



Contribution ID: 1908 Contribution code: THPA008

Type: **Poster Presentation**

Development of a Modular X-ray Detector for Beamline Diagnostics at Los Alamos National Lab

Thursday, 11 May 2023 16:30 (2 hours)

An X-ray detector is being developed for diagnostic measurement and monitoring of the Drift Tube LINAC (DTL) at the Los Alamos Neutron Science Center (LANSCE) at Los Alamos National Lab. The detector will consist of a row of x-ray spectrometers along the DTL which will measure the spectrum of X-rays resulting from bremsstrahlung of field emission electrons (FEE) and spilled beam. Each spectrometer will monitor a specific gap between drift tubes, and the broad array of detectors is intended to allow for location of beam spill and arcs in the DTL, a concept demonstrated to be feasible in previous measurements at the DTL. Two prototypes are under development: one with a LaBr scintillator coupled to a photomultiplier tube (PMT) along with a second LYSO scintillator that is also coupled to a PMT; and a prototype with two LYSO crystals each coupled to a silicon photomultiplier (SiPM). In both prototypes, LYSO provides a tagged gamma source with three peaks that are used for self-calibration. The LaBr-PMT module has better energy resolution than the LYSO-SiPM module, but is more expensive and more difficult to shield from background radiation. Both prototypes were tested at the LANSCE DTL to validate the feasibility of measuring gamma spectra, performing in situ self-calibration, and detecting spilled beam relative to nominal operating conditions in situ. Results from these tests and plans for future development and other possible applications will be presented.

Funding Agency

Footnotes

Speaker is Patrick Freeman

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Yes

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Session Classification: Thursday Poster Session

Track Classification: MC6: Beam Instrumentation, Controls, Feedback and Operational Aspects: MC6.T03: Beam Diagnostics and Instrumentation