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Annular Core Research Reactor Flux Characterization: Active Dosimetry

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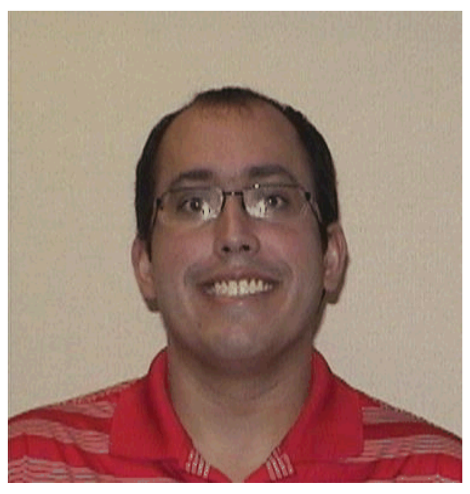
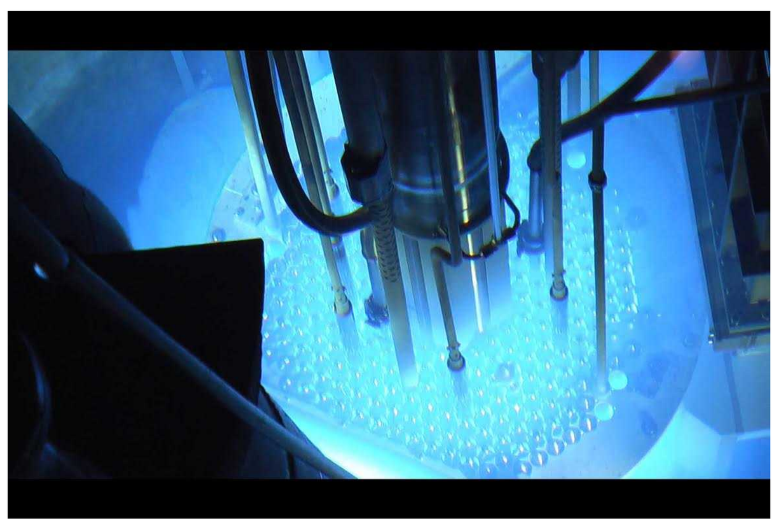
Organization: 1384- Applied Nuclear Technologies





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Purpose:

The Annular Core Research Reactor (ACRR) at Technical Area V (TA-V) preforms an essential function to the mission of Sandia National Laboratories through qualification and testing of electronic components in radiation environments. ACRR is unique in the sense that these environments can be tailored to specific need through use of "buckets" of a given material that change the energy spectrum of neutrons.

With this comes a fundamental question: namely, how can one properly characterize this and offer a clear cut metric to experimenters with regards to the electronic signal processing when faced with millions of data? This summer project looked at various digital signal processing techniques to create a process for making a compendium of characterized signals for each neutron environment of interest.

Digital Signal Results:

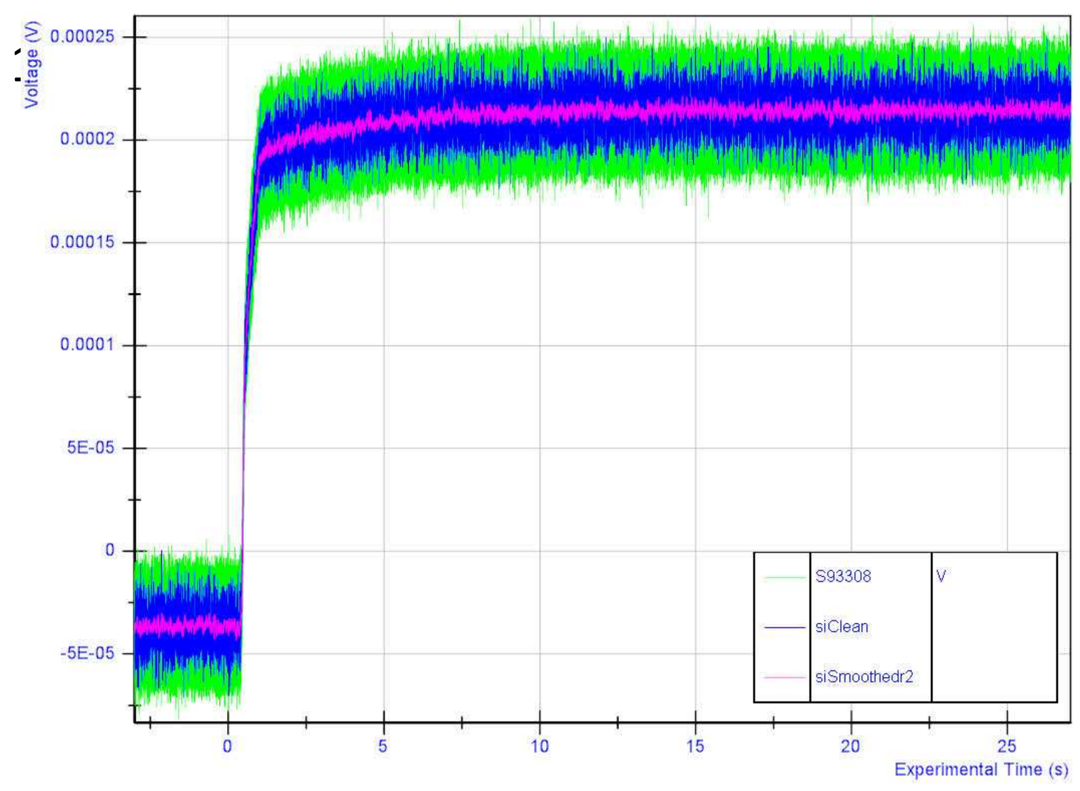

Fig. 1. Comparison with N=100 times data compression for a Si calorimeter.

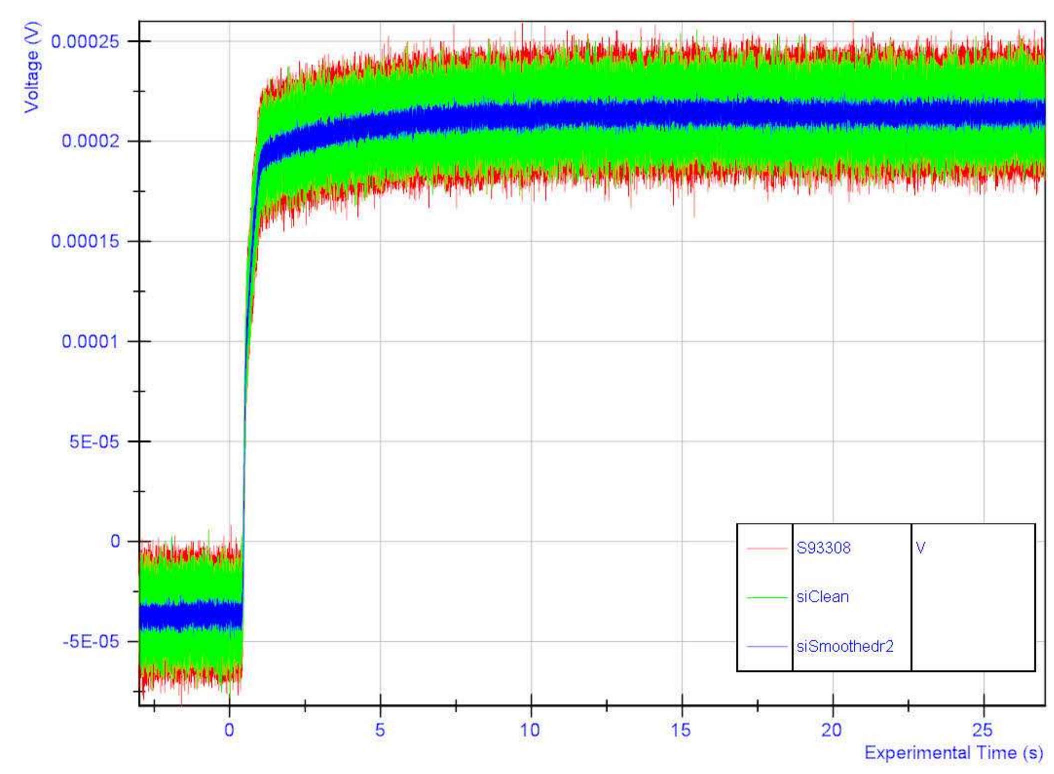

Fig. 2. Comparison with N=10 times data compression for a Si calorimeter.

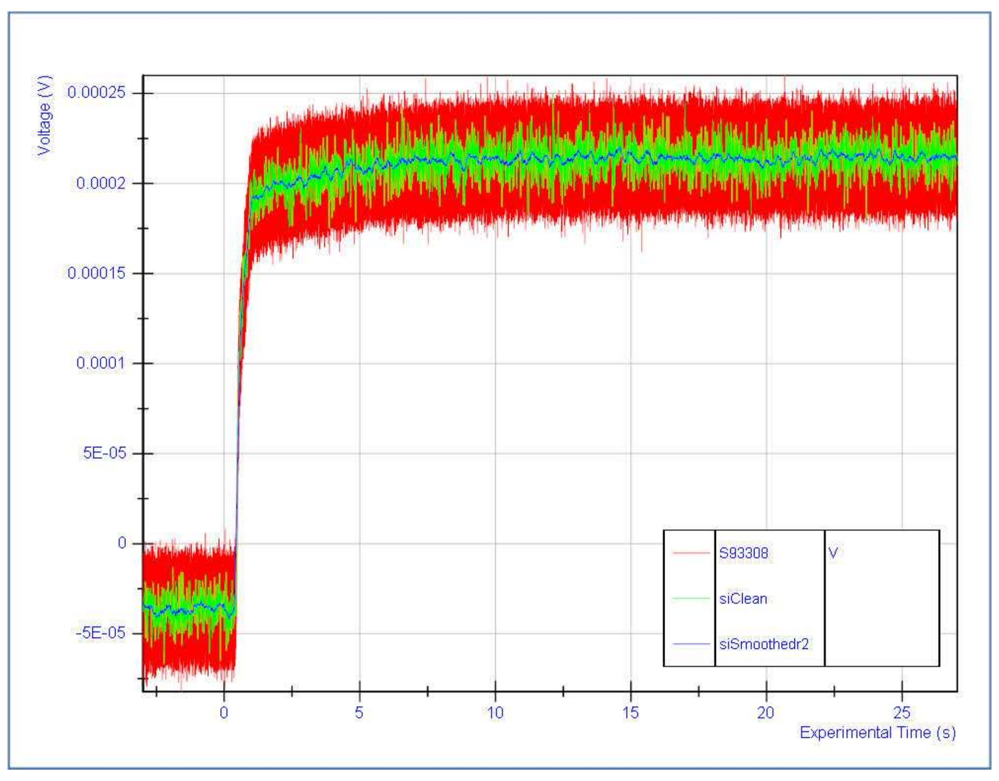

Fig. 3. Comparison with N=1000 times data compression for a Si calorimeter.

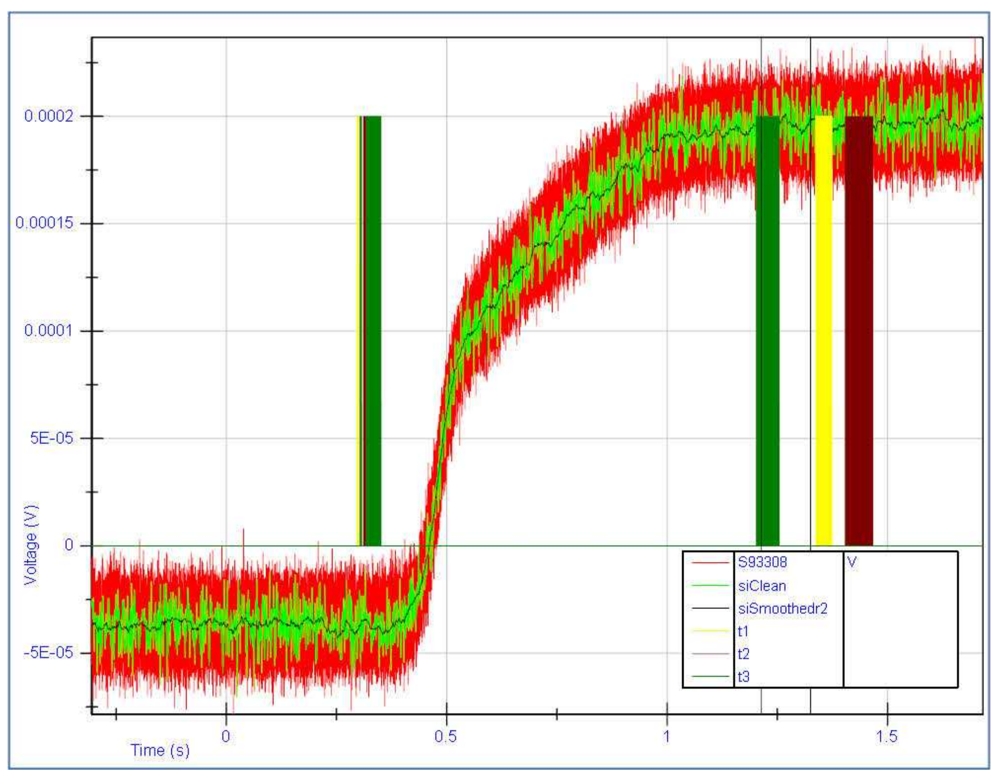

Fig. 4. Smoothed Calorimeter data with transient position status

Method:

Raw Data → Digital Filter → Data Load Reduced by 1000X → Curve Fitting in 2 zones:
1. Peak/Growth
2. Outside Peak

→ Experimenter Spreadsheet

Discussion:

Thus far, the most promising method makes use of a combination of digital filtration (Chebyshev), moving average calculations, and curve fitting on over **3 million** data points per channel. The optimization process begins now to determine what frequencies are contributing to the over all noise. Preliminary analysis indicates a source of high frequency noise as well as a need to generate a smoother curve when completing the regression.

Acknowledgments:

I would like to thank my manager, Ken Reil, Organization 1384 for their support and with my mentor, Ed Parma for answering a myriad of questions.

U.S. DEPARTMENT OF ENERGY   NNSA National Nuclear Security Administration

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