SHMS Tracking Efficiency and Track Parameter Optimization

Ali Usman









in the previous meeting

Final PID cuts for individual particles in the SHMS was shown.

Moved to 100k replay because 50k replay had large error bars.

Looking at number of runs in the spring 2019 data with same wide range of rates/currents.

> There was a trend in the tracking efficiency with rates.

SHMS Tracking Efficiencies (100k)



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SHMS Track Parameters

Parameter	Ali's Values	Mark's Values
pmax_hits	25, 25	
pmin_hit	4, 4	4, 4
pmin_combos	3, 3	3, 3
pspace_point_criterion	1.2, 1.2	1.2, 1.2
pxt_track_criterion	100.0	100.0
pyt_track_criterion	100.0	20.0
pxpt_track_criterion	1.0	1.0
pypt_track_criterion	1.0	1.0
pSmallAngleApprox	0	0
pstub_max_xpdiff	0.2	0.2

Track Parameter Optimization

The track parameters are defined in

Hallc_replay_lt/PARAM/SHMS/GEN/ptracking.param

Looking at the variation of tracking efficiency for a single parameter at a time.

- Using two runs from the same run period
 - ≻ 8038 (706 kHz)
 - ≻ 8054 (76 kHz)
- Haven't included the scalars' replay yet.
- In this presentation, initial 3 parameters (as shown in the previous slide) are looked in detail.

Max_Hits

> The maximum hits within a single spacepoint for each chamber.



E = 8.2 GeV P = +6.05 GeV Angle = 6.91 High Rate -> 706 kHz (8038) Low Rate -> 76 kHz (8054) Ali Usman

Max_Hits

> The maximum hits within a single spacepoint for each chamber.



E = 8.2 GeV P = +6.05 GeV Angle = 6.91 High Rate -> 706 kHz (8038) Low Rate -> 76 kHz (8054) Ali Usman

Min_Hits

> The minimum hits within a single spacepoint for each chamber.



High Rate -> 706 kHz (8038) 7/8/20 Low Rate -> 76 kHz (8054)

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Min_Hits

> The minimum hits within a single spacepoint for each chamber.



E = 8.2 GeV P = +6.05 GeV Angle = 6.91 High Rate -> 706 kHz (8038) 7/8/20 Ali Usman

Min_combos

Minimum number of combos in each spacepoint for each chamber. Must be 3,3 for 4/6 tracking and 4,4 for 5/6 tracking.

Rate	Value	Hadron Efficiency	Electron Efficiency	Pion Efficency	Proton Efficiency
High	3, 3	90.84 ± 0.28	93.47 ± 0.74	90.94 ± 0.36	91.07 ± 0.97
High	4, 4	90.84 ± 0.28	93.47 ± 0.74	90.94 ± 0.36	91.07 ± 0.97
Low	3, 3	96.00 ± 0.25	97.38 ± 0.60	96.09 ± 0.30	95.54 ± 0.89
Low	4, 4	96.00 ± 0.25	97.38 ± 0.60	96.09 ± 0.30	95.54 ± 0.89
E = 8.2 GeV		P = +6.05 GeV	Angle =	= 6.91	
High Rate -> 706 kHz (8038)				Low Rate -> 76	5 kHz (8054)
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Summary & Outlook

- Out of the three parameters which are looked, "Max_hits" has more effect on the efficiencies.
- Current results look promising and we might be able to suggest improved values of some parameters to Hall C.
- Investigating "Max_hits" for each chamber separately might be good idea??
- > Will look into the other track parameters as well.

Need to do the scalars' replay as well to be sure about currents and rates.
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Backup Slides

Recall: Basic Definitions

> **Hit** is a signal from a sense wirein the Drift Chamber plane.

Cluster of Hits are known as *space points*.

> **Combo** is a hit from pair of unlike planes and gives information for space point.

Space point criterion" is radius of circle around space point in which all space points are considered as single space point.

A Stub (track candidate) is combination of space point information from all the planes.

New Cuts

HGC

		Ξ	P.hgcer.npeSum > 1.5
		Pi	P.hgcer.npeSum > 1.5
		Р	P.hgcer.npeSum <= 1.5
•	Aero		
		E	P.aero.npeSum > 1.5
		Pi	P.aero.npeSum > 1.5
		Ρ	P.aero.npeSum <= 1.5
•	Cal		
		F	P_{cal} etotnorm > 0.6 && P_{cal} et

- P.cal.etotnorm > 0.6 && P.cal.etotnorm < 1.6
- Pi P.cal.etotnorm <= 0.6 && P.cal.etotnorm > 0

P P.cal.etotnorm <= 0.6 && P.cal.etotnorm > 0

shmsScinShould	shmsScinGood && shmsGoodBetanotrk
shmsScinShoulde	shmsScinShould && pcut_elec_all
shmsScinShouldpi	shmsScinShould && pcut_pi_all
shmsScinShouldp	shmsScinShould && pcut_p_all
shmsScinShouldh	<pre>shmsScinShould && P.cal.etotnorm <= 0.6 && P.cal.etotnorm > 0.</pre>
shmsScinDid	shmsScinShould && P.dc.ntrack > 0
shmsScinDide	shmsScinShoulde && P.dc.ntrack > 0
shmsScinDidpi	shmsScinShouldpi && P.dc.ntrack > 0
shmsScinDidp	shmsScinShouldp && P.dc.ntrack > 0
shmsScinDidh	shmsScinShouldh && P.dc.ntrack > 0
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SHMS Tracking Efficiencies (100k)

➢ E = 8.2 GeV

P = +6.05 GeV

Angle = 6.91

Run #	l (uA)	Rate (¾)	Efficiency (New Had)	Efficiency (New Pi)	Efficiency (New P)	Efficiency (New E)
8038	71	706.87	90.84 ± 0.28	90.94 ± 0.36	91.07 ± 0.97	93.47 ± 0.74
8051	62	580.95	92.93 ± 0.23	92.99 ± 0.29	94.15 ± 0.71	93.01 ± 0.70
8042	48	507.71	92.67 ± 0.24	92.55 ± 0.30	93.33 ± 0.78	93.81 ± 0.64
8091	8??	483.18	93.07 ± 0.24	93.00 ± 0.30	94.98 ± 0.69	93.62 ± 0.67
8073	19	423.35	93.19 ± 0.23	93.02 ± 0.30	93.72 ± 0.79	94.02 ± 0.64
8056	41	352.22	95.34 ± 0.17	95.96 ± 0.22	96.32 ± 0.53	96.13 ± 0.48
8092	2 ??	315.66	93.34 ± 0.25	93.07 ± 0.32	95.00 ± 0.71	94.25 ± 0.65
8054	10	76.19	96.00 ± 0.25	96.09 ± 0.30	95.54 ± 0.89	97.38 ± 0.60