New Mexico Research Spotlight Forum

4/17/2019 Advancing Resilience for Space Systems

radionuclide source based device testing

PRESENTED BY:

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ABOUT YOURSELF

Brief biography: Nuclear Engineering professor at UNM since 2008.

- PhD Physics Yale in low energy particle physics (nuclear structure),
- postdoc Argonne National Laboratory physics division,
- postdoc U. W. Madison medical physics writing particle interaction simulations

- Research areas:
  - Radiation detector development,
  - detection technique and algorithm development,
  - device development and experiments for fission data

- Research group: 4 grad students + hiring, several undergrads, female and minority demographics

- **Keywords:** radiation interactions, damage, dose quantification

Note: Prior simulation and experiment work on dose to individual components on circuit board in radiation tests.

CURRENT WORK IN ADVANCING RESLIENCE FOR SPACE SYSTEMS

overview: We are looking at implementing radionuclide sources for radiation damage tests on electronics,

looking at single event effects (SEE).

Cf for fission fragments and neutrons, Am etc for alpha, various for beta/gamma.

problem: Large scale testing facilities such as ion beam labs are expensive and require waiting.

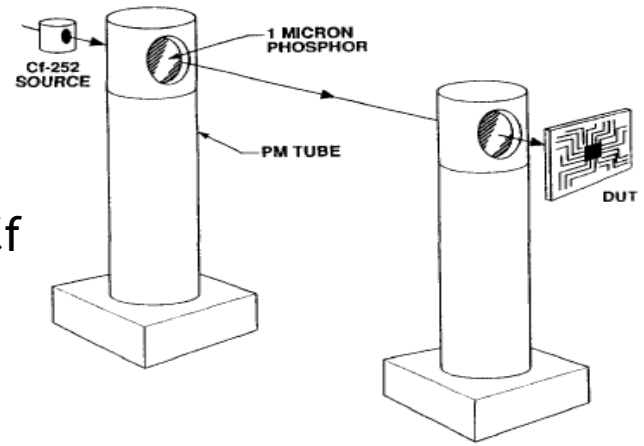
solution: We can develop benchtop electronics testing with radionuclide sources. Electronics can be run while irradiated.

Lower flux but far cheaper and far more accessible; there is a sweet spot.

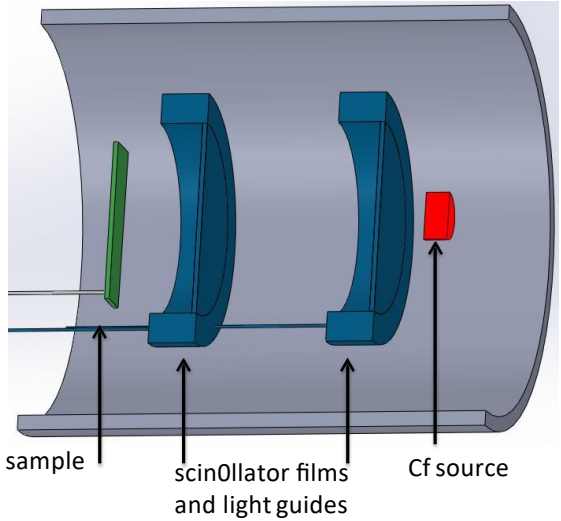
history: Prior work by JPL with ^{252}Cf fission source. TOF to discriminate light/heavy fission fragments.

Can reproduce with thin scintillator foils.

JPL
with ^{252}Cf



UNM
proposed



FUNDING SOURCES

For this project:

Looking

Current funding for other projects:

Sandia Academic Alliance on detector development and characterization

NNSA Stockpile Stewardship Academic Alliance on highly correlated fission data measurements

NNSA-MTV (U Mich heading) on muon imaging of used fuel storage casks

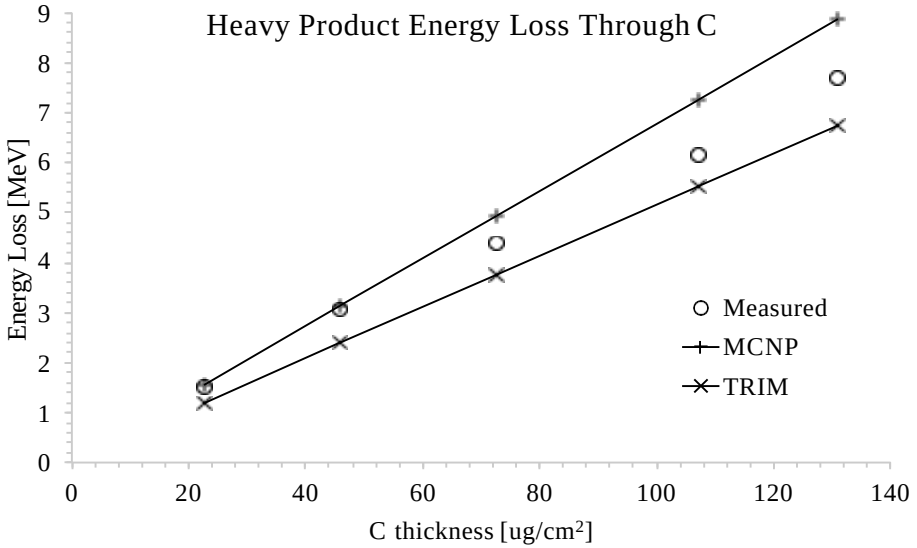
DTRA on neuromorphic computing

unfunded collaboration with LLNL on machine learning on gamma spectra for nuclear threat identification

RESEARCH NEEDS

We can apply this capability to electronics testing and examining radiation hardness. This has a direct application to space electronics needs.

This is **enabling technology** which will produce a level of testing that is extremely accessible.

For research, this will allow direct measurements for comparison with simulations on radiation interactions.

For example, we just wrote a paper on fission fragment energy loss in C and SiN foils comparing data with SRIM and MCNP. For heavy fragments MCNP was consistently 10-20% above data, and SRIM 10-20% below. Energy loss rates are not well characterized for these heavy ions.