Topic: X2.04

NASA SBIR/STTR Technologies

Improved Models and Tools for Prediction of Radiation Effects on Space Electronics in Wide Temperature Range

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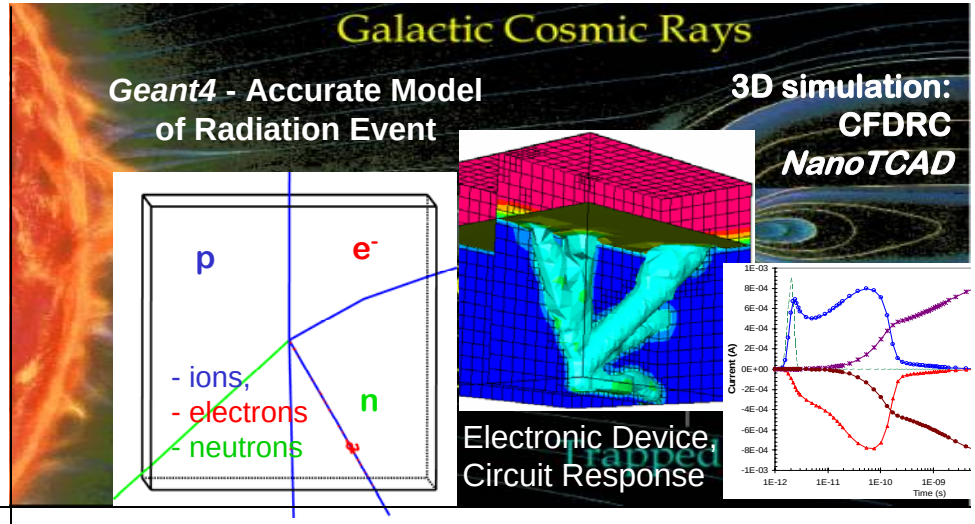
Identification and Significance of Innovation

- Modern, nanometer-scale electronics response to space radiation is strongly related to the microstructure of the ionization. The traditional, average *linear energy transfer* (LET) approach will be *not accurate* for new technologies.
- Innovation: physics-based simulations of radiation events in the very wide temperature range (-230ºC to +130 ºC).
- Significance: Electronic parts are getting smaller, the radiation & temperature effects are more severe – the life time and reliability become essential – the capability to predict them increases confidence and reduces risk.



Technical Objectives

➢ Tools to predict the radiation response of future electronic devices & circuits in wide temperature range (-230ºC to +130 ºC)
➢ Predict statistics of such events, upsets, and error rates
➢ Provide data for engineering models to enable design and verification of rad-hard low power mixed-signal and analog circuits

Work Plan

- Use Vanderbilt accurate physics models (MRED/Geant4) of radiation events across a very wide energy range and materials.
- Interface Vanderbilt/Geant4 with CFDRC 3D Device Simulator
- Adapt & validate physics models for very low temp. (to -230ºC)
- Enable physics-based simulations on supercomputing clusters, to predict statistics of radiation effects, for improved modeling of upset & error rates, and support rad-hard design margins

NASA Applications

- Prediction of electronics behavior in extreme environments (wide temperatures, high radiation) is crucial to design reliable electronics for all NASA missions (Moon, Mars, etc.)
- More accurate engineering models for future rad-hard ICs.
- Reduction of radiation/temperature testing cost and time.

Non-NASA Applications

- Radiation hardening and IC design by other space electronics suppliers, in particular for DoD space communication and surveillance systems and cryo-electronics (e.g. IR imagers).

Firm Contacts

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NON-PROPRIETARY DATA