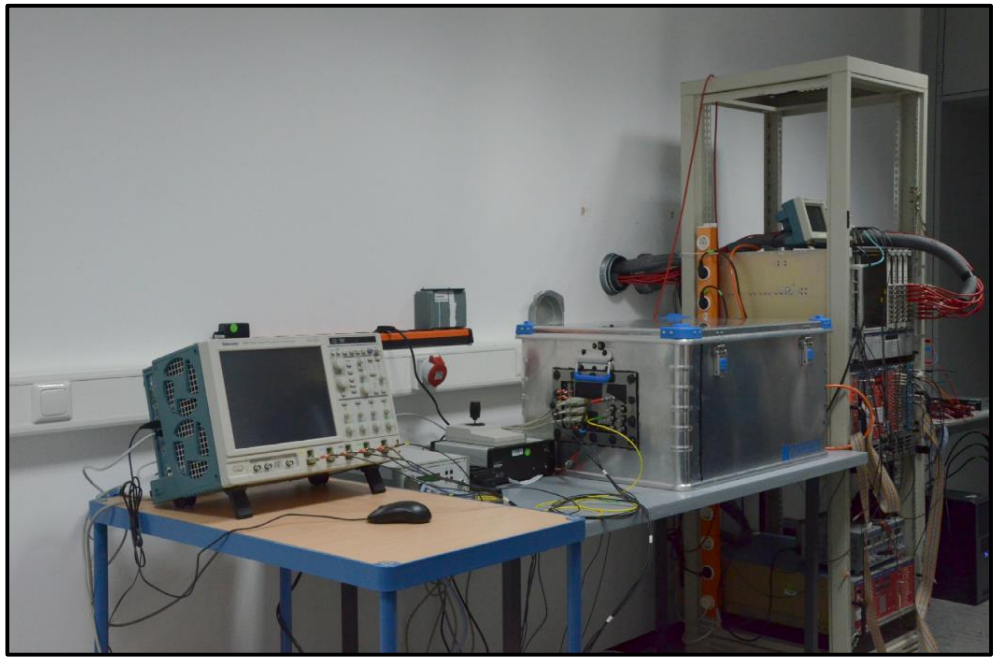
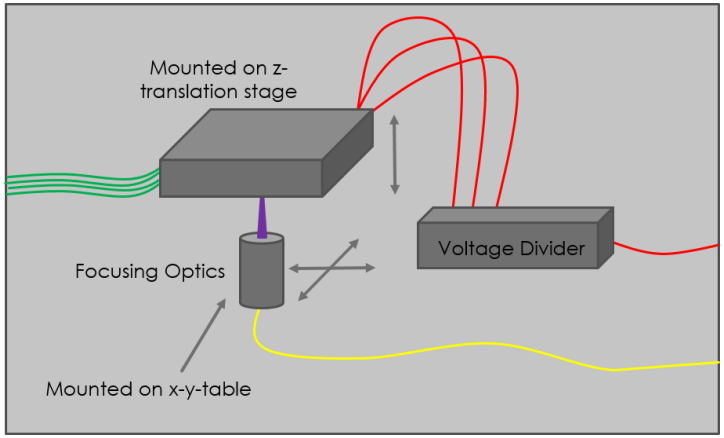
Position resolution of our MCP-PMT prototypes

PANDA PID-Meeting, 2015

Reminder

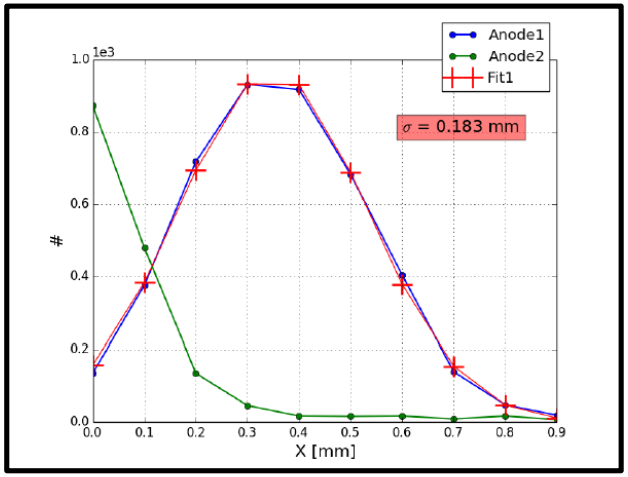


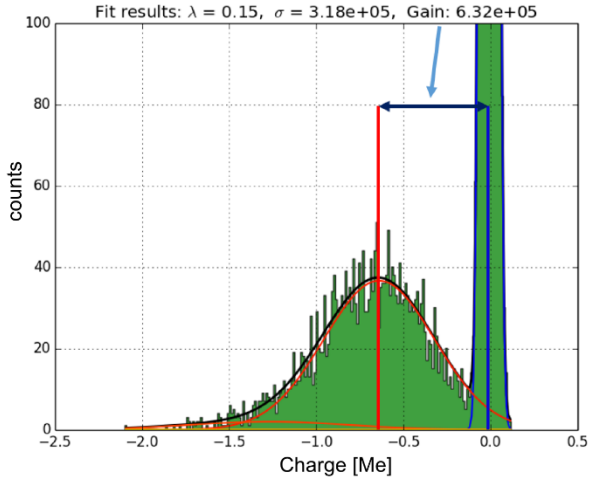
Measurements without magnetic field can be taken with our fully automated setup



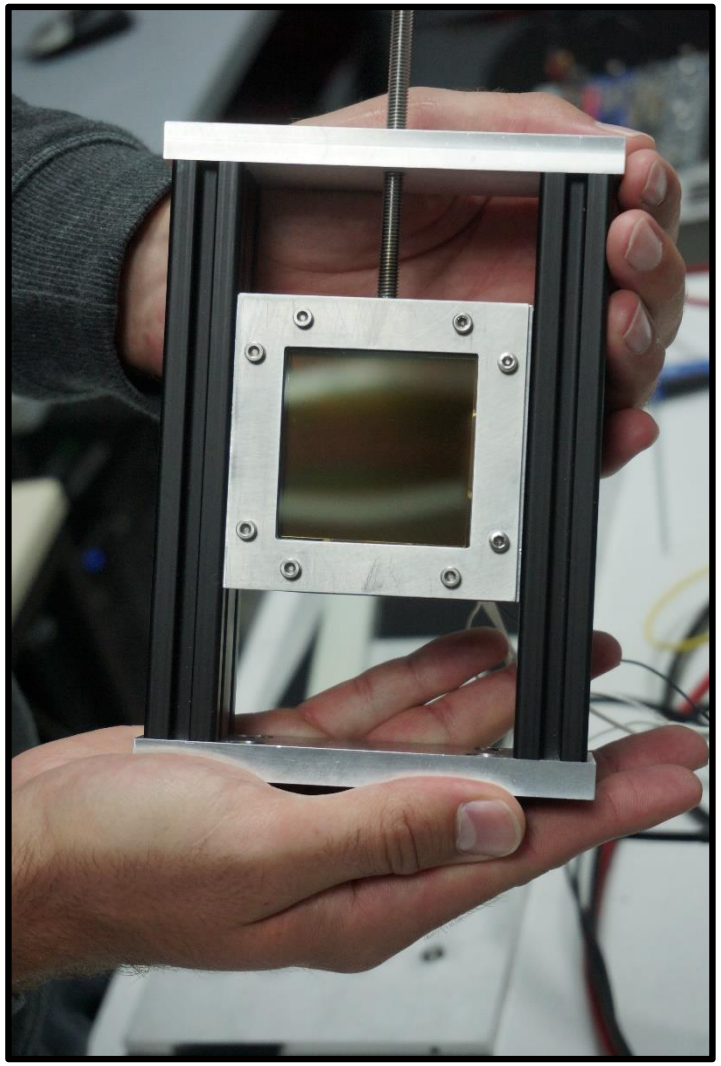
- Charge spectra
- position resolution

- Old measurements show PHOTONIS device with prox. focus ($\sigma = 183\ \mu m$)

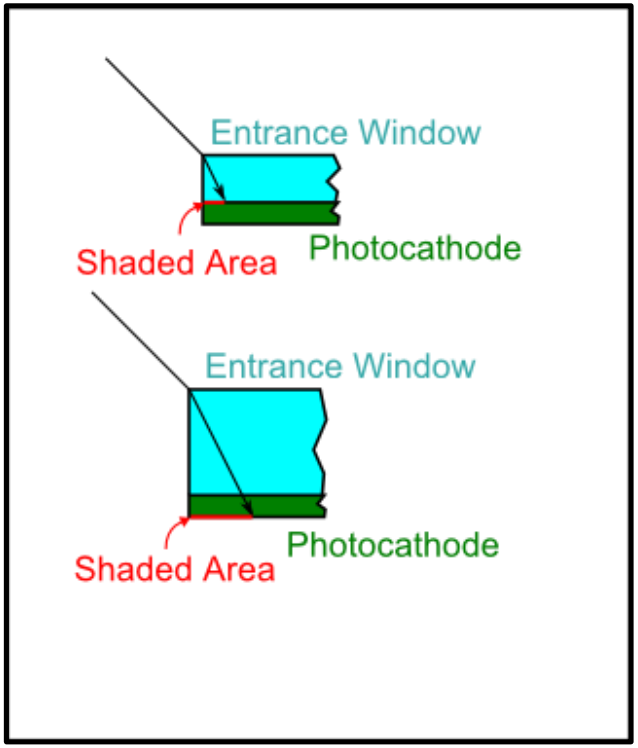




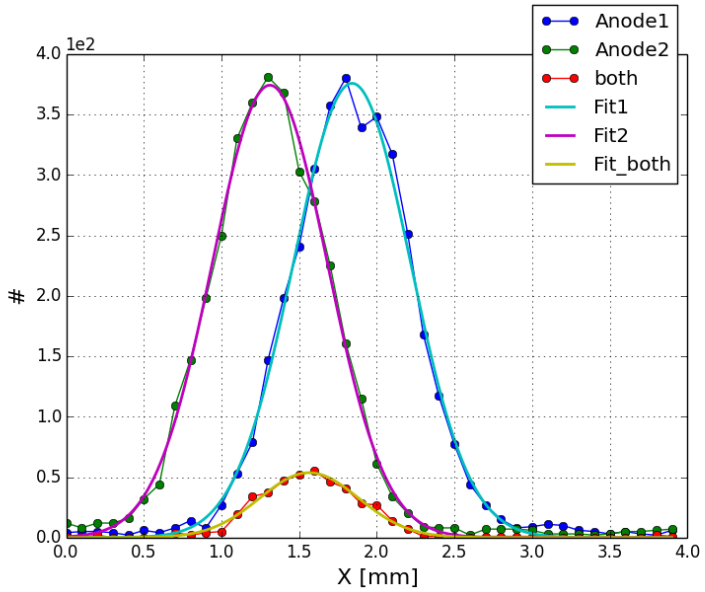
The new PHOTONIS device



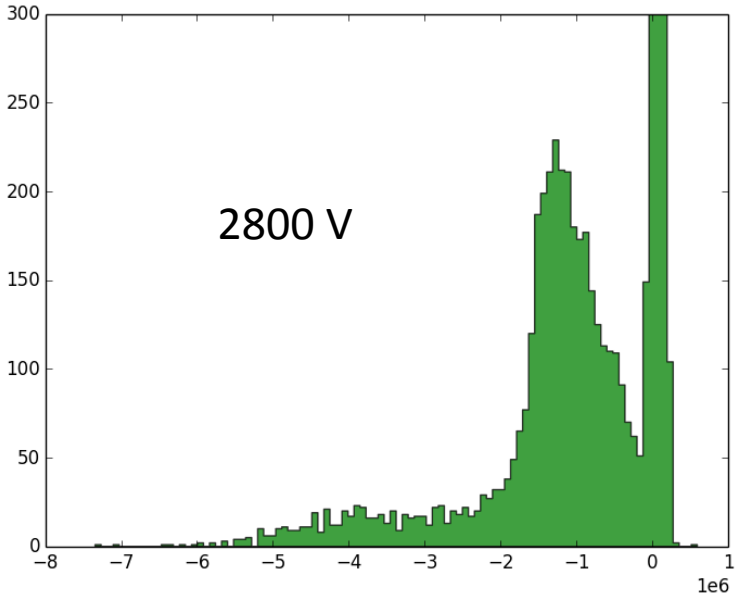
- looks just like the first prototype, but does NOT have prox. focus
- MCP backplate and anodes are much further apart
- “worse” position resolution in field free space
- Better geometric acceptance
- Tests with and without field have been done

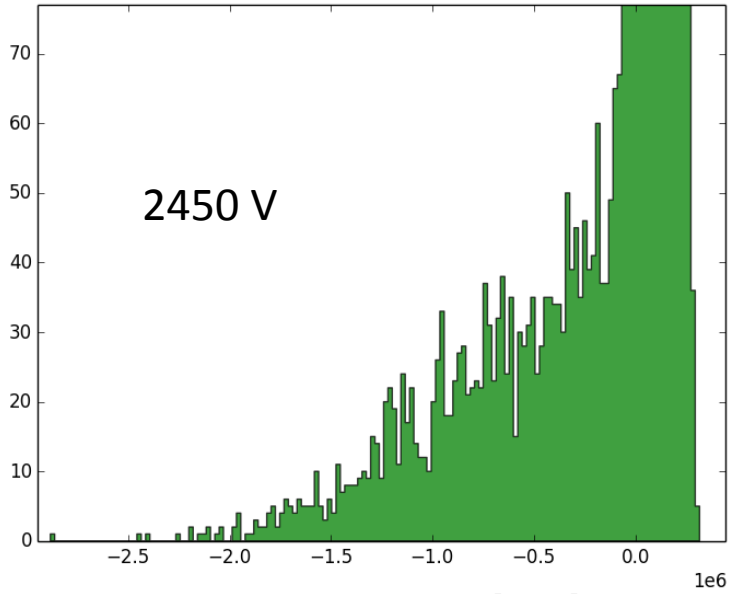


PHOTONIS

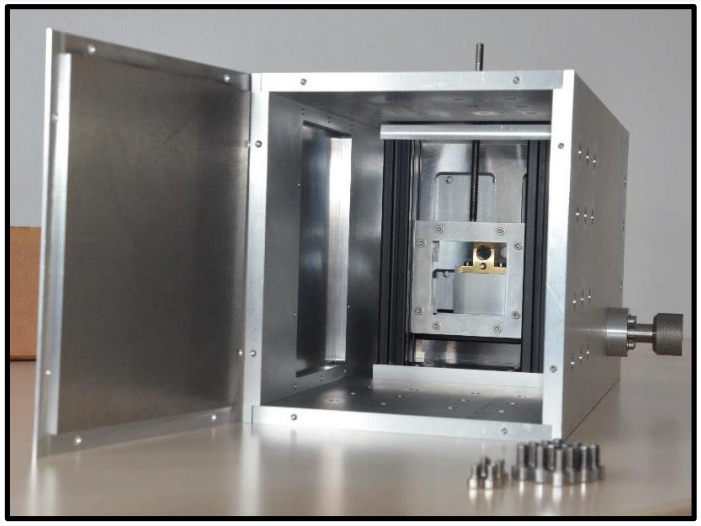


- Measured position resolution in automated setup
- $\sigma = 376\ \mu m$
- Charge spectrum at 2450 V does not show nicely seperated single photon peak (like prox. focus did)
- Increasing the voltage to 2800 V (max voltage) reveals single photon peak

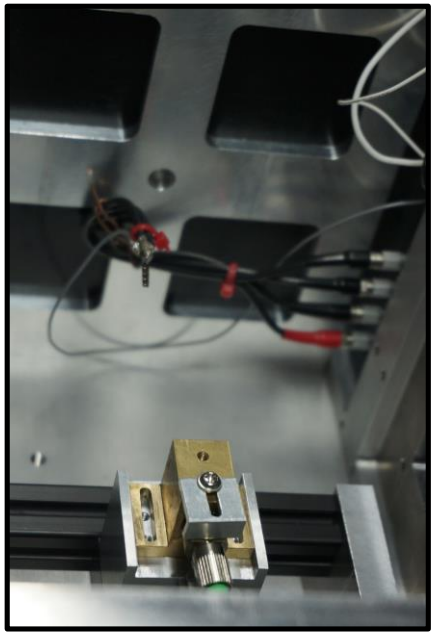


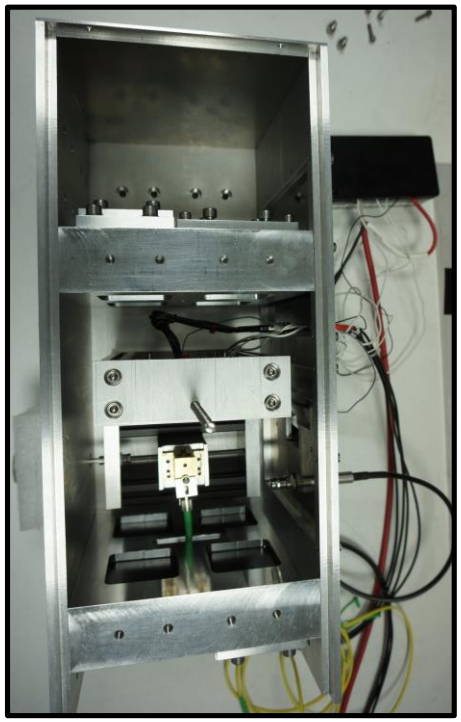


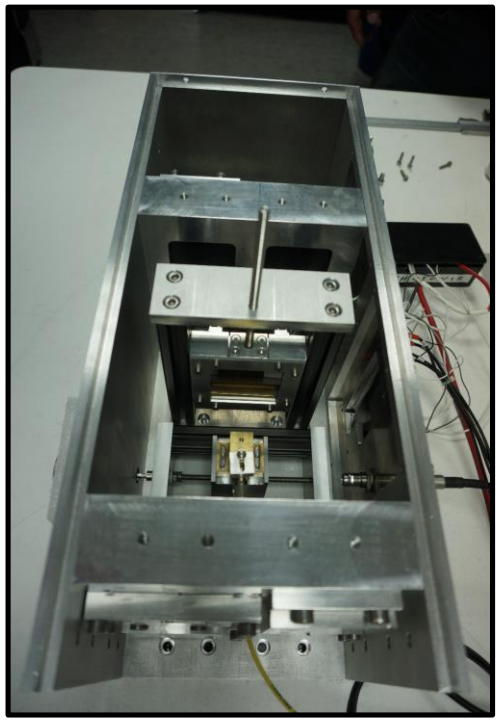
PHOTONIS



- In the next step the magnet box was used to do measurements with a magnetic field applied
- Different field strength can be dialed
  - (65, 55, 43, 34, 33, 24) mT







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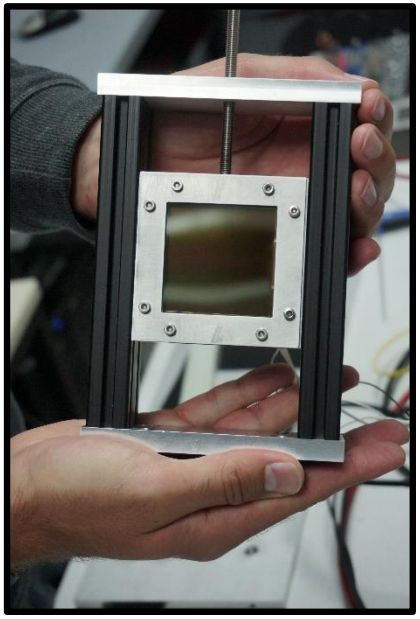
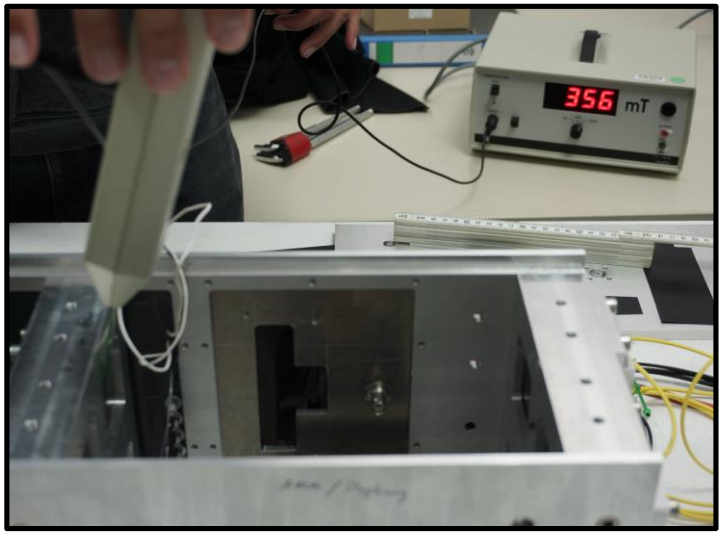
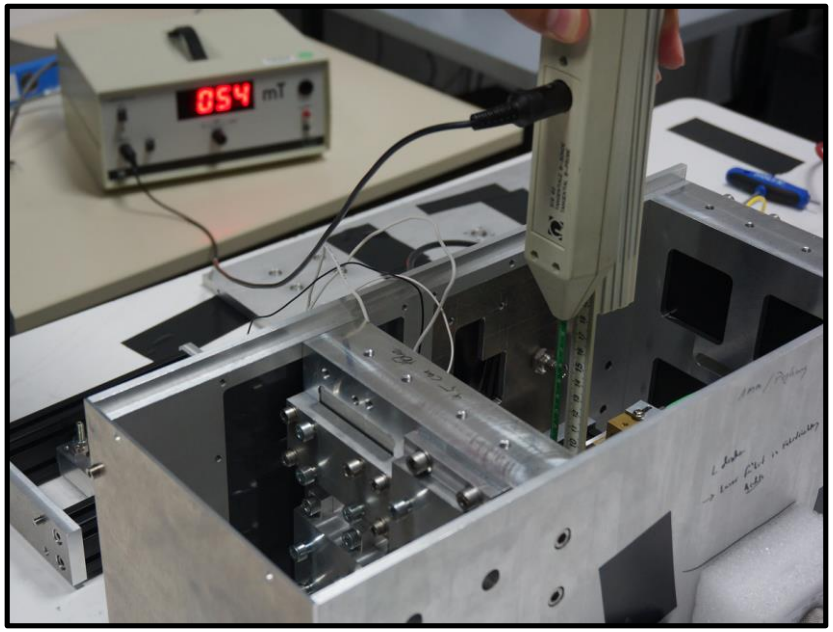


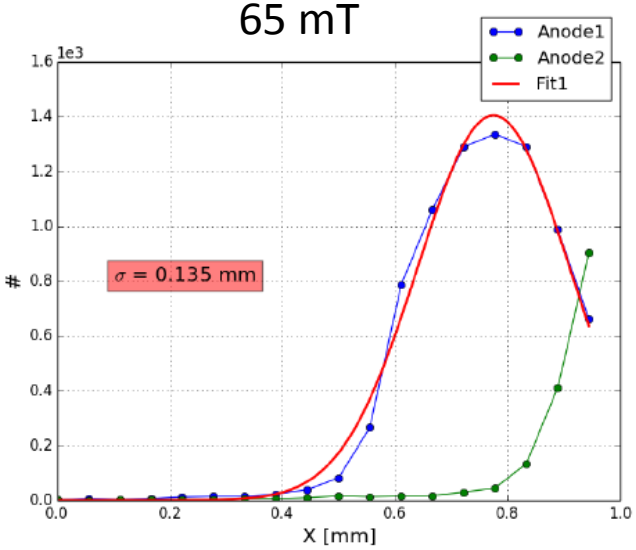
- The magnetic field is quite homogenous in the middle of the to magnet walls
- Field is measured in the absence of the sensor
- Many thanks to PHOTONIS for the new HV-connections!



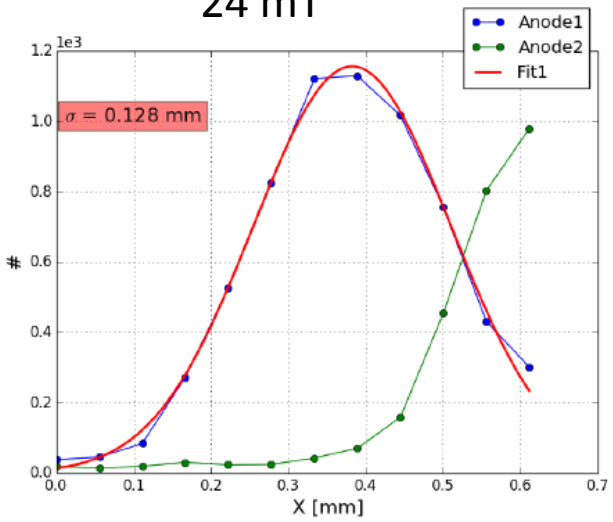


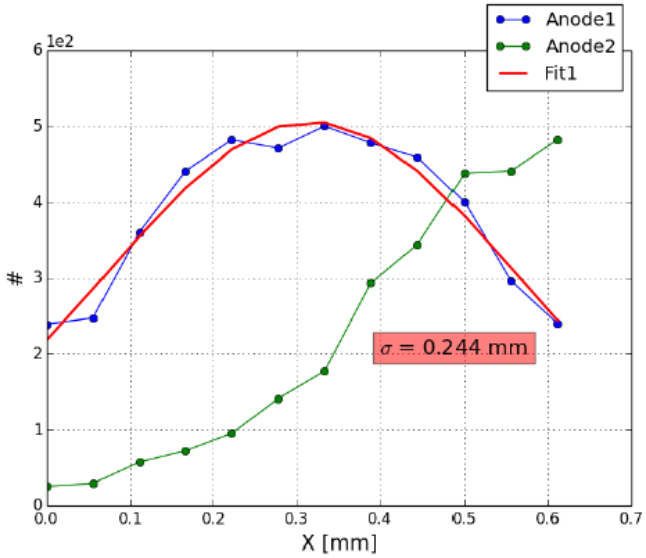
PHOTONIS

65 mT

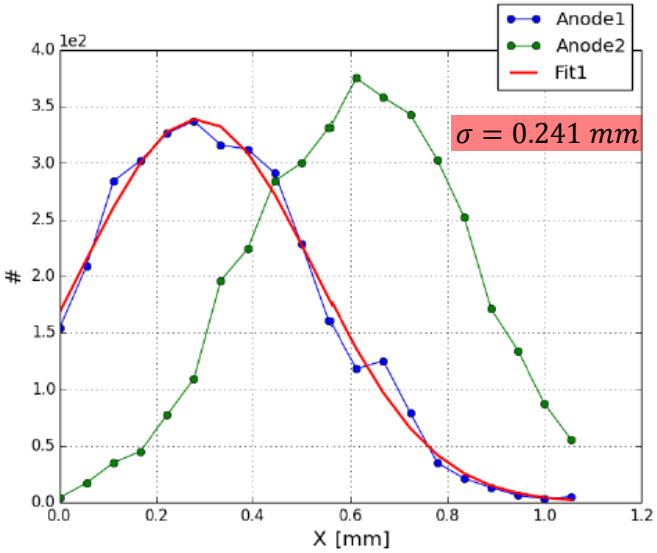


24 mT





Remanence?



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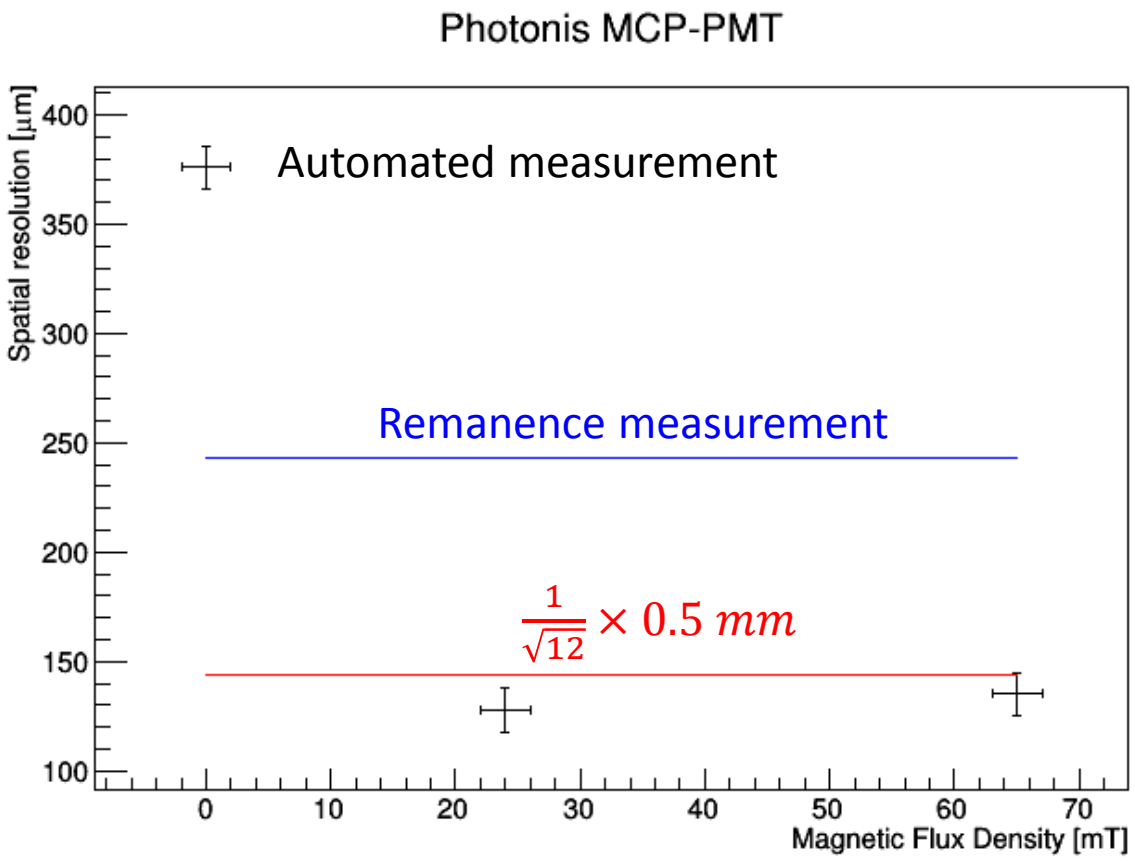
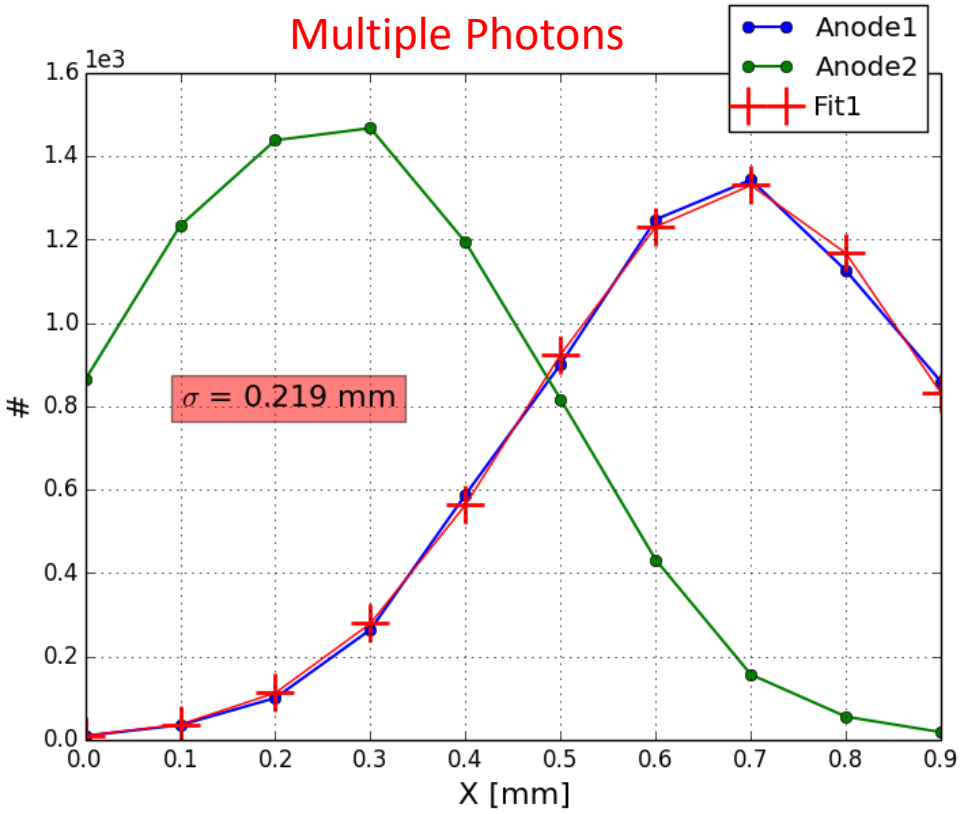
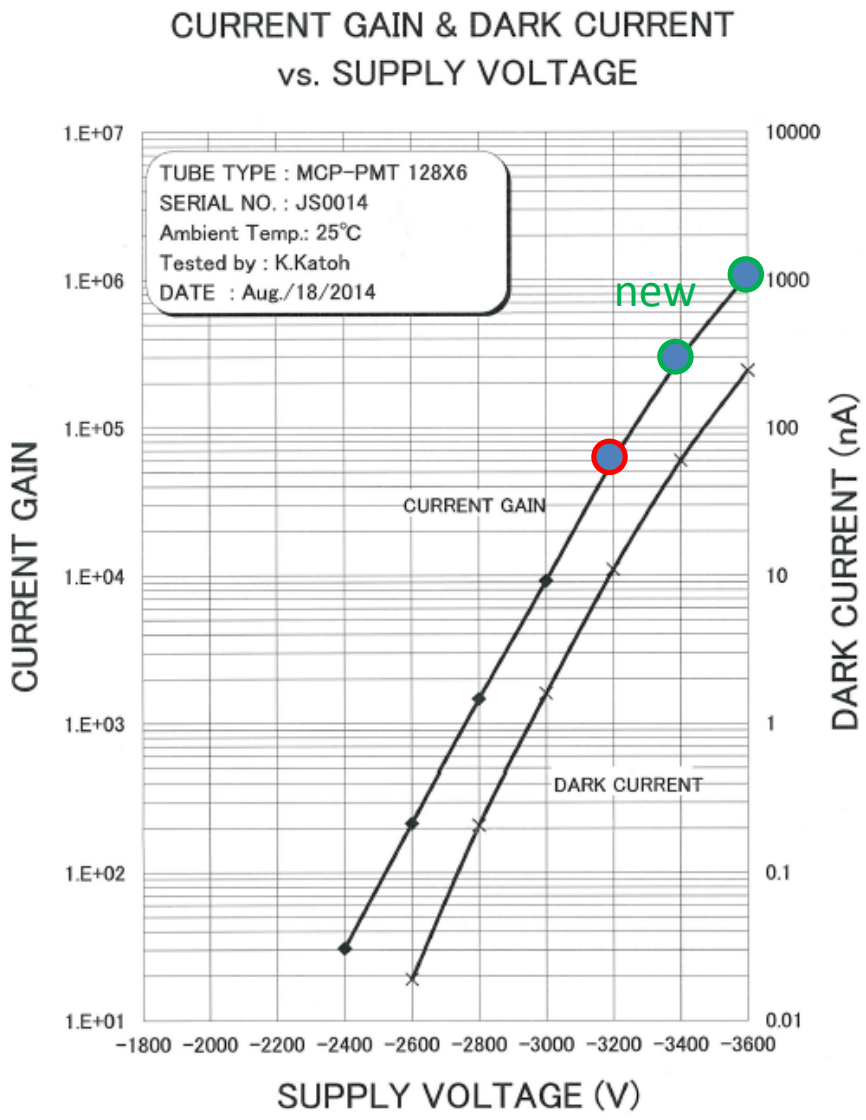


- The MCP-PMT does contain ferromagnetic materials
- Remanence field can be measured with the Hall device, so the sensor is magnetized
- Next step: Redo measurement in automated setup to see if we have agreement

Hamamatsu (Reminder)

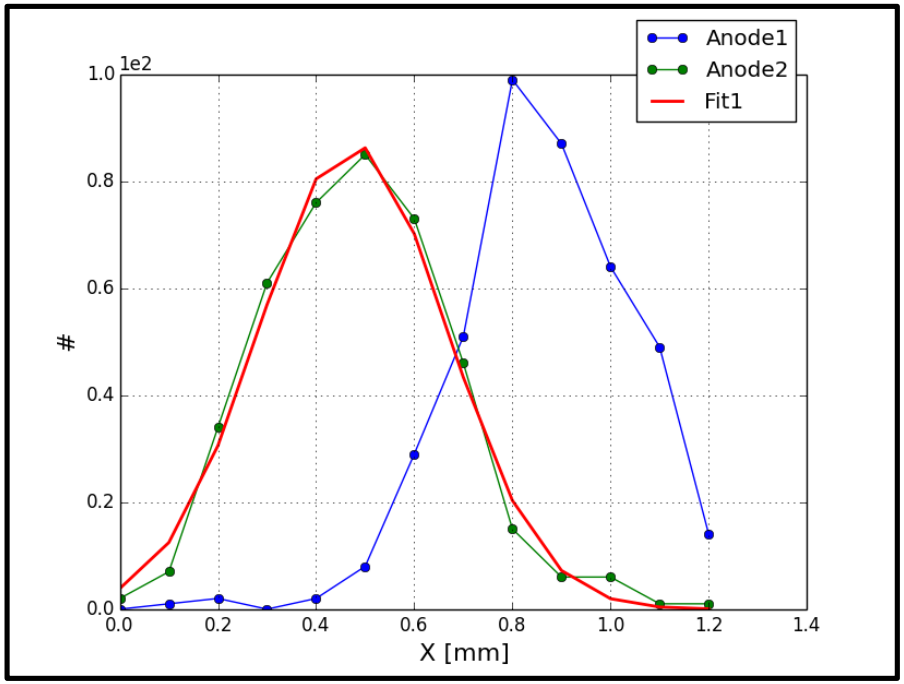


- Old measurements have been done with multiple photons at low gains ($< 10^6$)
- New measurements at suitable SP gains

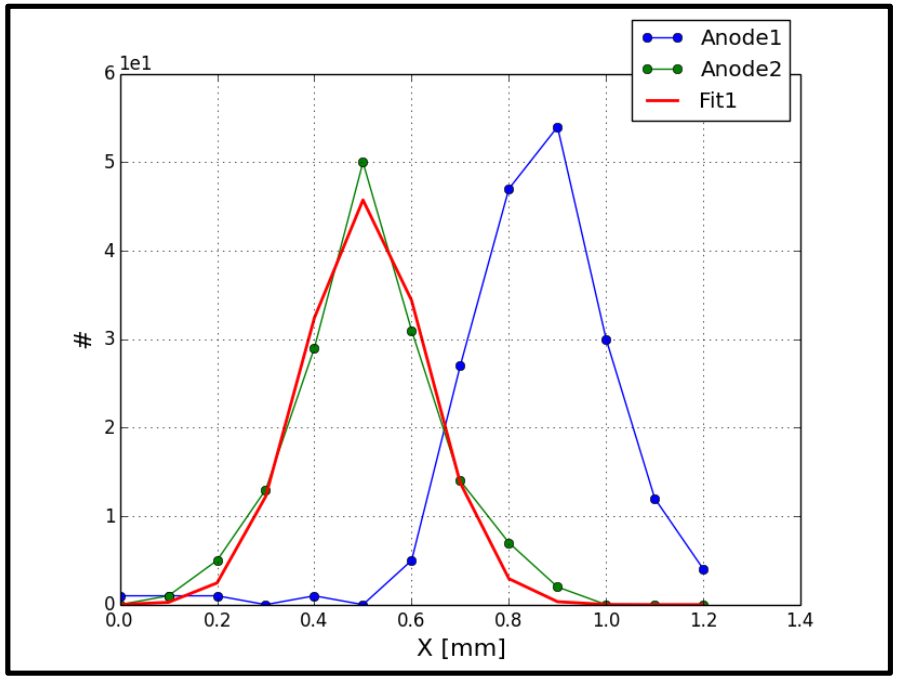


Hamamatsu

$\sigma = 120\ \mu m$ 3400 V

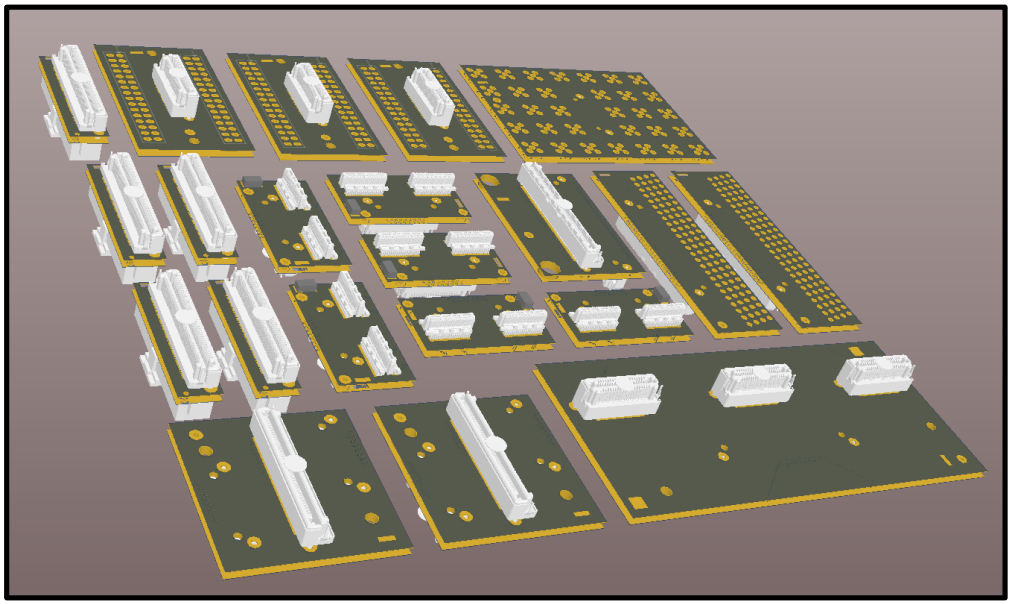


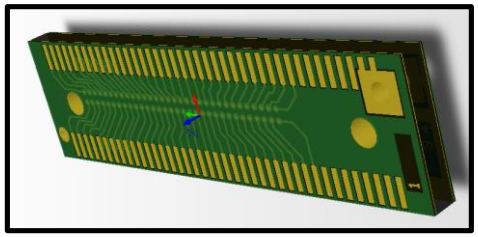
$\sigma = 190\ \mu m$ 3600 V

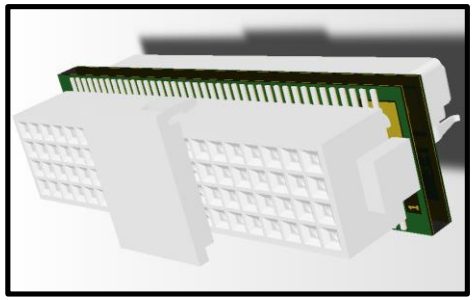


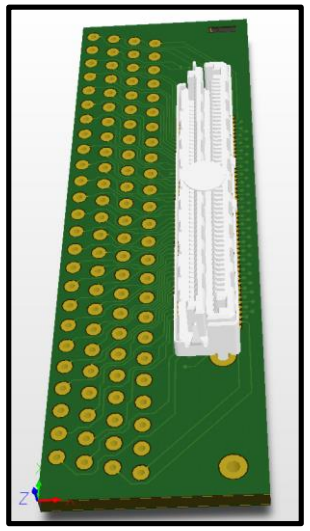
- Position resolution without magnetic field
- Anode pitch only 0.3 mm instead of 0.5 mm (PHOTONIS)
- Next step: apply magnetic field

New Prototype Hardware

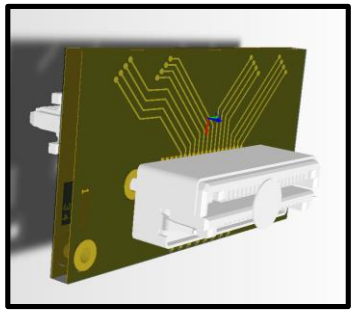


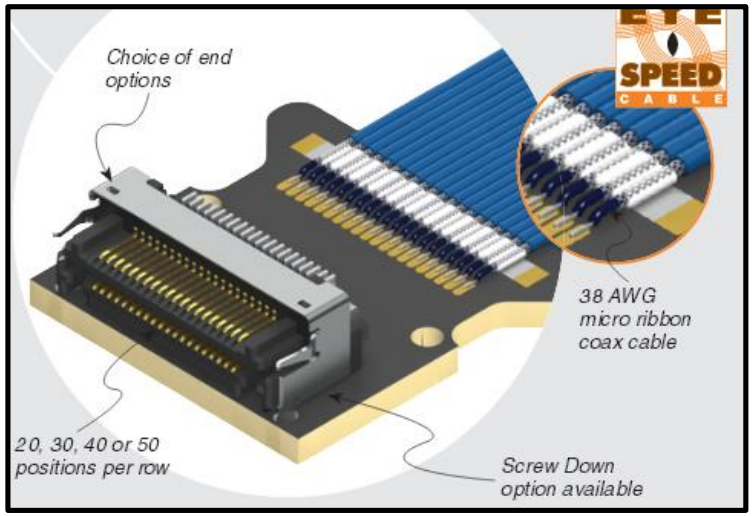






- CERN testbeam was very successful with old hardware
- However, the TOFPET ASIC seems to be very sensitive when using the unshielded flex cables
- Flex cables pick up noise in the magnet box
- Mechanical stability of connections can be improved
- Impedance control of flex prints is inacurate





Also used by Erlangen!