

Time-based cluster and hit finding for the STS detector in the CBM experiment at FAIR

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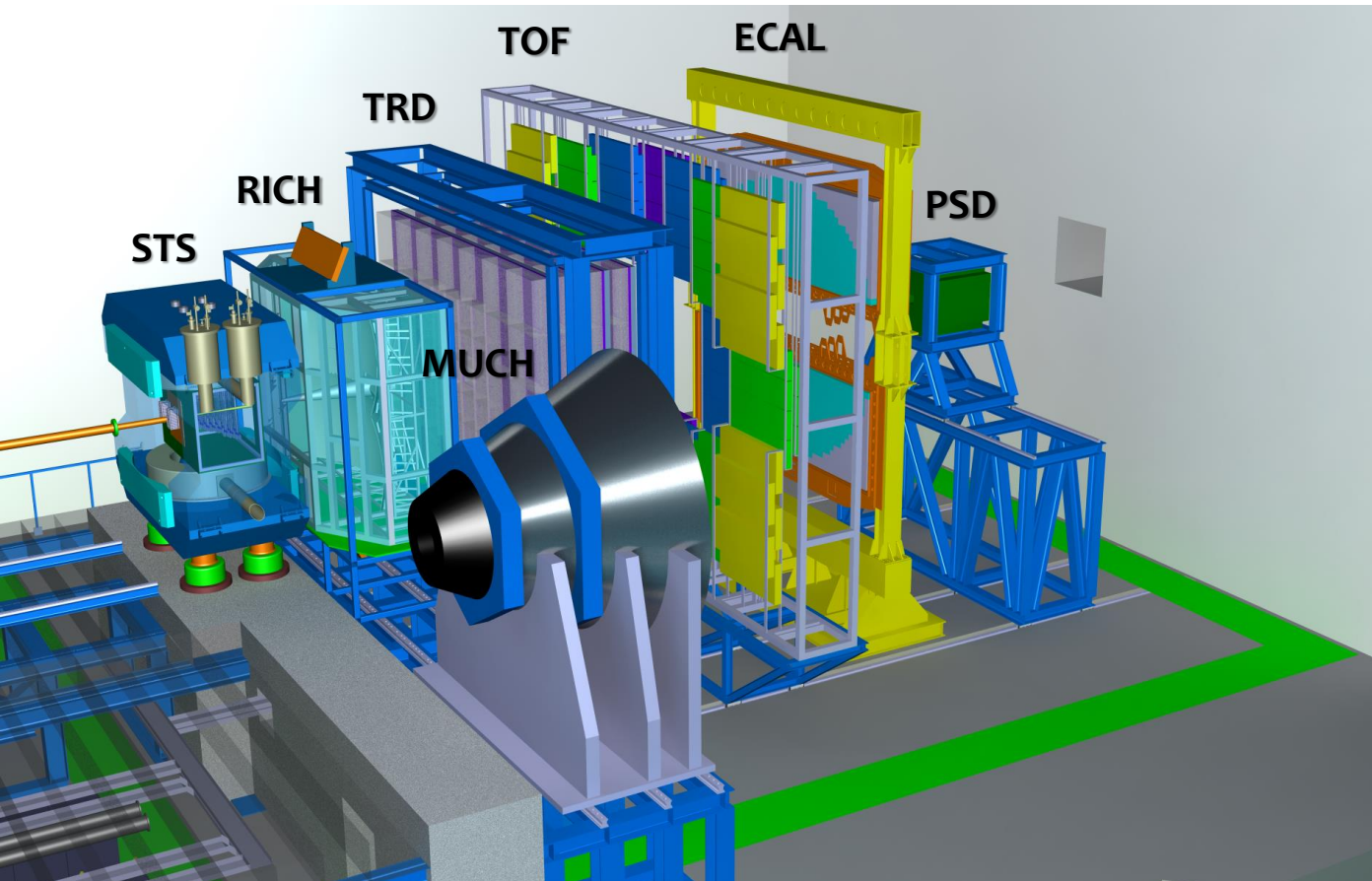
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CBM experiment



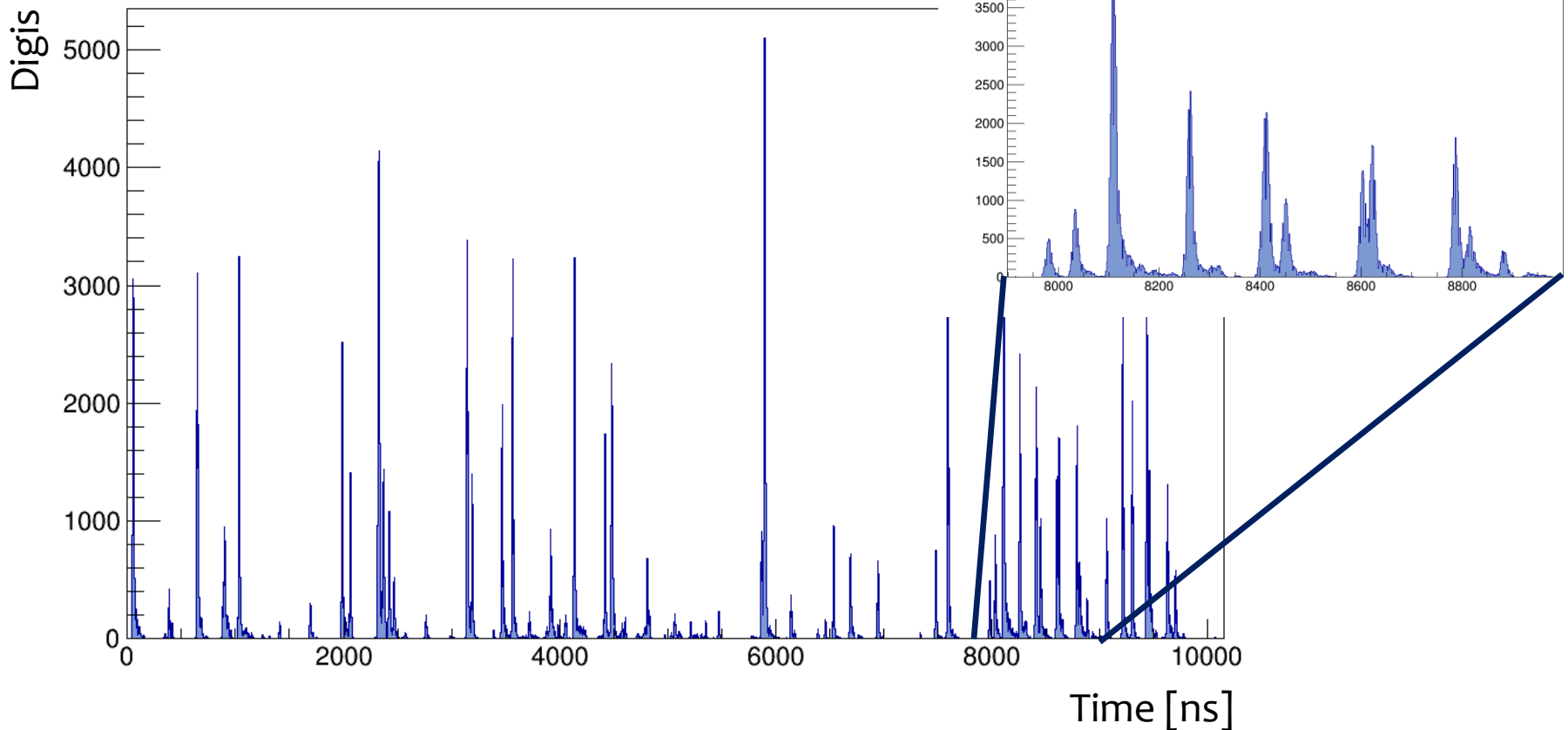
- Fixed-target heavy-ion experiment
- 10^7 Au+Au collisions/sec
- Double-sided strip detector (85% fake space-points)
- Input data is not divided into events

Time Slice

- The CBM beam: no bunch structure
- Interaction rate up to 10 MHz



- Big amount of data
- Overlapping events
- Multiple-fired strips

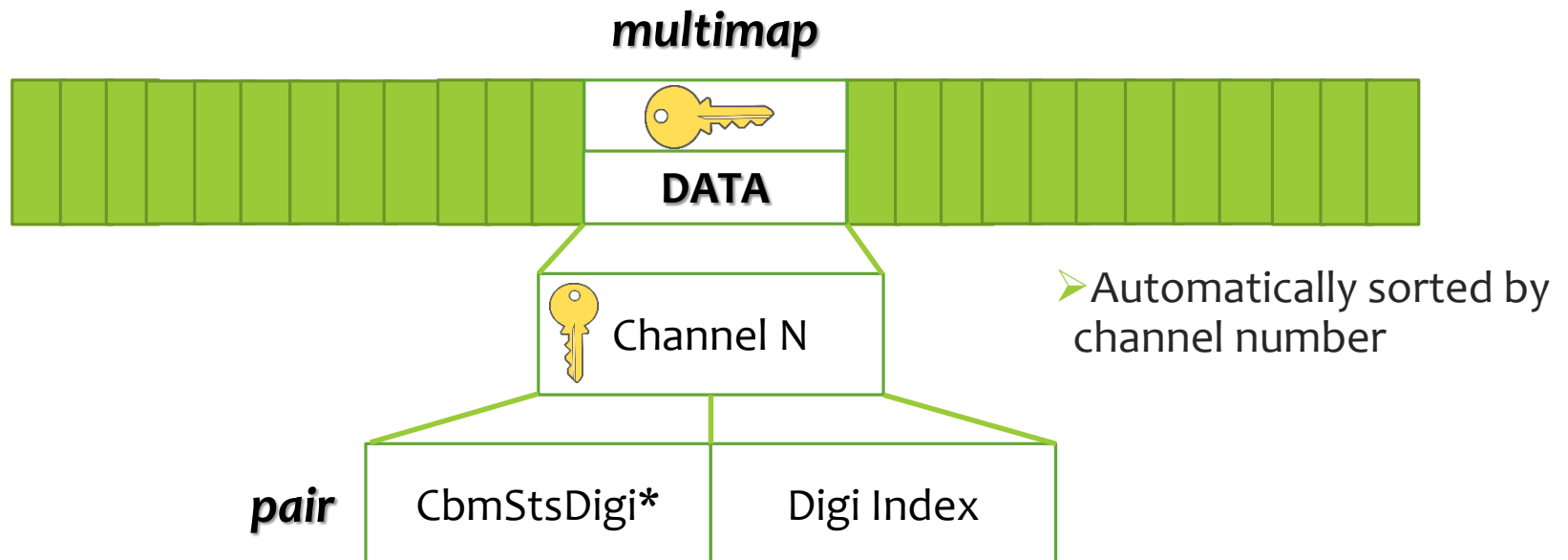


Time-based cluster finding

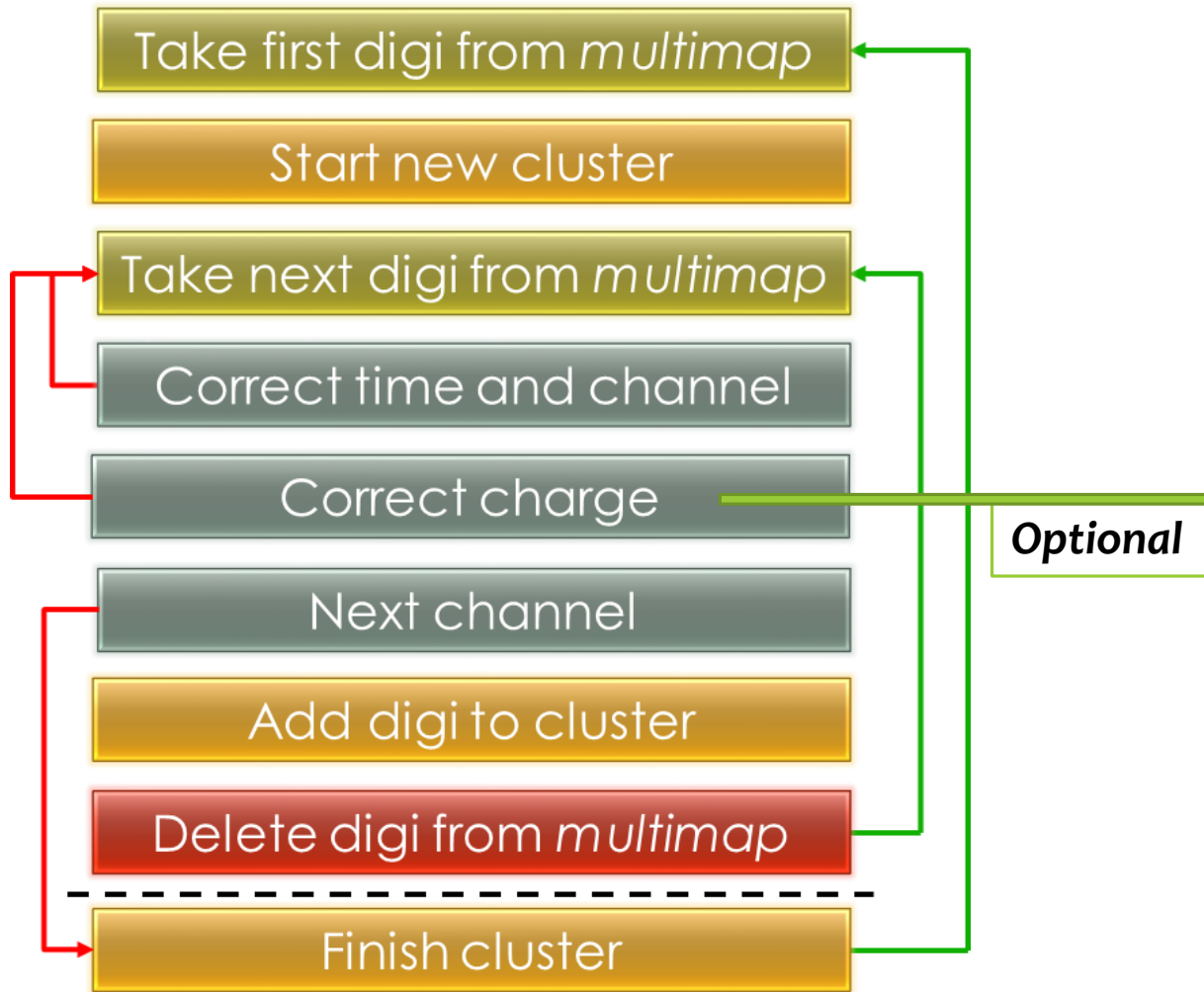
STS cluster is a set of strips with neighboring channel numbers.

Data structure:

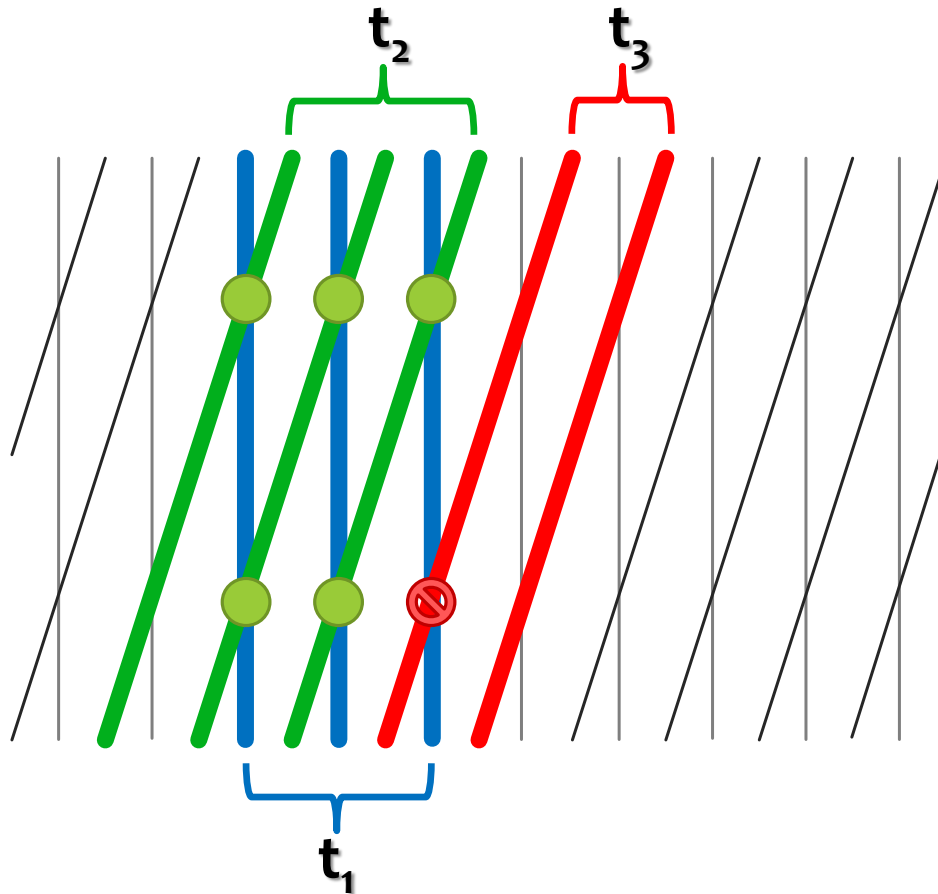
- Access by the channel number
- Fast data sorting
- Not unique channel numbers



Clustering algorithm



Time-based hit finding

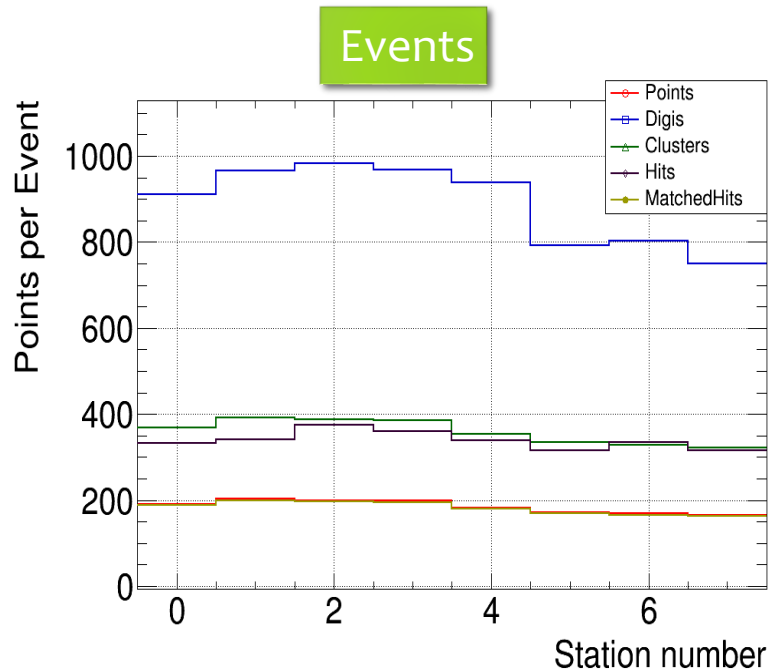


- Standard hit finder can be used in non-parallel reconstruction.
- Additional time check should be added.
- Two clusters create hit only if $|t_{\text{cluster1}} - t_{\text{cluster2}}| < dt$

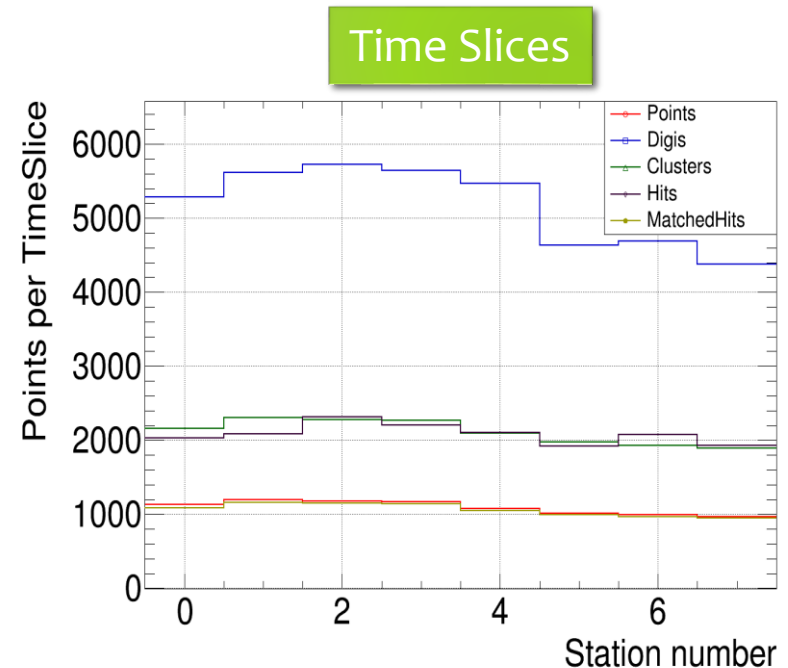
Number of objects / Efficiency

➤ 1000 minimum bias Au+Au events at 25 GeV

➤ Time slice – 10000 ns



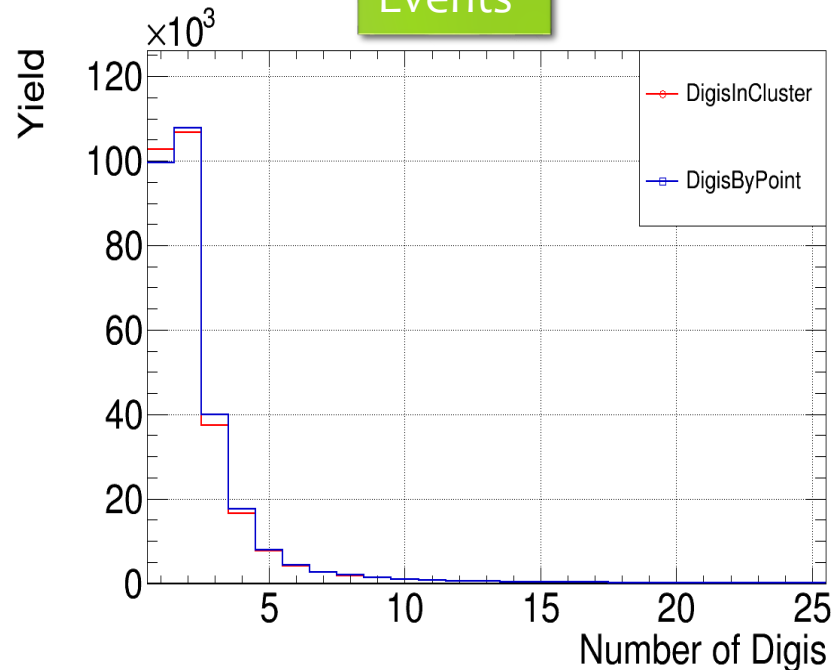
- Matched Hits : 54.7 %
- Efficiency : 98.3 %
- Ghost : 81.3 %



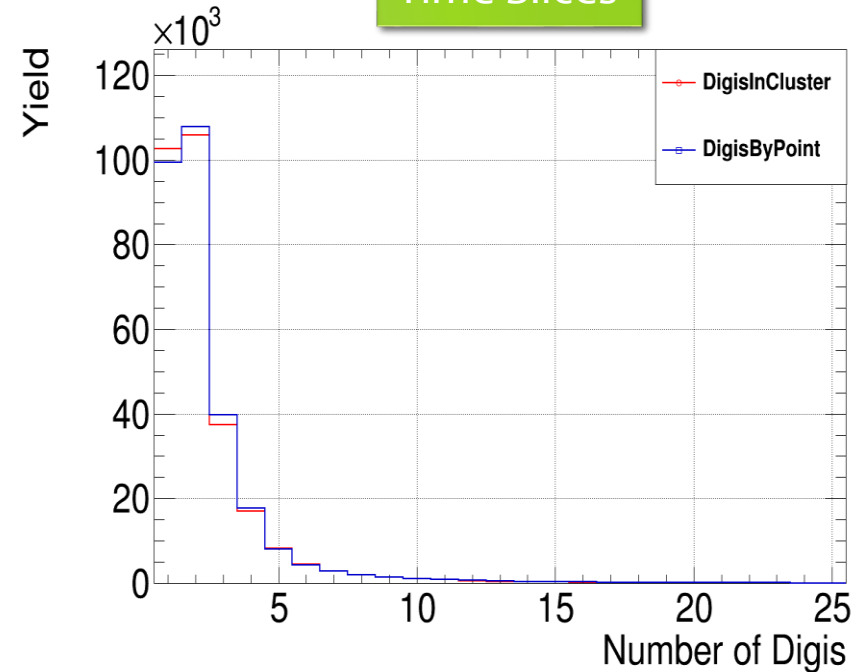
- Matched Hits : 52.8 %
- Efficiency : 97.4 %
- Ghost : 97.1 %

Size of clusters

Events



Time Slices

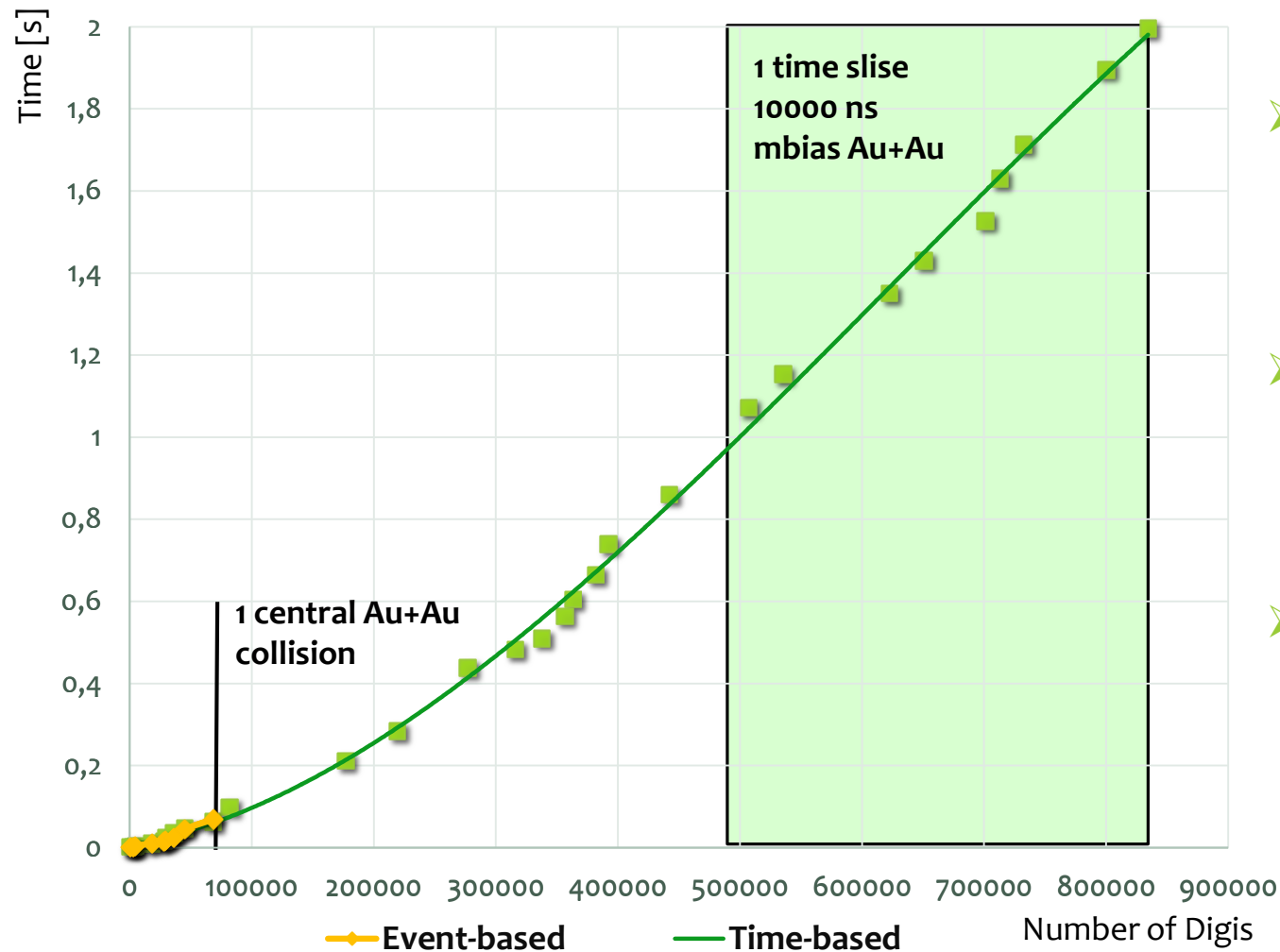


Digis which were produced by Point on the sensor side.

Digis which correspond to each cluster.

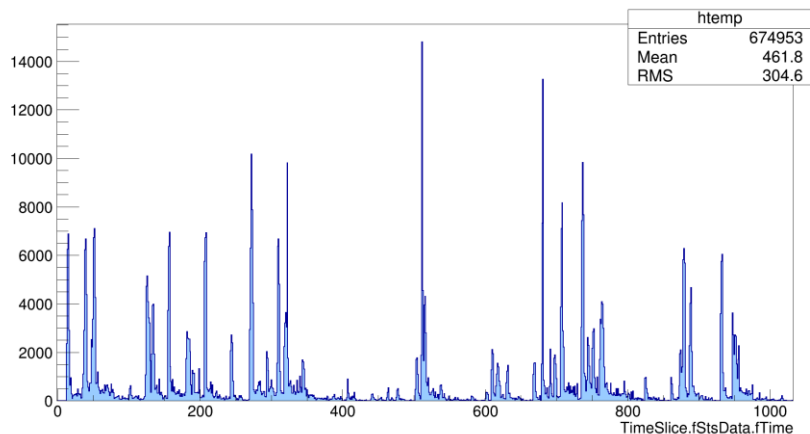
Cluster size distributions are mostly the same. The number and size of clusters correspond to the Monte Carlo data.

Time



- Calculation time increasing accordingly to the number of digis
- Sensors can be processed independently from each other
- The algorithm can be accelerated by parallelization

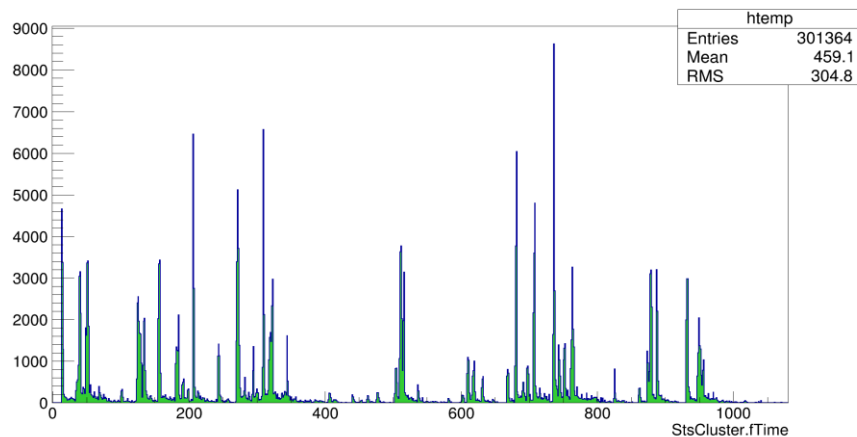
Cluster and hit finding



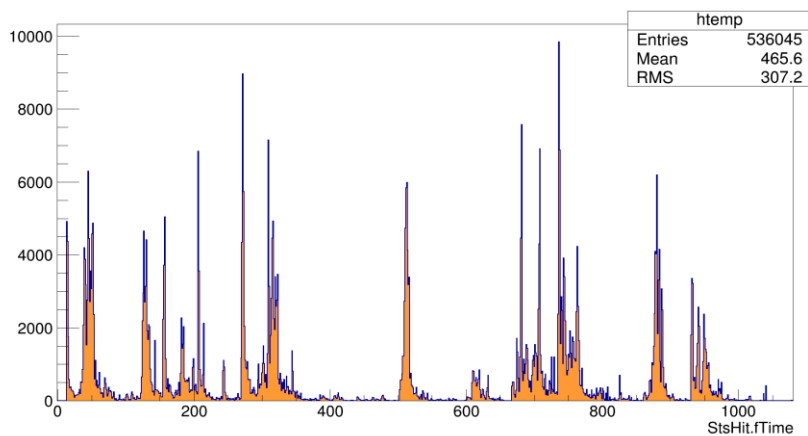
Digis

- 100 mbias AuAu events at 25 GeV;
- Time Slice duration: 1000 ns;
- Interaction rate: 100 MHz;

Clusters



Hits



Conclusions

- Time-based cluster finder for the STS detector was developed.
- Event-based hit finder with time check can be used for time slices as well as for events.
- Efficiency and speed of the new clustering correspond to the performance of the standard event based cluster and hit finders.

Thank you for your attention!