In-Core Neutron Detectors for The University of Texas at Austin TRIGA Reactor

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Collaborators: NA

ABSTRACT:

The main focus of this project is to upgrade the in-core neutron detector instrumentation within the 1.1 MW TRIGA reactor at the Nuclear Engineering Teaching Laboratory (NETL) at The University of Texas at Austin. This includes a wide range neutron flux channel (DWK 250) from Mirion Technologies, a series of self-powered neutron detectors for monitoring the flux in experimental locations and associated electronics. The wide range neutron flux channel (DWK 250) utilizes a fission chamber to cover 10 to 12 decades of measurement. At source range reactor powers it utilizes pulse counting mode and transitions to Campbell (RMS) mode processing at intermediate powers. It has continuous functional self-checks and a remote test generator. This power channel will reduce the electronic noise within the system and subsequently reduce the variance of the signal output. As a result, the NETL TRIGA reactor will be able to operate closer to the 1.1 MW licensed power level than we currently can with the original General Atomics instrumentation.

In this proposal we also request both Co and Cd based self-powered neutron detectors with associated electronics. The Cd based detector has a sensitivity of 10-27 A n-1 cm-2 with negligible burn-up. This type of detector is commonly used in slowpoke reactors for flux monitoring. These self-powered neutron detectors will be utilized to instrument in-core activation facilities such as our pneumatic facility, 3-element in-core irradiator, 7-element in-core irradiator, rotary specimen rack irradiator, and central thimble irradiator facility. These facilities are frequently utilized for sample irradiation with the application for the majority of the samples being for neutron activation analysis (NAA). Within NAA it is important to know the precise neutron fluence hitting the samples. Past experiments with activation foil neutron monitors has shown a standard deviation of the neutron flux around 5-7% within these facilities. When NAA accuracy is required to be better than 10%, neutron foil, wire, or powder flux monitors are utilized for each sample irradiation. These activation flux monitors then have to be counted on a HPGe detector and the flux calculated. The goal of instrumenting the irradiation facilities with self-powered neutron detectors is to make the NAA process simpler and more efficient. This will have a significant pay-off considering that NETL processes between 2,000 and 4,000 samples per year for NAA.