Test Beam Plan of JLab GEM Tracker (June-July 2011)
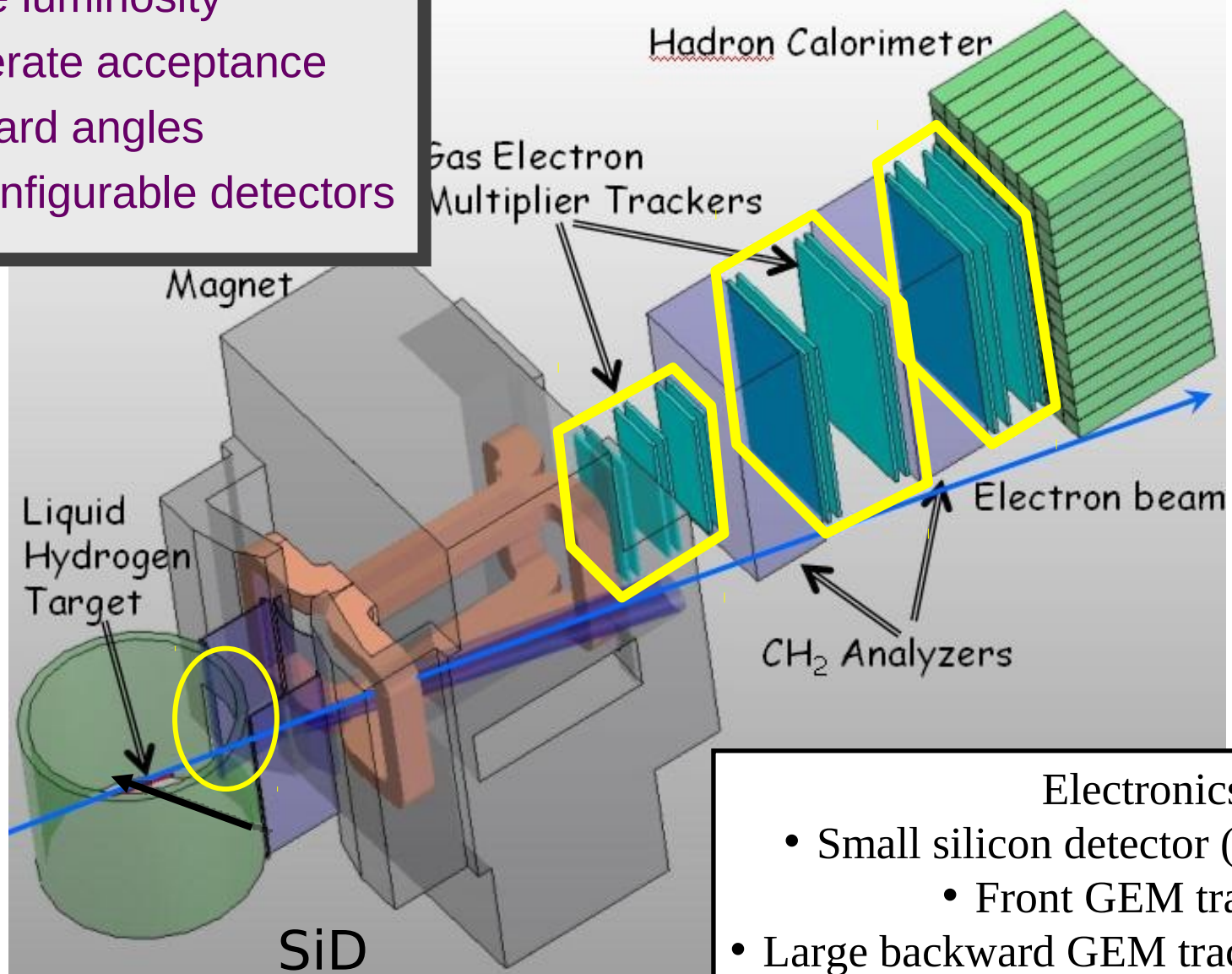
E. Cisbani

INFN-Rome Sanità Group

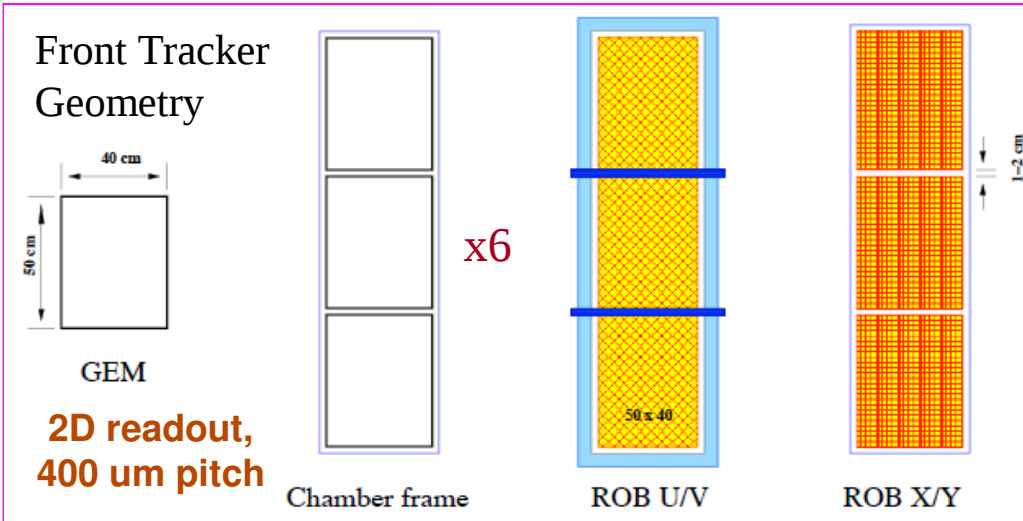# SBS Spectrometer in Hall A

- Large luminosity
- Moderate acceptance
- Forward angles
- Reconfigurable detectors

Hadron Calorimeter

Gas Electron Multiplier Trackers

Magnet

Liquid Hydrogen Target

CH$_2$ Analyzers

Electron beam

SiD
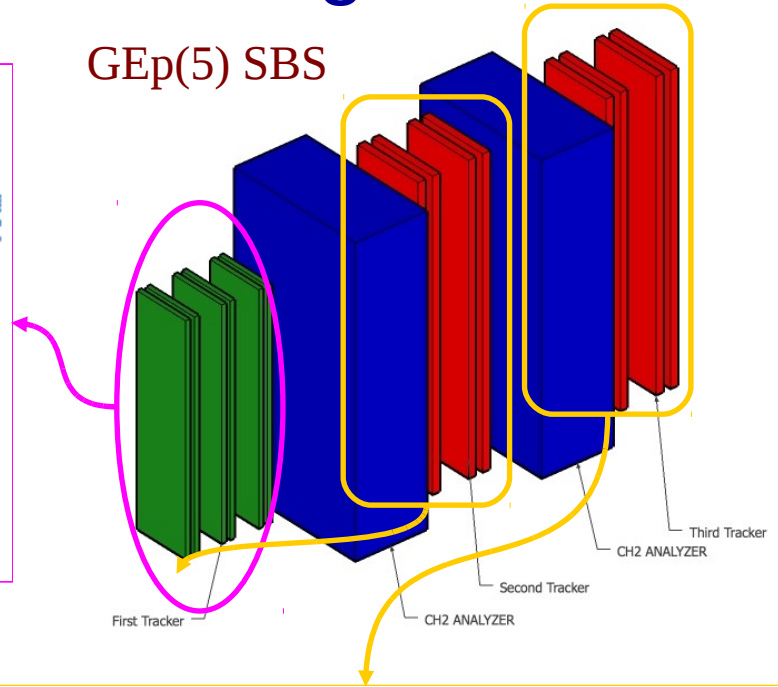
Electronics for:
- Small silicon detector (SiD)
- Front GEM tracker
- Large backward GEM trackers
⇨ **>100k channels**

# SBS Tracker Chambers configuration

Front Tracker Geometry

GEM

2D readout, 400 um pitch

x6

Chamber frame   ROB U/V   ROB X/Y

GEp(5) SBS

Third Tracker
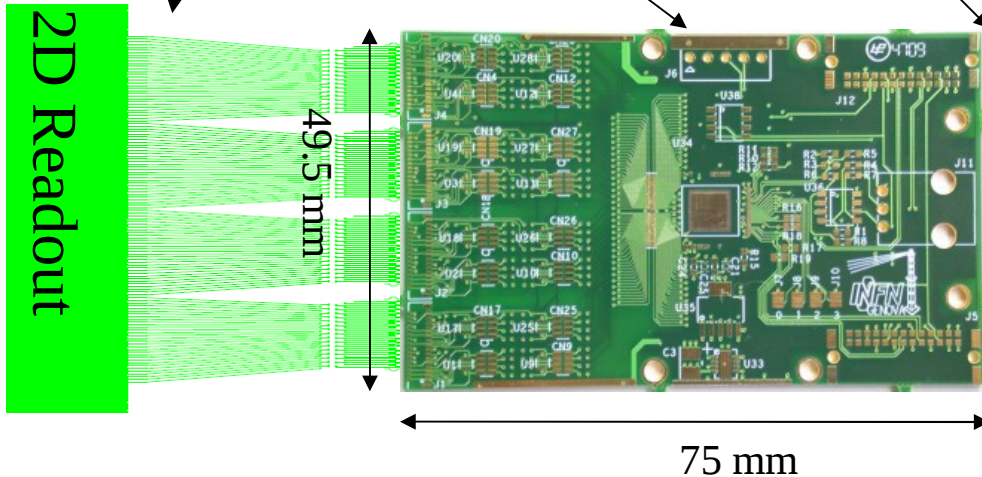CH2 ANALYZER
Second Tracker
First Tracker
CH2 ANALYZER

- ✓ **40x50 cm2 modules are composed to form larger chambers with different sizes**
- ✓ **Electronics along the borders and behind the frame (at 90°) – cyan and blue in drawing**
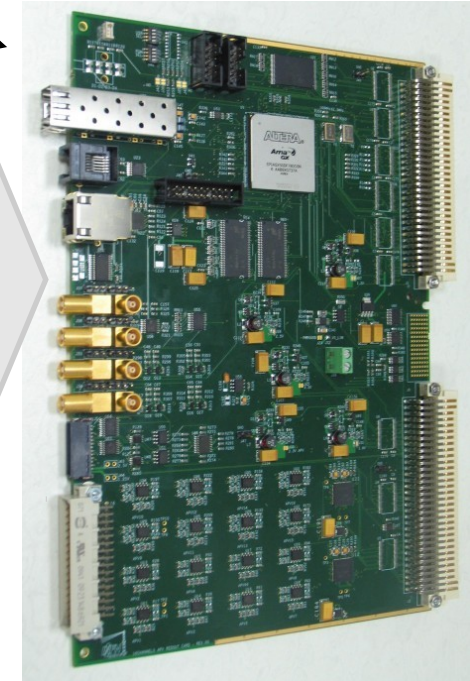- ✓ **Front Tracker operates in Magnetic Fringe Field up to 200 Gauss**

x(4+4)

GEM

2D readout, 1.6 mm pitch

U/V ROB

Chamber unit

X/Y ROB

Back Trackers Geometry
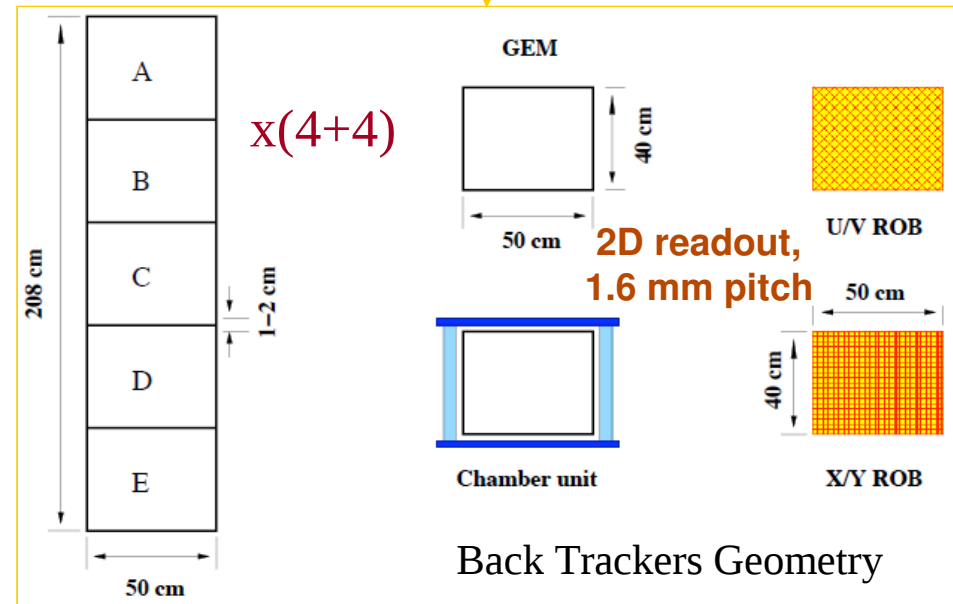
Electronics Components

GEM $\Rightarrow$ **FEC** $\Rightarrow$ **ADC+VME Controller** $\Rightarrow$ DAQ

2D Readout

49.5 mm

8 mm
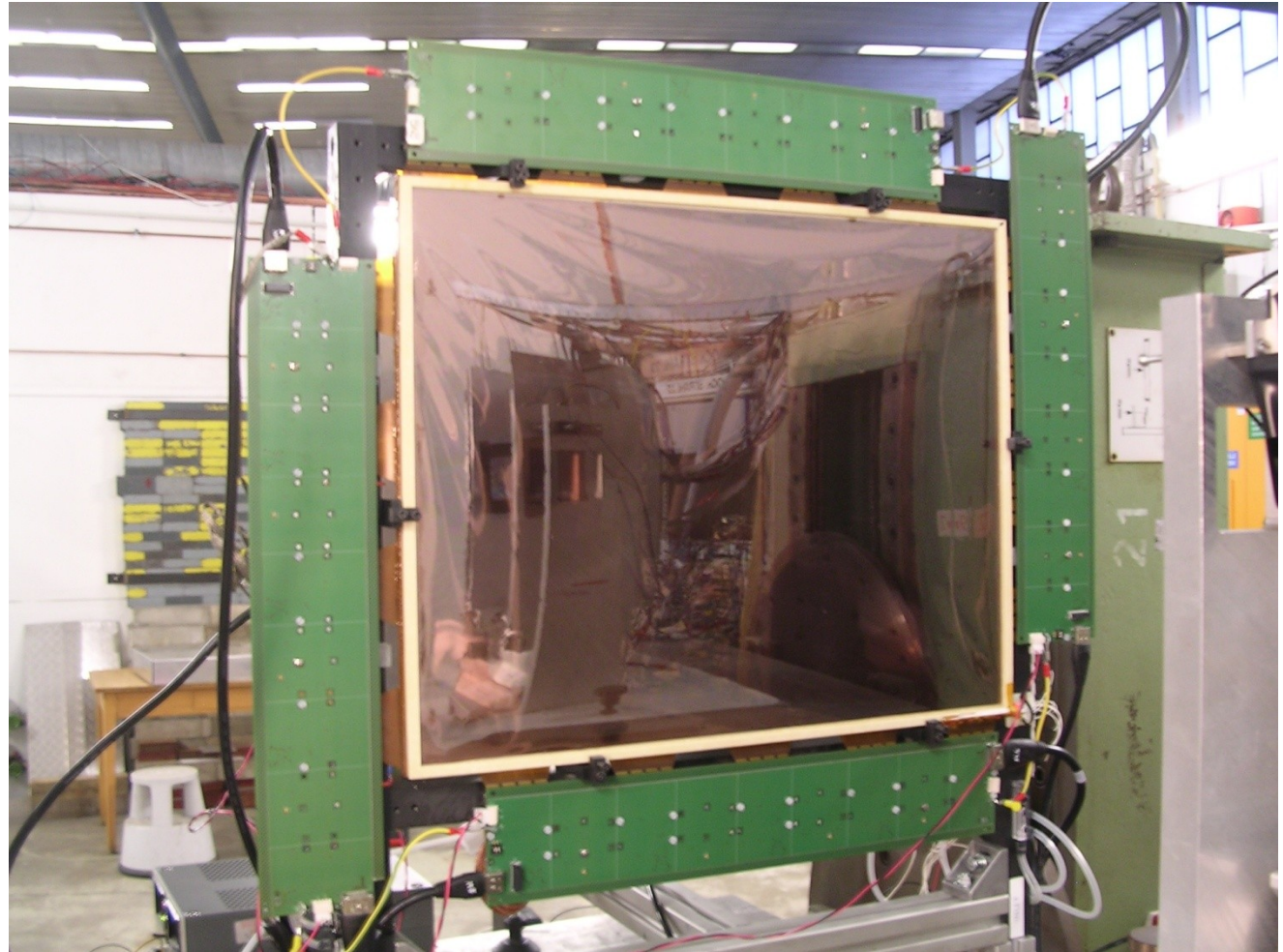
Up to 10m twisted, shielded copper cable

75 mm

Main features:

- Use analog readout APV25 chips
- 2 active components: Front-End card and VME64x custom module
- Copper cables between front-end and VME

Prototype to be tested

- Fully equiped 3xGEM 40x50 cm2 module

- 2D readout, 400 um strip pitch

- 18 front-end APV25 cards (2304 channels)

- Gas: Ar/CO2 70/30
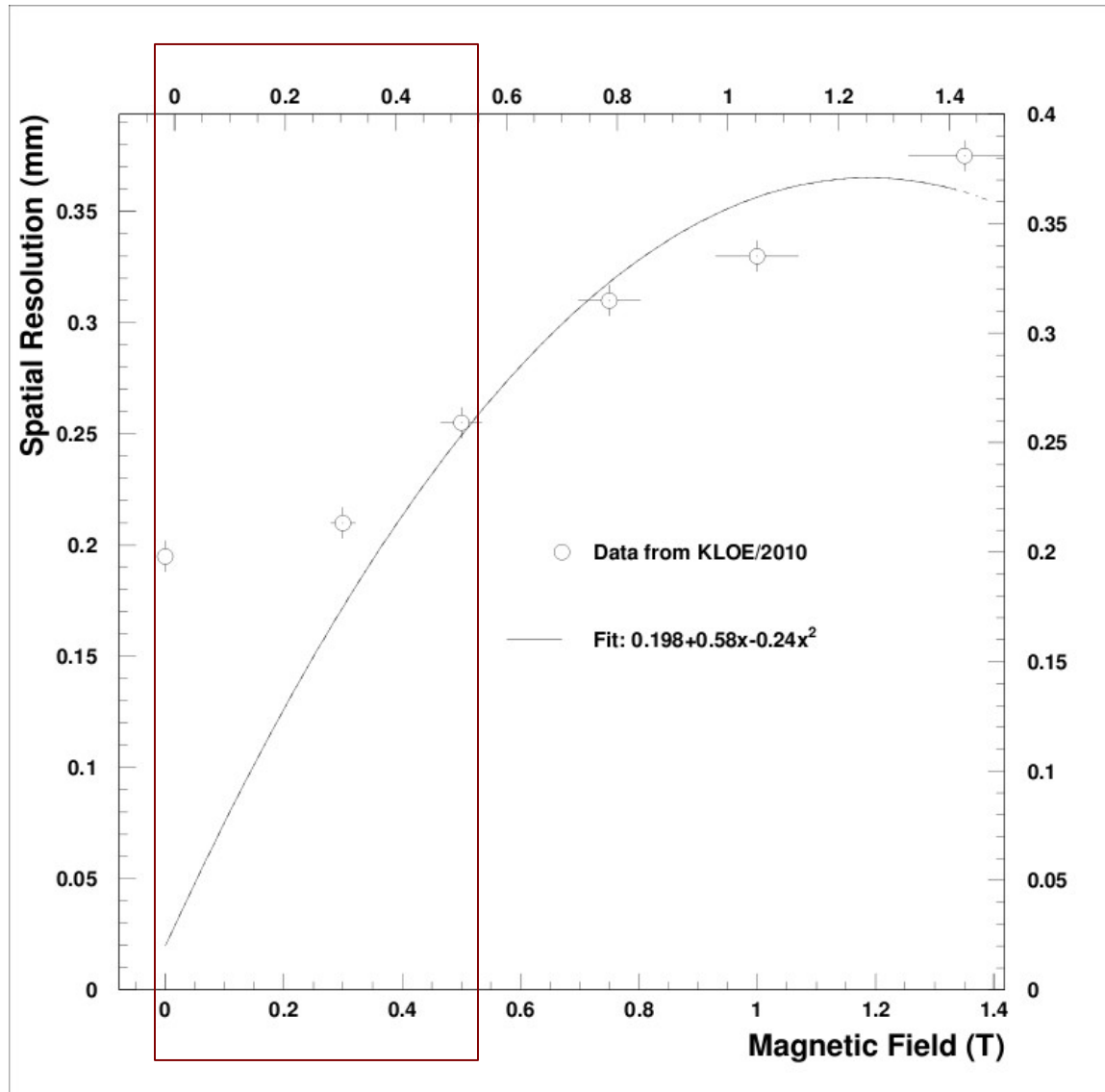

Front End Cards on the other side of the backplanes
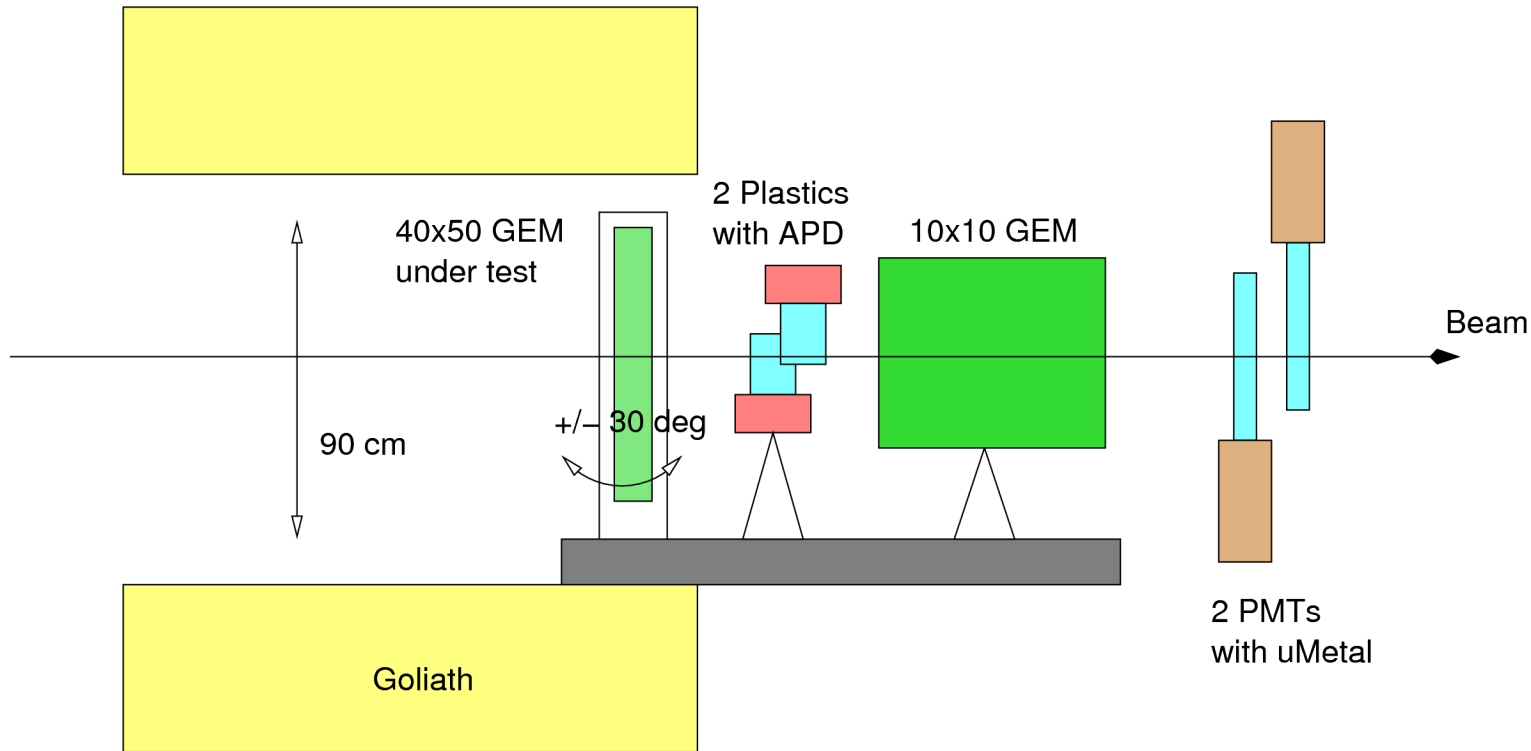
Beam test @ DESY (EUDET support)

Purpose of the Test

- Characterize the 40x50 cm^2 3xGEM module prototype in terms of:
    - Cluster width and displacement
    - Collected charge
    - Efficiency
    - Residuals

- Study in Magnetic Field up to 500 Gauss

- Study at highest intensity beam (?)

- Further characterization of the APV25 based electronics (field effects, noise ...)

Verify assumption at low field

Setup

40x50 GEM under test

2 Plastics with APD

10x10 GEM

Beam

90 cm

+/− 30 deg

Goliath

2 PMTs with uMetal

Detector Under Tests: 40x50 cm2 – 3xGEM Prototype

Ancillary Detectors:
2 PMTs
2 APDs
RD51 GEM (or uM)

- Use of Goliath (up to 500 Gauss)
- Gas: Ar/CO_2 70/30 (premixed)

Space requirements

- Control Room:

  - Desktop table

- Test Area:

  - 100x90 cm2 for the detectors on

  - 100x50 cm2 table for: low voltage and high voltage power supply and computer

  - 2 crates (VME+NIM) in ½ rack

Preliminary Plan

- 1 day: installation + "commissioning" (first time!)

- 1 day: operation with stable beam

- 2 days: magnetic field scan (50 – 500 Gauss), different GEM-field angles (access to change the angle, ~3 per day), preferable low beam intensity (at least at the beginning)

- 2 days: beam intensity scan (low - medium - high intensity)

- 0.5 day: dismounting