Present Status of Gas Electron Multiplier (GEM) Detector Development

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We plan to performe the measurement of Coherent Pion Production (CPP) with $^{12}C(p, n\pi^+)^{12}C(Ground\ State)$ reaction. In order to identify this reaction, coinsidence measurement for π^+ and neutron with high energy resolution is need. The generated π^+s are tracked by position detector which placed in the dipole magnet. Therfore, to achieve the high energy resolution of π^+, high position resolution is need. Furthermore, because detection point is close to scattering point, this detector must be able to be operated under the harsh radiation environments. For these reason, we developed tracking counter with Gas Electron Multiplier (GEM)[1] for pion measurement.

A prototype detector was fabricated and its performance have been observed[2]. And, we found that GEM detector had sufficient specification for our experiment. In the next step, performance test with proton beam was performed with GRAND RAIDEN(GR) Spectrometer. In this experiment, focal plane detectors, which consist of two MWDCs and two Scintillation counters, were also used for the reference. The photograph of experimental setup is shown in Figure 1. The performance test had been done with following procedure. First, tracking test with faint beam was performed. A relatiron between position and magnetic field of GR was observed.

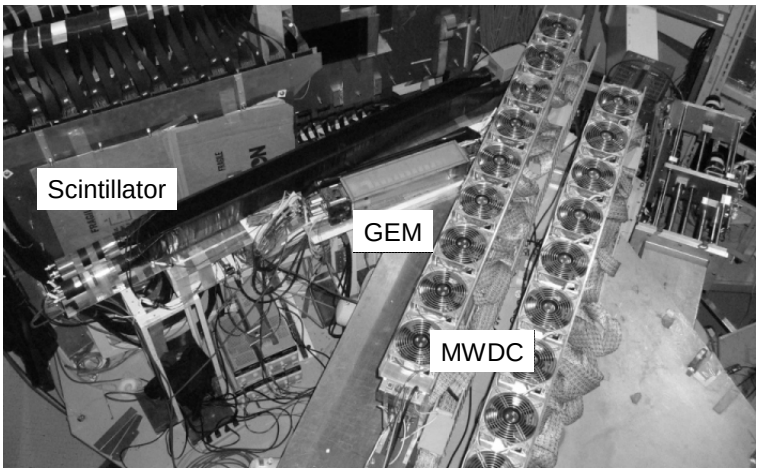

Figure 1: Photograph of experimental setup. GEM detector placed between MWDC and Scintillator. And, beam come from right side

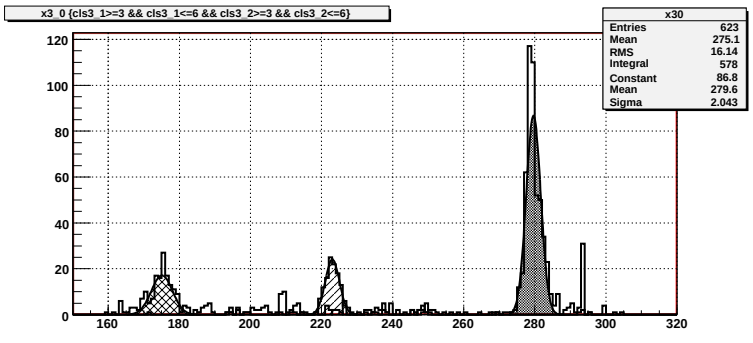

Figure 2: beam position with three magnetic field settings.

In this test, faint beam was injected directry to GEM. Second, measurement of lower excitation state of $^{12}C(p, p')$ was performed. In this test, we checked wheather GEM detector could identify the discrete state of ^{12}C. The last, position dependence of efficiency and gain was observed for all over the effective area of GEM detector. The higher excitation state of $^{12}C(p, p')$ was used as the white beam in this test.

The result of first test is shown in Figure 2. The X axis shows position information at the center of GEM detector and Y axis represents the number of count. You can see that the beam position moved when magnetic field of Spectrometer changed. Data analysis for second and third test is now in progress.

References

[1] F. Sauli, Nucl. Inst. and Meth. **A386** (1997) 531.

[2] K. Fujita and Y. Sakemi, RCNP Annual Report (2004)