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Advanced Techniques for Flight Path Alignment at LANSCE

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During the 2022 maintenance outage, installation was completed for the new generation of spallation target-moderator-reflector-shield, known as Mark-IV at the LANSCE. The upper-tier of Mark-IV target requires precision Flight Path (FP) alignment, because of the line-of-sight view of the spallation disk within. This paper demonstrates the importance of using advanced Laser Tracker Survey (LTS) technology to inform geometry in the Monte Carlo N-Particle Transport (MCNP) code for beam spot simulation*. Based on LTS of FP14 we found out the FP14 axis to be intersecting the upper target emission surface is about 20% farther from the target center than depicted in the existing design drawings and the MCNP geometry. We have updated the MCNP geometry model based on the LTS data and used it to calculate detailed beam spot neutron intensity distributions in various neutron energy bins. The beam spot was experimentally measured by an active, high-speed, and gated PI-Max4 imager for each energy decade from 1meV to 1MeV and passive image plates. The experimental beam spot distributions agree very well with our MCNP simulations. Finally, we used our updated MCNP model to propose a realignment for FP14, along with redesigned external collimator to produce a uniform beam spot for FP14 experiments.

Funding Agency

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Footnotes

- MCNP simulations of FP14 found lateral beam spot shifts as a function of neutron energy due to the non-uniform emission from the upper target within the field of view (FOV).

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Primary author: SVOBODA, Josef (Los Alamos National Laboratory)

Co-authors: BROUGHTON, David (Los Alamos National Laboratory); COOPER, Andrew (Los Alamos National Laboratory); COUTURE, Aaron (Los Alamos National Laboratory); LEAL-CIDONCHA, Esther (Los Alamos National Laboratory); MOCKO, Michael (Los Alamos National Laboratory)

Presenter: SVOBODA, Josef (Los Alamos National Laboratory)

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