Report on trigger and WaveDAQ

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X FOOT Collaboration Meeting, 25/05/2021

Istituto Nazionale di Fisica Nucleare

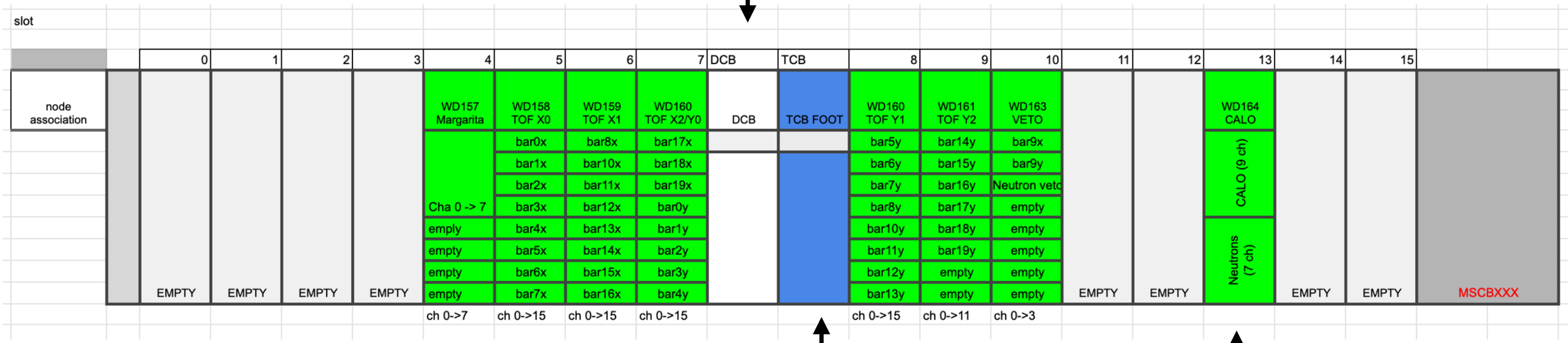
WaveDAQ crate for CNAO 202Z

Istituto Nazionale di Fisica Nucleare

DCB

Read out board

From last collaboration meeting



TCB

Trigger board

NEW

BGO

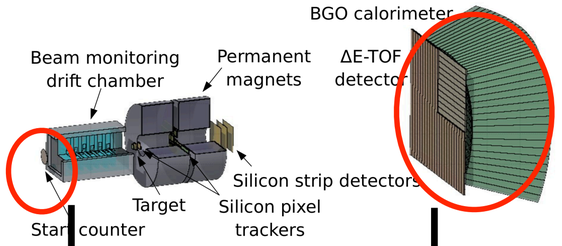
The FOOT WaveDAQ system

The FOOT WaveDAQ system

- Movable rack with
  - *2 WaveDAQ crates*
  - *Network switch for WDB data readout*
  - *Server to build WaveDAQ event and connect to central DAQ*

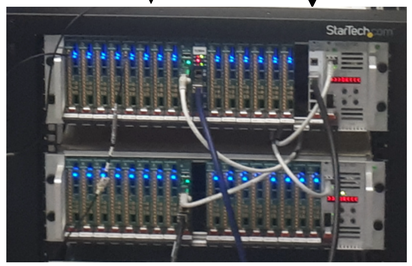
- Successfully and easily moved to Bologna for integration tests
  - *suited for FOOT*

Connection to central DAQ



→ waveforms
← configurations

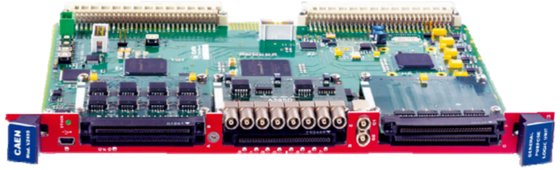
WaveDAQ



WaveDAQ PC

FOOT DAQ

trigger board



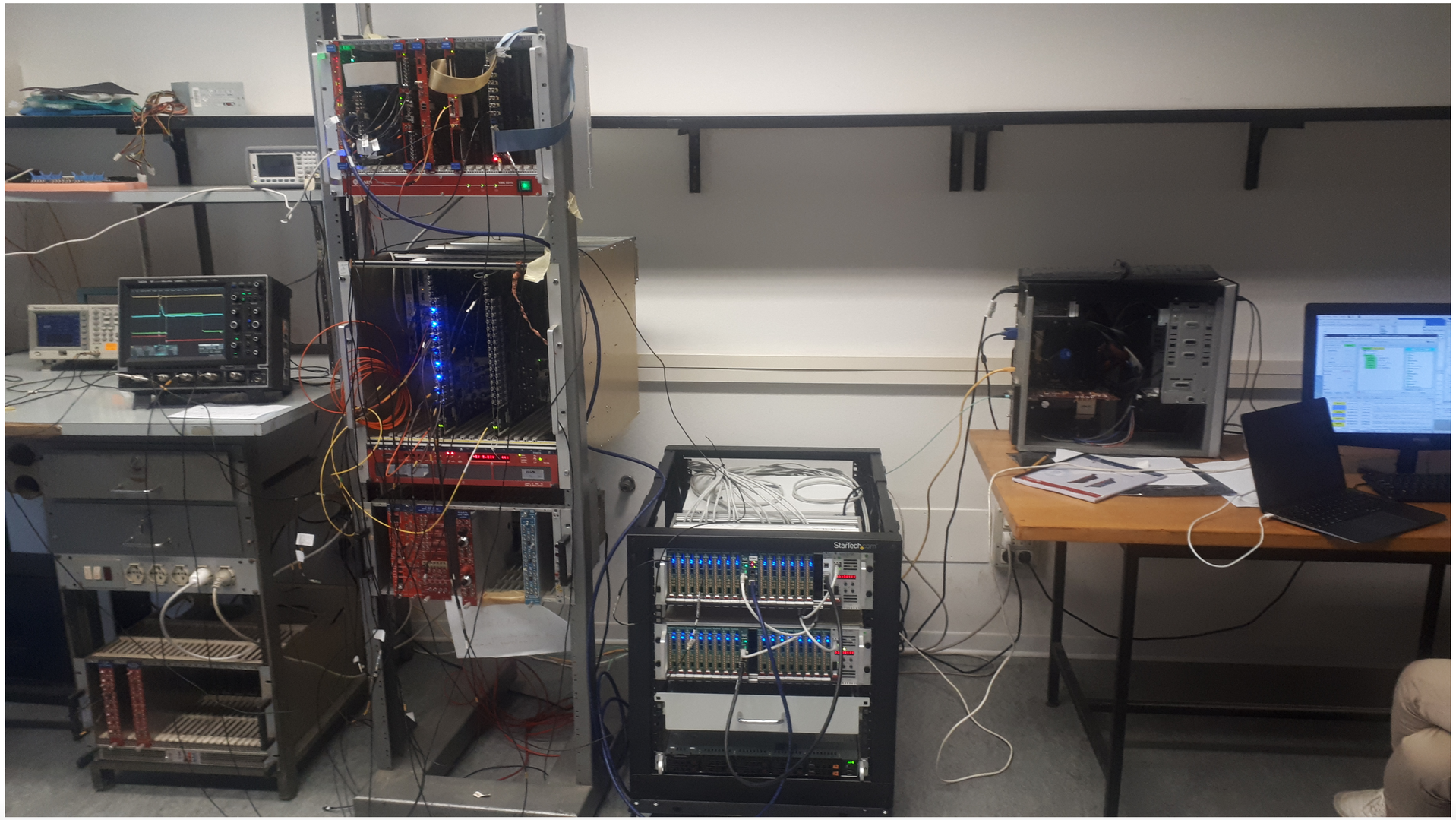
tested this May!

adapter fanout

trigger, busy, SYNC CLK and pulse

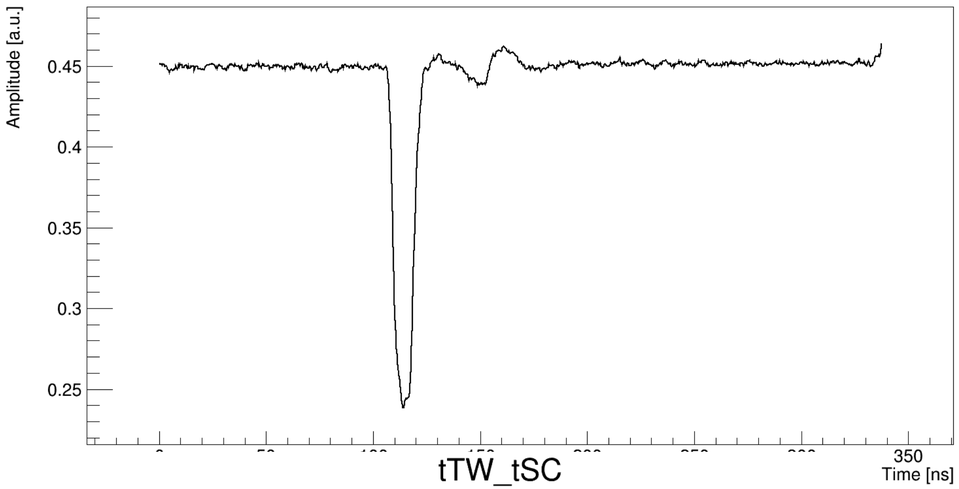
full chain commissioned thanks to Bologna DAQ group

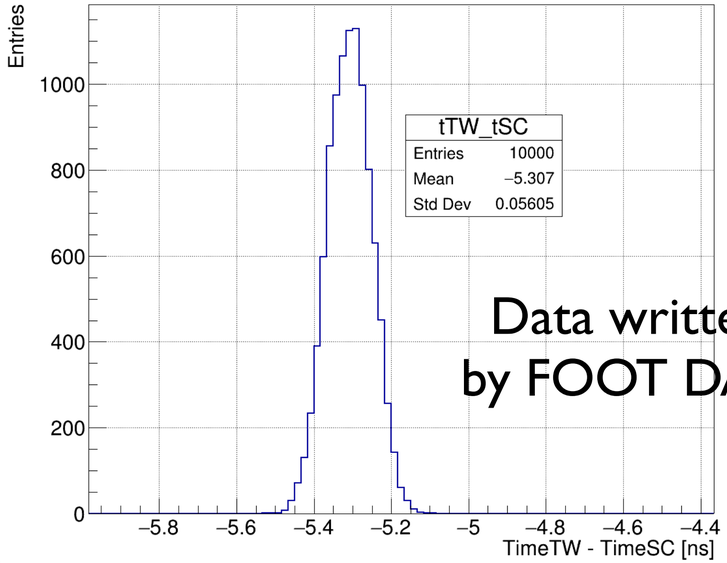
Integration test @Bologna



Some results from integration tests

- Full chain worked properly
  - *DAQ run without problems for few equivalent 10 hours*
  - *Majority trigger with pulser and simulated beam profile*
  - *Full trigger data readout*
    - to be used for efficiency evaluations





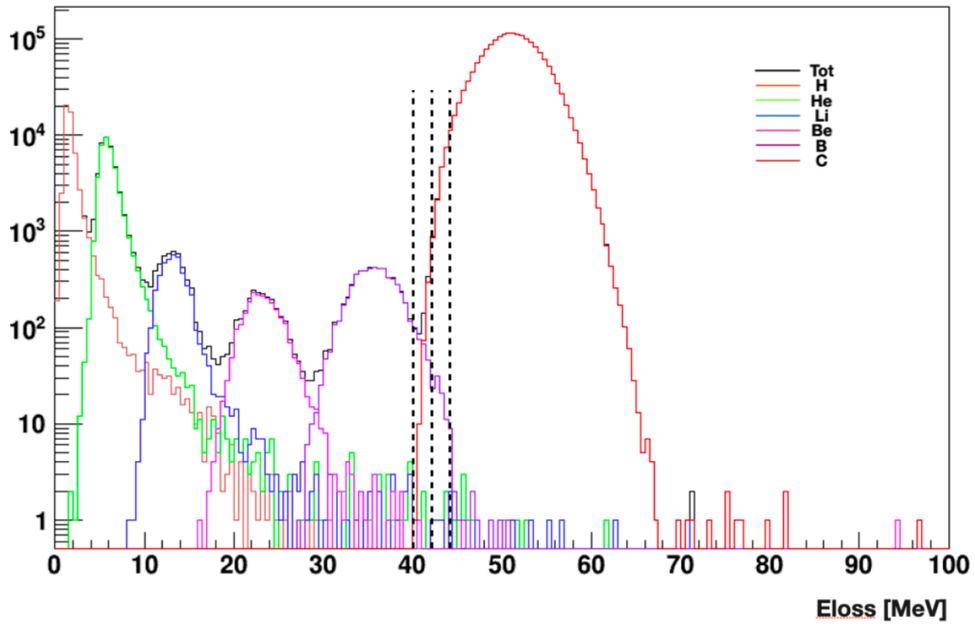
Data written by FOOT DAQ

- Input signal split and fed to 2 WDBs
  - *Margarita @3GSPS and TW @2GSPS (ONLY for this test)*
    - time reconstruction tested also by delaying trigger input for TW boards
      - *56ps measured —> no timing issue*

Trigger working group

- After last collaboration meeting a trigger working group was arranged in order to collect ideas and define a strategy for the fragmentation trigger to be tested/used @GSI 2021
- open questions:
  - *can we use DRS at 3 GigaSamplePerSecond instead of 4GSPS? Is time resolution deteriorated?*
  - *fragmentation trigger logic:*
    - energy release on TW central bars to discriminate primary/ fragments or topological cuts?
- Final proposal: veto on TW central bars when energy deposit is over threshold
  - *expected good purity with small bias on fragments*
    - Details in Angelica's slides

We take all fragments arriving on the TW except the ones hitting the bars n° 9 (front and rear) with energy loss (front or rear) above the threshold

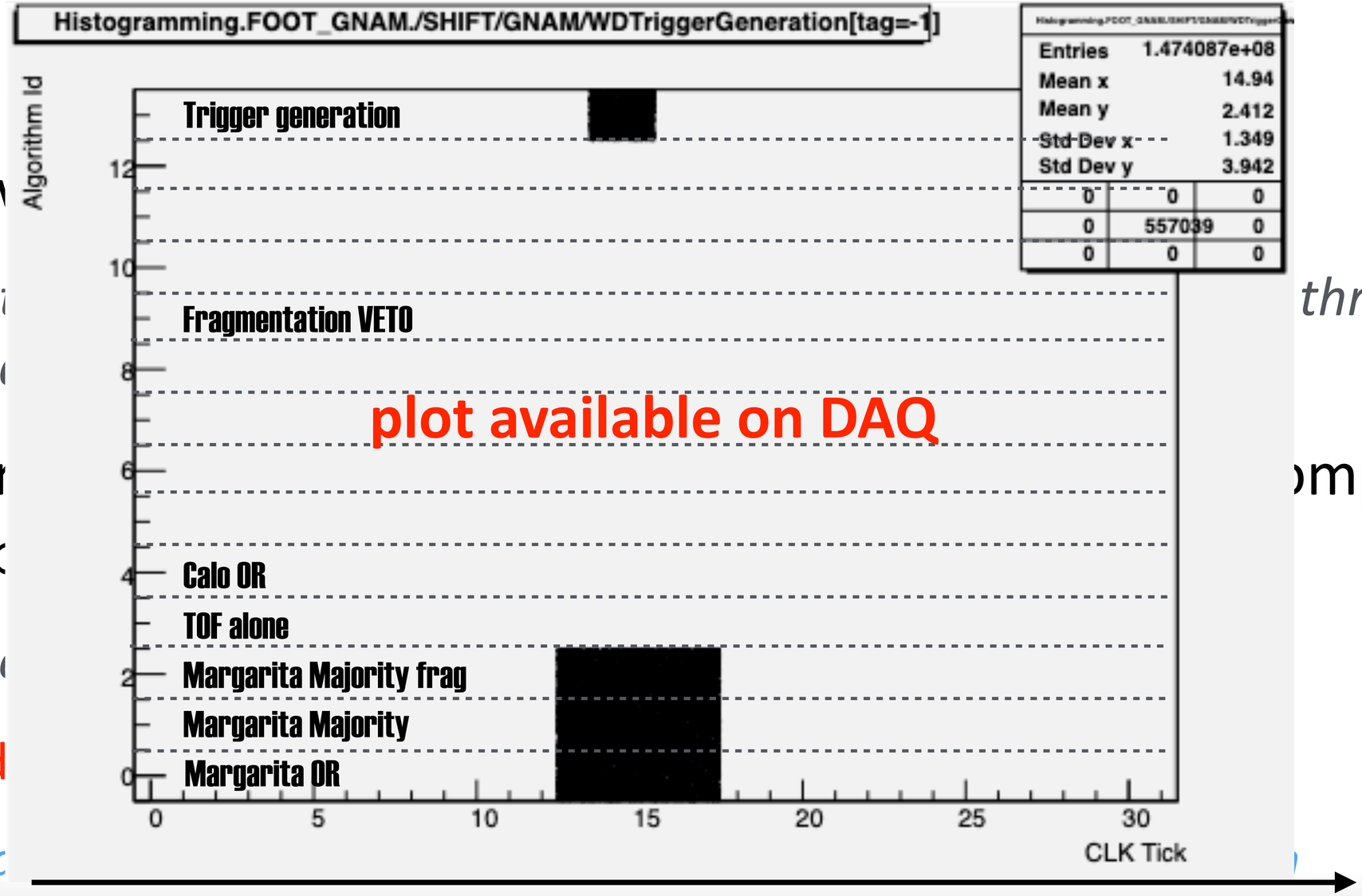


Fragmentation trigger status

- Logic implemented
- basic tests with pulser done
  - *TW channels pulse height input trimmed to be larger/smaller than veto threshold with trigger firing (or not) accordingly*
- Anti-coincindence setup: if needed Margarita hit can be delayed into veto window to compensate for cables/beam transport to TW
  - *delay can be applied quickly via SW*
    - delay and working
      - *Margarita - TW timing can be studied (also) with a new online histogram*

Fragmentation trigger status

- Logic impla
- basic tests v
  - *pulse heigh* *thr and trigger was acting*
- If need Mar *ompensate* for cables/k
  - *delay can b*
    - tested and
      - *Margarit*



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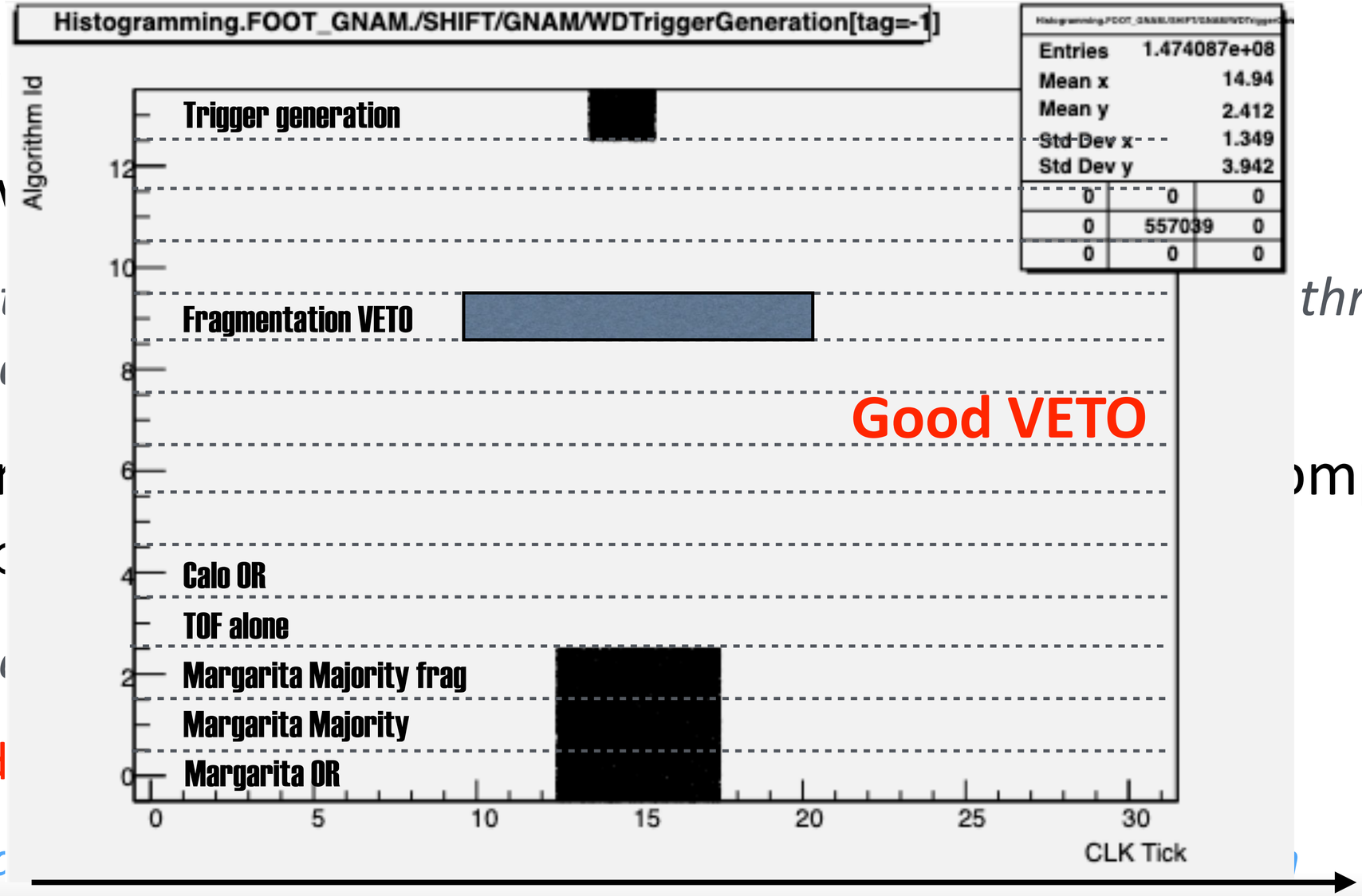

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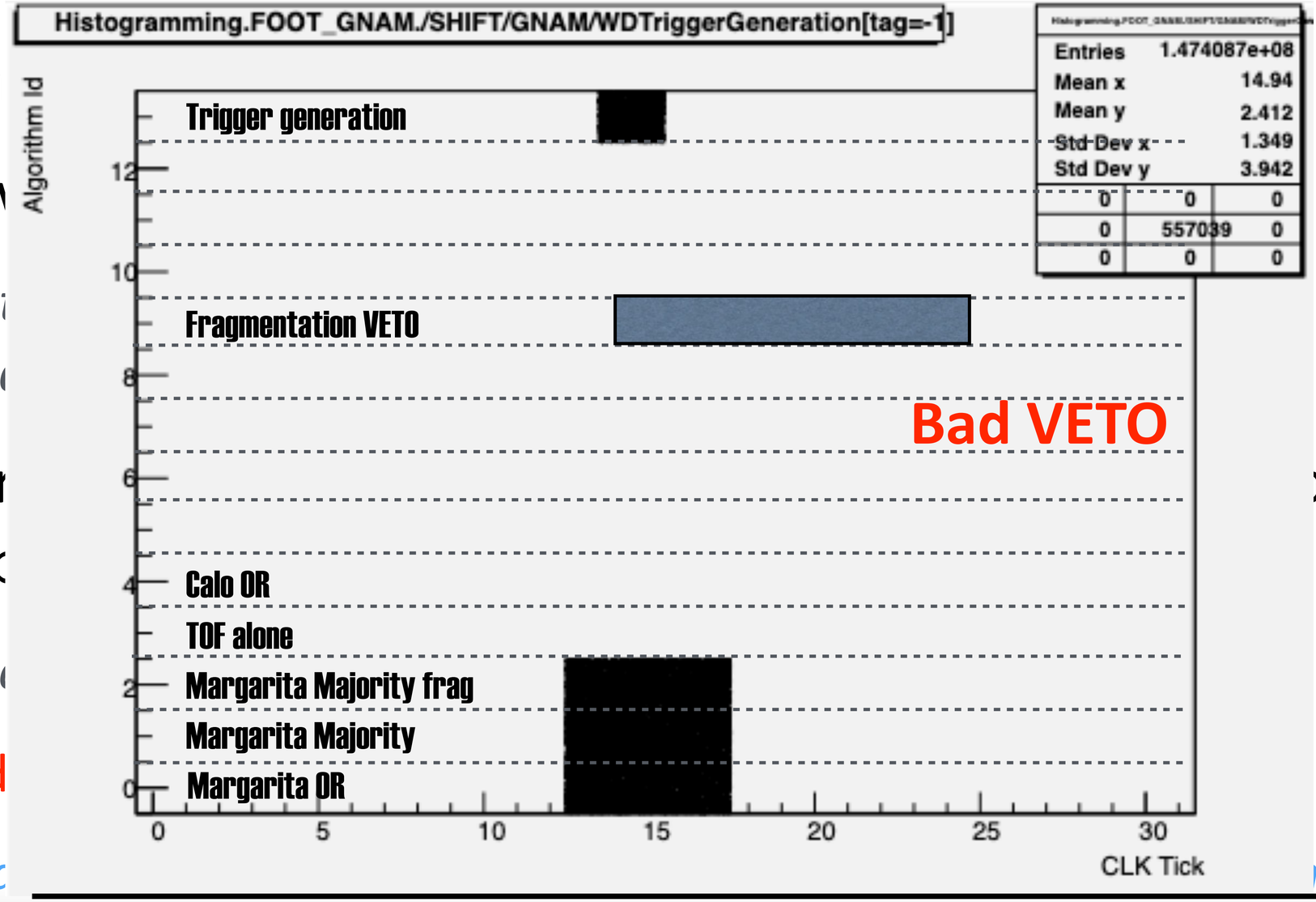

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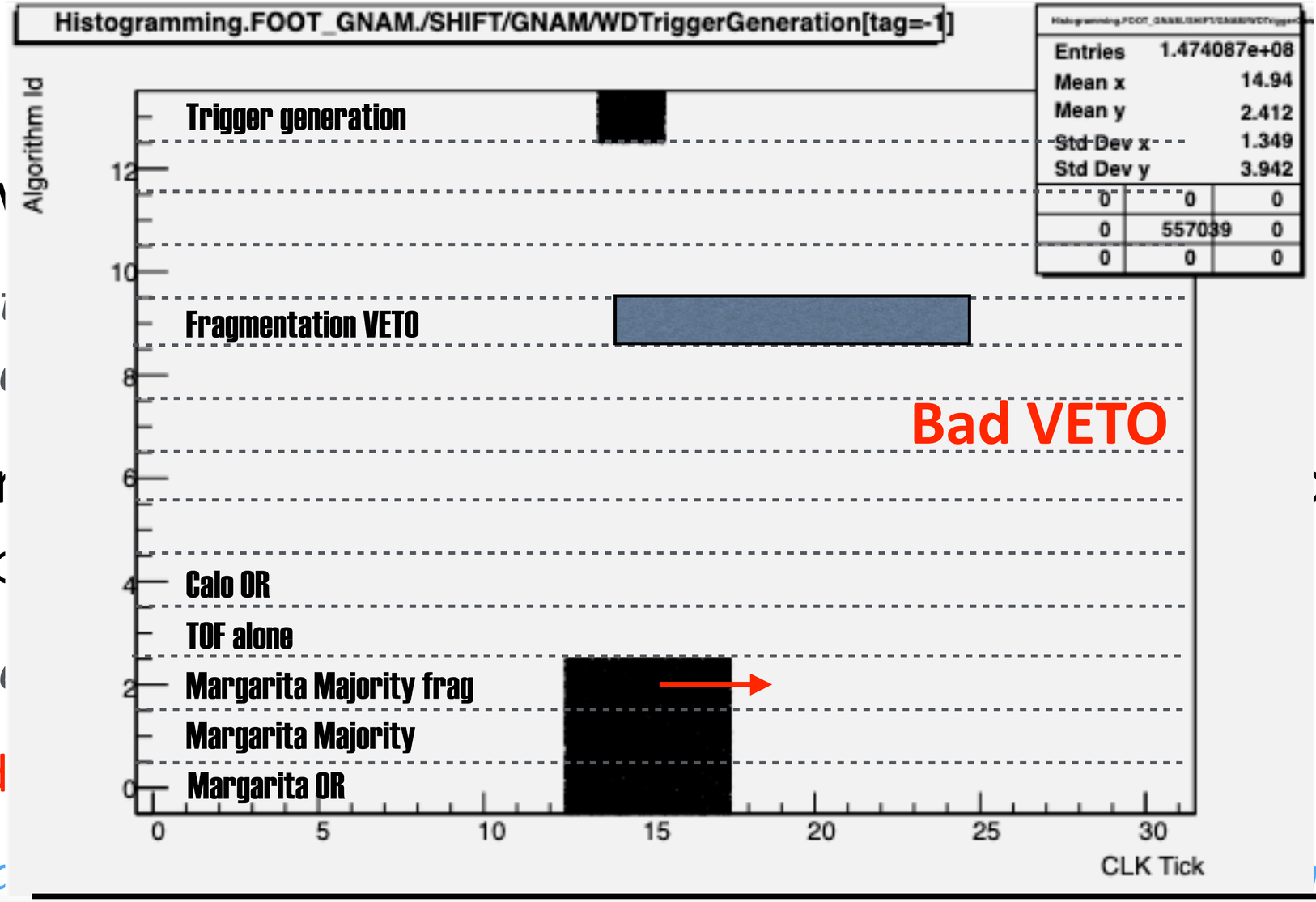

this data are also available in SHOE

time (12,5ns)

Fragmentation trigger calibration

- Assumption: first hour or so dedicated to minimum bias, in parallel trigger can be calibrated as follows
  - *Step 1: analyse minimum bias events and produce the pulse height and charge distributions for TW central channels*
    - possible both with stand alone dedicated code and SHOE
    - check margarita hit and veto timing both online and offline
  - *Step 2: apply thresholds and restart the run: fragmentation trigger still disabled*
    - no need to stop the DAQ for more than a minute or so to load new thresholds
  - *Step 3: measure minimum bias and fragmentation trigger rates and prepare the prescaling values for fragmentation trigger run*
    - further check anti-coincidence timing
  - *Step 4: at the end of the minimum bias run (or when ready) start with fragmentation run*
    - DAQ configuration can be prepared in parallel to data collection
- Important: the trigger calibration is performed parasitically to the main DAQ, so no dead time is induced
  - *must be done for all beam energies*

Conclusions

- The WaveDAQ is fully commissioned into the DAQ
  - *data transfer from WDAQ to central DAQ working properly and tested in several long runs*
  - *slow control also checked in details and working properly*
    - new online plots added for trigger monitoring
- Fragmentation trigger based on energy cut studied and prepared for GSI
  - *basic test of FW done*
  - *tools for trigger timing setup developed*
  - *trigger calibration procedure designed*