Measurement data of the new Hamamatsu YH0250 MCP-PMT

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ERLANGEN CENTRE FOR ASTROPARTICLE PHYSICS

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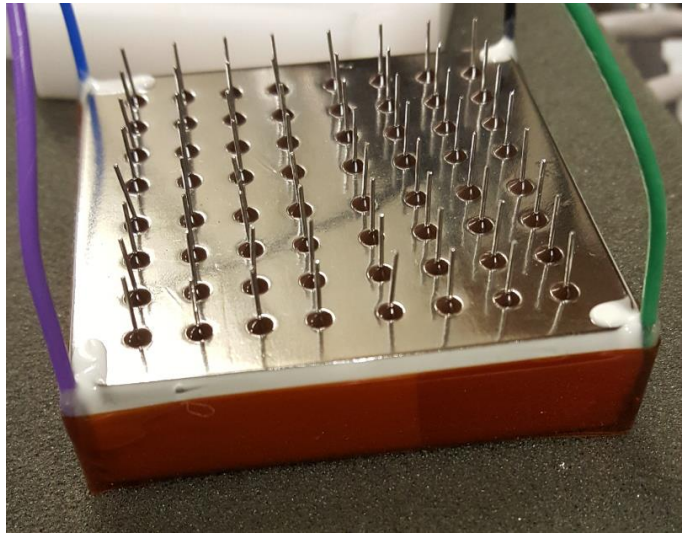
NATURWISSENSCHAFTLICHE FAKULTÄT

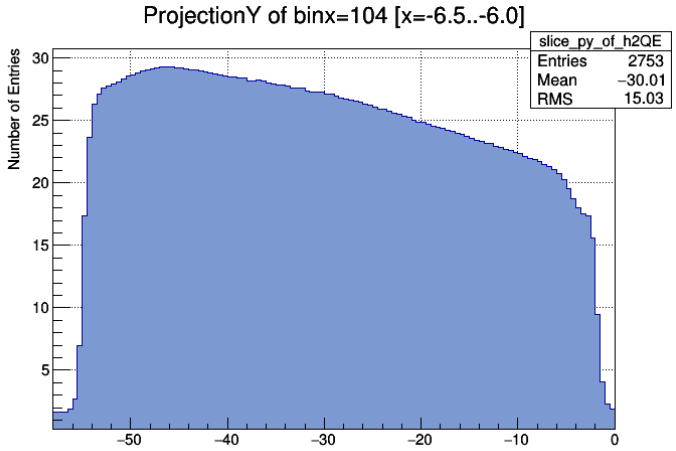
Hamamatsu R13266-07-M64 M YH0250 (10µm)

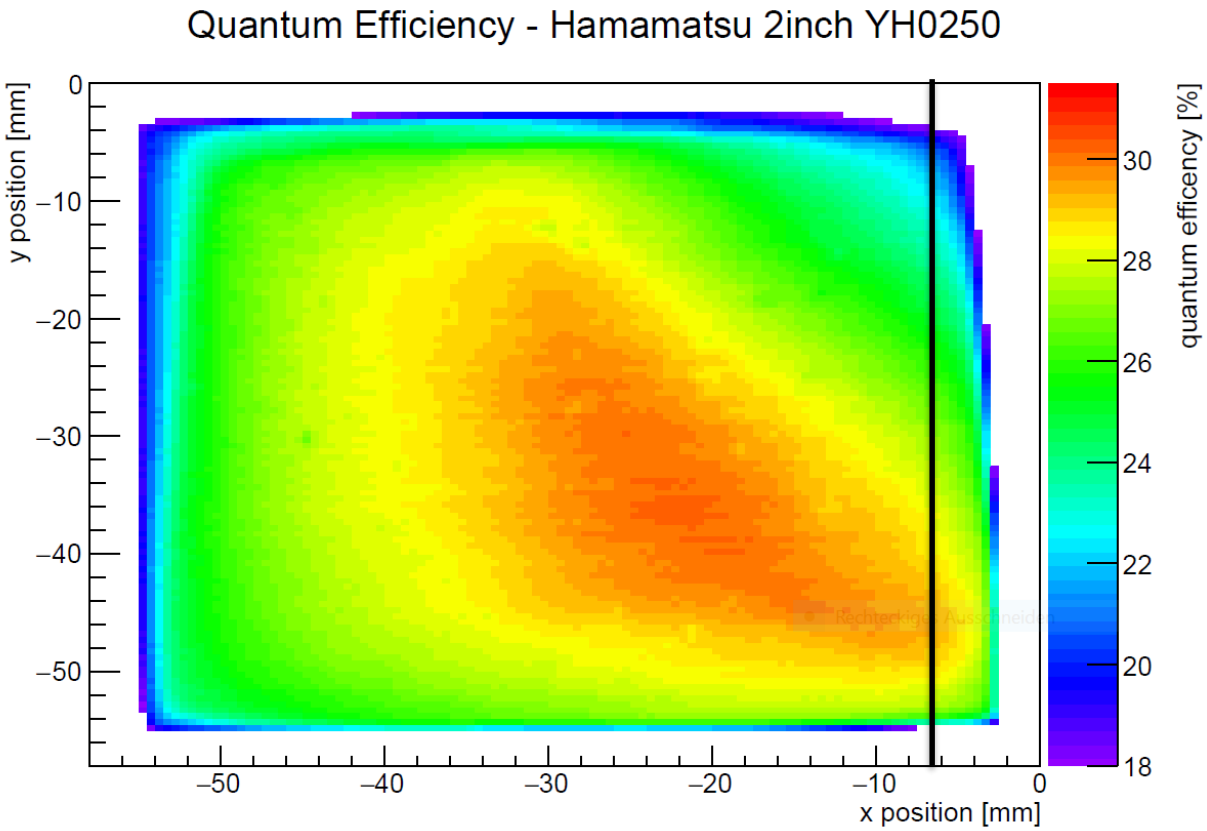
- 2 inch x 2 inch, 8 x 8 pixels
- 10µm MCP (ALD coating)
- No extra Al2O3 layer in front of first MCP like older MCP-PMTs
- 10^6 Gain at 2400 V (datasheet)



QE scan blue laser (372nm) Hamamatsu YH0250

- QE uniform over surface (±4%)
- Higher QE towards middle and bottom right of the sensor
- Overall high QE

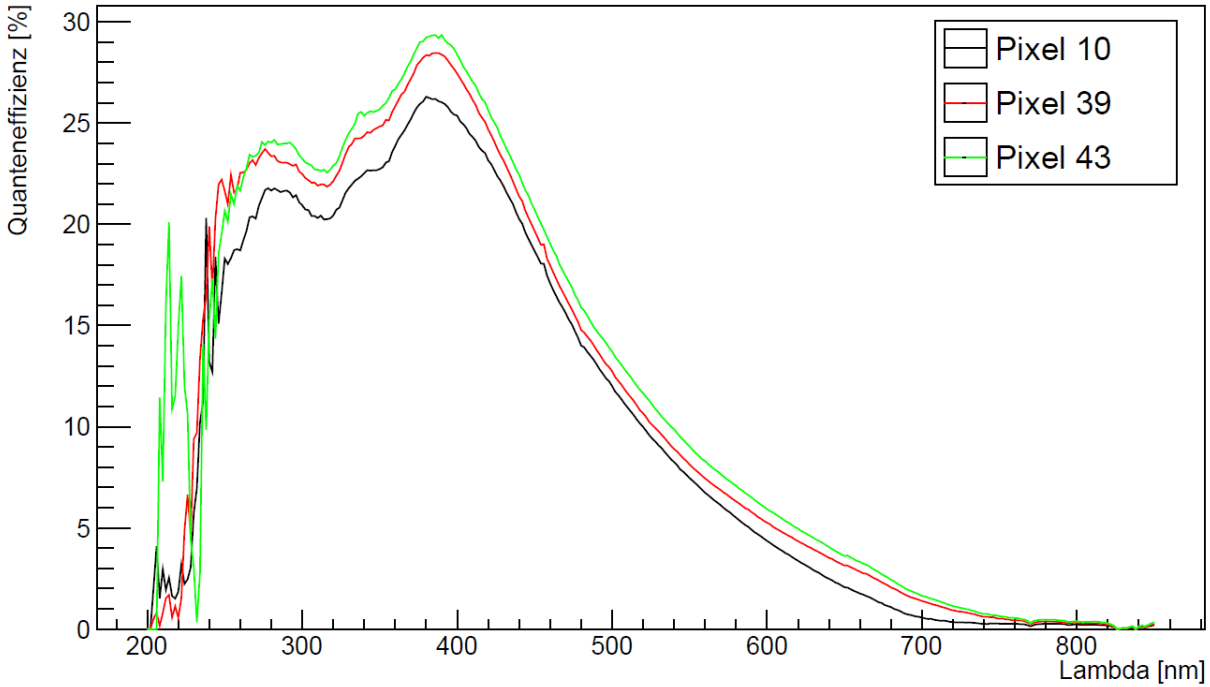




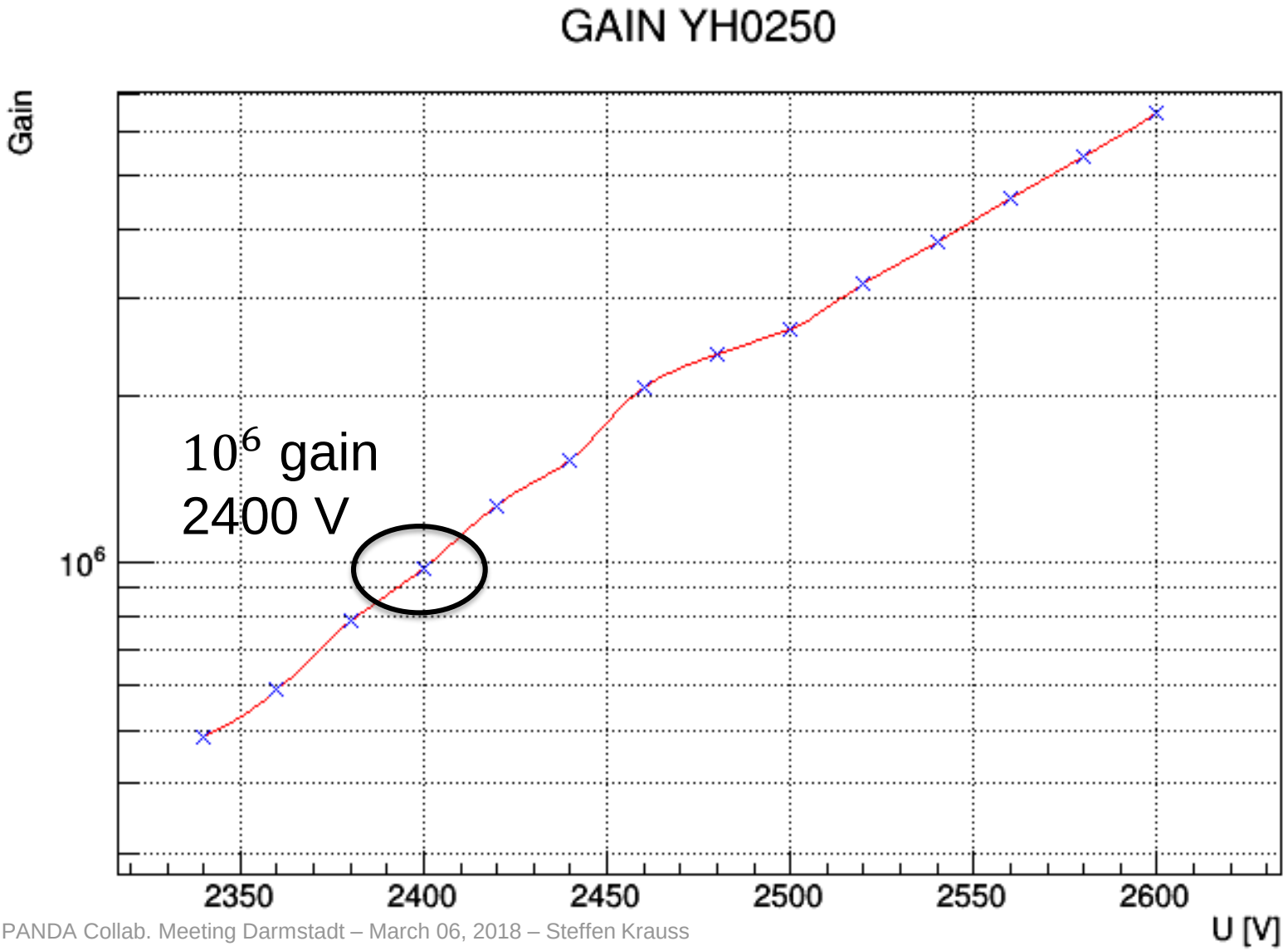
Wavelength dependent QE Hamamatsu YH0250

- QE measurement at single pixel
- QE for different wavelengths in 2 nm steps
- Highest QE area between 350 and 450 nm
- Max QE almost 30% at 400 nm

➢ Very promising



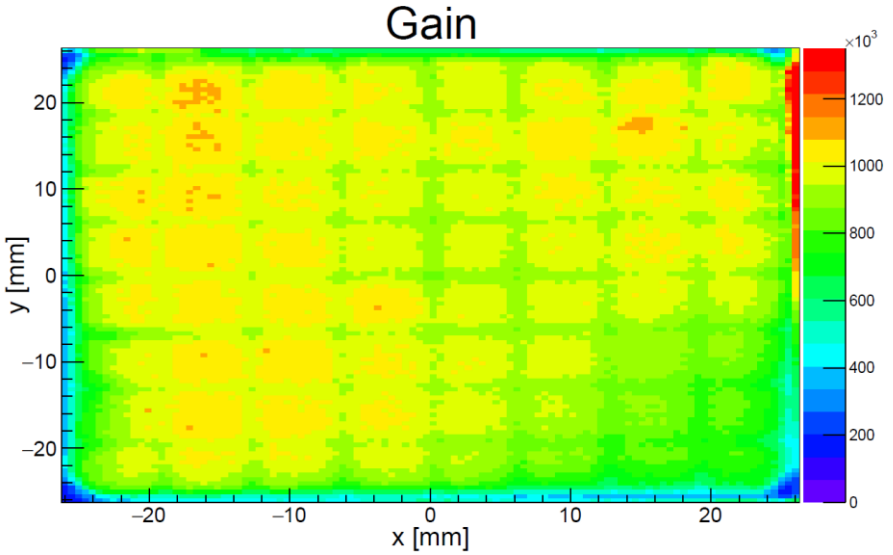
Gain curve Hamamatsu YH0250 pixel 29

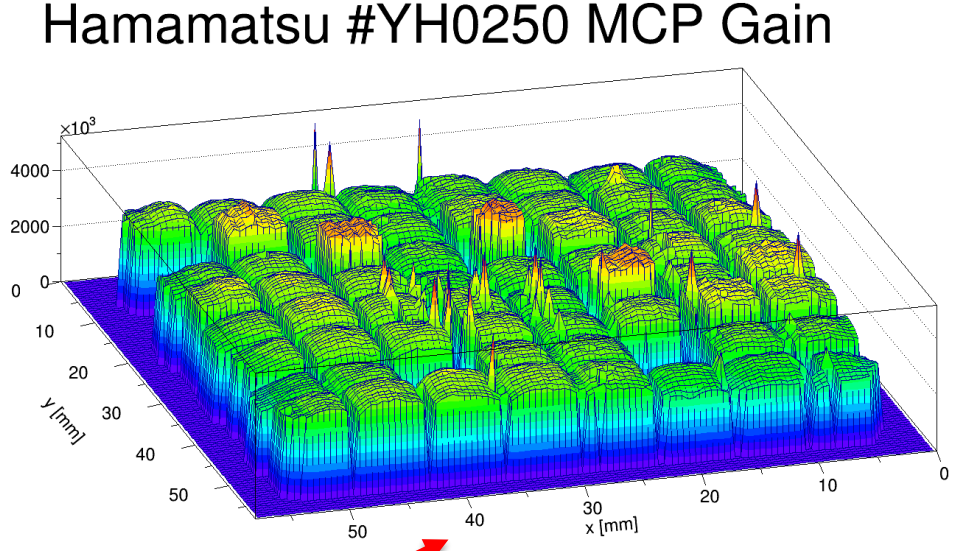


Gain scans Hamamatsu YH0250

- Current of shortened anodes measured at 2440 V (single Photons)
- Relative gain
- QE corrected

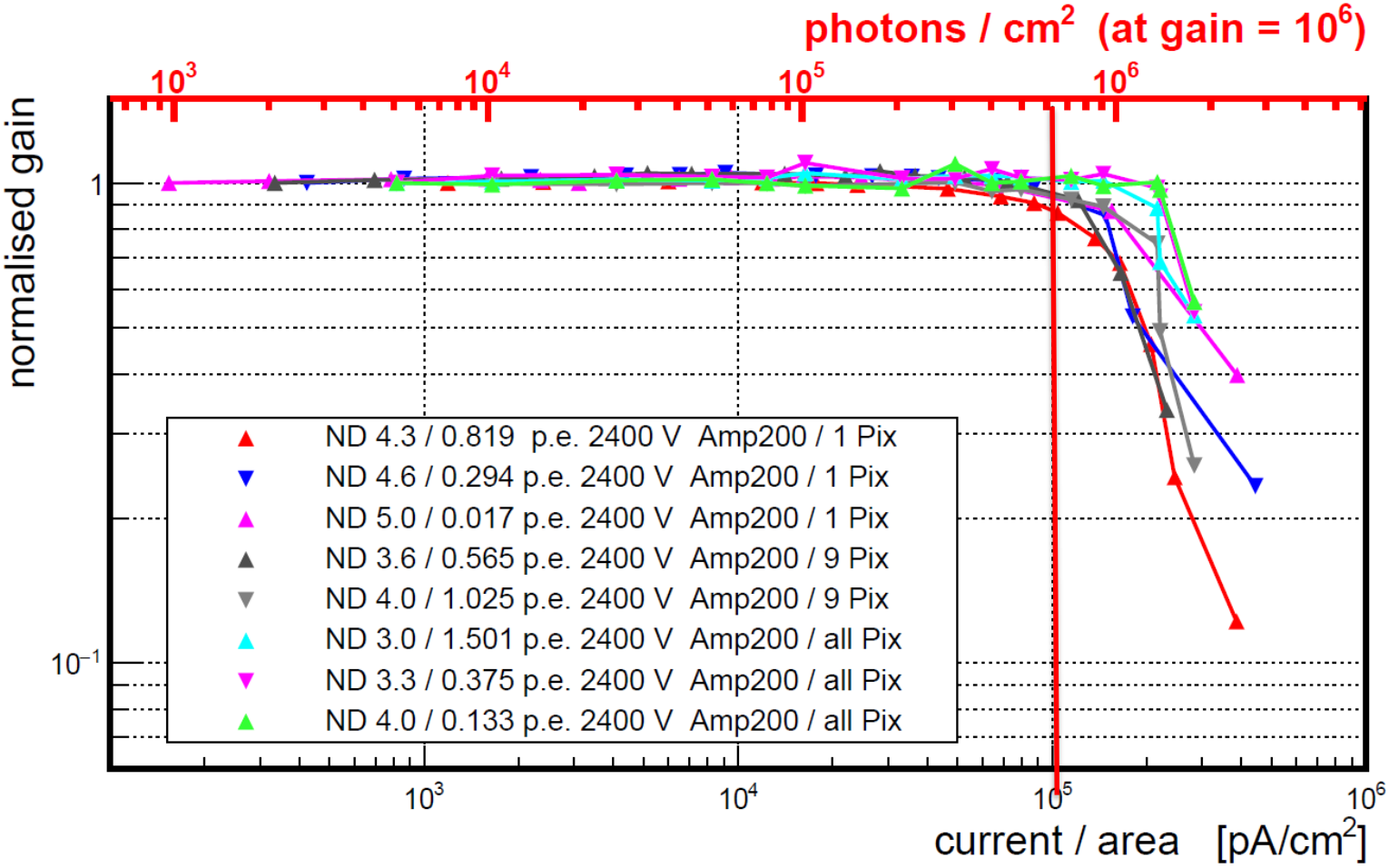
- Determination of gain with pulse high distribution (single Photons)
- Measured at 2400 V
- About 7x amplifier cards





Similar gain distribution

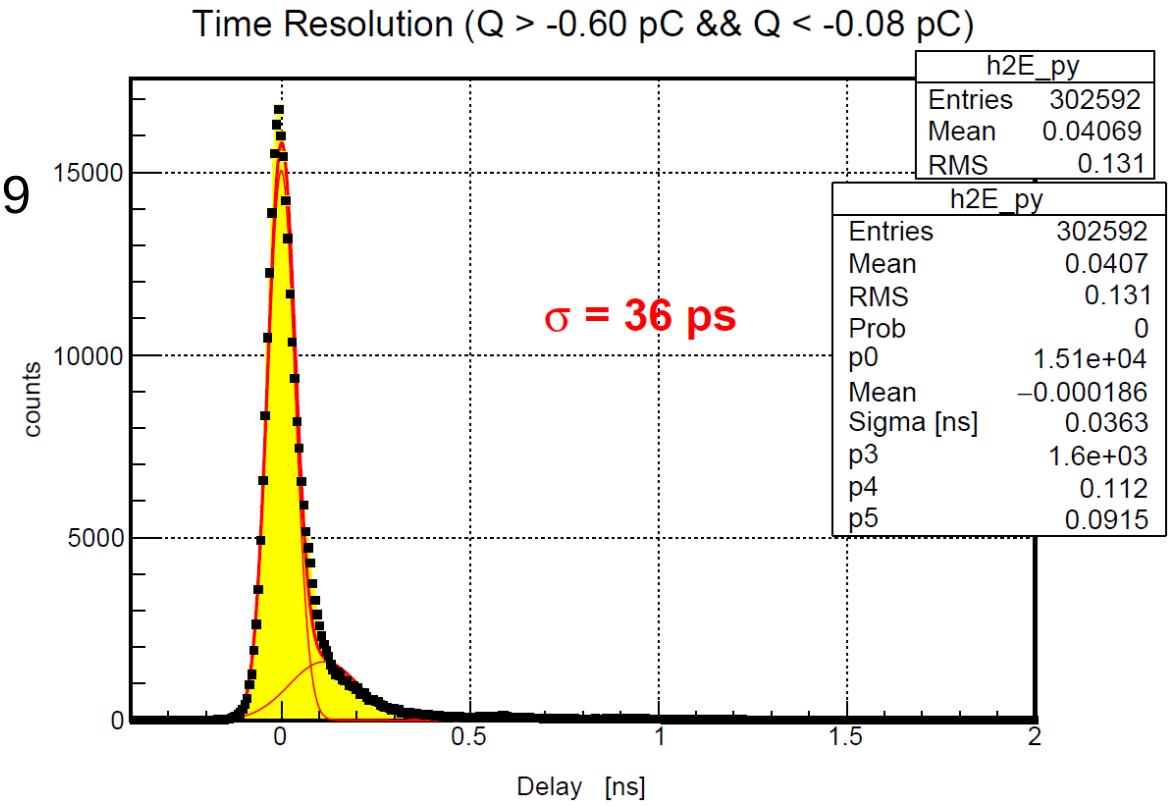
Rate stability Hamamatsu YH0250



Barrel DIRC requirement: 600 kHz per cm^2

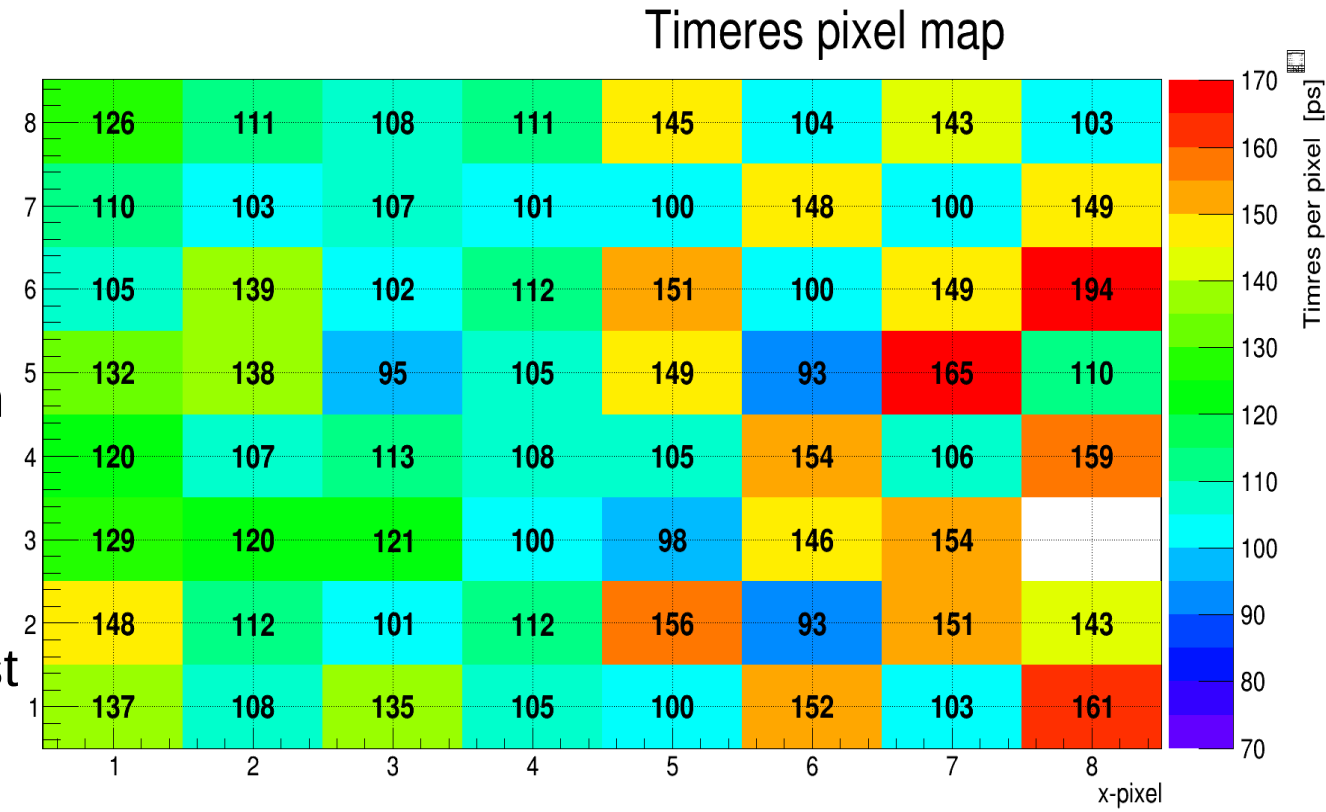
Time resolution Hamamatsu YH0250

- Measured with blue laser and Oscilloscope
- 2440 V (~10^6 Gain), pix 29
- 200x Fast amp ORTEC FTA 820 (impedance matched splitter)
- TDC threshold at 15 mV
- Time walk corrected



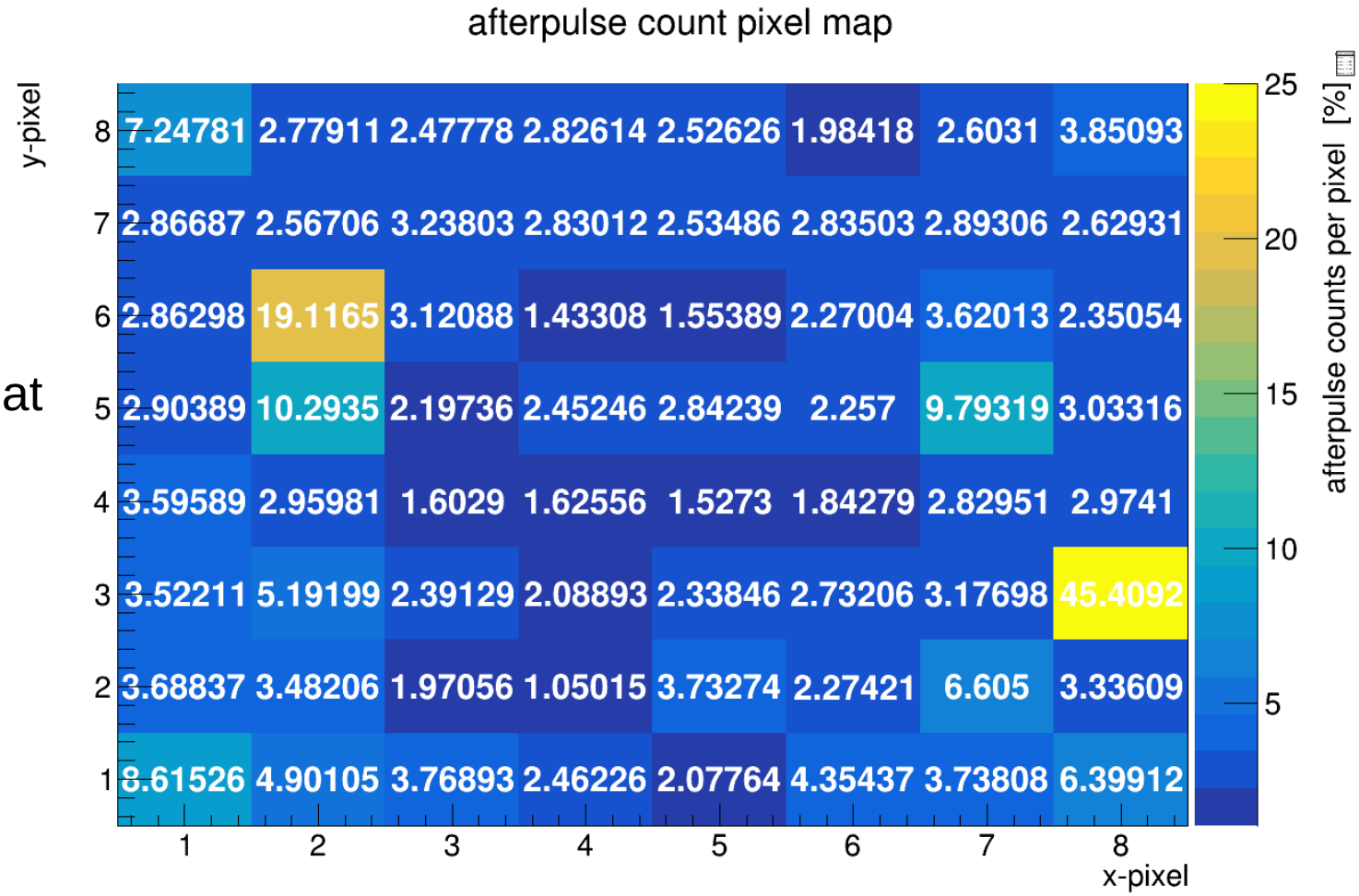
Time resolution scan with TRBv3 board YH0250

- Measured with blue laser and TRBv3 DAQ
- 2440 V (~10^6 Gain)
- TDC threshold at 15 mV
- Not time walk corrected
- Time walk correction brings no significant difference
- Different time resolutions by almost factor 2



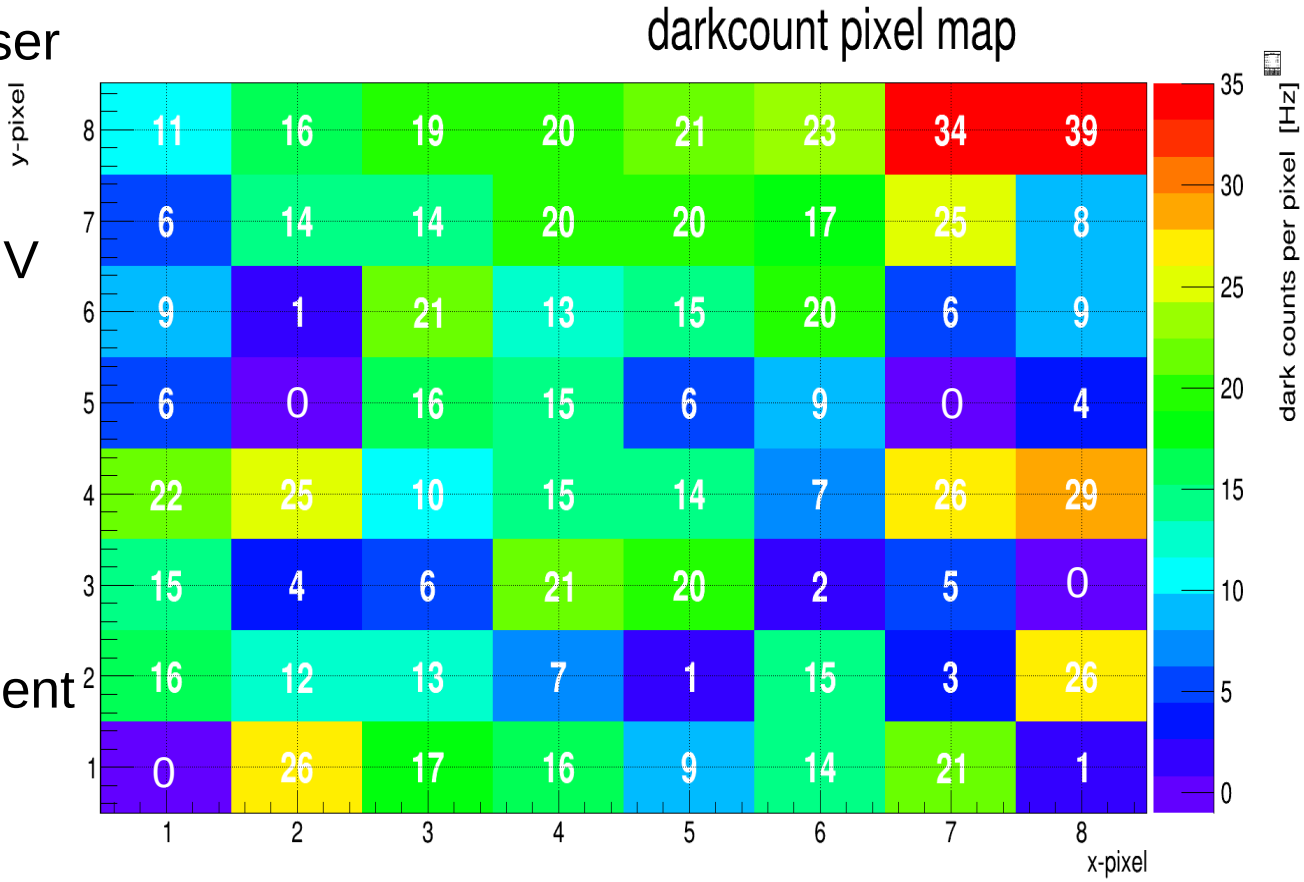
Afterpulse scan with TRBv3 board YH0250

- Measured with blue laser and TRBv3 DAQ
- 2440 V (~10^6 Gain)
- TDC threshold at 15 mV
- Darkcount corrected
- Low afterpulse rate



Darkcount scan with TRBv3 board YH0250

- Measured with blue laser and TRBv3 boards
- 2440 V (~10^6 Gain)
- TDC threshold at 15 mV
- Low darkcount rate
- Overall detector rate:
  - 900 Hz
- Lower darkcount rates reachablewith waiting time before measurement



Summary

- Overall high QE but bad uniformity
- Gain distribution similar with both measurement methods
- Good gain uniformity
- Rate stability for Barrel DIRC sufficient
- Time resolution nearly achieved for Barrel DIRC
- Low afterpulse and darkcount rates

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

Thank you for your attention

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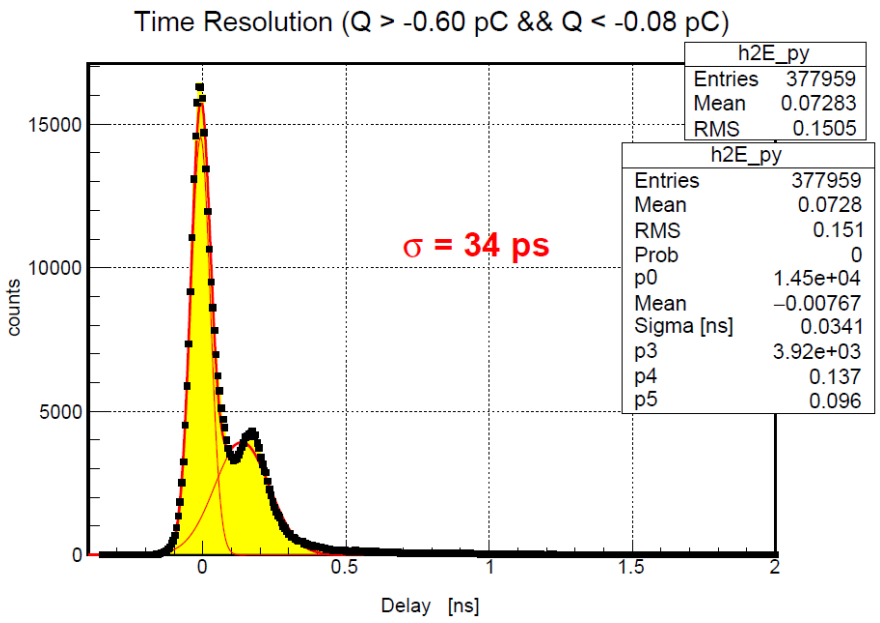
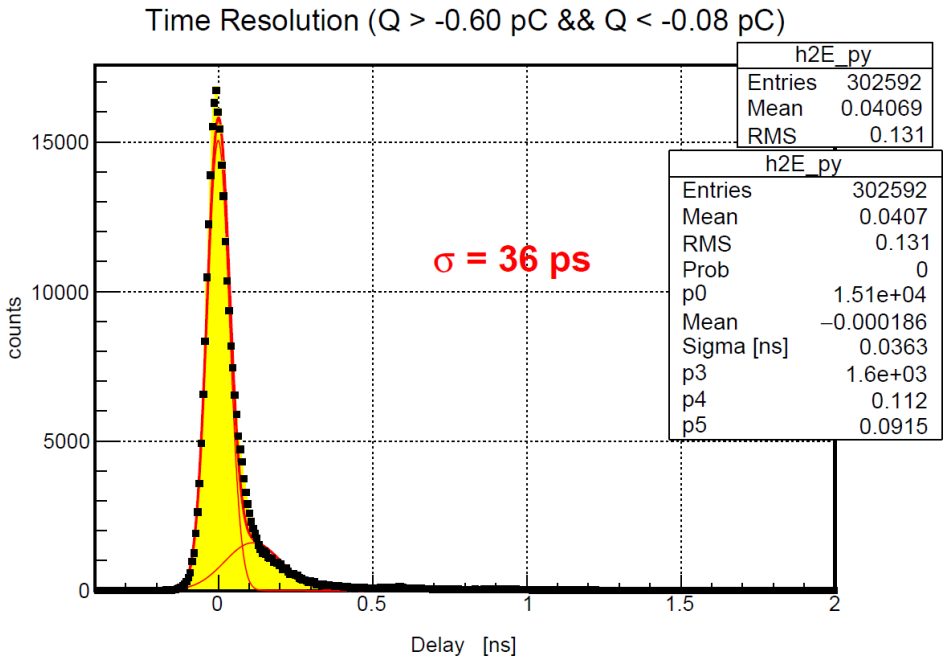
Laser tune dependency second peak at scope measurement



Tune 30



Tune 46

Different gain curves