RPWELL for SDHCAL

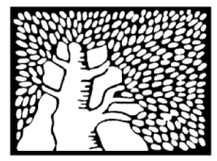
Take 1

27.09.2018

D. Shaked Renous, P. Bhattacharya, L. Moleri, A. Tesi, E. Kajomovitz
and S. Bressler

Project supported by the RD51 common project
(WIS-Aveiro-Coimbra & LAPP-Demokritos)

מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

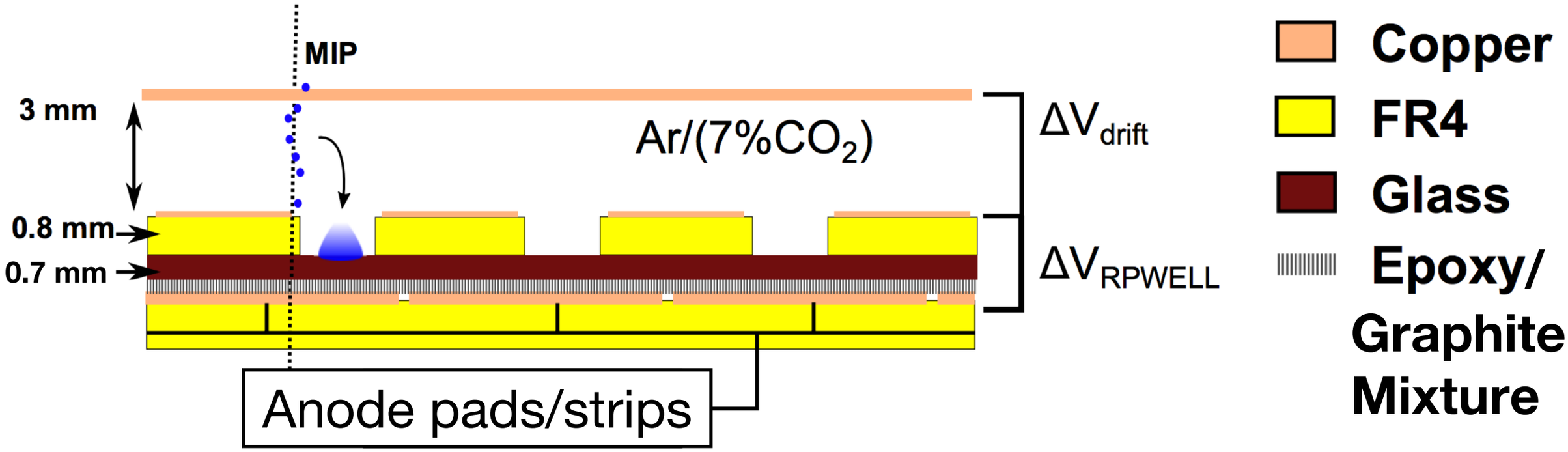


Two 50x50 cm^2 prototypes

- **<u>Prototype 1</u>: Pad anode** with **semi-digital readout** (MICROROC)
  - Operated for the first time focused on:
    - Noise and threshold estimation
    - Efficiency and gain measurements

- **<u>Prototype 2</u>: Strips anode** with APV25/SRS
  - Improved production technique
    - Following experienced gained in previous TBs
  - Focus on:
    - Potential production weak points
    - Uniformity

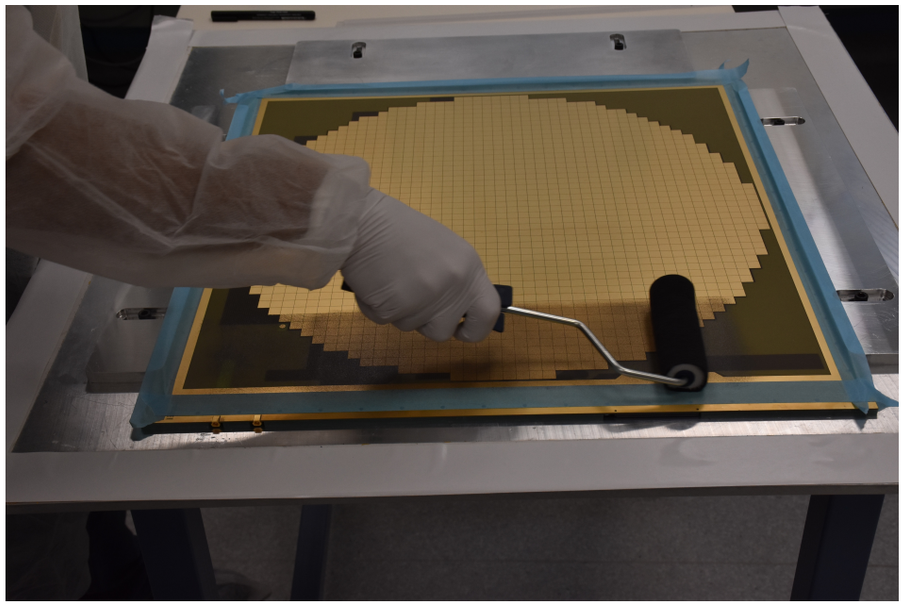
50x50 cm^2 RPWELL

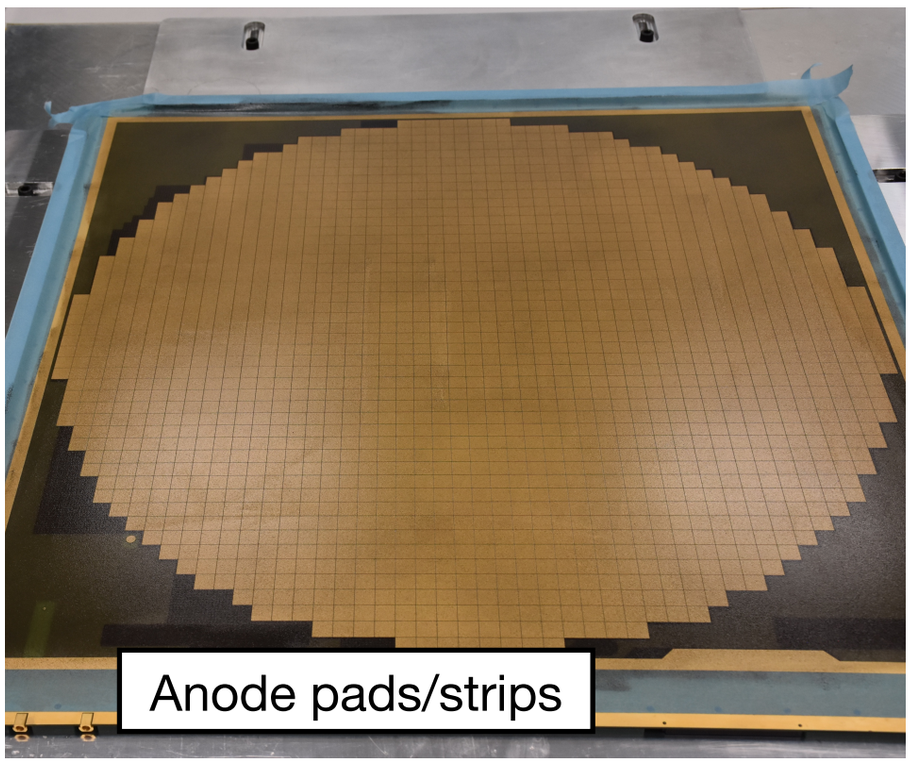


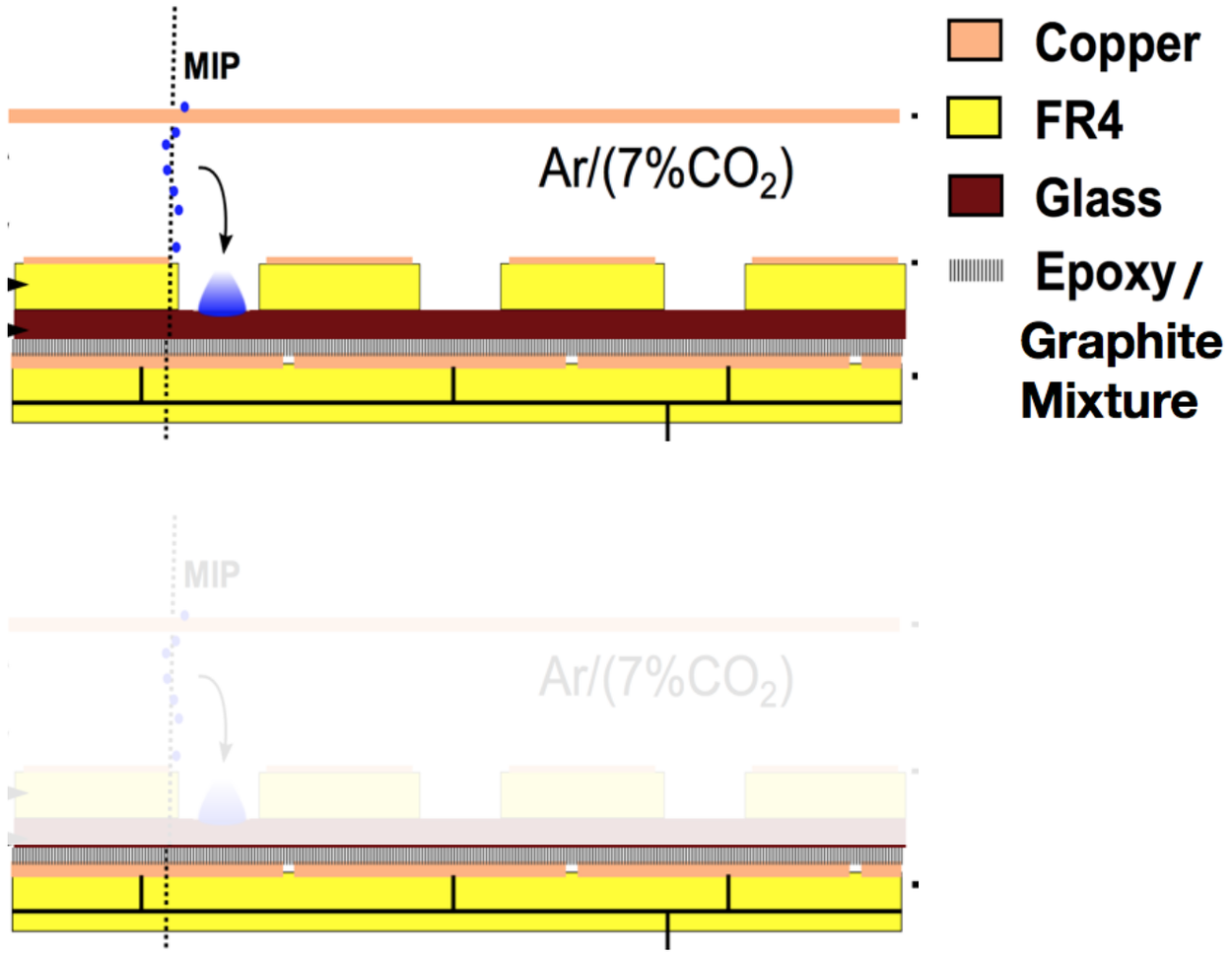
- Silicate glass resistive plate (~10^{10} Ωcm)
- Resistive plate coupled to anode through graphite-epoxy layer (~ MΩ)

Construction

Spreading epoxy and graphite mixture

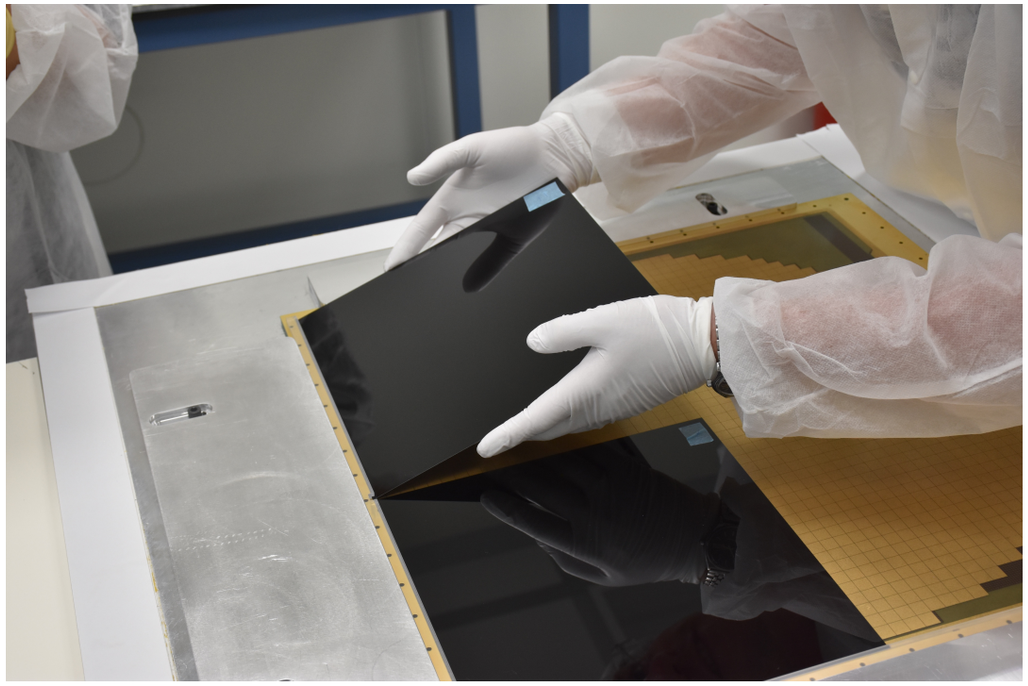




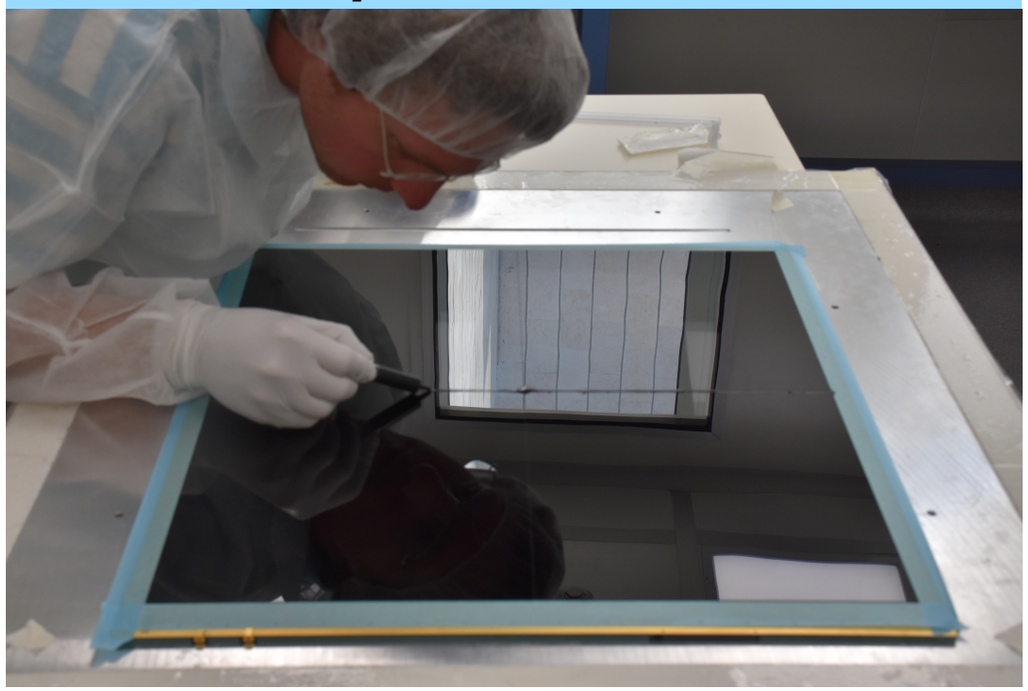


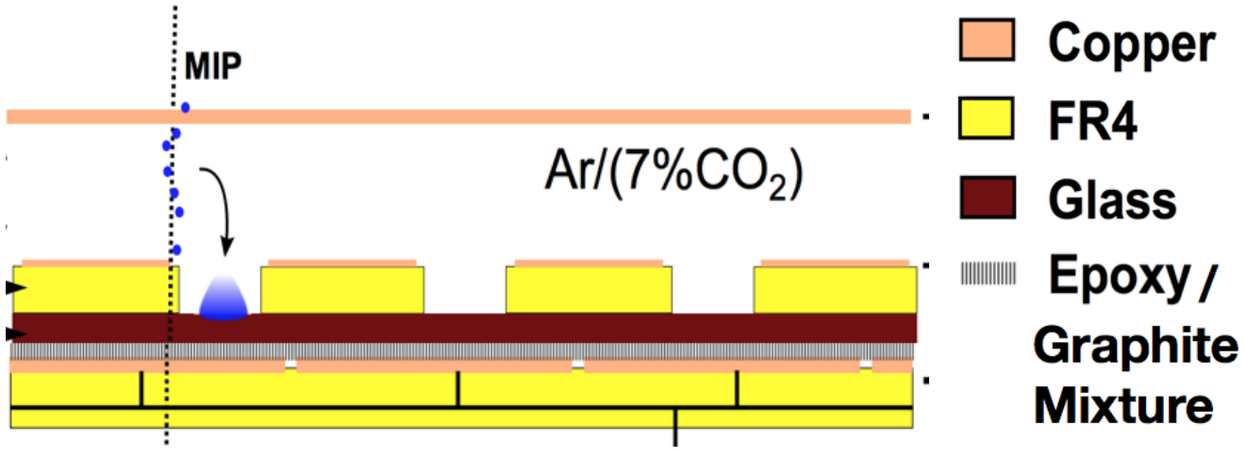
Construction

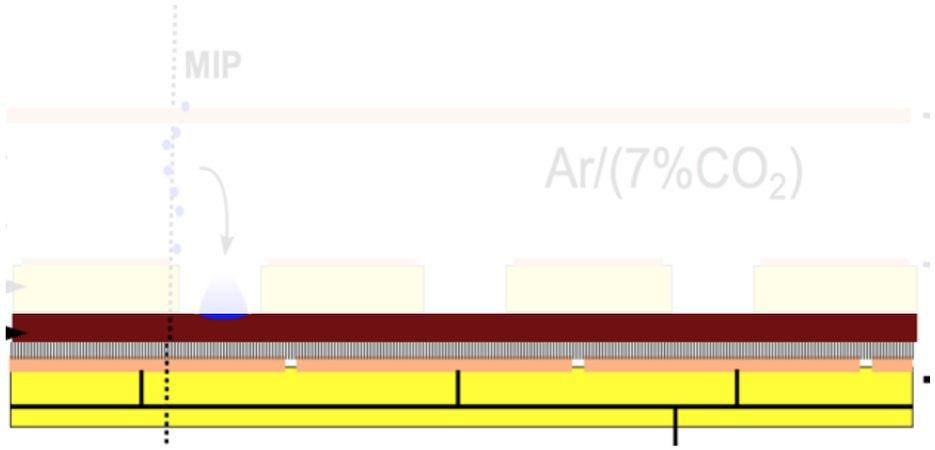
Placing the glass tiles



Insultation paint for tiles interface



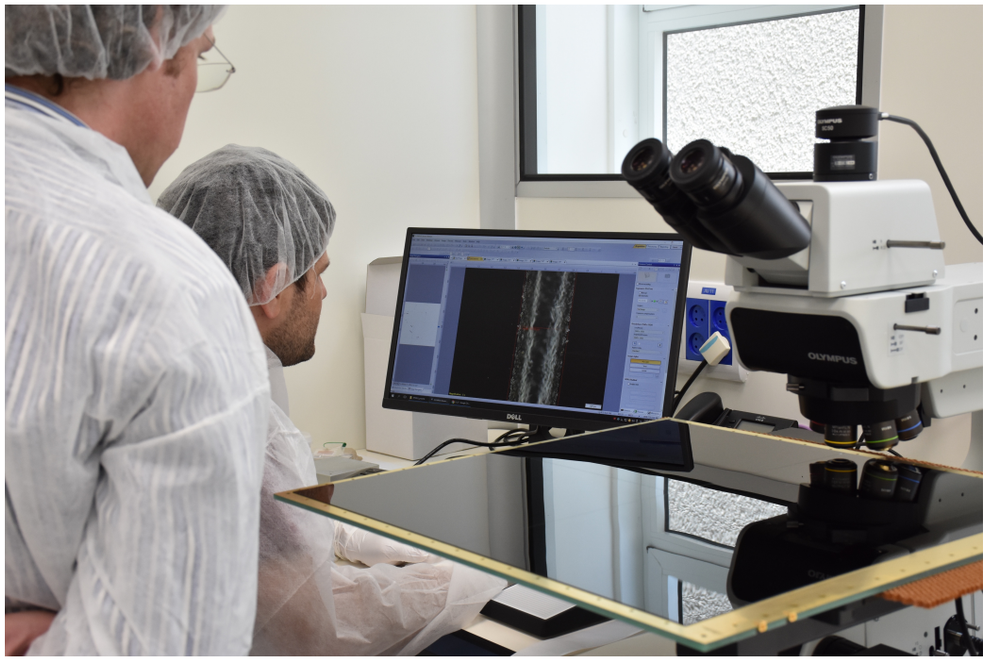


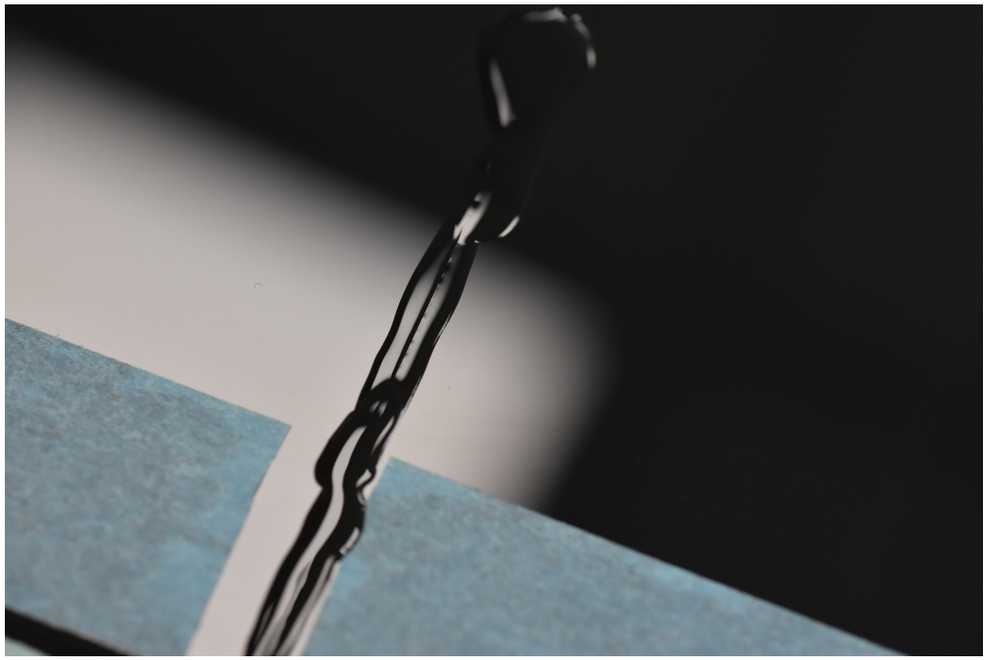


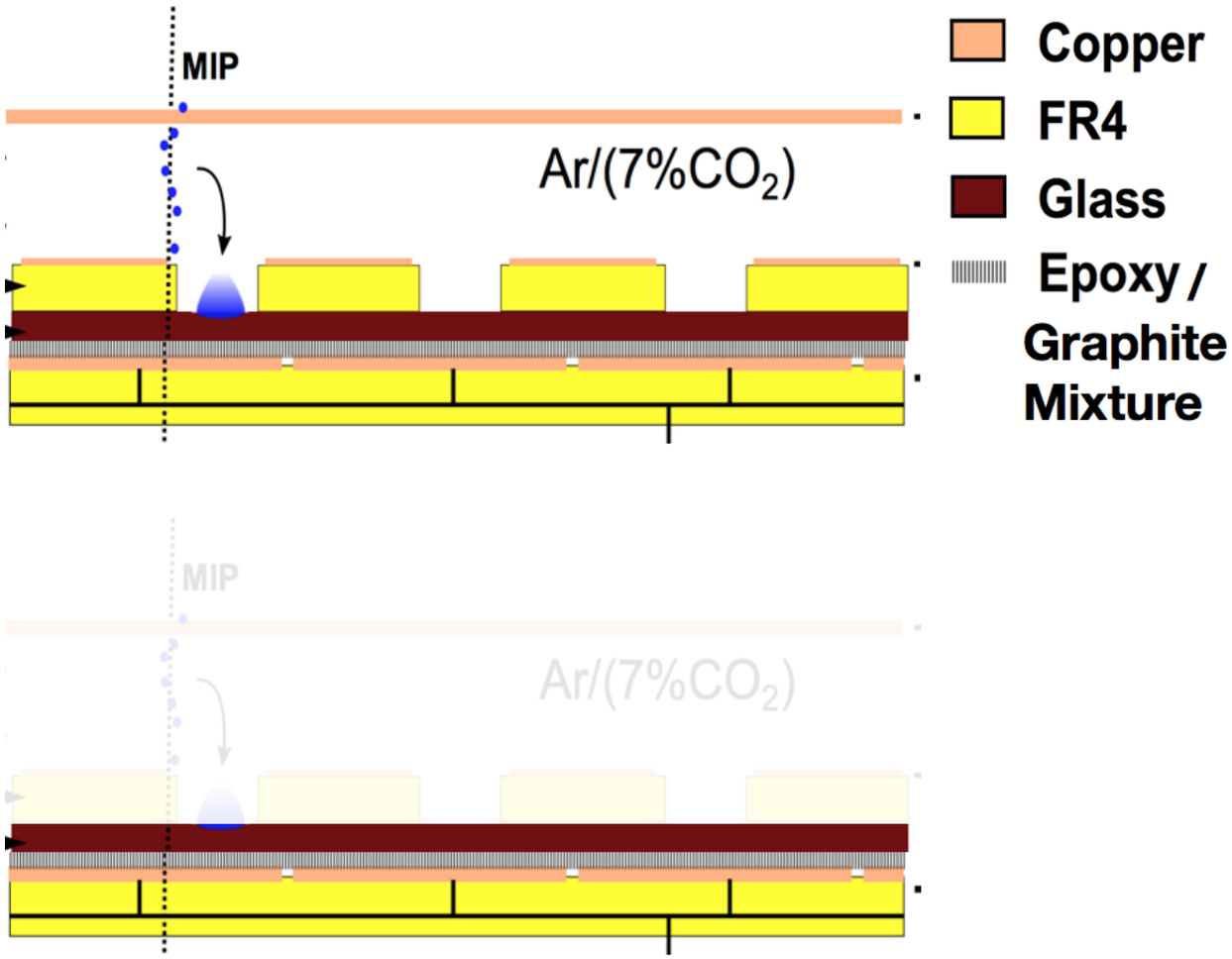
- Maximum tile size 25x25 cm2
- 4 tiles are needed for each detector
- Tile interface is a weak point in the production

Construction

Verifying full interface coating



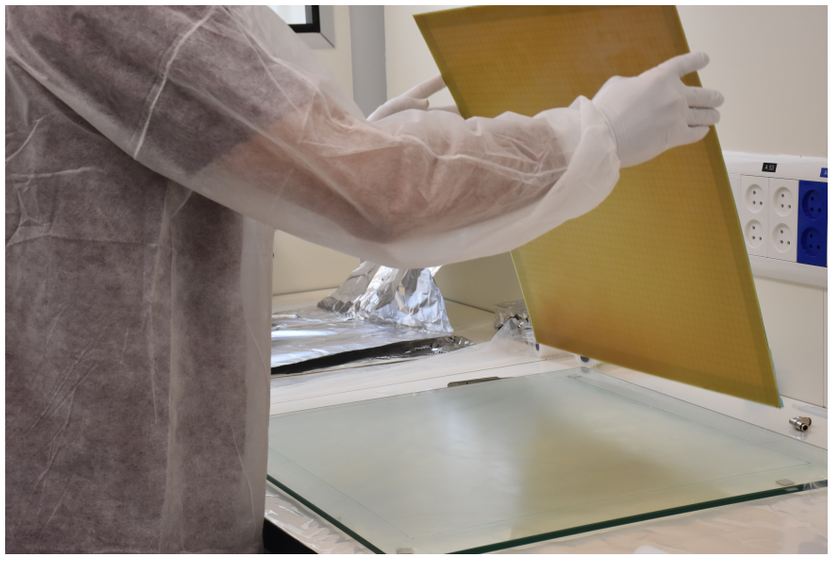


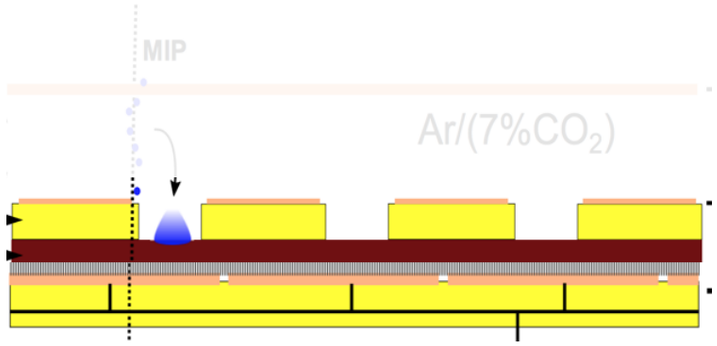


- Maximum tile size 25x25 cm2
- 4 tiles are needed for each detector
- Tile interface is a weak point in the production

Construction

Gluing the THGEM to the glass tiles

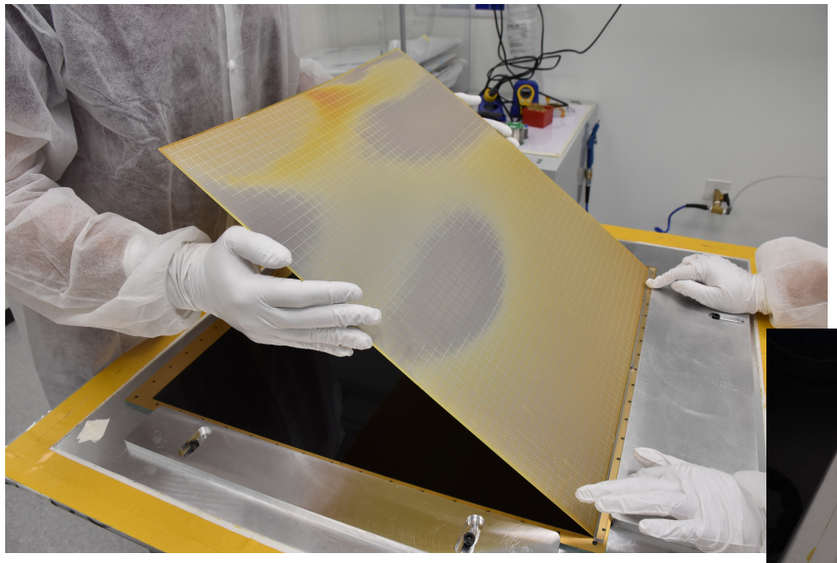


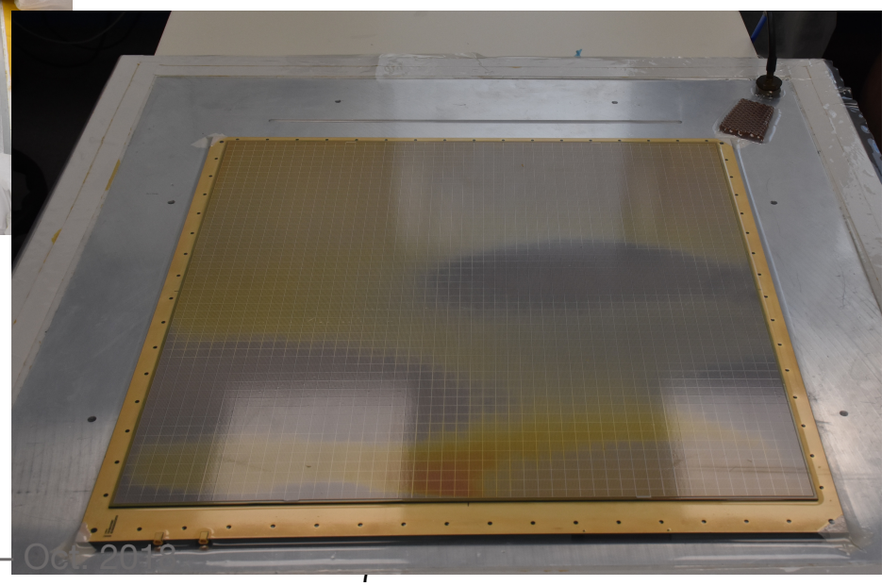


Copper
FR4
Glass
Epoxy / Graphite Mixture

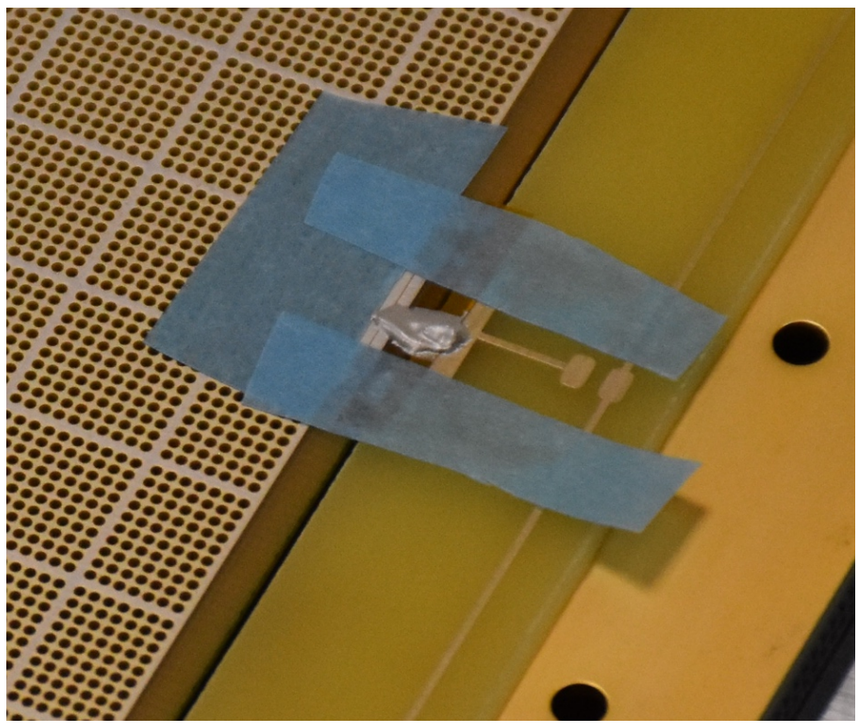
Goal: avoid glue penetrating into the holes

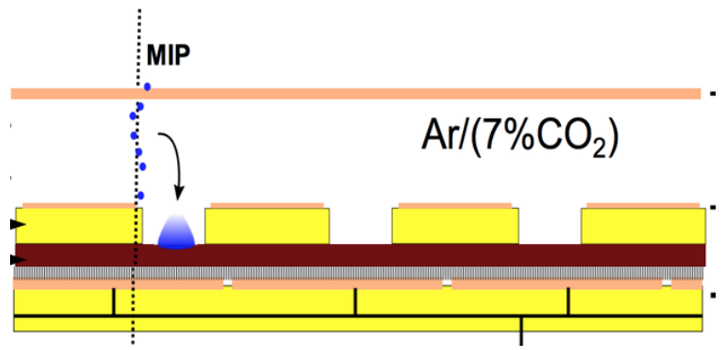
1. Thin layer of liquid glue is spread on a glass plate
2. Glue is transferred (through contact) to the THGEM
3. THGEM is placed on the glass
4. Curing under vacuum pressure



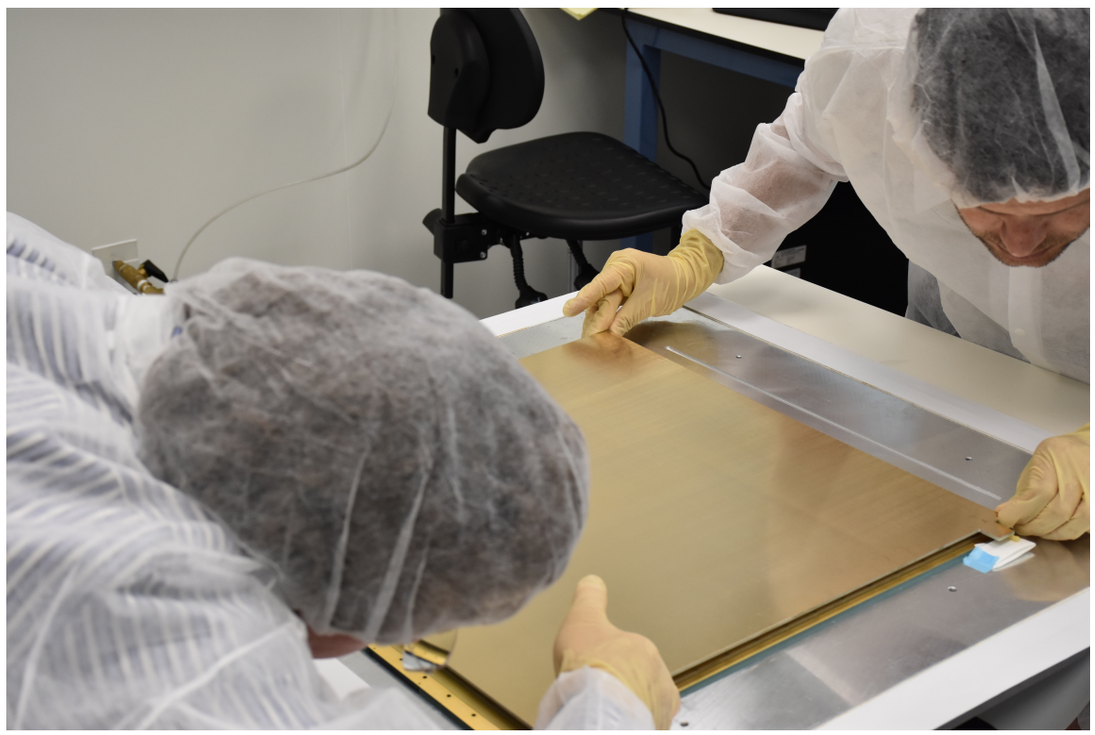


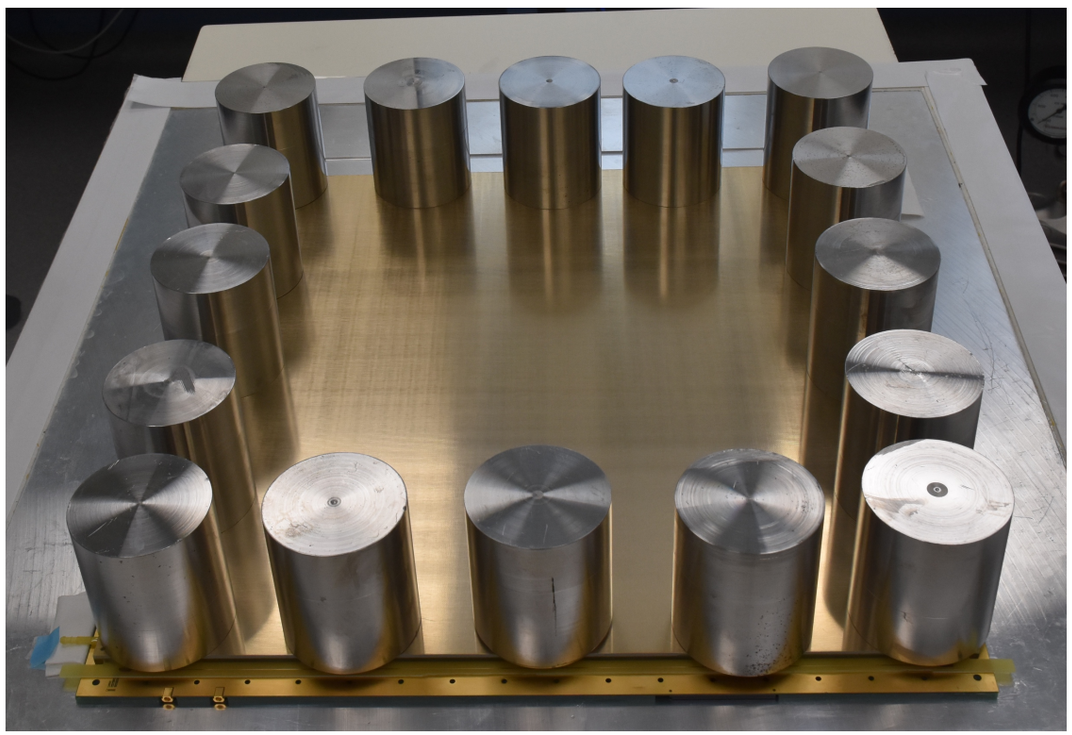
Construction – Final steps



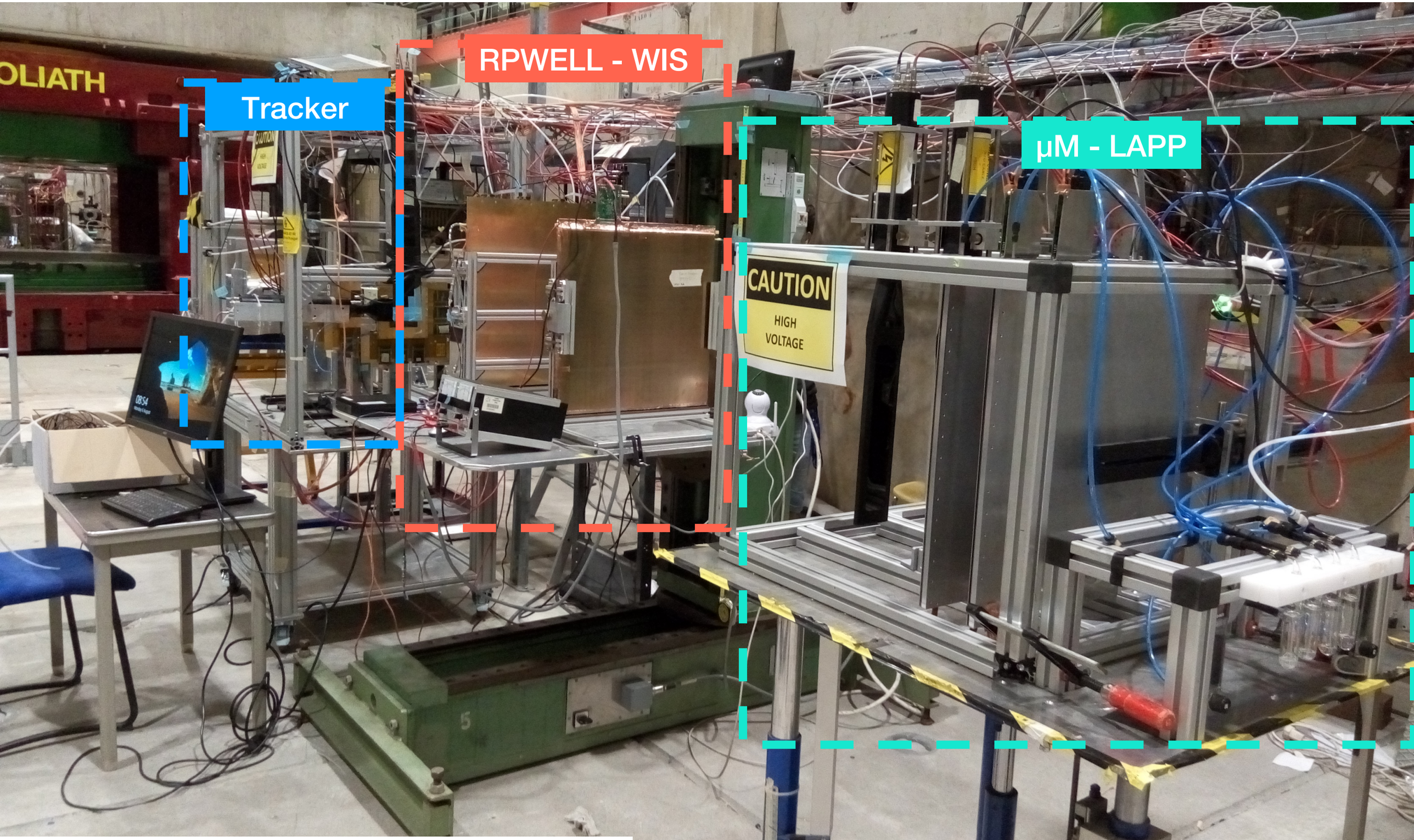


1. HV connections
2. Gluing the cathode
   Curing under weight to avoid bending the cathode





Setup



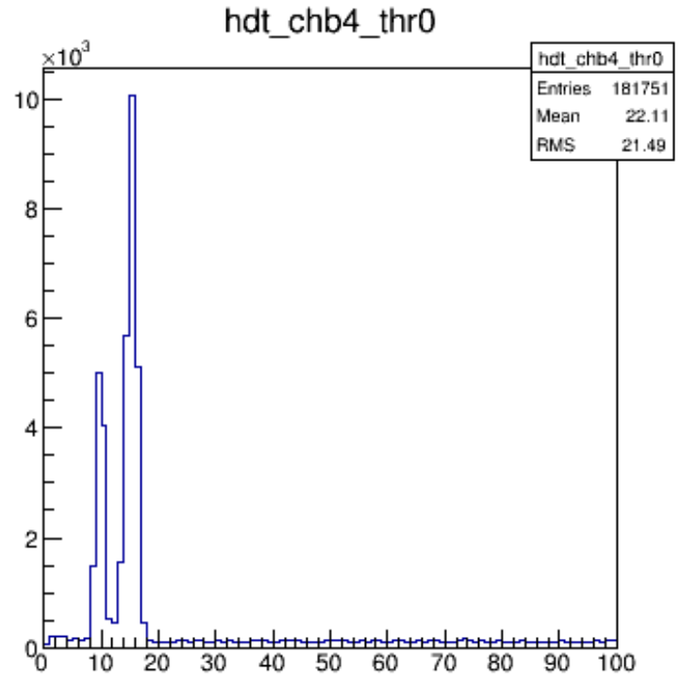
Preliminary results: Prototype 1

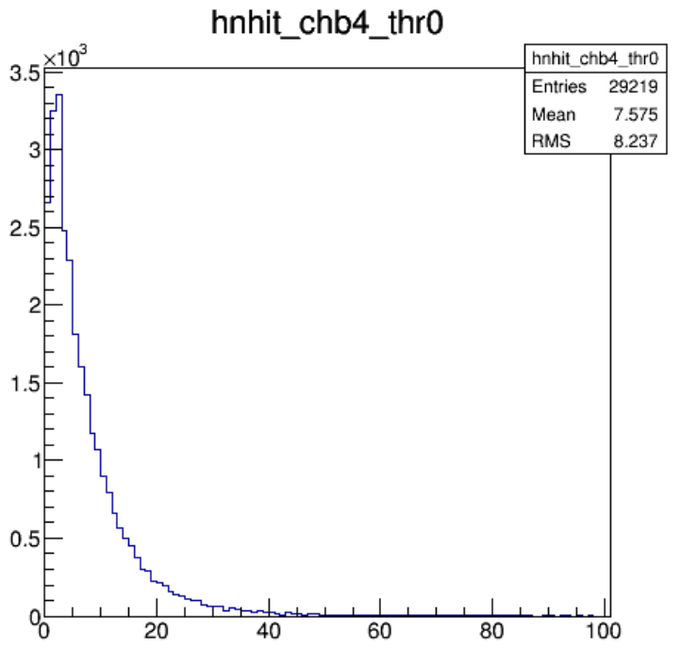
- **<u>Prototype 1</u>: Pad anode** with **semi-digital readout** (MICROROC)
  - Operated for the first time focused on
    - Noise and threshold estimation
    - Efficiency and gain measurements

ASU readout

- ASU reads all the events
- Operation in trigger mode
- Events are written to a file given an external trigger

  By construction all recorded events occurred before the trigger





Results: ASU hit-map - ’good’ profile

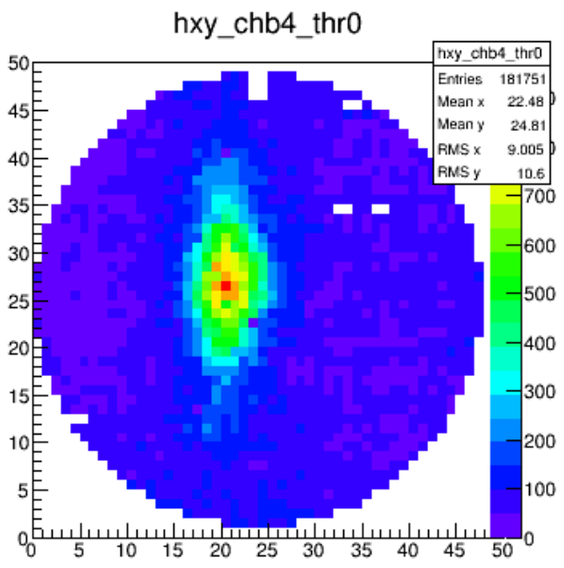
Triggers with less than 100 hits

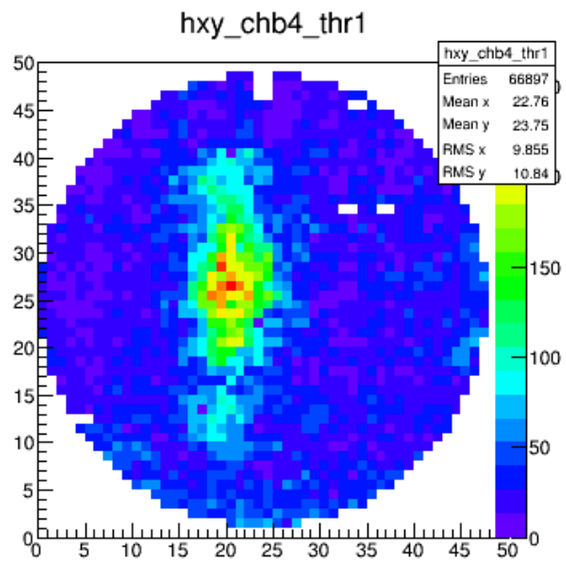
Thr0 ~0.8 fC

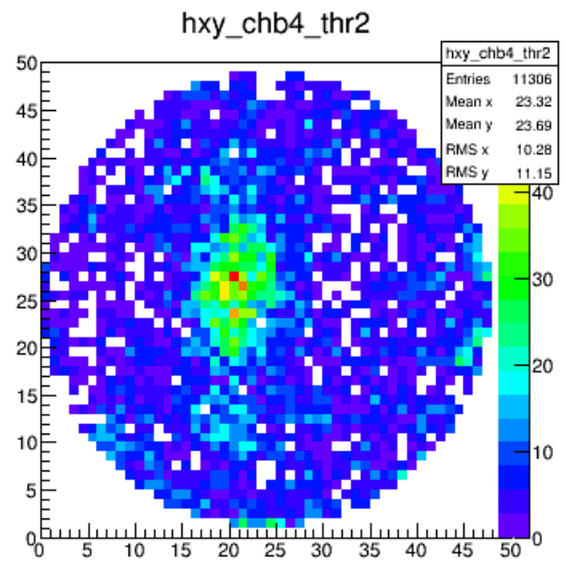
Thr1 ~1.4 fC

Thr2 ~3.8 fC

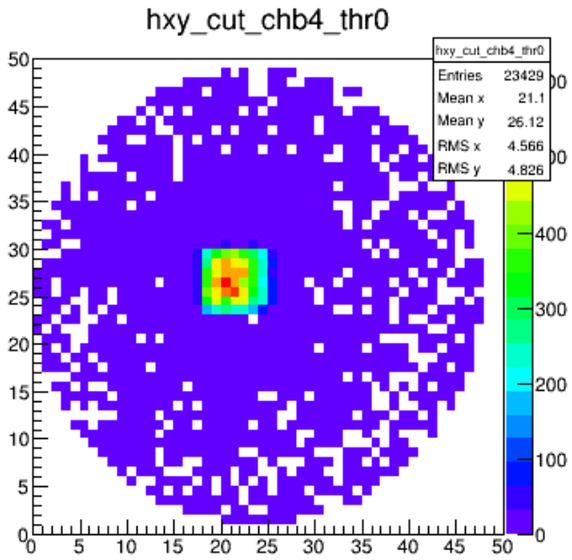
All hits

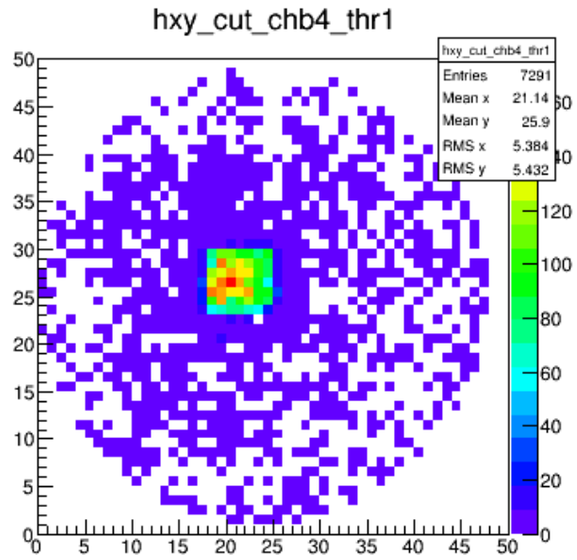


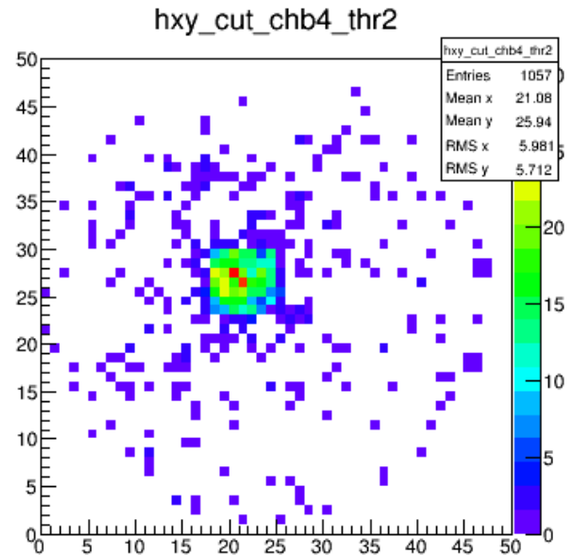




Hits @ time of trigger

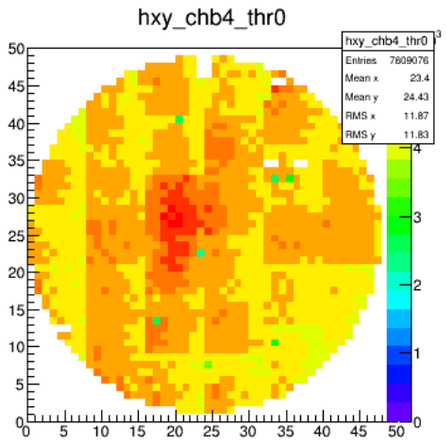


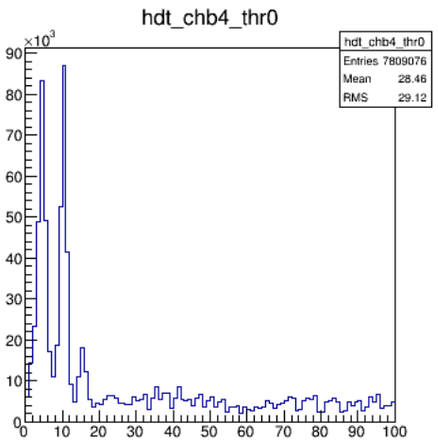




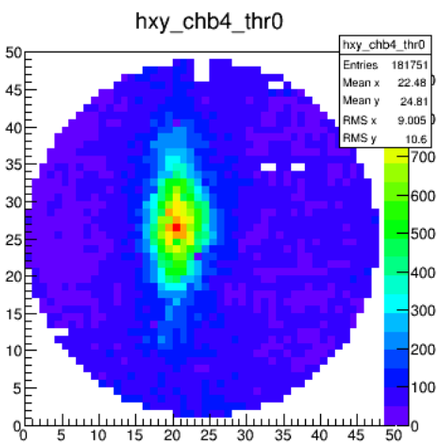
Results: ASU hit-map – some anomalies

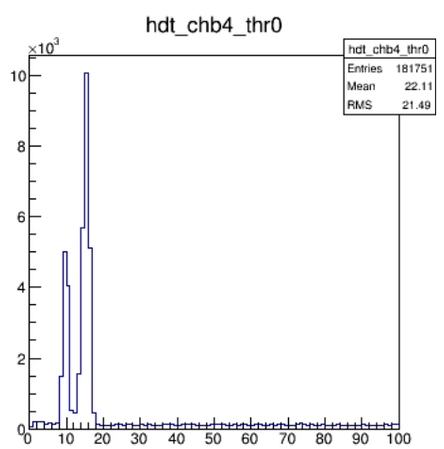
All hits



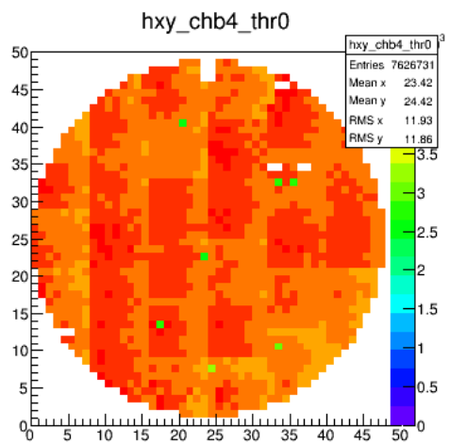


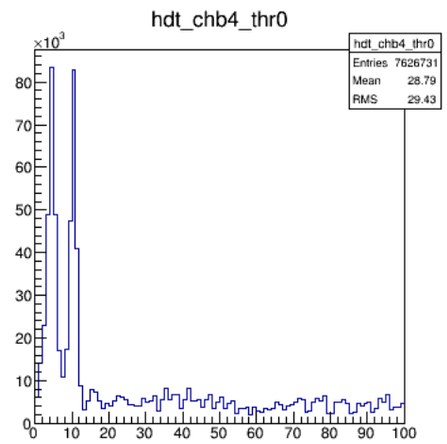
Nhits < 100





Nhits > 100

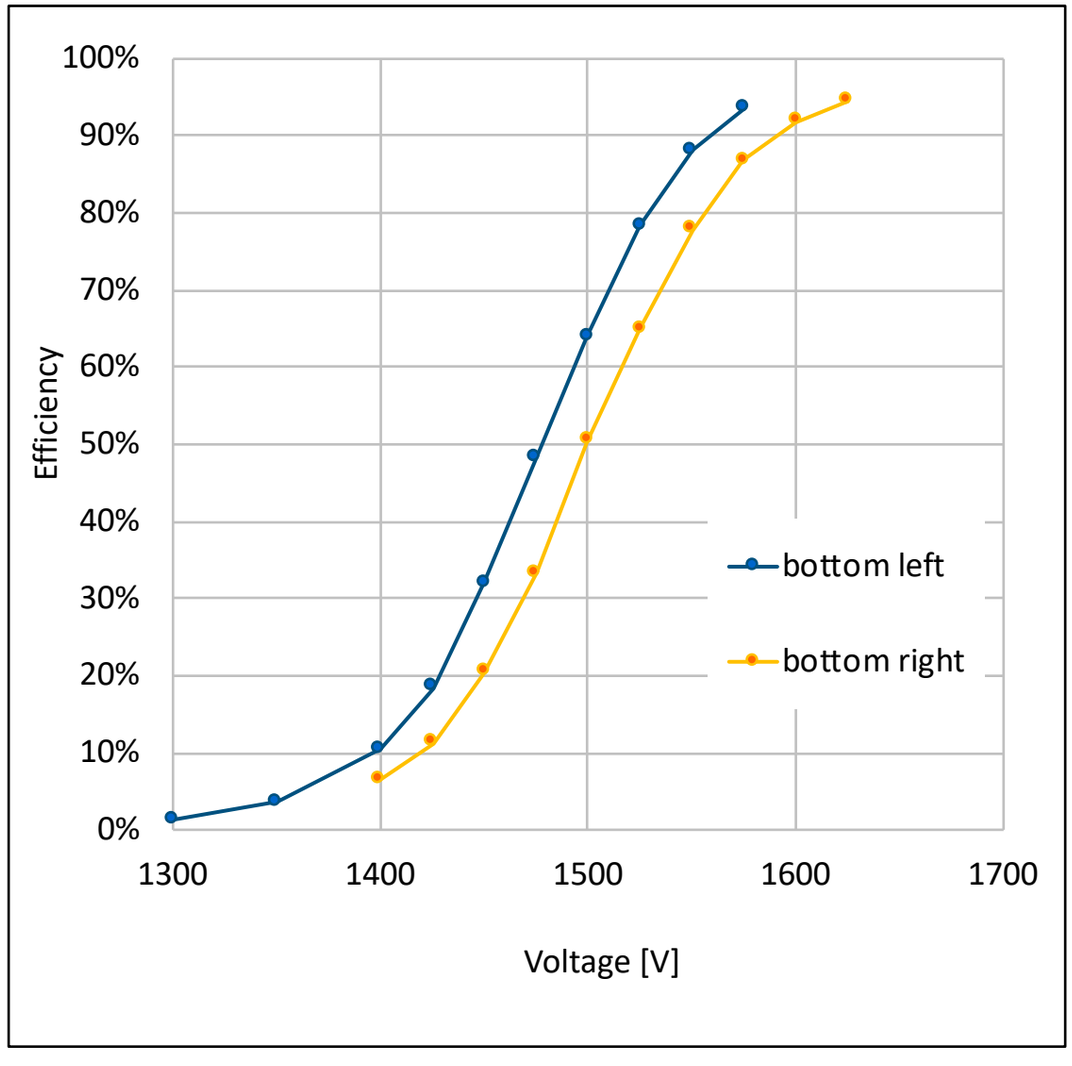




- Observed some events with large (>100) hits
  - Distribute ~uniformly over the entire area
- Not necessarily correlated with the external trigger
- Not correlated with current fluctuations
- Not yet understood

Results: Efficiency curves

- Preliminary - 95% efficiency was achieved
  - Lower than efficiency recorded with APV/SRS (>98%)
- Efficiency (gain) variations
  - Associated with 20% thickness variations measured across the THGEM

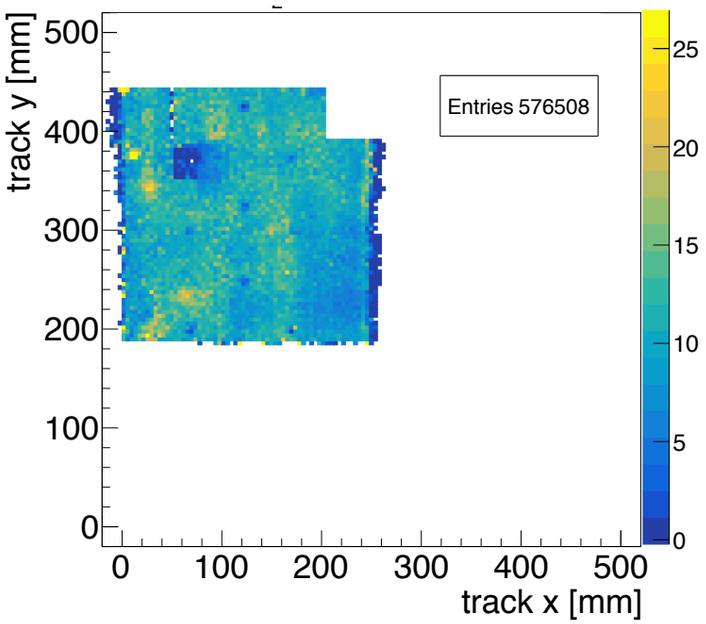


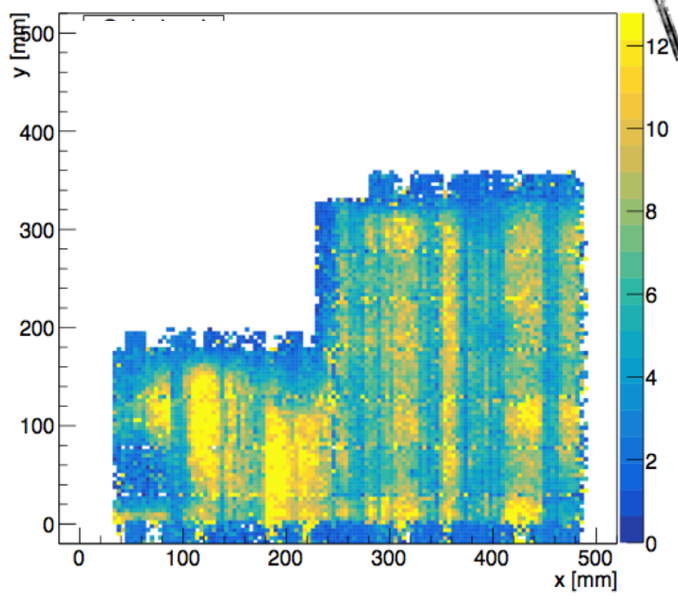
Preliminary results: Prototype 2

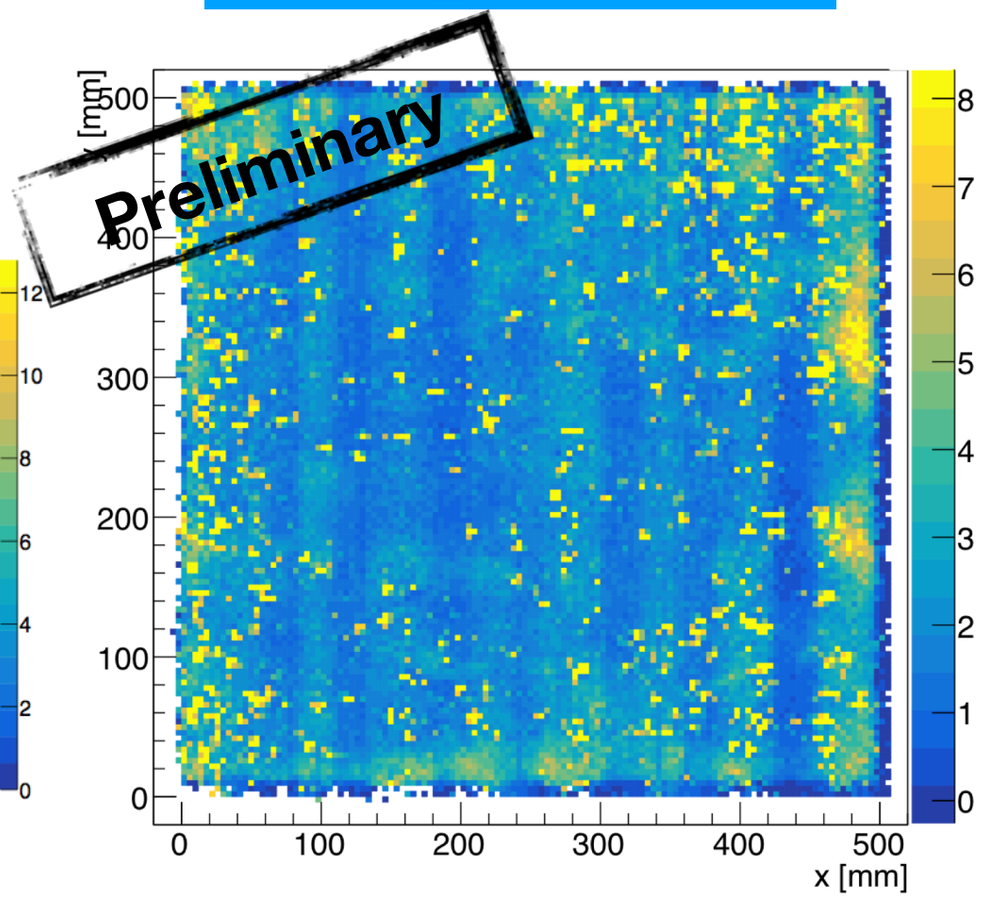
- **<u>Prototype 2</u>: Strips anode** with APV25/SRS
  - Improved production technique
    - Following experienced gained in previous TBs:
      - July 2017 – THGEM pressed to the glass tiles with spacers and buttons, no gluing
      - April 2018 – First attempt to glue the THGEM to the glass tiles
      - August 2018 – Second gluing attempt
  - Focus on:
    - Potential production weak points
    - Uniformity

Results: Strips

July 2017	April 2018	August 2018
Pressing	Gluing: the top part has very low gain	







- The entire area is operational
- Relatively large gain variations
  - The 20% thickness variations can not fully explain this
- Vertical lines pattern in all three prototypes -> not electrode gluing.

Near Future plans

- ASU: Nov 2018 test beam in PS
  - Up to 10 sampling elements: 6 RPWELL + 4 μM
    - low energy electrons
- Goal: start looking at hadronic showers
  - Despite expected significant leakage

Thank you