

Progress in the Small-pad Resistive Micromegas October Test-Beam at H4

M. Iodice on behalf of the Small pad Micromegas enthusiasts

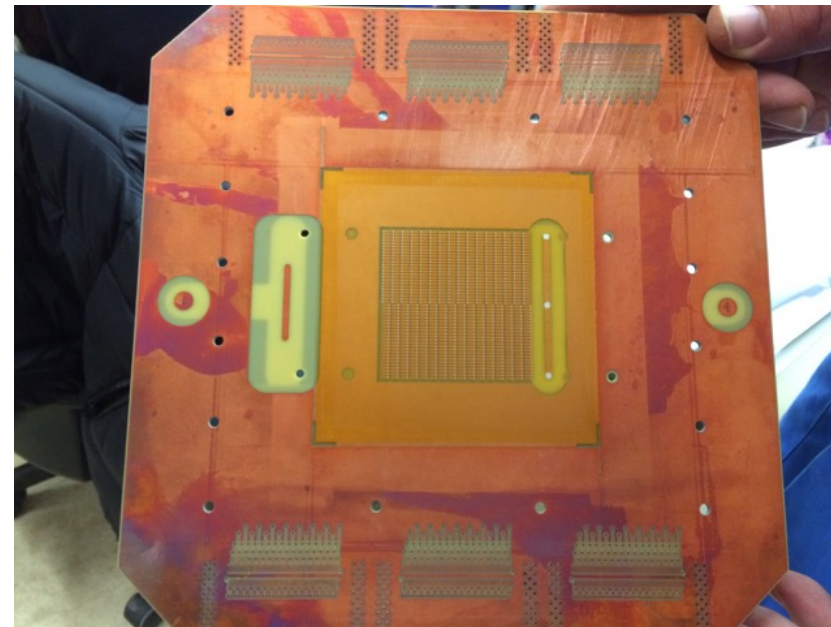
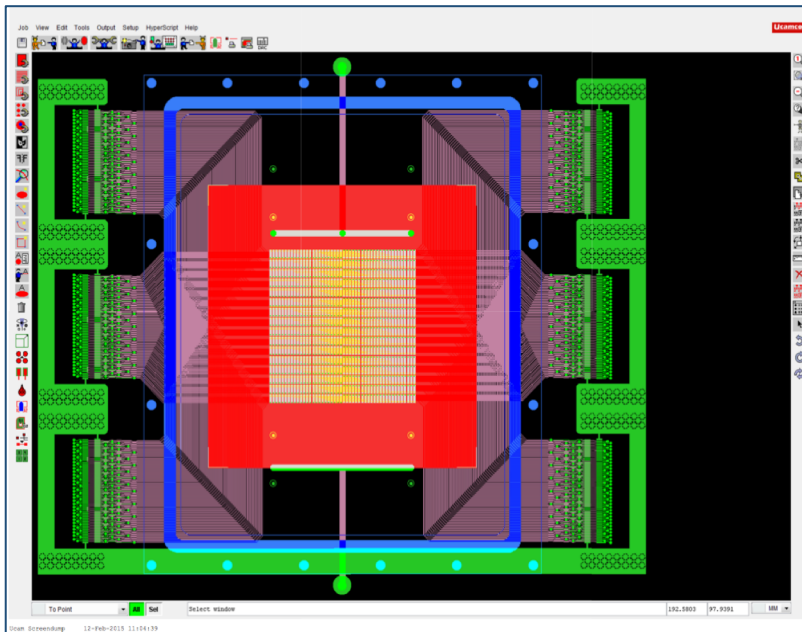
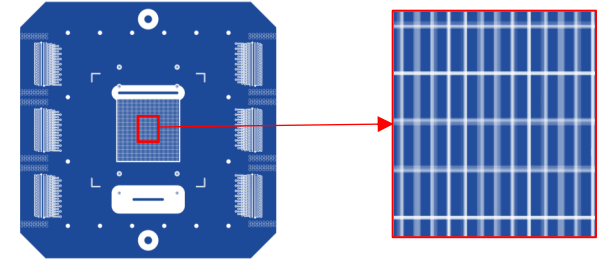
RD51 mini-week - CERN, December 6, 2018

Small Pad Resistive micromegas

REMINDER: Anode structure.

In all prototypes built so far the anode structure is always the same

- All prototypes with same anode configuration: Matrix of 48x16 pads
- Pad size 0.8mm x 2.8mm (pitch of 1 and 3 mm in the two coordinates)
- Active surface 4.8x4.8 cm²
- Total # Channels: 768

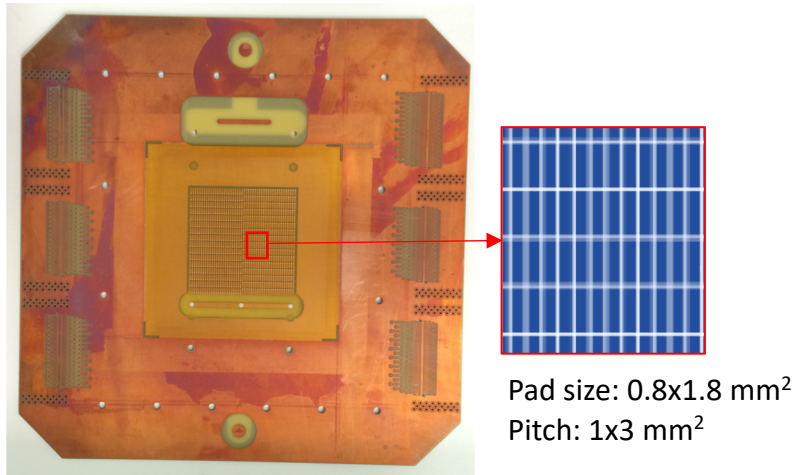


Two different implementations of the Resistive layer

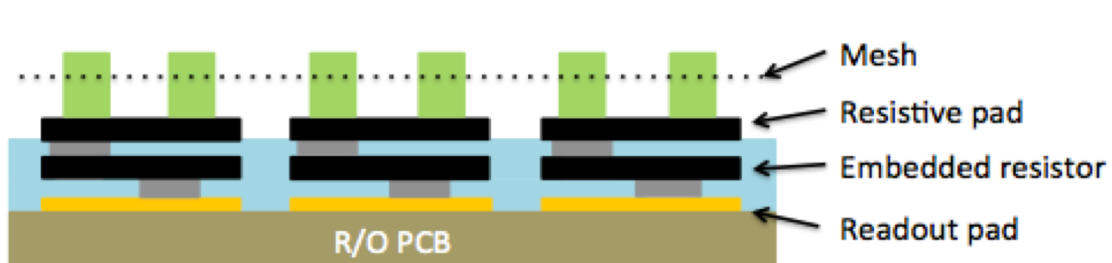
Two series of small pad resistive micromegas prototypes built so far with **pad dimension 3 mm²**.

The two series differ for the implementation of the resistive protection system against discharges :

DETECTOR LAYOUT

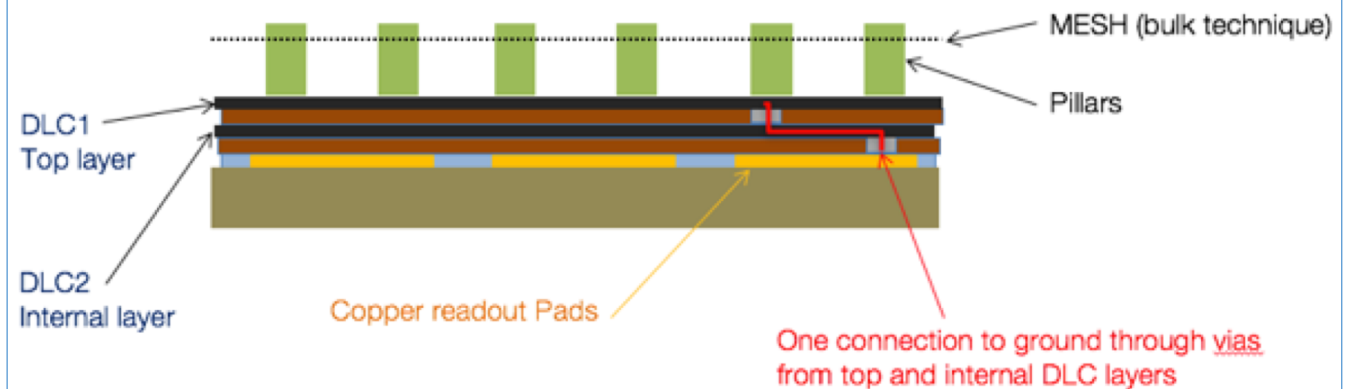


Side view of SERIES 1 prototype:
Embedded Resistors with Patterned resistive layer

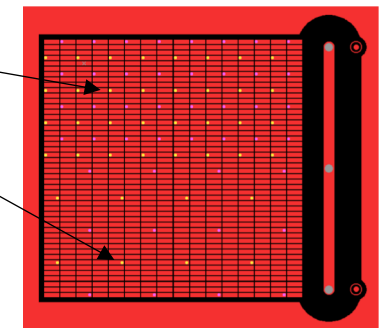


Resistive pad to anode pad Resistance: ~3-7 MOhm

Side view of SERIES 2 prototype:
Double DLC (Diamond Like Carbon) resistive layer a' la uRWell
(*M. Poli Lener yesterday's talk*)



Region with grounding vias every 6 mm
Region with grounding vias every 12 mm



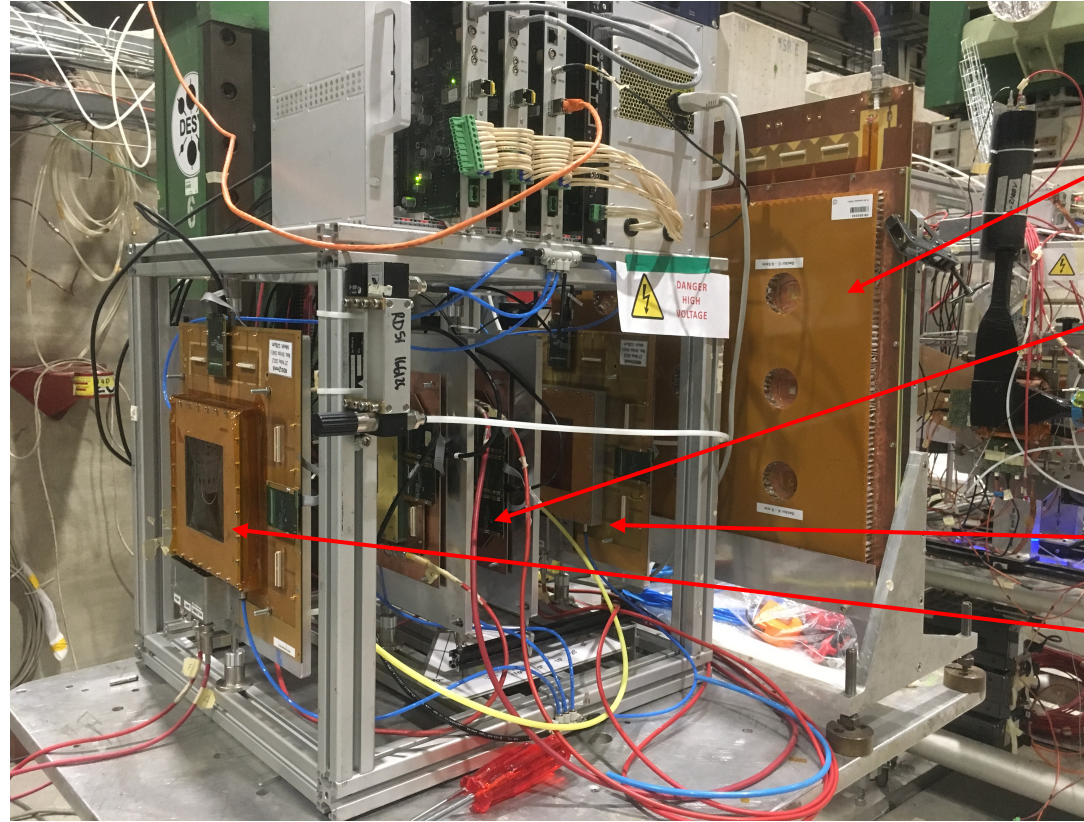
2 Prototypes tested with different
DLC Foils: High (~60 MOhm/sq) and
Low (20 MOhm/sq)

Test Beam SPS H4 at CERN – SETUP

SPS H4 CERN **OCTOBER 2018**

Beam:

- 1st period: muons/pions 150 GeV/c
- 2nd period: pions 80 GeV/c
- Prototypes Tested:
DLC 60 MOHM
DLC 20 MOHM
- Additional study: micromegas
Performance with different Gas
mixtures (presented by **V. D'Amico** on
Tuesday morning)



ExMe at 30°

DLC60, DLC20,

TMMdownstream

TMMupstream

SETUP: Chambers under test: DLC60 (60 Mohm/sq), DLC20 (20MOhm/sq), ExMe

- Tracking system: 2 Tmm strips micromegas (x-y readout) for external tracking
- Operating gas on DLC20, DLC60: Ar:CO₂ 93:7 Gas studies on ExMe: Ar:CO₂ 93:7 and 85:15 – Ar:CO₂:Iso 88:10:2
- Scintillators for triggering
- DAQ: SRS + APV25 with custom DAQ

Preliminary Results – Beam Spot

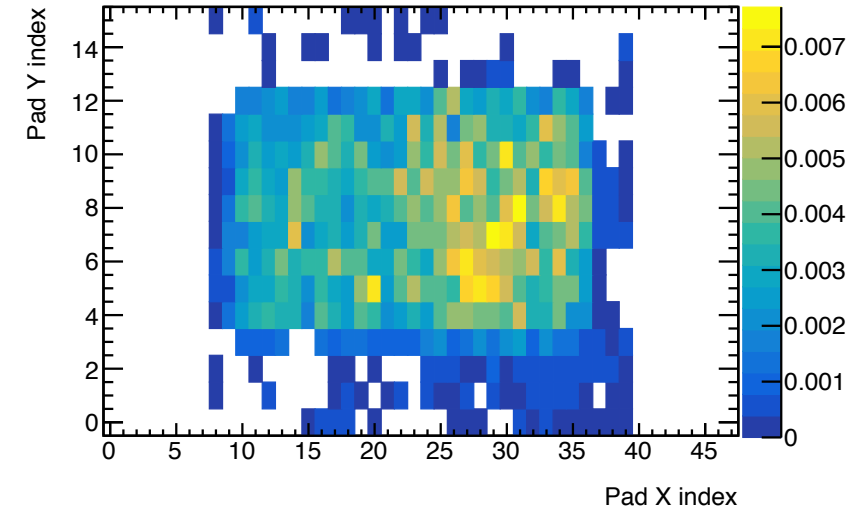
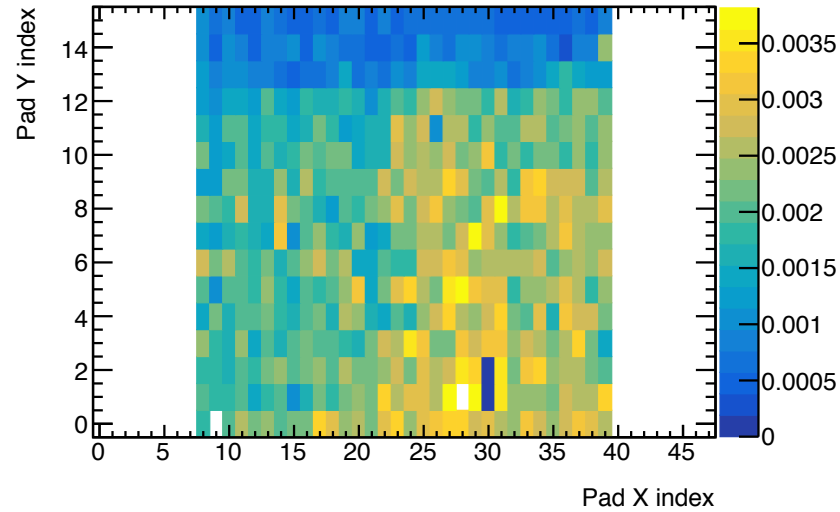
All triggered events



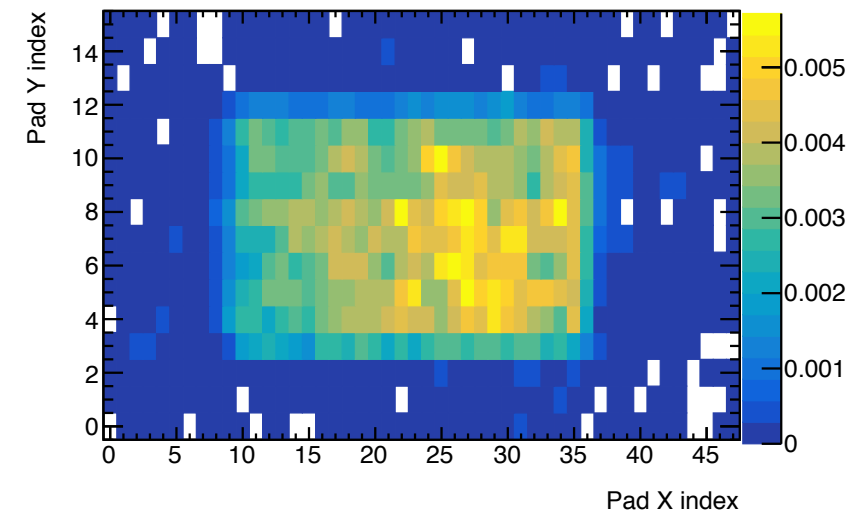
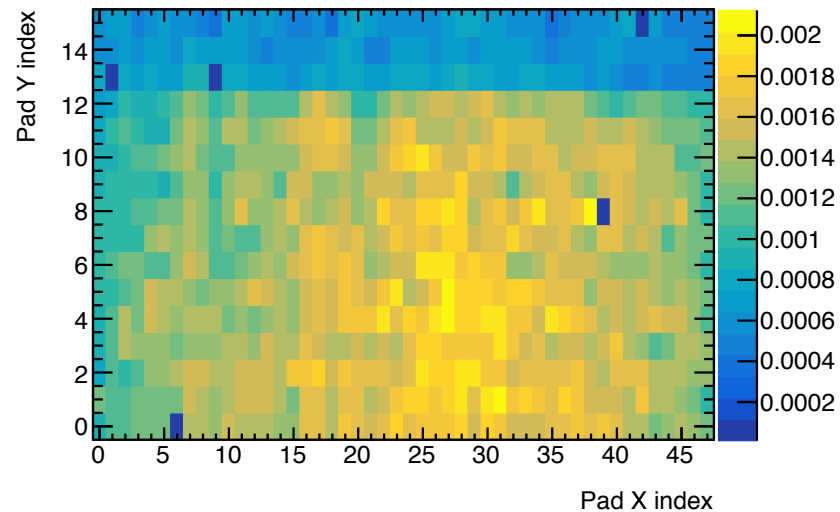
Associated with one reconstructed track in the Tmm



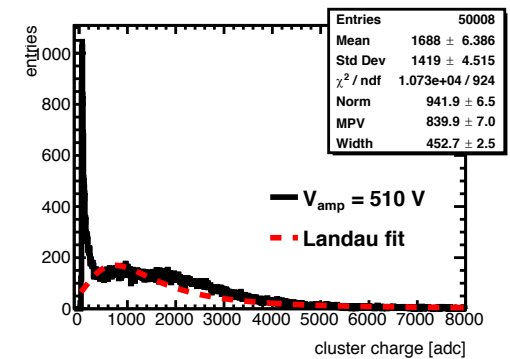
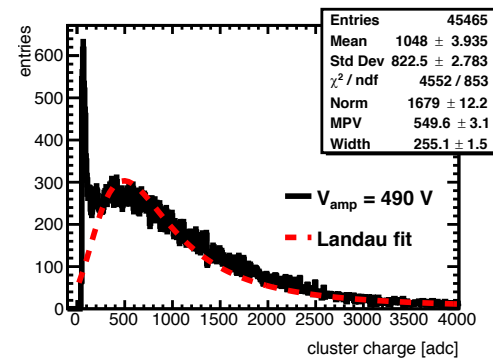
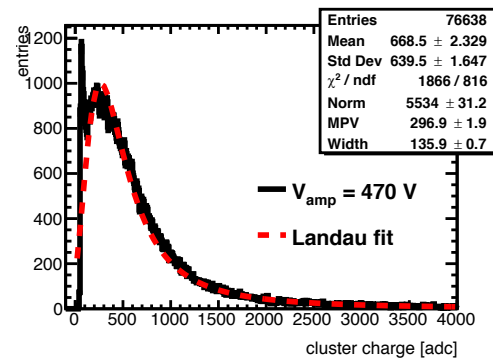
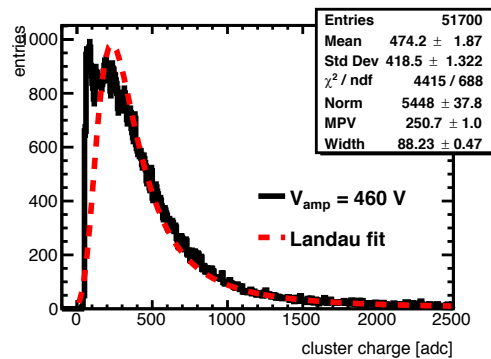
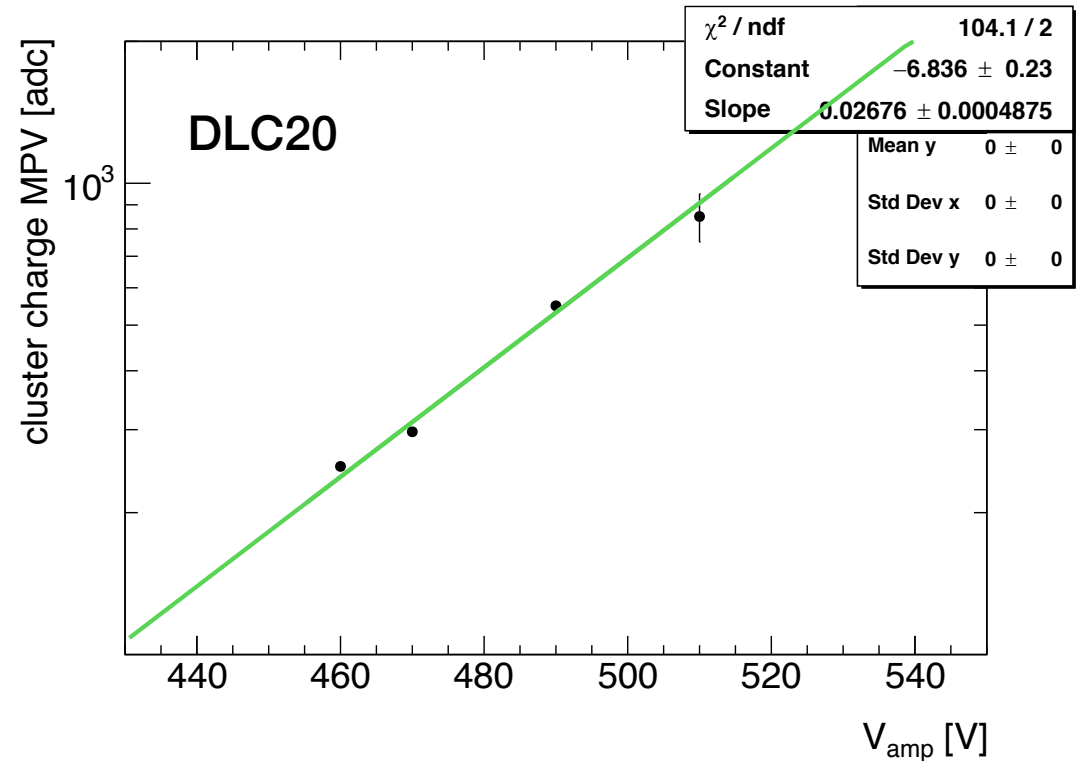
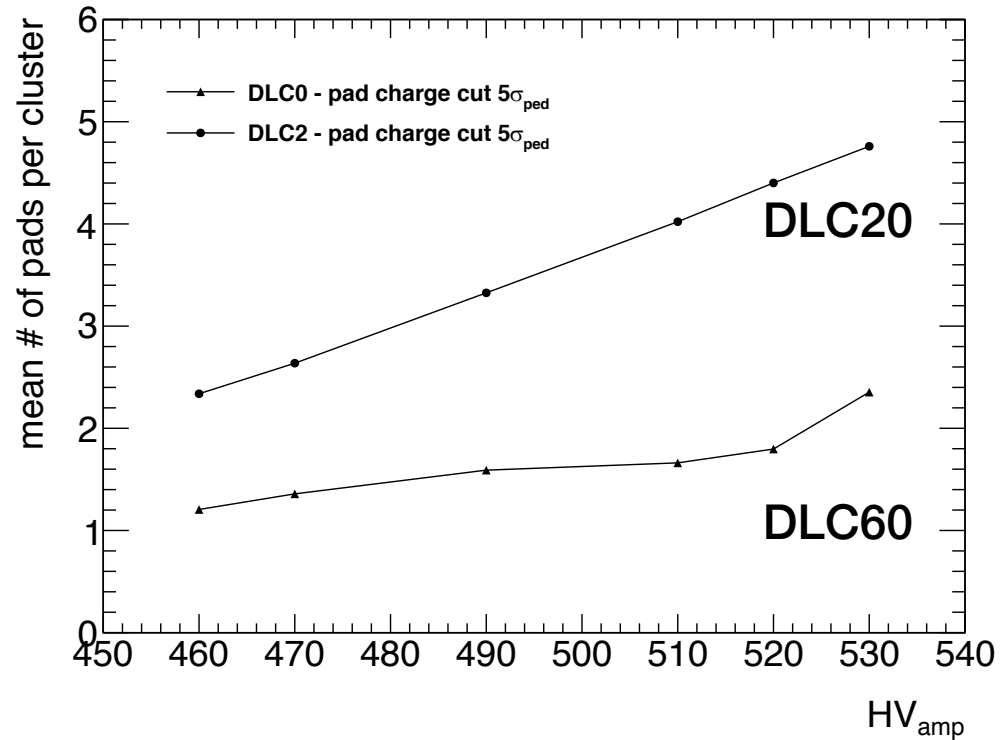
DLC60



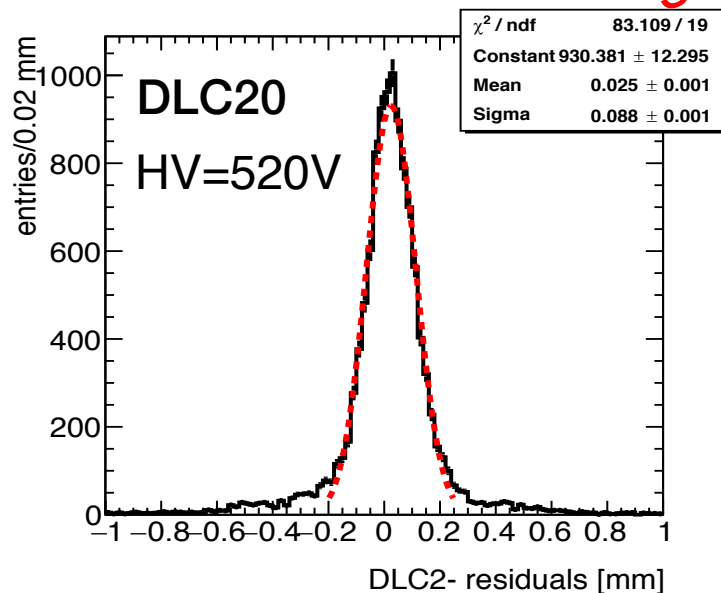
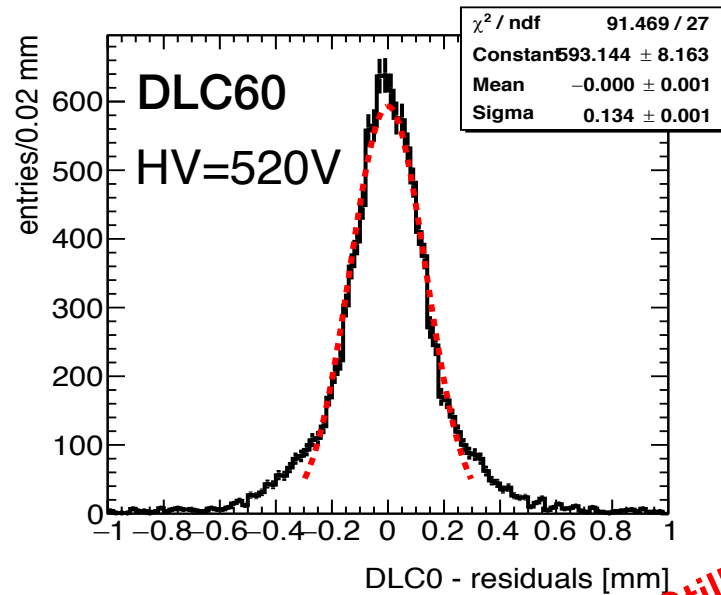
DLC20



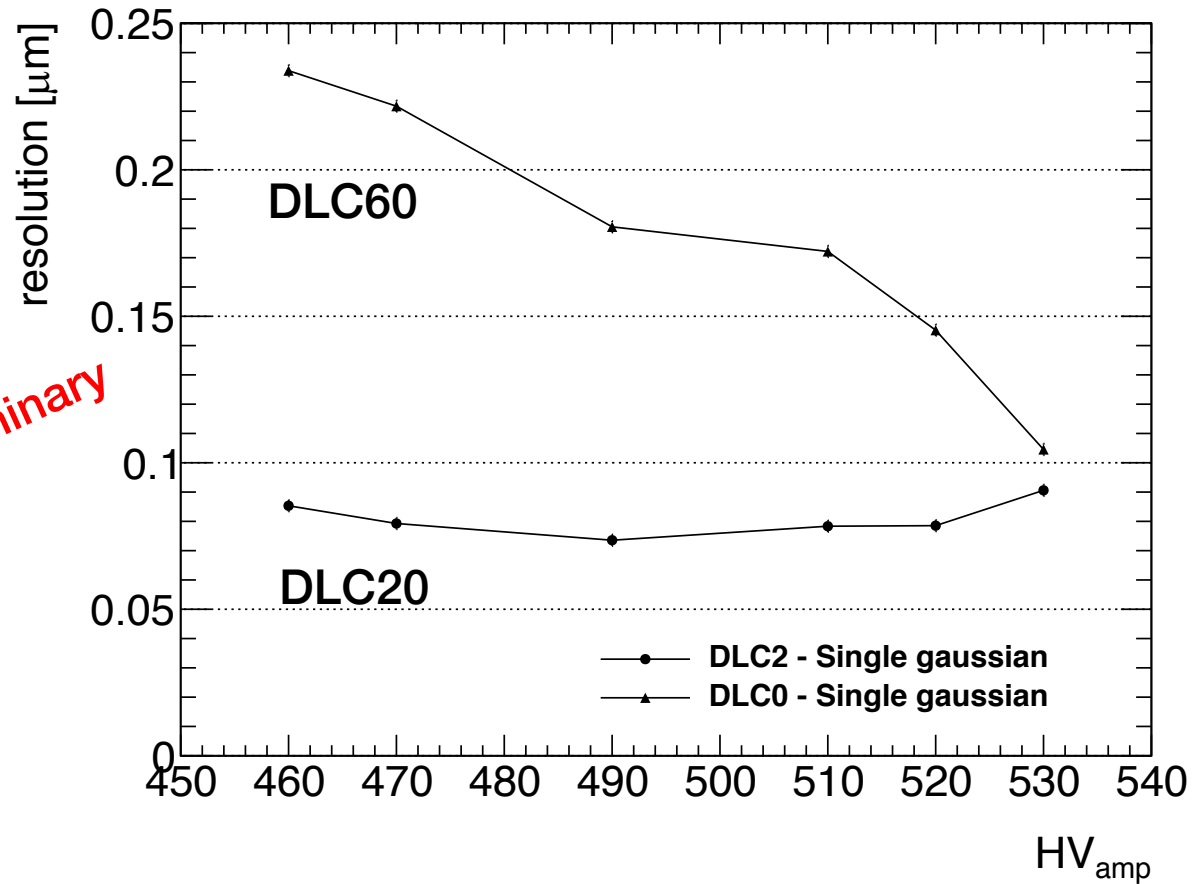
Preliminary Results – Cluster size and Cluster Charge



Preliminary Results – Spatial Resolution



Still Very Preliminary

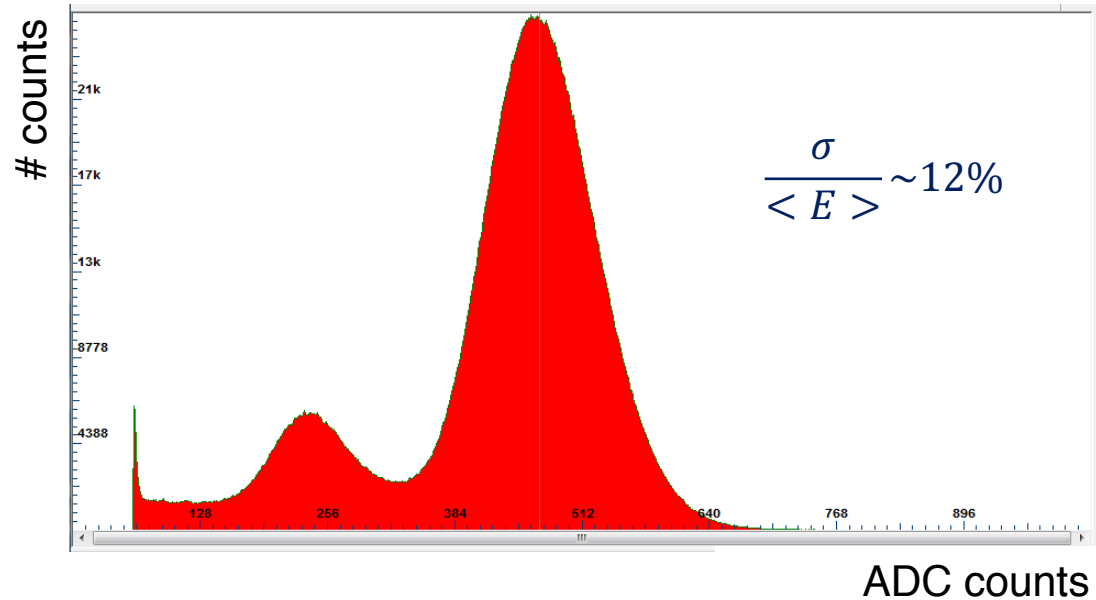


Very Good SPATIAL resolution BELOW 100 μm for the DLC20
Better for DLC20 due to the lower resistivity
→ larger cluster-size → more precise charge weighted centroid

In the meantime in the GDD Lab...

Gain and High rates Measurements with ^{55}Fe sources and X-rays WITH DLC20 (today/tomorrow with DLC60)

^{55}Fe source

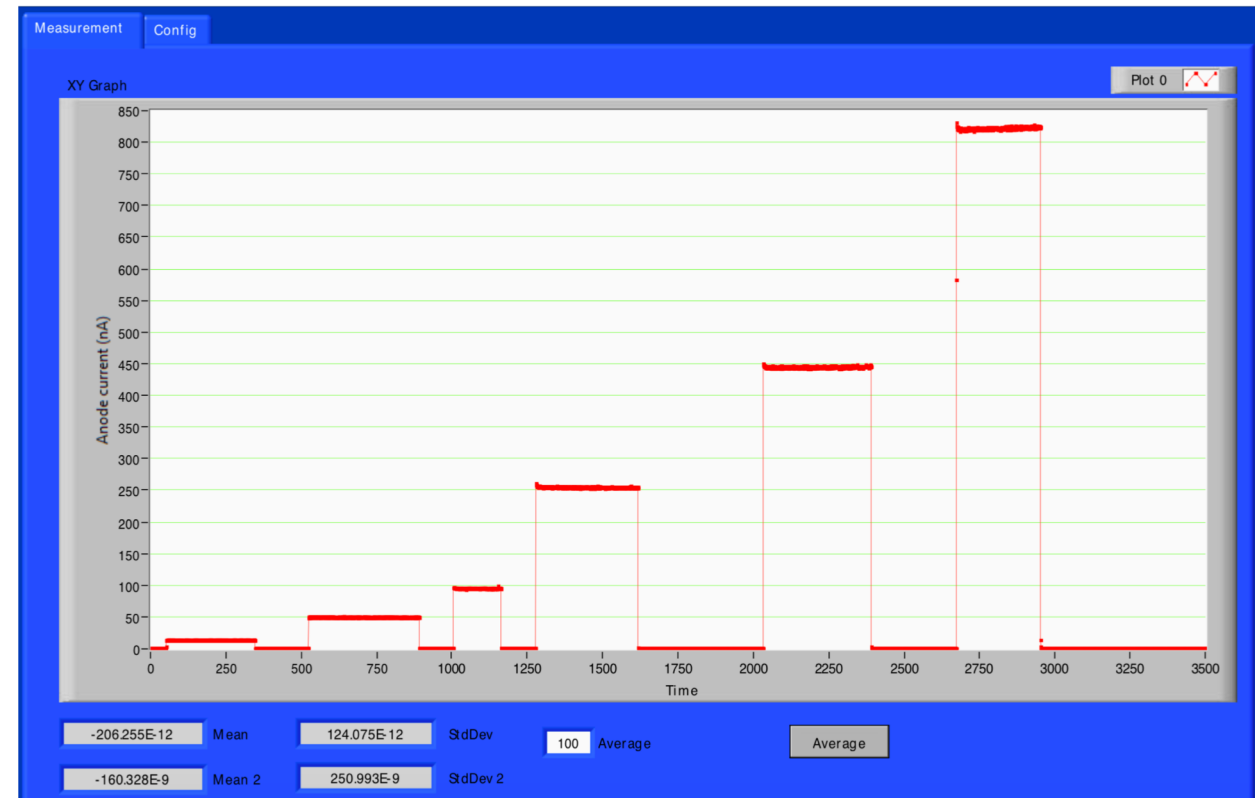


Very Good Energy resolution

Slightly better than with DLC60 (last year data)

Much better than Series-1 Paddy (patterned resistive plane)

X-rays Gun



Confirmation of negligible (or unmeasurable) charging-up up to 10 MHz/cm^2 (in this plot rates up to $\sim 1 \text{ MHz/cm}^2$)

**Many many thanks to RD51 for this
successful Test-Beam**

...we will miss this experience and the nice
atmosphere in the next years...

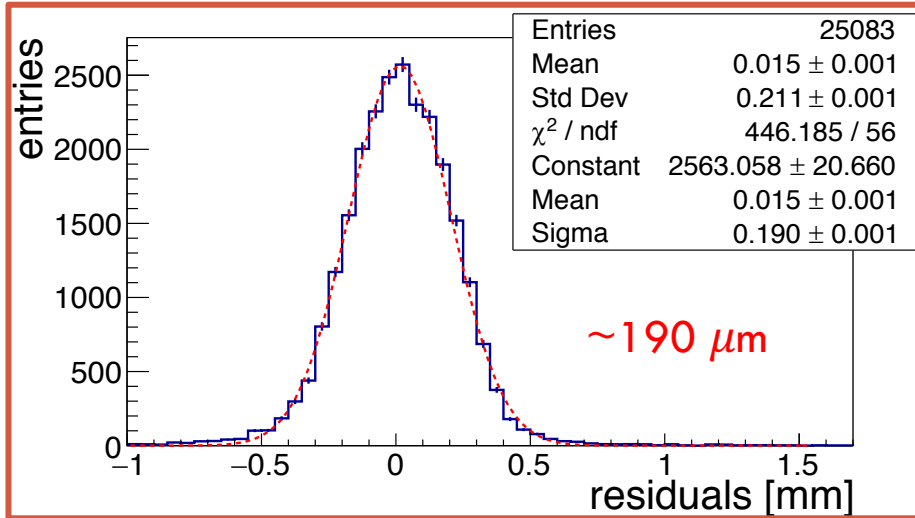
In particular many many thanks to Eraldo and
Yorgos for their restless/sleepless continuous
support and help

BACKUP

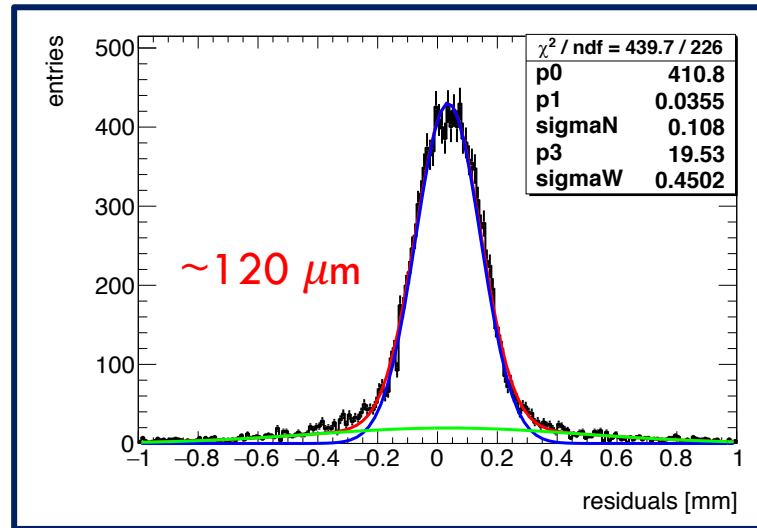
Spatial Resolution – Embedded resistors Vs DLC60 and DLC20

Residuals between the cluster position on prototype and extrapolated position from external tracking chambers.

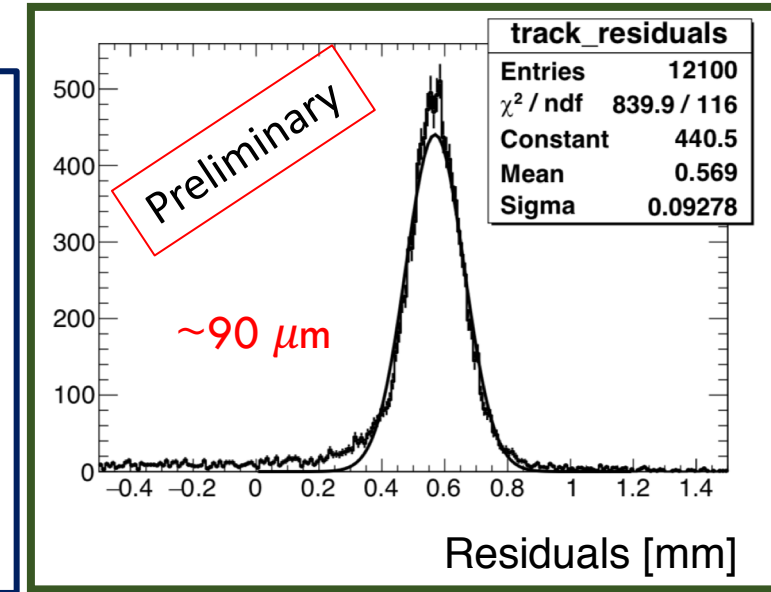
Embedded Resistors



DLC 60 MOhm



DLC 20 MOhm



Precision coordinate (pad pitch 1 mm)

- Significant improvement of spatial resolution (pad charge weighted centroid) on the DLC prototypes
- More uniform charge distribution among pads in the cluster
- Due to the lower resistivity the number of pads per cluster is larger than in the higher DLC resistivity prototype.
 - This has the advantage to improve the charge weighted centroid position measurement.
 - On the other side the occupancy increases as well, which is not desirable under very high rates