

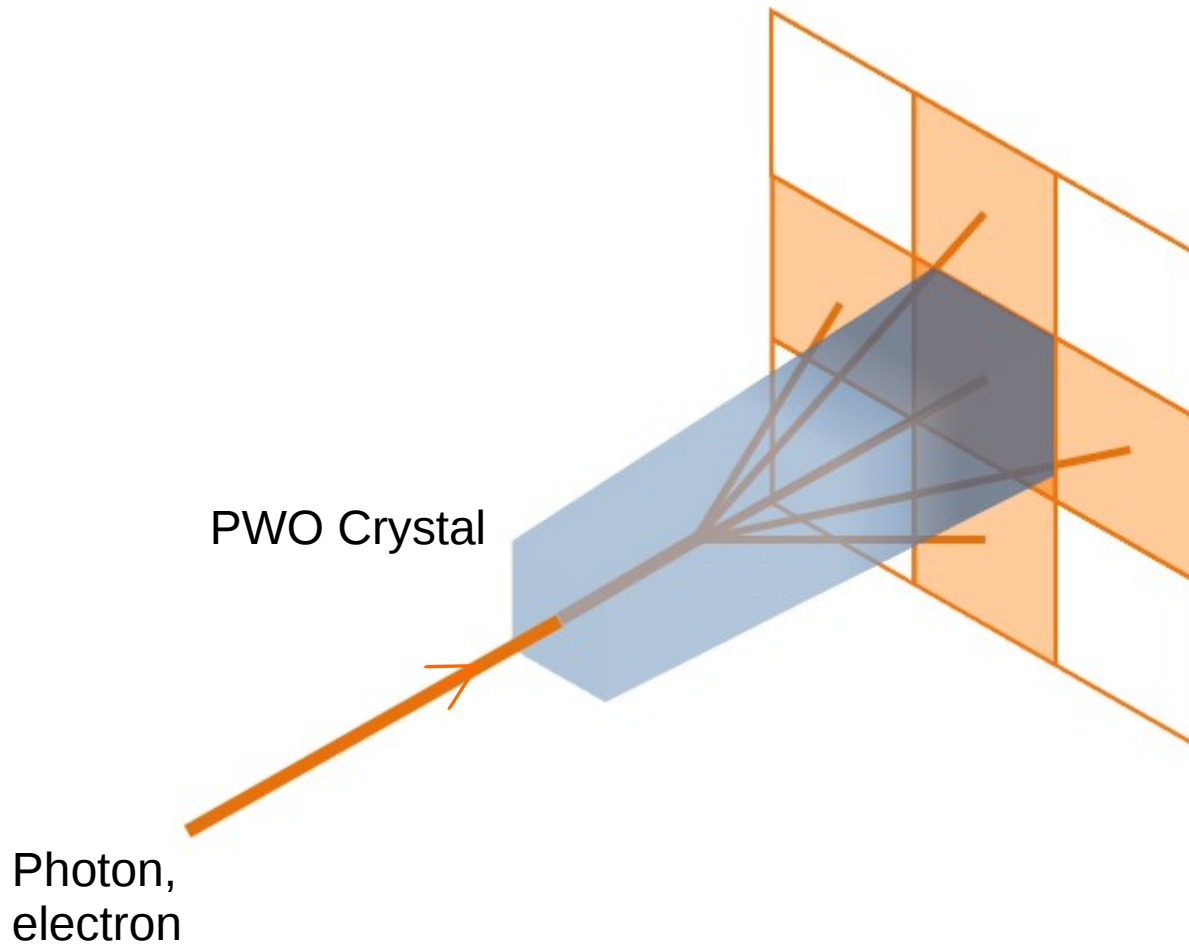


Distributed Clustering for Online Event Reconstruction





Cluster Forming

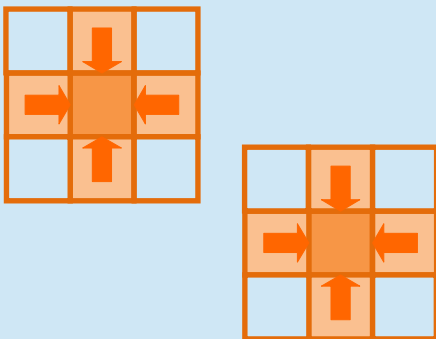


Clustering Finding Methods

Standard

(Built-in PandaRoot)

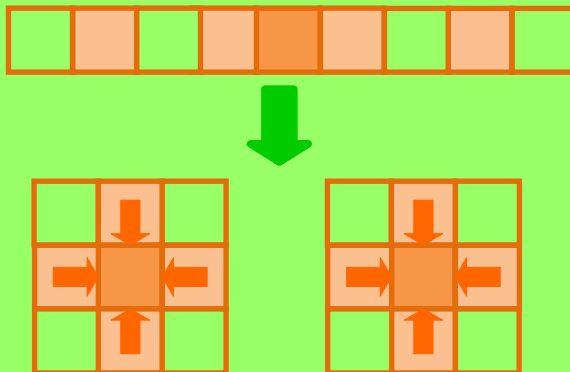
- Treats each new hit as a cluster, and adds neighbouring hits to it



Online

(Shown in Jülich CM)

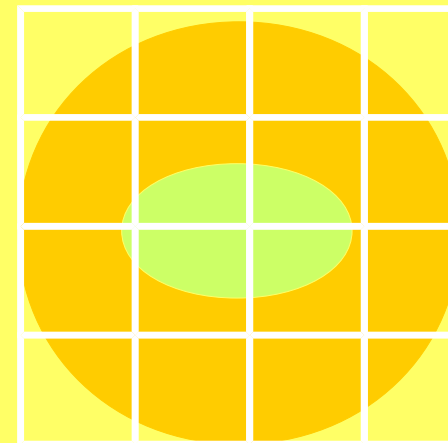
- Builds neighbour relations for all hits in the current input stream
- Uses that info to merge hits into clusters



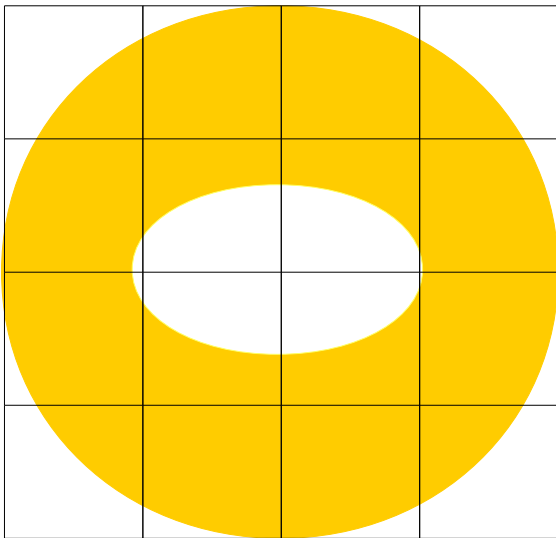
Distributed

(This presentation)

- Same as Online, but first map hits onto Data Concentrators (closer to real readout)



Distributed Clustering – What?



Example: Forward Endcap
(impression)

- Each digitiser can read out ~16 crystals (64 channels, dual gain → 32 Preamps, 2 preamps per crystal → 16 crystals)
- Each Data Concentrator can read out ~8 digitisers.

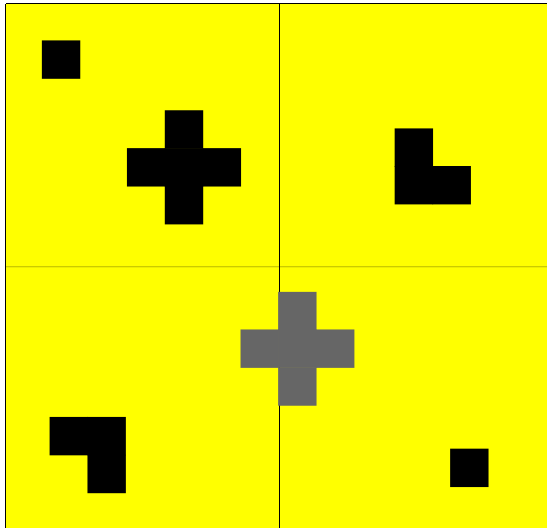


Possible to look for clusters at DC level



Reduces load at CN level

Distributed Clustering – How?



Example: clusters in 4 DC

- 1) In each DC, look for clusters using the online clustering algorithm
- 2) As we don't know if this is a 'real' cluster, first only specify its 4D location and radius
- 3) At the CN level, using preclusters as input, merge them if $(x_1 - x_2) < (r_1 + r_2)$

● Each DC has a small sample of the dataset → Fast

● CNs only have to work with preclusters, not hits → Fast



Comparing Methods (preliminary)

Example channel: $5000 \times p\bar{p} \rightarrow \gamma\gamma$, $\bar{p}(\bar{p}) = 1 \text{ GeV}/c$

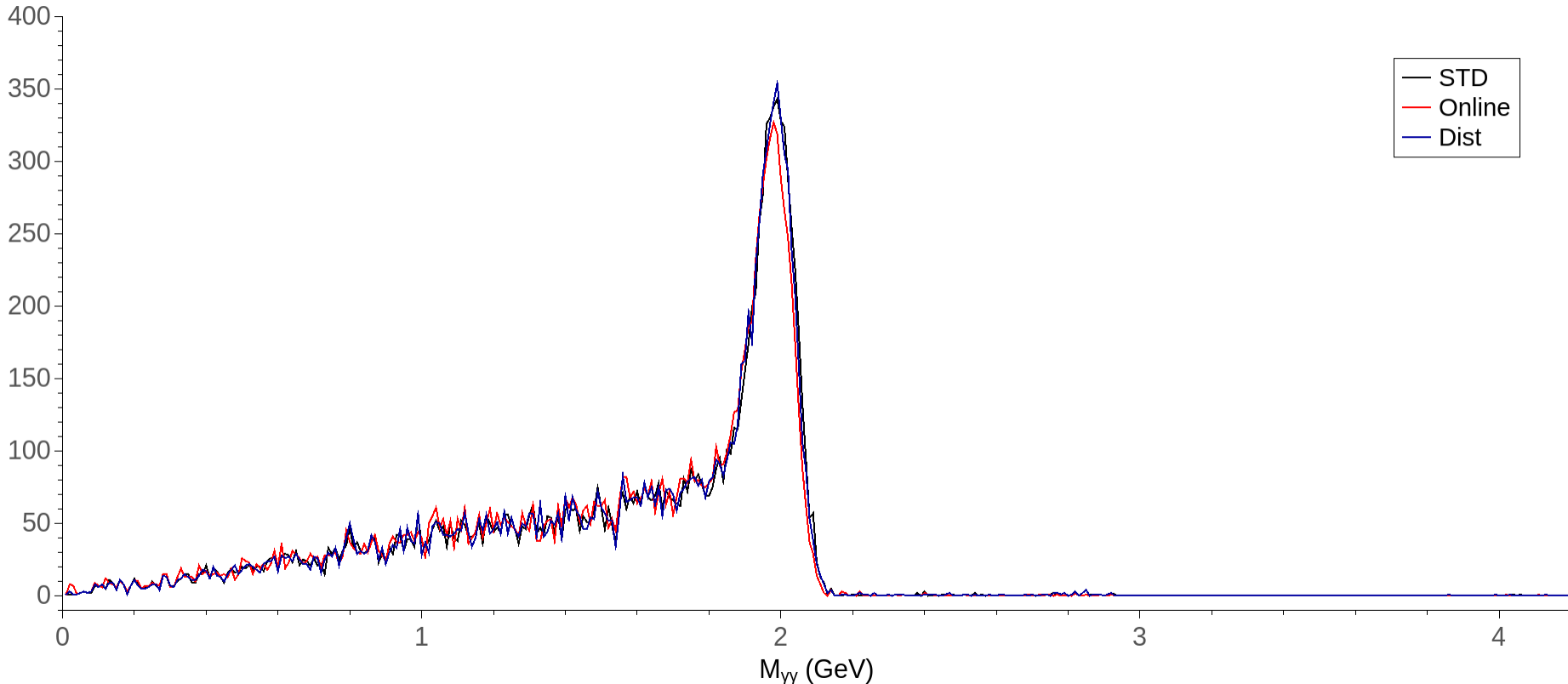
TEST, PART 1:
Ability to reconstruct events



Comparing Methods (preliminary)

Example channel: $5000 \times p\bar{p} \rightarrow \gamma\gamma$, $\bar{p}(\bar{p}) = 1 \text{ GeV}/c$

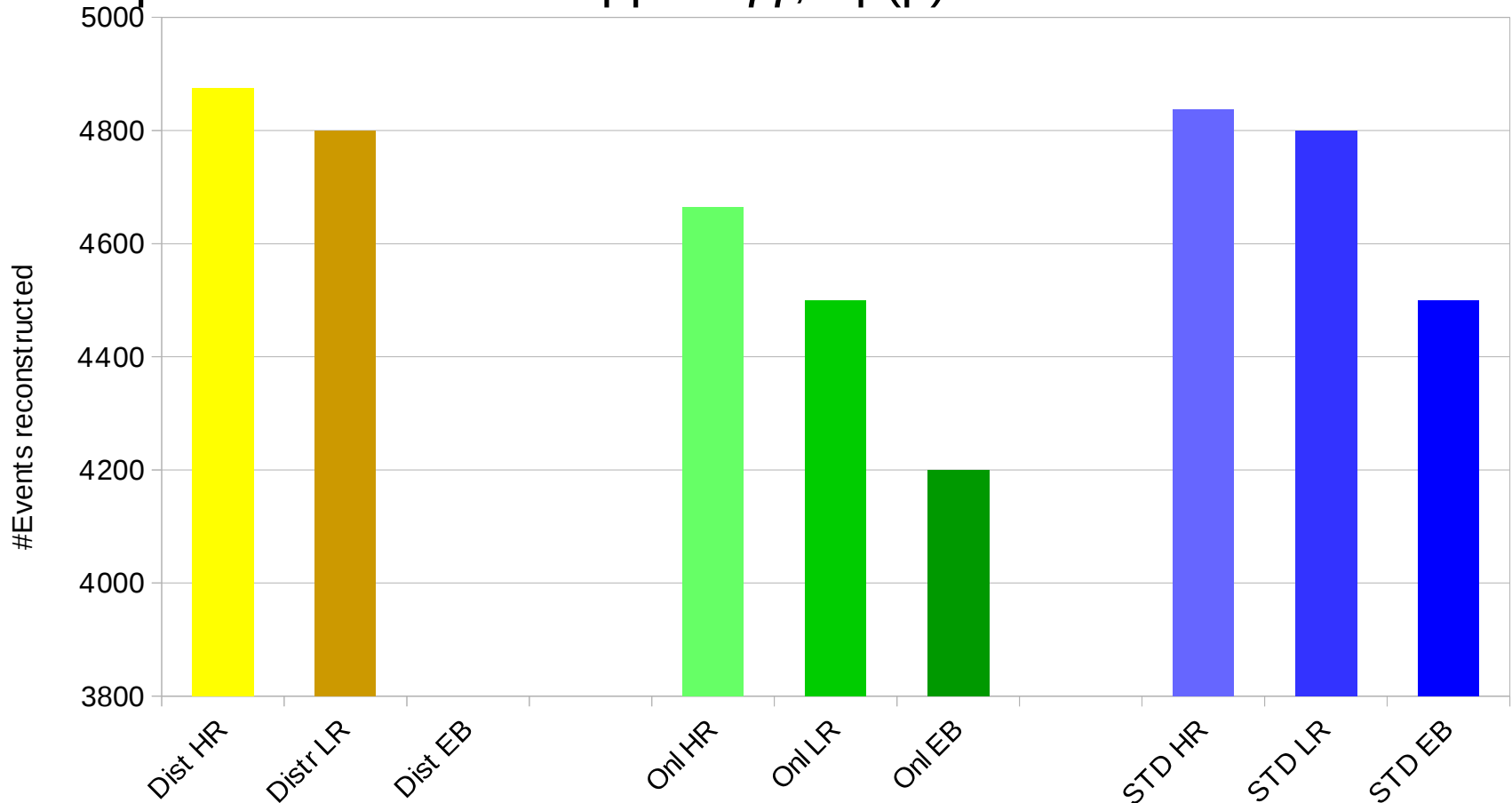
2-photon invariant mass





Comparing Methods (preliminary)

Example channel: $5000 \times p\bar{p} \rightarrow \gamma\gamma$, $\bar{p}(\bar{p}) = 1 \text{ GeV}/c$





Comparing Methods (preliminary)

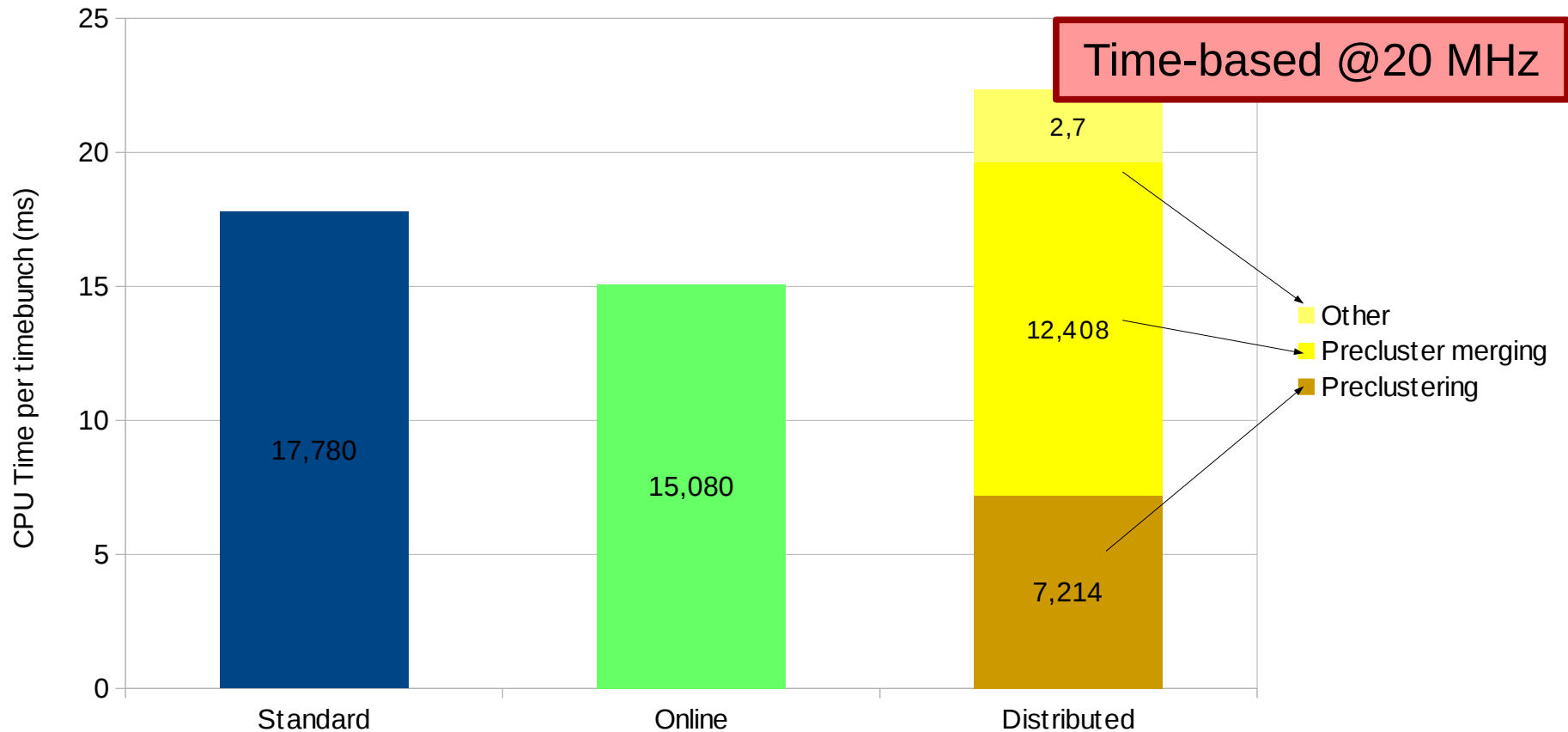
Example channel: $5000 \times p\bar{p} \rightarrow \gamma\gamma$, $\bar{p}(\bar{p}) = 1 \text{ GeV}/c$

TEST, PART 2:
Time needed to perform reconstruction



Comparing Methods (preliminary)

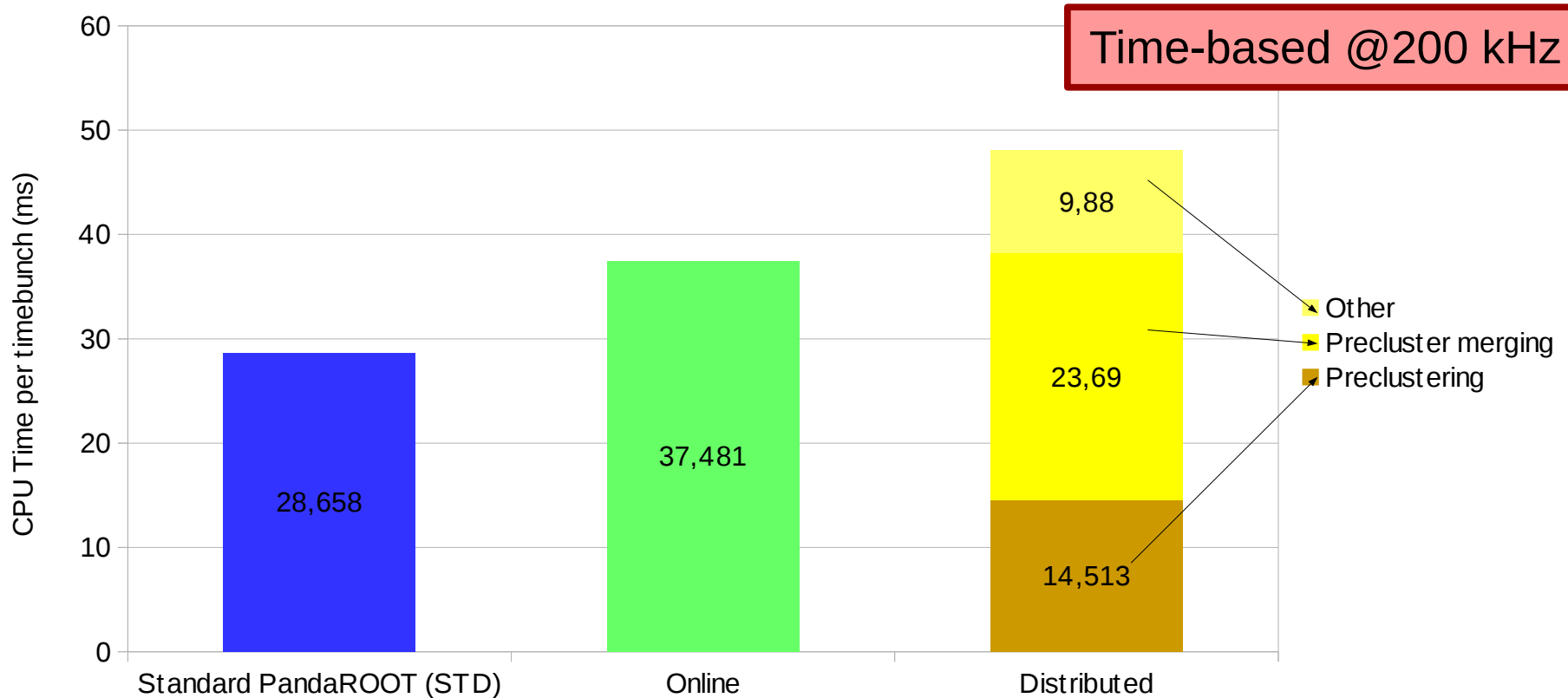
Example channel: $5000 \times p\bar{p} \rightarrow \gamma\gamma$, $\bar{p}(\bar{p}) = 1 \text{ GeV}/c$





Comparing Methods (preliminary)

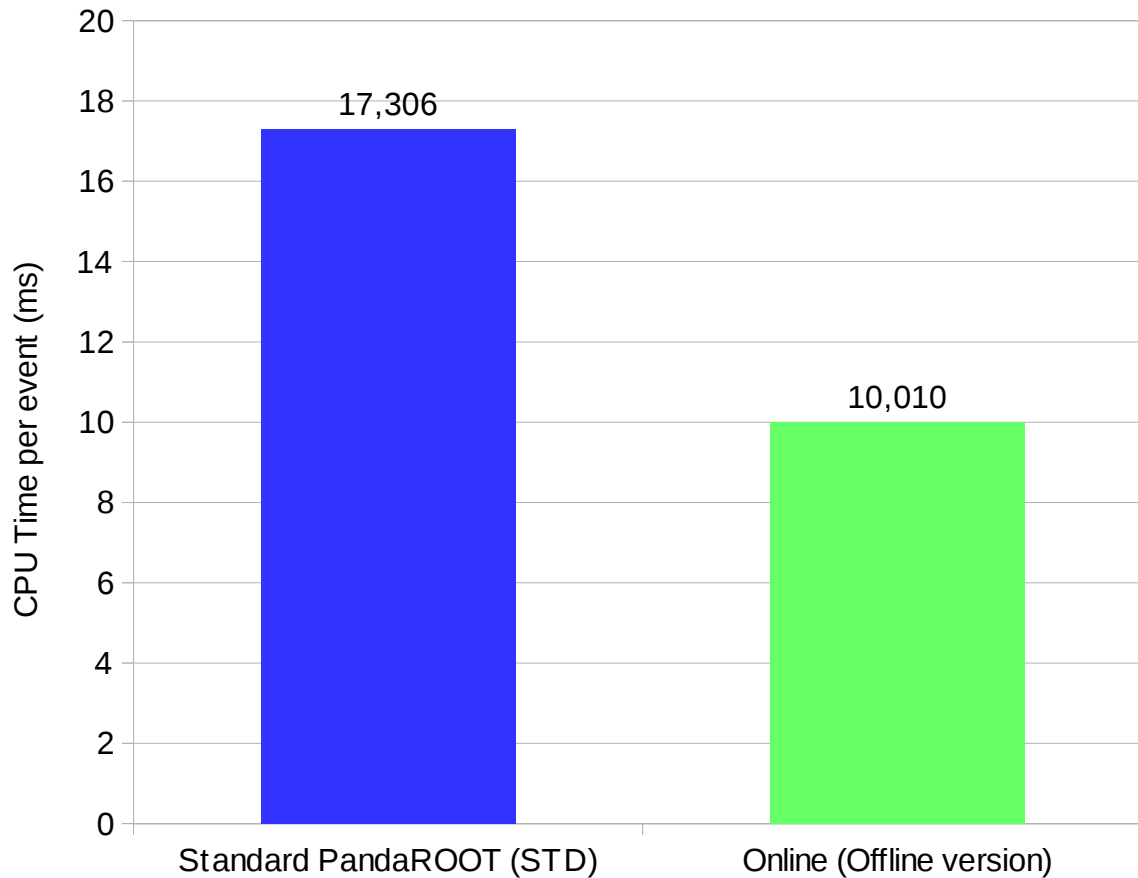
Example channel: $5000 \times p\bar{p} \rightarrow \gamma\gamma$, $\bar{p}(\bar{p}) = 1 \text{ GeV}/c$





Comparing Methods (preliminary)

Example channel: $5000 \times p\bar{p} \rightarrow \gamma\gamma$, $\bar{p}(\bar{p}) = 1 \text{ GeV}/c$



Event-based



Conclusion

- All methods yield a similar number of events
- Online Cluster Finding is the fastest
- Processing time for all methods is comparable, but the two steps in distributed clustering are separately considerably faster



Outlook

- Investigate behaviour at low rate
- Expand to more complicated channel $h_c \rightarrow 7\gamma$
- Include background
- Investigate effect of bump splitting