



Rossi- α with Organic Scintillators Measuring Highly Enriched Uranium

Flynn Darby^{1,2}

2nd Yr. PhD Student, ¹University of Michigan, ²Los Alamos National Laboratory

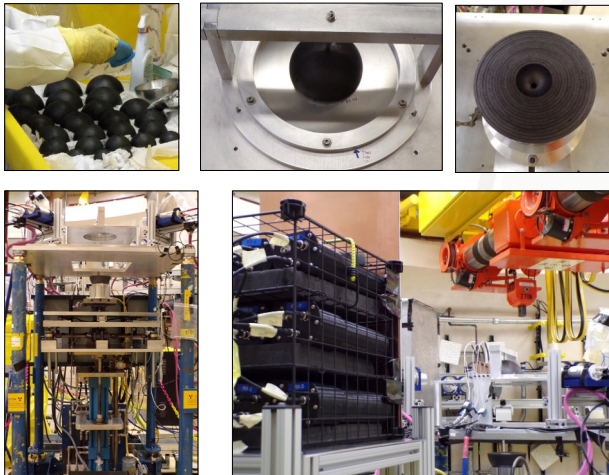
Coauthors: Michael Y. Hua^{1,2}, Jesson D. Hutchinson², Robert A. Weldon², George E. McKenzie², Juliann R. Lamproe^{1,2}, Shaun D. Clarke¹, Sara A. Pozzi¹

¹University of Michigan, ²Los Alamos National Laboratory



Introduction and Motivation

- Special nuclear material (highly-enriched uranium, plutonium) accounted for by International Atomic Energy Agency (IAEA)
- Rossi- α technique provides non-destructive method for verification

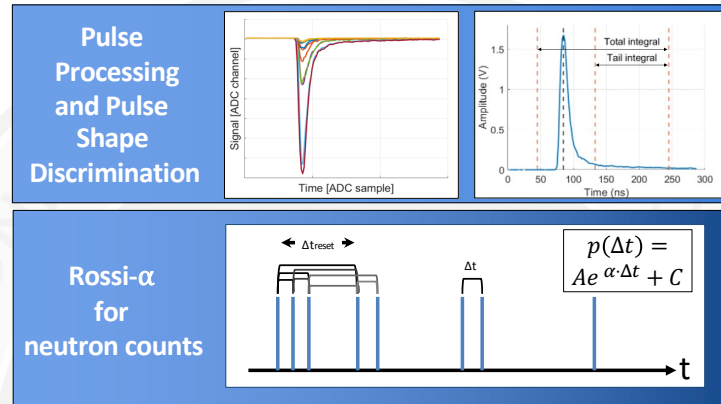


- Experiments performed at the National Criticality Experiments Research Center (NCERC) within the Nevada National Security Site (NNSS) with Los Alamos National Laboratory (LANL)
- Planet vertical-lift critical assembly
- 3 by 4 array of *trans*-stilbene organic scintillators 1.66 m from the assembly center measuring tens of kilogram configurations of the Rocky Flats shells (93% ²³⁵U) actively interrogated by Cf-252

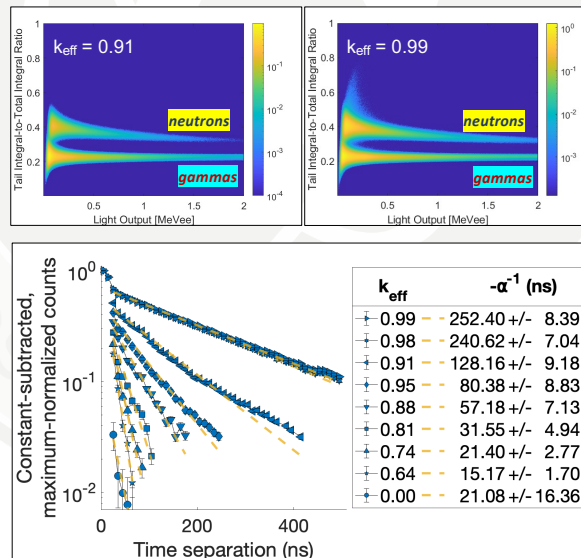


This work is supported by the National Criticality Experiments Research Center through the Department of Energy (DOE) Nuclear Criticality Safety Program, funded and managed by the National Nuclear Security Administration (NNSA), the Consortium for Monitoring, Technology, and Verification under DOE NNSA award number DENA0003920, and the DOE through the Los Alamos National Laboratory (LANL) operated by Triad National Security, LLC, for the NNSA under Contract No. 89233218CNA000001. Research reported in this publication was supported by the U.S. Department of Energy LDRD program at Los Alamos National Laboratory.

Technical Approach



Results



Discussion

- High precision measurements of the prompt neutron period, $-\alpha^{-1}$
- Increasing $-\alpha^{-1}$ corresponds to increasing k_{eff}
- Prompt period ($-\alpha^{-1}$) serves as an indicator for reactivity of a static fission system
- Independent of interrogating source
- All distributions show an abrupt change in shape just below 500 ns

Impact

- Future journal publication (tentative NIM-A)
- MTV fosters connection with NCERC
- Enables use of organic scintillators by IAEA
- Improves verification methods for nonproliferation



Conclusion and Next Steps

- Demonstrated that stilbene array can measure neutron Rossi alpha for highly enriched uranium of varying mass
- Results highlight possible application of organics for monitoring reactor criticality (k_{eff}) levels
- Fully analyzed configurations will inform benchmark data for NCERC
- Rossi- α is displaying two different exponential regions. Future work will investigate the cause.

