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The ceramic nTHGEM-based neutron detector in CSNS

With the international development of the new generation neutron source, the traditional neutron detector can't satisfy the demand of the application of the high flux especially. And facing the global crisis of 3He supply, the research on the new style of the neutron detector becomes extremely urgent. Considered with the development demand of the domestic neutron scattering facility CSNS (China Spallation Neutron Source), this research proposes to develop the new style of neutron detector based on the boron convertor and a new nTHGEM with high flux capacity and two-dimensional position sensitivity. The nTHGEM, which use ceramics as the insulator with the gold coated on the two sides, is customized and designed specially for the neutron detection with the less scattering than the kapton GEM.

Several prototypes have been constructed and tested on the reactor beamlines. A thin boron coating on the cathode is used as the neuron convertor and a single ceramic nTHGEM (active area:50mm*50mm, thickness: 200μm, pin: 200μm, pitch:600μm) is employed for the gas multiplication. 64 channels x-y crossed strips (x:32 channels, y:32 channels, strip period 1.56mm) are arranged for 2-D signal readout. The electronics integrates a 64 channel ASIC based readout with FPGA by using x-y coincidence. The latest test results using the radiation source, the monoenergetic beam and the pulsed beam are present, including the spectrum(˜25%@5.9keV X ray), efficiency(4.9%@1.59 Å), counting rate(>1MHz), spatial resolution(<3mm/FWHM), TOF(<1μs) and the 2-D imaging(Fig.1). The detector can be used for the beam monitor or the diagnostor to measure the beam specifications such as the profile, the size, the intensity distribution and the wavelength spectrum. This would be helpful to study the nTHGEM based neutron detector with the larger area and the higher efficiency in the future.

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