TOF-Wall performance and new developments

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XI Collaboration Meeting

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Detector Status

- The detector is completed and tested
- The motion system for the scan of the detector has been completed and used at GSI
- The WaveDaq system can already host all the channels of SC, TW, Calorimeter and additional detectors (such as neutron detectors).
- The board that distributes the voltage in the WaveDaq has been improved, reducing the noise level

Detector calibration

- Up to now we have performed a full scan of the detector using oxygen beam at GSI
  - 20 minutes scan, all the 400 intersections were irradiated

    → See Roberto Zarrella presentation

- We have irradiated the center of the detector with 4 carbon energies using a carbon target for fragmentation
  - It was not possible to move the detector in treatment room
  - Another scan of the detector could be performed in the future in the experimental room at CNAO

Test at CNAO – November 2021

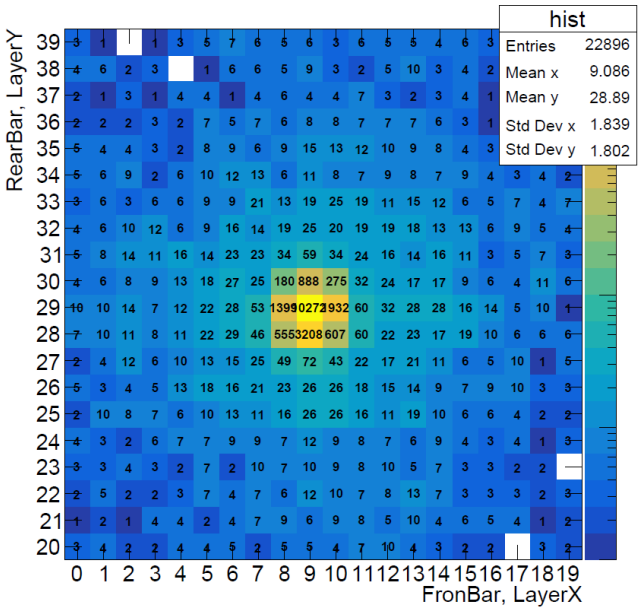
- The set-up was composed of:
  - Start counter
  - Target
  - TOF-Wall
  - Calorimeter module
  - Phoswitch detector (off-beam)

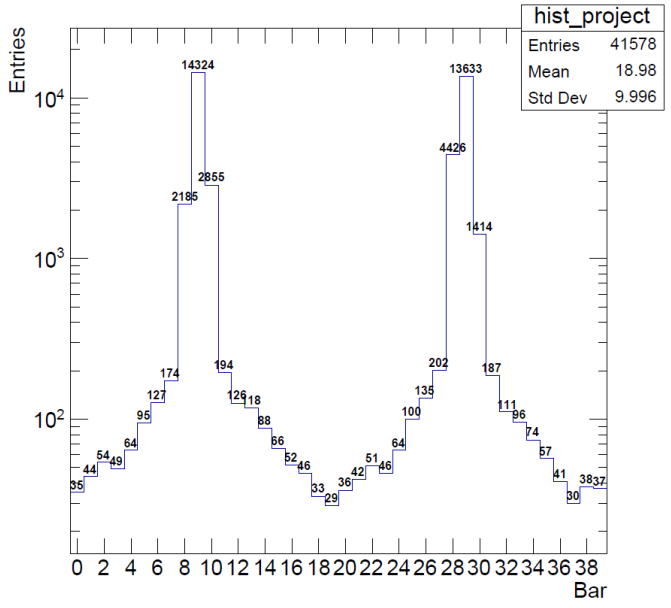
Test at CNAO – November 2021

- Data acquired with carbon beam (200 MeV/u)
  - C target
    - 2,7 Mevents minimum bias, 2,5 Mevents fragmentation trigger
  - Polyethilene target
    - 1,5 Mevents minimum bias, 6,2 Mevents fragmentation trigger (higher prescaling)
- Data acquired with C target using different energies (carbon beam)
  - 150.71 MeV/u (500k m.b. + 800k f.t.)
  - 200.61 MeV/u
  - 301.44 MeV/u (400k m.b. + 400k f.t.)
  - 398.84 MeV/u (600k m.b. + 700k f.t.)

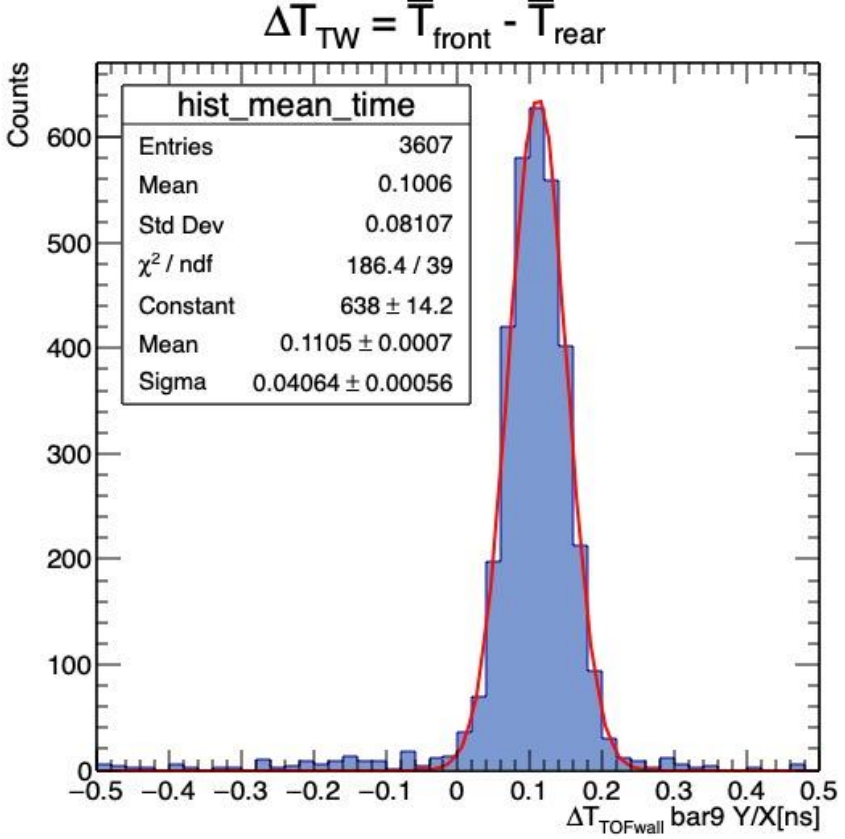
Test at CNAO – November 2021

- The system worked properly during the first night of data taking
- Fragmentation trigger was applied considering 3+3 central bars



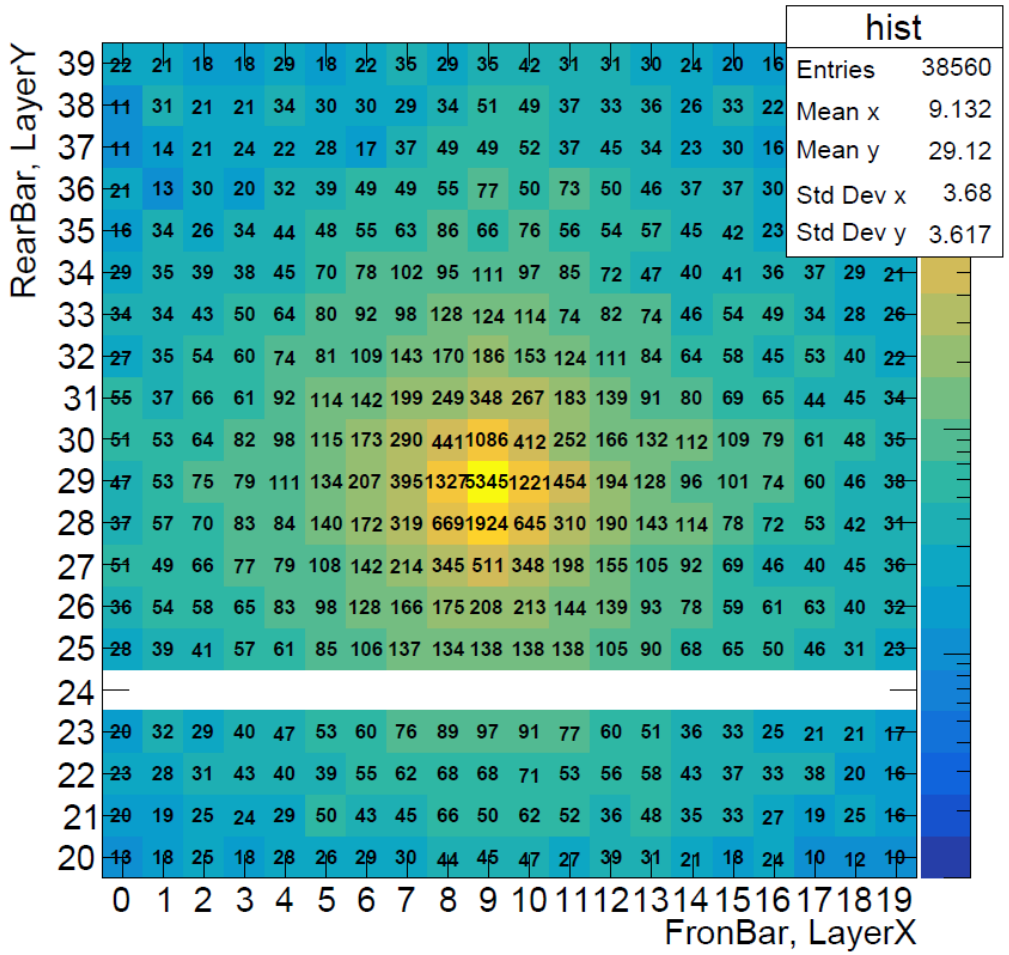


Preliminary plots from Lorenzo Marini



Example of time resolution between one bar of the horizontal and one bar of the vertical layer

Test at CNAO – November 2021

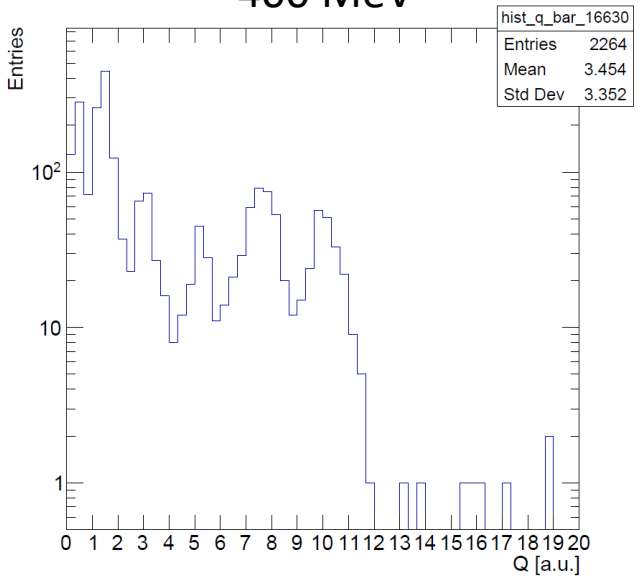


- A couple of bars did not work properly in the second and third nights.
- Possible causes could be:
  - Problem in the configuration process of one of the board
  - Problem in the HV part of that board
  - Problem in one of the SiPM board of the bar
- Since all the bars worked properly in the first night of data taking and during the acquisition of cosmic rays, this issue needs to be fully understood.

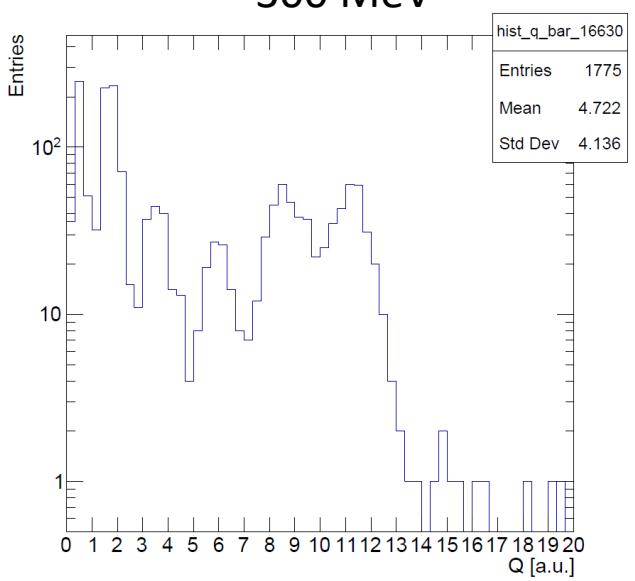
Test at CNAO – November 2021

The fragments peaks can be distinguished in the charge histogram for all the four energies. These peaks can be used for a more detailed study of the energy response for at least few points in the detector.

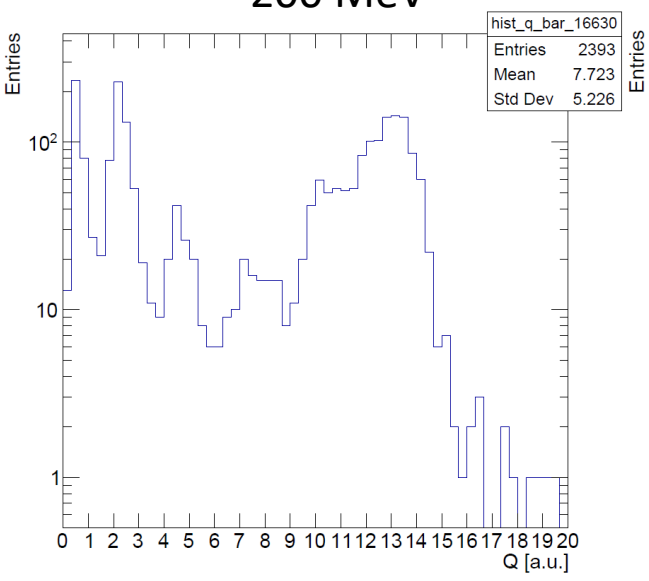
400 MeV



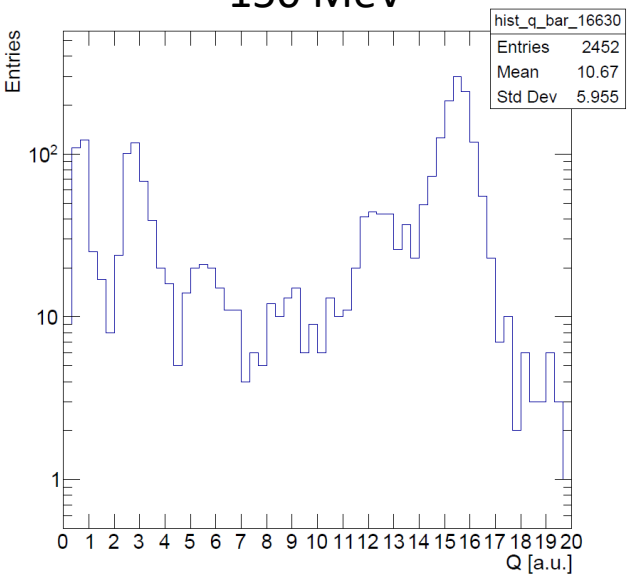
300 MeV



200 MeV



150 MeV



Only a subset of data is represented in the plots

Next steps

- The channels that did not work properly during the last two nights at CNAO have to be checked. We must verify if this can be done directly at CNAO of if the system need to come back to Pisa.

- Some tests planned for November have been skipped and hopefully could be made in future:
  - Test of the detector with higher gain to verify the sensitivity to light fragments (mainly protons)
  - Tests with the TW positioned at a large angle

- Data taken in November need to be analyzed

Further Improvements

- Not much really, the detector is almost ready…
  - Buy SSD drive for fast data writing on the server (2022 budget, but maybe anticipated to this year)
  - Increase of 16GB the RAM of the server (a usage of about 84% of the RAM was observed during the CNAO data taking)
  - Investigate for a method to avoid the disconnection of the cabling every data taking from the WaveDAQ (to minimize the chance to damage the board connector)