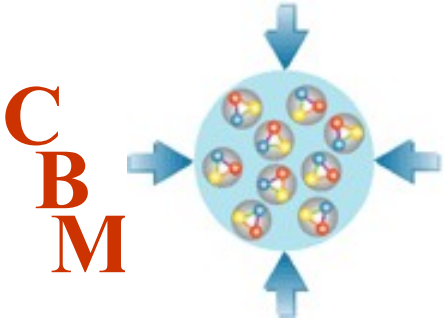
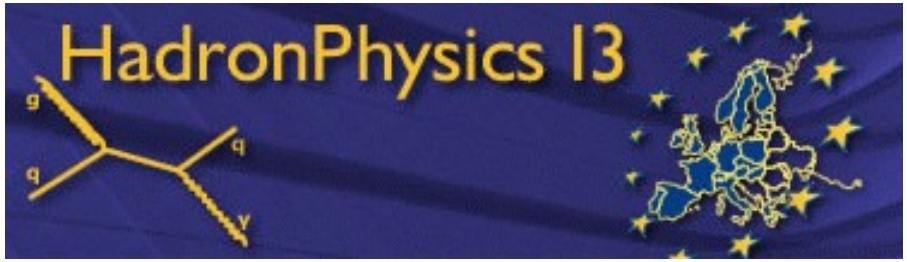
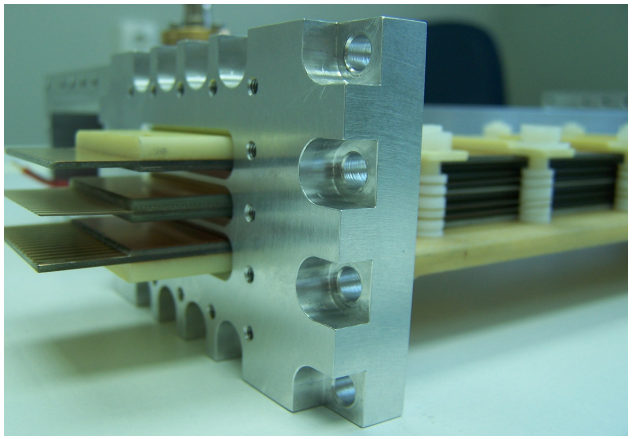


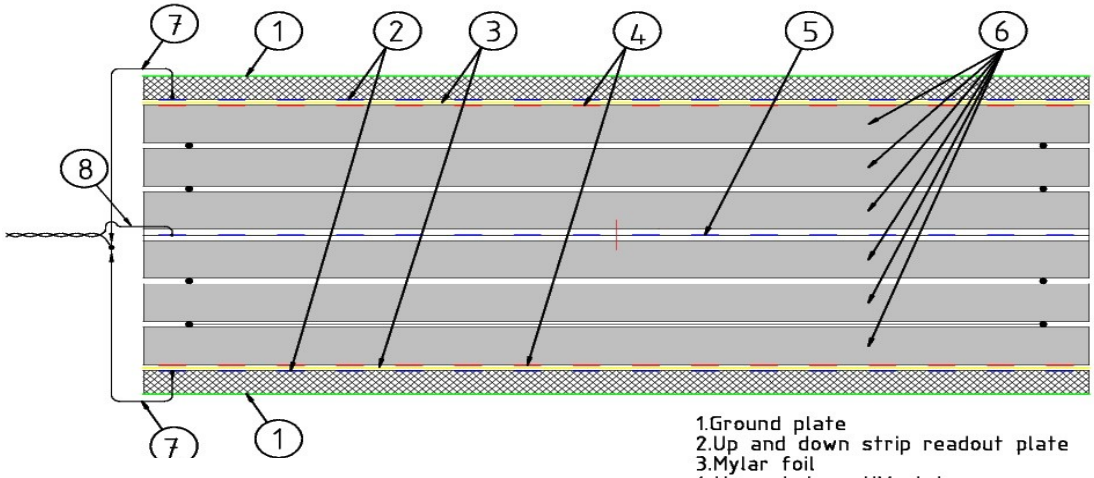


Toward a high granularity, high counting rate differential read-out RPC

- ***Differential strip architecture based on Pestov glass – short review***
- ***High granularity differential strip architecture***
  - ***^{60}Co source tests***
  - ***First results from in-beam tests (GSI-Aug. 2009)***
- ***Conclusions & Outlook***

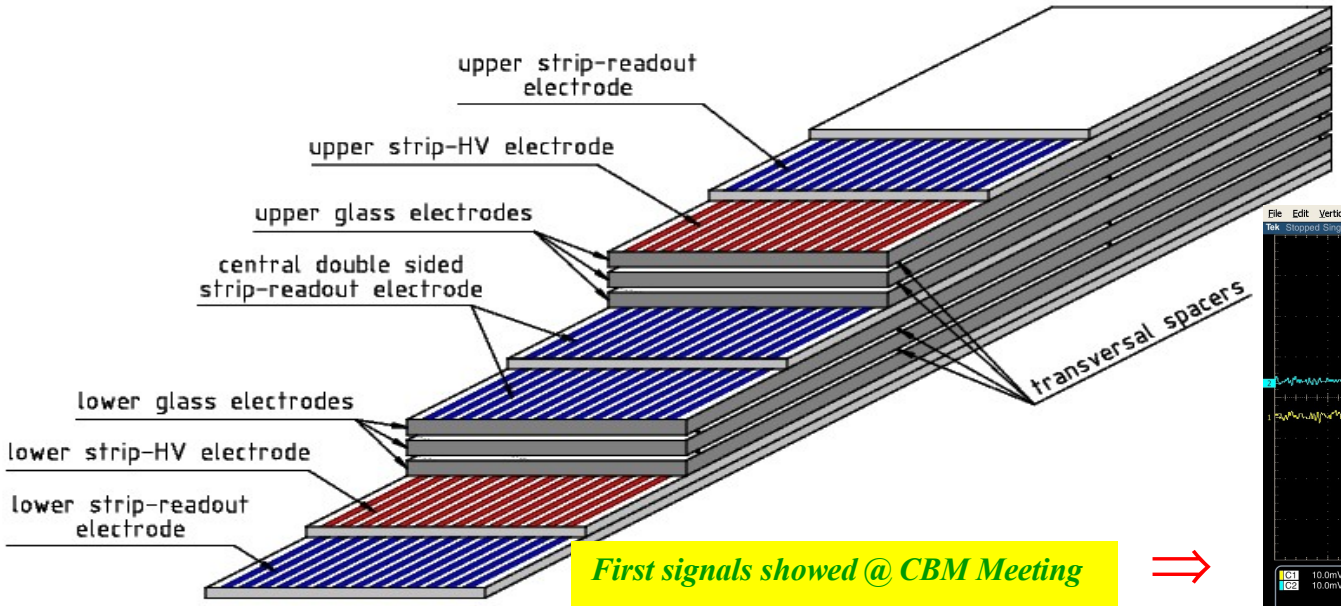
Differential Strip – Readout Pestov Glass RPC Prototype





1.Ground plate
2.Up and down strip readout plate
3.Mylar foil
4.Up and down HV plate
5.Central strip readout plate
6.Pestov glass electrodes
7.Up and down strip readout plate signal
8.Central strip readout plate signal

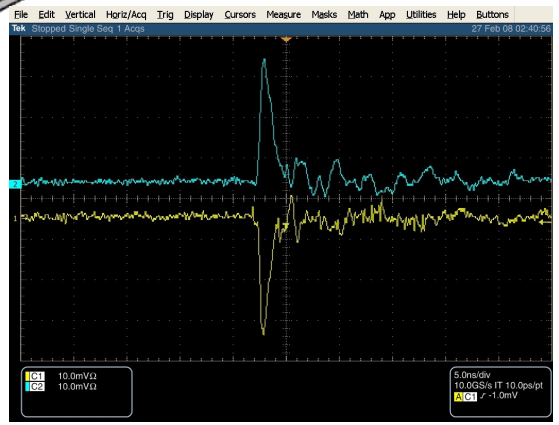
Gap size = 300 μm



First signals showed @ CBM Meeting

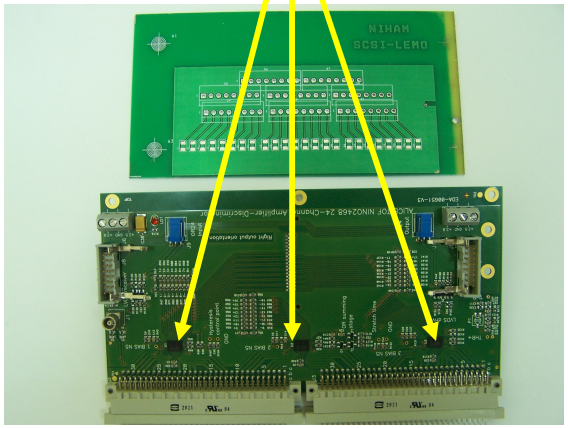
Feb. 2008, GSI

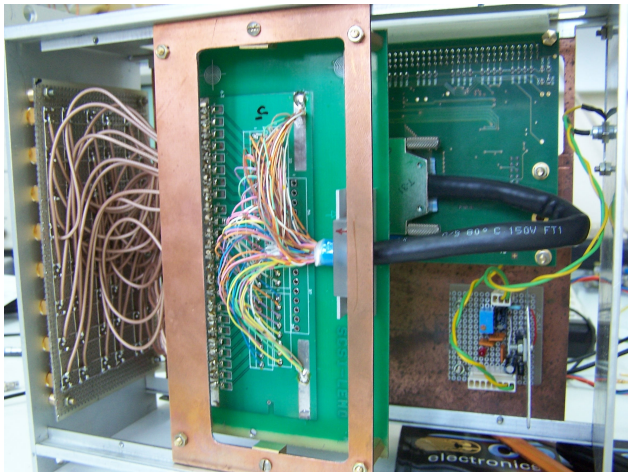
⇒



Differential FEE

FEE NINO chips





RPC

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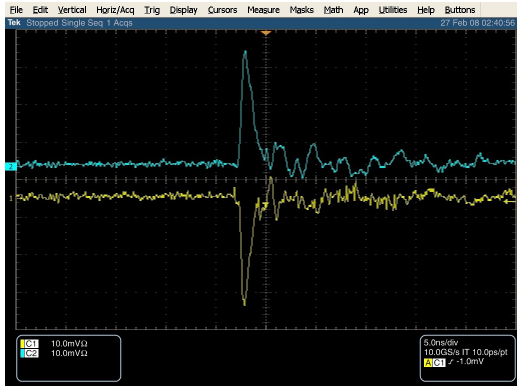

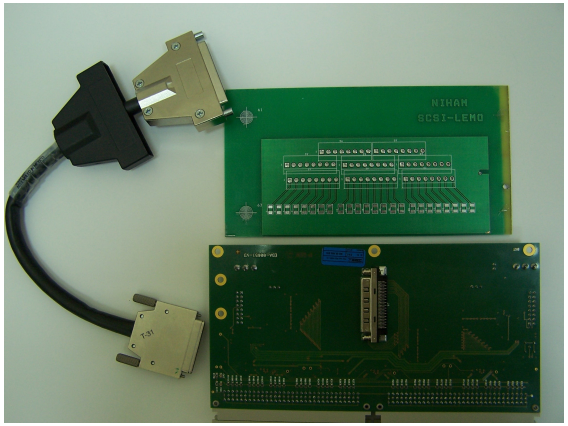

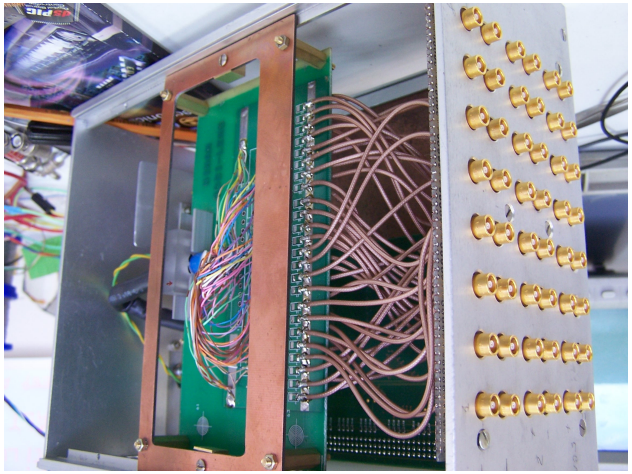

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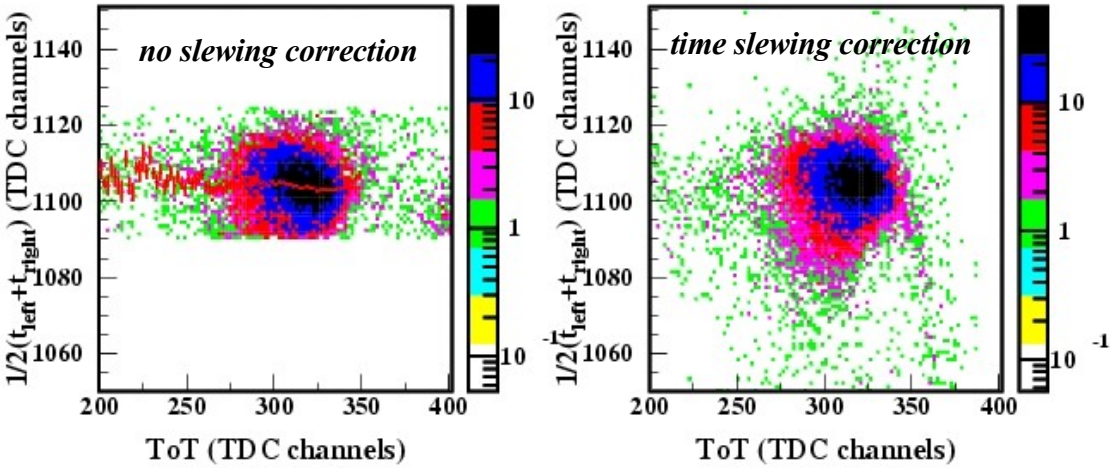
TDC

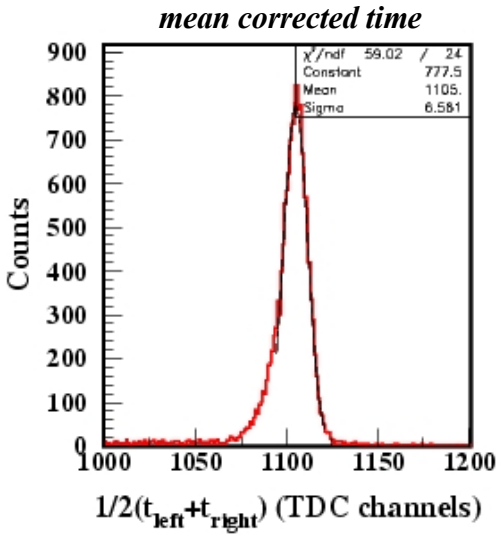
LVDS ⇒ NIM converter

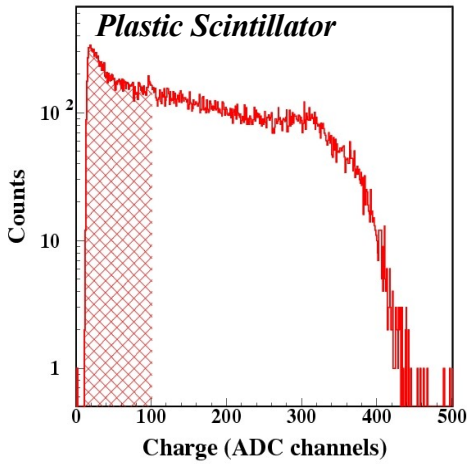
^{60}Co source test – time resolution

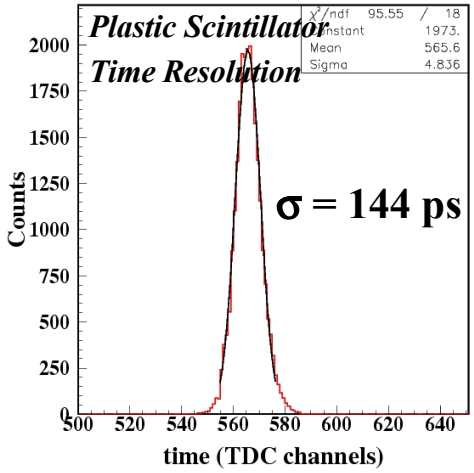
differential architecture

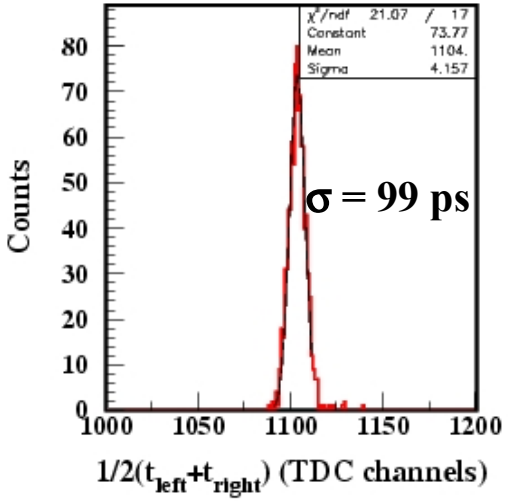
Applied High Voltage = 6400 V







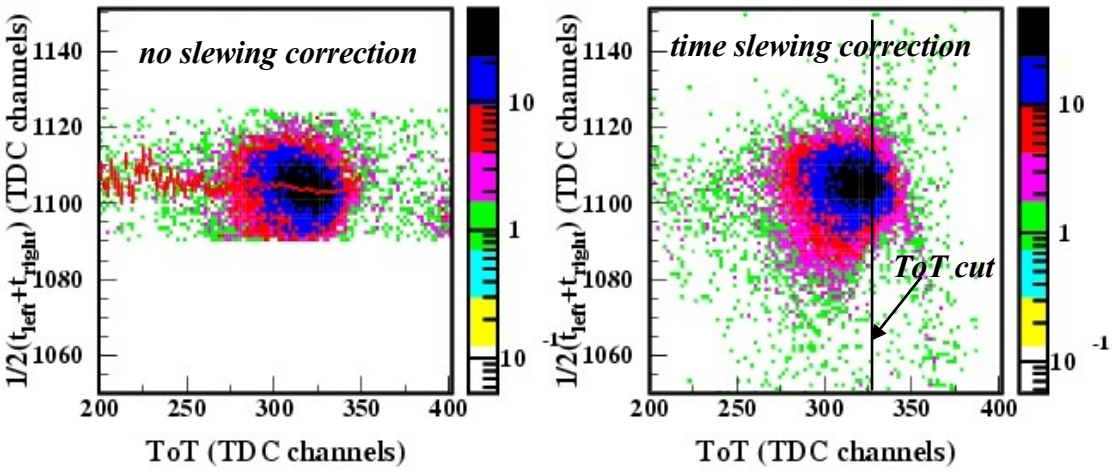




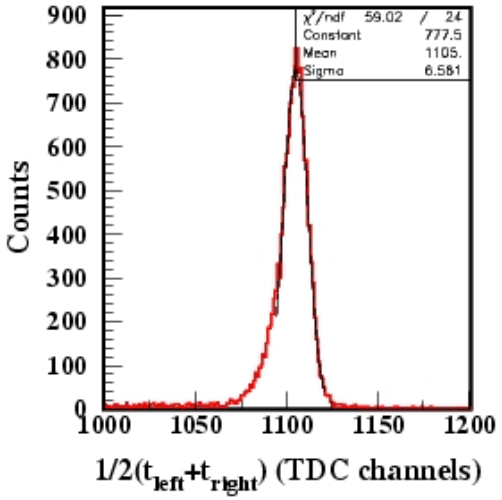
^{60}Co source test – time resolution

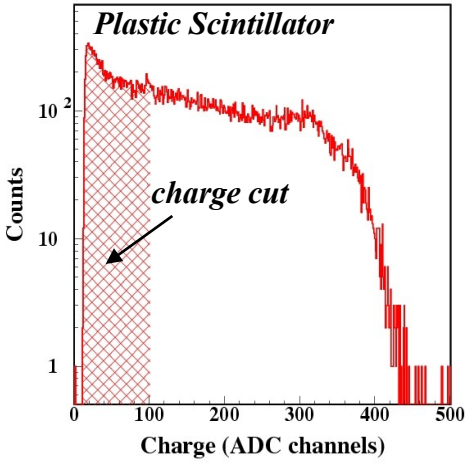
differential architecture

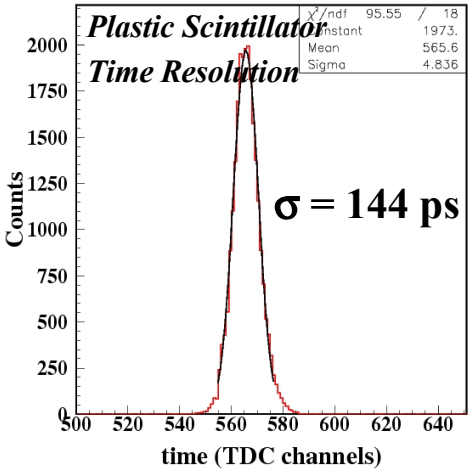
Applied High Voltage = 6400 V

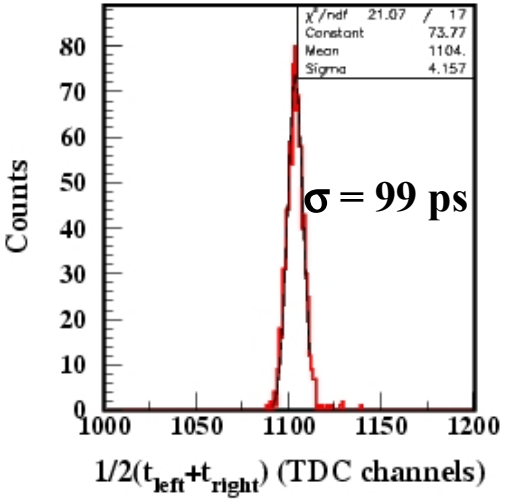


mean corrected time

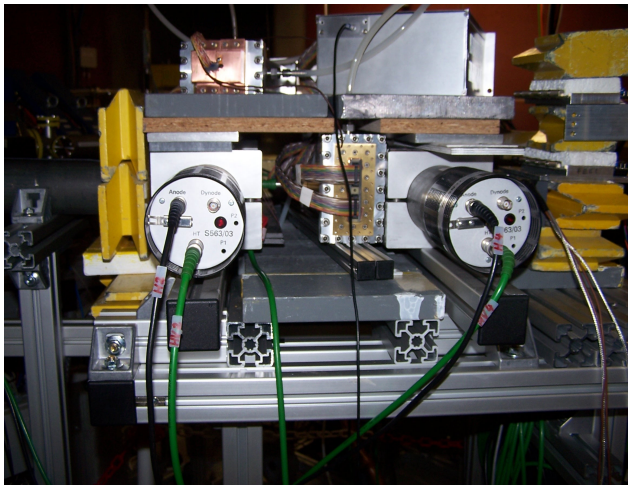






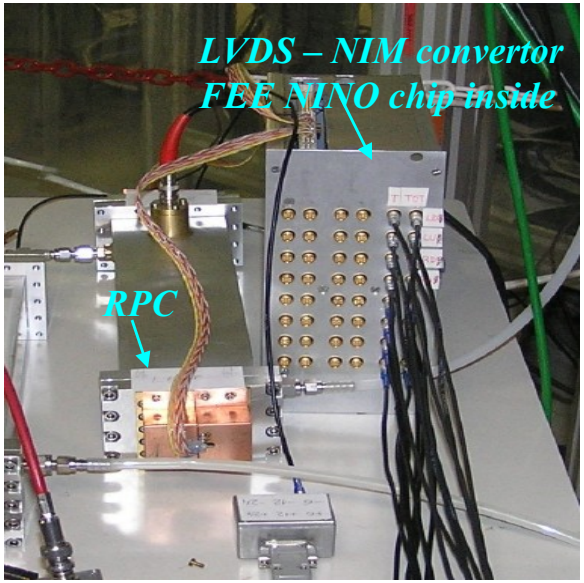


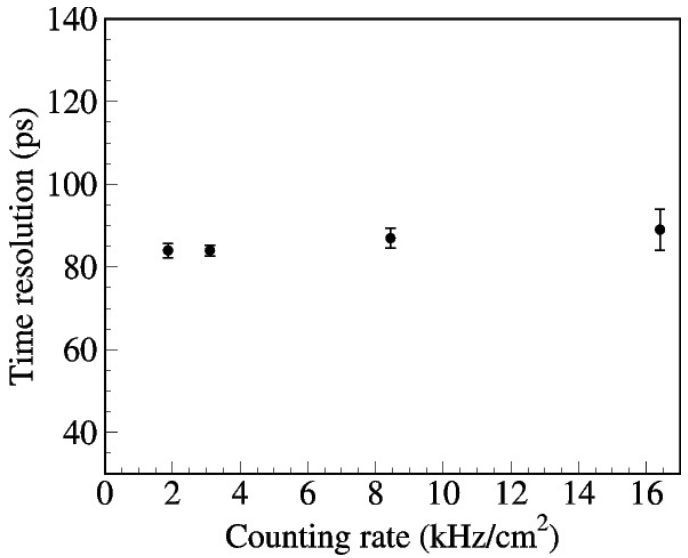
In-Beam Tests @ ELBE



Experimental set-up:

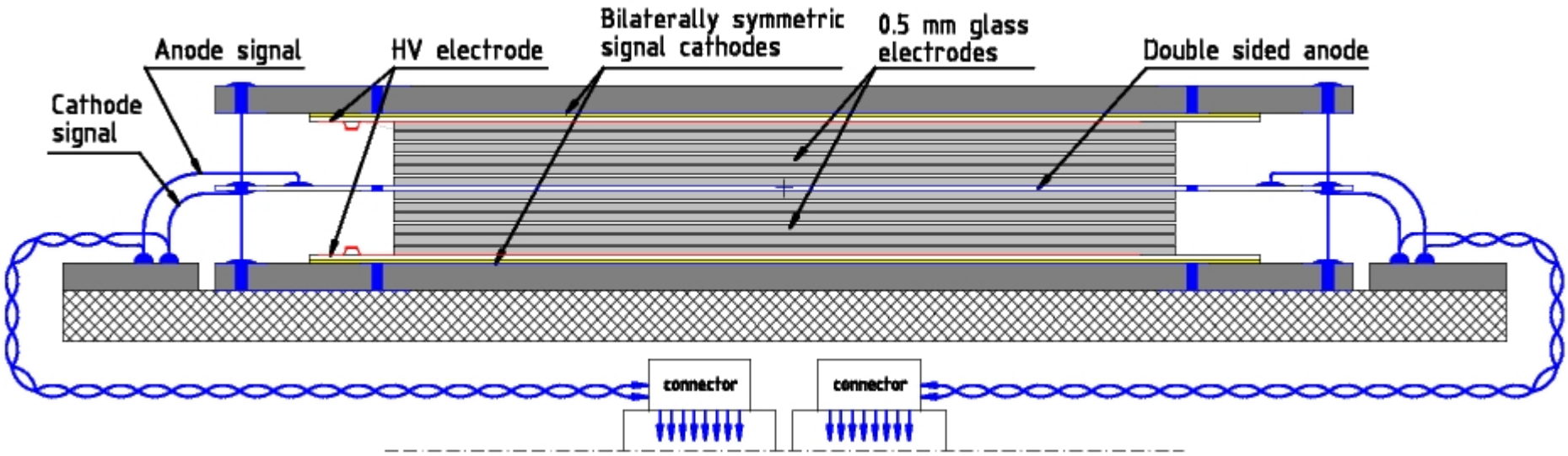
- *electron beam, 28 MeV, scattered @ 45^0 by a 18 μm Al foil*
- *plastic scintillators S5(XP2972), S12(XP2020), S34(XP2020), (2 x 2 cm^2) used for active collimation*
- *signal amplification: differential readout based on NINO chip developed within ALICE Collaboration*
- *digital converters: CAEN TDC V1290N*
- *DAQ – MBS*
- *<u>information recorded for 2 central strips</u>*





M. Petris et al. CBM Collaboration Meeting, 13-18 October, 2008, Dubna, Russia

High granularity HCRRPC – cross section



Symmetrical structure, differential readout

Active area 46 x 180 mm^2

Electrodes: Float glass: 0.5 mm

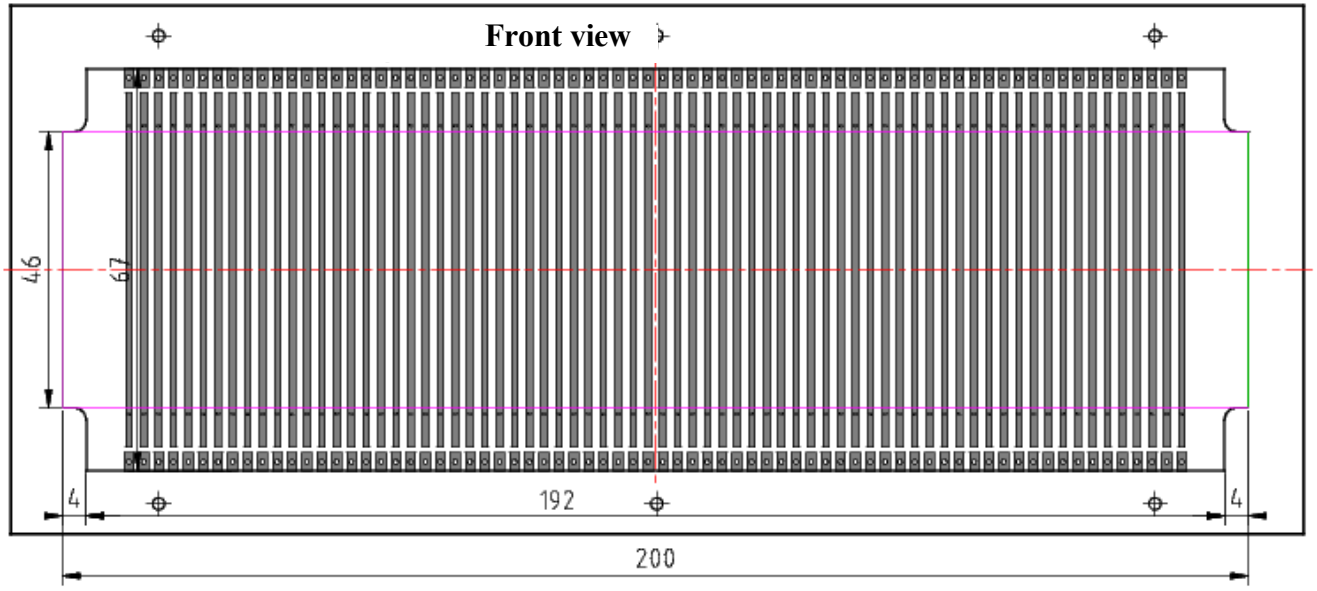
2 x 5 gas gaps; 140 μm thickness each gap

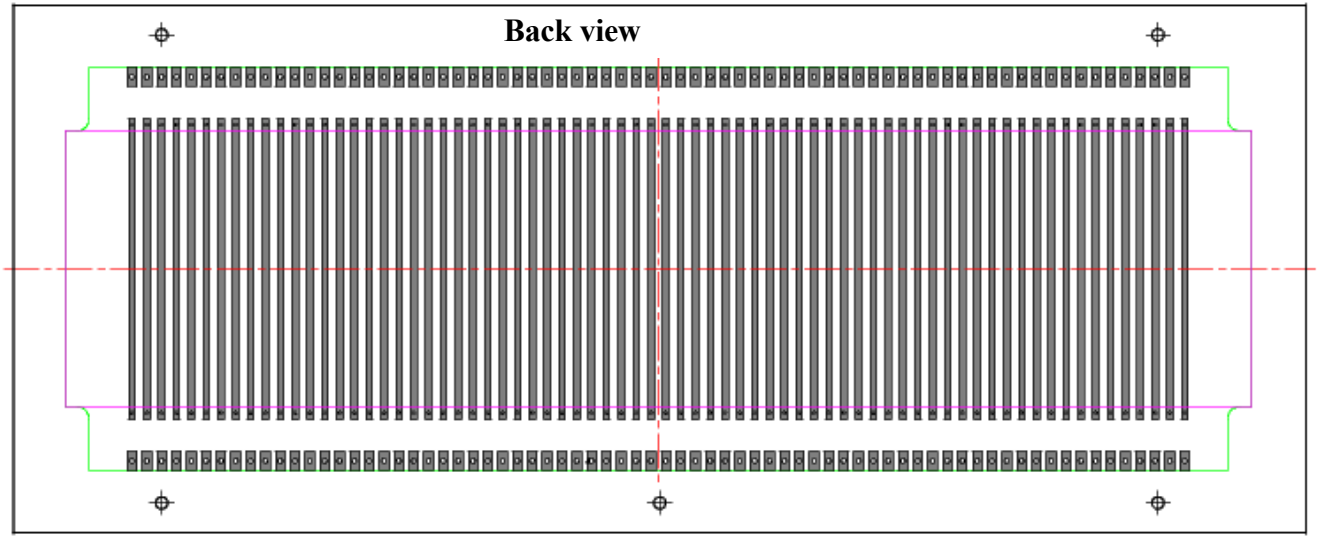
Readout electrodes: 1 double sided anode and 2 single sided cathodes

made from pcb with copper strips: 72 strips each side:

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

High granularity HCRRPC





Active area 46 x 180 mm²

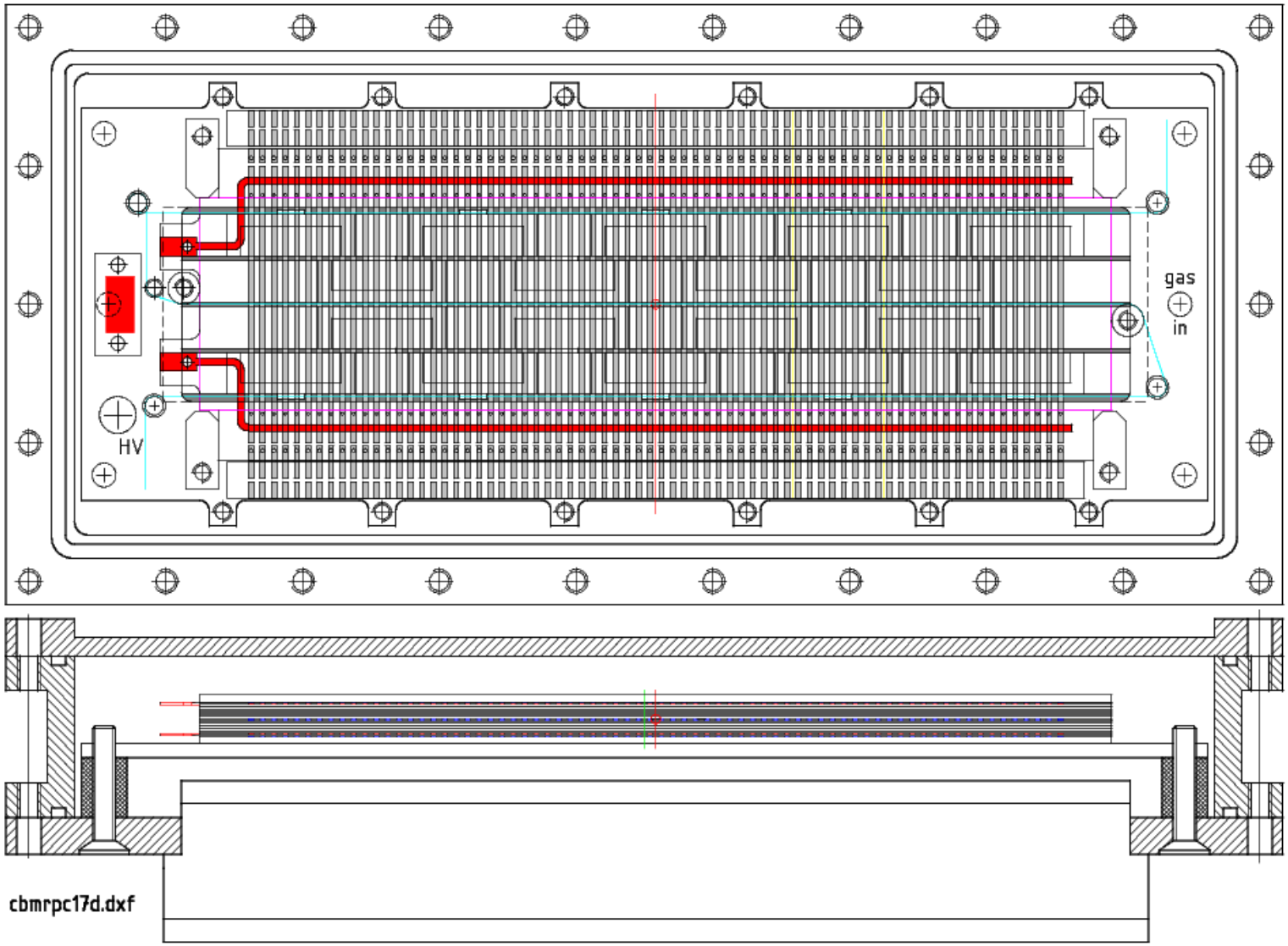
72 strips:

- 2.5 mm pitch

- 1.1 mm width

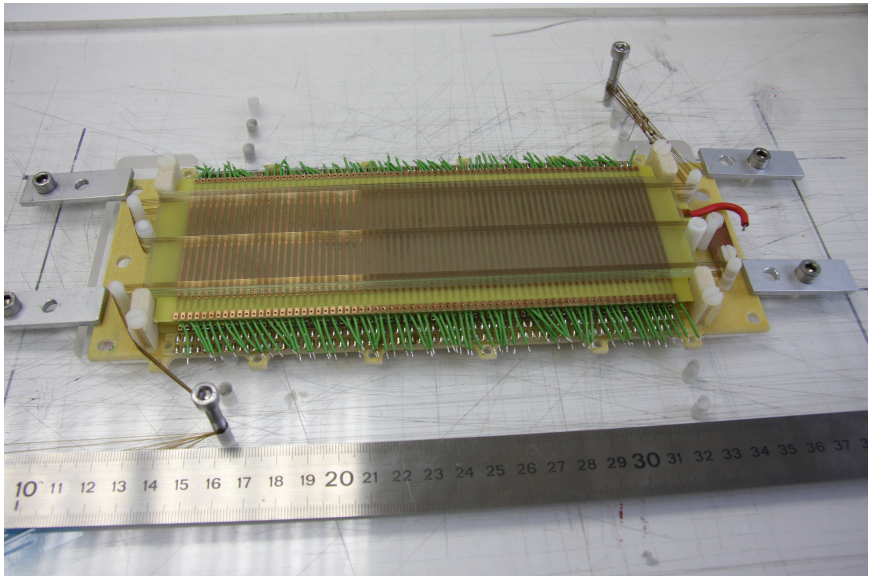
- 1.4 mm gap

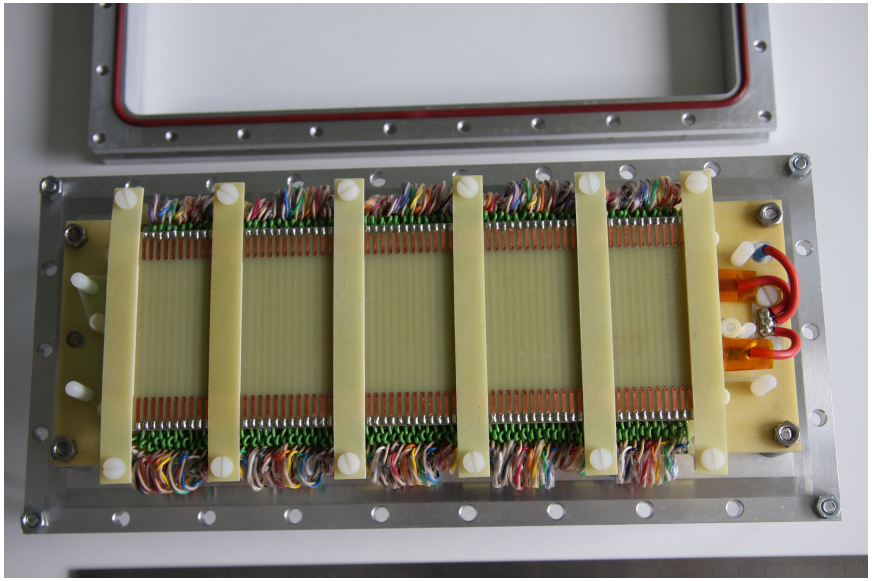
High granularity HCRRPC

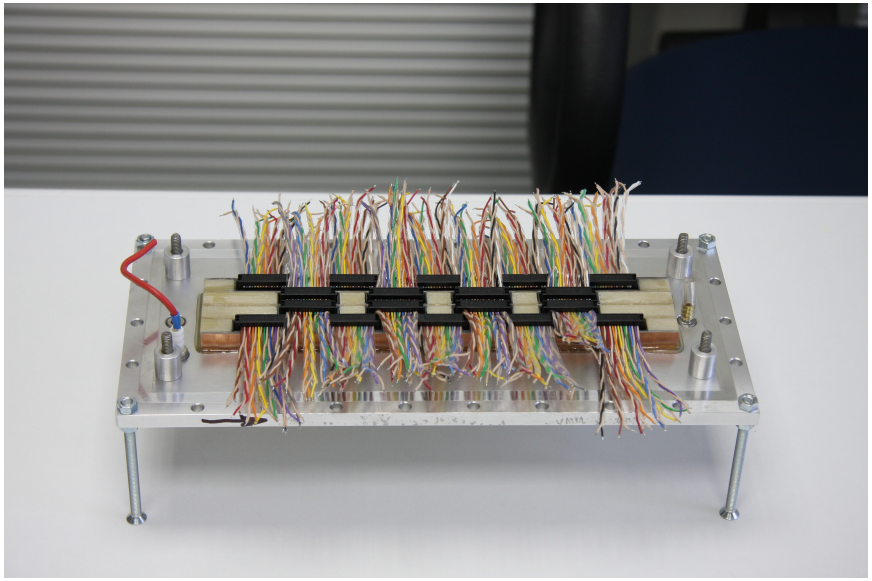


HV distribution

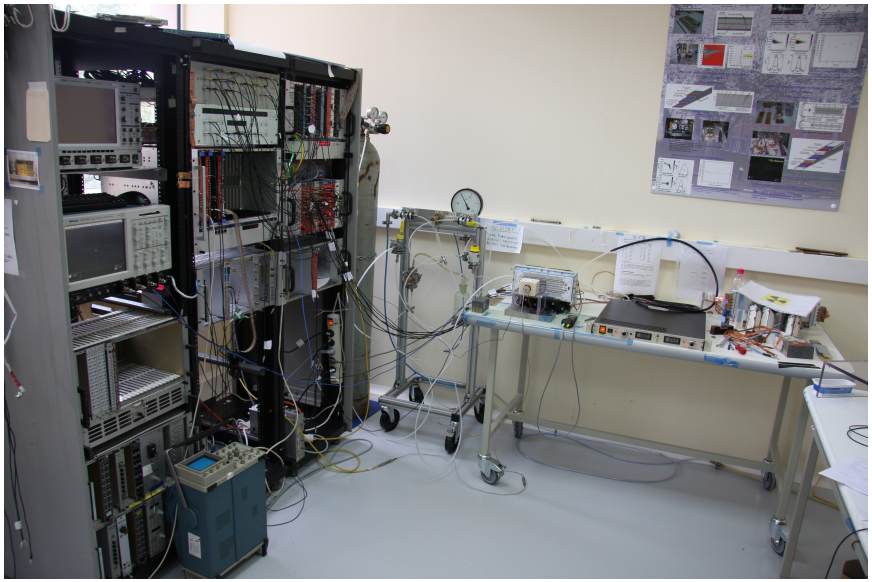
Construction Details

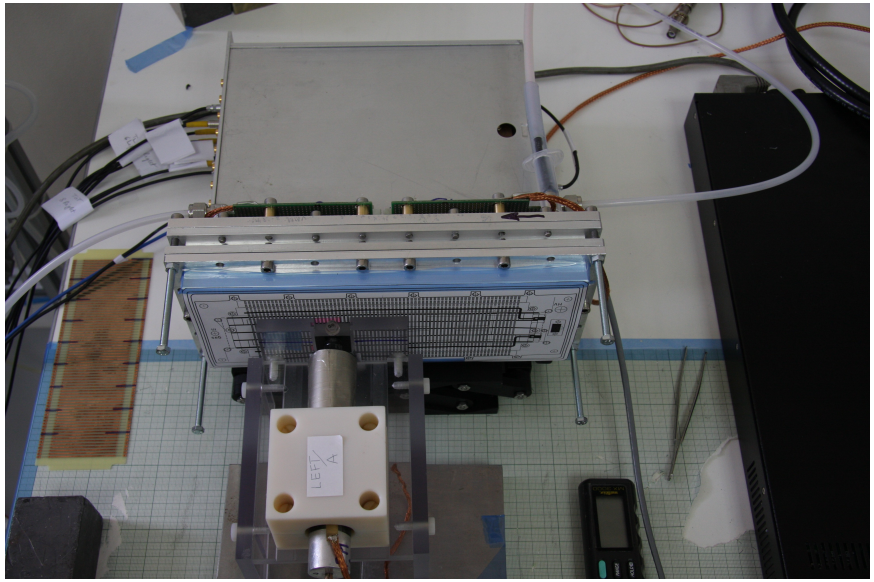


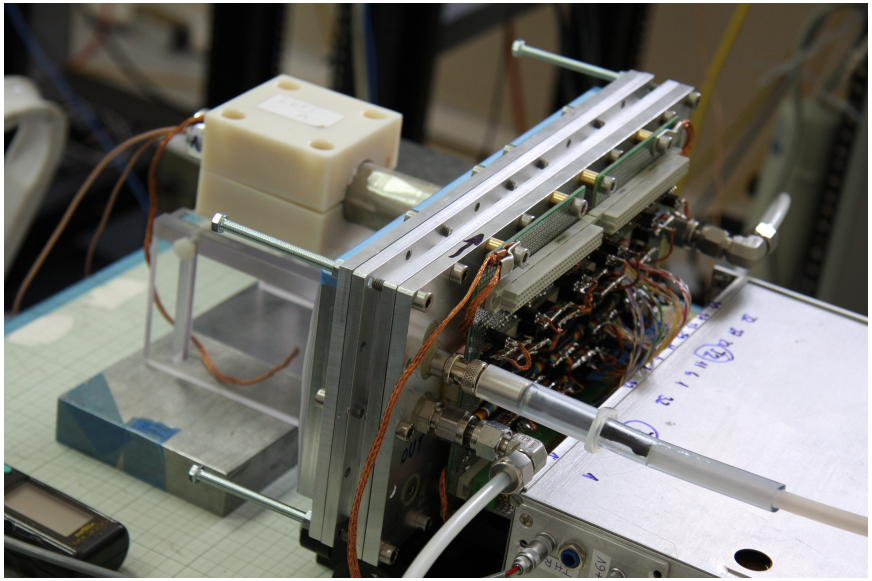


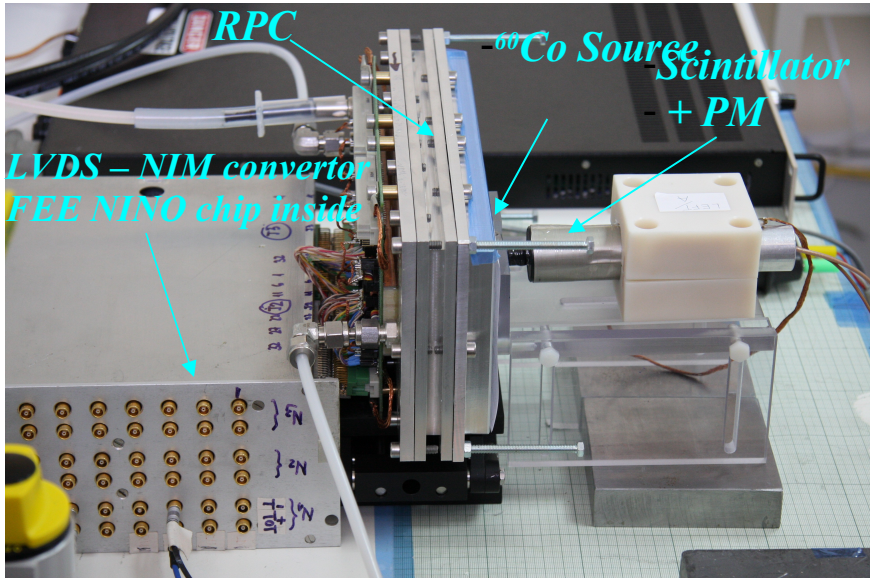


^{60}Co source test set-up

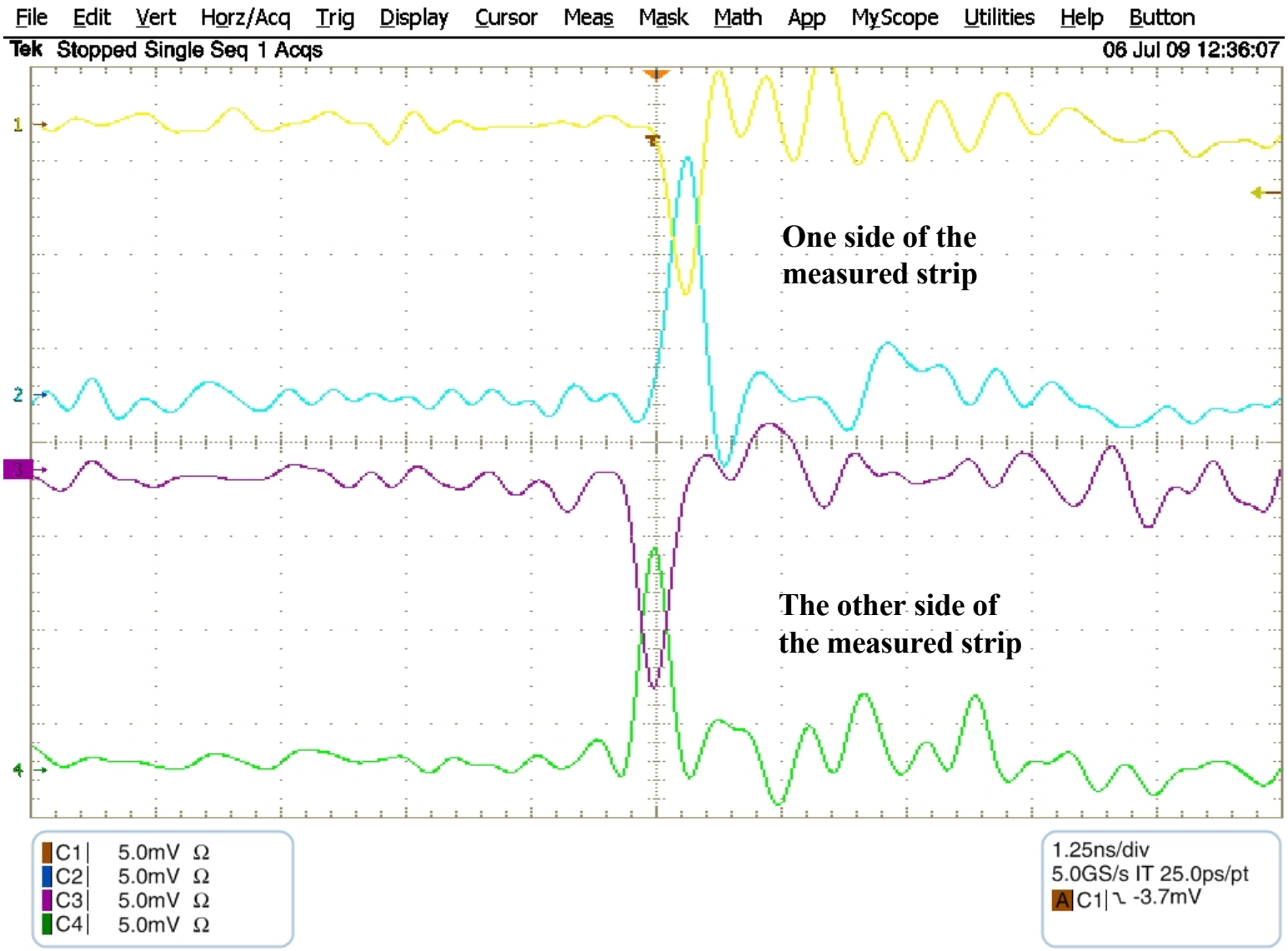




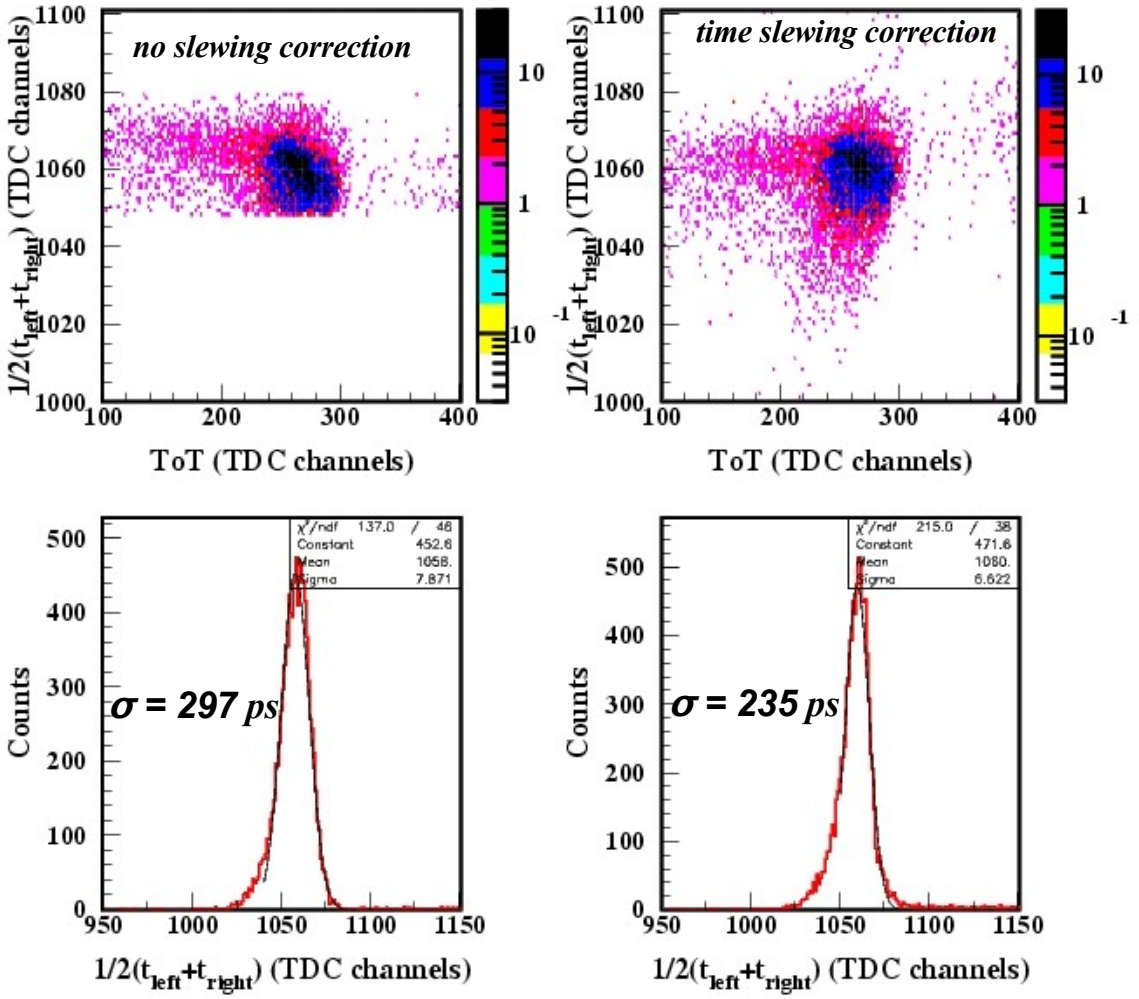




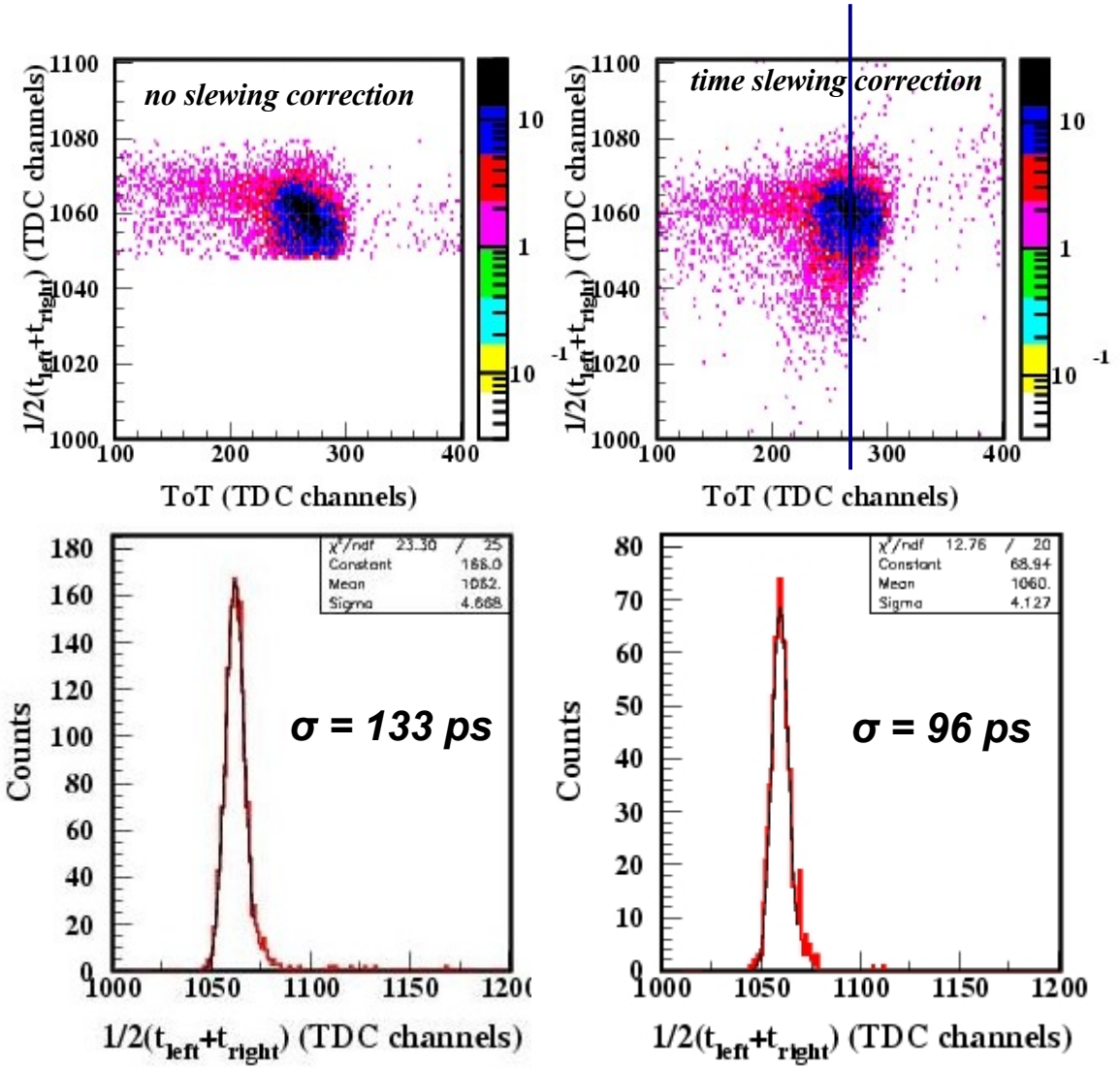
^{60}Co signals recorded from one strip without any amplification



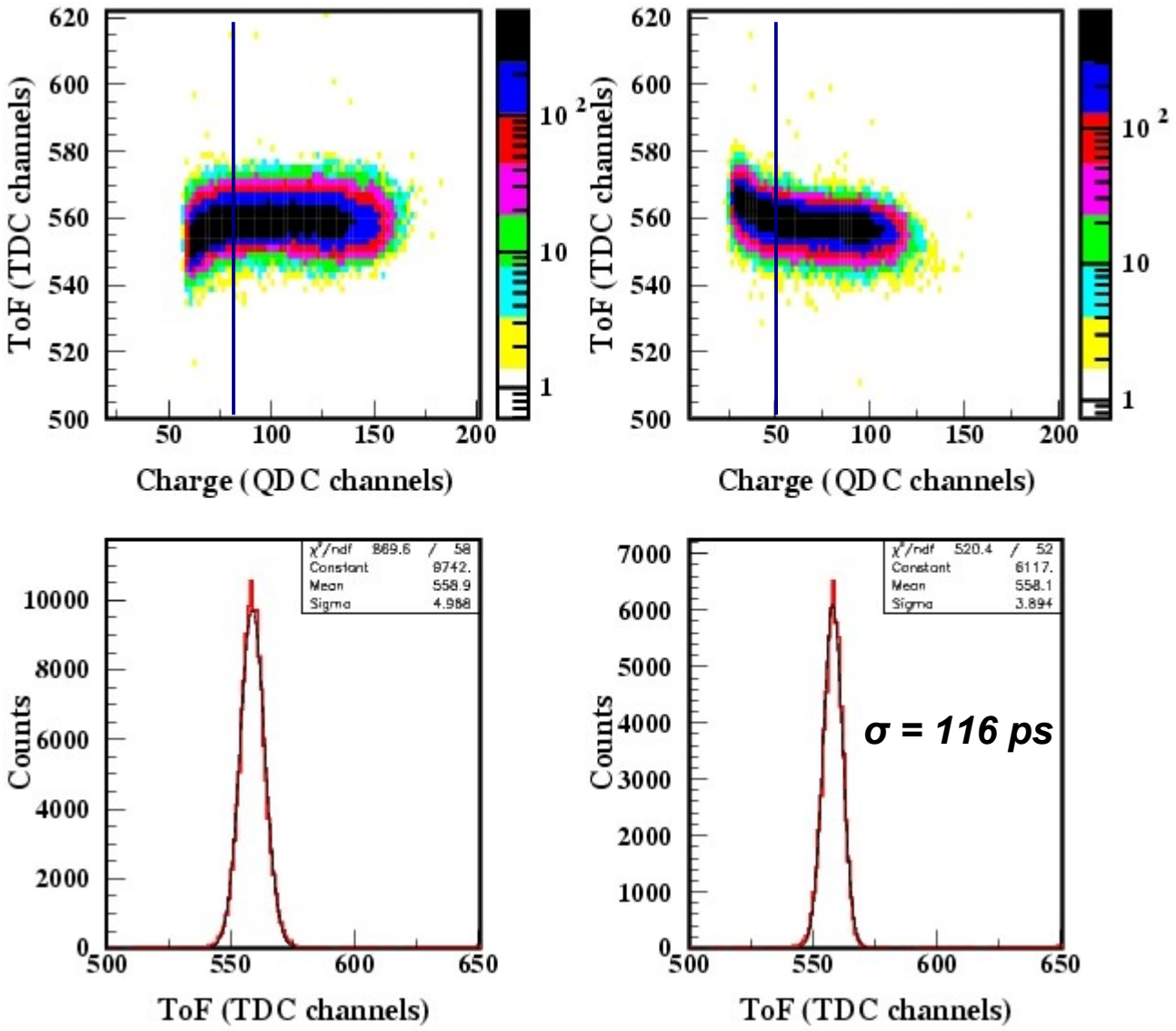
^{60}Co source test – time resolution
RPC transverse strips



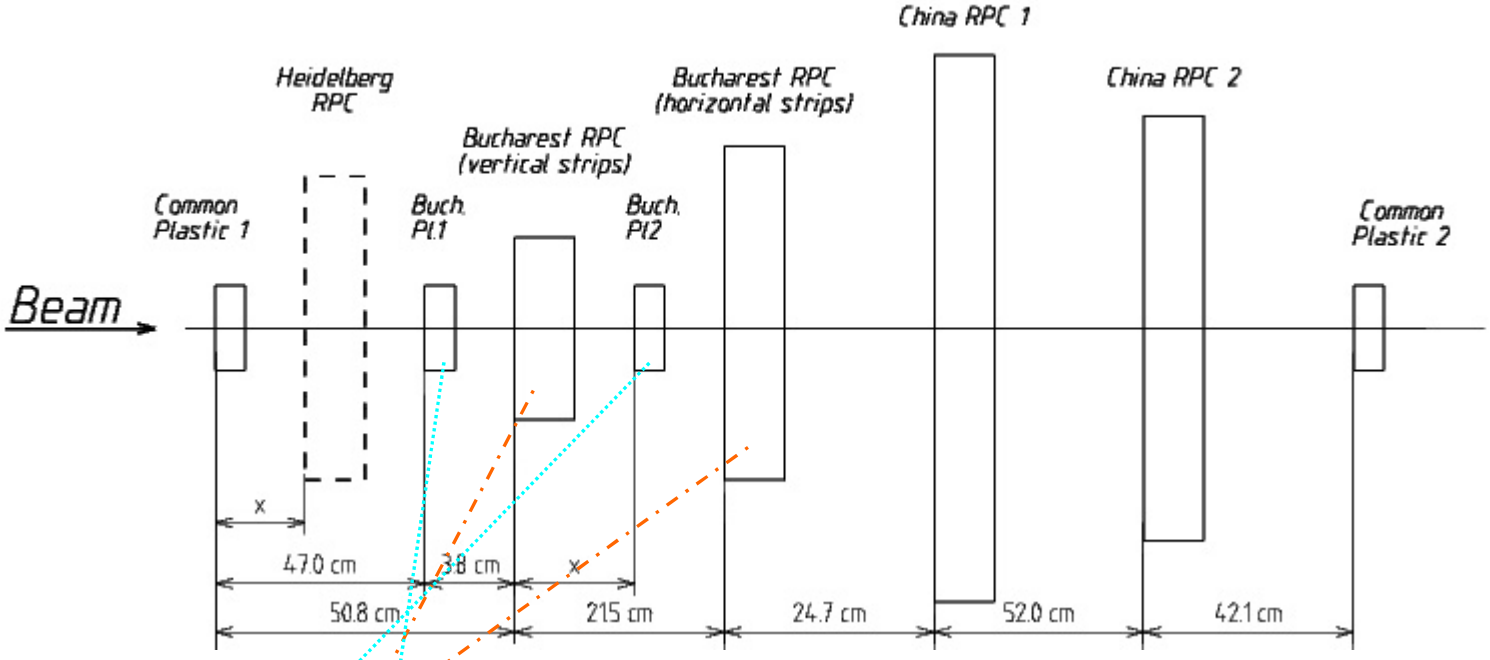
^{60}Co source test – time resolution
RPC transverse strips

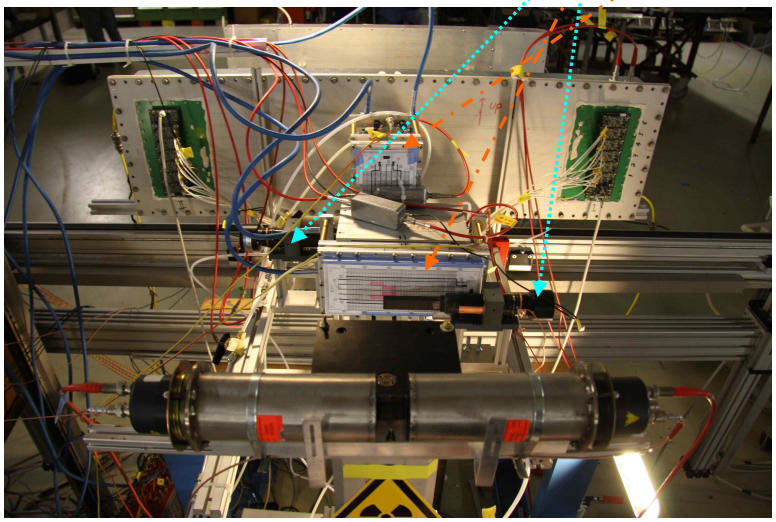


^{60}Co source – Plastic Scintillator Time Resolution



In-Beam Tests @ SIS – GSI

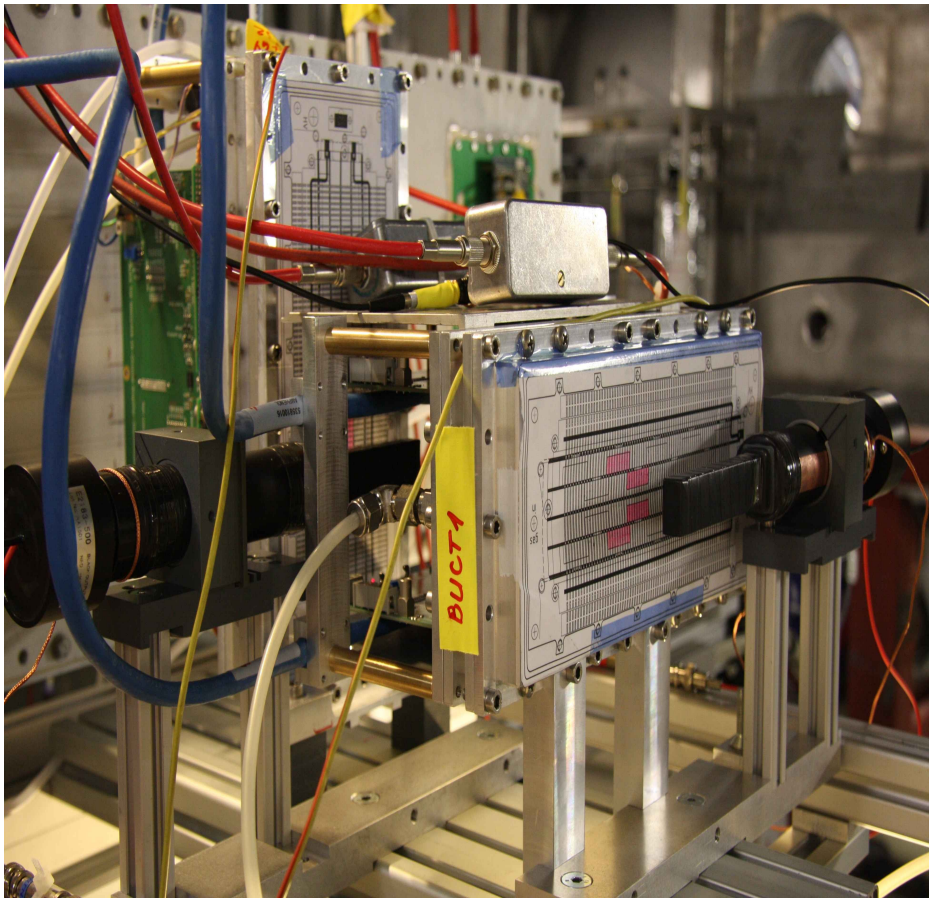


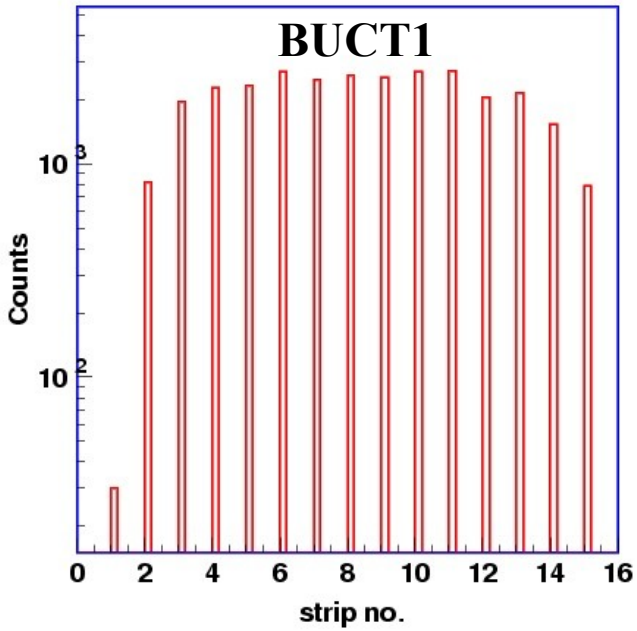


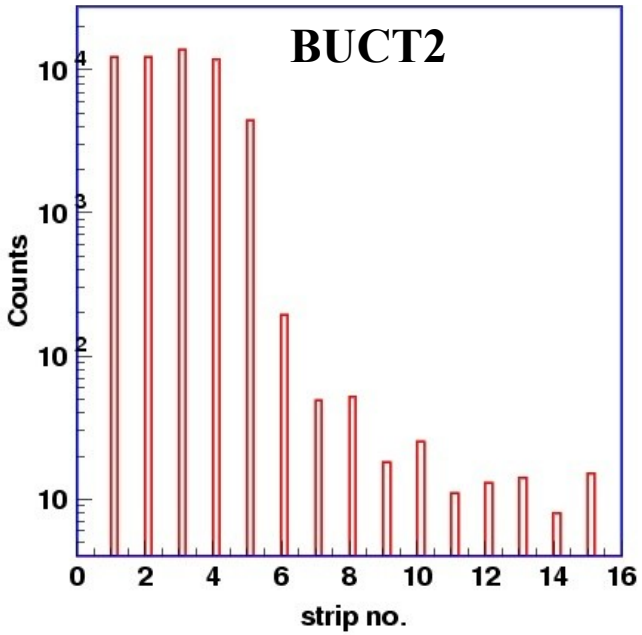
Experimental set-up:

- ***proton beam, 3.1 GeV***
- ***2 plastic scintillators overlapped 2 x 3 cm^2, readout by Hamamatsu R9800 PM, used for active collimation***
- ***signal amplification: differential readout based on NINO chip developed within ALICE Collaboration***
- ***digital converters: CAEN TDC V1290A***
- ***DAQ – MBS***
- ***information recorded for 15 strips readout at both ends, for each counter***

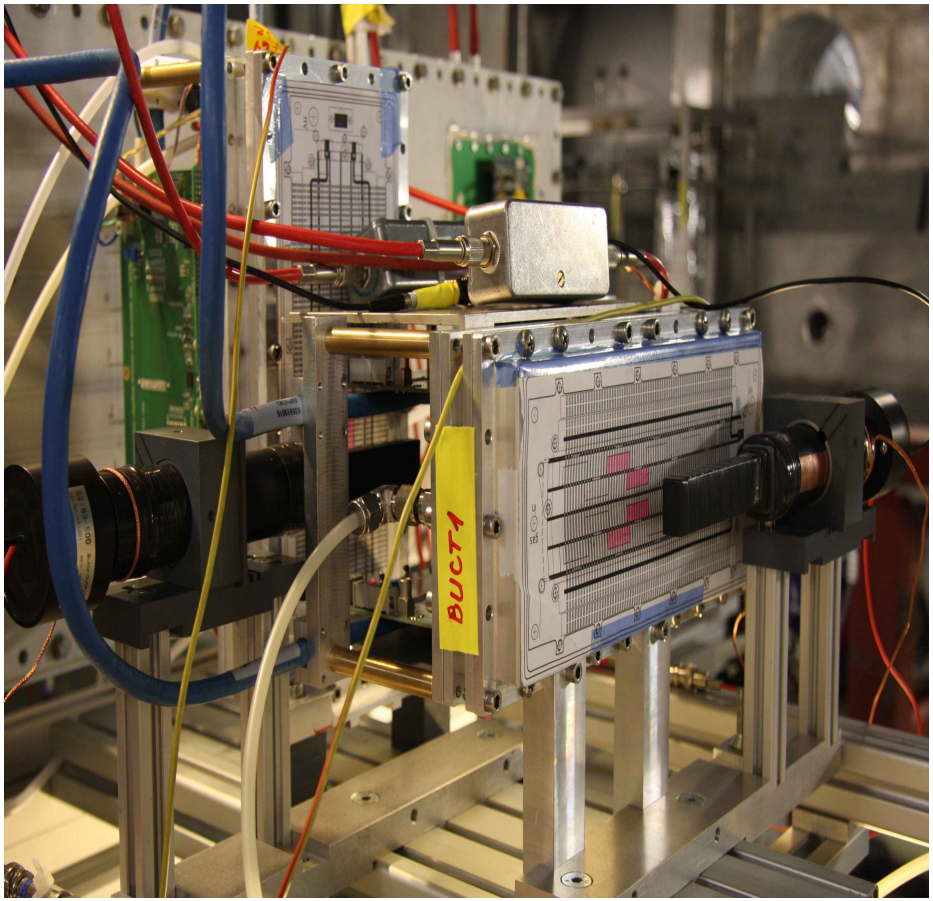
Events Distribution on Strips

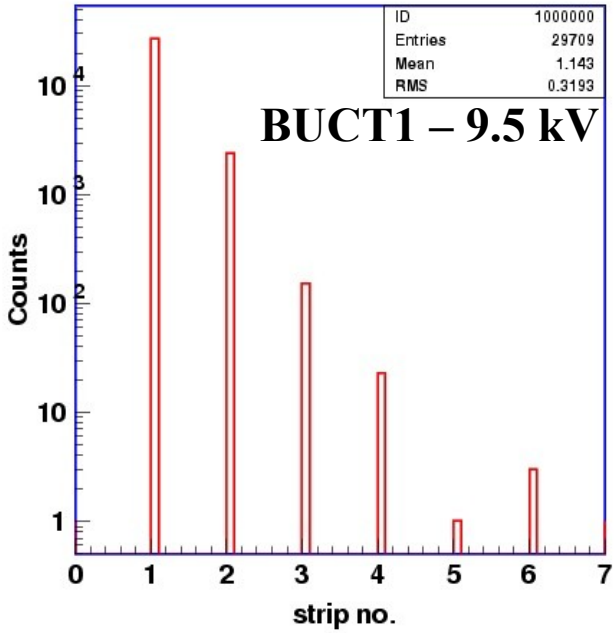


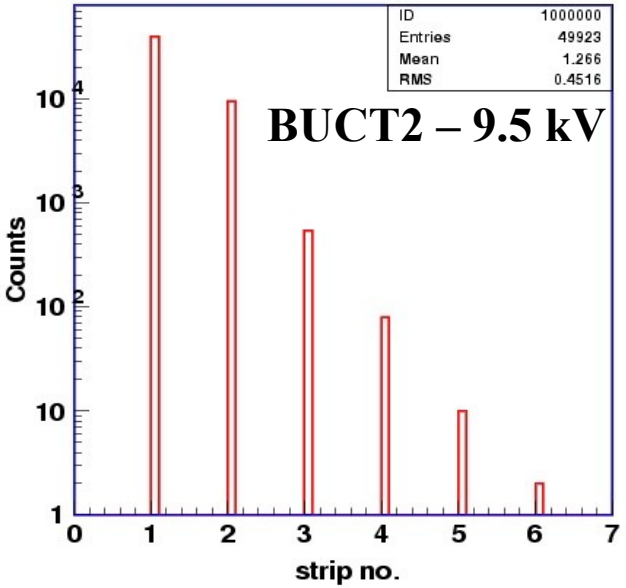




Cluster size

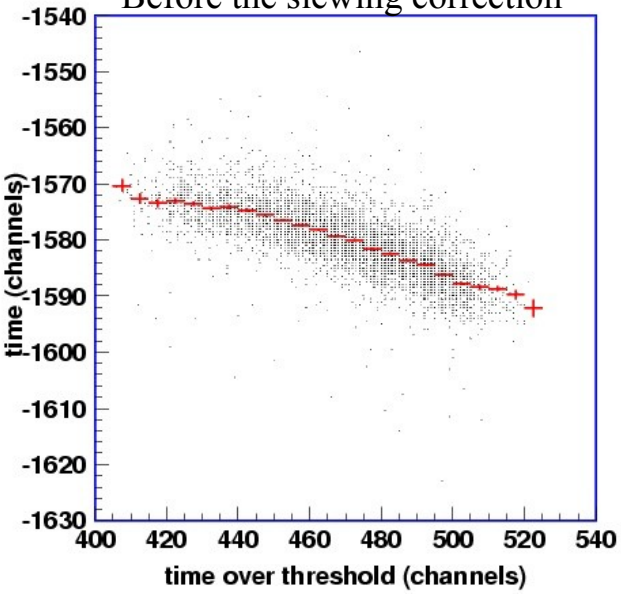




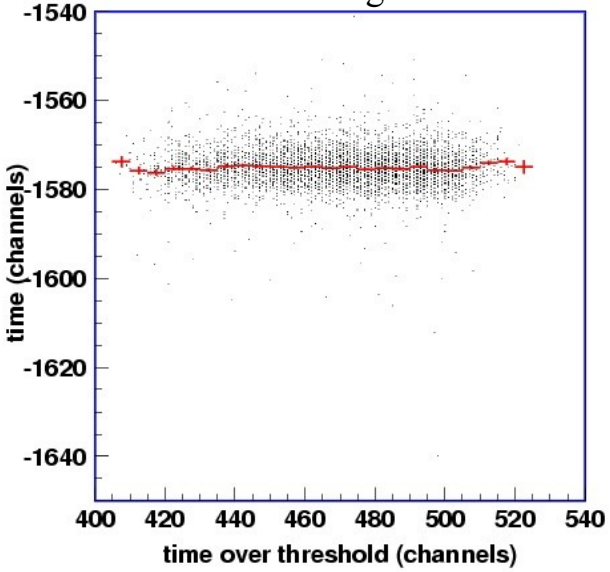


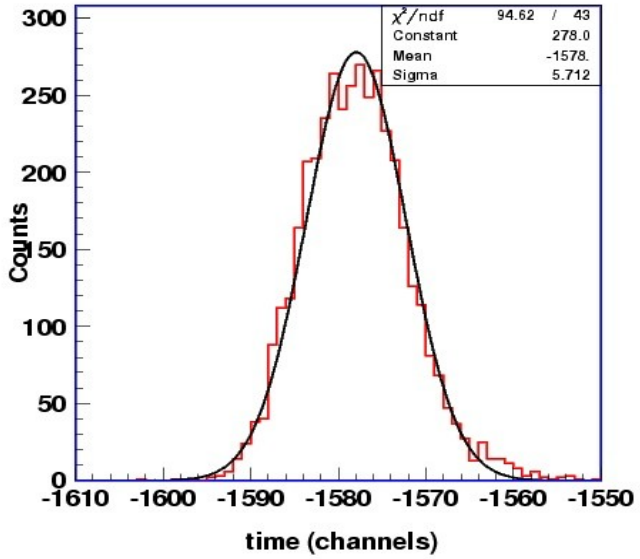
Time resolution

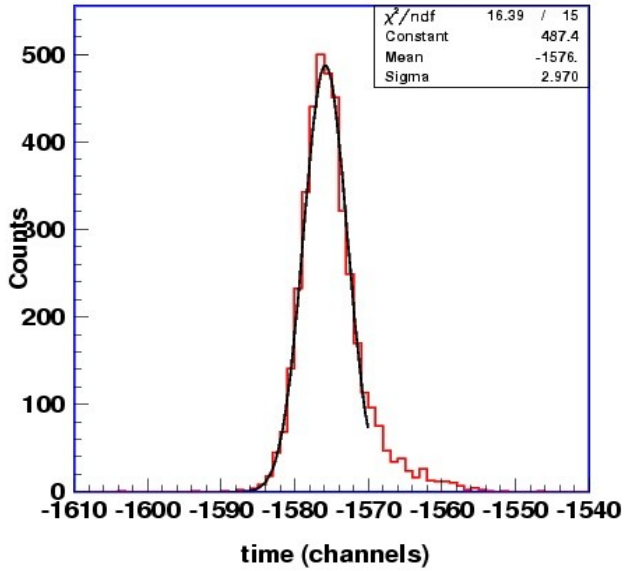
Before the slewing correction



After the slewing correction

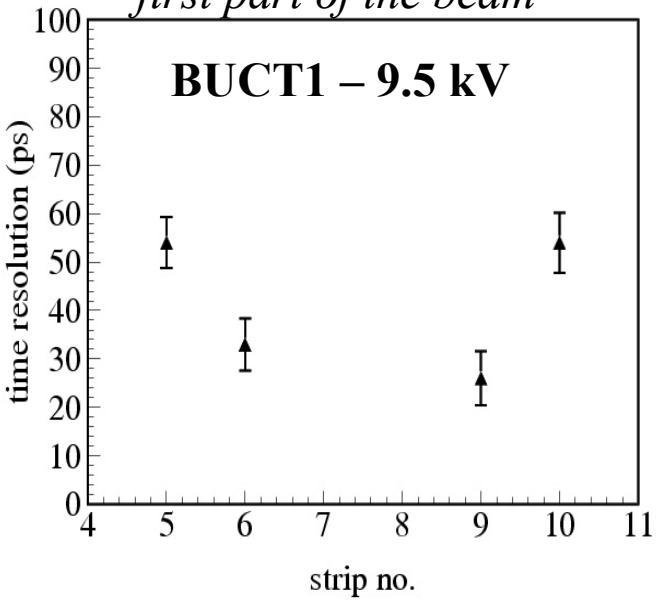




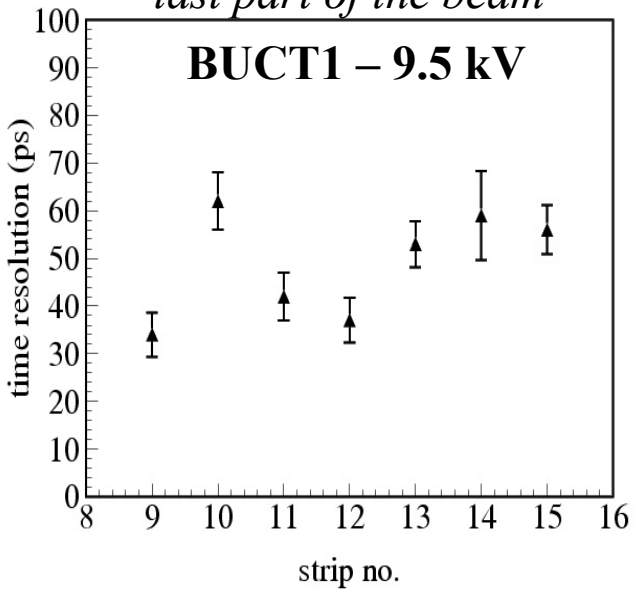


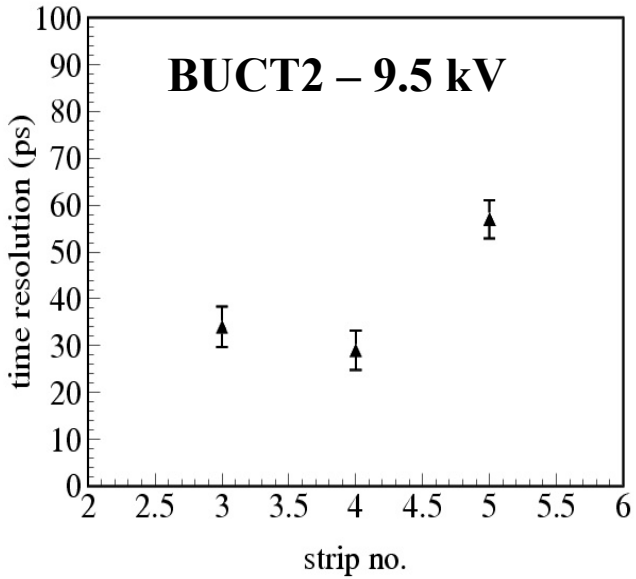
Time resolution as a function of strip no.

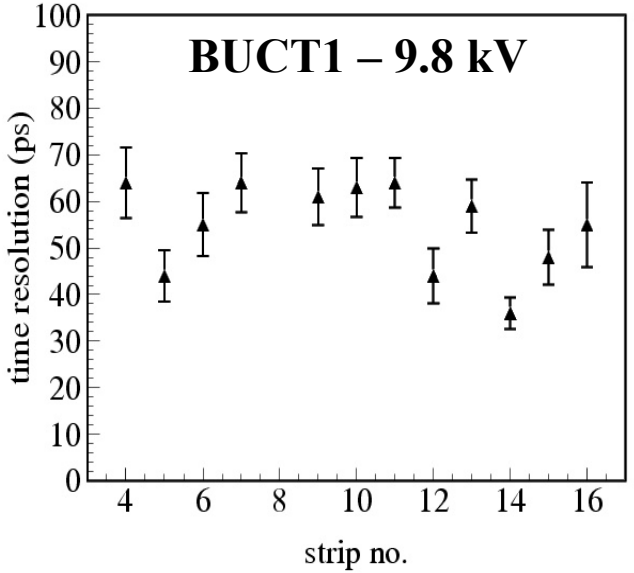
first part of the beam



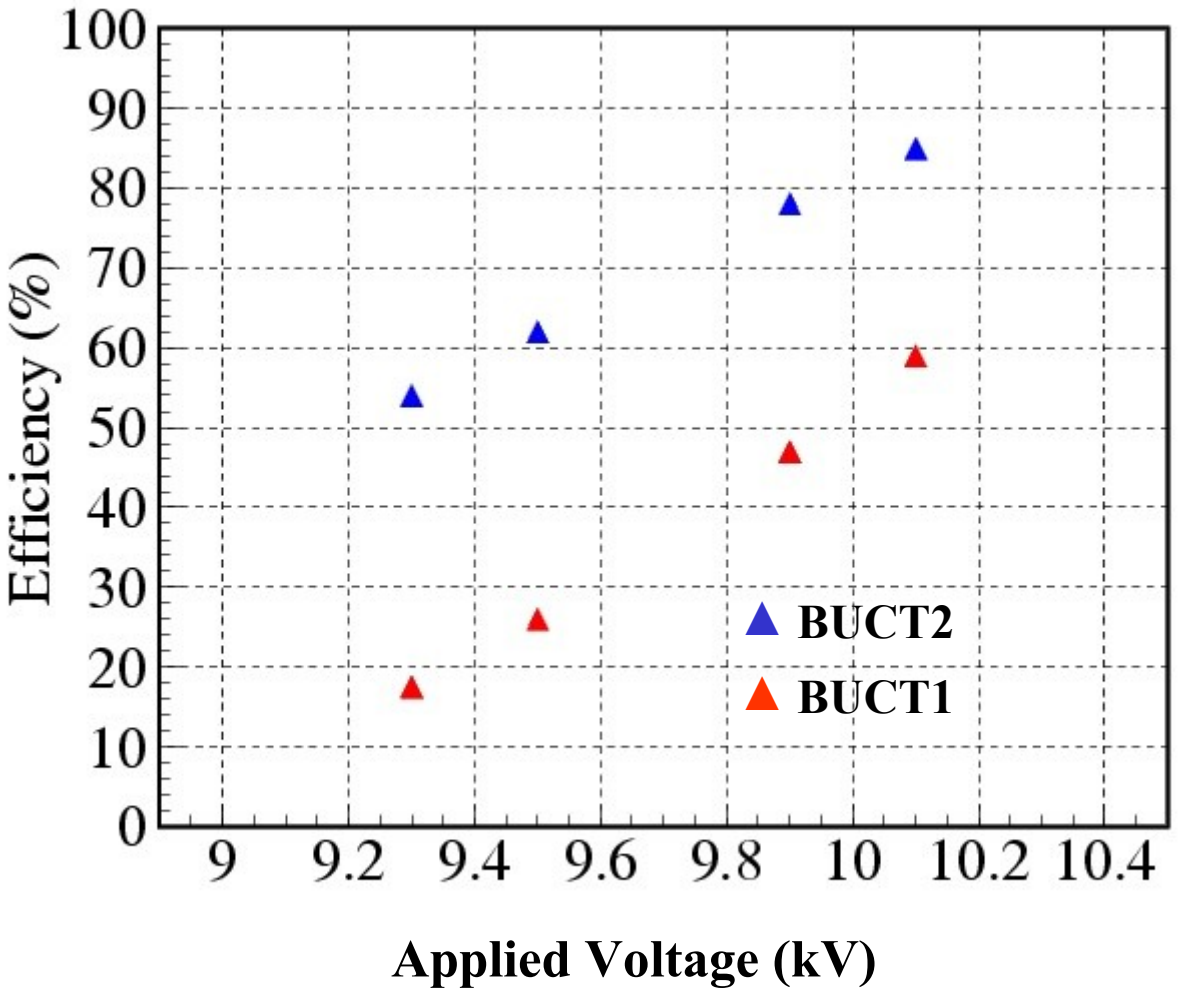
last part of the beam







Efficiency



BUCT2:

NINO FEE1 **Th = 159 mV**

NINO FEE2 **Th = 160 mV**

BUCT1:

NINO FEE3 **Th = 212 mV**

NINO FEE4 **Th = 259 mV**

Conclusions and Outlook

- ***Differential strip readout Pestov Glass RPC prototype***
  - *The in-beam test showed the good performance of the counter with a differential readout based on NINO chip in terms of time resolution ~85 ps (! Including LVDS – NIM converter)*
  - *No deterioration of time resolution as a function of counting rate was observed up to ~ 16,000 part/cm^2· sec in condition of an uniform illumination of the whole active area of the counter*

- *We **designed**, **built** and **tested** with ^{60}Co source a new configuration of a **high granularity, strip read-out, differential high counting rate RPC** using thinner glass electrodes, for small polar angles*
- *^{60}Co source and **in -beam** test showed:*
  - *excellent time resolution*
  - *high granularity (multihit performance to be checked in real conditions)*
  - *preliminary 85% efficiency, not yet at the plateau value (the influence of NINO gain, threshold and electric field distribution to be studied!)*
  - *counting rate performance under investigation*
  - *identical architecture using low resistivity glass electrodes – MUST!*
  - *differential NINO – FEE is completely adequate for this type of architecture.*

- ***In beam tests using:***
  - *Minimum ionizing particles*
  - *Uniform illumination of the whole counter at high counting rate*
  - *Sufficient statistics for a multidimensional studies of the prototype*
- ***Aging tests***

In the near future, are mandatory

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Special Thanks to: M. Ciobanu, D. Gonzalez-Diaz
V. Aprodu, L. Prodan and A. Radu