AD-A153 241 RESULTS FROM RADIATION MONITORING EQUIPMENT EXPERIMENT 1/1
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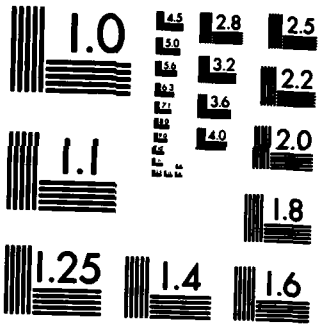

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AFTAC-TR-84-4

RESULTS FROM RADIATION MONITORING EQUIPMENT EXPERIMENT ON STS-8

RICHARD G. MADONNA, ROSS L. AMICO, VIRGIL L. BROWN, AND VESTON R. KIDD

9 JULY 1984

FINAL REPORT.

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The results from the Radiation Equipment Monitoring (RME) experiment, flown onboard STS-8 are presented and discussed. The RME consists of the HRM-III gamma ray counter and PRM neutron/proton dosimeter. The gamma ray data agree with data from previous flights. Large increases in count rates are observed when the Orbiter is in the South Atlantic Anomaly. Neutron/proton dosage is consistent with NASA predictions for STS-8.

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SUMMARY

The Radiation Monitoring Equipment (RME) was flown on STS-8 Space Shuttle Mission for the purpose of testing a concept for in-cabin, real-time crew dosimetry, and for the purpose of obtaining time resolved gamma-ray background data and neutron/proton background data. The RME consists of two instruments, EG&G HRM-III gamma-ray counter and EG&G Pocket REM Meter (PRM) neutron/proton dosimeter. The HRM-III was operated by the astronaut crew seven times during the mission, with each operation lasting 52.5 minutes. The PRM was operated twice during the mission with each operation lasting a minimum of ten hours.

The results from the HRM-III operations were plotted as a function of time and as a function of ground position. The data show large increases in count rate during the periods when the Orbiter was in the South Atlantic Anomaly. These data are consistent with data obtained from other missions.

The PRM results are displayed in tabular form. The average dose rate from these operations is .312 ± .012mrem/hr ((2.49 ± .013) x 10^{-5} rad/hr). The total mission neutron/proton dosage predicted by these readings is approximately 52.931mrem (4.224mrads). This value is in agreement with NASA predictions for neutron/proton dosage for the STS-8 mission.

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CONTENTS

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SECTION I
INTRODUCTION

This report presents the results of the Radiation Monitoring Equipment (RME) experiment flown on STS-8. The objectives of the RME experiment are two-fold. The first objective was to exercise our ability to fly small non-space-specific hardware on the Space Shuttle. The RME tested the feasibility of using state-of-the-art dosimetry equipment that was not originally designed for orbital application for in-cabin, real-time crew dosimetry. The second objective of the experiment was to obtain time resolved gamma-ray background data and neutron/proton background data.

The first objective was partially met during the flight of STS-6 (ref 1). The RME was flown for the first time and a limited amount of data were taken. The quality of the data was sufficient to convince us that the instruments will work in space, and, more importantly, that the crew can operate them and obtain meaningful data. Longer operations were required to fully meet the first objective since the instruments were not utilized to their fullest extent during the STS-6 mission.

The second objective was also achieved, in part, during the STS-6 mission. The neutron/proton dosimeter, EG&G's Pocket REM Meter (PRM), was operated for sufficiently long periods of time and gathered meaningful background data. The gamma-ray counter, EG&G's HRM III, was only operated for 10 seconds each time it was activated and did not yield enough background data to meet the second objective.

STS-8 provided an opportunity to meet both objectives of the RME experiment. The HRM III was operated seven times with each operation lasting 52.5 minutes. The PRM was operated twice with each operation lasting a minimum of 10 hours.

SECTION II

EQUIPMENT

HRM-III.

The HRM-III (Figure 1) (ref 2) is a hand-held gamma-ray counter. It weighs approximately 1 kilogram (2.2 pounds) and is about the size of a small cassette recorder. The circuitry is all solid state and microprocessor controlled. The detector is a mecuric iodide (HgI_2) crystal with a detection threshold of 100keV.

The HRM-III has 105 internal memories that can store counting data for playback at a later time. These memories are filled with the average counts obtained during a user determined time interval. The interval can vary from 1/3 of a second to 33 seconds. Playback of the stored data is accomplished through a liquid crystal display (LCD) on the HRM-III. This record-playback feature allows for a time-history of the gamma-ray counts without having a user continually monitoring the instrument. (For a more complete description of the HRM-III, see reference 2).

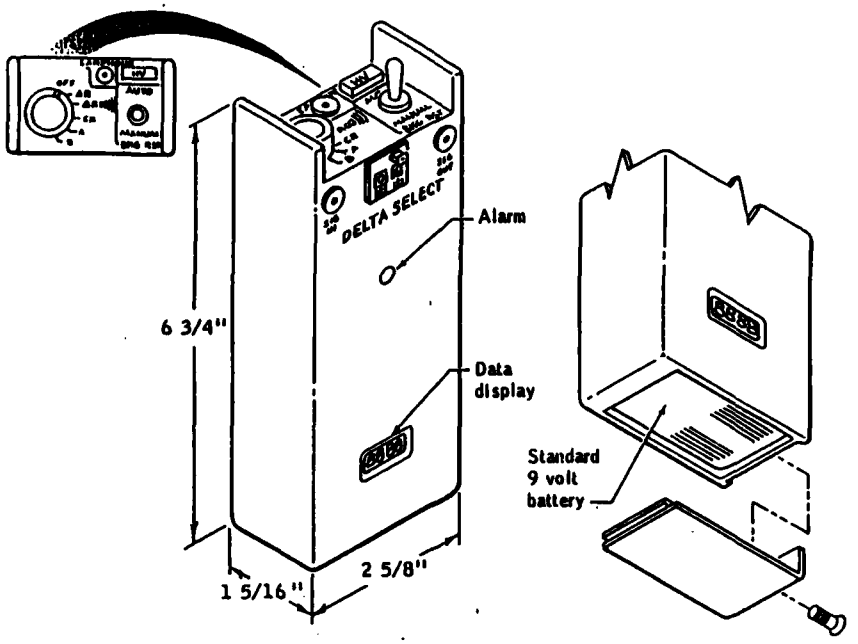
PRM.

The PRM (Figure 2) (ref 3) is a hand-held neutron/proton dosimeter. It weighs approximately 1 kilogram (2.2 pounds) and is somewhat larger than the HRM-III. The PRM has microprocessor-controlled solid-state circuitry. It uses three ionization tubes as detectors. These tubes are surrounded by a tissue equivalent plastic. The associated electronics then produces data in the form of counts, rads and rems in real time.

Data are obtained via an LCD. The PRM will read out either hours (elapsed time since turn-on), counts, rads, or rems just by changing the position of a rotary switch. The LCD displays the current value of the function (hours, counts, RADs, REMs) chosen and the LCD readout is updated as the value changes. Thus the PRM is a real time dosimeter. (For a more complete description, see reference 3).

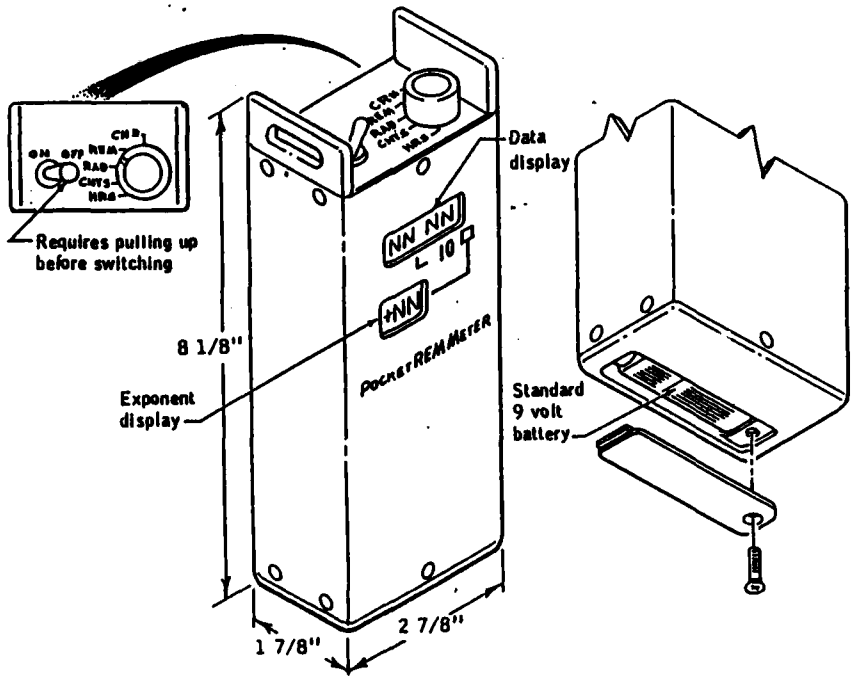
Crew Training.

Crew training on the RME was accomplished at Patrick AFB, FL, in June 1983. Three of the crew were given a 2-hour briefing on the instruments and were allowed to operate them. Questions that the crew had on the operation of the instruments were answered at that time. The crew then practiced with the training units at Johnson Space Center.



Handheld Radiation Monitor (HRM-III)

Figure 1.



Pocket REM Meter (PRM)

Figure 2.

SECTION III

RESULTS

HRM-III.

The HRM-III was operated seven times during the mission. Each operation lasted for 52.5 minutes. The HRM-III was setup to fill one memory every 30 seconds. In this configuration the HRM-III took data over approximately 58% of a 165 nautical mile (nm) (305.6 (km)) orbit.

The HRM-III performed well during STS-8. The only anomaly that occurred was during operation 4. (See Appendix). During the data readout and deactivation phase of operation 4, the crew reported that the display read "8888" and there was data in one channel only. This condition indicates a weak battery. The crew was advised to changeout the battery and reinitiate operation. The HRM-III functioned properly for all other operations.

The data obtained from the seven runs have been plotted two different ways. The first set of plots (Figures 3, 5, 7, 9, 11, 13, 15 and 17) show average counts per second plotted against time elapsed since instruments turn on. The second set of plots (Figures 4, 6, 8, 10, 12, 14, and 16) show the average counts per second plotted on a map of the world based on the Orbiter's subpoint. As an aide, the "unusual" numbering sequence for the operations, i.e., 3, 4a, 6, 7, and 8, corresponds to the numbers assigned by the crew during the flight. (See Appendix A).

The data plotted in Figures 3 through 17 show the background counts/second for gamma-rays. The data can clearly be divided into two categories: one for count rate in the South Atlantic anomaly; and the other for count rates outside of the South Atlantic anomaly. For data taken outside the South Atlantic anomaly, the background average count rate is 28 counts/sec. For data taken in the anomaly the average count rate goes as high as 265 counts/sec.

There is no easy way to convert these counts over to a dosage for gamma-rays. We are, however, currently exploring the possibility of modifying the PRM to include gamma-ray dosage with neutron/proton dosage.

No calibration is required for the HRM-III due to its use of solid state components and detector. The HRM-III that was flown had been checked by EG&G several months prior to STS-8.

In general, the data shows no surprises and appears consistent with previous measurements and expectations. Future flights will provide data from different altitudes and orbital inclinations thereby adding to the data base of background data.

PRM.

The PRM was operated twice during the STS-8 mission. The first operation occurred at Mission Elapsed Time (MET) 1/07:10:57 and lasted 15.44 hours. The second operation took place at MET 2/21:49:10 and lasted for 10.01 hours. The PRM had no anomalous behavior during either operation.

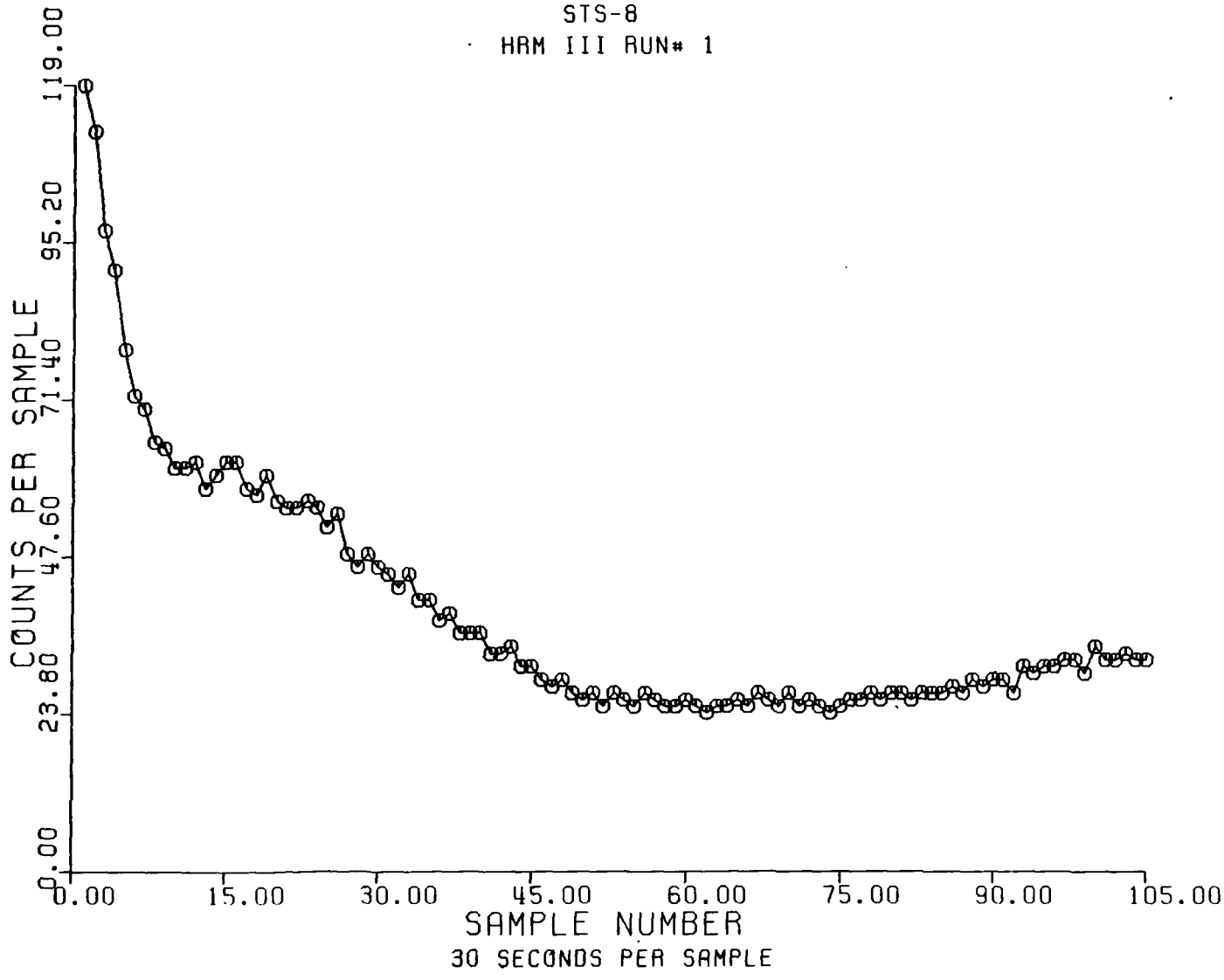
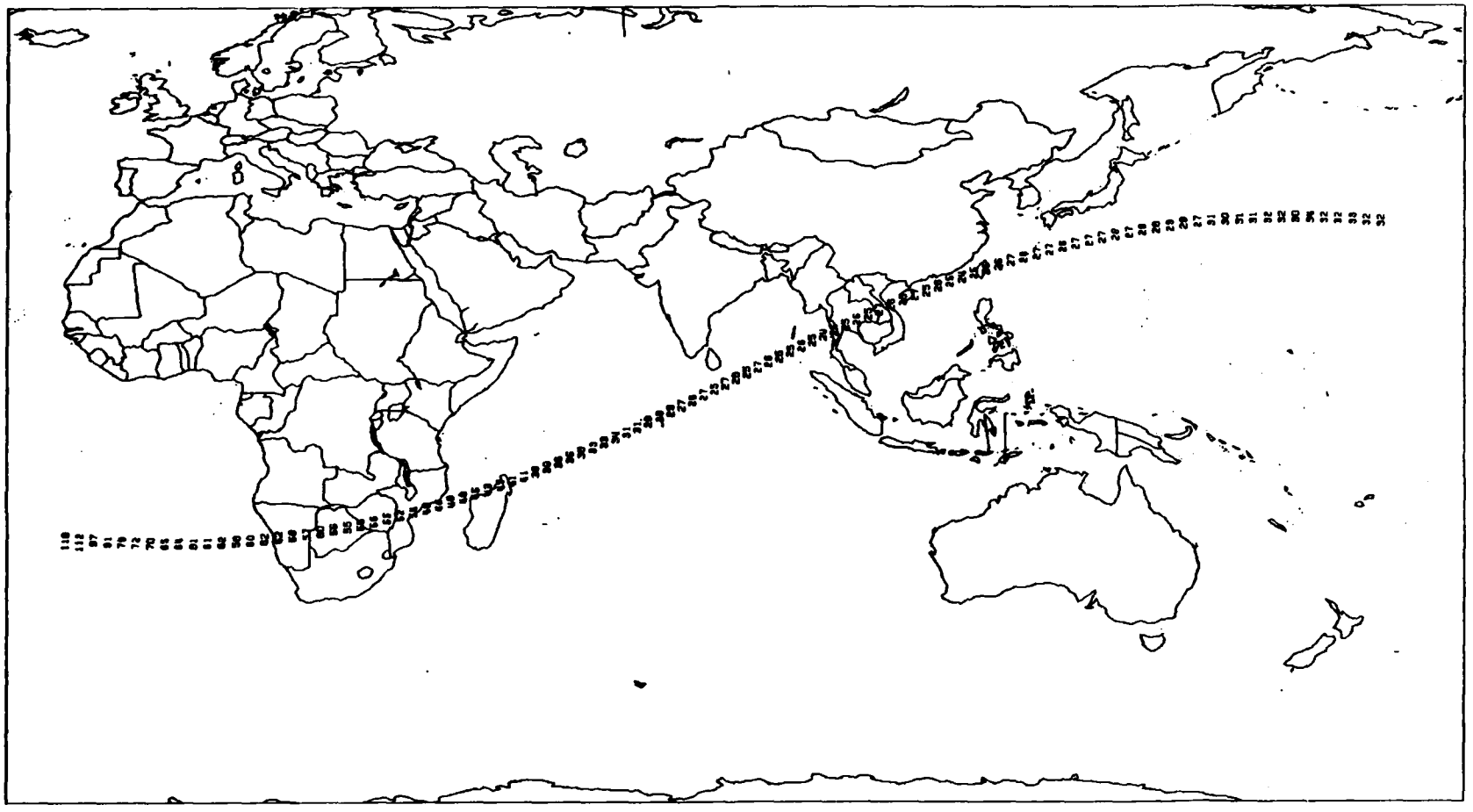

STS-8
HRM III RUN# 1
COUNTS PER SAMPLE
0.00
23.80
47.60
71.40
95.20
119.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
SAMPLE NUMBER
30 SECONDS PER SAMPLE

Figure 3

HRM-III

OPERATION NO. 1



STS-8

Figure 4

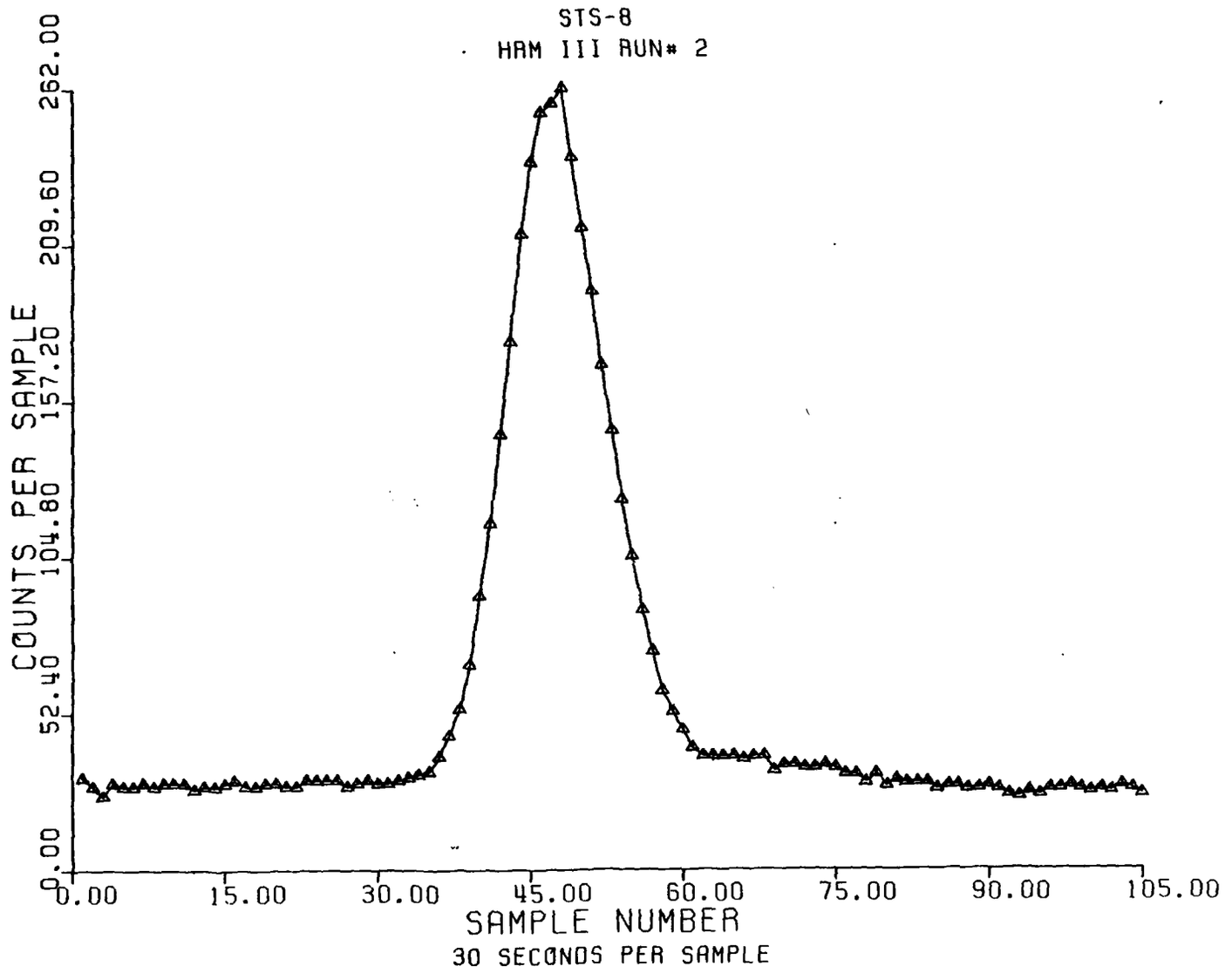
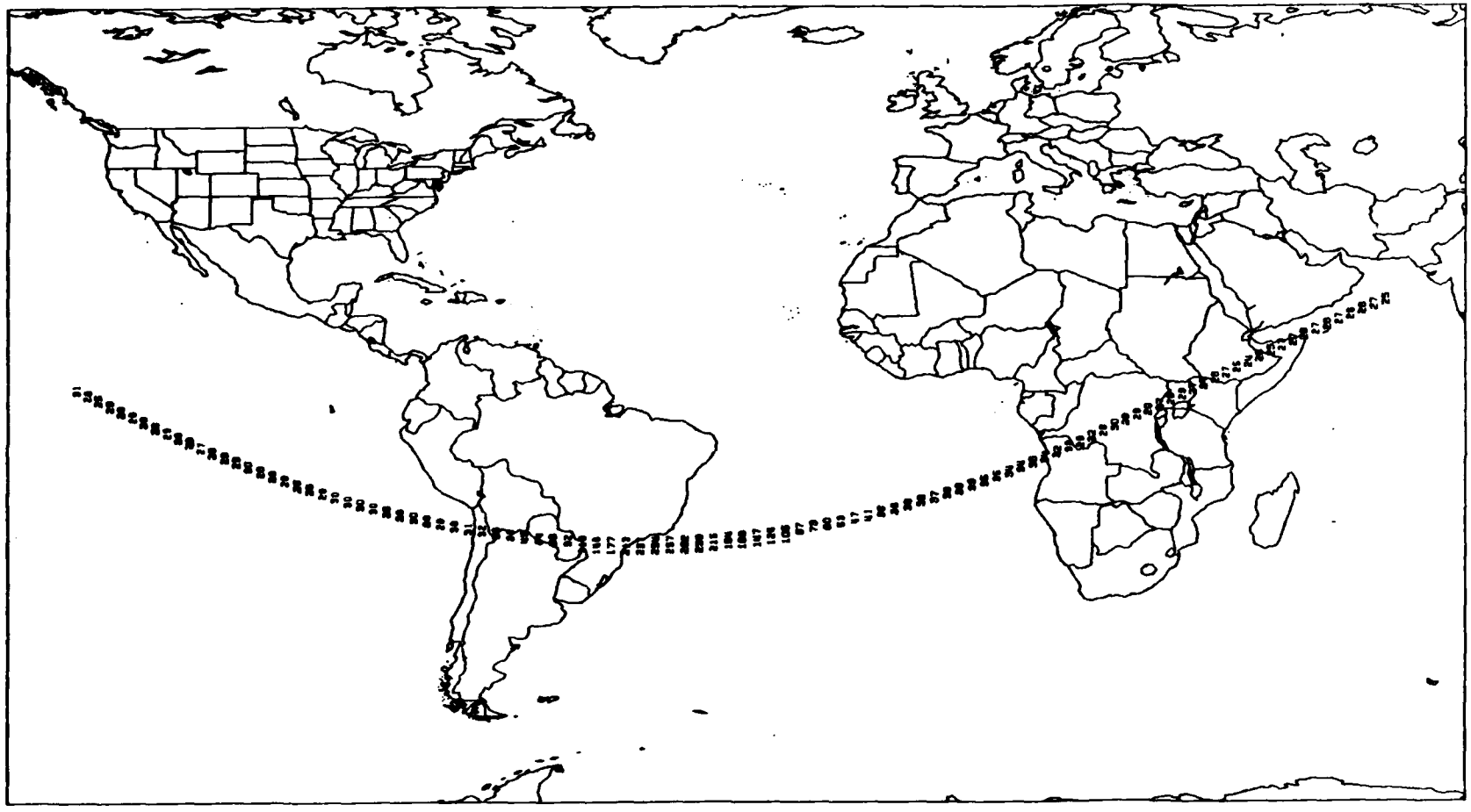

STS-8
HAM III RUN# 2
COUNTS PER SAMPLE
0.00
52.40
104.80
157.20
209.60
262.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
SAMPLE NUMBER
30 SECONDS PER SAMPLE

Figure 5

HAM-III

OPERATION NO. 2



STS-8

Figure 6

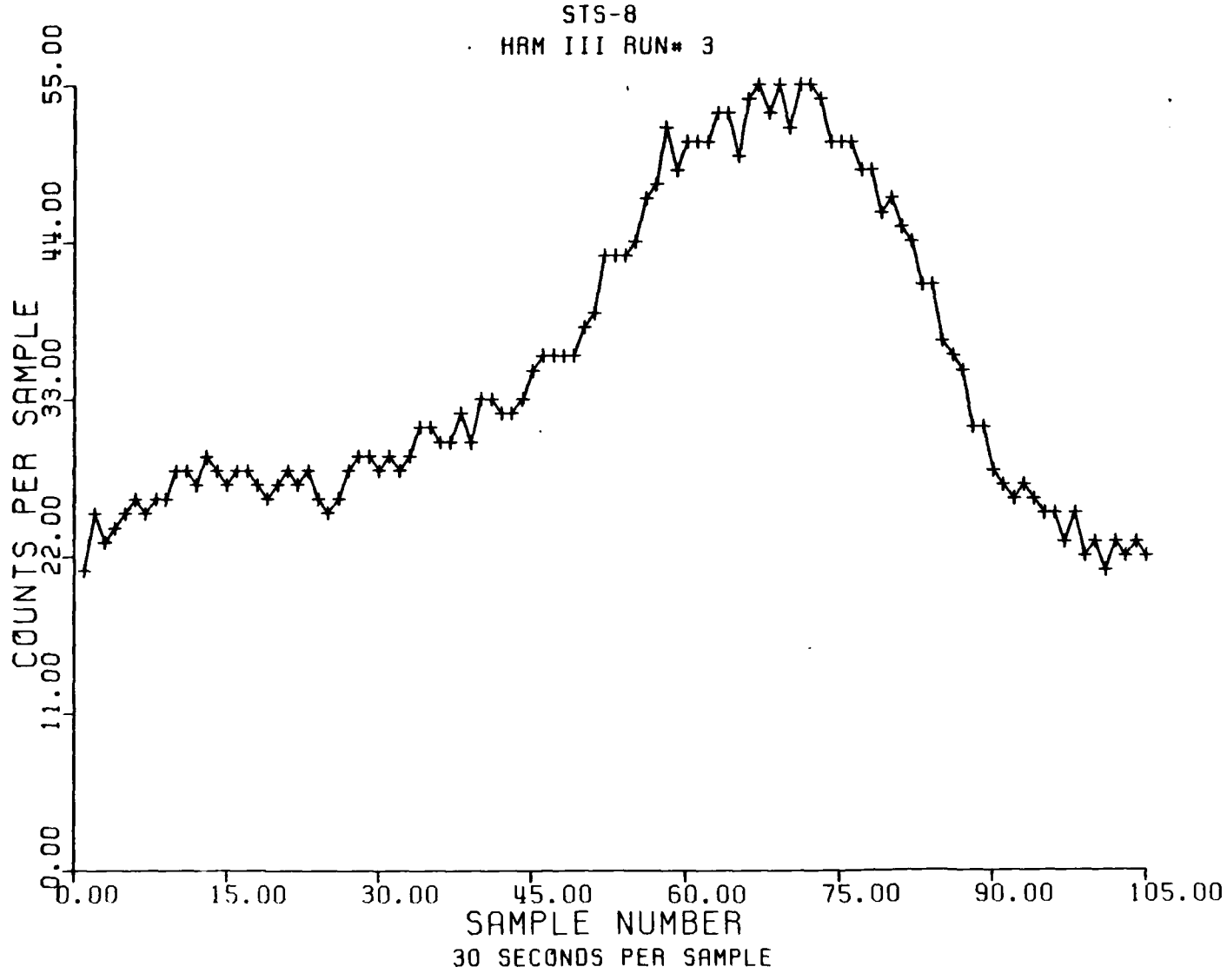
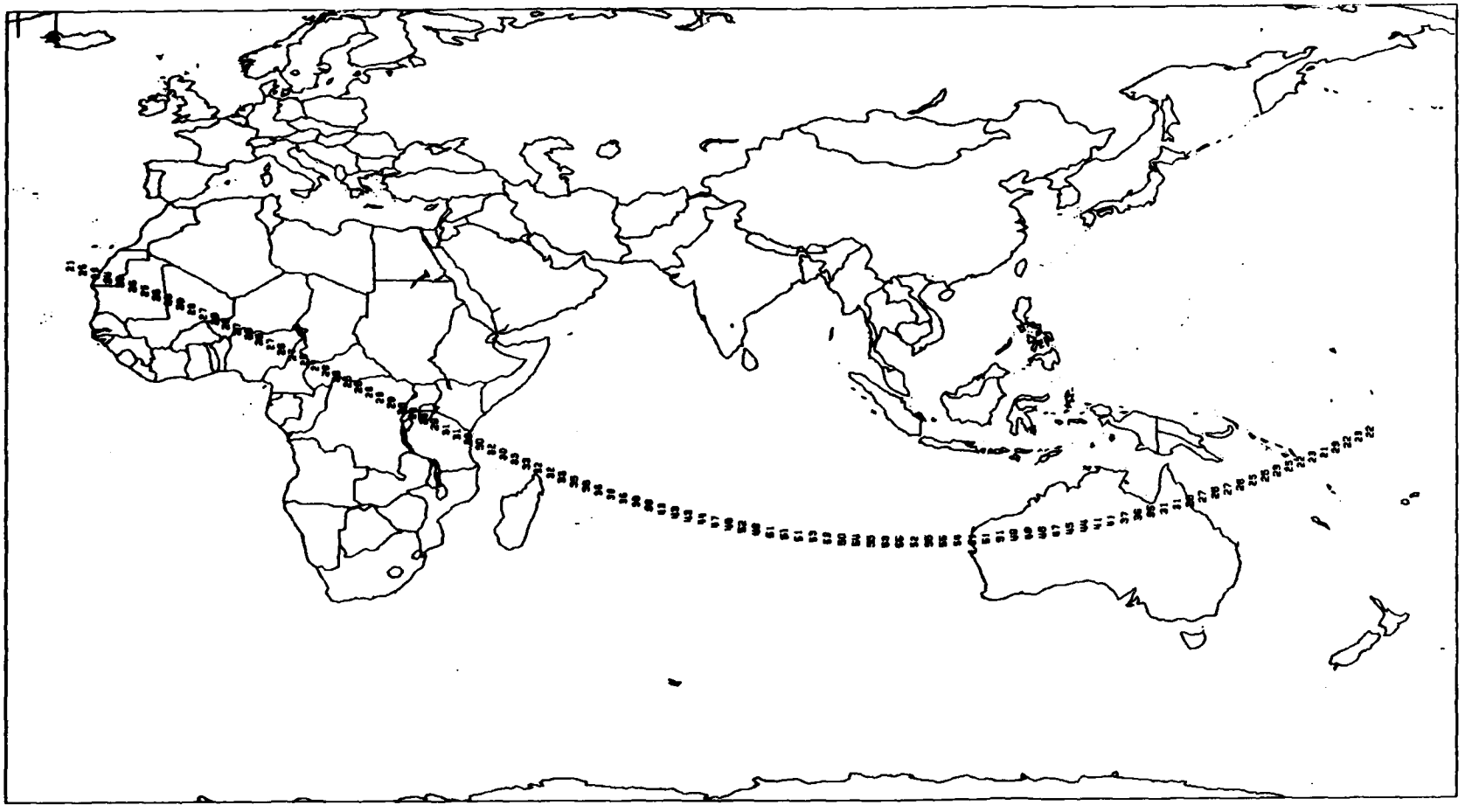

STS-8
HAM III RUN# 3
COUNTS PER SAMPLE
0.00
11.00
22.00
33.00
44.00
55.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
SAMPLE NUMBER
30 SECONDS PER SAMPLE

Figure 7

HAM-III

OPERATION NO. 3



10

STS-8

Figure 8

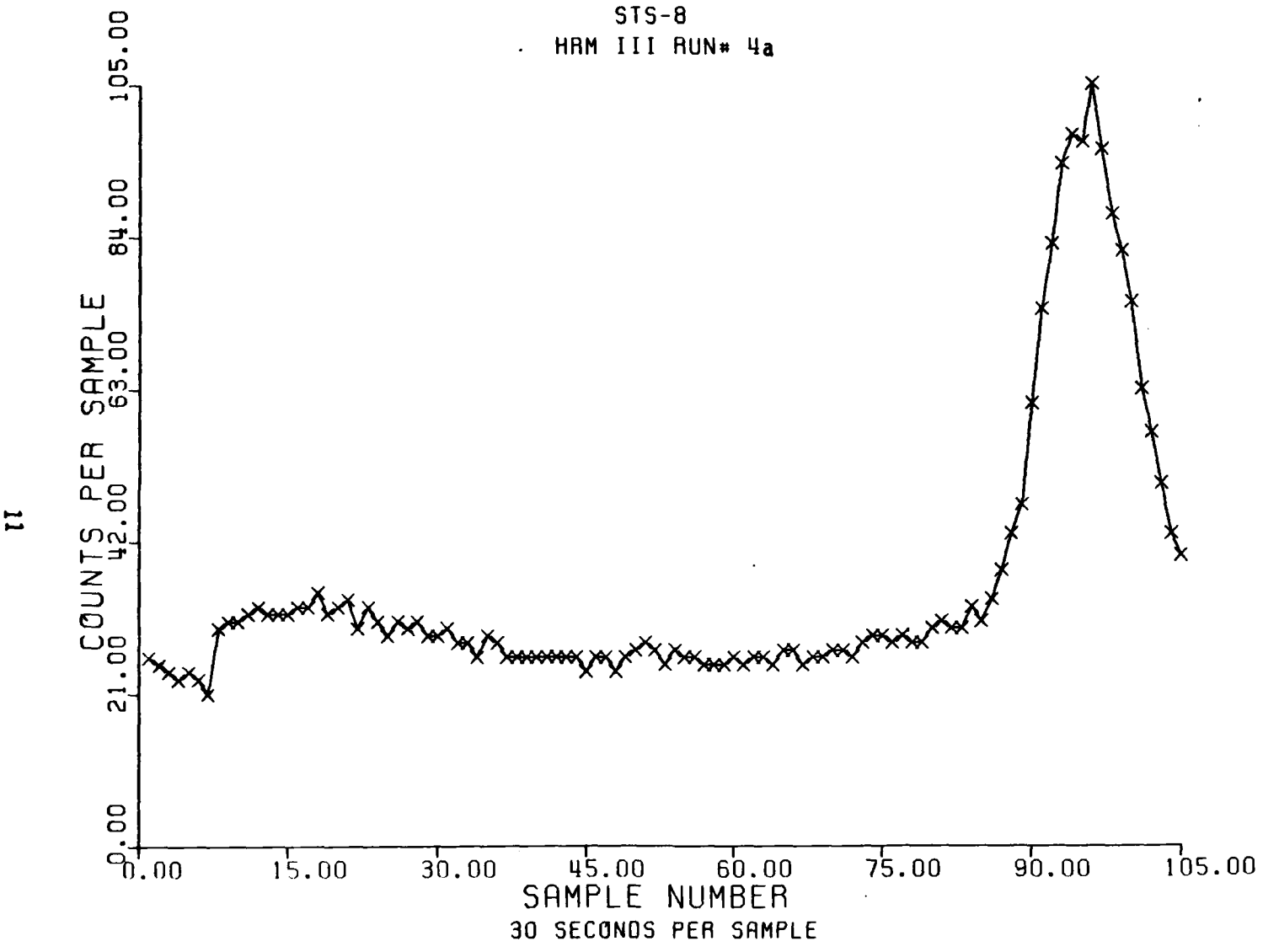
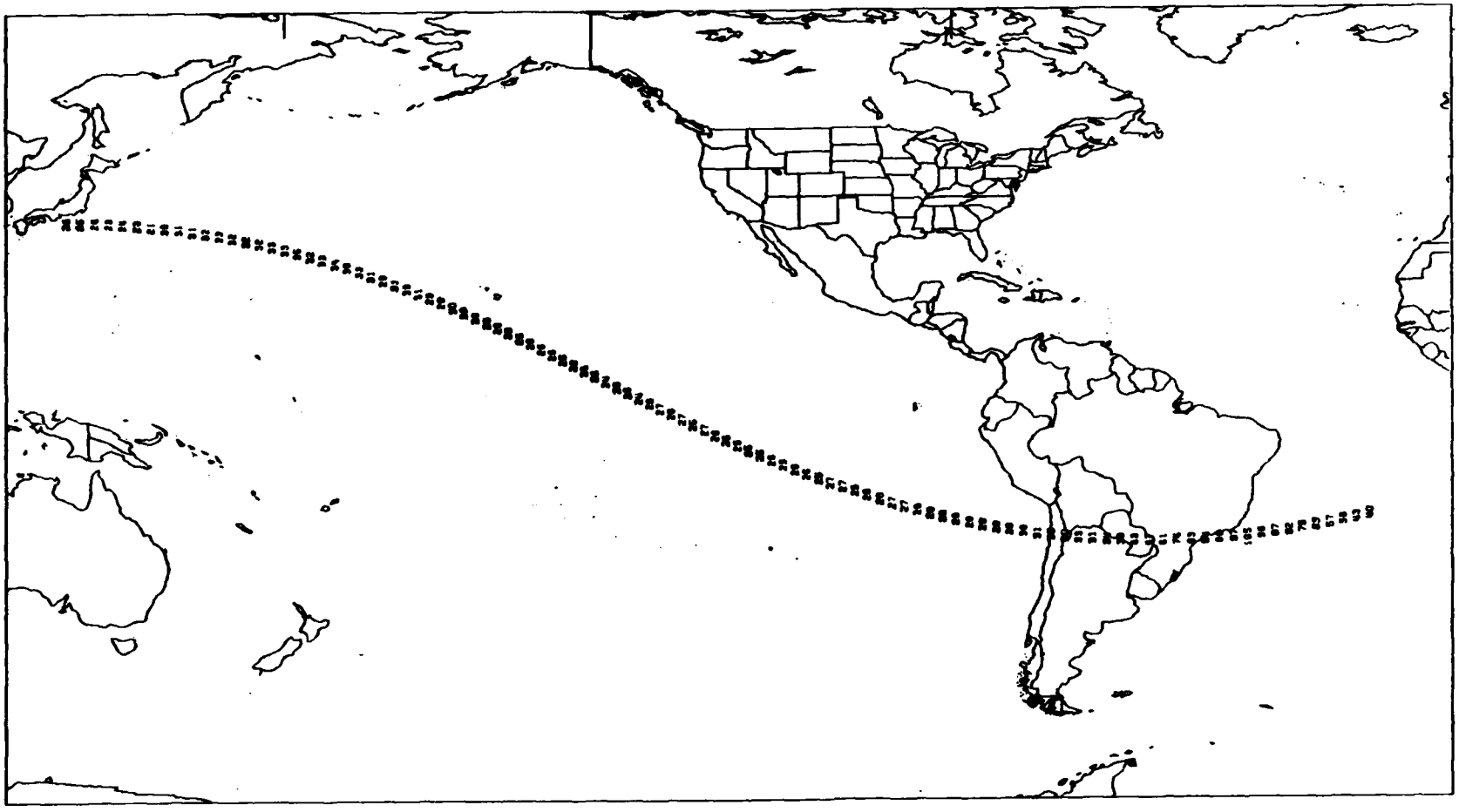

STS-8
HRM III RUN# 4a
COUNTS PER SAMPLE
0.00
21.00
42.00
63.00
84.00
105.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
SAMPLE NUMBER
30 SECONDS PER SAMPLE

Figure 9

HRM-III

OPERATION NO. 4a



STS-8

Figure 10

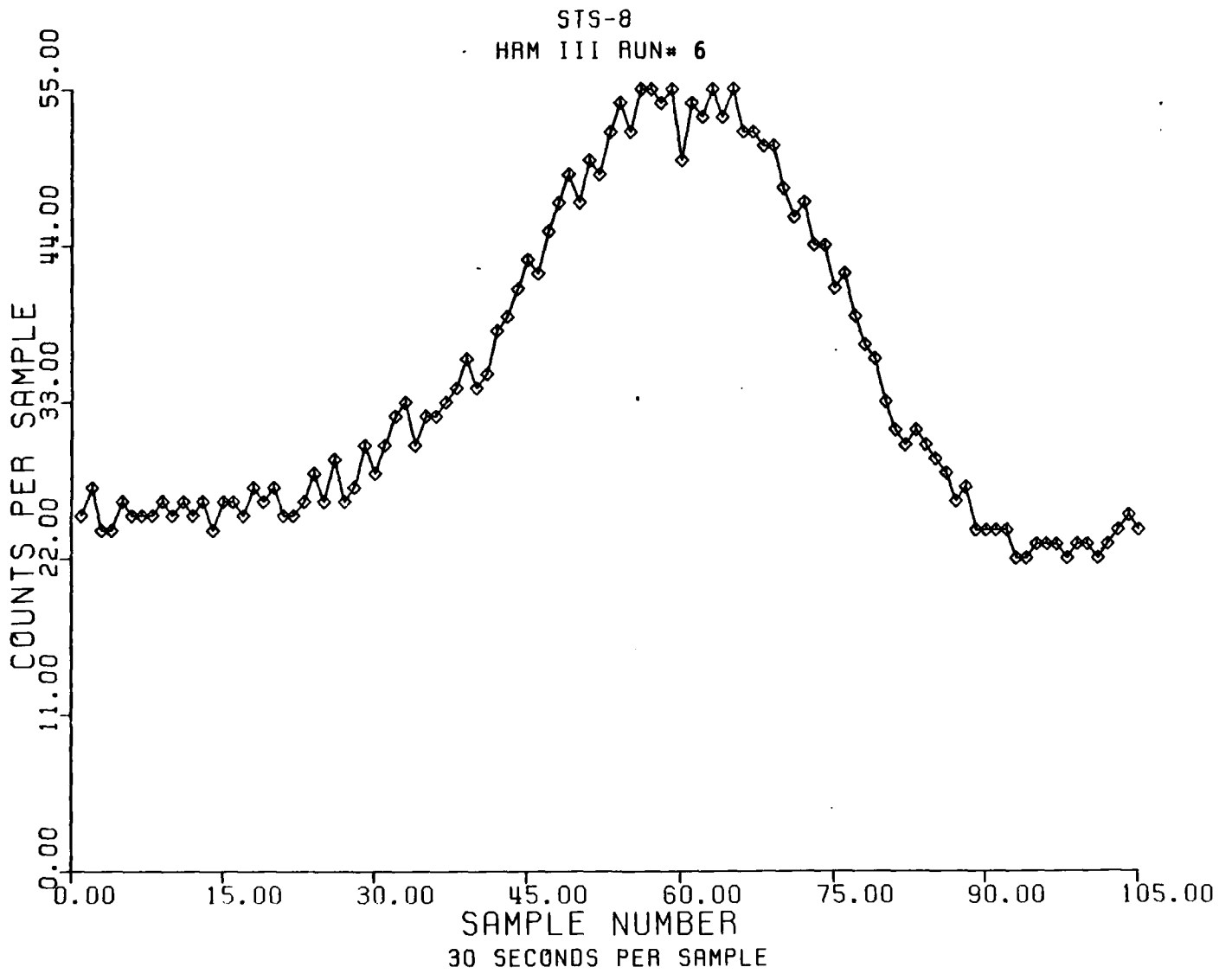
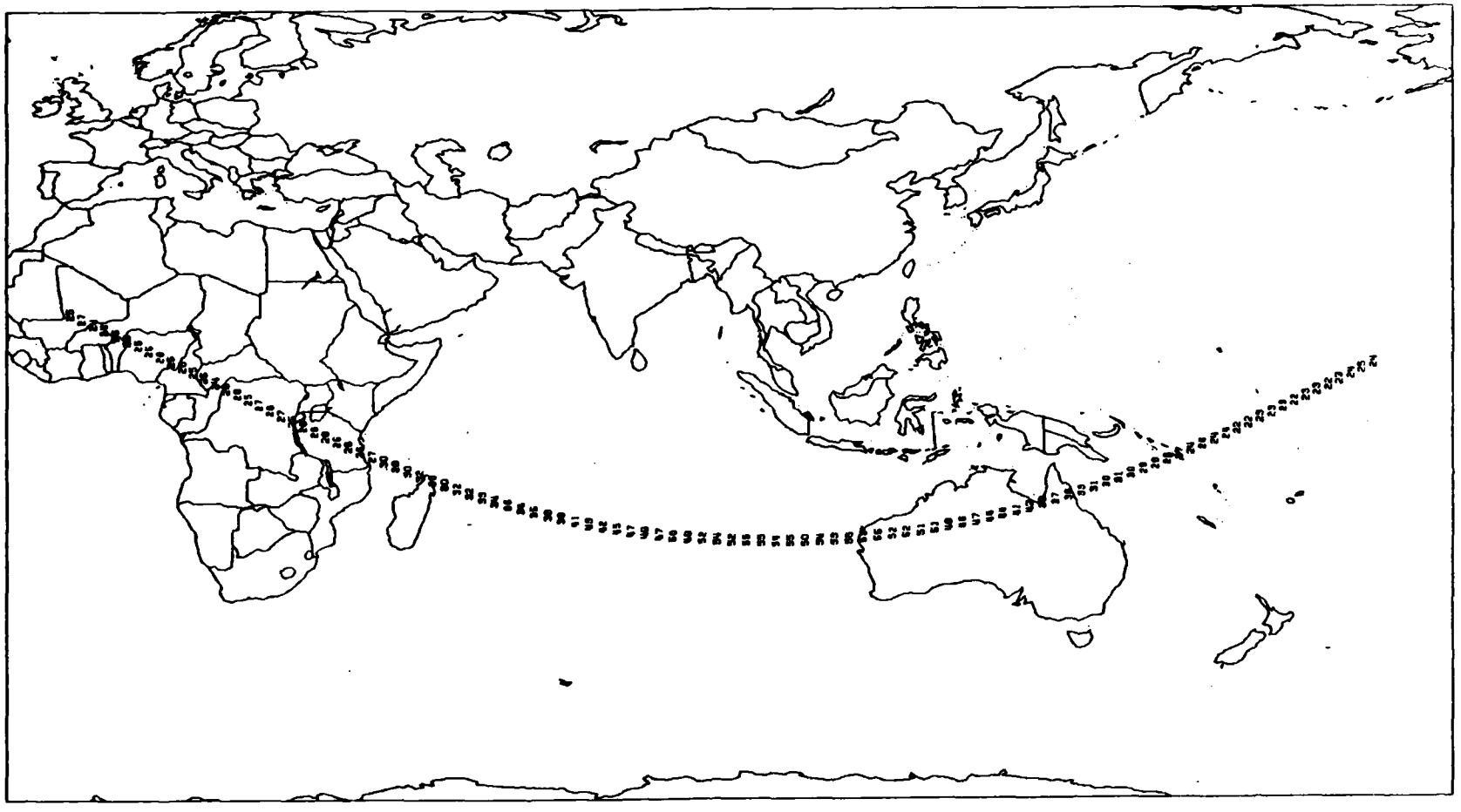

STS-8
HRM III RUN# 6
COUNTS PER SAMPLE
0.00
11.00
22.00
33.00
44.00
55.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
SAMPLE NUMBER
30 SECONDS PER SAMPLE

Figure 11

HAM-III

OPERATION NO. 6



STS-8

Figure 12

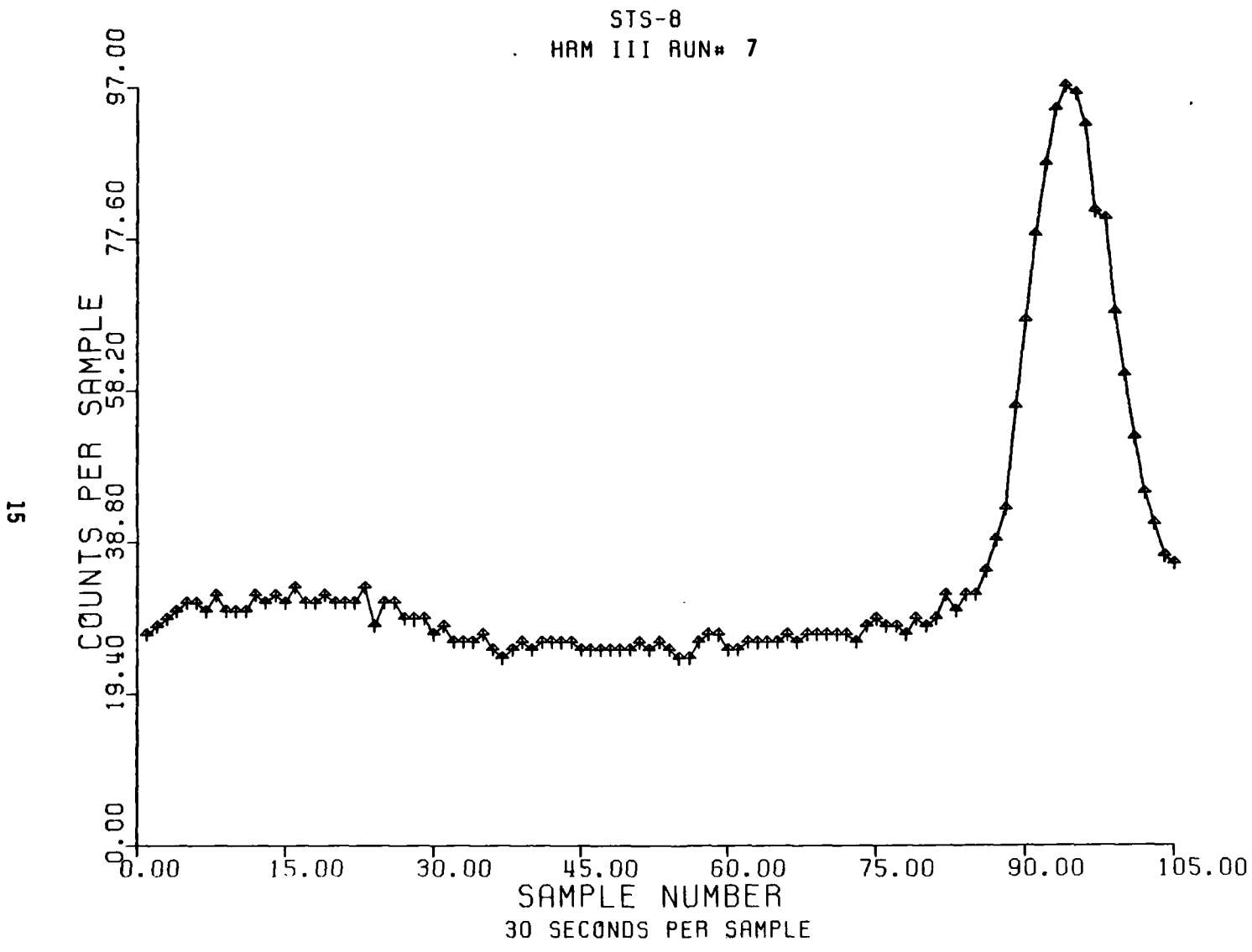
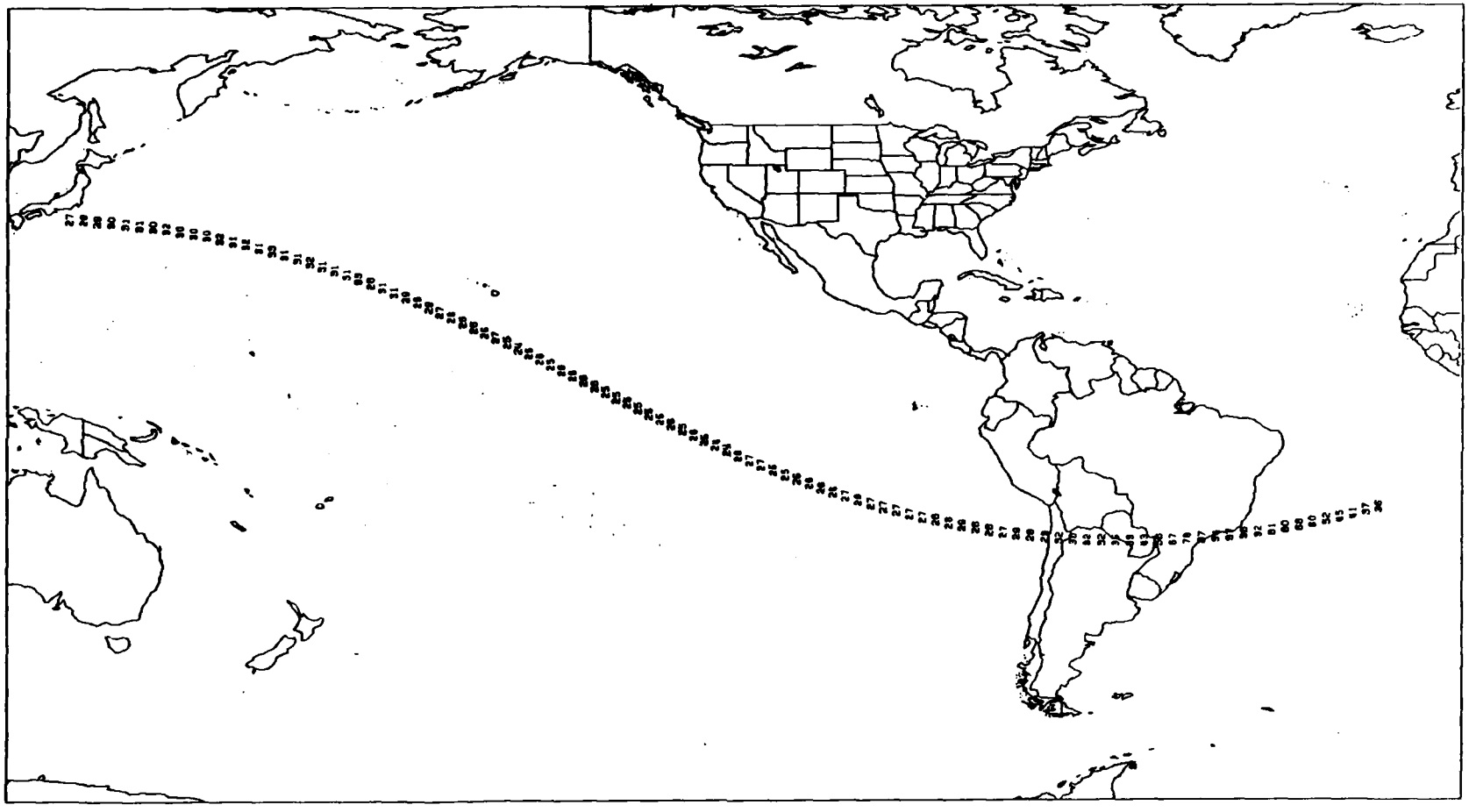

STS-8
HAM III RUN# 7
COUNTS PER SAMPLE
0.00
19.40
38.80
58.20
77.60
97.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
SAMPLE NUMBER
30 SECONDS PER SAMPLE

Figure 13

HAM-III

OPERATION NO. 7



STS-8

Figure 14

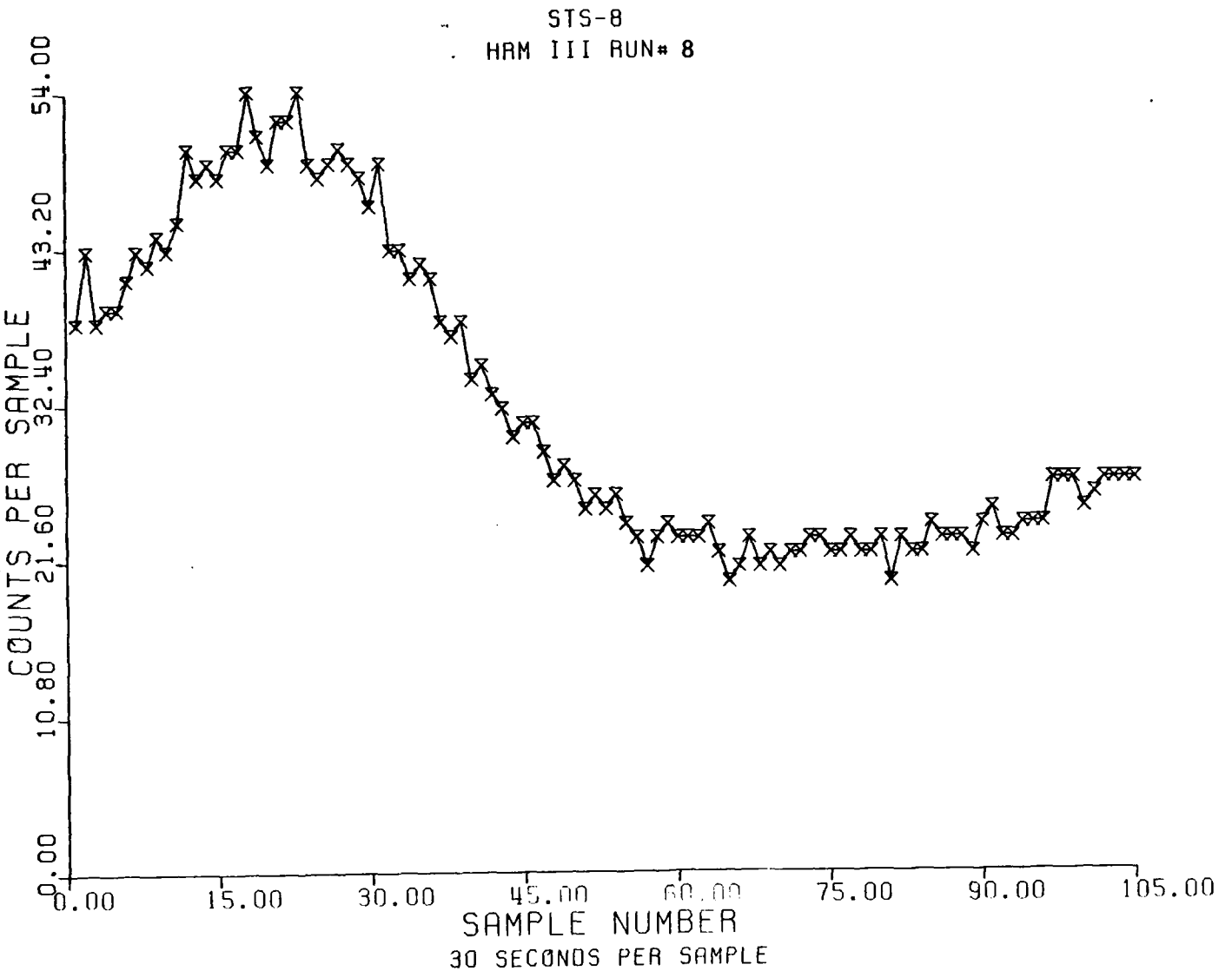

STS-8
HAM III RUN# 8
COUNTS PER SAMPLE
0.00
10.80
21.60
32.40
43.20
54.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
SAMPLE NUMBER
30 SECONDS PER SAMPLE

Figure 15

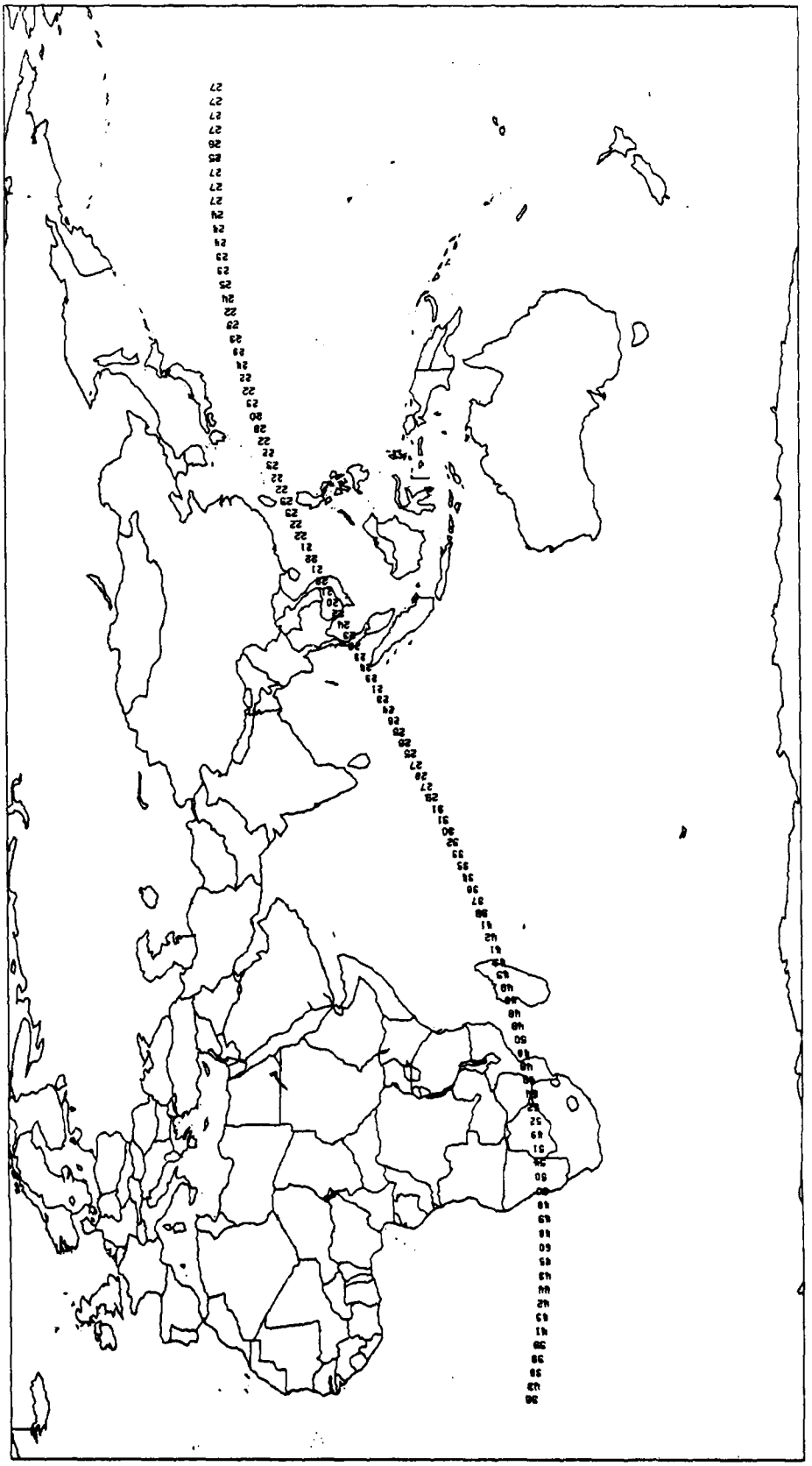


Figure 16

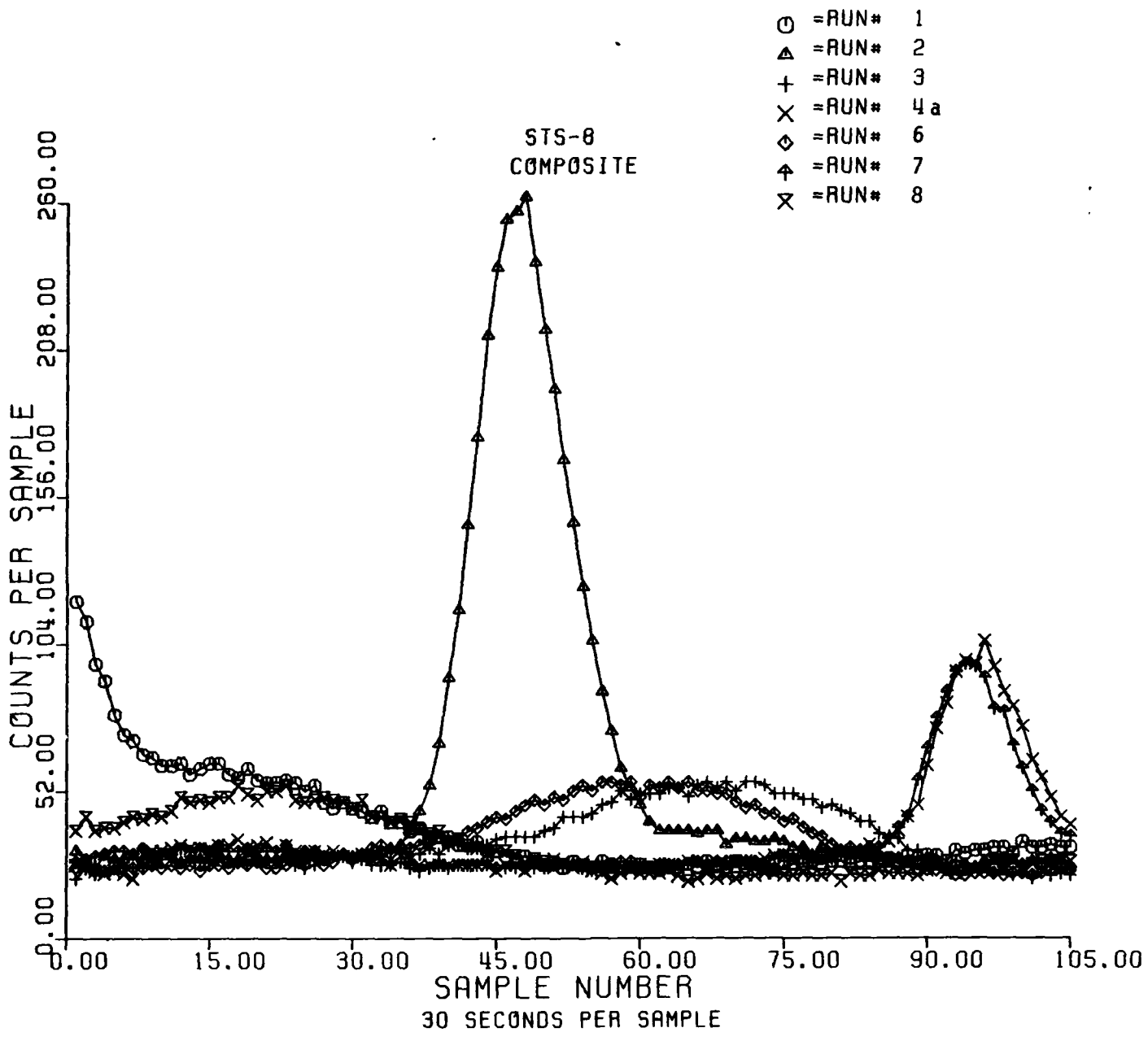

STS-8
COMPOSITE
=RUN# 1
=RUN# 2
=RUN# 3
=RUN# 4a
=RUN# 6
=RUN# 7
=RUN# 8
COUNTS PER SAMPLE
0.00
52.00
104.00
156.00
208.00
260.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
SAMPLE NUMBER
30 SECONDS PER SAMPLE

Figure 17

PRM data is presented in Table 1. The count rate is approximately the same for both operations. Table 2 shows the average dose rate for each operation and the average dose rate for both operations combined. For a seven day mission (more exactly 7 days, 1 hour, 39 minutes), this would predict a dosage from neutrons and protons to be 53.02m REM or 4.22m RAD. These are much lower than NASA values (ref 4) since gamma-ray dosage is not included.

PRM calibration (ref 1) was performed by EG&G in May of 1983. The PRM was found to be accurate to within 3% during this calibration.

TABLE 1

PRM DATA FROM STS-8

RAW DATA

MET	1/07:10:57	2/21:49:10
Counts	1340	826
Average Count Rate	86.79/hr	82.52/hr
Stdr Dev	± 9.32/hr	± 9.08/hr
rem	4.96 mrem	3.04 mrem
rad	.398 mrad	.240 mrad
Hours	15.44 hrs	10.01 hrs

TABLE 2

PRM DATA FROM STS-8

AVERAGE DOSE RATES

MET	1/07:10:57	2/21:49:10
Dose Rate (mrem/hr)	.321	.304
Dose Rate (mrad/hr)	.0258	.0240

Average dose rate for both operations:

(mrem/hr) .3125 $\pm$ .012

(mrad/hr) .0249 $\pm$ .0013

SECTION IV

CONCLUSIONS

The data collected from the RME are consistent with data taken on previous missions. There were no surprises in the data and any variations in the data correspond to natural external sources of radiation (e.g., the South Atlantic Anomaly).

The procedures used for the RME on STS-8 allowed the crew to employ the full capability of both instruments. Thus, the objective of testing the feasibility of using non-space specific hardware in space was adequately demonstrated. An important point to note here is that the instruments were easily operated and read by the crew and meaningful data were obtained. These instruments are also easily serviced by the crew. The second objective of obtaining radiation background data was also satisfied by this mission.

Future flights of the RME will contribute to the data base on background radiation. Different mission profiles will yield data from different altitudes and orbital inclination. Such a data base will prove useful for planning future space systems, including crew health and safety requirements as may exist in permanently inhabited stations and platforms.

REFERENCES

1. STS-6 Report, (in publishing), AFTAC, Caplan et al.

2. HRM-III Handheld Radiation Monitor User's Handbook; EG&G Report No. EGGM83-2424 S-347-MN, June 1981

3. Pocket Neutron REM Meter; W. Quam, T. DelDuca et al, preprint, February 1980

4. Flight Note to Flight Surgeon from Radiation, STS-8, Flight Day #6, 4 Sep 83. The flight note places an estimate of the total mission dosage to be 45mrads.

APPENDIX A

RAW DATA

FOR WHEATCRAFT

PRM OPS

1 ACTIVATION & CHECKOUT

Unstow PRM
If second operation, replace, mark, and stow used battery
Set Rotary sw - HRS
ON/OFF sw - ON
√Display counts down from 9999 and record MET on PRM DATA PAD when Display = 0.00

* If display shows a colon or is *
* blank, set ON/OFF sw - OFF; *
* replace, mark, and stow used *
* battery and repeat step 1 *

Report MET to MCC
Restow PRM (leave ON)

2 DATA RECORDING

8-10 hrs after step 1, unstow PRM
Set rotary switch to appropriate positions and record display outputs on PRM DATA PAD

Set ON/OFF sw - OFF
Stow PRM

PRM DATA PAD

0.00 MET	1/07:10:57	2/21:49:10
HRS	15.44	10.01
CNTS	1.340 E (+) 03	.826 E (+) 03
RAD	3.98 E (−) 04	2.40 E (−) 04
REM	4.96 E (−) 03	3.04 E (−) 03

DATA PAD FOR THE

PRM

DATA PAD FOR THE
HRM-III
OPERATION 1
27

FS 3-5

Run 1

2 5/05 28:00

HRM DATA PADS

CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC
0_01	119	0_22	55	0_43	34	0_64	25	0_85	27
0_02	112	0_23	56	0_44	31	0_65	26	0_86	28
0_03	97	0_24	55	0_45	31	0_66	25	0_87	27
0_04	91	0_25	52	0_46	29	0_67	26	0_88	29
0_05	79	0_26	54	0_47	28	0_68	26	0_89	28
0_06	72	0_27	48	0_48	29	0_69	25	0_90	29
0_07	70	0_28	46	0_49	27	0_70	27	0_91	29
0_08	65	0_29	48	0_50	26	0_71	25	0_92	27
0_09	64	0_30	46	0_51	27	0_72	26	0_93	31
0_10	61	0_31	45	0_52	25	0_73	25	0_94	30
0_11	61	0_32	43	0_53	27	0_74	24	0_95	31
0_12	62	0_33	45	0_54	26	0_75	25	0_96	31
0_13	58	0_34	41	0_55	25	0_76	26	0_97	32
0_14	60	0_35	41	0_56	27	0_77	26	0_98	32
0_15	62	0_36	38	0_57	26	0_78	27	0_99	30
0_16	62	0_37	39	0_58	25	0_79	26	0100	34
0_17	58	0_38	36	0_59	25	0_80	27	0101	32
0_18	57	0_39	36	0_60	26	0_81	27	0102	32
0_19	60	0_40	36	0_61	25	0_82	26	0103	33
0_20	56	0_41	33	0_62	24	0_83	27	0104	32
	55		33		25		27		32

RUN #2

1-2 REF 2/08:10:30 HRM DATA PADS

CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC
0_1	31	0_22	28	0_43	177	0_64	38	0_85	27
0_2	28	0_23	30	0_44	213	0_65	38	0_86	28
0_3	25	0_24	30	0_45	237	0_66	37	0_87	28
0_4	29	0_25	30	0_46	254	0_67	38	0_88	27
0_5	28	0_26	30	0_47	257	0_68	38	0_89	27
0_6	28	0_27	28	0_48	262	0_69	33	0_90	28
0_7	29	0_28	29	0_49	239	0_70	35	0_91	27
0_8	28	0_29	30	0_50	215	0_71	35	0_92	25
0_9	29	0_30	29	0_51	194	0_72	34	0_93	24
0_10	29	0_31	29	0_52	169	0_73	34	0_94	26
0_11	29	0_32	30	0_53	147	0_74	35	0_95	25
0_12	27	0_33	31	0_54	124	0_75	34	0_96	27
0_13	28	0_34	32	0_55	105	0_76	33	0_97	27
0_14	28	0_35	33	0_56	87	0_77	32	0_98	28
0_15	29	0_36	38	0_57	73	0_78	29	0_99	27
0_16	30	0_37	45	0_58	60	0_79	32	0100	26
0_17	28	0_38	54	0_59	53	0_80	28	0101	27
0_18	28	0_39	69	0_60	47	0_81	30	0102	26
0_19	29	0_40	92	0_61	41	0_82	29	0103	28
0_20	29	0_41	116	0_62	38	0_83	29	0104	27
0_21	28	0_42	146	0_63	38	0_84	29	0105	25

FS 3-6 STS-8/FIG A

DATA PAD FOR THE
HRM-III
OPERATION 2

Run #3

#3 21

UNIT HET 21:30:00 HRM DATA PADS

CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC
0__1	21	0_22	27	0_43	32	0_64	53	0_85	37
0__2	25	0_23	28	0_44	33	0_65	50	0_86	36
0__3	23	0_24	26	0_45	35	0_66	54	0_87	35
0__4	24	0_25	25	0_46	36	0_67	55	0_88	31
0__5	25	0_26	26	0_47	36	0_68	53	0_89	31
0__6	26	0_27	28	0_48	36	0_69	55	0_90	28
0__7	25	0_28	29	0_49	36	0_70	52	0_91	27
0__8	26	0_29	29	0_50	38	0_71	55	0_92	26
0__9	26	0_30	28	0_51	39	0_72	55	0_93	27
0_10	28	0_31	29	0_52	43	0_73	54	0_94	26
0_11	28	0_32	28	0_53	43	0_74	51	0_95	25
0_12	27	0_33	29	0_54	43	0_75	51	0_96	25
0_13	29	0_34	31	0_55	44	0_76	51	0_97	23
0_14	28	0_35	31	0_56	47	0_77	49	0_98	25
0_15	27	0_36	30	0_57	48	0_78	49	0_99	22
0_16	28	0_37	30	0_58	51	0_79	46	0100	23
0_17	28	0_38	32	0_59	49	0_80	47	0101	21
0_18	27	0_39	30	0_60	51	0_81	45	0102	23
0_19	26	0_40	33	0_61	51	0_82	44	0103	22
0_20	27	0_41	33	0_62	51	0_83	41	0104	23
0_21	28	0_42	32	0_63	53	0_84	41	0105	22

FS 3-7 STS-3/FIN A

DATA PAD FOR THE
HRM-III
OPERATION 3

RUN 4 UNSUCCESSFUL

UNIT NO: 3/04:12:00 HRM DATA PADS

CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC
0_1	2-12	0_22		0_43		0_64		0_85	
0_2	0	0_23		0_44		0_65		0_86	
0_3	0	0_24		0_45		0_66		0_87	
0_4	0	0_25		0_46		0_67		0_88	
0_5	[illegible]	0_26		0_47		0_68		0_89	
0_6	[illegible]	0_27		0_48		0_69		0_90	
0_7		0_28		0_49		0_70		0_91	
0_8		0_29		0_50		0_71		0_92	
0_9		0_30		0_51		0_72		0_93	
0_10		0_31		0_52		0_73		0_94	
0_11		0_32		0_53		0_74		0_95	
0_12		0_33		0_54		0_75		0_96	
0_13		0_34		0_55		0_76		0_97	
0_14		0_35		0_56		0_77		0_98	
0_15		0_36		0_57		0_78		0_99	
0_16		0_37		0_58		0_79		0100	
0_17		0_38		0_59		0_80		0101	
0_18		0_39		0_60		0_81		0102	
0_19		0_40		0_61		0_82		0103	
0_20		0_41		0_62		0_83		0104	
0_21		0_42		0_63		0_84		0105	

When picked up READ 8888 CHECK out failed HPV 2nd try -OK- start counting 3/07:44 RETRY 05 HOUR

FS 3-8

FS 3-6

STS-8/FIN A

DATA PAD FOR THE
HRM-III
OPERATION 4

RUN 4A - OK
(5)

3/07:44:00

HRM . A PADS

CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC
0_1	26	0_22	30	0_43	26	0_64	25	0_85	31
0_2	25	0_23	33	0_44	26	0_65	27	0_86	34
0_3	24	0_24	31	0_45	24	0_66	27	0_87	38
0_4	23	0_25	29	0_46	26	0_67	25	0_88	43
0_5	24	0_26	31	0_47	26	0_68	26	0_89	47
0_6	23	0_27	30	0_48	24	0_69	26	0_90	61
0_7	21	0_28	31	0_49	26	0_70	27	0_91	74
0_8	30	0_29	29	0_50	27	0_71	27	0_92	83
0_9	31	0_30	29	0_51	28	0_72	26	0_93	94
0_10	31	0_31	30	0_52	27	0_73	28	0_94	98
0_11	32	0_32	28	0_53	25	0_74	29	0_95	97
0_12	33	0_33	28	0_54	27	0_75	29	0_96	105
0_13	32	0_34	26	0_55	26	0_76	28	0_97	96
0_14	32	0_35	29	0_56	26	0_77	29	0_98	87
0_15	32	0_36	28	0_57	25	0_78	28	0_99	82
0_16	33	0_37	26	0_58	25	0_79	28	0_100	75
0_17	33	0_38	26	0_59	25	0_80	30	0_101	63
0_18	35	0_39	26	0_60	26	0_81	31	0_102	57
0_19	32	0_40	26	0_61	25	0_82	30	0_103	50
0_20	33	0_41	26	0_62	26	0_83	30	0_104	43
0_21	34	0_42	26	0_63	26	0_84	33	0_105	40

FS 3-5

DATA PAD FOR THE
HRM-III
OPERATION 4A

RUN # 6

HISC

INIT MET 3/21:19:00 HRM DATA PADS

CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC
0__1	25	0_22	25	0_43	39	0_64	53	0_85	29
0__2	27	0_23	26	0_44	41	0_65	55	0_86	28
0__3	24	0_24	28	0_45	43	0_66	52	0_87	26
0__4	24	0_25	26	0_46	42	0_67	52	0_88	27
0__5	26	0_26	29	0_47	45	0_68	51	0_89	24
0__6	25	0_27	26	0_48	47	0_69	51	0_90	24
0__7	25	0_28	27	0_49	49	0_70	48	0_91	24
0__8	25	0_29	30	0_50	47	0_71	46	0_92	24
0__9	26	0_30	28	0_51	50	0_72	47	0_93	22
0_10	25	0_31	30	0_52	49	0_73	44	0_94	22
0_11	26	0_32	32	0_53	52	0_74	44	0_95	23
0_12	25	0_33	33	0_54	54	0_75	41	0_96	23
0_13	26	0_34	30	0_55	52	0_76	42	0_97	23
0_14	24	0_35	32	0_56	55	0_77	39	0_98	22
0_15	26	0_36	32	0_57	55	0_78	37	0_99	23
0_16	26	0_37	33	0_58	54	0_79	36	0100	23
0_17	25	0_38	34	0_59	55	0_80	33	0101	22
0_18	27	0_39	36	0_60	50	0_81	31	0102	23
0_19	26	0_40	34	0_61	54	0_82	30	0103	24
0_20	27	0_41	35	0_62	53	0_83	31	0104	25
0_21	25	0_42	38	0_63	55	0_84	30	0105	24

FS 3-6
FS 3-8

STS-2/FIII A

DATA PAD FOR THE
HRM-III
OPERATION 6

RUN #7

4/07/26+00

DATA PAD FOR THE
HRM-III
OPERATION 7
33

FS 3-7

STS-8/FIII A

CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC
0__1	27	0_22	31	0_43	26	0_64	26	0_85	32
0__2	28	0_23	33	0_44	26	0_65	26	0_86	35
0__3	29	0_24	28	0_45	25	0_66	27	0_87	39
0__4	30	0_25	31	0_46	25	0_67	26	0_88	43
0__5	31	0_26	31	0_47	25	0_68	27	0_89	56
0__6	31	0_27	29	0_48	25	0_69	27	0_90	67
0__7	30	0_28	29	0_49	25	0_70	27	0_91	78
0__8	32	0_29	29	0_50	25	0_71	27	0_92	87
0__9	30	0_30	27	0_51	26	0_72	27	0_93	94
0_10	30	0_31	28	0_52	25	0_73	26	0_94	97
0_11	30	0_32	26	0_53	26	0_74	28	0_95	96
0_12	32	0_33	26	0_54	25	0_75	29	0_96	92
0_13	31	0_34	26	0_55	24	0_76	28	0_97	81
0_14	32	0_35	27	0_56	24	0_77	28	0_98	80
0_15	31	0_36	25	0_57	26	0_78	27	0_99	68
0_16	33	0_37	24	0_58	27	0_79	29	0100	60
0_17	31	0_38	25	0_59	27	0_80	28	0101	52
0_18	31	0_39	26	0_60	25	0_81	29	0102	45
0_19	32	0_40	25	0_61	25	0_82	32	0103	41
0_20	31	0_41	26	0_62	26	0_83	30	0104	37
0_21	31	0_42	26	0_63	26	0_84	32	0105	36

Run 48

DATA PAD FOR THE
HRM-III
OPERATION 8

FS 3-8

INIT HC: 5:03:15.00 HRM DATA PADS

CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC	CHANNEL	COUNTS/SEC
0_01	38	0_22	52	0_43	32	0_64	22	0_85	24
0_02	43	0_23	54	0_44	30	0_65	20	0_86	23
0_03	38	0_24	49	0_45	31	0_66	21	0_87	23
0_04	39	0_25	48	0_46	31	0_67	23	0_88	23
0_05	39	0_26	49	0_47	29	0_68	21	0_89	22
0_06	41	0_27	50	0_48	27	0_69	22	0_90	24
0_07	43	0_28	49	0_49	28	0_70	21	0_91	25
0_08	42	0_29	48	0_50	27	0_71	22	0_92	23
0_09	44	0_30	46	0_51	25	0_72	22	0_93	23
0_10	43	0_31	49	0_52	26	0_73	23	0_94	24
0_11	45	0_32	43	0_53	25	0_74	23	0_95	24
0_12	50	0_33	43	0_54	26	0_75	22	0_96	24
0_13	48	0_34	41	0_55	24	0_76	22	0_97	27
0_14	49	0_35	42	0_56	23	0_77	23	0_98	27
0_15	48	0_36	41	0_57	23	0_78	22	0_99	27
0_16	50	0_37	38	0_58	21	0_79	22	0100	25
0_17	50	0_38	37	0_59	23	0_80	23	0101	26
0_18	54	0_39	38	0_60	24	0_81	20	0102	27
0_19	51	0_40	34	0_61	23	0_82	23	0103	27
0_20	49	0_41	35	0_62	23	0_83	22	0104	27
0_21	52	0_42	33	0_63	24	0_84	22	0105	27

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