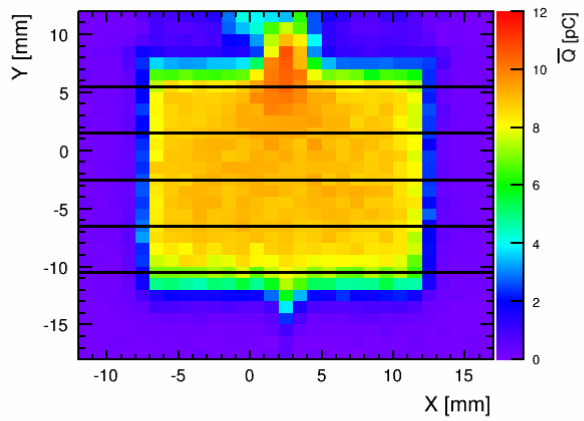
Analysis of scintillator tile scans

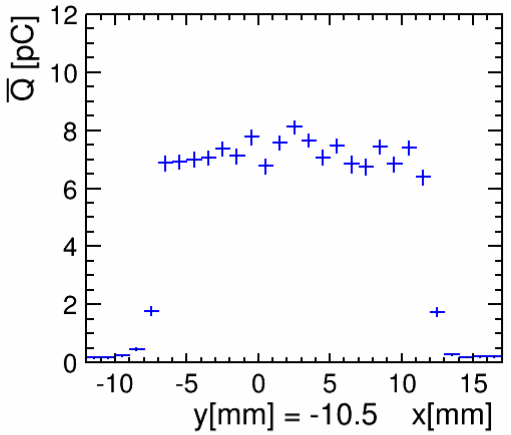
ECAL Lab Meeting
2015.03.20
Laszlo Varga (CERN, Eotvos Lorand University HU)

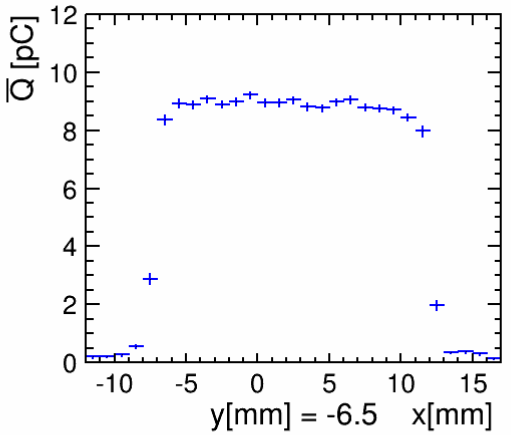
Data sets

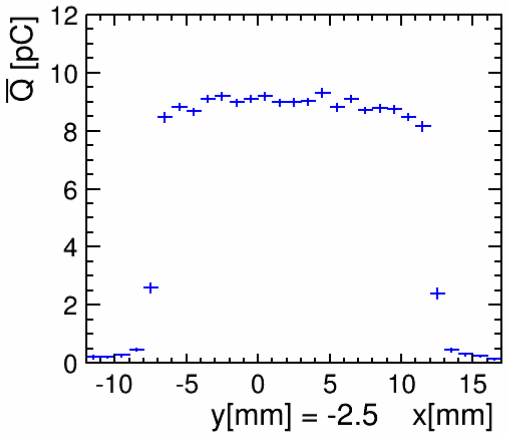
- Date:
  - Wrapped tile (□20mm & □15mm): 2015.02.20 & 2015.02.23
  - Painted tile (□20mm & □15mm): 2015.02.27 & 2015.02.25
  - Wrapped tile_1 (□20mm & □15mm): 2015.03.16 & 2015.03.12
  - Painted tile_1 (□20mm & □15mm): 2015.03.17 & 2015.03.13
- Scanned range [mm]:
  - □20mm tile: x ϵ [-12:17] ; y ϵ [-18:12]
  - □15mm tile: x ϵ [-10:14] ; y ϵ [-11:12]
- Measurement time in each point is 100 s
- Setup after replacement of the tile holders
- Apply temperature correction discussed in the first talk

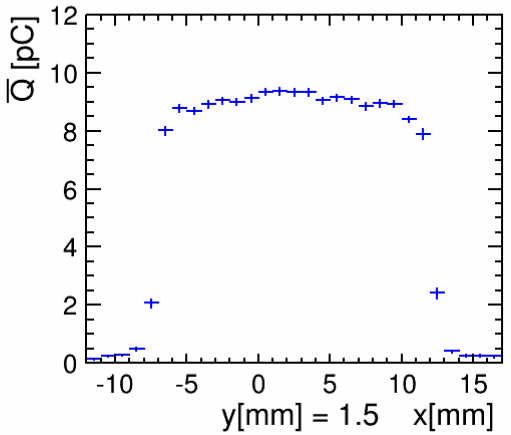
Principle of the analysis

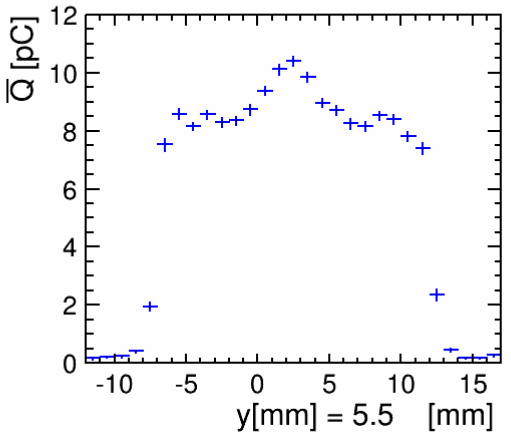








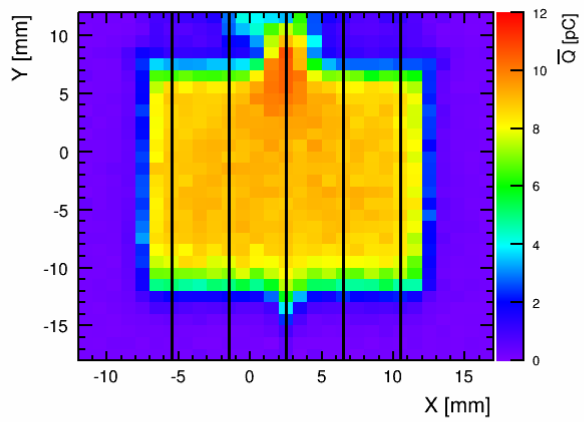


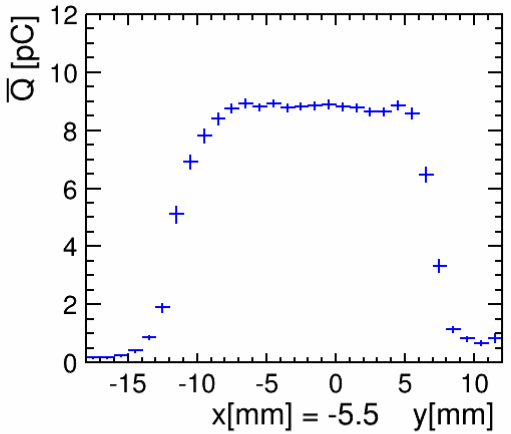


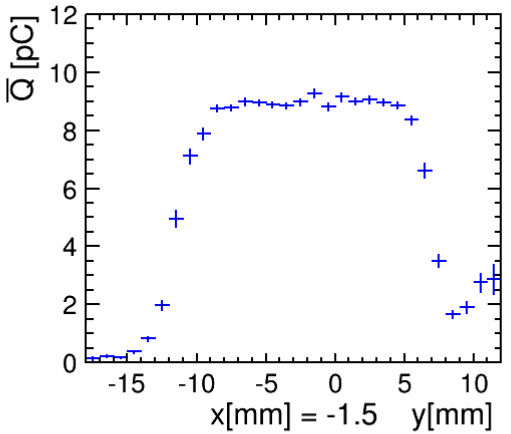
Sections at y =

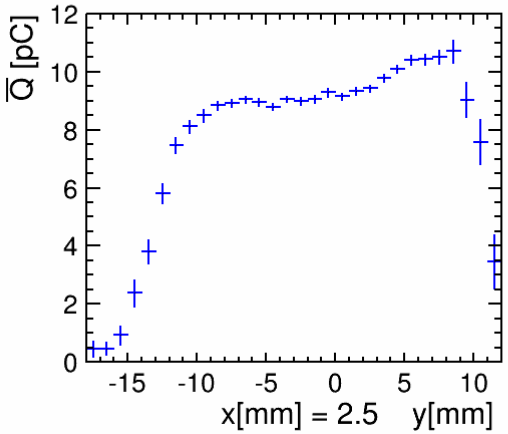
- (Tile_middle_y) – 80% * (tile_size)/2
- (Tile_middle_y) – 40% * (tile_size)/2
- (Tile_middle_y)
- (Tile_middle_y) + 40% * (tile_size)/2
- (Tile_middle_y) + 80% * (tile_size)/2

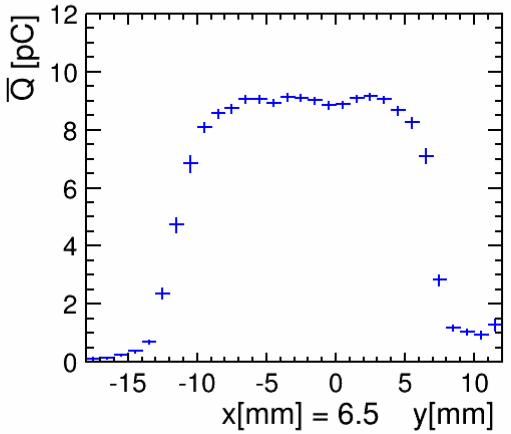
Principle of the analysis

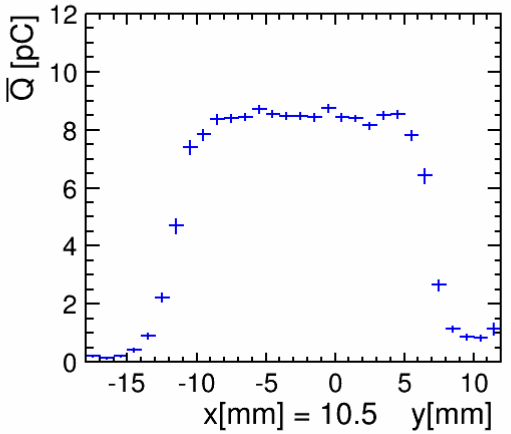










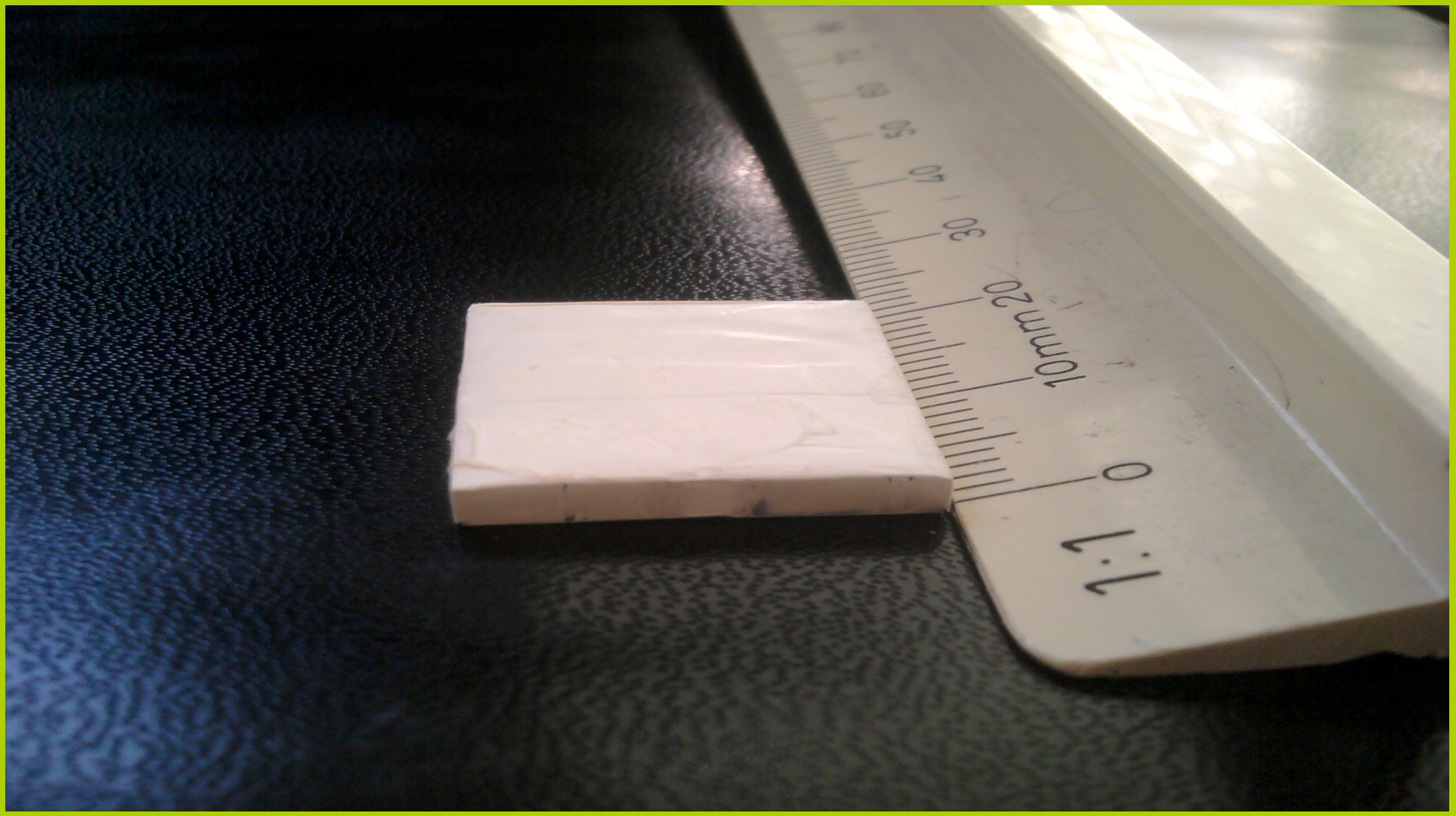


Sections at x =

- (Tile_middle_x) – 80% * (tile_size)/2
- (Tile_middle_x) – 40% * (tile_size)/2
- (Tile_middle_x)
- (Tile_middle_x) + 40% * (tile_size)/2
- (Tile_middle_x) + 80% * (tile_size)/2

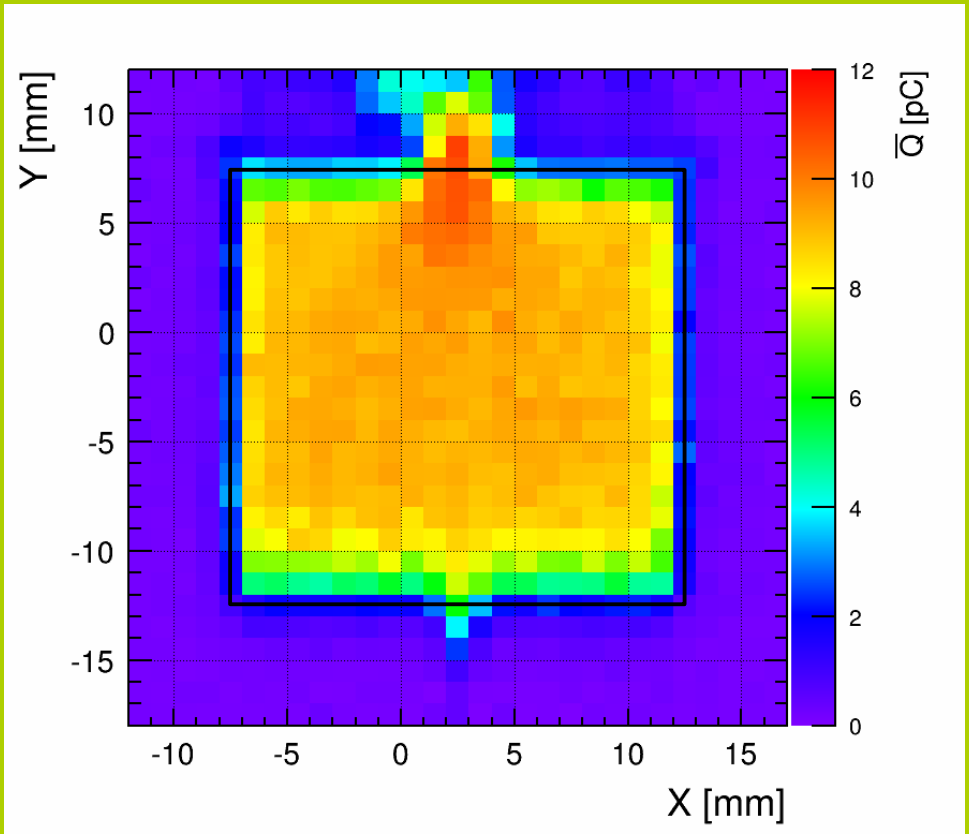
Test of reproducibility of tile scans

The □20mm Wrapped tile

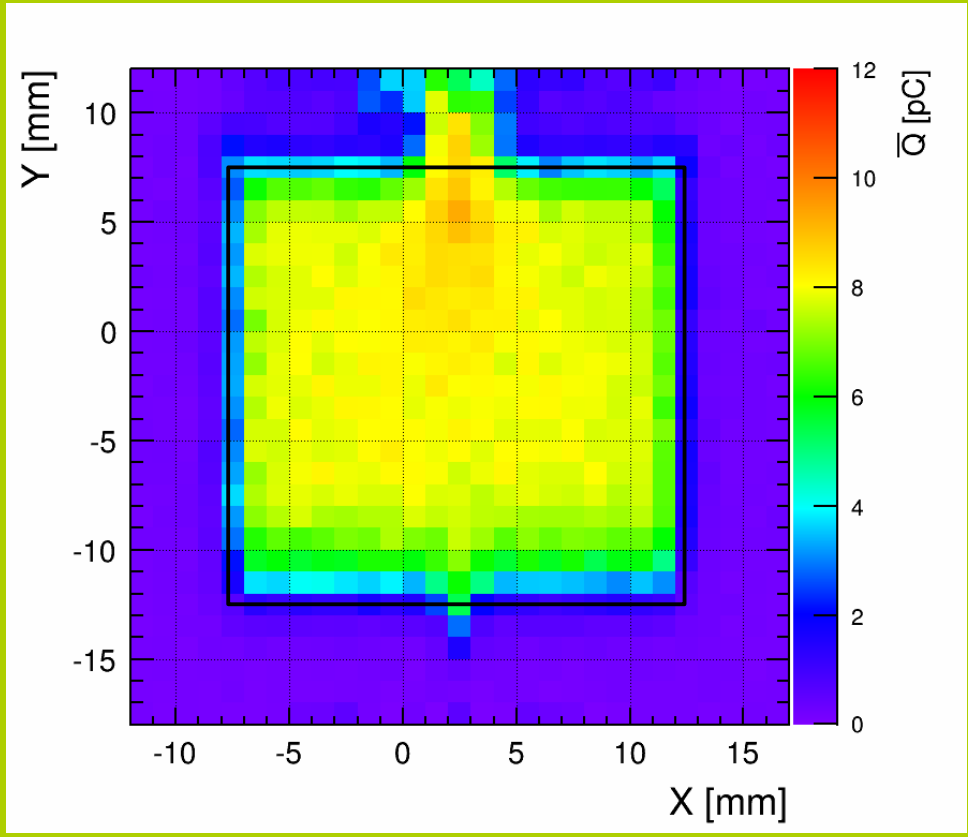


The □20mm Wrapped tile

B1W20



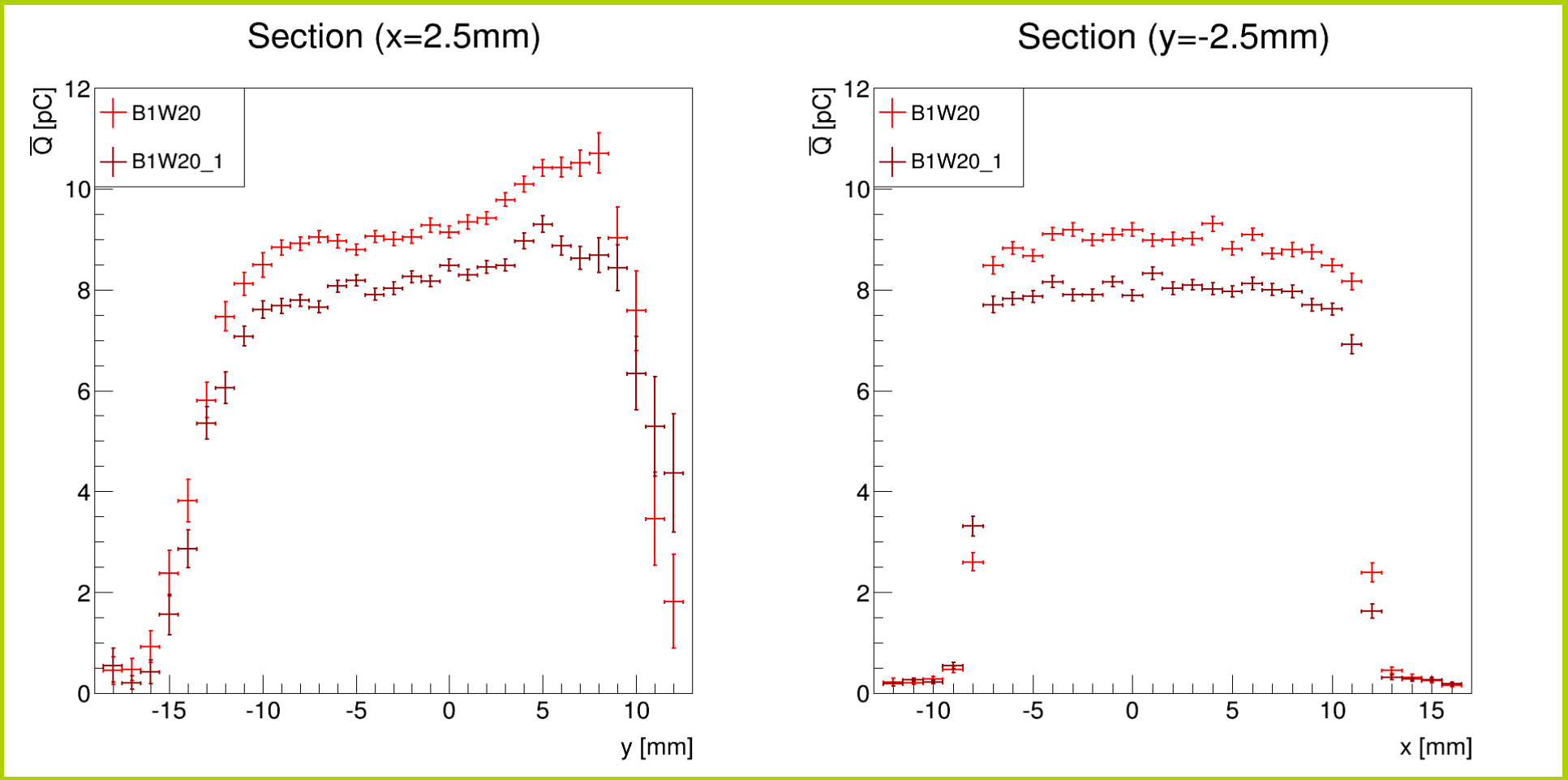
B1W20_1



Marking:

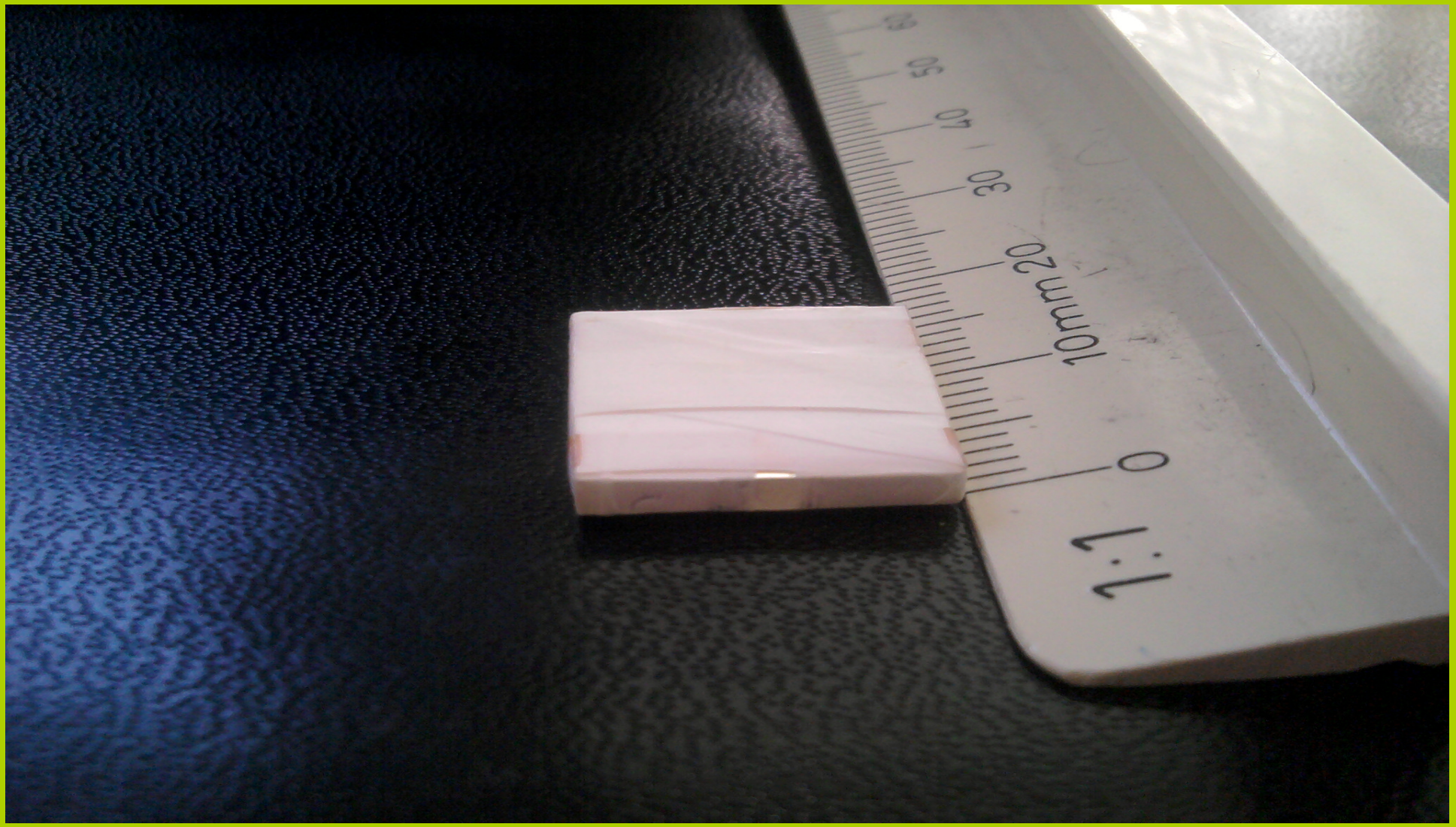
- B1W20 = Batch 1, Wrapped, □20mm tile, first measurement
- B1W20_1 = Batch 1, Wrapped, □20mm tile, second measurement

The □20mm Wrapped tile



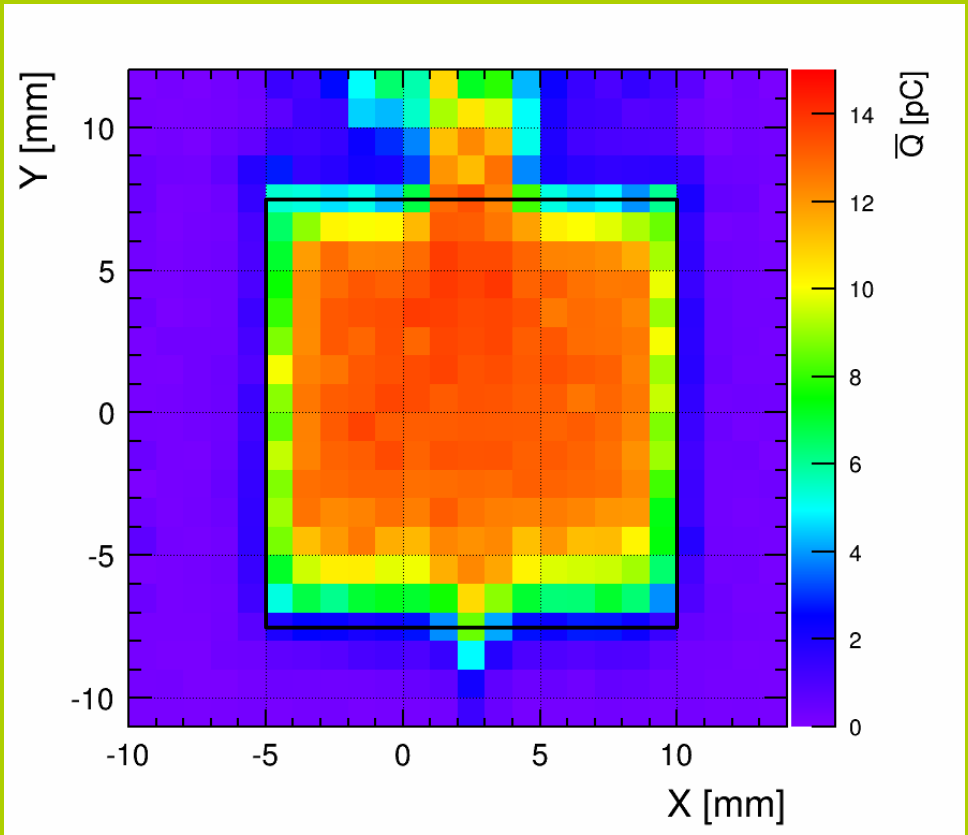
- The measurements don't agree within uncertainties:
  ~ 1 pC shift (~11% less charge compare to the first measurement)
- $\bar{Y}\bar{Q}$ section: Peak at the SiPM
- Charge-drop at the edges:
  ~2mm in x direction
  ~4mm in y direction

The □15mm Wrapped tile

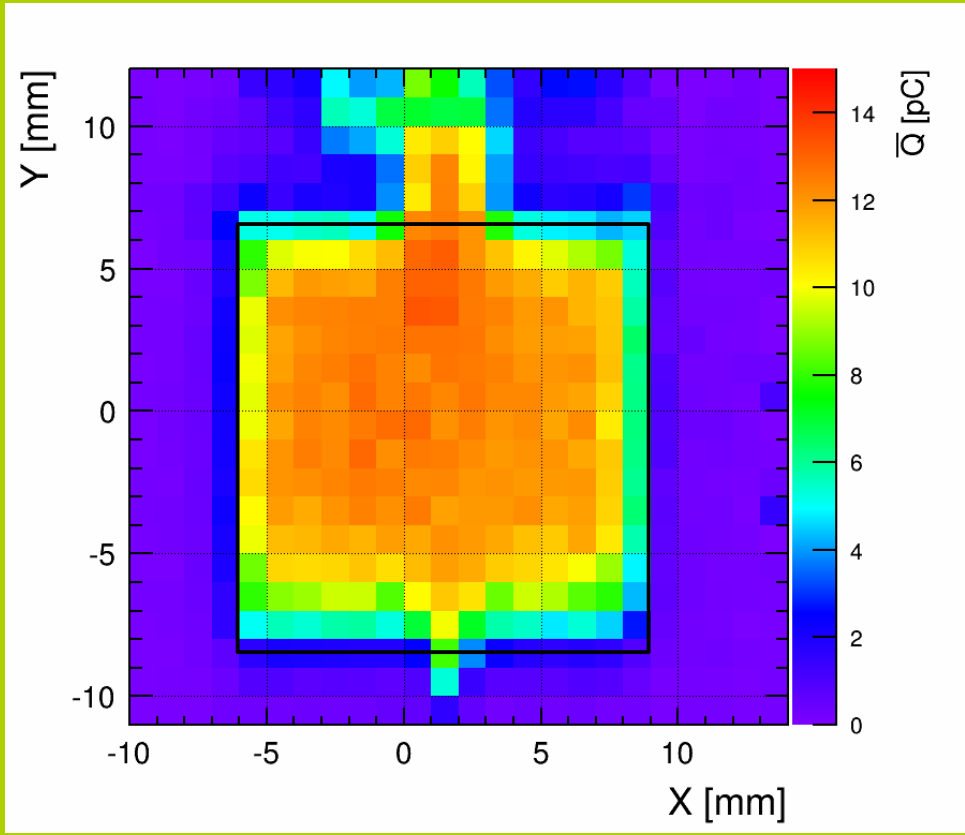


The □15mm Wrapped tile

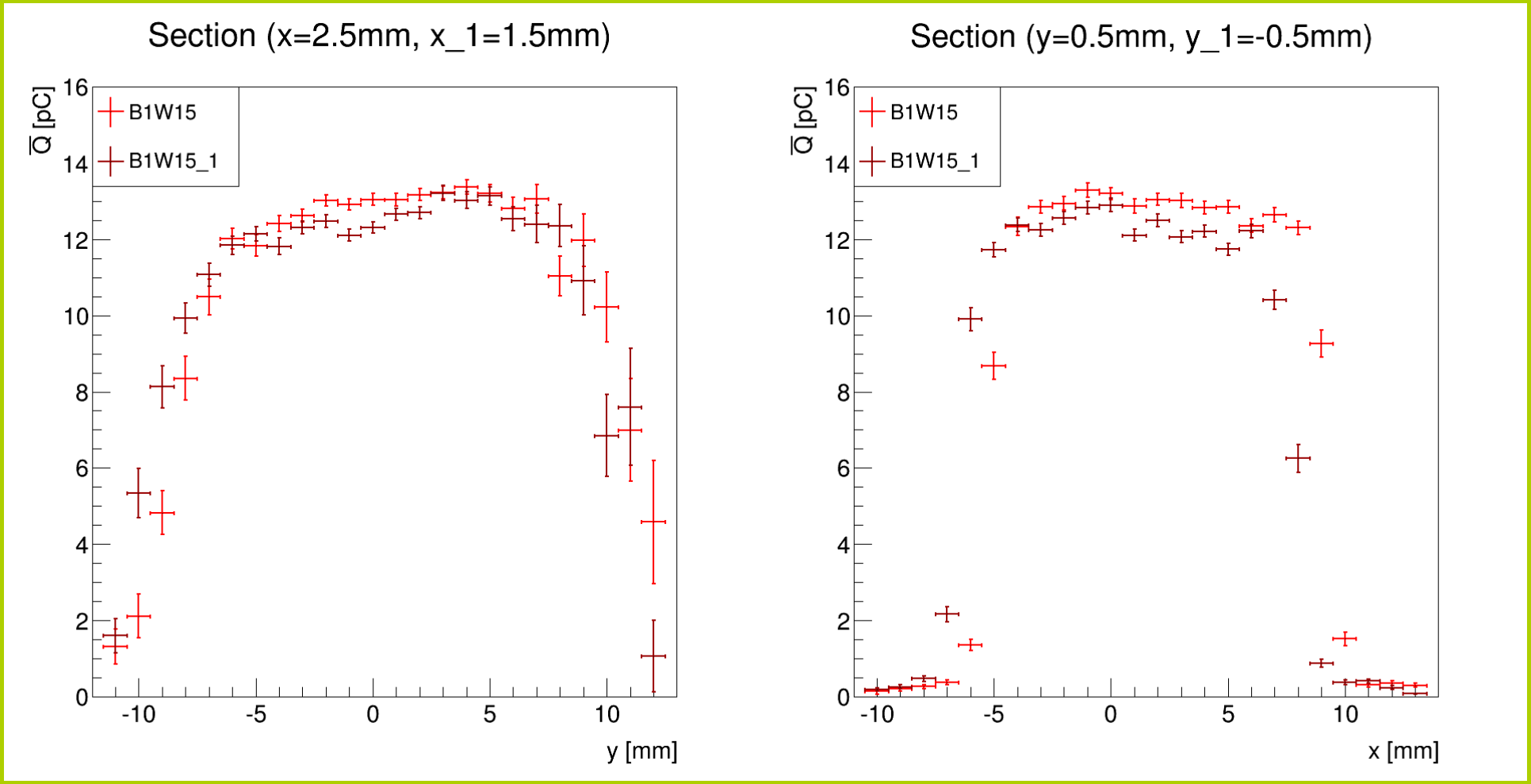
B1W15



B1W15_1

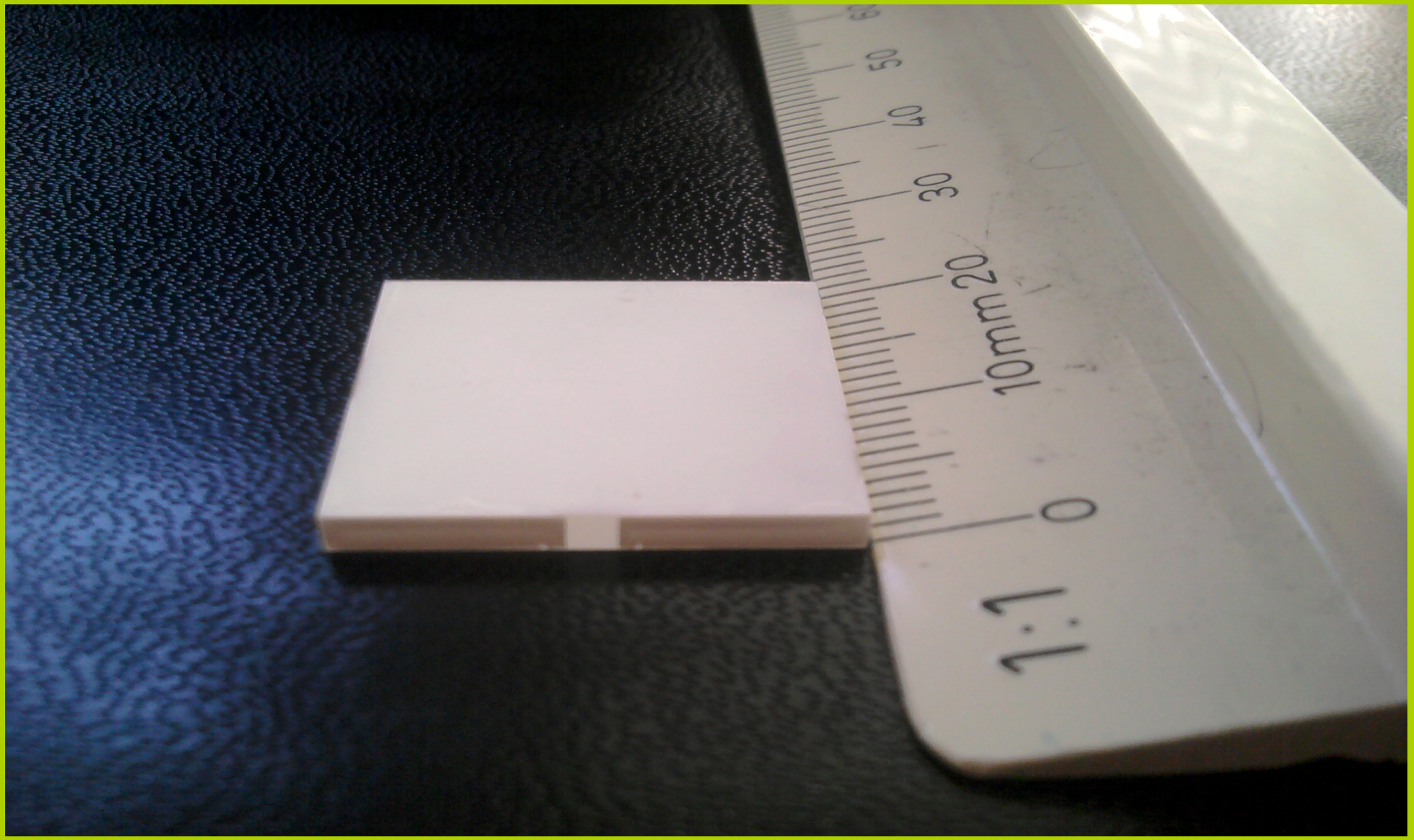


The □15mm Wrapped tile



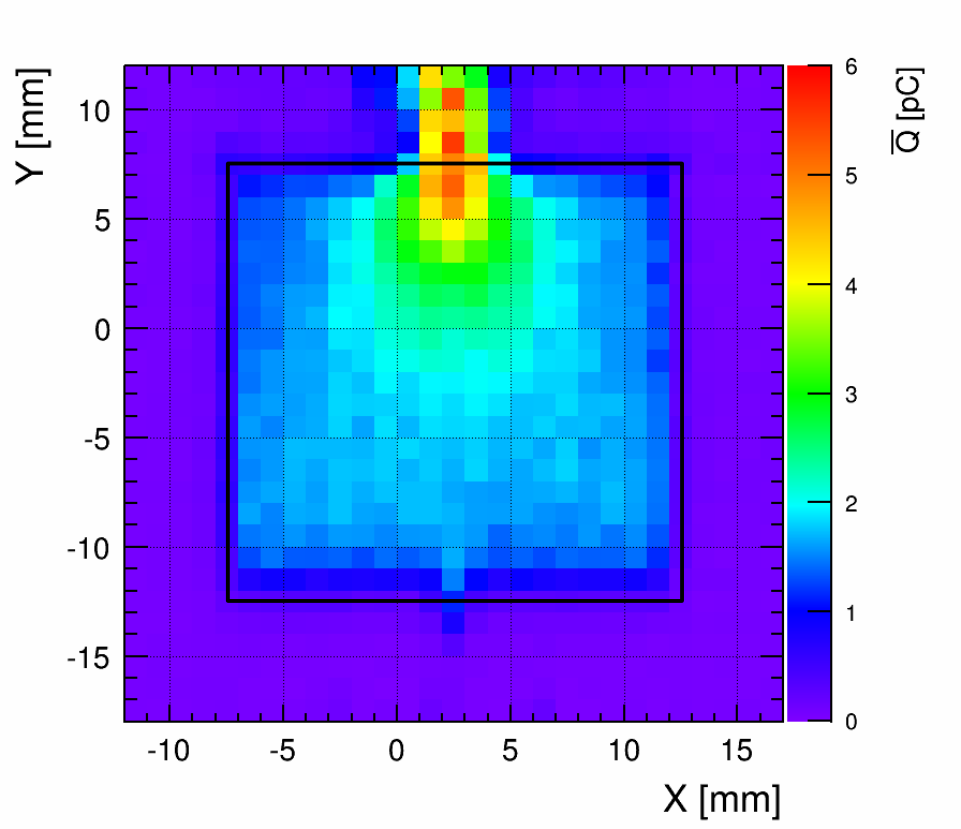
- The measurements don't agree within uncertainties:
  ~ 0.5 pC shift (~4% less charge compare to the first measurement)

The □20mm Painted tile

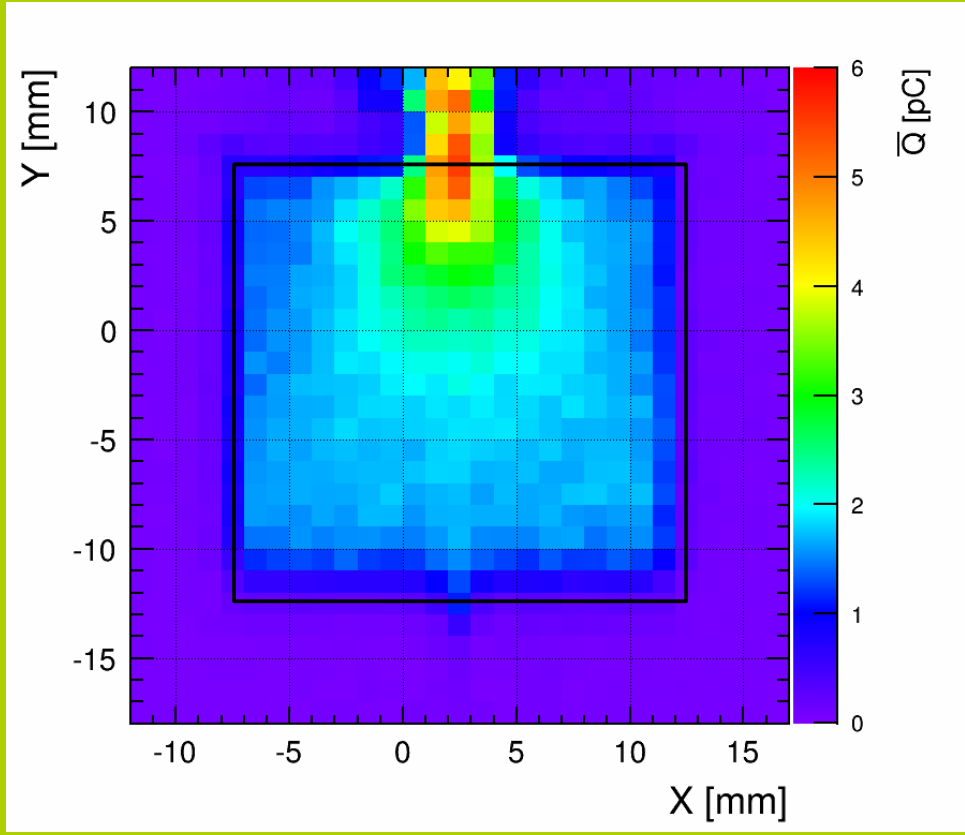


The □20mm Painted tile

B1P20



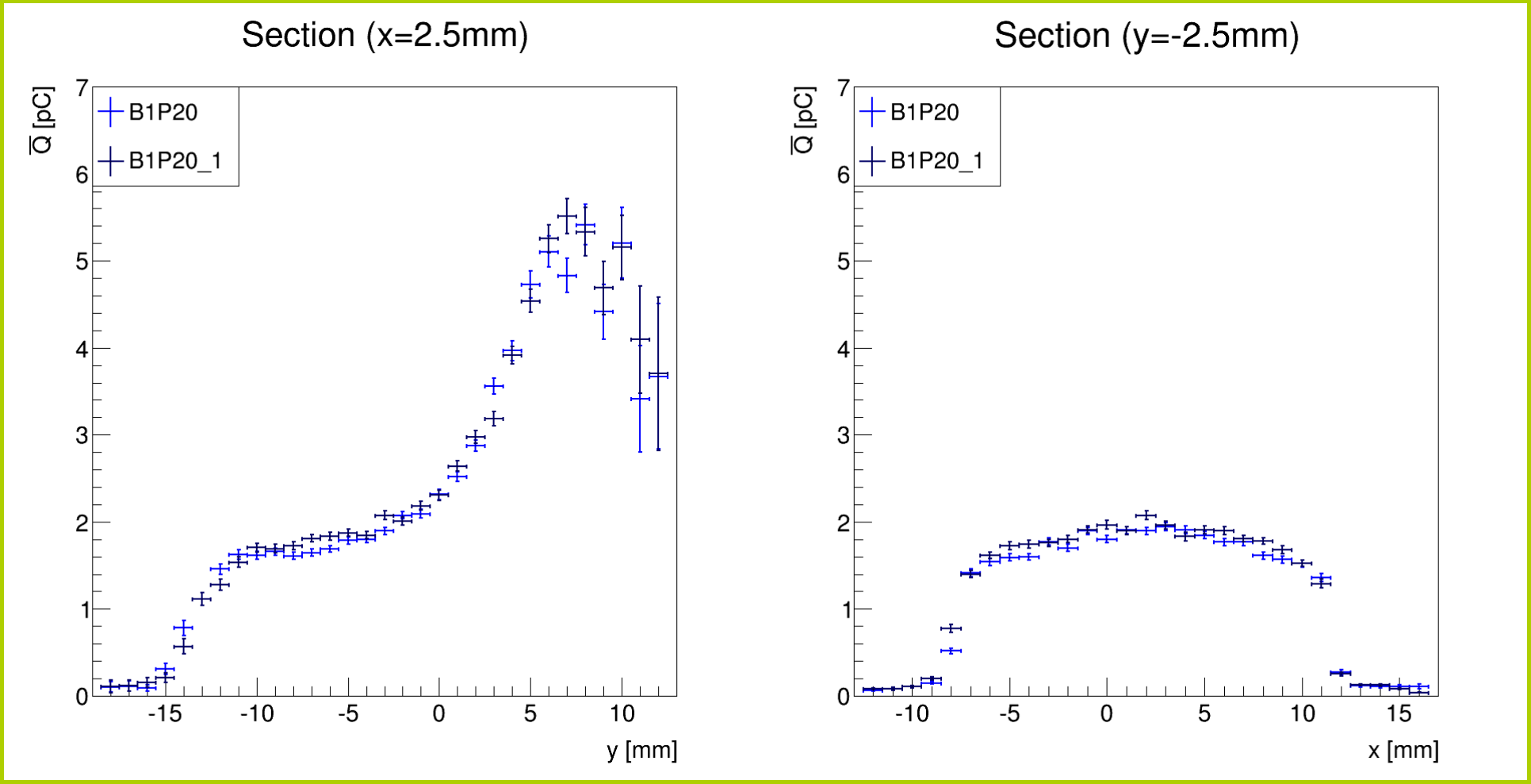
B1P20_1



Marking:

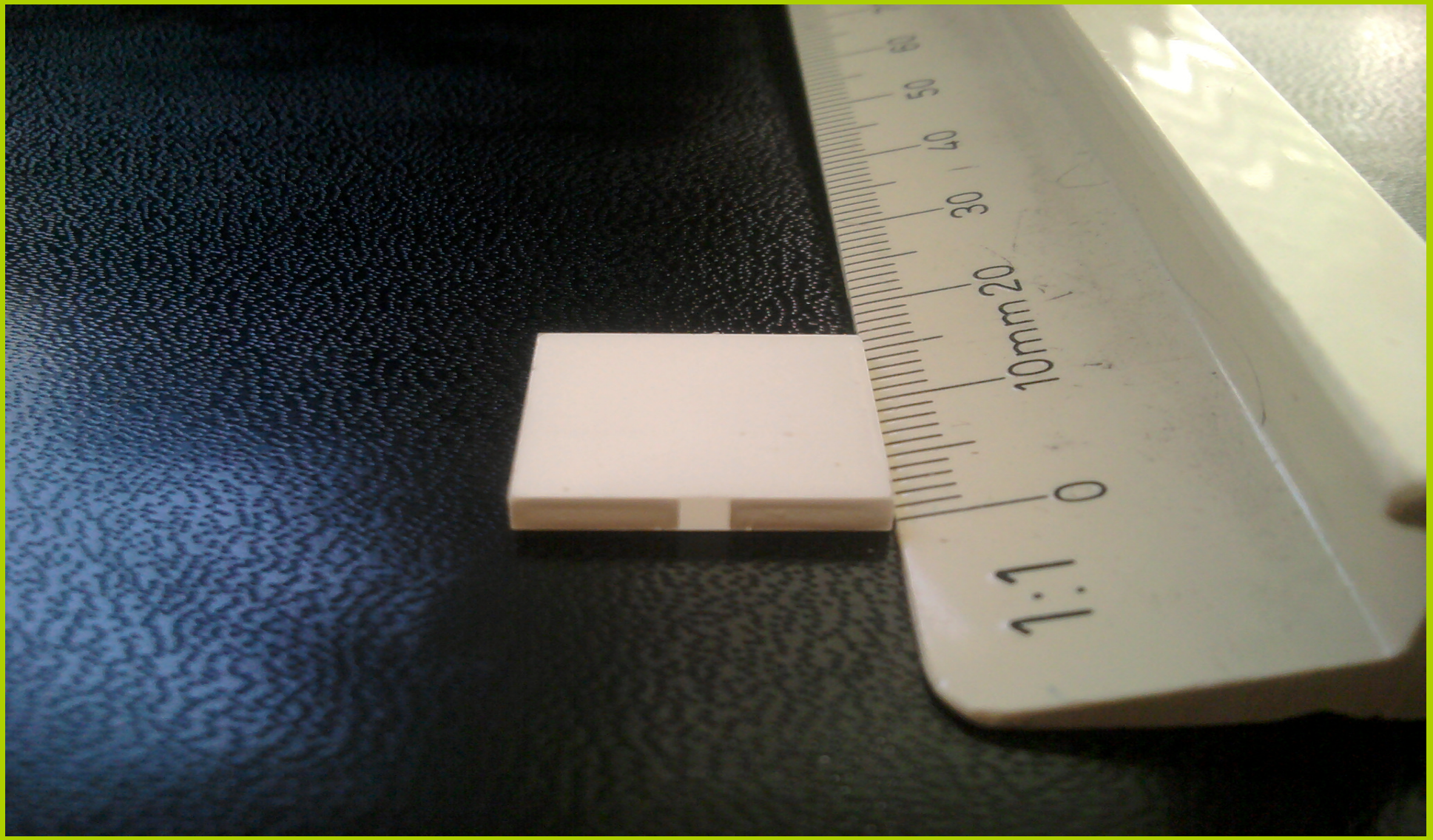
- B1P20 = Batch 1, Painted, □20mm tile, first measurement
- B1P20_1 = Batch 1, Painted, □20mm tile, second measurement

The □20mm Painted tile



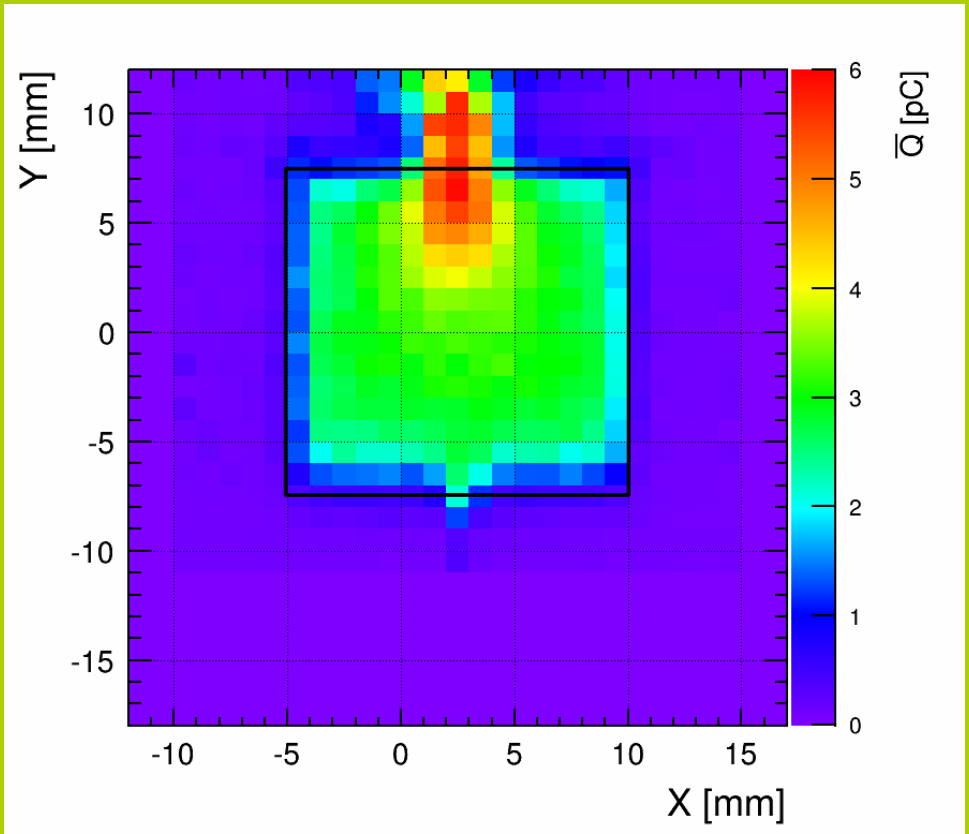
- The measurements agree within uncertainties
- Y$\overline{Q}$ section: Peak at the SiPM

The □15mm Painted tile

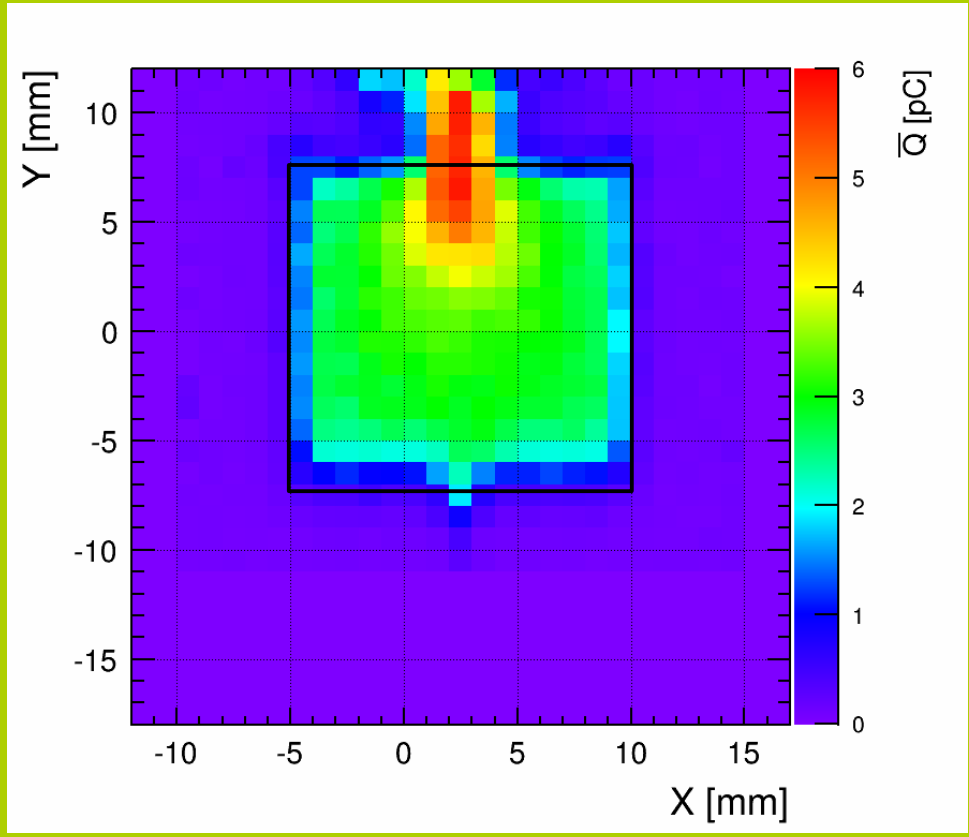


The □15mm Painted tile

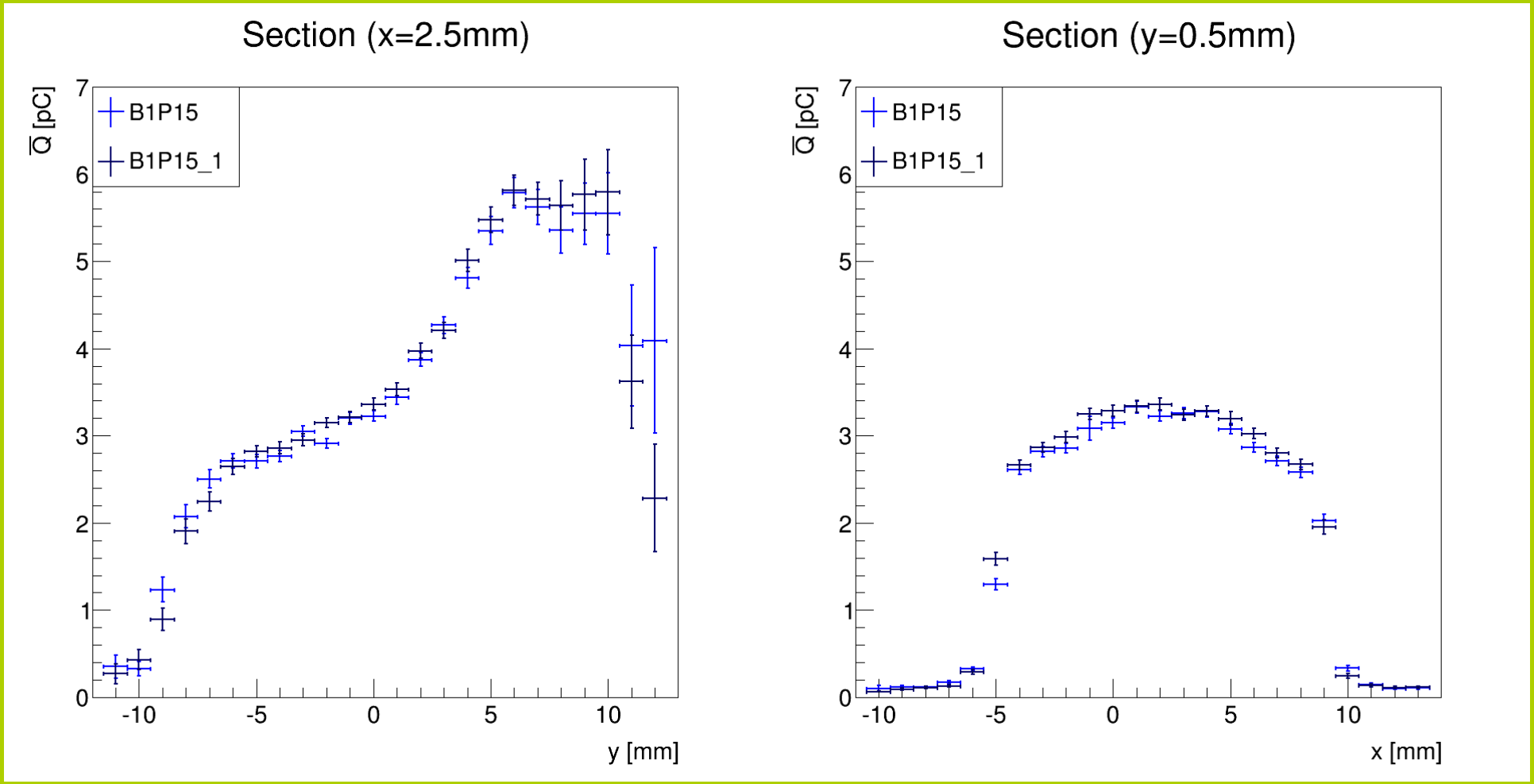
B1P15



B1P15_1



The □15mm Painted tile



- The measurements agree within uncertainties
- $Y\overline{Q}$ section: Peak at the SiPM
- The $X\overline{Q}$ section: less uniformity in comparison to the 15mm wrapped tiles (painted: ~25% difference between edge and the middle region; wrapped: ~8%)

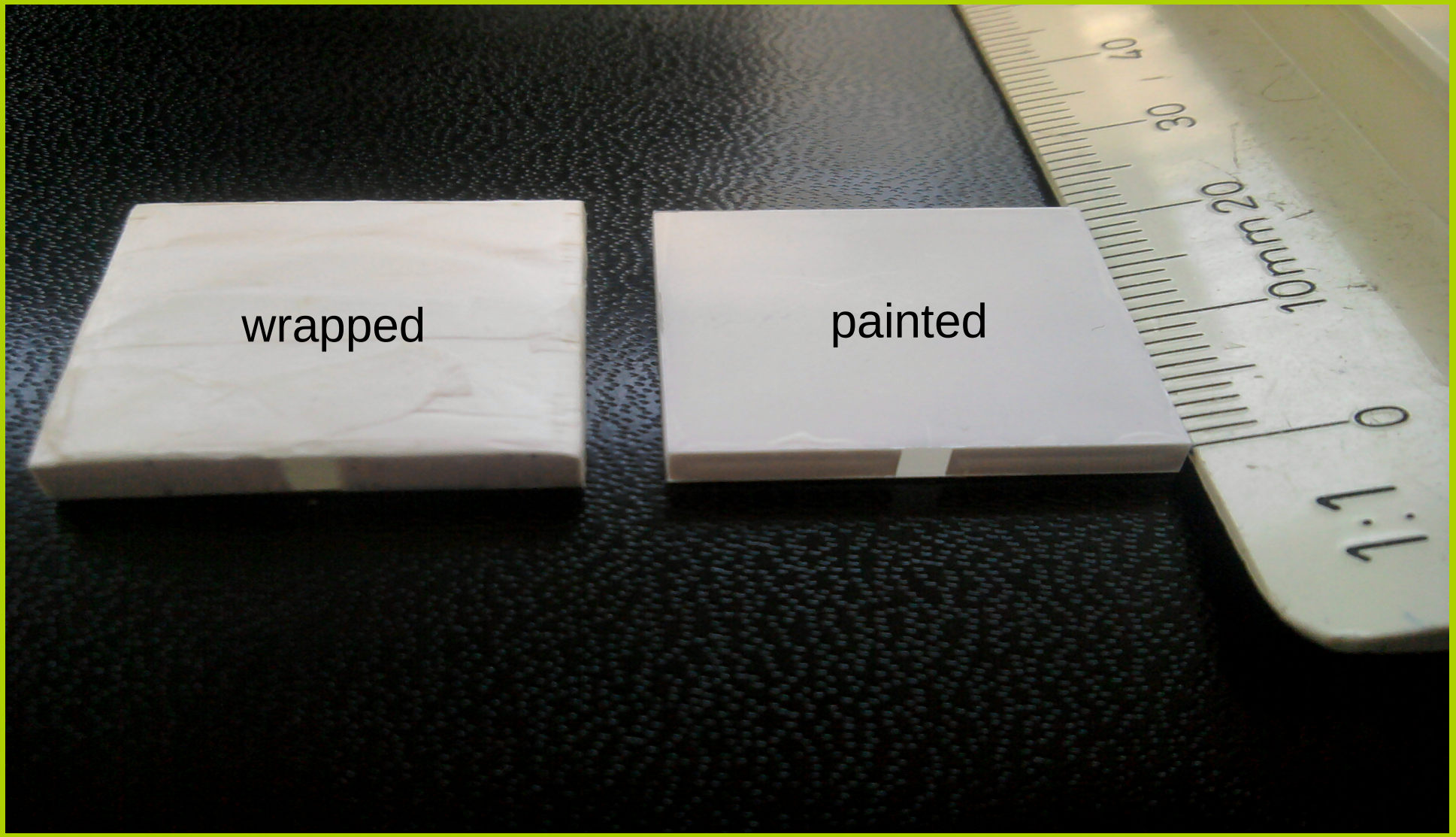
Conclusion on reproducibility of measurement

- Wrapped tiles: ~0.5 – 1 pC shift (~4% - 11% difference compare to the first measurement) between the measurements
- Painted tiles: The measurements agree within uncertainties

- In the following just the results of the 1. measurement

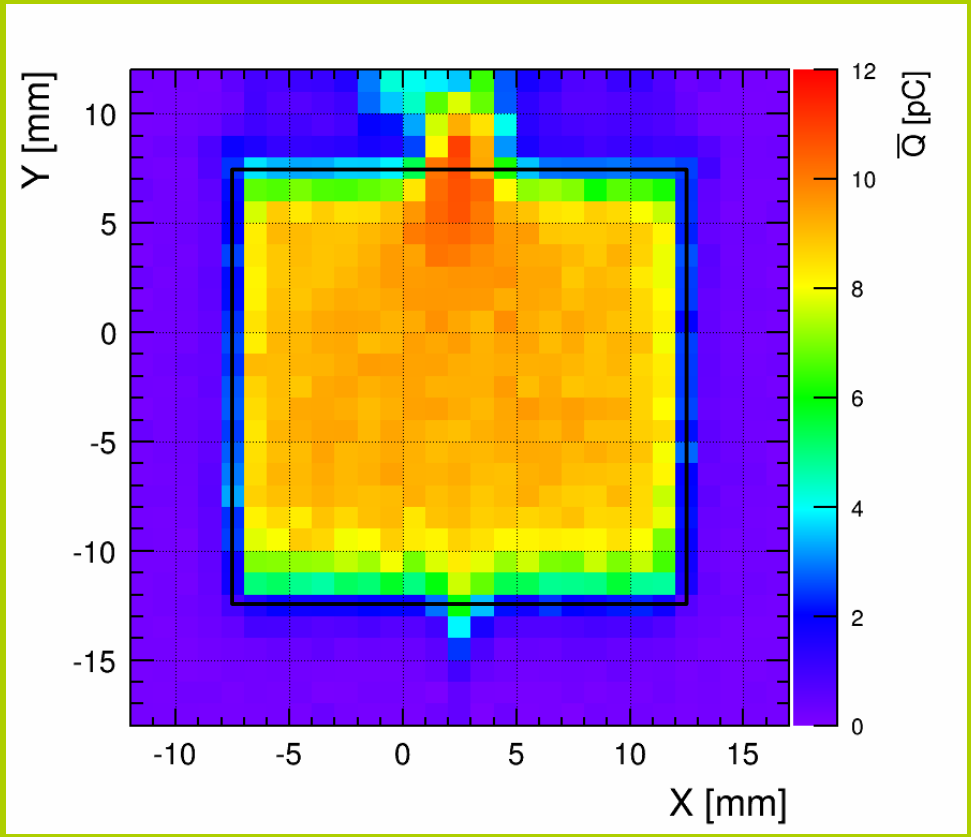
Comparison of wrapped and painted tiles

The □20mm tiles

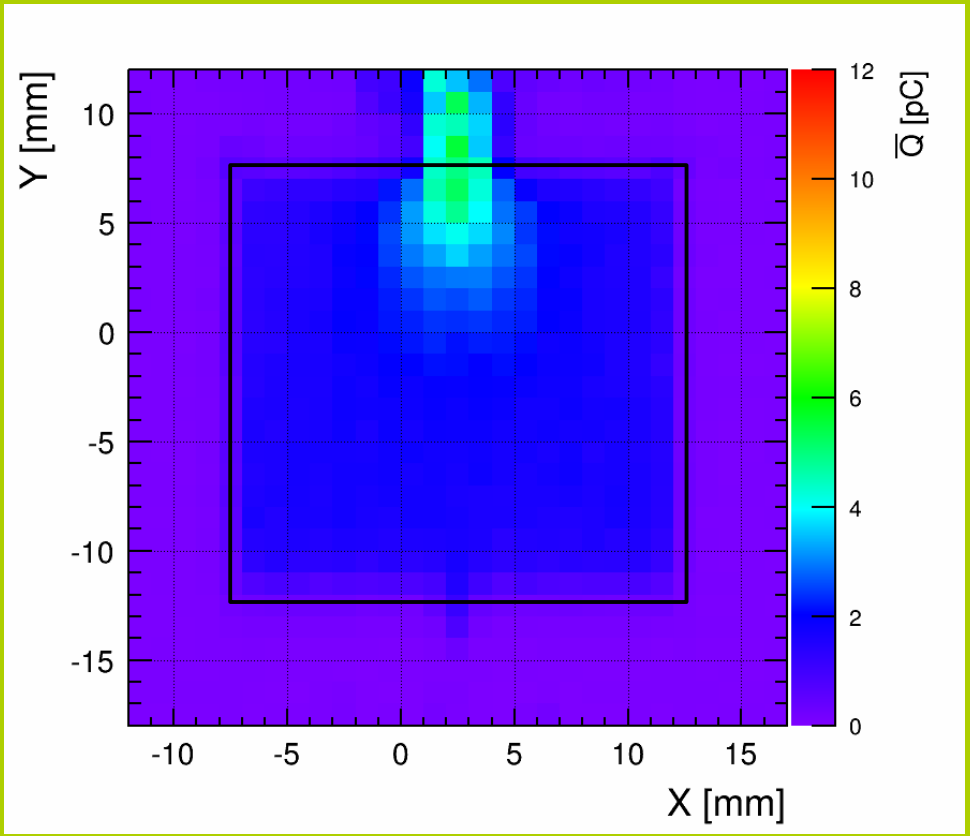


The □20mm tiles

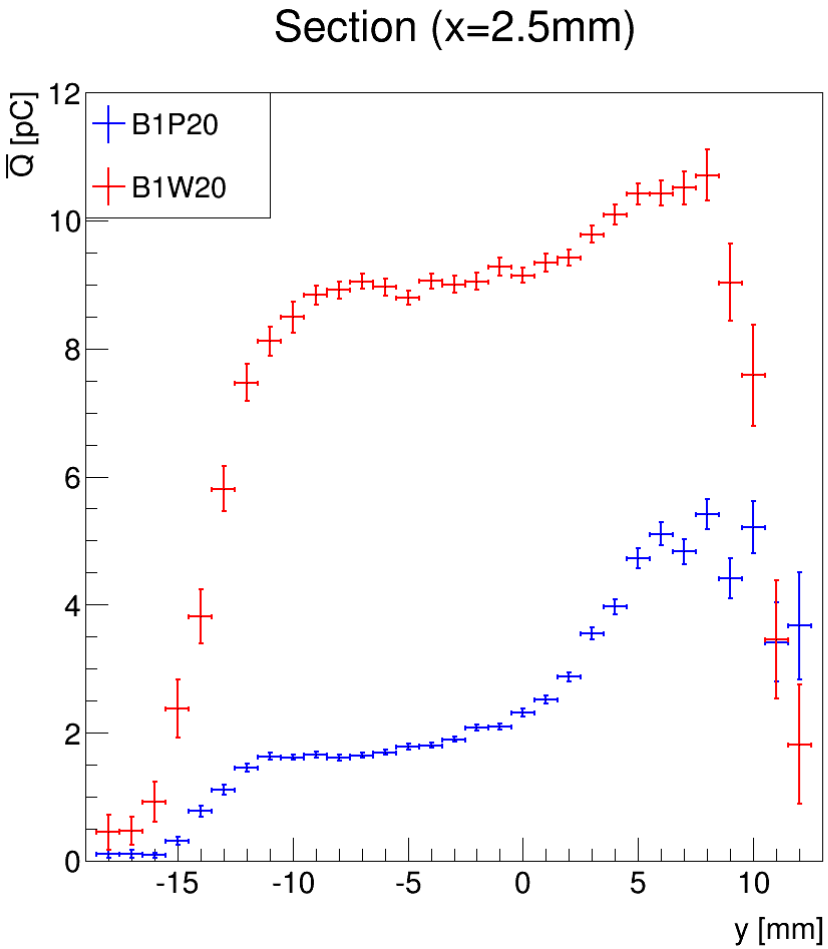
B1W20

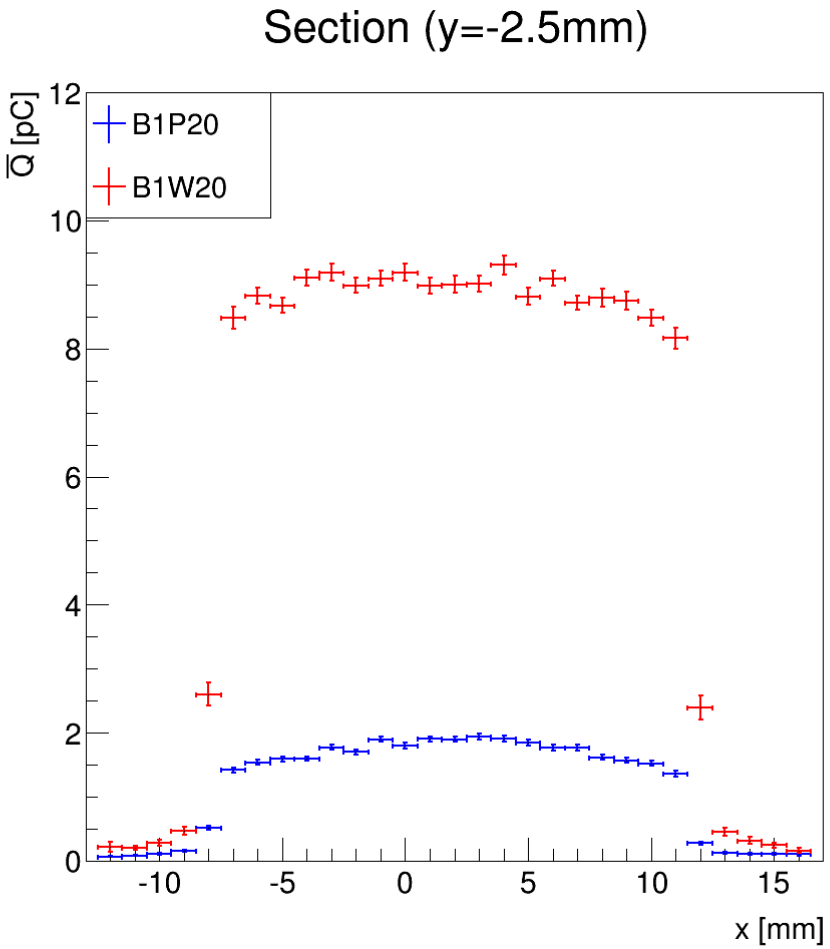


B1P20



The □20mm tiles



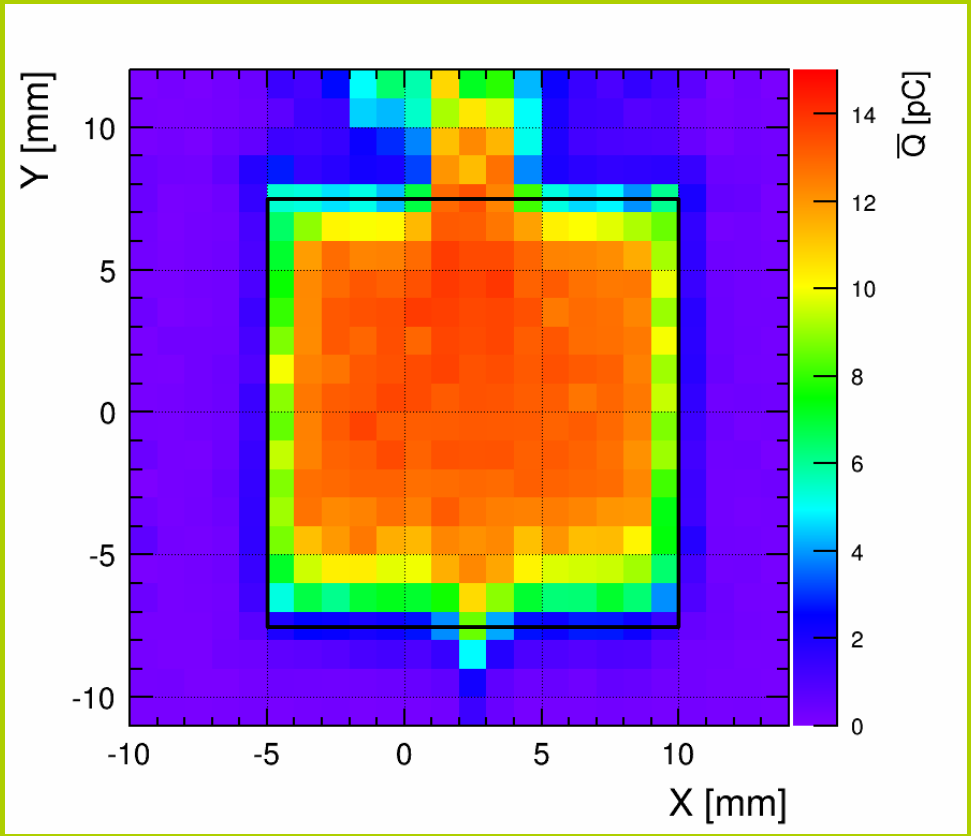


The light yield of the wrapped □20mm tile ~4.5 times higher

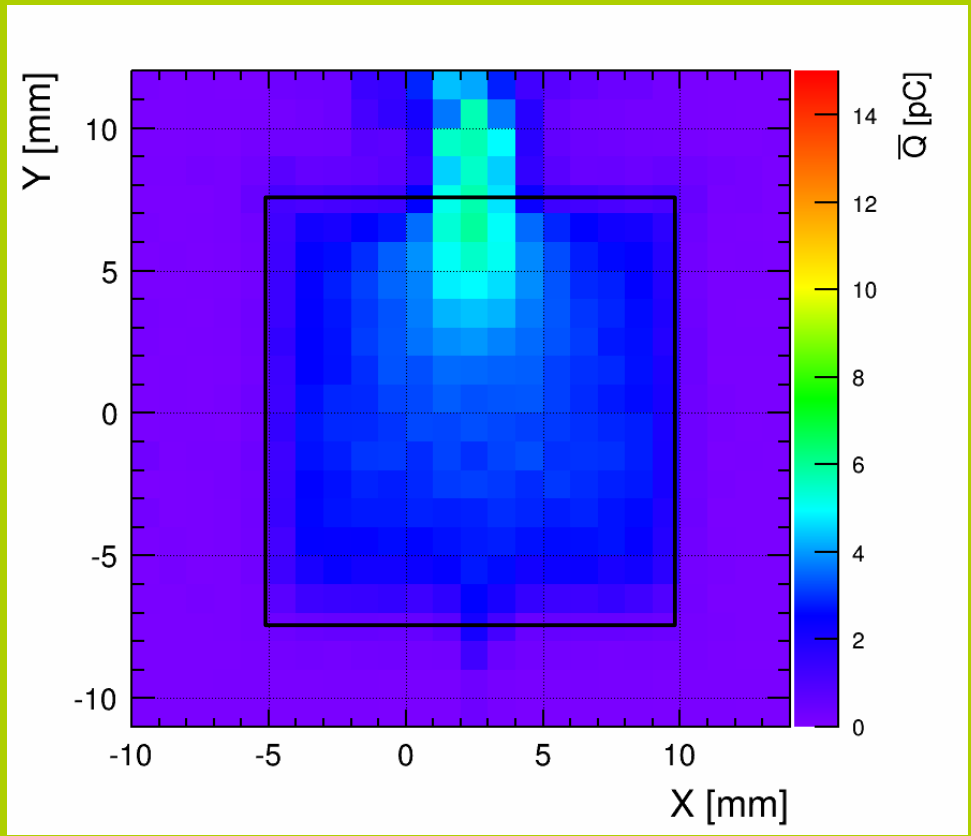
The □15mm tiles

The □15mm tiles

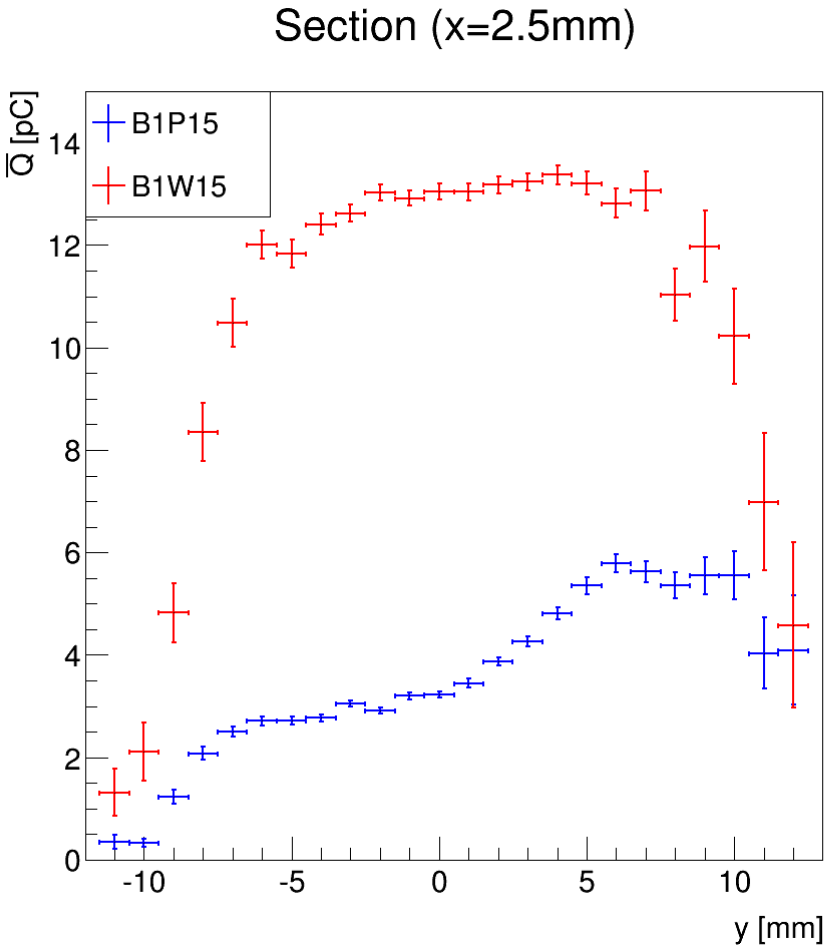
B1W15

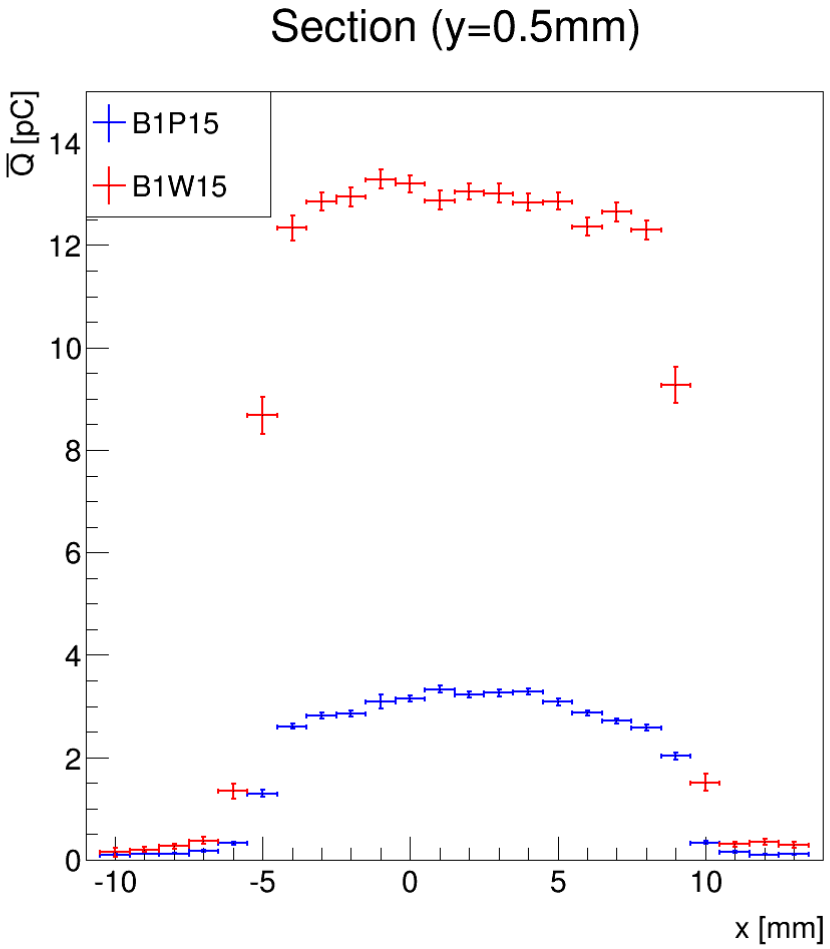


B1P15



The □15mm tiles

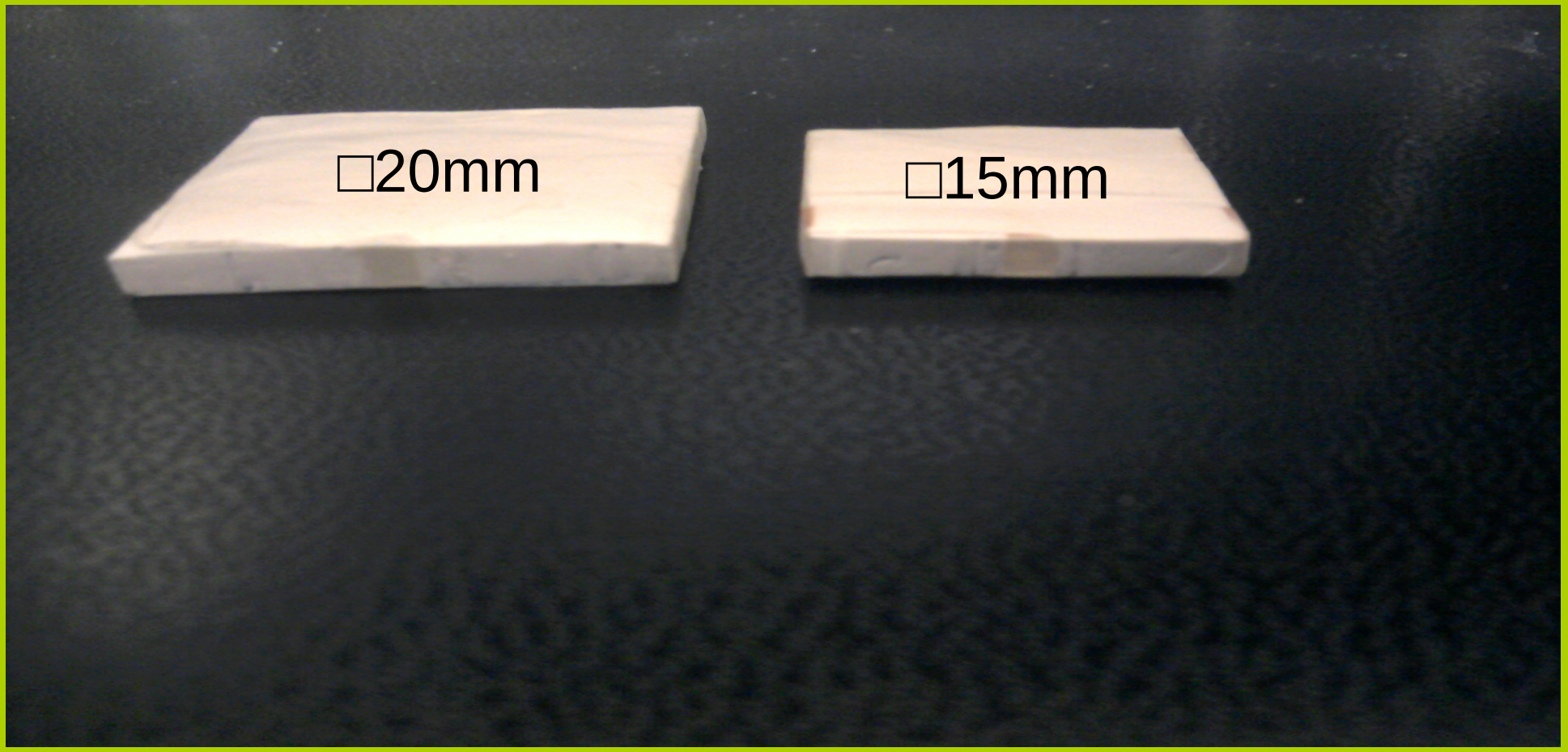




Same light yield difference as observed for the 20mm tiles (the light yield of the wrapped tile ~4.5 times higher)

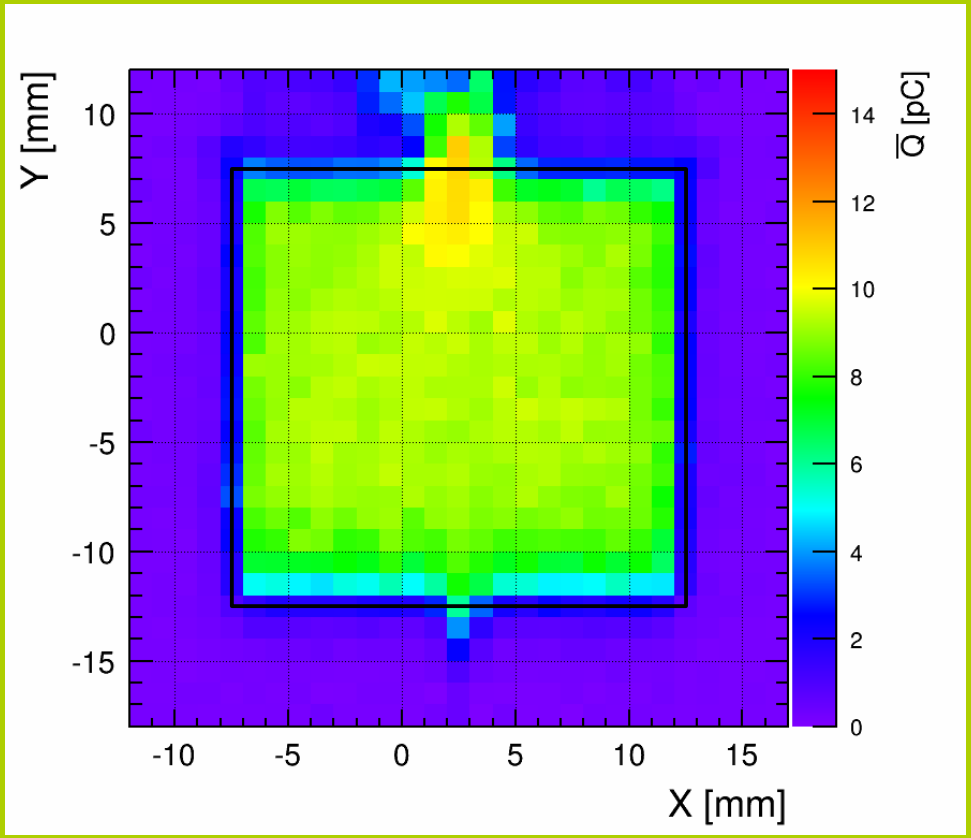
Comparison of 15mm and 20mm tiles

The wrapped tiles

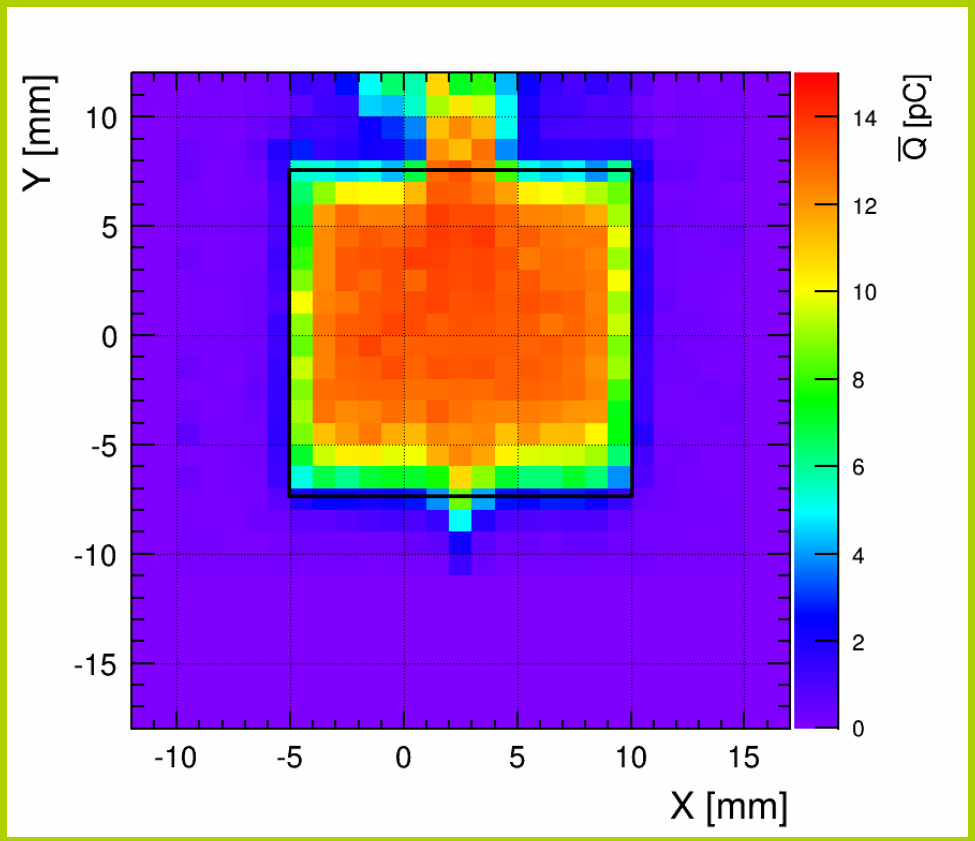


The wrapped tiles

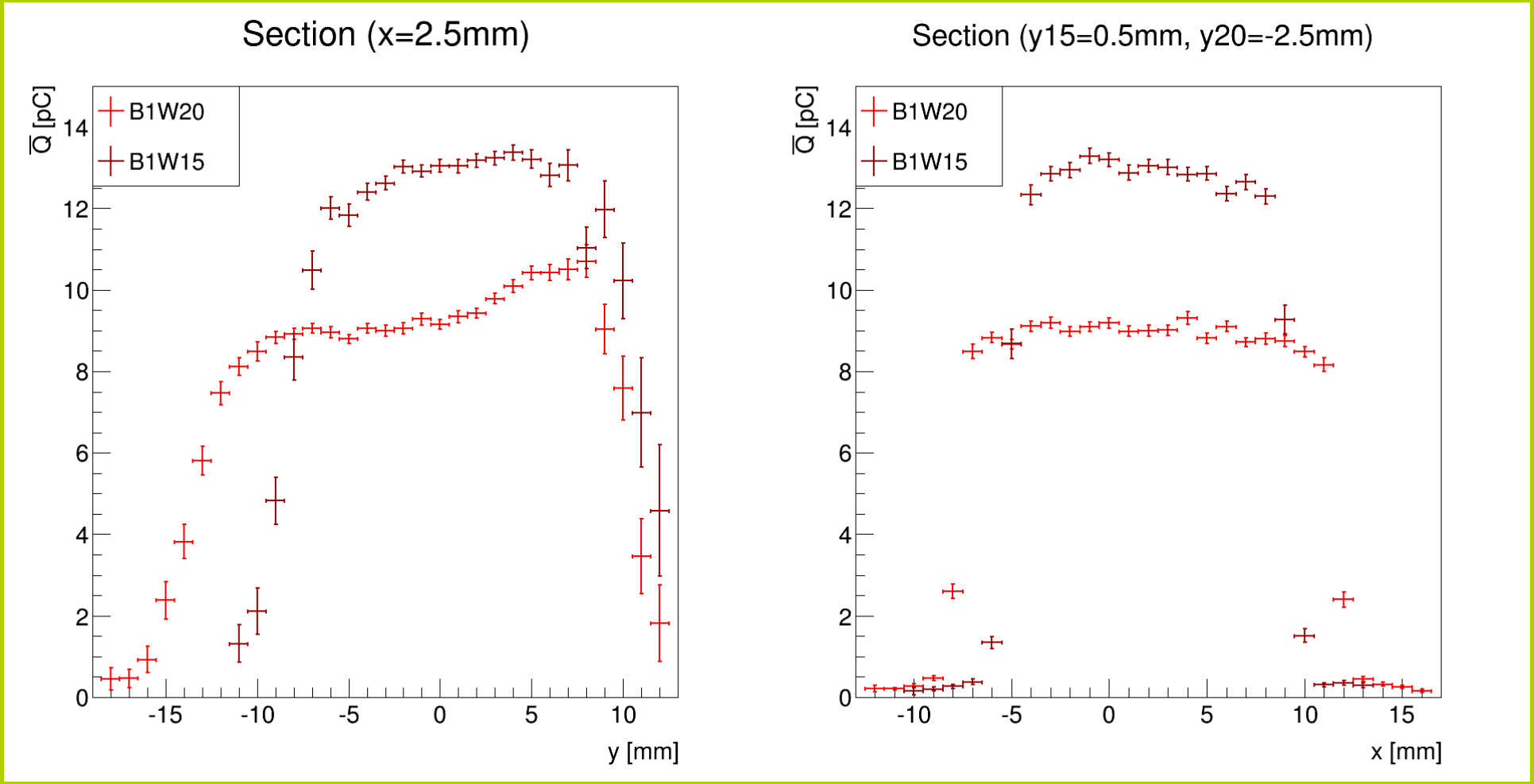
B1W20



B1W15

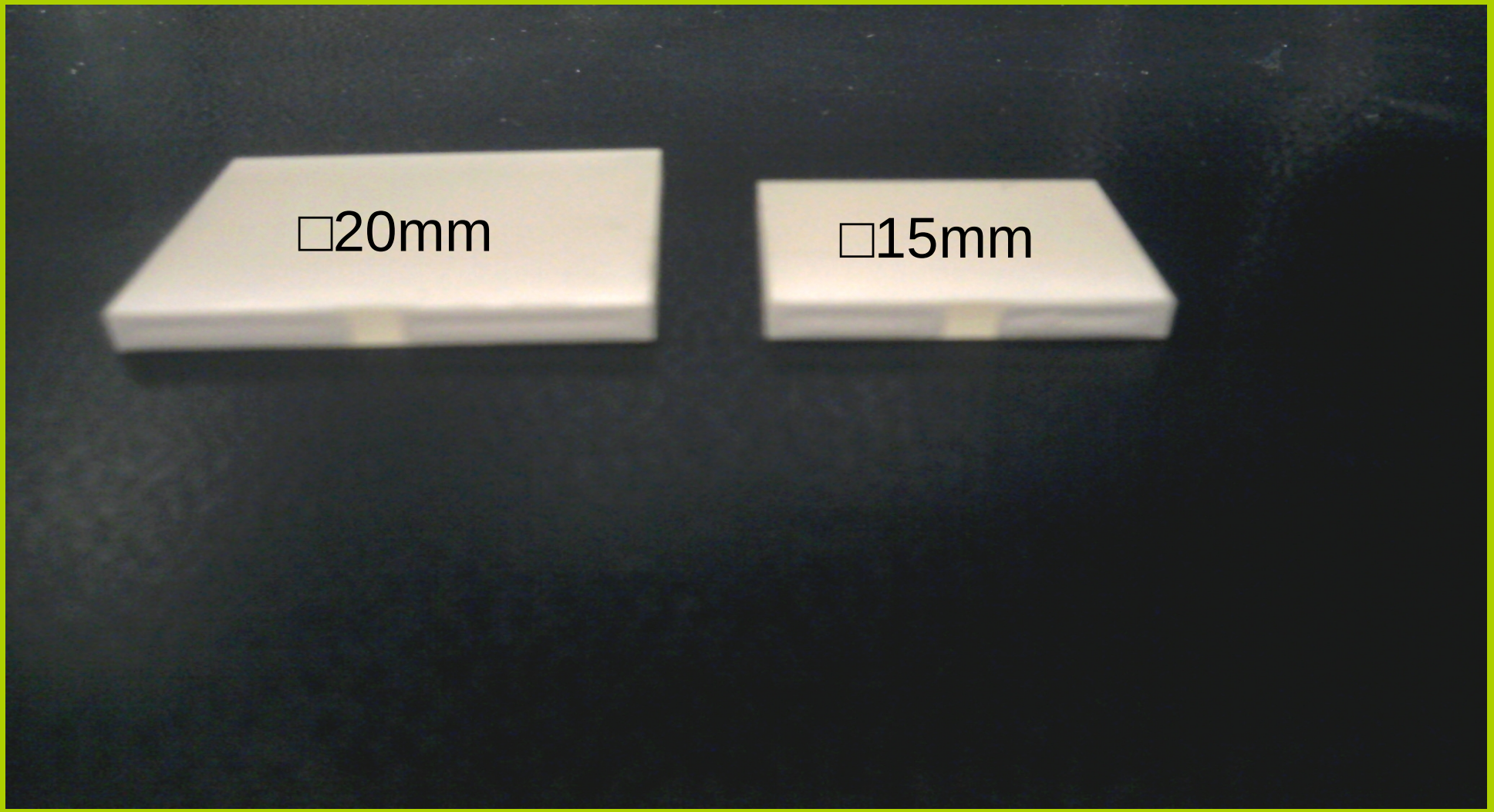


The wrapped tiles



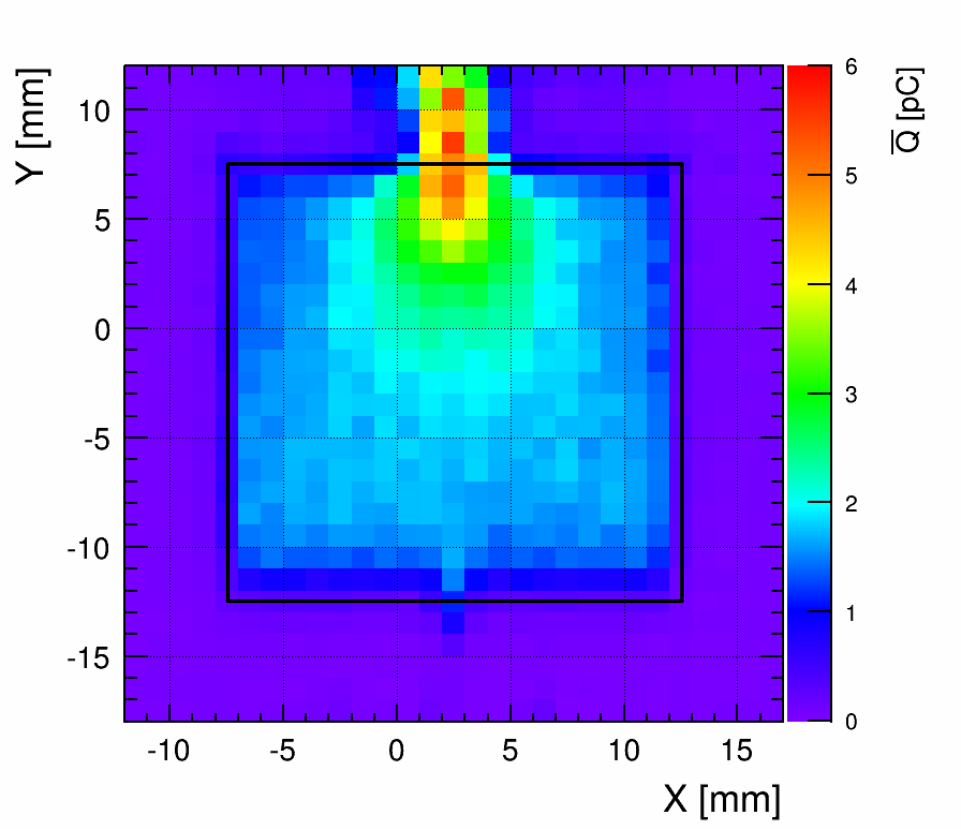
The light yield of the wrapped □15mm tile ~1.4 times higher

The painted tiles

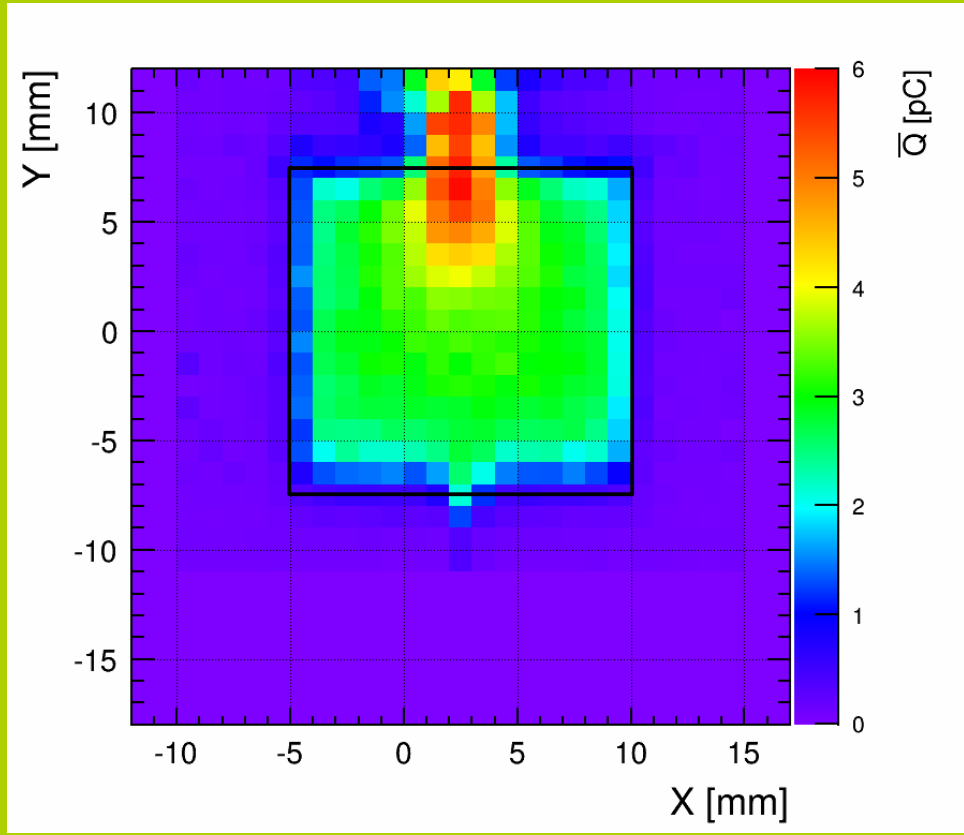


The painted tiles

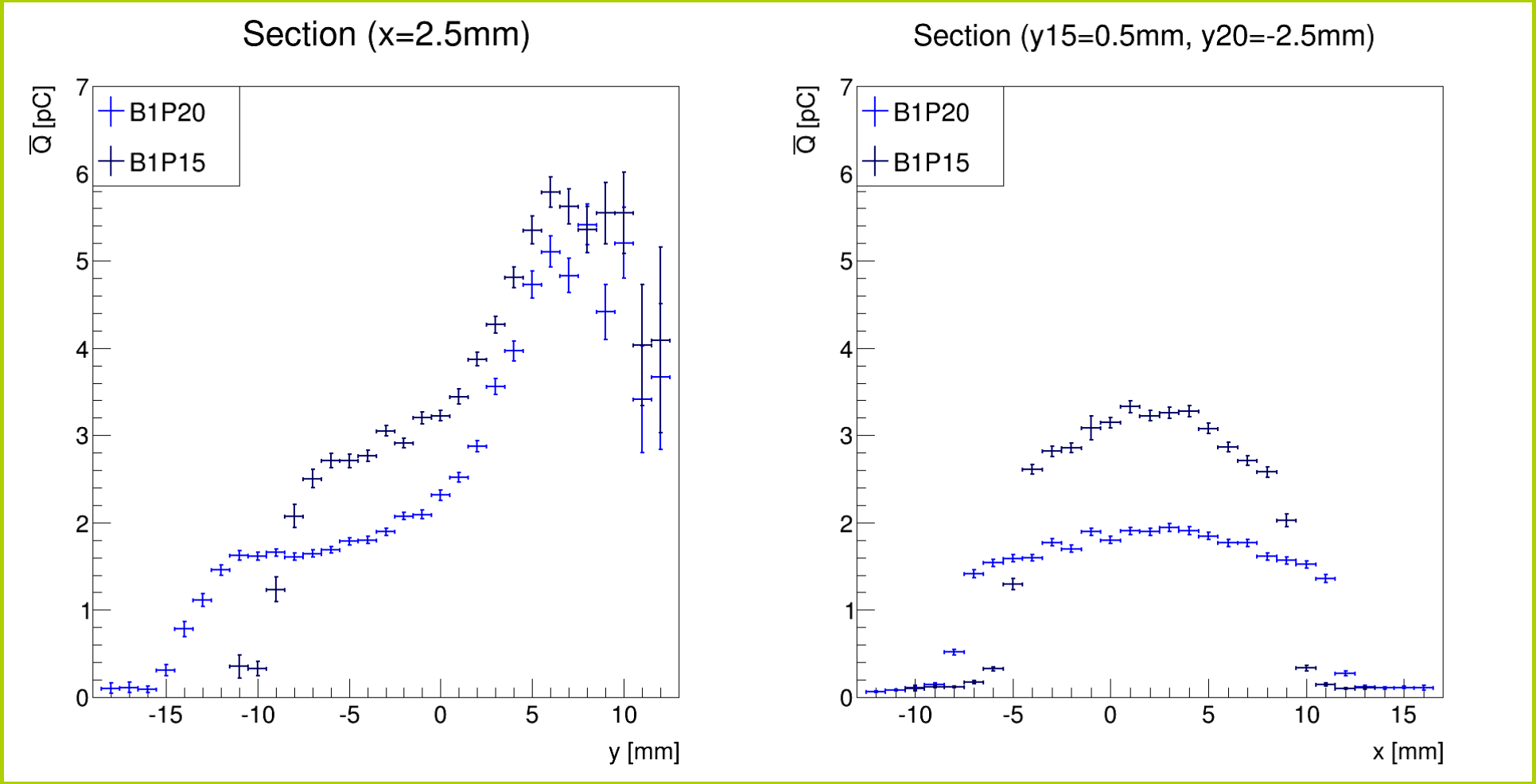
B1P20



B1P15

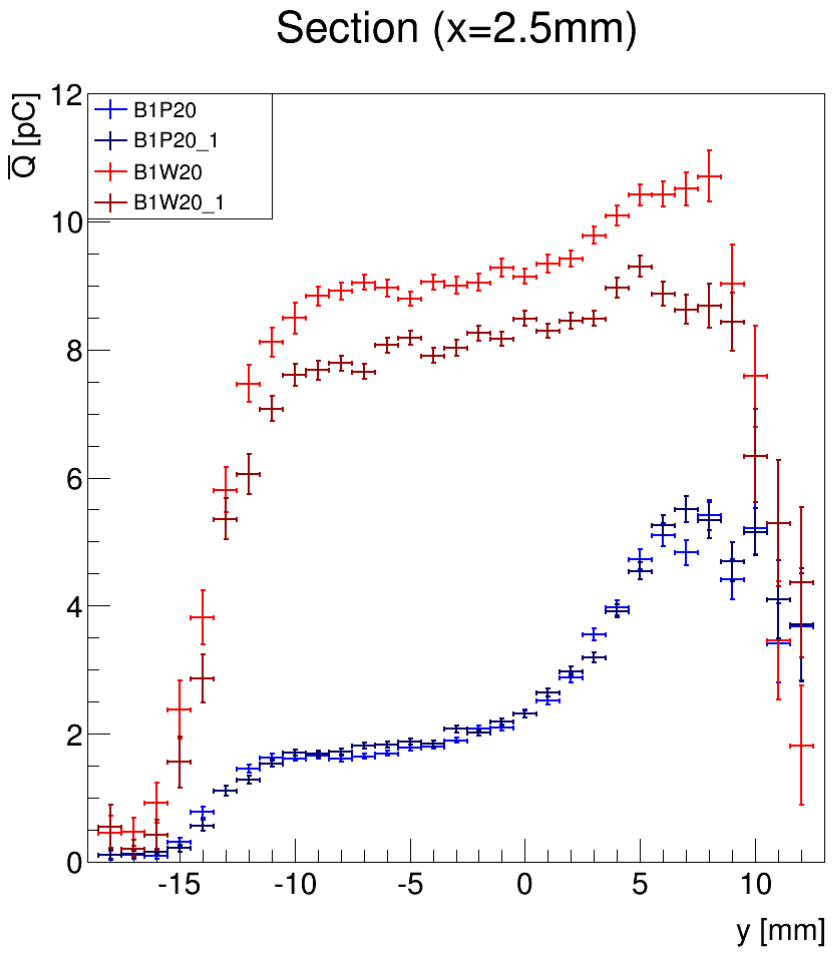


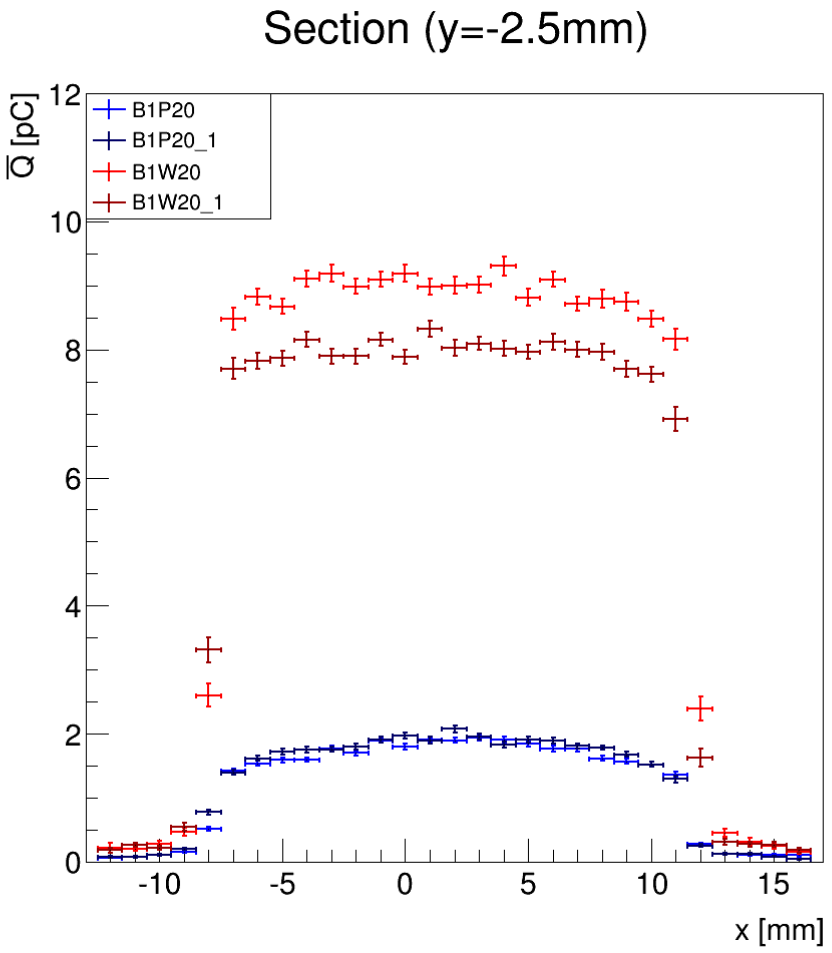
The painted tiles



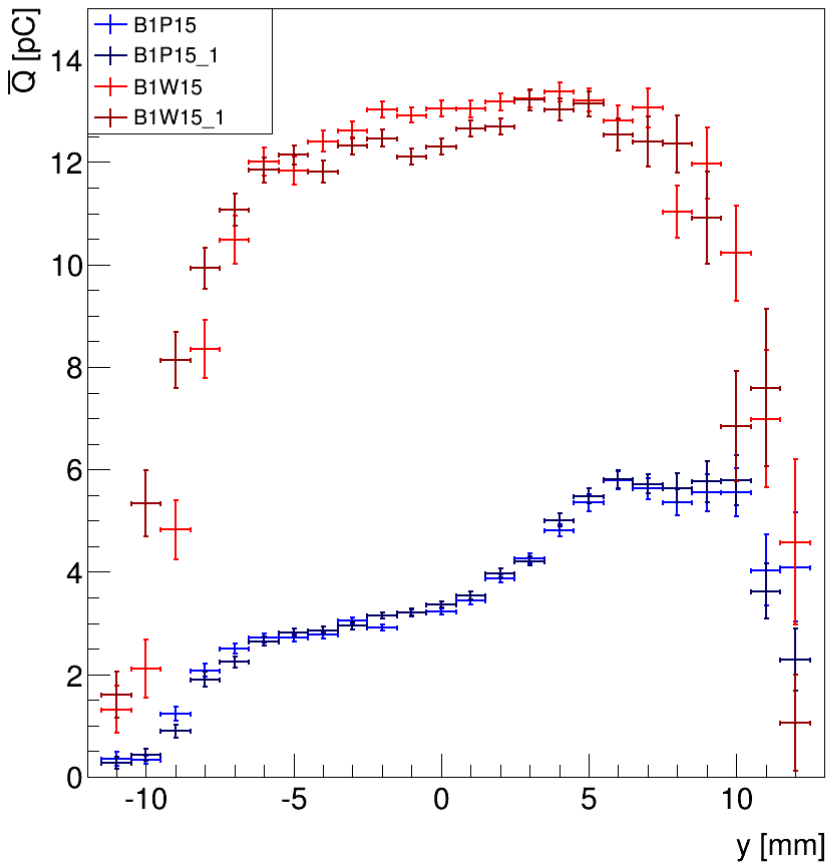
The light yield of the painted □15mm tile ~1.7 times higher

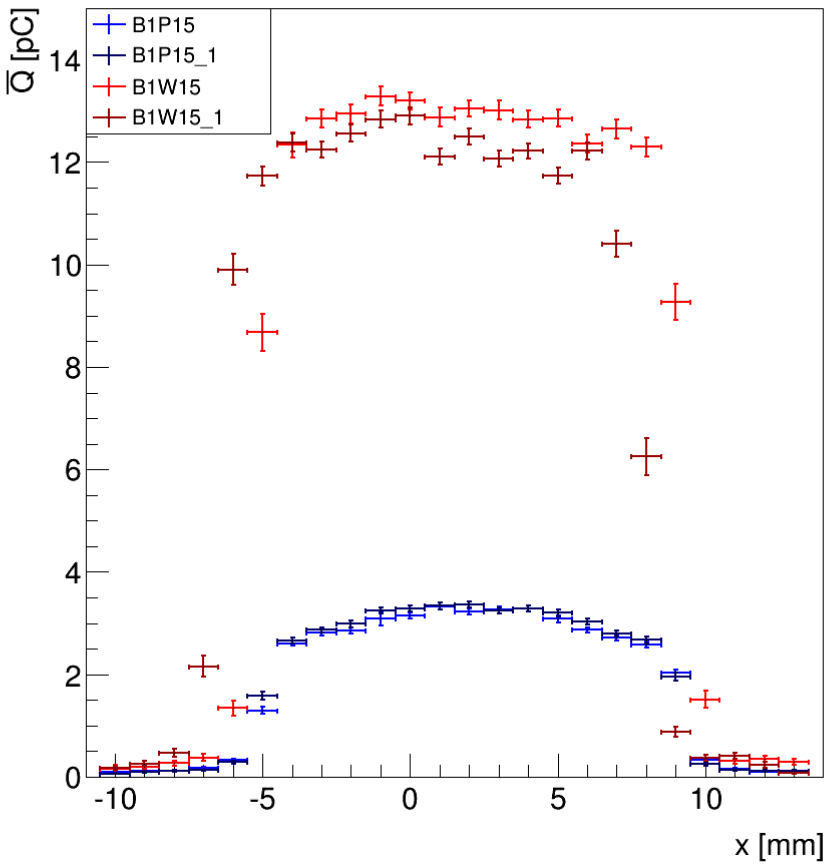
Summary
□20mm tiles





Summary
□15mm tiles





Summary

- Tile scans of a wrapped tile and a painted tile with tile sizes □20mm and □15mm
- Run each tile scan twice to test reproducibility:
  - Wrapped tiles: ~0.5 – 1 pC shift (~4% - 11% difference compare to the first measurement) between measurements
  - Painted tiles: differences within uncertainties
- Comparison of light yield for different configurations:
  - The wrapped tile produced more charge than the painted one
  - The smaller tile produced more charge than the bigger tile

Further plans

- Investigation of □10mm tiles
- Measure additional tiles with different sizes (□20mm, □15mm, □10mm)
- Testing of additional SiPMs

Thank you for your attention!