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The South Atlantic Anomaly (SAA)

The SAA is a region where the magnetic field, and hence the inner radiation belt dips to its lowest point over the Earth. Satellites in Low Earth Orbit flying through this region are bombarded with the energetic particles trapped in the inner radiation belt, causing problems with electronics and instruments.



The unsymmetric magnetic field causes the inner radiation belt to dip lower over the South Atlantic (figure from Wikipedia)



A plot of the locations of electronics problems (Single Event Upsets - squares) on the Topex/ Poseidon spacecraft, most of which occur in the South Atlantic Anomaly region

UV Photometric Instruments and **Particle Hits**



The SSUSI instrument consists of a scanning imaging spectrograph (uses 2-d microchannel plates) and 3 nadir pointing photometers. **GUVI** consists of only the scanning imaging spectrograph. All UV photometers on these instruments are affected by particle hits



Orbital Parameters

SSUSI (Spectial Sensor Ultraviolet Spectrographic Imager) flies on DMSP F16, F17, F18, and soon F19 spacecraft DMSP Orbital Inclination ~ 99 degrees DMSP Orbital Altitude ~ 850 km

GUVI (Global UltraViolet Imager) flies on NASA's TIMED mission TIMED Orbital Inclination ~ 74 degrees TIMED Orbital Altitude ~ 630 km



Phototubes are mounted horizontally in the white instrument box below the sunshades.

The response of photomultiplier instruments to hits from energetic charged particle radiation is well studied (e.g., Johnson, 1973 and Gavrilov, et al, 1995). It was noted that the photometer pulse rate is proportional to the the energetic particle hit rate for charged particles of energy ~ 1 MeV or greater.

Phototubes are surrounded by metal. The housing is 1/16 inch thick aluminum. Most paths between the phototube and outer space pass through two layers of aluminum, so 1/8 inch aluminum is roughly the amount of metal between the phototube and empty space.

Charged particles with low energies cannot pass through 1/8 inch aluminum. The energies of particles that can penetrate this amount of metal:



SAA Visualization Monitoring Tool Based on SAA Model and SSUSI Near-Realtime Data

The prototype Widget at right was developed as a Space Stiuational Awareness tool for the Air Force Weather Agency. It uses SSUSI photometer data to update the intensity of the SAA.



Monitoring the South Atlantic Anomaly with Photometric Particle Hit Noise in Low Earth Orbit

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