

Gas distribution and control of the GEM tracker for the Super Big Bite spectrometer of JLab Hall A

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INFN groups of the JLAB12/CSNIII Collaboration [1] share responsibility of building the primary (front) GEM tracker [2] of the new Super Bigbite Spectrometer [3] for high luminosity experiments with the upgraded 12 GeV continuous electron beam of Jefferson Lab [4]. The front tracker consists of six large area ($40 \times 150 \text{ cm}^2$) high resolution ($\sim 70 \text{ }\mu\text{m}$) GEM chambers [5] and will track accurately particles emerging from the electron scattering in a large background of soft photons ($\sim 0.5 \text{ MHz/cm}^2$) and mips ($\sim 0.2 \text{ MHz/cm}^2$).

The basic module of a chamber is a triple (double mask foil) GEM with active area $40 \times 50 \text{ cm}^2$. A carbon fiber outer frame integrates the modules into one single chamber, and supports all services (readout electronics, cabling, gas, HV).

Participants from Bari/Lecce Group are responsible for the design and set-up of the gas distribution and control system for the tracker chambers. A small scale ($10 \times 10 \text{ cm}^2$) triple GEM module was set-up (Fig. 1) in local laboratory in order to gain confidence with the technology and operation. In addition, studies of I-V, noise, gas-mix characterization, cosmics response, radioactive sources spotting are planned.

Two mass flow-meters (MKS 1179B) feed the two gas components (Ar 70%, CO₂ 30%) to three full chambers through a manifold, and are driven and controlled by an eight-channel controller (MKS 647C), interfaced to a computer through serial communication.

This solution allows one to finely change the gas mixture to adjust to best performance. The system will be integrated with differential pressure transmitters (to guarantee the chambers impedance monitoring during gas operation) and temperature sensors, which will all be networked into the detector control system for real-time adjustment of the flow and the trapping of potential failures, with managed alarms. The gas flow parameters, on-chamber temperatures and differential pressures will be broadcast to clients in the



Figure 1. The laboratory set-up for testing a prototype of triple GEM with cosmics and sources (right table) and development of the gas distribution and control system for the JLab12 front tracker GEM chambers (left rack).

experiment DAQ infrastructure through TCP/IP communication.

REFERENCES

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