SFAIR årsmöte

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Stockholm University

VPTT sensors for the PANDA EMC: tests at photon energies below 100 MeV

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outline

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   - shaping time 0,8 μs (σ)
     - calibration procedure
     - results
   - shaping time 0,12 μs (σ)
     - results
3. measurements with shaper-sADC provided by Uppsala University (will be used in PANDA)
     - results
4. Conclusion

Introduction

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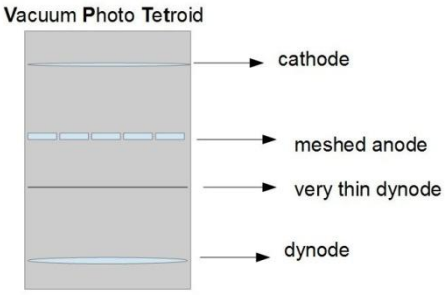
Motivation:

- In the PANDA experiment it is not possible to use PMT
- So it was decided to use (V)acuum (P)hoto (T)riods

→They are as well no sufficient because of the bad resolution

- (V)acuum (P)hoto (T)e(t)roids will be used now instead of VPT´s

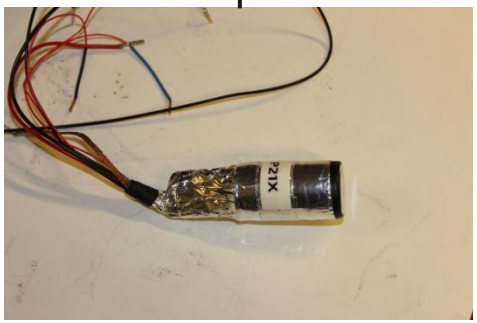


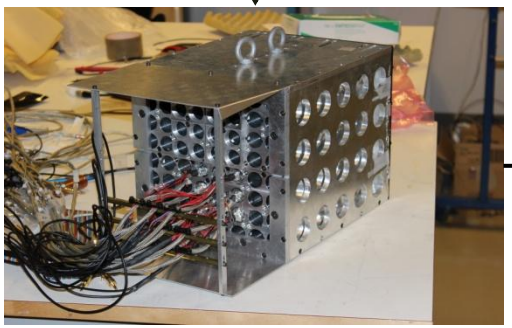
Idea of the experiment:

- compare the resolution of the VPTT with the PMT and VPT
- test if the VPTT resolution is sufficient enough for the PANDA experiment with:

1. peak sensing ADCs
2. (s)amplingADC (which will be used in PANDA)

experimental setup





Generel setup

- VPTTs with Basel Preamp. attached to forward end cap PWO crystals
- battery powered
- extra shielding of the cables
- placed in a 3 X 3 Matrix
- matrix placed in a fridge on a x-y movable table
- cooled down to -25°C

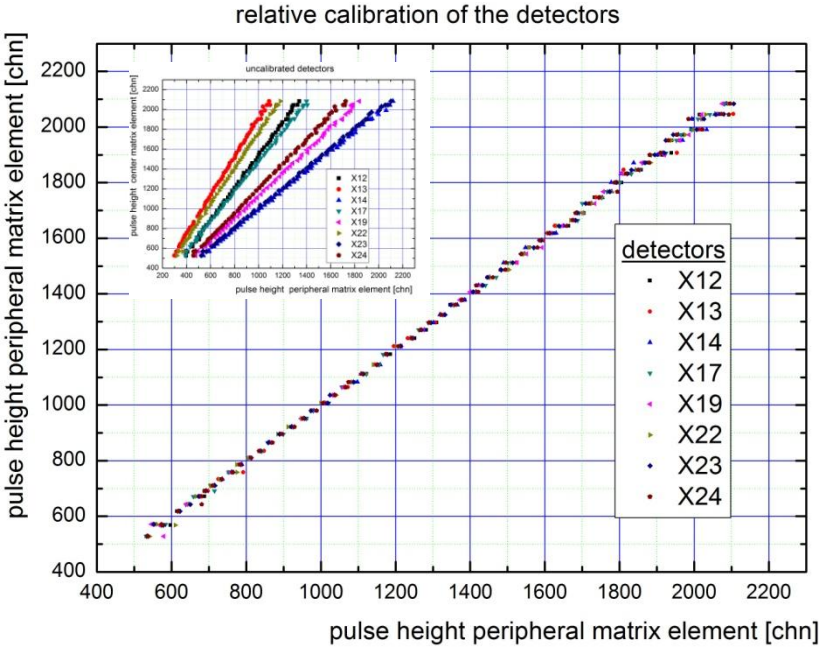
first experiment:

- mesytec MSCF-16 shaper/Amplifier
- Peak sensing ADC
- trigger is AND between the tagger channels and detectors
- different conditions
  - Shaping time 0,8 µs (σ)
  - Shaping time 0,12 µs (σ)

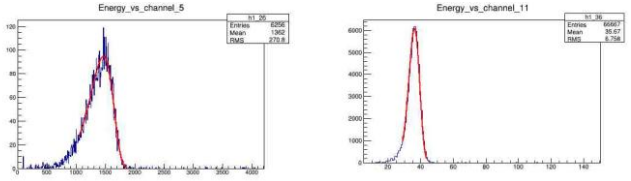
second experiment:

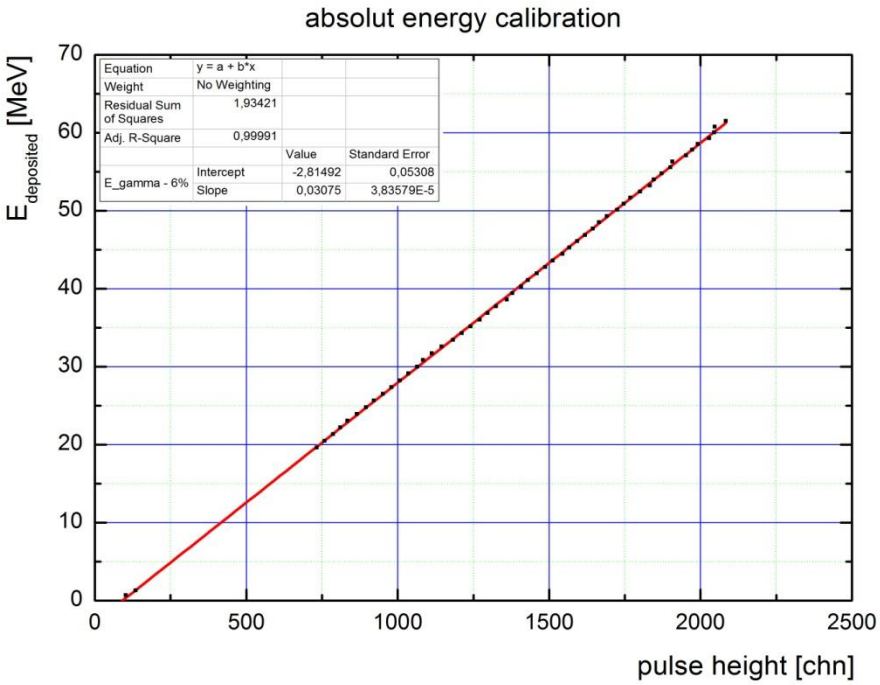
- Shaping-(s)ampling ADC
- triggering on the tagger

calibration procedure



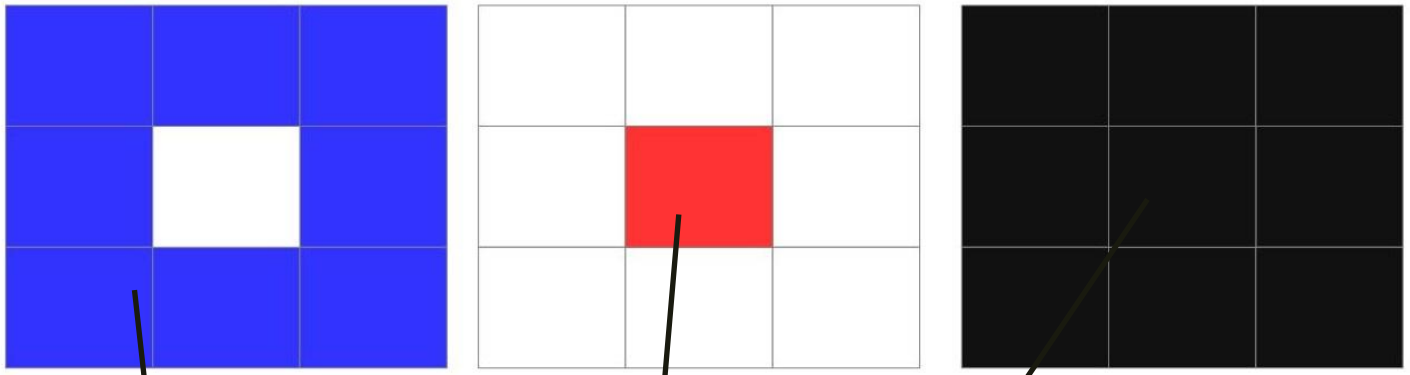
- all detectors calibrated relative to the central detector of the matrix
- pulse height spectra were fitted with Novosibirsk function

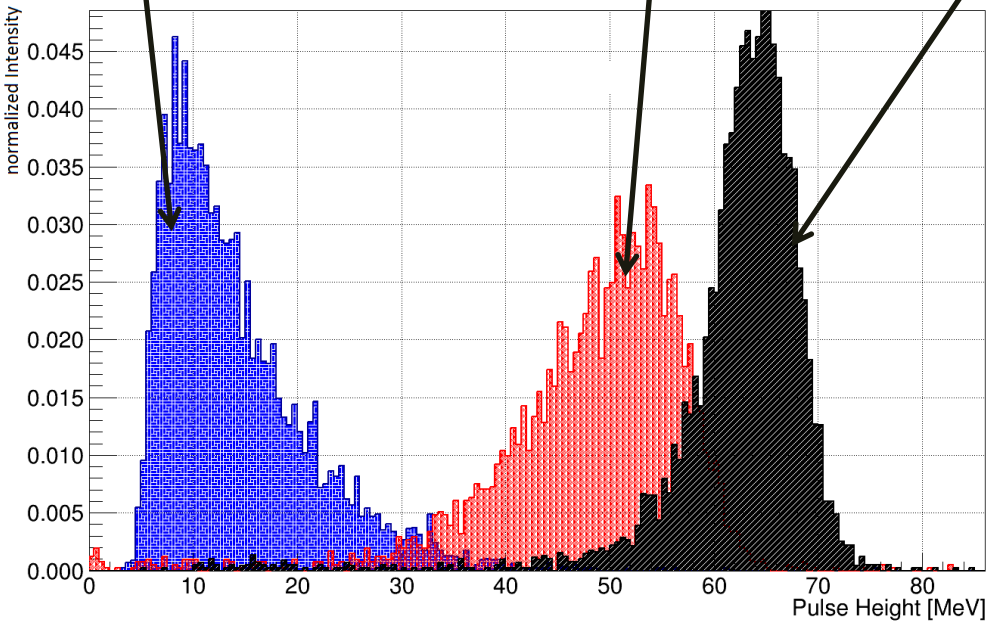




- deposited energy calculated with a Geant4 simulation
- realistic conditions are used (e.g. beam shape photoelectron statistics)
- the calibration function is a linear function

summed pulse height spectra





pulsed height spectra for 62 MeV

red: center Matrix element

blue: sum of the eight surrounding detectors

black: sum of the whole Matrix

determination of the optimal threshold

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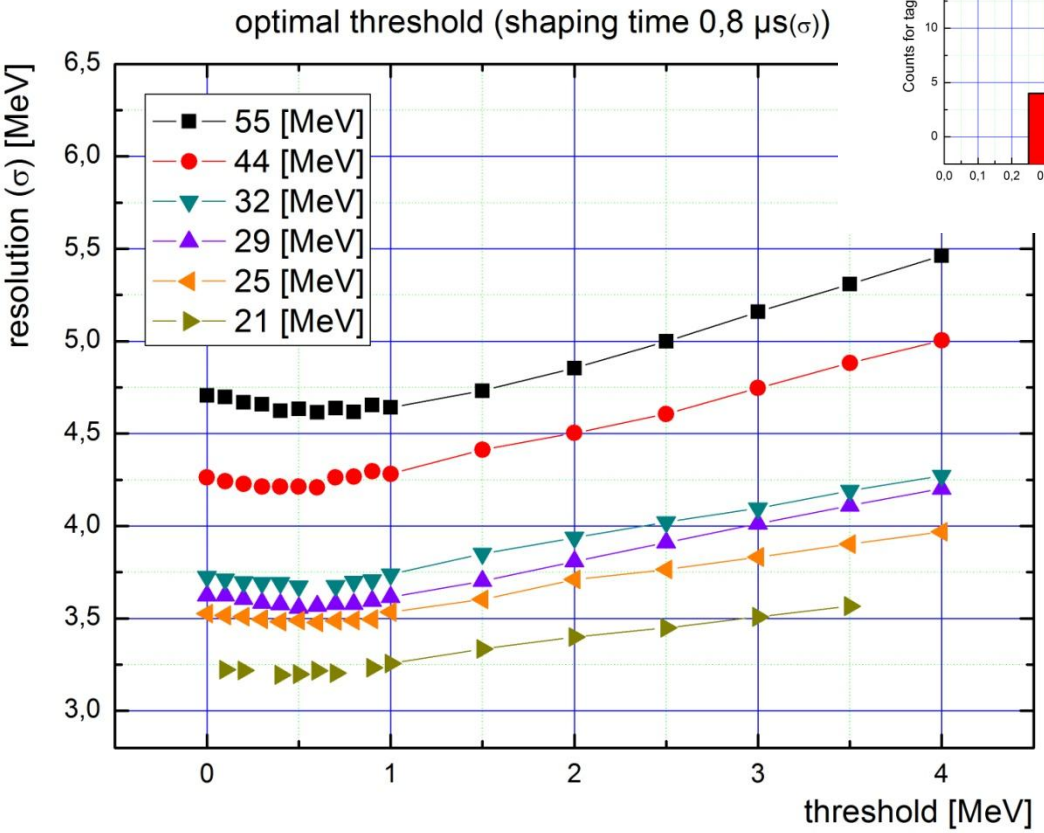
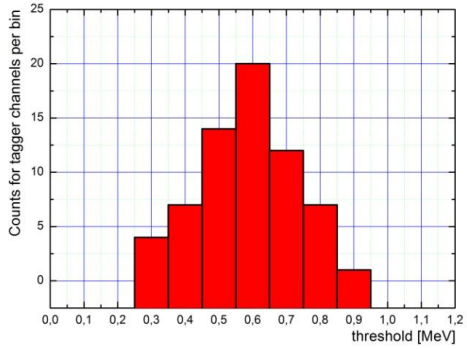
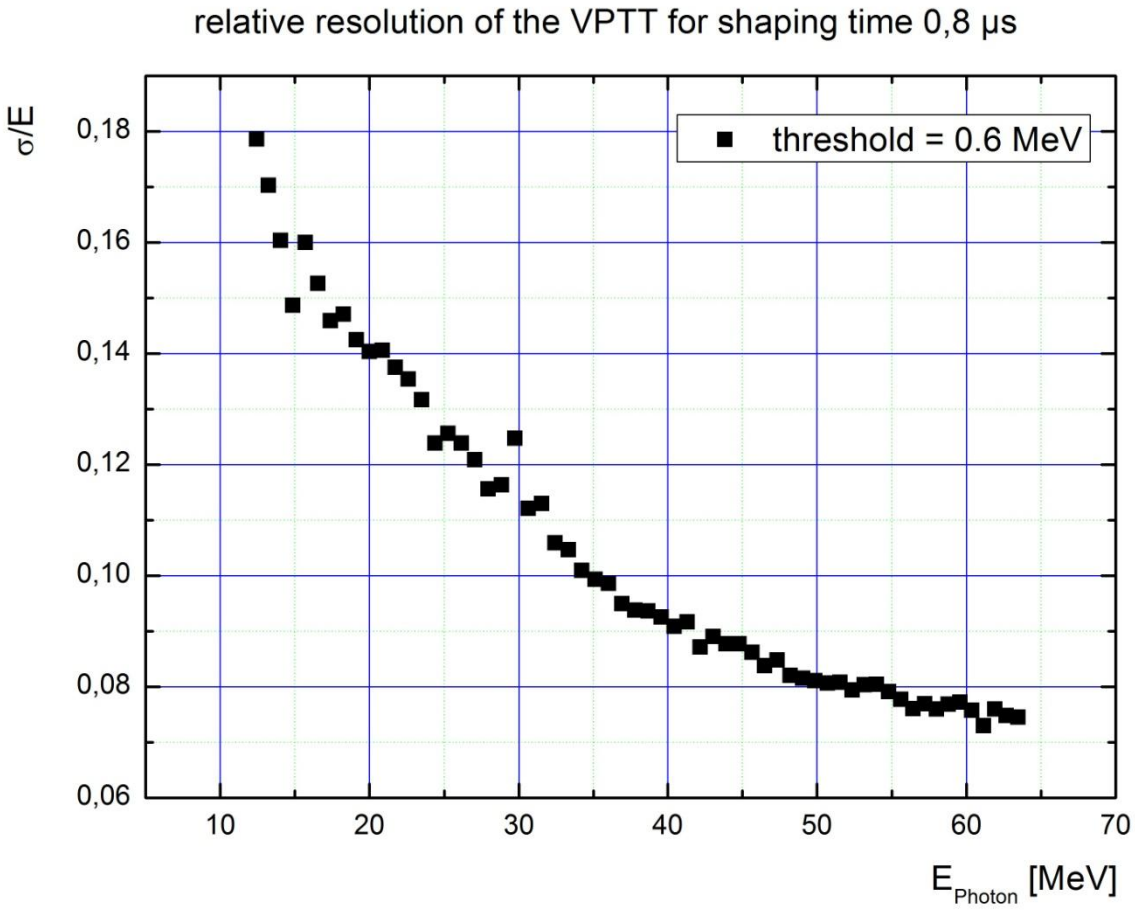




→ threshold for the analysis is choosen as 0,6 MeV

relative resolution



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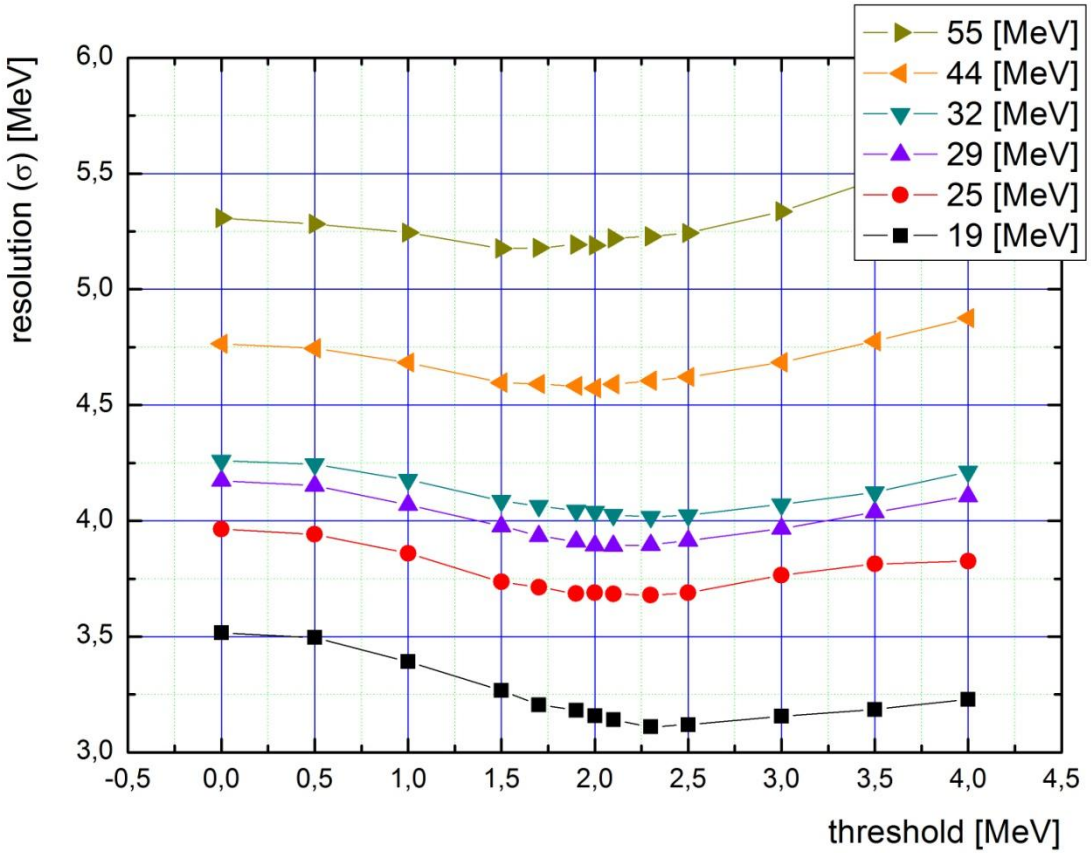
Changing shaping time

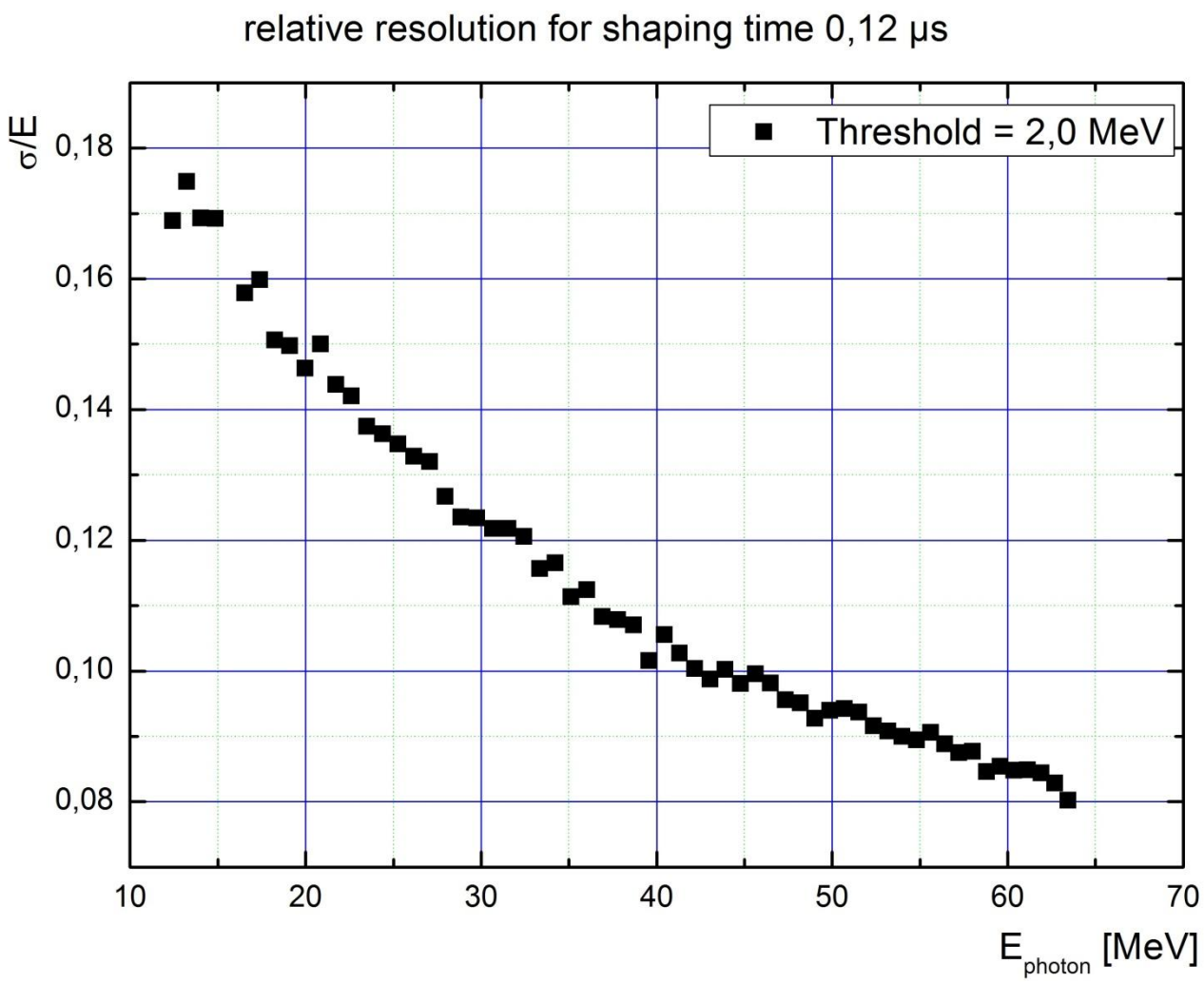
from 0,8 µs to 0,12 µs

determination of the optimal threshold

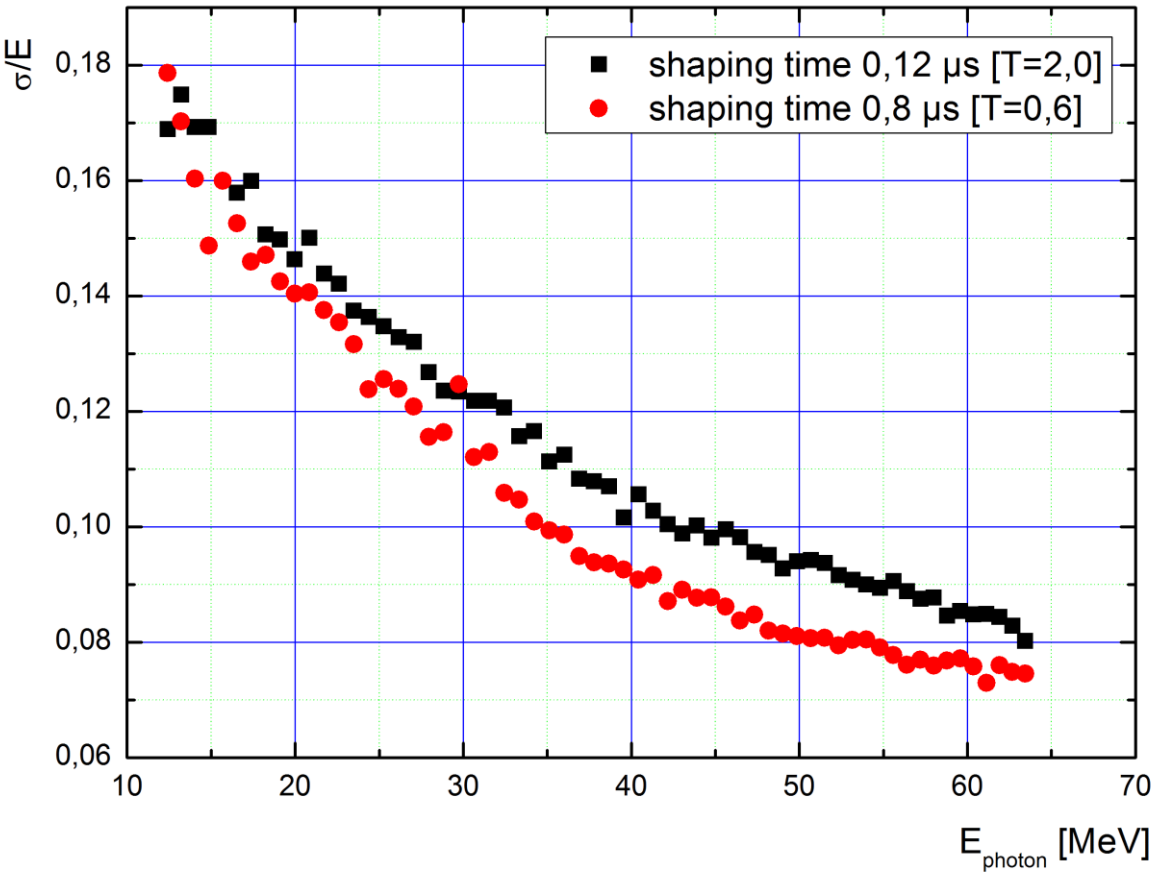


threshold 2,0 MeV is choosen for the analysis

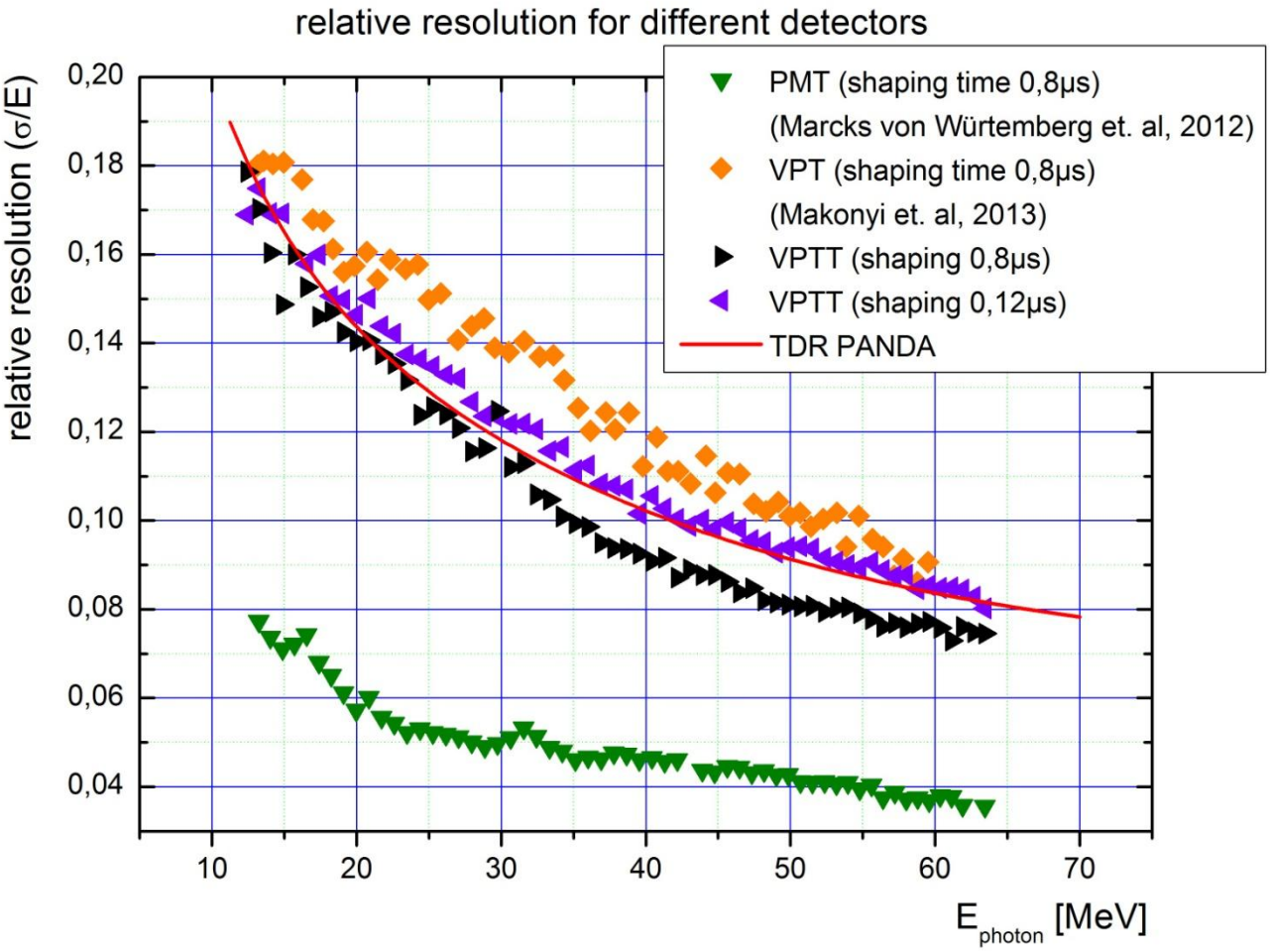
relative resolution



relative resolution for both shaping times



comparison between VPTT, VPT and PMT



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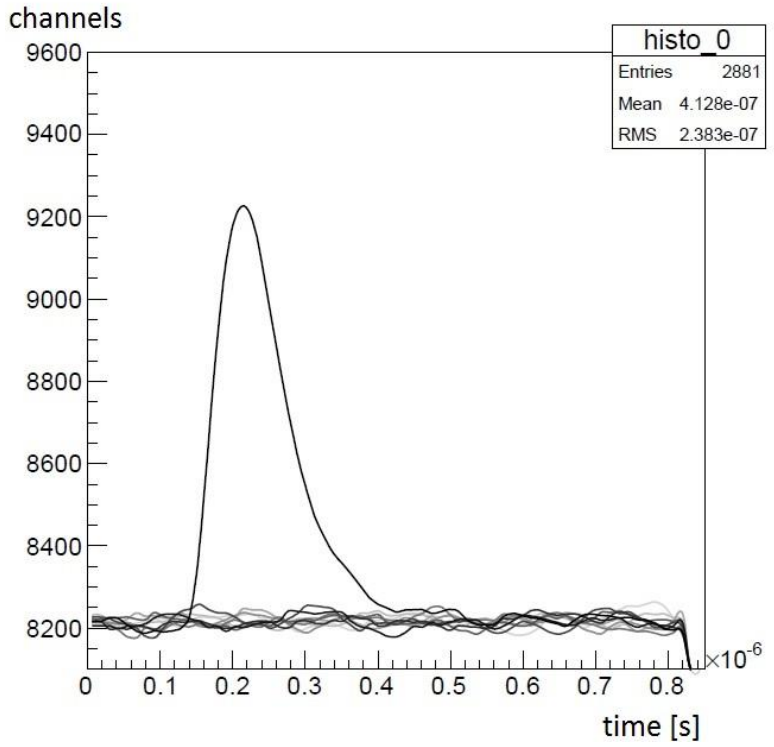
measurement with shaper-sADC provided from Uppsala

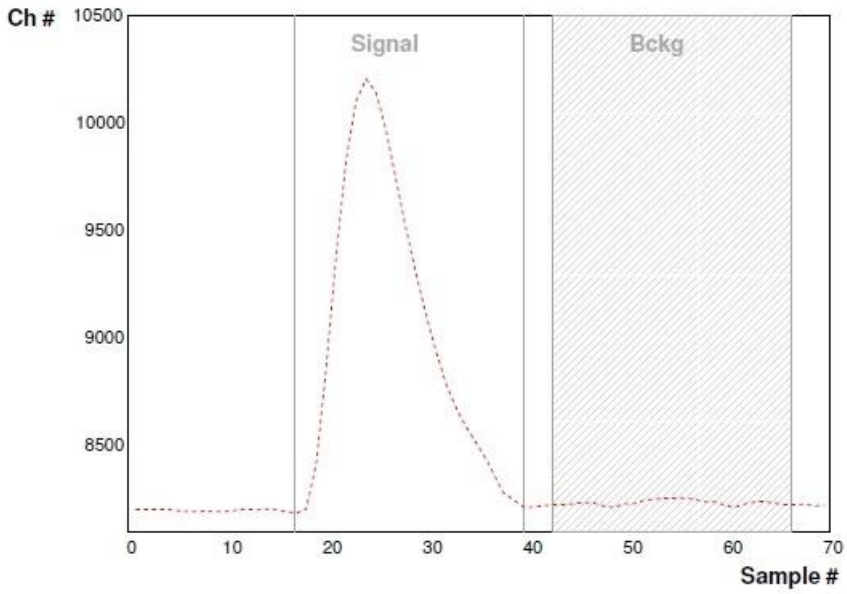
raw (shaped) signal

- one signal consists out of 67 samples
- sampling frequency is 80 Mhz
  (1 sample is 0,83 µs)
- shaping time is 0,04µs (σ)

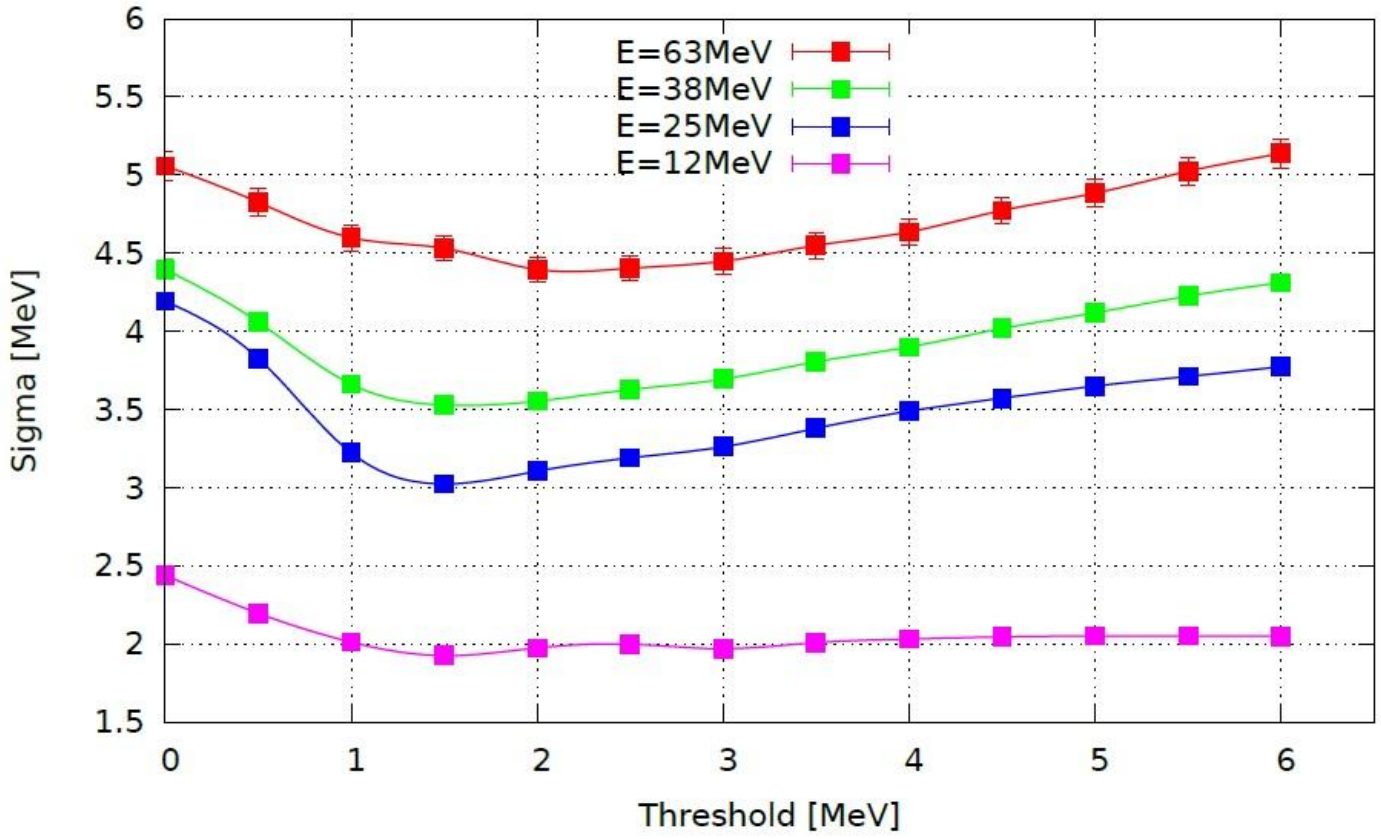


determination the intergral of the signal over the baseline

- we know the position and the time of the signal
- Use the fix interval and integrate that
- This will not be the case in PANDA

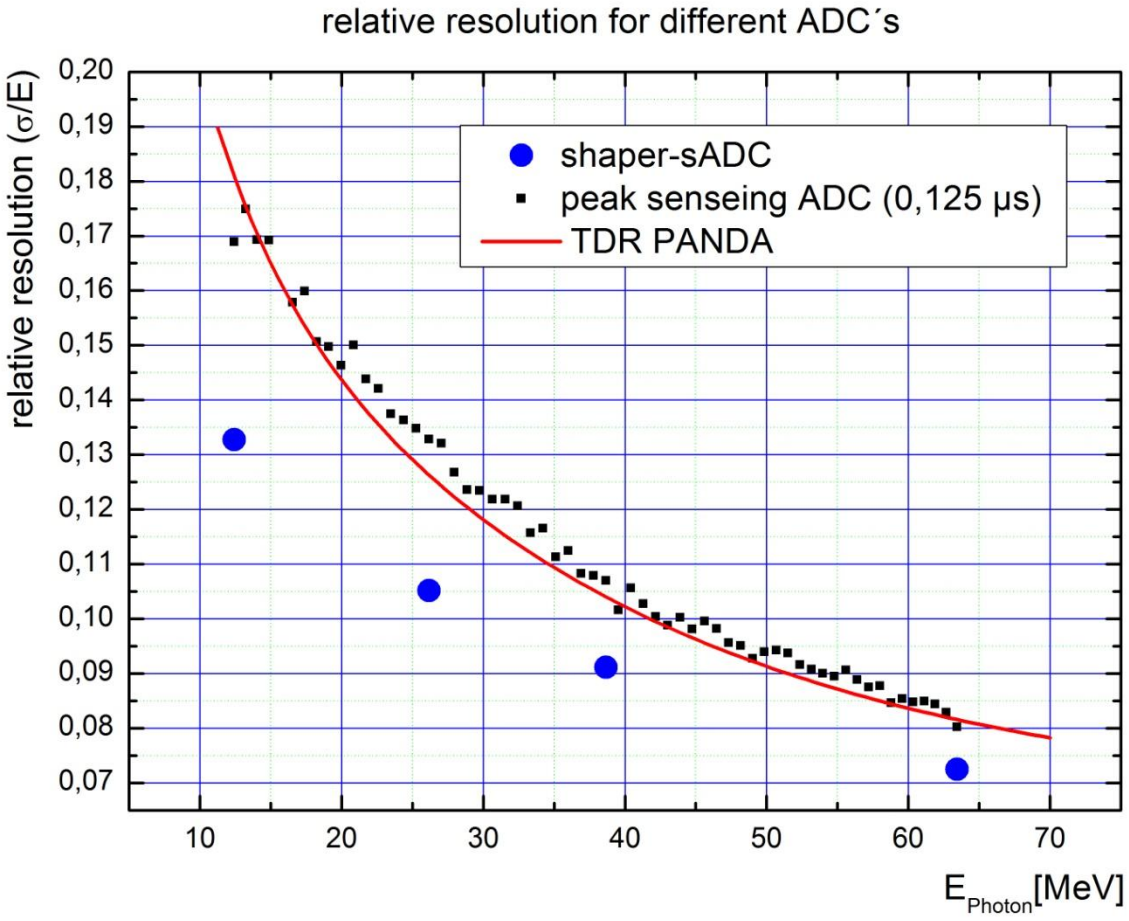


optimal threshold



→ optimal threshold is chosen to 1,5 MeV

relative resolution



Conclusion

- Readout using VPTTs fulfills the requirement of the PANDA TDR in the low-energy region (below 100 MeV)This is consistent with results from the Bochum group at higher photon energies
- VPTT´s connected to the sADC are also fulfil the requirements of the TDR in the low Energy area
- VPTTs will be used for a part of the forward end cap of the electromagnetic calorimeter

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special Thanks:

- **universities of Bochum and Bonn for providing the VPTTs**
- **all members of the Max IV facility in Lund**

Thank you for your attention