Abstract submitted to HNPS2022

MCNP simulations for the n_TOF NEAR station

S.A.Kopanos[1], R.Vlastou[1], M.Diakaki[1], M.Kokkoris[1], S.Chasapoglou[1], C.Frantzis[1], V.Michalopoulou[1]

[1] *Department of Physics, National Technical University of Athens, 157 80 Athens, Greece*
Presenting author email: s.kopanos96@gmail.com

The NEAR station is the newest experimental area at the n_TOF facility at CERN, utilizing the spallation process to generate extremely high neutron flux within a broad energy spectrum ranging from thermal up to a few GeV. Since the intense neutron flux and the short flight path render time of flight active detectors inadequate, an extensive campaign has been undertaken for the determination of the spectral features of the neutron beam using the multi foil activation technique as well as through a thermalization detector. Numerous foils have been irradiated last year and the induced activities were measured implementing a HPGe detector. Our goal is to analyze the data and utilize them for the unfolding of the neutron flux through data deconvolution.

During the experimental data analysis of the n_TOF gamma-ray spectra, the corresponding saturated activities for each material were calculated. Given that the cross sections for each energy and each reaction are well known, those results can be used to unfold the characteristics of the neutron flux through data deconvolution using the SAND-II code. Since this process is mostly mathematical and does not account for geometry and other effects that might have influenced the measured activity, correction factors need to be defined and applied to the measured activities in order to produce a more robust and accurate result.

For this purpose Monte Carlo simulations using the MCNP code were performed to investigate the self-shielding of the foils and its effect on both the neutron flux and the gamma rays emitted. Also, a detailed simulation including the full geometry of the experimental setup was built and used in order to investigate possible influence of the peripheral materials (cement, other foils, mylar as well as the aluminum sample holder and rails) to the total flux that reaches each individual foil through scattering of neutrons. The results of these simulations are presented along with a detailed comparison between the theoretical and the corrected experimental activities.