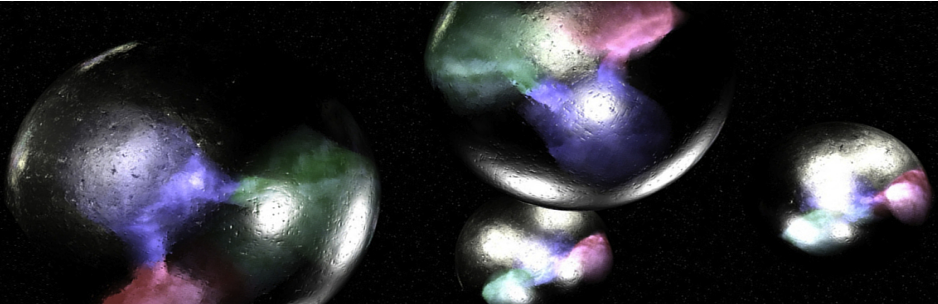# VXDTF2 Status Report from Karlsruhe

F2F Tracking Meeting

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Institut für Experimentelle Teilchenphysik (ETP)

Overview

1. Overlapping Tracks

2. More Memory and Run Time Issues

3. Other News

Overlapping Tracks

Overlapping Tracks

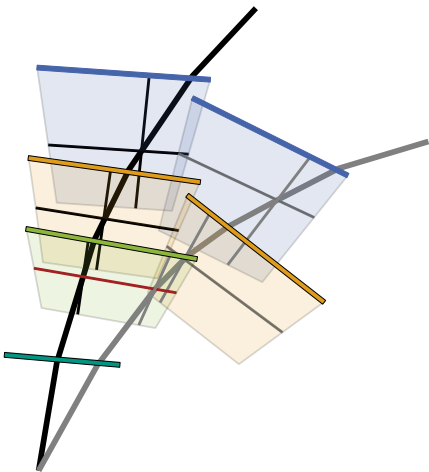**Two MC Tracks can overlap in 1 or more SVD Custer (hits).**

The VXDTF2 forbids any overlap!
$\Rightarrow$ lower finding eff. expected
$\Rightarrow$ by factor $1/2$

Overlap between two MC Tracks

Overlap in	1 Hit	2 Hits	> 2 Hits
Rate	3.6 %	1.3 %	0.5 %
Found	2.8 %	0.7 %	0.2 %

Overlapping Tracks

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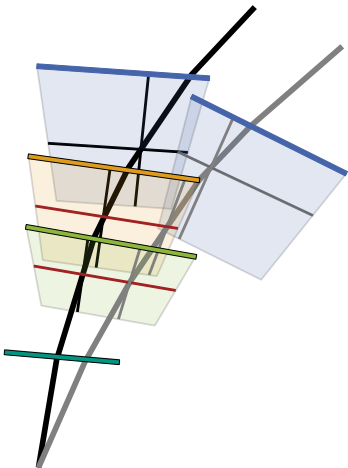$\Rightarrow$ by factor $1/2$

Same applies for the more unlikely overlaps in ≥ 2 hits.

A study was performed

- with 5k $\Upsilon(4S)$ Events w/ BKG
- to quantify the extend of the effect, and
- how allowing for an overlap can recover such tracks.

Overlapping Tracks

Allowing no Overlap ⇒ Allowing 1 Hit Overlap

Overlap between two MC Tracks

Overlap in	1 Hit	2 Hits	> 2 Hits
Rate	3.6 %	1.3 %	0.5 %
Found	2.8 %	0.7 %	0.2 %
Fakes		2.15 %	

Overlap between two MC Tracks

Overlap in	1 Hit	2 Hits	> 2 Hits
Rate	3.6 %	1.3 %	0.5 %
Found	3.2 %	0.8 %	0.3 %
Fakes		3.76 %	

Tracks with 1 Hit Overlap

MC-Tracks
found MC-Tracks
fake Tracks

with x other Tracks
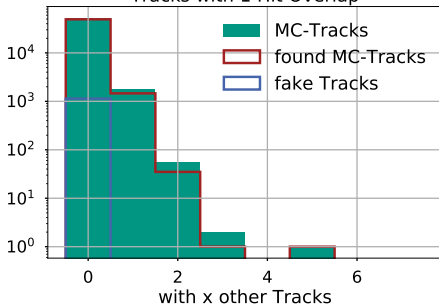
Tracks with 1 Hit Overlap, allowing for 1

MC-Tracks
found MC-Tracks
fake Tracks
fake Tracks \w QI > 0.9

with x other Tracks
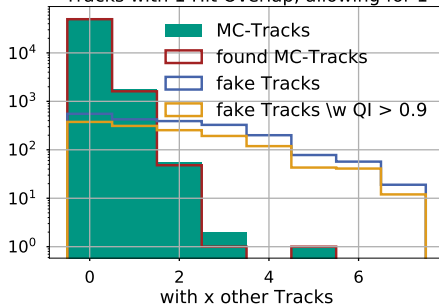
Overlapping Tracks

Conclusion:

- Loss of roughly 1 % of tracks due to overlaps.
- Partly recovery of such tracks comes at high cost as fake rate increases significantly!

  ⇒ **I would refrain from allowing for overlaps for now.**
  ⇒ **We should keep the option in mind.**

More Memory and Run Time Issues

More Memory and Run Time Issues

Recent test runs for the Phase 2 dress rehearsal (BIIDP-330) and the HLT Trigger (BII-3059) showed

- a **memory cosumption** above the required limit of 2 GB in rare cases;
- **run times** of the order of a several seconds.

Both issues are caused by the **SegmentNetworkProducer** when our well known Freak Events occuring in Bhabha events are processed.

$\Rightarrow$ High momentum electron causes shower in the VXD sensors;

$\Rightarrow$ Many possible combinations of SVD Clusters;

$\Rightarrow$ SegmentNetworkProducer takes time to fill large containers. . .

More Memory and Run Time Issues

The **rate and impact** of events with high combinatorics in the SegmentNetworkProducer are much **higher in Phase 2** runs.

⇒ **might be caused by the SectorMap for Phase 2**

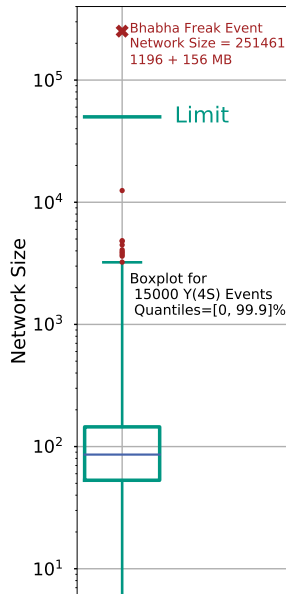Nonetheless, **precautions** should be taken to decrease the effect on performance of these events!

Originally a cut in the VXDTrackFinderCellOMat caused the event to be aborted in case the SegmentNetwork size was above a limit.

Now the problem already appears during in the **SegmentNetwork Producer!**

⇒ **Already abort the event during the filling of the SegmentNetwork!**

More Memory and Run Time Issues

⇒ **Check for SegmentNetwork size already during filling process!**

⇒ Memory allocated for the SegmentNetwork is limited to ∼100 MB.

⇒ Module run time is significantly reduced, but still of the order of a few seconds.

⇒ **The Freak Events should be identified in an earlier stage.**

⇒ Evaluate size of **HitNetwork** (2 SpacePoint combinations).

⇒ Perform cut and event abortion there…

Bhabha Freak Event
Network Size = 251461
1196 + 156 MB

Limit

Boxplot for
15000 Y(4S) Events
Quantiles=[0, 99.9]%

Network Size

10^5

10^4

10^3

10^2

10^1

More Memory and Run Time Issues

Evaluation of the distibution of the HitNetwork size for

- 10k $\Upsilon(4S)$ events with BKG
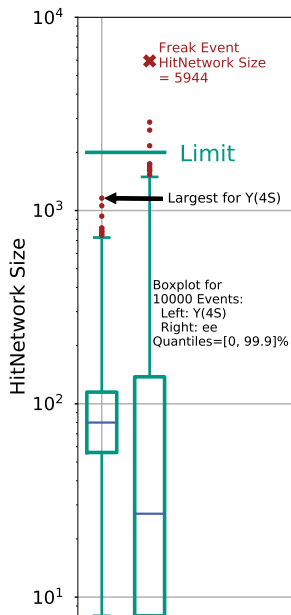- 10k Bhabha events with BKG (bh-wide default simulation)

$\Rightarrow$ **Choosing cut at size of 2000**

$\Rightarrow$ reduces run time to the order of ms for observed freak event!

Problems:

- Validation revealed also $\Upsilon(4S)$ event with size > 2000;
- Some problematic events slip through cut;
- Study based on wrong simulation setting!

$\Rightarrow$ **Fine tuning necessary...**

Freak Event
HitNetwork Size
= 5944

Limit

Largest for Y(4S)

Boxplot for
10000 Events:
Left: Y(4S)
Right: ee
Quantiles=[0, 99.9]%

HitNetwork Size

Other News

Deletion of the VXDTF2

- Most of the VXDTF V1 code is removed
- Testbeam package was updated to VXDTF2 thanks to Thomas Lück
- Restructuring of the VXDTF2 directories still to be done

VXD Standalone Cosmics TF for $B = 0\,\text{T}$

- Implemented a simple track finder for linear tracks from cosmics
- Assuming no other track in the event
- Based on Prinzipal Component Analysis ansatz
- A χ^2 value is calculated for quality estimation
- Some outliers/noise hits can be removed based on the χ^2 value