DANISH TECHNOLOGICAL INSTITUTE

The lifetime of instrumentation under plasma storms

The Tribology Centre now offers an accelerated method for investigating the effects of radiation exposure of materials and electronics intended for space applications.

In addition to emitting photons, the sun is also emitting the so-called "primary cosmic rays" consisting of charged or neutral particles, primarily protons and electrons.

Most of the high-energy charged particles found in the terrestrial orbit come from the sun. The impact of the solar environment depends critically on the distance from the sun.

Validating the impact of charged particles on instruments and electronics is critical in order to predict the reliability of materials and electronics when used in space.

Reliable performance data is therefore a prerequisite for validating and documenting the lifetime of various instrumentations to be used in outer space. The proton flux, measured as the number of protons per cm^2, and the involved energies at the earth-sun distance depends on the origin of the protons as seen in Figure 1. Plasma storms can be simulated by e.g. 100 keV protons with a flux of 10^4 protons per cm^2 per second (red circle). 100 years in space life corresponds to a dose of 5.25×10^{11} protons/cm^2.

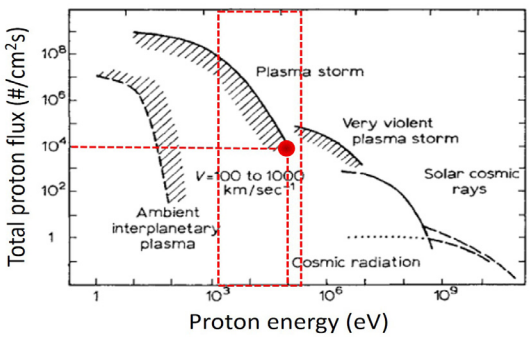

Figure 1: Energy spectrum of solar particles at the terrestrial orbit (Jean-Claude Pecker, Space Observations). The indicated energy-flux area can be mapped by the 1090 Danfysik accelerator.

Scanning a proton beam over e.g. 100 cm^2 will correspond to a total proton dose of 5.25×10^{13}, which is attainable within hours with the new high-current Danfysik 1090 ion implanter hosted by Danish Technological Institute.

Figure 2: Danfysik 1090 high current ion implanter.

Specifications:
Acceleration voltage: Ion energies between 20 kV to 200 kV for singly charged ions and higher for multiply charged ions.
Currents: 0.2-4.0 mA depending on the charge and ion type.
Mass separation: Mass separation up to 250 amu.

For more information, please contact

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