
NEULAND: THE HIGH RESOLUTION NEUTRON TIME-OF-FLIGHT SPECTROMETER FOR R³B

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NeuLAND (new Large-Area Neutron Detector) is the next-generation neutron detector [1] designed for the R3B (Reactions with Relativistic Radioactive Beams) facility at FAIR. NeuLAND features a high detection efficiency, a high resolution, and a large multi-neutron hit resolving power. This is achieved by a highly granular design of plastic scintillators. The detector will consist of 3000 individual submodules with a size of 5x5x250 cm³, arranged in 30 double planes with 100 submodules providing an active face size of 250x250 cm² and a total depth of 3 m.

The main design goals comprise a one-neutron detection efficiency above 95% in a wide energy range and a full acceptance corresponding to an angular coverage of ~ 80 mrad. The desired resolutions for momenta and thus the excitation energies lead to the required spatial resolutions of $\sigma_{x,y,z} \leq 1.5$ cm and to a time resolution of $\sigma_t \leq 150$ ps for the standard distance between detector and target of 15.5 m. When placed at a distance of 35 m, an excitation-energy resolution of less than 20 keV(!) will be reached for an excitation energy of 100 keV above threshold for a beam energy of 600 AMeV.

We will present the final design and the production status of NeuLAND. The specifics of the building blocks of the detector will be summarized. Results from test measurements with the NeuLAND demonstrator will be detailed and the detector capabilities will be discussed along selected physics examples, e.g. the detector response to the excitation of the giant dipole resonance in ¹³⁶Sn.

REFERENCES

- [1] NeuLAND@R3B: A Fully-Active Detector for Time-of-Flight and Calorimetry of Fast Neutrons, NeuLAND Technical Design Report, <http://www.fair-center.de/fileadmin/fair/experiments/NUSTAR/Pdf/TDRs/NeuLAND-TDR-Web.pdf>