# Updating Tracking Efficiency Calculation

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## Recall (Efficiency Calculation)

> The tracking efficiency was calculated using following formula

 $SHMS Tracking Efficiency = \frac{shmsScinDid.npassed}{shmsScinShould.npassed}$ 

#### The individual variable were defined as follows

shmsScinShould	<pre>shmsScinGood &amp;&amp; shmsGoodBetanotrk &amp;&amp; !shmsDCany_large</pre>
shmsScinShoulde	shmsScinShould && P.cal.etotnorm > 0.6 && P.cal.etotnorm < 1.6 && P.hgcer.npeSum > 0.5
#shmsScinShouldh	shmsScinShould && P.cal.etotnorm <= 0.6 && P.cal.etotnorm > 0. && P.hgcer.npeSum < 0.2
shmsScinShouldh	shmsScinShould && P.cal.etotnorm <= 0.6 && P.cal.etotnorm > 0.
shmsScinDid	shmsScinShould && P.dc.ntrack > 0
shmsScinDide	shmsScinShoulde && P.dc.ntrack > 0
shmsScinDidh	shmsScinShouldh && P.dc.ntrack > 0
shmsDC1Planes_large shmsDC2Planes_large shmsDCany_large	<pre>(P.dc.1x1.nhit + P.dc.1u2.nhit + P.dc.1u1.nhit + P.dc.1v1.nhit + P.dc.1x2.nhit + P.dc.1v2.nhit) &gt; 20 (P.dc.2x1.nhit + P.dc.2u2.nhit + P.dc.2u1.nhit + P.dc.2v1.nhit + P.dc.2x2.nhit + P.dc.2v2.nhit) &gt; 20 shmsDC1Planes_large    shmsDC2Planes_large</pre>

Dave Gaskell mentioned that "shmsDCany\_large" is a tracked variable and should not be used in as it gives high tracking efficiency.

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## Recall (Cuts)

Following were the cuts used in the calculation of efficiency variables.

pcut\_cer\_hg\_elec pcut\_cer\_hg\_pi pcut\_cer\_ag\_elec pcut\_cer\_ag\_pi pcut\_cer\_pi\_both pcut\_cer\_elec\_both pcut\_cal\_elec pcut\_cal\_pi pcut\_elec\_all pcut\_pi\_all P.hgcer.npeSum > 0.5 P.hgcer.npeSum <= 0.5 P.aero.npeSum > 0.5 P.aero.npeSum <= 0.5 pcut\_cer\_ag\_pi && pcut\_cer\_hg\_pi pcut\_cer\_ag\_elec && pcut\_cer\_hg\_elec P.cal.etracknorm > 0.6 && P.cal.etracknorm < 1.6 P.cal.etracknorm <= 0.6 && P.cal.etracknorm > 0. pcut\_cer\_hg\_elec && pcut\_cal\_elec pcut\_cer\_hg\_pi && pcut\_cal\_pi

```
shmsScinGood P.hod.goodscinhit == 1
shmsGoodBetanotrk P.hod.betanotrack > 0.5 && P.hod.betanotrack < 1.4
```

#### **Updating DEF-Files**

Cuts are now updated as follows:

pcut\_cer\_hg\_elec pcut\_cer\_hg\_pi pcut\_cer\_ag\_elec pcut\_cer\_ag\_pi pcut\_cer\_ag\_p pcut\_cer\_ag\_p pcut\_cal\_elec pcut\_cal\_pi pcut\_cal\_p pcut\_cal\_p pcut\_elec\_all pcut\_pi\_all pcut\_p\_all P.hgcer.npeSum > 1.5 P.hgcer.npeSum > 1.5 P.hgcer.npeSum < 1.5 P.aero.npeSum > 1.5 P.aero.npeSum > 1.5 P.aero.npeSum < 1.5 P.cal.etracknorm > 0.6 && P.cal.etracknorm < 1.6 P.cal.etracknorm <= 0.6 && P.cal.etracknorm > 0. P.cal.etracknorm <= 0.6 && P.cal.etracknorm > 0. pcut\_cer\_hg\_elec && pcut\_cer\_ag\_elec && pcut\_cal\_elec pcut\_cer\_hg\_pi && pcut\_cer\_ag\_pi && pcut\_cal\_pi pcut\_cer\_hg\_p && pcut\_cer\_ag\_p && pcut\_cal\_p

## **Updating DEF-Files**

#### > Variables for the efficiency calculation are also updated as follows:

#### 

###### Using new cut variables for efficiency calculation (Adding individual particle efficiency

shmsScinShould	shmsScinGood && shmsGoodBetanotrk
shmsScinShoulde	shmsScinShould && pcut_elec_all
shmsScinShouldpi	shmsScinShould && pcut_pi_all
shmsScinShouldp	shmsScinShould && pcut_p_all
shmsScinShouldh	shmsScinShould && P.cal.etotnorm <= 0.6 && P.cal.etotnorm > 0.
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

## Updating Template File

The template file is also updated accordingly

pdid pdide pdidh pdidpi pdidp pscinshould pscinshoulde pscinshouldh pscinshouldpi pscinshouldpi

- : {shmsScinDid.npassed}
- : {shmsScinDide.npassed}
- : {shmsScinDidh.npassed}
- : {shmsScinDidpi.npassed}
- : {shmsScinDidp.npassed}
- : {shmsScinShould.npassed}
- : {shmsScinShoulde.npassed}
- : {shmsScinShouldh.npassed}
- : {shmsScinShouldpi.npassed}
- : {shmsScinShouldp.npassed}

#### SHMS Tracking Efficiency

Run # 8038
P = +6.05 GeV

	E = 8.2 GeV						71 ı	۱
eV .	Angle = 6.91			Ra	te ¾	/4 = 7	706	k
pdid pdide pdidh pdidpi pscinshould pscinshoulde pscinshouldh pscinshouldpi pscinshouldpi			5949 564 5142 2753 372 6526 564 5634 2753 372					
SING FID TRACK	EFFIC	:	0.9	9116	+-	0.0	037	
E SING FID TRAC HADRON SING FIC Pi SING FID TRA P SING FID TRAC	CK EFFIC D TRACK EFFIC ACK EFFIC CK EFFIC		1.0 0.9 1.0 1.0	0000 0127 0000 0000	+ + + +	0.0 0.0 0.0 0.0	000 039 000 000	

Ηz

#### SHMS Tracking Efficiency

Run # 8054
P = +6.05 GeV

	E = 8.2 GeV	7				I = 4	uA
ieV	Angle = $6.9$	1		Ra	ate	<sup>3</sup> ⁄4 = 76	5 k
odid odide odidh odidpi oscinshould oscinshoulde oscinshouldh oscinshouldpi oscinshouldpi			6992 677 6083 3775 469 7281 677 6330 3775 469				
SING FID TRACK	EFFIC	:	0.9	503	+-	0.0023	
ADRON SING FID	CK EFFIC D TRACK EFFIC	:	1.00	000 510	+- +-	0.0000	
SING FID TRAC	CK EFFIC	:	1.0	000	+-	0.0000	

kHz

## Tracking Efficiency Comparison

The "should" and "did" values for specific particles are identical due to the "Aero" and "HGC" cuts.

Probably the cuts are on tracked variables !!!

The comparison b/w hadron efficiencies before and after the fixing of bug is as follows

Run Number	Old Value	New Value
8038	98.92 ± 0.15	91.27 ± 0.39
8054	99.38 ± 0.10	96.10 ± 0.25

Will look into more runs to confirm this trend.

#### Summary

A bug in the efficiency calculation is fixed which results in reasonable efficiency numbers.

There is a problem in the efficiency for individual particles (may be due to the specific PID cuts).

The DEF-files and Template file is now updated with new variables.

Selected a bunch of spring runs (8038-8110) which gives nice range of current and SHMS rates.

## Outlook

Will need to dig into HCANA to identify corrected variables for PID cuts.

Deb shared some slides of his work on tracking which is nice way of optimizing track parameters.

Will implement same correction to the HMS tracking calculation as well.

#### Deb's Slides

#### Space point criterion



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#### Deb's Slides



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