

*Status of data analysis with  
Sampling Analog-to-Digital Converter  
for PROTO60*

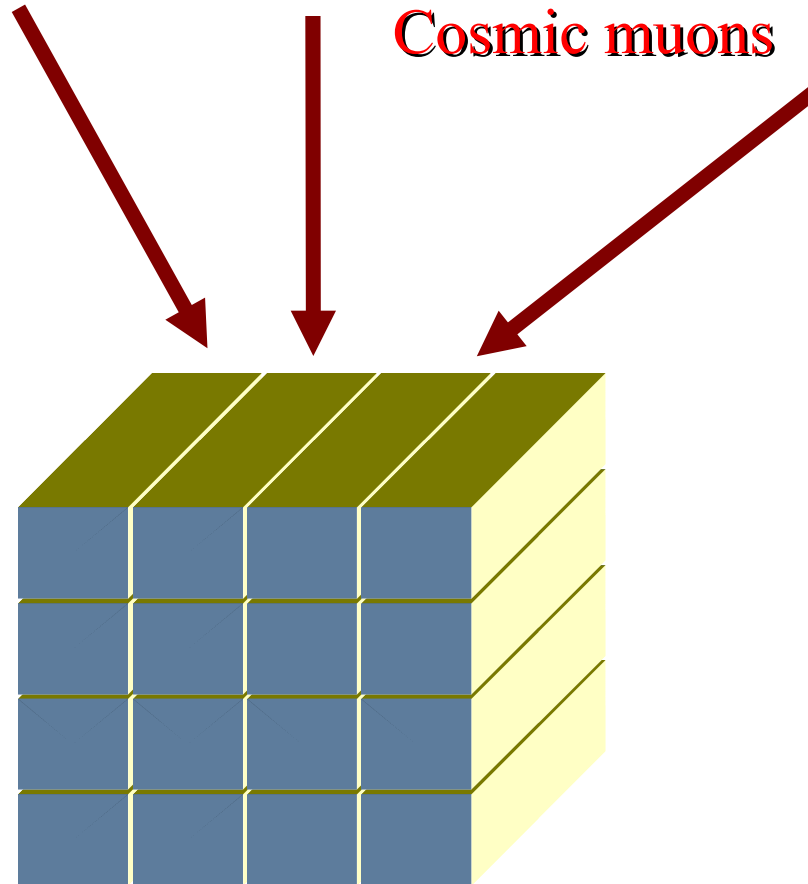
**E. Guliyev, M. Kavatsyuk, H. Löhner, G. Tambave**

**PANDA XXVIII Colloboration Meeting  
3 March 2009  
GSI, Darmstadt**

## Outline:

1. Measurements of cosmic muons and high-energy gammas  
with PROTO60
2. Time resolution for cosmic muons
3. Energy and time resolution for high-energy gammas

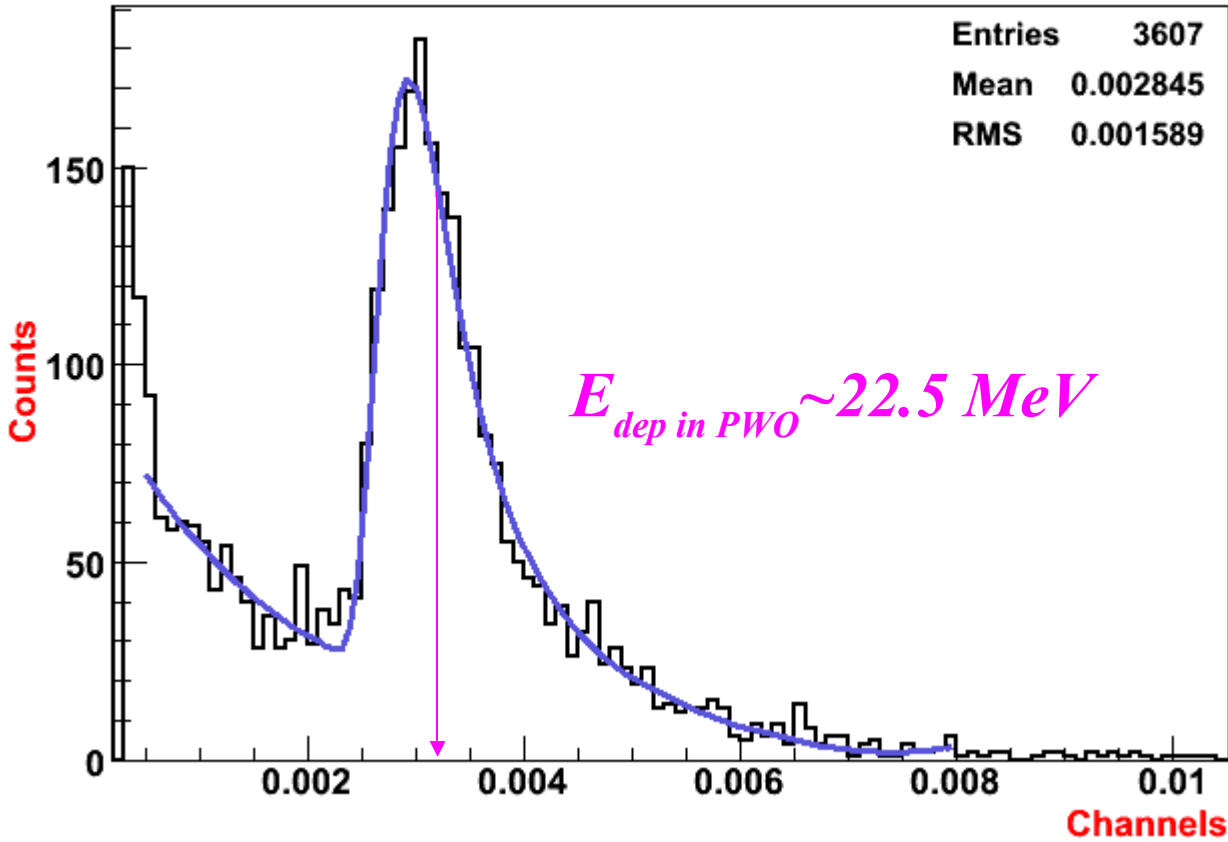
# Measurements of cosmic muons with PROTO60 @ Giessen (week 6)



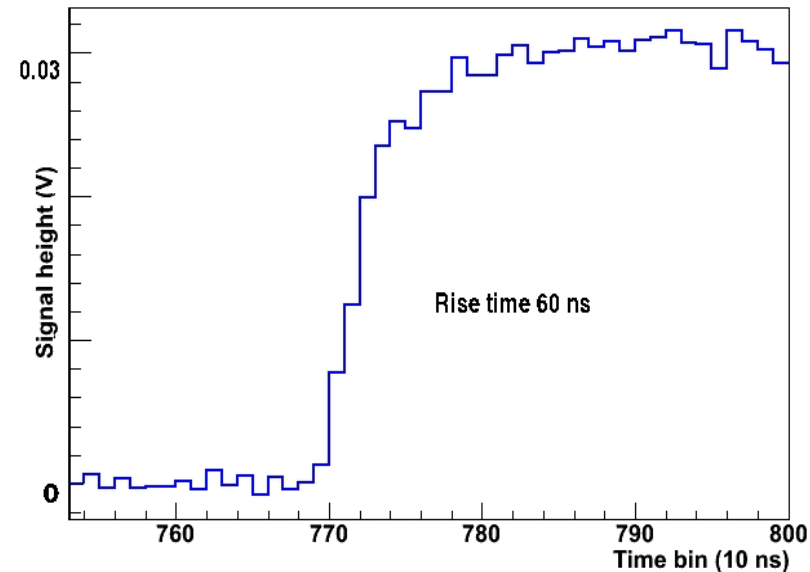
16  $\text{PbWO}_4$  crystals  
LAAPD +  
Basel LNP Preamplifier

16 channel 100 MHz 16 Bit  
SADC readout

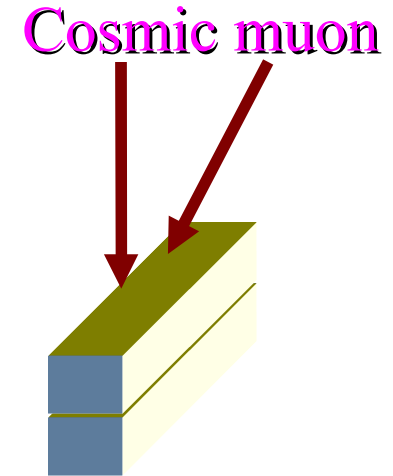
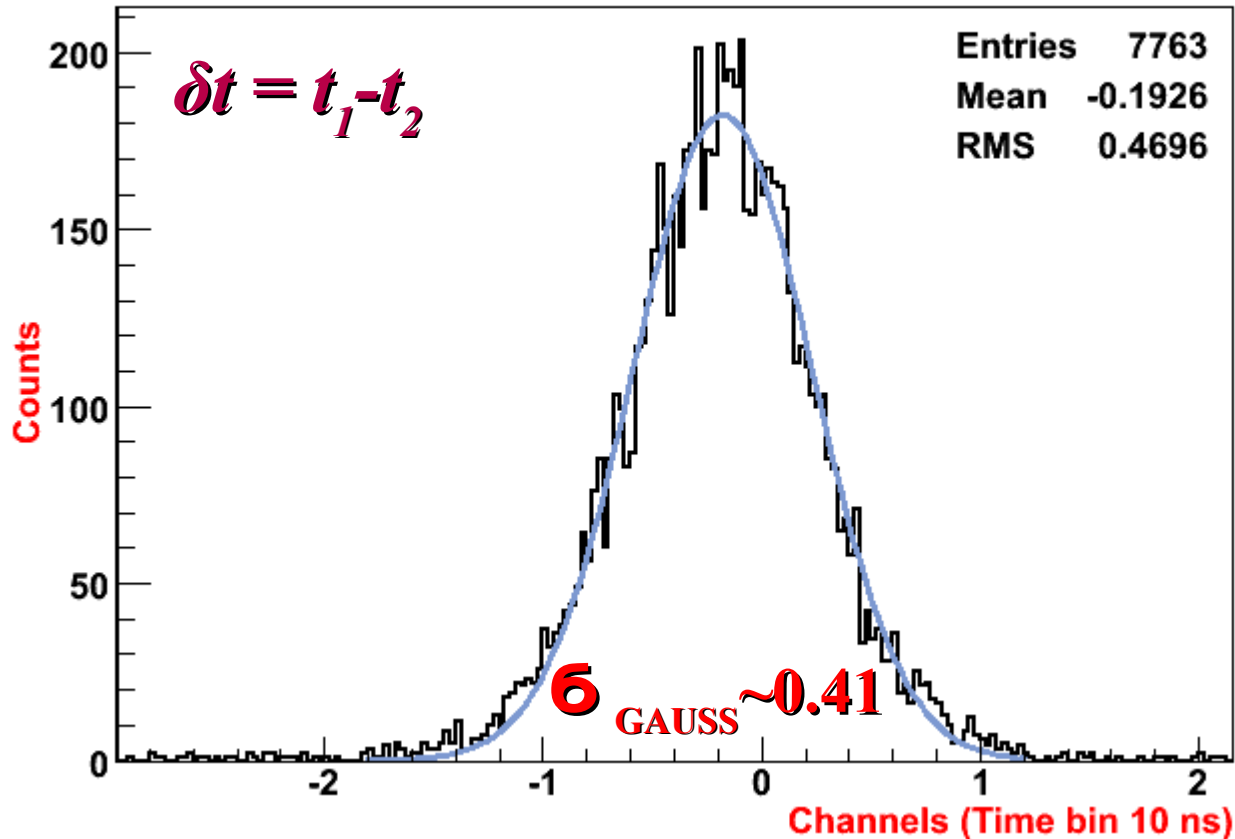
# Spectrum of energy deposition for cosmic muons



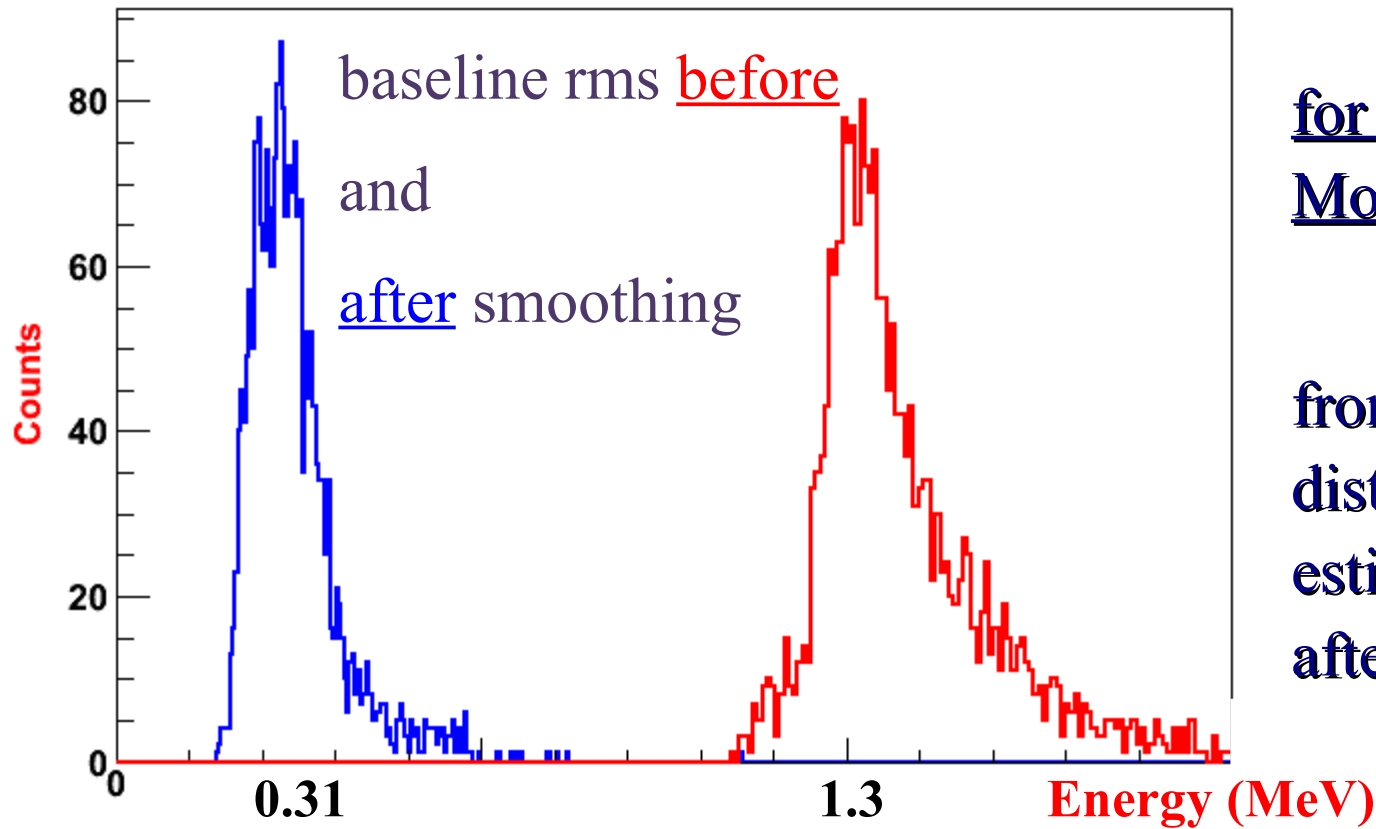
Signal trace for Cosmic Muon



# Difference between time stamps of 2 crystals in one row



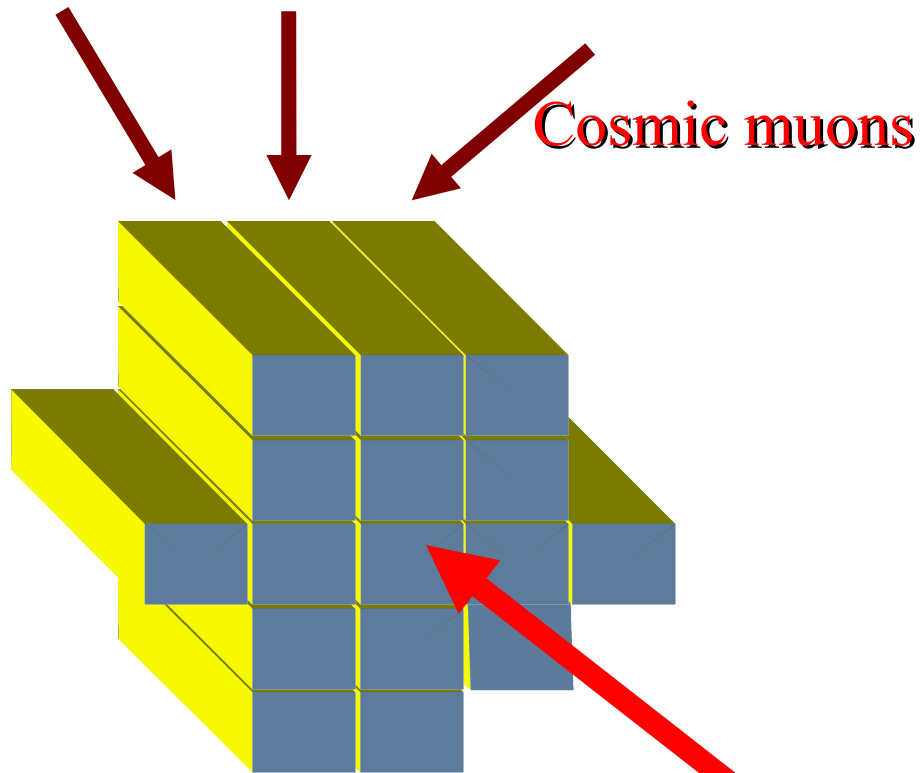
**Time resolution = 6 GAUSS \* Time bin = 0.41 \* 10 ns = 4.1 ns**



for smoothing applied:  
Moving Average algorithm.

from baseline rms  
distribution:  
estimation of noise level  
after smoothing: ~310keV!

# High-Energy Photon Measurement with PROTO60@MAINZ (week 8)



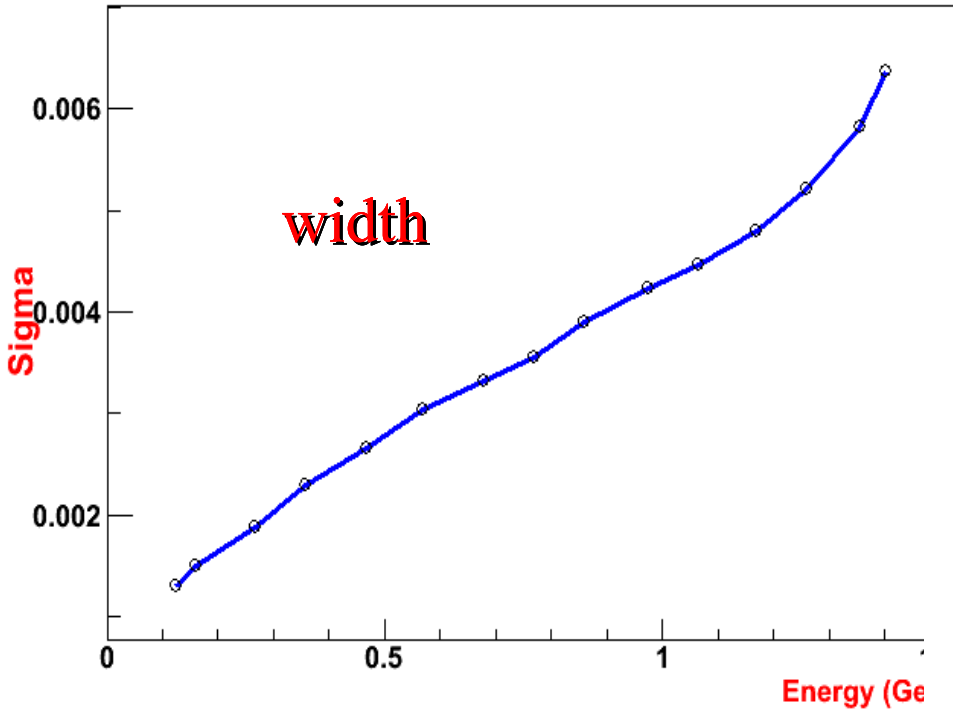
Photon energy  
124 - 1441 MeV

Cosmic muon measurement used  
for calibration

High energy photons – MAMI - C

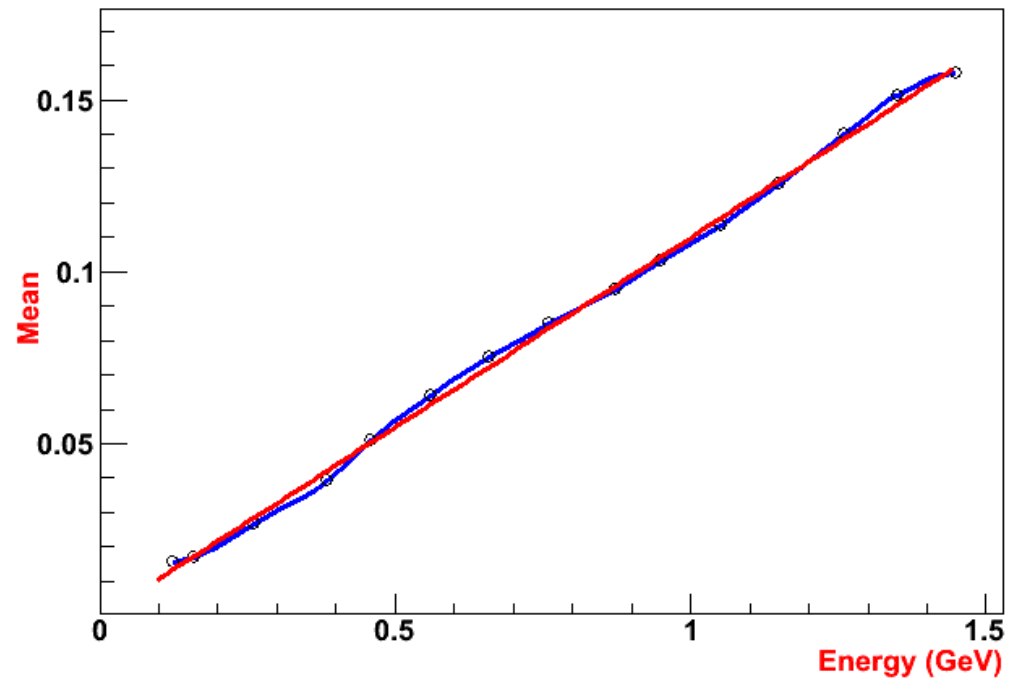
# Dependence of width and peak position

of cluster energy on gamma energy



3x3 array from PROTO60

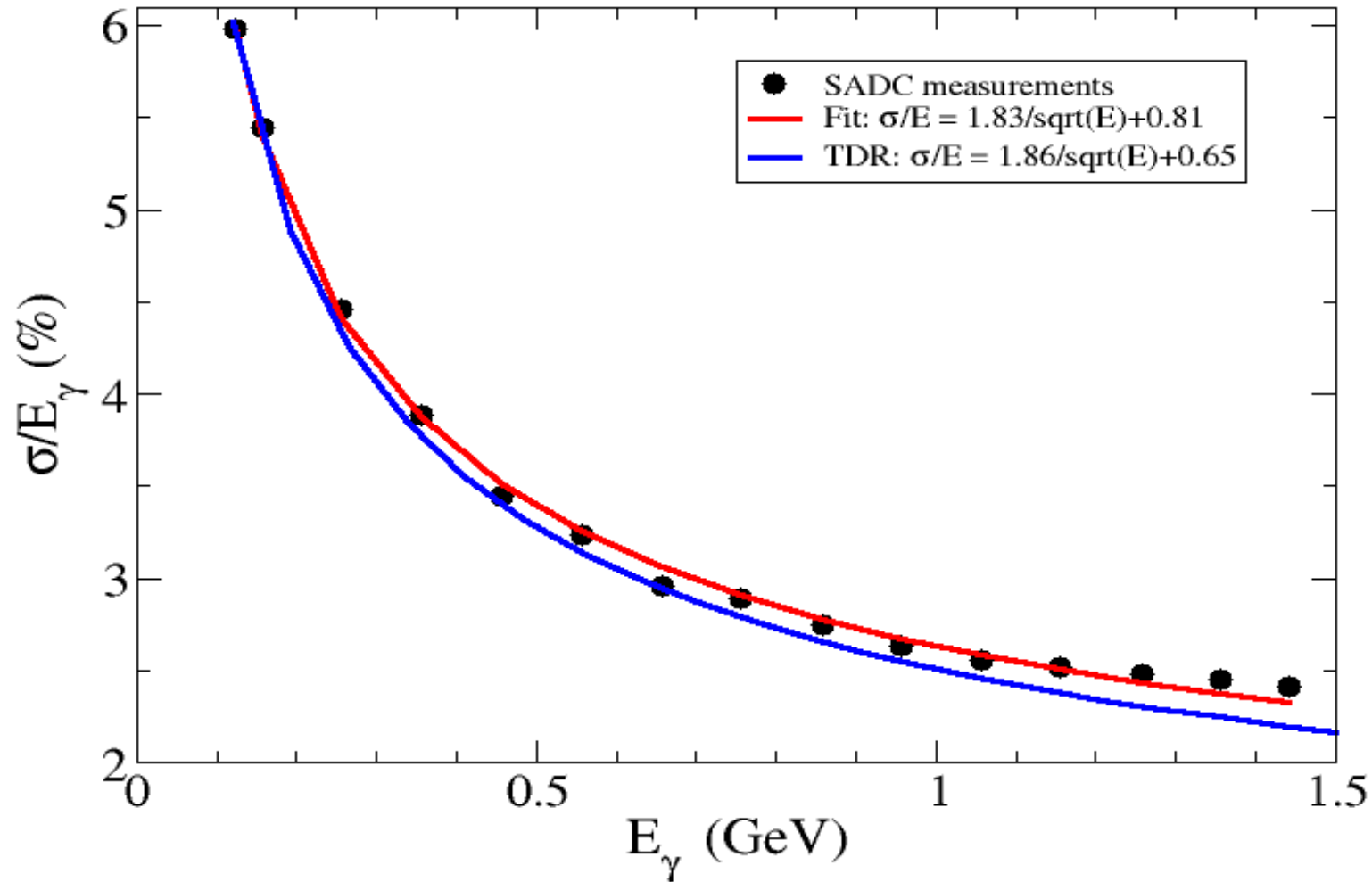
threshold 6 MeV



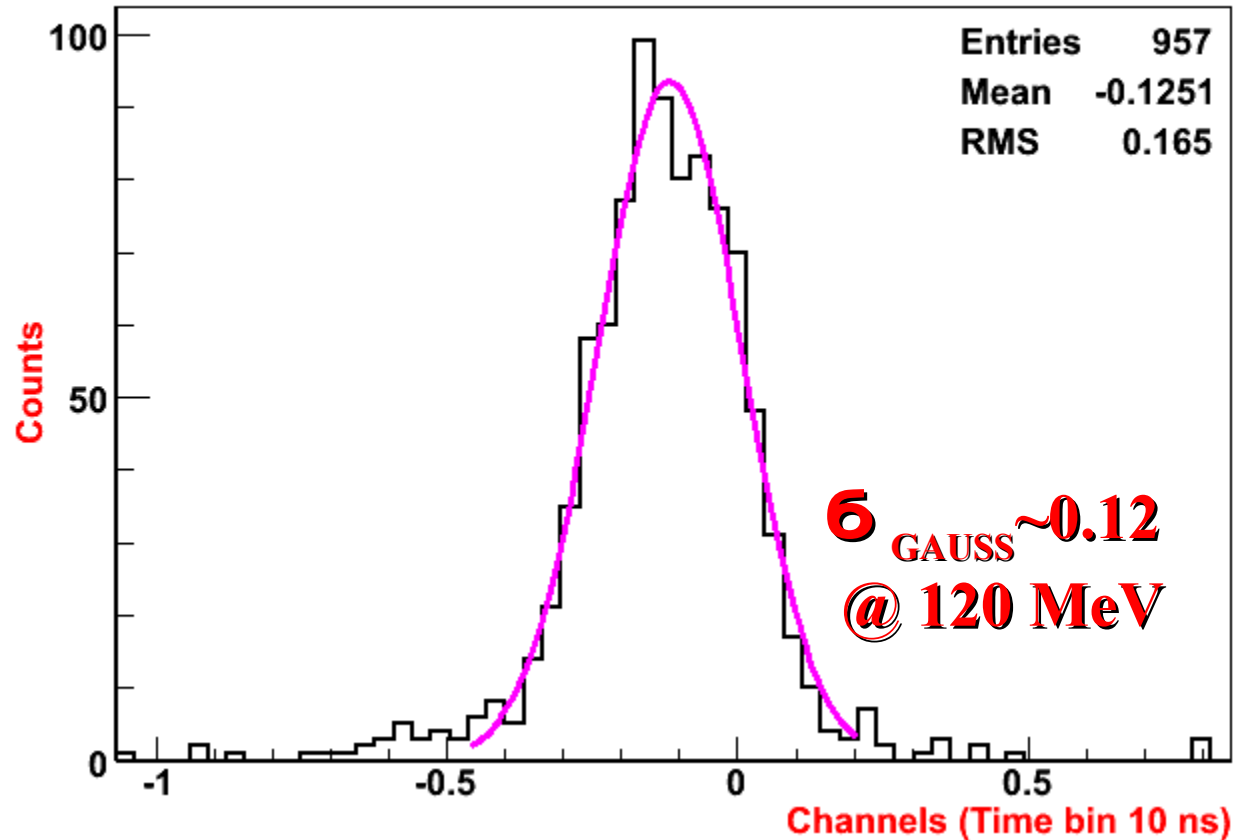
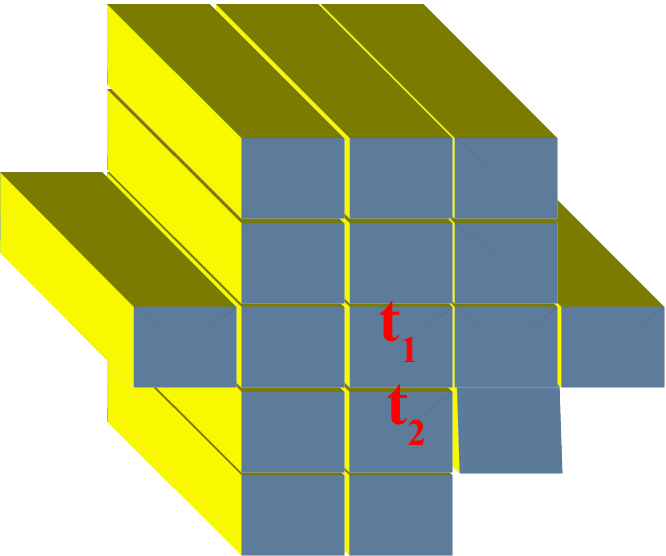


# Dependence of cluster energy resolution

on gamma energy



# Difference between time stamps of 2 neighbour crystals



Time resolution at 120 MeV photon energy  $\sim 1.2$  ns

close to value for 2 GeV  ${}^6\text{Li}$  (energy dep  $\sim 180$  MeV)  $\sim 1$  ns

## Conclusion:



1. Measured cosmic muons and high-energy gammas with PROTO60 and 100 MHz 16 Bit SADC
2. Applied digital signal analysis algorithm to improve noise level
3. Analysed time and energy resolution for both experiments
4. Time resolution for 120 MeV gamma energy (1.2 ns) equals time resolution for 180 MeV  ${}^6\text{Li}$  energy deposition (1 ns)
5. Energy resolution:  $\sigma/E (\%) = 1.83\% / \sqrt{E/\text{GeV}} + 0.81\%$
6. Continue to improve analysis algorithm