ferent equatorial pitch angles on Atlantic and Pacific orbits; the difference in dose will depend upon the steepness of the particle pitch-angle distributions. The second reason for a dose difference is due to the fact that the Atlantic perigee occurs at L value; thus HEO spacecraft see a larger energetic proton flux at the Atlantic perigee.

It is interesting to note in Figure 2that the variability of dose does not continue to increase with decreasing shield thickness but maximizes around 50 mil. In particular, compare the 12 mil history with that at 49.5 mil.

ANALYSIS

For some space weather considerations, such as bulk charging and sensor backgrounds, the parameter of interest is the maximum dose rate rather than the integrated mission dose. Figure 3 shows the probability that a given dose/orbit is exceeded during the time period from Day 128, 1994 to Day 250, 1998. Note that the maximum dose/orbit appears to have reached an asymptotic value. However, we are yet to make solar maximum observations.

It is of interest to compare the observations with the predictions of the standard radiation-belt models: AE-8 and AP-8. We make two comparisons: 94128-98250 with data only from 1994-026 and 97314-98250 with data from 1994-026 and 1997-068. The reason for this division in time is that the perigee altitude of an HEO satellite varies over a several year time period and significantly affects the proton dose. The variation in perigee altitude of 1994-026 is shown in Figure 4. Note the gradual decline of the dose/orbit under the two thickest shields in Figure 1; a direct result of the rise in perigee shown in Figure 4.

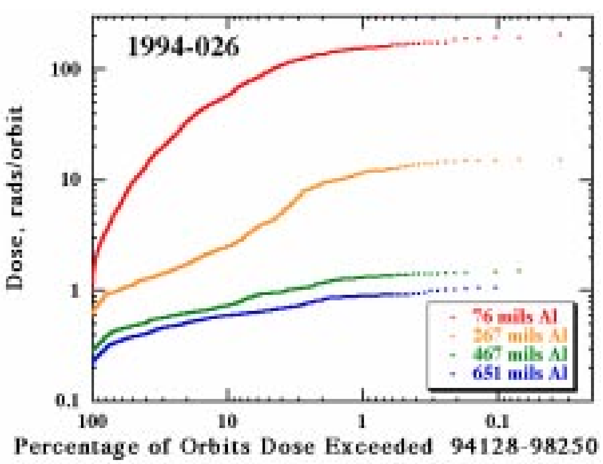

Figure 3. *The percentage of orbits that a given total dose per orbit was exceeded is shown.*

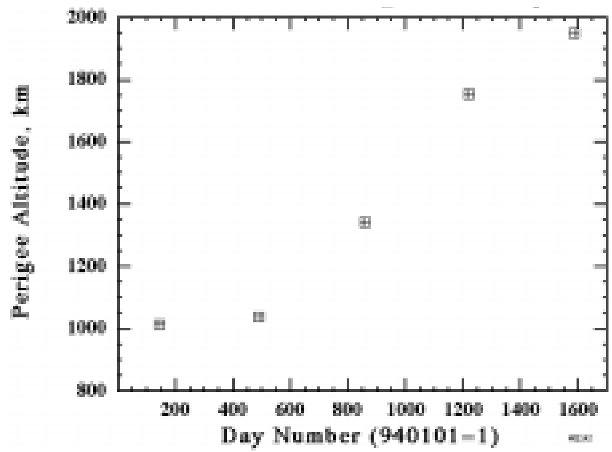

Figure 4. *The time history of the perigee altitude of 1994-026 is shown.*

Figure 5 is a comparison of measurements from 1994-026 with the model predictions for the two extreme perigee altitudes. (Figure 4 shows that more of the measurement period was spent with a perigee closer to the low value of 1000 km than the high value of 1900 km.) The plot shows that for thicker shielding, where protons dominate, the agreement between model and measurement is good, whereas for thinner shielding, where electrons dominate, the dose is substantially smaller than predicted.

Figure 6 compares the measurements from 1994-026 and 1997-068 with the NASA models over the time period from 97314 to 98250. This figure also shows that, for thicker shielding, the agreement between model and measurement remains good. For thinner shielding, the agreement between model and measurement gets steadily worse with decreasing shielding thickness, becoming more than an order of magnitude at 12 mil.

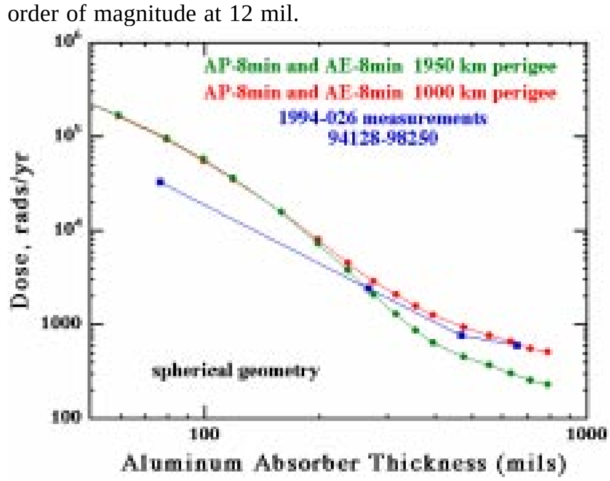

Figure 5. *The dose measurements from 1994-026 are plotted as a function of shielding thickness. Also plotted are the predictions from the AE-8 and AP-8 models for the two perigee altitude extremes.*

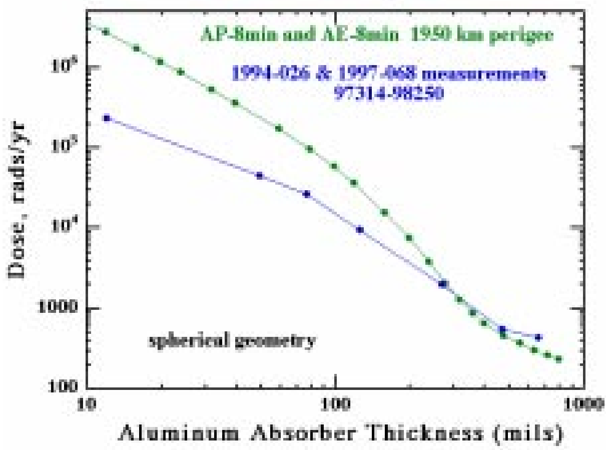

Figure 6. *The dose measurements from 1994-026 and 1997-068 are plotted as a function of shielding thickness for the time period when the 1997-068 data were available.*

CONCLUSIONS

1. The HEO radiation-dose measurements are in good agreement with the predictions of AP-8.

2. The predictions of AE-8 substantially exceed the measurements. The difference between model and data increases with decreasing shielding thickness.

3. The present measurements are congruent with earlier measurements made in HEO orbit during the 1980s (Ref 1).

4. The temporal variability of MeV electrons exceeds that of electrons in the 100s of keV range.

REFERENCE

1. Blake, J. B. 1990, The Energetic Radiation Environment in a Highly Elliptical (Molniya) Orbit, in *Proceedings of the ESA Workshop on Space Environment Analysis*, ESA-WPP-23, ESTEC, Noordwijk, The Netherlands, 1990, 5.3.

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