PANDA Collaboration Meeting

First measurements in the Quality assurance test box

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Quality assurance for MCP-PMTs

- First QA measurements of 3 used MCPs
- Surface scans with a 3-axis stepper using a PILAS Laser, data aquisition with TRB and PADIWA Amps
- Measurement of gain, quantum efficiency , time resolution, crosstalk, darkcount rate and afterpulsing, all position dependent
- Quantum efficiency scans wavelength dependent

- Measurements in light tight and copper shielded box
- Surface scans with a 3-axis stepper using a PILAS Laser, data aquisition with TRB and PADIWA 1 or a Picoamperemeter

Quality assurance for MCP-PMTs

- Measurement of time resolution, crosstalk, darkcount rate and afterpulsing with TRB
- No triggerwindow and recording multihits

- Measurement of gain and quantum efficiency with picoamp separately
- Separately measurement of Gain vs Voltage and wavelenth dependent QE

- -> At the moment each sensor has to be scanned 3 times!

- Could be reduced to 2x by using Padiwa Amps for gain measurement

Measurement box

- Shielded with copper to block EMI

Measurement setup

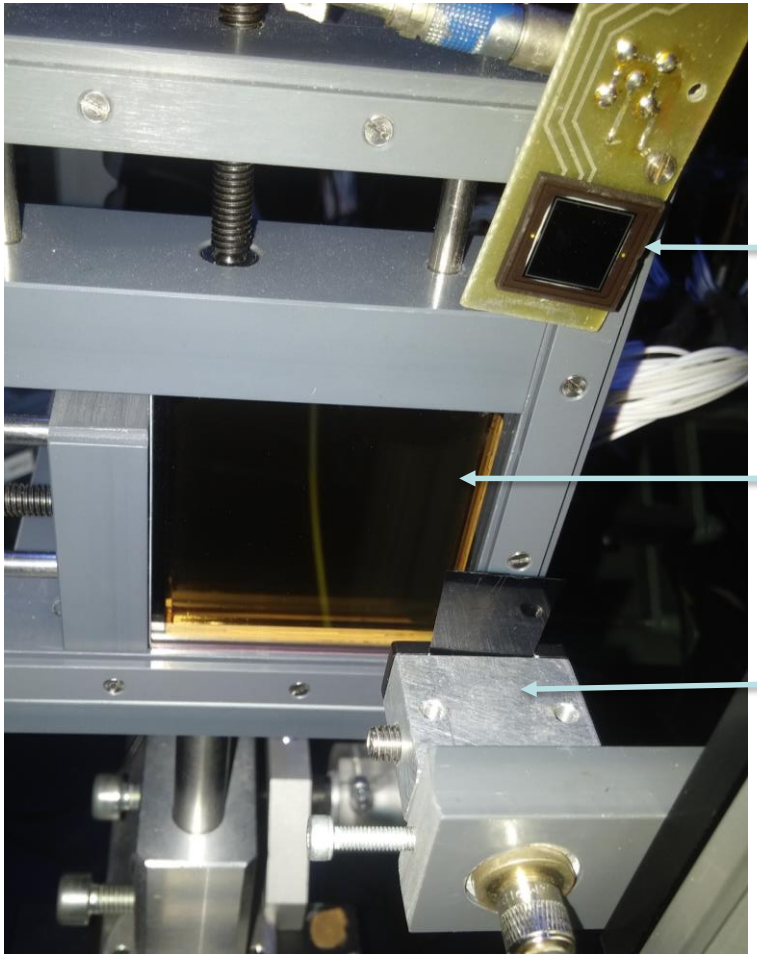


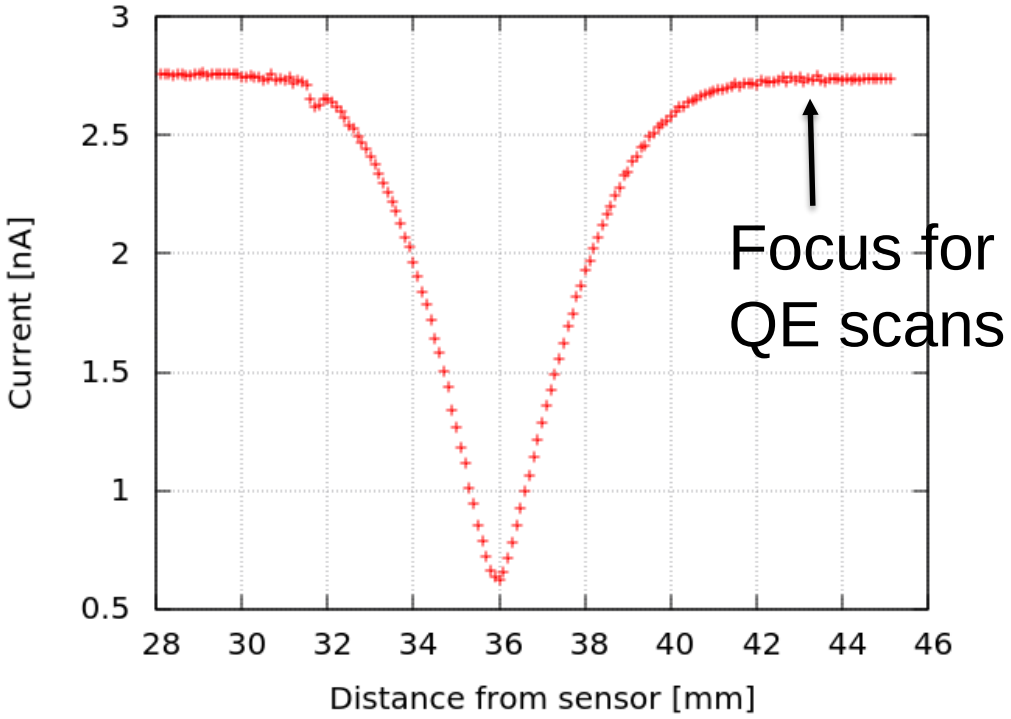
Photo diode

MCP-PMT

Laser with ND-Filter

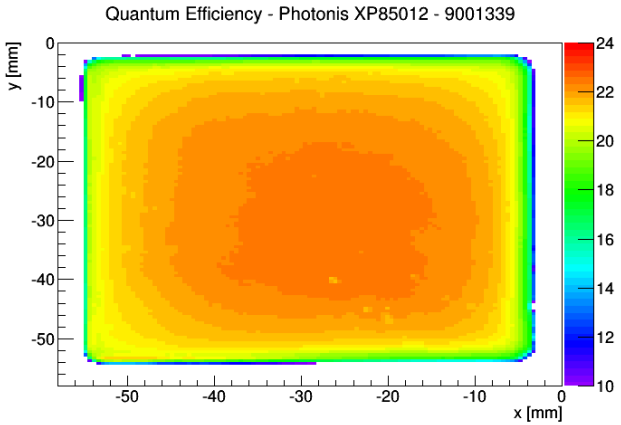
QE measurement

- For QE measurement Laser must not be focussed on the sensor because Photo cathode saturates. Measured with no ND filter

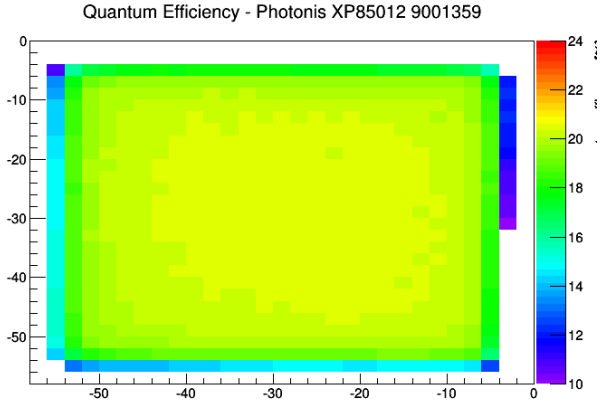


QE surface scans

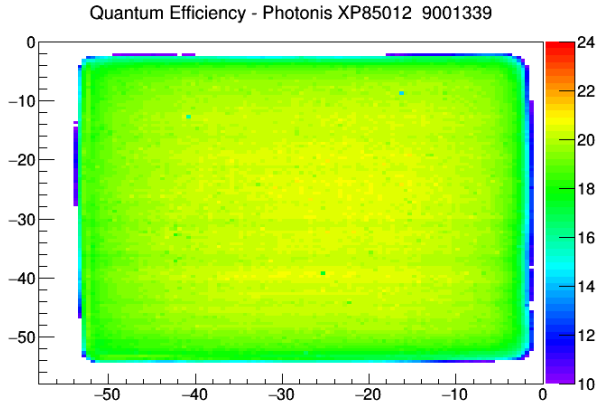
Nov 2015

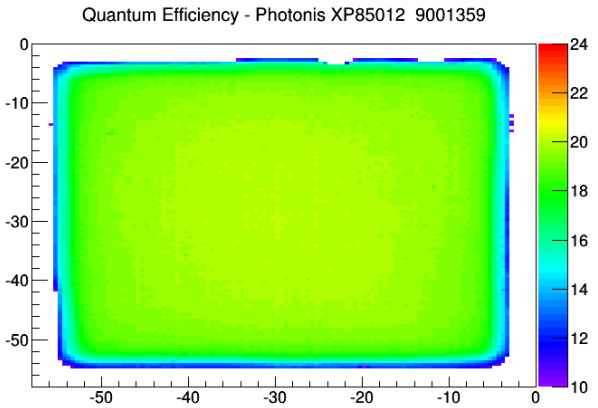


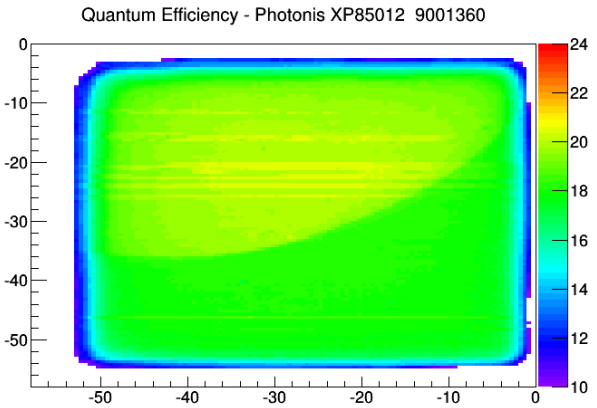
Feb 2015



Now

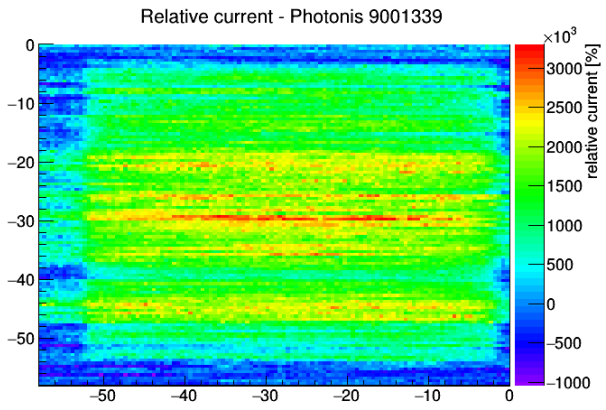


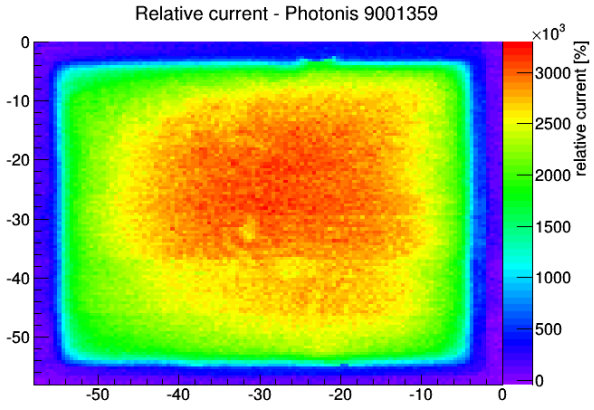


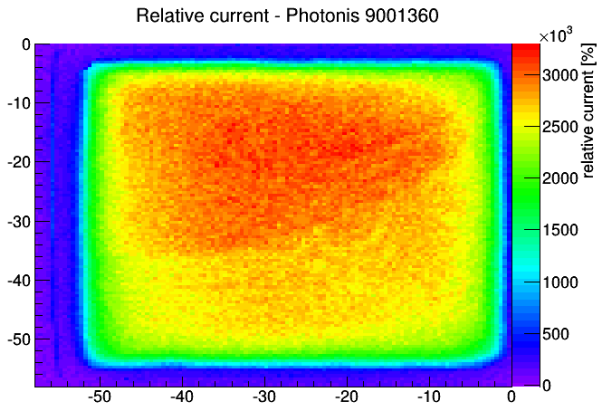


Gain surface scans

- Measured at voltage used at CERN Beam time in Nov 2016
- ND4 Filter in front of laser, single photons
- Same focus as in QE measurements
- Measured gain depends on QE

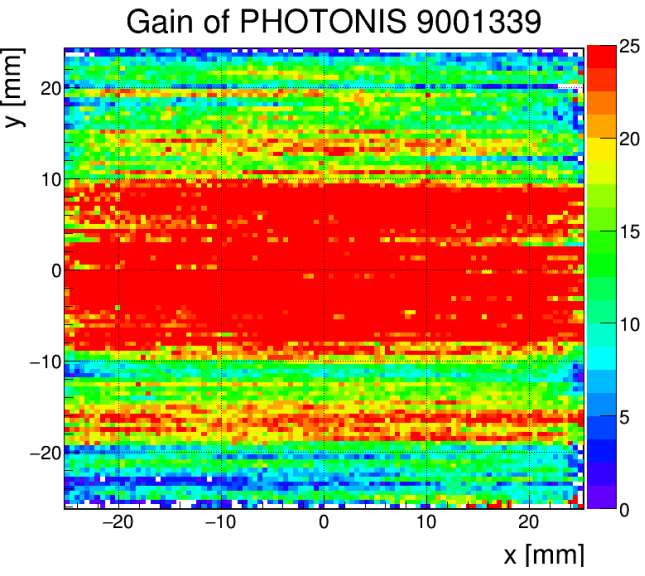


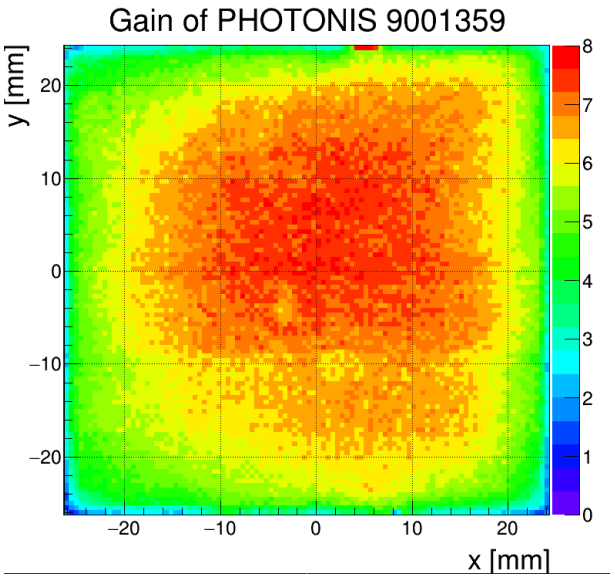


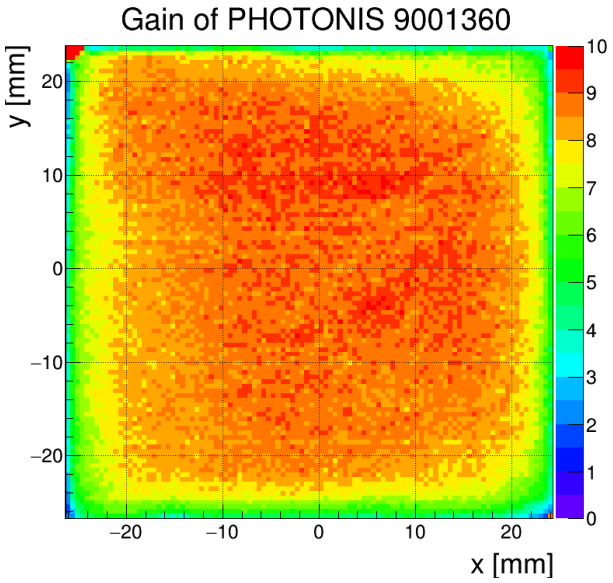


Gain surface scans

- Getting real gains, measured gain has to be divided by QE
- This has to be divided by attenuation factor of ND Filter
- Exact attenuation factor has yet to be measured

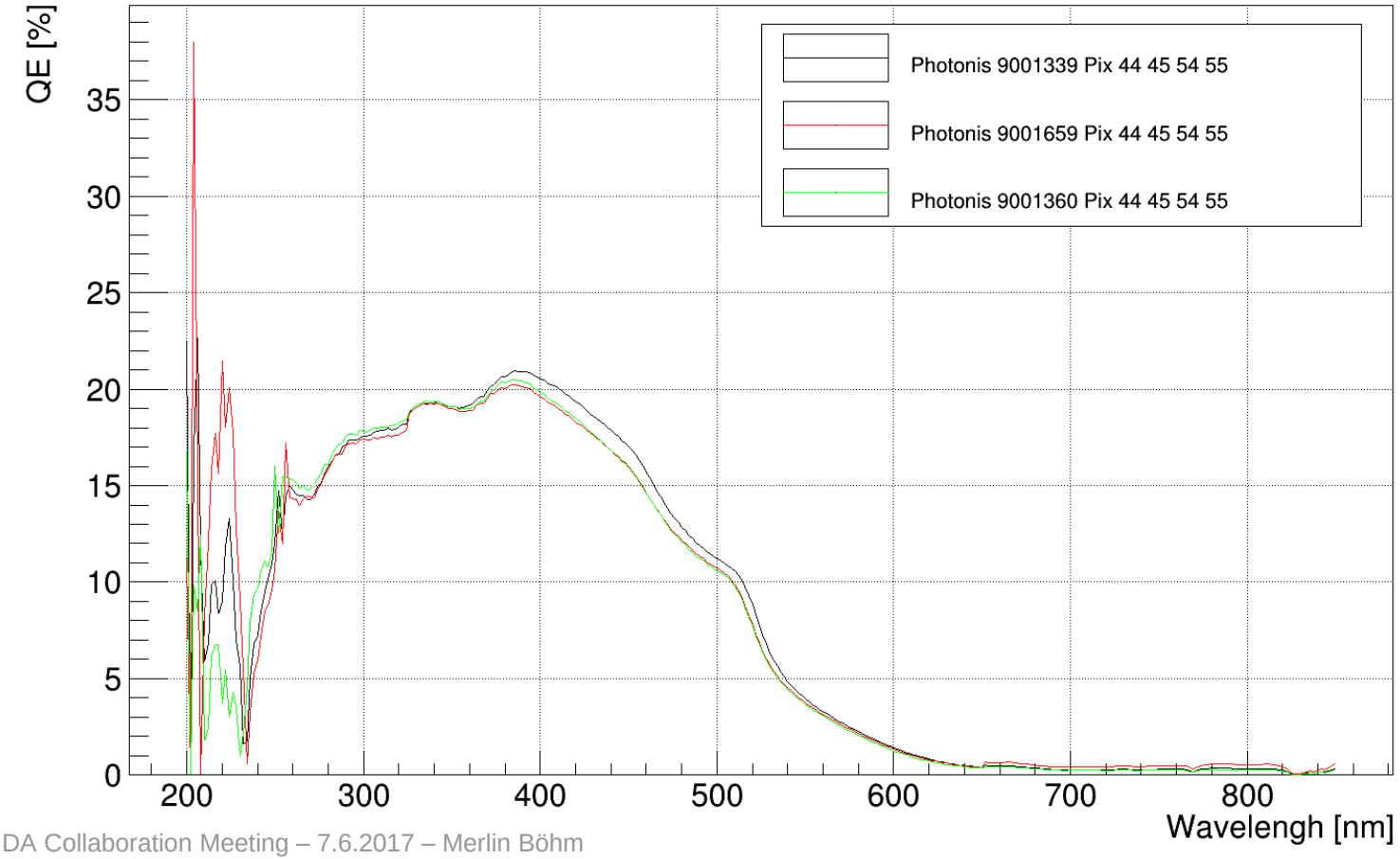






Wavelength dependent QE measurements

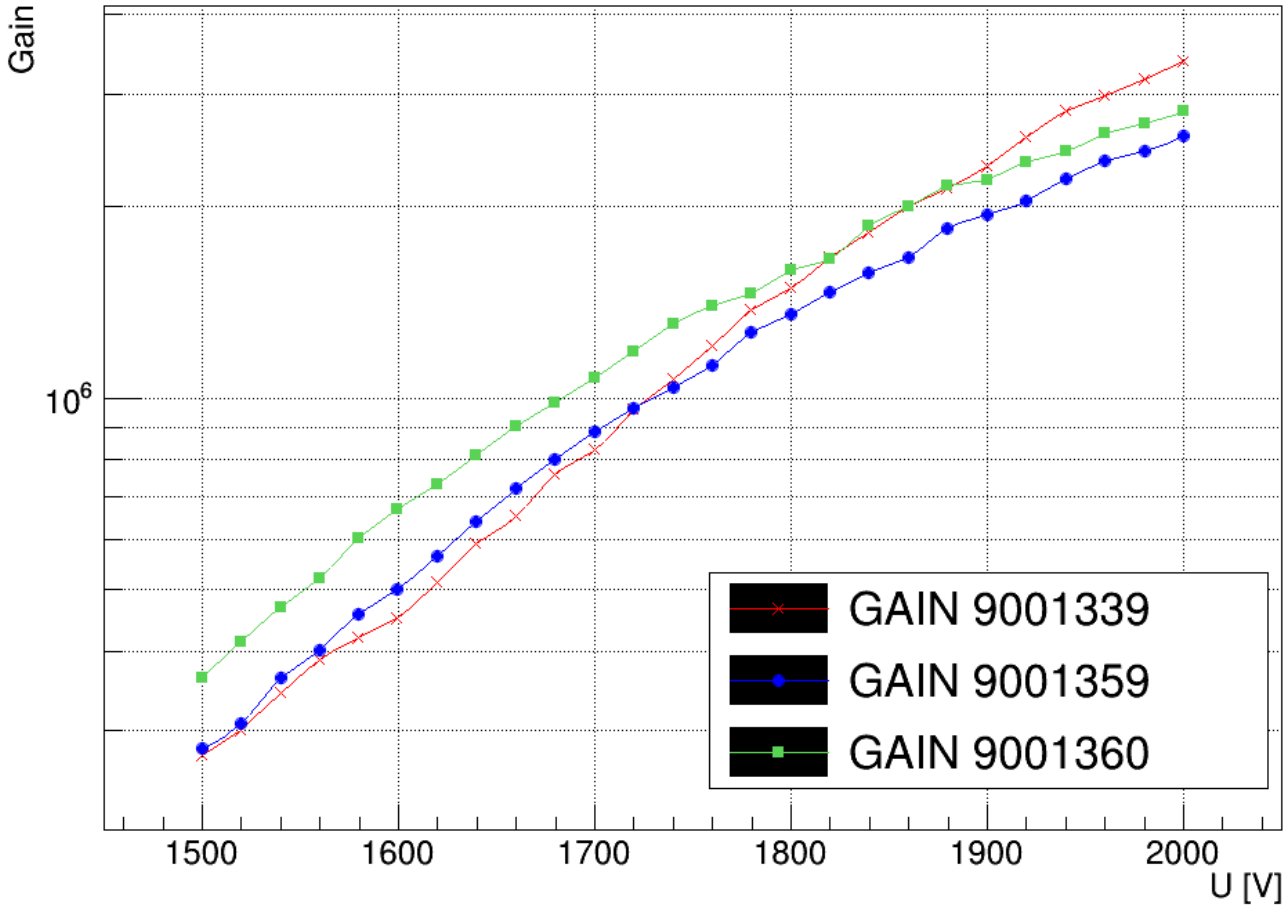
- Laser used for scans has 375 nm, 200 V



Gain measurement

- Voltage vs Gain

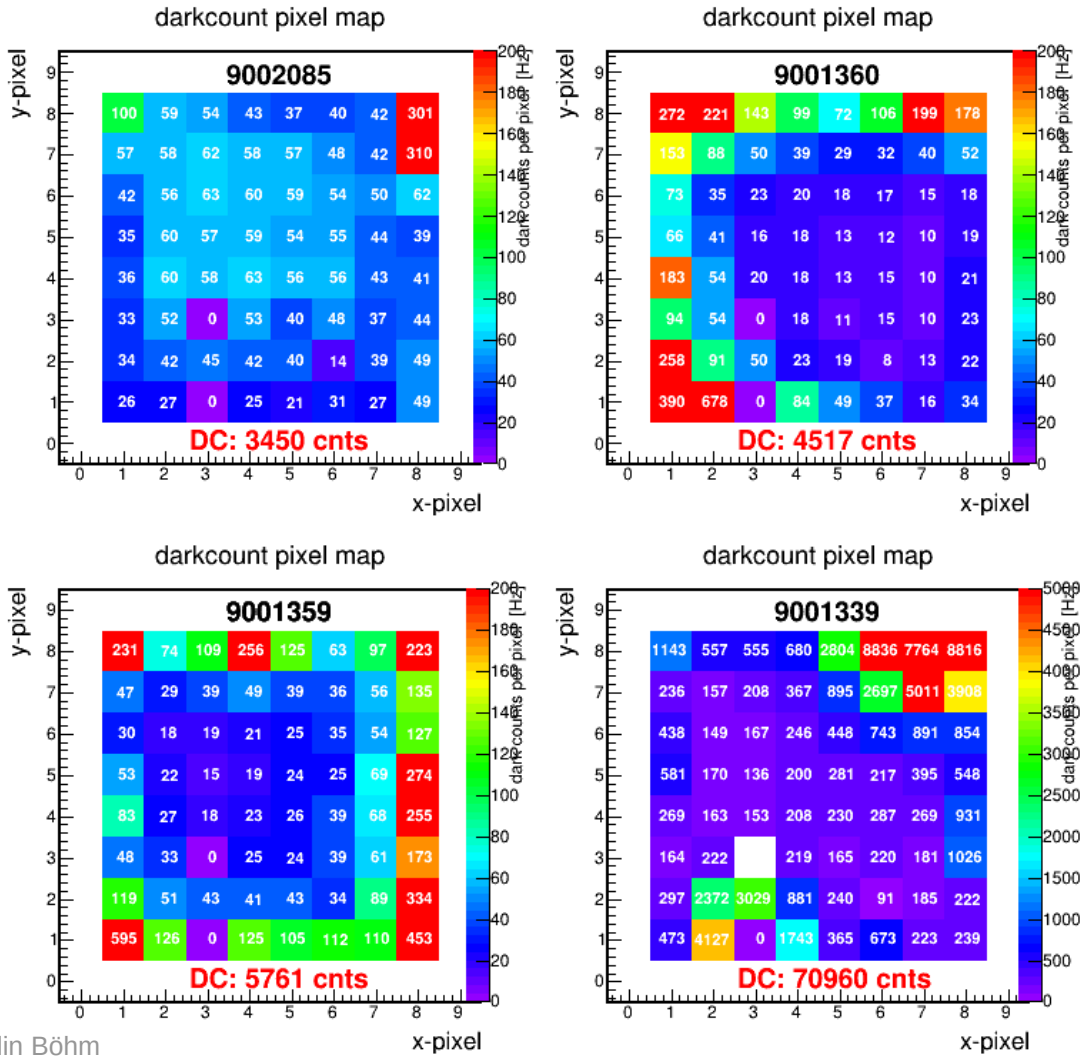
- Voltages used for scans:
- 1339: 1886 V
- 1359: 1905 V
- 1360: 1875 V



TRB Scans – Darkcount rate

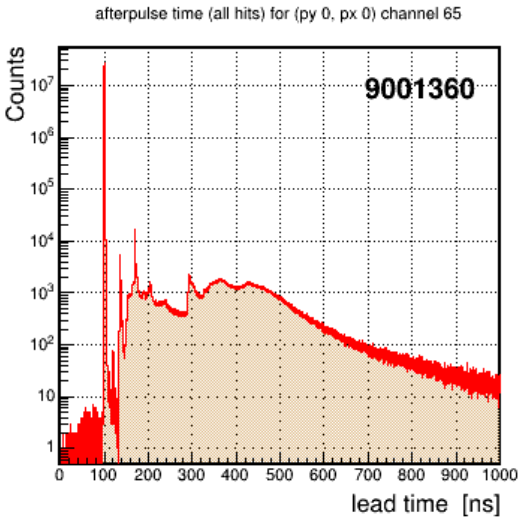
- Laser Trigger rate: 10 kHz
- Measurement time window ~ 1 µs
- Darkcounts: 900 ns before Laser pulse

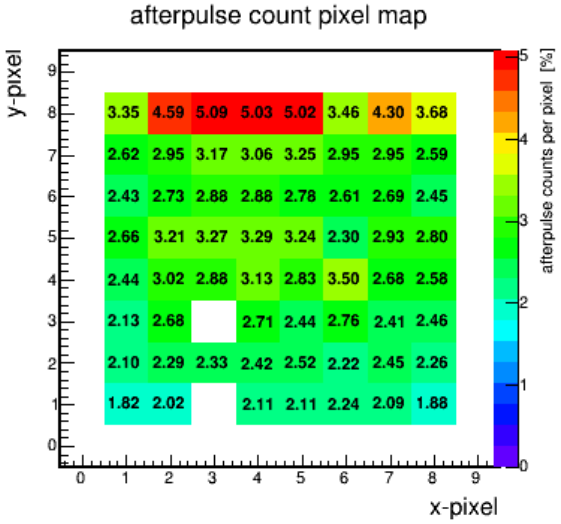
- Darkcounts in Hz
- Not dead time corrected

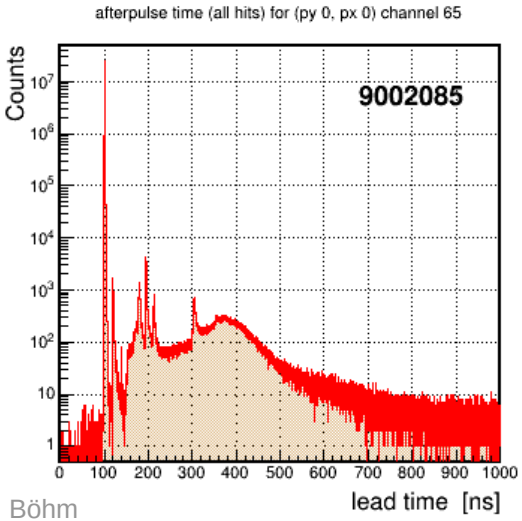


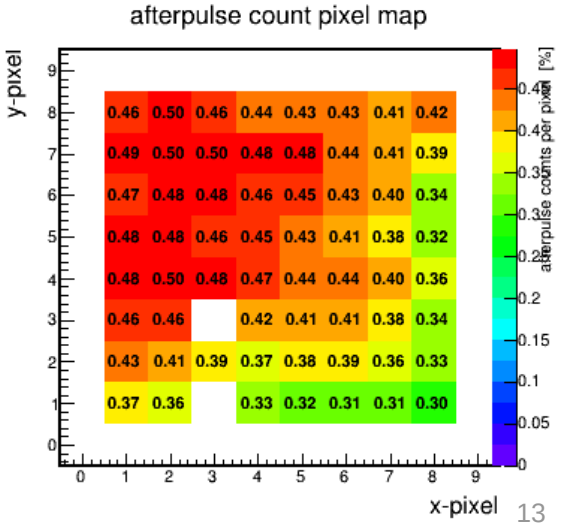
TRB Scans – Afterpulsing

- MCP signals shifted to 100 ns for better analysis
- Spectra have been verified by our scope





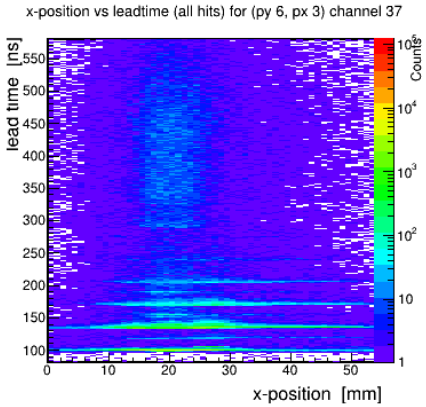


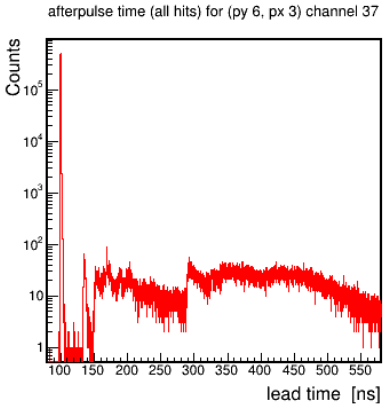


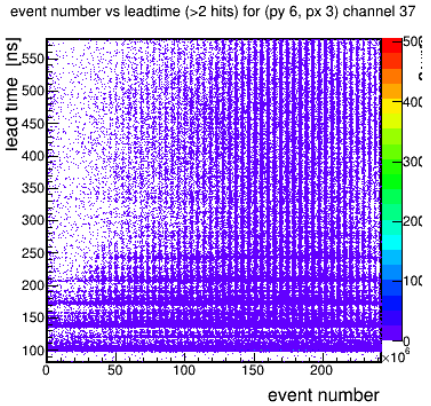
TRB Scans – Afterpulsing

- MCP signals shifted to 100 ns for better analysis
- Pattern on 9001360?

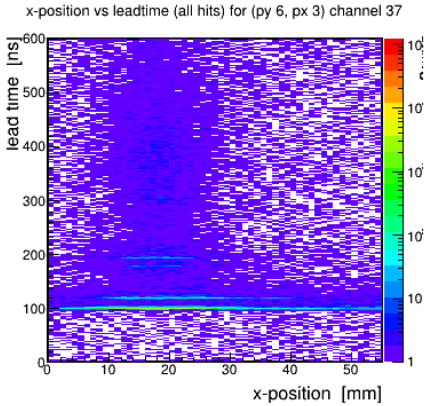
1360

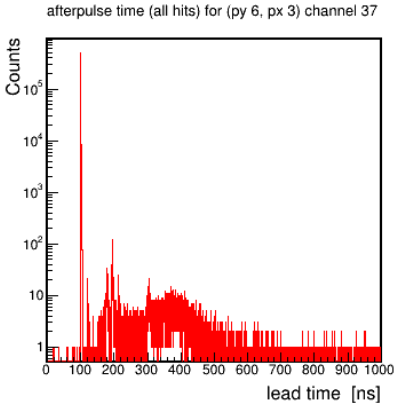


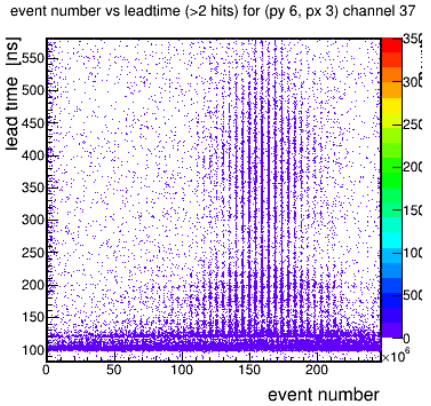




2085



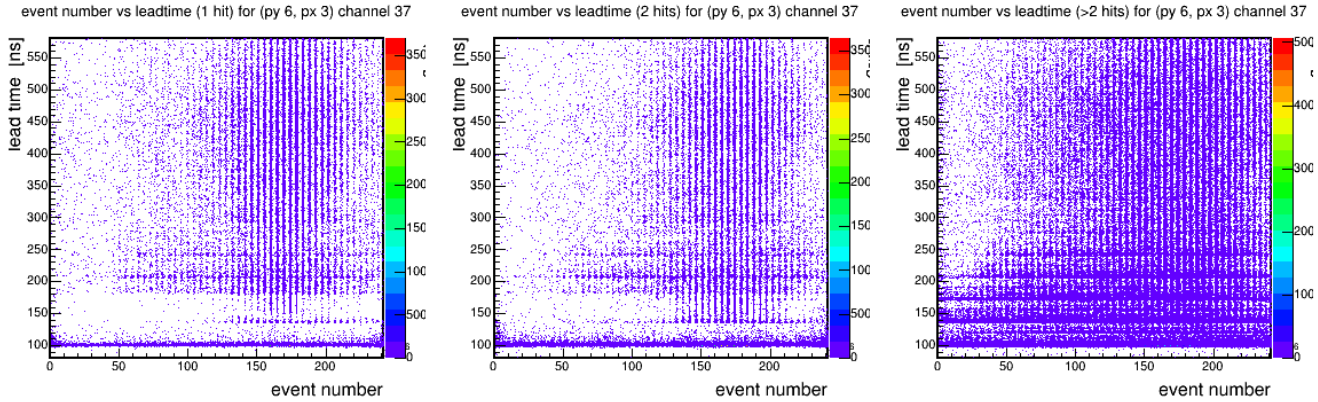




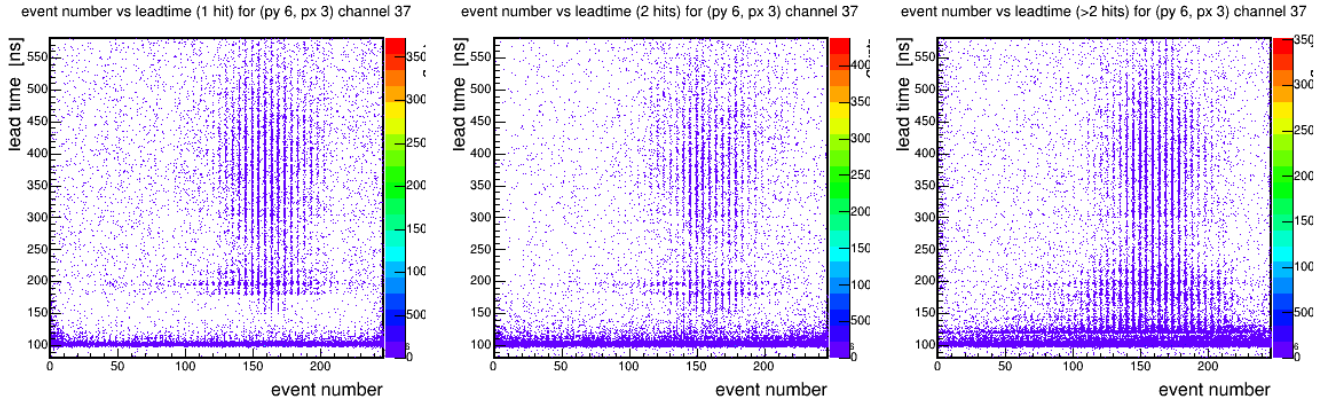
TRB Scans – Afterpulsing

- MCP signals shifted to 100 ns for better analysis
- Pattern on 9001360? Only if >2 hits

1360

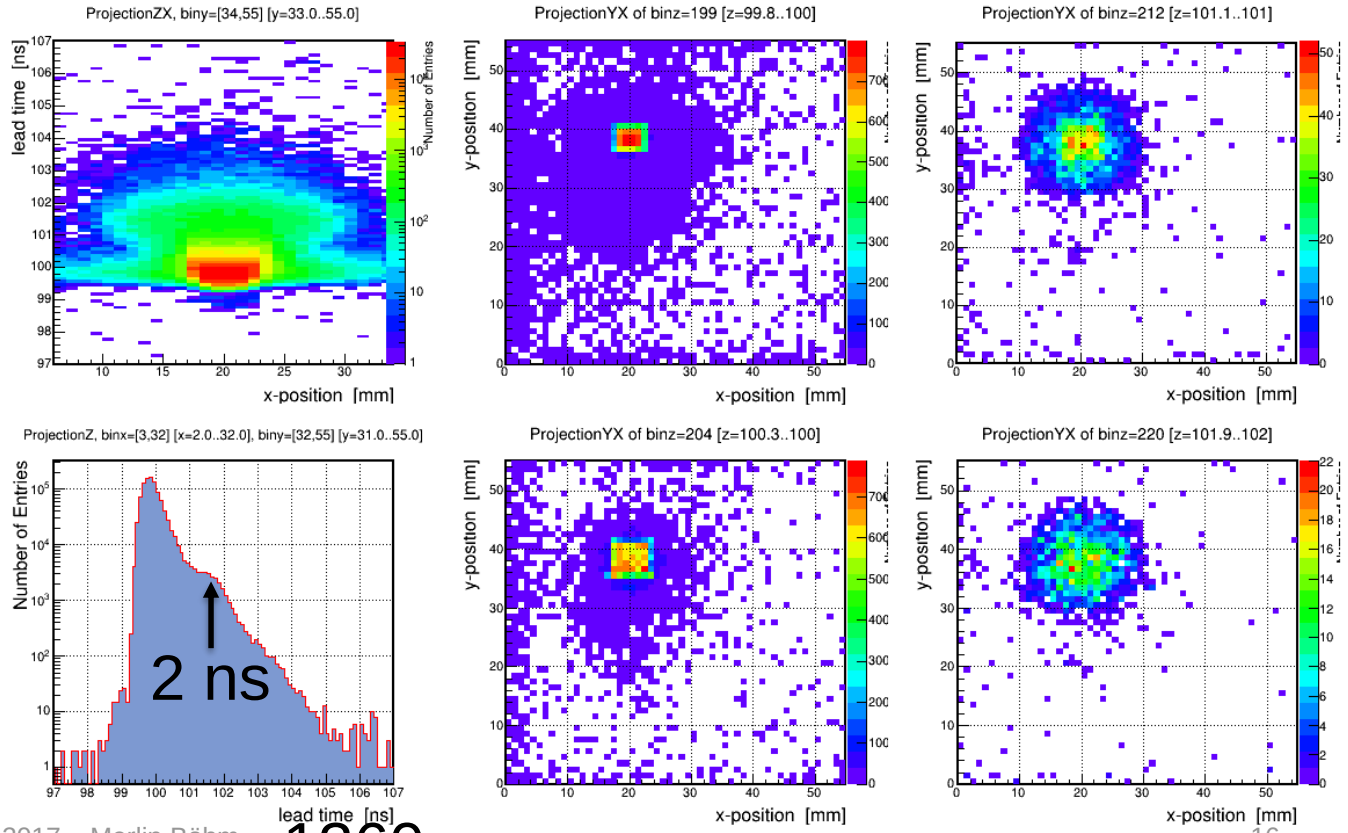


2085



TRB Scans – Time spectrum

- MCP signals shifted to 100 ns for better analysis
- Delayed events -> Backbouncing electrons?
- Time resolution ~150-200 ps
- Time resolution measured with scope below 50 ps

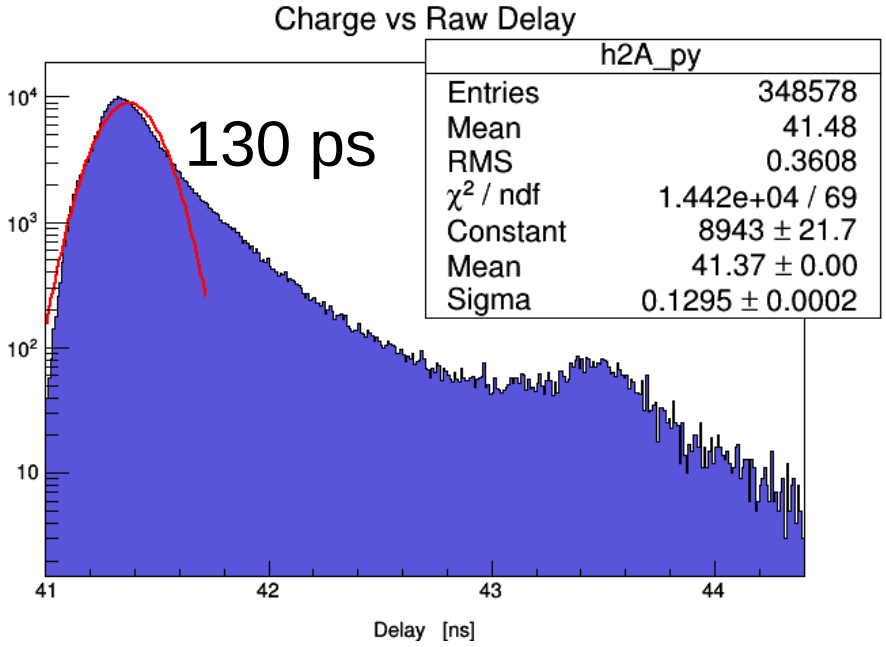


1360

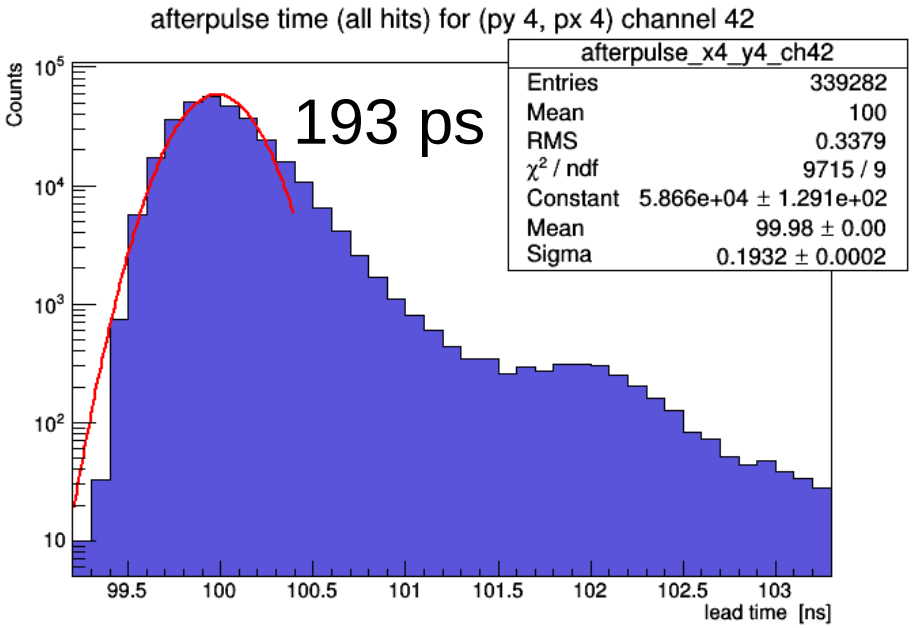
TRB Scans – Time spectrum

- Time resoluion measured with the scope is much better
- Scope: ~130 ps, timewalk corrected <50 ps
- TRB: ~190 ps, timewalk corrected ~ 150 ps

Oscilloscope



TRB



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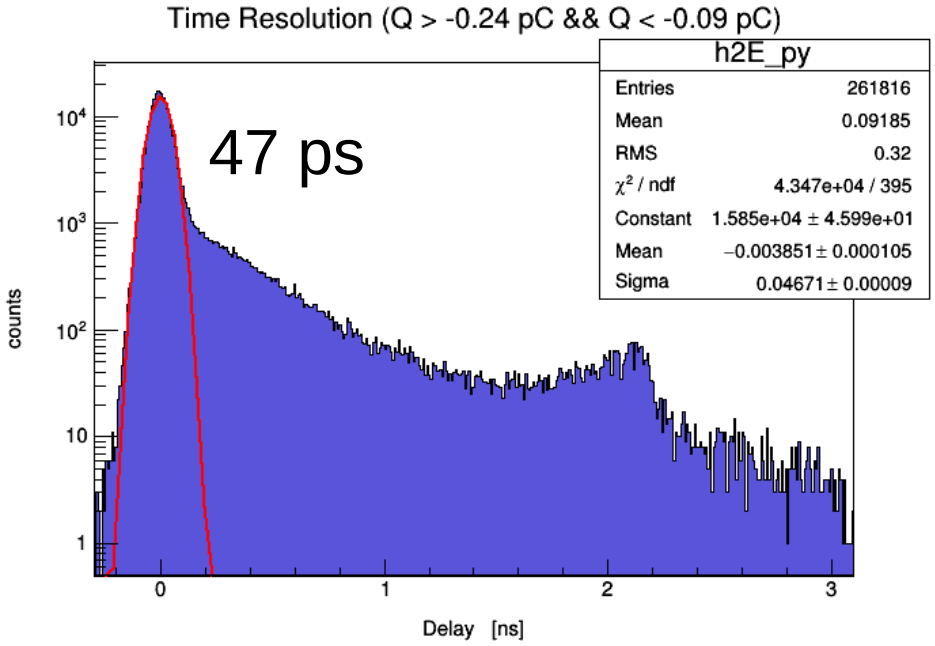
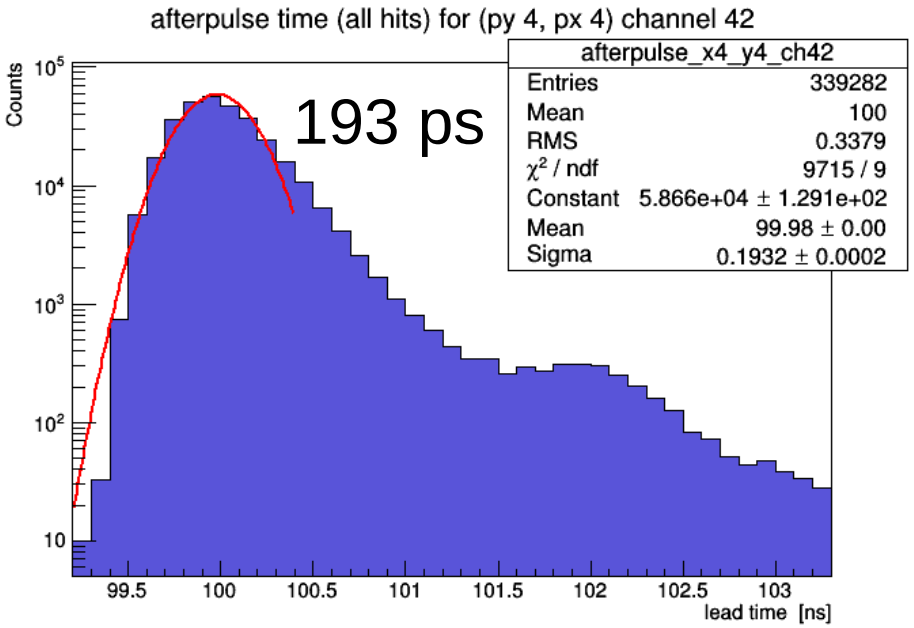
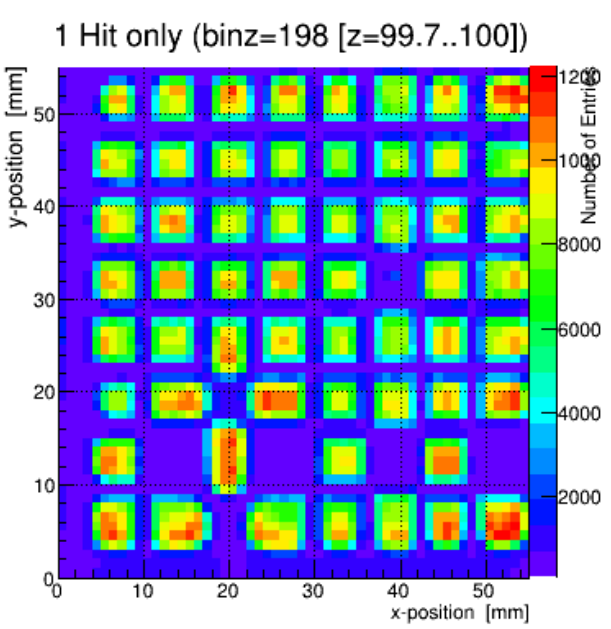


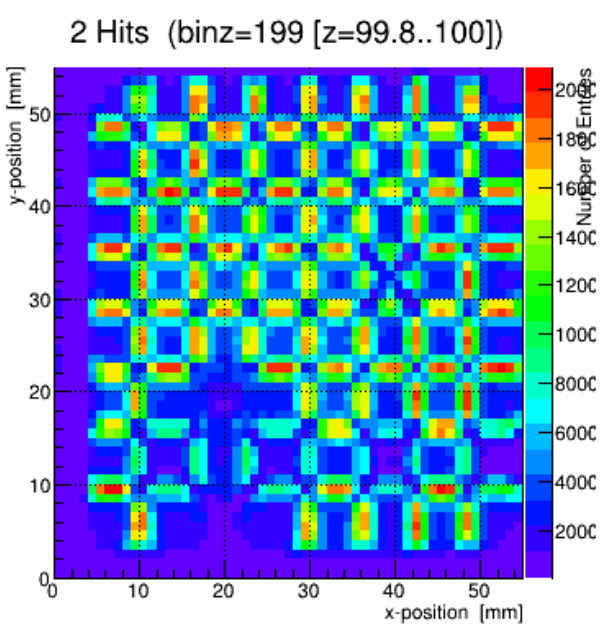
TRB

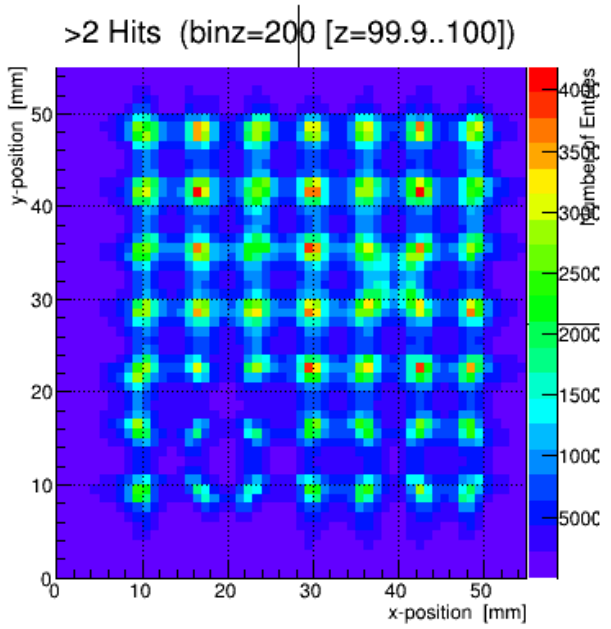


TRB Scans – Charge sharing

- Cut to only 1 hit on the MCP per Laser pulse: Pixels, 2 Hits: Borders, 3 Hits: edges



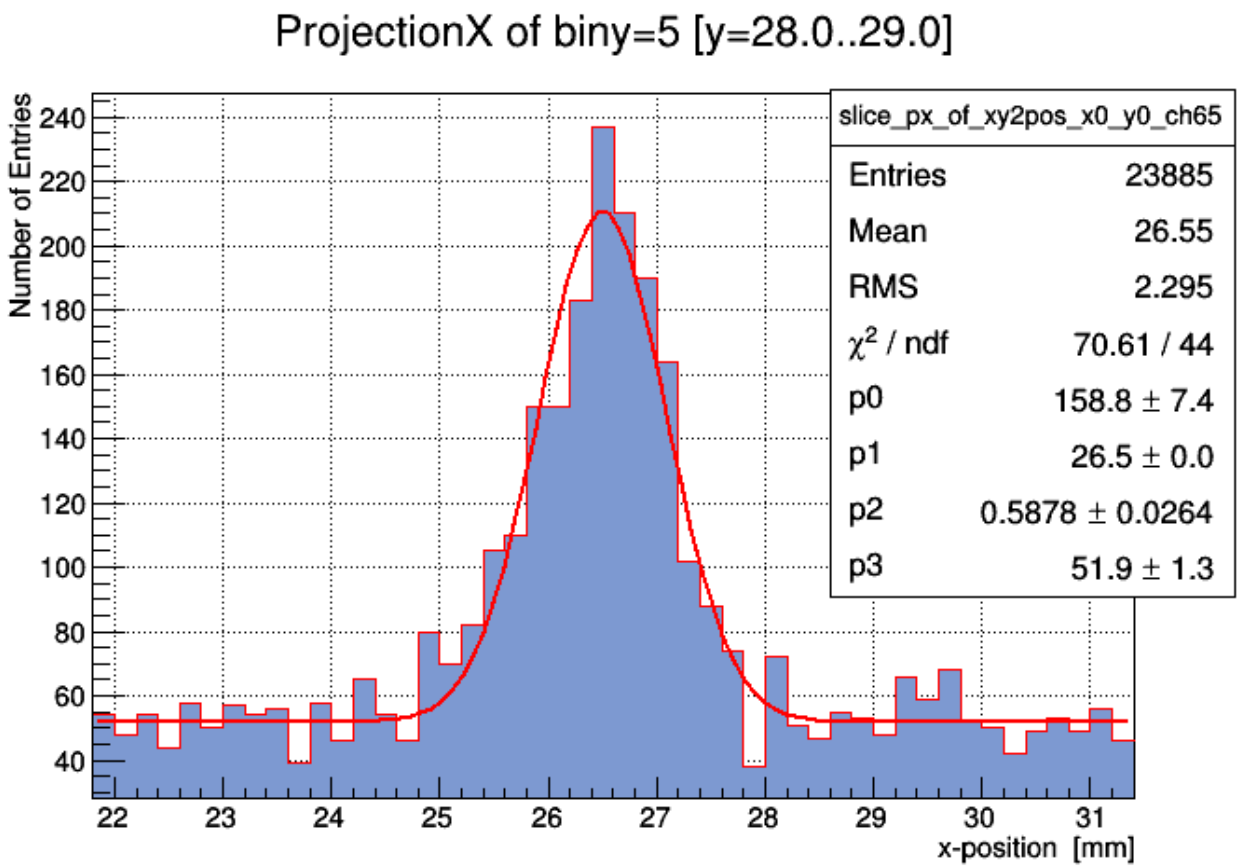




1360

TRB Scans – Charge sharing

- Width of charge sharing ~0.6 mm



Summary

- QA Setup is running, still needs improvements
- Need more investigation in data analysis
- Need to find source of bad time resolution

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