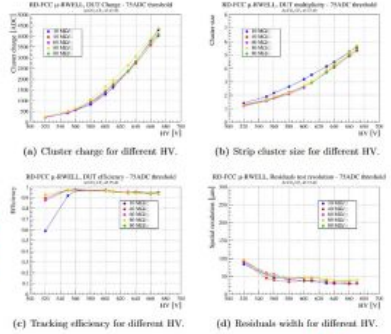
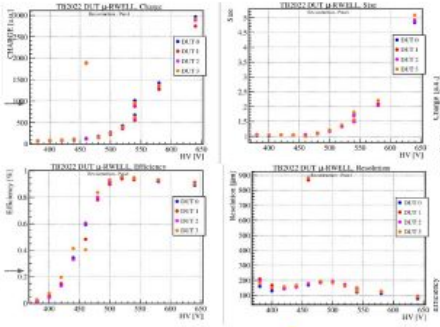
Summary analysis TB

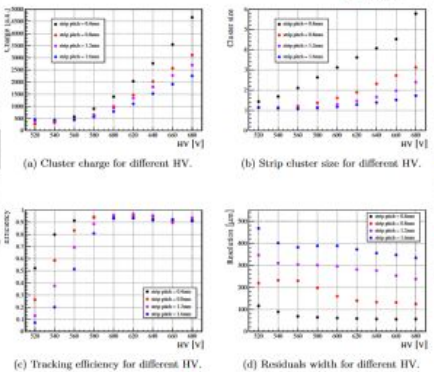
R. Farinelli

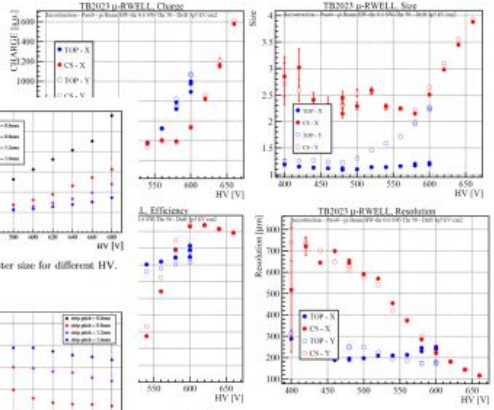
R&D for FCC

TB with DC + pre-shower + CALO+ Muon









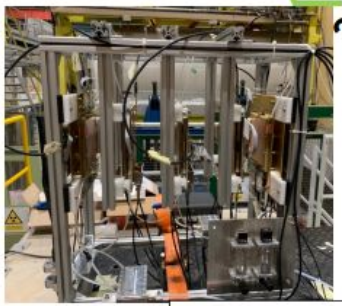
2020 — 2021 — 2022 — 2023

1D PERFORMANCE

2D performance

Resistivity Scan @ fixed pitch

Pitch Scan @ fixed resistivity & 2x1D performance

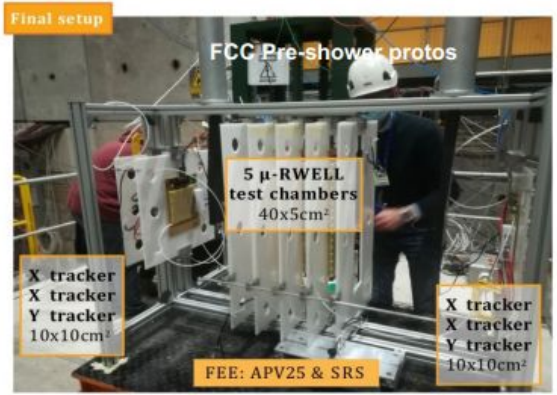


2D layouts

Resistivity Optimization

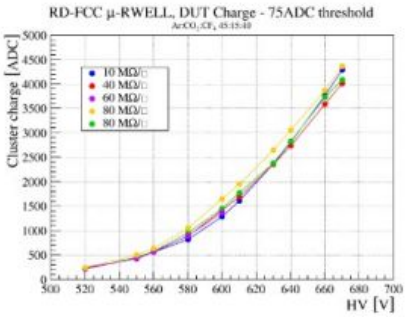
TB with DC + pre-shower + CALO+ Muon

2020 — 2021

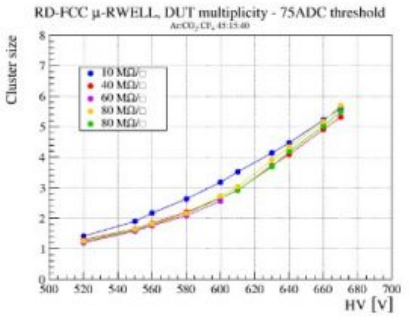


Active area= 400x50 mm2
Pre-preg thickness= 50 um
Resistivity= 10 ÷80 MΩ/
Strip pitch= 0.4 mm
Strip width = 0.150 mm
Ratio p/w= 2.66

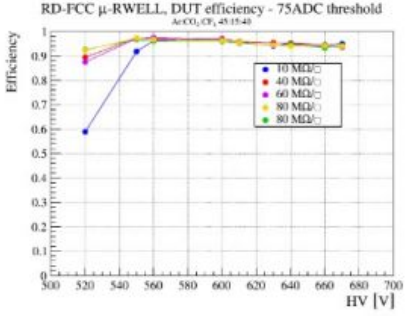
Resistivity Scan @ fixed pitch



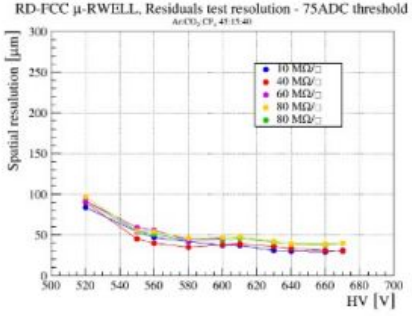
(a) Cluster charge for different HV.



(b) Strip cluster size for different HV.



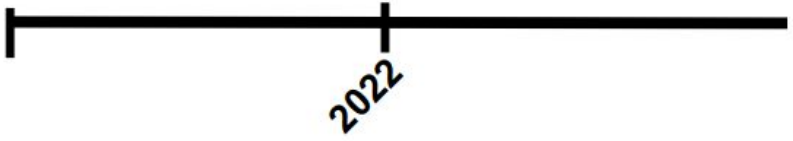
(c) Tracking efficiency for different HV.

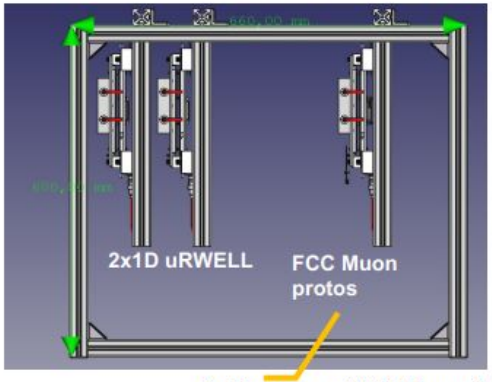


(d) Residuals width for different HV.

Same performance except the **10 MΩ/□ proto**
Efficiency knee @ 550 V, σ_x < 100 um

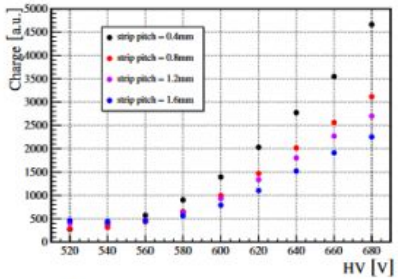
1D R/out strip pitch



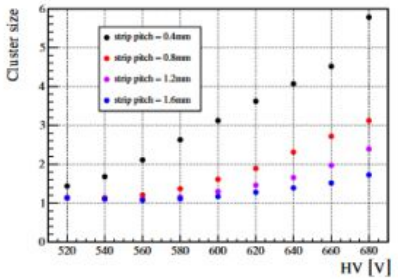


Active area= 400x50 mm2
Pre-preg thickness= 50 um
Resistivity= 30 MΩ/
Strip pitch= 0.4-1.6 mm
Strip width = 0.15 mm
p/w ratio= 2.66 – 10.66

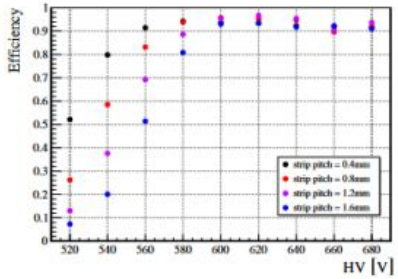
R/O pitch scan @ fixed resistivity



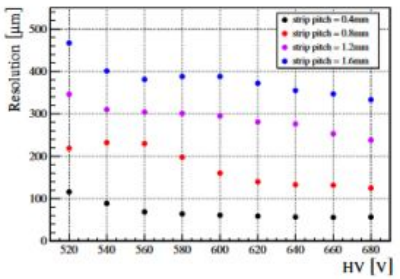
(a) Cluster charge for different HV.



(b) Strip cluster size for different HV.



(c) Tracking efficiency for different HV.



(d) Residuals width for different HV.

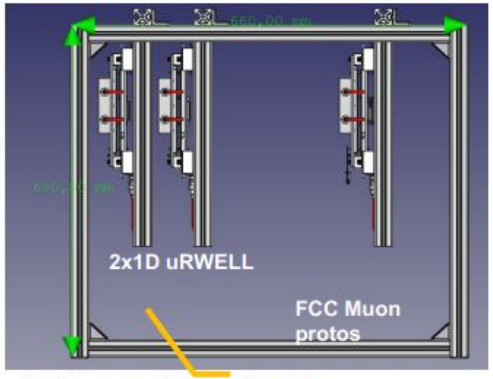
Larger is the strip pitch, lower is the charge signal requiring a higher gain to reach full efficiency.

Efficiency knee @ 600 V & σ_x < 400 um for a strip pitch = 1.6 mm

A high p/w ratio implies a worsening of the detector performance

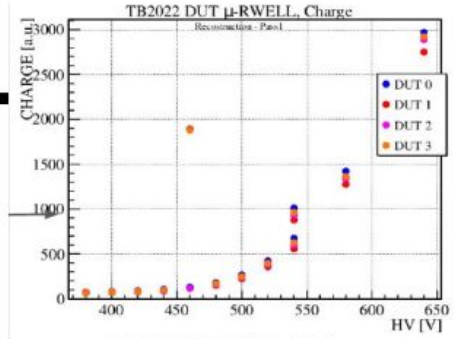
2x1D R/out

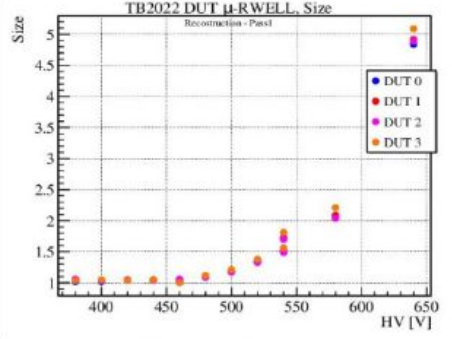
2022

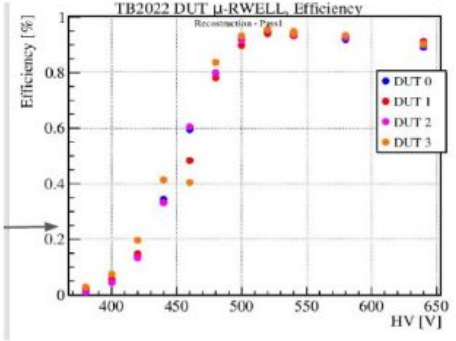


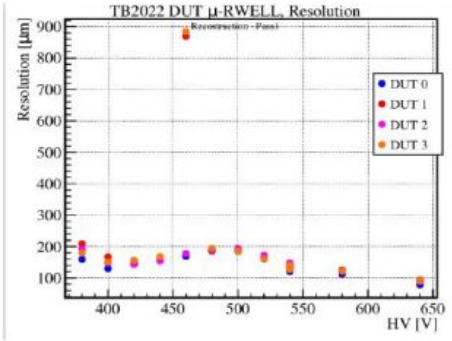
Active area= 100x100 mm2
Pre-preg thickness= 20 um
Resistivity= 50 MΩ/
Strip pitch= 0.76 mm
Strip width = 0.3 mm
Ratio p/w= 2.53

2x1D performance









The 1D proto show very good performace @ 500 V to be compared with 2D ones (TB 2023)
Efficiency knee @ 500 V & σx < 200 um for a strip pitch ~ 0.8 mm

2D R/out layout: Charge Sharing (red)

An ugual charge sharing on the X-Y coordinates is shown for both 2D r/out

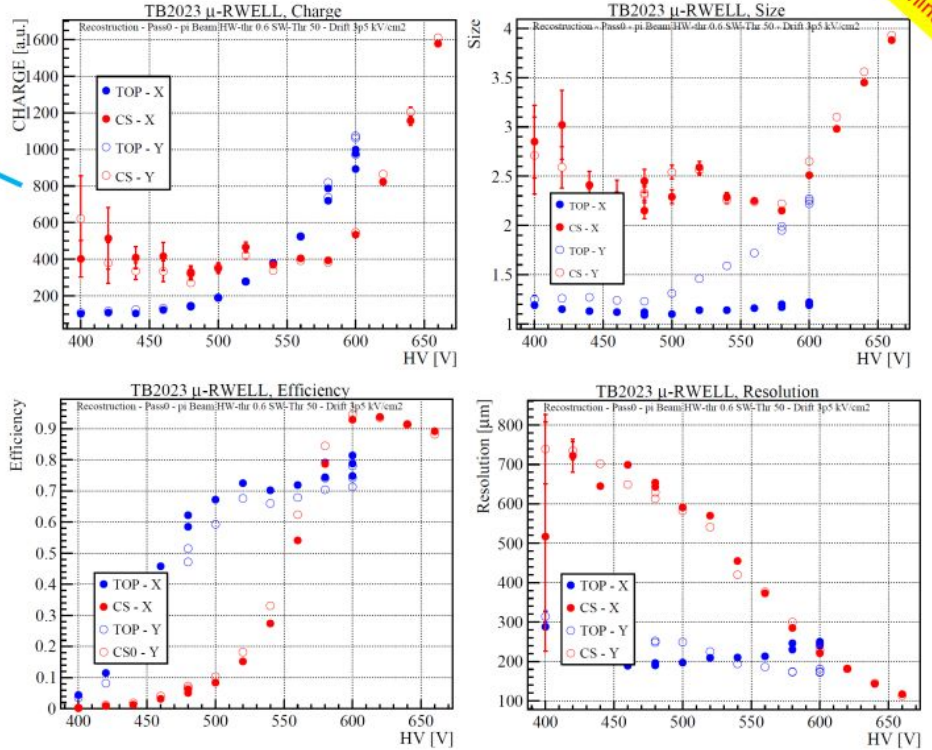
TOP r/o:

- **The total charge isn't divided between X & Y view**;
- **Efficiency knee @ 500 V** (such as 1D proto);
- **Low efficiency plateau (~70%) due to dead zone**
- Cluster Size does not change on X (TOP layer), while changing on the Y (due to the DLC spread);
- **Digital spatial resolution** on the X (Strip size ~ 1.5), strip Size>, improving on the Y (due to DLC spread)

CS r/o:

- **The total charge is divided between X & Y view**;
- **Efficiency knee @ 600 V;**
- **High efficiency plateau (~95%)**
- Cluster size increase to 4 strips (Charge Sharing mechanism work)
- **Spatial resolution** improves at higher gain reaching **150 um with a strip pitch of 1.2 mm**

preliminary



List of the TB

1. TB 2021 ⟶ resistivity scan
2. TB 2022 (a) ⟶ pitch scan
3. TB 2022 (b) ⟶ 2x1D
4. TB 2023 ⟶ 2D
5. Cremlin ⟶ cylindrical μRWELL

Analysis (1)

List of the event selections:

- 6 firing trackers (XXY fw and XXY bw)
- trk_X_fw_1 - trk_X_fw_2 in 3 sigma
- trk_X_bw_1 - trk_X_bw_2 in 3 sigma
- **line fit chi2 better than 0.1**
- efficiency selection in 10 sigma

List of the calibrations:

- XY rotation

Optimization done:

- **Threshold scan [25,200] ADC** → selected 75 ADC
- Resolution evaluated with two method:
  - only trackers
  - all the detectors but the one under test

Missing:

- **evaluate the contribution of the tracking system**
- trk cluster size cut

Analysis (2+3)

List of the event selections:

- 4 firing trackers (XY fw and XY bw)
- **trk_X_fw - trk_X_bw in 3 sigma**
- **trk_Y_fw - trk_Y_bw in 3 sigma**
- geometrical area selection XY (border and/or PEP)
- efficiency selection in 10 sigma

List of the calibrations:

- XY rotation

Optimization done:

- Resolution evaluated with two method:
  - only trackers
  - all the detectors but the one under test

Missing:

- trk cluster size cut

Analysis (4)

List of the event selections:

- 4 firing trackers (XY fw and XY bw)
- **fit value selection in X and Y: |m_fit|<0.05**
- **trk cluster size <= 4**
- efficiency selection in 1 cm

List of the calibrations:

- XY rotation

Optimization done:

- Tiles alignment