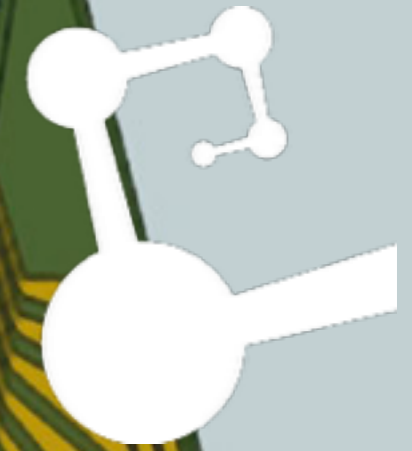


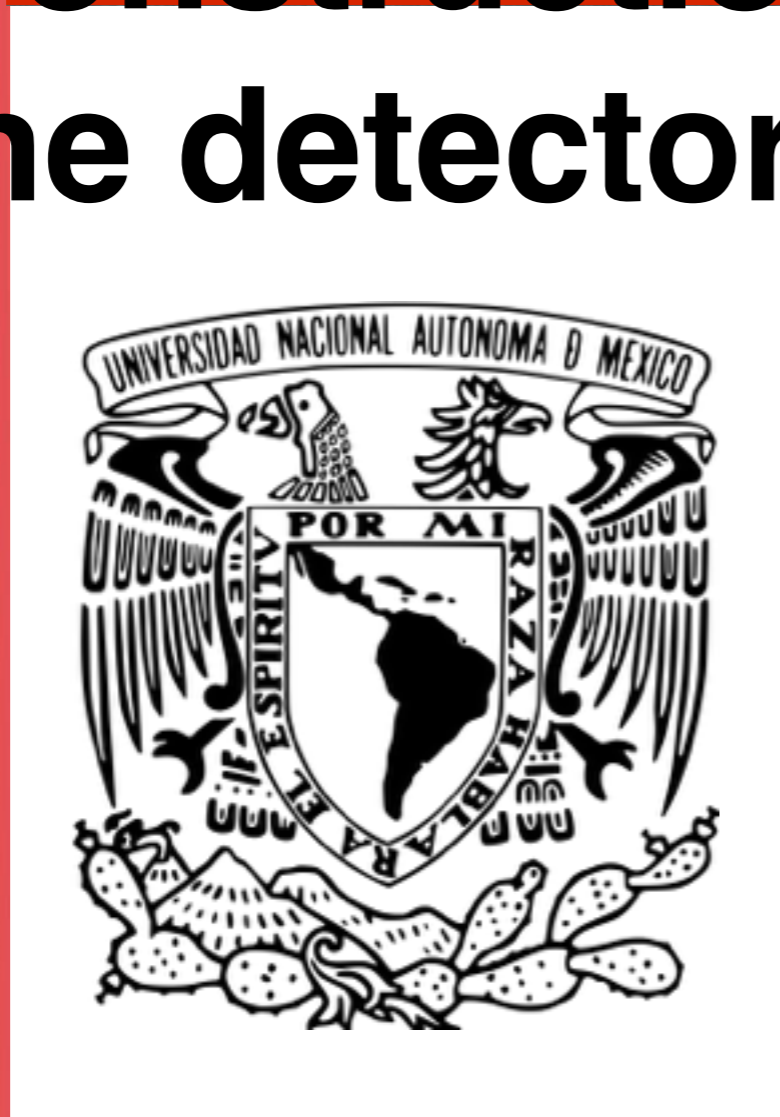
RPC 2018

XIV Workshop on
Resistive Plate Chambers
and related detectors

Instituto de
Ciencias
Nucleares
UNAM



Construction of MRPCs at the detectors lab of UNAM



Luis Díaz, Yosef García, Viridiana
González, Arlette Melo, Roberto Monarrez,
Antonio Ortiz, Guy Paić, Brandon Patiño,
Enrique Patiño, Vladimir Ruiz, Enrique
Sánchez, Nelly Solano



February 22, 2018

Puerto Vallarta, Mexico

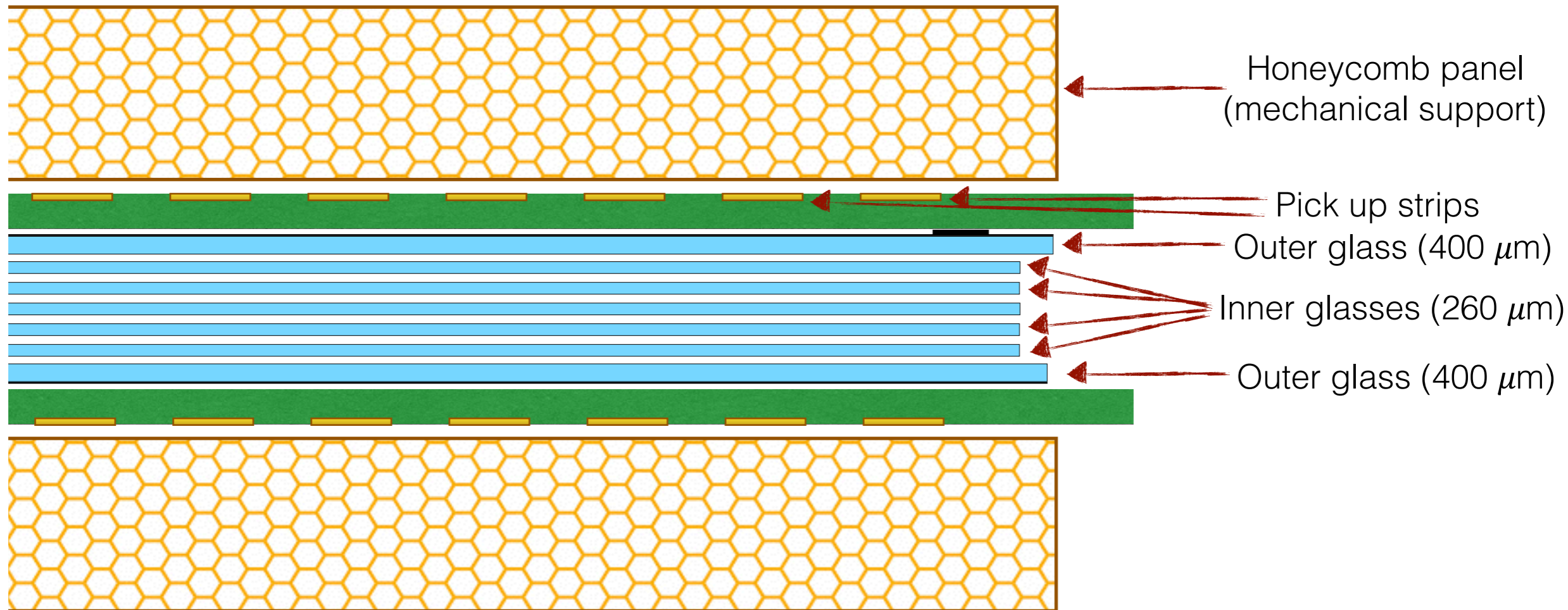
Motivation

- Contribute to the teaching of high-energy physics in the University of Mexico
- We use to teach a lab on modern physics, where students measure the muon flux as a function of the zenith angle. So far we use a scintillation detectors
- Next step, teach students (involved in HEP) on the construction and operation of MRPC detectors. Crucial for the formation of our students.
- Short-term goal: construction of a muon telescope for our detectors lab

Detector design



We are following the design of the ALICE TOF modules.
We thank Crispin Williams for instructing us on the construction of the chambers

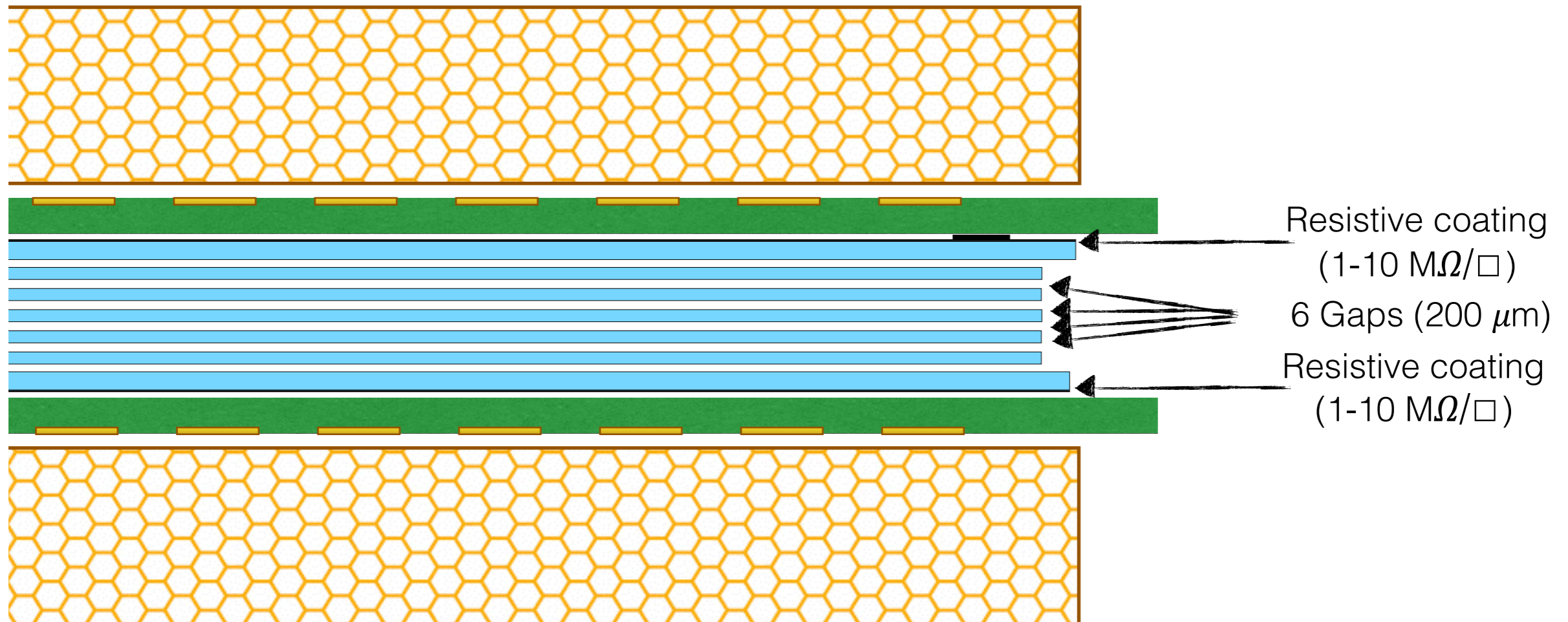


S. An et al., NIM A594 (2008) 39-43

Detector design



We are following the design of the ALICE TOF modules.
We thank Crispin Williams for teaching us on the construction of the chambers

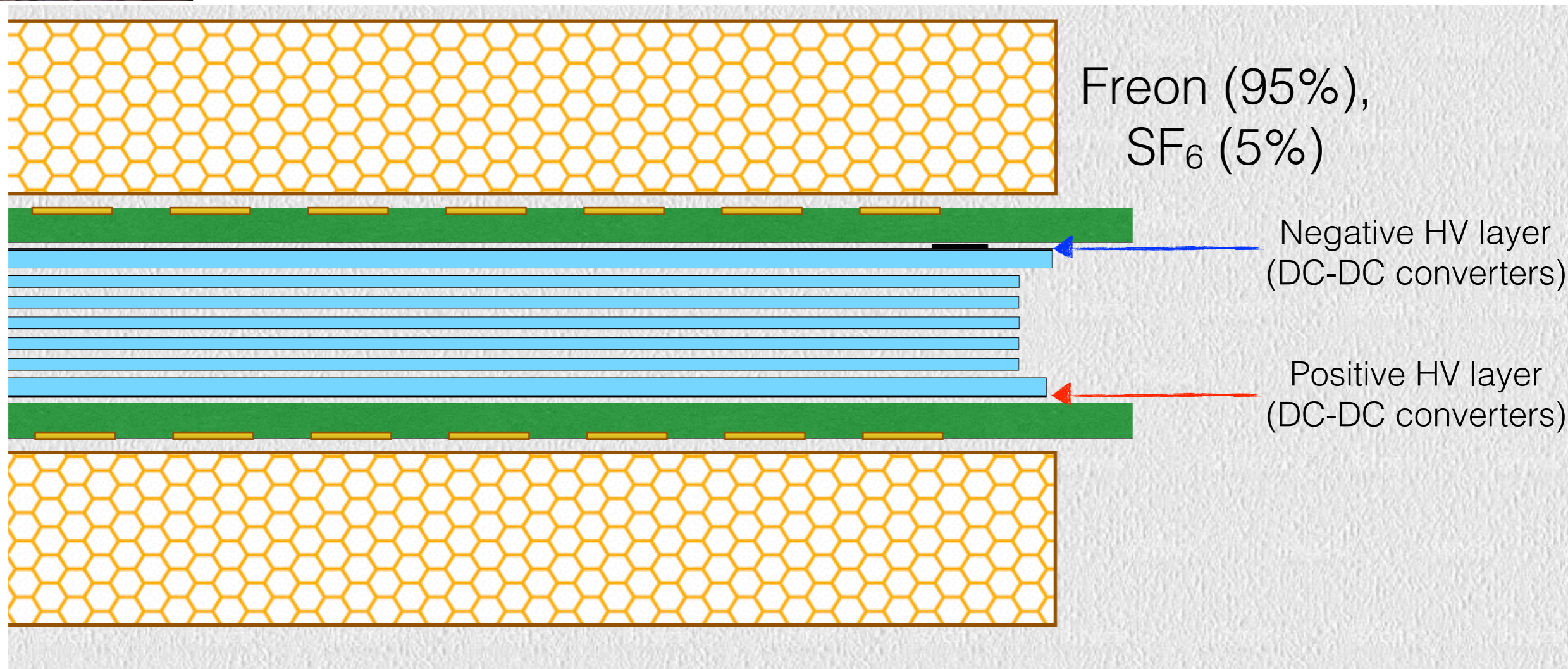


S. An et al., NIM A594 (2008) 39-43

Detector design



We are following the design of the ALICE TOF modules.
We thank Crispin Williams for teaching us on the construction of the chambers



S. An et al., NIM A594 (2008) 39-43

Construction

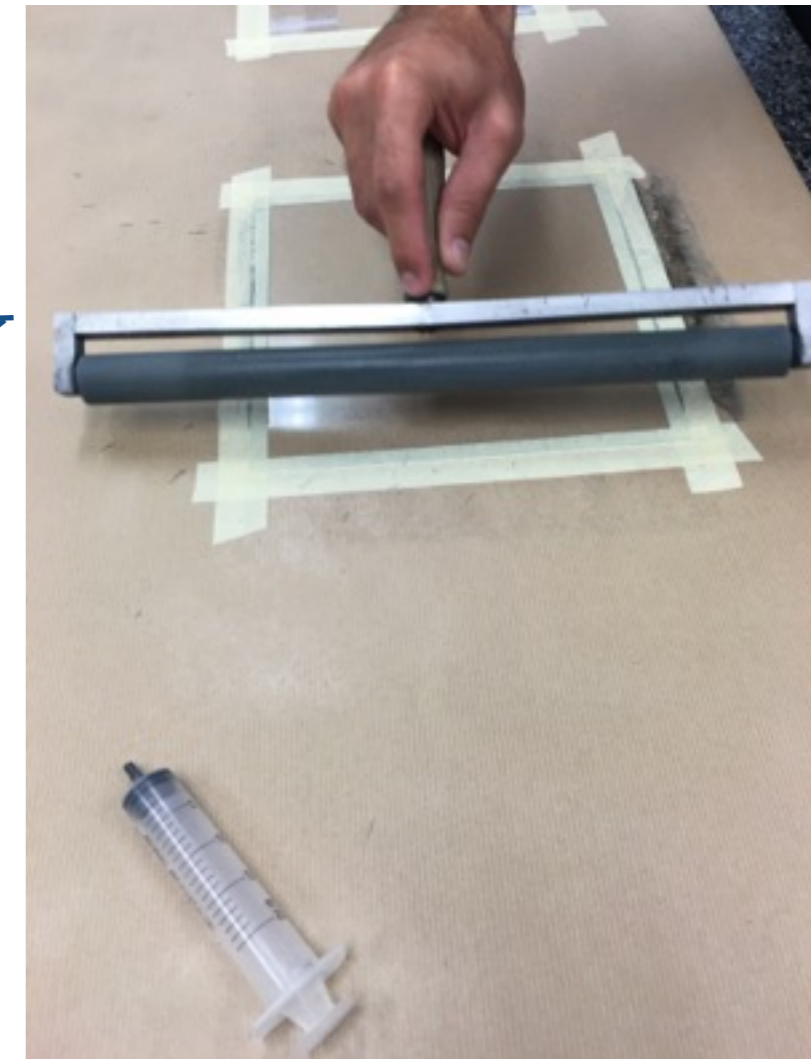
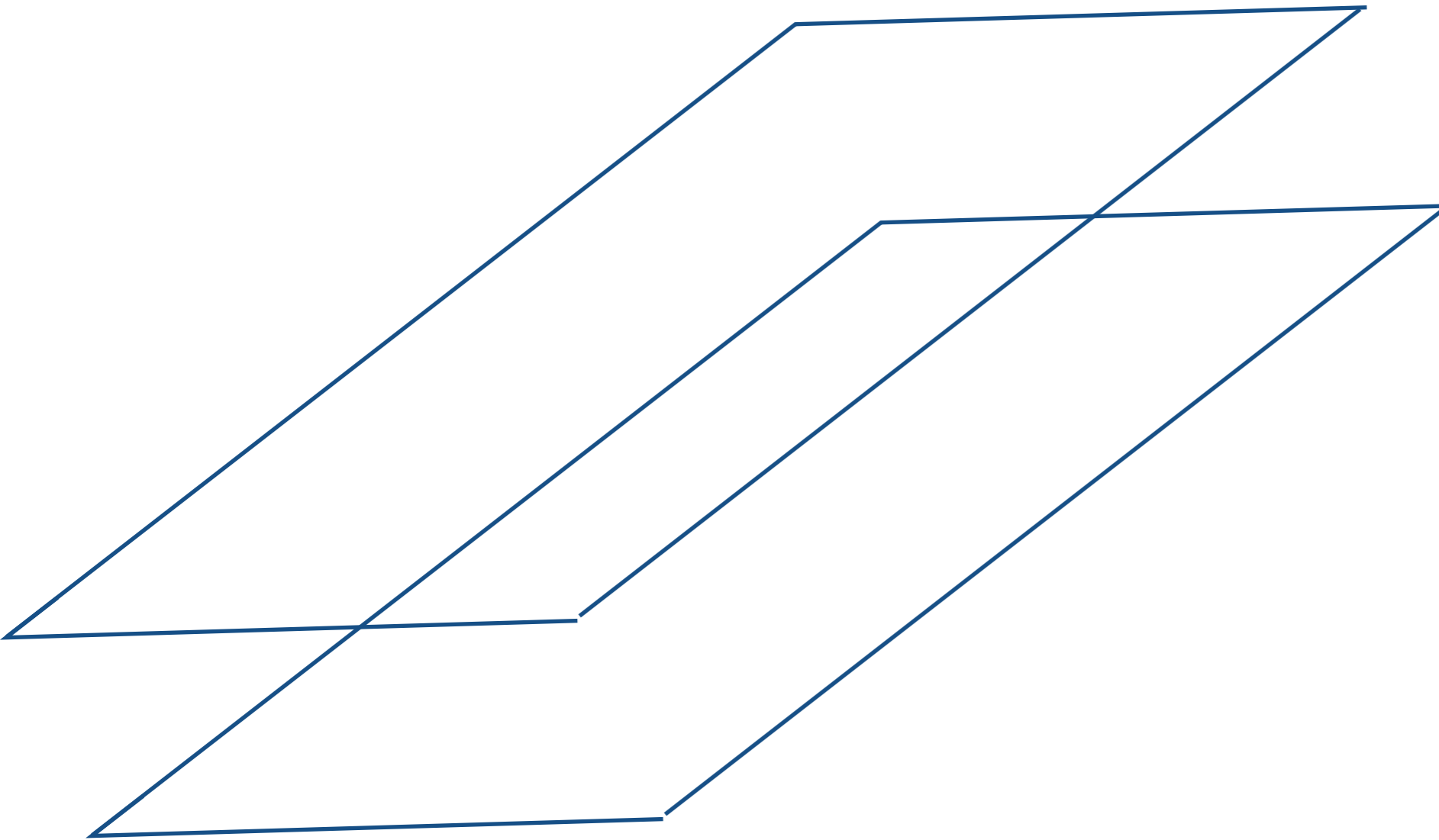


External glasses: $70 \times 75 \times 0.4 \text{ mm}^3$
Internal glasses: $50 \times 60 \times 0.26 \text{ mm}^3$



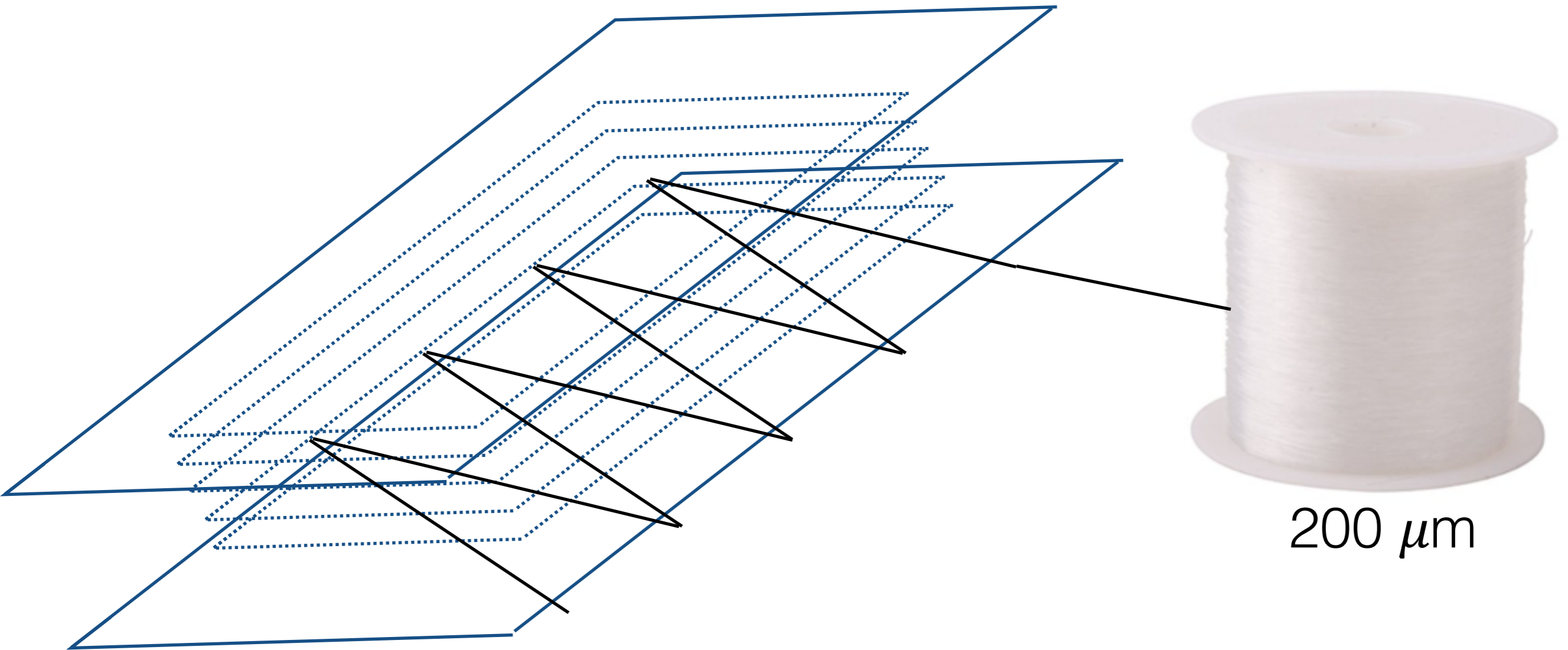
Resistive plates made of “soda-lime” glass sheets

Construction



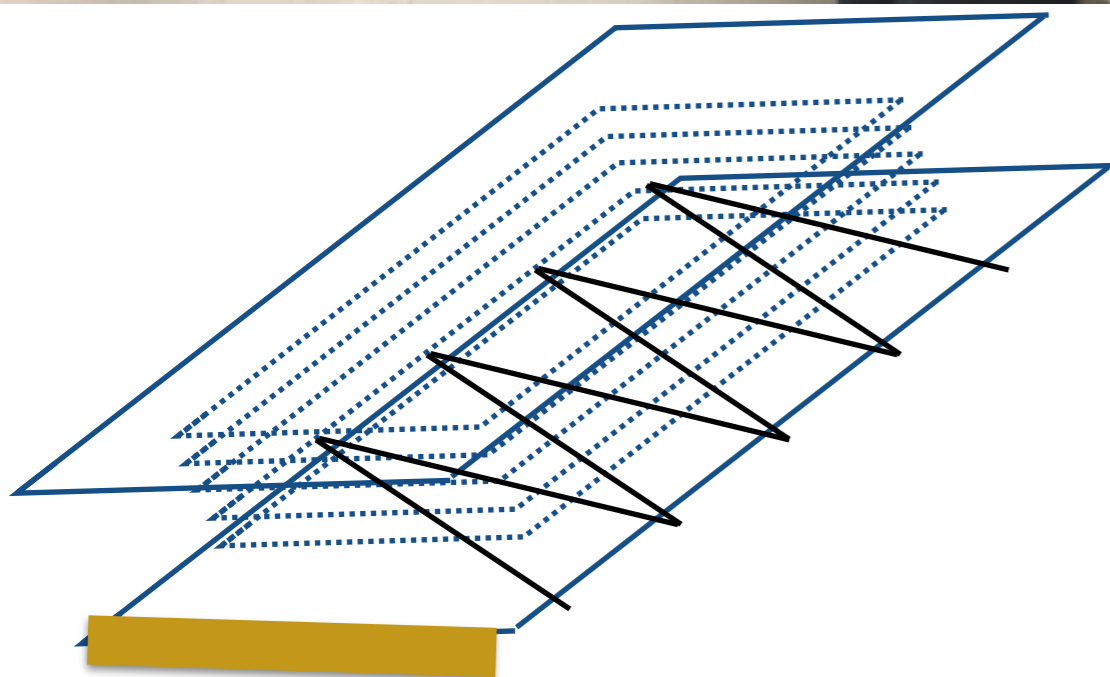
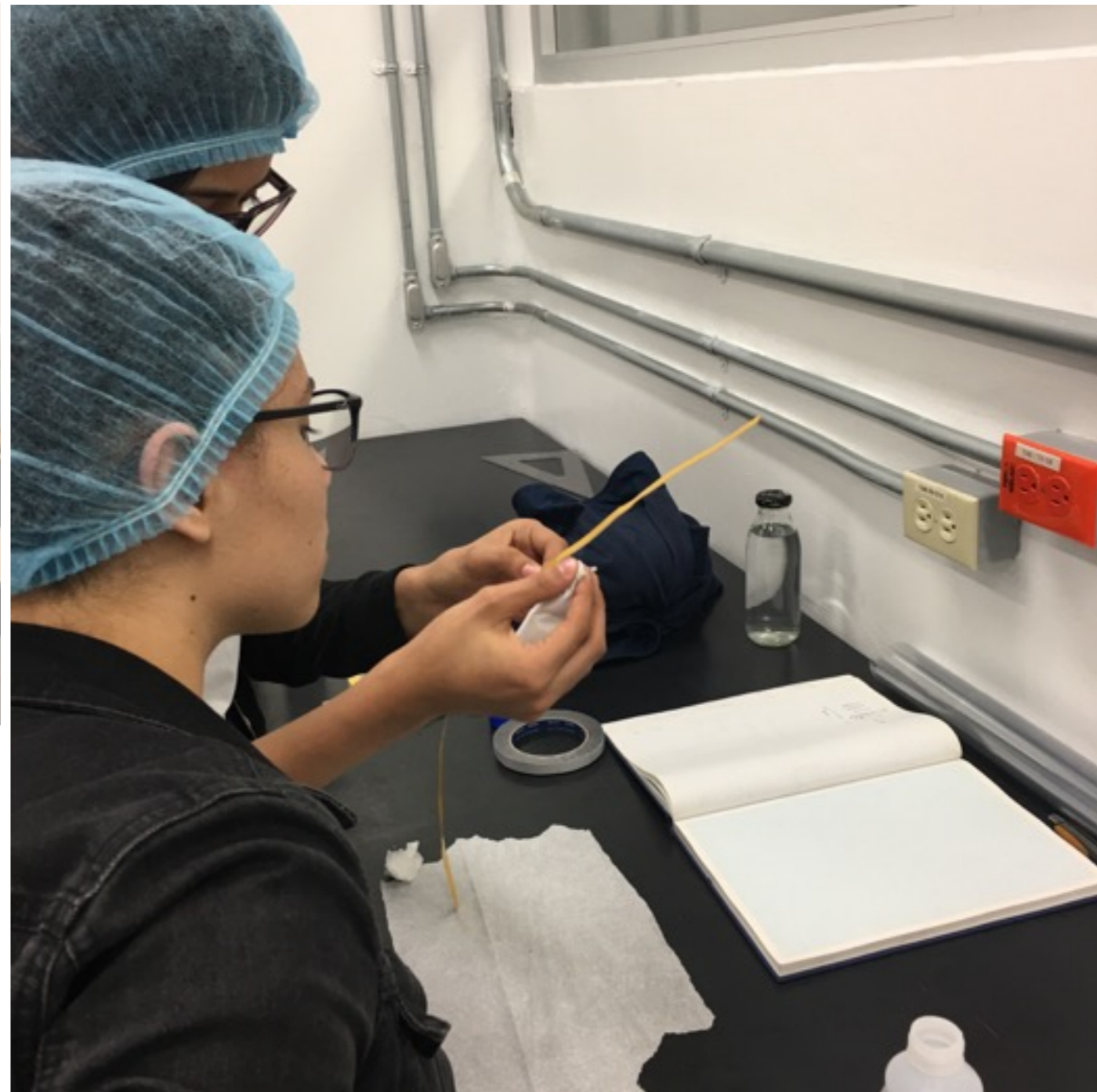
The outer surfaces of the outermost glasses are coated with a resistive coating

Construction



The inner glasses are placed inside the larger ones. The plates are separated using monofilament fishing line

Construction



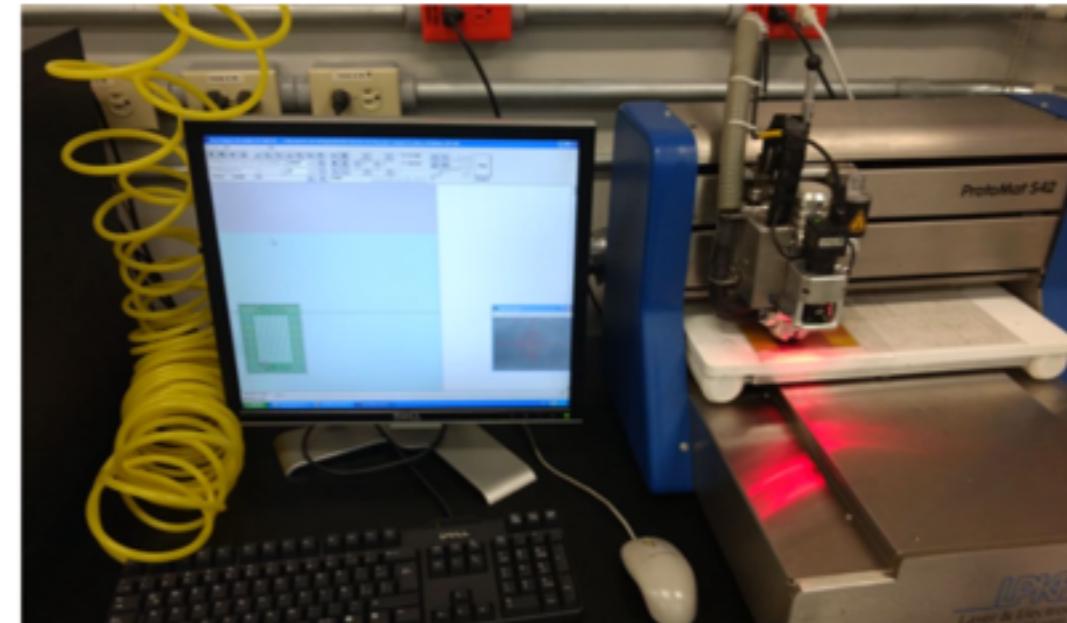
Preparation of the spacers

Construction

Area of the PCB: 60x88 mm²

- 9 mm was reserved to make the HV connection
- The remaining 51 mm was divided into 8 readout strips
 - width of 5.5 mm, separation 1mm

The anode and cathode signals are connected by pins and sent to the NINO front end card.



[F. Anghinolfi et al., NIM A533 \(2004\) 183-187](#)

Manufacture of printed circuit board (8 strips)

Construction

Area of the PCB: 60x88 mm²

- 9 mm was reserved to make the HV connection
- The remaining 51 mm was divided into 8 readout strips
- width of 5.5 mm, separation 1mm

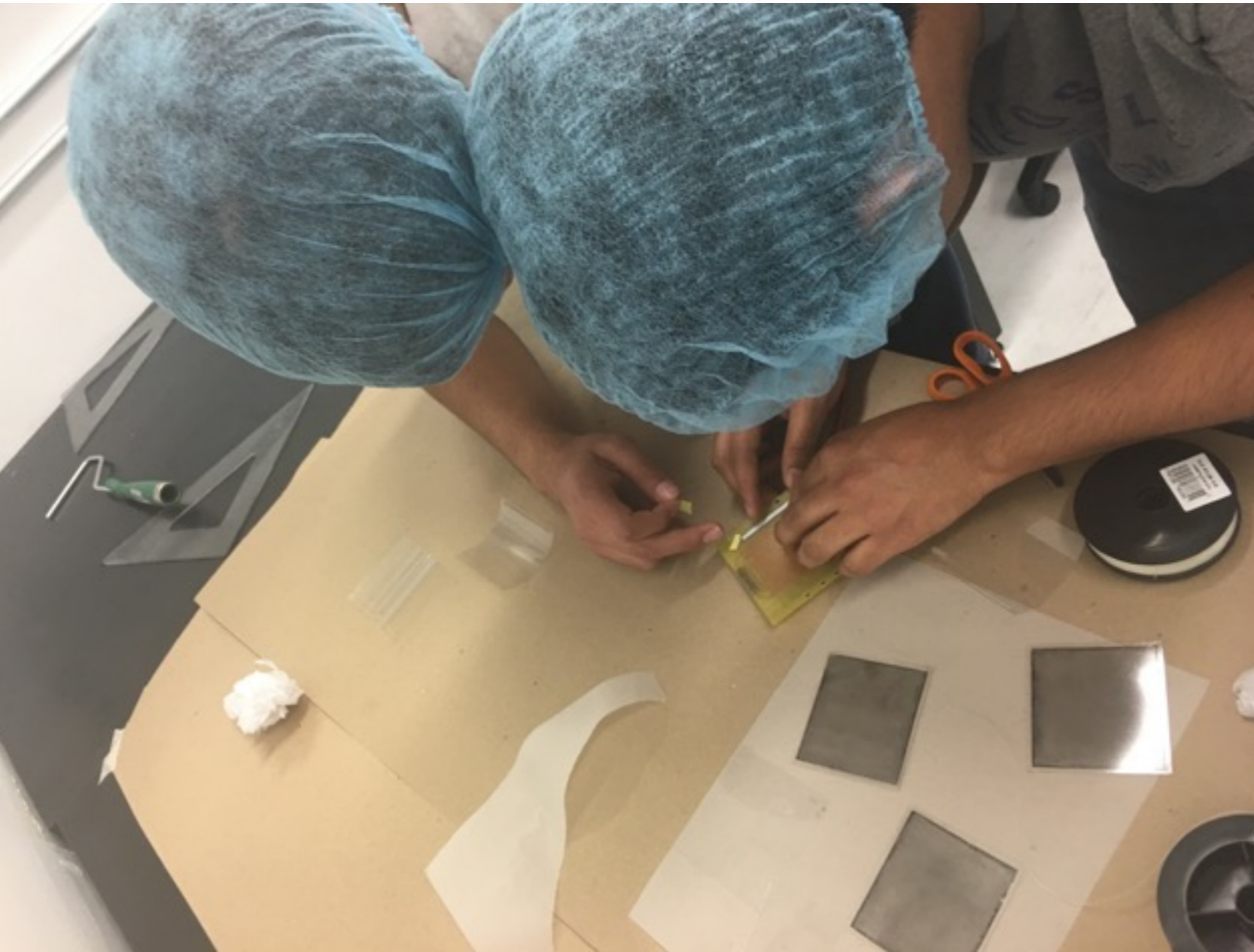
The anode and cathode signals are connected by pins and sent to the NINO front end card.

[F. Anghinolfi et al., NIM A533 \(2004\) 183-187](#)



Manufacture of printed circuit board (8 strips)

Construction



Assemble of the first chamber

Construction



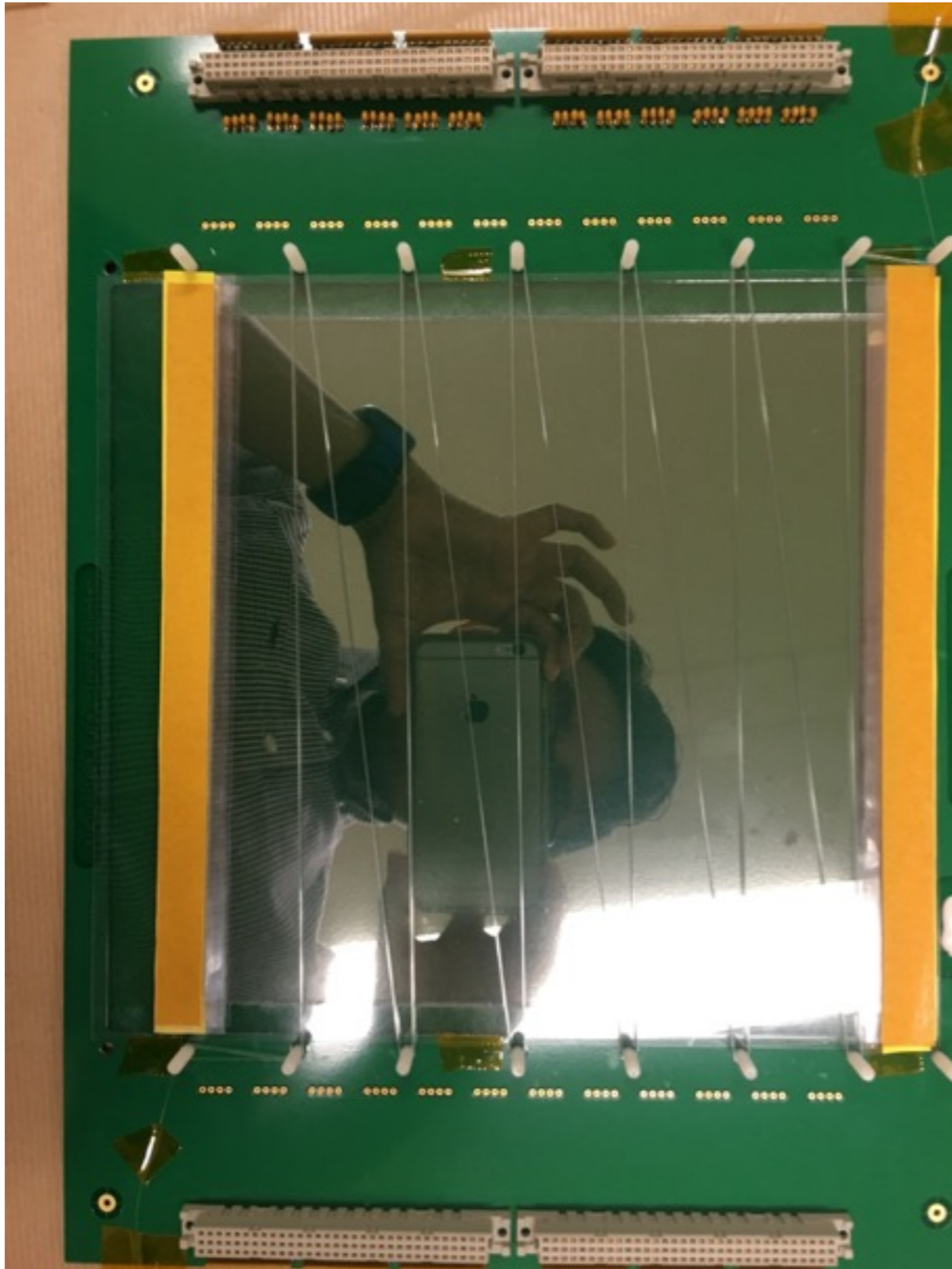
Assemble of the first chamber

Construction



Assemble of the first chamber

Construction



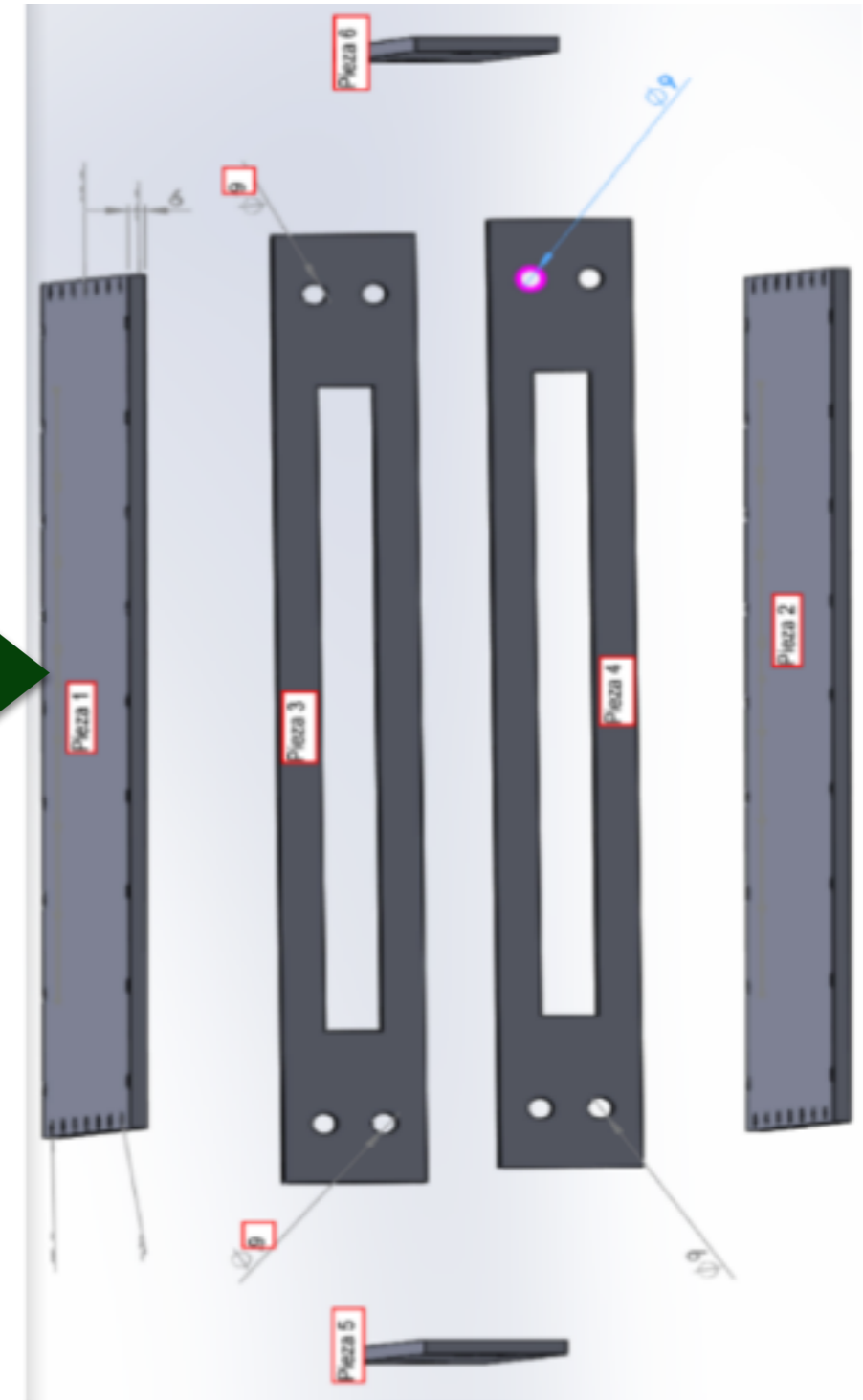
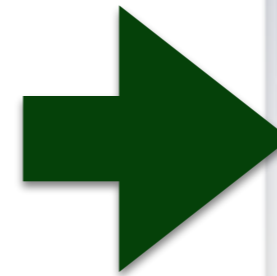
MRPC with slightly larger area

- active area of 20cm × 20cm

- 24 pickup strips

- 6 gaps with 200 μ m

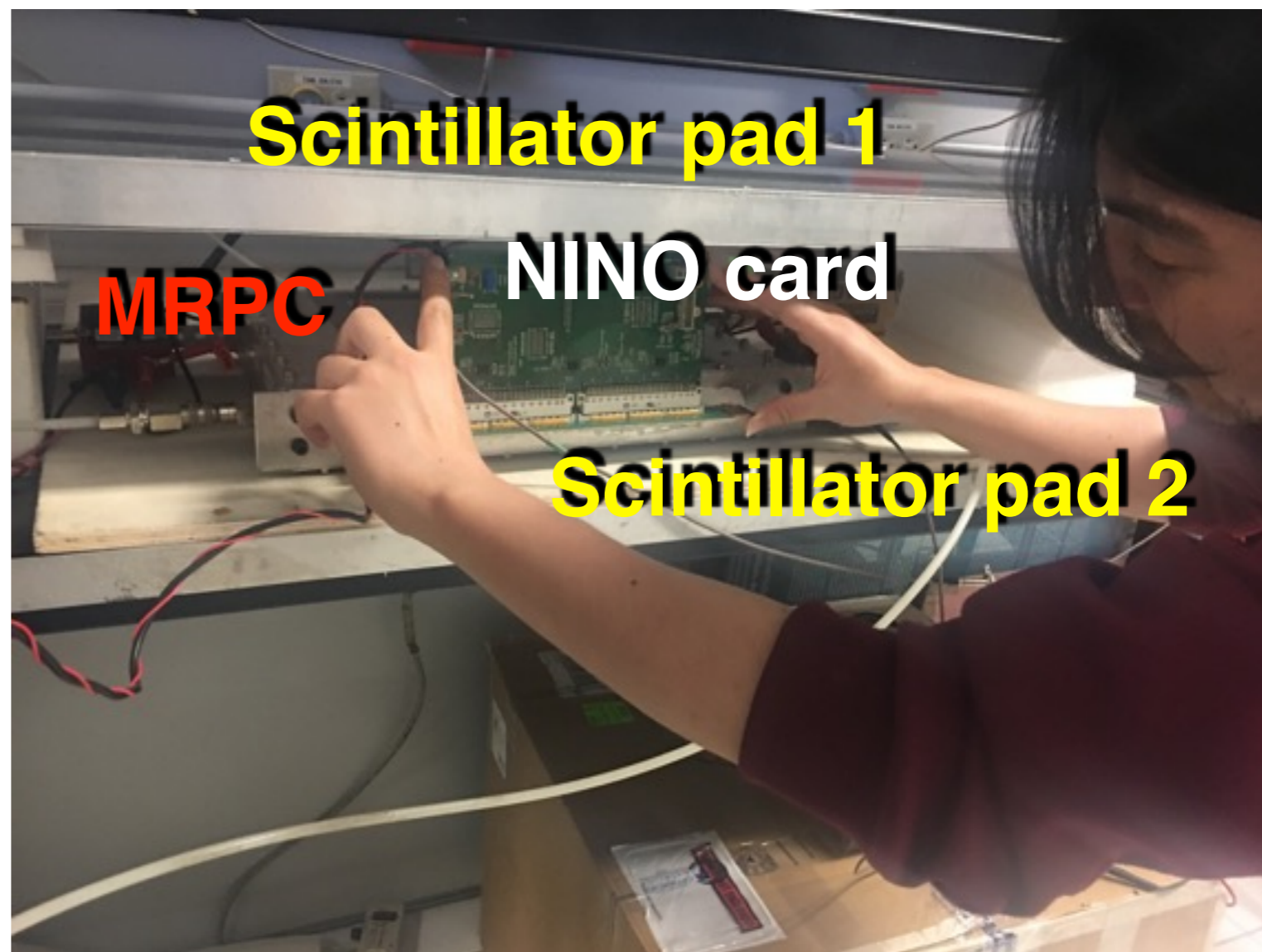
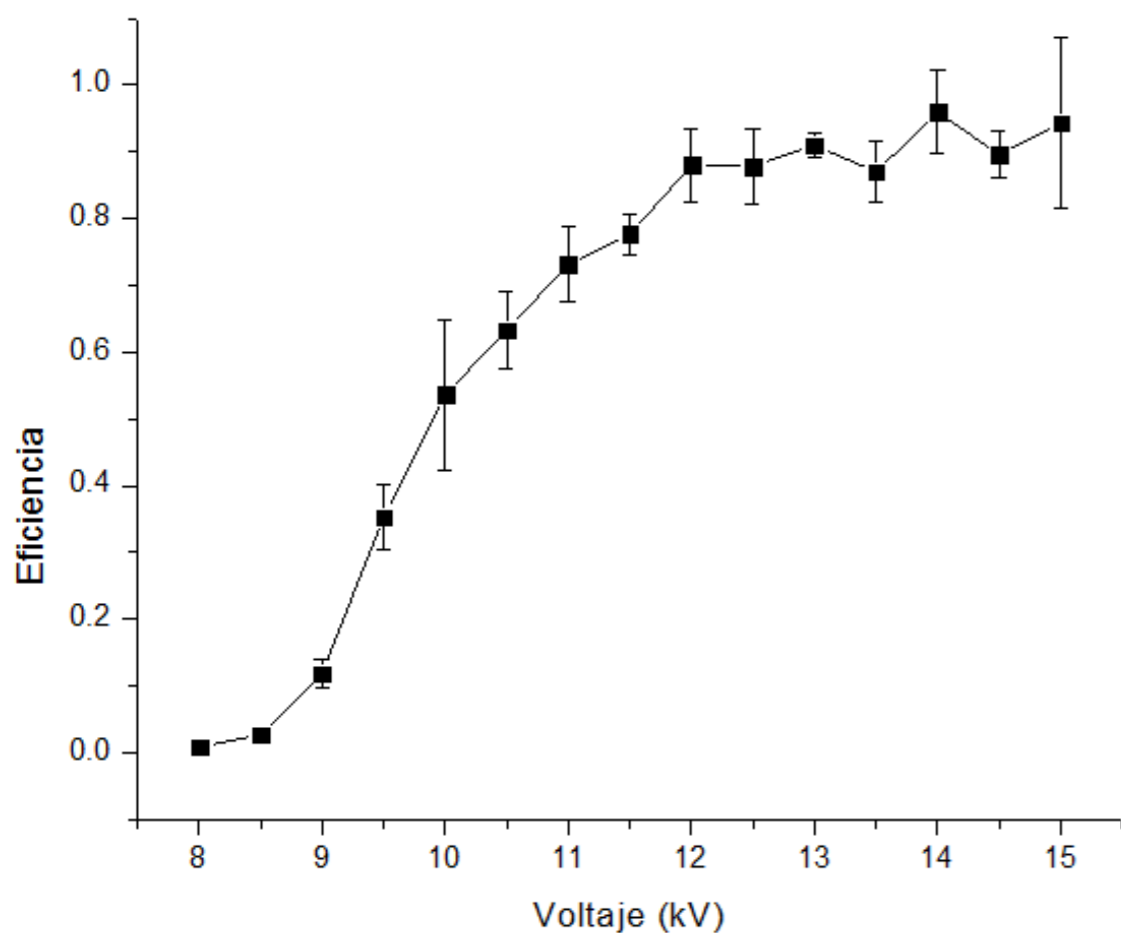
Construction



Test at our lab



Cosmic rays

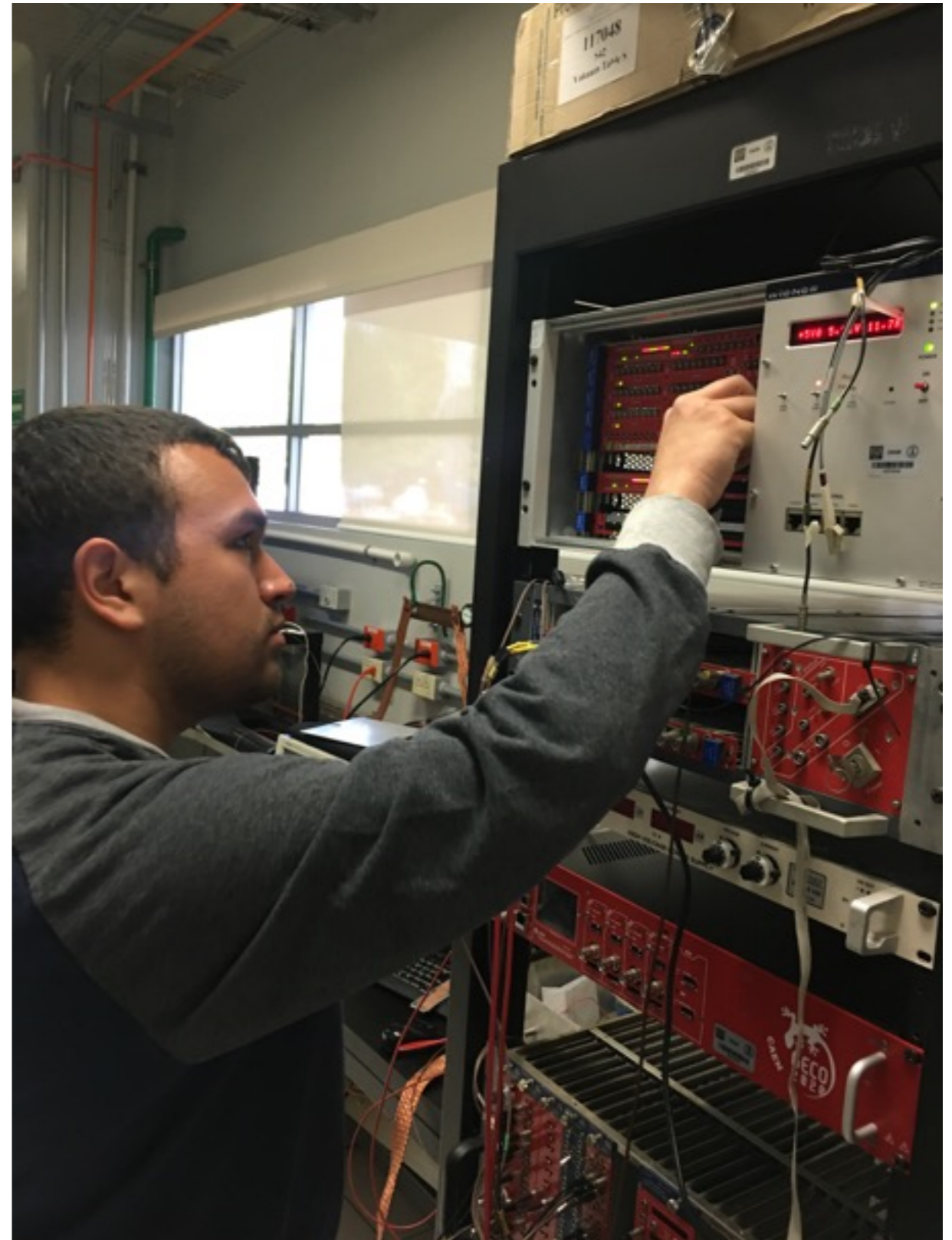


The chambers were also tested at CERN

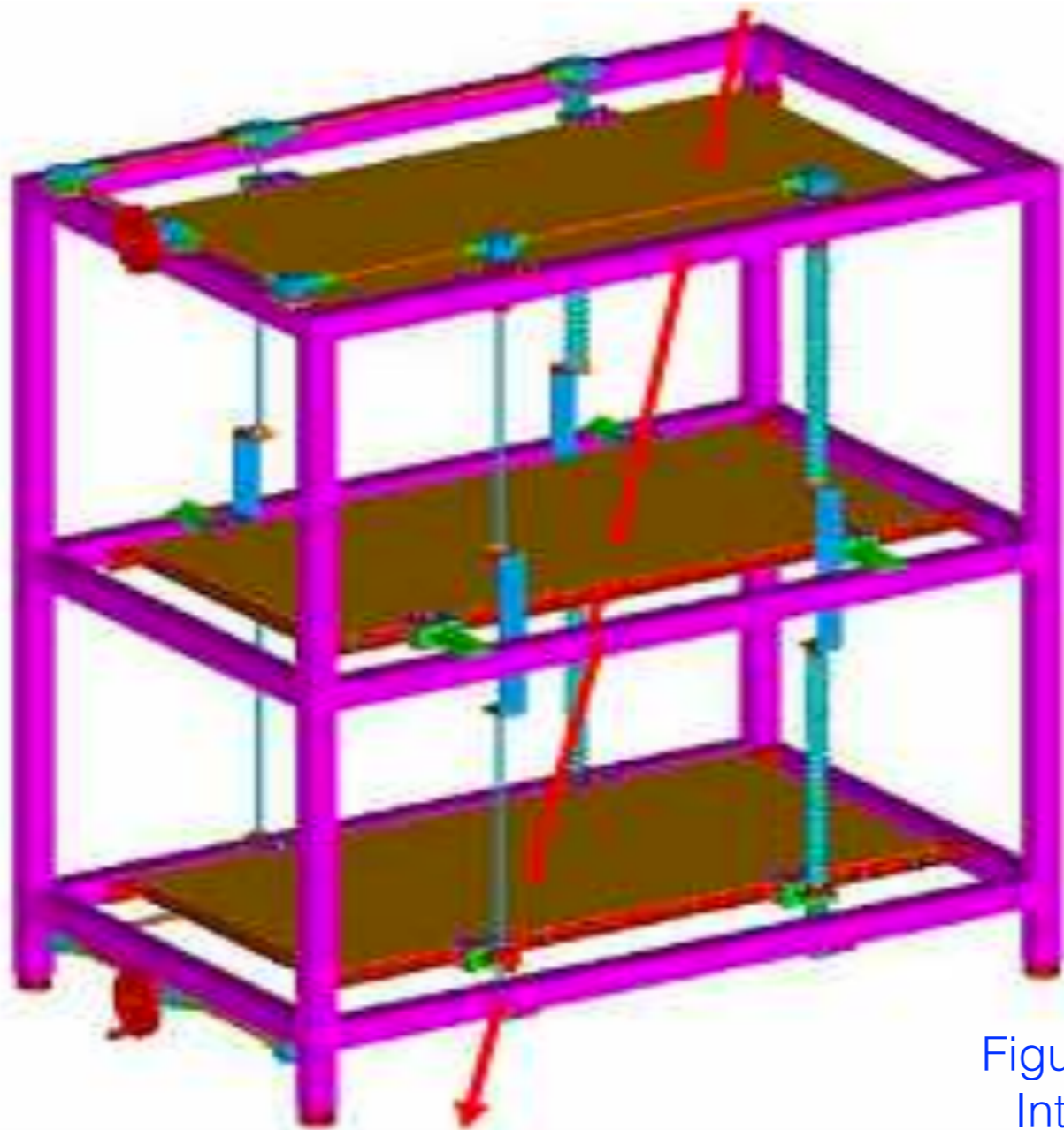
Ongoing (time resolution)



- TDC (V1290N), bridge (V1718) and logic unit (V2495)



Near future



Construction of a muon telescope

■ Three MRPCs

Figure taken from M. Abbrescia, Proceedings of the 30th International Cosmic Ray Conference, vol. 5, 977-980

Final words



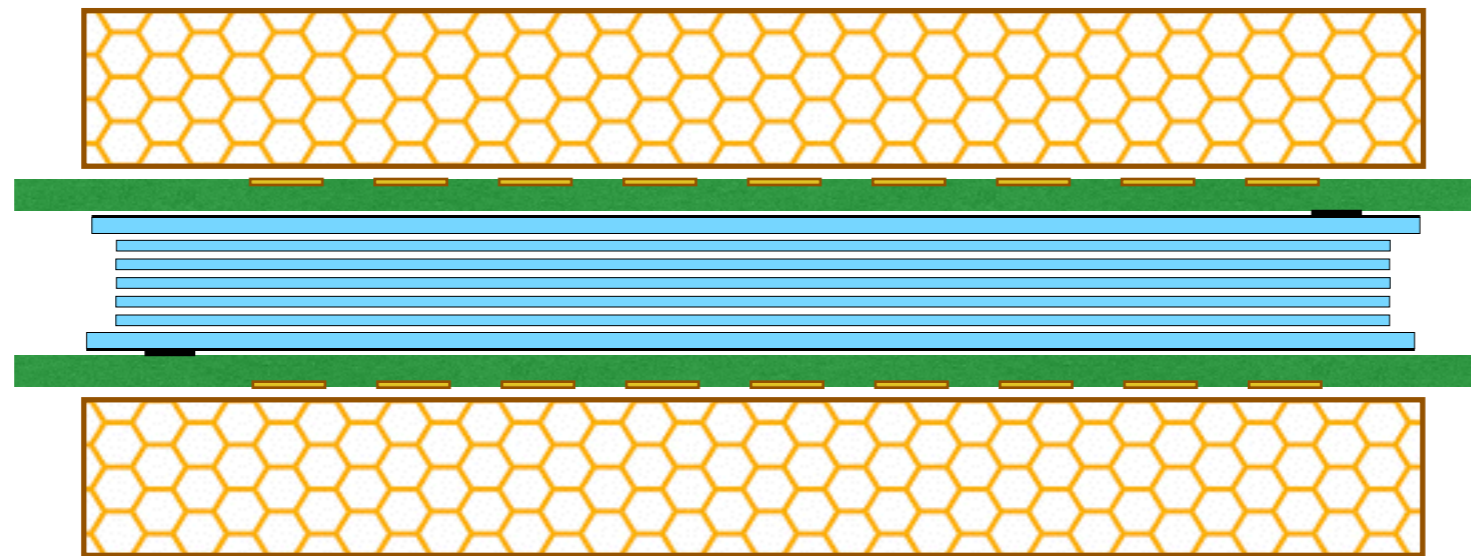
Education

- We have built the first chambers in our lab at the National University of Mexico.
- The chambers were tested using cosmic rays (results validated at CERN)
- Our chambers were used in the first RPC school (Mexico City 2018)
- Within six months, we expect to conclude the muon telescope and then we will be ready to focus on MRPC research



backup

Detector design



Test at our lab



Discriminator
TTL to NIM converter
Logic unit
Counter

