

# Collaboration Meeting: TDAQ Update

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March 18th 2024



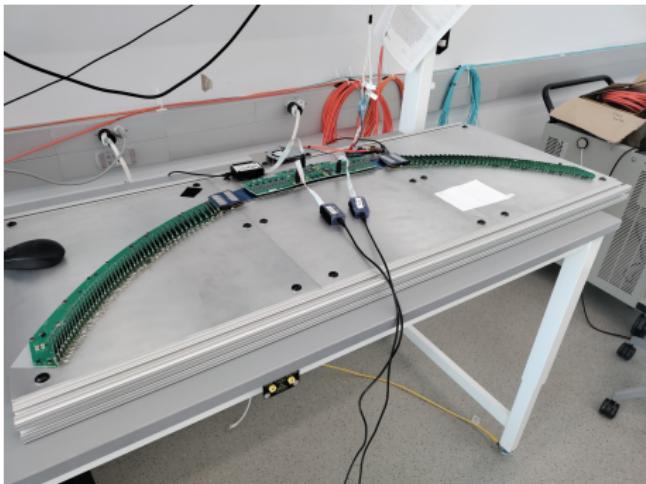
Based on work of many people working on TDAQ. Monica, Richie, Vadim, Pasha contributed the most.

# A snapshot of the current job

- Currently in the phase of commissioning and integration;
- Reading out from a tracker station is imminent;
- Getting ready to read the detector;
- Learning how to read panels;
- We are reading the individual panels (teststands).

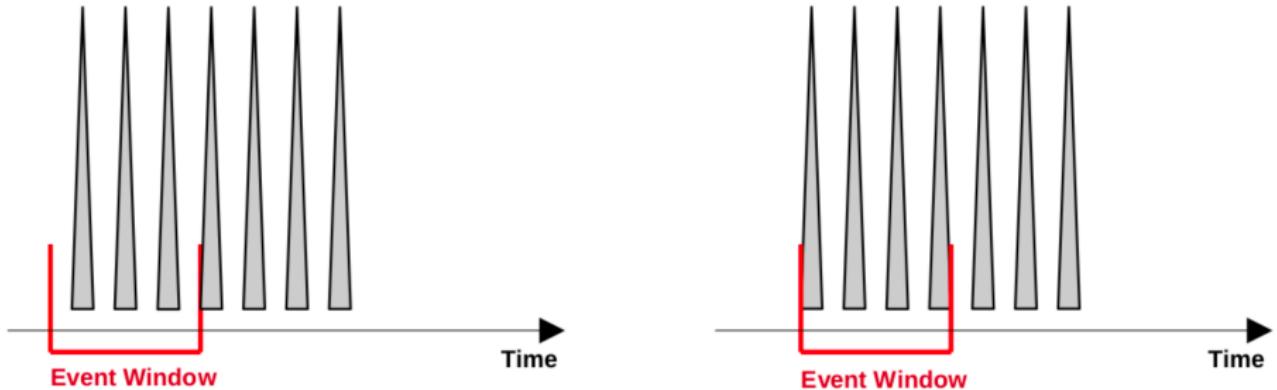
⇒ The rest of the talk will be about what we are doing and what we have accomplished during GR1

# Working area



- 3 test stands @IERC (only 2 have been used).
- Each teststand has 96 channels;
- DRAC card connected to the DTC installed in the DAQ computer mu2edaq09 via optical fibers;
- A pulser implemented in the DRACs is sending pulses to the preamps (CAL side);
- 40 MHz ADCs;
- Pulse every 8 channel;
- One DTC and 1 or 2 ROCs at the same time.

# Description of the readout logic



- Running, most of the time, with an EW of  $50 \mu\text{s}$ ;
- The timing of the readout is uncorrelated with the generator timing sequences → number of readout pulses is variable;
- ROC is reading digiFPGAs;
- ROC hit buffer stores up to 255 hits (DOCDB47837);
- The channel readout sequence is fixed.

# Available Histograms and Error Identification

Real Time Monitoring:

- **Channel histograms**
- **ROC histograms**
- **Event histograms**

Real Time Diagnostic:

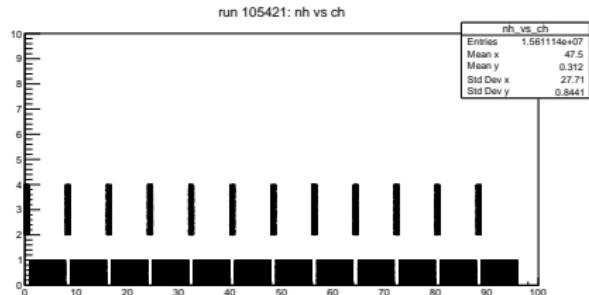
- Number of bytes error bit;
- Number of ADC packets > 2;
- Undefined link ID;
- Invalid channel ID;
- More hits than the maximum in a given channel.

To be implemented:

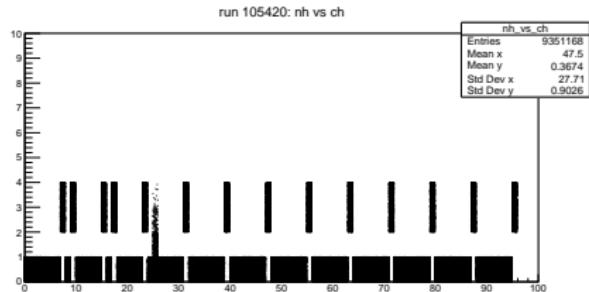
- Slow control of the low and high voltages.

# Channel response and crosstalks

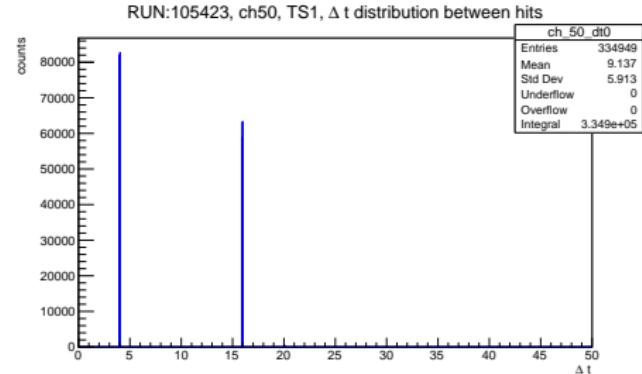
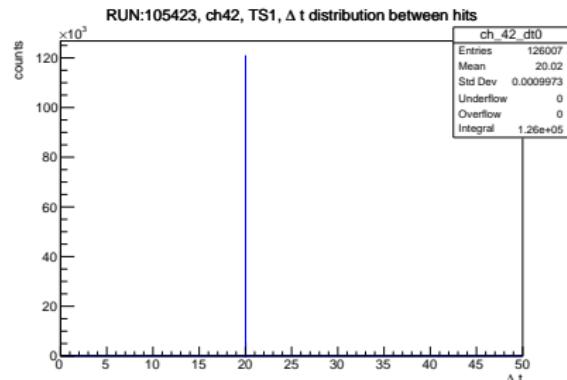
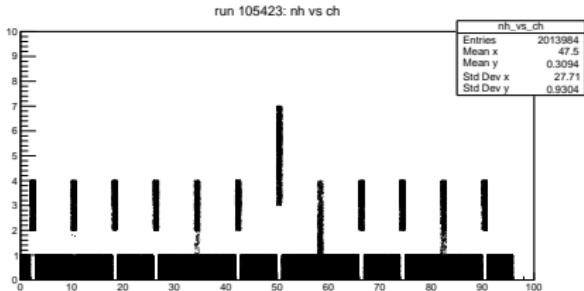
- Cross talks between channels:  
→ 1 pulsed channel out of 8.
- normal case:



- Cross talks in odd pulsed channels only;
- Asymmetric cross talks (e.g. 3→5, not seen 3→1).



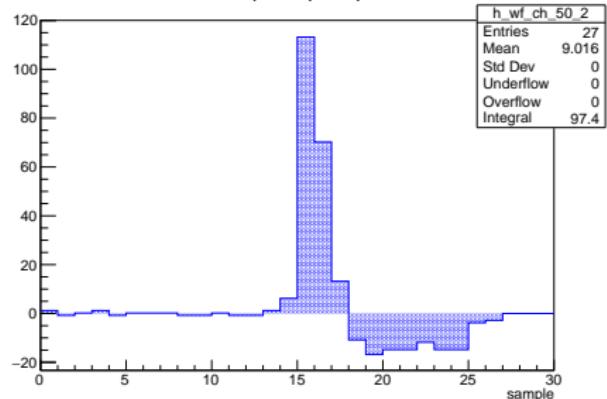
# Different channels response



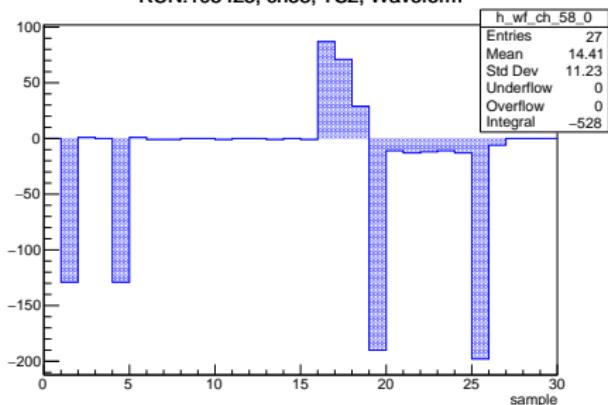
- one DEAD channel found;
- Less hits than expected;
- More hits than expected:
  - ⇒  $\Delta t$  distribution.
  - ⇒ inverted waveforms (next slide).
- need to reduce pulse duration.

# Waveforms

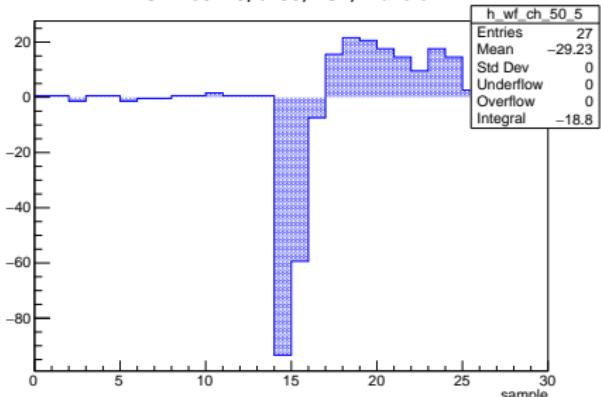
RUN:105423, ch50, TS2, Waveform



RUN:105423, ch58, TS2, Waveform



RUN:105423, ch50, TS2, Waveform

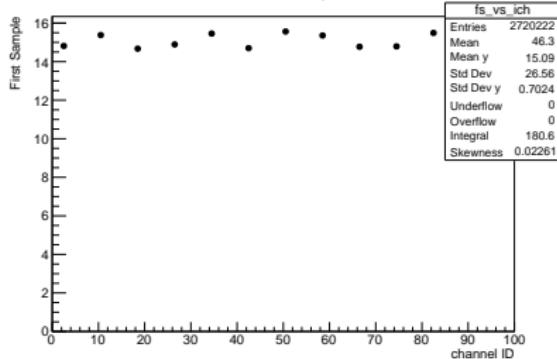


- Negative peaks (baseline and tail);
- Peaks depth is 64, 128 or 192 (6th or/and 7th bit error);
- Reconstruction of the waveforms: isolation of negative peaks;
- Inverted wfs  $\rightarrow \Delta t$  distribution.

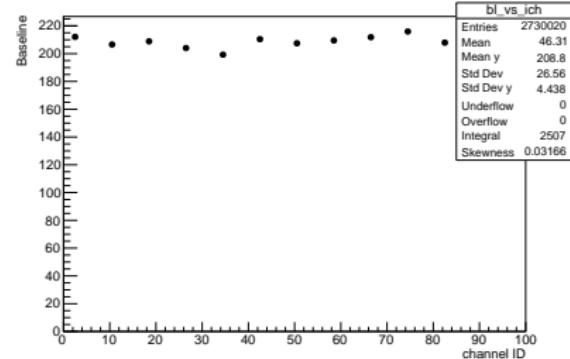
# Initial DQM Histograms

SPLIT IN 2 Checking that all channel respond the same way to identify problematic channels (noise, inverted wf) DO THIS WITH ALL CHANNELS

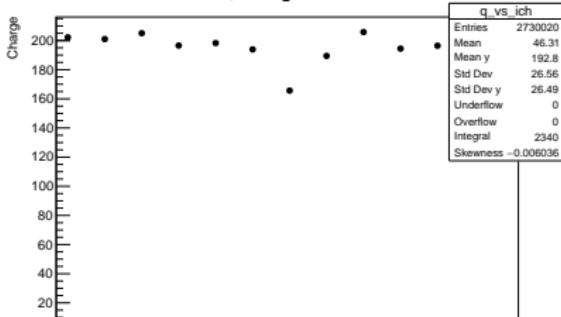
RUN:105423, First Sample vs Channel



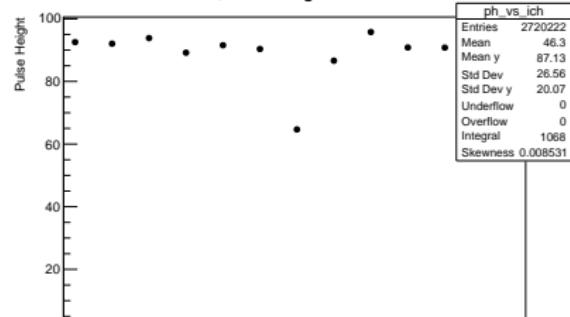
RUN:105423, Baseline mean vs Channel



RUN:105423, Charge mean vs Channel



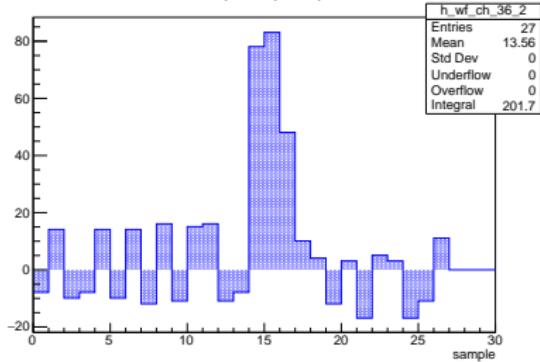
RUN:105423, Pulse height mean vs Channel



# Noisy channels and glitches

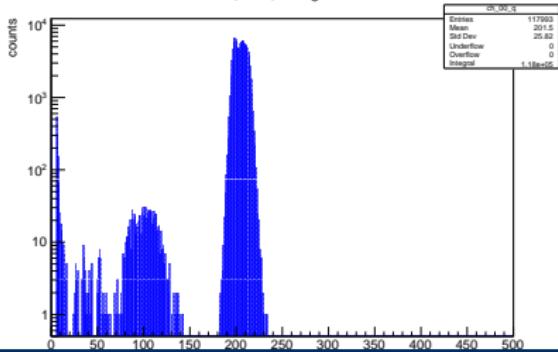
## SPLIT IN 2

RUN:105344, ch36, TS1, Waveform

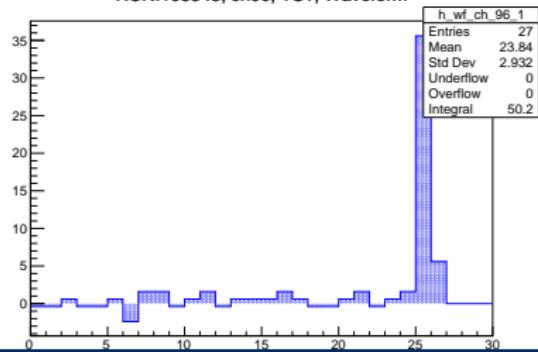


- noisy channels: value of the charge systematically lower than the expected;
- origin of the glitches not understood yet ( $20 < q < 70$ ).

run 105348, ch 0, Charge distribution

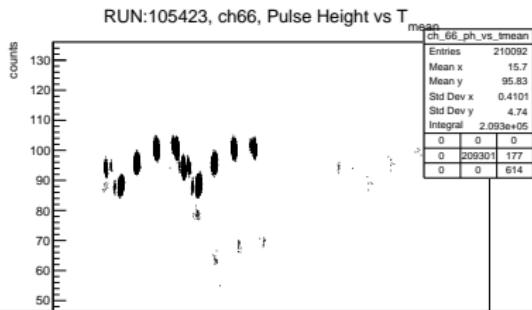
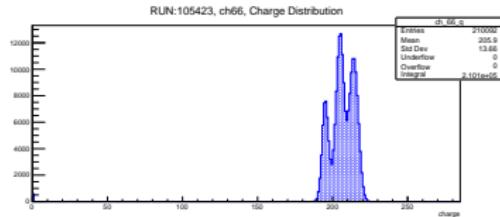
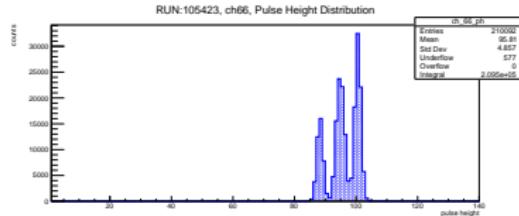


RUN:105348, ch00, TS1, Waveform

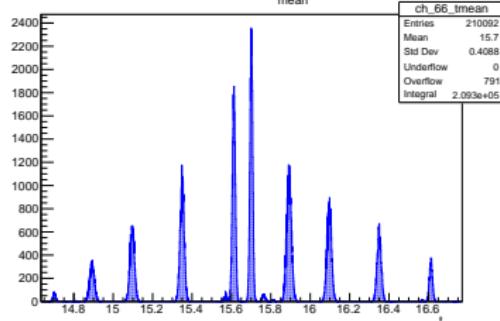


# Analysis of the charge and pulse height distribution

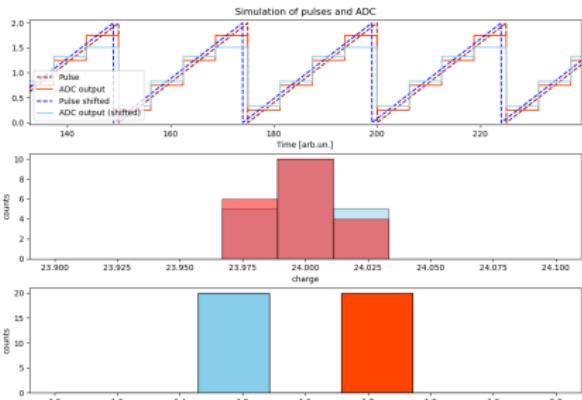
WRITE SOMETHING



RUN:105423, ch66, T<sub>mean</sub> distribution



$$t_{mean} = \frac{\sum_i t_i \cdot q_i}{\sum_i q_i}$$



# Artdaq Testing

# Global Run 1 Updates

- 
- Horizontal Slice Test: all detectors talked with one CFO;