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Neutron detector development at the ILL. Prospects for ^3He alternatives

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^3He is often used as the neutron converter for detectors in neutron scattering science, but this gas has become rare and very expensive since 2008. The growing lack of Large Area Neutron Detectors becoming a major concern in most of the research neutron institutes, the development of techniques based on alternative converters is of the highest priority. ^{10}B is another popular neutron converter which can be used either in solid scintillators, or in proportional counters as thin films (^{10}B or $^{10}\text{B}_4\text{C}$) or gas compound ($^{10}\text{BF}_3$). In the so-called Multi-Grid detector, the volume of the detector is filled with grids, electrically insulated and stacked together to form square tubes. Each tube has a wire at its centre for charge collection and gas amplification. The mechanics of this design allows building large area vacuum compatible detectors with no dead space. In a ^{10}B Multi-Grid detector, one grid consists of blades coated with thin Boron films on both sides mounted on a frame, whereas in a $^{10}\text{BF}_3$ Multi-Grid detector, one grid is made of a single block of Aluminium, machined to create the holes. A ^{10}B Multi-Grid prototype with 30 layers of B_4C has been tested on a monochromatic neutron beam line. The absorption profile through the detection planes has been measured for films containing natB and ^{10}B . Preliminary results agree with the simulated performance, and show that this technique allows to reach a detection efficiency $> 50\%$ for thermal neutrons.

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