

Godiva IV CAAS Shielding Benchmark Pre CED-3A Overview

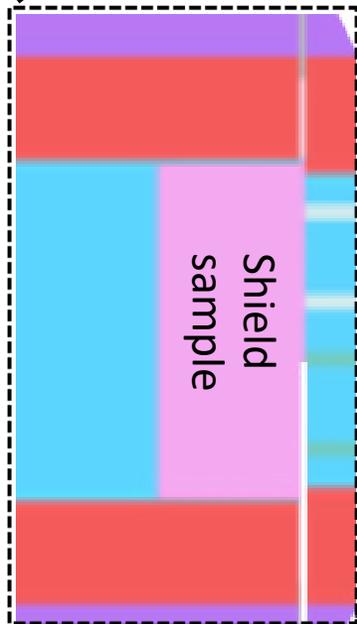
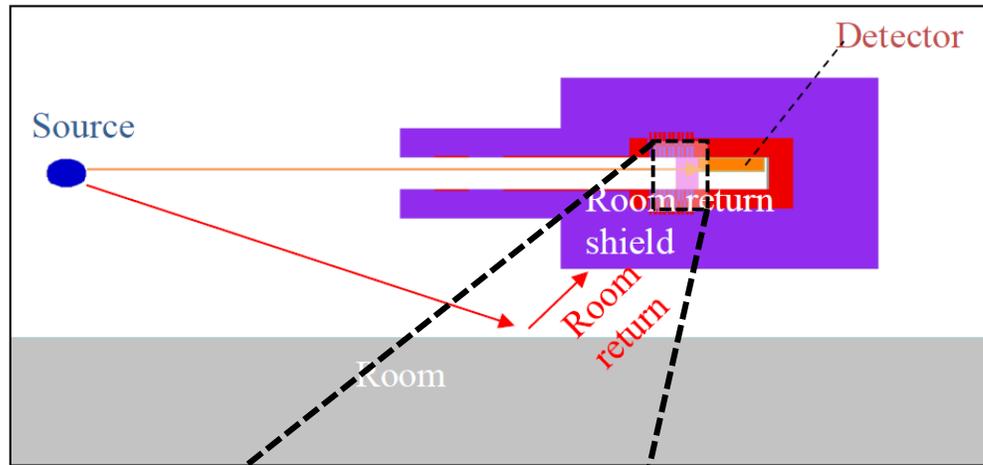
Riley Cumberland

This presentation briefly outlines the CAAS benchmark project using Godiva IV as a source (IER 498) and discusses the implications of the Godiva IV Reproducibility work (IER 557)

Overview

- Why Godiva IV?
- The IER 498 benchmark quantity
- What happened during the IER 498's gap year?

Why Godiva IV?



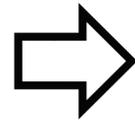
- Inherently has similarity to a criticality accident
 - Can we inform on other uncertainties besides nuclear data?
 - When is nuclear data the dominant uncertainty?
- Real super prompt critical fast spectrum burst with limited room return
- Source is strong enough to use foils as detectors

The IER 498 benchmark quantity is a comparison

The test relies on a comparison of shield sample vs no-shield sample to reduce uncertainty



VS



Shielded measurement, with bias uncertainty

Baseline measurement, with bias uncertainty

Effect of shielding

$$\text{Benchmark Quantity } Q = \frac{x_{i,shielded}}{x_{i,baseline}}$$

$Q_{Trial1} \cong Q_{Trial2}$ \Rightarrow Confidence in the measurements

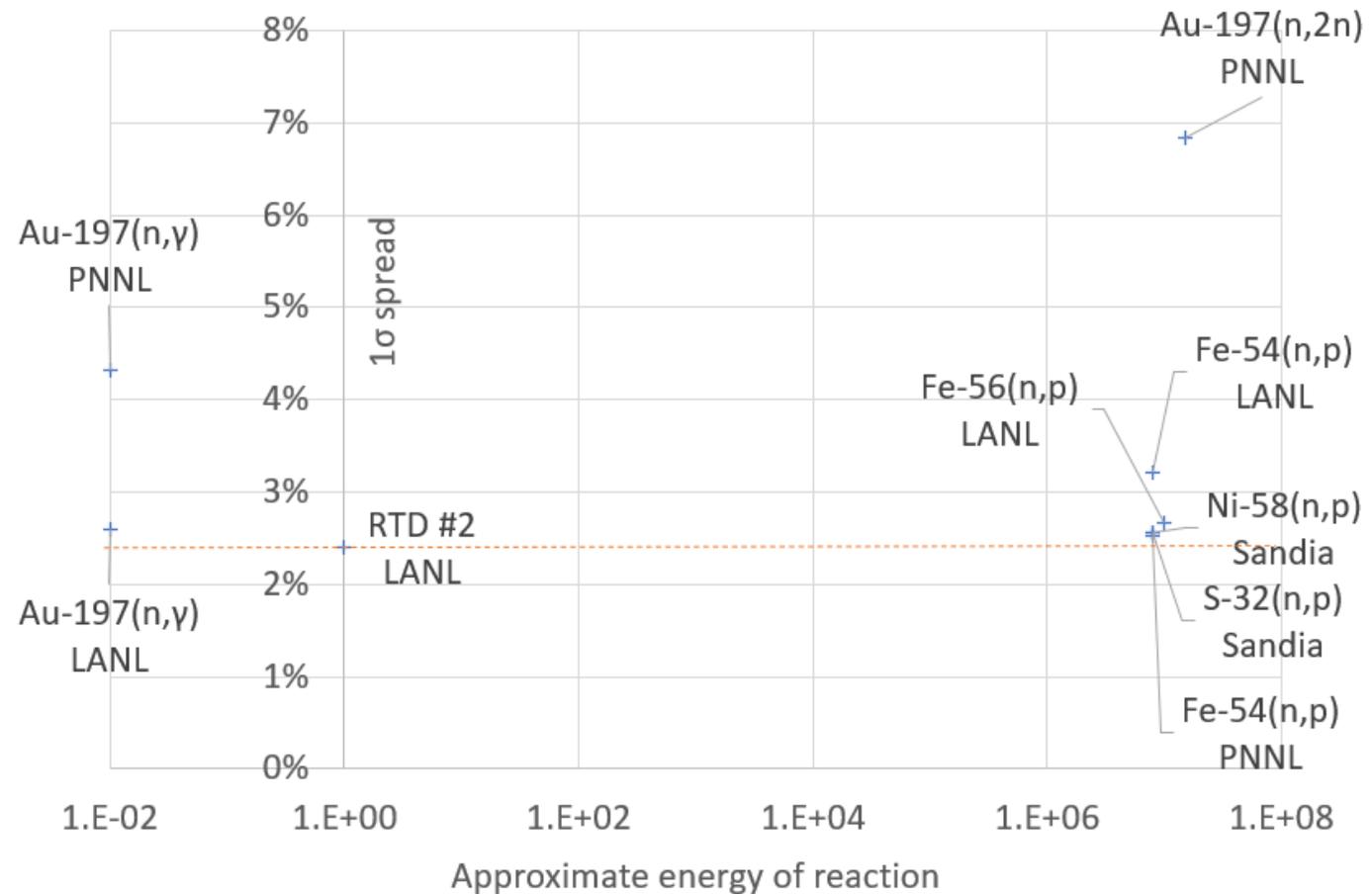
$Q \cong Q_{simulated}$ \Rightarrow Confidence in the simulation of shielding sample

$x \cong x_{simulated}$ \Rightarrow Confidence in full simulation (very lucky)

Knowing the difference in burst size is fundamentally necessary for burst tests

IER 557 has aided IER 498

- Onsite experience with foil counting
- Sandia and PNNL provided excellent instrumentation expertise
- Demonstrated the reproducibility for $\Delta T=70\text{C}$
 - We can claim a 1σ uncertainty of 3%
 - All we needed was 7%



Summary

- Integral experiments increase the level of realism from that of data measurements.
- Godiva IV is capable of intensities to activate foils
- IER 498 uses a relative measurement to provide an intermediate level of realism.
 - Reproducibility and room return management are key components
 - The test matrix put forward in CED-2 enables numerous cross comparisons
- IER 498 facilitates various additional works using a room return shield to isolate the source
- IER 557 demonstrated burst reproducibility sufficient for IER 498

Proposed CED-2 test matrix ranges from low power to burst

- The burst operations can provide more foil information
- The steady-state operation provides contrasting data, with fewer passive detectors
- The steady-state operation with electronic detectors can provide a second cross-comparison
 - Could enable streamlined experiments
- Materials are selected to minimize nuclear data and material data used

Table 17. Test matrix.

Shielding Sample	Number of Detectors		
	Steady state operation electronic detectors	Steady state operation passive detectors	Burst operation passive detectors
Blank	2+	2	2
Pb 10cm	1	1	2
Pb 5cm	1	1	2
PE 10cm	1	1	2
PE 5cm	1	1	2
SiO₂ 10cm	1	1	2
SiO₂ 5cm	1	1	2
total	8+	8	14