

Survey of RD51 institutes test beam and irradiation programmes

- Answers from institutes
- Proposals from WG7

Answers received so far..



GAS DETECTOR DEVELOPMENT GROUP



Test beam planning CERN GDD (M. Alfonsi, G. Croci, E. Rocco, S. Duarte Pinto, L. Ropelewski)

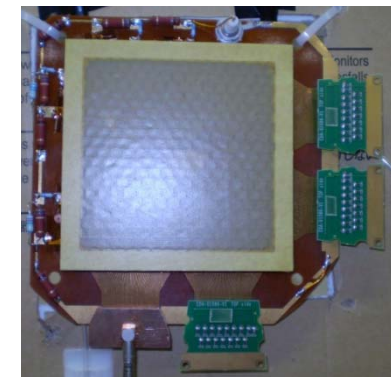
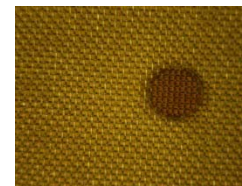
- Large area GEM project:

- 2 test beam campaigns in 2009
- Trigger, moderate spatial resolution requested for an external tracker
- Highest achievable rate
- MIPS and highly ionizing beams
- Construction for mechanical positioning (light detector, ~1kg)
- dimension of the detector: 70 x 70 cm²



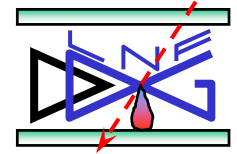
- Radiation hardness of several MPGD detectors and components:

- irradiation program for components and detectors starting in 2009
- total integrated dose of 10⁶ – 10⁷ Gy
- photons as well as hadrons irradiation
- possibility to apply voltage on detectors
- volume of detectors: 15 x 15 x 2 cm³



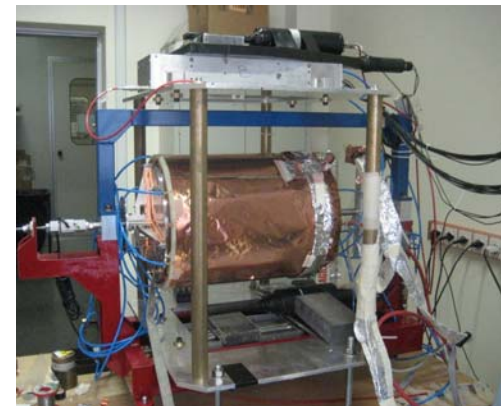


: beam planning CGEM-KLOE2 (LNF-INFN)



Cylindrical GEM as Inner Tracker for KLOE upgrade (G.Bencivenni):

- 1 test beam in 2009
- test of XV-readout (650 μm pitch) for final CGEM design, using small planar prototypes ($\sim 100 \times 100 \text{mm}^2$ active area), $N_{\text{ch}} \sim 128 \times 128$ (readout w/custom VME board)
- B-field (0.3-1.0 T) operation test ($B \perp E_{\text{drift}}$)
- external trackers needed ($\sigma_x \sim 100 \mu\text{m}$)
- different gas mixtures (Ar/CO₂ & CF₄ added gas mix.)
- MIPS beams
- dimension of the detector set-up: $\sim 400 \times 400 \text{mm}^2$





ATLAS MUON MICROMEAS

Test-beam activity foreseen for years 2009-2010 (P.lengo)



2007 & 2008:

- Test beam performed within the ATLAS TB activity in the NA at CERN

2009:

- 2-3 TB periods with muon/pion beam
- External trigger (scintillators) + tracker (res < 100 μm)
- Test of different FE electronics
- 32 channels analog R/O
- Mid-size prototype (40x50 cm²) + Large prototype (~50x150 cm²)
- Mechanical installation for moving/rotating the chamber

2010:

- Same as 2009 with:
 - Large prototype (~50x200 cm²) + full scale chamber (~ 100x200 cm²)
- Ageing test with photons/neutrons
 - Integrated charge: ~0.3 C/cm²



Radiation hard pixelMM as small angle tracker for Compass (F. Kunne, D. Neyret):

- **1 or 2 pion test beams in summer or fall 2009**
- **Study of pixelMM prototypes performances in high discharge rate environment**
- **Discharge rate, gain and efficiency measurements**
- **Spatial resolution measurements if external tracker available ($\sigma_x \sim 100 \mu\text{m}$)**
- **1000 to 2500 channels to read with custom ADC readout**
- **Custom DAQ, read-out of external detectors may be possible**
- **Flammable gas mixture (Ne-10%, C₂H₆-10%, CF₄) if possible, non-flammable mixture would also be tested**
- **Dimension of each detector: 580x500mm² (active area 300x300mm²), smaller detectors may also be tested**

Test beam planning ELTE - RMKI Budapest

- ALICE VHMPID high transverse momentum trigger;
NA61 centrality detector “test of principle” module:
 - *5 days test beam in 2009 (twice 5 days in 2010)*
 - *Timing trigger (provided by ourselves)*
 - *Medium rate (order of 10k / spill), MIP hadron beam*
 - *Ar + CO₂ gas supply necessary*
 - *Detector weight with supporting elements 5-8 kg*
 - *Dimension of the complete setup 0.5m x 0.5m x 1m*
 - *May be done in parasitic mode (behind an other setup which is transparent to large fraction of beam particles)*

Tests Beam Plan 2009/2010 (INFN-RM,BA,CT,GE/JLab)

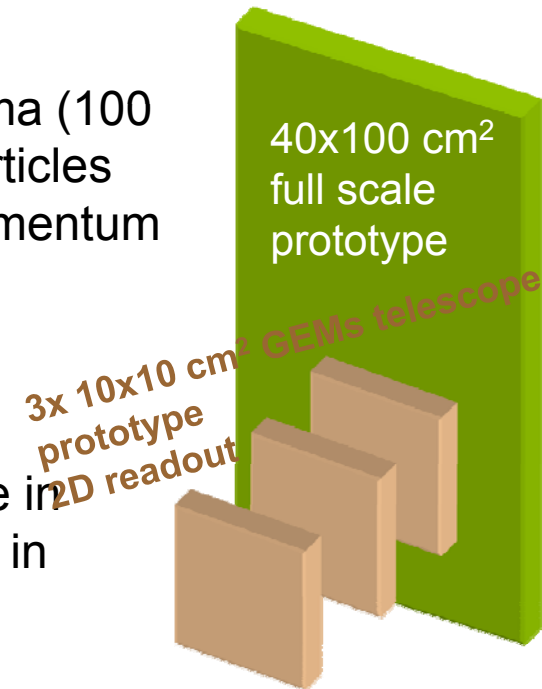
GEM Tracker Prototype for SBS at JLab/Hall A

2009 (Small 3xGEMs Telescope Prototype)

- Study charge particle reconstruction capability in gamma (100 keV-10 MeV) 100 MHz/cm² background with MIPS particles
- Characterize spatial resolution (down to 70 μm) \Rightarrow momentum and angular resolutions of the MIPS tracks

2010 (Full chamber prototype + Small GEMs telescope)

- Test design solutions and assess detector performance in charged particle beam (resolution, track reconstruction in high luminosity experiment)



Minimum Test Beam Requirements:

- Beam gate synch
- Hodoscopes for MIPS particles trigger (and gamma-flux measurement)
- High resolution device (e.g. silicon tracker) for precise MIPS track definition
- MIPS energy/momentum characterization

Test beam planning LAPP:

- Large area MicroMegas project for a DHCAL (Catherine Adloff):
 - 1 test beam campaign in 2009
 - 2 test beam campaigns in 2010
 - own Trigger
 - tracker
 - moderate rate
 - MIPS and hadron beams
 - dimension of the detector:
several layers of $8 \times 32 \text{ cm}^2$, $32 \times 48 \text{ cm}^2$, $100 \times 100 \text{ cm}^2$
interleaved with Stainless Steel absorbers

Summarizing the survey..

Specific requirements for TB

- Largest detector: 1x2 m²
- Thickness also relevant for some applications
- CF₄ and flammable gas mixtures
- High resolution (better than 70μm) external tracker
- High rate beam.
- MIPS (pions preferred) but also high-ionizing beam
- Mechanical Support allowing X-Y position and rotation
- *Magnetic field*
- *Many readout schemes and custom DAQ systems can make really hard the development of a common R&D system*

Specific requirements for irradiation facilities

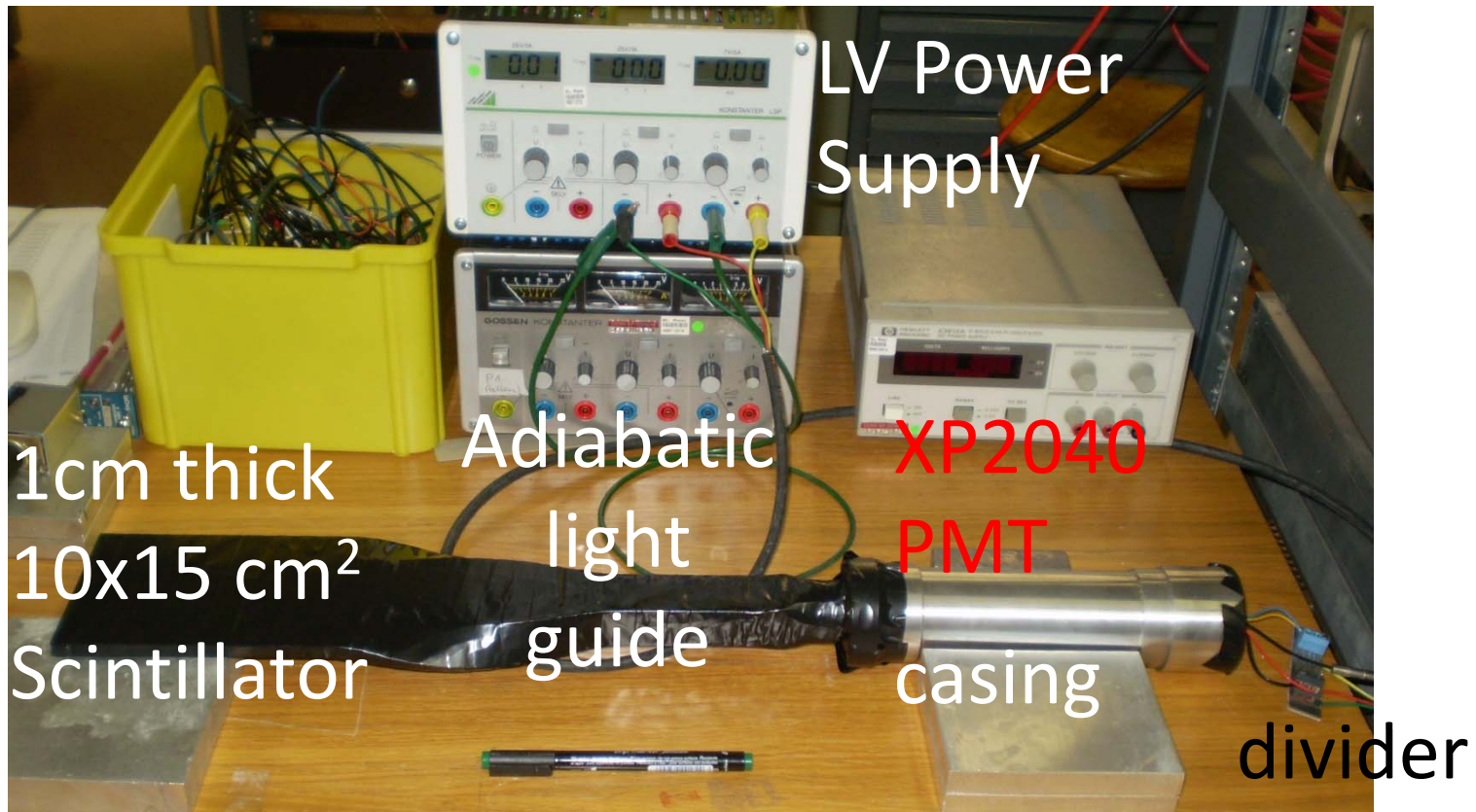
- Largest detector: 1x2 m²
- Mechanical Support allowing X-Y position and rotation
- Very intense photon fluxes, up to 10⁷ Gy
- Also neutrons or hadrons in general
- *Organizing combined irradiation campaigns could help to reduce costs*

Some proposals..

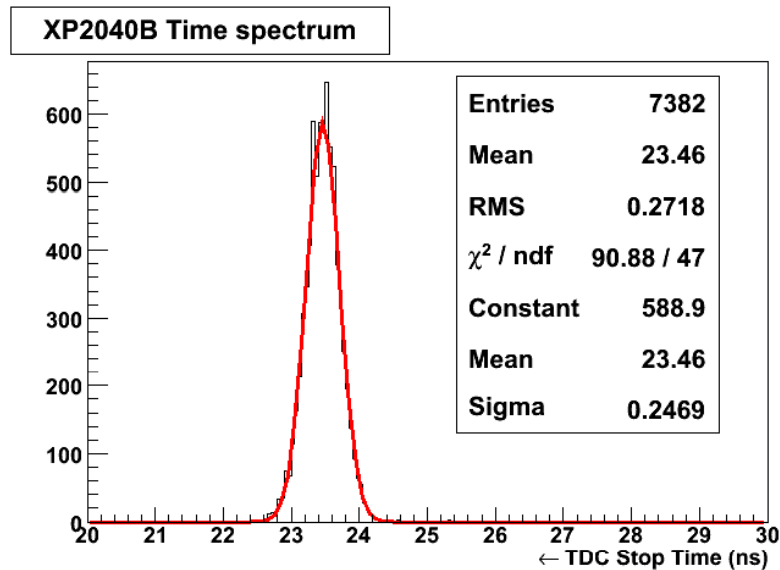
Some Test Beam equipment from our group – CERN GDD

- Trigger scintillators
- GEM trackers

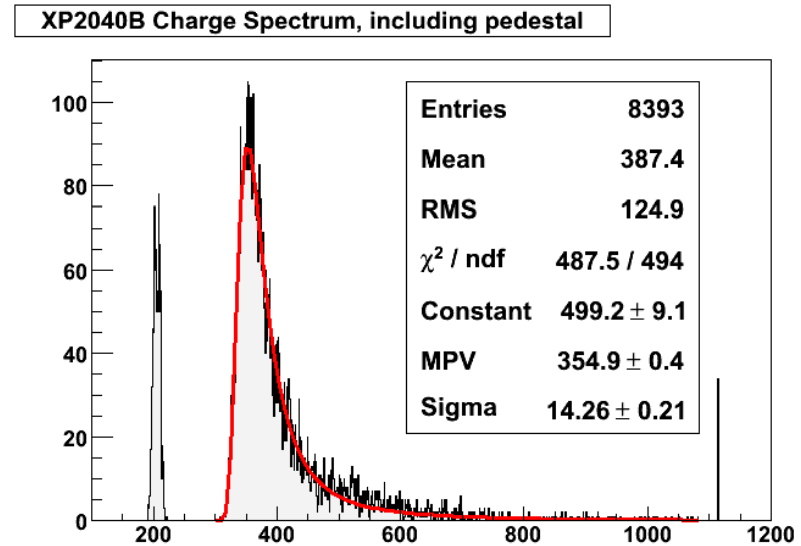
Photonis XP2040B PMT



Performance of the device



Disentagled from the trigger devices time resolution ($\sim 180\text{ps}$), the XP2040 exhibits a very good **time resolution** of the order of **200ps**

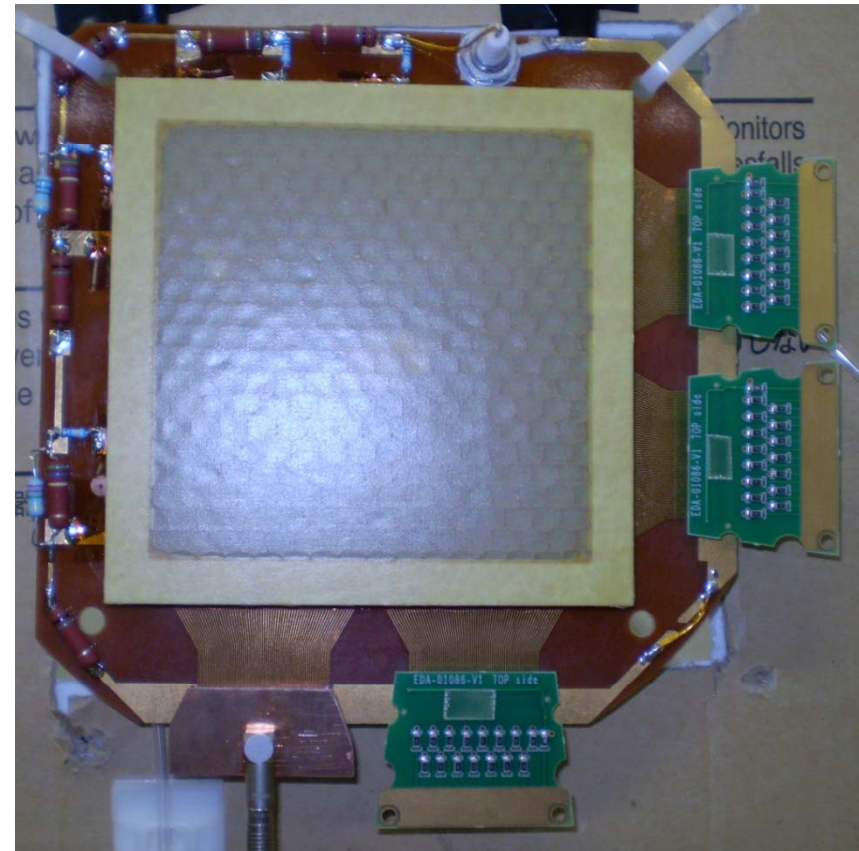


Cosmic rays (\rightarrow mostly mip)s charge spectrum.

Energy resolution to be measured with Iron source (should be ok)

Sealed 3-GEM detector for tracking

- ❑ “All-in-box” detector.
- ❑ HV divider → only 1 HV line (4kV, 1mA PS)
- ❑ X-Y 400 μ m pitch strips readout (a possibility is TOTEM VFAT digital readout)
- ❑ See G. Croci presentation for performance measurements



Other proposals from WG7

The proposals can be organized in (just guess from my e-mail understand.. please correct wrong statements..):

- “**Micromegas consortium**”: Saclay, Athens Univ. and NTU, Demokritos, Thessaloniki plans to provide a tracking system, DAQ and analysis framework
- **Bonn** is developing DAQ (general purpose but TPC oriented) in the framework of EuDet european program
- Need more detailed information are required from Arlington UT, Geneve Univ., Carleton Univ.

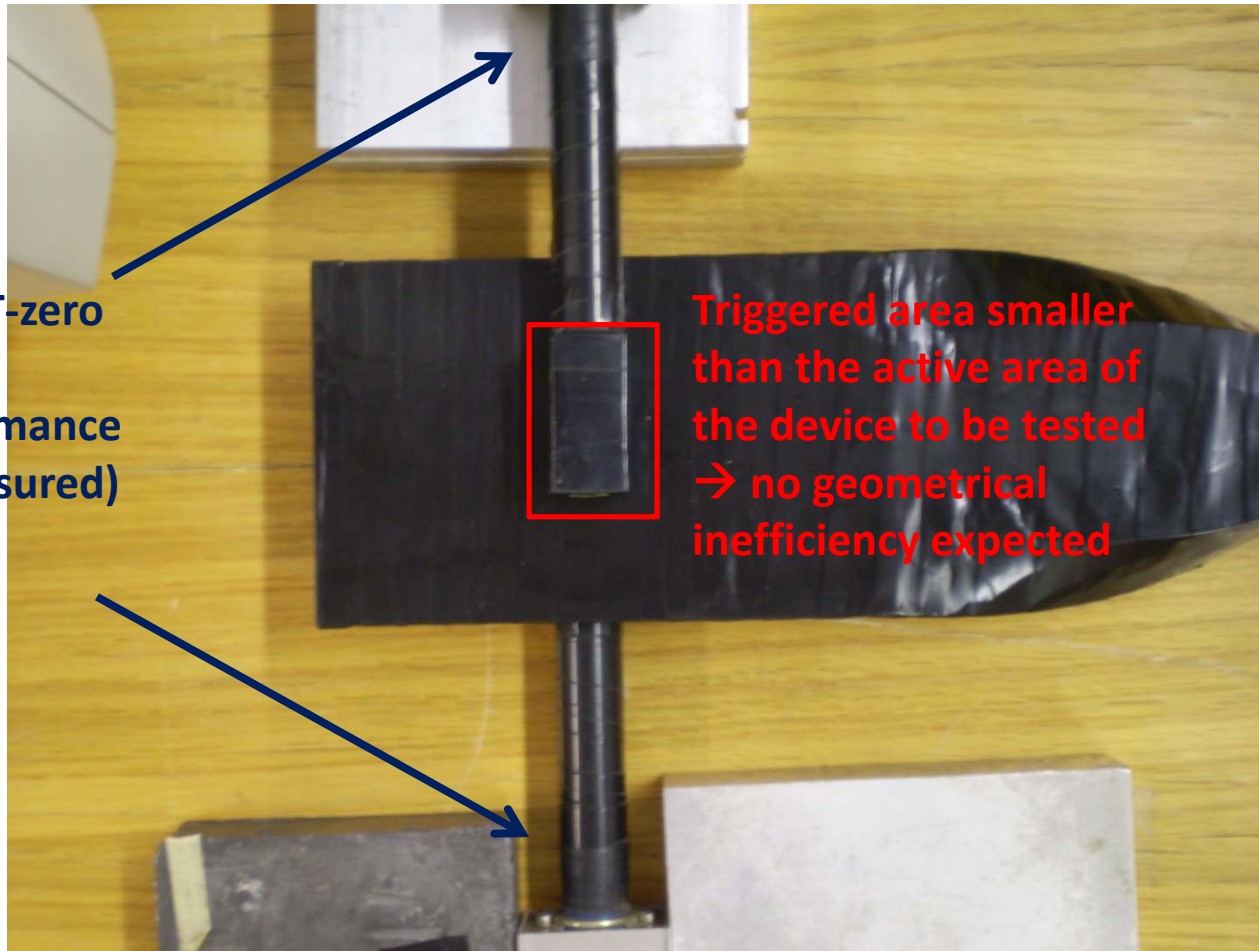
Conclusions

- 1) Many groups foresee test beam and irradiation activities in the following years (as expected in R&D programmes)
 - *1st hint for discussion: can be worth to join all these test beams under the same tag?*
CERN test beams schedules for 2009 will be finalized by the end of october, we have to rush!
- 2) **Common DAQ and analysis framework** are the hardest WG7 tasks (*2nd hint for discussion*), that for sure cannot be provided by CERN-PH
- 3) A magnet facility is in the wishlist but at the moment it requires more contributors for related infrastructure (or much more requests)

Backup Slides

Measurement setup

Trigger and T-zero
devices
(time performance
already measured)



Triggered area smaller
than the active area of
the device to be tested
→ no geometrical
inefficiency expected