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FASTRAD V3
Radiation Tool

- RADIATION SHIELDING TOOL WITH A NEW MONTE CARLO MODULE -

FASTRAD® is a complete engineering software developed for 3D radiation shielding analyses. A new Monte Carlo module performs electron and photon transport in 3D geometry. For space application, the FASTRAD reverse Monte Carlo approach gives a powerful solution for accurate TID calculation.

Several application cases show the efficiency of this method even for complex 3D models.

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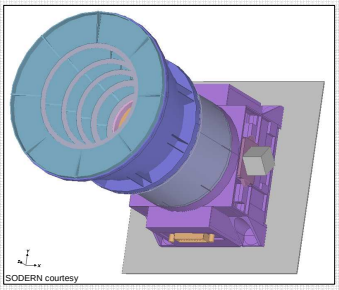
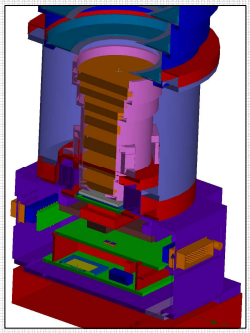
Reverse Monte Carlo Comparison and Validation

>> Electron environment during a Jovian mission

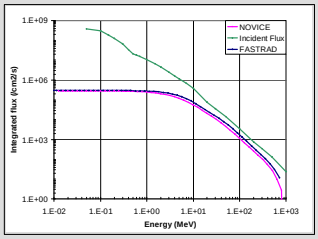
The energy of the trapped electrons around Jupiter can reach up to 1 GeV. This is a particular concern for sensitive external units such as Star Trackers. A study was realised using the FASTRAD Reverse Monte Carlo tool to assess the transmitted electron flux in critical parts of the unit, such as the CCD camera and the lenses along the optical path.



1. Star Tracker designed for a Jovian mission. The unit is located outside the spacecraft represented by a baseplate.



2. Analyses were carried out at the optical path level, from the outermost lens to the CCD detector.

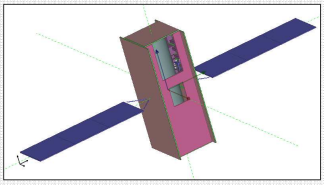


Transmitted electron flux comparison between FASTRAD and NOVICE reverse Monte Carlo method calculation for the innermost lens.

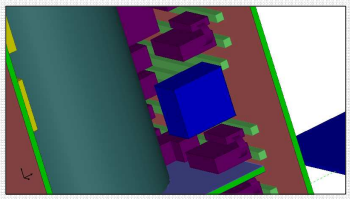
Incident flux is given as an indication of the particle attenuation.

>> Electron flux at geosynchronous orbit

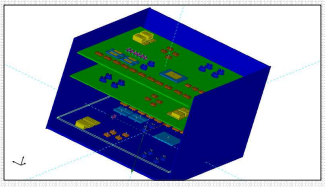
The 3D radiation model includes the complete satellite structure, the electronic units and the component packages. The satellite is exposed to a geostationary environment.



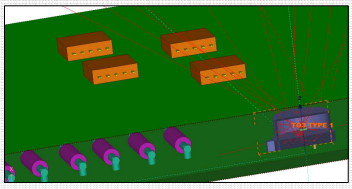
1. The whole satellite structure is designed under the FASTRAD CAD interface.



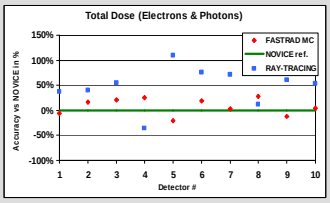
2. Units are modeled together with all elements (heatpipes, tanks,...) that can induce a radiation shielding effect.



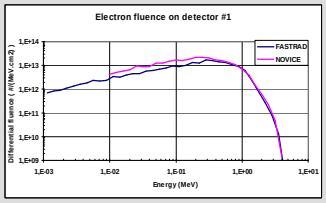
3. All sensitive components are taken into account in the equipment unit.



4. This clipping view shows silicon die inside the TO39 package. The deposited energy due to incident electrons is calculated inside this sensitive area.



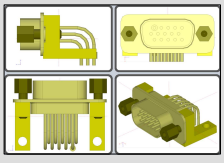
Deposited dose comparison between ray-tracing and FASTRAD reverse Monte Carlo method using NOVICE as a reference for 10 point detectors.



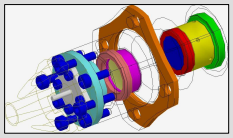
Transmitted electron flux comparison between FASTRAD and NOVICE reverse Monte Carlo method calculation for the first detector.

Radiation Analysis Scheme

STEP Model Import from mechanical CAD tools

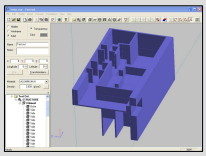


- Hierarchy tree
- Labels
- Colors

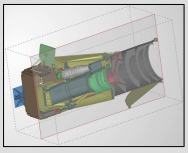


3D Graphical User Interface

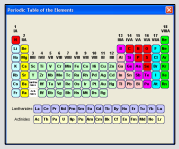
CSG Modeling



Toolset (measure, mass, ...)

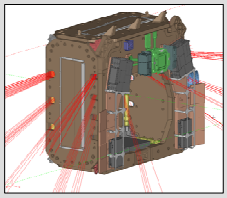


Materials Management

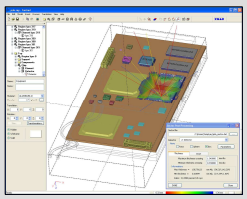


Calculation and Shielding tools

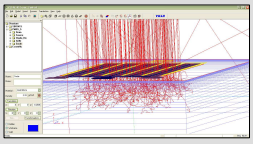
Sector Analysis



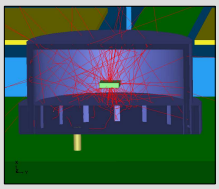
Shielding Design



Forward Monte-Carlo



Reverse Monte-Carlo



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