Tracking Algorithm Analysis

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The Problem

- Tracking efficiencies not behaving as expected, particularly for the SHMS
- Richard observing "anti-boiling" in his luminosity analysis
- Dave Gaskell believes that the tracking algorithm may be biased towards events where only one "track" is found
- May go some way to explaining why SHMS is more problematic, we expect more tracks!
- Is it a quick fix? E.g. parameter tweaking
- *Or* is it an issue with the algorithm itself?

Tracking Overview 1/3

- Two Drift Chambers per spectrometer
- Drift Chamber hits used to define "space points"
- A *minimum* and *maximum* number of allowed hits per chamber is specified
- Generate space points from hits in pairs of planes, *combos*
- Hits in $X - Y$, $X - Y'$, $X' - Y$, $U - Y$, $U - Y'$, $V - Y$, $V - Y$ and $U - V$ planes examined
- First "combo" is taken as a space point

- Next combo is then examined, if it is within a set *space point criterion* it is combined (averaged) with the first combo to update our first space point
- If *not* within the set range, make a new space point
- All combos in each DC are examined
- All planes corresponding to a space point are used to make a "stub" through the chamber
- Effectively, a short track

- Stubs in each chamber that lie within a range of the *stub criteria* are used to form a track
- If more than one track is created, the track which most closely matches a calorimeter hit is used
- Simplified slightly, there are extra criteria based upon hodoscope information too

Parameter Tweaking

- One avenue to quickly check is that there is no issue simply from the tracking parameters as they have been set

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

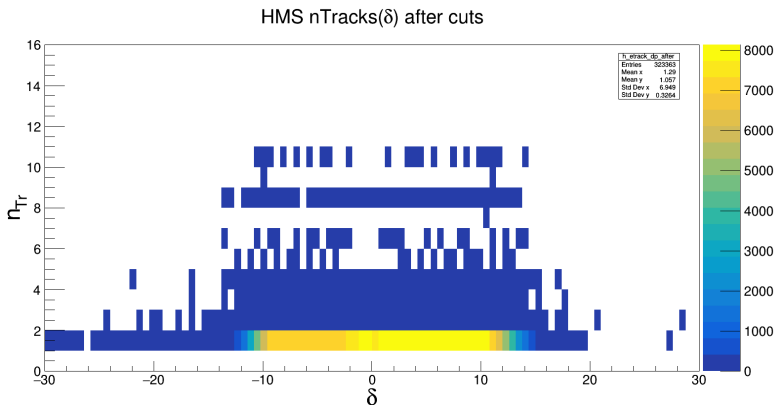## Algorithm Checking - Runs to Examine

- Examining carbon runs to begin with

Run Number	E_{Beam}/GeV	SHMS/HMS Polarity
4781 - 4783	10.6	-ve/-ve
4787	10.6	-ve/-ve
6619-6620	3.8	-ve/-ve
6868	4.9	-ve/-ve
5174 - 5181	10.6	+ve/-ve

- Let me know if you recall any others I've missed!
- Also need to check through SIDIS runs too

HMS nTracks(δ) after cuts

Algorithm Checking

- nTracks as outputted by the replay already heavily pruned, need more "raw" data
- Is the relevant information, effectively the coarse selection stage, kept or not?
- Once selected, want to see how the number of tracks varies across δ for each spectrometer
- May also be nice to see how this varies as tracking parameters are changed too

Algorithm Checking - Closing Thoughts

- From examining the algorithm tracks are treated differently if they are from a "HMS" or "SOS" like detector
- From discussion with Garth I believe ours are actually "SOS" like now!
- To do with plane orientations
- This needs to be checked though