ECNS 2023 Garching

EUROPEAN CONFERENCE ON NEUTRON SCATTERING

Contribution ID: **412**   Type: **Poster**

Development of a large-area curved Trench-MWPC 3He detector for D16 neutron diffractometer at ILL

Monday 20 March 2023 16:00 (2 hours)

The D16 instrument is a versatile cold-neutron diffractometer operating at the ILL. It benefited from a number of upgrades over the years, such as the installation of a large-area 3He Multi-Wires Proportional Chamber (MWPC) in 2014. This detector provides a resolution of 1 x 1 mm2 over an area of 32 x 32 cm2. After 8 years of operation, the detector is now being replaced by a new curved detector covering a wider active area while still maintaining a high spatial resolution. Its 86° angular coverage will make it possible to perform time-resolved experiments with a large q-range. This new detector is based on the Trench-MWPC detector technology developed at the ILL. In the Trench-MWPC design, cathode electrodes consist in curved aluminium blades with teeth machined along one side of the blade. These blades are stacked on top of each other to form trenches inside which anode wires are stretched. In the D16 Trench-MWPC, 6 modules are mounted side by side in an 3He-filled curved vessel. Each module consists of 192 cathode blades spaced with a pitch of 2 mm and 192 anode wires with a pitch of 1.5 mm. The radius of curvature of the cathode blades is 1150 mm providing a parallax-free resolution of 0.075° horizontally along the 86° angular coverage of the 38 cm high detector. The various fabrication and mechanical inspection steps of the D16 Trench-MWPC detector modules and pressure vessel are presented as well as experimental results obtained during the characterisation with neutrons.

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Session Classification: Poster Session MONDAY

Track Classification: Neutron Instrumentation, Optics, Sample Environment, Detectors, and Software