



Contribution ID: 145

Type: **Contributed Poster**

A neutron imaging gas detector with individual read-outs

Thursday 15 September 2005 10:30 (30 minutes)

We have been developing a neutron imaging gas detector with a high spatial resolution and with a high temporal response for the neutron scattering instruments at the pulsed neutron source in the Japan proton accelerator research complex.

To meet the requirements for the instruments for neutron reflectometry or for small angle neutron scattering, where a spatial resolution of less than 1 mm and a pulse-pair resolution of less than 1 μ s are required, the gas detector with individual read-outs was developed. The detector comprises the gas vessel which withstands up to 10 atm with the feed-throughs of 541 channels, multi-channel fast amplifier-shaper-discriminator boards, data encoding and taking system.

The performances of the prototype detector using a multi-wire (MW) detector head, which has an active area of 40 x 40 mm² with a wire pitch of 1 mm for each dimension, were evaluated using a collimated neutron beam. It was confirmed that the detector exhibited a spatial resolution of 1.5 mm and a pulse-pair resolution of about 100 ns with a gas pressure of 6 atm helium with a mixture of 30% CF₄. The position-linearity with a deviation less than 1 % was also confirmed.

Moreover, the micro-strip (MS) detector head, which has an active area of 50x50 mm² with a strip pitch of 0.4 mm for each dimension, was installed on the detector system and the performances were also evaluated up to the total gas pressure of 8 atm.

In the presentation the results obtained by the detector with the MW / MS heads are presented as well as the description of the developed detector system.

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Session Classification: P : Coffee and Poster Session

Track Classification: Novel Gas-based Detection Techniques