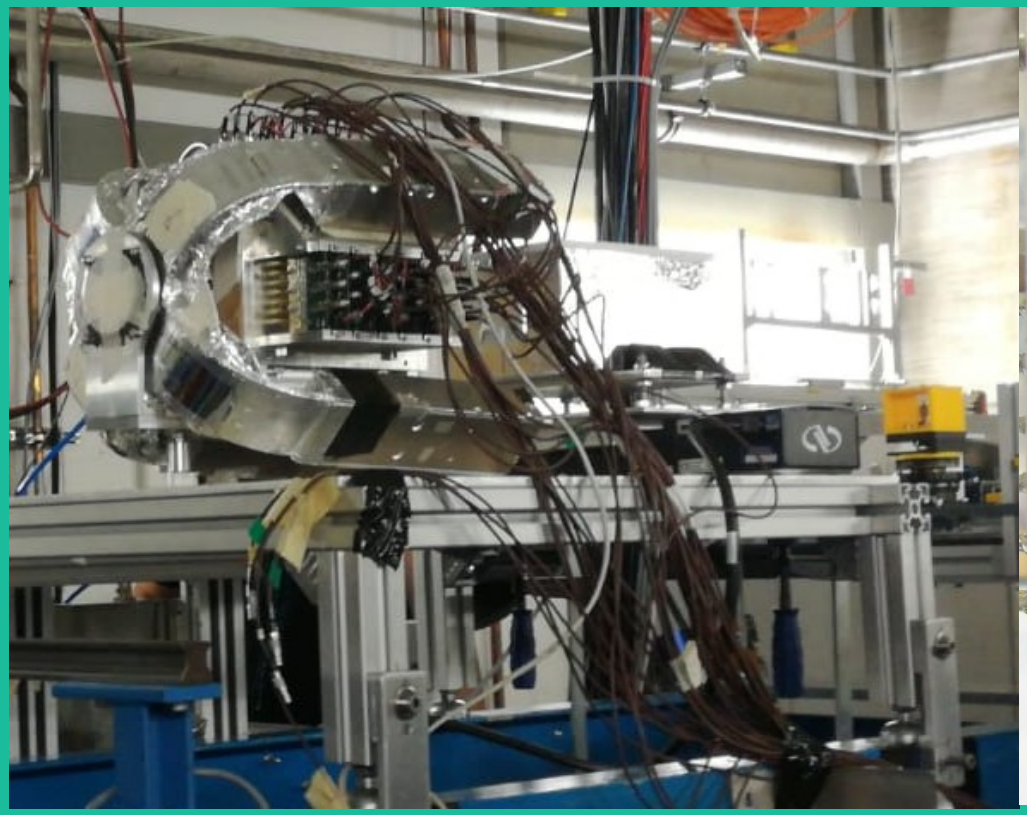
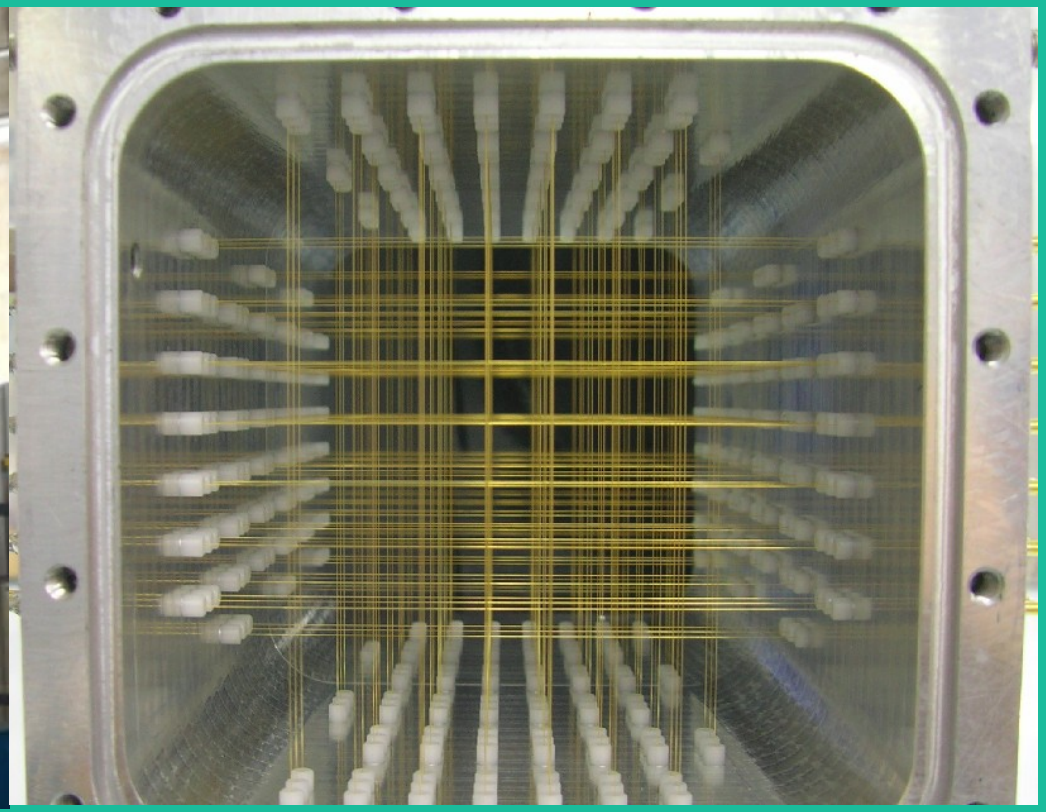




Beam Monitor status

Yunsheng Dong

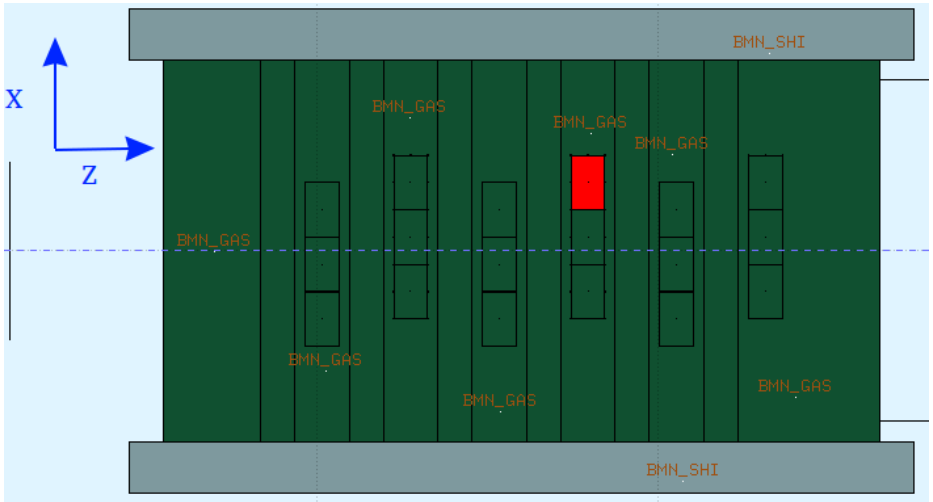
VIII FOOT collaboration meeting

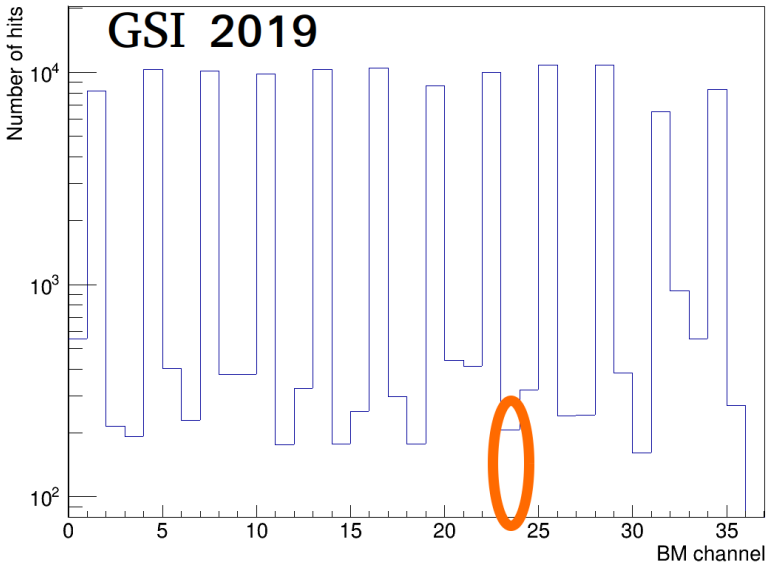
11/06/2020

Outline

- Channel lost
- GSI data taking with emulsion setup:
  -Emulsion setup results
  -Characterization of the C beam at 700 MeV/u
- BM calibration test with MSD
  -Paper for NIM
  -Results about the BM spatial resolution
- Events with fragmentation in SC
- Software status
- Future perspectives

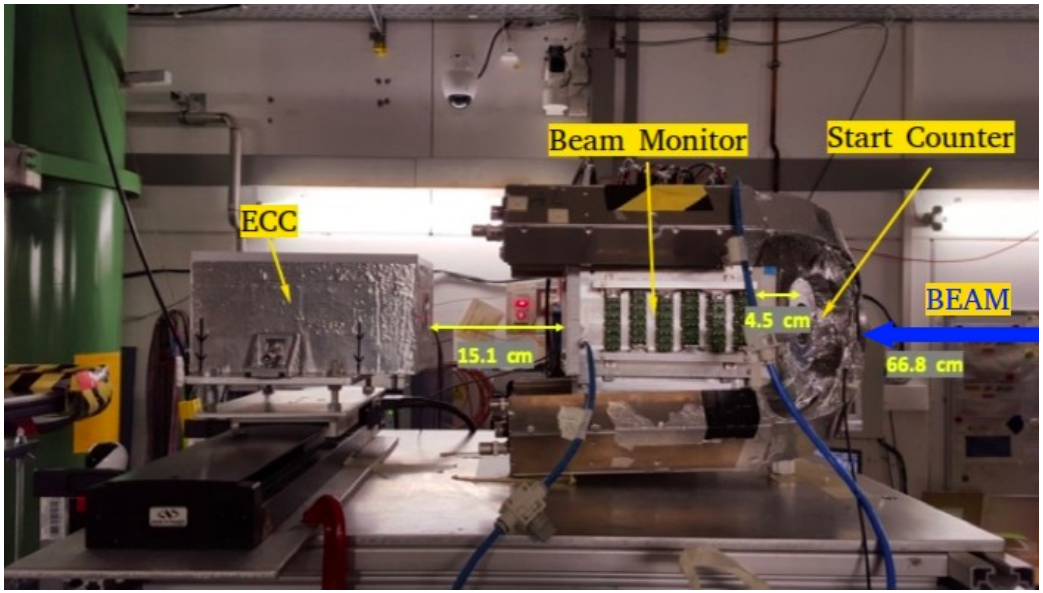
Channel lost





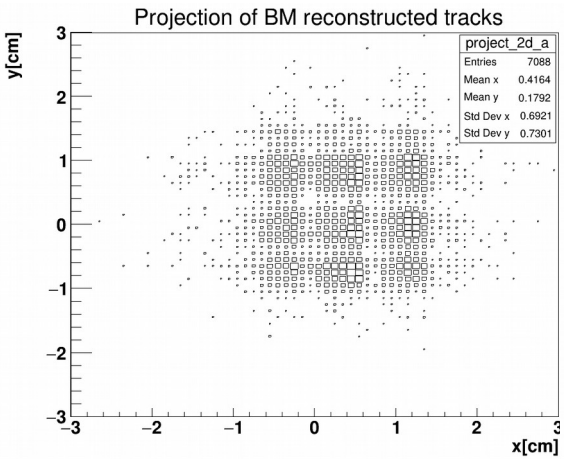
- The capacitors used in the voltage stabilizer circuit have been damaged.
- During the substitution of the capacitors, one sense wire of a cell has been broken and it has been extracted.
- The BM lost a cell, but no relevant effect has been found on the reconstruction performances since it was a side cell.
- Possibility to restore the sense wire. (time and coronavirus permitting)

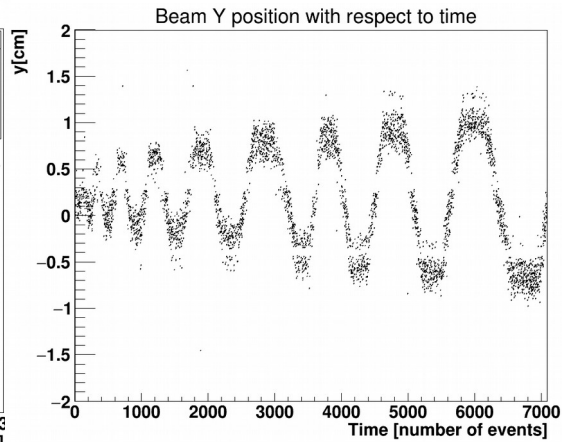
GSI data taking in February 2020

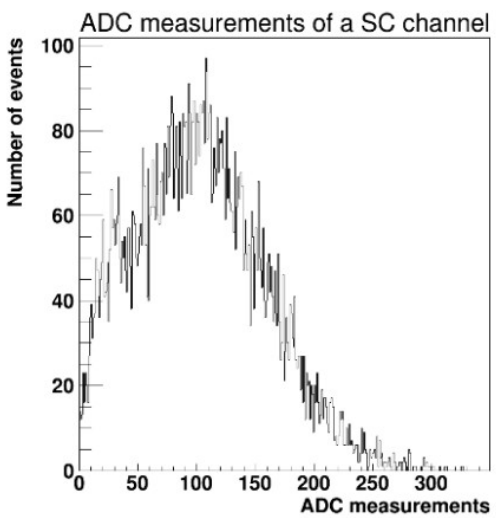


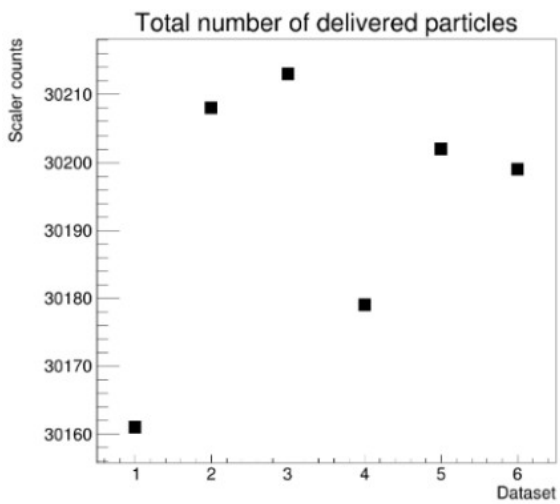
- Beam: ^{12}C @ 700 MeV/u in Cave A
- Two bricks of emulsion with C and C_2H_4 target
- Margherita placed at the isocenter
- Beam time: one long shift of 7 Hours
- Total time adopted for the ECC setup operations ~ 2.5 Hours

Results for the ECC setup









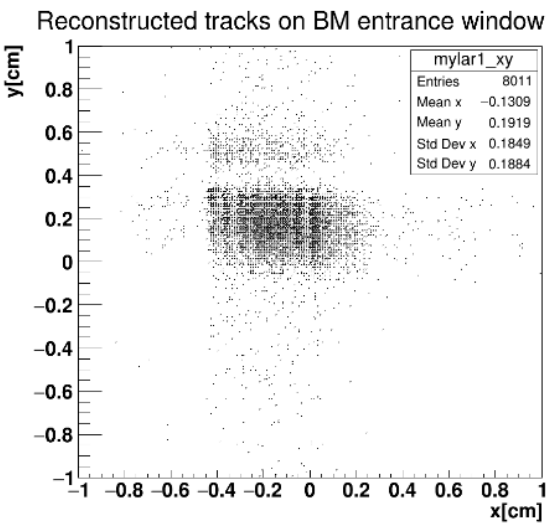
Expected irradiation pattern:

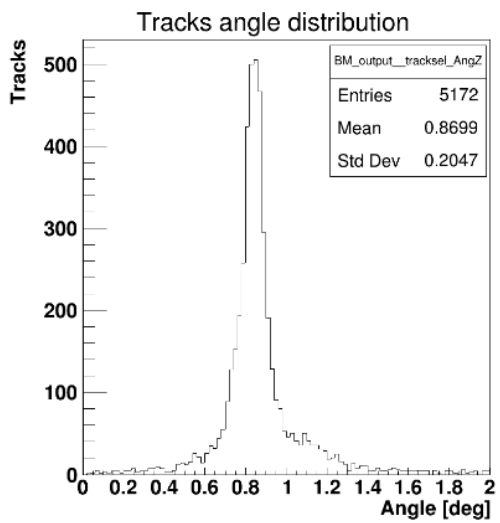
- 625 beam spots in 2.4 x 2.4 cm^2
- Beam step: 1 mm
- Number of particle per spot: 48
- Total number of particles: 30000

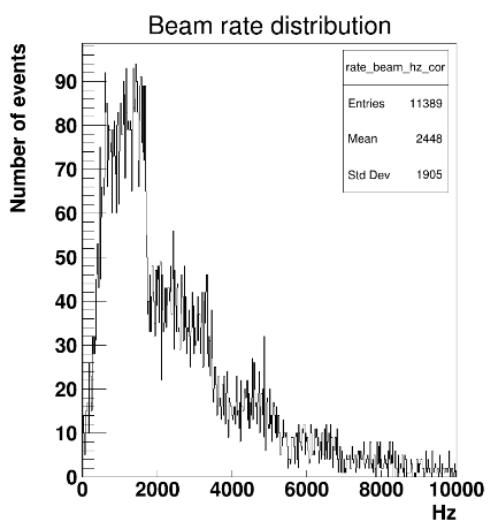
Mesured:

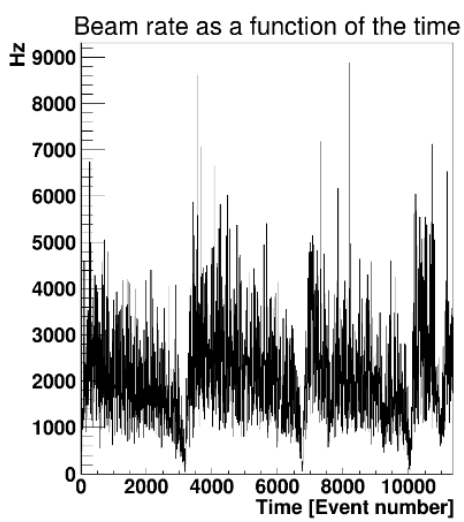
- Total irradiated area ~ 2.5 x 2.5 cm^2
- No double particles counting from the ADC
- Stable number of particles delivered among the repetitions.
- C target: 30179 particles
  C2H4 target: 30199 particles

Characterization of the 700 MeV/u ^{12}C beam at GSI









The first FOOT internal note:

https://www.overleaf.com/read/kmbgydbrbsyn

Characterization of the ^{12}C beam at 700 MeV/u at GSI using the FOOT Beam Monitor

FOOT internal note number: 1

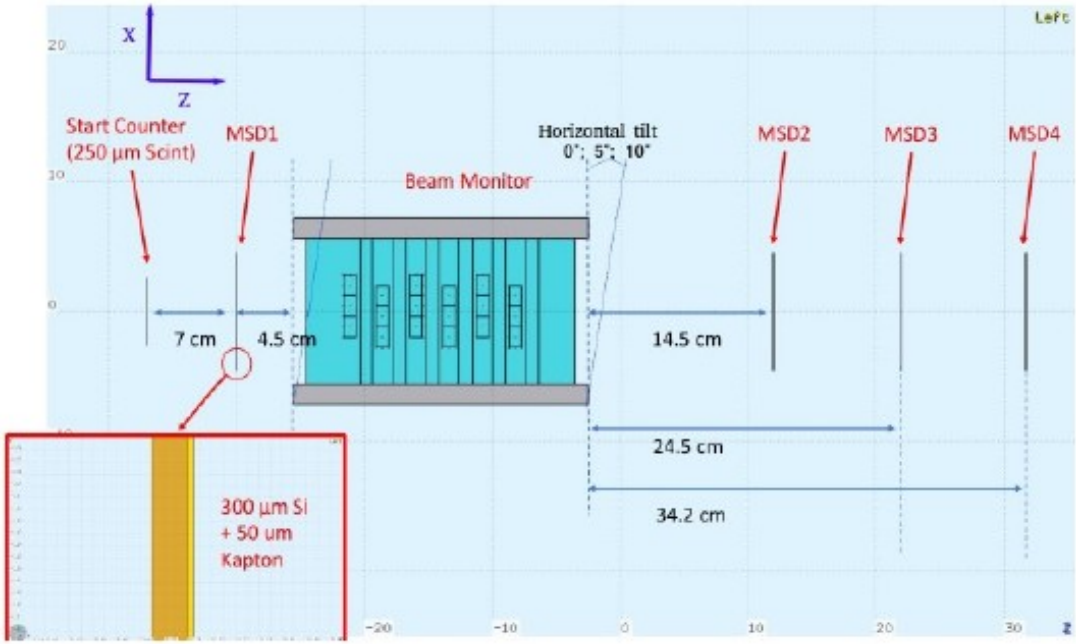
G. Battistoni[a], Y. Dong[a,b], I. Mattei[a], S. Muraro[a], S. M. Valle[a]

[a] *Istituto Nazionale di Fisica Nucleare (INFN), Section of Milano, Milano, Italy*
[b] *University of Milano, Department of Physics, Milano, Italy*

Abstract

The emulsion setup of the FOOT experiment has been exposed at GSI with a beam of ^{12}C ions at 700 MeV/u, with both C and C_2H_4 targets. A plastic scintillator and a drift chamber have been adopted to characterize the beam properties. In particular it was possible to verify that the beam had a Gaussian shape with standard deviation of 0.2 cm and an angular spread of 0.2°. Since we asked for a beam with low intensity, a stable beam with a mean rate of 2.4 kHz has been provided. About 30200 particles distributed on an area of $2.5 \times 2.5\text{cm}^2$ have been delivered on the FOOT emulsion setup, as requested by a specific irradiation pattern.

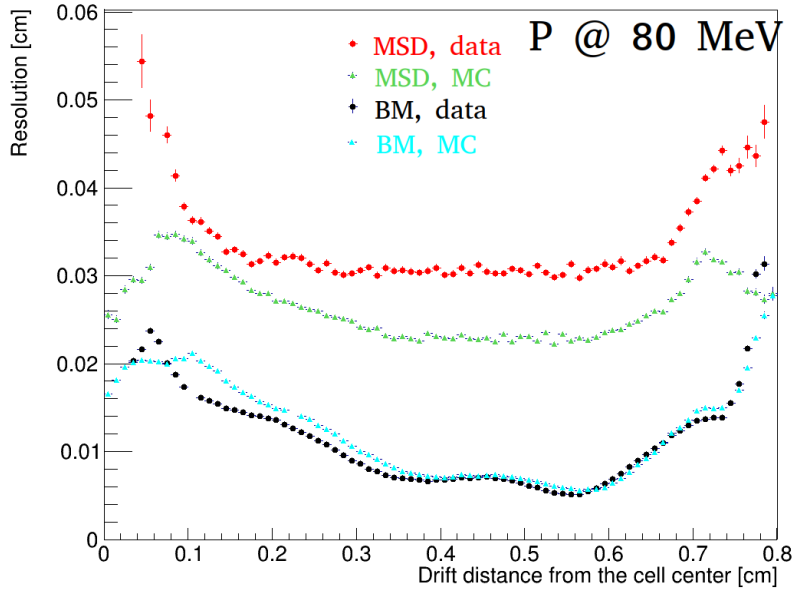
BM–MSD calibration with P @ Trento

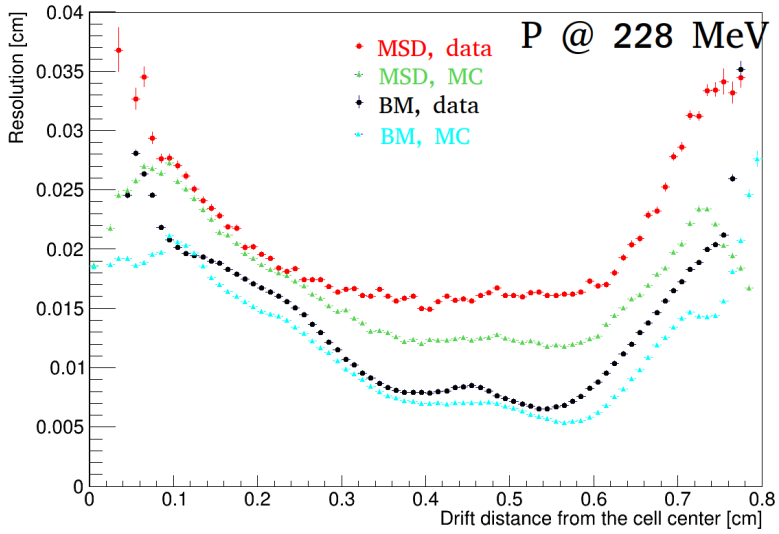


BM Space-time relation calibration and performance assessment conducted at Trento with protons at 228 and 80 MeV

- Technical paper prepared and reviewed by the EB.
- FOOT internal review deadline: 18/06

Spatial resolution results





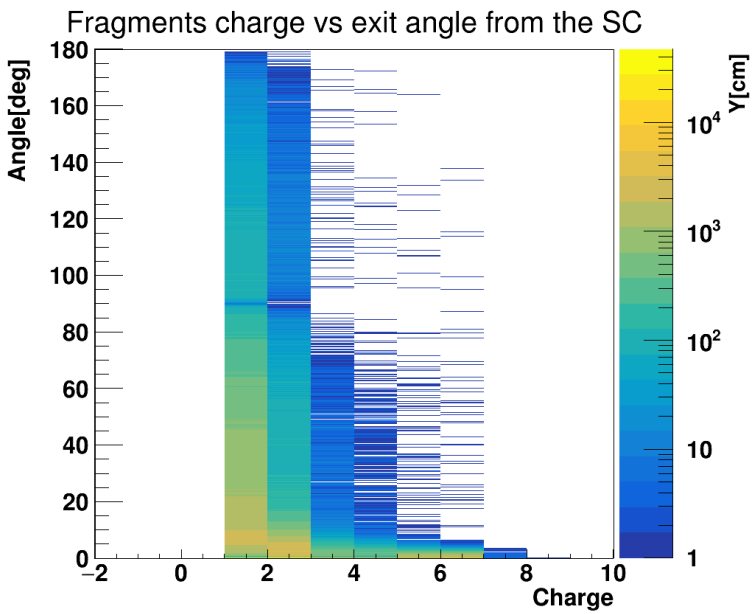
Method BM
Resolution as the residual between the **BM** fitted track and the hit distance meas.

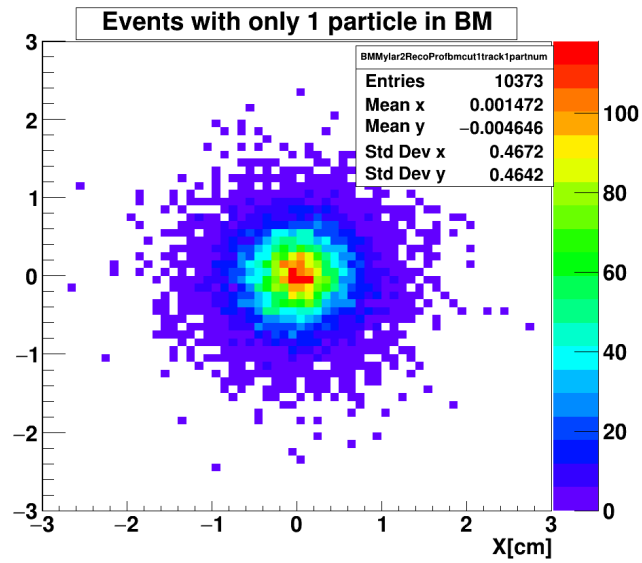
- Use only the BM hits and tracks
- Depends on the space time relations
- Depends on the BM reconstruction algorithm and selection criteria.
- MCS negligible

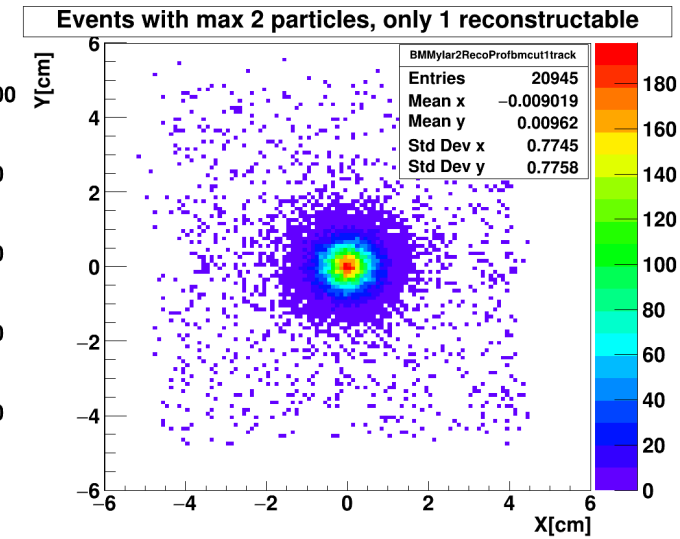
Method MSD
Resolution as the residual between the **MSD** track and the BM distance measurements.

- Use an external independent detector
- Depends on the space time relations
- No dependence on BM reconstruction algorithm
- MCS effect included

Events with fragmentation in SC







MC simulation: 12C beam @ 200 MeV/u on C target

Pre target region fragmentation rate:

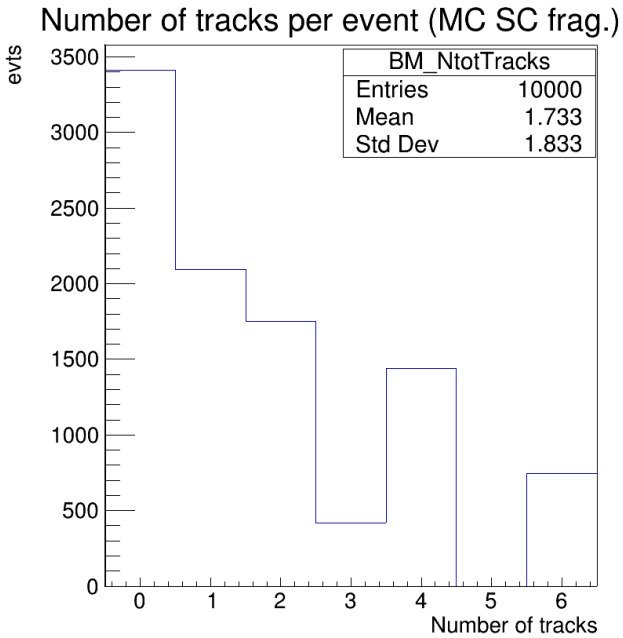
- Target ~ 1.46%
- Start Counter ~ 0.13%
- Beam Monitor ~ 0.12%

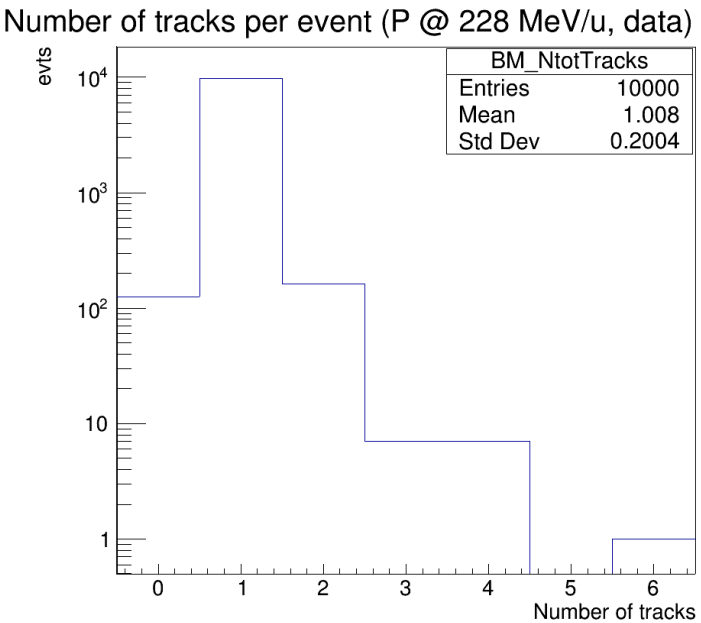
Events with fragmentation in SC:

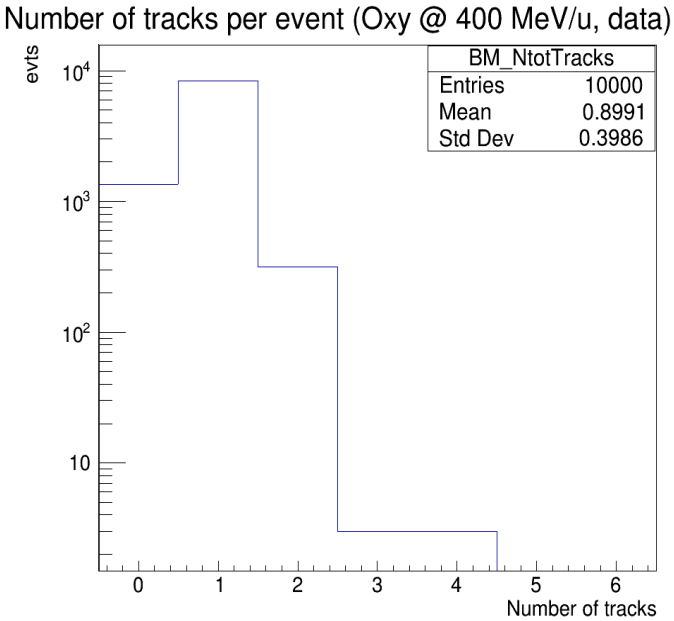
- About **10%** of the events have the same signature of non-fragmented events with only 1 B or C fragment crossing the BM
- About **21%** 1 reconstructable track + some hits from other particles

Multitrack selection

The BM reconstruction algorithm has been improved with the **multi-track capability**.







Select the events with only 1 reconstructed track:

- MC with SC frag: 21%
- Data with P @ 228 MeV: 97%
- Data with O @ 400 MeV/u: 83%

Software status

bm_calibration branch:

- Very old branch from the FIRST version of SHOE
- All the old reconstruction methods are still present.
- Adopted for the BM stand alone run.
- Space time relation self calibration tool ---> need to be exported in a stand alone code

bm_develop branch:

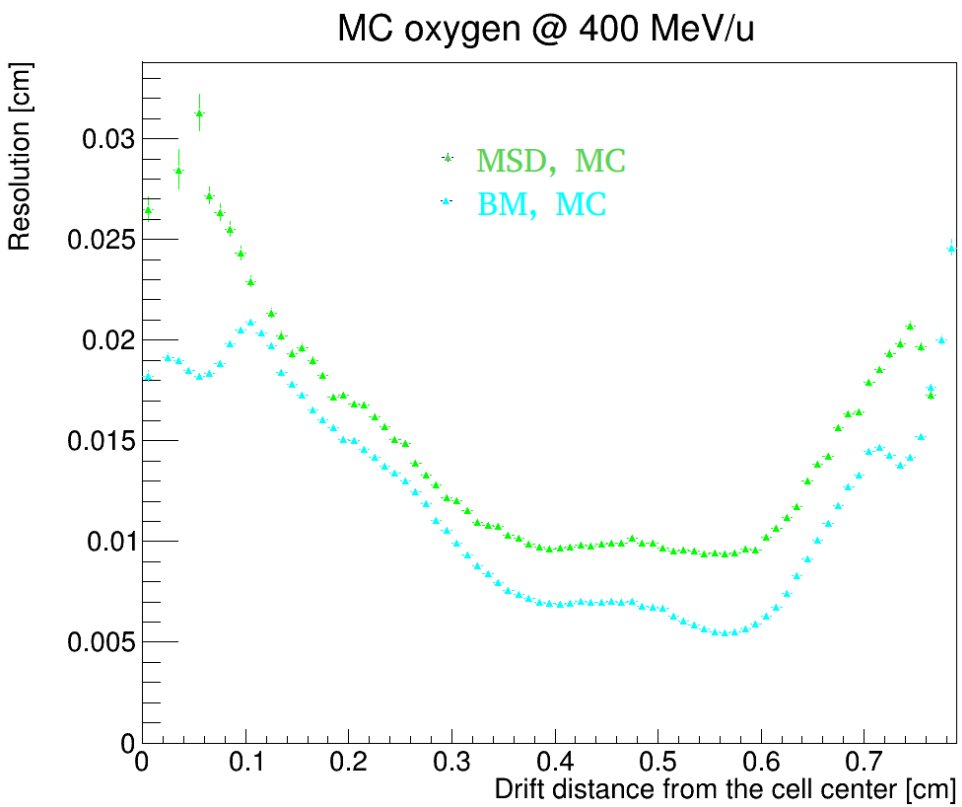
- From december 2019 master branch.
- Multi-track reconstruction capability.
- MC digitizer added.
- Ready for the merge with the master branch
- No relevant development are foreseen.

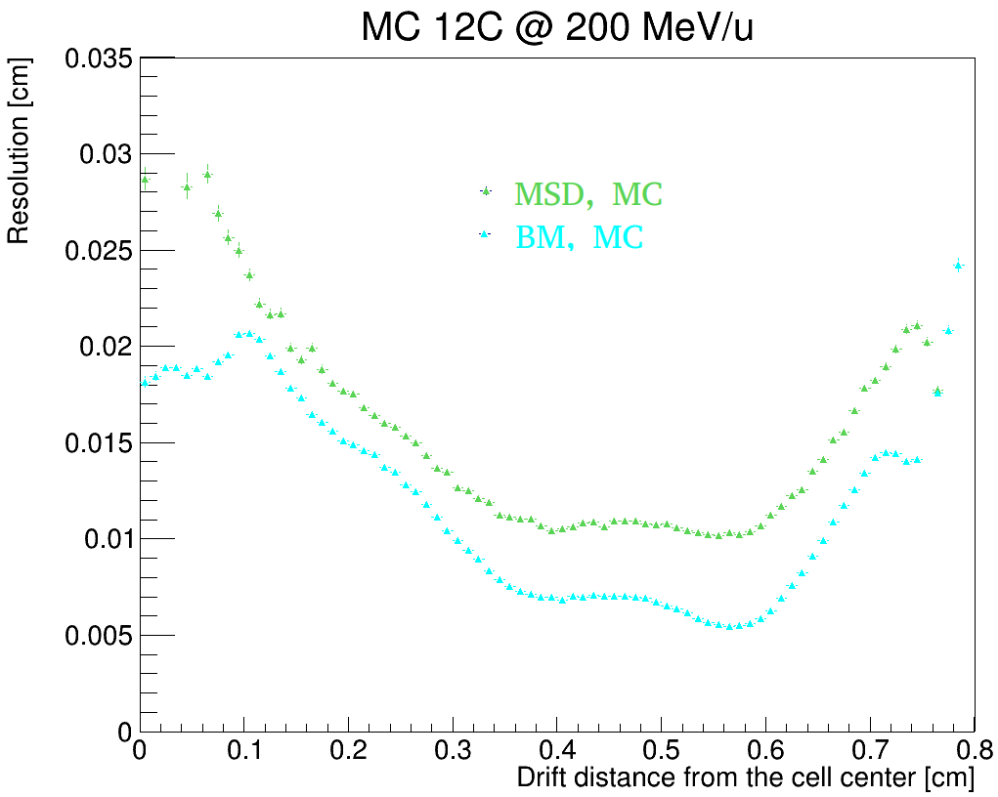
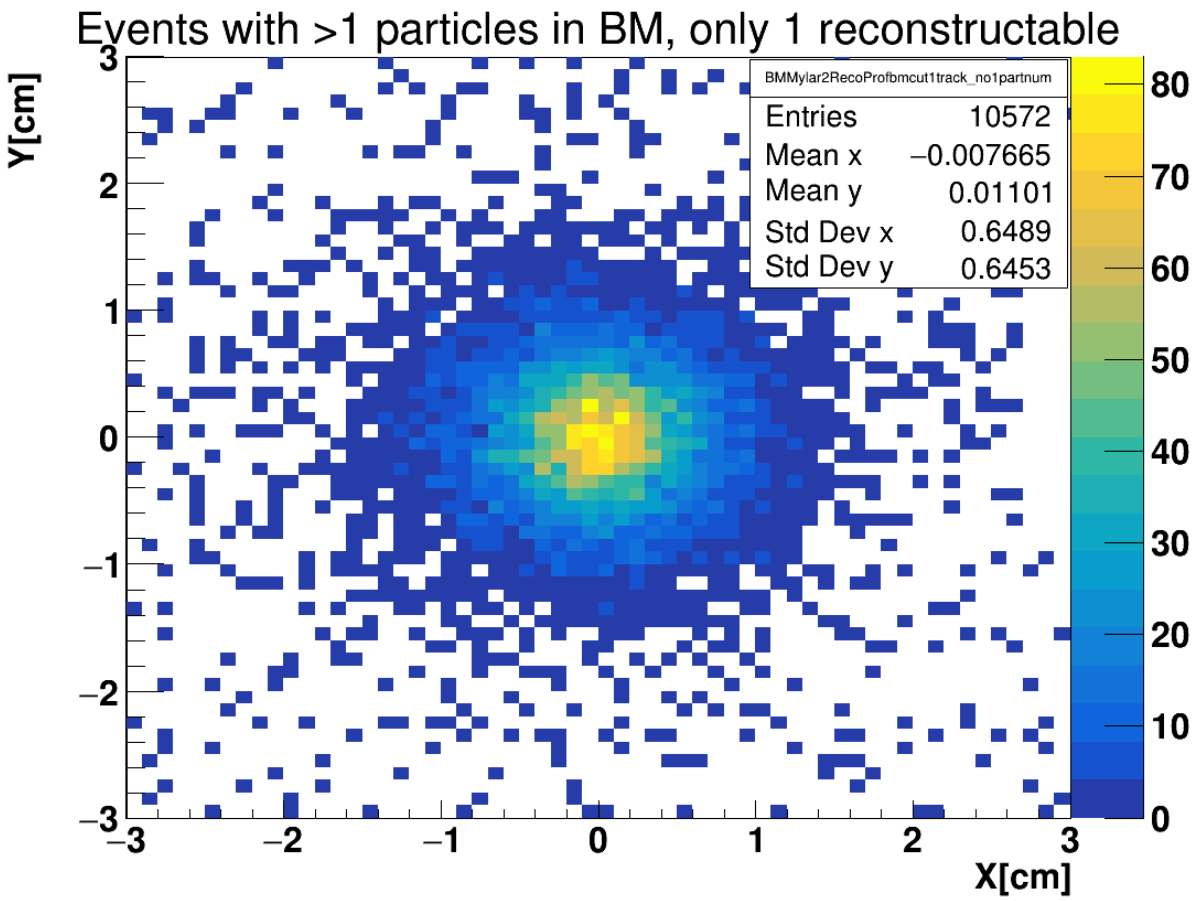
Future perspectives

- Study of the events in which the projectile fragmented in the BM
- BM performances for the inverse kinematic approach

Back Up

Spatial resolution: MC studies





Events with fragmentation in SC