MRED: Monte Carlo Radiation Effects Simulator for Microelectronics Reliability

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VU Ref. Number: VU06107

ADDRESSED NEED

Radiation-induced failures in advanced semiconductors range from non-destructive erroneous system responses to catastrophic failure, affecting **aerospace, defense, automotive, and data-center** industries. Legacy methods to model these failures in advance miss **rare, high-consequence events** and require costly beam time to characterize. Designing electronics that are resistant to these failures is critical, and organizations need fast, defensible predictions to reduce tests and guide hardening early.

KEY BENEFITS

- **De-risk missions** by capturing rare, high-impact nuclear events
- **Lower cost** versus exhaustive hardware screening
- **Faster decisions** via automated, scriptable studies
- **Integration with circuit design plans** for tailored simulations

TECHNOLOGY FEATURES

- **Python API** for batch runs, workflows, and integration
- **Variance reduction** to model rare nuclear reactions efficiently
- **Scales** from planar stacks to complex 3D device geometries
- **Validated physics** across ions, protons, neutrons, electrons, and muons

SUMMARY

MRED is a **Python-based, Monte Carlo radiation simulation** software platform that models energy deposition and charge generation in microelectronic devices due to ionizing radiation. It enables product teams to predict **single-event effects**, **total ionizing dose**, and **displacement damage** before hardware testing. Companies use MRED to **de-risk designs**, prioritize mitigations, and **cut test cost and time**.

OTHER DETAILS

Intellectual Property Status:
Software copyrighted.

Stage of Development:
Mature, research-validated software; production-tested across numerous published studies. Seeking commercialization partners.

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