LII PANDA collaboration meeting

16. - 20. March 2015

JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

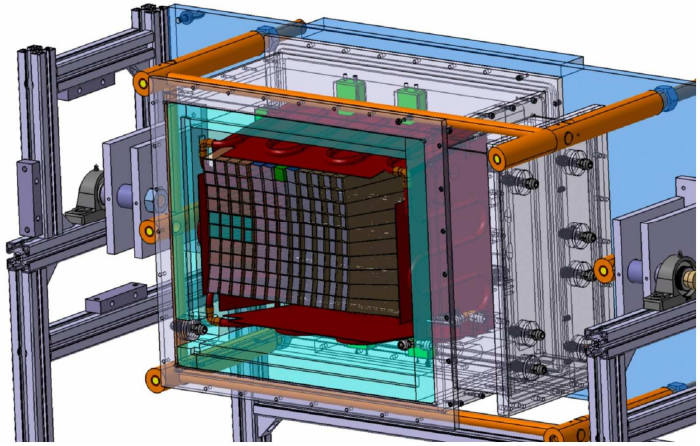
Status of the PROTO 120 Beamtime Analysis

Stefan Diehl[1], Christoph Rosenbaum[1], Peter Drexler[1], Valery Dormenev[1], Christine Le Gallard[2], Miktat Imre[2], Myroslav Kavatsyuk[5], Svetlana Nazarenko[1], Till Kuske[1], Dominique Marchand[2], Rainer W. Novotny[1], Philippe Rosier[2], Andrej Ryantsev[3], Peter Wieczorek[4], Andrea Wilms[4] and Hans-Georg Zaunick[1]
for the PANDA-Collaboration

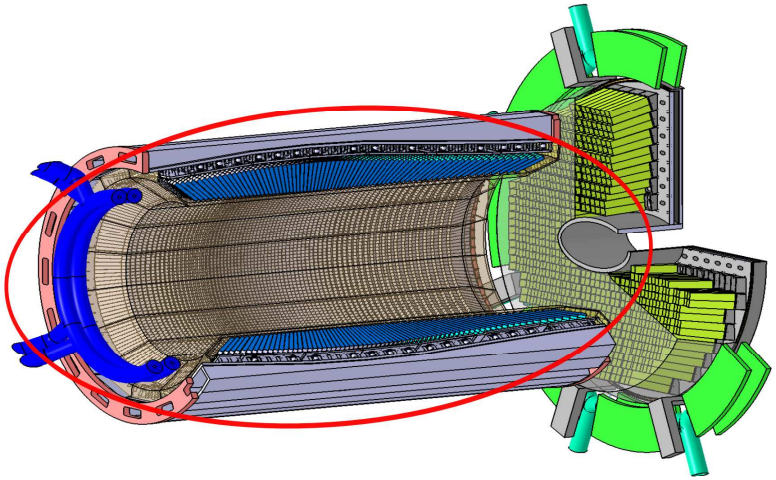
[1]2nd Physics Institute, Justus-Liebig-University Giessen [2]IPN Orsay, Orsay, France
[3]IHEP Protvino [4]GSI Helmholtzzentrum für Schwerionenforschung [5]KVI Groningen

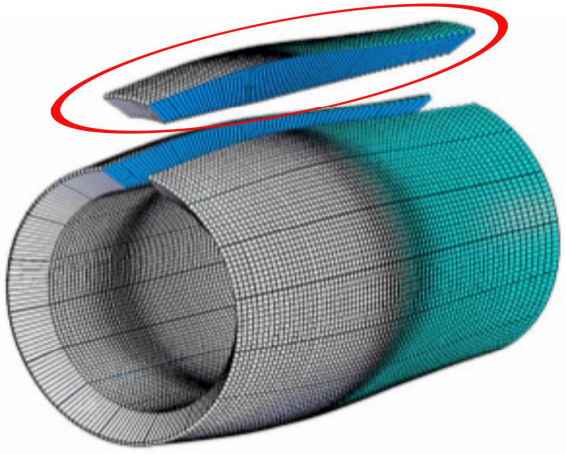
Overview

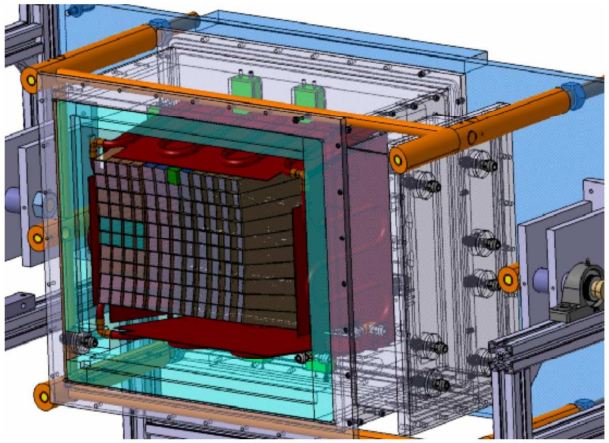
- The PROTO 120 setup of the last beamtime
- The status of the data analysis
- Future plans with PROTO 120

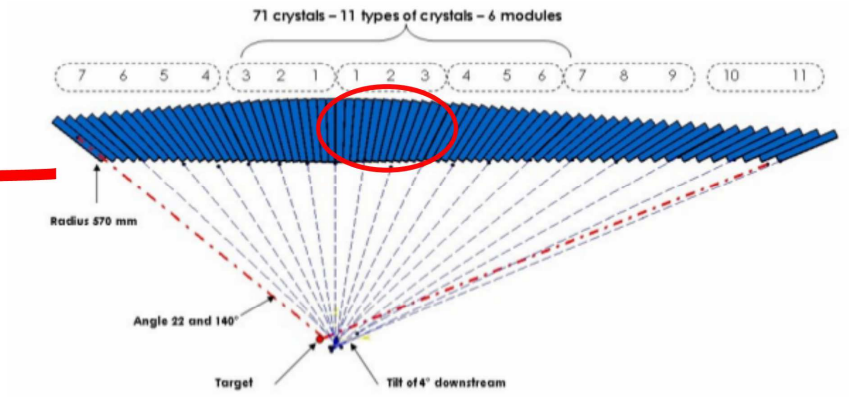


Introduction





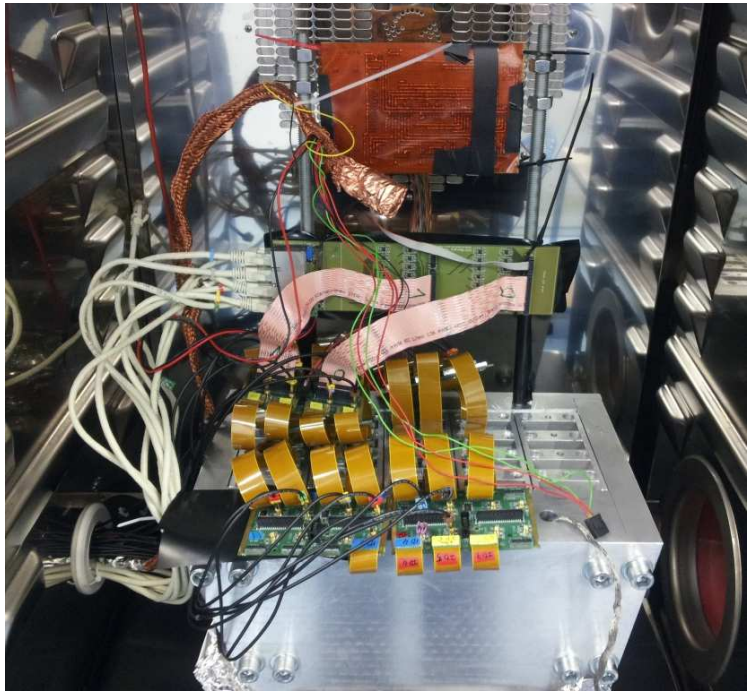




Beamtime preparations

- Remaining alveoles with type 2 and type 3 crystals have been equipped in December
- A part of the type 2 alveole has been equipped with ASICS

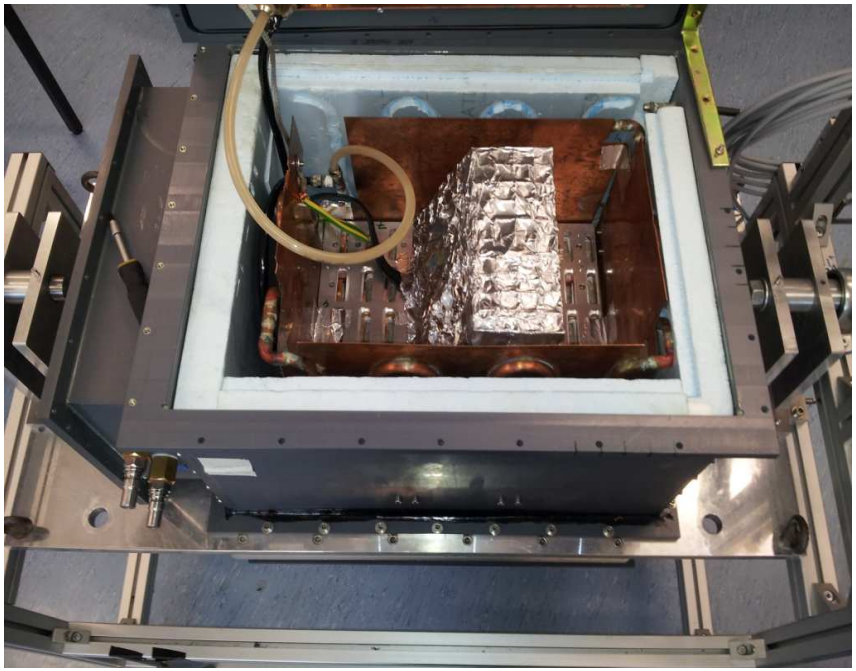
front view in the mounting tool



rear view with ASICS

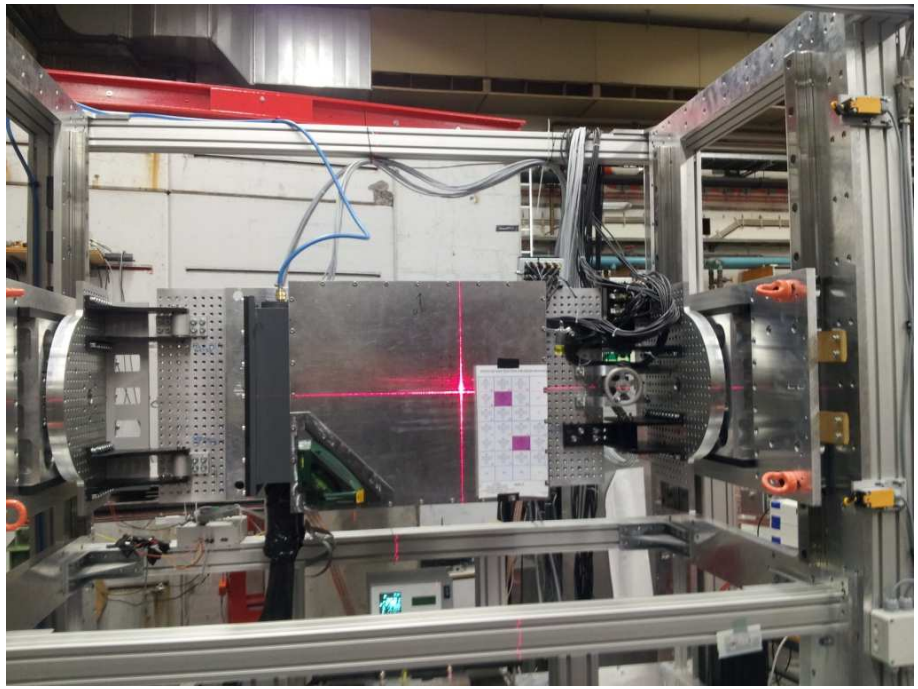
The setup of PROTO 120 during the last beamtime

- Only type 2 section mounted in PROTO 120



- Beamtime from 30.01. – 02.02. at MAMI in Mainz
- Tagged photon beam from 50 MeV up to 743 MeV

The setup of PROTO 120 during the last beamtime



PROTO 120 seen from front side (beam direction)

324*	321*	177*	318
229*	226*	224*	220*
331* 0	326* 1	328 2	349 (not connected) 3
218 4	241 (HG2 dead) 5	244 6	238 7
325 (LG not connected) 8	322 (HG2 dead) 9	320 10	337 11
250 (LG not connected) 12	570 12	252 13	237 14
323	340	341	327

type 3 ← top of type 2 alveole → type 1

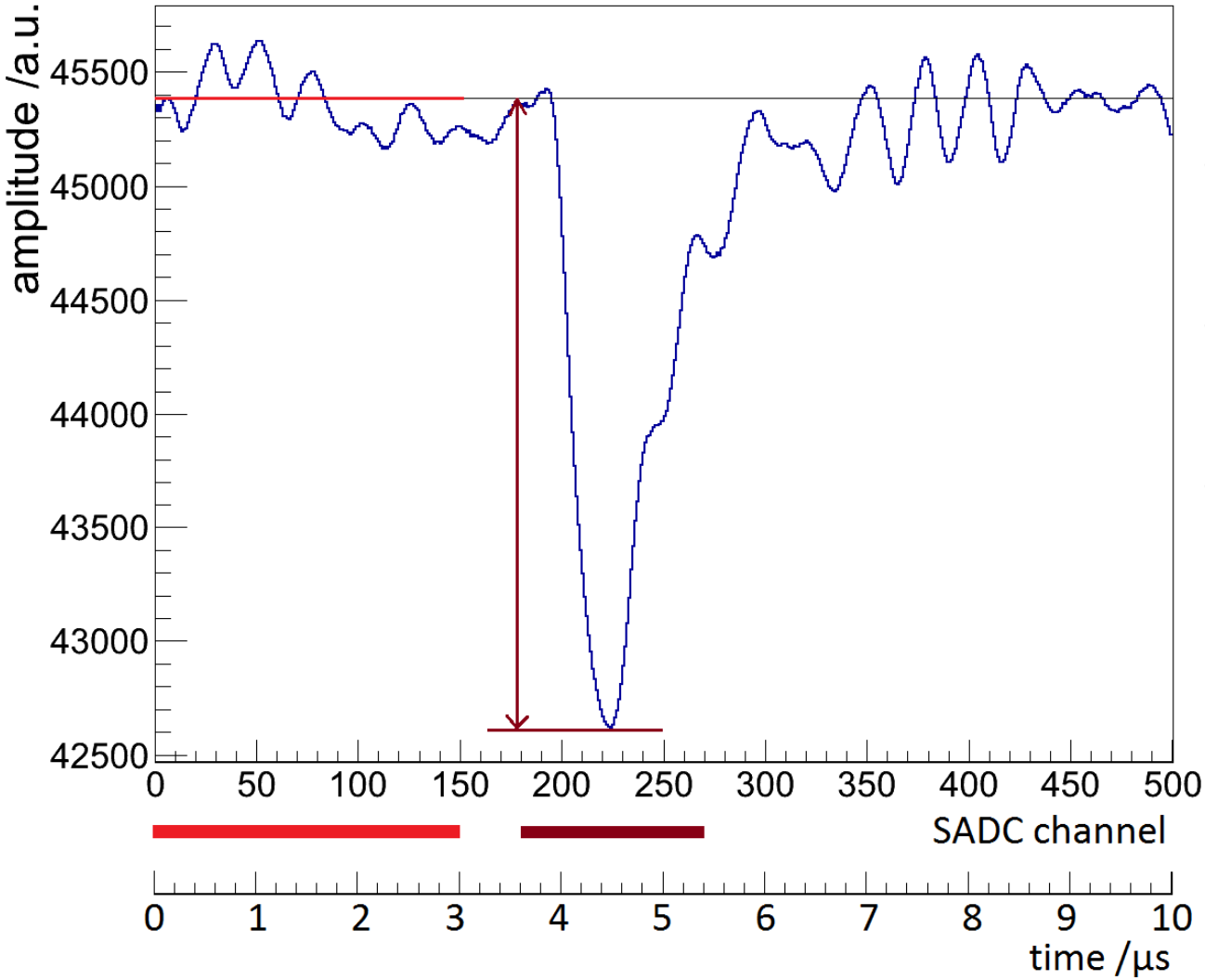
* depolished crystal

Original plan: Comparison of 2 3x3 matrixes with polished and depolished crystals

- ASIC of crystal 226 died due to a short circuit

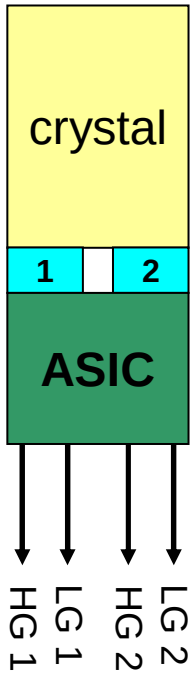
New plan: 4x4 matrix with one missing crystal

Feature extraction

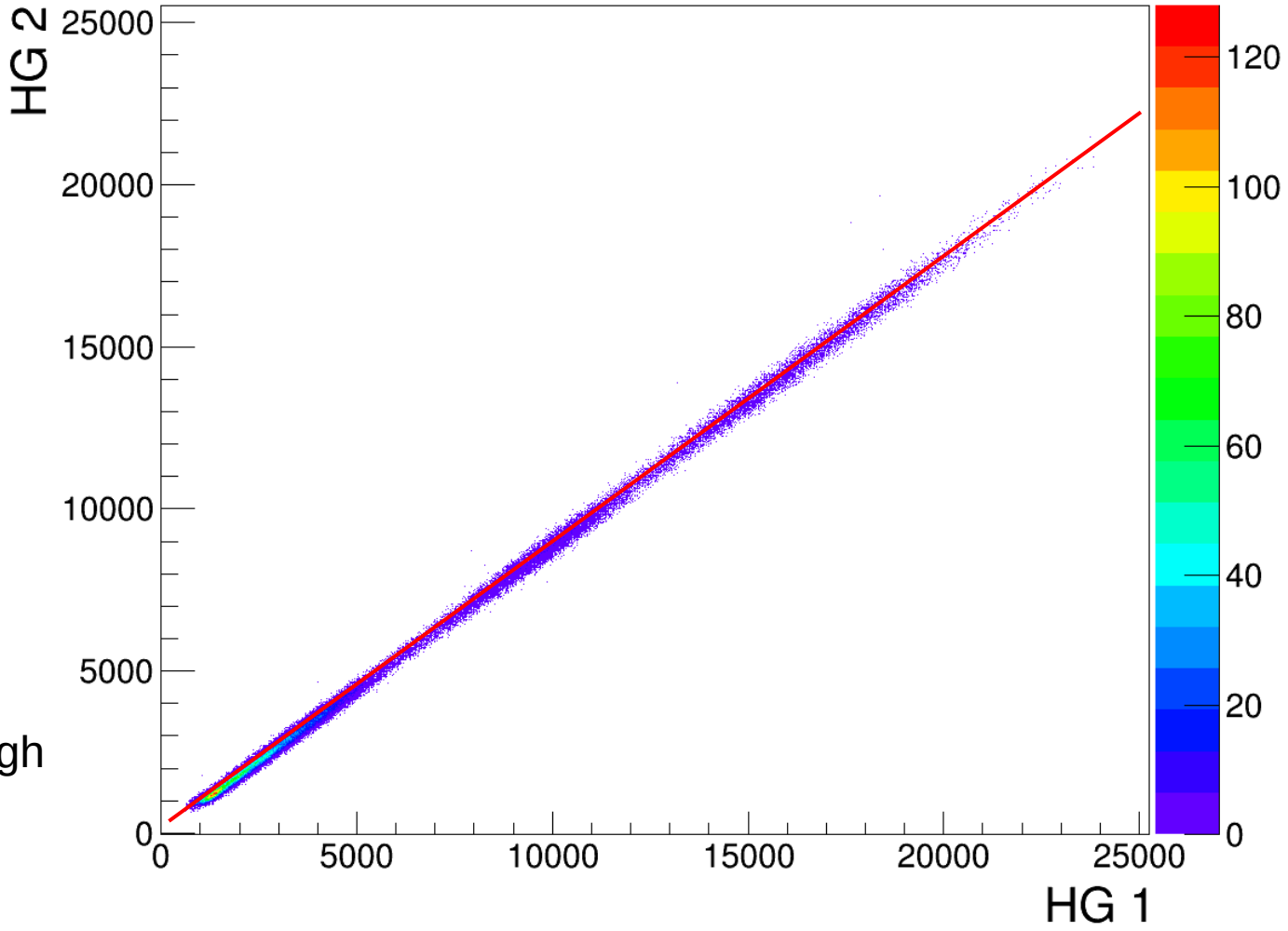


- Pedestal averaged over the first 3 µs
- Minimum searched in a region of 1.4 µs
- reduced to 100 ns in the later analysis by using the extracted time information

Relative APD calibration

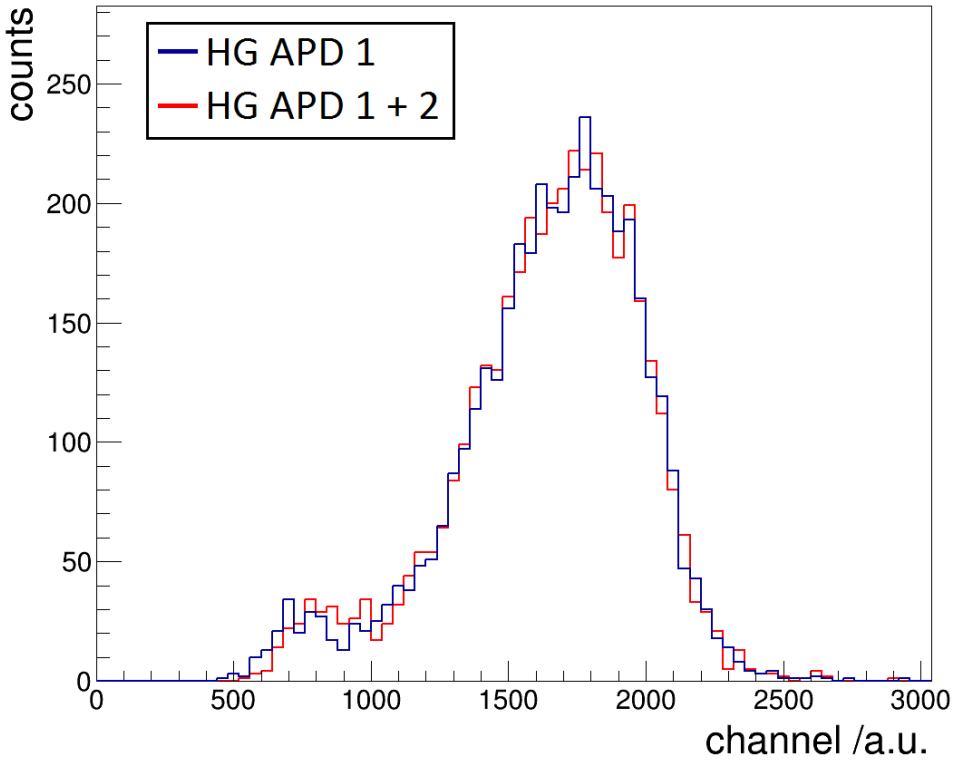


- Relative calibration of both APDs for high gain and low gain

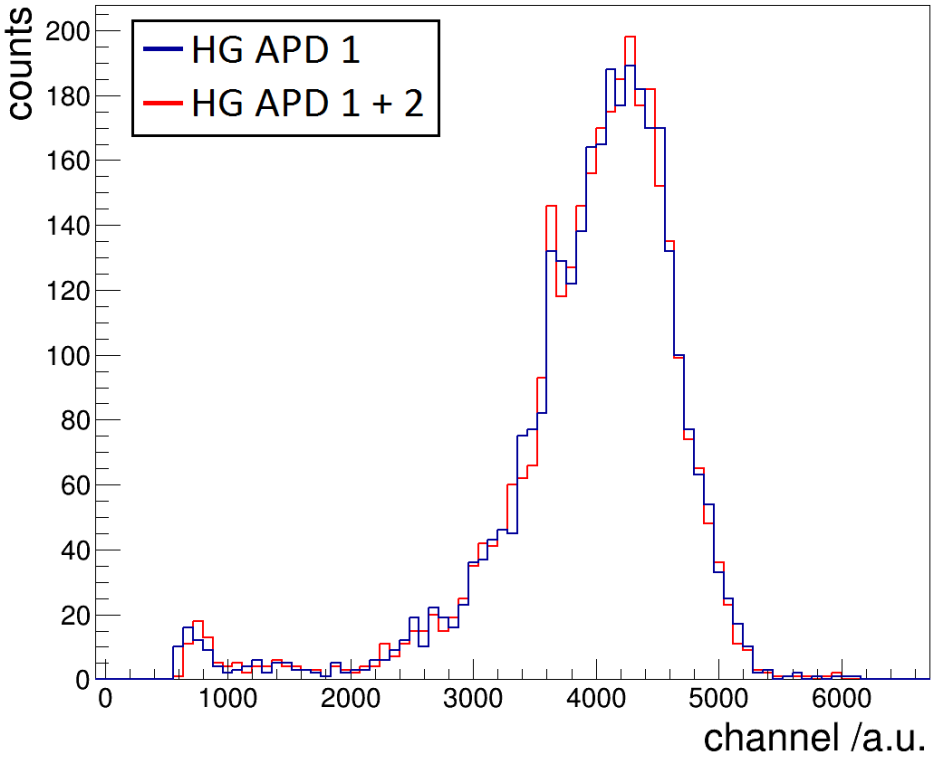


Comparison of single and combined APD data

73 MeV

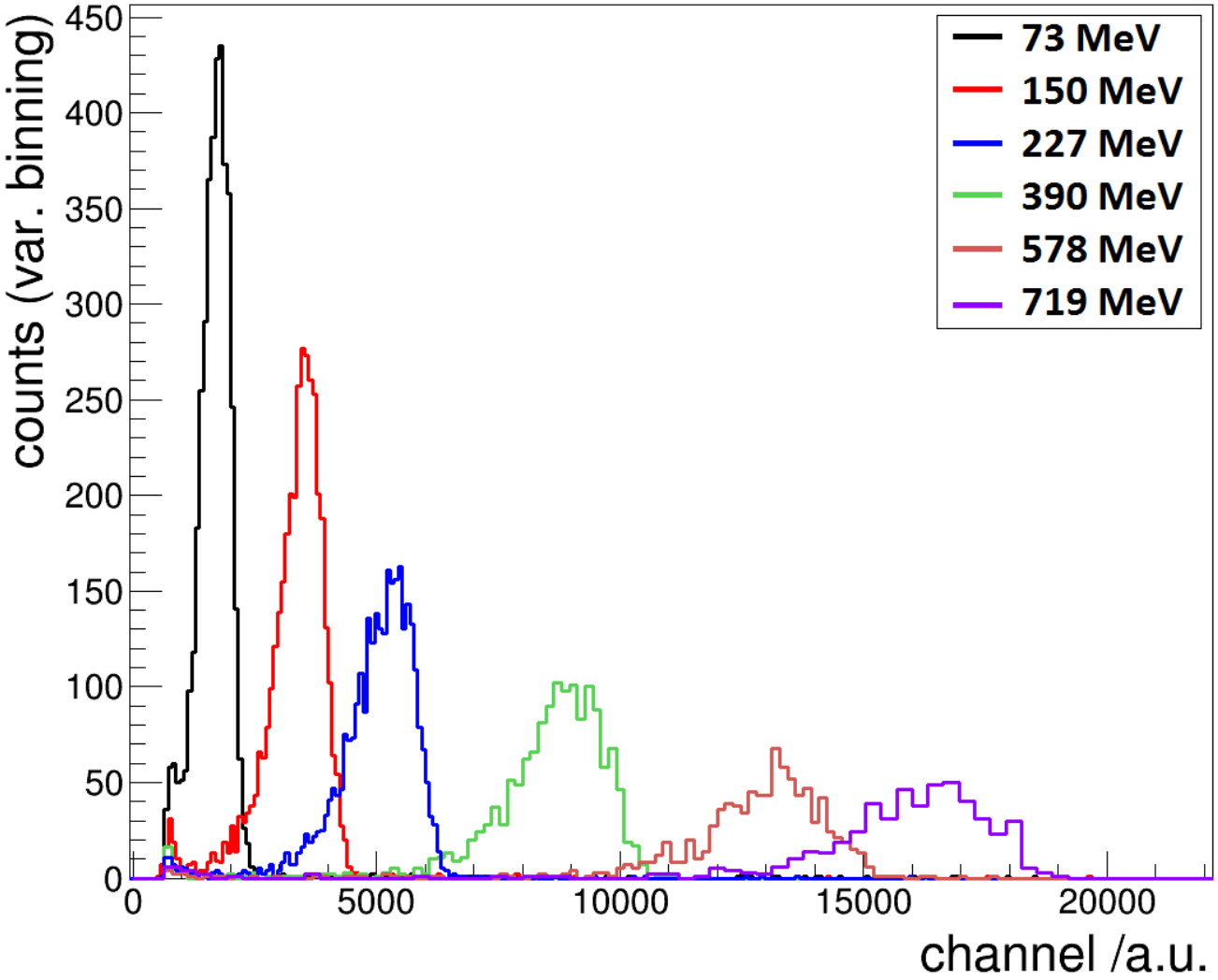


181 MeV



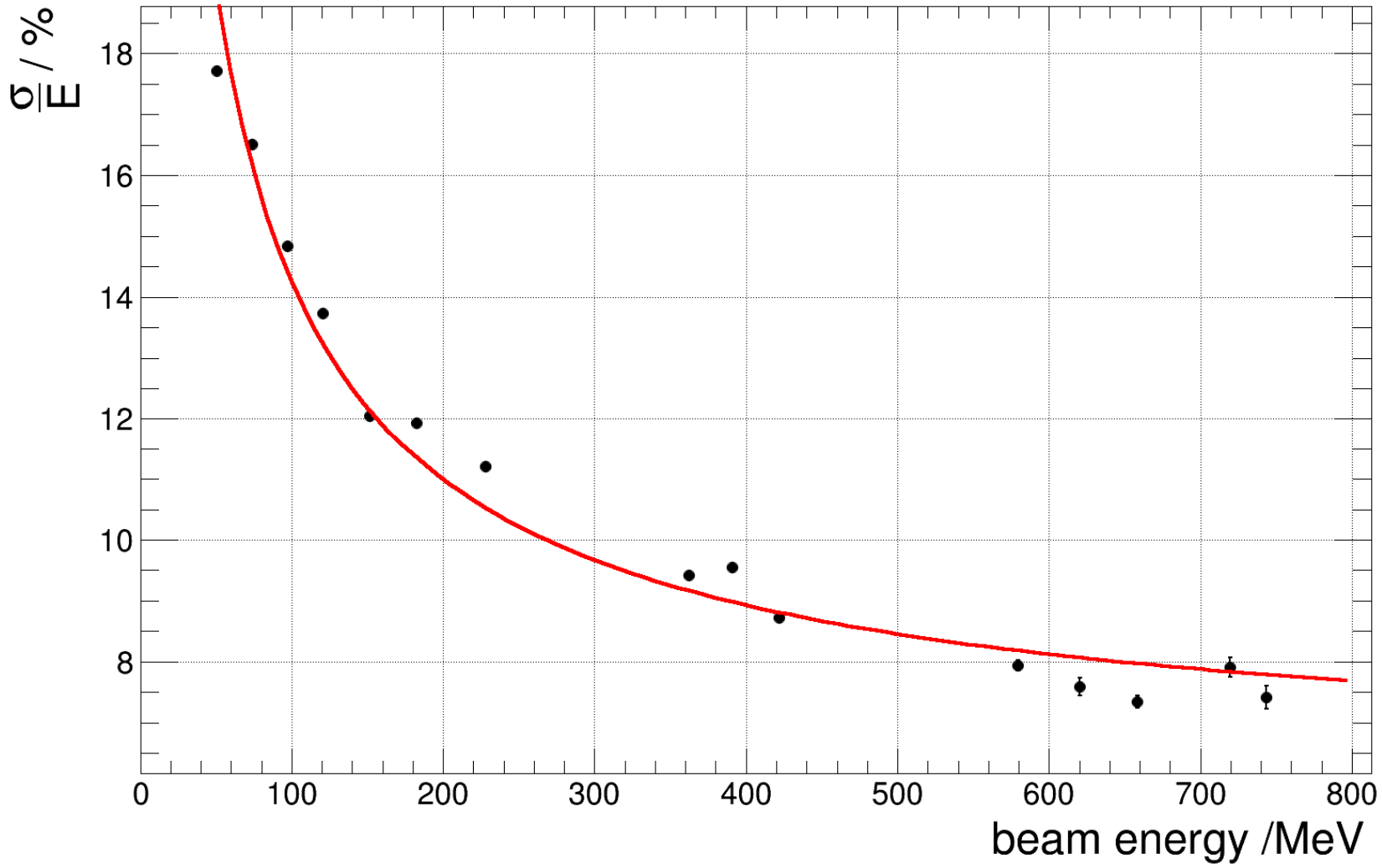
- Noise level gives the dominant contribution !

Lineshape of the central crystal



Fitted with a Novosibirsk function

Energy resolution of the central crystal



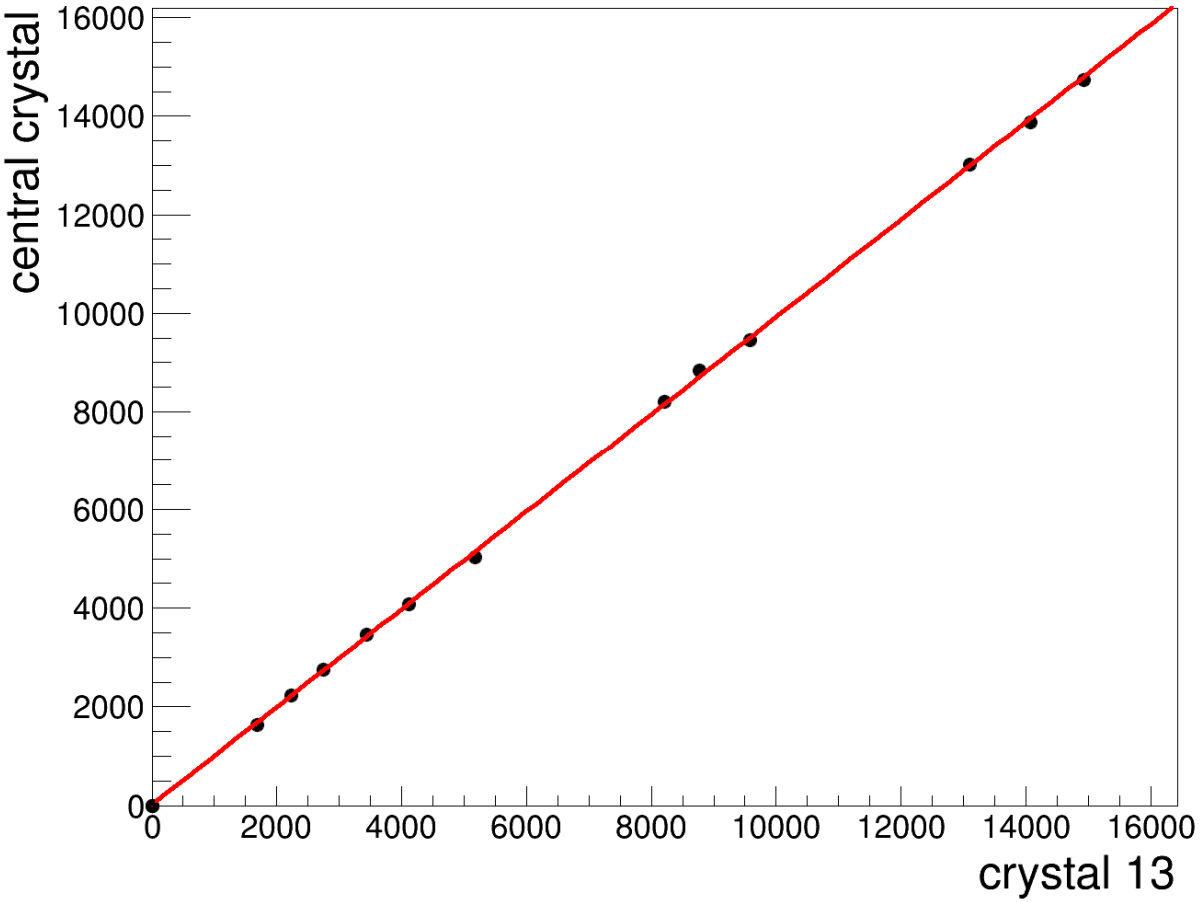
Relative and absolute calibration of the crystals

Calibration run: Beam interaction in the center of each crystal

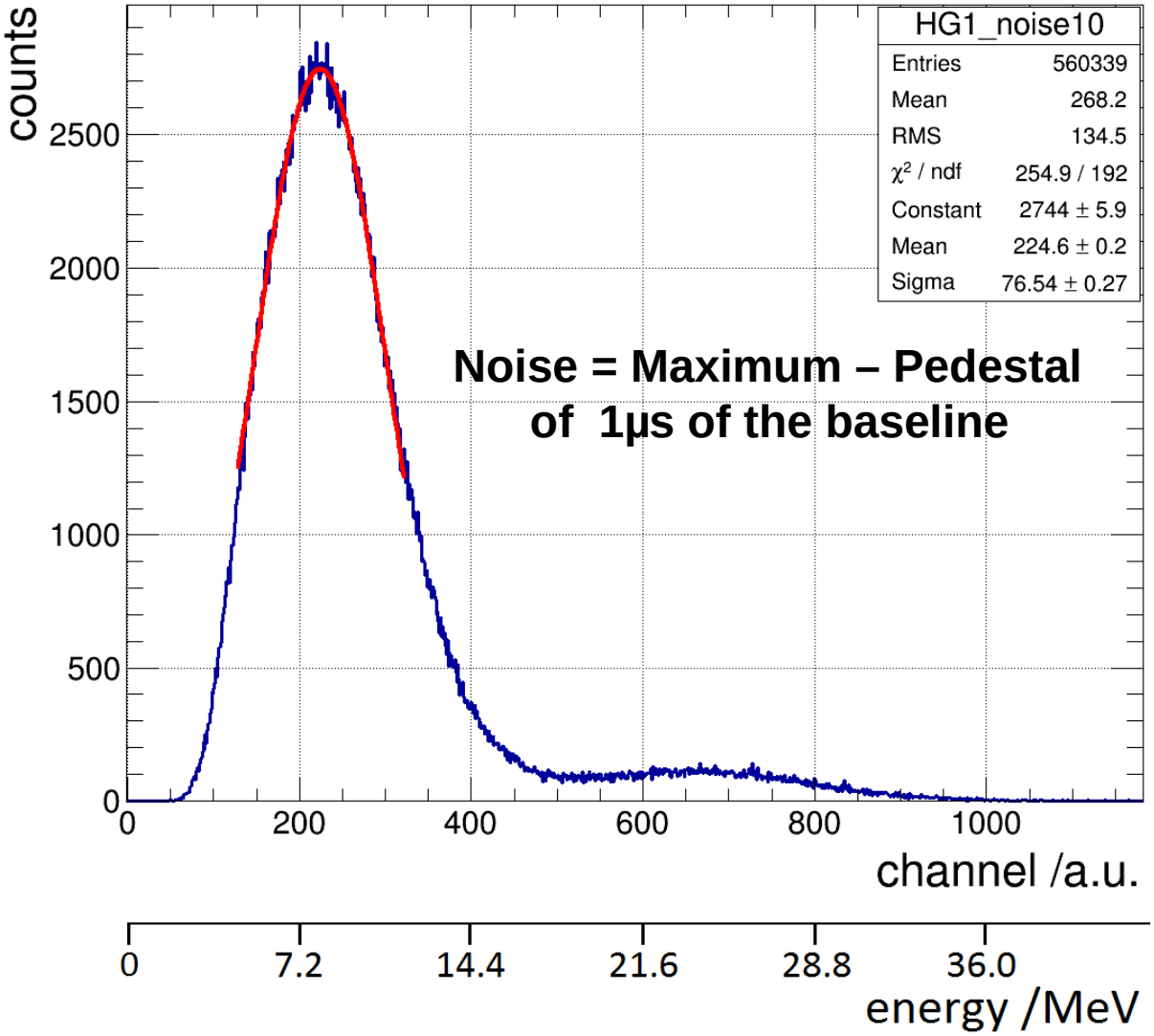
Relative calibration
of the deposited energies in those runs to the central crystal

Absolute calibration based on GEANT 4 simulations:

79 % of the beam energy is deposited in the central crystal (for a central interaction of the beam)



Noise level and threshold



mean ~ 8 MeV

sigma ~ 2.7 MeV

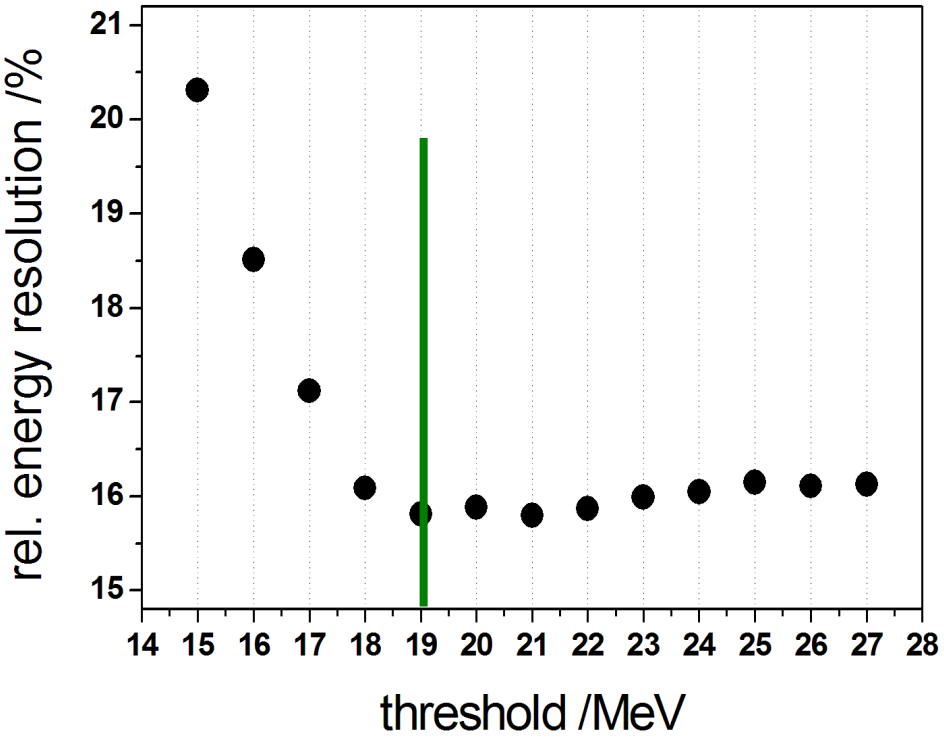
threshold ~ 16 MeV

Noise level and threshold

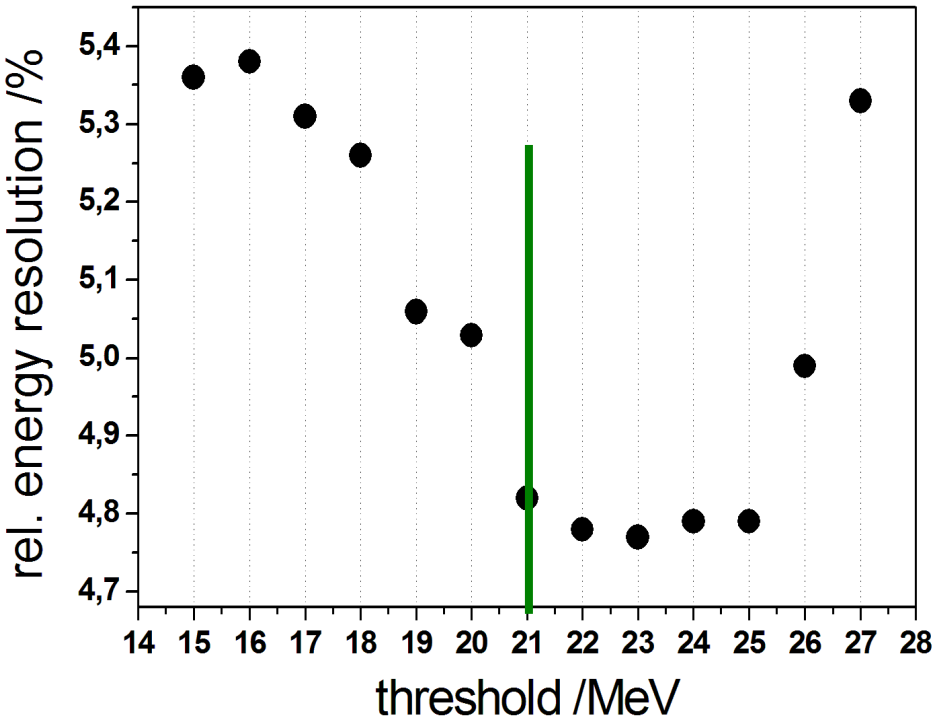
- treshold scan of energy resolution -

3 x 3 array

73 MeV

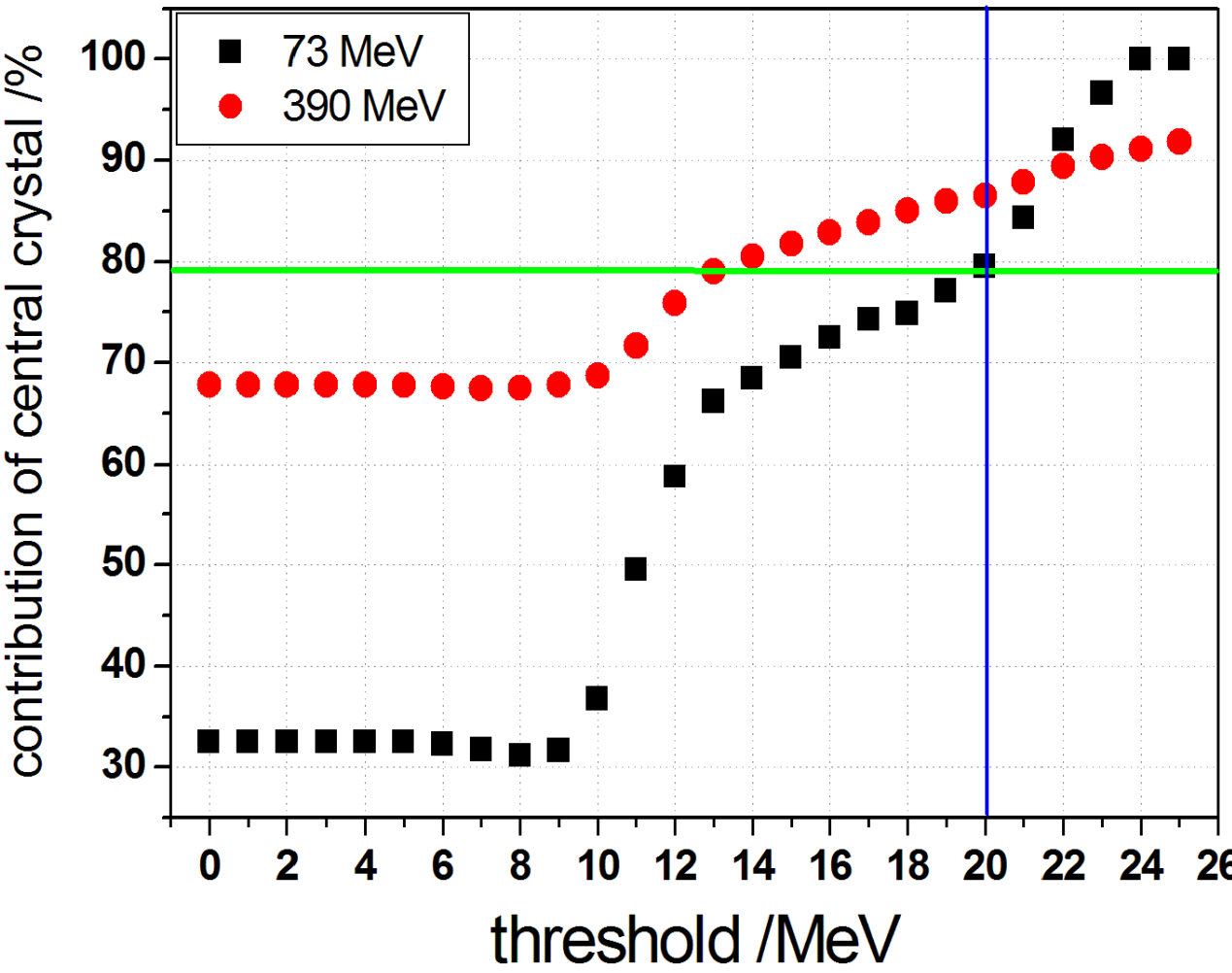


719 MeV



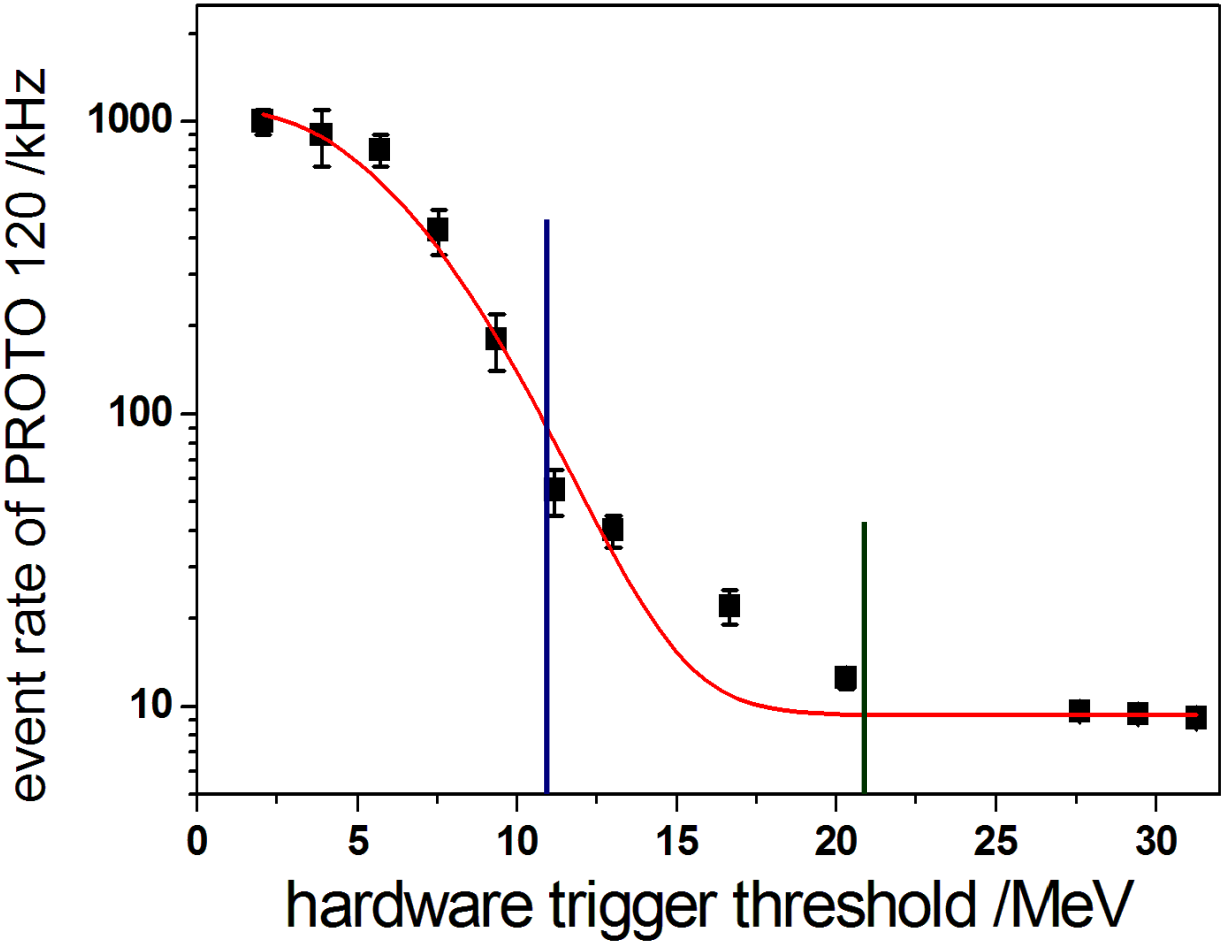
Noise level and threshold

- Contribution of the central crystal to the 3x3 energy sum -



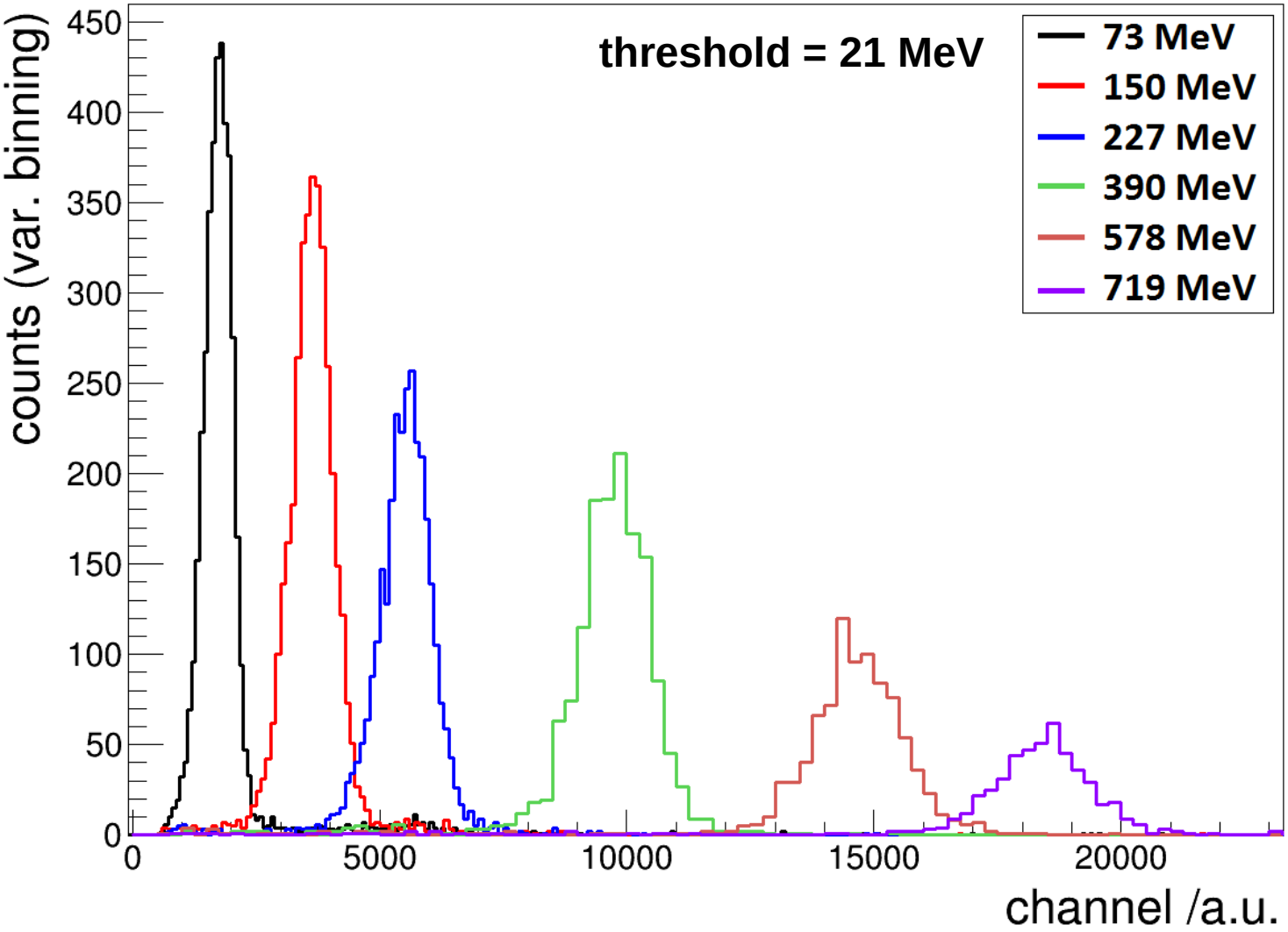
- Expected from simulation: 79 %
- Reasonable values for E_{thr} ~ 20 MeV

Noise level and threshold
- hardware trigger threshold -

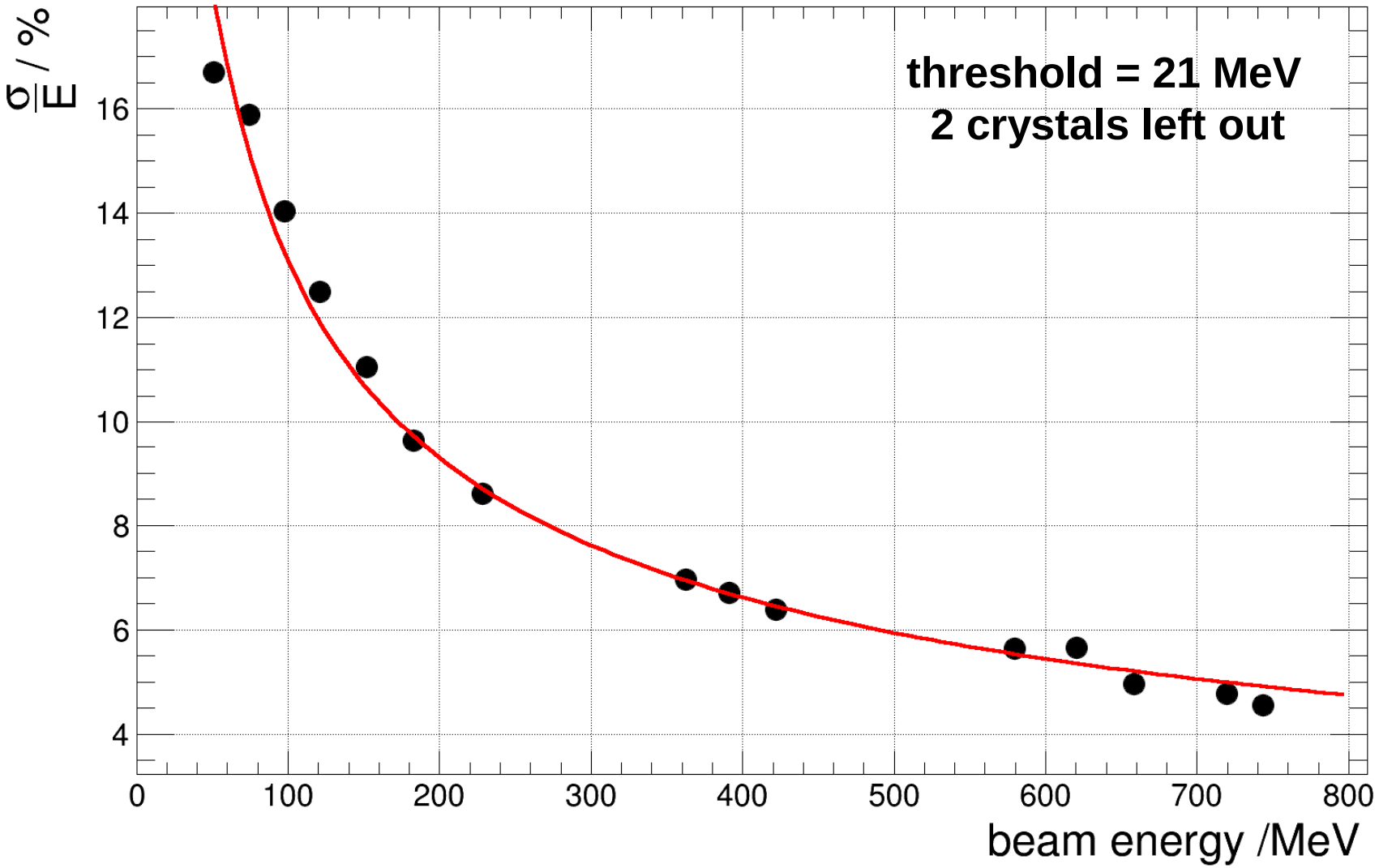


- Dead time effects at thresholds below 12 MeV
- Trigger threshold of 15-20 MeV needed for the central crystal!
- Only central crystal is triggering (common readout)
  → No threshold for other crystals
- **Later:** triggerless readout
  → threshold for all crystals

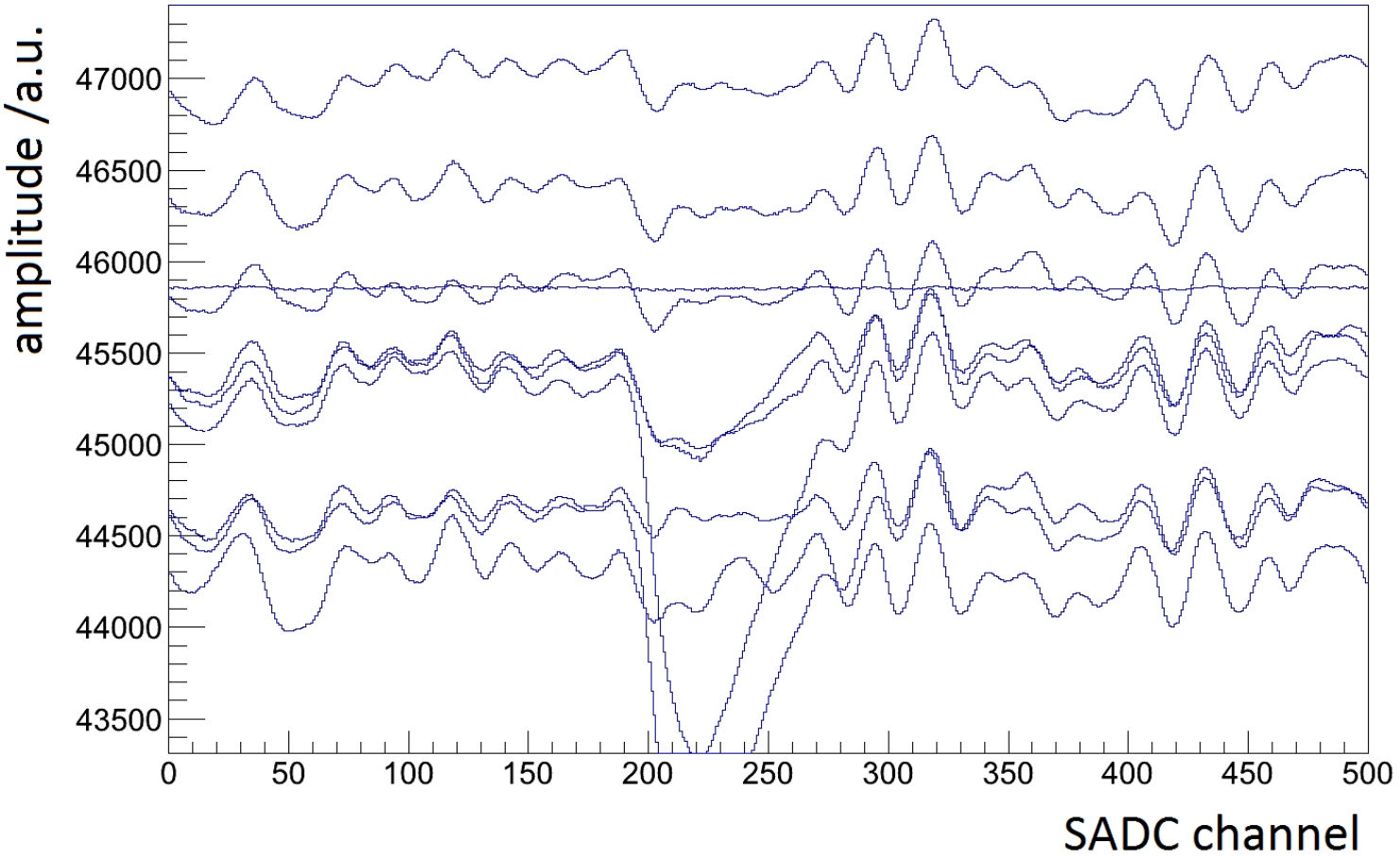
Lineshapes for a 3x3 array



Energy resolution of a 3x3 array



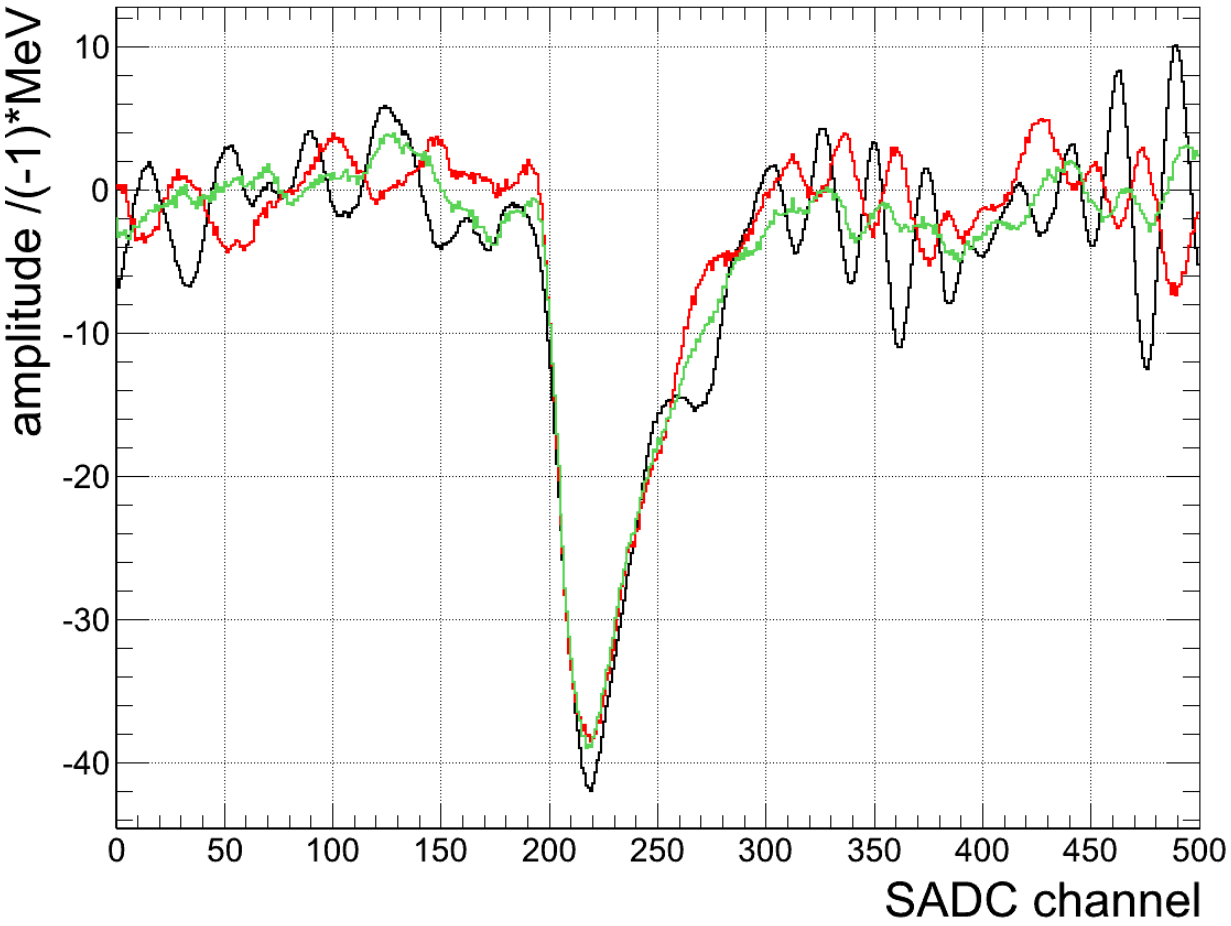
Outlook: Reduction of the correlated noise

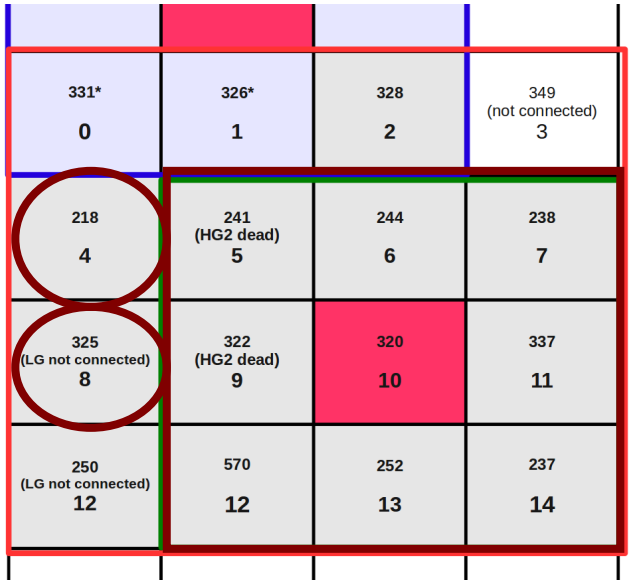


signal amplification in HG: **x 20** noise amplification in HG: **x 14**

➔ 70 % of noise coupled in before the amplification stage of the ASIC

Outlook: Reduction of the correlated noise



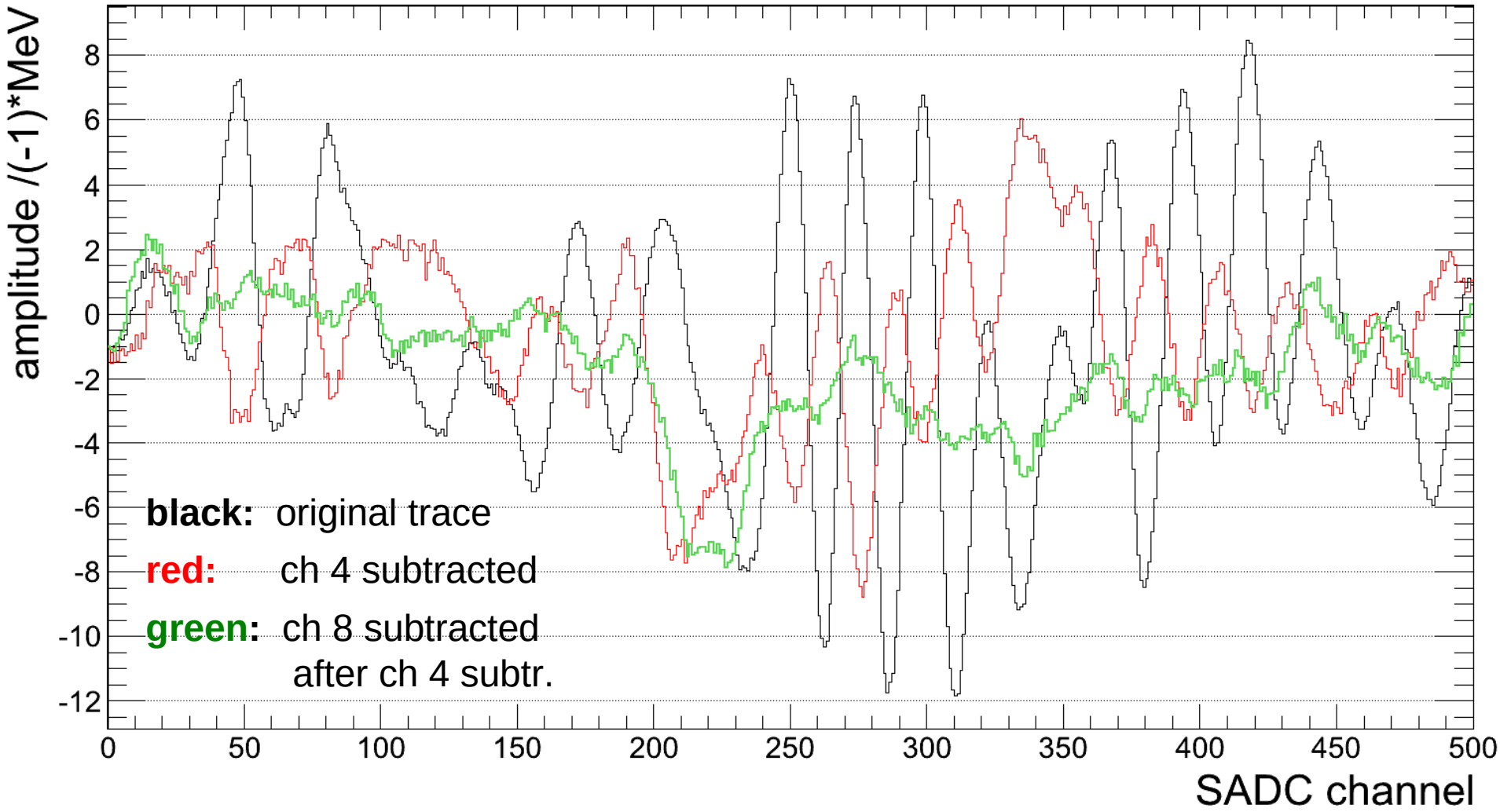


black: original trace

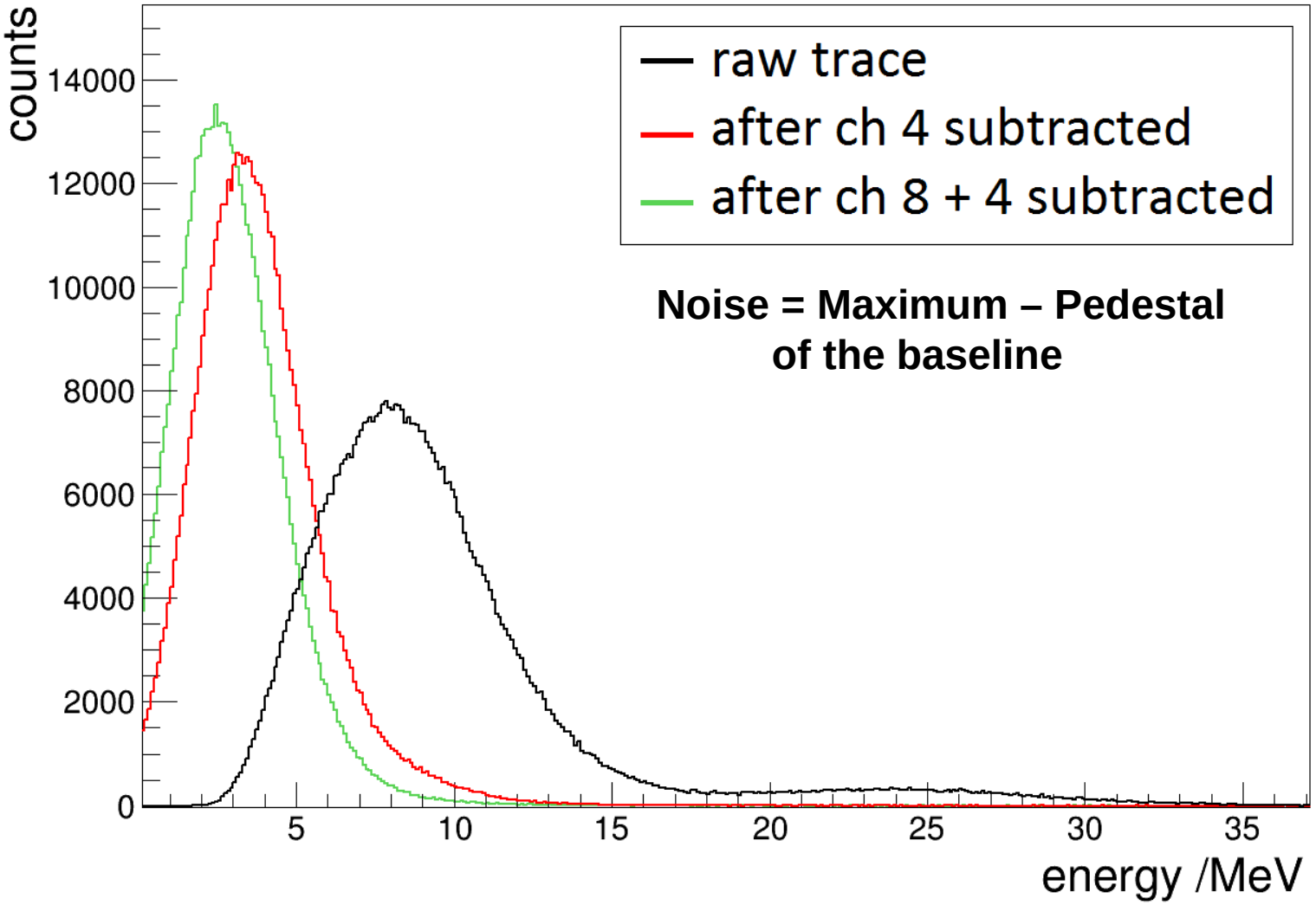
red: ch 4 subtracted

green: ch 8 subtracted after ch 4 subtr.

Outlook: Reduction of the correlated noise

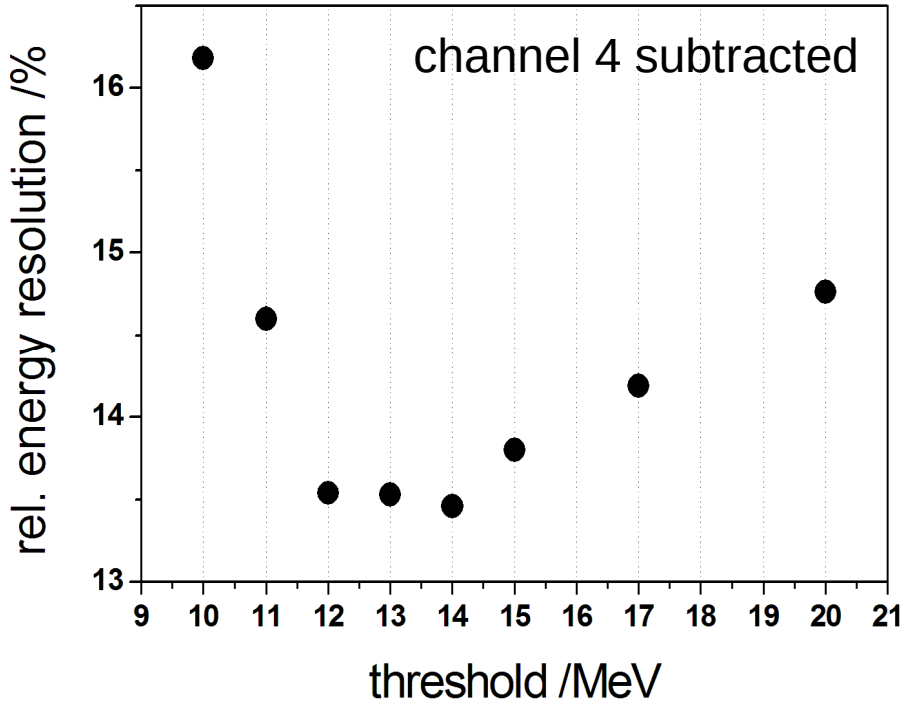


Outlook: Reduction of the correlated noise - Noise level -

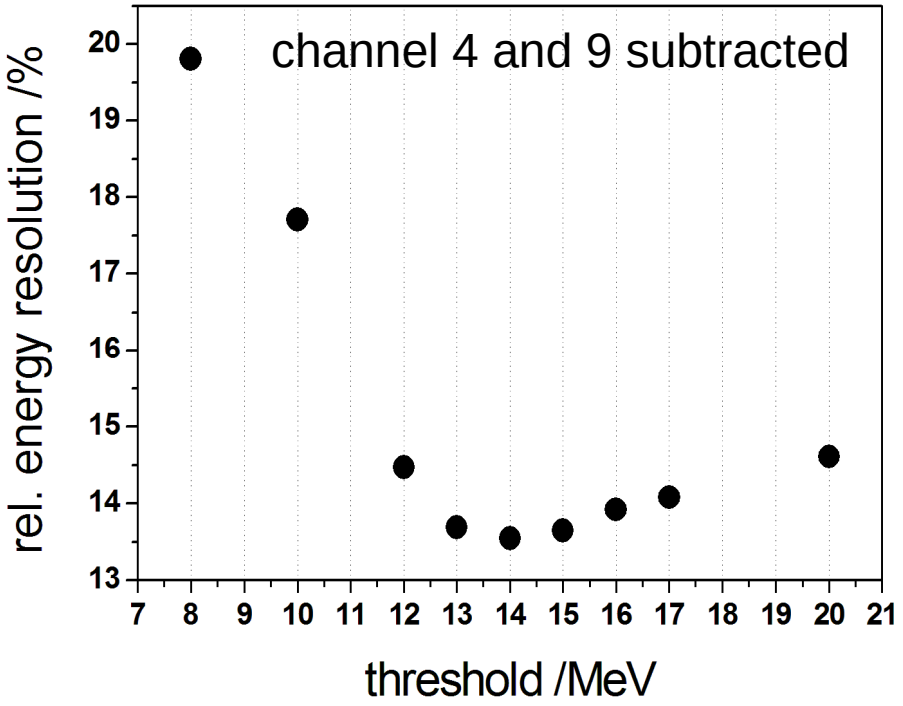


Outlook: Reduction of the correlated noise

threshold scan for E = 73 MeV

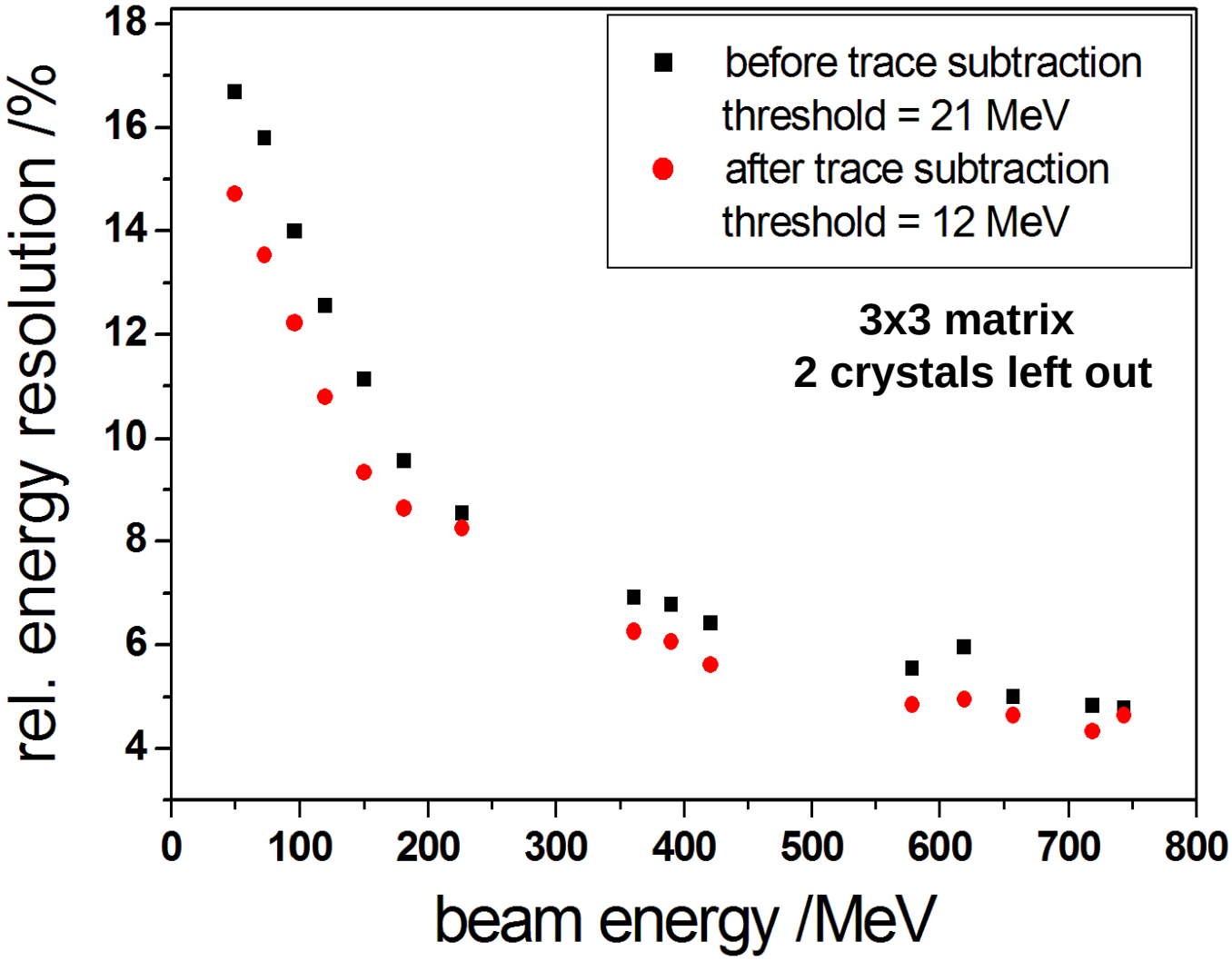


optimal threshold: 12 MeV



optimal threshold: 13-14 MeV

Outlook: Reduction of the correlated noise



Conclusion and Outlook

- Analysis of the data is still in progress
- High correlated noise has been observed on the traces
- Noise could be partly reduced by additional shielding + grounding
- Next PROTO 120 beamtime in April @ MAMI
  - General performance of the prototype (new ASICS)
  - Influence of the depolished crystals on the energy resolution

Thank you for your attention!

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Helmholtz International Center

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