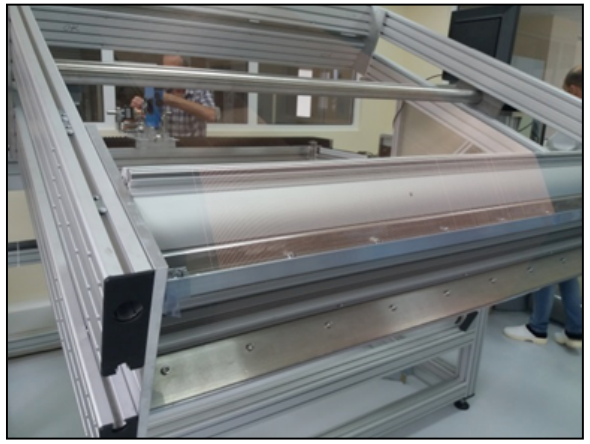
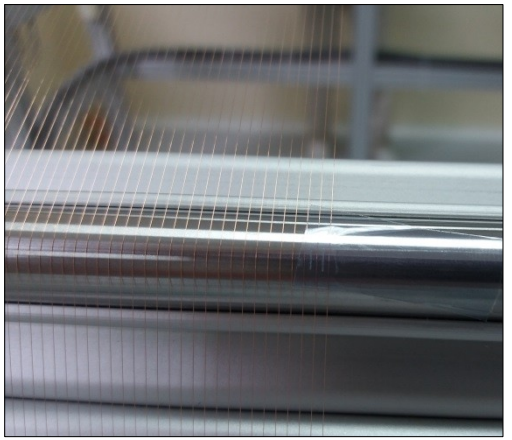
TRD-2D QA Tests

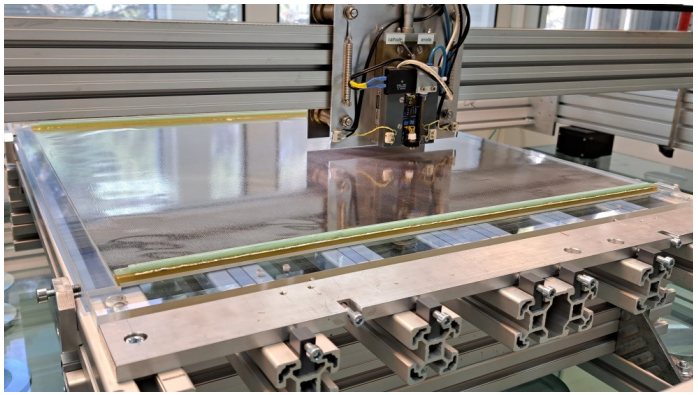
Outline

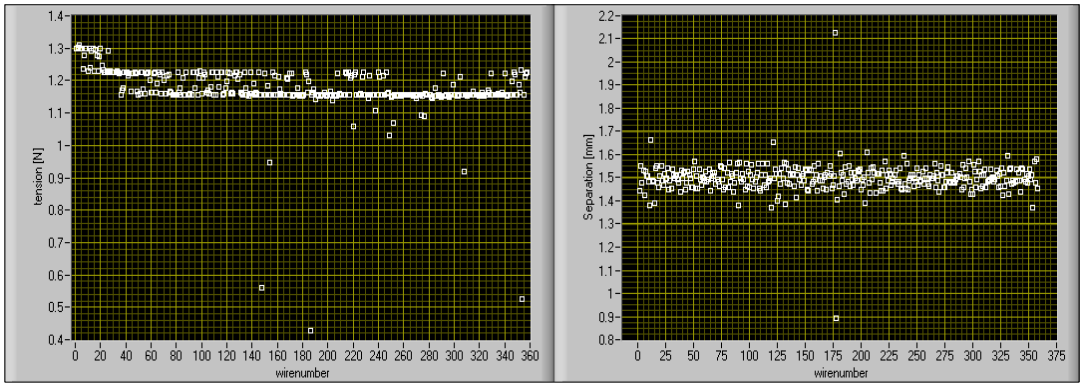
- **Prototype assembling ->briefly**
- **Experimental setup for QA tests**
- **^{55}Fe source spectra: absolute gain, energy resolution**
- **Gain mapping**
- **Exposure to high intensity X-ray flux**
- **Summary and Outlook**

Prototype assembling







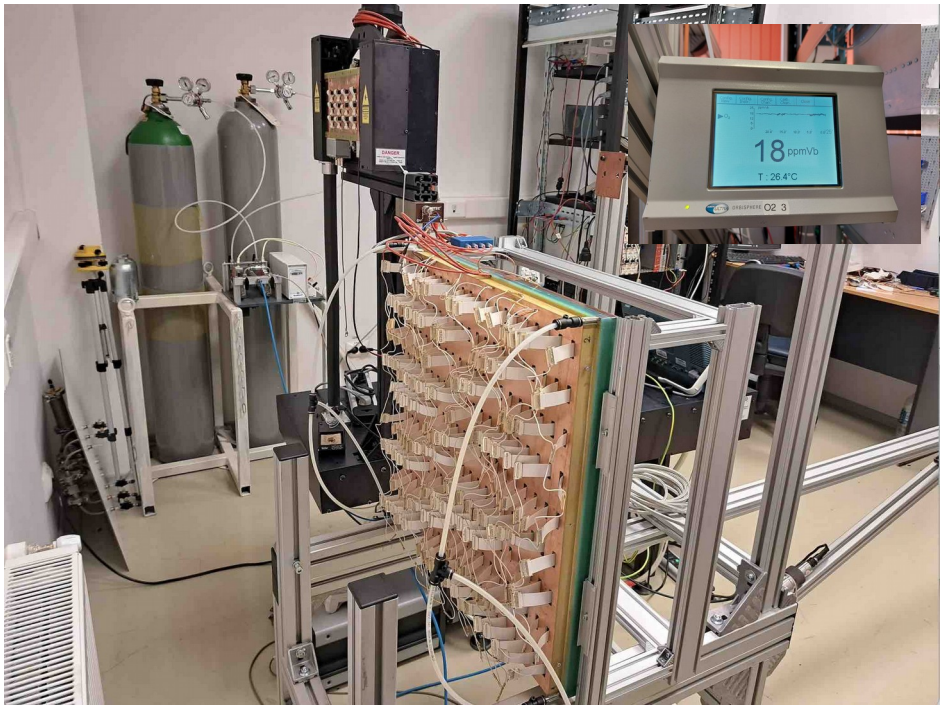


Much more details in Laura's talk at the Collaboration Meeting in Warsaw.

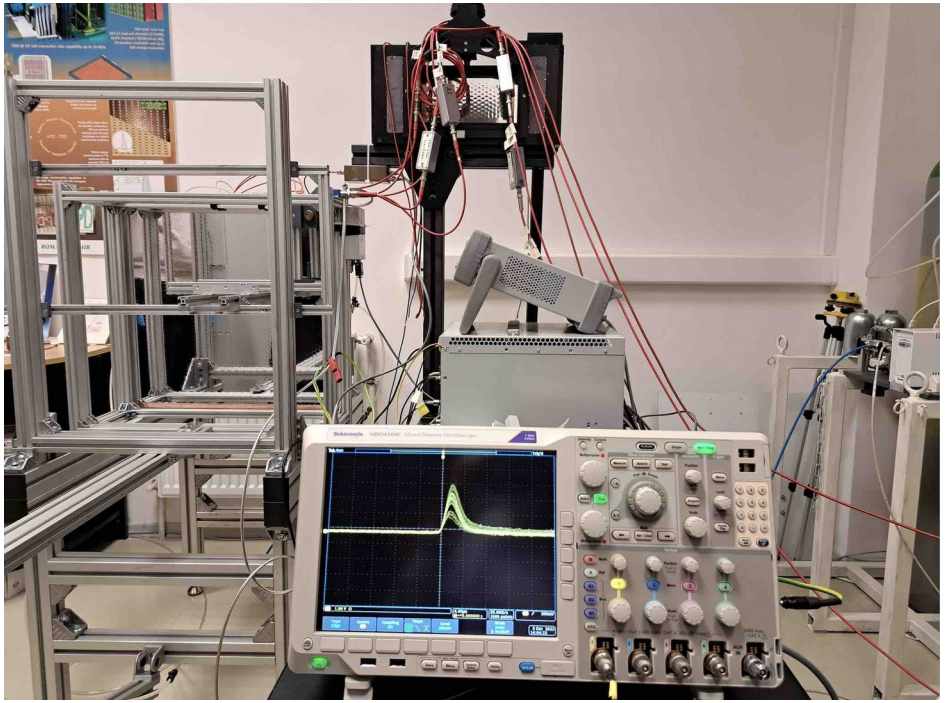
- Cathode wires were aligned with 1.5 mm pitch combs produced at GSI – our thanks to Mladen!
- Mechanical wire tension has been possible to be measured only for glued cathode wires.
- The machine has not been able to measure the anode wire mechanical tension due to their short length.
- The anode wires were only visually inspected.
- Anode wires has been split in 4 HV sections.

Prototype preliminary tests

Tightness

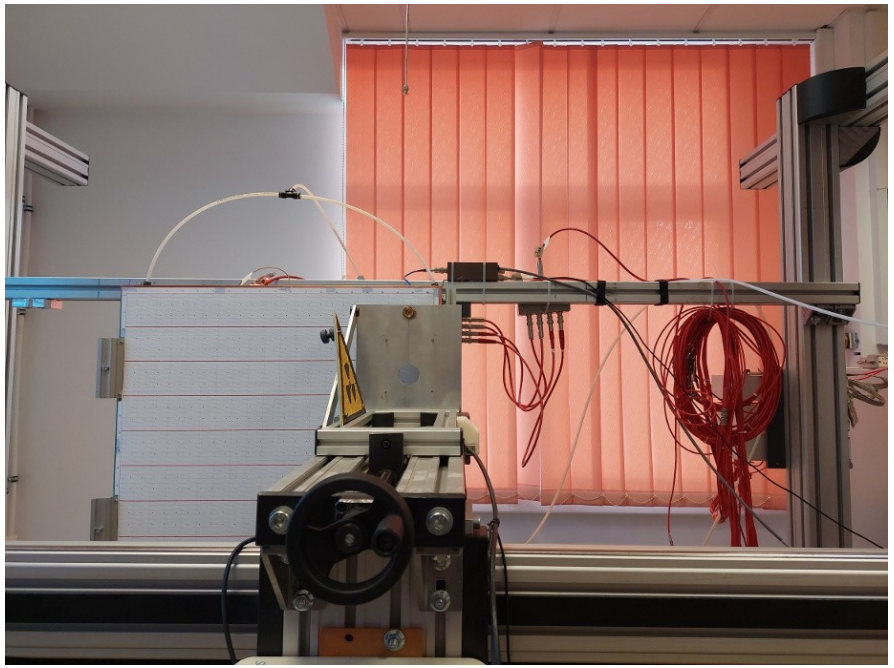


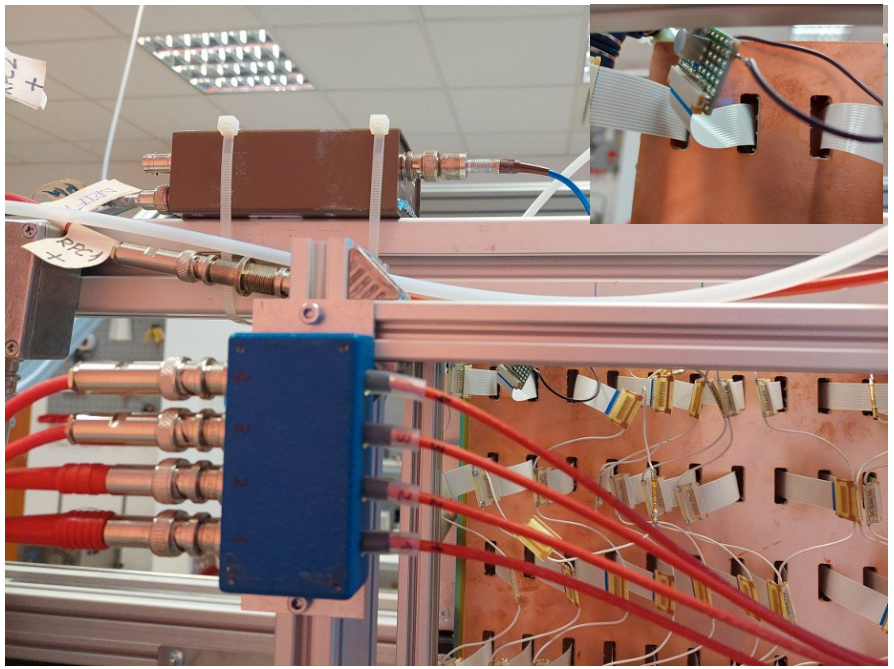
First ^{55}Fe signals

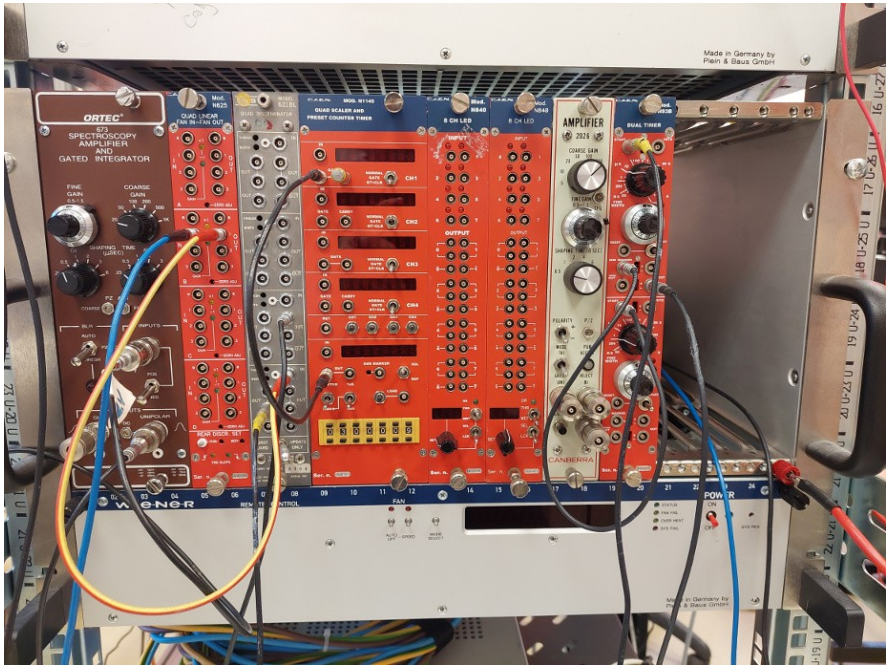


Gas mixture: 80%Ar + 20% CO_2

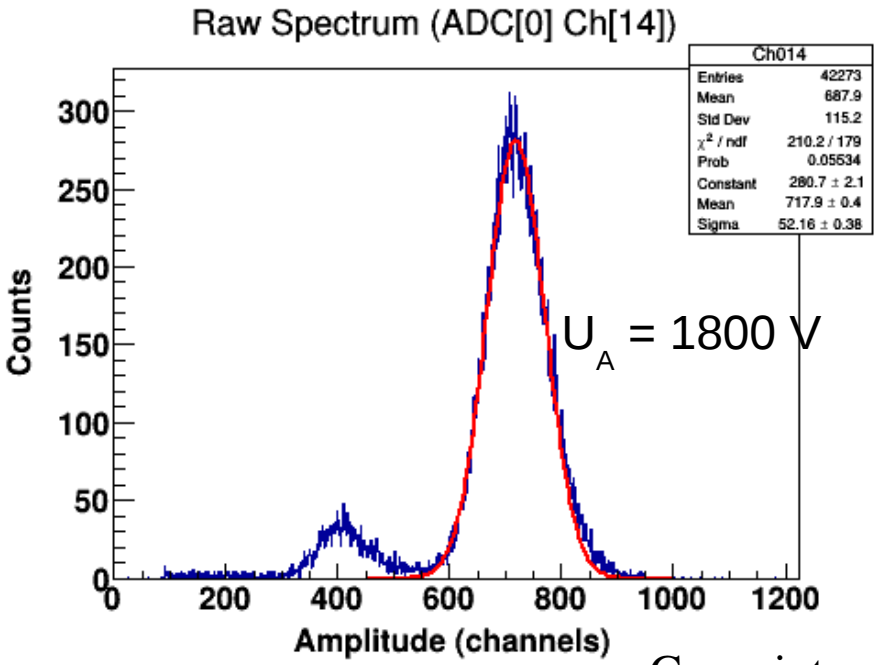
Commissioning tests – experimental setup

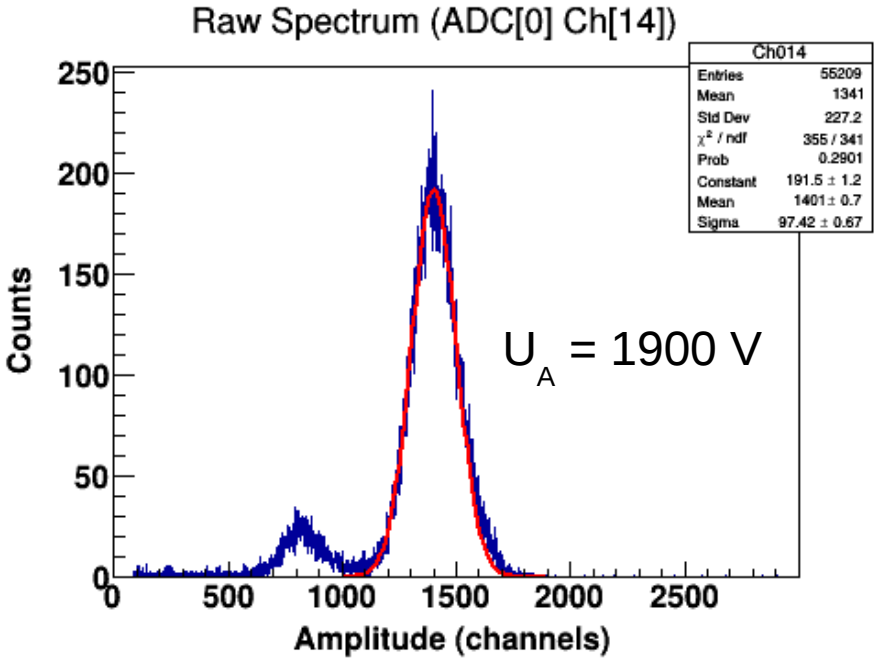




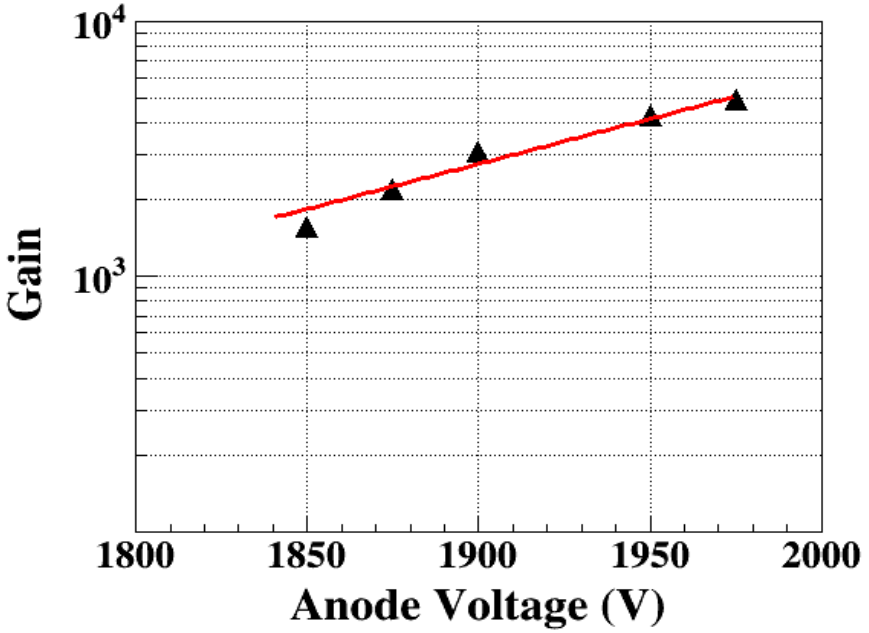


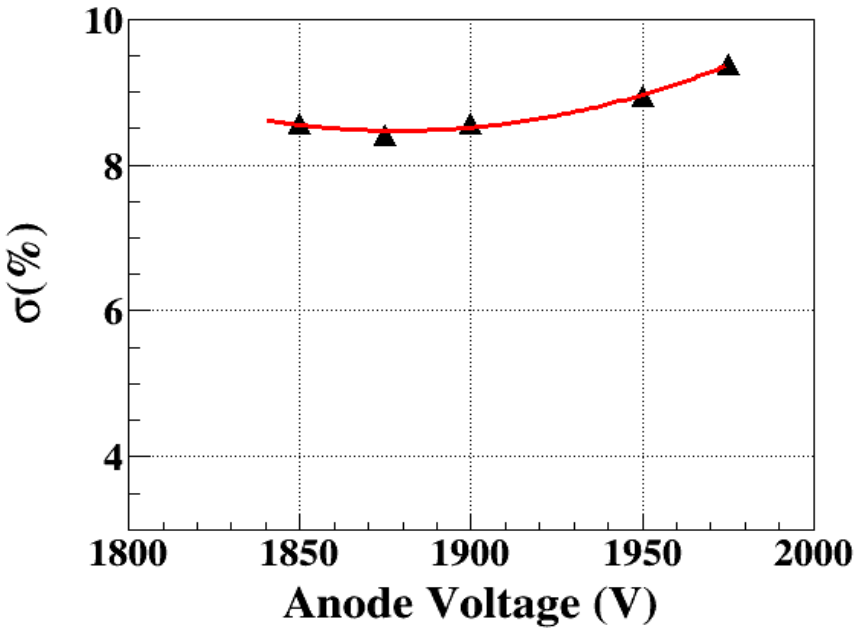
^{55}Fe source spectra





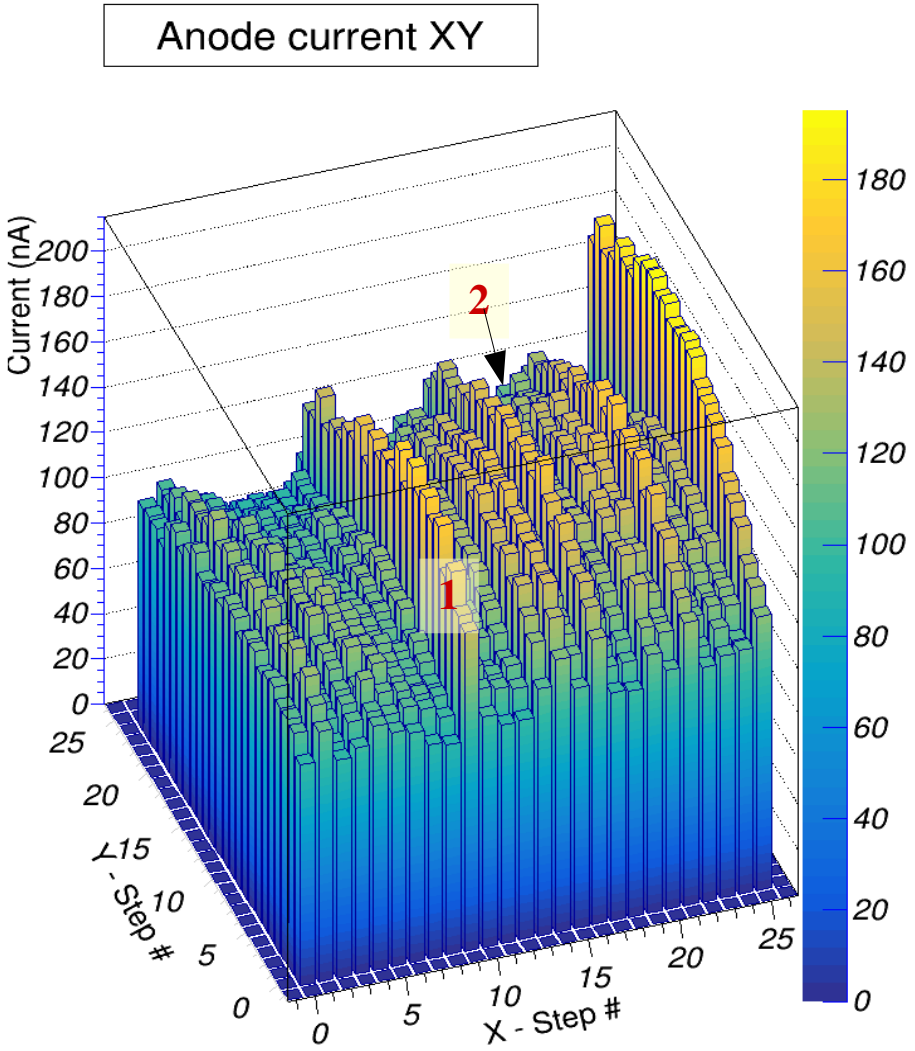
Gas mixture: 80%Ar + 20% CO_2





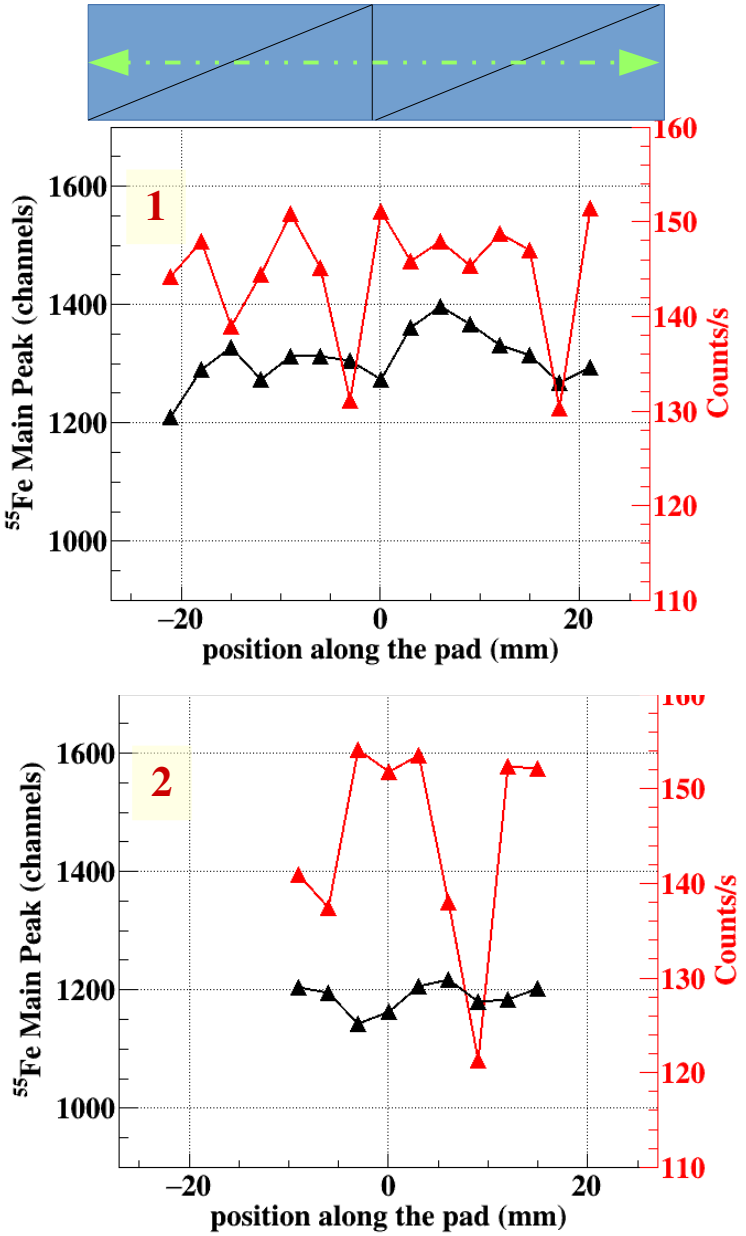
Gain uniformity test

- collimated ^{55}Fe source
- active area was mapped in steps of 2 cm



Non-uniform tensioned anode wires

1D scanning, 3 mm step, across the wires using collimated ^{55}Fe & spectrometric chain



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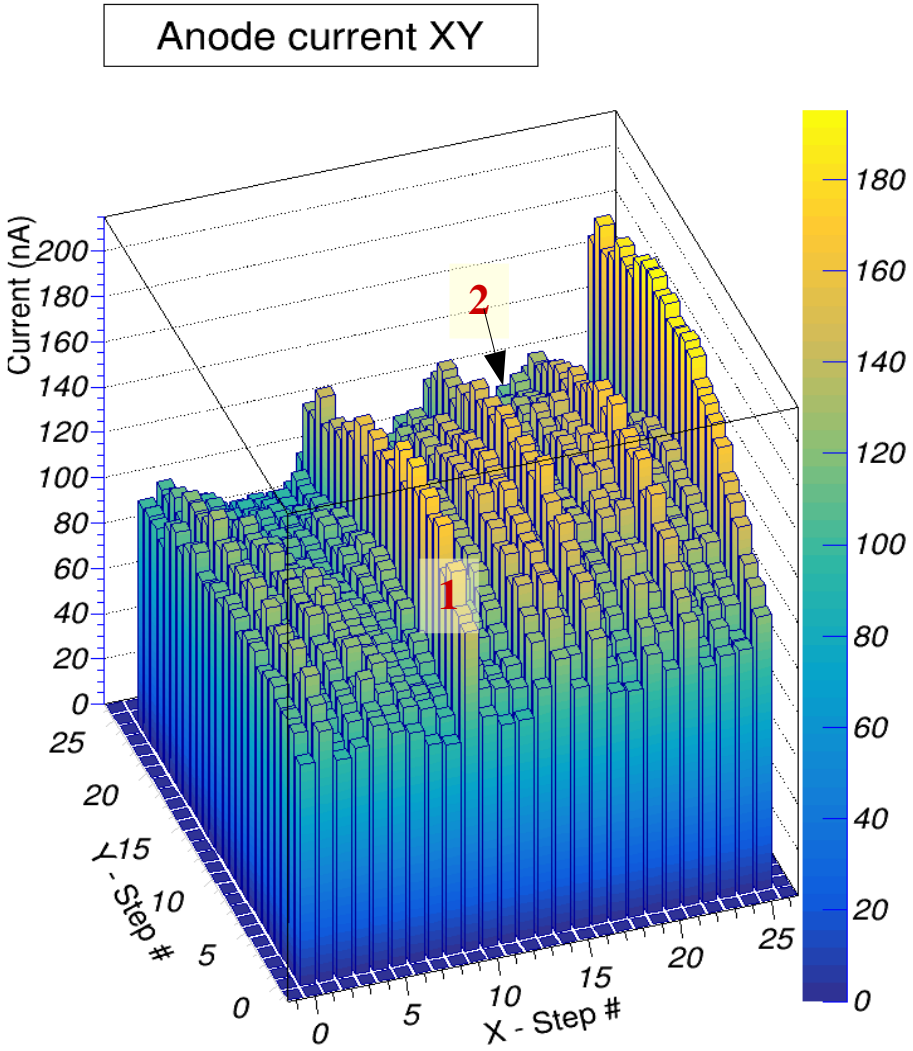

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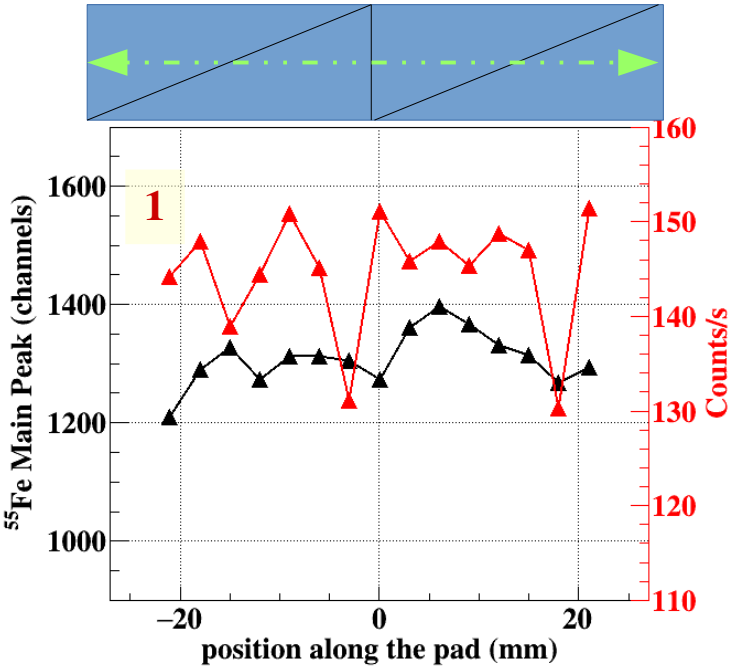
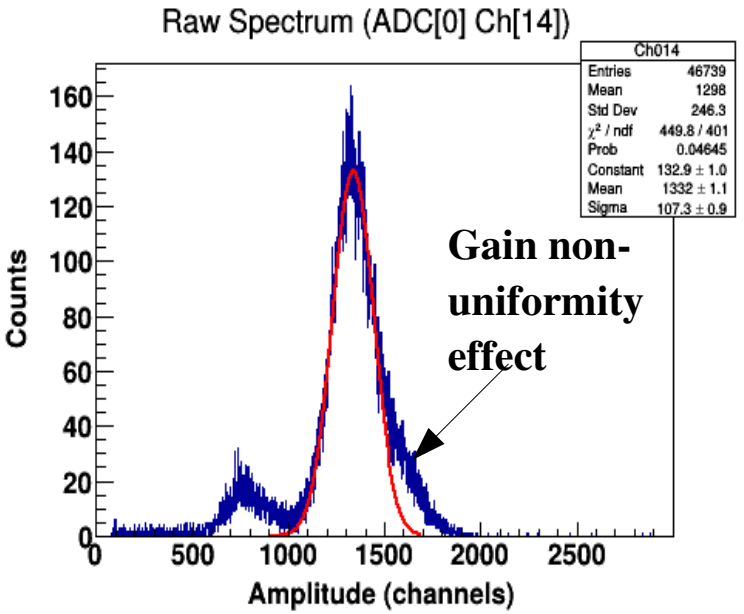


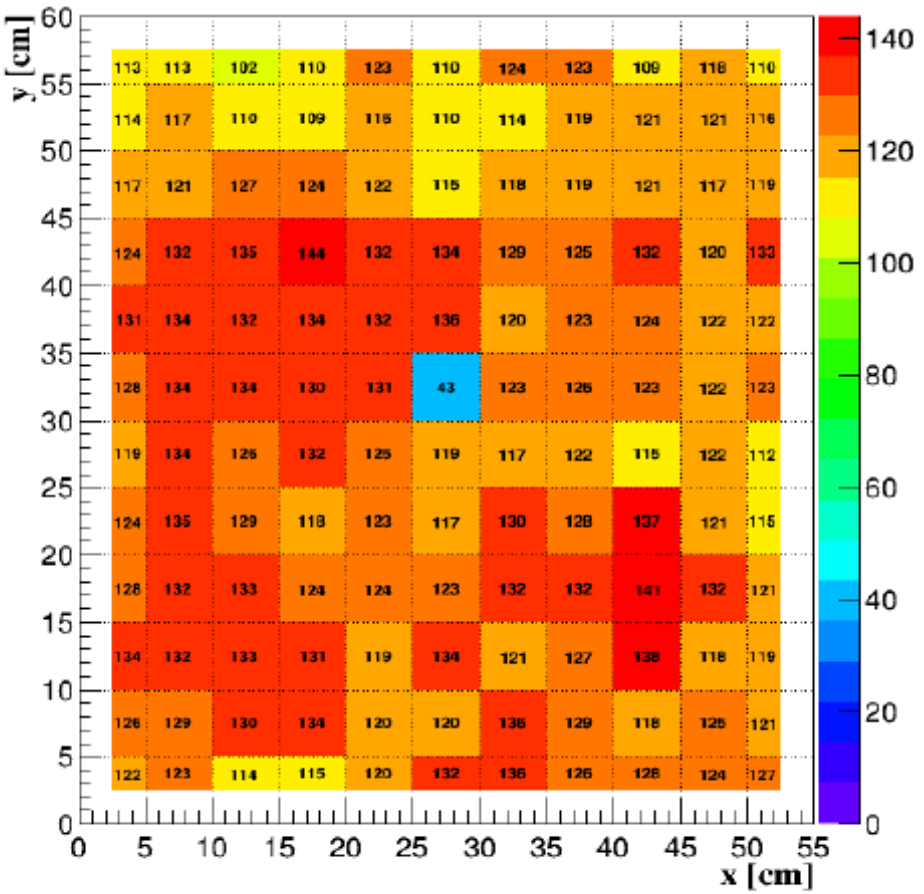


TRD2012 – currently installed in mCBM

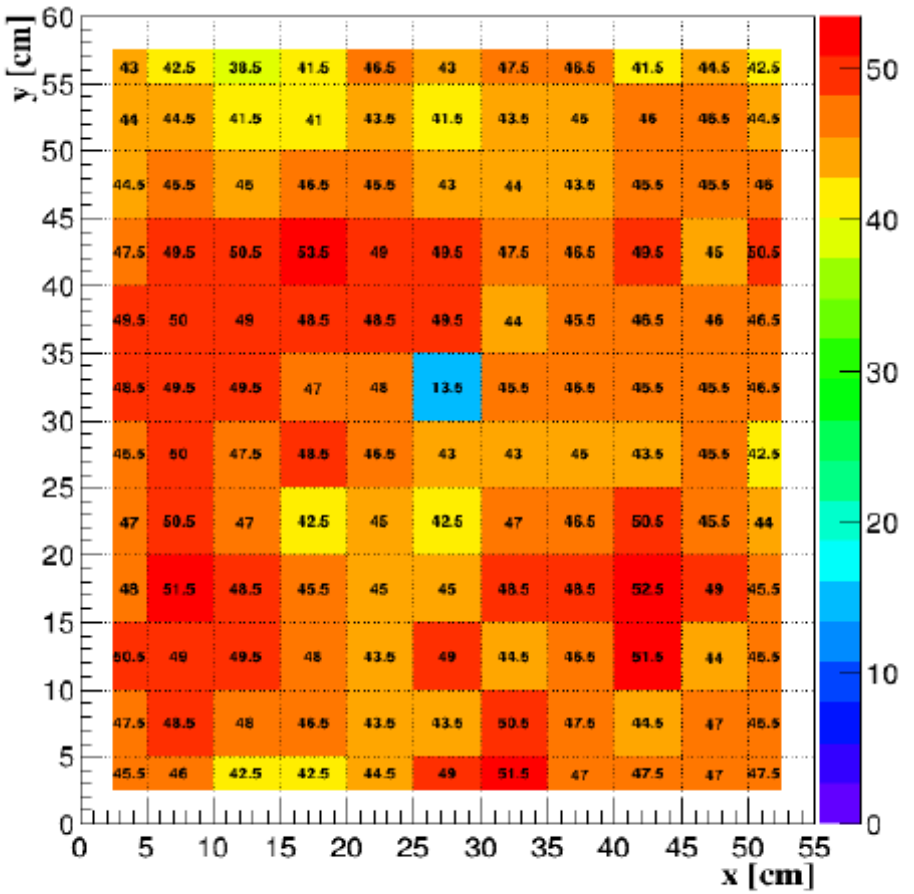
Detector gain uniformity

- operated detector: **TRD 2012 prototype**
- gas mixture: Ar+CO_2 (80%+20%)
- a collimated ^{55}Fe source
- detectors surface was mapped with a step of 5 cm, starting from a corner

I_{anode} [nA]

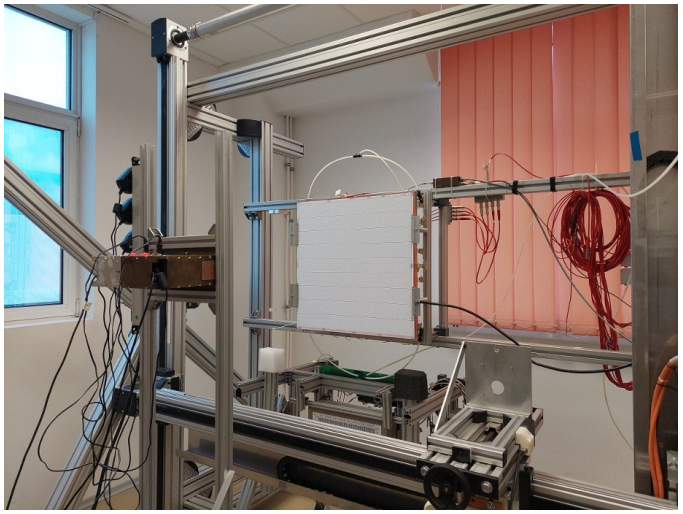


I_{pad} [nA]



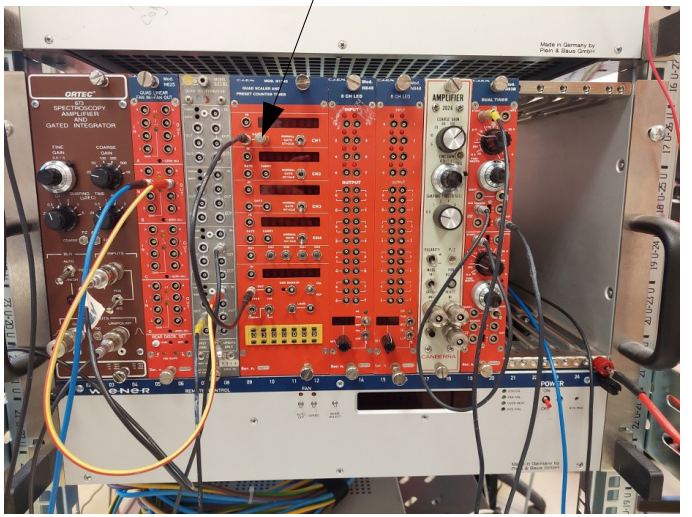
Exposure to high intensity X-rays

Experimental setup

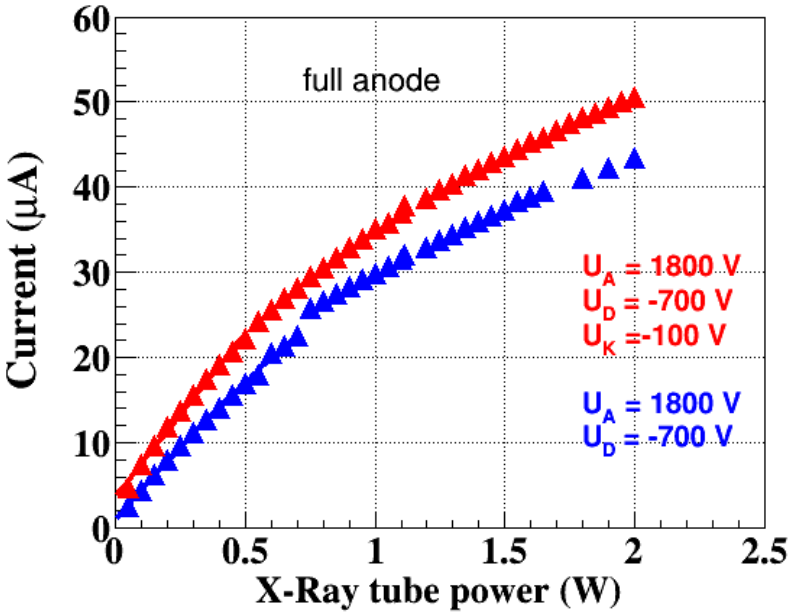


Detector current measurement

Counting rate of a rectangular pad recorded with a scaler



Gas mixture: 90%Ar + 10% CO_2



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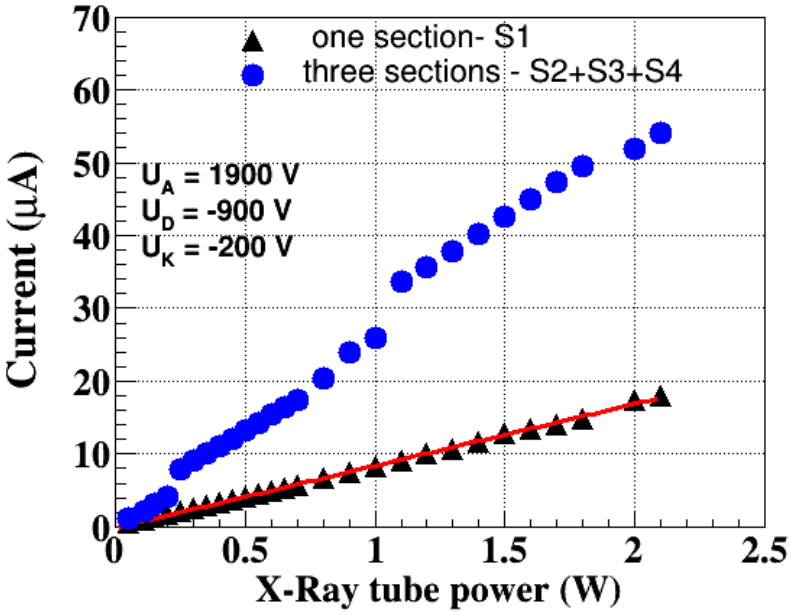
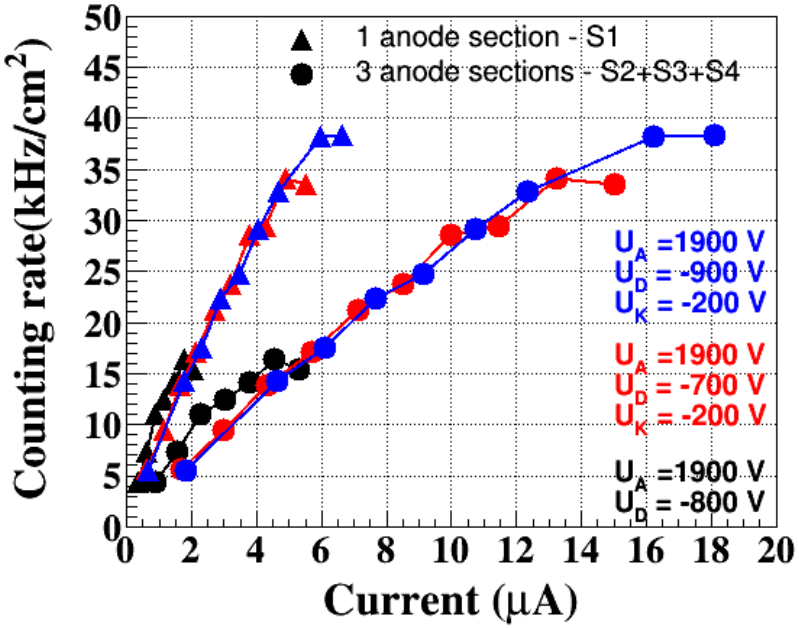
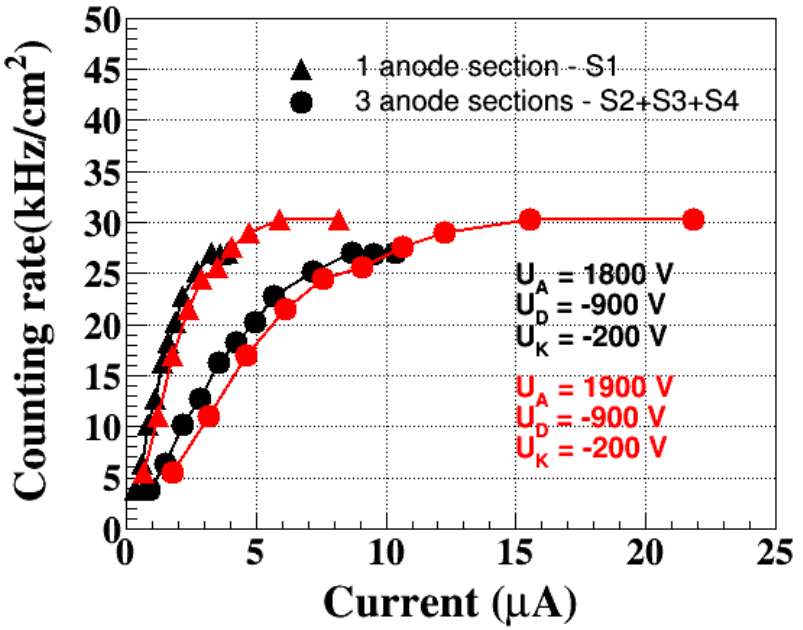


Exposure to high intensity X-rays

Counting rate ->Triangular pad



Counting rate ->Rectangular pad



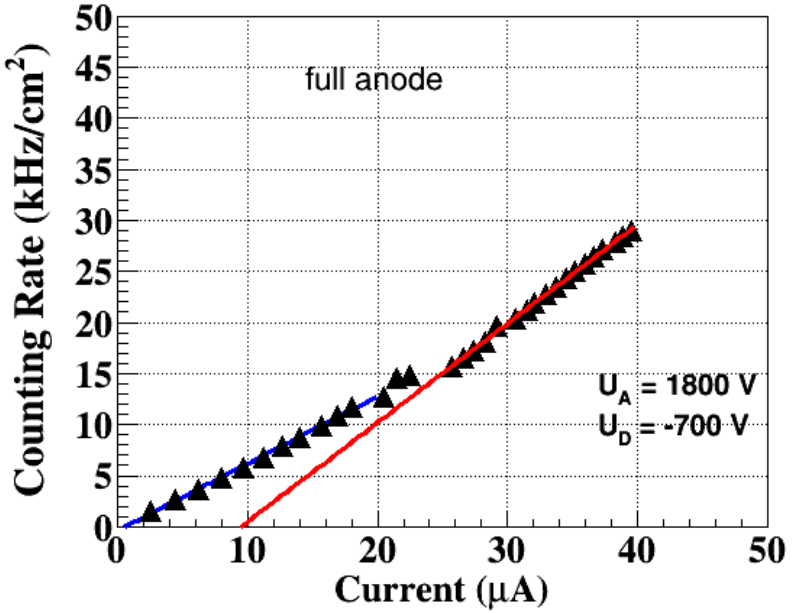
Gas mixture: 80%Ar + 20% CO_2

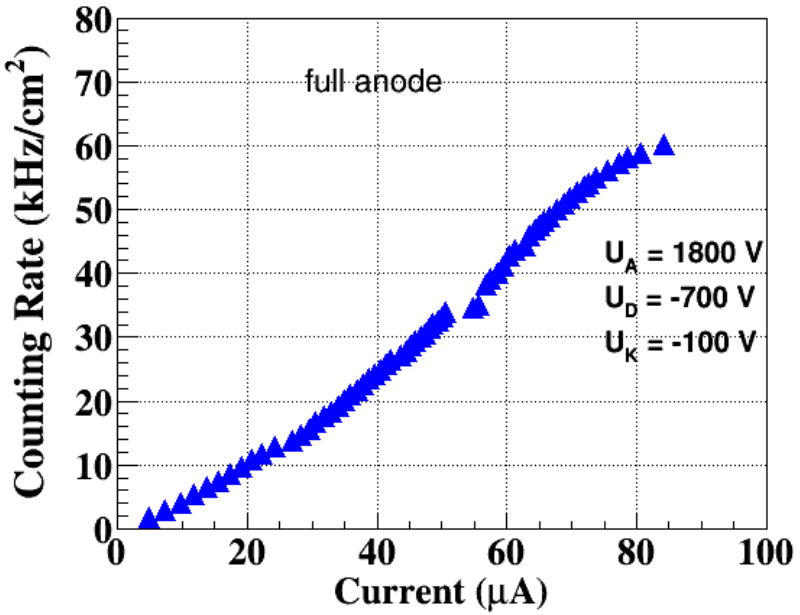
Flow: 6 l/h

"Counting rate" - was estimated as the number of of events recorded from a triangular/rectangular pad readout by one electronic channel (ORTEC charge PA + Amplifier), discriminated by a leading edge and counted by a CAEN scaler.

Exposure to high intensity X-rays

Counting rate ->Rectangular pad



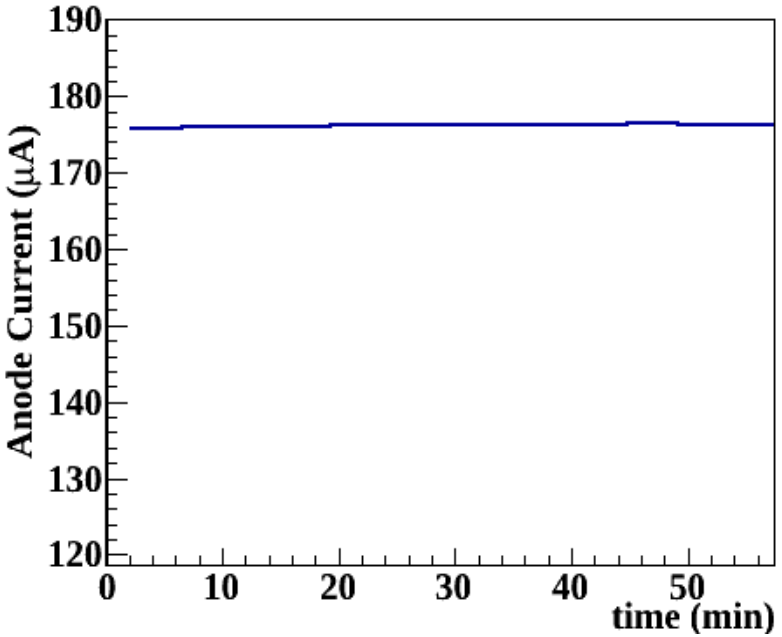


Gas mixture: 90%Ar + 10% CO_2

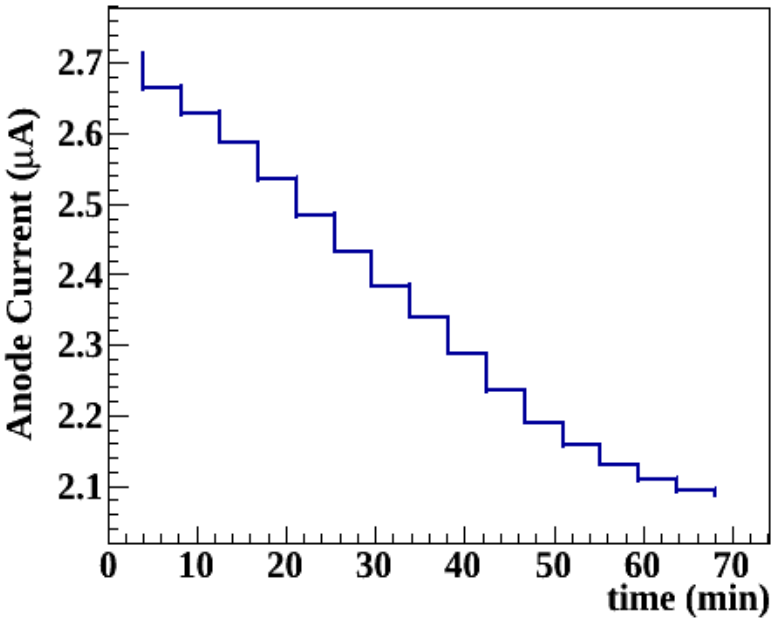
Flow: 6 l/h

Exposure to high intensity X-rays

During exposure to the high X-Ray flux



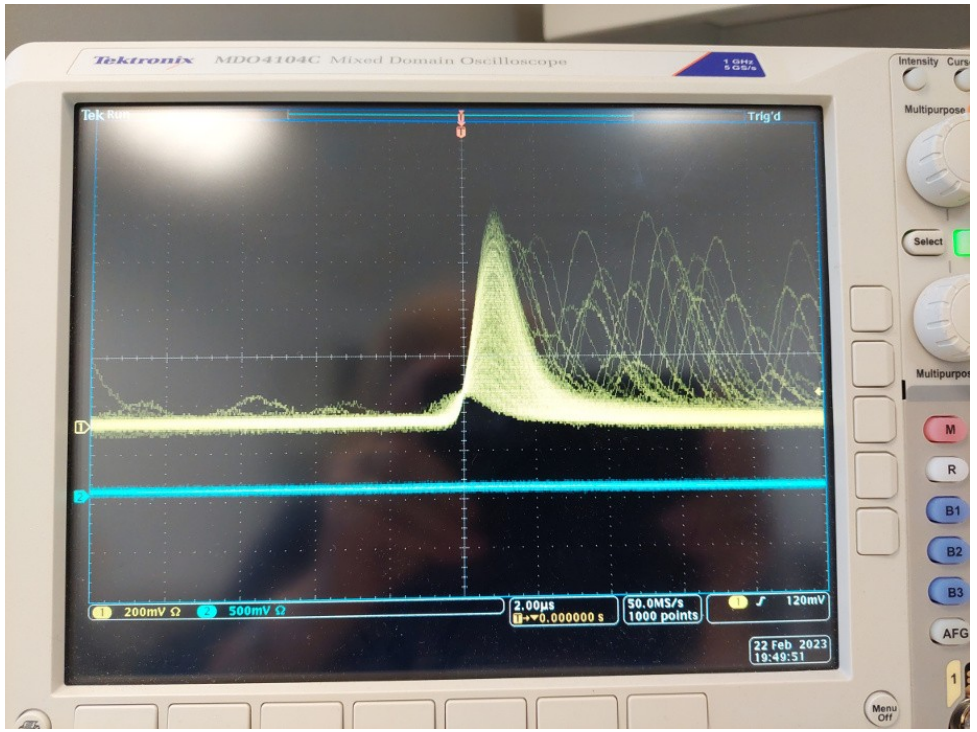
After exposure to the high X-Ray flux



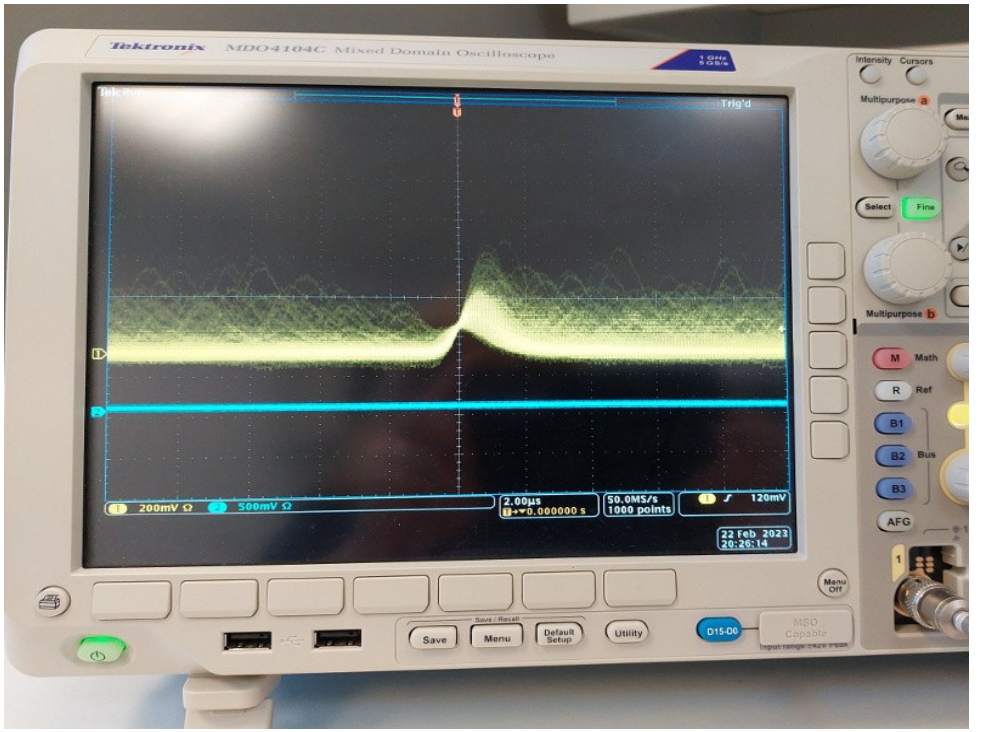
Gas mixture: 90%Ar + 10% CO_2

Flow: 6 l/h

Exposure to high intensity X-rays
Space charge effect



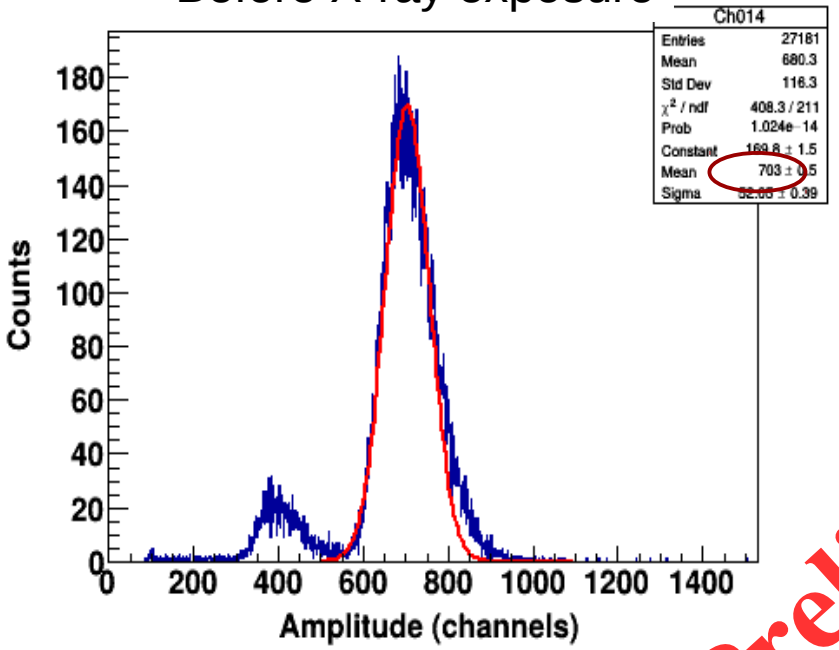
Low intensity (15:18 h)



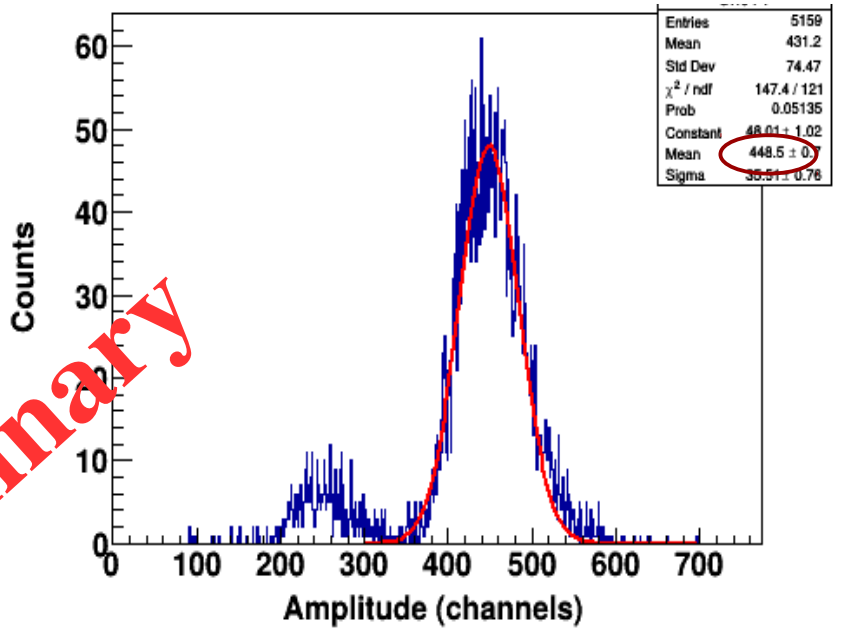
High intensity (15:55 h)

Gain hysteresis

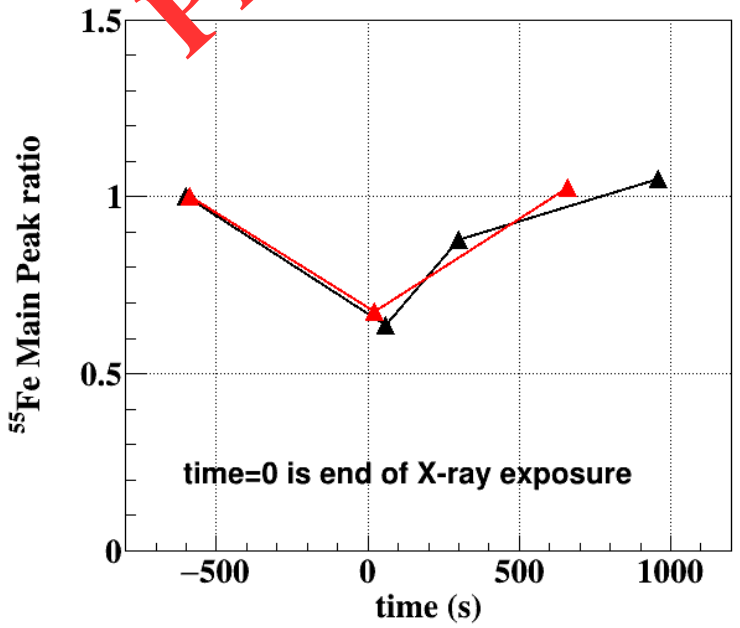
Before X-ray exposure



After 10 min X-ray exposure @ ~28 kHz



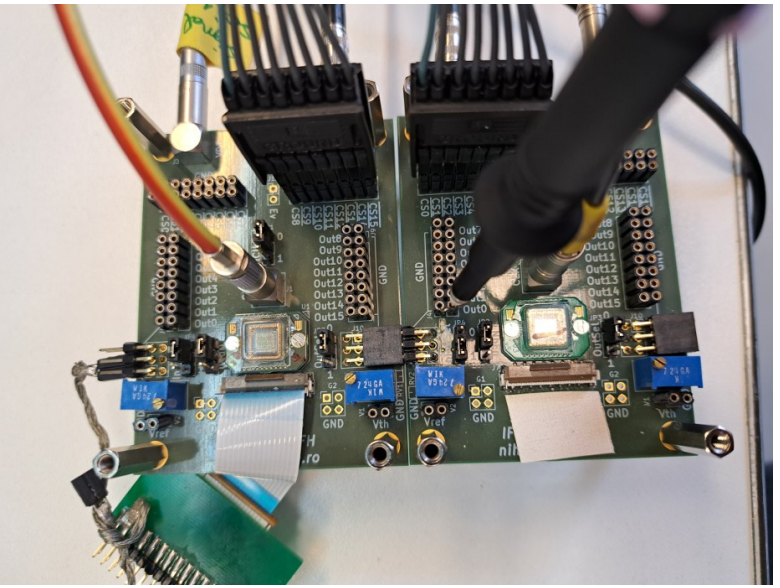
Preliminary



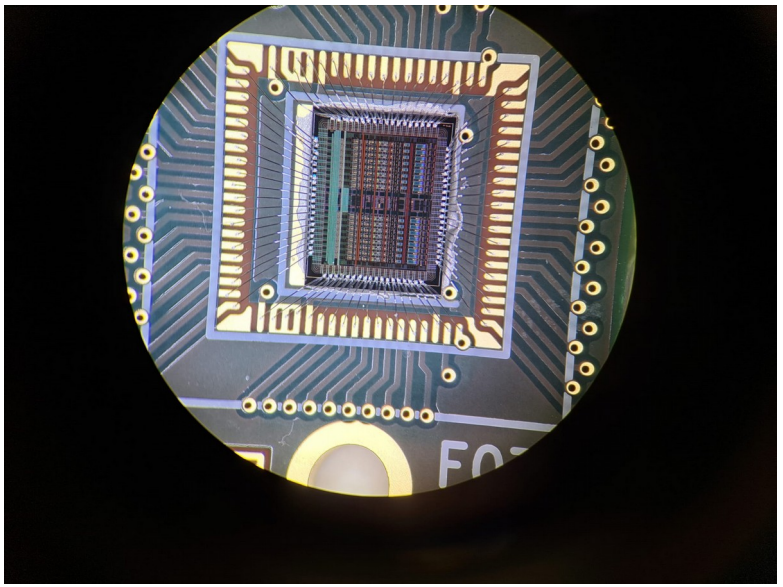
FEE status

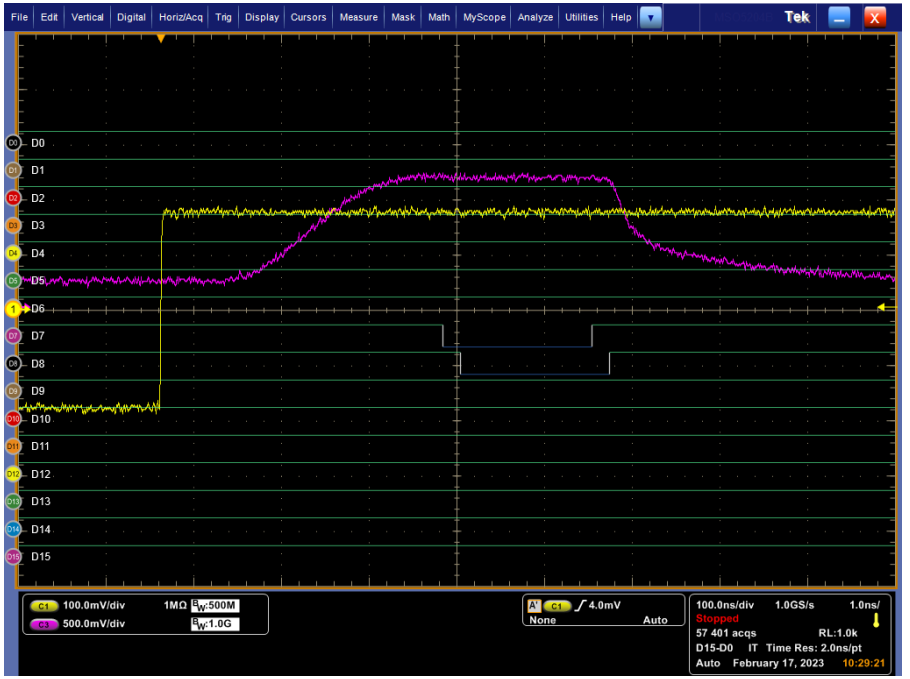
- 500 ordered FASP ASICs arrived in HPD.
- 3 +1 ASICs bonded in HPD.
- 490 will be bonded outside.
- 10 ASICs will be kept in HPD.
- A new motherboard for testing the bonded chips will be designed and used for mass chip tests.
- They will be used to fully equip 2 TRDs (2 x 180 ASICs).

First tests confirmed their functionality



ASIC bonded in HPD





Summary & Outlook

- Space charge effect is there, the impact on the tracking and PID performance has to be investigated.
- The presented results show that it is mandatory to measure the mechanical tension and the pitch in the anode wire plane after gluing it on the frame. Efforts will be dedicated to either:
  - upgrade the existing device,
  - scrutinize the market for a new one.

Maintenance by a specialist for the winding machine would be useful.
Having in mind the infrastructure has to be the same/similar in all assembling centers, any joint effort from the CBM-TRD community is very welcome.

- Tests with the dedicated readout electronics will be performed in the near future.

- The prototype will be opened and the components, including the wires, will be inspected with very much attention.

- A new prototype will be assembled taking into consideration all the above considerations.

- High counting rate tests are mandatory. The counting rate capability should be evaluated with a chamber equipped with dedicated readout electronics and proper analysis, i.e. hit clusters.

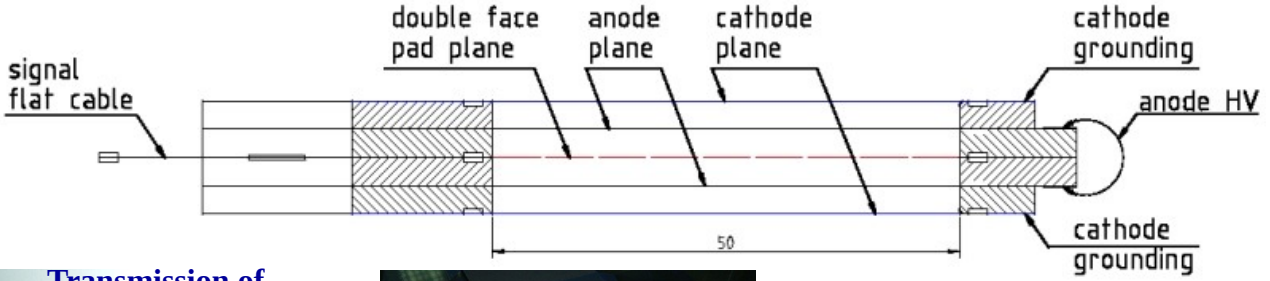
People involved in the presented activities:

Cristian Andrei, Valerica Aprodu, Daniel Bartos, Alexandru Bercuci, Daniel Dorobantu, Gheorghe Caragheorgeopol, Vasile Catanescu, Viorel Duta, Andrei Herghelegiu, Mariana Petris, Mihai Petrovici, Andrei Radu, Laura Radulescu, Claudiu Schiaua, George Stoian

Backup slides

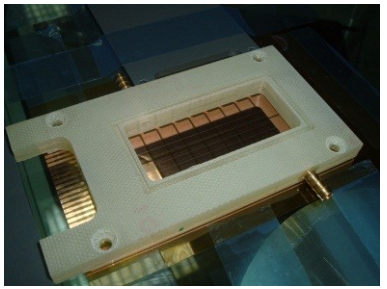
Double - sided pad readout HCRTRD prototype

Double – MWPC 2 x 3 mm gas gap, 2.5 mm anode pitch
0.5 x 1 cm^2 rectangular pad area

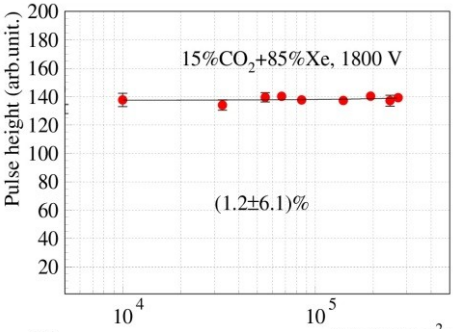


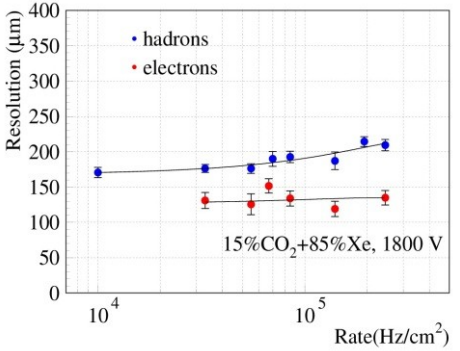
Readout electrode made from kapton foil of 25 μm; rectangular pads and signal traces are etched on both sides in the 0.3 mm evaporated Cu layer.

Transmission of ^{55}Fe X – ray = 84%



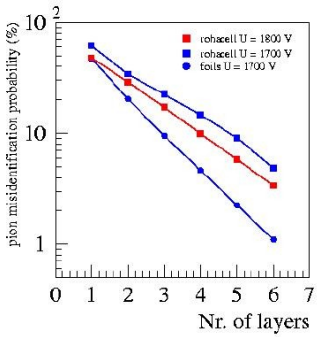
High counting rate in-beam test 2 GeV/c proton

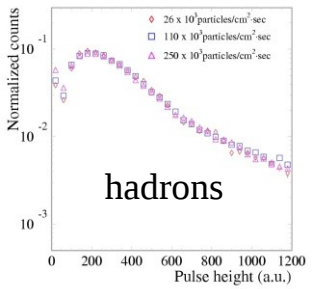


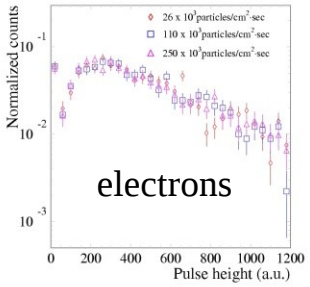


In-beam test SIS, GSI – Darmstadt
e/π discrimination @1.5 GeV/c:

1800 V + Foil (20/500/120) @ 6 TRD layers = 0.7%







M. Petrovici et al., Nucl. Instr. and Meth .579(2007), 961