Developement of a test stand for MAPMT series tests*

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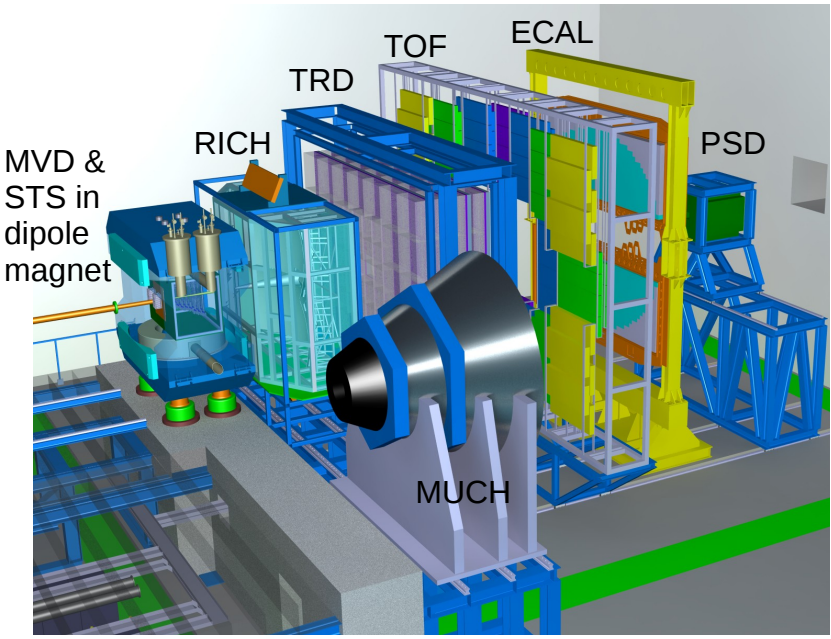
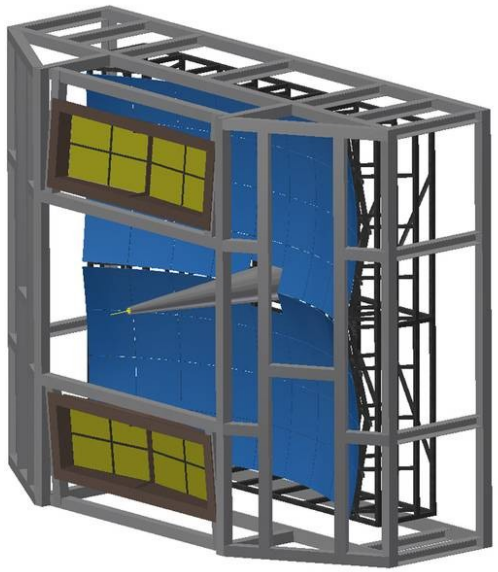
The CBM Experiment

- Explore QCD phase diagram in the region of high net baryon densities and moderate temperatures using heavy ion collisions
- Energy range from 2 to 11 AGeV (Au + Au) at SIS100
- Explore the fireball with e.g. $\rho \rightarrow e^+e^-$

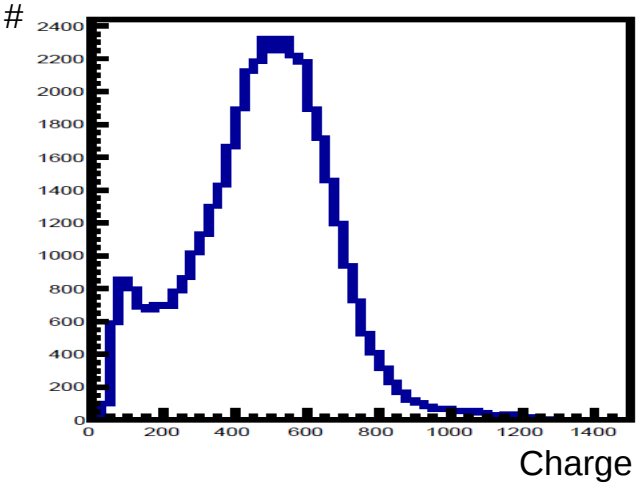


- The RICH is used to distinguish between electrons and pions
- Vertical splitted gaseous detector
- CO_2 used as a radiator (180 nm cutoff)
- Spherical mirrors project ring on photodetection plane
- Using HAMAMATSU H12700 as photodetector
- 55K Channels at 2.4 m^2

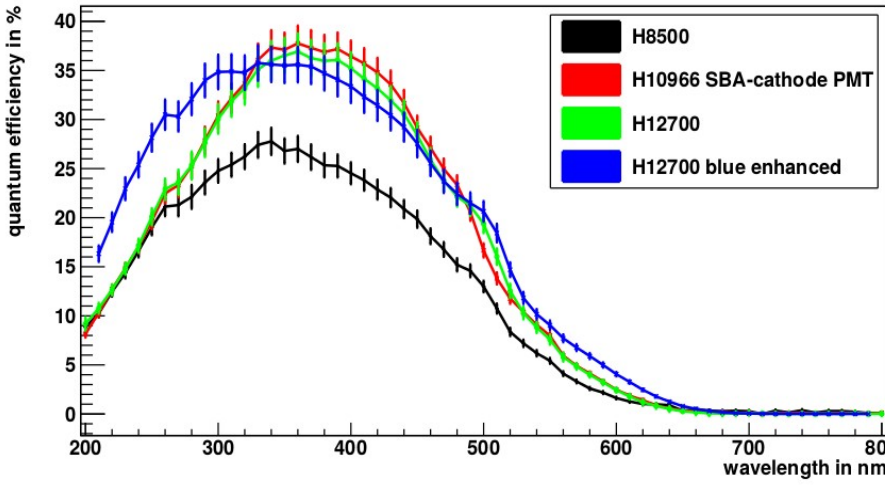


The Motivation (for the H12700)

- Clear separable single photon peak with high gain
- High quantum efficiency using a blue enhanced “SBA”-cathode (>30% at peak)
- High collection efficiency (~90%)
- High effective area with high pixel resolution (64ch @ 2x2 in²)
- Low noise / low dark rate (<6.4 kHz)



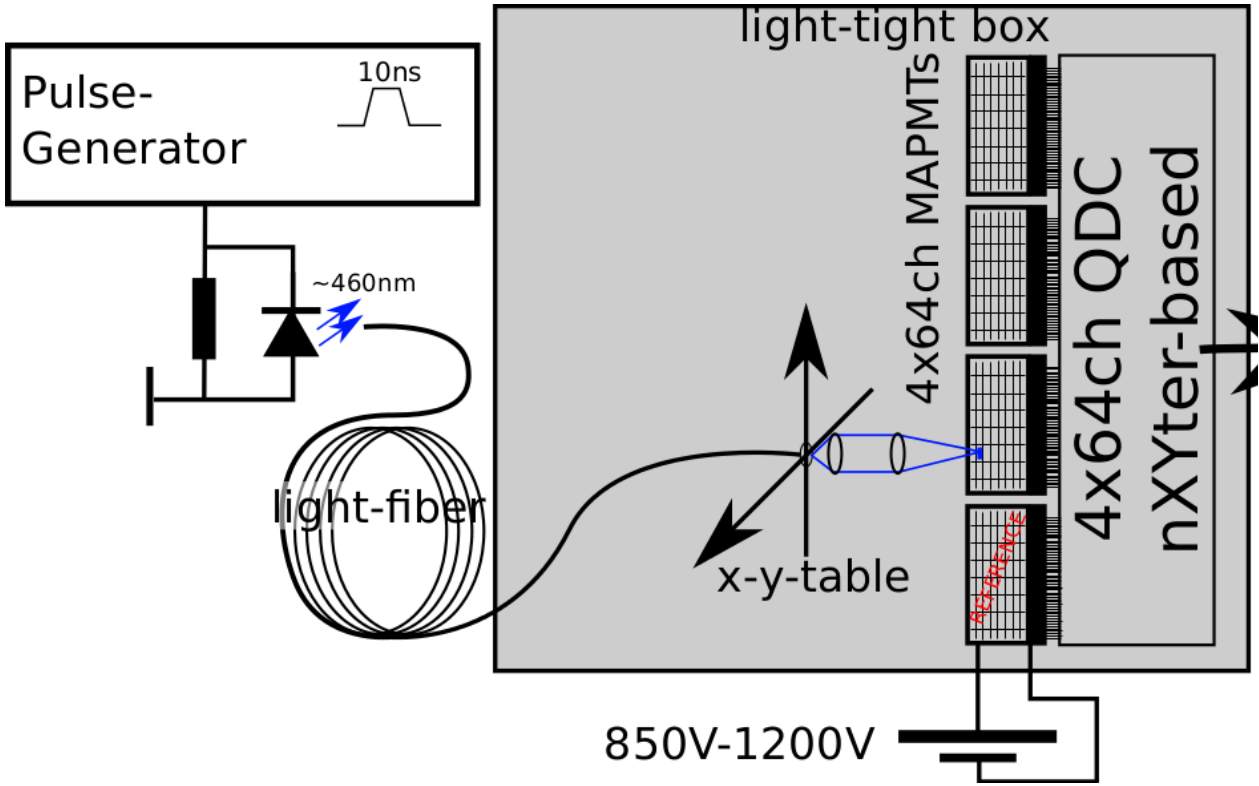
- **All these quantities are measurable with one single photon scan (except quantum efficiency)**



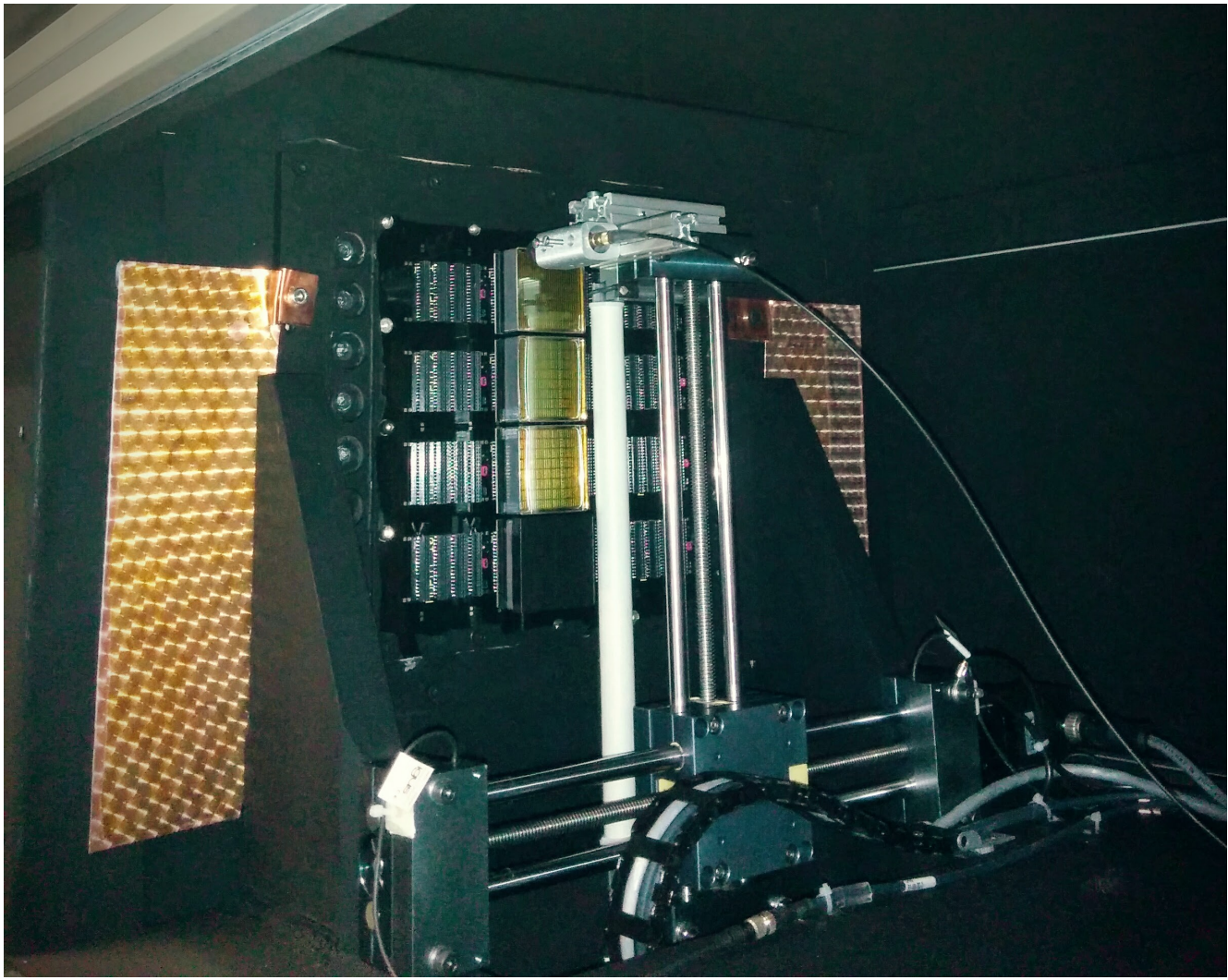
- 1100pc were ordered with 50pc being delivered every month → Quality control needed

The single photon scan

- Measurement principle
  - Triggered light-source emitting "single" photons
  - Leading photons to single point on MAPMT (e.g. optical fiber)
  - Checking for pulses in each channel of the MAPMT
  - Reference PMT needed
- Our setup
  - Pulsed LED 460 nm (~12kHz)
  - EPICS controlled XY-table
  - Self triggered nXYter ADC readout
  - Fully automated
  - 9h for 3+1 MAPMTs incl. cooldown and HV-scan

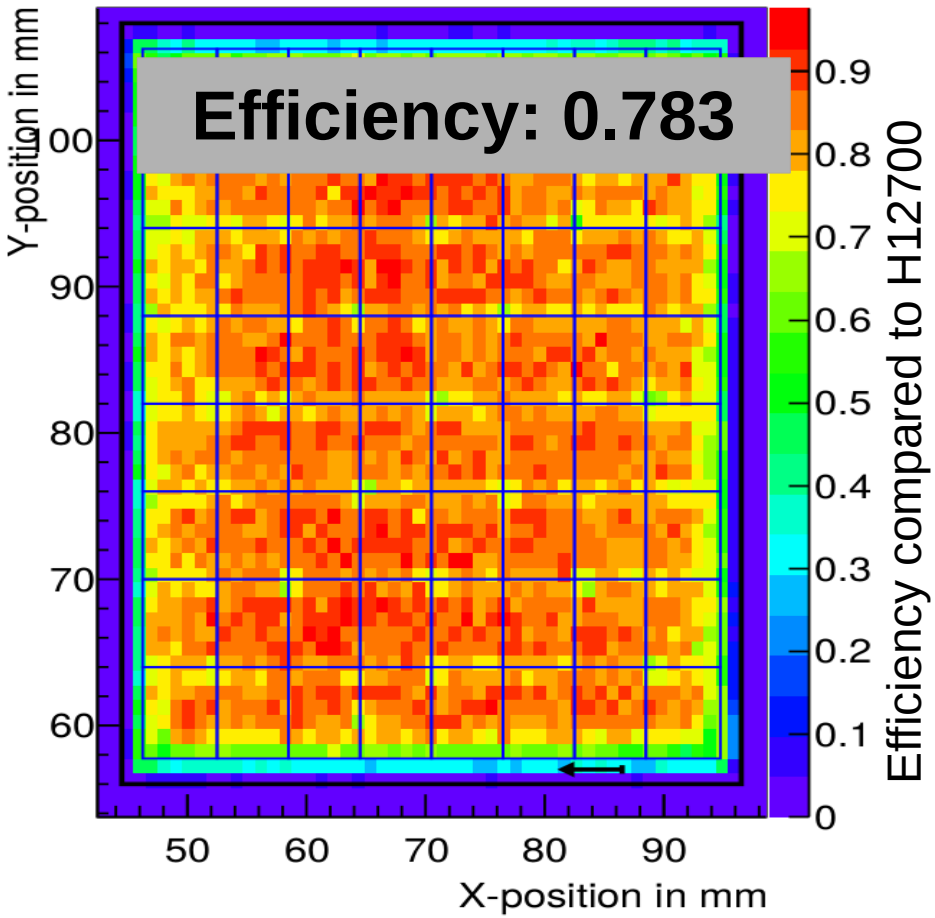


The Test stand

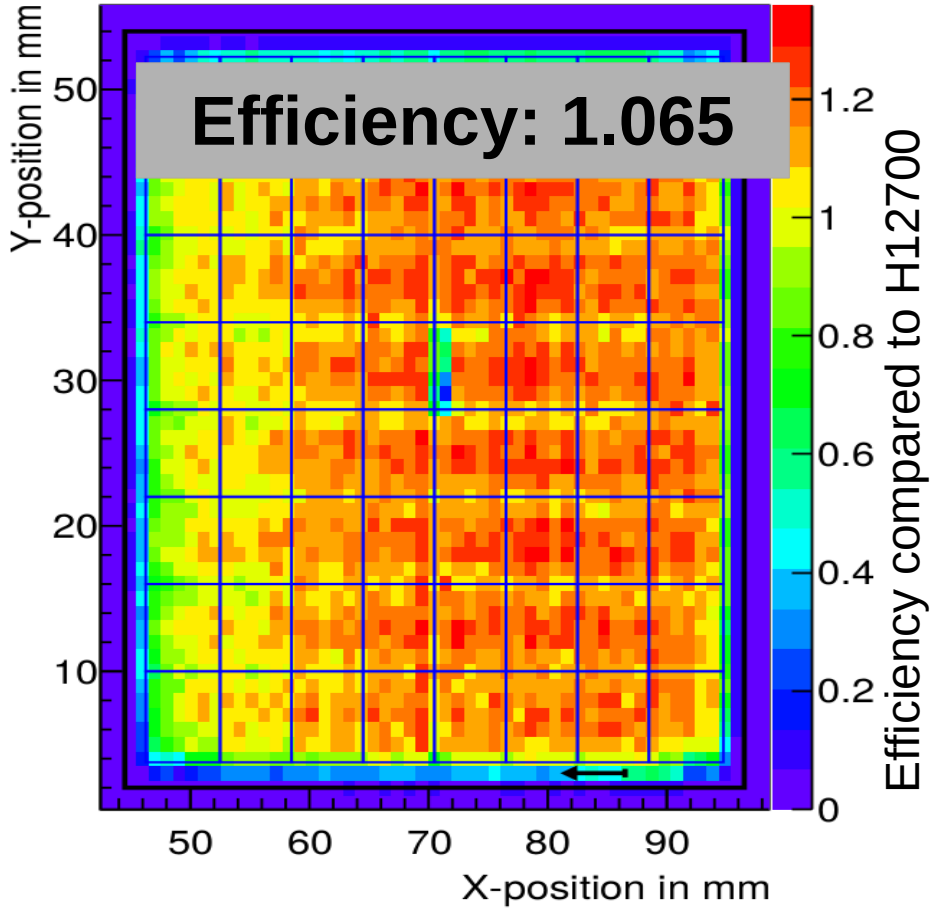


First results: Comparison H8500 to H12700

H8500-03



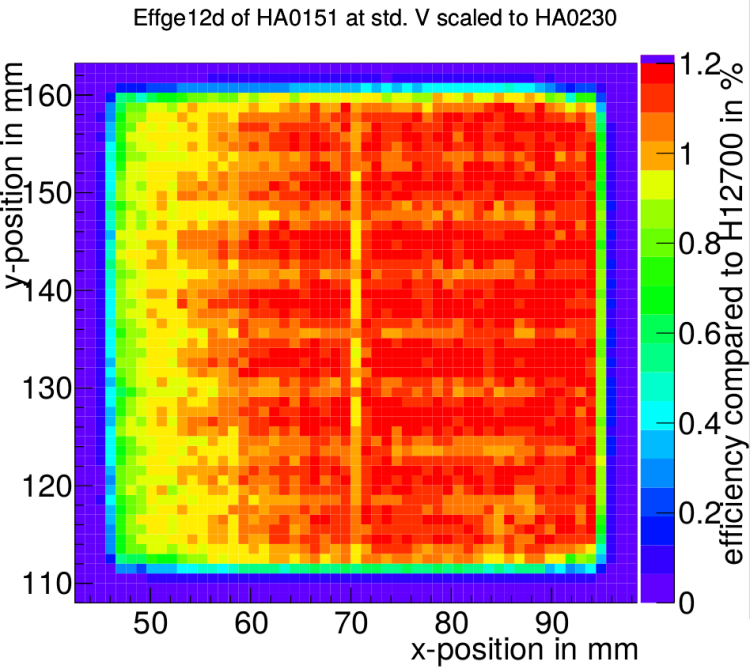
H12700-03

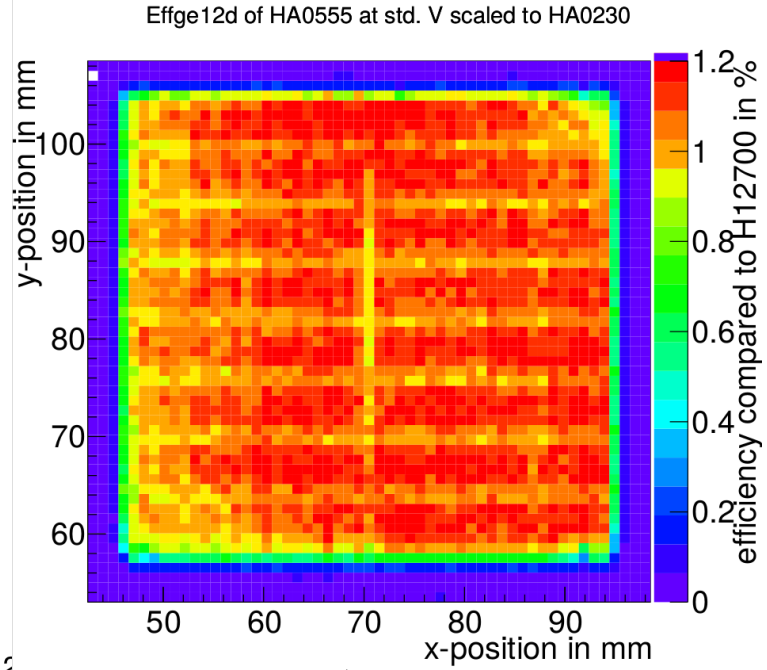


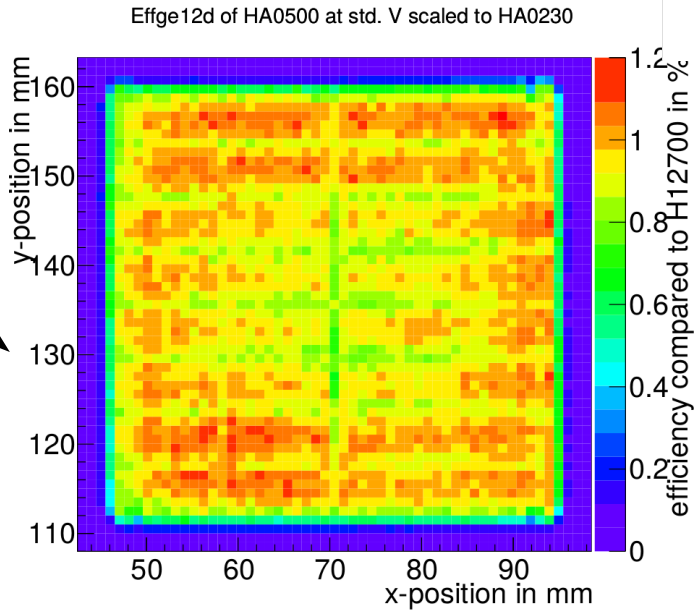
Efficiency Index:

Average efficiency in area above a certain threshold (depending on maximum-efficiency)

First results: Homogeneity evolution of H12700 (I)

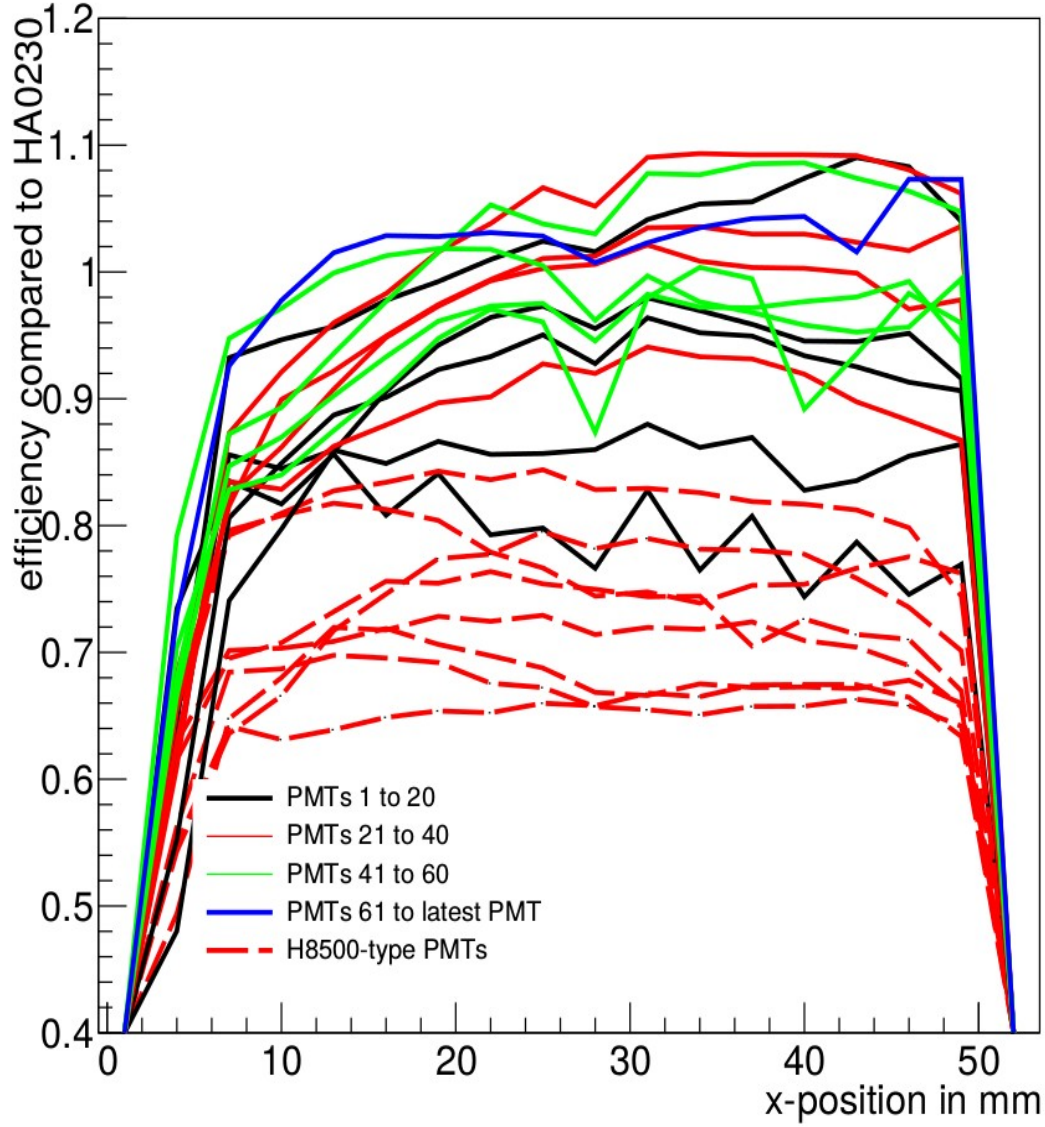




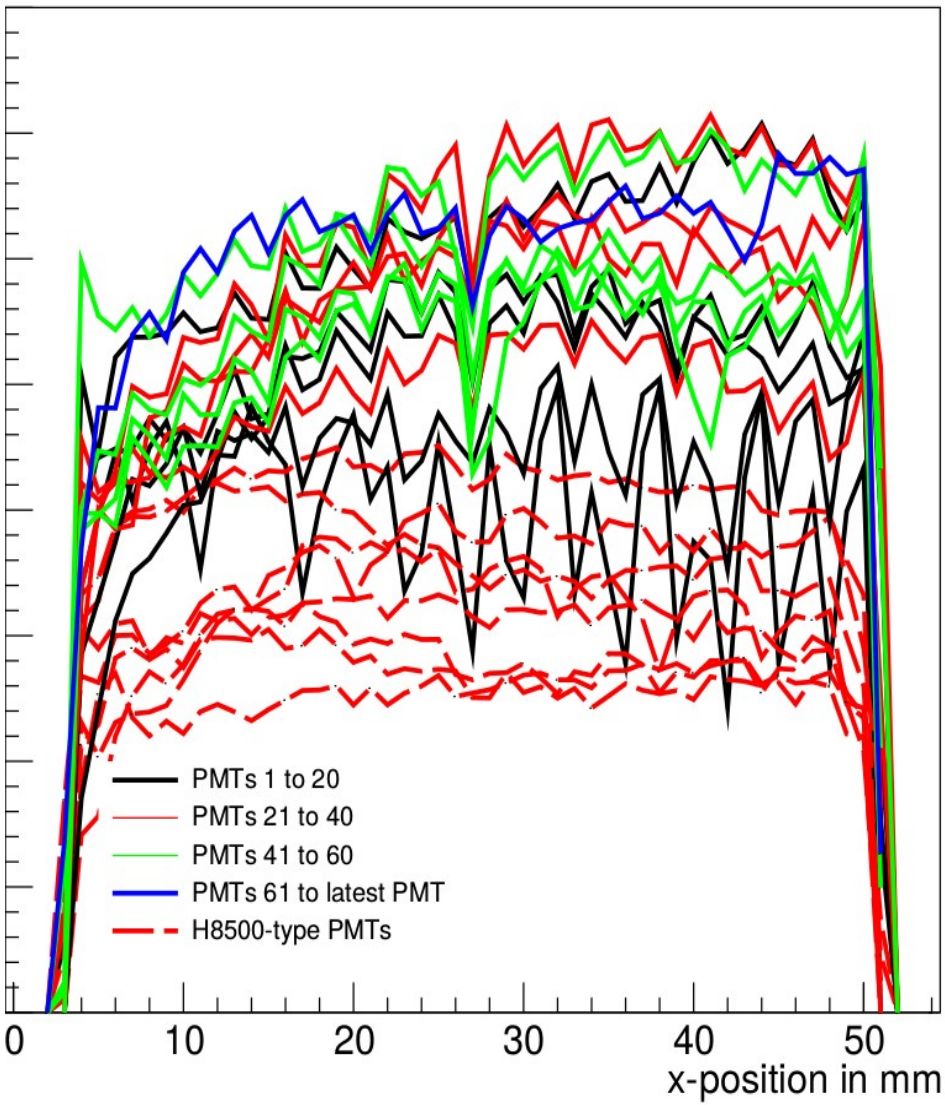


First results: Homogeneity evolution of H12700 (II)

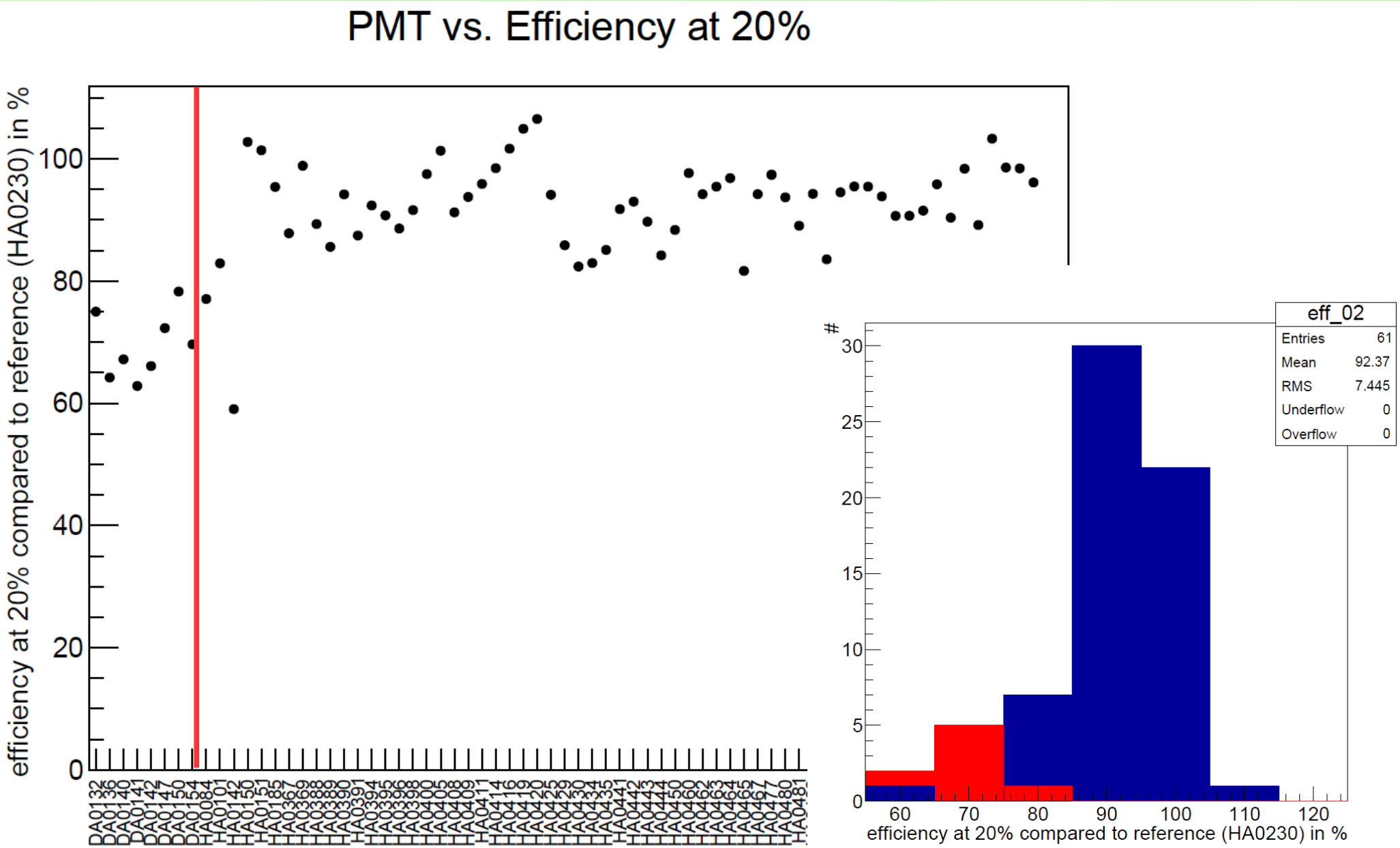
X-Projection



Y-Projection



First results: H12700-Statistics (I)



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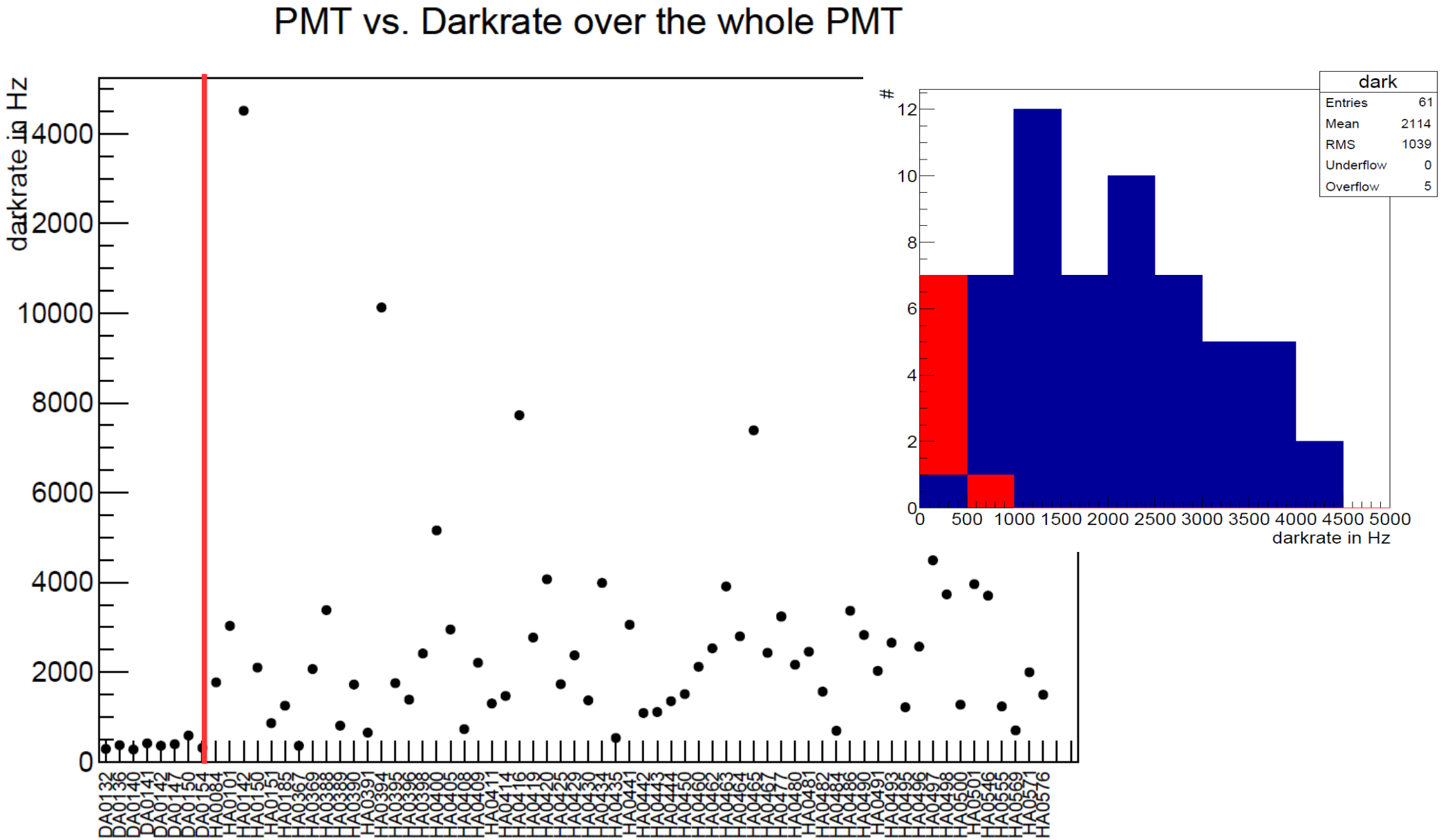
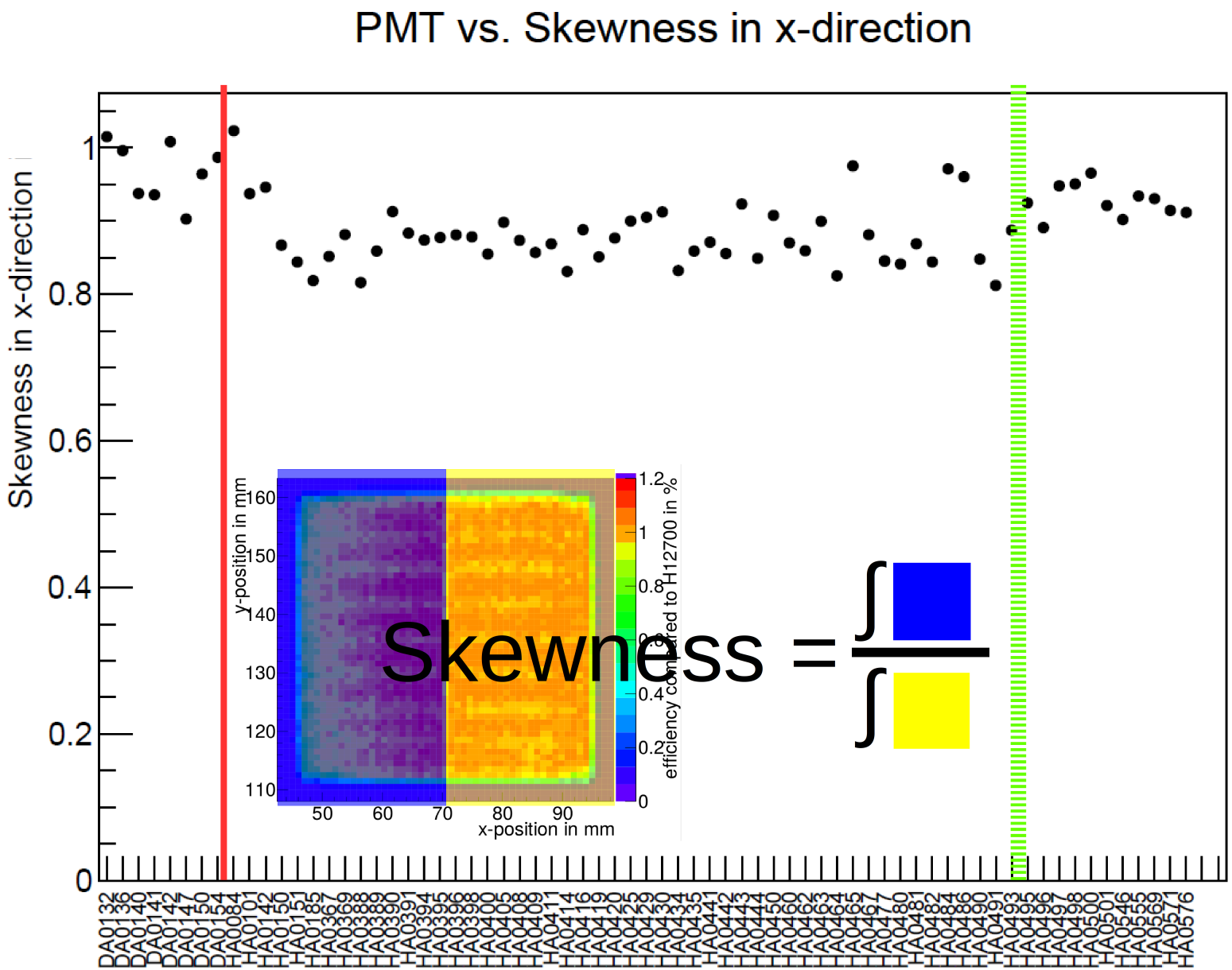


First results: H12700-Statistics (III)



Summary

- Currently 200 H12700 PMTs at Wuppertal
  - Out of which ~75 are currently measured
- If no severe problems occur the rest of the PMTs (~125) will be measured in 1 ½ months
- First PMTs show a tilted efficiency plane which seems to be fixed for newer PMTs
- The fully automated test stand gives valuable and quick results