Working Group 1

Design optimization & development of new structures

http://indico.cern.ch/sessionDisplay.py?sessionId=1&slotId=0&confId=72610#2009-11-23

Place: *CERN*
Room: **BE Auditorium Meyrin**

Dates: Monday 23 November 2009 14:00

Conveners: **Duarte Pinto, Serge**
Colas, Paul

Material: **EVO link**

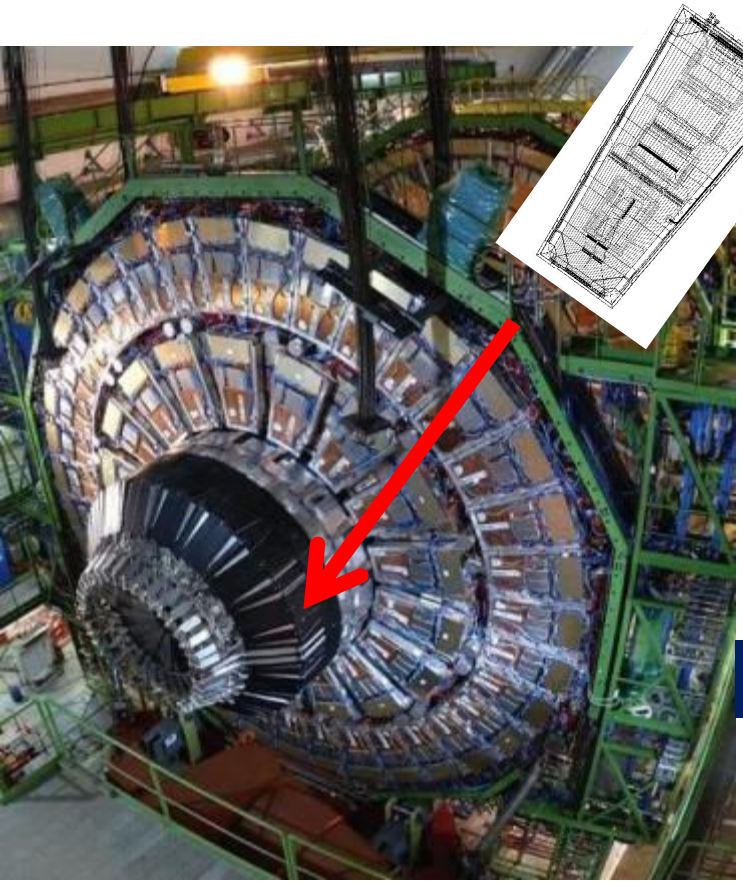
Contribution List | **Time Table**

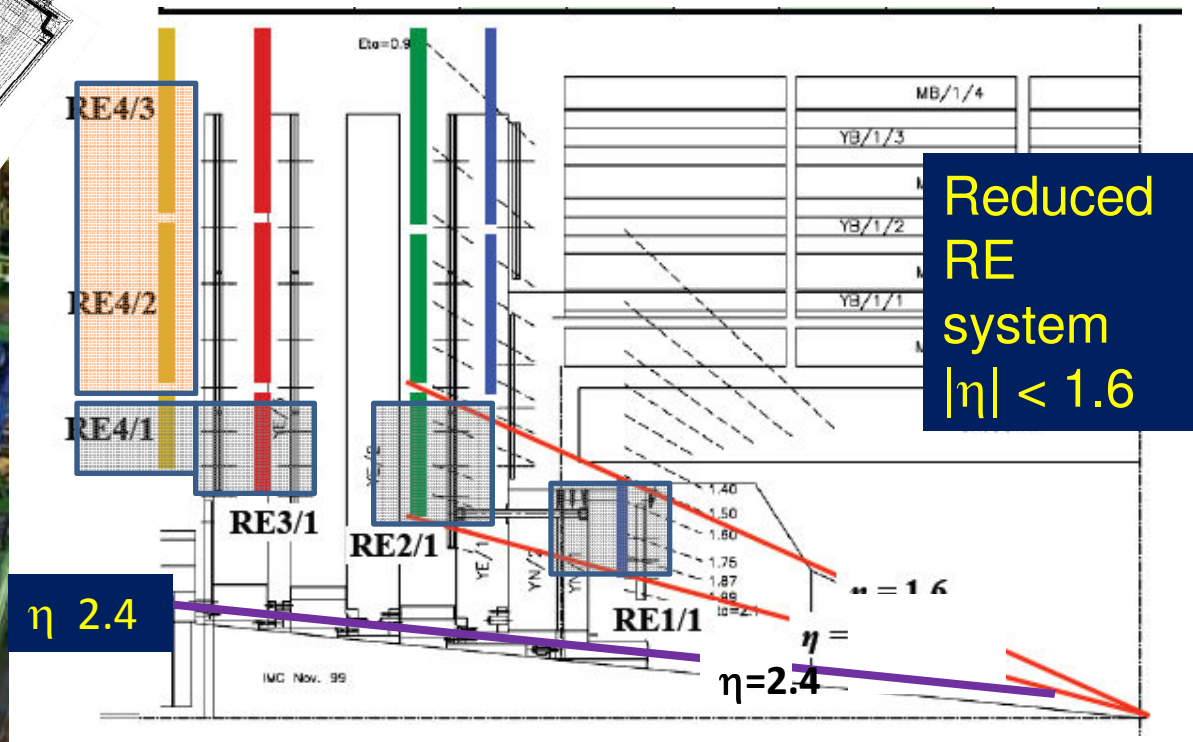
Monday, 23 November 2009

14:00	[9] **CMS upgrade plans and design studies** by Archana SHARMA (CERN); Hans POSTEMA (CERN); Stephane BALLY (CERN) (BE Auditorium Meyrin: 14:00 - 14:20)	slides
	[63] **MAMMA R&D, a progress report** by Venetios POLYCHRONAKOS (Department of Physics); Joerg WOTSCHACK (CERN) (BE Auditorium Meyrin: 14:20 - 14:40)	slides
	[14] **Micro Pixel Chamber as endcap muon detector of ATLAS upgrade** by Atsuhiko OCHI (Department of Physics) (BE Auditorium Meyrin: 14:40 - 15:00)	slides
15:00	[6] **Detector development projects in Budapest** by Gergoe HAMAR (Eotvos Lorand University-Unknown-Unknown) (BE Auditorium Meyrin: 15:00 - 15:20)	slides
	coffee break (15:20 - 15:50)	
16:00	[8] **TH-COBRA, a thick-hole structure for IBF reduction** by joao VELOSO (university of aveiro); Mr. Carlos AZEVEDO (Universidade de Aveiro) (BE Auditorium Meyrin: 15:50 - 16:10)	slides
	[23] **First observation of Cherenkov light with triple CsI coated THGEM** by Paolo MARTINENGO (CERN); Vladimir PESKOV (Pole Universitaire Leonardo de Vinci) (BE Auditorium Meyrin: 16:10 - 16:30)	slides
	[24] **Updated on GEM muon tomography project and future plans** by Kondo GNANVO (Florida Institute of Technology, Melbourne, Fl, USA); Marcus HOHLMANN (Florida Tech); Amilkar QUINTERO (Florida Institute of Technology) (BE Auditorium Meyrin: 16:30 - 16:50)	slides
17:00	[46] **Status of GEM detectors for STAR-FGT upgrade** by Mr. Douglas Kenneth HASELL (MIT) (BE Auditorium Meyrin: 16:50 - 17:10)	slides
	[7] **Resistive layers, grids and plates** by Prof. imad LAKTINEH (ipn LYON) (BE Auditorium Meyrin: 17:10 - 17:30)	slides

A high eta forward muon trigger and tracking detector for CMS

Archana Sharma





STAGED

	RE 1/1	RE 1/2	RE 1/3	RE 2/1	RE 2/2	RE 2/3	RE 3/1	RE 3/2	RE 3/3	RE 4/1	RE 4/2	RE 4/3
No. of chambers	36*2	36*2	36*2	18*2	36*2	36*2	18*2	36*2	36*2	18*2	36*2	36*

Tests with candidate technologies

Micromegas and triple GEM

- Efficiency studies
- Gain curves
- Rate capability
- Discharge probability
- Comparison of gas mixtures
- RD51 test beam in October

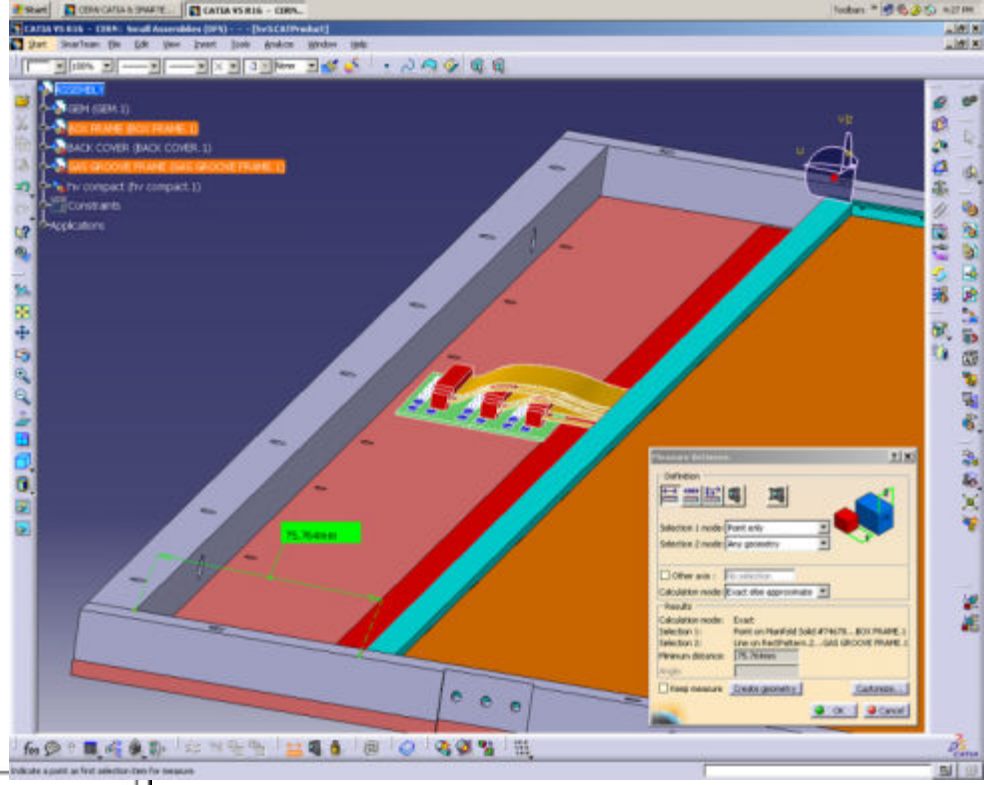
Discharge problems using Micromegas

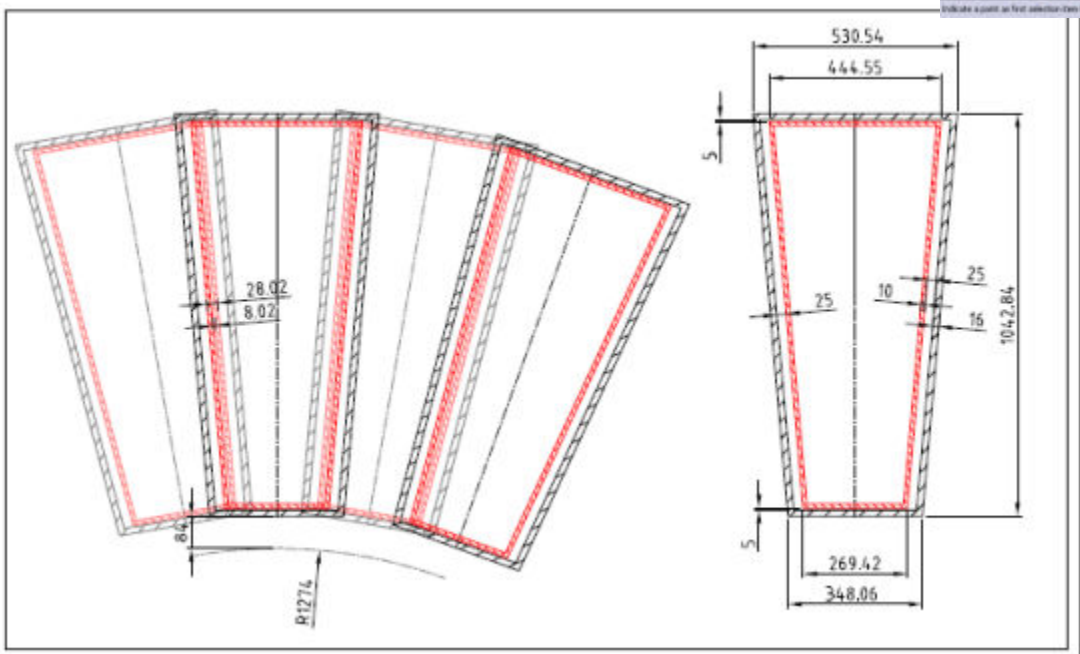
Decided to go for large area triple GEM detectors

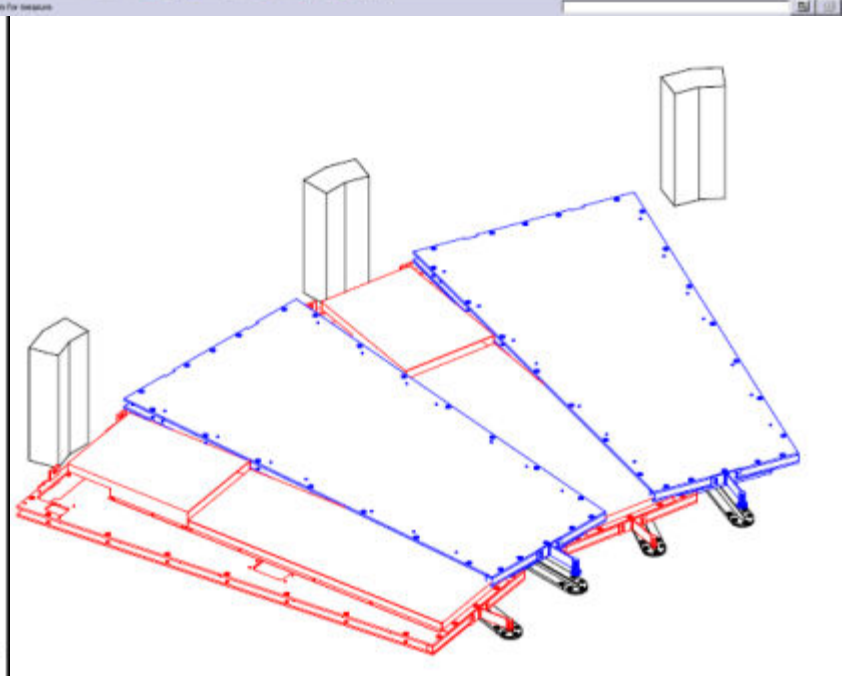
Prototype design

For replacement of a Re1/1 station

- Detail mechanical design
- Definition of the readout electronics and its mechanical support
- Services and routing
- Mockup realization of the detector
- Production of the prototype

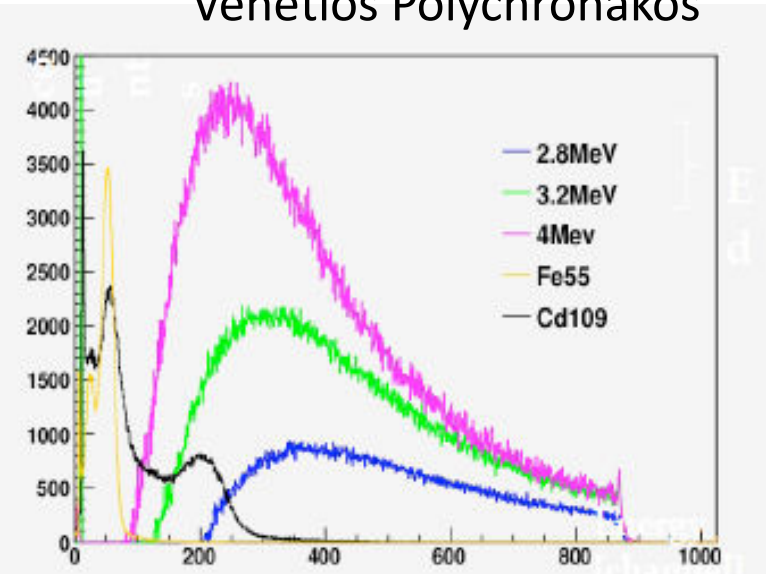


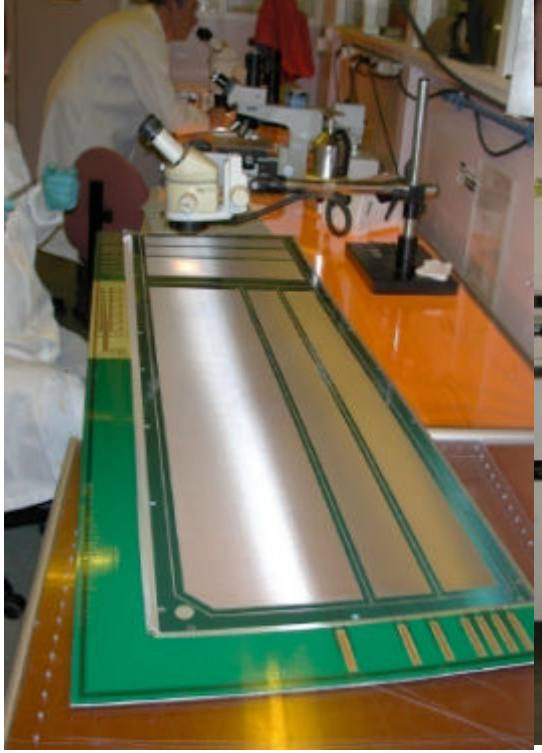


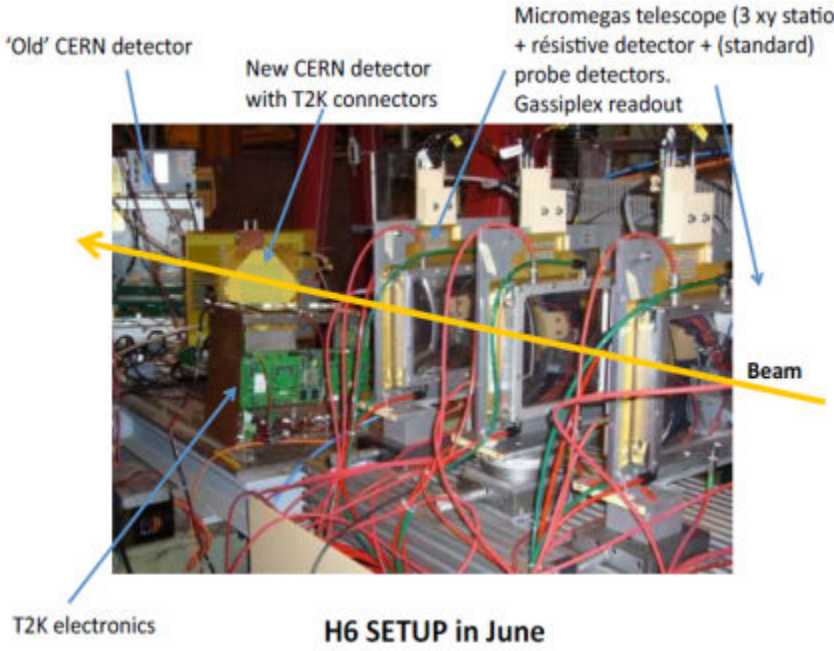


MAMMA R&D progress report

Venetios Polychronakos







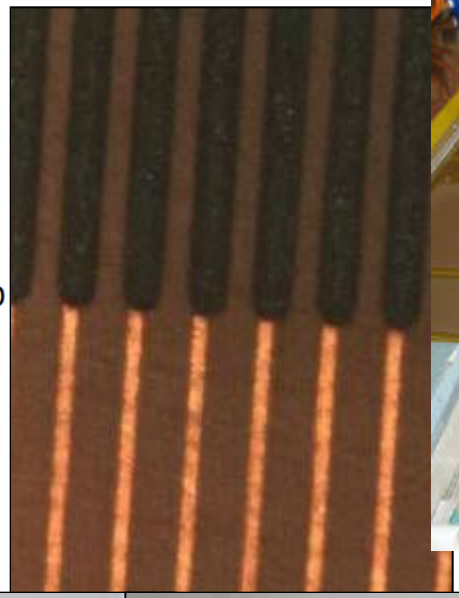
H6 SETUP in June

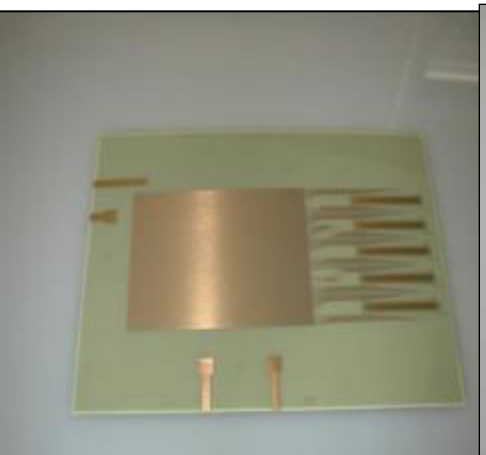
Activities in 2009

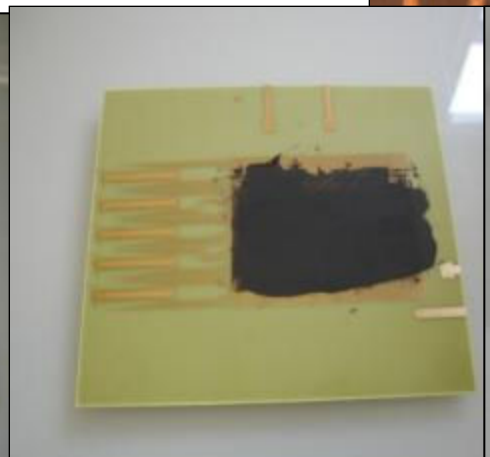
- Test beam runs in H6 at CERN in Jun, Jul, Nov; combined effort with Saclay & Greek groups
  - MM performance with/out isobutane in Ar:CO_2
  - Study performance of MM with resistive coating
  - Timing performance
- Neutron beam at Demokritos
- Towards specification of front-end electronics
- Towards larger chamber size

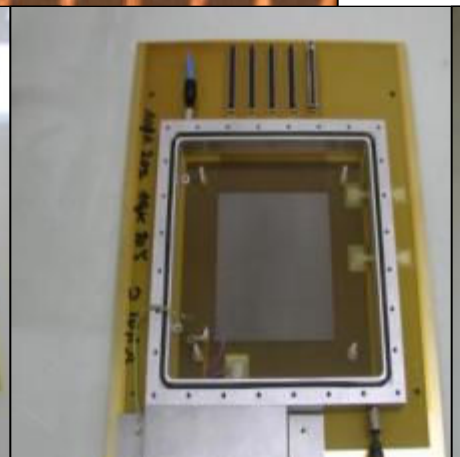
Discharge problems
And solutions

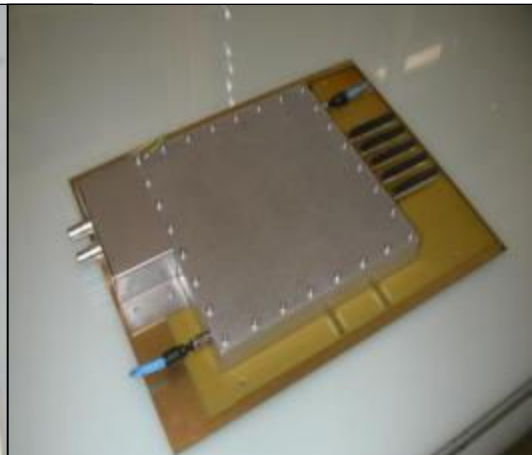
- Micromegas are different from wire chambers
  - No wires to break
  - Spark rate in test beam (10–20 kHz/cm^2): < 1 Hz
  - Many sparks over test beam exposure, no damage
- Sparking leads to a partial discharge of the amplification mesh => dead time during charge-up
- Different spark reduction options under study
  - Resistive coating (Saclay + CERN)
  - Mesh segmentation
  - Double step amplification (GEM + MM, MM + MM)



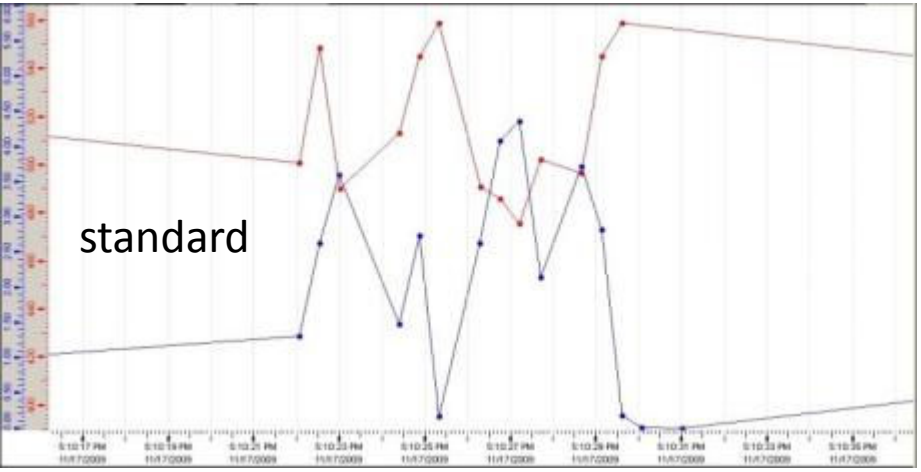




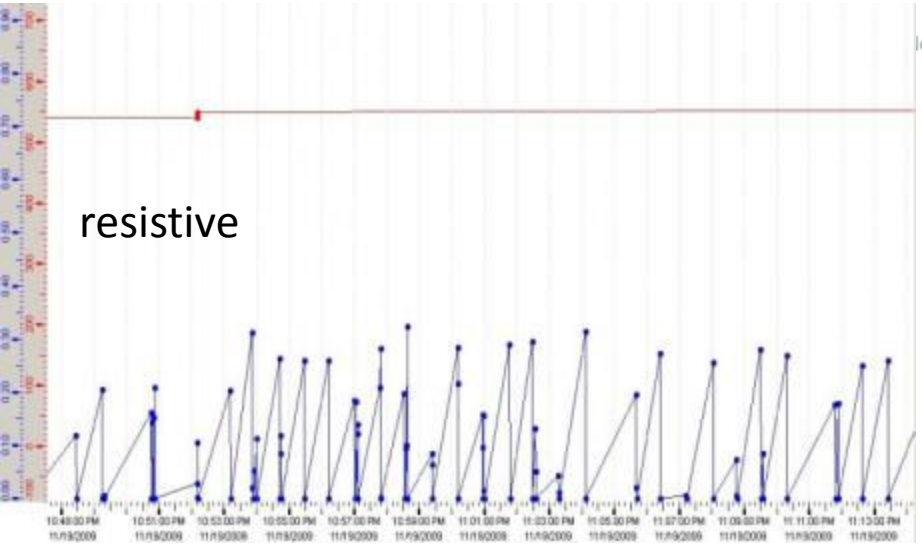




Plans for near future

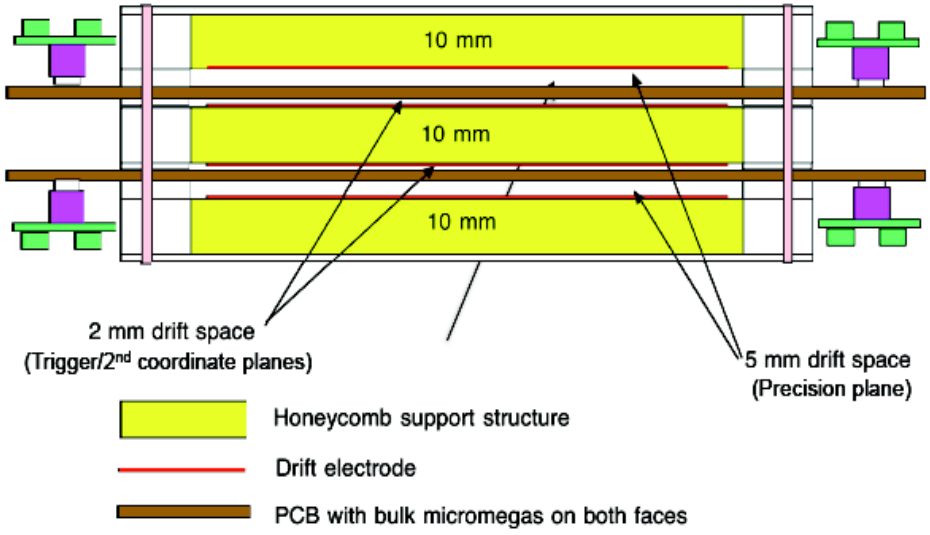


standard



resistive

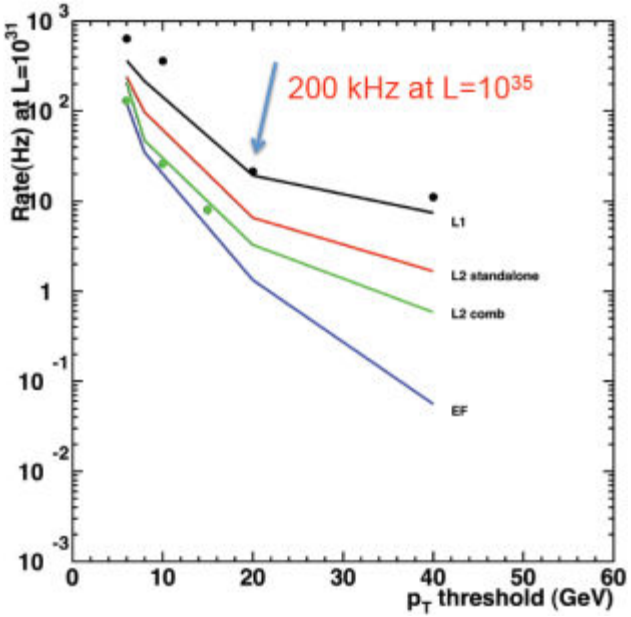
MICROMEGAS station
with two precision and two pad/2nd coordinate planes



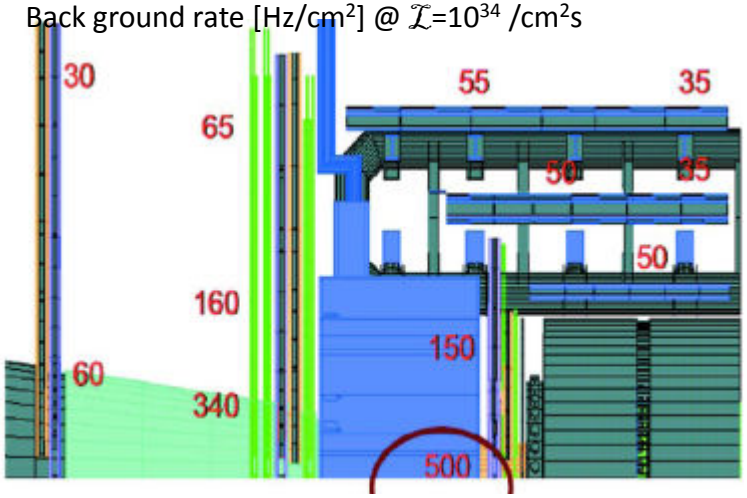
- Try different front-end electronics and readout (T2K, TRT, BNL, …)
  - Aim for specifications for readout electronics by spring 2010
- Continue study of spark reduction/protection
- Evaluate 1.5 x 0.5 m^2 prototype (test beam starts this week)
- Design of CSC-size prototype in fall 2009; to be constructed in 2010 (at CERN and possibly in industry (BNL))
  a) Single plane (1.2 x 1.2 m^2)
  b) Chamber with several bulk micromegas for precision/trigger/2nd co-ordinate planes
- Start work on integration in ATLAS …
  - Aim for a realistic layout for the ATLAS upgrade LoI in 2010

Micro Pixel Chamber for ATLAS muon upgrade

Atsuhiko Ochi



Back ground rate [Hz/cm^2] @ $\mathcal{L}$=10^{34} /cm^{2}s

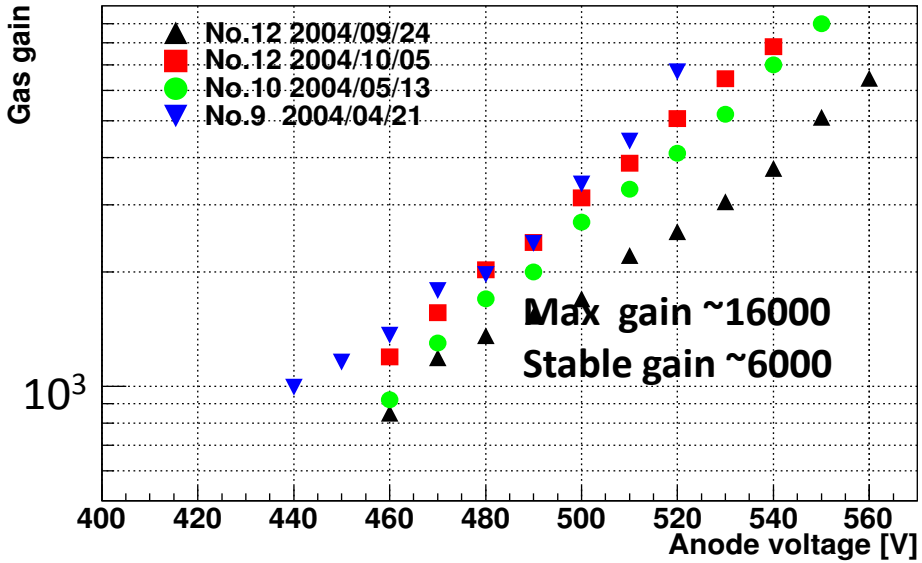


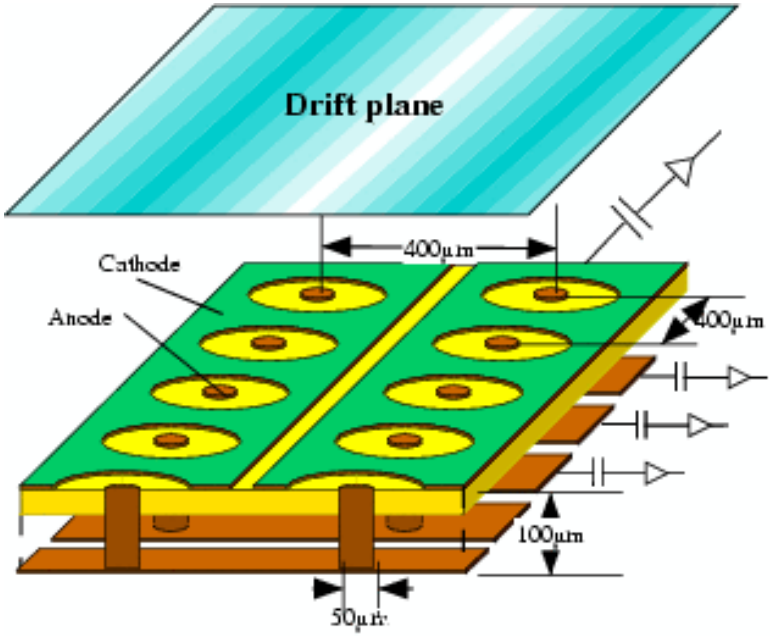
Baranov et al. : ATL-GEN-2005-001, Geneva 2005

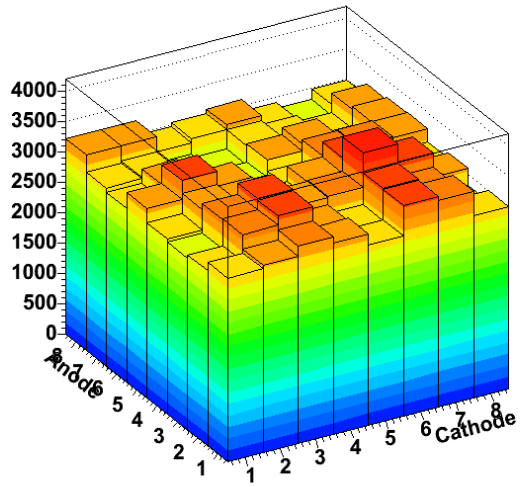
	LVL1 Trig?	Dimension	Posi. resol. [μm]	Ang. resol. [mrad]	Max. rate [Hz/cm^2]	Timing req. [nsec]	Read elec.	Area / unit [m^2]	Cost [CHF/m^2]
μ-PIC	◎	2+α	60～115	0.3	>10^9	<20	Hit only	<0.1	10^4
Fine TGC	◎	2	50～100		10^5	25	ADC	2	10^4
Fine MDT	×	1	112		10^3	200	Hit Timing		
Micro Megas	◎	2	100		10^{11}	5	?	2	

Micro Pixel Chambers

Some properties

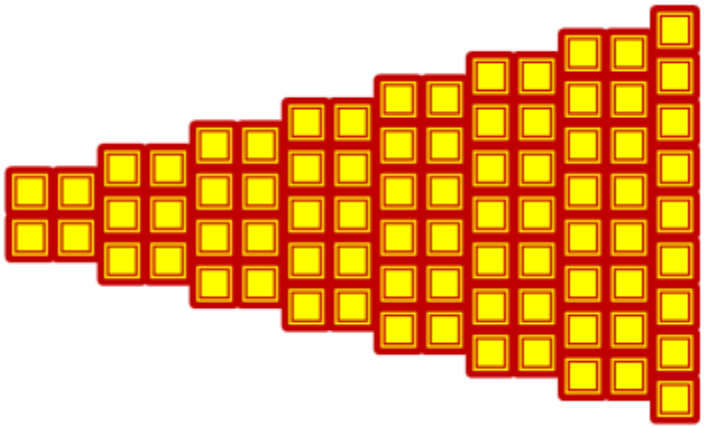


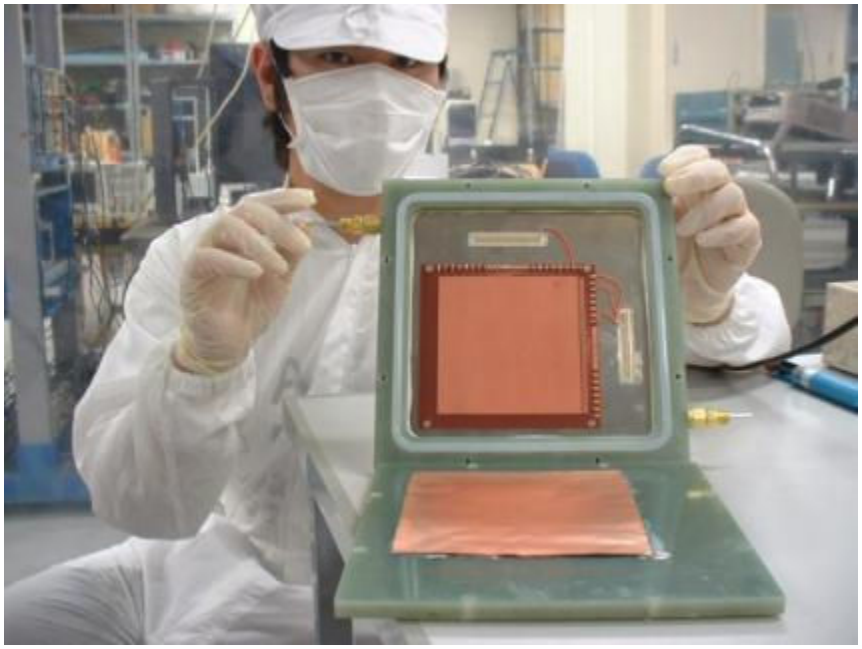


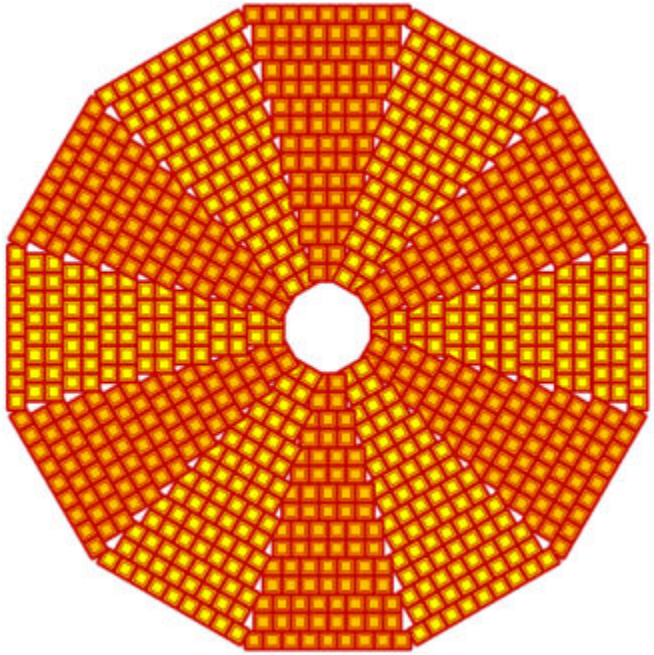


	MSGC	μ-PIC
Maximum gain	1700(with capillary)	50000 (with mesh)
Stable Gain	1000	7000
Long time		>30 days
Area	10×10cm^2	30×30cm^2
Pitch	200μm	400μm (300μm possible)
uniformity (σ)	~35%	4%

- Not very large (up to 30x30 cm)
- Need tiling to cover large areas
- Discharge tests with α's indicate few-% discharge probability at low gain
- Improve gain to ~10000 (~6000 now)
- Prove time resolution < 10 ns
- Still pretty expensive (~12 kCHF/m^2)



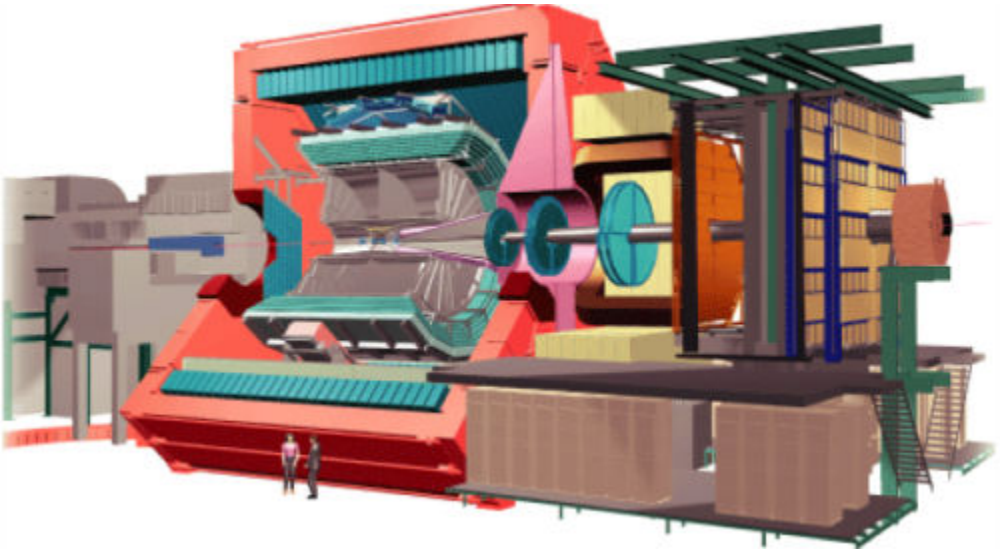


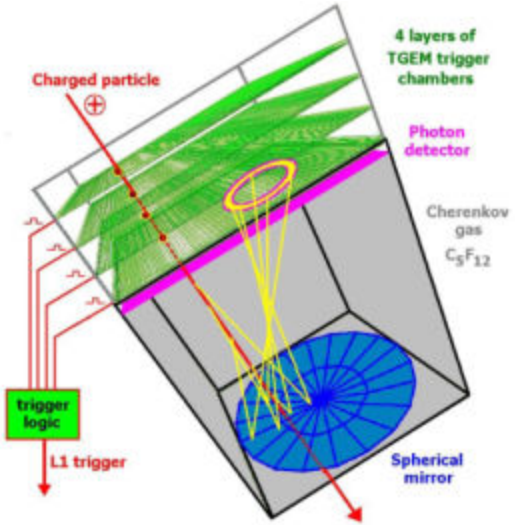


Detector development projects in Budapest

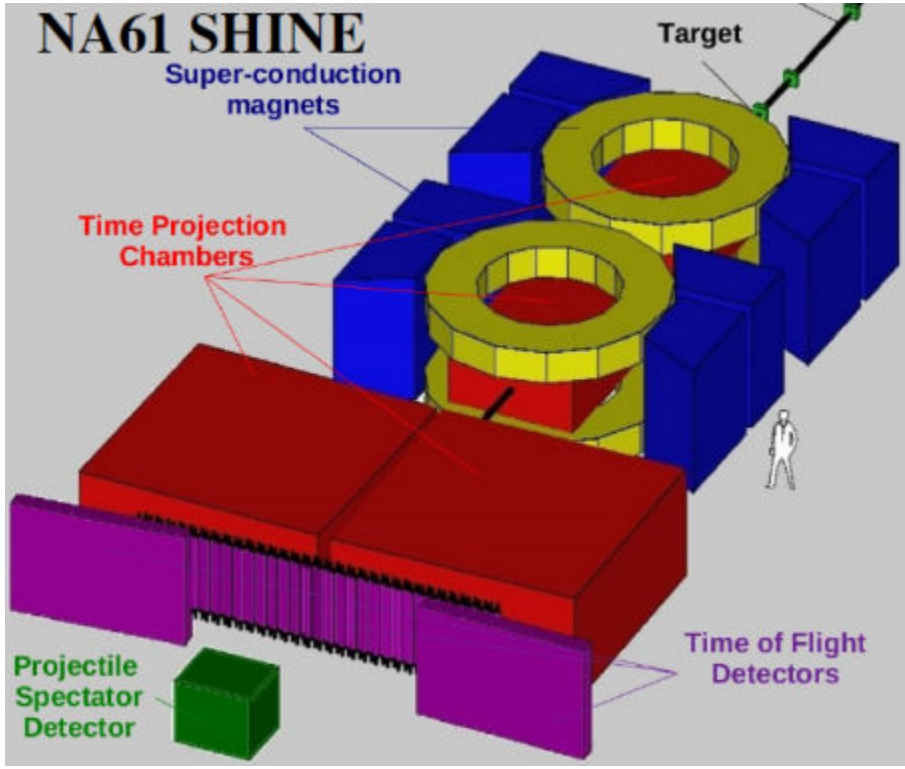
Gergoe Hamar

ALICE VHMPID (THGEMs)

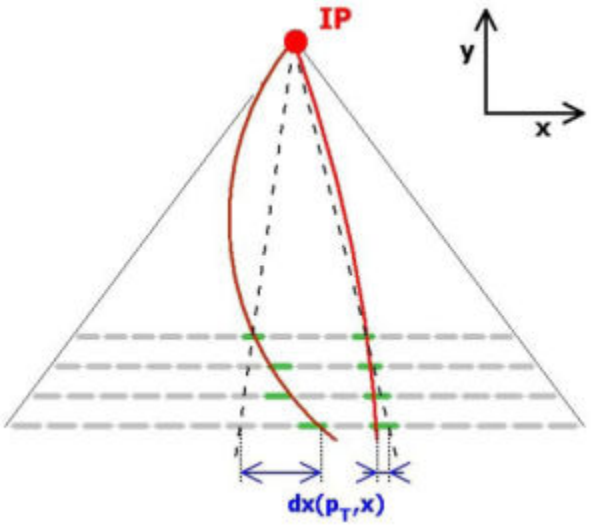


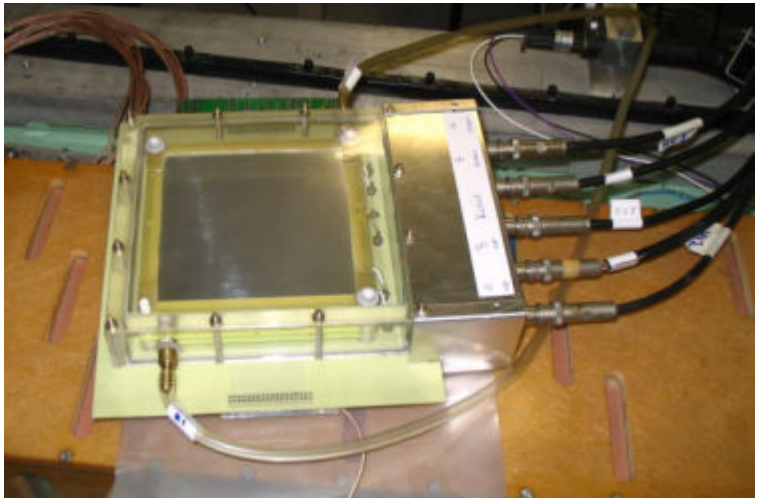


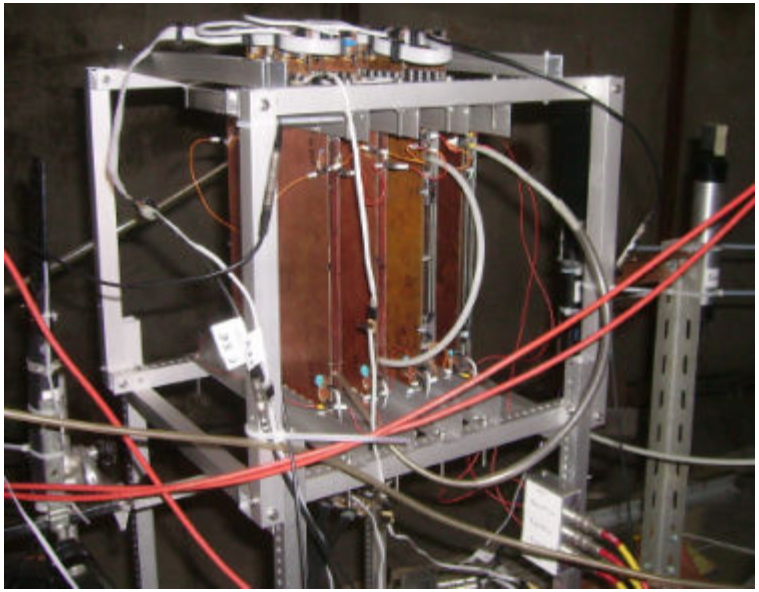
NA61 centrality detector (GEMs)



High momentum trigger detector

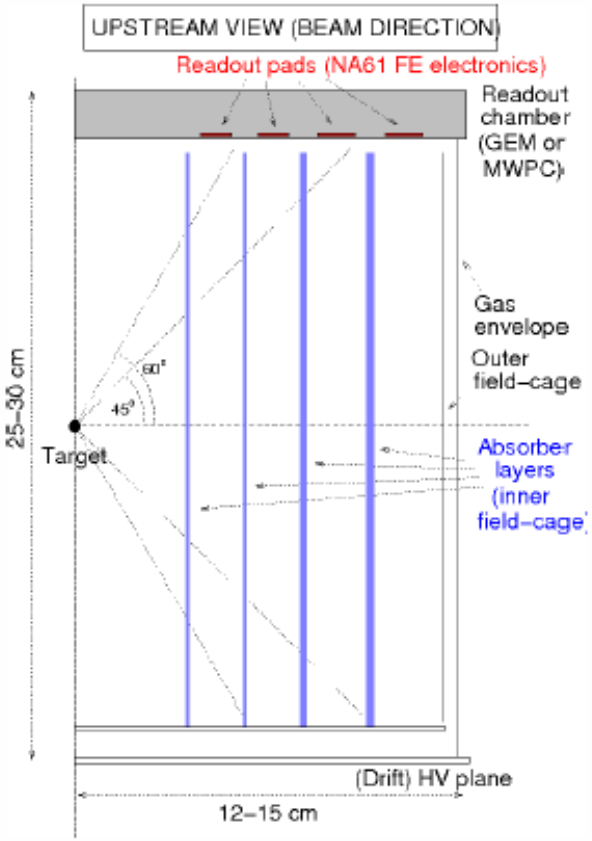




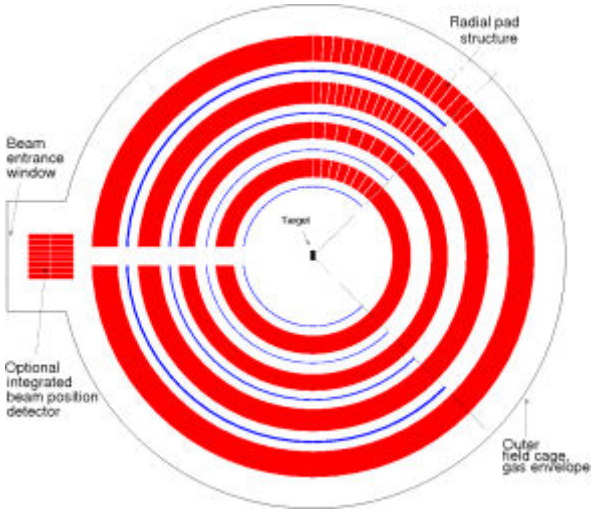


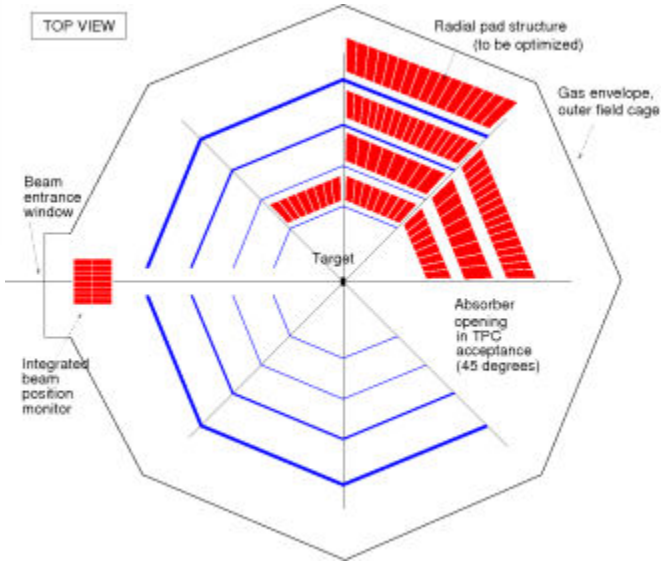
- Four layers of fast position-sensitive detectors
- THGEMs and MWPCs tested, but not fully satisfactory
- GEMs or Micromegas considered (prototypes foreseen for 2010)

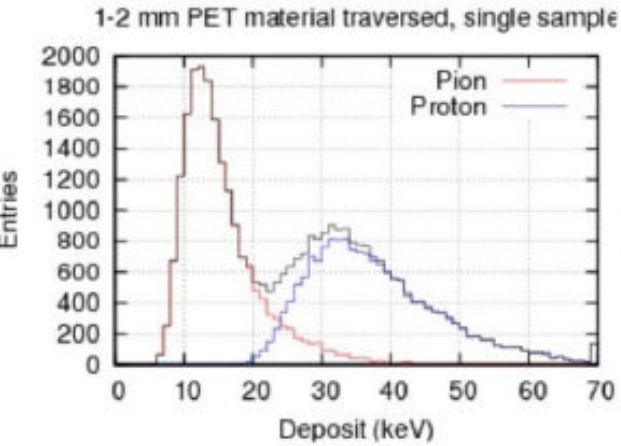
Principle of operation

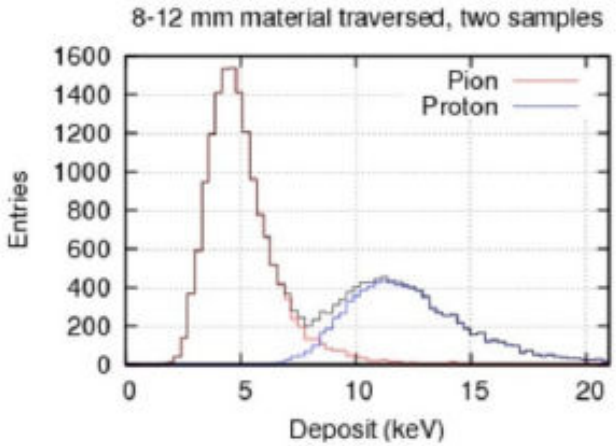


- Simultaneous measurement of **dE/dx** and **range**: energy and identification
- Intervals in particle range defined by absorber layers (constant thickness to be traversed)
- dE/dx measured over order of 1 cm in a small TPC (field cage printed on absorber)
- Electronics: same as for NA61!



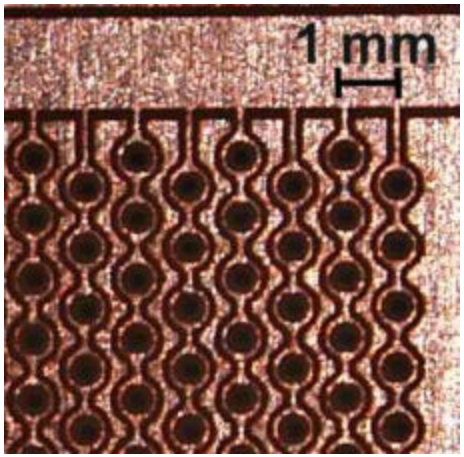


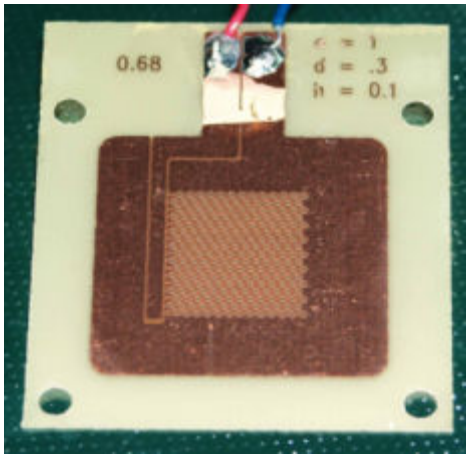




THCOBRA, a thick hole structure for IBF reduction

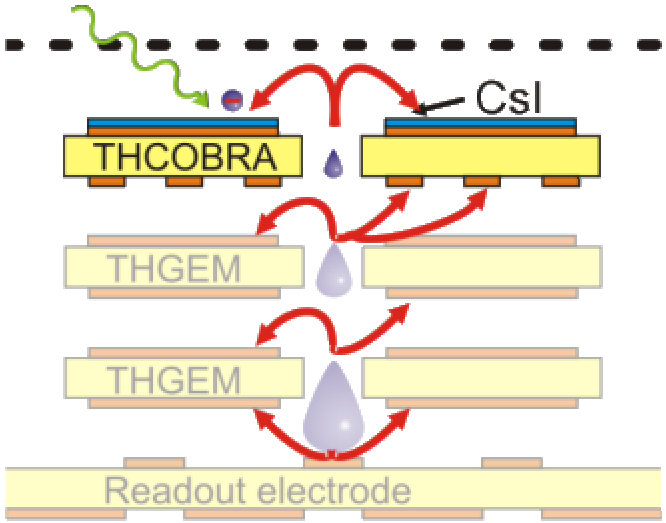
Carlos Azevedo

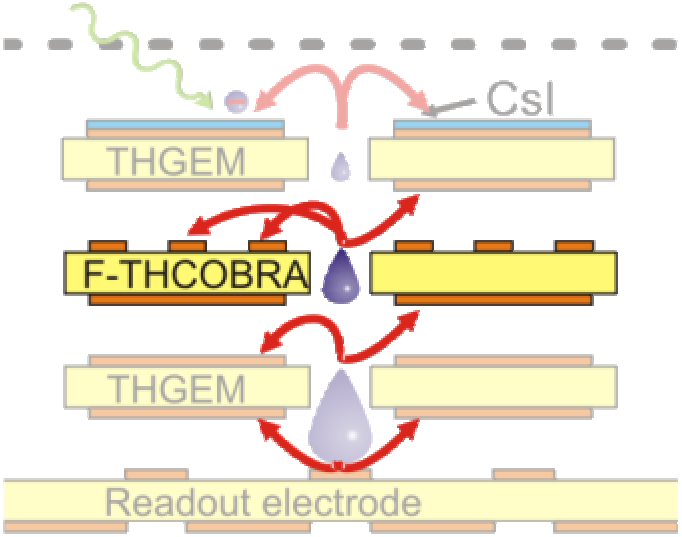




IBF reduction is important for gaseous photon detectors and TPCs

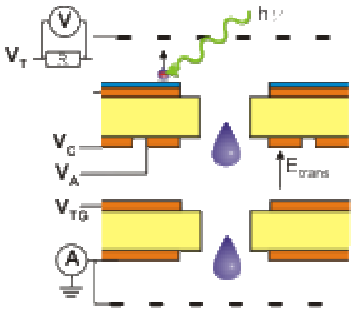
Two scenarios considered:





Measurements on THCOBRA

IBF vs V_{AC}

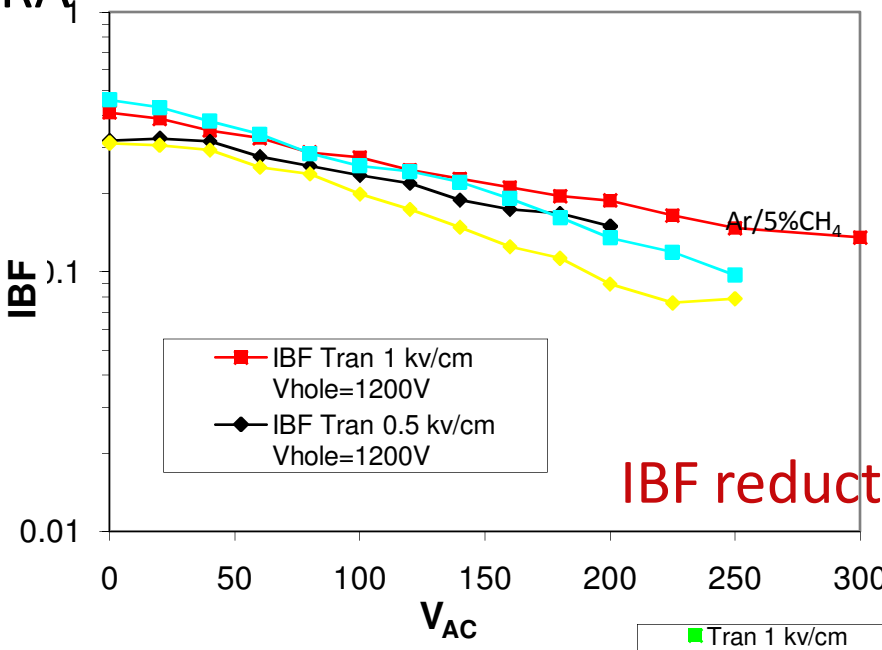


Hole Voltage	Gain
900	1E01
1100	1E02
1200	1E03
1400	1E04

Transfer Field

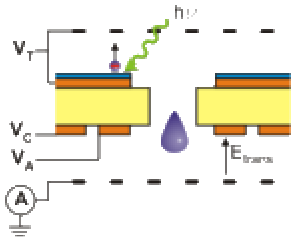
0.5 kV/cm

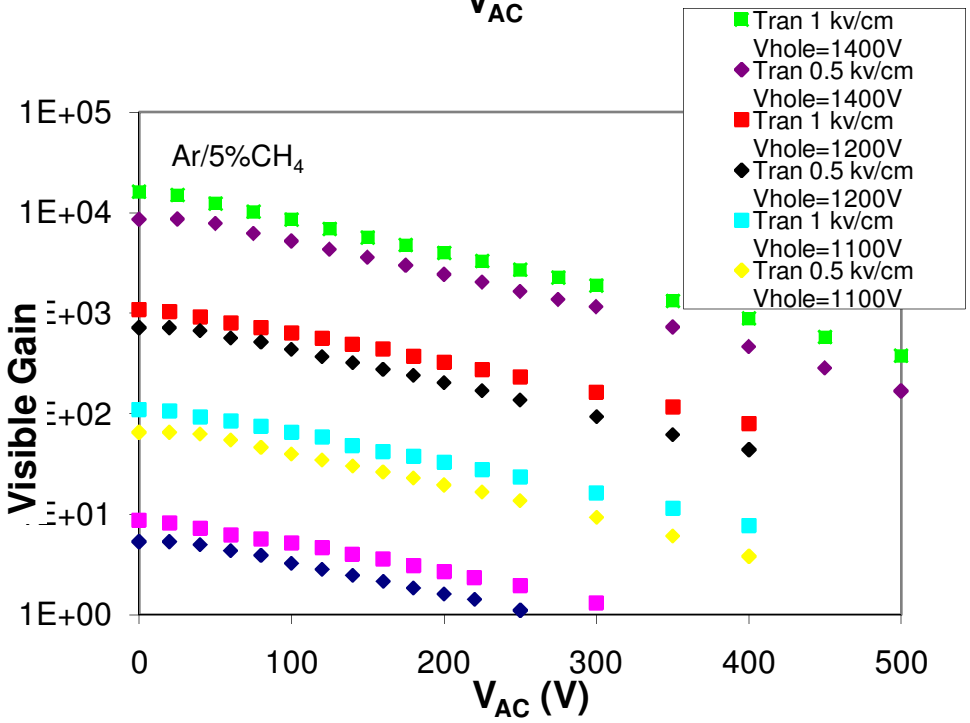
1.0 kV/cm



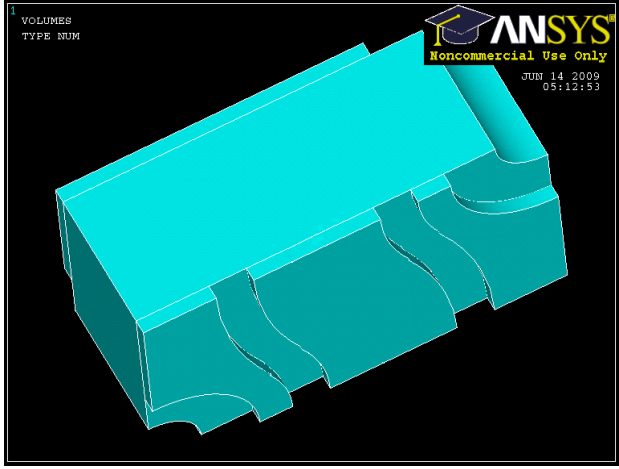
IBF reduction ~ 5

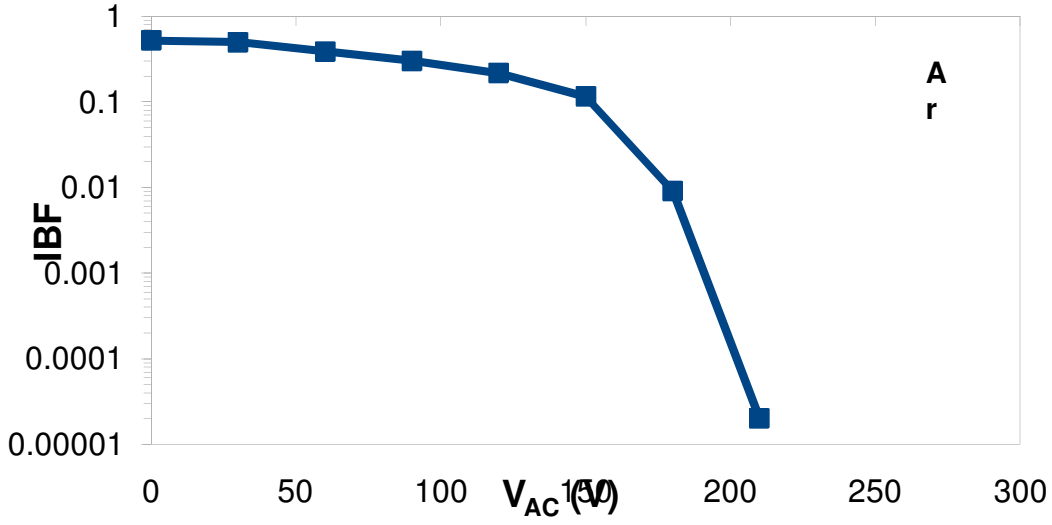
Visible Gain vs V_{AC}



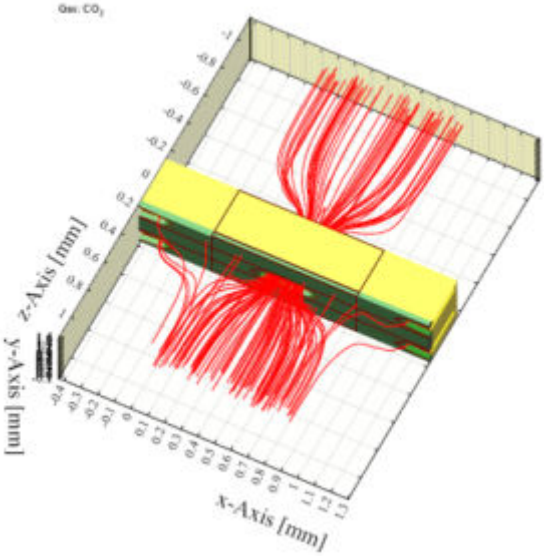


Simulations on flipped THCOBRA

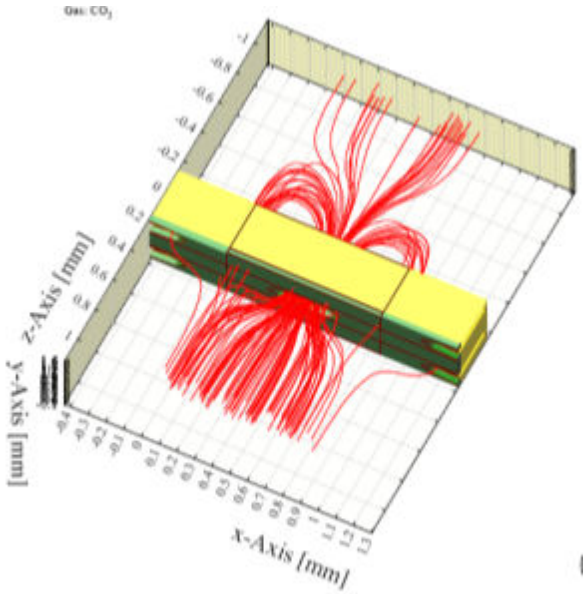




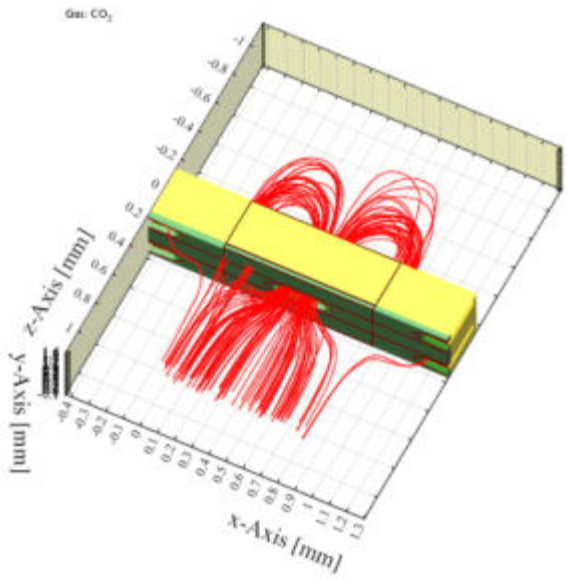
$V_{AC} = 0$



$V_{AC} = 120$

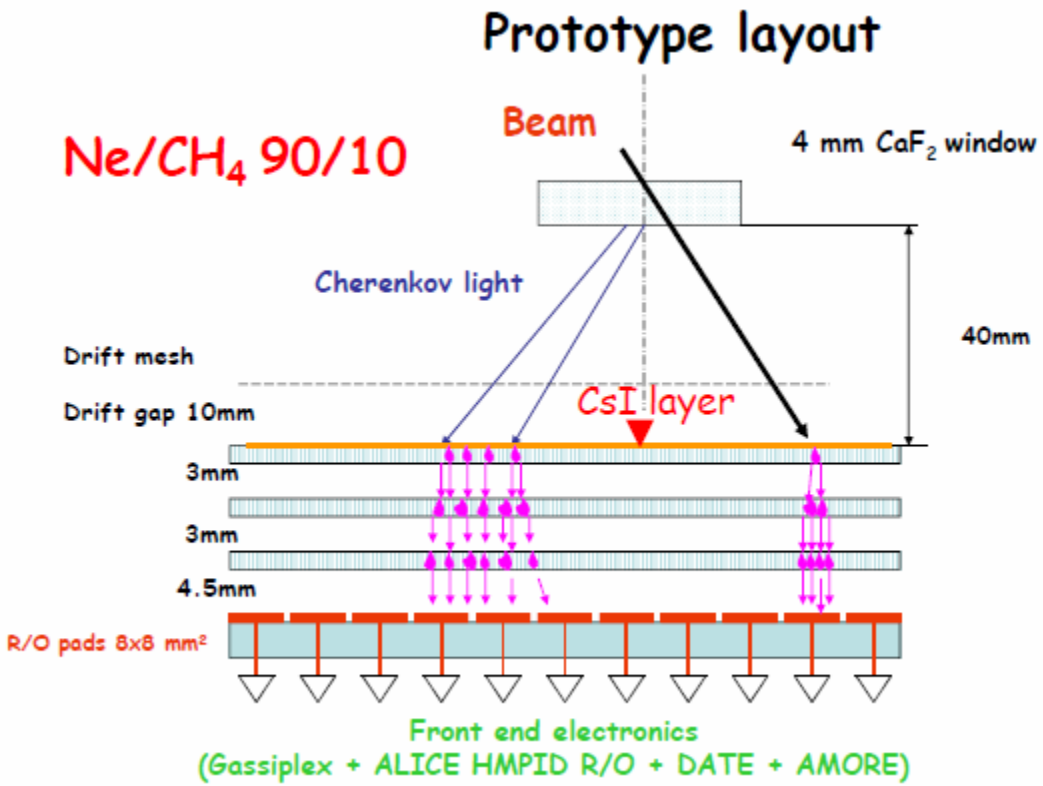


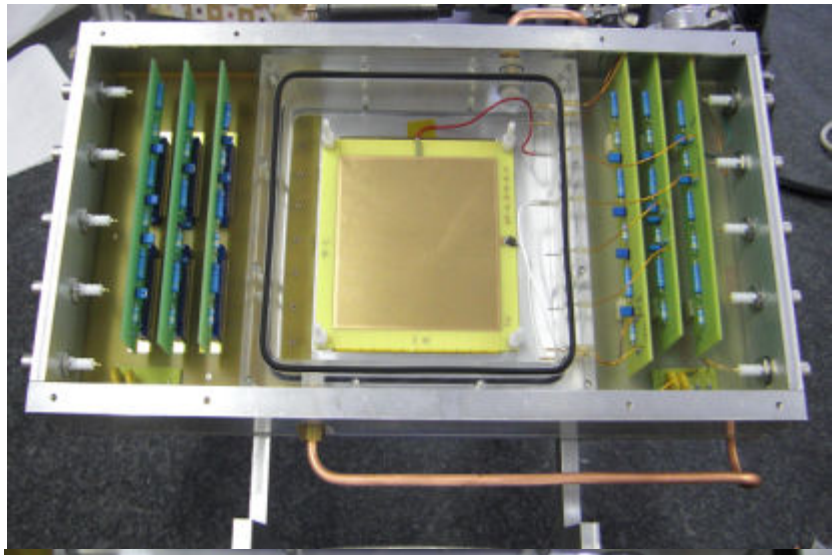
$V_{AC} = 180$

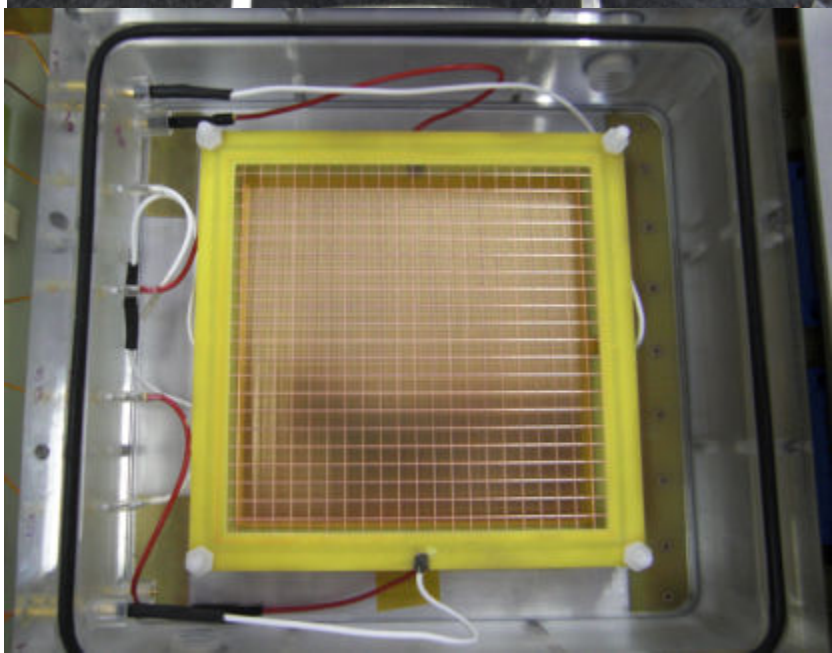


Detection of Cherenkov light with CsI coated triple THGEM

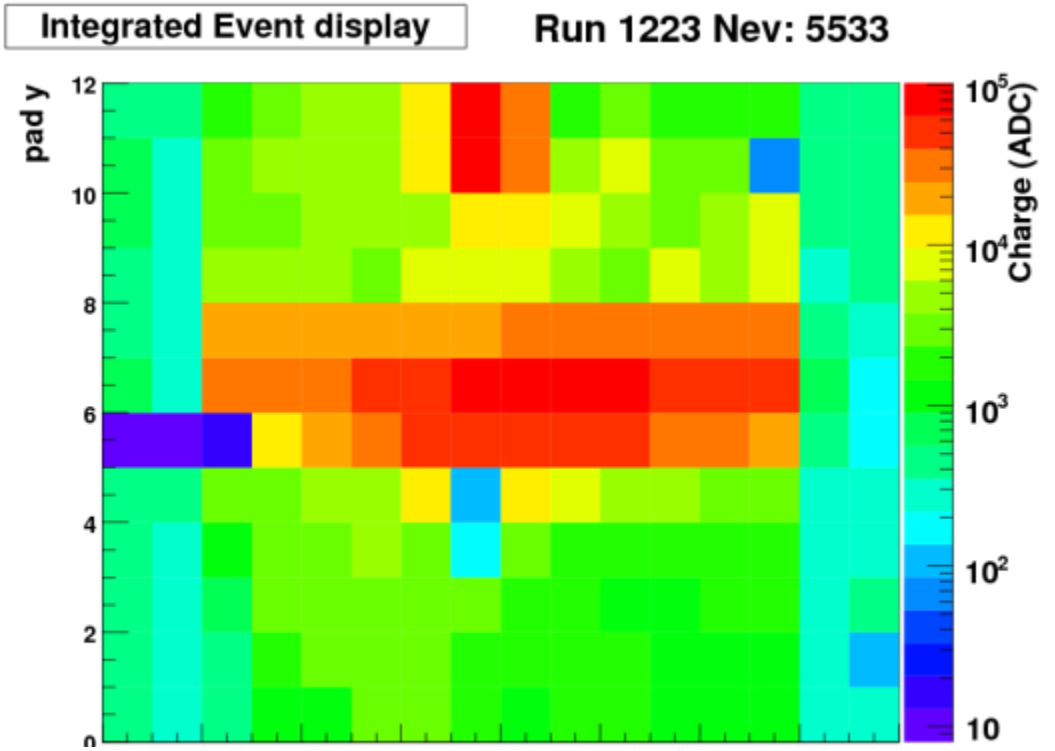
Paolo Martinengo

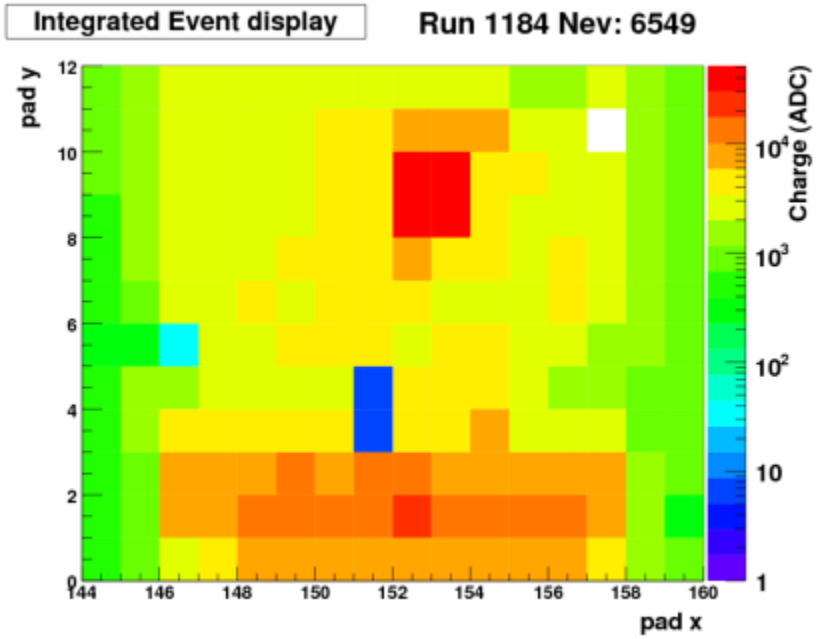


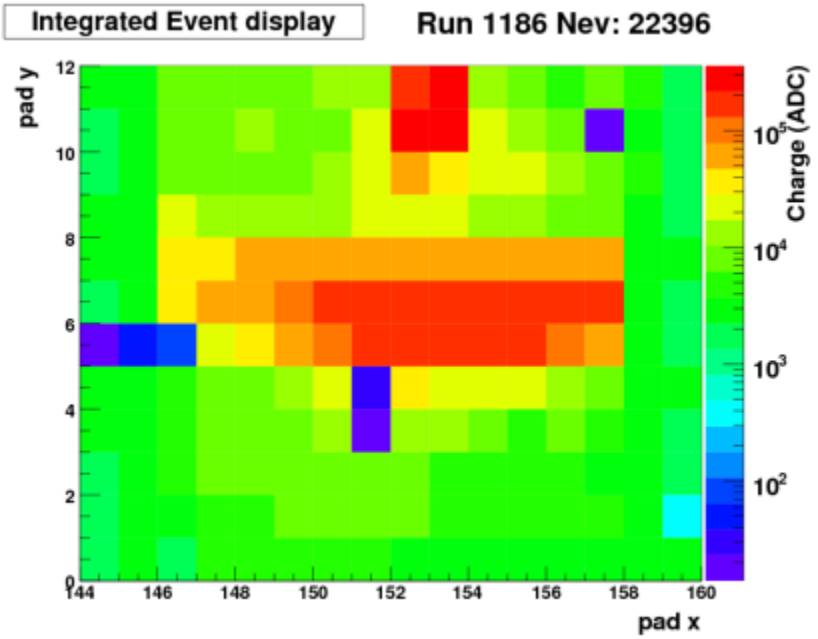




- Cherenkov photons detected with THGEM+CsI
- Several hours of stable operation
- Data to be analysed
- Various parameters are not yet optimized

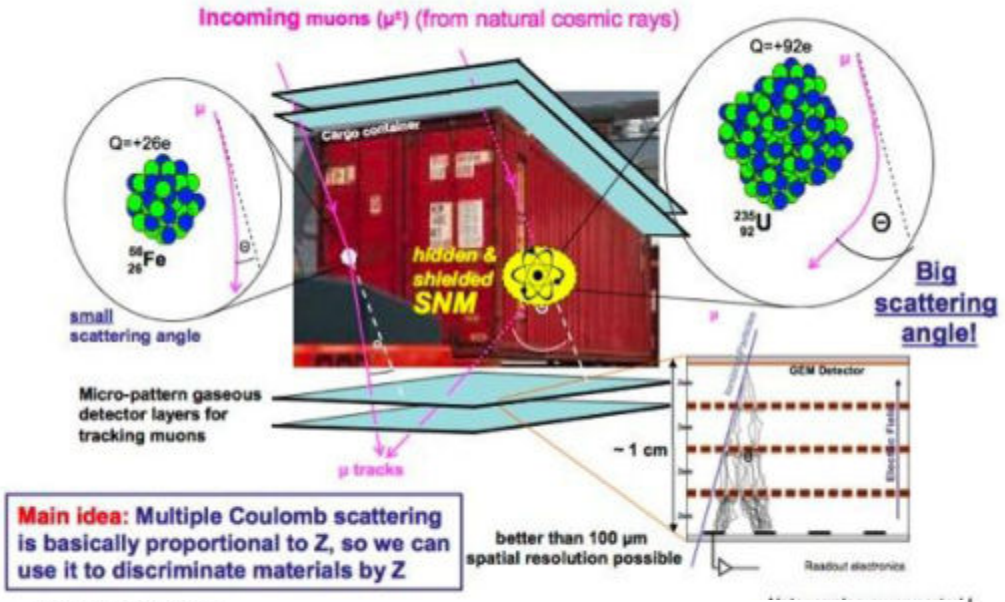


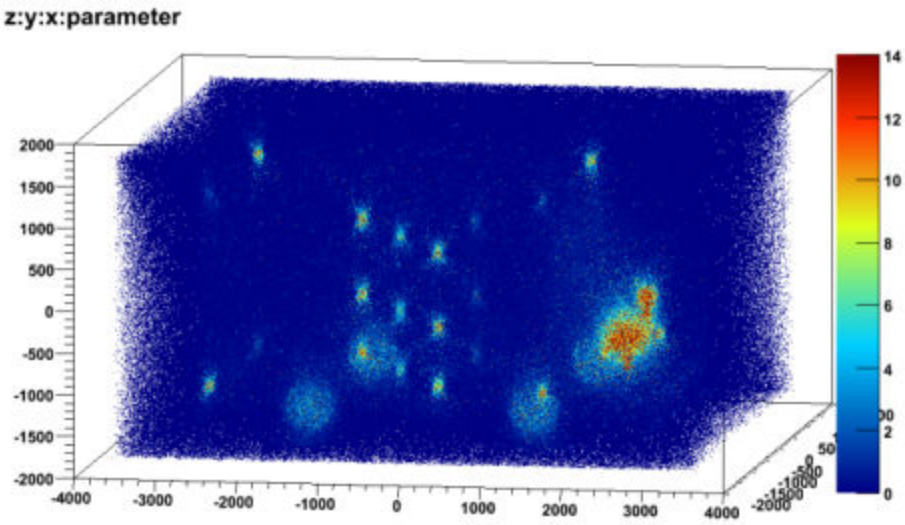




Update on the triple GEM detectors for muon tomography

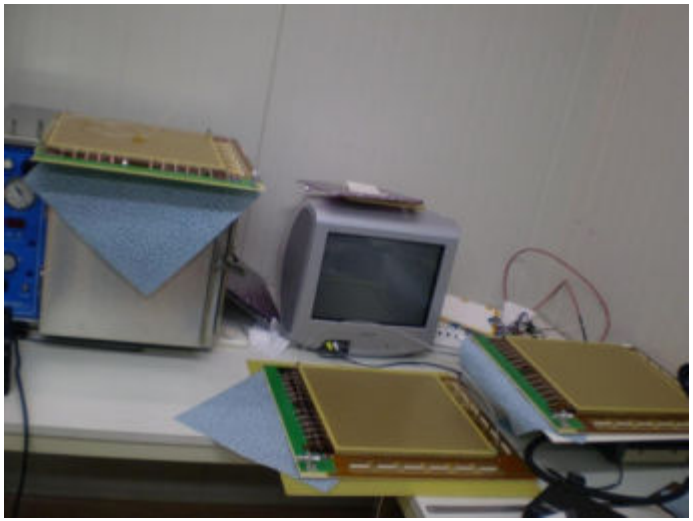
Kondo Gnanvo

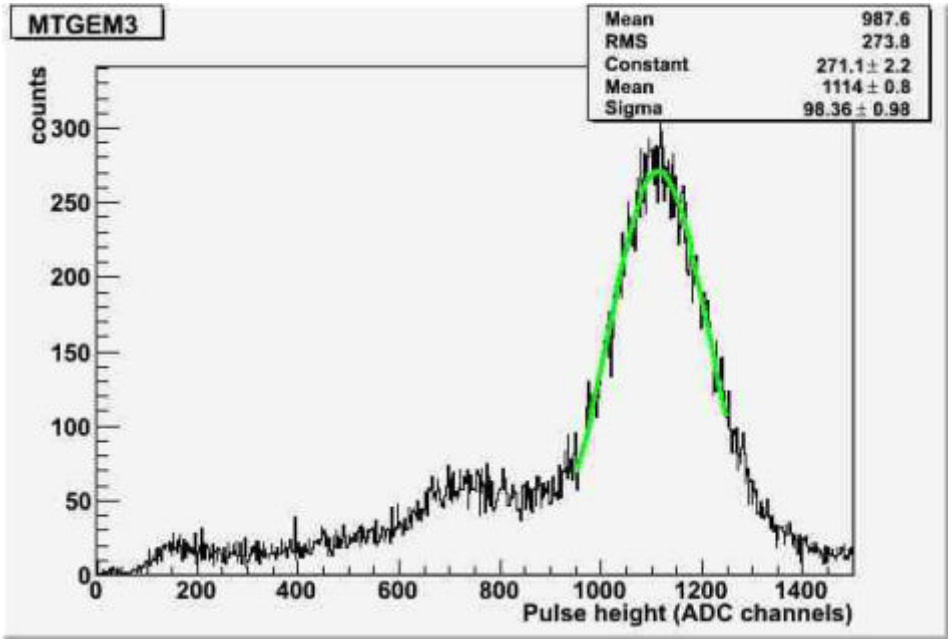


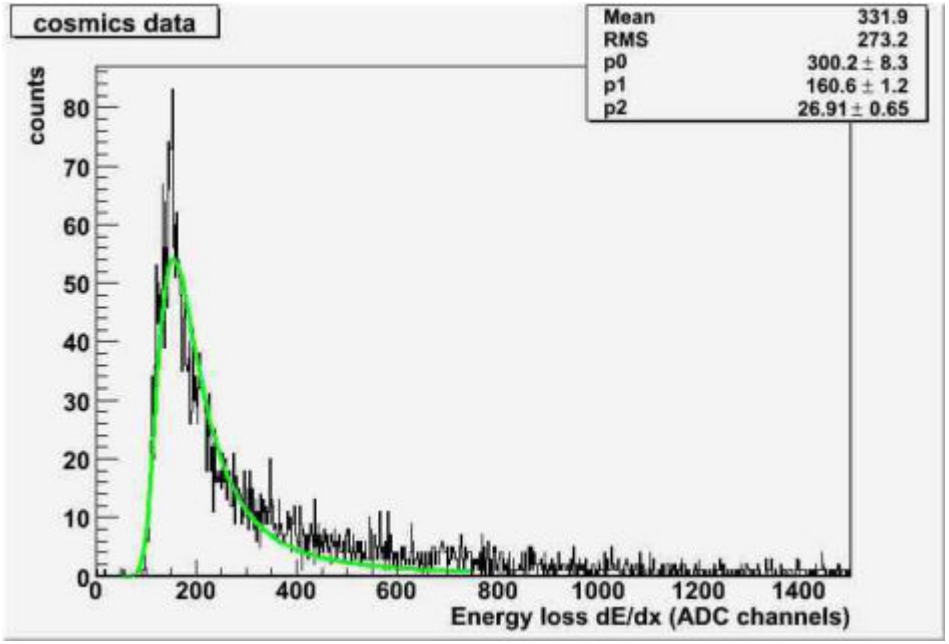


Construction of 10 30x30 cm triple GEM chambers for small scale tests of muon tomography principle.

Started early this year, should be completed within few months.







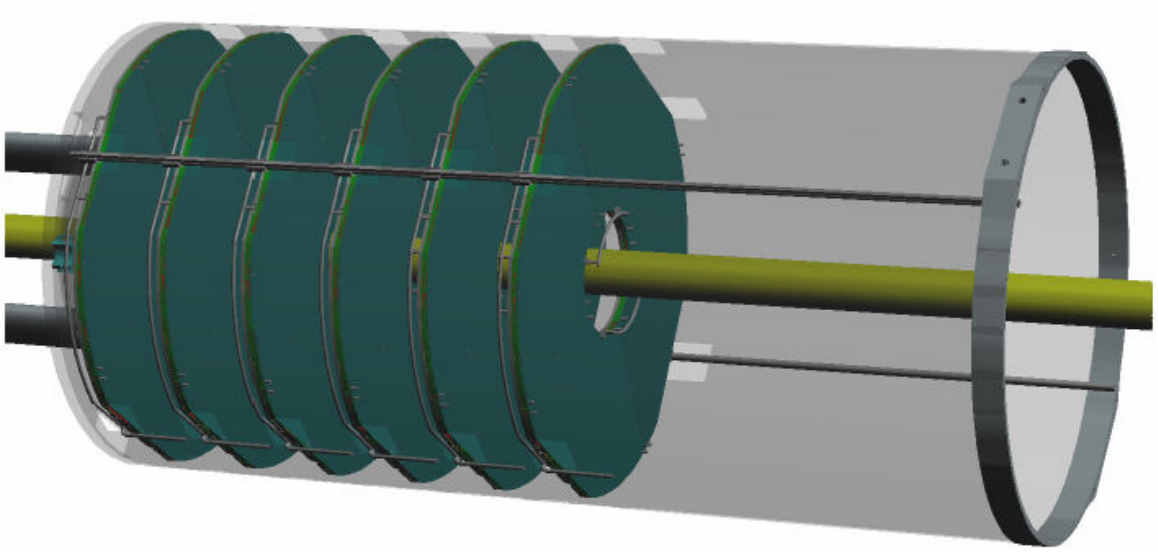
Tests with Cu x-rays and cosmics indicate good energy resolution and efficiency.

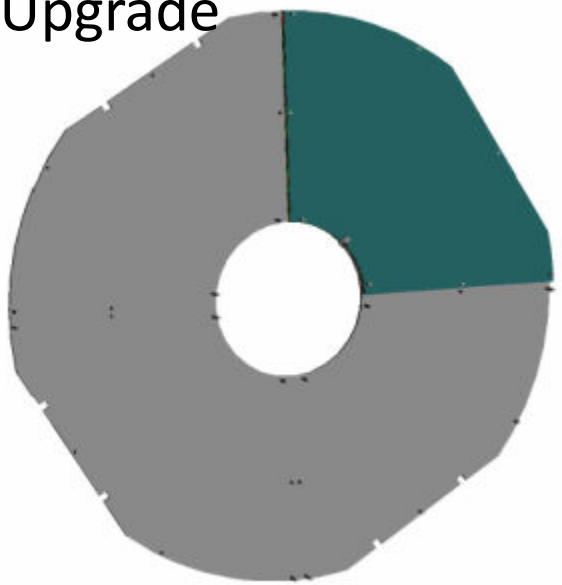
However, no electronics available (yet) to read out several.

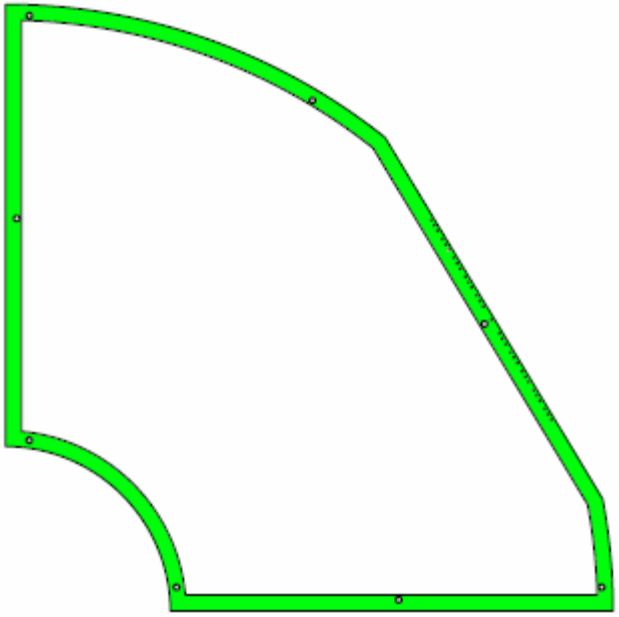
Mechanics prepared for tomography test

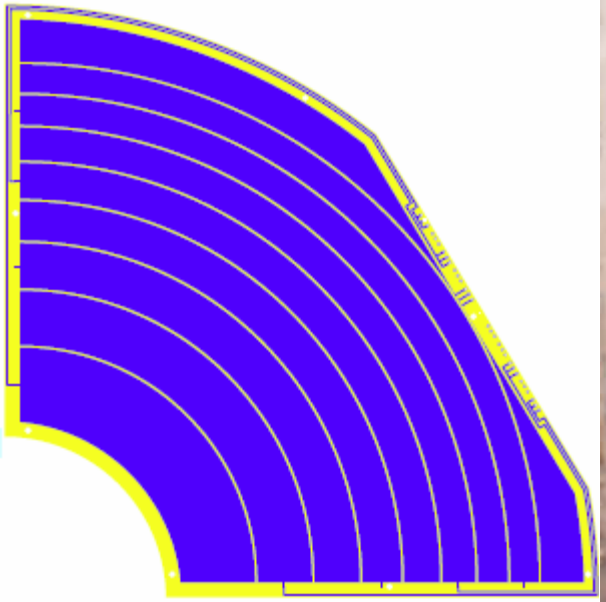
STAR Forward GEM Tracking Upgrade

Douglas Hasell



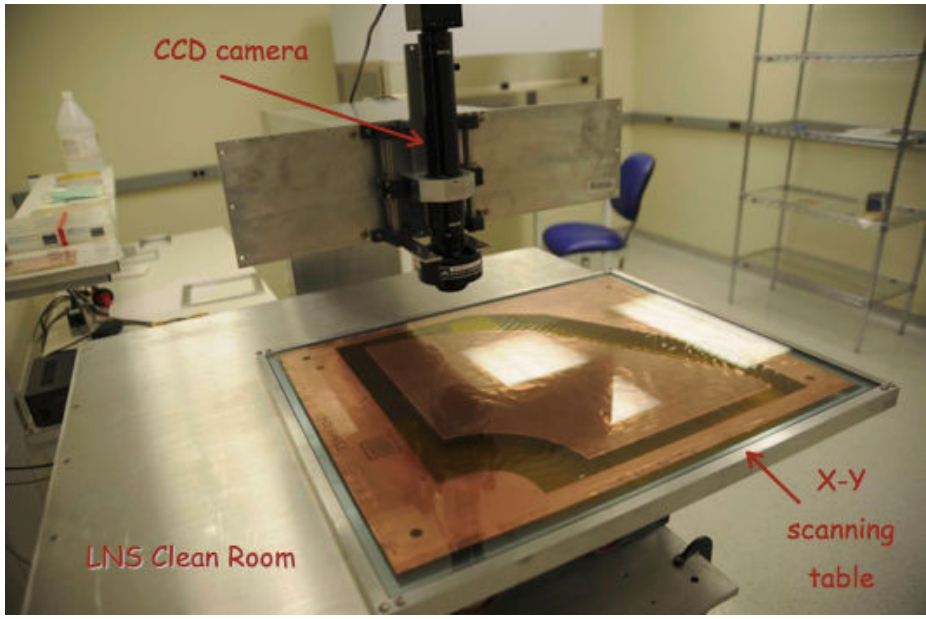


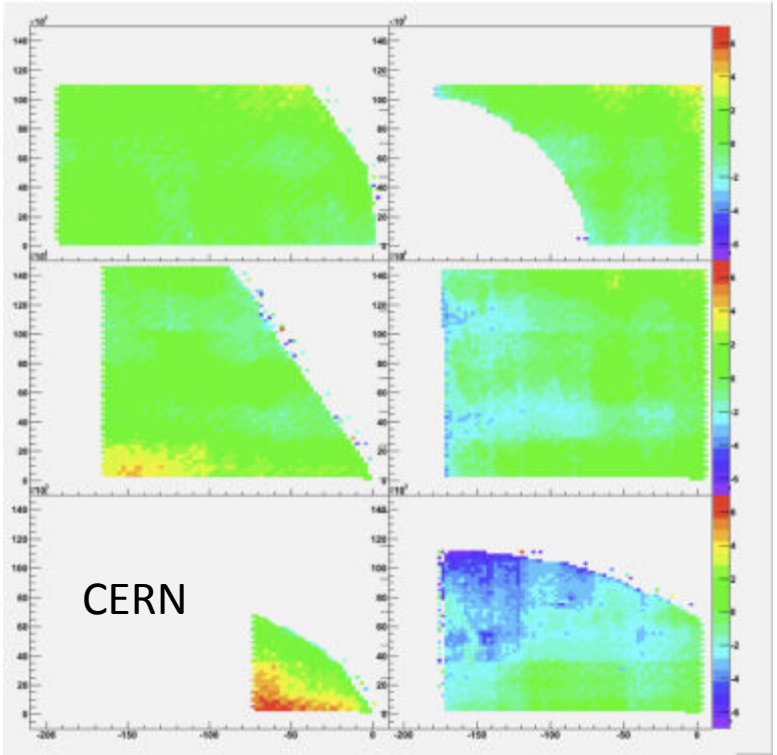


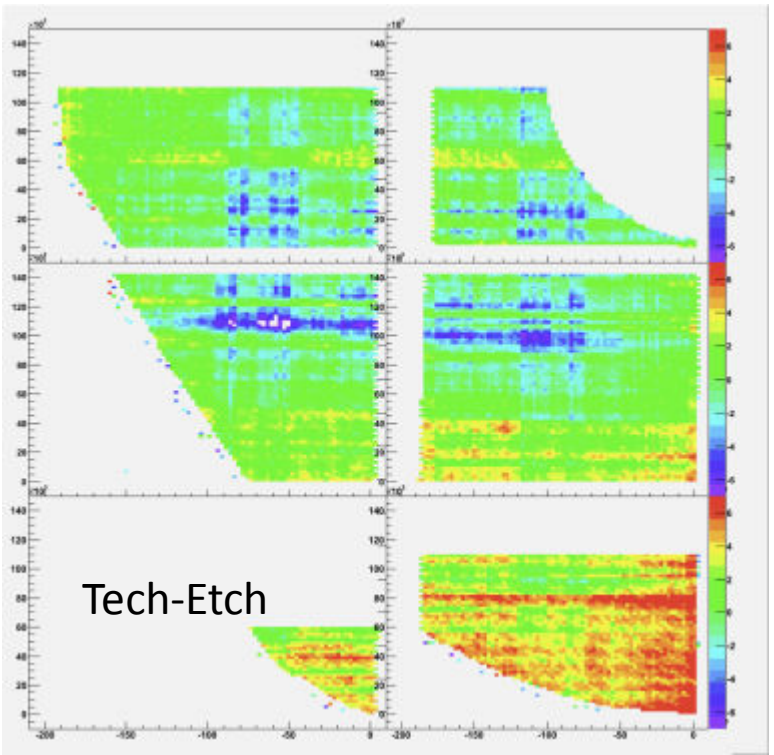


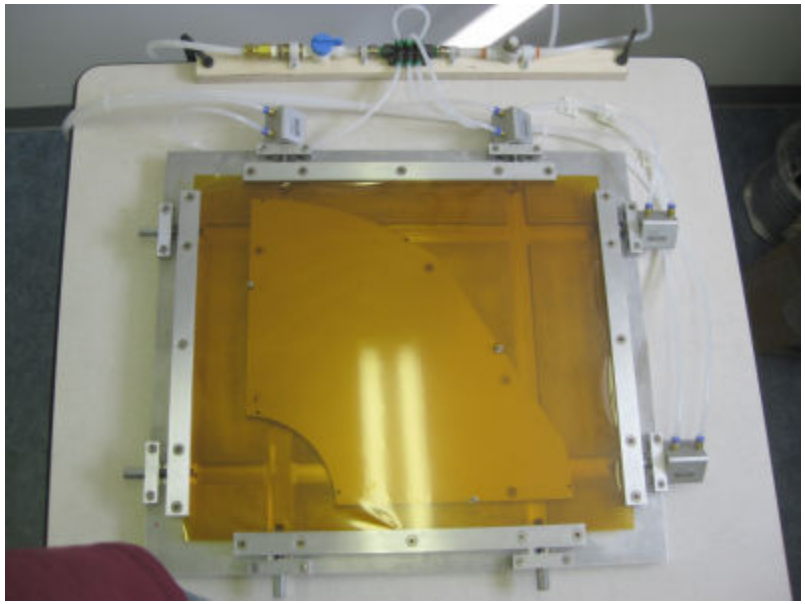
CCD surface scanner to assess foil quality

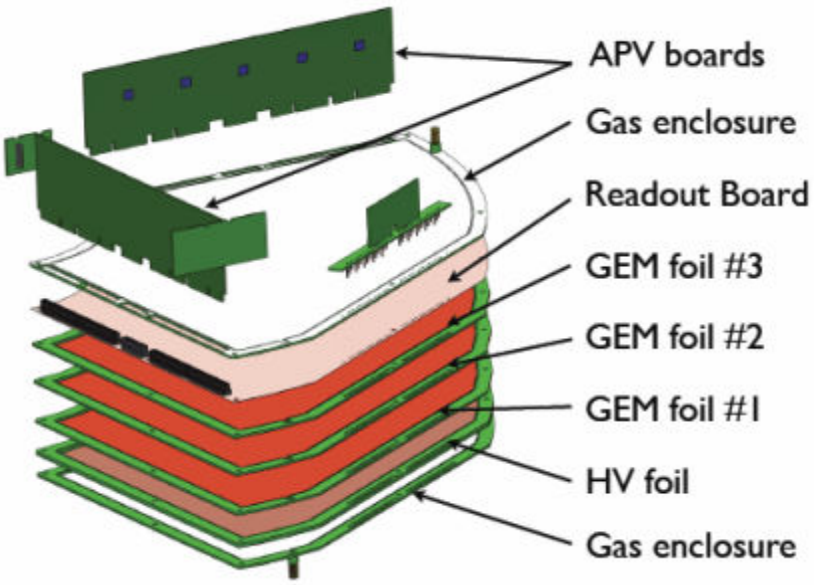
Found some minor differences between CERN and Tech-Etch GEMs, most of which are due to difference in image transfer technique.







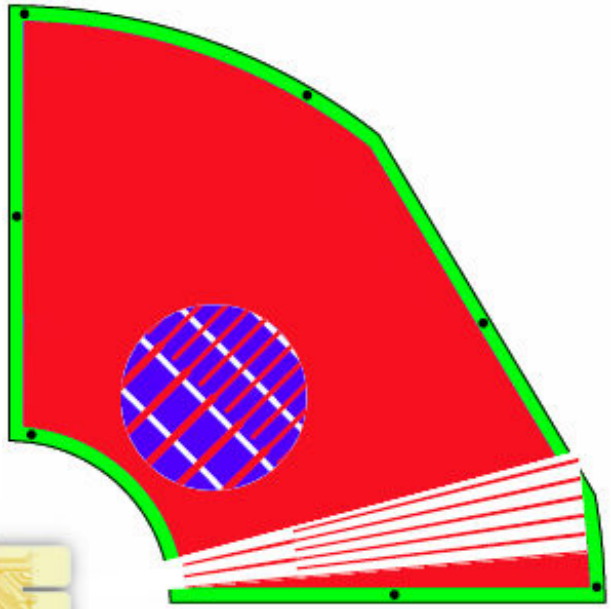


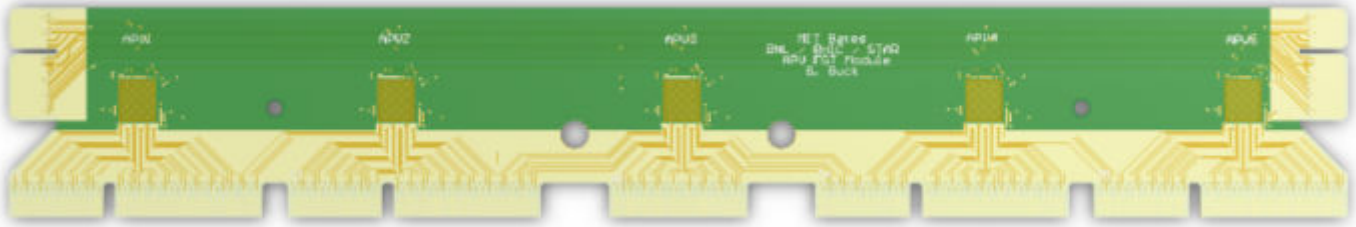


Stretching jig similar to Frascati design.

R-phi strip readout board, still figuring out the charge sharing between strips.

Plans to package APV25 chips to avoid interconnection issues.



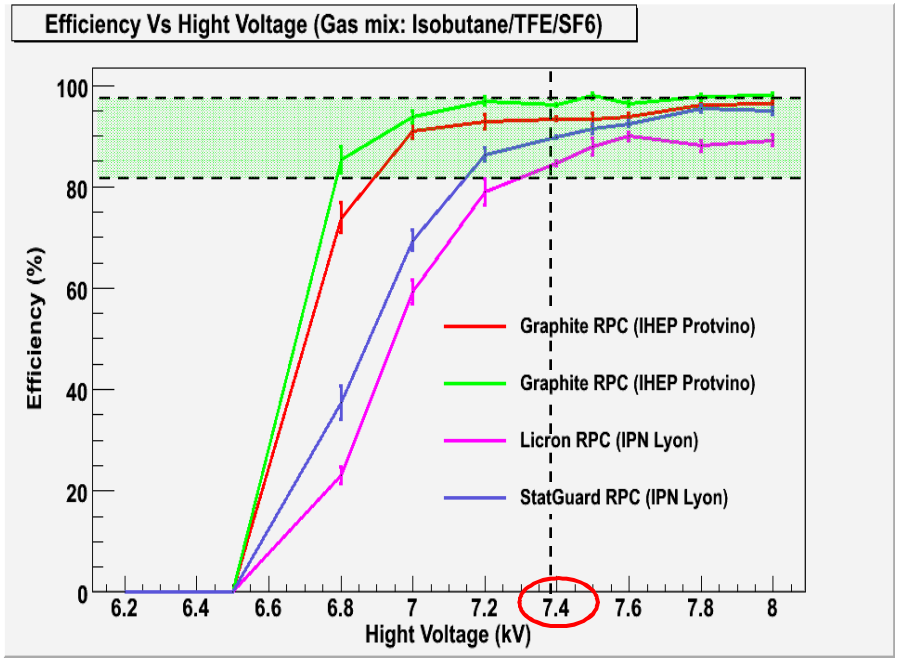


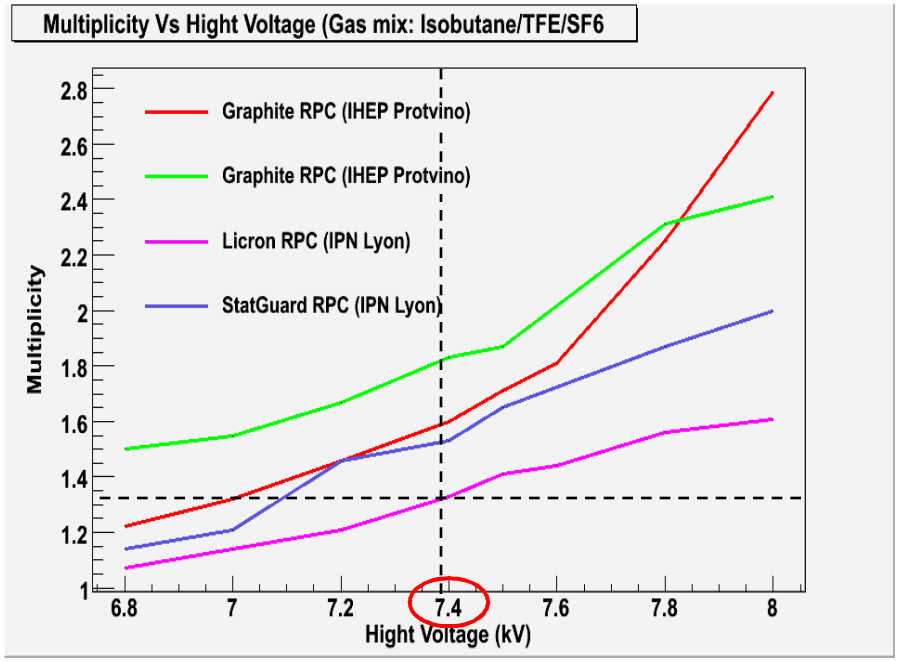
Resistive layers, grids and plates

Imad Laktineh

Resistive electrodes can be useful for charge spreading and quenching discharges.

Graphite 400 K Ω/□
Licron : > 20 M Ω/□
Statguard few M Ω/□





Colloidal graphite:
Suitable for silk-screen printing, and rather uniform.
Requires a heat cure at 180°C.