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Two-dimensional thermal neutron detector

Two-dimensional detector of thermal neutrons has been designed and constructed for neutron diffraction experiments at the St.-Petersburg Nuclear Physics Institute. Detector is based on MWPC with cathode strip delay line readout and has sensitive area of 170mm×300mm. In order to achieve the best physical parameters of detector it was necessary to optimize an anode signal transmission into cathode strips. For this purpose some more important geometrical parameters of the MWPC have been chosen according to the following principal: anode wire spacing, "anode-cathode"gap and strip width have to be equal to each other. Anode wire spacing is 4mm. Detector operates with the gas mixture 1.5Bar 3He + 2Bar CF 4 and has 1mm space resolution. To improve the gas purity by a few orders of magnitude a new technology for detector's electrodes fabrication successfully developed. The electronic noise limited resolution of FWHM=0.6mm and differential non-linearity of ±5% are achieved in the detector. It was shown that detector has space resolution of about 1mm and efficiency of 60% for 9°A neutrons. Pulse height spectra behavior via high voltage and electric field tension in the drift regions has been investigated. It was shown that these spectra are very similar to those observed from proportional counters that have a gas pressure of 10Bar and intended for thermal neutron detection. Based on obtained results a new detector with sensitive area of 300mm×300mm and anode wire spacing of 2mm has already constructed. In order to perform efficiency of 90% and space resolution about 1mm, the gas pressure is increased up to 5-7Bar.

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