

On-going ESA R&D on Geant4

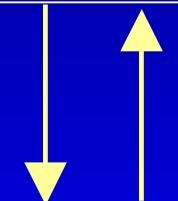
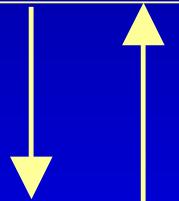
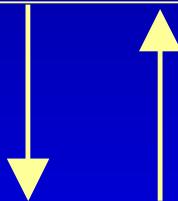
E. Daly, H.D.R. Evans, A. Keating,
A. Mohammadzadeh, P. Nieminen, G. Santin

ESA-ESTEC

Developments in Geant4 kernel

- Radioactive Decay Module
- General Particle Source
- Internal Conversion process
- Low-energy electromagnetic physics
- XML, STEP, Graphical representation

X-ray telescope
advanced example



Geant4-derivatives

- Sector Shielding Analysis Tool
- Mulassis (also in SPENVIS)
- CAD front-end tool
- SpaceGRID
- NIEL studies
- INTAS project 00-629

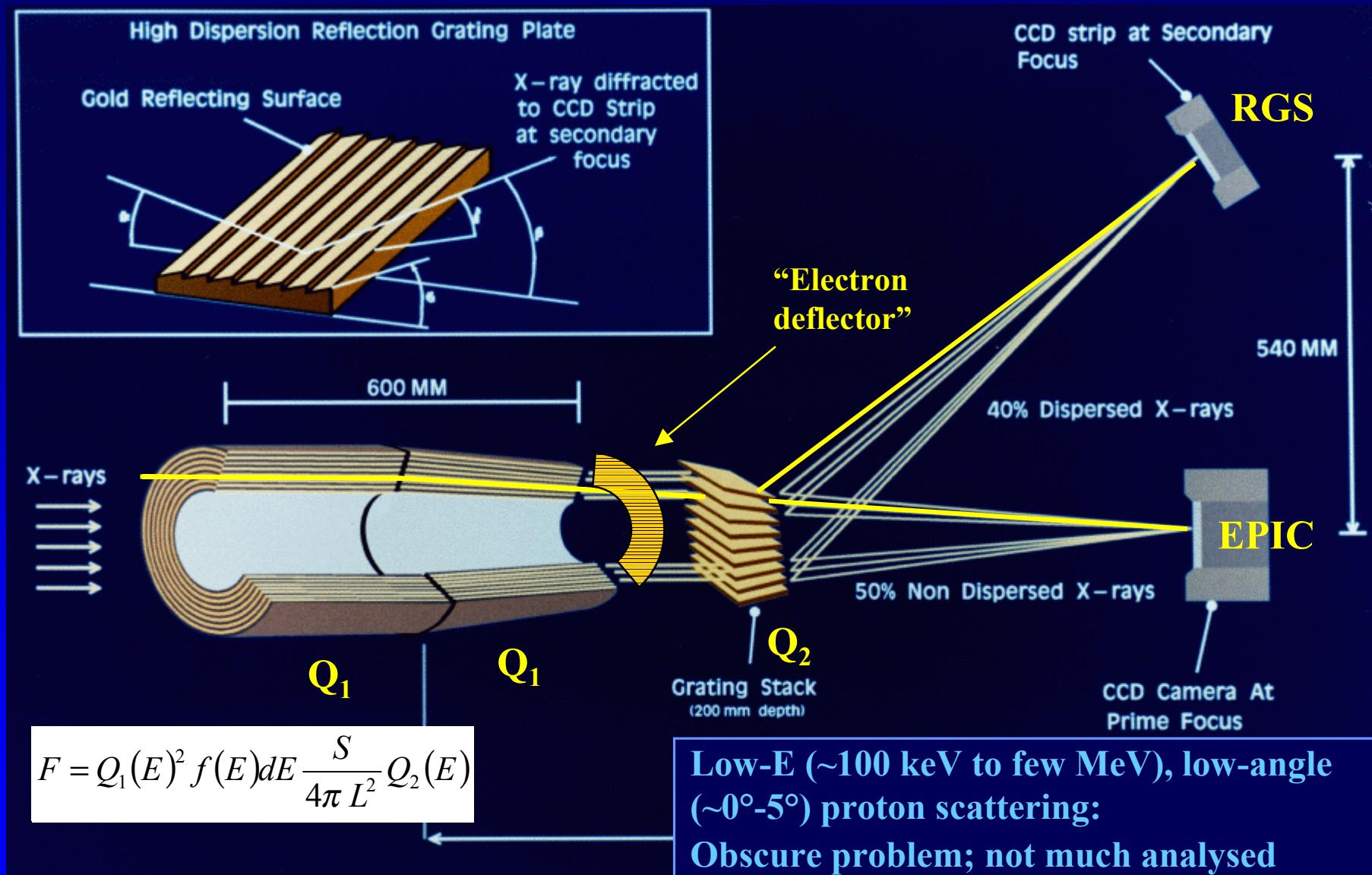
Validation

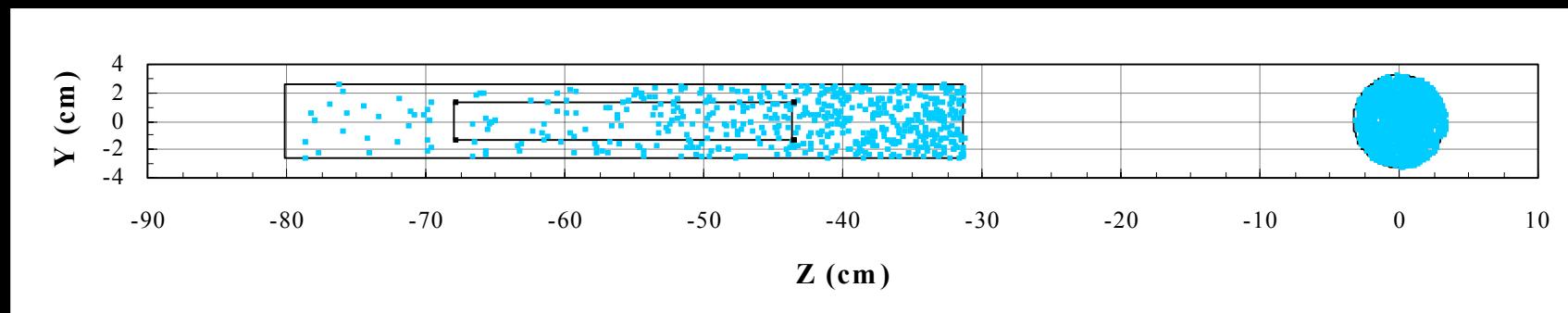
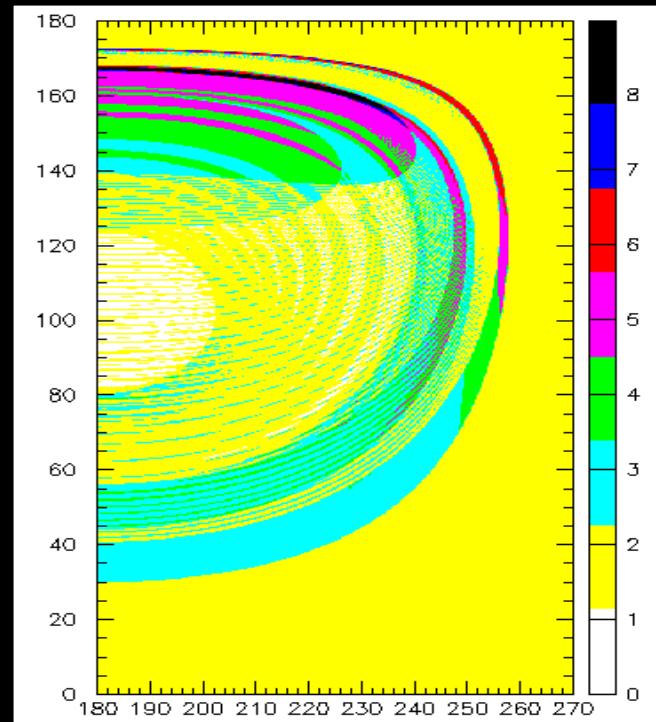
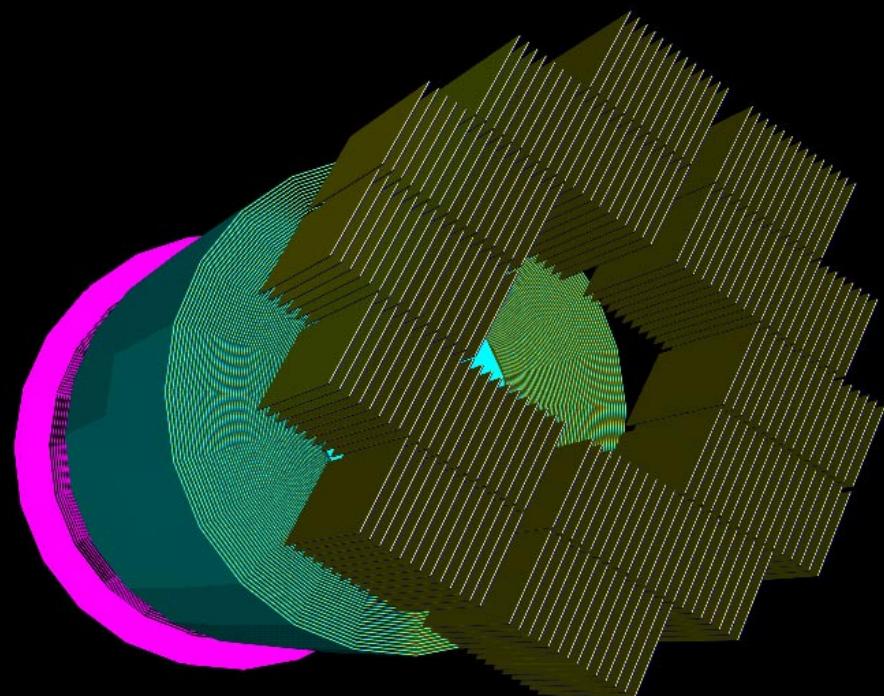
- BepiColombo tests
- QinetiQ comparisons
- DESIRE
- INTAS

Geant4 use

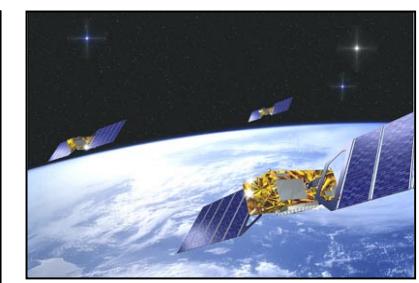
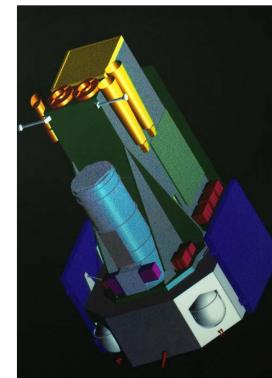
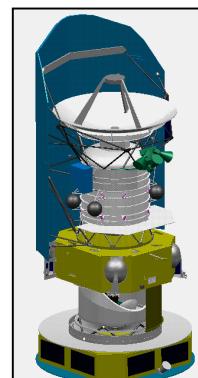
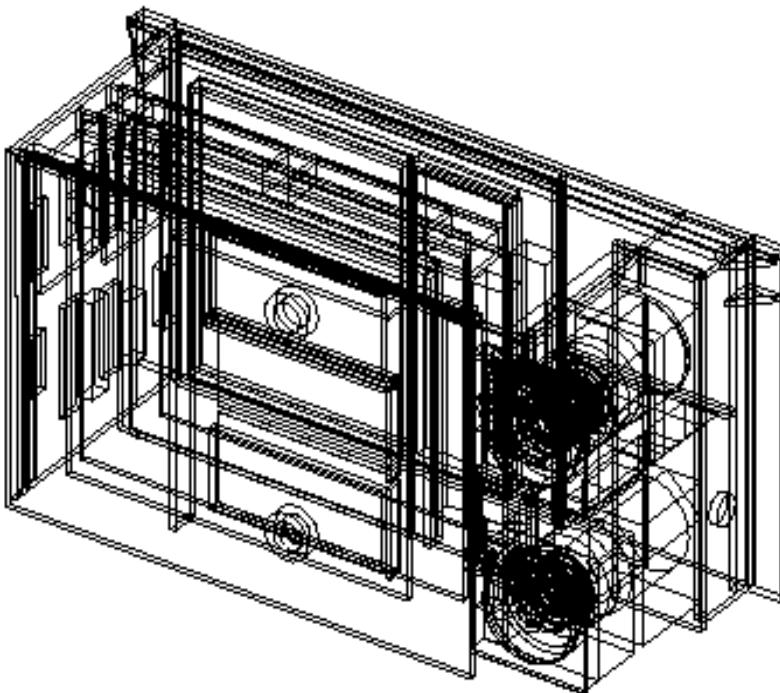
- XMM-Newton
- SMART-2
- ISS/Columbus
- BepiColombo
- Component studies
- Radiation monitors



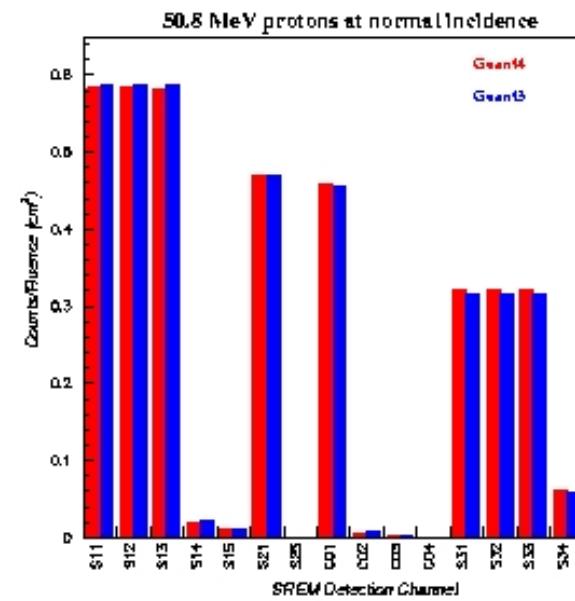
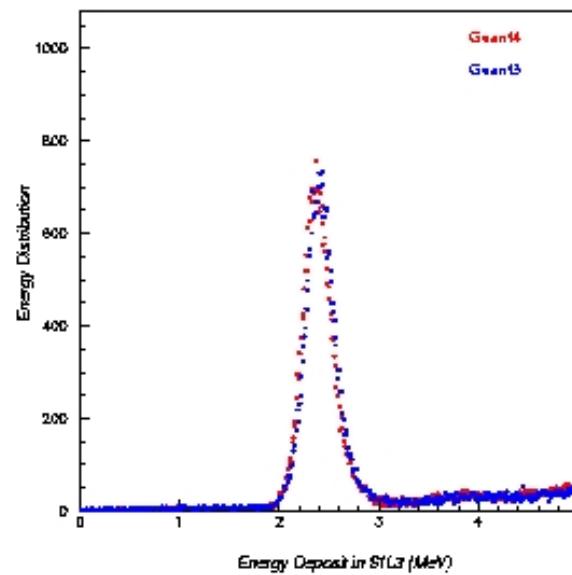
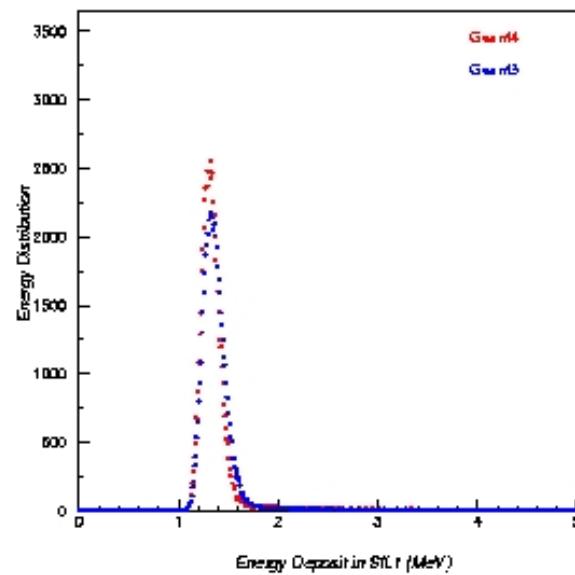


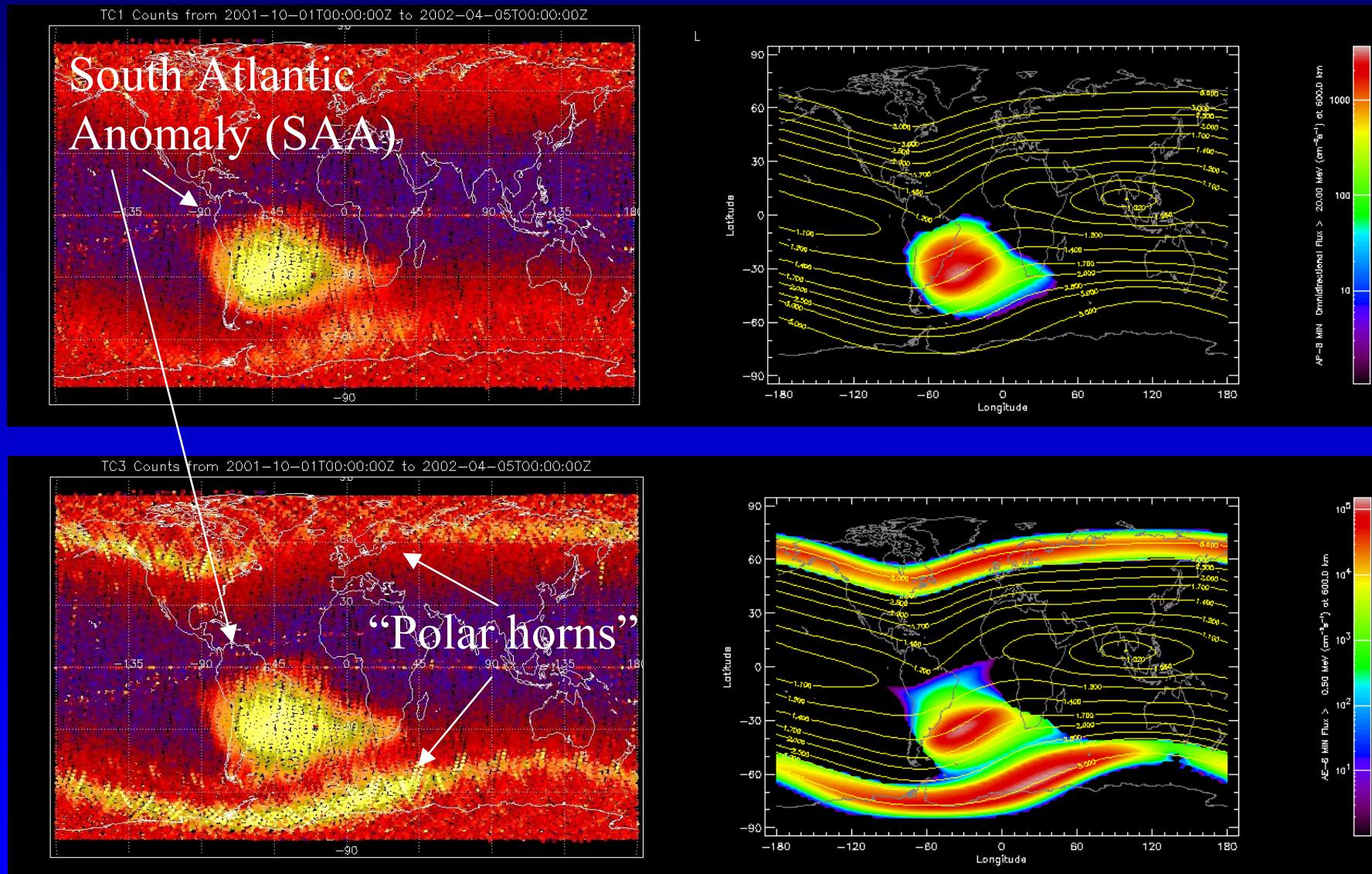


Standard Radiation Environment Monitor (SREM)



Standard Radiation Environment Monitor (SREM)





Modelling packaging effects on proton irradiation response of NMRC RadFETs

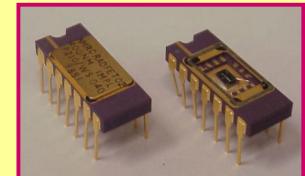


A.Keating¹, A.Mohammadzadeh¹, B.Nickson¹, A.Jaksic², W. Hajdas³

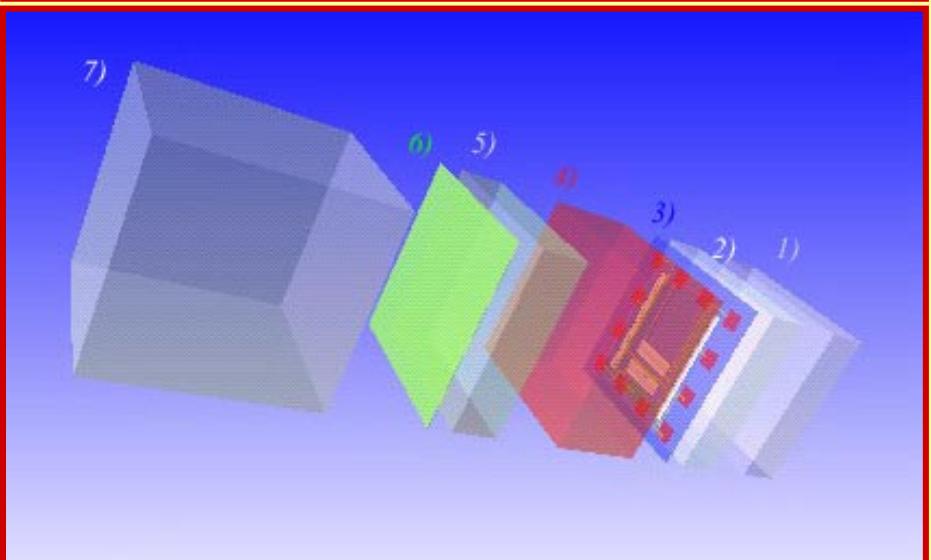
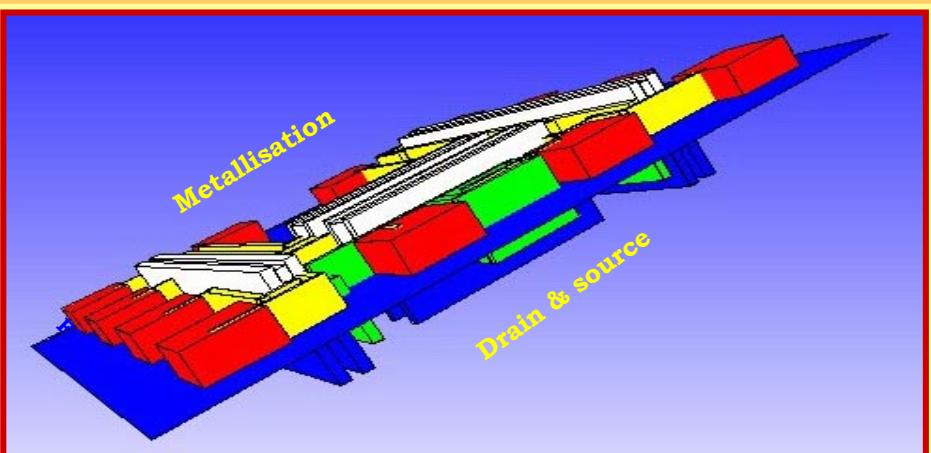
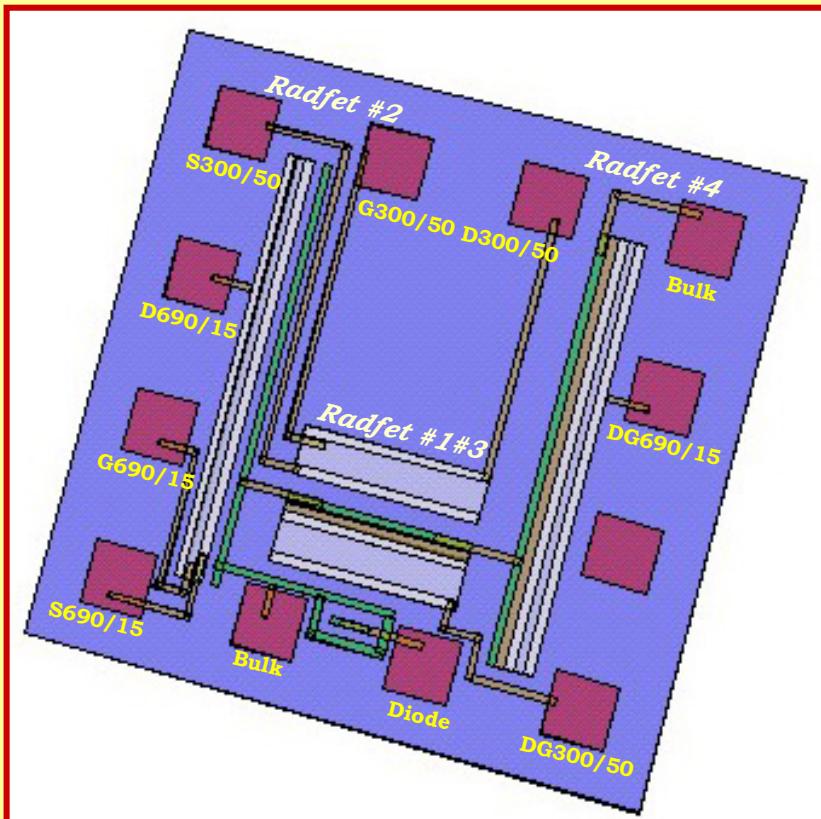
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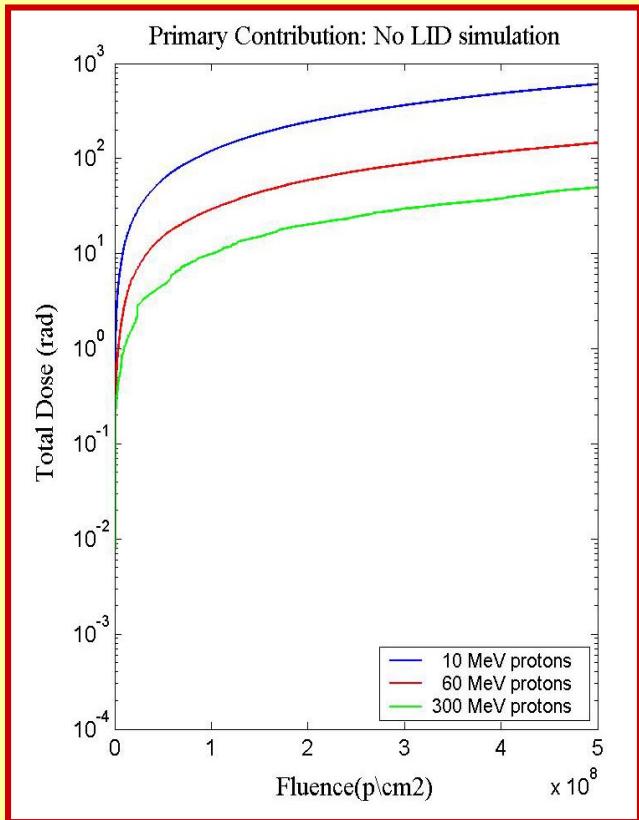


Geometry description

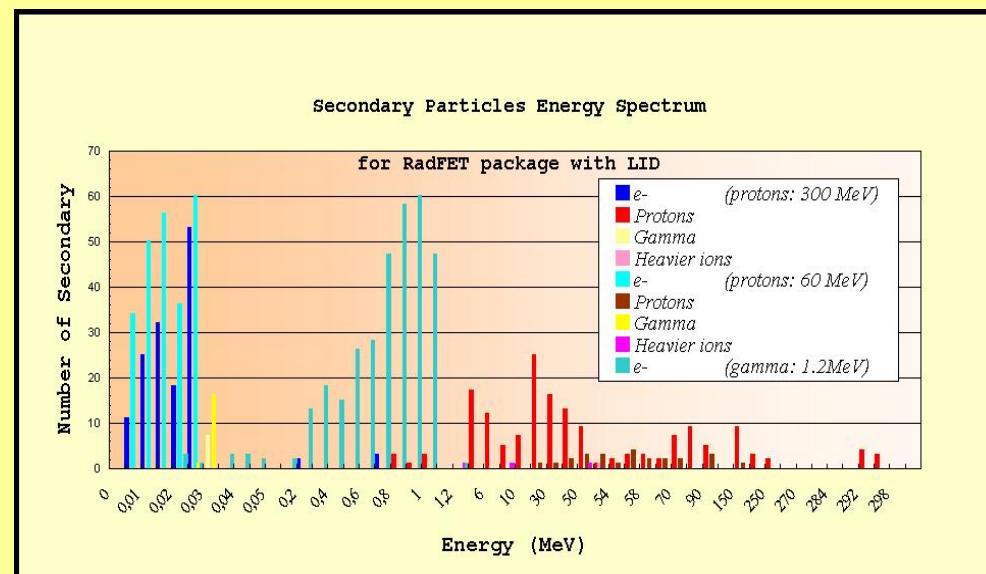
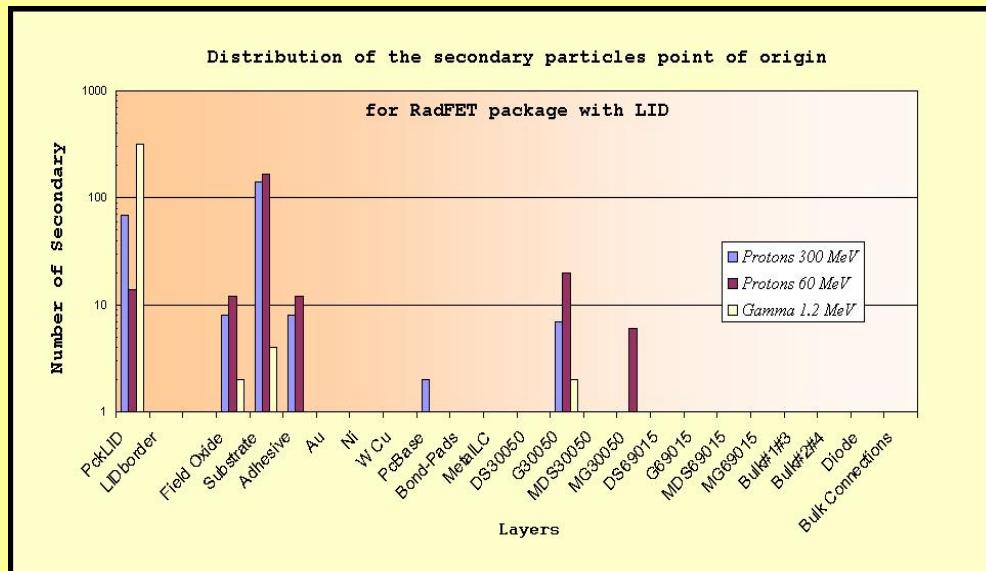


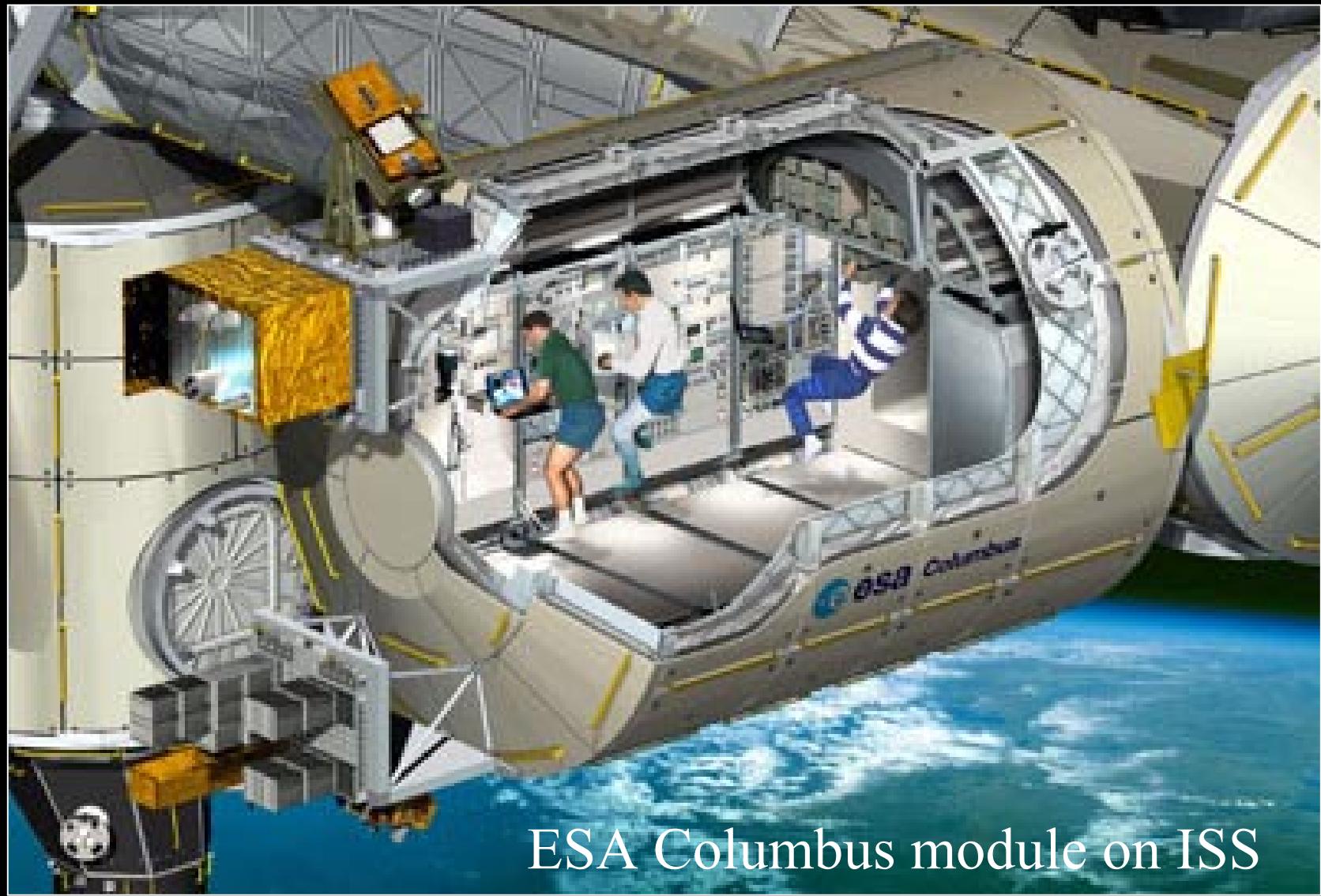
Main results:

- Simulated Response to Proton Irradiation



- Investigating Secondary Particles and Package Effect

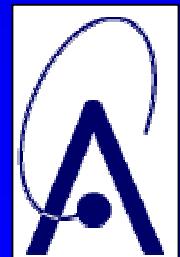
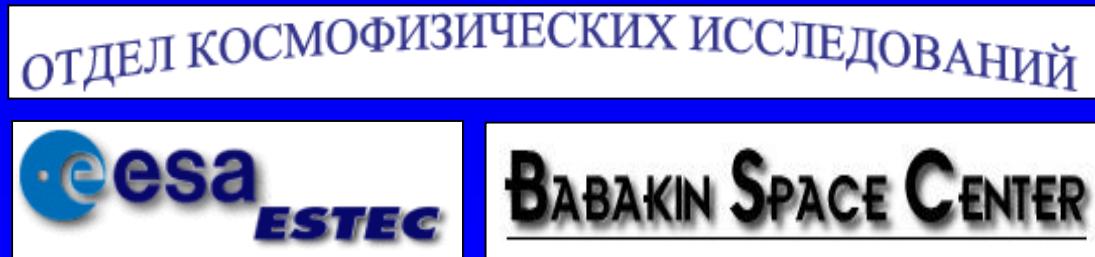




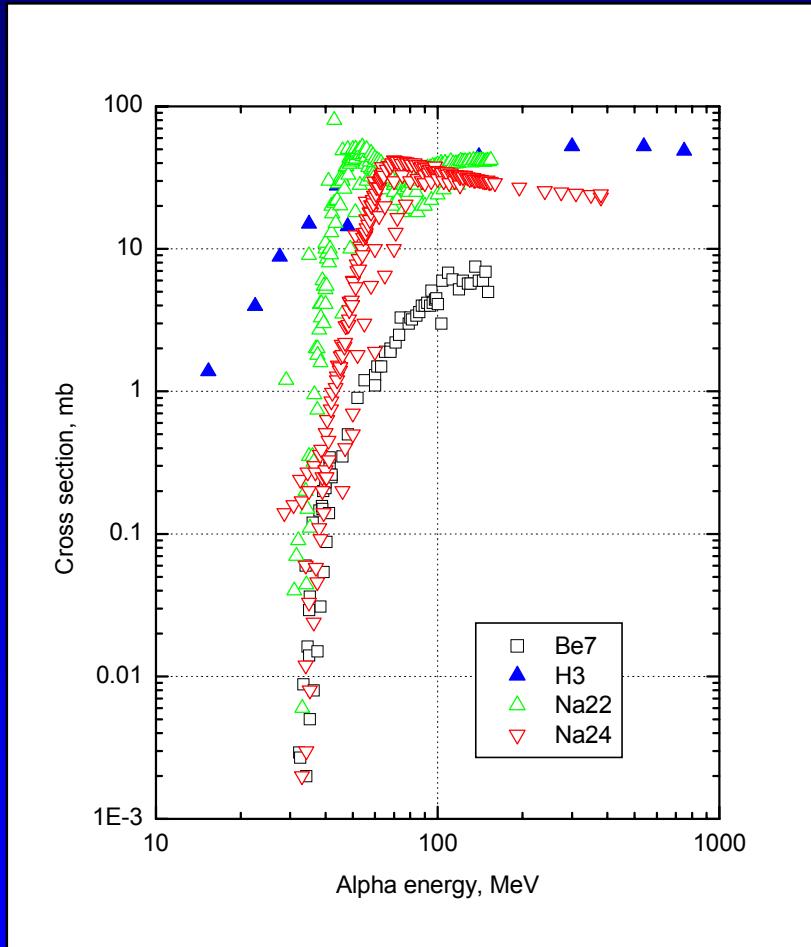
INTAS project 00-629

Study of the High-Energy Interplanetary Radiation Fields and Radiation
Effect Simulation for Spacecraft Missions

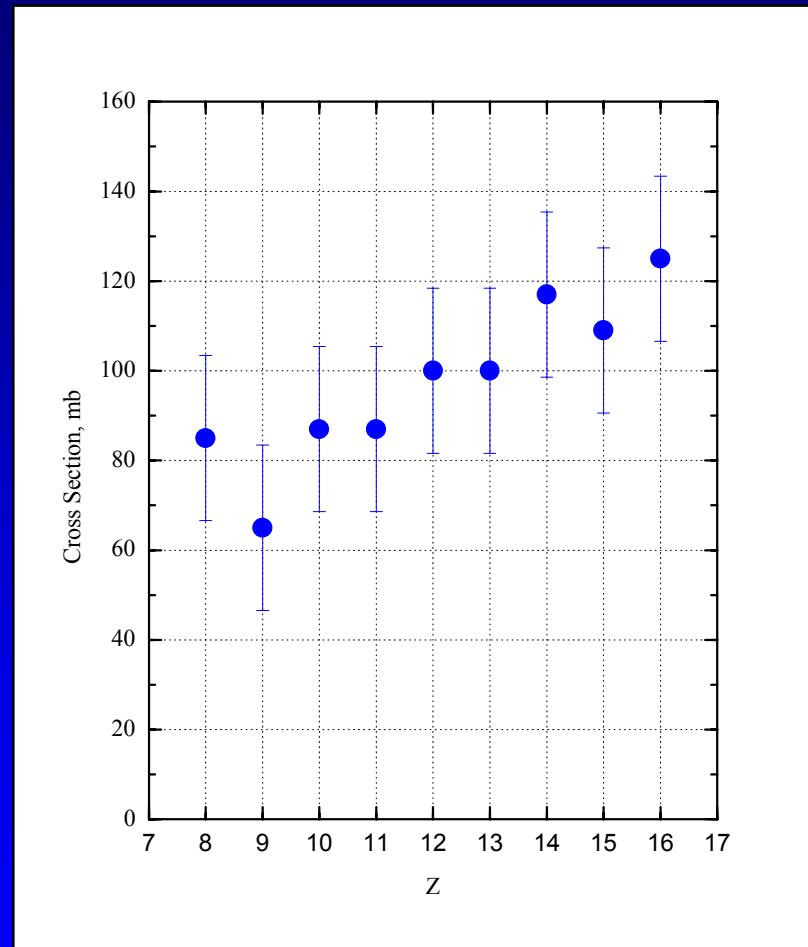
- Differential cross sections for secondary particles
- Cross sections of production of residual nuclei
- Energy spectra of residual nuclei
- Distribution of energy deposition over the target
- Total and differential yield of particles



INTAS-00-629: heavy ion fragmentation data base

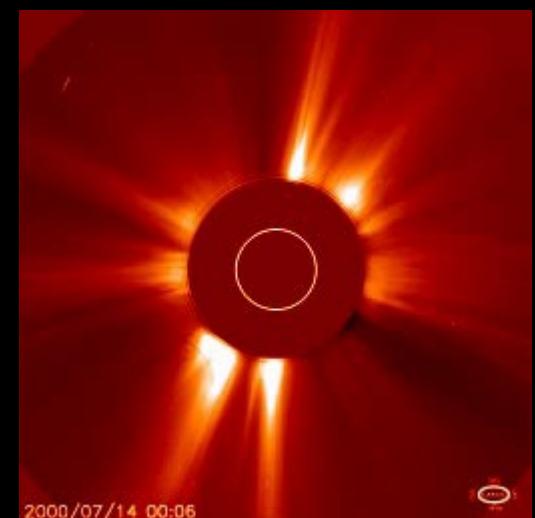
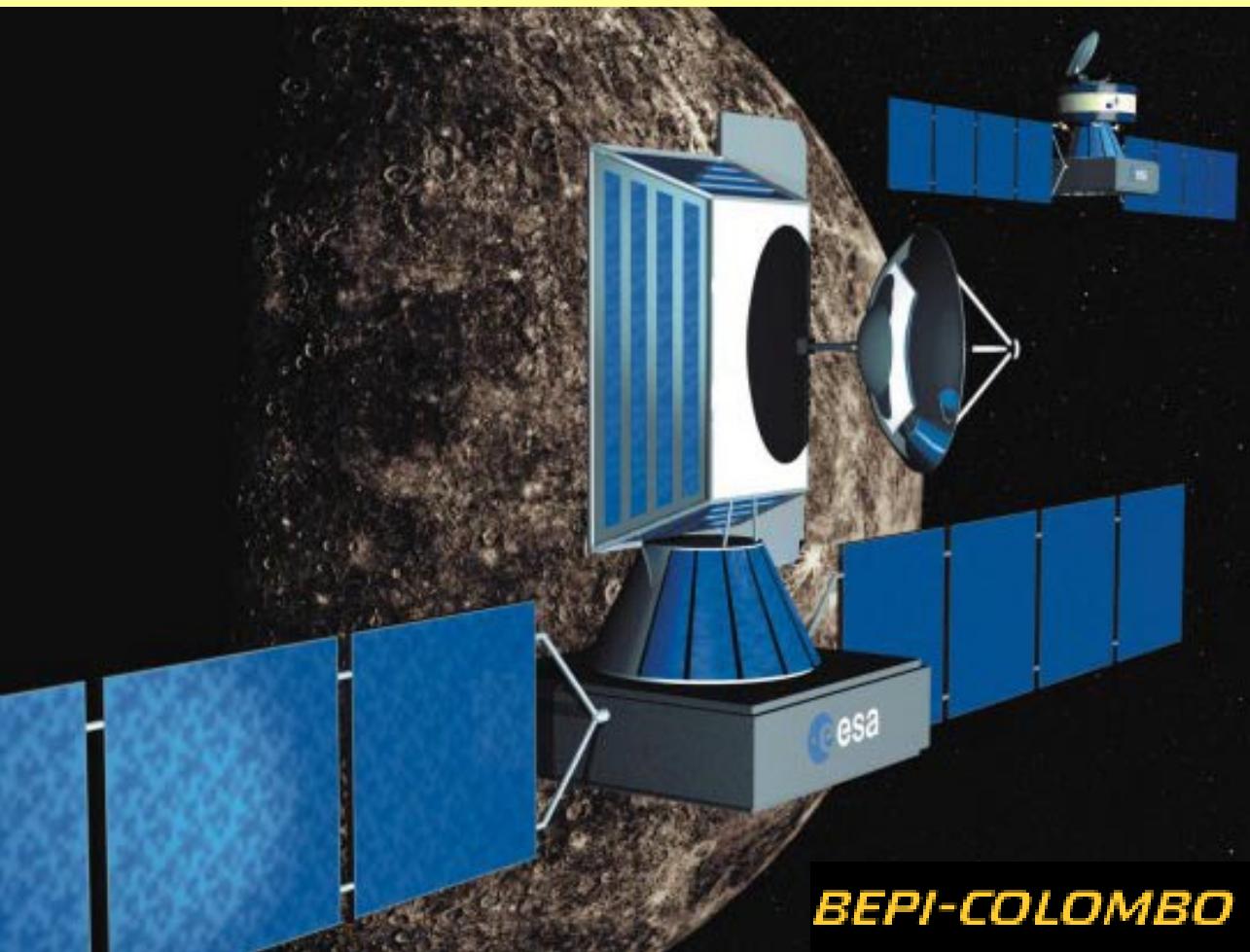


Production of radioisotopes ^3H , ^7Be ^{22}Na and ^{24}Na from interaction of α -particles with Al.



Production of elements from fragmentation of ^{40}Ar (213 MeV/u) on nucleus-target C.

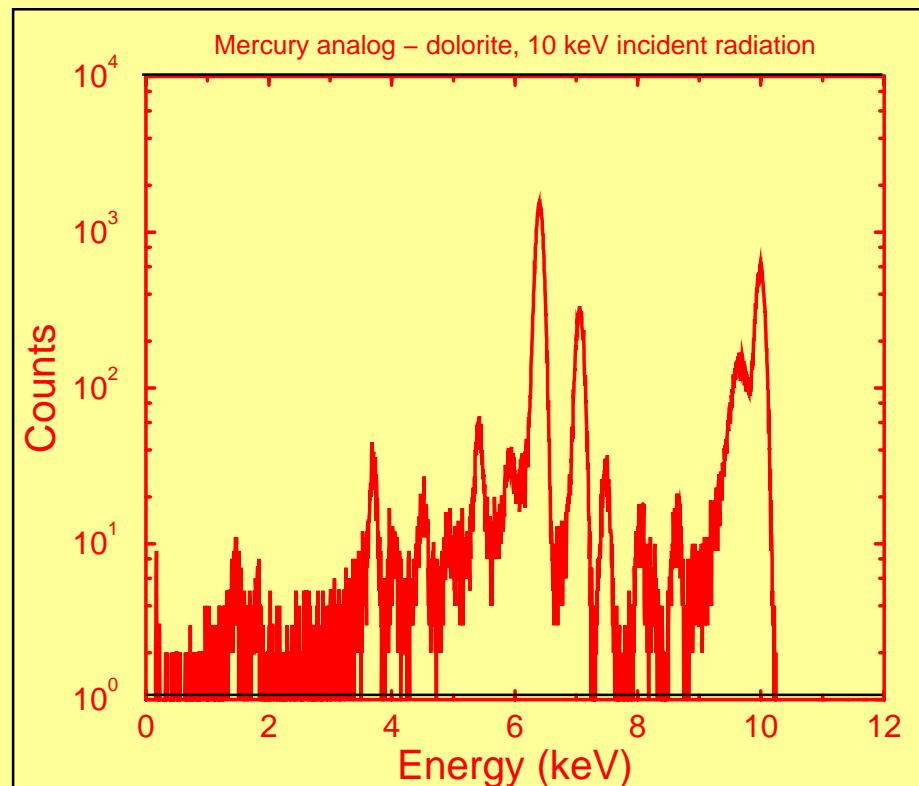
HERMES X-Ray Spectrometer on Mercury Planetary Orbiter



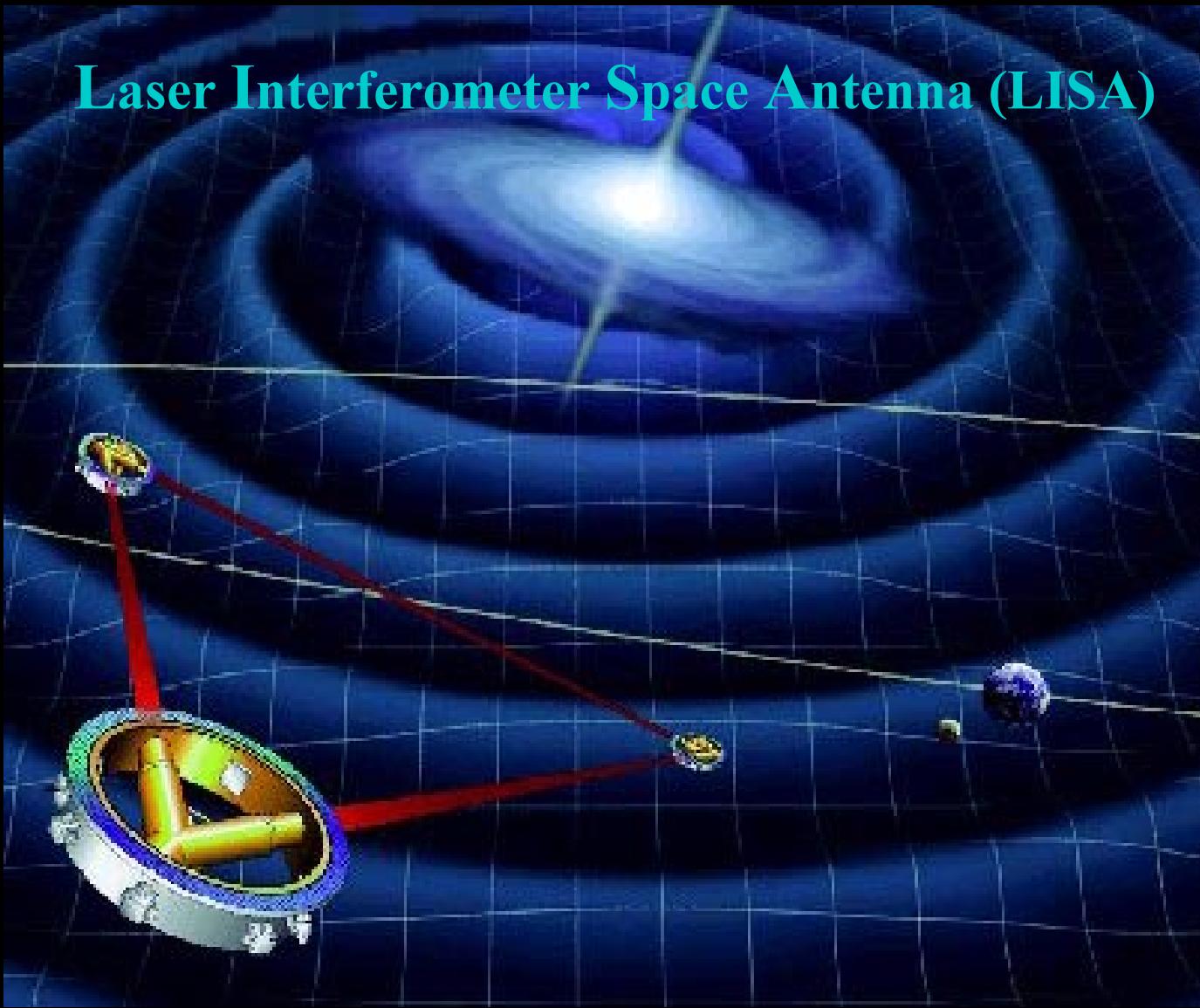
PIXE from solar
proton events

HERMES X-Ray Spectrometer on Mercury Planetary Orbiter

BESSY-II data

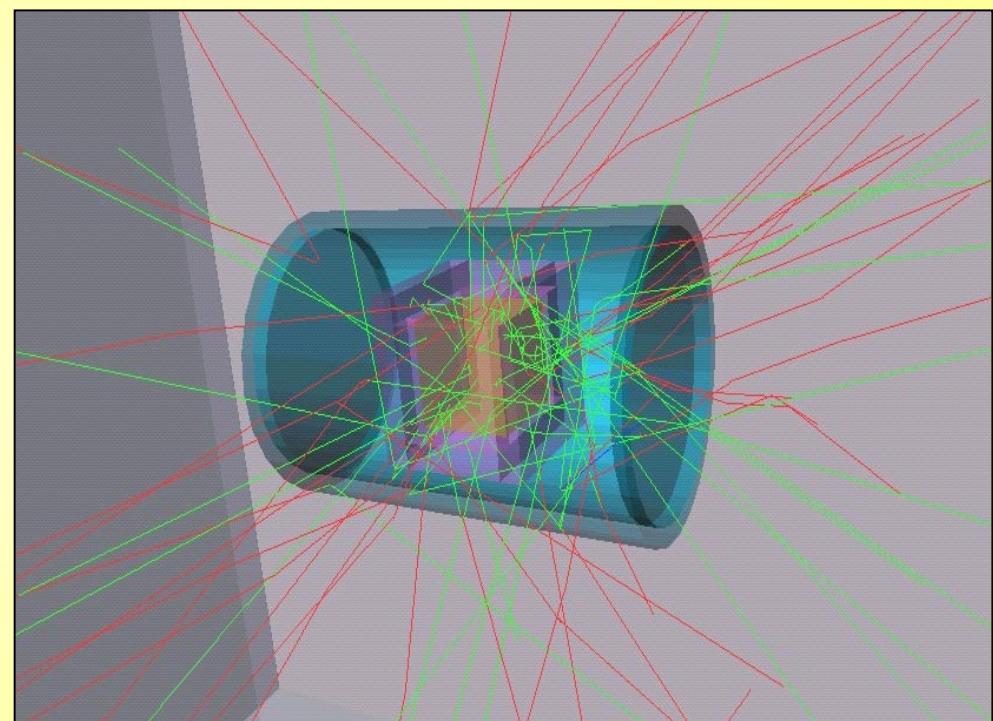
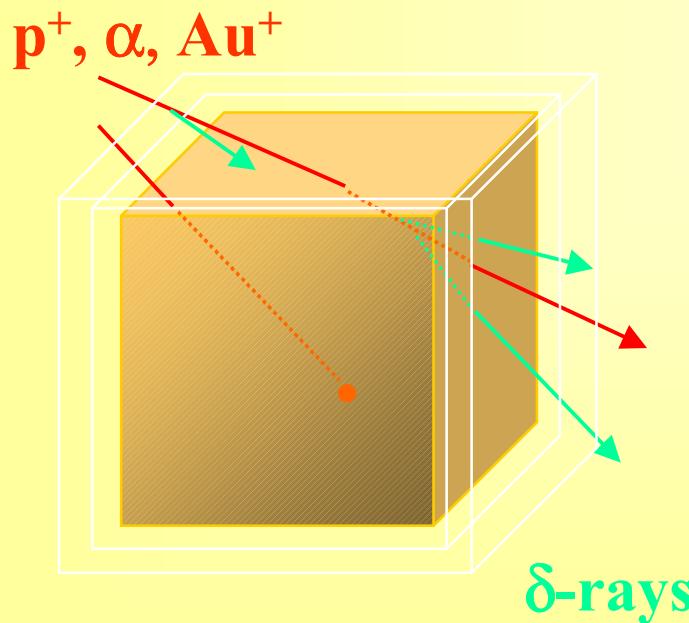


Laser Interferometer Space Antenna (LISA)

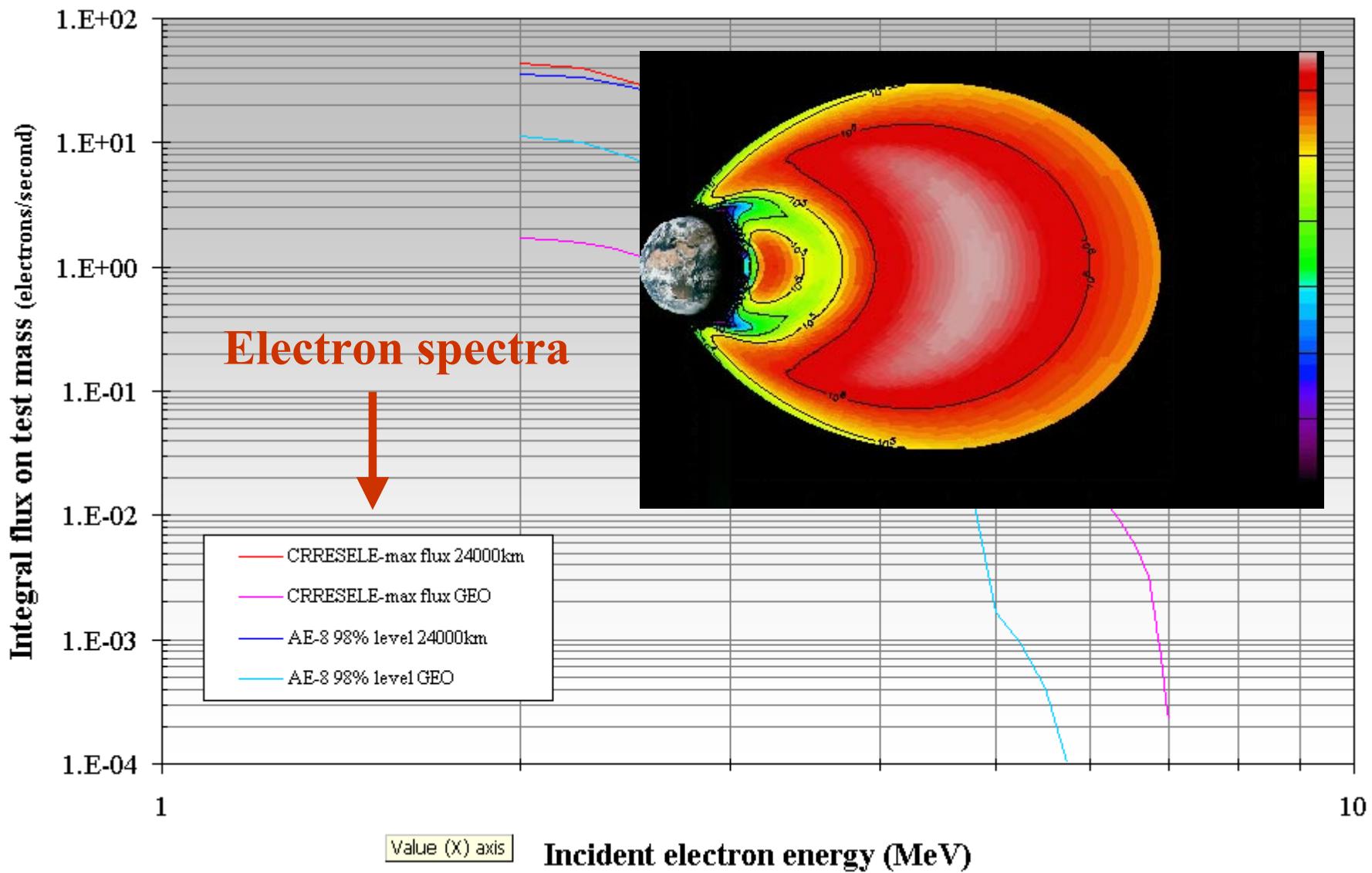


Laser Interferometer Space Antenna (LISA) Satellite Test of the Equivalence Principle (STEP)

Charging of test masses by cosmic rays and solar particles, δ -rays, and displaced gold ions



- **Geant4:** Analysis possible in one framework down to 250 eV.
- SMART-2 application



Upcoming ESA Geant4 R&D

- Energetic Particle Shielding and Interactions Software, major R&D item.
5 ESA Science missions + 4 other activities for Geant4 *development* and *applications* [QinetiQ + 4 other Institutes / Teams]
- Proposal for ESA-Portugal Task Force: Study on EUSO and AMS on the ISS [LIP Lisbon]
- Proposals in the 2003-04 ESA General Studies Programme for plasma and components tools and applications
- In-house simulations for future ESA missions

AURORA

Manned and unmanned Solar System Exploration initiative in 20-30 years time frame. Items for radiation environments and effects:

- ✓ Radiation Shielding and Effects (*Geant4 models*, open competition)
- ✓ Radiation Exposure and Mission Strategies for Interplanetary Manned Missions (*Geant4 applications*, open competition)

