A First look @ Tracking Analysis

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Outline

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- Best (Golden) Track Selection
  - BestTrackSimple()
  - BestTrackUsingScin()
  - BestTrackUsingPrune()
- Tracking Efficiency
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Introduction

- Two chambers in each spectrometer.
- Each chamber has six planes which are 1 cm apart from each other.
- Each plane consist of anode sense wires which are 1 cm apart.
- Set of cathode field wires sandwich the anode wires with potential range (-1800 V to -2500 V).
- Planes are U, U’, X, X’, V, V’ for first chamber and opposite for second.
- X planes are horizontal where as U and V planes are 60^{o} on either side.
- Chambers are filled with mixture of argon and ethane.

Track Selection

- Hit is a signal from a sense wire in the DC plane.
- At least 5 out of 6 planes must fire for each chamber.
- Cluster of hits are called "*space points*".
- Combo (Hits from a pair of unlike planes) gives information for space point.
- ***"Space point criterion"*** is a radius of circle around space point in which all space points are considered as a single space point.
- If combo is out of the range of space point criterion then program creates a new space point.
- A ***"stub"*** (track candidate) is combination of space point information from all planes.

Track Parameters

- The stub from two chambers having slopes and positions which point to each other are linked together to form a track.
- For multiple tracks, the one with lowest χ^2 for the fit is selected.

Parameter	HMS	SHMS
Min. Hits	4	4
Max. Hits	35	25
Min. Combos	3	3
SP Criteria	1,1	1.2, 1.2
X Stub	100 mm	100 mm
Y Stub	20 mm	20 mm
X' Stub	1 rad	1 rad

Best Track Selection

Hcana gives three different types of algorithm for selection of best track.

- BestTrackSimple ()
  - Old algorithm which only looks at χ^2
- BestTrackUsingScin()
  - Vladas' algorithm which looks at calorimeter and hodoscopes as well.
- BestTrackUsingPrune()
  - Peter's improvement which looks at additional pruning variables.

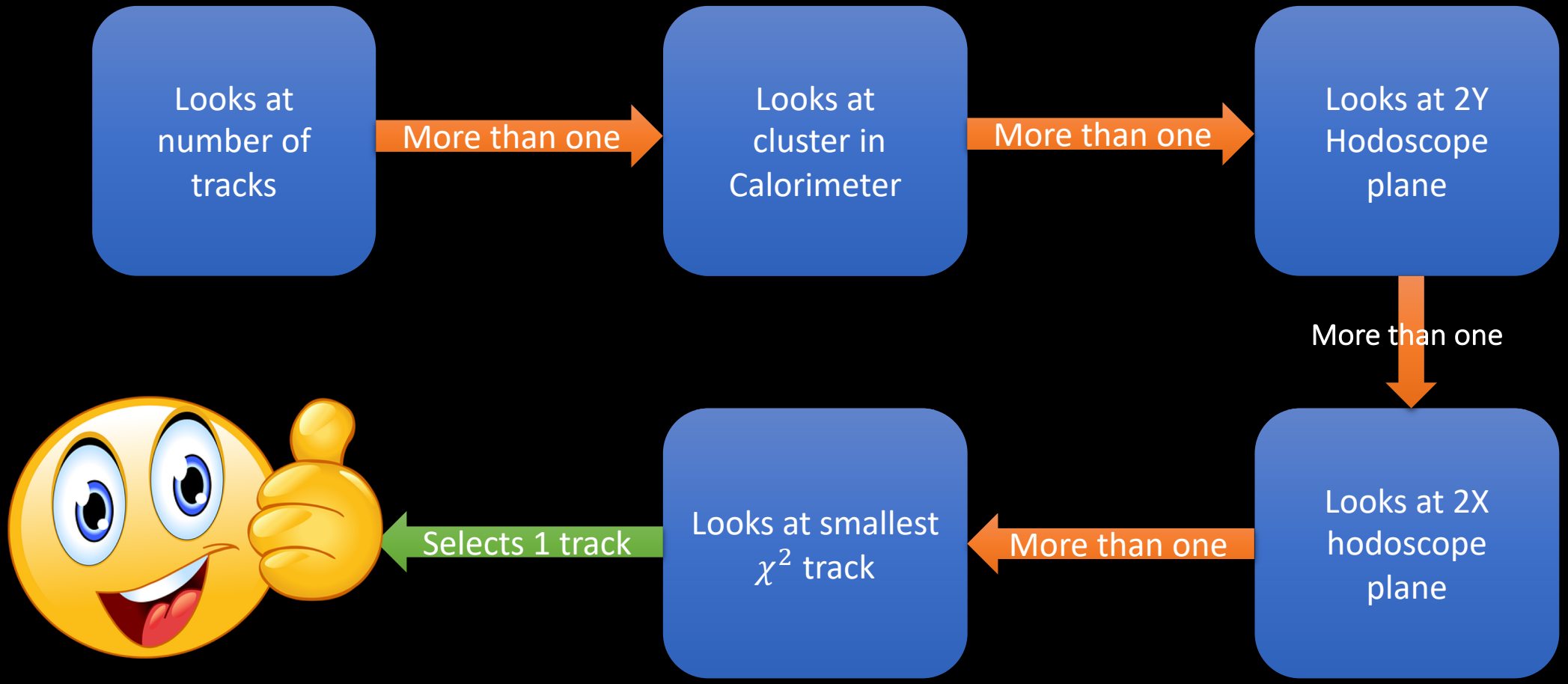
BestTrackSimple ()

- The algorithm looks at all the tracks and chooses one which has best χ^2 as a final track.
- χ^2 is given by

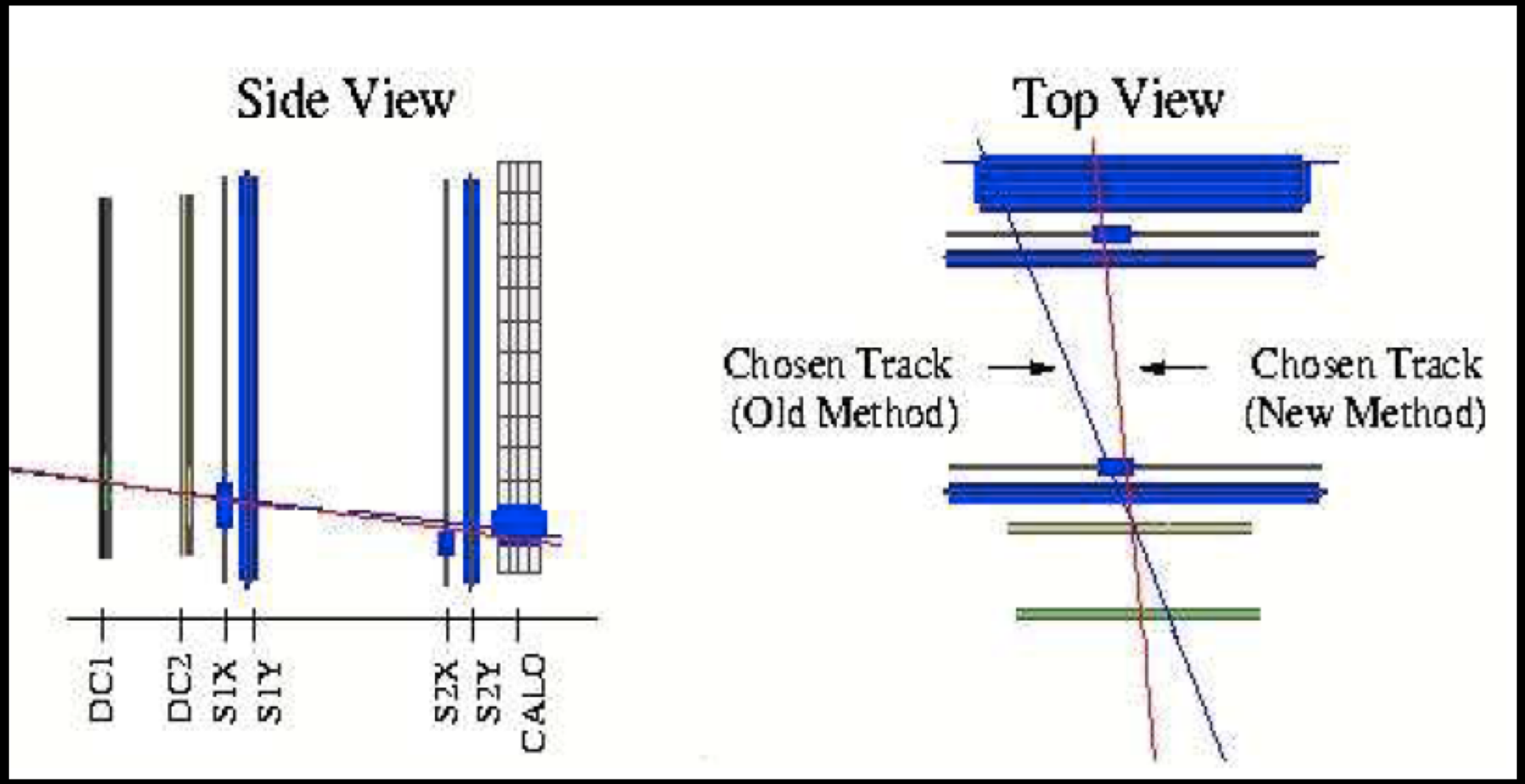
$$\chi^2 = \frac{DC_{wc} + DC_{tc}}{\sigma_{DC}^2}$$

- DC_{wc} → wire co-ordinate of stub
- DC_{tc} → track co-ordinate of stub
- σ_{DC}^2 → wire chamber resolution of the plane

BestTrackUsingScin ()



Comparison b/w two techniques



[1]Vladas Thesis p56

BestTrackUsingPrune ()

Parameter	Default value
Prune_xp	0.2
Prune_yp	0.2
Prune_ytar	20
Prune_delta	30
Prune_beta	30
Prune_df	1
Prune_chibeta	100
Prune_npmt	6
Prune_fptime	1000
Prune_dipoleExit	0

Tracking Efficiency

- The tracking efficiency is defined as follows

$$\epsilon_{tracking} = \frac{Trig\ \&\ PID\ \&\ TR}{Trig\ \&\ PID}$$

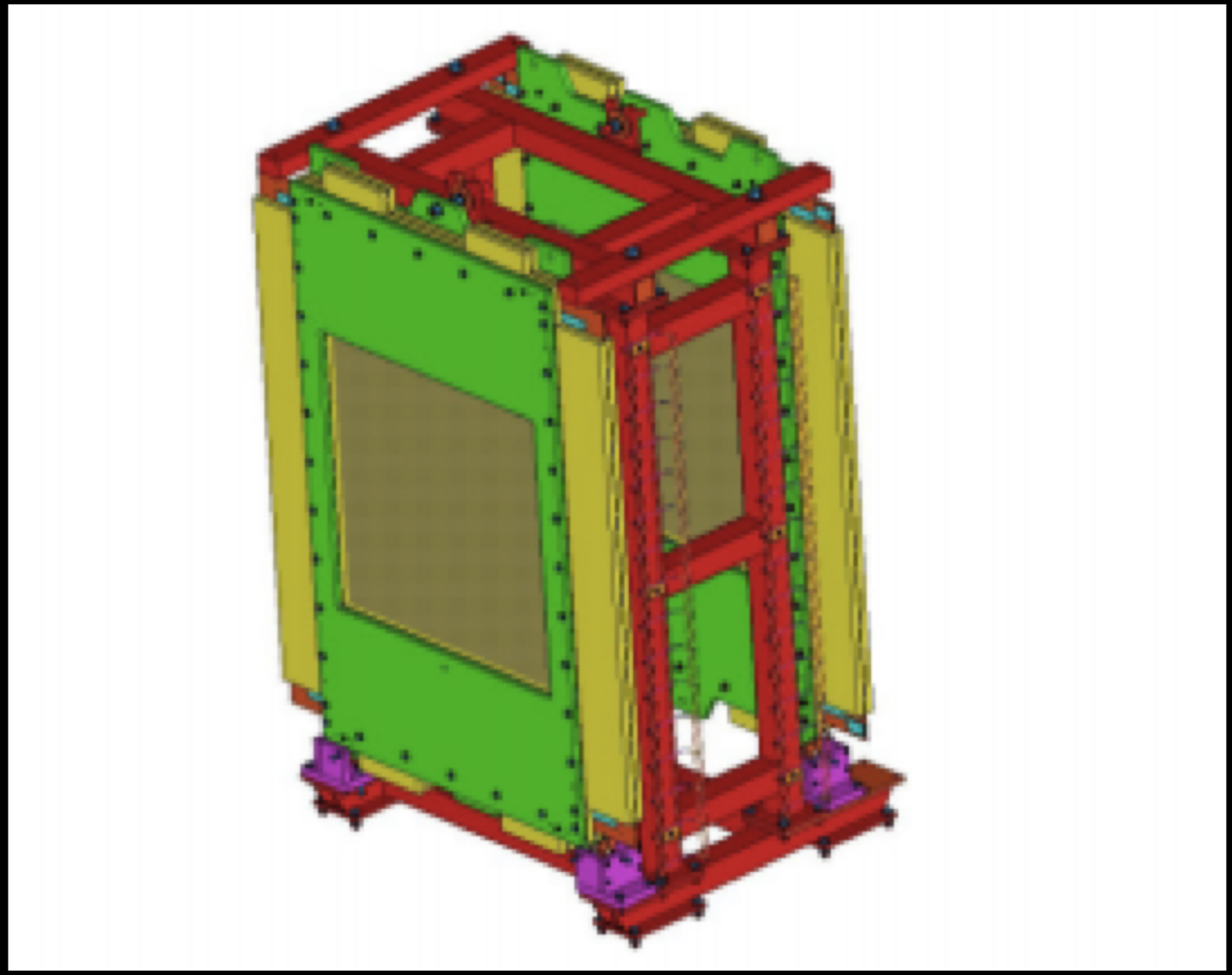
- Trig → No. of Triggered events
- PID → No. of events after PID cut
- TR → No. of events with good track

Outlook

- Need to understand pruning algorithm in detail.
- Start to get the efficiency plots for the luminosity scans using default parameters.
- Will tweak the parameters and check the effect on efficiency.
- Will look at physics runs.

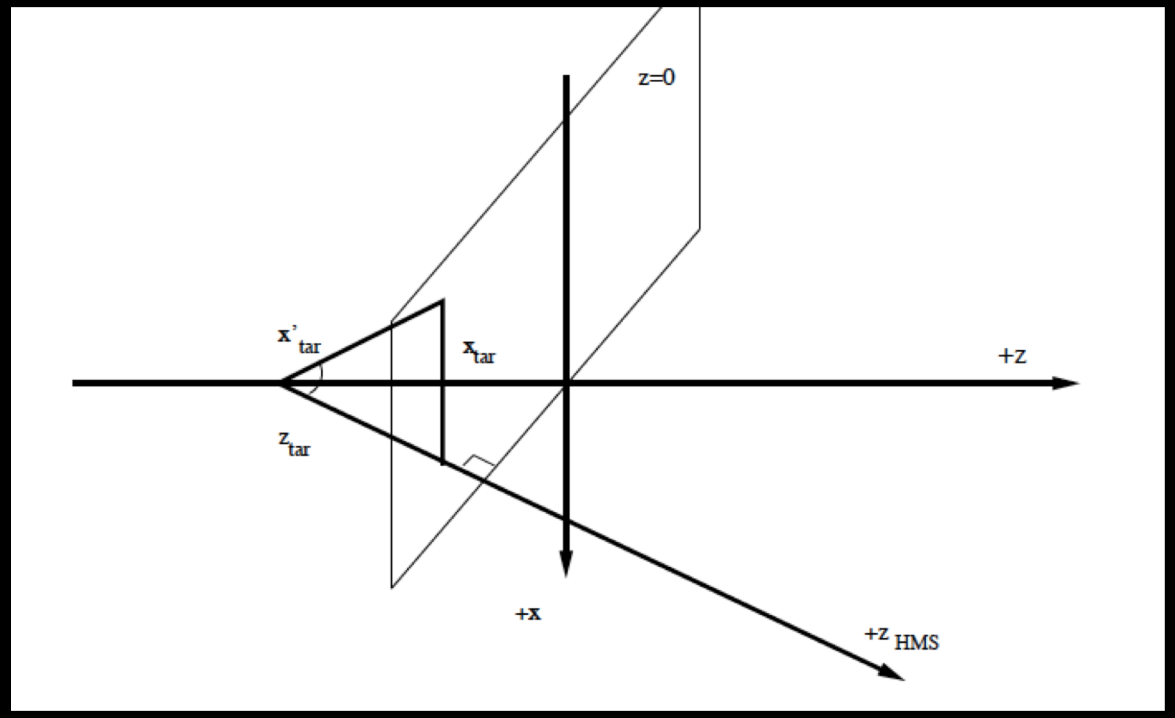
Backup Slides

Drift Chambers



Co-ordinate System

- Lab Co-ordinate System
  - z-axis is parallel to beamline.
  - y-axis is vertical.
  - x-axis is perpendicular.
- Transport Co-ordinate System
  - z-axis points towards Spectrometer.
  - x-axis is vertical
  - y-axis is perpendicular



DC Calibrations

- The time in which ionized electrons reach the nearest sense wire is known as drift time.
- This time is proportional to the distance of track from the sense wire.
- Drift time is taken from TDCs.
- Drift distance distribution must be flat for each plane.
- Residual is the difference between final track position and the hit location obtained from individual planes.
- Residual for each plane should be narrow peak centered at zero.

DC Calibrations