ROD status

Alberto Valero

Universidad de Valencia

History

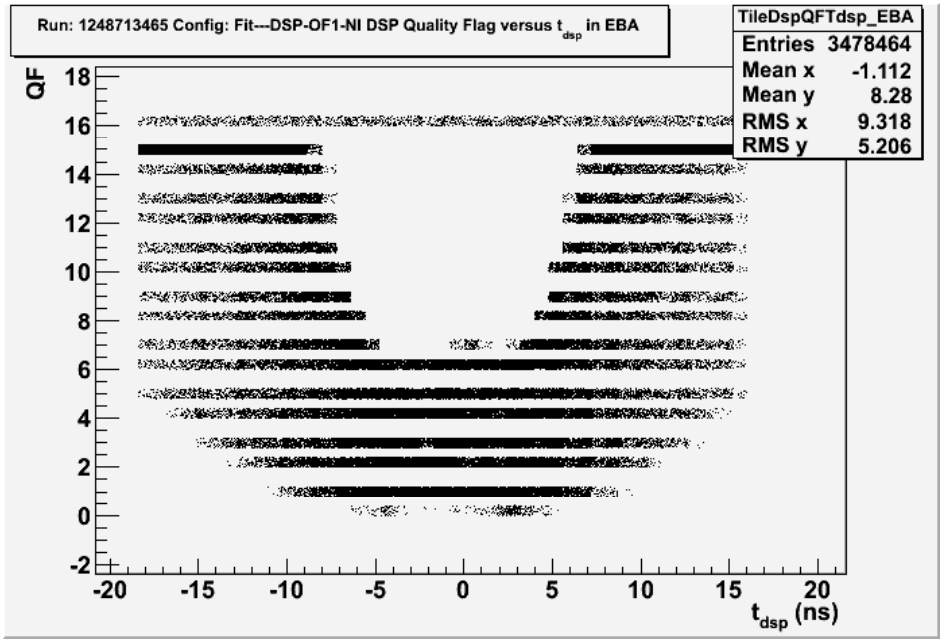
- We had a QF computed using pulse shape
  - QF increases with Phase (not desired)

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

- Then we decide to introduce pulse derivative
  - We expected to have constant QF for small phases….

$$Q = \frac{1}{4}\sqrt{\sum_{i=1}^{7}(S_i - (Ag_i + A\tau g' + ped))^2}$$

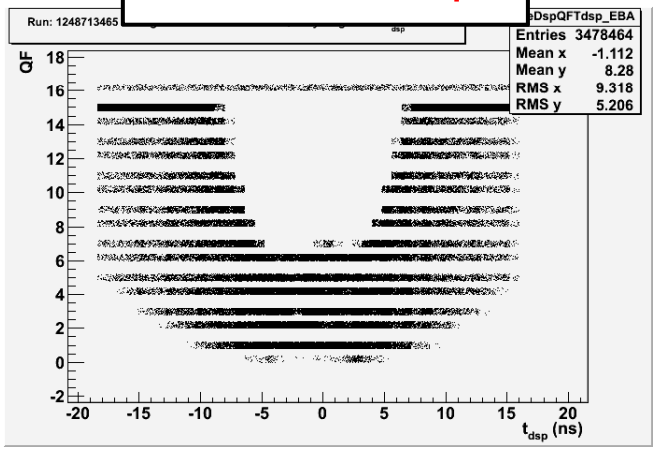
E=[100,900]ADCs
T=[-15,15]ns
Ped=20ADCs



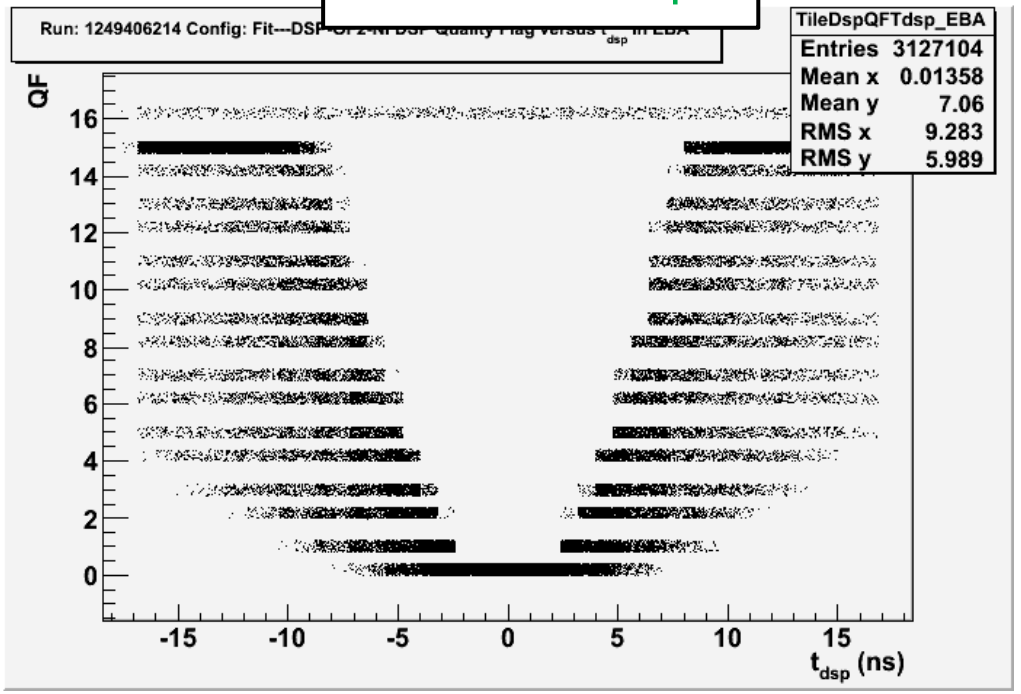
New pulse shape

- Finally we realized that we were not using the same pulse shape for injection (OMB) and reconstruction (weights in DSP).
- We updated the OMB pulse shape… and we obtained the expected result
  - QF constant for small phases (if pulse shape as expected)

OLD Pulse Shape



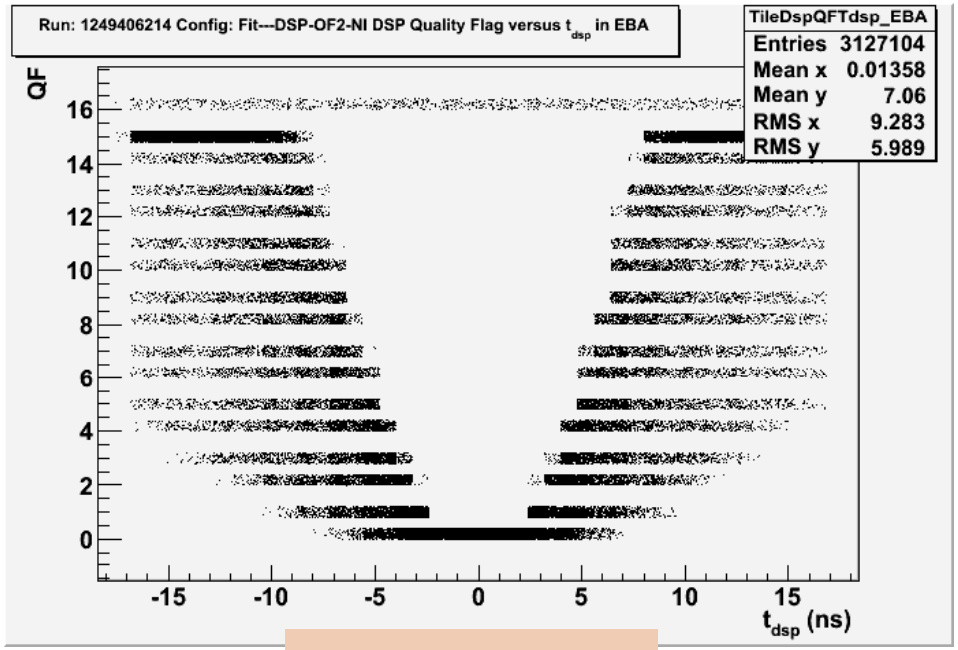
NEW Pulse Shape



Square Root Implementation inside DSP

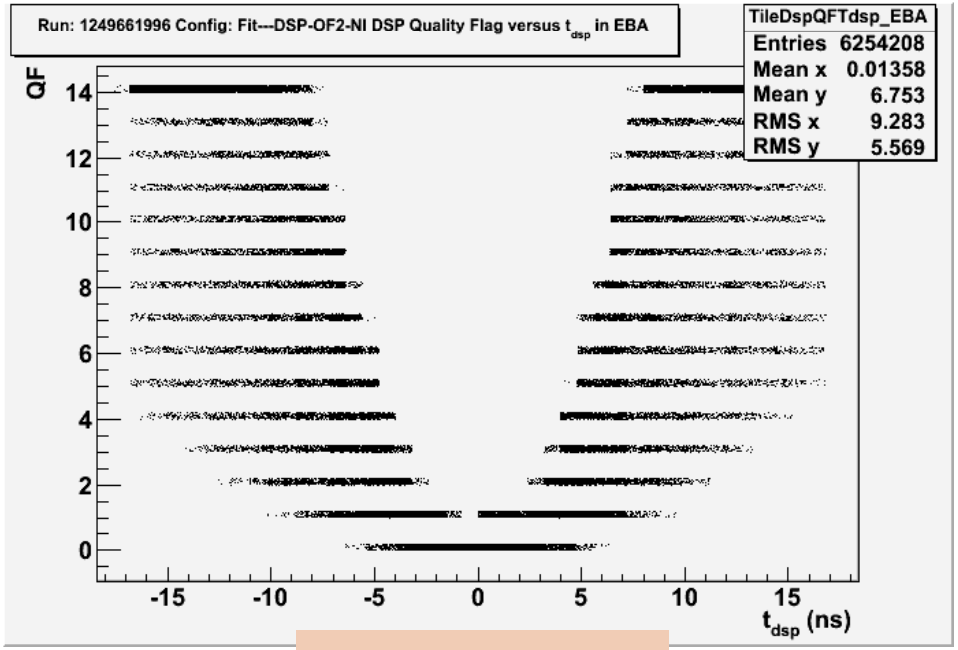
- With SQRT implemented with a LUT we loose some precision.
- The QF constant region around 0 ns disappears….

$$Q = \frac{1}{4}\sqrt{\sum_{i=1}^{7}\left(S_i - (Ag_i + A\tau g' + ped)\right)^2}$$



SQRT

$$Q = \sqrt{\frac{1}{16}\sum_{i=1}^{7}\left(S_i - (Ag_i + A\tau g' + ped)\right)^2}$$

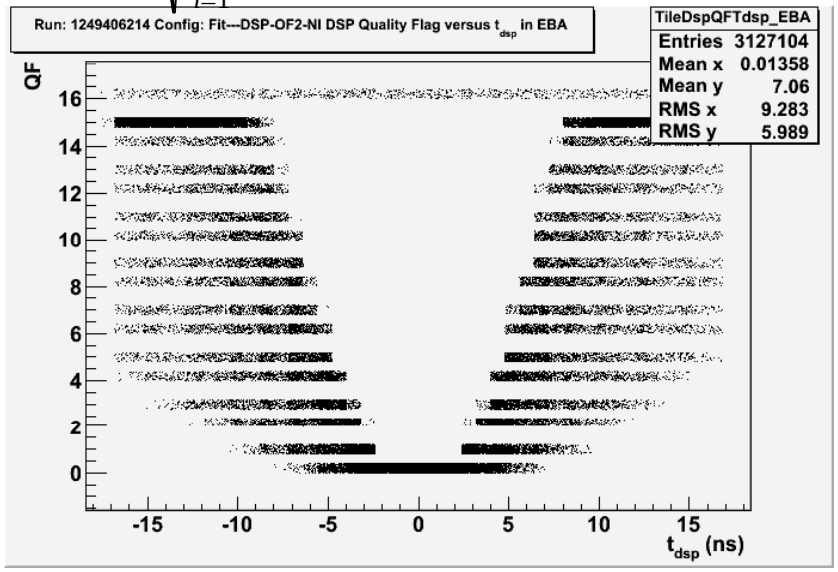


LUT

Square Root Implementation inside DSP

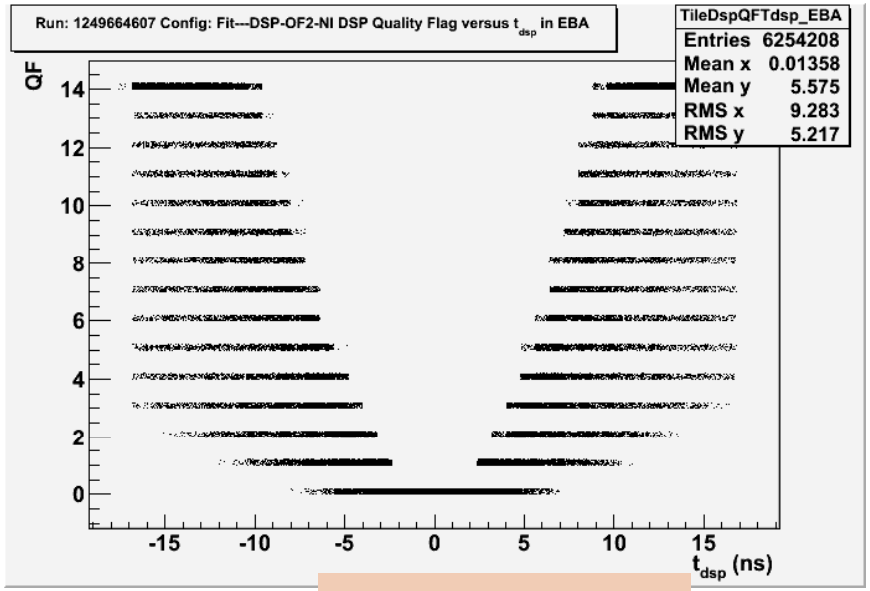
- Instead of re-scaling we could make the sqrt-lut wider around zero.

$$Q = \frac{1}{4}\sqrt{\sum_{i=1}^{7}\left(S_i - (Ag_i + A\tau g' + ped)\right)^2}$$



SQRT

$$Q = \sqrt{\frac{1}{32}\sum_{i=1}^{7}\left(S_i - (Ag_i + A\tau g' + ped)\right)^2}$$

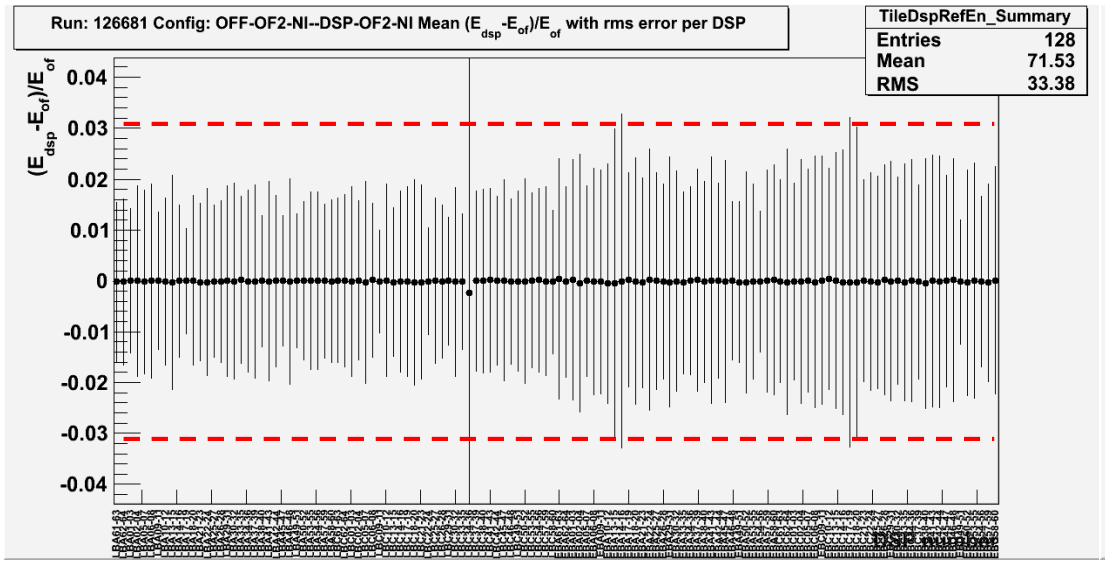


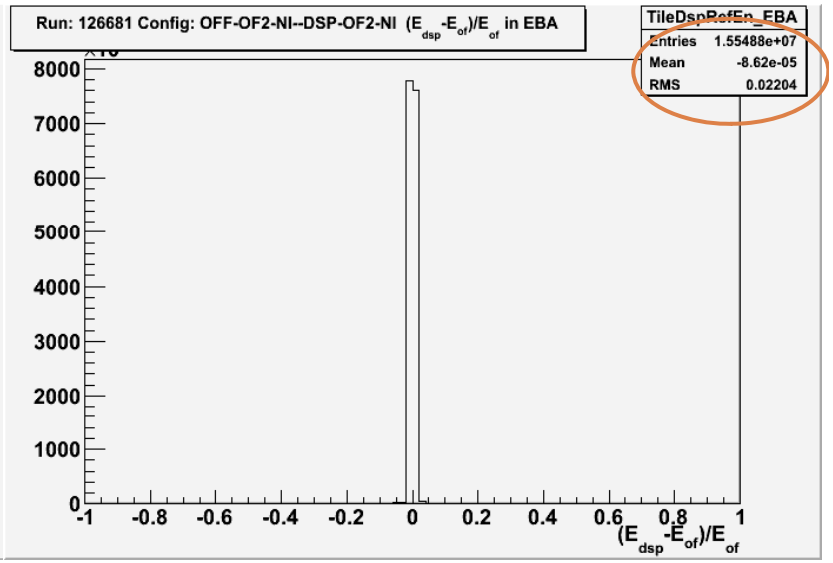
LUT

$$Q = \frac{1}{5.6}\sqrt{\sum_{i=1}^{7}\left(S_i - (Ag_i + A\tau g' + ped)\right)^2}$$

Installation & OF Performance

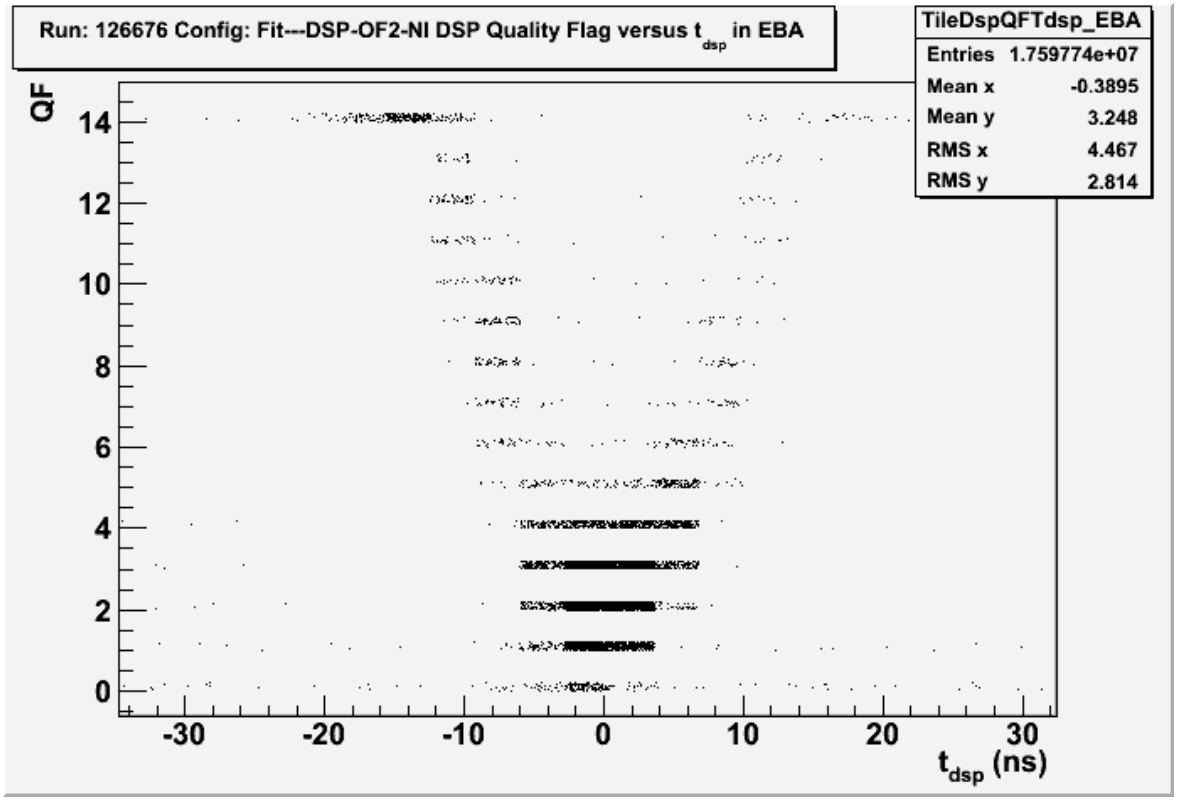
- Final version installed in P1 two weeks ago. Many changes needed.
- Processing Time for QF: ~2µs (old version ~1.5µs)
  - Energy+Phase+QF ~ 9µs
- First results in P1 with CIS runs processed without iterations.
- Optimal Filtering performance: Example: Run 126681 : CIS Scan ramp autogain
  - Difference between DSP and Offline around 0 (RMS < 3%) (Except-LBC34-35)
  - EBA: Mean ~ 0.01% ; RMS ~2%



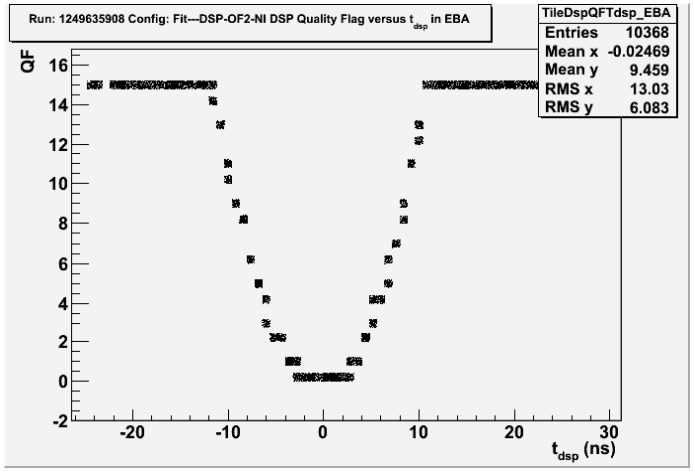


Quality Factor. CIS fixed charge

- Run 126676. Fixed charge injected (~460ADC)
- Events around 0ns with QF different than 0 → pulse shape distortion?
- Could also be electronic noise ~1.5 ADC. A wider sqrt-lut could give better results here.



Lab test:
Ideal pulse shape
E=500 ADCs

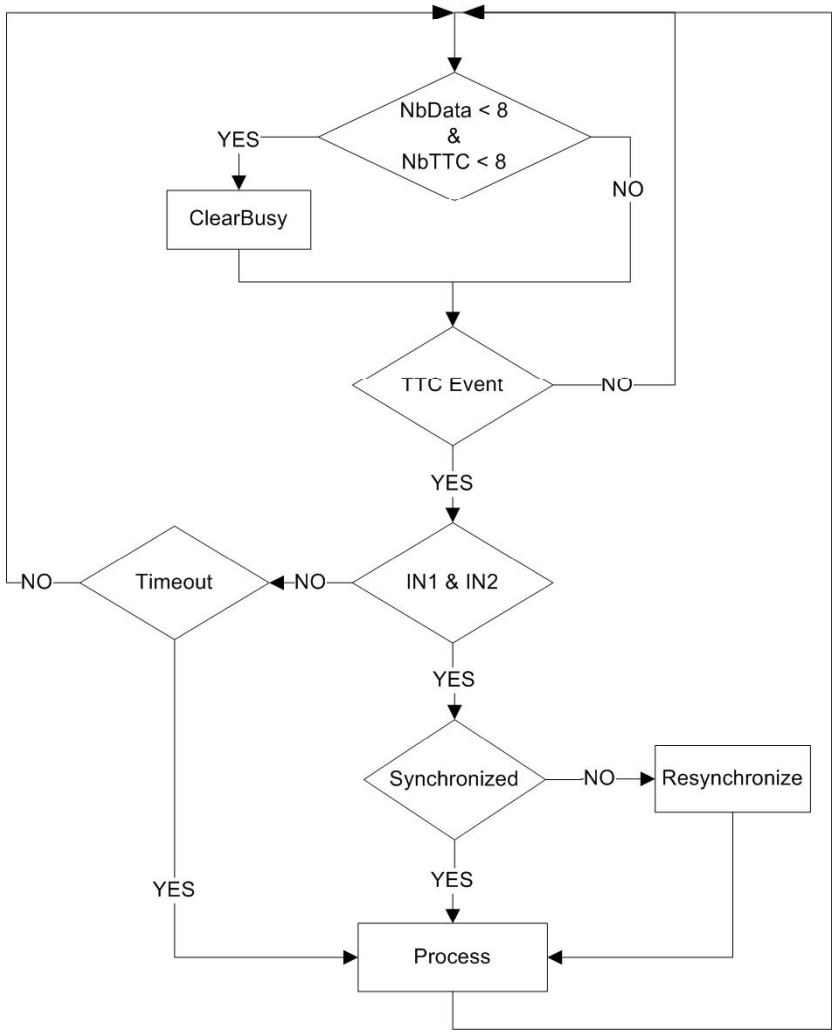


New features in the DSP/ROD

- Monitoring of percentage of BUSY per ROD. MRS message.
  - Next step: Histograms of Busy level (ROD / CTP)
- DSP memory area CRC checking:
  - Weights and Calibration Constants
  - Code ?
- Fragment 1 Condition (digits):
  - Energy / Phase / QF
  - Less then / Greater than : $E > E_{th}$, $QF < QF_{th}$
  - AND / OR :
- New 'input' Full Mode to disable known bad modules.
  - The output fragment contains empty data fragments for modules disabled.
- Stopless recovery:
  - Disable ROD input link producing busy in the DSP.
  - It is possible to disable one or two DSP inputs.
  - Currently working on automatic stopless recovery machanism (Carlos)

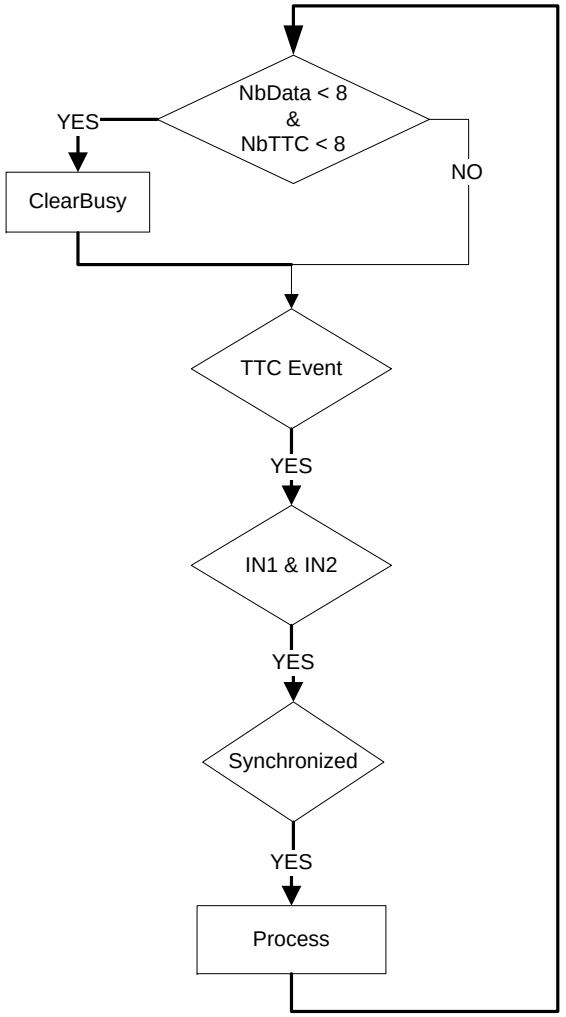
Synchronization task. How the busy is set?

- Synchronization
  - 1.- CheckBusy
  - 2.- Events TTC & Data
  - 3.- Synchronize
  - 4.- Process
- Event Reception
  - 1.- Isr reception
  - 2.- Events in Buffer incremented
  - 3.- If (Events > 8) → Set Busy
- Issue: One module OFF
  - Timeout → slower data processing
  - Solution: remove the link from acquisition
    - Normal Operation : L1 Max rate ~ 115KHz
    - One Module OFF : L1 Max Rate ~ 105 KHz
    - Removing One/Two links ~ 115 KHz



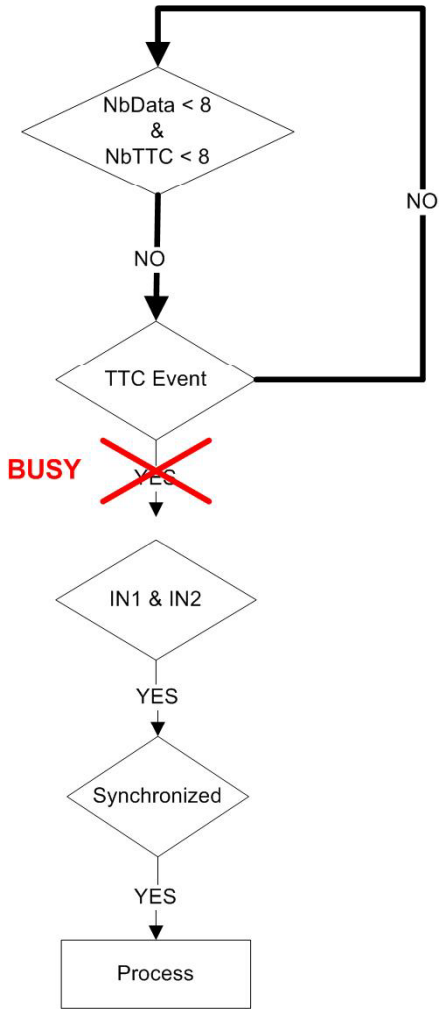
Normal Operation

- In Normal Operation the busy is set when input buffer full.
- Events are processed and the busy is cleared when input buffer is empty.



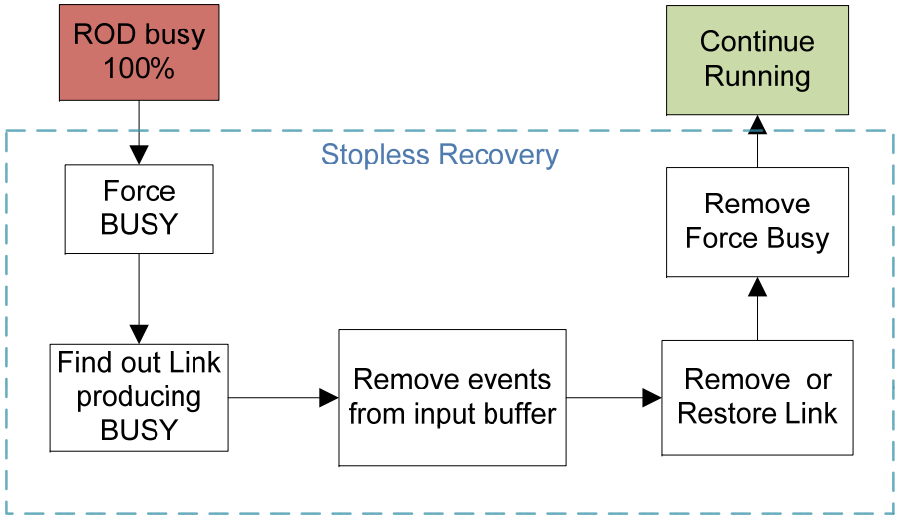
Unrecoverable busy

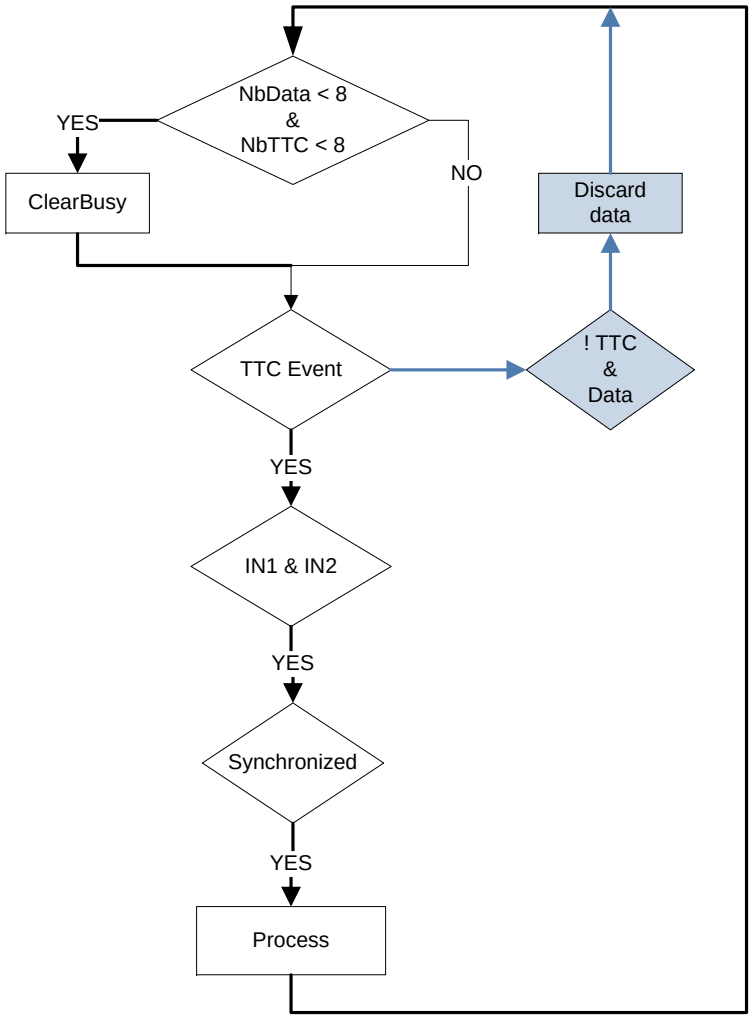
- Data buffer full & TTC buffer empty
  - Events are not processed
  - Infinite LOOP since BUSY is set and no more TTC events are received.
- What can produce it?
  - Module responding too slow
    - When data from module arrives the DSP has already processed the TTC event because of timeout.
    - TTC events are not received:
      - TTCvi / TBM / TTCrx problem
- How can we restore the initial status?
  - Remove events from data buffer



Restoring the dataflow

- New feature in the DSP
  - Data events are discarded if no TTC events
  - It is based in the fact that TTC events come always before Data events
- Stopless recovery
  - Probably not needed with this feature
  - However, it is possible to remove/restore an input link without stopping the run





Last Calo Week

- Some busies from Tile (Monday / Tuesday)
  - One / Two times produced by LBA35 sending events delayed
  - Others unrecoverable busies produced by some RODs receiving less TTC events than others
    - TTCrx roblem (In different partitions at the same time?)
    - DSP TT ISR problem (In different partitions at the same time?)
    - External Signal sent to RODs (TTCrx reset?)
- Wednesday standalone (Carlos and me) tests.
  - No busy. New version DSP (v14.6.2)
- Thursday till Monday combined running no busy anymore
  - Two overnight runs Wednesday/Thursday
  - Very long run (85KHz) from Friday till Monday (70 h)