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Analysis of neutron spectra of candidate materials for potential moderator locations in the NEAR station at the CERN/n_TOF facility

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The n_TOF is one of the few neutron spallation facilities in the world capable of delivering neutron spectra. These spectra are used for precise neutron-induced cross-section measurements using the time of flight technique. The facility has made significant contributions to a wide range of scientific fields including astrophysics, nuclear technologies and medical applications since the beginning of its operation in 2001. The n_TOF facility produces neutrons by directing a 20 GeV pulsed proton beam extracted from the proton synchrotron onto a pure lead target cooled with nitrogen gas.

In 2021, the third irradiation area, the NEAR station, was built next to the n_TOF target. The station consists of two study locations. One of the locations is situated inside the shielding of the n_TOF target. Its aim is to study irradiation damage of high doses (in the order of MGy) in materials. The other location, outside the shielding, uses a collimator to convey the high-intensity neutrons to the outside area.

In this work we incorporate MCNP6 code and the FENDL-3.1 cross-section library, along with the generated weight windows of the target for variance reduction, to simulate the irradiation of materials in the NEAR station. Three locations in the NEAR station were irradiated and neutron spectra were estimated for different moderator candidate materials. The results will be used during neutron capture cross section measurements by the activation method at the n_TOF NEAR Station.

Footnotes

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Europe

Primary author: STANKUNAS, Gediminas (Lithuanian Energy Institute)

Co-authors: MENGONI, Alberto (European Organization for Nuclear Research); TOGOBICKIJ, Benjaminas (Lithuanian Energy Institute); LERNER, Giuseppe (European Organization for Nuclear Research); CECCHETTO,

Matteo (European Organization for Nuclear Research); VLACHOUDIS, Vasilis (European Organization for Nuclear Research)

Presenter: STANKUNAS, Gediminas (Lithuanian Energy Institute)

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