SHMS Tracking Efficiency & Track Parameter Optimization

Ali Usman

Kinematic Settings

- Run # 8038, 8040, 8042, 8043, 8056, 8057, 8066, 8085
- E = 8.2 GeV

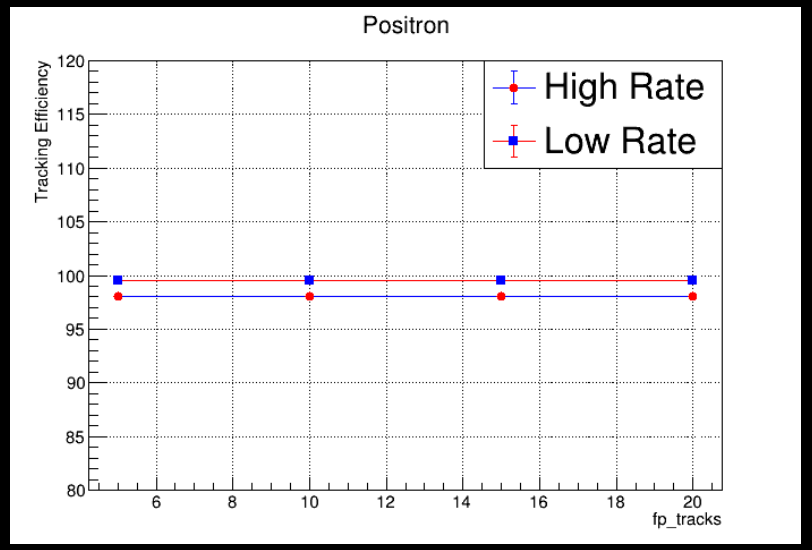
Spec.	P	Angle
HMS	**-1.82 GeV**	**25.89**
SHMS	+6.05 GeV	**6.91**

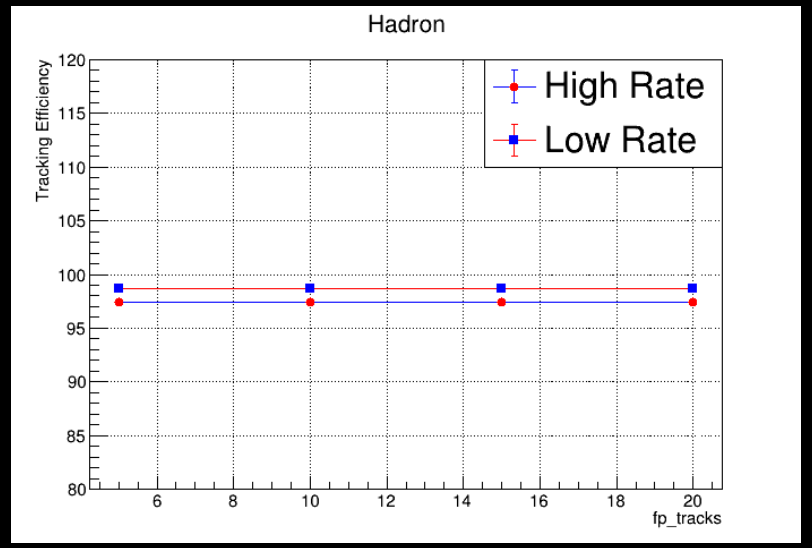
Track Selection Parameter

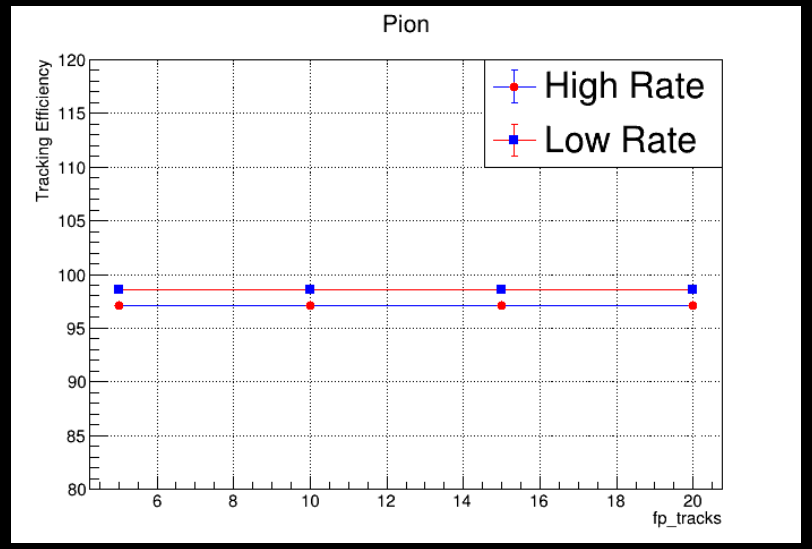
Parameter	Default value
Pmax_pr_hits	**25, 25**
Pmin_hit	**4, 4**
Pmin_combo	**3, 3**
Pspace_point_criterion	**1.2, 1.2**
Pntracks_max_fp	**10**
Pxt_track_criterion	**100**
Pyt_track_criterion	**20**
Pxpt_track_criterion	**1**
Pypt_track_criterion	**1**
Pstub_max_xpdiff	**0.2**

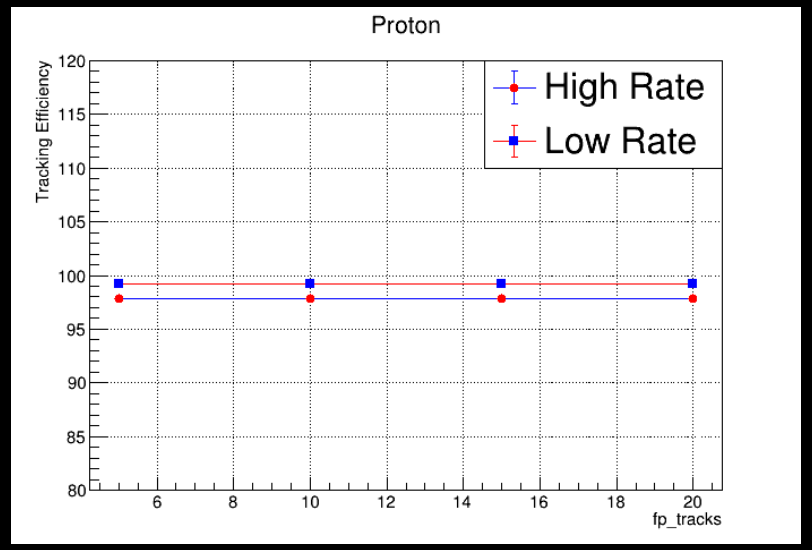
Fp_ntracks

- High Rate
  - Run # 8038
  - ¾ rate -> 667 kHz
  - S1X rate -> 2541 kHz
- Low Rate
  - Run # 8085
  - ¾ rate -> 73 kHz
  - S1X rate -> 509 kHz



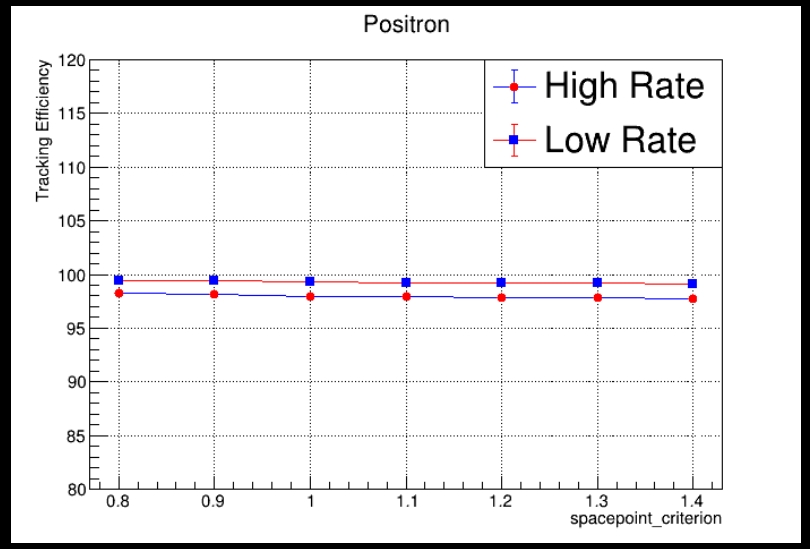


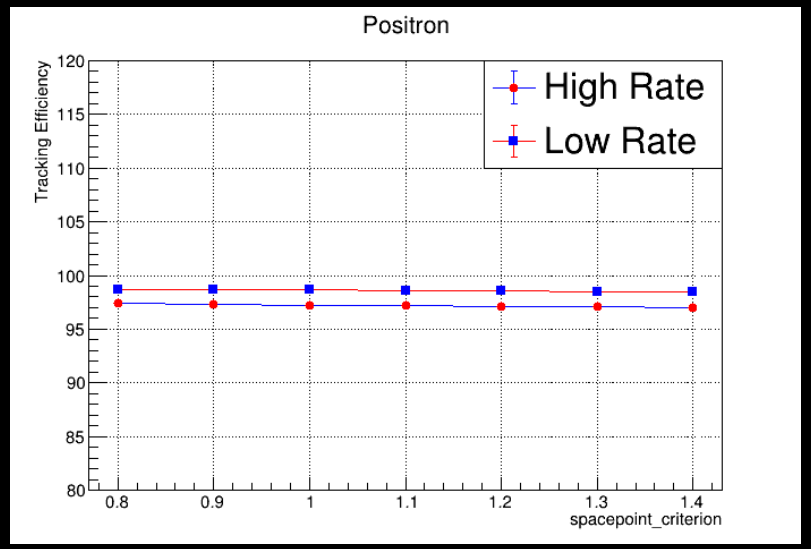




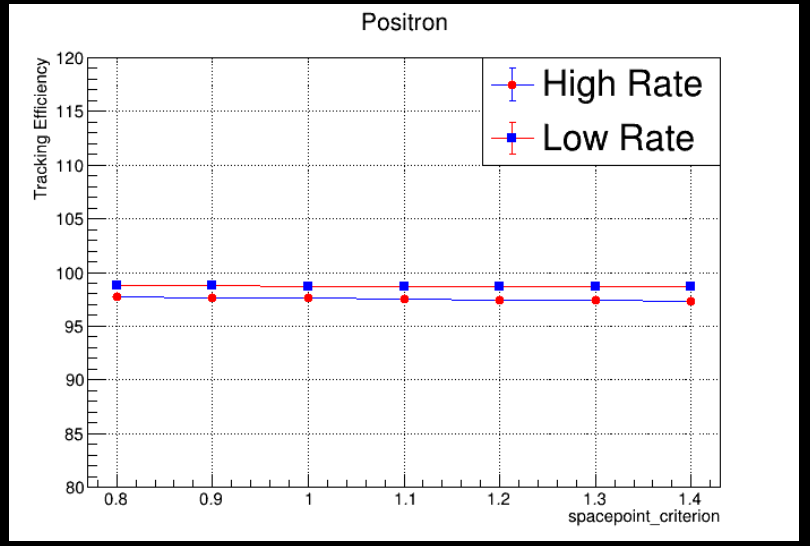
Spacepoint_criterion

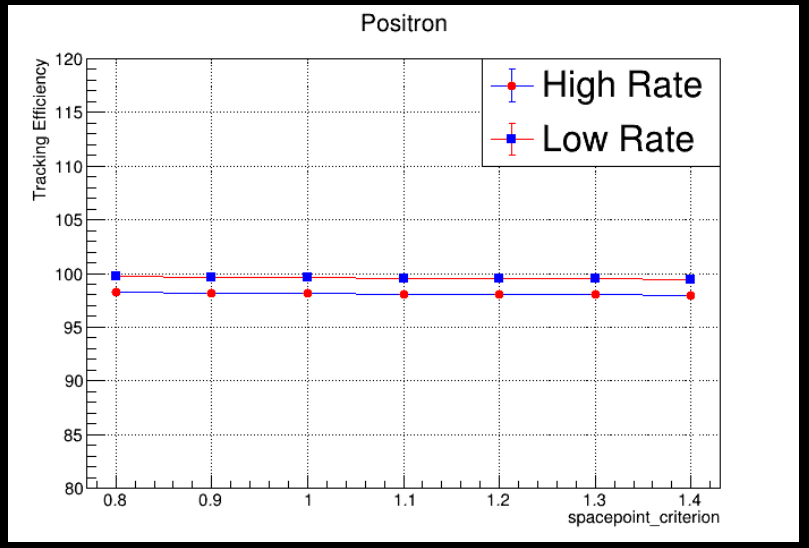
- High Rate
  - Run # 8038
  - ¾ rate -> 667 kHz
  - S1X rate -> 2541 kHz





- Low Rate
  - Run # 8085
  - ¾ rate -> 73 kHz
  - S1X rate -> 509 kHz





Mark's Study

Optimize tracking parameters

- Use SHMS run 1583 with 0.5% carbon at 25 deg and -1.6 GeV. Ebeam=2.2
- Rate of HODO = 2.7 kHz. P1X = 16 kHz
- Used pSmallAngleApprox = 0

Xt_track	Yt_track	Xpt_track	Stub_max_xpdiff	Track eff
100	100	1	1000	97.2%
100	100	1	0.2	99.3
20	5	0.4	1000	89.6
20	5	0.2	0.2	98.5

Xt_track_criterion

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- Low Rate
  - Run # 8085
  - ¾ rate -> 73 kHz
  - S1X rate -> 509 kHz

Value	Positron	Hadron	Pion	Proton
100	H = 98.05±0.19 L = 99.51±0.09	97.45±0.18 98.69±0.22	97.11±0.10 98.53±0.06	97.88±0.23 99.22±0.11
20	H = 97.79±0.20 L = 99.23±0.11	96.86±0.19 98.44±0.24	96.74±0.10 98.24±0.07	97.59±0.24 98.07±0.15

Yt_track_criterion

- High Rate
  - Run # 8038
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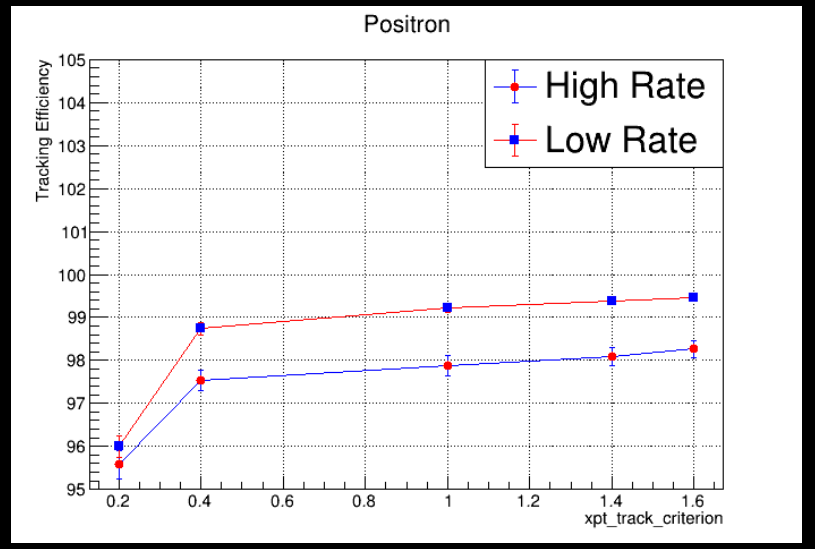
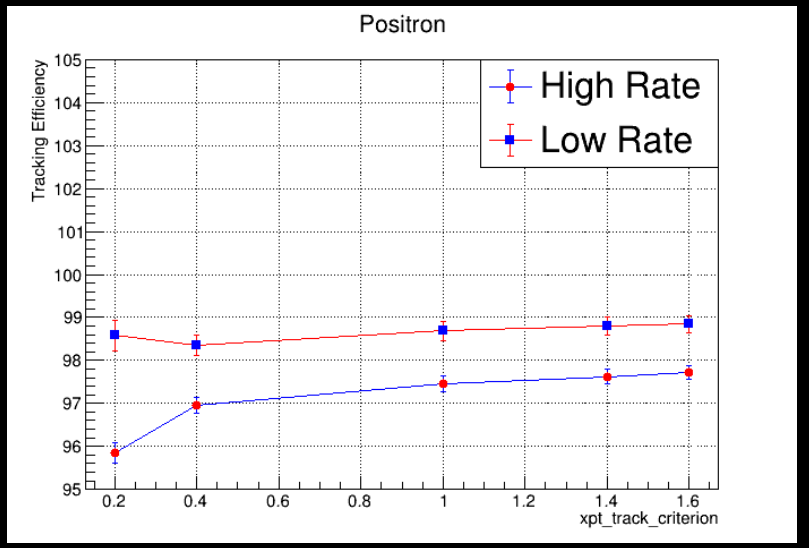
- Low Rate
  - Run # 8085
  - ¾ rate -> 73 kHz
  - S1X rate -> 509 kHz

Value	Positron	Hadron	Pion	Proton
20	H = 98.05±0.19 L = 99.51±0.09	97.45±0.18 98.69±0.22	97.11±0.10 98.53±0.06	97.88±0.23 99.22±0.11
5	H = 97.78±0.20 L = 99.35±0.10	96.85±0.19 98,11±0.26	96.81±0.10 98.17±0.07	96.89±0.27 97.75±0.19

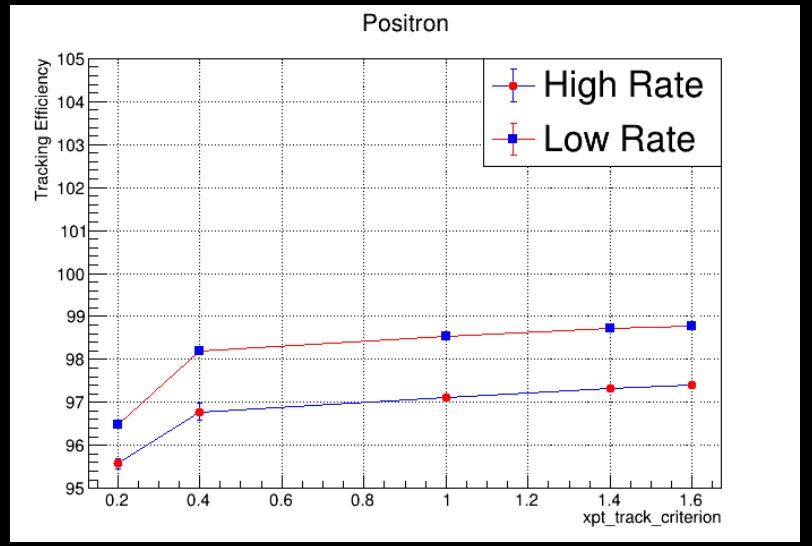
Xpt_track_criterion

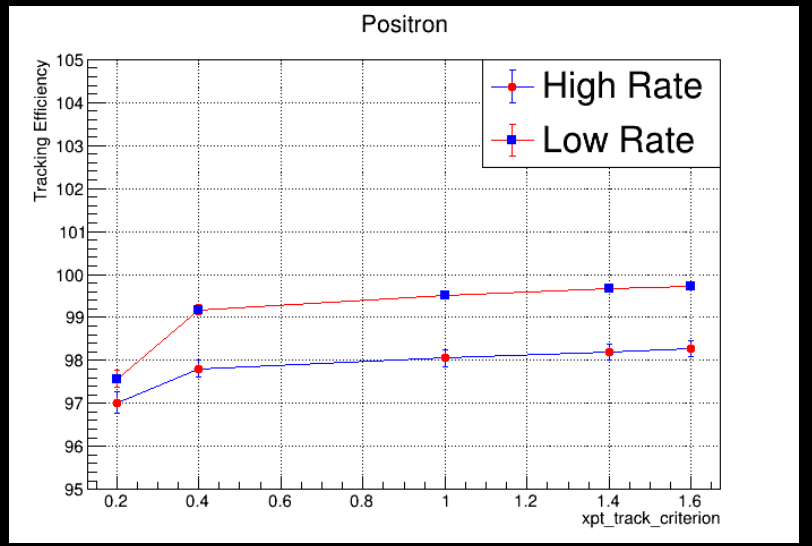
- High Rate
  - Run # 8038
  - ¾ rate -> 667 kHz
  - S1X rate -> 2541 kHz





- Low Rate
  - Run # 8085
  - ¾ rate -> 73 kHz
  - S1X rate -> 509 kHz





Ypt_track_criterion

- High Rate
  - Run # 8038
  - ¾ rate -> 667 kHz
  - S1X rate -> 2541 kHz
- Low Rate
  - Run # 8085
  - ¾ rate -> 73 kHz
  - S1X rate -> 509 kHz

Value	Positron	Hadron	Pion	Proton
1	H = 98.05±0.19 L = 99.51±0.09	97.45±0.18 98.69±0.22	97.11±0.10 98.53±0.06	97.88±0.23 99.22±0.11
0.4	H = 98.05±0.19 L = 99.51±0.09	97.45±0.18 98.69±0.22	97.11±0.10 98.53±0.06	97.88±0.23 99.22±0.11
0.2	H = 98.05±0.19 L = 99.51±0.09	97.45±0.18 98.69±0.22	97.11±0.10 98.53±0.06	97.88±0.23 99.22±0.11

stub_max_xpdiff

- High Rate
  - Run # 8038
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  - S1X rate -> 2541 kHz
- Low Rate
  - Run # 8085
  - ¾ rate -> 73 kHz
  - S1X rate -> 509 kHz

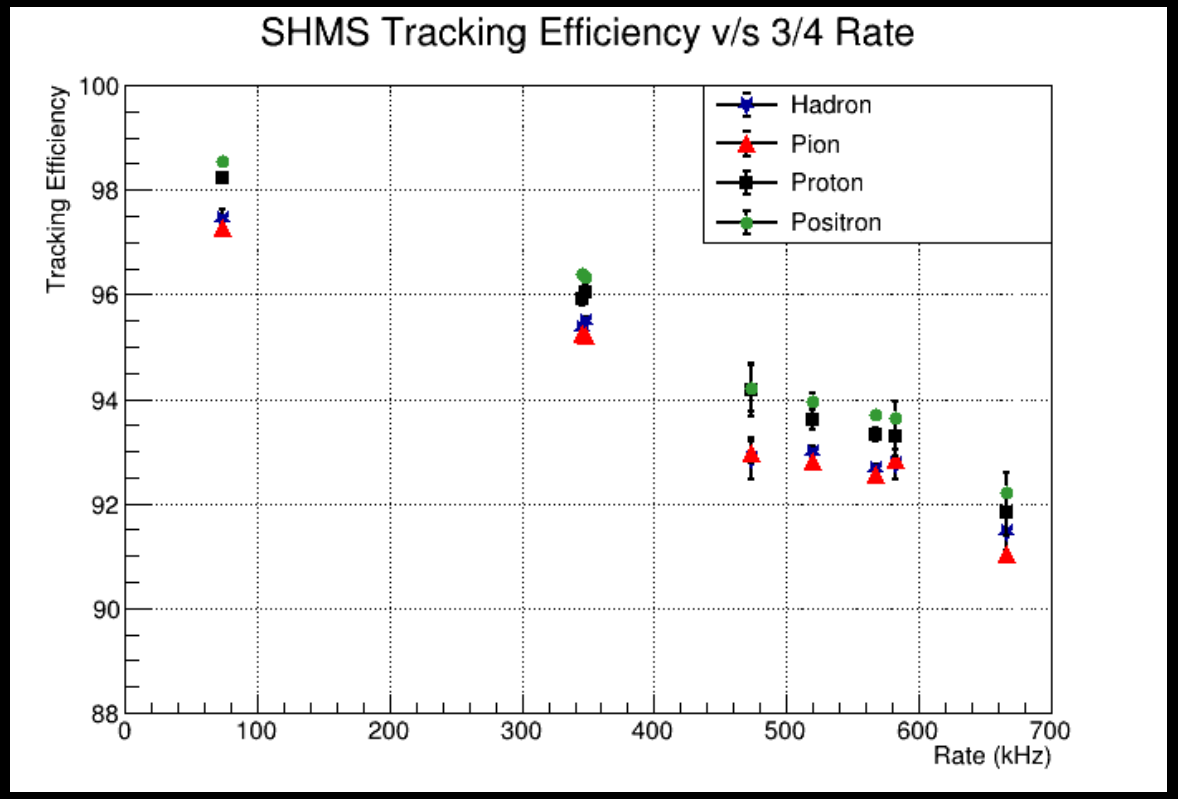
Value	Positron	Hadron	Pion	Proton
0.2	H = 98.05±0.19 L = 99.51±0.09	97.45±0.18 98.69±0.22	97.11±0.10 98.53±0.06	97.88±0.23 99.22±0.11
1000	H = 97.37±0.22 L = 98.90±0.14	96.68±0.20 97.80±00.28	96.50±0.11 97.94±0.08	97.11±0.26 98.03±0.18

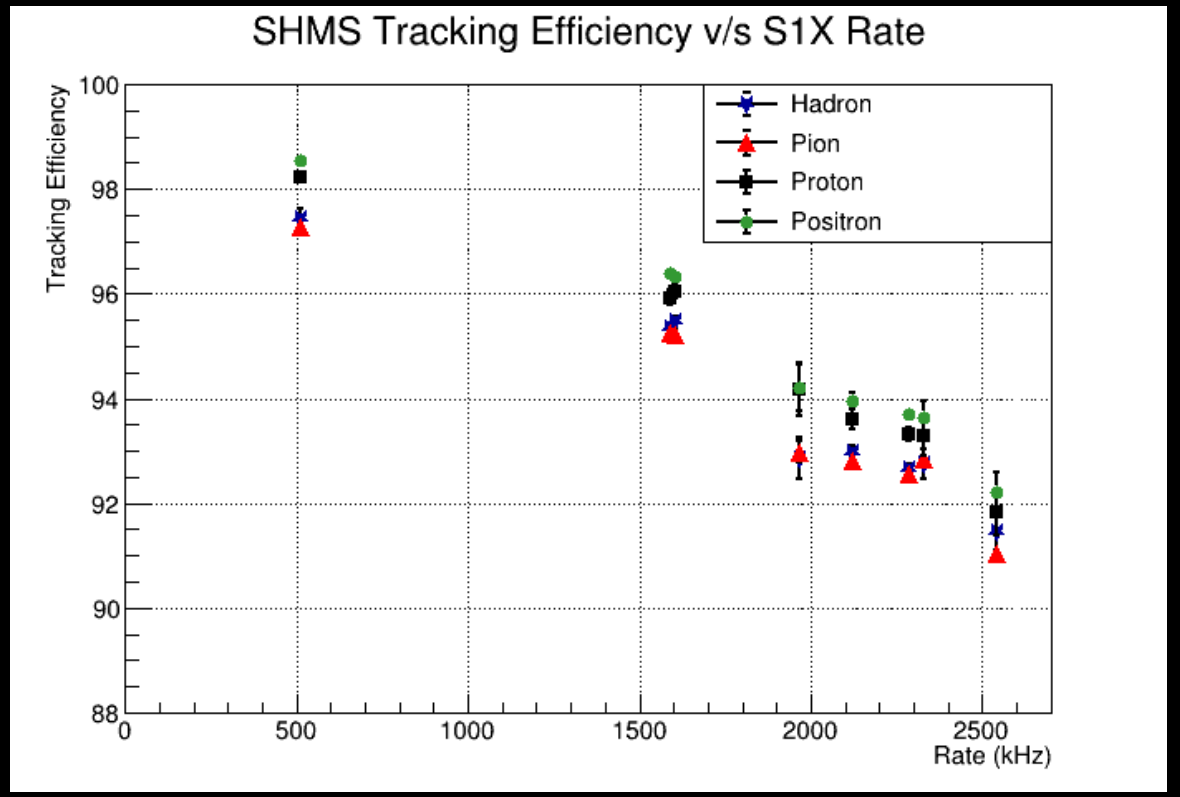
Summary & Outlook

- The parameter study showed that there are some variables which change the efficiency more.
- Need to look the the number of tracks in each event for both low and high rate runs.
- Will plot efficiency v/s rate with new parameter values and see the extrapolation of efficiency to zero rate.
- Will start looking at the yield as well and try and see the stability v/s rate.

Backup

Tracking Efficiency





Introduction

- Tracking Efficiency is calculated in the coin report files.
- Using new cut and template files for the replays.
- Calculating efficiencies for both HMS and SHMS simultenously.

$$\text{Tracking Efficiency} = \frac{(s)hmsscindid}{(s)hmsscinshould}$$

- Trying to check the stability of calculation with default track parameters.

Tracking Cuts

- (s)hmsscinshould = hod + PID
  - hod = goodscinhit + goodstarttime + betanotrack
- (s)hmsscindid = (s)hmsscinshould + dc.ntrack > 0
- PID cuts

Det	SHMS			HMS	
	Positron	Pion	Proton	Electron	Hadron
HGC	> 1.5	> 1.5	<= 1.5	> 0.5	< 0.5
Cal	> 0.6 & < 1.6	<= 0.6 & > 0	<= 0.6 & > 0	> 0.6 & < 2.0	< 0.6 & > 0
Aero	> 1.5	> 1.5	<= 1.5		