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mCBM experiment

- mCBM is a part of FAIR phase 0 program
- A CBM full-system test-setup at the SIS18 facility of GSI/FAIR
- Real size prototypes or pre-series productions of all CBM detector systems

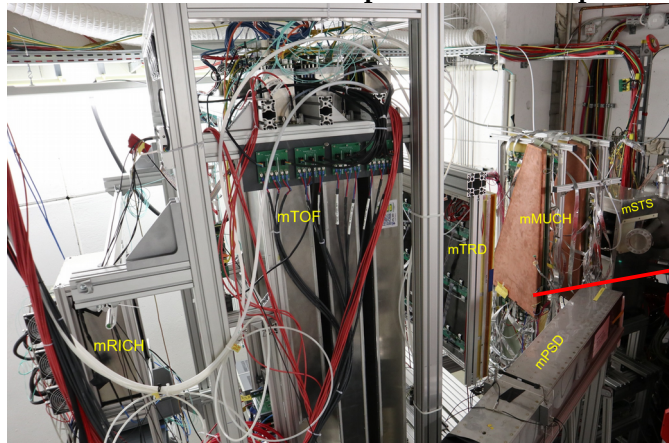
Major objectives

- To commission and optimize the complex interplay of the different detector systems with the triggerless streaming data acquisition
- Validate time based event reconstruction & track reconstruction at high particle density environment
- Control software packages

mMUCH data analysis

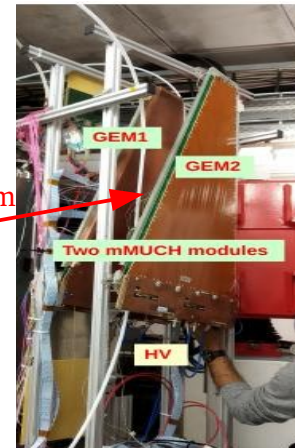
- Data analysed for Pb+Au collisions at 1.06 AGeV.
- Analyzed 2020 data (MUCH could not join 2021, but ongoing 2022 campaign)

mCBM experimental setup



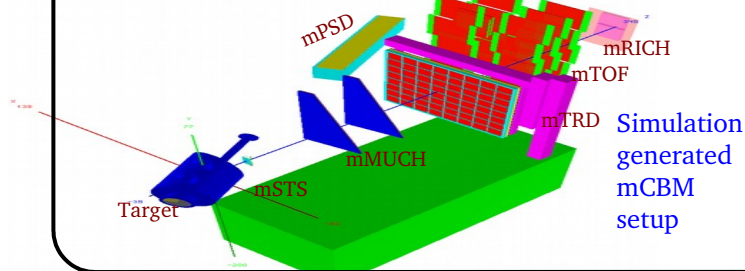
Photograph of mCBM 2020 setup

Beam

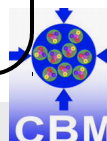


Two Real size trapezoidal GEM modules for the first station of MUCH have been installed

Triple GEM with 3:2:2:2 gas gap

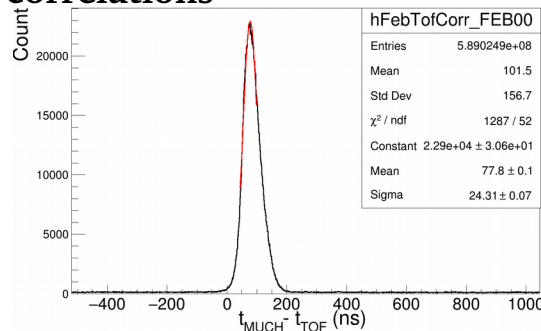
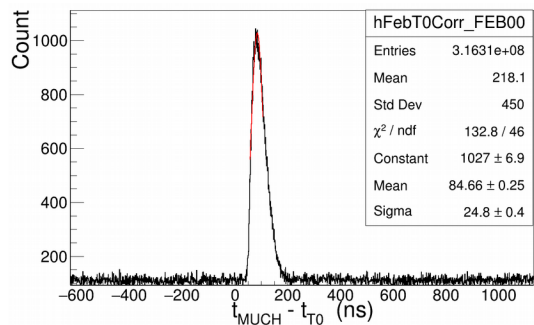


Simulation generated mCBM setup

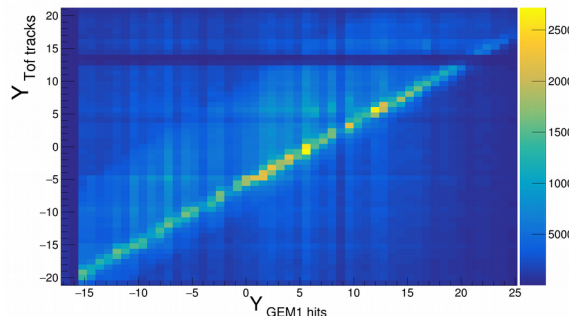
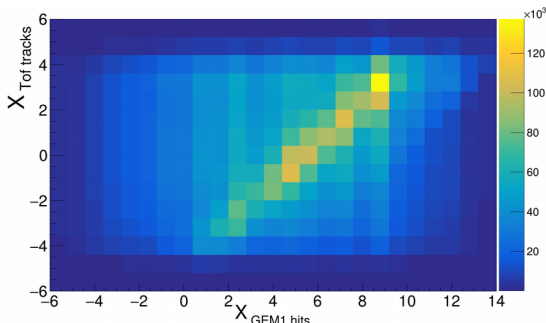


Free streaming data transport in mCBM: time & spatial correlations

Time correlations



Spatial correlations



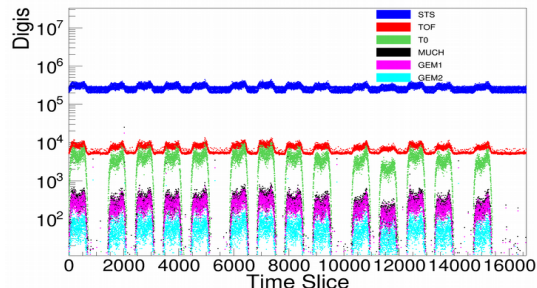
- Time and spatial correlations are extracted for mMUCH with other sub-subsystems

- A clear time correlation is observed between MUCH-T0 and MUCH-T0F with narrow time correlation width

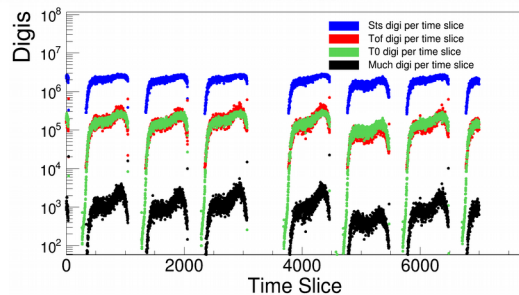
- Spatial correlations of reconstructed GEM-hits with projected mTOF tracks at GEM plane shows a clear correlation band in both X and Y

- Time and spatial correlation proves synchronicity of data streams

Spill structure



Low intensity
 $2 \times 10^6 / 9s$
 spill, thin target

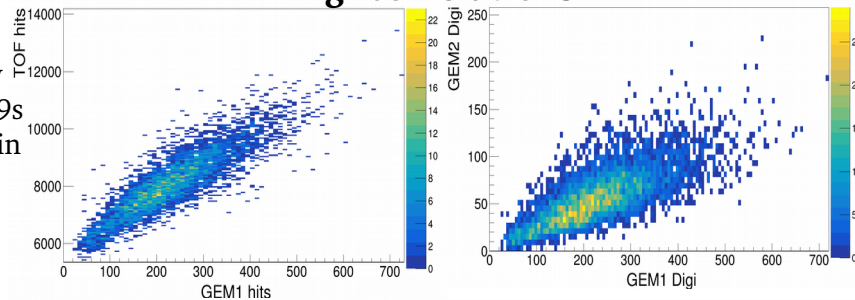


High intensity,
 $1 \times 10^8 / 9s$
 spill, thin target

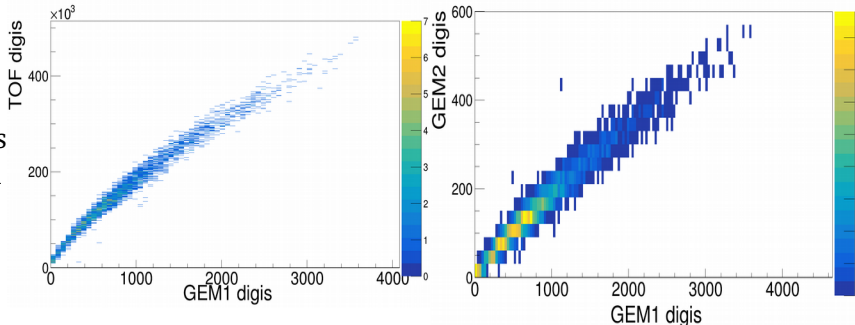
Spills are clearly visible for all subsystems at low as well as at high intensity. The spill structure of the accelerator, followed by a short break, can be clearly identified.

Digi correlations

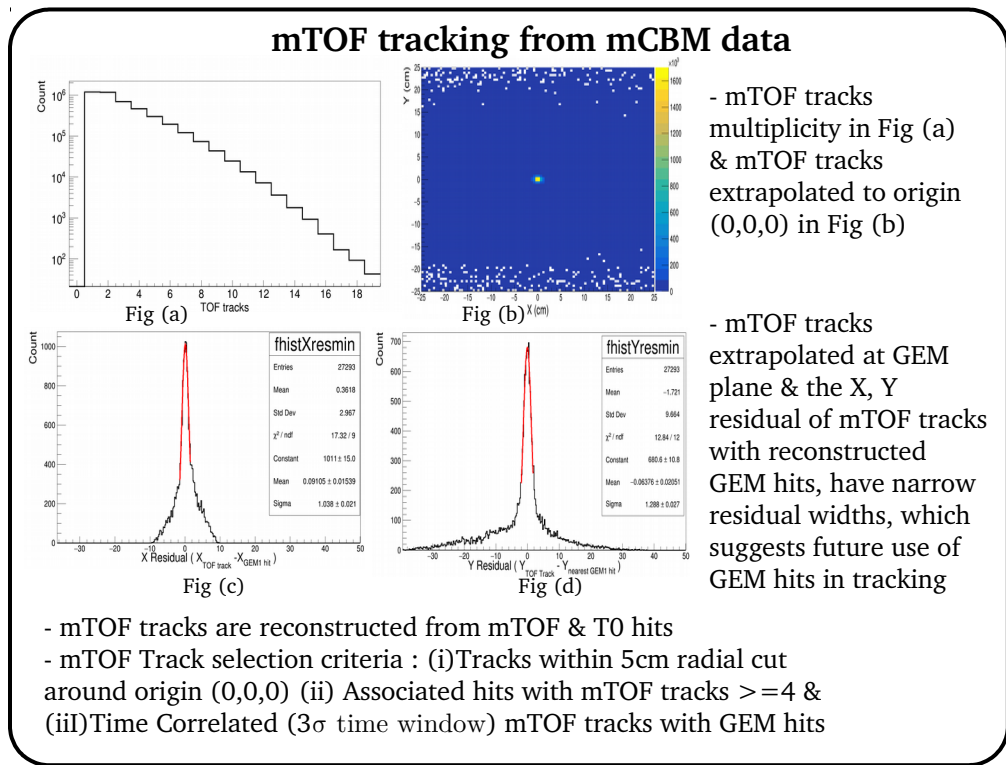
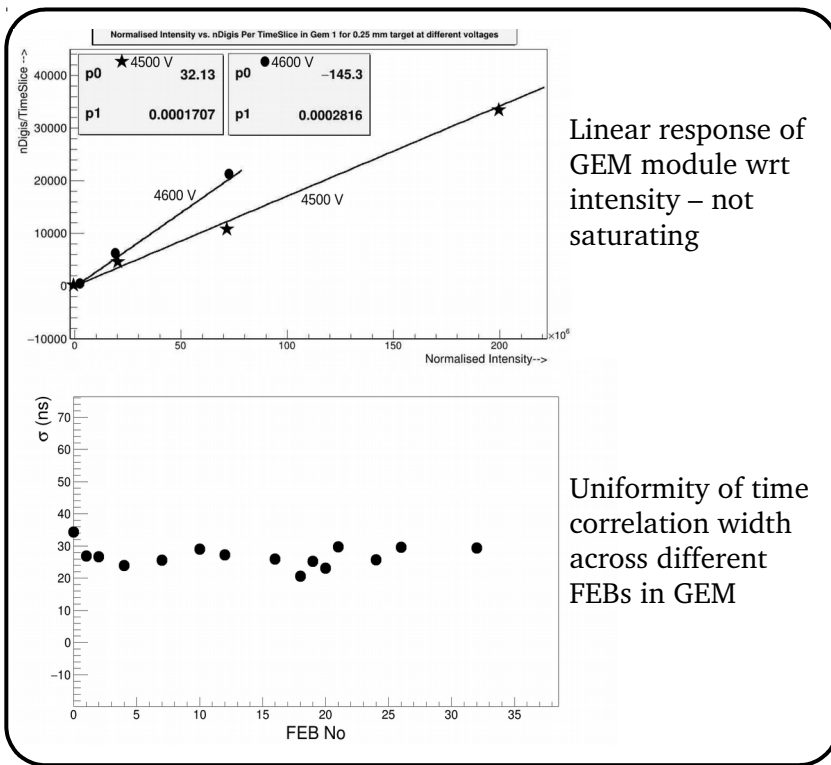
Low intensity
 $2 \times 10^6 / 9s$
 spill, thin target



High intensity,
 $1 \times 10^8 / 9s$
 spill, thin target



Linearity in digi-correlations observed between GEM1 & GEM2 at low and high intensity.



Summary

- Two Real size trapezoidal GEM modules (mMUCH) designed for the first two layers of the CBM MUCH system have been installed within the mCBM experiment
- Successful test of the triggerless-streaming read out system under realistic conditions; time and spatial correlations demonstrate synchronicity of the subsystem data streams
- Clear spill structure observed for GEMs, at low as well as at high collision rates
- No saturation with rate observed for GEMs

Outlook

- GEM Efficiency determination using mTOF tracks will be performed
- Systematics of GEM efficiency with MUCH HV & threshold scan from next mCBM 2022 campaign will be performed

Acknowledgement

Apar Agarwal, CBM-MUCH collaboration, GSI team.

Thank you