Update on the SttCellTrackFinder

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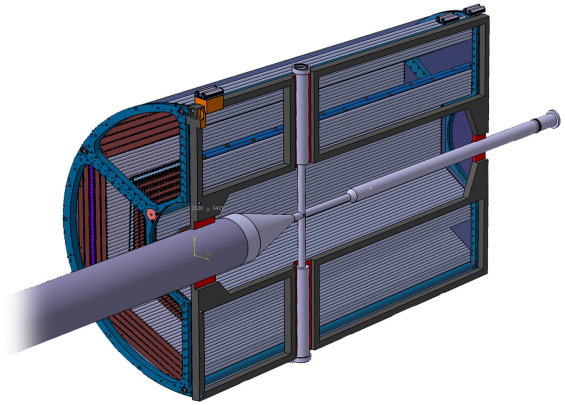
Outline

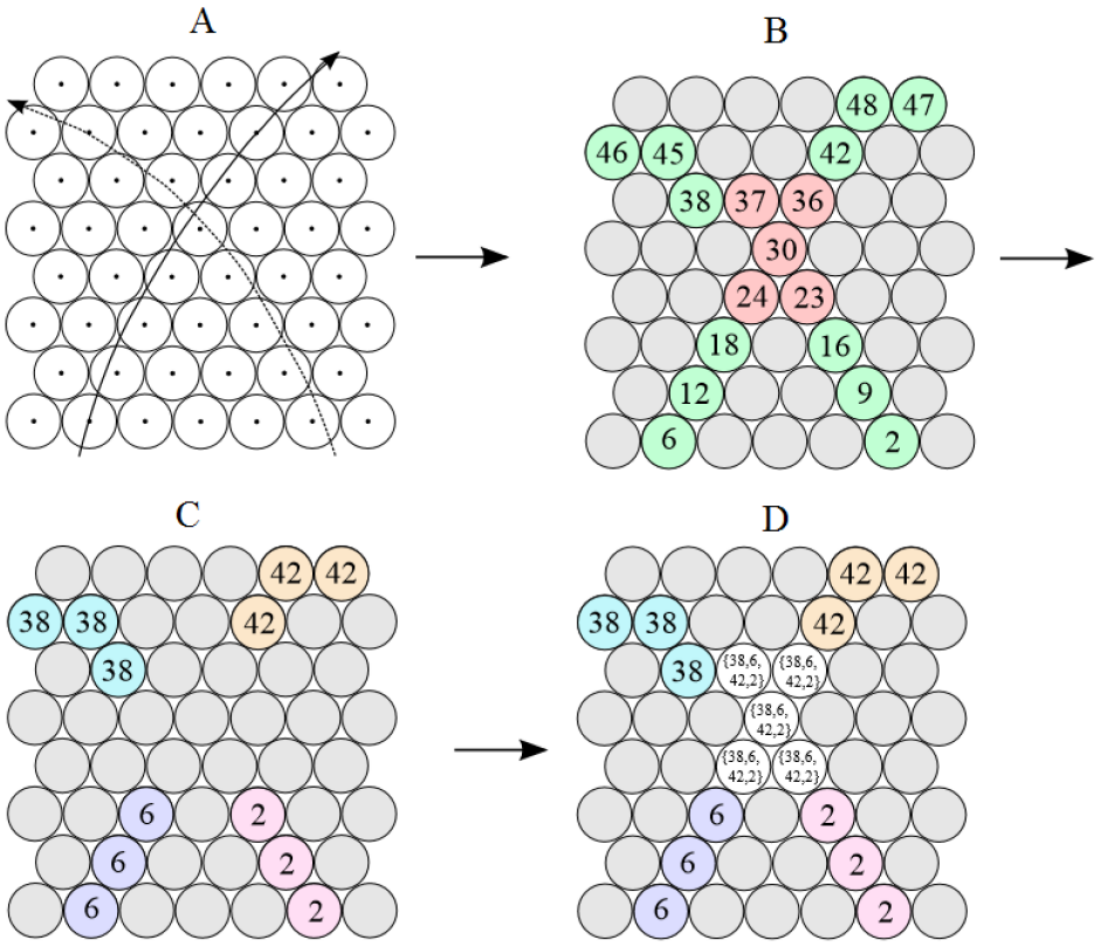
- SttCellTrackFinder
- Time Based Simulation
- Time clustering in SttCellTrackFinder
- Extension to MVD
- Outlook

SttCellTrackFinder

J. Schumann

- Cellular Automaton
- Riemann Fit





A Tracks traverse STT

B Hit straws are numbered

C **Unambiguous** hits are iteratively renumbered until hits in one cluster have same number

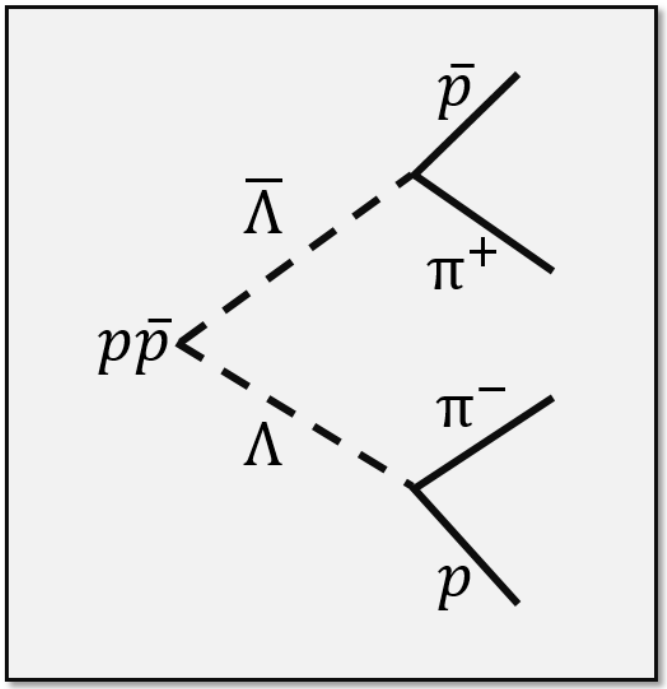
D **Ambiguous** hits are give all numbers possible

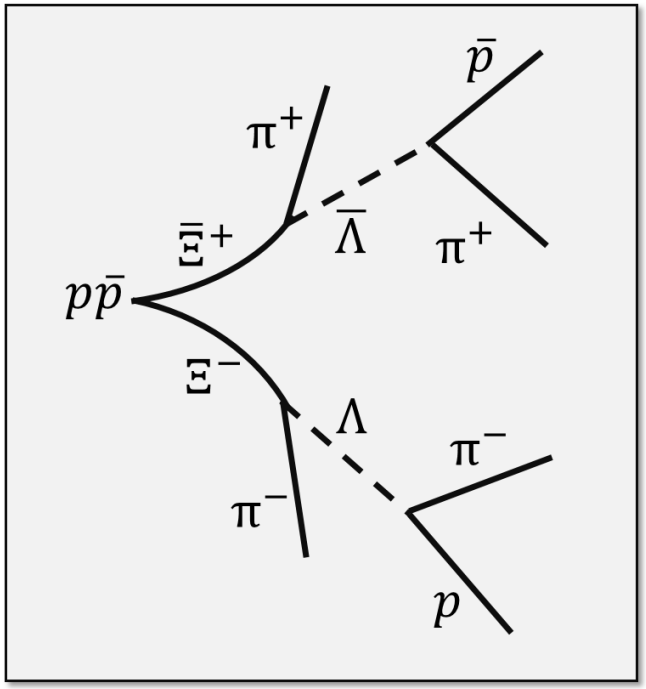
Tracklets need to have at least 3 hits

SttCellTrackFinder for Hyperons

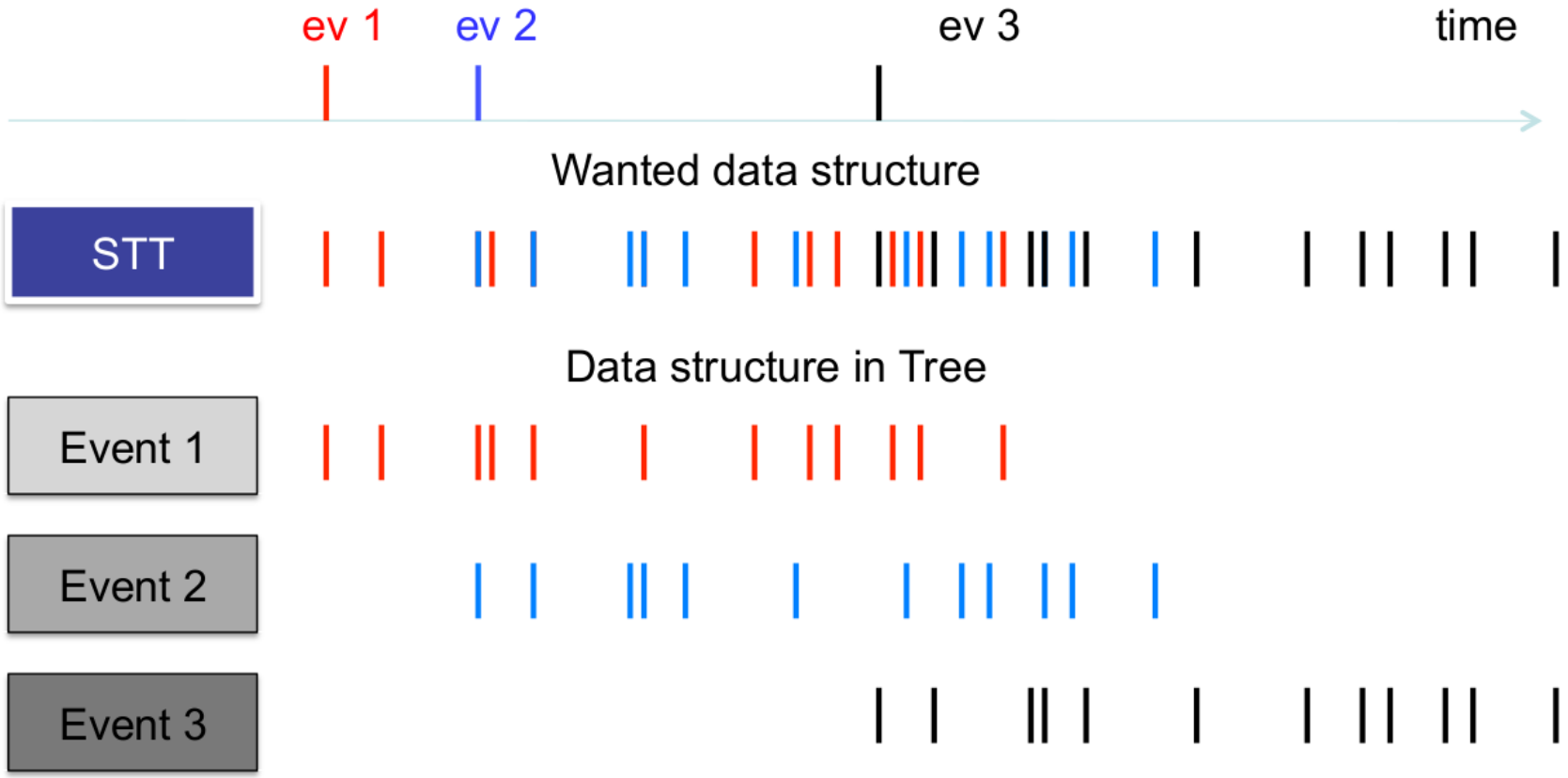
Why?

- Secondary track finder
  - $\rightarrow$ does not assume track originate from IP
- Hyperon event $\rightarrow$ displaced vertex
- Most hyperon decay vertices will occur within range of STT
- STT good starting point for tracking

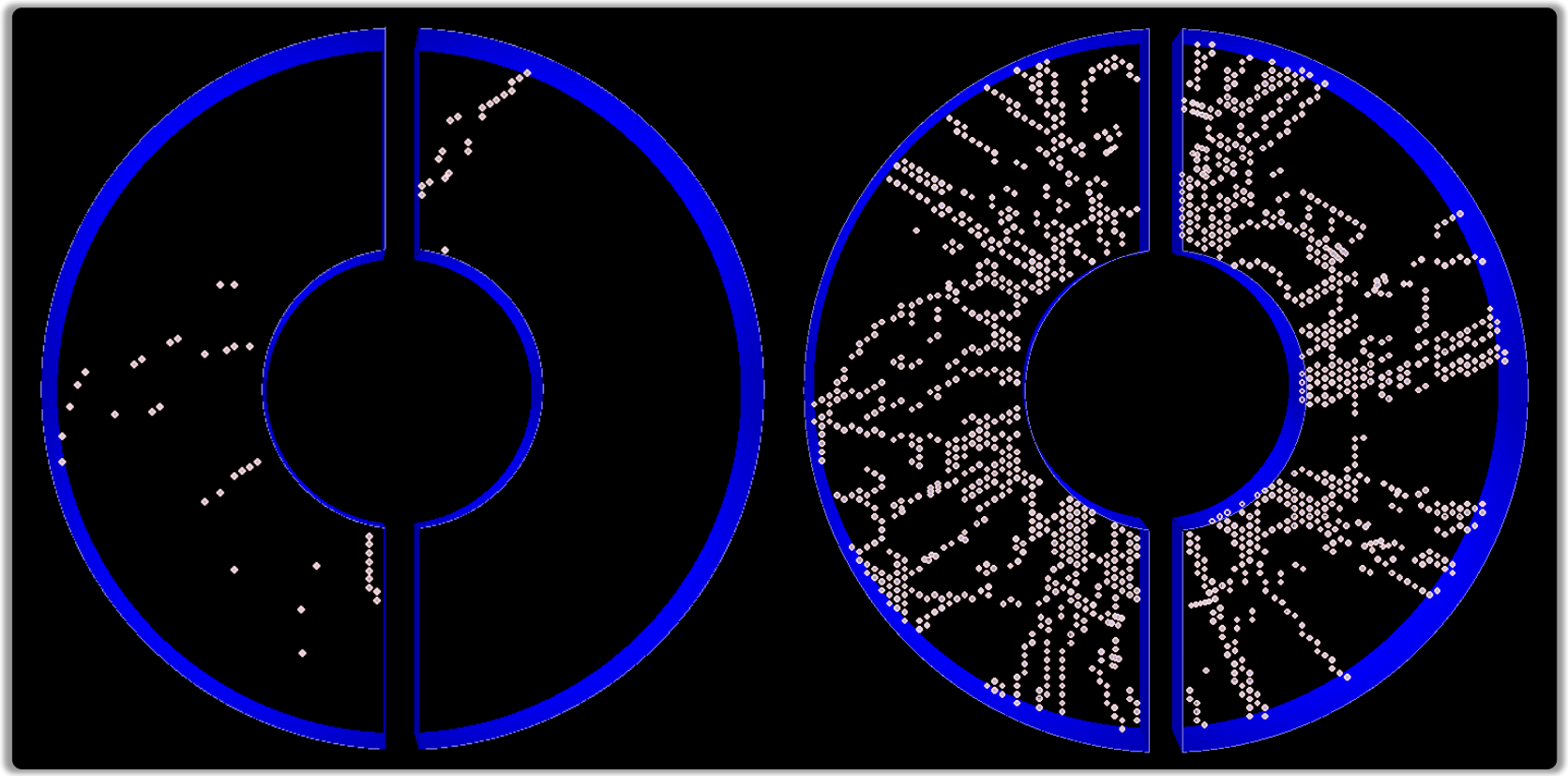




Time Based Reconstruction



Time Based Reconstruction, DPM generator



Left:

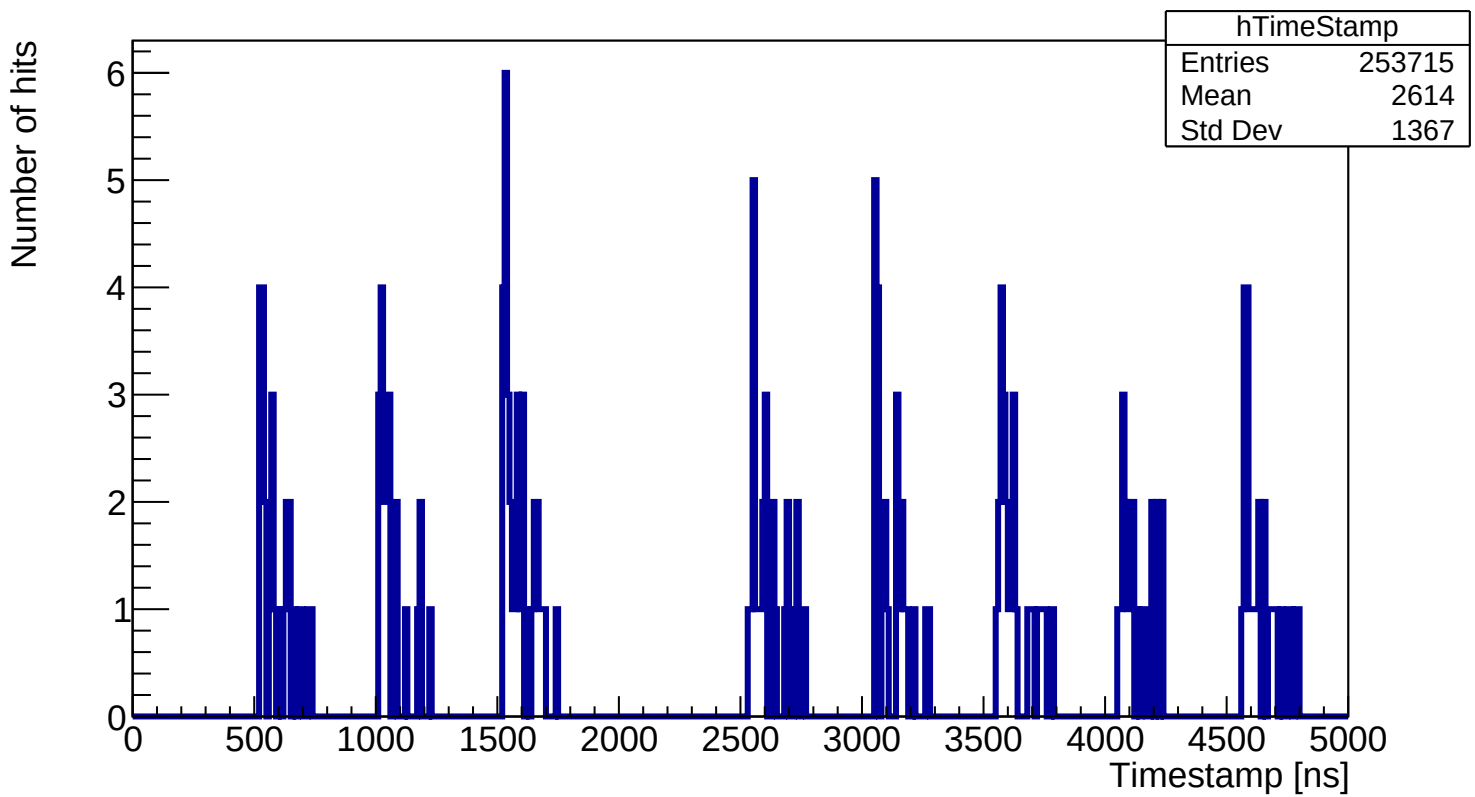
- 200 ns time window
- Tracks well separated

Right:

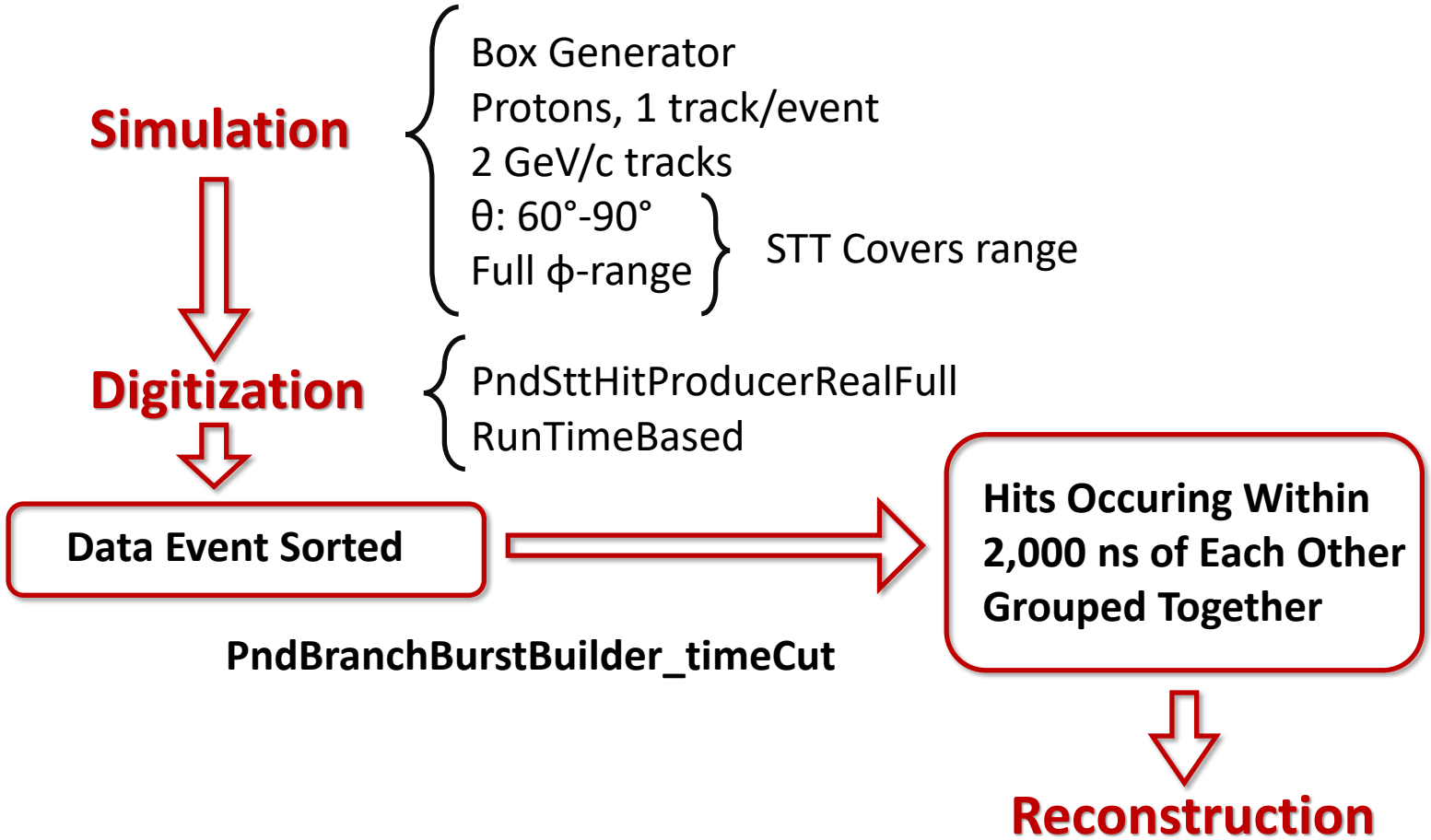
- 2,000 ns time window
- Event mixing
- Overlap between tracks

Time Structure

- Mean event time interval: 500-550 ns
- 1 track/event, 1 event occur within 250 ns
- Events well separated
  - Should be similar as event based
- Time structure corresponding to low luminosity mode



Time Based Simulation

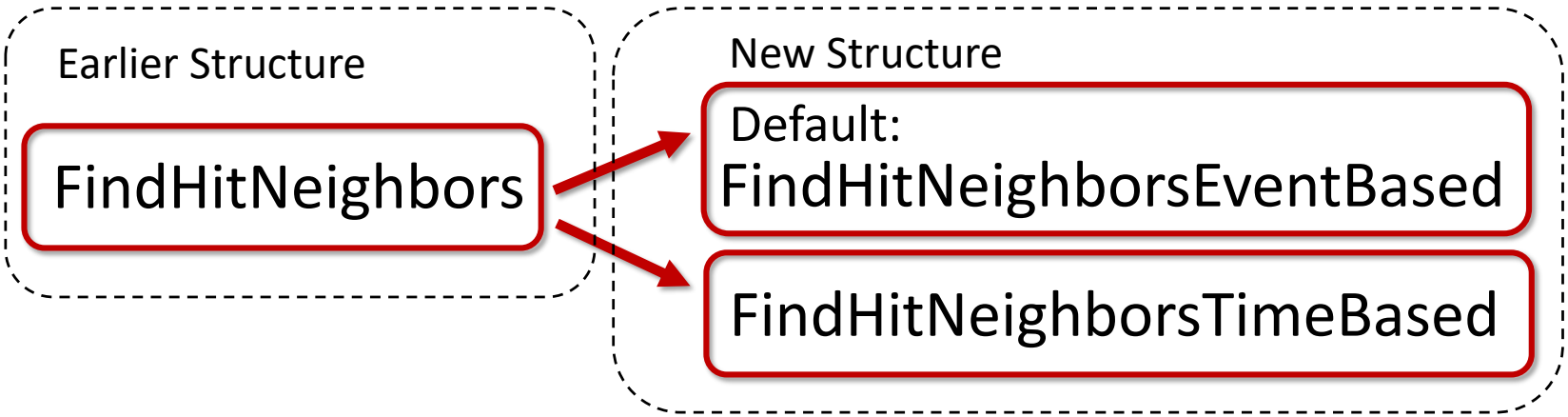


For more information about the PndBranchBurstBuilder:
https : *//indico.gsi.de/event/6354/contribution/7/material/slides/0.pdf*

Time Clustering in SttCellTrackFinder

- Previously, only spatial relations taken into consideration
- Time based: compare timestamps of direct neighbors
- FindHitNeighbors = FindHitNeighborsEventBased

PndSttCellTrackFinderData



Running Time Based Reconstruction

Getting time structure:

```
PndBranchBurstBuilder_timeCut *combi = new PndBranchBurstBuilder_timeCut();
combi->AddInputBranch("STTHit");
combi->SetOutputPrefix("Burst_tb");
combi->SetTimePeriod(2000); // ns
combi->SetPersistence(kTRUE);
fRun->AddTask(combi);
```

Performing time based reconstruction:

```
PndSttCellTrackFinderTask *cellTrackFinder = new PndSttCellTrackFinderTask();
cellTrackFinder->SetPersistence(kTRUE);
cellTrackFinder->AddHitBranch("Burst_tb_STTHit");
cellTrackFinder->SetAnalyseSteps(kTRUE);
cellTrackFinder->SetClusterTime(300);  // ns
fRun->AddTask(cellTrackFinder);
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```
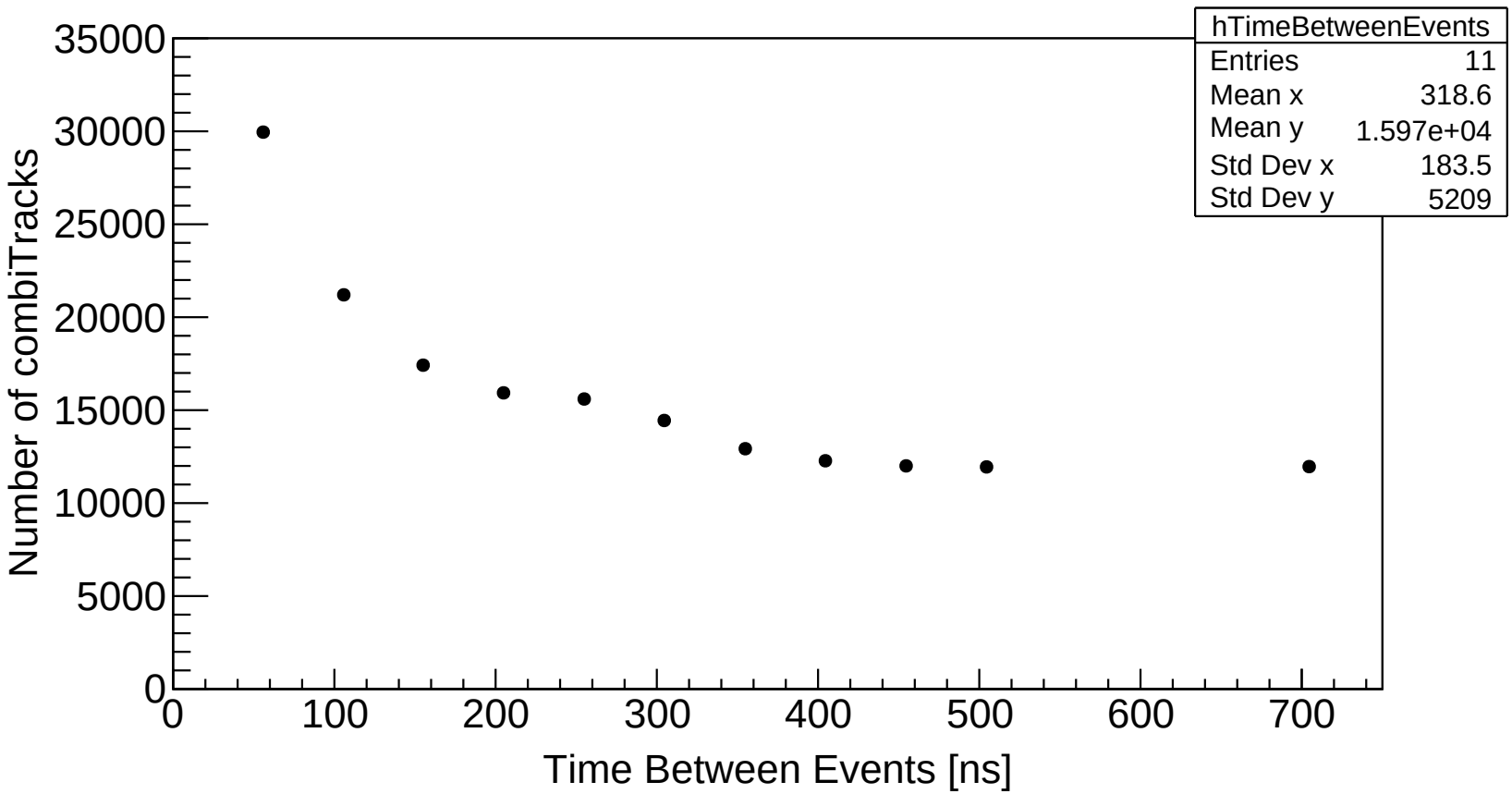

250 ns default cluster time (unreasonable value in development branch, will be changed a.s.a.p, for now, set cluster time!)

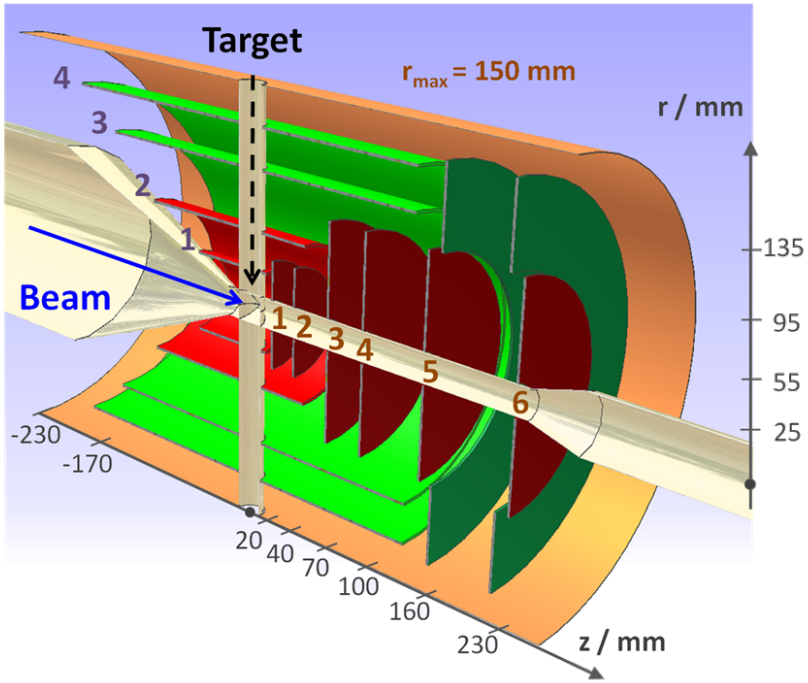
Test

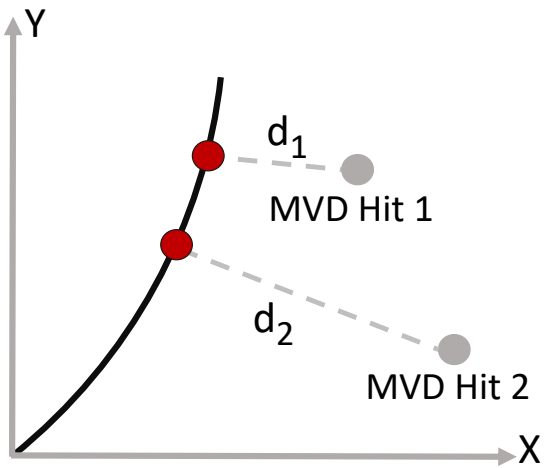
- 2,000 ns burst time, 250 ns cluster time, $\sim$ 250 ns event time
- Varying time between events
- No separation between primary and secondary tracks
- For time between events $>$ 300 ns, # combiTracks level out around 11,000

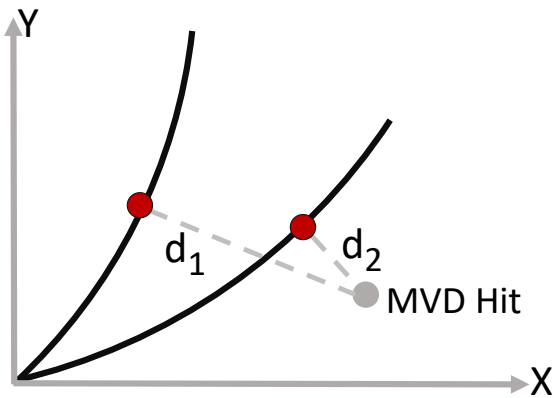


MVD

- Include MVD hits in tracking
- Use distance from projections of MVD hits in xy-plane to Riemann track
- Riemann track object: circular in xy-plane at z=0







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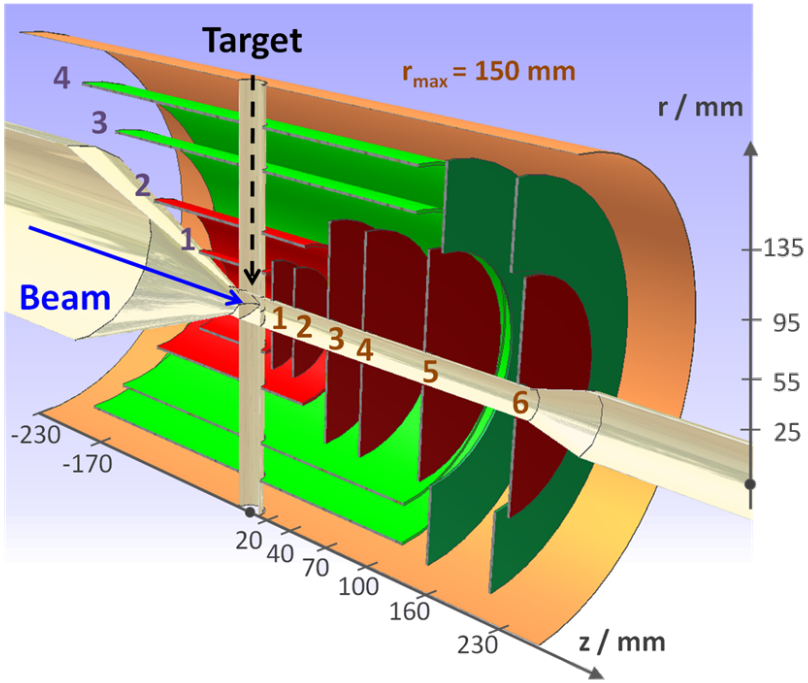
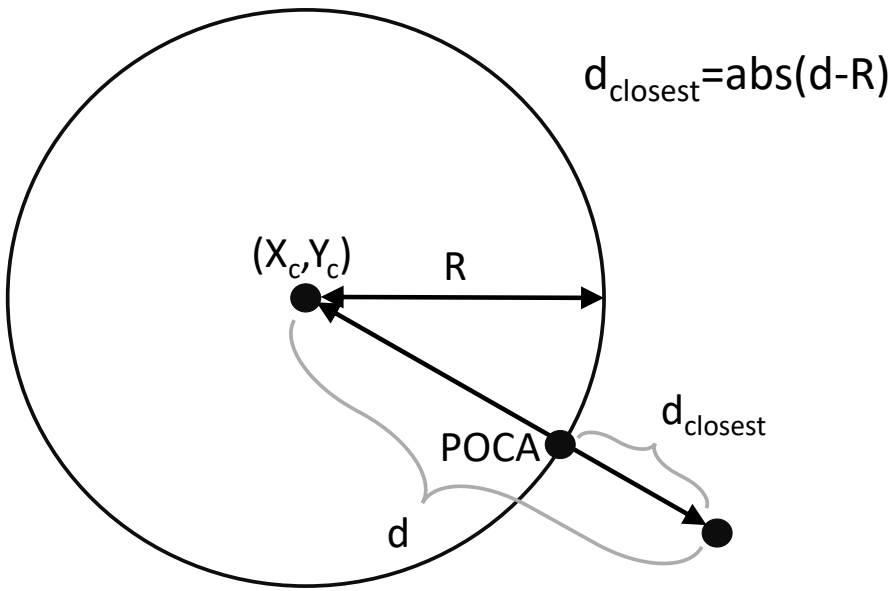
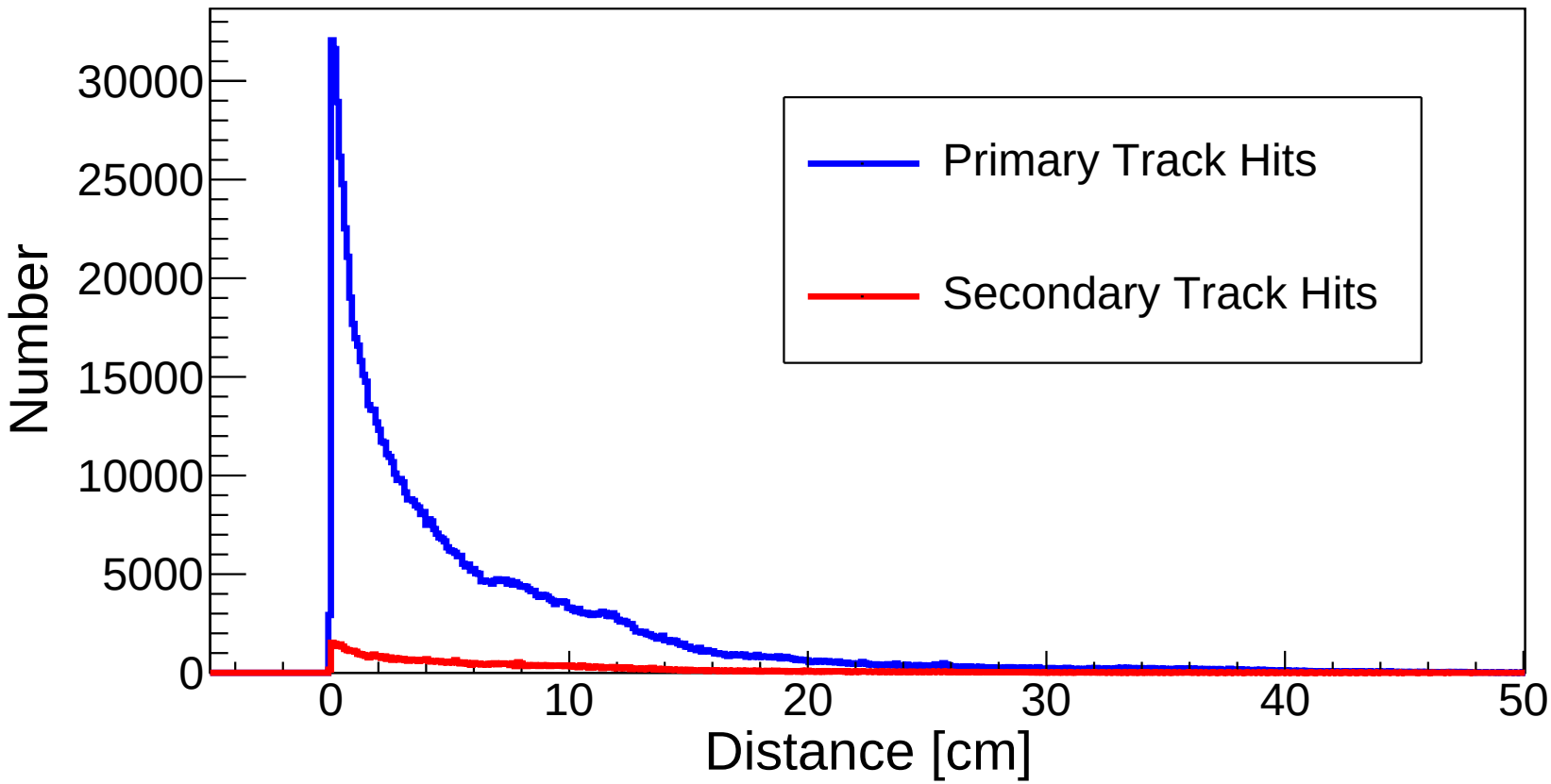




Hit Selection, 5 tracks/event, Box generator

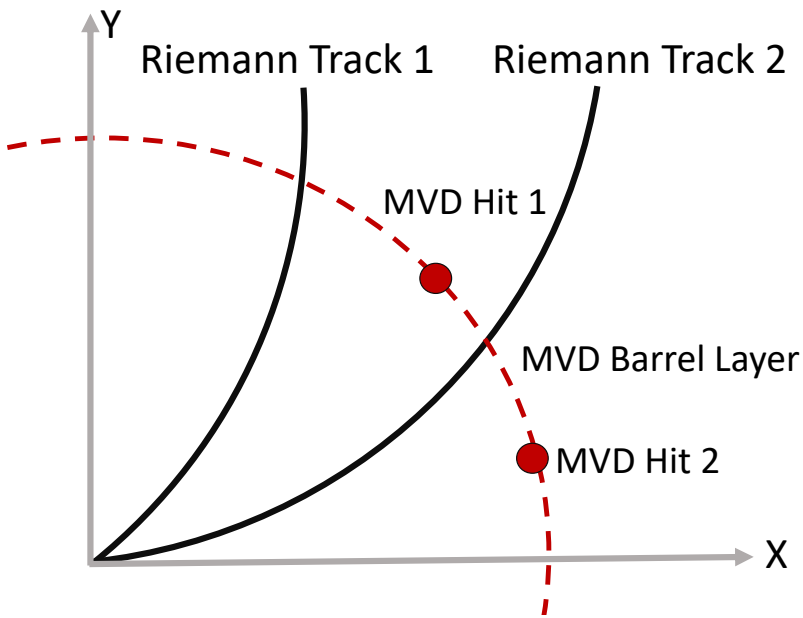
- Distance between secondary track hits and all tracks → linear behaviour of plot
- Distance cut only → insufficient



Hit Selection

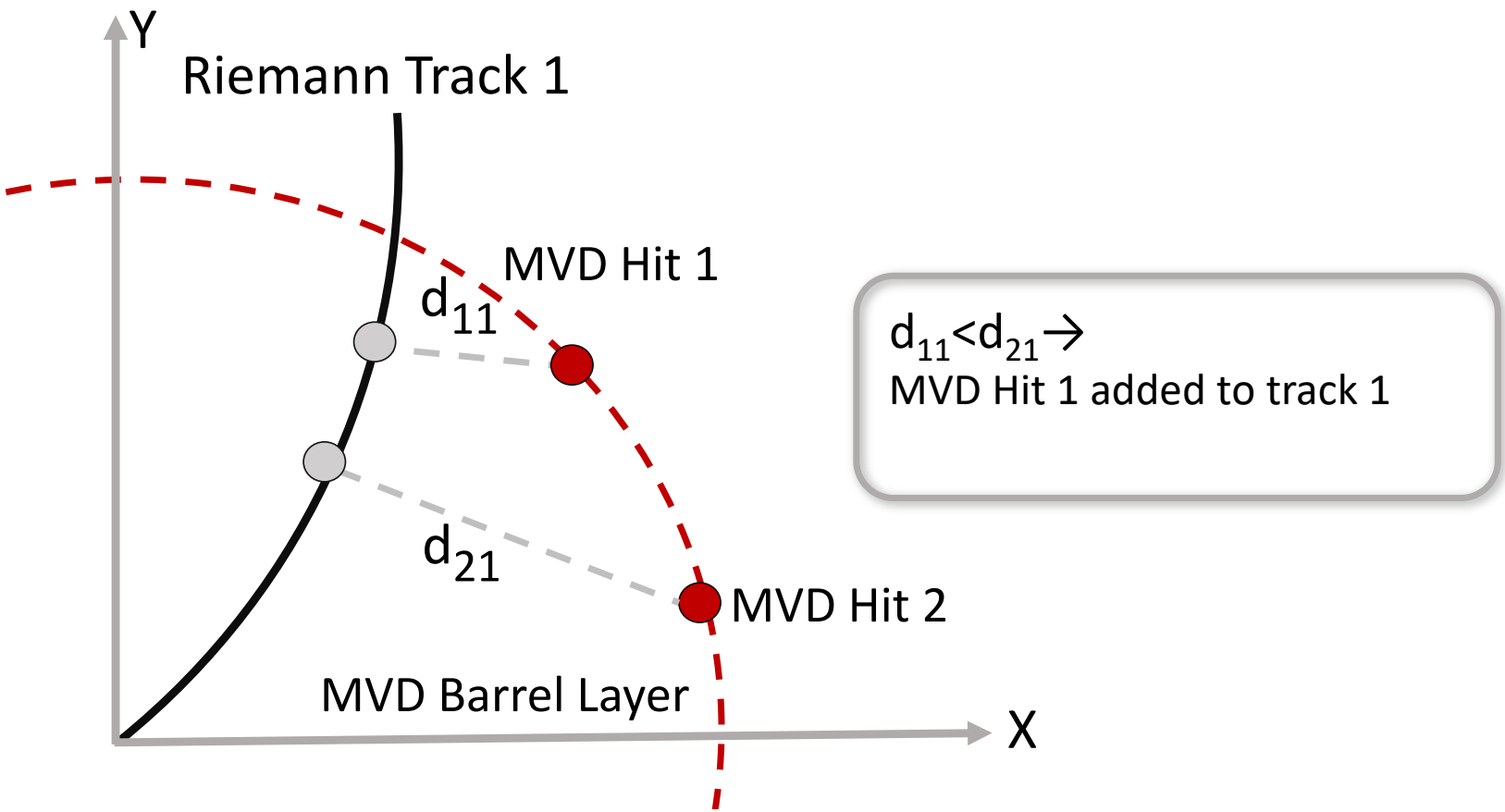
Add best hit from each barrel layer to track

- Barrel layers picked from radial position
- Disks not taken into account
- Presently, one hit can be added to several tracks
- One track can at most have 4 hits assigned to it
- Introduce cut on d



Hit Selection

- Distance, d, between MVD hits in one barrel layer and POCA of all tracks calculated
- Hit with smallest d is added to track



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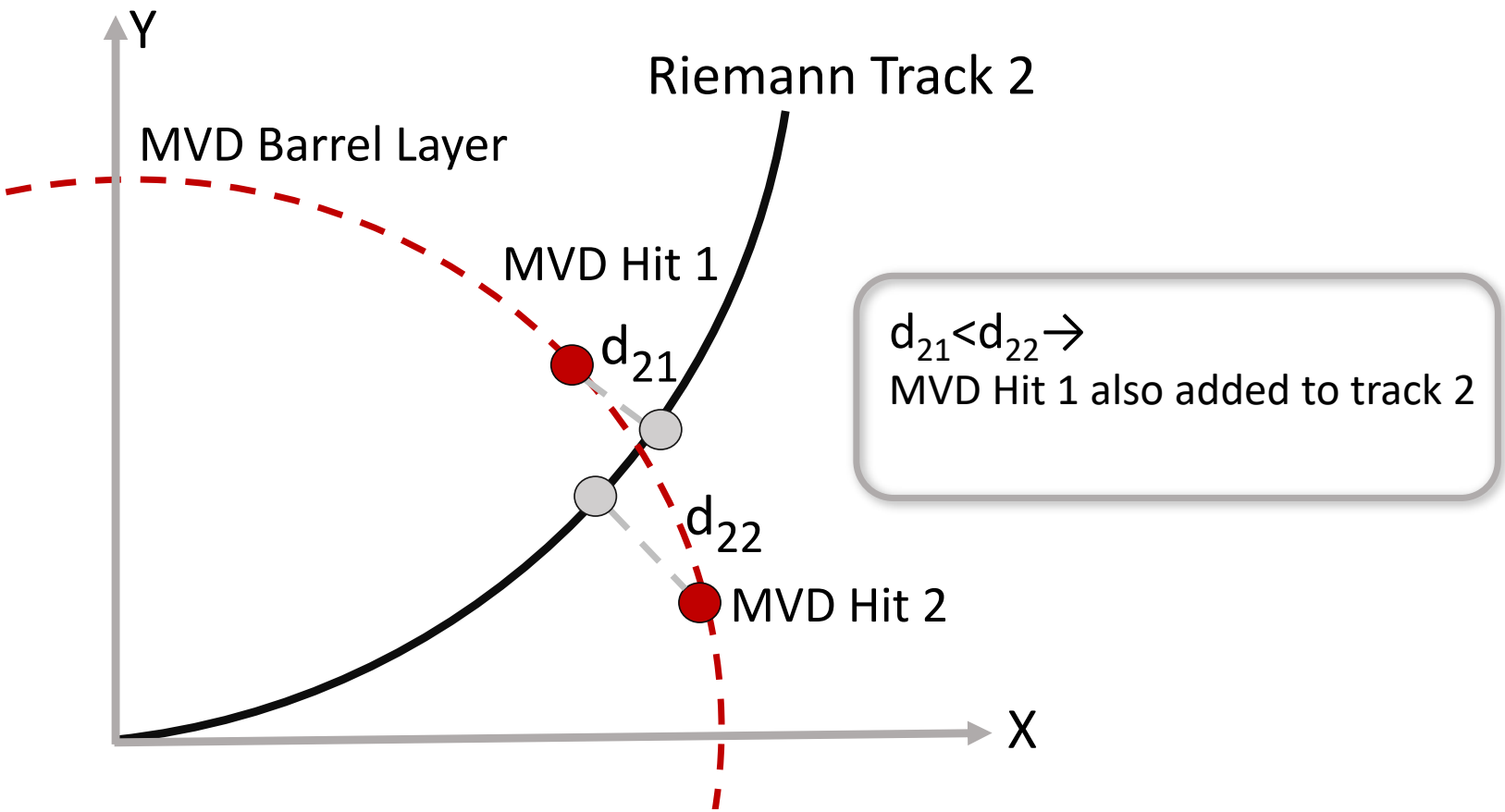

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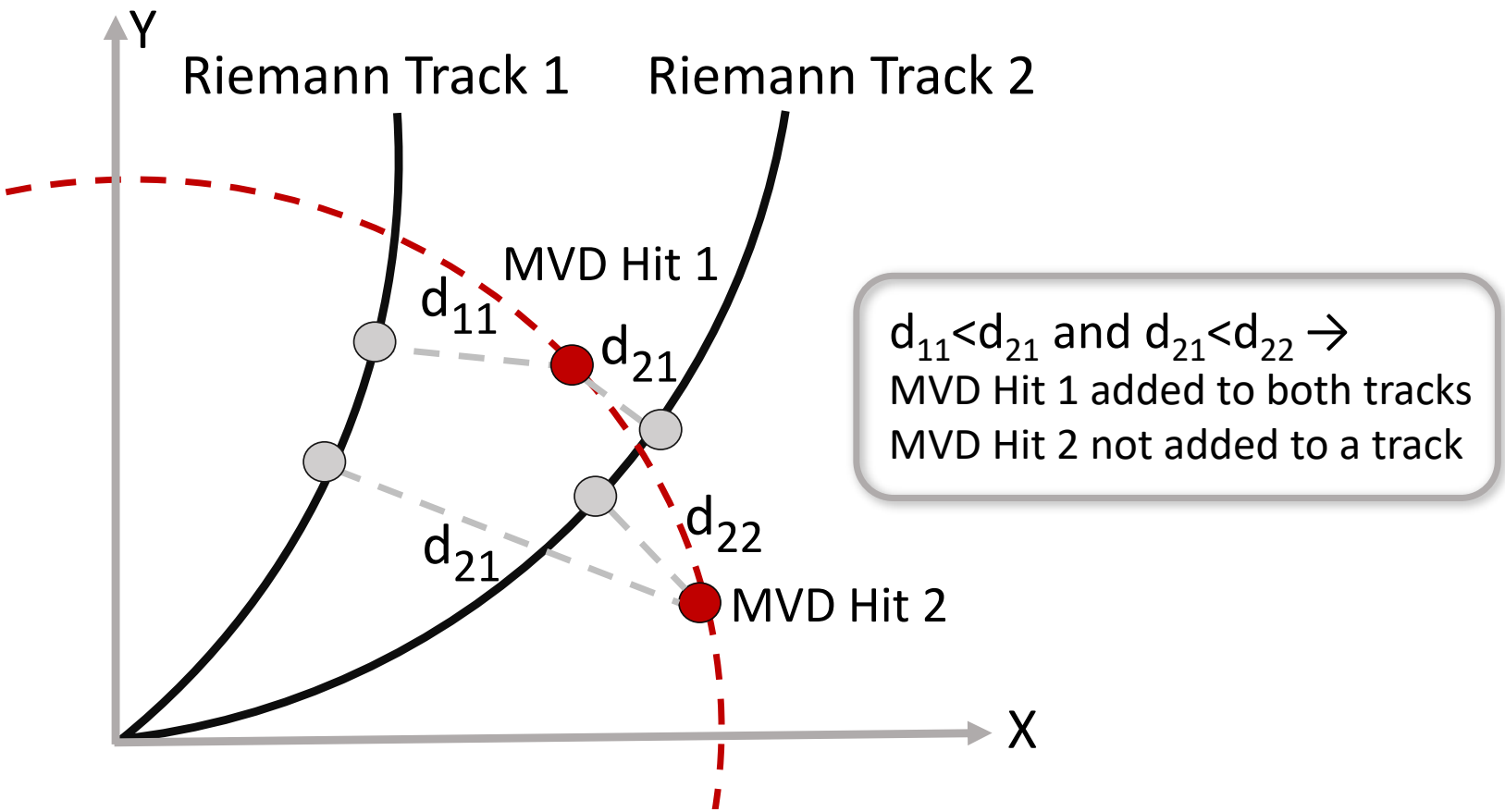
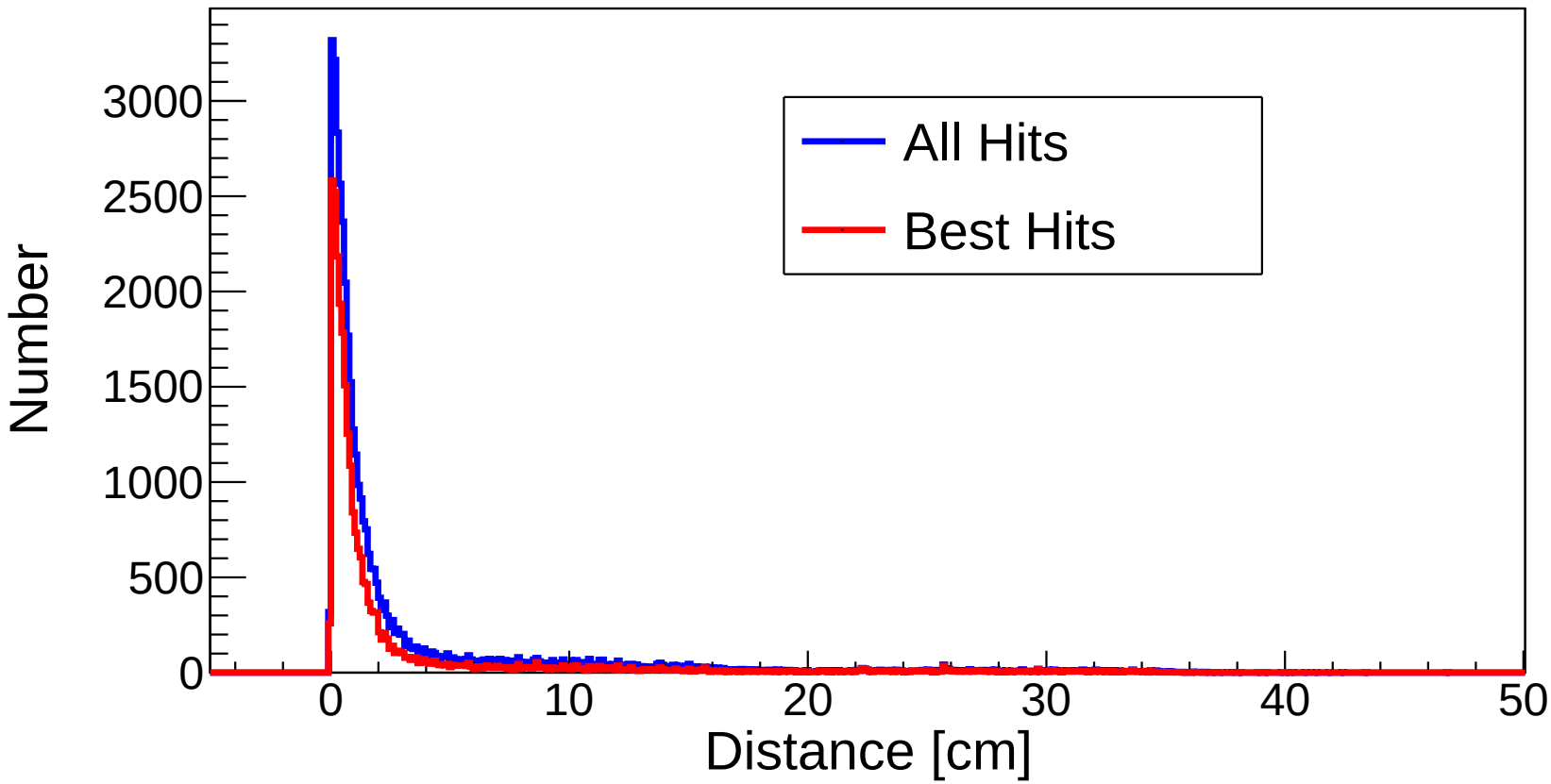


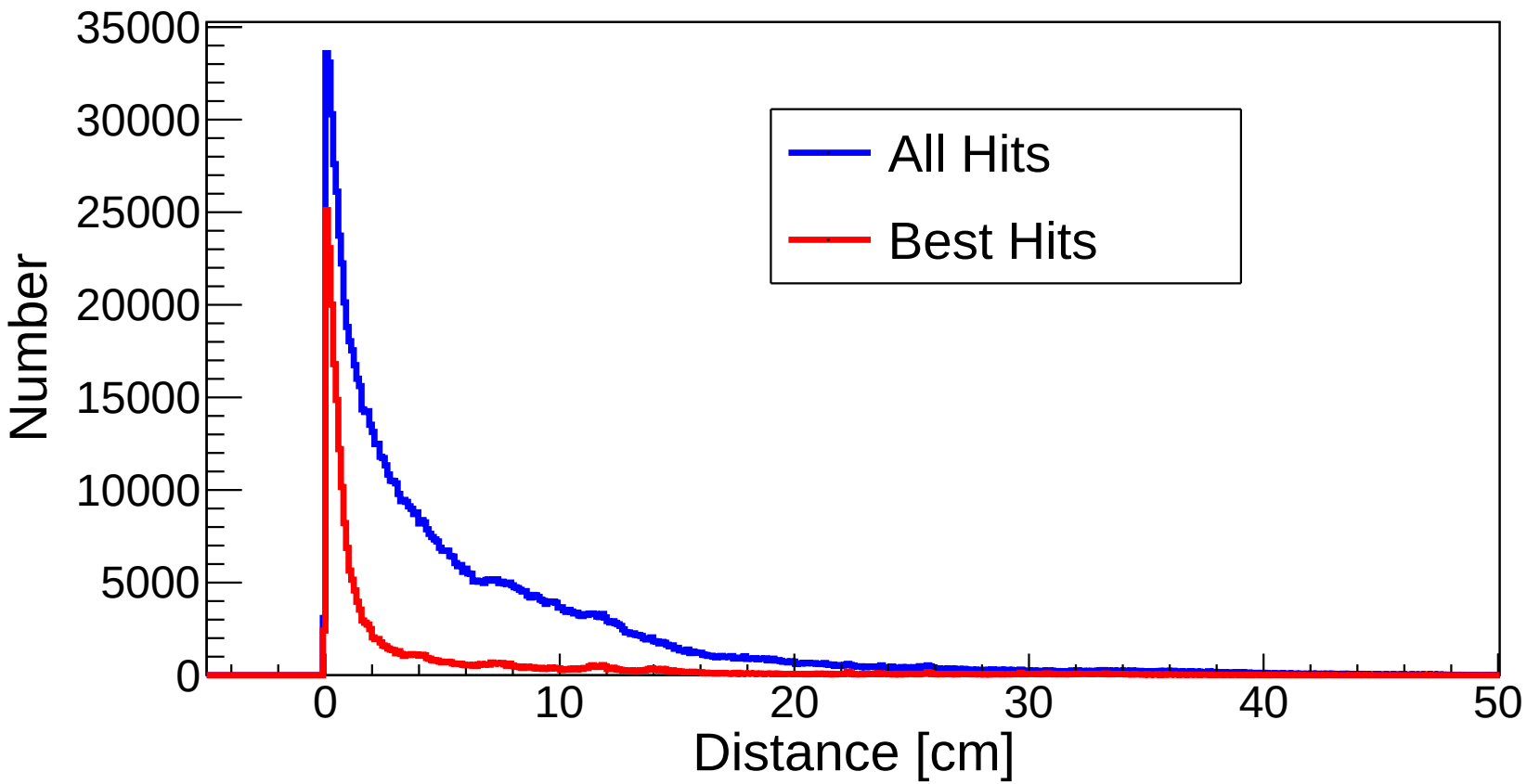
Results, 1 track/event, Box generator

- No big difference between lines-expected



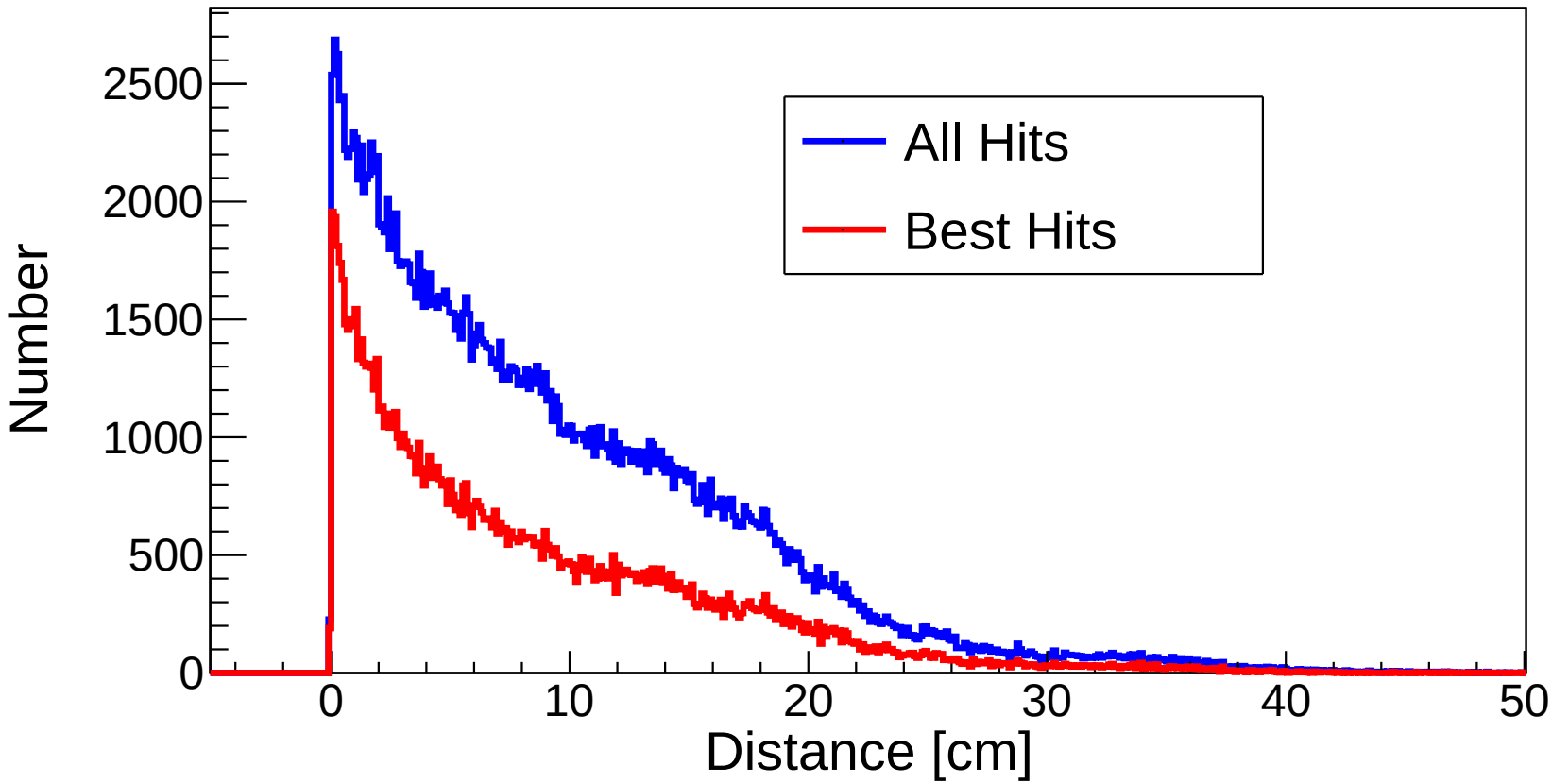
Results, 5 tracks/event, Box generator

- Red peak somewhat narrower than in previous case
- Distance plot peaks more at low distances after best hits chosen



Results, Hyperon Events

- More complicated case due to decay topology



$\Rightarrow$ Method needs to be able to handle this situation

Summary and Outlook

- Time clustering have been implemented in the SttCellTrackFinder
- Work to include MVD hits in progress

- Add additional, *e.g.* position, requirements to MVD hit selection
- Include uncertainties in MVD hit selection
- How do wrongly assigned hits affect momentum resolution of Riemann tracks?
- Investigating z-resolution from STT skewed straws
- Evaluate efficiency of different track propagators
- Associate Barrel ToF hits with Riemann fit for event building
- t_0 algorithms using ToF detectors taking into account displaced vertex - future plans?

Thank You!