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CHARGED PARTICLE RADIATION ENVIRONMENT FOR THE SPACELAB AND OTHER MISSIONS IN LOW EARTH ORBIT – REVISION A

By John W. Watts, Jr. and Jerry J. Wright
Space Sciences Laboratory

November 29, 1976

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16. ABSTRACT

The physical charged particle dose to be encountered in low Earth orbit Spacelab missions is estimated for orbits of inclinations from 28.5 to 90° and altitudes from 200 to 800 km. The dose encountered is strongly altitude dependent, with a weaker dependence on inclination. Doses range from 0.007 rads/day at 28.5° and 200 km to 1.57 rads/day at 28.5° and 800 km behind a 5.0 g/cm^2 shield. Geomagnetically trapped protons were the primary source of damage over most of the range of altitudes and inclinations, with galactic cosmic rays making a significant contribution at the lowest altitudes.

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INTRODUCTION

Missions planned for the Spacelab will use orbital trajectories ranging in inclination from 28.5 to 90° and in altitude from 200 to 800 km. Mission duration can range up to 28 days. For these orbits and mission lifetimes, any equipment on board will be subjected to fluxes of high energy charged particles and charged-particle-induced secondary particles. Many items may be sensitive to the radiation encountered. All material in the spacecraft will acquire a level of background radioactivity as a result of nuclear activation. Experiments employing nuclear particle counters (X-ray, gamma-ray, and cosmic-ray experiments) will have an excessive background counting rate as a result of activation gamma rays and the incident particle fluxes that will impact experiment operation [1,2] and may reduce counter lifetime. Biological samples, especially where shielding thicknesses are minimal, may be influenced by the radiation dose levels that are encountered. Photographic film will acquire a background density because of the radiation. The effects on photographic film for the Skylab mission were studied extensively [3-6].[1] Figure 1 shows the range of background density as a function of dose for some Skylab films [7].

ENVIRONMENT

This report defines the important components of the radiation environment and gives estimates of dose rates to be expected. This information will be useful in identifying problem areas for more detailed radiation analysis later. There are four possible sources of damaging radiation for Spacelab: geomagnetically trapped electrons and protons, galactic cosmic-ray particles, solar flare proton events, and onboard radiation sources (if there are any). Hopefully,

1. Private communication with K. E. Huff and H. M. Cleare, Eastman Kodak Company, Rochester, N.Y.

any onboard sources will be small and well shielded. We are concerned here with planning for nominal missions which, because of their short durations and low orbital altitudes, are unlikely to encounter significant solar flare proton fluxes. (Since 1956 there have been perhaps four events that would have resulted in significant dose contributions at Spacelab orbits.) Thus, we will confine our consideration to geomagnetically trapped particles and cosmic rays. Reference 8 gives a complete and well written description of the near-Earth radiation environment.

Figures 2 through 21 show the average trapped proton and electron omnidirectional integral fluxes above various energies for the proposed Spacelab orbits. The numerical values are tabulated in Appendix A together with the differential flux with respect to energy. The fluxes were obtained by using James Vette's new model environments [9] AP8 max for the protons and AE4-AE6 max for the electrons in a program [10] that averages the flux along the orbital trajectory for several orbits. Over most of the range of orbits, there is an uncertainty factor of four in the electron environment and two in the proton environment. For the very lowest altitude given (200 km), the uncertainties are larger because these orbits fall directly on the edge of the region described by the Vette model. When we compare the new environment projected to the 1980 time frame with the one reported in Reference 11, we find that the electron environment has changed significantly. All the artificially injected electrons have been decayed out of the new model, resulting in a considerable reduction in the high energy electron flux (more than an order of magnitude in some cases). There is also a reduction in the proton flux, usually at higher energy. It is not as extensive as the reduction in the electron flux, however, typically being less than a factor of two.

The exponential increase of both electron and proton flux with altitude can be explained in terms of charged-particle motion in the Earth's magnetic field. A charged particle follows a helical path around magnetic field lines. As the lines converge near the Earth's poles, the turns of the helix come closer and closer together until the helix reverses direction and the particles spiral up a field line away from the pole. The point of reversal is called the particle's "mirror point." The particles encountered at lower altitudes must necessarily have mirror points near the top of the atmosphere where the probability of removal because of interaction with air molecules is significant. There is a distortion of the geomagnetic field from a true dipole that results in a region called the South Atlantic Anomaly, where higher trapped particle fluxes are seen at lower altitudes than usual over most of the Earth's surface. Most of the fluxes encountered by Spacelab orbits, especially at lower altitudes, will be in this region centered at approximately 35° south latitude in the South Atlantic.

Figure 22 shows proton isoflux contours in this region. As orbital inclination increases from 0° at a given altitude, the flux encountered will increase, reaching a peak in the 30 to 40° range as more and more of the Anomaly is swept out. Above 60° the north and south "horns" of the outer trapped electron belt will be encountered, resulting in a significant increase in electron flux. (The name "horn" is given because of the crescent shape of electron isoflux contours. At lower fluxes the contours grow into a set of double rings that approximately circumscribes each pole.)

The trapped flux encountered during the Spacelab missions will have two types of temporal variations, a very short-term variation and a long-term variation. The short-term variation is the variation seen as the spacecraft passes in and out of the South Atlantic Anomaly, with the flux rising and falling rapidly as the center of the Anomaly is passed. Figure 23 shows the proton flux during several passes through the Anomaly. Almost all the radiation damage will occur during these passages, which usually last less than 15 min at lower altitudes. The maximum flux during a pass may reach 40 to 50 times the average daily flux. The other temporal variation is associated with the 11 year solar cycle. There is an enhancement of the proton belt by perhaps a factor of two during the quiet part of the cycle as a result of changes in the high atmosphere density [12]. The Vette model environment used is projected to the 1980 time frame.

The galactic cosmic ray flux is also affected by both the geomagnetic field and the solar magnetic field. The free space maximum (outside the geomagnetosphere) cosmic ray flux occurs during the quiet part of the solar cycle and is approximately 4.0 particles/cm^2-s [13]. During the active part of the cycle, the portion of the energy spectrum below approximately 400 MeV/nucleon is reduced in intensity. However, this reduction is not particularly significant in low Earth orbit because, except during passages over the poles, these particles are already shielded out by the geomagnetic field. Figure 24, from Reference 13, shows how the cosmic ray proton flux is affected for various orbital inclinations. As one can see, the spectrum is very "hard" (having a preponderance of high energy particles) and, thus, is not attenuated rapidly by shielding material.

SPACELAB GEOMETRICAL MODEL

To predict the radiation flux or dose at a point inside a spacecraft, consideration must be given to geometrical configuration and types of materials surrounding the point. A geometrical model of Spacelab was constructed using the Lockheed complex geometry computer program [14] and following relatively

closely the Spacelab description provided in a letter from the European Space Research and Technology Center (ESTEC)[2] that described a short module and included racks, viewports, feedthroughs, floor, subfloor, and an overhead structure involving four containers, an optical window, and a viewport. The only modification in that model for this report was the addition of flat walls covering the holes in the end cones so that no part of the Spacelab interior would see free space without shielding. These walls were of the same thickness and composition as the end cones.

Figures 25, 26, and 27, which were redrawn from figures in the ESTEC letter, show the Spacelab used for these calculations. (Figure 25 has been altered to show the cone end covers that were added.) The model involved approximately 130 separate volume elements. It was constructed in the Spacelab coordinate system and then translated to the Shuttle coordinate system. The Spacelab coordinate system is centered 100 cm in front of the start of the cylindrical shell section with the positive X-axis passing down the center of the cylindrical section in the aft direction. The Z-axis is vertically upward, and the positive Y-axis makes a right-handed system. The transformation to Shuttle coordinates is defined as follows:

$$X' = X + 1885.95 \text{ cm}$$

$$Y' = Y$$

$$Z' = Z + 1016 \text{ cm}$$

where X', Y', and Z' are Shuttle coordinates and X, Y, and Z are Spacelab coordinates.

LIMITATIONS

We believe the model has a major defect in that only spacecraft walls are considered. All racks and containers are empty, and none of the equipment and wiring that will exist there has been modeled. Self-shielding (as one would expect to have if, for example, one were calculating dose in a canister of film) has not been included. Experience with Skylab suggests that this type of modeling leads to overestimations of dose rates. Also, with more careful modeling, the variation of dose rates from thinly to more heavily shielded regions should be larger. Our modeling of the Shuttle should compensate, at least partially, for the conservative Spacelab model; however, we homogenized the Shuttle into

2. Close Out of RID B01-054, Orbit Environment and Action Item NM-0196, European Space Research and Technology Center letter from W. Nellessen to Mr. L. Powell, December 8, 1975.

a relatively small number of volume elements and defined their density so as to obtain a 90 000 kg Shuttle. This approach is probably appropriate for the nose and tail sections, since they subtend a total of between 5 and 10 percent of the total solid angle as seen from typical points in Spacelab. It is less appropriate for the bay section, leading to rather heavy shielding over half the total solid angle or more as seen from points in Spacelab. (Typical Shuttle bay wall thicknesses were on the order of 12 g/cm^2.) Figure 28 shows the basic configuration of the Shuttle model.

A number of effects that may become important, depending on the response of the instrument or material, have not been considered. Long-term averaged dose rates may not be useful if an instrument is dose rate sensitive (i.e., the fire alarm on Skylab) rather than cumulative dose sensitive. (The rad, a unit of dose, is defined as the deposition of 100 ergs of energy per gram of material receiving the dose.) In these cases, maximum dose rates or dose rates as a function of time probably better define the problem. The averaging of flux over direction can also be significant if, for example, the spacecraft is gravity-gradient stabilized for long periods. The angular distributions for trapped particle fluxes in low Earth orbit are "pancake" shaped, with most of the particles arriving from directions perpendicular to the magnetic field lines. Thus, actual dose could be considerably different from the dose predicted using isotropic fluxes if the shielding perpendicular to the magnetic field is markedly different from the average shielding. Materials do not respond in exactly the same manner when exposed to the same physical dose from different types of particles or even from particles of the same type but different energies. Some photographic films are as much as 30 to 40 times as sensitive to gamma rays as to protons [15]. (Their sensitivity is also highly energy dependent.) Biological effects are better measured in terms of rems (rad equivalent man), which include a quality factor depending on the type and energy of radiation depositing the dose. For example, cosmic rays have an unusually high quality factor because of the heavy particle component; thus, cosmic ray doses in rems are six or seven times as high as doses in rads [13]. Behind heavy shielding (>25 g/cm^2),[3] secondary particles (bremsstrahlung and secondary electrons from primary electrons and neutrons, secondary protons, alphas, etc., from primary protons) that may have significantly different quality factors deposit a significant part of the dose. Also, behind heavy shielding, cosmic ray particle cascades [16, 17] composed of a great variety of particles make an

3. The unit grams per square centimeter for shield thickness is typical in charged-particle shielding work because different materials have approximately the same shielding effectiveness per unit length in these units. That is, 1.0 g/cm^2 of air is approximately as effective in stopping protons as 1.0 g/cm^2 of aluminum. The problem of density variations between samples of material with the same chemical composition is also avoided.

important contribution to dose deposited, which is very difficult to analyze. None of these effects were considered here; thus, care must be taken in arbitrarily applying these results to any given problem. No calculation was made for bremsstrahlung because the results presented in Reference 11, as well as results presented later in this report, demonstrate that the bremsstrahlung dose rate is unimportant when compared to the dose rate resulting from other particles and because bremsstrahlung calculations in complex geometries are very expensive.

RESULTS

Figure 29 shows the approximate location of 14 detector points in Spacelab. The first six points survey the Spacelab environment, while the last eight are concentrated in the rack area. Figures 30 through 57 show the total daily dose rates to be expected at these points as a function of orbital altitude and inclination. Appendix B gives the exact Shuttle coordinate location of each point and the dose rate in rads relative to the incident particle as well as the total dose rate.

The dose rates range over almost an order of magnitude between detector point 1 at the outer wall on the top side of Spacelab and detector point 3 at the outer wall on the bottom side. Generally, however, the variation seen between detector points was on the order of from two to four, with the high dose rates seen near the top side of the lab. The proton component of the dose rate was most important in most cases. However, at the higher inclinations for thinly shielded points, the electron dose rate was comparable to the proton dose rate, and at lower altitudes for more heavily shielded points, the cosmic ray dose rate was the dominant component.

Figures 58 through 65 present the dose rates predicted for a detector point behind a spherical aluminum shell shield of the specified thickness as a function of orbital altitude and inclination. Appendix C tabulates the predicted numerical values. The dose rates include contributions from trapped protons, trapped electrons, electron-induced bremsstrahlung, and galactic cosmic rays. (Bremsstrahlung is secondary electromagnetic radiation generated as electrons are accelerated primarily during close passages by atomic nuclei.)

The geometry for the trapped proton and cosmic ray dose rate calculations consisted of a point tissue receiver at the center of a spherical aluminum shell of the given thickness. The technique used for the proton dose rate calculation is described in Reference 18. The cosmic ray dose rates were interpolated

from tabular data in Reference 13. The geometry for the electron and bremstrahlung dose rates is different. In these calculations, the electrons are assumed to be isotropically incident on an aluminum infinite plane shield rather than a sphere. The differences in dose rates for the two geometries are insignificant when compared to environmental uncertainties. The methods used are described in Reference 19. The trapped proton component is dominant for shield thicknesses from 1.0 to 30 g/cm^2, the range of thicknesses of most practical importance. In very thinly shielded regions the electrons become important, and for an unusually thick shield, the cosmic rays become important. The relative importance of the component varies with altitude and inclination, but, as a rule, the proton component dominates for practical shield thicknesses. Basically, the cosmic rays place a lower limit on dose rates achievable of approximately 0.01 rads/day independent of shield thickness and are less important at higher altitudes. The electrons become important for higher inclinations which encounter the outer belt "horns" and for very thin shield thicknesses.

These data have at least two uses. First, comparisons with the results of complex geometry calculations give some estimate of how realistic the geometrical model is and help detect weaknesses in the model. For example, the contribution due to electrons at higher inclinations for some detectors when compared to the spherical shell calculations suggests that a major portion of this dose is coming from a rather thinly shielded region. More detailed modeling might eliminate much of this contribution. A second use of these data is for an approximate extension of the complex geometry calculation. For example, if an additional amount, X g/cm^2, of shielding is added, the following procedure may be used. Referring to the free detector dose rate on the corresponding dose rate versus shield thickness curve, one follows the curve out for X g/cm^2 more shielding and reads the dose rate. This should approximate the dose rate with additional shielding. (The estimate should work best for more heavily shielded detectors.)

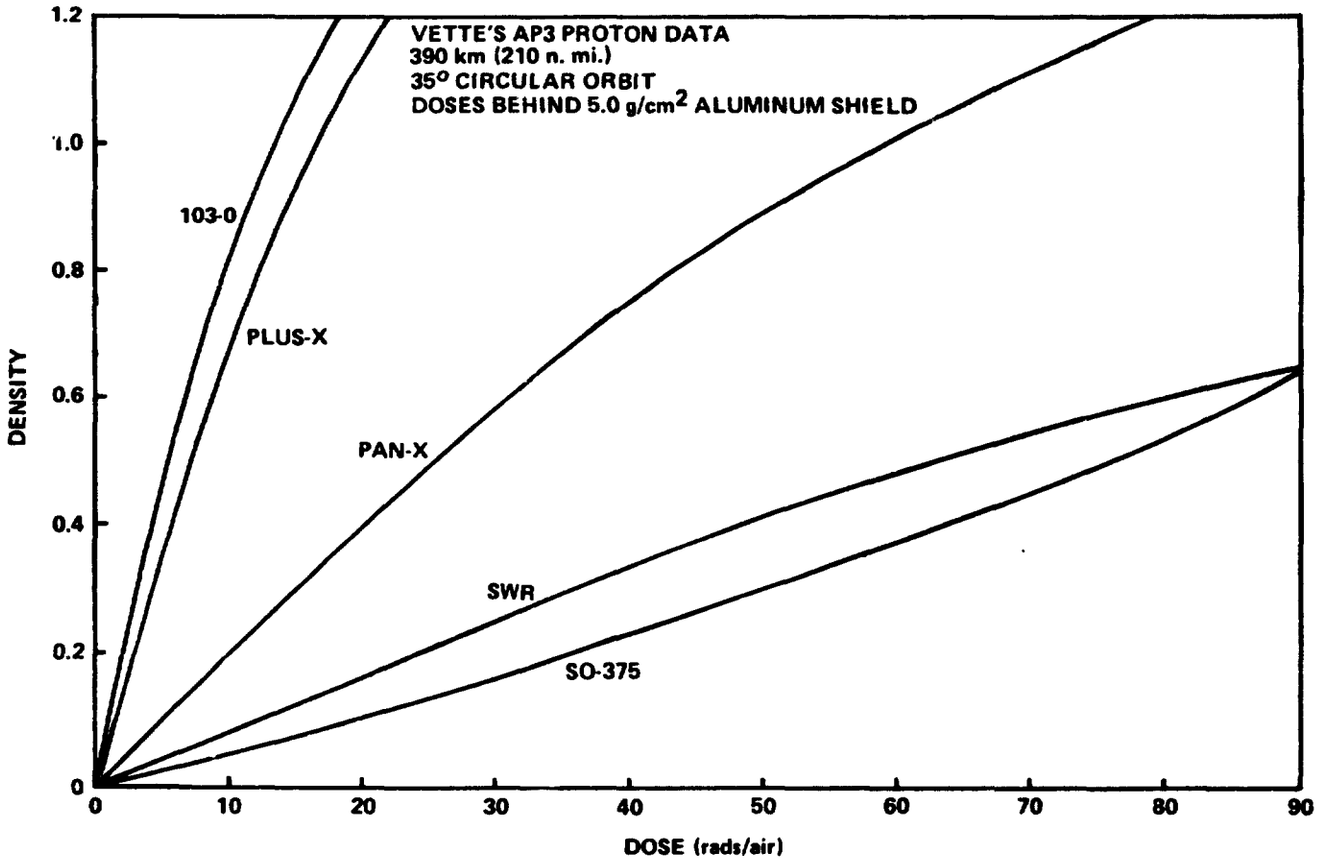


Figure 1. Film density versus dose for some Skylab photographic films [7].

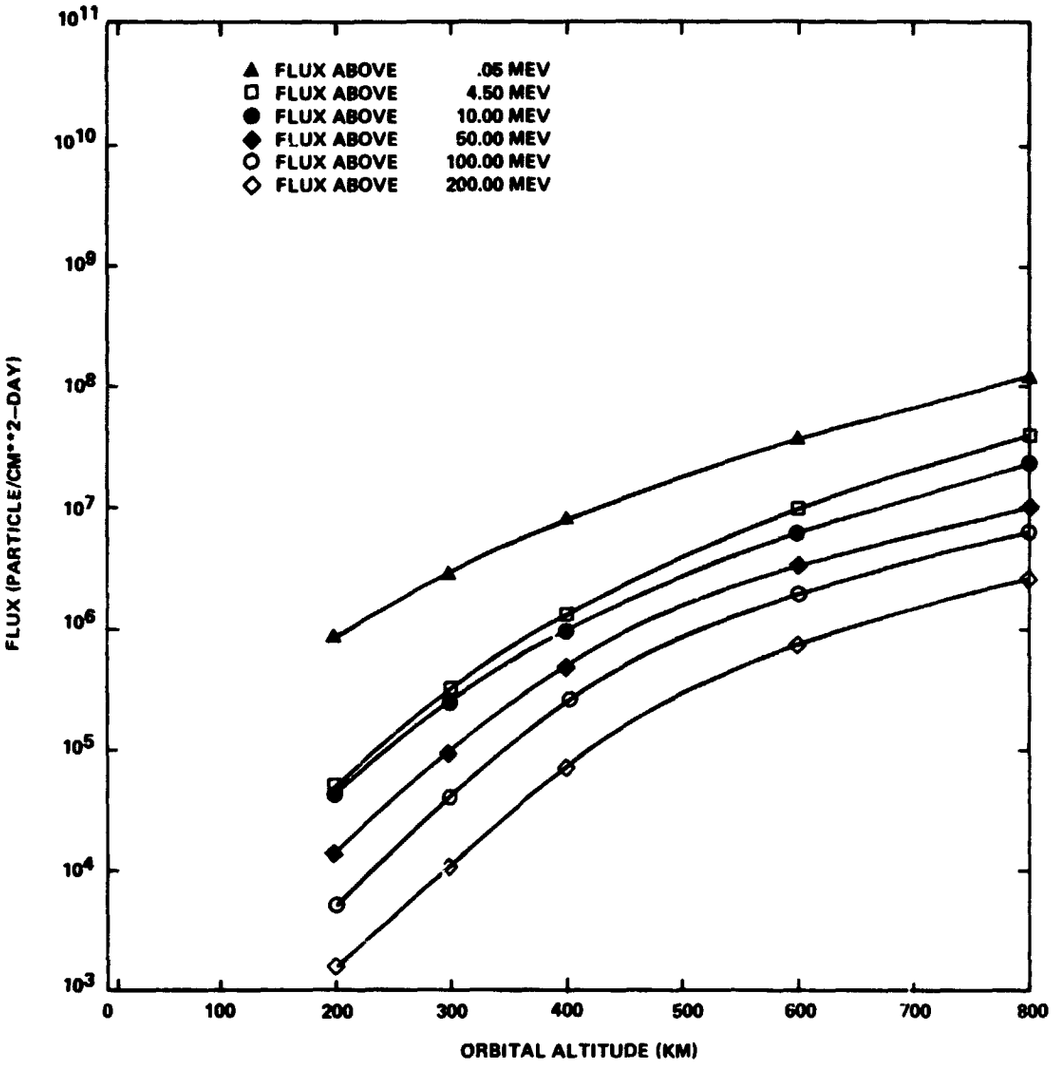


Figure 2. Proton flux versus altitude above various energies at 28.5° inclination.

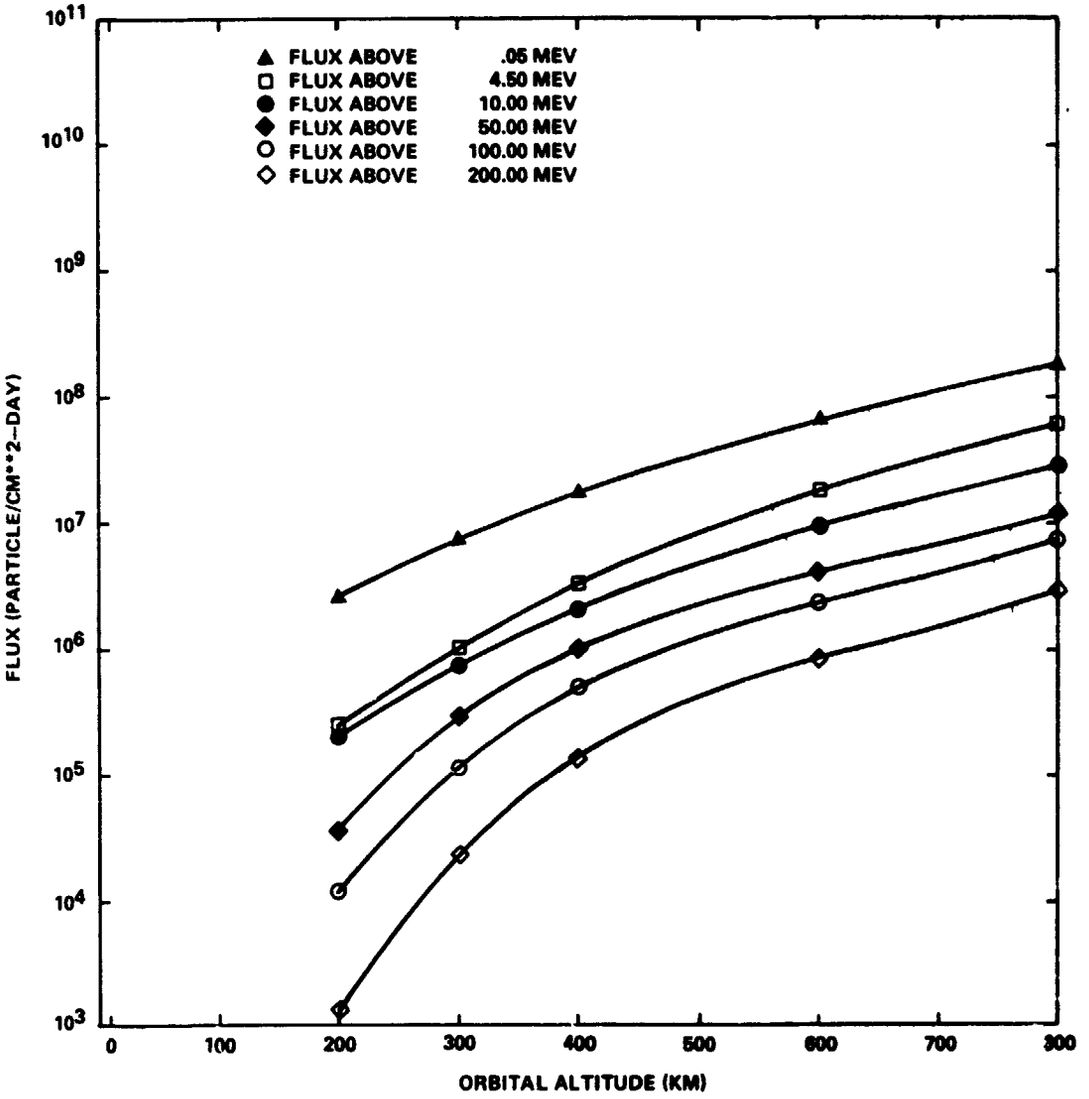


Figure 3. Proton flux versus altitude above various energies at 35° inclination.

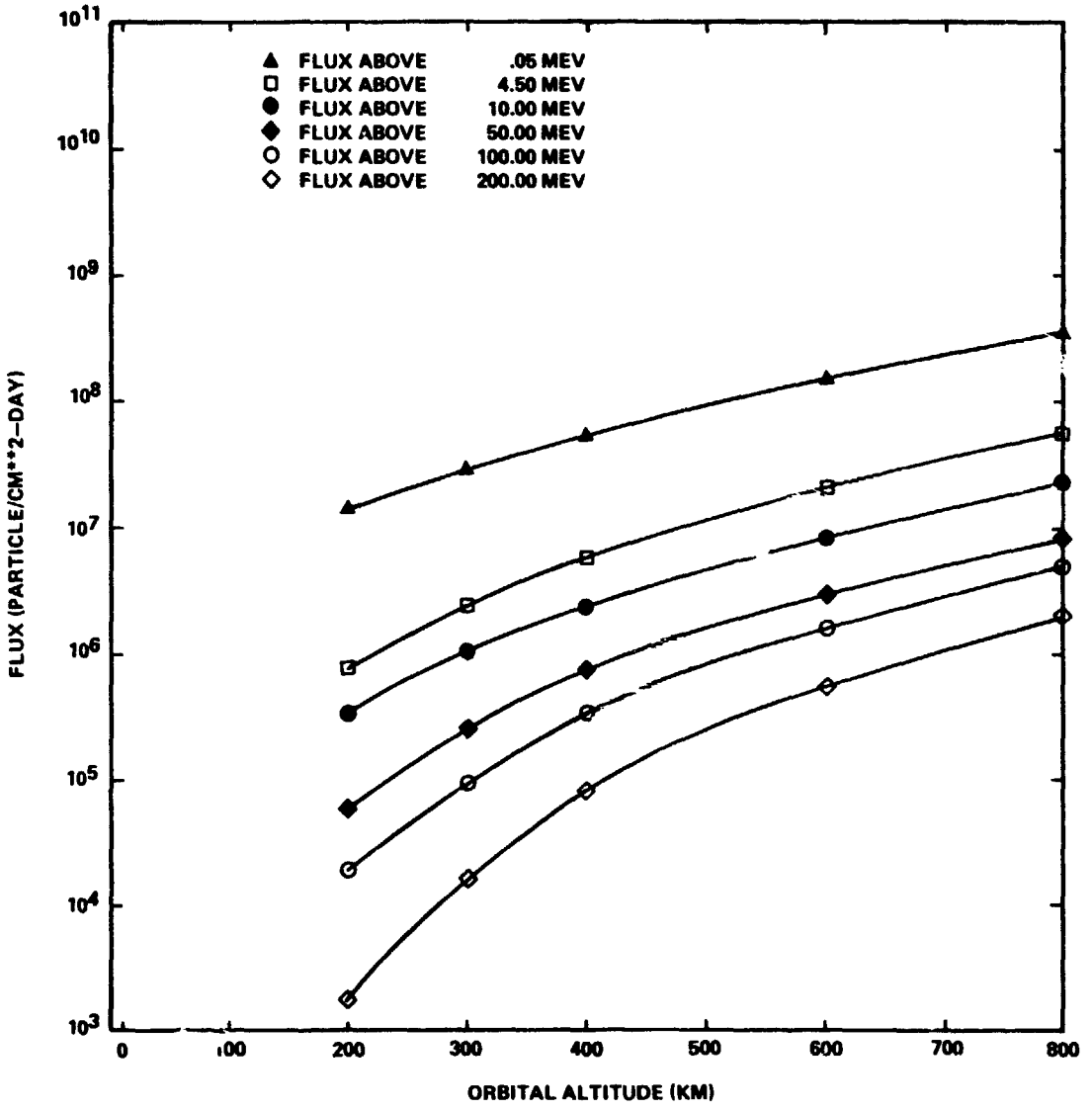


Figure 1. Proton flux versus altitude above various energies at 45° inclination.

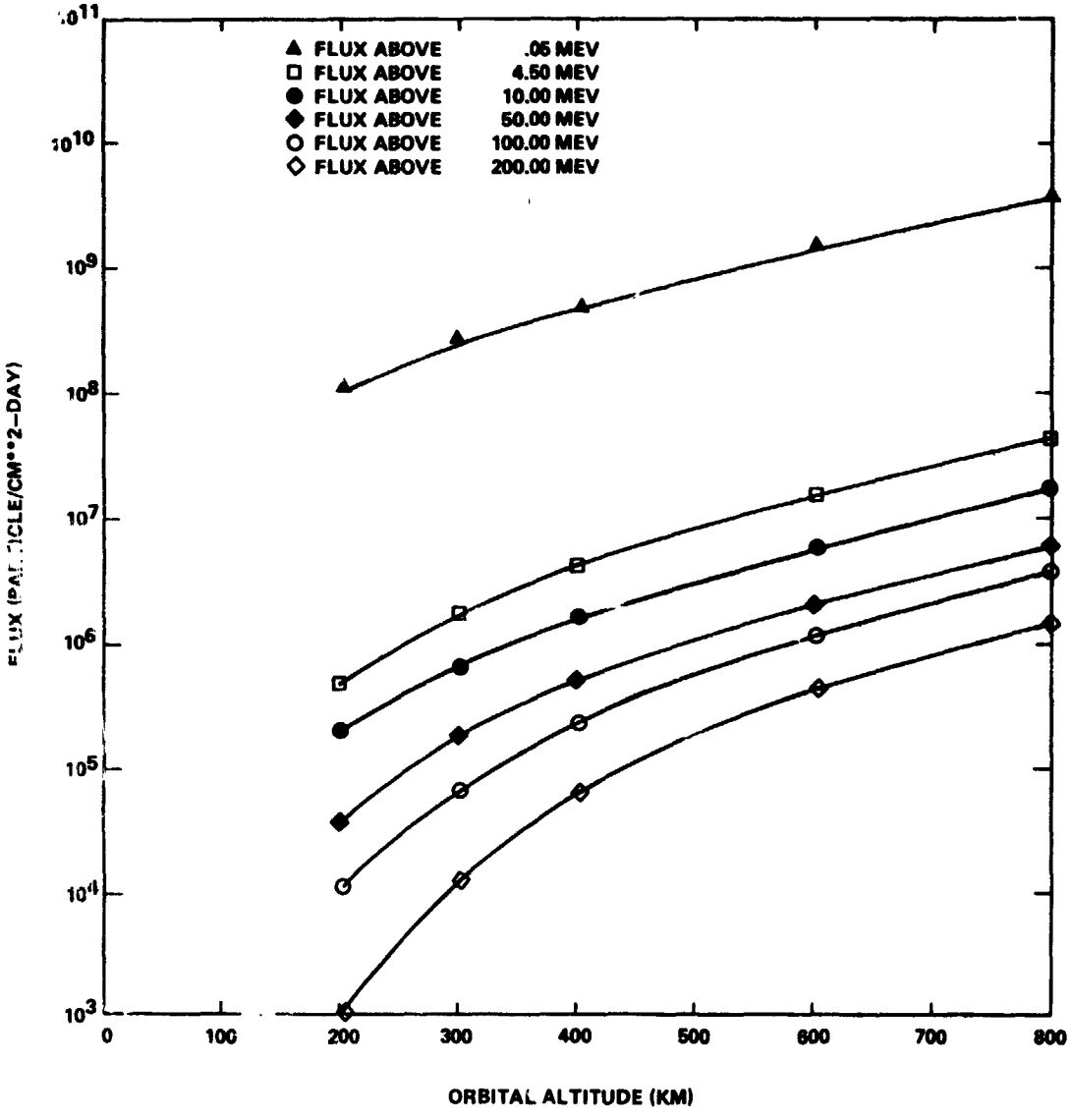


Figure 5. Proton flux versus altitude above various energies at 57° inclination.

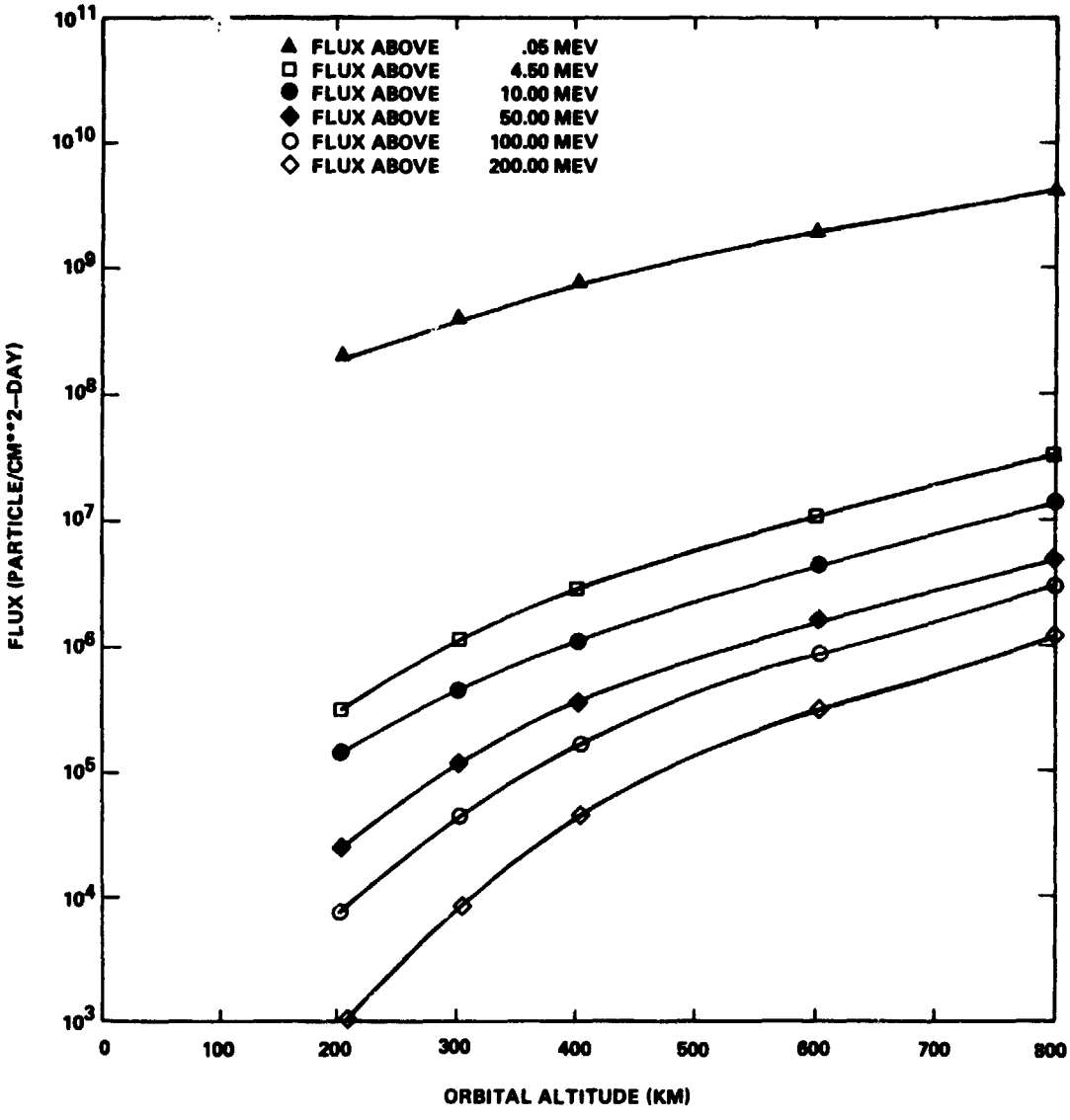


Figure 6. Proton flux versus altitude above various energies at 90° inclination.

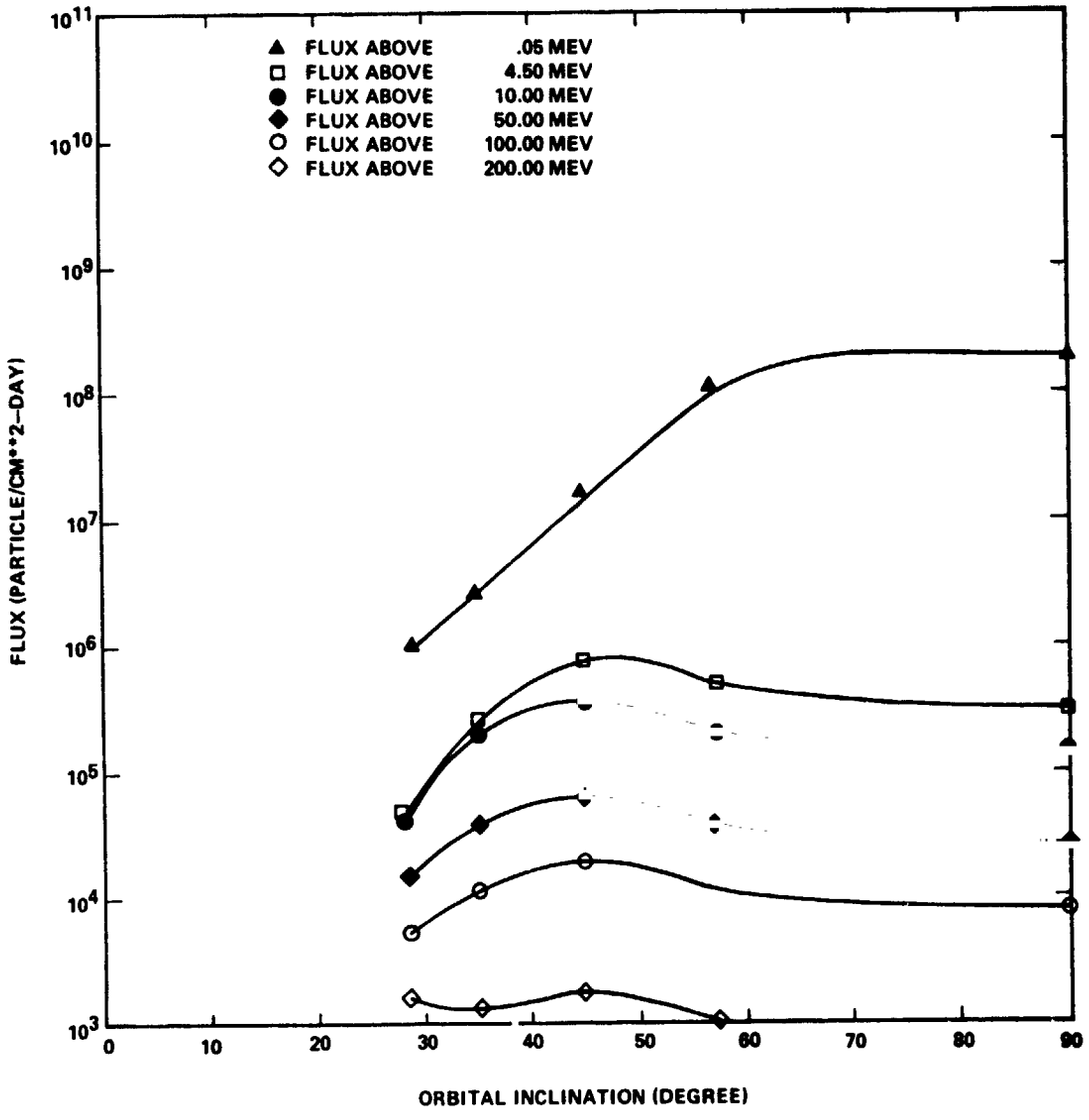


Figure 7. Proton flux versus inclination above various energies at 200 km altitude.

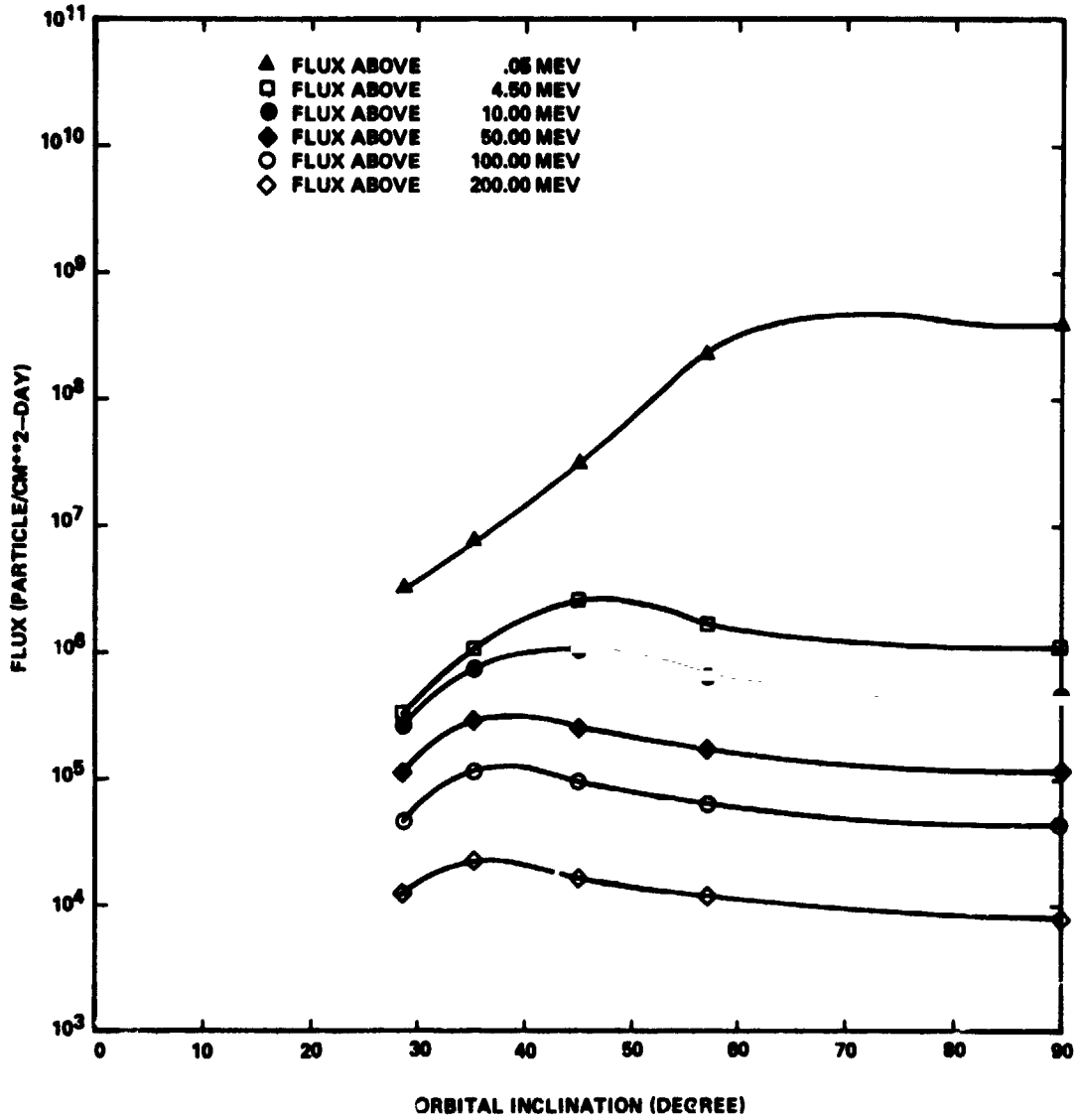


Figure 8. Proton flux versus inclination above various energies at 300 km altitude.

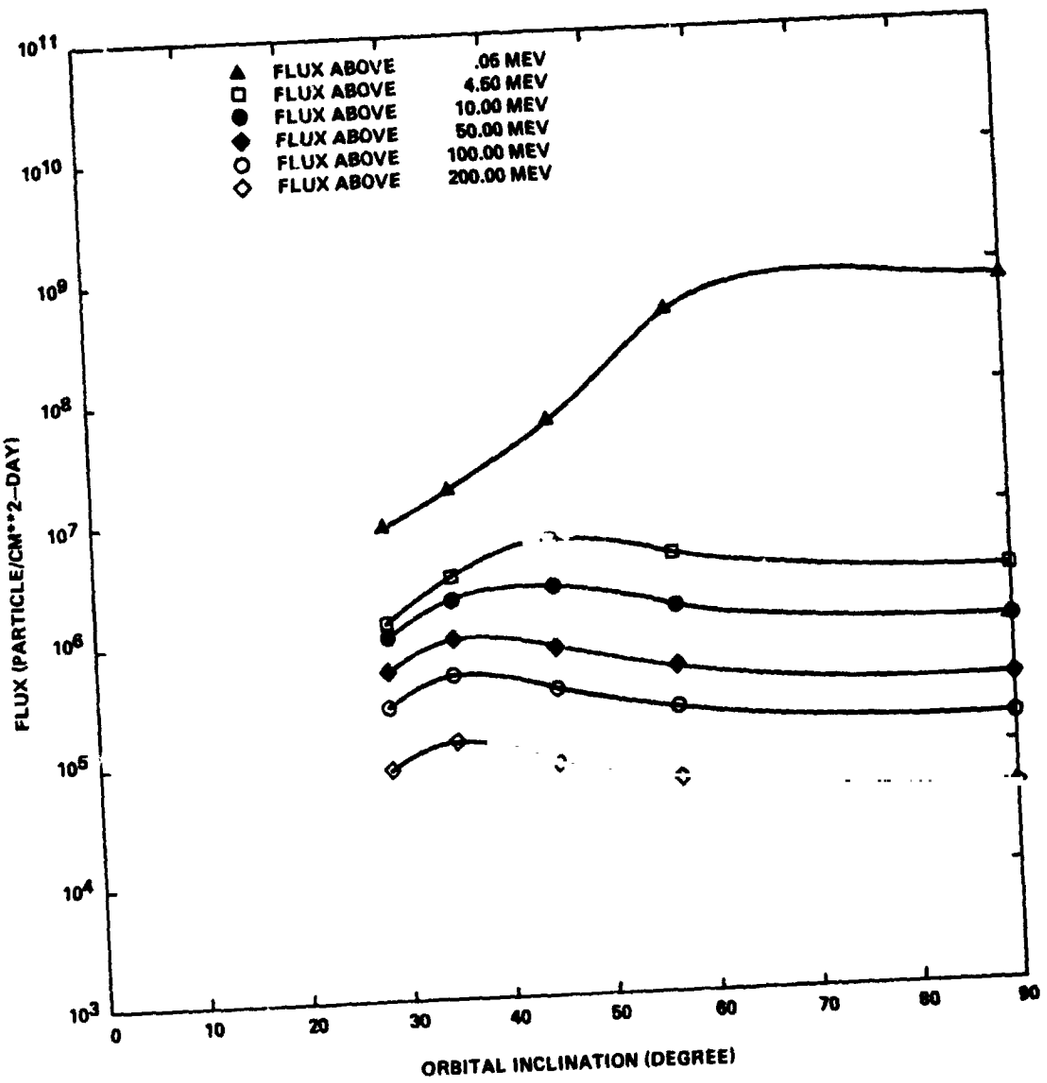


Figure 9. Proton flux versus inclination above various energies at 400 km altitude.

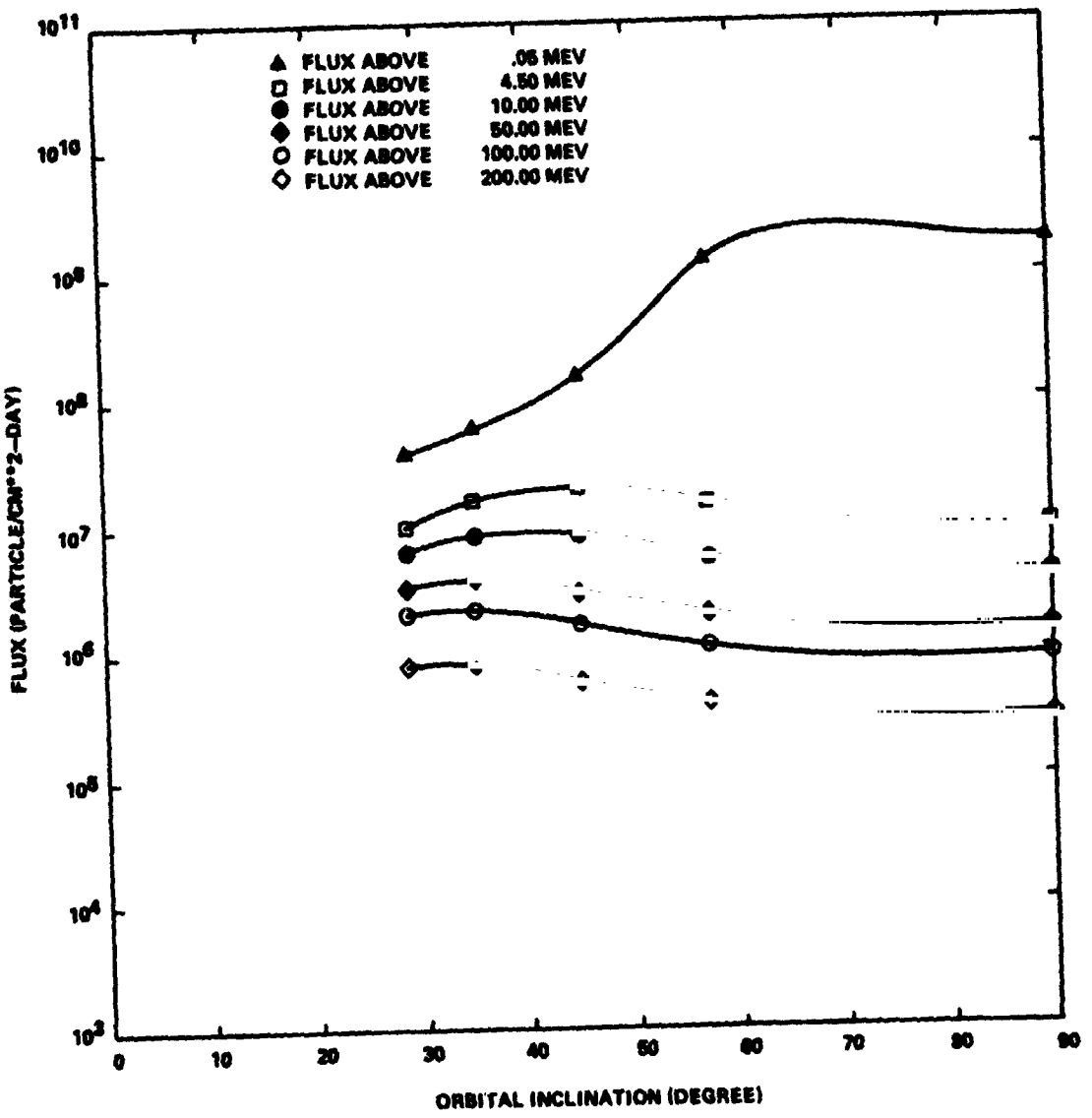


Figure 10. Proton flux versus inclination above various energies at 600 km altitude.

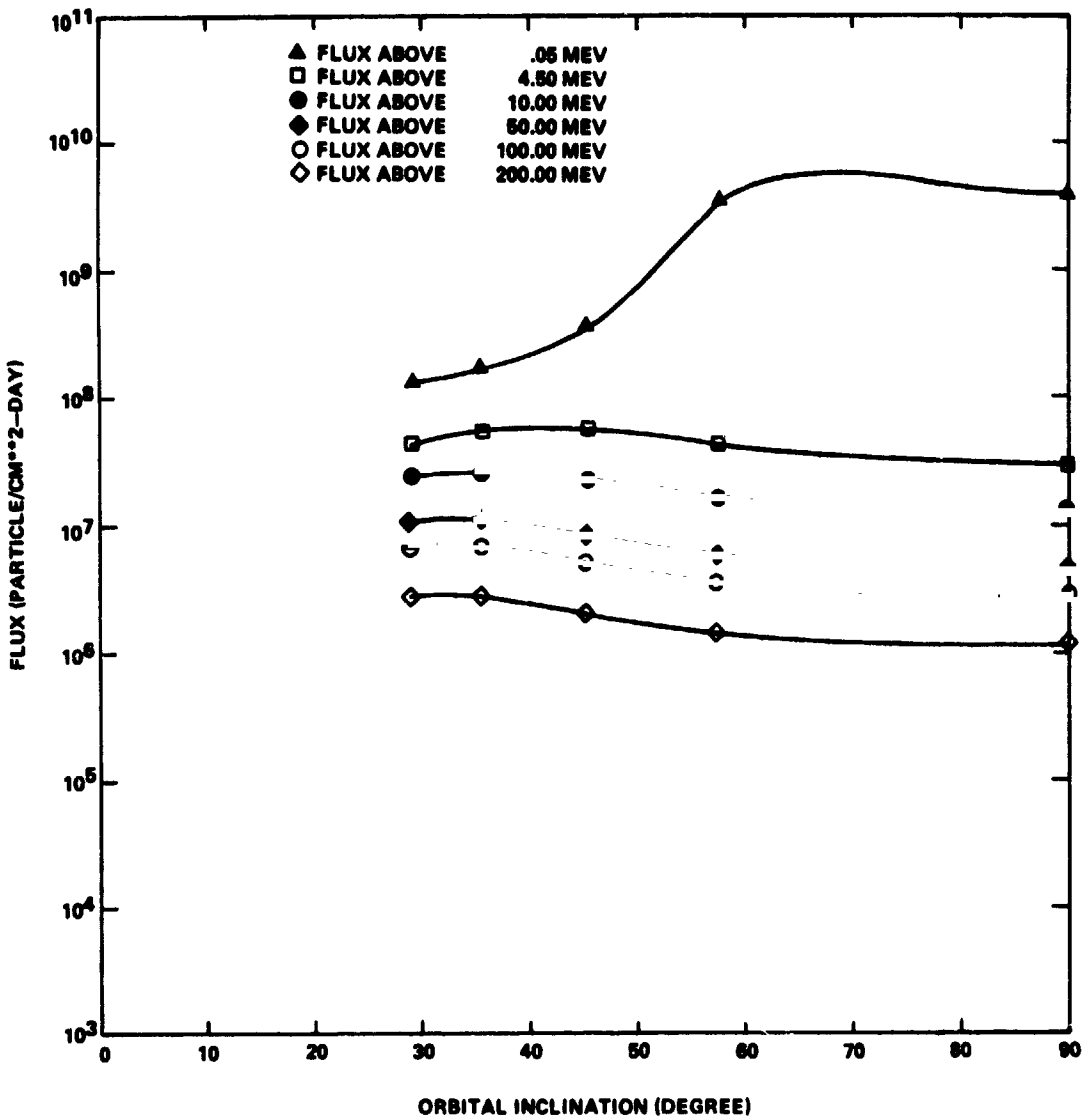


Figure 11. Proton flux versus inclination above various energies at 800 km altitude.

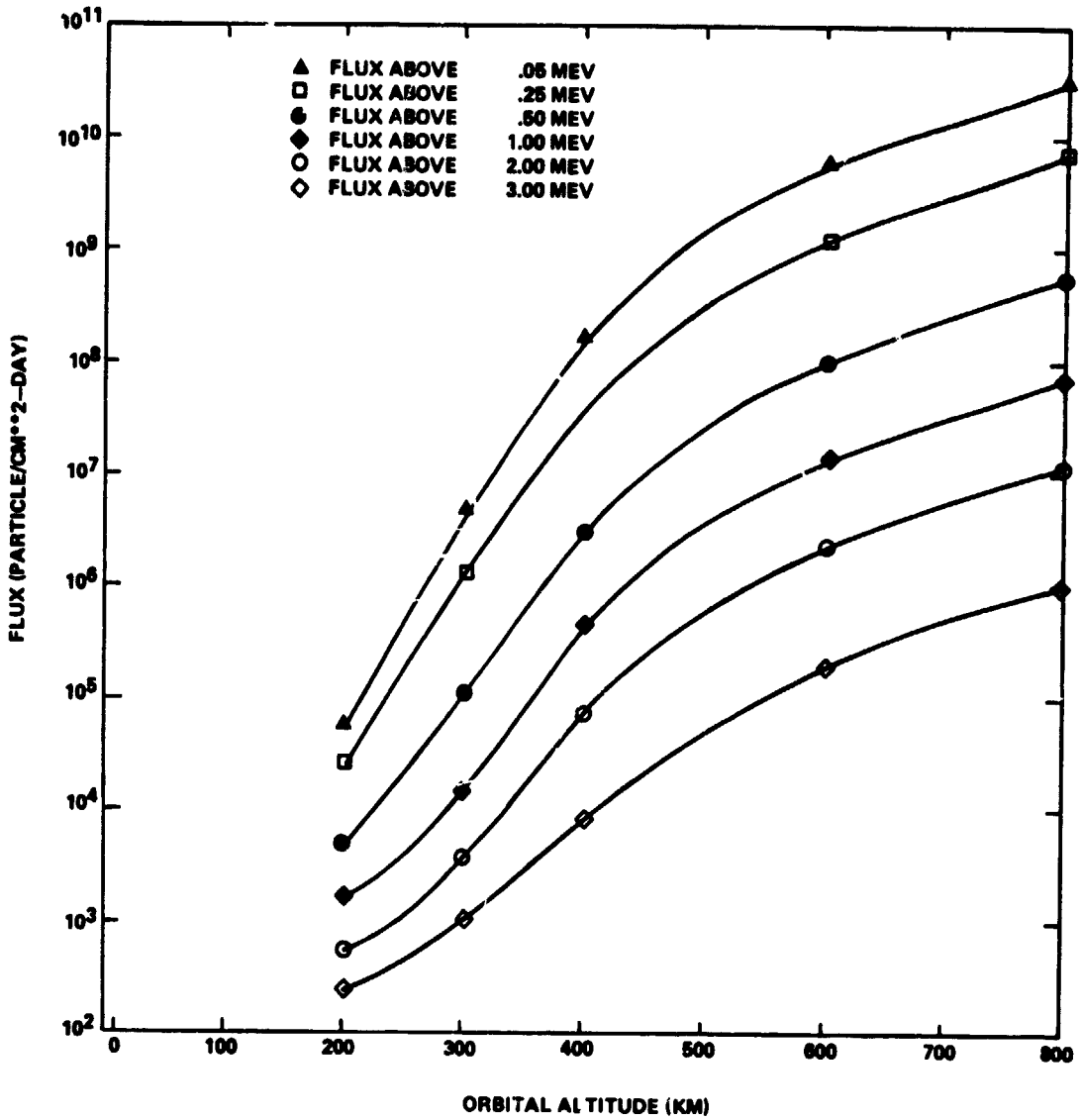


Figure 12. Electron flux versus altitude above various energies at 28.5° inclination.

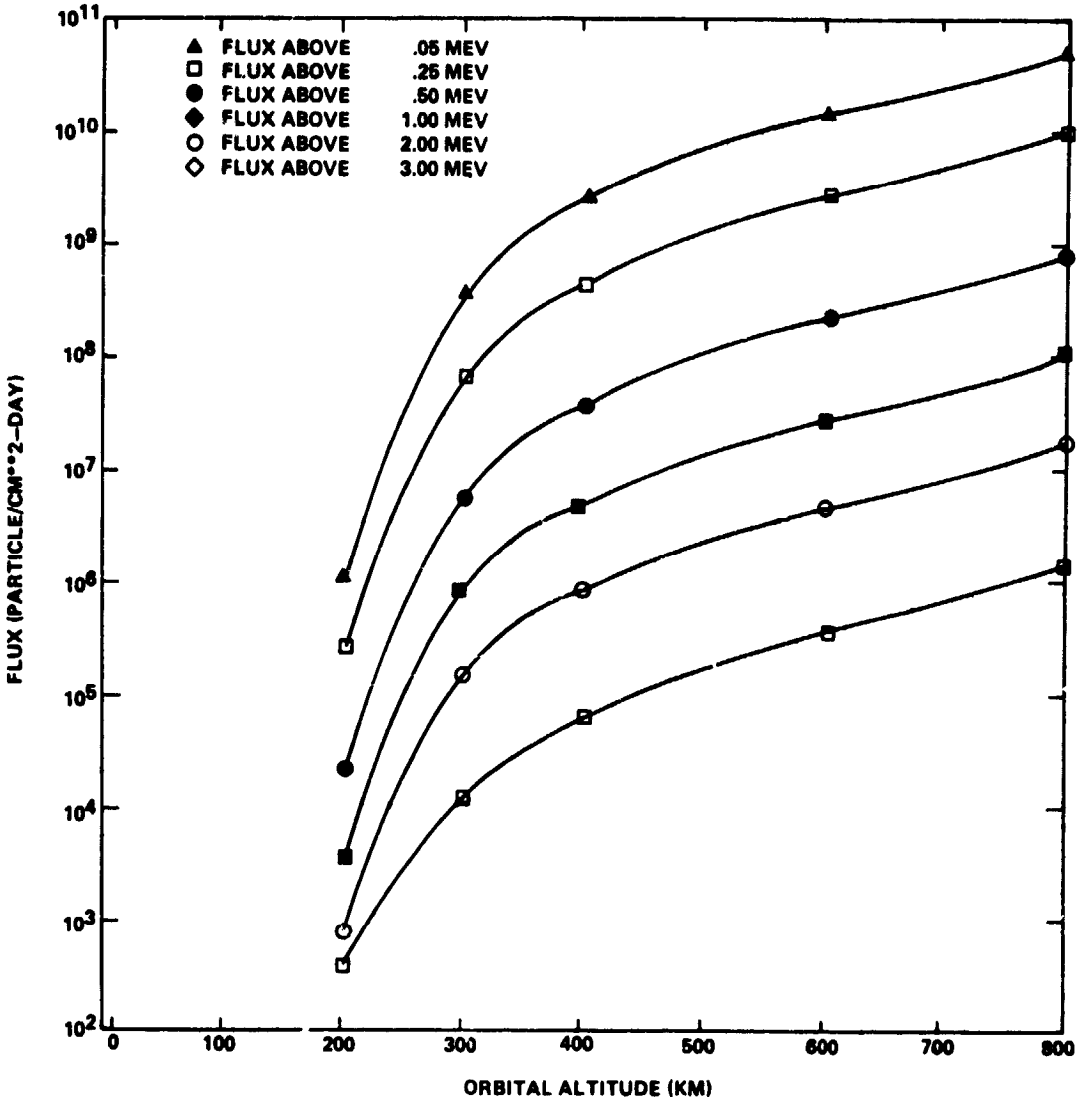


Figure 13. Electron flux versus altitude above various energies at 35° inclination.

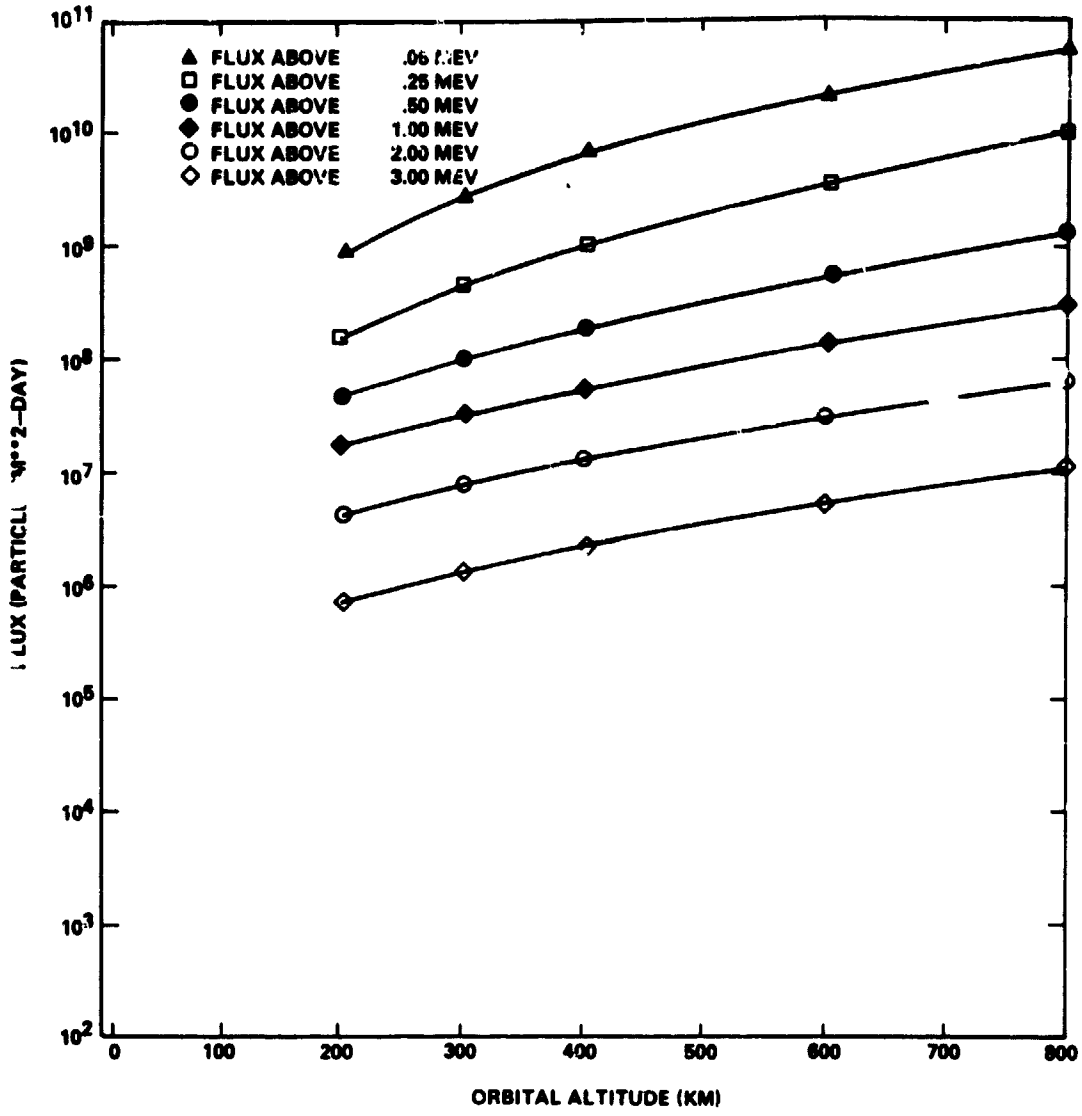


Figure 14. Electron flux versus altitude above various energies at 45° inclination.

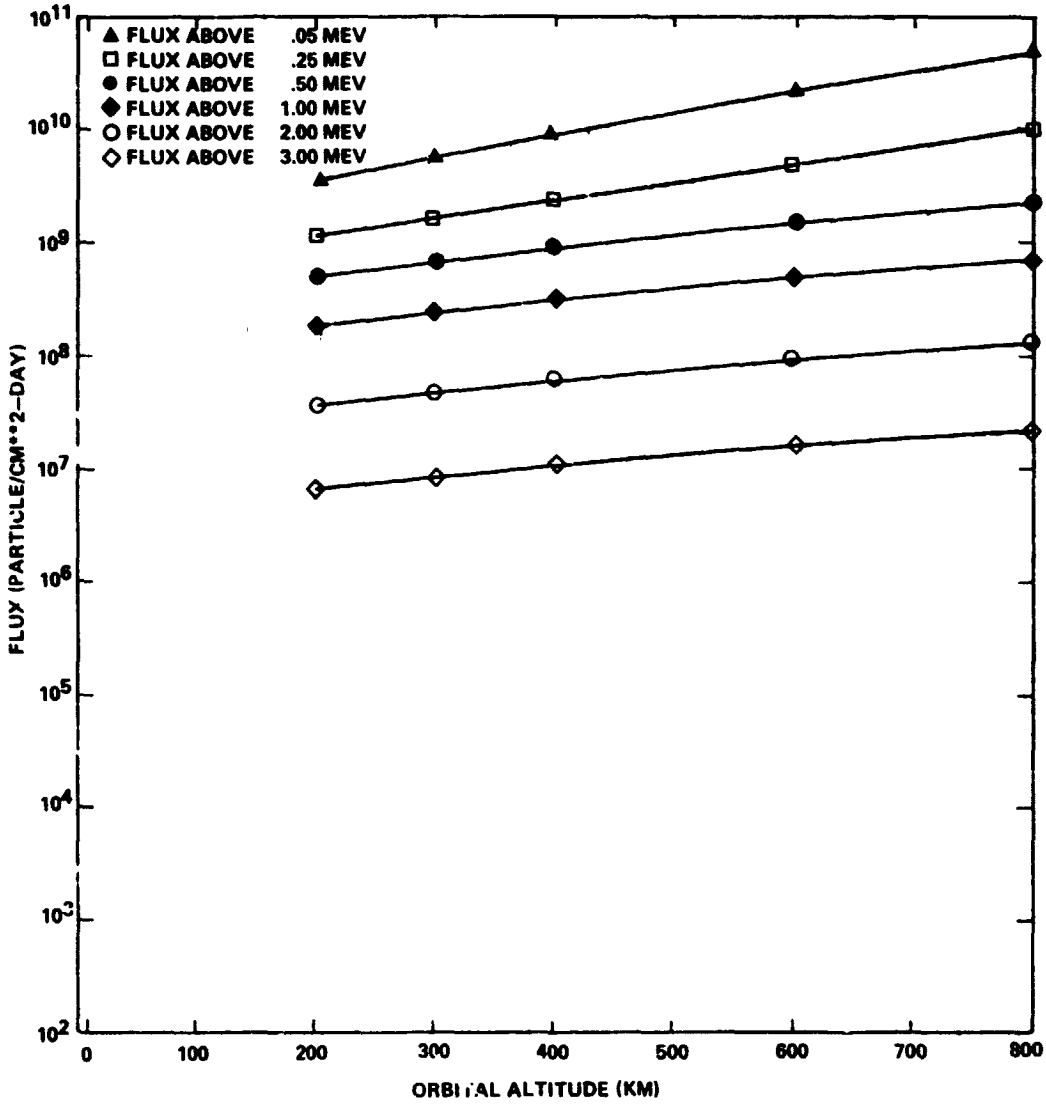


Figure 15. Electron flux versus altitude above various energies at 57° inclination.

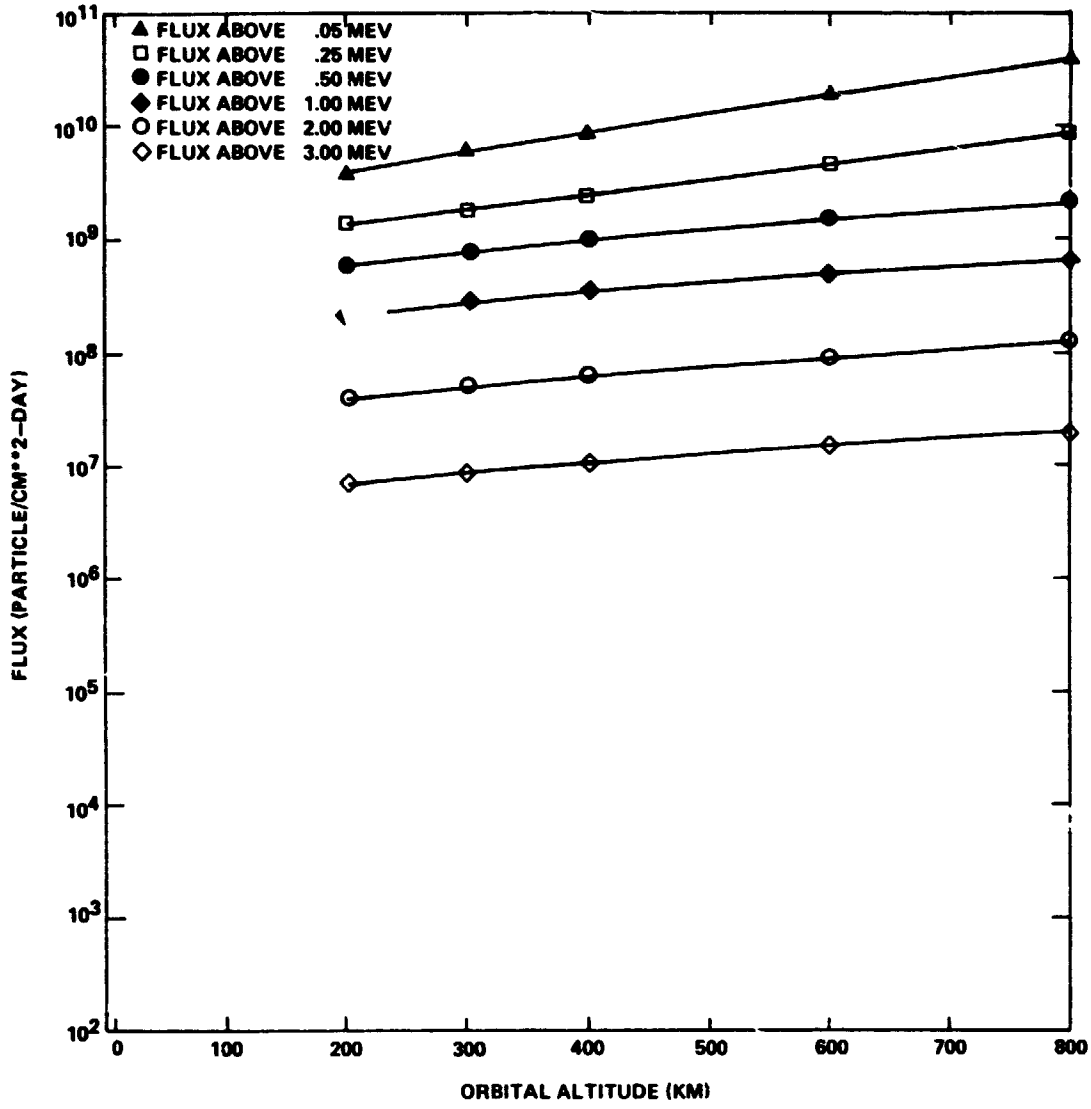


Figure 16. Electron flux versus altitude above various energies at 90° inclination.

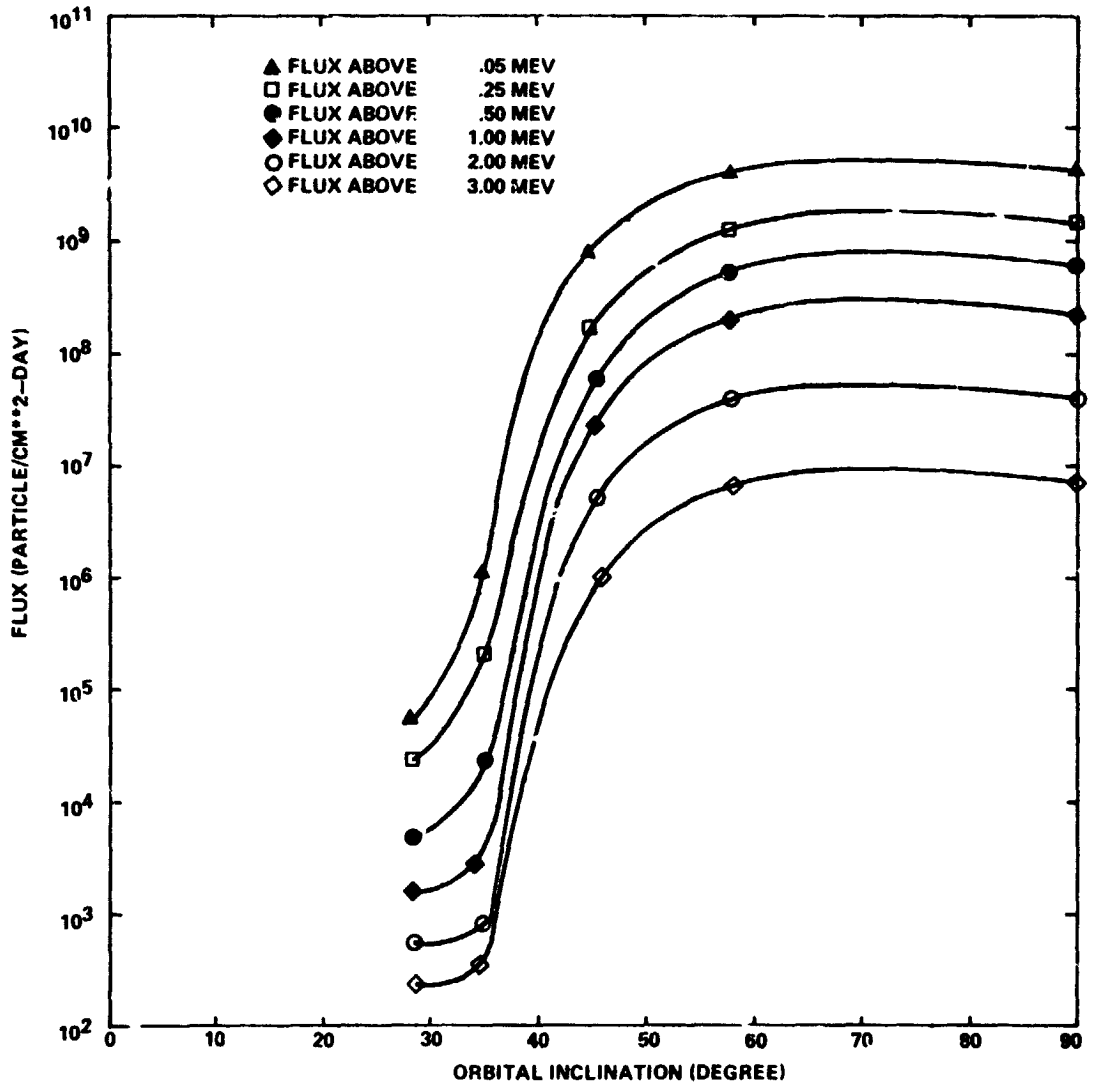


Figure 17. Electron flux versus inclination above various energies at 200 km altitude.

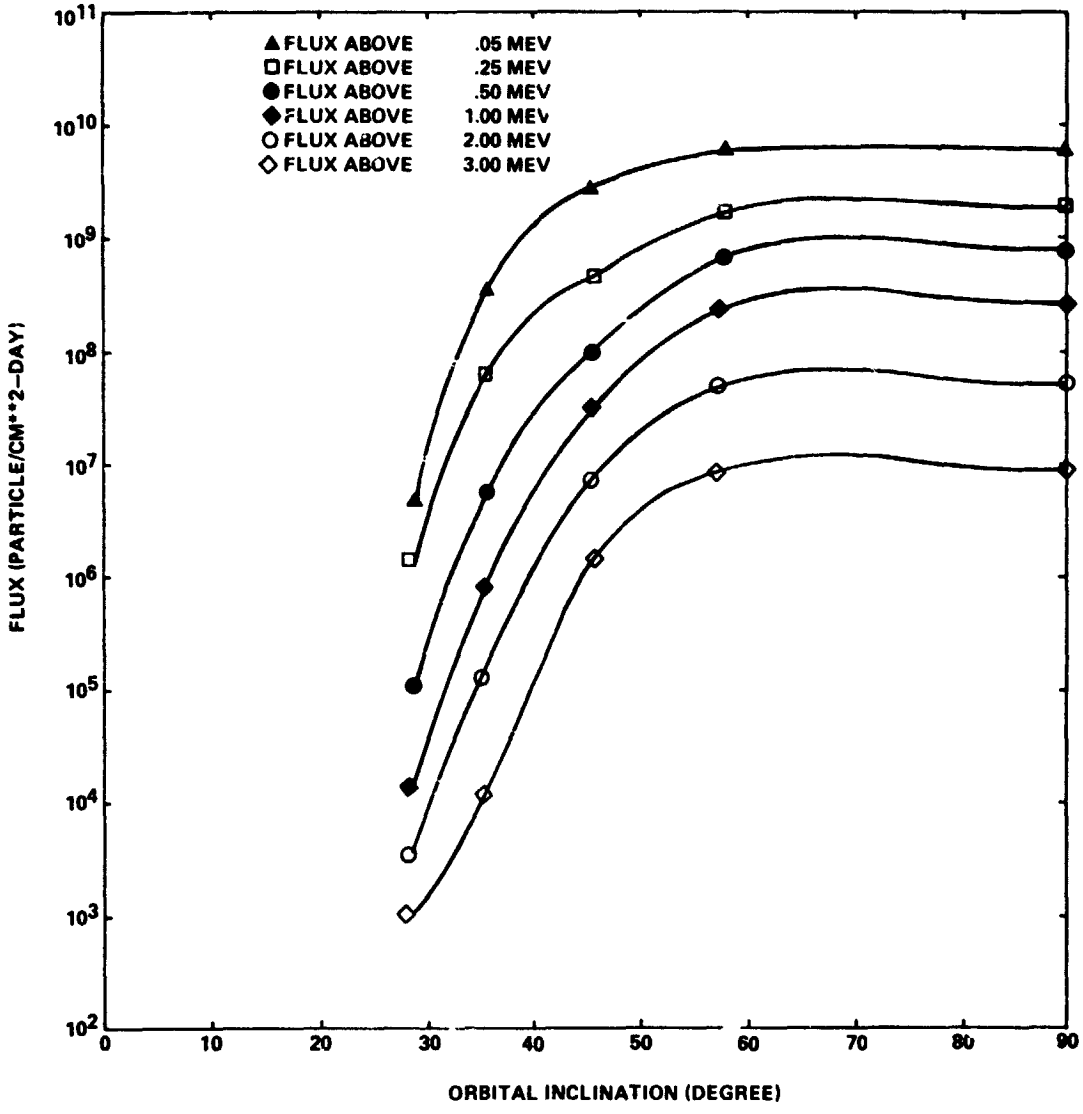


Figure 18. Electron flux versus inclination above various energies at 300 km altitude.

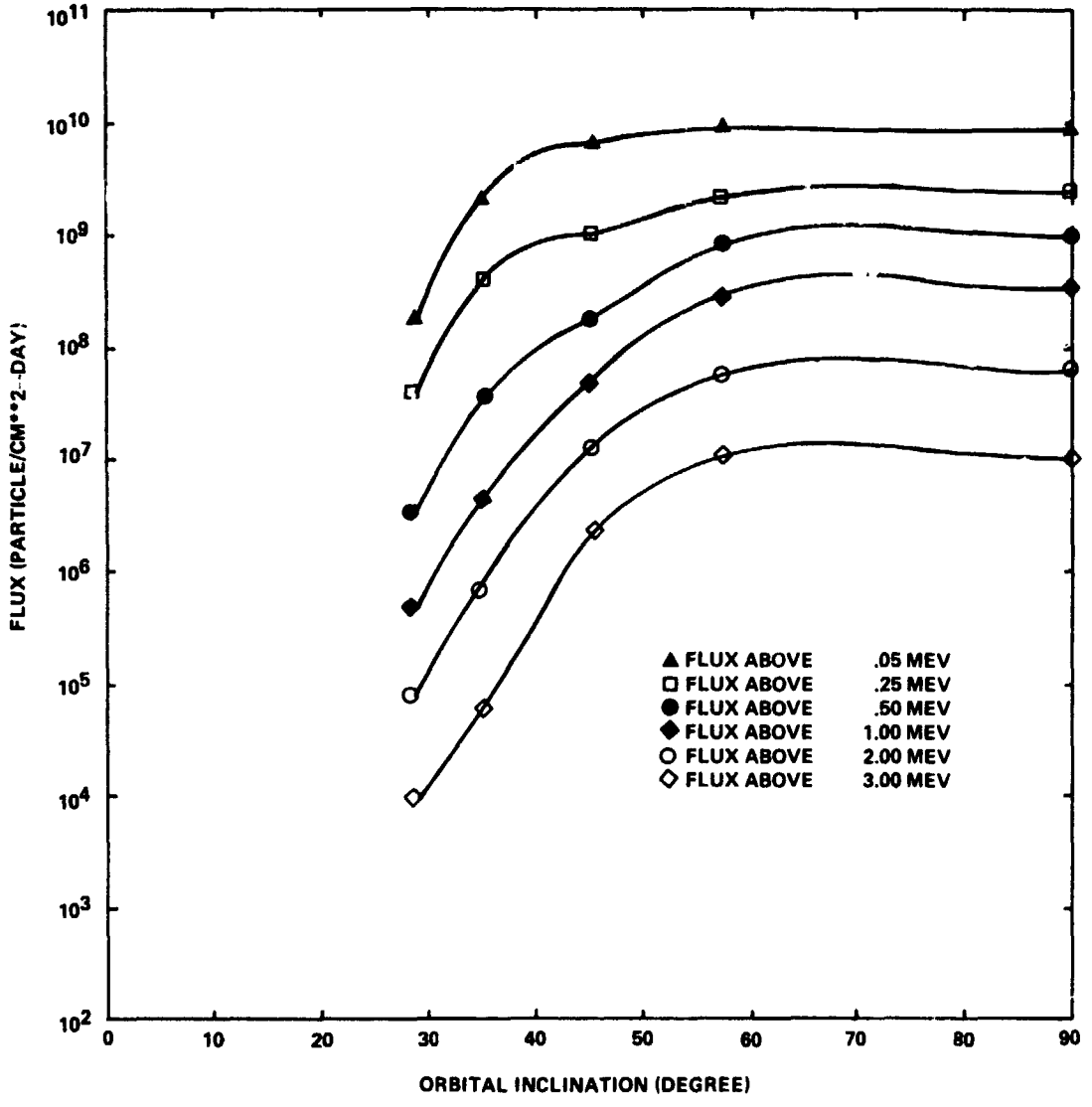


Figure 19. Electron flux versus inclination above various energies at 400 km altitude.

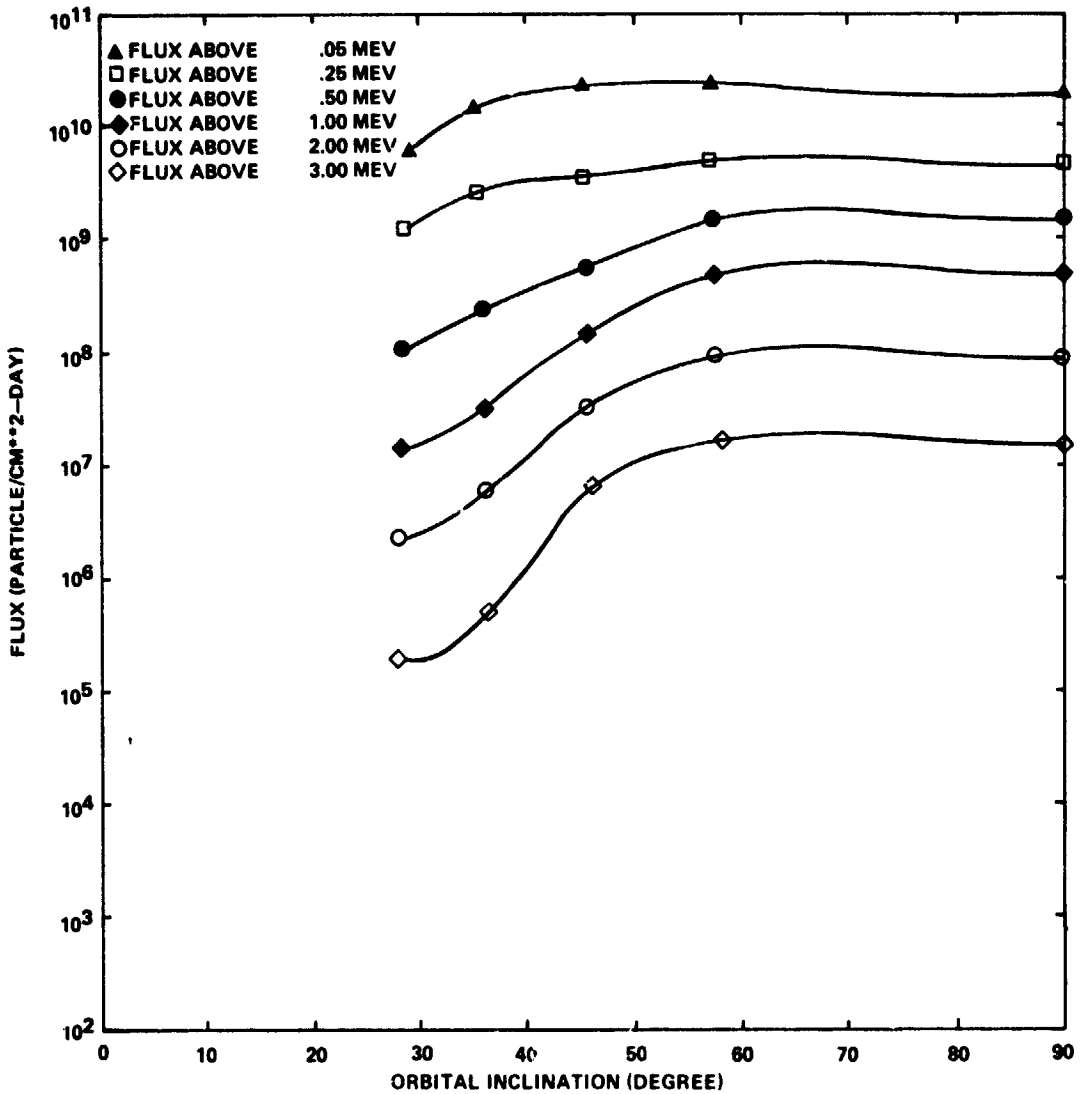


Figure 20. Electron flux versus inclination above various energies at 600 km altitude.

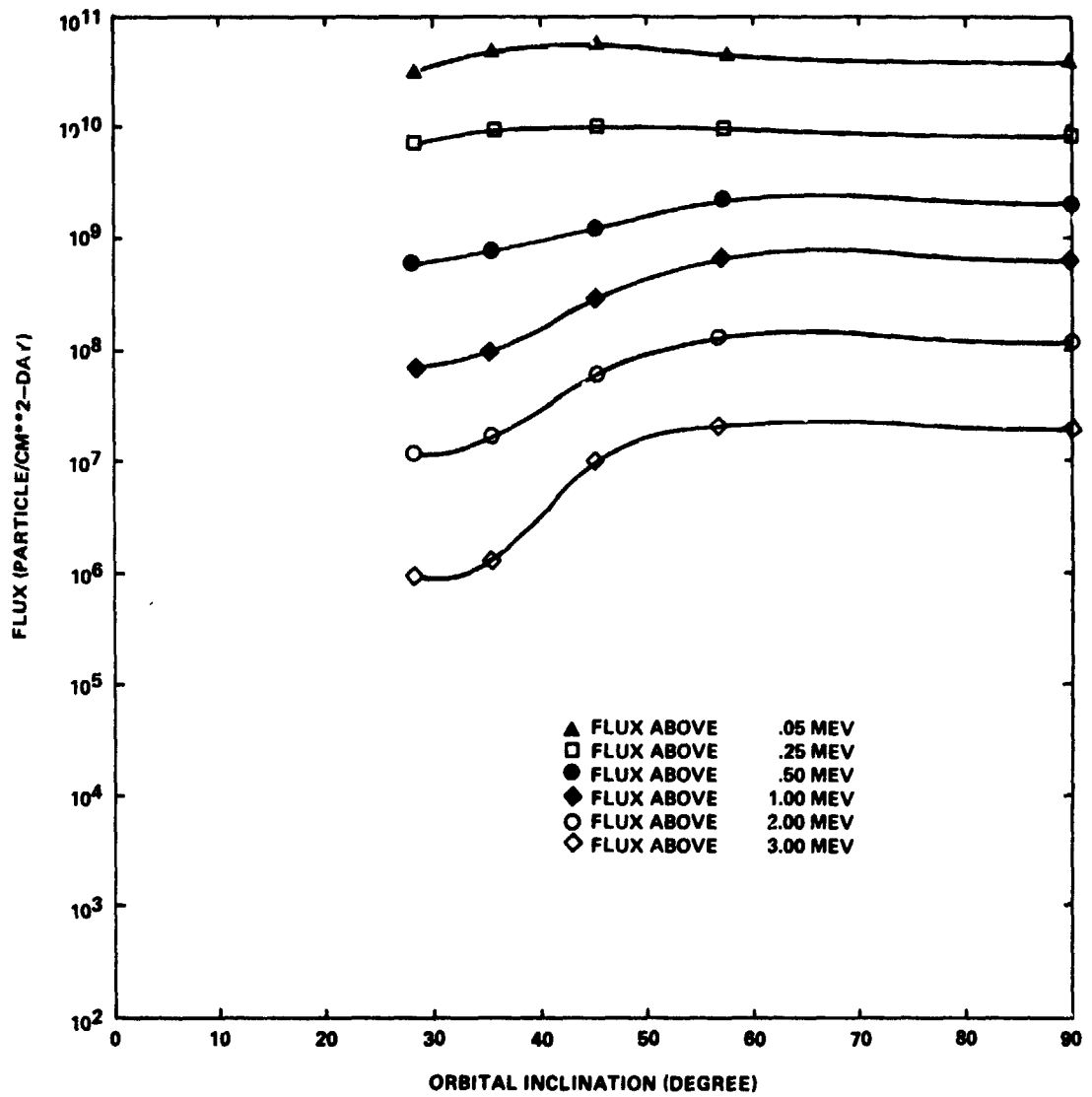


Figure 21. Electron flux versus inclination above various energies at 800 km altitude.

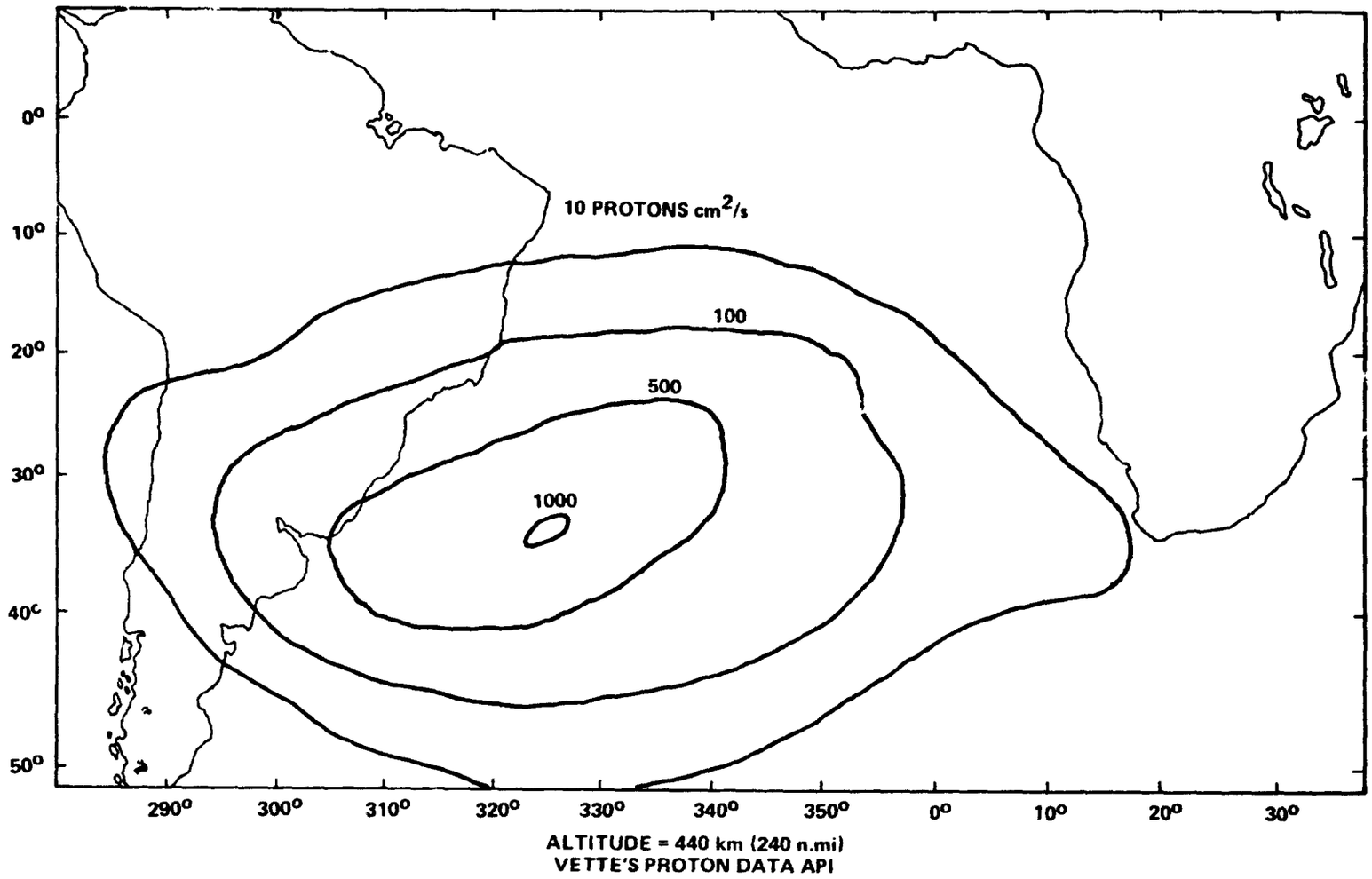


Figure 22. Proton isoflux contours for energies above 34 MeV in the South Atlantic Anomaly at 440 km (240 n. mi.) altitude.

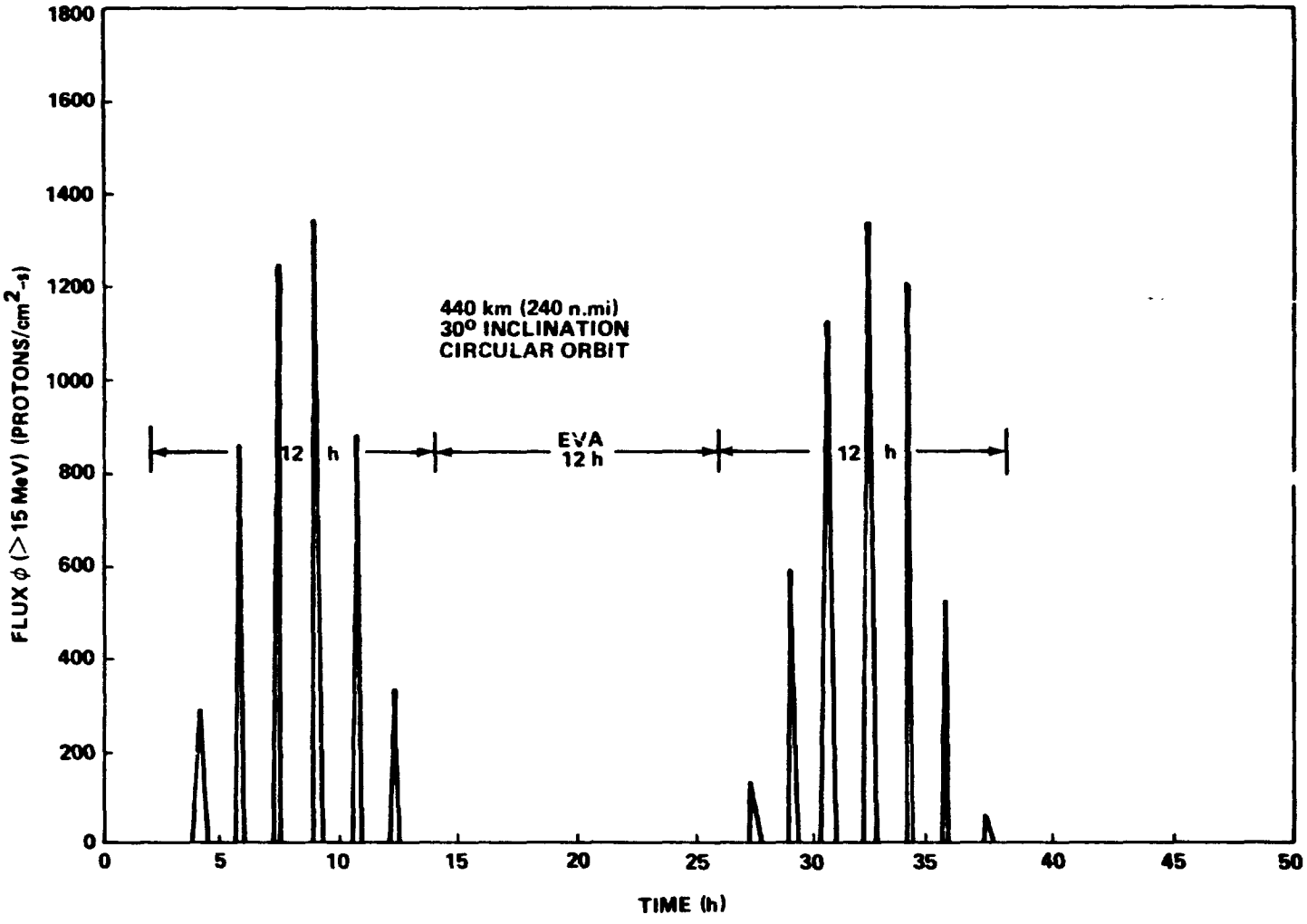


Figure 23. Proton flux as a function of time during several South Atlantic Anomaly passes on a 440 km (240 n.mi.), 30° inclination, circular orbit.

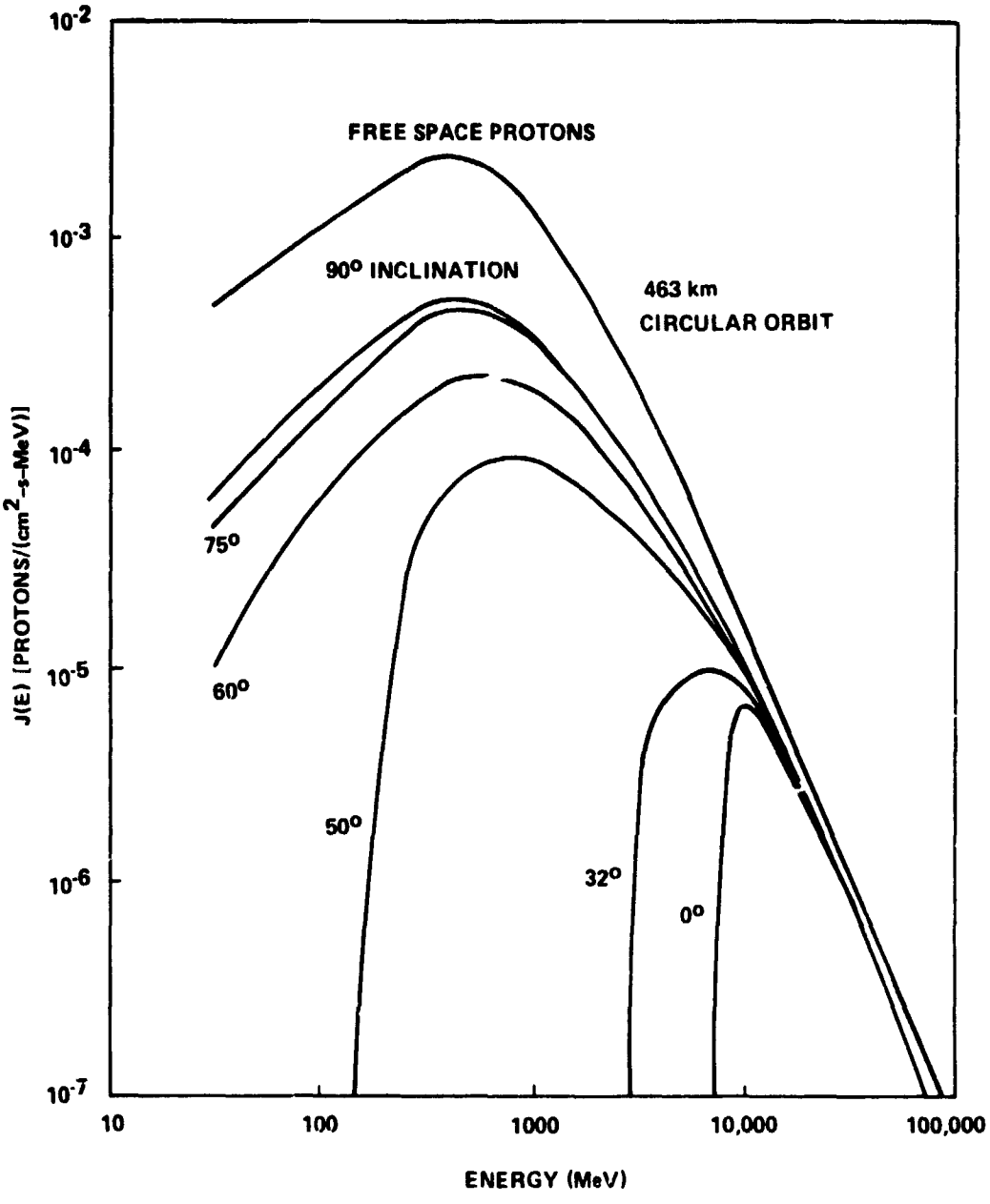


Figure 24. Differential energy spectra for cosmic ray protons in a 463 km orbit of various inclinations [13].

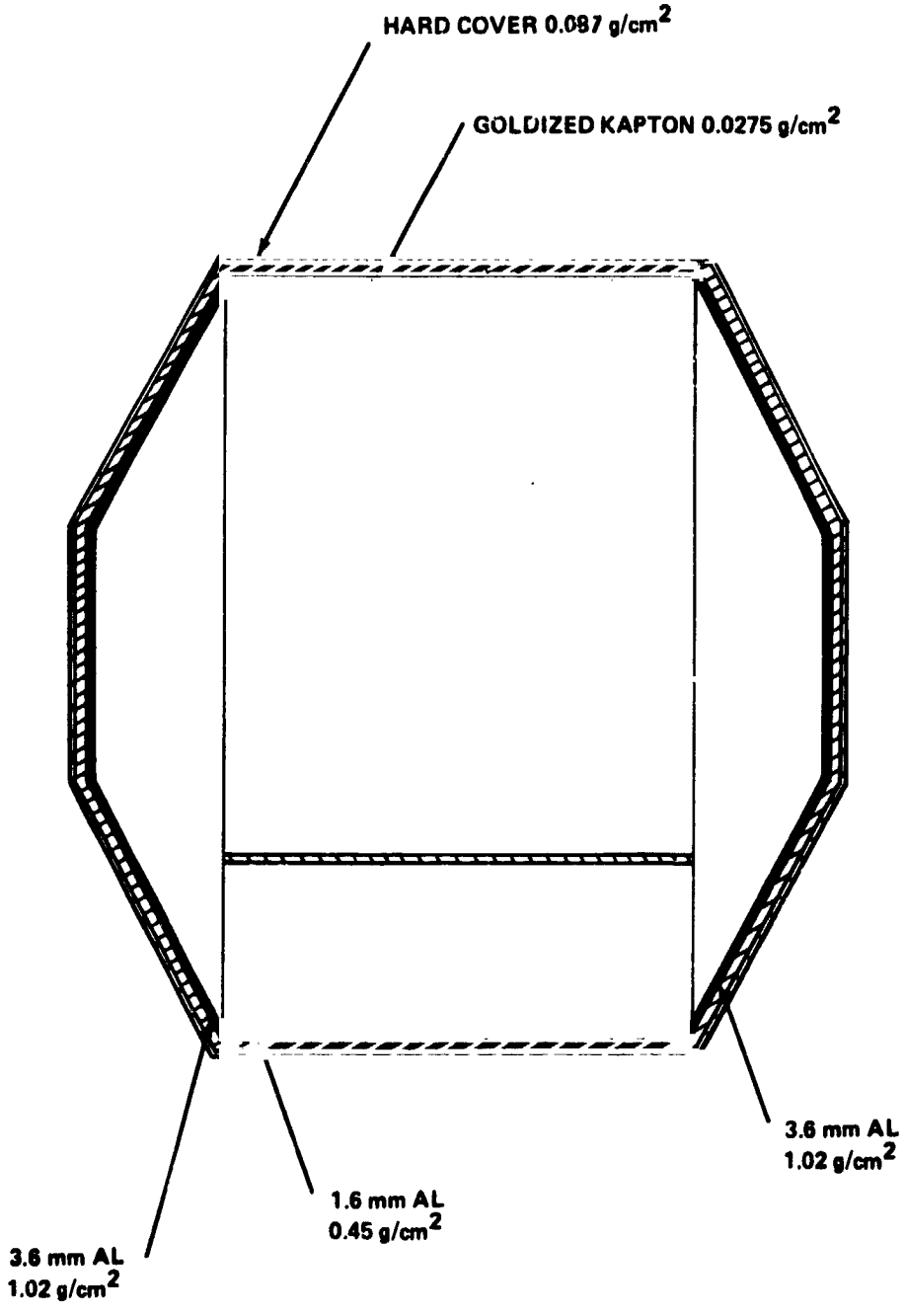


Figure 25. Shell structure for Spacelab short module.

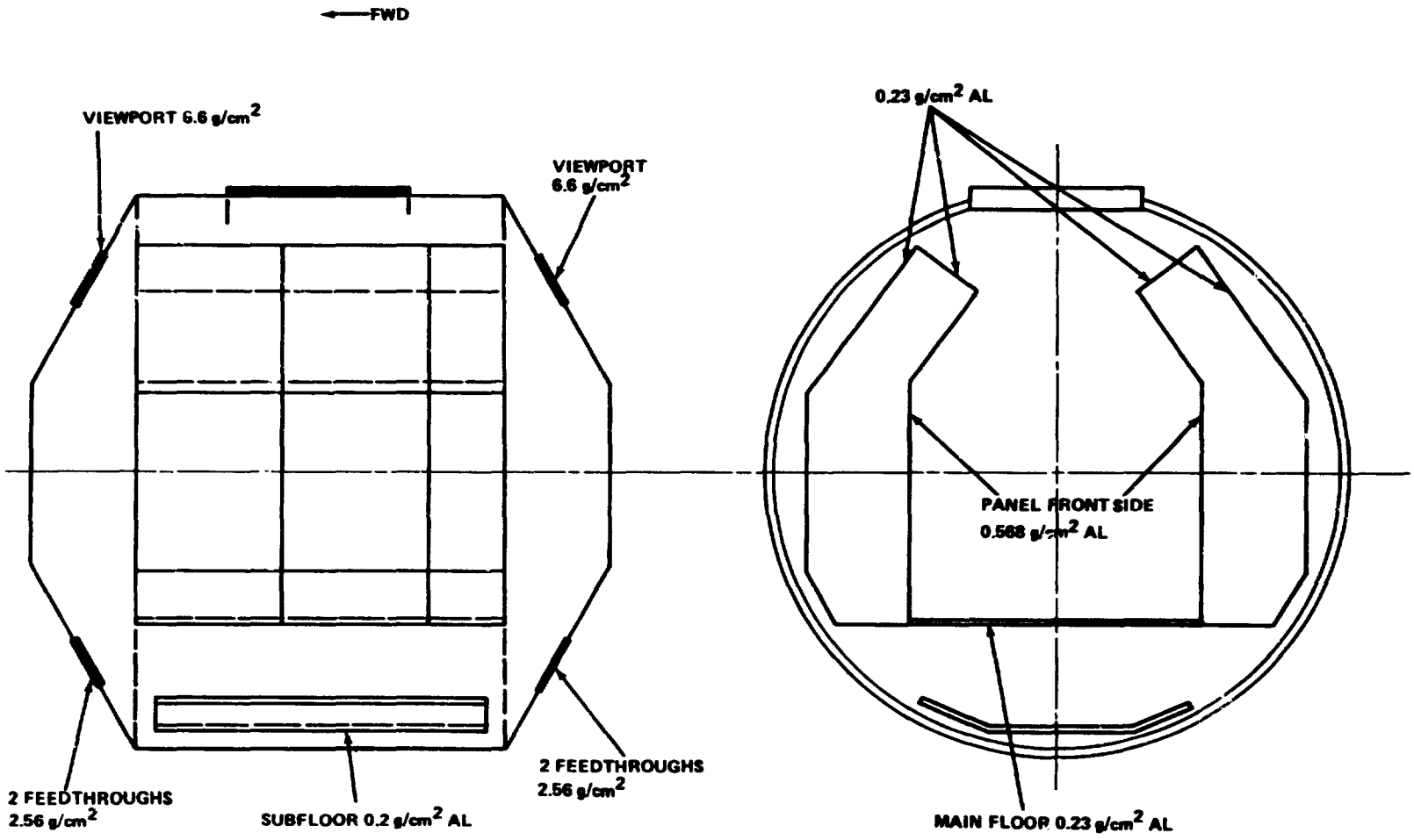
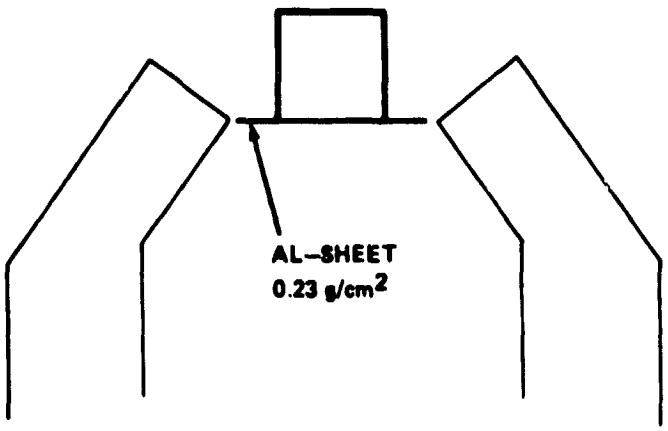
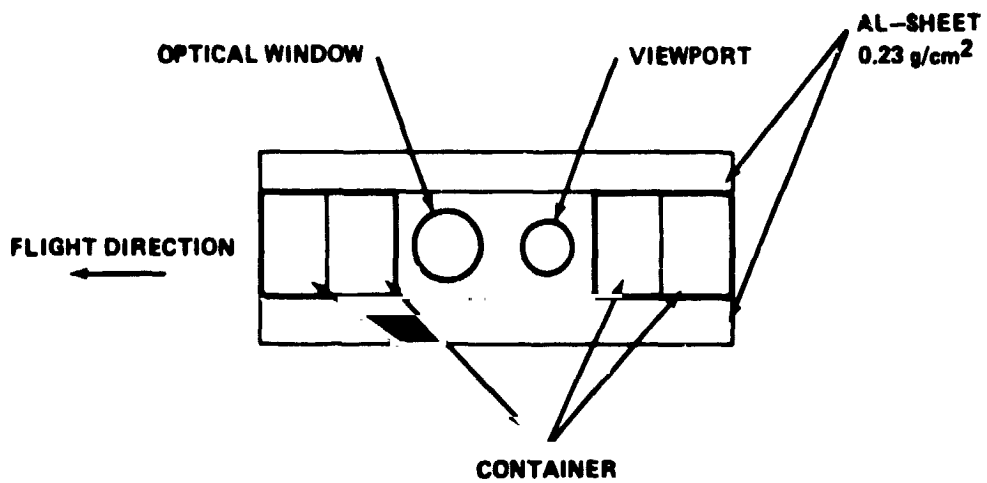


Figure 26. Viewports, feedthroughs, and rack structure for Spacelab short module.





VIEWPORT:	ϕ 300 mm	3 cm QUARTZ GLASS 6.6 g/cm^2
OPTICAL WINDOW:	ϕ 500 mm	3 cm QUARTZ GLASS 6.6 g/cm^2

Figure 27. Overhead structure with optical window for Spacelab short module.

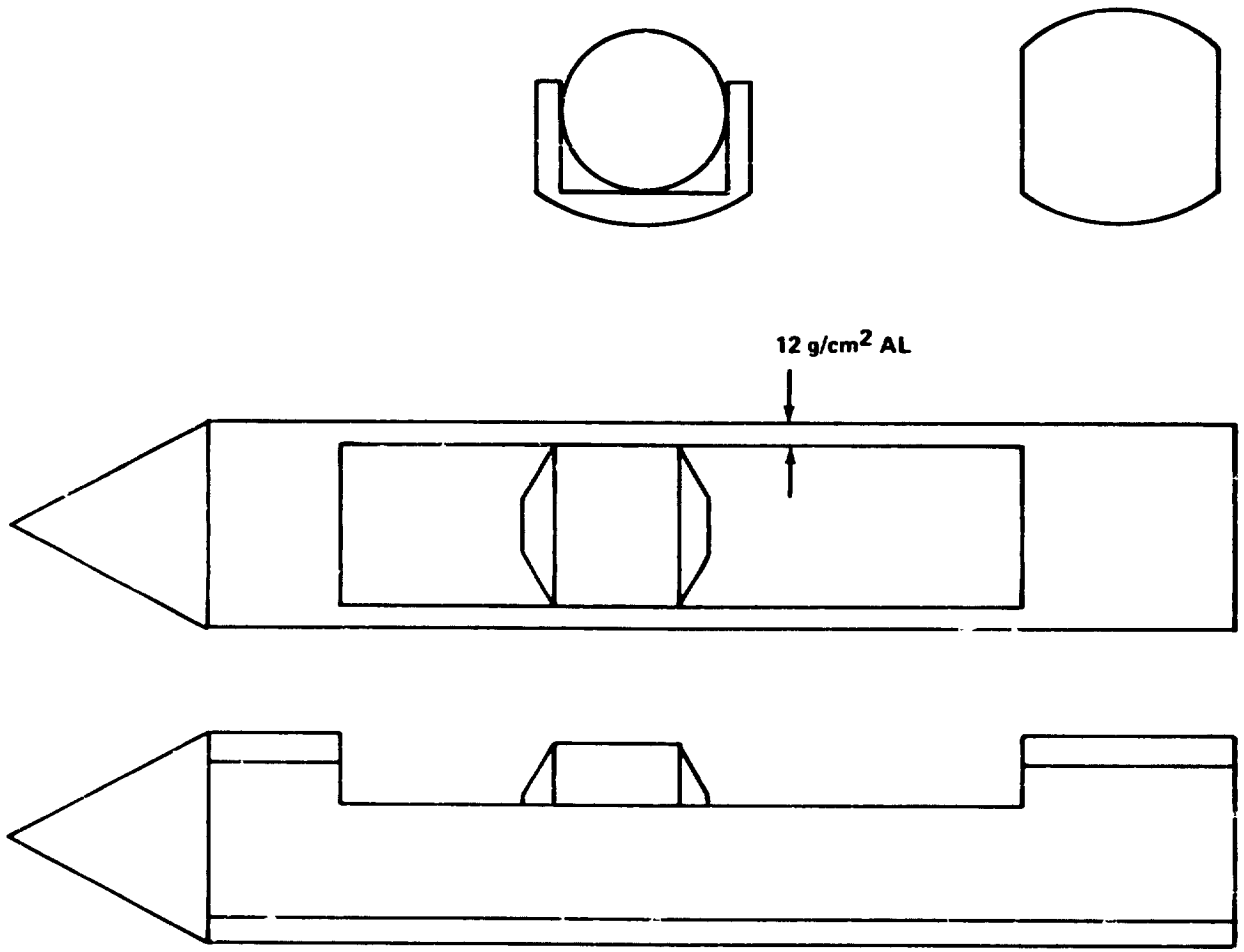


Figure 28. Geometrical configuration of Shuttle model.

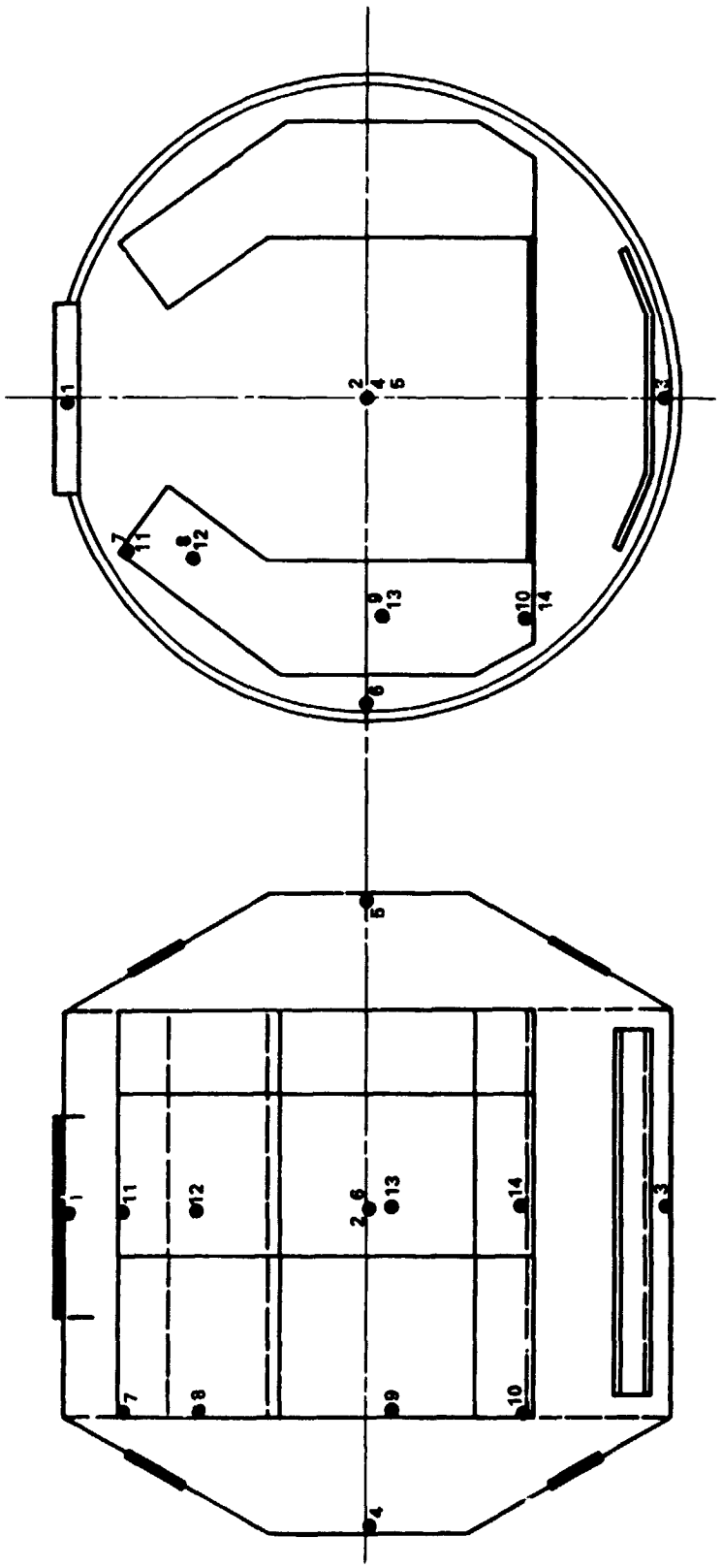


Figure 29. Location of detector points in the Spacelab model for which dose rates were calculated.

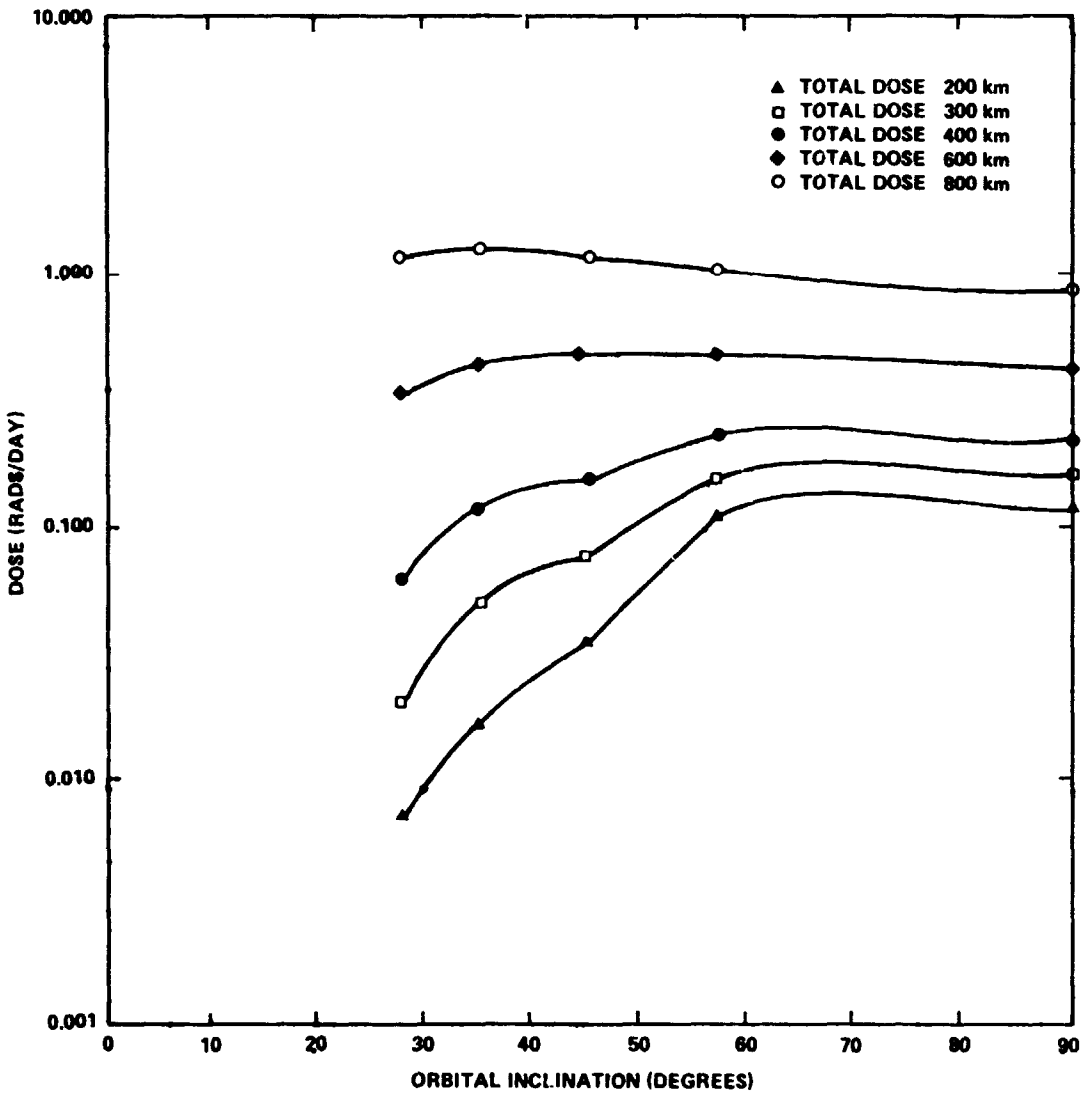


Figure 30. Dose rate as a function of inclination at various altitudes for detector point number 1.

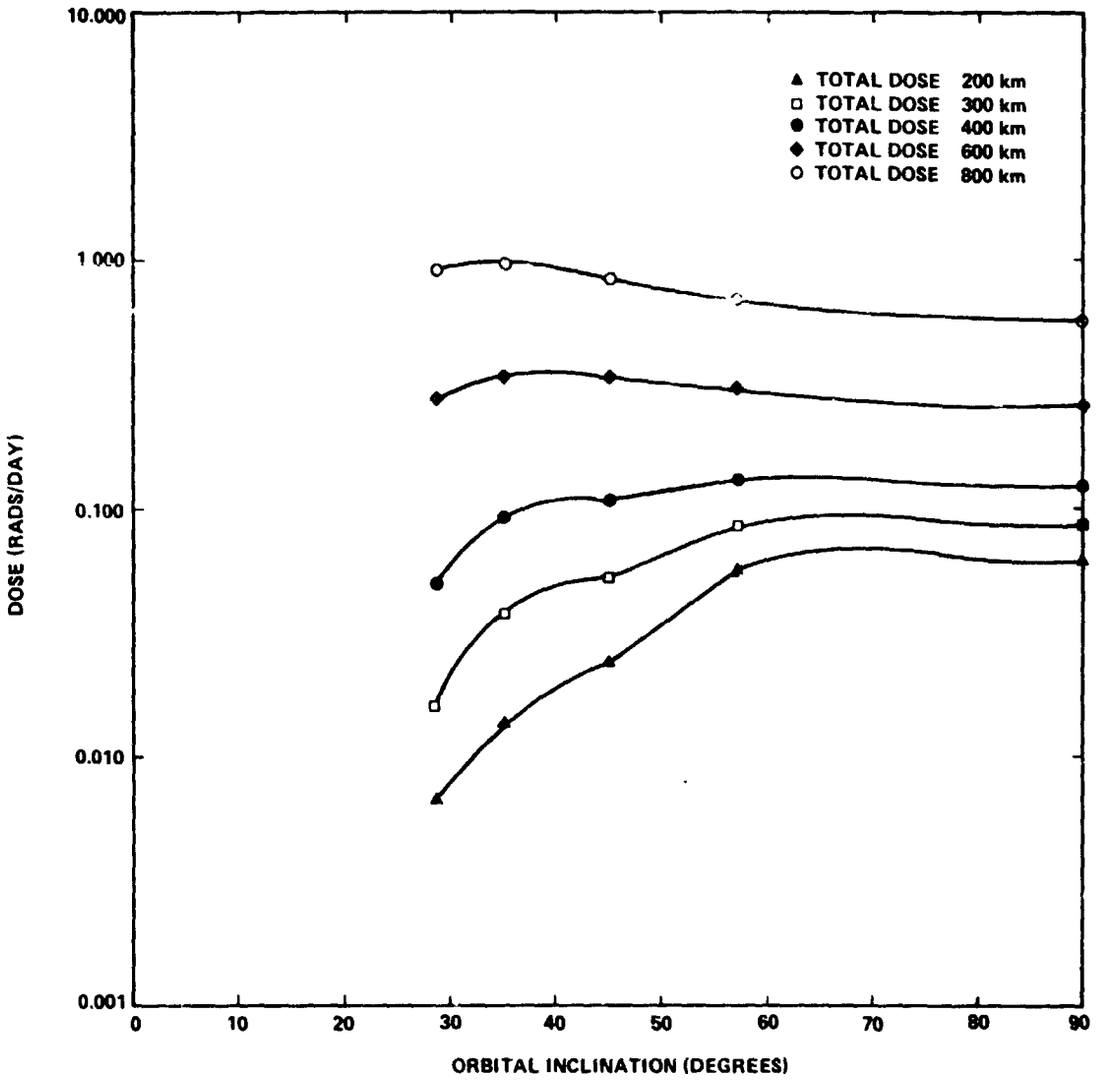


Figure 31. Dose rate as a function of inclination at various altitudes for detector point number 2.

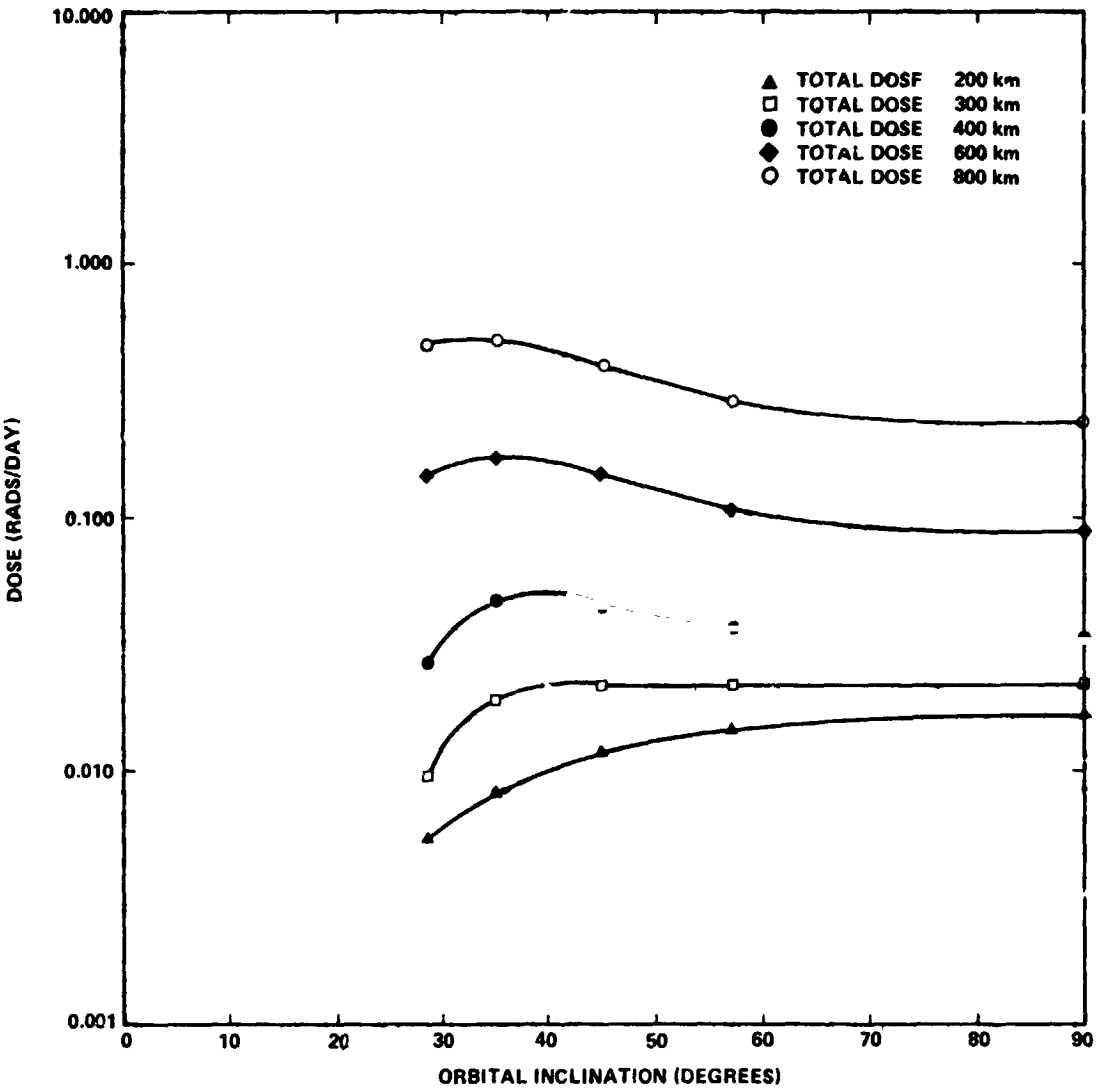


Figure 32. Dose rate as a function of inclination at various altitudes for detector point number 3.

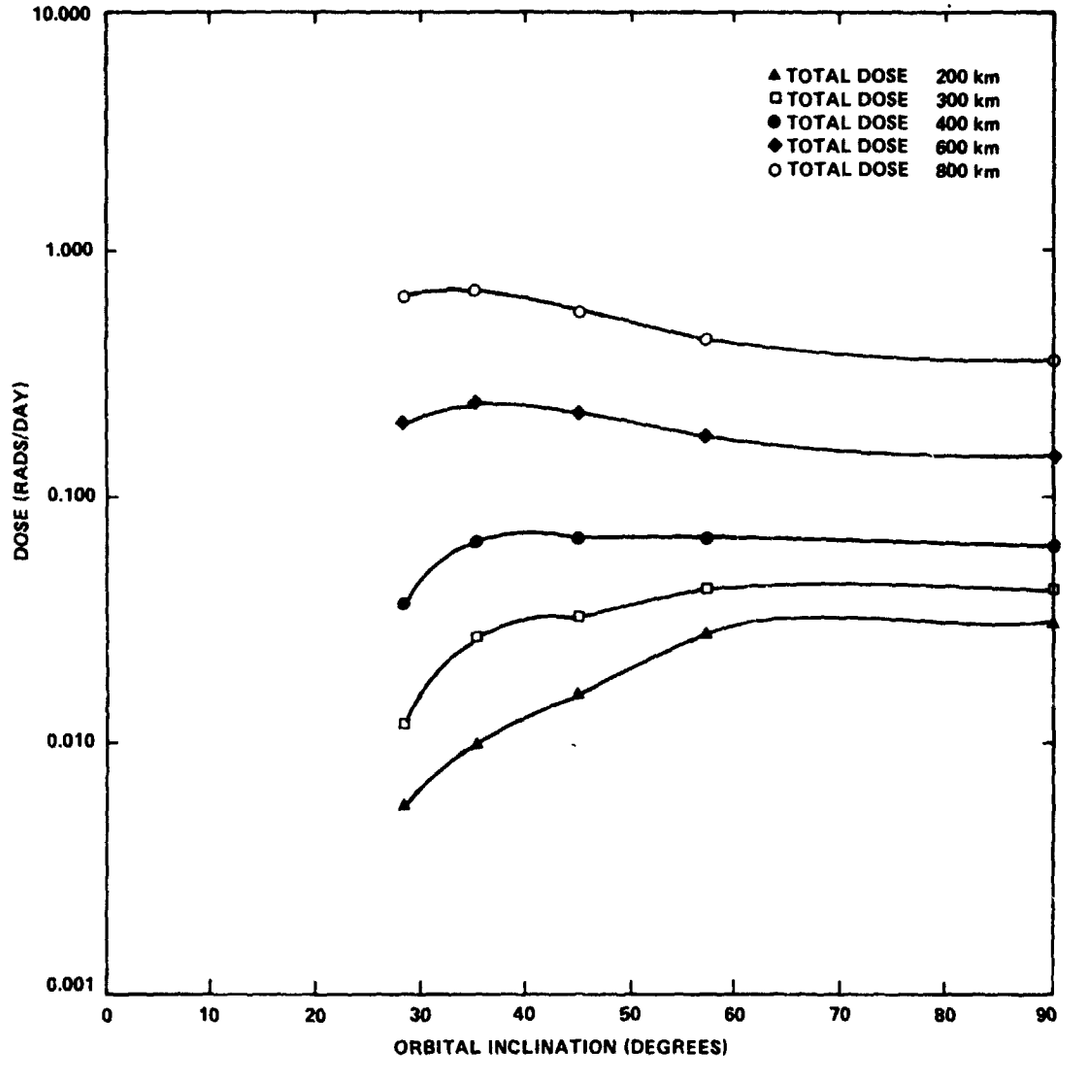


Figure 33. Dose rate as a function of inclination at various altitudes for detector point number 4.

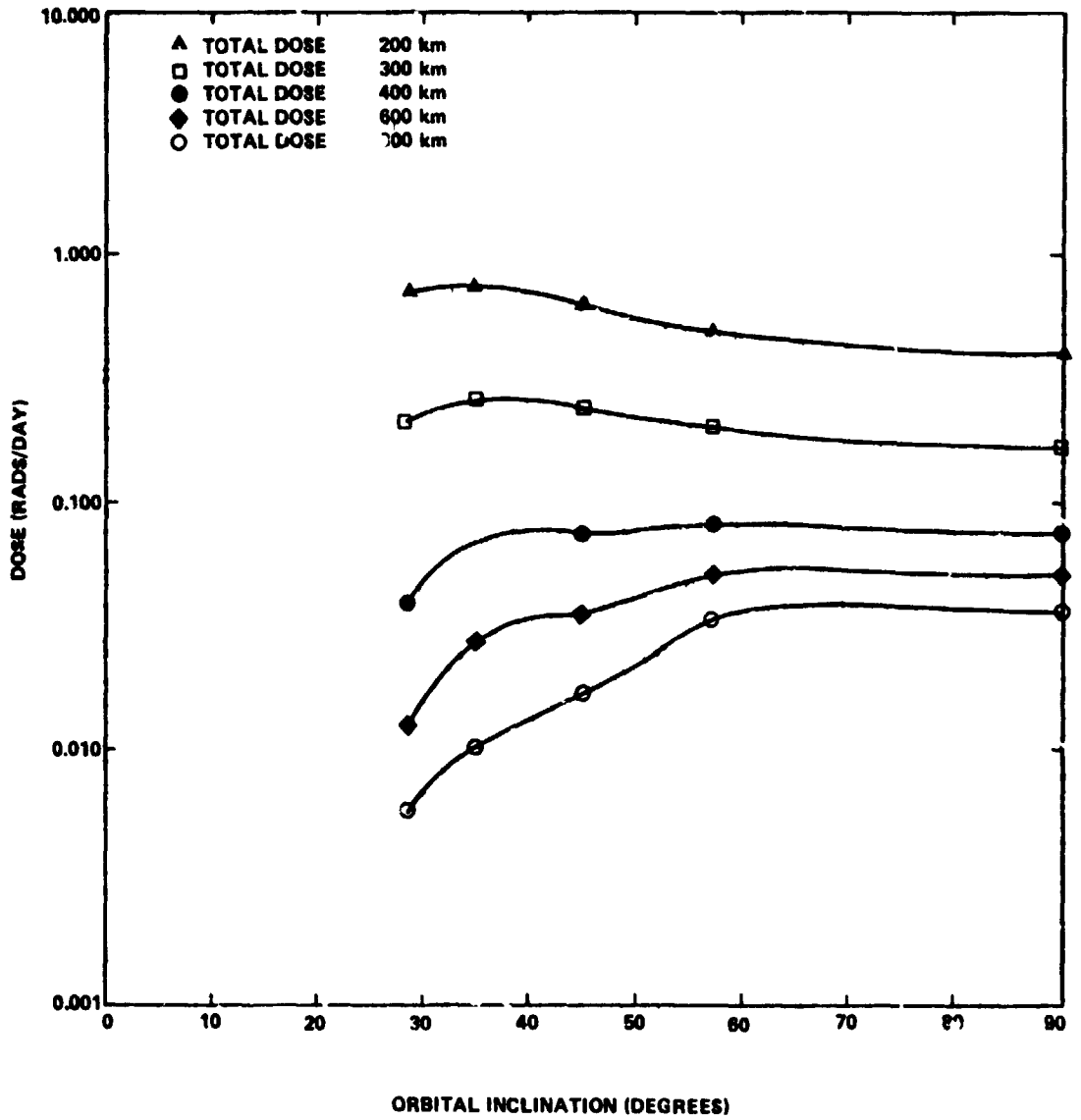


Figure 34. Dose rate as a function of inclination at various altitudes for detector point number 5.

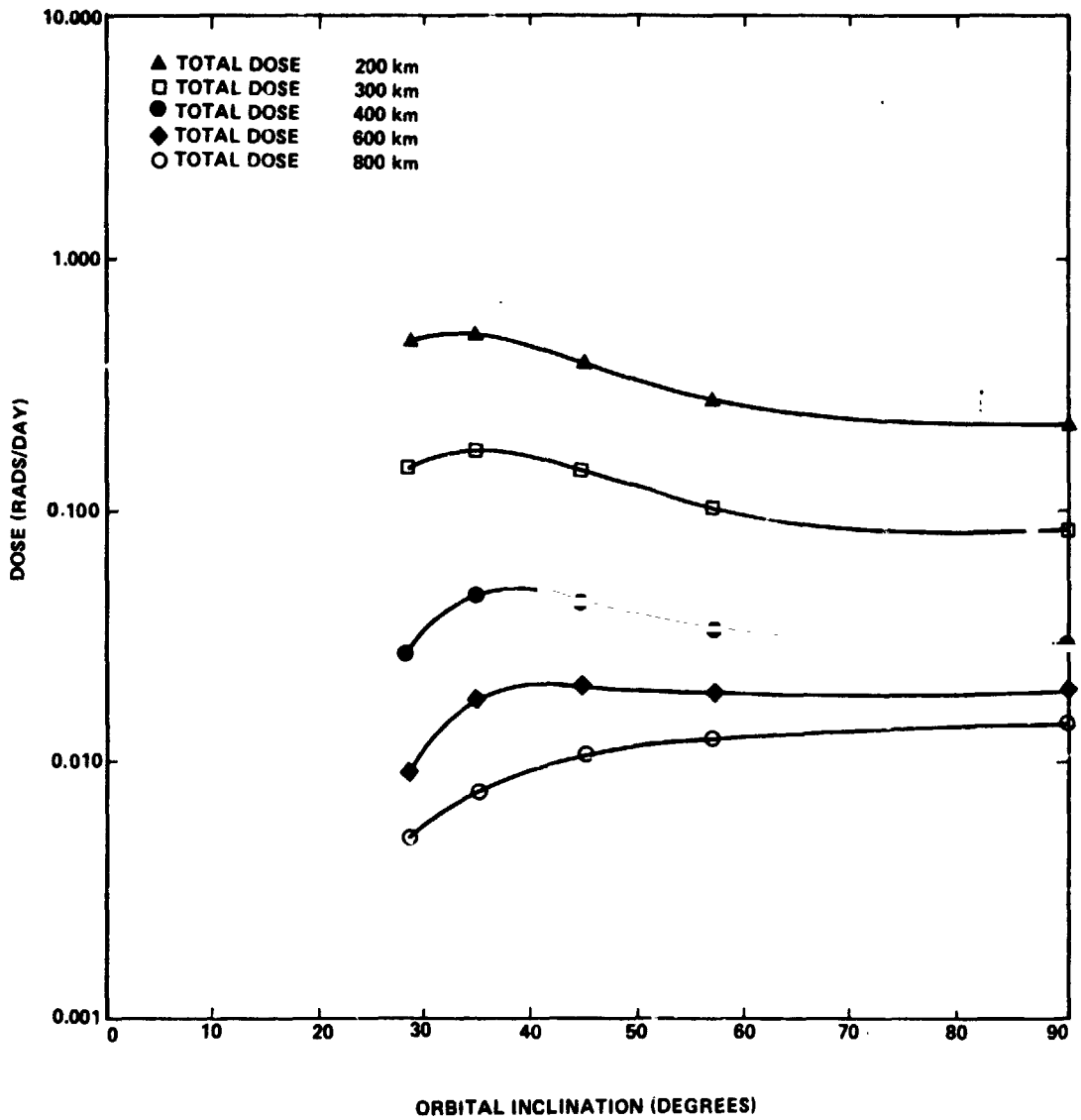


Figure 35. Dose rate as a function of inclination at various altitudes for detector point number 6.

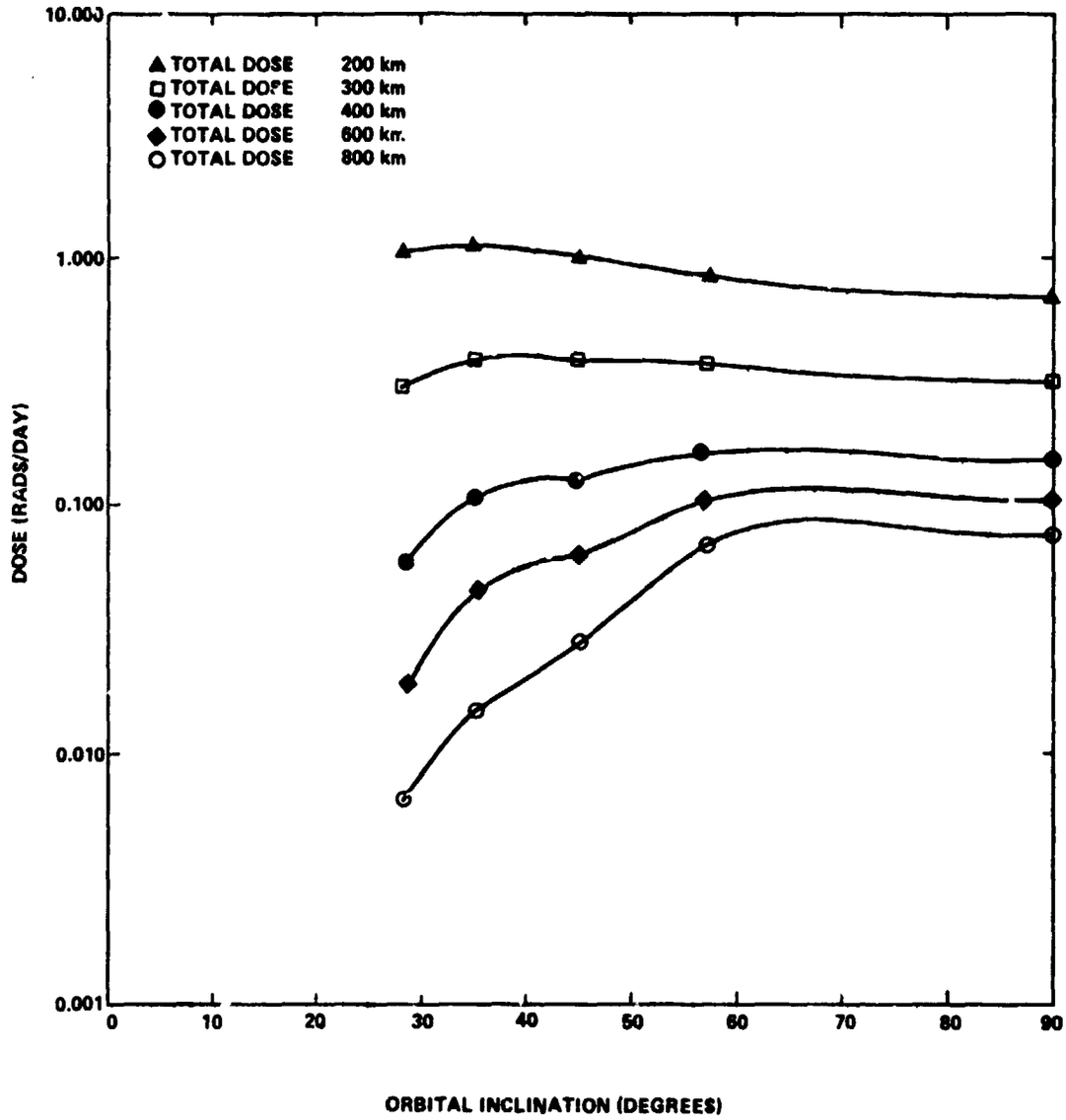


Figure 36. Dose rate as a function of inclination at various altitudes for detector point number 7.

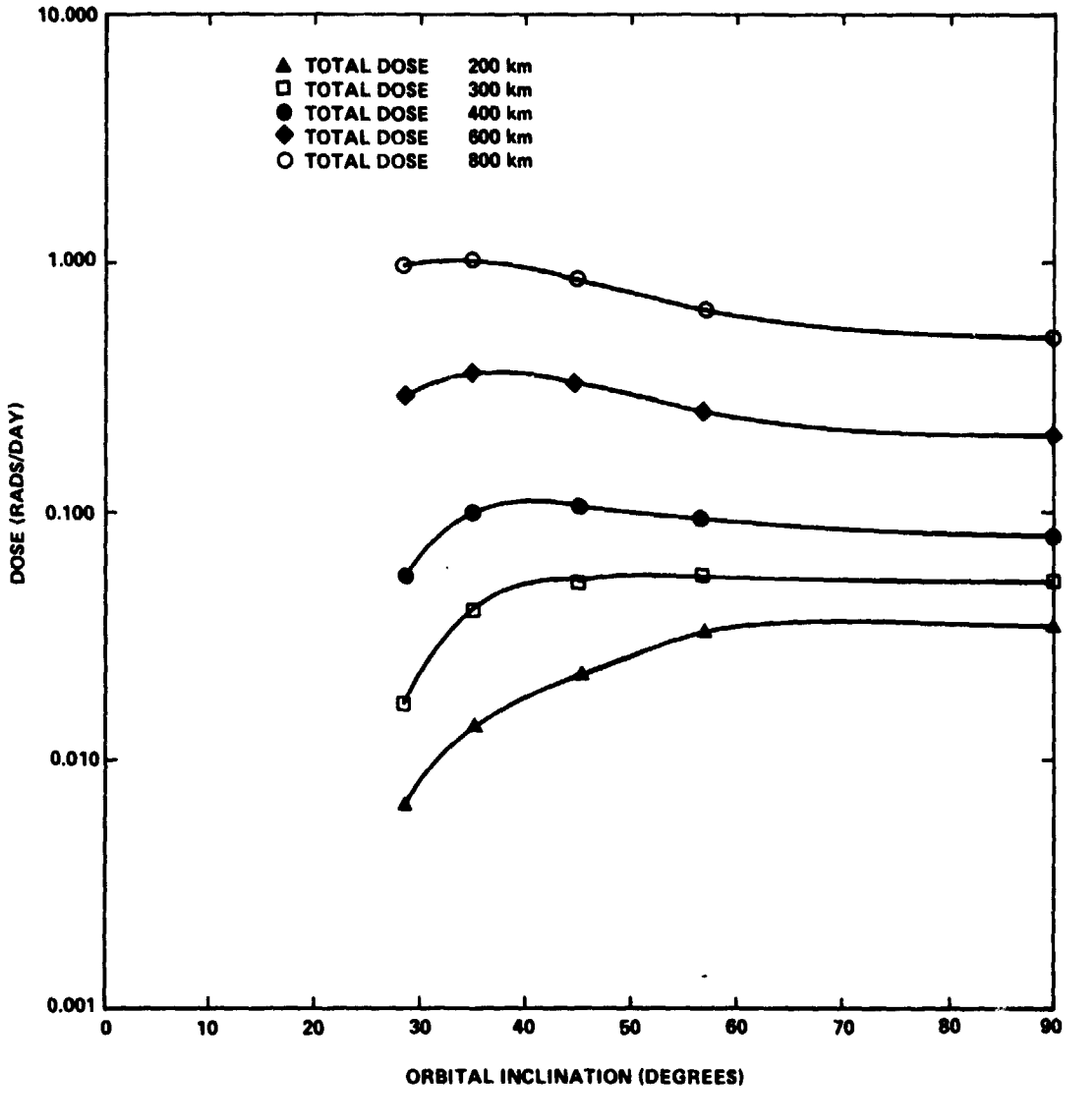


Figure 37. Dose rate as a function of inclination at various altitudes for detector point number 8.

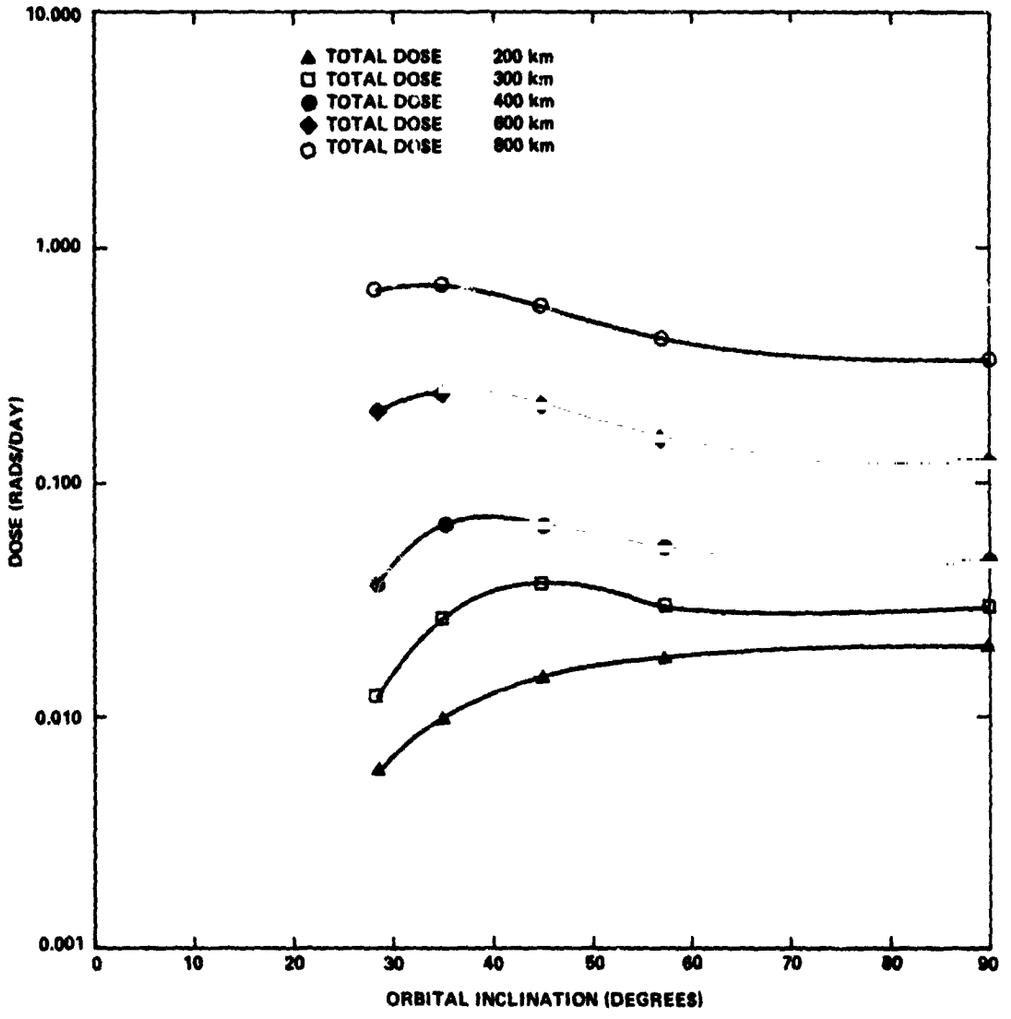


Figure 38. Dose rate as a function of inclination at various altitudes for detector point number 9.

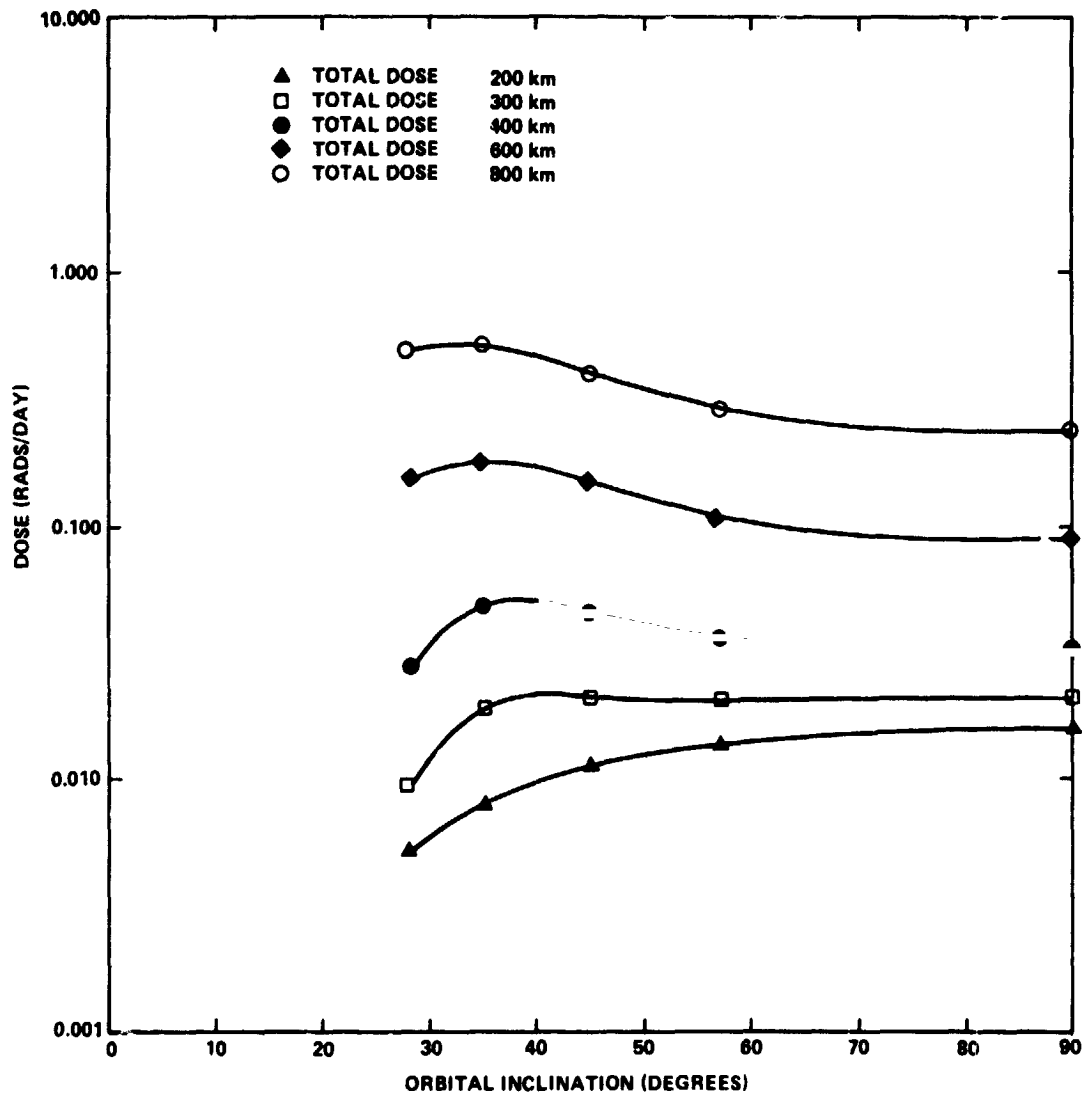


Figure 39. Dose rate as a function of inclination at various altitudes for detector point number 10.

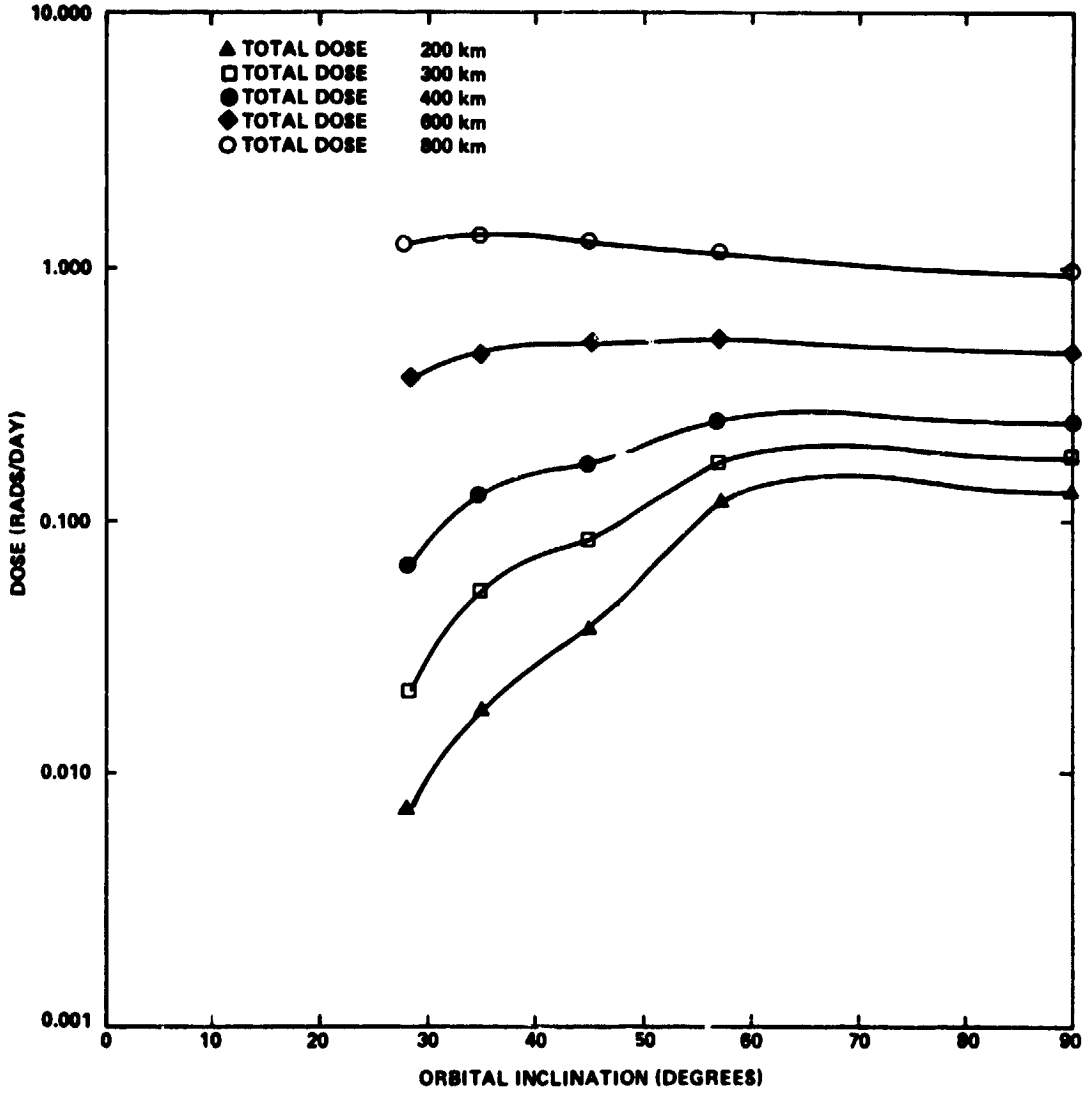


Figure 40. Dose rate as a function of inclination at various altitudes for detector point number 11.

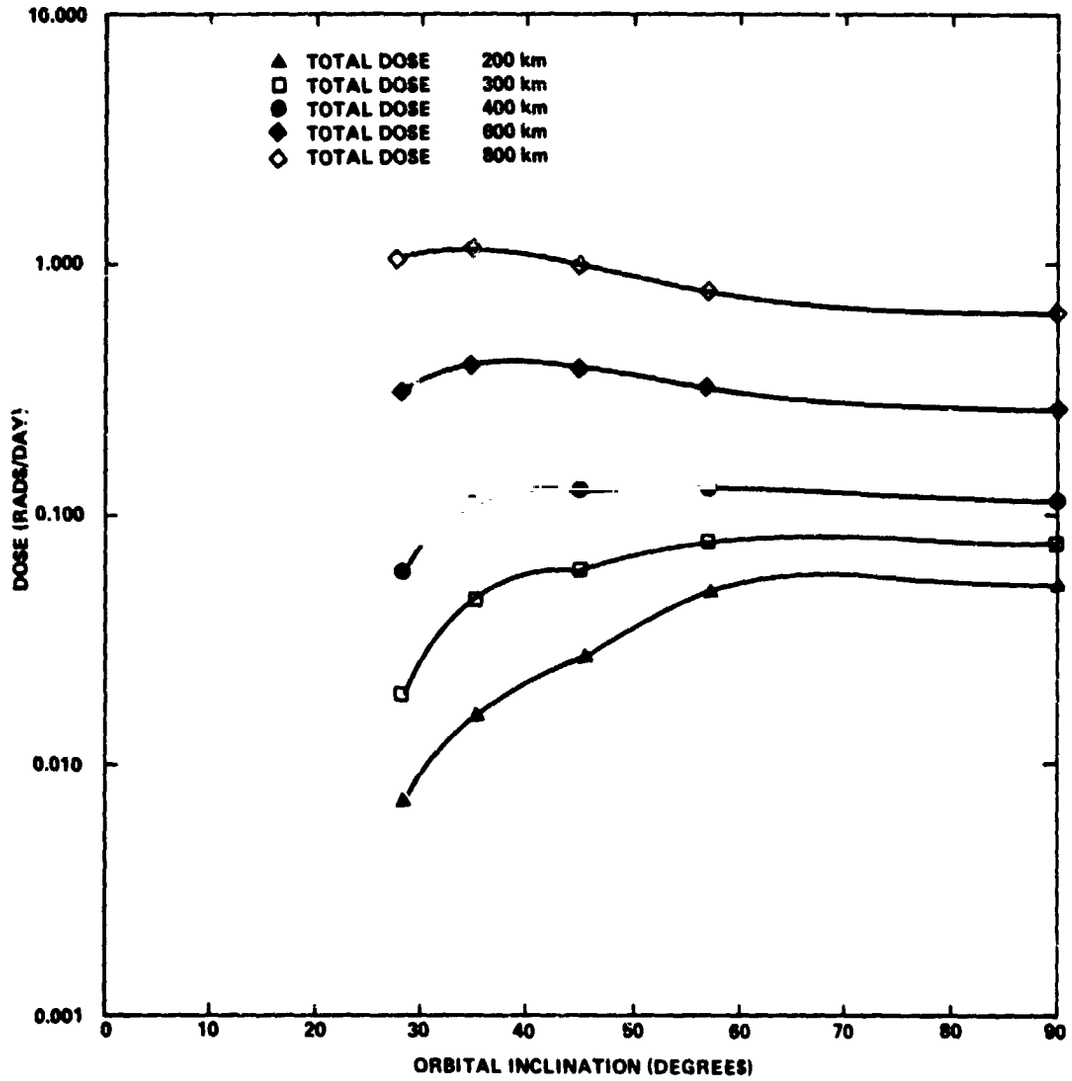


Figure 41. Dose rate as a function of inclination at various altitudes for detector point number 12.

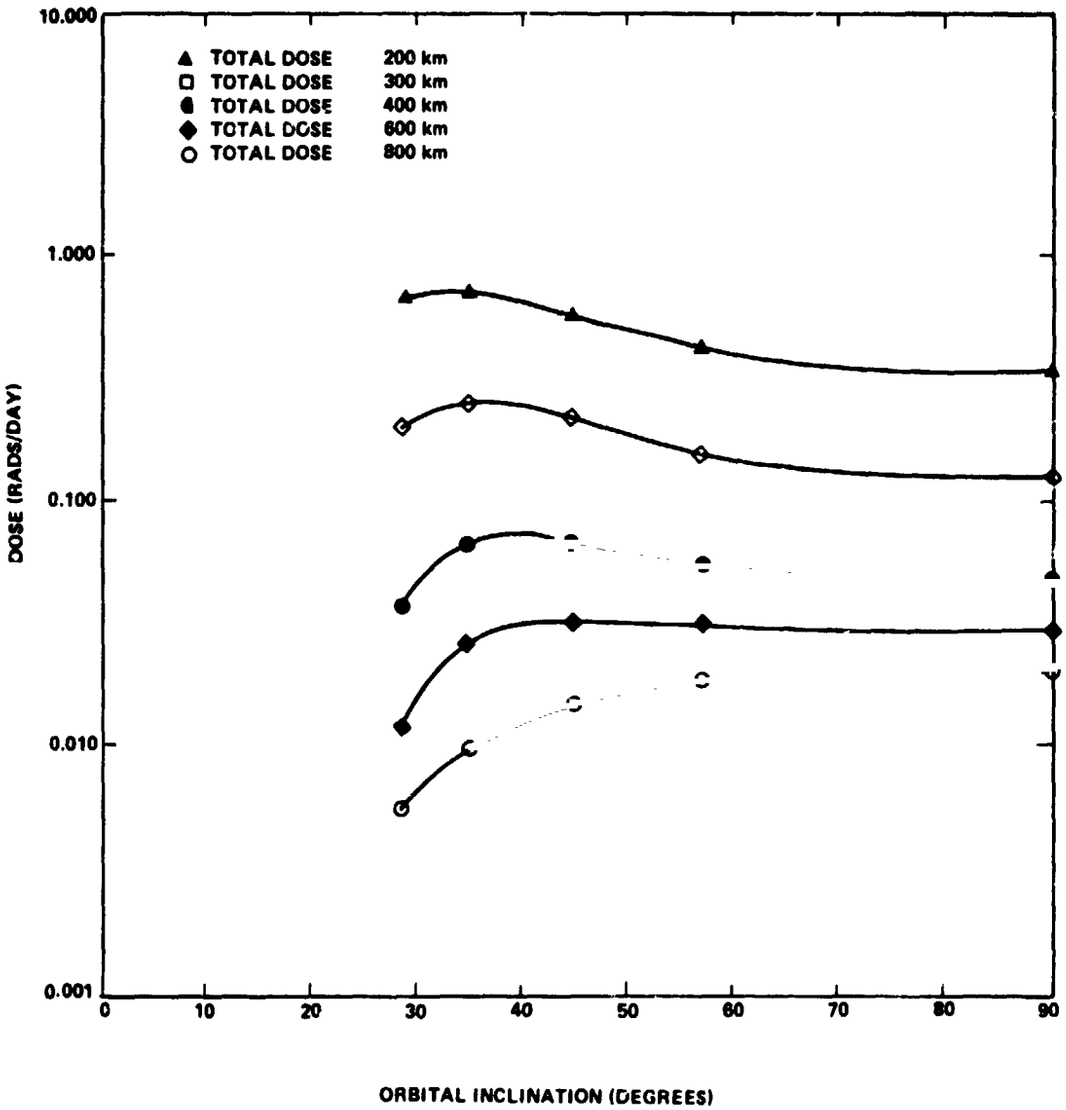


Figure 42. Dose rate as a function of inclination at various altitudes for detector point number 13.

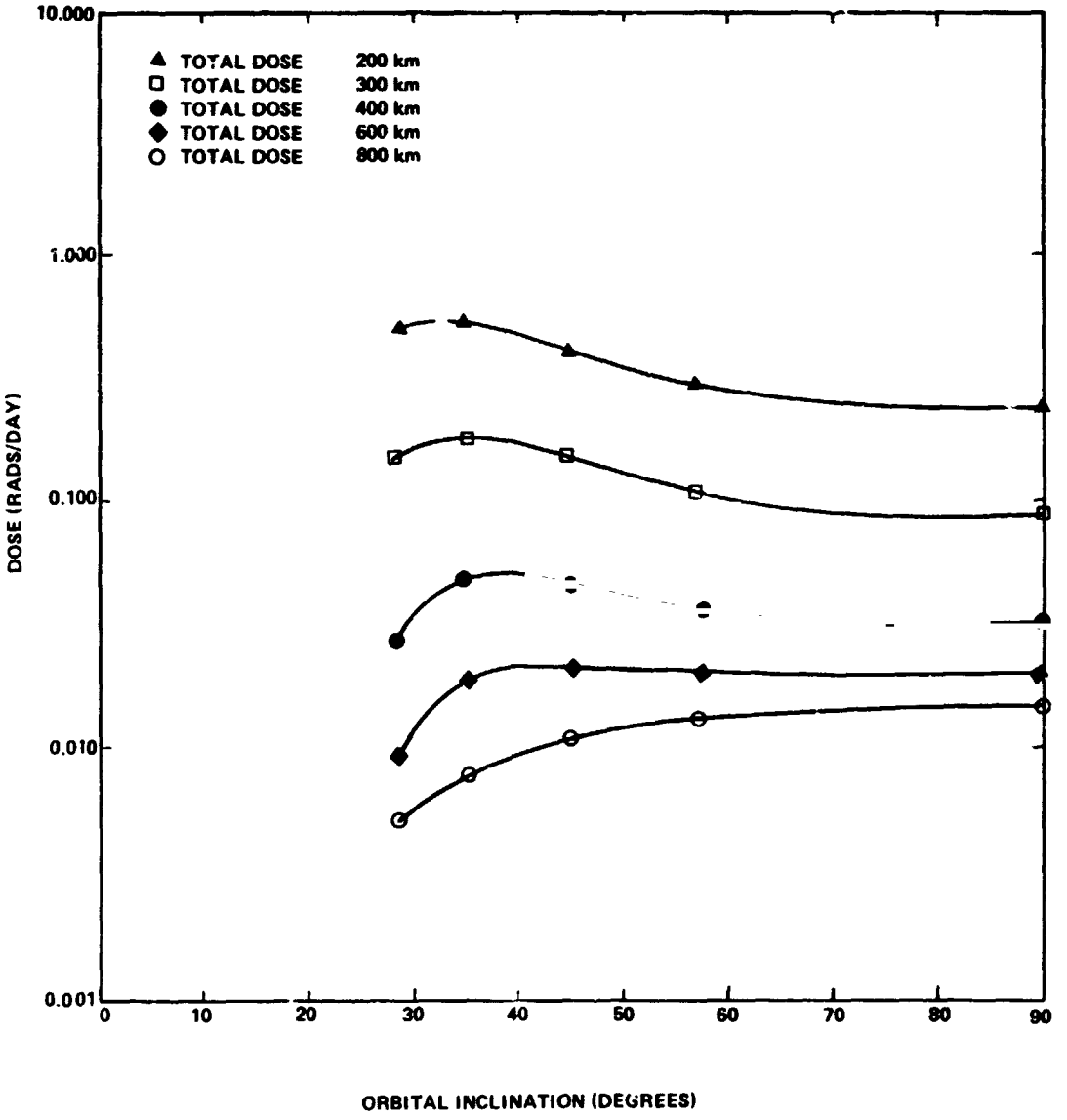


Figure 43. Dose rate as a function of inclination at various altitudes for detector point number 14.

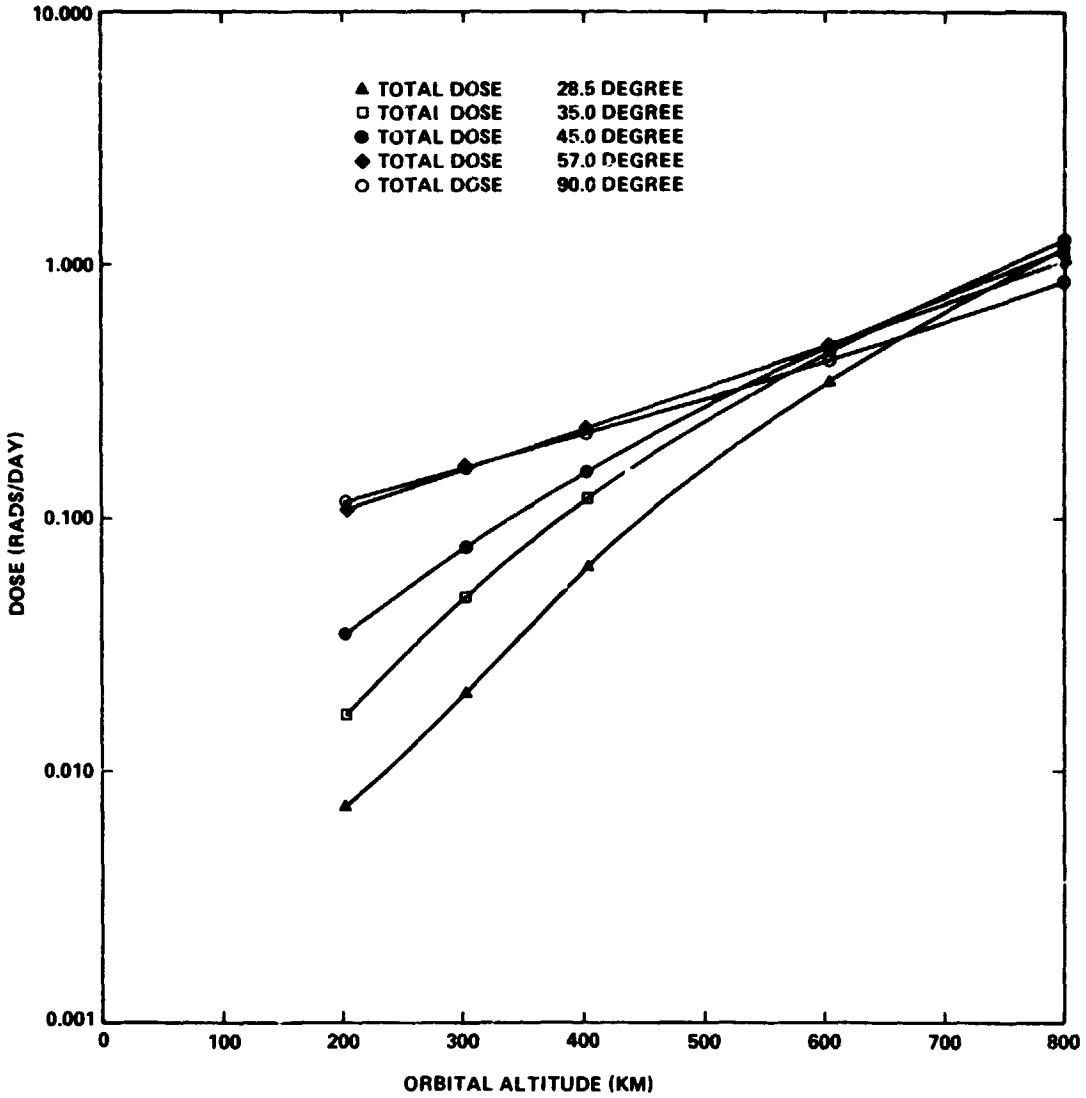


Figure 44. Dose rate as a function of altitude at various inclinations for detector point number 1.

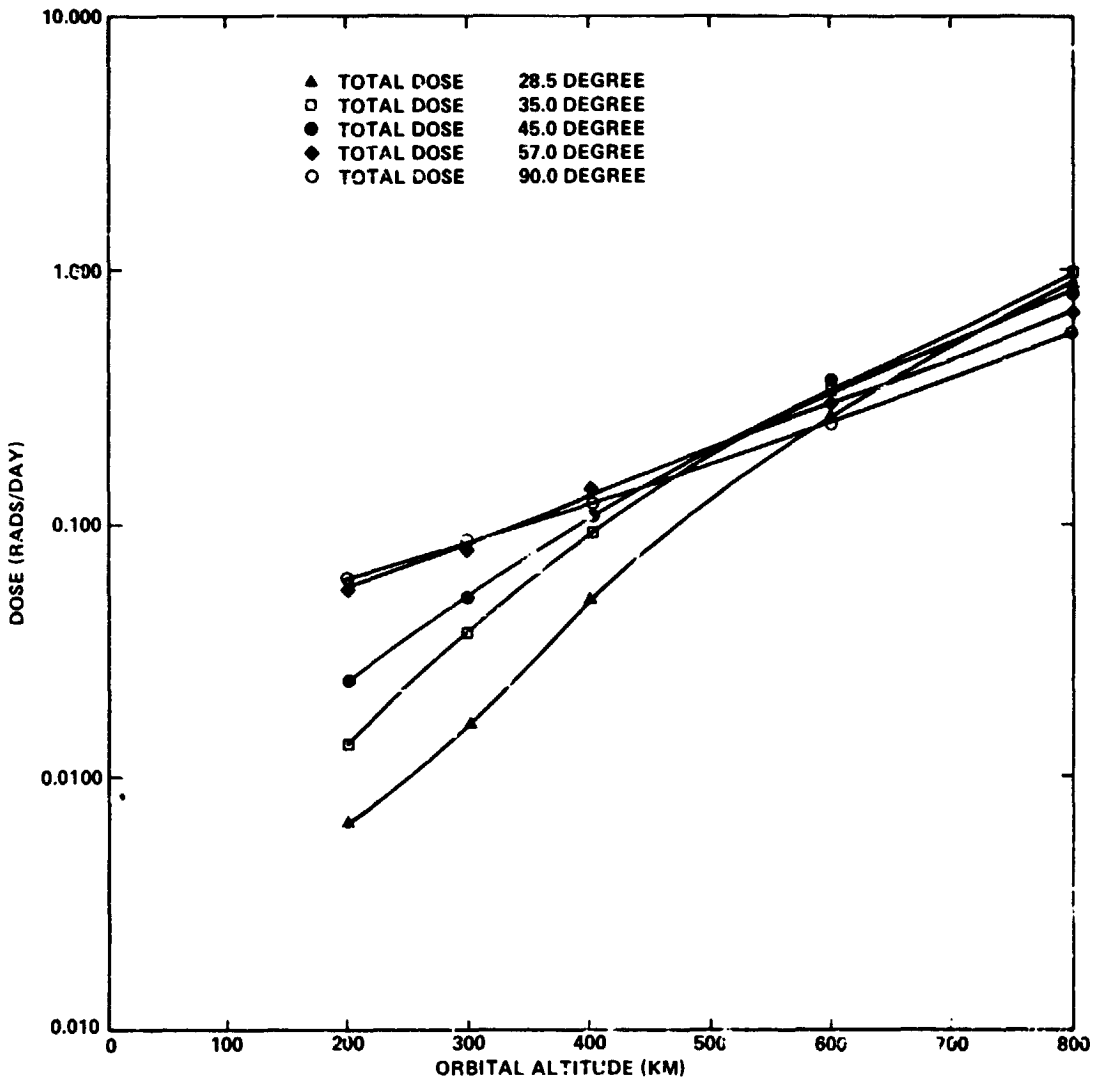


Figure 45. Dose rate as a function of altitude at various inclinations for detector point number 2.

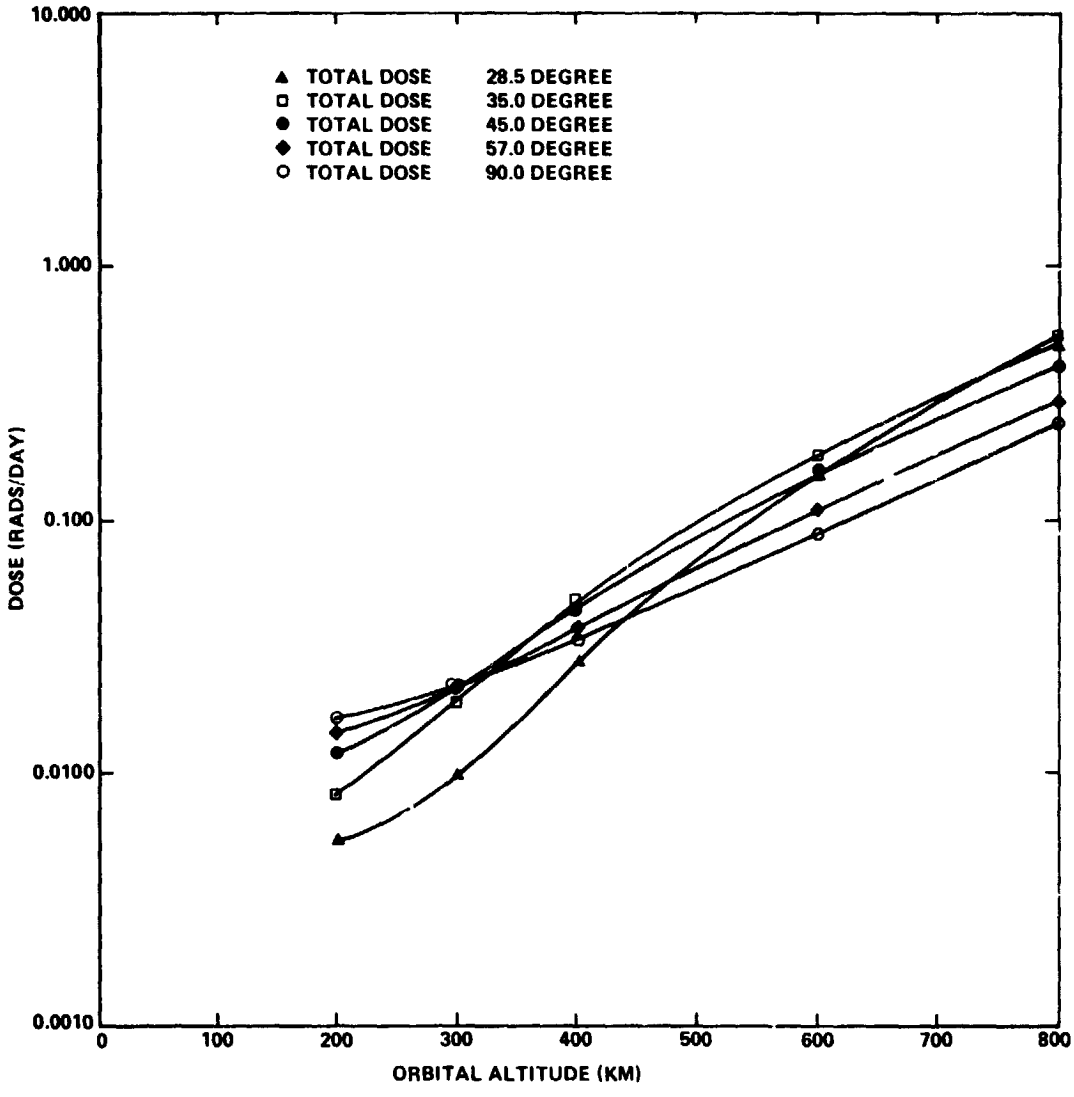


Figure 46. Dose rate as a function of altitude at various inclinations for detector point number 3.

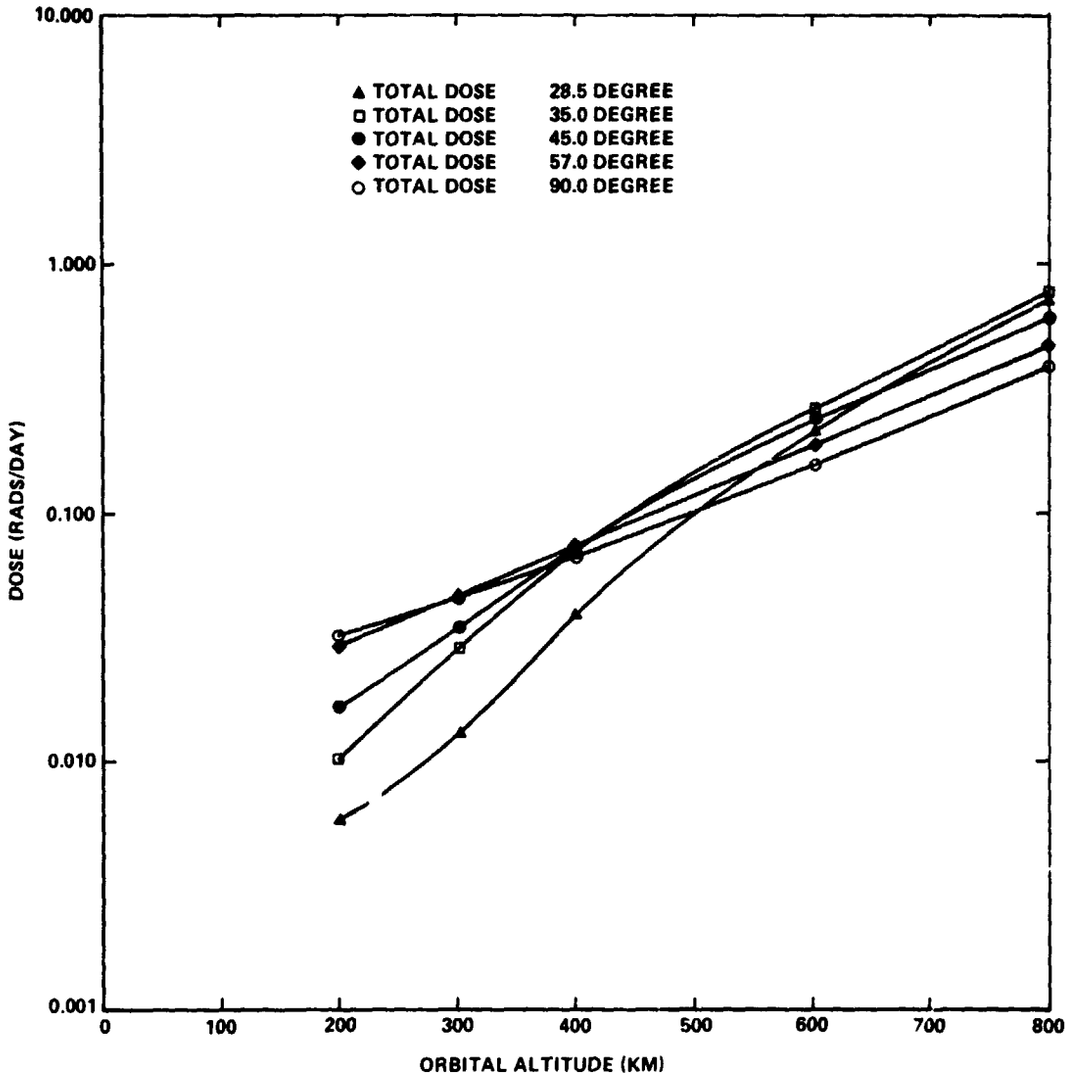


Figure 47. Dose rate as a function of altitude at various inclinations for detector point number 4.

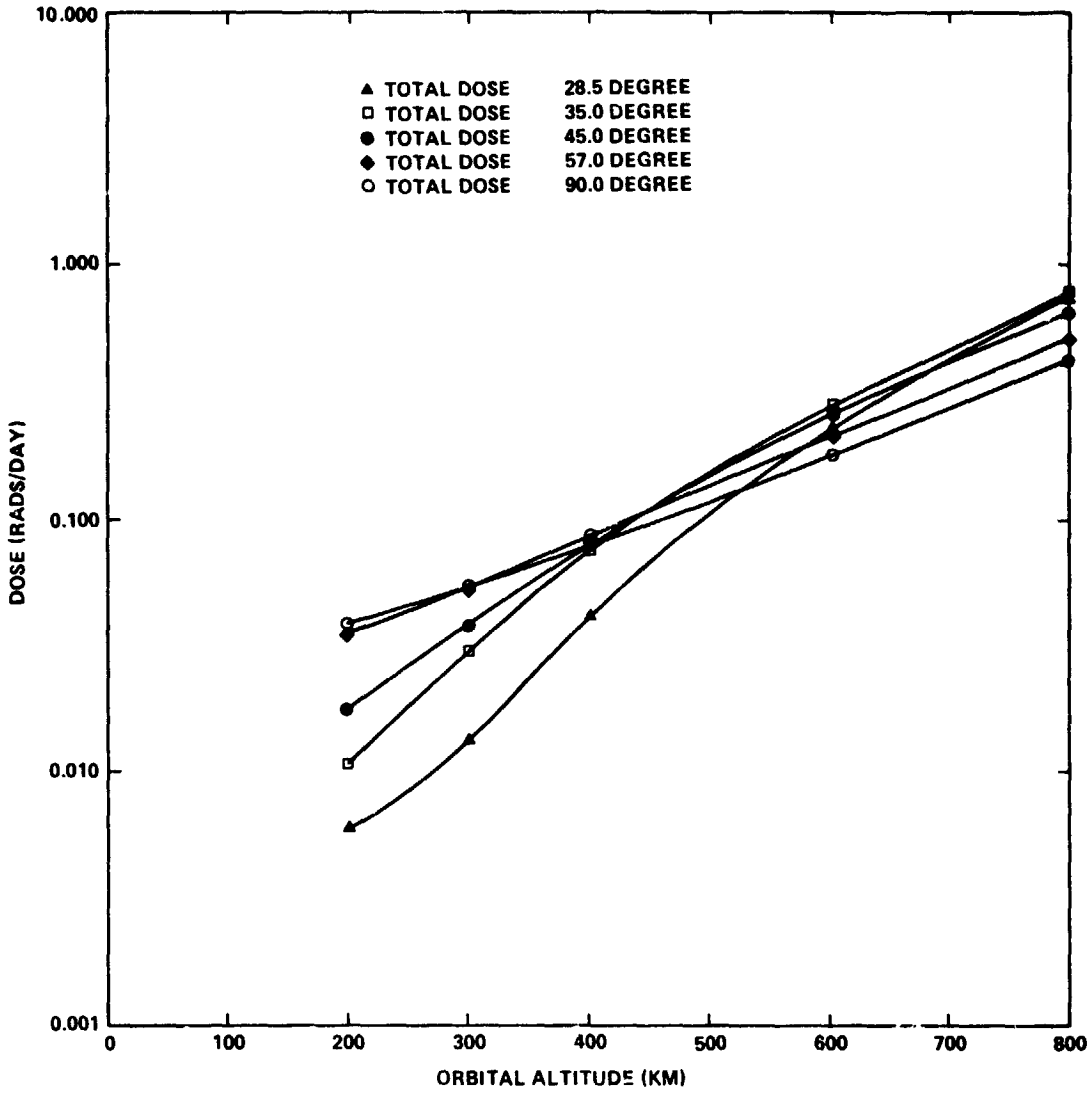


Figure 48. Dose rate as a function of altitude at various inclinations for detector point number 5.

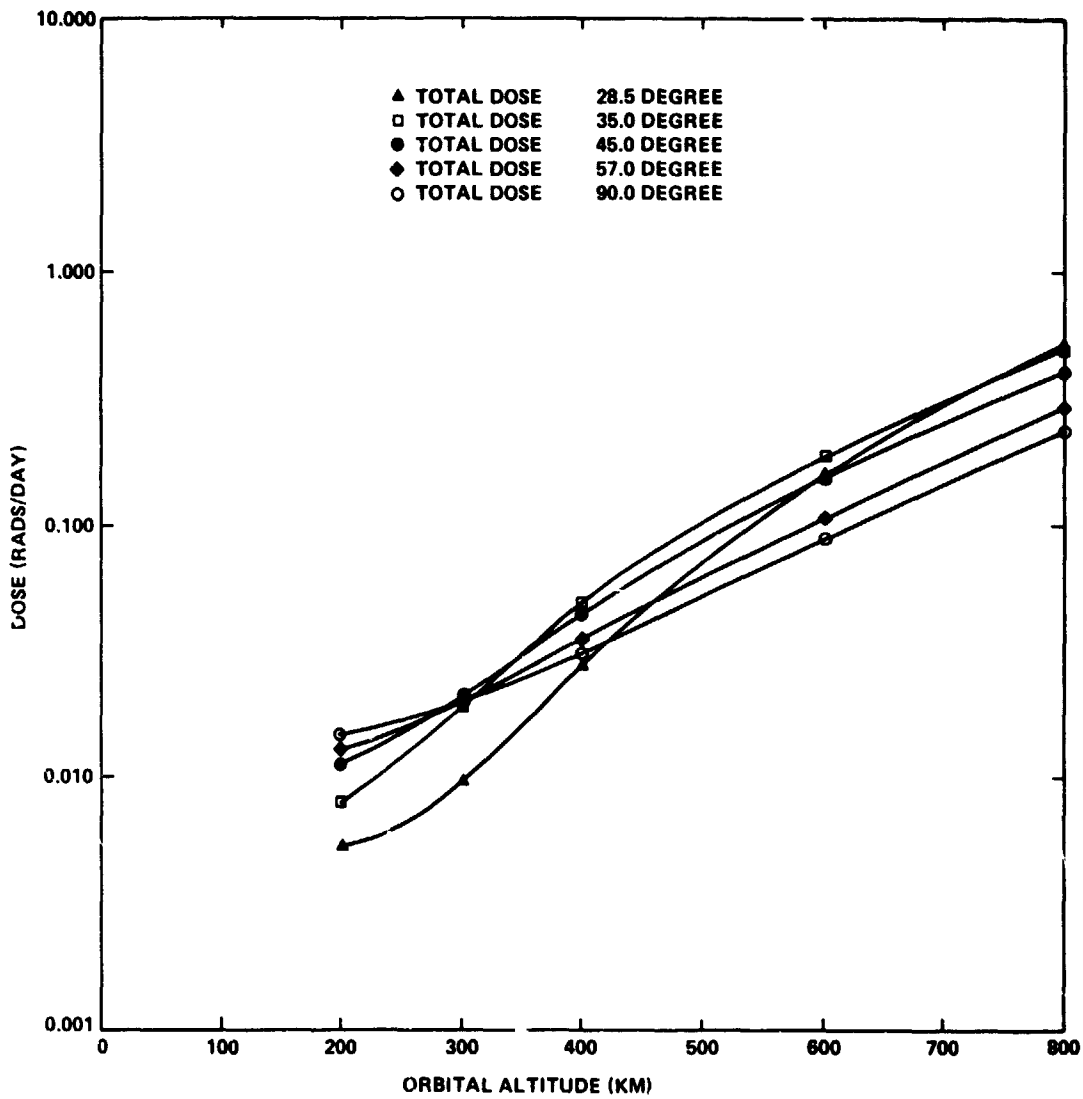


Figure 49. Dose rate as a function of altitude at various inclinations for detector point number 6.

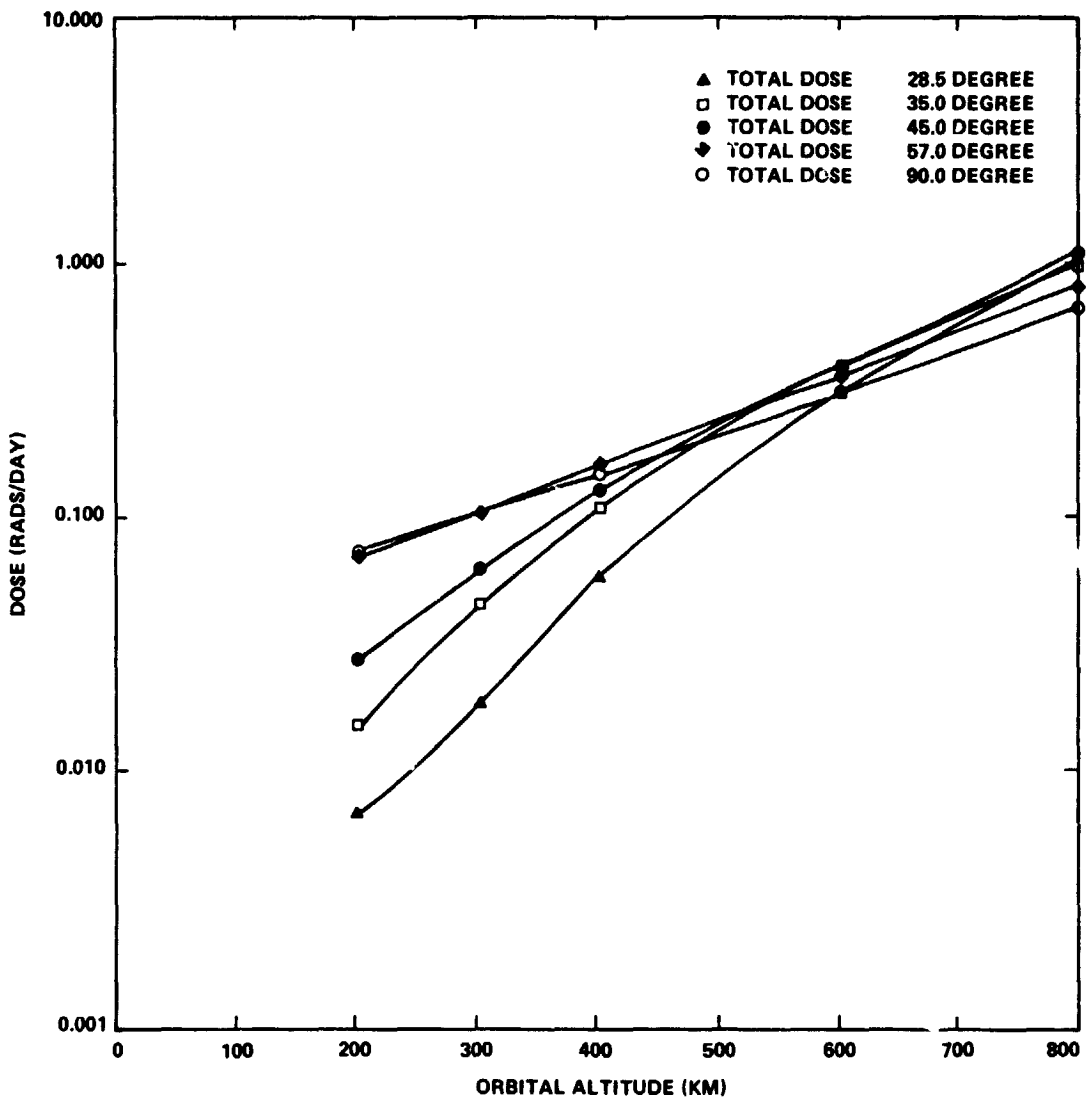


Figure 50. Dose rate as a function of altitude at various inclinations for detector point number 7.

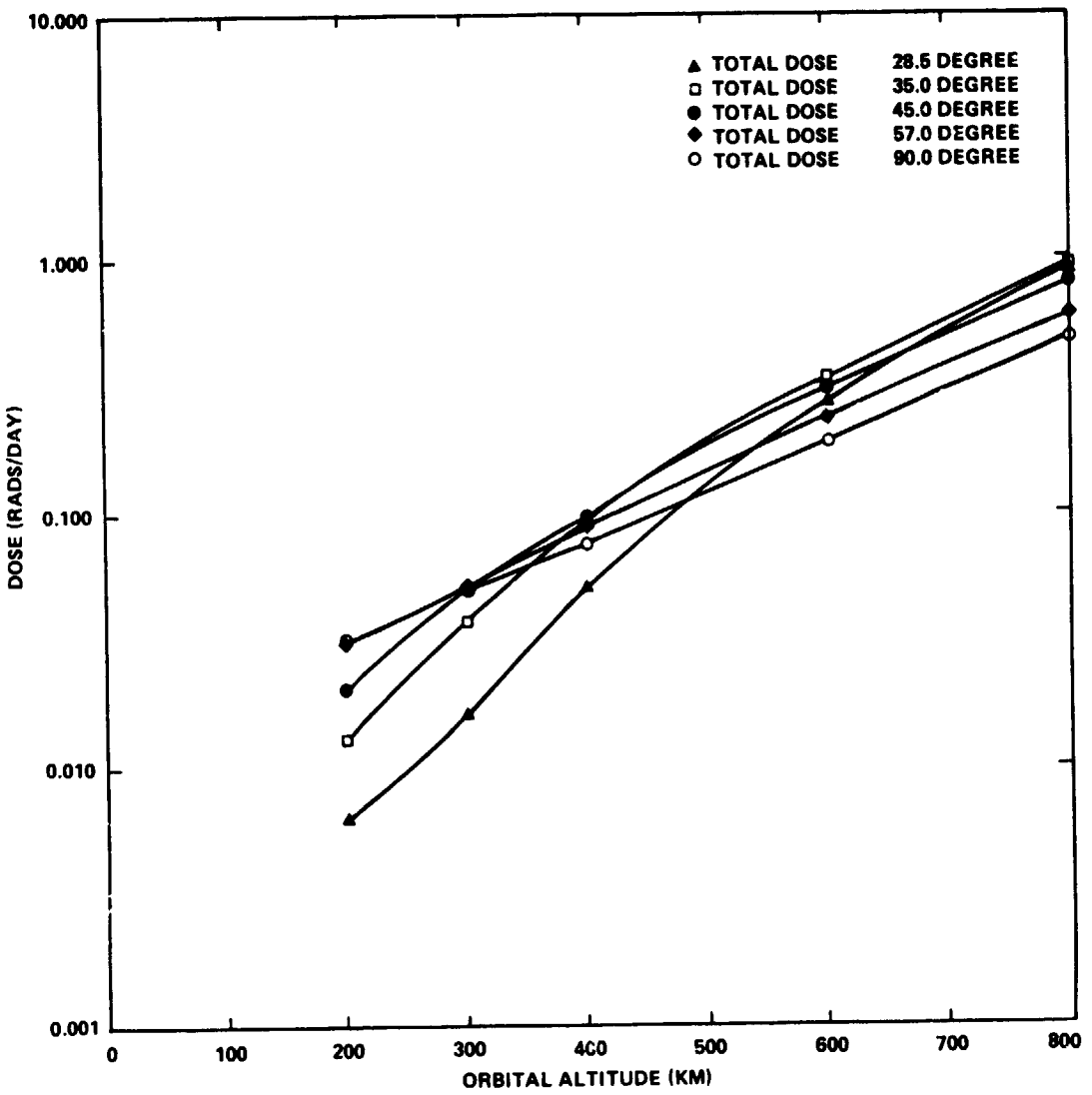


Figure 51. Dose rate as a function of altitude at various inclinations for detector point number 8.

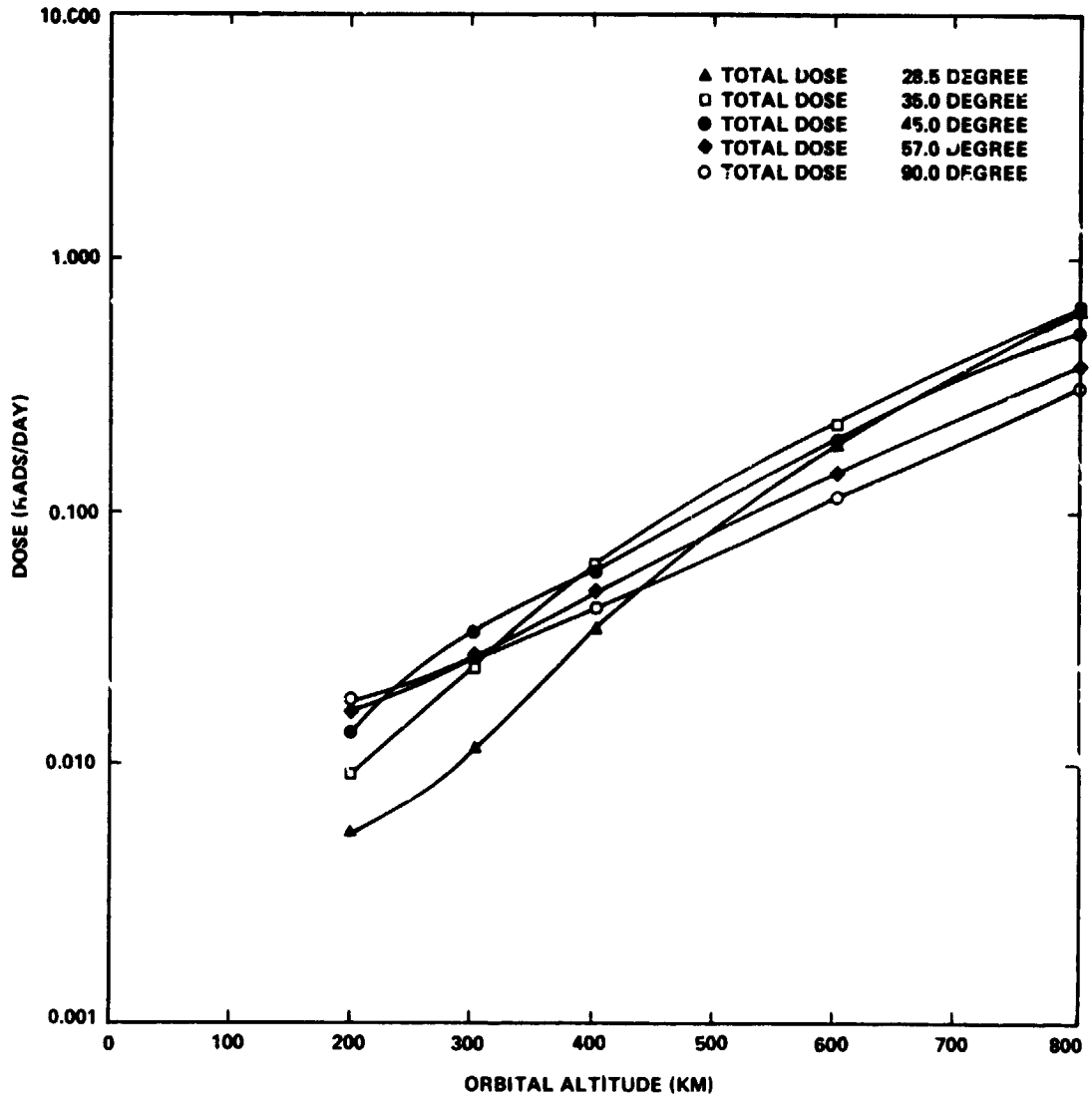


Figure 52. Dose rate as a function of altitude at various inclinations for detector point number 9.

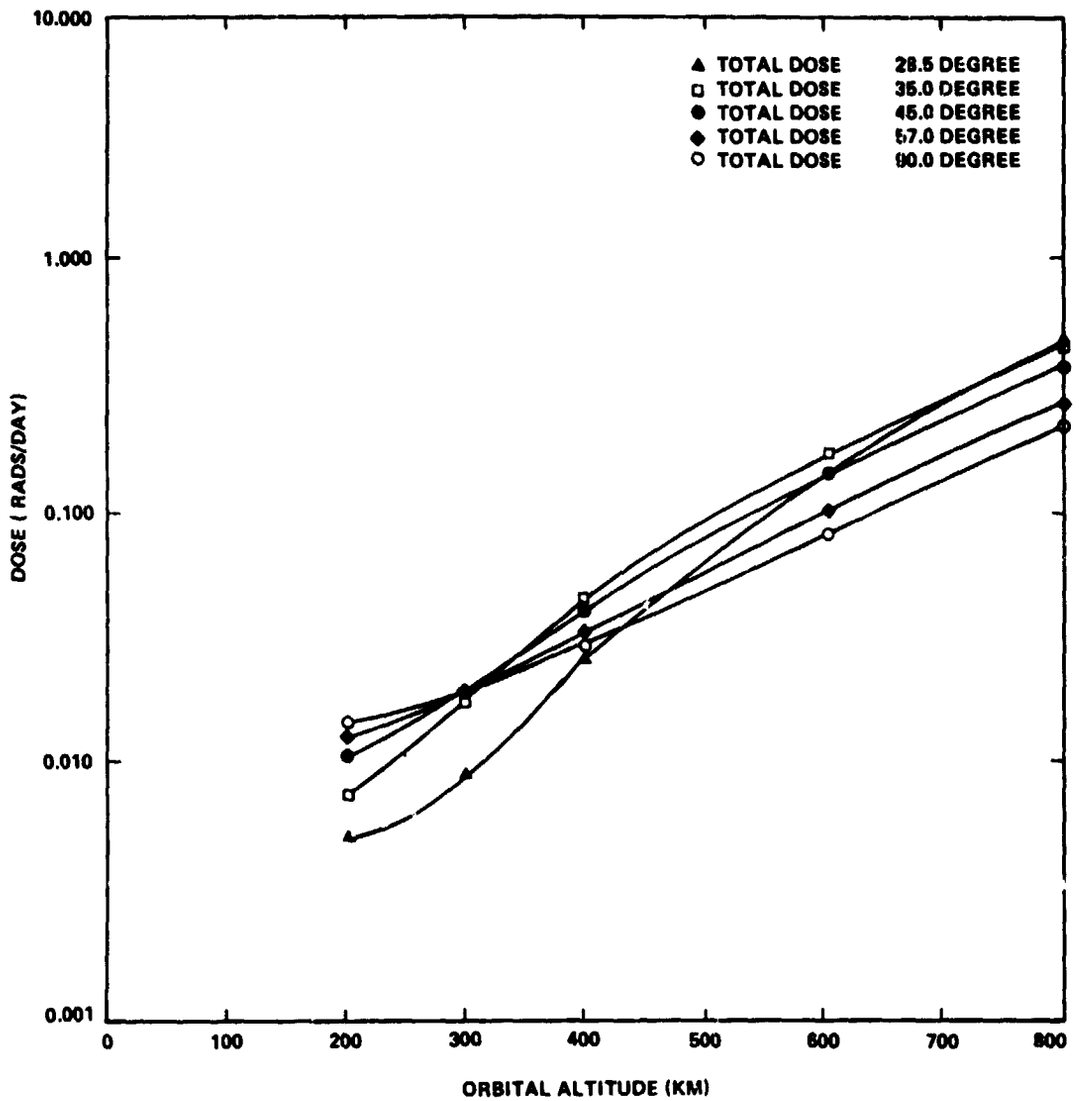


Figure 53. Dose rate as a function of altitude at various inclinations for detector point number 10.

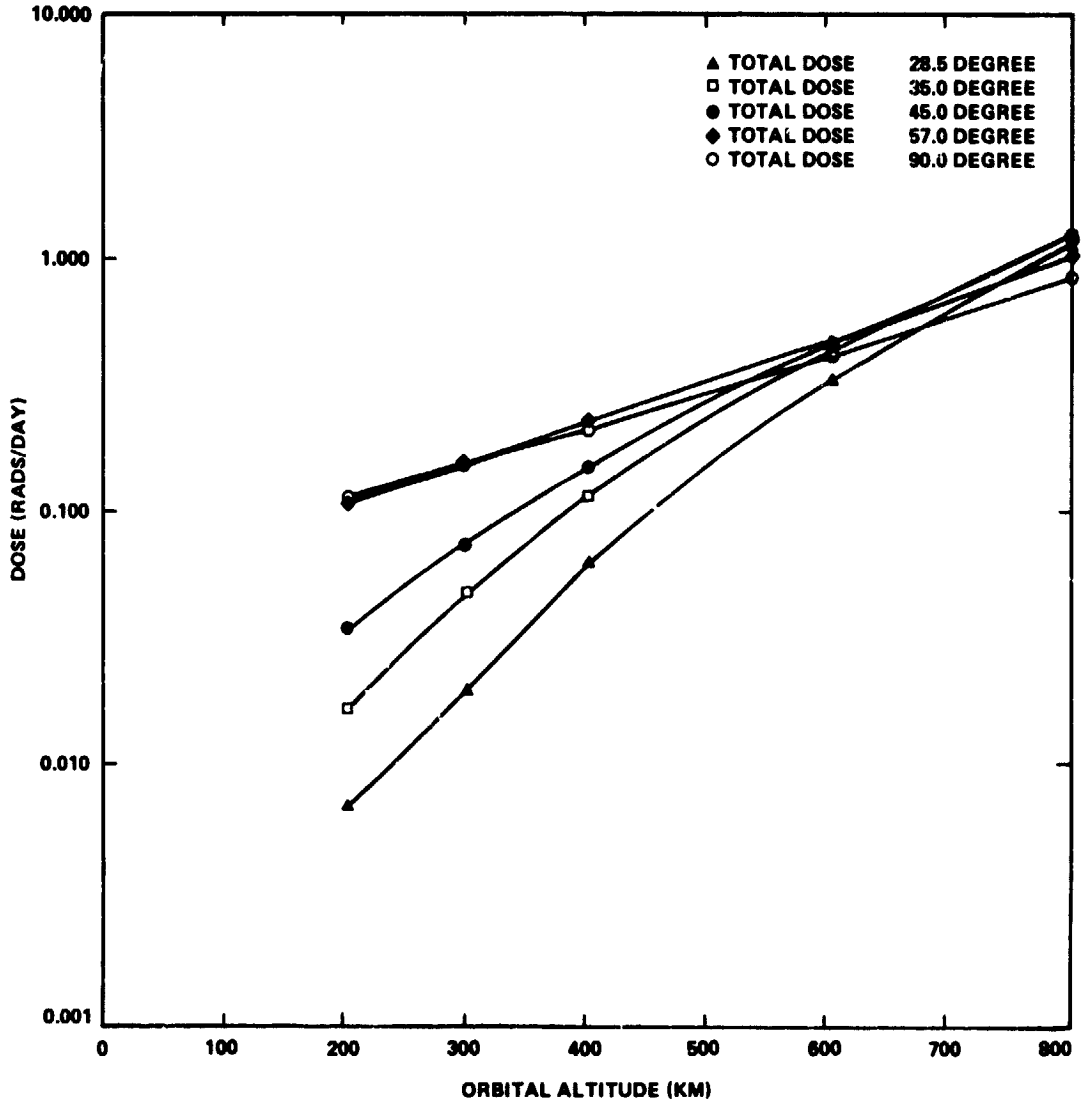


Figure 54. Dose rate as a function of altitude at various inclinations for detector point number 11.

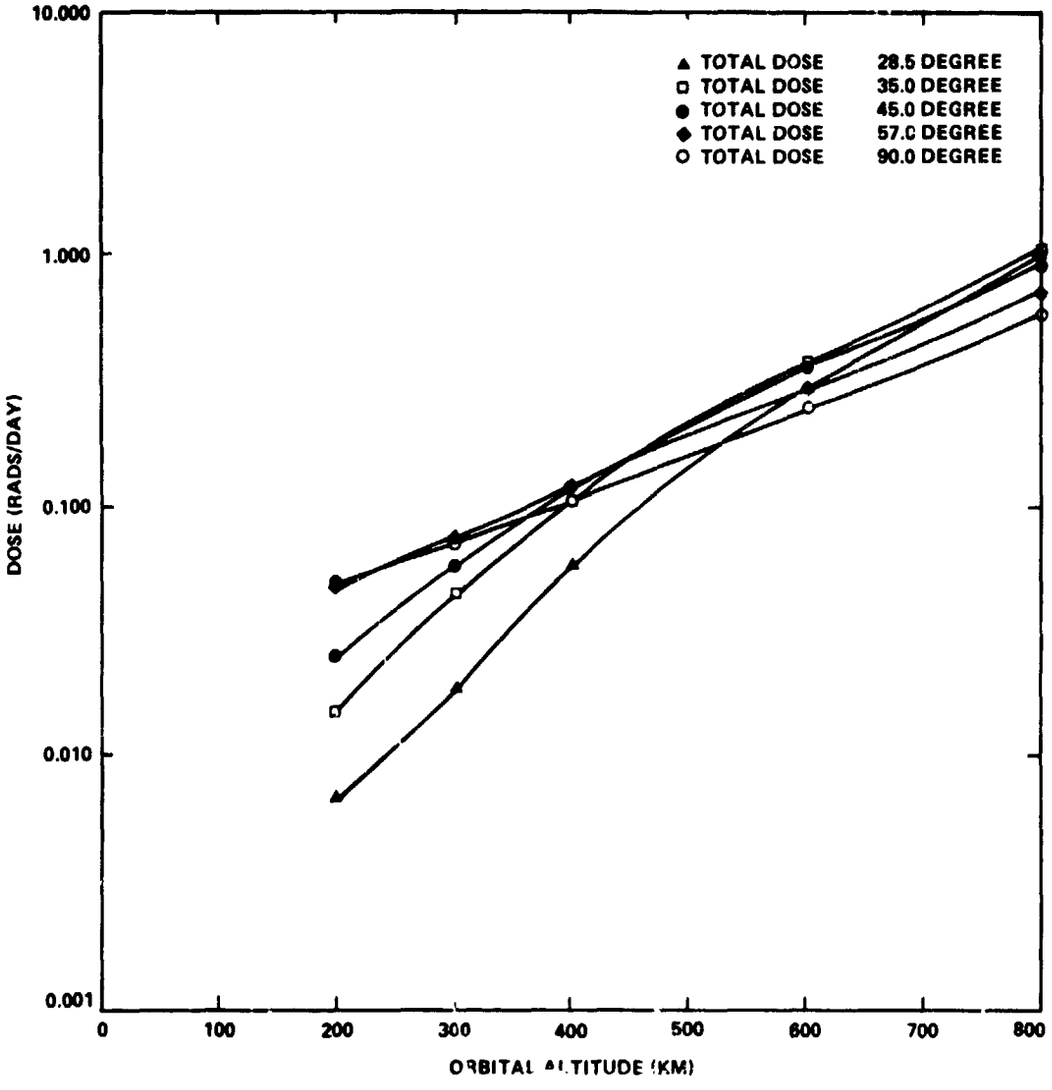


Figure 55. Dose rate as a function of altitude at various inclinations for detector point number 12.

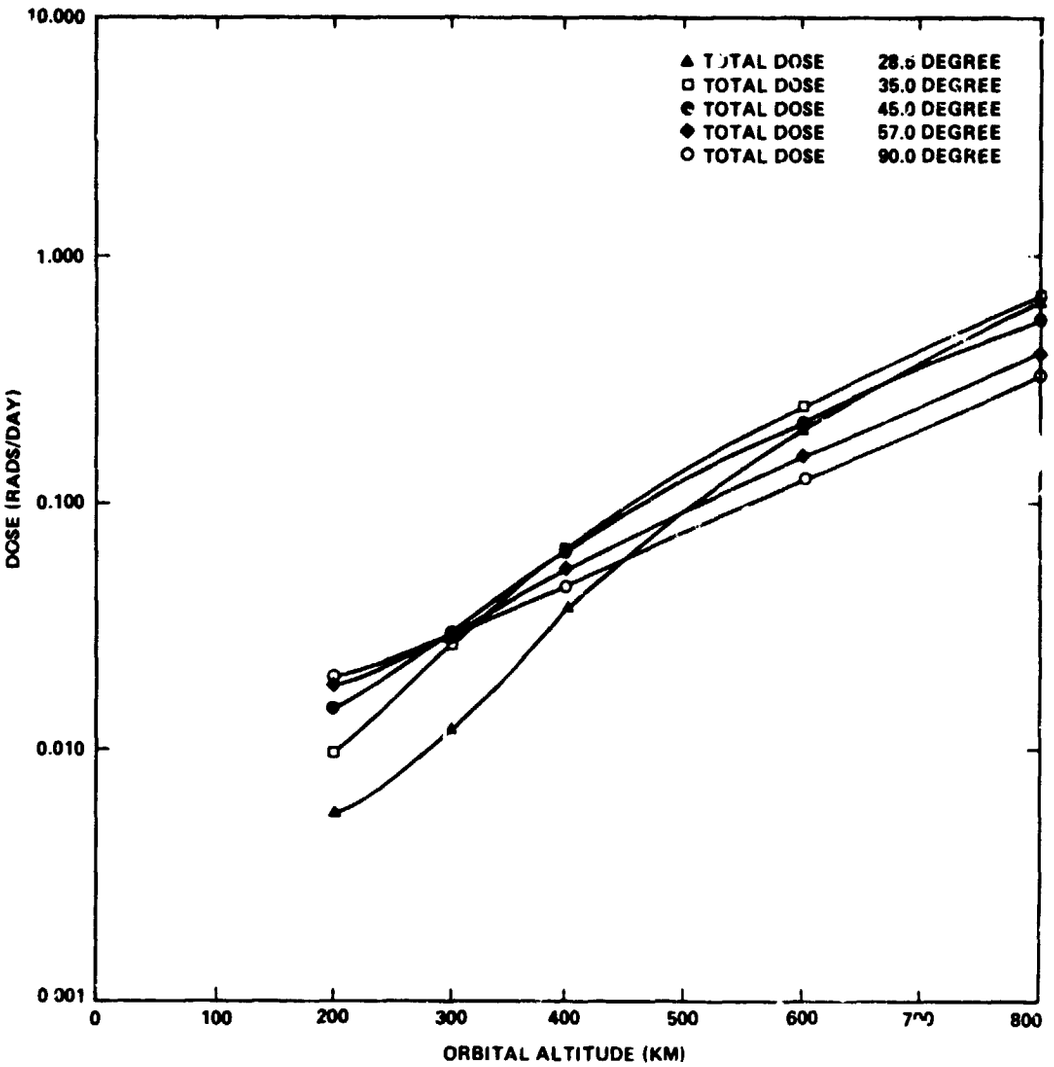


Figure 56. Dose rate as a function of altitude at various inclinations for detector point number 13.

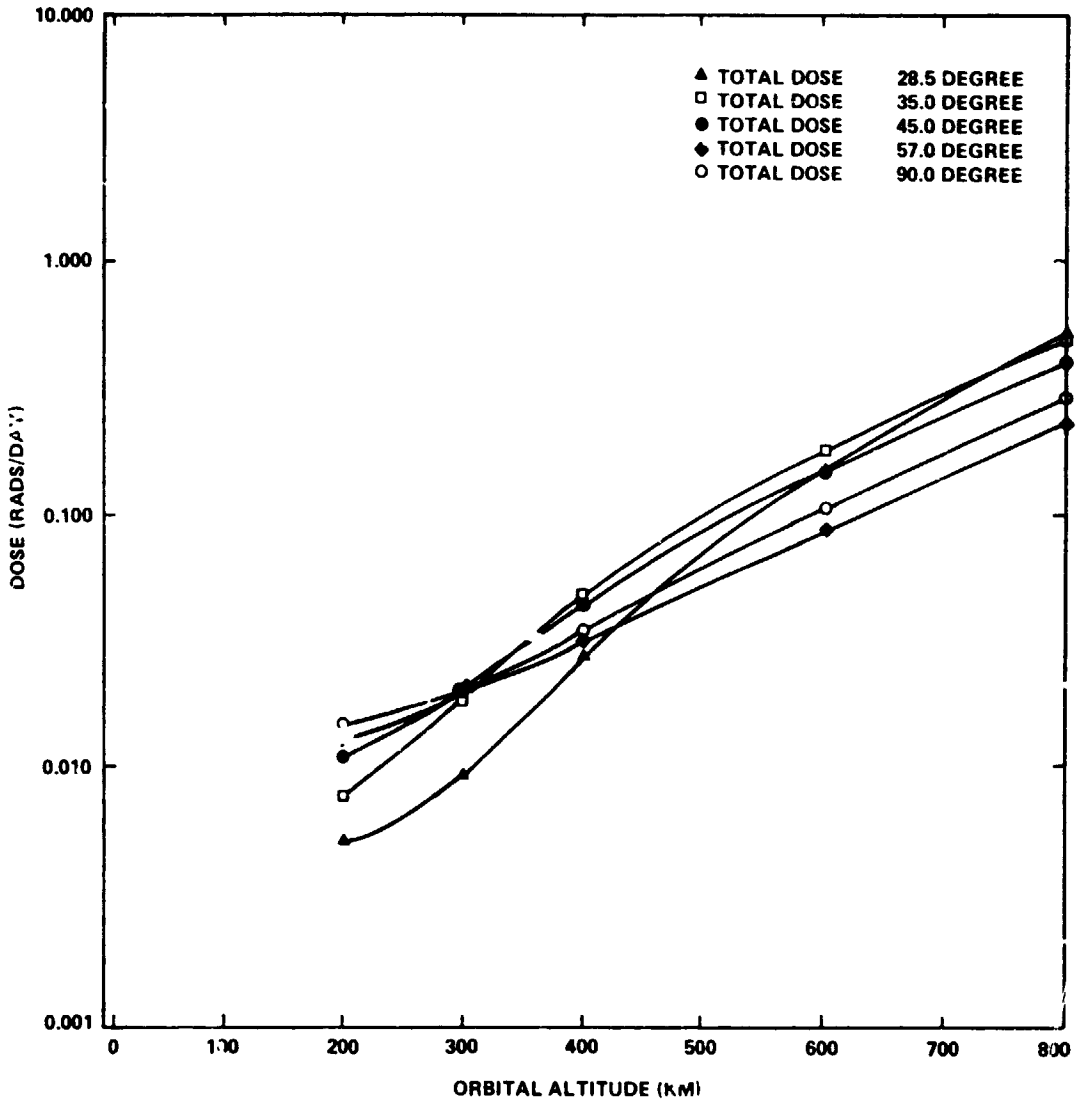


Figure 57. Dose rate as a function of altitude at various inclinations for detector point number 14.

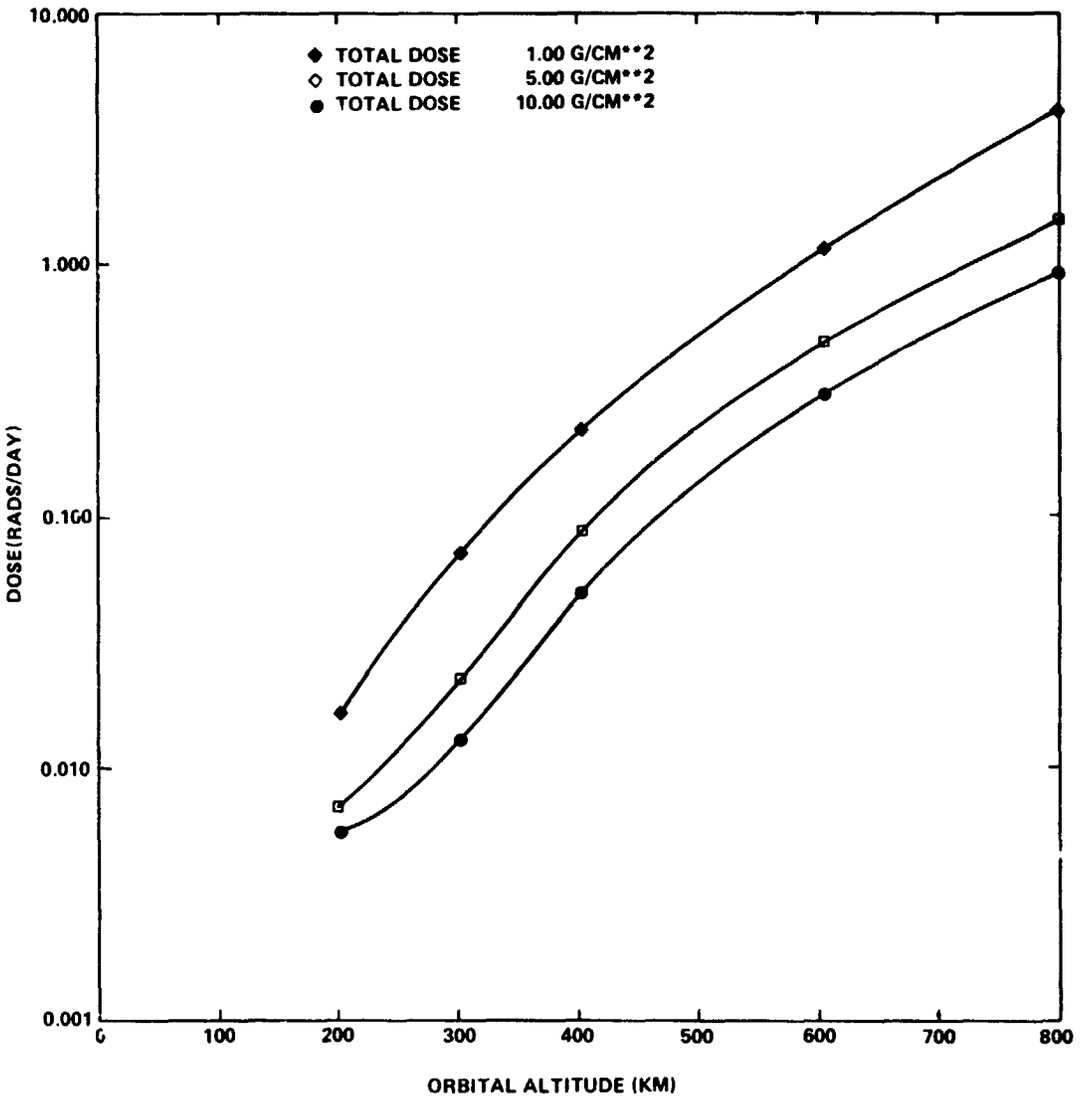


Figure 58. Dose rate behind a spherical aluminum shell shield versus altitude for various shield thicknesses and 28.5° inclination.

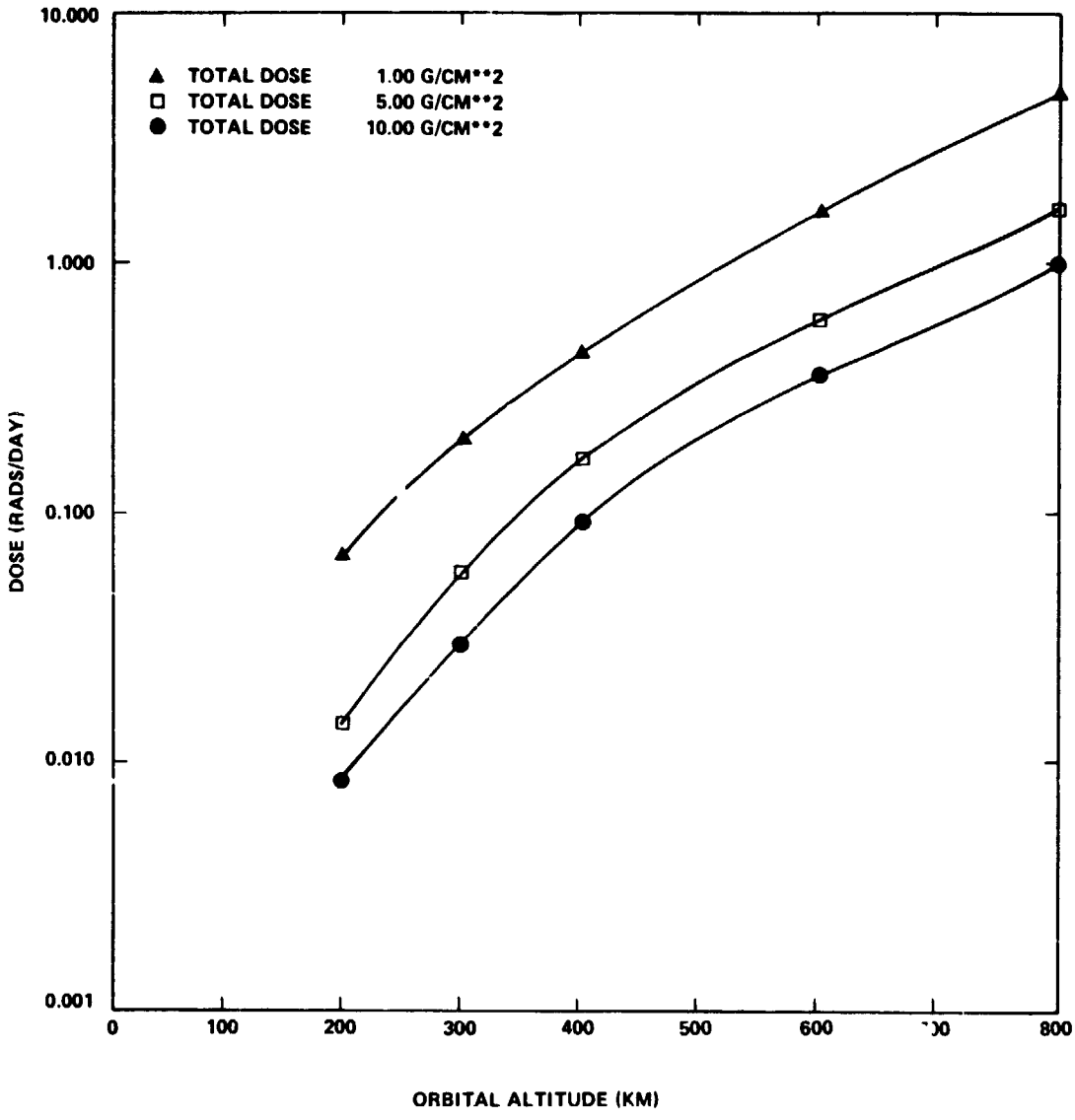


Figure 59. Dose rate behind a spherical aluminum shell shield versus altitude for various shield thicknesses and 35° inclination.

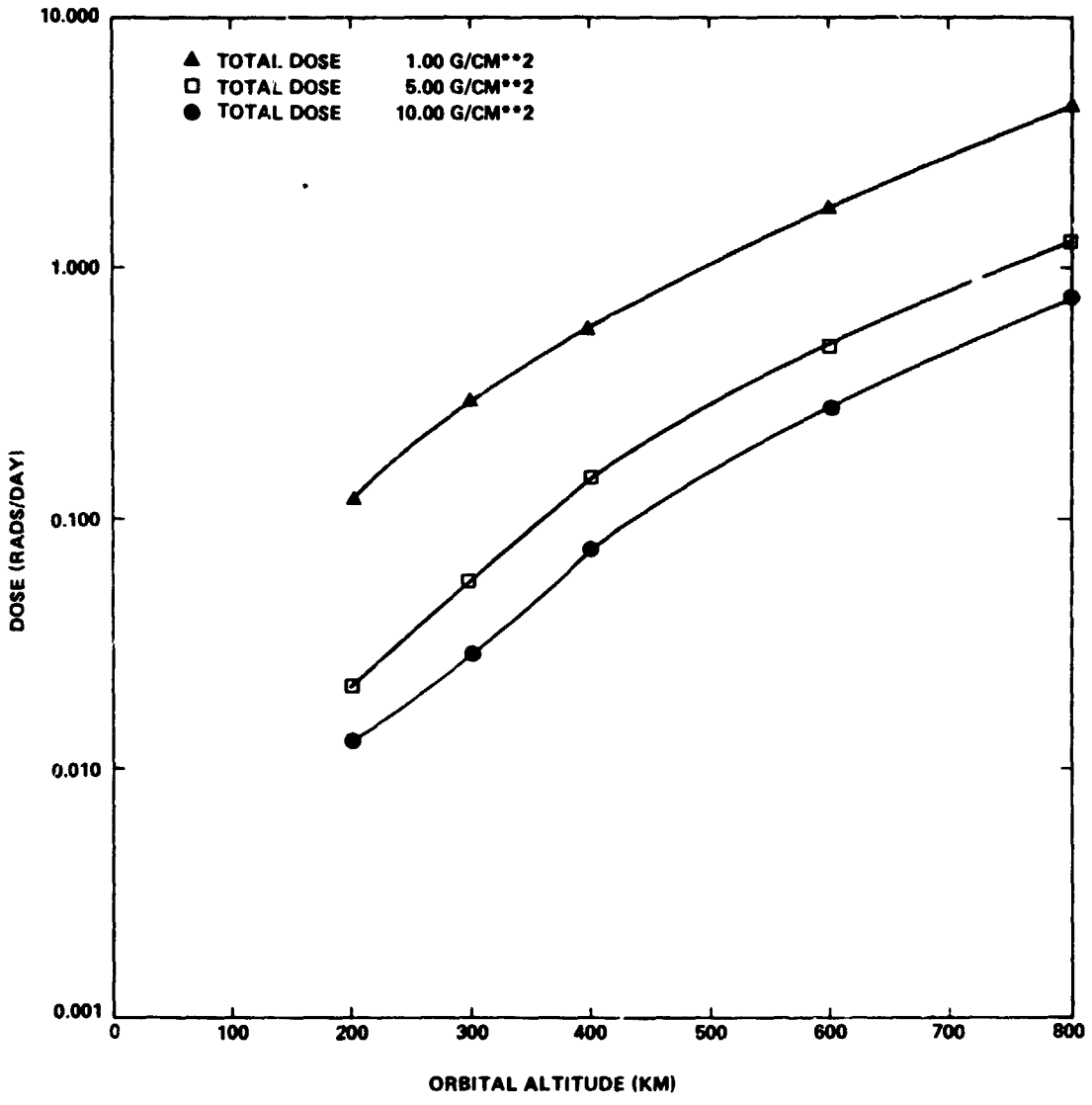


Figure 60. Dose rate behind a spherical aluminum shell shield versus altitude for various shield thicknesses and 45° inclination.

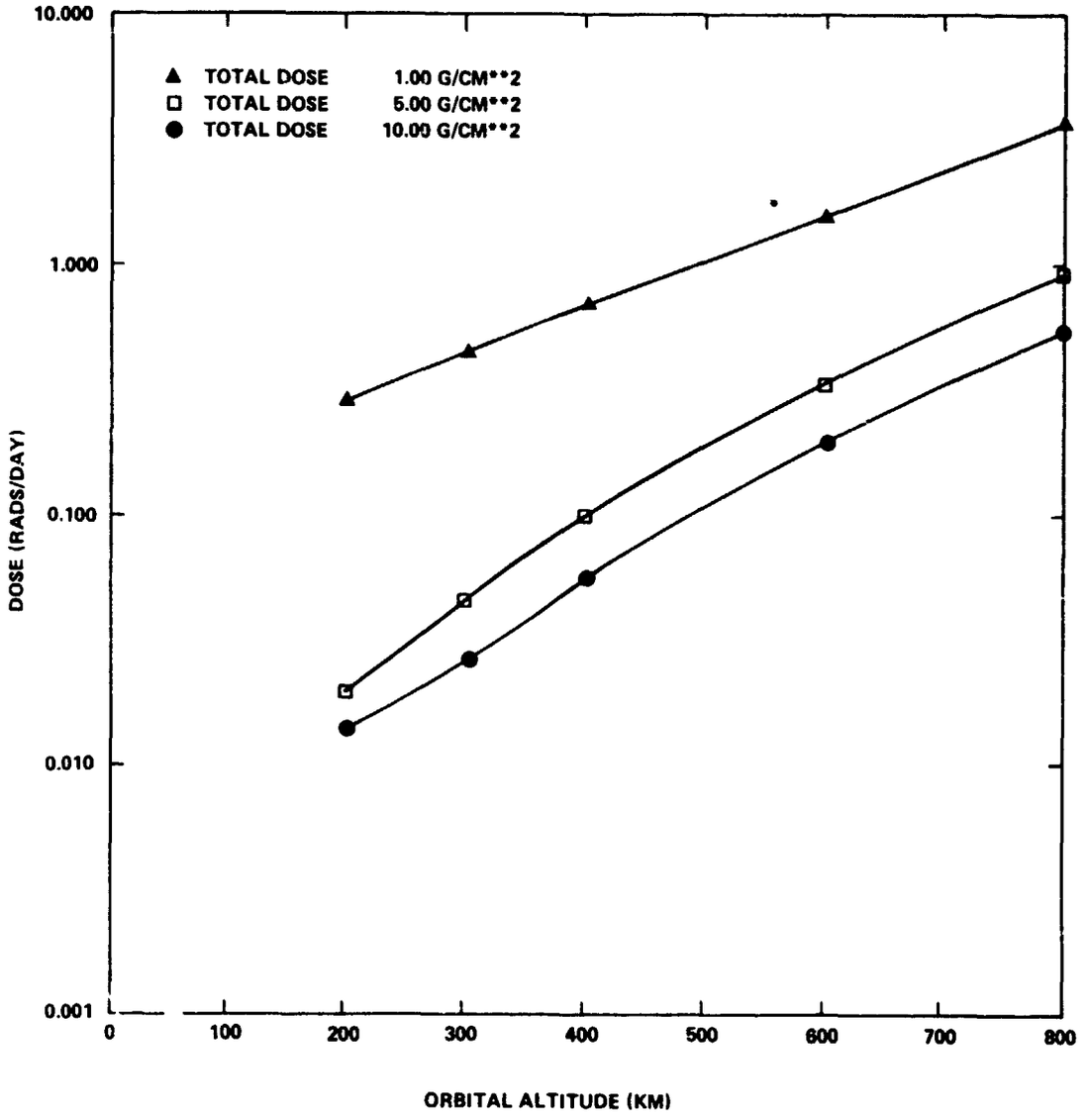


Figure 61. Dose rate behind a spherical aluminum shell shield versus altitude for various shield thicknesses and 57° inclination.

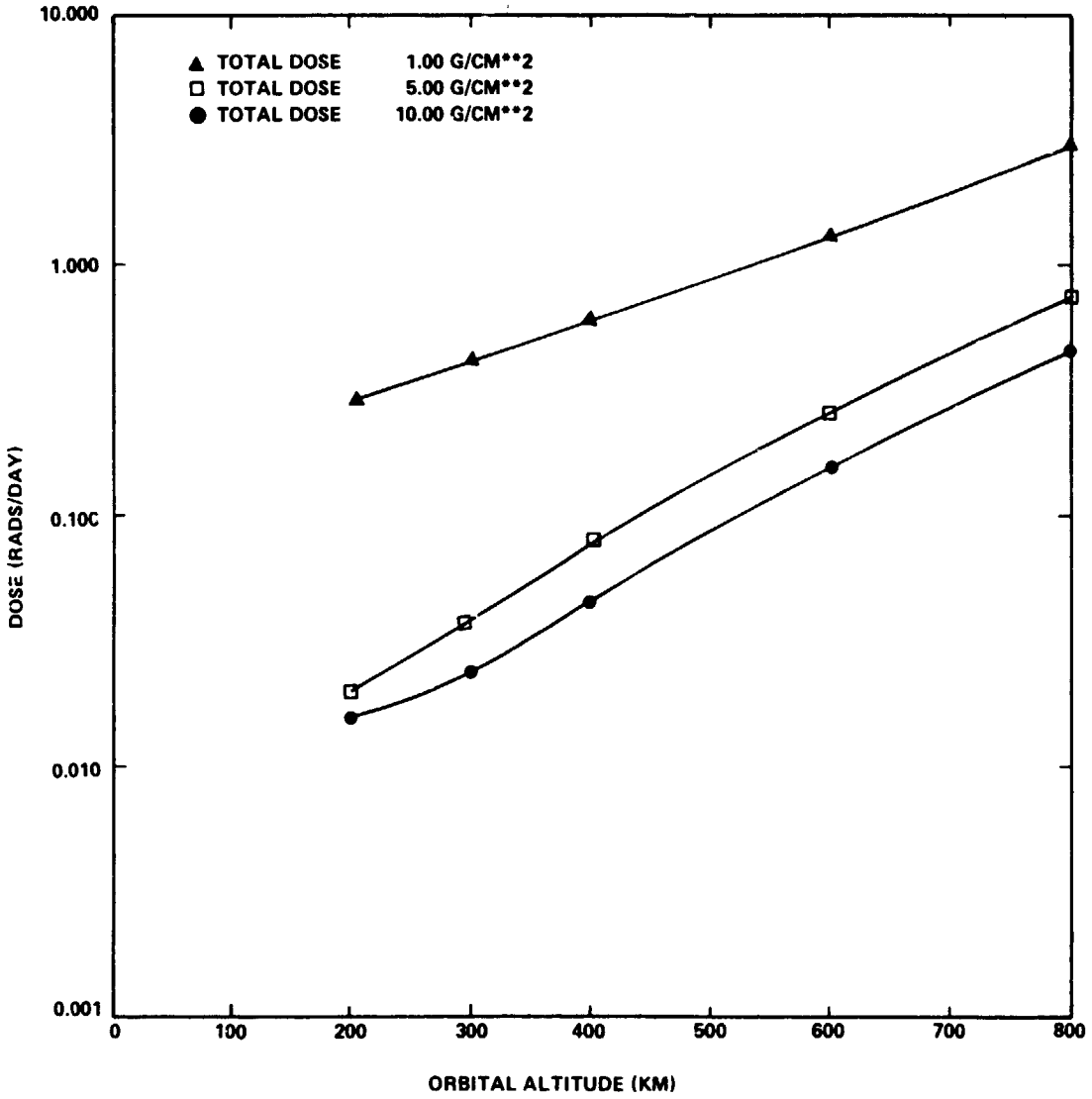


Figure 62. Dose rate behind a spherical aluminum shell shield versus altitude for various shield thicknesses and 90° inclination.

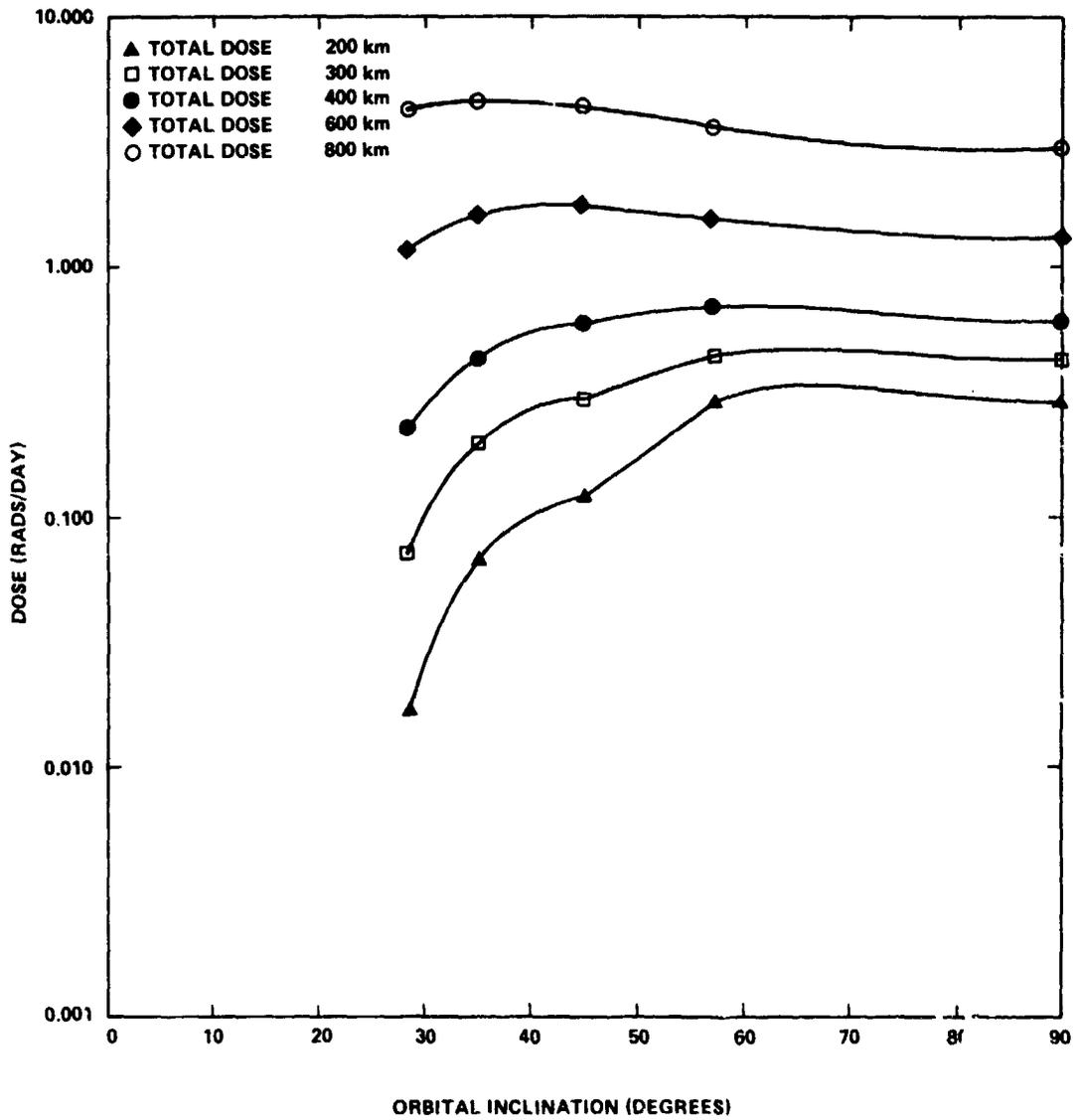


Figure 63. Dose rate behind a 1.0 g/cm^2 spherical aluminum shell shield versus inclination for various altitudes.

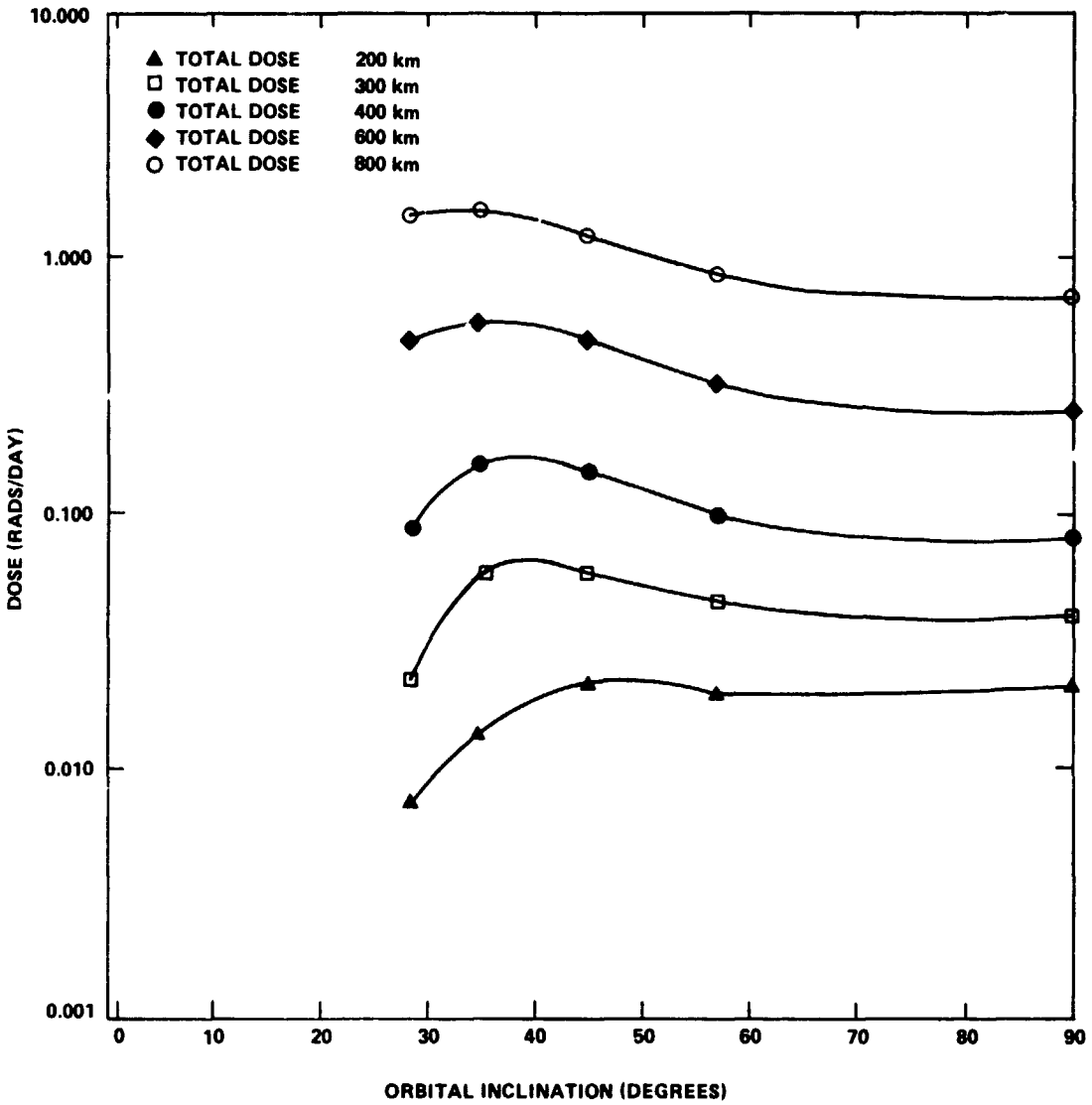


Figure 34. Dose rate behind a 5.0 g/cm^2 spherical aluminum shell shield versus inclination for various altitudes.

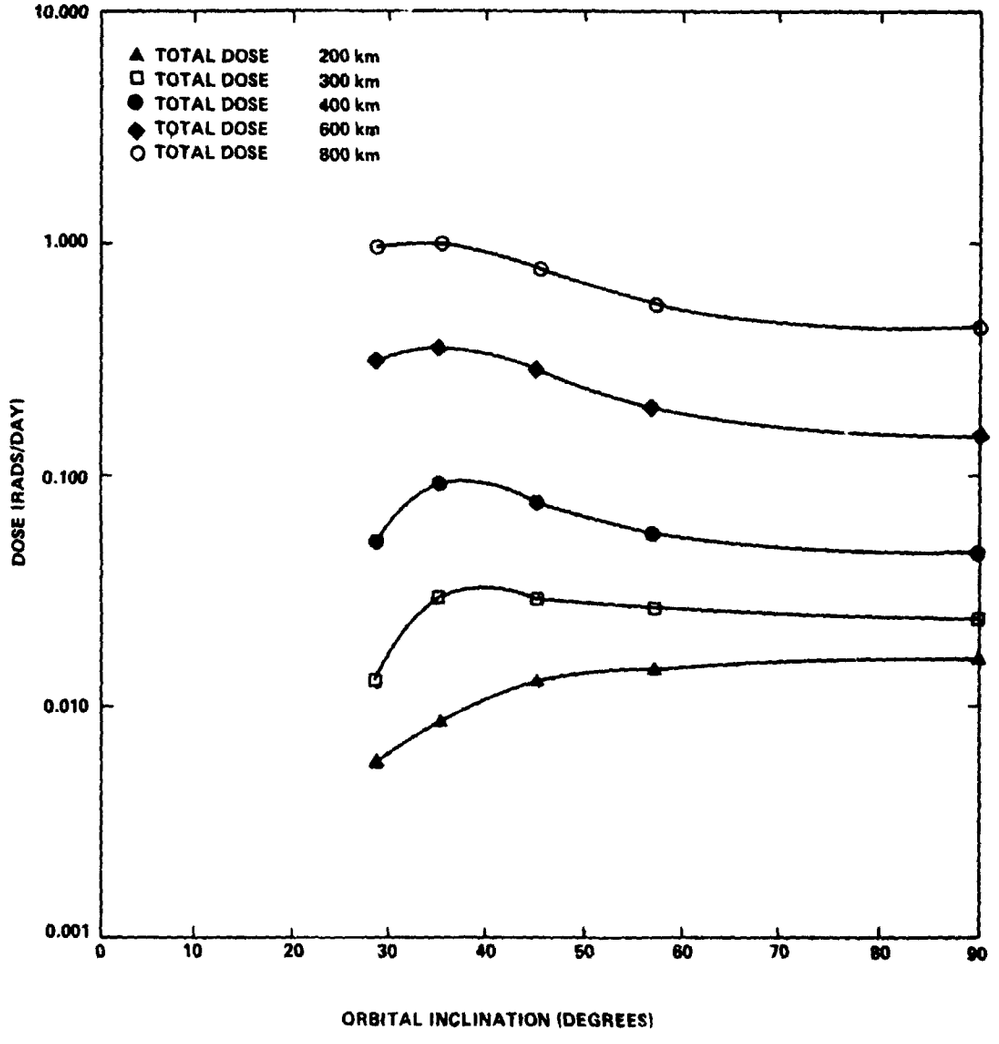


Figure 65. Dose rate behind a 10.0 g/cm^2 spherical aluminum shell shield versus inclination for various altitudes.

APPENDIX A

PROTON AND ELECTRON INTEGRAL AND DIFFERENTIAL FLUX AS A FUNCTION OF ORBITAL ALTITUDE AND INCLINATION

PROTON INTEGRAL FLUX (PROTONS/CM**2-DAY) ABOVE GIVEN ENERGIES.

ORBITAL INCLINATION 28.5

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
[illegible]	[illegible]	0.310E 07	0.842E 07	0.383E 08	0.130E 09
[illegible]	[illegible]	0.284E 07	0.771E 07	0.355E 08	0.119E 09
[illegible]	[illegible]	0.255E 07	[illegible]	0.310E 08	0.106E 09
[illegible]	[illegible]	0.197E 07	0.550E 07	0.262E 08	0.892E 08
[illegible]	[illegible]	0.145E 07	[illegible]	[illegible]	0.795E 08
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.710E 08
[illegible]	0.161E 06	0.603E 06	[illegible]	0.166E 08	0.636E 08
[illegible]	0.112E 06	[illegible]	[illegible]	0.144E 08	0.571E 08
3.75	[illegible]	0.397E 06	[illegible]	0.126E 08	0.487E 08
[illegible]	[illegible]	[illegible]	0.135E 07	[illegible]	0.430E 08
[illegible]	[illegible]	[illegible]	0.123E 07	0.874E 07	0.354E 08
[illegible]	[illegible]	[illegible]	[illegible]	0.655E 07	0.243E 08
[illegible]	[illegible]	[illegible]	[illegible]	0.514E 07	0.178E 08
[illegible]	[illegible]	0.159E 06	[illegible]	[illegible]	0.139E 08
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.138E 08
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.679E 07
[illegible]	0.167E 04	0.121E 05	[illegible]	0.773E 06	0.292E 07
[illegible]	0.971E 03	0.625E 04	0.377E 05	0.331E 06	0.123E 07
[illegible]	0.572E 03	0.432E 04	0.140E 05	0.147E 06	0.559E 06
[illegible]	[illegible]	0.226E 04	0.931E 04	0.350E 05	0.130E 06

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

PROTON INTEGRAL FLUX (PROTONS/CM**2-DAY) ABOVE GIVEN ENERGIES.

ORBITAL INCLINATION 35.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
.05	0.261E 07	0.749E 07	0.172E 08	0.616E 08	0.173E 09
.25	0.240E 07	0.686E 07	0.158E 08	0.564E 08	0.158E 09
0.50	0.215E 07	0.615E 07	0.141E 08	0.505E 08	0.141E 09
1.00	0.165E 07	0.485E 07	0.114E 08	0.418E 08	0.118E 09
1.50	0.119E 07	0.374E 07	0.925E 07	0.362E 08	0.106E 09
2.00	0.872E 06	0.290E 07	0.756E 07	0.315E 08	0.945E 08
2.50	0.642E 06	0.227E 07	0.621E 07	0.274E 08	0.848E 08
3.00	0.475E 06	0.178E 07	0.513E 07	0.239E 08	0.762E 08
3.75	0.307E 06	0.125E 07	0.387E 07	0.196E 08	0.651E 08
4.50	0.247E 06	0.103E 07	0.326E 07	0.169E 08	0.564E 08
6.00	0.232E 06	0.926E 06	0.279E 07	0.134E 08	0.436E 08
10.00	0.209E 06	0.754E 06	0.210E 07	0.936E 07	0.272E 08
15.00	0.186E 06	0.634E 06	0.167E 07	0.647E 07	0.190E 08
30.00	0.922E 05	0.443E 06	0.129E 07	0.511E 07	0.145E 08
50.00	0.382E 05	0.286E 06	0.878E 06	0.390E 07	0.112E 08
100.00	0.117E 05	0.116E 06	0.491E 06	0.226E 07	0.695E 07
200.00	0.132E 04	0.222E 05	0.139E 06	0.918E 06	0.281E 07
300.00	0.730E 03	0.607E 04	0.458E 05	0.319E 06	0.118E 07
400.00	0.639E 03	0.239E 04	0.190E 05	0.133E 06	0.520E 06
600.00	0.492E 03	0.149E 04	0.458E 04	0.290E 05	0.113E 06

PROTON INTEGRAL FLUX (PROTONS/CM**2-DAY) ABOVE GIVEN ENERGIES.

ORBITAL INCLINATION 45.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.147E 0[illegible]	0.315E 08	0.580E 08	0.162E 09	0.366E 09
0.25	0.110E 08	0.242E 08	0.446E 08	0.125E 09	0.285E 09
0.50	0.815E 07	0.182E 08	0.336E 08	0.937E 08	0.216E 09
1.00	0.537E 07	0.123E 08	0.233E 08	0.649E 08	0.153E 09
1.50	0.387E 07	0.944E 07	0.183E 08	0.534E 08	0.128E 09
2.00	0.296E 07	0.740E 07	0.149E 08	0.450E 08	0.109E 09
2.50	0.214E 07	0.568E 07	0.123E 08	0.395E 08	0.953E 08
3.00	0.161E 07	0.470E 07	0.102E 08	0.332E 08	0.838E 08
3.75	0.106E 07	0.339E 07	0.779E 07	0.268E 08	0.698E 08
4.50	0.799E 06	0.265E 07	0.624E 07	0.220E 08	0.586E 08
6.00	0.490E 06	0.188E 07	0.442E 07	0.156E 08	0.421E 08
11.00	0.355E 06	0.109E 07	0.251E 07	0.879E 07	0.237E 08
15.00	0.264E 06	0.757E 06	0.172E 07	0.583E 07	0.156E 08
20.00	0.135E 06	0.455E 06	0.116E 07	0.420E 07	0.113E 08
30.00	0.623E 05	0.260E 06	0.787E 06	0.311E 07	0.843E 07
100.00	0.209E 05	0.973E 05	0.355E 06	0.173E 07	0.511E 07
200.00	0.174E 04	0.170E 05	0.851E 05	0.566E 06	0.201E 07
300.00	0.517E 03	0.469E 04	0.261E 05	0.229E 06	0.842E 06
400.00	0.426E 03	0.235E 04	0.988E 04	0.963E 05	0.370E 06
600.00	0.131E 03	0.136E 04	0.269E 04	0.223E 05	0.830E 05

PROTON INTEGRAL FLUX (PROTONS/CM**2-DAY) ABOVE GIVEN ENERGIES.

ORBITAL INCLINATION 57.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.[illegible]E 09	0.25[illegible]E 09	0.476E 09	0.144E 10	0.354E 10
0.25	0.[illegible]E 08	0.723E 08	0.139E 09	0.311E 09	0.694E 09
0.5[illegible]	0.17[illegible]E 08	0.34[illegible]E 08	0.618E 08	0.141E 09	0.303E 09
1.00	0.[illegible]E 07	0.142E 08	0.276E 08	0.674E 08	0.151E 09
1.50	0.[illegible]E 07	0.827E 07	0.177E 08	0.464E 08	0.109E 09
2.00	0.[illegible]E 07	0.558E 07	0.128E 08	0.361E 08	0.878E 08
2.50	0.[illegible]E 07	0.403E 07	0.986E 07	0.296E 08	0.742E 08
3.00	0.[illegible]E 06	0.312E 07	0.778E 07	0.248E 08	0.640E 08
3.75	0.[illegible]E 06	0.221E 07	0.560E 07	0.194E 08	0.523E 08
4.50	0.[illegible]E 06	0.169E 07	0.431E 07	0.156E 08	0.434E 08
5.00	0.[illegible]E 06	0.136E 07	0.348E 07	0.129E 08	0.367E 08
10.00	0.[illegible]E 06	0.653E 06	0.159E 07	0.591E 07	0.169E 08
15.00	0.[illegible]E 06	0.461E 06	0.109E 07	0.383E 07	0.111E 08
30.00	0.[illegible]E 05	0.288E 06	0.732E 06	0.274E 07	0.798E 07
50.00	0.[illegible]E 05	0.174E 06	0.503E 06	0.204E 07	0.593E 07
100.00	0.112E 05	0.661E 05	0.236E 06	0.116E 07	0.362E 07
200.00	0.[illegible]E 04	0.127E 05	0.627E 05	0.[illegible]E 06	0.145E 07
300.00	0.[illegible]E 03	0.[illegible]E 04	0.210E 05	0.[illegible]E 06	0.619E 06
400.00	0.[illegible]E 03	0.[illegible]E 04	0.[illegible]E 04	0.[illegible]E 05	0.277E 06
600.00	0.[illegible]E 03	0.[illegible]E 04	0.[illegible]E 04	0.[illegible]E 05	0.640E 05

PROTON INTEGRAL FLUX (PROTONS/CM**2-DAY) ABOVE GIVEN ENERGIES.

ORBITAL INCLINATION 90.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.10	0.1[illegible]E 08	0.397E 09	0.752E 09	0.1[illegible]E 10	0.406E 10
0.20	0.2[illegible]E 08	0.561E 08	0.1[illegible]E 09	0.281E 09	0.617E 09
0.50	0.1[illegible]E 08	0.122E 08	0.354E 08	0.987E 08	0.234E 09
1.00	0.[illegible]E 07	0.[illegible]E 07	0.153E 08	0.462E 08	0.110E 09
1.50	0.21[illegible] 07	0.52[illegible] 07	0.971E 07	0.322E 08	0.78[illegible] 08
2.00	0.13[illegible] 07	0.27[illegible] 07	0.721E 07	0.25[illegible] 08	0.637E 08
2.50	0.947E 06	0.279E 07	0.572E 07	0.203E 08	0.541E 08
3.00	0.673E 06	0.215E 07	0.46[illegible] 07	0.169E 08	0.469E 08
3.75	0.419E 06	0.14[illegible] 07	0.351E 07	0.131E 08	0.385E 08
4.50	0.30[illegible]E 06	0.113E [illegible]7	0.27[illegible]E 07	0.10[illegible]E 08	0.320E 08
6.00	0.225E 06	0.[illegible]E 06	0.194E [illegible]7	0.[illegible]E 07	0.230E 08
10.00	0.1[illegible]E 06	0.[illegible]E [illegible]6	0.11[illegible]E [illegible]7	0.423E 07	0.130E 08
15.00	0.[illegible]E [illegible]6	0.[illegible]E [illegible]6	0.[illegible]E [illegible]6	0.285E 07	0.856E 07
30.00	0.[illegible]E 05	0.[illegible]E [illegible]6	0.51[illegible] 06	0.[illegible]E 07	0.623E 07
50.00	0.[illegible]E [illegible]5	0.[illegible]E [illegible]5	0.[illegible]E [illegible]6	0.152E 07	0.465E 07
100.00	0.[illegible]E [illegible]4	0.[illegible]E [illegible]5	0.166E 06	0.[illegible]E [illegible]6	0.214E 07
200.00	0.[illegible]E [illegible]3	0.[illegible]E [illegible]4	0.[illegible]E [illegible]5	0.[illegible]E [illegible]6	0.[illegible]E 07
300.00	0.[illegible]E [illegible]3	0.[illegible]E [illegible]4	0.149E 05	0.[illegible]E [illegible]6	0.[illegible]E 06
400.00	0.[illegible]E [illegible]3	0.[illegible]E [illegible]4	0.[illegible]E [illegible]4	0.[illegible]E [illegible]5	0.[illegible]E [illegible]6
600.00	0.[illegible]E [illegible]3	0.[illegible]E [illegible]3	0.[illegible]E [illegible]4	0.141E [illegible]5	0.[illegible]E [illegible]5

PROTON DIFFERENTIAL FLUX (PROTONS/CM**2-MEV-DAY).

ORBITAL INCLINATION: 28.5

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	[illegible]E 06	0.135E 07	0.37JE 07	0.172E 08	0.574E 08
[illegible]	[illegible]E 06	0.123E 07	0.338E 07	0.157E 08	0.538E 08
[illegible]	[illegible]E 06	0.120E 07	0.309E 07	0.141E 08	0.423E 08
[illegible]	[illegible]E 06	0.110E 07	0.255E 07	0.912E 07	0.251E 08
1.00	0.290E 06	0.871E 06	0.202E 07	0.694E 07	0.181E 08
[illegible]	[illegible]E 06	0.639E 06	0.157E 07	0.578E 07	0.158E 08
2.00	[illegible]E 06	0.467E 06	0.122E 07	0.485E 07	0.139E 08
[illegible]	0.799E 05	0.340E 06	0.958E 06	0.412E 07	0.122E 08
3.75	0.321E 05	0.155E 06	[illegible]E 06	0.247E 07	0.913E 07
4.50	0.509E 04	0.358E 05	[illegible]E 06	0.133E 07	0.630E 07
6.00	0.173E 04	[illegible]E 05	0.645E 05	0.727E 06	0.390E 07
[illegible]	0.753E 03	[illegible]E 04	[illegible]E 05	0.398E 06	0.165E 07
15.00	[illegible]E 03	0.570E 04	0.196E 05	0.132E 06	0.570E 06
[illegible]	[illegible]E 03	[illegible]E 04	0.101E 05	0.499E 05	0.200E 06
50.00	[illegible]E 02	0.231E 04	0.712E 04	0.349E 05	0.117E 06
100.00	[illegible]E 02	[illegible]E 03	[illegible]E 04	[illegible]E 05	0.612E 05
200.00	[illegible]E 02	[illegible]E 03	0.877E 03	0.722E 04	0.240E 05
300.00	0.513E 01	[illegible]E 02	0.261E 03	0.278E 04	0.994E 04
400.00	0.256E 01	0.149E 02	[illegible]E 02	[illegible]E 04	0.423E 04
600.00	0.104E 01	0.732E 01	[illegible]E 02	[illegible]E 03	0.948E 03

PROTON DIFFERENTIAL FLUX (PROTONS/CM**2-MEV-DAY).

ORBITAL INCLINATION 35.0

ENERGY (MEV)	200. KM	300. KM	400. KM	500. KM	600. KM
.15	0.179E 07	0.329E 07	0.730E 07	0.271E 08	0.78 E 08
.20	0.103E 07	0.300E 07	0.694E 07	0.248E 08	0.717E 08
.30	0.163E 07	0.290E 07	0.620E 07	0.2 E 08	0.567E 08
1.00	0.970E 06	0.240E 07	0.480E 07	0.137E 08	0.326E 08
1.50	0.759E 06	0.192E 07	0.379E 07	0.102E 08	0.235E 08
2.00	0.529E 06	0.144E 07	0.301E 07	0.877E 07	0.210E 08
2.50	0.398E 06	0.113E 07	0.240E 07	0.756E 07	0.182E 08
3.00	0.291E 06	0.952E 06	0.194E 07	0.642E 07	0.161E 08
3.75	0.129E 06	0.435E 06	0.113E 07	0.456E 07	0.130E 08
4.50	0.371E 05	0.139E 06	0.502E 06	0.295E 07	0.102E 08
6.00	0.822E 04	0.559E 05	0.239E 06	0.167E 07	0.620E 07
10.00	0.972E 04	0.312E 05	0.119E 06	0.71 E 06	0.250E 07
15.00	0.351E 04	0.181E 05	0.469E 05	0.211E 06	0.683E 06
30.00	0.418E 04	0.102E 05	0.199E 05	0.732E 05	0.221E 06
50.00	0.123E 04	0.569E 04	0.135E 05	0.455E 05	0.124E 06
100.00	0.268E 03	0.200E 04	0.447E 04	0.237E 05	0.540E 05
200.00	0.10 E 02	0.325E 03	0.154E 04	0.80 E 04	0.249E 05
300.00	0.206E 01	0.667E 02	0.446E 03	0.2 E 04	0.994E 04
400.00	0.844E 00	0.111E 02	0.144E 03	0.10 E 04	0.411E 04
600.00	0.639E 00	0.3 1E 01	0.311E 02	0.220E 03	0.962E 03

PROTON DIFFERENTIAL FLUX (PROTONS/CM**2-MEV-DAY).

ORBITAL INCLINATION 45.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.213E 09	0.415E 08	0.761E 08	0.210E 09	0.457E 09
0.25	0.145E 08	0.296E 08	0.544E 08	0.152E 09	0.330E 09
0.50	0.815E 07	0.172E 08	0.311E 08	0.862E 08	0.189E 09
1.00	0.397E 07	0.792E 07	0.135E 08	0.347E 08	0.769E 08
1.50	0.243E 07	0.479E 07	0.793E 07	0.195E 08	0.433E 08
2.00	0.169E 07	0.333E 07	0.591E 07	0.147E 08	0.320E 08
2.25	0.122E 07	0.266E 07	0.466E 07	0.117E 08	0.250E 08
3.00	0.936E 06	0.207E 07	0.374E 07	0.965E 07	0.209E 08
3.75	0.485E 06	0.129E 07	0.253E 07	0.734E 07	0.166E 08
4.50	0.226E 06	0.726E 06	0.162E 07	0.540E 07	0.132E 08
7.00	0.918E 05	0.334E 06	0.797E 06	0.294E 07	0.749E 07
10.00	0.302E 05	0.167E 06	0.459E 06	0.945E 06	0.259E 07
15.00	0.135E 05	0.371E 05	0.766E 05	0.244E 06	0.661E 06
25.00	0.561E 04	0.140E 05	0.261E 05	0.761E 05	0.200E 06
50.00	0.185E 04	0.409E 04	0.139E 05	0.412E 05	0.102E 06
100.00	0.463E 03	0.150E 04	0.535E 04	0.193E 05	0.493E 05
200.00	0.319E 02	0.254E 03	0.112E 04	0.601E 04	0.181E 05
300.00	0.256E 01	0.442E 02	0.267E 03	0.208E 04	0.712E 04
400.00	0.143E 01	0.101E 02	0.770E 02	0.766E 03	0.290E 04
500.00	0.772E 00	0.371E 01	0.274E 02	0.163E 03	0.620E 03

PROTON DIFFERENTIAL FLUX (PROTONS/C**2-MEV-DAY).

ORBITAL INCLINATION 57.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.519E 09	0.164E 10	0.312E 10	0.110E 11	0.283E 11
0.25	0.137E 09	0.311E 09	0.559E 09	0.153E 10	0.360E 10
0.5	0.427E 08	0.793E 08	0.133E 09	0.334E 09	0.651E 09
1.0	0.110E 08	0.199E 08	0.330E 08	0.797E 08	0.147E 09
1.5	0.372E 07	0.771E 07	0.134E 08	0.294E 08	0.570E 08
2.00	0.160E 07	0.391E 07	0.744E 07	0.161E 08	0.335E 08
2.50	0.863E 06	0.232E 07	0.480E 07	0.110E 08	0.234E 08
3.00	0.543E 06	0.154E 07	0.354E 07	0.844E 07	0.190E 08
3.75	0.292E 06	0.979E 06	0.219E 07	0.598E 07	0.135E 08
4.50	0.148E 06	0.508E 06	0.129E 07	0.416E 07	0.103E 08
6.00	0.613E 05	0.220E 06	0.583E 06	0.212E 07	0.569E 07
10.00	0.179E 05	0.653E 05	0.170E 06	0.666E 06	0.189E 07
15.00	0.744E 04	0.215E 05	0.487E 05	0.165E 06	0.476E 06
20.00	0.204E 04	0.791E 04	0.163E 05	0.487E 05	0.144E 06
30.00	0.1 3E 04	0.3 2E 04	0.847E 04	0.203E 05	0.719E 05
40.00	0.262E 03	0.122E 04	0.234E 04	0.125E 05	0.344E 05
60.00	0.172E 02	0.179E 03	0.754E 03	0.4 5E 04	0.127E 05
80.00	0.7 3E 00	0.325E 02	0.206E 03	0.144E 04	0.512E 04
100.00	0.1 2E 00	0.963E 01	0.632E 02	0.545E 03	0.212E 04
150.00	0.16 E 00	0.351E 01	0.157E 02	0.175E 03	0.46 E 03

PROTON DIFFERENTIAL FLUX (PROTONS/CM**2-MEV-DAY).

ORBITAL INCLINATION 90.0

ENERGY (MEV)	200. KM	300. KM	400. KM	500. KM	900. KM
0.05	0.178E 10	0.388E 10	0.747E 10	0.178E 11	0.382E 11
0.25	0.176E 09	0.358E 09	0.671E 09	0.177E 10	0.372E 10
0.50	0.296E 08	0.529E 08	0.947E 08	0.249E 09	0.566E 09
1.00	0.672E 07	0.109E 08	0.191E 08	0.483E 08	0.112E 09
1.50	0.228E 07	0.421E 07	0.714E 07	0.194E 08	0.417E 08
2.00	0.111E 07	0.229E 07	0.378E 07	0.114E 08	0.236E 08
2.50	0.679E 06	0.151E 07	0.249E 07	0.793E 07	0.165E 08
3.00	0.[illegible]	0.109E 07	0.193E 07	0.[illegible]	0.129E 08
3.75	0.[illegible]	0.682E 06	0.120E 07	0.[illegible]	0.[illegible]
4.50	0.[illegible]	0.339E 06	0.759E 06	0.[illegible]	0.[illegible]
6.00	0.[illegible]	0.143E 06	0.337E 06	0.[illegible]	0.[illegible]
7.50	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
10.00	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
15.00	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
20.00	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
30.00	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
40.00	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]
60.00	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]

ELECTRON INTEGRAL FLUX (ELECTRONS/CM**2-DAY) ABOVE GIVEN ENGERGIES.

ORBITAL INCLINATION 28.5

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.531E 05	0.459E 07	0.165E 09	0.590E 10	0.325E 11
0.25	0.249E 05	0.142E 07	0.404E 08	0.124E 10	0.734E 10
0.50	0.499E 04	0.111E 06	0.323E 07	0.192E 09	0.584E 09
0.75	0.235E 04	0.306E 05	0.791E 06	0.301E 08	0.165E 09
1.00	0.166E 04	0.146E 05	0.459E 06	0.137E 08	0.733E 08
1.25	0.113E 04	0.844E 04	0.273E 06	0.931E 07	0.440E 08
1.50	0.578E 03	0.535E 04	0.166E 06	0.507E 07	0.265E 08
2.00	0.515E 03	0.379E 04	0.775E 05	0.227E 07	0.119E 08
2.50	0.275E 03	0.219E 04	0.372E 05	0.135E 07	0.536E 07
3.00	0.253E 03	0.119E 04	0.861E 04	0.192E 06	0.996E 06
3.75	0.203E 03	0.288E 03	0.115E 04	0.925E 04	0.352E 05
4.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

REPRODUCIBILITY OF THE ORIGINAL PAGE IS POOR

ELECTRON INTEGRAL FLUX (ELECTRONS/CM**2-DAY) ABOVE GIVEN ENERGIES.

ORBITAL INCLINATION 35.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	900. KM
0.05	0.106E 07	0.353E 09	0.243E 10	0.147E 11	0.489E 11
0.25	0.252E 06	0.649E 08	0.420E 09	0.265E 10	0.965E 10
0.50	0.215E 05	0.557E 07	0.363E 08	0.224E 09	0.798E 09
0.75	0.705E 04	0.185E 07	0.106E 08	0.626E 08	0.224E 09
1.00	0.332E 04	0.963E 06	0.484E 07	0.280E 08	0.100E 09
1.25	0.211E 04	0.539E 06	0.300E 07	0.172E 08	0.611E 08
1.50	0.145E 04	0.338E 06	0.186E 07	0.108E 08	0.374E 08
2.00	0.736E 03	0.153E 06	0.836E 06	0.472E 07	0.166E 08
2.50	0.448E 03	0.714E 05	0.387E 06	0.218E 07	0.767E 07
3.00	0.371E 03	0.123E 05	0.631E 05	0.370E 06	0.132E 07
3.75	0.111E 03	0.775E 03	0.246E 04	0.136E 05	0.417E 05
4.50	0.000E 00	0.000E 00	0.000E 00	0.000E 00	0.000E 00

ELECTRON INTEGRAL FLUX (ELECTRONS/C**2-DAY) ABOVE GIVEN ENERGIES.

ORBITAL INCLINATION 65.0

ENERGY (M.E.)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.816E 09	0.272E 10	0.651E 10	0.721E 11	0.557E 11
0.25	0.152E 09	0.443E 09	0.101E 10	0.361E 10	0.101E 11
0.50	0.776E 08	0.998E 08	0.147E 09	0.536E 09	0.129E 10
0.75	0.776E 08	0.533E 08	0.924E 08	0.244E 09	0.539E 09
1.00	0.171E 08	0.323E 08	0.548E 08	0.137E 09	0.296E 09
1.25	0.120E 08	0.226E 08	0.381E 08	0.917E 08	0.201E 09
1.50	0.849E 07	0.159E 08	0.268E 08	0.644E 08	0.136E 09
2.00	0.422E 07	0.781E 07	0.131E 08	0.312E 08	0.646E 08
2.50	0.[illegible]E 07	0.361E 07	0.674E 07	0.165E 08	0.300E 08
3.00	0.[illegible]E 07	0.195E 07	0.380E 07	0.939E 07	0.167E 08
3.75	0.[illegible]E 06	0.125E 06	0.[illegible]E 06	0.[illegible]E 06	0.934E 06
4.50	0.[illegible]E 06	0.[illegible]E 06	0.[illegible]E 06	0.[illegible]E 06	0.805E 06

ELECTRON INTEGRAL FLUX (ELECTRONS/CM**2-DAY) ABOVE GIVEN ENERGIES.

ORBITAL INCLINATION 57.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.363E 10	0.366E 10	0.893E 10	0.218E 11	0.481E 11
0.25	0.117E 10	0.184E 10	0.235E 10	0.480E 10	0.100E 11
0.50	0.485E 09	0.679E 09	0.994E 09	0.147E 10	0.232E 10
0.75	0.209E 09	0.402E 09	0.522E 09	0.821E 09	0.121E 10
1.00	0.109E 09	0.241E 09	0.312E 09	0.485E 09	0.702E 09
1.25	0.120E 09	0.150E 09	0.205E 09	0.316E 09	0.455E 09
1.50	0.805E 08	0.136E 09	0.136E 09	0.209E 09	0.297E 09
2.00	0.300E 08	0.478E 08	0.606E 08	0.917E 08	0.130E 09
2.50	0.160E 08	0.213E 08	0.371E 08	0.402E 08	0.570E 08
3.00	0.889E 07	0.981E 07	0.107E 08	0.155E 08	0.216E 08
3.75	0.819E 06	0.790E 06	0.975E 06	0.139E 07	0.191E 07
4.50	0.408E 04	0.450E 04	0.600E 04	0.100E 05	0.200E 05

ELECTRON INTEGRAL FLUX (ELECTRONS/CM**2-DAY) ABOVE GIVEN ENERGIES.

SYNTHETIC INCLINATION 90.0

ENERGY (MEV)	310. KM	350. KM	400. KM	500. KM	600. KM
0.05	0.41[illegible] 10	0.6[illegible] 10	0.[illegible]E 11	0.139E 11	0.291E 11
0.08	[illegible]	[illegible]	[illegible]	0.487E 10	0.955E 10
[illegible]	[illegible]	[illegible]	[illegible]	0.151E 10	0.216E 10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.115E 10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ELECTRON DIFFERENTIAL FLUX (ELECTRONS/CM**2-MEV-DAY).

ORBITAL INCLINATION 28.5

[illegible] GM (MEV)	200. KV	300. KV	400. KV	600. KV	800. KV
1.15	0.231E 06	0.269E 09	0.116E 10	0.447E 11	0.241E 12
0.25	0.123E 06	0.140E 09	0.[illegible]E [illegible]	0.[illegible]E 11	0.637E 11
[illegible]	0.210E 05	0.[illegible]E [illegible]	0.[illegible]E 08	0.712E 09	0.417E 10
0.75	0.[illegible]E 04	0.[illegible]E [illegible]	0.[illegible]E 07	0.[illegible]E 09	0.[illegible]E 09
1.00	0.242E [illegible]	0.[illegible]E [illegible]	0.[illegible]E 07	0.[illegible]E [illegible]	0.199E 09
1.25	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.895E [illegible]
1.50	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]
2.00	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]
2.50	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]
3.00	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]
[illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]
[illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]	0.[illegible]E [illegible]

ELECTRON DIFFERENTIAL FLUX (ELECTRONS/CM**2-MEV-DAY).

ORBITAL INCLINATION 35.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.761E 07	0.298E 10	0.213E 11	0.125E 12	0.396E 12
0.25	0.211E 07	0.585E 09	0.389E 10	0.243E 11	0.867E 11
0.50	0.142E 06	0.391E 09	0.252E 09	0.159E 10	0.568E 10
0.75	0.258E 05	0.694E 07	0.416E 08	0.253E 09	0.906E 09
1.00	0.775E 04	0.206E 07	0.118E 08	0.701E 08	0.252E 09
1.25	0.348E 04	0.101E 07	0.573E 07	0.334E 08	0.120E 09
1.50	0.206E 04	0.581E 06	0.325E 07	0.187E 08	0.667E 08
2.00	0.854E 03	0.237E 06	0.131E 07	0.746E 07	0.262E 08
2.50	0.274E 03	0.165E 06	0.914E 06	0.510E 07	0.178E 08
3.00	0.289E 03	0.442E 05	0.236E 06	0.146E 07	0.531E 07
3.75	0.178E 03	0.285E 04	0.133E 05	0.599E 05	0.192E 06
4.50	0.110E 03	0.184E 03	0.758E 03	0.245E 04	0.694E 04

ELECTRON DIFFERENTIAL FLUX (ELECTRONS/C**2-MEV-DAY).

ORBITAL INCLINATION 45.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.6[illegible]E 10	0.246E 11	0.606E 11	0.208E 12	0.475E 12
0.25	0.[illegible]E 09	0.325E 10	0.[illegible]E 10	0.300E 11	0.846E 11
0.5[illegible]	0.149E 09	0.385E 09	0.[illegible]15E 09	0.265E 10	0.691E 10
.75	0.[illegible]57E 08	0.[illegible]19E 09	0.224E 09	0.644E 09	0.[illegible]5E 10
1.0[illegible]	0.271E 08	0.546E 08	0.[illegible]5E 08	0.251E 09	0.575E 09
1.25	0.[illegible]68E 08	0.220E 08	0.[illegible]5[illegible]E 08	0.141E 09	0.3[illegible]E 09
1.50	0.119E 08	0.[illegible]24E 08	0.379E 08	0.952E 08	0.207E 09
2.00	0.[illegible]26E 07	0.[illegible]16E 08	0.194E 08	0.467E 08	0.976E 08
2.50	0.332E 07	0.624E 07	0.[illegible]04E 08	0.253E 08	0.533E 08
3.[illegible]	0.[illegible]95E 07	0.[illegible]12E 07	0.[illegible]72E 07	0.136E 08	0.277E 08
3.75	0.213E 06	0.[illegible]E 07	0.[illegible]8E 06	0.154E 07	0.303E 07
4.50	0.[illegible]E 06	0.[illegible]E 06	0.776E 06	0.175E 06	0.332E 06

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ELECTRON DIFFERENTIAL FLUX (ELECTRONS/CM**2-MEV-DAY).

ORBITAL INCLINATION 57.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.05	0.235E 11	0.347E 11	0.596E 11	0.164E 12	0.377E 12
0.25	0.514E 10	0.778E 10	0.119E 11	0.287E 11	0.677E 11
0.50	0.131E 10	0.185E 10	0.257E 10	0.488E 10	0.904E 10
0.75	0.698E 09	0.821E 09	0.109E 10	0.181E 10	0.288E 10
1.00	0.326E 09	0.444E 09	0.580E 09	0.921E 09	0.136E 10
1.25	0.193E 09	0.261E 09	0.347E 09	0.535E 09	0.782E 09
1.50	0.127E 09	0.171E 09	0.221E 09	0.344E 09	0.498E 09
2.00	0.577E 08	0.782E 08	0.977E 08	0.150E 09	0.214E 09
2.50	0.281E 08	0.365E 08	0.468E 08	0.712E 08	0.101E 09
3.00	0.160E 08	0.205E 08	0.260E 08	0.393E 08	0.541E 08
3.75	0.196E 07	0.248E 07	0.311E 07	0.446E 07	0.617E 07
4.50	0.240E 06	0.300E 06	0.372E 06	0.520E 06	0.705E 06

ELECTRON DIFFERENTIAL FLUX (ELECTRONS/CM**2-MEV-DAY).

ORBITAL INCLINATION 90.0

ENERGY (MEV)	200. KM	300. KM	400. KM	600. KM	800. KM
0.25	0.223E 11	0.349E 11	0.553E 11	0.134E 12	0.297E 12
0.50	0.[illegible]E 10	0.[illegible]E 10	0.118E 11	0.256E 11	0.552E 11
0.75	0.[illegible]E 10	0.214E 10	0.290E 10	0.481E 10	0.804E 10
1.00	0.754E 09	0.[illegible]E 09	0.123E 10	0.[illegible]E 10	0.[illegible]E 10
1.25	[illegible]	0.529E 09	0.655E 09	0.965E 09	0.[illegible]E 10
1.50	0.[illegible]E 09	0.[illegible]E 09	0.385E 09	0.[illegible]E 09	0.746E 09
1.75	0.152E 09	0.197E 09	0.245E 09	0.355E 09	0.472E 09
2.00	0.[illegible]E 08	0.842E 08	0.[illegible]E 09	0.[illegible]E 09	0.201E 09
2.50	0.[illegible]E 08	0.[illegible]E 08	0.[illegible]E 08	0.[illegible]E 08	0.957E 08
3.00	0.167E 08	0.214E 08	0.[illegible]E 08	0.[illegible]E 08	0.507E 08
3.75	0.[illegible]E 07	0.[illegible]E 07	0.[illegible]E 07	0.[illegible]E 07	0.583E 07
4.50	0.242E 06	0.[illegible]E 06	0.[illegible]E 06	0.511E 06	0.670E 06

APPENDIX B

DOSE RATES AT THE VARIOUS SPACELAB DETECTOR POINTS AS A FUNCTION OF ORBITAL ALTITUDE AND INCLINATION

FOR DETECTOR POINT 1
LAB SURVE TOP X 2120.66 Y 0 Z 1222.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0024	0.0150	0.0581	0.3314	1.1482
35.0	0.0106	0.0427	0.1113	0.4228	1.2265
45.0	0.0161	0.0494	0.1142	0.3805	1.0045
57.0	0.0088	0.0302	0.0716	0.2481	0.7127
90.0	0.0064	0.0211	0.0502	0.1851	0.5508

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0001	0.0049	0.0253
35.0	0.0000	0.0003	0.0017	0.0100	0.0353
45.0	0.0101	0.0189	0.0312	0.0748	0.1545
57.0	0.0894	0.1157	0.1475	0.2213	0.3136
90.0	0.0967	0.1237	0.1516	0.2174	0.2950

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0072	0.0202	0.0639	0.3427	1.1807
35.0	0.0167	0.0496	0.1201	0.4407	1.2706
45.0	0.0347	0.0772	0.1548	0.4659	1.1705
57.0	0.1093	0.1577	0.2315	0.4830	1.0412
90.0	0.1163	0.1593	0.2173	0.4198	0.8649

FOR DETECTOR POINT 2
LAB SURVE MIDDLE X 2120.66 Y 0 Z 1016.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0017	0.0112	0.0449	0.2632	0.9031
35.0	0.0074	0.0316	0.0855	0.3294	0.9584
45.0	0.0112	0.0353	0.0844	0.2901	0.7726
57.0	0.0061	0.0218	0.0531	0.1893	0.5476
90.0	0.0044	0.0152	0.0373	0.1412	0.4241

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0022	0.0114
35.0	0.0000	0.0001	0.0008	0.0045	0.0159
45.0	0.0045	0.0085	0.0139	0.0333	0.0689
57.0	0.0400	0.0518	0.0661	0.0994	0.1410
90.0	0.0432	0.0556	0.0682	0.0978	0.1325

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0065	0.0164	0.0506	0.2718	0.9218
35.0	0.0135	0.0383	0.0932	0.3418	0.9831
45.0	0.0241	0.0528	0.1077	0.3339	0.8531
57.0	0.0573	0.0855	0.1316	0.3023	0.7035
90.0	0.0613	0.0853	0.1210	0.2563	0.5758

FOR DETECTOR POINT 3
LAB SURVE BOTTOM X 2120.66 Y 0 Z 810

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0006	0.0046	0.0221	0.1441	0.4822
35.0	0.0022	0.0130	0.0413	0.1700	0.5028
45.0	0.0035	0.0129	0.0358	0.1398	0.3864
57.0	0.0019	0.0083	0.0228	0.0919	0.2733
90.0	0.0013	0.0057	0.0161	0.0683	0.2131

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0000	0.0003
35.0	0.0000	0.0000	0.0000	0.0001	0.0004
45.0	0.0001	0.0003	0.0005	0.0013	0.0026
57.0	0.0015	0.0020	0.0025	0.0037	0.0053
90.0	0.0016	0.0021	0.0025	0.0036	0.0049

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0054	0.0098	0.0277	0.1506	0.4898
35.0	0.0083	0.0195	0.0483	0.1790	0.5120
45.0	0.0121	0.0222	0.0458	0.1516	0.4006
57.0	0.0146	0.0221	0.0376	0.1093	0.2935
90.0	0.0166	0.0223	0.0341	0.0892	0.2372

FOR DETECTOR POINT 4
LAB SURVE FORWARD X 1910.63 Y 0 Z 1016.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0011	0.0076	0.0338	0.2071	0.6944
35.0	0.0042	0.0217	0.0638	0.2512	0.7304
45.0	0.0066	0.0227	0.0586	0.2130	0.5735
57.0	0.0036	0.0144	0.0370	0.1[illegible]	0.4054
90.0	0.0026	0.0099	0.0261	0.1037	0.3153

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0008	0.0043
35.0	0.0000	0.0000	0.0003	0.0017	0.0060
45.0	0.0017	0.0032	0.0052	0.0126	0.0262
57.0	0.0151	0.0196	0.0250	0.0376	0.0533
90.0	0.0163	0.0210	0.0257	0.0369	0.0501

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0059	0.0128	0.0395	0.2143	0.7059
35.0	0.0103	0.0283	0.0711	0.2609	0.7452
45.0	0.0167	0.0348	0.0733	0.2362	0.6112
57.0	0.0299	0.0458	0.0745	0.1905	0.4736
90.0	0.0326	0.0454	0.0673	0.1580	0.3845

FOR DETECTOR POINT 5
LAB SURVE AFT X 2330.70 Y 0 Z 1016.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0012	0.0093	0.0362	0.2196	0.7391
35.0	0.0048	0.0236	0.0684	0.2679	0.7788
45.0	0.0074	0.0250	0.0637	0.2289	0.6146
57.0	0.0040	0.0158	0.0402	0.1496	0.4347
90.0	0.0029	0.0108	0.0283	0.1114	0.3378

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0011	0.0058
35.0	0.0000	0.0000	0.0004	0.0023	0.0092
45.0	0.0023	0.0044	0.0072	0.0173	0.0357
57.0	0.0207	0.0268	0.0341	0.0513	0.0727
90.0	0.0223	0.0286	0.0351	0.0504	0.0684

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0060	0.0135	0.0418	0.2272	0.7522
35.0	0.0109	0.0302	0.0758	0.2781	0.7959
45.0	0.0182	0.0383	0.0803	0.2566	0.6619
57.0	0.0359	0.0544	0.0968	0.2145	0.5223
90.0	0.0388	0.0541	0.0789	0.1792	0.4253

FOR DETECTOR POINT 6
LAB SURVE SIDE X 2120.66 Y 206. Z 1016.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0006	0.0045	0.0233	0.1536	0.5051
35.0	0.0019	0.0130	0.0436	0.1793	0.5260
45.0	0.0031	0.0123	0.0363	0.1451	0.4002
57.0	0.0017	0.0081	0.0232	0.0954	0.2823
90.0	0.0012	0.0054	0.0163	0.0708	0.2205

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0000	0.0000
35.0	0.0000	0.0000	0.0000	0.0000	0.0000
45.0	0.0000	0.0000	0.0000	0.0001	0.0002
57.0	0.0001	0.0002	0.0002	0.0004	0.0005
90.0	0.0001	0.0002	0.0002	0.0004	0.0005

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0054	0.0097	0.0289	0.1601	0.5123
35.0	0.0080	0.0195	0.0506	0.1872	0.5348
45.0	0.0115	0.0213	0.0458	0.1557	0.4120
57.0	0.0130	0.0201	0.0359	0.1094	0.2977
90.0	0.0150	0.0202	0.0321	0.0885	0.2401

FOR DETECTOR POINT 7
RACK FORWARD TOP X 1986.95 Y 107. Z 1178.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0023	0.0144	0.0566	0.3228	1.1074
35.0	0.0098	0.0410	0.1080	0.4083	1.1787
45.0	0.0147	0.0461	0.1085	0.3635	0.9575
57.0	0.0080	0.0284	0.0679	0.2366	0.6785
90.0	0.0058	0.0198	0.0477	0.1767	0.5251

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0001	0.0030	0.0156
35.0	0.0000	0.0002	0.0010	0.0062	0.0218
45.0	0.0063	0.0119	0.0195	0.0468	0.0965
57.0	0.0559	0.0723	0.0922	0.1383	0.1960
90.0	0.0601	0.0773	0.0947	0.1358	0.1842

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0071	0.0196	0.0624	0.3322	1.1302
35.0	0.0159	0.0477	0.1161	0.4224	1.2093
45.0	0.0295	0.0673	0.1374	0.4207	1.0656
57.0	0.0752	0.1126	0.1726	0.3885	0.8493
90.0	0.0796	0.1116	0.1580	0.3298	0.7285

FOR DETECTOR POINT 8
RACK FORWARD UPPER MIDDLE X 1986.95 Y 104. Z 1130.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0019	0.0120	0.0491	0.2838	0.9603
35.0	0.0076	0.0342	0.0930	0.3532	1.0163
45.0	0.0114	0.0411	0.0999	0.3079	0.8135
57.0	0.0062	0.0231	0.0564	0.2004	0.5755
90.0	0.0045	0.0160	0.0397	0.1497	0.4465

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0007	0.0035
35.0	0.0000	0.0000	0.0002	0.0014	0.0050
45.0	0.0018	0.0035	0.0056	0.0133	0.0272
57.0	0.0159	0.0204	0.0259	0.0384	0.0543
90.0	0.0168	0.0215	0.0263	0.0376	0.0509

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0066	0.0172	0.0547	0.2910	0.9712
35.0	0.0137	0.0408	0.1003	0.3625	1.0301
45.0	0.0217	0.0535	0.1050	0.3317	0.8522
57.0	0.0334	0.0553	0.0947	0.2525	0.6446
90.0	0.0350	0.0521	0.0815	0.2046	0.5168

FOR DETECTOR POINT 9
RACK FORWARD LOWER MIDDLE X 1986.95 Y 145. Z 993.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0010	0.0070	0.0316	0.1954	0.6516
35.0	0.0037	0.0198	0.0594	0.2349	0.6834
45.0	0.0057	0.0207	0.0534	0.1971	0.5325
57.0	0.0031	0.0129	0.0338	0.1289	0.3762
90.0	0.0022	0.0098	0.0238	0.0960	0.2929

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0001	0.0006
35.0	0.0000	0.0000	0.0000	0.0002	0.0008
45.0	0.0003	0.0010	0.0011	0.0026	0.0053
57.0	0.0031	0.0040	0.0050	0.0075	0.0105
90.0	0.0032	0.0042	0.0051	0.0073	0.0098

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0079	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0058	0.0122	0.0372	0.2019	0.6595
35.0	0.0098	0.0263	0.0665	0.2431	0.6930
45.0	0.0145	0.0306	0.0639	0.2102	0.5493
57.0	0.0175	0.0287	0.0513	0.1500	0.4017
90.0	0.0192	0.0276	0.0444	0.1206	0.3219

FOR DETECTOR POINT 10
RACK FORWARD BOTTOM X 1[illegible]6.95 Y 145. Z 909.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	900 KM
28.5	0.0006	0.0044	0.0223	0.1433	0.4610
35.0	0.0019	0.0124	0.0417	0.1731	0.5111
45.0	0.0030	0.0119	0.0340	0.1403	0.3993
57.	0.0017	0.0078	0.0223	0.0874	0.2749
90.	0.0011	0.0053	0.0157	0.0695	0.2142

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	900 KM
28.5	0.0000	[illegible]	[illegible]	0.0000	0.0001
35.0	0.0000	0.0000	[illegible]	0.0000	0.0002
45.0	0.0001	0.0001	[illegible]	0.0006	0.0013
57.0	0.0008	0.0010	[illegible]	0.0018	0.0027
90.0	0.0008	[illegible]	[illegible]	[illegible]	0.0025

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	900 KM
28.5	0.0047	0.0061	[illegible]	[illegible]	0.0072
35.0	0.0060	0.0065	0.0069	[illegible]	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0146
90.0	0.0136	[illegible]	[illegible]	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	900 KM
28.5	[illegible]	[illegible]	[illegible]	[illegible]	0.4924
35.0	[illegible]	[illegible]	[illegible]	[illegible]	0.5200
45.0	0.0115	[illegible]	[illegible]	[illegible]	0.4020
57.	0.0136	[illegible]	[illegible]	0.1009	[illegible]
90.	0.0157	[illegible]	0.0335	0.0877	[illegible]

FOR DETECTOR POINT 11
MIDDLE RACK TOP X 2120.66 Y 107. Z 1178.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	900 KM
28.5	0.0023	0.0164	0.0620	0.3504	1.2712
35.0	0.0119	0.0464	0.1190	0.4500	1.3965
45.0	0.0179	0.0542	0.1237	0.4091	1.0756
57.0	0.0097	0.0429	0.0774	0.2659	0.7435
90.0	0.0071	0.0231	0.0544	0.1985	0.5896

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	900 KM
28.5	0.0000	0.0000	0.0001	0.0059	0.0274
35.0	0.0000	0.0000	0.0019	0.0139	0.0583
45.0	0.0110	0.0207	0.0341	0.0917	0.1687
57.0	0.0976	0.1263	0.1610	0.2434	0.3421
90.0	0.1049	0.1350	0.1654	0.2372	0.3218

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	900 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0145
90.0	0.0134	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	900 KM
28.5	0.0074	0.0214	0.0678	0.3621	1.3059
35.0	0.0179	0.0529	0.1279	0.4717	1.4635
45.0	0.0374	0.0838	0.1672	0.5083	1.2558
57.0	0.1185	0.1712	0.2509	0.5210	1.1205
90.0	0.1257	0.1726	0.2353	0.4529	0.9305

FOR DETECTOR POINT 12
MIDDLE RACK UPPER MIDDLE X 2120.66 Y 104. Z 1130.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0023	0.0149	0.0554	0.3148	1.0824
35.0	0.0099	0.0404	0.1054	0.3982	1.1508
45.0	0.0146	0.0459	0.1059	0.3543	0.9346
57.0	0.0090	0.0279	0.0663	0.2306	0.6625
90.0	0.0058	0.0194	0.0466	0.1722	0.5127

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0014	0.0072
35.0	0.0000	0.0000	0.0005	0.0028	0.0099
45.0	0.0036	0.0068	0.0109	0.0260	0.0531
57.0	0.0311	0.0399	0.0506	0.0751	0.1059
90.0	0.0329	0.0421	0.0514	0.0739	0.0995

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0089	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0071	0.0185	0.0611	0.3227	1.0968
35.0	0.0160	0.0470	0.1129	0.4089	1.1695
45.0	0.0267	0.0611	0.1262	0.3908	0.9992
57.0	0.0502	0.0796	0.1294	0.3193	0.7833
90.0	0.0523	0.0761	0.1195	0.2430	0.6319

FOR DETECTOR POINT 13
MIDDLE RACK LOWER MIDDLE X 2120.66 Y 145. Z 993.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	500 KM	600 KM
28.5	0.0011	0.0077	0.0341	0.2179	0.4869
35.0	0.0044	0.0229	0.0841	0.2517	0.7215
45.0	0.0067	0.0329	0.0999	0.2133	0.5740
57.0	0.0036	0.0145	0.0372	0.1294	0.4058
90.0	0.0028	0.0098	0.0262	0.1079	0.3156

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	500 KM	600 KM
28.5	0.0000	0.0000	0.0000	0.0002	0.0010
35.0	0.0000	0.0000	0.0000	0.0003	0.0013
45.0	0.0006	0.0011	0.0017	0.0041	0.0083
57.0	0.0049	0.0063	0.0080	0.0115	0.0166
90.0	0.0051	0.0066	0.0080	0.0115	0.0155

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	500 KM	600 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0135	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	500 KM	600 KM
28.5	0.0059	0.0129	0.0396	0.2242	0.4949
35.0	0.0105	0.0295	0.0911	0.2598	0.7317
45.0	0.0157	0.0429	0.0700	0.2279	0.5839
57.0	0.0198	0.0326	0.0576	0.1648	0.4373
90.0	0.0214	0.0311	0.0497	0.1327	0.3503

FOR DETECTOR POINT 14
MIDDLE RACK BOTTOM X 2120.66 Y 145. Z 905.

PROTON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0006	0.0048	0.0240	0.1571	0.5197
35.0	0.0021	0.0137	0.0450	0.1843	0.5416
45.0	0.0034	0.0132	0.0380	0.1502	0.4139
57.0	0.0019	0.0086	0.0243	0.0987	0.2923
90.0	0.0013	0.0058	0.0171	0.0733	0.2281

ELECTRON DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0000	0.0000	0.0000	0.0000	0.0001
35.0	0.0000	0.0000	0.0000	0.0000	0.0002
45.0	0.0000	0.0001	0.0002	0.0005	0.0012
57.0	0.0007	0.0009	0.0011	0.0017	0.0024
90.0	0.0007	0.0009	0.0011	0.0016	0.0022

COSMIC RAY DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0047	0.0051	0.0056	0.0064	0.0072
35.0	0.0060	0.0065	0.0069	0.0078	0.0087
45.0	0.0083	0.0089	0.0094	0.0104	0.0115
57.0	0.0111	0.0117	0.0123	0.0136	0.0148
90.0	0.0136	0.0145	0.0154	0.0172	0.0190

TOTAL DOSE RATE (RADS/DAY)

ORBITAL INCLINATION	200 KM	300 KM	400 KM	600 KM	800 KM
28.5	0.0054	0.0100	0.0296	0.1635	0.5271
35.0	0.0082	0.0202	0.0520	0.1922	0.5506
45.0	0.0119	0.0223	0.0477	0.1613	0.4266
57.0	0.0138	0.0213	0.0378	0.1140	0.3095
90.0	0.0157	0.0214	0.0337	0.0922	0.2494

APPENDIX C

DOSE RATES BEHIND SPHERICAL ALUMINUM SHELL SHIELD OF VARIOUS THICKNESSES AS A FUNCTION OF ORBITAL ALTITUDE AND INCLINATION

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 28.5 DEGREES AND ALTITUDE 200 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	0.026	0.000	0.000	0.004	0.031
0.25	0.022	0.000	0.000	0.004	0.027
0.50	0.017	0.000	0.000	0.004	0.022
0.75	0.014	0.000	0.000	0.004	0.019
1.00	0.012	0.000	0.000	0.004	0.016
1.50	0.008	0.000	0.000	0.004	0.013
2.00	0.005	0.000	0.000	0.004	0.011
3.00	0.004	0.000	0.000	0.004	0.009
4.00	0.003	0.000	0.000	0.004	0.007
5.00	0.002	0.000	0.000	0.004	0.007
6.00	0.001	0.000	0.000	0.004	0.006
8.00	0.001	0.000	0.000	0.004	0.006
10.00	0.000	0.000	0.000	0.004	0.005
15.00	0.000	0.000	0.000	0.004	0.005
20.00	0.000	0.000	0.000	0.004	0.005
25.00	0.000	0.000	0.000	0.004	0.005
30.00	0.000	0.000	0.000	0.004	0.004
40.00	0.000	0.000	0.000	0.004	0.004
50.00	0.000	0.000	0.000	0.004	0.004

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 28.5 DEGREES AND ALTITUDE 300 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	0.198	0.006	0.000	0.005	0.209
0.25	0.134	0.004	0.000	0.005	0.143
0.50	0.100	0.001	0.000	0.005	0.106
0.75	0.081	0.000	0.000	0.005	0.086
1.00	0.068	0.000	0.000	0.005	0.073
1.50	0.051	0.000	0.000	0.005	0.056
2.00	0.040	0.000	0.000	0.005	0.045
3.00	0.029	0.000	0.000	0.005	0.033
4.00	0.022	0.000	0.000	0.005	0.027
5.00	0.017	0.000	0.000	0.005	0.022
6.00	0.014	0.000	0.000	0.005	0.019
7.00	0.010	0.000	0.000	0.005	0.015
10.00	0.007	0.000	0.000	0.005	0.013
15.00	0.004	0.000	0.000	0.005	0.009
20.00	0.003	0.000	0.000	0.005	0.008
25.00	0.002	0.000	0.000	0.005	0.007
30.00	0.001	0.000	0.000	0.005	0.006
40.00	0.000	0.000	0.000	0.005	0.006
50.00	0.000	0.000	0.000	0.005	0.005

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 28.5 DEGREES AND ALTITUDE 400 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	0.937	0.186	0.000	0.005	1.129
0.25	0.498	0.019	0.000	0.005	0.523
0.50	0.333	0.003	0.000	0.005	0.342
0.75	0.262	0.001	0.000	0.005	0.269
1.00	[illegible]	0.000	0.000	0.005	0.226
1.50	0.177	0.000	0.000	0.005	0.183
2.00	0.151	0.000	0.000	0.005	0.157
3.00	0.118	0.000	0.000	0.005	0.124
4.00	0.094	0.000	0.000	0.005	0.103
[illegible]	[illegible]	0.000	0.000	0.005	0.089
[illegible]	[illegible]	0.000	0.000	0.005	0.077
8.00	0.056	0.000	0.000	0.005	0.062
10.00	0.045	0.000	0.000	0.005	0.051
15.00	0.029	0.000	0.000	0.005	0.035
20.00	0.020	0.000	0.000	0.005	0.026
25.00	0.015	0.000	0.000	0.005	0.020
30.00	0.011	0.000	0.000	0.005	0.017
40.00	0.007	0.000	0.000	0.005	0.012
50.00	0.004	0.000	0.000	0.005	0.010

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 28.5 DEGREES AND ALTITUDE 600 KM

SHIELD THICKNESS (G/C**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	8.654	5.880	0.001	0.006	14.542
0.25	3.294	0.584	0.001	0.006	3.886
0.50	1.909	0.116	0.001	0.006	2.033
0.75	1.420	0.036	0.001	0.006	1.464
1.00	1.157	0.011	0.000	0.006	1.174
1.50	0.933	0.000	0.000	0.006	0.940
2.00	0.806	0.000	0.000	0.006	0.813
3.00	0.649	0.000	0.000	0.006	0.656
4.00	0.556	0.000	0.000	0.006	0.563
5.00	0.487	0.000	0.000	0.006	0.494
6.00	0.434	0.000	0.000	0.006	0.441
8.00	0.356	0.000	0.000	0.006	0.362
10.00	0.300	0.000	0.000	0.006	0.307
15.00	0.213	0.000	0.000	0.006	0.219
20.00	0.160	0.000	0.000	0.006	0.167
25.00	0.125	0.000	0.000	0.006	0.132
30.00	0.101	0.000	0.000	0.006	0.107
40.00	0.069	0.000	0.000	0.006	0.075
50.00	0.050	0.000	0.000	0.006	0.056

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 28.5 DEGREES AND ALTITUDE 800 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	40.723	33.920	0.010	0.007	74.661
0.25	13.818	3.189	0.008	0.007	17.022
0.50	7.537	0.618	0.006	0.007	8.170
0.75	5.409	0.190	0.005	0.007	5.613
1.00	4.274	0.059	0.005	0.007	4.345
1.50	3.282	0.002	0.004	0.007	3.296
2.00	2.737	0.000	0.004	0.007	2.749
3.00	2.122	0.000	0.003	0.007	2.132
4.00	1.798	0.000	0.002	0.007	1.808
5.00	1.563	0.000	0.002	0.007	1.573
6.00	1.384	0.000	0.002	0.007	1.393
8.00	1.125	0.000	0.001	0.007	1.134
10.00	0.951	0.000	0.001	0.007	0.960
15.00	0.690	0.000	0.000	0.007	0.698
20.00	0.530	0.000	0.000	0.007	0.538
25.00	0.422	0.000	0.000	0.007	0.430
30.00	0.344	0.000	0.000	0.007	0.352
40.00	0.242	0.000	0.000	0.007	0.249
50.00	0.178	0.000	0.000	0.007	0.185

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 35.0 DEGREES AND ALTITUDE 200 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	0.158	0.001	0.000	0.006	0.166
0.25	0.126	0.000	0.000	0.006	0.132
0.50	0.095	0.000	0.000	0.006	0.101
0.75	0.076	0.000	0.000	0.006	0.082
1.00	0.061	0.000	0.000	0.006	0.067
1.50	0.039	0.000	0.000	0.006	0.045
2.00	0.026	0.000	0.000	0.006	0.032
3.00	0.015	0.000	0.000	0.006	0.021
4.00	0.010	0.000	0.000	0.006	0.016
5.00	0.007	0.000	0.000	0.006	0.014
6.00	0.006	0.000	0.000	0.006	0.012
8.00	0.003	0.000	0.000	0.006	0.009
10.00	0.002	0.000	0.000	0.006	0.008
15.00	0.001	0.000	0.000	0.006	0.007
20.00	0.000	0.000	0.000	0.006	0.006
25.00	0.000	0.000	0.000	0.006	0.006
30.00	0.000	0.000	0.000	0.006	0.006
40.00	0.000	0.000	0.000	0.006	0.006
50.00	0.000	0.000	0.000	0.006	0.006

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 35.0 DEGREES AND ALTITUDE 300 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	0.793	0.331	0.000	0.006	1.131
0.25	0.441	0.035	0.000	0.006	0.483
0.50	0.296	0.007	0.000	0.006	0.311
0.75	0.231	0.002	0.000	0.006	0.240
1.00	0.190	0.000	0.000	0.006	0.198
1.50	0.143	0.000	0.000	0.006	0.150
2.00	0.114	0.000	0.000	0.006	0.121
3.00	0.081	0.000	0.000	0.006	0.088
4.00	0.063	0.000	0.000	0.006	0.070
5.00	0.051	0.000	0.000	0.006	0.058
6.00	0.042	0.000	0.000	0.006	0.049
8.00	0.030	0.000	0.000	0.006	0.037
10.00	0.023	0.000	0.000	0.006	0.029
15.00	0.013	0.000	0.000	0.006	0.019
20.00	0.008	0.000	0.000	0.006	0.014
25.00	0.005	0.000	0.000	0.006	0.012
30.00	0.003	0.000	0.000	0.006	0.010
40.00	0.002	0.000	0.000	0.006	0.008
50.00	0.001	0.000	0.000	0.006	0.007

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 35.0 DEGREES AND ALTITUDE 400 KM

SHIELD THICKNESS (G/C **2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
.10	2.766	2.081	0.000	0.006	4.855
.25	1.156	0.206	0.000	0.006	1.370
.50	0.697	0.042	0.000	0.006	0.747
.75	0.525	0.013	0.000	0.006	0.545
1.00	0.428	0.004	0.000	0.006	0.439
1.50	0.339	0.000	0.000	0.006	0.346
2.00	0.287	0.001	0.000	0.006	0.294
3.00	0.223	0.000	0.000	0.006	0.230
4.00	0.184	0.000	0.000	0.006	0.191
5.00	0.156	0.000	0.000	0.007	0.163
6.00	0.135	0.000	0.000	0.007	0.142
7.00	0.105	0.000	0.000	0.006	0.112
10.00	0.085	0.000	0.000	0.006	0.092
15.00	0.055	0.000	0.000	0.007	0.062
20.00	0.038	0.000	0.000	0.007	0.045
25.00	0.027	0.000	0.000	0.007	0.034
30.00	0.021	0.000	0.000	0.007	0.028
40.00	0.013	0.000	0.000	0.007	0.020
50.00	0.008	0.000	0.000	0.007	0.015

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 35.0 DEGREES AND ALTITUDE 600 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
.10	15.792	12.908	0.004	0.007	28.711
.25	5.152	1.214	0.003	0.007	6.378
.50	2.749	0.282	0.002	0.007	3.042
.75	2.00	0.075	0.002	0.007	2.086
1.00	1.592	0.023	0.002	0.007	1.616
1.50	1.229	0.001	0.001	0.007	1.239
2.00	1.033	0.000	0.001	0.007	1.043
3.00	0.905	0.000	0.001	0.007	0.914
4.00	0.879	0.000	0.001	0.007	0.887
5.00	0.587	0.000	0.000	0.007	0.595
7.00	0.518	0.000	0.000	0.007	0.525
10.00	0.415	0.000	0.000	0.007	0.423
12.00	0.345	0.001	0.000	0.007	0.354
15.00	0.240	0.000	0.000	0.007	0.248
20.00	0.179	0.000	0.000	0.007	0.186
25.00	0.137	0.001	0.000	0.007	0.145
30.00	0.109	0.000	0.000	0.007	0.117
40.00	0.074	0.000	0.000	0.008	0.081
50.00	0.051	0.000	0.000	0.008	0.059

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 35.0 DEGREES AND ALTITUDE 800 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	54.775	46.105	0.014	0.008	100.900
0.25	16.449	4.340	0.011	0.008	20.810
0.50	8.534	0.862	0.009	0.008	9.414
0.75	5.979	0.267	0.008	0.008	6.264
1.00	4.647	0.082	0.007	0.008	4.745
1.50	3.514	0.006	0.006	0.008	3.537
2.00	2.911	0.000	0.005	0.008	2.925
3.00	2.237	0.000	0.004	0.008	2.250
4.00	1.892	0.000	0.003	0.008	1.904
5.00	1.642	0.000	0.003	0.008	1.654
6.00	1.451	0.000	0.002	0.008	1.463
8.00	1.177	0.000	0.002	0.008	1.188
10.00	0.992	0.000	0.001	0.008	1.003
15.00	0.716	0.000	0.000	0.008	0.725
20.00	0.547	0.000	0.000	0.008	0.556
25.00	0.433	0.000	0.000	0.009	0.442
30.00	0.351	0.000	0.000	0.008	0.360
40.00	0.244	0.000	0.000	0.008	0.253
50.00	0.177	0.000	0.000	0.008	0.186

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 45.0 DEGREES AND ALTITUDE 200 KM

SHIELD THICKNESS (G/C**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
[illegible]	0.728	1.972	0.000	0.008	2.709
[illegible]	0.298	0.577	0.000	0.008	0.885
[illegible]	[illegible]	0.146	0.000	0.008	0.365
0.75	0.118	0.067	0.000	0.008	0.195
1.00	[illegible]	0.024	0.000	0.008	0.121
1.50	0.056	0.002	0.000	0.008	0.067
2.00	[illegible]	0.000	0.000	0.008	0.047
3.00	0.023	0.000	0.000	0.008	0.032
4.00	0.017	0.000	0.000	0.008	0.025
5.00	0.013	0.000	0.000	0.008	0.021
6.00	0.010	[illegible]	0.000	0.008	0.018
8.00	0.006	[illegible]	0.000	0.008	0.015
10.00	0.004	[illegible]	0.000	0.008	0.012
15.00	0.002	0.000	0.000	0.008	0.010
20.00	0.001	0.000	0.000	0.008	0.009
25.00	0.000	0.000	0.000	0.008	0.008
30.00	0.000	0.000	0.000	0.008	0.008
40.00	0.000	0.000	0.000	0.008	0.009
50.00	0.000	0.000	0.000	0.008	0.009

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 45.0 DEGREES AND ALTITUDE 300 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	2.493	4.498	0.000	0.009	6.992
0.25	0.851	1.116	0.000	0.009	1.977
0.50	0.461	0.350	0.000	0.009	0.821
0.75	0.321	0.127	0.000	0.009	0.457
1.00	0.243	0.045	0.000	0.009	0.298
1.50	0.166	0.004	0.000	0.009	0.180
2.00	0.125	0.000	0.000	0.009	0.135
3.00	0.082	0.000	0.000	0.009	0.092
4.00	0.062	0.000	0.000	0.009	0.072
5.00	0.049	0.000	0.000	0.009	0.058
6.00	0.039	0.000	0.000	0.009	0.049
8.00	0.027	0.000	0.000	0.008	0.036
10.00	0.020	0.000	0.000	0.008	0.029
15.00	0.011	0.000	0.000	0.008	0.020
20.00	0.006	0.000	0.000	0.008	0.015
25.00	0.004	0.000	0.000	0.008	0.013
30.00	0.002	0.000	0.000	0.008	0.011
40.00	0.001	0.000	0.000	0.008	0.010
50.00	0.000	0.000	0.000	0.008	0.009

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 45.0 DEGREES AND ALTITUDE 400 KM

SHIELD THICKNESS (G/C**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	5.881	8.826	0.002	0.009	14.719
0.25	1.800	1.939	0.001	0.009	3.751
0.50	0.941	0.592	0.001	0.009	1.544
0.75	0.654	0.215	0.001	0.009	0.879
1.00	0.500	0.079	0.000	0.009	0.591
1.50	0.364	0.006	0.000	0.009	0.381
2.00	0.293	0.000	0.000	0.009	0.301
3.00	0.208	0.000	0.000	0.009	0.219
4.00	0.166	0.000	0.000	0.009	0.176
5.00	0.136	0.000	0.000	0.009	0.146
6.00	0.114	0.000	0.000	0.009	0.124
8.00	0.085	0.000	0.000	0.009	0.095
10.00	0.066	0.000	0.000	0.009	0.076
15.00	0.040	0.000	0.000	0.009	0.050
20.00	0.027	0.000	0.000	0.009	0.036
25.00	0.019	0.000	0.000	0.009	0.028
30.00	0.013	0.000	0.000	0.009	0.023
40.00	0.008	0.000	0.000	0.009	0.017
50.00	0.005	0.000	0.000	0.009	0.014

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 45.0 DEGREES AND ALTITUDE 600 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	21.000	24.613	0.006	0.010	47.630
0.25	5.830	4.990	0.005	0.010	10.836
0.50	2.926	1.445	0.004	0.010	4.386
0.75	2.009	0.515	0.003	0.010	2.540
1.00	1.536	0.199	0.003	0.010	1.739
1.50	1.139	0.015	0.002	0.010	1.167
2.00	0.926	0.000	0.002	0.010	0.940
3.00	0.692	0.000	0.002	0.010	0.705
4.00	0.573	0.000	0.001	0.010	0.585
5.00	0.488	0.000	0.001	0.010	0.500
6.00	0.424	0.000	0.001	0.010	0.435
8.00	0.333	0.000	0.001	0.010	0.344
10.00	0.273	0.000	0.000	0.010	0.284
15.00	0.186	0.000	0.000	0.010	0.197
20.00	0.136	0.000	0.000	0.010	0.146
25.00	0.103	0.000	0.000	0.010	0.114
30.00	0.081	0.000	0.000	0.010	0.091
40.00	0.053	0.000	0.000	0.010	0.064
50.00	0.037	0.000	0.000	0.010	0.047

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 45.0 DEGREES AND ALTITUDE 800 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	57.181	66.281	0.017	0.011	123.490
0.25	15.686	11.097	0.013	0.011	26.806
0.50	7.769	3.051	0.010	0.011	10.843
0.75	5.290	1.071	0.009	0.011	6.383
1.00	4.015	0.386	0.008	0.011	4.422
1.50	2.941	0.031	0.007	0.011	2.991
2.00	2.374	0.001	0.006	0.011	2.393
3.00	1.772	0.000	0.005	0.011	1.789
4.00	1.481	0.000	0.004	0.011	1.497
5.00	1.273	0.000	0.003	0.011	1.288
6.00	1.115	0.000	0.003	0.011	1.130
8.00	0.891	0.000	0.002	0.011	0.906
10.00	0.745	0.000	0.002	0.011	0.758
15.00	0.531	0.000	0.001	0.011	0.543
20.00	0.401	0.000	0.000	0.011	0.413
25.00	0.315	0.000	0.000	0.011	0.327
30.00	0.254	0.000	0.000	0.011	0.266
40.00	0.175	0.000	0.000	0.011	0.187
50.00	0.127	0.000	0.000	0.011	0.138

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 57.0 DEGREES AND ALTITUDE 200 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
[illegible]	[illegible]	[illegible]	0.004	0.011	19.680
[illegible]	[illegible]	[illegible]	[illegible]	0.011	6.276
[illegible]	[illegible]	1.797	[illegible]	0.011	1.903
0.75	[illegible]	[illegible]	[illegible]	0.011	0.693
1.00	[illegible]	[illegible]	[illegible]	0.011	0.285
1.50	[illegible]	[illegible]	[illegible]	0.011	0.063
2.00	[illegible]	[illegible]	[illegible]	0.011	0.035
3.00	[illegible]	[illegible]	[illegible]	0.011	0.026
4.00	[illegible]	[illegible]	[illegible]	[illegible]	0.022
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
40.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 57.0 DEGREES AND ALTITUDE 300 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	1.520	26.483	0.005	0.012	28.021
0.25	0.498	8.180	0.003	0.012	8.695
0.50	0.268	2.366	0.003	0.012	2.650
0.75	0.187	0.801	0.002	0.012	1.003
1.00	0.142	0.288	0.002	0.012	0.446
1.50	0.100	0.024	0.002	0.012	0.140
2.00	0.078	0.000	0.001	0.012	0.093
3.00	0.053	0.000	0.001	0.012	0.067
4.00	0.040	0.000	0.001	0.012	0.054
5.00	0.032	0.000	0.001	0.012	0.045
6.00	0.026	0.000	0.001	0.012	0.039
8.00	0.018	0.000	0.000	0.011	0.031
10.00	0.013	0.000	0.000	0.011	0.026
15.00	0.007	0.000	0.000	0.011	0.019
20.00	0.004	0.000	0.000	0.011	0.016
25.00	0.003	0.000	0.000	0.010	0.014
30.00	0.002	0.000	0.000	0.010	0.012
40.00	0.001	0.000	0.000	0.009	0.010
50.00	0.000	0.000	0.000	0.009	0.009

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 57.0 DEGREES AND ALTITUDE 400 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	3.904	35.563	0.006	0.013	39.492
0.25	1.147	10.621	0.005	0.013	11.787
0.50	0.592	3.038	0.004	0.013	3.647
0.75	0.409	1.022	0.003	0.013	1.448
1.00	0.312	0.366	0.003	0.013	0.694
1.50	0.226	0.031	0.002	0.012	0.273
2.00	0.180	0.001	0.002	0.012	0.197
3.00	0.129	0.000	0.002	0.012	0.144
4.00	0.103	0.000	0.001	0.012	0.118
5.00	0.085	0.000	0.001	0.012	0.099
6.00	0.072	0.000	0.001	0.012	0.086
8.00	0.054	0.000	0.001	0.012	0.067
10.00	0.042	0.000	0.000	0.012	0.055
15.00	0.026	0.000	0.000	0.012	0.039
20.00	0.018	0.000	0.000	0.011	0.030
25.00	0.012	0.000	0.000	0.011	0.024
30.00	0.009	0.000	0.000	0.011	0.020
40.00	0.005	0.000	0.000	0.010	0.016
50.00	0.003	0.000	0.000	0.009	0.013

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 57.0 DEGREES AND ALTITUDE 600 KM

SHIELD THICKNESS (G/C**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	14.707	61.651	0.011	0.014	76.384
0.25	3.925	16.695	0.009	0.014	20.643
0.50	1.935	4.648	0.007	0.014	6.605
0.75	1.317	1.542	0.006	0.014	2.880
1.00	1.000	0.543	0.005	0.014	1.563
1.50	0.737	0.045	0.004	0.014	0.801
2.00	0.597	0.001	0.004	0.014	0.618
3.00	0.446	0.000	0.003	0.014	0.464
4.00	0.370	0.000	0.003	0.014	0.387
5.00	0.316	0.000	0.002	0.014	0.333
6.00	0.275	0.000	0.002	0.013	0.292
8.00	0.217	0.000	0.001	0.013	0.233
10.00	0.179	0.000	0.001	0.013	0.194
15.00	0.124	0.000	0.000	0.013	0.138
20.00	0.091	0.000	0.000	0.012	0.104
25.00	0.070	0.000	0.000	0.012	0.082
30.00	0.055	0.000	0.000	0.012	0.067
40.00	0.035	0.000	0.000	0.011	0.048
50.00	0.026	0.000	0.000	0.010	0.036

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 57.0 DEGREES AND ALTITUDE 800 KM

SHIELD THICKNESS (G/C**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
[illegible]	41.643	103.[illegible]	[illegible]	0.015	145.500
.25	11.298	24.[illegible]	0.016	0.015	35.928
[illegible]	5.573	6.652	0.012	0.015	12.254
.75	2.785	2.188	0.011	0.015	6.003
1.0[illegible]	2.968	0.762	0.010	0.015	3.656
1.50	2.035	0.063	0.009	0.015	2.175
2.00	1.677	0.002	0.007	0.015	1.703
3.00	1.246	0.010	0.006	0.015	1.268
4.00	1.0[illegible]	0.[illegible]	0.005	0.015	1.061
5.00	0.[illegible]	0.001	0.004	0.015	0.913
6.00	0.792	0.[illegible]	0.[illegible]	0.015	0.[illegible]
8.00	0.625	0.000	0.003	0.014	0.643
10.00	0.522	0.000	0.002	0.014	0.540
15.00	0.374	0.000	0.001	0.014	0.390
20.00	0.284	0.000	0.000	0.014	0.299
25.00	0.224	0.000	0.000	0.013	0.238
30.00	0.181	0.000	0.000	0.013	0.195
40.00	0.126	0.000	0.000	0.012	0.138
50.00	0.091	0.000	0.000	0.012	0.103

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 90.0 DEGREES AND ALTITUDE 200 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	0.275	23.332	0.004	0.015	23.627
0.25	0.117	7.271	0.002	0.015	7.408
0.50	0.067	2.030	0.002	0.015	2.116
0.75	0.047	0.668	0.002	0.015	0.733
1.00	0.035	0.236	0.002	0.015	0.289
1.50	0.022	0.020	0.001	0.015	0.059
2.00	0.015	0.000	0.001	0.015	0.033
3.00	0.009	0.000	0.001	0.014	0.025
4.00	0.006	0.000	0.001	0.014	0.022
5.00	0.004	0.000	0.001	0.014	0.020
6.00	0.003	0.000	0.000	0.014	0.019
8.00	0.002	0.000	0.000	0.013	0.017
10.00	0.001	0.000	0.000	0.013	0.015
15.00	0.000	0.000	0.000	0.013	0.014
20.00	0.000	0.000	0.000	0.012	0.013
25.00	0.000	0.000	0.000	0.012	0.012
30.00	0.000	0.000	0.000	0.011	0.011
40.00	0.000	0.000	0.000	0.010	0.010
50.00	0.000	0.000	0.000	0.009	0.009

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 90.0 DEGREES AND ALTITUDE 300 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	1.021	30.666	0.006	0.016	31.709
0.25	0.346	9.419	0.004	0.016	9.786
0.50	0.139	2.616	0.003	0.016	2.825
0.75	0.133	0.860	0.003	0.016	1.012
1.00	0.101	0.302	0.002	0.016	0.423
1.50	0.071	0.025	0.002	0.016	0.115
2.00	0.054	0.001	0.002	0.015	0.073
3.00	0.036	0.000	0.001	0.015	0.054
4.00	0.027	0.000	0.001	0.015	0.044
5.00	0.021	0.000	0.001	0.015	0.038
6.00	0.017	0.000	0.001	0.015	0.034
8.00	0.012	0.000	0.000	0.014	0.028
10.00	0.009	0.000	0.000	0.014	0.024
15.00	0.005	0.000	0.000	0.014	0.019
20.00	0.003	0.000	0.000	0.013	0.017
25.00	0.002	0.000	0.000	0.013	0.015
30.00	0.001	0.000	0.000	0.012	0.014
40.00	0.000	0.000	0.000	0.011	0.012
50.00	0.000	0.000	0.000	0.010	0.011

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 90.0 DEGREES AND ALTITUDE 400 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	2.557	39.106	0.007	0.017	41.687
0.25	0.780	11.707	0.005	0.017	12.510
0.50	0.409	3.230	0.004	0.017	3.661
0.75	0.284	1.056	0.004	0.017	1.362
1.00	0.218	0.370	0.003	0.017	0.610
1.50	0.159	0.031	0.003	0.016	0.210
2.00	0.127	0.001	0.002	0.016	0.148
3.00	0.091	0.000	0.002	0.016	0.110
4.00	0.073	0.000	0.001	0.016	0.091
5.00	0.060	0.000	0.001	0.016	0.078
6.00	0.051	0.000	0.001	0.016	0.068
8.00	0.038	0.000	0.001	0.015	0.055
10.00	0.030	0.000	0.000	0.015	0.046
15.00	0.018	0.000	0.000	0.014	0.034
20.00	0.012	0.000	0.000	0.014	0.027
25.00	0.009	0.000	0.000	0.014	0.023
30.00	0.006	0.000	0.000	0.013	0.020
40.00	0.004	0.000	0.000	0.012	0.016
50.00	0.002	0.000	0.000	0.011	0.014

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 90.0 DEGREES AND ALTITUDE 600 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	10.045	62.135	0.011	0.019	72.210
0.25	2.821	17.154	0.008	0.018	20.002
0.50	1.422	4.663	0.007	0.018	6.112
0.75	0.977	1.518	0.006	0.018	2.521
1.00	0.747	0.529	0.005	0.018	1.301
1.50	0.553	0.044	0.004	0.018	0.620
2.00	0.449	0.001	0.004	0.018	0.473
3.00	0.335	0.000	0.003	0.018	0.357
4.00	0.277	0.000	0.003	0.018	0.299
5.00	0.236	0.000	0.002	0.018	0.257
6.00	0.205	0.000	0.002	0.017	0.225
8.00	0.161	0.000	0.001	0.017	0.181
10.00	0.133	0.000	0.001	0.017	0.151
15.00	0.091	0.000	0.000	0.016	0.109
20.00	0.067	0.000	0.000	0.016	0.083
25.00	0.051	0.000	0.000	0.015	0.067
30.00	0.040	0.000	0.000	0.015	0.055
40.00	0.027	0.000	0.000	0.014	0.041
50.00	0.019	0.000	0.000	0.013	0.032

DOSE RATE VS DEPTH AT ORBITAL INCLINATION 90.0 DEGREES AND ALTITUDE 800 KM

SHIELD THICKNESS (G/CM**2)	PROTON DOSE RATE (RADS/DAY)	ELECTRON DOSE RATE (RADS/DAY)	BREMSSTRAHLUNG DOSE RATE (RADS/DAY)	COSMIC RAY DOSE RATE (RADS/DAY)	TOTAL DOSE RATE (RADS/DAY)
0.10	31.220	94.599	0.018	0.020	125.850
0.25	8.554	23.302	0.014	0.020	31.891
0.50	4.241	6.292	0.011	0.020	10.556
0.75	2.892	2.063	0.010	0.020	4.986
1.00	2.197	0.723	0.009	0.020	2.951
1.50	1.610	0.059	0.007	0.020	1.697
2.00	1.300	0.002	0.006	0.020	1.329
3.00	0.971	0.000	0.005	0.020	0.997
4.00	0.811	0.000	0.004	0.020	0.836
5.00	0.697	0.000	0.004	0.019	0.721
6.00	0.611	0.000	0.003	0.019	0.634
8.00	0.489	0.000	0.002	0.019	0.511
10.00	0.409	0.000	0.002	0.019	0.430
15.00	0.292	0.000	0.001	0.019	0.312
20.00	0.222	0.000	0.000	0.018	0.241
25.00	0.175	0.000	0.000	0.017	0.193
30.00	0.142	0.000	0.000	0.017	0.159
40.00	0.098	0.000	0.000	0.016	0.115
50.00	0.072	0.000	0.000	0.015	0.087

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APPROVAL

CHARGED PARTICLE RADIATION ENVIRONMENT FOR THE SPACELAB AND OTHER MISSIONS IN LOW EARTH ORBIT – REVISION A

By John W. Watts, Jr. and Jerry J. Wright

The information in this report has been reviewed for security classification. Review of any information concerning Department of Defense or Atomic Energy Commission programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

This document has also been reviewed and approved for technical accuracy.

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