DATA SET CATALOG # 5

Explorer 11 - Gamma Ray Telescope

61-013A-01A 2 Tapes (D-0002, D0003)

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1. INTRODUCTION:

The documentation for this data set was originally on paper, kept in NSSDC's Data Set Catalogs (DSCs). The paper documentation in the Data Set Catalogs have been made into digital images, and then collected into a single PDF file for each Data Set Catalog. The inventory information in these DSCs is current as of July 1, 2004. This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system. The information existing in the DSCs is now not needed for locating the data files, but we did not remove that inventory information.

The offline tape datasets have now been migrated from the original magnetic tape to Archival Information Packages (AIP's).

A prior restoration may have been done on data sets, if a requestor of this data set has questions; they should send an inquiry to the request office to see if additional information exists.

2. ERRATA/CHANGE LOG:

NOTE: Changes are made in a text box, and will show up that way when displayed on screen with a PDF reader.

When printing, special settings may be required to make the text box appear on the printed output.

Version	Date	Person	Page	Description of Change
01				
02				

3 LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC INFORMATION SYSTEM:

http://nssdc.gsfc.nasa.gov/nmc/

[NOTE: This link will take you to the main page of the NSSDC Master Catalog. There you will be able to perform searches to find additional information]

4. CATALOG MATERIALS:

a. Associated Documents — To find associated documents you will need to know the document ID number and then click here. http://nssdcftp.gsfc.nasa.gov/miscellaneous/documents/

b. Core Catalog Materials

EXPLORER 11

ASPECT & OBSERCE TIME GAMMA EVENTS

61-013A-01A

THIS DATA SET HAS BEEN RESTORED. ORIGINALLY THERE WERE TWO 7-TRACK, 556 BPI TAPES WRITTEN IN BINARY. THERE IS ONE RESTORED TAPE, WHICH WAS PACKED DURING THE RESTORATION PROCESS. THE DR TAPE IS A 3480 CARTRIDGE AND THE DS TAPE IS 9-TRACK, 6250 BPI. THE ORIGINAL TAPES WERE CREATED ON AN IBM 7094 COMPUTER. THE DR AND DS NUMBERS ALONG WITH THE CORRESPONDING D NUMBERS AND TIME SPANS ARE AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN
DR004217	DS004217	D000002	1	04/27/61 - 11/17/61
		D000003	2	04/27/61 - 11/17/61

EXPLORER 11 (1961 NU 1)
GAMMA RAY TELESCOPE EXPERIMENT

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NSSDC 67-25

EXPLORER 11 (1961 NU 1)

GAMMA-RAY TELESCOPE EXPERIMENT

MAY 1967

NATIONAL SPACE SCIENCE DATA CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.

DATA USERS' NOTE
NSSDC 67-25

EXPLORER 11 (1961 NU 1)
GAMMA-RAY TELESCOPE EXPERIMENT

EXPERIMENTERS
W. L. Kraushaar
G. W. Clark

MAY 1967

FOREWORD

This Data Users' Note is specifically designed to help potential data users decide if they can make use of the data obtained in the Explorer 11 (1961 Nu 1) gamma-ray telescope experiment. Once a data user decides that he requires the data, it will serve as the unifying element - the key - in the actual use of the data available at the National Space Science Data Center (NSSDC). To achieve these goals, the Note briefly describes the experiment, including the instrumentation and measurements, the telemetry, and the operational experience. All available details are then provided on the actual reduction techniques and format of recorded data. For those desiring more details, names and addresses of the experimenters are provided to facilitate direct contact. As a further aid, detailed references (and bibliography) are also included. When available, NASA accession numbers* are given. The primary purpose of these references is to identify the sources containing complete information concerning the subject under discussion. Most of these references are physically available at NSSDC - those that are not are readily obtainable.

Inquiries concerning the availability of data should be directed to:

National Space Science Data Center
Goddard Space Flight Center
Greenbelt, Maryland 20771
Area Code 301 982-6695

*For example, N64-2243 is an accession number for an article reported in the *Scientific and Technical Aerospace Reports* (STAR), and A63-5921 refers to an entry in the *International Aerospace Abstracts* (IAA).

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LIST OF FIGURES

EXPLORER 11 (1961 NU 1)
GAMMA-RAY TELESCOPE EXPERIMENT

BACKGROUND

The Explorer 11 (1961 Nu 1) gamma-ray telescope experiment was designed by researchers at the Massachusetts Institute of Technology primarily to detect cosmic gamma rays >50 Mev.

This experiment (see Figure 1) was carried aboard the Explorer 11 (1961 Nu 1) satellite, previously known as S-15, which was launched on April 27, 1961, from Cape Canaveral (Cape Kennedy), Florida. Explorer 11 achieved an orbit with an apogee of 1786 km, a perigee of 486 km, a period of 108.1 min, and an inclination of 28.9 deg. In addition to detecting gamma rays, Explorer 11 was designed to map their direction with emphasis on the plane of the galaxy, the galactic center, the sun, and other known radio noise sources; to relate the measurements to the cosmic-ray flux density and the density of interstellar matter; and to measure the high-energy gamma-ray albedo of the earth's atmosphere. The satellite was spin-stabilized at launch and maintained a large fraction of its initial angular momentum throughout its useful lifetime.[1, 2]

The gamma-ray detector was mounted within an aluminum housing; located outside were solar cells that provided battery-charging power. The fourth-stage solid-fuel rocket motor remained attached to the instrument in orbit.[3]

FIGURE 1
EXPLORER 11 EXPERIMENT

No.	Experiment	Investigator(s)	Affiliation
01	Gamma-Ray Telescope	W. Kraushaar G. Clark	MIT MIT

NOTE: Charged particle data were obtained by G. Garmire (MIT) by using the counting rates normally telemetered.

EXPERIMENTERS

W. L. Kraushaar* - Massachusetts Institute of Technology
G. W. Clark** - Massachusetts Institute of Technology

*Present location: University of Wisconsin, Madison, Wisconsin.
**Address: Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, Massachusetts.

EXPERIMENT

Instrumentation and Measurements

Explorer 11 was constructed so that its stable motion was an end-over-end tumble about the transverse principal axis which had the largest moment of inertia. The gamma-ray telescope assembly was mounted so that its axis of sensitivity, which was parallel to the long axis of the satellite, would rotate in the plane of tumble. The orientation of this axis in space was determined to approximately 5 deg by means of optical aspect detectors and the use of the known radiation pattern of the vehicle antenna.[3, 8]

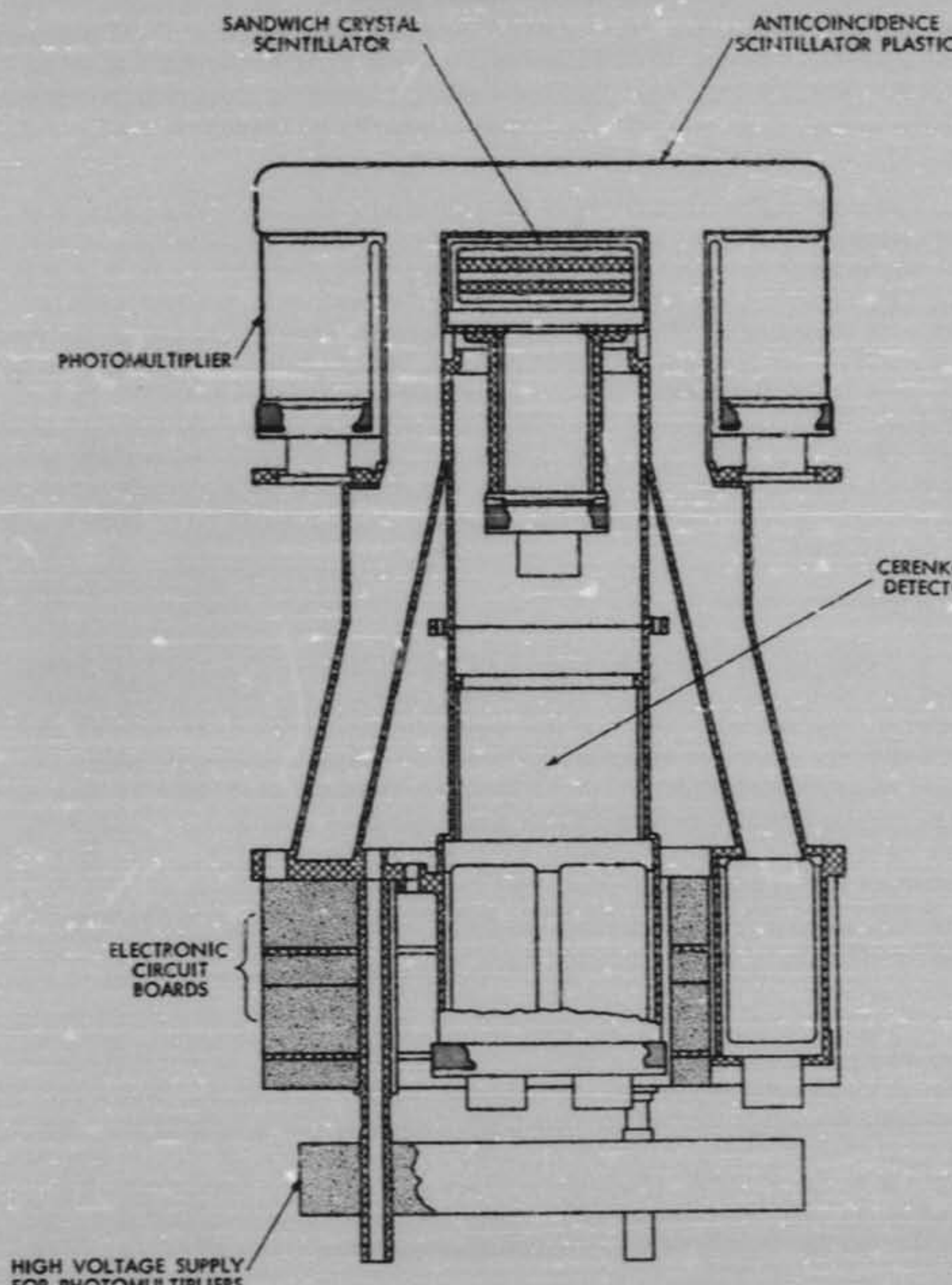
The gamma-ray telescope, which is illustrated schematically in Figure 2, consisted of an anticoincidence plastic scintillation counter roughly 1500 cm^2 in area, a sandwich crystal scintillator 7.6 cm in diameter and 3 cm thick, and a cylindrical lucite Cerenkov detector approximately 7.6 cm in diameter and 7.6 cm thick. The sandwich of scintillating crystals was viewed by one photomultiplier, and the Cerenkov detector was viewed by two photomultipliers. These instruments, operating with the anticoincidence shield, permitted the identification of events caused by gamma rays and neutrons within a specified conical field of view (15-deg half angle).[3]

The anticoincidence shield scintillated when it was traversed by charged particles, but did not react to traversals by gamma rays or neutrons. The sandwich detectors served to convert the incident gamma rays into electron pairs and to detect the occurrence of this event. The Cerenkov detector reacted only to high-speed charged particles arriving from a forward direction.[2]

The "signature" of a high-energy gamma ray was thus $SC\bar{A}$; i.e., coincident pulses from the scintillator (S) and the Cerenkov detector (C) with no pulse from the anticoincidence shield (A). High-energy neutrons could forge this signature by causing nuclear interactions in the scintillator, which would produce fast particles that traversed the Cerenkov detector. A means, therefore, had to be provided to discriminate against them.

This was accomplished by making the scintillator a layer-like sandwich of alternating CsI (Tl) and NaI (Tl) phosphors. A neutron, when it interacts with either of these phosphors, will usually produce (in addition to minimum ionizing particles) several short-range, heavily ionizing particles. These would lose their energy in the sandwich layer where the interaction took place, which would, in turn, produce a correspondingly larger light pulse from one of the crystals. The two crystals had different fluorescent decay constants for their emission of light, and the output signal from the photomultiplier was accordingly

FIGURE 2
GAMMA-RAY TELESCOPE



separated electronically into fast and total components. Both of these components were telemetered. Events caused by gamma rays would produce pulses corresponding to approximately equal energy losses in the "fast" and "slow" phosphors, whereas neutron events would generally cause one pulse or the other to be especially large. Ground laboratory tests with artificial beams of neutrons and gamma rays provided criteria for distinguishing these characteristics.[2]

The solid-angle—area factor of the telescope was about 4.3 cm^2 ster, and was determined from the geometry and sea-level counting rate of mu mesons. The efficiency of the instrument was measured in an effectively monoenergetic (tagged) gamma-ray beam at the Synchrotron Laboratory of the California Institute of Technology. Efficiency was measured as a function of energy for the forward direction (see Figure 3) and as a function of angle at 105 and 405 Mev (see Figure 4). The results of these measurements have been folded with a gamma-ray spectrum typical of π°-decay to yield an effective solid-angle—area factor of 1.0 ±0.3 cm^2 ster for the detector in the presence of an isotropic gamma-ray flux produced by cosmic rays. The large uncertainty is the result of the poor statistical accuracy of the measured efficiency of the instrument at large angles.[3]

Telemetry

A single scaling circuit in Explorer 11 permitted one detector to be monitored at a time. The scaler operated in two modes, with scale factors of 64 and 4096, respectively. The sandwich crystal scintillator was designated as channel 1, the Cerenkov detector as channel 2, and the coincidence pulses between the crystal scintillator and the Cerenkov detector as channel 3. The large plastic scintillator was divided into two regions, H and A, that were monitored separately and designated as channel 4 and channel 5, respectively. A command from a tracking station was required to change from one channel to another. The commands were given in an ordered sequence on a predetermined schedule.[1]

Gates that opened for 1 μsec when all coincidence and anticoincidence conditions had been met permitted signals to pass into the data conversion and transmission circuits. The subcarrier modulator was a simple frequency modulator that originated one of four frequencies depending upon whether the "fast" and "total" parts of the circuit were passing a pulse. If a pulse was received from the circuits of both these components, the subcarrier modulator originated a pulse at a frequency 6% above the center frequency (147 cps). A signal from the "total pulse only" portion resulted in a pulse 2% above center

FIGURE 3
DETECTION EFFICIENCY IN FORWARD DIRECTION

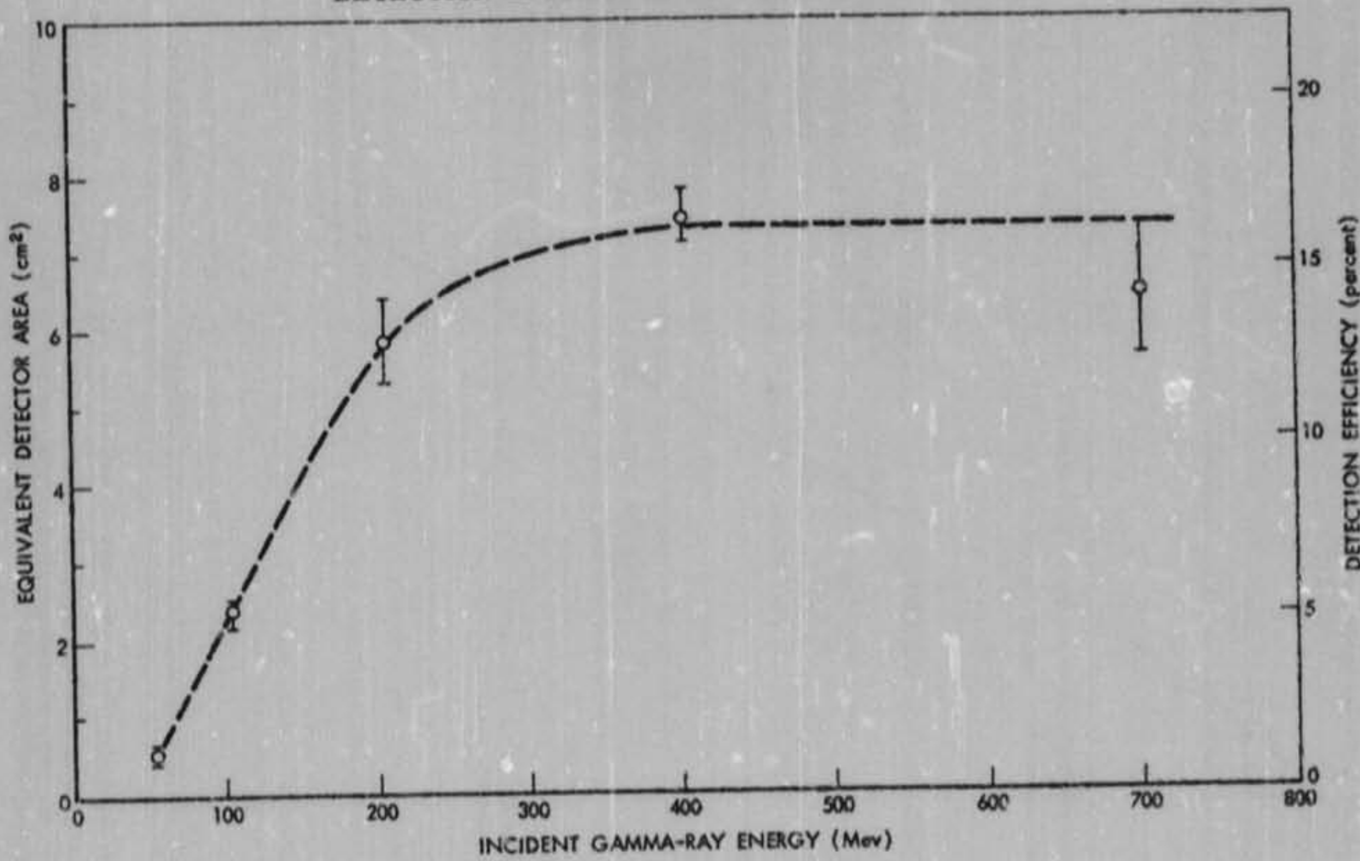
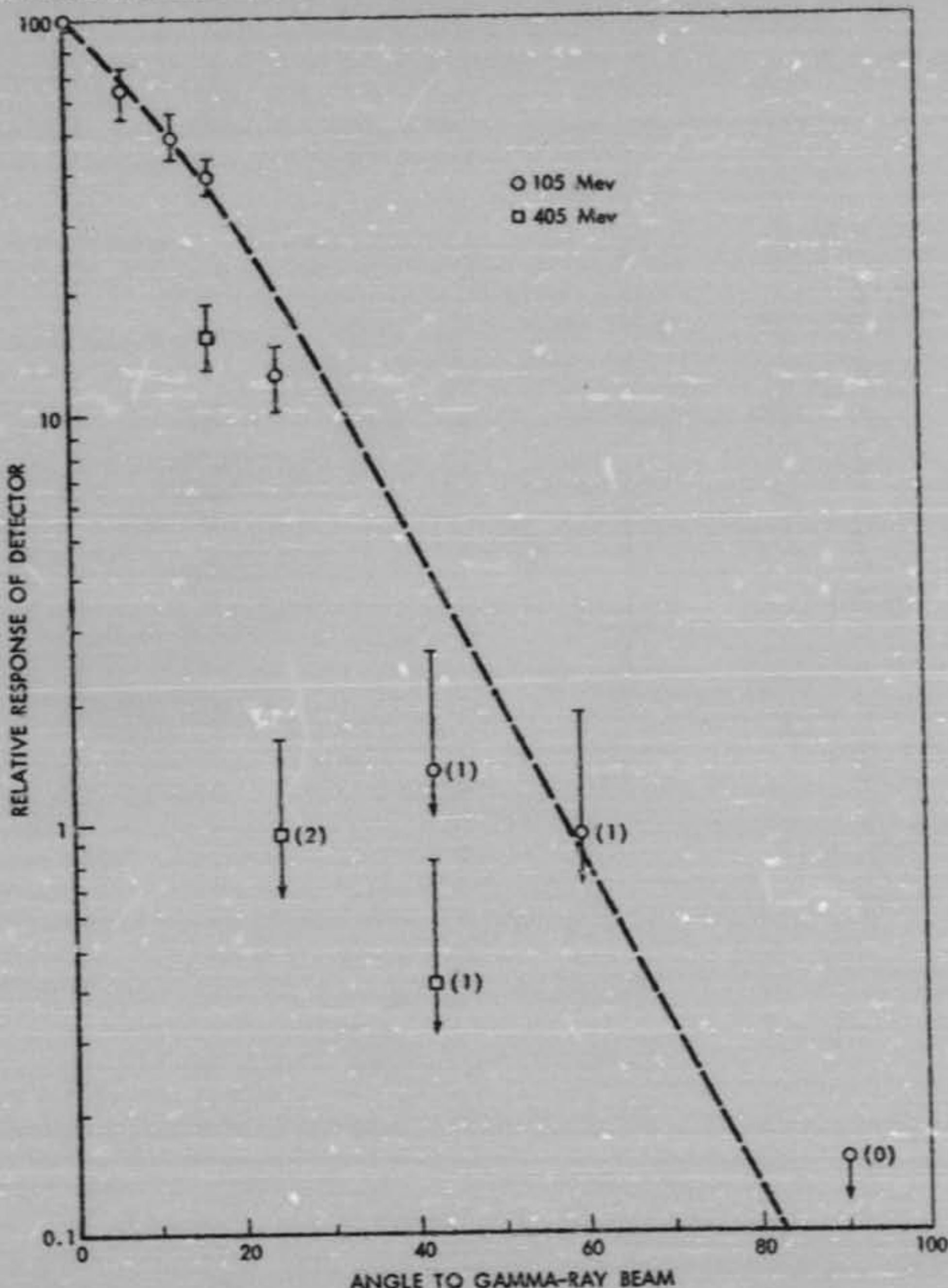


FIGURE 4
ANGULAR RESPONSE AS MEASURED AT TWO GAMMA-RAY ENERGIES



frequency. "Fast only" corresponded to -2% frequency modulation (2% below center frequency), and "no signal" was noted as a -6% pulse.[2]

The FM outputs from the data, aspect, housekeeping, and scaler input selector subsystems and the output of the reference oscillator were mixed in two mixing amplifiers.

The output of one amplifier was fed to a low-power, phase-modulated transmitter that operated continuously at 108.06 Mc/s with a power output of 20-25 mw. The output of this transmitter was monitored by the ground stations for tracking purposes.

The output of the second mixing amplifier was fed to a tape recorder that recorded at 1/4 ips and played back at approximately 12 ips. The tape recorder required 0.5-watt power while recording and approximately 0.7-watt for playback. On command, the tape recorder fed a higher power (125-mw), phase-modulated transmitter. The signal from this transmitter was applied to a circular loop antenna configuration.[2]

The Minitrack ground stations were used for tracking and control. Four of these stations (Fort Myers, Florida; Quito, Ecuador; Lima, Peru; and Antofagasta, Chile), in addition to tracking the satellite and receiving data transmitted over the low-power channel, were designated as command stations. The other stations used were Santiago, Chile; South Point, Hawaii; Johannesburg, South Africa; and Woomera, Australia. The four command stations are so located that one of them was able to interrogate the high-power channel each orbit.[2, 5]

Operational Experience

One portion of the telemetry system failed shortly after launch, leaving only one of the two pulse-height data channels operating. The amount of data available, however, was sufficient to eliminate neutron interactions as a likely source of background.[3]

Because the onboard tape recorder failed to work properly, the experimental data obtained were recorded directly by the Minitrack stations, the Green Mountain station of the George C. Marshall Space Flight Center, and the South Point station of the Pacific Missile Range.[1]

For a period of about 15 days following launch, the opening angle of the cone of motion remained quite small, as the satellite maintained its initial 5-rps spin rate about its long axis. During this period, small magnetic torques caused precession and decreased somewhat the angular momentum. The cone of motion opened rapidly on May 16, 1961. By May 19, the satellite had for all practical purposes reached its intended stable motion—an end-over-end tumble about the transverse principal axis having the largest moment of inertia. In 7 months, the initial tumble period of 12 sec increased to approximately 15 sec. The angular momentum vector during this period precessed about 10 deg/day. This precession permitted the detector to scan not just a plane but the entire celestial sphere.[3, 6]

At apogee (1786 km) Explorer 11 was quite deep in the inner radiation zone. The high particle flux in this region jammed the electronics and restricted the usefulness of the data to just a fraction of each orbit.

The satellite operated continuously until about August 5, 1961, when the power supply system deteriorated, and the spacecraft no longer functioned reliably while it was in the earth's shadow. After somewhat sporadic operation until the end of October and during November, the instrument was turned off on December 6, 1961.[3, 7]

DATA

Reduction Techniques

Of the total of about 7 months that the instrument was turned on and working in orbit, only 141 hr, or 3%, have been culled as useful observing time. During these 141 hr, 1012 events were accepted as gamma rays by the circuit logic. Several pertinent quantities were computed for each detected event. In addition, for purposes of such further analysis as evaluating apparent gamma-ray intensities from different parts of the sky, random events were generated at such a rate that their total number is about 25 times the total number of real events.[3, 7]

The tapes obtained from the tracking stations were delivered to GSFC for processing.[3] The five-channel composite satellite transmission was separated back into five channels through the use of filters. Frequency variations of the outputs of these filters were converted to voltage amplitudes by discriminators.

The outputs of the discriminators, along with the outputs of some of the other channels, were displayed on a multichannel oscilloscope.[2] A moving 35-mm film recorded the oscilloscope indications, displaying six different channels of information:

1. Intensity of received radio signal

2. Temperatures at several points on the instrument package and voltages of the different power supplies

3. The scaler

4. Aspect sensors

5. Time that data were recorded (UT)

6. Gamma-ray pulses or charged-particle pulses through the telescope when the anticoincidence requirement was removed.[5]

The data from each orbit were processed through this system in a little over 2 min; the rate of the recording camera film was 200 in./min. Approximately 36 ft of film were thus expended for the data presentation of each 100-min orbit. Final analysis, which included the plotting of such phenomena as gamma-ray events vs celestial position, was conducted by the experimenters.[2]

Satellite position is listed in an ephemeris giving the geographical longitude, latitude, and altitude of Explorer 11 for each minute of time. Ephemerides have been supplied by both GSFC and the Marshall Space Flight Center, based upon separate observations and, hence, separate orbital elements. These ephemerides provide a means of determining the accuracy of the satellite's position as a function of time. The variance between these two ephemerides covers a range of approximately 10 min of arc in latitude and longitude and about 6 km in altitude.[5]

For each event time, the following quantities were calculated by the Moore-Agogino (MA) program: RA, DEC, *GLONG, **GLAT, ***ERA, †EDEC,

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*Galactic longitude.
**Galactic latitude.
***Earth's right ascension as seen from the satellite (E).
†Earth's declination as seen from the satellite (E).

HOR, ODE, RASUN, DECS, ODS, LONG, LAT, and ALP (see Figure 5 for definitions).

FIGURE 5
DATA WORDS

Data Word*	Definition
Z	Local hour angle of Greenwich (= 15 T, T is UT in hours; Z = 99999 is used as a control word for the last entry)
RA	Right ascension of satellite axis (0)
DEC	Declination of satellite axis (0)
RASUN	Right ascension of sun (S)
DECS	Declination of sun (S)
LONG, LAT	Coordinate directions of 0 in a solar-based coordinate system, the polar axis of which is the line from the satellite to the north ecliptic pole. LAT = +90 deg corresponds to this line; LONG is the longitude about this axis; the vector toward the sun is (0, 0).
HOR	Angle between earth's center, satellite, and horizon (= 180 deg when satellite is pointing outward radially)
ODE	Angle between 0 and E
ODS	Angle between 0 and S
ALP	ODE-HOR

*All data words are floating point.

ERA and EDEC can be reconstructed from the tapes as follows: The day (in 1961) is calculated from the position of the sun along the ecliptic, and the time during that day is determined by Z. This time is used with the orbital elements of the satellite (updated every 2 days by GSFC) to calculate ERA and EDEC.

In addition, other quantities were calculated for checking program consistency, or specialized hypotheses, for convenience or because they were vestiges of earlier modifications of a complicated FAP program.

The "on time intervals" were justified by the McCarthy (MC) program, and event times were generated according to a Poisson distribution, taking into account the fraction of the interval lost because of noise bursts. The justified "on time intervals" and random events were run through the MA program.

The output of the MA program, for final analysis, was a binary tape, which was examined by the Clark-Higbie (CH) program (essentially a sorting routine). For example, all events at a given geomagnetic altitude range, above a given angle to the horizon, and in a certain galactic sector could be counted and compared with the number of random events satisfying the same criteria. Since the generation rate of the latter is known, an intensity can be derived immediately.

Timespan of Data

Data on this experiment are available at NSSDC for the period of April 27 to November 17, 1961.

Format of Available Data

The data available at NSSDC consist of one digital tape of real events and one digital tape of random events. These tapes were prepared by an IBM 7094 in binary FORTRAN format at 556-bpi density.

The physical records of both tapes contain 1 count word and 23 logical records of 11 floating point data words each, making a total of 254 binary words per physical record. The 11 data words are defined in Figure 5.

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Kraushaar, W. L., G. W. Clark, M. Agogino, G. Garmire, H. Helmken, and P. Higbie, "Cosmic Gamma Ray Results from Explorer XI," Massachusetts Institute of Technology. N64-18432, NASA CR-53590.

Kraushaar, W. L., G. W. Clark, G. Garmire, H. Helmken, P. Higbie, and M. Agogino, "Explorer XI Experiment on Cosmic Gamma Rays," Astrophys. J., 141, No. 3, 845-863, Apr. 1, 1965.

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Schatzman, E., "Gamma Astronomy [La Gamma Astronomie]," presented at COPERS Colloquium on Space Astronomy, Paris, July 20-21, 1962, Space Science Reviews, 1, 774-780, May 1963 (in French). A63-19946.

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      REAL  LONG, LAT
      DIMENSION  Z (23), RA (23), DEC (23), RASUN (23), DECS (23),
     1LONG (23),  LAT (23),  HOR (23), ODE (23), ODS (23), ALP (23)
   10 FORMAT((1H , 11( F7.2, 4X )))
   20 FORMAT(1H1,4X,1HZ,10X,2HRA,9X,3HDEC,8X,4HLONG,7X,3HLAT,7X,5HRASUN,
     16X,4HDECS,8X,3HHOR,8X,3HODE,6X,3HODS,8X,3HALP)
      DO 80  K = 1,30
   90 WRITE ( 3,20)
      READ (5) (Z(I),RA(I),DEC(I),LONG(I),LAT(I),RASUN(I),DECS(I),HOR(I)
     1,ODE(I),ODS(I),ALP(I), I=1,23)
      WRITE(3,10) (Z(I),RA(I),DEC(I),LONG(I),LAT(I),RASUN(I),DECS(I),
     1HOR(I),ODE(I),ODS(I),ALP(I), I=1,23)
   80 CONTINUE
  100 STOP
      END
```

PROGRAM USED TO LIST 30 PHYSICAL REC

INPUT ON UNIT A-5 OUTPUT ON UNIT A-

INTERNAL FORMULA NUMBER(S)

3),
(23)

,SHRASUN,

	.1	.2			
	.3	.4			
I),MCR(I)					
	.5	.6	.7	.8	.9
CS(I),					
	.10	.11	.12	.13	.14
	.15	.16			
	.17				
	.18				

CAL RECORDS OF TAPE

UNIT A-3

Z	RA	DEC	LONG	LAT	RASUN	DECS
340.96	169.27	-27.29	128.14	-29.11	51.52	18.75
214.56	62.05	28.05	8.92	6.92	54.14	19.37
252.67	172.08	-1.53	116.68	-4.56	54.35	19.42
351.02	15.55	3.13	-41.28	-3.25	54.51	19.45
7.95	155.05	12.35	95.17	2.76	54.56	19.46
37.69	170.82	-4.56	116.44	-7.83	~~54.64~~	19.48
96.29	23.26	11.64	-31.28	1.76	54.80	19.52
96.40	7.58	-6.55	-52.76	-9.03	54.80	19.52
311.98	62.28	36.82	9.59	15.48	55.40	19.65
166.61	-102.04	-56.98	-156.11	-32.81	55.99	19.78
17.86	103.59	37.17	42.33	14.20	56.58	19.90
46.05	156.83	-5.51	101.79	-14.13	56.66	19.92
48.55	-50.58	-38.24	-117.06	-19.01	56.66	19.92
213.62	-66.64	-46.93	-131.97	-24.83	57.12	20.01
265.93	-146.72	-49.41	169.74	-33.64	57.27	20.05
322.94	-99.56	-52.93	-156.24	-29.65	57.42	20.08
339.45	175.48	-29.88	129.27	-28.95	57.47	20.09
339.83	30.67	38.37	-17.33	24.19	57.47	20.09
340.95	168.06	-22.96	119.11	-25.71	57.47	20.09
350.34	-31.74	-14.14	-94.12	-1.19	57.50	20.09
350.74	24.11	35.72	-23.77	23.77	57.50	20.09
10.52	160.26	-14.73	107.97	-21.31	57.56	20.10
304.06	131.21	20.00	67.74	1.82	59.37	20.27

SUN	DECS	HOR	ODE	ODS	ALP
.52	18.75	60.50	36.59	122.63	-23.91
~~.14~~	19.37	64.78	104.90	11.29	40.13
.35	19.42	68.16	99.21	116.59	31.05
.51	19.45	61.94	65.99	41.38	-15.95
.56	19.46	59.51	19.55	95.16	-39.96
~~.64~~	19.48	65.05	54.74	116.17	-10.31
.80	19.52	67.05	86.78	31.33	19.73
.80	19.52	66.91	74.37	53.29	7.46
.40	19.65	67.53	112.34	18.19	44.81
.99	19.78	68.20	78.88	139.40	10.68
.58	19.90	60.73	72.40	44.23	11.67
.66	19.92	66.82	89.40	101.41	22.58
.66	19.92	67.45	83.28	115.45	15.83
.12	20.01	67.10	52.36	127.35	-14.74
.27	20.05	68.22	85.29	144.96	17.07
.42	20.08	65.76	65.53	142.66	-0.22
.47	20.09	56.04	48.90	123.61	-7.14
.47	20.09	56.65	108.08	29.49	51.43
.47	20.09	58.64	47.21	115.98	-11.43
.50	20.09	64.29	8.42	94.12	-55.86
.50	20.09	63.47	71.06	33.15	7.58
.56	20.10	63.84	70.98	106.69	7.14
.37	20.27	56.81	33.61	67.75	-23.20

20

Z	RA	DEC	LONG	LAT	RASUN	DECS
304.26	167.86	-21.07	117.16	-24.07	58.37	20.27
358.63	170.52	-23.62	120.68	-25.31	58.52	20.30
359.20	140.83	9.61	79.48	-5.46	58.53	20.30
0.61	55.74	49.55	4.75	29.34	58.53	20.30
56.75	-116.41	-48.07	-170.22	-26.33	58.69	20.33
85.39	-28.36	14.13	-81.77	24.05	58.77	20.35
302.12	-24.73	17.86	-77.18	26.11	59.37	20.47
302.65	-70.30	-29.38	-134.28	-7.05	59.37	20.47
323.75	136.79	2.54	76.92	-13.42	59.43	20.48
0.00	-20.58	21.87	-71.48	28.14	59.53	20.50
1.00	-48.92	-9.01	-110.60	8.82	59.53	20.50
75.53	-44.26	7.43	-101.23	23.24	59.74	20.54
322.43	-63.56	-13.58	-126.61	7.57	60.43	20.67
323.57	-18.57	30.78	-65.80	35.34	60.43	20.67
10.55	-123.50	-44.83	-178.10	-24.25	60.57	20.69
66.44	83.05	33.73	21.34	10.37	60.72	20.72
67.29	-50.11	10.80	-107.17	28.19	60.72	20.72
1.70	-63.39	5.10	-123.84	25.89	61.55	20.87
56.97	133.61	-22.24	80.29	-37.91	61.70	20.90
58.00	-55.60	13.41	-113.23	32.19	61.71	20.90
165.59	-153.77	-47.92	159.35	-34.24	62.01	20.96
166.01	171.52	-43.74	129.98	-42.58	62.01	20.96
332.12	-21.87	40.62	-64.42	45.22	62.48	21.04

AT	RASUN	DECS	HOR	ODE	ODS	ALP
7	58.37	20.27	57.15	43.25	114.62	-13.91
1	58.52	20.30	58.13	48.77	117.44	-9.36
6	58.53	20.30	58.82	43.20	79.52	-15.63
4	58.53	20.30	61.67	96.79	29.73	35.12
3	58.69	20.33	65.86	73.52	151.99	7.66
5	58.77	20.35	67.94	62.13	82.51	-5.81
1	59.37	20.47	68.22	56.06	78.53	-12.16
5	59.37	20.47	68.11	34.25	133.85	-33.86
2	59.43	20.46	59.63	59.16	77.27	-0.47
4	59.53	20.50	63.56	40.34	73.76	-23.22
2	59.53	20.50	61.50	36.69	110.35	-24.80
4	59.74	20.54	66.86	60.59	100.33	-6.27
7	60.43	20.67	66.67	14.05	126.25	-52.62
4	60.43	20.67	64.69	50.25	70.49	-14.44
5	60.57	20.69	63.00	72.65	155.64	9.65
7	60.72	20.72	66.50	127.28	23.64	60.78
9	60.72	20.72	67.60	42.73	105.10	-24.87
9	61.55	20.87	63.01	68.80	120.09	5.79
1	61.70	20.90	65.48	118.29	82.32	52.81
9	61.71	20.90	67.10	41.04	109.52	-26.06
4	62.01	20.96	66.45	76.56	140.64	10.11
8	62.01	20.96	67.07	98.59	118.20	31.52
2	62.48	21.04	66.06	61.96	72.33	-4.11

Z	RA	DEC	LONG	LAT	RASUN	DECS
351.55	167.81	-43.65	126.32	-43.94	62.53	21.05
352.27	-99.35	-23.85	-163.06	-0.63	62.53	21.05
47.37	-147.22	-45.60	162.42	-30.28	62.69	21.08
47.78	-66.34	-11.50	-150.99	11.55	62.69	21.08
321.33	-171.19	-44.94	143.20	-37.19	63.46	21.21
37.37	-79.80	5.18	-144.04	28.27	63.67	21.24
37.64	-107.75	-21.14	-172.11	1.35	63.67	21.24
311.34	-155.92	-43.38	153.13	-30.77	64.44	21.37
341.02	-86.90	5.08	-152.88	28.54	64.53	21.38
342.17	-48.82	34.39	-98.76	49.96	64.53	21.38
0.15	-115.18	-21.49	-180.00	-0.01	64.58	21.39
1.69	-109.99	-17.16	-175.60	5.02	64.58	21.39
56.64	-26.13	42.38	-69.14	48.41	64.74	21.42
57.44	-54.12	31.55	-106.95	49.04	64.74	21.42
302.01	-15.36	44.21	-58.69	45.66	65.43	21.53
302.55	-62.70	26.08	-120.74	46.17	65.43	21.53
302.81	-4.41	44.97	-49.04	42.06	65.43	21.53
303.98	-48.52	34.53	-99.17	49.99	65.44	21.53
332.90	-53.02	32.17	-106.03	49.28	65.52	21.54
351.06	52.90	22.21	-11.37	2.99	65.57	21.55
128.47	-66.30	30.87	-123.98	51.62	65.96	21.61
291.80	-51.02	38.23	-100.55	54.19	66.42	21.68
294.35	-84.77	24.59	-151.02	47.96	66.43	21.68

DECS	HOR	CDE	ODS	ALP
21.05	60.32	81.38	115.21	21.06
21.05	61.82	61.50	163.04	-0.32
21.08	64.07	69.86	145.37	5.79
21.08	64.88	40.86	148.98	-24.02
21.21	68.21	94.43	129.59	26.22
21.24	61.71	55.69	135.50	-6.02
21.24	62.28	48.34	172.01	-13.94
21.37	68.07	77.27	140.00	9.20
21.38	66.71	54.93	141.47	-11.78
21.38	64.68	67.53	95.66	2.85
21.39	58.98	59.00	180.00	0.02
21.39	62.10	41.28	173.37	-20.82
21.42	64.05	80.47	76.36	16.43
21.42	65.58	52.35	101.06	-13.23
21.53	67.70	78.11	68.74	10.40
21.53	68.12	37.56	110.77	-30.55
21.53	68.23	82.53	60.91	14.30
21.53	68.01	53.81	95.92	-14.20
21.54	65.46	66.29	100.41	0.83
21.55	58.53	127.47	11.76	68.94
21.61	63.34	50.85	110.35	-12.49
21.68	65.80	57.93	96.19	-7.87
21.68	68.30	46.91	125.93	-21.39

Z	HA	DEC	LONG	LAT	RASUN	DECS
23.05	37.93	-41.88	-155.42	-52.62	170.90	3.94
25.16	69.53	-8.49	-106.94	-29.83	170.90	3.93
50.46	25.26	-45.37	-174.83	-53.79	170.96	3.91
51.85	-77.20	-39.33	110.14	-16.29	170.97	3.91
53.09	-29.88	-57.44	138.60	-41.77	170.97	3.90
80.31	52.83	-27.66	-129.35	-45.02	171.04	3.82
81.99	32.28	-45.64	-164.70	-53.57	171.04	3.87
82.10	82.86	16.78	-87.10	-6.55	171.04	3.87
43.16	-137.05	23.00	40.80	37.48	171.85	3.53
43.68	69.91	24.33	-99.35	2.10	171.85	3.53
83.80	-129.68	10.55	53.47	28.01	171.95	3.49
99.00	88.74	45.49	-82.20	21.99	171.99	3.47
99.76	55.85	-0.29	-117.81	-19.54	171.99	3.47
171.90	55.05	-1.79	-119.22	-20.81	172.17	3.39
162.89	76.23	37.80	-93.58	14.83	173.05	3.02
152.26	-160.20	42.64	3.14	46.10	173.93	2.64
180.94	110.26	64.06	-71.77	41.38	174.00	2.61
59.02	29.64	-12.45	-151.38	-22.97	174-70	2.31
100.02	41.53	20.85	-128.75	4.55	174.70	2.31
171.40	168.44	54.25	-40.25	52.31	174.88	2.24
200.72	-11.93	-64.39	139.32	-52.31	174.95	2.29
88.64	63.66	65.93	-99.67	43.66	175.58	1.94
88.66	25.61	-5.18	-153.36	-14.74	175.58	1.94

SUN	DECS	HOR	ODE	ODS	ALP
90	3.94	62.96	93.43	123.50	30.47
90	3.93	58.66	74.52	104.64	15.86
96	3.91	62.11	88.53	126.04	26.41
97	3.91	59.28	95.54	109.30	36.25
97	3.90	57.00	93.05	124.01	36.05
04	3.82	56.64	65.15	116.62	8.51
04	3.87	54.20	68.78	124.94	14.58
04	3.87	54.07	39.59	87.12	-14.47
35	3.53	58.88	115.23	53.08	56.35
35	3.53	57.90	53.17	99.34	-4.73
95	3.49	56.32	75.94	58.30	19.62
99	3.47	55.73	51.94	82.77	-3.80
99	3.47	54.66	27.33	116.08	-27.32
17	3.39	68.21	147.84	117.15	79.63
05	3.02	68.18	135.83	93.46	67.65
93	2.64	66.34	62.71	46.19	-3.63
00	2.61	68.14	105.61	76.43	37.47
70	2.31	56.20	30.20	143.91	-25.99
70	2.31	54.74	10.05	128.61	-44.69
38	2.24	67.68	84.88	62.19	17.20
95	2.20	67.68	95.44	117.62	27.76
58	1.94	58.88	52.85	96.98	-6.03
58	1.94	58.85	27.48	149.81	-31.37

Z	RA	DEC	LONG	LAT	RASUN	DECS
247.75	31.84	17.47	-139.91	4.28	175.98	1.77
78.84	20.06	10.46	-153.63	1.84	176.46	1.56
143.78	-150.71	-77.01	70.94	-58.19	177.55	1.10
200.59	13.69	53.11	-139.79	42.59	177.70	1.04
205.97	14.67	56.75	-136.41	45.36	177.70	1.04
314.82	-177.40	55.46	-27.94	49.97	180.00	0.14
315.03	-33.07	50.16	179.03	57.52	180.00	0.14
344.05	-22.25	21.61	168.73	28.56	180.00	0.11
344.49	-38.21	57.46	-175.60	64.92	180.00	0.11
11.93	-100.61	76.92	-77.08	79.10	180.00	0.08
12.00	-17.50	2.18	164.92	8.91	180.00	0.08
12.83	-17.40	1.74	164.84	8.46	180.00	0.07
239.35	55.58	-18.94	-137.72	-37.50	-175.15	-2.12
268.11	57.65	-19.40	-135.23	-37.53	-175.07	-2.15
286.18	28.34	-12.49	-164.95	-22.53	-174.12	-2.56
286.57	54.00	-9.73	-137.56	-28.23	-174.12	-2.56
316.13	100.78	-0.28	-84.78	-23.34	-174.04	-2.60
318.17	-58.53	-4.40	116.18	15.59	-174.04	-2.60
6.72	60.70	-8.66	-130.19	-28.81	-173.91	-2.65
7.07	-88.16	2.33	85.37	25.82	-173.91	-2.65
219.55	-145.60	5.01	23.09	17.73	-173.38	-2.88
247.36	18.03	-5.74	-172.98	-12.39	-173.31	-2.91
277.79	116.35	2.58	-69.55	-18.40	-173.23	-2.94

RASUN	DECS	HOR	ODE	ODS	ALP
175.98	1.77	64.86	53.53	139.73	-11.33
176.46	1.56	60.63	16.27	153.57	-44.36
177.55	1.10	66.47	92.75	80.09	26.28
177.70	1.04	68.00	58.58	124.21	-9.42
177.70	1.04	67.71	54.53	120.59	-13.18
180.00	0.14	66.11	67.24	55.37	1.13
180.00	0.14	66.43	58.57	122.48	-7.86
180.00	0.11	68.20	37.69	149.47	-30.51
180.00	0.11	68.15	31.24	115.00	-36.91
180.00	0.08	67.94	53.98	87.58	-13.97
180.00	0.08	67.89	38.01	162.54	-29.88
180.00	0.07	67.04	29.09	162.69	-37.94
-175.15	-2.12	65.58	60.18	125.94	-5.40
-175.07	-2.15	62.11	35.67	124.27	-26.44
-174.12	-2.56	62.20	4.13	153.13	-58.07
-174.12	-2.56	61.40	23.52	130.56	-37.87
-174.04	-2.60	56.55	42.86	85.21	-13.69
-174.04	-2.60	56.50	117.81	115.15	61.31
-173.91	-2.65	63.21	41.00	124.44	-22.21
-173.91	-2.65	62.47	112.21	85.83	49.75
-173.38	-2.88	68.05	119.62	28.81	51.57
-173.31	-2.91	67.38	32.65	165.80	-34.73
-173.23	-2.94	61.14	83.09	70.64	21.95

Z	RA	DEC	LONG	LAT	RASUN	DECS
278.11	104.82	1.44	-81.49	-21.24	-173.23	-2.94
306.37	-73.71	-1.59	99.98	20.93	-173.16	-2.97
331.74	39.75	-4.69	-151.80	-19.21	-173.09	-3.00
331.79	2.24	-6.00	172.12	-6.39	-173.09	-3.00
331.98	-18.95	-5.64	152.83	2.22	-173.09	-3.00
26.61	71.16	-2.04	-118.44	-24.19	-172.95	-3.06
268.45	31.85	5.36	-156.84	-7.12	-172.34	-3.32
268.50	-14.72	-0.66	157.83	5.20	-172.34	-3.32
268.77	63.69	7.69	-125.01	-13.42	-172.34	-3.32
269.21	-23.47	-1.88	149.22	7.40	-172.34	-3.32
269.54	47.76	6.78	-141.16	-10.66	-172.34	-3.32
286.39	-156.26	-4.46	15.19	5.09	-172.30	-3.34
287.04	-122.94	-7.37	48.06	12.37	-172.29	-3.34
287.29	-142.45	-5.92	28.70	8.46	-172.29	-3.34
287.63	-58.67	-6.02	113.79	14.03	-172.29	-3.34
288.06	-116.37	-7.68	54.67	13.39	-172.29	-3.34
320.82	-32.42	-3.07	140.20	9.46	-172.21	-3.38
351.19	-25.72	-2.18	146.77	7.93	-172.13	-3.41
351.21	65.20	7.74	-123.92	-13.60	-172.13	-3.41
8.63	11.39	17.29	-172.37	11.37	-171.18	-3.82
8.70	34.75	12.79	-152.90	-1.07	-171.18	-3.82
9.27	-17.52	18.97	162.08	24.30	-171.18	-3.82
249.19	102.66	-16.42	-84.54	-39.23	-170.57	-4.08

1) Events [illegible] +179] RA
-179]

2) Events /20° ALP Real
Artificial
Real/Artificial

UN	DECS	HOR	DDE	DDS	ALP
3	-2.94	60.49	67.94	82.07	7.45
6	-2.97	58.05	125.00	99.31	66.95
9	-3.00	61.28	13.23	146.33	-48.05
9	-3.00	61.16	33.47	169.87	-27.69
9	-3.00	60.77	56.08	152.74	-4.70
5	-3.06	59.55	31.26	115.75	-29.29
4	-3.32	62.08	22.50	155.83	-39.58
4	-3.32	61.96	48.71	157.26	-13.25
4	-3.32	61.40	38.59	123.93	-22.81
4	-3.32	60.51	66.15	148.42	5.65
4	-3.32	59.83	29.48	139.95	-30.35
0	-3.34	61.47	58.71	15.99	-2.75
9	-3.34	62.82	45.13	49.24	-17.69
9	-3.34	63.34	60.65	29.82	-2.69
9	-3.34	64.02	42.91	113.04	-21.12
9	-3.34	64.89	51.66	55.76	-13.23
1	-3.38	65.37	41.45	139.28	-23.92
3	-3.41	58.61	81.71	145.94	23.11
3	-3.41	58.58	34.42	122.85	-24.16
8	-3.82	59.90	57.07	166.33	-2.83
8	-3.82	59.77	41.68	152.88	-18.08
8	-3.82	58.66	87.94	150.13	29.28
7	-4.08	65.04	82.85	85.78	17.81

– (HOR – DDE)

Corrected Format

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/ Artipical X100

FILE 0001 REC 0001 CH 1524

Partial Dump
D-0002

0001	000375000001	211524752525	210522421545	605664501477
0049	206743773454	206444571126	207752415760	605576404654
0097	203672607760	206661054413	205455701235	207403063720
0145	210530122573	601610036023	207722563636	603443440600
0193	207722261476	205760625364	211537011125	204761536253
0241	205407166561	206757372654	206557712542	206513030454
0289	207574531300	202541063500	206664360714	205467314223
0337	206455374401	210525502460	603443457601	207721507532
0385	206555707270	207720532062	604511747140	207601132336
0433	206666327425	205470211217	207414151150	207533073312
0481	603643245035	606646032736	604440654220	206666330555
0529	203735532660	211467765600	206762177635	206446413724
0577	207416101252	207701254571	205442775220	206546346636
0625	606416406271	206677737502	205474331441	207420624060
0673	207636270523	206451307322	206522464205	204706271655
0721	206541652406	204565273034	206600335646	210471517505
0769	205476547064	207413225037	207545461743	207625514263
0817	507724161416	605460107006	206705230652	205476551363
0865	210653175666	607412436320	606567332462	610407744640
0913	205542706457	207775305414	604727474364	211411732363
0961	206712076735	205500560767	207420710331	207525130223
1009	606547346334	610470367076	605732326101	206713302621
1057	576714300000	211523344541	210536755250	605736014344
1105	206700230525	206607150656	207756343324	603710576470
1153	205503031625	206713607367	205501313641	206705171430
1201	210520075122	605557335616	207734351345	605633233571
1249	207717726220	604555626410	211536253743	605773625153
1297	205501374745	207401113112	204415452032	207570364477
1345	505574177701	205574300770	206714003447	205501376655
1393	204520421000	210500415407	604727221601	207657704246
1441	207433723750	207652600442	203710613020	211460037265
1489	206722763550	205504246053	206706374112	206414713320

FILE 0001 REC 0002 CH 1524

0001	000375000001	211460205423	210517556371	605521042637
0049	206711152047	206531756105	207712353526	604674763610
0097	605524765035	206724144107	205504537320	206721020640
0145	210431520325	204463515721	207475730074	603535404713
0193	207476001751	604764004740	200472011760	206675730217
0241	205504647404	206755264477	207603113134	205733565340
0289	510524335043	605645260741	206725370537	205505245673
0337	207525450062	605705622176	204704054740	607507044265
0385	206751023606	207512013234	603563732260	211456073232
0433	206732751543	205507360105	207420703525	206700372115
0481	605726026031	610414432160	603703166412	206732762114
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FILE 0001 REC 0002 CH 1524

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FILE 0001 REC 0005 CH 1524

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