

Contribution ID : 108

Type : Oral talk

Unfolding methods for reconstructing the spectrum of spectator neutrons obtained by the HGND prototype in the BM@N experiment

Wednesday, 28 October 2026 16:20 (15)

The development of a Highly Granular Time-of-Flight Neutron Detector (HGND) for measuring neutron yields and flow in the 0.3-4 GeV kinetic energy range in nuclear collisions at the BM@N experiment is almost finished. To validate the concept of the full-scale HGND, a compact HGND prototype was tested in 3.8A GeV 124Xe collisions with a CsI target in the BM@N experiment in 2022. The prototype was positioned at an angle of 0 degrees to the undeflected beam axis in order to measure the yields of spectator neutrons resulting from hadronic interactions of nuclei, as well as the yields of neutrons resulting from electromagnetic dissociation (EMD) of projectile nuclei [2].

Despite the high neutron detection efficiency and relatively good time resolution of the HGND prototype of approximately 270 ps, it is insufficient for measuring high-energy neutrons. The measured neutron kinetic energy spectra, reconstructed using the time-of-flight method, are significantly smeared due to the contribution of the time resolution. In order to restore the true neutron kinetic energy spectrum from the distorted reconstructed spectrum, an unfolding procedure was used [3]. This method of spectrum reconstruction uses the measured kinetic energy spectrum as input data, as well as the detector response matrix and background estimations obtained through the detector response simulation in the complete geometry of the BM@N setup using the DCM-QGSM-SMM and UrQMD-AMC models as event generators. An intercomparison of the various unfolding methods implemented in the RooUnfold framework for reconstructing the neutron spectrum was conducted.

This approach allows the measurement of double-differential inclusive cross sections of forward neutron emission as a function of rapidity and solid angle even with limited time resolution. In order to validate the approach, measurements of neutrons from EMD were performed, as these neutrons are characterised by a very narrow energy distribution, centred around the projectile beam energy [4].

References

1. S. Morozov et al., Nucl. Instrum. Meth. A 1072, 170152 (2025).
2. A. Zubankov et al., Nucl. Sci. Tech. 36, 226 (2025).
3. L. Brenner et al., Int. J. Mod. Phys. A, 35 (24), 2050145 (2020).
4. I.A. Pshenichnov et al., Int. J. Mod. Phys. E 33, 2441007 (2024).

Primary author(s) : ZUBANKOV, Aleksandr (INR RAS); GOLUBEVA, Marina (Institute for Nuclear Research RAS); GUBER, Fedor (INR); KARPUSHKIN, Nikolay (INR RAS); MOROZOV, Sergey (INR RAS); Prof. PSHENICHNOV, Igor (Institute for Nuclear Research of the Russian Academy of Sciences); SAVENKOV, Savva (INR); SHABANOV, Arseniy; SVETLICHNYI, Aleksandr (INR RAS, MIPT(NRU))

Presenter(s) : ZUBANKOV, Aleksandr (INR RAS)

Session Classification : High energy physics: experiment

Track Classification : High energy physics: experiment