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Performance characteristics of the new detector array for the SANS2d instrument on the ISIS spallation neutron source

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The performance of the new position sensitive neutron detector arrays of the Small Angle Neutron Scattering (SANS) instrument SANS2d is described. The SANS2d instrument is one of the seven instruments currently available for users on the second target station (TS2) of the ISIS spallation neutron source. Since the instrument became operational in 2008 it has used two one metre square multi-wire proportional detectors (MWPC). However, these detectors suffer from a low count rate capability, are easily damaged, are expensive to repair and over the last two years have become increasingly unreliable. The new detector arrays consist of 120 individual position sensitive tubes filled with 15 bars of 3He. Each of the tubes is one metre long and has a diameter of 8 mm giving a detector array with an overall area of one square metre. Two such arrays have been built and installed into the SANS2d vacuum tank where they are currently taking user data.

Operation of the detector within a vacuum is essential in order to reduce air scattering. A novel, fully engineered approach has been utilised to ensure that the high voltage connections and preamps are located inside the SANS2d vacuum tank at atmospheric pressure, within air tubes and air boxes respectively. The signal processing electronics and data acquisition system are located remotely in a counting house outside of the blockhouse. This allows easy access for maintenance purposes, without the need to remove the detector from the vacuum tank. The design will be described in detail.

The initial measurements taken from a standard sample indicate that whilst the detector array itself only represents a moderate improvement in overall detection efficiency (˜50% better) compared with the MWPCs, the count rate capability is increased by a factor of ˜100 for a comparable position resolution (˜8mm). A significant advantage of the new array is the ability to change a single tube in situ within approximately 1 day with a relatively small staff effort. The results obtained from the first user trials will be reported.

Author: DUXBURY, Dominic (STFC, Rytherford Appleton Laboratory)

Presenter: DUXBURY, Dominic (STFC, Rytherford Appleton Laboratory)

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