

Status of Micromegas Central Tracker

MCT : Outline

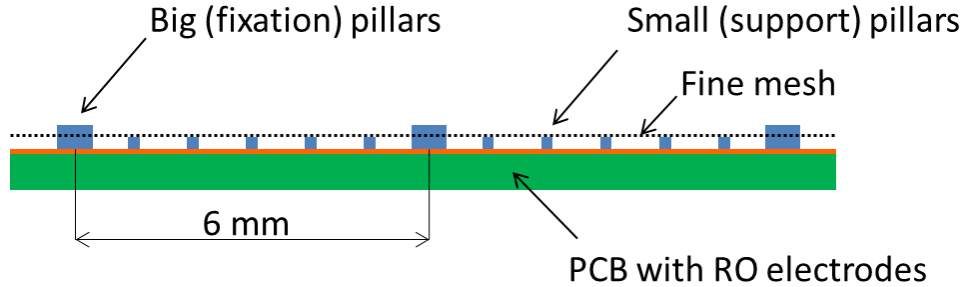
- July 2024 beam test results
- VMM3a certification results
- Current activities and plans

July 2024 beam test

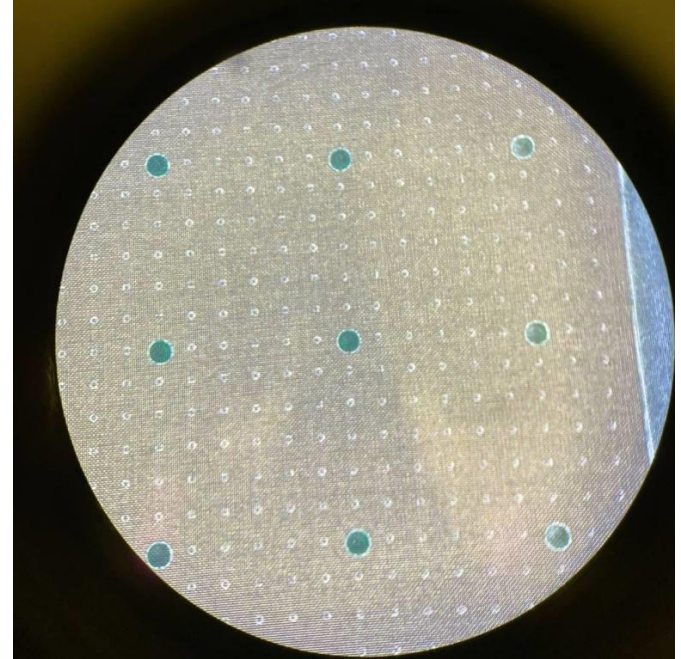
Aims:

- First measurement of intrinsic resolution and efficiency
- Pillar structure effect
 - cylindrical geometry require very dense pillar structure (1 mm pitch)
- Study the effect of strip pitch and DLC resistance on space resolution

MCT pillar structure

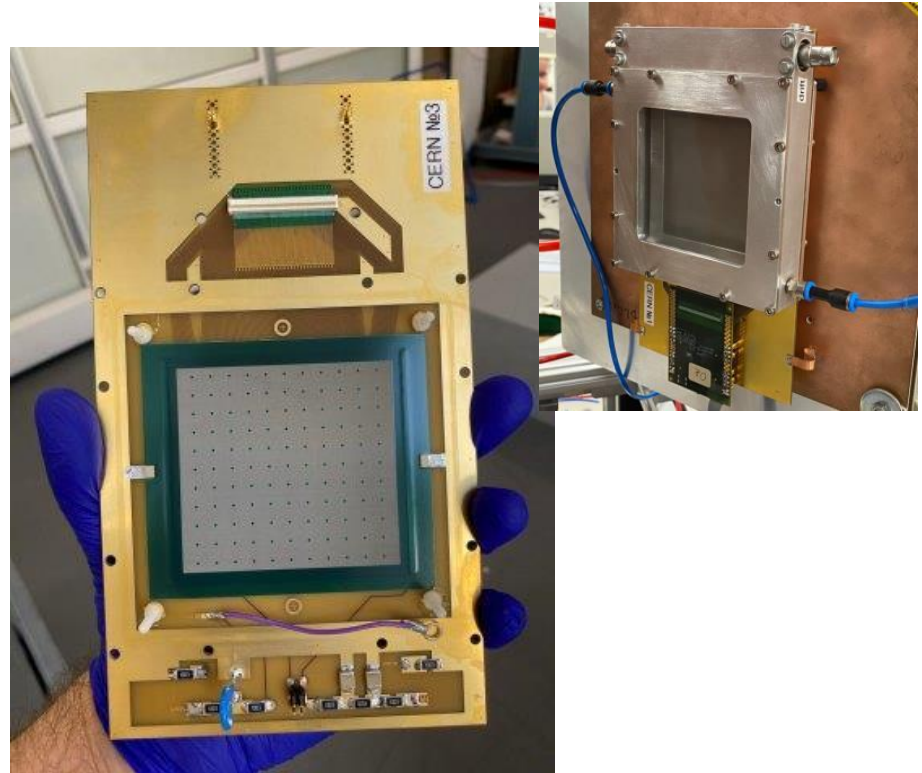


- Due to small bending radius we are forced to put additional small “supporting” pillars with 1 mm pitch. Standard pillar pitch is 5 mm+
- This additional pillars takes about 6% of detector area



MM prototype used for test

- 2 flat chambers, $8 \times 8 \text{ cm}^2$,
0.45mm and 0.7mm pitch (1/2 of
active area for each pitch)
- Chamber #1 : MCT pillars,
 $R_{DLC} = 20M\Omega$
- Chamber #2 : Classic pillars,
 $R_{DLC} = 10M\Omega$

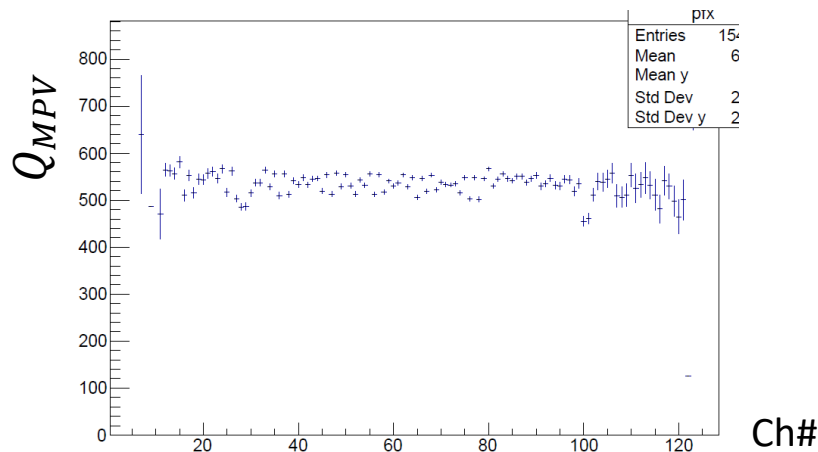
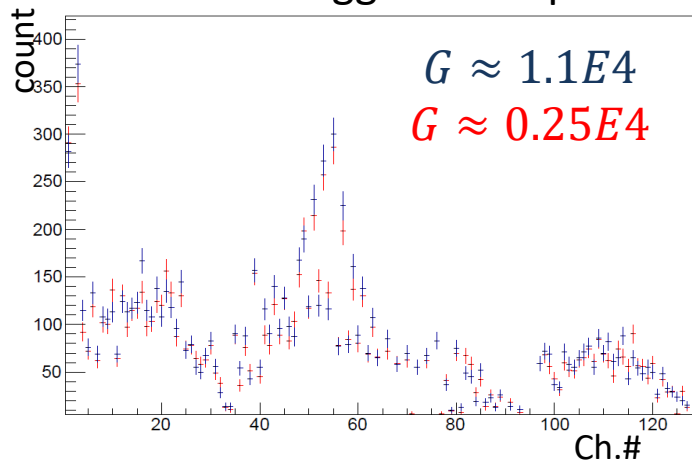


Experimental setup

- 2 reference 2-coord MM chambers, $\sigma_x \cong 80\mu\text{m}$
- $\sigma_{Xexp} \cong 60\mu\text{m}$
- APV/SRC readout,
- External trigger, zero suppression
- Noise : 2500 e^- (0.4 fC) RMS
- Threshold: 0.9 fC

BT results : general MM quality

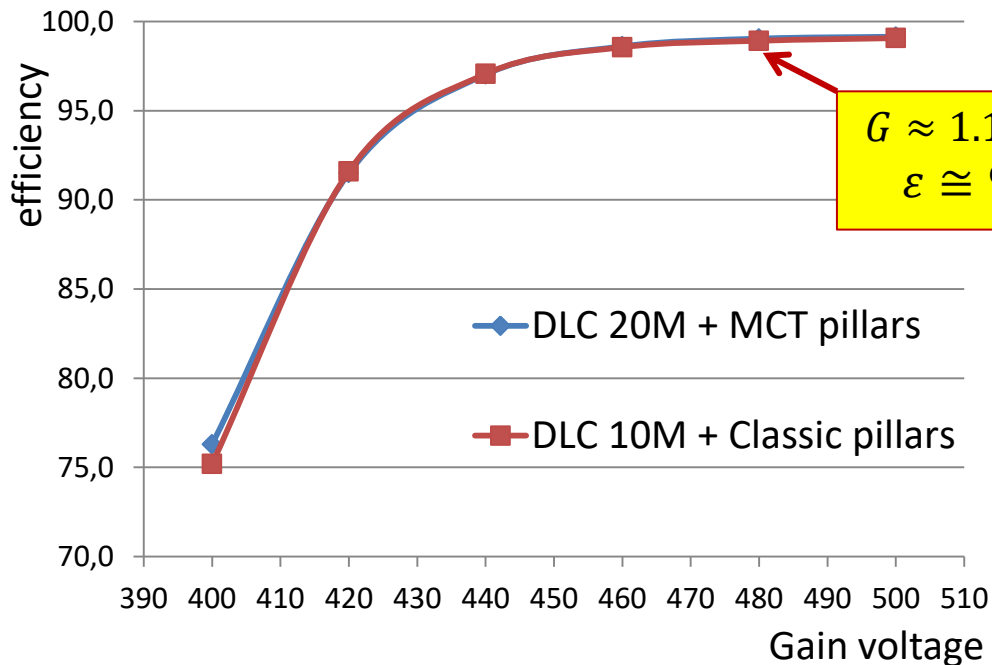
Random trigger Hitmap



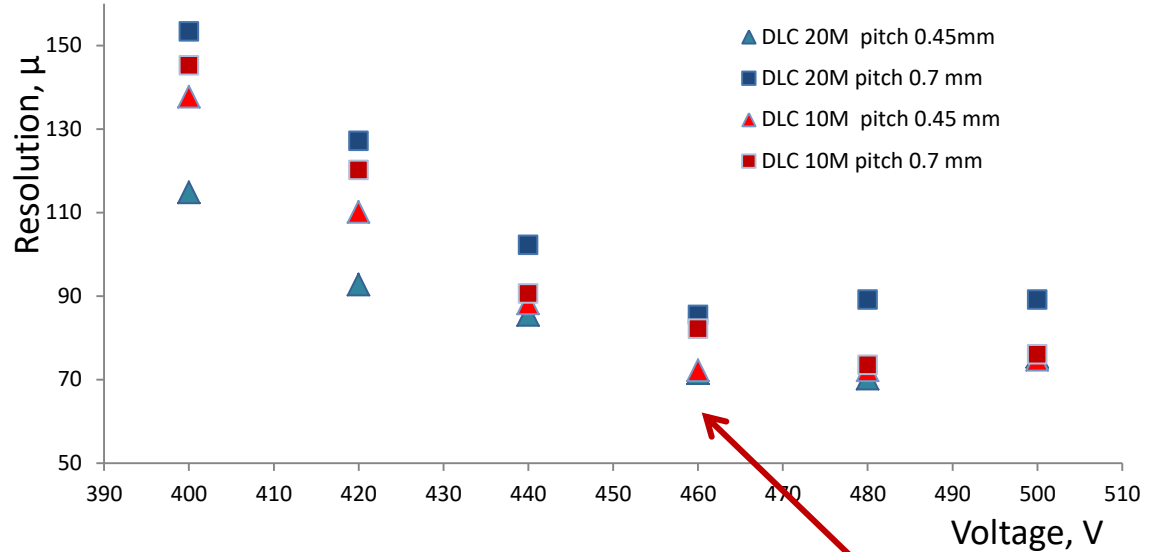
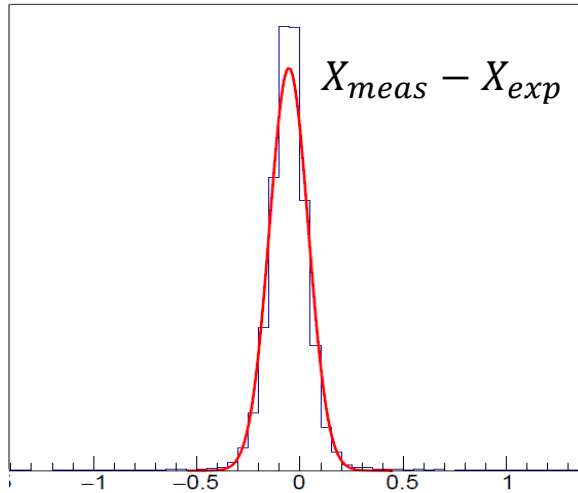
- Noise rate do not depend on gain => no sparks
- Q_{MPV} on central strip of the cluster is extremely uniform
- Not a single problem during the two weeks of beam test

BT results : intrinsic efficiency

- Gas gain is doubled for every 20 Volts
- Intrinsic efficiency is 99%
- MCT pillar structure do not cause efficiency degradation



BT results : resolution



- Intrinsic resolution is about 80μ , 150μ is required by specification
- No significant effect of pillar structure is observed
- Strip pitch may be increased without crucial resolution degradation

$G \approx 5.5 \times 10^4$

BT results : summary

- The intrinsic efficiency of the chambers producer in Dubna is about 99% and resolution is better than 80μ
- The structure of MCT pillars minimally affects the performance of the detector
- For 10-20 M Ω DLC resistance the pitch of the strips can be increased. Increasing the pitch from 0.42 mm to 0.58 mm will reduce the required number of FE cards from 44 to 32, with little degradation in resolution. The effect on efficiency at high threshold is not clear

Certification of VMM3a ASICs

- Test bench development and ASIC certification was carried out by the Tomsk State University team

- O. Kuchinskaia
- V. Kostyukhin,
- V. Borsch,
- I. Akimov,
- R. Makhmanazarov,
- I. Shreyber,
- S. Filimonov,

88 ASICs are needed for MCT FE

	Quantity, pc.	Fraction, %
Total	225	100
Perfect	87	38.7
Acceptable	29	12.9
Failed	109	48.4

- Acceptable - Not perfect , but may be used for MCT/SPD FE. Not more then 2 channels do not pass the test, all functions needed for SPD is OK

Current activities and plans

- Ordering of components for full-functioning cylindrical prototype is ongoing
- Study of edge effect is planned for nearest future
- Beam test with magnetic field and optimized gas mixture