Proto60 analysis and FPGA based signal analysis

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Outline:

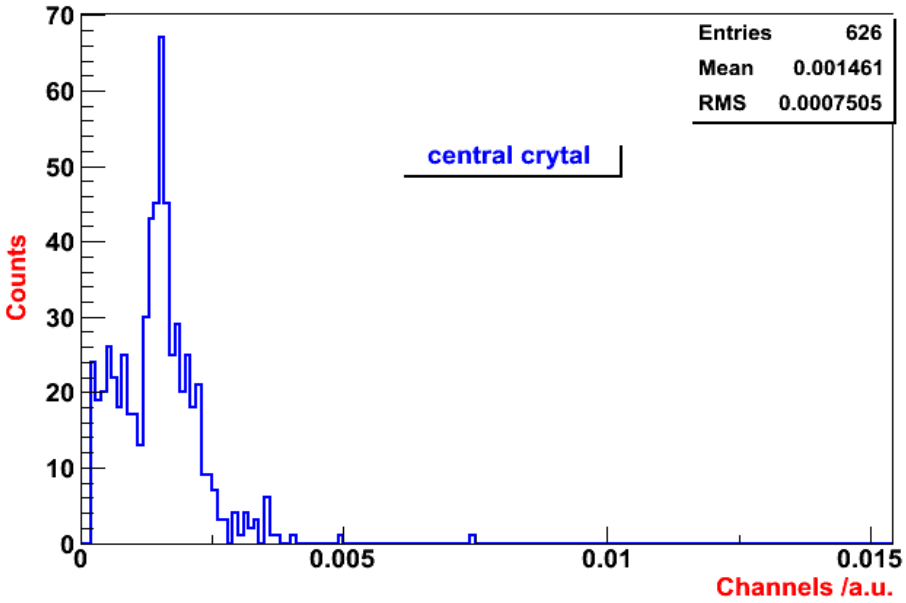
1. Status of fitting of energy response

2. Status of FPGA board

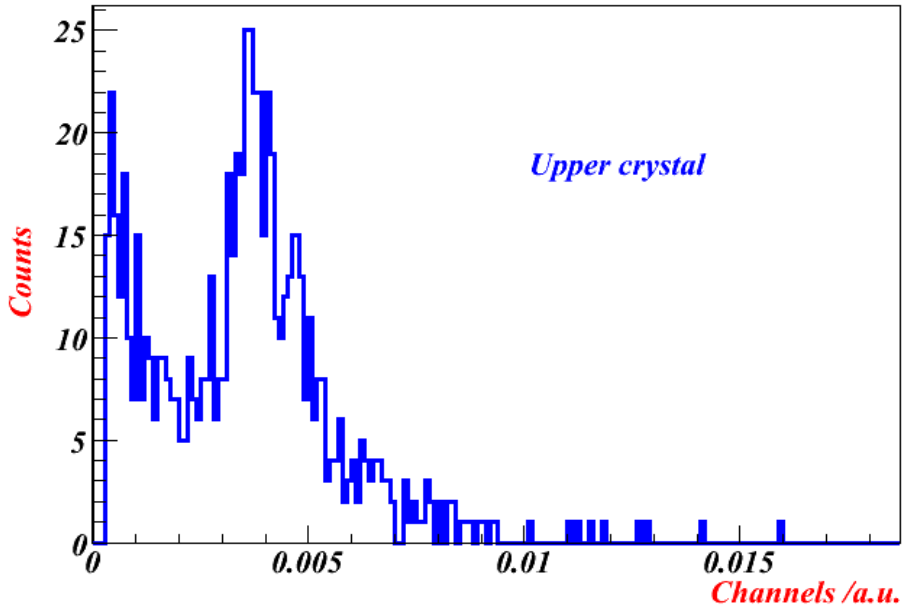
Calibration

Cosmic muon energy deposition in PWO crystals

Poor Calibration spectrum



Good Calibration spectrum



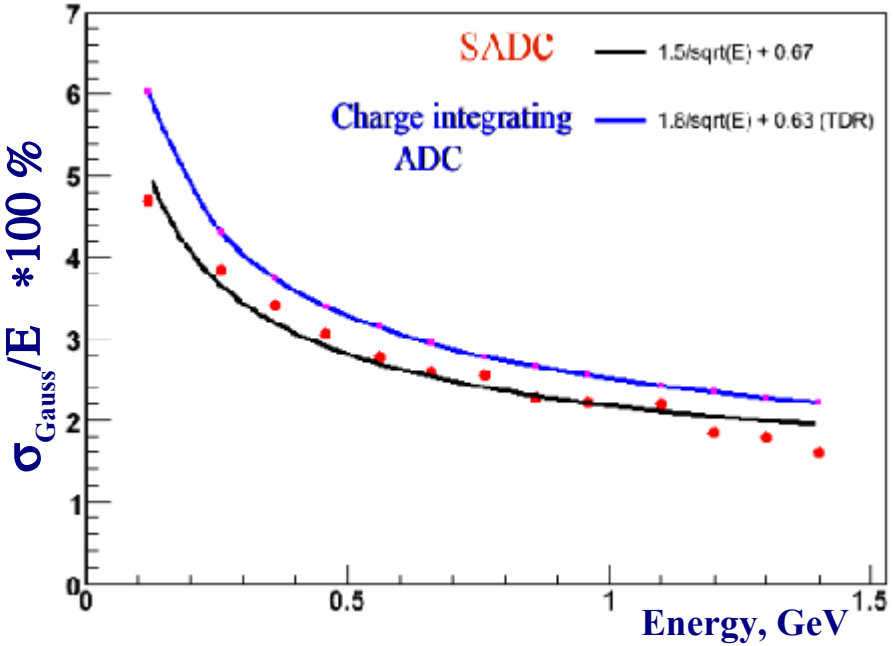
Cluster-energy resolution is limited by the precision of the calibration

There is not enough statistics!

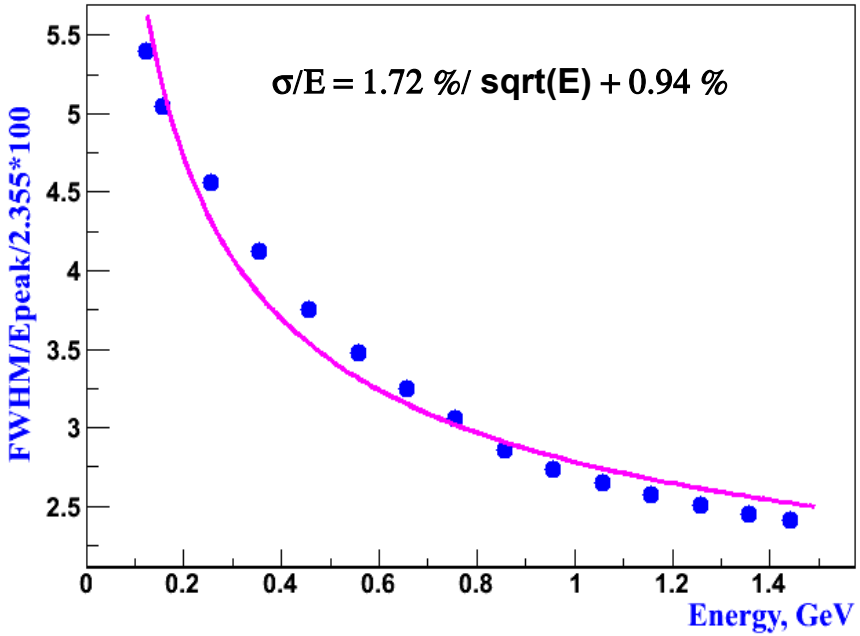
The new measurement is required!

Energy resolution for Proto60

Previous result



Recent result



$FWHM_{Gauss}/2.35E = 4.9\ \%$ @ 0.12GeV

$FWHM_{Gauss}/2.35/E = 2.2\ \%$ @ 1 GeV

$FWHM/2.35/E = 5.4\ \%$ @ 0.12 GeV

$FWHM/2.35/E = 2.6\ \%$ @ 1 GeV

100 MHz 16 SADC was used

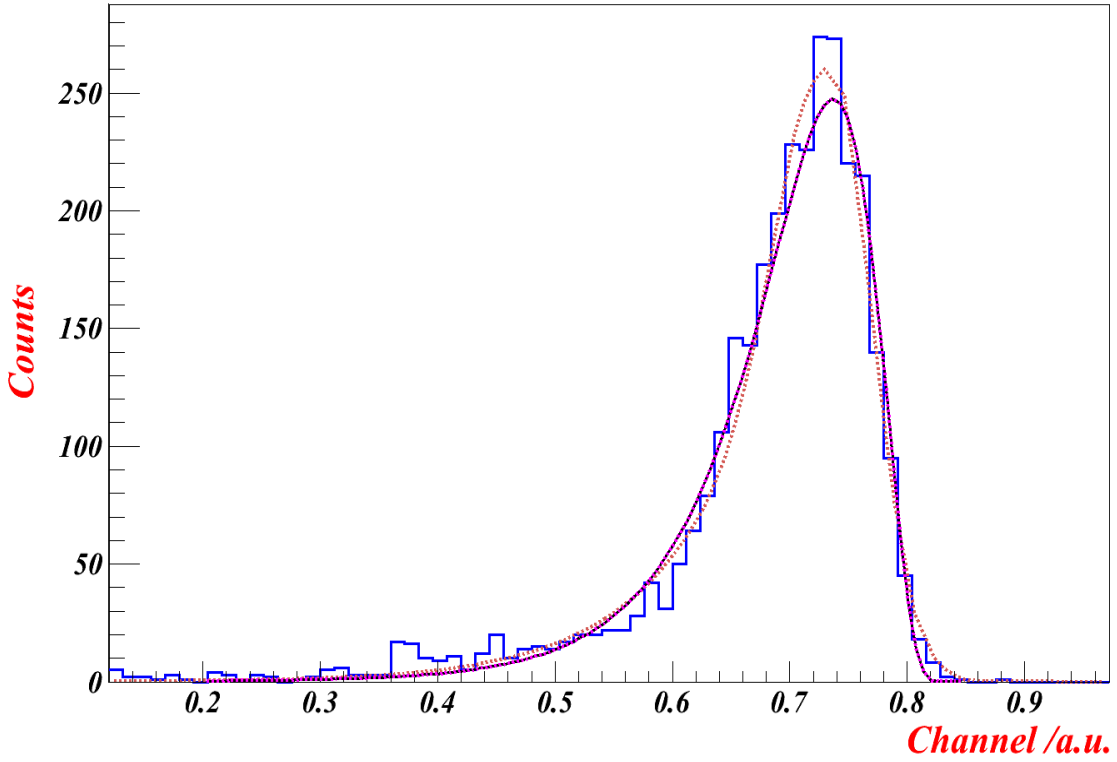
2 *different* fit functions

Energy response @ 1 GeV

Fitted:

1. Non-symmetric Gaussian function

2. Novosibirsk function



$FWHM_{N\ sym\ G} = 1.6e\text{-}01$ a.u.

$FWHM_{Novosibirsk} = 1.3e\text{-}01$ a.u.

2 *different* fit functions

Fit Parameters, a.u.	Fit Functions	
	Non-Sym Gauss	Novosibirsk
Amplitude	2.6e+02	2.8e+02
Sigma $_{Gauss}$	6.6e-02	5.4e-02
Sigma $_{Tail}$	8.5e-02	4.9e-01
Mean	7.4e-01	7.4e-01

The Novosibirsk function fit "reports" better resolution!

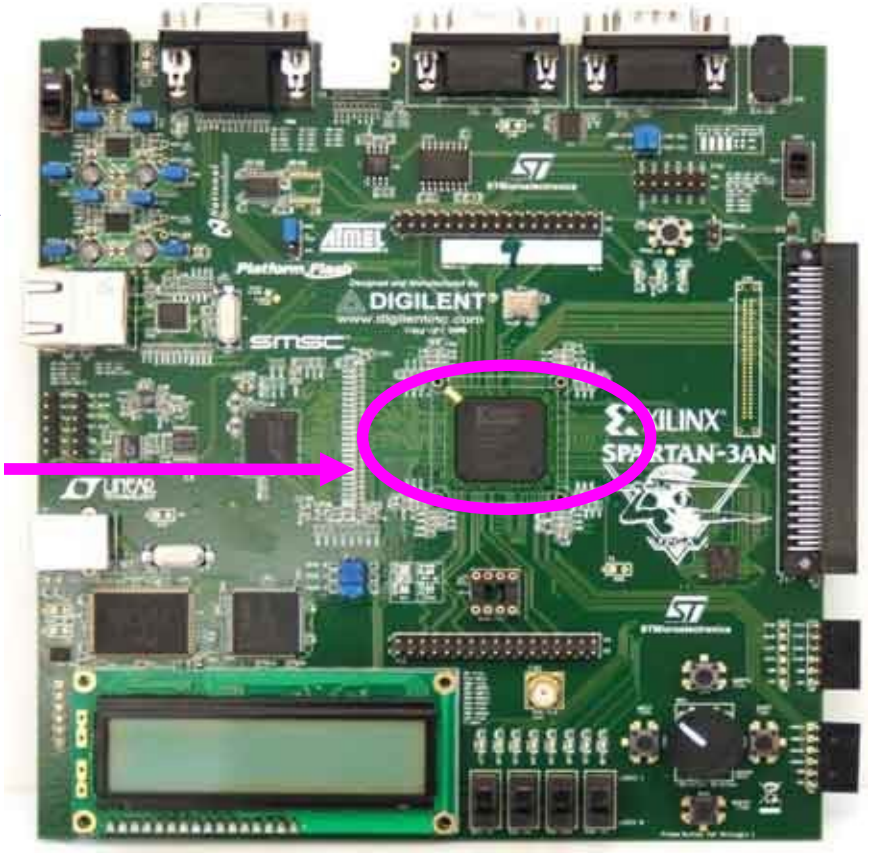
FPGA -Field Programmable Gate Array

Feature-extraction algorithm for the LNP preamplifier recently developed @ KVI by P. Lemmens

XILINX Spartan development board

The board ready for testing

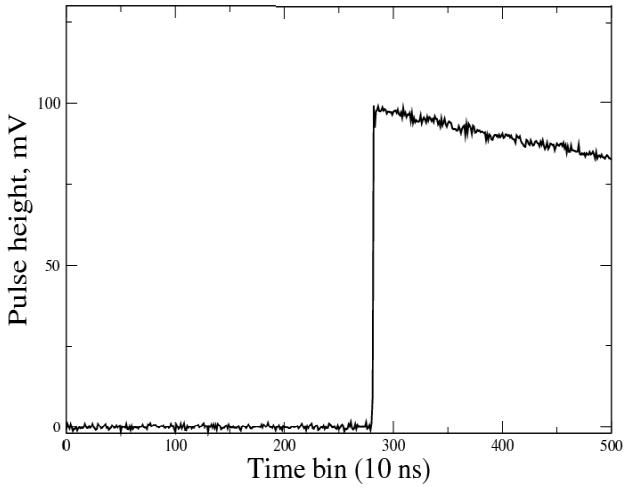
RS – 232 Serial port Connection



Analyze off-line Proto60 data in FPGA !

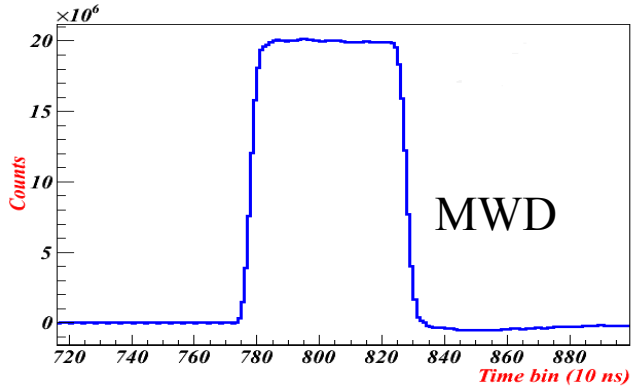
Input:

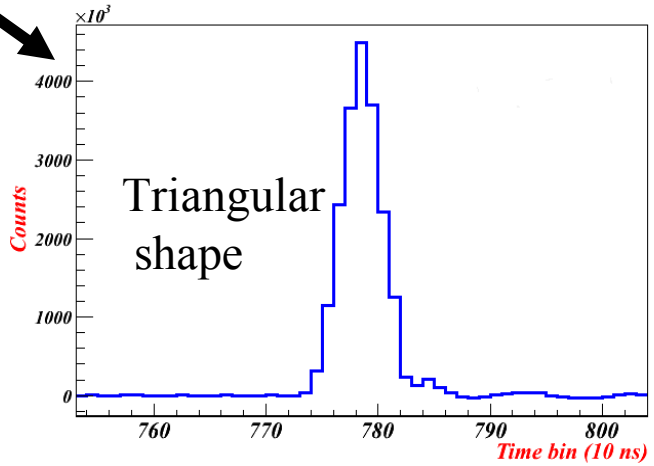
Single Trace



DATA

Output





The processed pulses are coming out of the board only in the debugging mode

During the analysis one gets only energy and time for the detected pulses

Summary:

1.Within collaboration we should agree which fitting function to use for the determination of the energy resolution.

2. FWHM for Gauss determined from Novosibirsk (0.13) Fit function is less than Non-Symmetric Gauss (0.16) fit function.

3. FPGA board programmed and ready for testing!

Next Steps!

Validation of the feature extraction algorithm implementation
Direct event-by event comparison with the off-line analysis
Porting VHDL code to the Febex16 board

BackUp Slide

0. Copy of input-data stream
1. Short pulse (MWD)
2. Triangle pulse (MWD+MA)
3. Sawtooth pulse
4. Smoothed pulse
5. Noise
6. MWD baseline
7. Zero-crossing
8. Gating signal
9. Event energy measurement
10. – 15: Event data