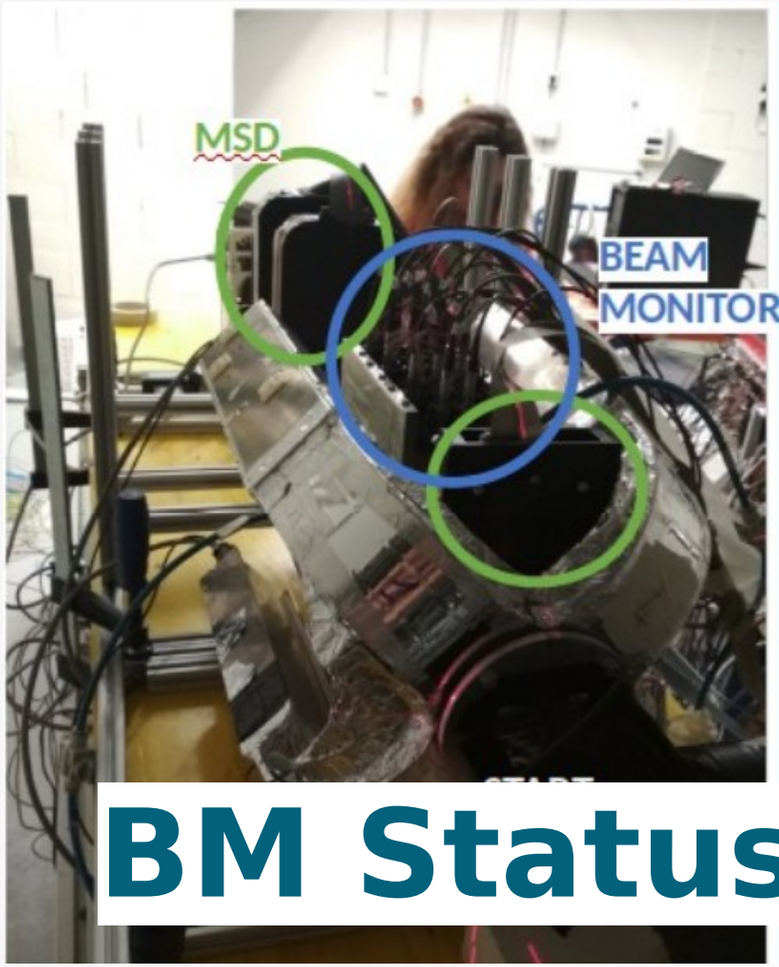
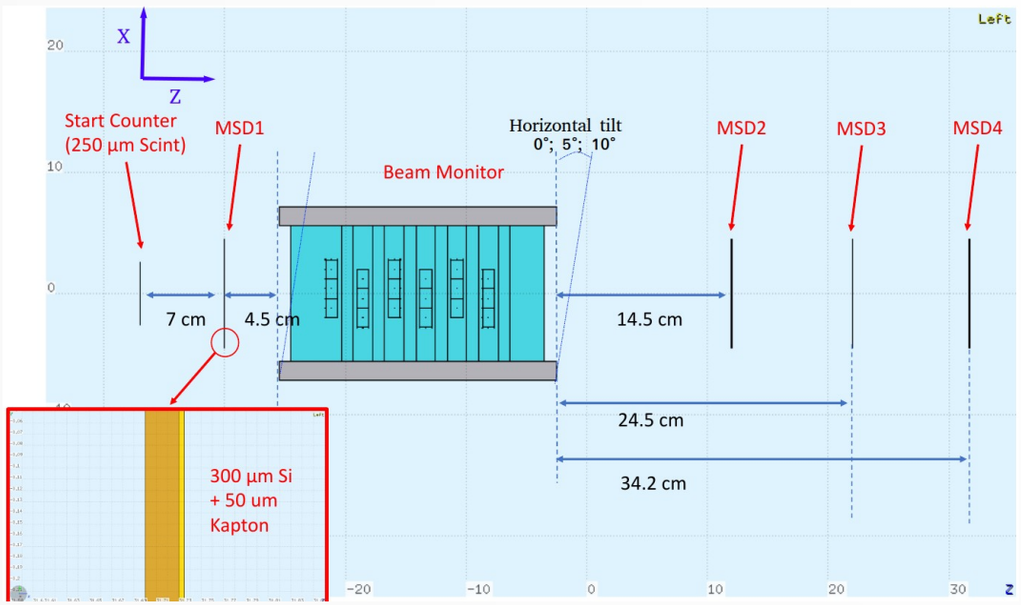


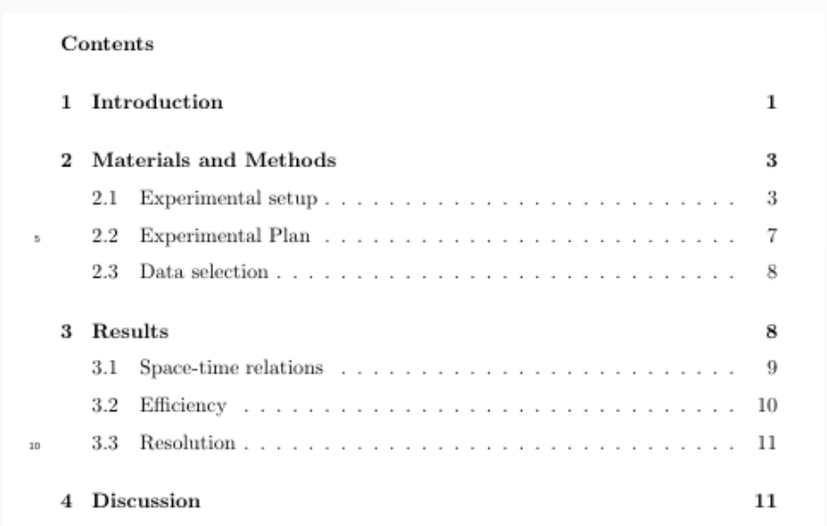
BM Status: analysis & paper

Y.Dong

Foot skype meeting
29/10/19

BM calibration with P @ Trento



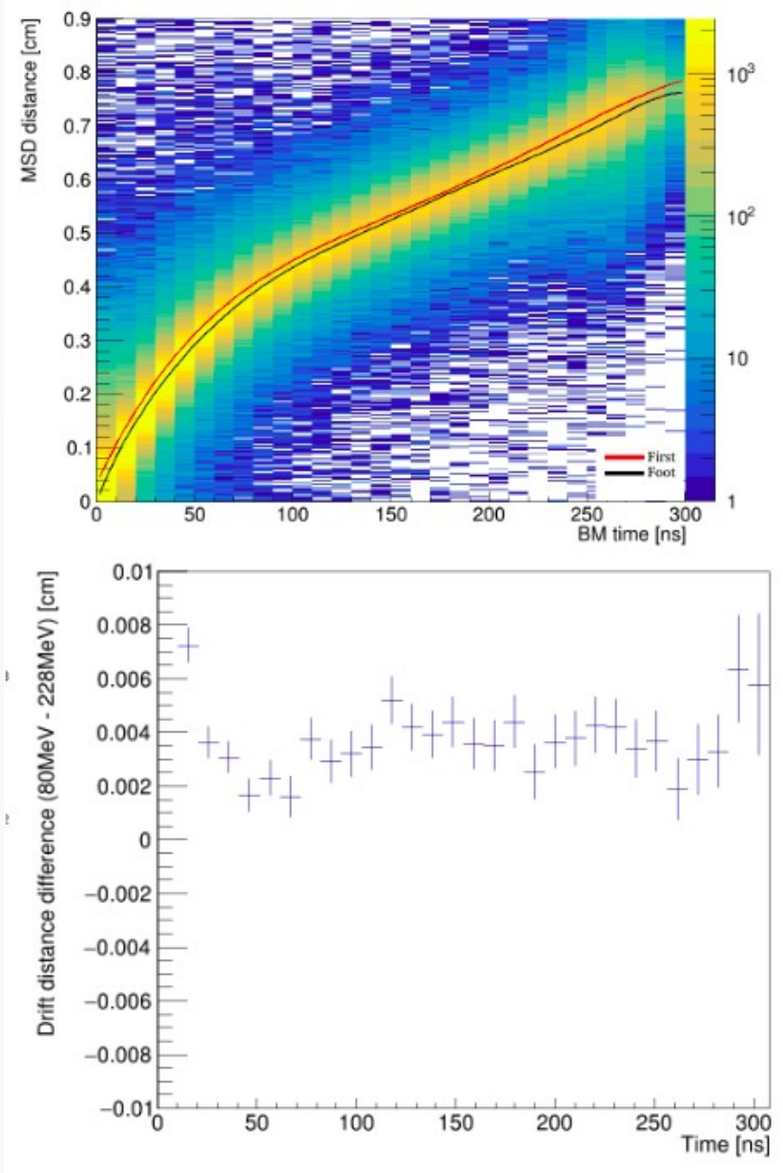


Contents

- Calibration test performed with Margherita and 4 layers of Microstrip Silicon detectors (MSD), together with the Perugia Team.
- Several noisy and dead strips (up to 4 points on X coordinate and 3 on Y coordinate)
- Multiple Coulomb scattering evaluation ongoing
- **Technical paper in preparation (NIM)**

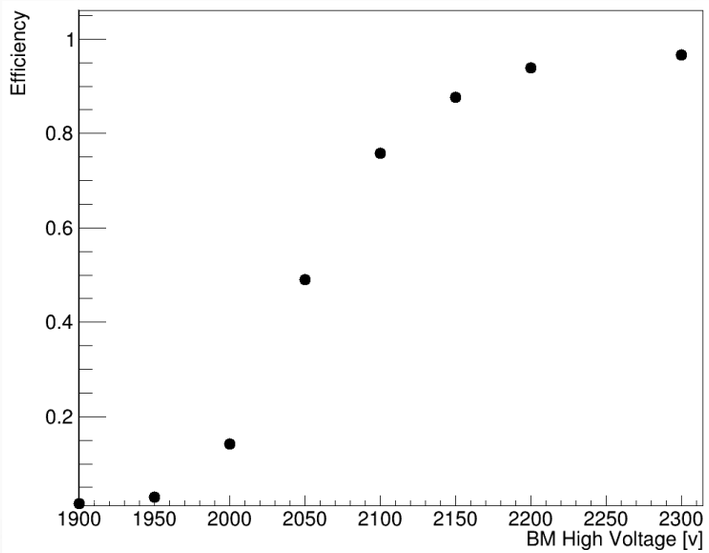
Collected data:
200 kevt.: 80 MeV, 0° tilt
100 kevt.: 228 MeV, 0° tilt
100 kevt.: 80 MeV, 5° tilt
100 kevt.: 228 MeV, 5° tilt
100 kevt: 228 MeV, 10° tilt

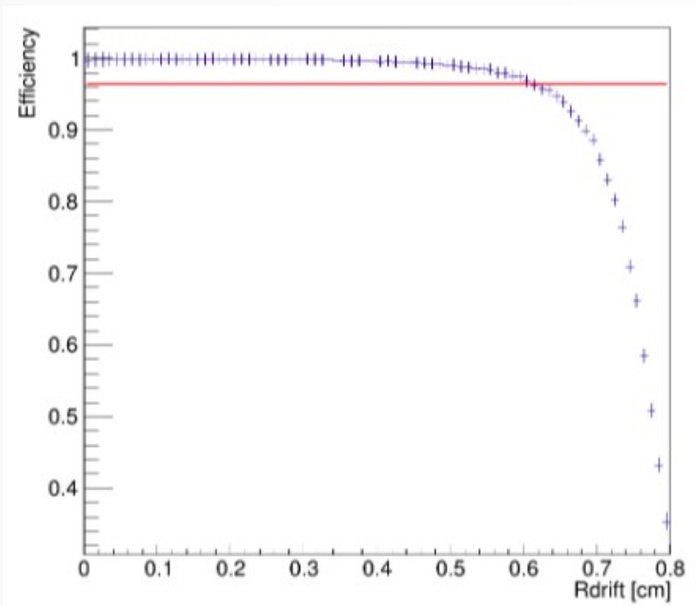
Preliminary results: Space-time rel



- Space time relations evaluated with the BM time and the MSD tracks extrapolated to the BM sense wire pos.
- Similar Space-time rel. as in FIRST, even if it was evaluated with C @ 80 MeV/u and with different BM working point (HV, pressure, gas)
- Difference between 80 and 228 MeV protons probably given by the different mean free path between two ionisation clusters
- MC Garfield++ simulation studies ongoing

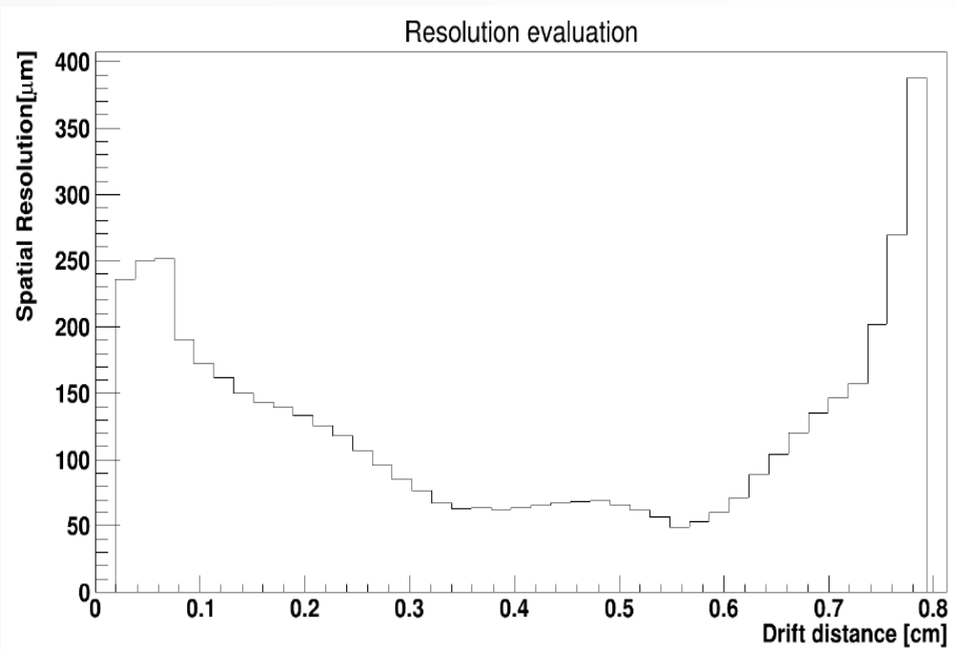
Efficiency





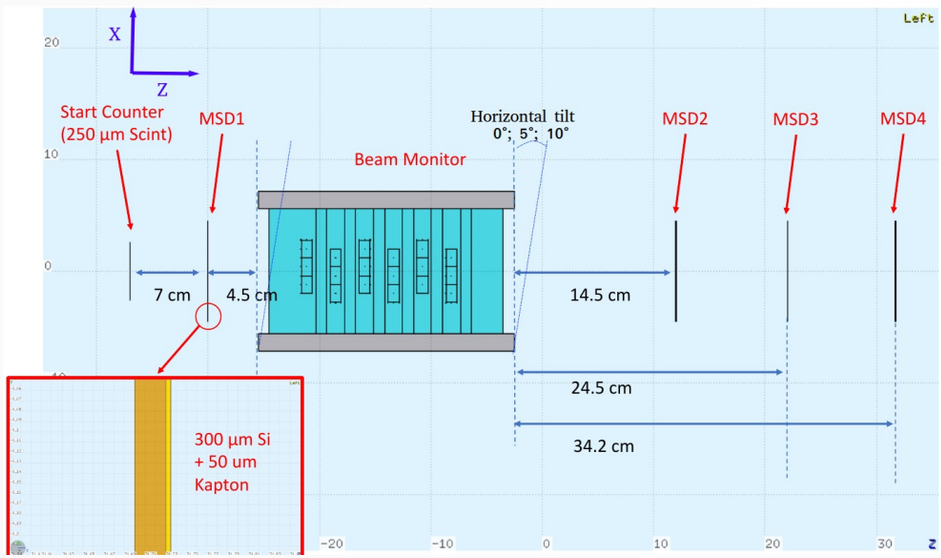
- Hit detection efficiency evaluated as fraction of events with one or two hit detected on even (odd) planes, when three single hits on odd (even) planes have been scored.
- HV efficiency scan previously measured compatible with FIRST measurement
- MSD track extrapolated to the BM cells and check if there's a hit or not.
- **The BM is inefficient at the cell border**, where the Electric field is weaker
- However the BM cells are staggered: the cell border of one layer correspond to the cell center on the next layer

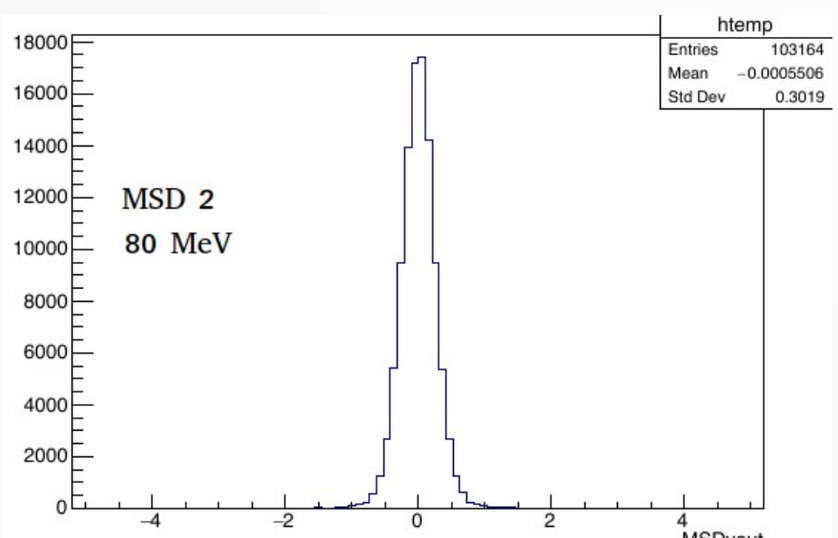
Resolution



- Using only the BM hits and tracks, the resolution can be evaluated as the residual between the BM fitted track and the hits measurement.
- The result is in a good agreement with the performances measured in FIRST
- The first method depends on the BM reconstruction algorithm and selection criteria.
- It is possible to evaluate the residual using the MSD tracks and the BM hits.
- No dependence on BM reconstruction, but MSD resolution and Multiple Coulomb scattering have to be evaluated properly

Multiple Coulomb Scattering



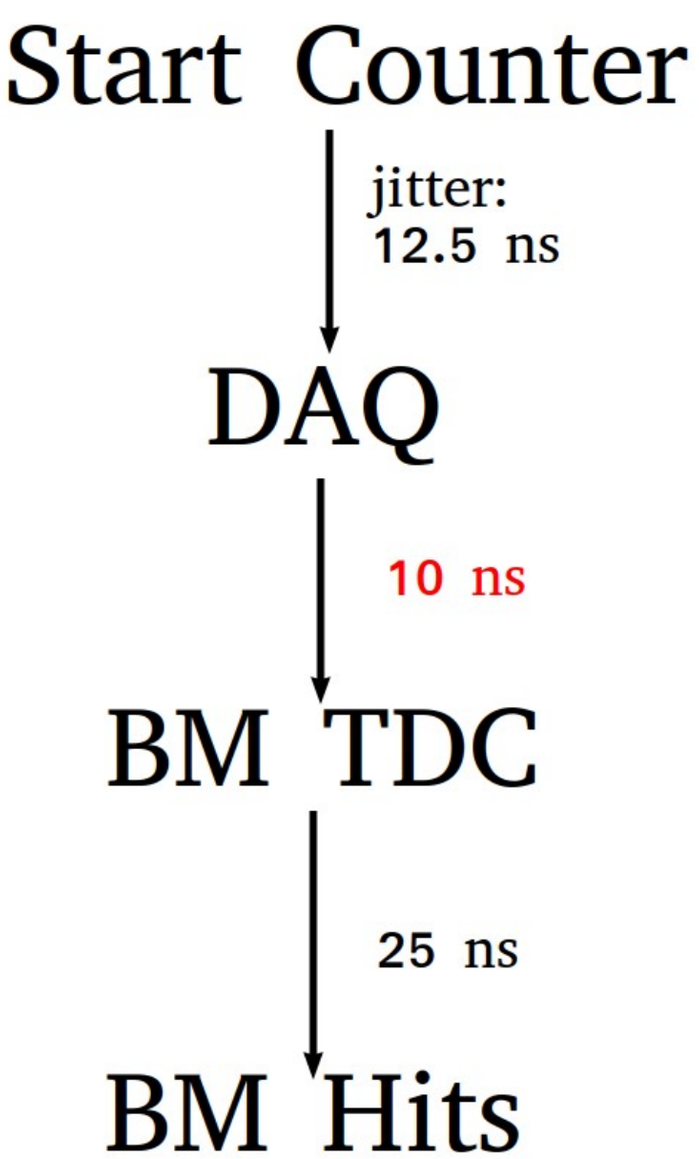


- The Multiple scattering given by the MSDs (300 µm of Si + 50 µm Kapton) is relevant.
- From FLUKA simulation of a pencil beam:

	Std. Dev. [cm] 80 MeV	Std. Dev. [cm] 228 MeV
MSD1	0.076	0.059
MSD2	0.3	0.13
MSD3	0.38	0.17
MSD4	0.46	0.2

- The evaluation of the MCS is ongoing
- Possibility to minimize it using the hits only from the first two MSD planes
- **It could be an issue in FOOT?**
  (MSD with 150µm of Si + Vertex + IT)

BM @ GSI



- From the arrival of the particle to the measurement of the BM cell signal there are different passages:

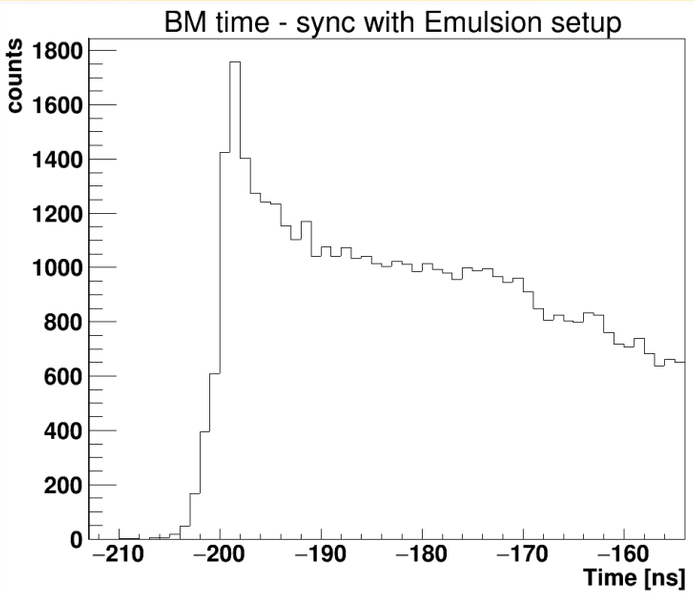
  1)A particle cross the Start Counter.

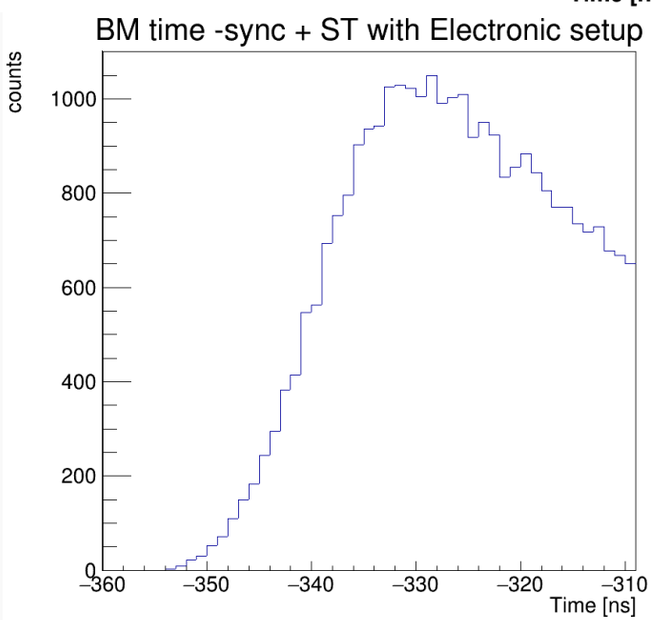
  2)The majority give a trigger signal with a jitter of 12.5 ns (measured by the WD).

  3)The signal is sampled by the DAQ and it is spread among all the subdetector with a jitter of ~10 ns **(Not measured).**

  4)The trigger give the start for the data transfer to the TDC with a jitter of 25 ns (measured by TDC).

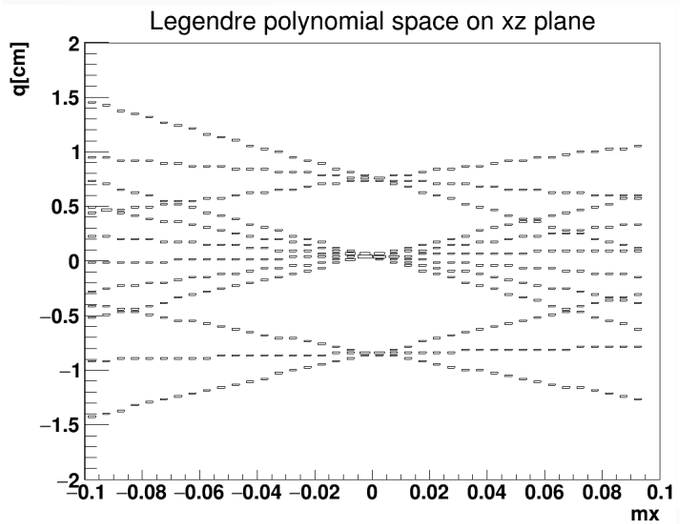
BM @ GSI

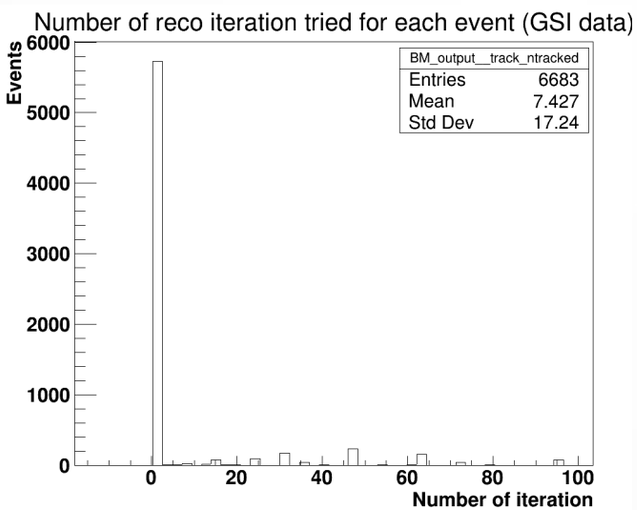


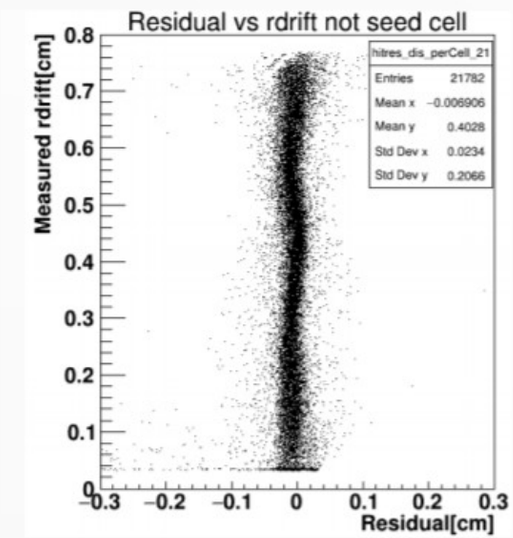


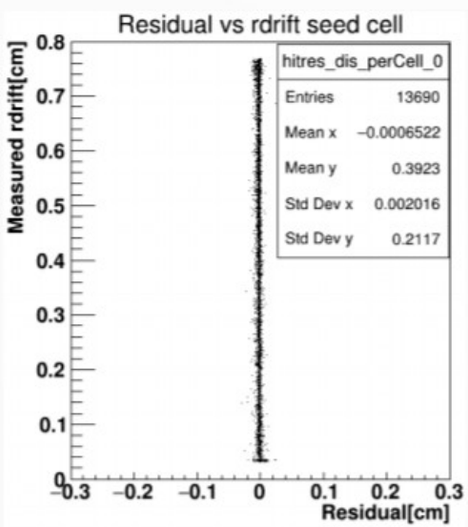
- **For each event taken with the electronic setup, the BM hits time measurement are shifted up to 10 ns**.
- This is evident comparing the BM time measurements with the emulsion setup and the electronic setup.
- This issue must be fixed for the next data taking.
- It is possible to modify the reconstruction algorithm and try to variate the T0 for each event to recover the data, increasing the computing time.
- **Is someone analysing the GSI data and needs the BM tracks?**

Legendre transform









bm_calibration branch:

- Legendre transform + chi2 added as new standard reconstruction algorithm in bm_calibration branch.
- It can be used for hit preselection and first guess of the track parameters
- It needs to be optimized.

new_geom branch:

- When the Legendre transform will be optimized it will be copied also in new_geom.
- No other relevant changes are foreseen

To do list

Calibration test @ Trento

- Use of Garfield++ simulation toolkit to check the Space-time relations
- Finalize the study on the Multiple Coulomb Scattering and the MSD track reconstruction and selection criteria.
- Evaluate the BM resolution performances using the MSD tracks and taking into account the MCS effect

Reconstruction and software improvement

- Legendre transform added as standard reconstruction algorithm in bm_calibration branch. It needs to be optimized and next it will be included also in new_geom.
- The Legendre transform should speed up the BM reconstruction.
  What about a tentative to speed up more using parallelization (multithreads)?

GSI data

- If someone is analysing the GSI data and needs the BM data, I can modify the reconstruction algorithm, shift the T0 and try to provide better BM tracks