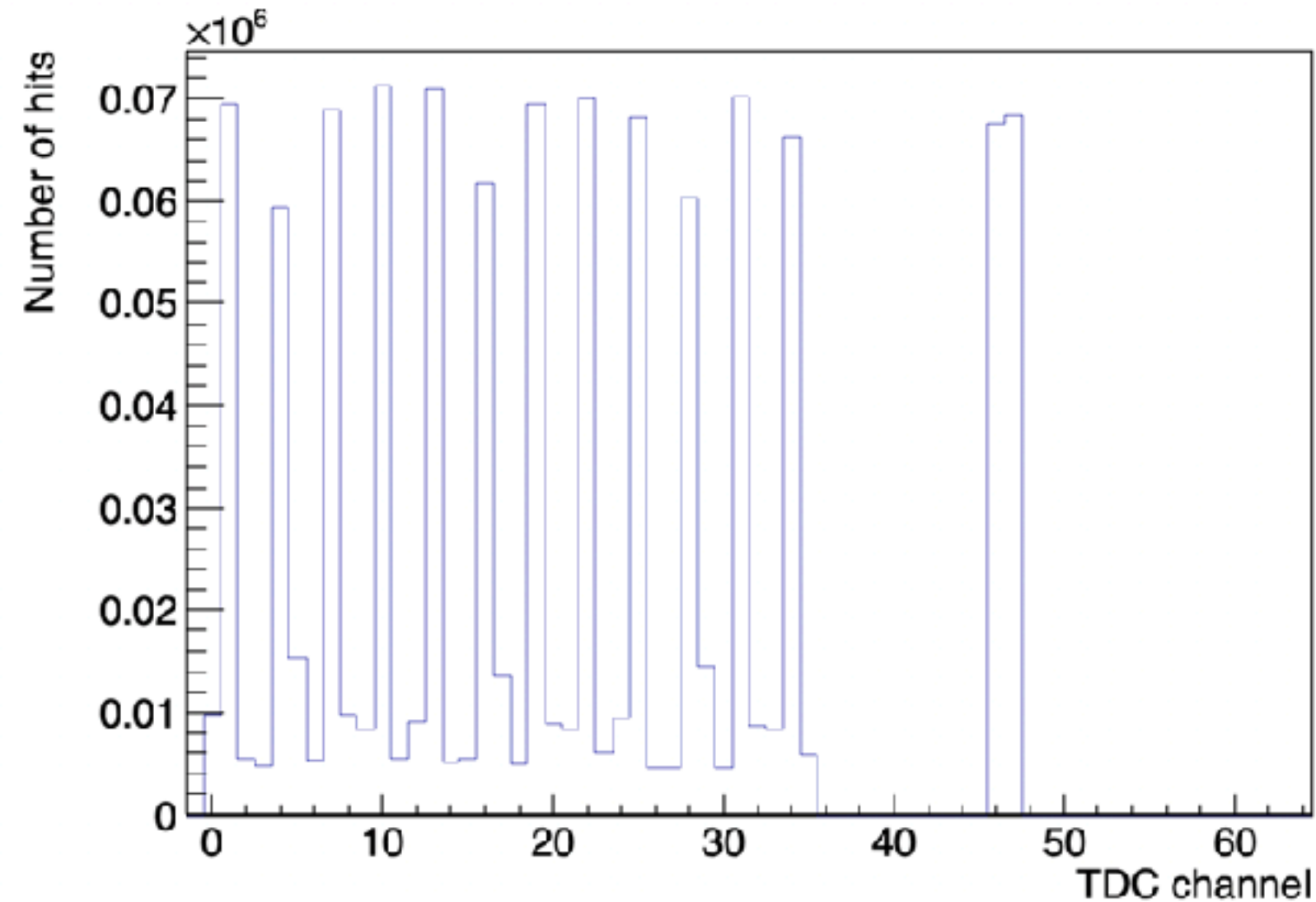


# Beam Monitor @ GSI2021

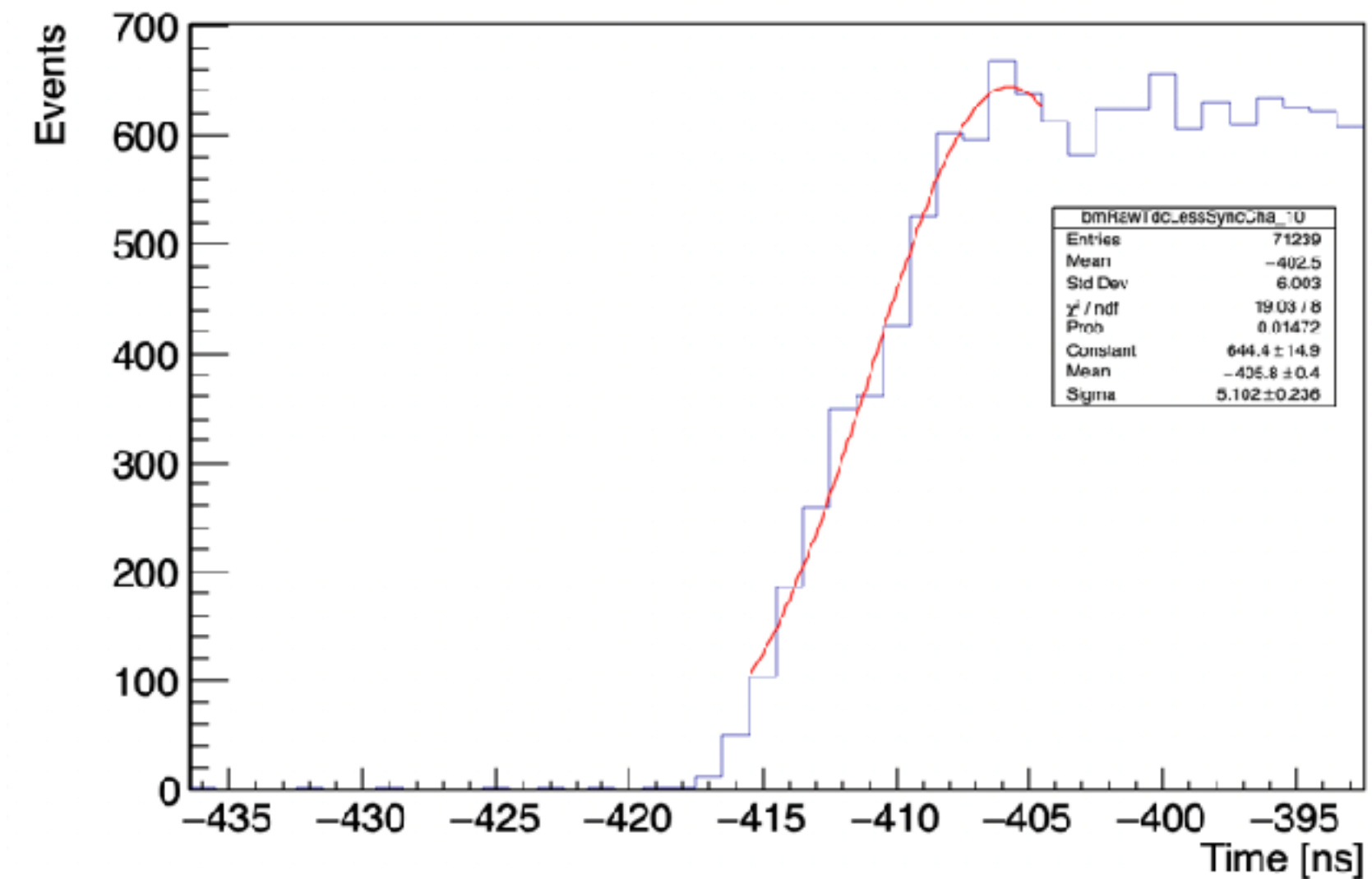
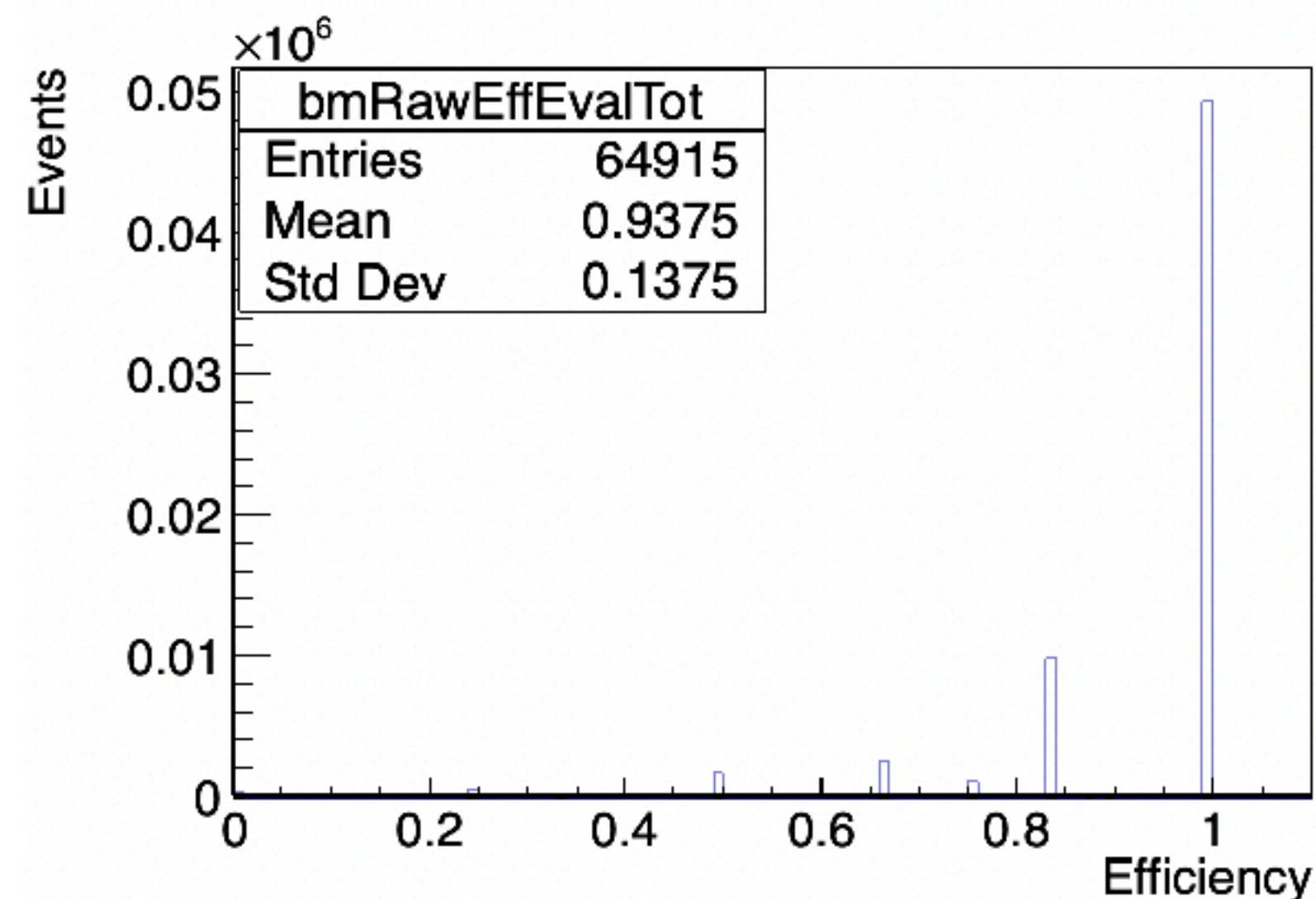
Yunsheng Dong



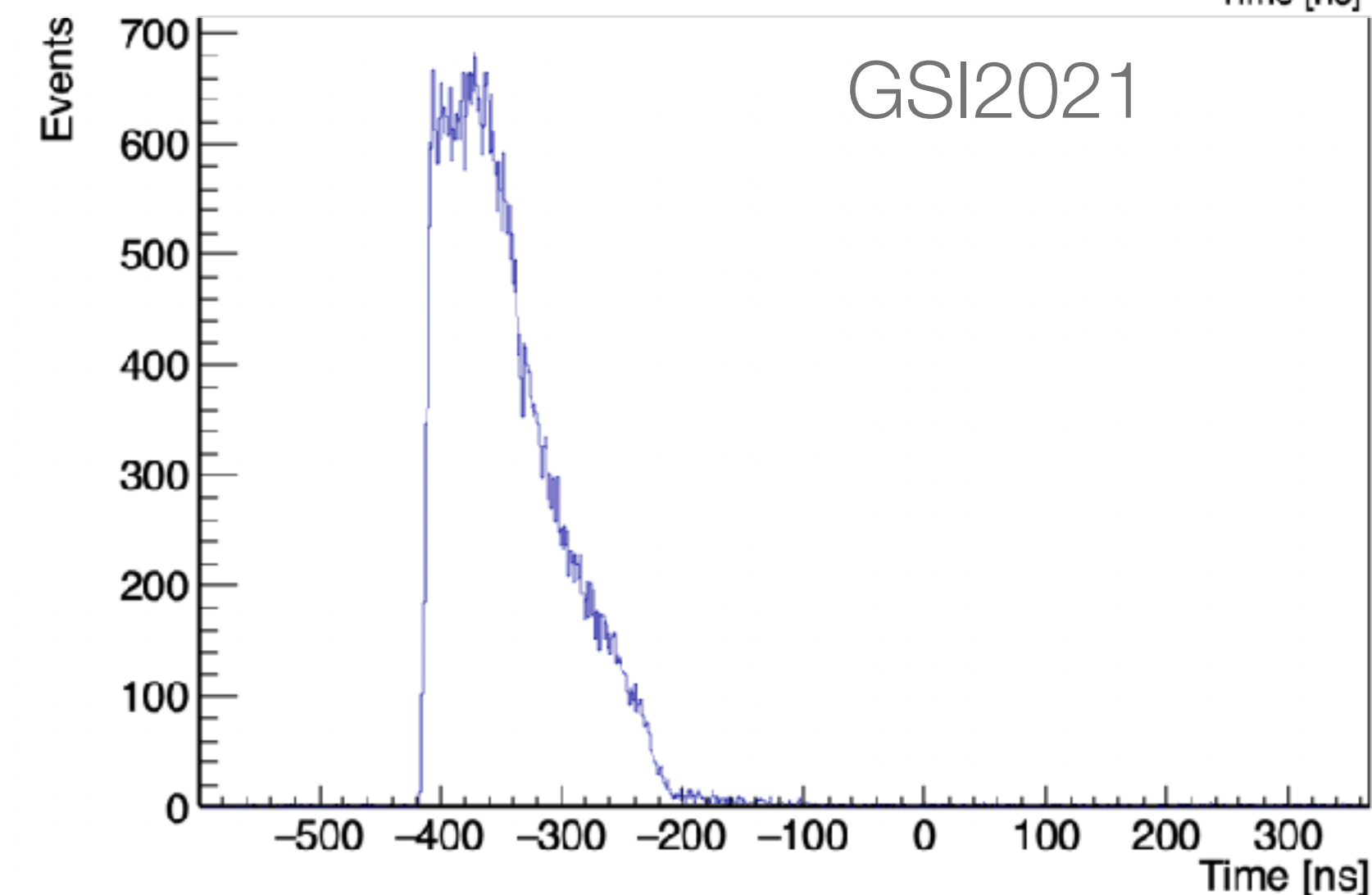
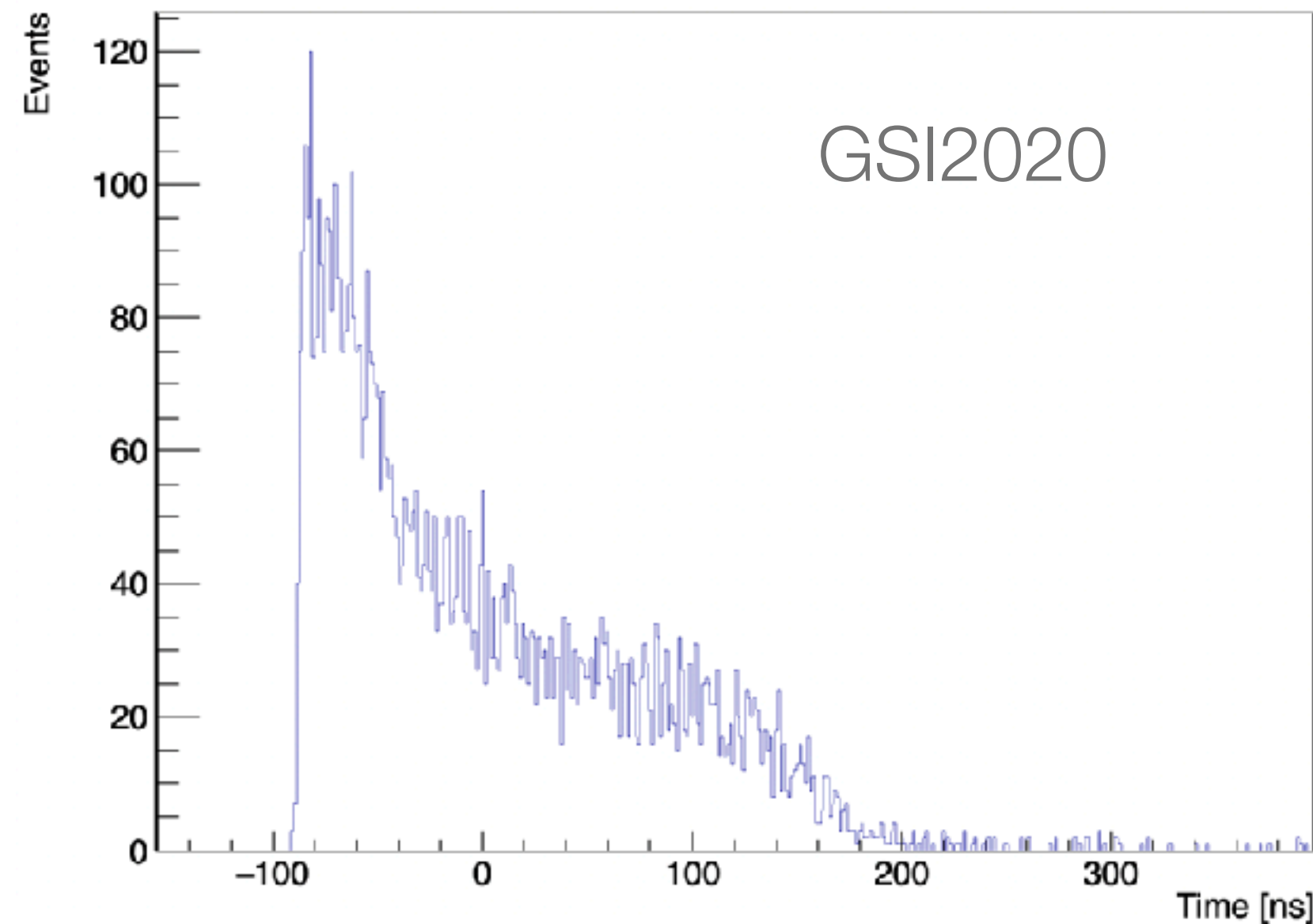
# Raw data analysis



- No dead or anomalous cells
- Raw hit detection efficiency  $\sim 0.9$   
(depending on the BM position in the specific run)
- **Time jitter of  $\sim 5$  ns**  
(GSI2019 with FOOT electronic was  $\sim 20$  ns, with BM standalone was  $\sim 2$  ns)

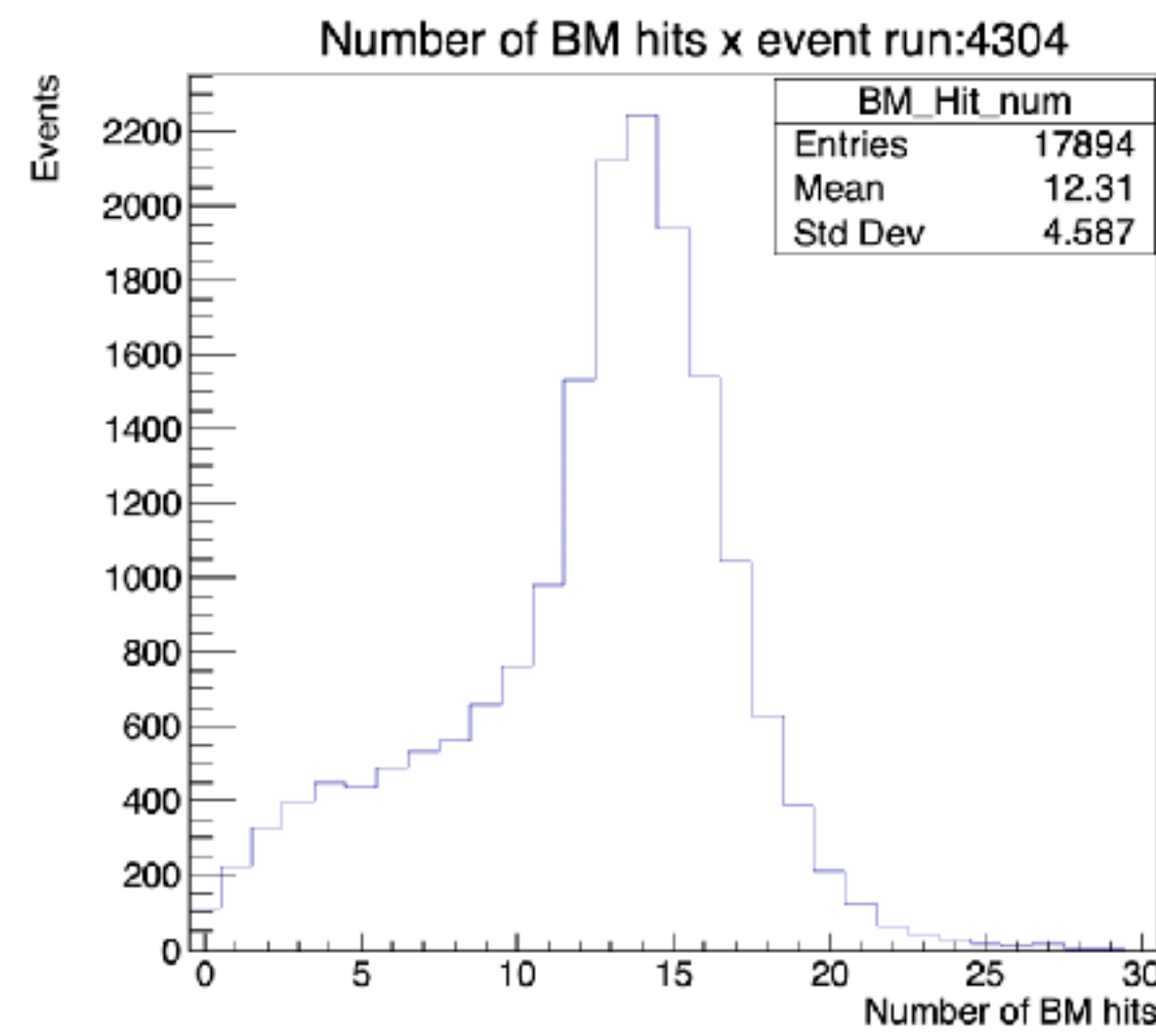
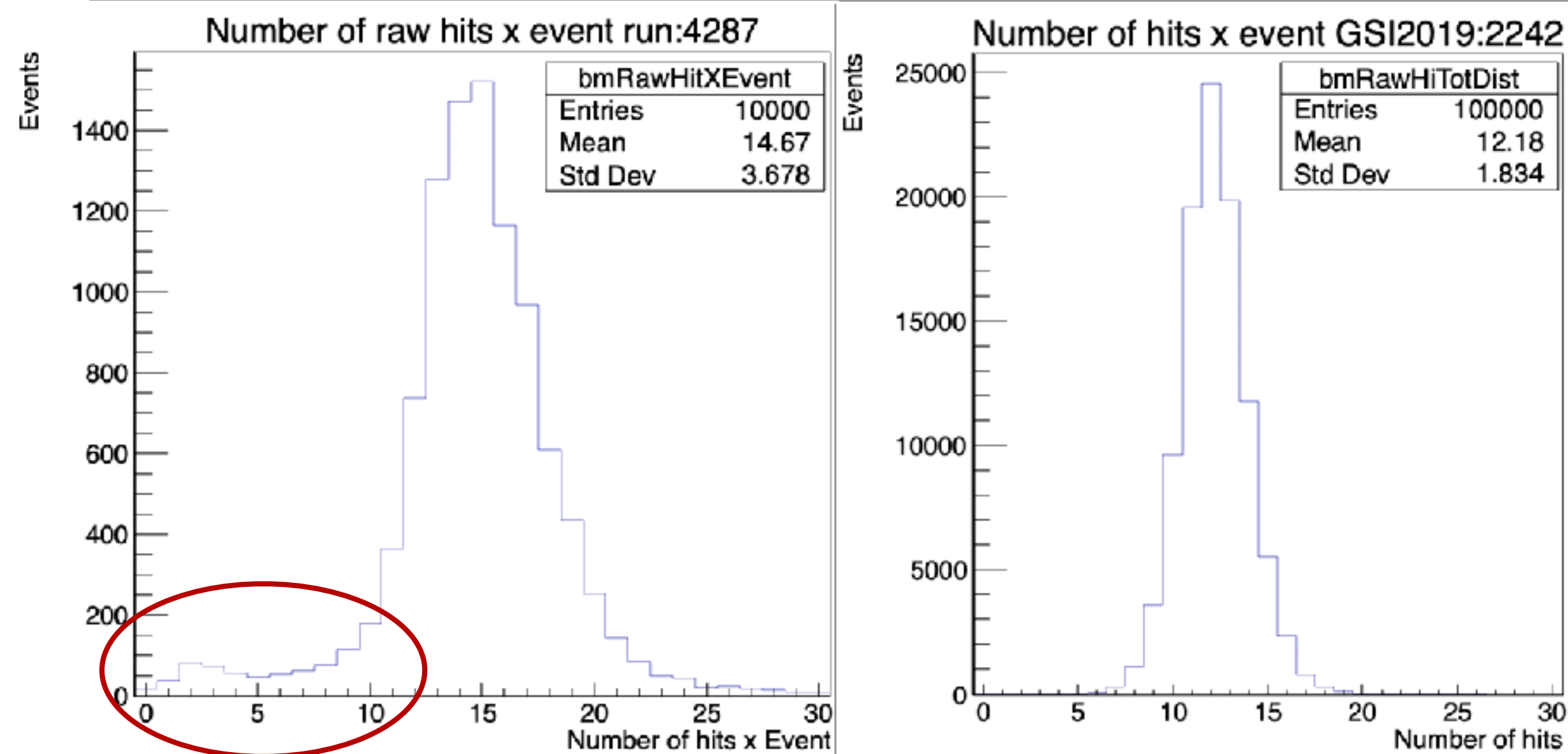


# BM working point



- GSI2021: maximum drift time  $\sim 220$  ns  
GSI2020/2019 maximum drift time  $\sim 300$  ns
- Different gas distribution system and probably different gas conditions (different pressure?)
- **The BM working point has changed with respect to GSI2019 and GSI2020**
- Need to modify the BM thresholds  
(GSI2021: 75mV, GSI2020/2019: 25 mV)
- Not a big issue, but:
  - need to recalibrate the BM space-time relations
  - more sensitivity to space time relations changes

# BM “strange” events

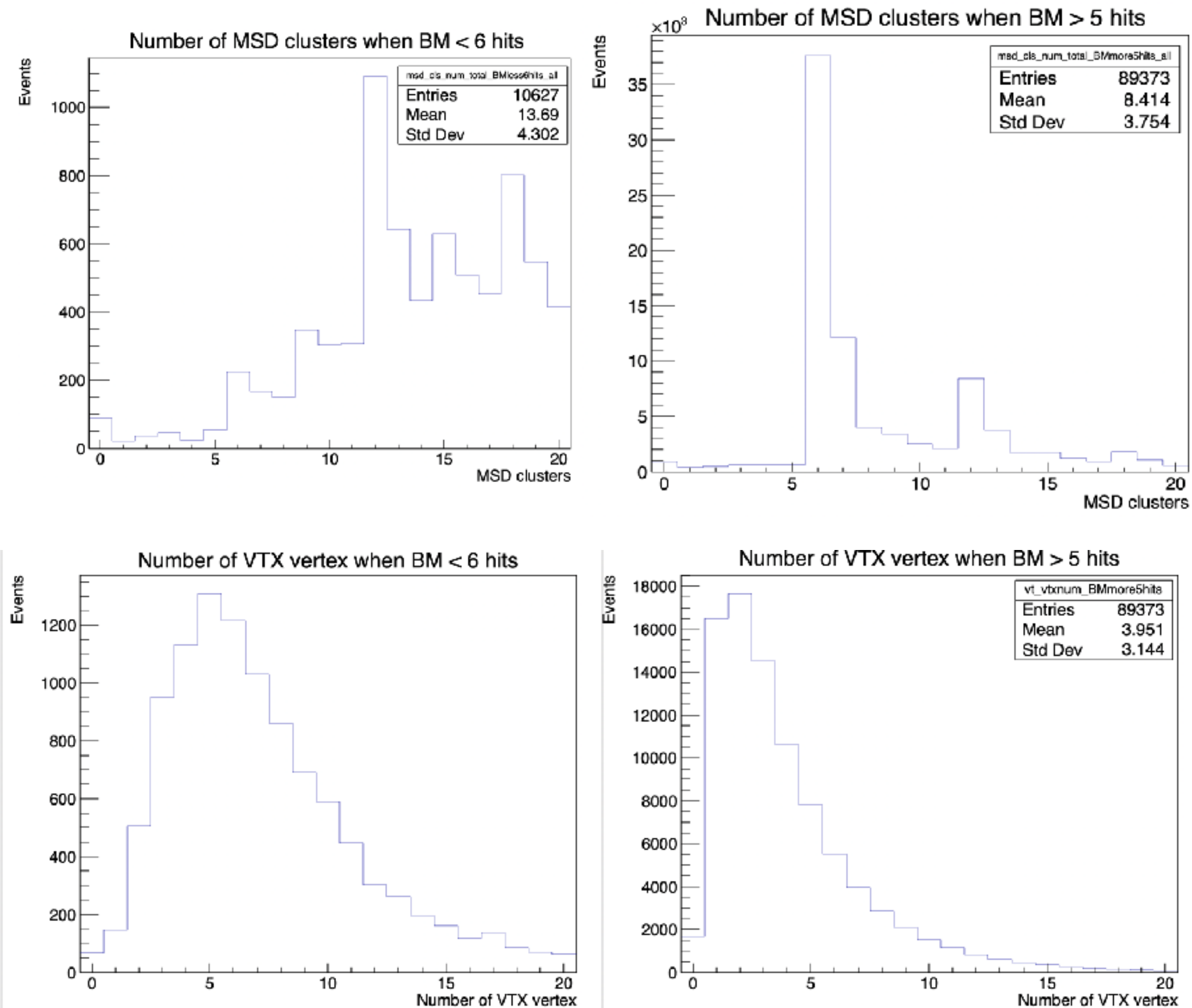


- The number of BM hits distribution shows an unusual tail in the low hits region (few %)
- Never detected in GSI 2019 or other BM stand alone data takings
- In some runs, this effect can be particularly relevant (e.g.: in 4303, 4304, 4328, 4330 the fraction of evts with less than 6 bm hits can be of ~10%)
- Not a constant effect: it can change significantly between two consecutive runs
- Currently under study





# BM “strange” events: run 4304

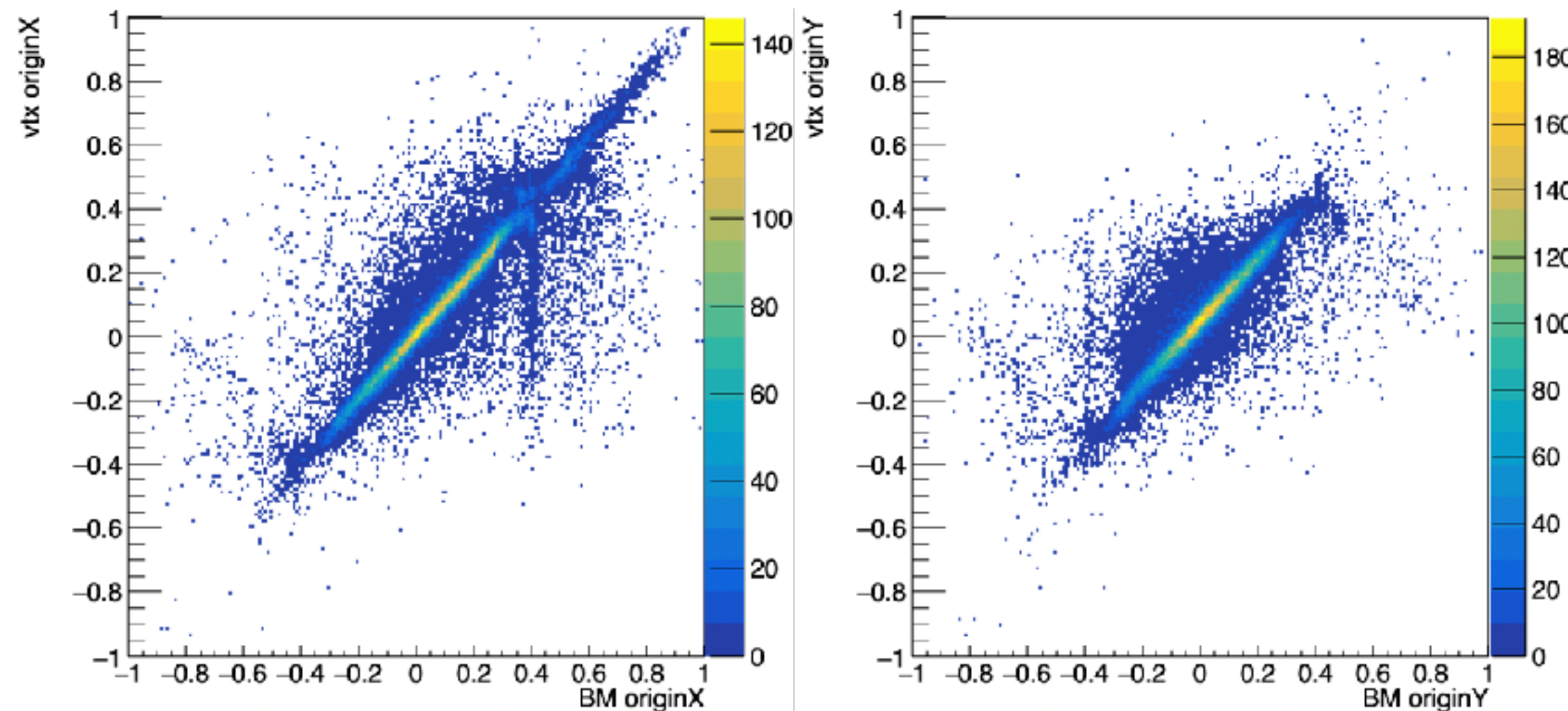


Some clues up to now:

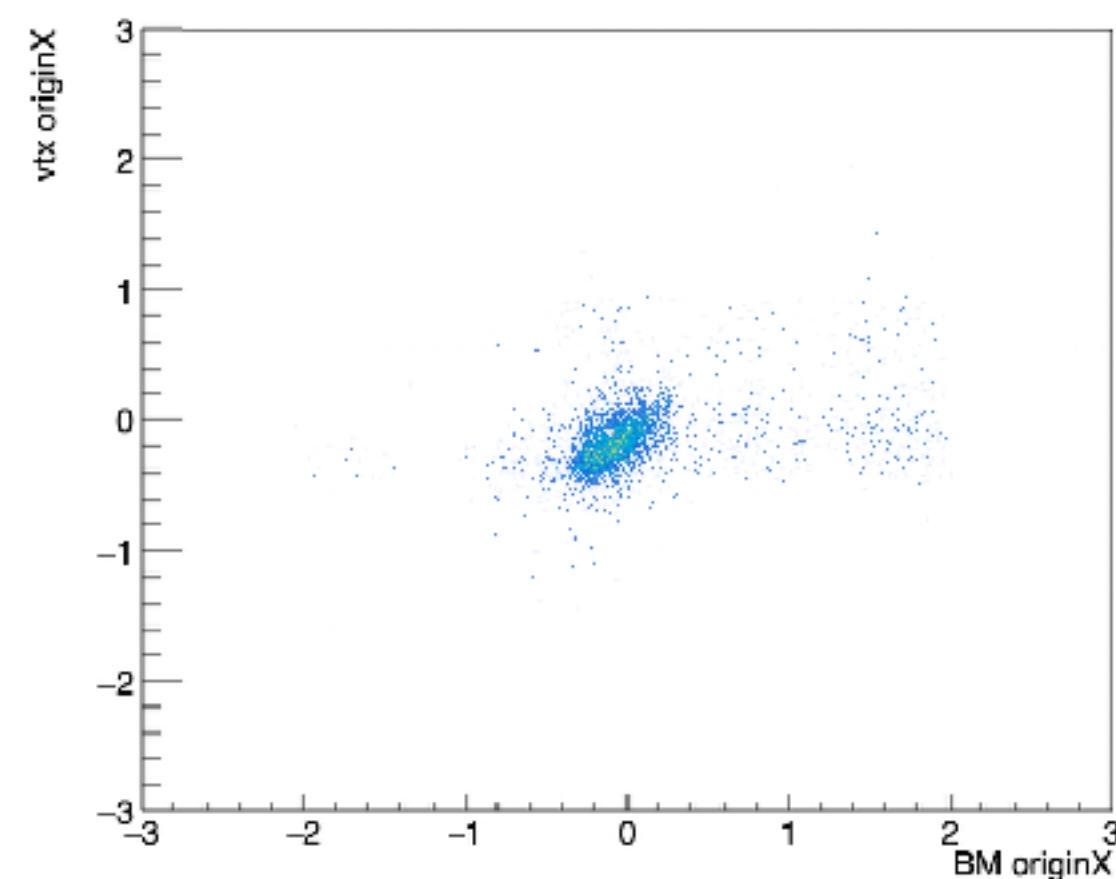
- Apparently only in fragmentation runs
- No difference spotted between majority and fragmentation trigger events in the same run
- Both VTX and MSD show an increased number of vertex/clusters (MSD calibration not finished)
- No differences in TW data
- It could be related to the beam rate (not easy to estimate such a rate by means of the available data)

# BM-VTX correlation

Run 4313

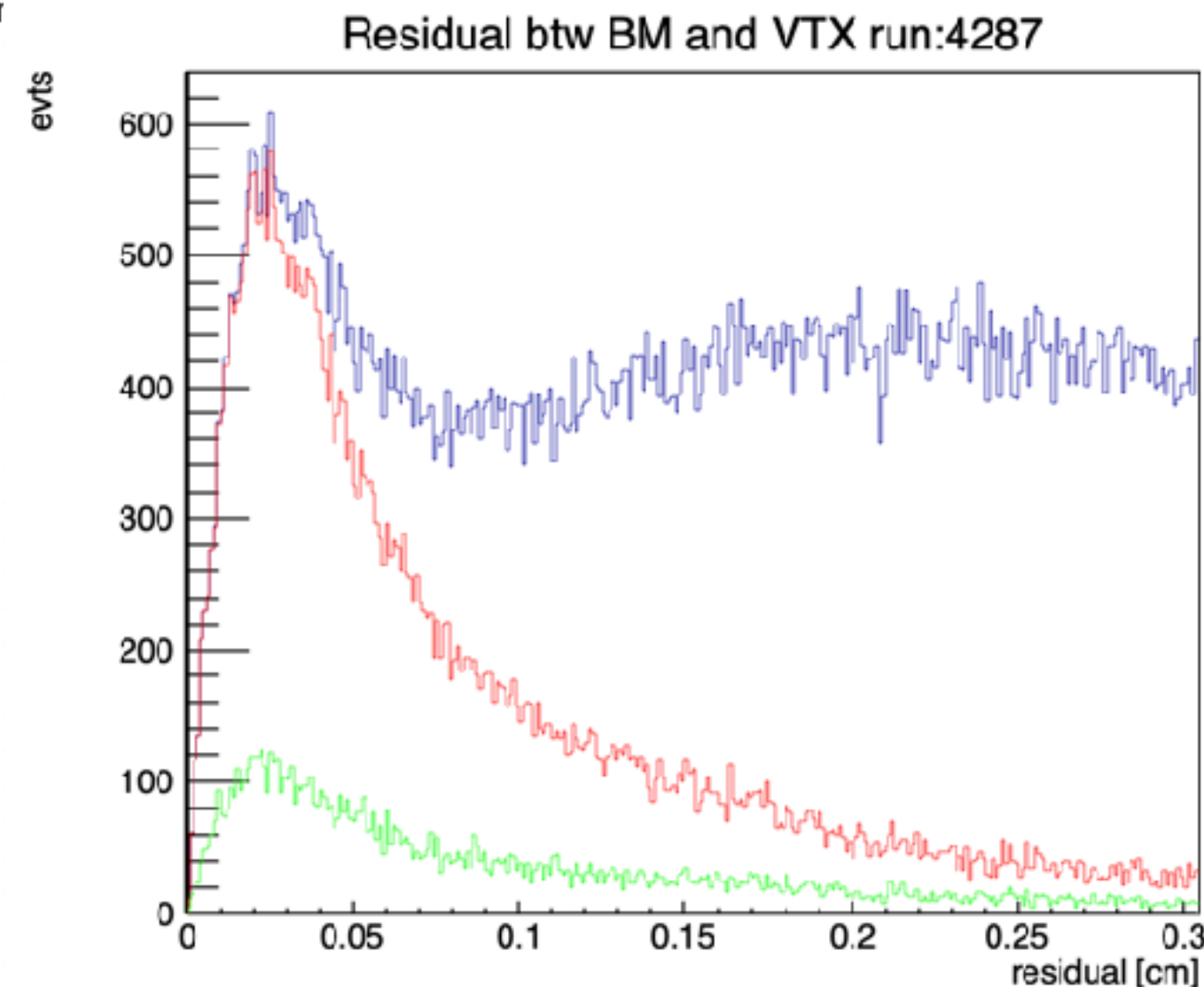
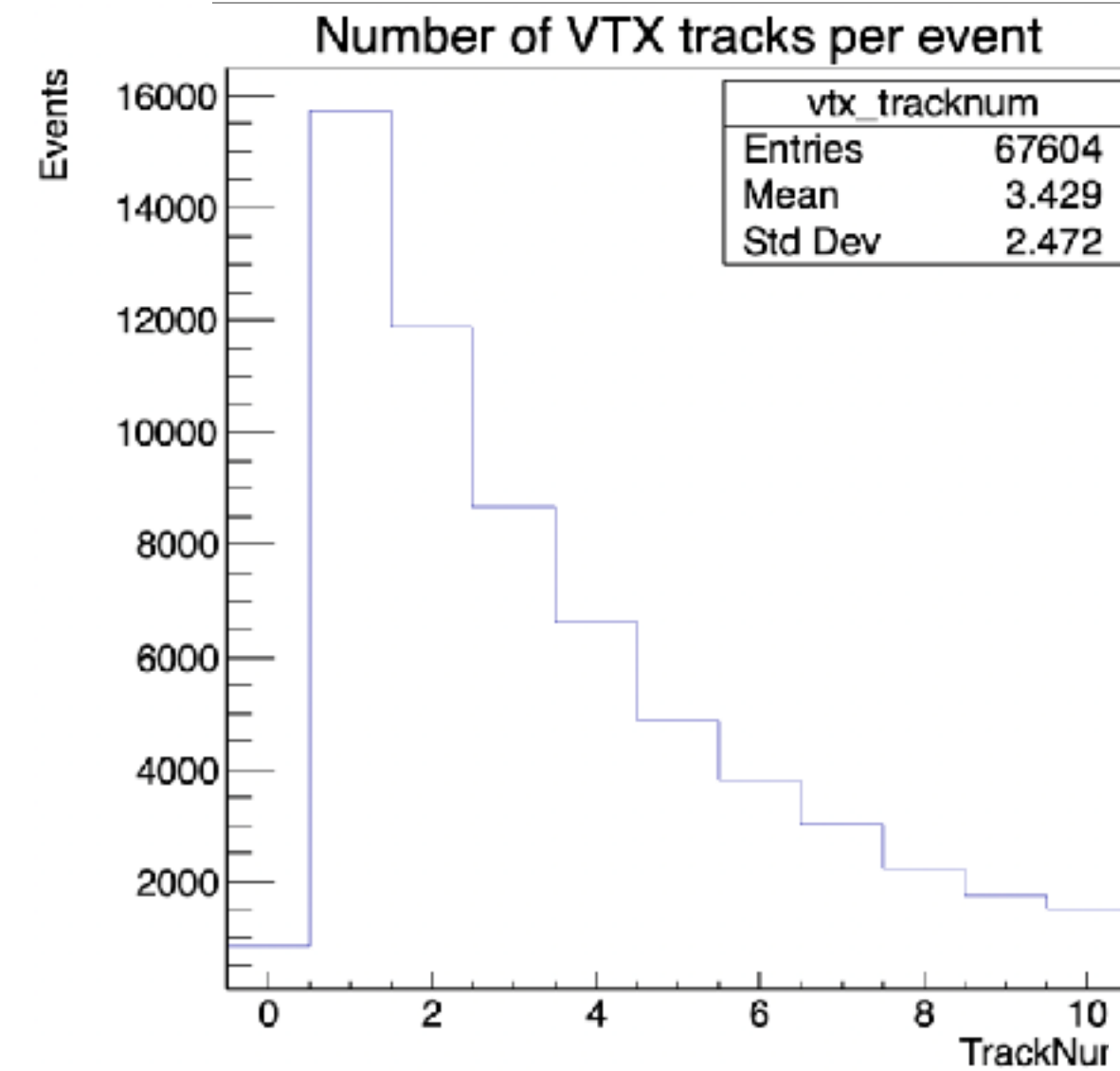


Run 4327: BM-VTX correlation for the events from 140k to 150k



- **Run 4313:** 400 MeV with VTX and no Target  
-The best run to calibrate the BM
- **Clear BM-VTX correlation**
- In some runs the VTX synchronisation is lost at a given event
- A very naive way to check the vtx synchronisation is to check the BM-VTX correlation every N events
- eg.: in run 4327 the vtx is synchronised up to about 140k evts, than the sync is lost somewhere between 140k and 150k evt.

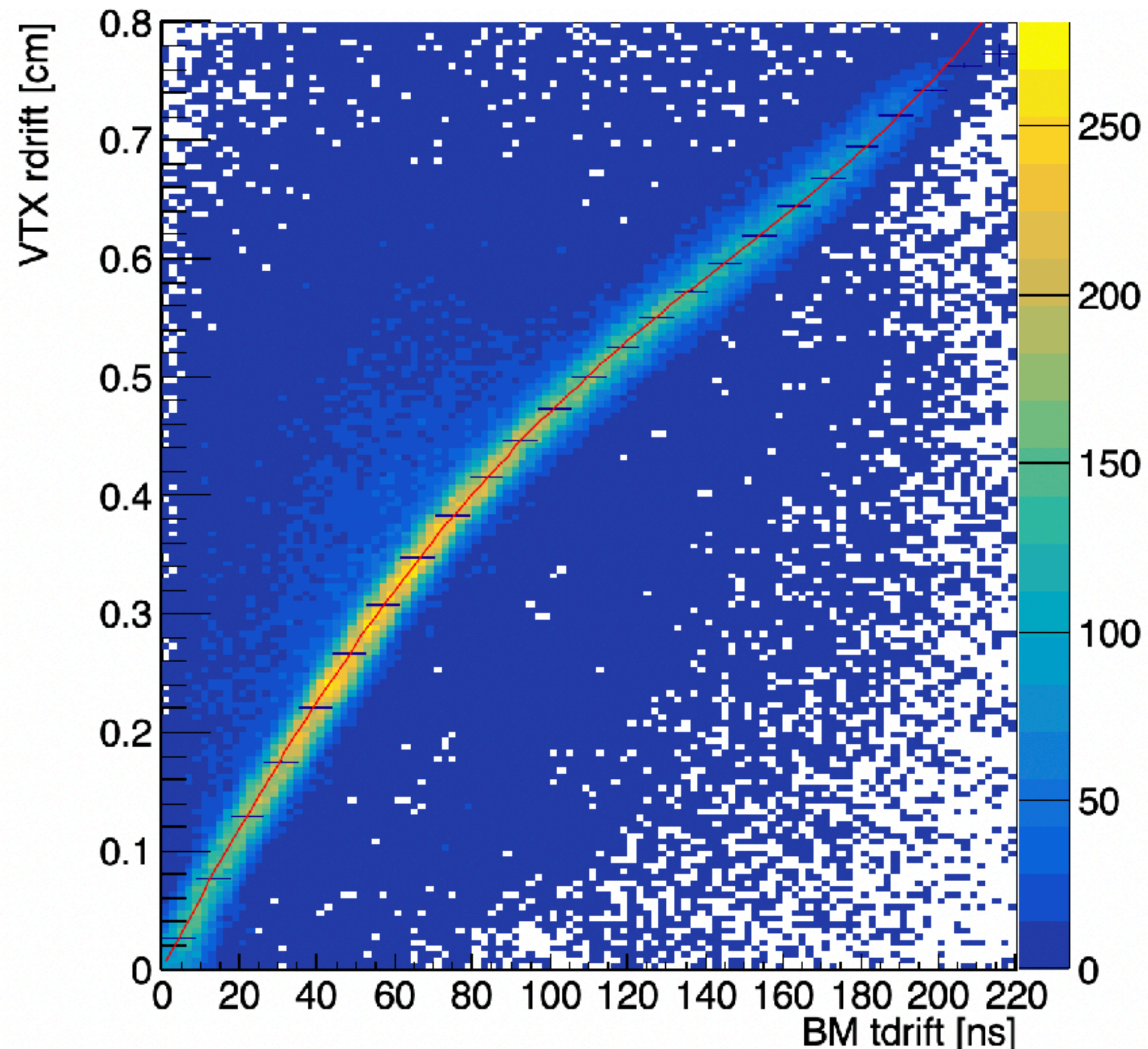
# BM-VTX vertex selection



- VTX pile up not negligible
- Use the BM to select the right VTX track/vertex:
  - align the detectors
  - select only the events with 1 BM track
  - project the BM and the VTX tracks on the target and select the VTX track that minimise the residual, defined as the difference btw BM and VTX projected tracks.
- BM and VTX residual plot:
  - blue: evts with 1 BM track and residuals with all the VTX tracks
  - green: evts with 1 BM track and 1 VTX track (clean evts)
  - red: evts with 1 BM track and residual calculated with the vtx track that is closer to the BM track
- TAVTvertex::IsBmMatched() to flag the matched vertex



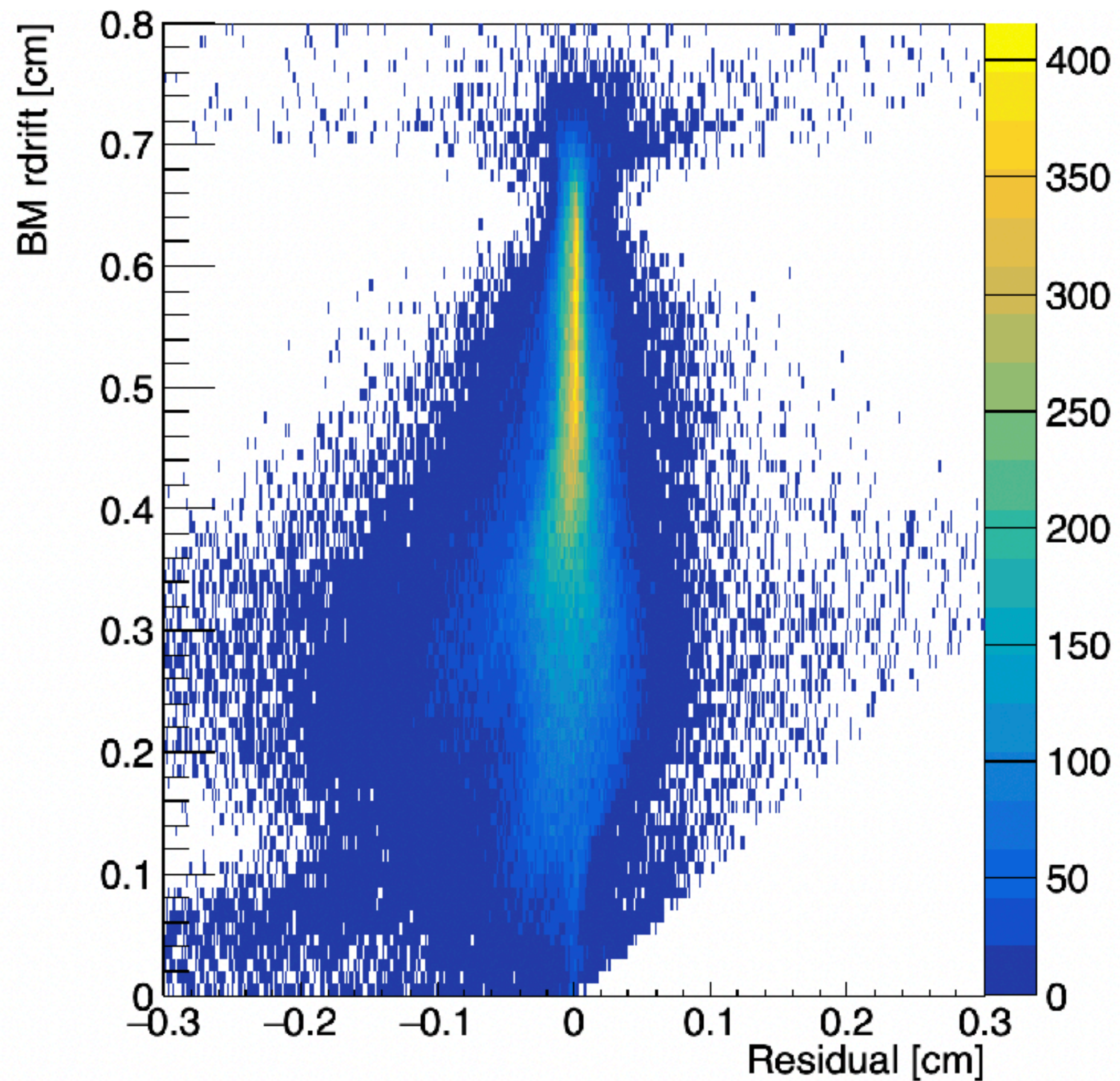
# BM space time relations calibration with VTX



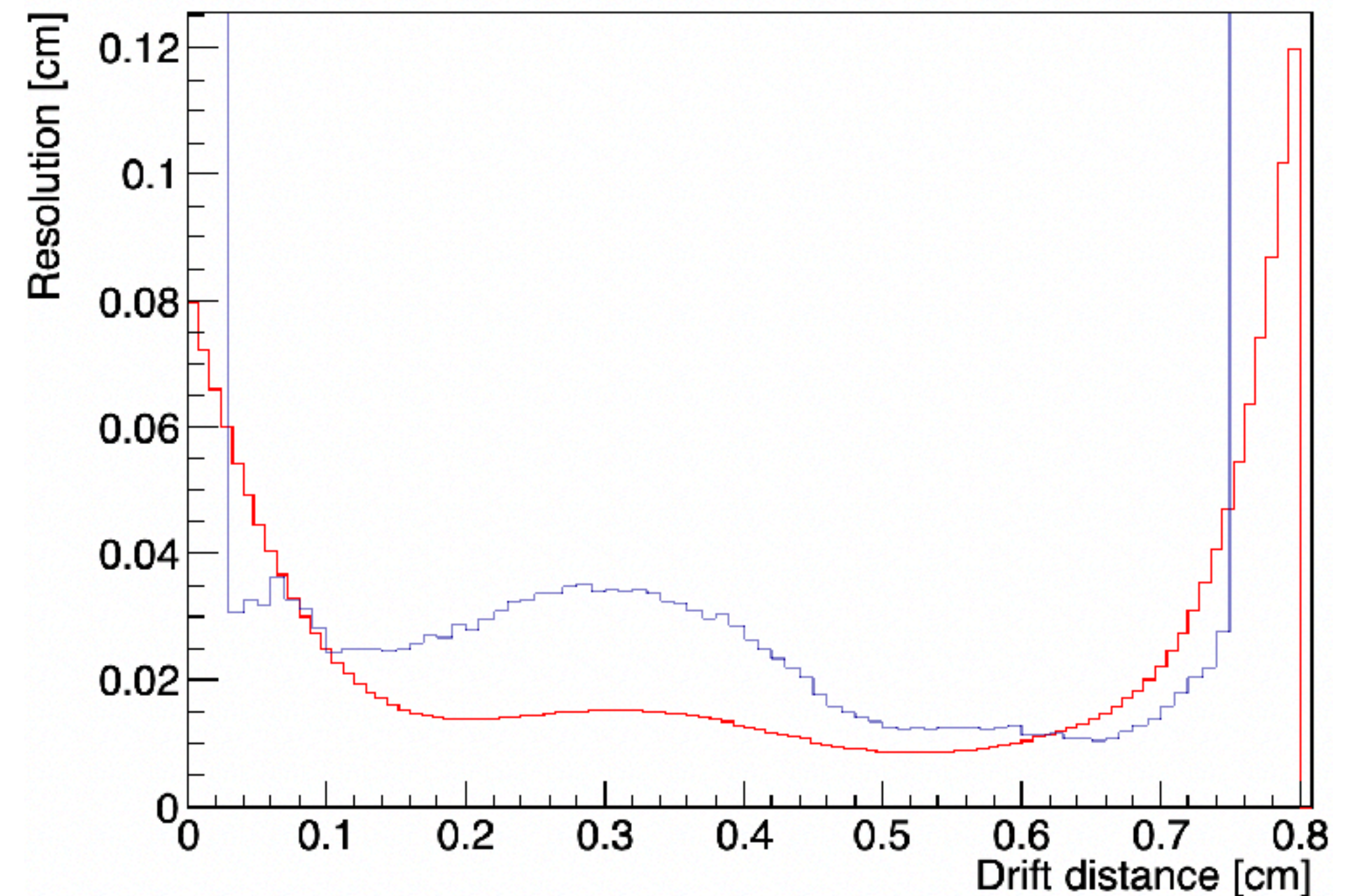
- Run 4313 (400 MeV, no target)
- Iterative procedure:
  - reconstruct BM and VTX tracks
  - align the two detectors with the tracks residual
  - extrapolate the VTX tracks into the BM and combine the VTX drift distances with the BM times
- Same procedure adopted to calibrate the BM with the MSD @ Trento in 2019



# BM spatial resolution

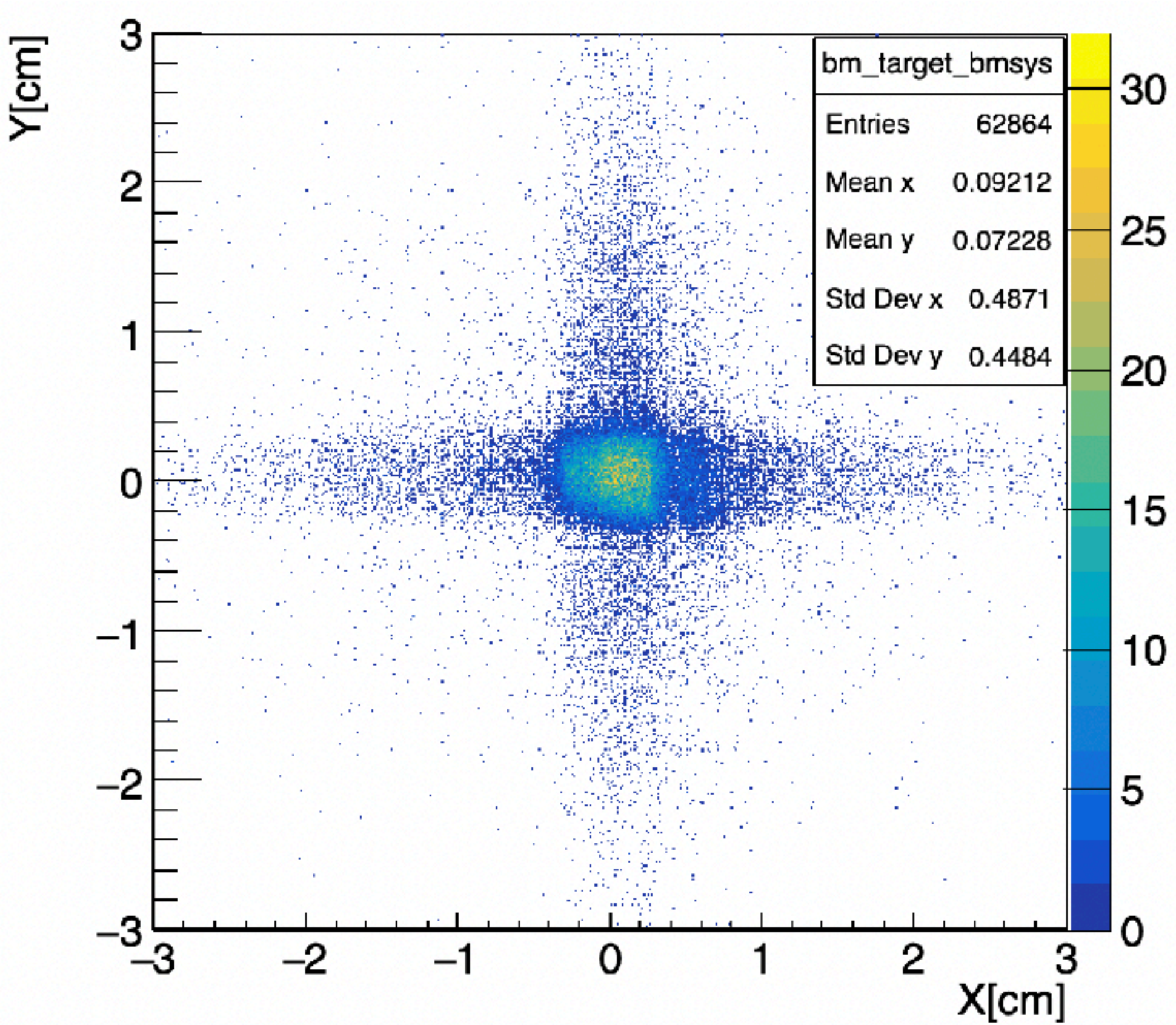


- With the preliminary space time relations, the BM spatial resolution in the central part of the cell is between 300 and 150  $\mu\text{m}$ , slightly worse than the performances obtained at Trento in 2019 (red)

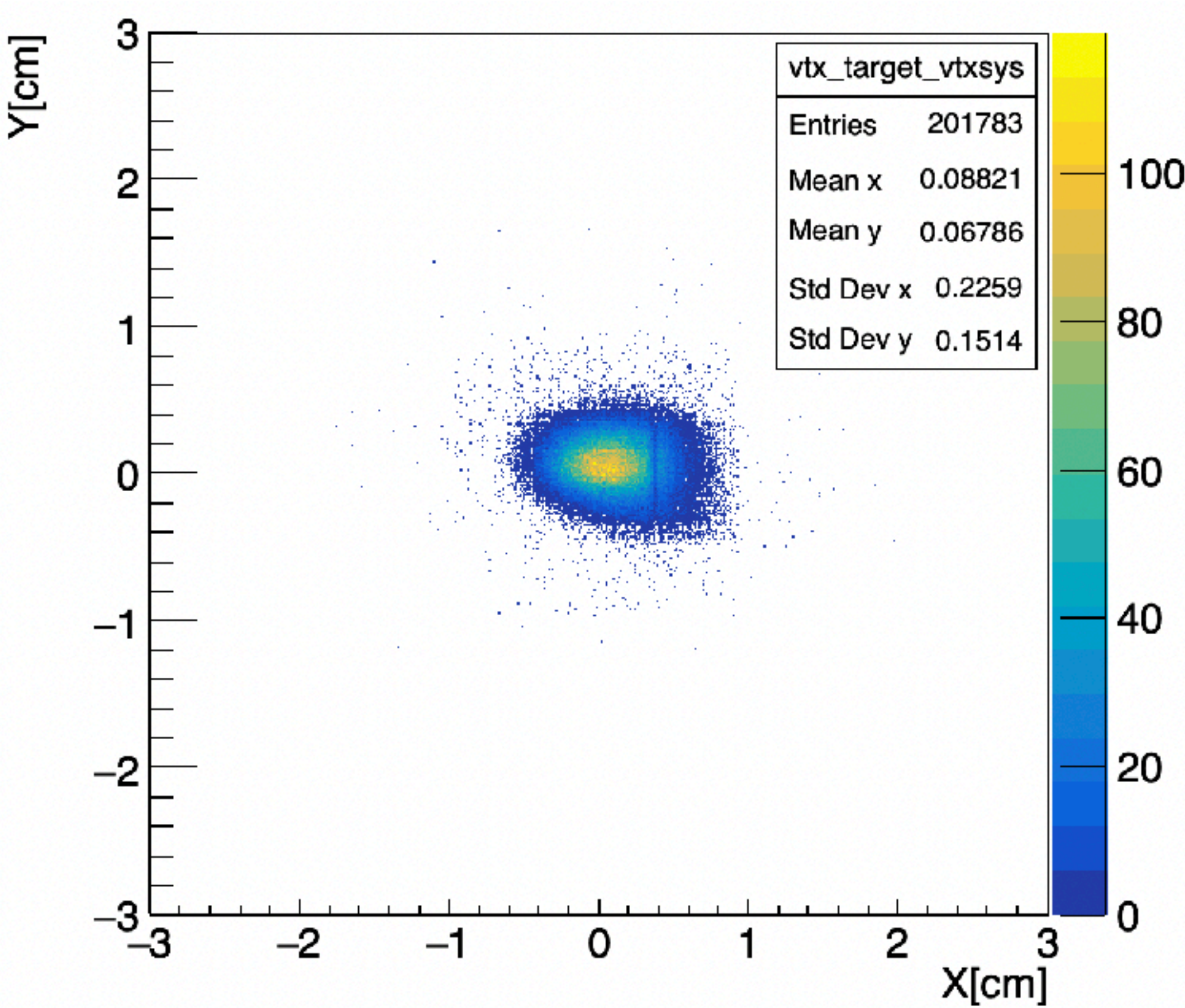




# BM and VTX beam profiles



Beam profile from BM



Beam profile from VTX



# Conclusions

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- The time jitter of 20 ns experienced in GSI2019 has been reduced to 5 ns
- With respect to the GSI2020 and GSI2019 campaigns, the detector working point has been changed, probably due to a different gas composition/pressure
- Clear VTX and BM correlation, at least for the first events (depending on the specific run)
- The BM space time relations calibrated with the VTX tracks
- BM track spatial resolution of 150-300  $\mu\text{m}$  in the central part of the BM cell
- In some runs the BM detected a lot of events with less than 6 hits, this is currently under study