The μ-RWELL technology for tracking apparatus in High Energy Physics

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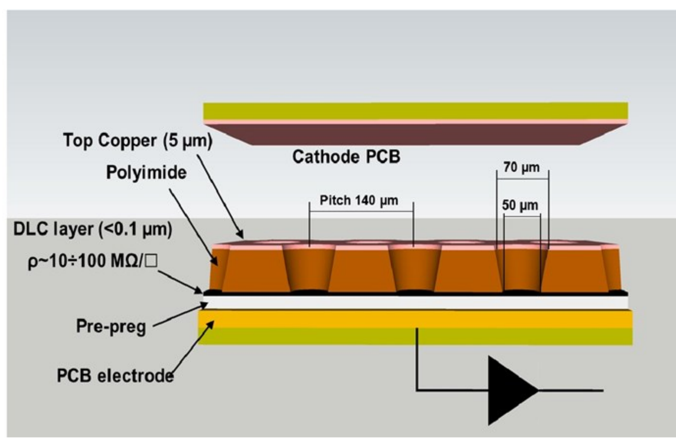
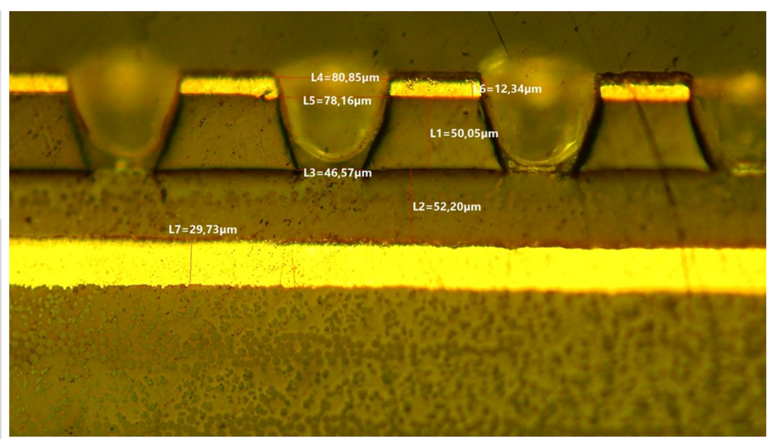
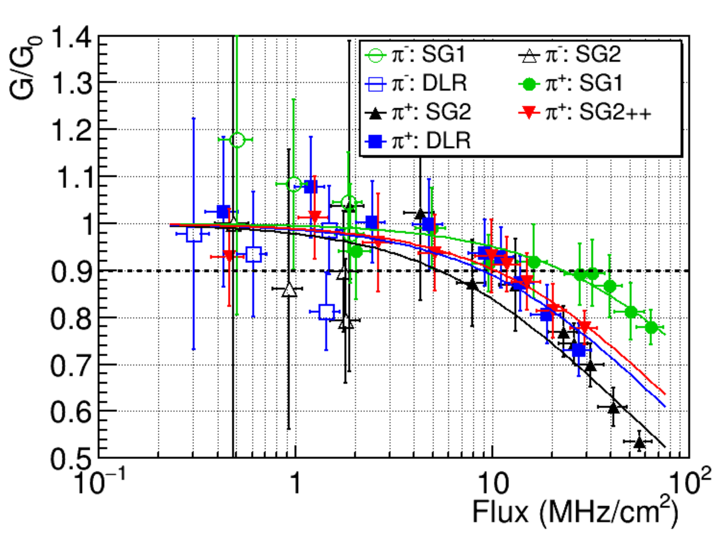
The **μ-RWELL technology**[1,*] can be adapted to any geometry, since the base material is Kapton. The **compactness and the ductility** of this very important part of the detector make this technology suitable for many applications, especially the ones needing a low material budget detector.

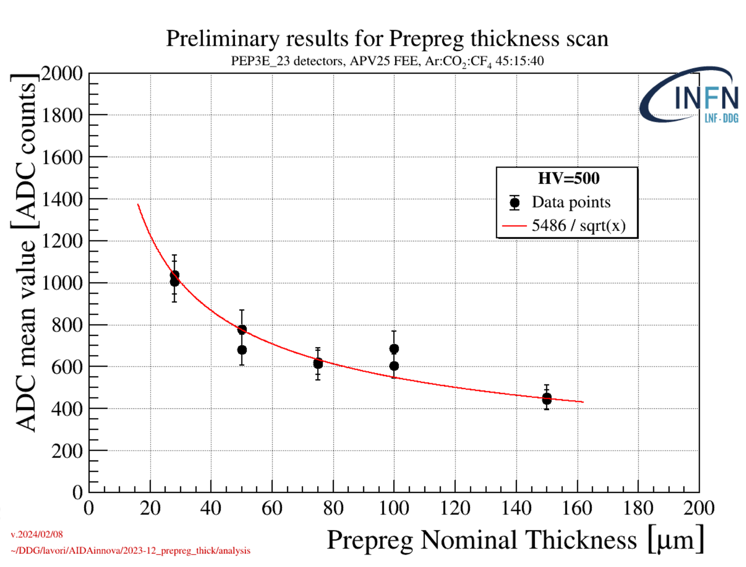


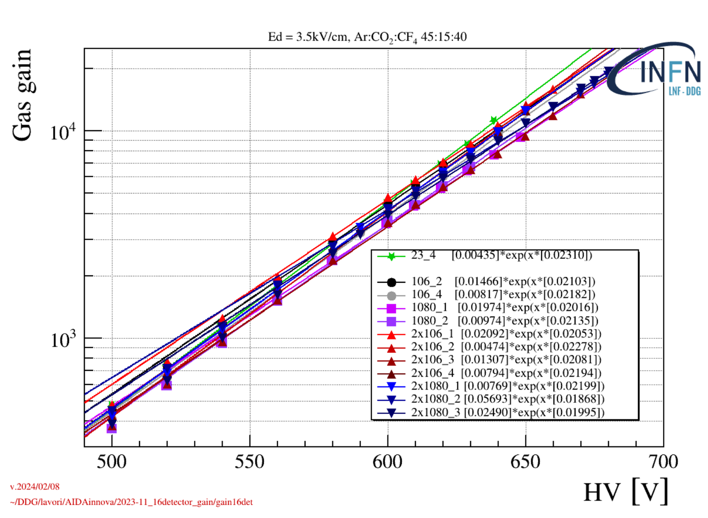


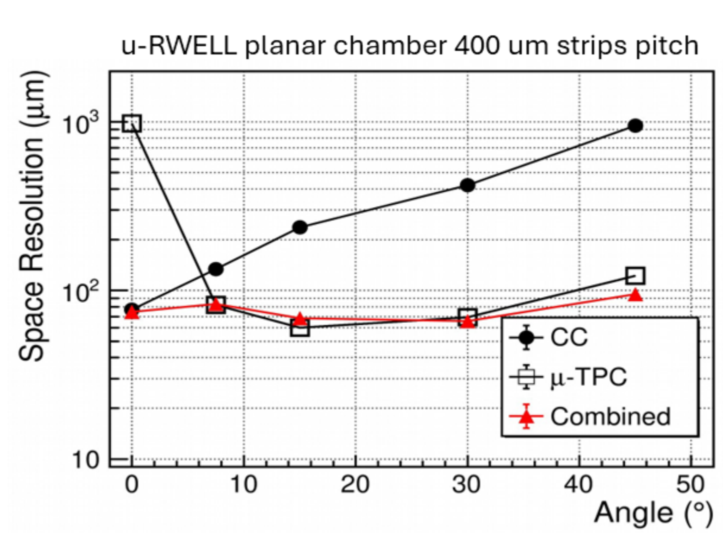
An extensive R&D has been carried out:

- To **optimize the resistive stage** to increase the detector rate capability
- To **increase the signal to noise** ratio
- To **improve** the **tracking performances**





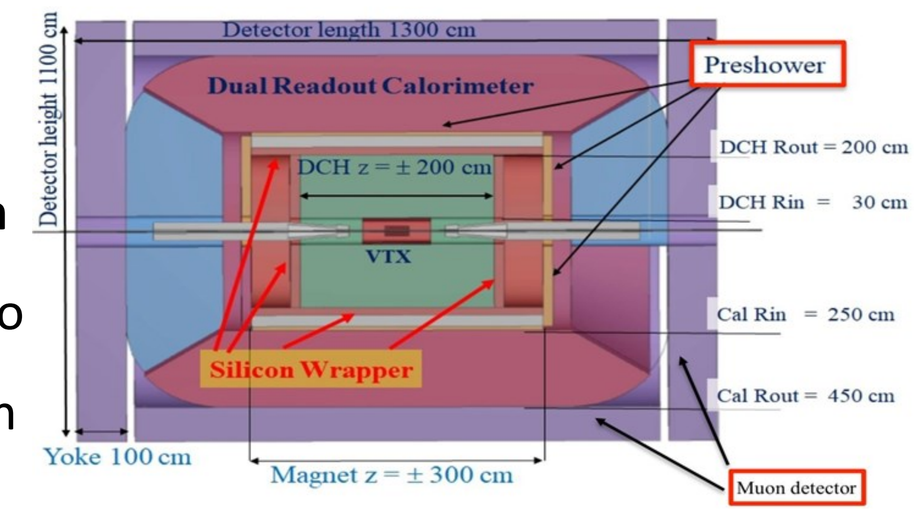




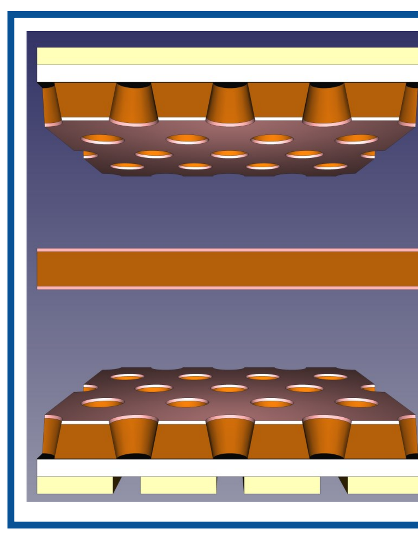
1. G. Bencivenni et al., The micro-Resistive WELL detector: a compact spark-protected single amplification-stage MPGD, 2015 JINST 10 P02008

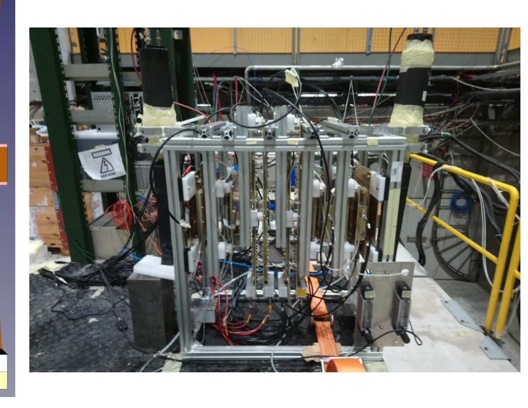
***SEE G. BENCIVENNI's talk: "The micro-RWELL for future HEP challenges"**

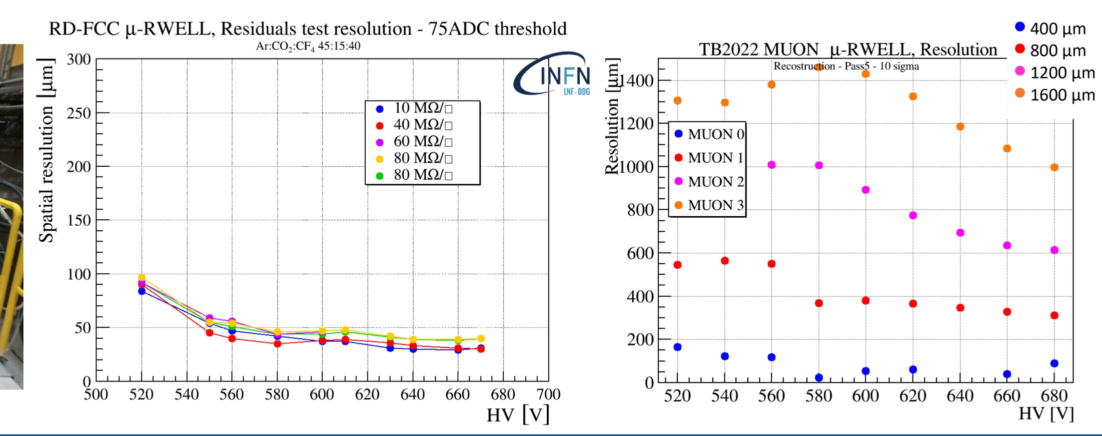
For the **IDEA apparatus** at FCC-ee two systems are nowadays under investigation to be equipped with μ-RWELL: the **pre-shower (~ 130 m²)** and the **muon stations (~1530 m²)**. Studies have been dedicated to two-dimensional readouts. Three layouts have been proposed and tested at H8C Cern-SpS North Area.

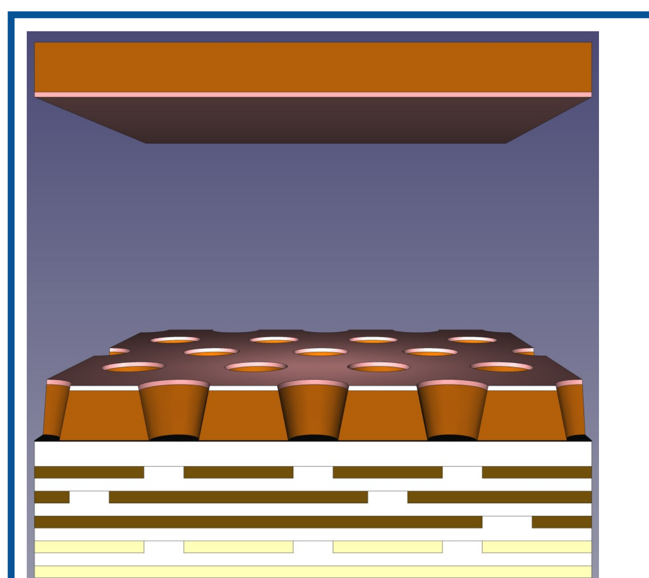


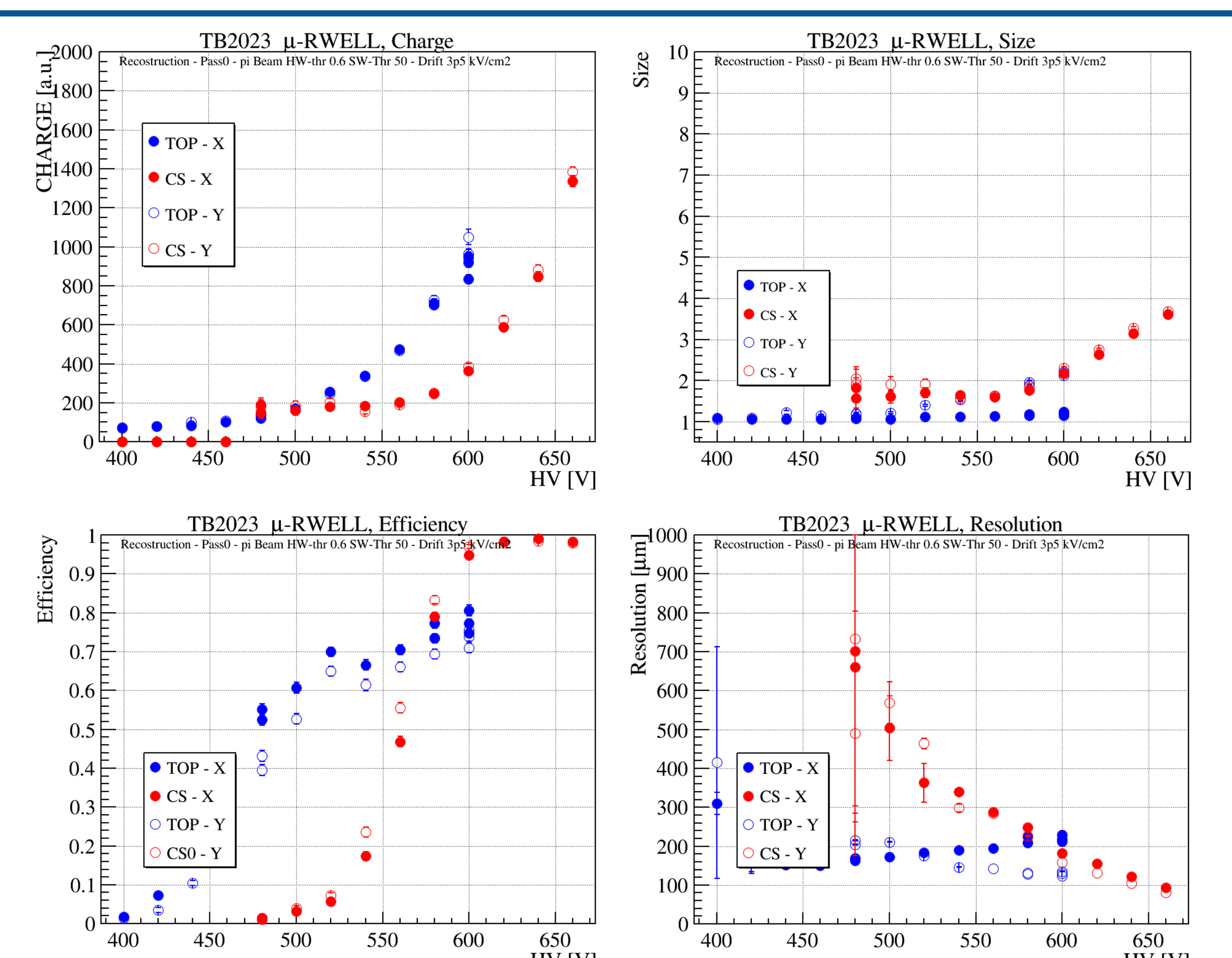
2 x 1D segmented readout with a common cathode: TB2022

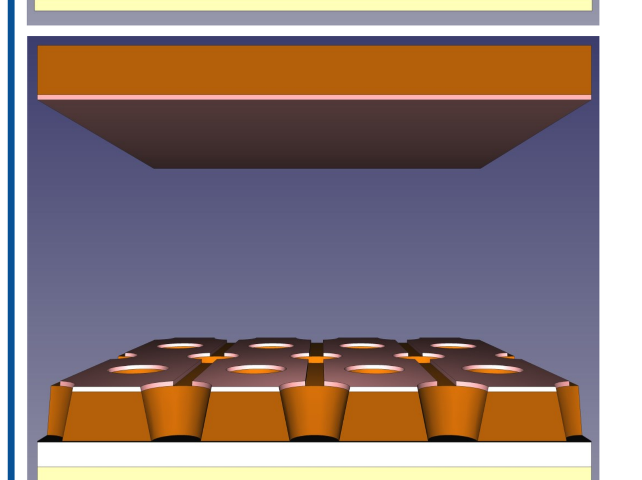


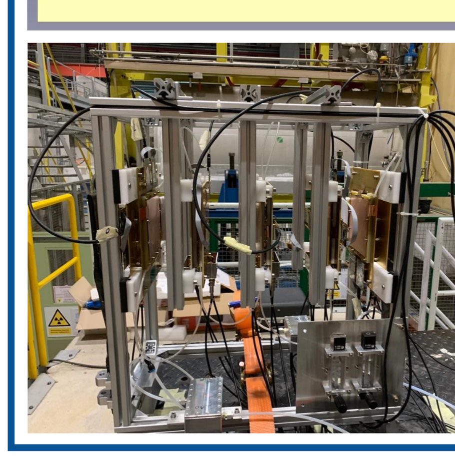












The charge **sharing**[2] **layout is based on capacitive coupling between a stack of layers** of pads and **the r/out board —>** Less **FEE channels**, but also **less charge per view***, as it is equally shared.

TOP-readout layout: top of the amplification stage segmented —> **dead zones in the active area and X resolution limited to pitch/√12**

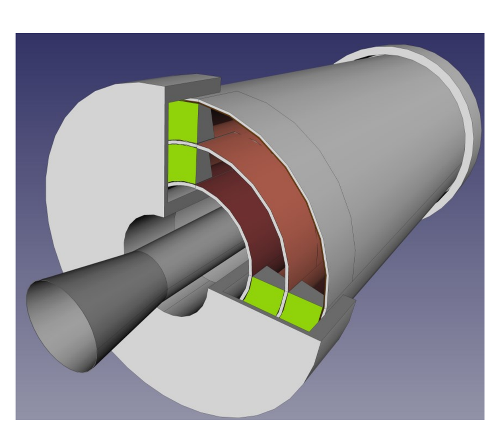
2. NIM A 1047 (2023) 167782

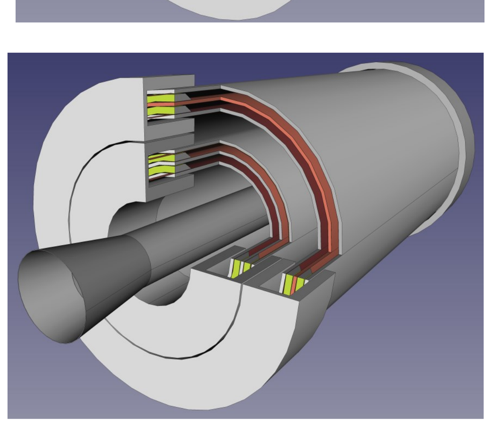
***SEE ALSO E. SIDORETTI's poster: "Corryvreckan framework integration for u-RWELL tracking detectors"**

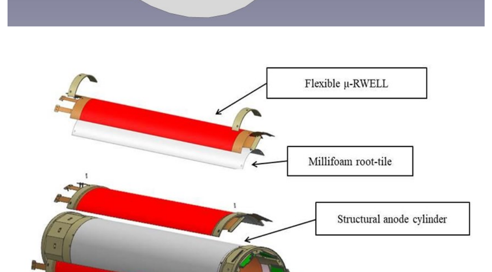
The project **EURIZON** requires a **low-mass detector** as inner tracker for future tau-charm factories.

The **μ-Resistive WELL** technology is a **suitable candidate** thanks to the possibility to realise the μ-RWELL_PCB on a **flexible substrate** and a **properly segmented readout**. The idea:

- Double– or quadri– coversion gap detector exploting a **common cylindrical cathode**
- Detector not sealed with glue to leave the possibility to **re-open it**
- Amplification stage divided in three parts (**roof-tiles**) fixed by plastic screws so that they can be replaced in case of malfunctioning







The roof-tiles

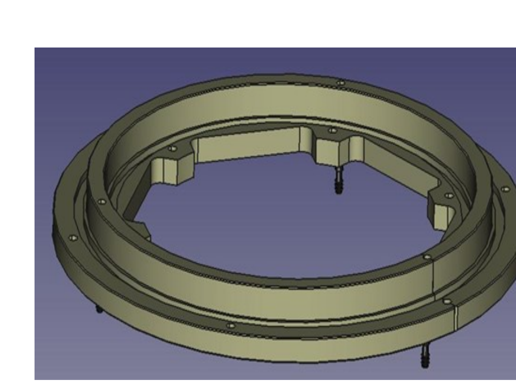
The amplification stage is glued on a **Millifoam® layer**. The choice of the material is a good compromise to cope with the rigidity of the μ-RWELL and with the request of a low-mass detector **(ρ_{Mlf}= 75 kg/m³)**.

The roof-tiles are then fixed on a further rectified Millifoam® acting as a central structure.

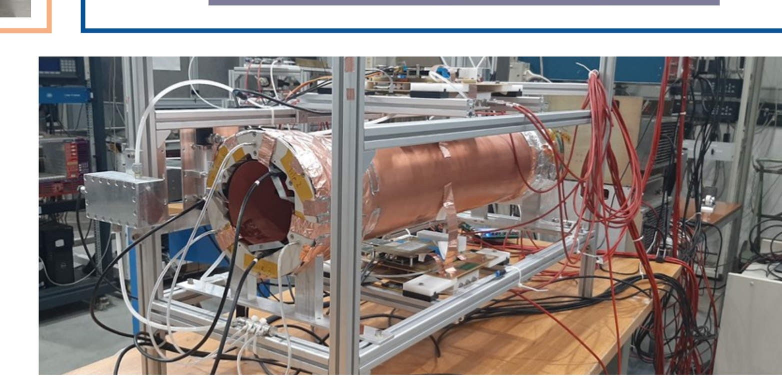
The role of the end-caps

They have great importance since:

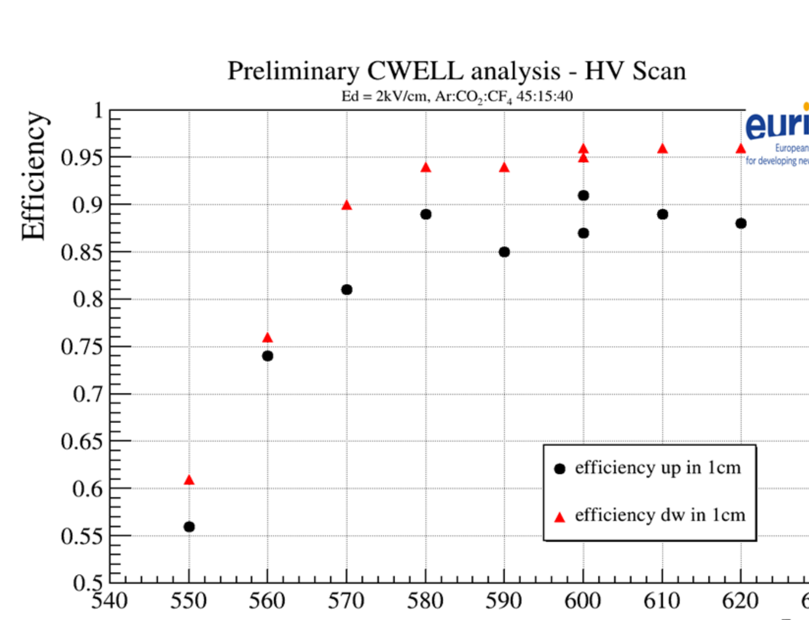
- They **host** the **gas connectors**
- They ensure **gas tightness** through two o-rings per side
- They **provide a 10 mm gap** between anode and cathode

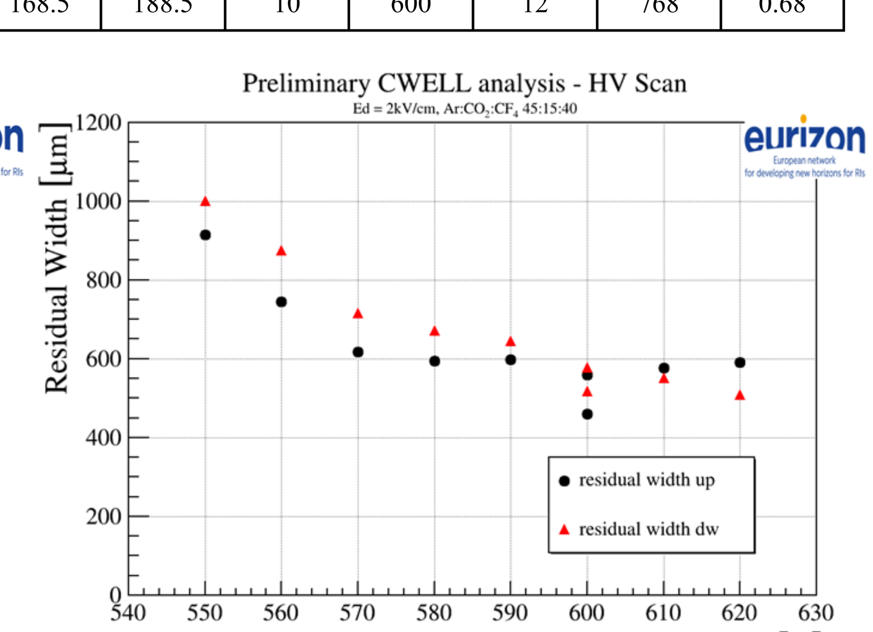


A **test** with **cosmic-ray muons** has been led at LNF with the use of two external trackers. The cylindrical **readout is divided in two halves** around the horizontal plane. A minimum of 500 μm in space resolution has been achieved (CC algorithm), **validating the technology** and opening the way to finer segmentation of the readout to improve this result.



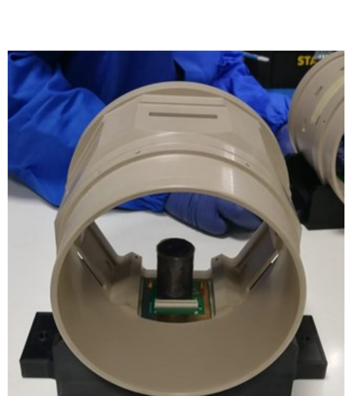
Anode diam.	Cathode diam.	drift size	active length	# HV chs	# r/out chs	strip pitch
168.5	188.5	10	600	12	768	0.68





The role of the flanges

Built in PEEK, the flanges are glued on the sides of each electrode. They host the interface boards for the signals and for the HV.



eurizon — European network for developing new horizons for RIs

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