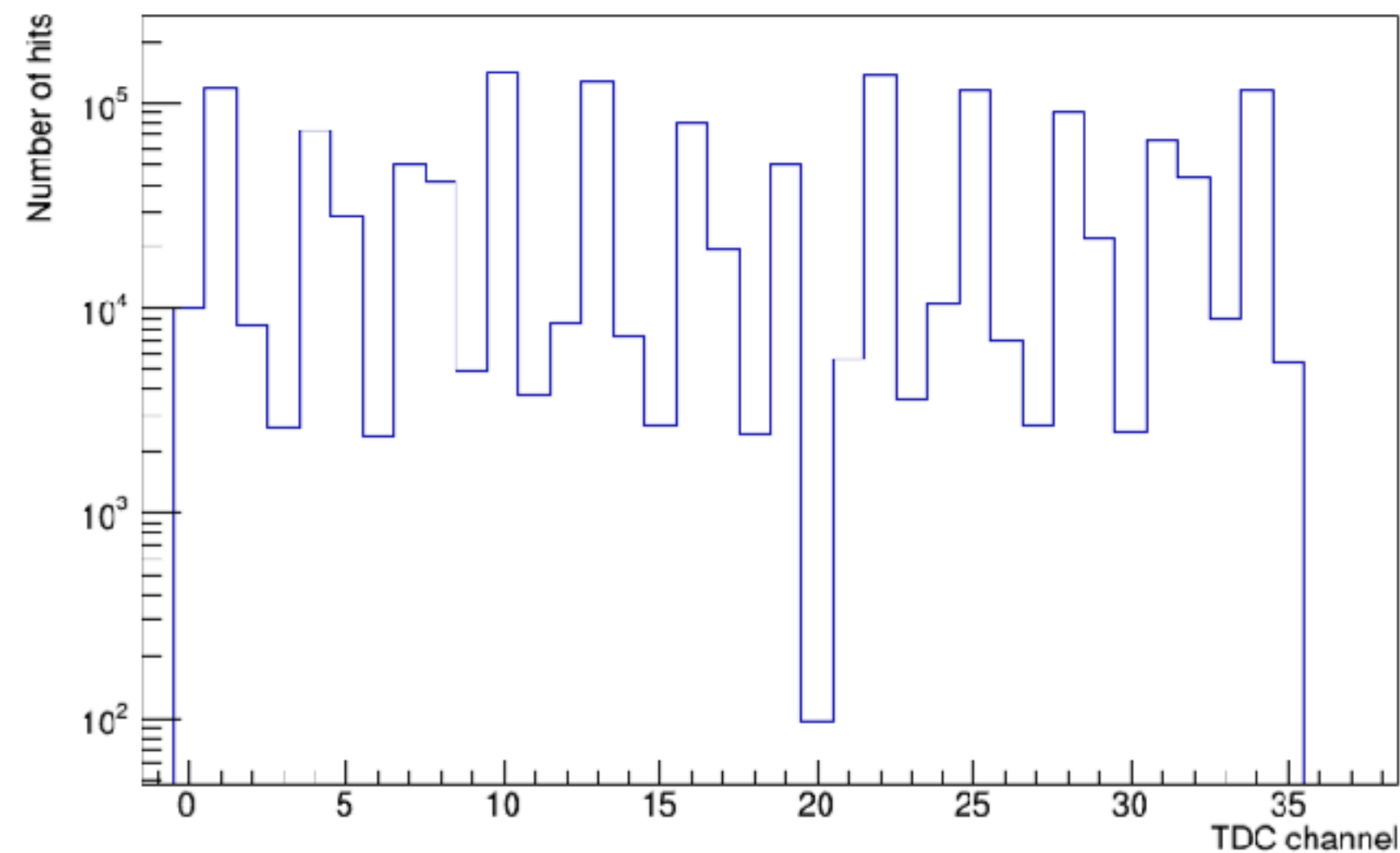
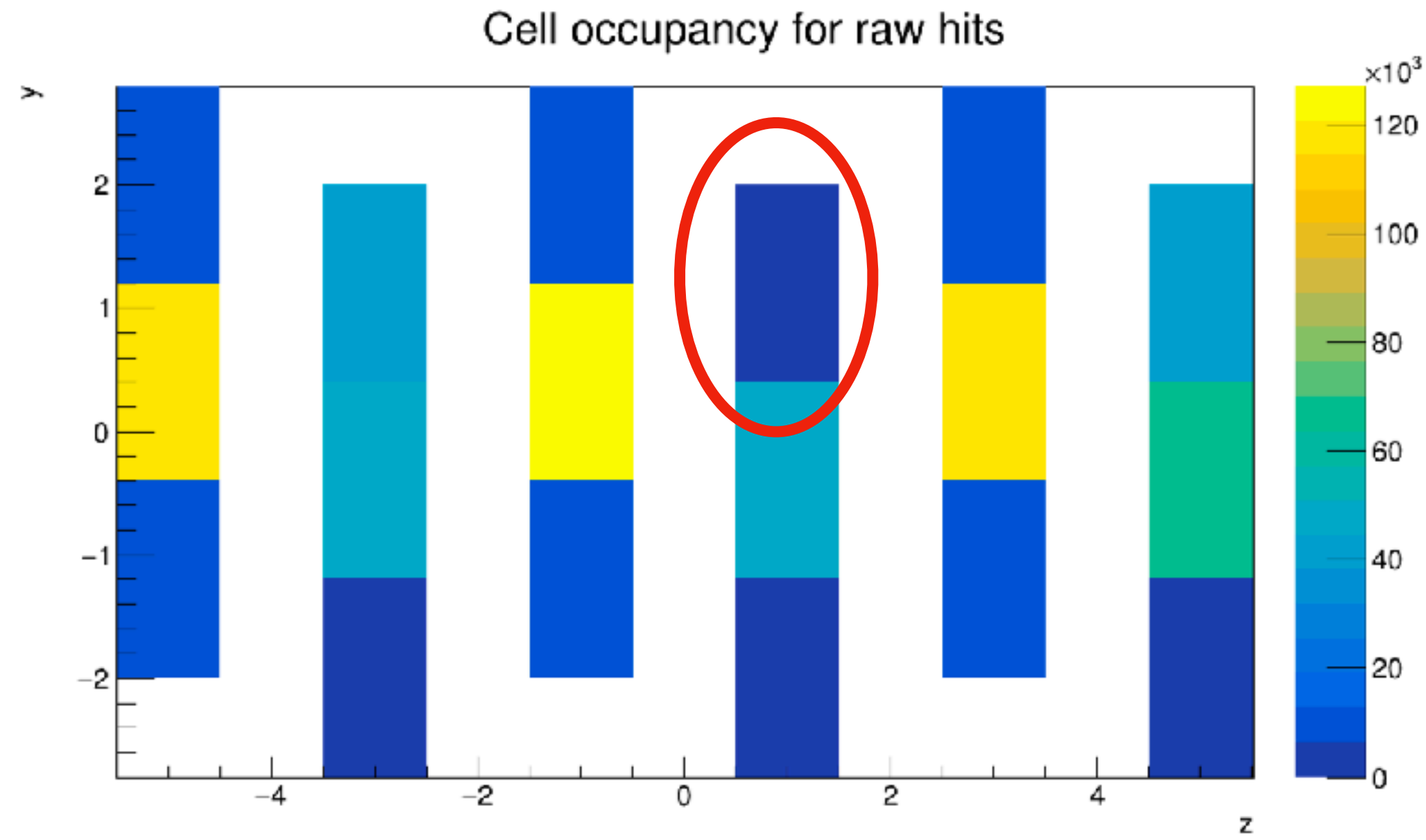


# BM updates

FOOT performance meeting  
Yunsheng Dong  
07/02/2024

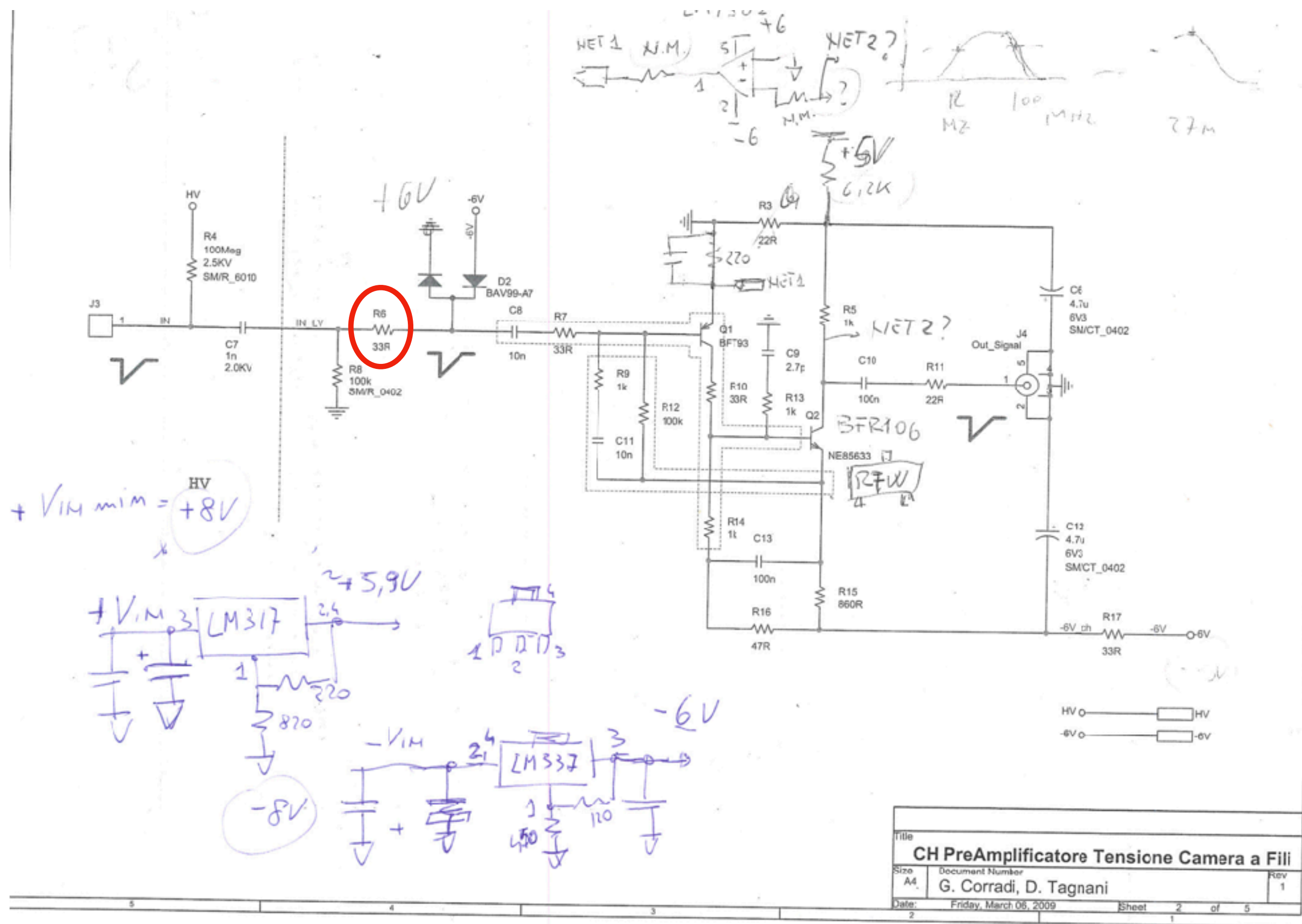
# Dead channel

*At the general meeting:*



- One of the BM cell didn't work properly. The signals were too low and not properly shaped.
- Need to check the channel in the Lab (the detector is at CNAO at the moment)
- Due to the redundancy, this effect can be mitigated, but it's not negligible

# Channel fix



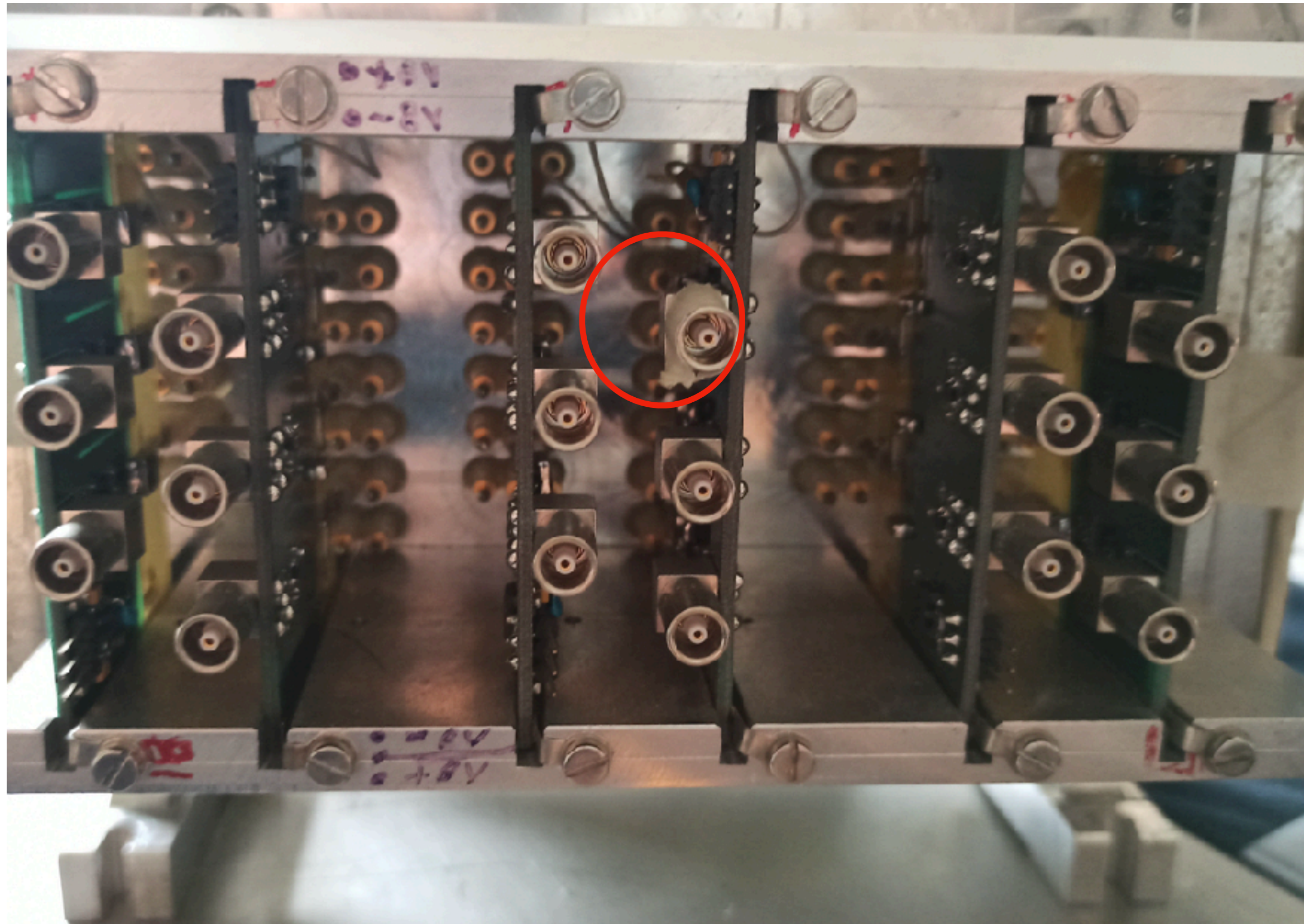
- We tested the channel in the laboratory and find out a problem of connection
- One “safety” resistance was disconnected

So there were three possibility:

1. Unmount the readout board to fix the resistance
2. Try to extract the wire signal and create a custom additional preamplifier
3. Weld the wire

This electric scheme is of the miniDC, the BM scheme is lost, but it should be similar to this one

# Channel fix

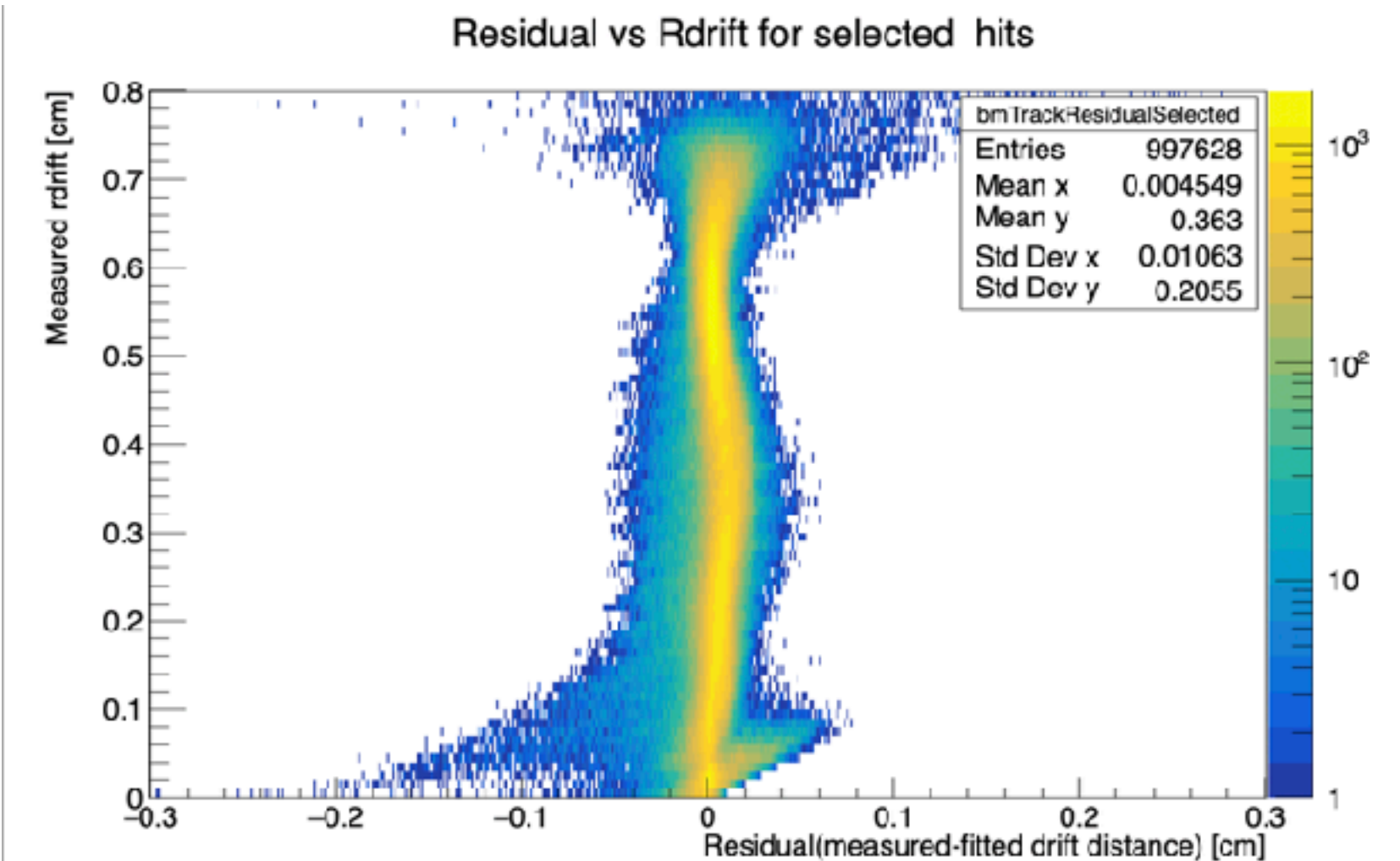
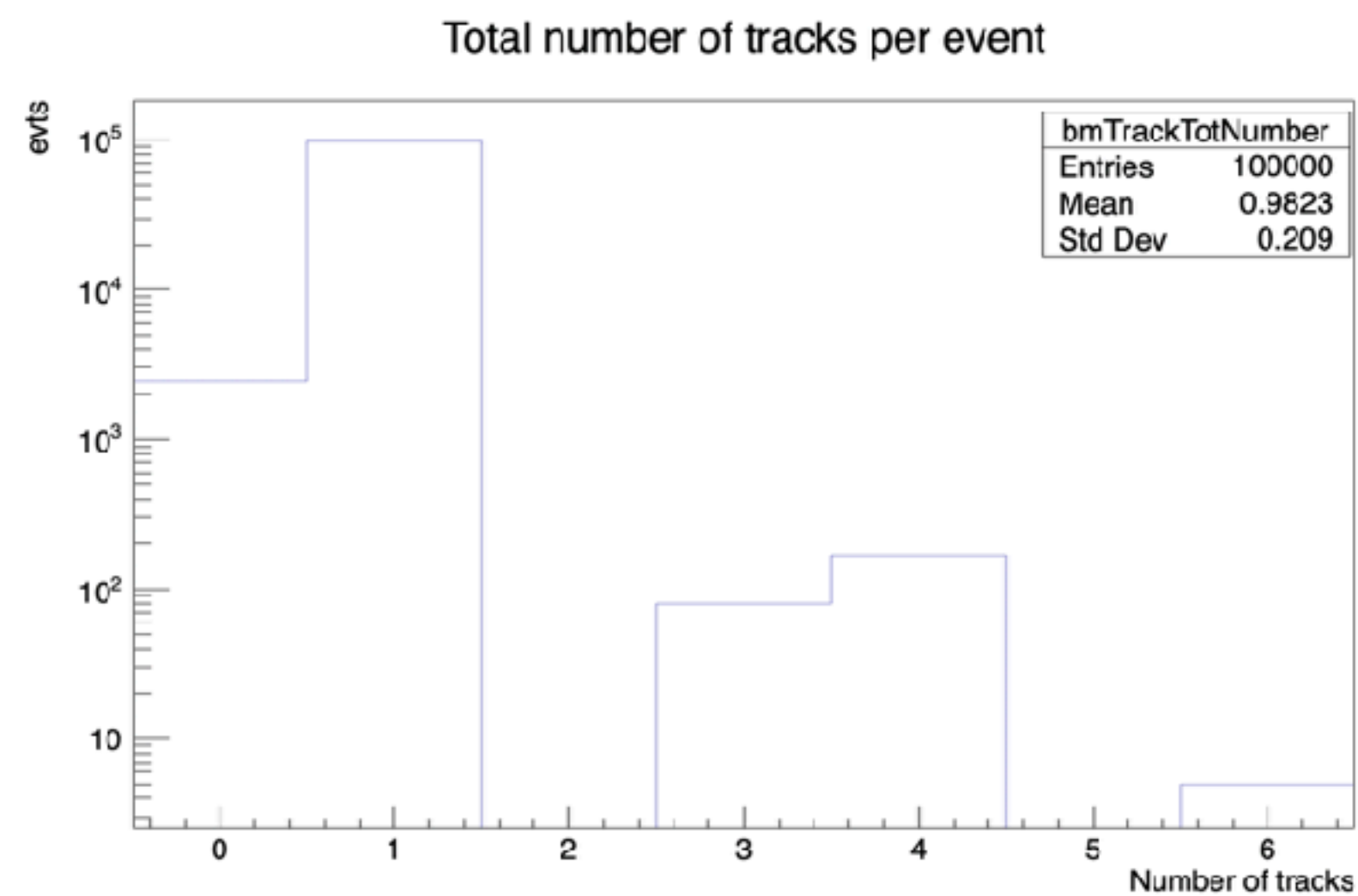
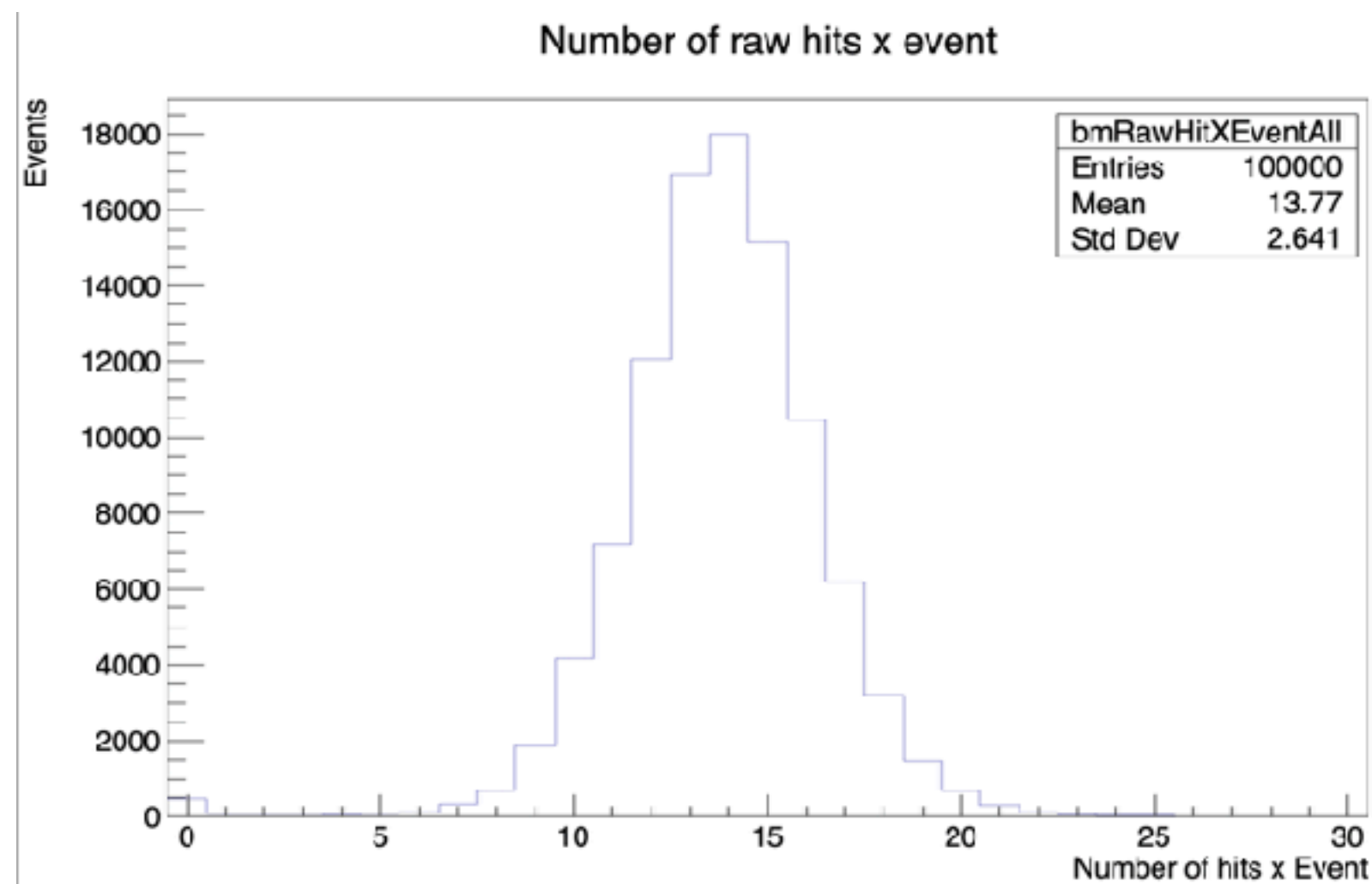


1. Possibility to fully restore the channel, but it is very risky (last time an expert electronics guy unmounted the readout board and broken a signal wire)
  2. Necessity to create a new readout board
  3. **“Easiest” solution, the lack of the resistance should have a negligible impact (higher signal) that can be compensated by the discriminator threshold**
- **The solution 3 worked!**

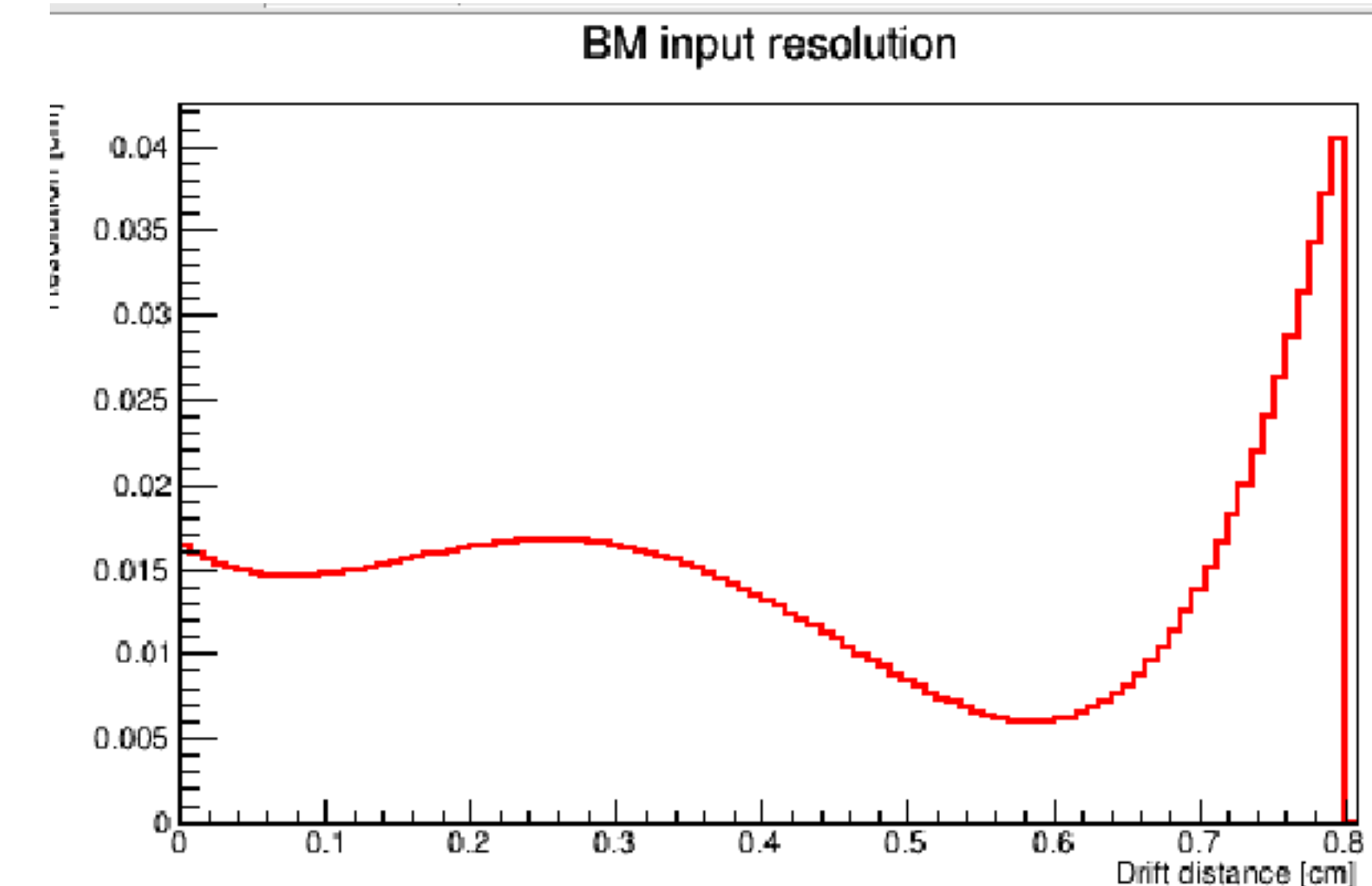
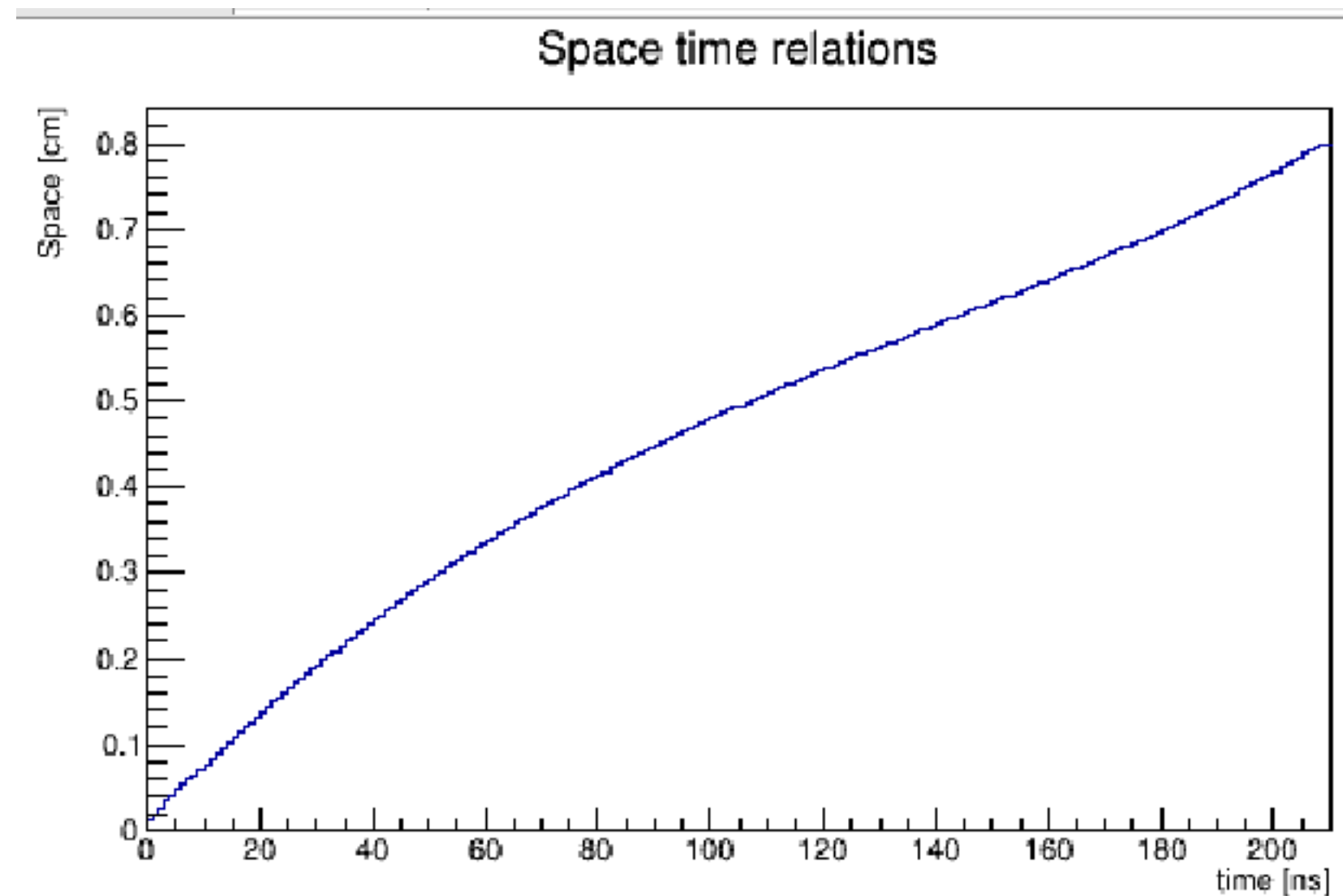
# To do list

*At the general meeting:*

- Re-process of all the past campaigns ongoing, optimising the tracking parameters
- e.g.: CNAO2022, 5466: track efficiency  $\sim 97-98\%$ , Space time relation and spatial resolution not fully optimized



# BM @ GSI2021: optimization

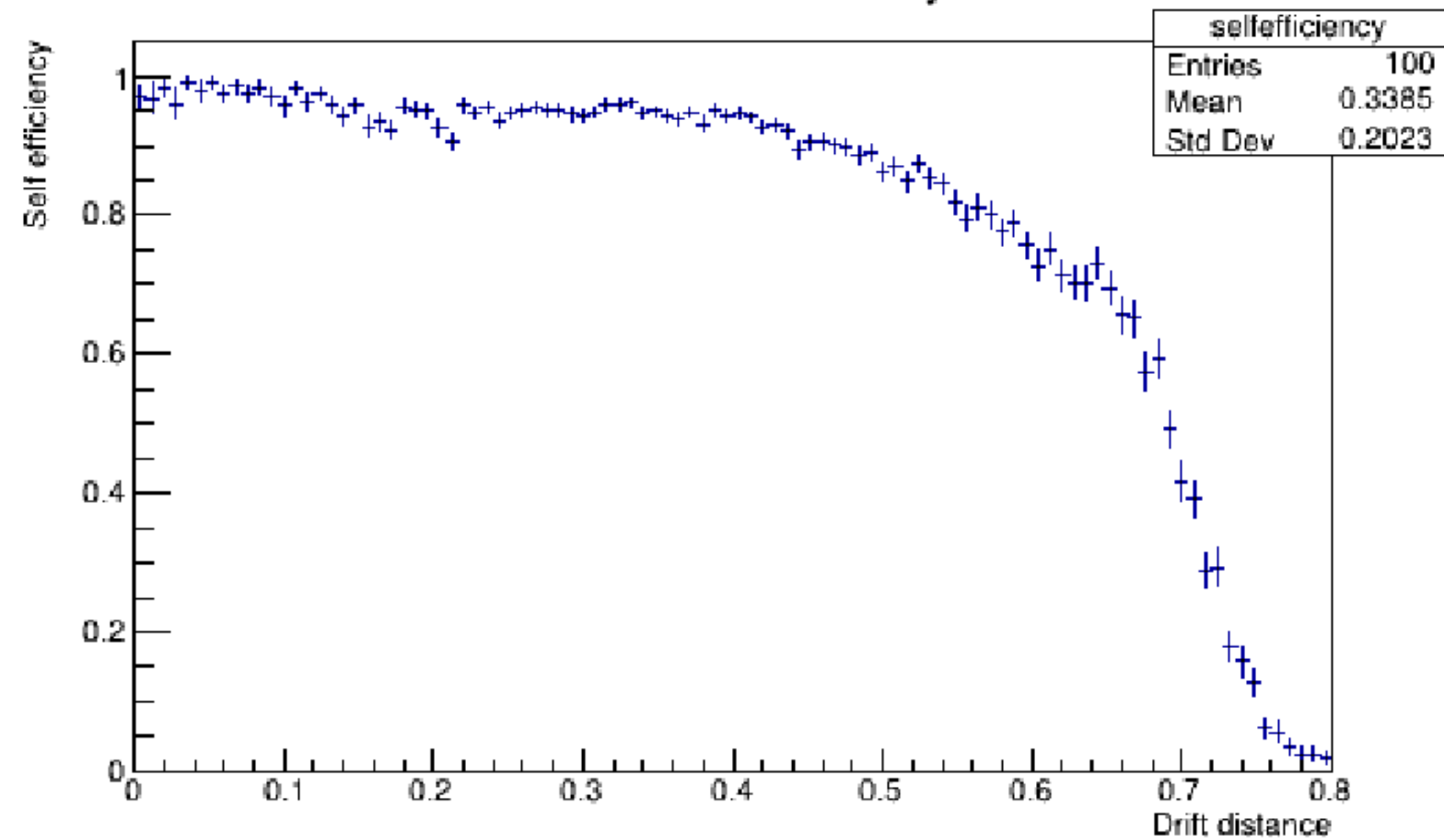


- “Maximum priority to GSI2021 for the cross section analysis” semicit.
- The BM Space time relations, tracking parameters and efficiencies has been optimised for the GSI2021 campaign
- BM space time relations are optimised combining the BM and the VTX measurements
- If the VTX is not present, a self calibration algorithm is used
- Then the spatial resolution is calculated
- Thanks to Tier1-CONDOR, there is the possibility to decode different runs in just few hours!

(Check R.Zarella presentation: [https://agenda.infn.it/event/37748/contributions/217769/attachments/114089/163743/FOOT\\_XV\\_General\\_Tier1.pdf](https://agenda.infn.it/event/37748/contributions/217769/attachments/114089/163743/FOOT_XV_General_Tier1.pdf) or check the new FOOT TWIKI: <https://baltig.infn.it/asarti/shoe/-/wikis/HTCondor>)

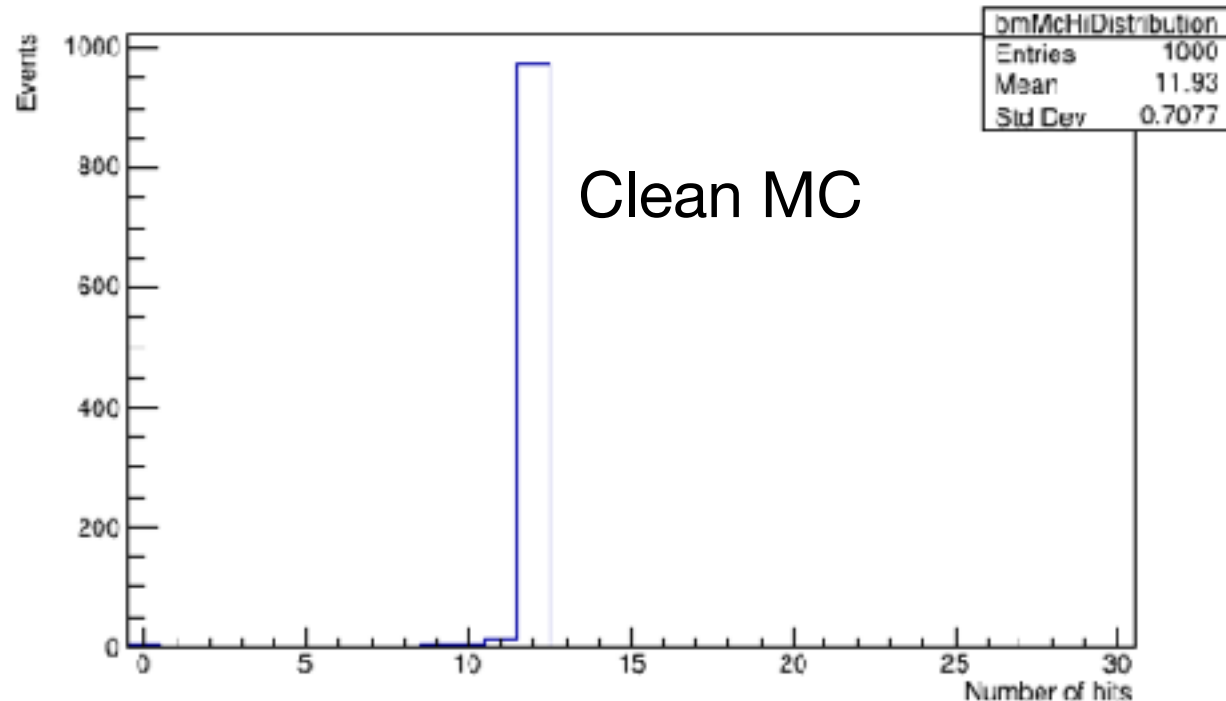
# BM @ GSI2021: efficiency

BM raw self efficiency

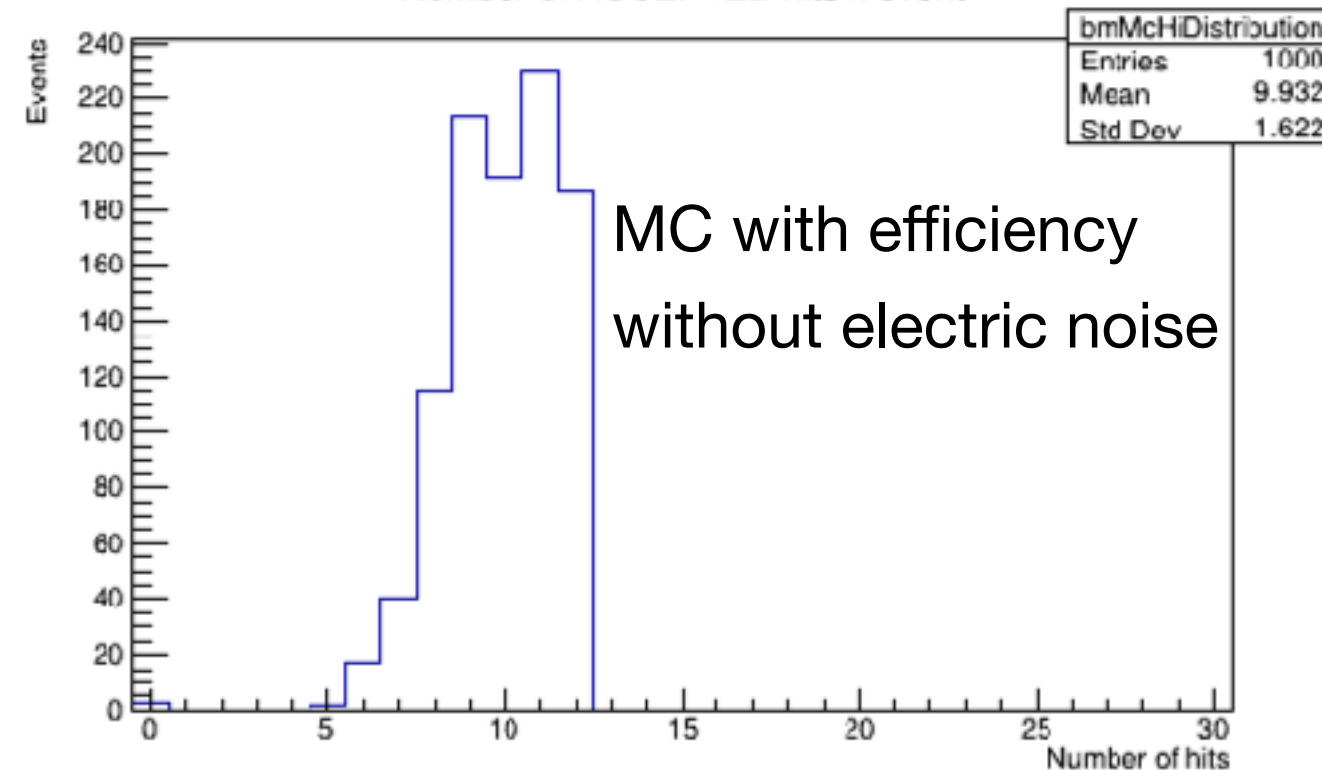


- The BM efficiency is calculated considering the BM tracks and checking the presence of a BM hit in a cell crossed by the track
- The spatial resolution and the efficiency and can be considered in the MC simulations.
- Also the noise is considered in the MC simulations if in FootGlobal.par  
EnableElecNoiseMc: y
- The tuning of the BM noise has been done considering the experimental number of raw hit distribution

Number of ACCEPTED hits x event



Number of ACCEPTED hits x event

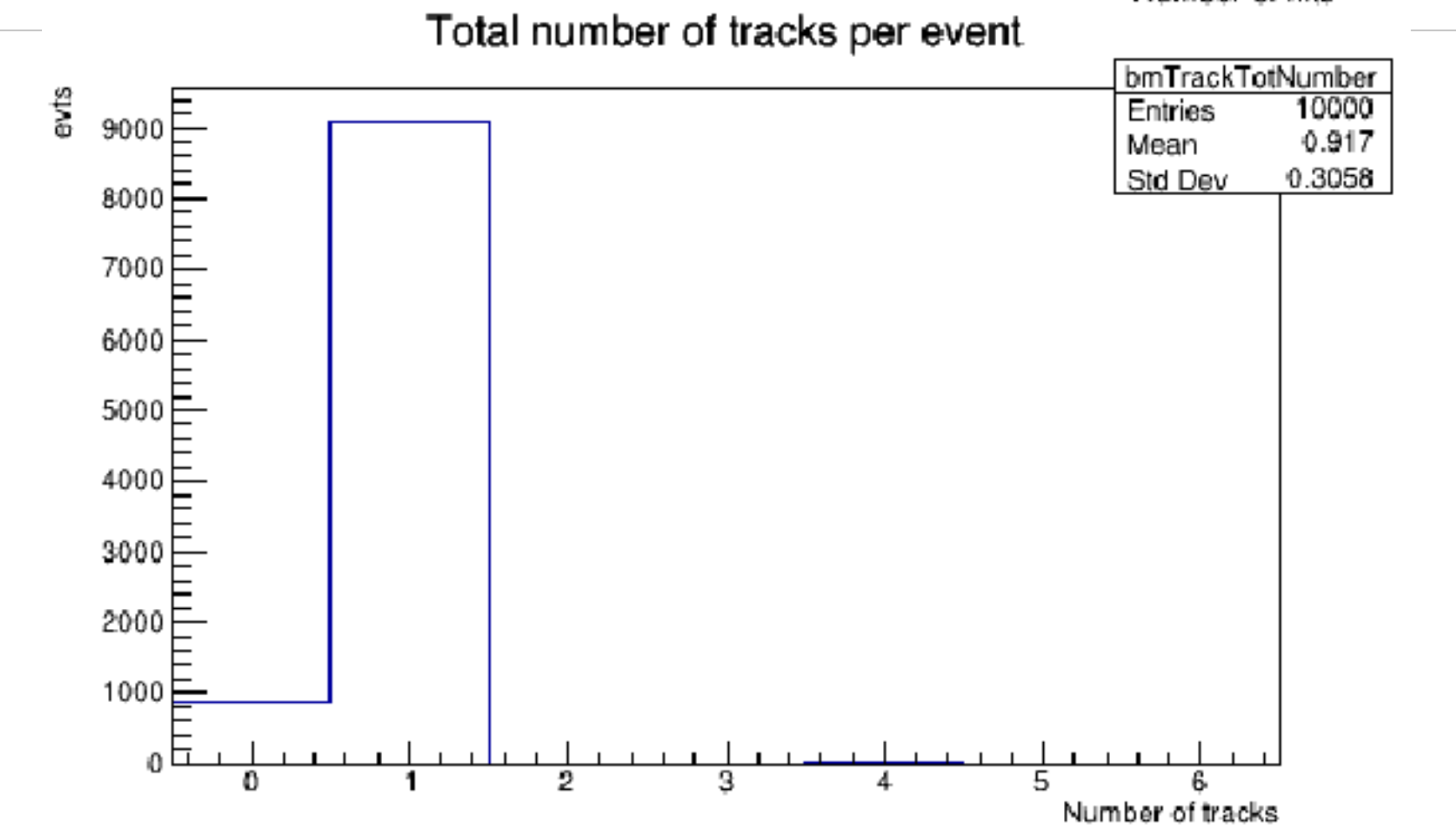
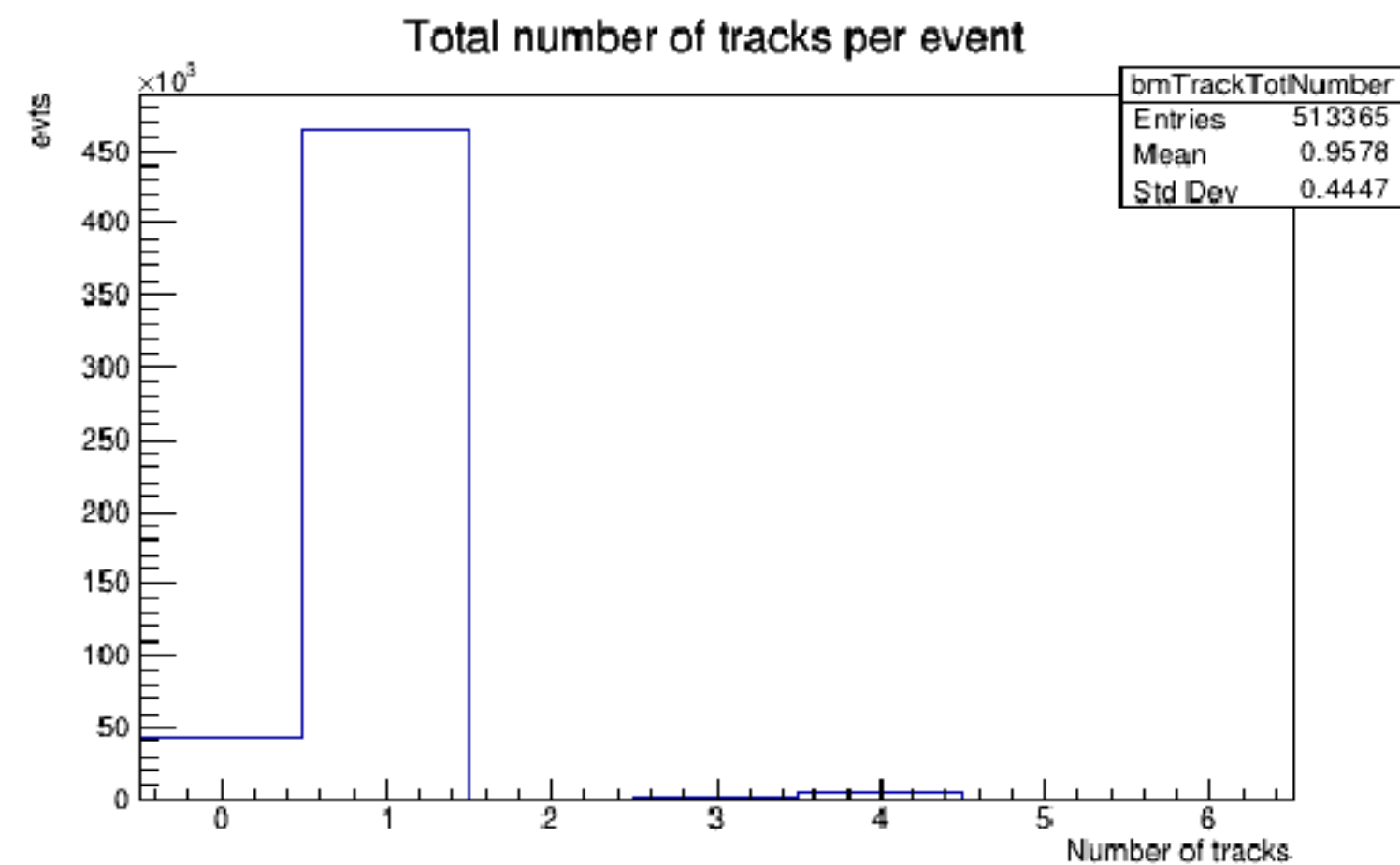
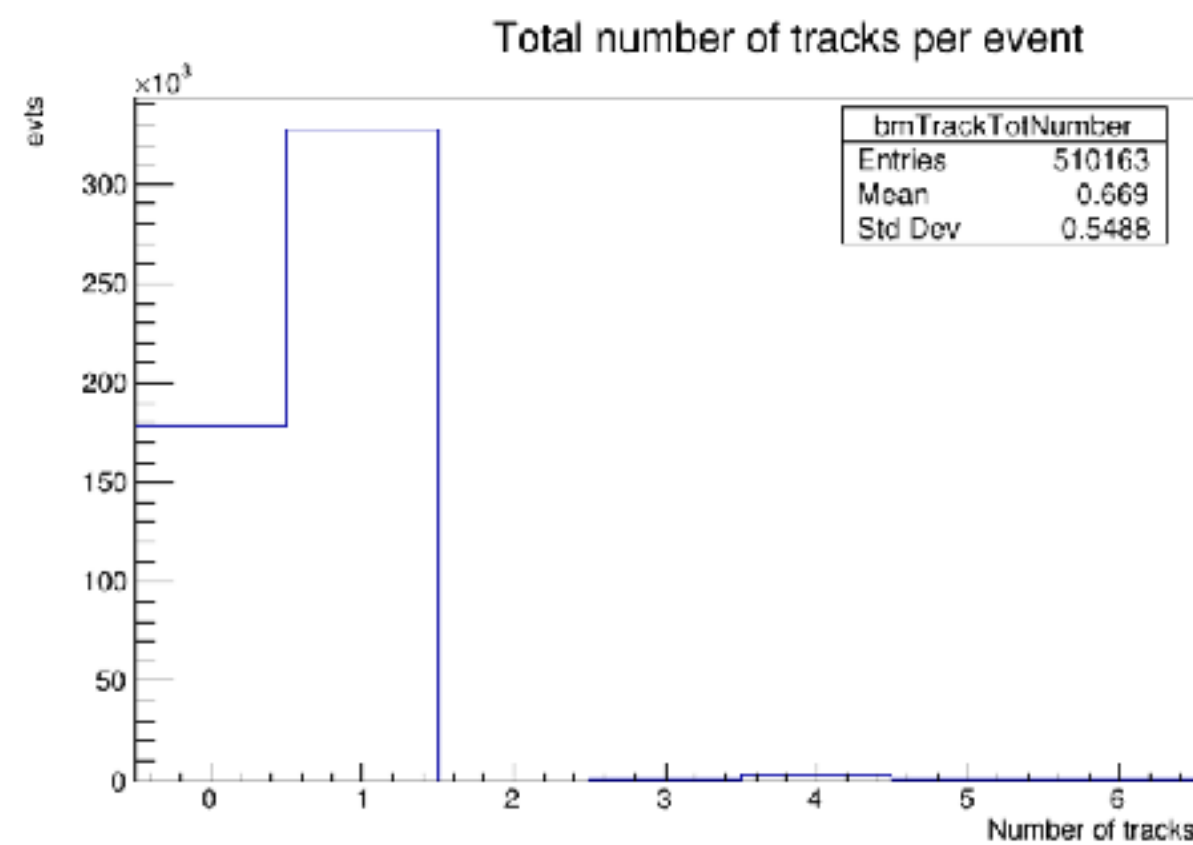
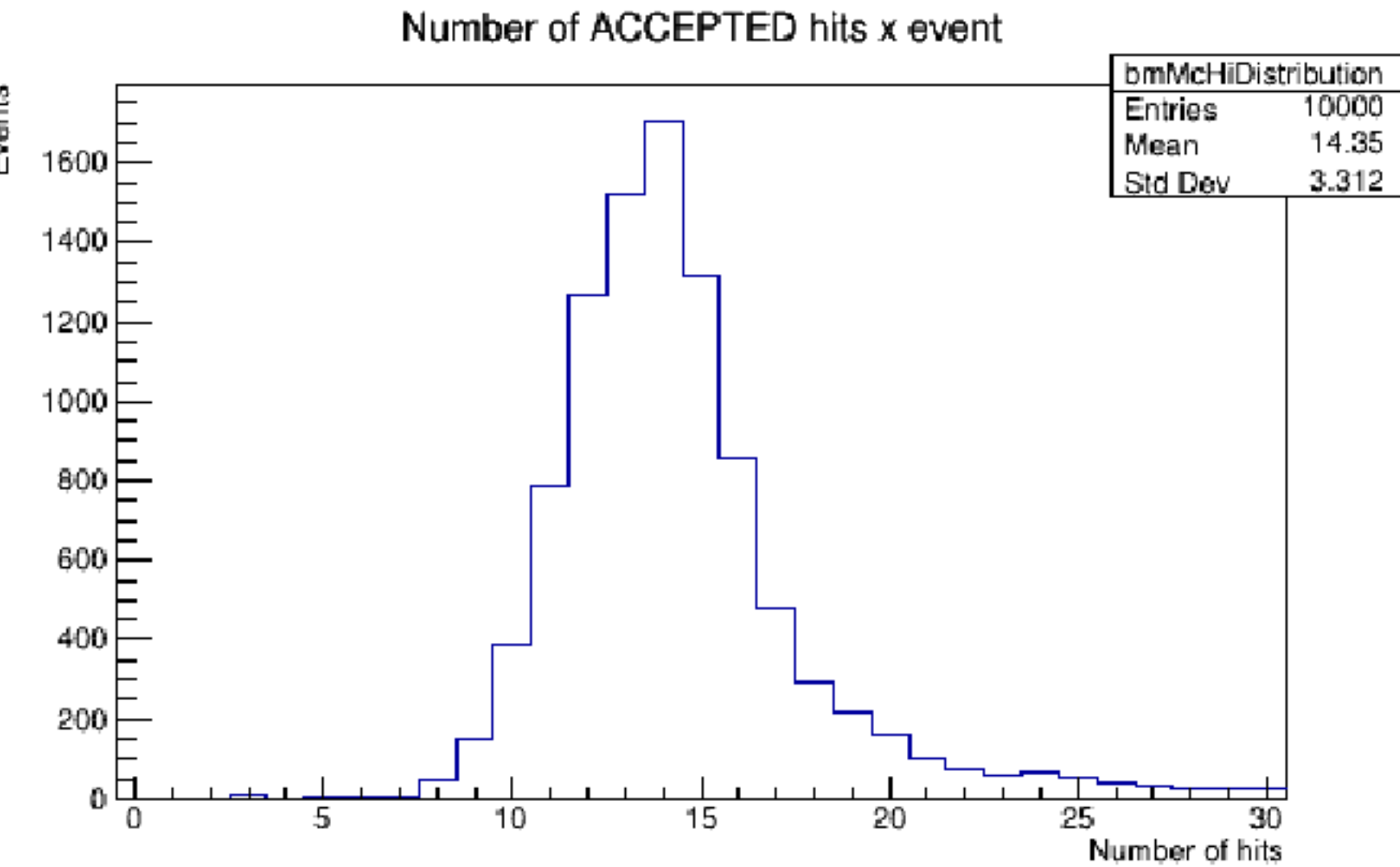
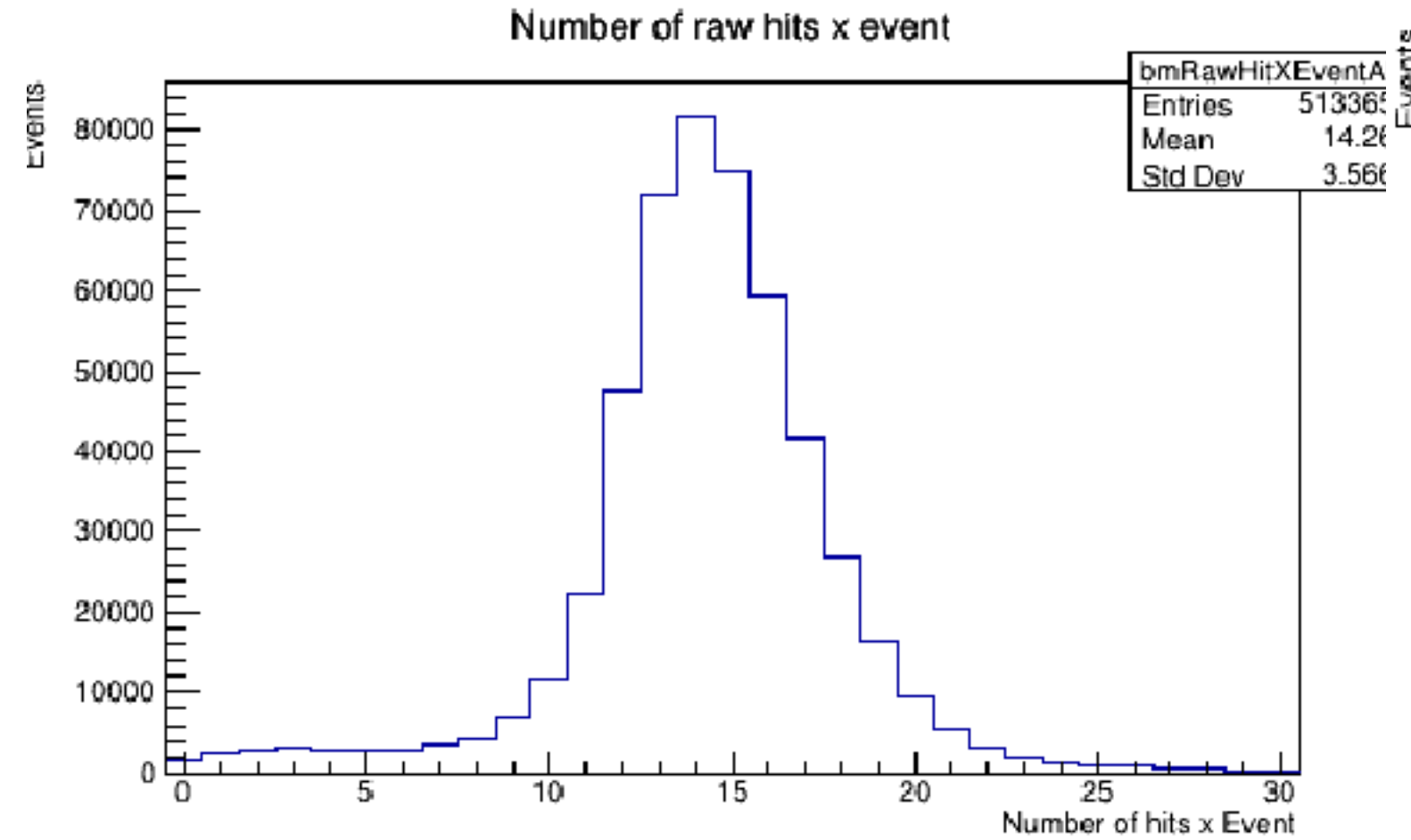
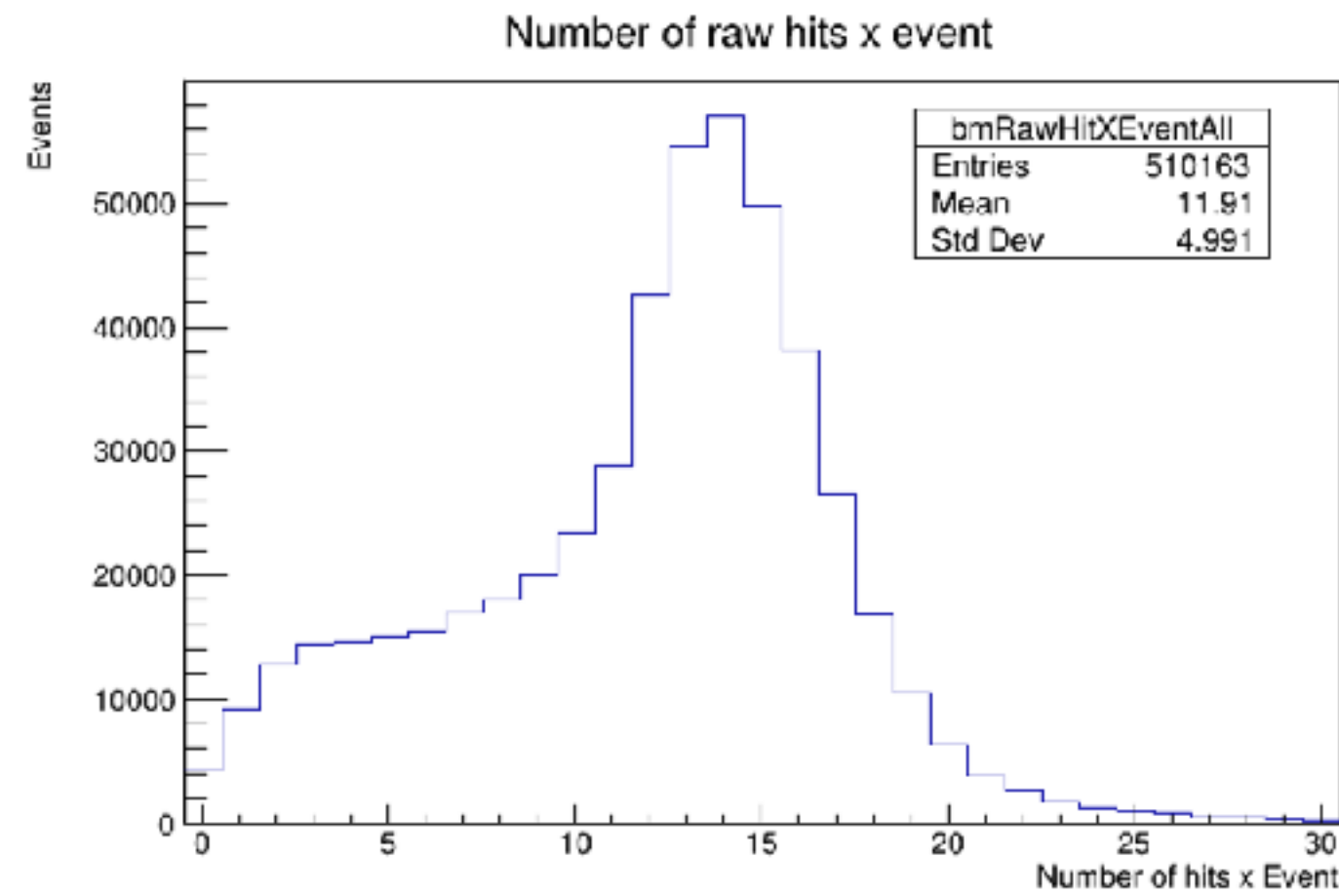


# BM @ GSI2021: data vs MC

DATA: Frag (4308)

DATA: Majority (4307)

MC



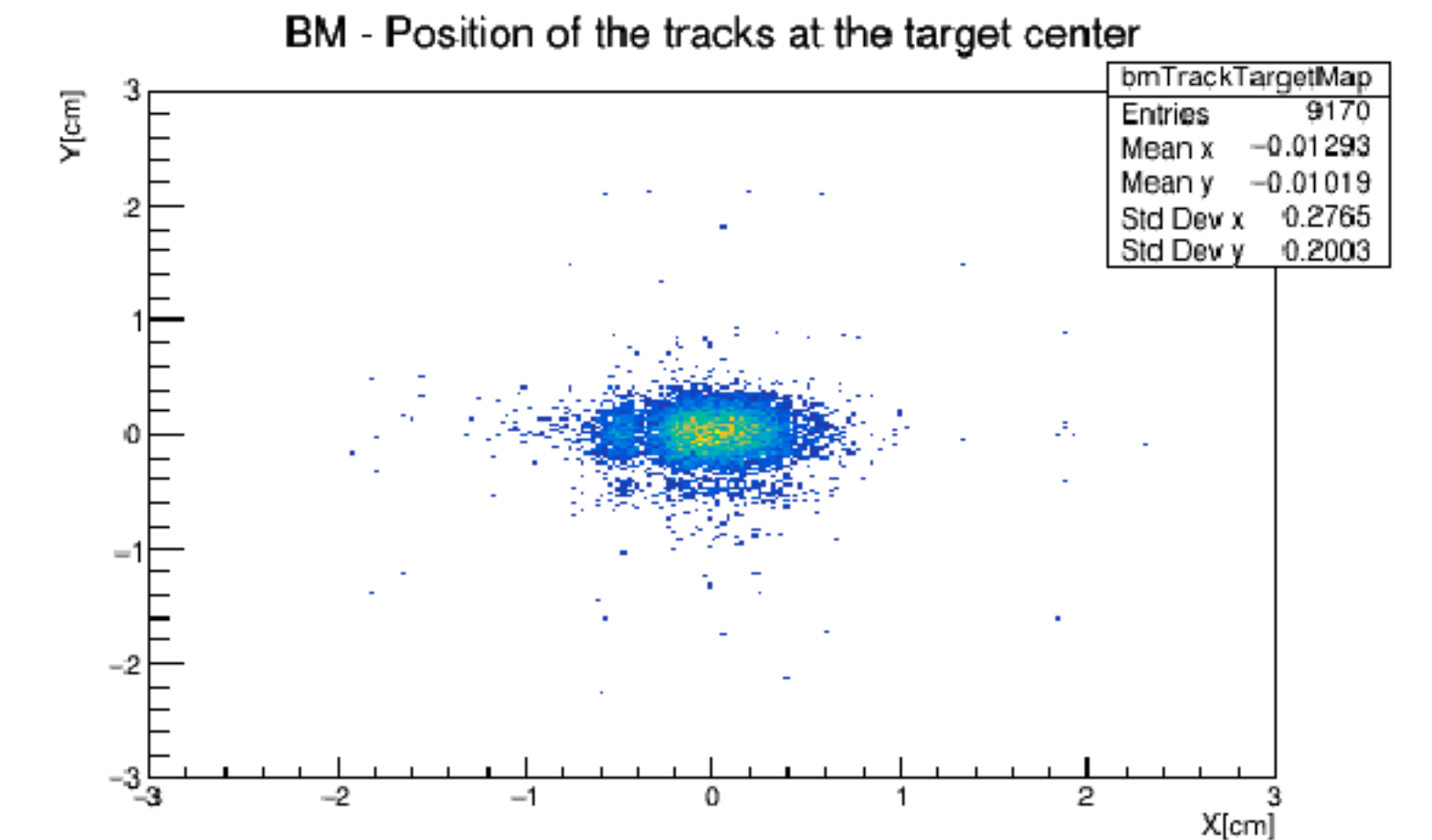
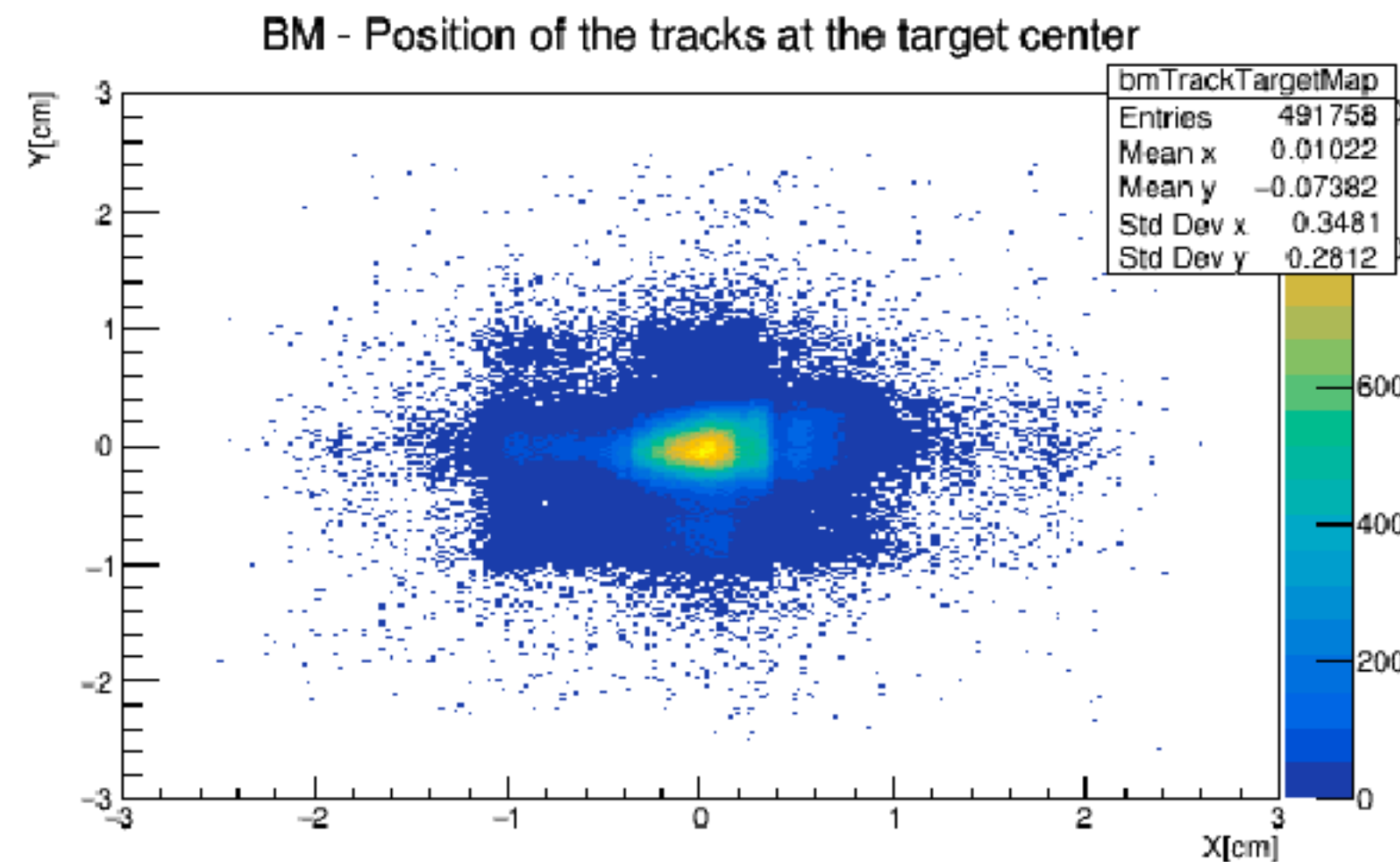
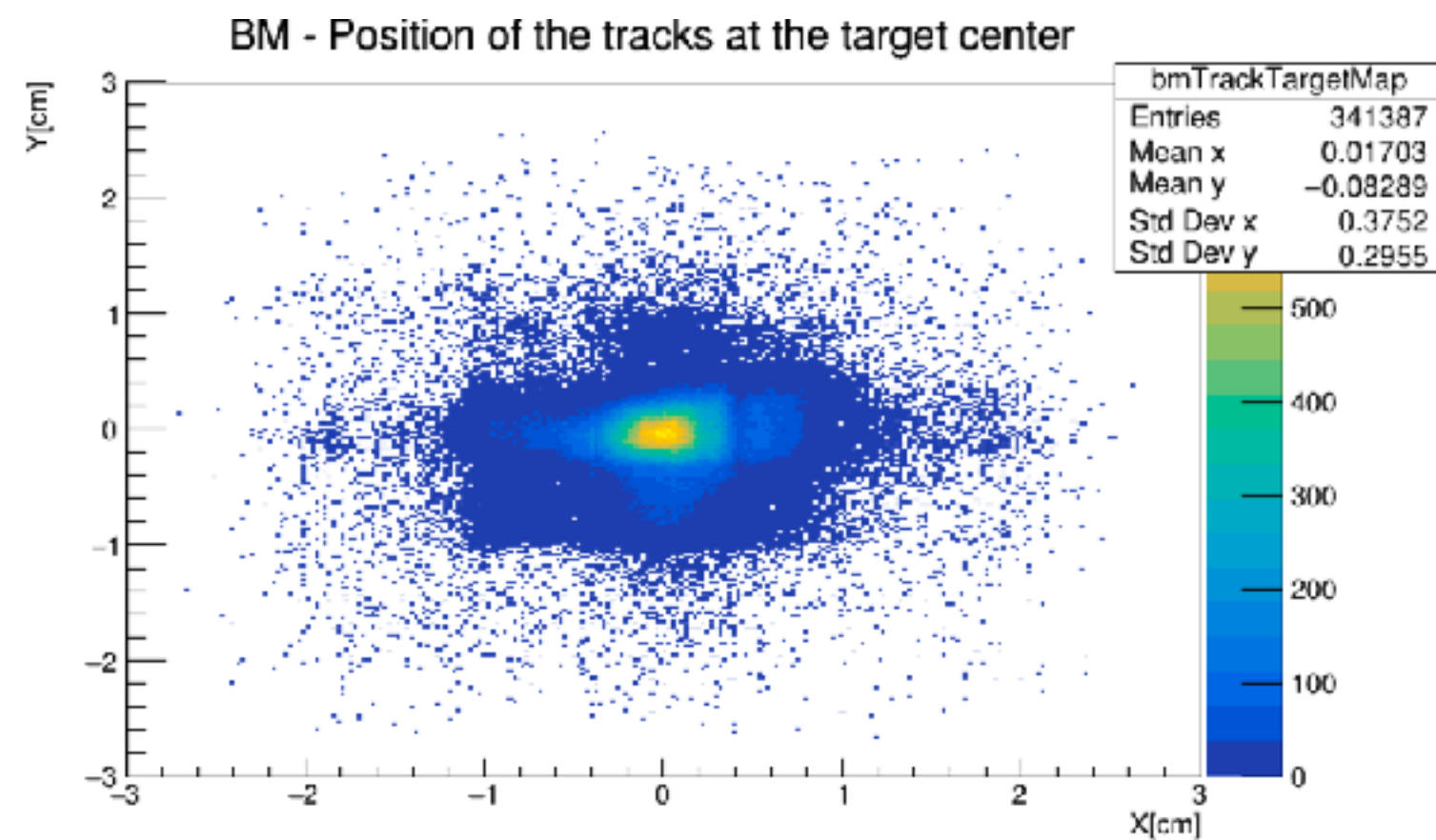
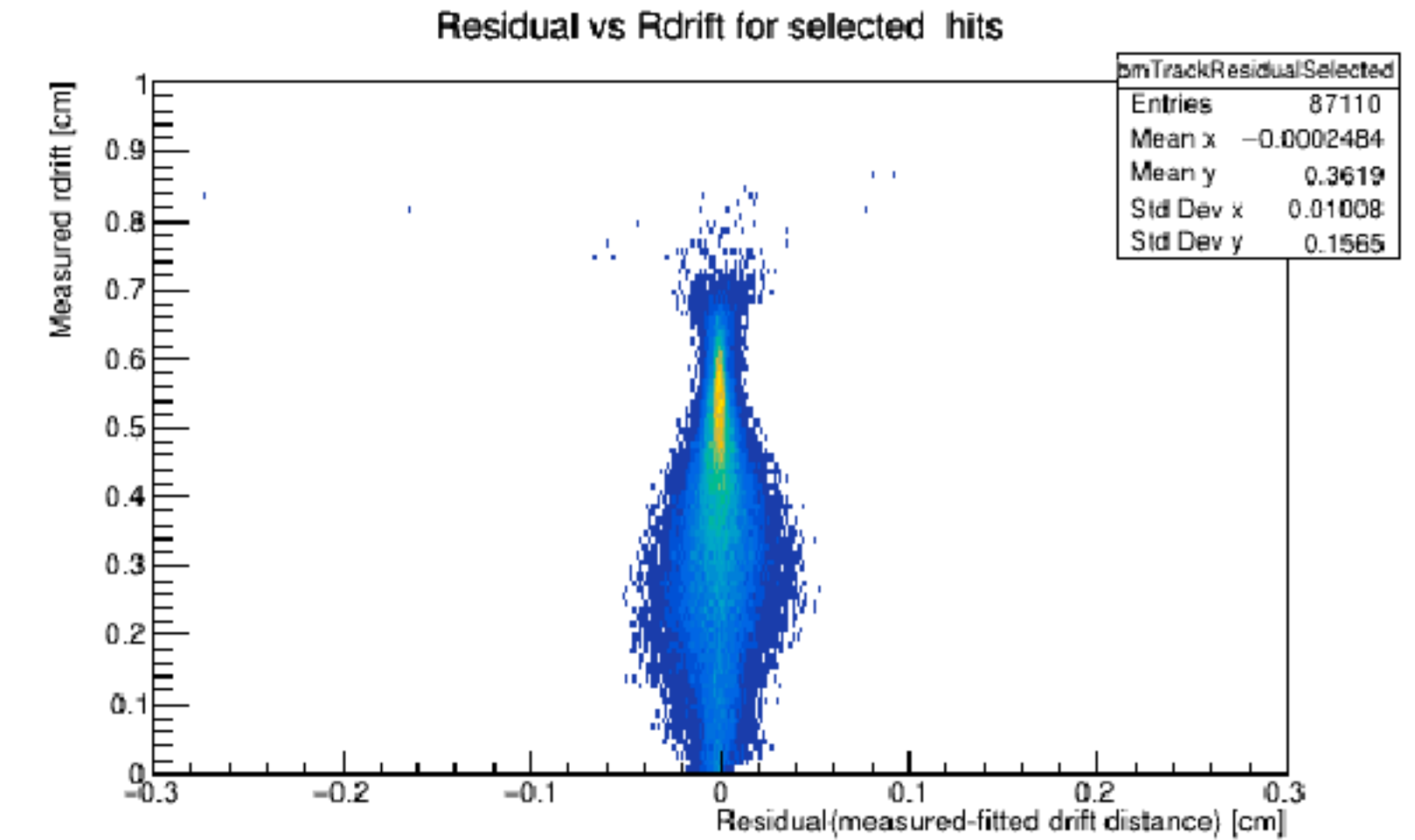
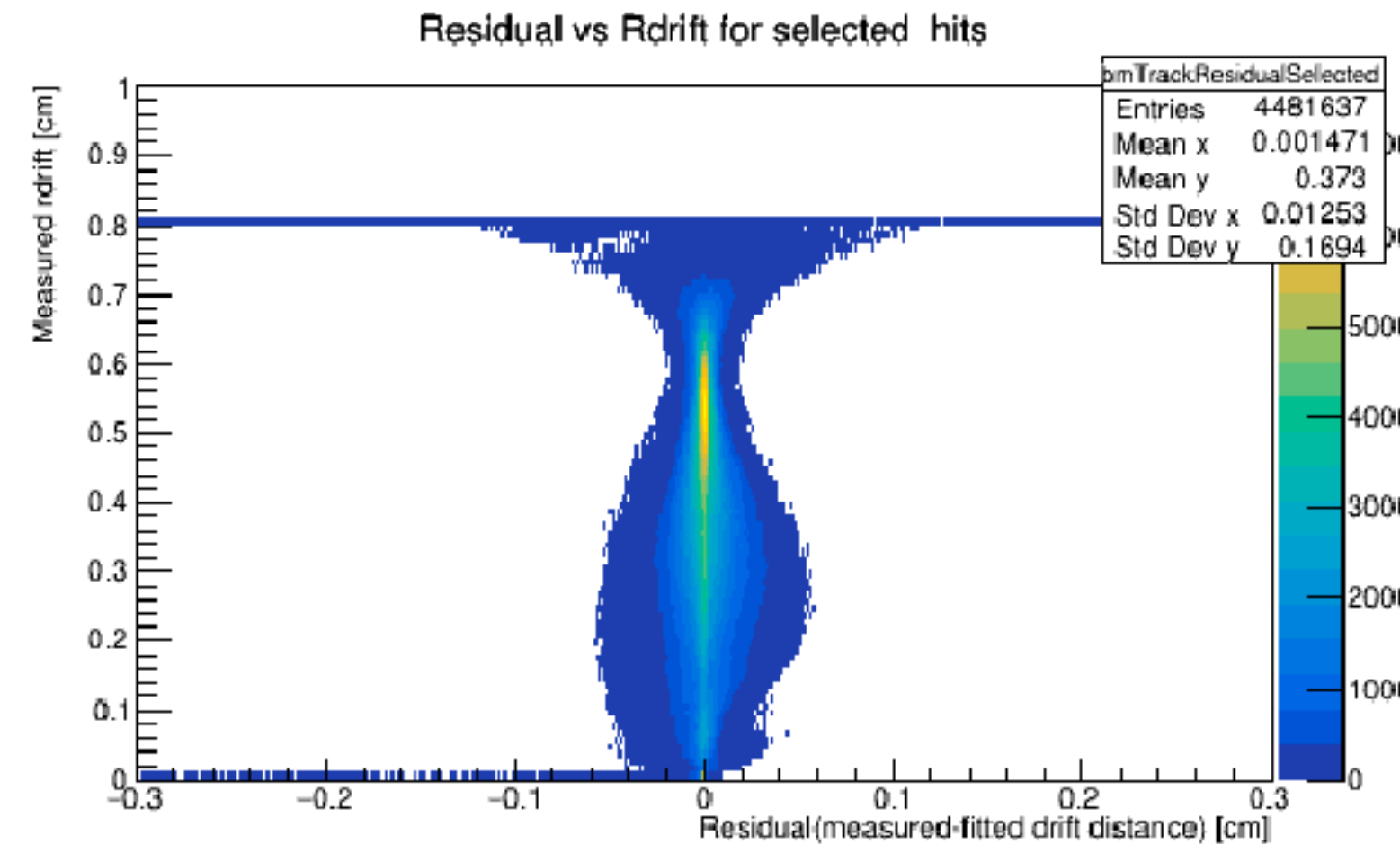
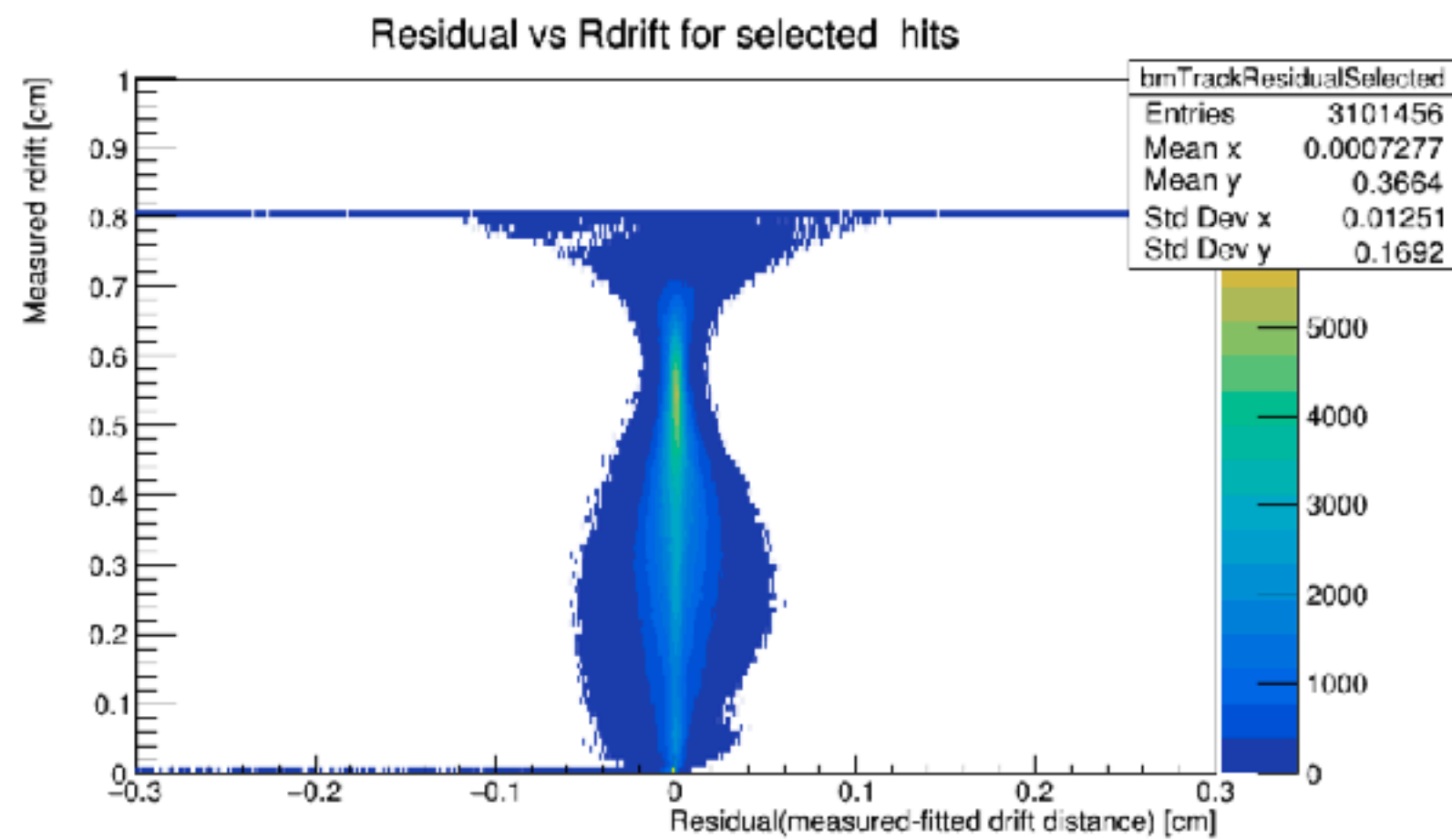


# BM @ GSI2021: data vs MC

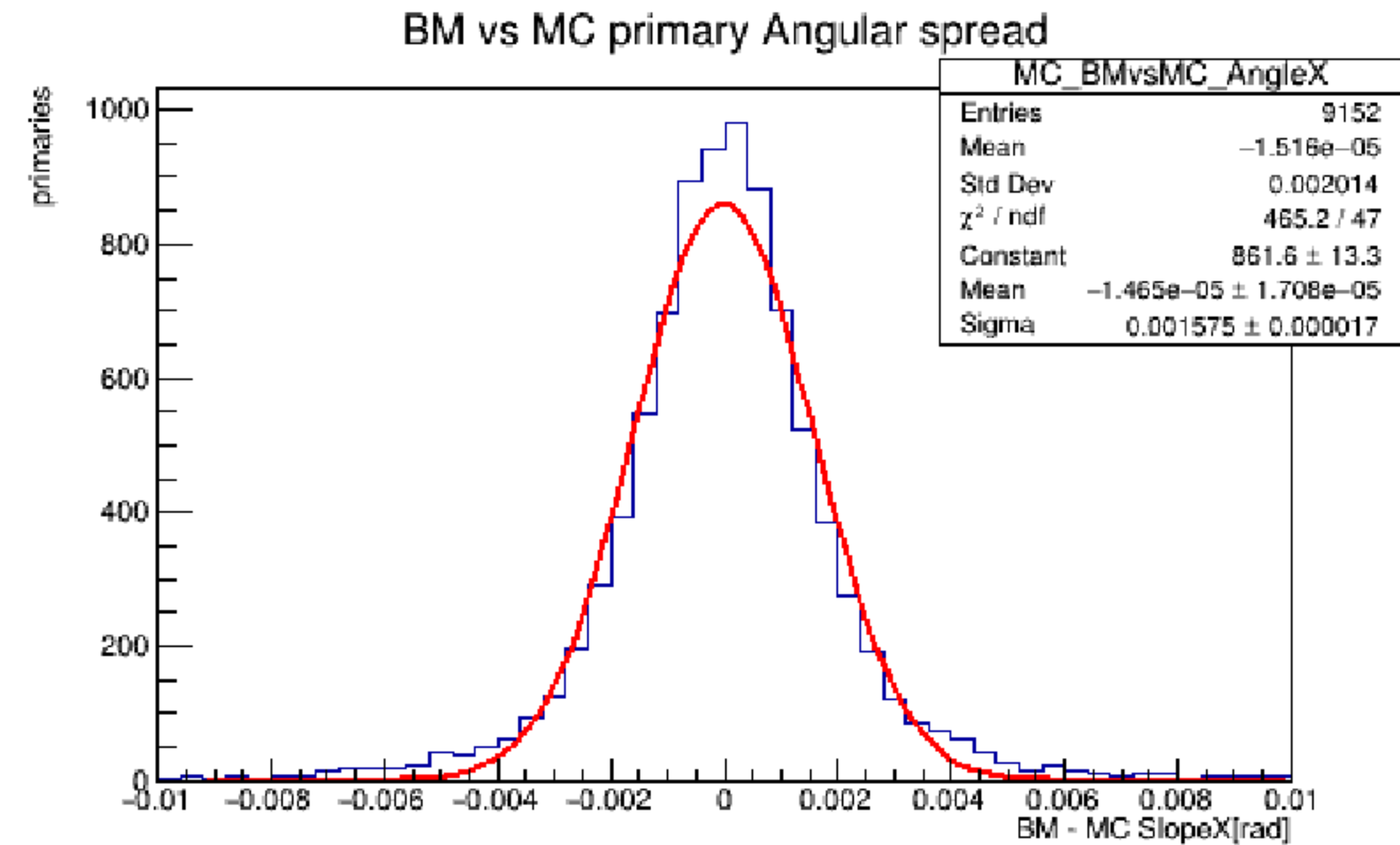
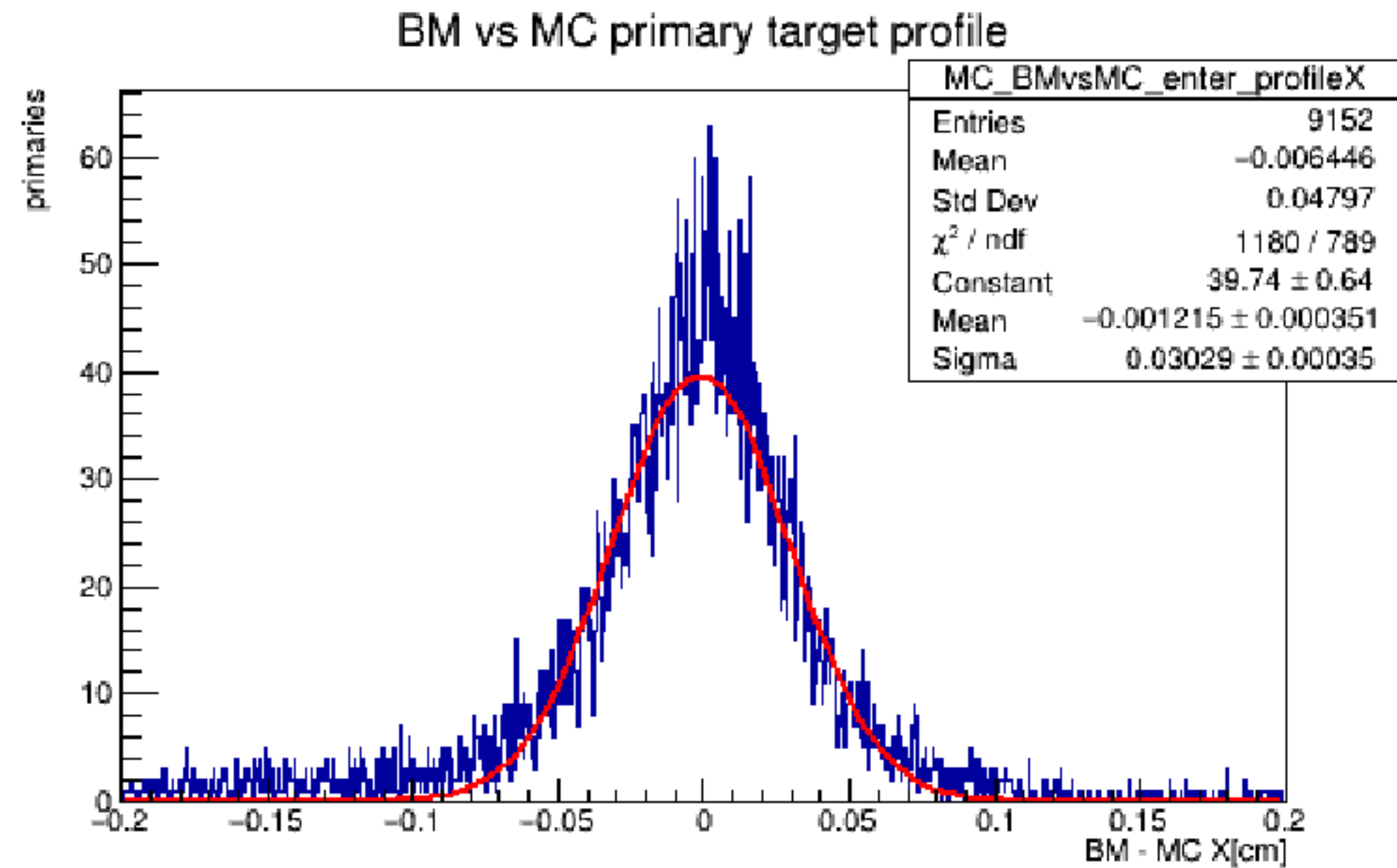
DATA: Frag (4308)

DATA: Majority (4307)

MC



# BM @ GSI2021: MC vs MCreco



# TO DO LIST

- Finish the optimisation of the BM parameters for all the campaigns
- Push the changes in newgeom\_v1.0 after some checks
- Add the BM relevance plot in the new shoe twiki!

<https://baltig.infn.it/asarti/shoe/-/wikis/home>

The screenshot shows a GitLab Wiki page for the FOOT experiment. The page title is "HOME" and the subtitle is "Wiki Home Page of the FOOT experiment". The page content is as follows:

Last edited by [Yunsheng Dong](#) 4 weeks ago

**HOME**  
Wiki Home Page of the FOOT experiment

**The FOOT experiment**

The study of nuclear fragmentation plays a central role in many important applications: from the study of Particle Therapy (PT) up to radiation protection for space (RPS) missions and the design of shielding for nuclear reactors. The FOOT (Fragmentation Of Target) experiment aims to study the nuclear reactions that describe the interactions with matter of different light ions (like  $^1\text{H}$ ,  $^4\text{He}$ ,  $^{12}\text{C}$ ,  $^{16}\text{O}$ ) of interest for such applications (energy range  $\sim [100,800]$  MeV), performing double differential fragmentation cross section measurements in the energy range of interest for PT and RPS.

In Charged Particle Therapy (PT) proton or  $^{12}\text{C}$  beams are used to treat deep-seated solid tumors exploiting the advantageous characteristics of charged particles energy deposition in matter. For such projectiles, the maximum of the dose is released at the end of the beam range, in the Bragg peak region, where the tumour is located. However, the nuclear interactions of the beam nuclei with the patient tissues can induce the fragmentation of projectiles and/or target nuclei and needs to be carefully taken into account when planning the treatment. In proton treatments, the target fragmentation produces low energy, short range fragments along all the beam path, that deposit a non-negligible dose especially in the first crossed tissues. On the other hand, in treatments performed using  $^{12}\text{C}$ , or other ( $^4\text{He}$  or  $^{16}\text{O}$ ) ions of interest, the main concern is related to the production of long range fragments that can release their dose in the healthy tissues beyond the Bragg peak. Understanding nuclear fragmentation processes is of interest also for radiation protection in human space flight applications, in view of deep space missions. In particular  $^4\text{He}$  and high-energy charged particles, like  $^{12}\text{C}$ ,  $^{16}\text{O}$ ,  $^{28}\text{Si}$  and  $^{56}\text{Fe}$ , provide the main source of absorbed dose in astronauts outside the atmosphere. The nuclear fragmentation properties of the materials used to build the spacecrafts need to be known with high accuracy in order to optimise the shielding against the space radiation.

The study of the impact of these processes, which is of interest both for PT and space radioprotection applications, suffers at present from the