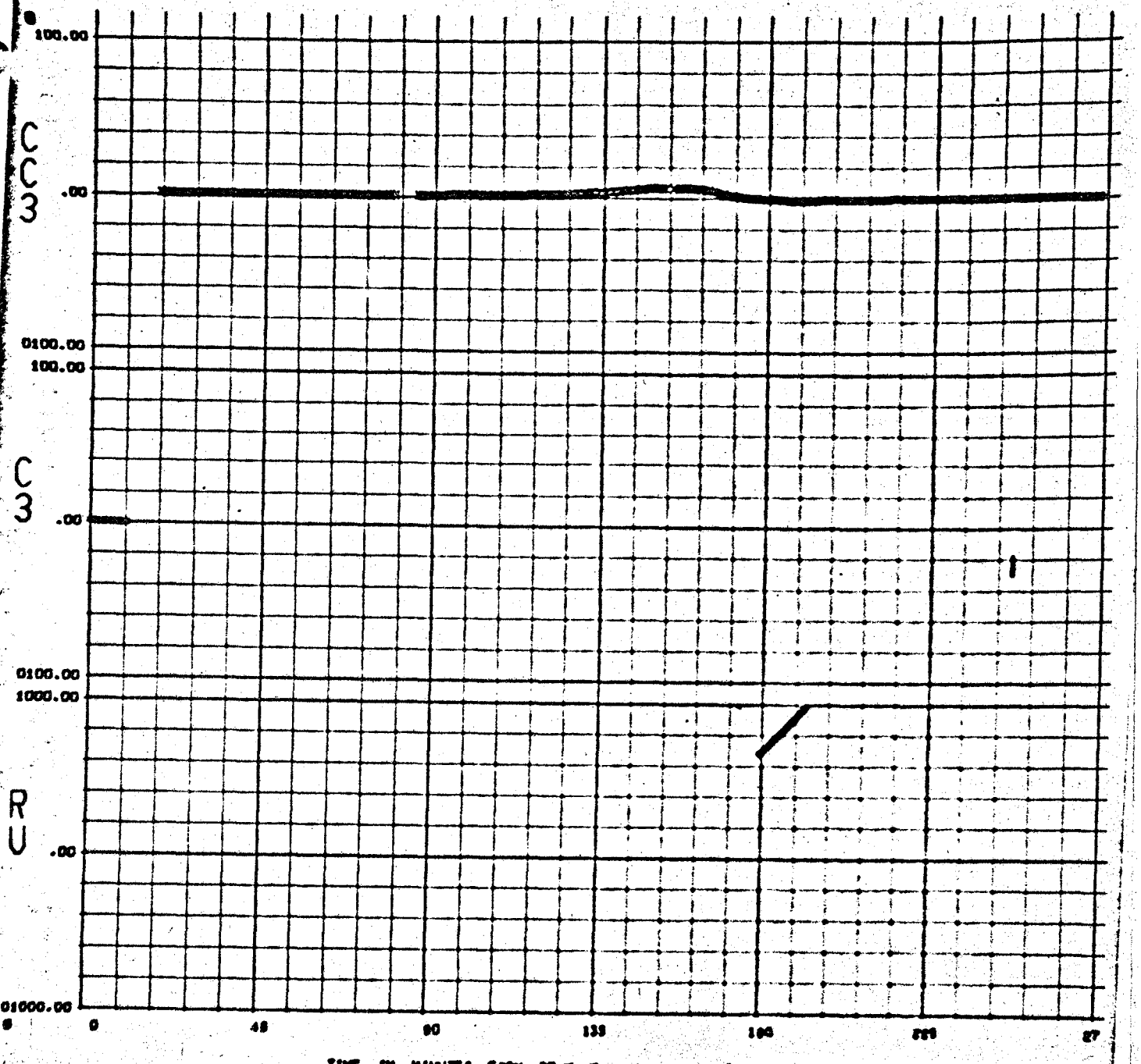
STATION 12 RESIDUALS PASS NUMBER 06/219

ODPL 5A11.2

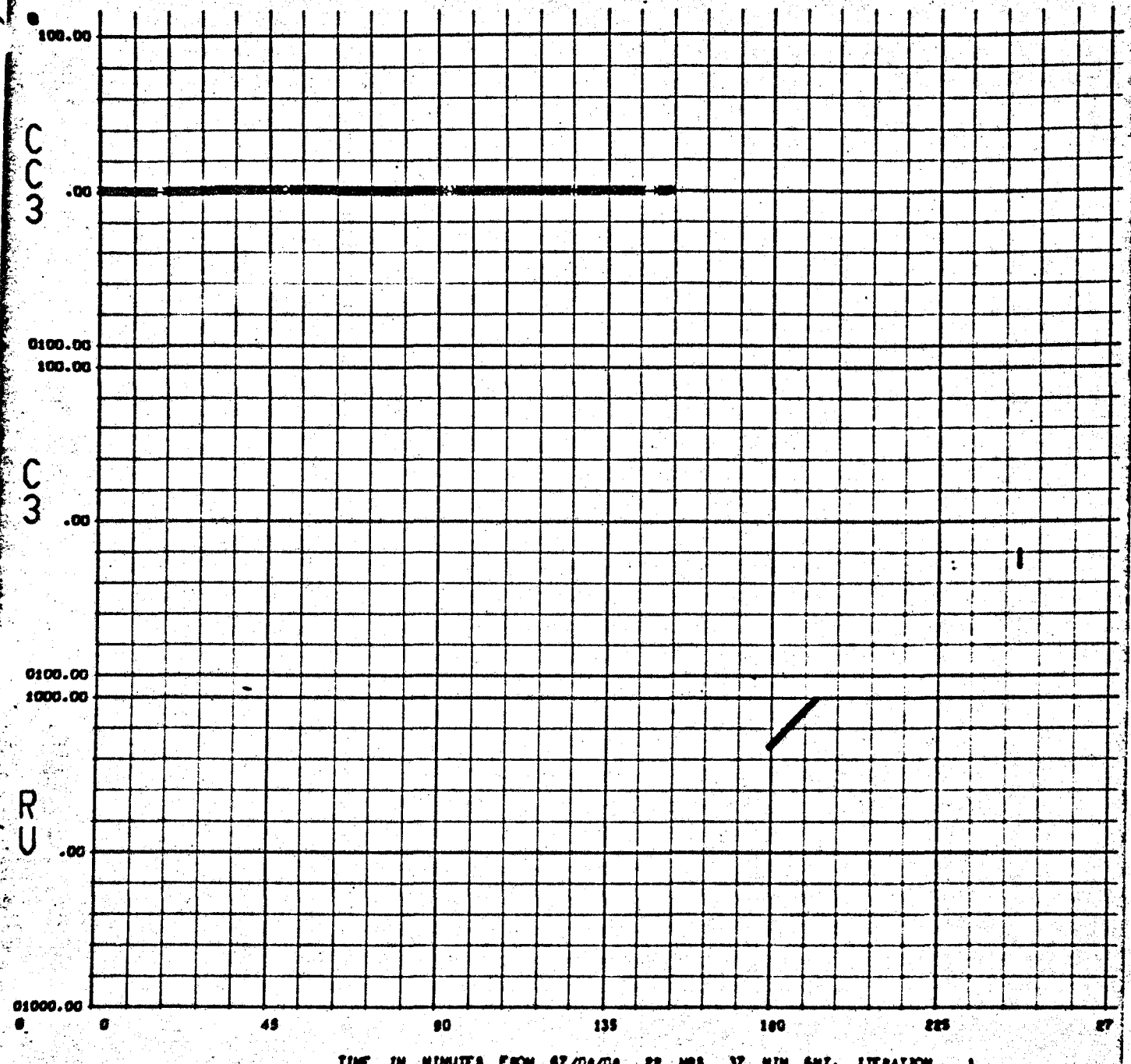
SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 07/220



STATION 12 RESIDUALS PASS NUMBER 07/220



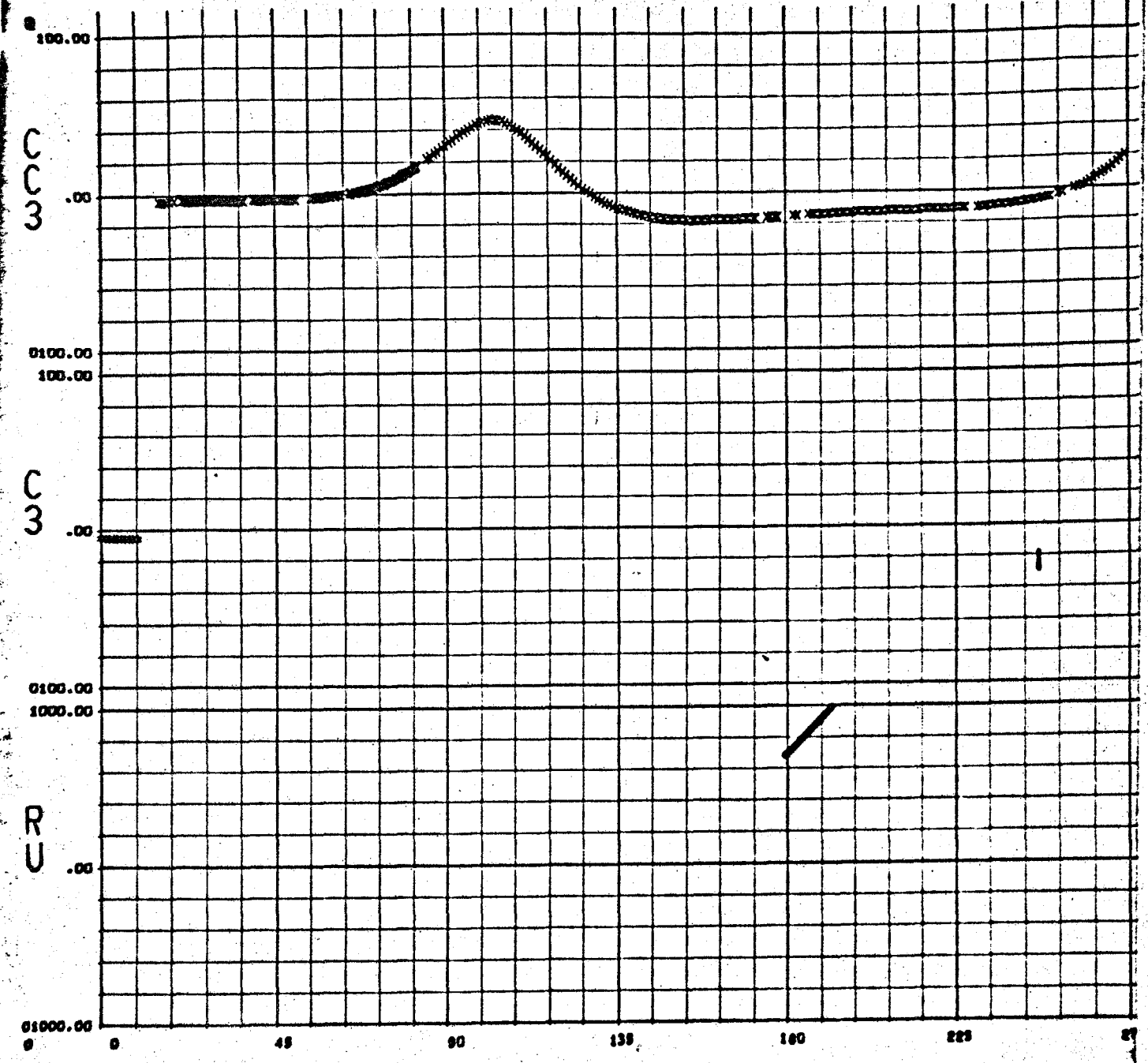
STATION 12 RESIDUALS PASS NUMBER 07/220

REV LTR

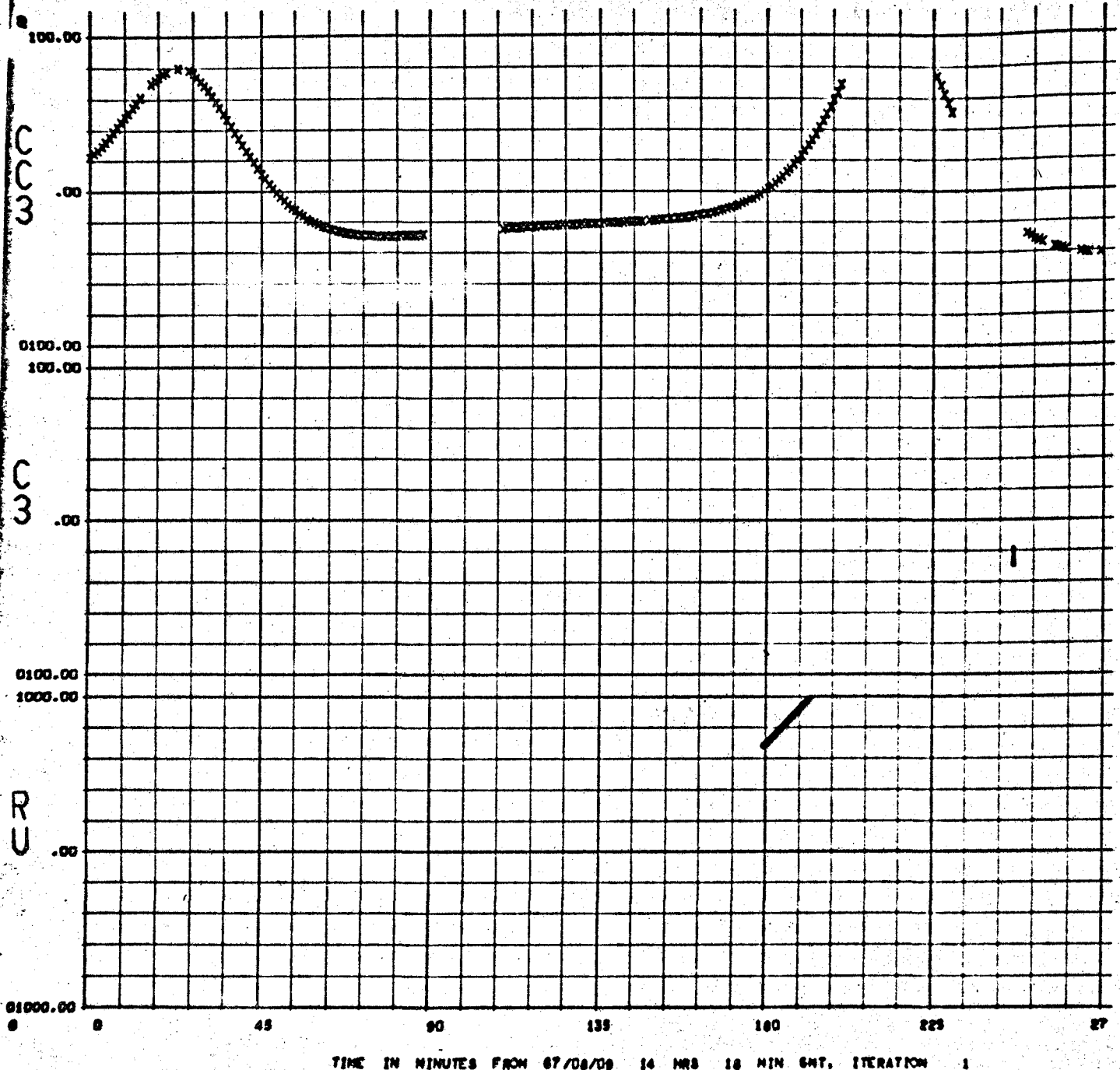
U3 4289-2000 REV. 6/64

ODPL 5A13

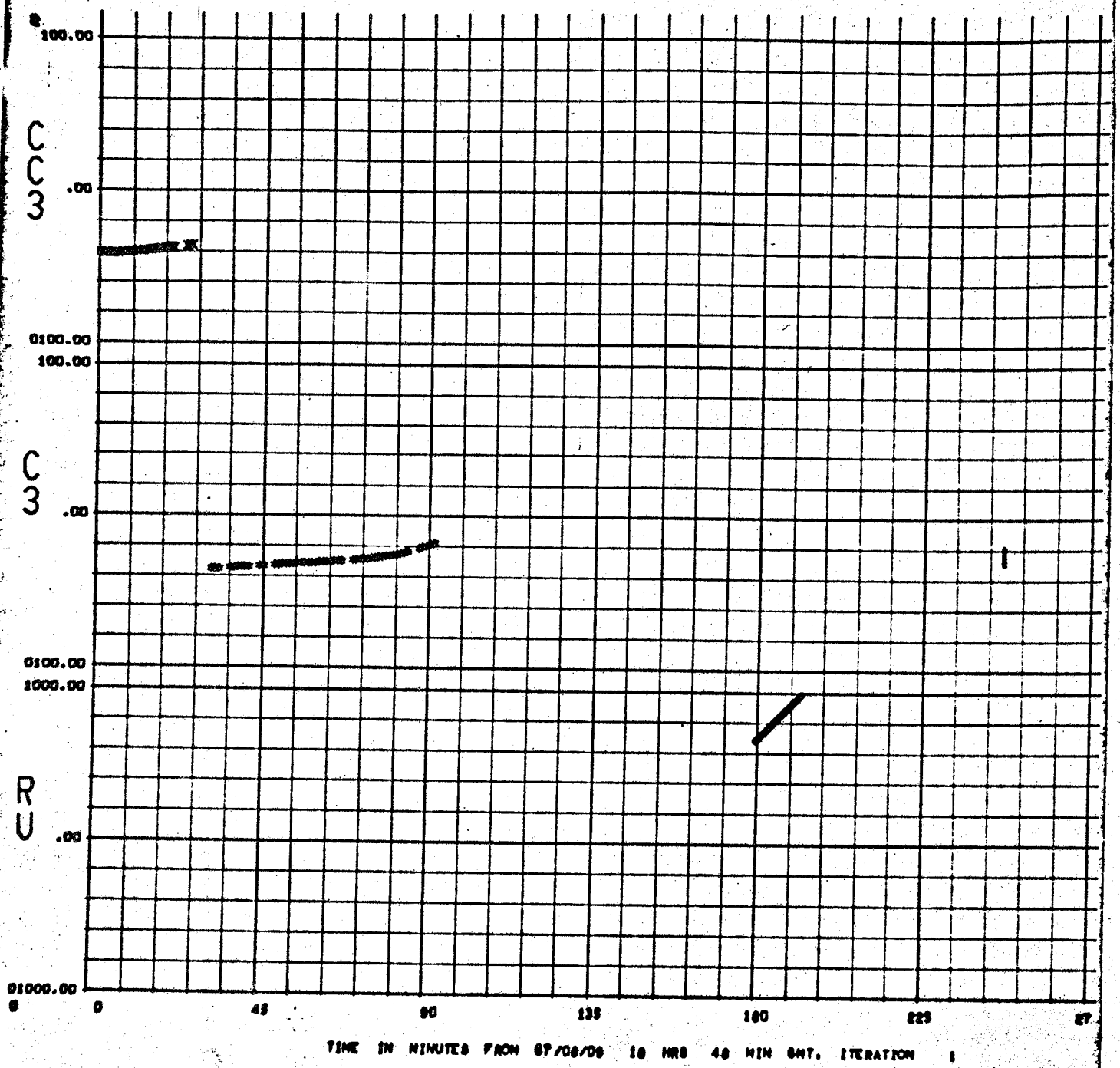
SIMPLE MOON



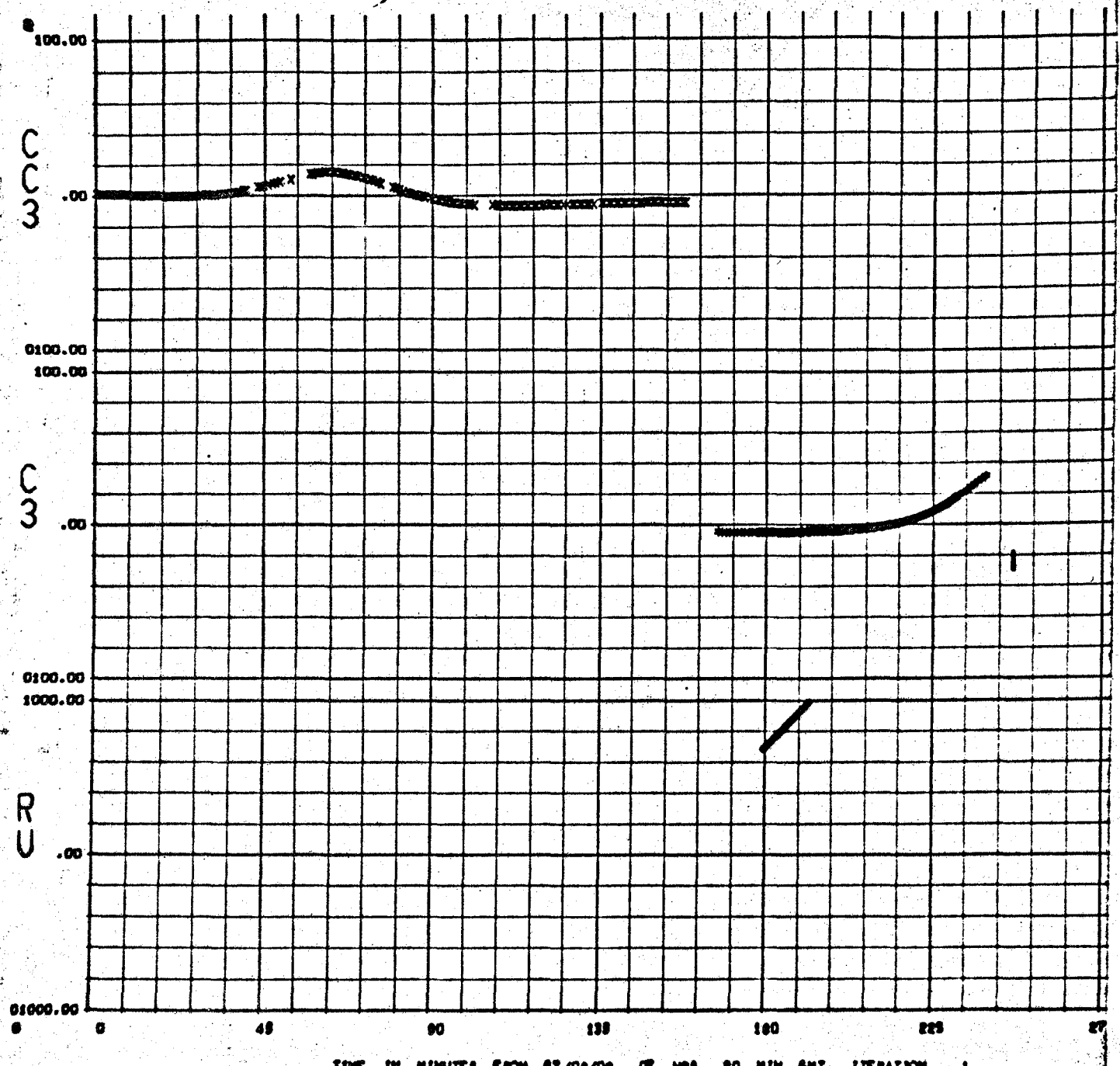
STATION 62 RESIDUALS PASS NUMBER 08/221



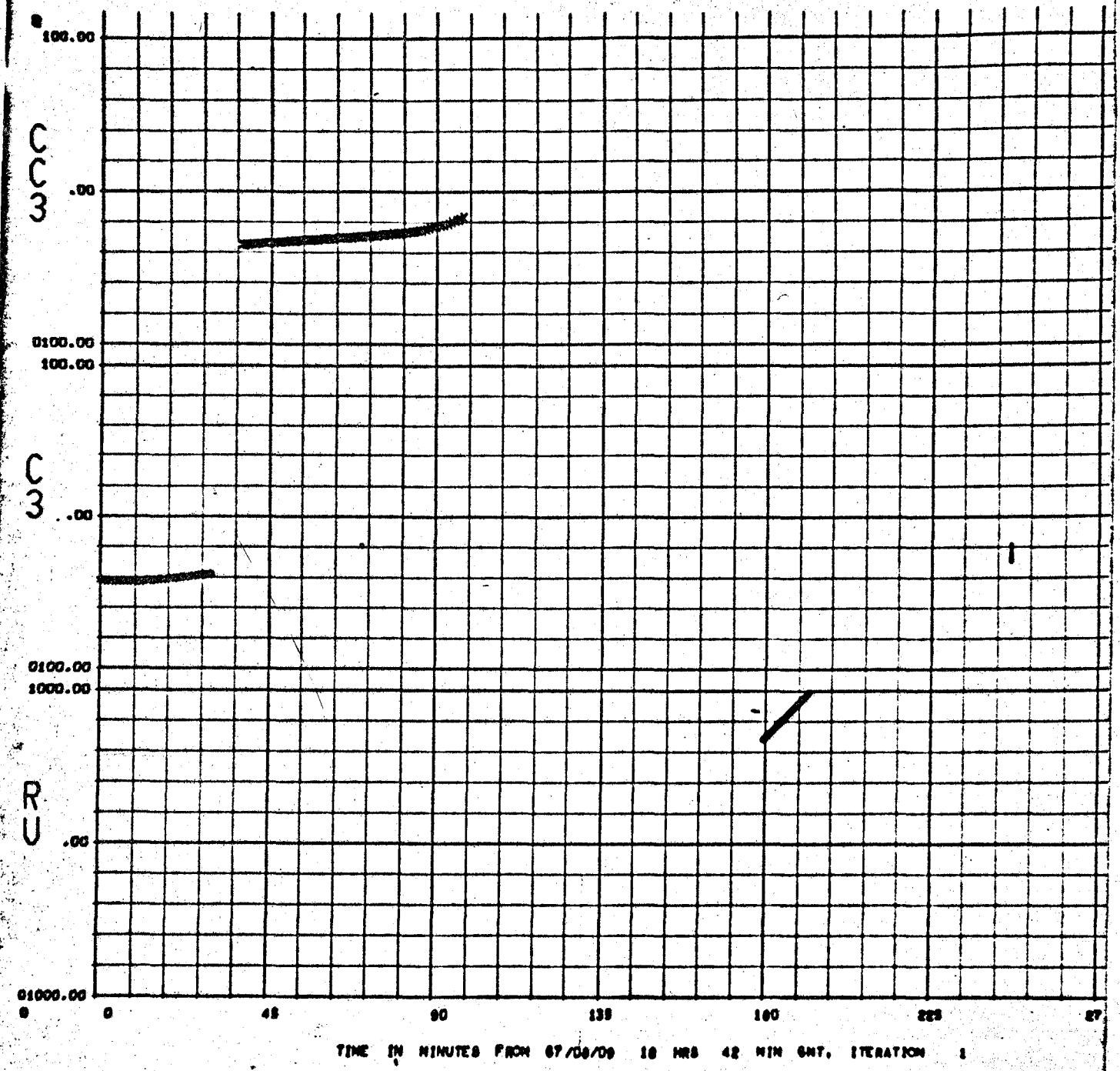
STATION 62 RESIDUALS PASS NUMBER 08/221



STATION 62 RESIDUALS PASS NUMBER 08/221



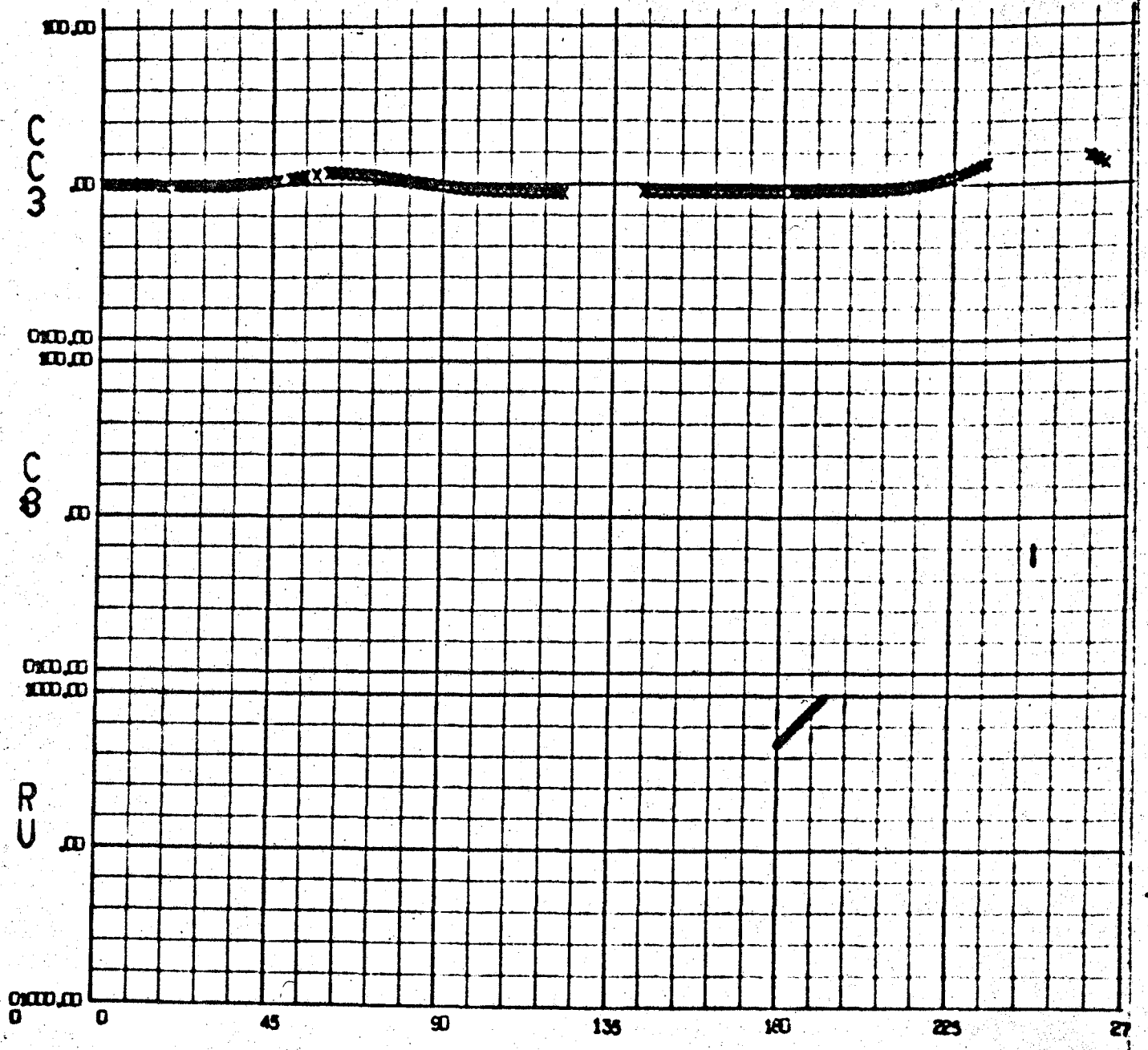
STATION 41 RESIDUALS PASS NUMBER 08/221



STATION 12 RESIDUALS PASS NUMBER 08/221

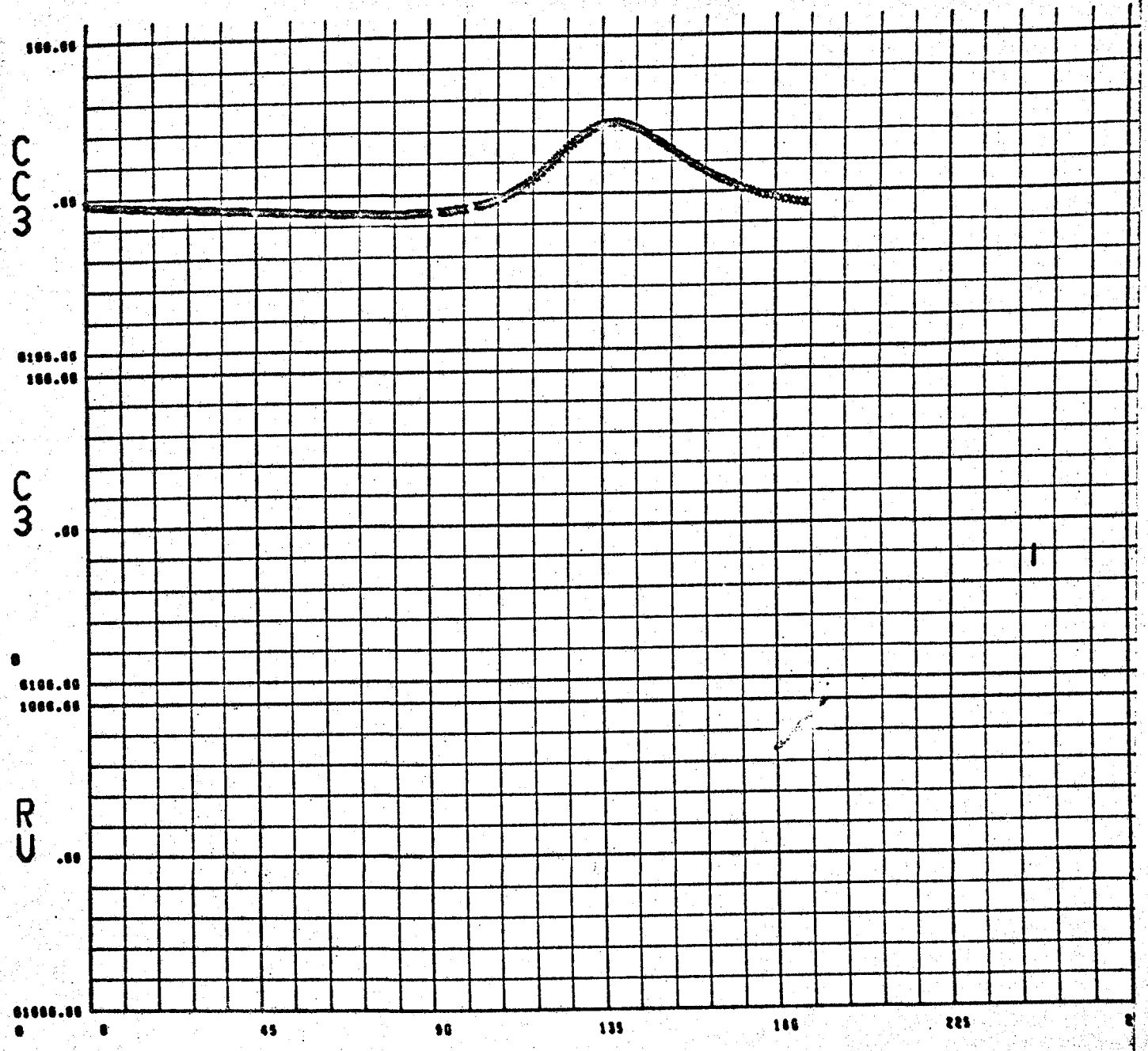
ODPL 5V1

SIMPLE MOON

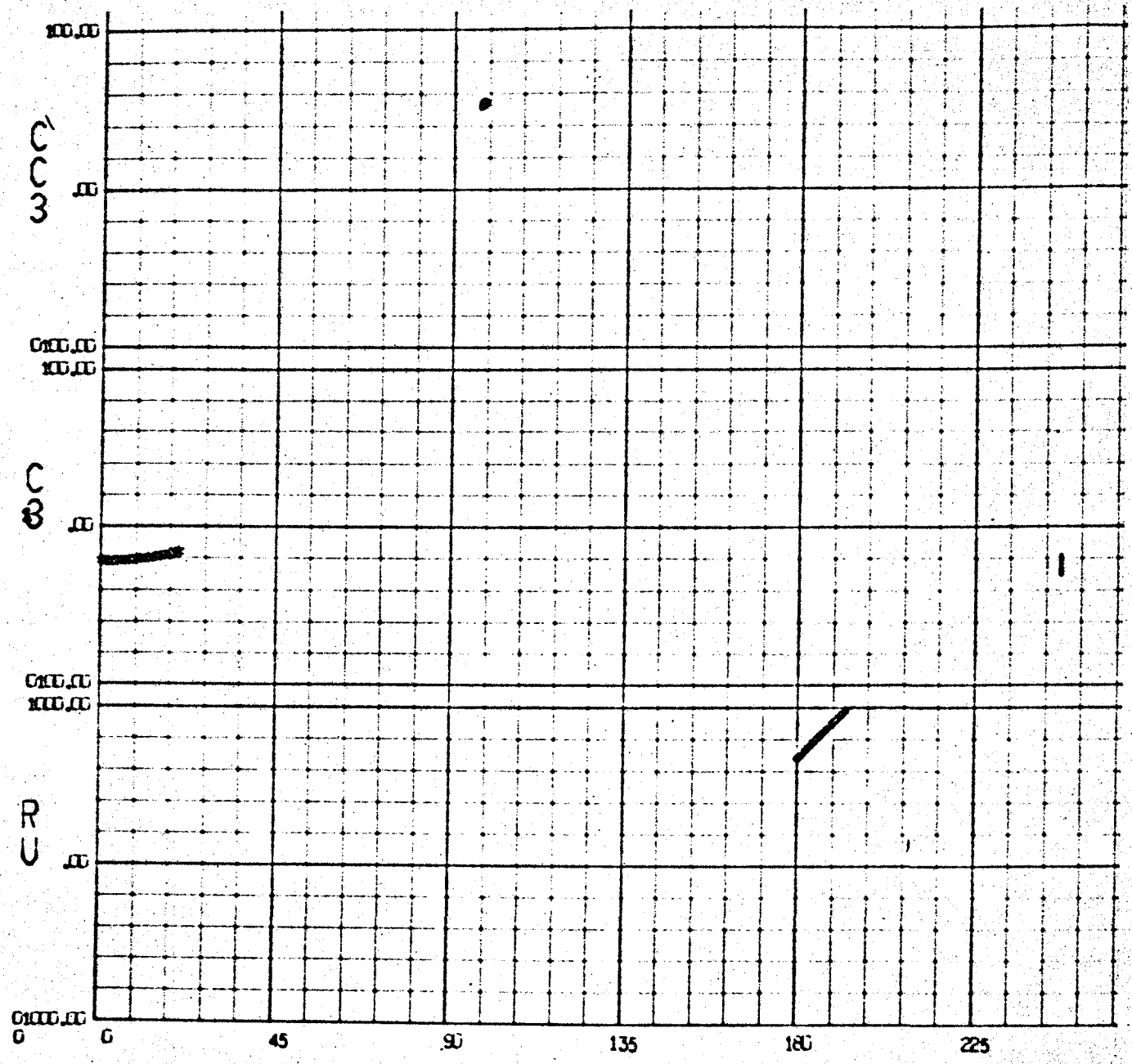


STATION 62 RESIDUALS PASS NUMBER 08/221

STATION 62 RESIDUALS PASS NUMBER 08/221

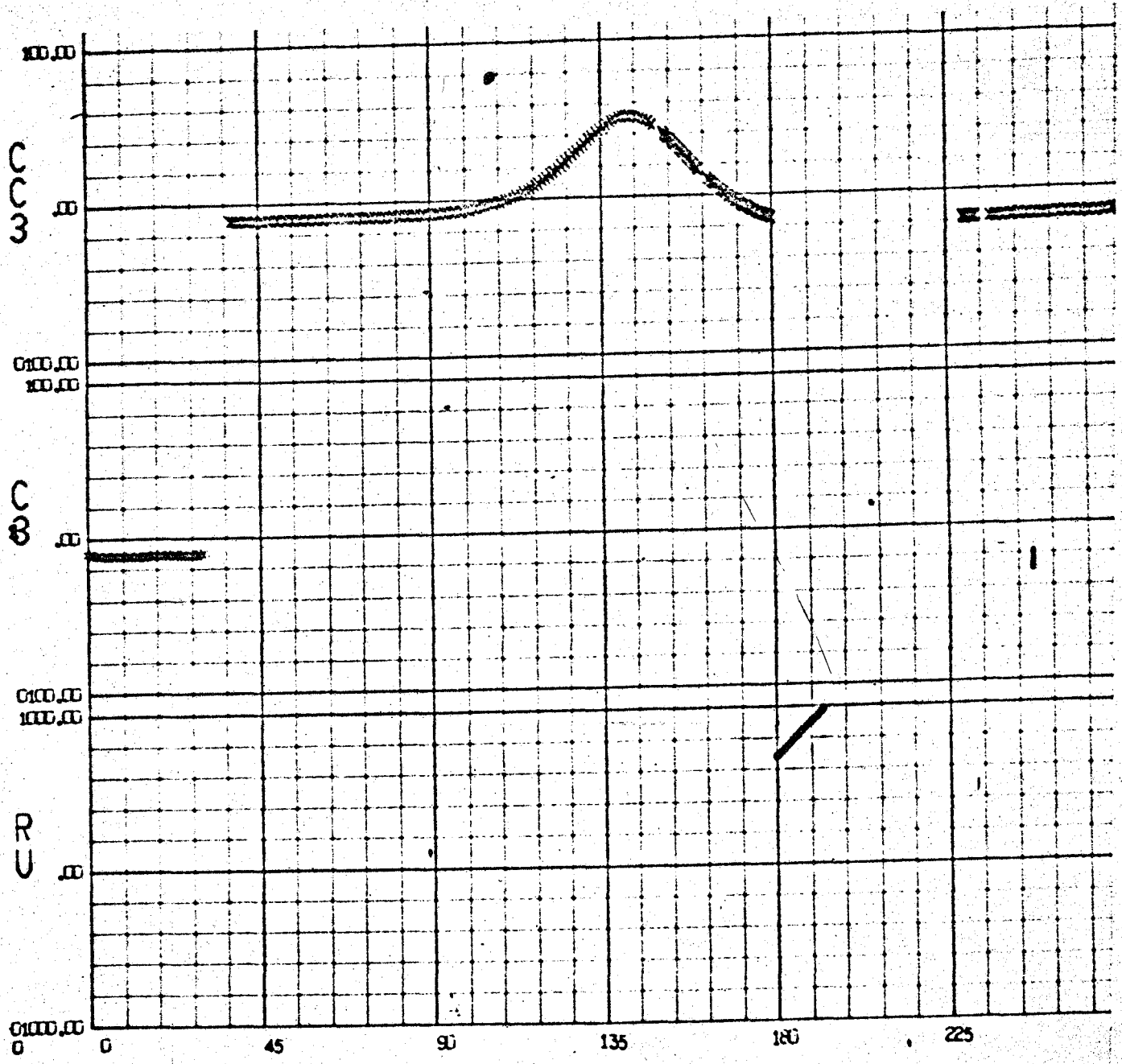


STATION 41 RESIDUALS PASS NUMBER 17/230



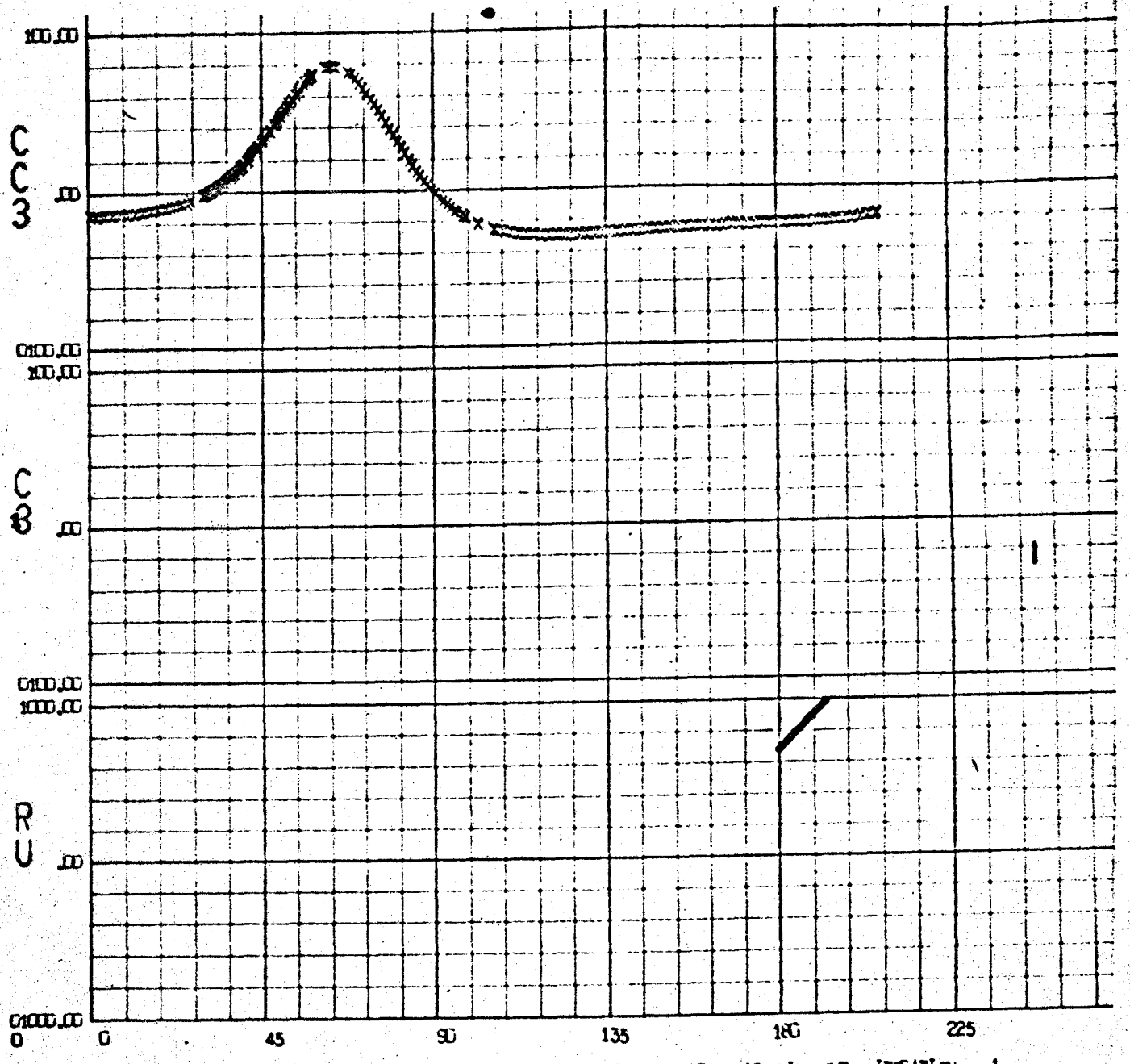
TIME IN MINUTES FROM 67/06/10 02 HRS 19 MIN GMT, ITERATION 1

STATION 41 RESIDUALS PASS NUMBER 08/221



TIME IN MINUTES FROM 67/08/09 18 HRS 42 MIN GMT, ITERATION 1

STATION 12 RESIDUALS PASS NUMBER 08/221

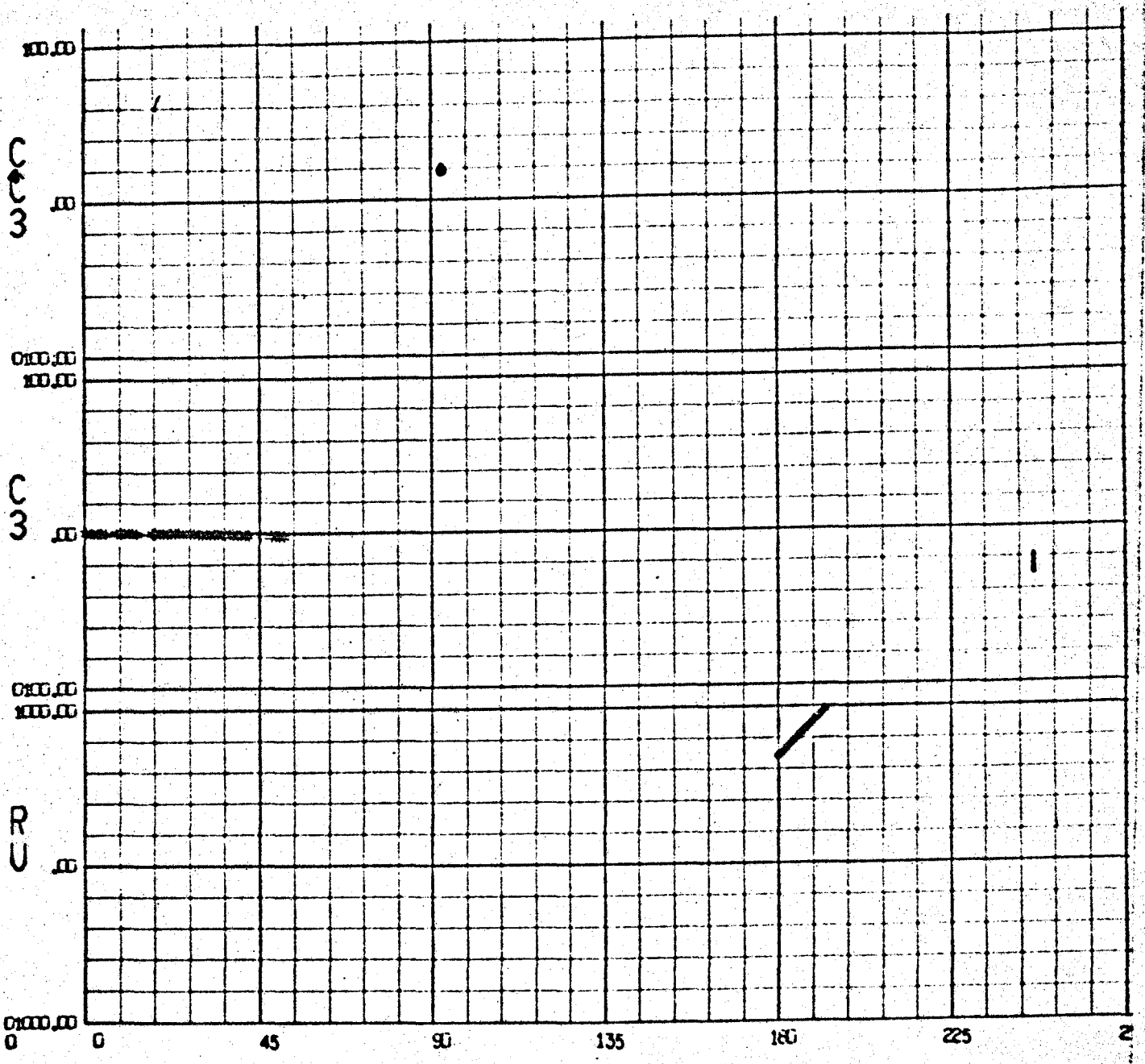


TIME IN MINUTES FROM 67/08/08 23 HRS 12 MIN GMT, ITERATION 1

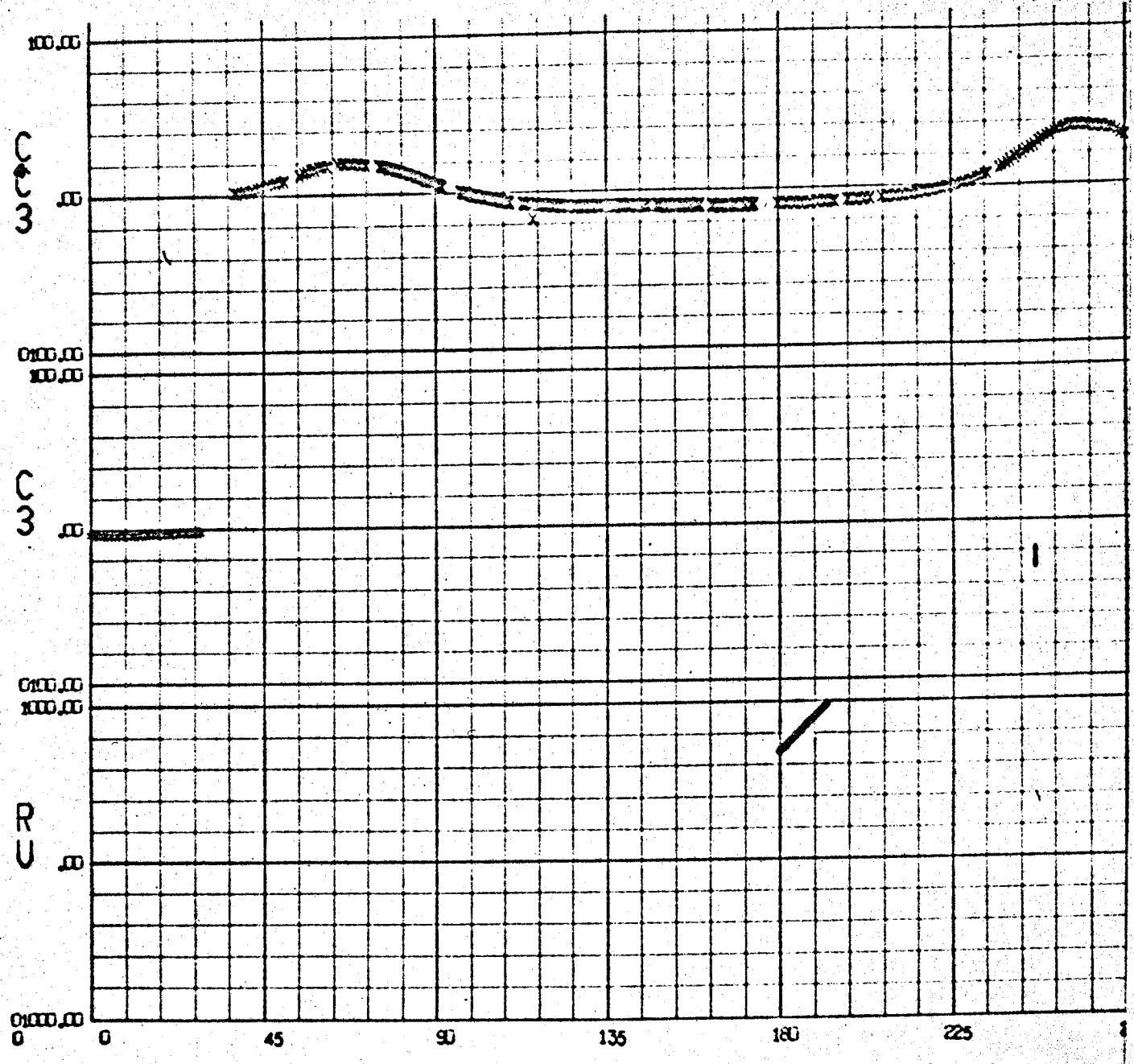
STATION 12 RESIDUALS PASS NUMBER 08/221

ODPL 5V2.1

SIMPLE MOON

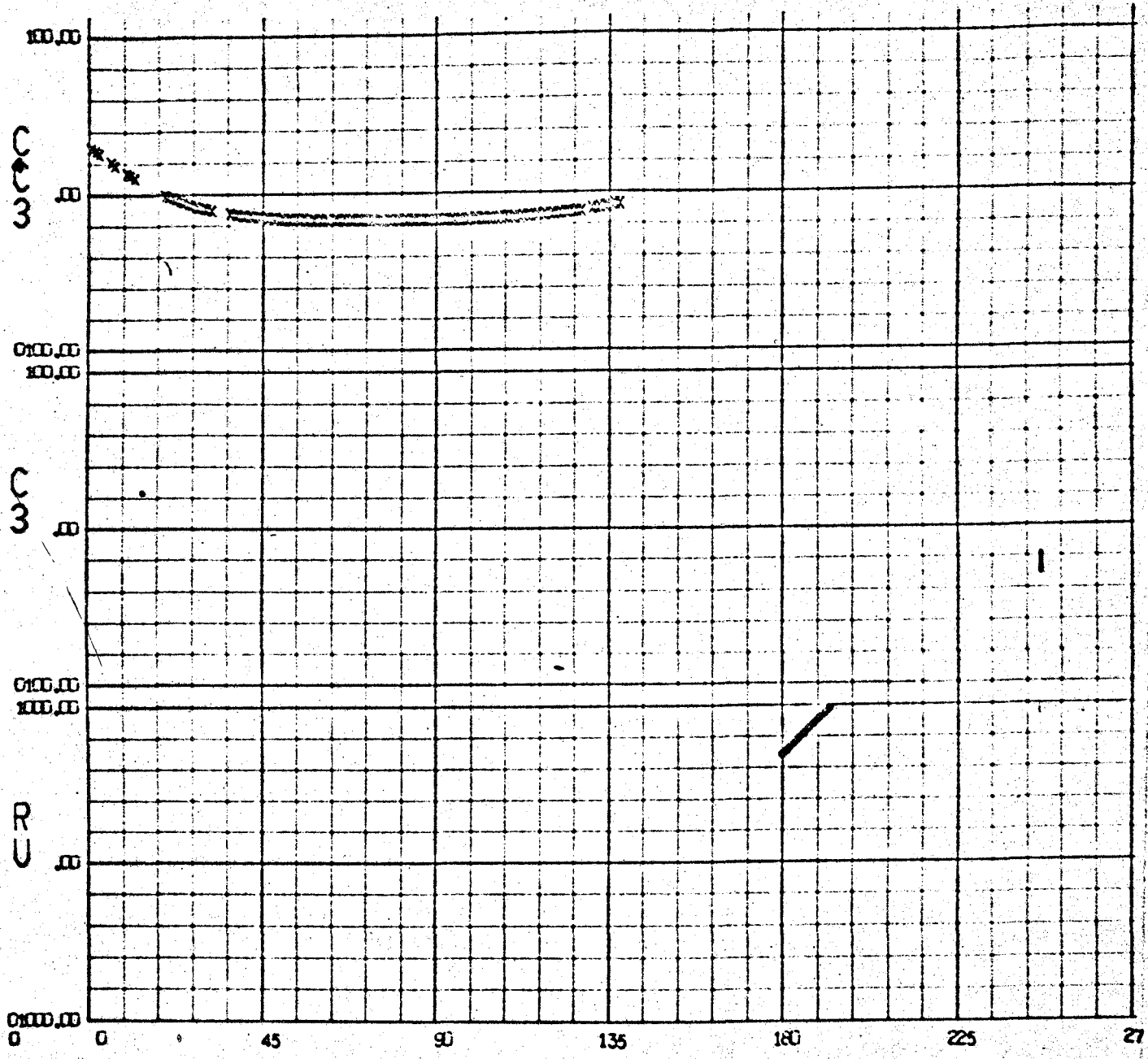


STATION 62 RESIDUALS PASS NUMBER 08/221

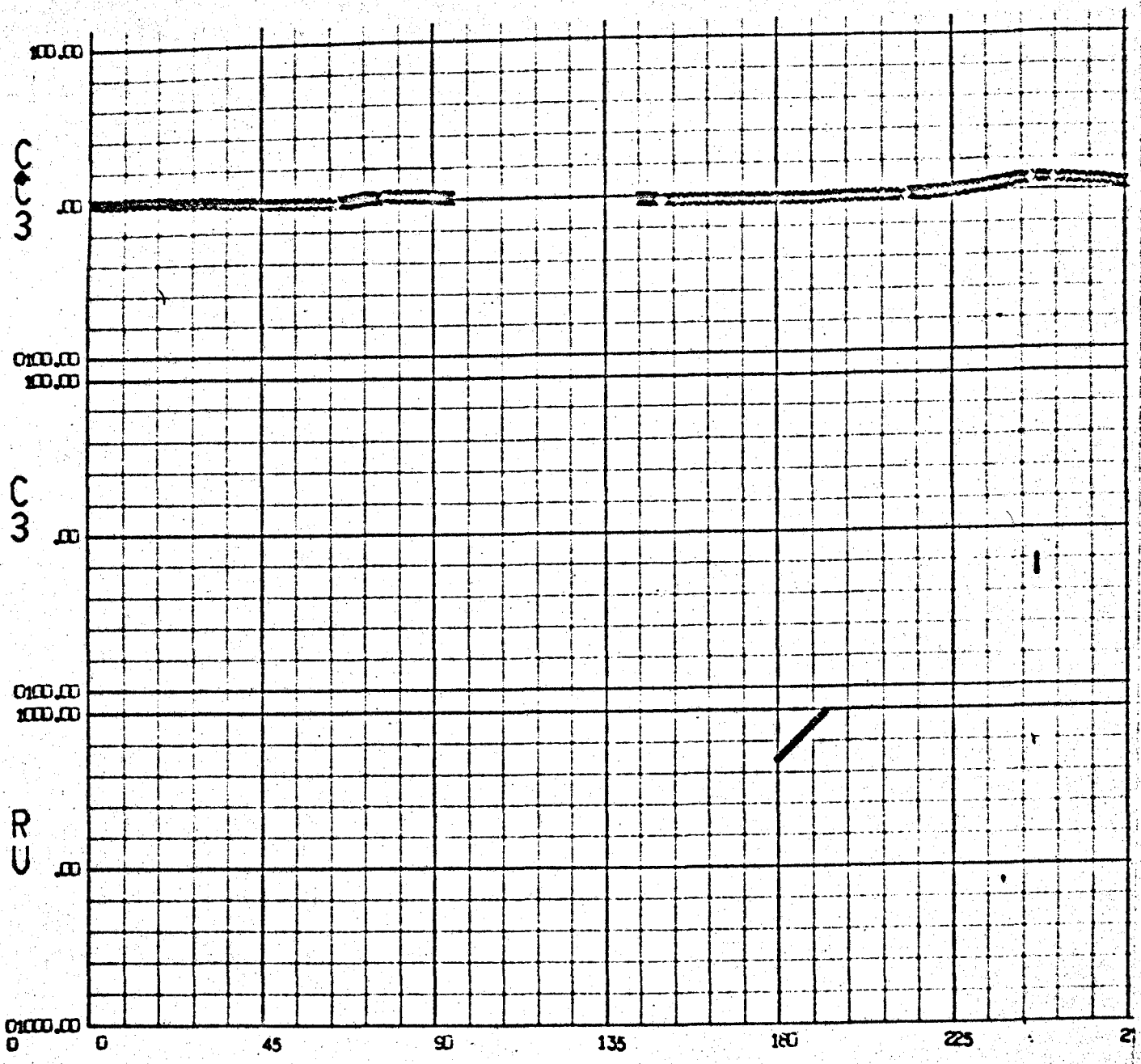


TIME IN MINUTES FROM 67/08/10 02 HRS 19 MIN GMT, ITERATION 1

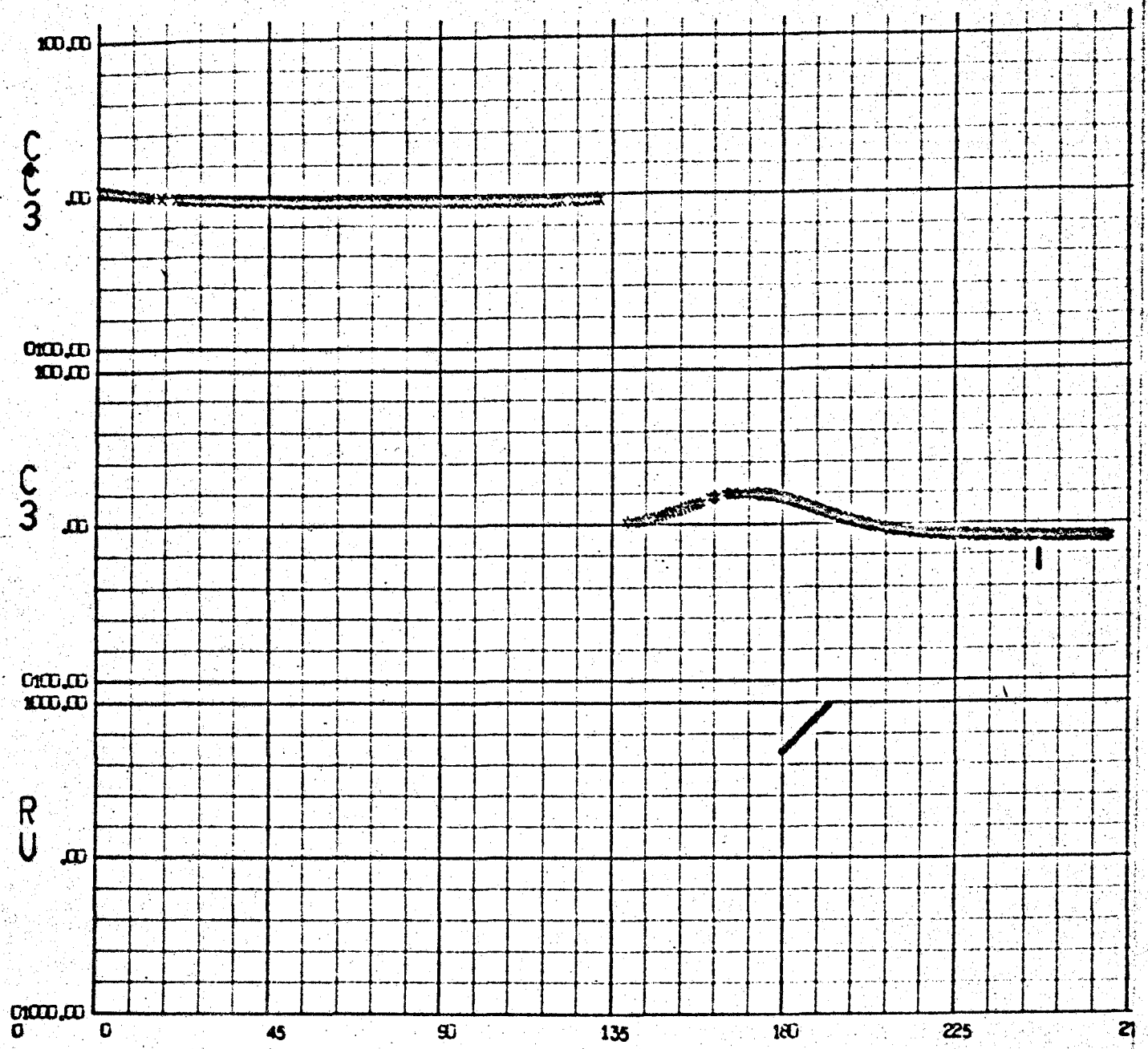
STATION 41 RESIDUALS PASS NUMBER 08/221



STATION 41 RESIDUALS PASS NUMBER 09/222



STATION 12 RESIDUALS PASS NUMBER 08/221

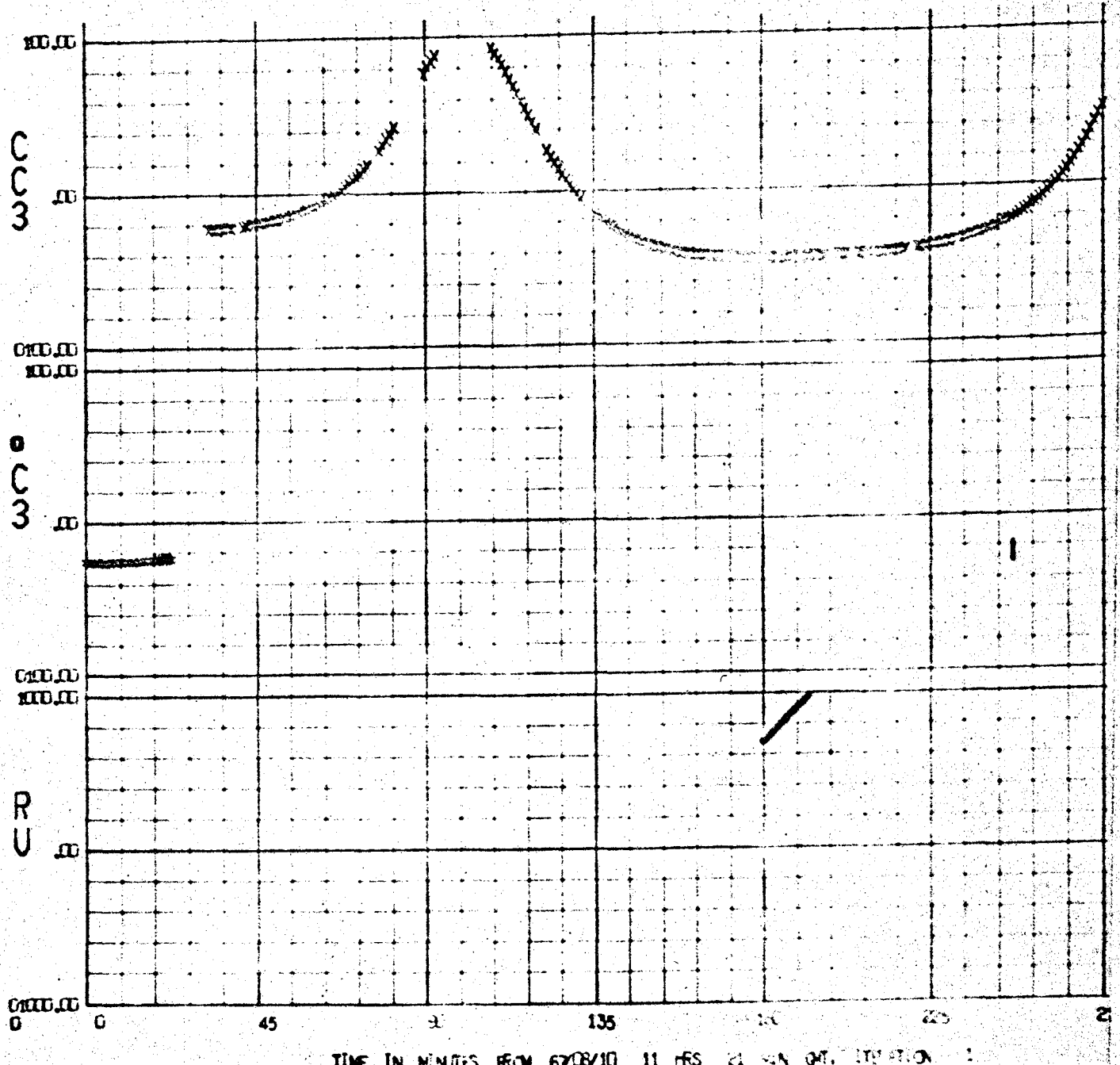


TIME IN MINUTES FROM 67/08/10 00 HRS 37 MIN GMT, ITERATION 1

STATION 12 RESIDUALS PASS NUMBER 08/221

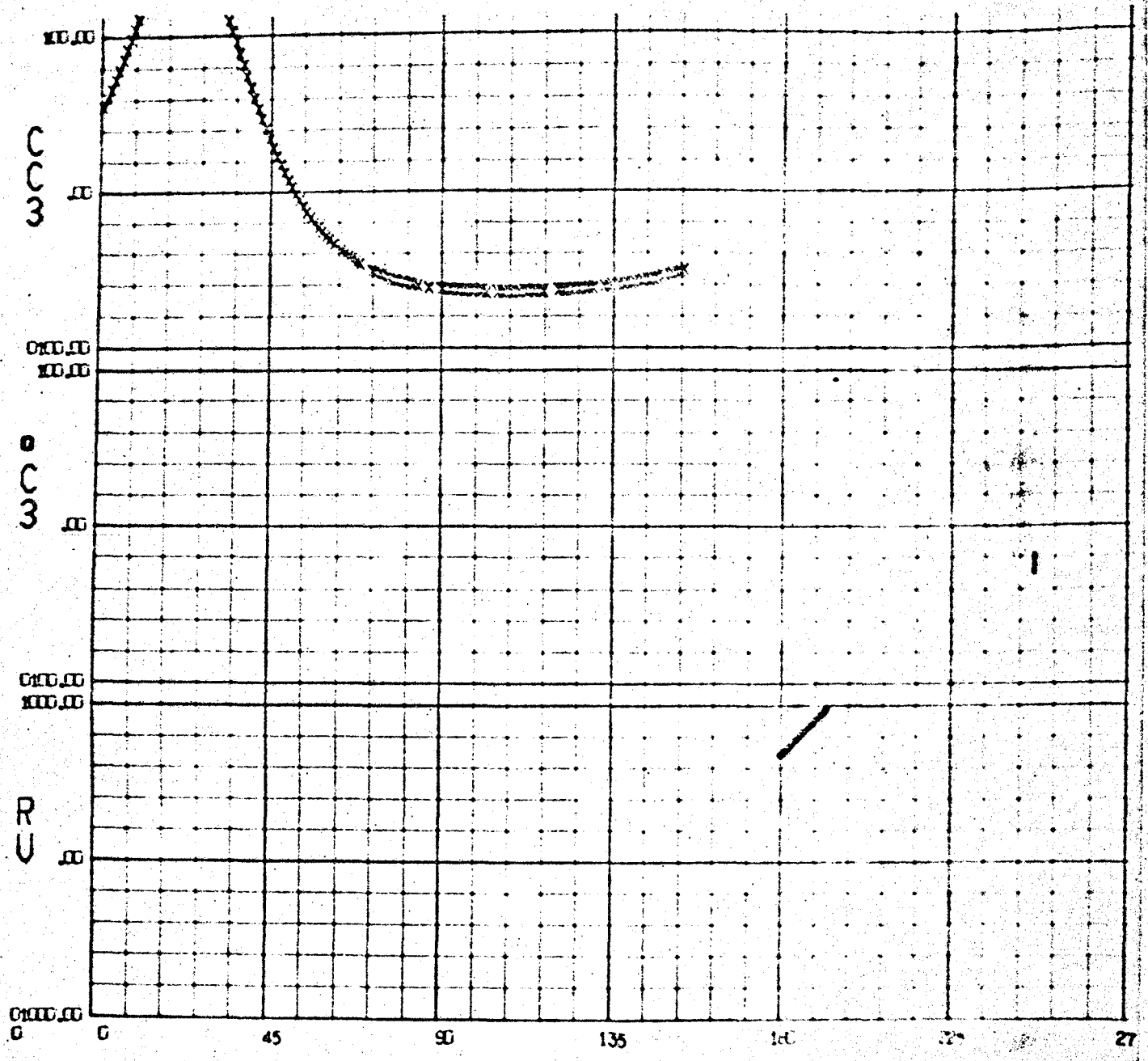
ODPL 5V3.1

SIMPLE MOON

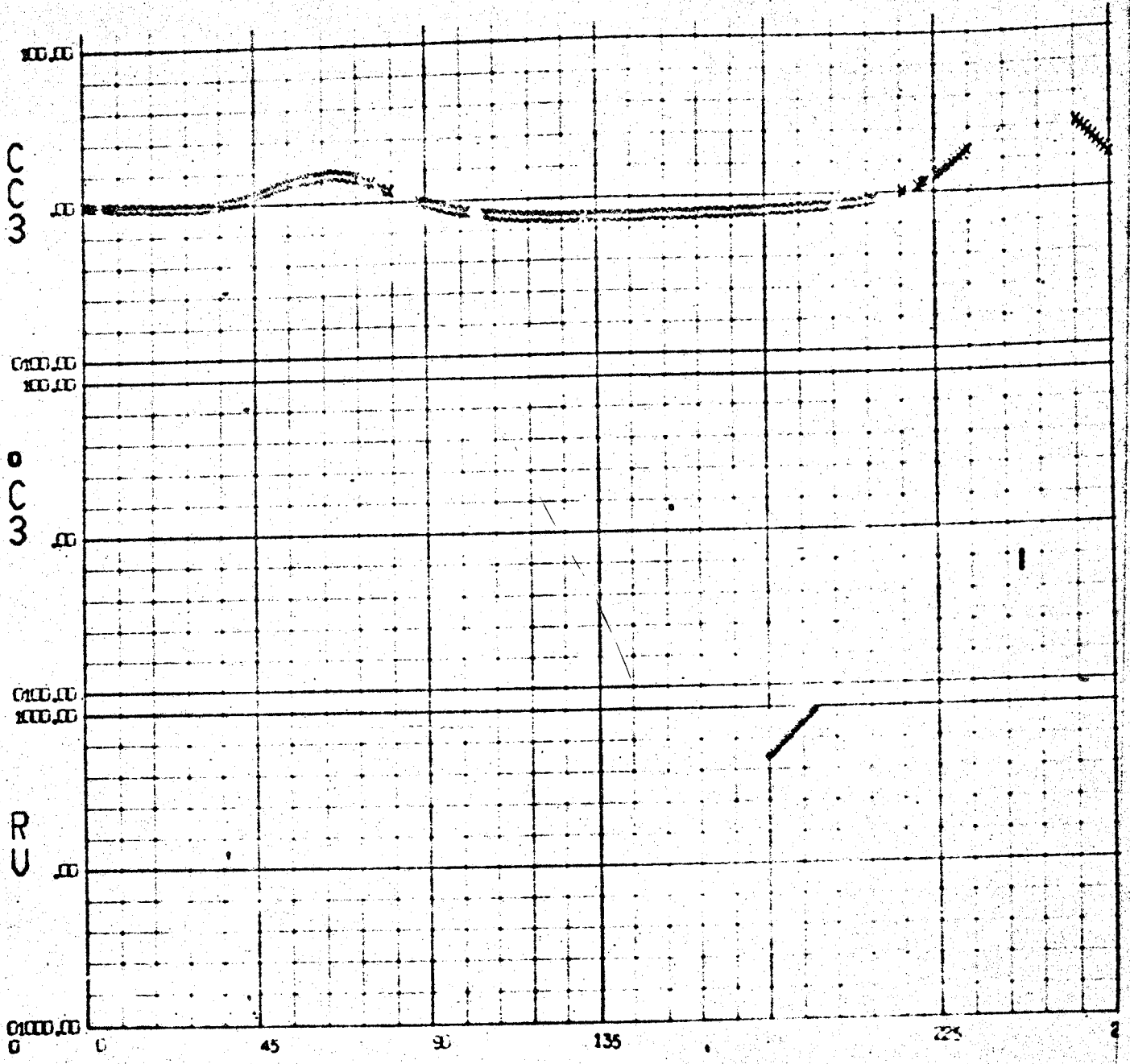


STATION 62 RESIDUALS PASS NUMBER 09/222

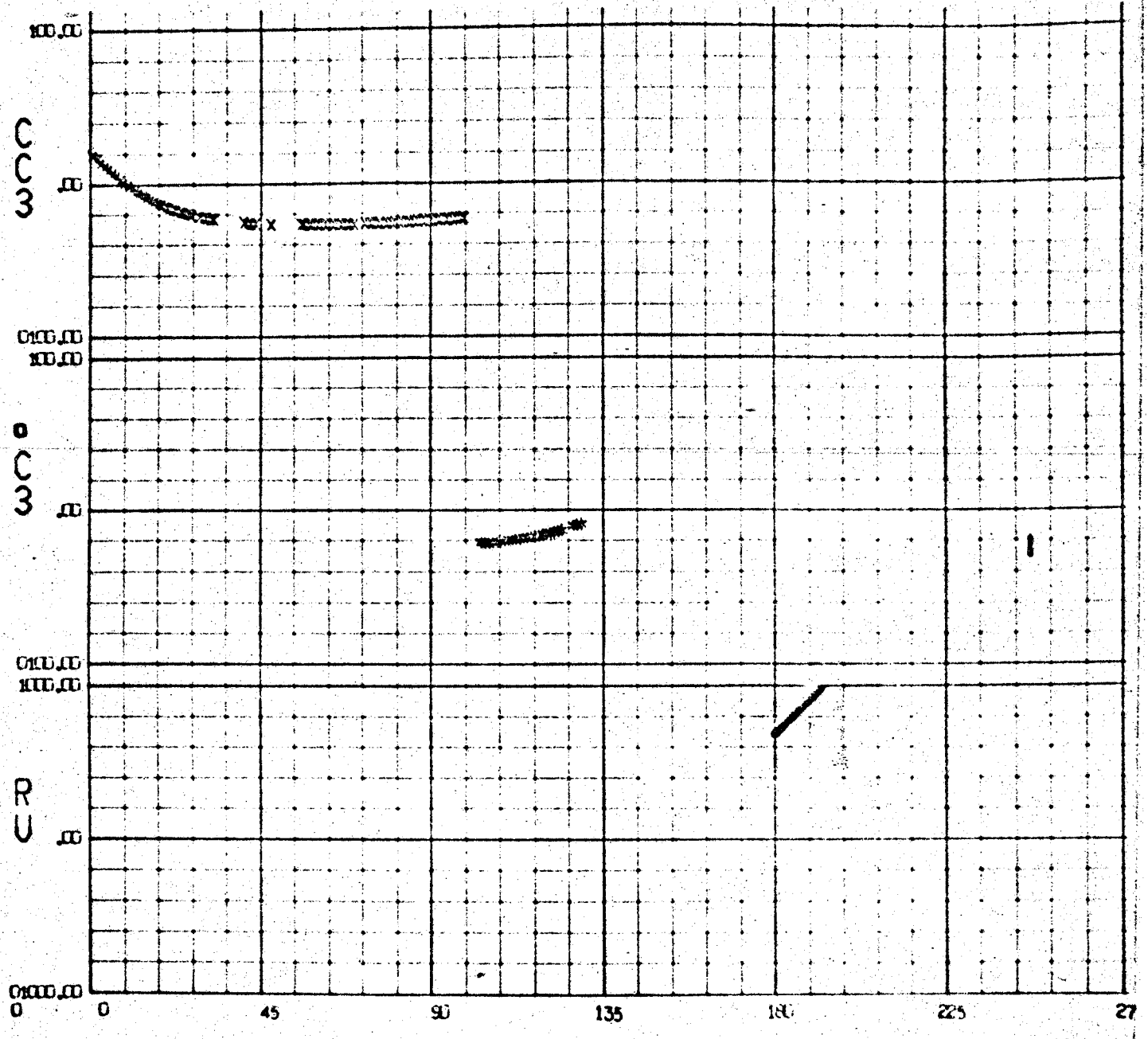
REV LTR



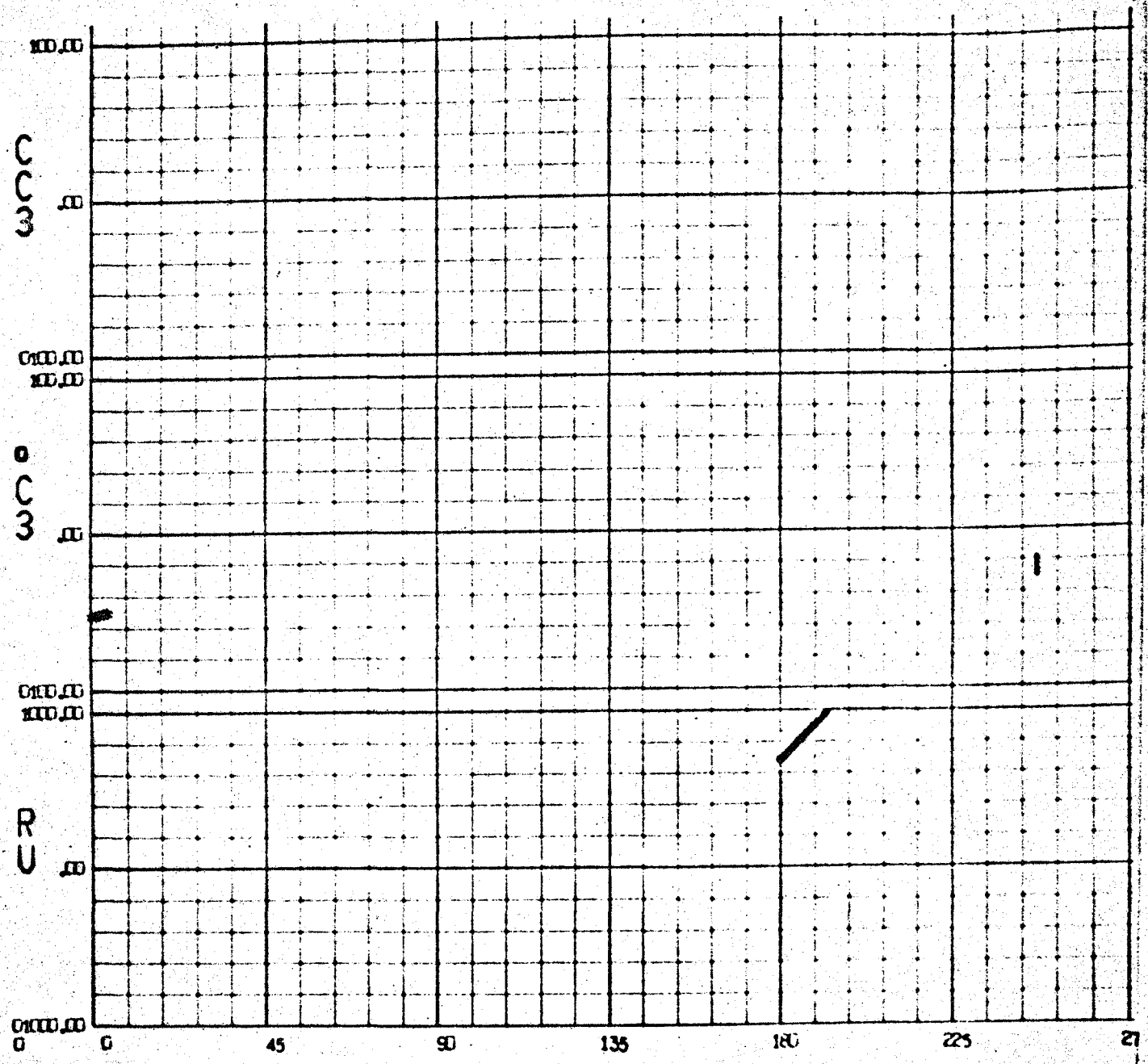
STATION 62 RESIDUALS PASS NUMBER 09/222



STATION 41 RESIDUALS PASS NUMBER 09/222

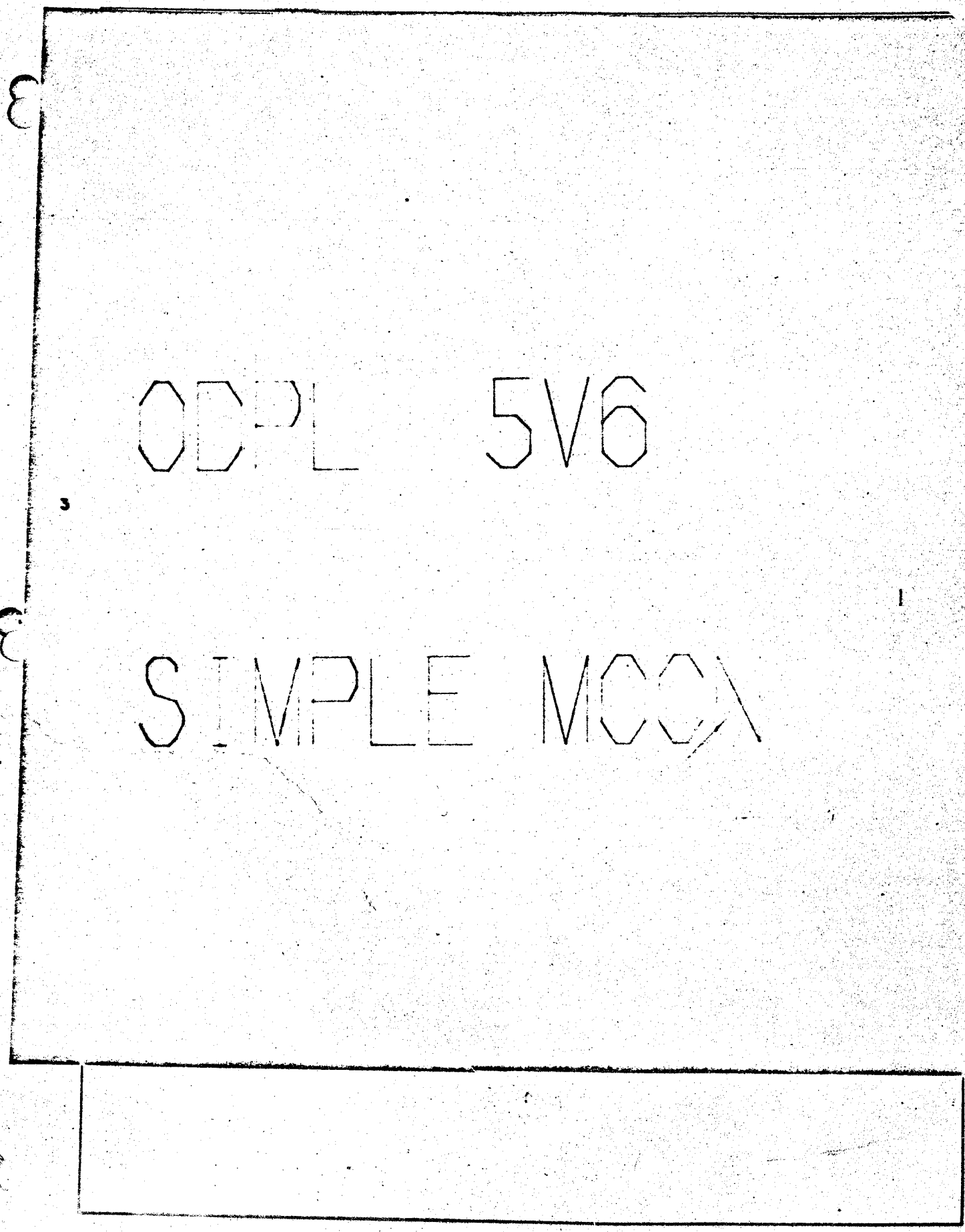


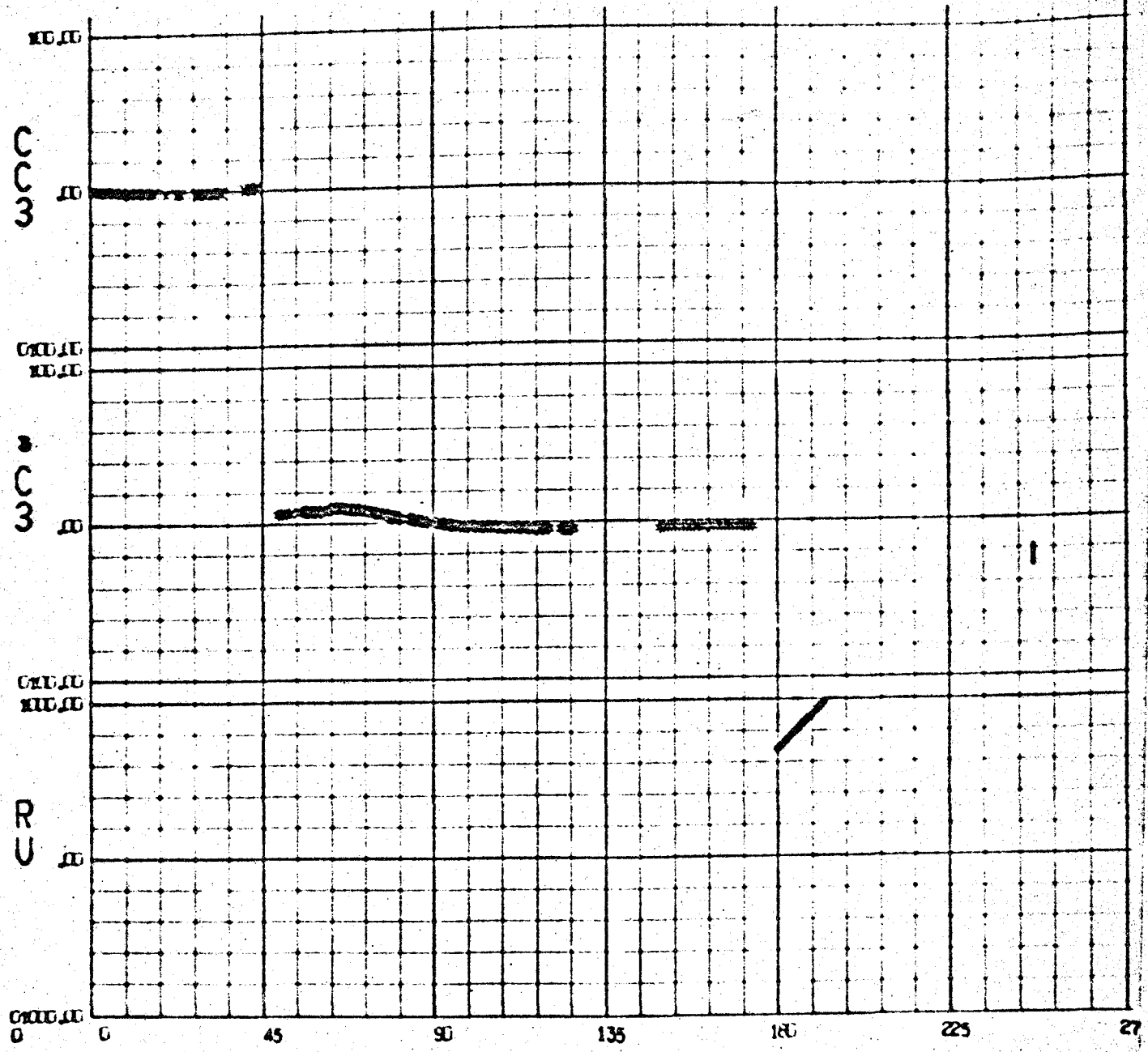
STATION 41 RESIDUALS PASS NUMBER 09/222



TIME IN MINUTES FROM 67/08/10 18 HRS 20 MIN GMT. ITERATION 1

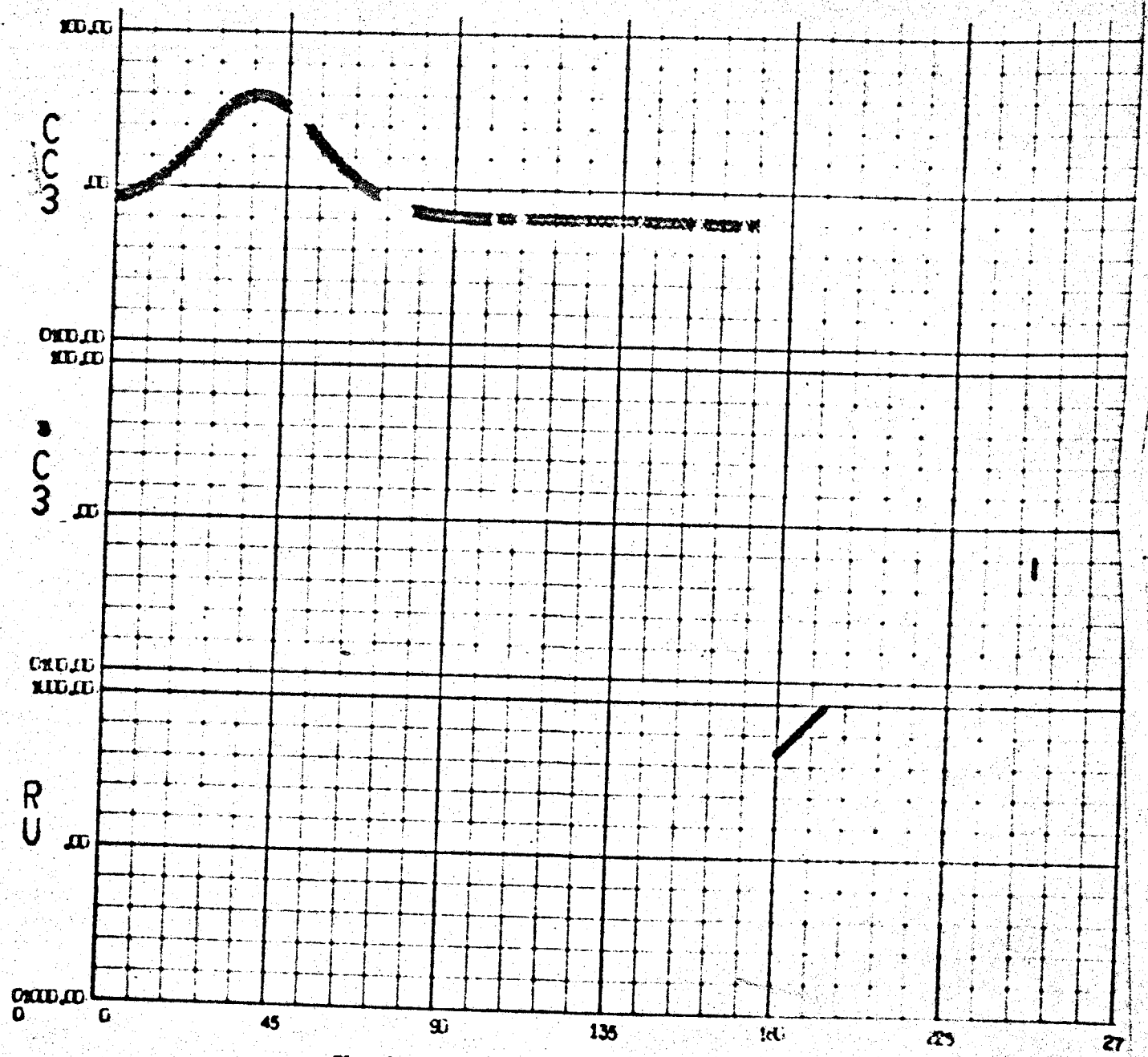
STATION 12 RESIDUALS PASS NUMBER 09/222


ODPL 5V6
SIMPLE MOD

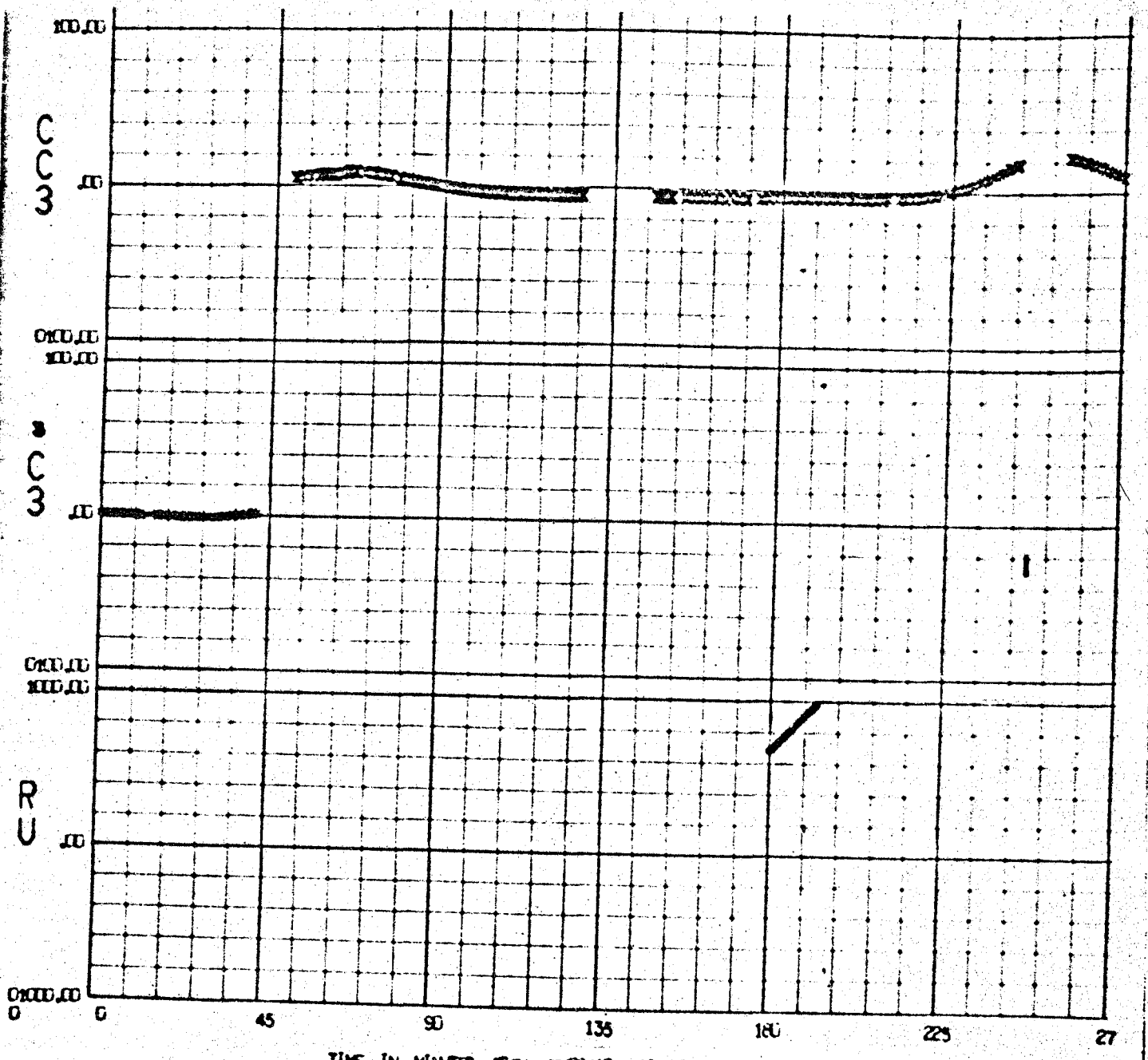


TIME IN MINUTES FROM 67/08/10 18 HRS 25 MIN GMT. ITERATION 1

STATION 62 RESIDUALS PASS NUMBER 09/222

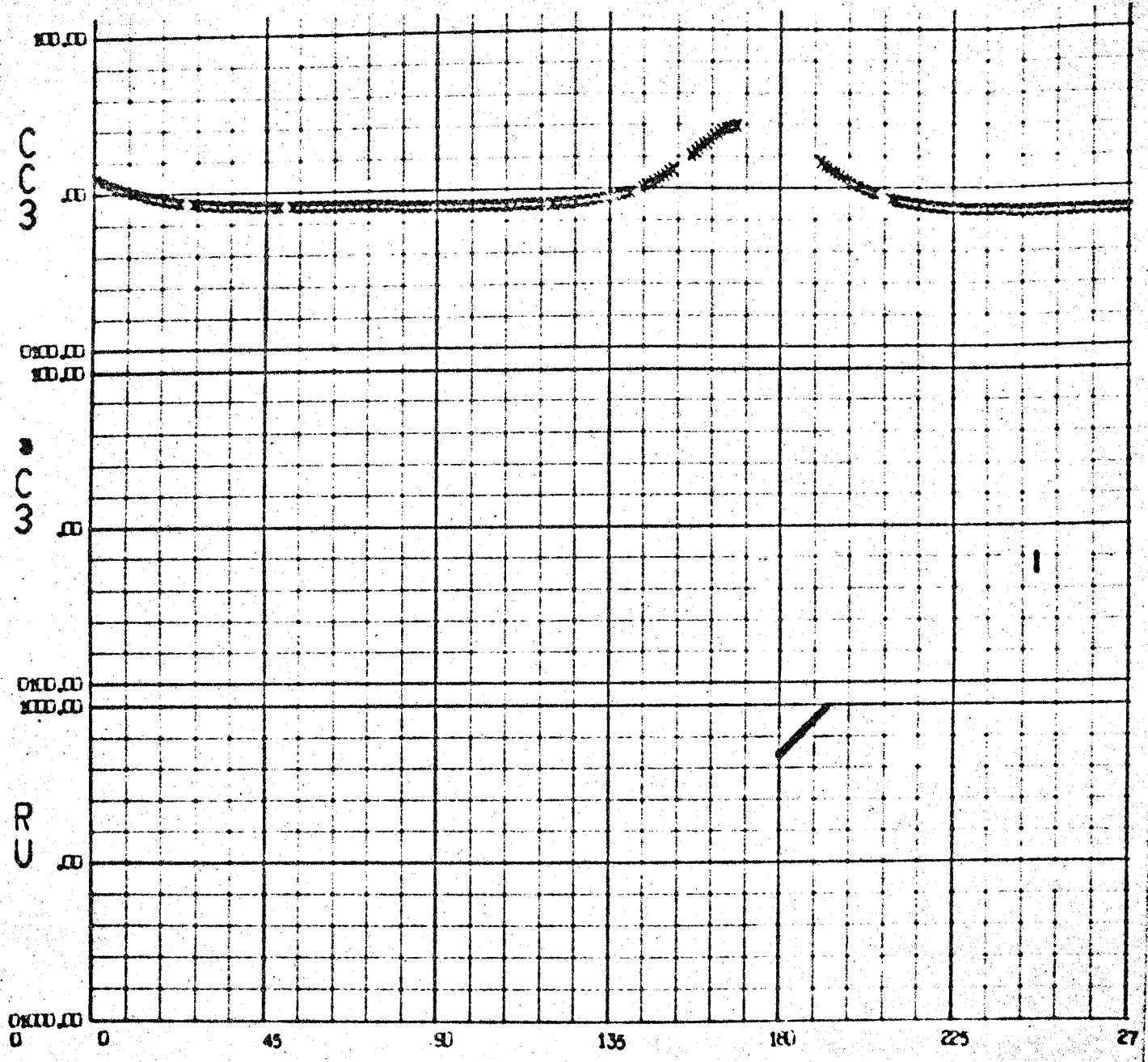


STATION 41 RESIDUALS PASS NUMBER 10/223

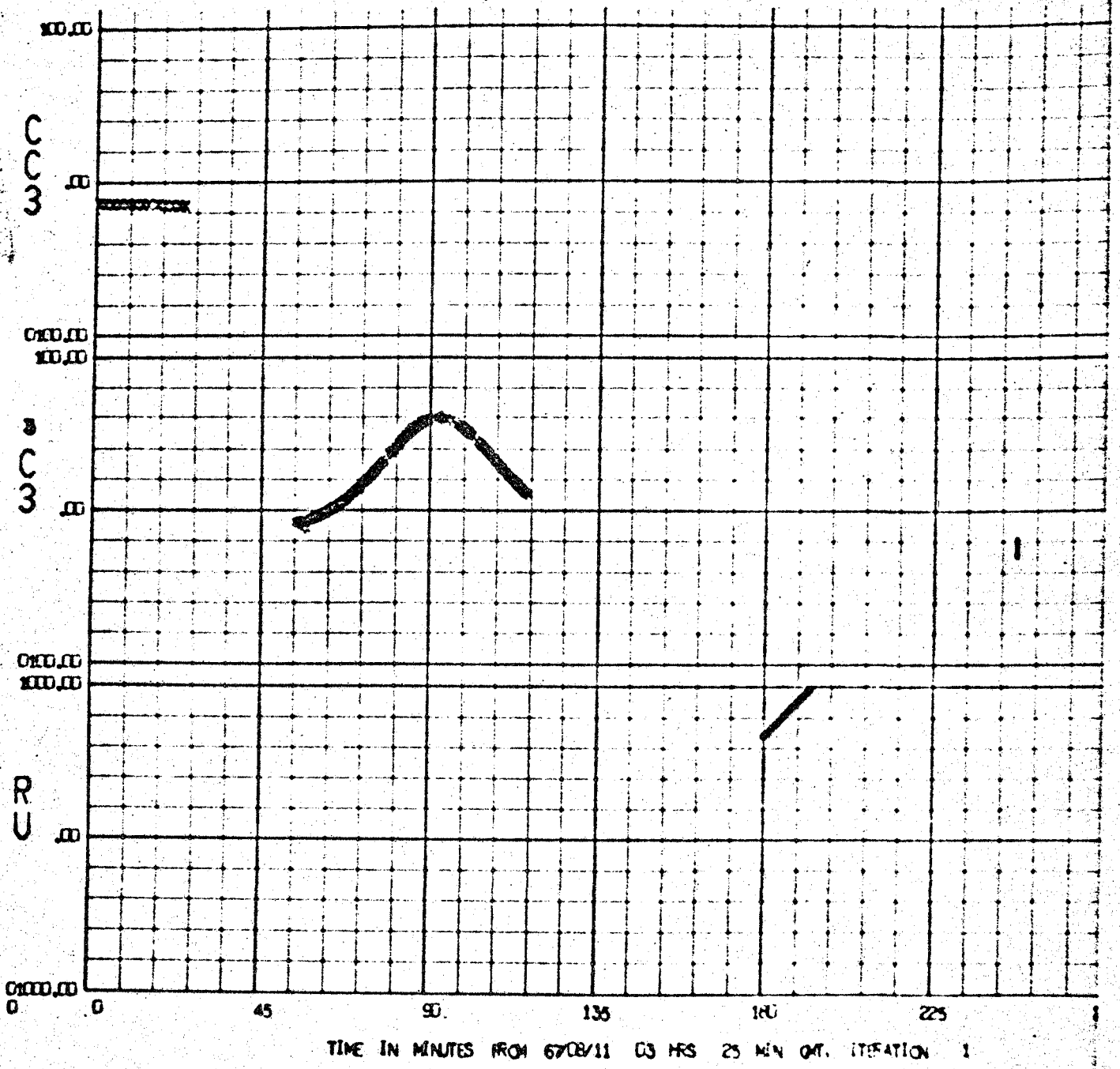


TIME IN MINUTES FROM 67/08/10 18 HRS 25 MIN GMT. ITERATION 1

STATION 12 RESIDUALS PASS NUMBER 09/222



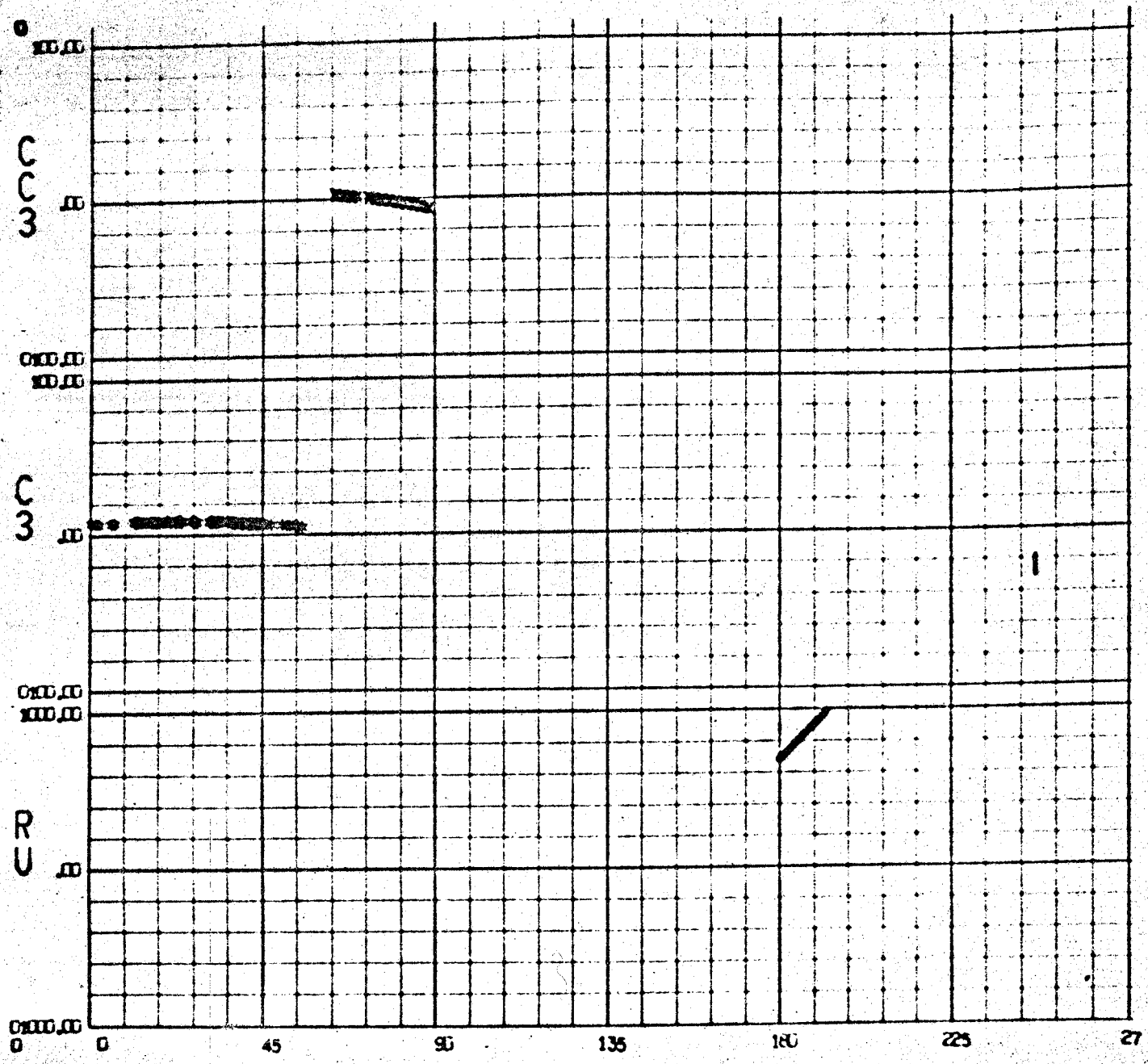
STATION 12 RESIDUALS PASS NUMBER 09/222



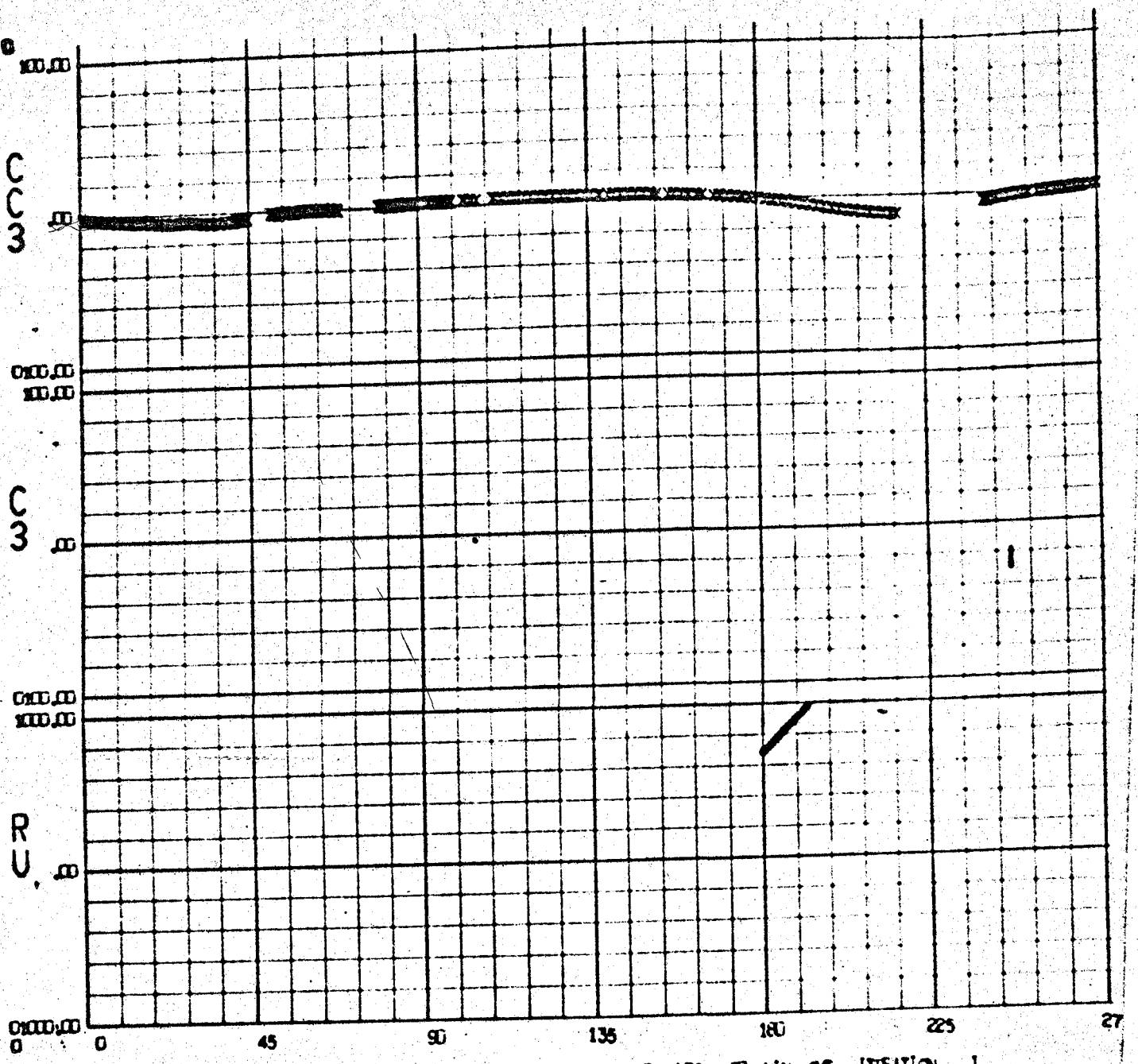
STATION 12 RESIDUALS PASS NUMBER 09/222

ODPL 5V8A

SIMPLE MOON

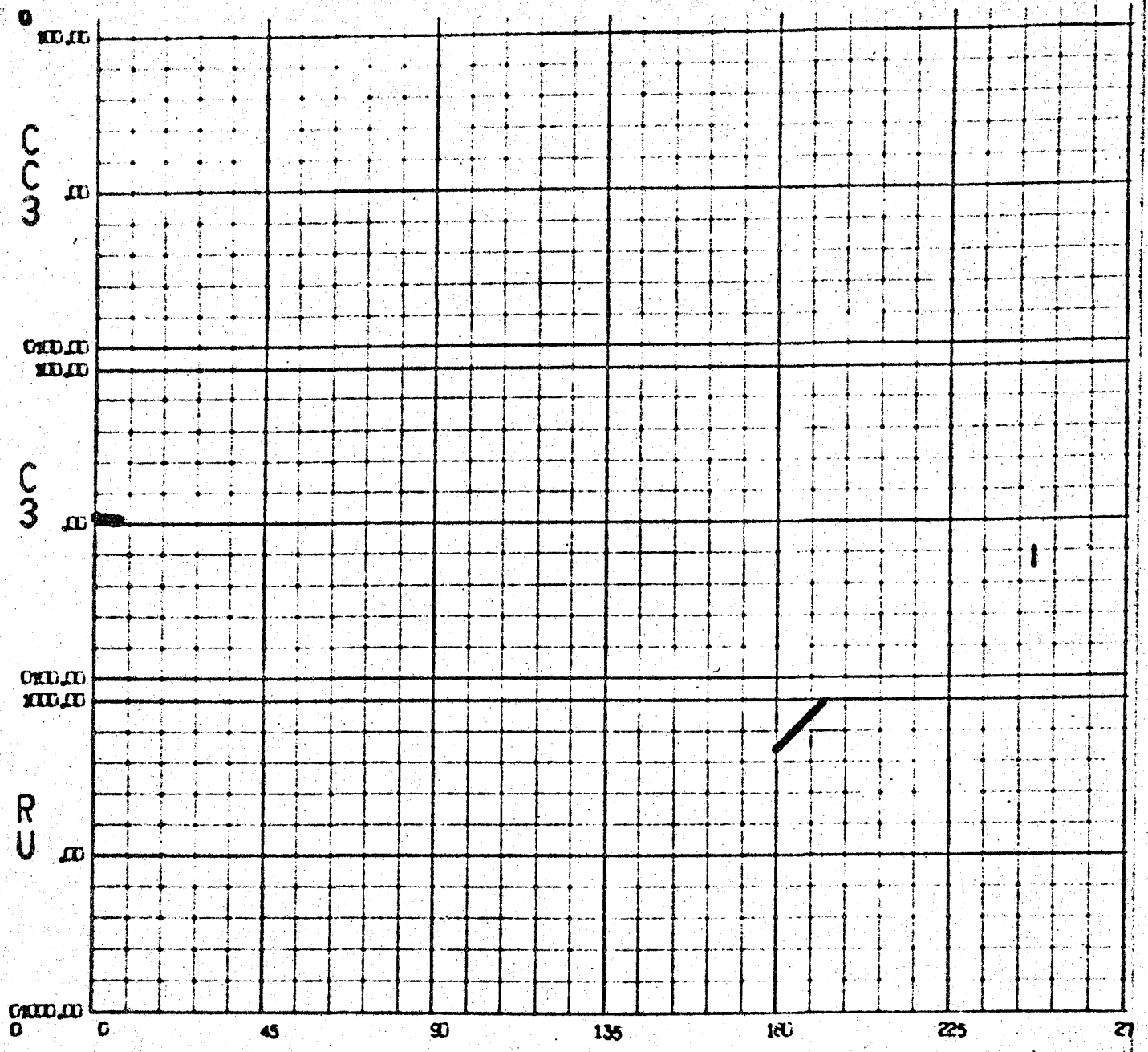


STATION 62 RESIDUALS PASS NUMBER 10/223

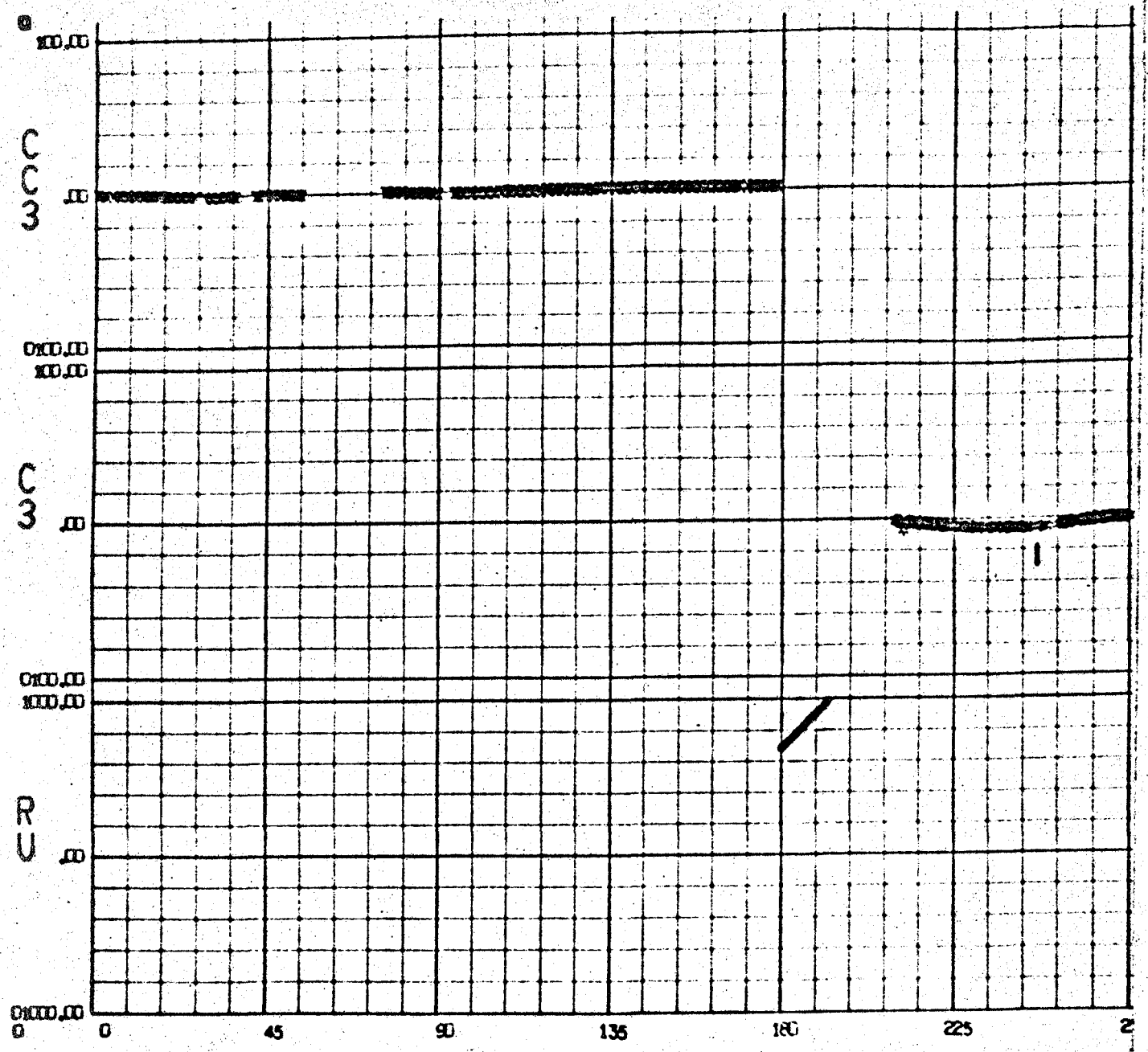


STATION 41 RESIDUALS PASS NUMBER 10/223

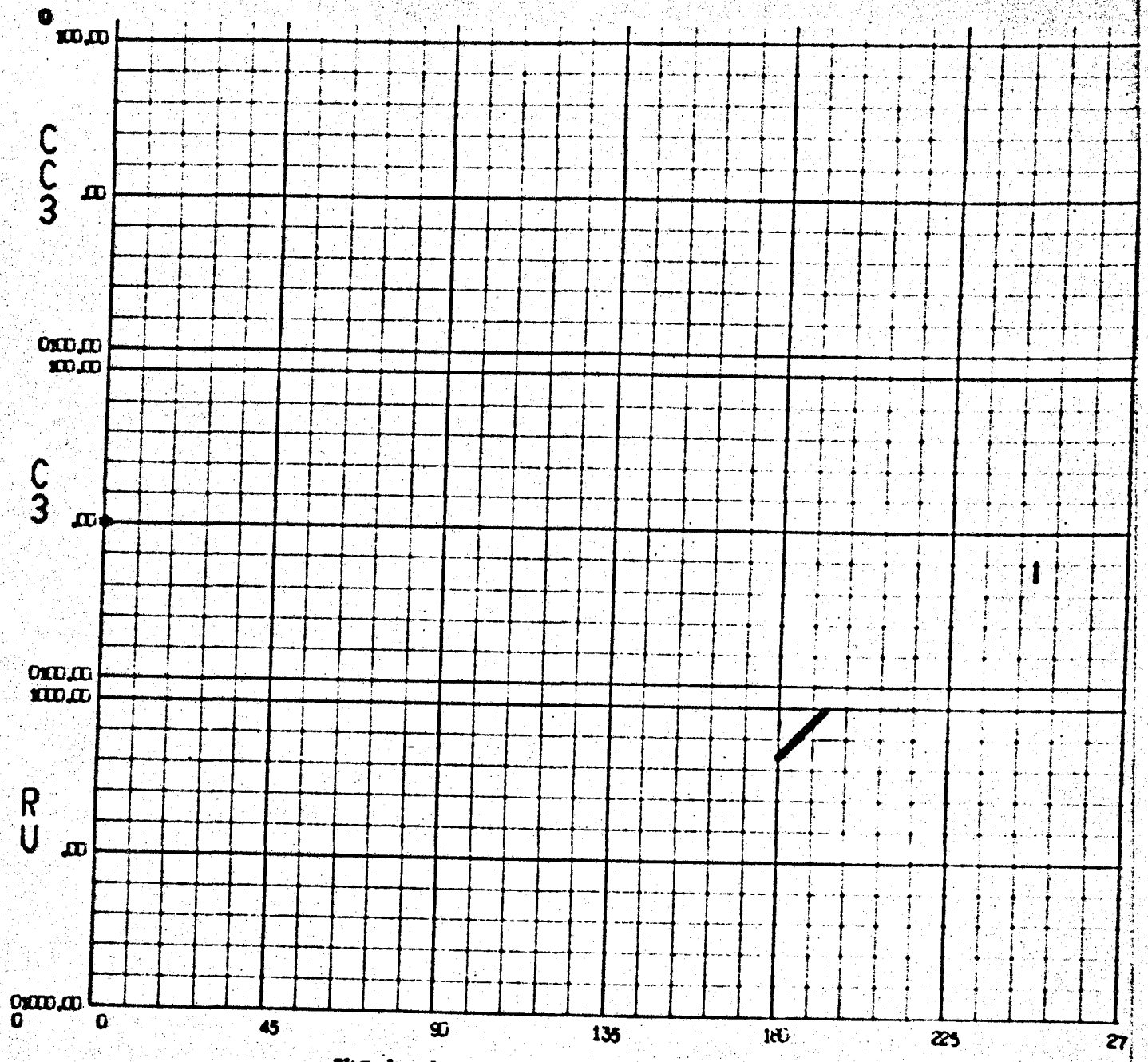
STATION 41 RESIDUALS PASS NUMBER 10/223



STATION 41 RESIDUALS PASS NUMBER 10/223



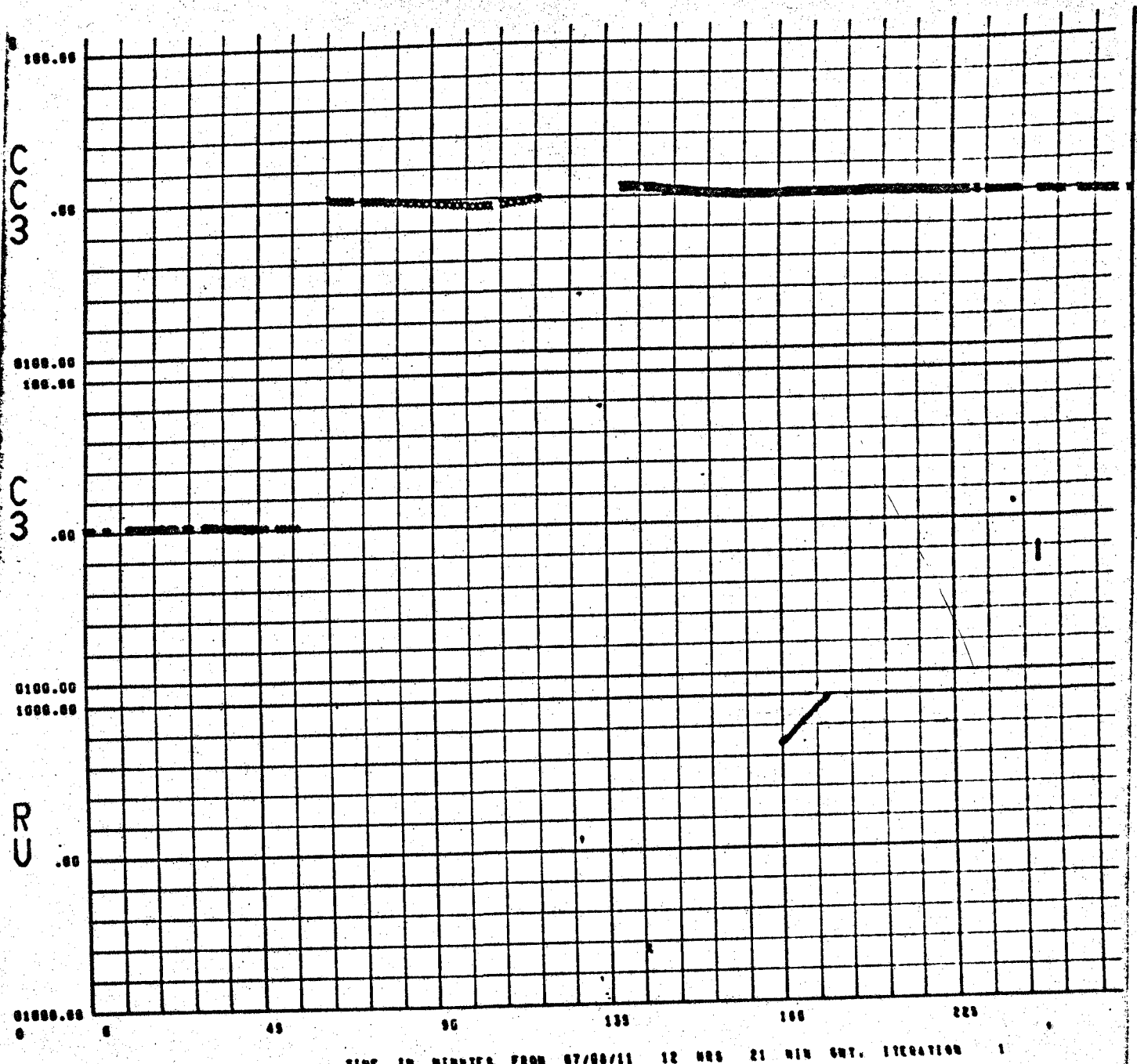
STATION 12 RESIDUALS PASS NUMBER 09/222



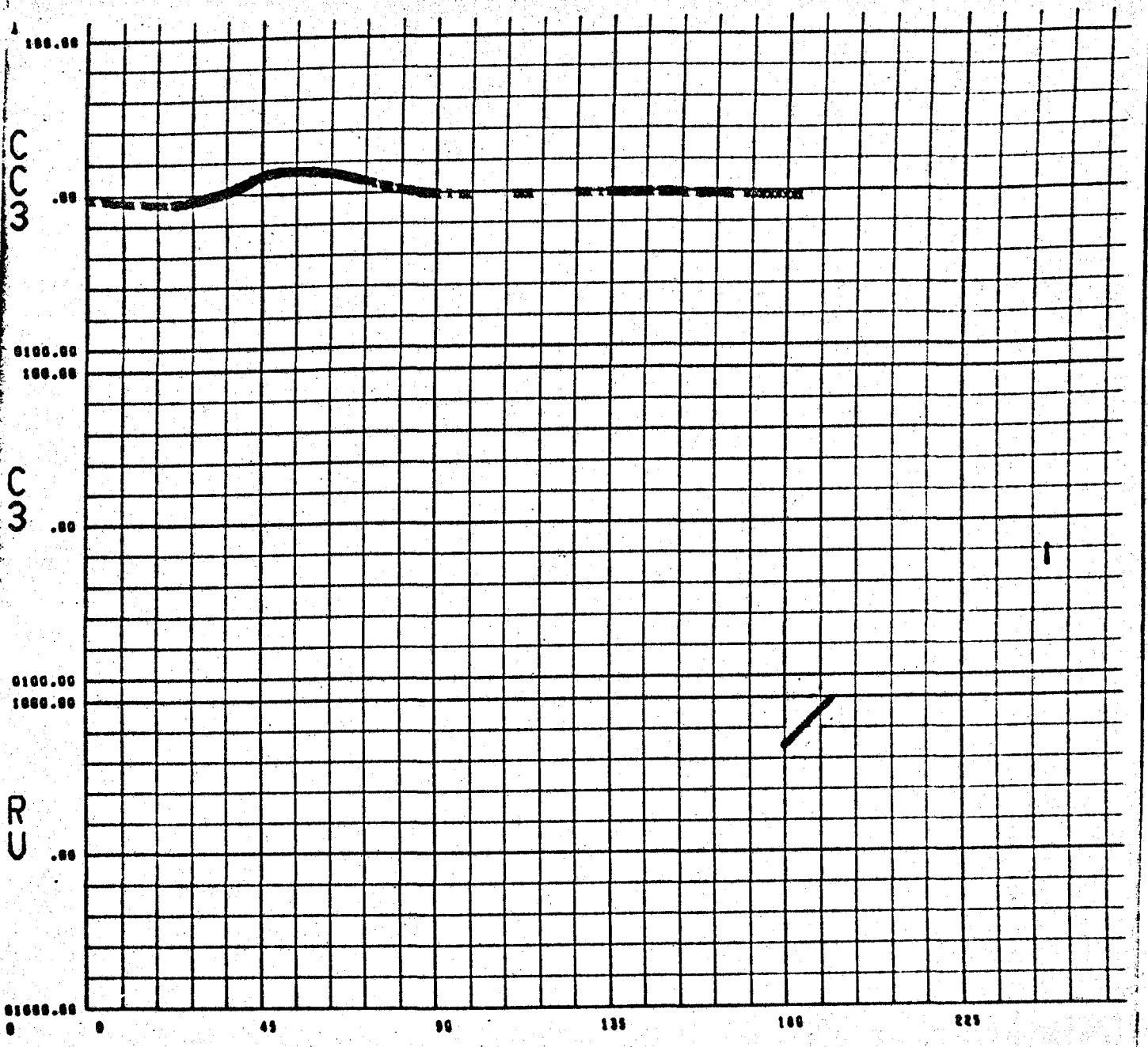
STATION 12 RESIDUALS PASS NUMBER 09/222

ODPL 5V9.1

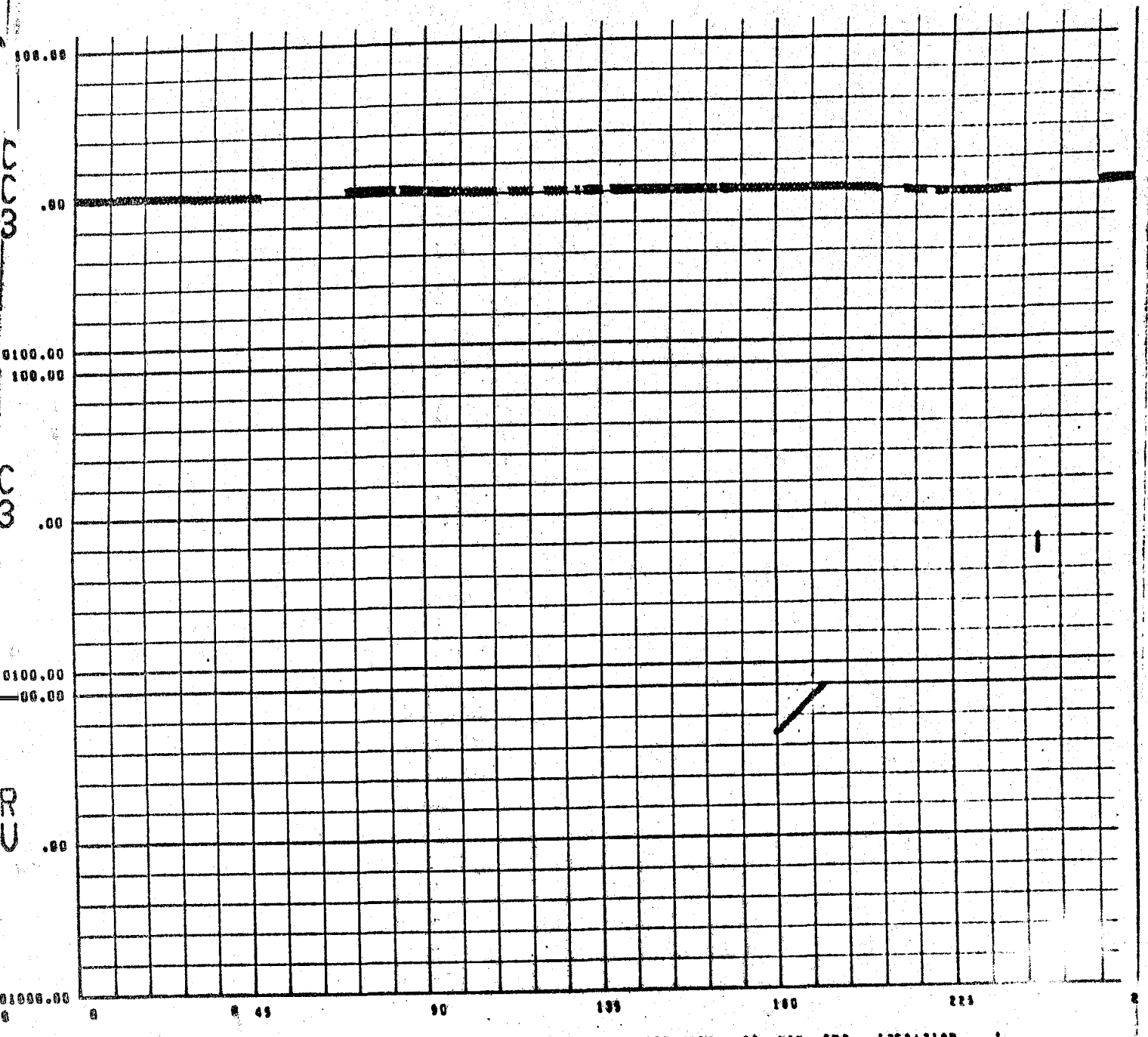
SIMPLE MOON



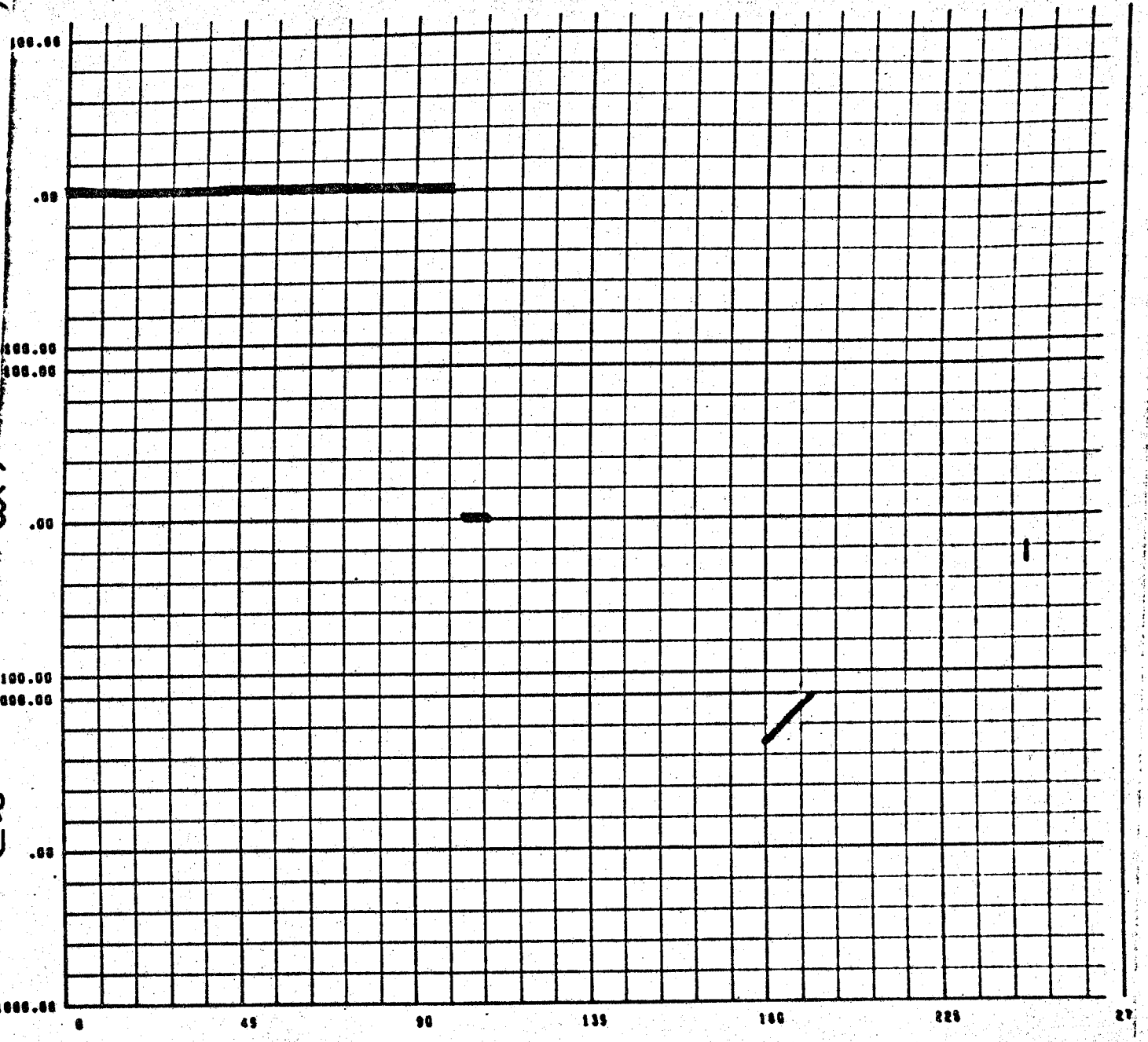
STATION 62 RESIDUALS PASS NUMBER 10/223



STATION 62 RESIDUALS PASS NUMBER 10/223

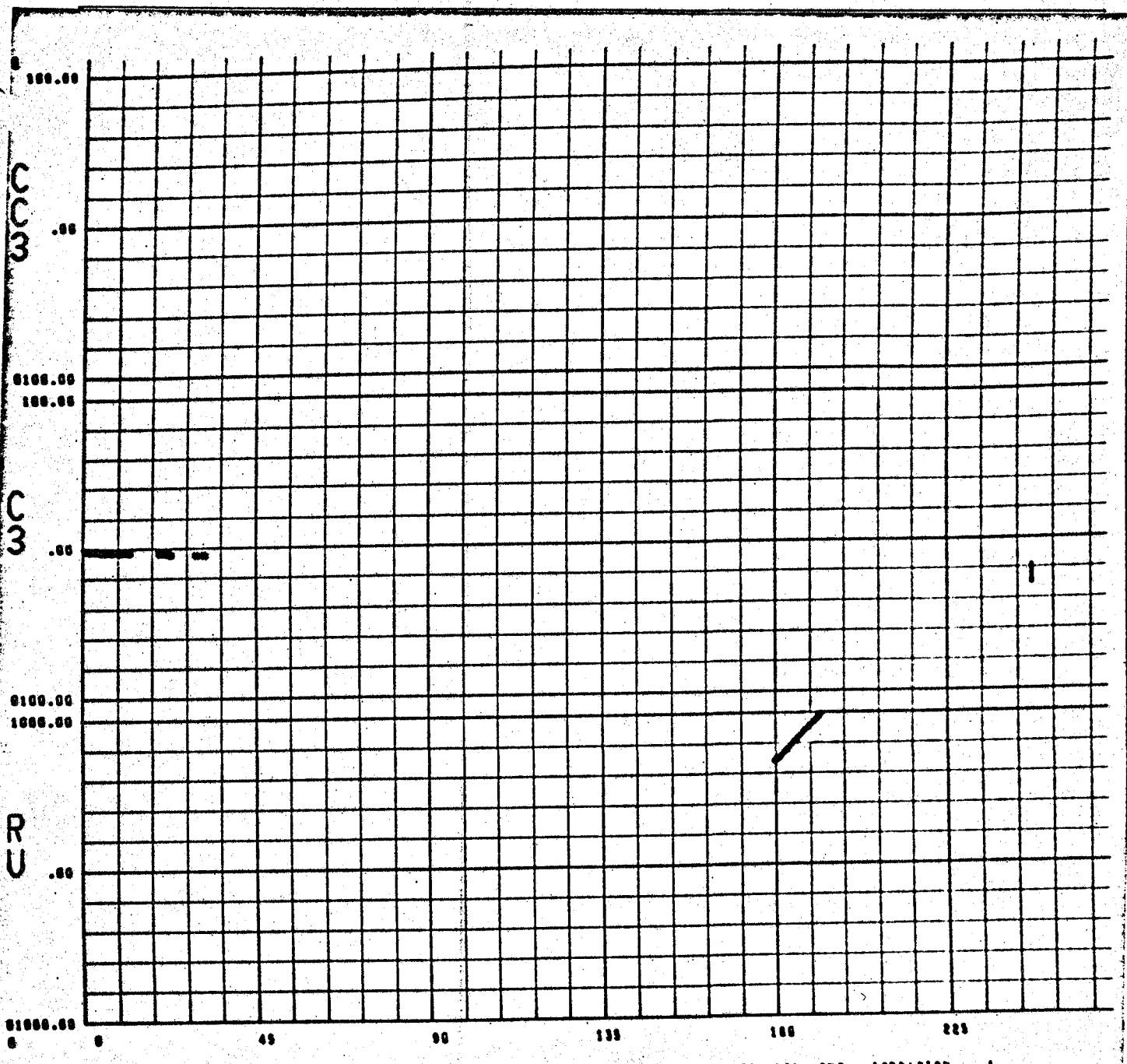


STATION 41 RESIDUALS PASS NUMBER 10/223



TIME IN MINUTES FROM 67/08/11 11 HRS 48 MIN GMT, ITERATION 1

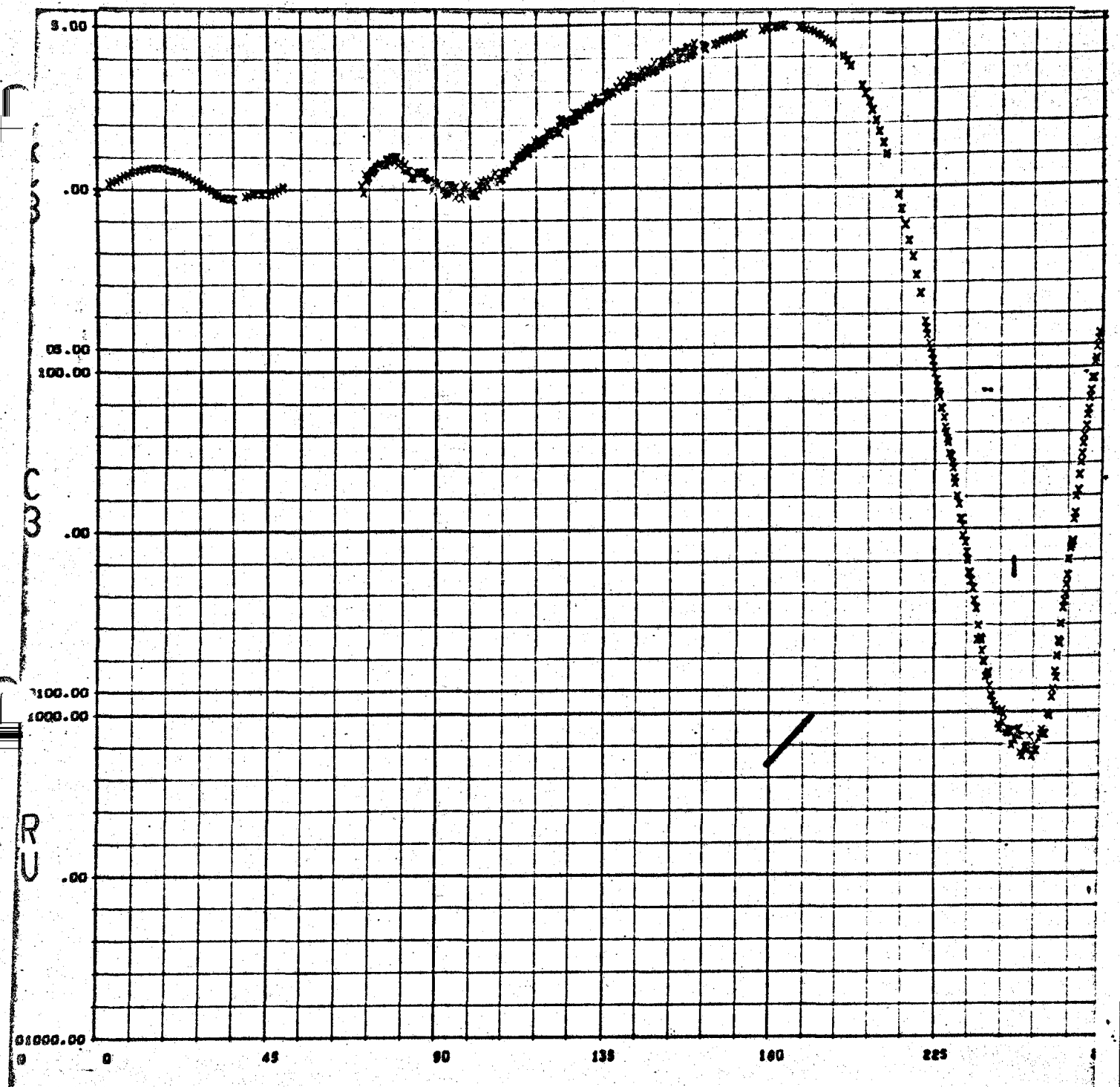
STATION 41 RESIDUALS PASS NUMBER 10/223



STATION 12 RESIDUALS PASS NUMBER 10/223

ODPL 5V10

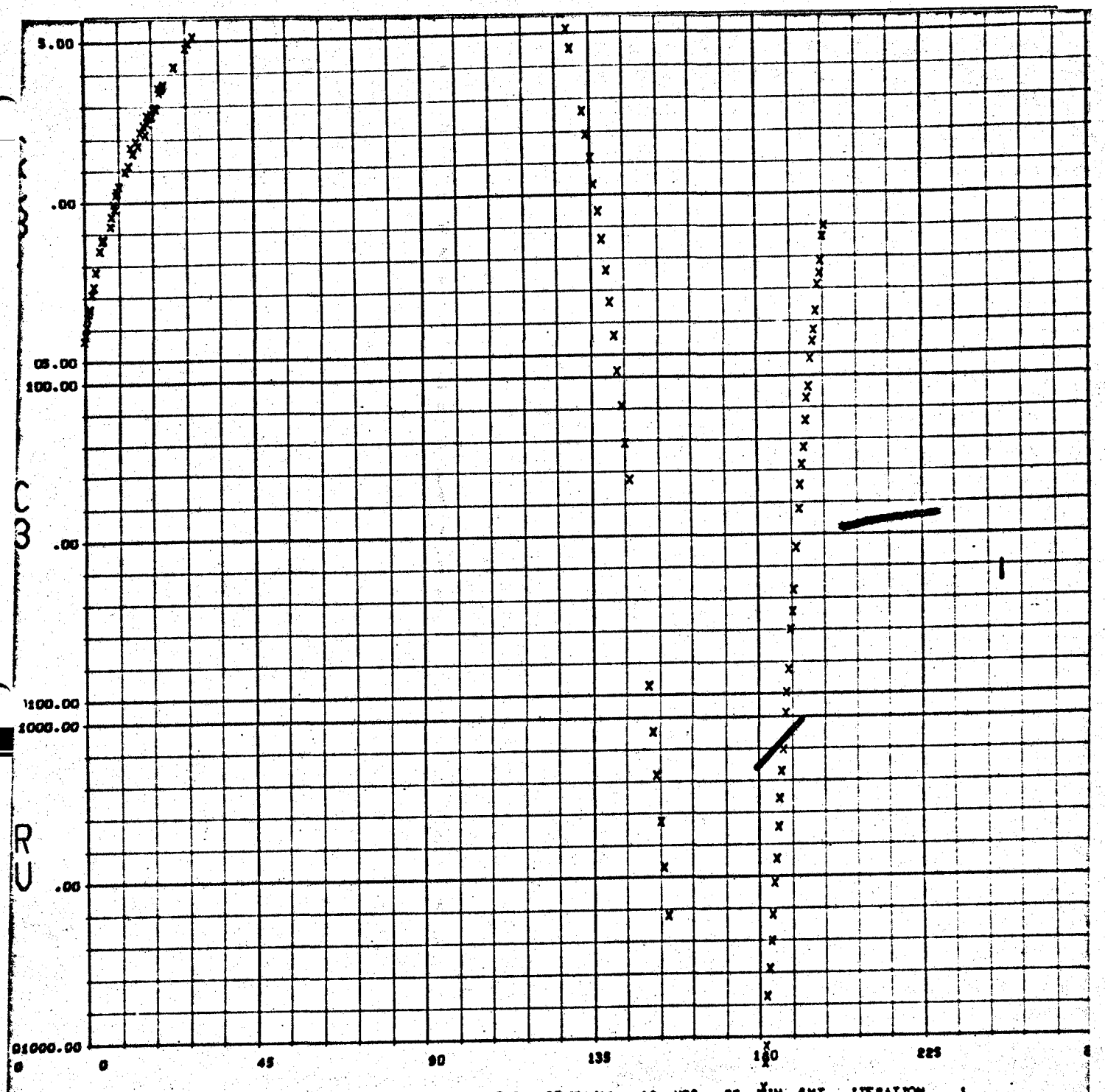
106 SIMPLI



STATION 62 RESIDUALS PASS NUMBER 10/223

REV LTR

U3 4288-2000 REV. 6/64



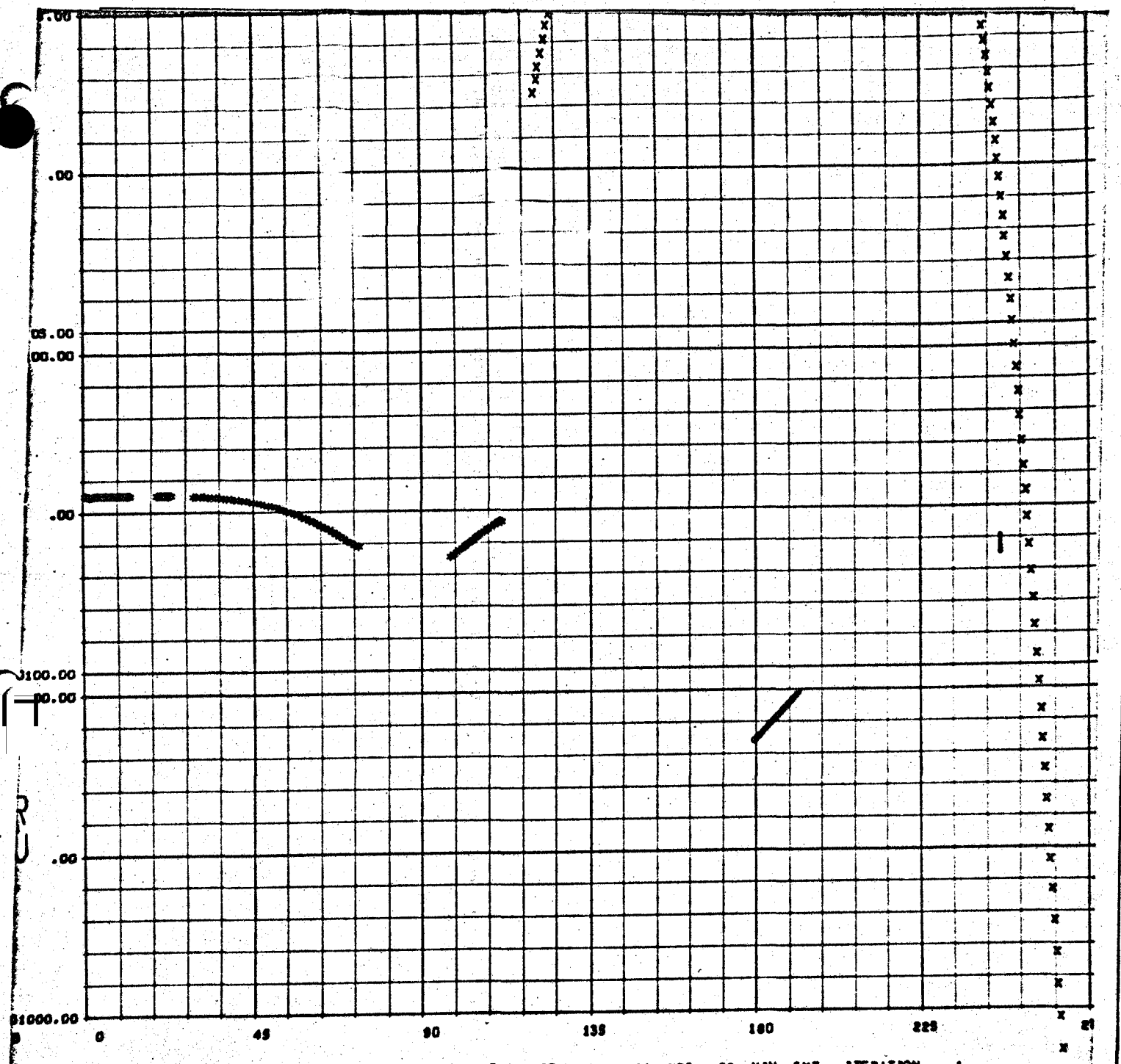
STATION 62 RESIDUALS PASS NUMBER 10/223

REV LTR

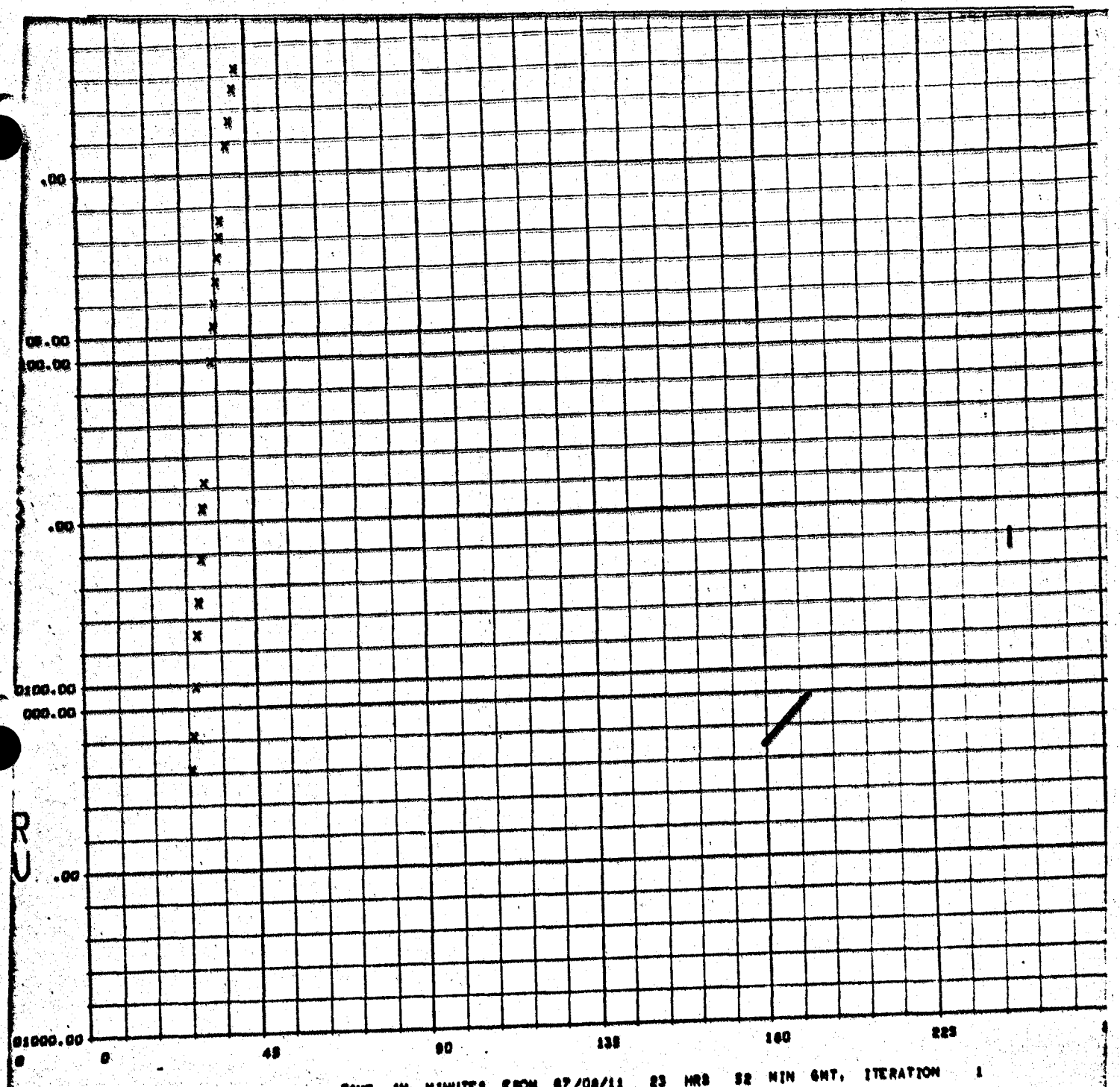
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 538

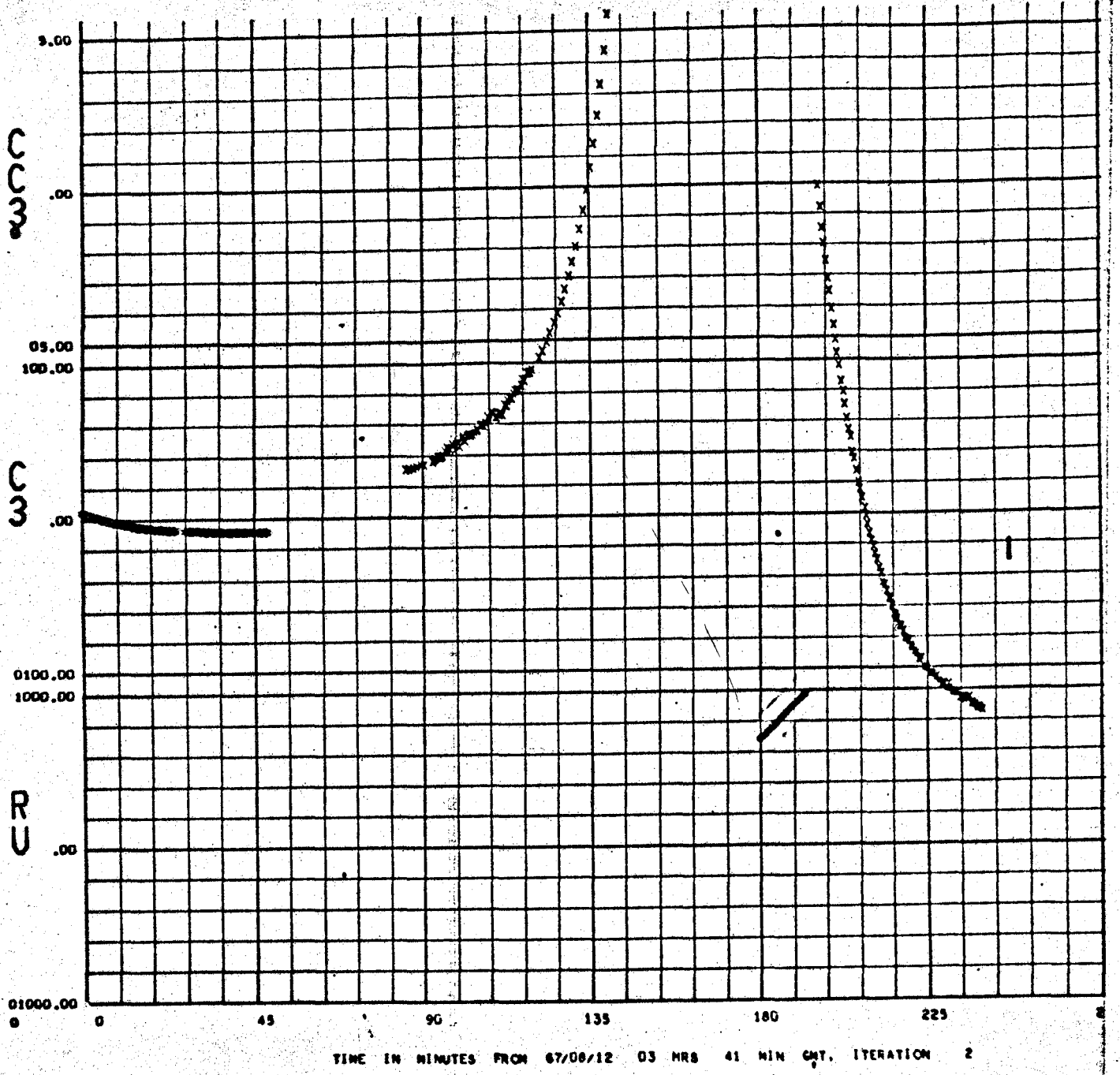


STATION 12 RESIDUALS PASS NUMBER 10/223

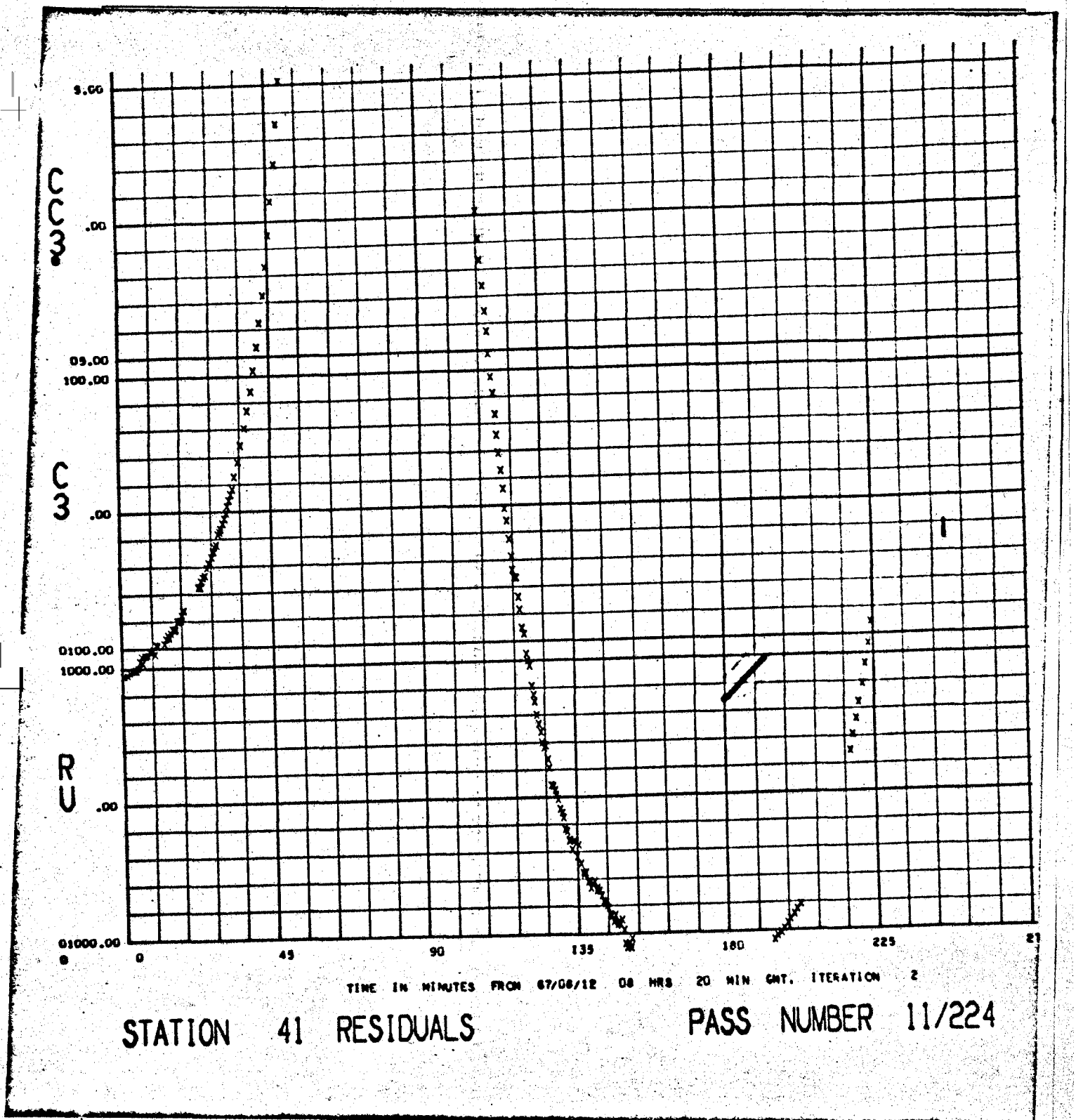

.00
00.00
100.00
.00
0100.00
000.00
.00
01000.00
0
45
90
135
180
225
TIME IN MINUTES FROM 67/08/11 23 HRS 52 MIN GMT, ITERATION 1
STATION 12 RESIDUALS
PASS NUMBER 10/223

0DPL 5V11B

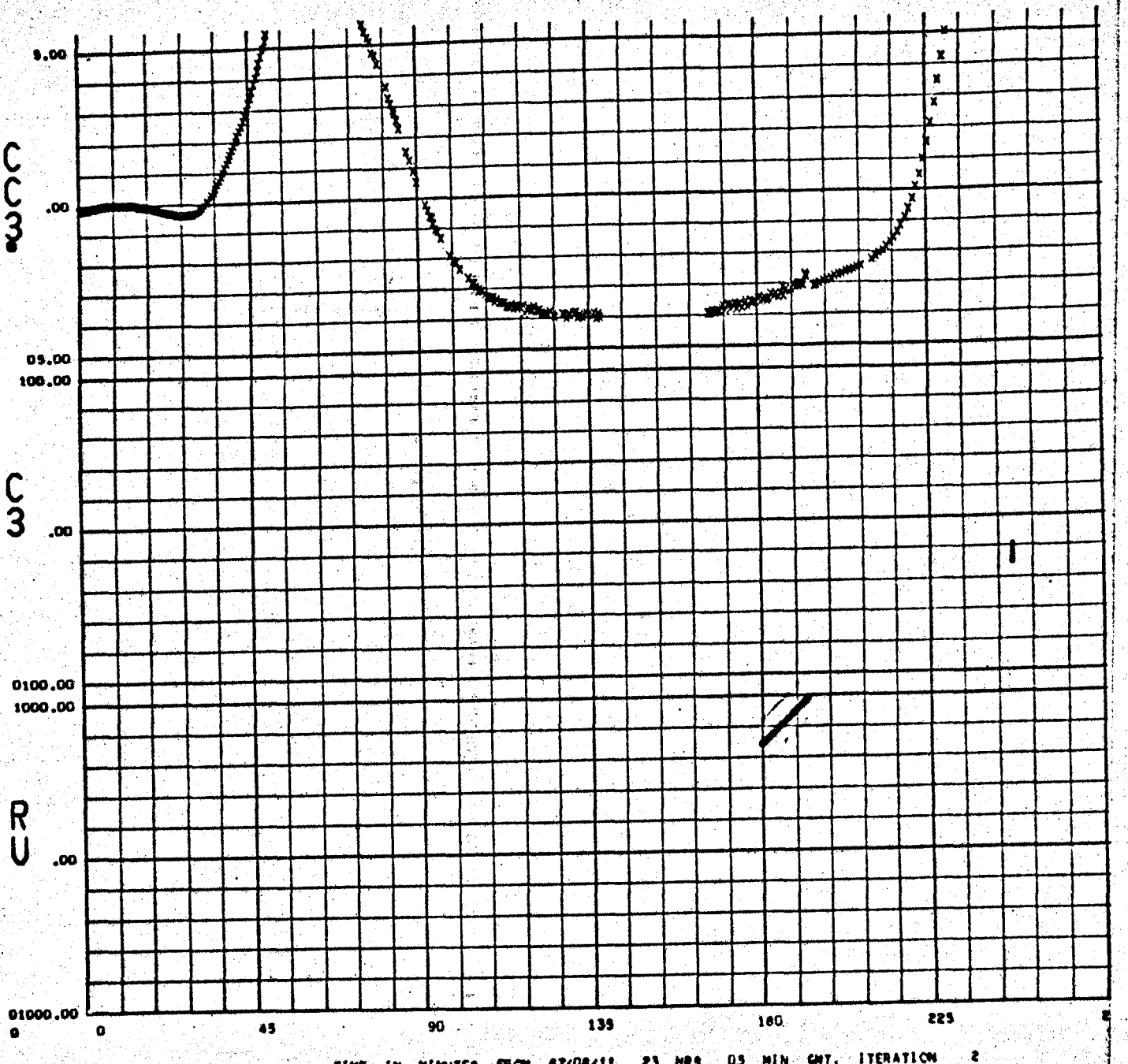
107 SIMPLI



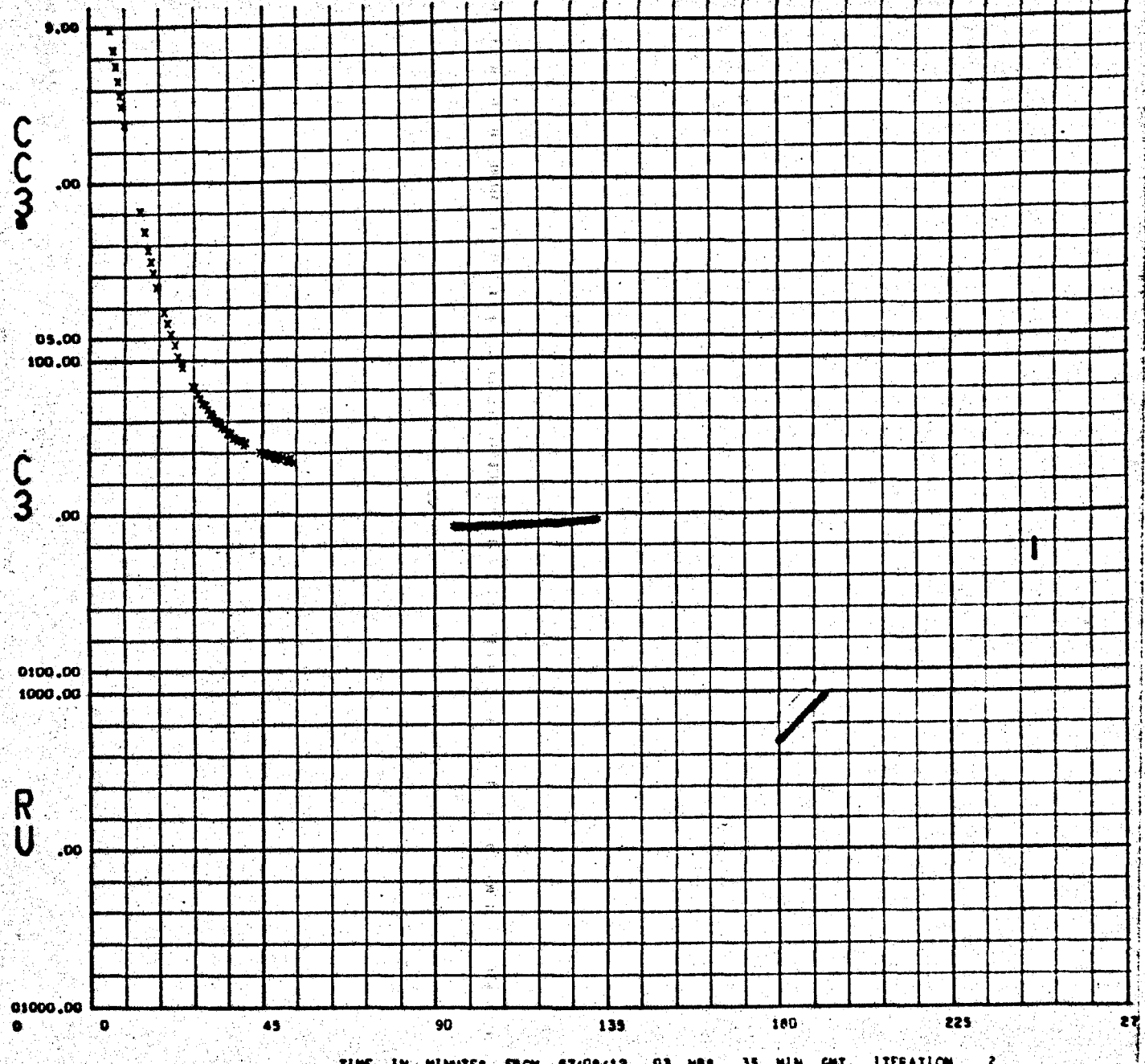
STATION 41 RESIDUALS PASS NUMBER 11/224



STATION 41 RESIDUALS PASS NUMBER 11/224



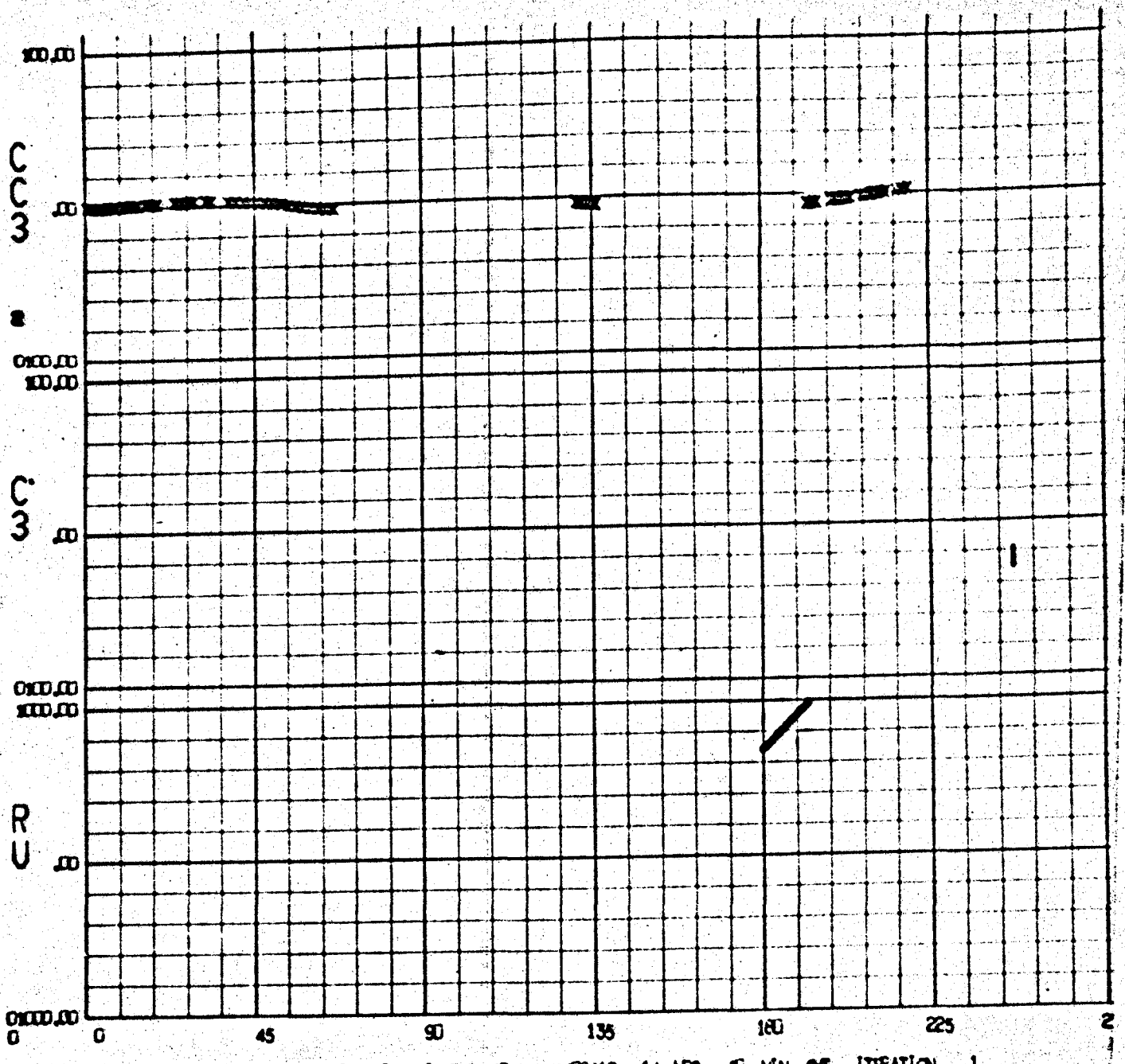
STATION 12 RESIDUALS PASS NUMBER 10/223



STATION 12 RESIDUALS PASS NUMBER 10/223

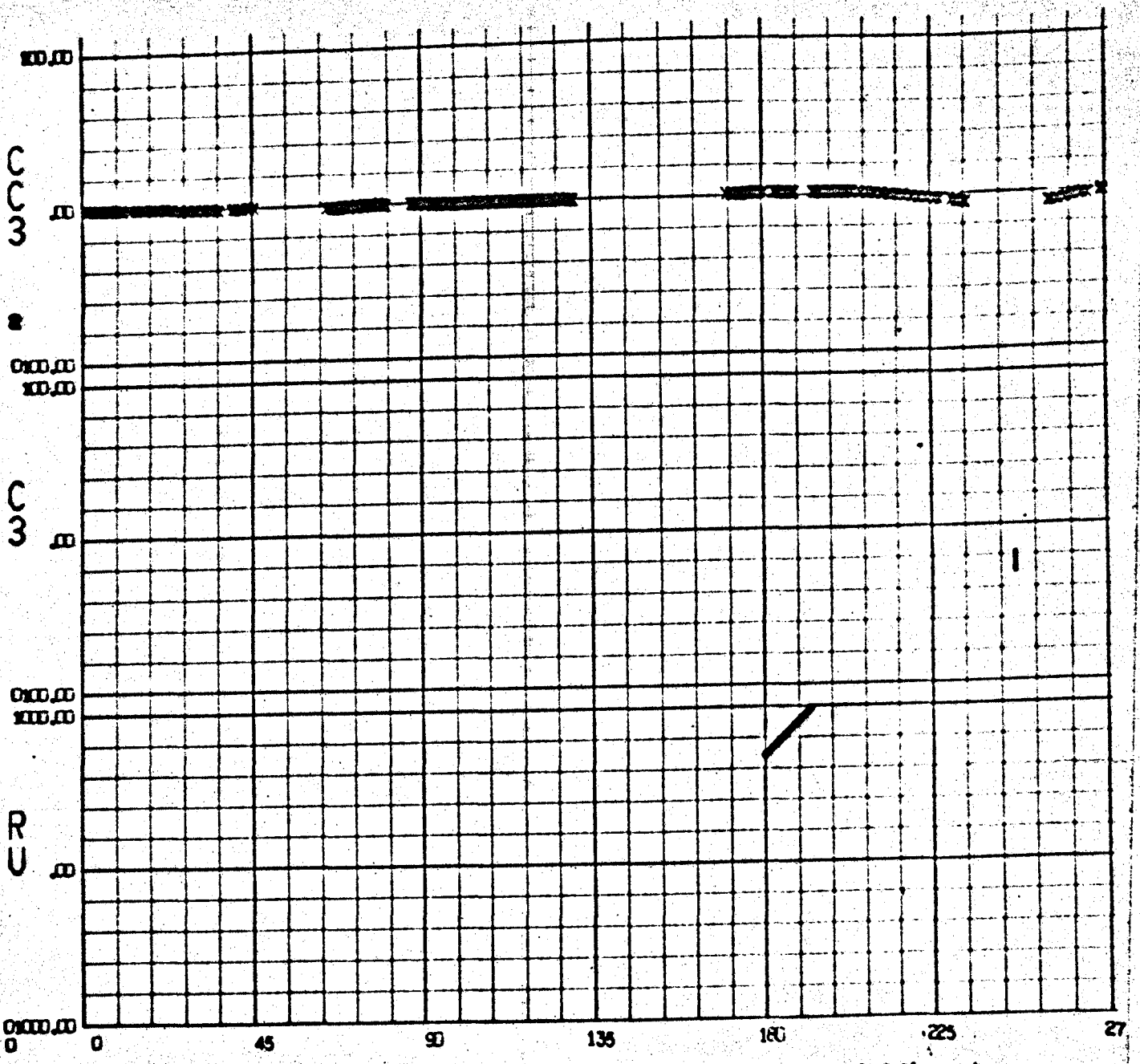
ODPL 5A18.1

SIMPLE MOON

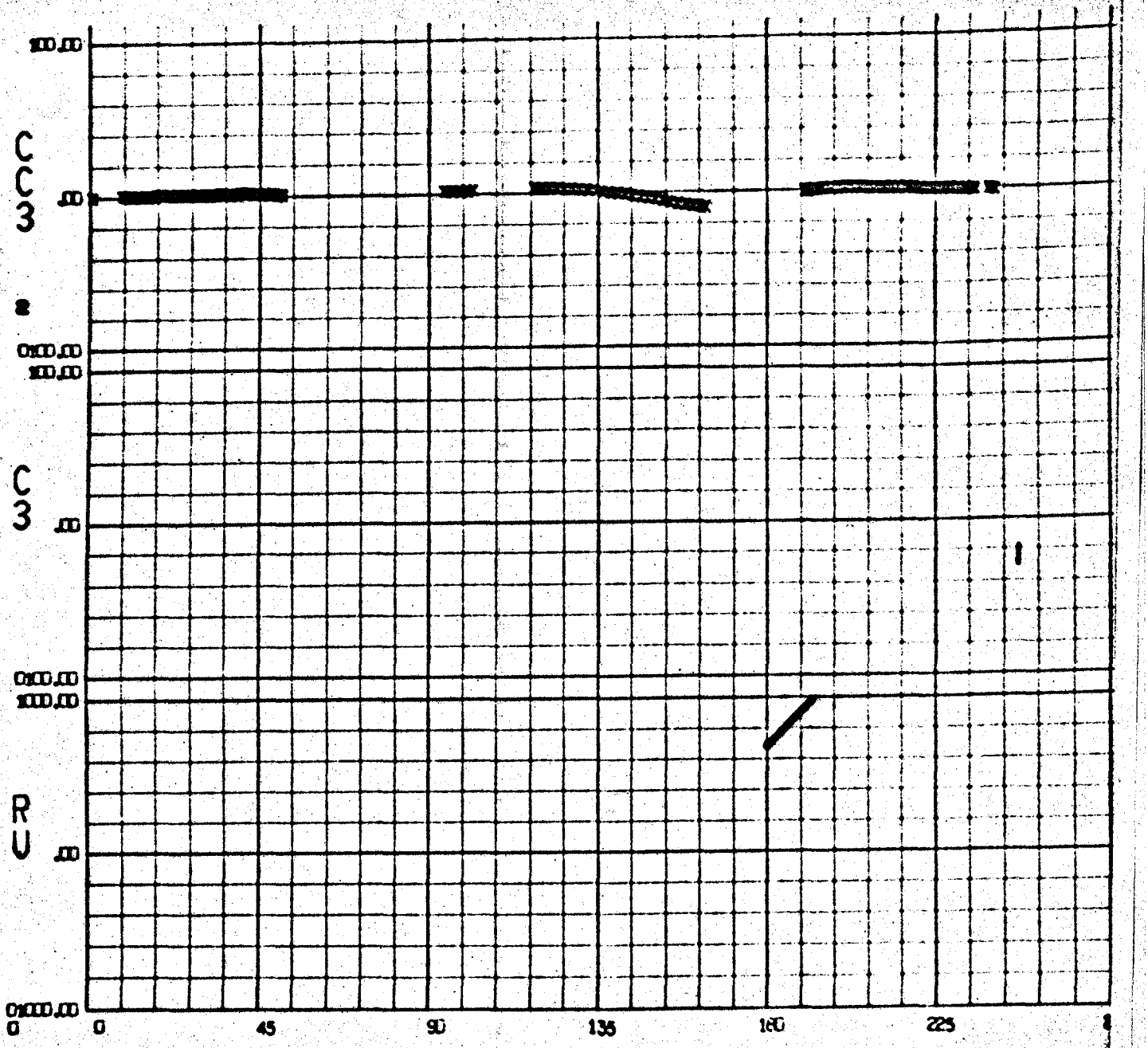


TIME IN MINUTES FROM 67/08/12 14 HRS 50 MIN GMT. ITERATION 1

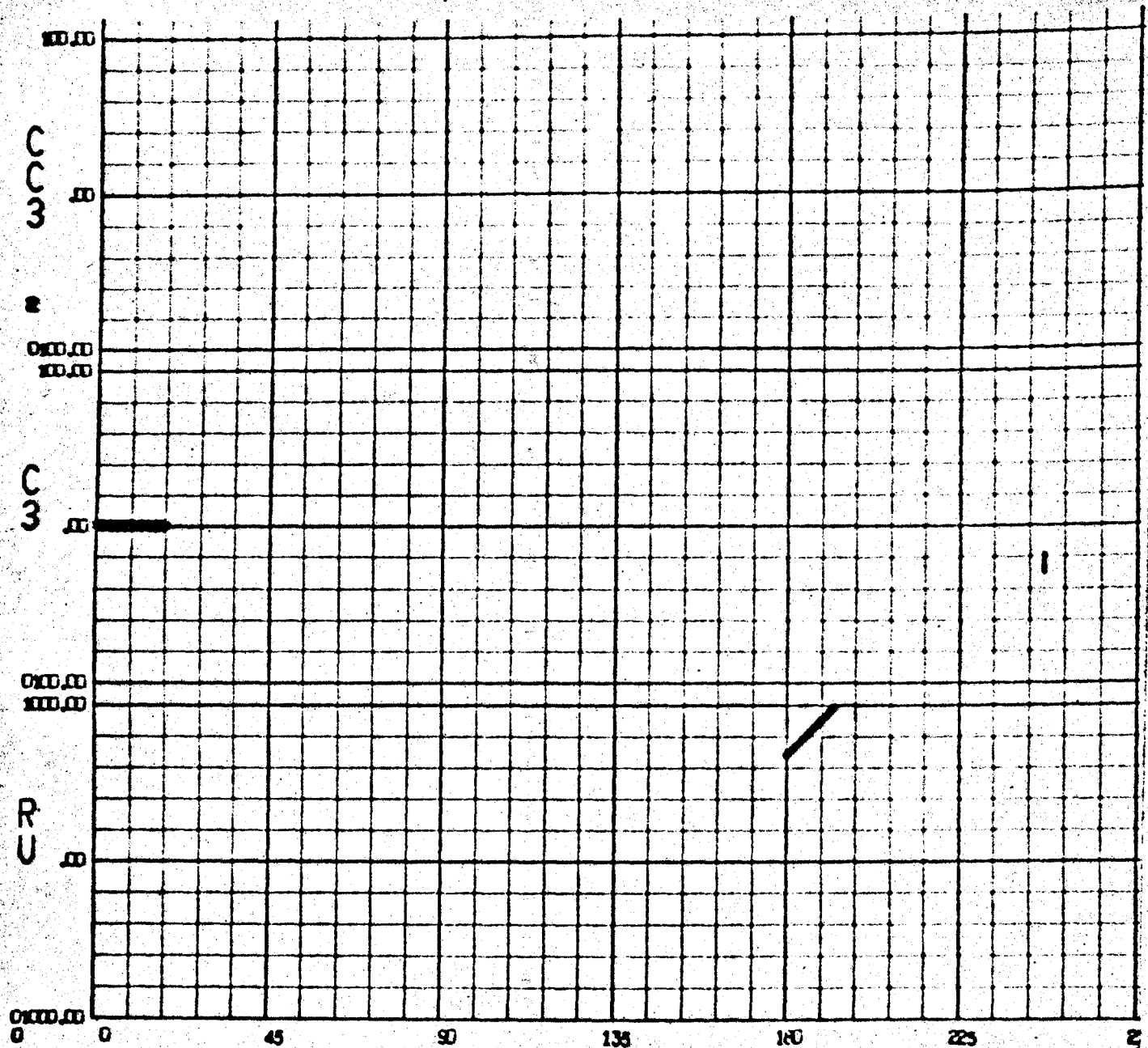
STATION 62 RESIDUALS PASS NUMBER 11/224



STATION 41 RESIDUALS PASS NUMBER 11/224



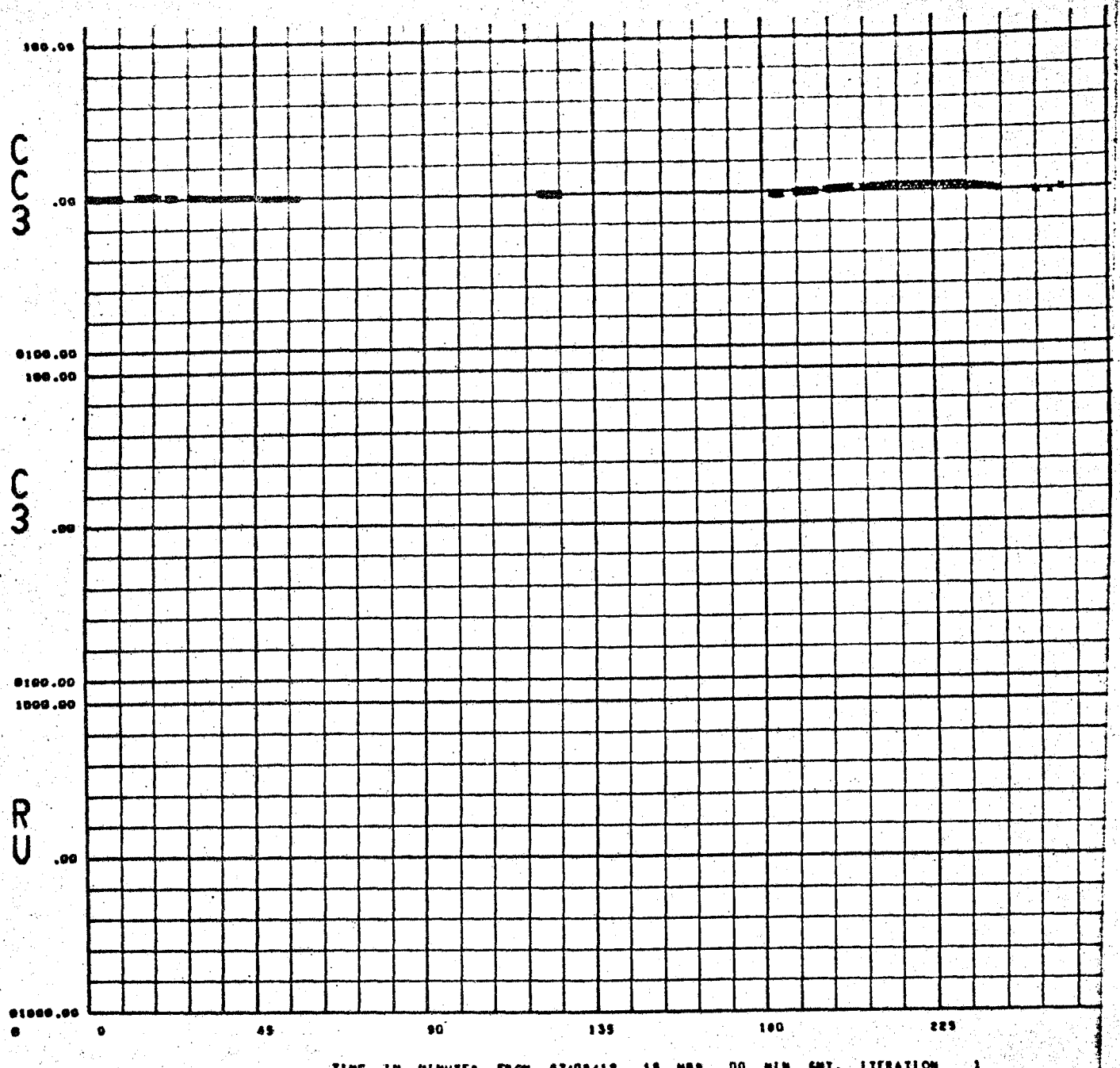
STATION 41 RESIDUALS PASS NUMBER 11/224



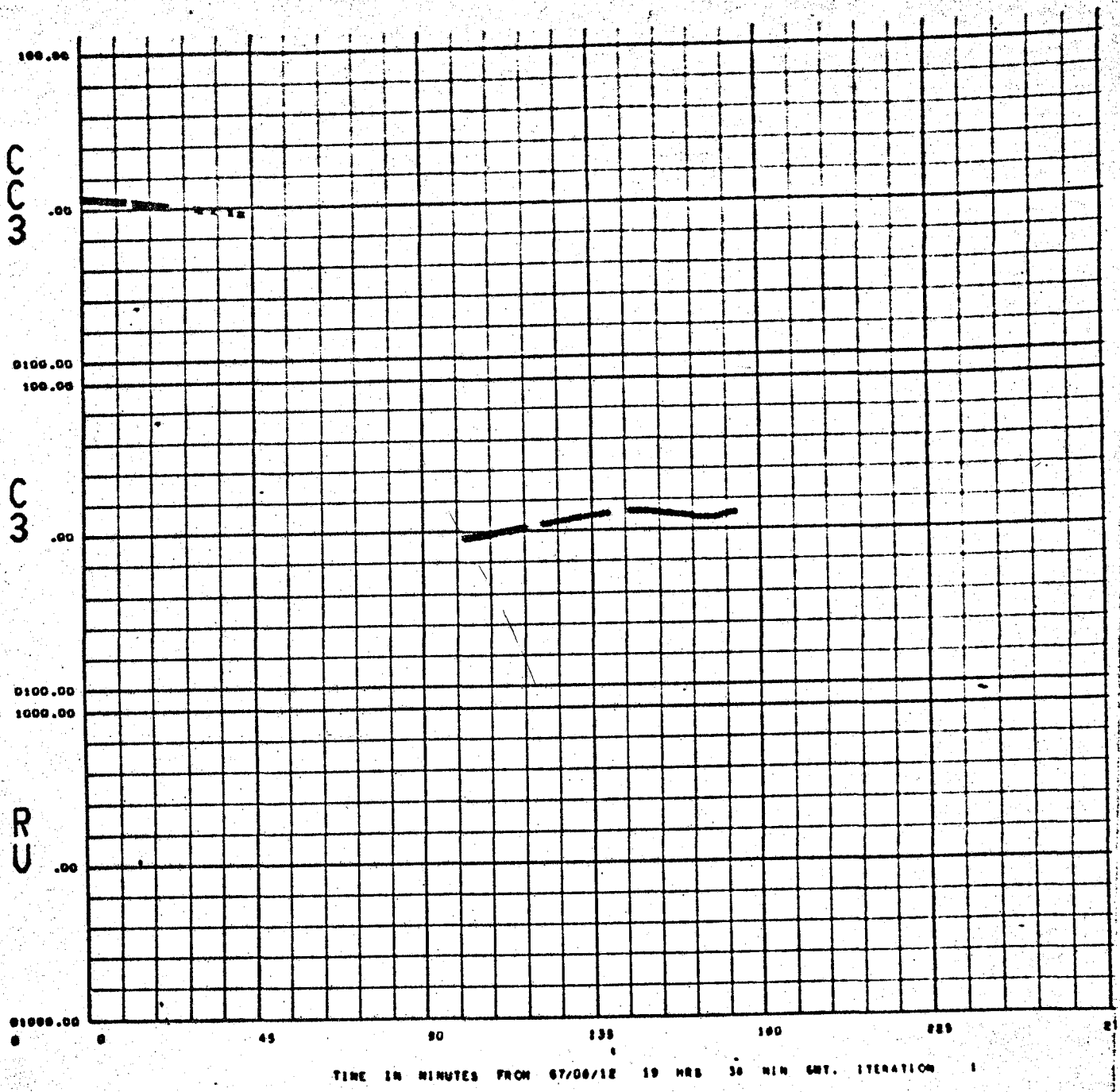
STATION 12 RESIDUALS PASS NUMBER 10/223

ODPL 5V16A

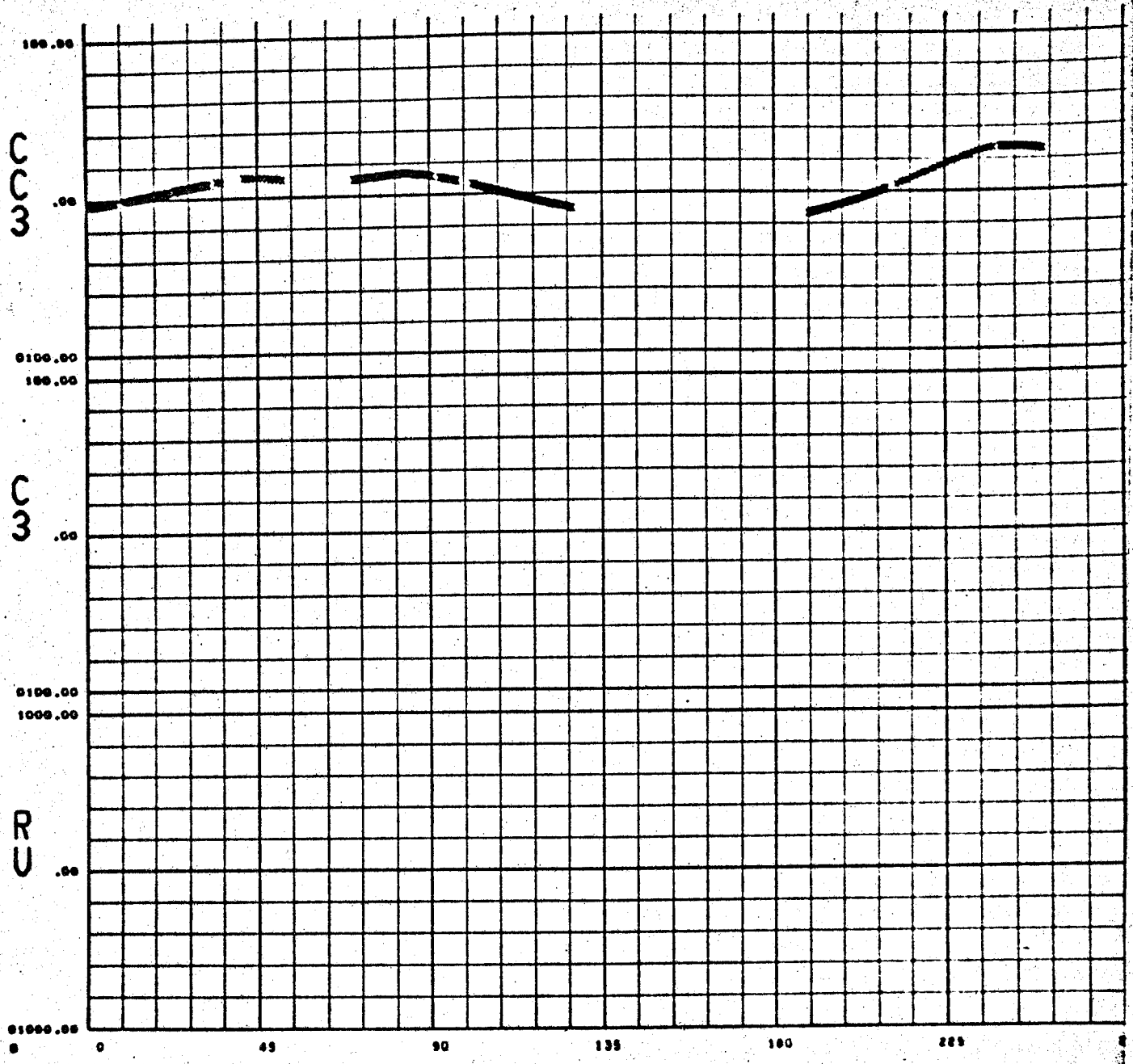
SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 11/224

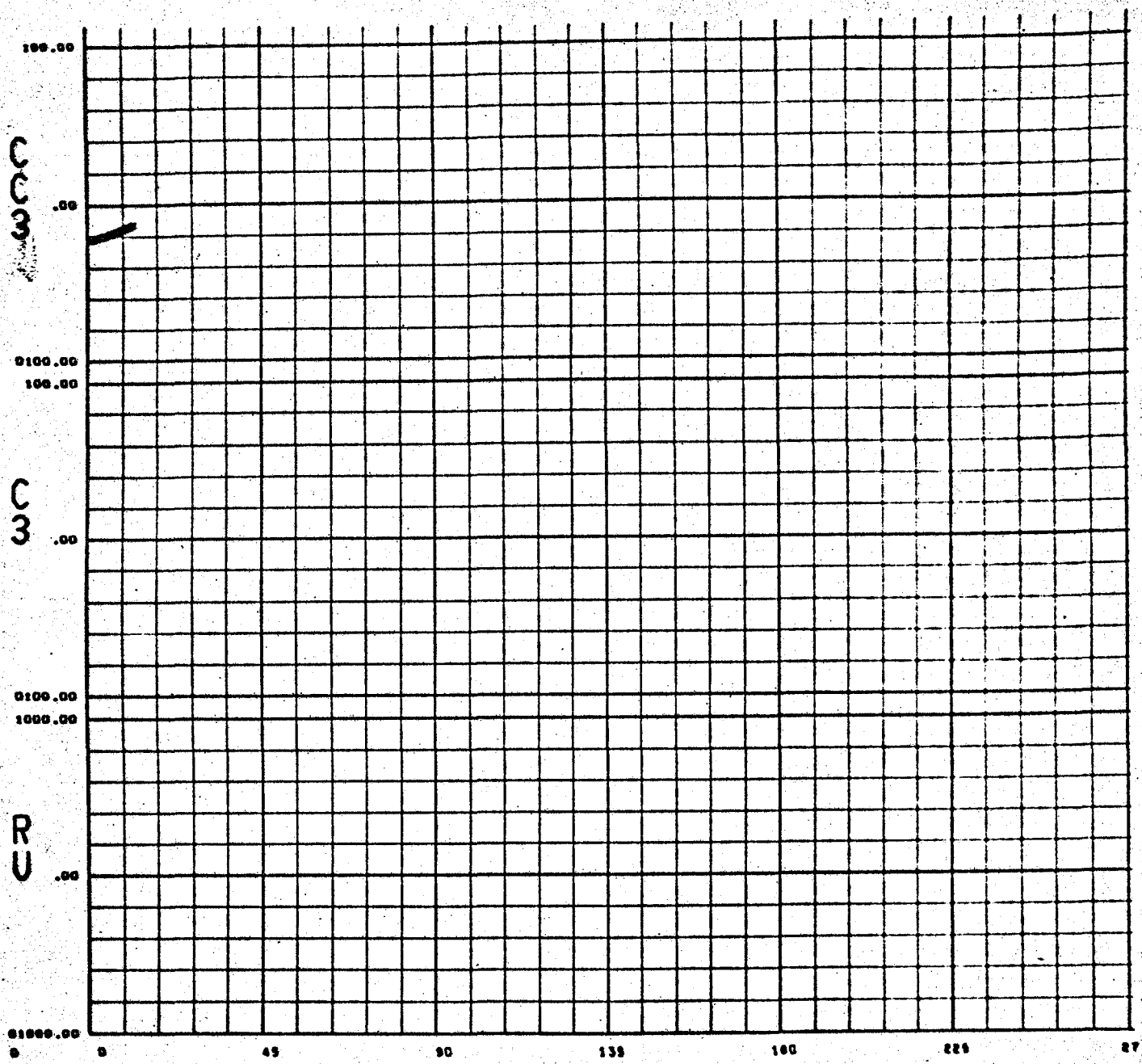


STATION 62 RESIDUALS PASS NUMBER 11/224



STATION 12 RESIDUALS PASS NUMBER 11/224

REV LTR

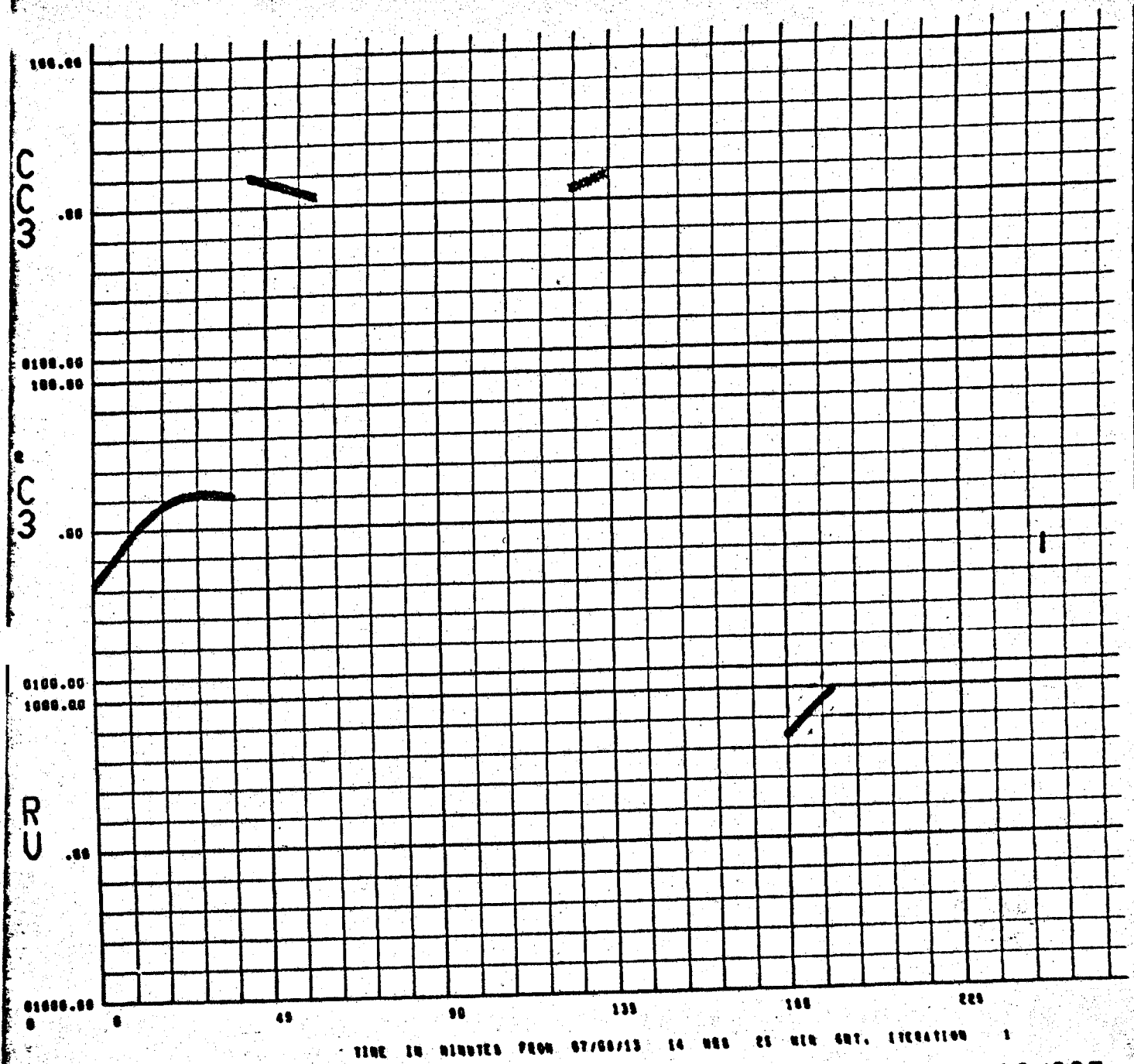


STATION 12 RESIDUALS PASS NUMBER 11/224

REV LTR

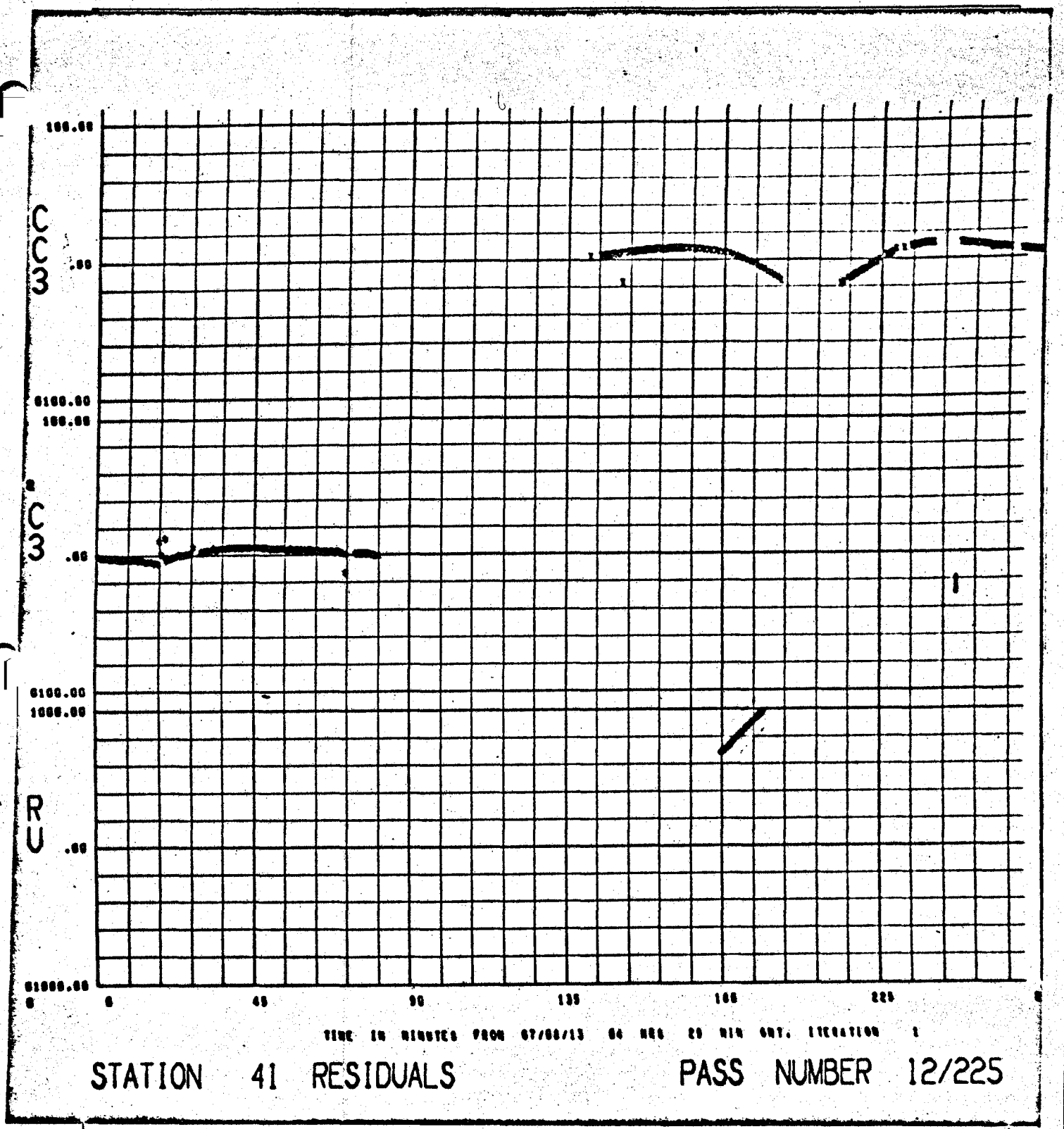
ODPL 5V18

SIMPLE MOON

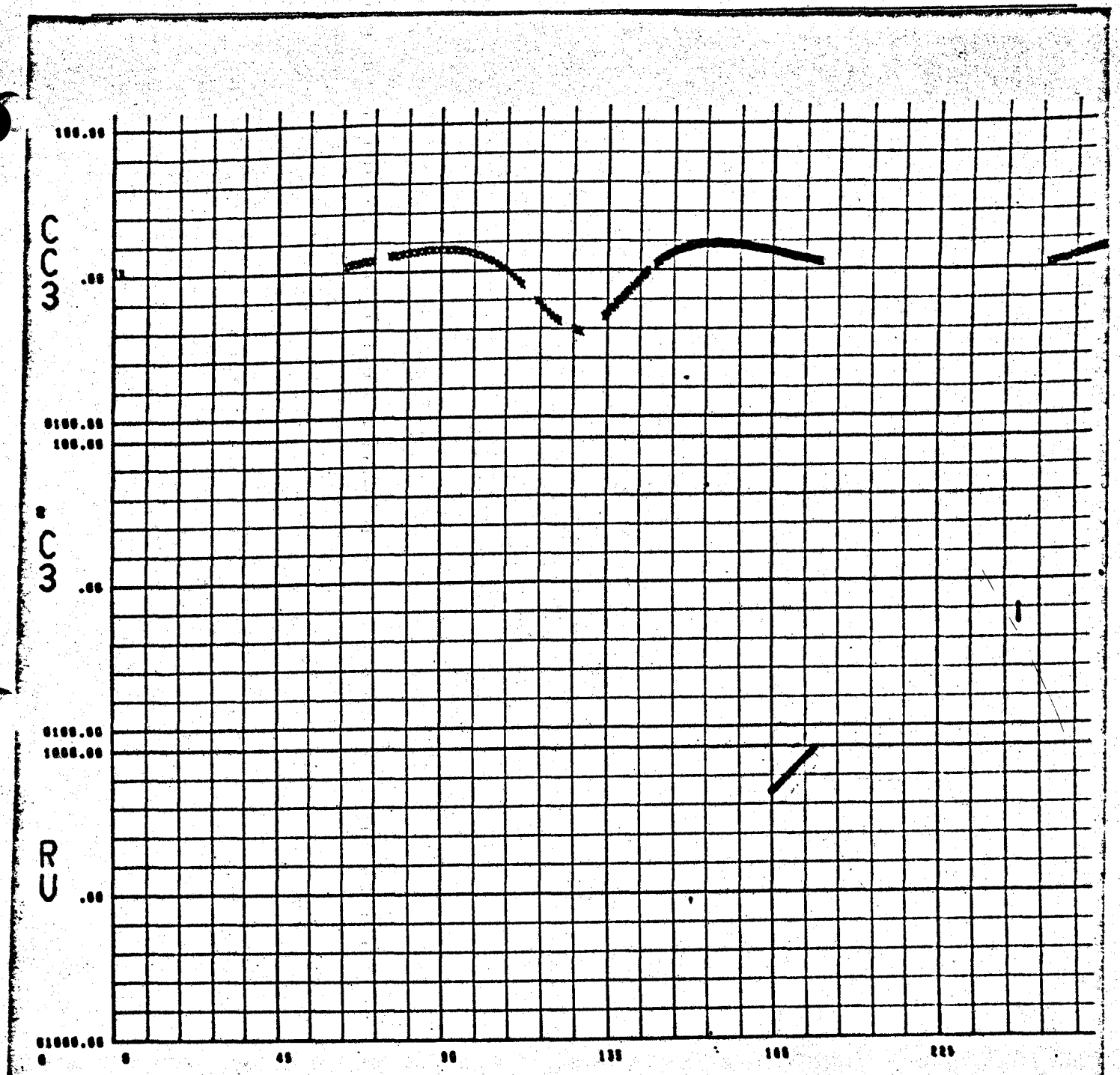


STATION 62 RESIDUALS PASS NUMBER 12/225

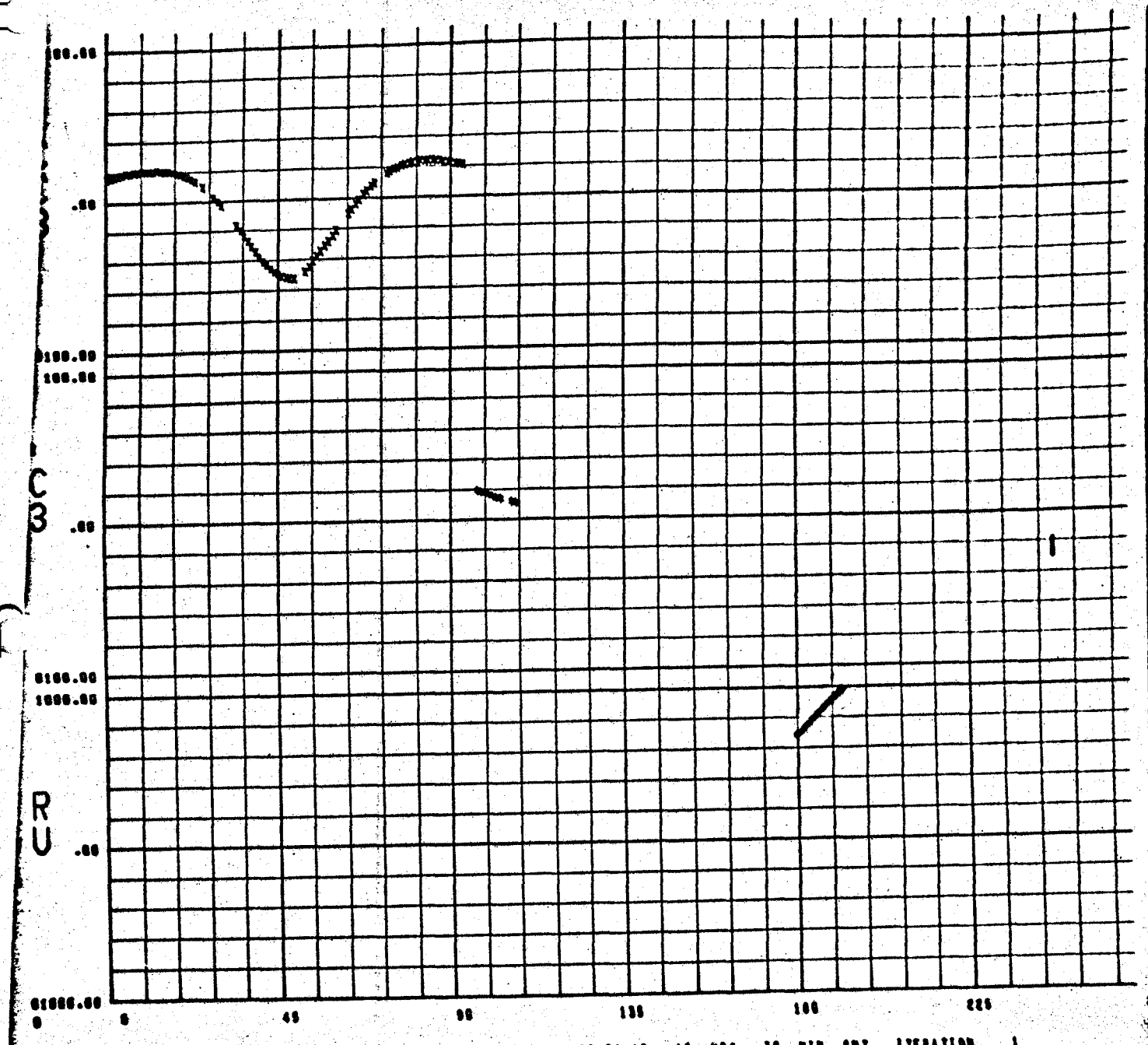
REV LTR



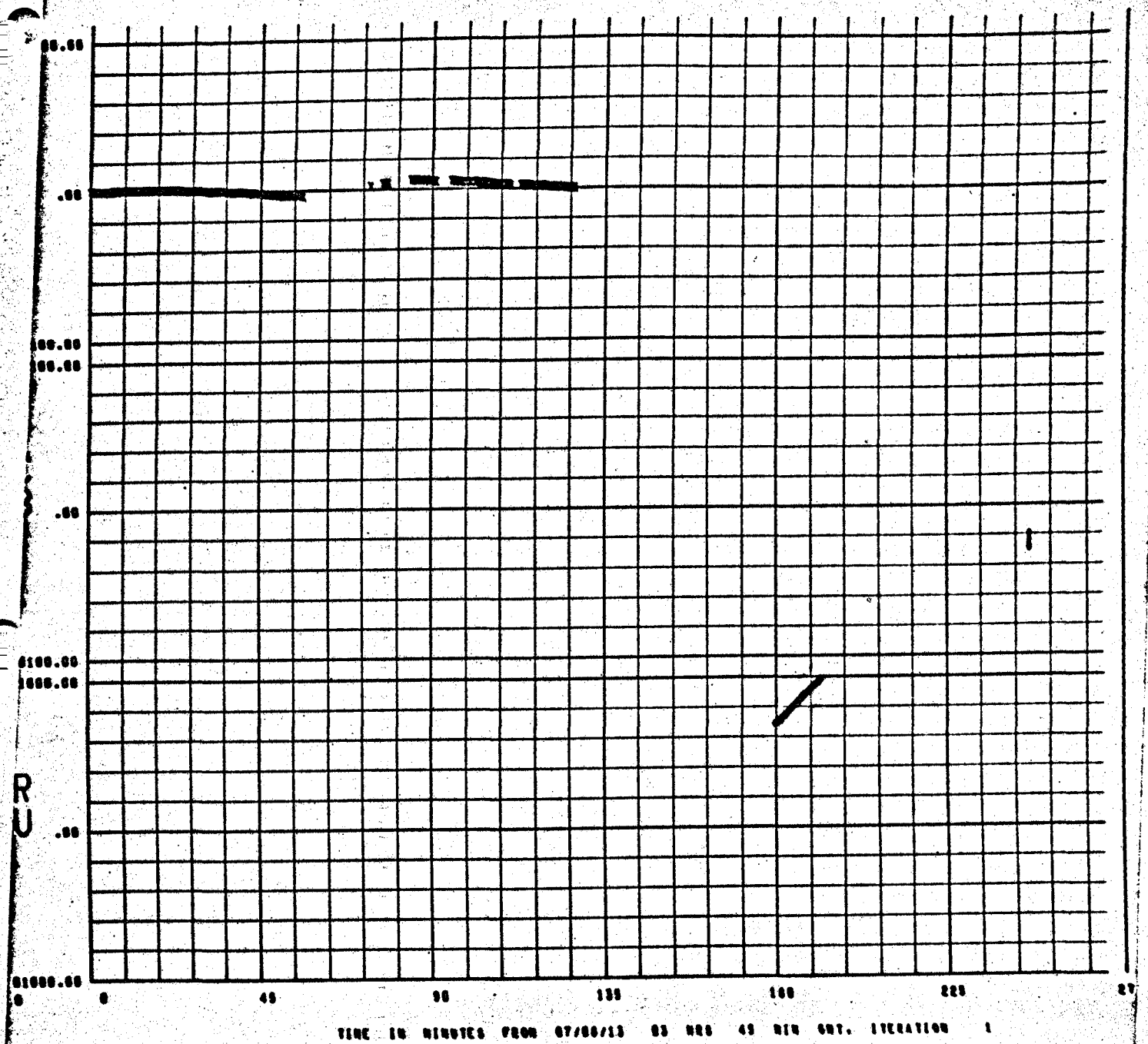
STATION 41 RESIDUALS PASS NUMBER 12/225



STATION 41 RESIDUALS PASS NUMBER 12/225



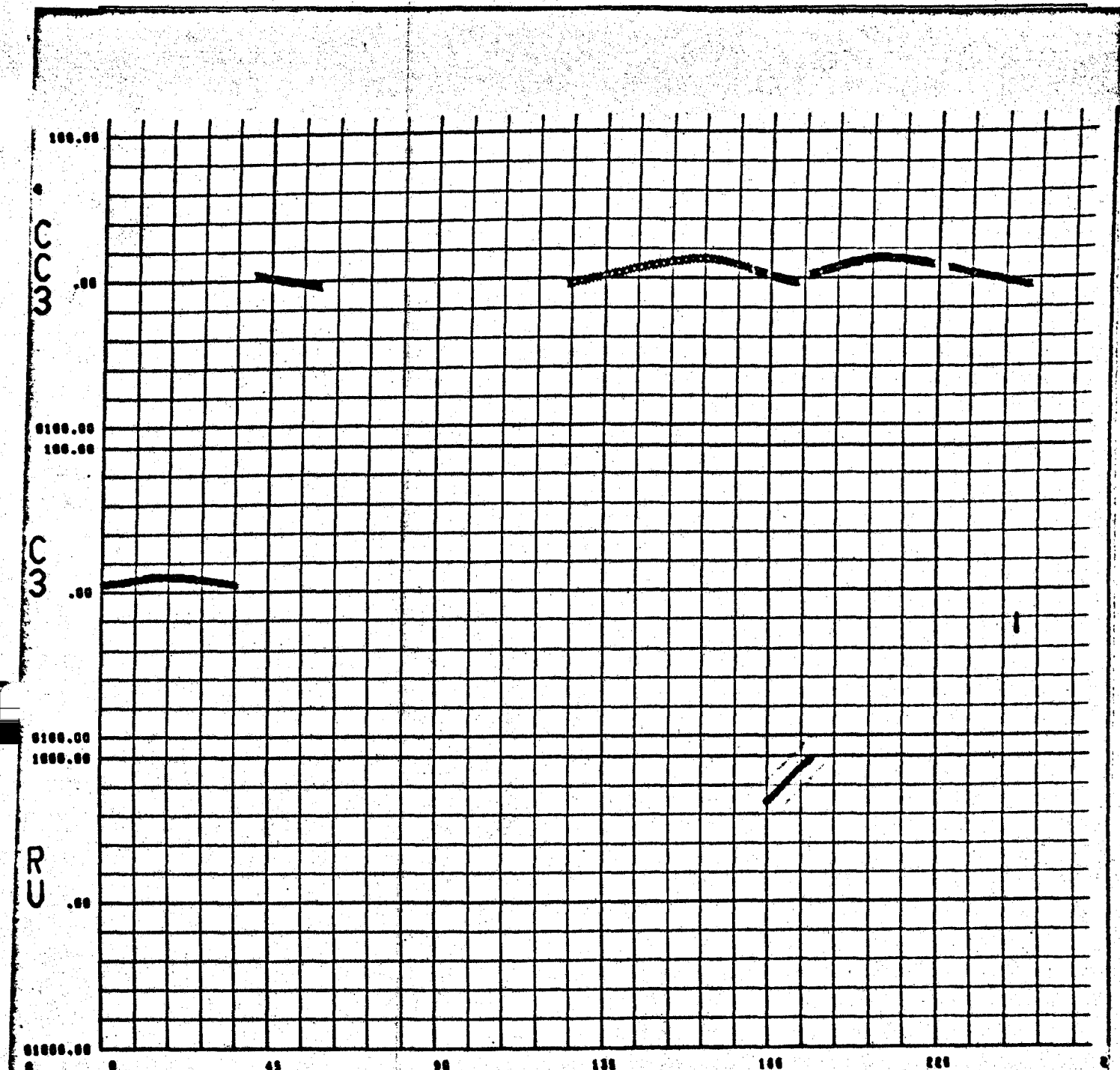
STATION 41 RESIDUALS PASS NUMBER 12/225



STATION 12 RESIDUALS PASS NUMBER 11/224

ODPL 5A20

SIMPLE MOON

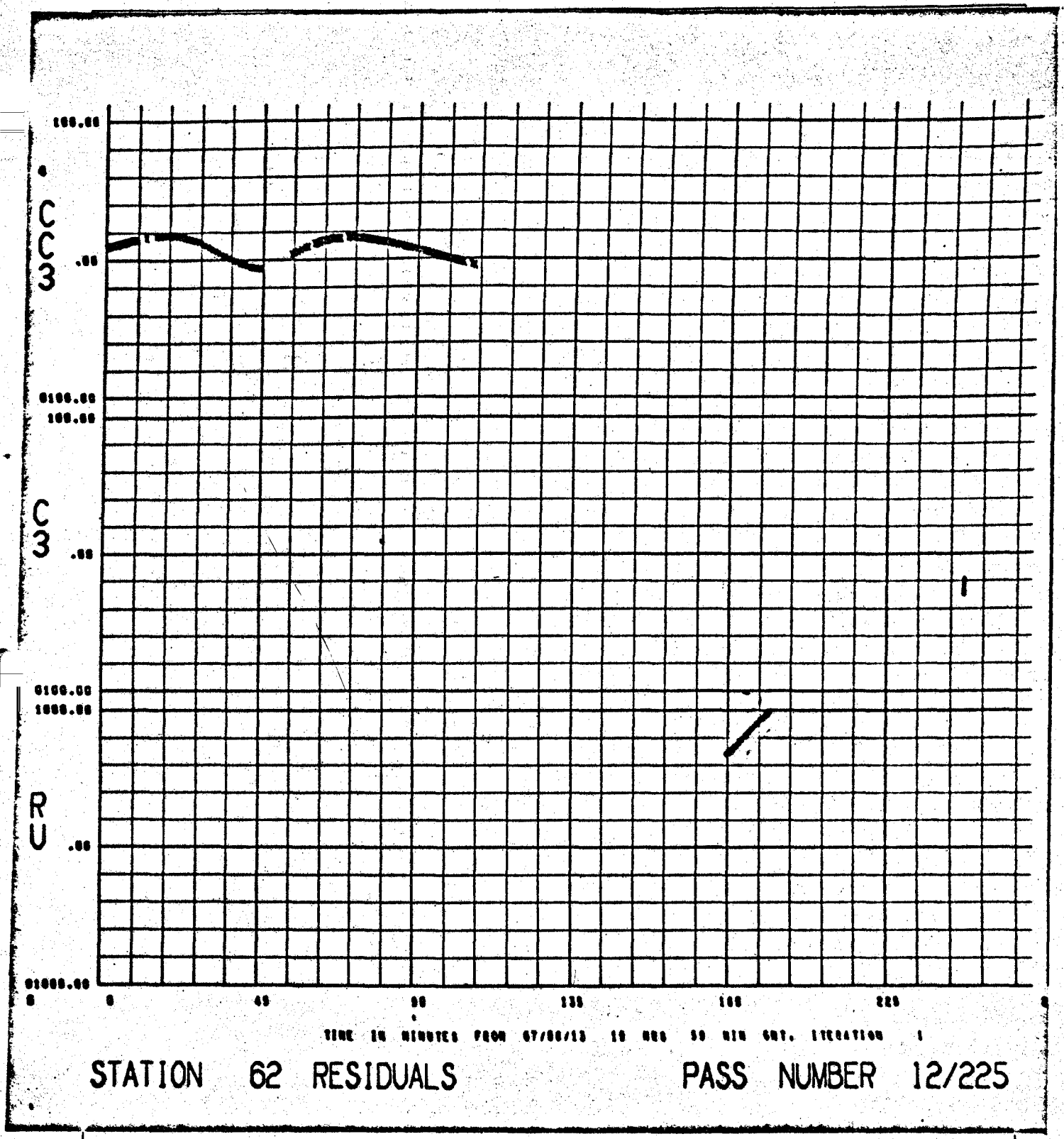


STATION 62 RESIDUALS PASS NUMBER 12/225

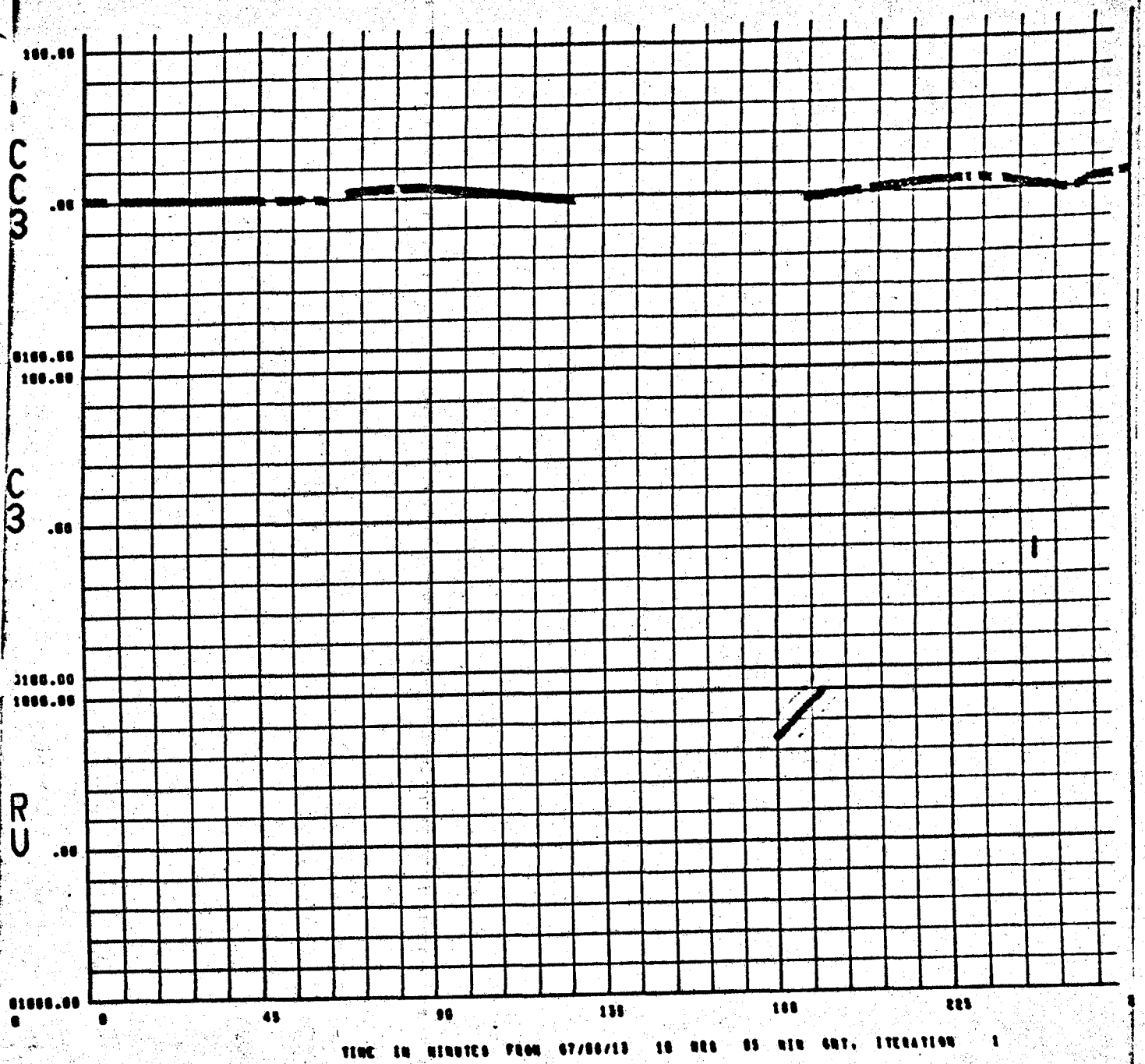
REV LTR

BOEING NO. D2-100816-1

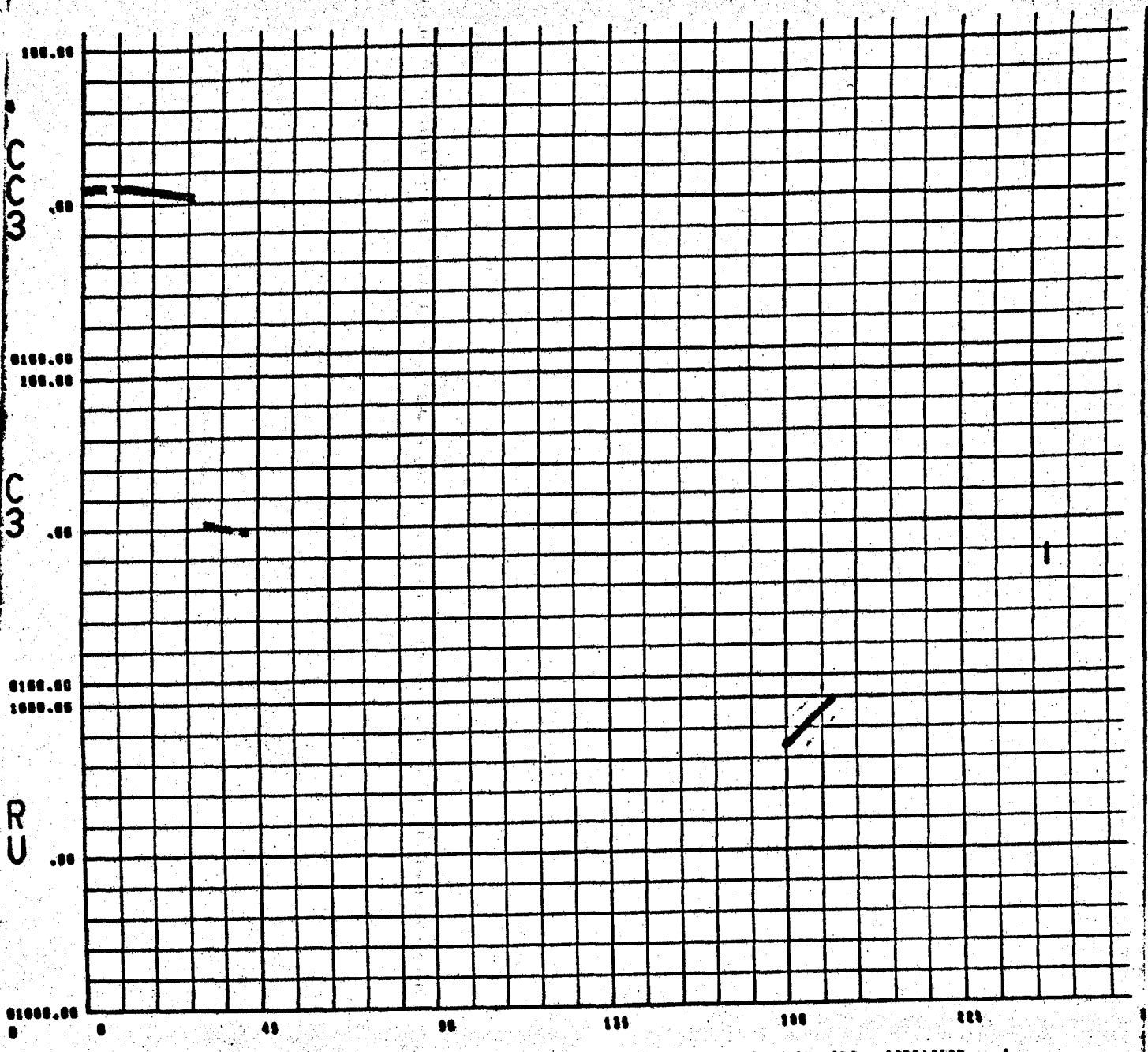
SH. 563



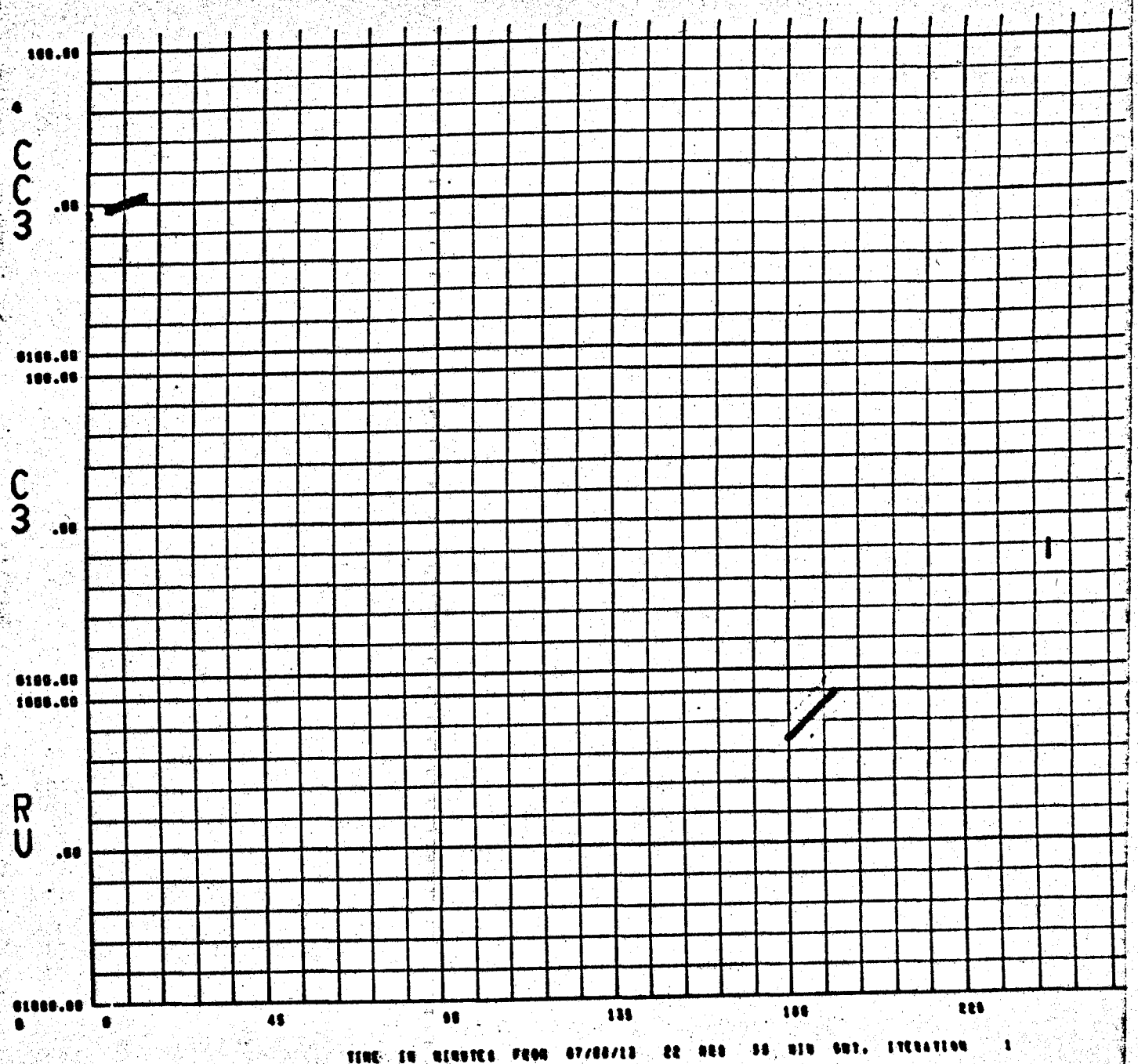
STATION 62 RESIDUALS PASS NUMBER 12/225



STATION 41 RESIDUALS PASS NUMBER 12/225



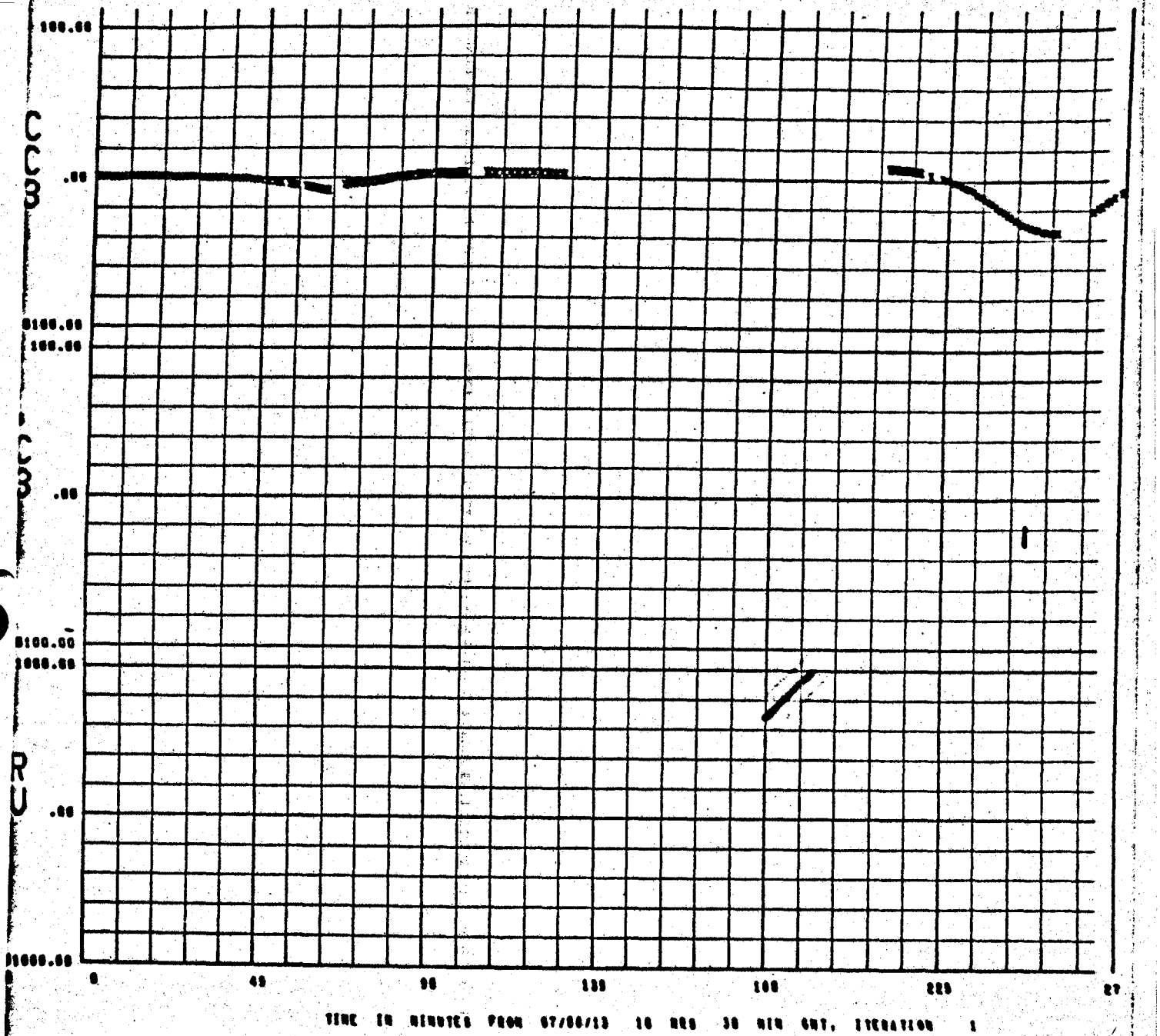
STATION 41 RESIDUALS PASS NUMBER 12/225



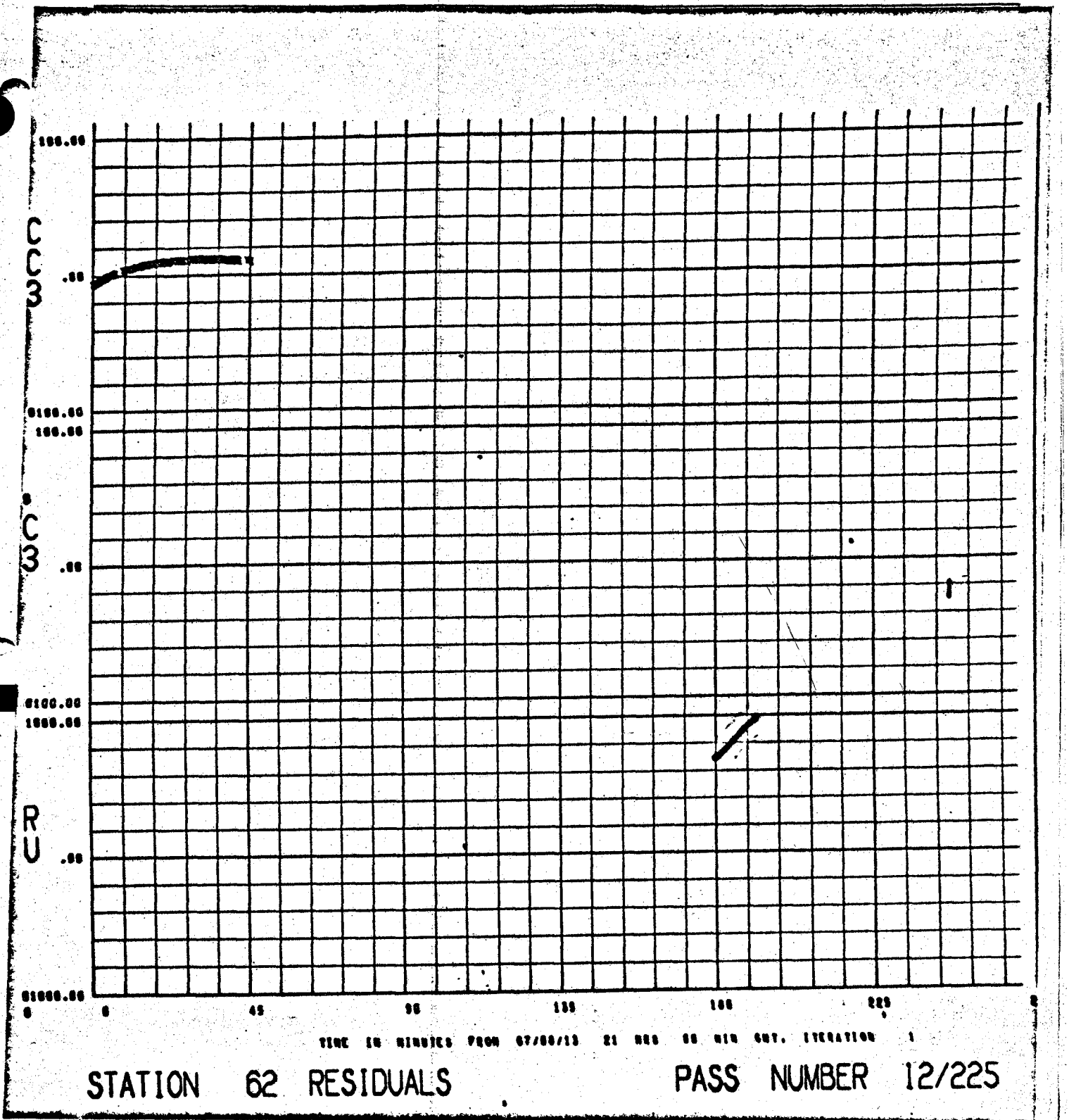
STATION 12 RESIDUALS PASS NUMBER 12/225

ODPL 5V22

SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 12/225



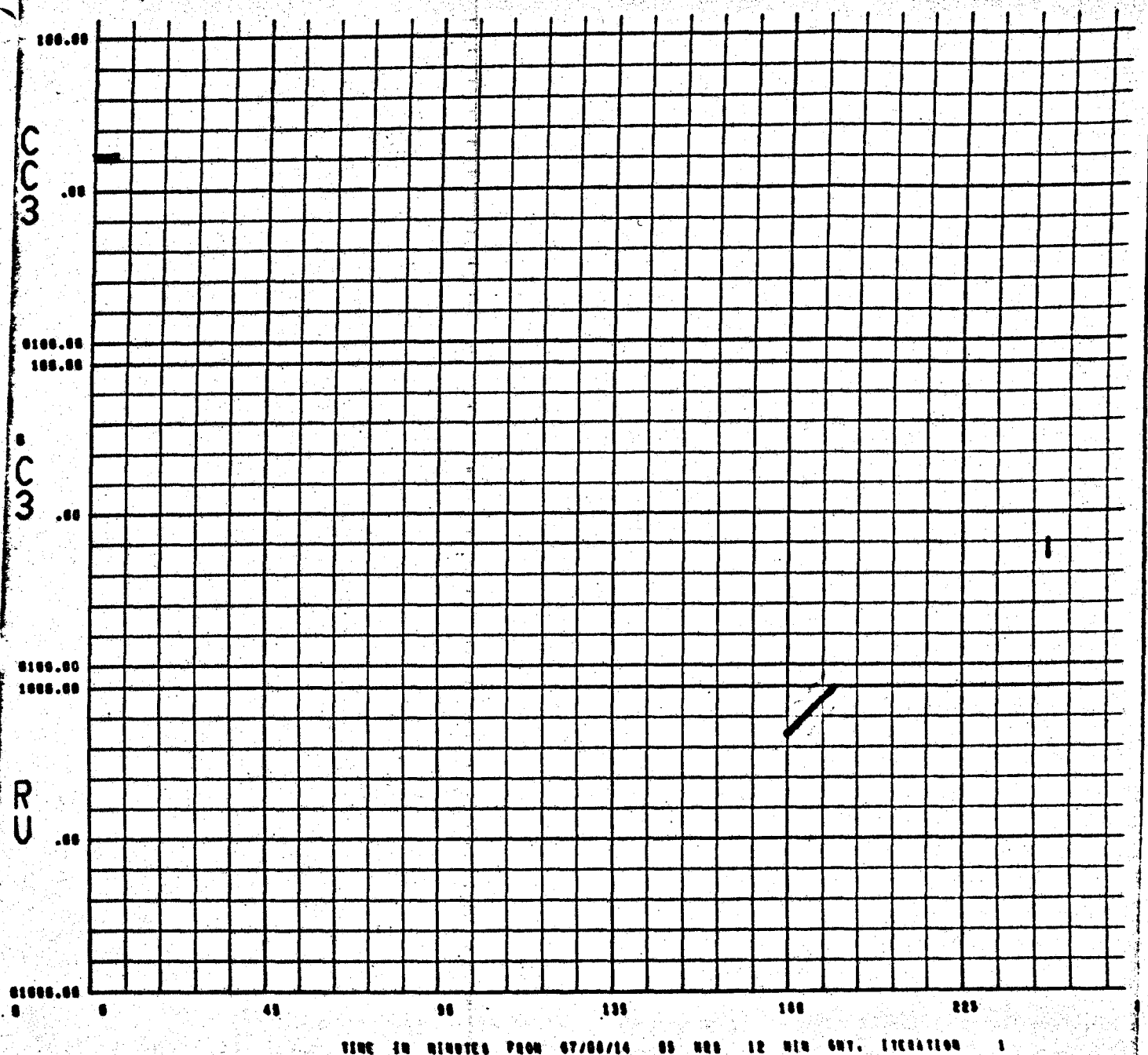
STATION 62 RESIDUALS PASS NUMBER 12/225

REV LTR

US 4289-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 570



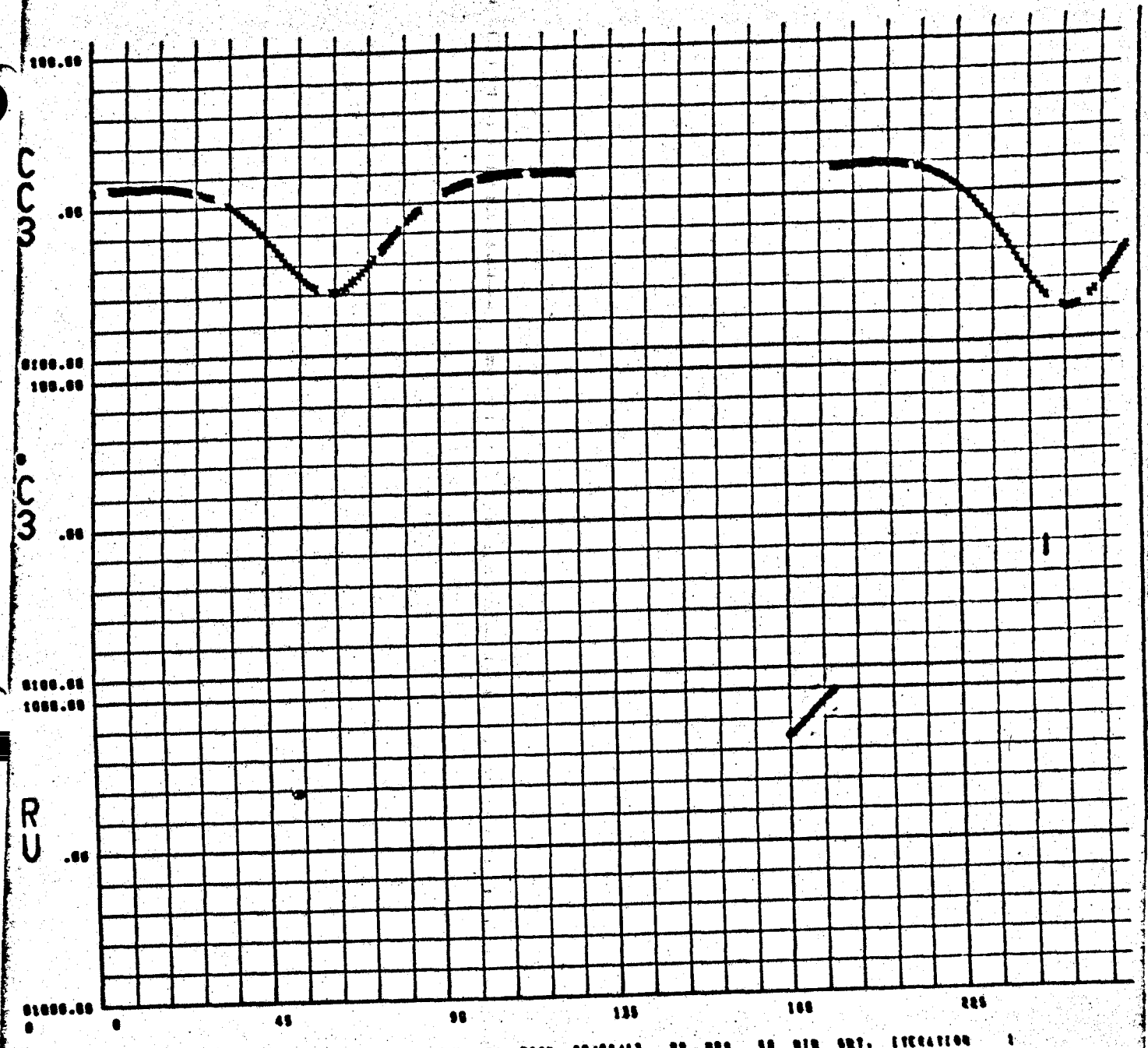
STATION 41 RESIDUALS PASS NUMBER 13/226

REV LTR

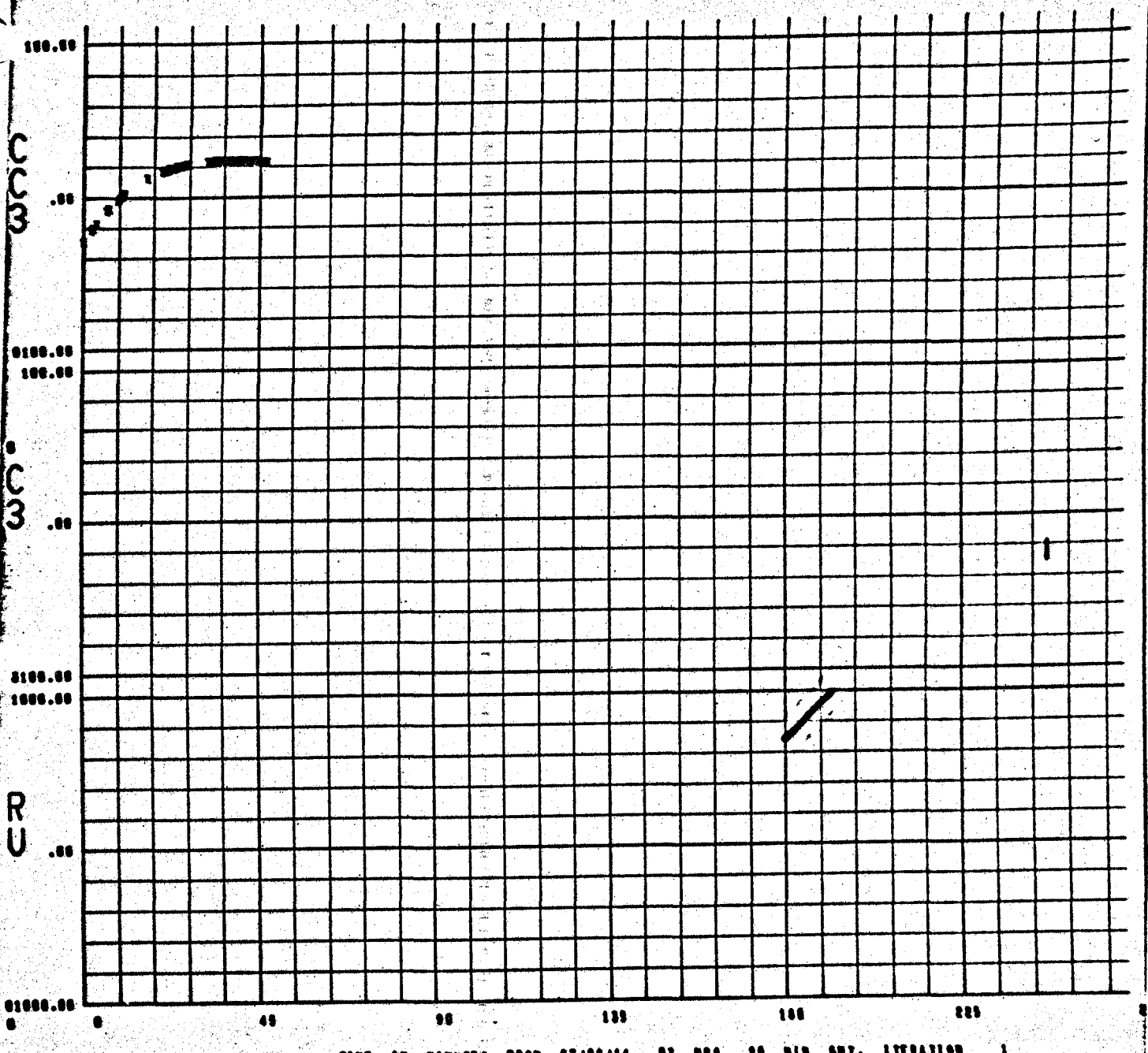
U3 4788-2000 REV. 6/64

BOEING NO. D2-100816-1

SH. 571



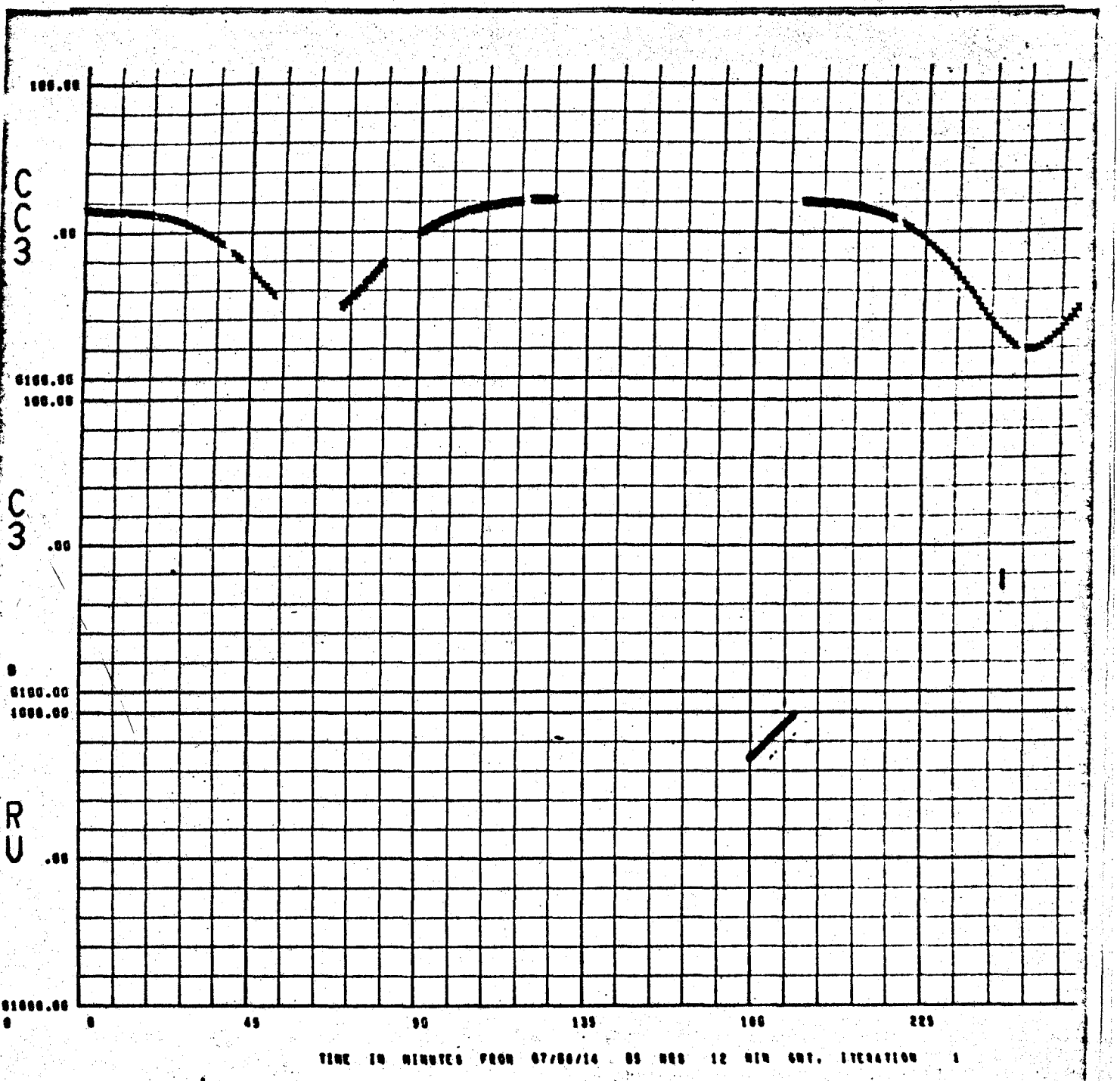
STATION 12 RESIDUALS PASS NUMBER 12/225



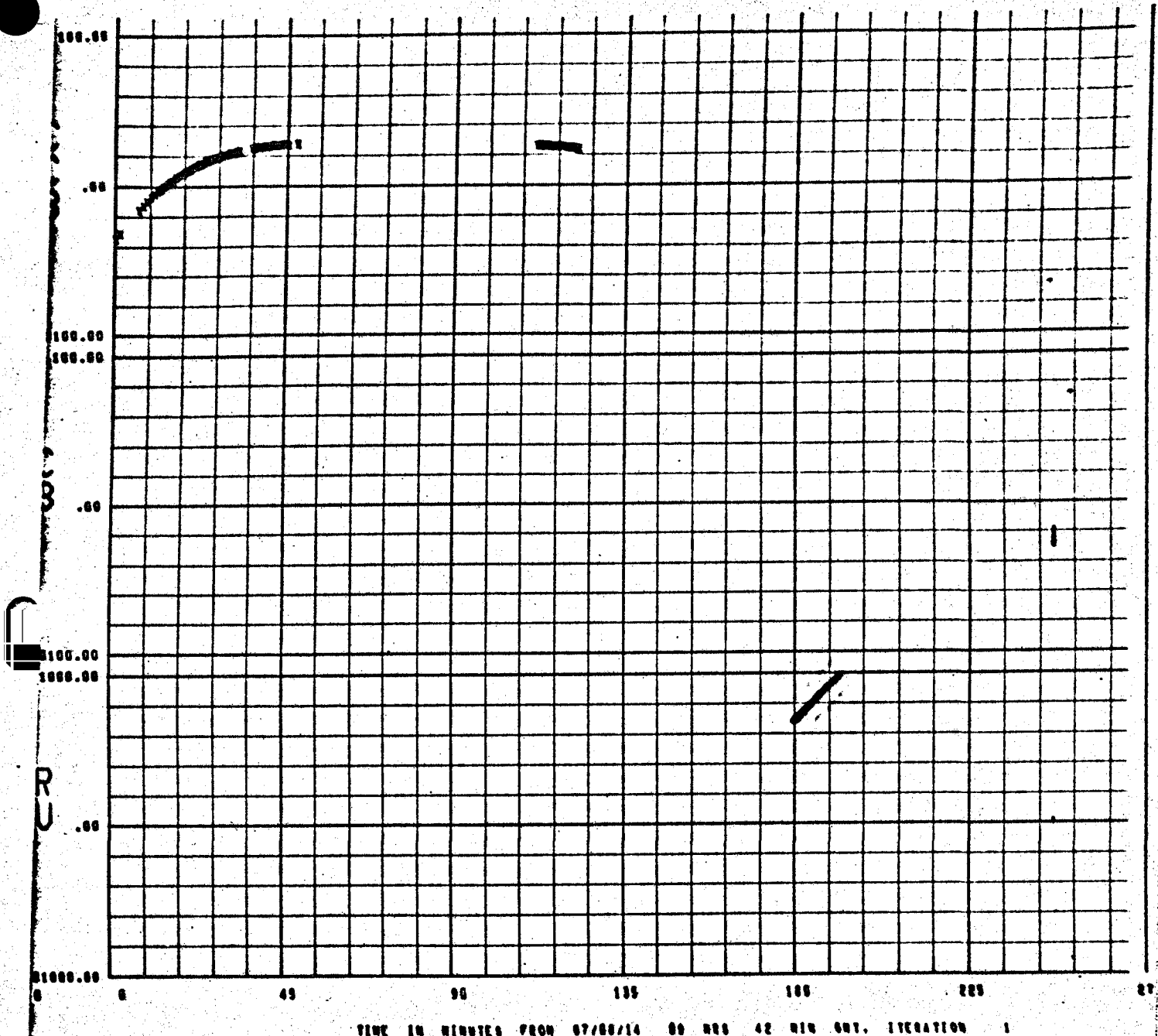
STATION 12 RESIDUALS PASS NUMBER 12/225

ODPL 5V24

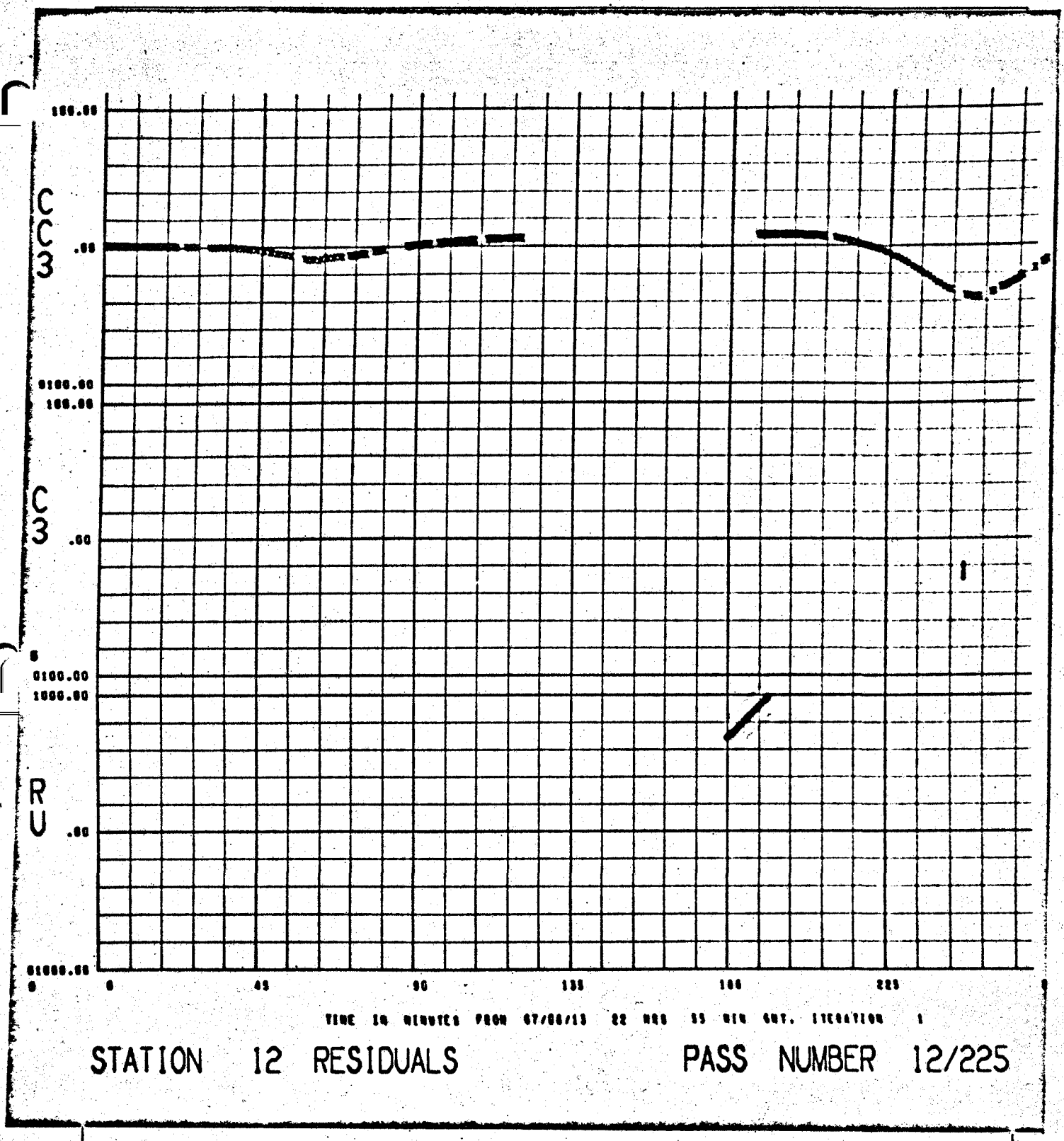
SIMPLE MOON



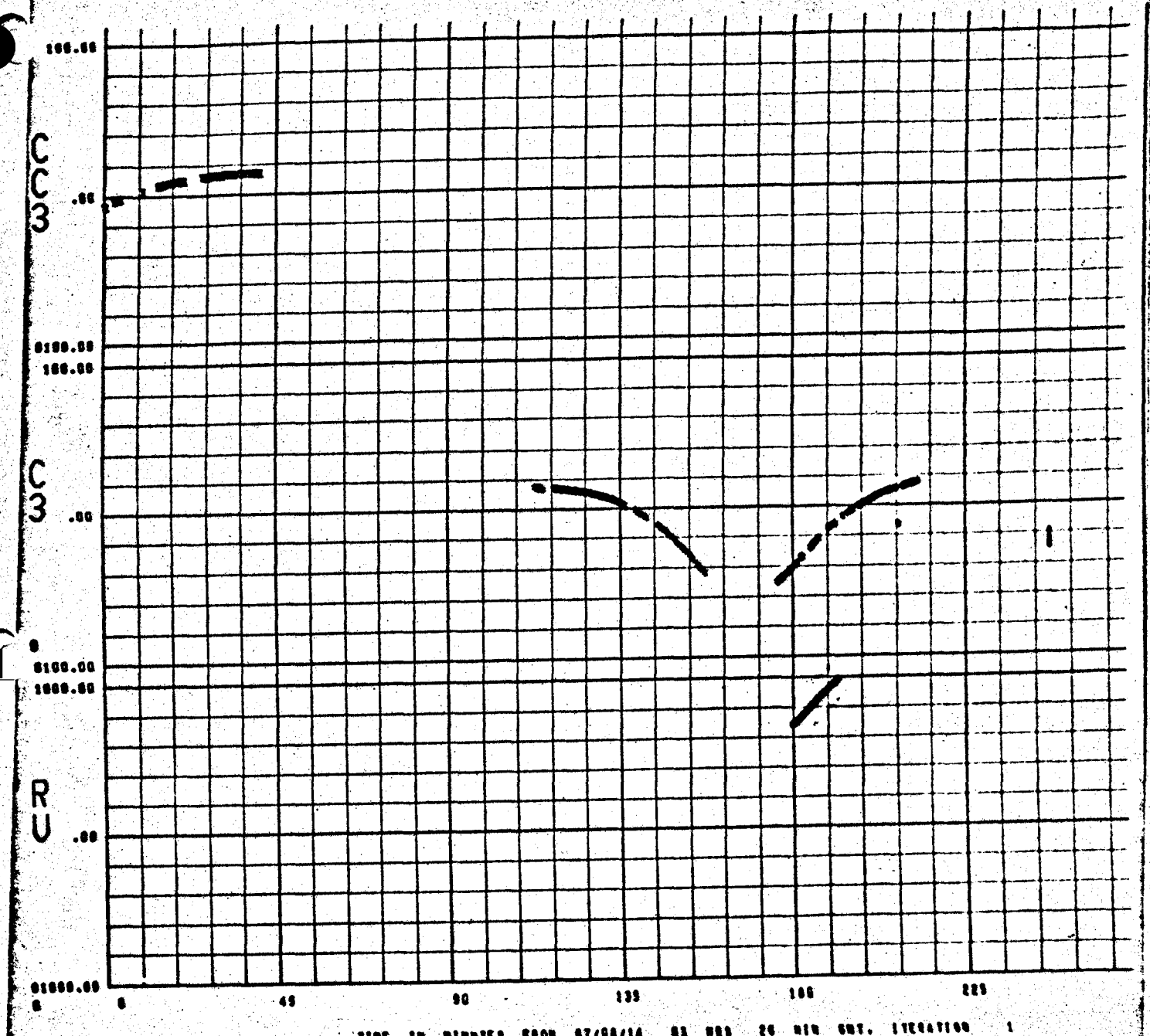
STATION 41 RESIDUALS PASS NUMBER 13/226



STATION 41 RESIDUALS PASS NUMBER 13/226



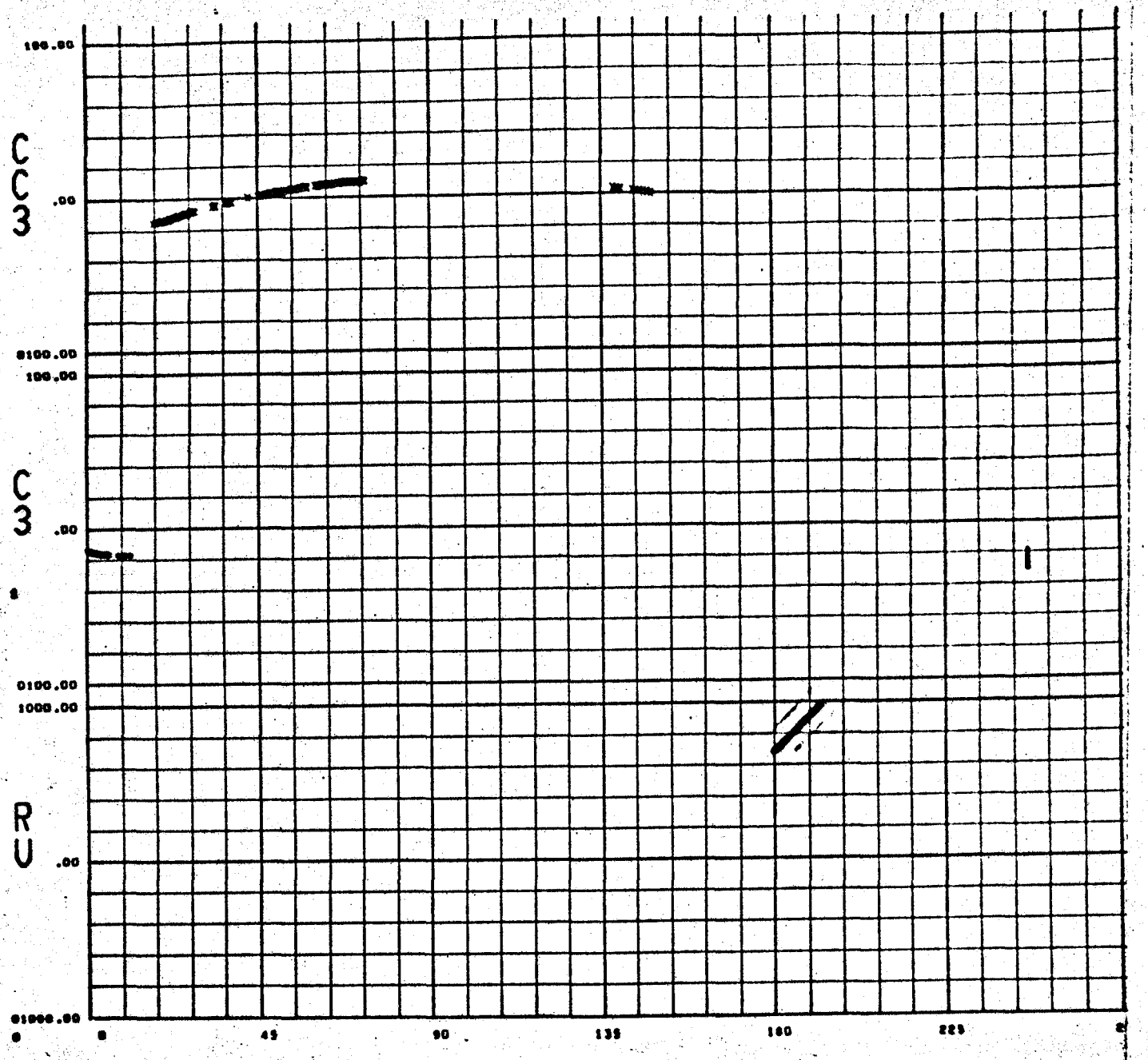
STATION 12 RESIDUALS PASS NUMBER 12/225



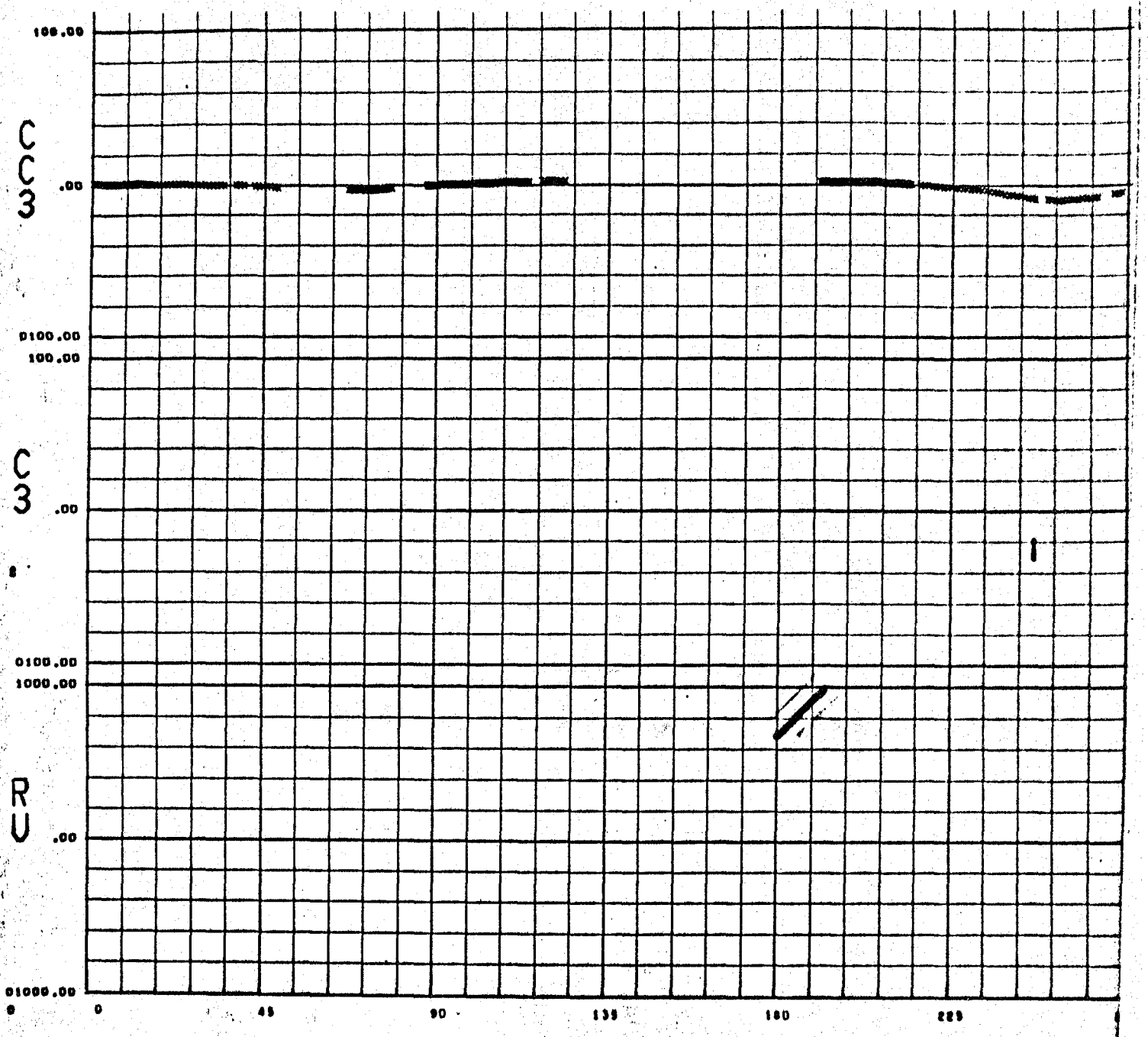
STATION 12 RESIDUALS PASS NUMBER 12/225

ODPL 5V26.1

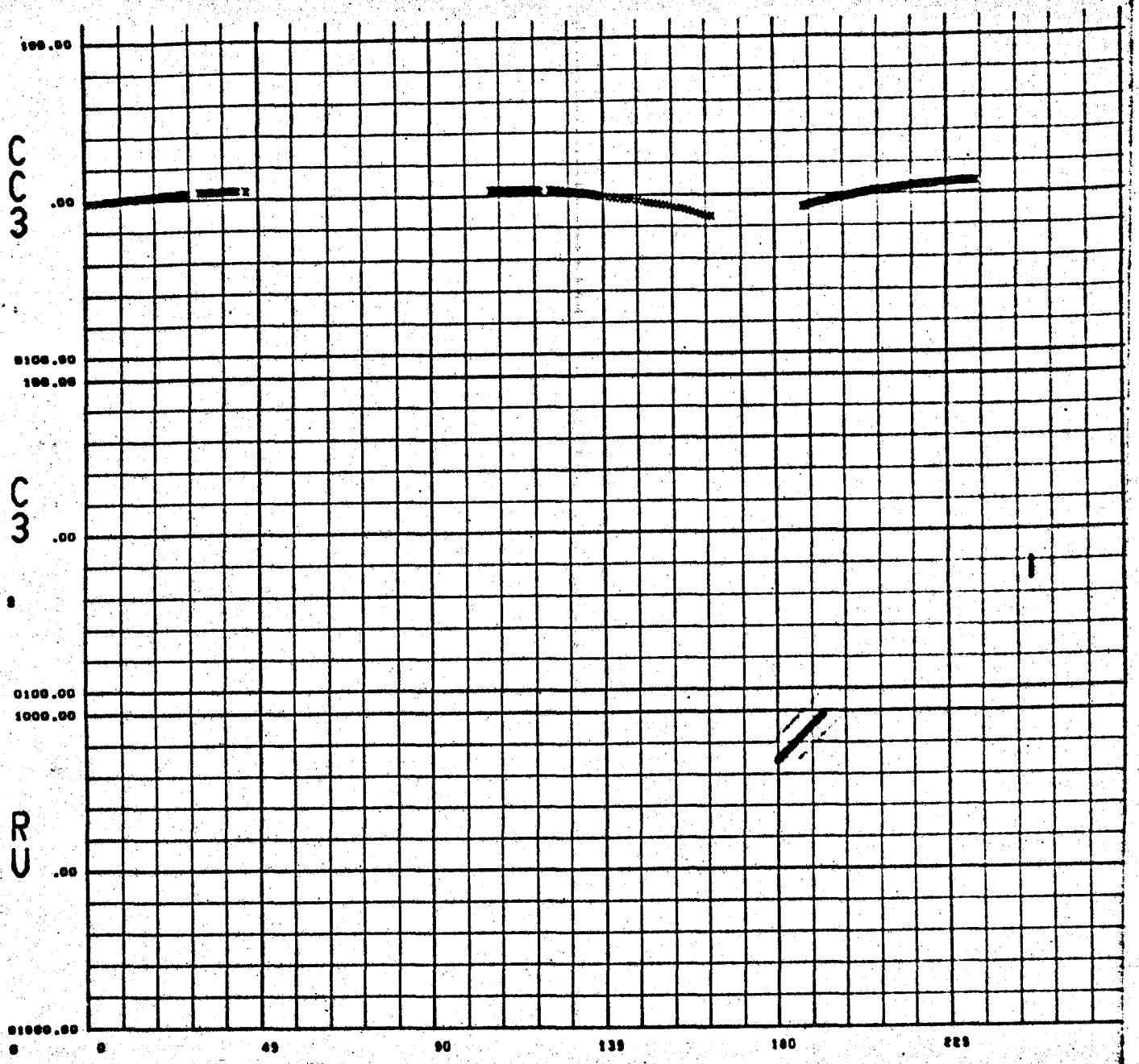
SIMPLE MOON



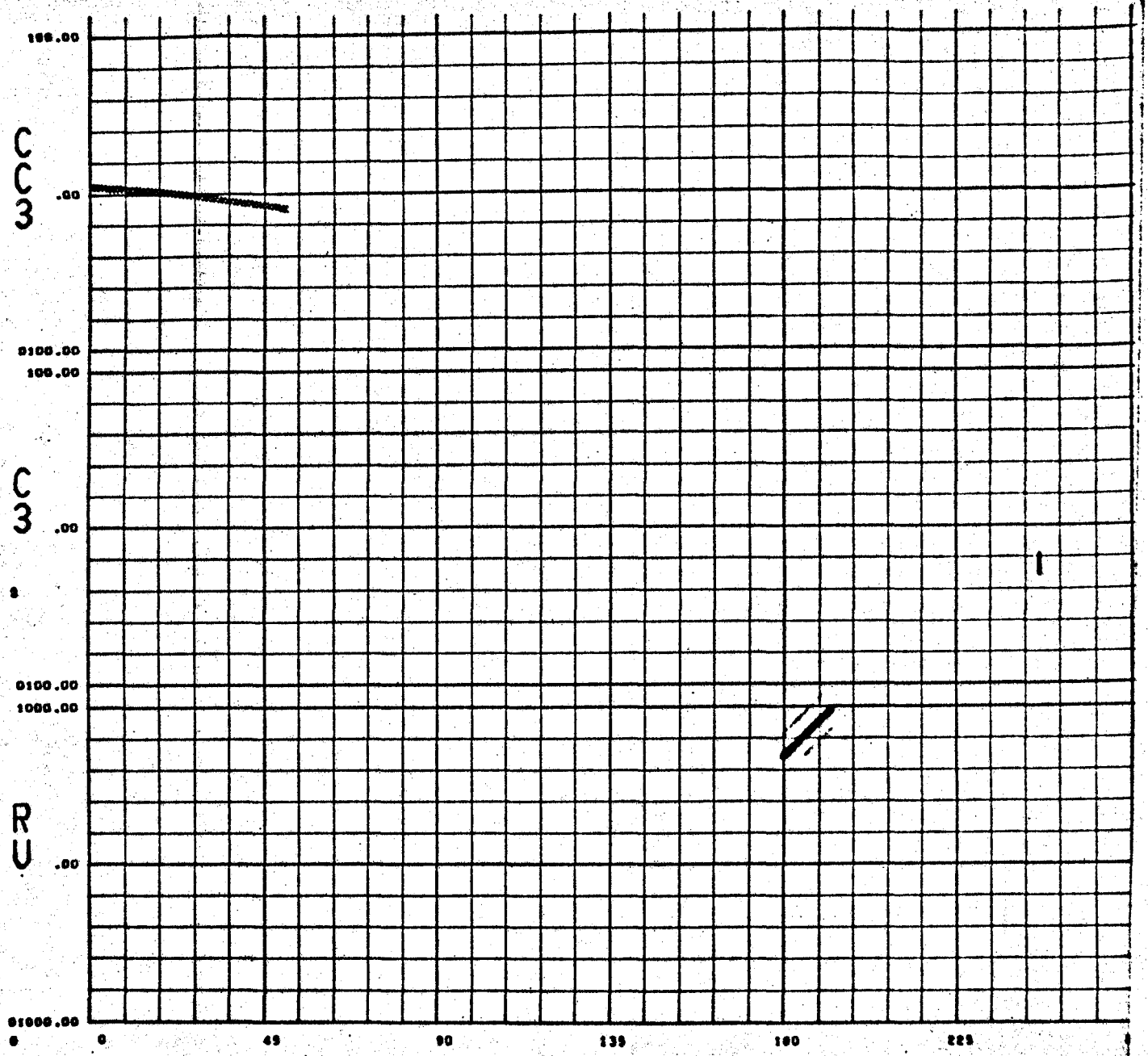
STATION 62 RESIDUALS PASS NUMBER 13/226



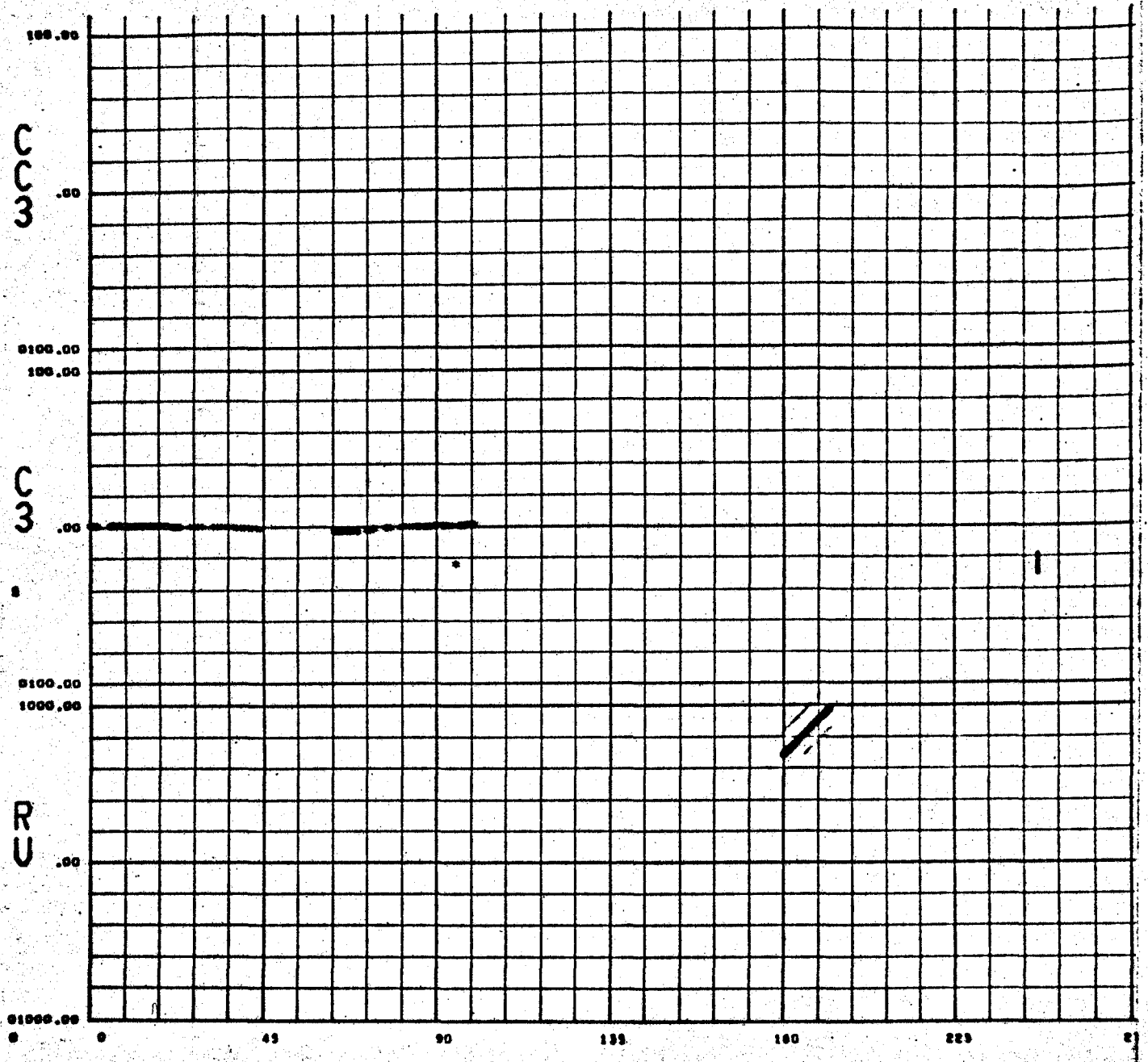
STATION 41 RESIDUALS PASS NUMBER 13/226



STATION 41 RESIDUALS PASS NUMBER 13/226



STATION 41 RESIDUALS PASS NUMBER 13/226



STATION 12 RESIDUALS PASS NUMBER 12/225

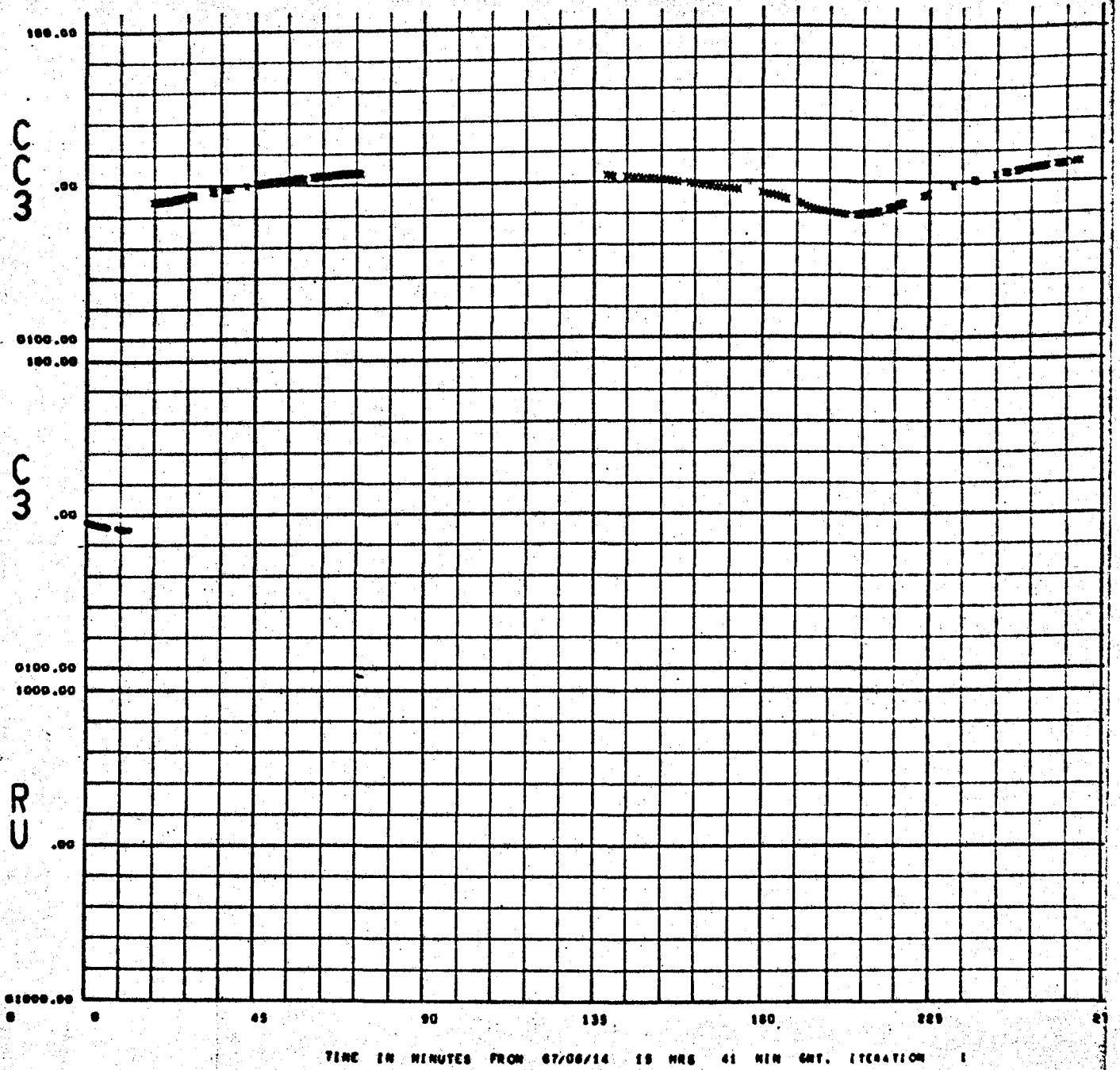
REV LTR

BOEING NO. D2-100816-1

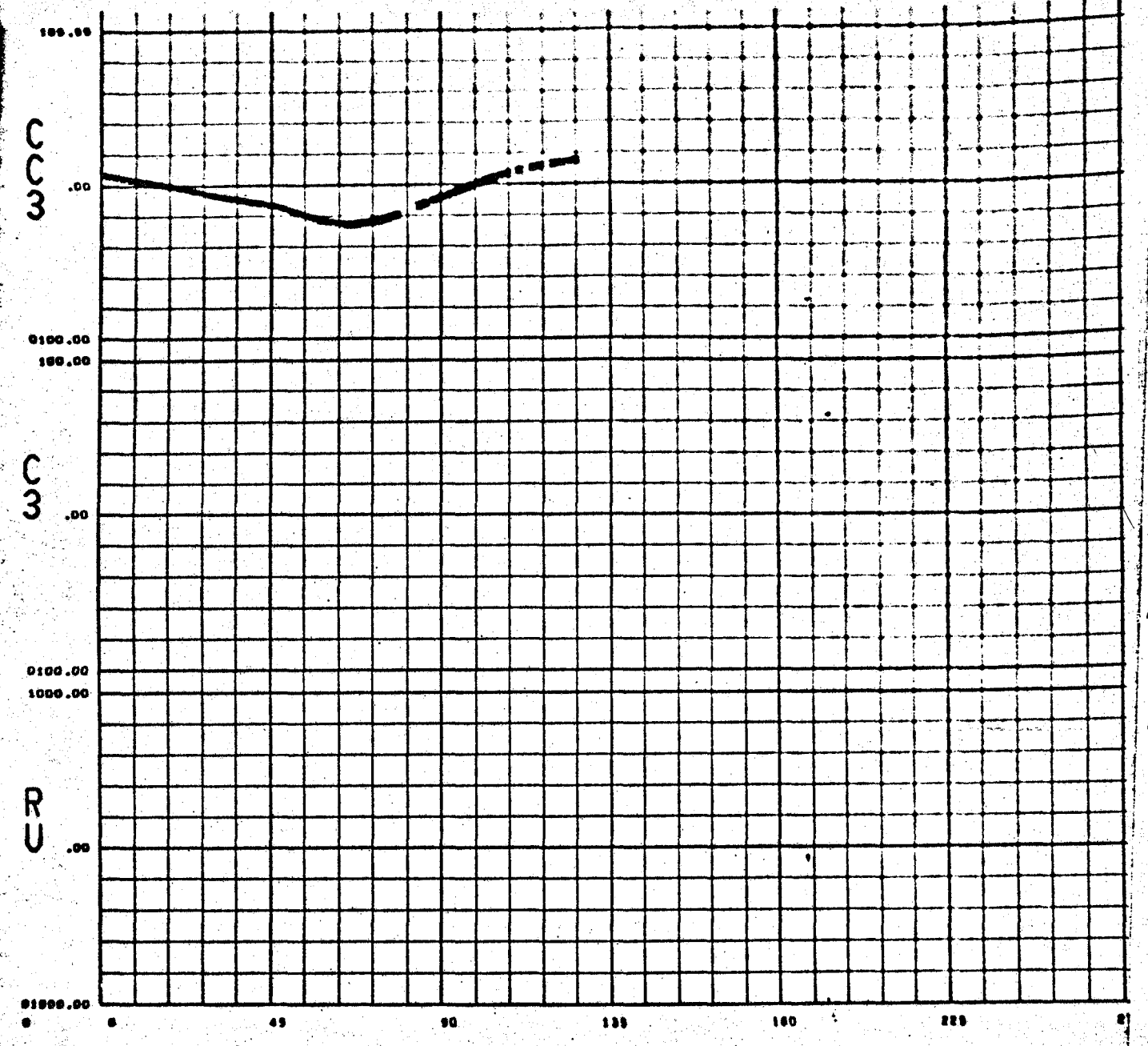
SH. 584

SIMPLE MOON

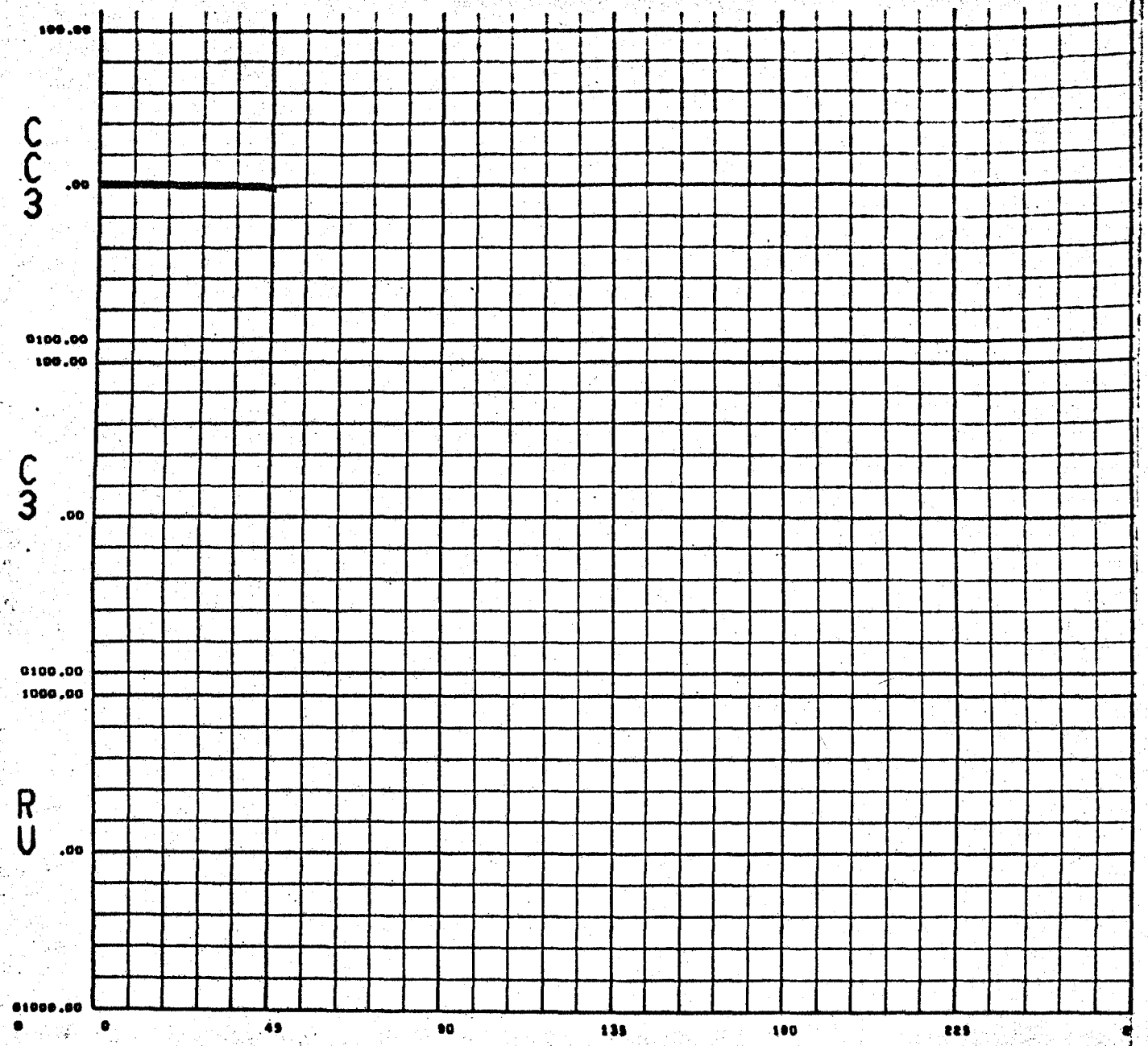
OOPL SV278



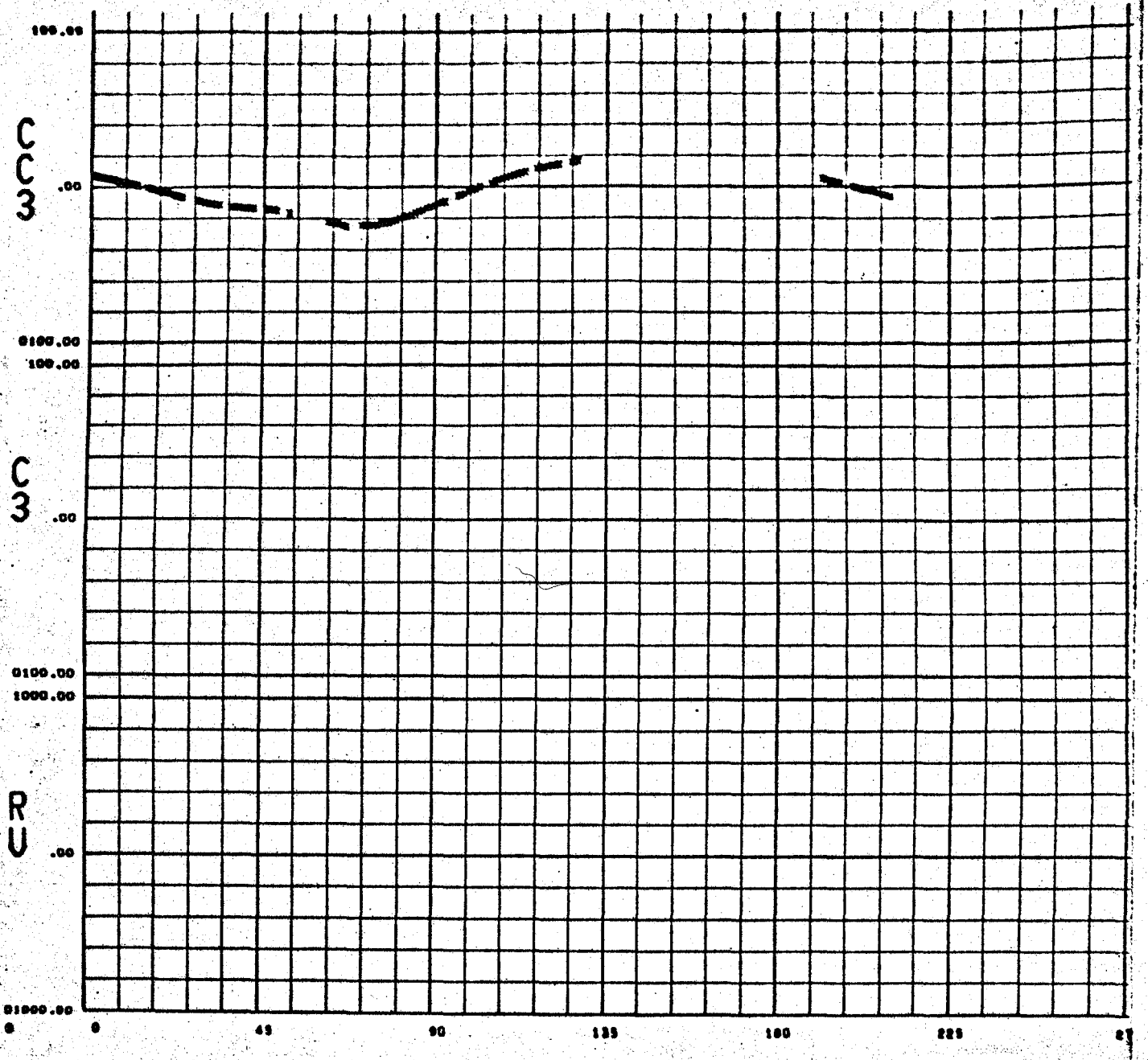
STATION 62 RESIDUALS — PASS NUMBER 13/226



STATION 62 RESIDUALS PASS NUMBER 13/226



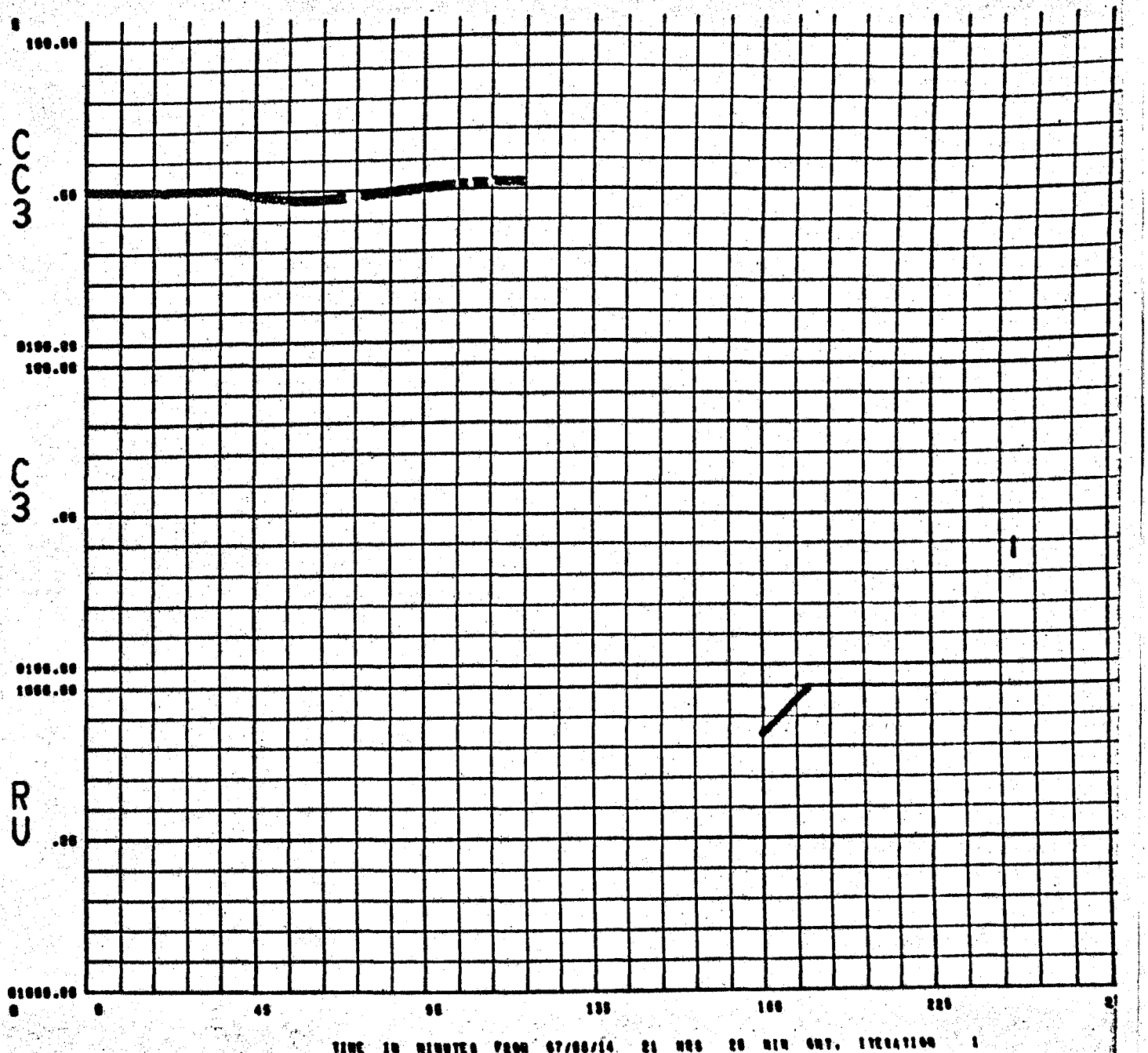
STATION 41 RESIDUALS PASS NUMBER 13/226



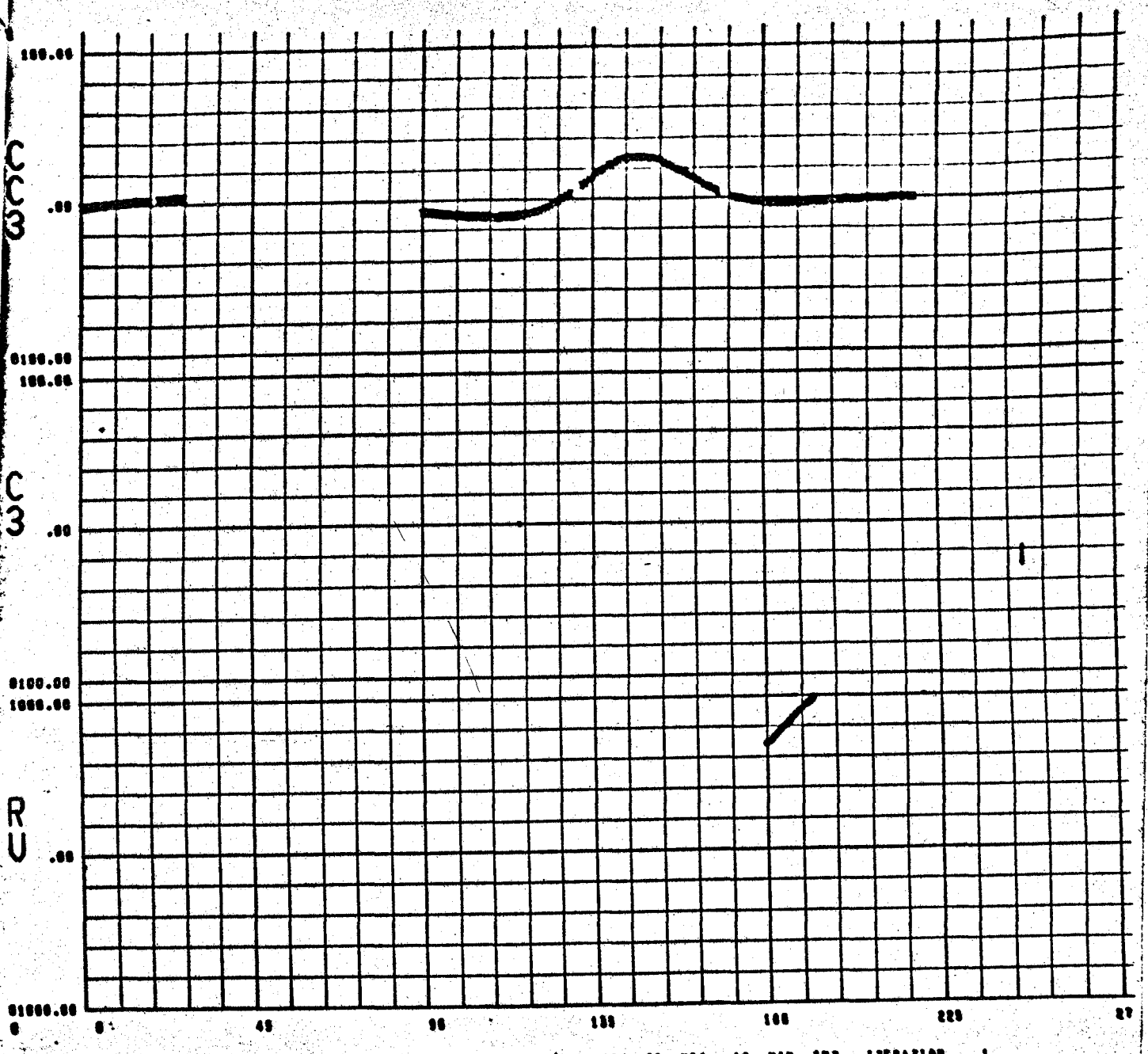
STATION 12 RESIDUALS PASS NUMBER 13/226

ODPL 5V30

SIMPLE MOON



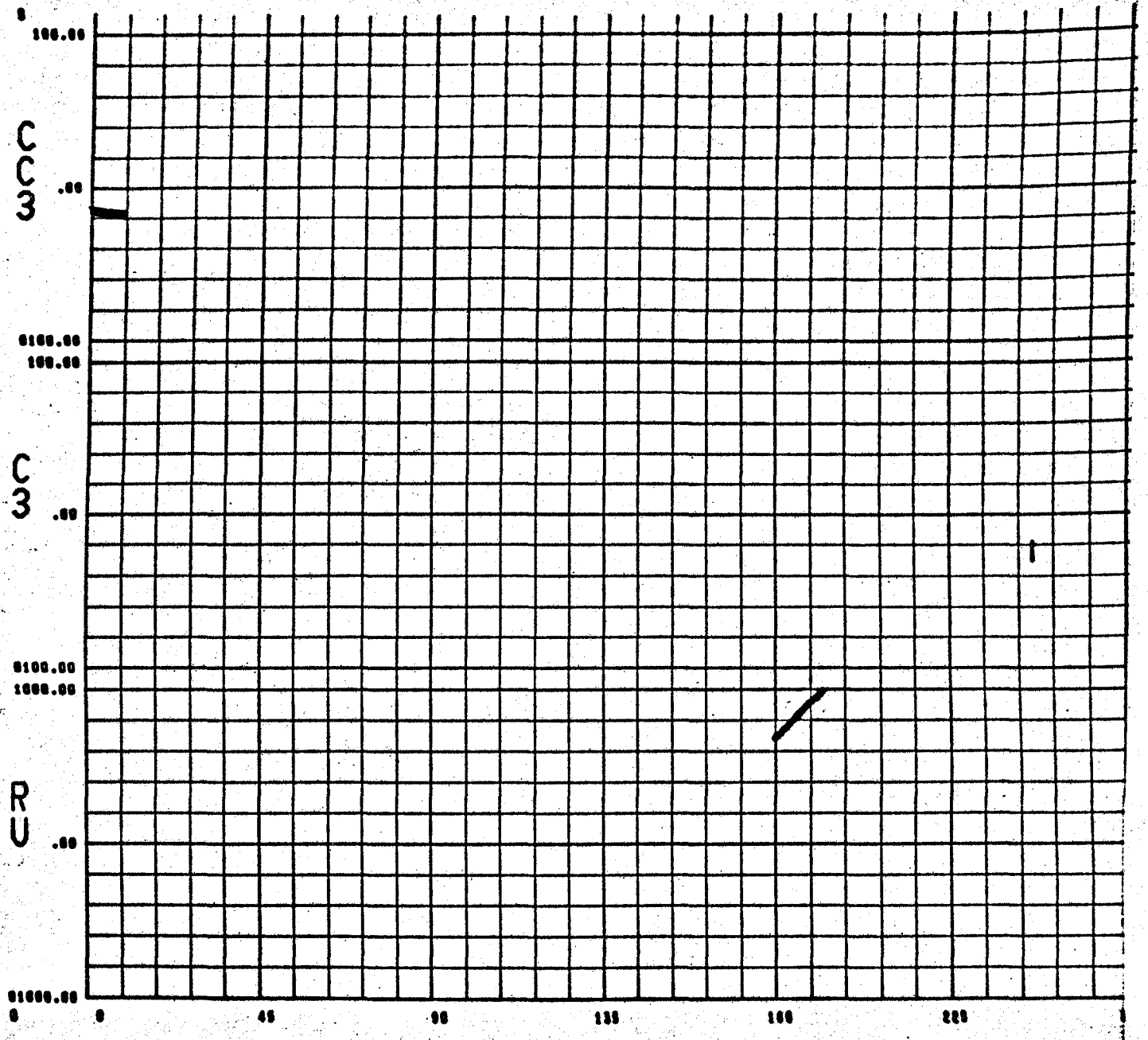
STATION 62 RESIDUALS PASS NUMBER 13/226



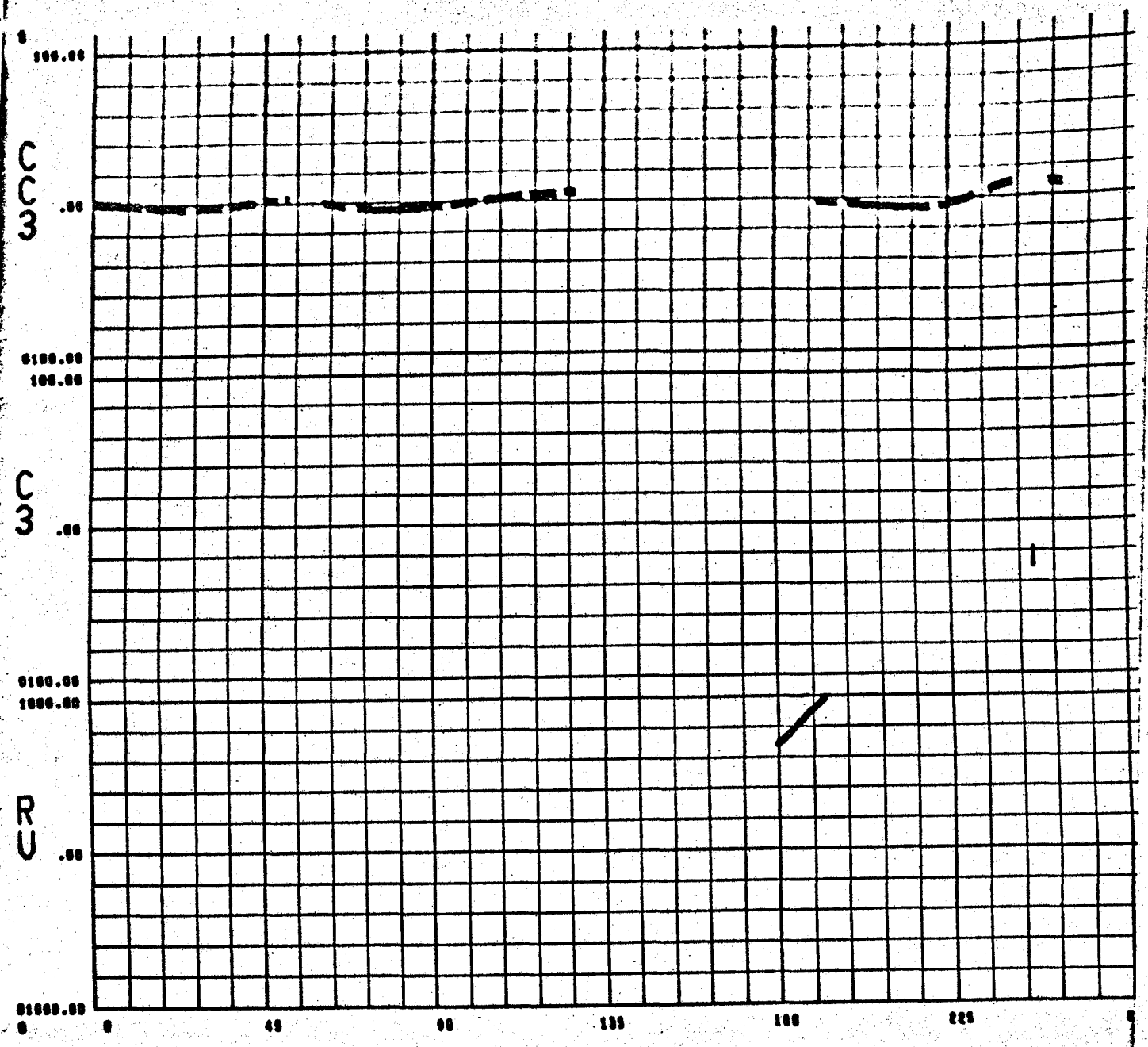
STATION 41 RESIDUALS PASS NUMBER 14/227

REV LTR

U3 4289-2000 REV. 6/64



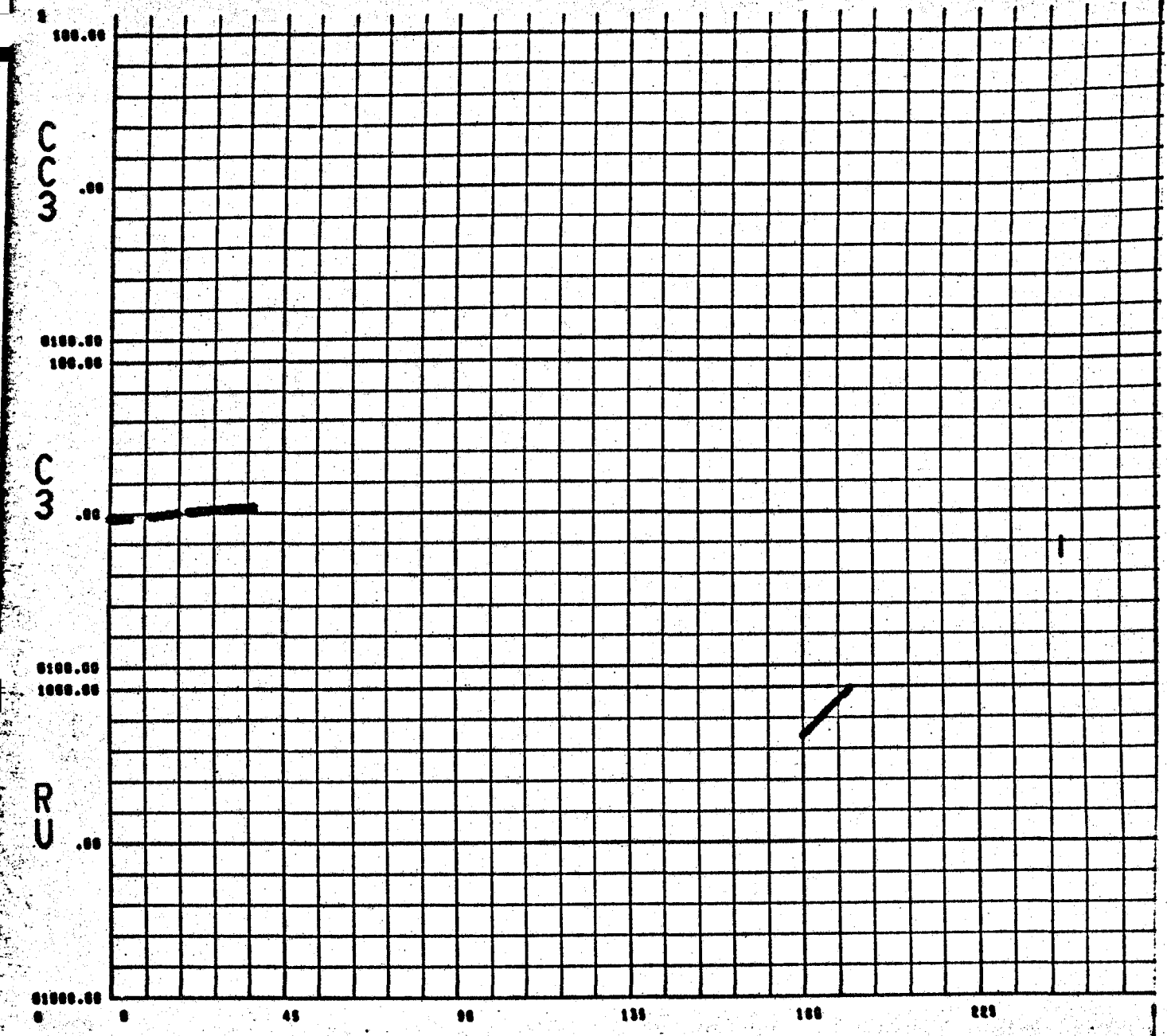
STATION 41 RESIDUALS PASS NUMBER 14/227



STATION 12 RESIDUALS PASS NUMBER 13/226

REV LTR

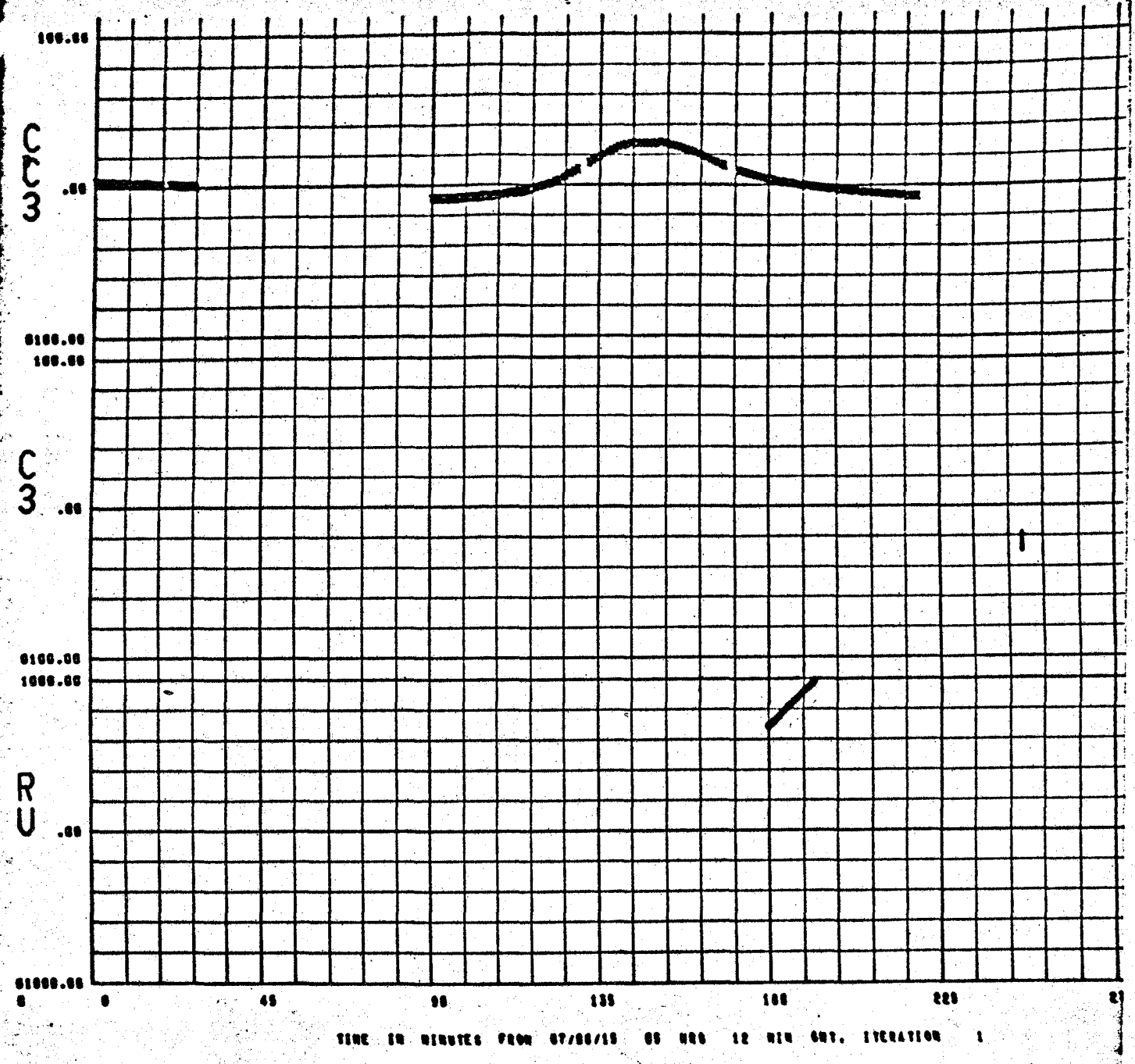
U3 4289-2000 REV. 6/64



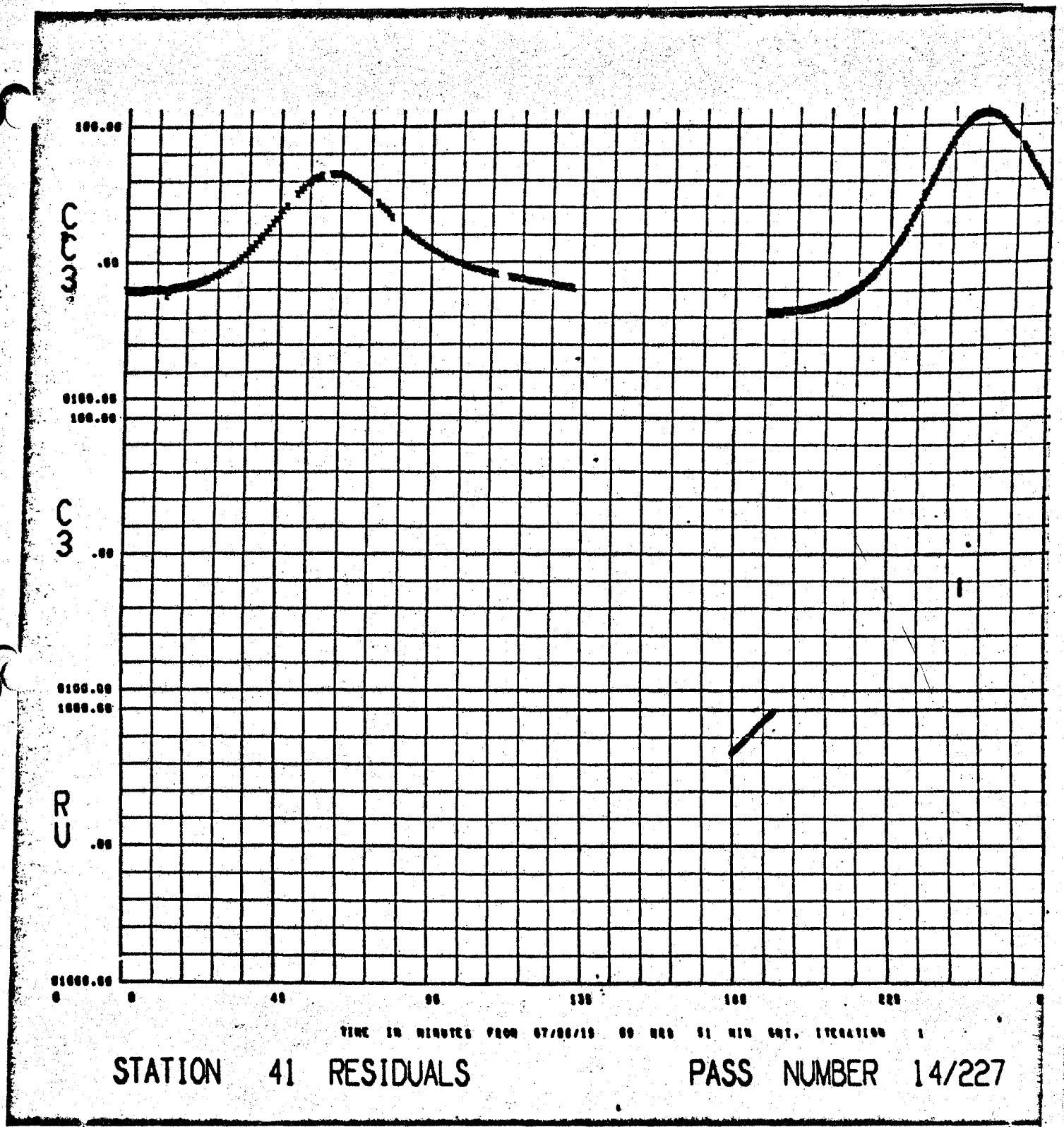
STATION 12 RESIDUALS PASS NUMBER 13/226

ODPL 5V32

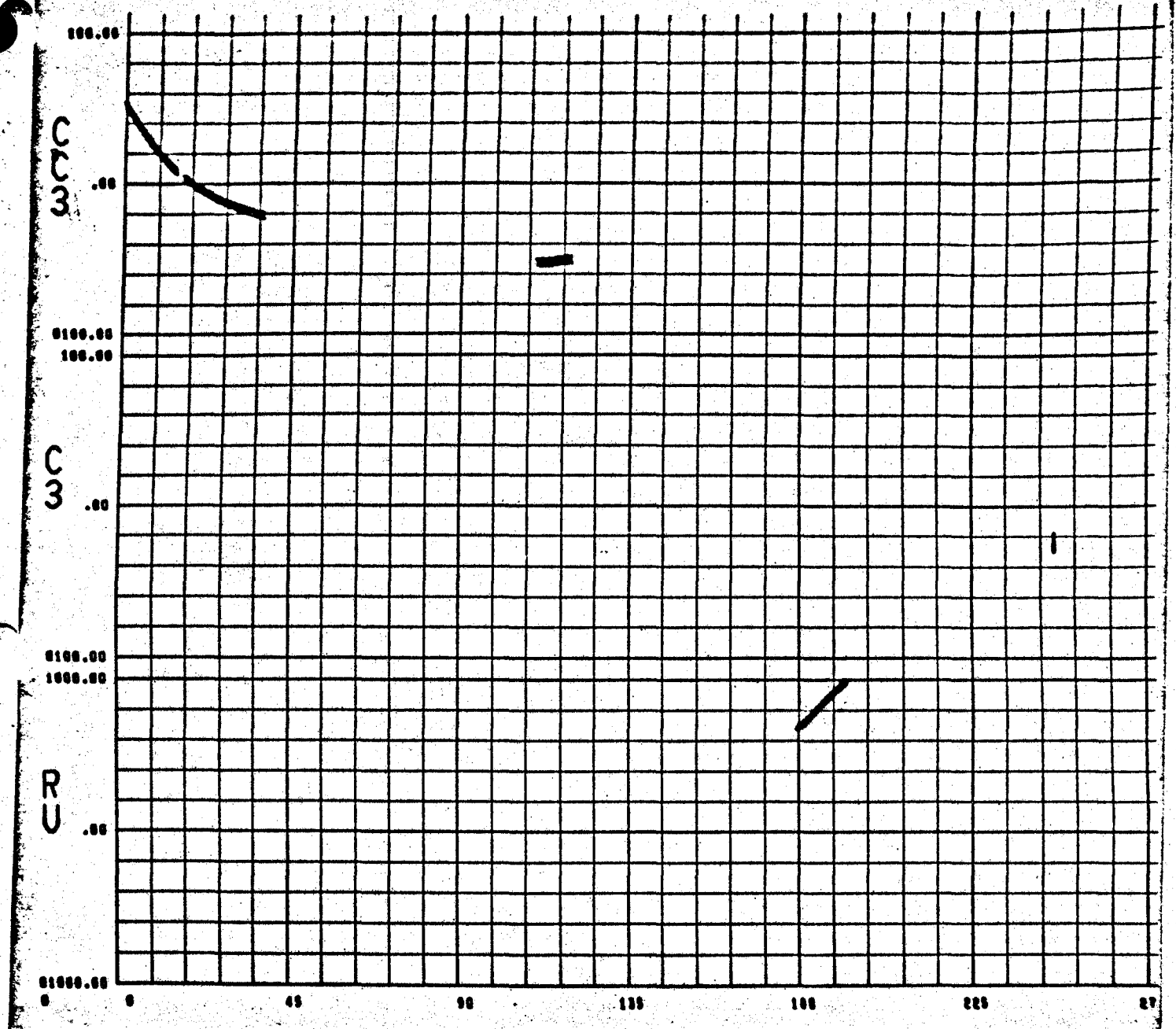
SIMPLE MOON



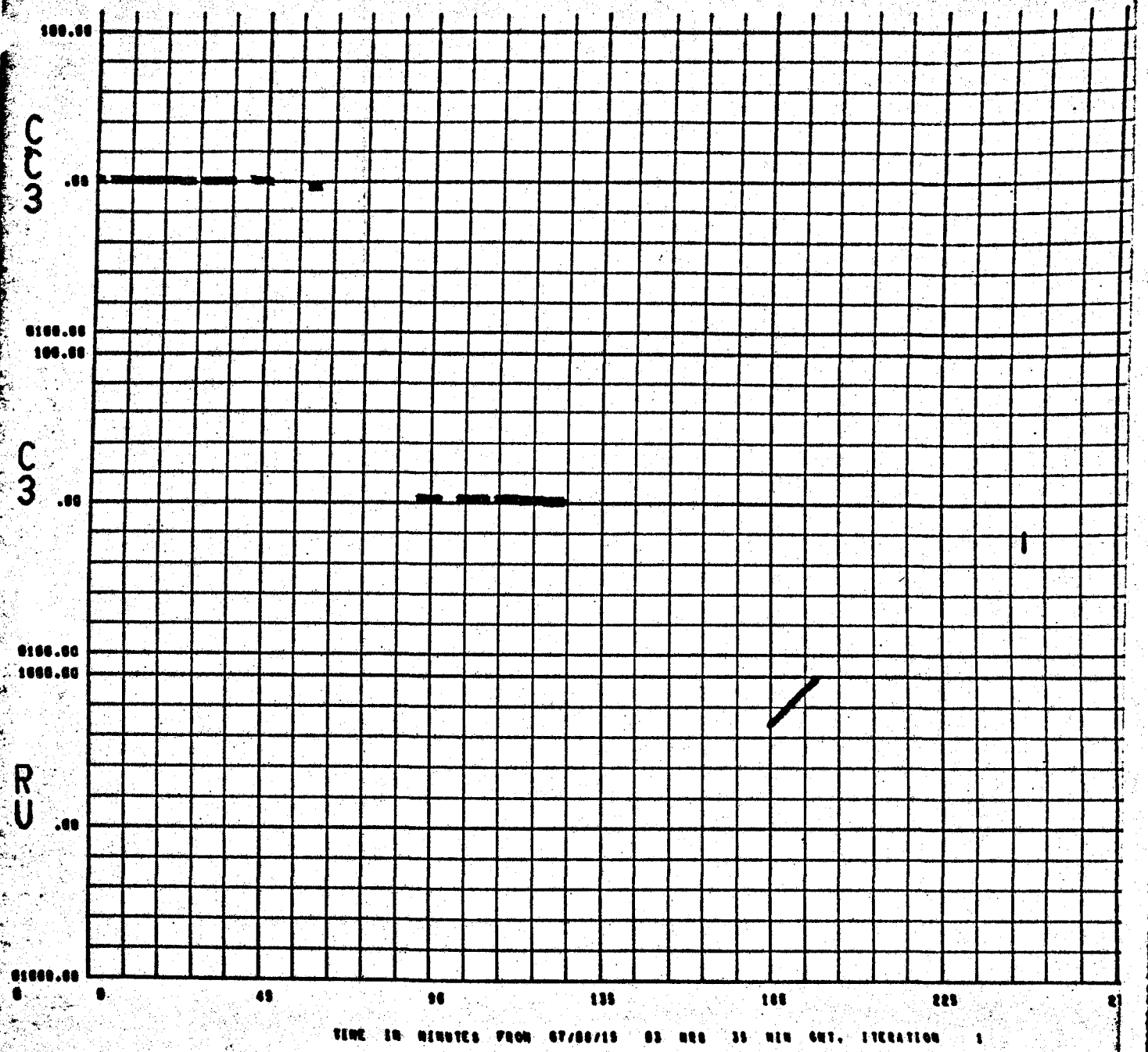
STATION 41 RESIDUALS PASS NUMBER 14/227



STATION 41 RESIDUALS PASS NUMBER 14/227



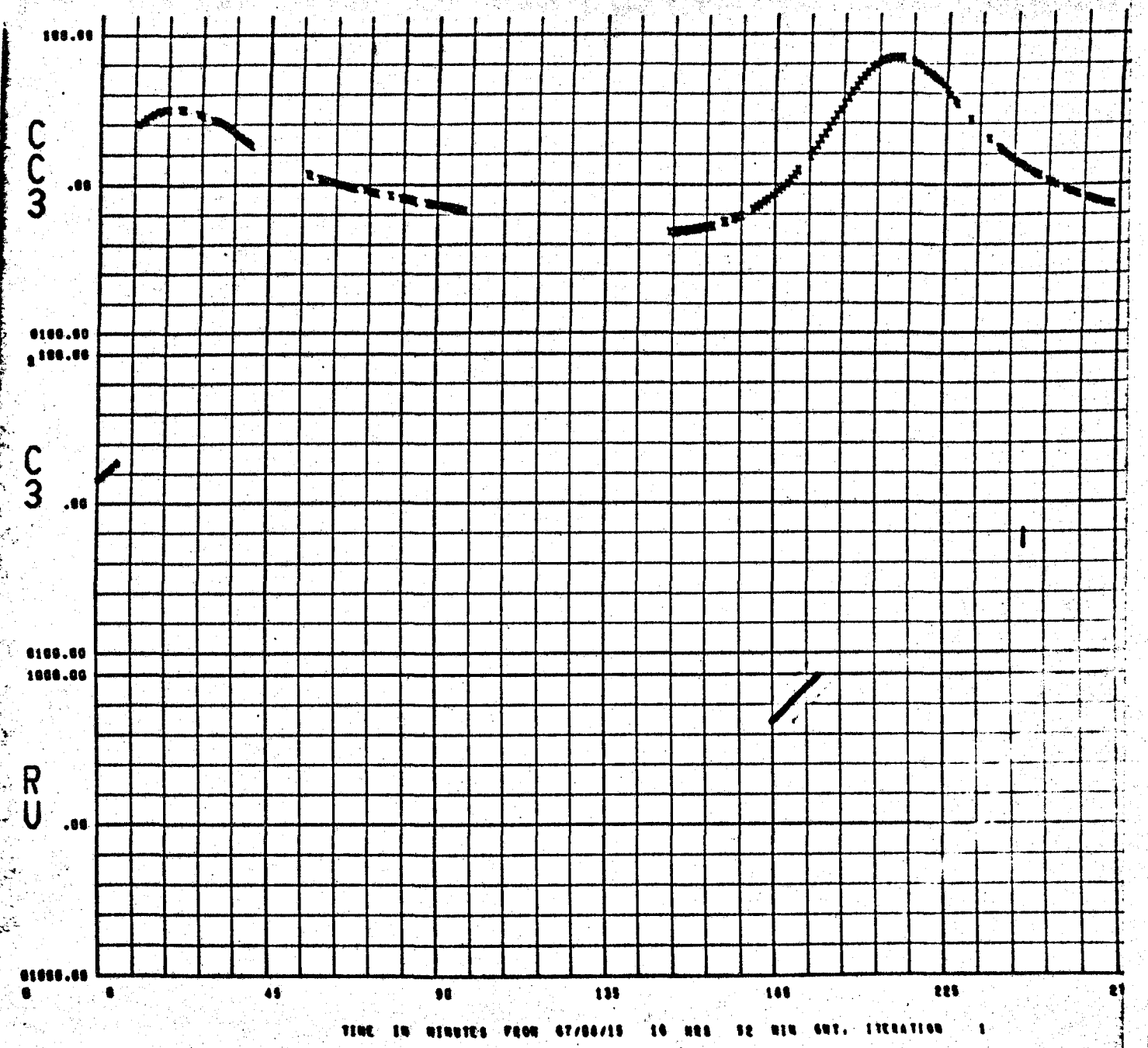
STATION 41 RESIDUALS PASS NUMBER 14/227



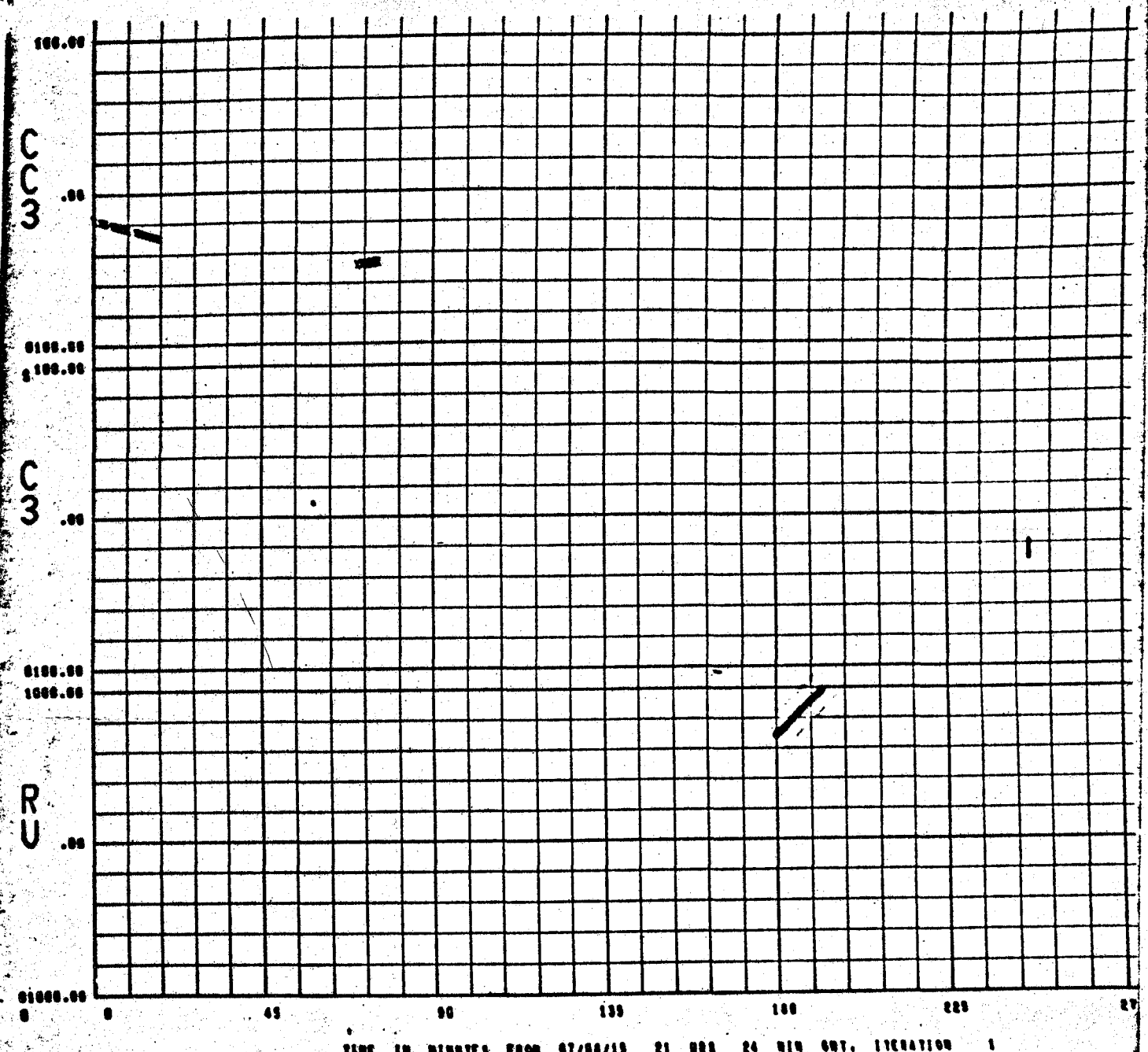
STATION 12 RESIDUALS PASS NUMBER 13/226

ODPL 5V33

SIMPLE MOON



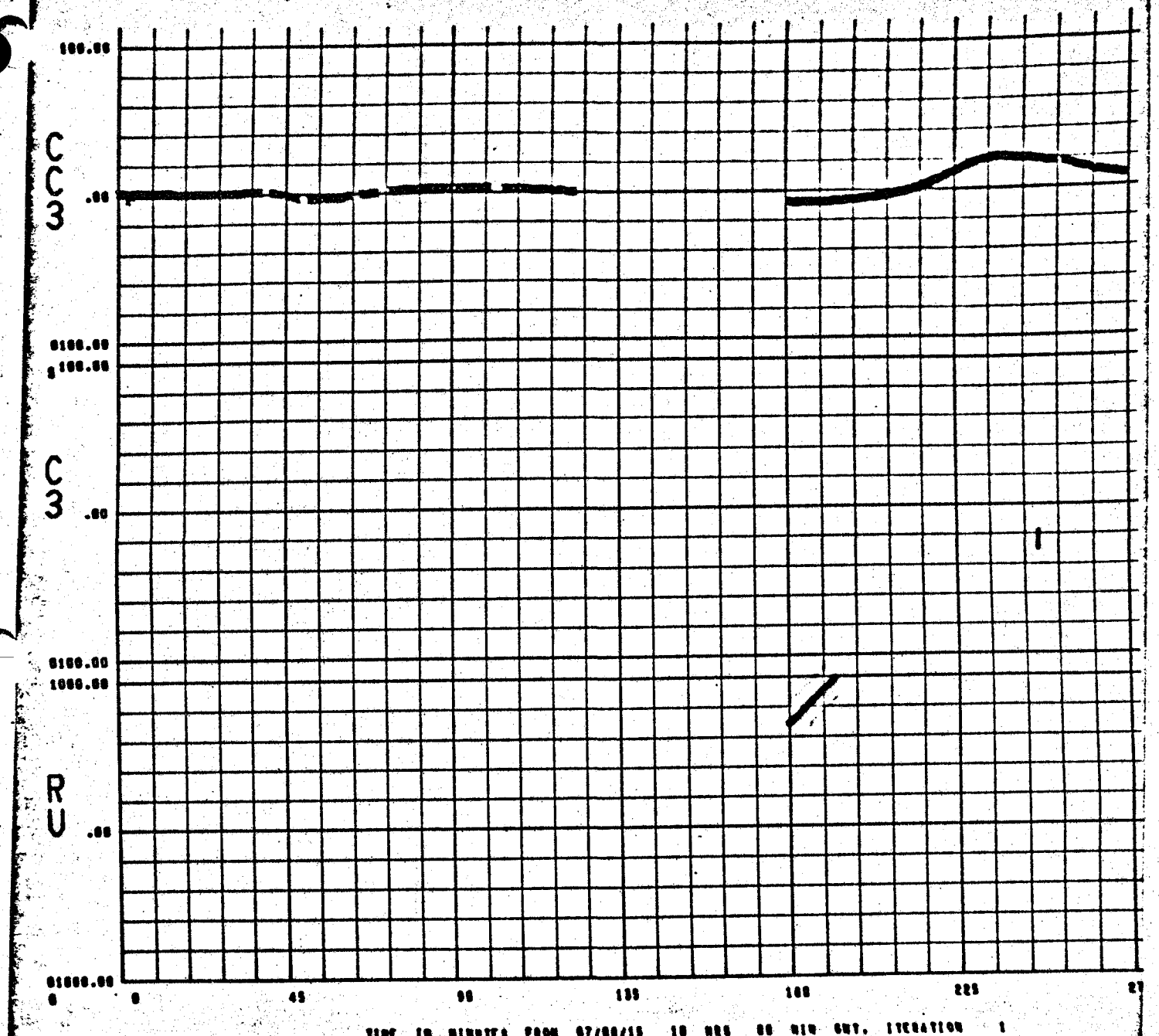
STATION 62 RESIDUALS PASS NUMBER 14/227



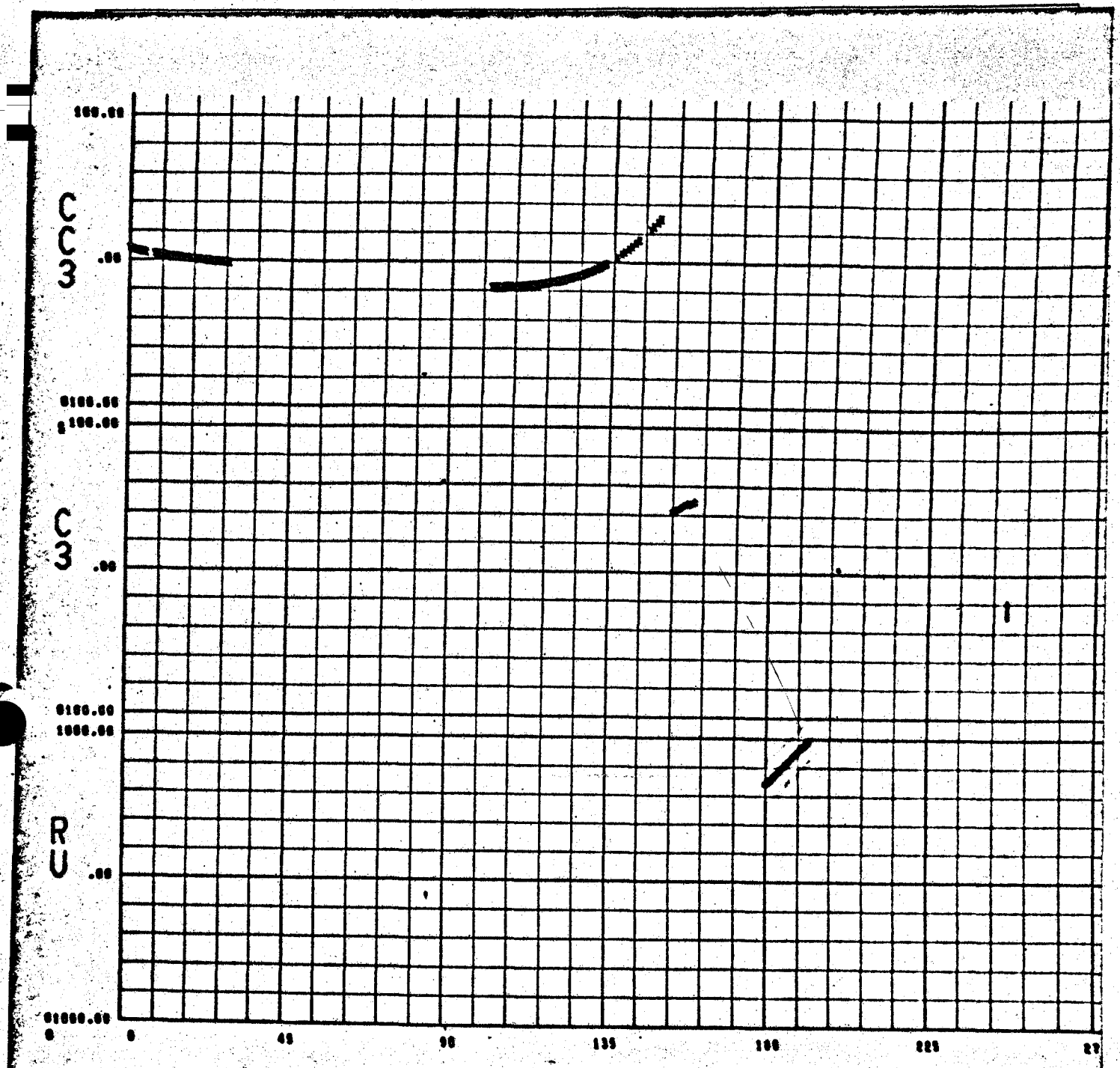
STATION 62 RESIDUALS PASS NUMBER 14/227

REV LTR

U3 4289-2000 REV. 6/64



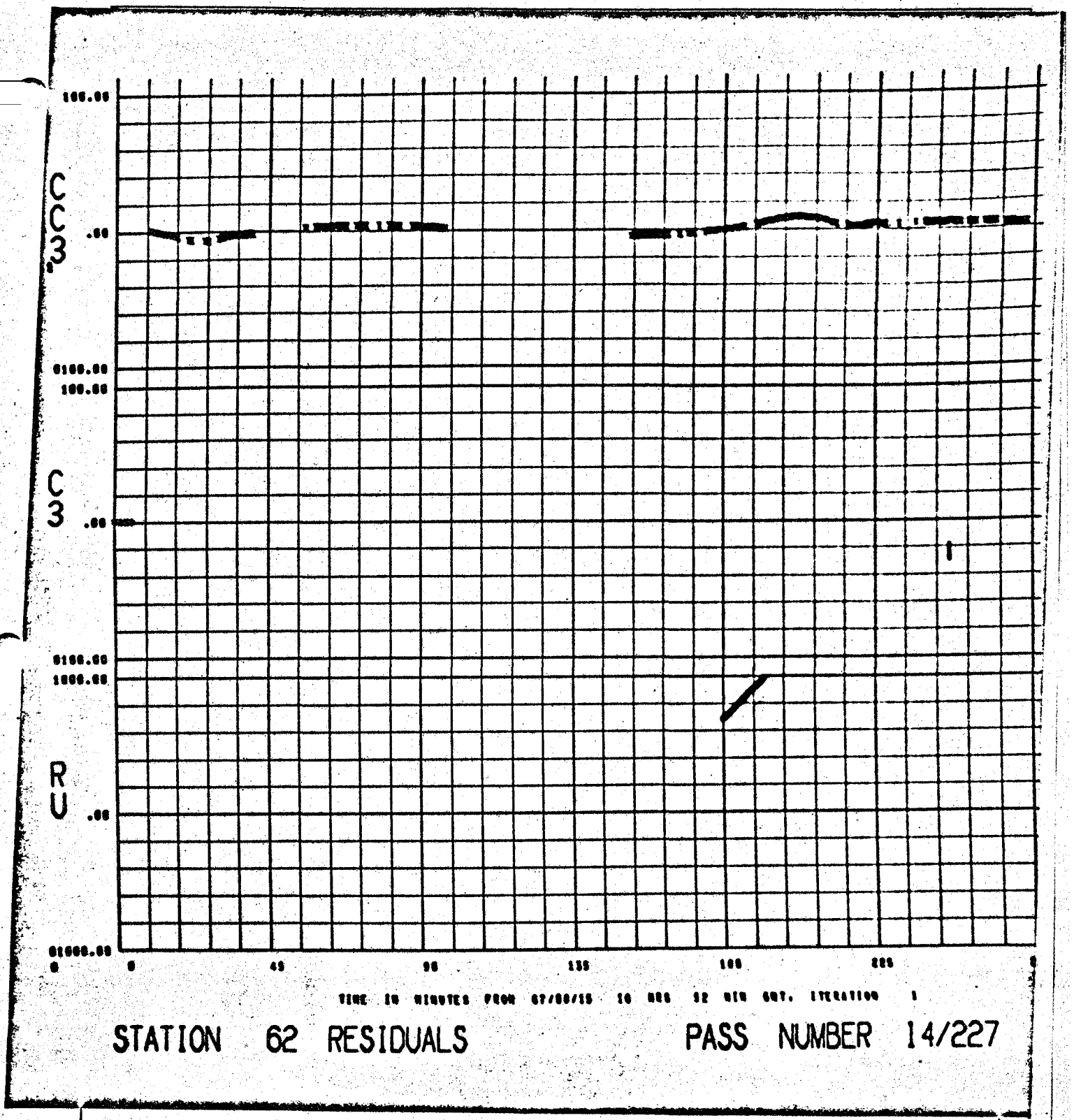
STATION 41 RESIDUALS PASS NUMBER 14/227



STATION 41 RESIDUALS PASS NUMBER 14/227

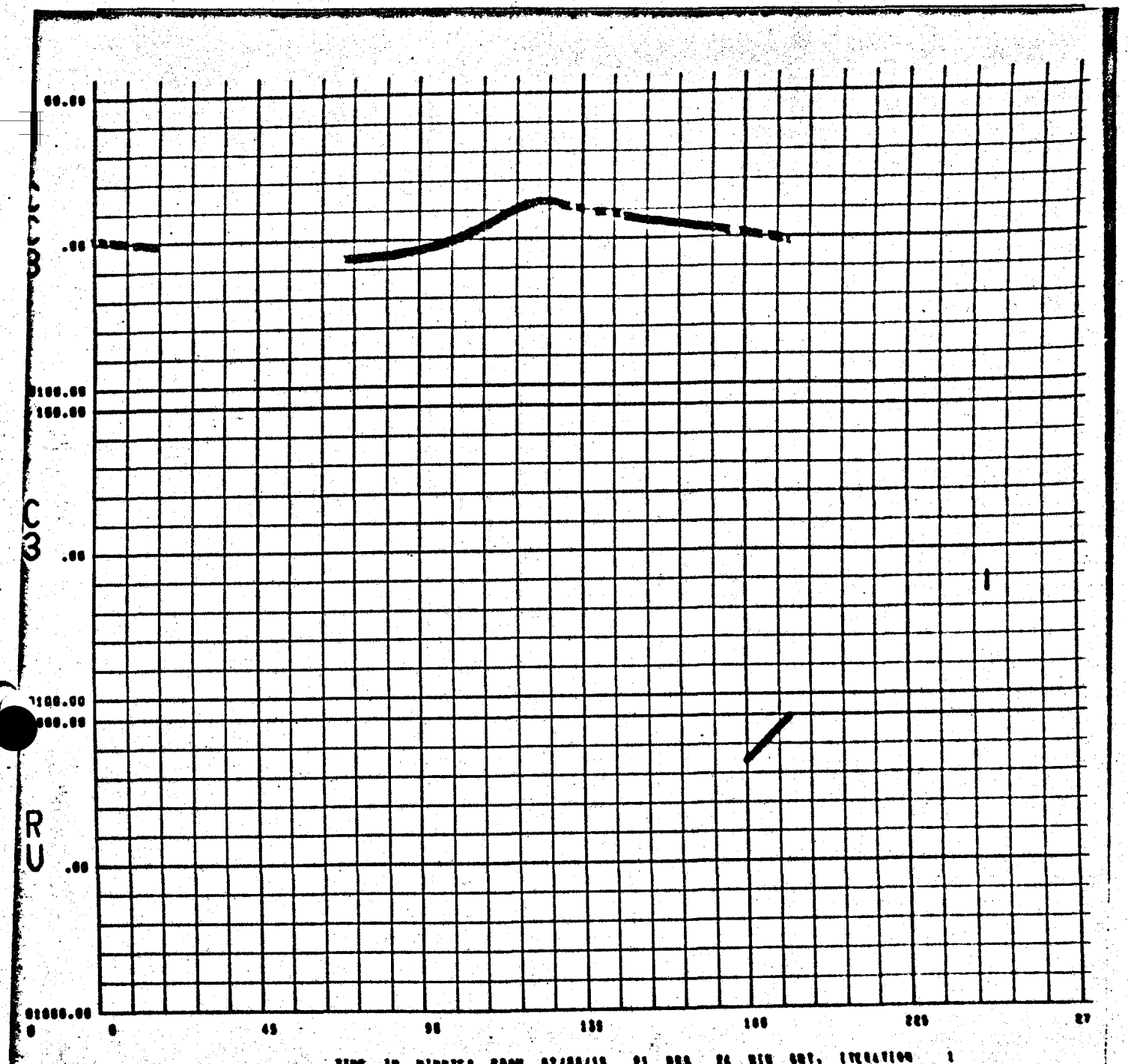
ODPL 5V35

SIMPLE MOON

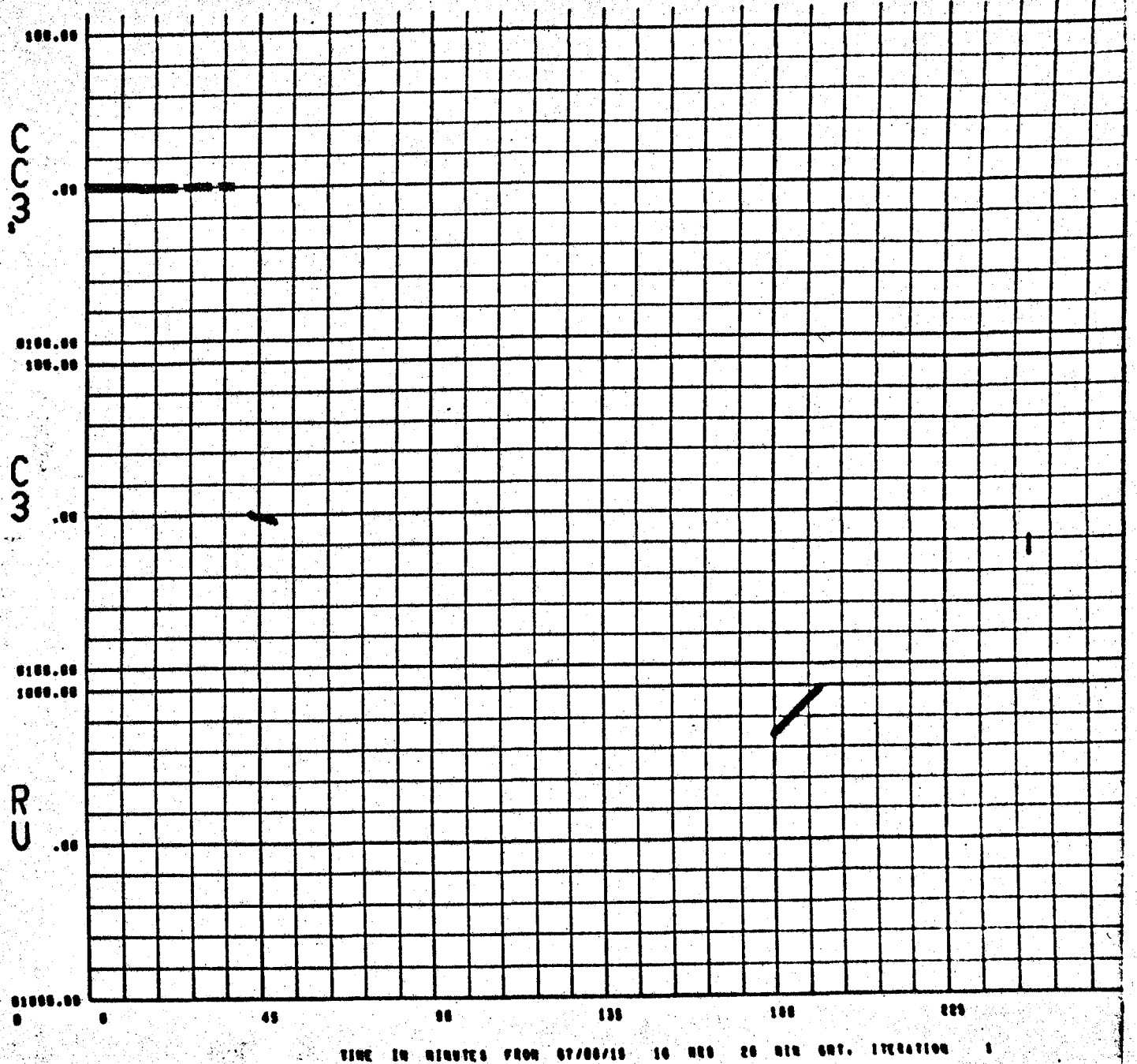


STATION 62 RESIDUALS PASS NUMBER 14/227

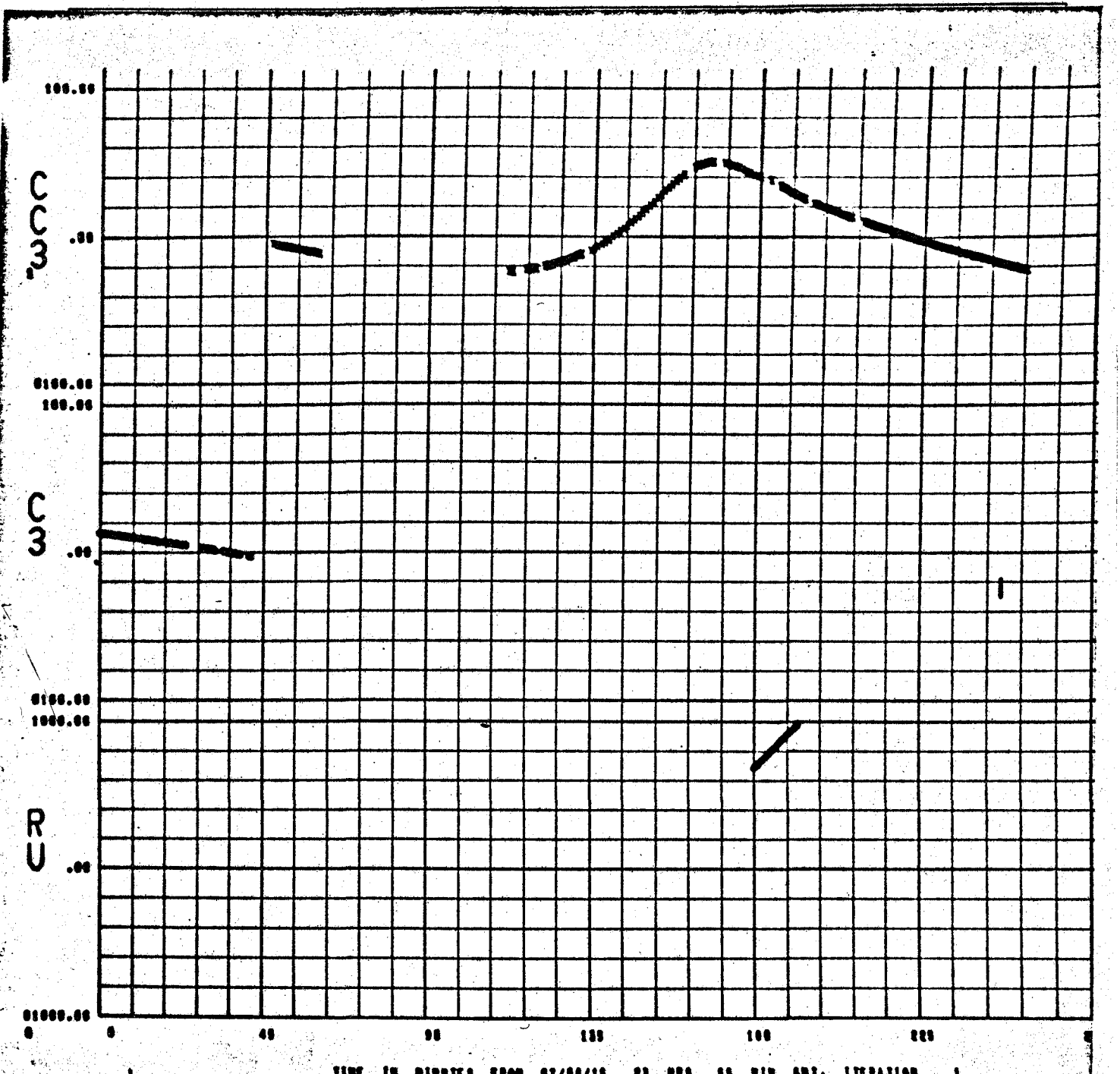
REV LTR



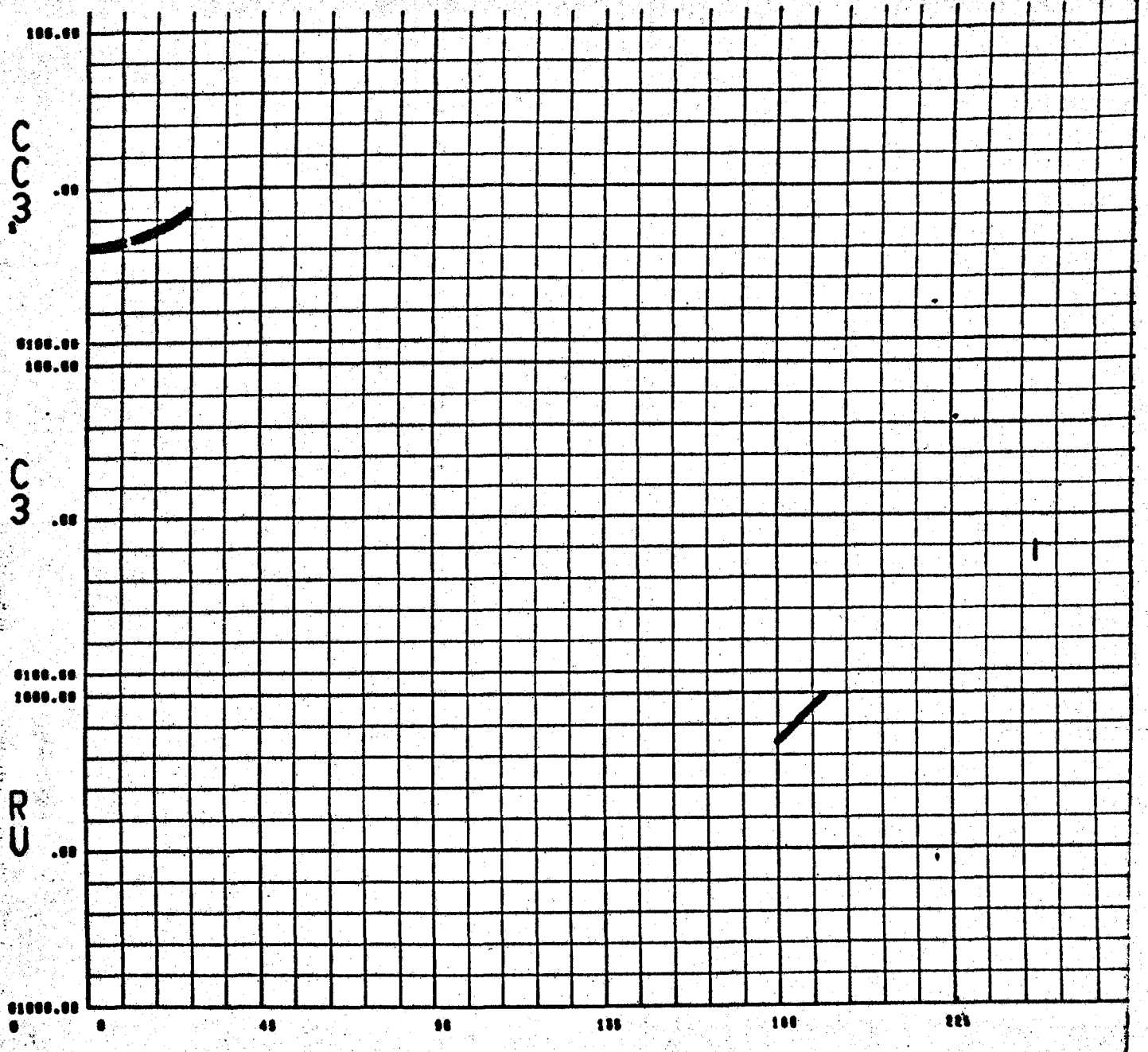
STATION 62 RESIDUALS PASS NUMBER 14/227



STATION 41 RESIDUALS PASS NUMBER 14/227



STATION 12 RESIDUALS PASS NUMBER 14/227



STATION 12 RESIDUALS PASS NUMBER 14/227

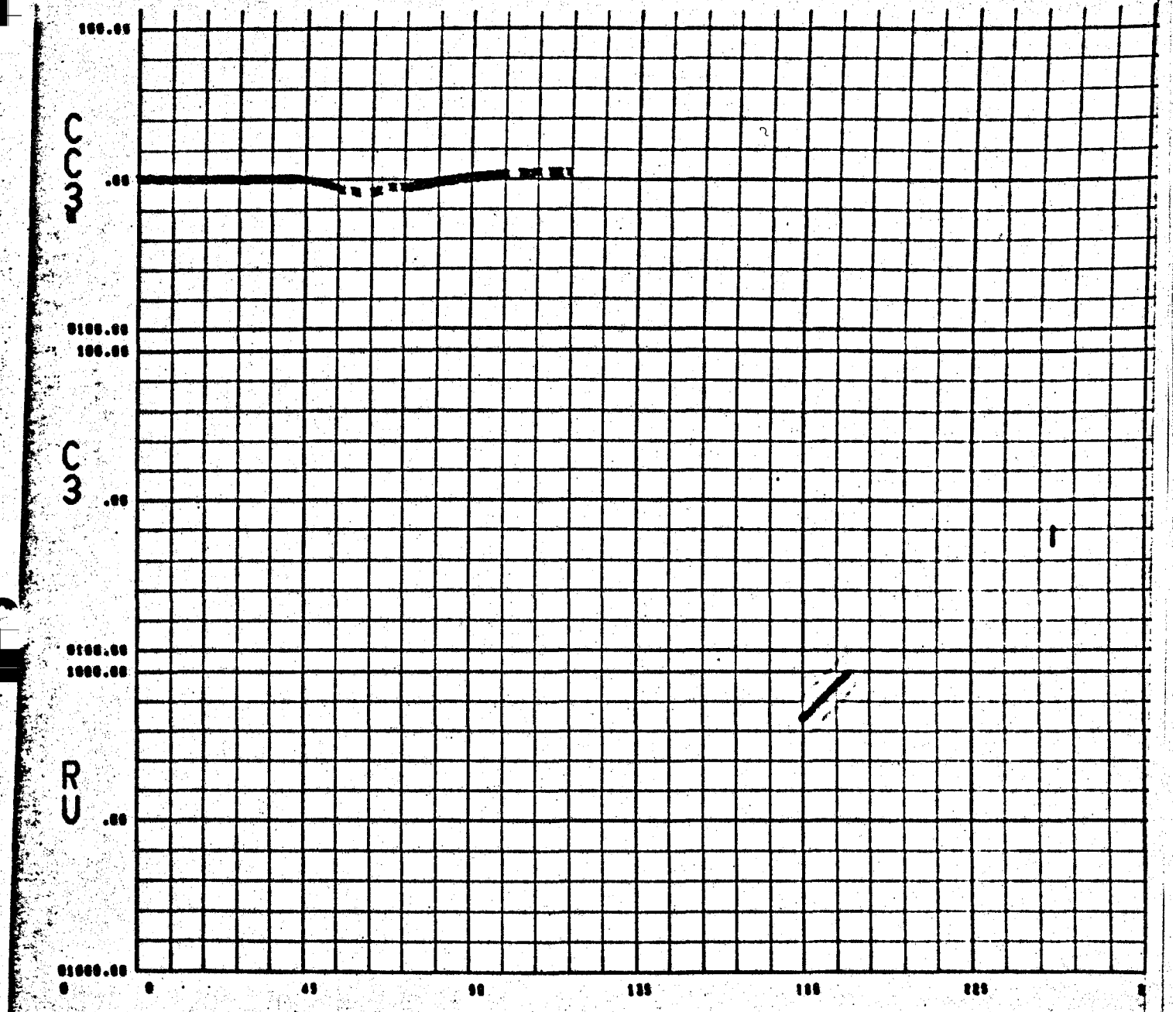
REV LTR

BOEING NO. D2-100816-1

SH. 611

ODPL 5V37

SIMPLE MOON



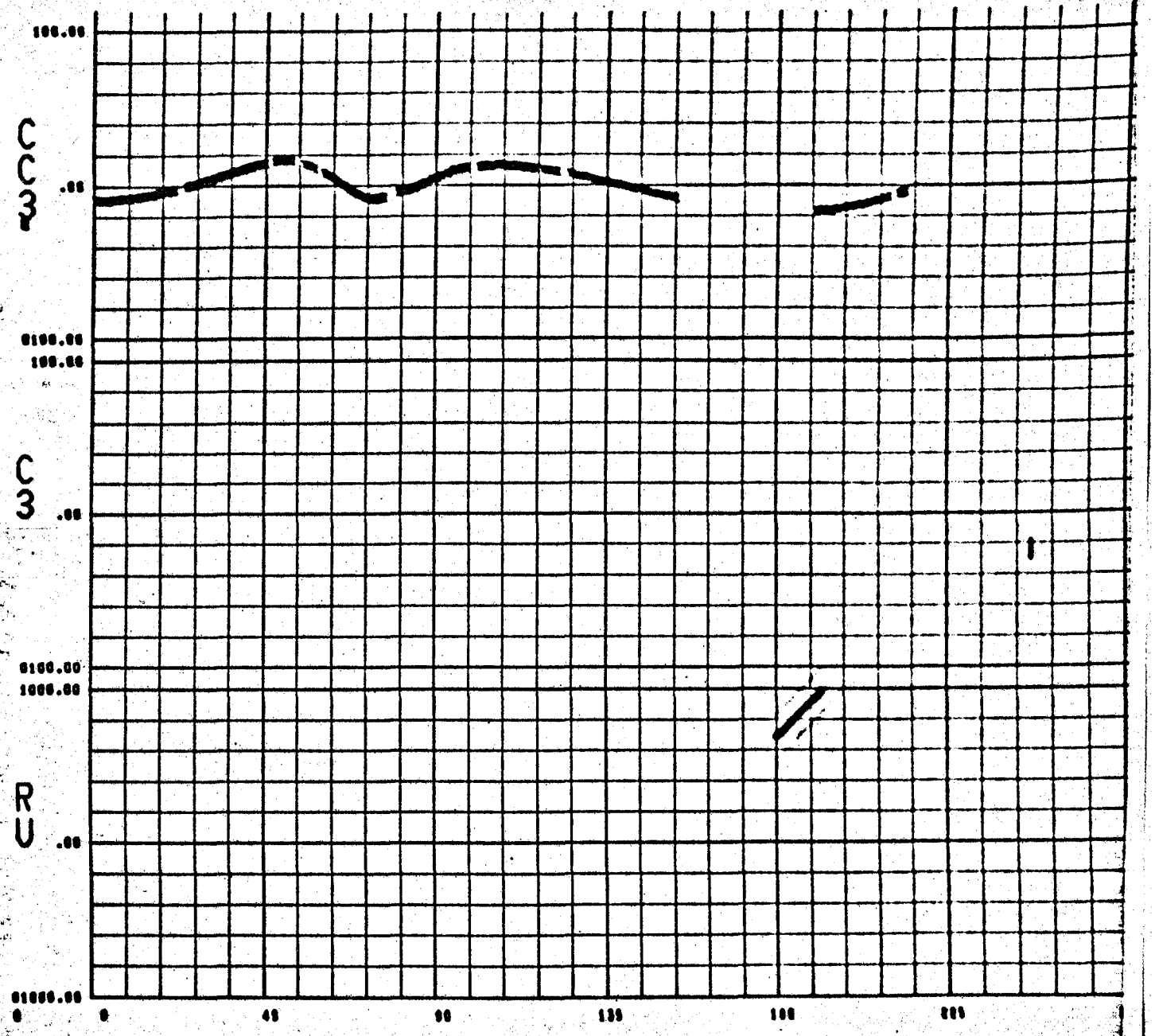
STATION 62 RESIDUALS PASS NUMBER 14/227

REV LTR

U3 4289-2000 REV. 8/64

BOEING NO. D2-100816-1

SH. 613



STATION 41 RESIDUALS PASS NUMBER 15/228

REV LTR

US 4288-2000 REV. 6/64

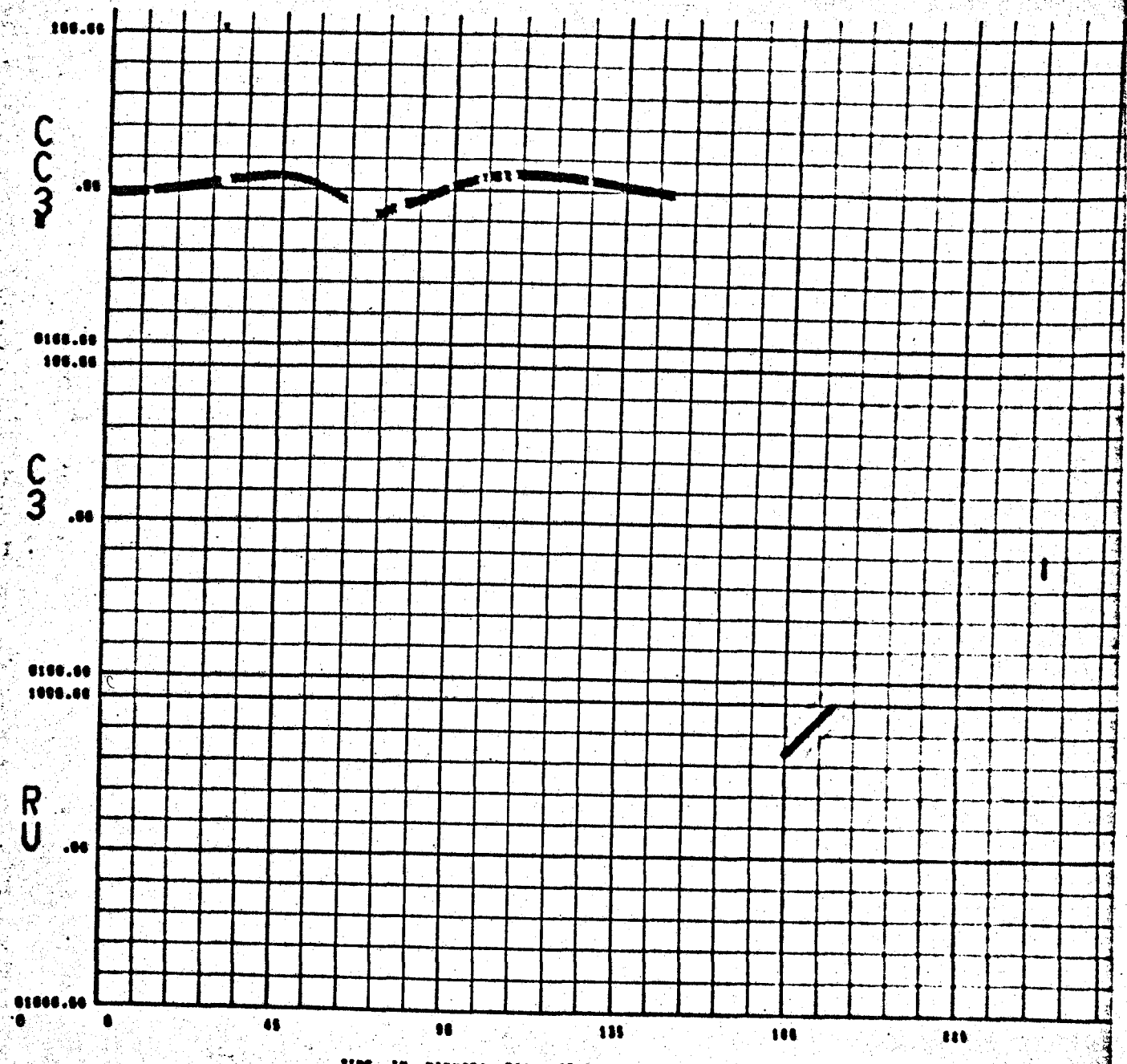
BOEING NO. D2-100816-1

SH. 614

STATION 12 RESIDUALS PASS NUMBER 14/227

REV LTR

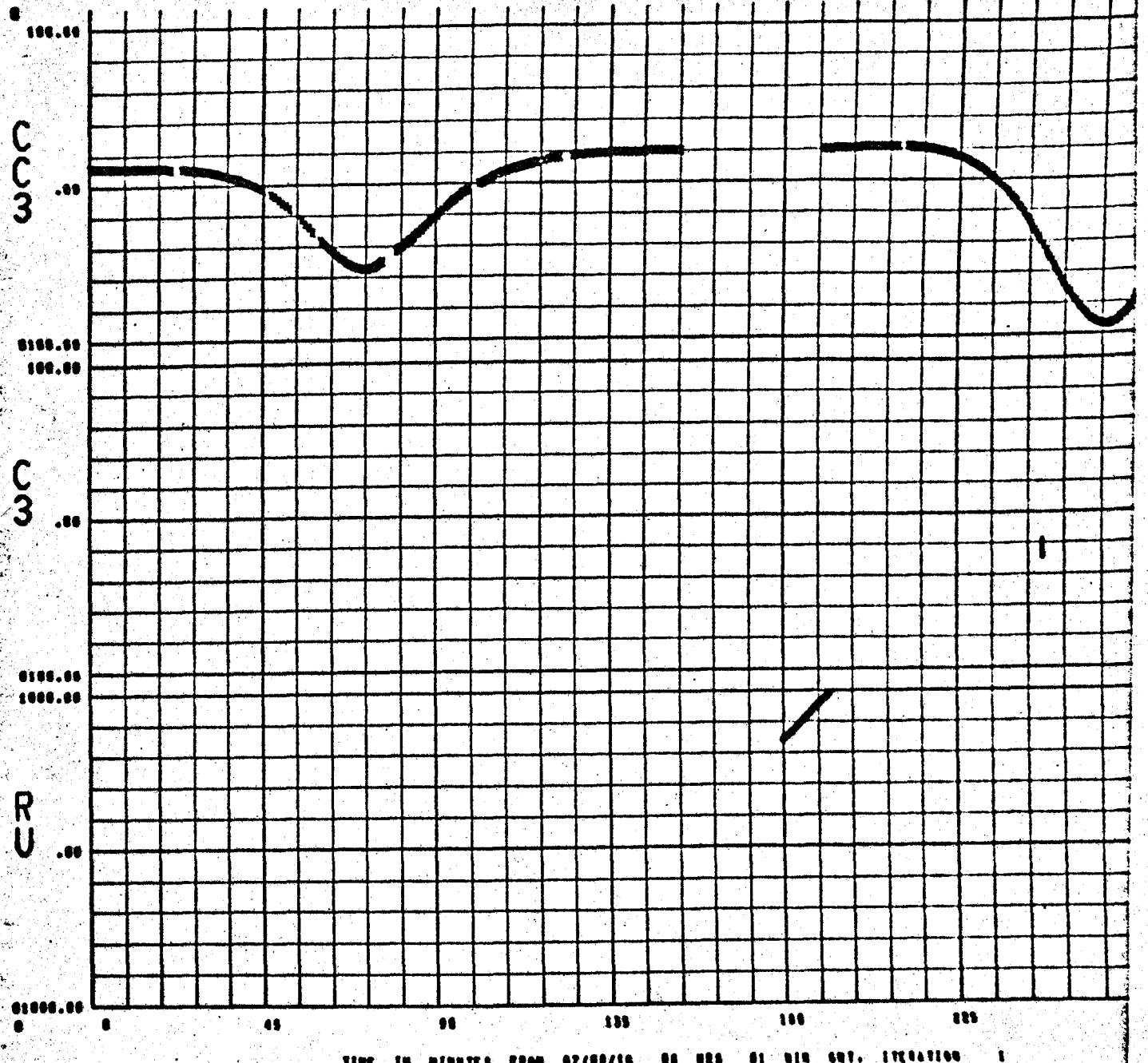
U3 4289-2000 REV. 6/64



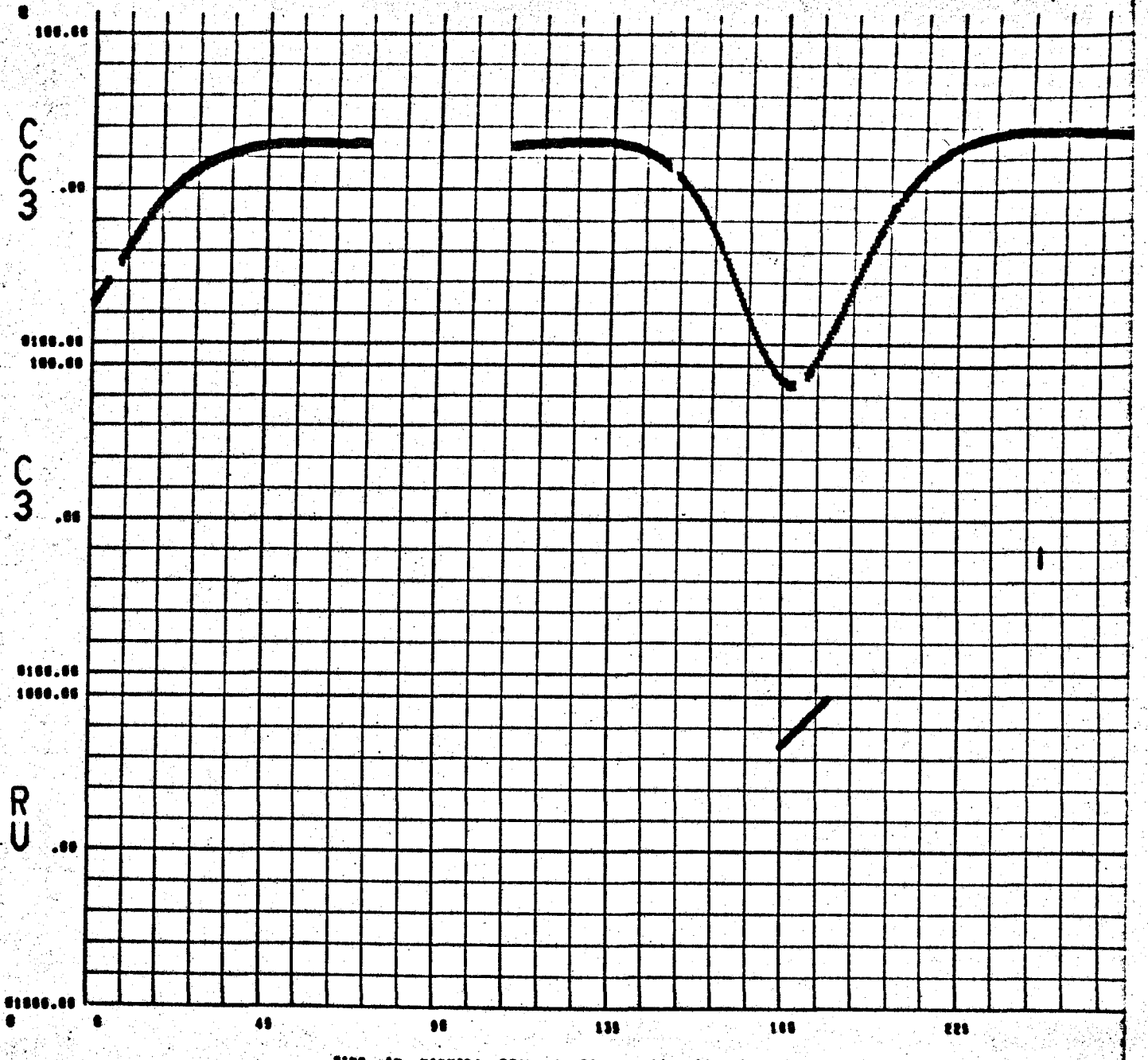
STATION 12 RESIDUALS PASS NUMBER 14/227

ODPL 5V38

SIMPLE MOON



STATION 41 RESIDUALS PASS NUMBER 15/228



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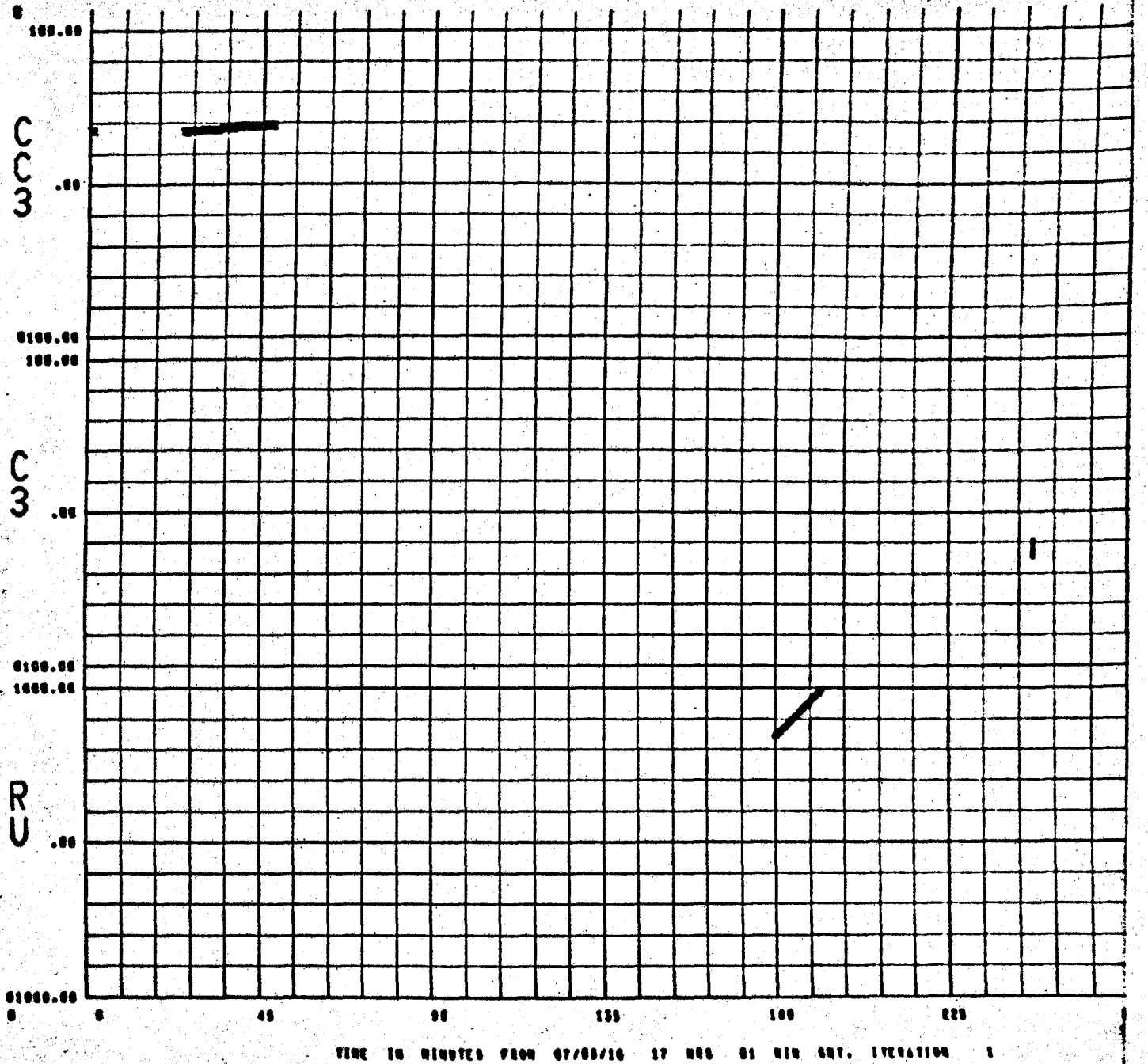
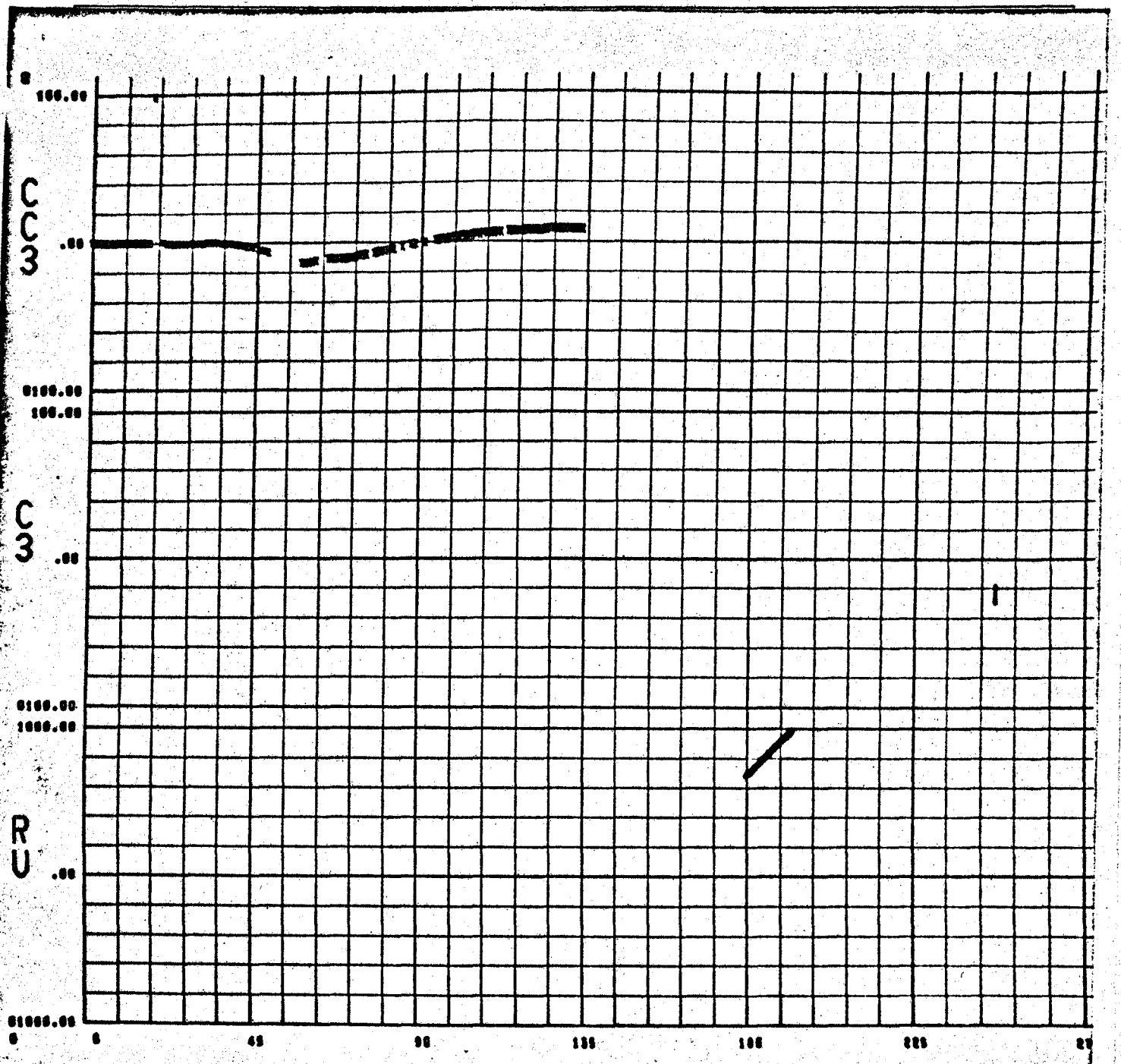


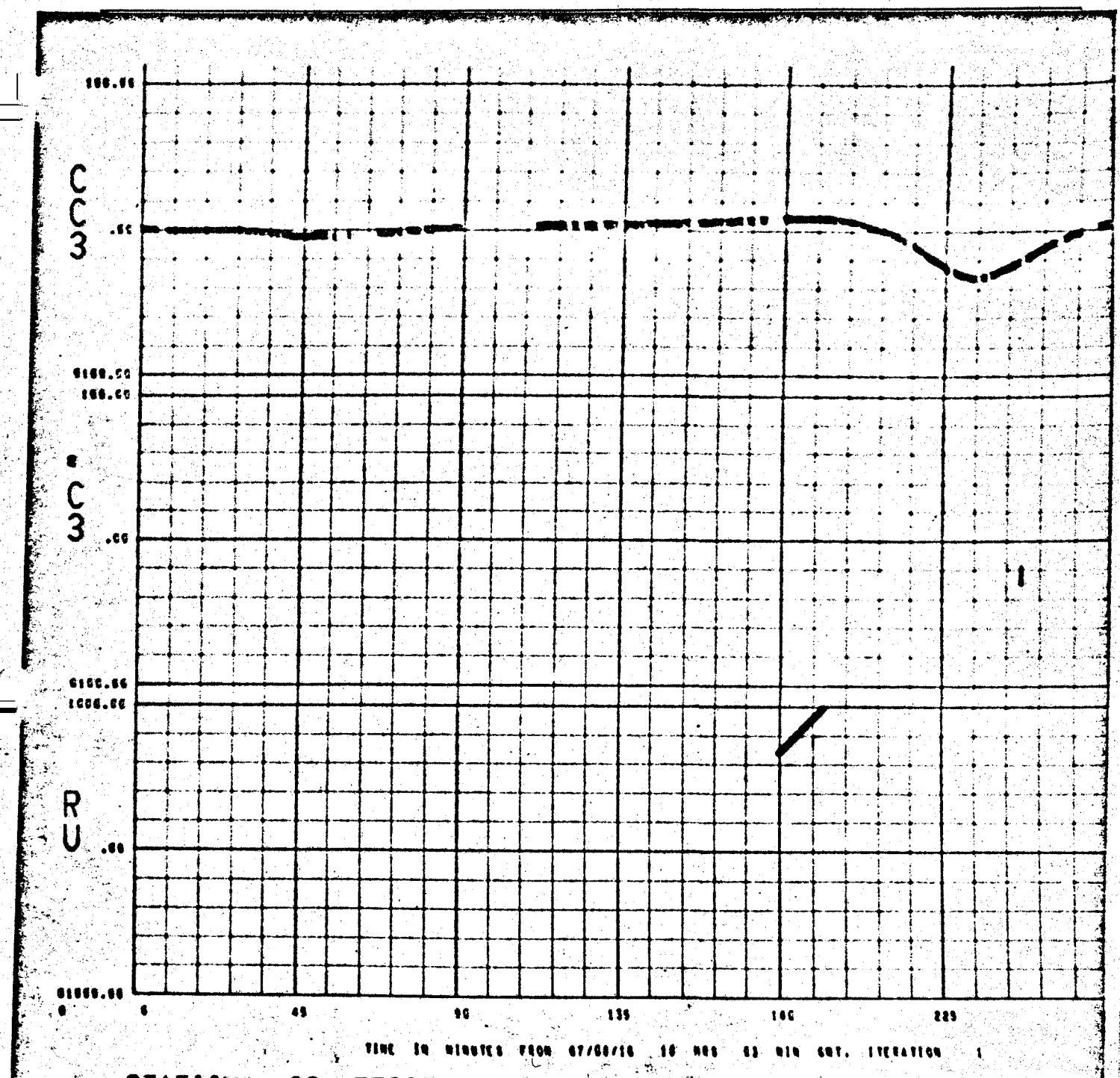
STATION 41 RESIDUALS PASS NUMBER 15/228



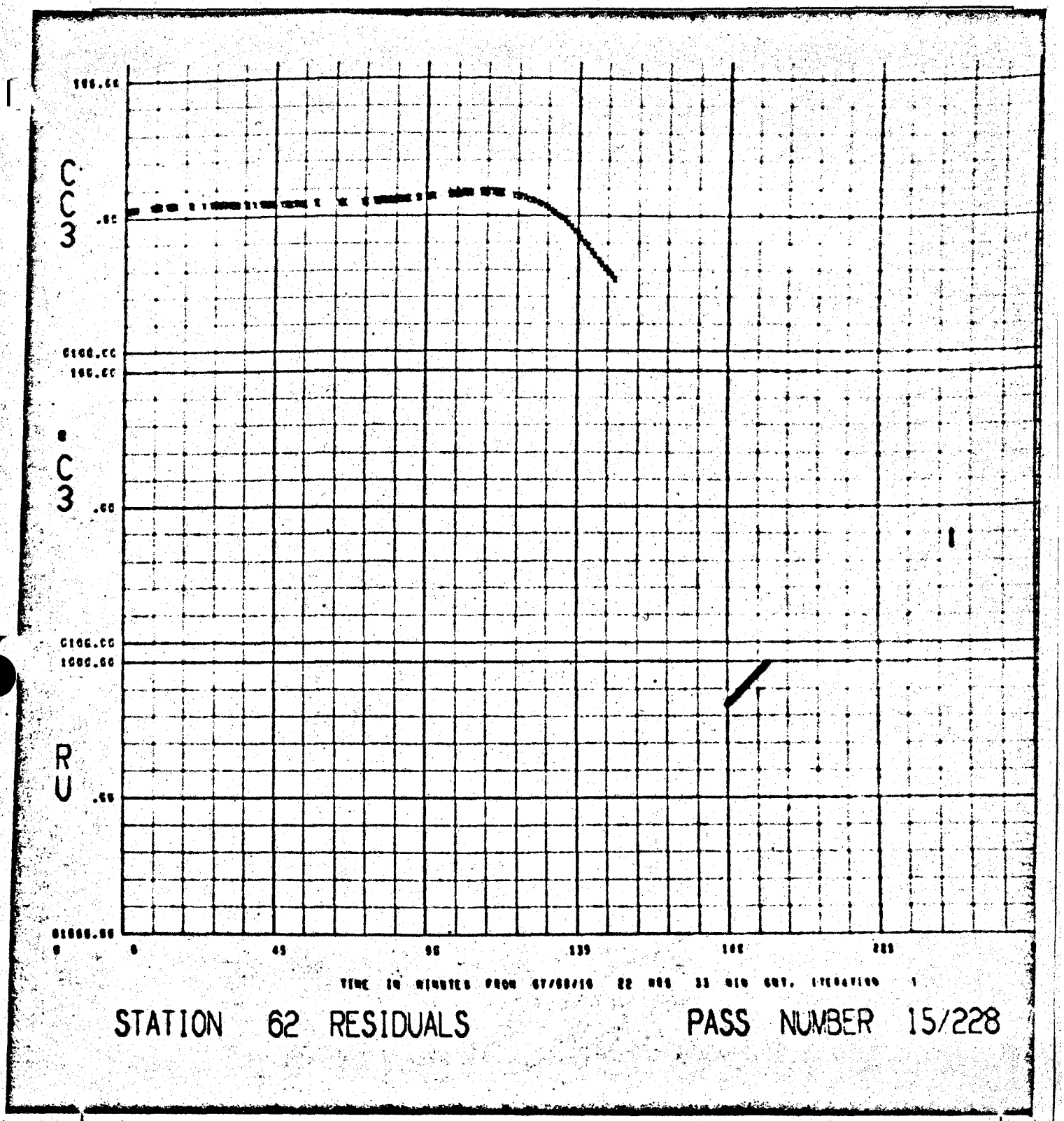
STATION 12 RESIDUALS PASS NUMBER 14/227

ODPL 5A24

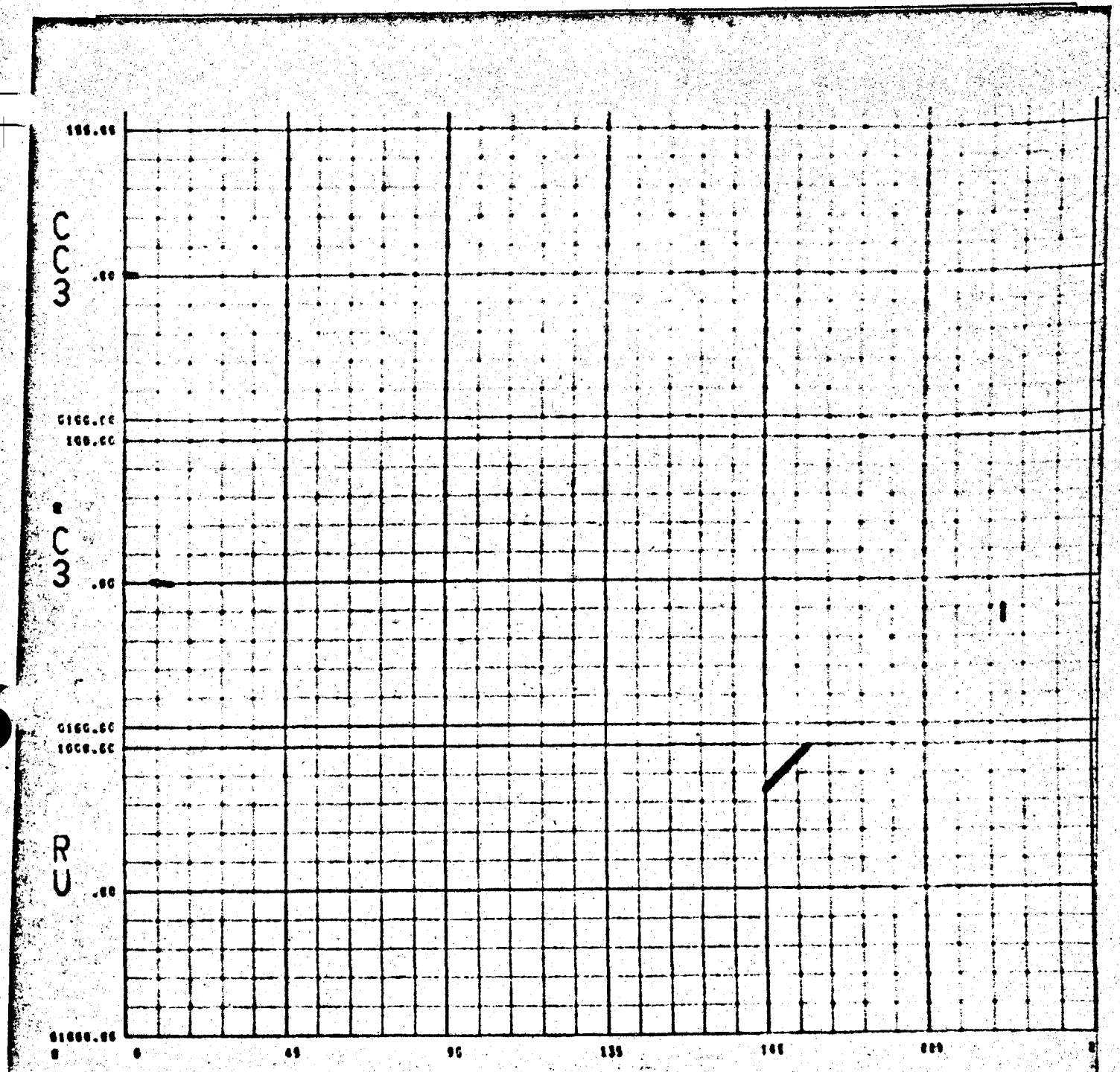
SIMPLE MOON



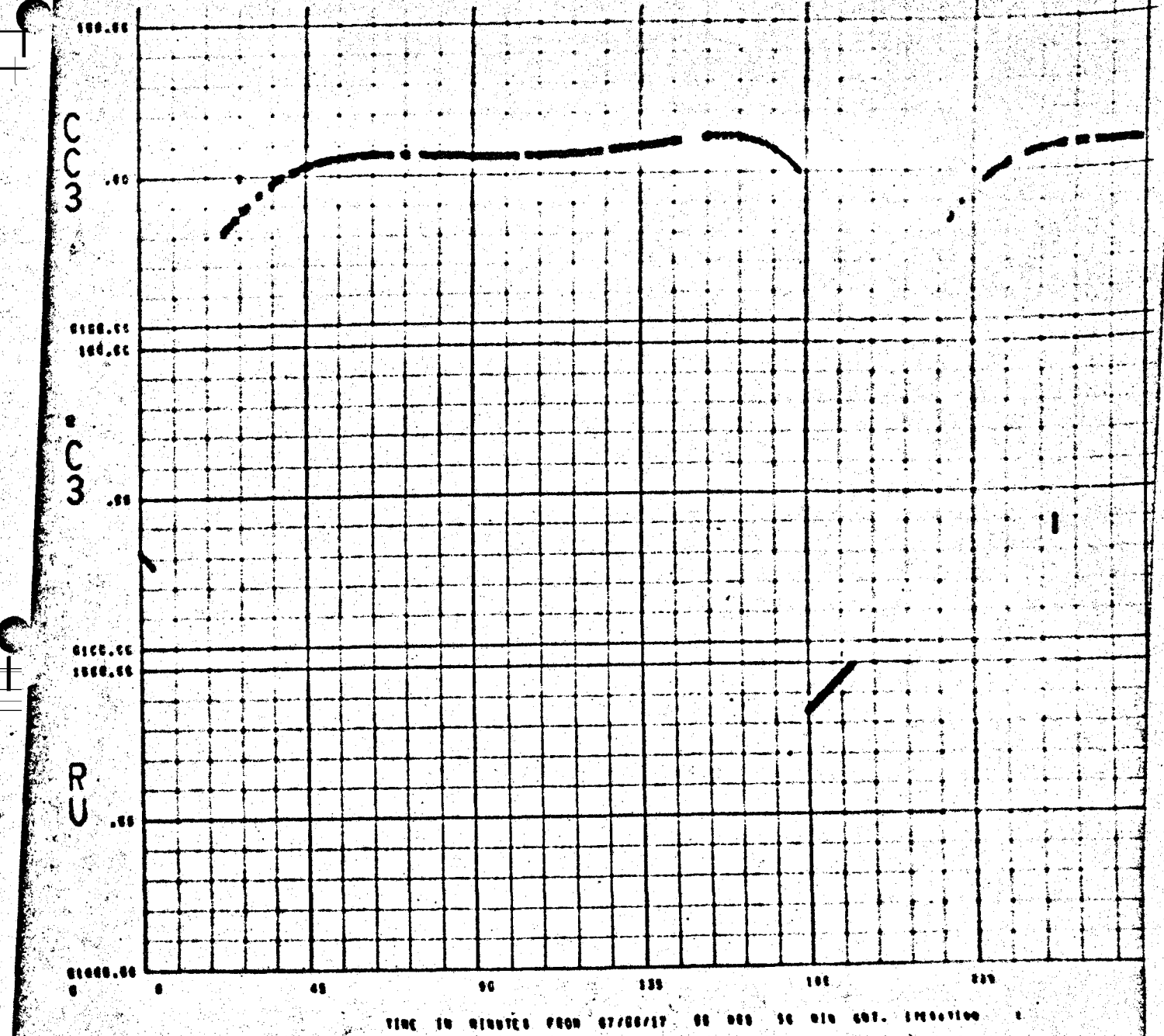
STATION 62 RESIDUALS PASS NUMBER 14/227



STATION 62 RESIDUALS PASS NUMBER 15/228



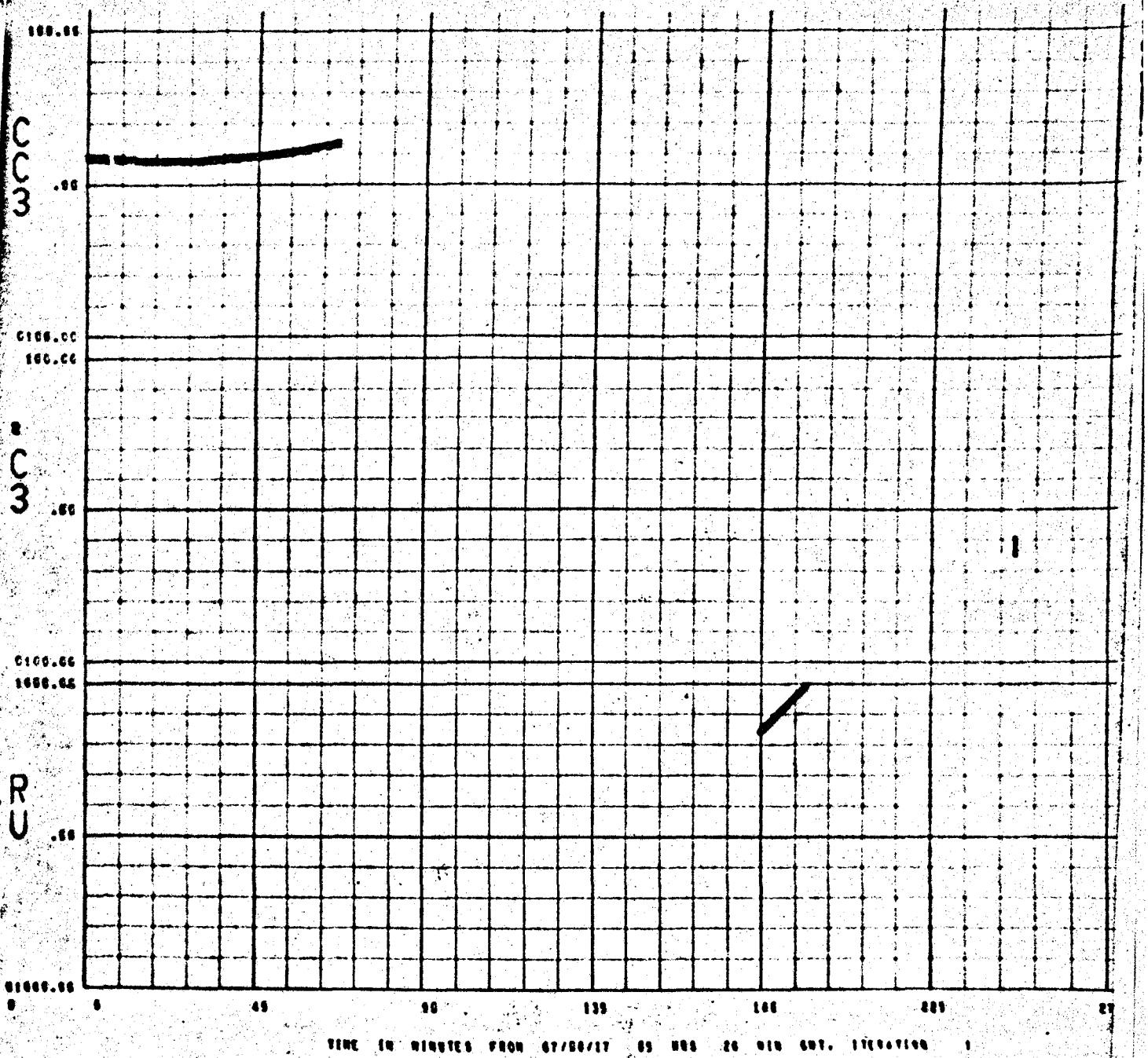
STATION 41 RESIDUALS PASS NUMBER 15/228



STATION 12 RESIDUALS PASS NUMBER 15/229

REV LTR

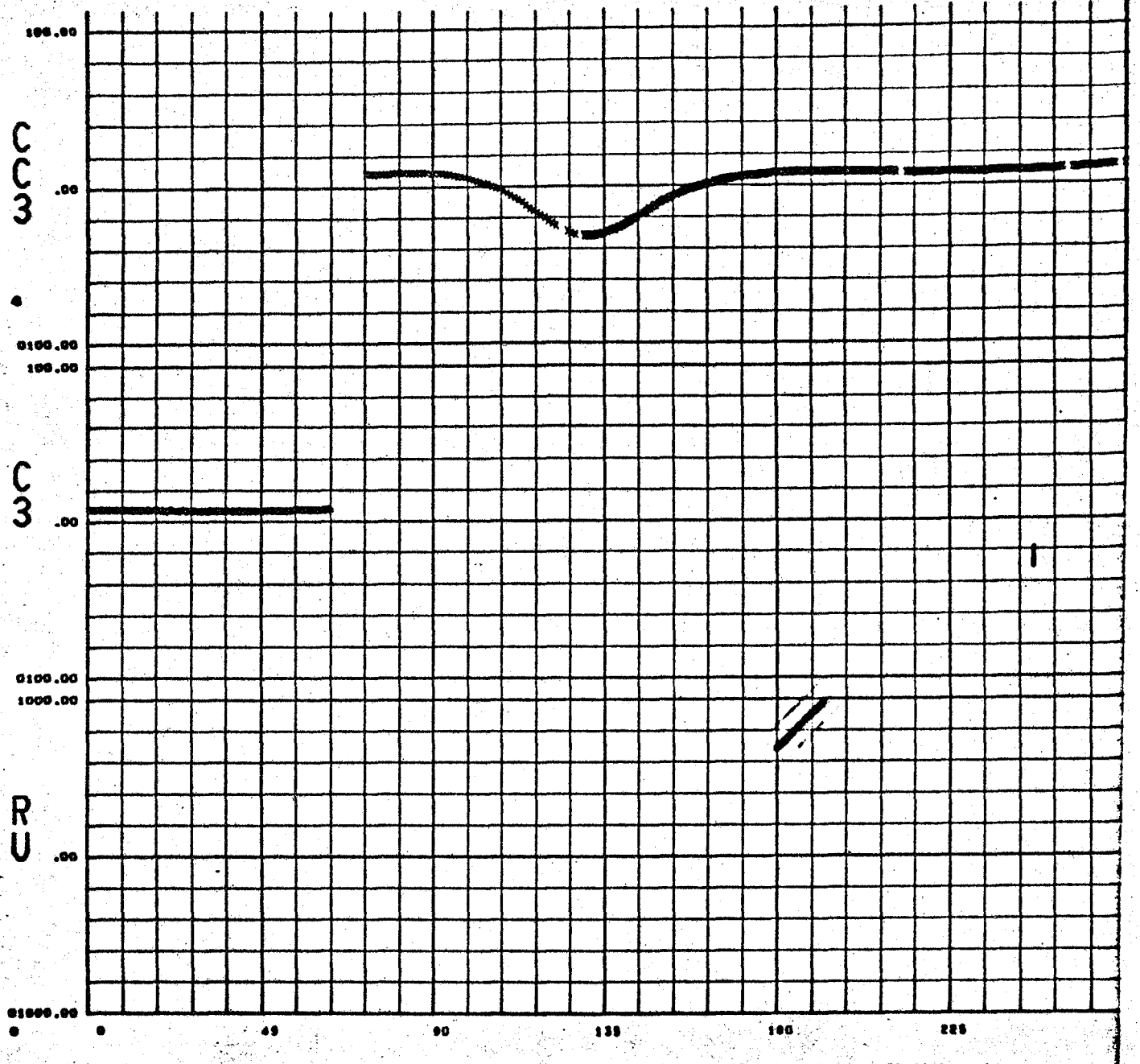
US 4288-2000 REV. 6/64



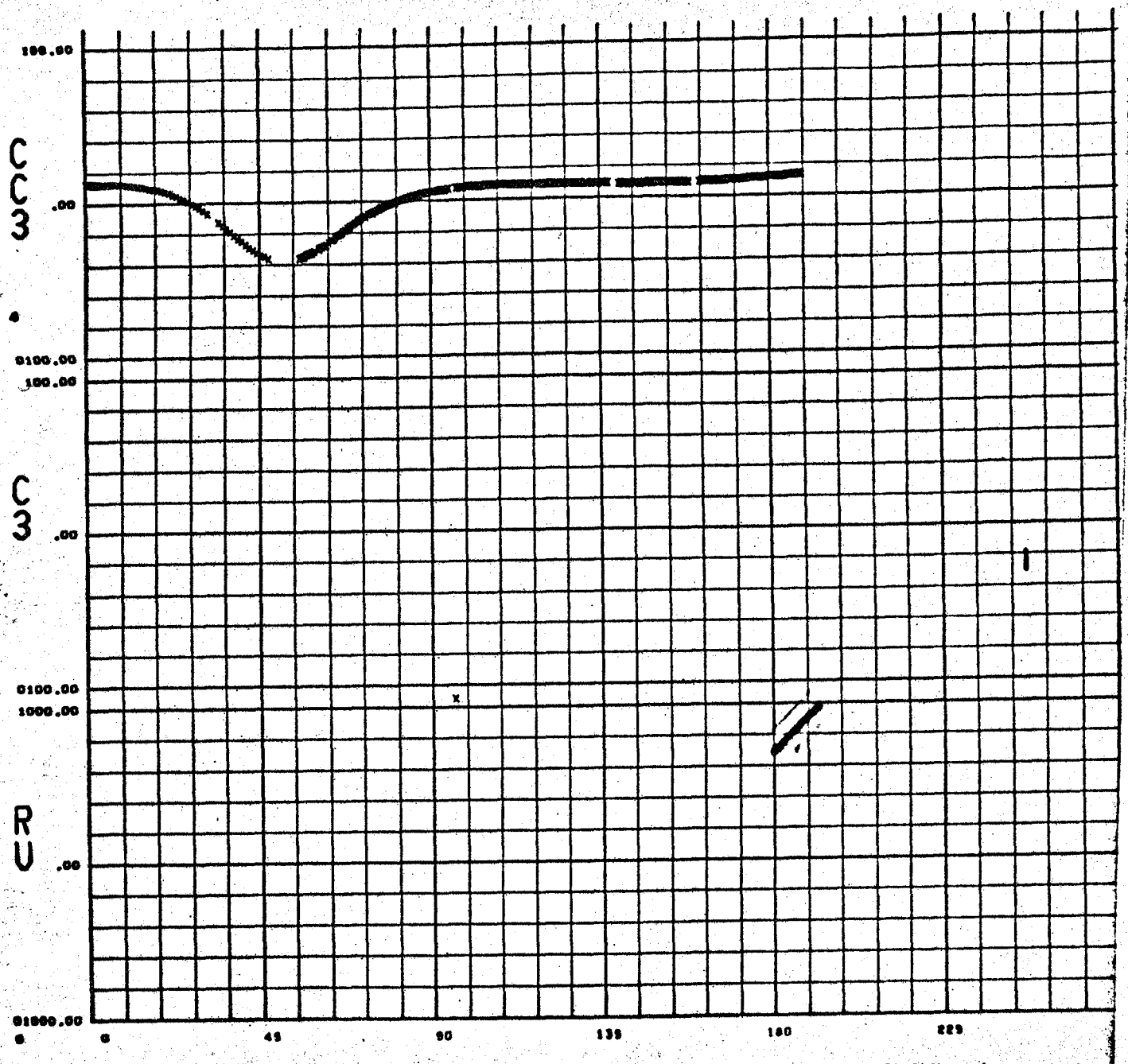
STATION 12 RESIDUALS PASS NUMBER 15/229

ODPL 5V42A 1

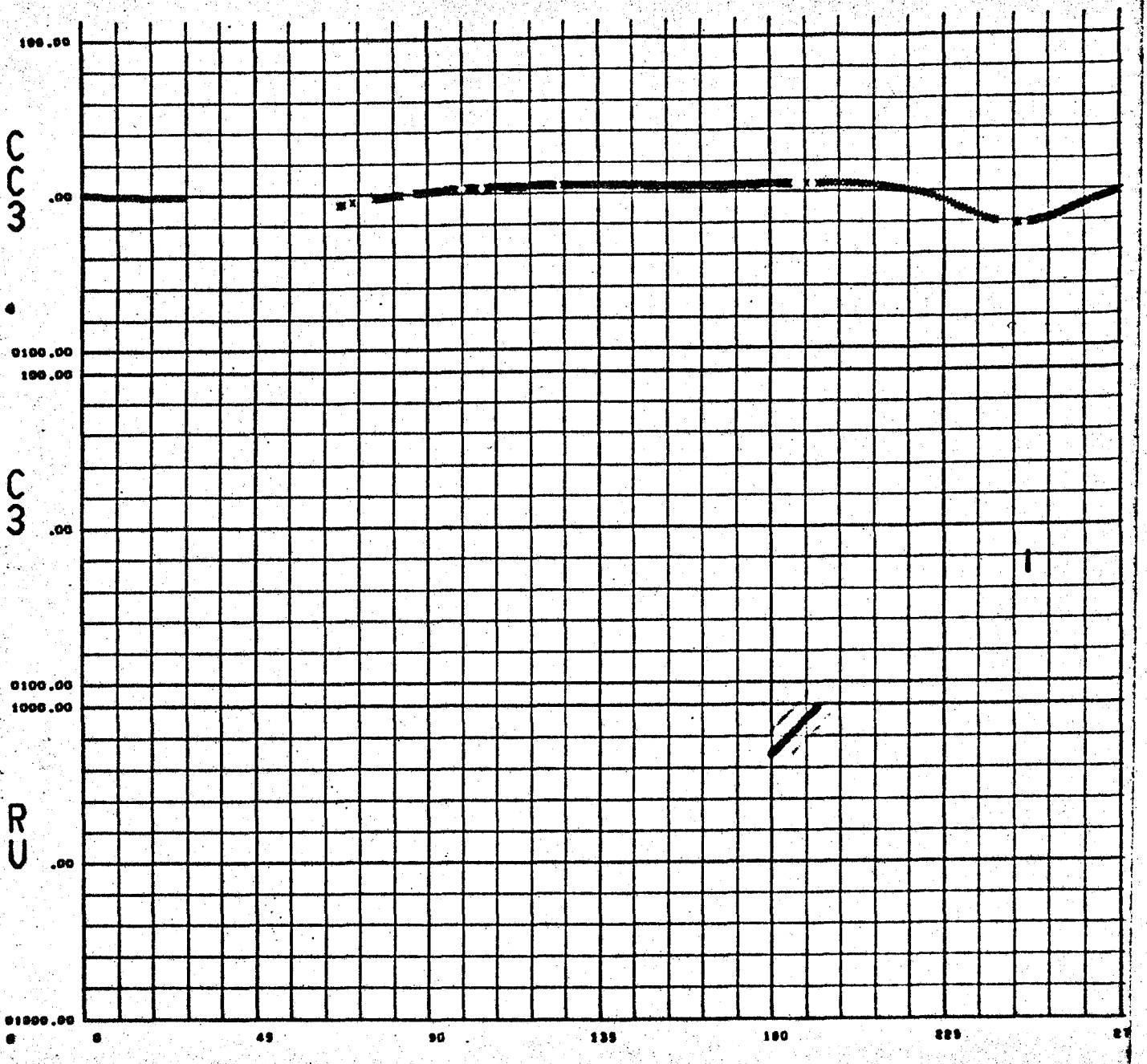
23 SIMPLE MO



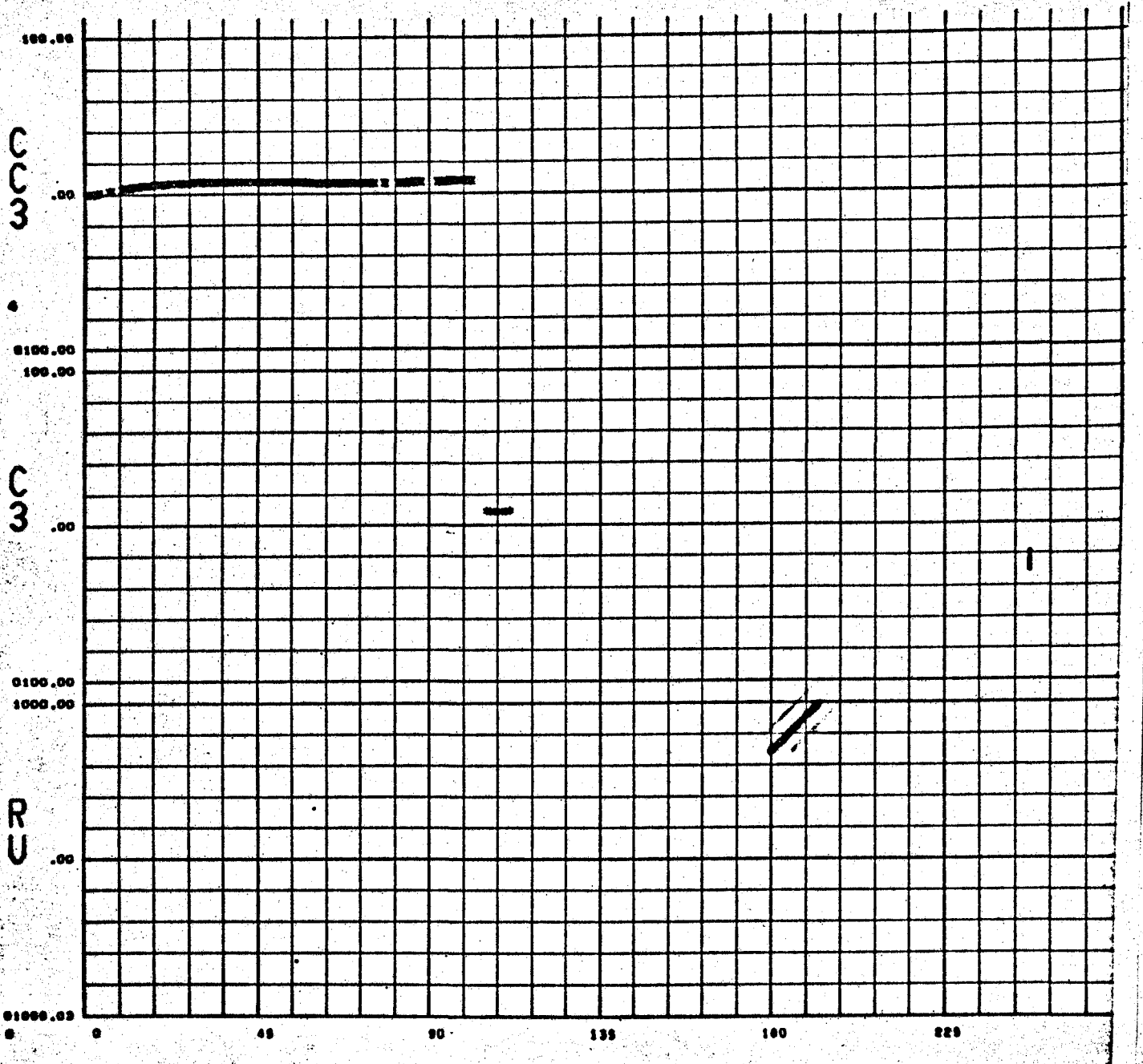
STATION 41 RESIDUALS PASS NUMBER 16/229



STATION 41 RESIDUALS PASS NUMBER 16/229



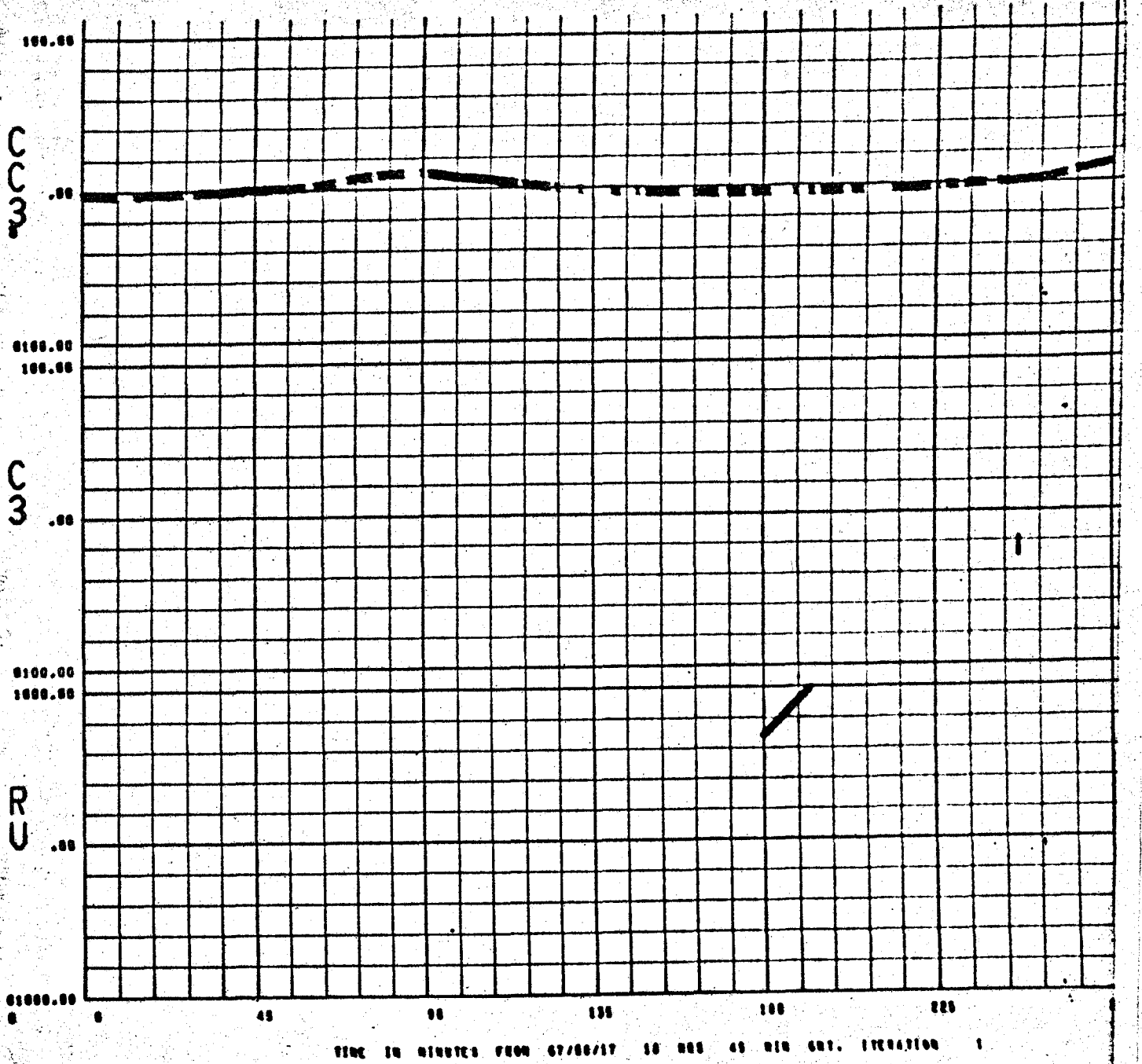
STATION 12 RESIDUALS PASS NUMBER 15/229



STATION 12 RESIDUALS PASS NUMBER 15/229

ODPL 5A25

SIMPLE MOON

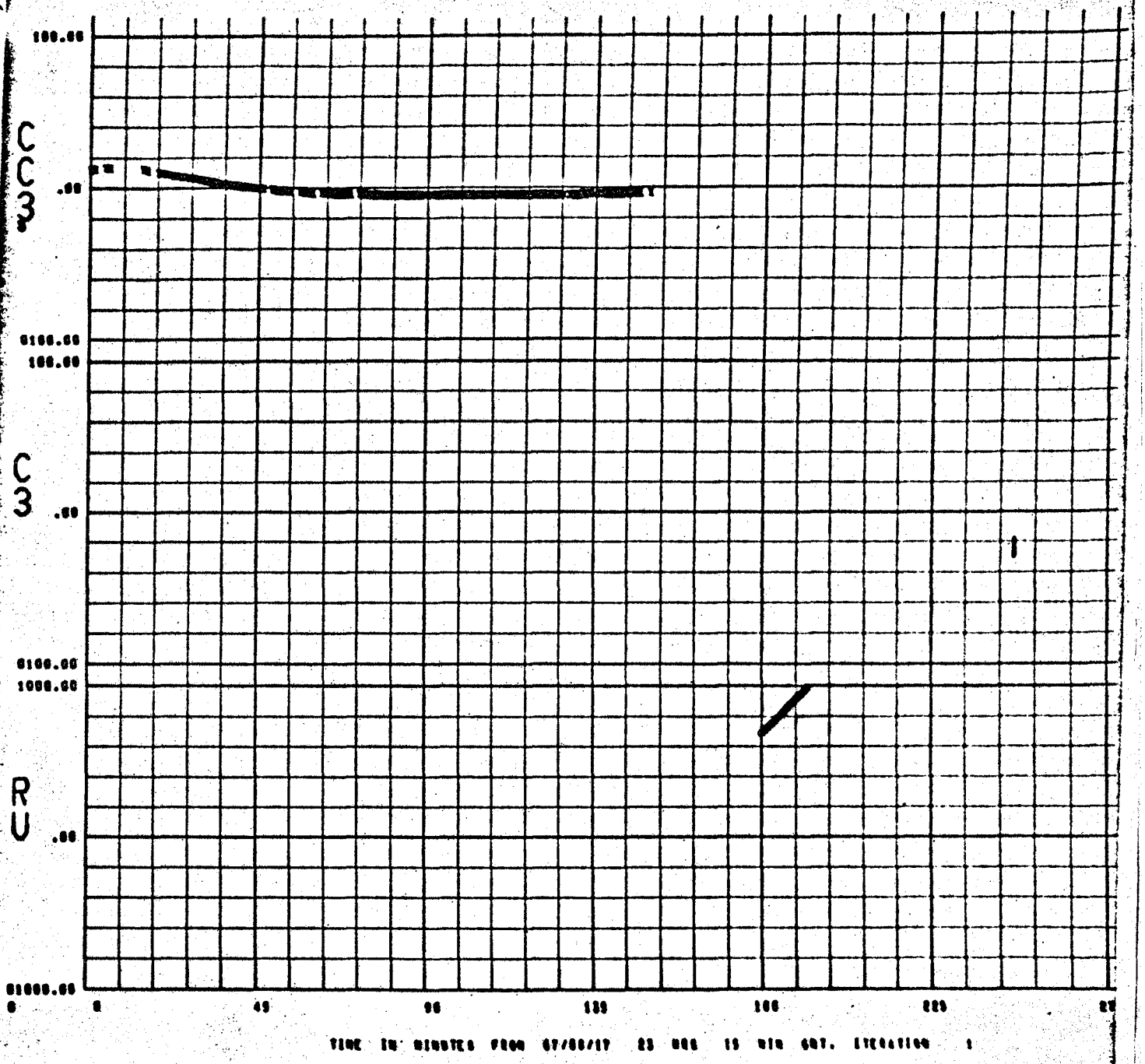


REV LTR

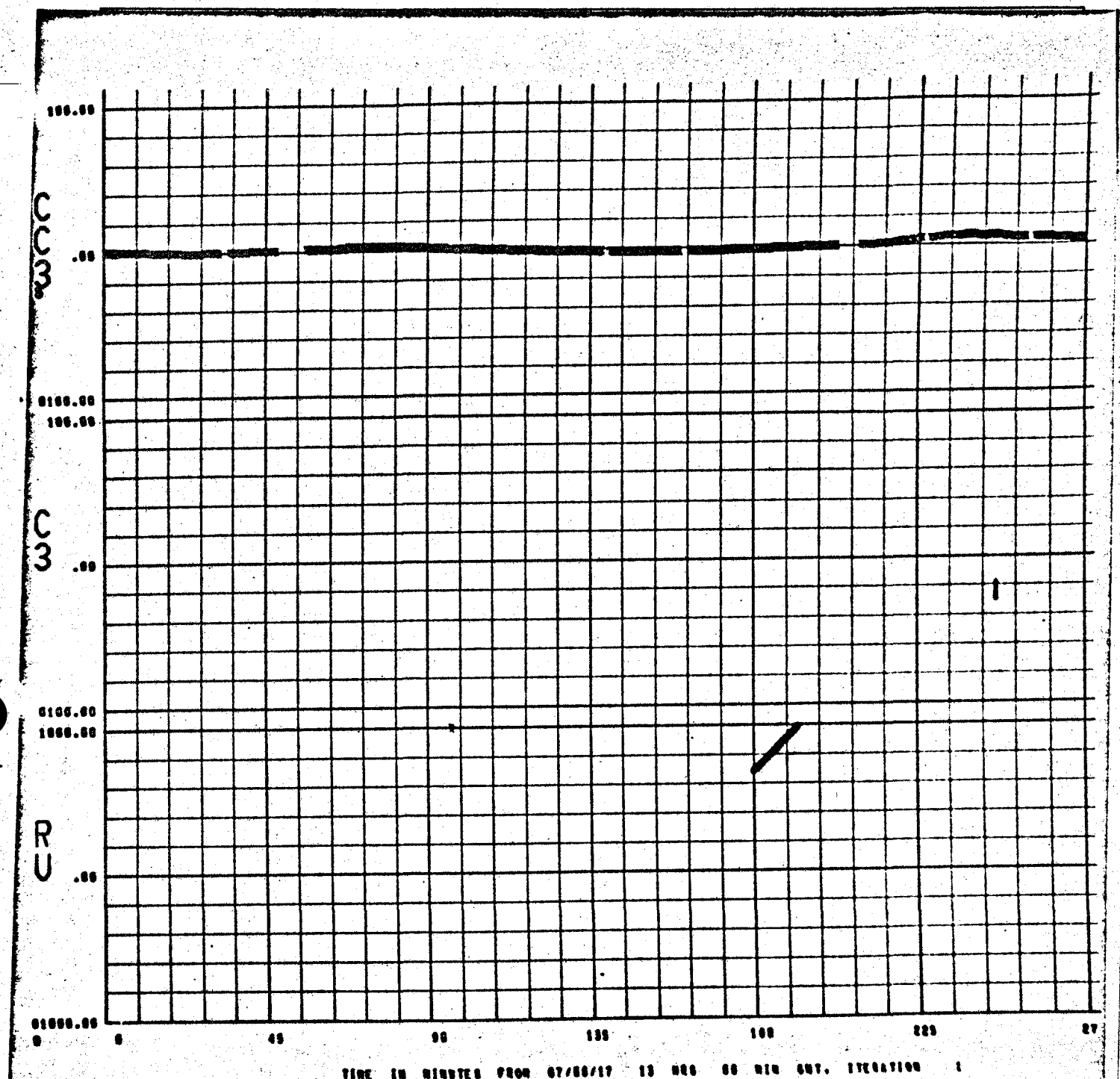
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

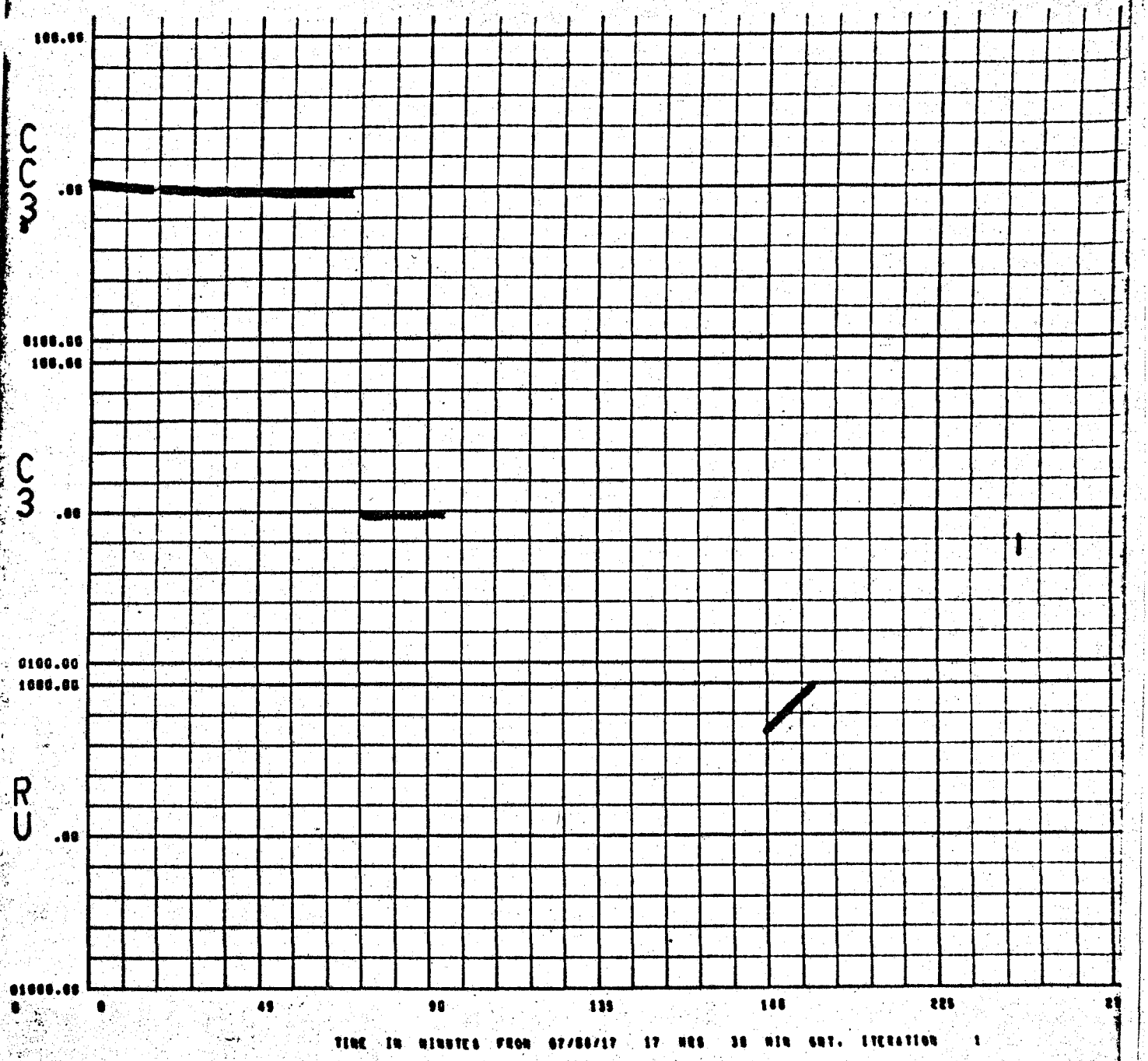
SH. 633



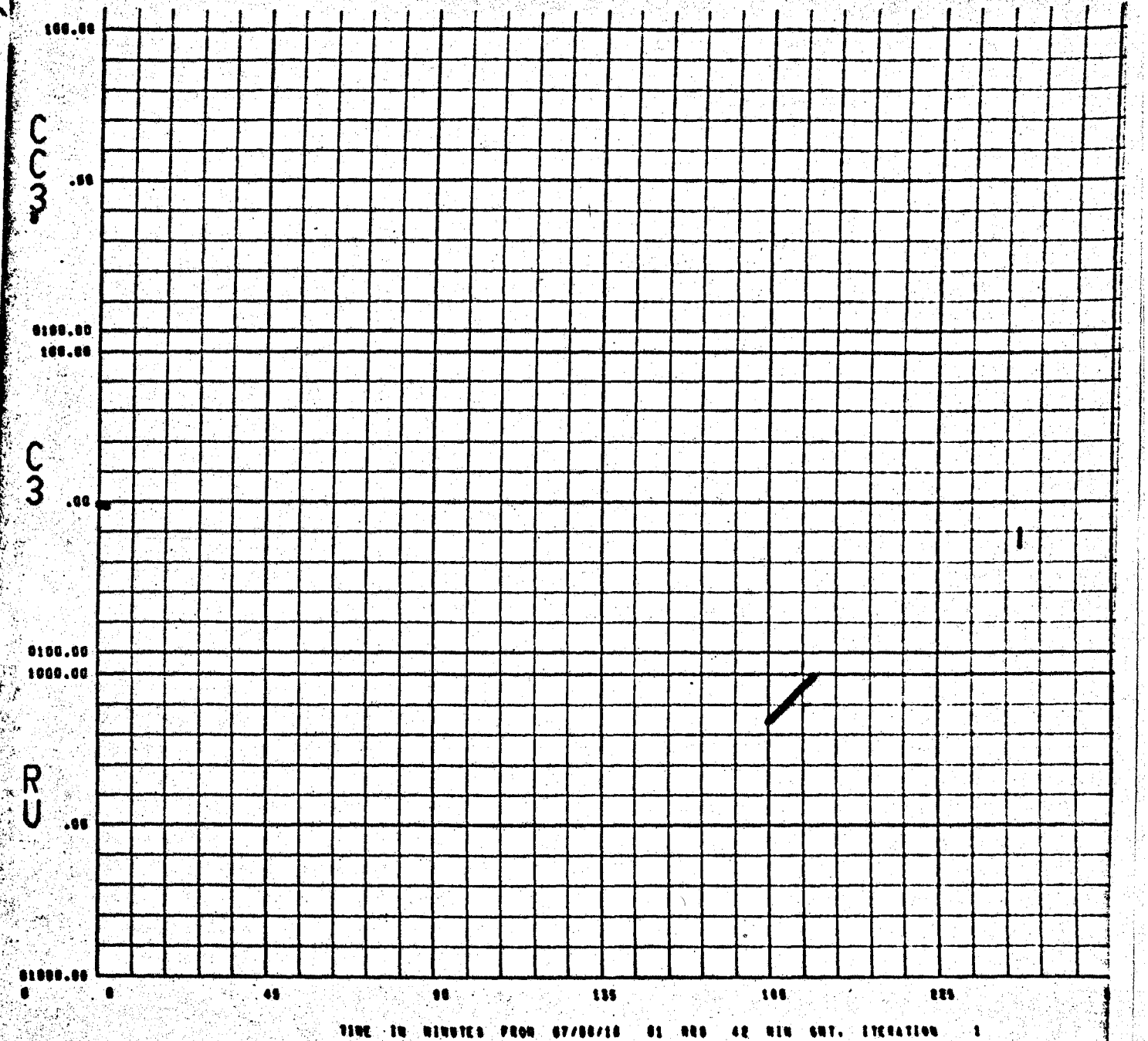
STATION 62 RESIDUALS PASS NUMBER 16/229



STATION 41 RESIDUALS PASS NUMBER 16/229



STATION 41 RESIDUALS PASS NUMBER 16/229



STATION 12 RESIDUALS PASS NUMBER 16/230

REV LTR

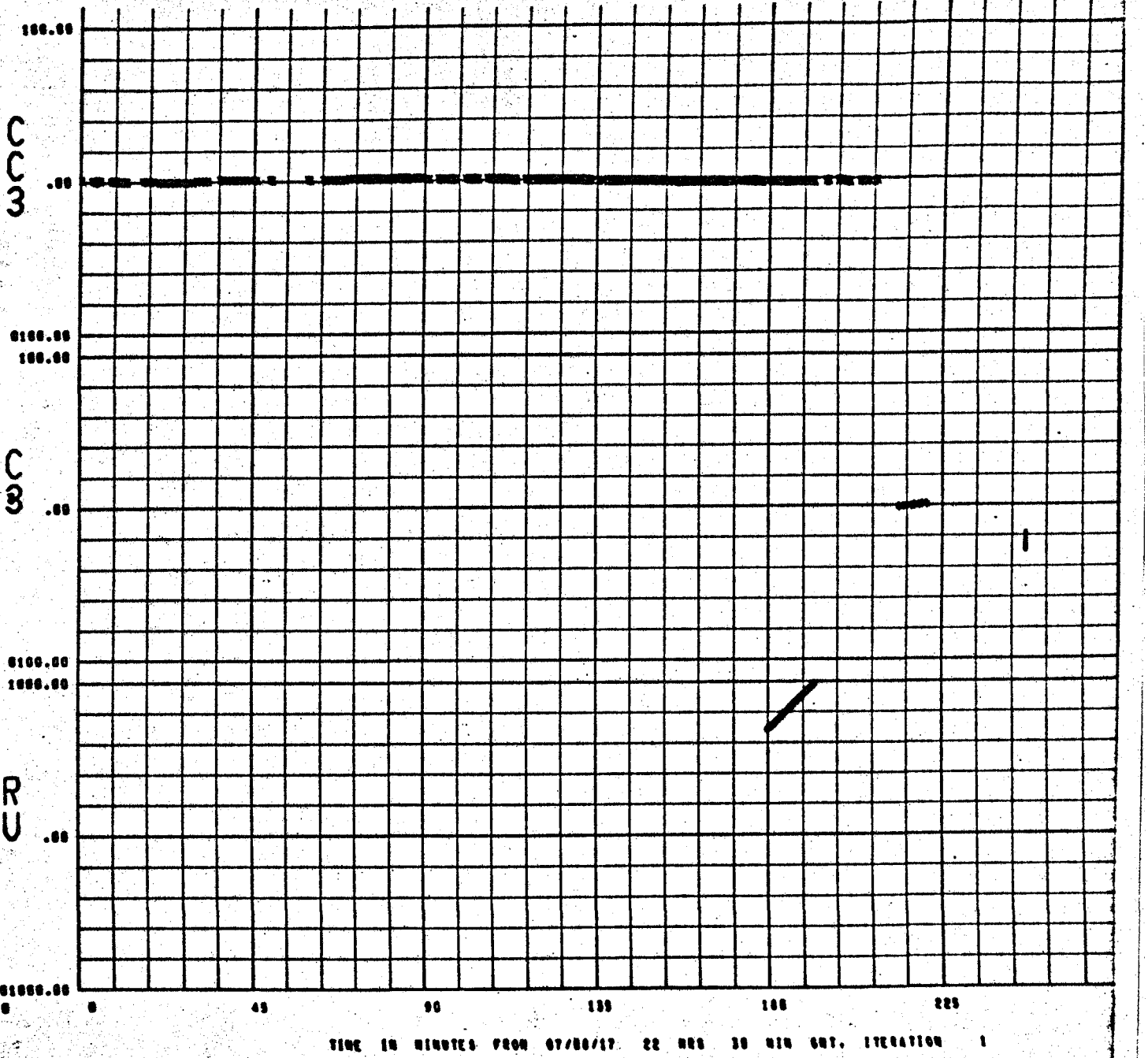
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

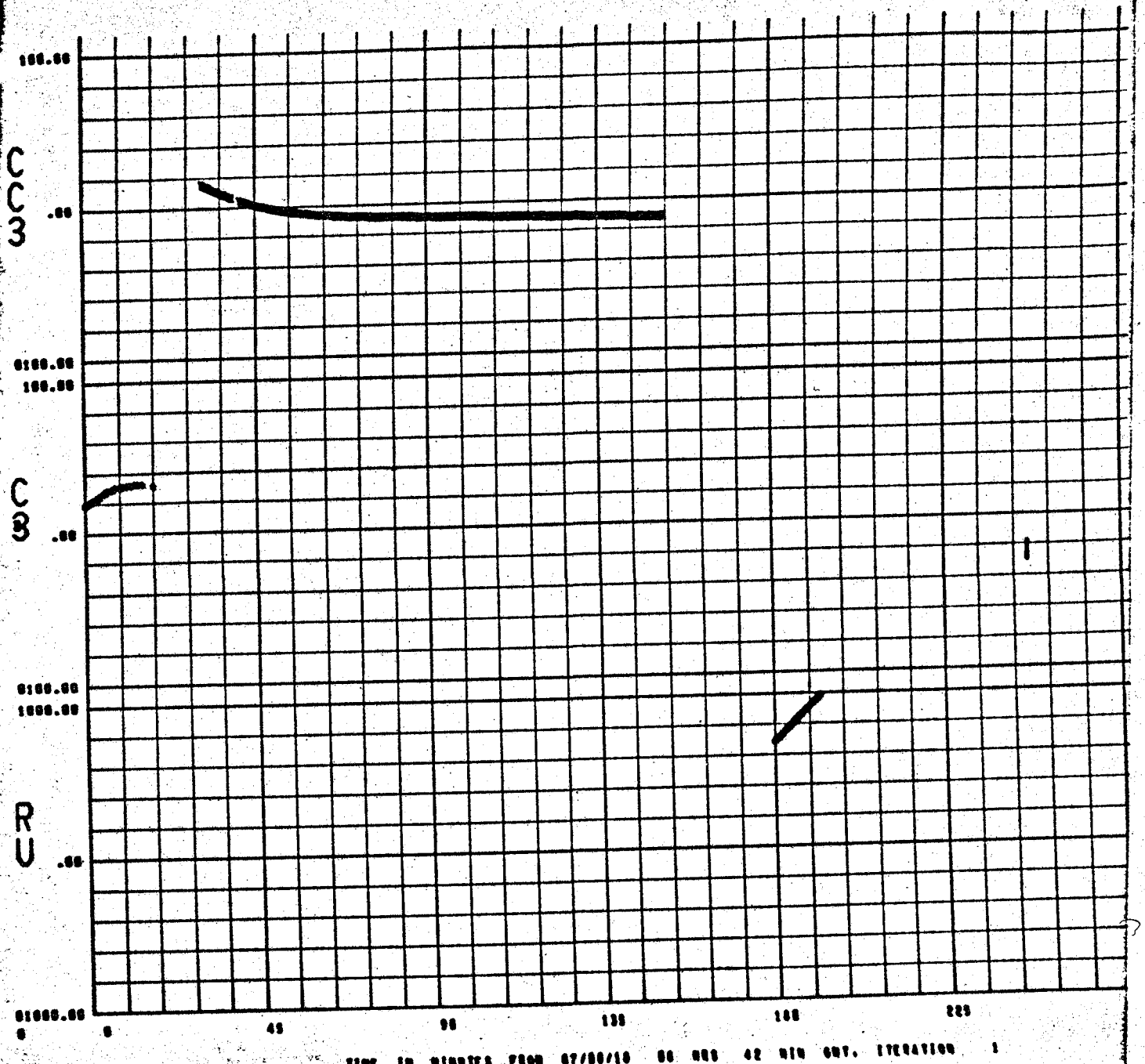
SH. 633

ODPL 5V46

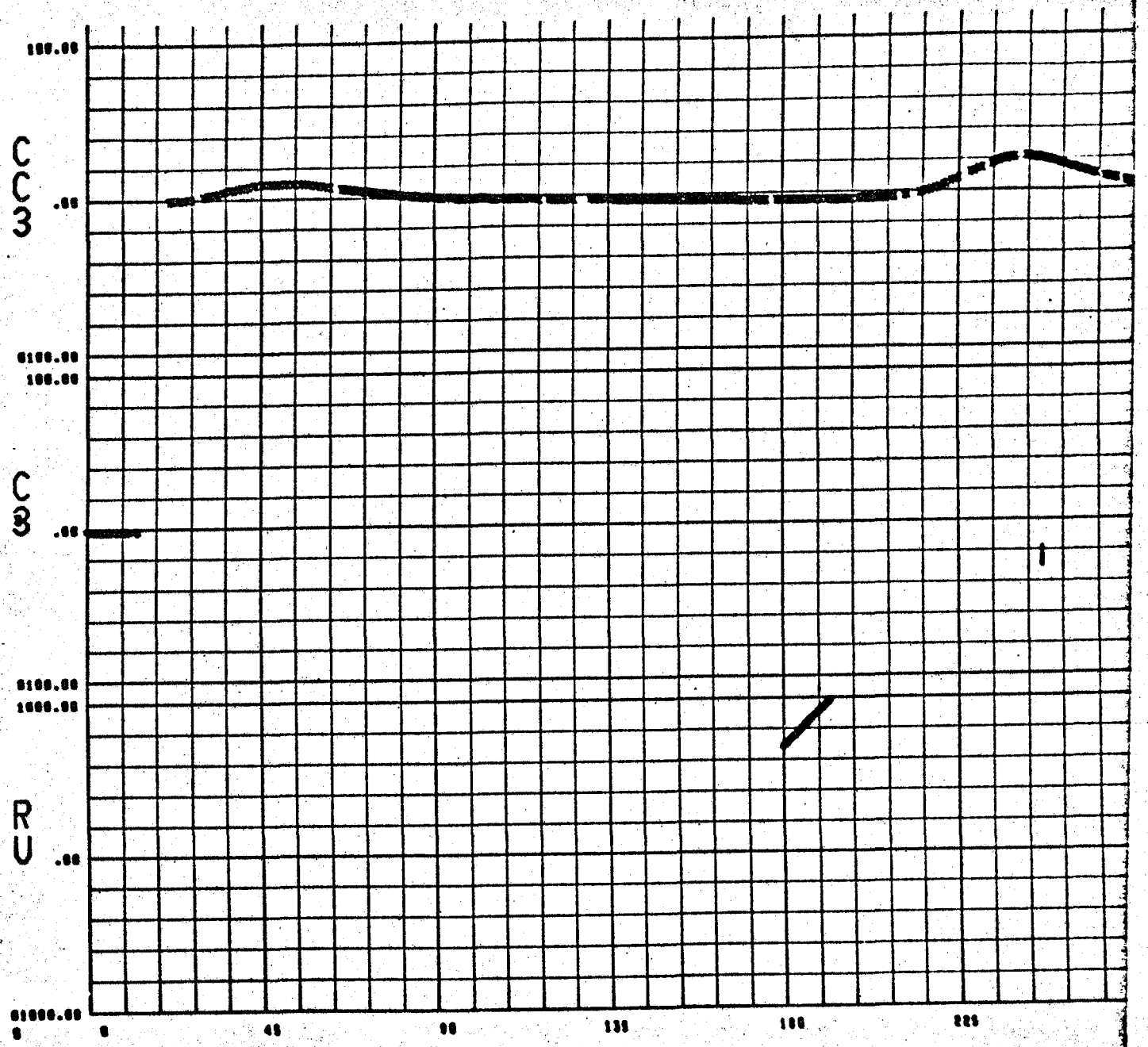
SIMPLE MOON



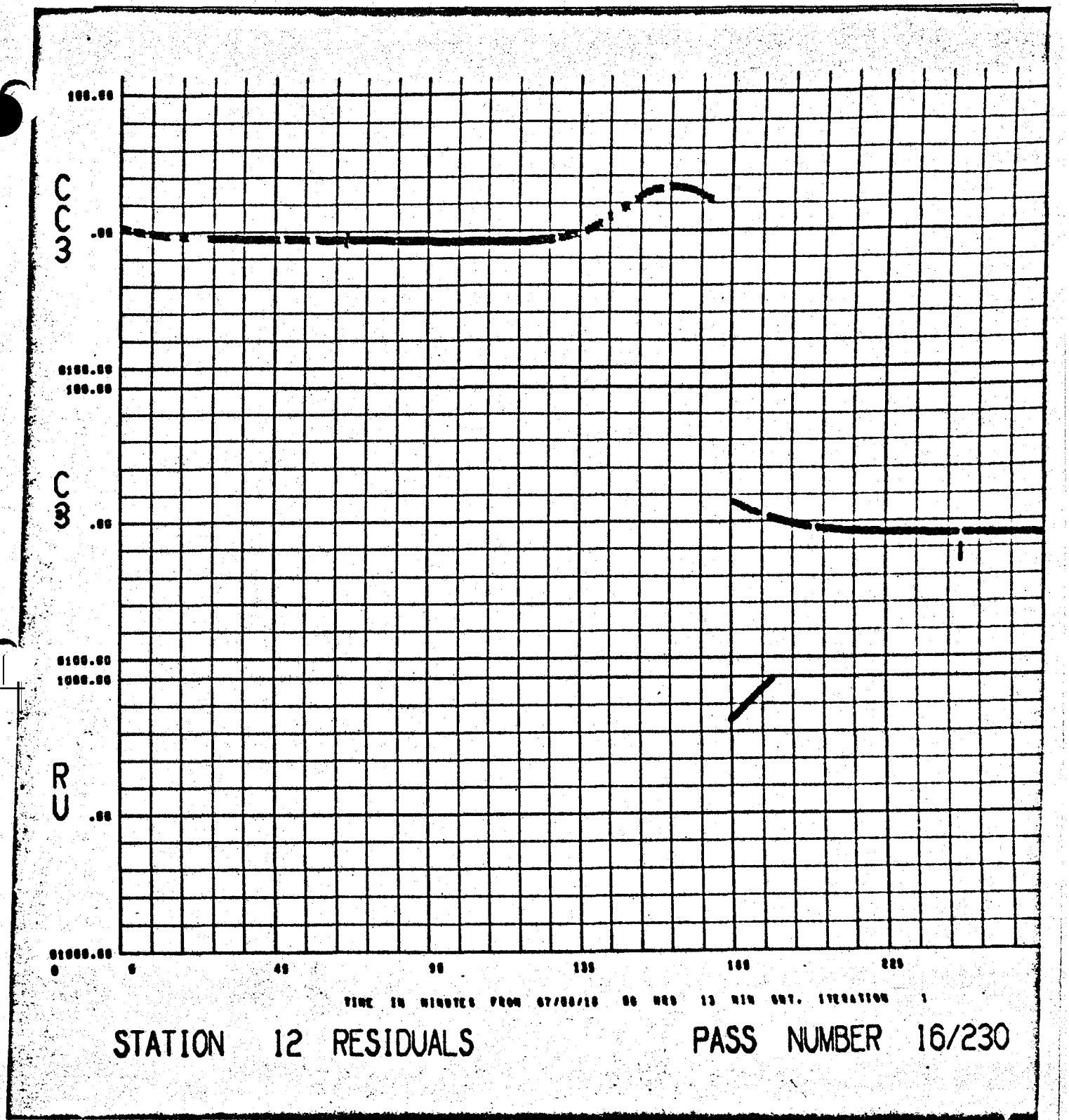
STATION 62 RESIDUALS PASS NUMBER 16/229



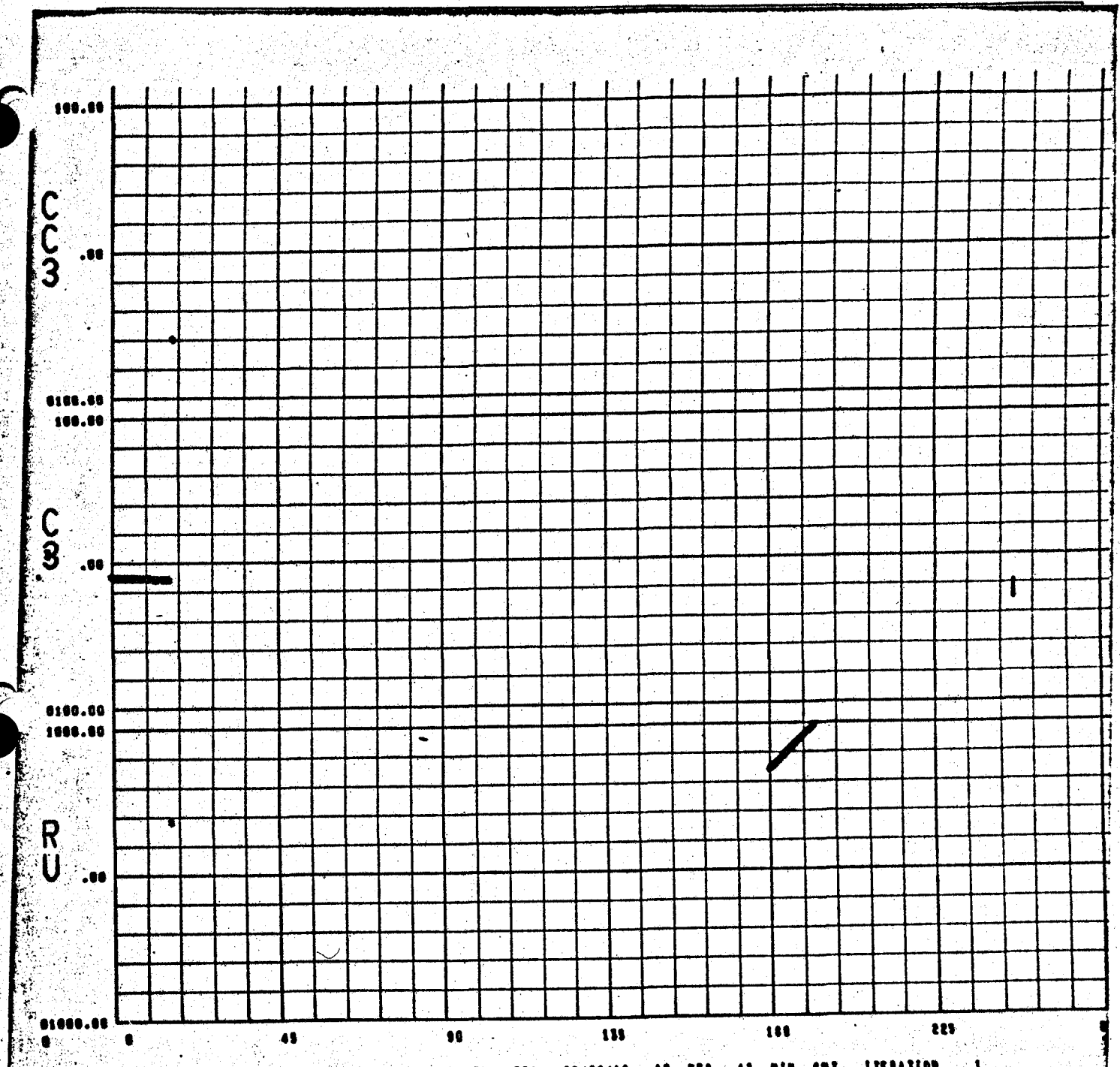
STATION 41 RESIDUALS PASS NUMBER 17/230



STATION 12 RESIDUALS PASS NUMBER 16/230



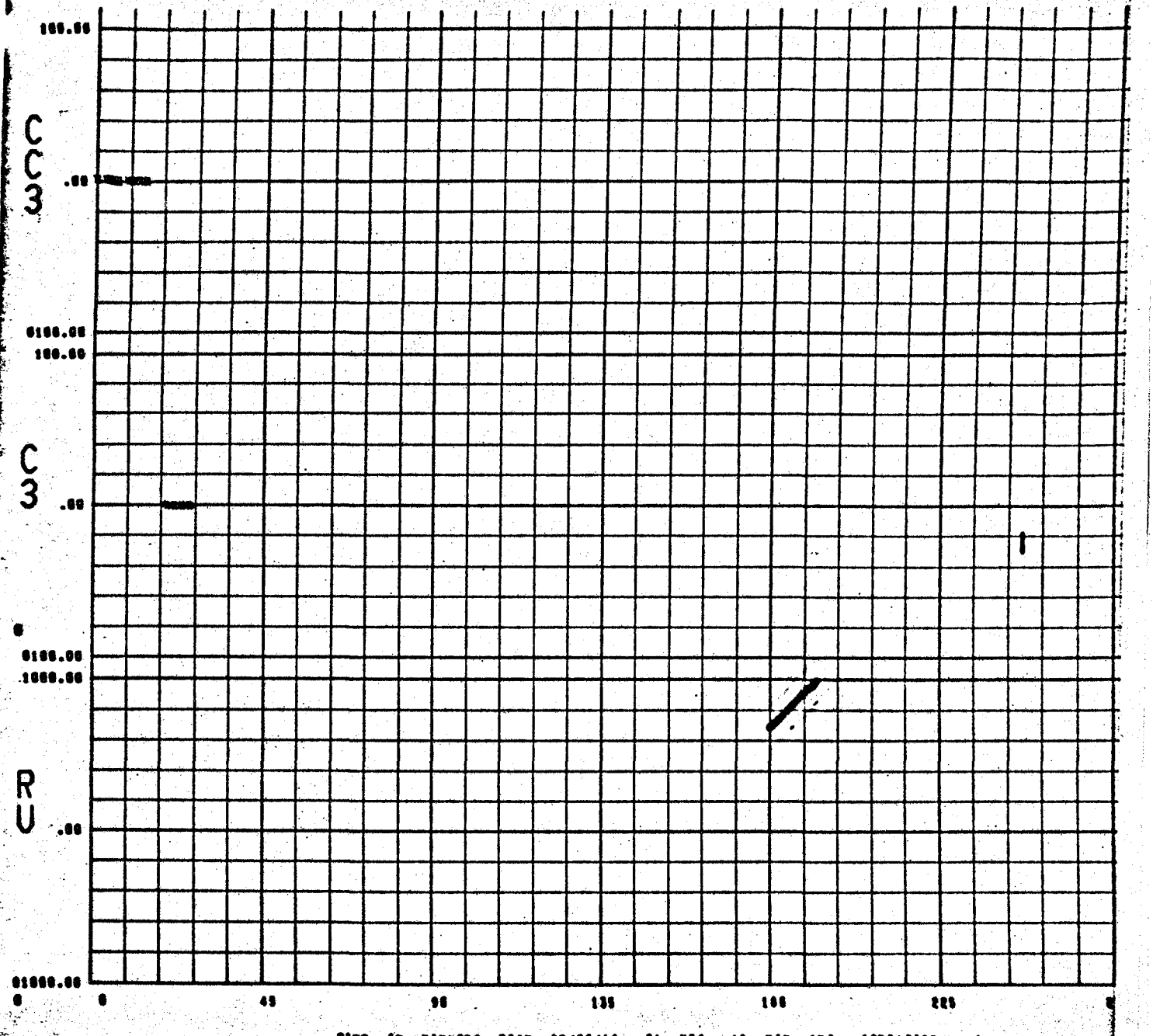
STATION 12 RESIDUALS PASS NUMBER 16/230



STATION 12 RESIDUALS PASS NUMBER 16/230

ODPL 5V49

SIMPLE MOON

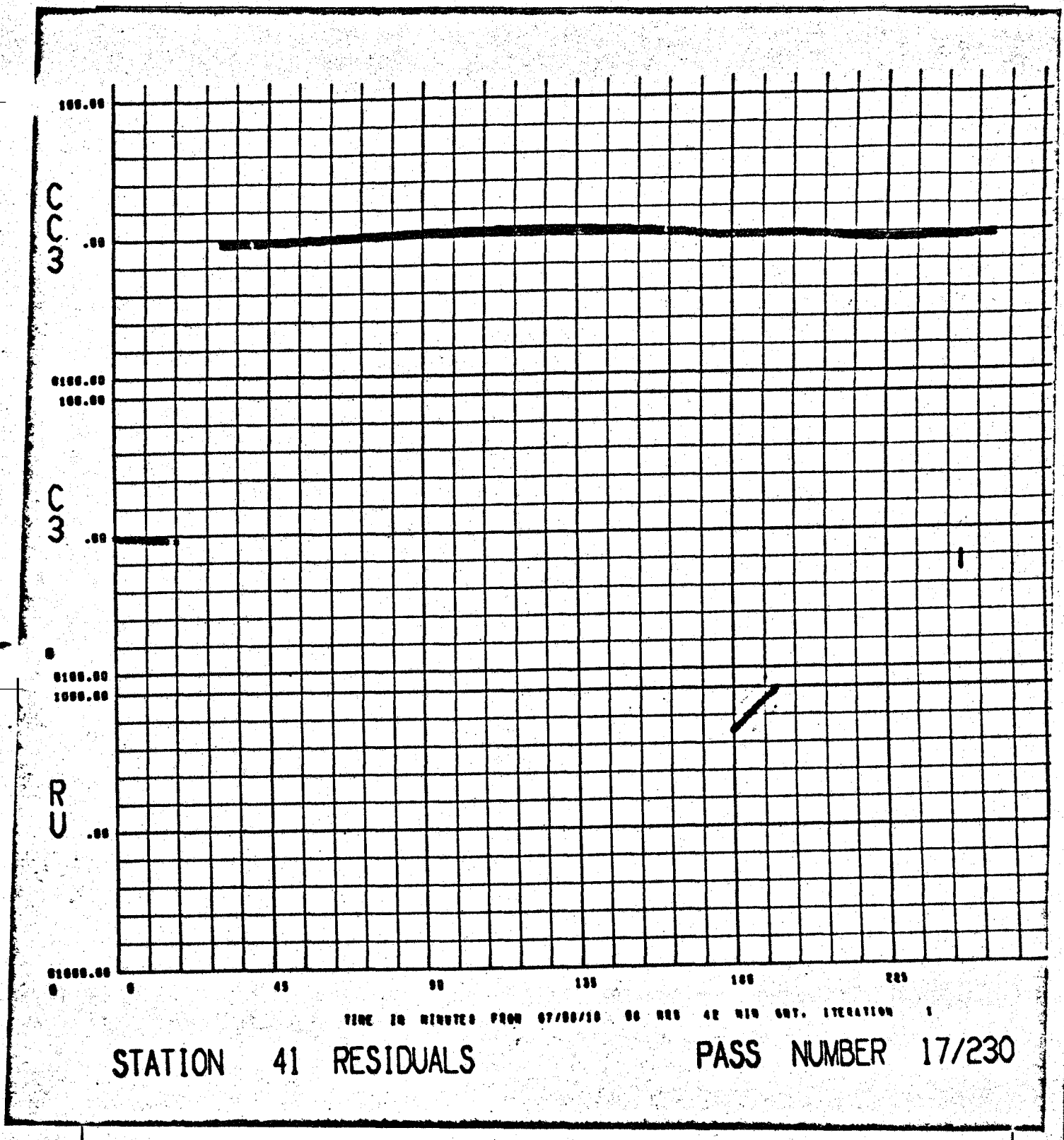


STATION 62 RESIDUALS PASS NUMBER 16/229

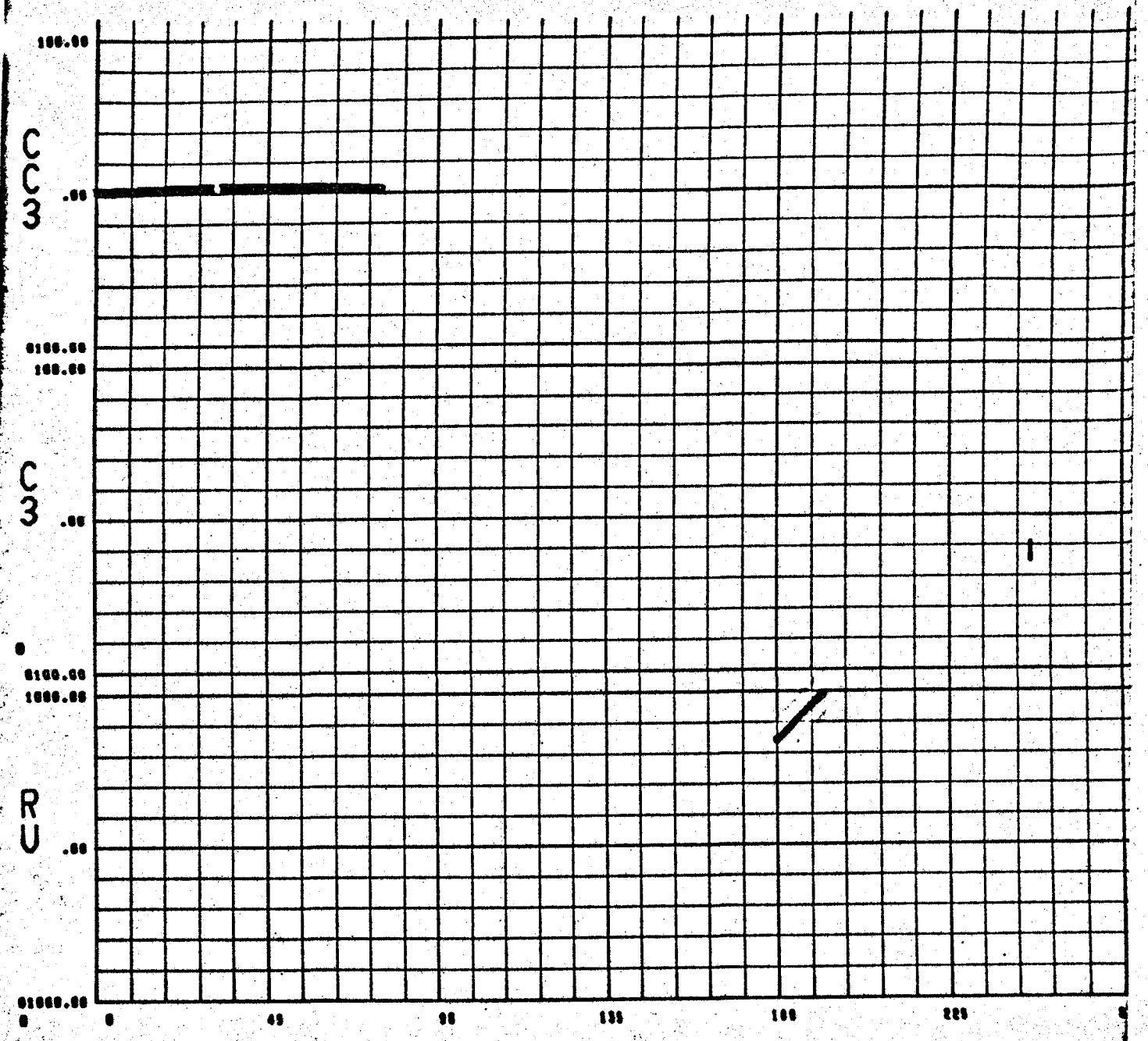
REV LTR

BOEING NO. D2-100816-1

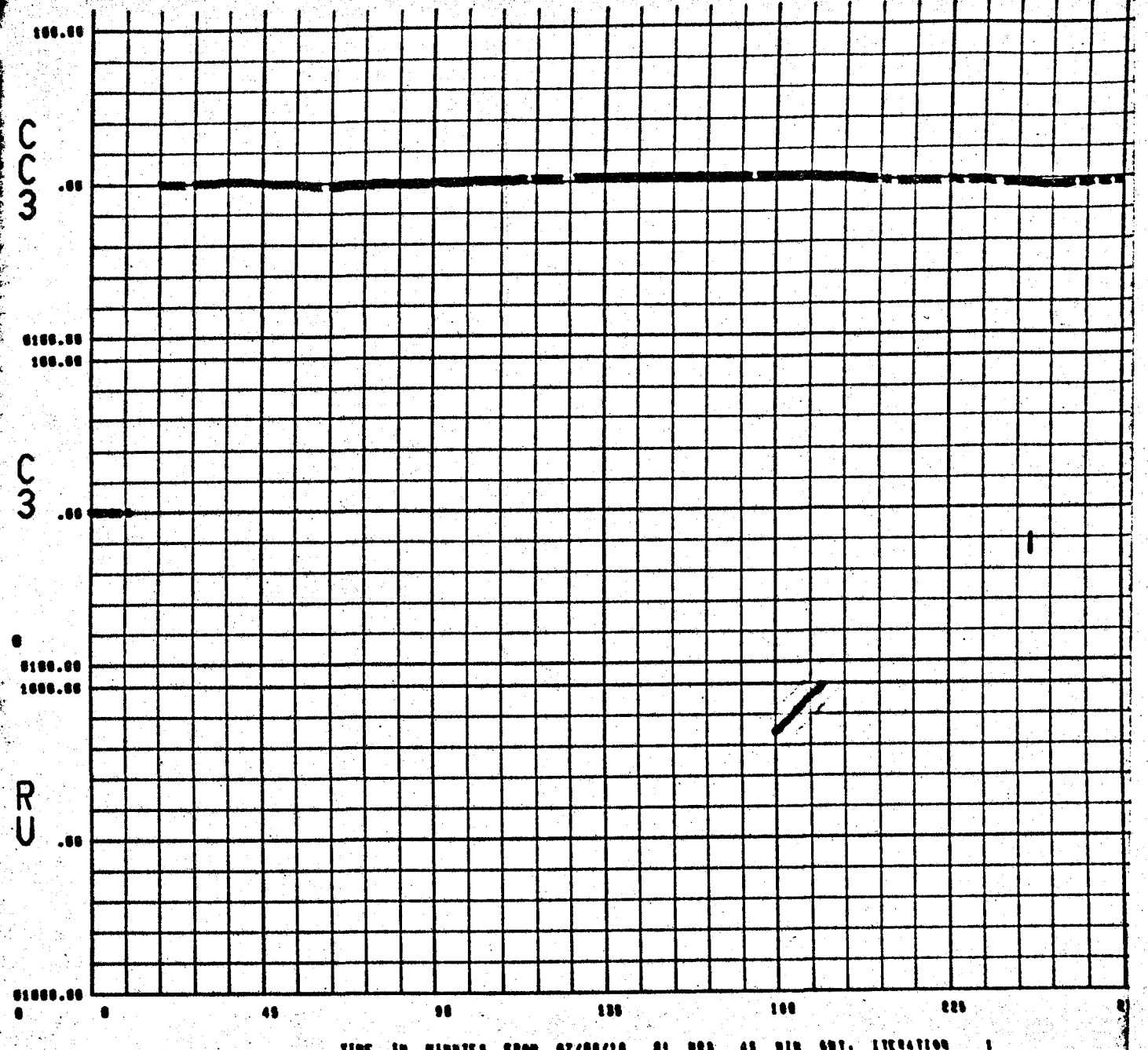
SH. 646



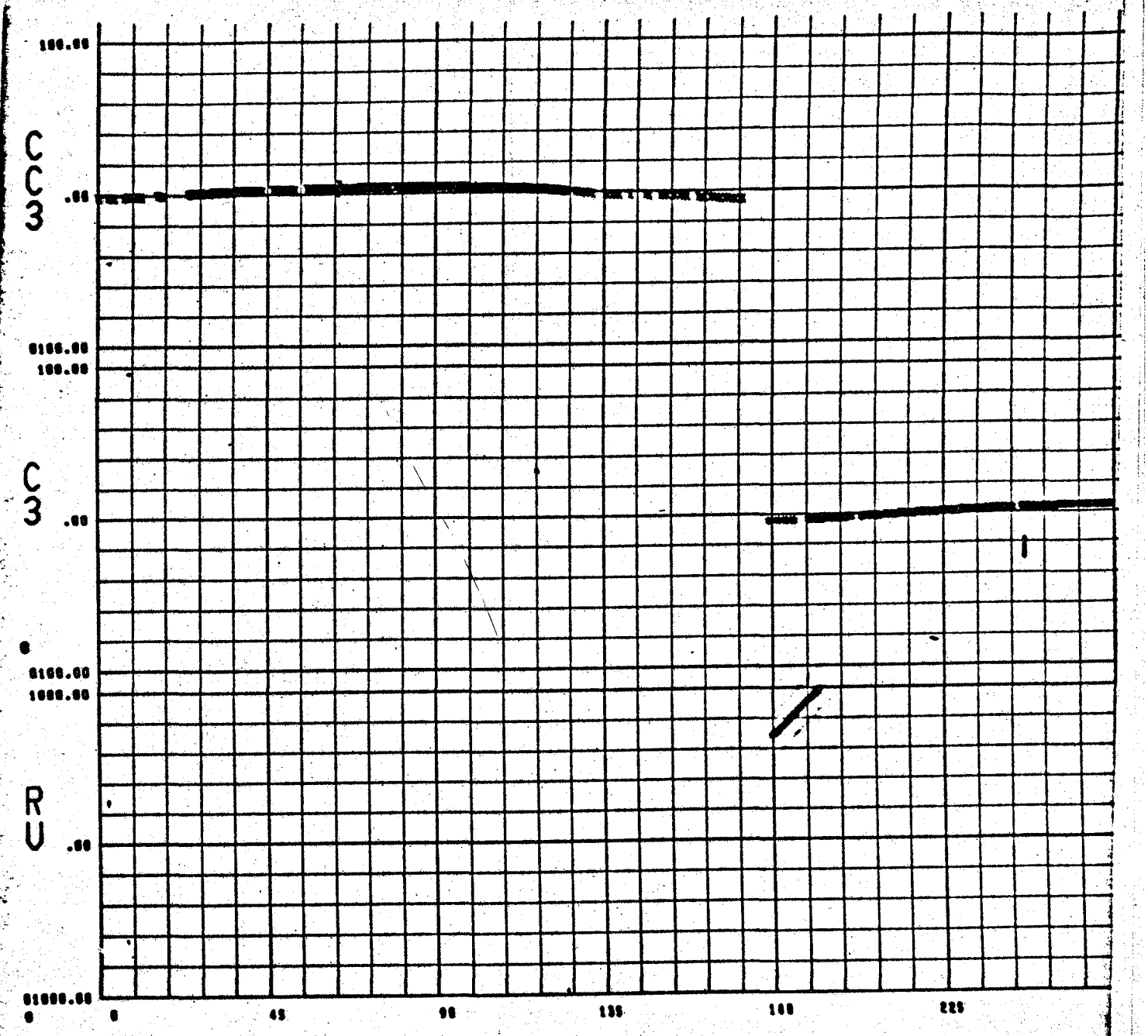
STATION 41 RESIDUALS PASS NUMBER 17/230



STATION 41 RESIDUALS PASS NUMBER 17/230

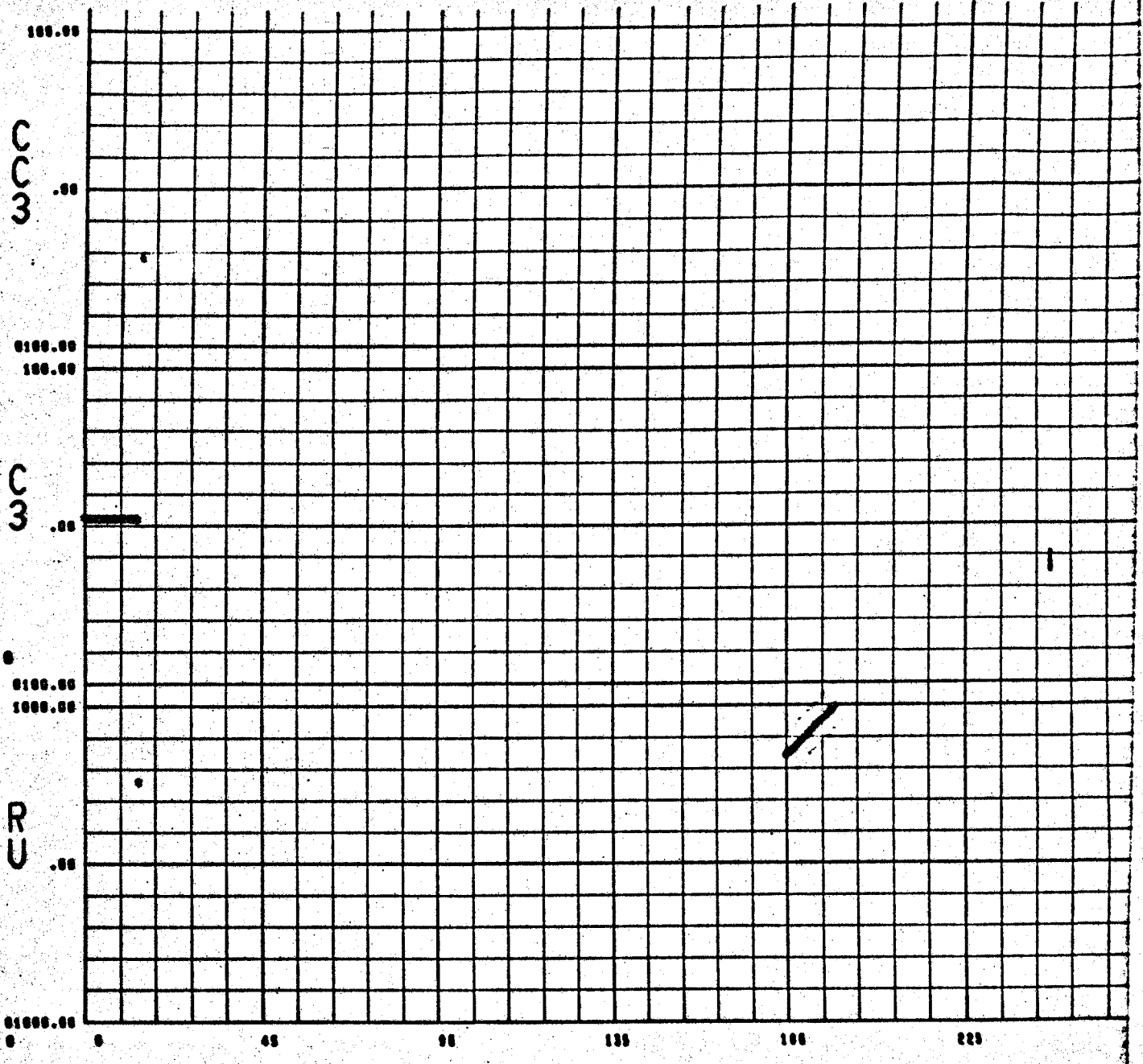


STATION 12 RESIDUALS PASS NUMBER 16/230



TIME IN MINUTES FROM 07/00/10 00 HRS 10 MIN GMT. ITERATION 1

STATION 12 RESIDUALS PASS NUMBER 16/230



STATION 12 RESIDUALS PASS NUMBER 16/230

REV LTR

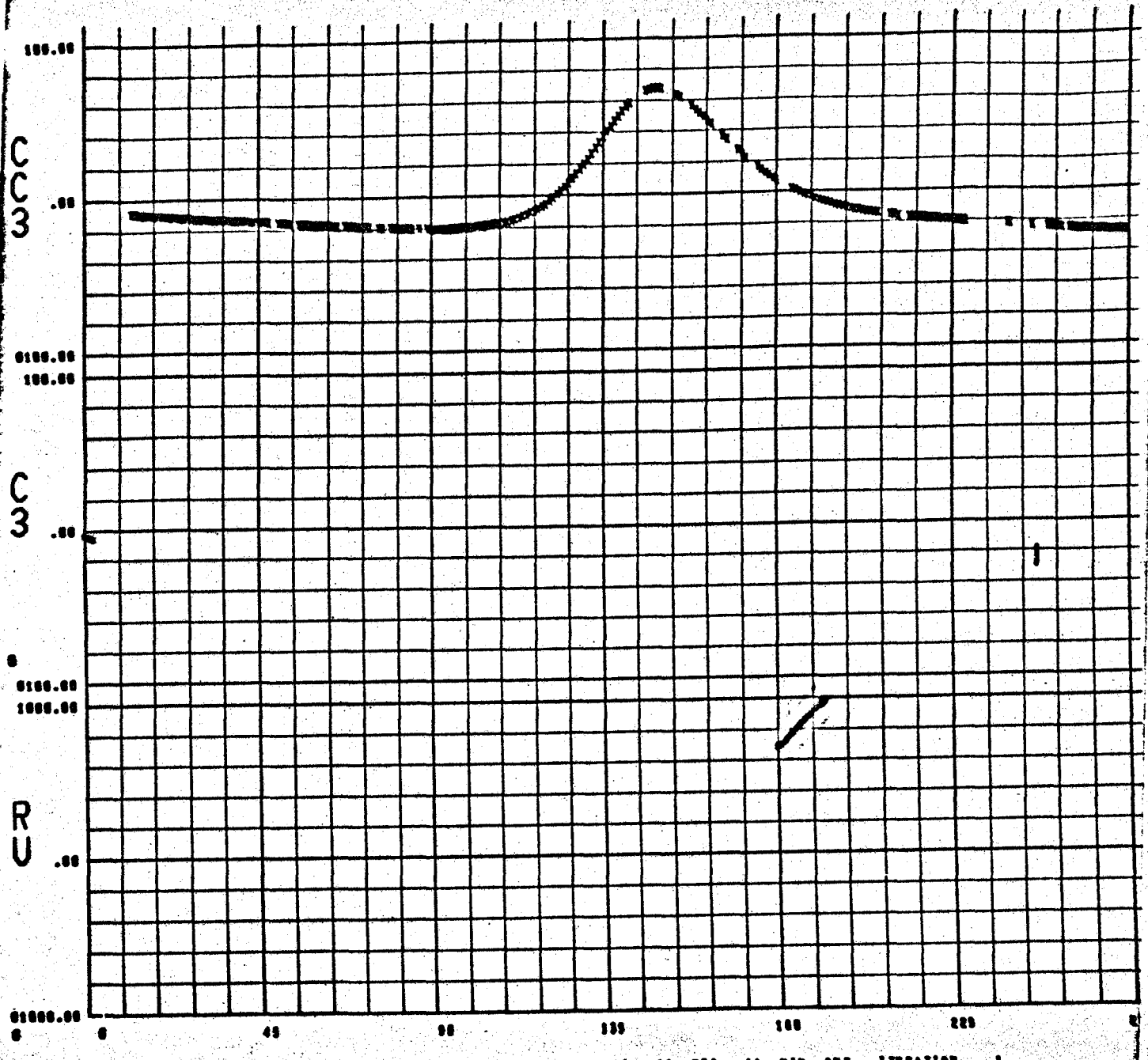
U3 4288-2000 REV. 6/64

BOEING NO. D2-100816-1

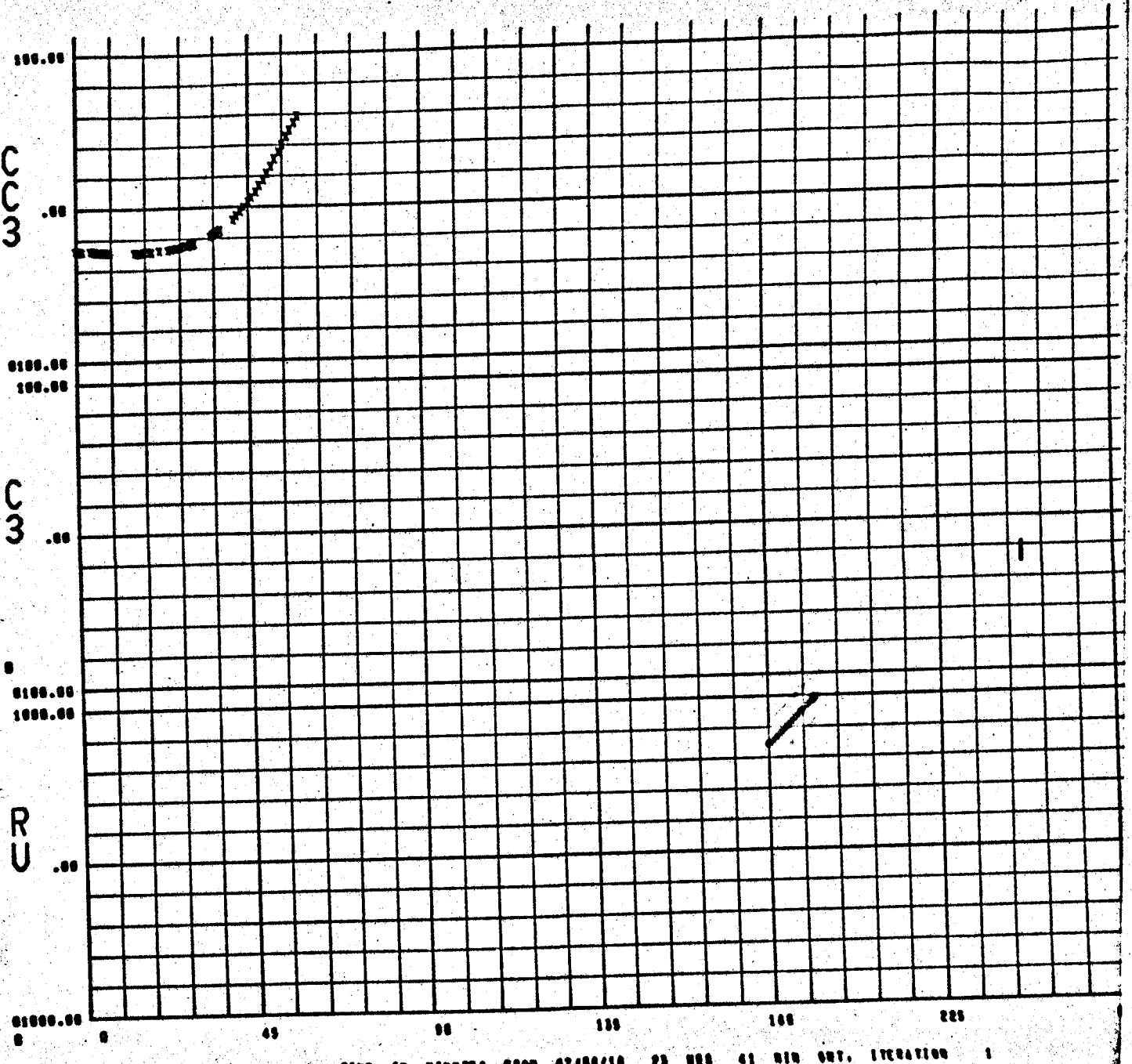
SH. 851

ODPL 5V50

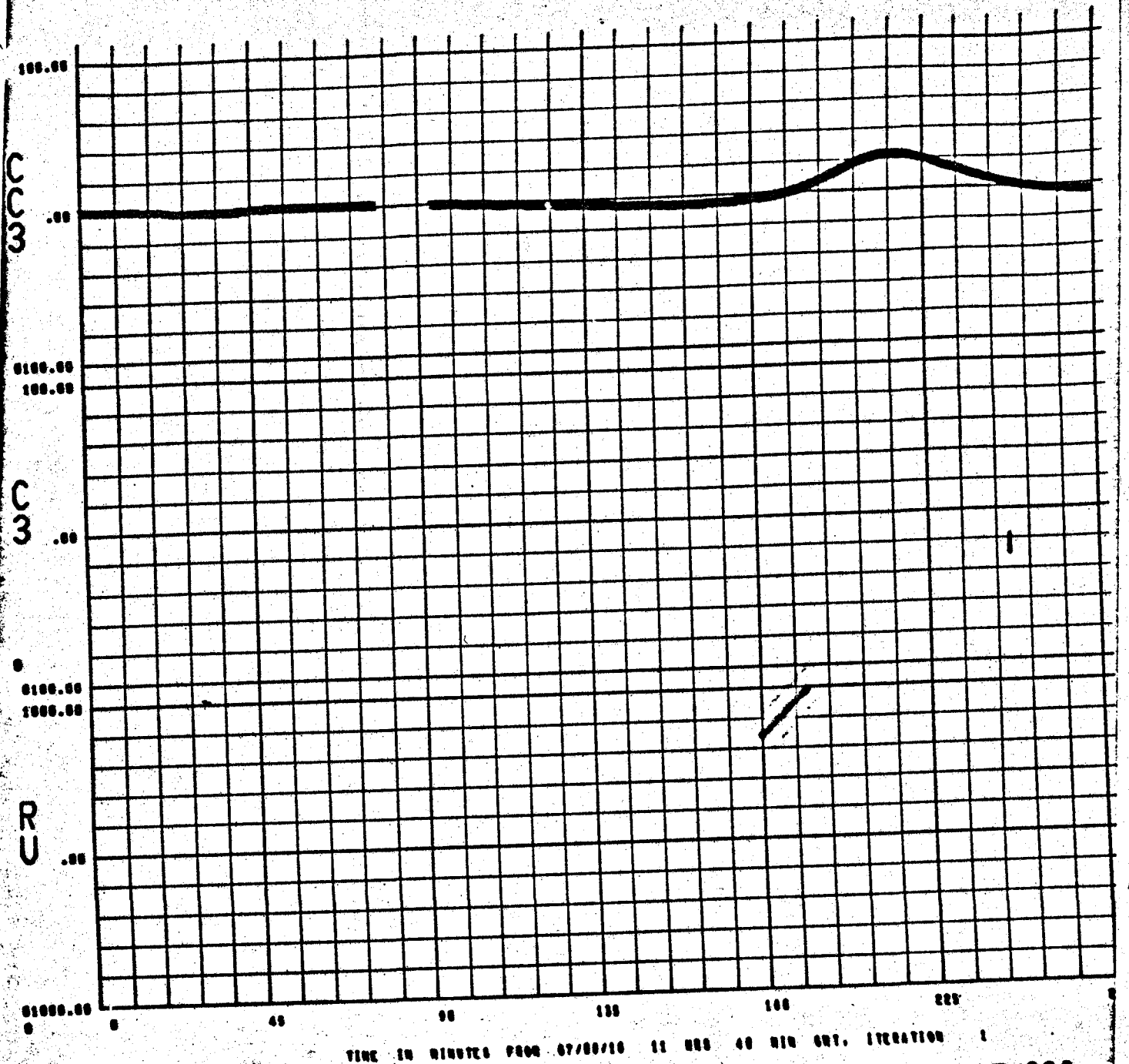
SIMPLE MOON



STATION 62 RESIDUALS PASS NUMBER 17/230



STATION 62 RESIDUALS PASS NUMBER 17/230



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