

# The response of a 5x5 matrix of PWO-crystals

- Type: Forward end cap
- Energy range: 12.7 – 71.2 MeV
- Temperature: -25 °C

Stockholm University

Lund university

Uppsala University

Per-Erik Tegnér

Bent Schröder

Tord Johansson

Klas Marcks

Kurt Hansen

Sophie Grape

Linda Gerén

Magnus Lundin

Erik Thomé

Kjell Fransson

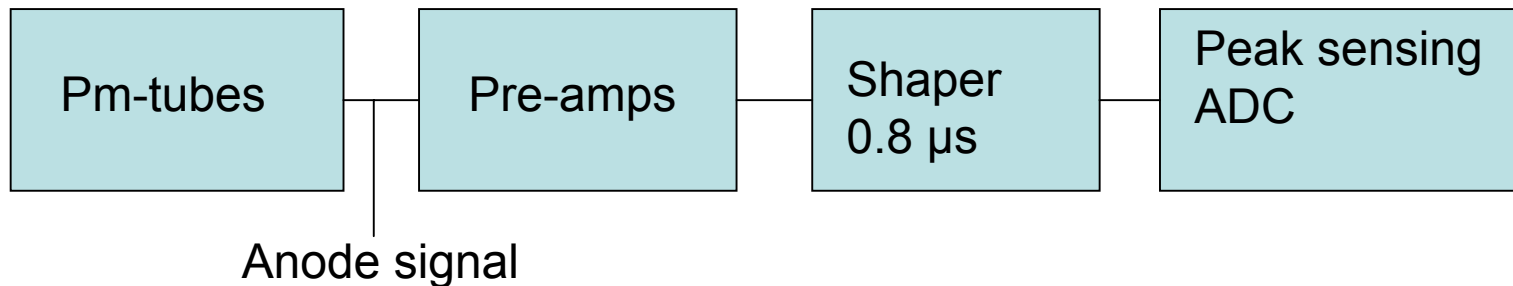
Pawel Marciniewski

# Outline

- Introduction
- Experimental setup
- Calibration procedure
- Results: Resolution as function of energy and threshold

- Experiment performed at Max-lab tagged photon beam facility in Lund.
- Energy range covered by two separate runs with different positioning of the focal planes.
- 1:st run 12.7 – 45 MeV. 2:nd run 43 – 72.1 MeV.
- Collimated photon beam: diameter < 1 cm
- Measurements also performed at -5 and -15 °C (analysis not finished).

### Electronics



# Experimental setup



- Tapered crystals with tight wrapping
- Temperature sensors
- Properly aligned pm-tubes
- Coordinate table
- Climate chamber

# Procedure

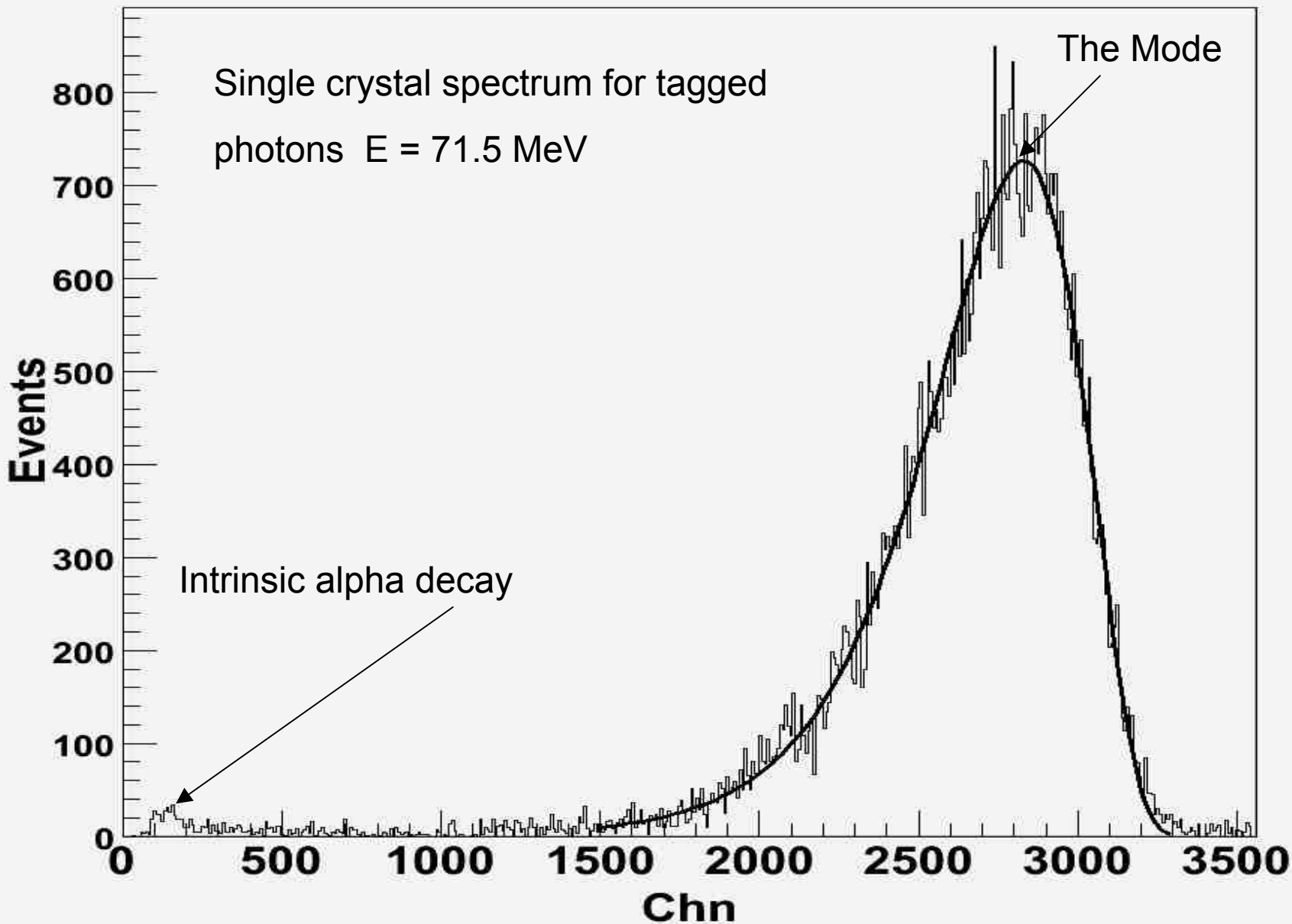
- Find calibration of all detector elements relative to central element.
- Aim the beam at the central detector and sum in energy contributions, with correct calibrations, from all crystals for each event.
- Map centroids of summed tagged photon spectra on focal plane energies to get the absolute calibration of the total matrix.
- Calculate relative resolution  $\sigma/E$ .

# Relative calibration

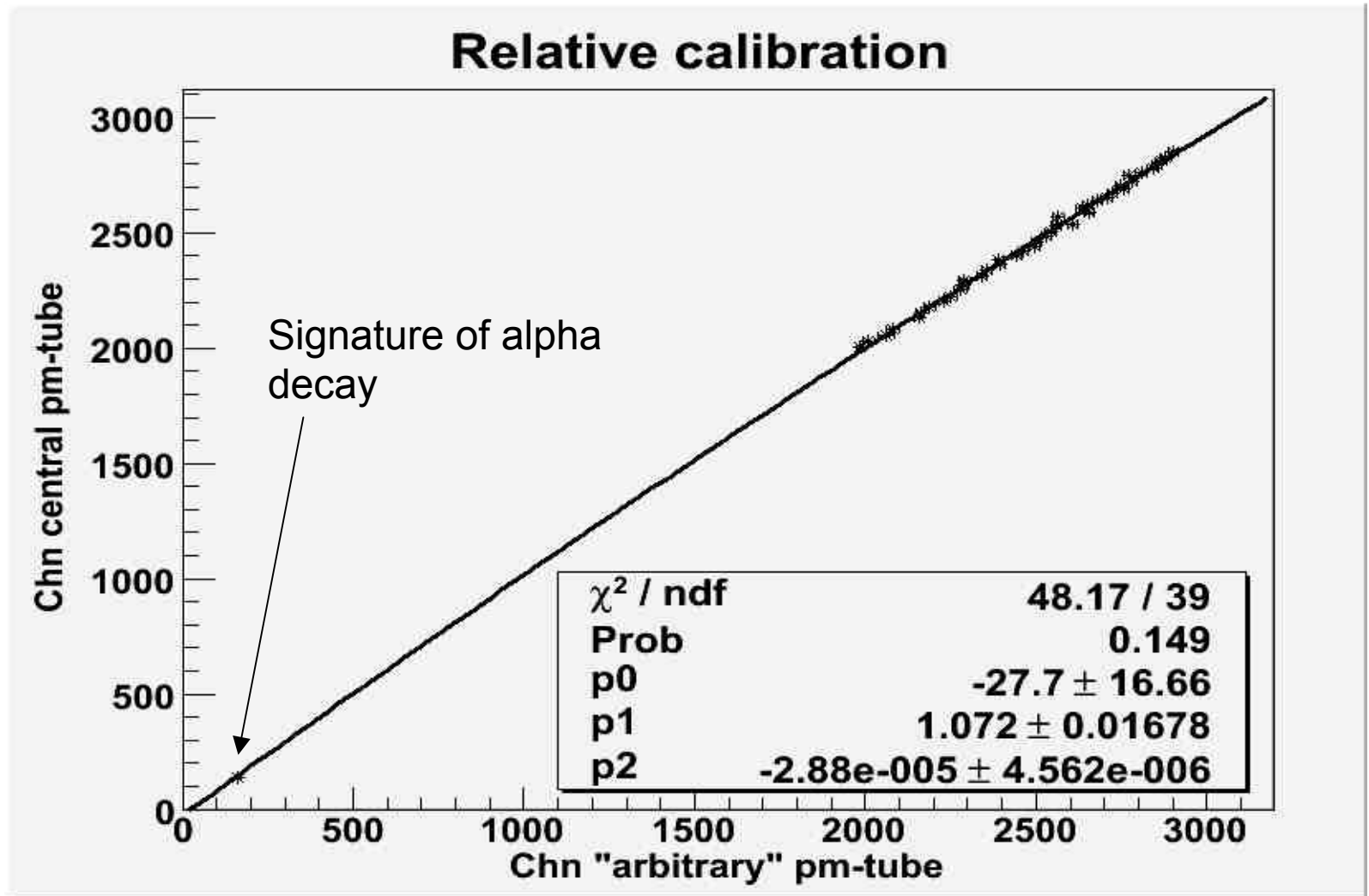
- Aim beam at same position of each crystal.
- Characterise each tagged photon spectrum (mean value, mode ...).
- Create calibration functions mapping tagged photon spectra of all detector elements on tagged photon spectra of the central element.

How do we characterise a tagged photon spectrum?

# Fitting the "Novosibirsk" function to raw data

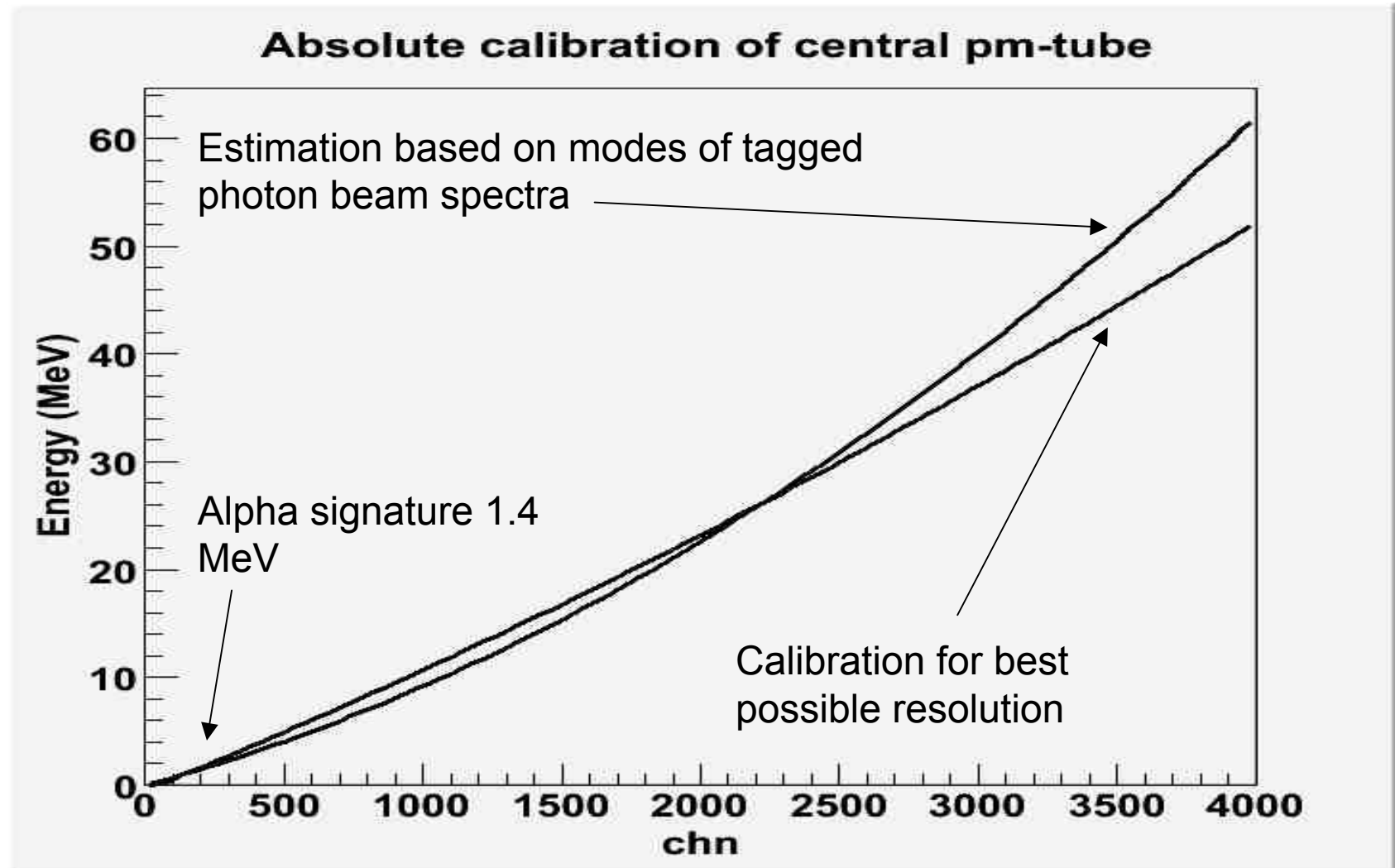


# Mapping modes on modes





Non-linearity of the central detector element demands knowledge of its absolute energy calibration if proper summation of energy contributions is to be performed.

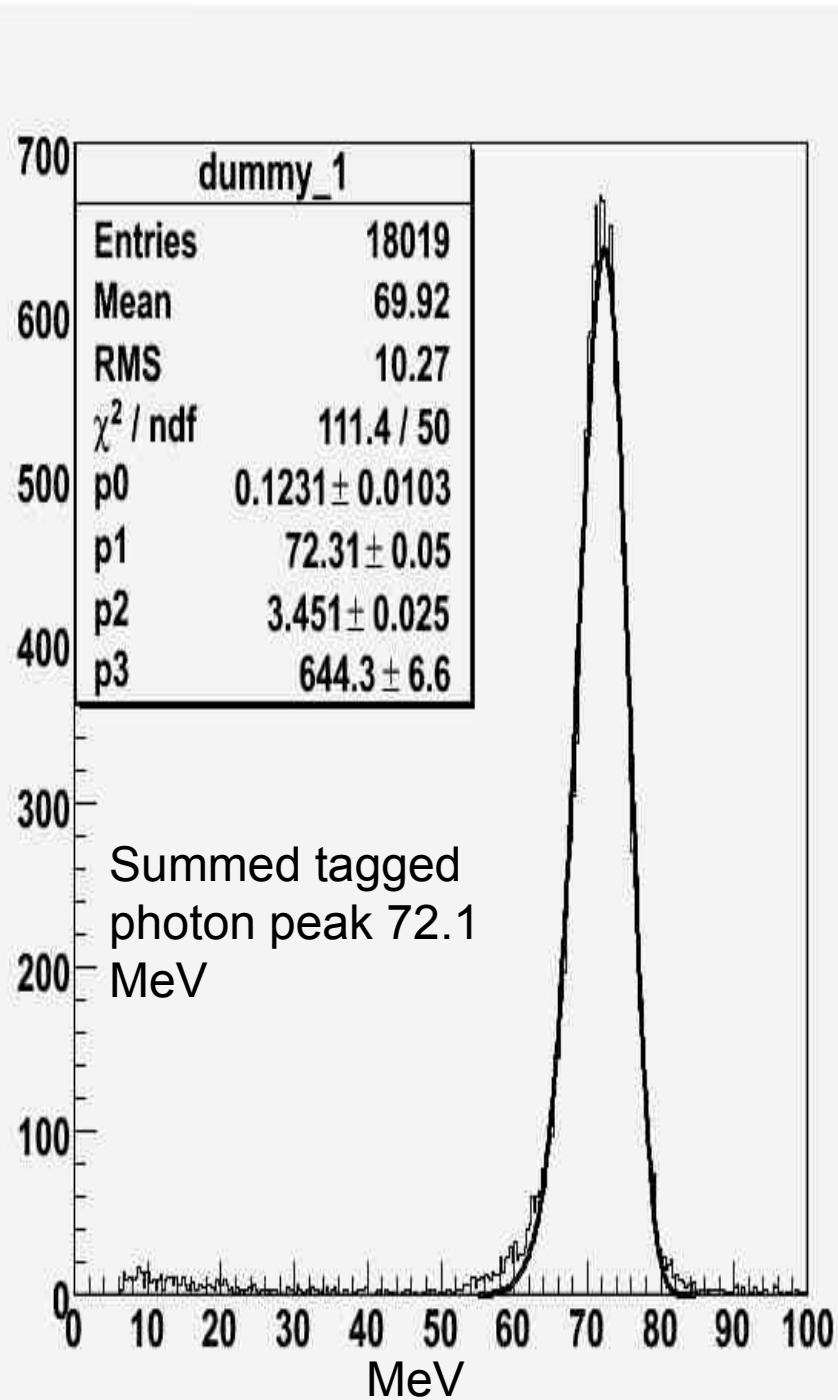
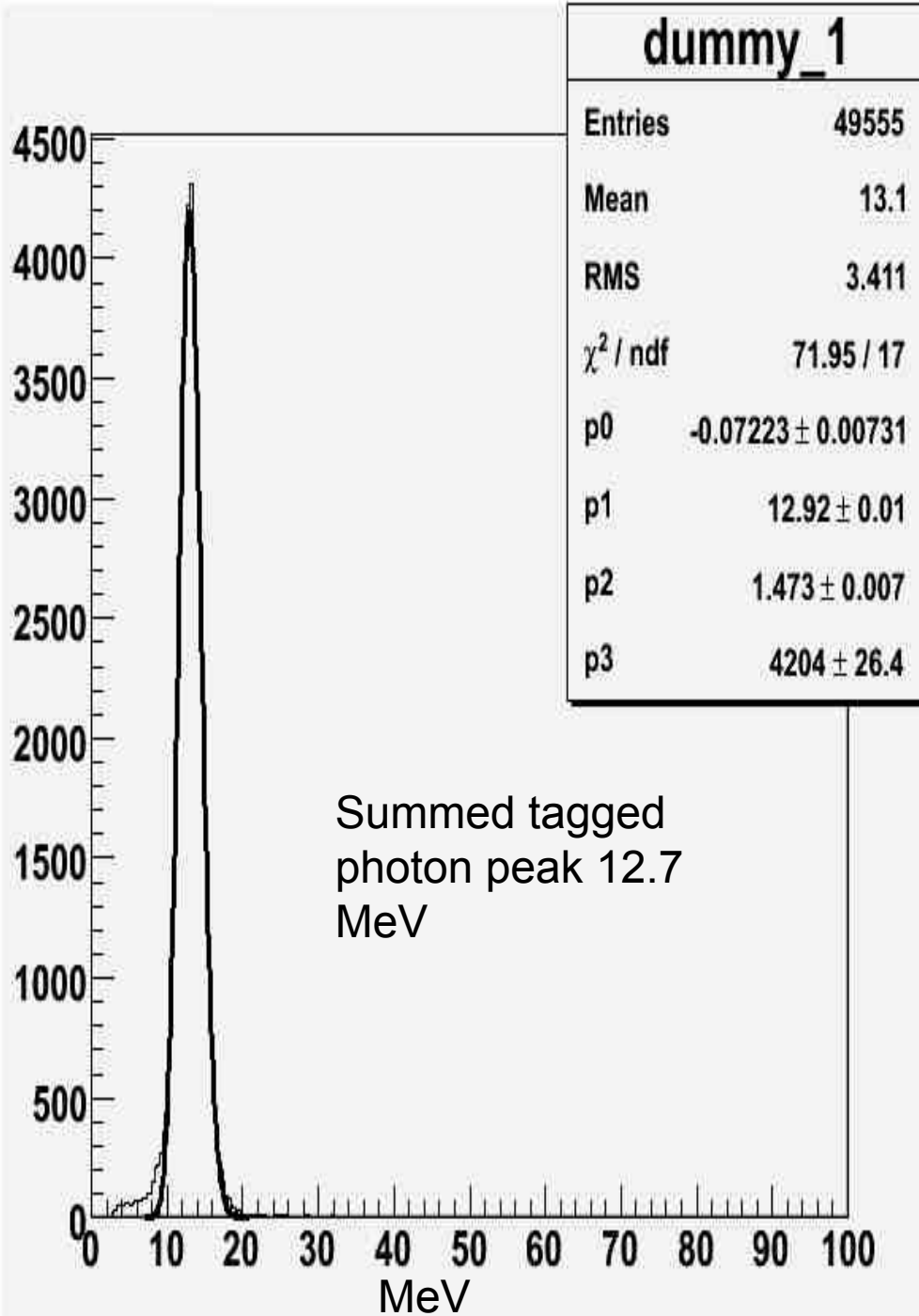


Average energy signature of intrinsic alpha decay for high and low energy settings given by absolute calibrations:

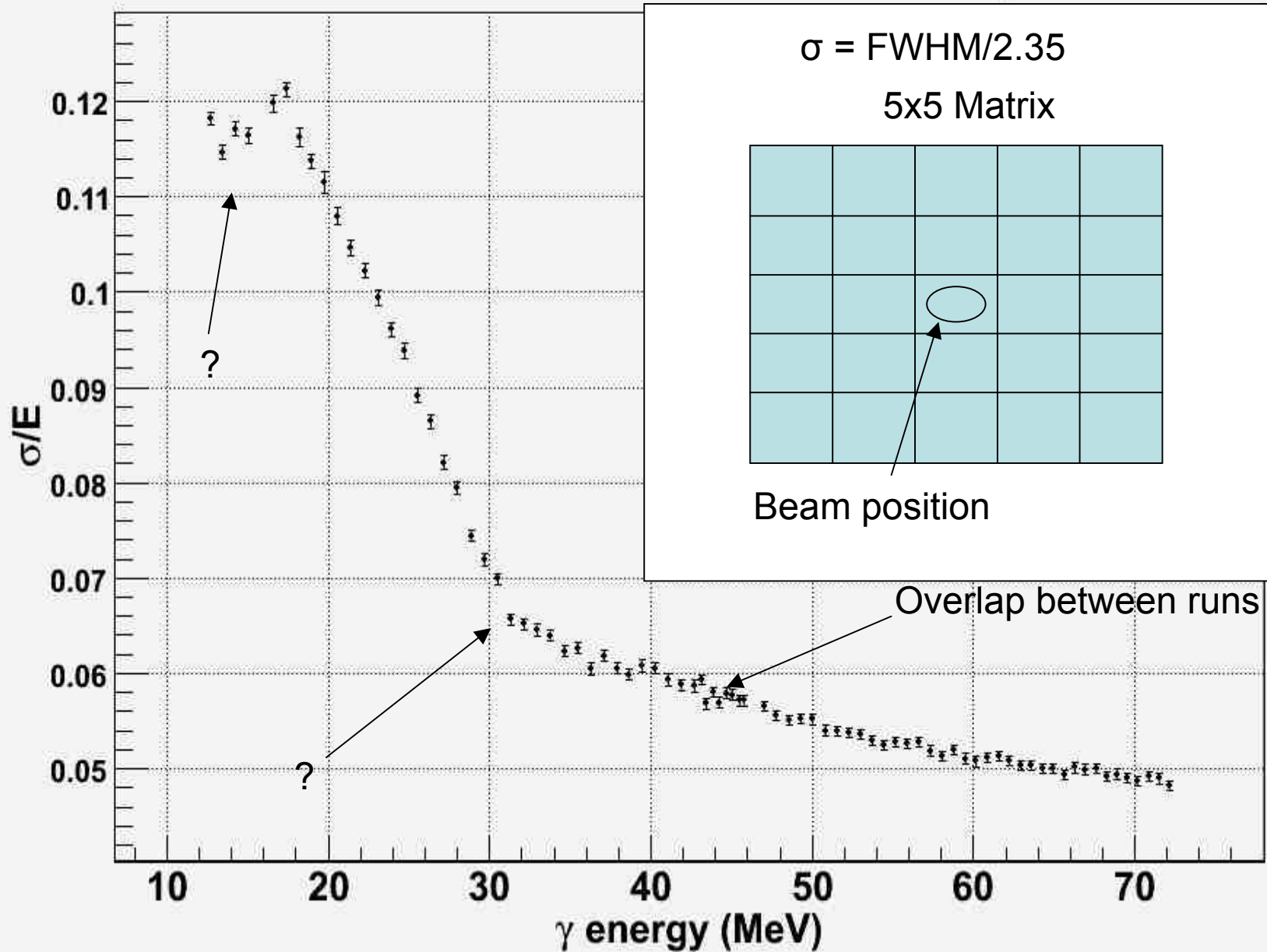
Low energy run:  $1.33 \pm 0.07$  MeV

High energy run:  $1.38 \pm 0.03$  MeV

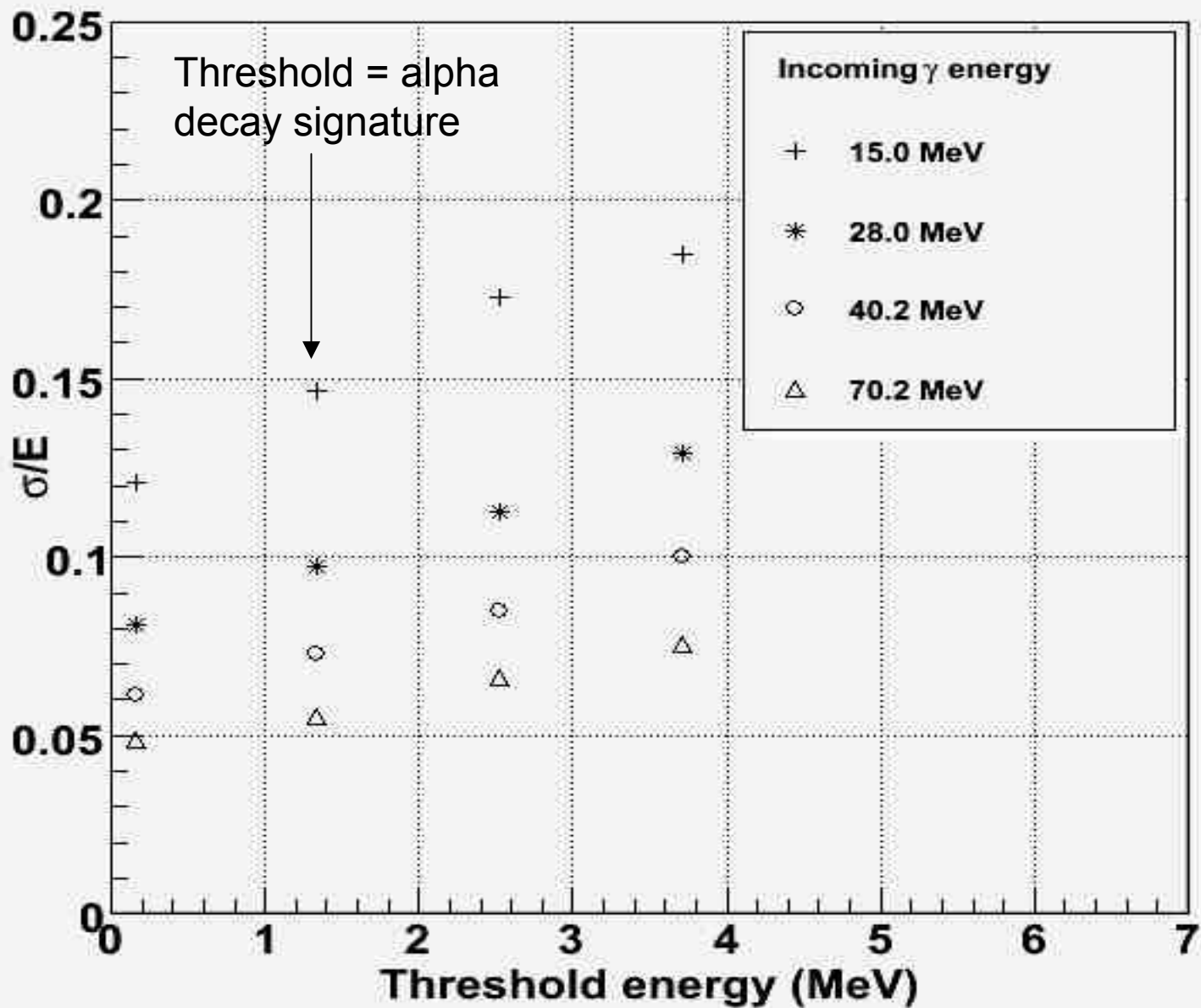
Measured value: 1.3 MeV ???



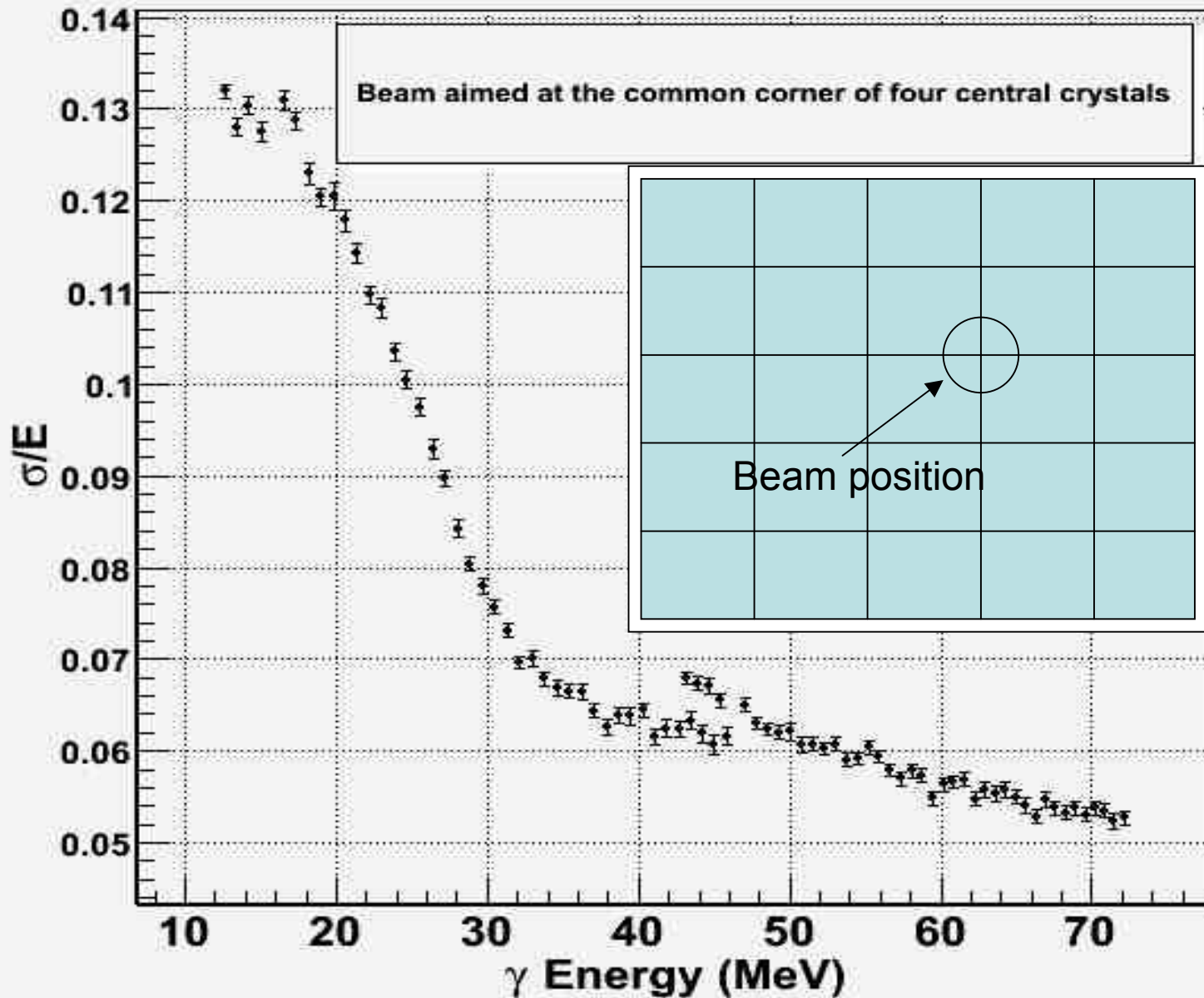
# Relative resolution as function of $\gamma$ energy



## Relative resolution as function of threshold



# Relative resolution as function of $\gamma$ energy

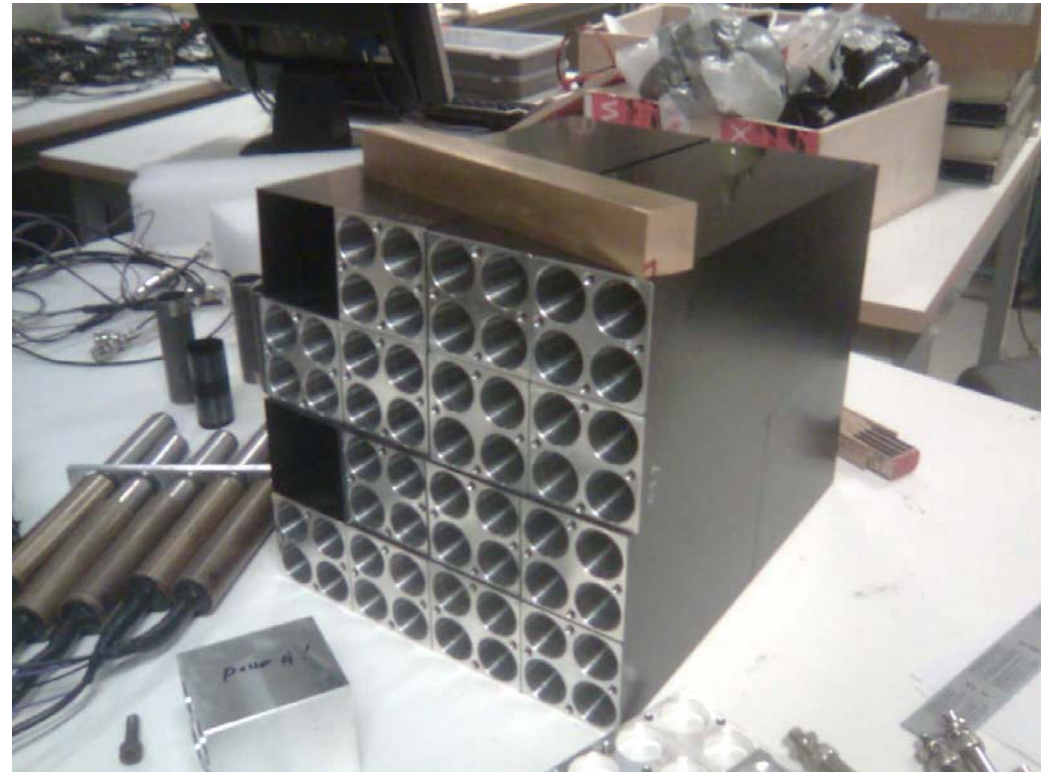


# Future analysis and measurements

Analysis of data from -15 and -5 degrees C measurements.

New matrix configuration: Crystals placed inside alveoles.

Next Max-lab run: November 2009



Thank you for your attention!