

# Proposal for TA activity at DESY Test Beam within EUDET project

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Title: GEM Prototypes test for JLab12 SBS Front Tracker and Olympus GEM detectors

Acronym: JLab12/SBS-FT

Group Leader for the test beam: Salvatore Frullani

Institute: INFN Rome

Participants:

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Vincenzo Bellini / Catania University and INFN Catania

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Massimo Gricia / INFN Rome and Istituto Superiore di Sanità

## Scientific Background and Planned Program

The equipment to be tested is a prototype of the tracking system for the Super BigBite Spectrometer under development for the HallA at Jefferson Laboratory (Newport News/VA). The prototype is a candidate for the Luminosity monitor in the Olympus experiment under definition at DESY.

The equipment is made of 3 GEM 10x10 cm<sup>2</sup> chambers with 2 dimensional readout; two of them with 3 GEM foils and slightly different geometry (fig. 1 and fig. 2); one with 2 GEM foils, geometrically similar to fig. 2.

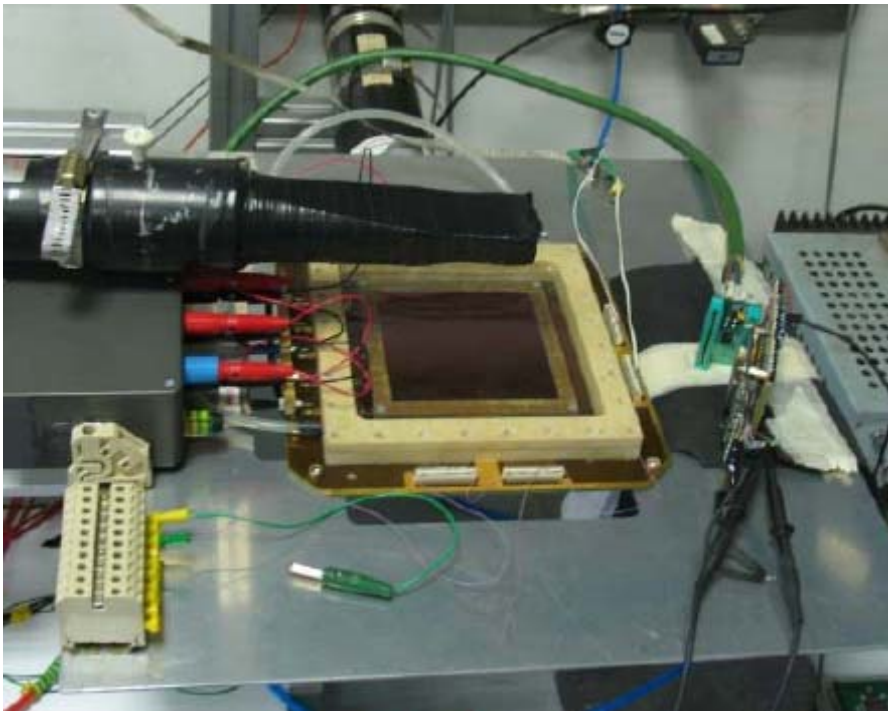


Fig. 1: first 3GEM foils prototype, during the cosmic test

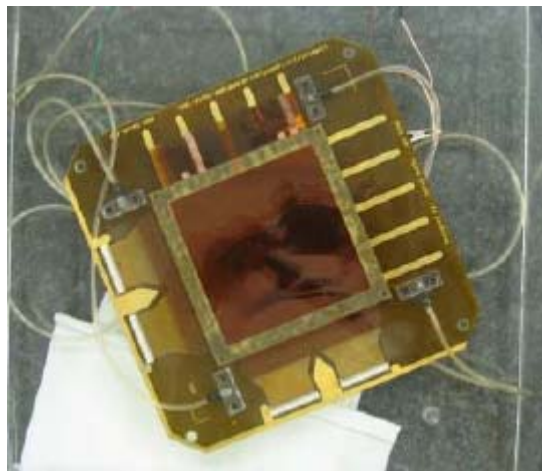


Fig. 2: second 3GEM foils prototype, during the assembling

The final readout electronics is under development and is based on the APV25 chips which offer an integration time between 25 and 75 ns, 20 and 40 MHz readout speed. The APV25 based front-

end card will be tested in two steps: the front-end cards prototype will be tested first with a simplified controller made of standard VME modules while the full electronics readout system (including the dedicated controller) will be tested in a second period.

In addition an old Gassiplex based electronics will be used to test the chamber functionality and to have an additional, significantly different integration time (approx. 1  $\mu$ s) to be compared to the APV25 performance.

## Test plan

The main goal of the beam test is the measurement of the hit spatial resolution at different incidence angles, different HV voltages (in the transfer and induction regions at least) and gas mixtures (Ar-CO<sub>2</sub>, N and CF<sub>4</sub>). Study the x/y signal correlation in 2D readout and the cluster size as a function of induction HV, gas mixture and beam direction. The new APV25 electronics will be also tested.

Moreover the performance in track reconstruction will be evaluated, exploiting the MVD silicon telescope of experimental area 22.

Tests are expected to be completed in two (or three) periods (of about 2 weeks each) from December/2009 to March 2010

The tentative starting day of the first test period is December the 8th 2009.

## Plan for December test

List of equipments needed in the experimental area (from DESY side):

1. scintillator fingers for trigger
2. Calorimeter for energy measurement
3. MVD telescope for precise tracking
4. Stand for GEM chamber support (possibly moveable)
5. Rack and crates for VME and NIM modules
6. Gasses: CO<sub>2</sub>, Ar, N and circulation system

In addition to the expected equipment listed above, the following major items will be used for testing:

1. GEM chambers (to be tested)
2. Readout systems (including few NIM and VME modules)
3. Computer for custom acquisition

The preliminary layout of the equipment during test is shown in fig. 3.

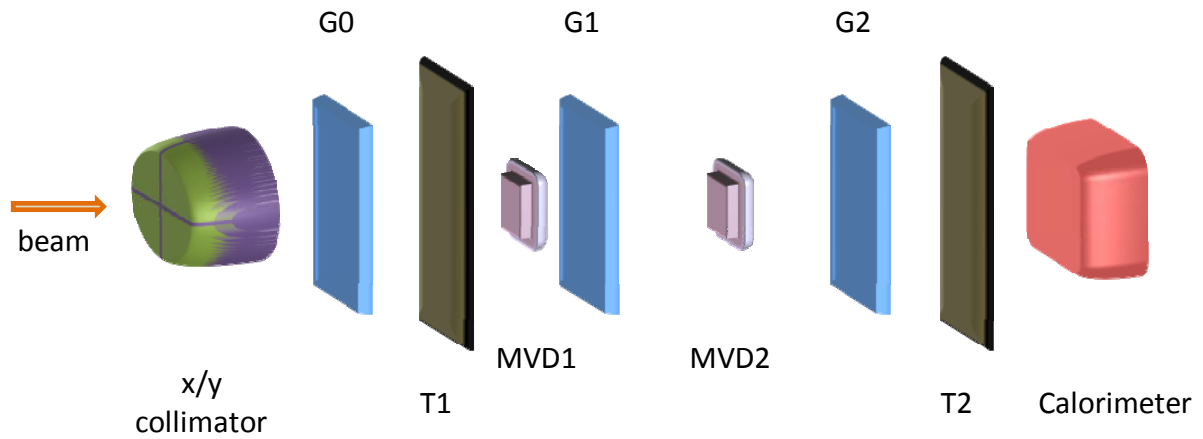


Fig. 3: generic layout; GEM chambers G0, G1 and G2 configuration will be changed during the test. T1, and T2 scintillator finger for trigger, calorimeter for energy measurement and two 2D planes of silicon detectors (MVD).

Preliminary run plan is presented in table 1; beam energy is expected to be fixed at 3 GeV (optimize rate).

Each test point consists of several runs; each run takes on average 15 min for data taking and configuration change.

Tab. 1: Preliminary run plan summary of the first test period in December 2009 starting at T0=08/December/2009

Test Point	From	To	Target	$E_{\text{Beam}}$	Devices	Comment
Installation	T0	T0+1d	NA	NA	Mechanical supports	
Commissioning	T0+1d	T0+4d	Min thick	3 GeV, perpendicular to the chamber	Scintillators, MVD, Calorimeter	Synch devices and DAQs; provide basic checks of the proper operation of the GEM chambers
Beam at 90° incidence angle	T0+4d	T0+6d	Max thick	3 GeV	All	Varies HV transfer and HV induction by +/- 20% as well as gas mixture (Ar/CO2=20/80, N)
Beam at 87° incidence angle	T0+6d	T0+8d	Max thick	3 GeV	All	Same as before
Beam at 82° incidence angle	T0+8d	T0+10d	Max thick	3 GeV	All	Same as before
Beam at 70° incidence angle	T0+10d	T0+12d	Max thick	3 GeV	All	Same as before

## **Request for travel support.**

Within EUDET project we request travel support for the following participants for the time periods specified:

Enzo Bellini 8 – 20 December

Donato Castelluccio 8 – 20 December

Evaristo Cisbani 8 – 20 December

Salvatore Frullani 14 – 19 December

Massimo Gricia 14 – 20 December

Fabio Santavenere 9 – 16 December