

“Pruebas de los detectores RPC para la actualización del detector ACORDE ”

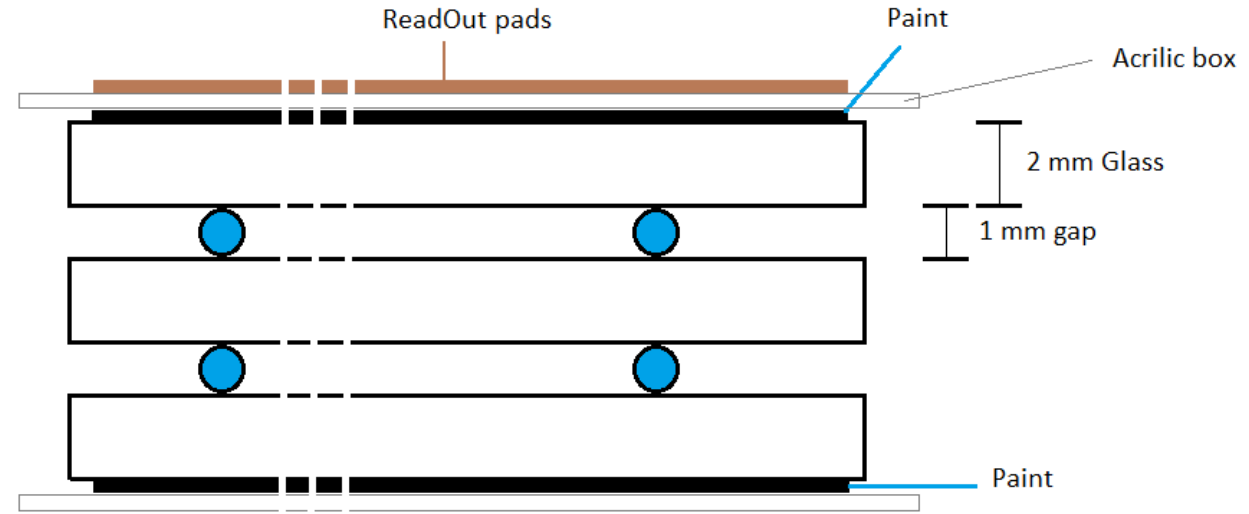
V Congreso de la Red Mexicana Científica y Tecnológica para ALICE-LHC (Red ALICE)

Outline

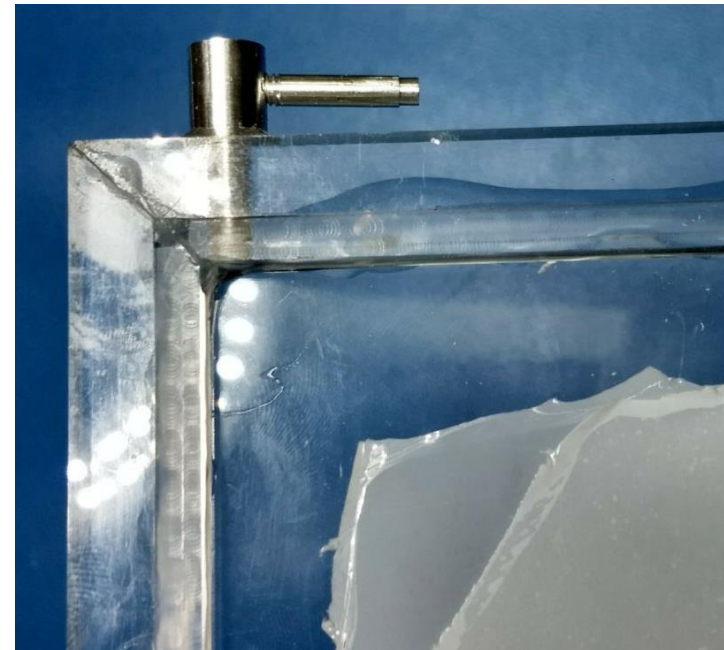
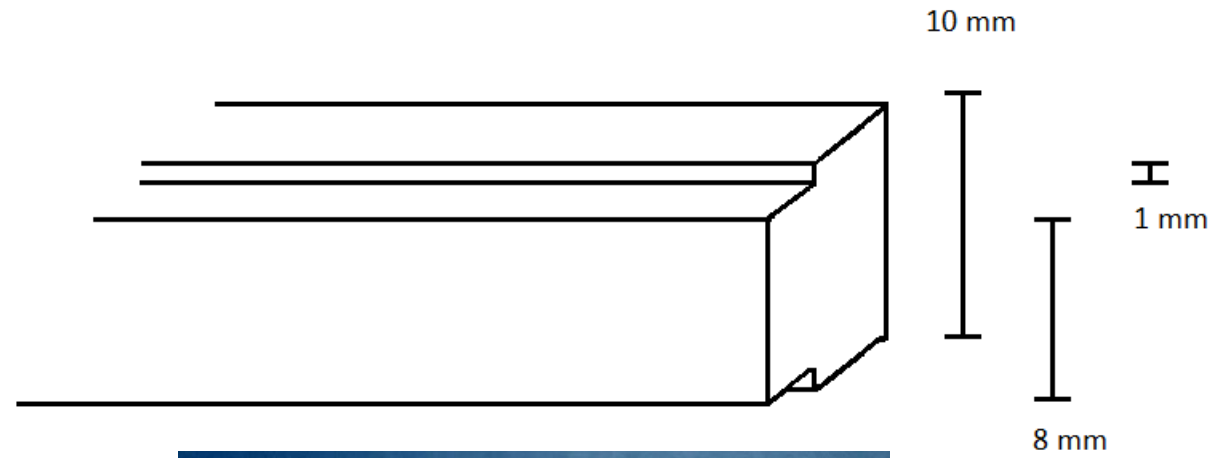
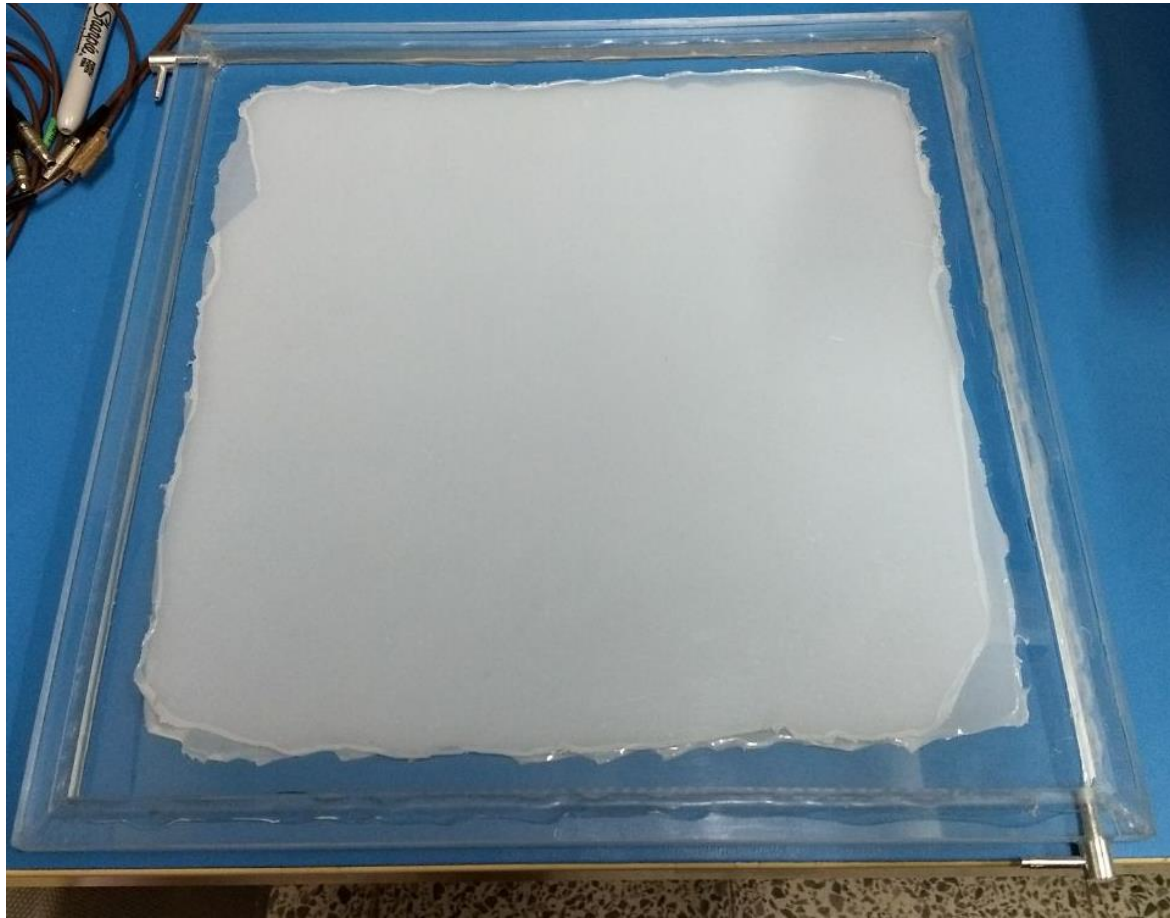
- **Introduction**
- **Fabrication**
- **Electronics**
- **Characterization**
- **Summary and Future Plans (ACORDE Upgrade)**

Construction

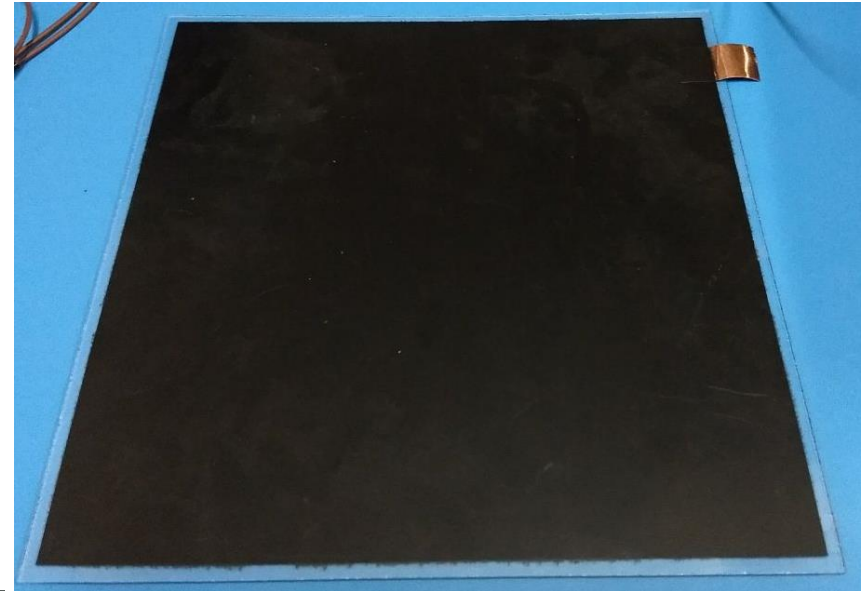
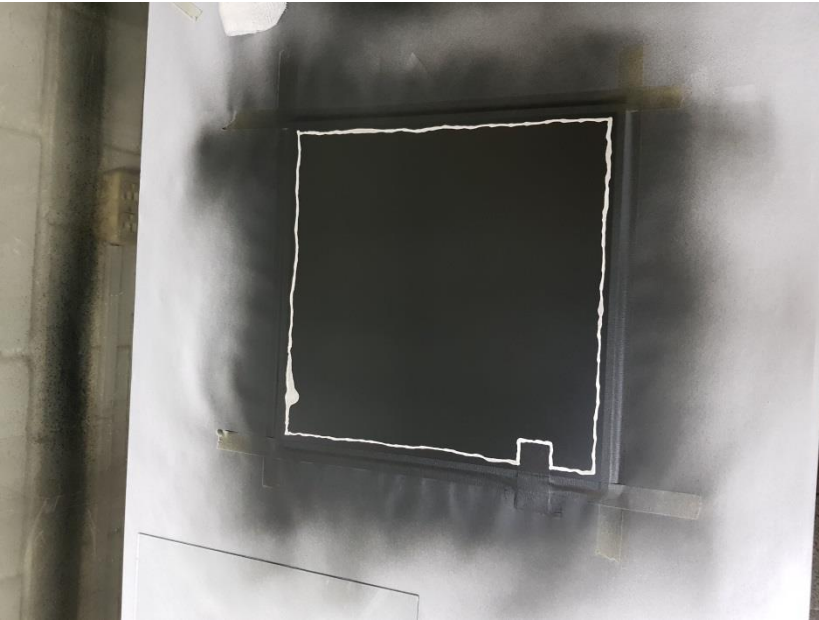
- RPC size-> 30 x 30 cm, 20 x 20 cm
- Glass -> 2 mm (Saint-Gobain)
- Gas Gap -> 2 x 1mm
- Acrilic gas box -> 35 x 35 cm
- ReadOut Pads-> 4 and 9
- ReadOut Strips-> 12
- Grafitte and acrilic paint for electrodes
- Paint resistivity -> $\sim 5\text{M}\Omega/\square$
- Gas -> Argon, Freon
(95.2% C₂H₂F₄, 4.5% i-C₄H₁₀, and 0.3% SF₆)



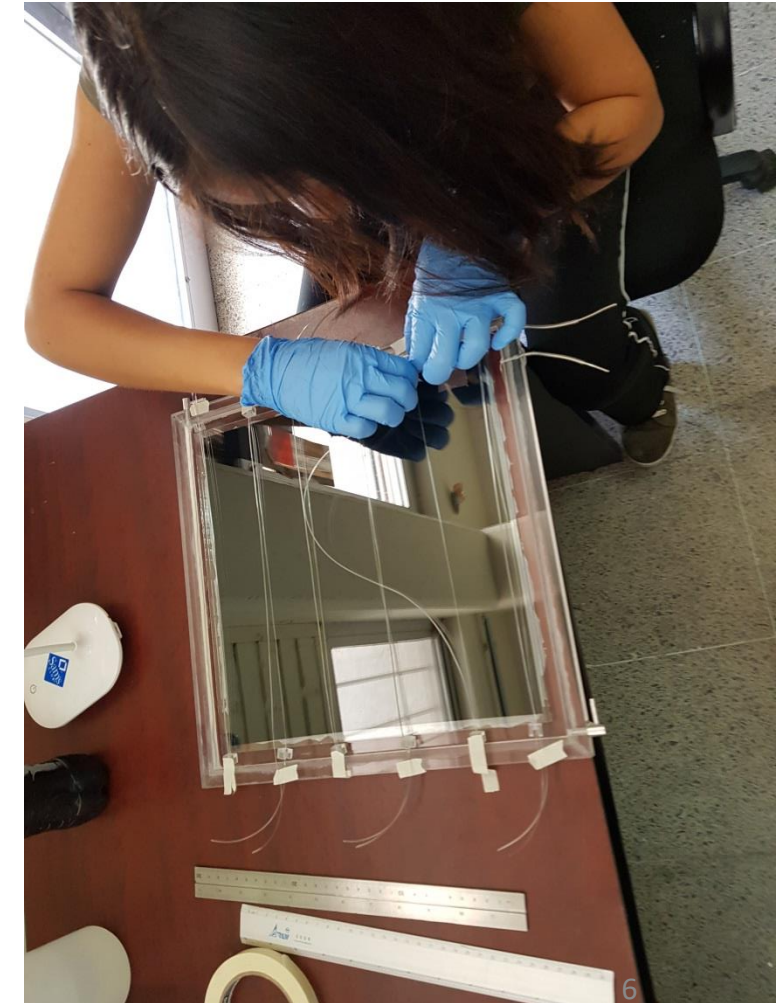
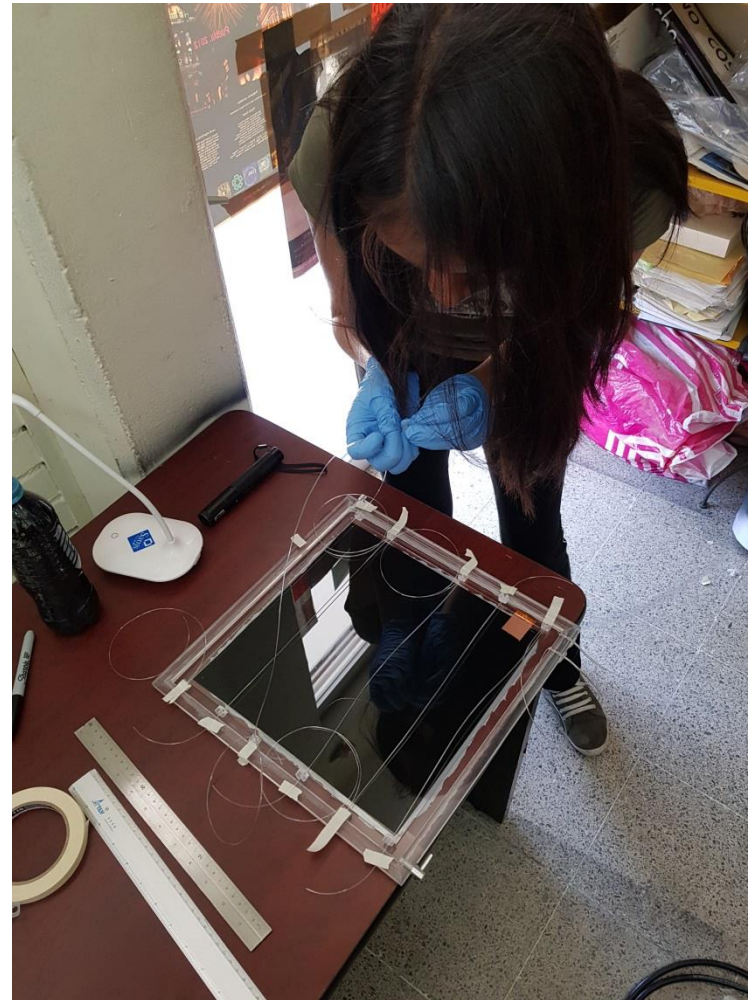
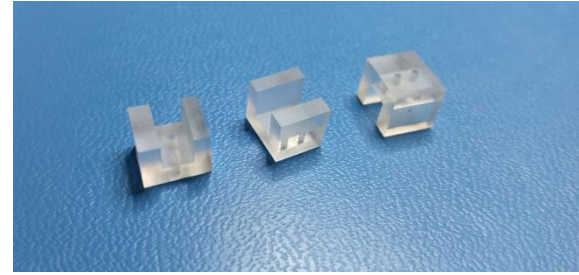
RPC box



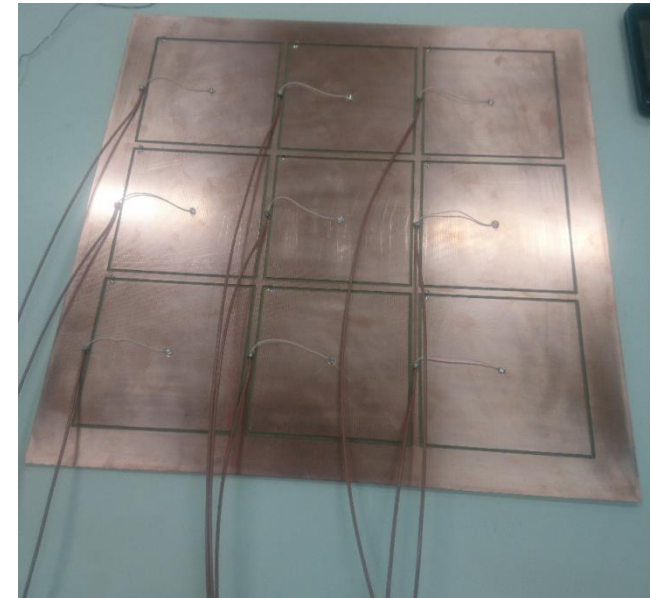
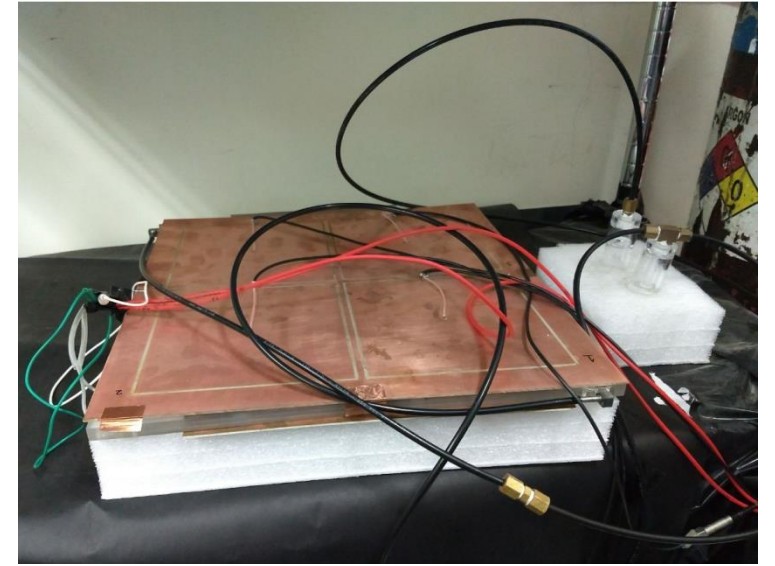
Paint



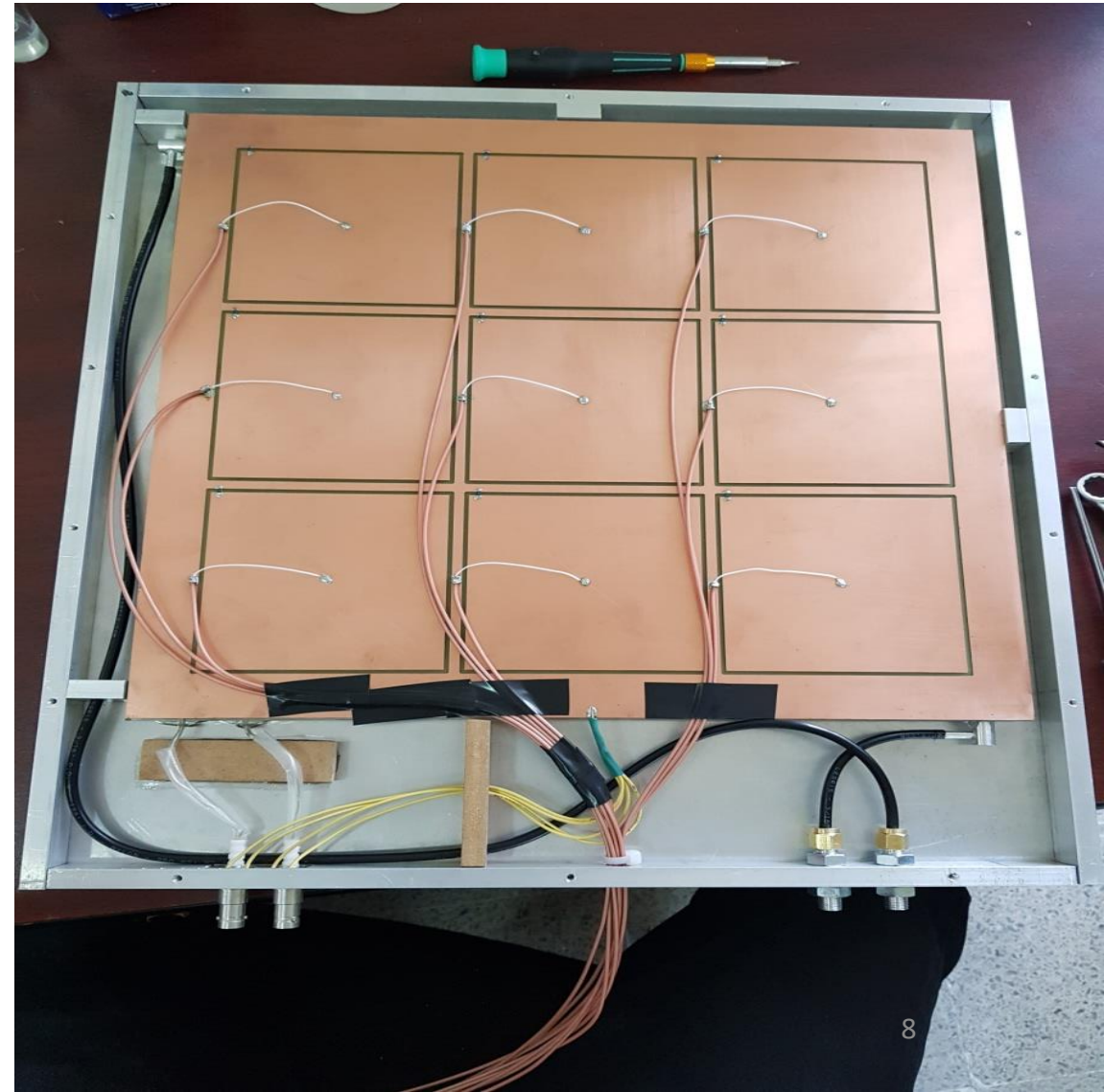
Assembling



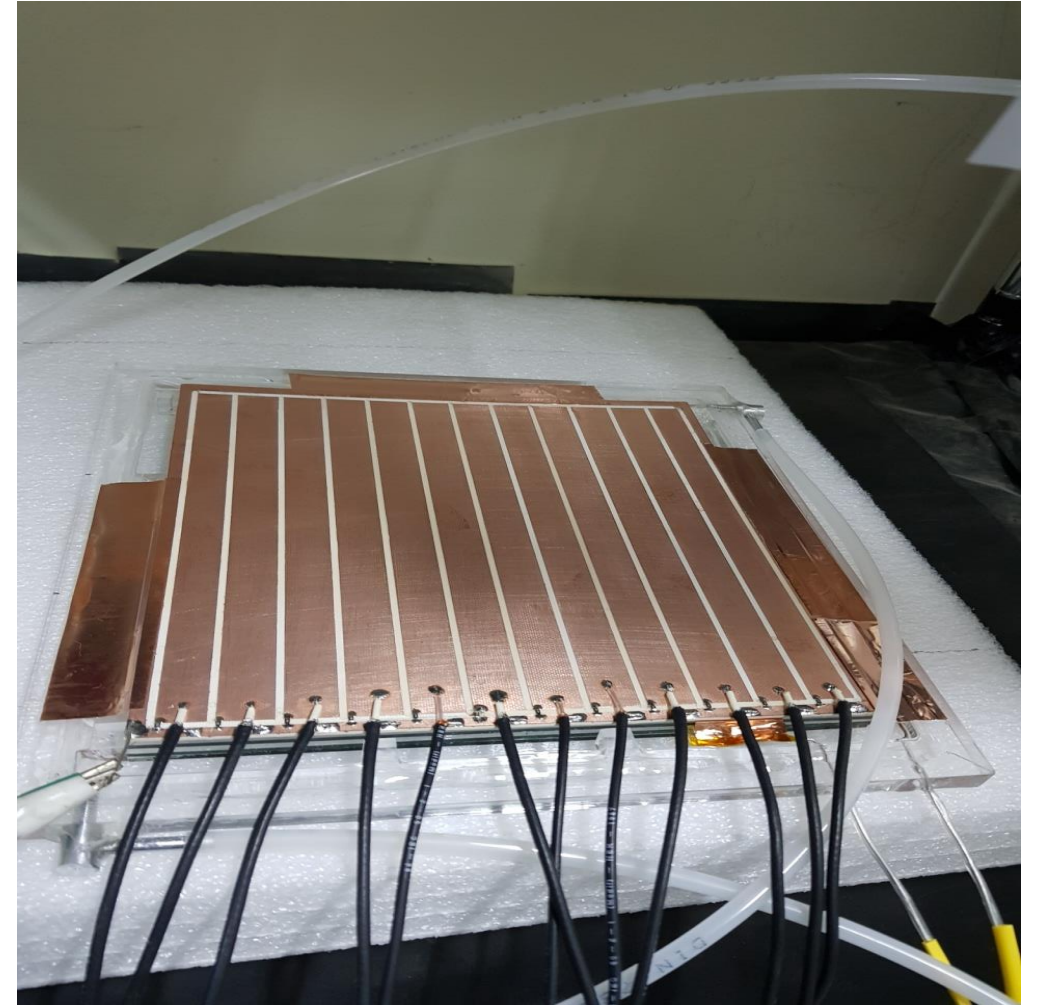
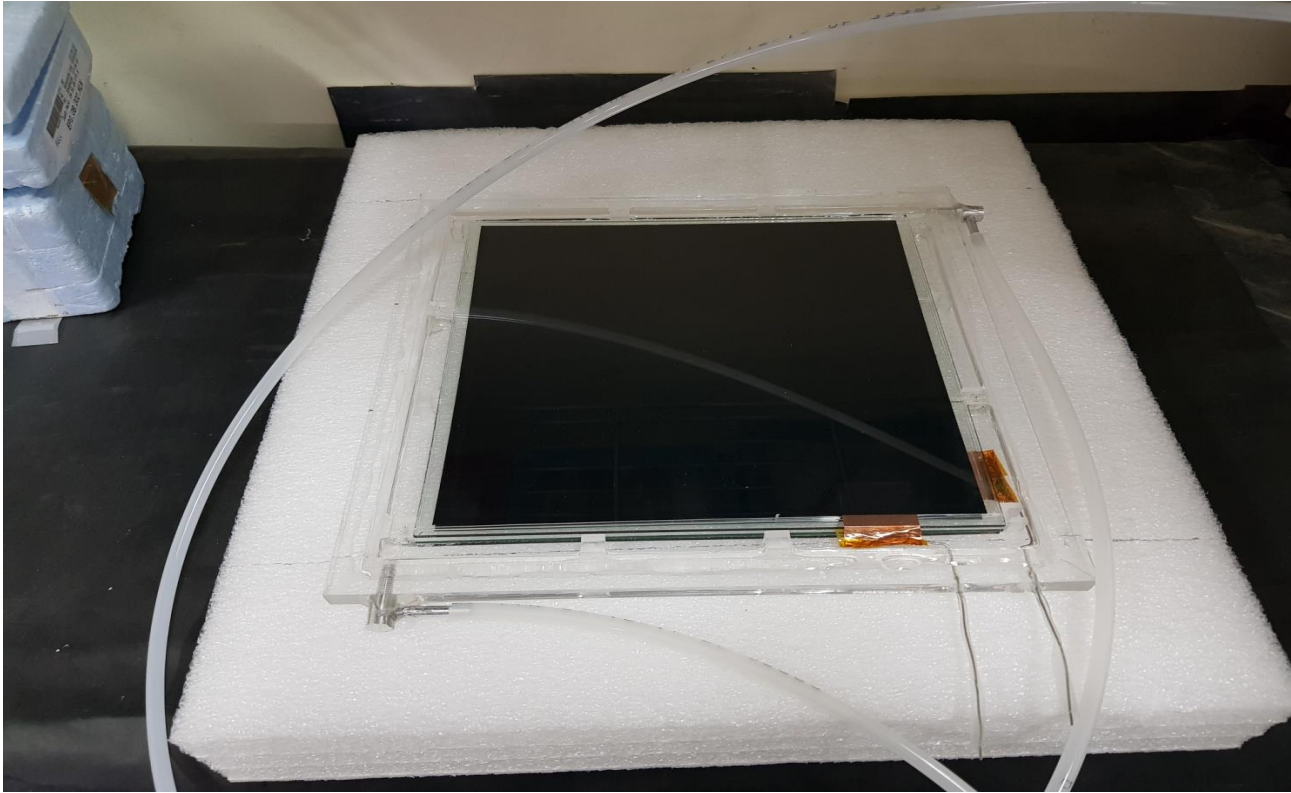
Final assembling for test



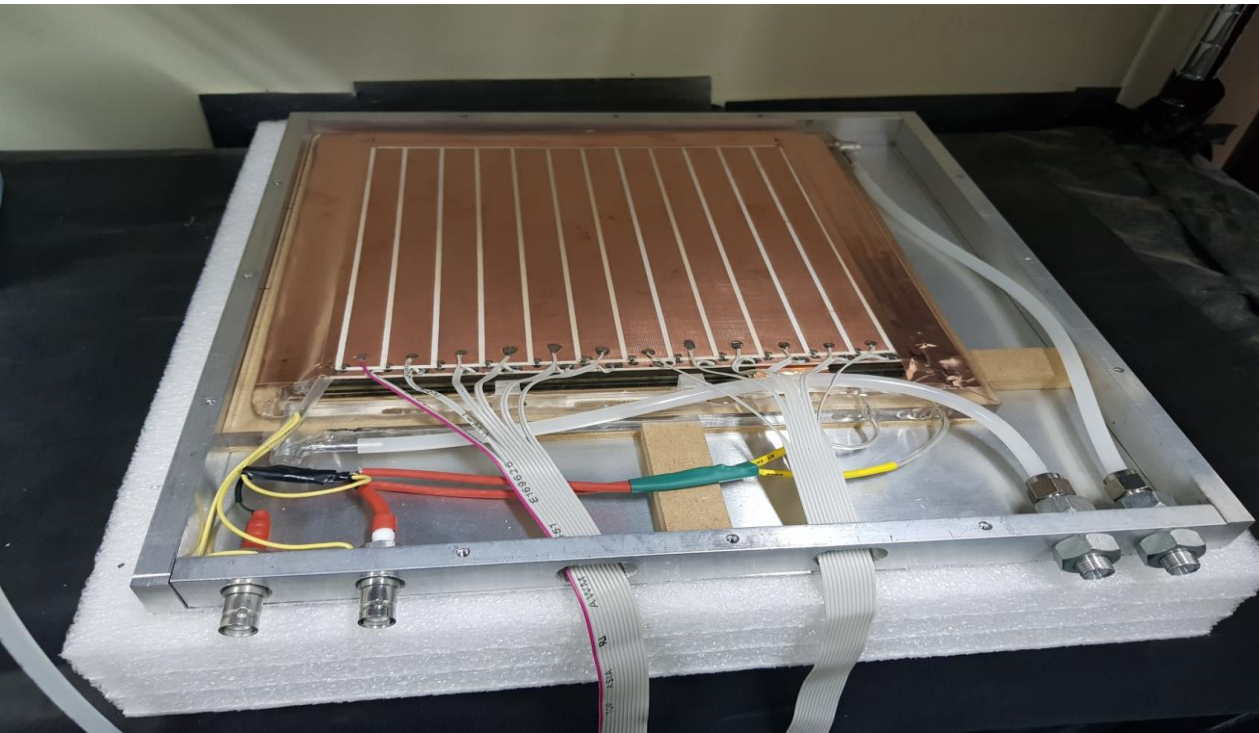
Prototipo RPC 1



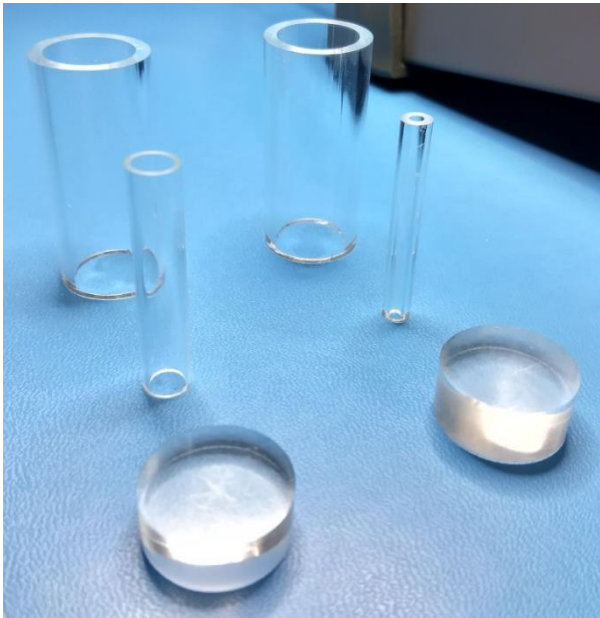
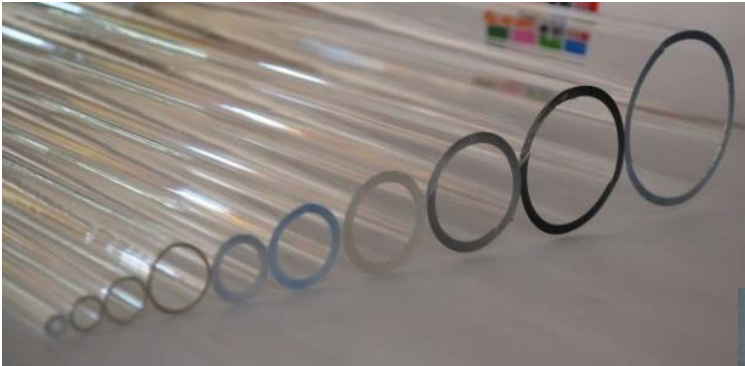
RPC 2 Argón cleaning



RPC 20 x 20 cm



Gas



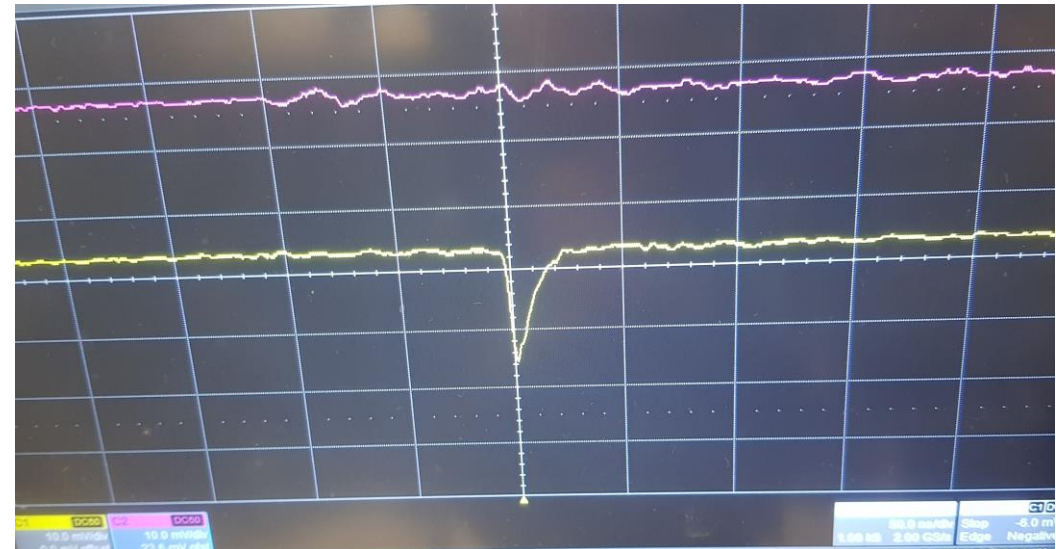
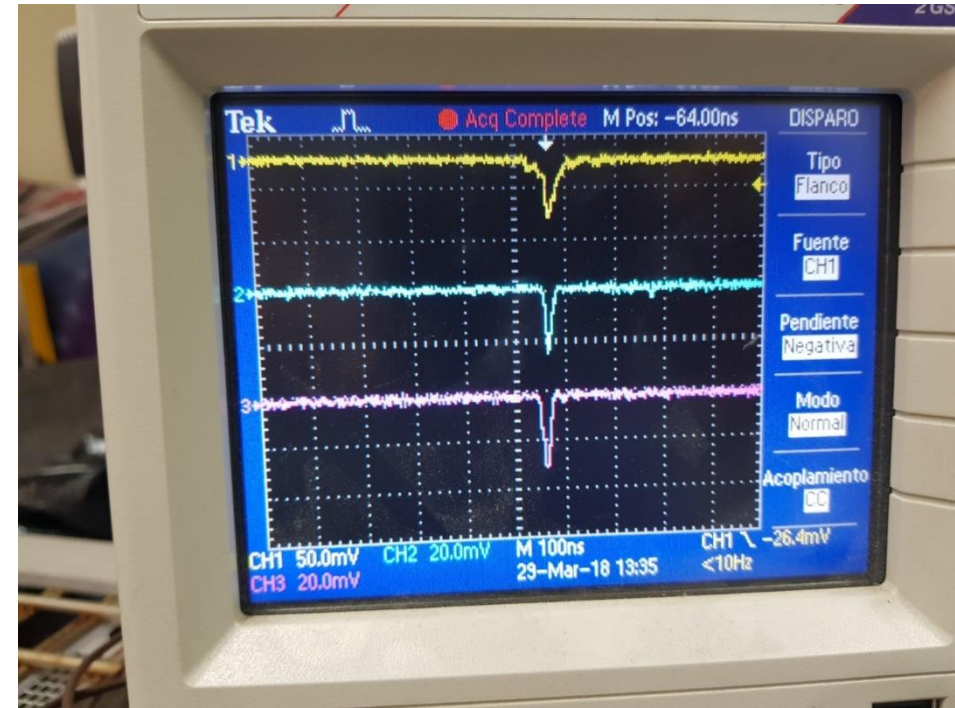
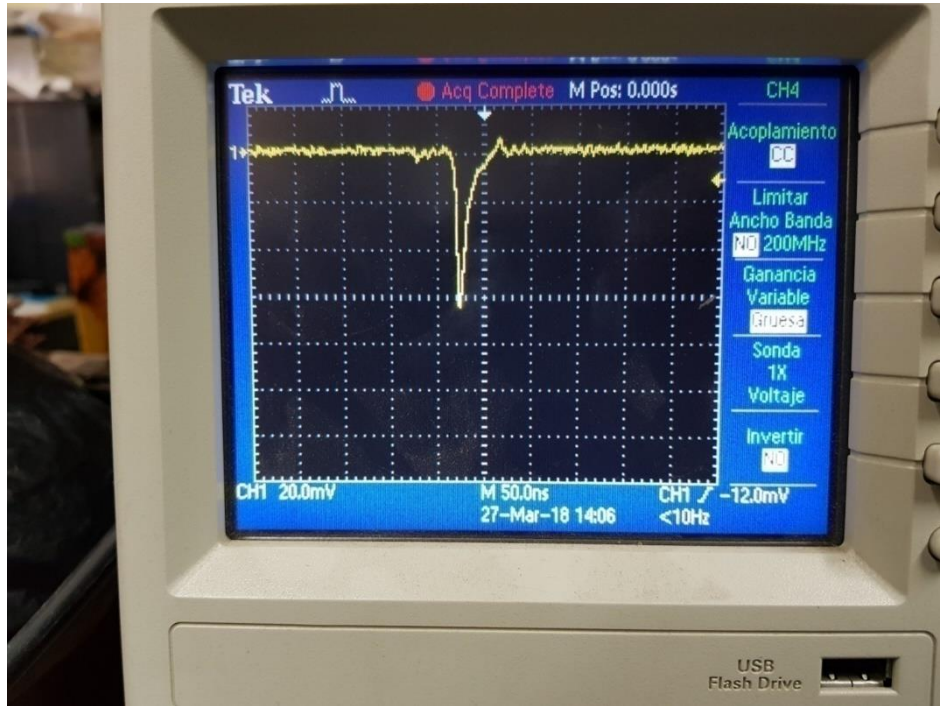
RPC Beam Test (T10 CERN)



RPC Beam Test (CERN 944)



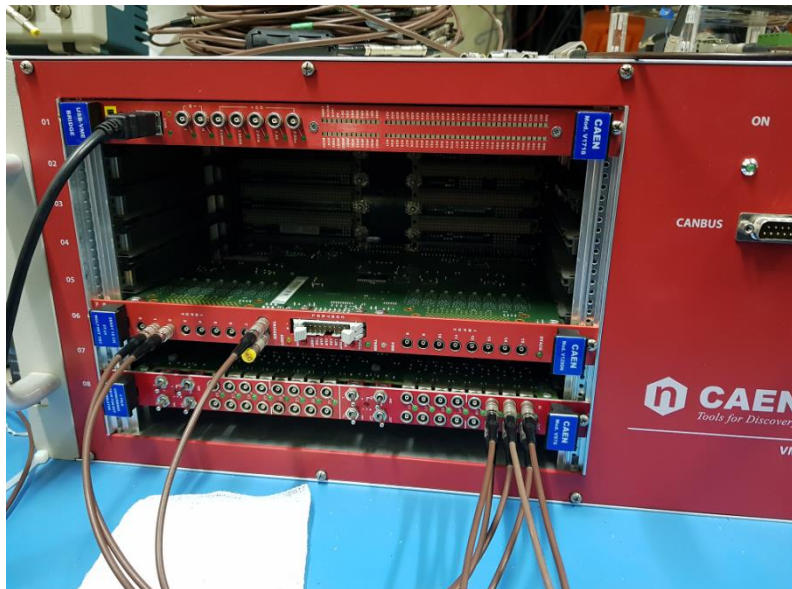
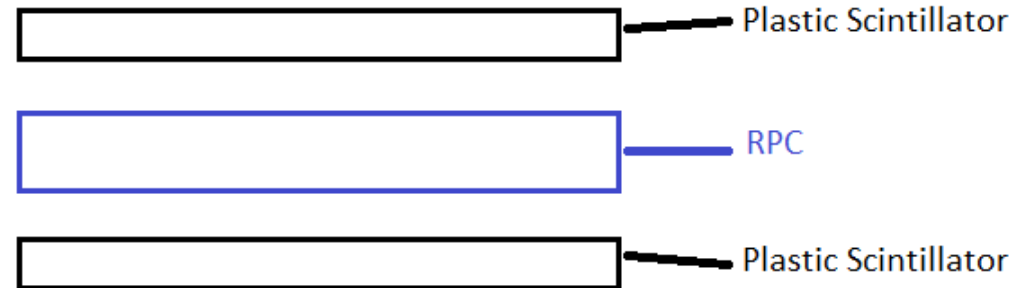
RPC Signals



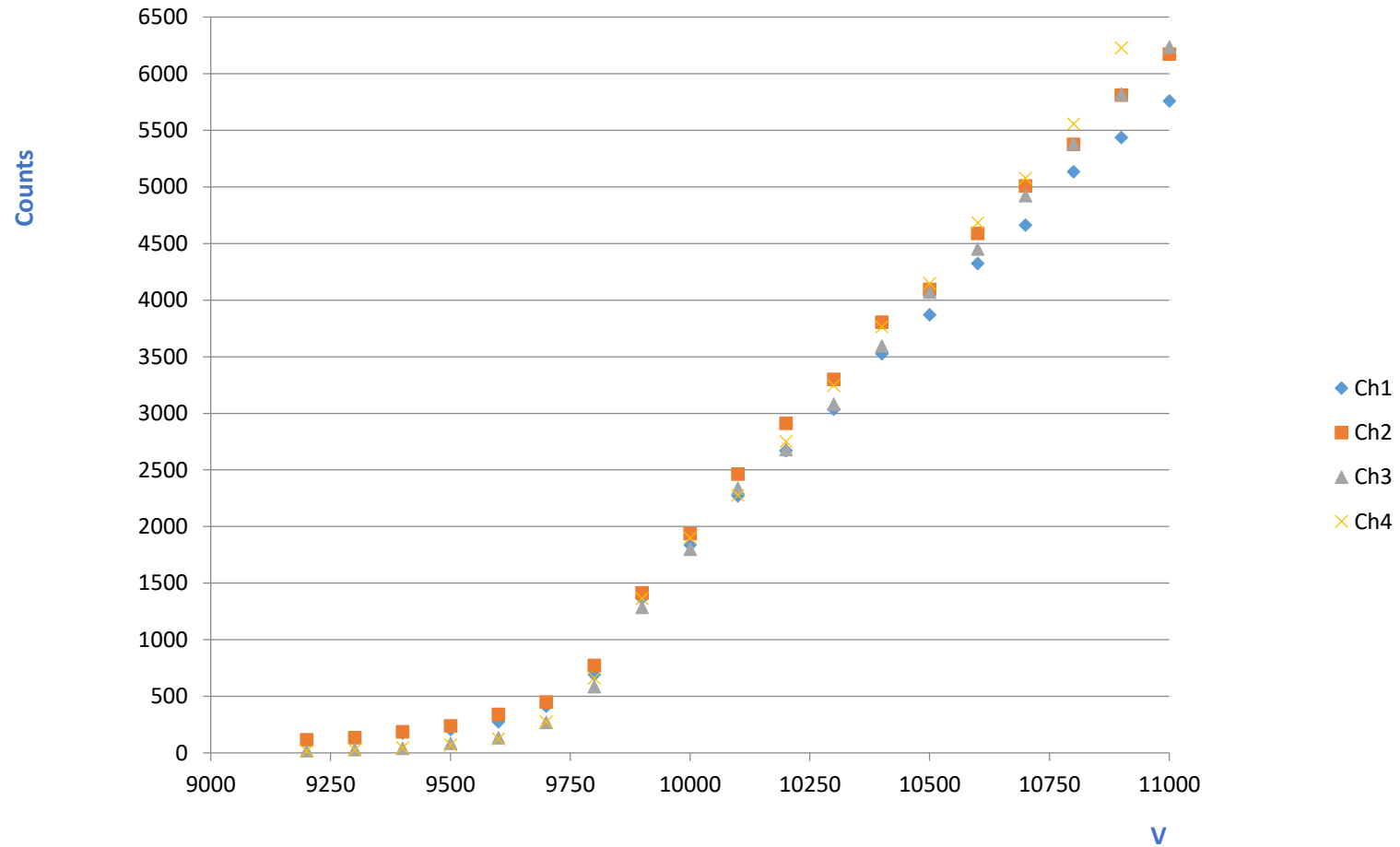
HV



Setup for efficiency



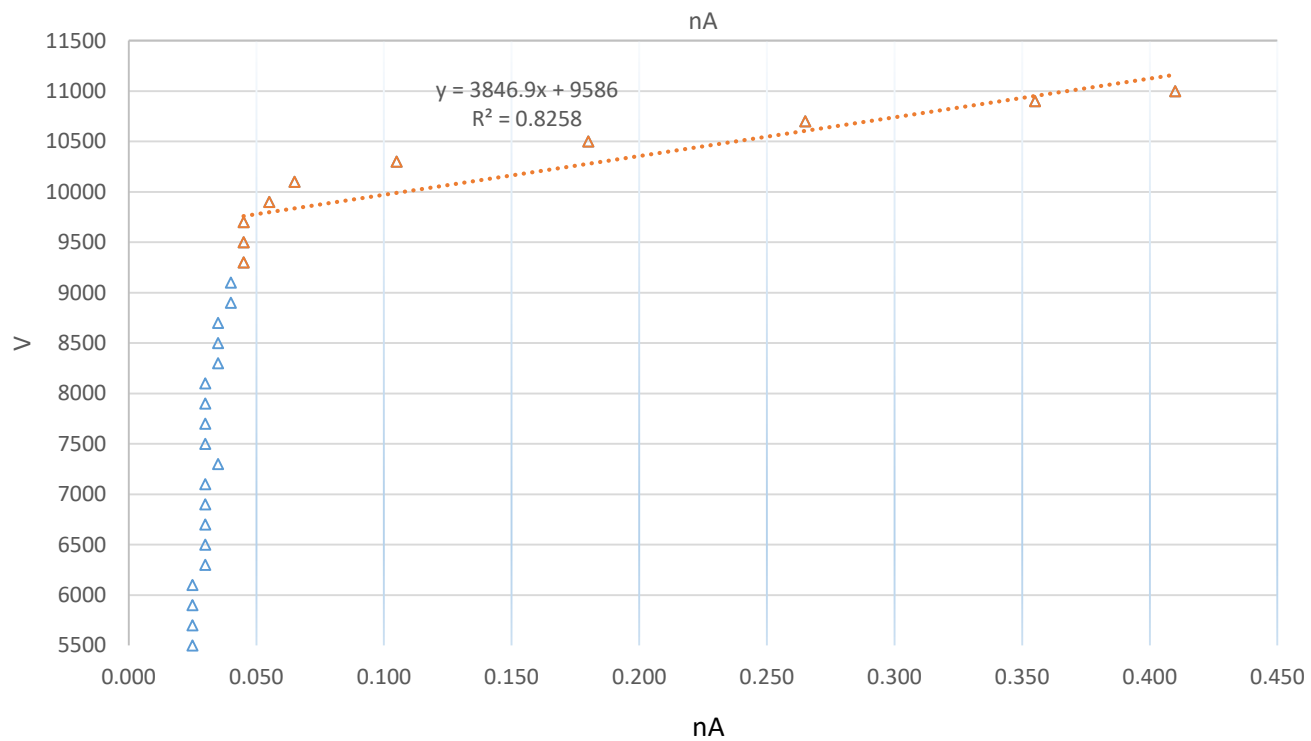
RPC Rate



Results

ARGON

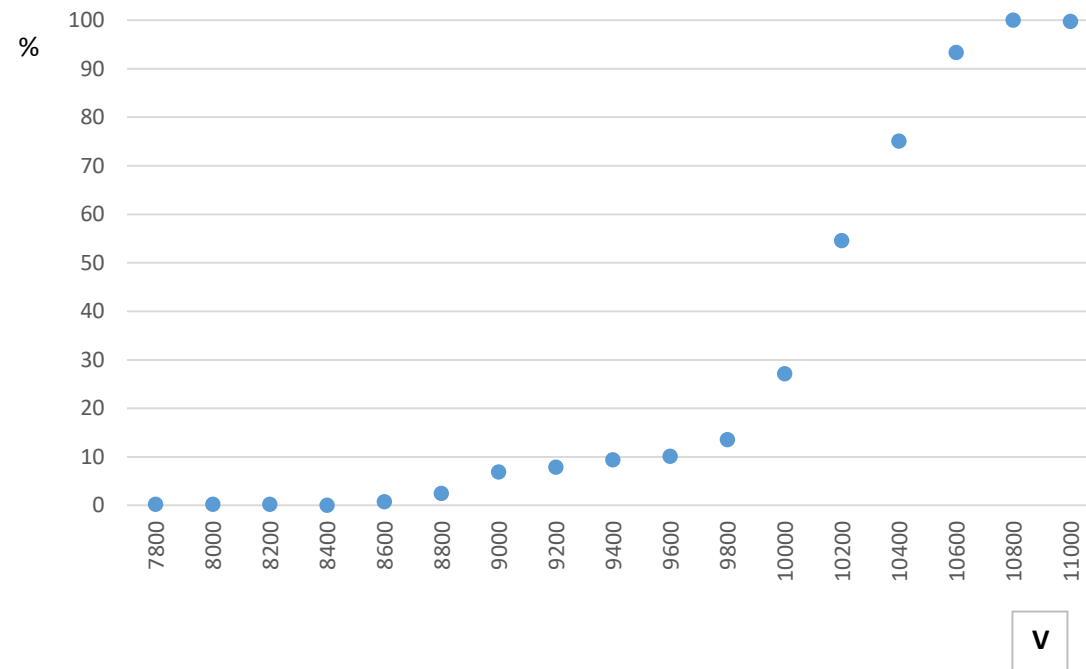
2 gaps RPC Resistivity



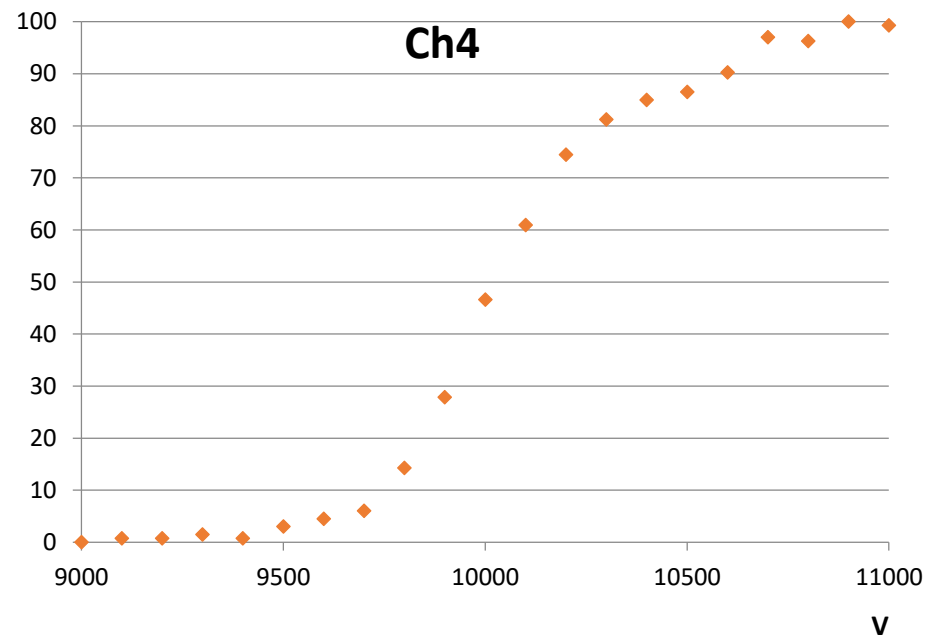
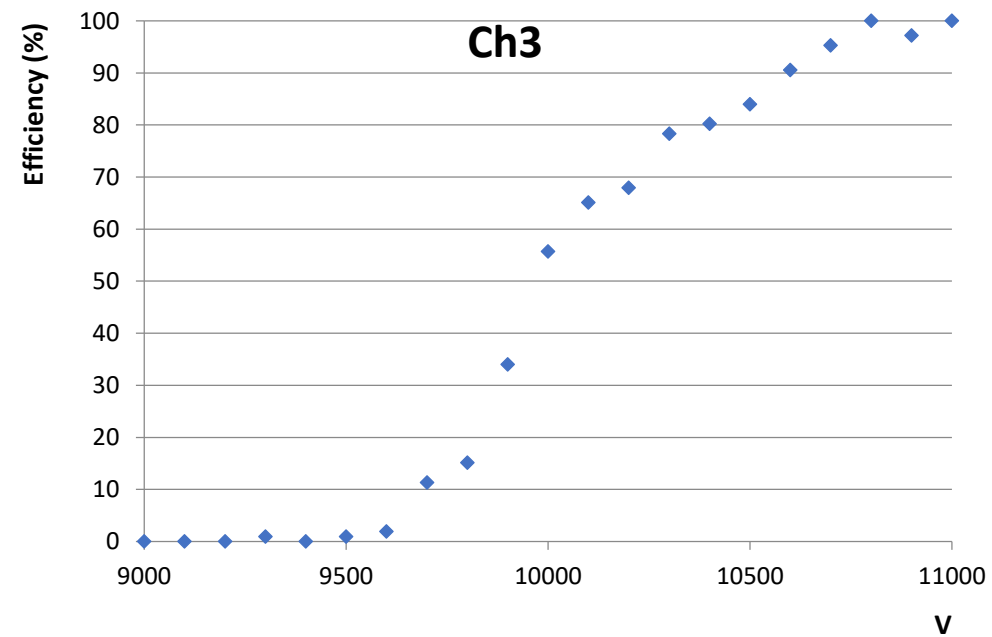
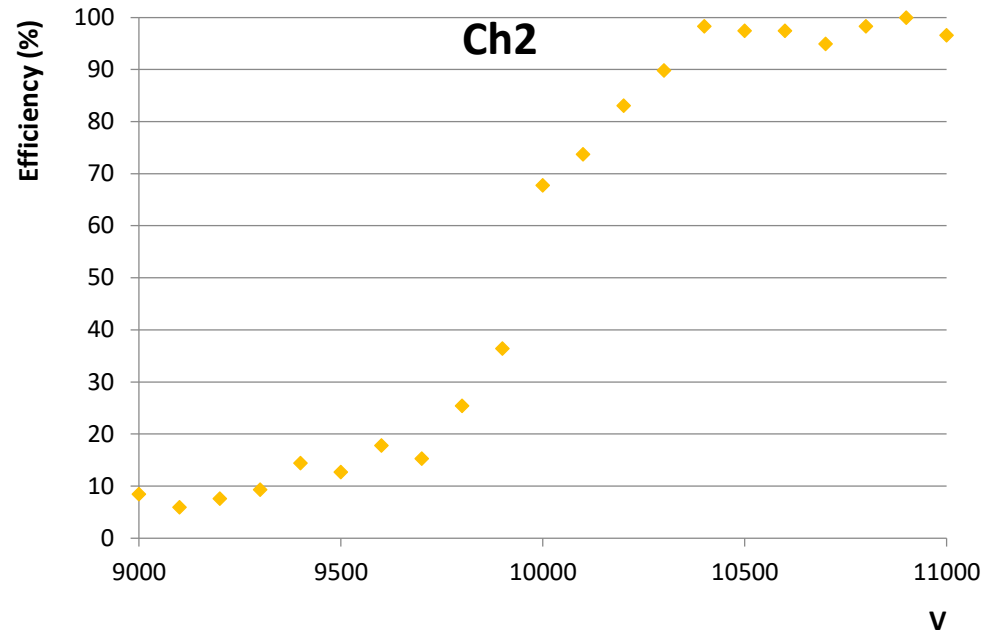
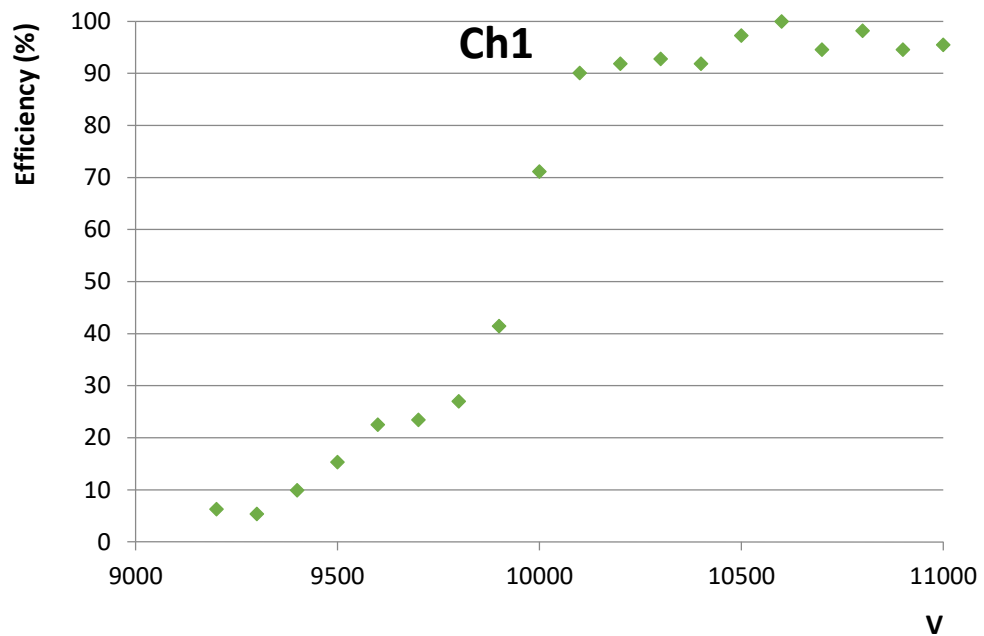
$5.6 \times 10^{12} \Omega \cdot \text{cm}^2$

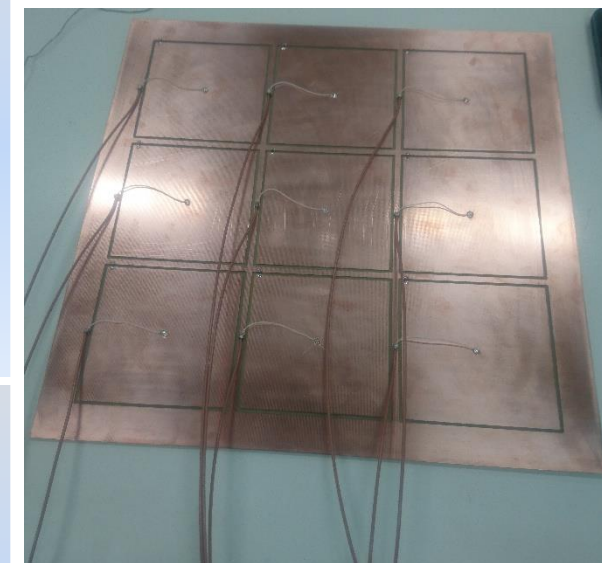
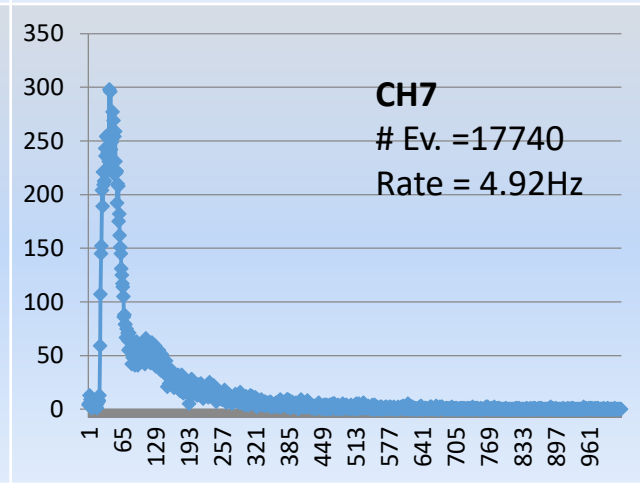
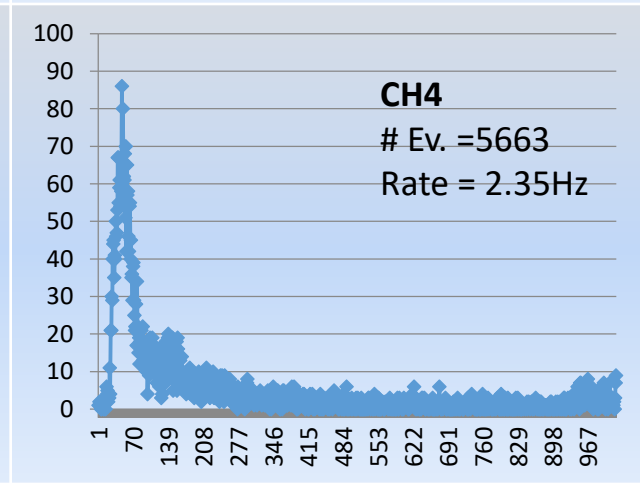
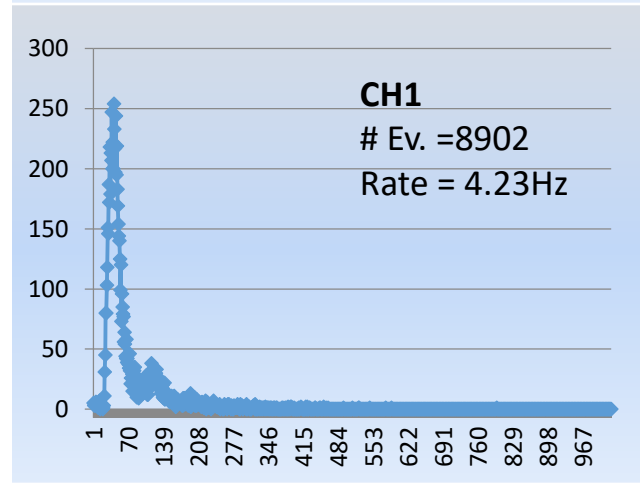
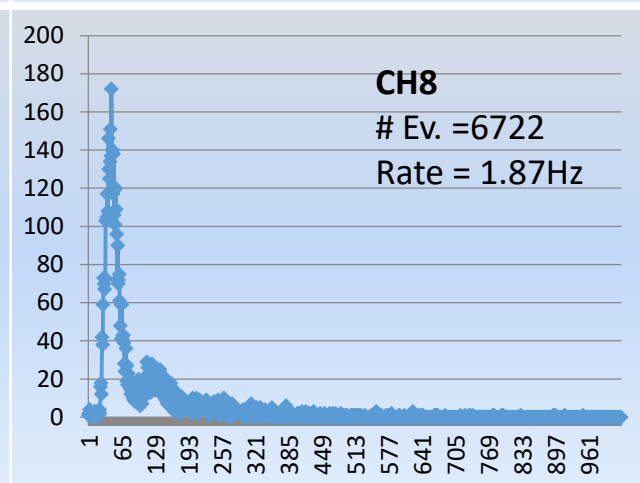
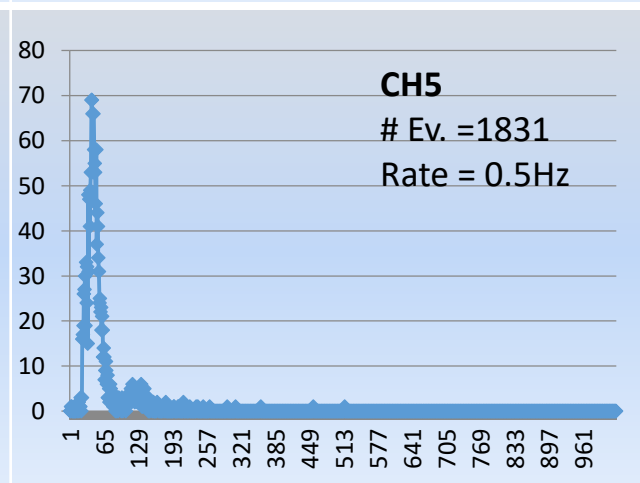
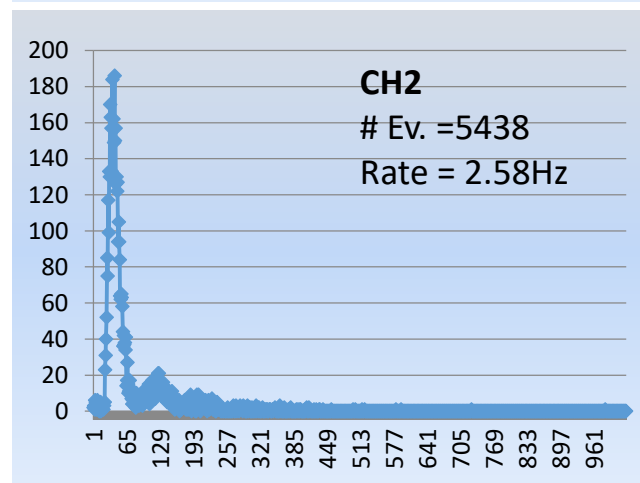
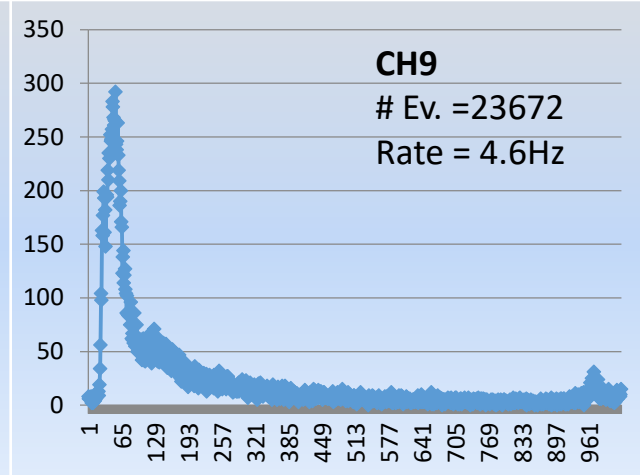
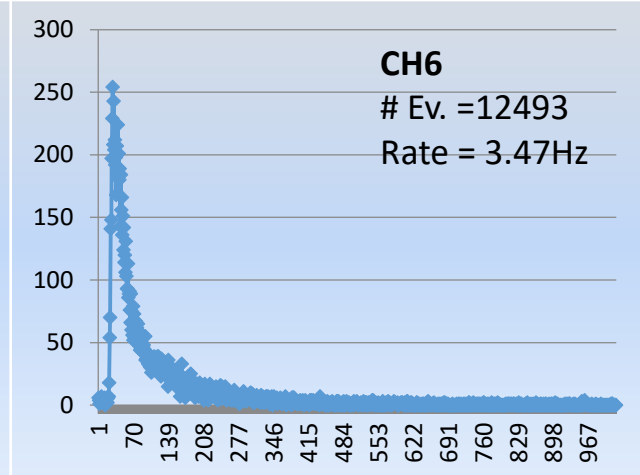
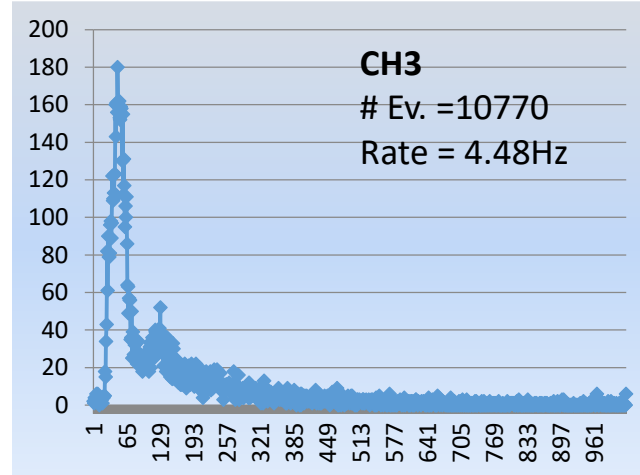
FREON

Efficiency



V

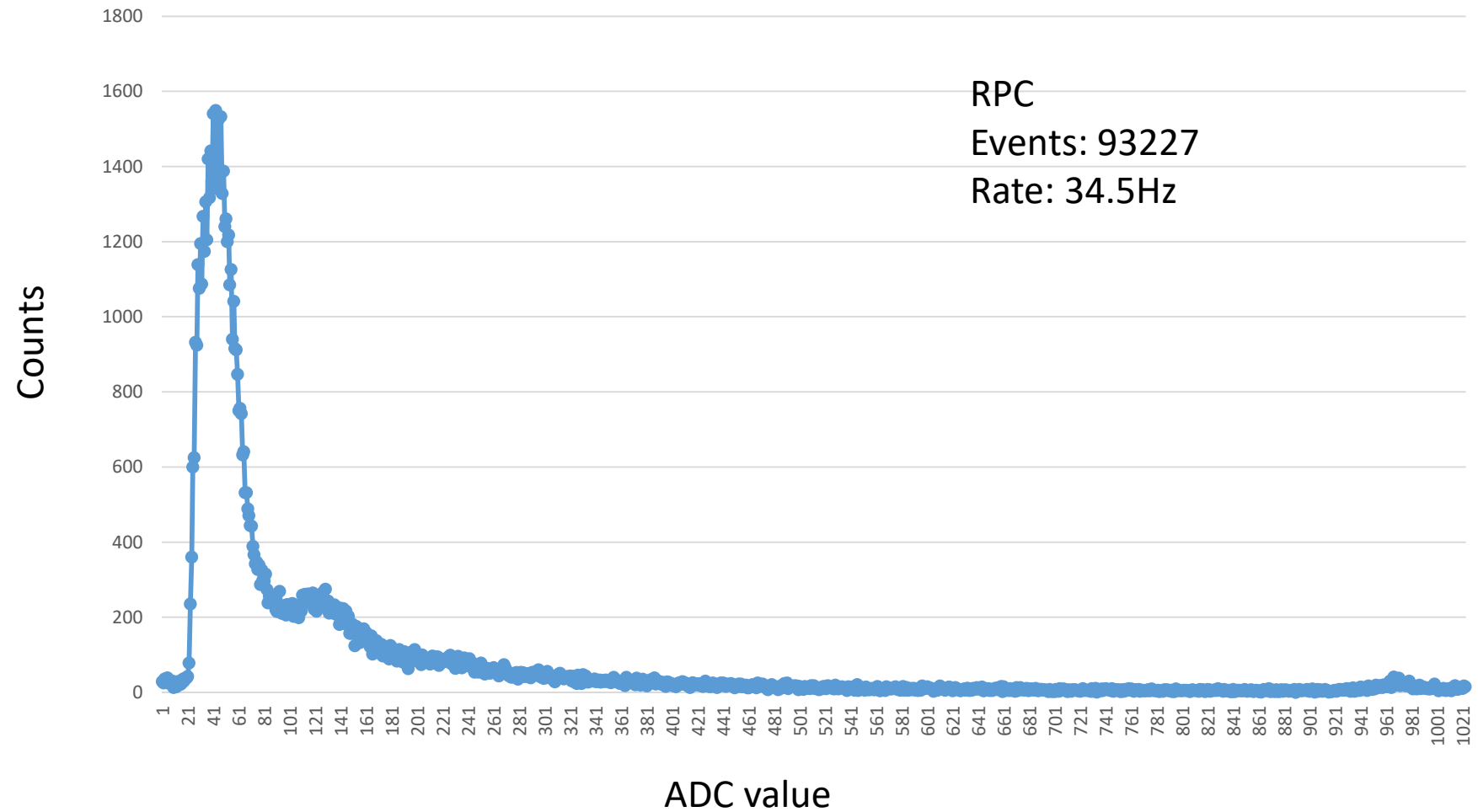




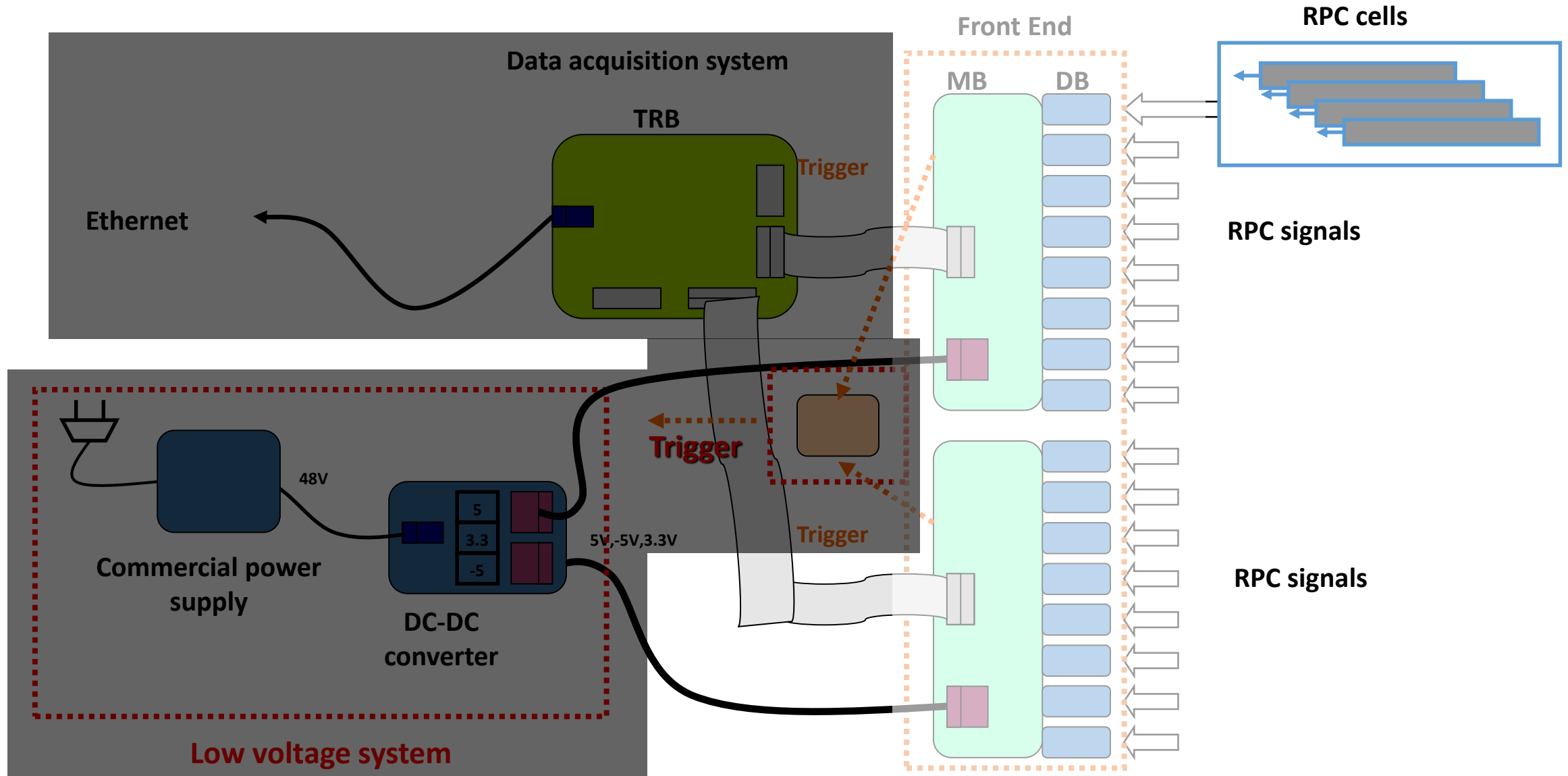
Counts

ADC Value

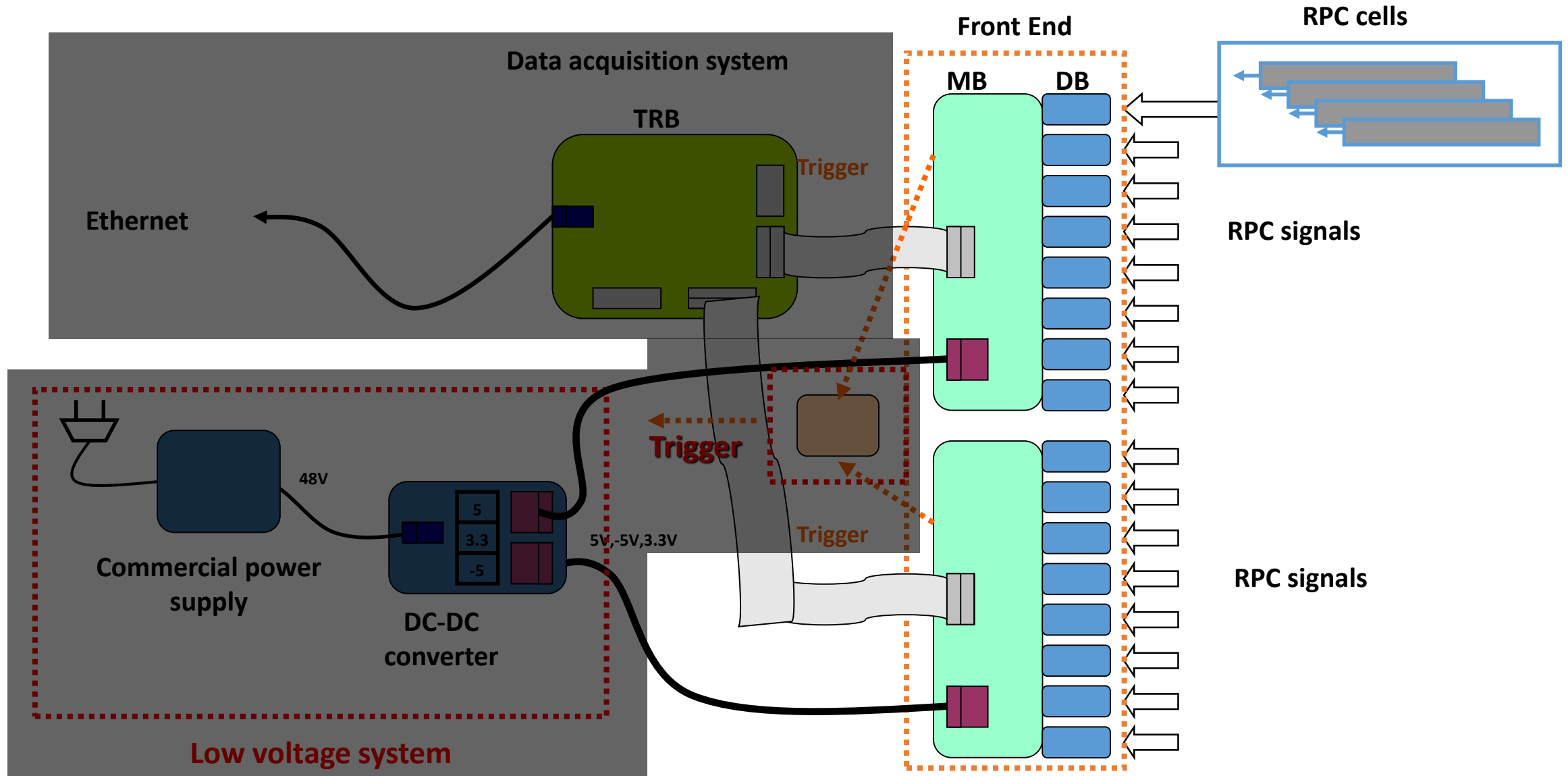
All RPC pads



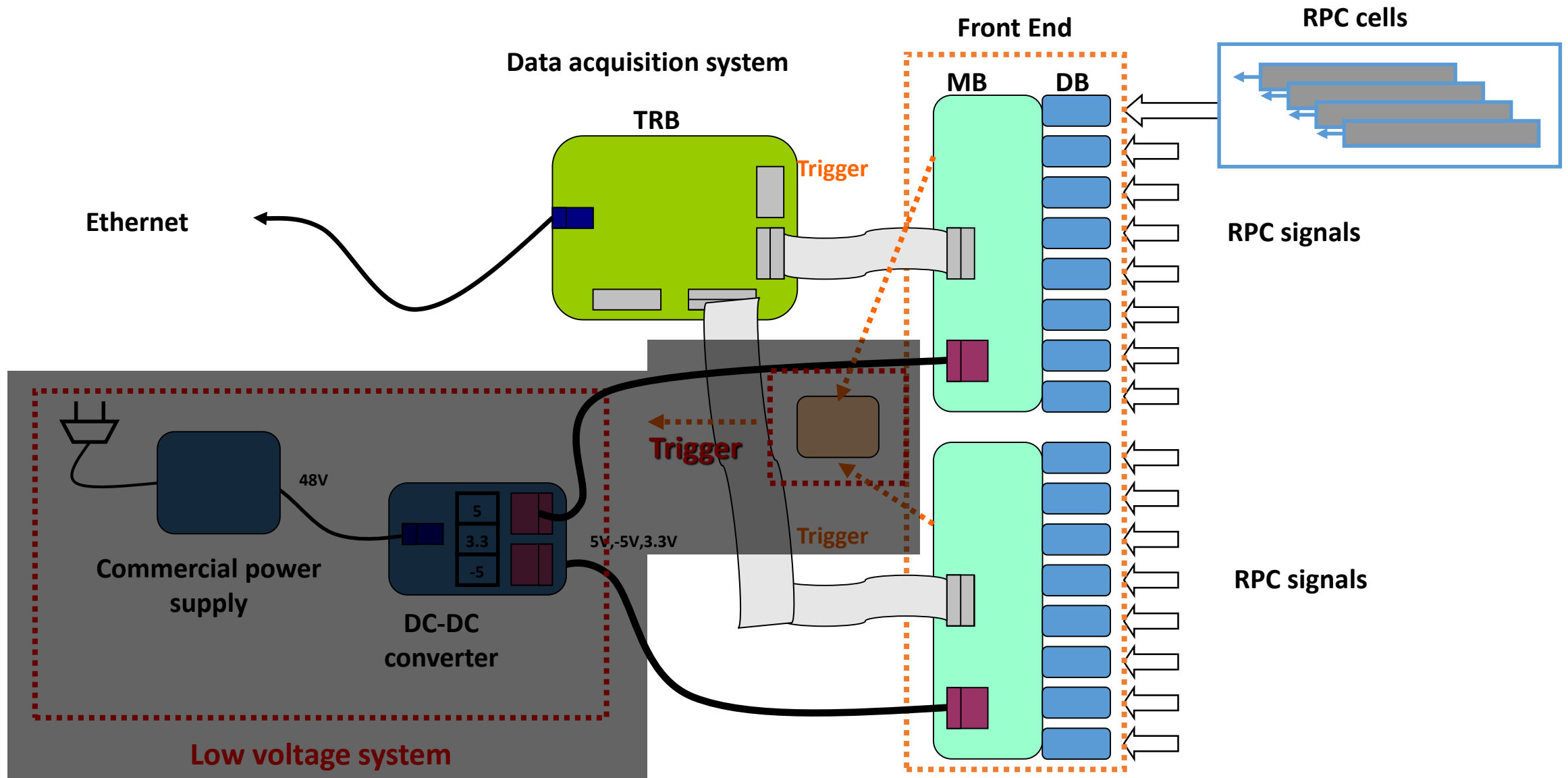
FEE architecture (II)



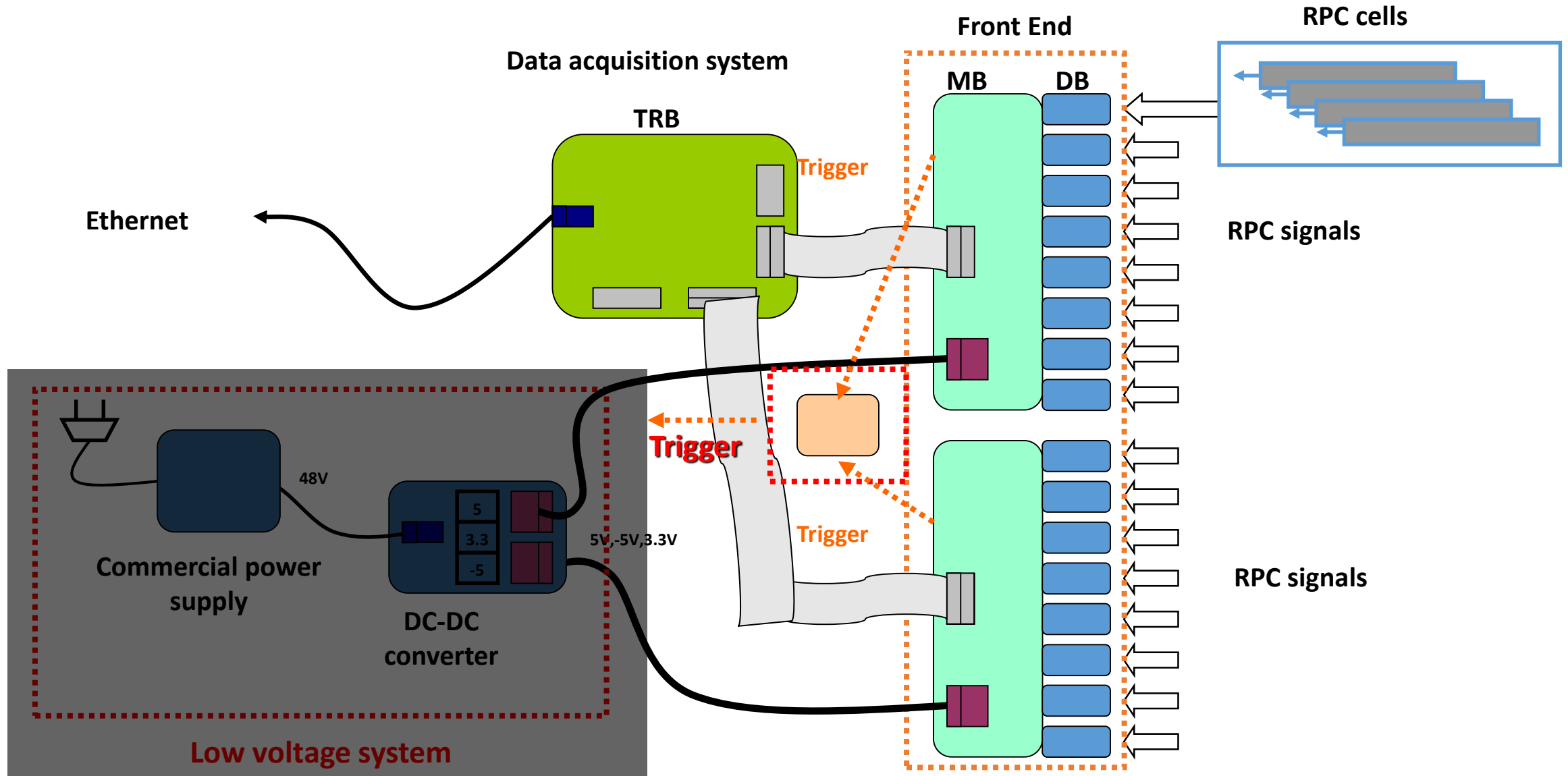
FEE architecture (II)



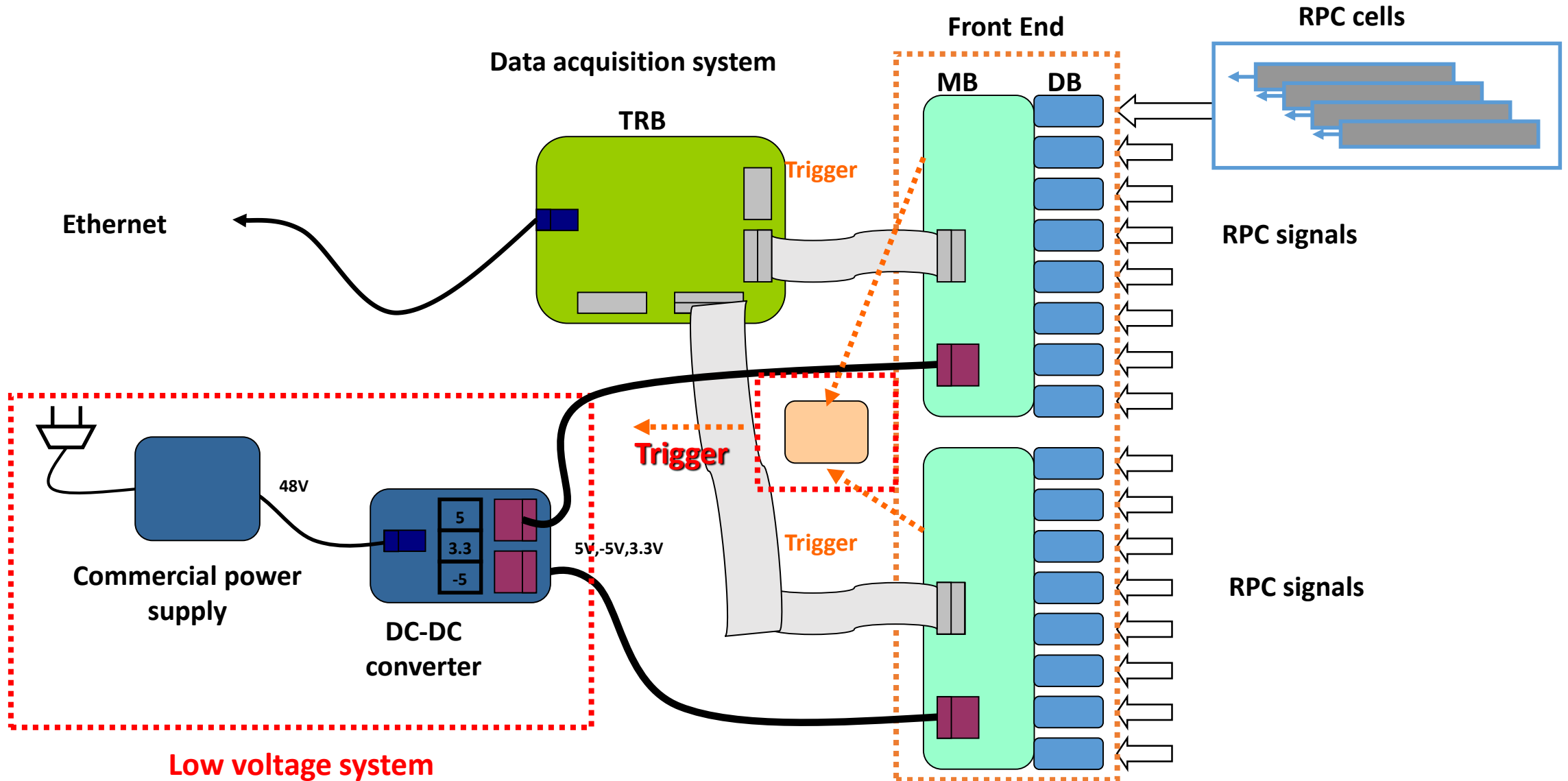
FEE architecture (II)



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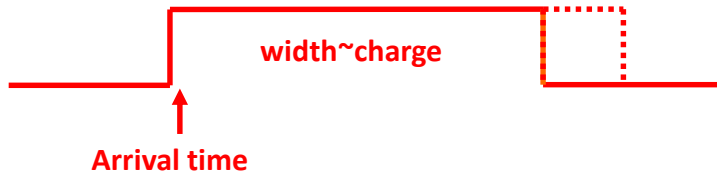


FEE architecture (II)



Daughterboard

- FEE side connected to the RPC cells.
- Time and charge codified in a single digital LVDS signal, using QtoW. Low power consumption, $\approx 400\text{mW/ch}$ (DBO+MBO channel).
- Arrival time (ToF measurement) $\rightarrow$ Leading edge.
- Charge of RPC signals $\rightarrow$ Pulse width (QtoW measurement).

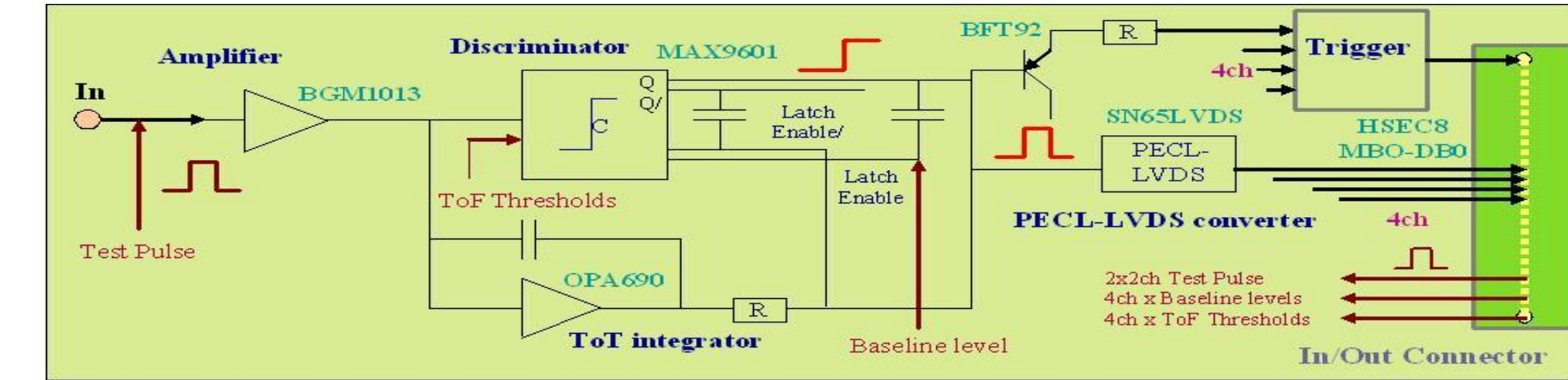


DBO: one channel logic

Analog stage

PHILIPS BGM1013 amp
(35.5dB,1GHz)

TI OPA690 amp for QtoW

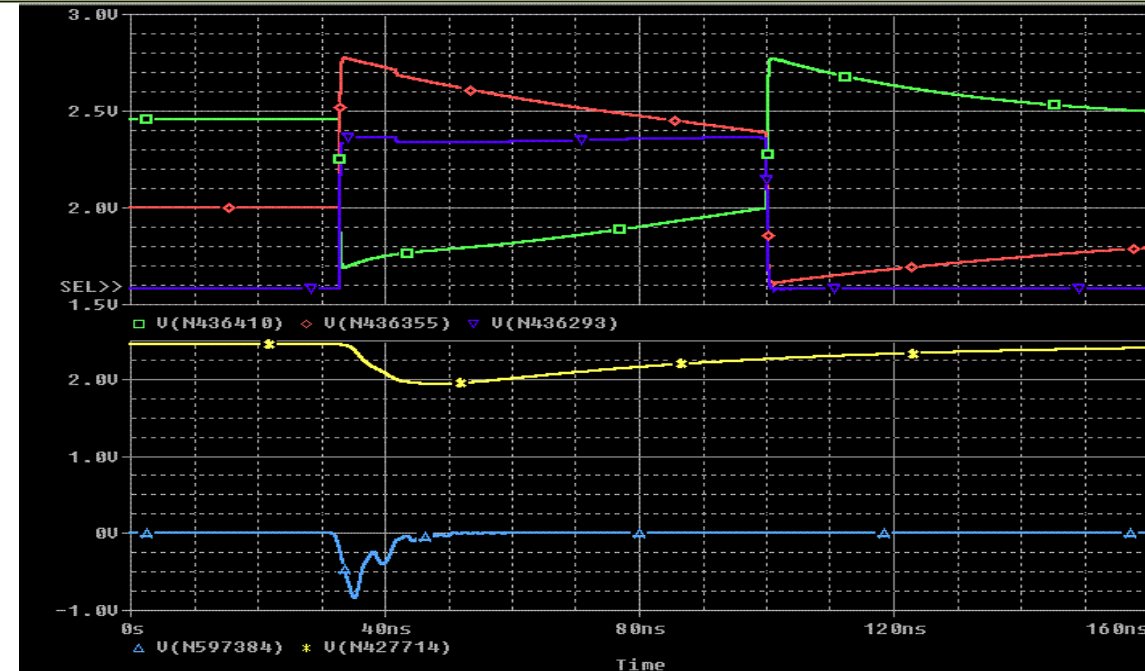


Digital stage

MAX9601 dual PECL discriminator: latch enable used for cut/shape
the output pulse

TI SN65LVDS100 PECL-LVDS converter

PHILIPS BFT92 PNP wideband (5 GHz) transistor for multiplicity
trigger sum



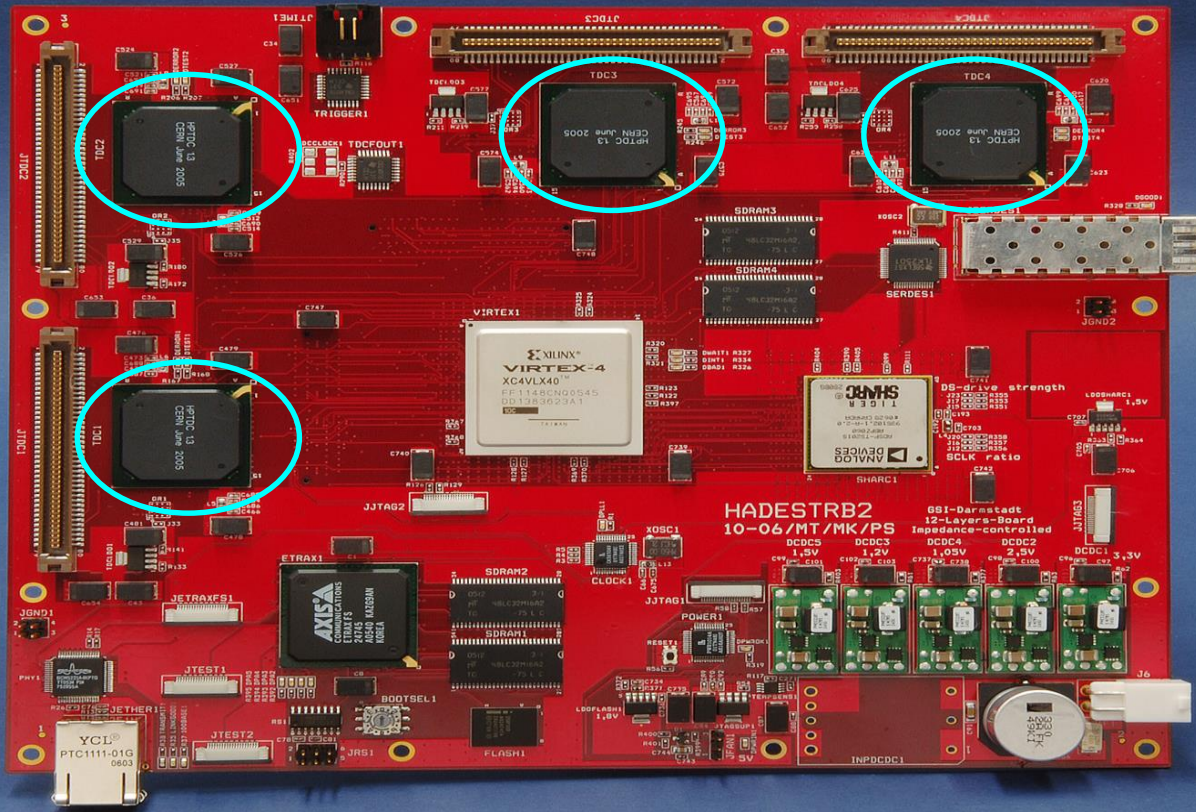
Motherboard v3.0 (MBO)

- FEE side connected to DBOs → interfaces DB with DAQ system (TRB).
- MBO provides support to 32 channels (8 DBOs) and 12 channels (3 DBOs) for short MBOs.



TRB and DAQ

(by GSI electronics group)



TRB (TDC Readout Board)

128 multihit TDC channels (CERN's HPTDC)

Computing power: FPGA+DSP

Control: ETRAX single chip computer + UNIX

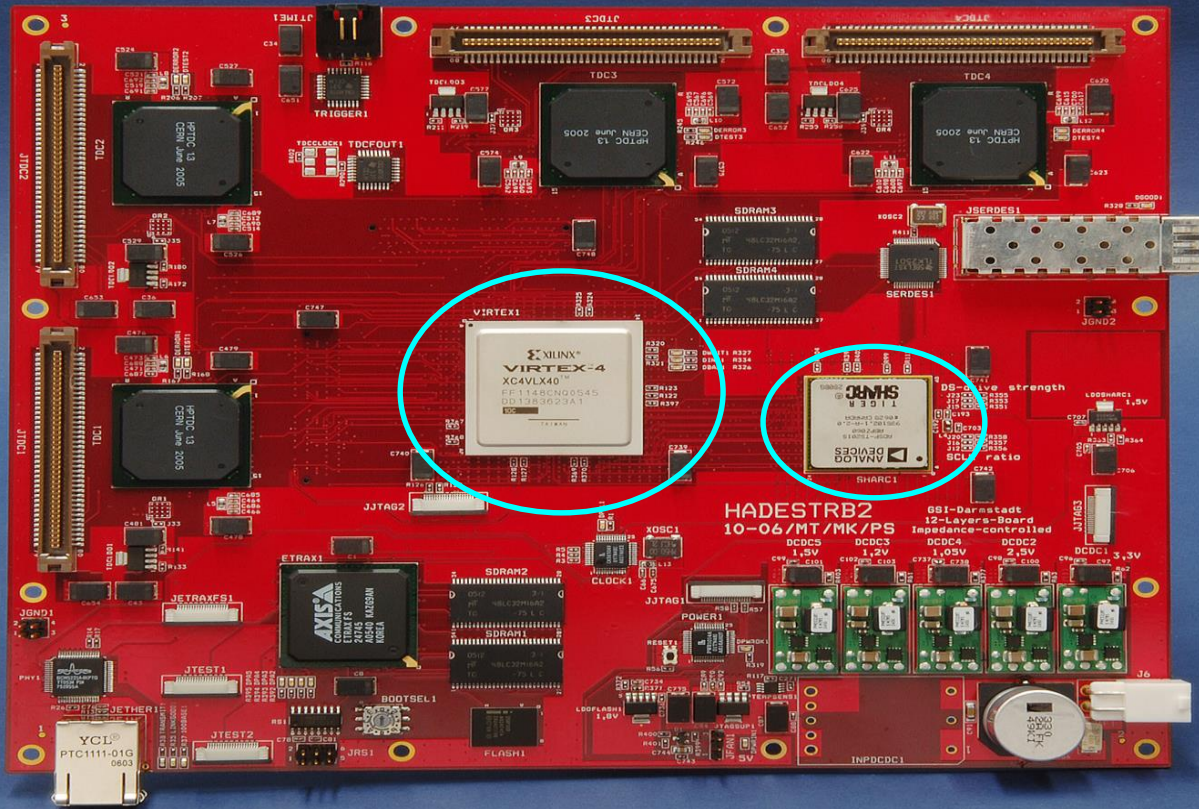
Communications:

Ethernet+optical link (2Gbit/s)

High speed data acquisition
based on the HPTDC ASIC.

TRB and DAQ

(by GSI electronics group)



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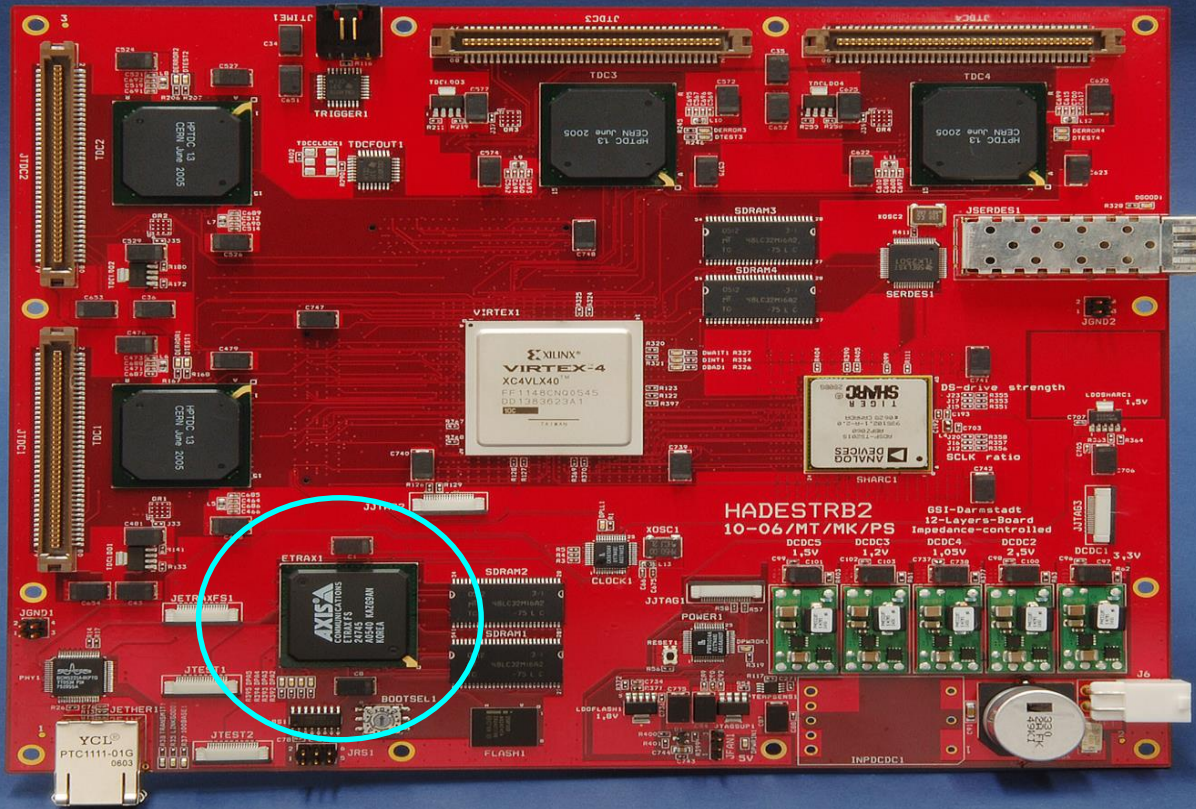
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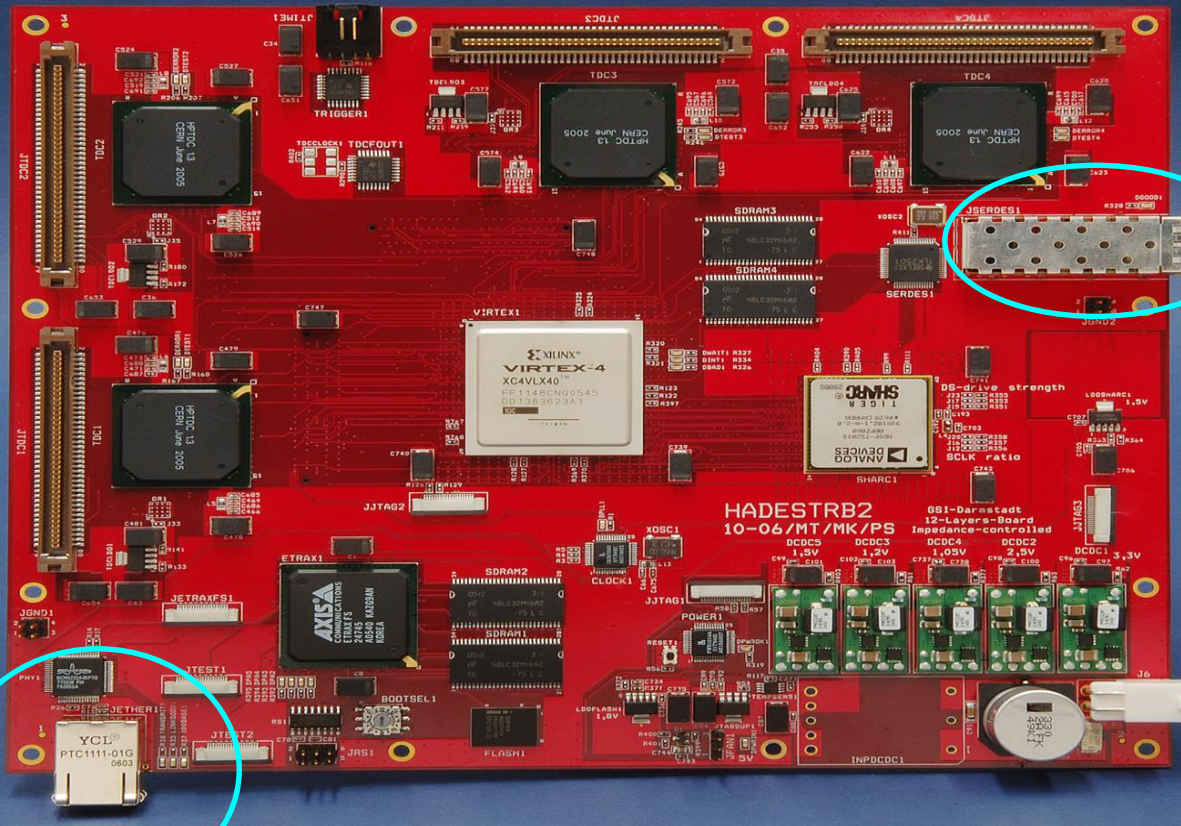
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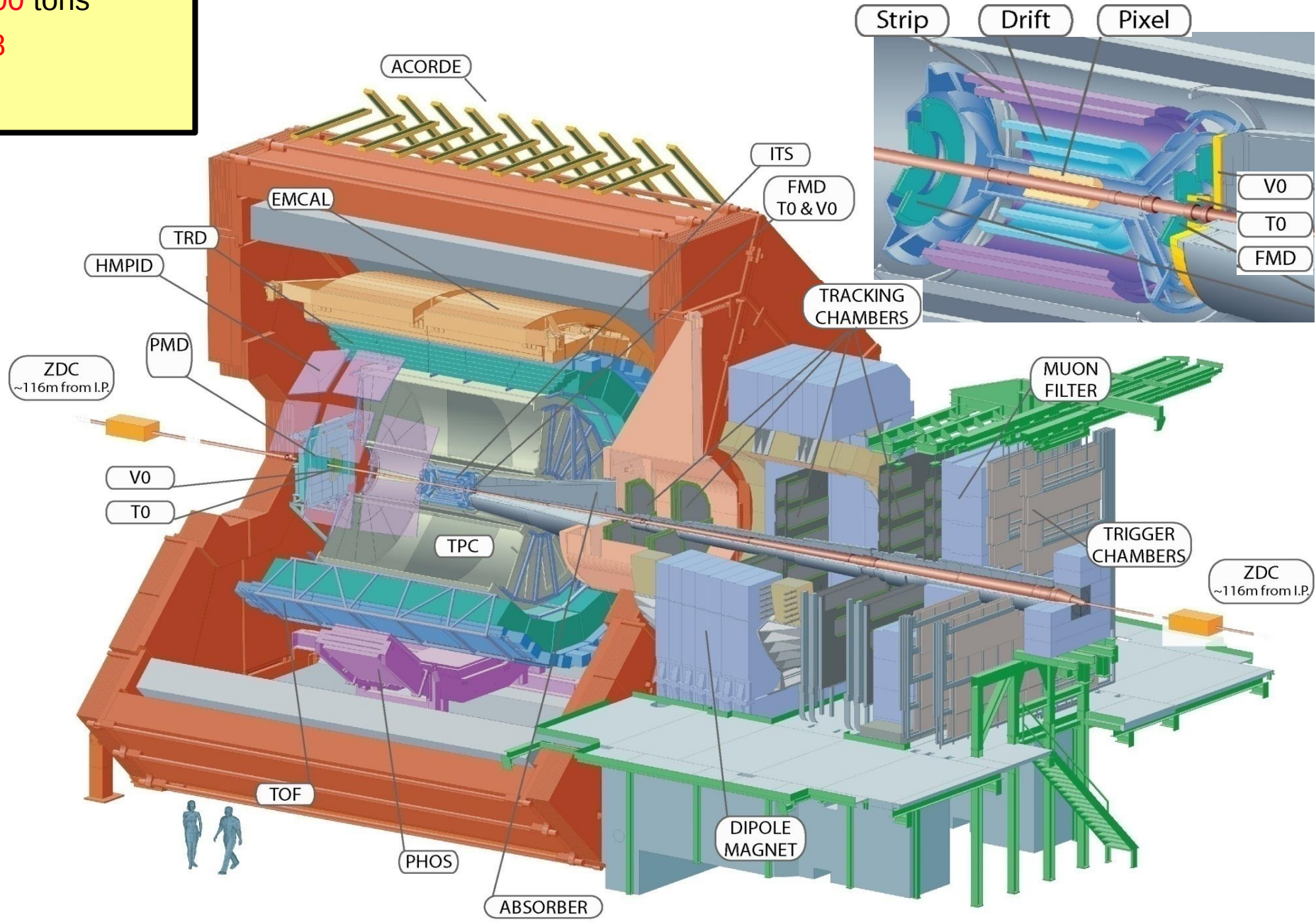
Ethernet+optical link (2Gbit/s)

High speed data acquisition
based on the HPTDC ASIC.



Size: 16 x 26 meters
Weight: 10,000 tons
Detectors: 18

ACORDE UPGRADE



ACORDE RPC

Size: 1.2m x 1.5m

Layers : 6

Gas: Freon, Isobutano and SF₆
(95%, 4.8%, 0.2%)

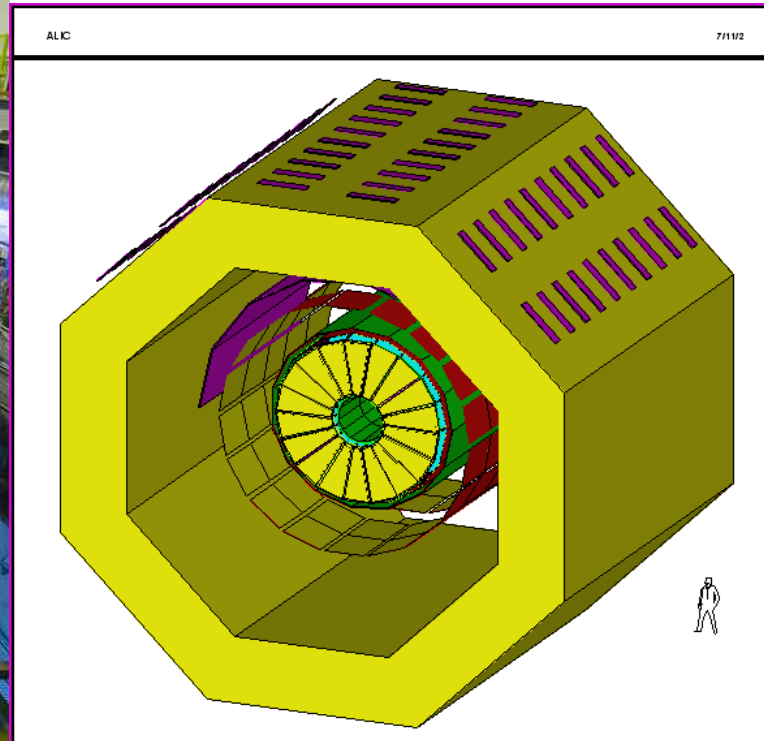
HV: 9.6 KV – 12 KV

Time resolution: 200ps - 500ps

Spatial resolution: 1 – 3 mm

Rate capability: ~ 2 – 5 KHz

Glass RPC



RPC BUAP Team

- Arturo Fernández
- Mario Iván Martínez
- Mario Rodríguez
- Guillermo Tejeda

- Karen Regules
- Davis Regules
- Fernando Rubalcaba
- Manuel Delfín
- Alexis Garay
- Daniela Blanco

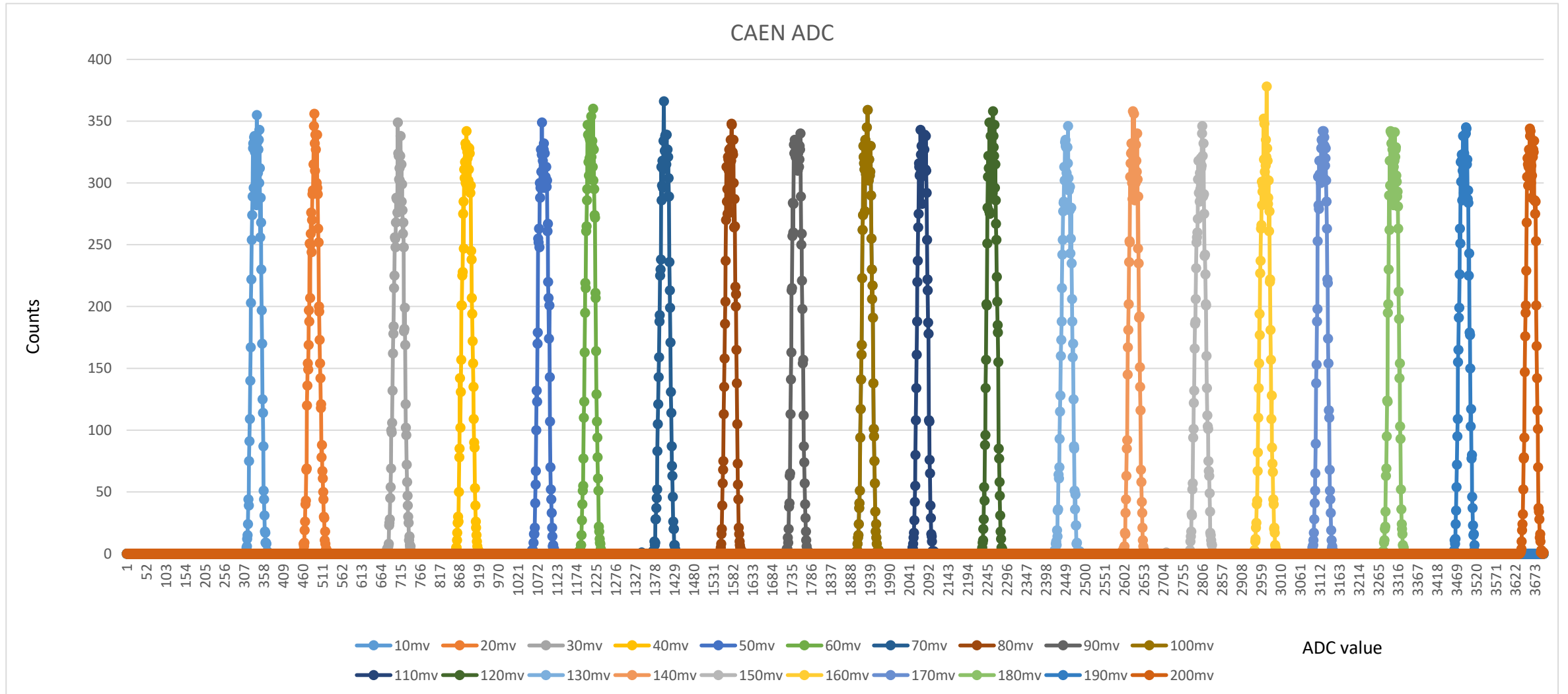


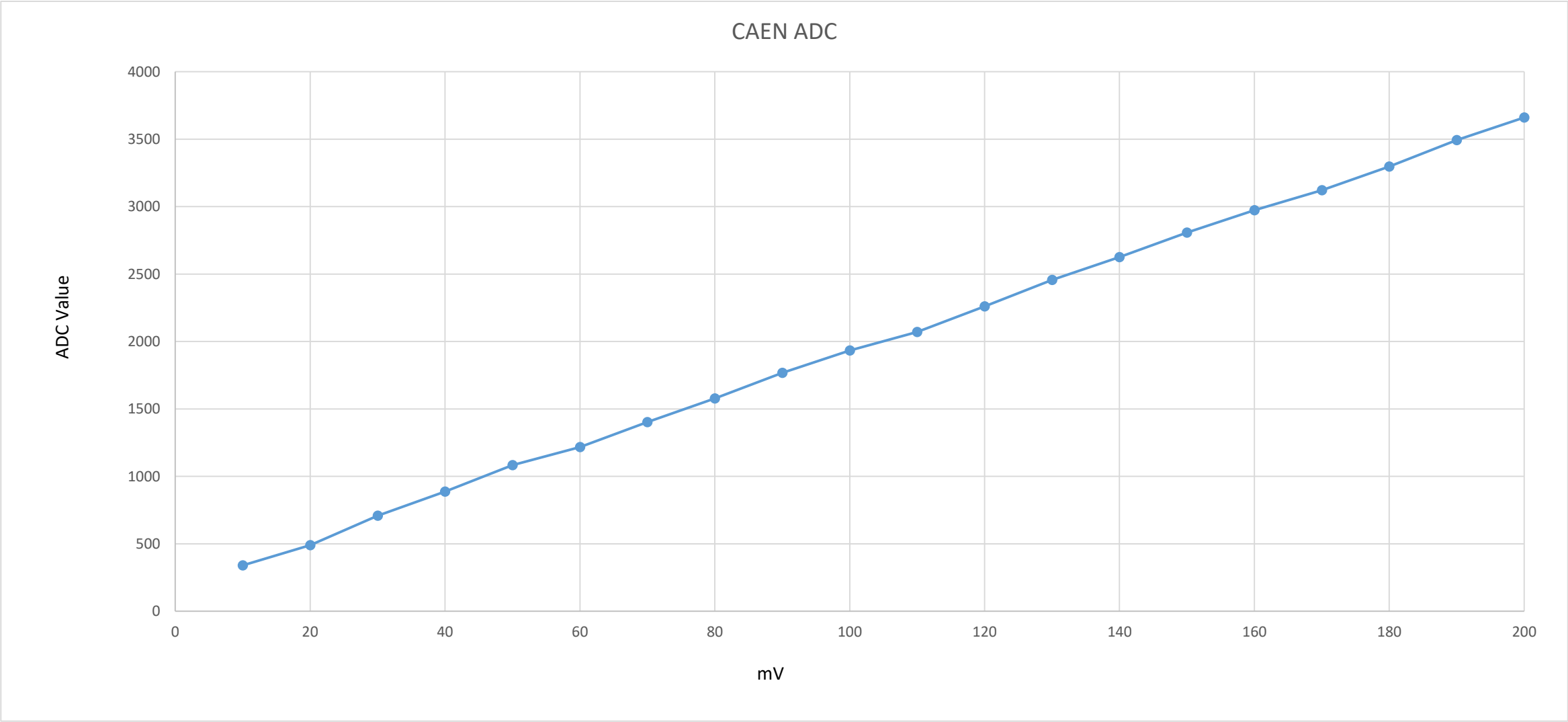
Summary on RPC construction

- **30 x 30** cm and **20 x 20** RPC Fully constructed and under test with cosmics
- Electronic is working for 128 channels
- The quality of the materials are ok.
- New electronics using Kintex 7 Ultra scale
- HVPS is under development

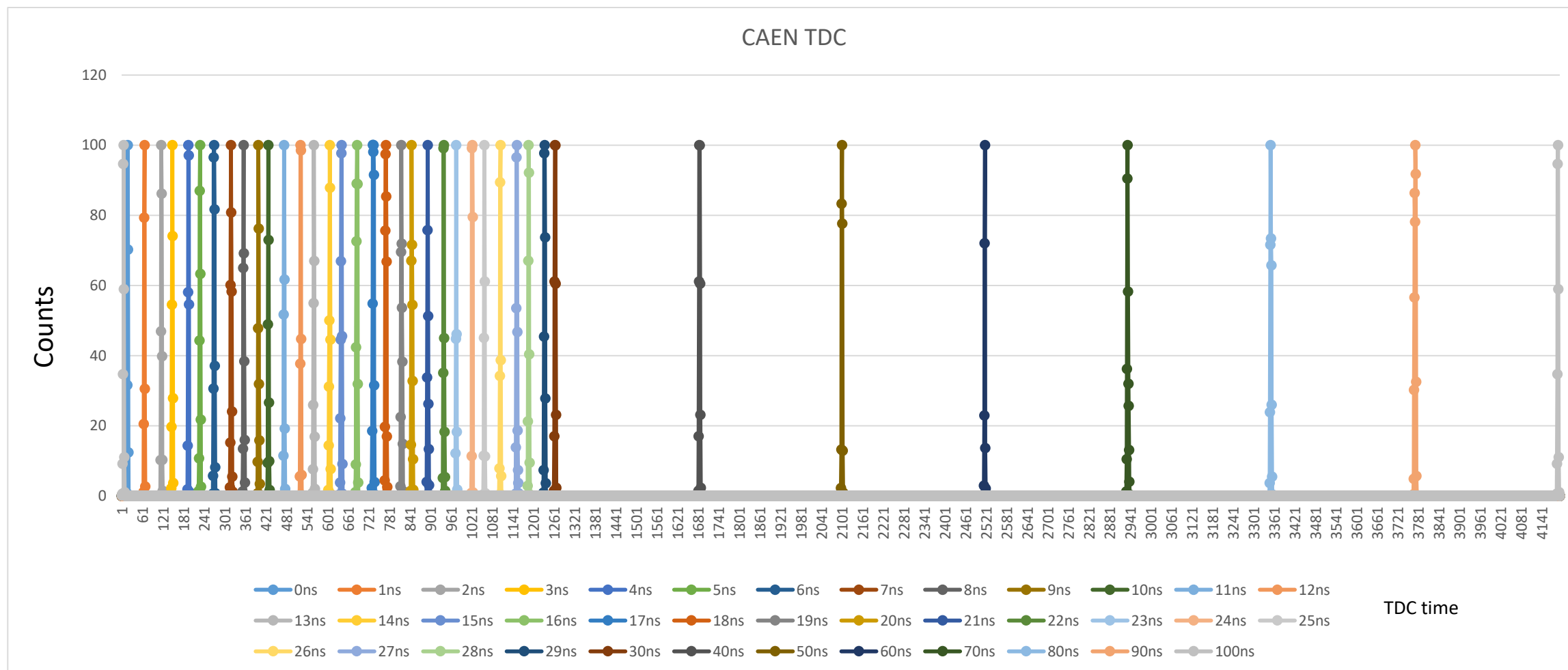
Thank You

CAEN ADC



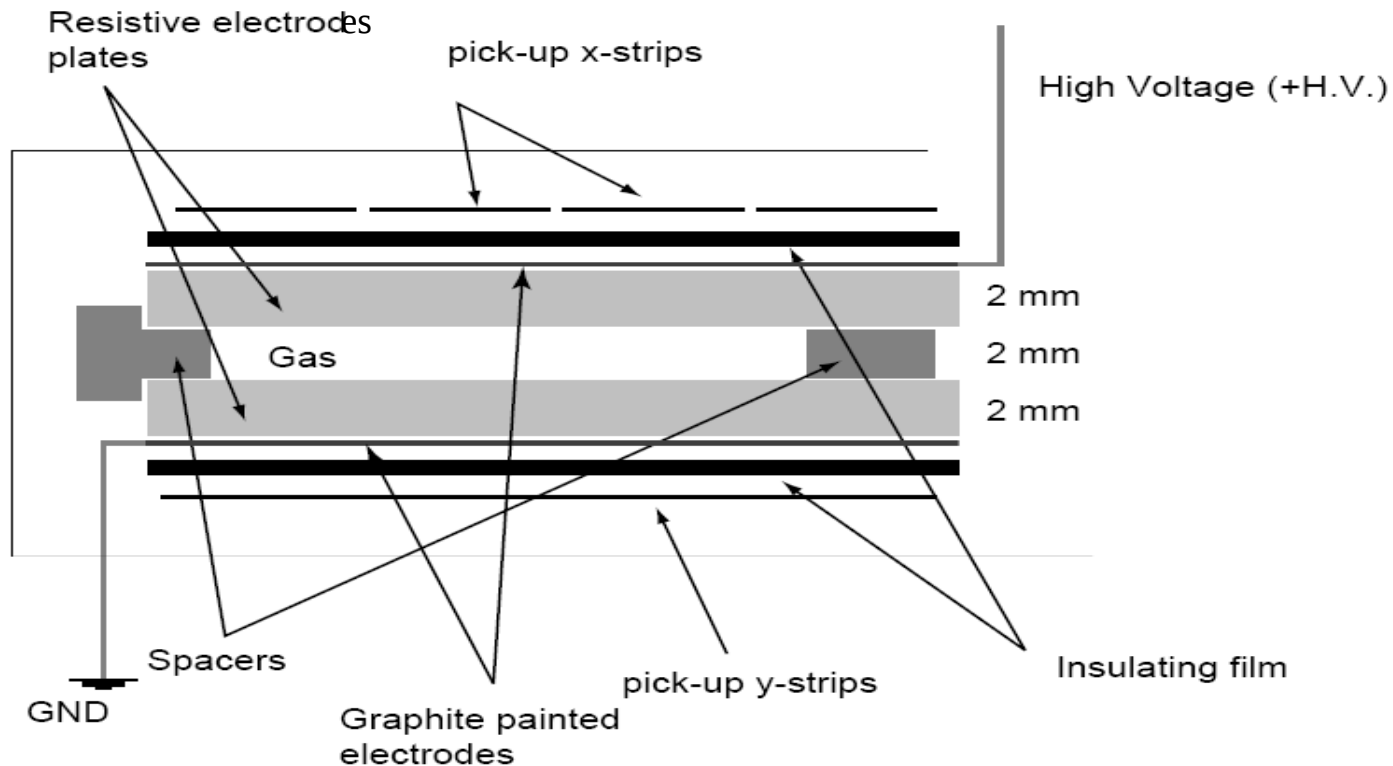


CAEN TDC



What is RPC?

- Resistive Plate Chambers (RPCs) are gaseous parallel plate avalanche detectors with time resolutions down to 50 ps, making them attractive for trigger and Time-Of-Flight applications in some cases covering large areas up to a few thousand square meters.



Basic parameter for a detector design:

- Gap width
- Single gap/double gap/multi gap design
- Gas mixture
- Gas flow distribution
- Bakelite/Glass bulk resistivity

