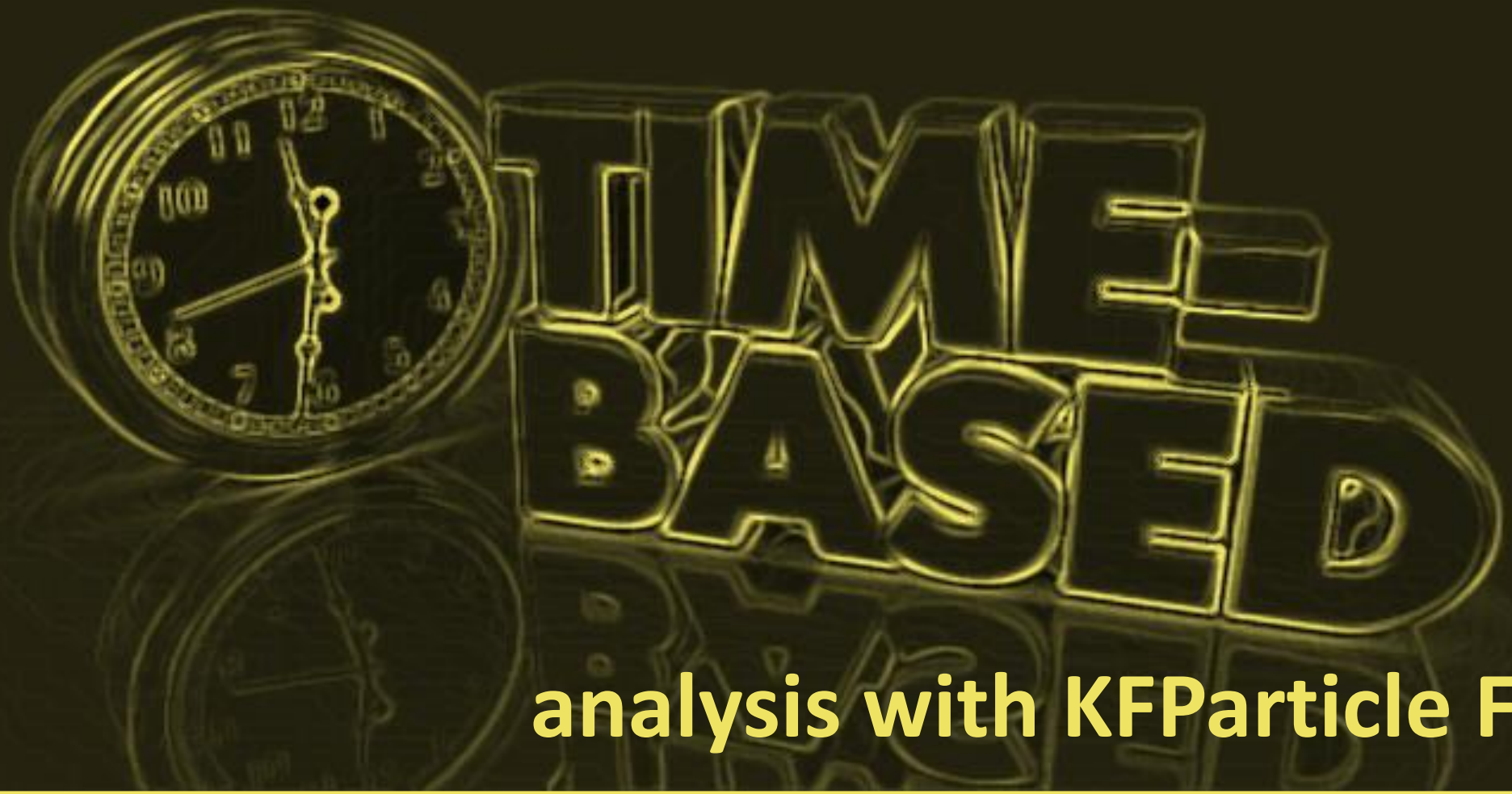
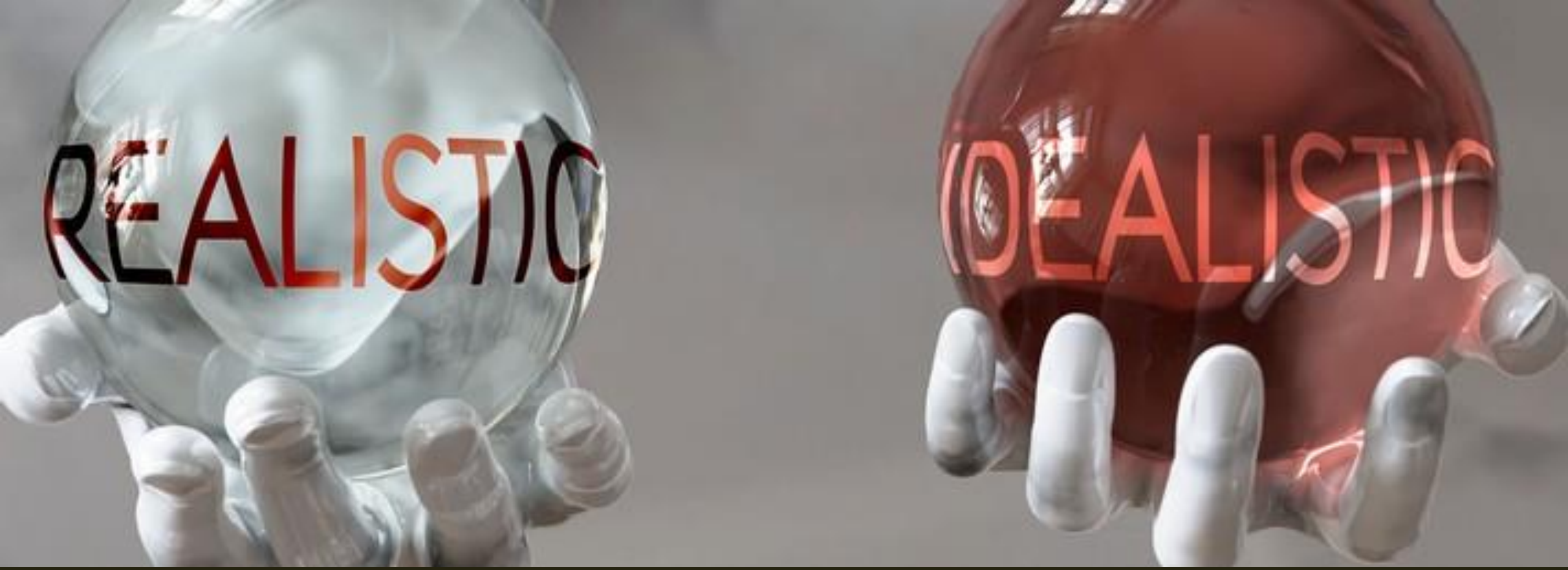


analysis with KFParticle Finder

Anna Senger

46th CBM Collaboration Meeting



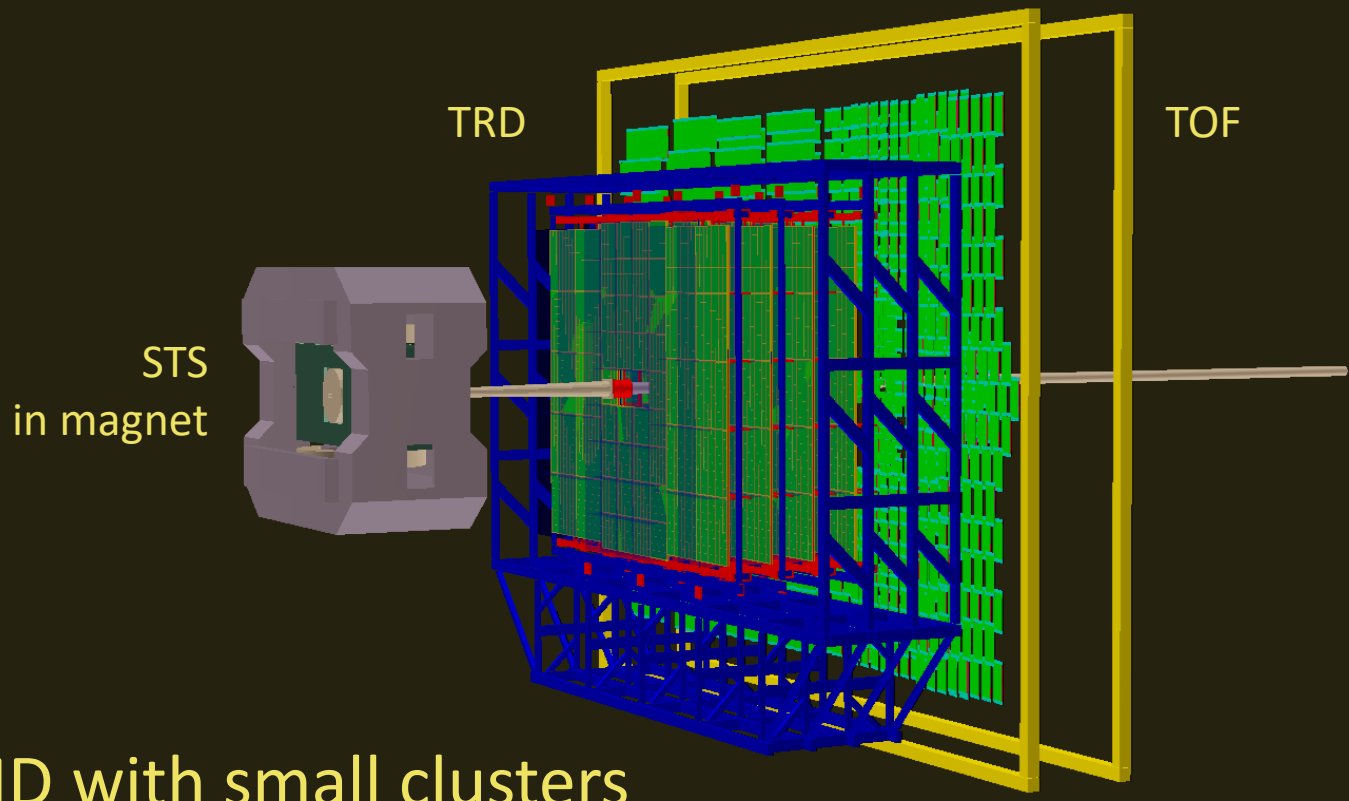
experiment:
time based, misalignment, calibration etc.

MC
100% control

Outline

- Simulation input
- Event selection based on raw data
- CA QA plots
- KFParticleFinder results
- Bonus: influence of the misalignment on reconstruction performance
- Next steps

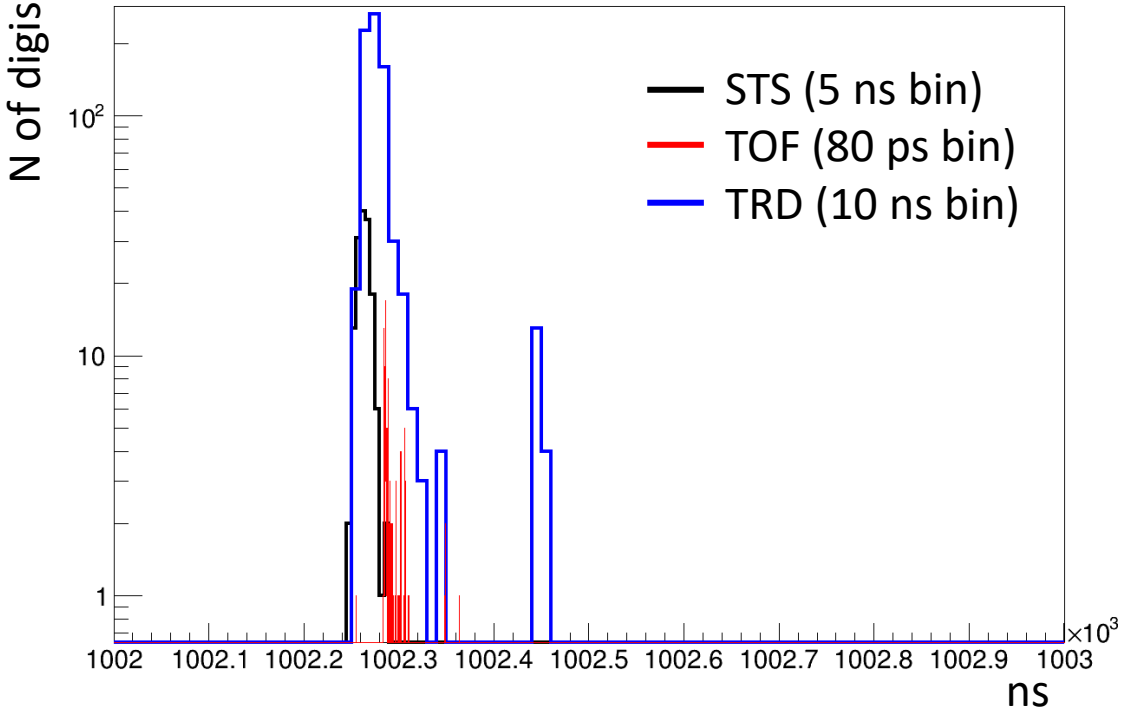
Simulation input



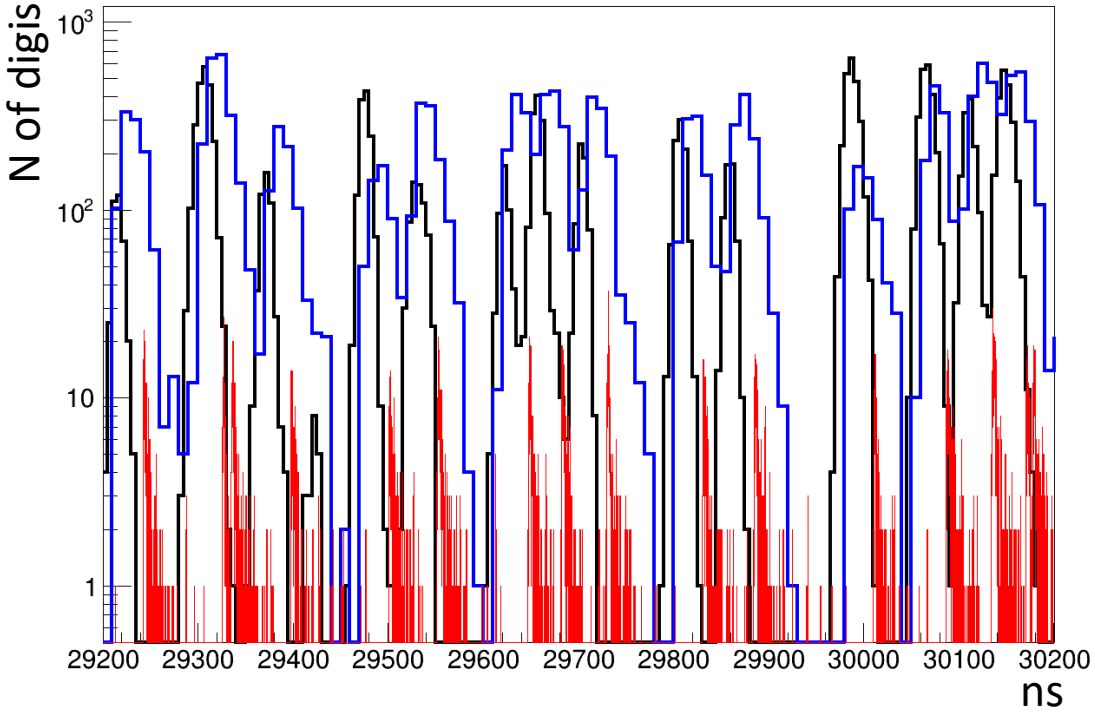
- setup SIS100_hadron
  - STS v22d
  - TRD v24c_1h
  - TOF v21a_1h
  - beam pipe v21d:v24i
  - magnetic field / magnet v22a
- particles generated using PHQMD with small clusters
  - /lustre/cbm/prod/gen/phqmd52_winn/auau/pbeam12agev/mbias/small_clusters
- transport with GEANT4
- reconstruction in event-by-event and in time-based (10^5 and 10^7) modes
- without detector noise and without beam

Digis in time slice: 1 µs

10^5 interaction / s

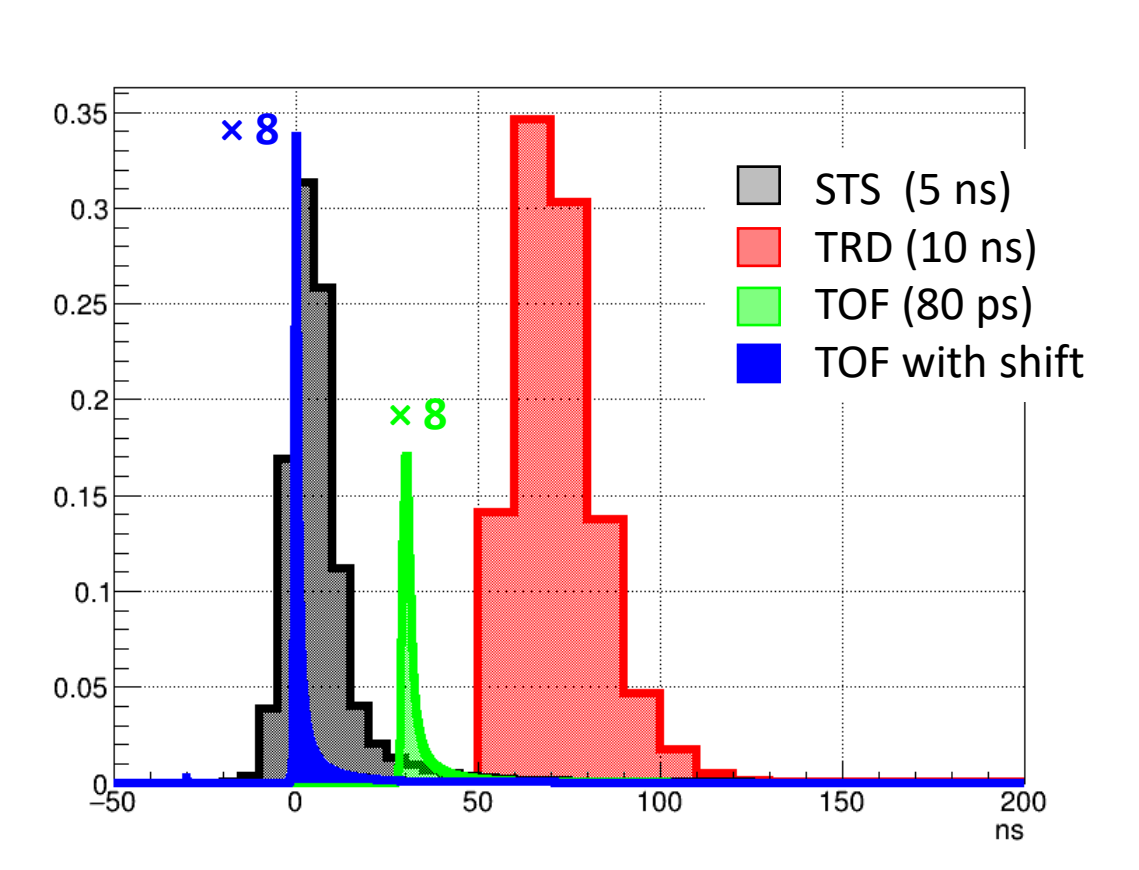


10^7 interaction / s



Event selection: reference detector

Event-by-event reconstruction



Reference detector:

STS – δ-electrons from the target and large time resolution 👎

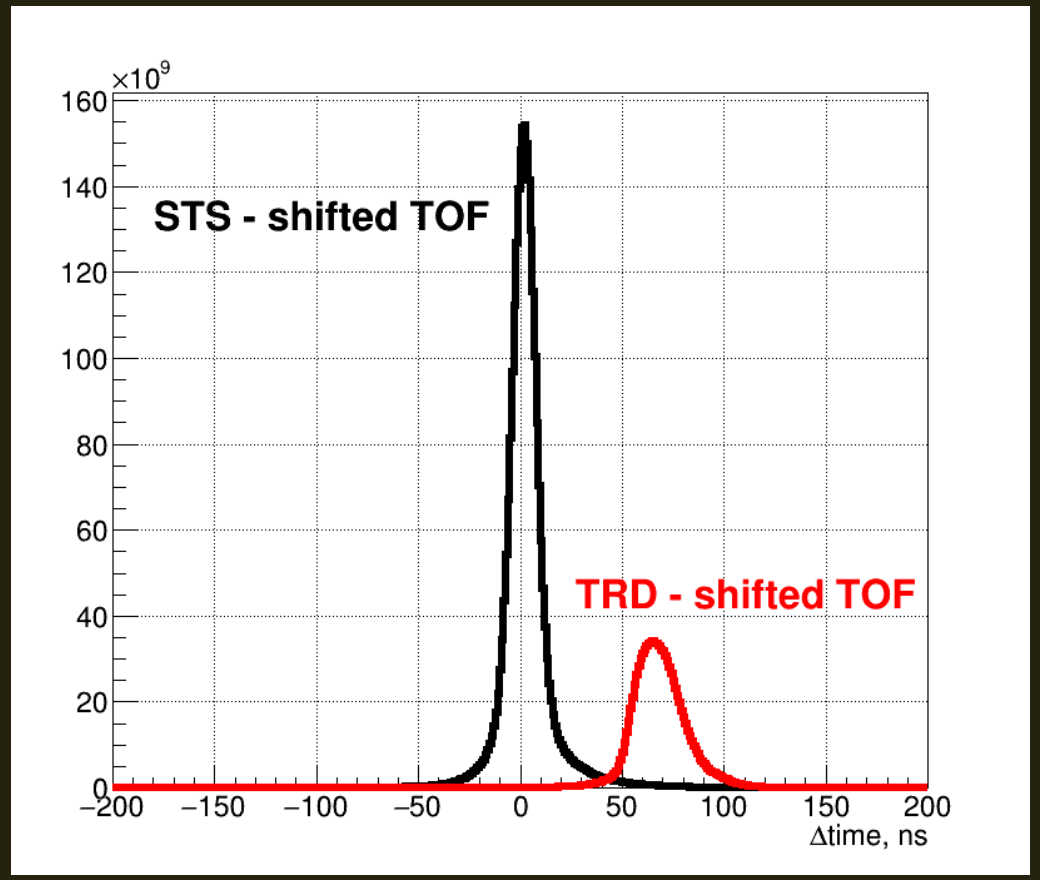
TRD – large time resolution 👎

TOF – small time resolution, less background particles from target 👍

Update TOF digi time taking into account time of flight („TOF with shift“):
event trigger window -2 ÷ 20 ns

Event selection: detector windows

Event-by-event reconstruction

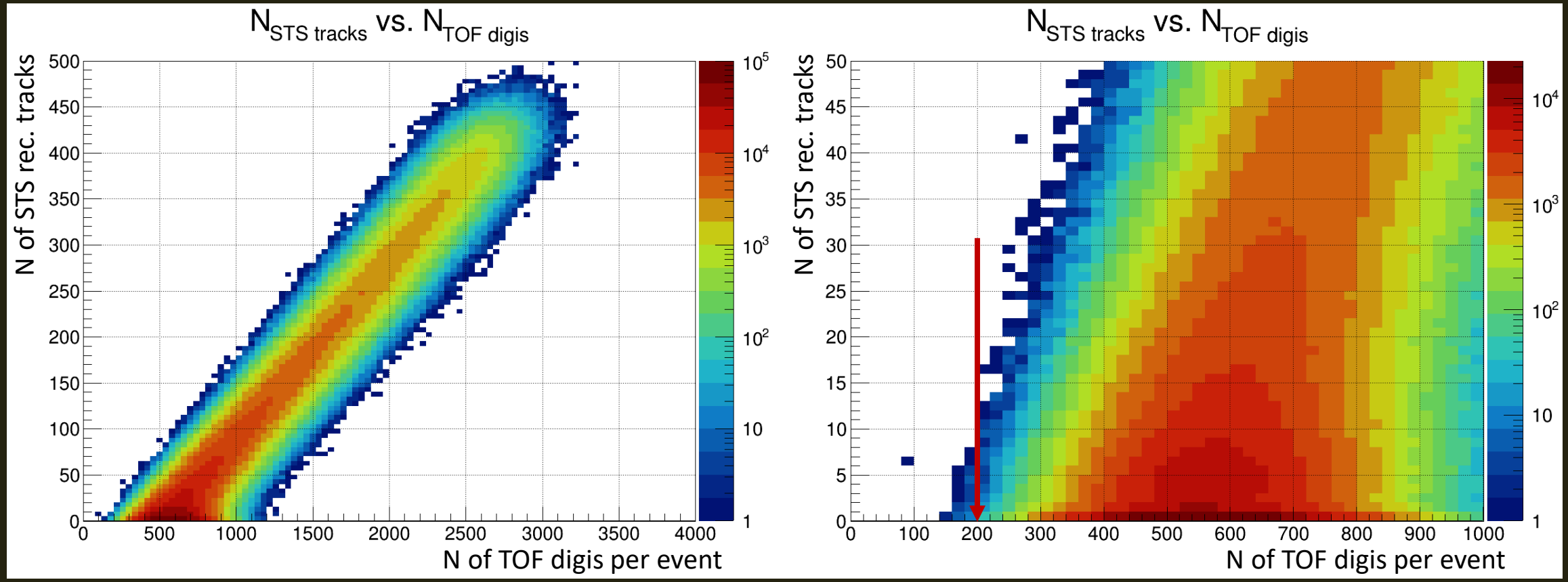


STS: -50 ÷ 55 ns

TRD: 0 ÷ 150 ns

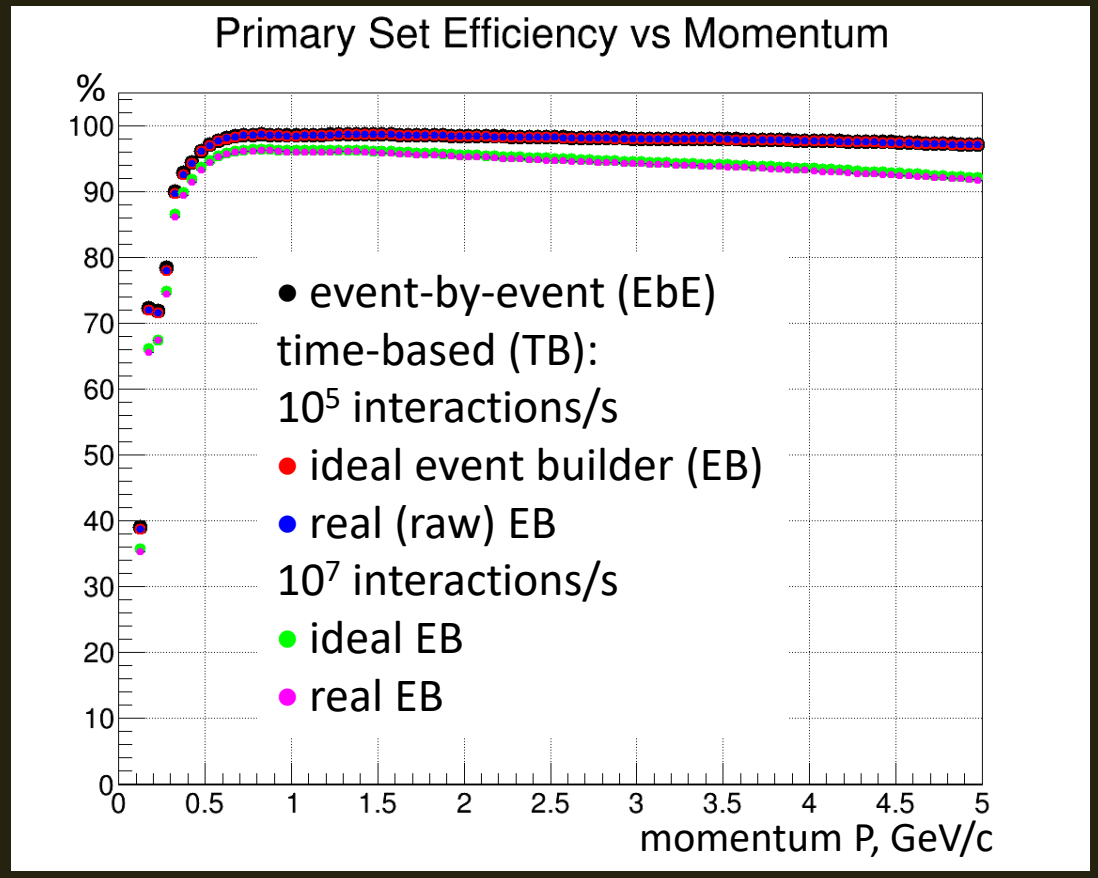
Event selection: minimum number of digis

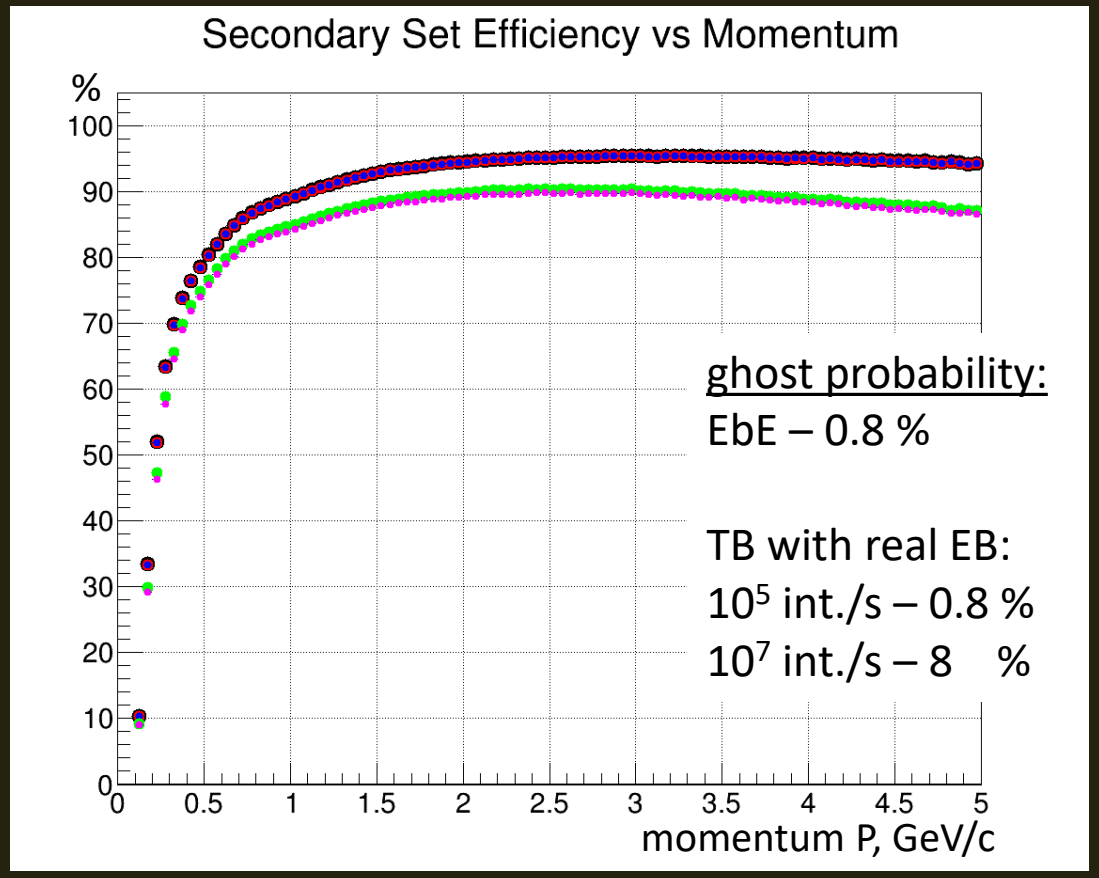
Event-by-event reconstruction



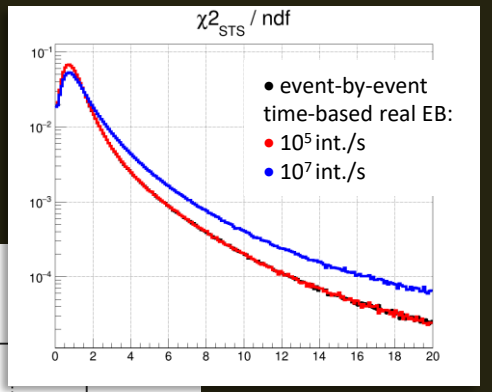
CA QA: reconstruction efficiency

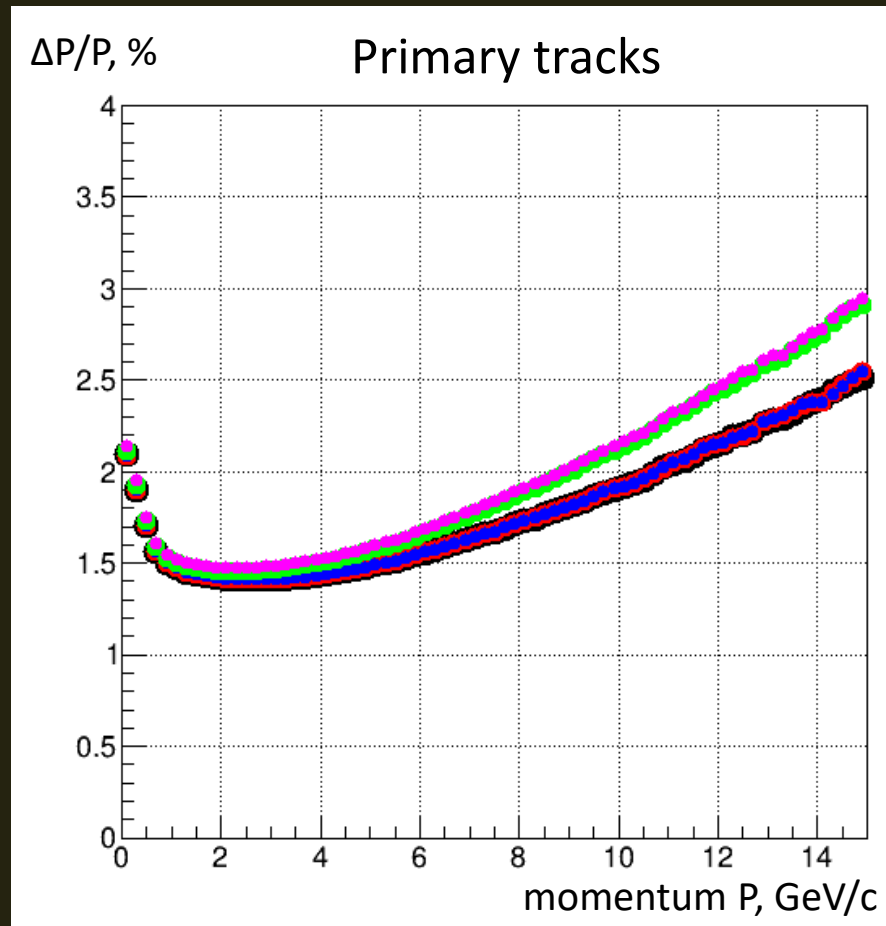
STS channel dead time 200 ns

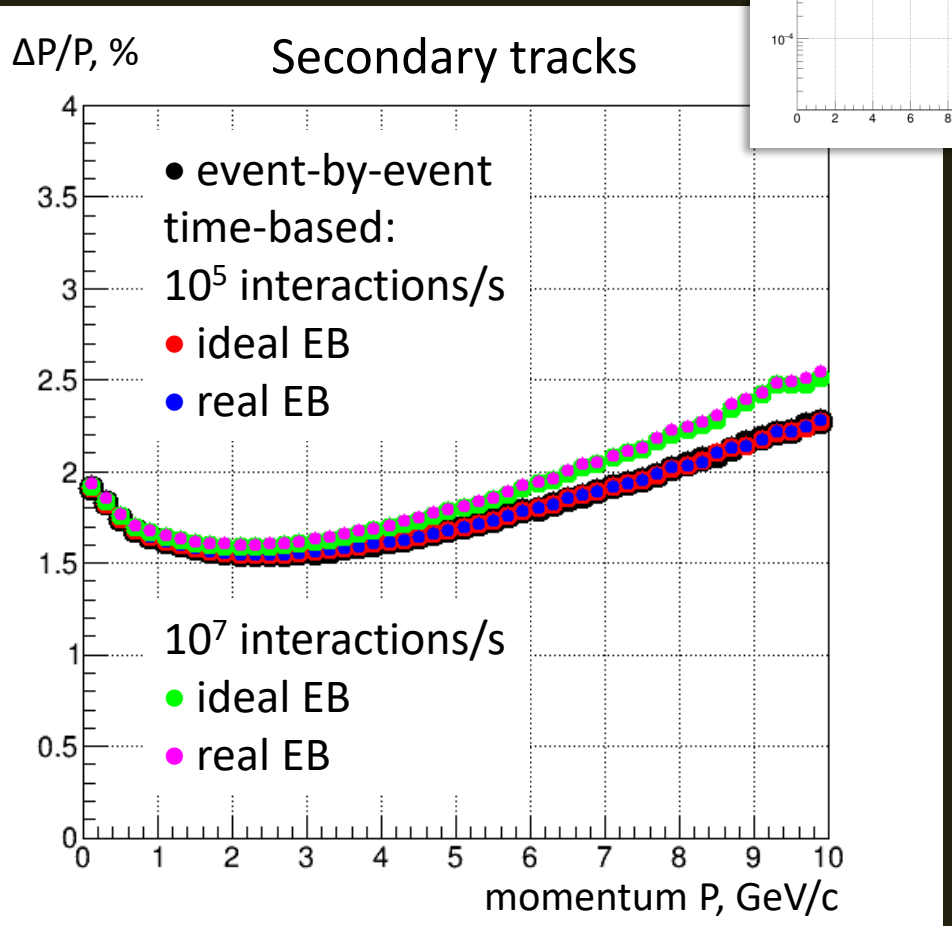




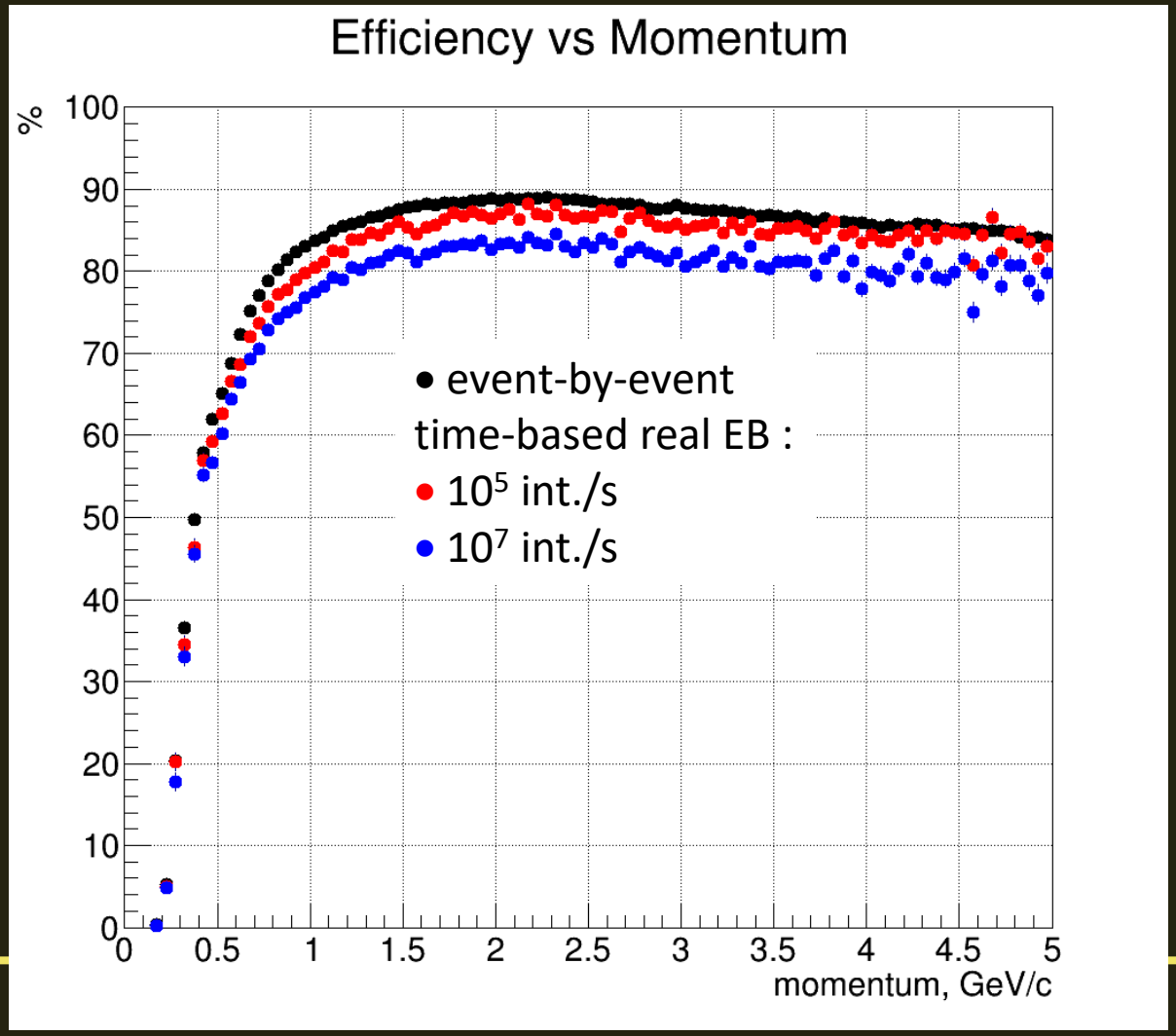
CA QA: momentum resolution







Global reconstruction efficiency STS+TRD+TOF

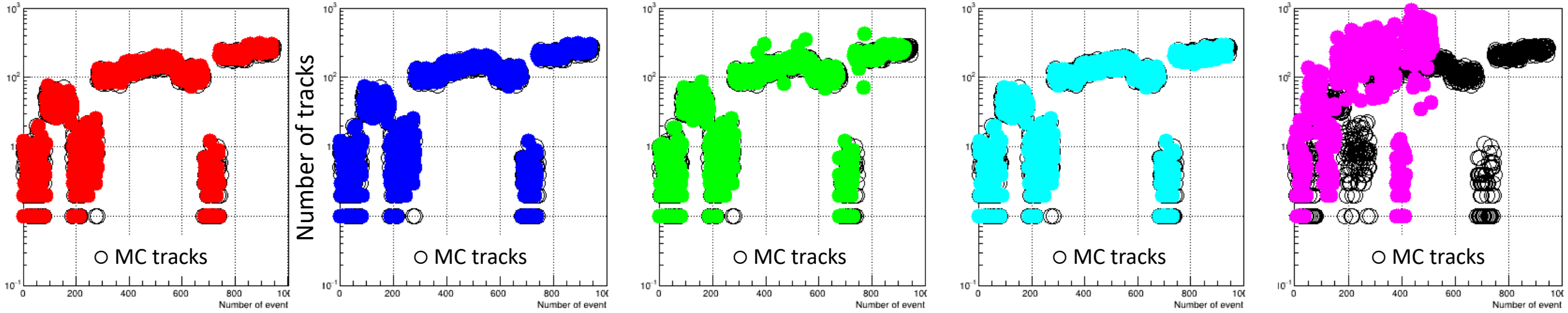


%

Event builder QA: number of long tracks

STS+TRD+TOF

Event-by-event | 10^5, ideal EB | 10^5, real EB | 10^7, ideal EB | 10^7, real EB



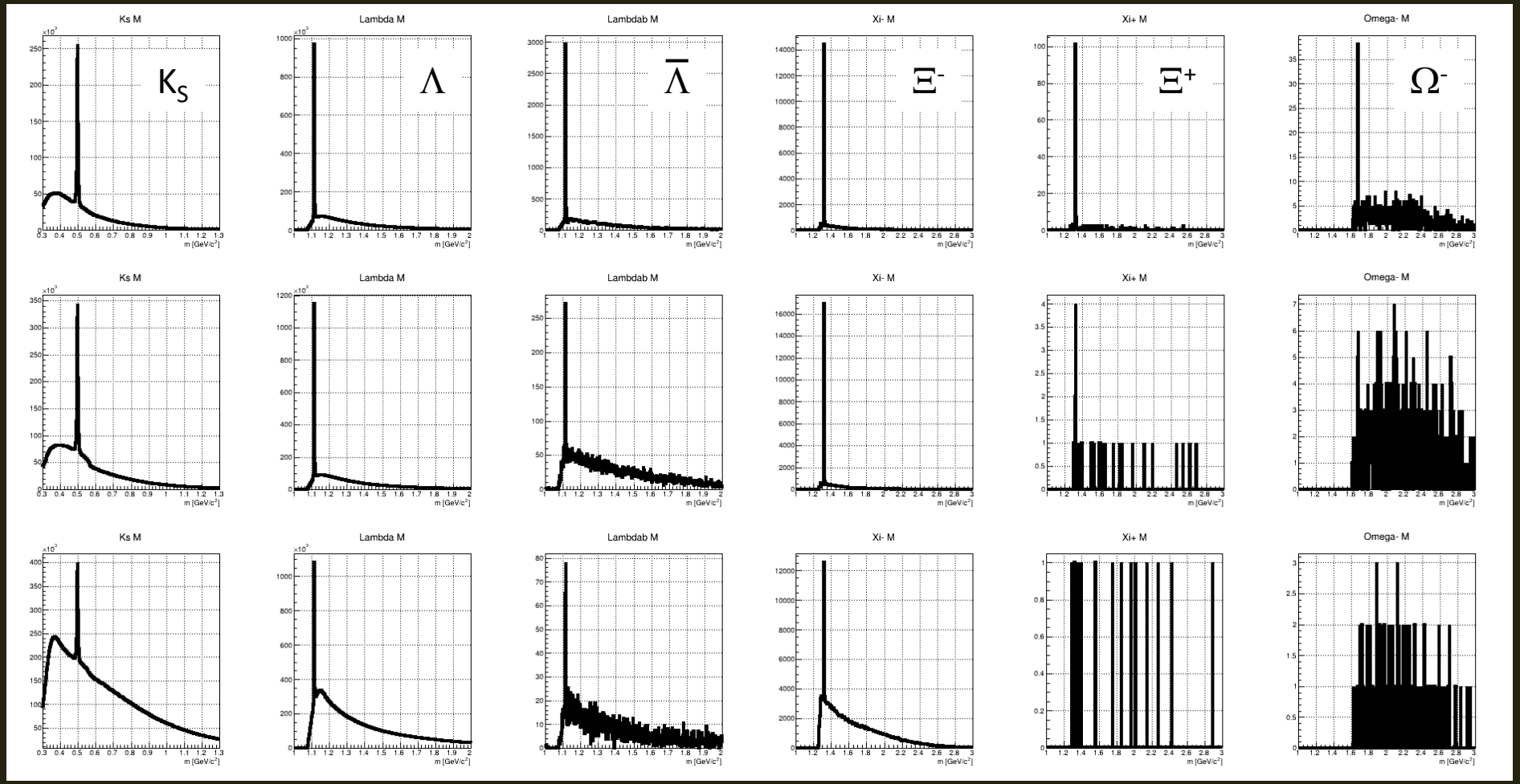
splitting: ~1%

splitting: 1.5%
merging: 30%

merging: reconstructed tracks from different MC events are put to one reconstructed event
splitting: reconstructed tracks from one MC event are put to different reconstructed events

Reconstructed particles: KFParticle Finder

event-by-event



3.879M mbias events

10^5 int./s real EB

4.82M mbias events

10^7 int./s real EB

4.775M mbias events

Misalignment tolerance of the reconstruction performance

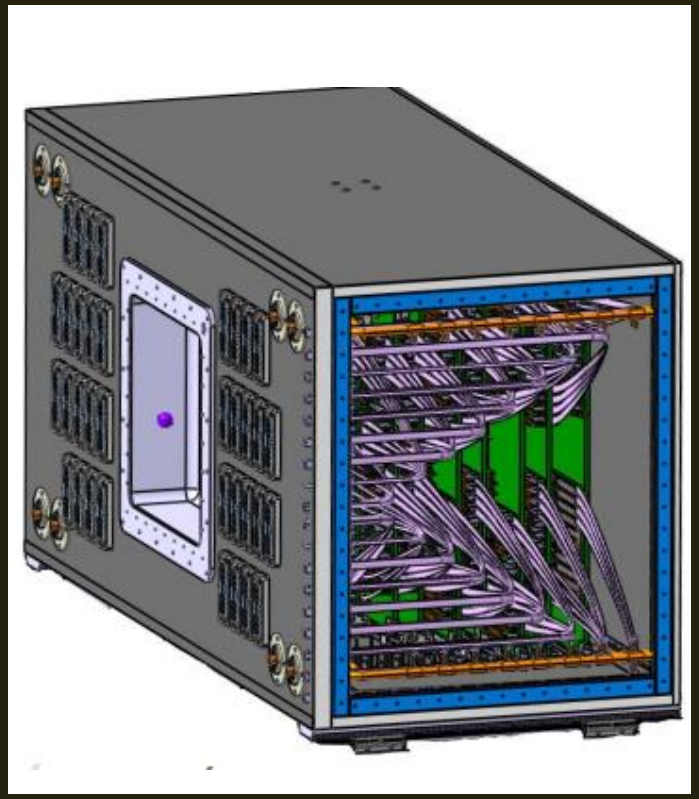
https://indico.gsi.de/event/23010/

https://indico.gsi.de/event/23066/

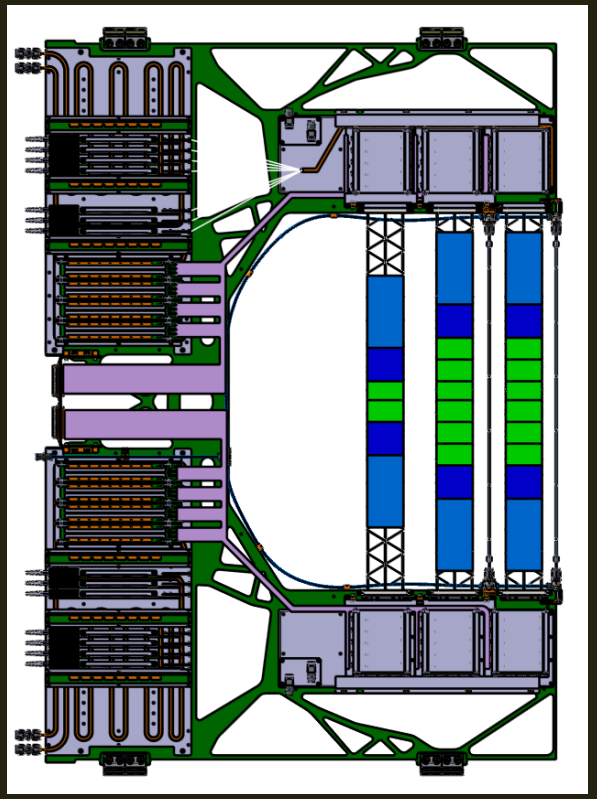
https://indico.gsi.de/event/23163/

STS: ~100 µm misalignment for each detector element

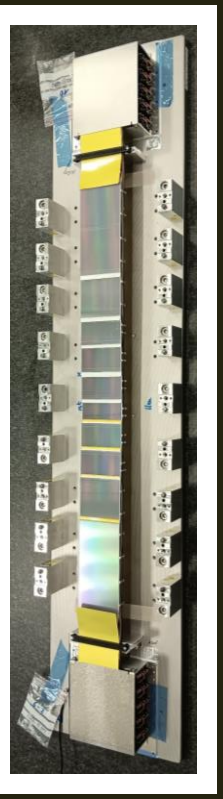
STS
(1)



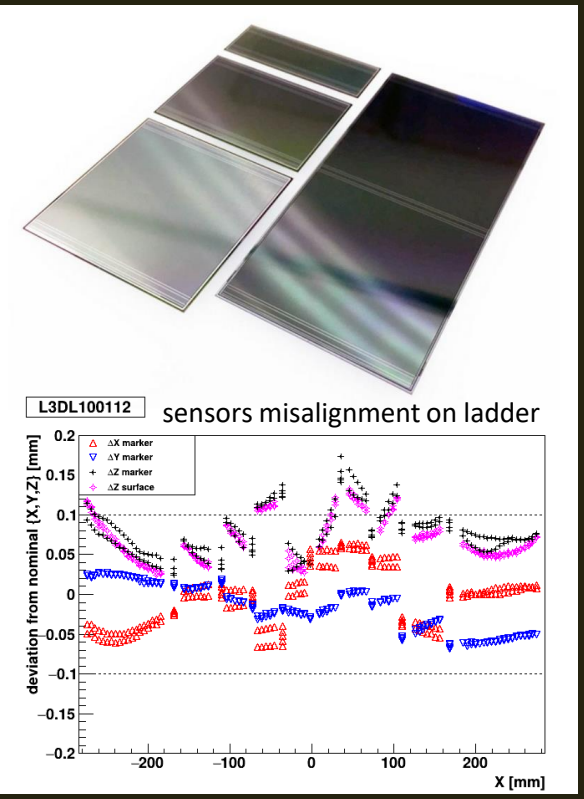
Units
(20)



Laddrers
(106)

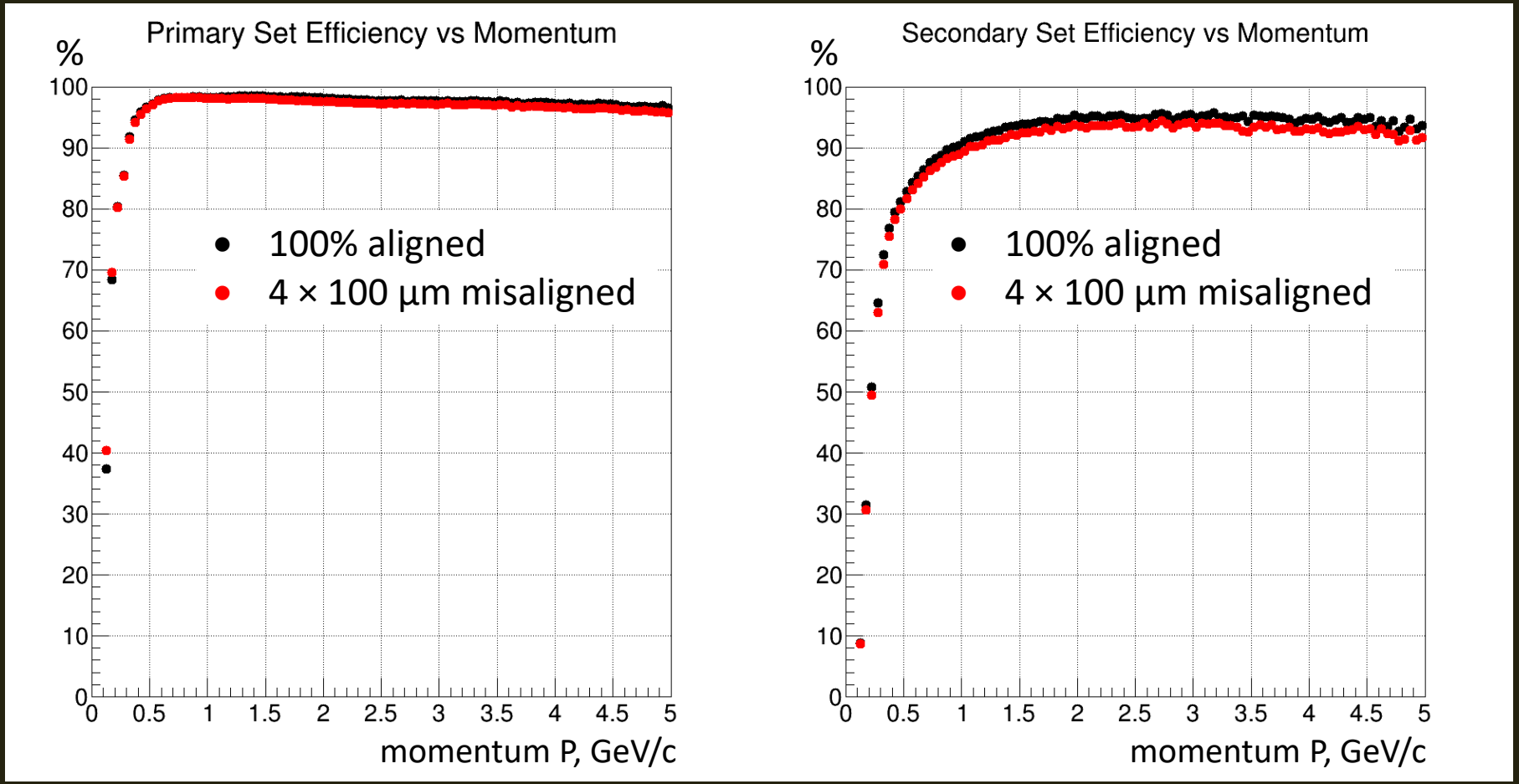


Sensors
(876)



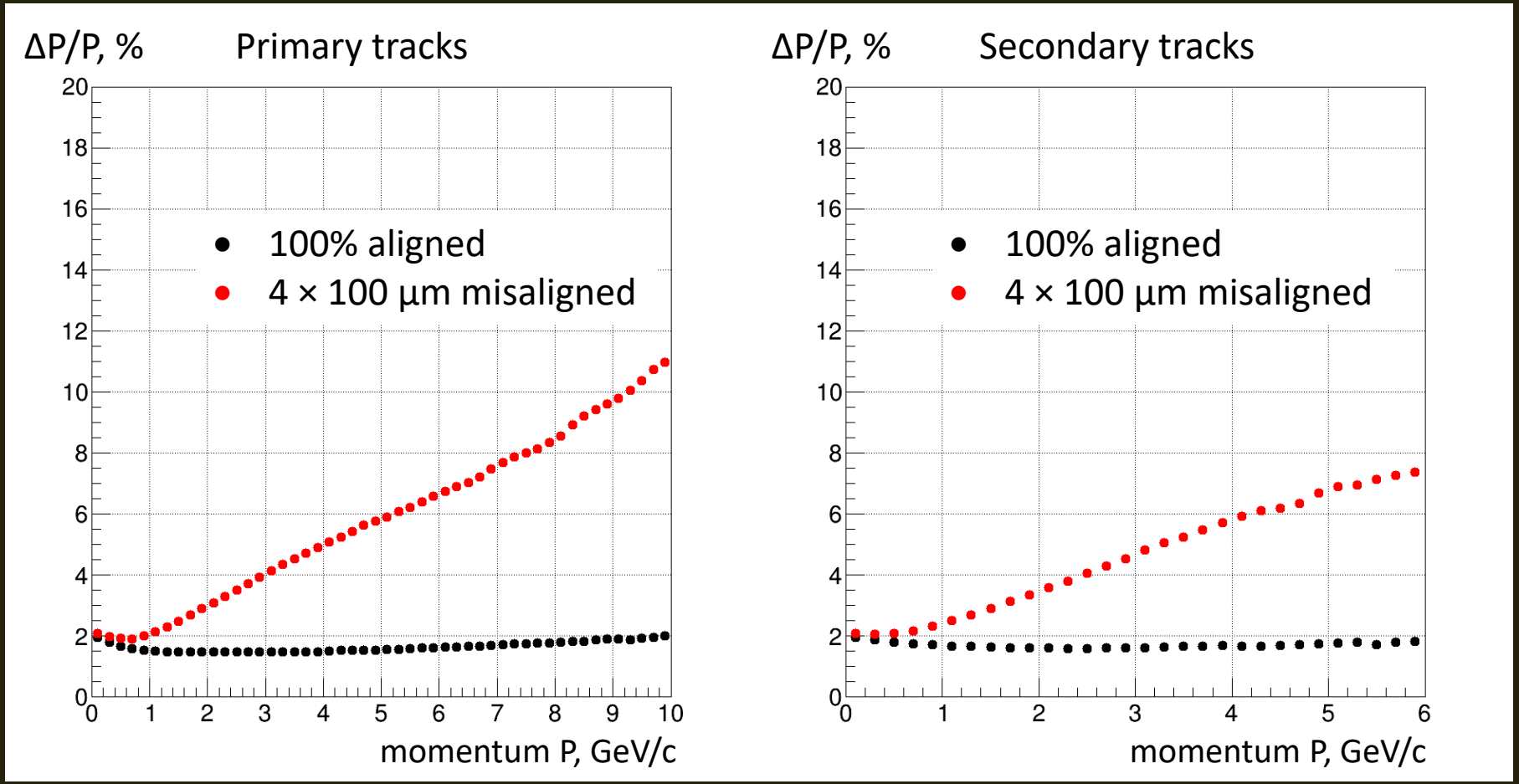
L1 QA: efficiency

100 µm misaligned sensors +
100 µm misaligned half ladders +
100 µm misaligned units +
100 µm misaligned STS
gRandom->Uniform(0.01*(-1.), 0.01);



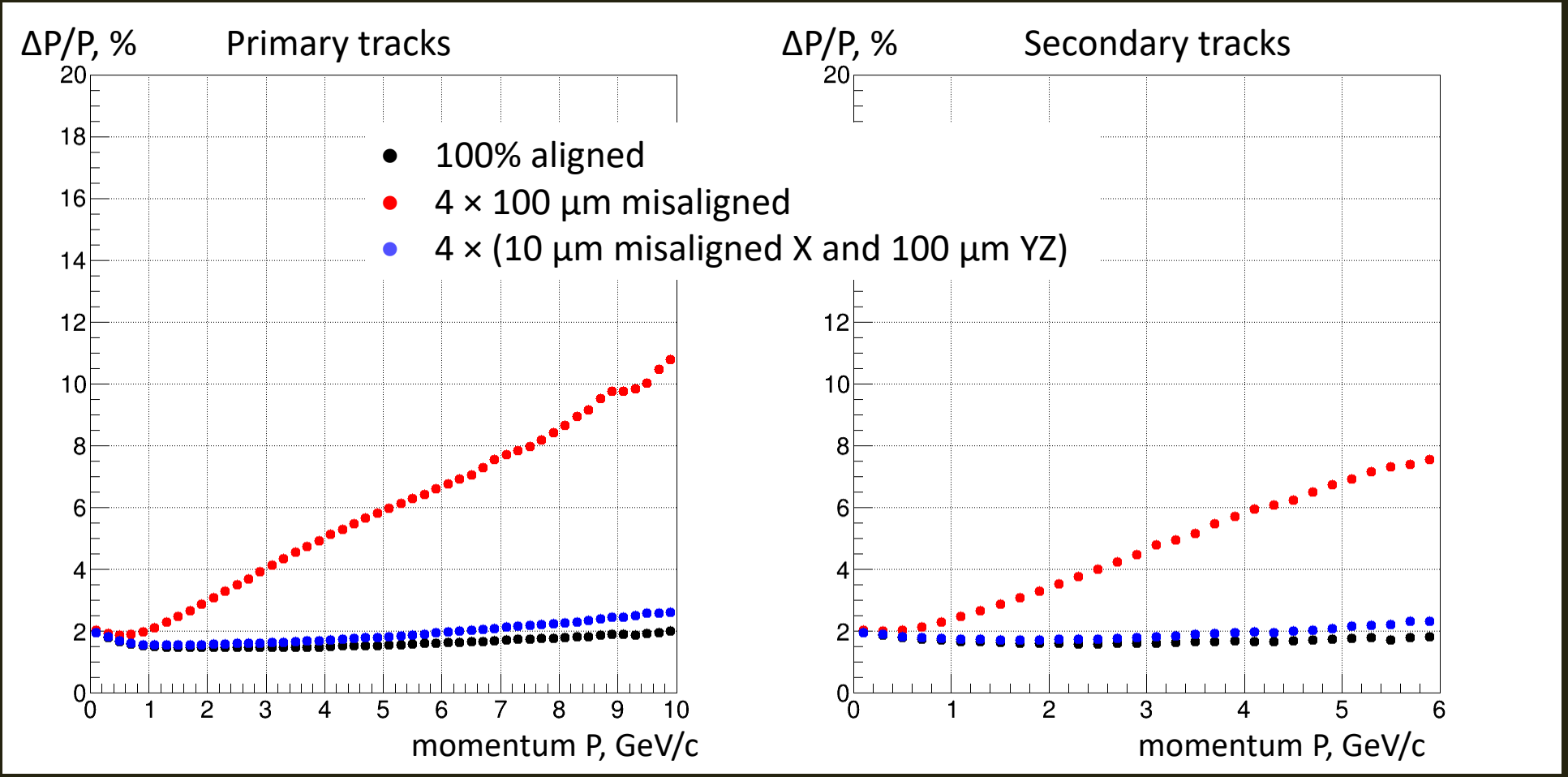
L1 QA: momentum resolution

100 µm misaligned sensors +
100 µm misaligned half ladders +
100 µm misaligned units +
100 µm misaligned STS
gRandom->Uniform(0.01*(-1.), 0.01);



L1 QA: momentum resolution

100 µm misaligned sensors +
100 µm misaligned half ladders +
100 µm misaligned units +
100 µm misaligned STS
gRandom->Uniform(0.01*(-1.), 0.01);



Next steps

- Use tracks or multiple primary vertices for event selection / separation. Needed: new or updated global tracking for reconstruction in time slice; multiple primary vertices reconstruction.

  Event builder based on global tracks
  https://indico.gsi.de/event/19534/contributions/82196/

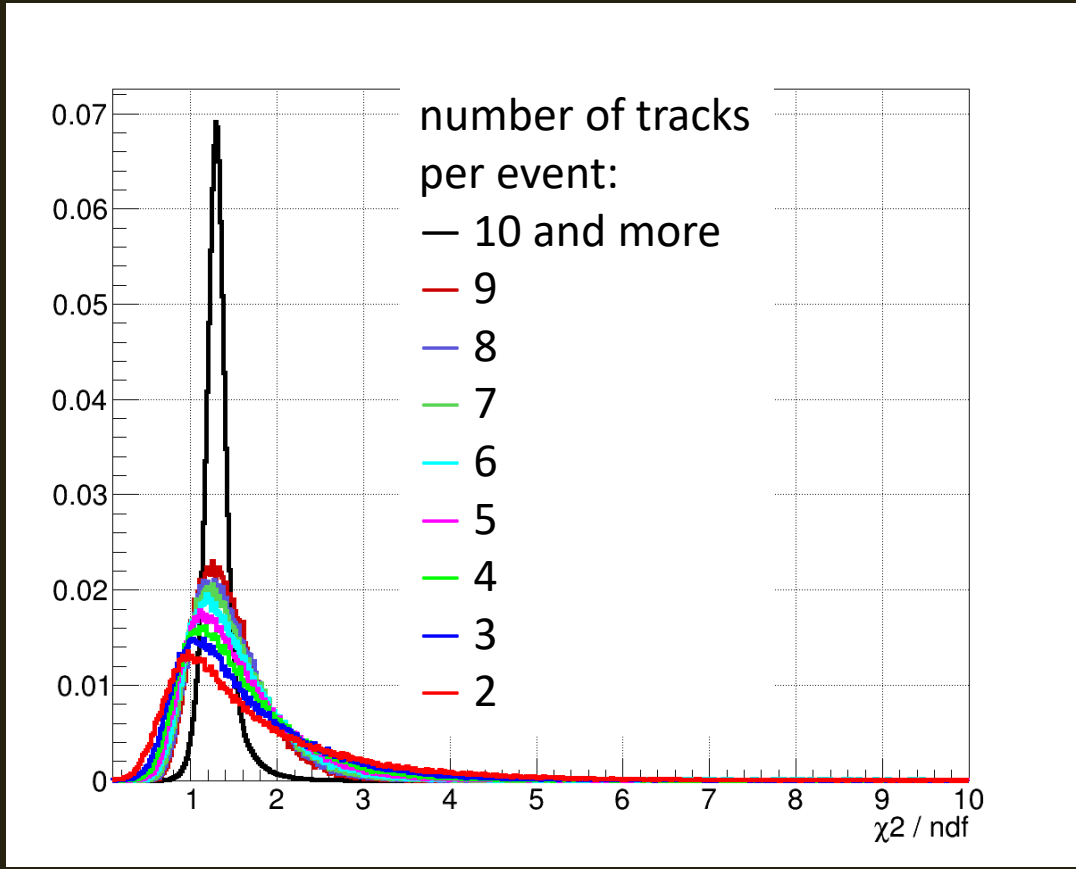
- Study influence of the misalignment on particle identification: misalignment tolerance level for online reconstruction and analysis (software particle trigger).

Backup

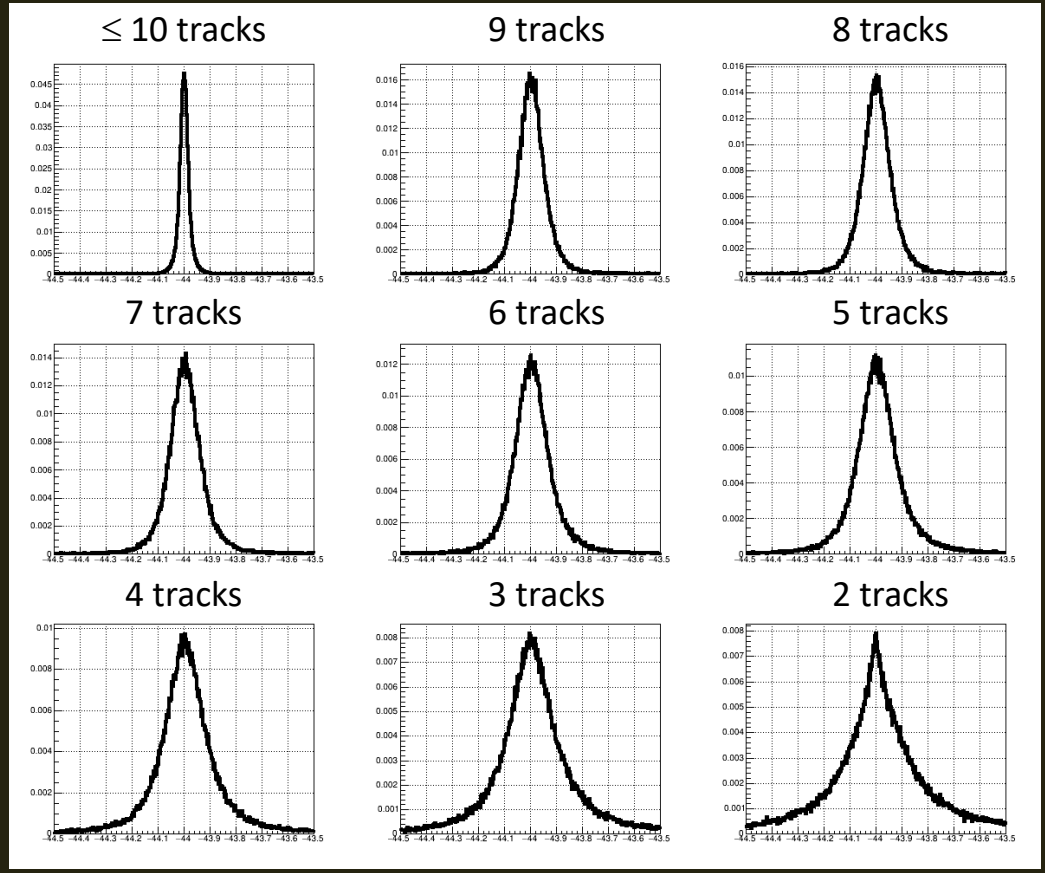
What is a CBM physical event ?

Event-by-event reconstruction

Reconstructed primary vertex



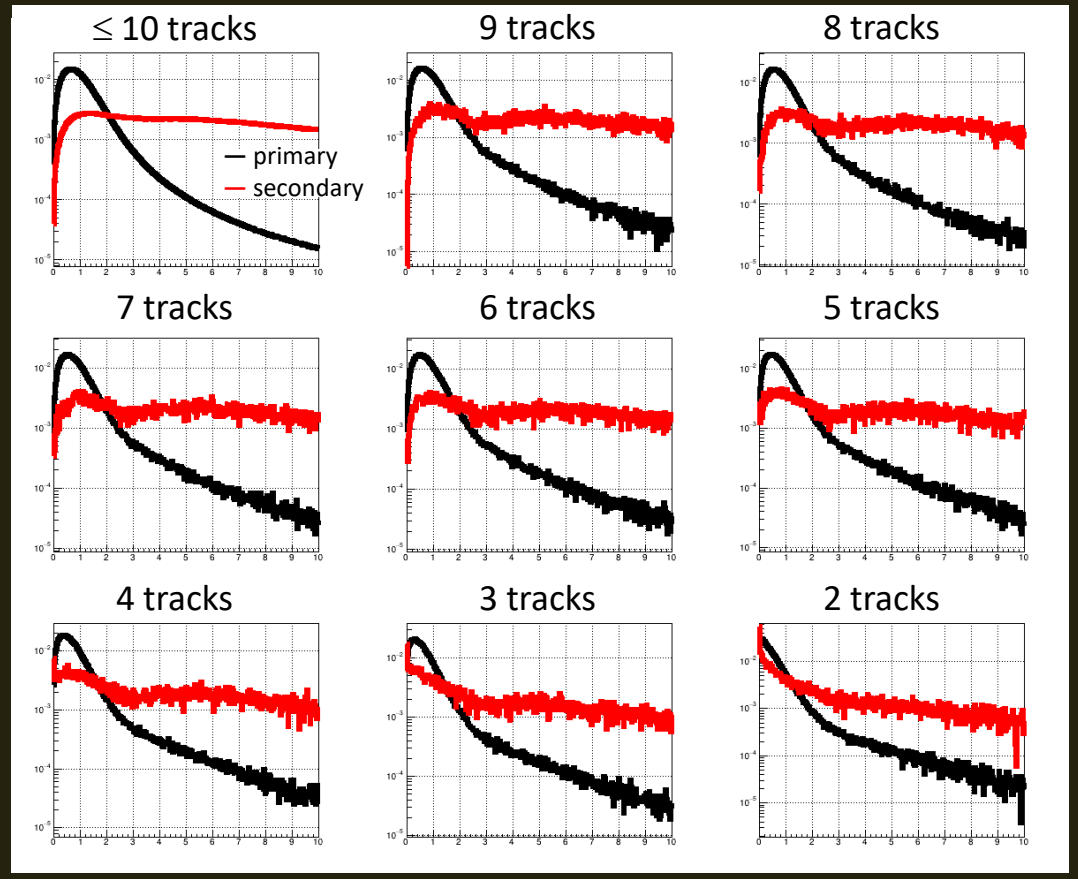
Reconstructed Z coordinate of primary vertex



What is a CBM physical event ?

Event-by-event reconstruction

χ^2/ndf of tracks in primary vertex

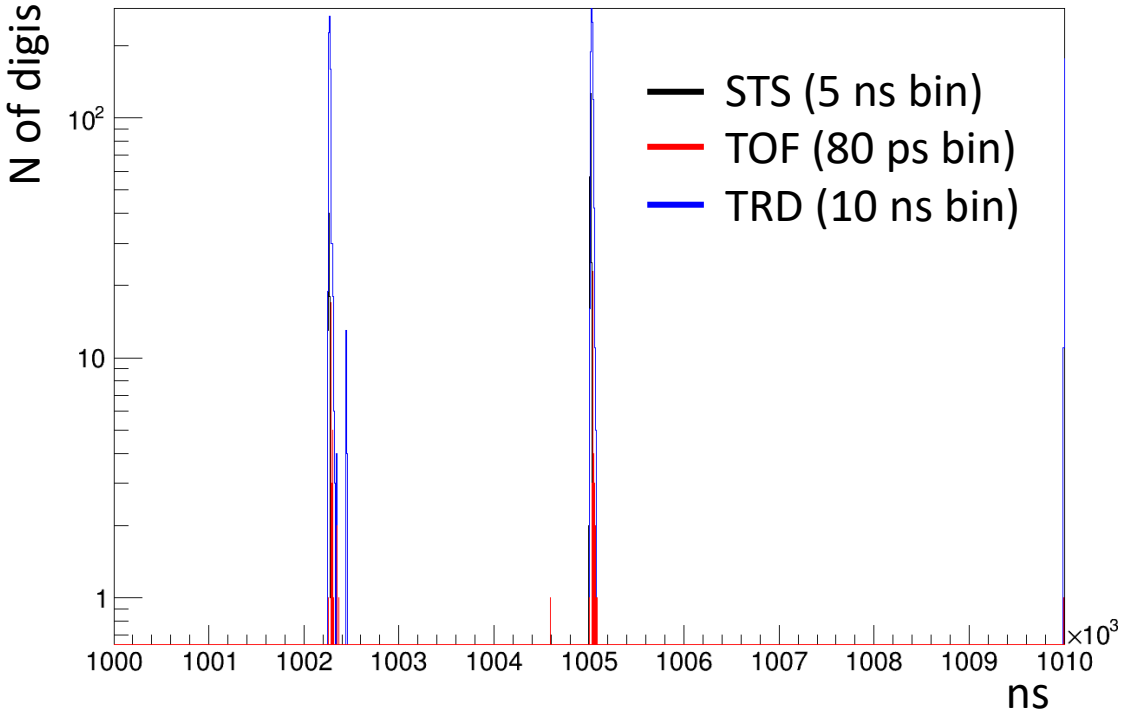


It is enough to have tracks only in STS, or tracks must have TOF hit for pID.

For example: physical event is an event with at least 3 STS reconstructed tracks matched with TOF hit.

Digis in time slice: 10 µs

10^5 interaction / s



10^7 interaction / s