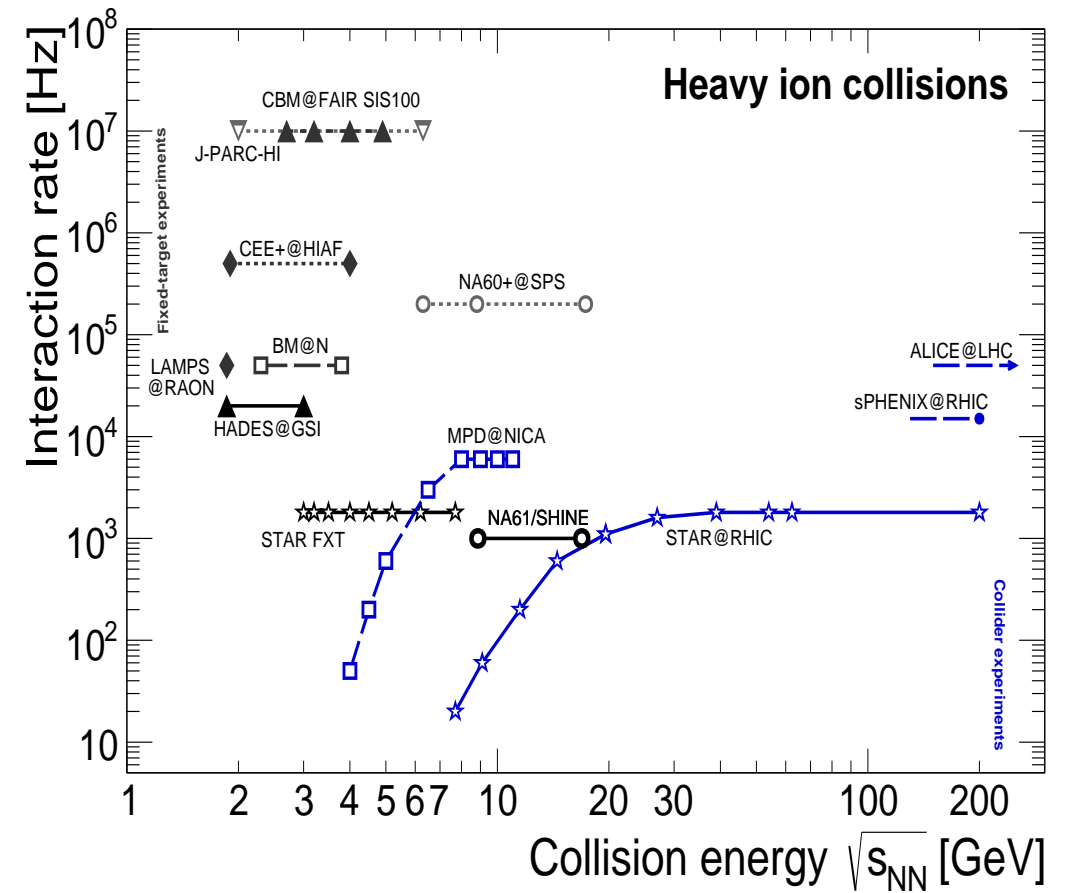


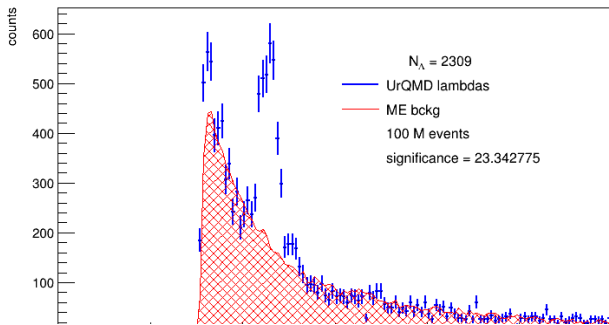
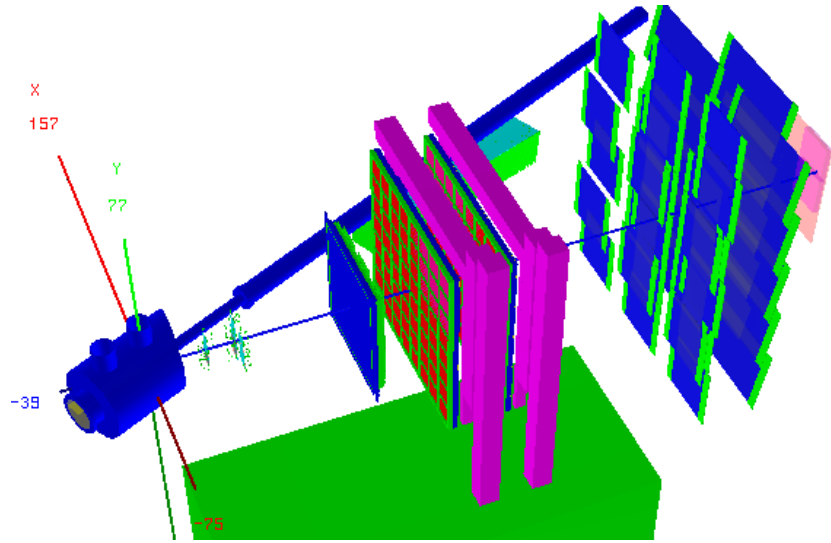
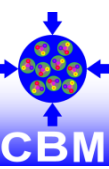
CBM Status & Plans

FAIR/GSI Research Retreat 2023

- mCBM needs for 2023/2024
- Plans for 2028

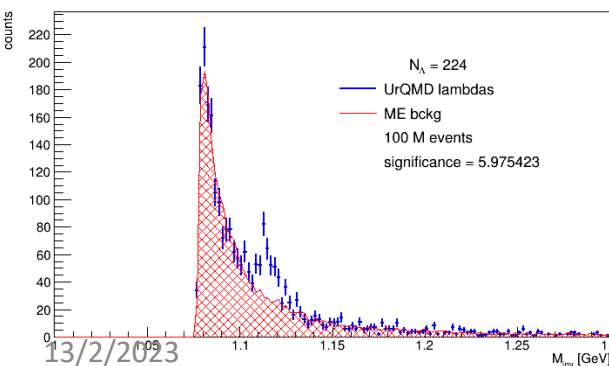


mCBM Campaign 2024/25 - granted proposal (G-22-00110)



Simulations:

Ni + Ni
1.93 AGeV



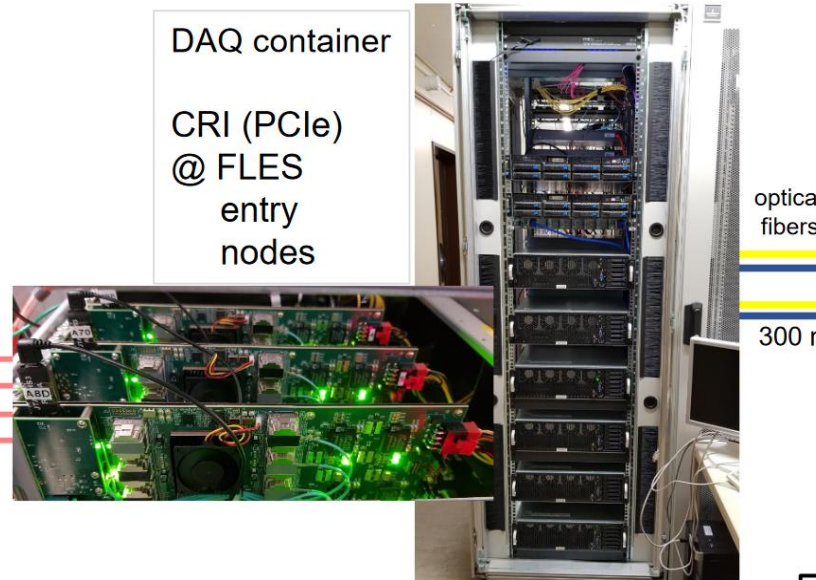
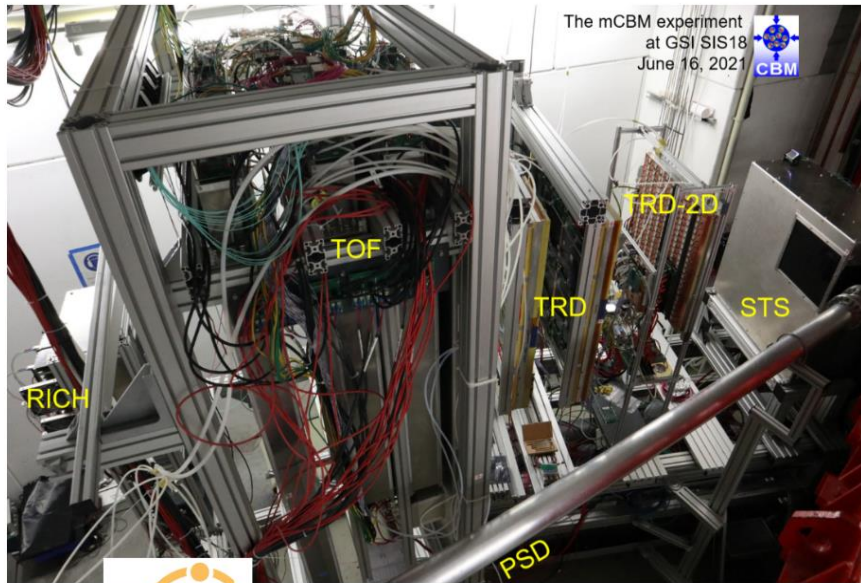
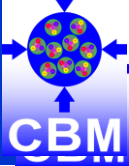
Au + Au
1.24 AGeV

2 TRD hits
TMVA selection

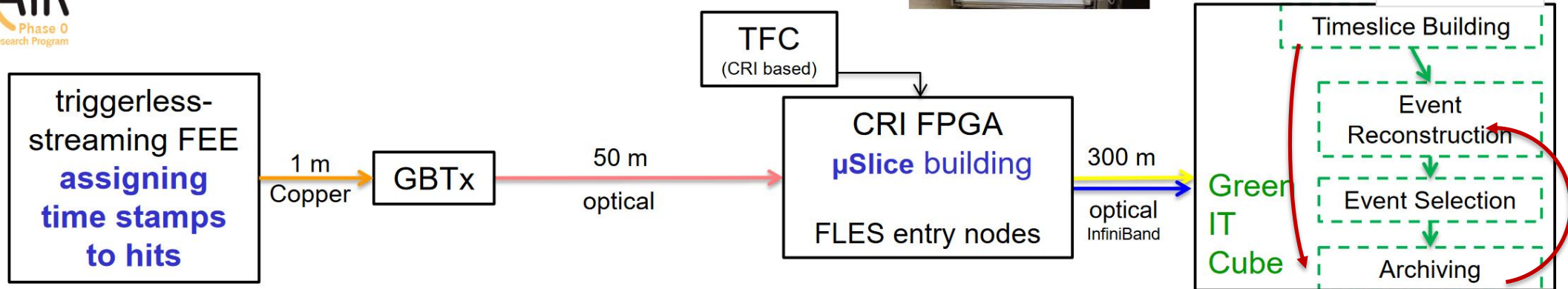
	Year	Objective	Projectile	Intensity per spill	Extraction	User type	Shifts
(1)	2023 2024	high-rate detector studies	ions 1 - 2 AGeV, preferably: Au, Pb, U	$10^7 - 10^9$	slow, 10 s	secondary	6
(2)	2023 2024	commissioning for benchmark run	ions 1 - 2 AGeV, preferably: Ni 1.93 AGeV	$10^7 - 10^8$	slow, 10 s	secondary	3
(3)	2023 2024	benchmark runs, Λ production excitation function	Ni 1.93, 1.58, 1.23, 1.0 AGeV	10^8	slow, 10 s	main	18 9
(4)	2024 2025	high-rate detector studies	ions 1 - 2 AGeV, preferably: Au, Pb, U	$10^7 - 10^9$	slow, 10 s	secondary	6
(5)	2024 2025	commissioning for benchmark run	ions 1 - 2 AGeV, preferably: Ag 1.58 AGeV	$10^7 - 10^8$	slow, 10 s	secondary	3
(6)	2024 2025	benchmark runs, Λ production excitation function	Ag 1.58, 1.23, 1.0 AGeV	10^8	slow, 10 s	main	18 9

- High rate detector tests
- System performance tests (with potential for physics results)

mCBM status

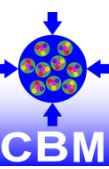


FLES processing nodes

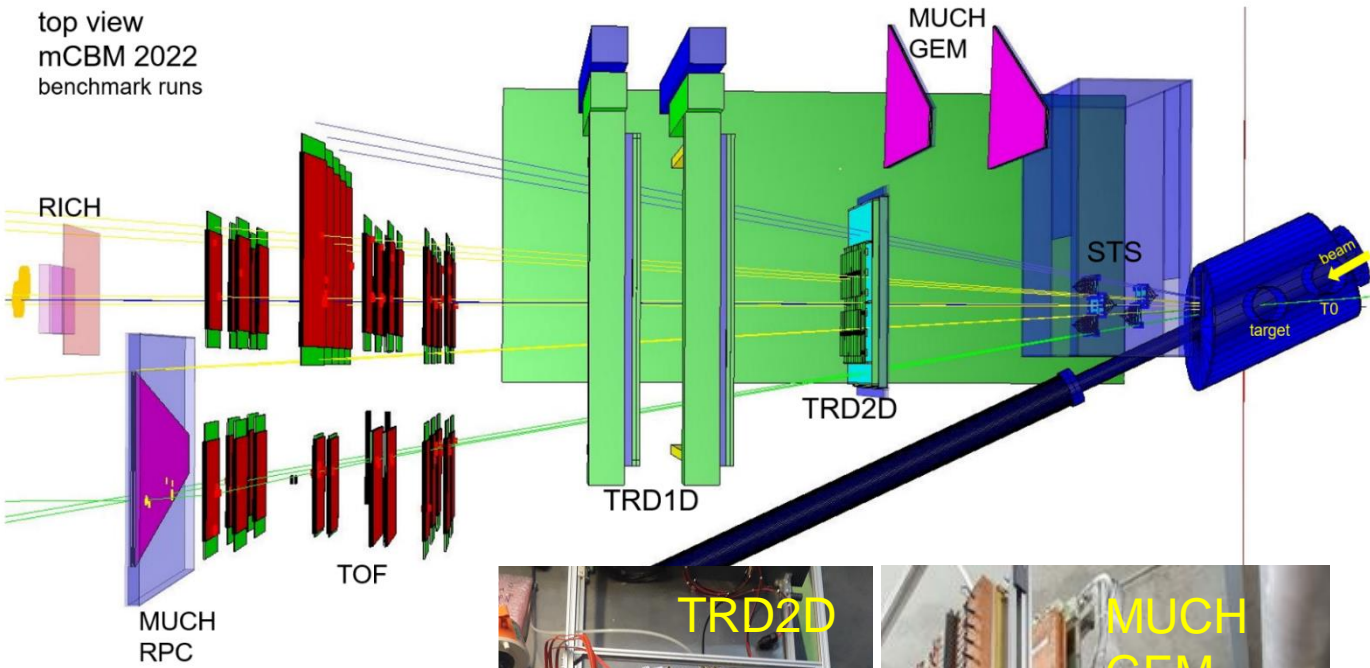


„Final“ DAQ chain running since June 2021

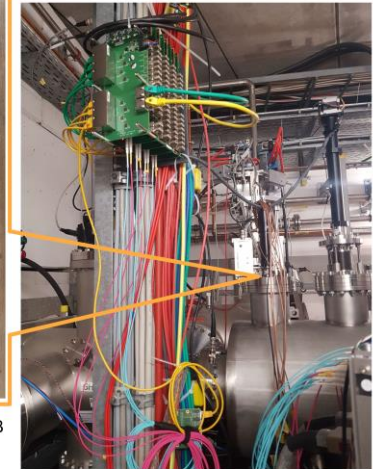
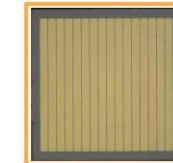
mCBM status



top view
mCBM 2022
benchmark runs

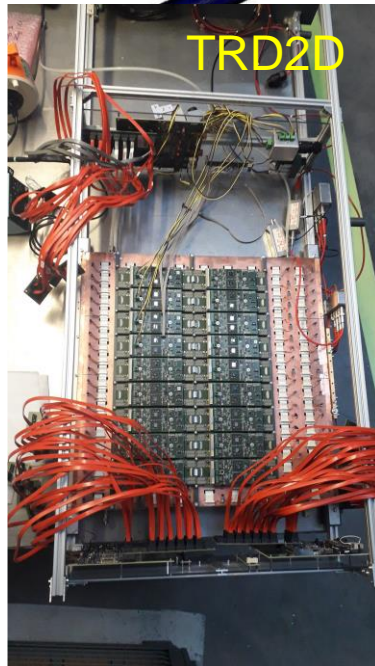


T0
diamond
counter



Diamond interface PCB
with pneumatic drive

New 10 mm x 10 mm x 80 μm
16-channels pcCVD diamond sensor



benchmark runs 2022

Ni + Ni, T = 1.93 AGeV

May 26, 2022, total run duration: 5h 55m

av. collision rate: 400kHz

av. data rate 1.5 GB/s to disc, 32 TB tsa files

Au + Au, T = 1.23 AGeV

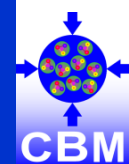
June 17 - 18, 2022, total run duration: 34h 33m

av. collision rate: 200 - 300kHz

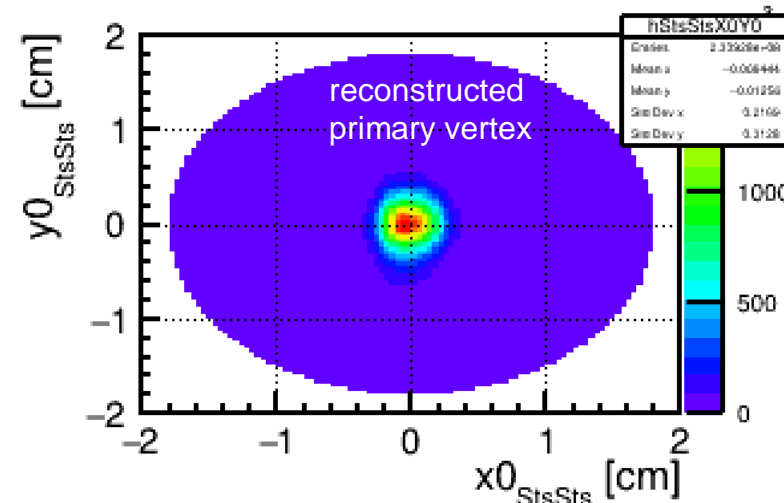
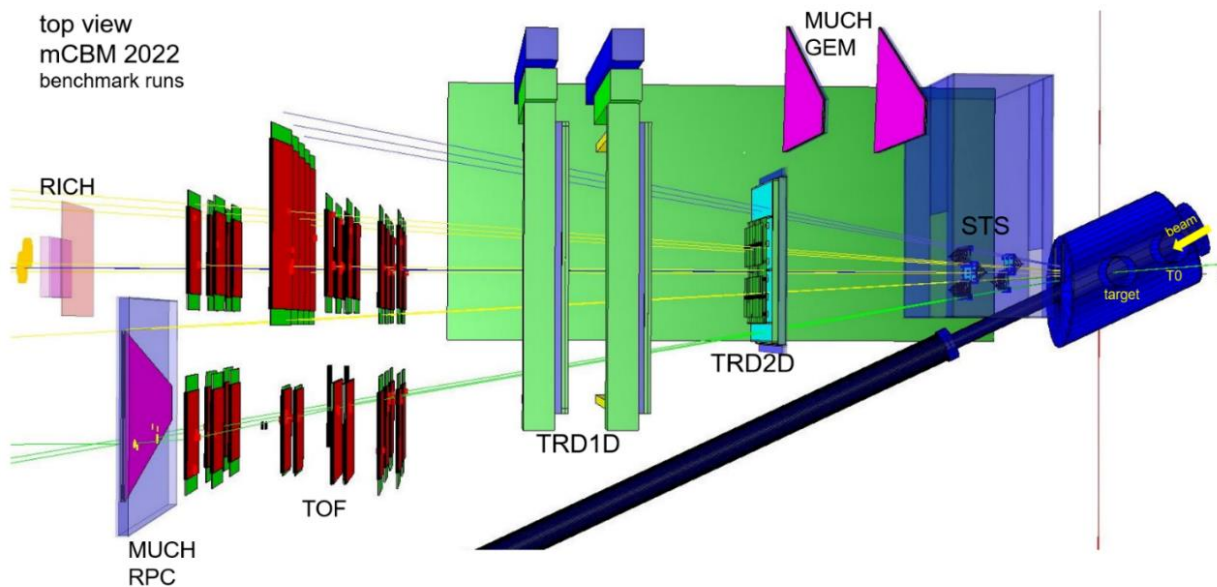
av. data rate 1.4 - 2.2 GB/s to disc,

180 TB tsa files

mCBM analysis status

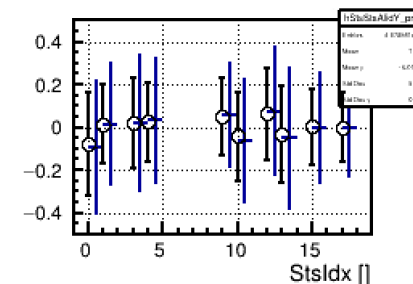
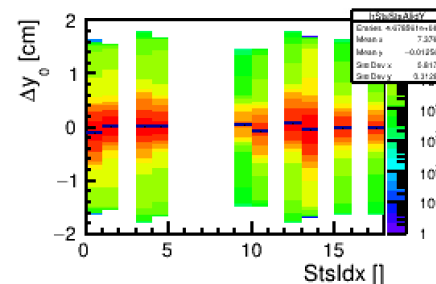
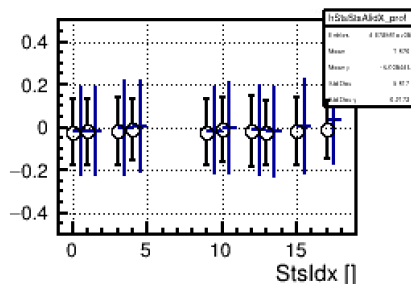
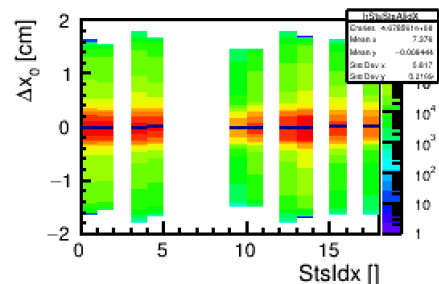


top view
mCBM 2022
benchmark runs

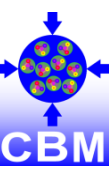


Alignment (under development)

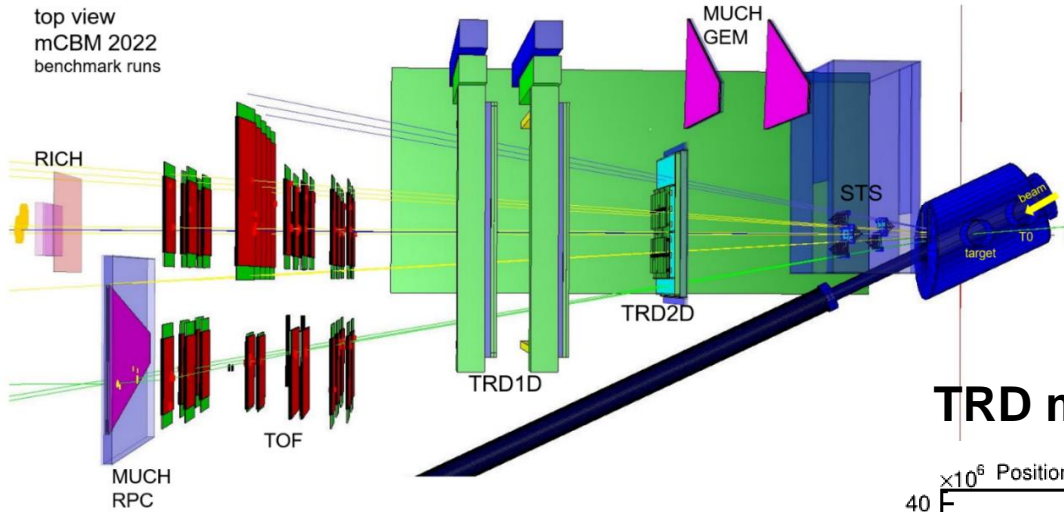
STS – STS – TOF



mCBM current data status



top view
mCBM 2022
benchmark runs



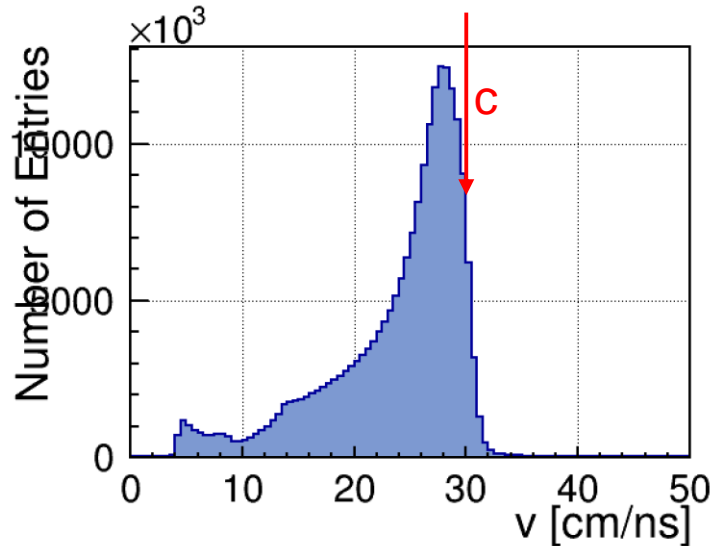
Run 2391

Data taken May 26, 2022

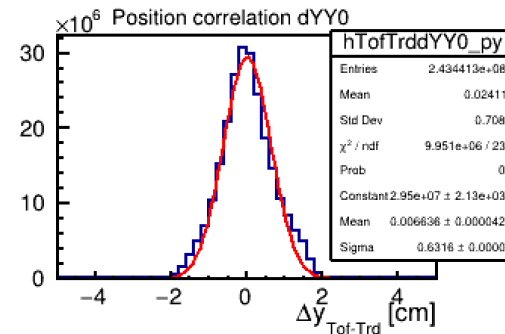
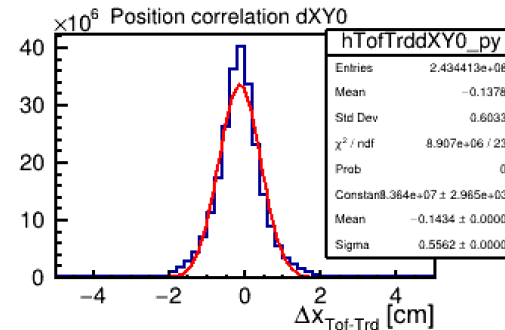
Duration: ~2h

5×10^7 ions per spill, 10s spill,
400 - 500 kHz collision rate

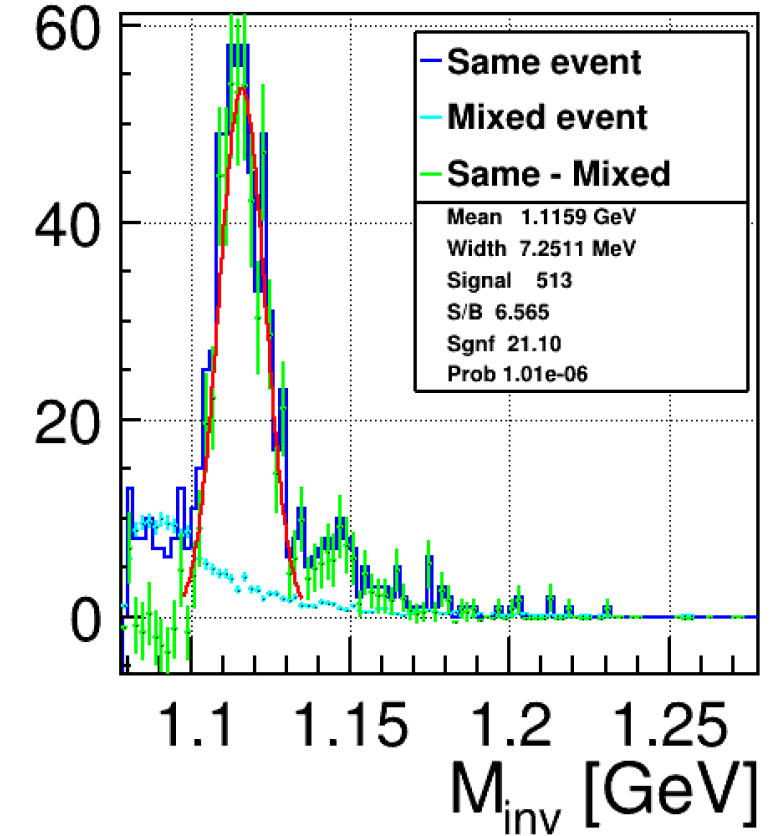
TOF calibration



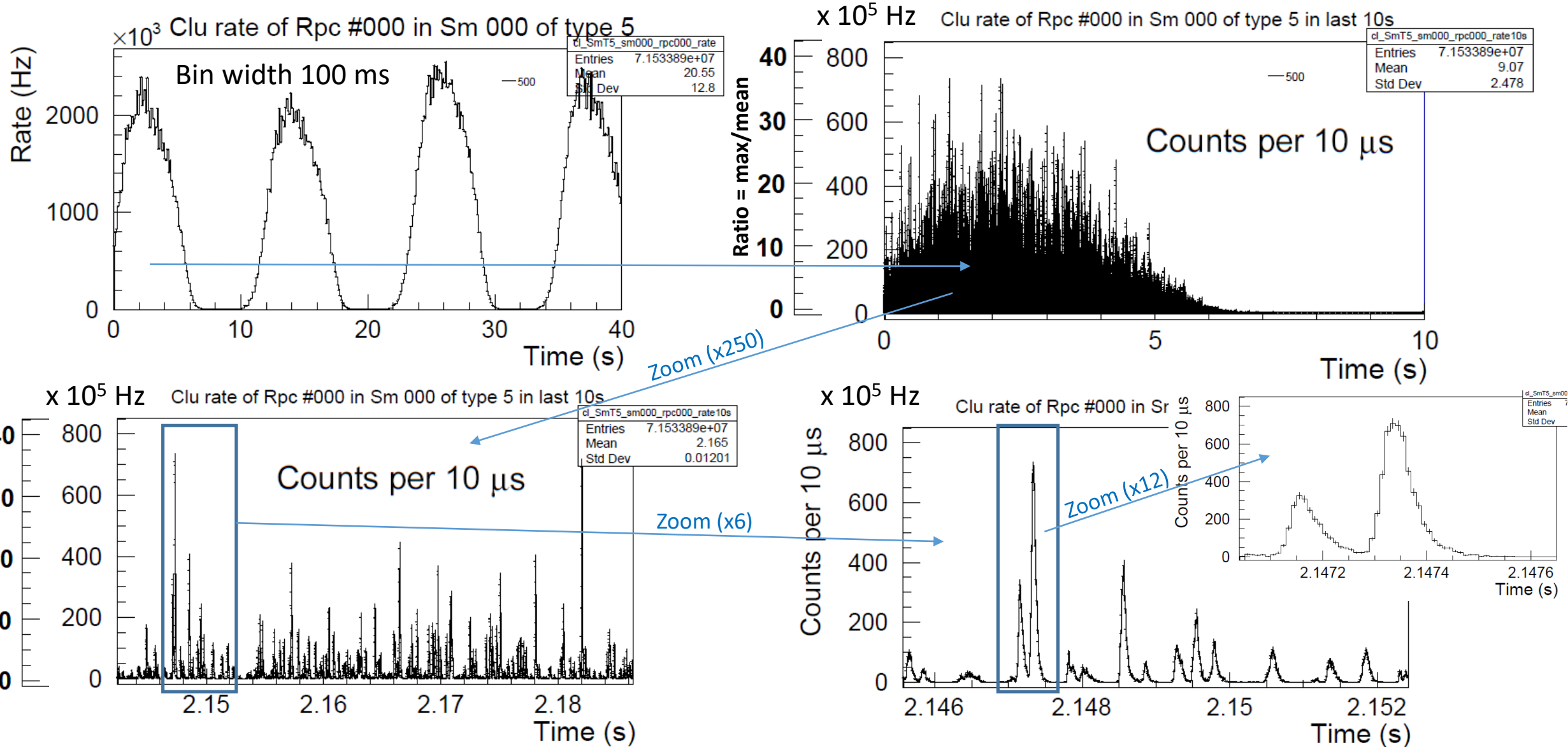
TRD matches



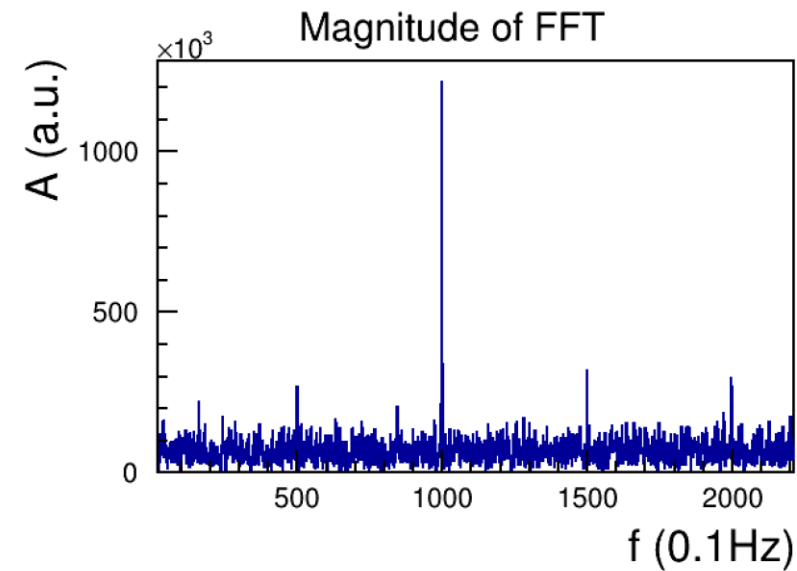
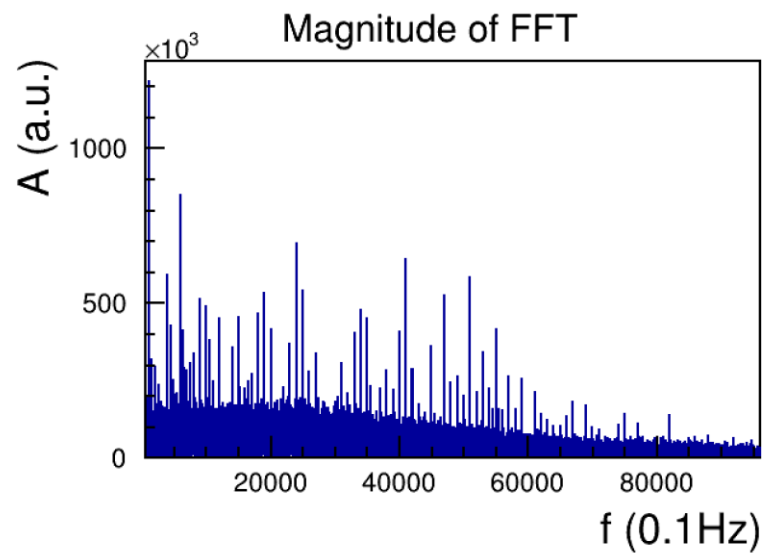
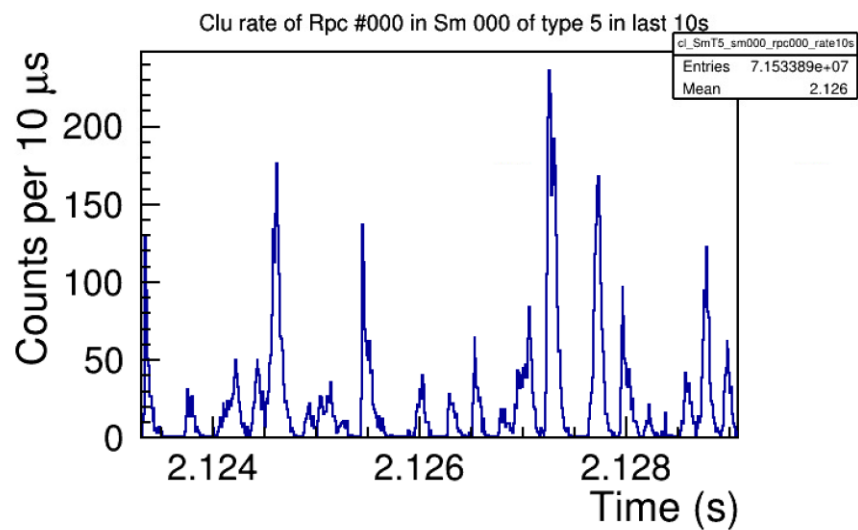
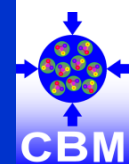
Yield



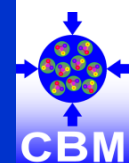
Rate on Diamond counter for Run 2554



mCBM Tof rate limitations, Fourier analysis

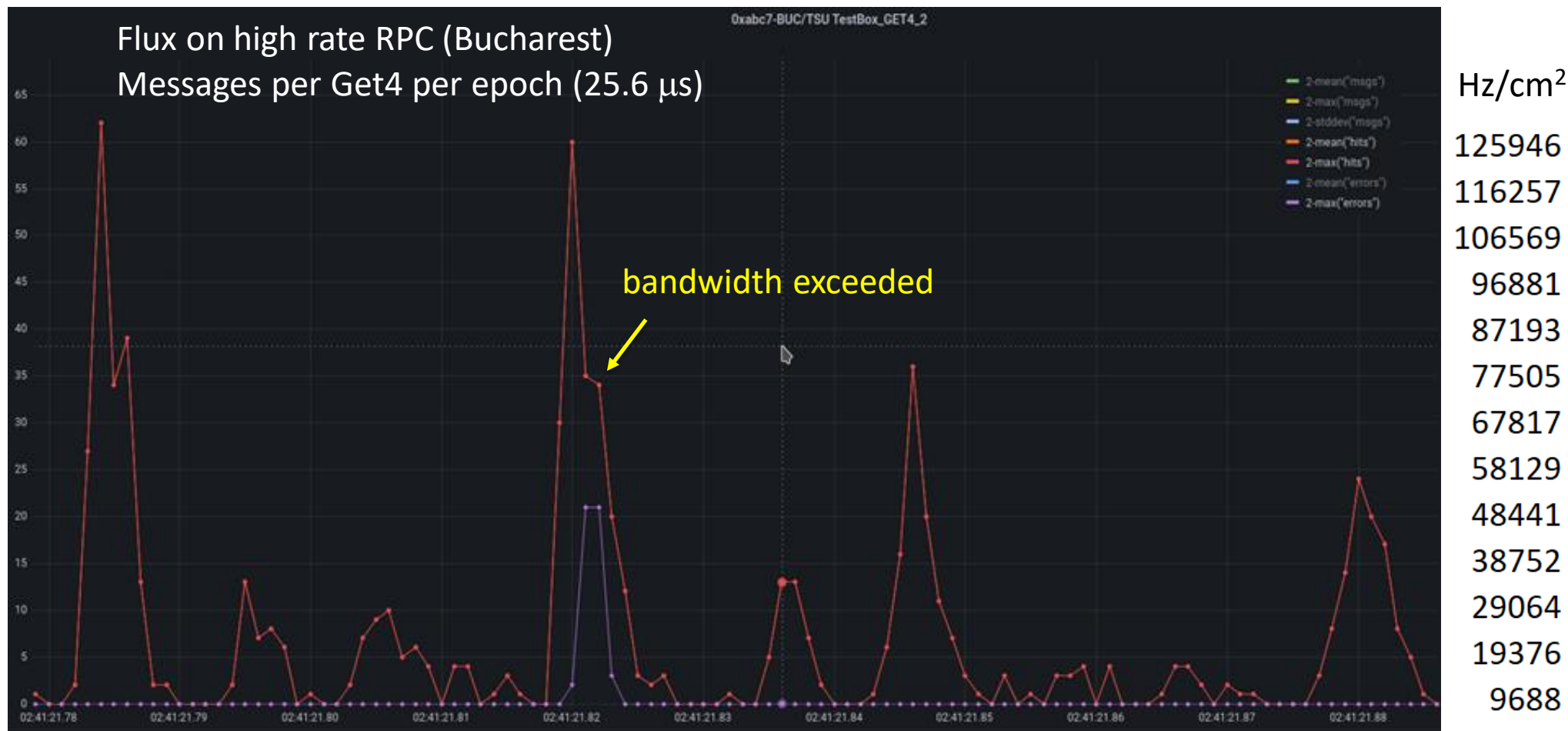


mCBM Tof rate limitations



Beam micro structure in Au+Au at 1.23 AGeV, run 2570, July 2022

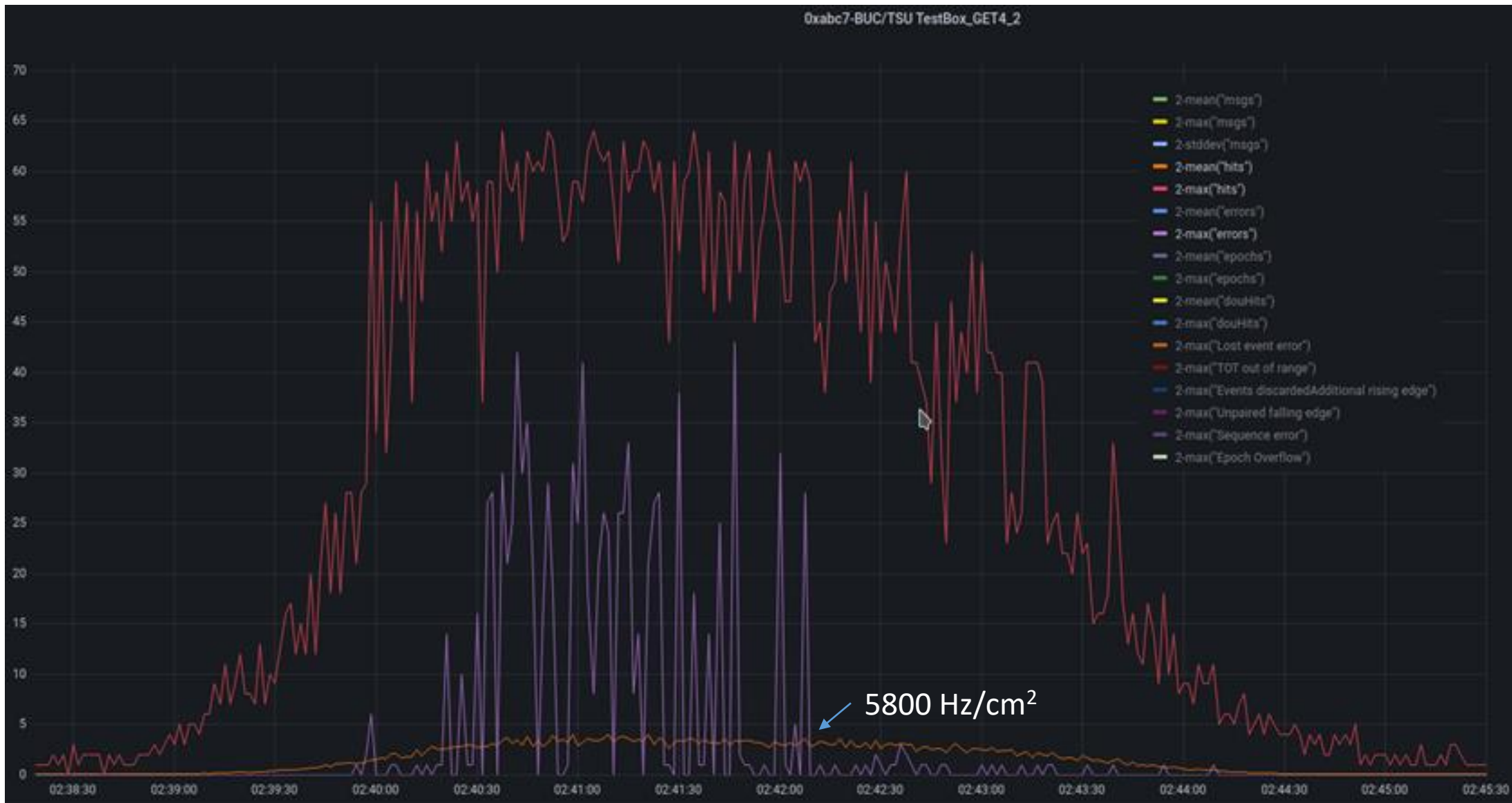
Ingo Deppner, Tof group meeting



Mean flux: 5.8 kHz/cm²

Peak flux: > 125 kHz/cm²

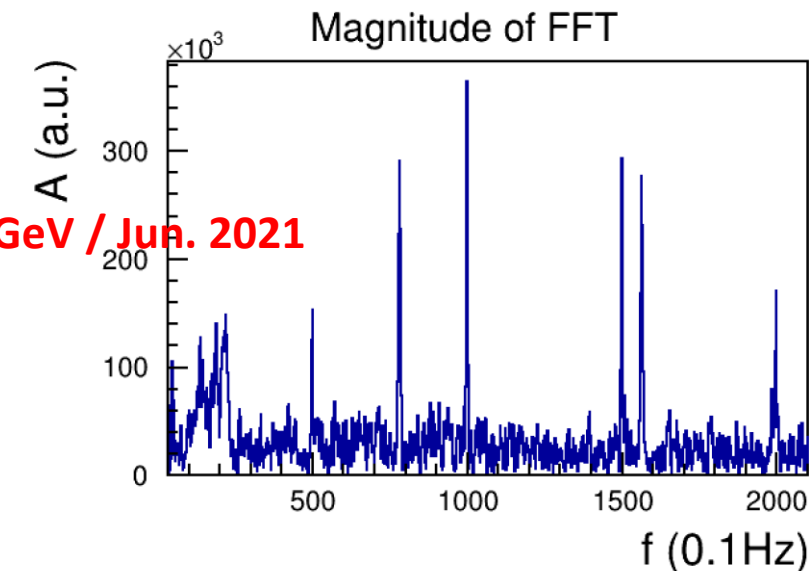
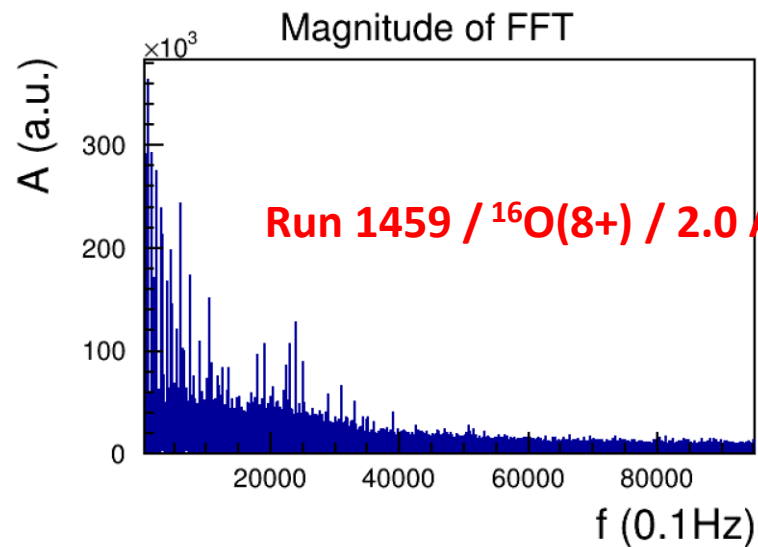
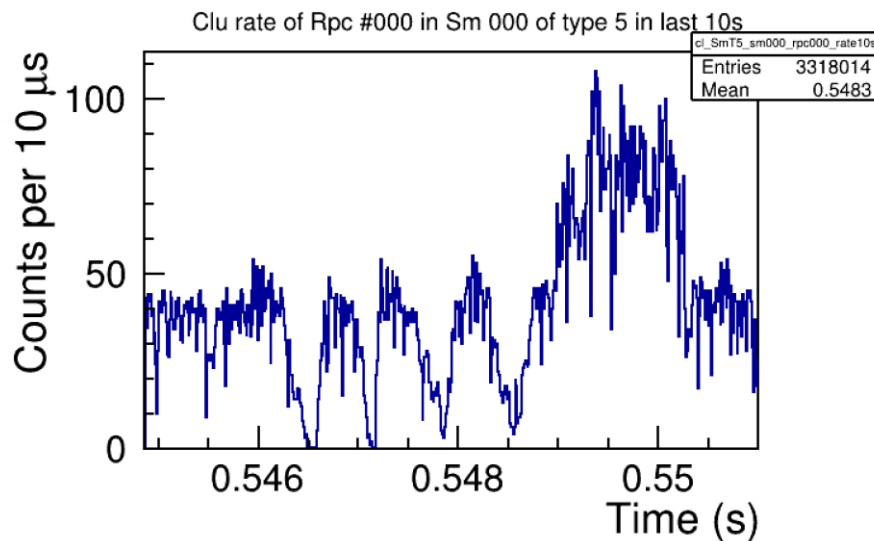
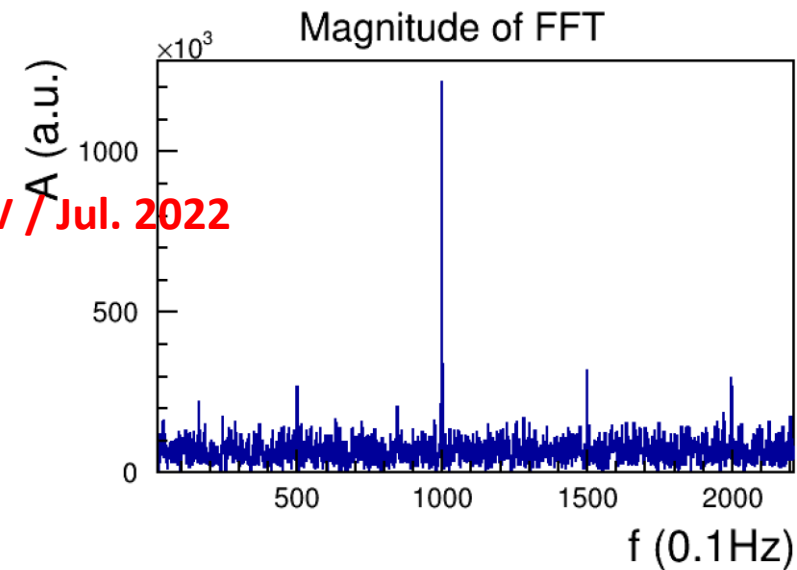
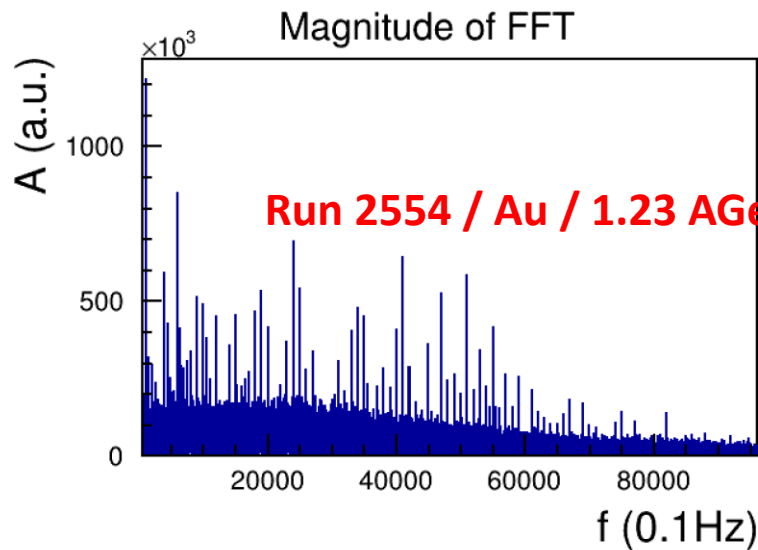
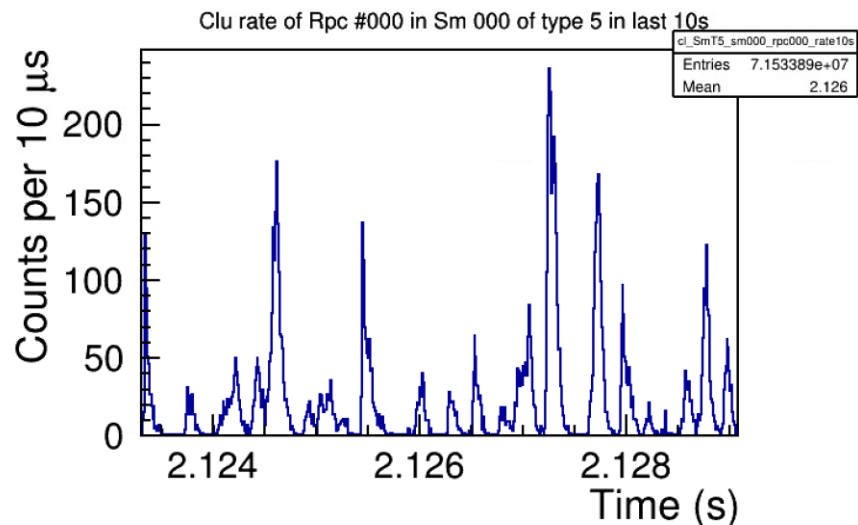
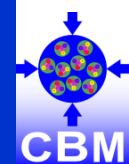
Flux on Bucharest counter in Run 2570, July 2022

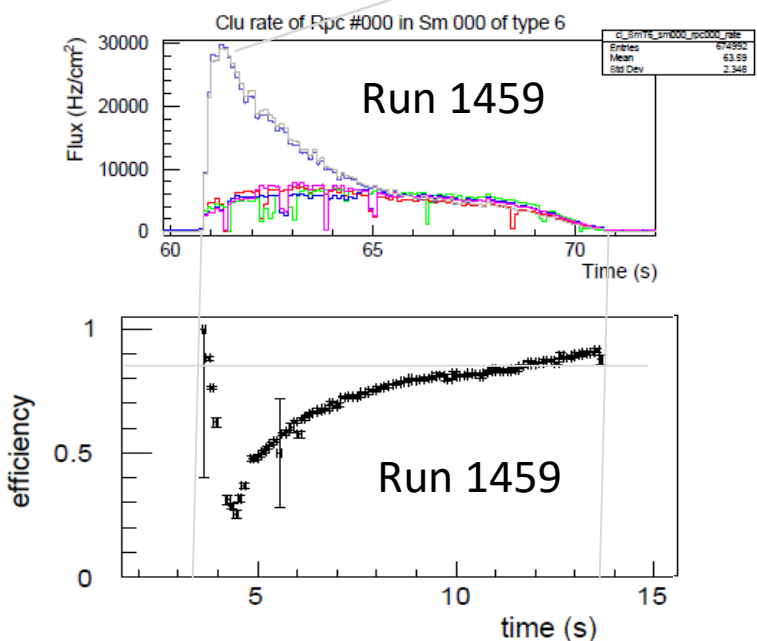
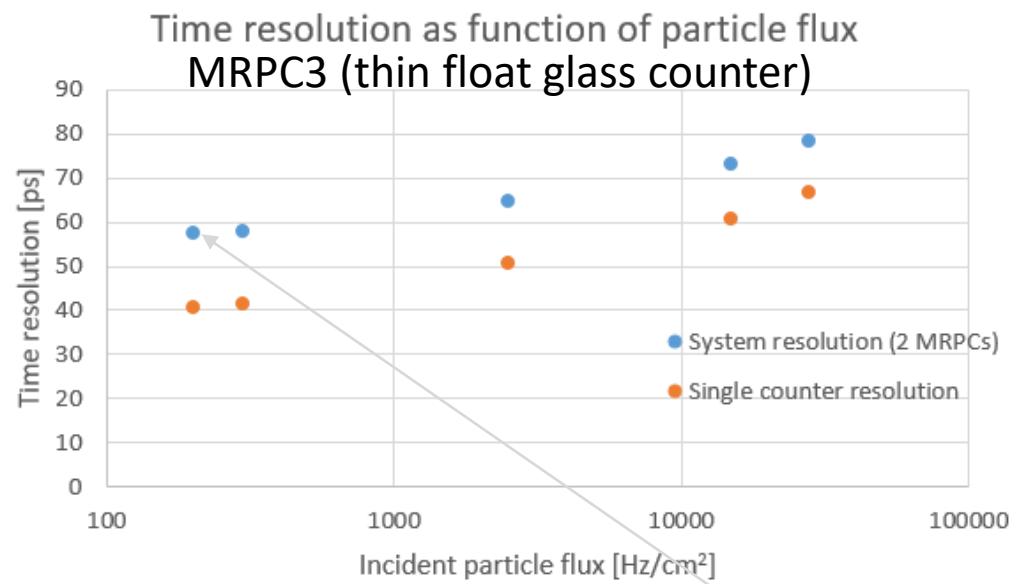
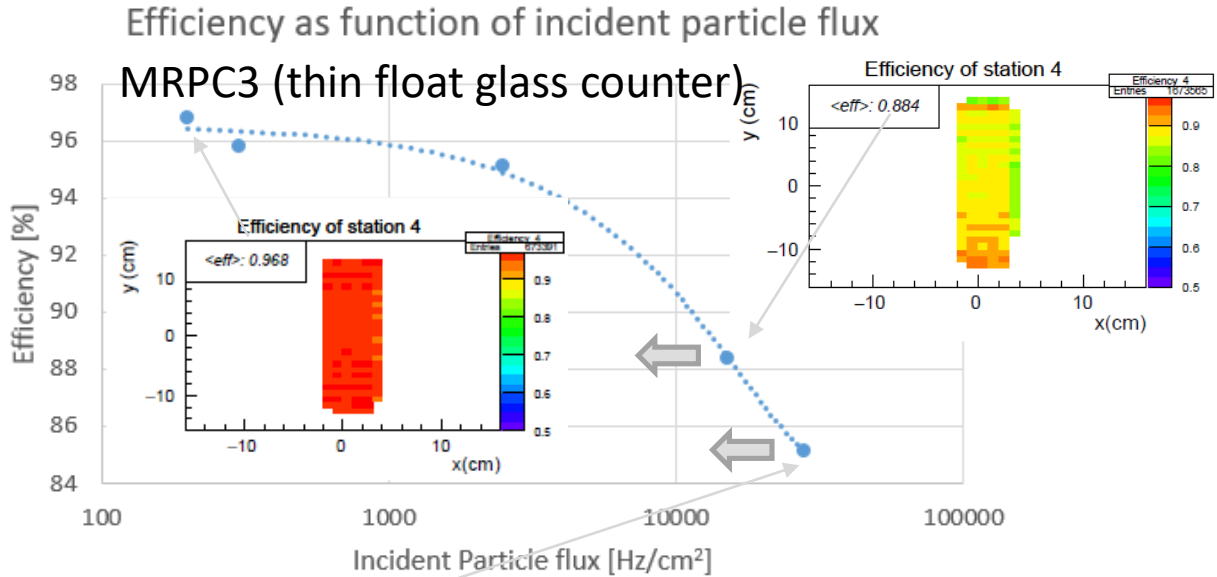


Hz/cm²

125946
116257
106569
96881
87193
77505
67817
58129
48441
38752
29064
19376
9688

mCBM Tof rate comparison, Fourier analysis



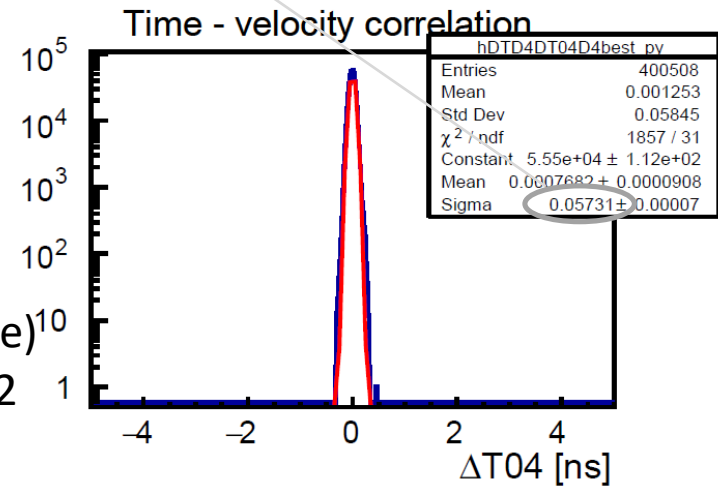


Data loss issues (faced during beam time)

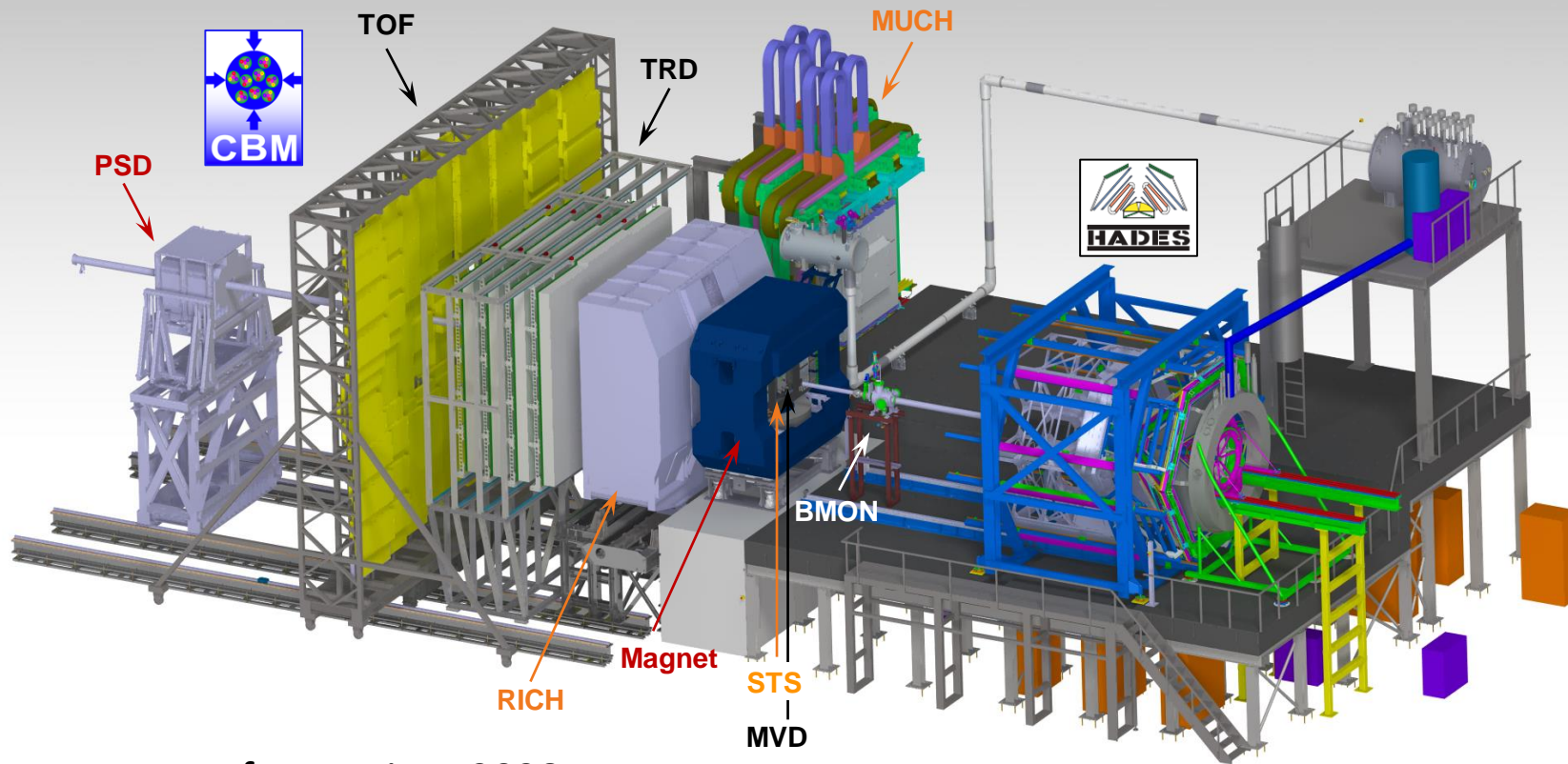
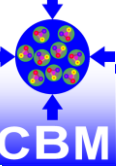
- Bandwidth limitations
- Get4 dropouts
- Time slice losses

Next steps

- Data analysis ongoing (much more to come)
- Data losses have to be solved prior to 2022 beam time
- More detector test at mCBM required



Needs of CBM for 2028



Key features of CBM

- Radiation hard detectors
- Tracking acceptance: $2^\circ < \theta_{lab} < 25^\circ$
- PID alternatives
 - electron/hadron: RICH, TRD, TOF
 - muon: MUCH, TRD, TOF
- Free streaming DAQ
- Software based event selection
- $R_{int} = 10 \text{ MHz (Au+Au)}$.

with MVD
 $R_{int} = 0.1 \text{ MHz (Au+Au)}$

Prepare start of operation: 2028

Replacements of former Russian contributions:

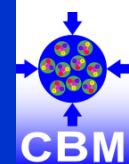
- Magnet (urgent FAIR procurement item), PSD
- (MUCH, RICH) gas system and mechanics
- STS module production workforce



covered by in-kind contracts,
 mitigation through FAIR resources
 Missing STS funds got granted by BMBF on Dec. 1, 2022

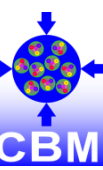
Optimize setup for future extensions

Summary of CBM wishes

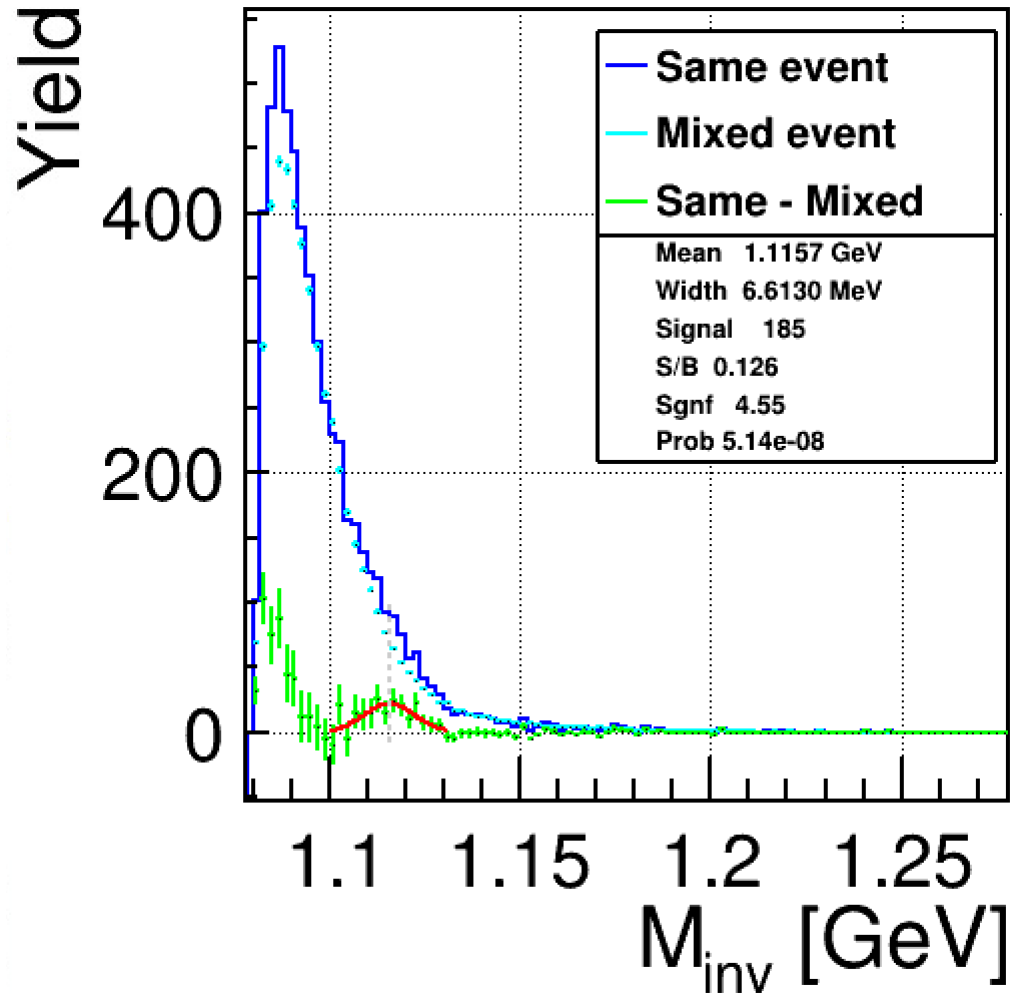


- 2023: prepare run conditions as in summer 2021 (or better)
mCBM could be online to help diagnose beam properties (micro structure)
- 2024: highest intensities for Ni beams with beam energies 1. – 2. AGeV
small beam intensity fluctuations (peak in $10 \mu\text{s}$ / mean $< 5 - 6$)
- 2028: Au beam from SIS100
support for procurement of CBM magnet – unconditionally ...

mCBM – Λ – next steps



Au+Au at 1.23 AGeV, 180 TB TSA data



CBM rare probe strategy is emerging for real data:

Detector alignment

L1 - tracking

KFParticle application

Efficiency correction methods

Machine Learning

Online event selection: gain factor > 10