31st International Seminar on Interaction of Neutrons with Nuclei: Fundamental Interactions & Neutrons, Nuclear Structure, Ultracold Neutrons, Related Topics (ISINN-31)

Contribution ID: **21** Type: **not specified**

Current Status and Experiments of the Back-n White Neutron Facility

Friday, 30 May 2025 12:00 (20 minutes)

The Back-n white neutron facility is a comprehensive experimental platform that serves a wide spectrum of research goals, including nuclear data measurement, experiments in nuclear physics and astrophysics, calibration of neutron detectors, investigation of neutron radiation effects, and applications in archaeology, among others. Operational since 2018, this beamline has facilitated over 300 varied experiments involving international collaborations with China, Russia, and the USA, afford more than 30,000 hours of beam time.

In 2023, the Back-n started employing boron nitride (BN) absorber sheets as a substitute for conventional cadmium sheets, thereby significantly reducing the cutoff energy for low-energy neutrons. This strategic enhancement has broadened the beamline's capacity to include accurate measurement of thermal neutron reaction cross-sections. The substantial neutron flux and extensive beam time have been crucial in securing high-quality statistical data in energy regions that were previously unattainable, leading to notable physical discoveries. These advancements are highlighted by the recently published measurements of the 232Th fission cross-section, which illustrate the improved capabilities of the beamline.

Moreover, Back-n's involvement in the NOPTREX international collaboration has facilitated the conduct of advanced polarized neutron physics experiments, leveraging the SEOP neutron polarization apparatus. The use of polarized neutrons in the eV energy range has enabled a series of fundamental physics experiments, including CP violation experiment etc.

The facility has also experienced significant enhancements in its detection technology. Recent developments include the commissioning of leading-edge detection systems such as a BaF2 detector array (GTAF) for capture cross-section measurements, a Multipurpose Time Projection Chamber (MTPC) for the charged particles and fission cross-sections, and a boron-doped Microchannel Plate detector (BMCP) for total cross-section measurements and neutron resonance radiography. These detectors are among the most advanced neutron detection technologies in the world. Their integration into the Back-n beamline is expected to lead to a wave of pioneering scientific results from the white neutron experiments.

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Session Classification: Plenary Session

Track Classification: Plenary session