SHIELDING ANALYSIS OF GOES PROTON DATA FOR ELECTRONICS APPLICATIONS

Mike Xapsos, Code 561, NASA/GSFC

Yihua Zheng, Code 674, NASA/GSFC

Craig Stauffer, AS&D, Inc., Greenbelt, MD

Tom Jordan, EMP Consultants, Gaithersburg, MD

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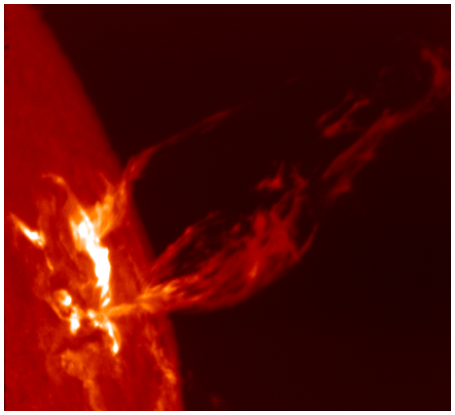
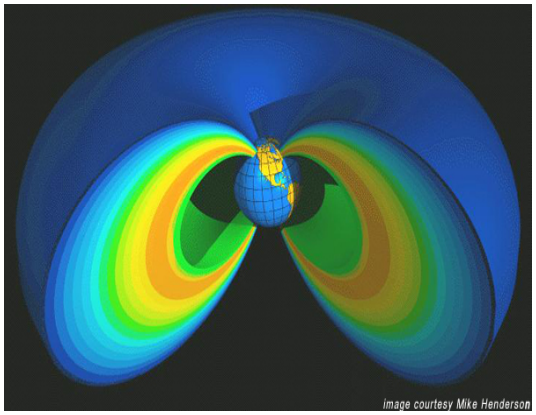
High Energy Particle Radiations

Galactic Cosmic Rays

Solar Particle Events

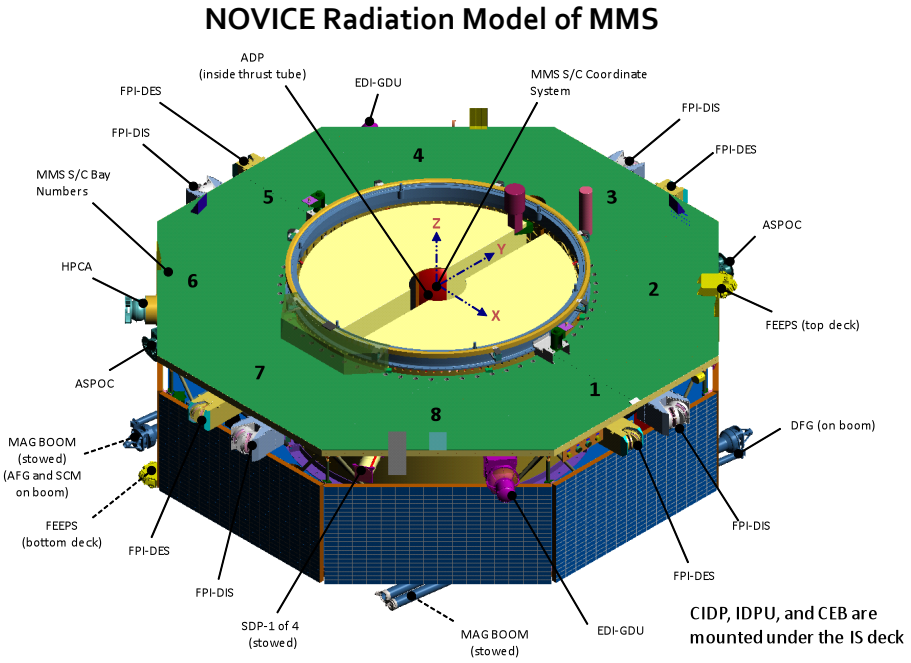


Trapped Particles



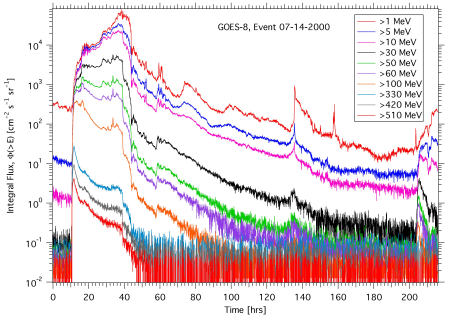
NOVICE Radiation Transport Code

- Commercial code originated by EMP Consultants
- Interfaces with CAD, allowing complex geometries such as spacecraft and instruments to be analyzed
- Adjoint (reverse) Monte Carlo capabilities significantly improve calculation efficiency

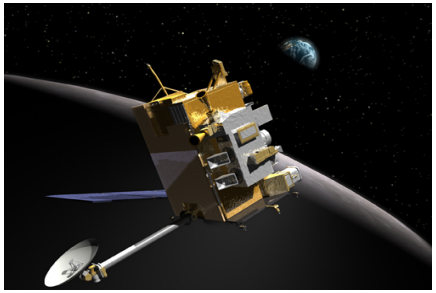


Dose Comparison to LRO's CRaTER

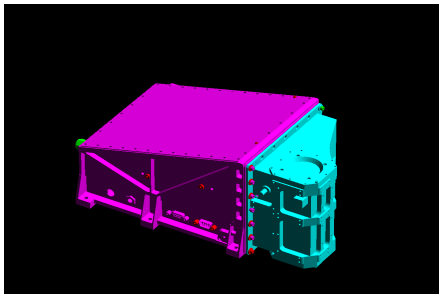
- Use GOES Data Feed from CCMC



- Account for lunar shadowing at 50 km altitude



- CRaTER Instrument CAD Model Provides Shielding

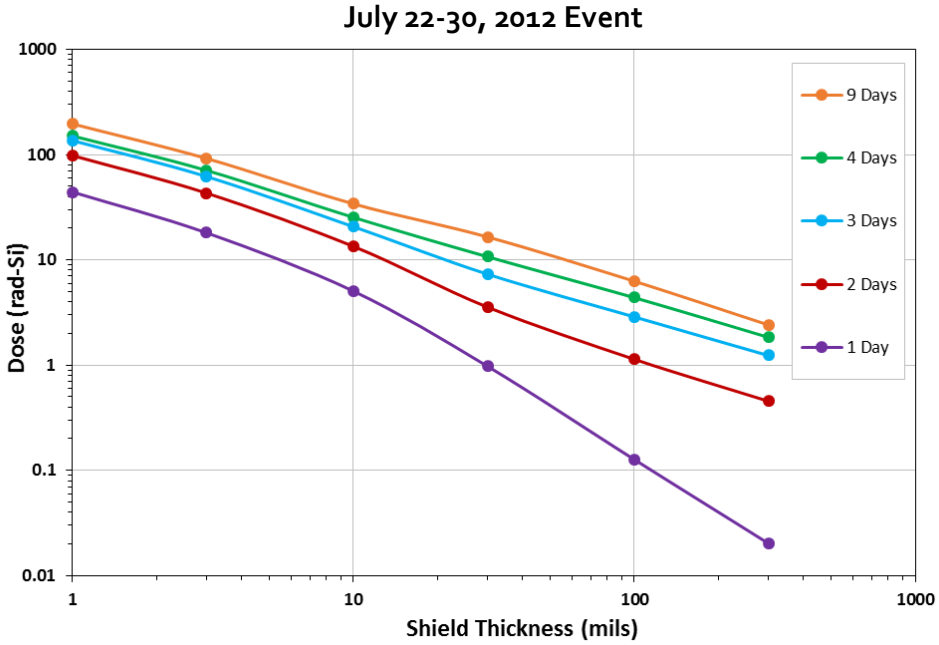


- Doses for 20 Jan. 2012 Solar Particle Event
  - NOVICE calculation: 159 rad-Si
  - CRaTER detector: 190 rad-Si*
  - 16% difference

*J. Joyce et al., 44th Lunar & Planetary Science Conference (2013)

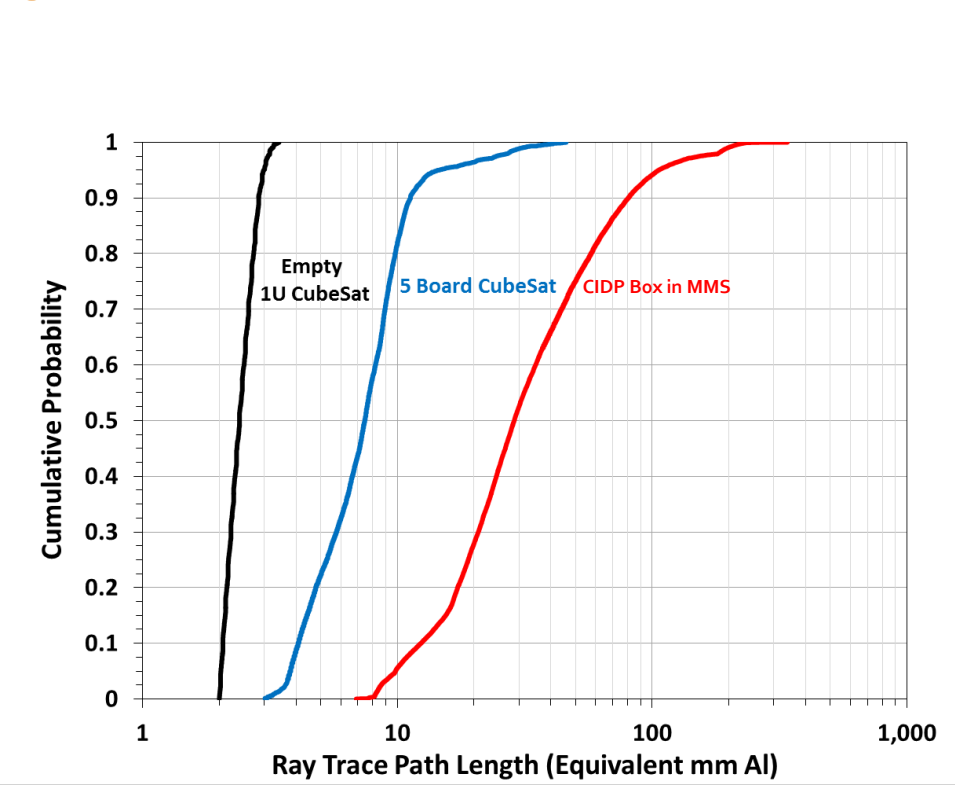
Use of GOES SEM Proton Data

- **Real time solar particle events**
  - **Useful for mission operations**
  - **Tracking electronic part total dose lifetimes**
- **Historical studies of solar particle event data (model development, anomaly studies)**
  - **GOES data base extends back to 1986**

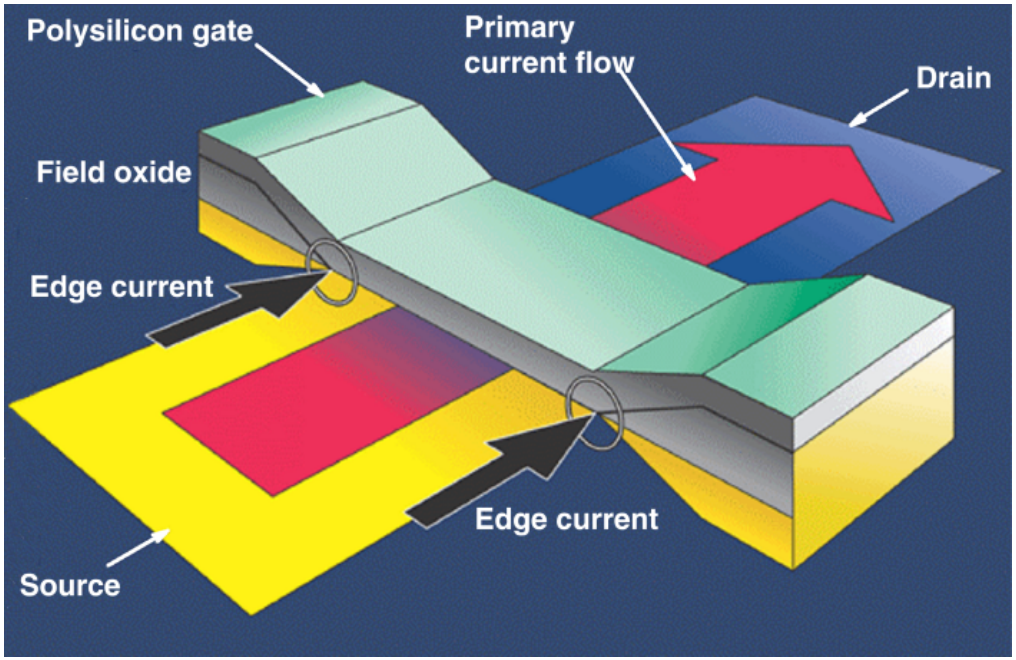


Possible Future Work

- Extend to complex geometries
- Each location within a spacecraft has a unique shielding distribution
- Ray trace through all materials to location of interest; convert to equivalent aluminum
- Makes real time analysis possible



Questions?


Polysilicon gate
Primary
current flow
Drain
Field oxide
Edge current
Edge current
Source