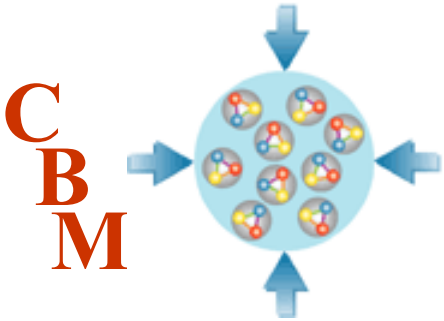
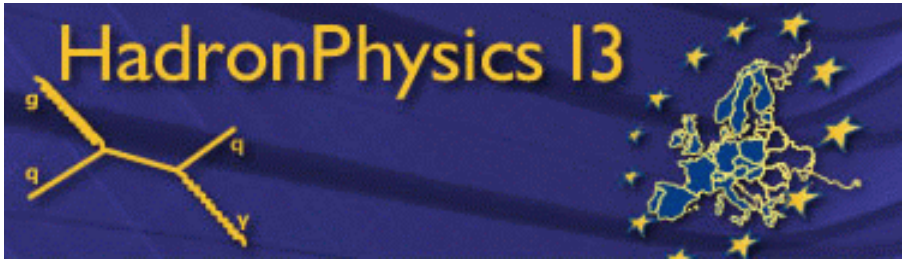




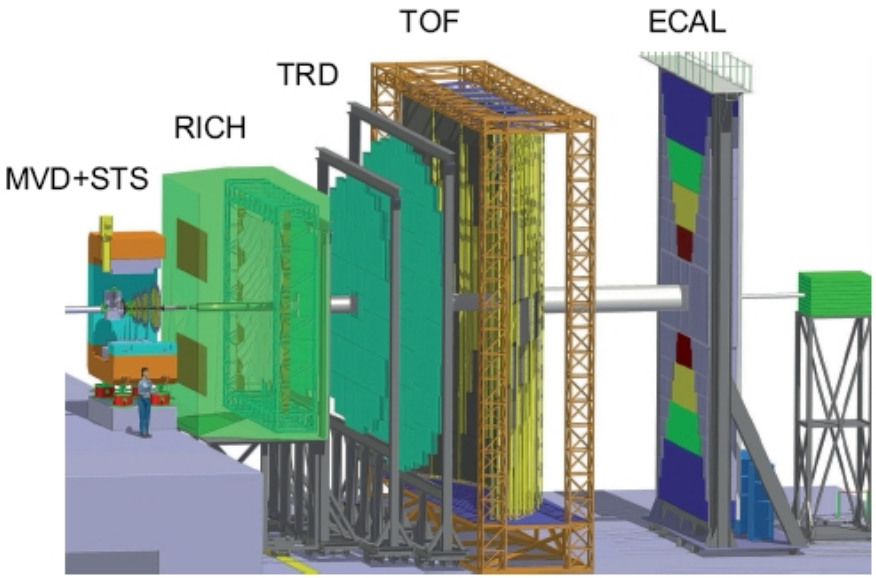
Proiectarea si realizarea unui detector RPC pentru rate mari de numarare, cu structura diferentiala multistrip

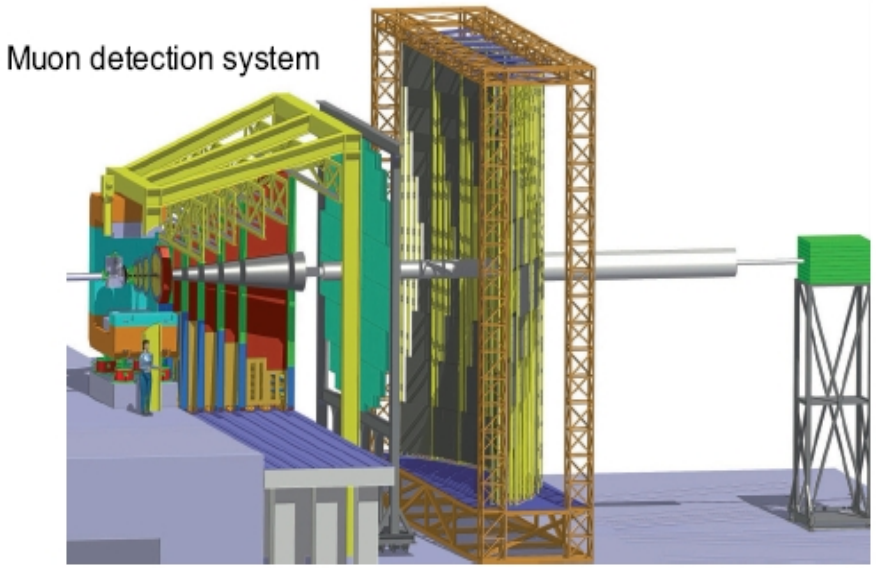
PROIECT FIZICA HADRONICA2

Program CAPACITATI – Modulul III/PC7

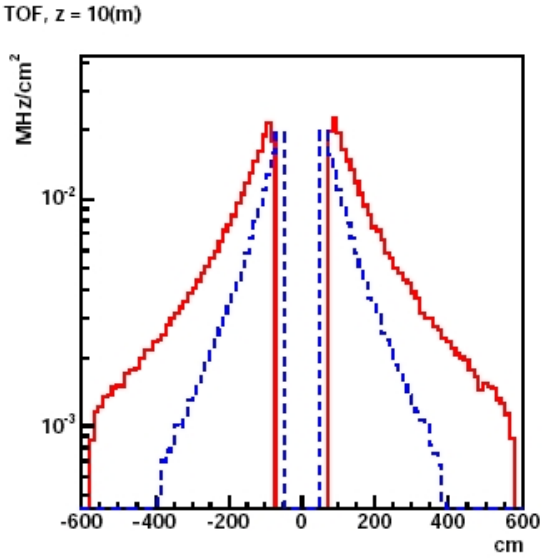
Mariana Petris, Decembrie 2009

CBM needs on the experiment





- Interaction rate 10^7Hz (~1000 tracks /event)
- TOF wall at 10m from target from 3º to 27º
- Rate from 1kHz/cm^2 (27º) to 20kHz/cm^2 (3º)
  - Hit density from 6.10^{-2}/dm^2 to 1/dm^2, more than 60000 cells to have occupancy below 5%
  - Total area >60m^2

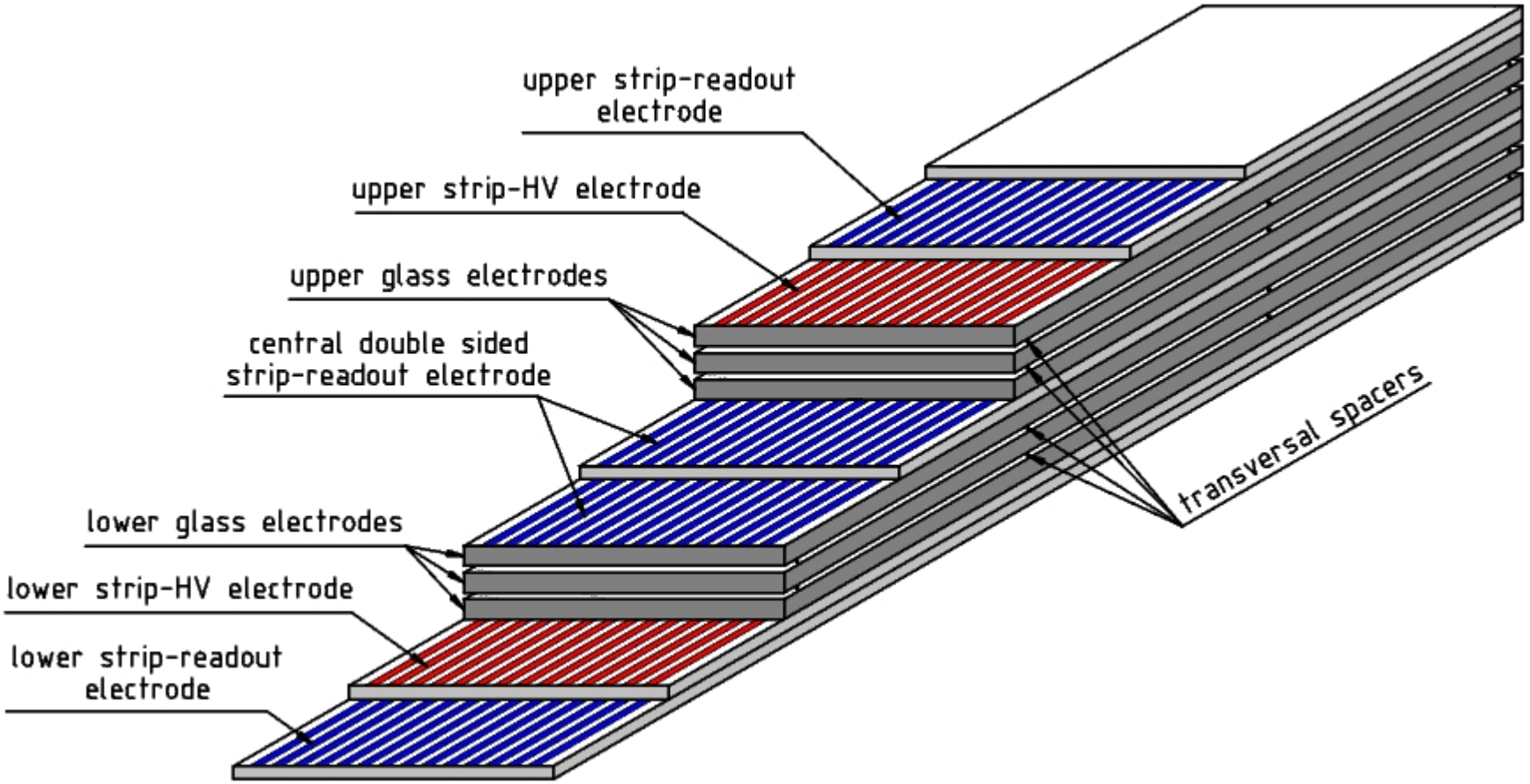


RPC Counting Rate Performance

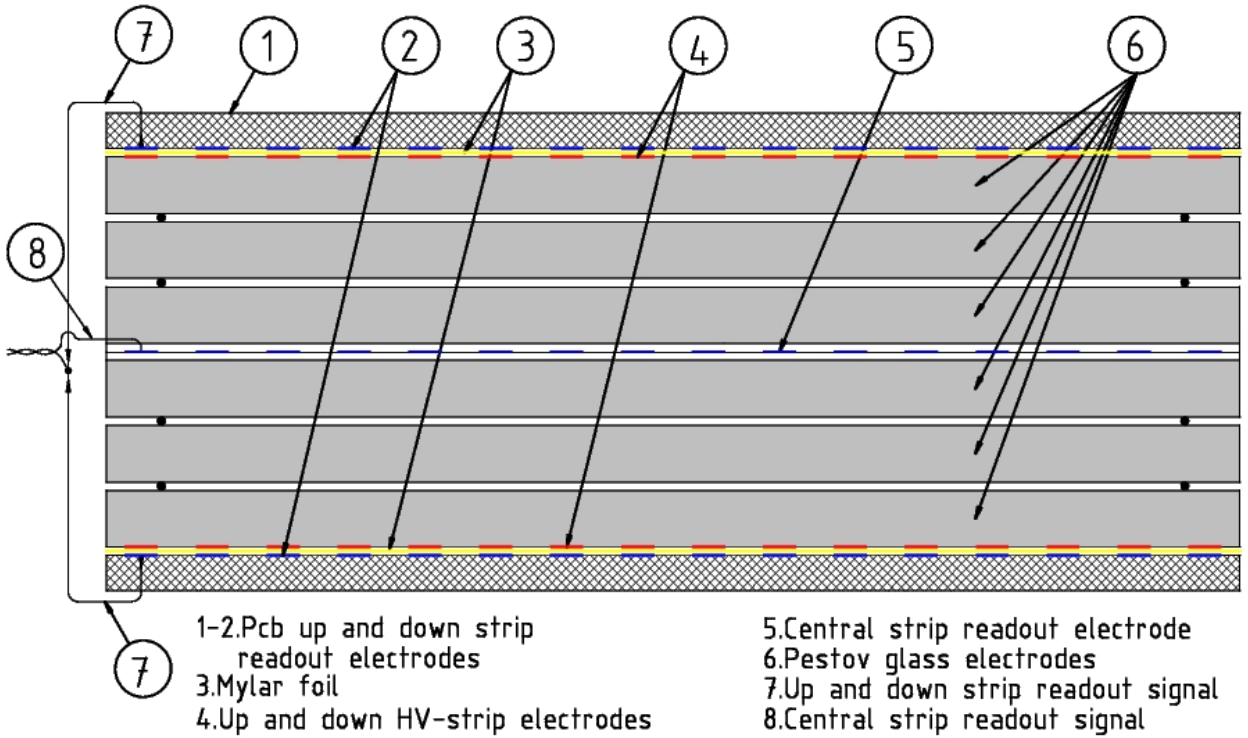
- *"Classical MSMGRPC" keeps the performances up to ~1 kHz/cm^2 ($\rho_{glass} \sim 10^{12}\ \Omega$ cm); this type of RPC could be a solution for a major part of the TOF – CBM subdetector.*
- *ToF – CBM subdetector at small polar angles – high counting rate environment (up to 20 kHz/cm^2).*
- *Solutions:*
  - *Electrodes with lower resistivity*
  - *Smaller and many gaps*
- *Our prototype was built using Pestov glass with $\rho \sim 10^{10}\ \Omega$cm, 2 mm glass thickness and 300 μm gas gap*

HCRRPC – differential architecture

- low cross-talk
- minimization of induced noise
- higher signal than single-ended architecture @ the same HV



HCRRPC – differential architecture



Symmetrical structure, differential readout

Active area 40.6 x 300 mm2

Electrodes: Pestov glass: 2.0 mm

2 x 2 gas gaps; 300 μm thickness each gap

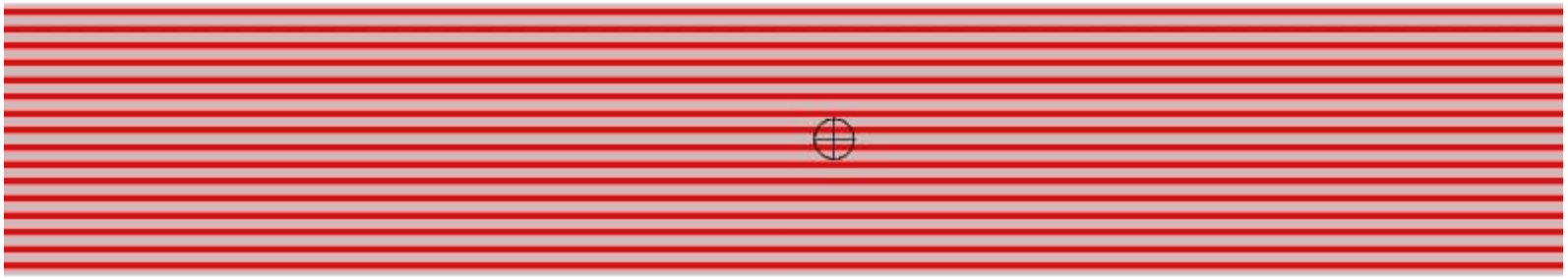
Readout electrodes: 1 double sided anode and 2 single sided cathodes

made from pcb with copper strips: 14 strips each side:

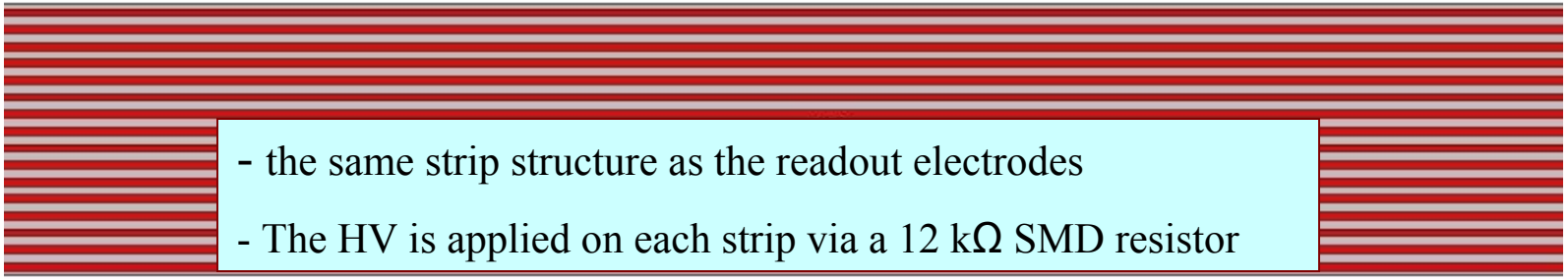
2.54 mm pitch = 1.1 mm strip width + 1.44 mm gap width

The readout and HV electrodes

Electroda semnal Pitch: 2.54 mm => 1.1 cooper line, 1.44 gap



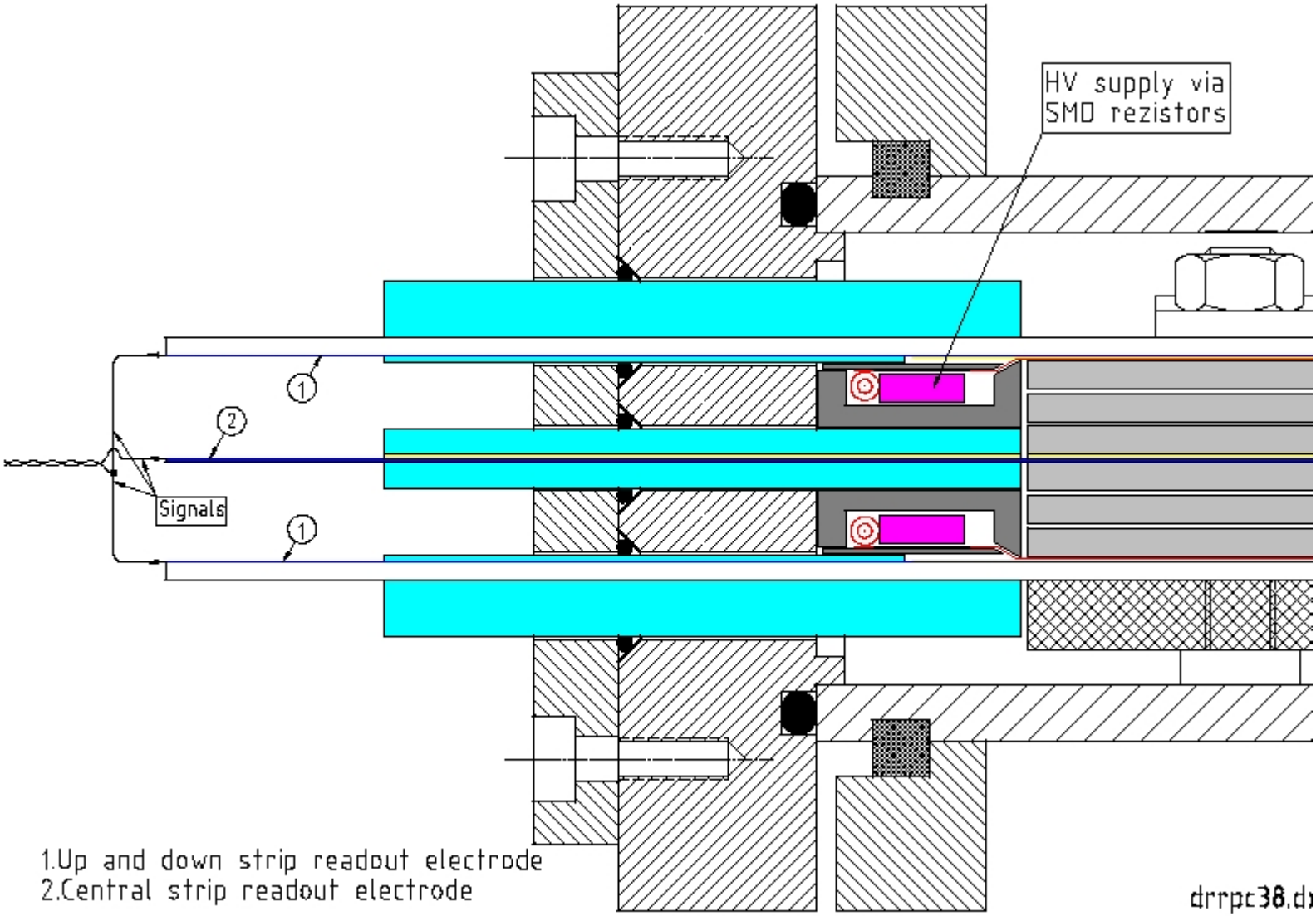
Electroda HV Pitch: 2.54 mm => 1.1 cooper line, 1.44 gap



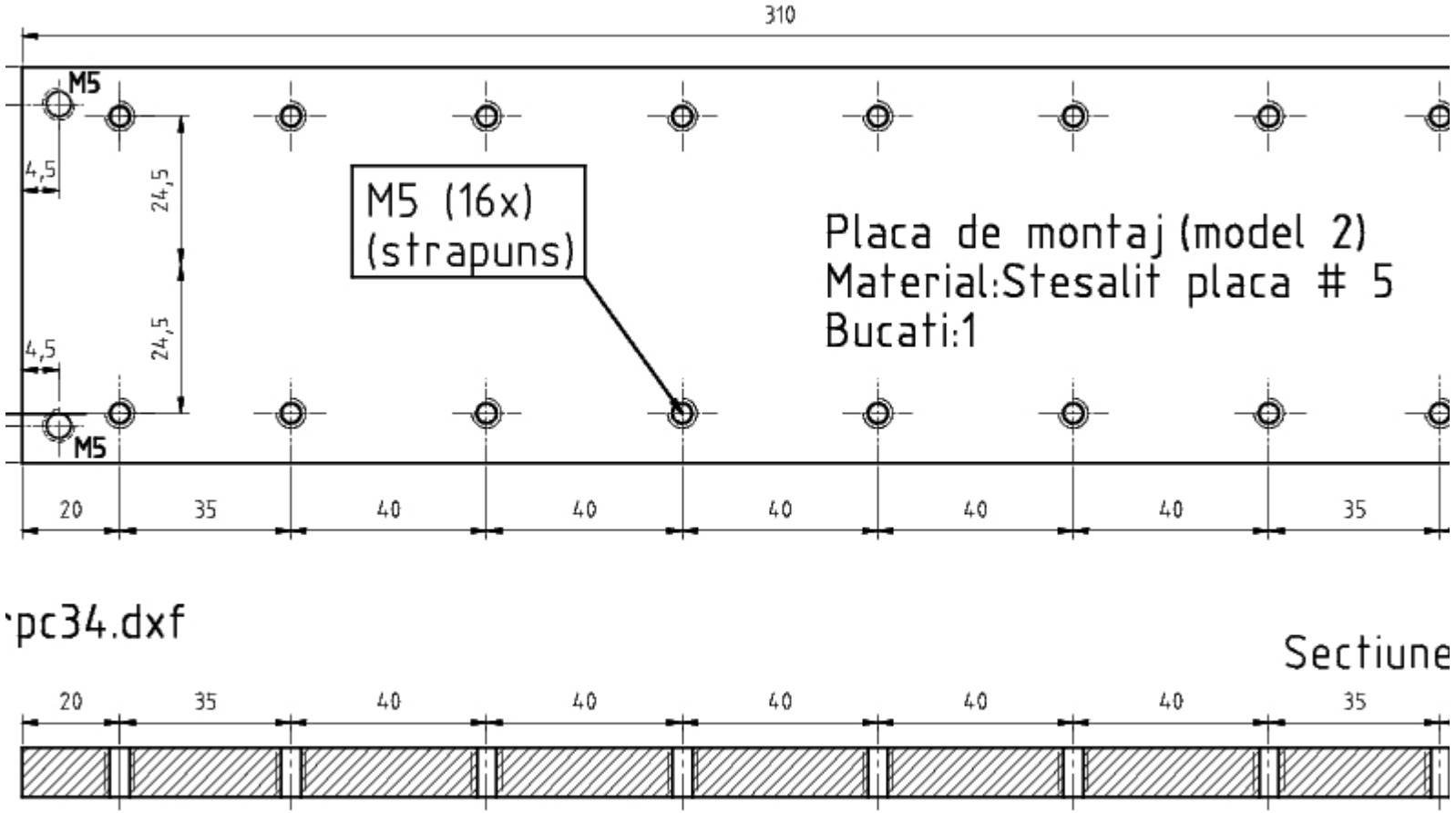
- the same strip structure as the readout electrodes
- The HV is applied on each strip via a 12 kΩ SMD resistor

rpc36c.dxf

Construction Details

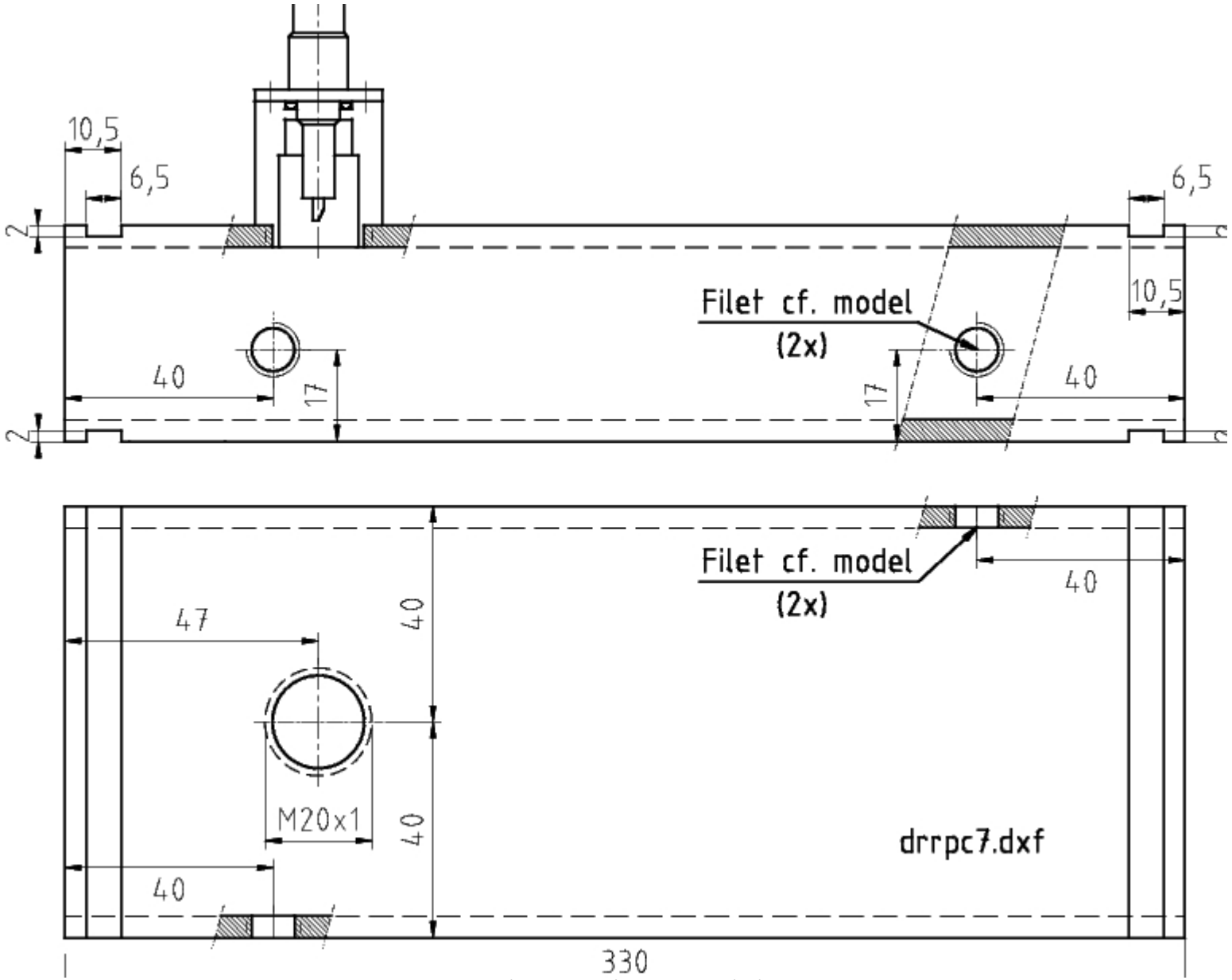


Mounting plate

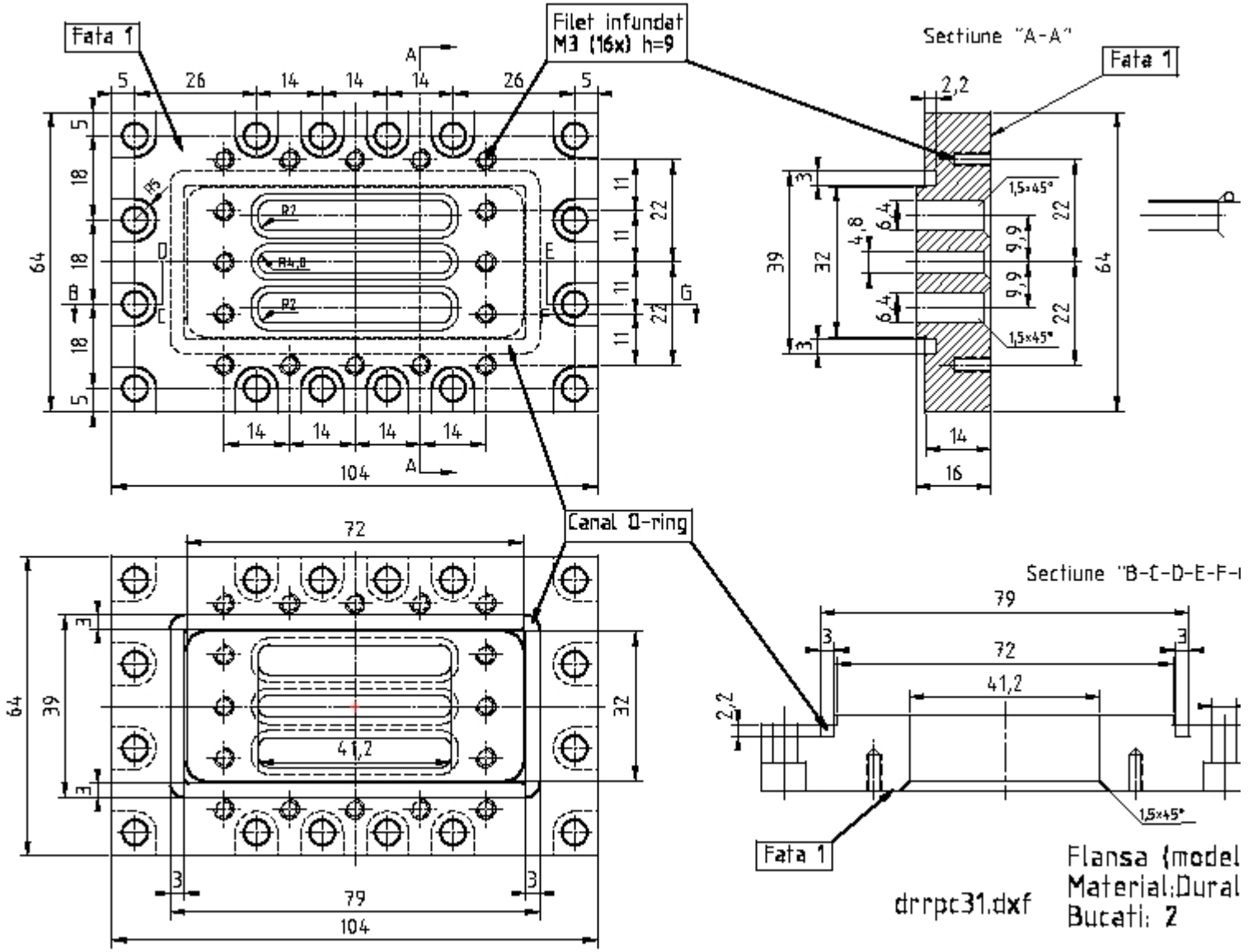


define the mechanical alignment of the RPC structure

Al Box

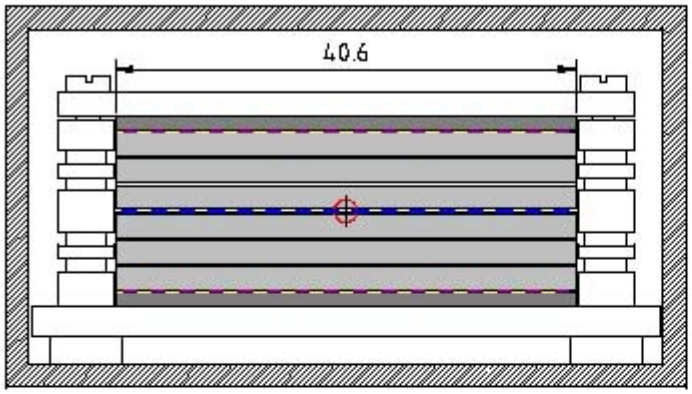

10,5
6,5
2
6,5
Filet cf. model
(2x)
10,5
40
17
17
40
2
Filet cf. model
(2x)
40
47
40
M20x1
40
drrpc7.dxf
330

Al Box Flanges



Mariana Petris, Decembrie 2009

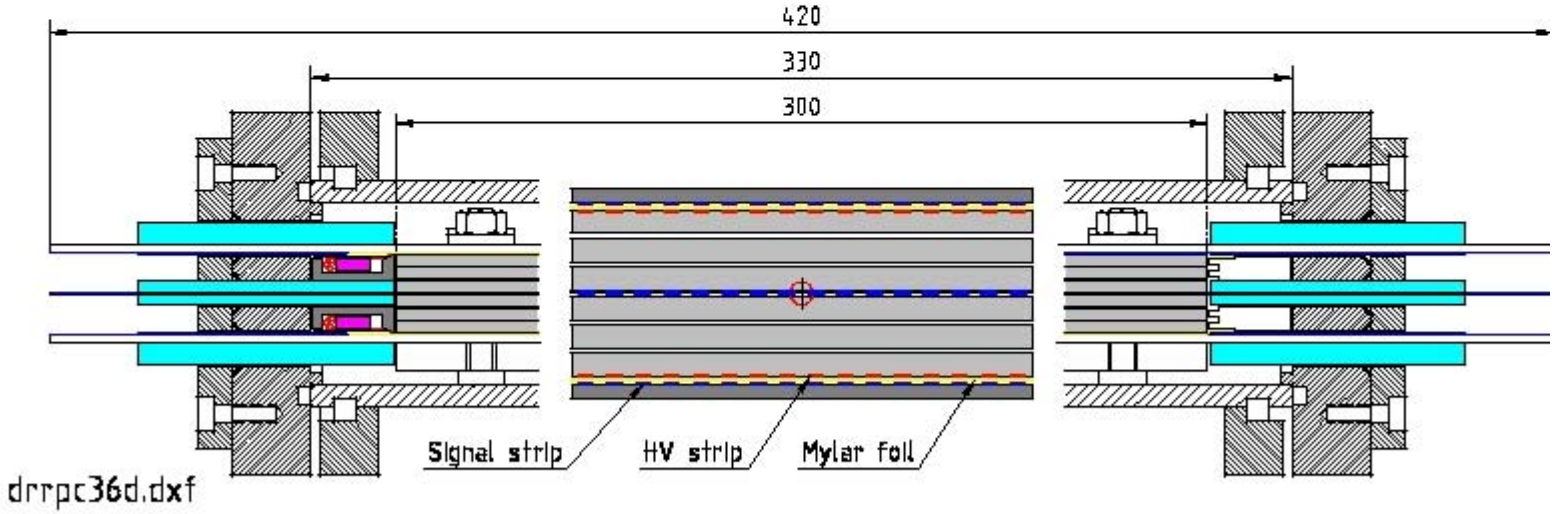
Construction Details



-Glass Electrodes:Pestov 2 mm x 40.6 mm x 300 r

-Gap: 300 miu fishing line

-Pitch: 2.54 mm => 1.1 cooper line, 1.44 gap

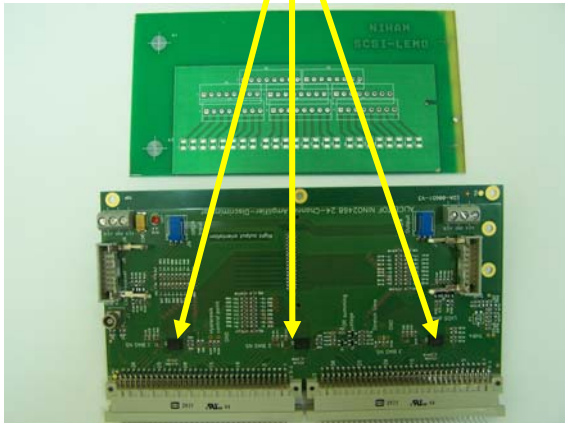


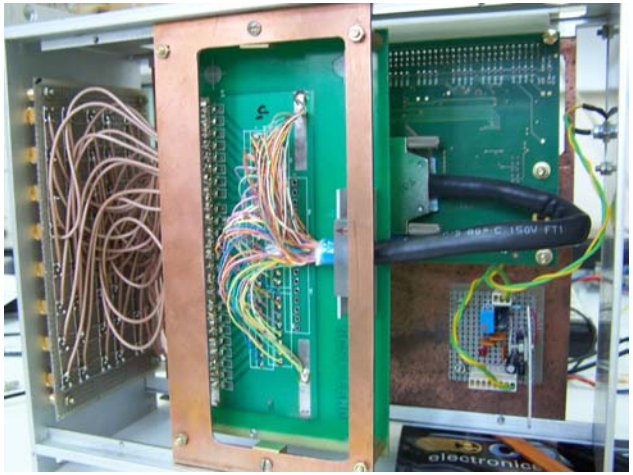
Differential FEE

RPC

⇓

FEE NINO chips





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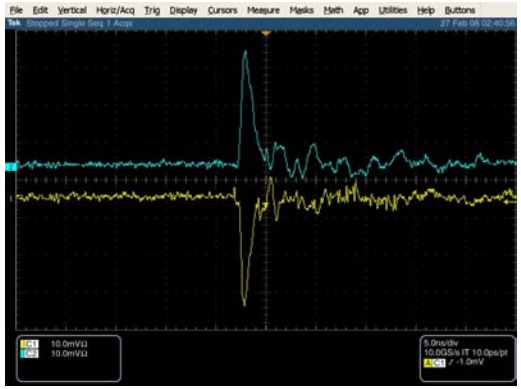

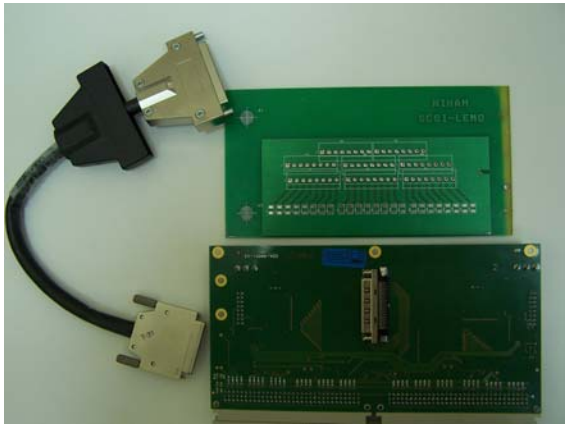

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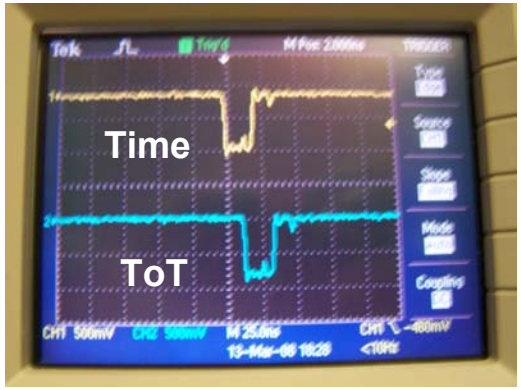

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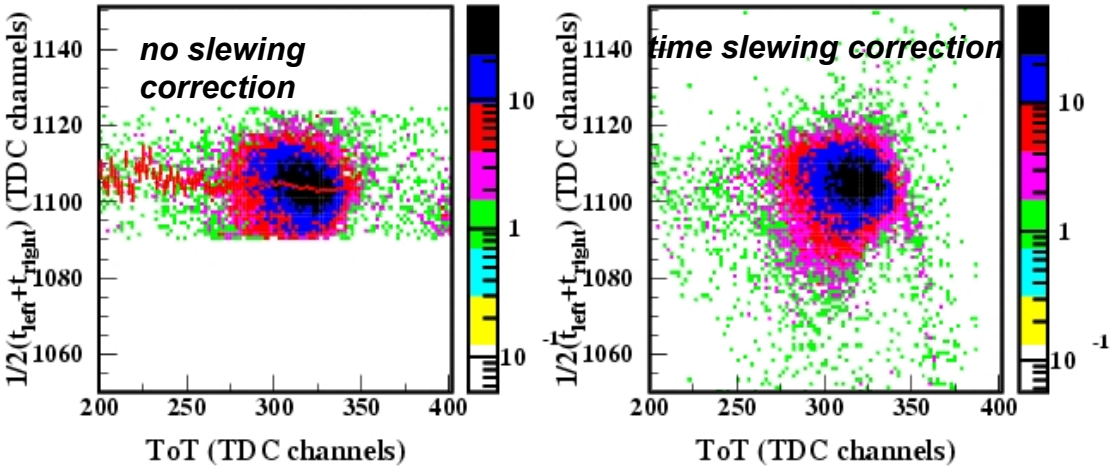
TDC

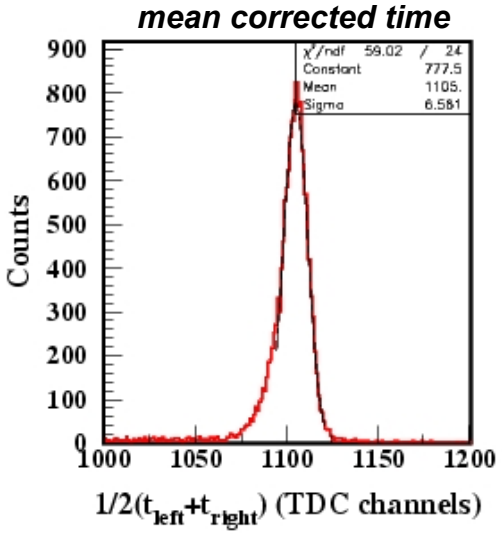
LVDS ⇒ NIM converter

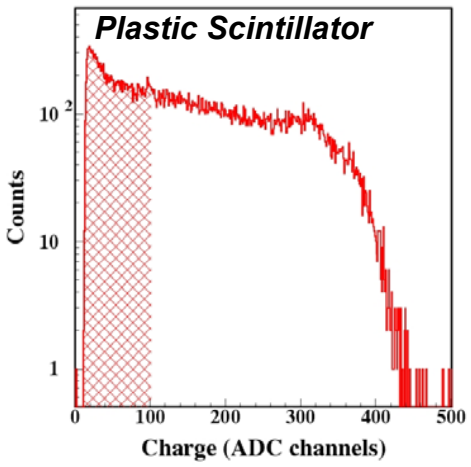
^{60}Co source test – time resolution

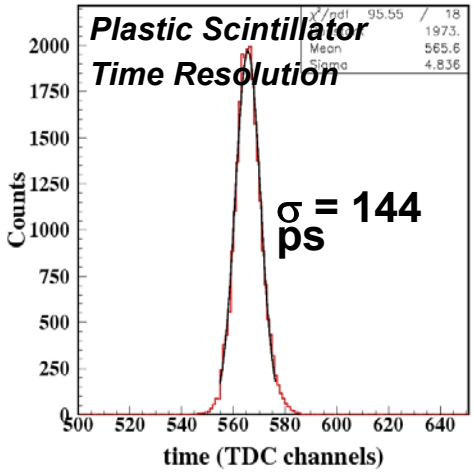
differential architecture

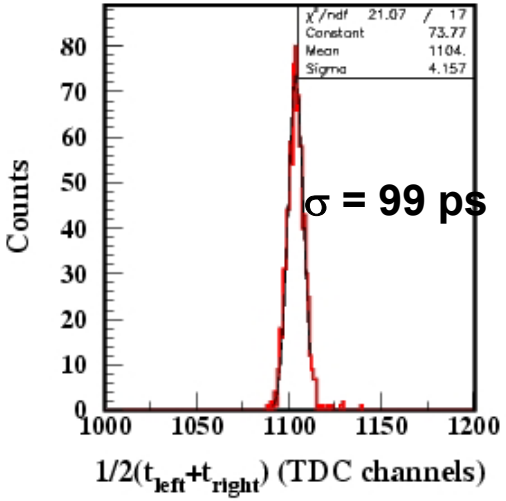
Applied High Voltage = 6400 V







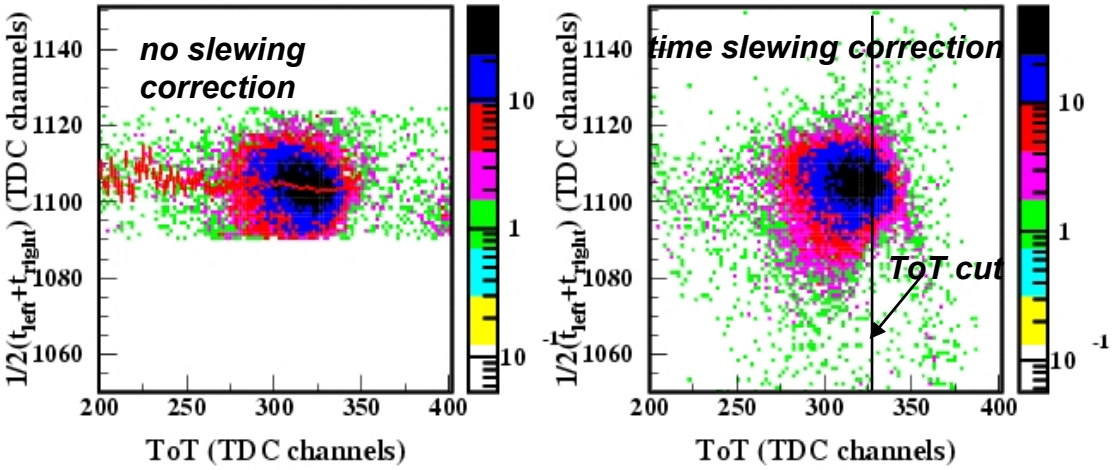


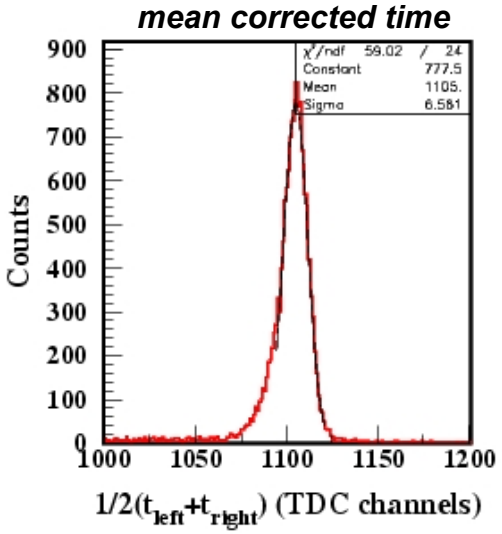


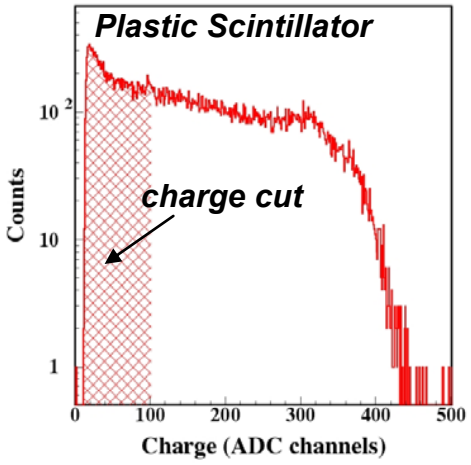
^{60}Co source test – time resolution

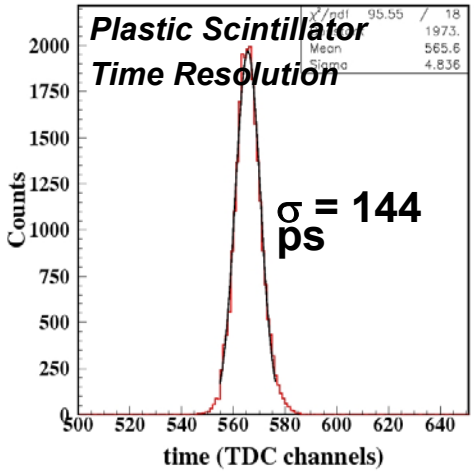
differential architecture

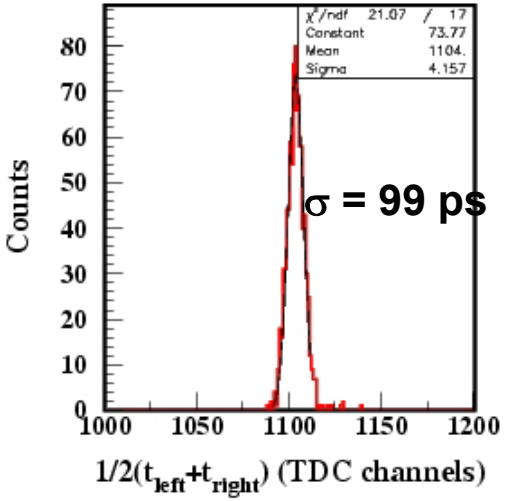
Applied High Voltage = 6400 V











Conclusions

• *A multi gap, multi strip, symmetric RPC prototypes with low resistivity electrodes and a differential readout has been designed and built; it is a new contribution of our group in the field of high time resolution time of flight detectors for high counting rate environments.*

• *Results have been presented at:*

1. M.Petris et al., "Status of differential strip RPCs", 13th CBM Collaboration Meeting, March 09-13, 2009, GSI Darmstadt, Germany.

2. M. Petris et al. "Status of Multigap, Symmetric, Strip readout, Differential architecture RPC prototypes", CBM-Hadron Meeting, July 13, 2009, GSI Darmstadt.

3. M. Petris et al. "Toward a high granularity, high counting rate differential read-out RPC", 14th CBM Collaboration Meeting, October 6 – 9, Split, Croatia