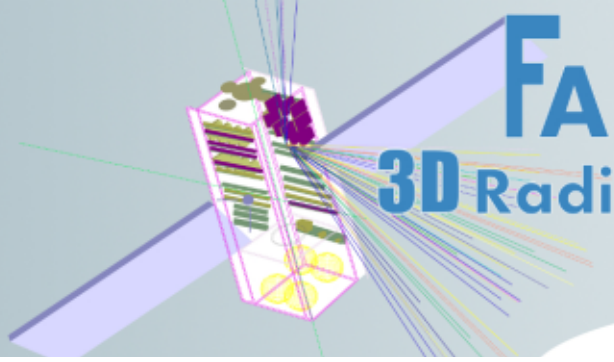

FASTRAD 3D Radiation Software

Discover the FASTRAD® Software

FASTRAD® software is available annualy in three different packages :

1. *Bronze - Easy to-use interface functions & effortless data-exchange*

Bronze service represents the first step of your FASTRAD® experience. It is a simplified configuration, limited to creating and handling 3D radiation models, allowing to import and export entire STEP object characteristics.

Features

Graphic User interface

Advanced CAD Toolkit
Data base interface
Exchange with other radiation codes(1)
Advanced STEP import

(1)This module provides an exchange protocol with other radiation calculation codes

2. *Silver - Extended modelling & key calculations*

Silver service goes beyond as it allows to perform essential calculations: sector analysis (Minimum and Slant Ray-tracing) and equivalent thickness. Furthermore, the extended interface is especially efficient for advanced modelling.

Features

Bronze features plus :

Extended modelling interface
TID by sector analysis (Ray-Tracing)
DDEF by sector analysis (Ray-Tracing)
Six Faces Equivalent Thickness
Ray view and shielding mapping

3. *Gold - High accuracy & high speed calculation capabilities*

Gold service gives you the keys to the most efficient Monte Carlo calculation: Both Forward and Reverse Monte Carlo calculations are available. The Monte Carlo is based on actual physical interactions of particles with the matter. It considers the material composition and the particle behavior, allowing you to get a higher level of accuracy.The calculation can be run on several threads (parallelization) to divide the computation time. The two calculations, Forward and Reverse MC, can be launched by command line (batch file) with dedicated arguments.

Features

Silver features plus :

Forward Monte Carlo calculation (Electron, Photon & Proton transport)
Reverse Monte Carlo (TID and TNID estimate for isotropic electron and proton flux)
3D mapping
Internal charging
Equivalent fluence

Software developed by TRAD Tests & radiations

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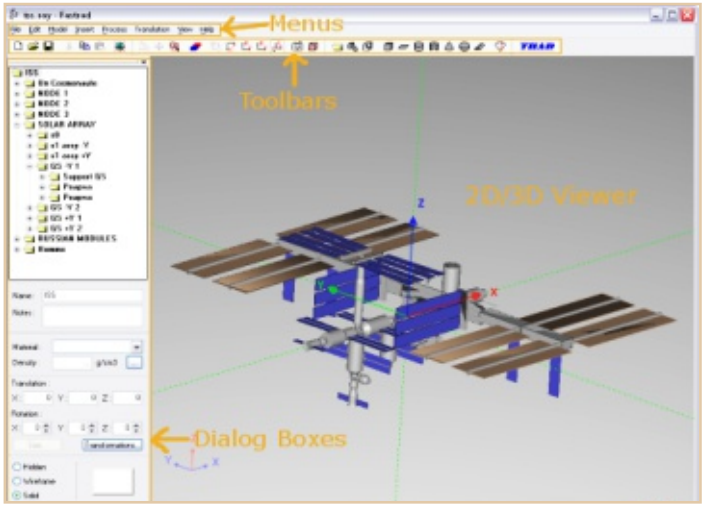
1. Bronze - Easy to-use interface functions & effortless data-exchange

Bronze service represents the first step of your FASTRAD® experience. It is a simplified configuration, limited to creating and handling 3D radiation models, allowing to import and export entire STEP object characteristics.

Graphical User Interface

- Framework: menus, toolbar buttons, property dialog boxes, hierarchical window
- Viewer 3D / 2D + objects handling (rotation, translation, etc.)
- Insertion of simple shapes (box, slab, cylinder, cake, sphere, cone, triangular prism, elliptical cylinder and torus, extruded trapeze).
- Cut operations on simple shapes
- A material definition interface with a database



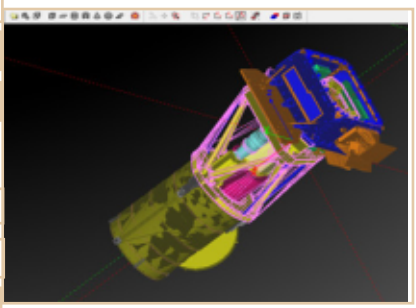
CAD Toolkit

General

- Keyword search engine
- Print & copy view functions
- Clipping plane view
- Black & white photo view

Geometry

- 3D measuring tool
- Detection of overlaps
- 2D grid
- 2D move



Radiation analysis tools

- Detection of invalid shapes
- Mass calculation
- Material tool (visualization, replacement, list cleaner)
- Detector handling tools
- Material & detector list exchange

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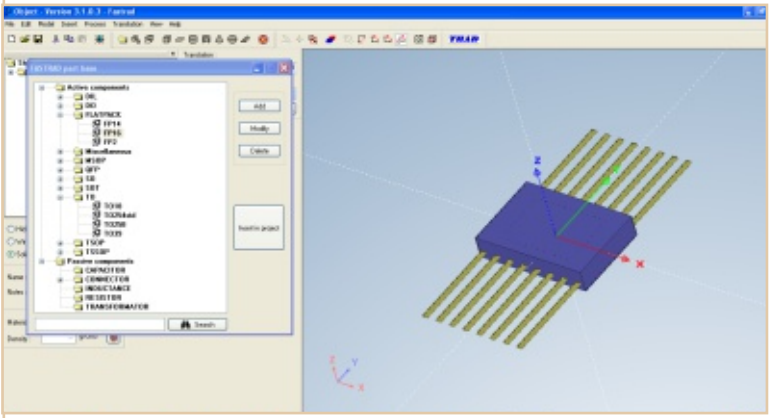
Database Interface

An interface that allows the management of a database of FASTRAD® models. When using this dialog you can store a model in your database or you can insert any model of your database inside your current FASTRAD® model.

FASTRAD® is delivered with an extensive component package model base (flatpack, TO, etc.). The user is invited to complement this database.



Exchange with other radiation codes

C++ GEANT4 project export

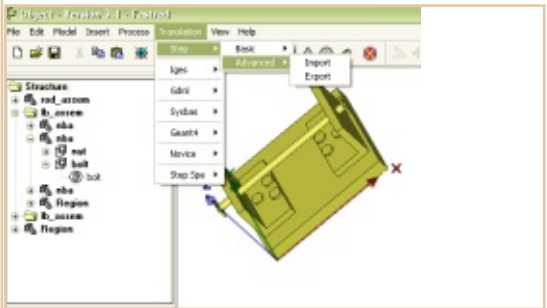
- Export the FASTRAD® model into GDML 2.7 format
- Geometry translator
- Particle source definition
- Sensitive volume detector definition
- Histograming (Dose, LET, etc.)
- Selection of physical processes

Advanced STEP import

Import models written in STEP format (AP209, AP214, partially AP203). Compatible STEP files can be generated by CAD tools.

The enhanced reader function also allows import of:

- the hierarchy
- the name of the solids
- the color of the solids



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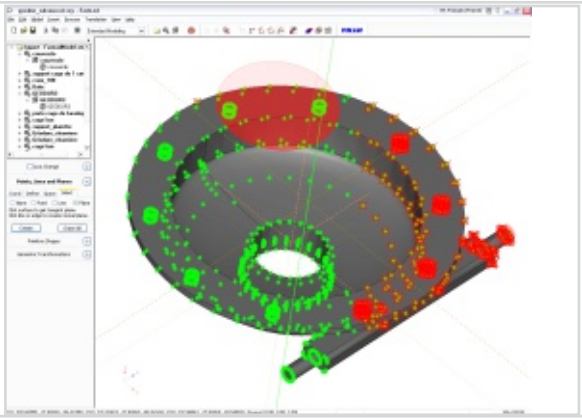
2. Silver - Extended modelling & Key calculations

Silver service goes beyond as it allows to create solids using points in the 3D model and to perform essential calculations: TID by sector analysis (Ray-tracing), DDEF by sector analysis (Ray-tracing), six faces equivalent thickness, ray view and shielding mapping.

Extended Modelling

The user is able to create points using the edges of existing solids and to apply different transformations (projections, spaces, etc).

Specific shape definition interfaces allow to create FASTRAD® solids by directly selecting the points of the 3D graph.



TID & DDEF by sector analysis (ray-tracing)

Dose calculation by sector analysis on any FASTRAD® model containing simple shapes or tessellated volumes (coming from STEP or IGES format files).

Two calculation methods are proposed:
-The slant one (associated with solid sphere Dose Depth Curve)
-The “minimum path” method (with a shell sphere Dose Depth Curve).

Displacement Damage Equivalent Fluence (TNID)
This interface is dedicated to the calculation of the Displacement Damage Equivalent Fluence (DDEF) in sensitive areas.

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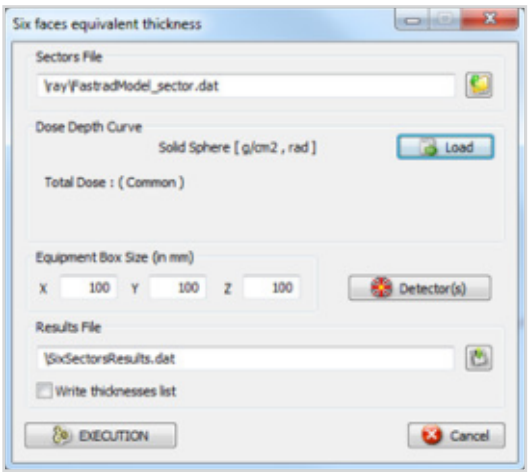
Six faces equivalent thickness

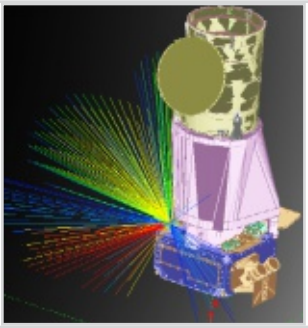
The 6 faces equivalent thickness dialogue allows to calculate the equivalent thickness seen by any detector in each of the 6 directions (+/-X, +/-Y, +/-Z).

The user can set the size of the shielding box that simulates the equivalent shielding.



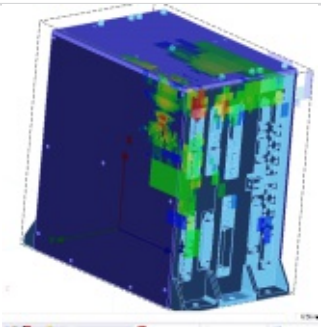
Sector analysis post-processing

The crossed thicknesses calculated by sector analysis can be visualized thanks to a color code applied for different thickness values.



This is a complementary feature of the ray view tool. It displays a mapping of the shielding seen by the selected detector on a chosen surface.

The color scale shows the most critical locations in terms of radiation shielding.



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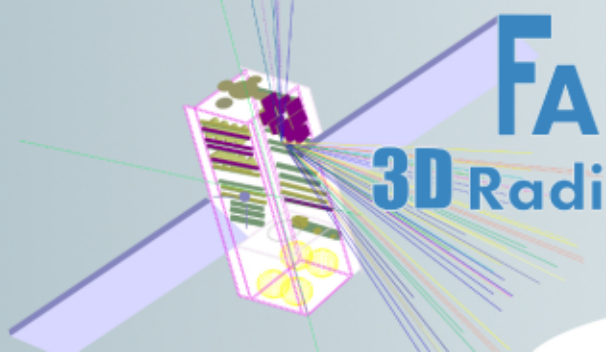

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3. Gold - High accuracy and high speed calculation capabilities

Gold service gives you the keys to the most efficient Monte Carlo calculation: Both Forward and Reverse Monte Carlo calculation are available. The Monte Carlo is based on actual physical interactions of particles with matter. It considers the material composition and the particle behavior allowing to get a higher level of accuracy. The calculation can be run on several threads (parallelization) to decrease the computation time. The two calculations, Forward and Reverse MC, can be launched by command line (batch file) with the definition of several computation parameters in optional argument (number of shots, output file, number of threads,etc.) for a given '.ray' model.

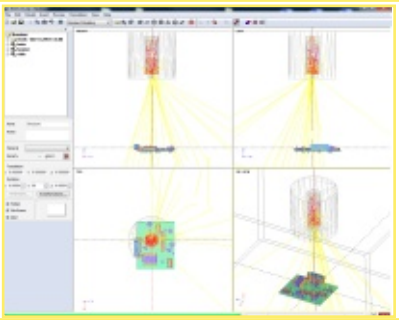
3D Forward Monte Carlo transport for electrons, photons and protons

This module allows to perform calculations using a Forward Monte Carlo algorithm. Primary electrons, protons and photons as well as secondary electrons and photons can be considered.

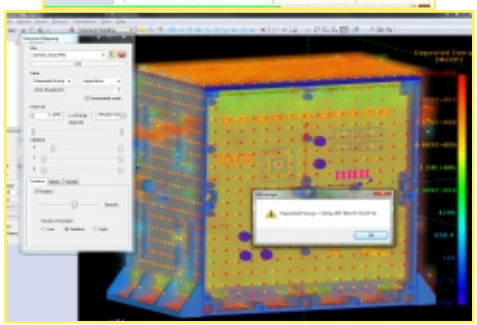
A wide range of source geometries can be defined.
Mono-energetic fluxes or continuous energy spectra can be used for the calculation.
Several sensitive volumes can be selected in the 3D model.
The results are:

- the deposited energy
- the dose depending on the material of the target
- the particle fluence

Particle trajectories can be visualized and interaction properties are displayed when a track is selected.



The 3D mapping module allows calculation of deposited energies, transmitted flux and associated errors in sensitive zones. With this tool critical zones can easily be identified.



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3D Reverse Monte Carlo for incident electrons and protons

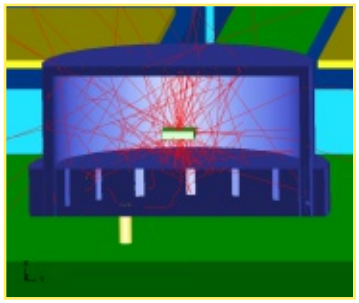
TID and TNID estimate using Reverse Monte Carlo for incident electron and proton flux.

For complex 3D models including different geometrical scales, the dose calculation becomes very time-consuming with a standard (Forward) Monte Carlo approach. The Reverse Monte Carlo approach gives a powerful solution for accurate TID calculation.

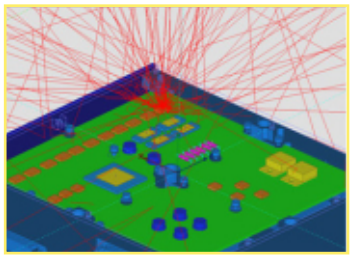
Primary and secondary electrons, primary protons and secondary photons (Bremsstrahlung) are taken into account. Point detectors and sensitive volumes can be considered to obtain:

- the deposited ioning dose: total and per particle type
- the total non-ionizing dose (NIEL tables)
- the transmitted fluence per particle type

TID and TNID calculations are performed in function of the materials assigned to the punctual or volume targets.
Note that the Reverse Monte Carlo method is dedicated to an isotropic environment. Reverse MC module proposes also to visualize the particle trajectories and to display the interaction properties when a track is selected. The 3D mapping module allows calculation of deposited energies, transmitted flux and associated errors in sensitive zones. The Reverse MC module is able to produce one mapping file for all the detectors and sensitive volumes or a merged mapping file including all the selected detectors.



Dose calculation inside a TO package. Fastrad displays the backward tracking of particles.



Internal Charging

The IC module allows the calculation of the current densities (in pA/cm²) between two points in a 3D model.

Charging processing calculates the number of electrons stopped between two points in a dielectric volume.

This calculation is based on the electron Monte Carlo algorithm.
A Reverse Monte Carlo estimates the incoming and outgoing electron fluxes for selected detectors.

The difference between the two fluxes for the detectors gives the electric current density created between these points.

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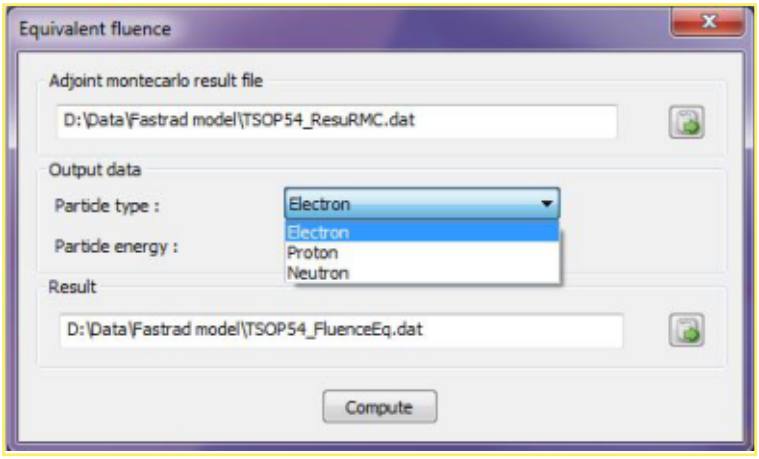
Equivalent Fluence

The equivalent fluence interface allows to convert a Non-Ionising Dose calculated with the Reverse Monte Carlo module into equivalent fluence.

The module reads the Reverse MC results file and converts TNID into equivalent fluence for the particle and energy specified in the interface. Two kind of particles can be defined: electrons and protons.

The NIEL tables used to perform the post-processing can be loaded from the user's database (respecting the required format) through the main options interface.



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