

# 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

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Institute: INFN Rome

Participants:

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## 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 Hall A at Jefferson Laboratory (Newport News/VA). The prototype electronics will also be used for the Luminosity monitor in the Olympus experiment that will be carried out at DORIS ring in DESY (next year test beam and 2012 data taking).

The equipment is made of 1 40x50 cm<sup>2</sup> chamber with 3 GEM foils and 2 dimensional readout and 1 10x10 cm<sup>2</sup> with 2 GEM foils and 2 dimensional readout (figures 1 and 2).

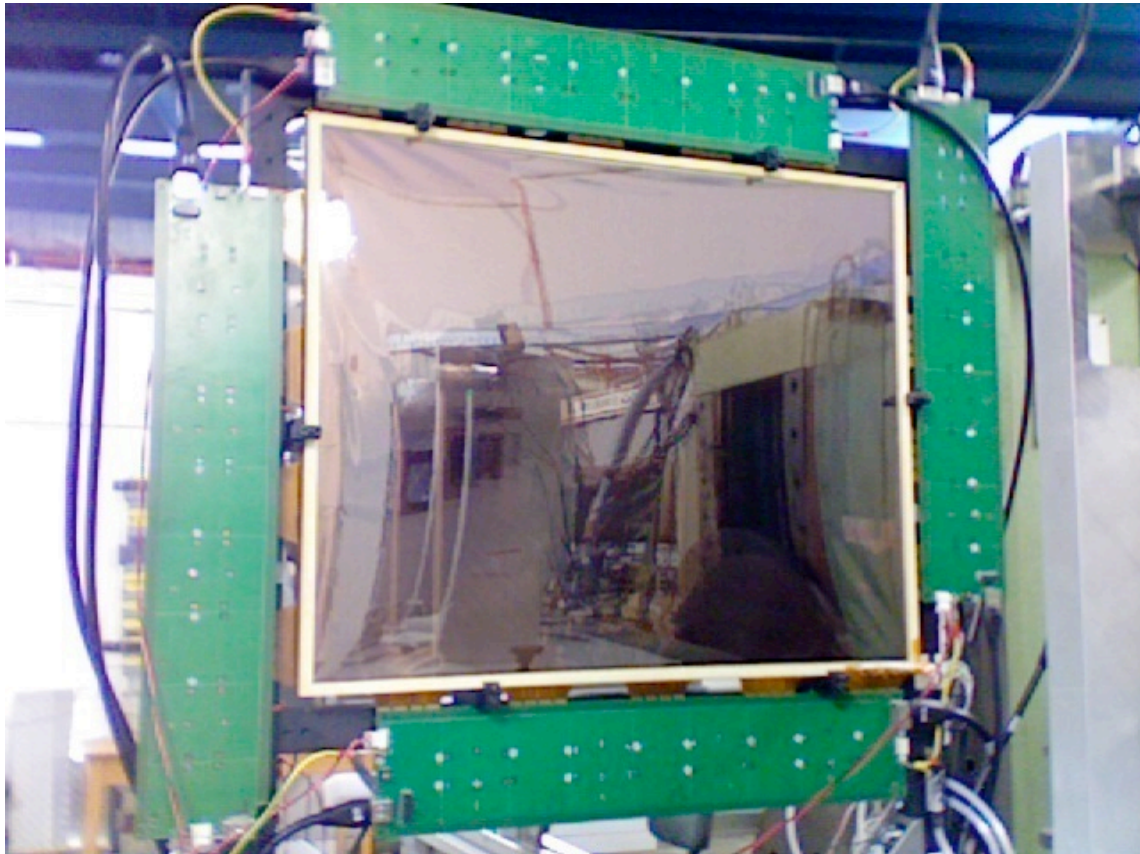


Fig. 1: 3GEM foils large (40x50 cm<sup>2</sup>) prototype

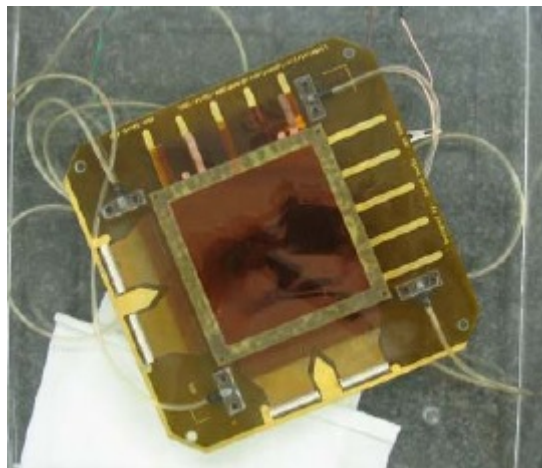
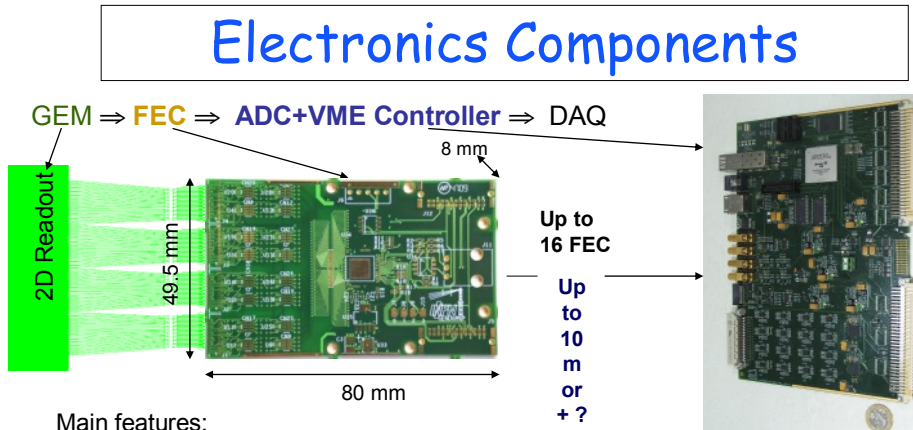


Fig. 2: 3GEM foils (10x10 cm<sup>2</sup>) prototype

The new prototype readout electronics 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 and the controller VME module will be tested in the requested period of test beam, changing parameters and components to find optimized working conditions and studying noise components.



Main features:

- Use analog readout APV25 chips (wire-bonded on standard PCB, no ceramics): proven to work in COMPASS
- ZIF connector on the GEM side (no soldering on readout foil)
- Minimum electronics components (front-end + VME custom module)
- Copper connection between front-end and VME

Roma cds 8 luglio 2010

## Test plan

The main goal of the beam test is testing the performance of the new electronics readout and the new GEM module 40x50 cm<sup>2</sup>. 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. Tests will be performed allowing different cable length between the FEC and VME module in order to test the maximum allowed distance between the chambers to transmit analog signal before digitization by ADC.

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

The tentative starting day of the next test period is November the 21st 2010, for 2 weeks.

## Plan for November test

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

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

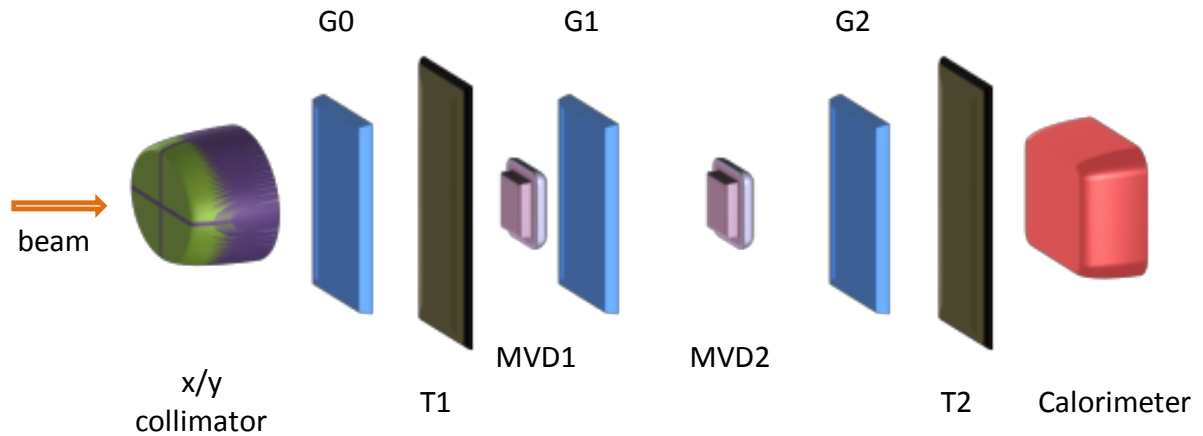


Fig. 3: generic layout; GEM chambers G0, G1 and G2 configuration will be changed during the test. T1, and T2 scintillator finger for trigger, calorimeter for energy measurement (but not needed for the present test) and two 2D planes of silicon detectors (MVD).

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 November 2010 starting at T0=22/November/2010

Test Point	From	To	Target	$E_{\text{Beam}}$	Devices	Comment
Installation	T0	T0+3d	NA	NA	Mechanical supports	
Commissioning	T0+4d	T0+5d	Min thick	3 GeV, perpendicular to the chamber	Scintillators, MVD	Synch devices and DAQs; provide basic checks of the proper operation of the GEM chambers
Beam at 90° incidence angle Test of 40x50 cm module	T0+6d	T0+14d	Max thick	3 GeV	All	Varies HV transfer and HV induction by +/- 20% as well as gas mixture (Ar/CO2=20/80, N)

## **Request for travel support.**

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

Salvatore Frullani November 23<sup>rd</sup> – December 2<sup>nd</sup>

Fabio Santavenere November 21<sup>st</sup> – November 26<sup>th</sup>

Fausto Guiliani November 21<sup>st</sup> – November 26<sup>th</sup>

Paolo Musico November 24<sup>th</sup> – December 2<sup>nd</sup>

Roberto Perrino November 23<sup>rd</sup> – December 2<sup>nd</sup>

Massimo Gricia November 29<sup>th</sup> – December 3<sup>rd</sup>

Evaristo Cisbani November 22<sup>nd</sup> – December 4<sup>th</sup> (only per diem)

Marco Capogni November 29<sup>th</sup> – December 4<sup>th</sup> (only per diem)