Status report of MCP-TOF

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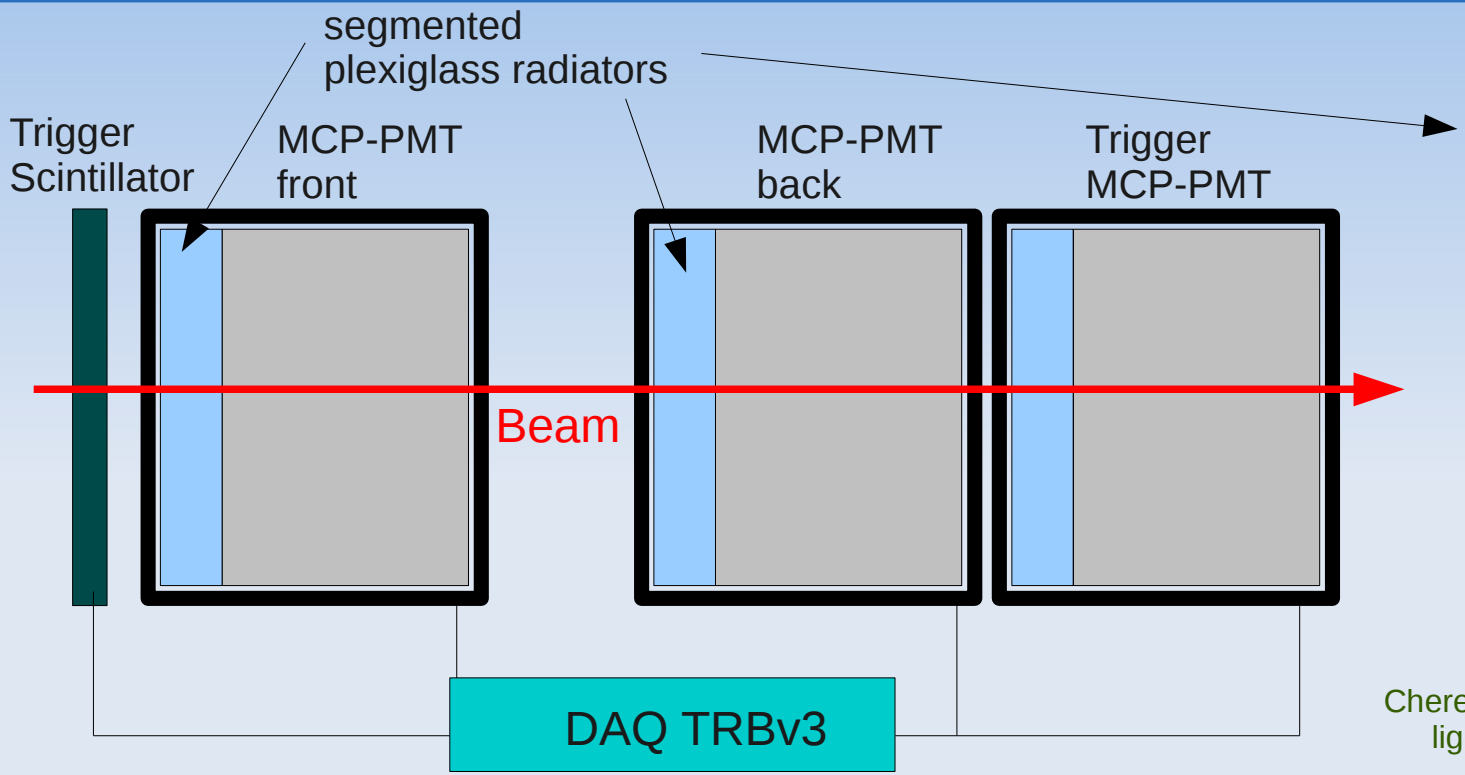
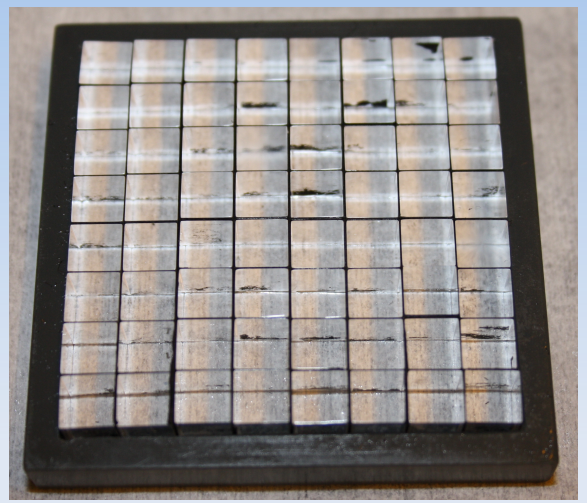
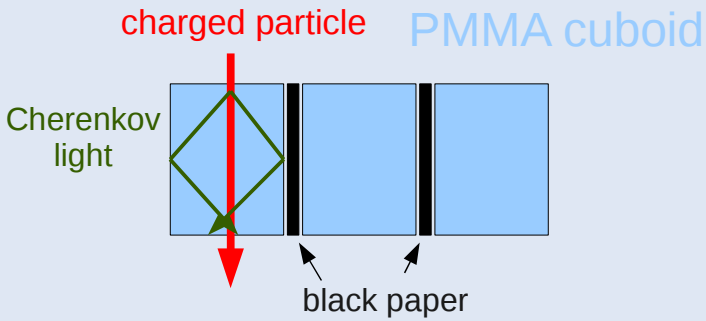
- MCP-TOF for PID and tracking at testbeam facilities
  - modified MCP-TOF setup
  - Padiwa frontend and TRBv3 readout electronics
  - time resolution of Photonis XP85012 MCP-PMT (MCP-Out, single pixel) in the lab
  - time resolution of MCP-TOF system with TRBv3 readout at FZ Juelich testbeam
- Summary

MCP-TOF Setup



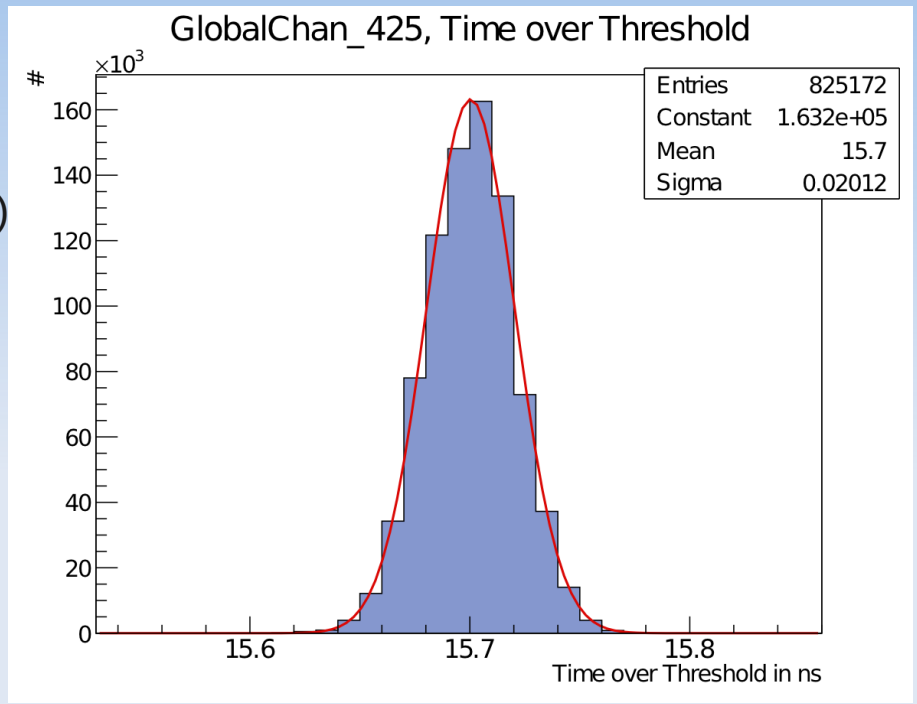




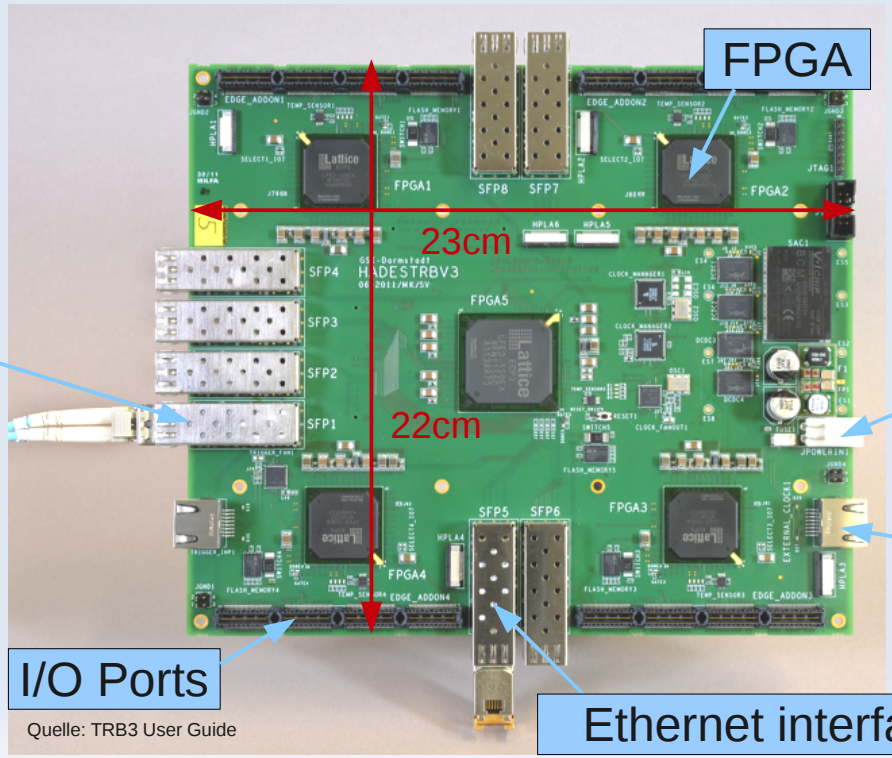
- 2 MCPs (Phot. XP85012-1D) with segmented (8x8 pixel, 6x6mm²) plexiglass radiator (1cm)
- Beam penetrates MCPs directly
- coincidence trigger between scintillator and MCP-trigger
- 64 channels and MCP-Out (sum of all 64 channels) signal for each sensor

TRBv3 DAQ System

- FPGA based TDC and trigger board
  - 256 TDC channels/board
  - 3.6ps time resolution possible (~10ps with 256 chans)
  - high rates (up to 700kHz recorded, 50MHz hits)
  - easy handling
    - connected to PC via ethernet
    - 48V powersupply



TOT spectra of Lasertrigger:
σ = 20 ps (with Padiwa FrontEnd)

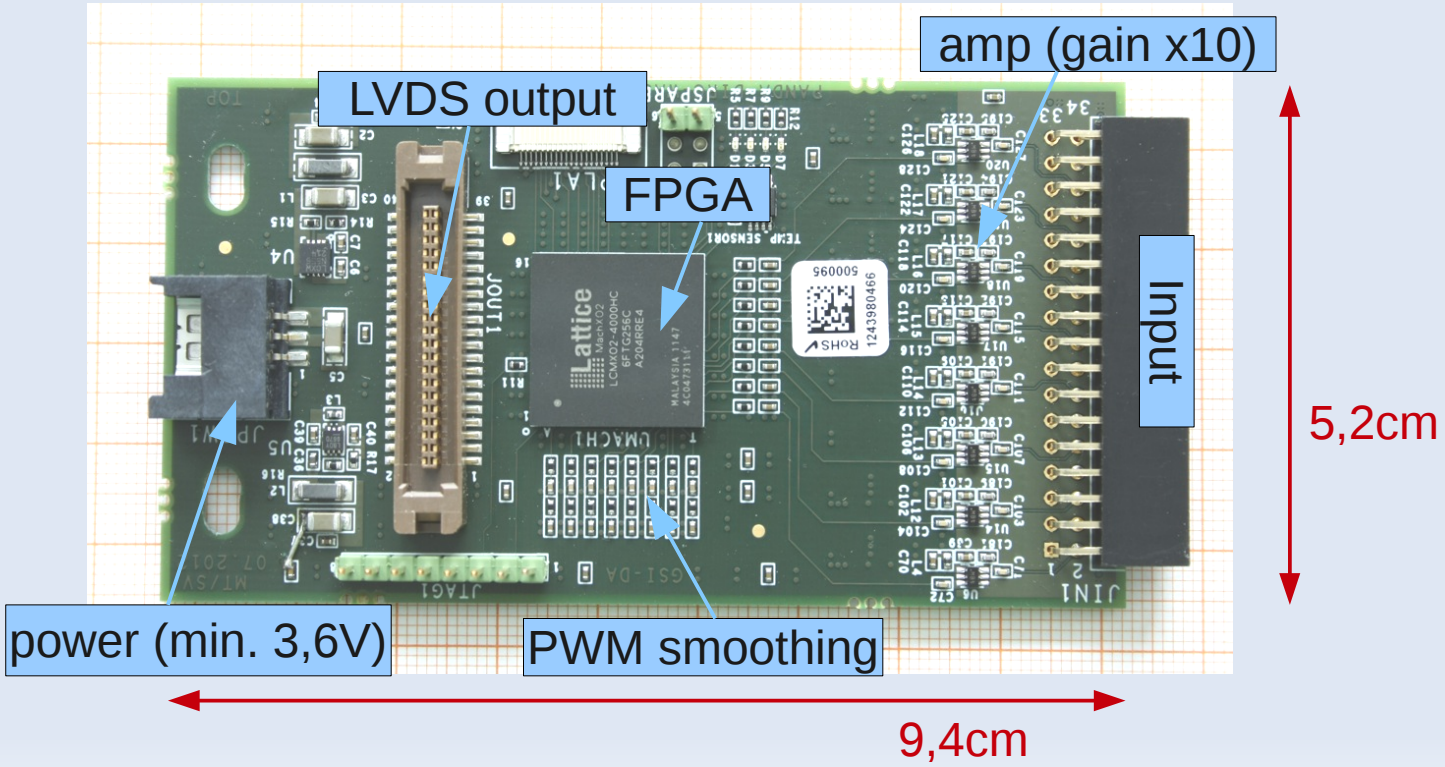


Quelle: TRB3 User Guide

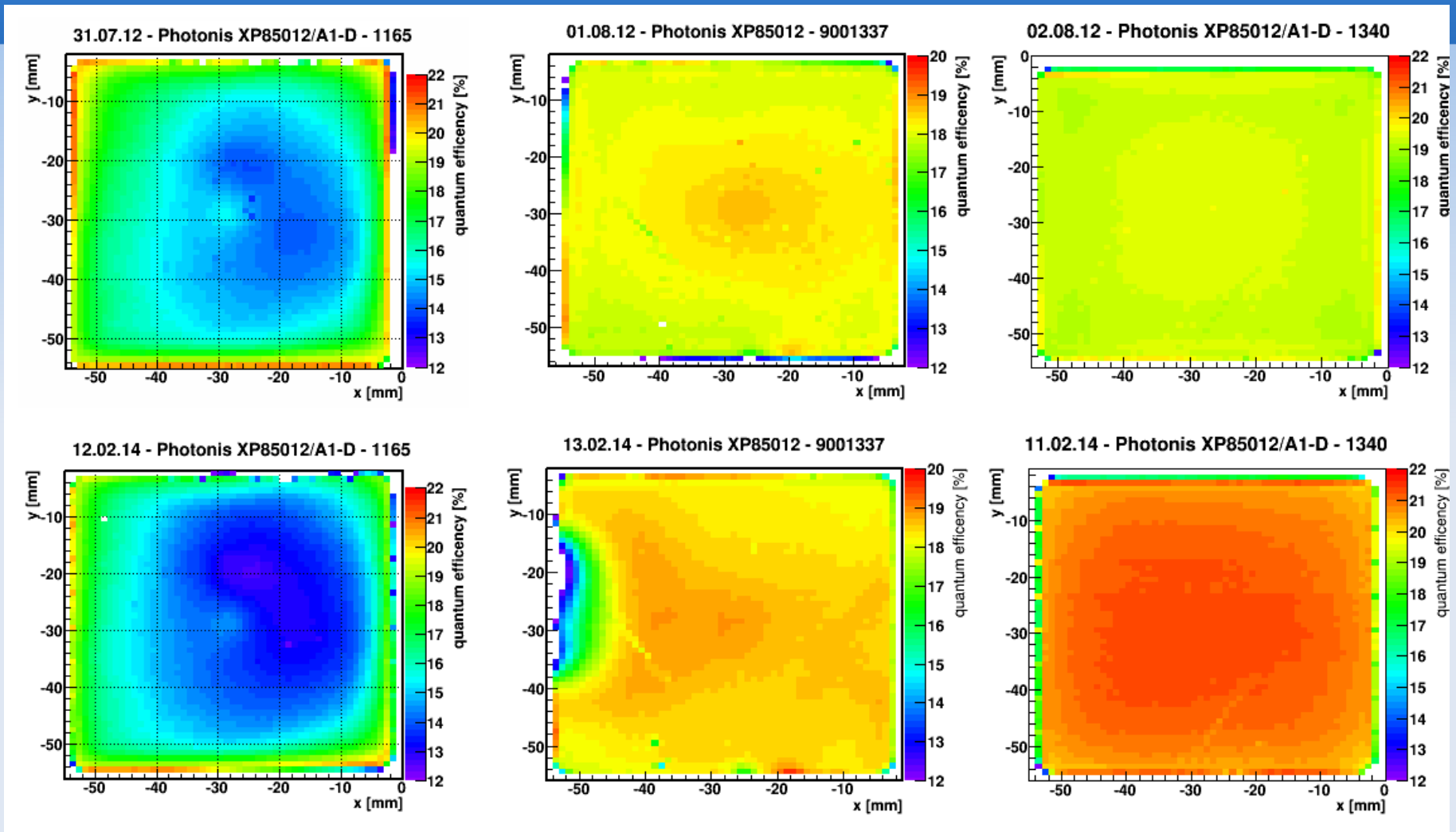
Promising candidate for PANDA DIRCs

Padiwa (PAndaDIrcWAsa) Front-End board

- New developed FPGA based discriminator board
  - 16 channels (single ended input (+ or -))
  - Threshold by PWM (puls width modulation) direct from FPGA
  - Threshold selection and other settings via TRB3 board
  - LVDS output
  - Monitor und trigger output

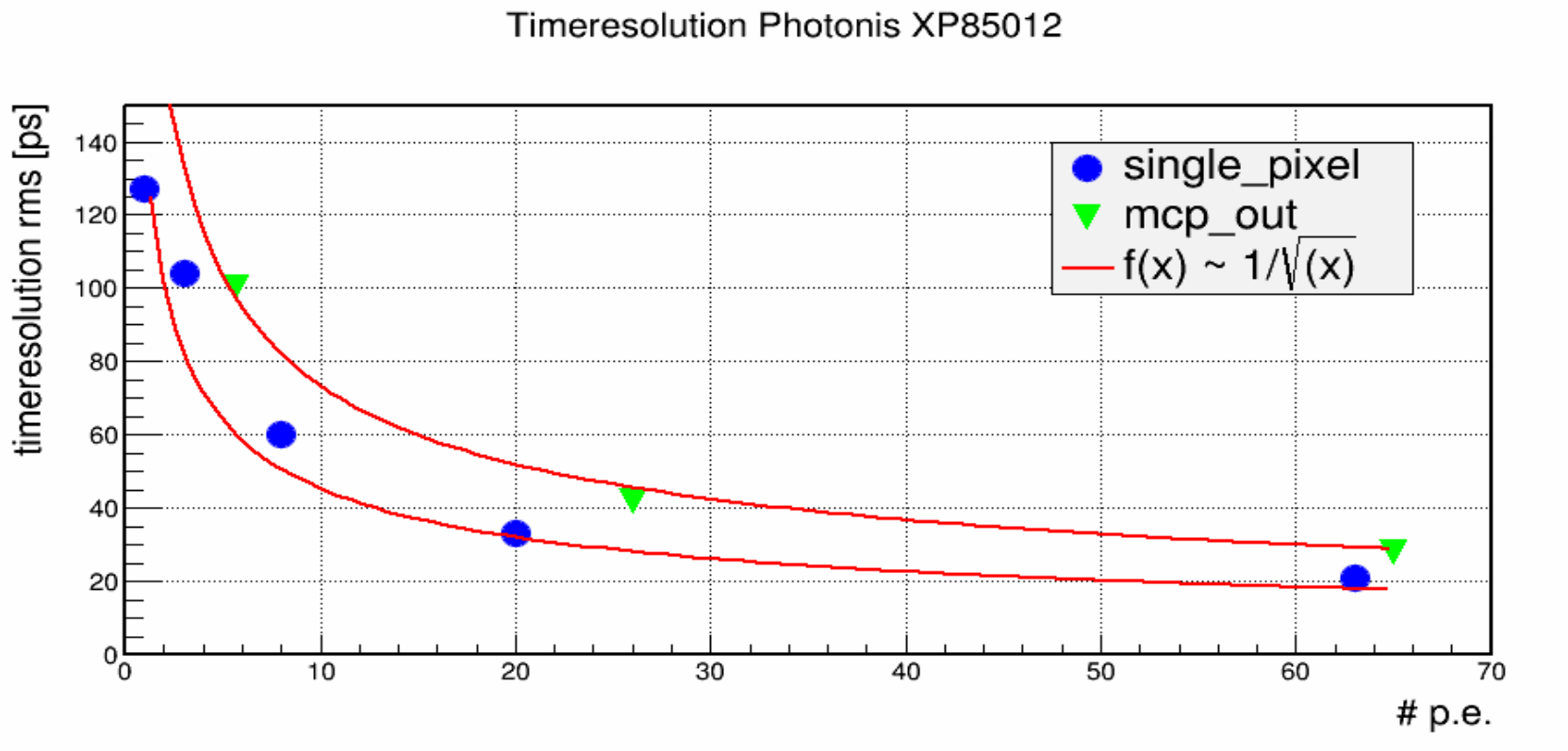


QE of MCP-TOF sensors



- sensors were used in three testbeams (1x CERN, 2x FZ Juelich)
- #9001165 and #9001337 show aging effects
- QE of #9001340 increased by ~2% (an effect which was also observed in our lifetime measurements)

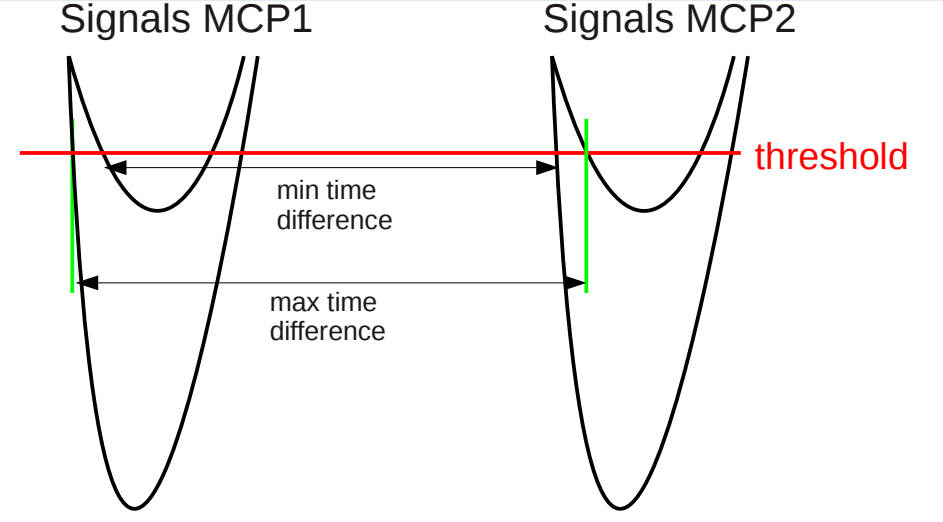
Timeresolution MCP-Out/Pixel

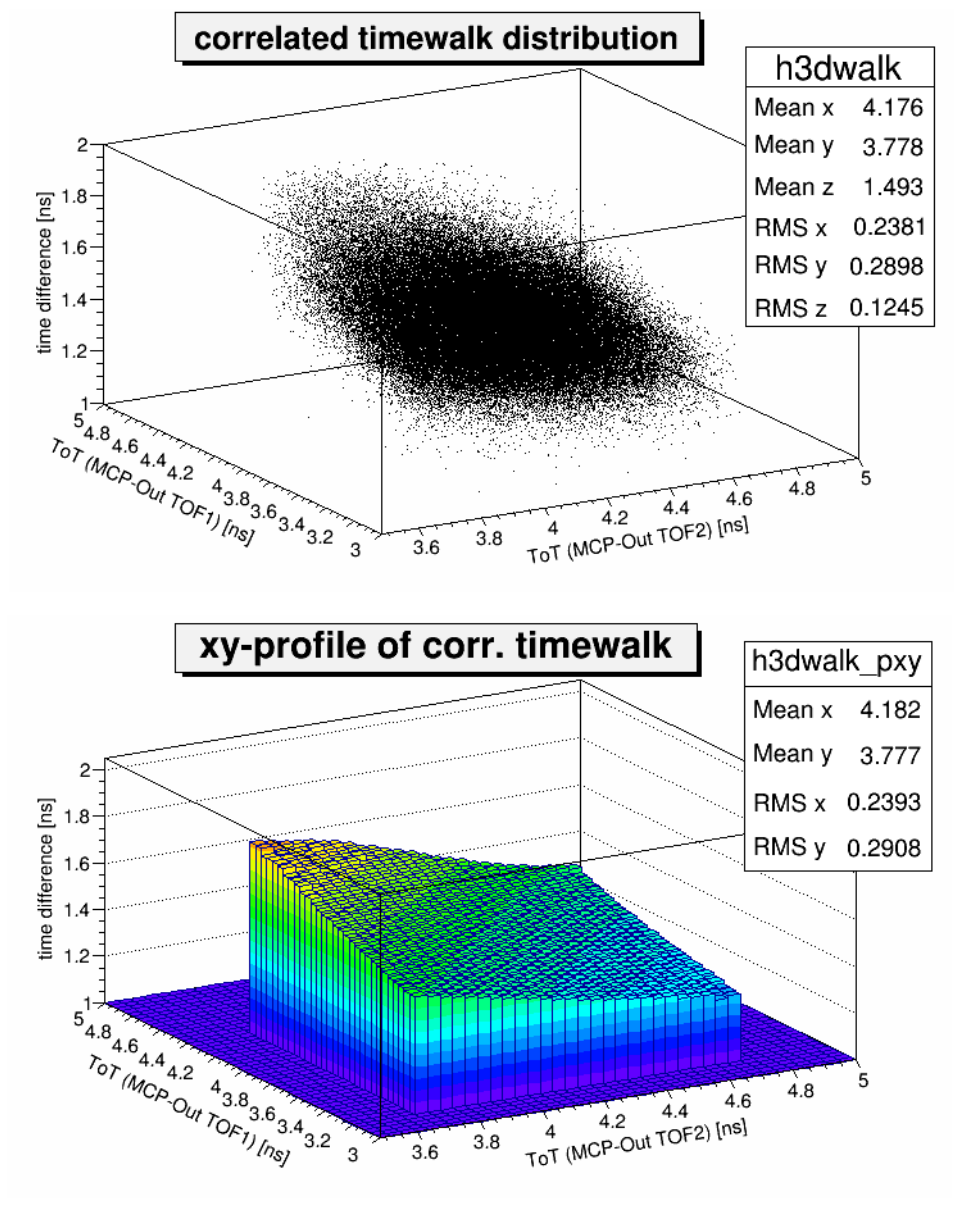


- Measurements with PiLas LASER and LeCroy Wave Pro 3700 Oszi
- ~20 photoelectrons expected (200 cherenkov photons in 1cm PMMA * 0,1 efficency) with MCP-TOF
- MCP-Out timeresolution ~55ps RMS (20 p.e.) $\rightarrow \sqrt{55^2+55^2} = 78\,ps$ for two sensors
- Single pixel timeresolution ~33ps RMS (20 p.e.) $\rightarrow \sqrt{33^2+33^2} = 46\,ps$ for two sensors

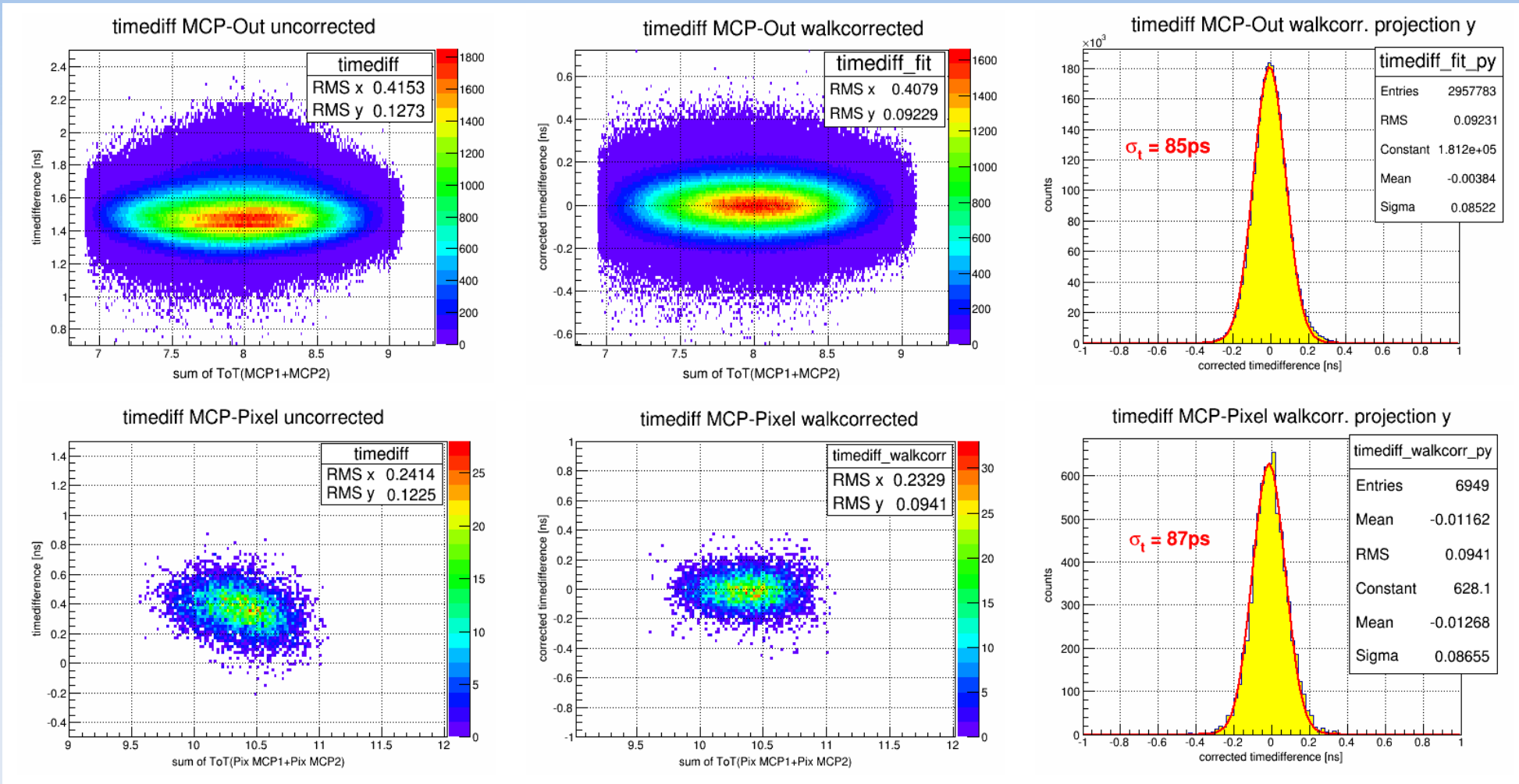
Time walk correction

- Problem: Lack of well defined reference time → timewalk correction only possible for time difference of two channels
- Solution: correct every ToT combination of MCP-TOF1 and MCP-TOF2 with mean value of time differences





Timeresolution of MCP-TOF

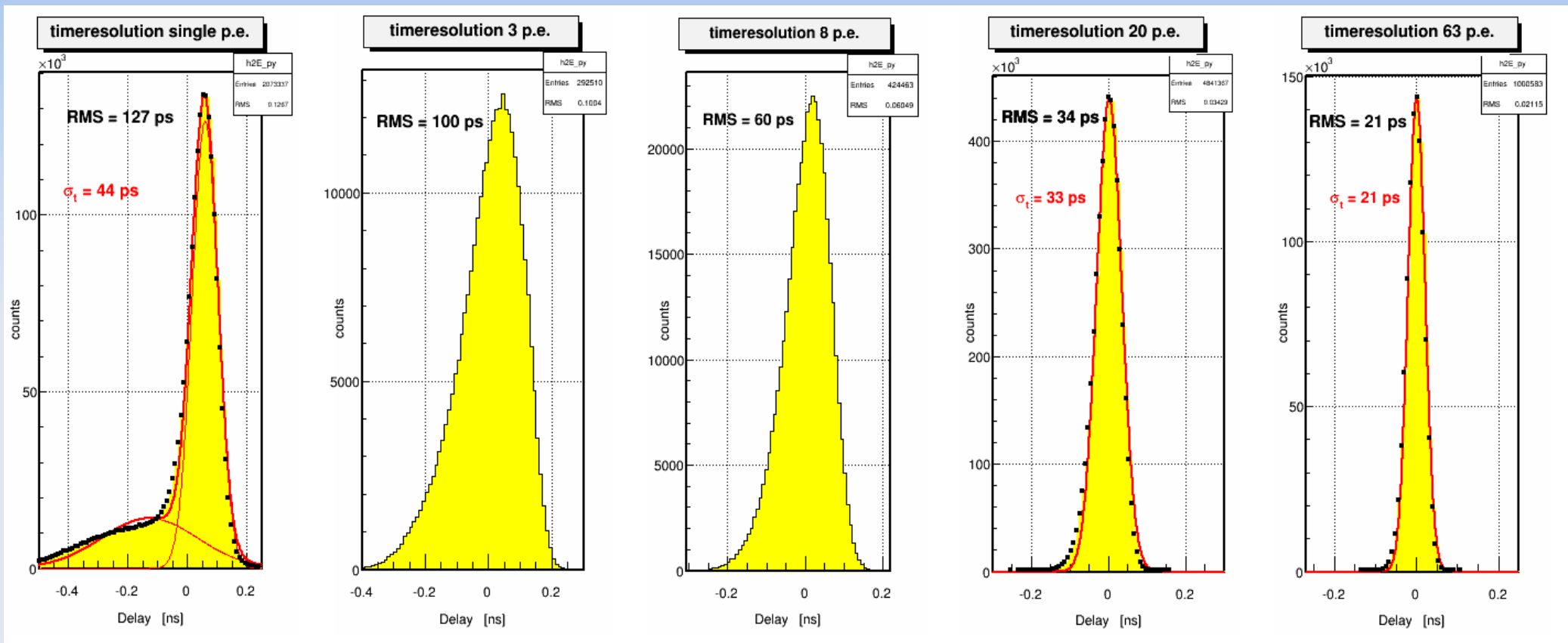


- timewalkcorrection improves timeresolution significant (RMS ~125ps to ~93ps)
- timeresolution (timewalkcorrected) σ = 85 ps for MCP-Out and single pixels

Summary

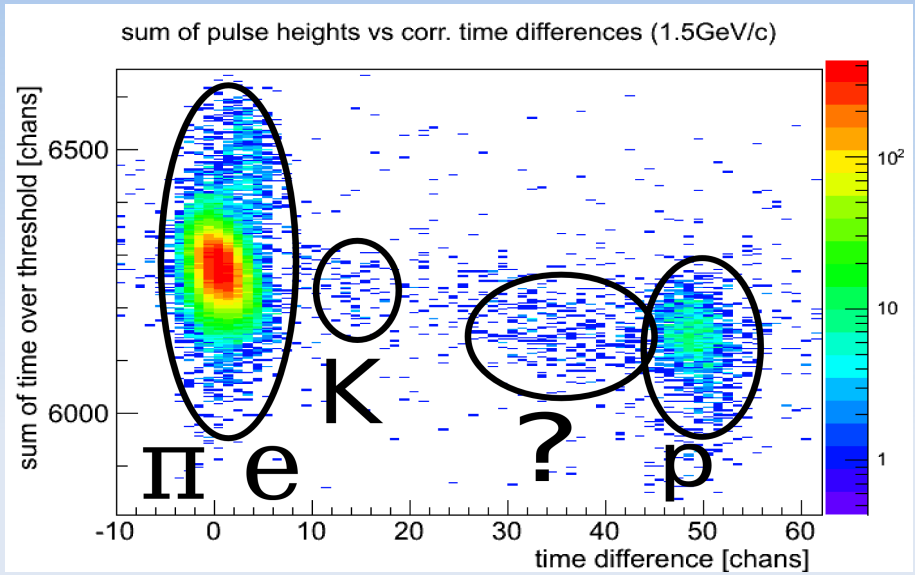
- aging of QE observed after three testbeamtimes with relativ low rates
- tracking capability improved with segmented plexiglass radiator
- performance with different readout electronics (Padiwa, TRBv3) similar to previously used readout systems
  - timeresolution of MCP-Out signal equal to the one measured with other DAQ systems(VME, TRBv2)
  - timeresolution of single pixel not as good as expected → further analysis in progress

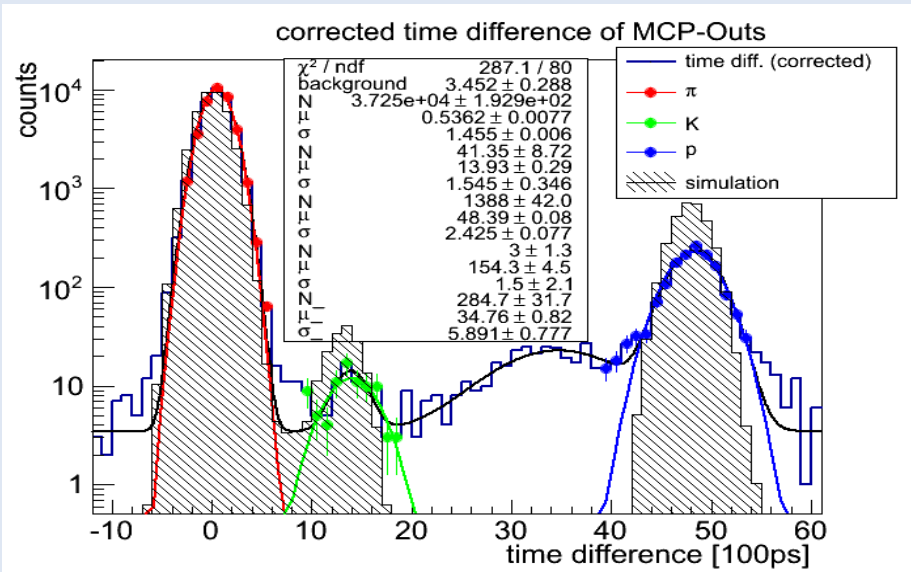
Timeresolution(pixel) multiple p.e.



PID performance (CERN Testbeam)

- Distance between MCPs 7.7m
- Light particles (π,μ,e) cannot be separated, even at lowest momenta (1.5GeV/c)
- Origin of cluster below p is unknown
- Simulation is in good agreement with data including:
  - Decay of Kaons
  - Momentum smearing
  - Beam divergence





PID performance (2)

- Kaons can only be separated up to 2GeV/c
- p/π up to 6GeV/c
- Amount of deuterons is small, but signal is clear
  → d/π separation up to 7GeV/c