

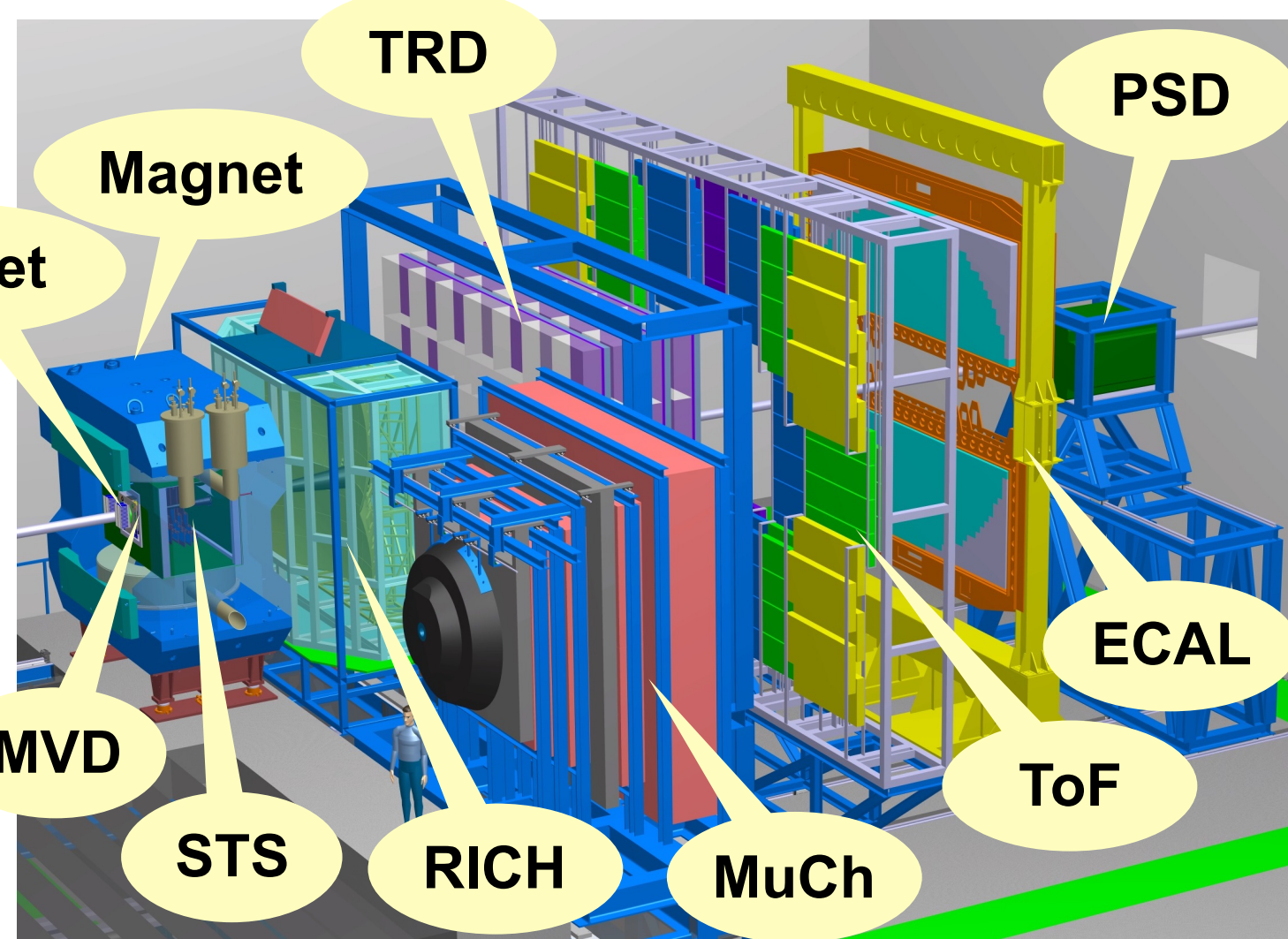
Online reconstruction of the collision topology in the CBM experiment

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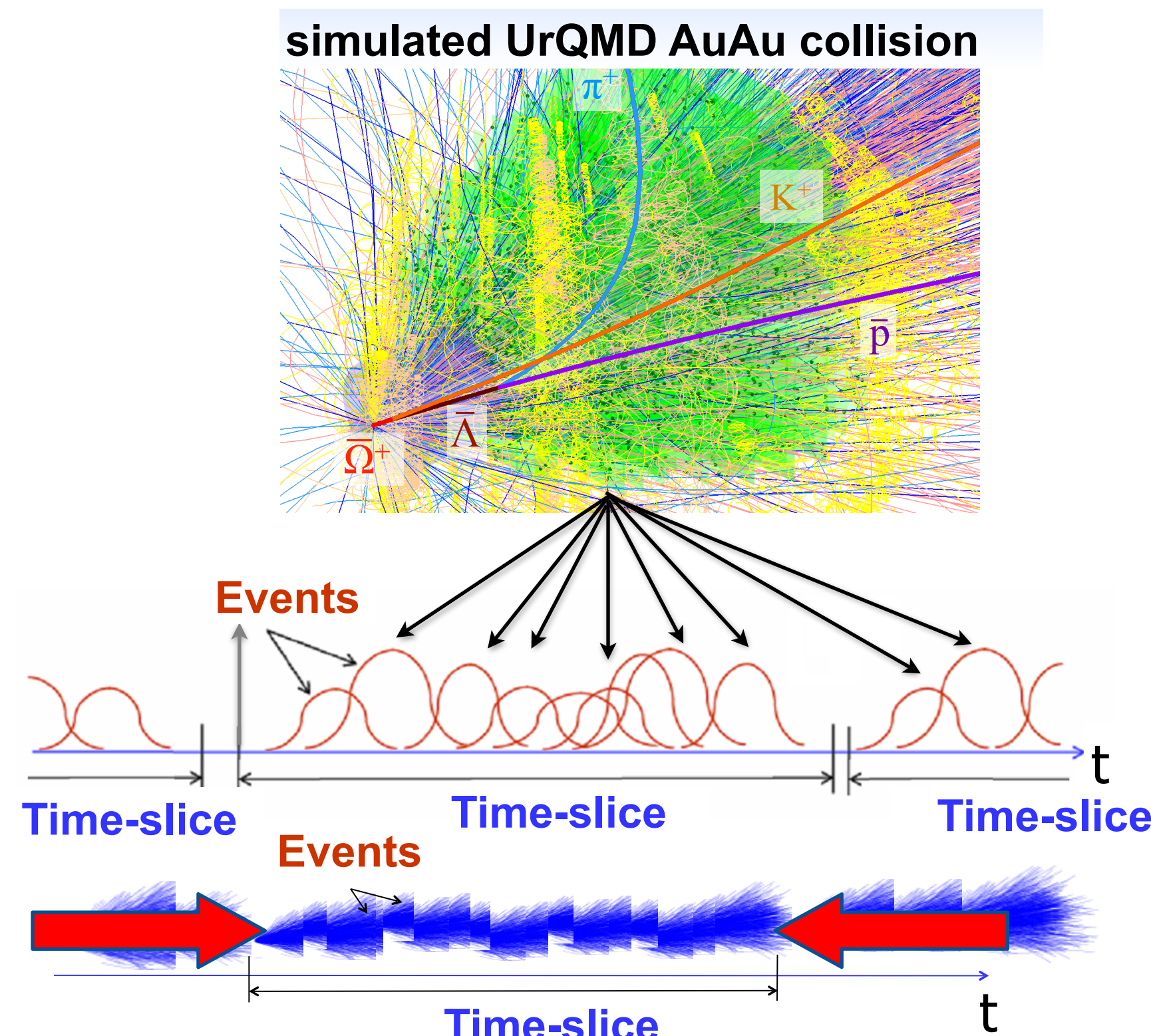
(for the CBM Collaboration)

Heavy-ion Experiment CBM



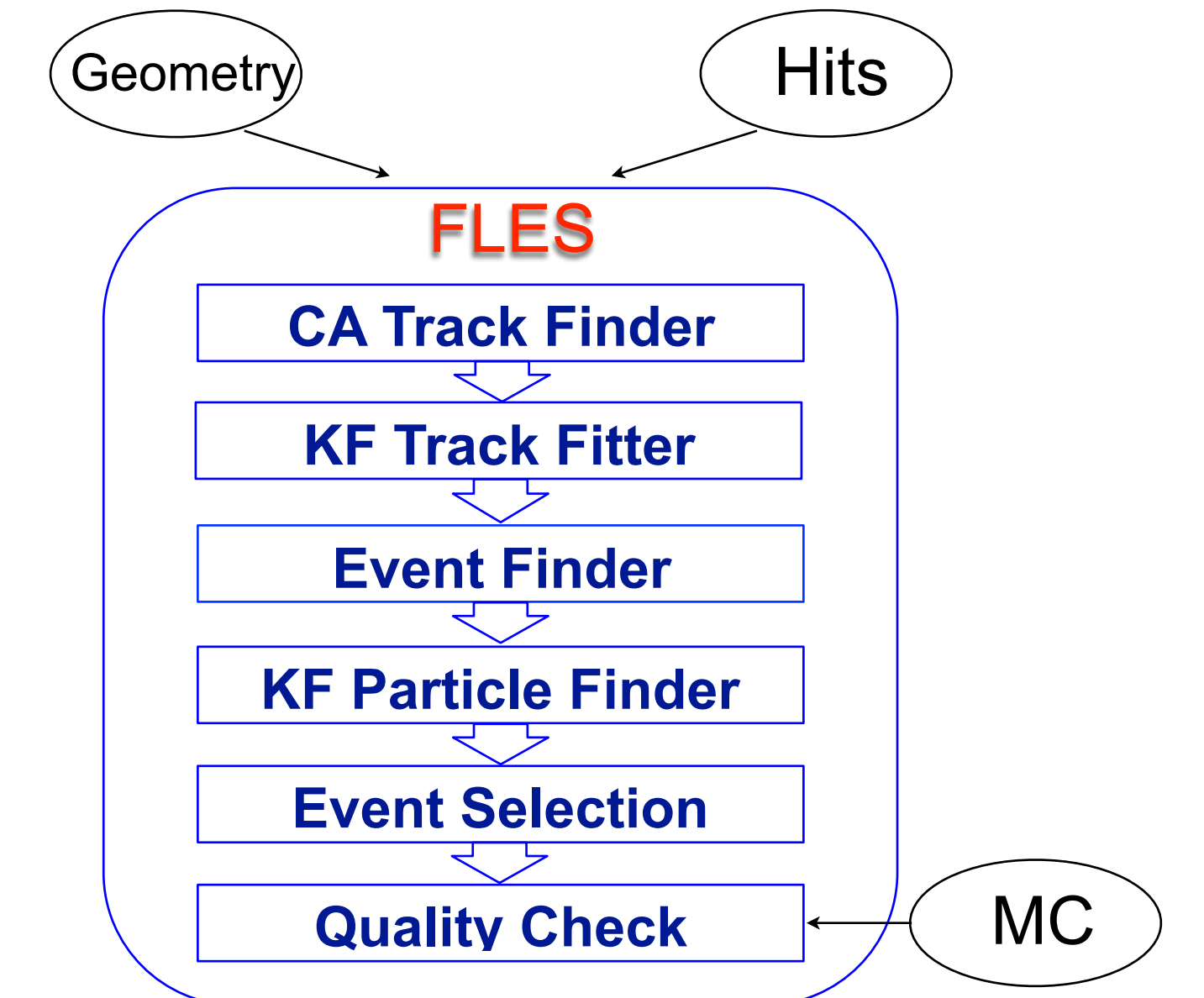
- CBM — future fixed-target heavy-ion experiment at FAIR
- observables include very rare (or extremely rare probes)
- very high interaction rates of up to 10 MHz
- up to 1000 charged particles/collision

Novel Data Processing Concept of CBM



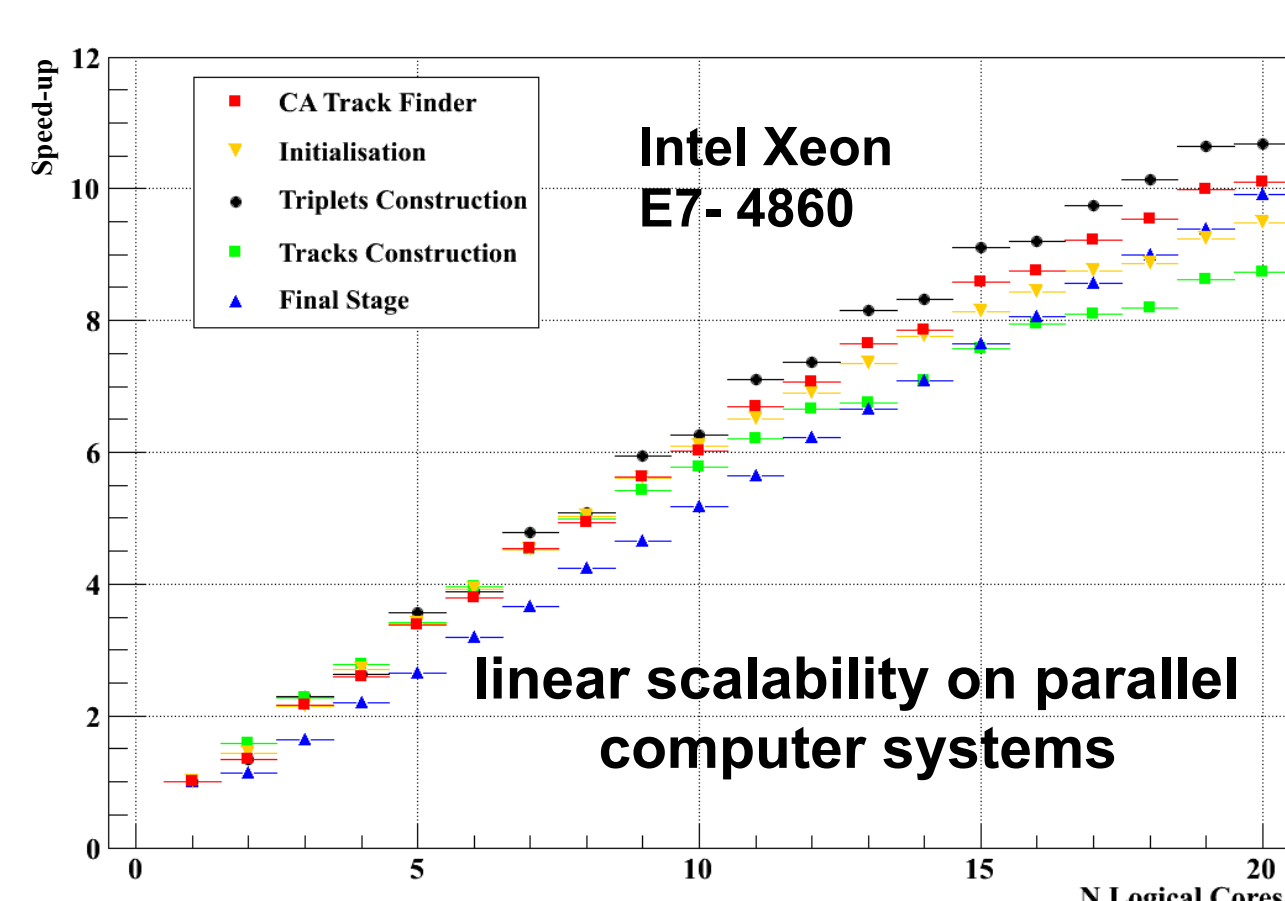
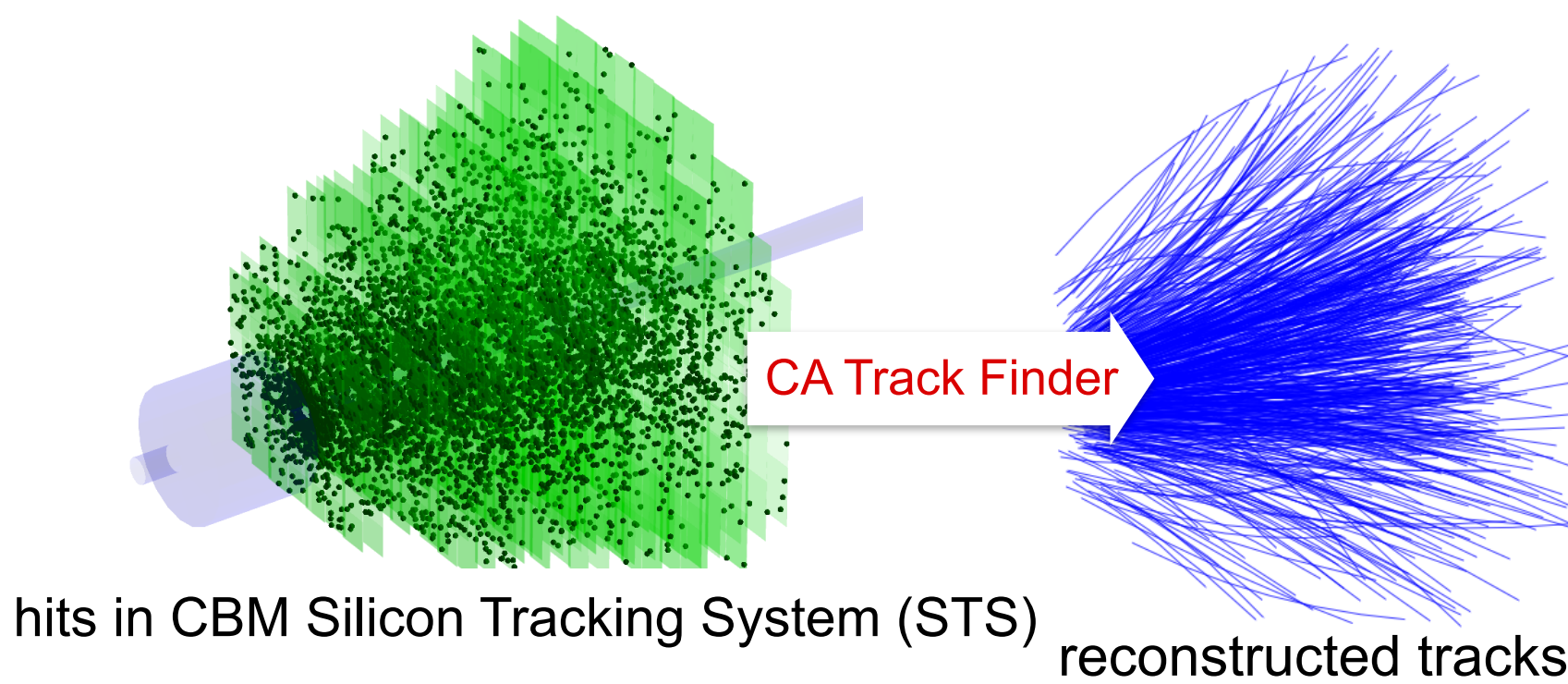
- free streaming data, no hardware trigger
- continuous time-slices instead of isolated collisions
- online 4D (3D + time) collision reconstruction and selection with parallel and efficient algorithms

First Level Event Selection Package



- Cellular Automaton track finder: track reconstruction
- Kalman filter based track fitter: track parameters estimation
- Event Finder based on the obtained set of tracks
- KF Particle Finder: short-lived particles reconstruction
- Module for a quality check

Cellular Automaton Track Finder in STS



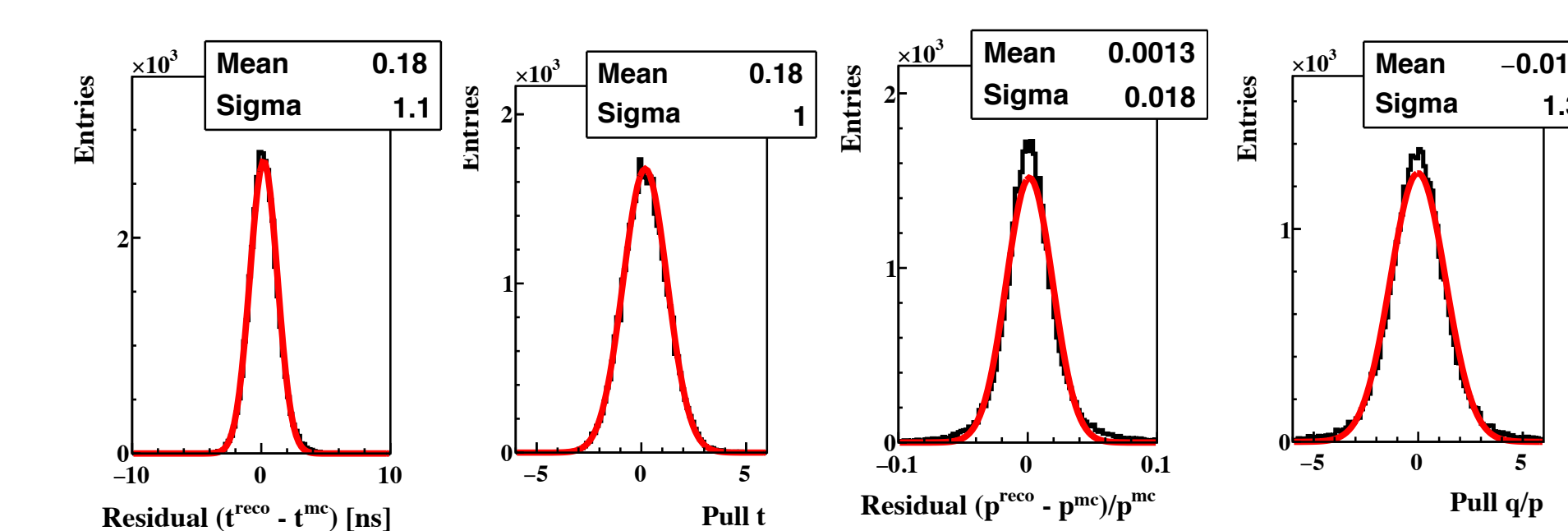
- efficient and stable track reconstruction
- vectorised and parallel algorithm
- 4D tracking shows speed and efficiencies similar to that of event-by-event analysis

mbias AuAu 25 AGeV events, obtained on Intel Xeon E7-4860

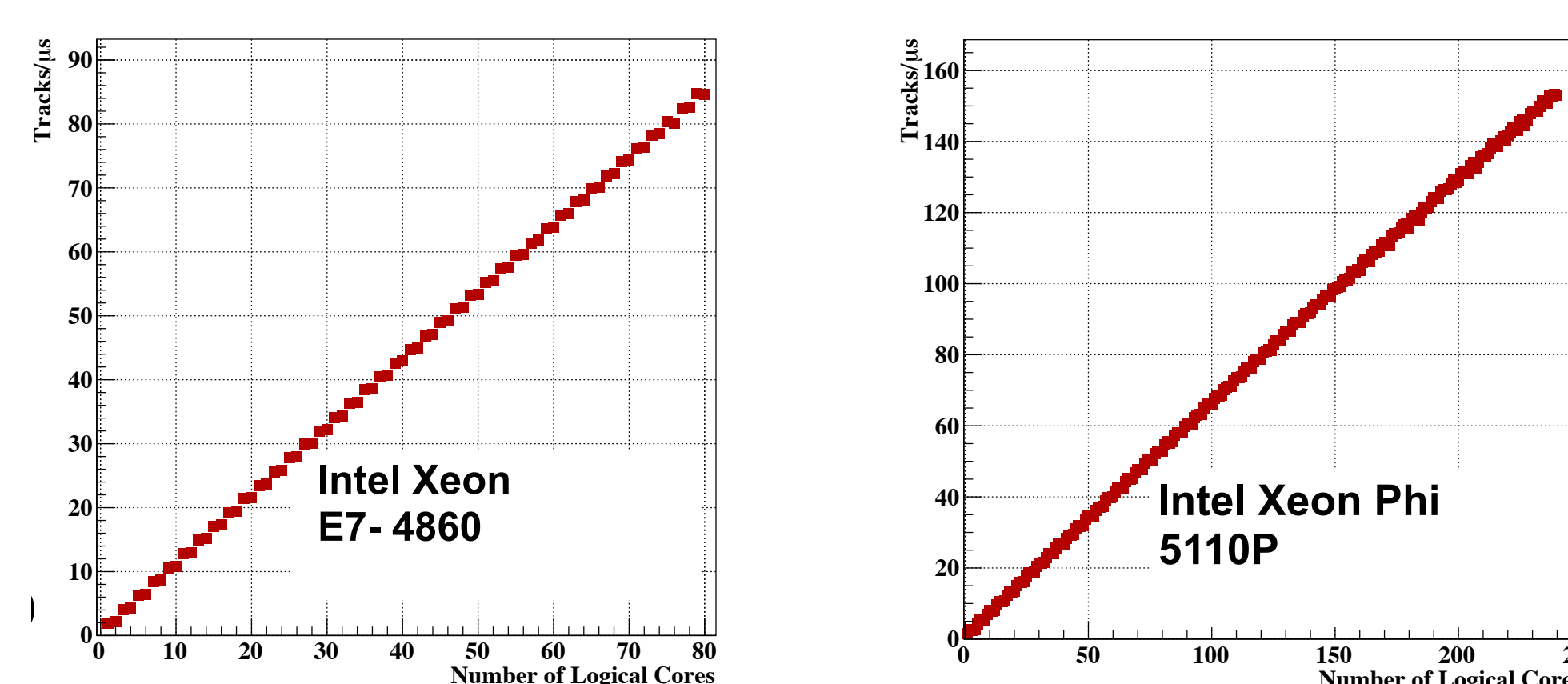
Efficiency, %	event-by-event	0.1 MHz	10 MHz
All tracks	92.5	93.8	91.7
Ghost level	1.8	0.6	0.6
Time, ms/ev	11.70	11.97	13.60

4D Kalman Filter Track Fit in STS

state vector: (x, y, t_x, t_y, q/p, t)

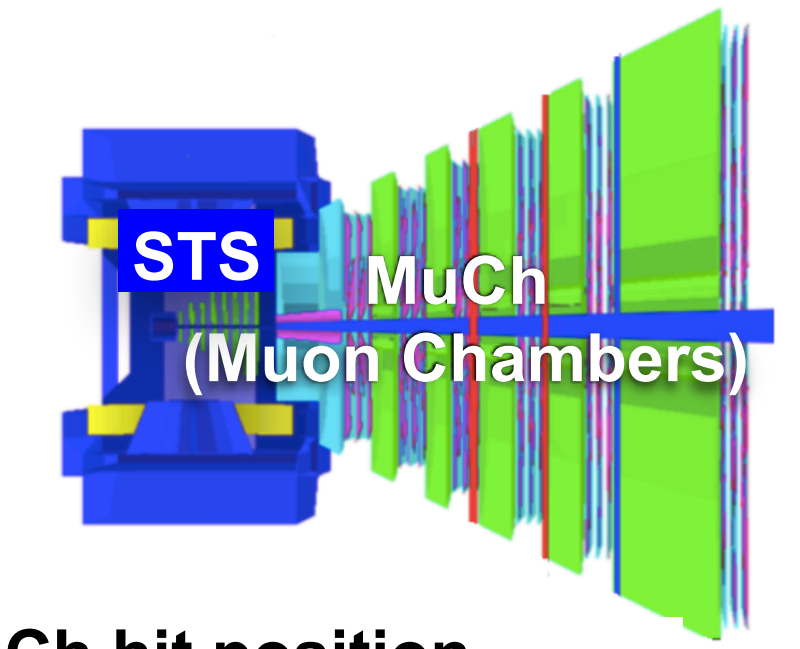


linear scalability on various systems

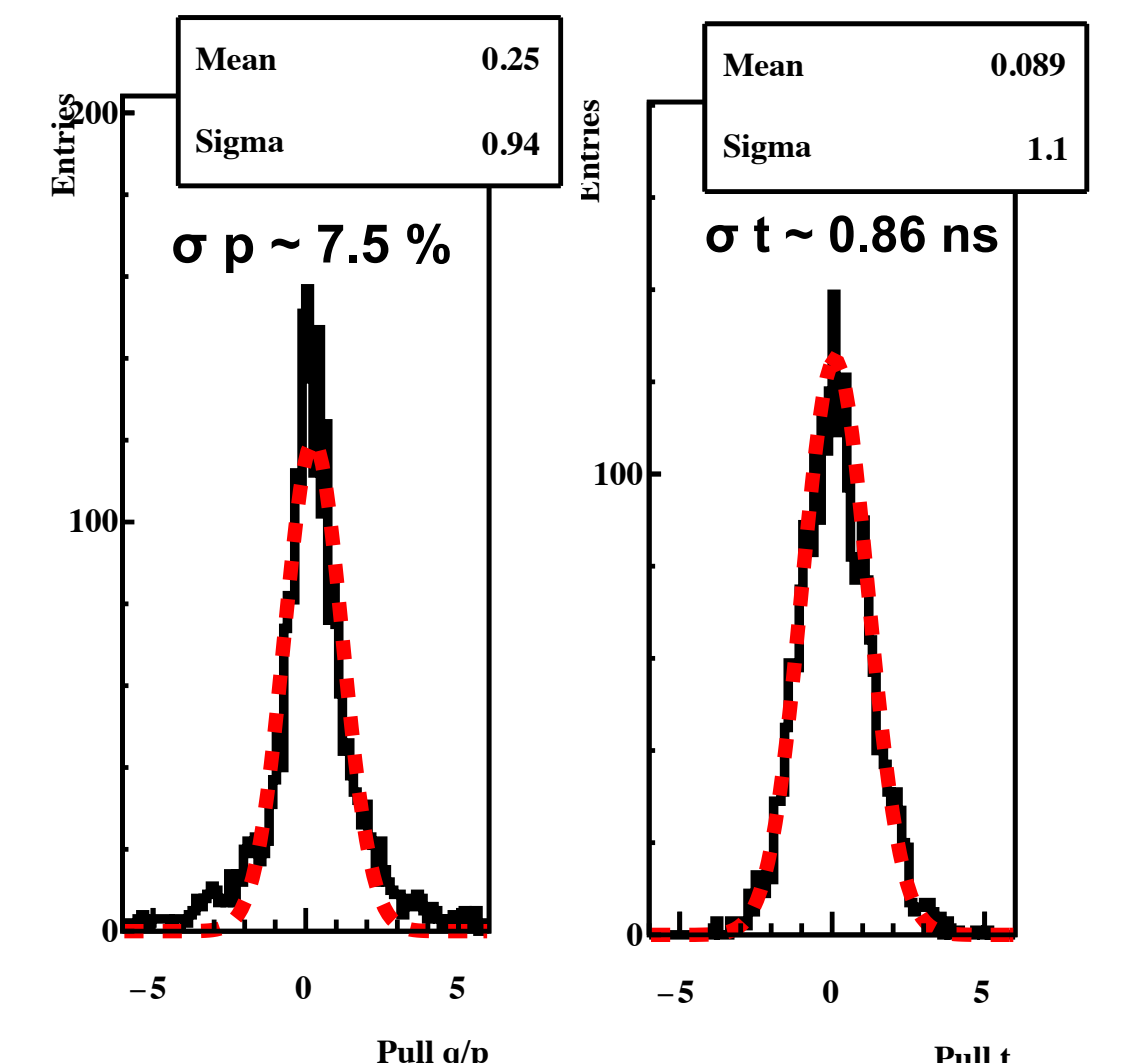


- unbiased track parameters with a high resolution
- correctly estimated errors
- strong scalability on various computer systems

Towards Global Track Reconstruction: STS + MuCh

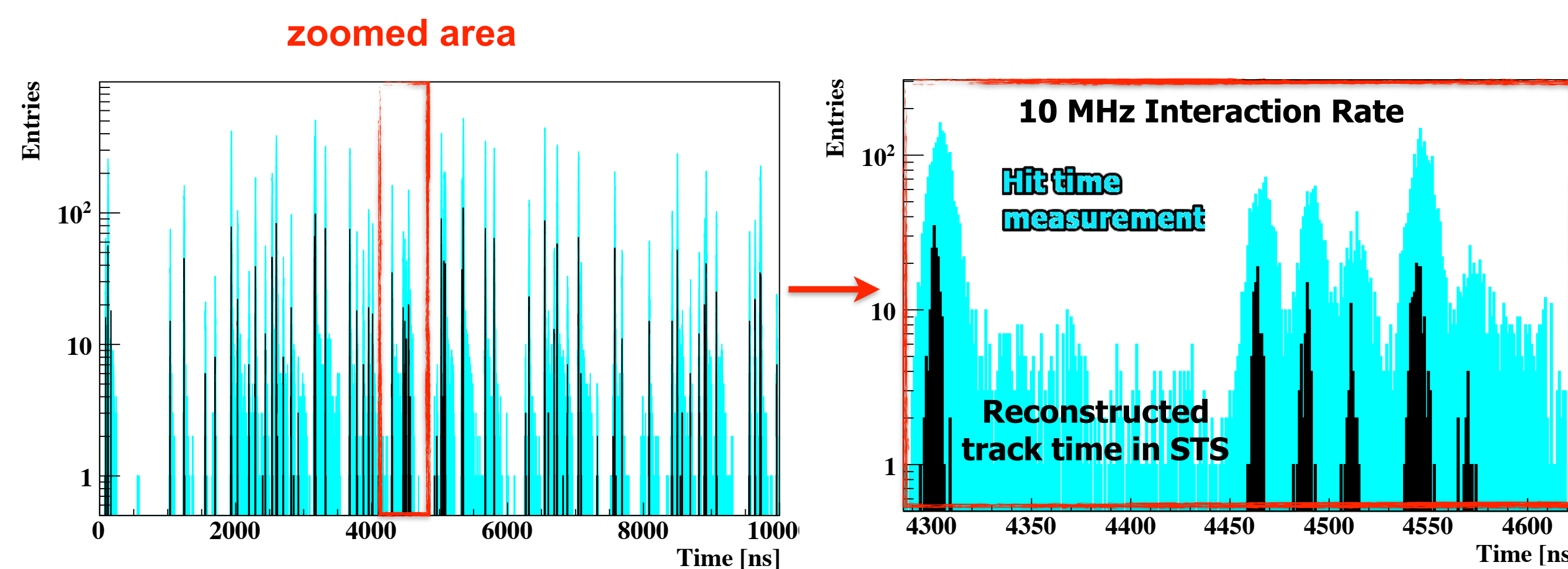


last MuCh hit position



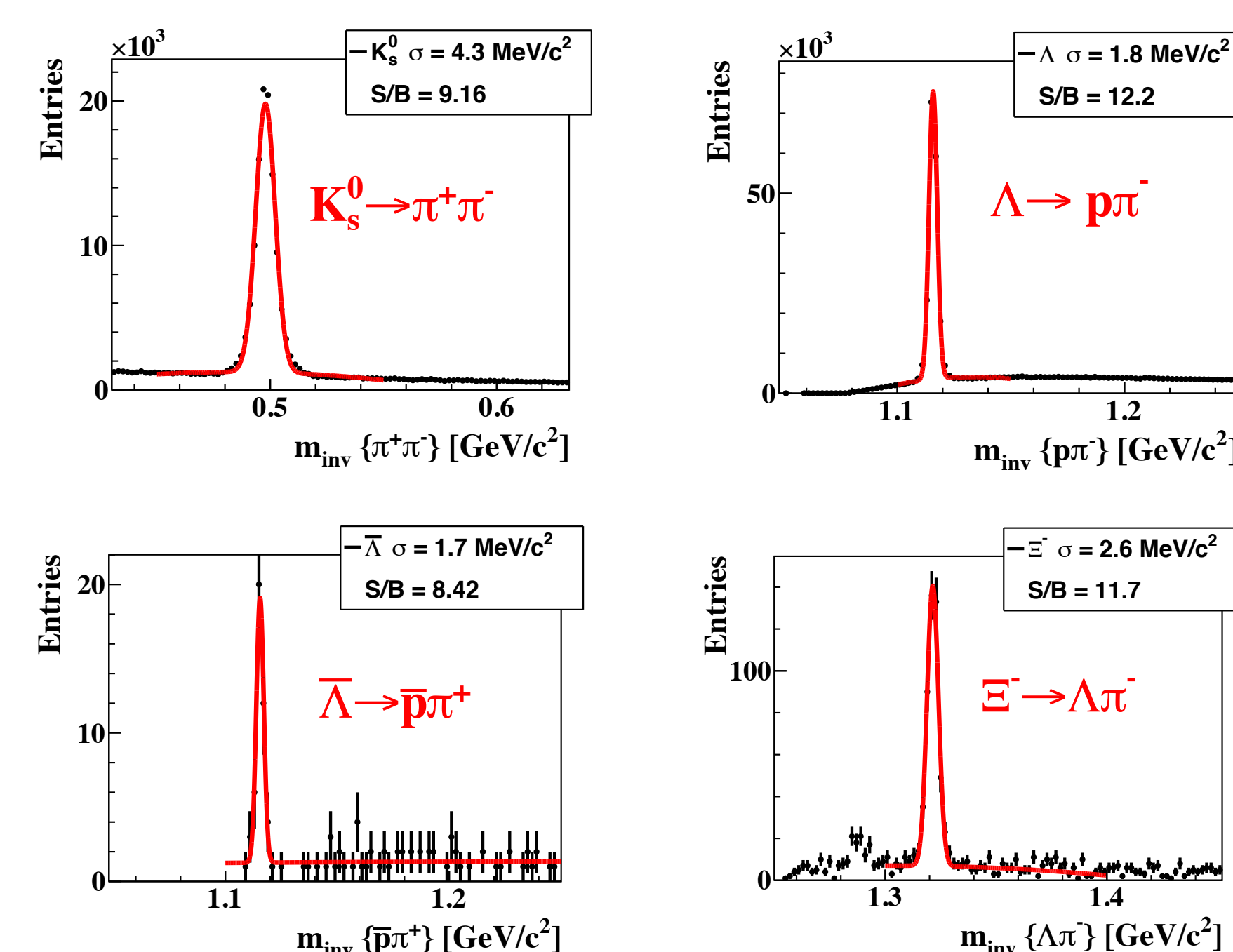
- parameters obtained at the last hit position
- unbiased track parameters with a high resolution
- energy loss in absorbers is estimated correctly

Event Finder in STS



- tracks are grouped into events based on the track time
- currently based on STS only, adding all sub-detectors information is in progress
- work in progress: multi-vertex analysis (search for several primary vertices within reconstructed event)
- events from event finder serve as input for KF Particle Finder

KF Particle Finder with Time-slices



300k mbias AuAu 10 AGeV events at 10 MHz, MC particle ID

poster by M. Zyzak

- particles are reconstructed via decay products
- time-based reconstruction performance is comparable to the event-based procedure

KF Particle Finder reconstruction efficiency including detector acceptance

Particle	3D	10 MHz
K _s ⁰ , %	22.9	21.2
Λ, %	21.9	19.6
Ξ ⁻ , %	7.8	6.3

Conclusions

- The FLES package is efficient, fast and is highly parallelized on both the data and the task level.
- The reconstruction chain of CBM is being developed capable of processing free-streaming data.
- It allows to reconstruct individual events out of continuous time-stamped data.
- Reconstructed collisions serve as an input for the high-level physics analysis.
- The performance of time-based reconstruction is comparable to that of the event-by-event analysis.

Compressed Baryonic Matter experiment at FAIR

