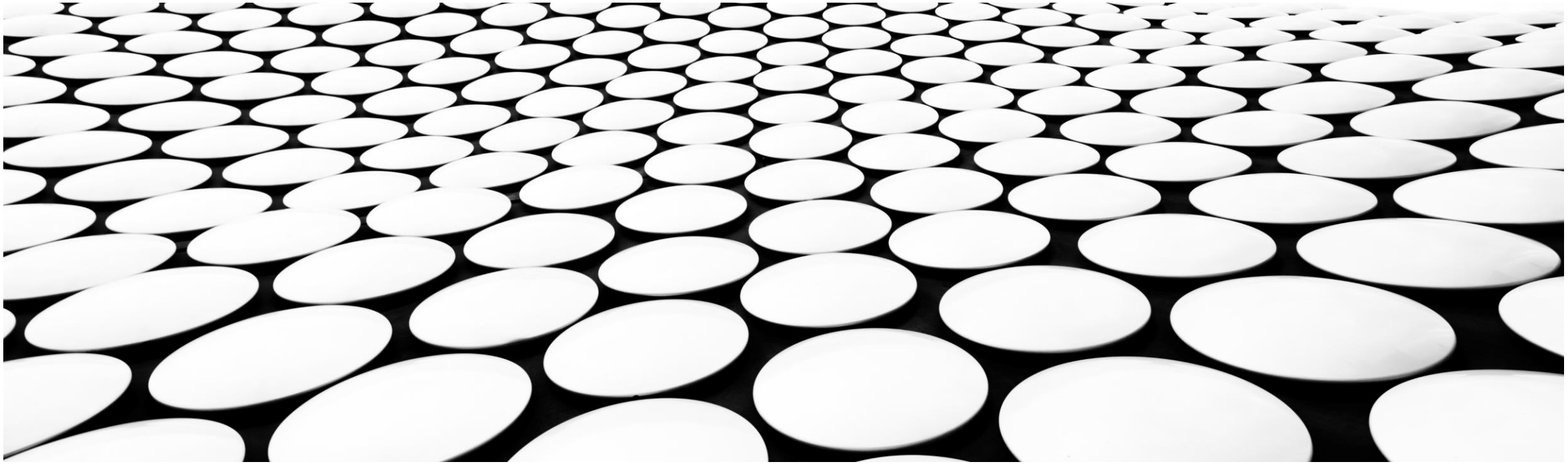
TEST BEAM 2022 (PROTOV @ H8)

ALESSANDRO ROCCHI



INTRODUCTION

Small RPC detector prototypes have been tested in the H8 beam dump platform. Most of the infrastructure have been provided by GIF++ staff.

Two prototypes have been tested extensively:

- New Resistive Cylindrical Chamber with 0.3 mm gas gap and 1 mm bakelite electrodes
- RPC detector with 0.2 mm gas gap and 0.4 mm phenolic glass electrodes

THE RCC DETECTOR (0.3 MM GAS-GAP)

The RCC detector is a device consisting of two concentric cylinders of resistive material. The detector's stratigraphy is like that of an RPC, but the cylindrical geometry introduces new control parameters on the detector's response, as well as extending its use to hostile environments thanks to the high strength mechanical structure

$$E(r) = \frac{V}{r\ ln\frac{R_o}{R_i}} \sim \frac{V}{R_i ln\frac{R_o}{R_i}} - \frac{V}{R_i ln\frac{R_o}{R_i}}\frac{r-R_i}{R_i}$$

$$R_o - R_i \ll R_i$$

Gas pressurization :

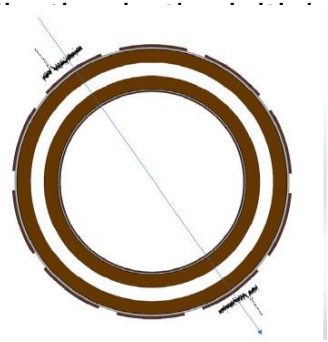
1. Increase the gas target density, with a consequent increase in intrinsic efficiency
   → MRPC time response with thin single gap configuration
   → light eco-friendly CO_2 based gas mixtures
2. Use the detector in hostile environments

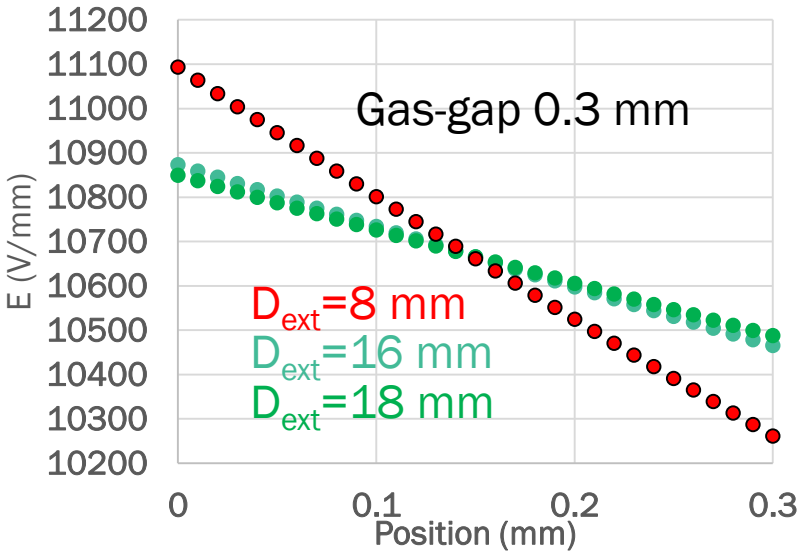
The electric field gradient, depending on the polarization allows to

1. Contribute to the gas discharge quenching
   → new eco-friendly gas components
2. Increase the charge collection efficiency enhancing the multip… part of the gas gap
3. Study the dependencies and optimize the time resolution

Double gap:

1. Tracking capability
2. Improvement in time resolution and efficiency





An R&D collaboration is ongoing between Tor Vergata Atlas group, MPI MDT group and University of Geneve

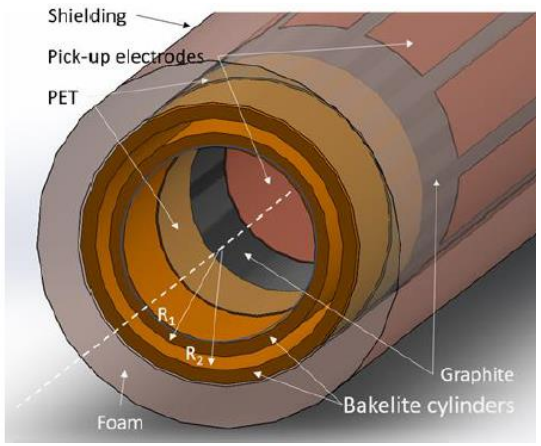
RCC PROTOTYPE DECRIPTION (0.3 MM GAS-GAP)

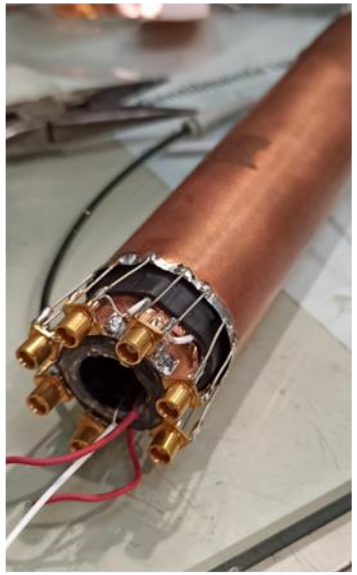
[Thanks to Alessandro Paoloni for the e' hamamatsu S14160-6050HS 6*6 detector and electroinics]

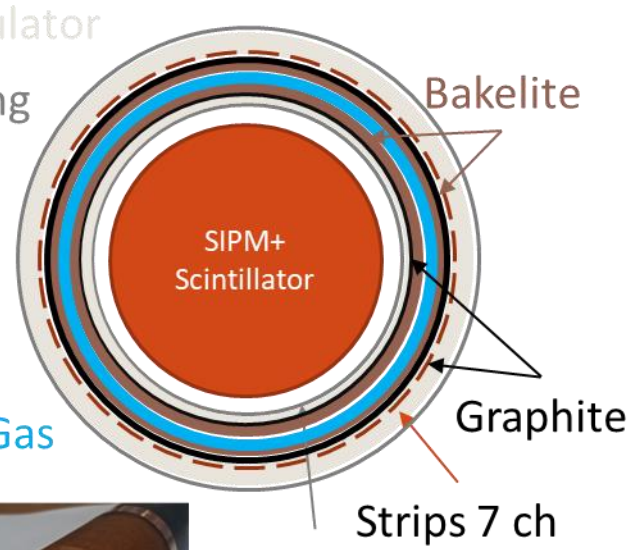
Features:

- Gas-gap 0.3 mm
- Outer electrode 1mm
- Inner electrode 0.7 mm
- Outer Radius 18 mm
- Inner Radius 15.3 mm
- Outer pickup 7 strips 1 cm pitch
- Inner pickup 1 pad

The internal detector made it possible to close the angle of acceptance and discriminate the tangential traces

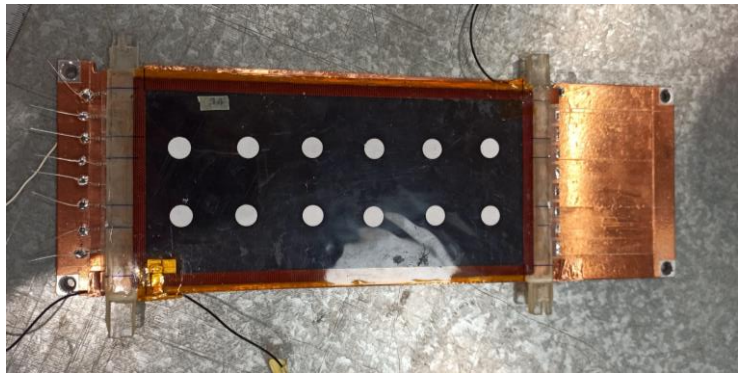




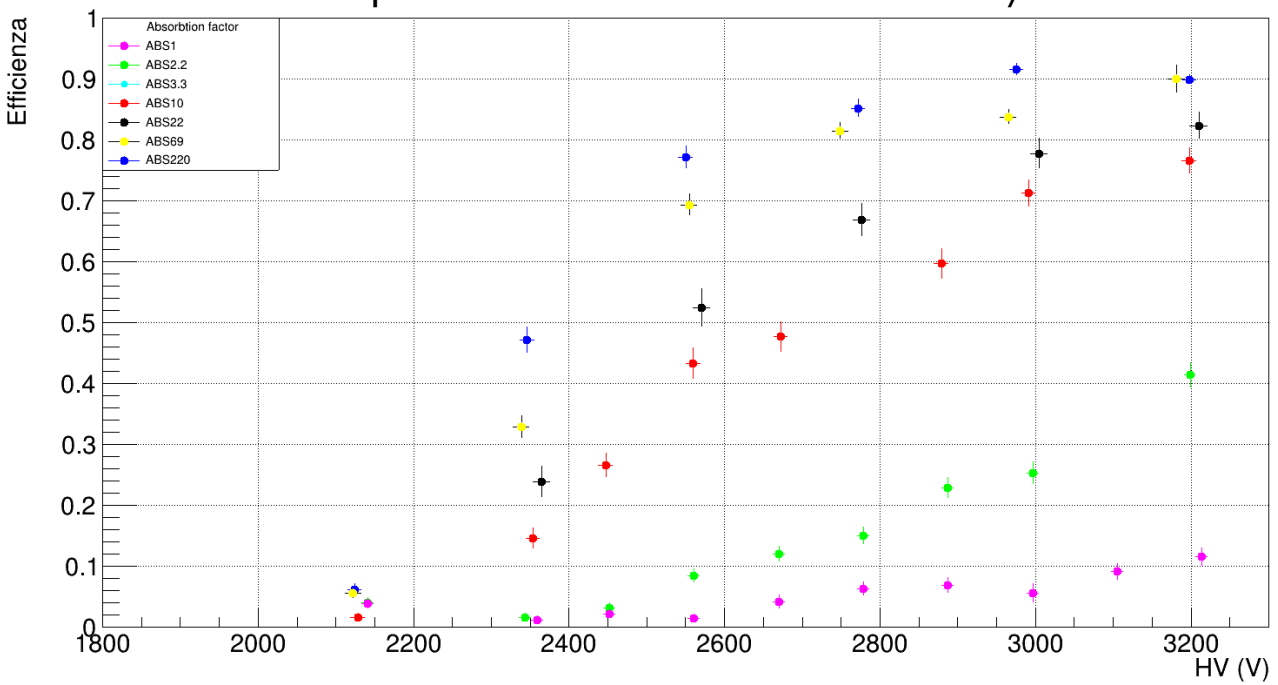


RPC 0.2 mm PROTOTYPES

The double gas gap RPC detector in single readout configuration (Tested ad Gif ++ during 2021) was disassembled and two identical detectors were built with the single gas volumes to evaluate the time performance.
Each detector has 8 read-out strips located on the ground side of the gas volume.
The gas volume dimensions are about 10 cm x 30 cm, with very thick spacers matrix.



Abs1 corresponds to a rate of about 40 kHz/cm2



It can be observed that, despite the gap of only 0.2 mm, the cooperation between the two volumes of gas allows to achieve an efficiency of more than 90% for 180 GeV / c muons.
The reported measurement was carried out by setting the discrimination threshold at 15 mV (on the amplified signal), about 5 fC.

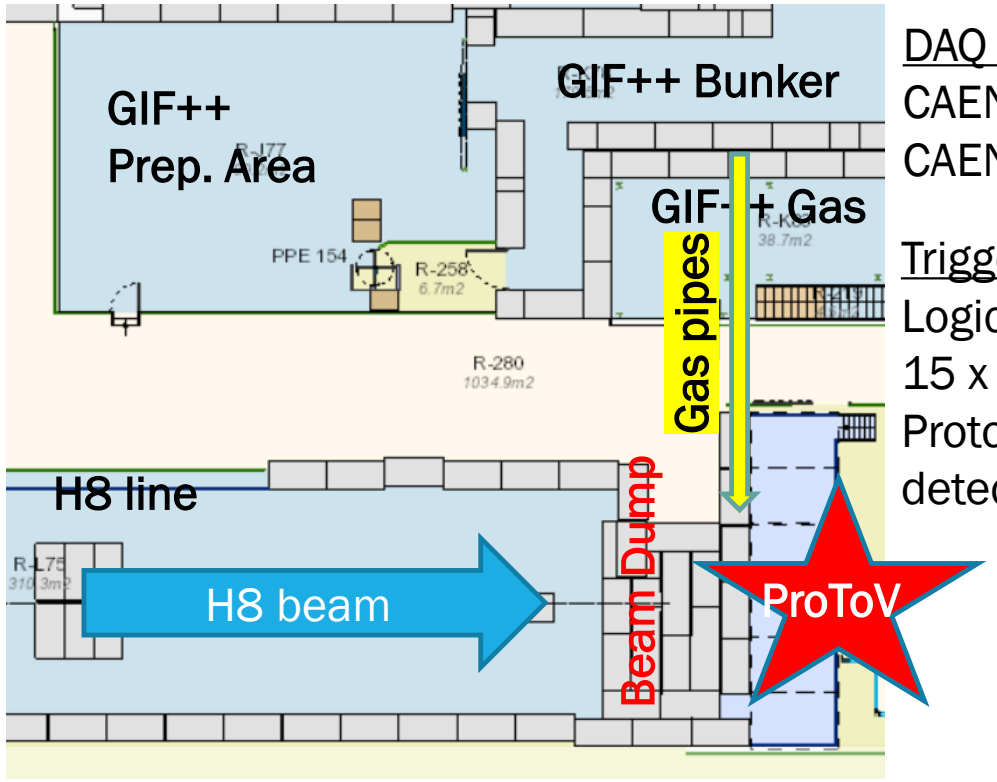
H8 BEAM DUMP EXPERIMENTAL AREA AND SETUP

The setup was installed on the RD51 trolley, shareing trigger scintillators

Two gas lines from GIF ++: Line 1 -> wet

94.7% TFE + 5% iC4H10+0.3%SF6 Line 2 -> dry

CO2 gas line from H8 gas rack



DAQ System:

CAEN V1718 USB Bridge

CAEN V1742 32 Ch Digitizer

Trigger System:

Logic & between RD51

15 x 15 cm2 scintillators and

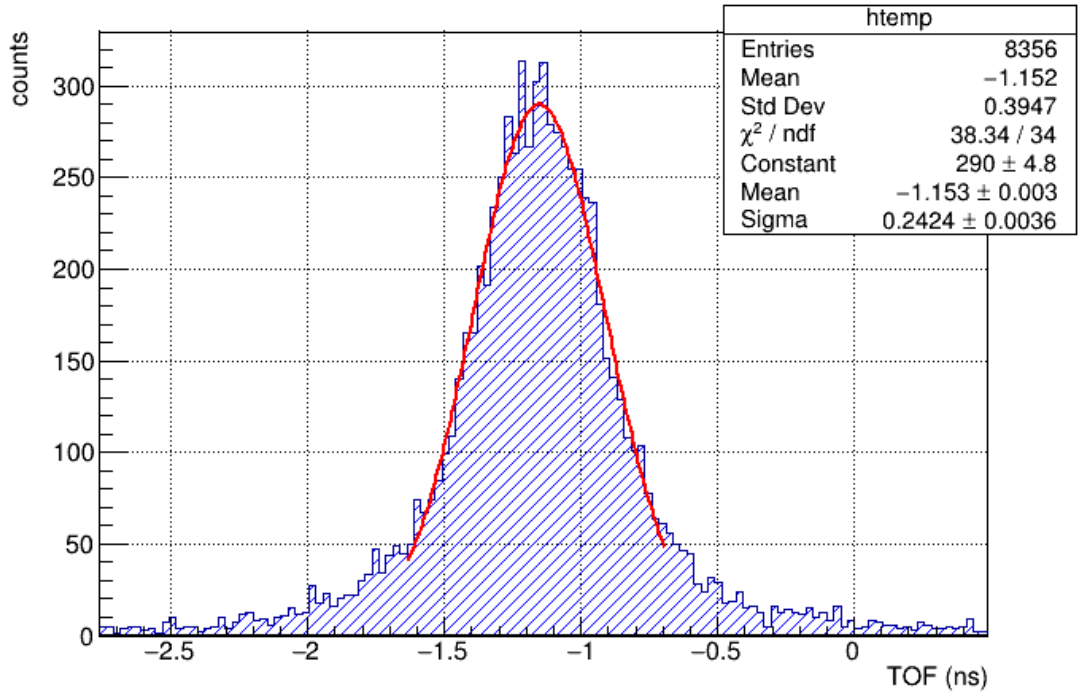
Protov 4 x 2 cm2 Cerenkov detector

PRELIMINARY RESULTS

0.2 mm RPC detectord Time response

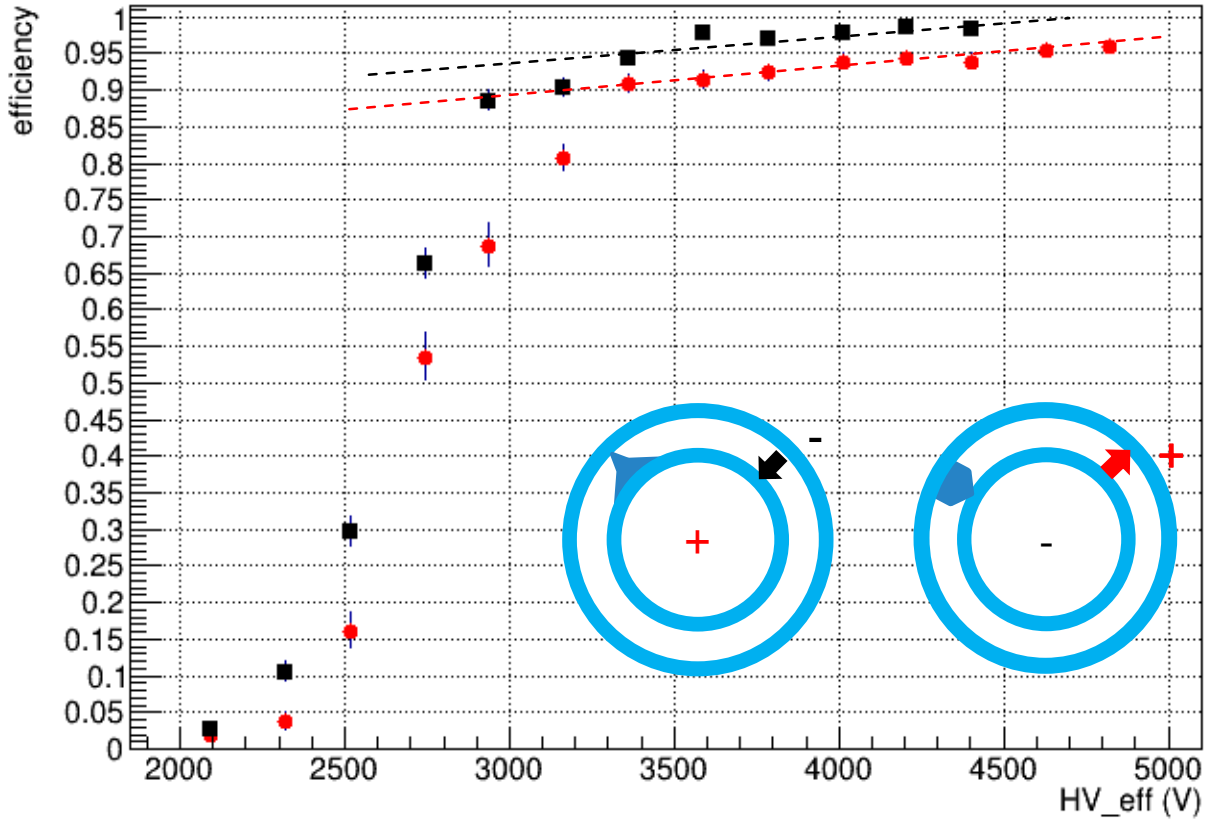
Gas mixture
94.7% TFE + 5% iC4H10 + 0.3% SF6

About 170 ps raw time resolution



RCC detector efficiency responce

Gas mixture
94.7% TFE + 5% iC4H10 + 0.3% SF6



Preliminary

CONCLUSIONS

For the second consecutive year the PROTOV project took data at the H8 dump platform.

- This position has proved particularly useful for the study of early-stage prototypes, as it allows continuous access to the experimental setup without any restrictions.

- The beam intensity is high enough to allow the characterization of even small detectors and there is easy access to dedicated gas lines.

- The installation of large setups like that of RD51, made the installation more complicated due to the blocking of the passage from one side of the platform to the other. We solved the problem by moving the setup on the RD51 trolley, but it would be useful for the next few years to install a ladder on both sides of the platform to be able to exploit the full platform width.