中国科学技术大学
University of Science and Technology of China

Isobar QA

2022/8/15

- Isobar pico:

  /star/u/suyuann/pwg/Isobar.Blind/isobar_ana/picoRaw_phy_20220807.list

  root://xrdstar.rcf.bnl.gov:1095//home/starlib/home/starreco/reco/production_isobar_2018/ReversedFullField/P20ic/2018/083/19083049/st_physics_19083049_raw_0000005.picoDst.root, an example of the pico

  ~0.36M pico in list, run ~1/2, many jobs report error,

  now ~1,600M event(MB) compared to ~100M auau(200GeV)

... finished processing 1881000 events.
Error in <StCloseFileOnTerminate::Notify>: Closing all TFiles ....

Error in <TBasket::Streamer>: The value of fNevBufSize is incorrect (-5691
Error in <TNetXNGFile::TNetXNGFile>: The remote file is not open

*** Break *** segmentation violation

- QA code:

  based on /star/u/suyuann/pwg/Isobar.Blind/isobar_QA/isobar_QA/

  in /star/u/dsli/Isobar_hypernuclei/Isobar_QA/

Cuts:

Trigger: 600031

Badrun: 19130085, 19131009, 19131010, 19131012, 19132063, 19133009, 19133010, 19133012, 19133013, 19133014, 19133018, 19134010, 19134011, 19135011, 19135013, 19135014, 19136016, 19137003, 19137022, 19137047, 19137050, 19137051, 19137052, 19137053, 19137056, 19137057, 19138008, 19138009, 19138014, 19139022, 19139023, 19139024, 19139026, 19139027, 19139028, 19139032, 19139033, 19139034, 19139037, 19140009, 19140014, 19141008, 19142005, 19142048, 19143008, 19143009, 19143010, 19143011, 19143012, 19143013, 19143014, 19143015, 19143016, 19143017, 19146016, 19147007, 19147008, 19147009, 19147010, 19147014, 19147015, 19147016, 19156002, 19156032, 19156044, 19156045, 19156046, 19157013, 19158003, 19158007, 19158009, 19158010, 19158011, 19158013, 19158014, 19158015, 19158017, 19158018, 19158019, 19160018, 19162002, 19162005, 19165015, 19165020, 19165021, 19167042

86 badruns in total

Good event:

-35 < Vz < 25

|Vx| > 1.e-5

|Vy| > 1.e-5

|Vz-VpdVz| <= 1000

|Vr| < 2.0

Good track:

nHitsFit >= 15

nHitsDedx >= 15

0.52<nHitsFit/nHitsMax<1.02

|eta| < 1.5

pt > 0.2

Dca < 200, Dca<3 for run by run QA

Check badrun list:

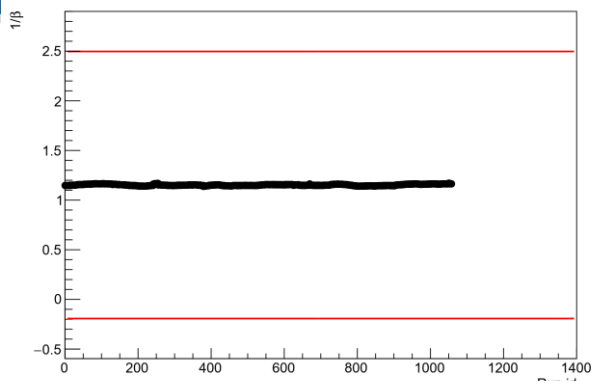
<Y>$\pm$5*σ

<Y> by TProfile::GetMean()

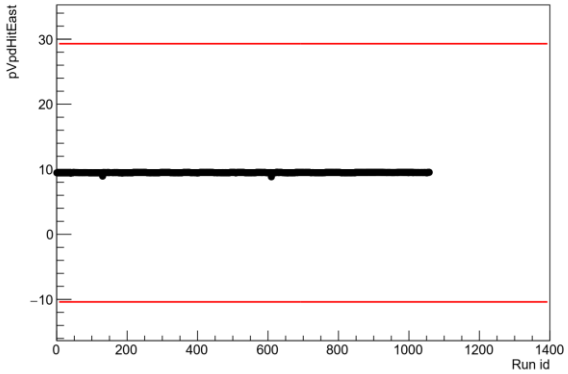
σ by TProfile::GetStdDev()

run by run QA

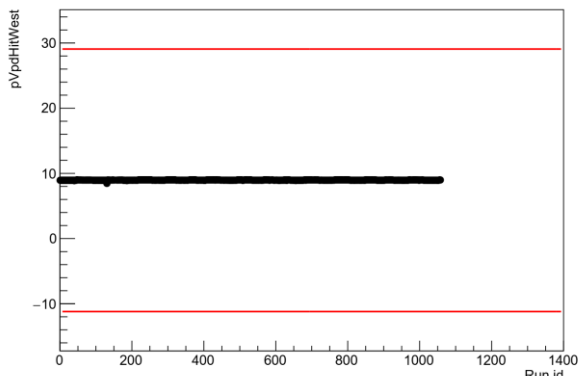
pTof



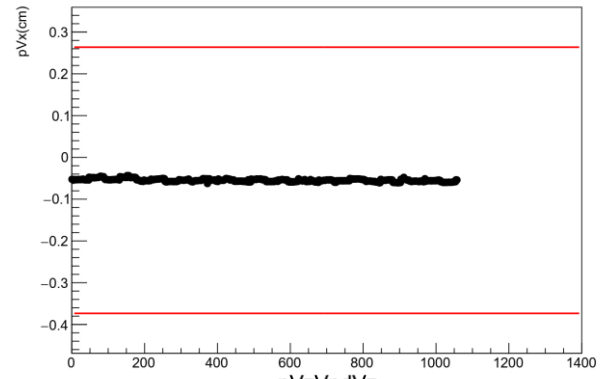
pVpdHitEast



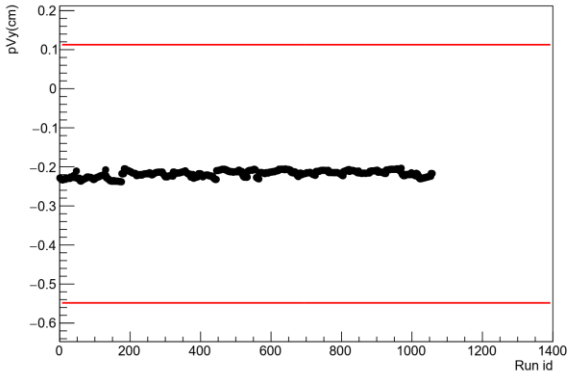
pVpdHitWest



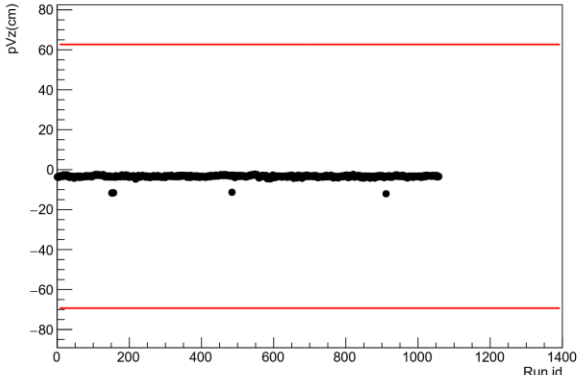
pVx



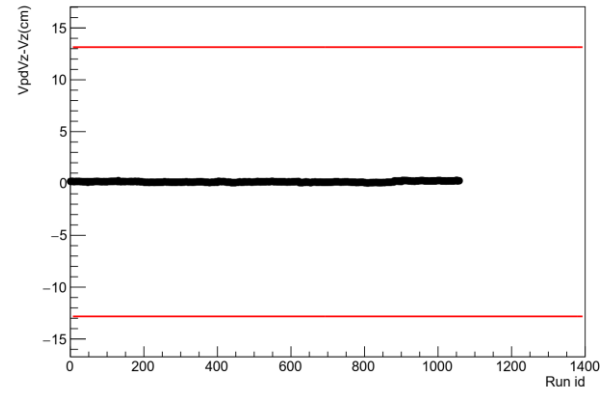
pVy



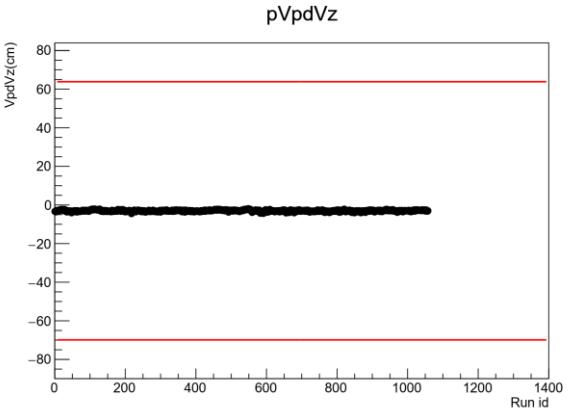
pVz



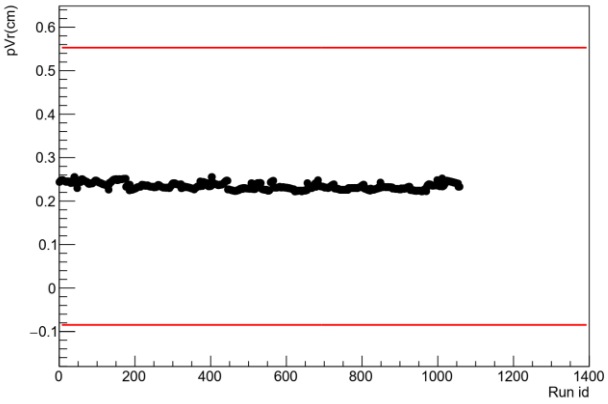
pVzVpdVz



pVpdVz

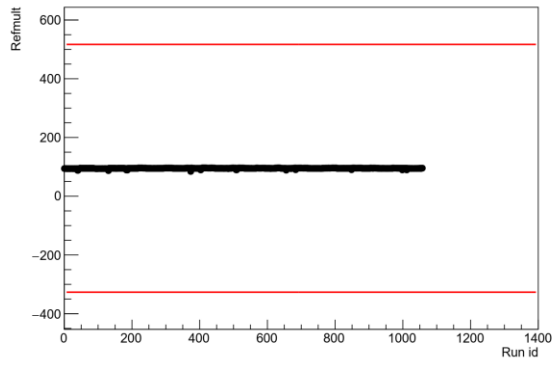


pVr

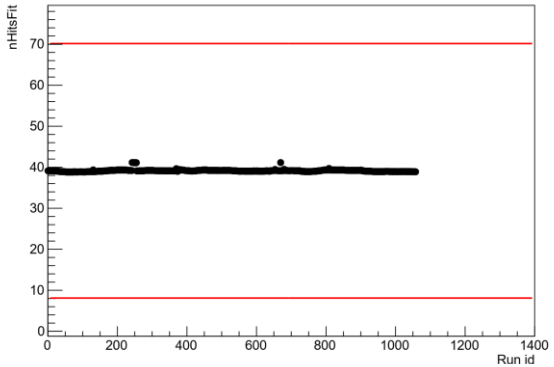


run by run QA

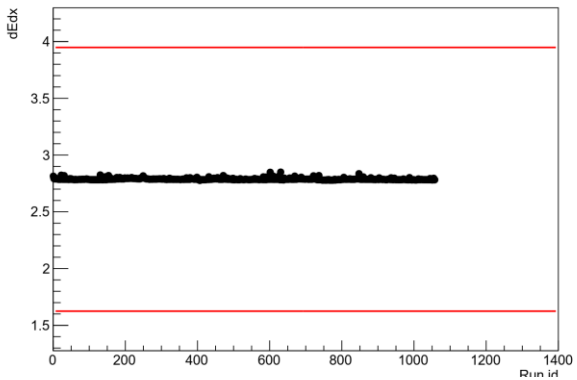
pRefmult



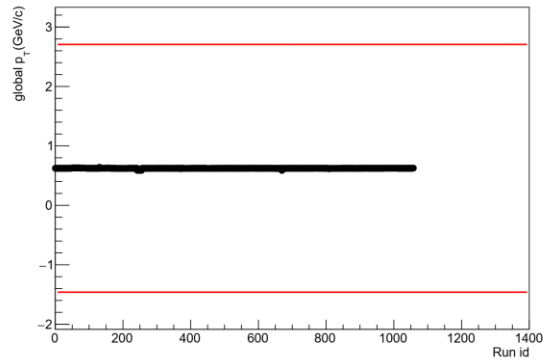
pNFits



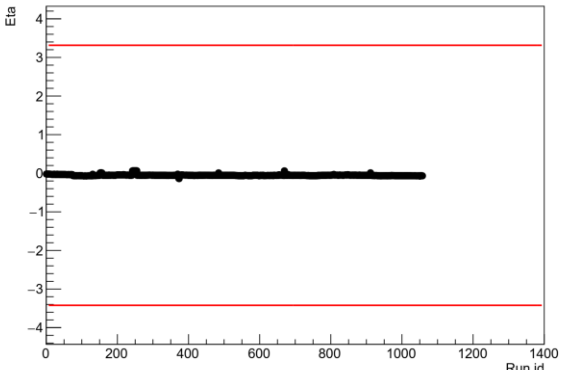
pDedx



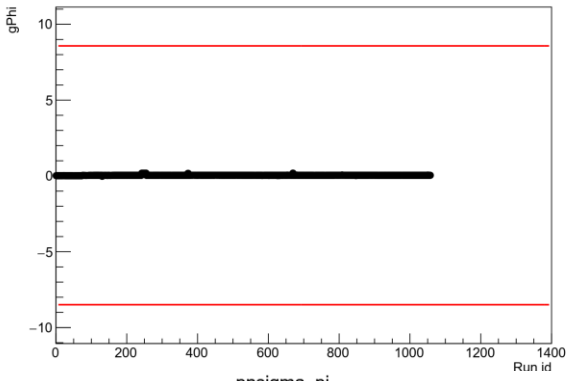
pgPt



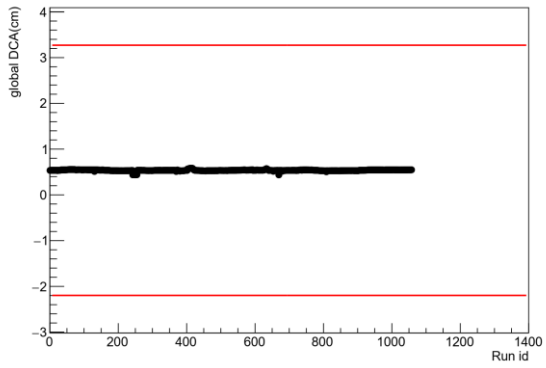
pgEta



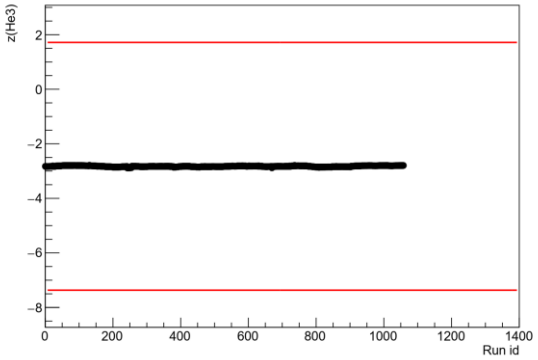
pgPhi



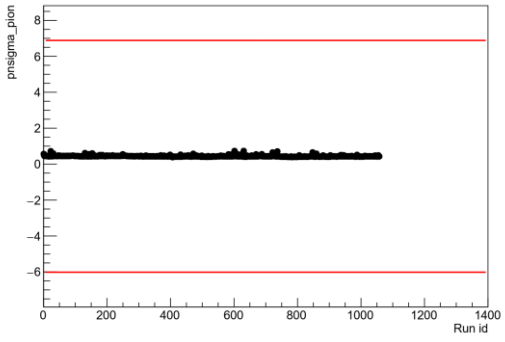
pgDCA



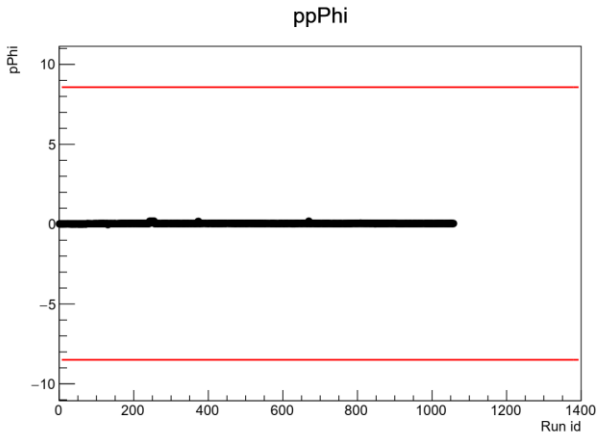
pz_he3

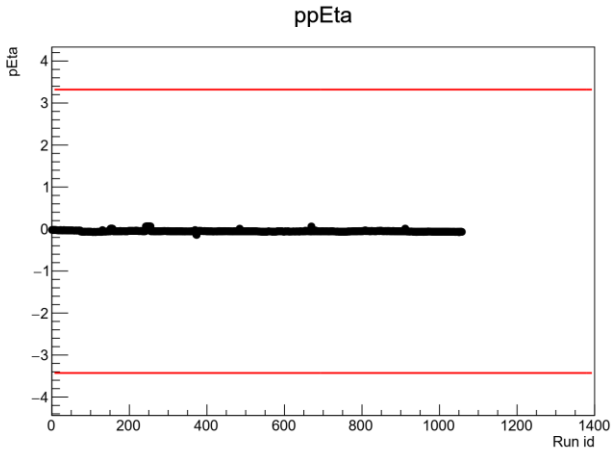


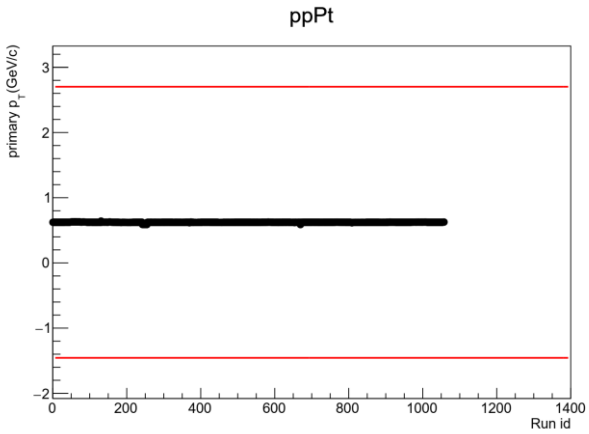
pnsigma_pi



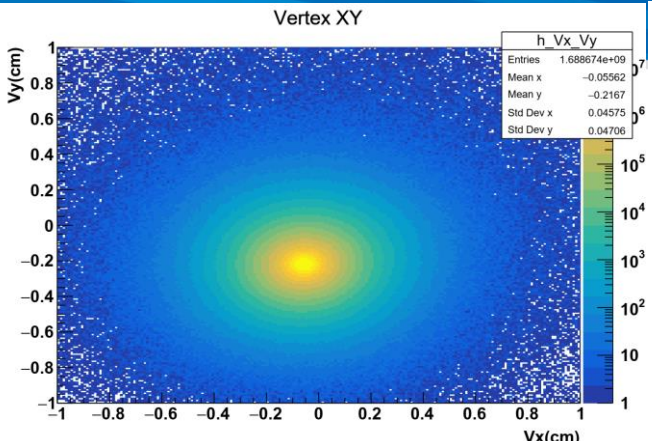
run by run QA

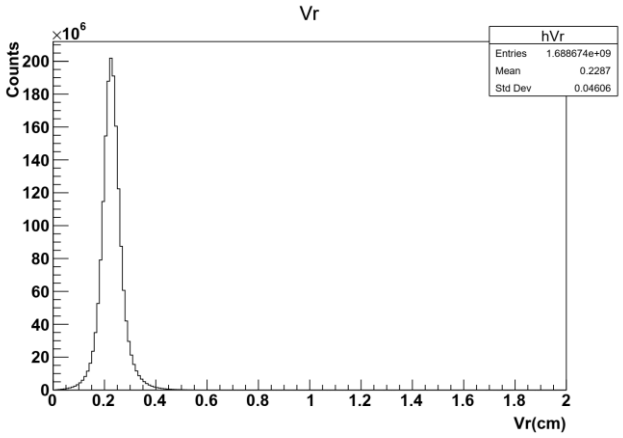

ppPhi
pPhi
Run id

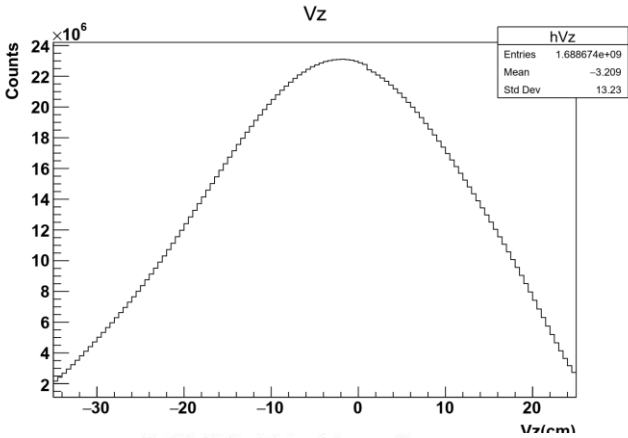

ppEta
pEta
Run id

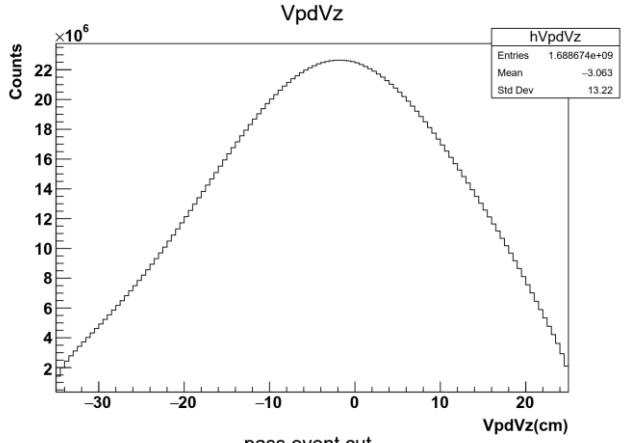

ppPt
primary p_T (GeV/c)
Run id

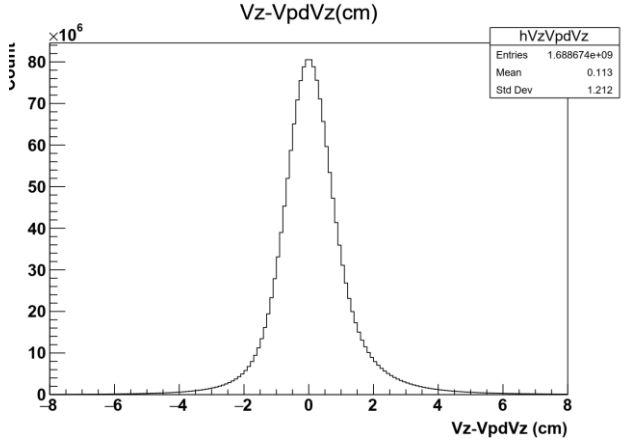
Event QA

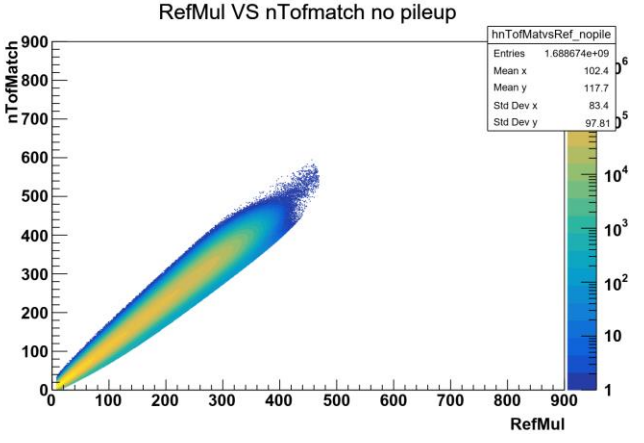

Vertex XY
h_Vx_Vy
Entries 1.688674e+09
Mean x −0.05562
Mean y −0.2167
Std Dev x 0.04575
Std Dev y 0.04706
Vy(cm)
Vx(cm)

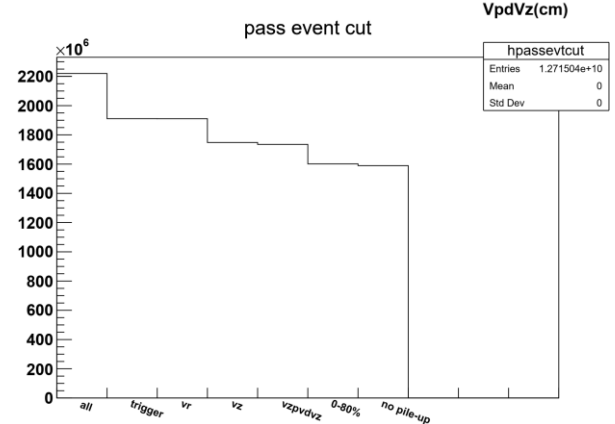

Vr
hVr
Entries 1.688674e+09
Mean 0.2287
Std Dev 0.04606
Counts
Vr(cm)


Vz
hVz
Entries 1.688674e+09
Mean −3.209
Std Dev 13.23
Counts
Vz(cm)

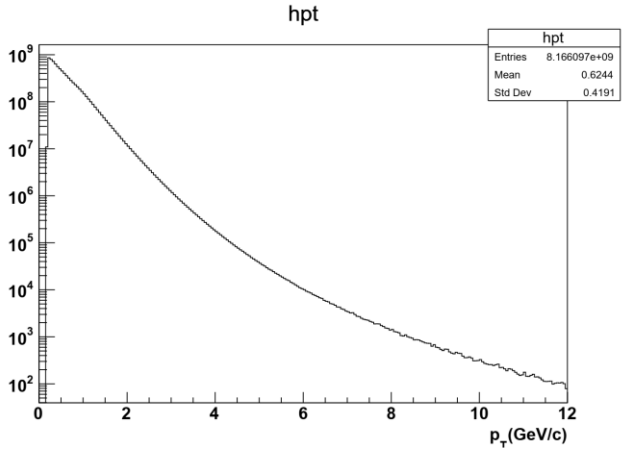

VpdVz
hVpdVz
Entries 1.688674e+09
Mean −3.063
Std Dev 13.22
Counts
VpdVz(cm)

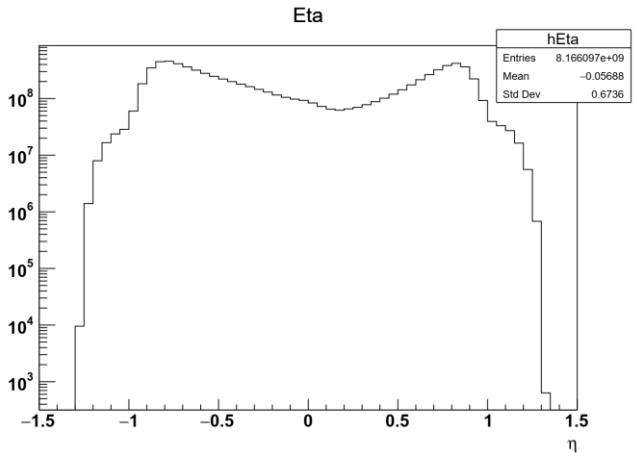

Vz-VpdVz(cm)
hVzVpdVz
Entries 1.688674e+09
Mean 0.113
Std Dev 1.212
Vz-VpdVz (cm)

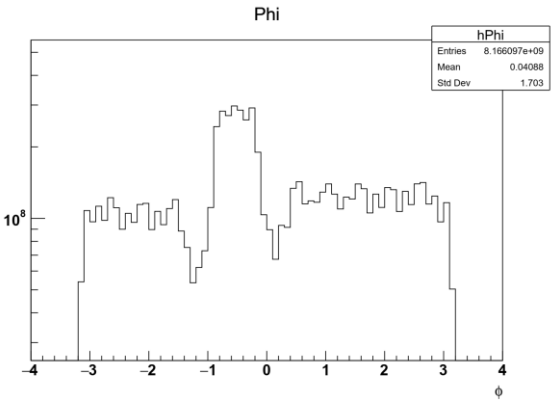

RefMul VS nTofmatch no pileup
hnTofMatvsRef_nopile
Entries 1.688674e+09
Mean x 102.4
Mean y 117.7
Std Dev x 83.4
Std Dev y 97.81
nTofMatch
RefMul

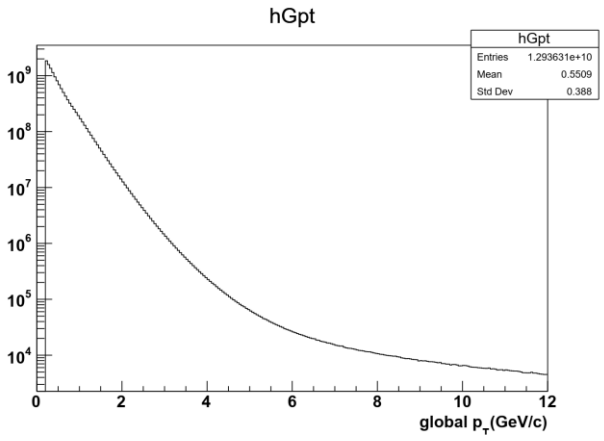

pass event cut
hpassevtcut
Entries 1.271504e+10
Mean 0
Std Dev 0
all
trigger
vr
vz
vzpvdvz
0-80%
no pile-up

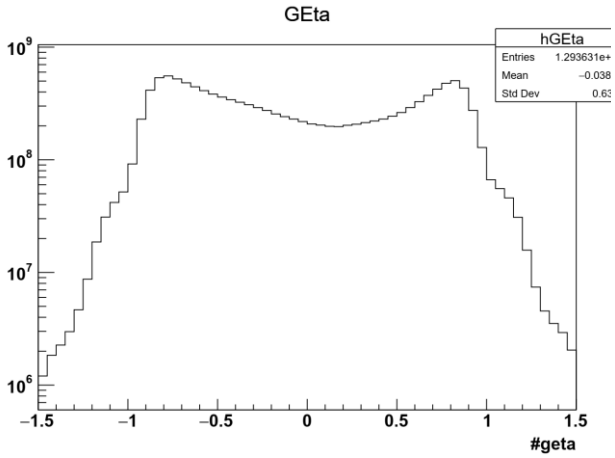
Track QA

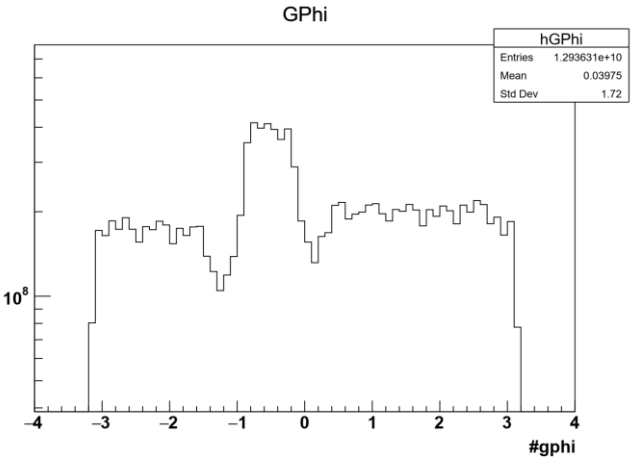






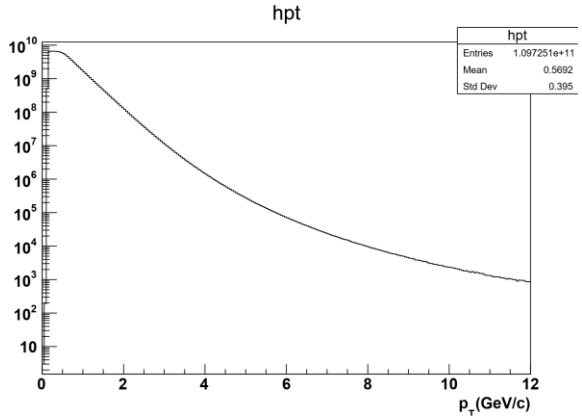


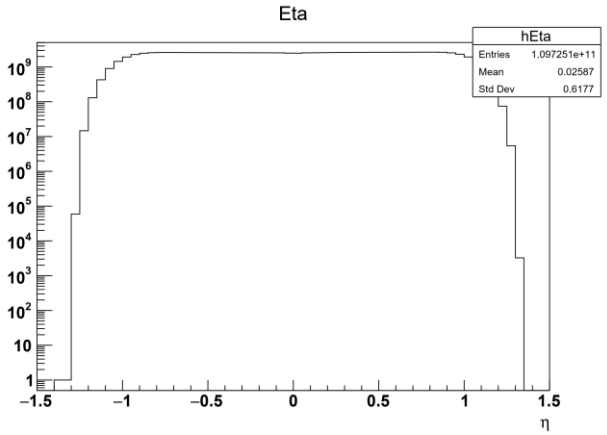


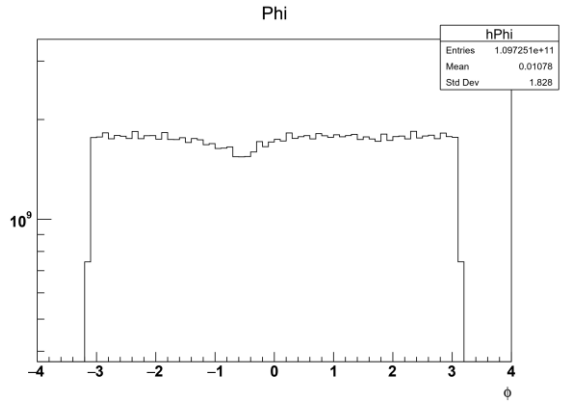


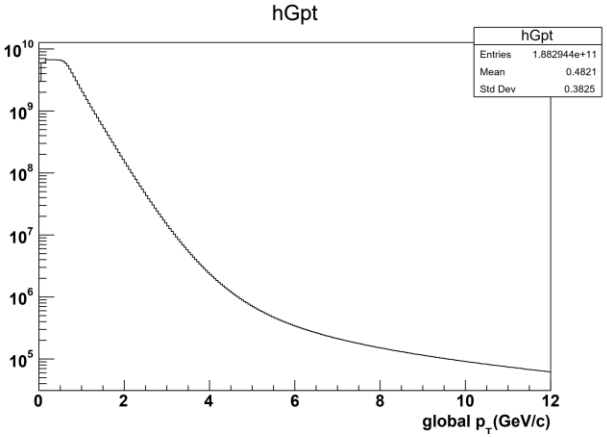
With 0.52<nHitsFit/nHitsMax<1.02 cut

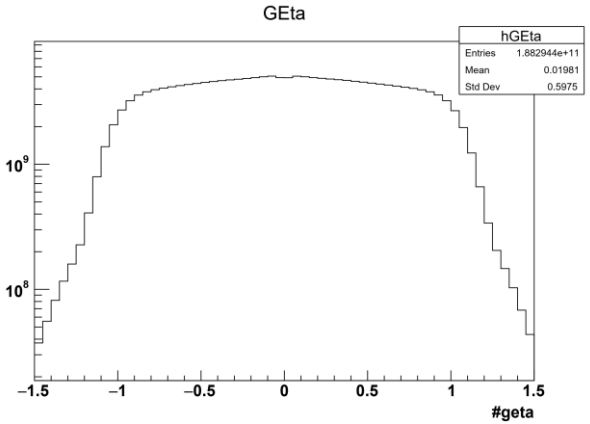
Track QA

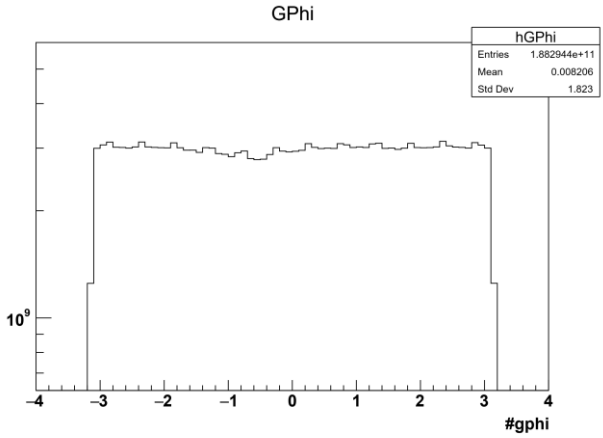










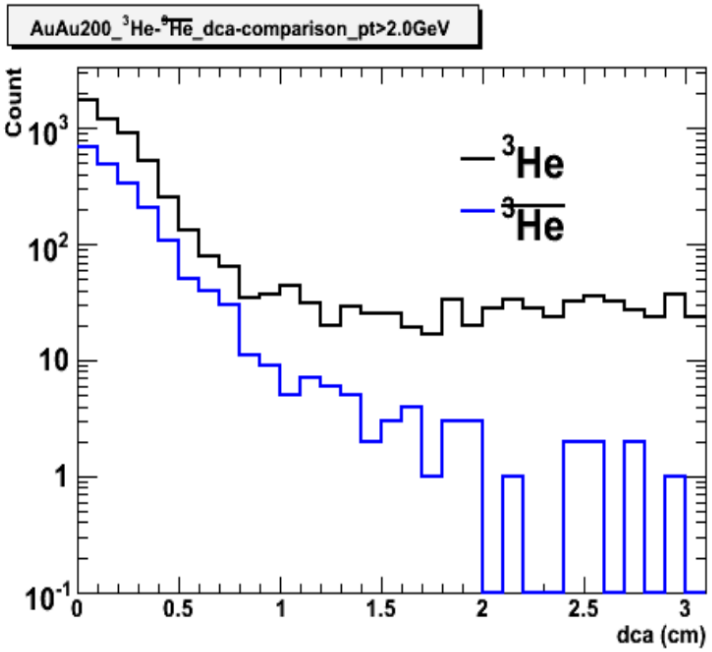


Without 0.52<nHitsFit/nHitsMax<1.02 cut

Pid

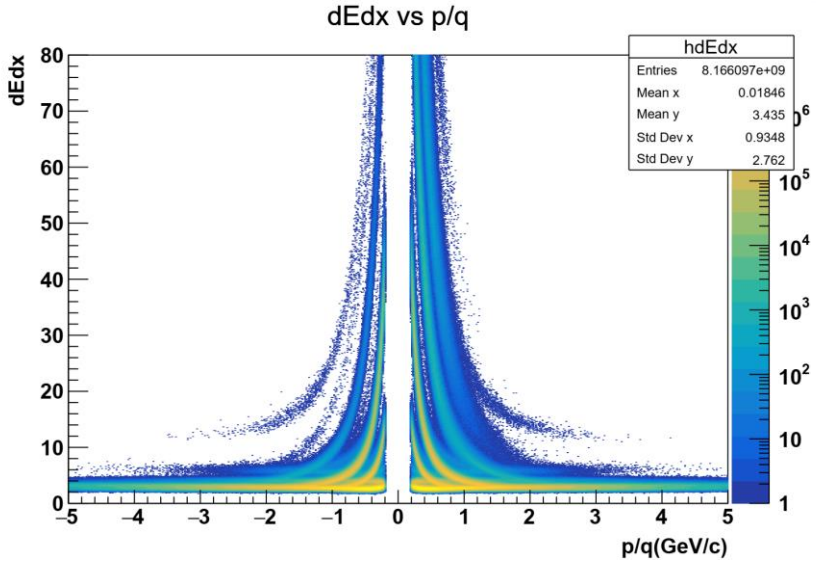
Observation of hypertriton and anti-hypertriton in Au+Au collisions at $\sqrt{s_{NN}}$=200 GeV

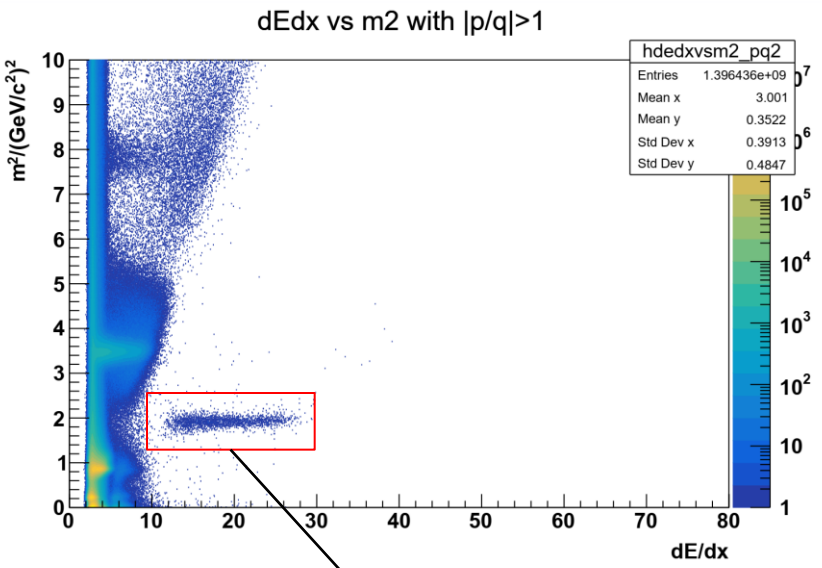
$${}^{3}_{\Lambda}\mathrm{H} \rightarrow {}^{3}\mathrm{He} + \pi^{-} \text{ (2-body decay)}$$



As seen from the plot, the dca distributions are similar below 1cm. So a dca<1 cm can effectively cut off the beam-pipe ^{3}He contribution. This cut is powerful in reducing the beam pipe pollution while only cut off a small fraction of the anti-^{3}He sample. Hence, we applied the same cuts on anti-^{3}He identification. Totally, about 5800 ^{3}He and 2100 anti-^{3}He candidate (-0.1<Z<0.3) past our cuts.

Pid





After event/track cut:

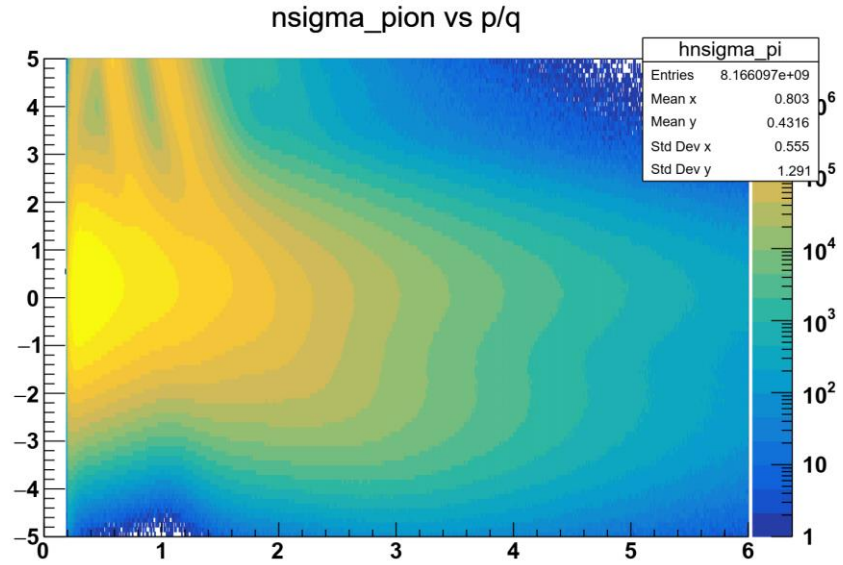
```
hdEdx->Fill(mom.Mag() / trk->charge() * 1.0, trk->dEdx());
```

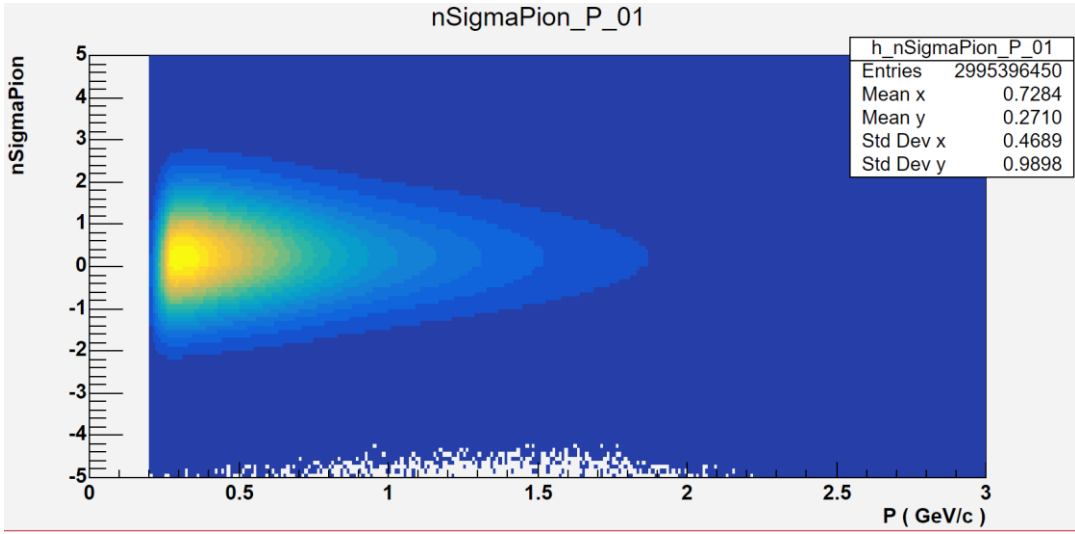
```
root [13] hdedxvsm2_pq2->GetYaxis()->GetBinCenter(126)
(double) 2.5100000
root [14] hdedxvsm2_pq2->GetYaxis()->GetBinCenter(70)
(double) 1.3900000
root [15] hdedxvsm2_pq2->GetXaxis()->GetBinCenter(250)
(double) 9.9800000
root [16] hdedxvsm2_pq2->GetXaxis()->GetBinCenter(750)
(double) 29.980000
root [17] hdedxvsm2_pq2->Integral(250,750,70,126)
(double) 2222.0000
```

~2000 He3 only by 1.4<m2<2.5

```
if(tofmatch){
…
if(fabs(mom.Mag() / trk->charge() * 1.0)>1)
hdedxvsm2->Fill(trk->dEdx(), mom.Mag2() * (1. / beta / beta - 1.));
…
}
```

Pid



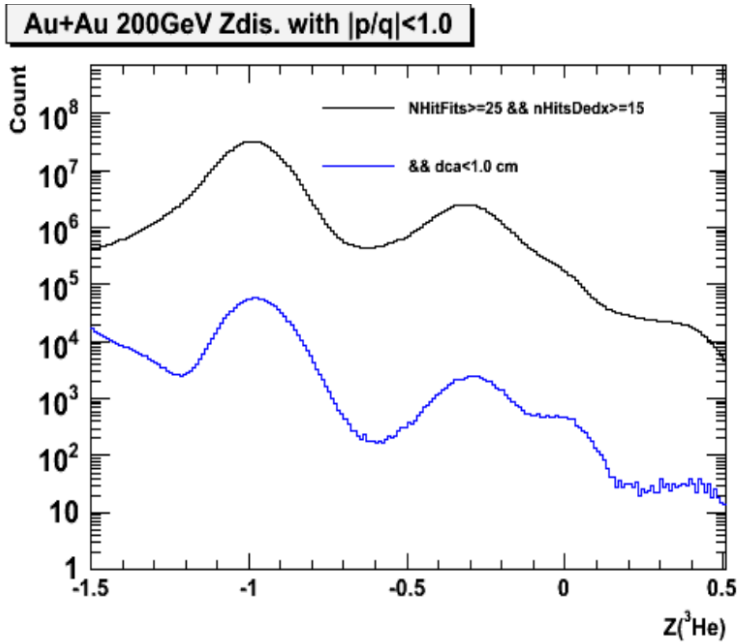


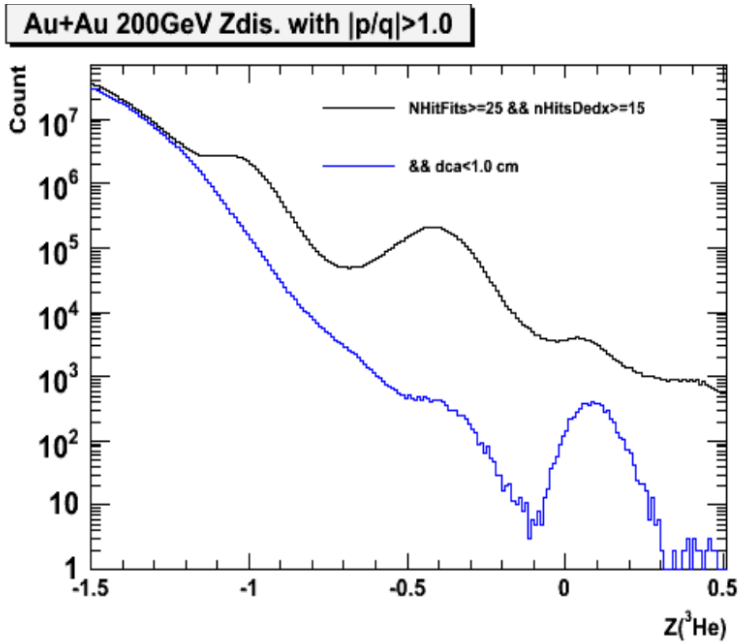
After event/track cut:

```
if(tofmatch){
…
hnsigma_pi->Fill(mom.Mag(),trk->nSigmaPion());
…
}
```

```
if(fabs(1.0/beta - sqrt(pow(M_pion,2)+pow(mom.Mag(),2))*1.0/mom.Mag()) < 0.01 && mom.Mag()>0.2)
        {
          h_nSigmaPion_P_01->Fill(mom.Mag(),trk->nSigmaPion());
        }
```

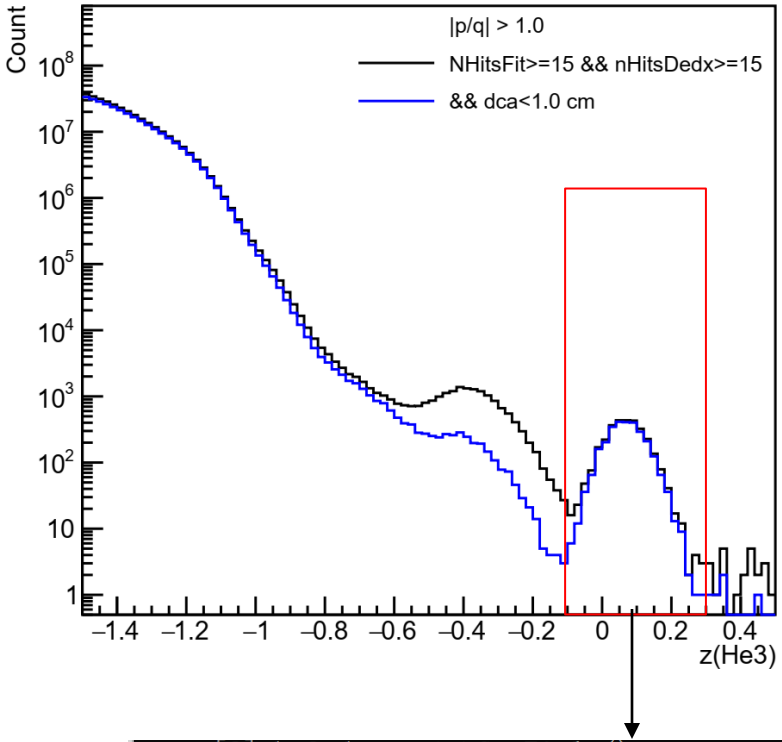
Observation of hypertriton and anti-hypertriton in Au+Au collisions at $\sqrt{s_{NN}}$=200 GeV

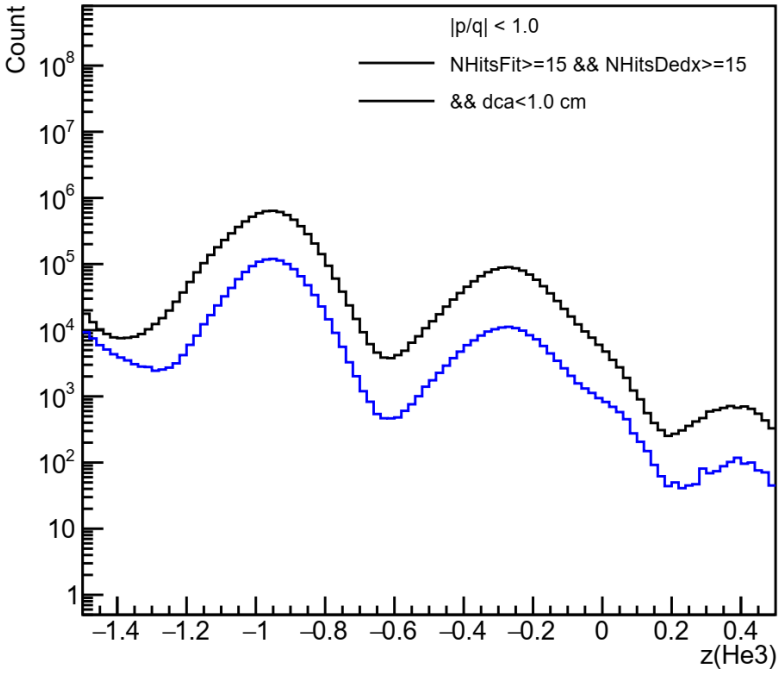




The ^{3}He cannot be clearly separate from other mixing in the low momentum region as indicated in the above left plot, so we start from p=2 GeV for this analysis. The ^{3}He has large beam-pipe background contamination. This need to be carefully study and correctly subtracted. Since beam-pipe cannot produce anti-^{3}He, the anti-^{3}He is a reference for this study. We here compare the dca distribution between ^{3}He and anti-^{3}He's:

Pid

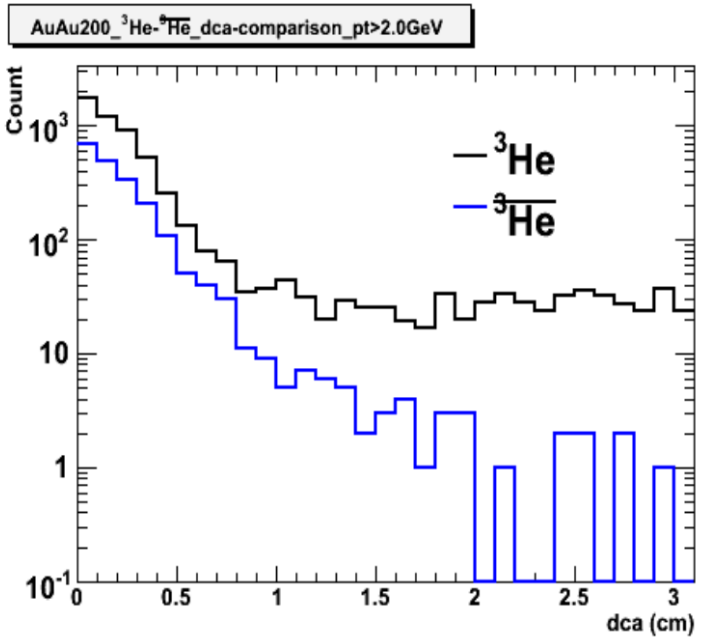


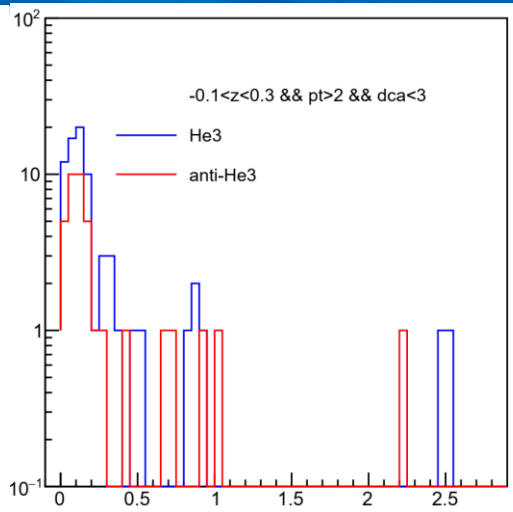


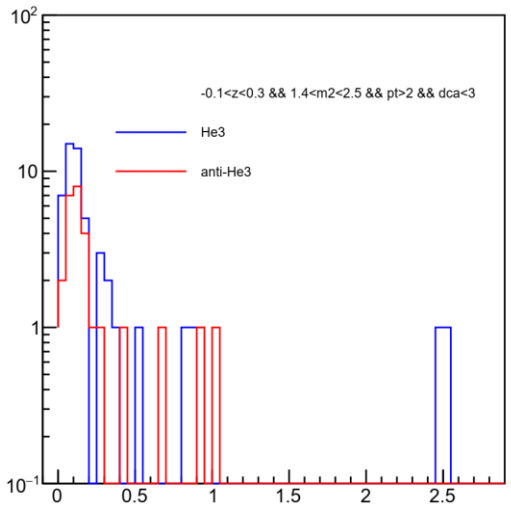

```
root [2] hz2_dcacut1->GetTitle()
(const char *) "z with dca < 1, |p/q|>1"
root [3] hz2_dcacut1->GetBinCenter(70)
(double) -0.11000000
root [4] hz2_dcacut1->GetBinCenter(90)
(double) 0.29000000
root [5] hz2_dcacut1->GetBinCenter(91)
(double) 0.31000000
root [6] hz2_dcacut1->Integral(70,91)
(double) 1621.0000
```

By dca && z cut
~1600 (anti-)He3

Pid







No pt cut----~1600 (anti-)He3
Pt>2 --------~100 (anti-)He3

After event/track cut:

```
if(tofmatch)

if (trk->gDCA(mVx, mVy, mVz) < 3. && mom.Perp() > 2.0 && trk-
>dEdxPull(2.80839, 1, 2) * trk->dEdxError() > -0.1 && trk-
>dEdxPull(2.80839, 1, 2) * trk->dEdxError() < 0.3&& mom.Mag2() * (1.
/ beta / beta - 1.)<2.5&& mom.Mag2() * (1. / beta / beta - 1.)>1.4)
{
            if (trk->charge() > 0.)
                hdca_he3_z1->Fill(trk->gDCA(mVx, mVy, mVz));
            else
                hdca_ahe3_z1->Fill(trk->gDCA(mVx, mVy, mVz));
        }
```

Pid

Au+Au
~100M events

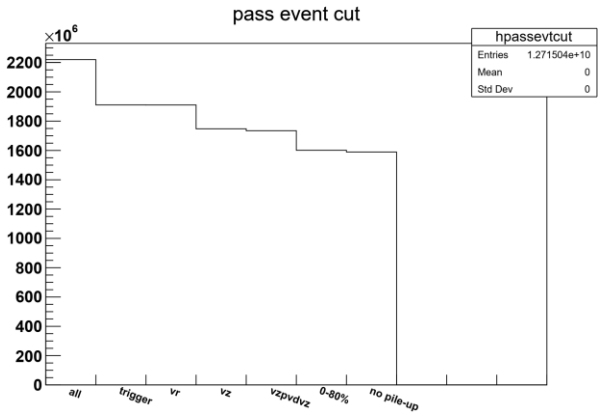
|vz|	<30.0cm
Run-4 Au+Au 200 GeV	Central trigger~23M events
Run-4 Au+Au 200 GeV	MB trigger~22M events
Run-7 Au+Au 200 GeV	MB trigger~68M events

Totally, about 5800 ^{3}He and 2100 anti-^{3}He

↓

Pt>2 && -0.1<z<0.3 && dca<1 ~8000 (anti-) He3

Isobar
~1600M events



No pt cut---~1600 (anti-)He3

Pt>2 --------~100 (anti-)He3