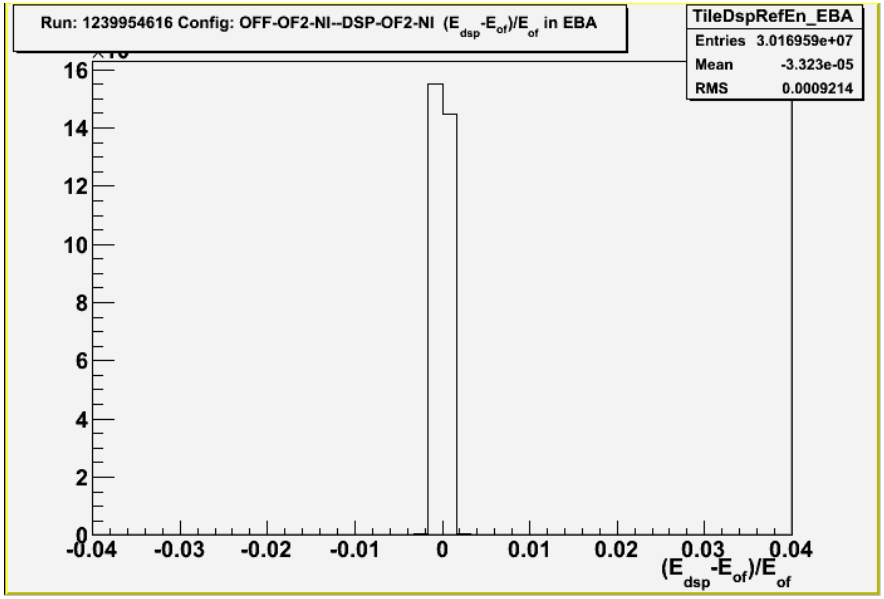
ROD & OMB Status

- Reco validation
- QF studies
- OMB status

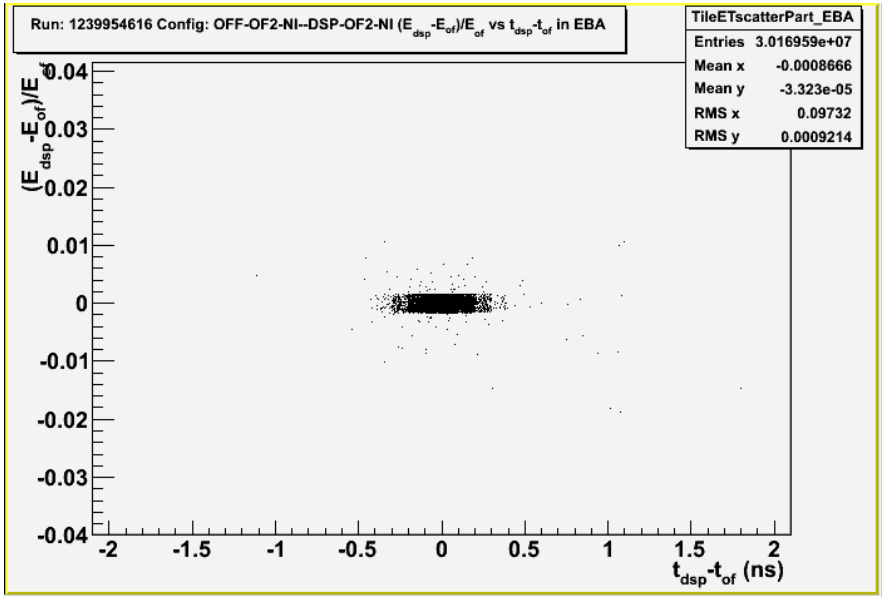
Alberto Valero

Optimal Filtering Validation

- OMB Pulse Injector : (No Iter)
- E=[0,990] ADC ,HG+LG; Phase =[15,-15]ns; Pedestal = 30ADCs



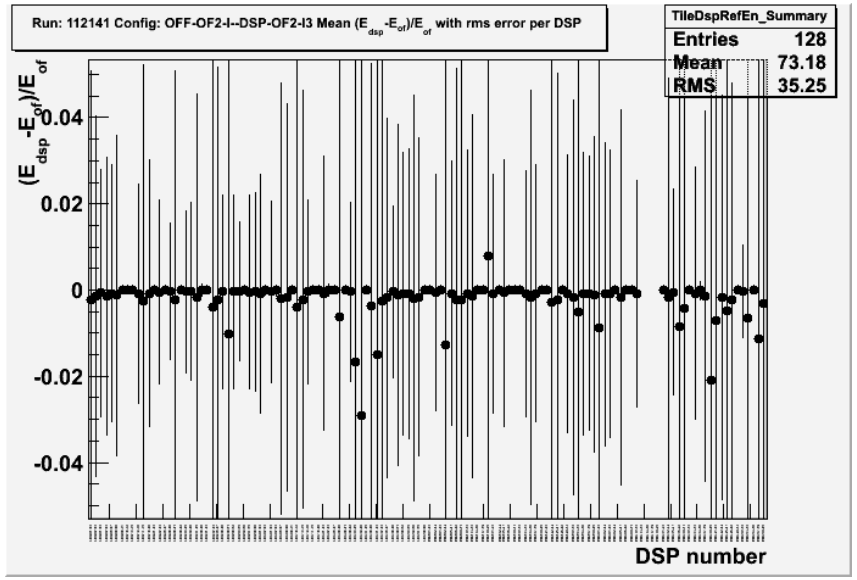
Good agreement DSP-OF



Small difference in Energy and Phase reconstruction

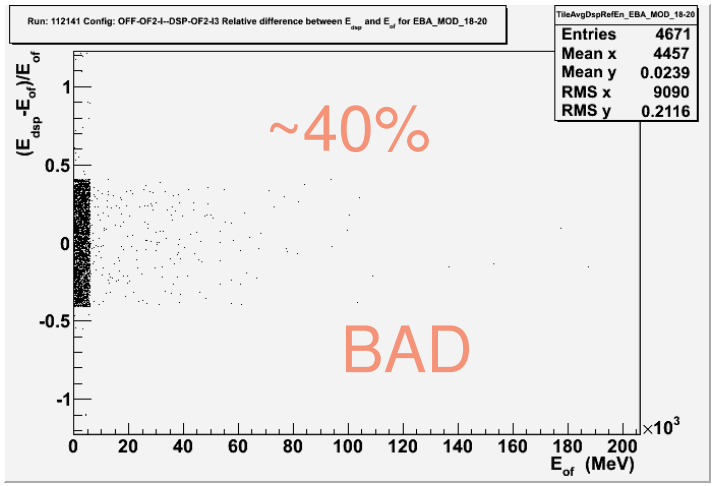
Optimal Filtering Validation

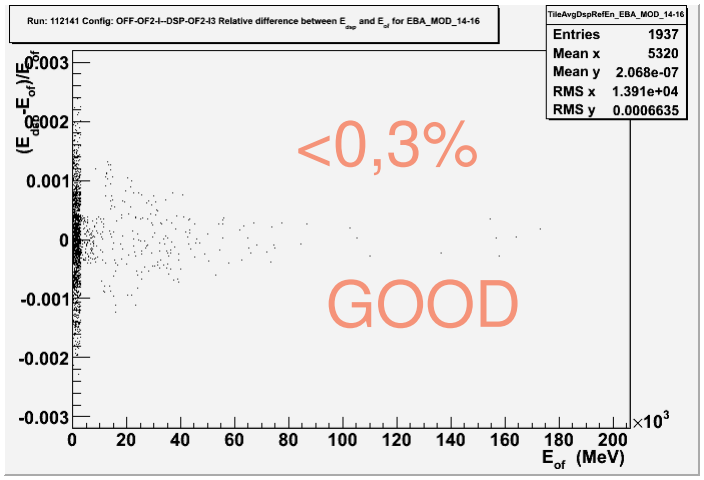
- COSMICS (Iterations) Run Number 112141



Mean error below 2%...

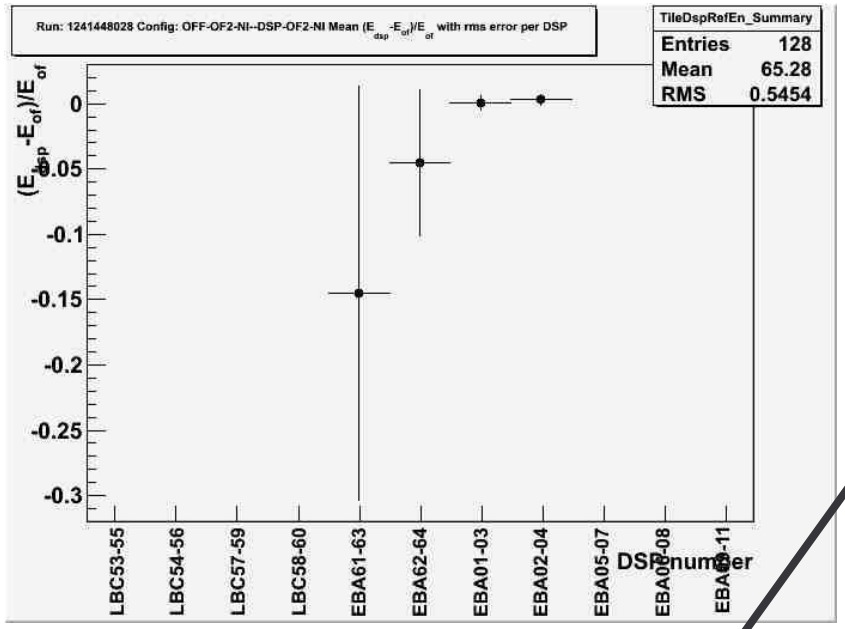
… But RMS in some cases high

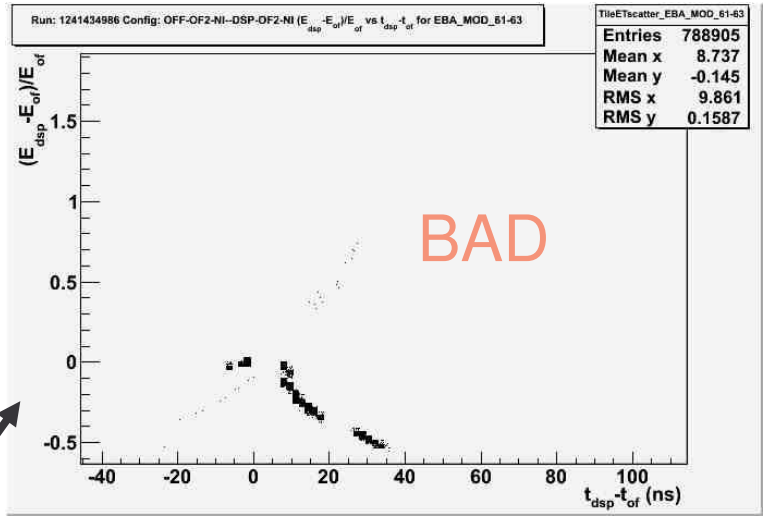


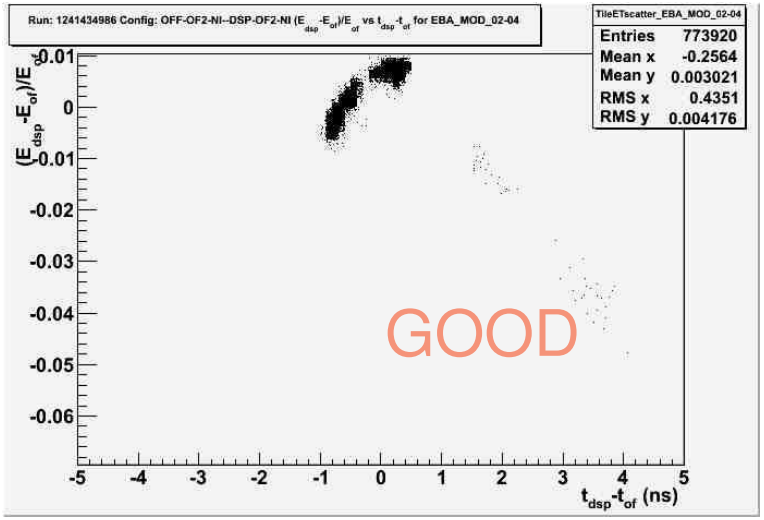


Optimal Filtering Validation

- CIS (No Iterations) Run Number 113724







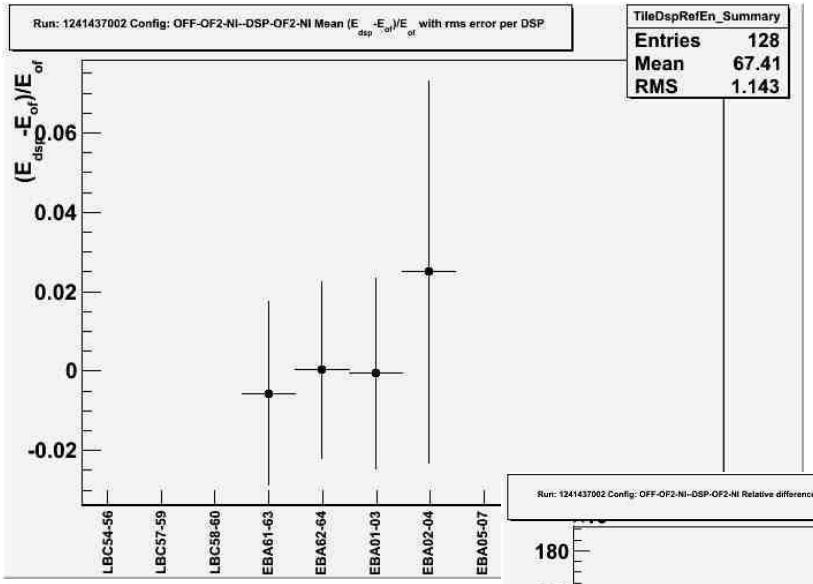
1 DSP very high error (~15%)

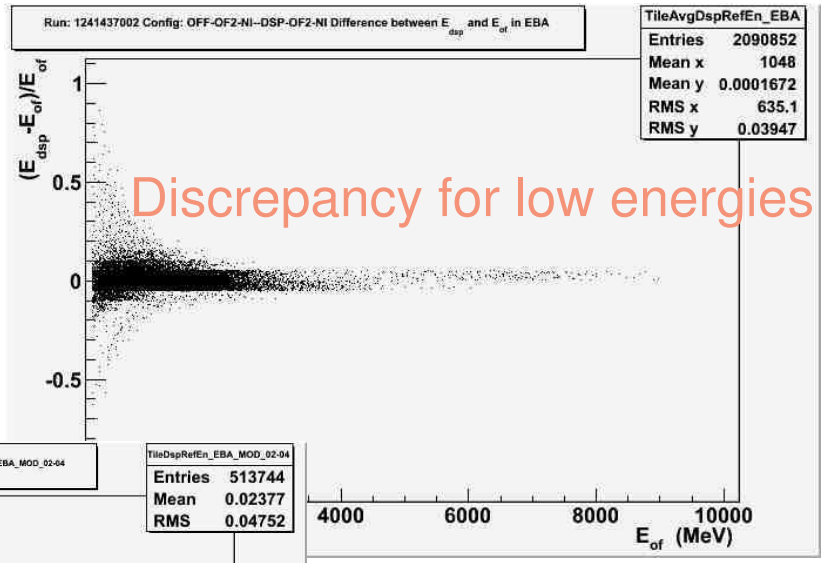
2 DSPs very low mean error

¿PhaseFromCOOL or Phase=0 ?

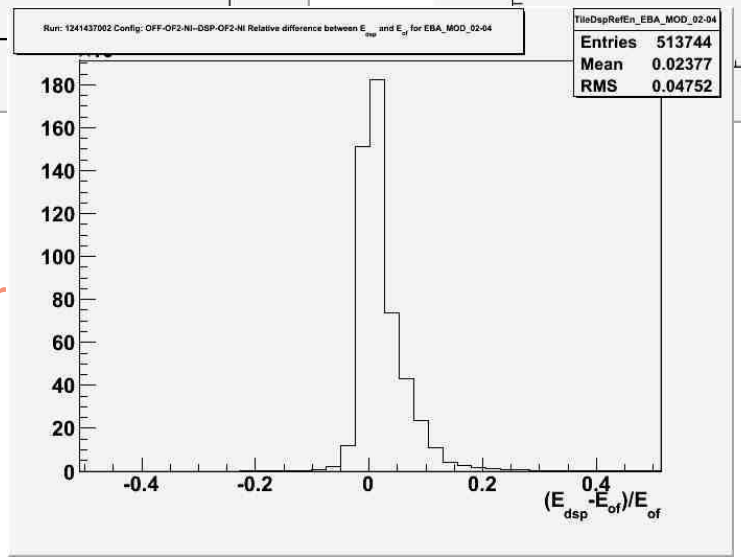
Optimal Filtering Validation

- Laser (No Iter) : Run number:113739





Discrepancy for low energies



Better performance

Worse case ~2% error

Quality Factor Studies

Three different implementations.

- Version 1. (Athena) ~ 2,1us

$$Q = \sum_{i=1}^{7} \frac{|S_i - (Ag_i + ped)|}{S_i} \longrightarrow Q = \sum_{i=1}^{7} \frac{|S_i - (Ag_i + ped)|}{X_i(S_i)}$$

LUT

Xi
- 1 for S<64
- 0,5 for 64<S<128
- 0,25 for S>128

- Version 2. Present QF. ~1,5us

$$Q = \frac{\sum_{i=1}^{7} (S_i - (Ag_i + ped))^2}{A}$$

- Version 3. ~1,5us

$$Q = \frac{\sum_{i=1}^{7} |S_i - (Ag_i + ped)|}{A}$$

Divisions implemented with LUT.

Divided by Energy reconstructed to remove Energy dependency

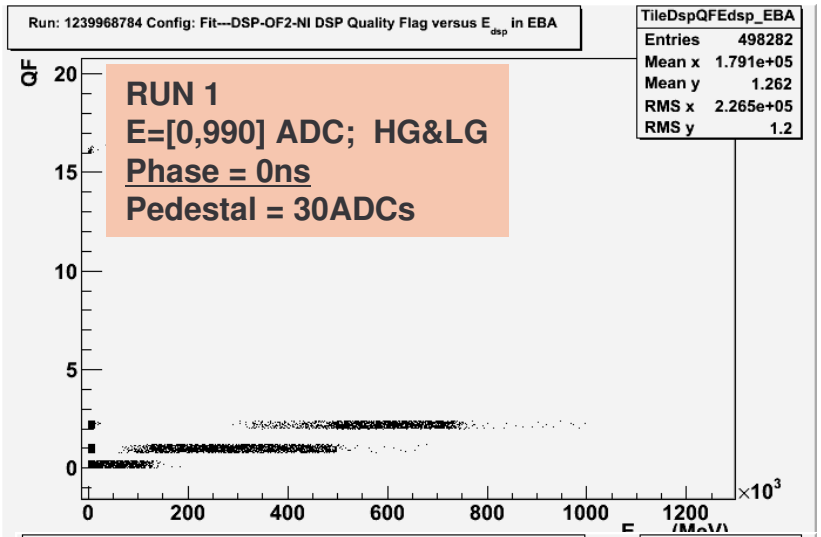
Quality Factor Studies

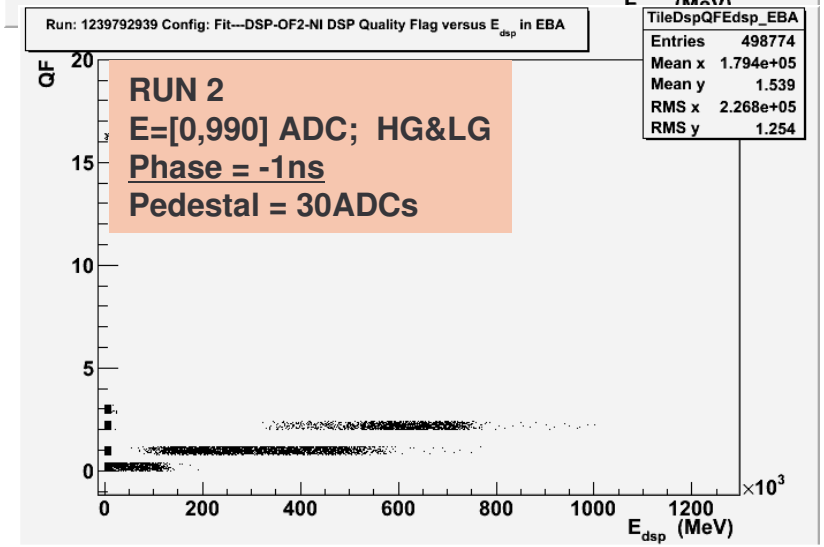
- The performance of QF implementation has been studied by injecting pulses with OMB.
  - Physics pulse shapes
  - Amplitude step: 1 ADC count
  - Phase step: 0,5 ns
- RUN 1: QF variation with Energy at fixed phase = 0ns
  - E=[0,990] ADC; High + Low Gain
  - Phase = 0ns
  - Pedestal = 30ADCs
- RUN 2: QF variation with Energy at fixed phase = -1ns
  - E=[0,990] ADC; High + Low Gain
  - Phase = -1ns
  - Pedestal = 30ADCs
- RUN 3: QF variation with Energy and phase
  - E=[0,990] ADC; High + Low Gain
  - Phase =_=[15,-15]ns
  - Pedestal = 30ADCs

Quality Factor Version 1.

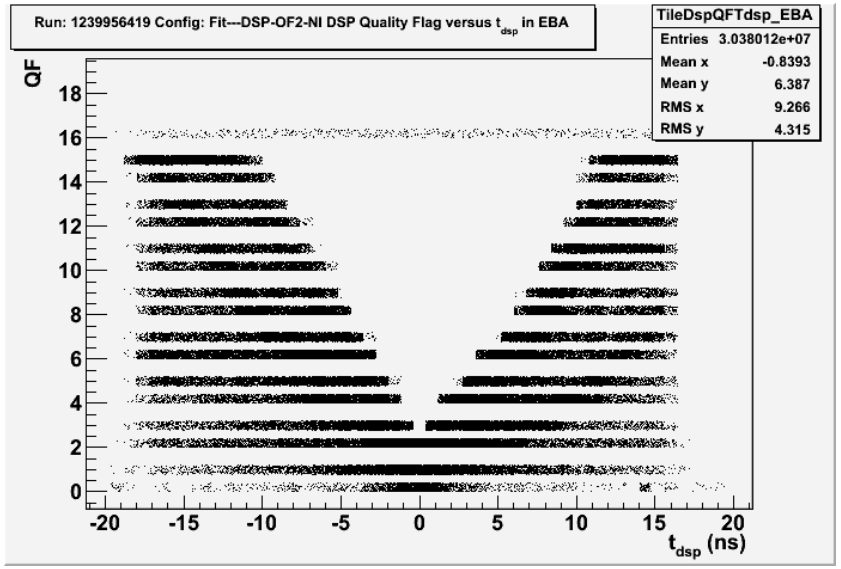
$$Q = \sum_{i=1}^{7} \frac{\left| S_i - (Ag_i + ped) \right|}{S_i}$$

Energy dependency for fixed phase





RUN 3
E=[0,990] ADC; HG&LG
Phase = [-15,15] ns
Pedestal = 30ADCs

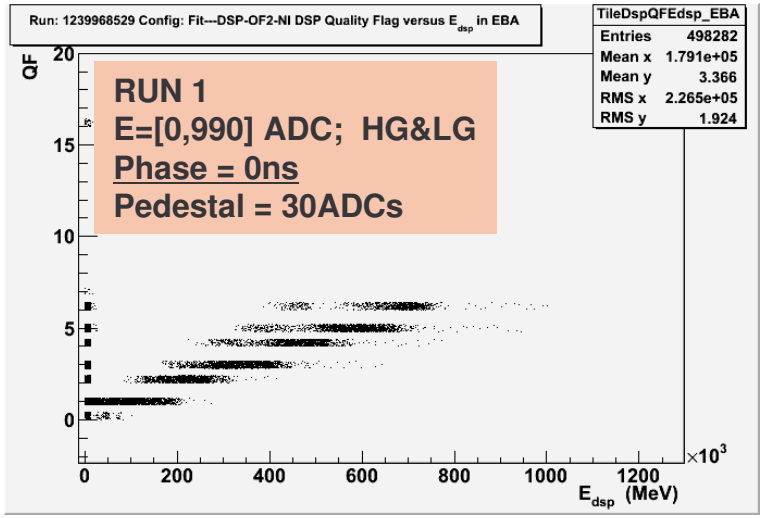


Phase dependency

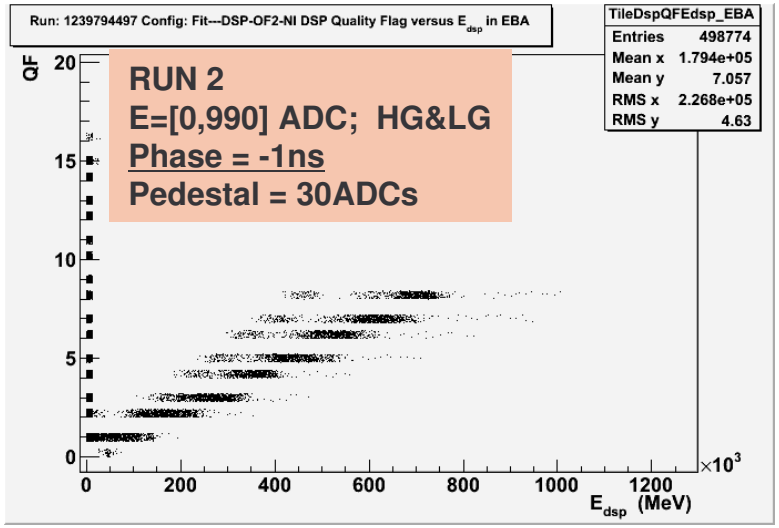
Quality Factor Version 2.

$$Q = \frac{\sum_{i=1}^{7} (S_i - (Ag_i + ped))^2}{A}$$

Energy dependency for fixed phase

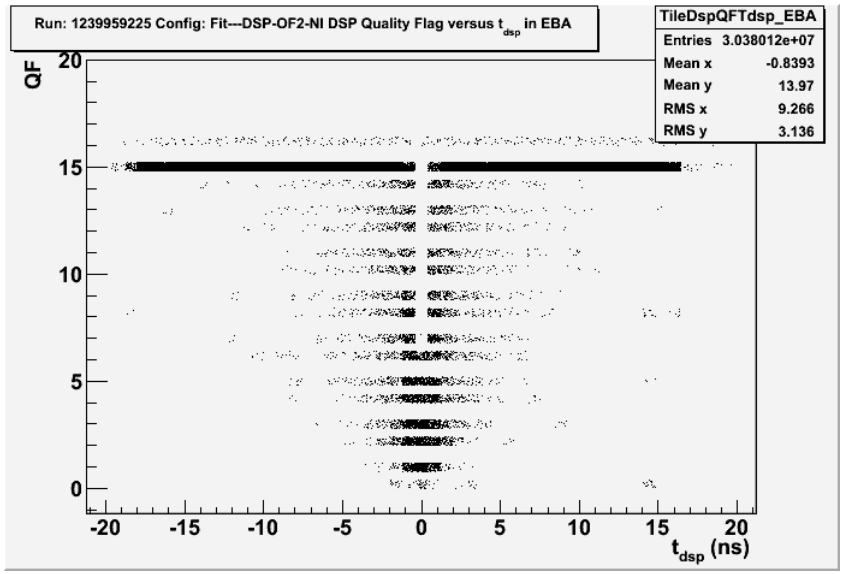


RUN 1
E=[0,990] ADC; HG&LG
Phase = 0ns
Pedestal = 30ADCs



RUN 2
E=[0,990] ADC; HG&LG
Phase = -1ns
Pedestal = 30ADCs

RUN 3
E=[0,990] ADC; HG&LG
Phase = [-15,15] ns
Pedestal = 30ADCs

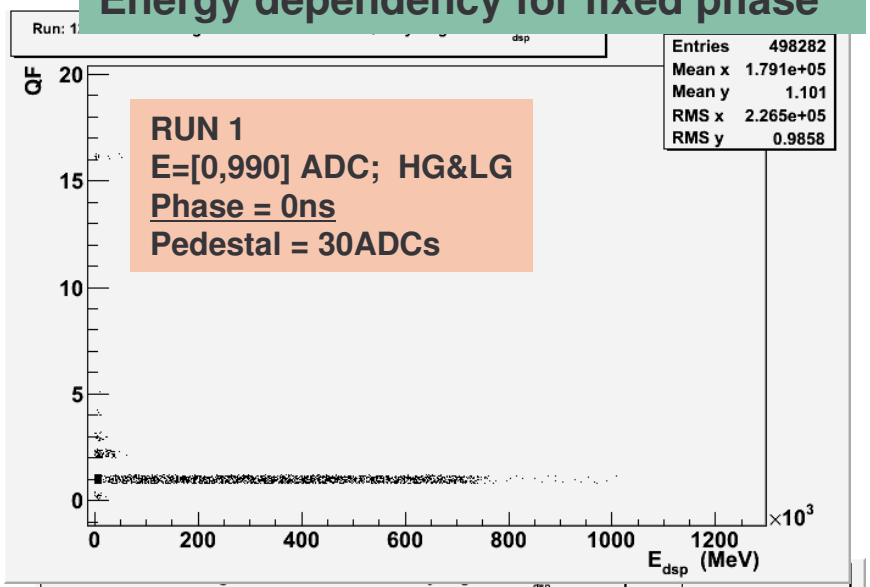


Phase dependency strong

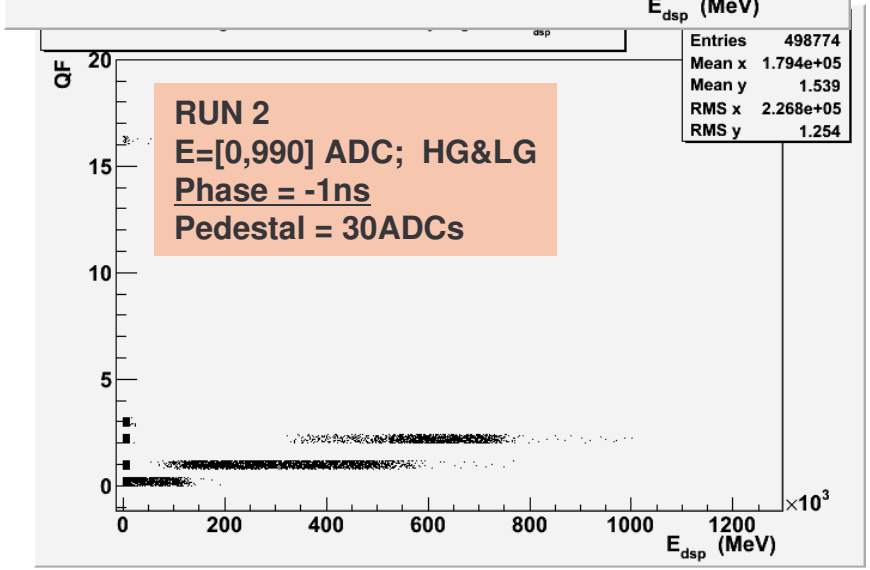
Quality Factor Version 3.

$$Q = \frac{\sum_{i=1}^{7} \left| S_i - (Ag_i + ped) \right|}{A}$$

Energy dependency for fixed phase

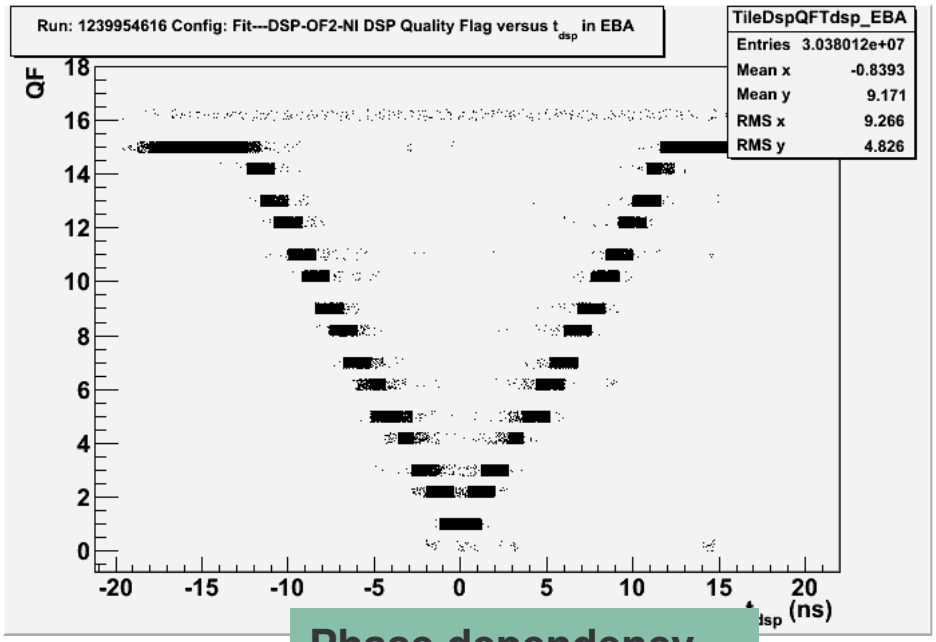


RUN 1
E=[0,990] ADC; HG&LG
Phase = 0ns
Pedestal = 30ADCs



RUN 2
E=[0,990] ADC; HG&LG
Phase = -1ns
Pedestal = 30ADCs

RUN 3
E=[0,990] ADC; HG&LG
Phase = [-15,15] ns
Pedestal = 30ADCs



Phase dependency

Next steps on QF

- Evaluate new implementation : $$Q = \frac{\sum_{i=1}^{7} (S_i - (Ag_i + ped))^2}{A^2}$$
- Separate plots for HG & LG
- Real Data (CIS, Laser, Cosmics) and Pile-Up
- Add plots of QF vs (Edsp-Einj)/ Einj

OMB production validation

- 38 boards produced and delivered.
- 15 board validated.
  - Minor problems fixed.
- FPGA firmware to be optimized.
  - 85% FPGA logic elements used.

Ongoing work

- DSP updates:
  - DSP Params:
    - Binning of histograms
    - MuTag thresholds
    - Frag1 conditions & thresholds. E - T – QF
- Reco validation
  - More statistics to understand discrepancies
- QF updates
  - New algorithm
  - Real data