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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 10Boron converter are presently used in very low efficiency or small area applications only. The deposition of uniform ˜1µm thin 10Boron 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 10BF3 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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