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State of the art neutron detection, ^3He problem and solutions

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Over the last years ^3He has been widely used in gas filled detectors for neutron scattering due to its outstanding characteristics. Driven by the escalating supply shortage of ^3He an International Detector Initiative to develop alternative technologies to ^3He detectors for neutron scattering applications was initiated by the major neutron facilities worldwide. Focused on the development of large area detectors the Initiative pursues three potential technologies:

- ZnS:6LiF(Ag) or ZnS:10B2O3(Ag) scintillator based detectors read out by coded arrays of clear or wavelength shifting fibres and PMTs recently have been built at several facilities. To substitute ^3He -detectors however, these devices need considerable improvement with respect to efficiency, count rate capability, ghosting and production cost.
- Gaseous detectors with solid ^{10}B converter are presently used in very low efficiency or small area applications only. The deposition of uniform $\sim 1\mu\text{m}$ thin ^{10}B layers on very large areas at reasonable cost and the detector design of multilayer arrangements using up to 30 Boron layers to achieve adequate efficiency is a considerable challenge to apply this technology for neutron scattering applications.
- Widely used in the past $^{10}\text{BF}_3$ was abandoned as detector gas due to its intrinsically lower efficiency and toxicity. Improved multilayer detector designs and the availability of high purity gas nowadays are considered as a potential replacement of ^3He detectors on a short term.

Details of the three different development lines pursued by the International Detector Initiative and present results will be reported.

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