IFIN-HH, Hadron Physics Department infrastructure for ALICE TPC upgrade

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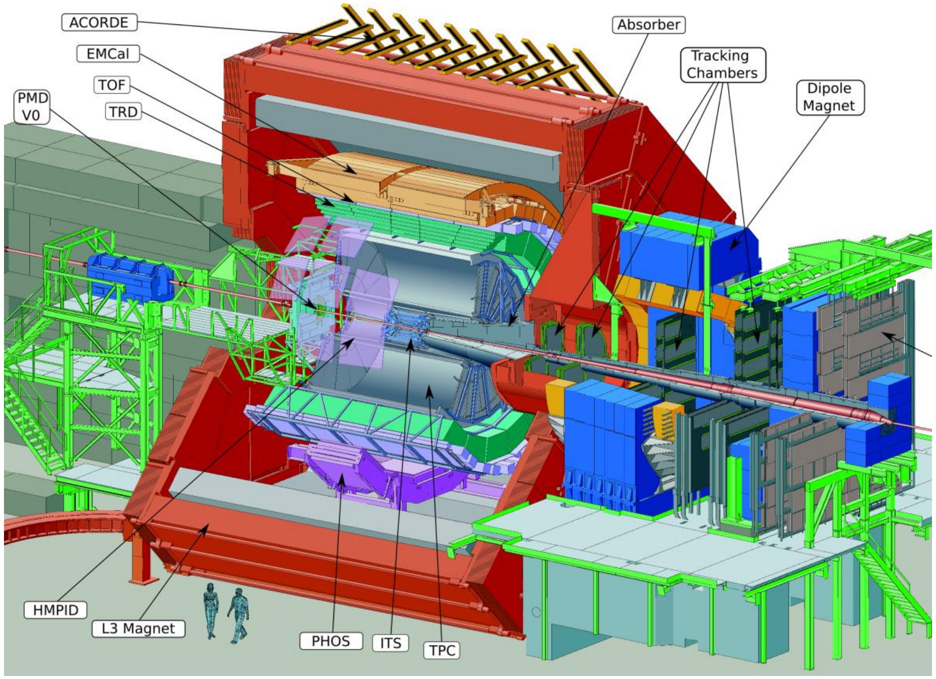
Gh. Caragheorgheopol, V. Catanescu, V. Duta, L. Prodan, A. Radu

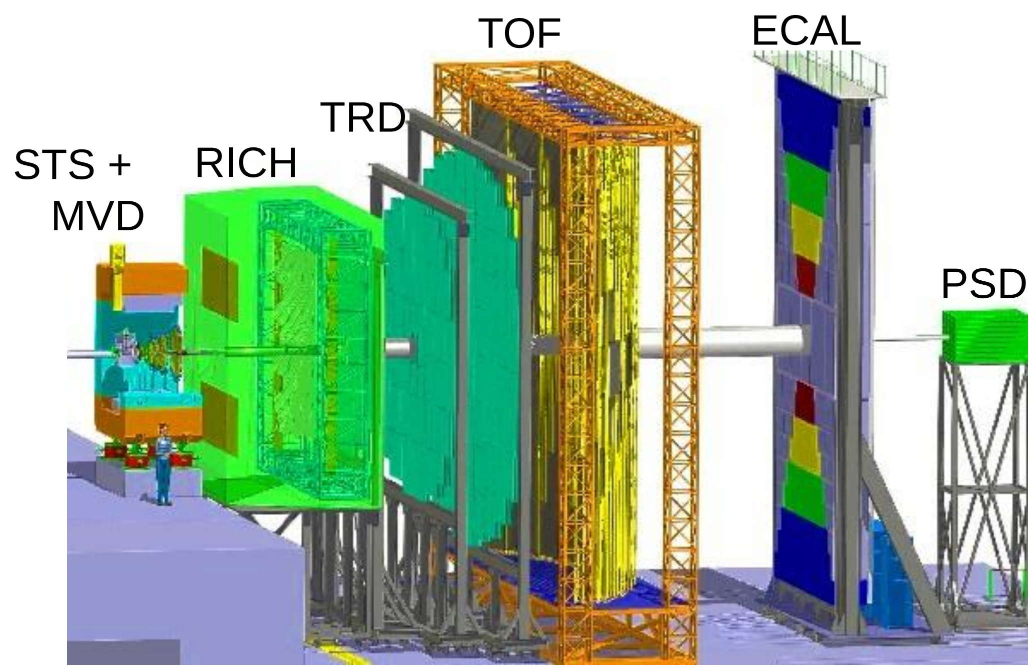
Major projects in which we are involved

ALICE experiment at LHC



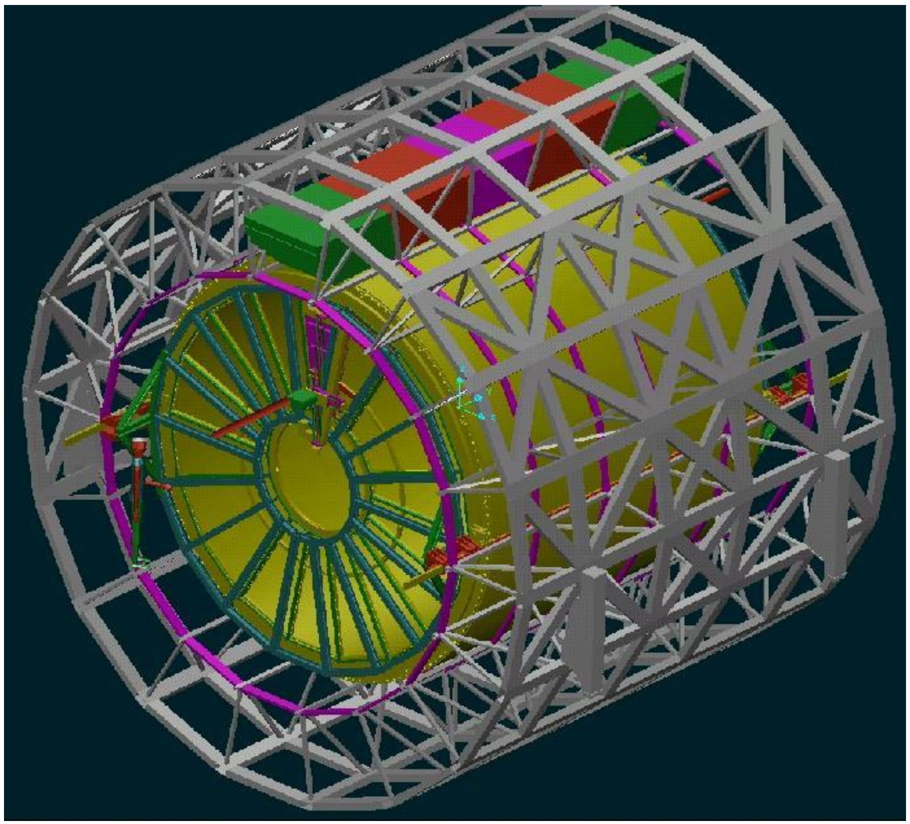
- ALICE-TRD prototype tests
- Design of the FEE chip (PASA)
- ALICE-TRD chamber construction
  & SMs installation
- Data analysis

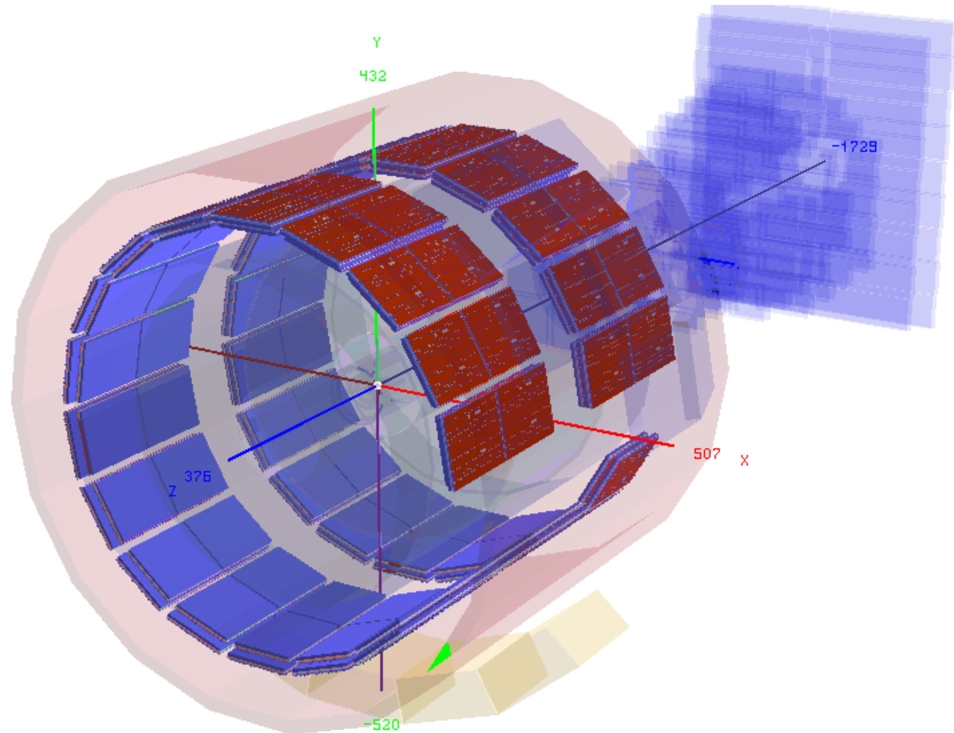
CBM experiment at FAIR



- R&D activities for:
  - CBM-TRD subsystem
  - CBM-TOF subsystem

Construction of 130 (24%) out of 540 ALICE-TRD chambers





Constructed chambers:

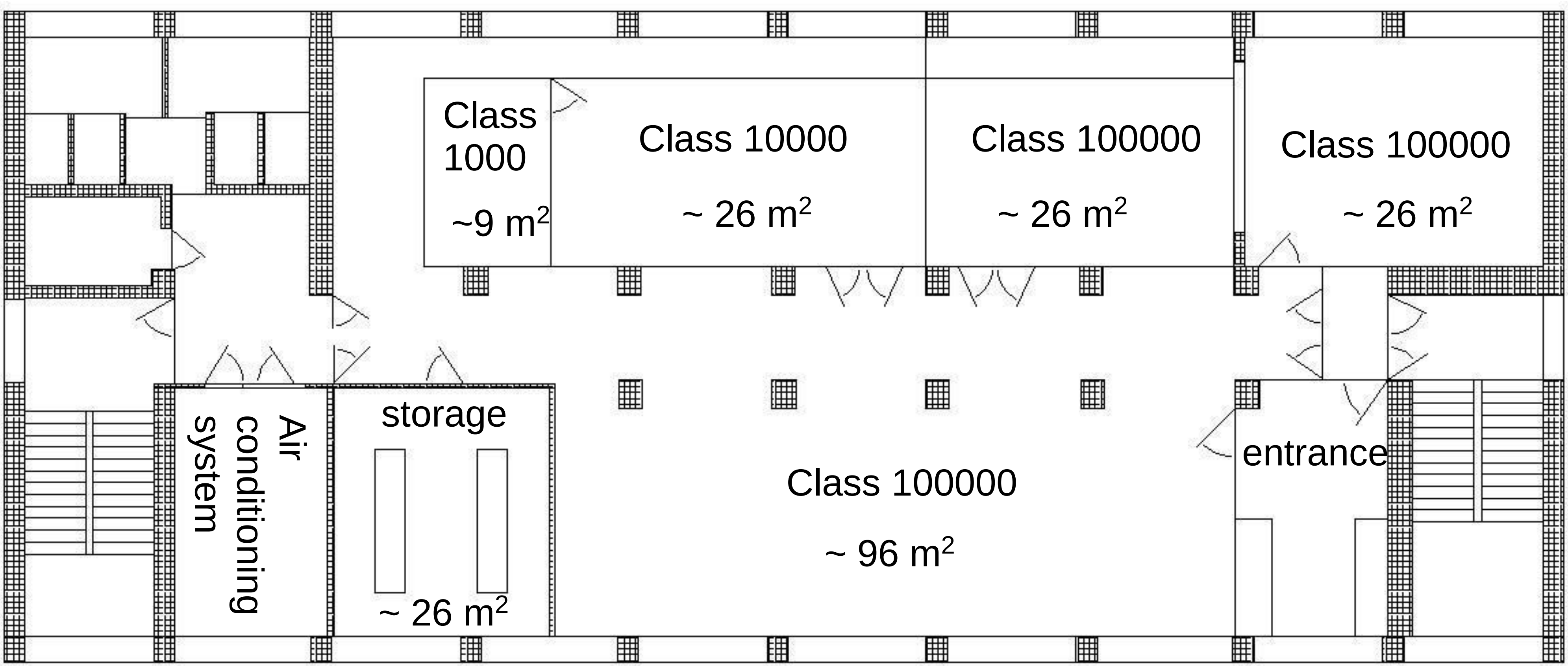
- 2 L1C0

- 1 L2C0

- 54 L2C1

- 73 L3C1

IFIN-HH, HPD Detector Laboratory Infrastructure



Five main clean rooms with 100000, 10000 and 1000 particles/ft^3 air purity,

control of temperature and humidity

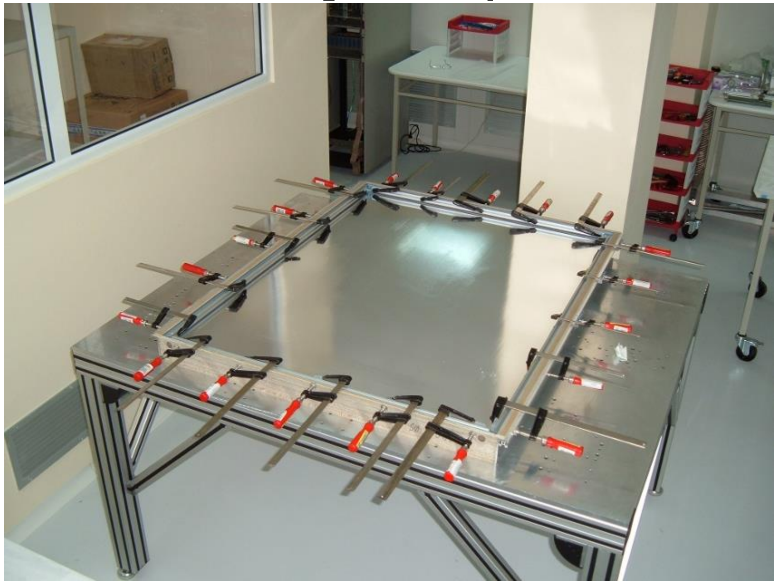
They were equipped during 2004 year for ALICE-TRD chamber construction & testing

Recently the existing infrastructure was extended

HPD Detector Laboratory Infrastructure

DFH Detector laboratory infrastructure used for the ALICE-TRD chamber construction

Frame assembly on the gluing table in 100000 particles/ft^3 room



Pad plane assembling on the vacuum table in 100000 particles/ft^3 room

Multiwire electrodes winding using winding machine

Soldering of the electrical connections of the multiwire electrodes in 10000 particles/ft^3 room

DFH Detector laboratory infrastructure used for the ALICE-TRD chamber testing

10000 particles/ft^3 room

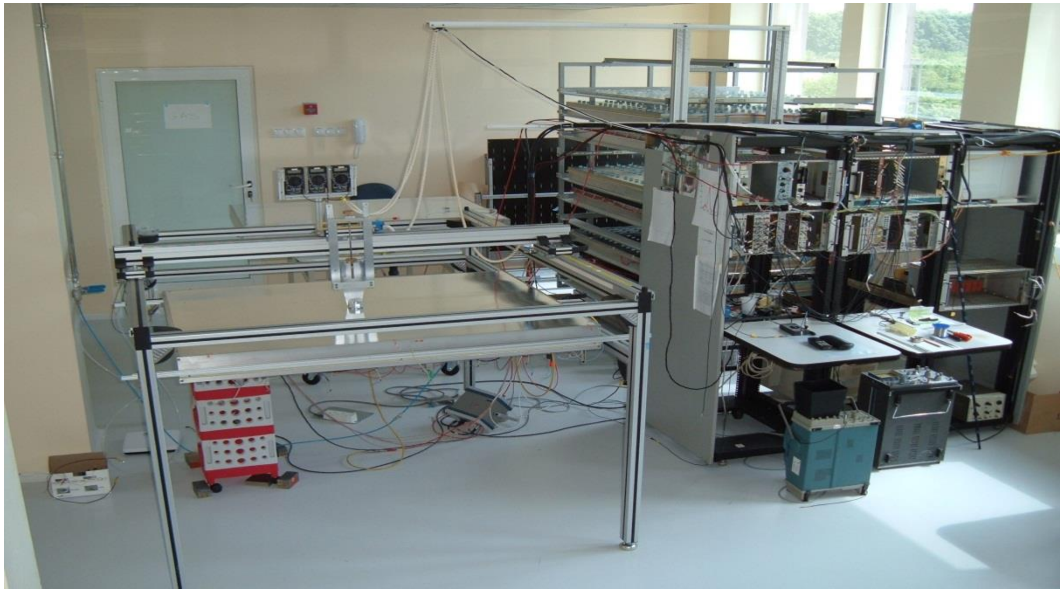
Wire tension measuring

Checks of electrical connections of multiwire electrodes

Gas leak rate test

Final tests: gain uniformity & energy resolution @^{55}Fe source

DFH Detector laboratory infrastructure used for the ALICE-TRD chamber testing

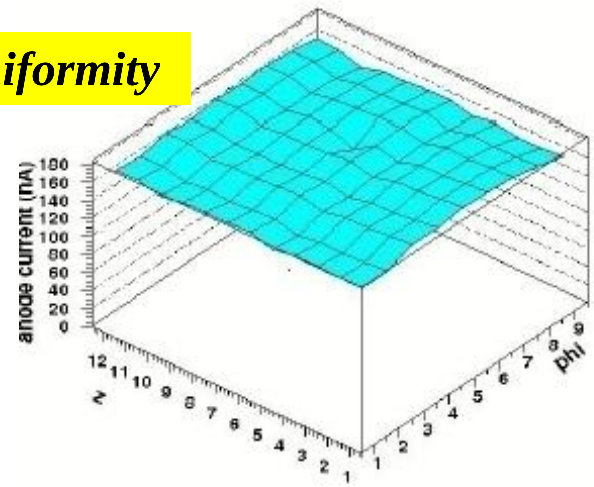


Dark current

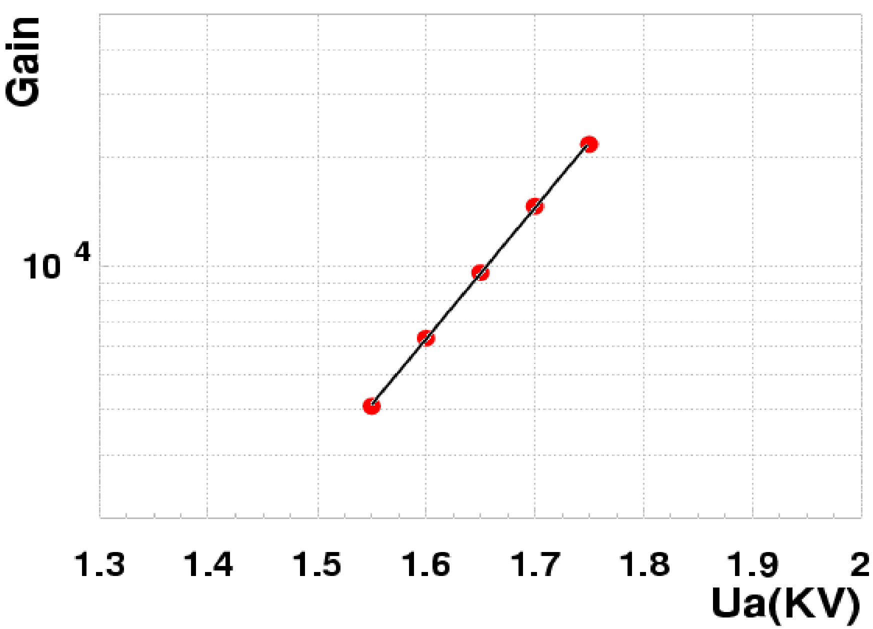
Oxygen content

Oxygen = 15 ppm
I^{dark} = 1-2 nA
70% Ar + 30% CO_2

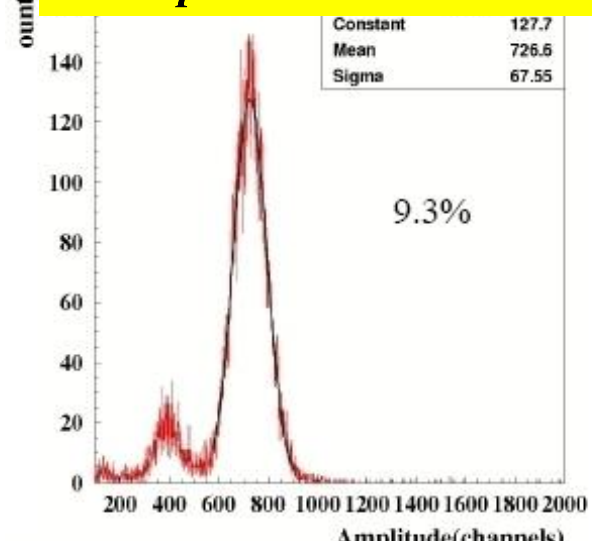
Gain uniformity



Absolute gas gain

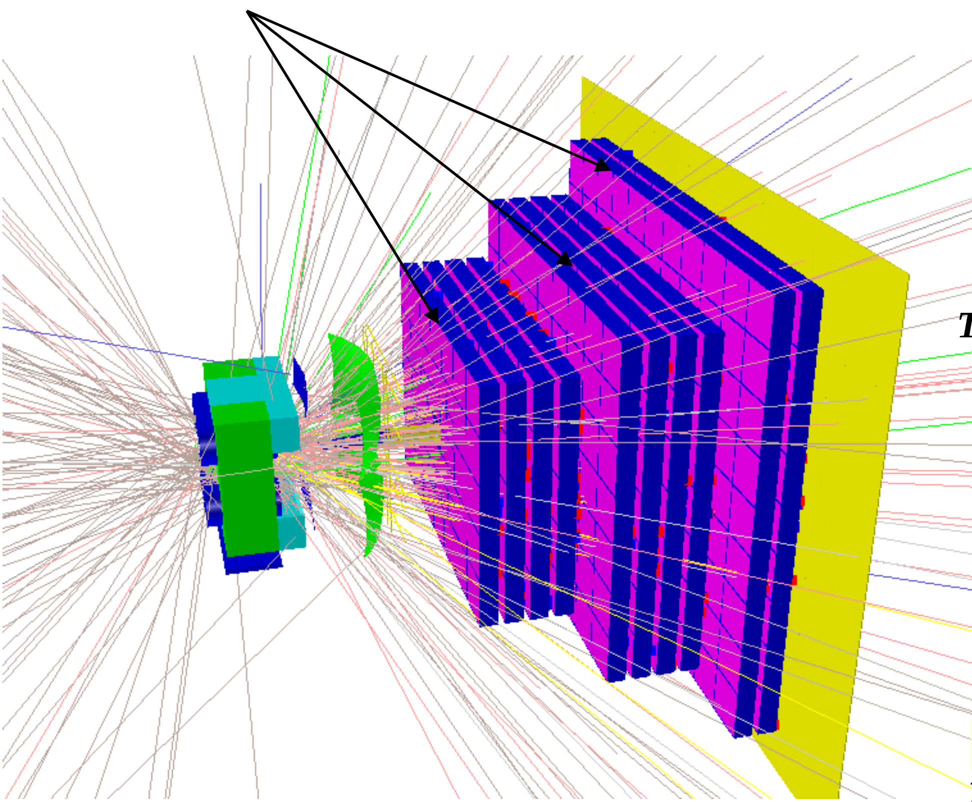


^{55}Fe spectral measurement

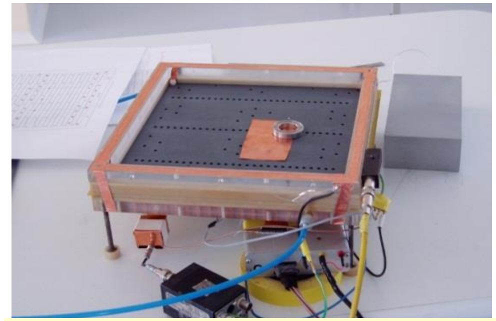


R&D activities for the innermost region of the CBM-TRD subsystem

CBM-TRD stations

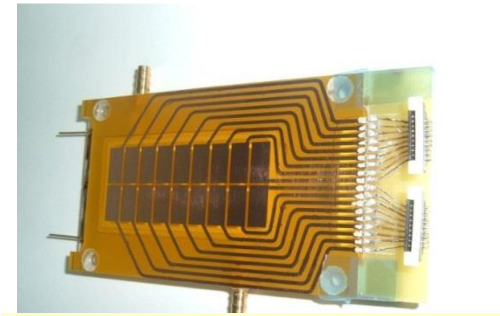


Single MWPC
2 x 3 mm amplification zone



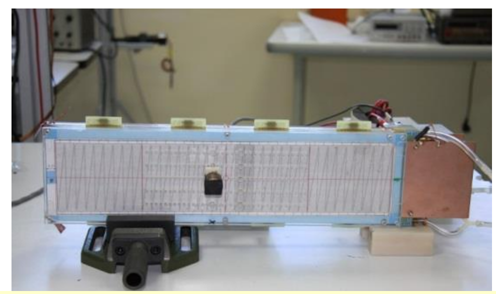
M.Petris et al., NIMA581(2007),406

Double MWPC
4 x 3 mm amplification zone



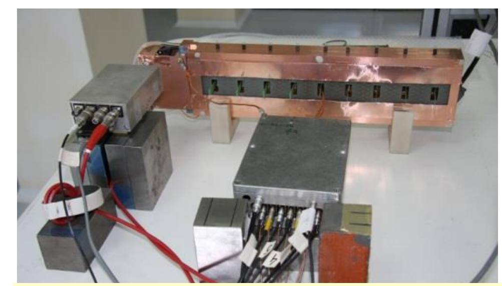
M.Petrovici et al., NIMA579(2007),961

Two-dimensional position sensitive double MWPC (4 x 3 mm & 4 x 4 mm)



M.Petris et al., NIMA 714(2013), 17

Two-dimensional position sensitive single MWPC + drift zone (2 x 4 mm + 4 mm)

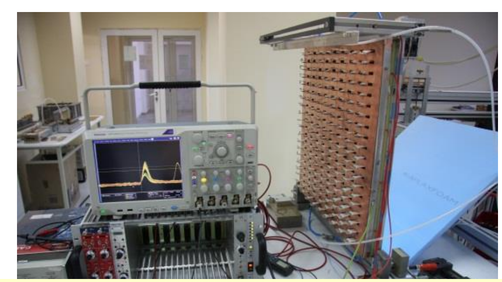


M.Petris et al., Submitted to NIMA (VCI2013 proceedings)

High granularity two-dimensional position sensitive single MWPC + drift zone

M.Tarzila et al., EUNPC2012 Conference

Real size TRD prototype



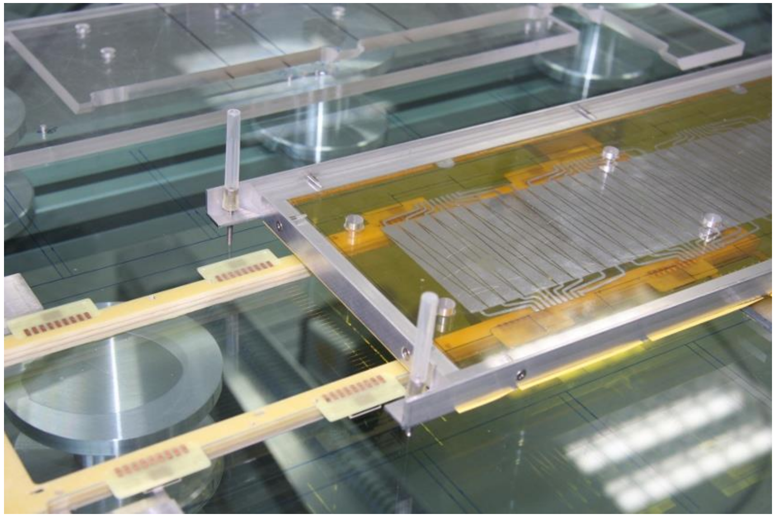
M.Petris et al., VCI2013 Conference

Highly granular and fast detectors which can stand the high rate environment
up to 10^5 part/cm^2 ·sec

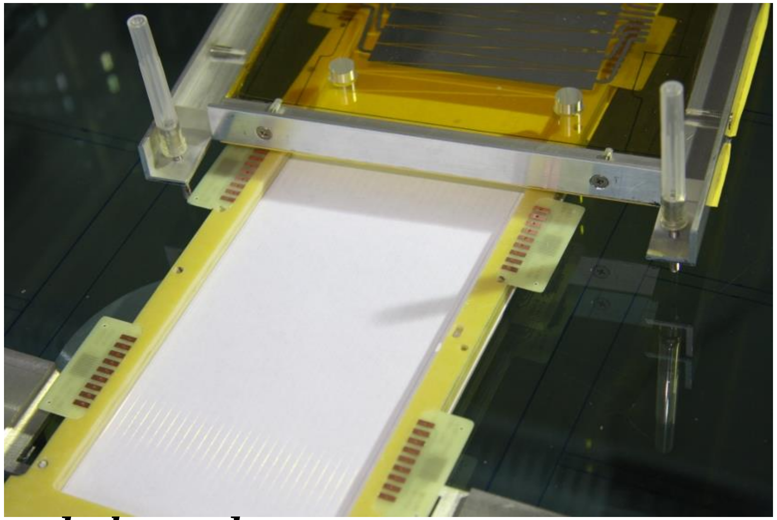
DFH Detector laboratory infrastructure used for CBM-TRD R&D

Some construction details of the two-dimensional position sensitive double MWPC TRD prototype using 10000 particles/ft^3 clean room

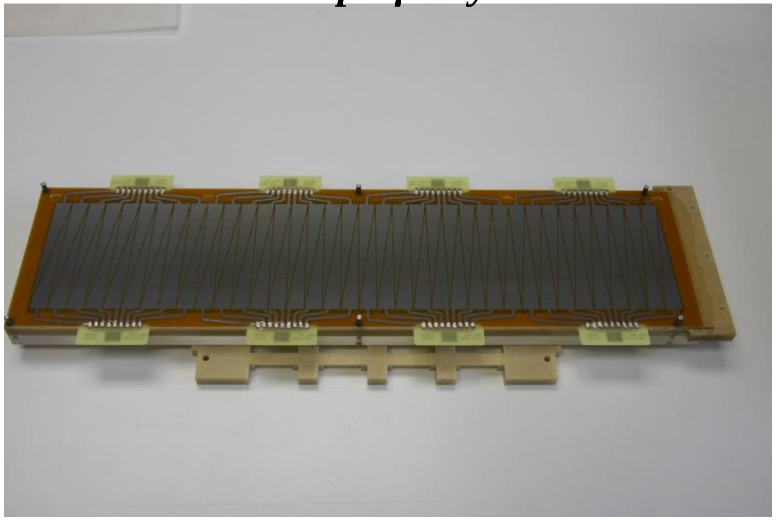
Stretching of the double-sided readout electrode made from an aluminized kapton foil



Gluing of the double-sided readout electrode



TRD chamber before to be closed: the readout electrode is perfectly stretched

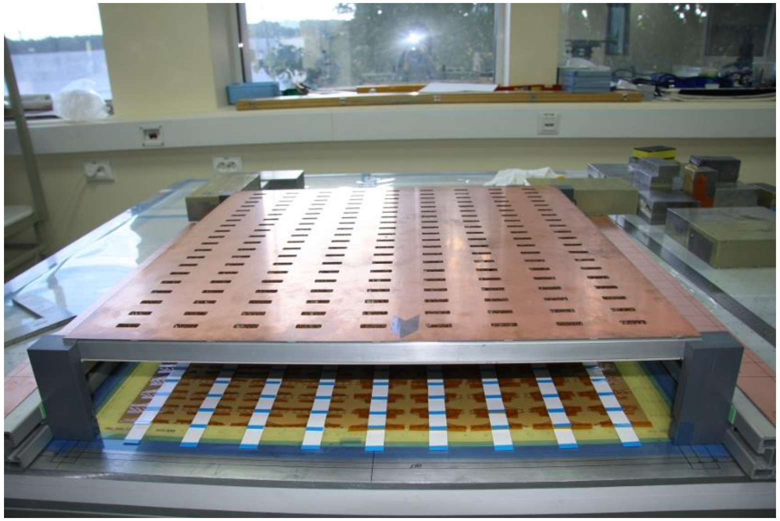


DFH Detector laboratory infrastructure used for CBM-TRD R&D

Some construction details of the real size prototype

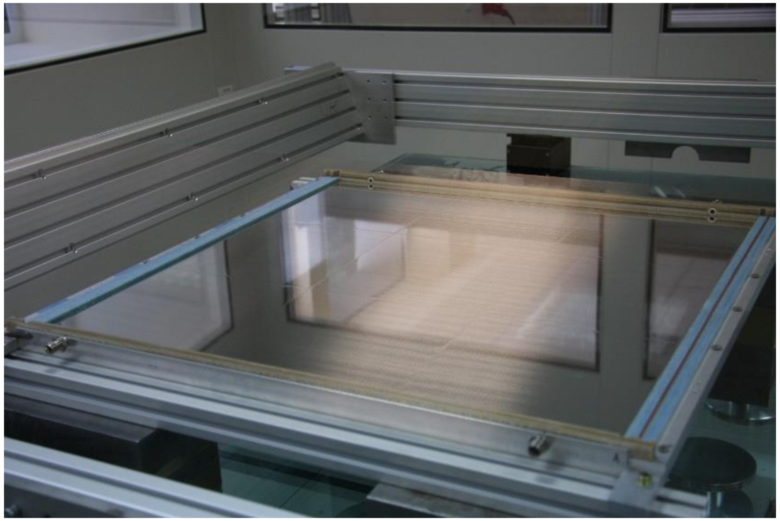
Soldering the flat cables on the back side of the readout electrode using pick and place machine

Assembling of the readout electrode using the vacuum table



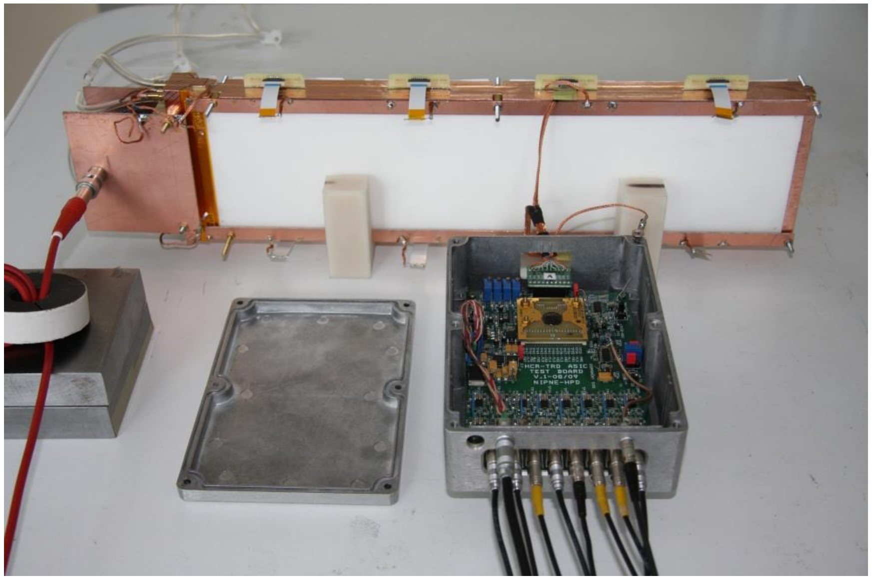
Assembling of the drift electrode using the gluing table

Gluing & soldering of the multiwire electrodes in 10000 particles/ft^3 clean room

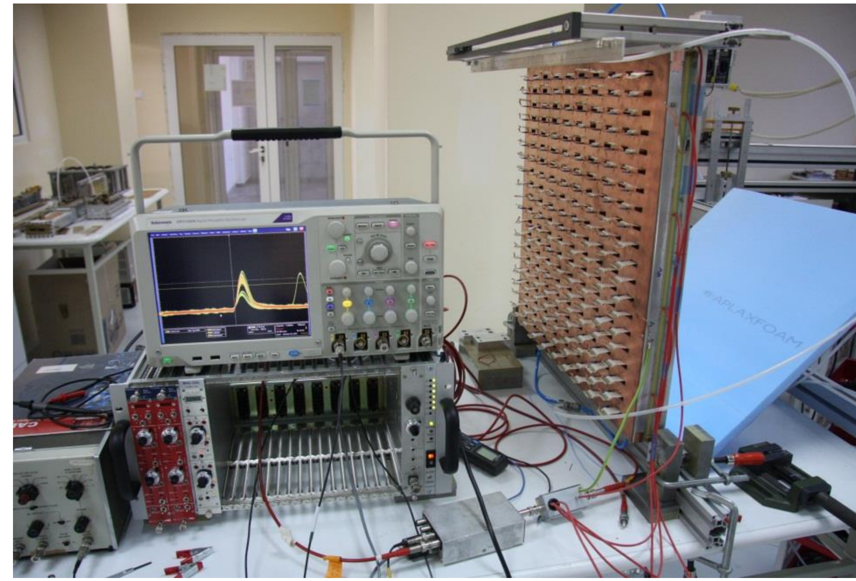


Laboratory ^{55}Fe source tests of the CBM-TRD prototypes

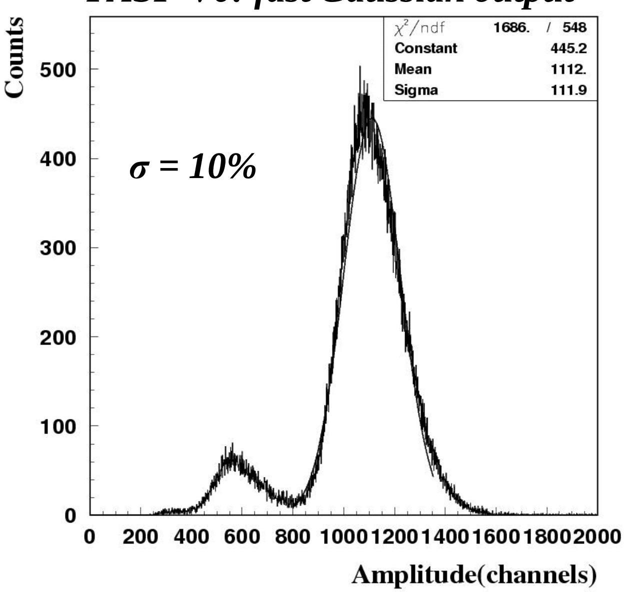
Preliminary measurements in the lab



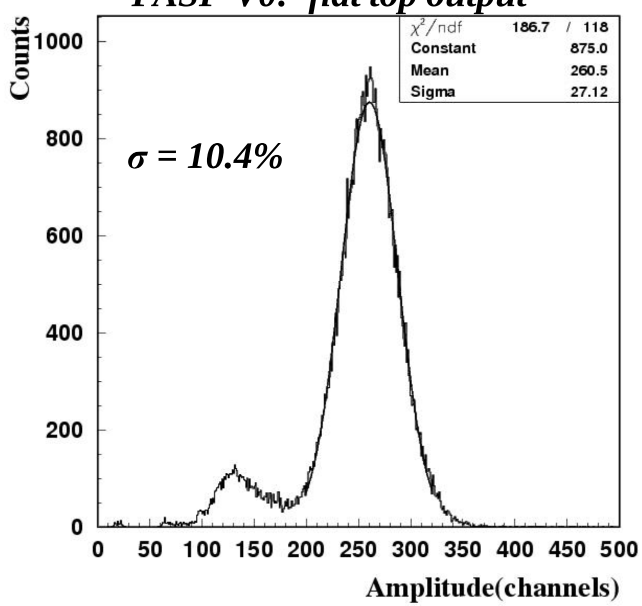
First signals from ^{55}Fe



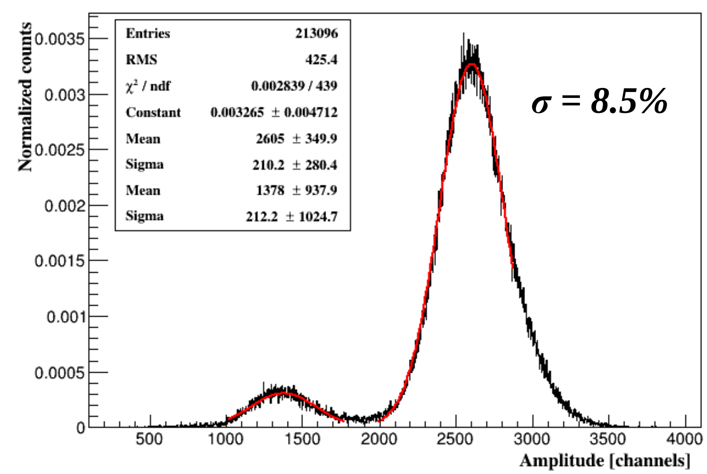
DSTRD-V2 Pad signal
FASP-V0: fast Gaussian output



DSTRD-V2 Pad signal
FASP-V0: flat top output



TRD2012 Pad signal
FASP-V0: flat top output



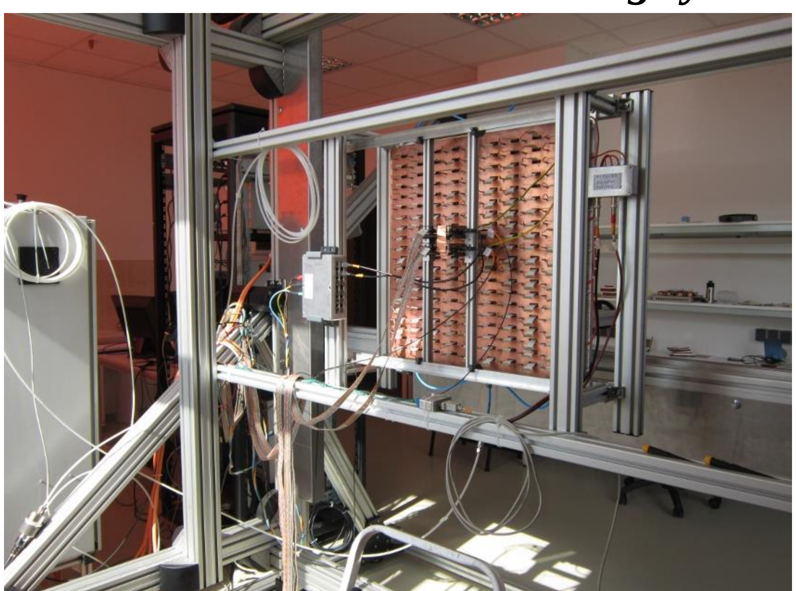
New detector laboratory for testing the TRD prototypes

Laboratory infrastructure

Laboratory infrastructure

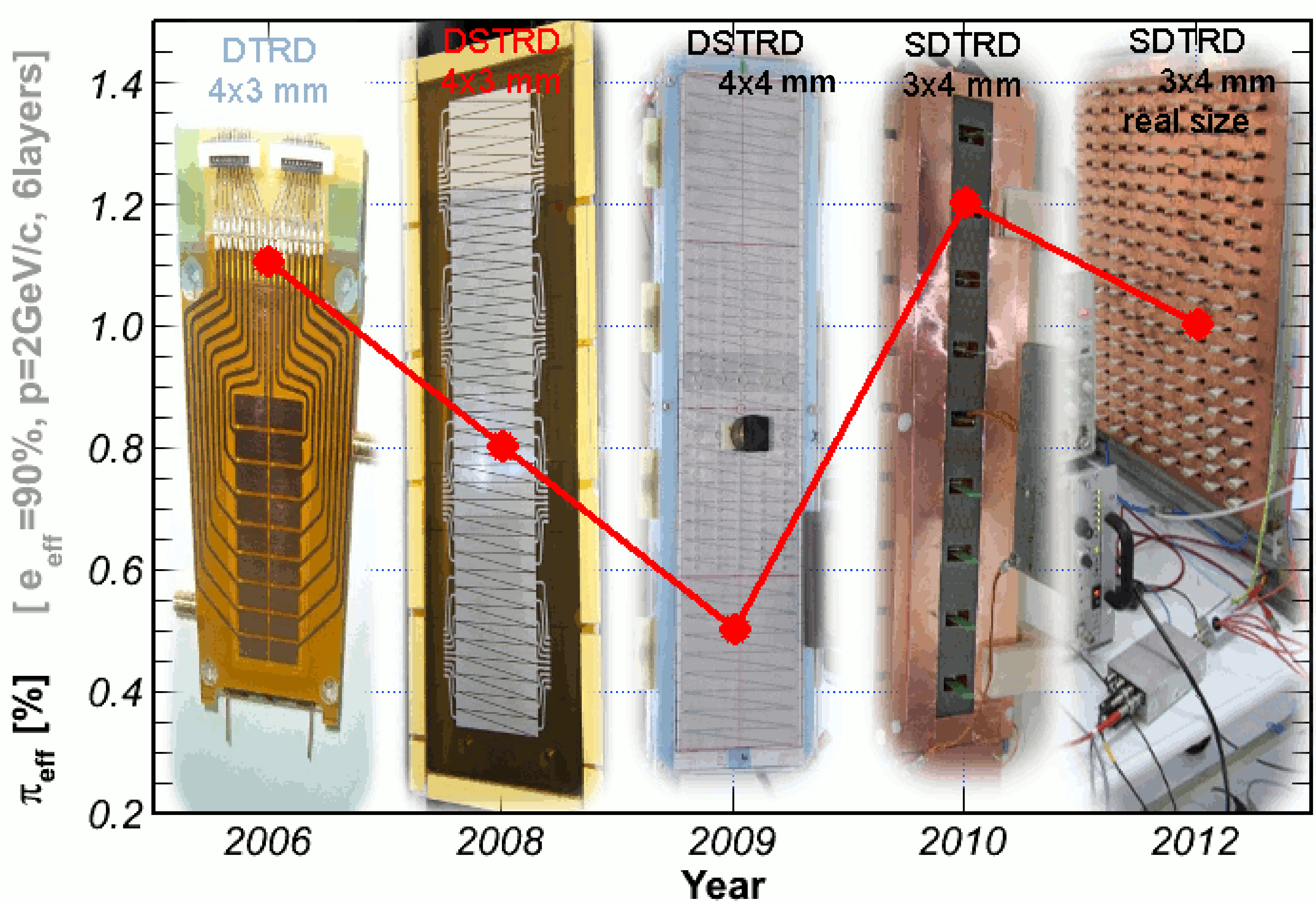
- ***gas system***
- ***oxygen meter***
- ***two-dimensional scanning system***
- ***mini X-ray tube***
- ***electronic modules***
- ***MBS acquisition system based on a RIO4 processor***

Real size TRD prototype installed on the two-dimensional scanning system



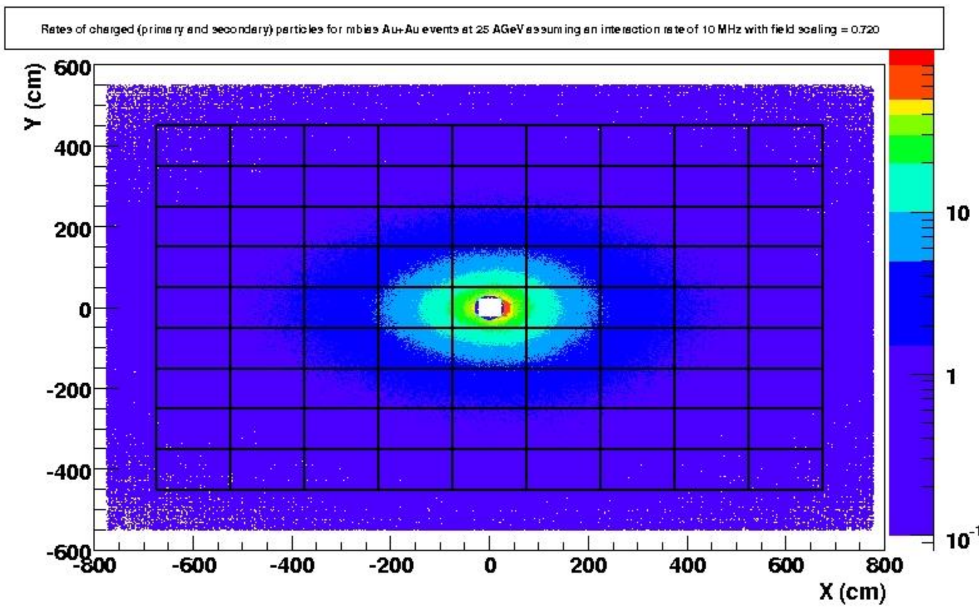
Taking data

CBM-TRD prototypes: pion misidentification performance for 6 layers

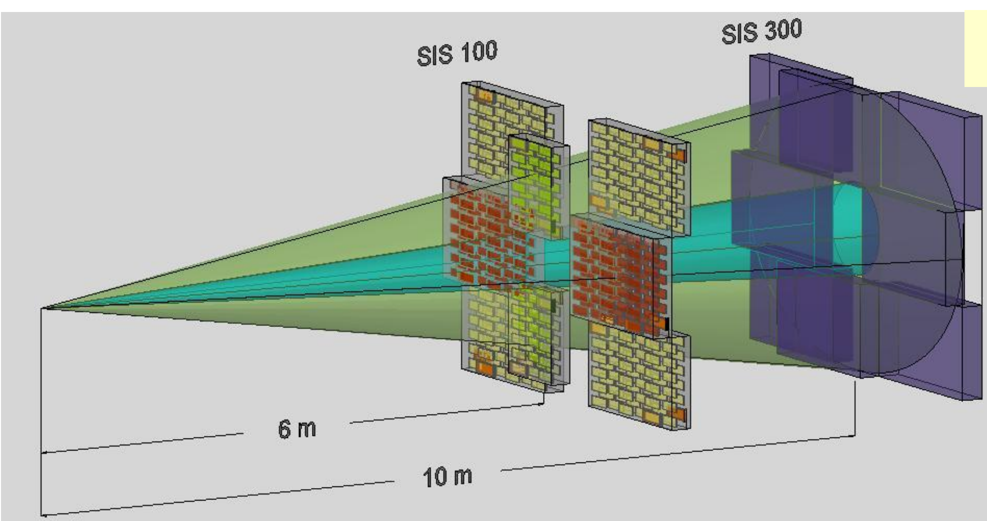


R&D activities for the innermost region of the CBM-TOF subsystem

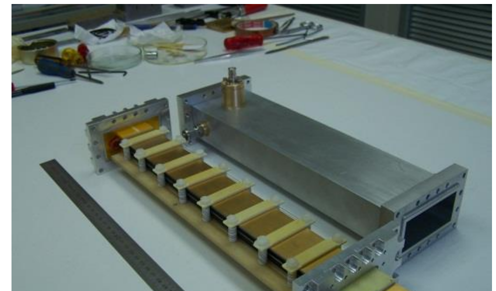
Expected flux of charged particles at the TOF wall at 10 m distance from the target



Inner zone (50 – 200 mrad) of the TOF wall



Single-ended – strip readout Pestov glass RPC prototype



M.Petris et al., Rom. Journ. Phys. 56(2011),349

Differential – strip readout Pestov glass RPC prototype

D.Bartos et al., Proceedings 2008 IEEE Nuclear Science Symposium (2009), 1933

High granularity, differential RPC prototype

M.Petris et al., NIMA661(2012), S129

High granularity, symmetrical, differential RPC prototype

M.Petrovici et al., JINST 7 P11003(2012)

High counting rate differential RPC prototype

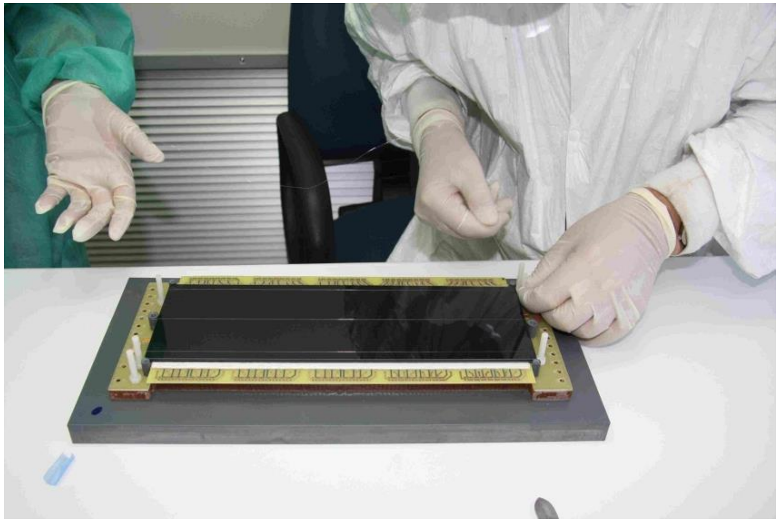
M.Petrovici et al., JINST 7 P11003(2012

RPC cell staggered architecture for CBM-TOF inner zone

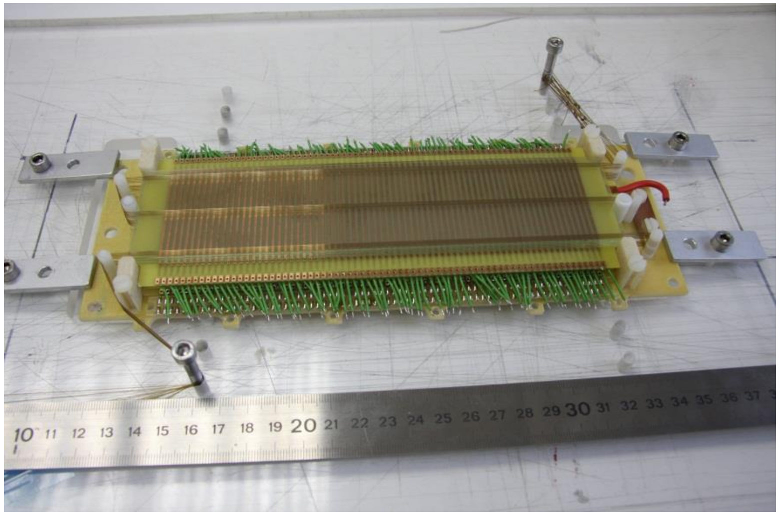
M.Petris et al., CBM Meeting, GSI 2013

DFH Detector laboratory infrastructure used for CBM-TOF R&D (1000 particles/ft^3 clean room)

RPC cell construction using low resistivity glass



Stretching the fishing line (spacer)

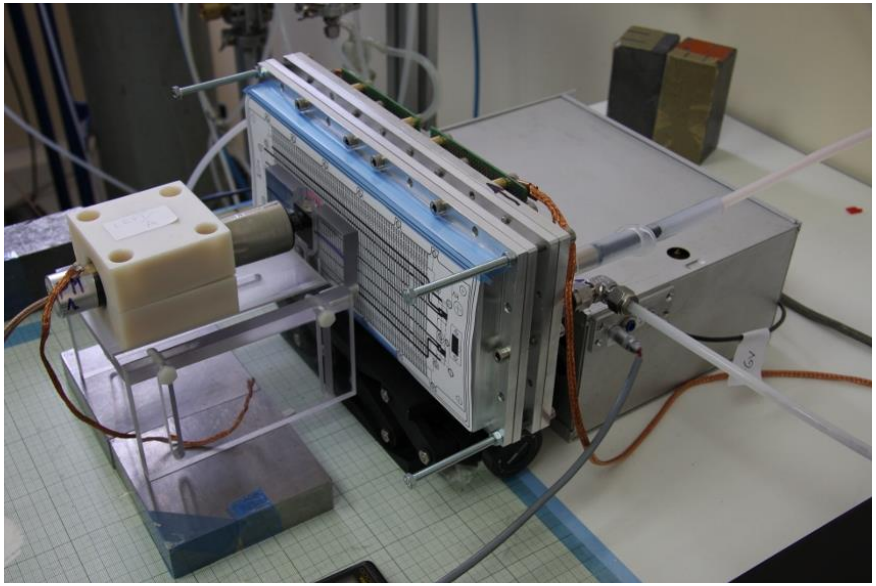


Final mounting of an RPC cell

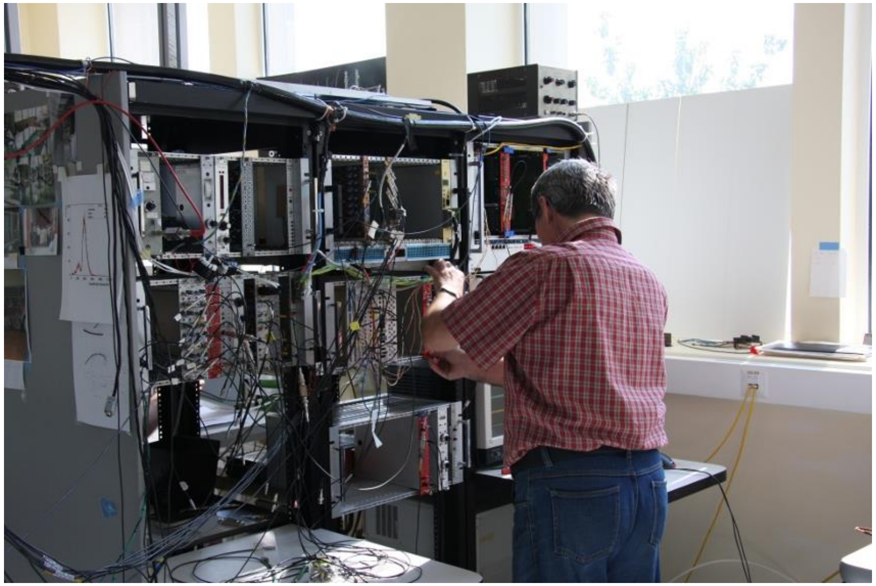
Cable connection for the 4 RPC cells prototype

Laboratory ^{60}Co source tests of the CBM-TOF RPC prototypes

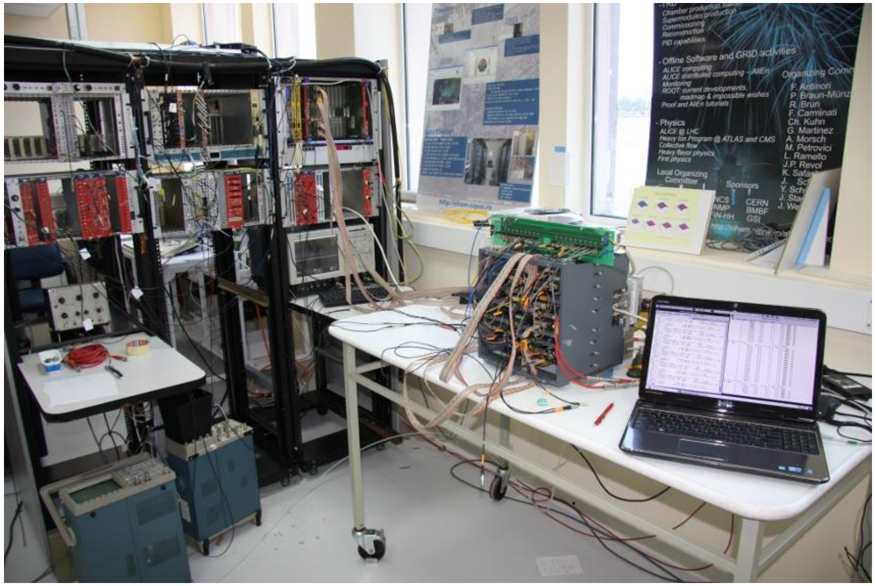
Experimental setup for ^{60} Co source test



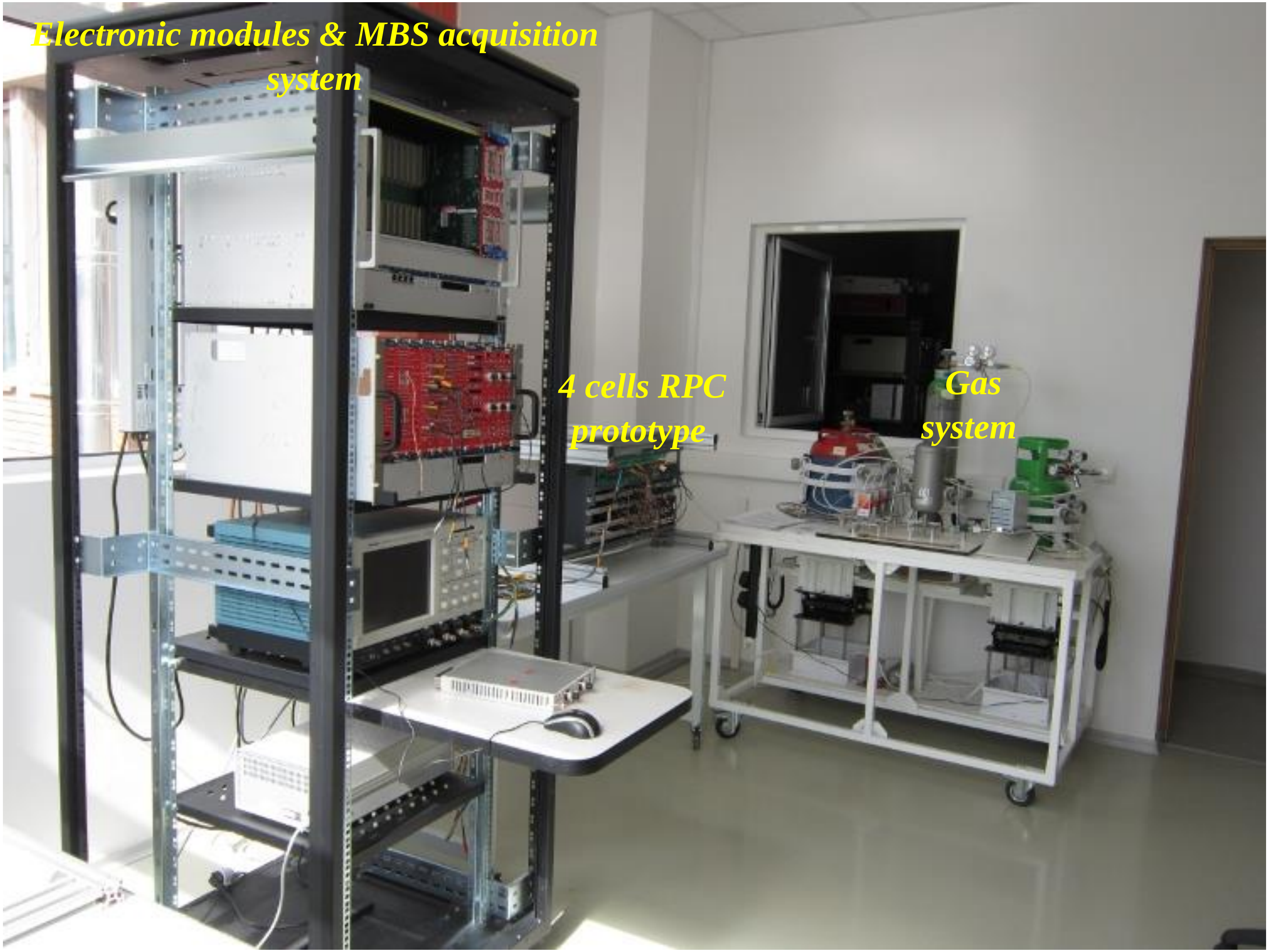
Setting the electronic chain



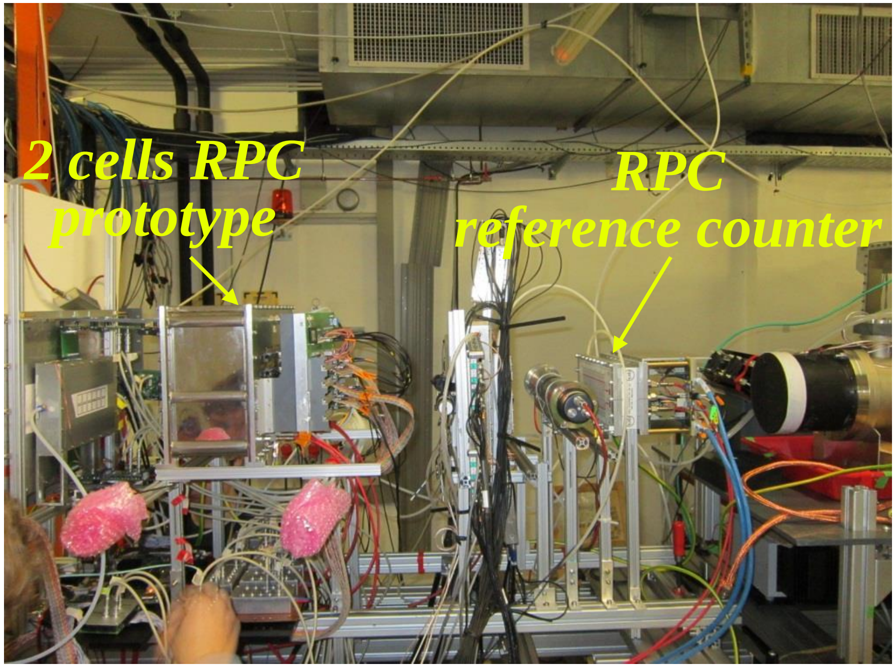
Acquisition system for ^{60} Co source test



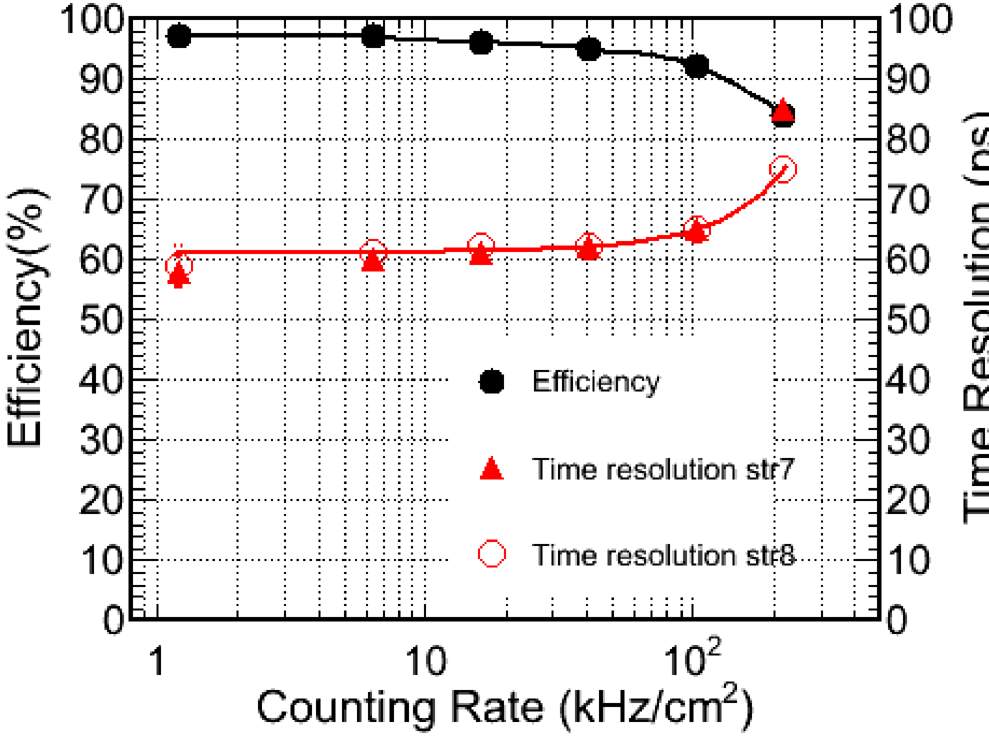
New detector laboratory for testing RPC detectors



CBM-RPC prototypes performance

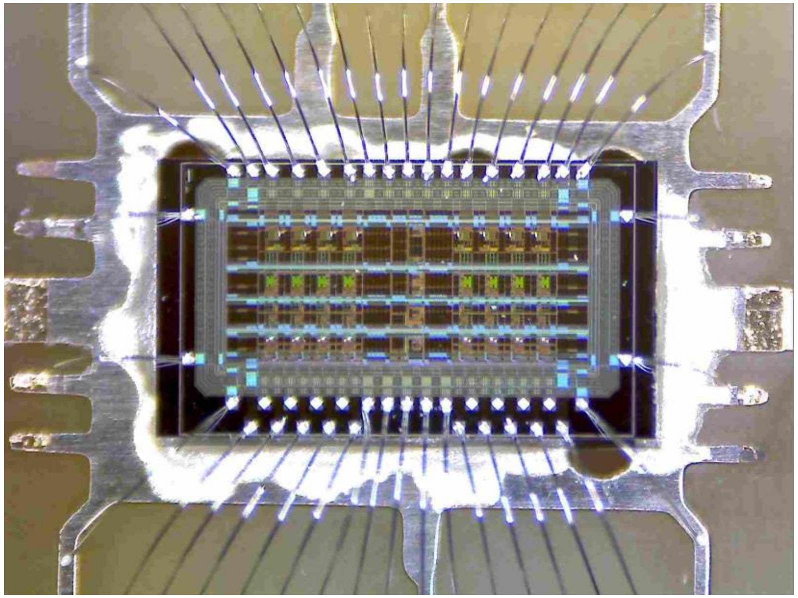


Efficiency & time resolution as a function of counting rate

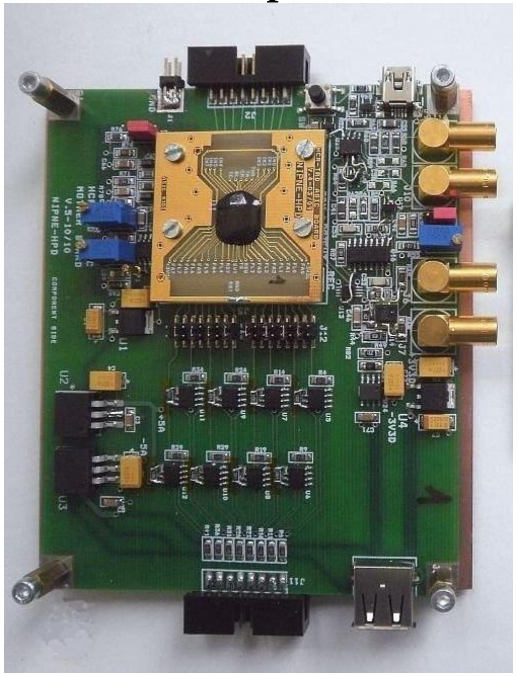


FEE R&D activities for the CBM-TRD

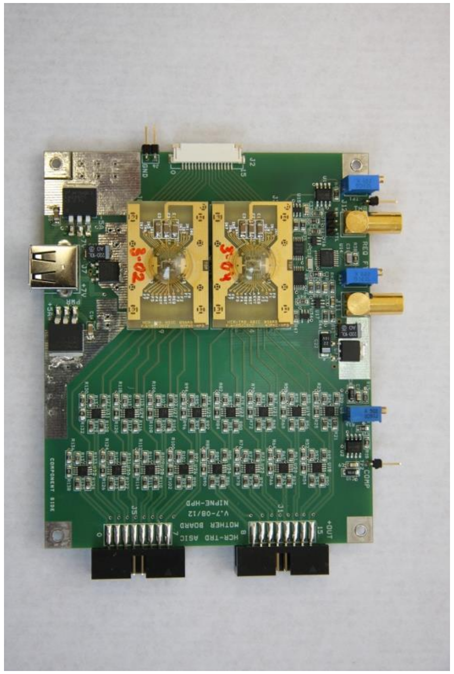
FASP chip bonded on a in house designed motherboard



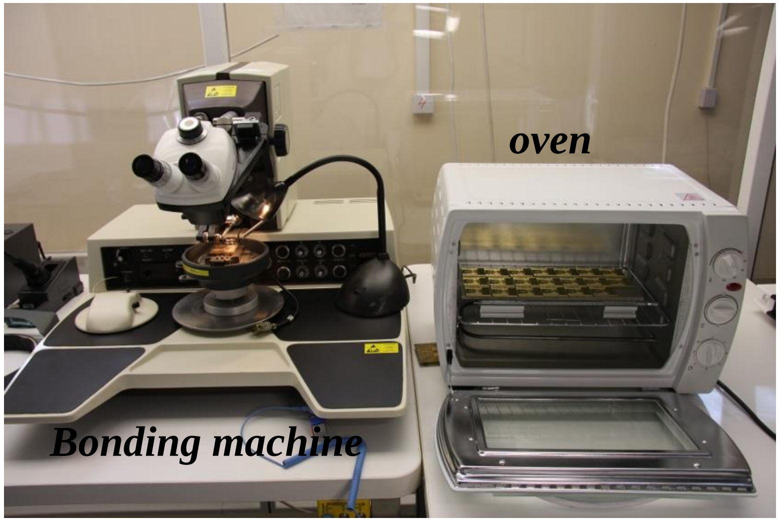
In house designed front end board (FEB) with a single FASP chip



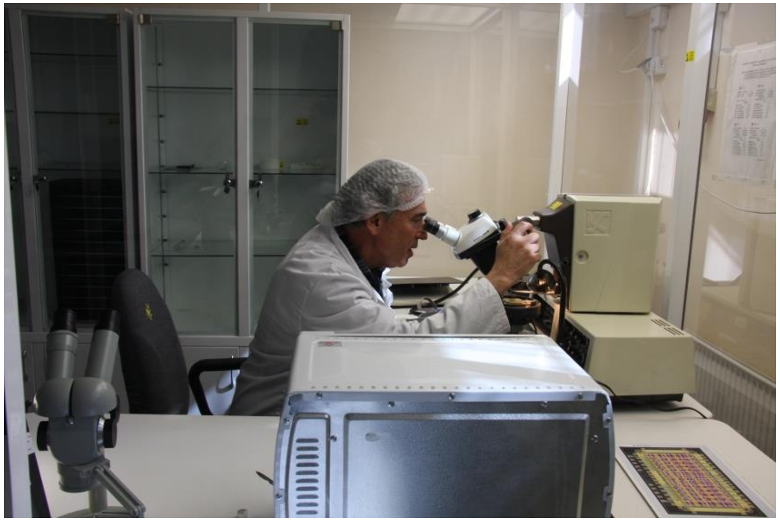
In house designed front end board (FEB) with two FASP chips



Bonding laboratory infrastructure



Bonding a chip

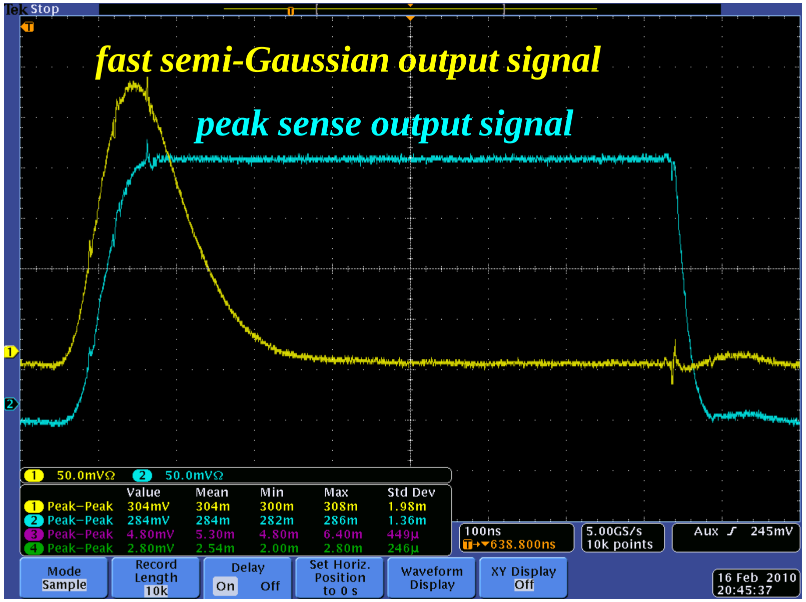


Fast Analog Signal Processor - FASP

FASP-VO

- *Designed in AMS CMOS 0.35 μm technology*
- *Gain: 6.2 mV/fC*
- *Selectable shaping time (ST): 20 ns and 40 ns*
- *Noise (C_{in} = 25 pF): 980 e^-@40 ns ST and 1170 e^-@20 ns ST*
- *Power consumption = 11 mW/channel*
- *Positive input polarity*
- *Variable threshold*
- *Self trigger capability*
- *8 input/output channels*

Analog channel outputs



Optimization of FASP characteristics for better performance with SSTRD architecture

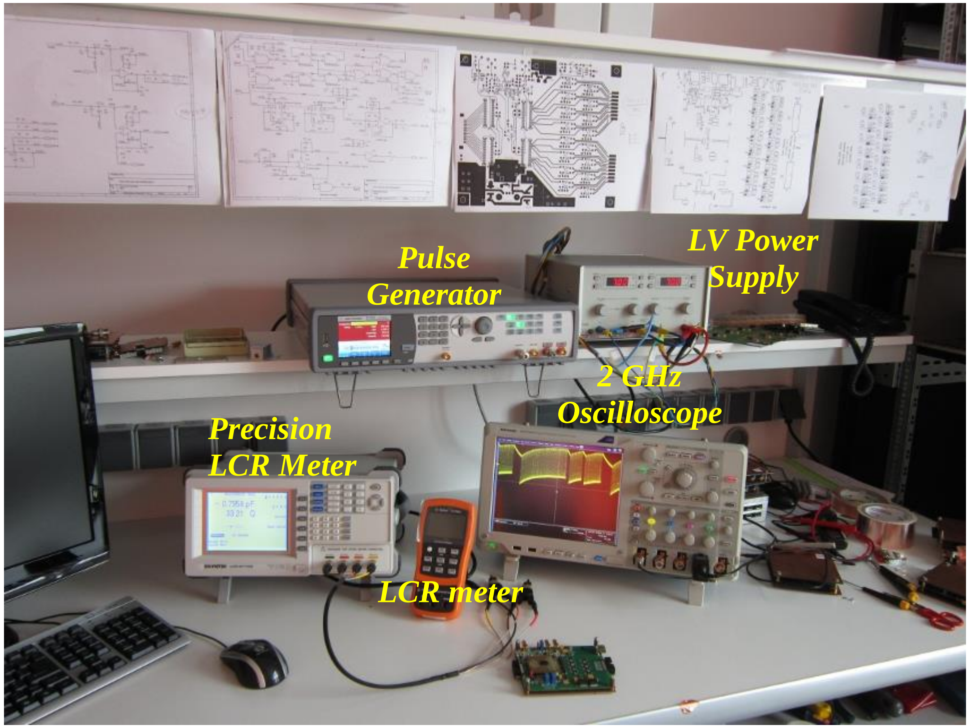
FASP-V1 – currently designing

- *Increased shaping time of 100 ns*
- *Pairing of the triangular pad signals inside the ASIC chip;*
  (a version of FASP-V1 will be designed without pairing)
- *16 input/output channels*
- *Input signal polarity switch*
- *Chip submission in the second part of the year*

New electronic laboratories

Laboratory infrastructure

Test and characterization of the FEE boards



Other recently acquired equipment

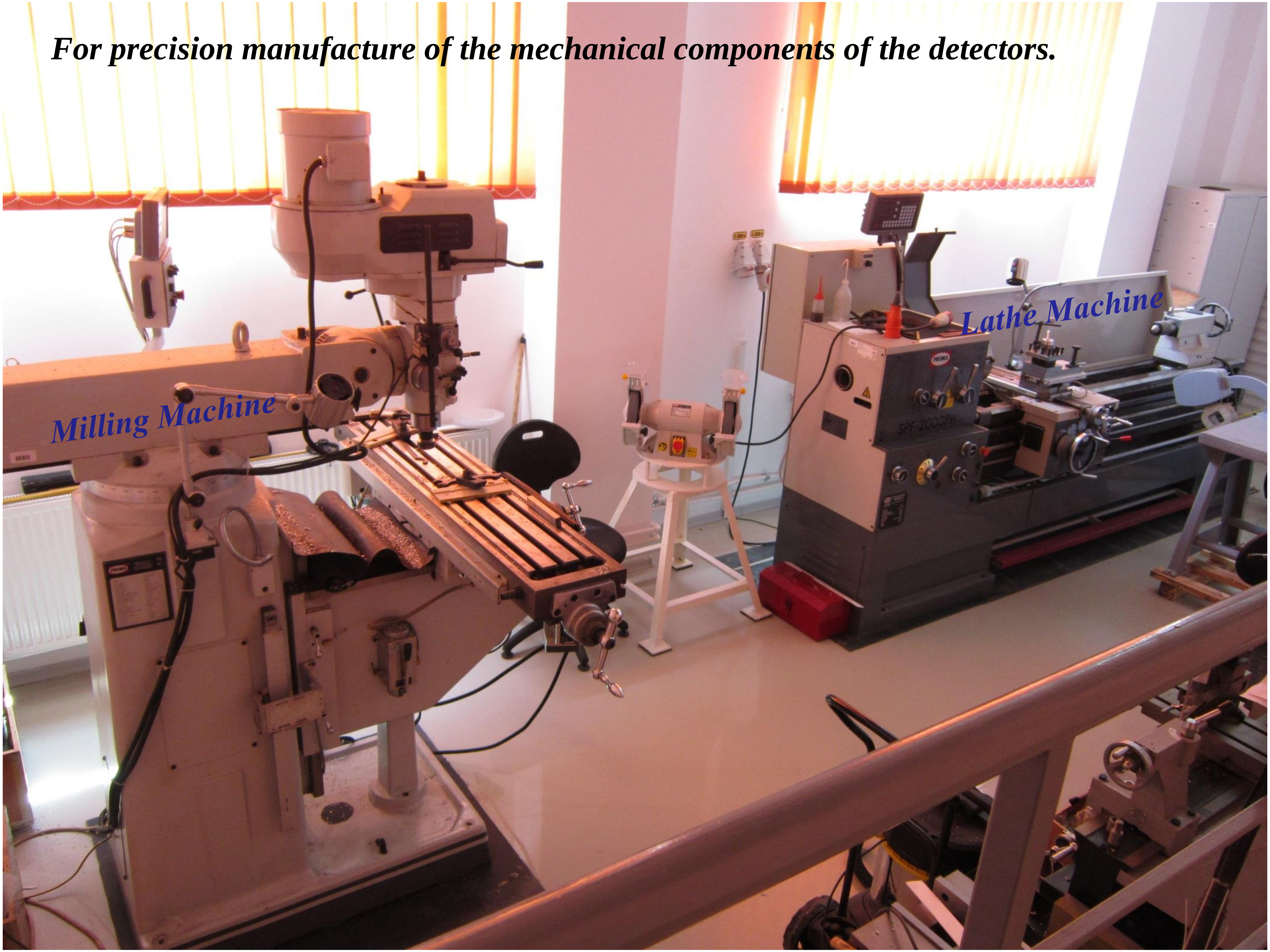
Unitron Z850 Stereo Microscope connected with a digital camera

Chemical hood

Oven

Optical table

Mechanical Workshop



Conclusions

We have the suitable:

- equipment

- man power

- experience

for participating to the construction of the GEM chambers for ALICE-TPC upgrading.

We would like to have a visible contribution to the ALICE-TPC upgrade.

For more information see our web page: http://niham.nipne.ro