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ACTIVE INTERROGATION FOR SPENT FUEL

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Benefit

This research project showed the feasibility of operating a Differential Dieaway Assay (DDA) instrument for nuclear safeguards applications. We used a full-scale neutron generator with fresh fuel and tested data acquisition and electronics capable of operating at extremely high count rates. Experimental results agreed with simulations. We have designed a facility independent and less massive DDA instrument.

Applications

The fields the DDA technique applies to include:

- Spent fuel safeguards
 - Input accountancy for reprocessing
 - Shipper receiver differences
- Plutonium inventory verification
- Material control and accountability

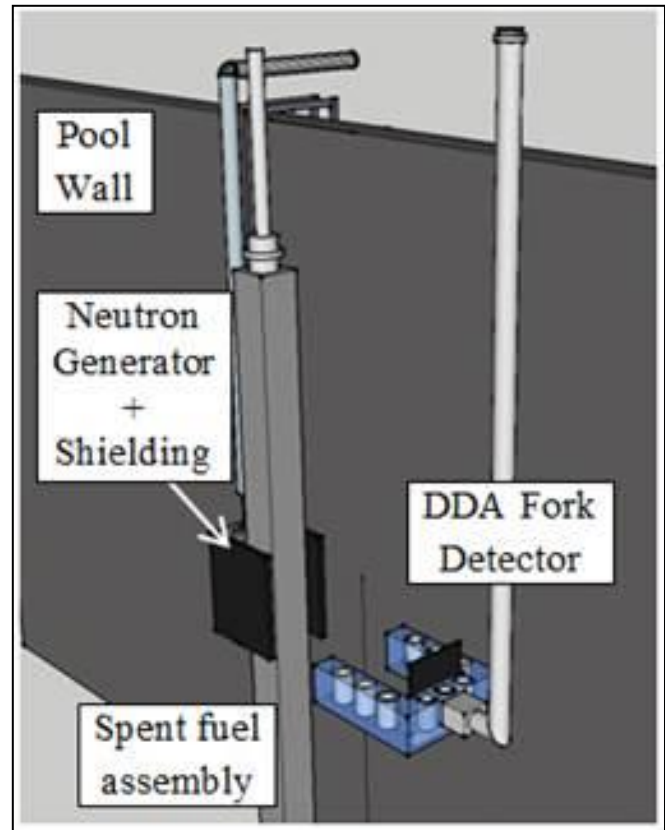
Current Capabilities

- High sensitivity to small changes in the amount of fissile material in the fuel assembly
 - Removal/replacement of 10 pins can be detected
- New front-end electronics for thermal neutron detectors capable of handling extremely high count rates (>1Mcps)
- Updated general-use design is facility independent and much less massive compared to previous design iterations

Anticipated Final Capabilities

The final prototype will have the following:

- Multiple ^3He detectors paired with fast post-burst front-end electronics to acquire list-mode data from positions around the spent fuel assembly
- Small mass such that safeguards inspectors can position the instrument and perform measurements



The general-use, facility independent DDA instrument for underwater spent fuel assay (inspired by the Fork Detector)

Project Description

The DDA instrument for nuclear safeguards is a fast, non-destructive assay, active neutron interrogation technique using an external 14 MeV DT neutron generator for characterization and verification of spent nuclear fuel assemblies.

Further Reading

1. V. Henzl, M. Swinhoe, S. Tobin, H. Menlove, J. Galloway and D. Won Lee, "Direct Measurement of Initial Enrichment, Burn-up and Cooling Time of Spent Fuel Assembly with a Differential Die-Away Technique Based Instrument," in *Institute of Nuclear Materials Management*, Orlando, 2012.
2. A. Goodsell, V. Henzl, M. Swinhoe, C. Rael, D. Desimone and W. Charlton, "Comparison of fresh fuel experimental measurements to MCNPX results using the differential die-away instrument for nuclear safeguards applications," *ESARDA Symposium 2015*, LA-UR-15-23252, 2015.
3. A. V. Goodsell, V. Henzl, M. T. Swinhoe, W. S. Charlton "Simulation Study for Detection of Pin Diversion with the Differential Die-Away Instrument Using Fresh Fuel" *Institute of Nuclear Materials Management*, 56th Annual Meeting Palm Desert 2015