Cross check for $e^+e^- \to \omega\pi^0\pi^0$

(Rscan data)

Sun Yankun

Event selection

- **Good Charged Track:**

  N_{Good} ==2 and NCharge = 0 and $|cos\theta|$<0.93;

- **PID with dE/dx and TOF:**

  Kaon: prob_ π >prob_K && prob_π >prob_p;

  N(π-)=N(π+) = 1;

- **Good Photon:**

  E_{barrel}>25MeV; E_{endcap}>50MeV; 0≤Time ≤ 14;

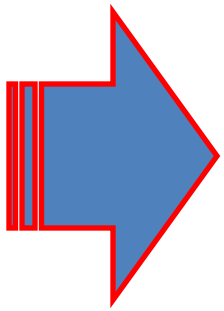
  $N_{\gamma} \geq 6$.

- **Choose the best combination of 6γ**
- **Vertex fit ($\pi^- \pi^+$)**
- **4C kinematic fit ($\pi^+ \pi^- 6\gamma$)**

Event selection

- ✓ Choose the best combination of 6γ
  - ➢ The best combination of 3 π^0

```
{ig0KF, ig1KF, ig2KF, ig3KF, ig4KF, ig5KF},
{ig0KF, ig1KF, ig2KF, ig4KF, ig3KF, ig5KF},
{ig0KF, ig1KF, ig2KF, ig5KF, ig4KF, ig3KF},
{ig0KF, ig2KF, ig1KF, ig3KF, ig4KF, ig5KF},
{ig0KF, ig2KF, ig1KF, ig4KF, ig3KF, ig5KF},
{ig0KF, ig2KF, ig1KF, ig5KF, ig4KF, ig3KF},
{ig0KF, ig3KF, ig1KF, ig2KF, ig4KF, ig5KF},
{ig0KF, ig3KF, ig1KF, ig4KF, ig2KF, ig5KF},
{ig0KF, ig3KF, ig1KF, ig5KF, ig4KF, ig2KF},
{ig0KF, ig4KF, ig1KF, ig2KF, ig3KF, ig5KF},
{ig0KF, ig4KF, ig1KF, ig3KF, ig2KF, ig5KF},
{ig0KF, ig4KF, ig1KF, ig5KF, ig3KF, ig2KF},
{ig0KF, ig5KF, ig1KF, ig2KF, ig3KF, ig4KF},
{ig0KF, ig5KF, ig1KF, ig3KF, ig2KF, ig4KF},
{ig0KF, ig5KF, ig1KF, ig4KF, ig3KF, ig2KF}
```



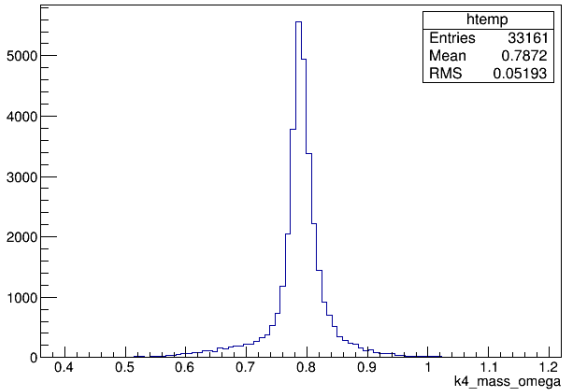
```
kmfit->AddTrack(0, 0.0, g0Trk);
kmfit->AddTrack(1, 0.0, g1Trk);
kmfit->AddTrack(2, 0.0, g2Trk);
kmfit->AddTrack(3, 0.0, g3Trk);
kmfit->AddTrack(4, 0.0, g4Trk);
kmfit->AddTrack(5, 0.0, g5Trk);
kmfit->AddTrack(6, wpip);
kmfit->AddTrack(7, wpim);
kmfit->AddResonance(0, mpi0, 0, 1);
kmfit->AddResonance(1, mpi0, 2, 3);
kmfit->AddResonance(2, mpi0, 4, 5);
kmfit->AddFourMomentum(3, ecms_lab);

if(!kmfit->Fit())continue;

double chisq_temp = kmfit->chisq();
```

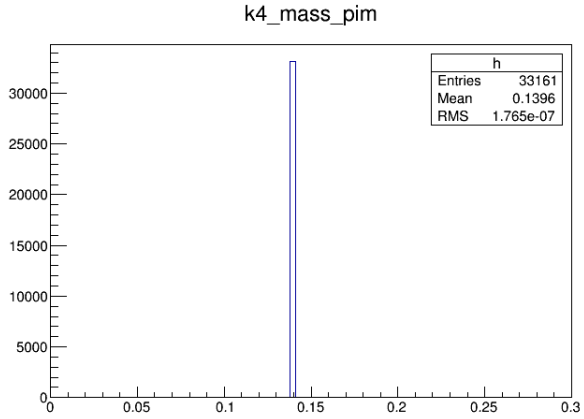
Decay Model

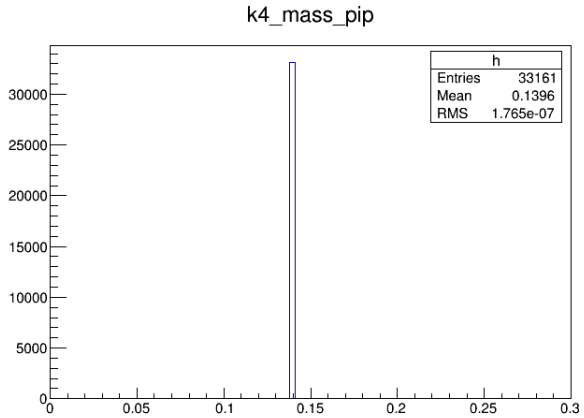
- ✓ $e^+e^- \to \omega\pi^0\pi^0 \to 6\gamma\pi^+\pi^-$
  - ➢ $\omega \to \pi^+\pi^-\pi^0$
  - ➢ $\pi^0 \to \gamma\gamma$
- ✓ Generator>>ConExc
  - ➢ BesEvtGen-00-03-69

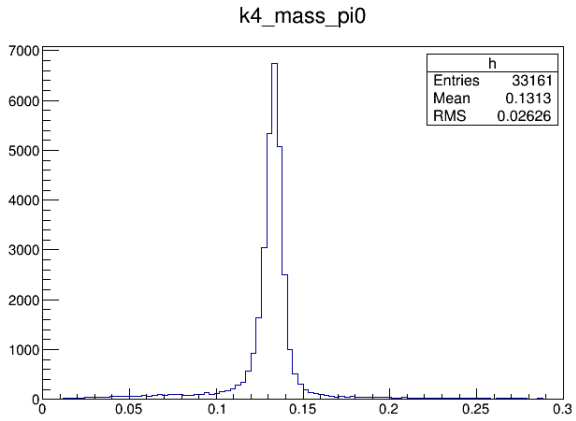
```
Particle vpho 2.125       0.0

Decay vpho
1 gamma  gamma*  ConExc  -2   223  111  111;
Enddecay

Decay gamma*
1.0   omega pi0 pi0 PHSP;
Enddecay

Decay omega
1.0    pi-  pi+  pi0      OMEGA_DALITZ;
Enddecay

Decay pi0
1.0    gamma gamma        PHSP;
Enddecay


End
```

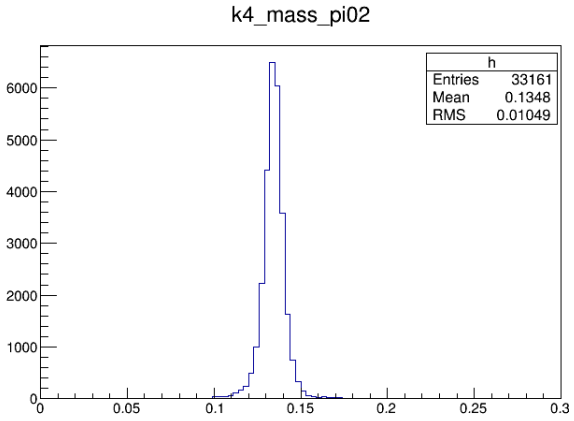
Invariant-Mass distribution

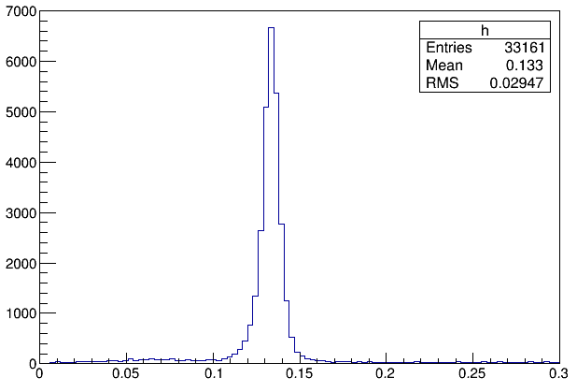




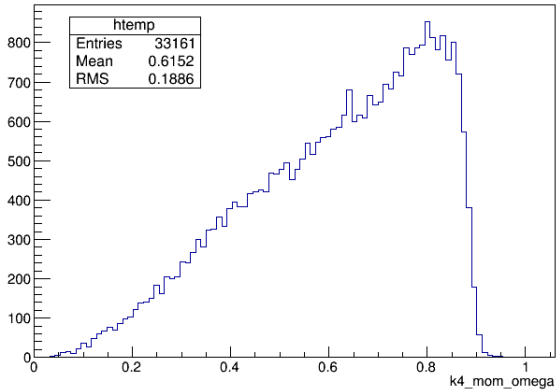


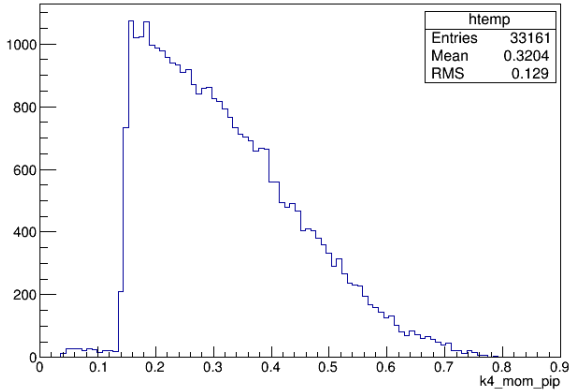


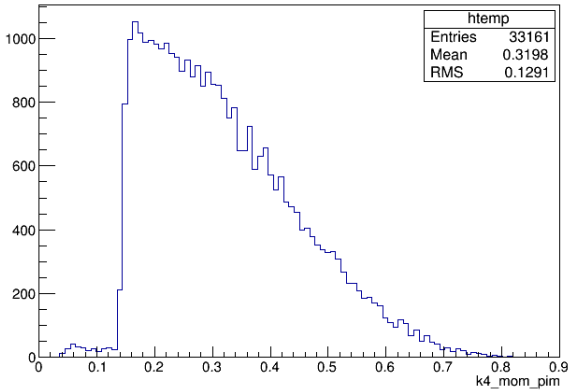


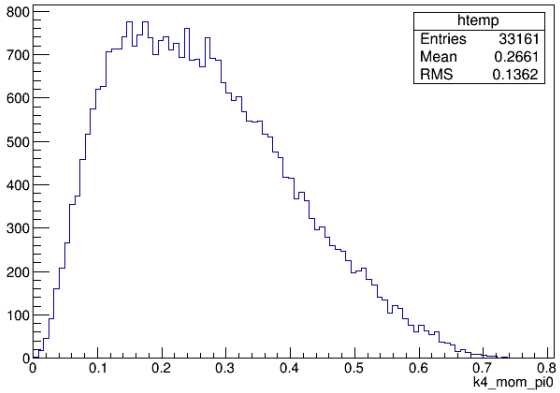


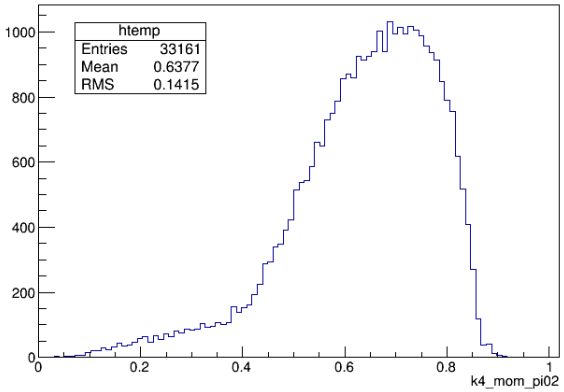
Momentum distribution

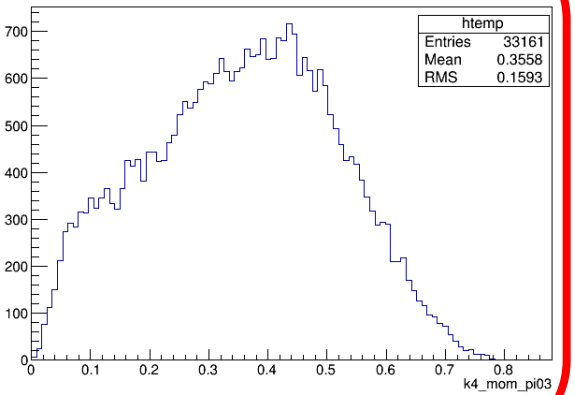




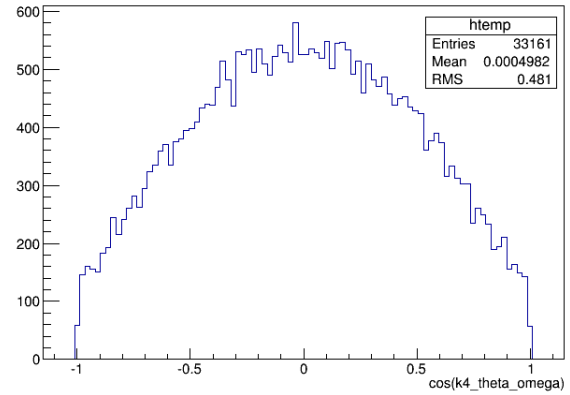


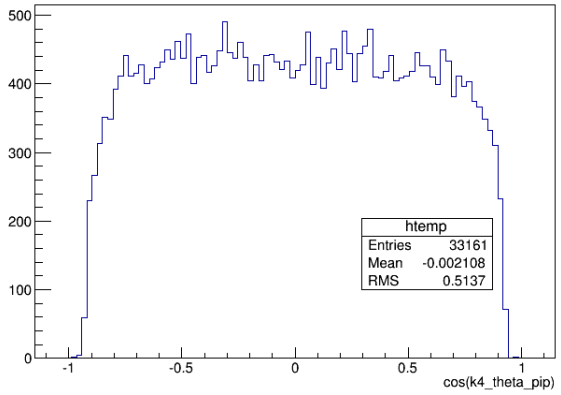


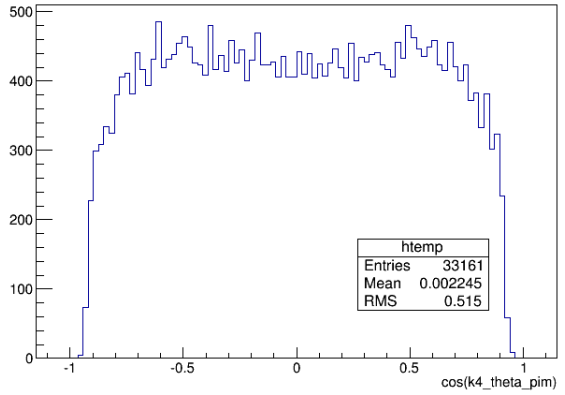


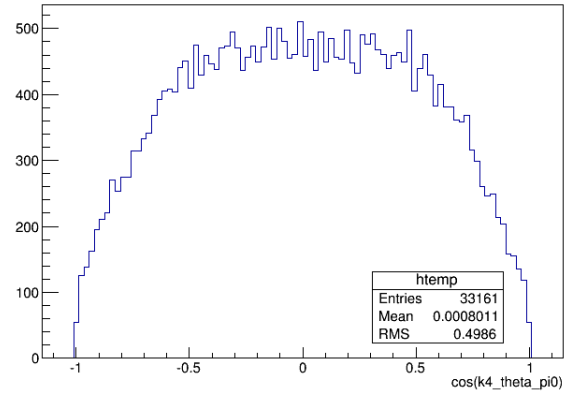


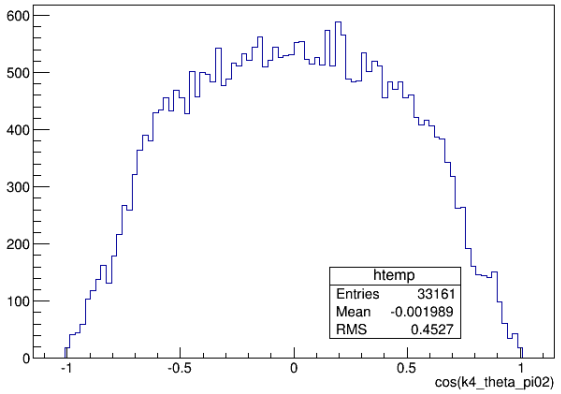
Cos(Theta) distribution

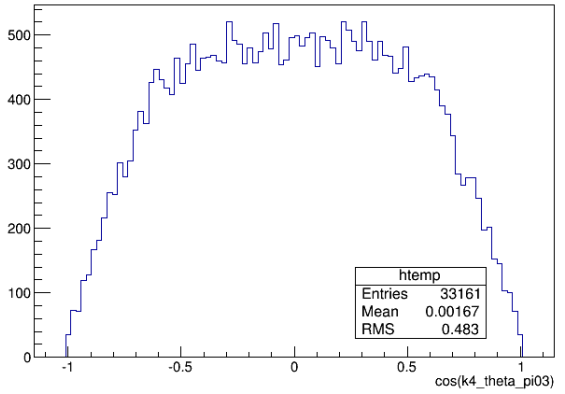












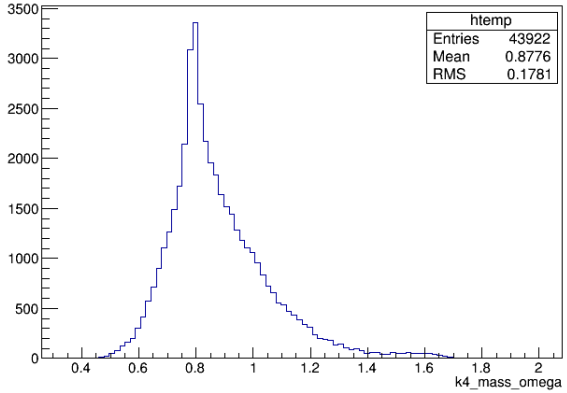
Signal efficiency

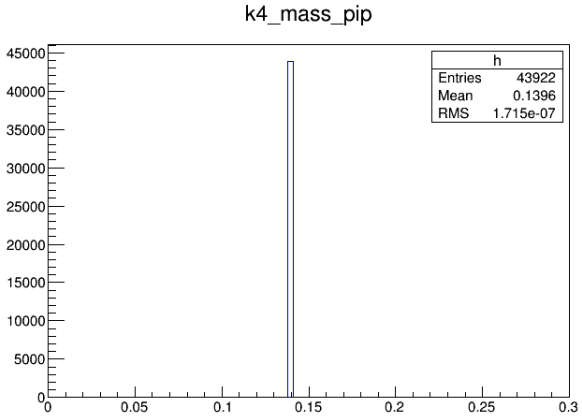
- ✓ $e^+e^- \to \omega\pi^0\pi^0 \to 6\gamma\pi^+\pi^-$
  - ➢ $\omega \to \pi^+\pi^-\pi^0$ $\mathcal{B}r = 89.2\%$
  - ➢ $\pi^0 \to \gamma\gamma$ $\mathcal{B}r = 0.988$
- ✓ Efficiency = 10.93 %
  - ➢ $\chi^2 < 100$
  - ➢ |mp0-0.135|<0.015 GeV
  - ➢ |mp02-0.135|<0.015 GeV
  - ➢ |mp03-0.135|<0.015 GeV

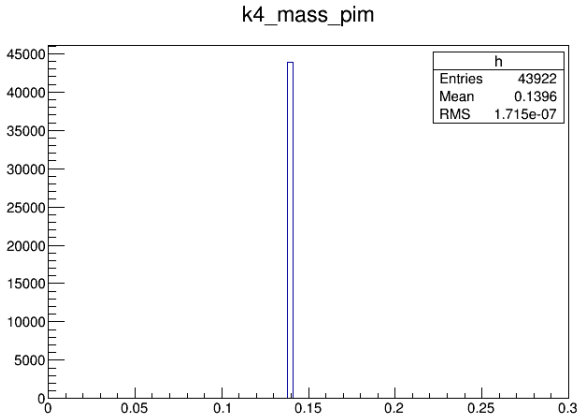
```
**********************************
Total Number:          10000
Good Track Sel.:       7183
Good Photon Sel.:      2517
PID:                   2398
Vertex ift:            2396
pi0:                   1676
4C Fit:                1676
**********************************
```

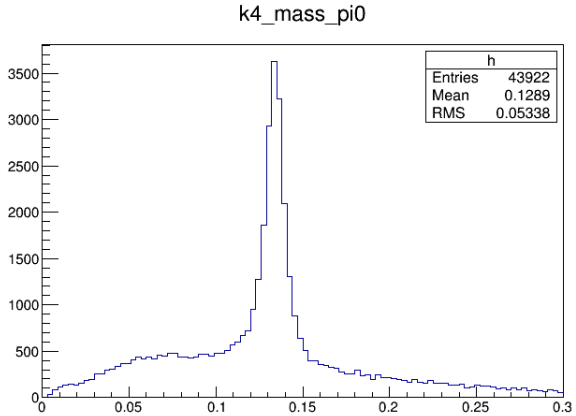
Mass distribution

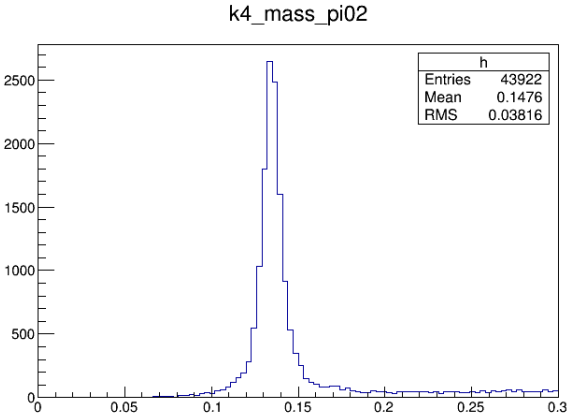
[Real Data]

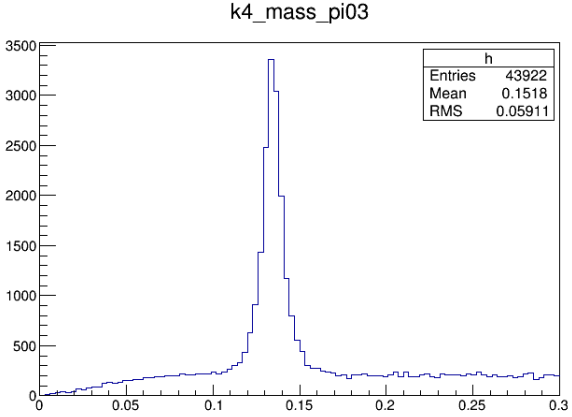






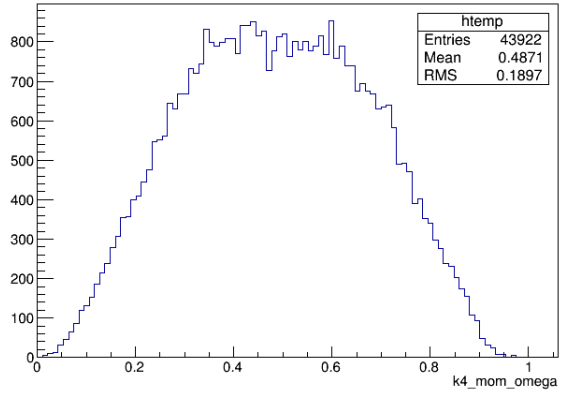


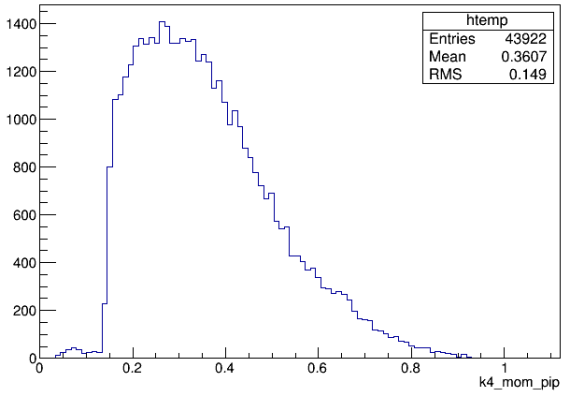


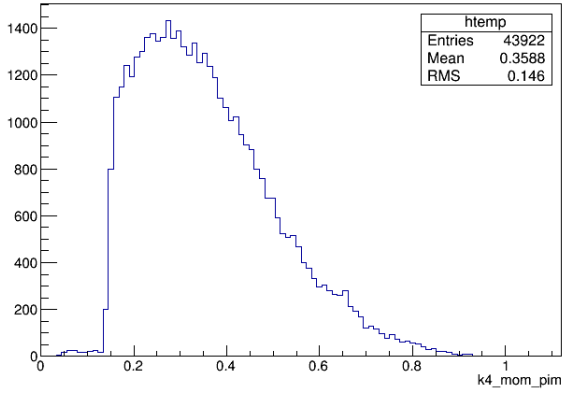


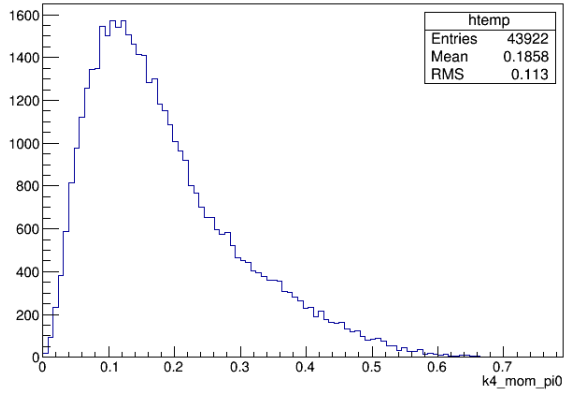
Momentum distribution

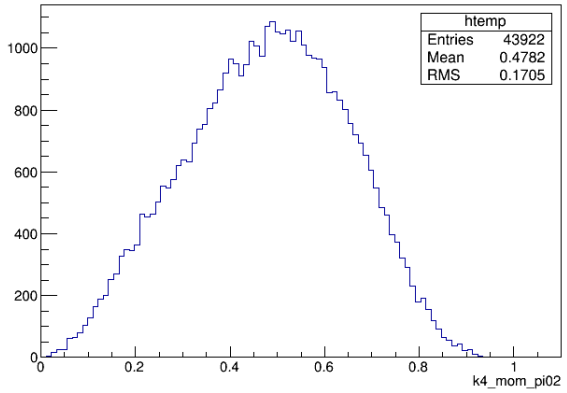
[Real Data]

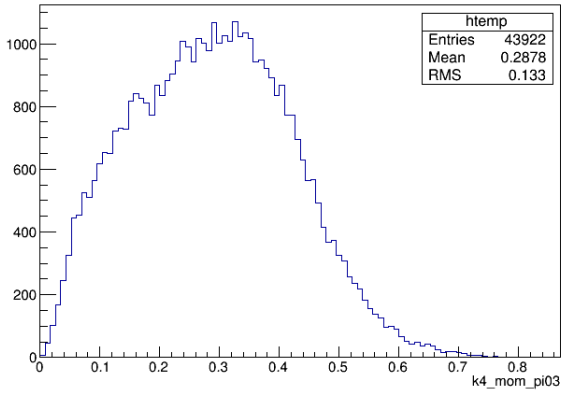






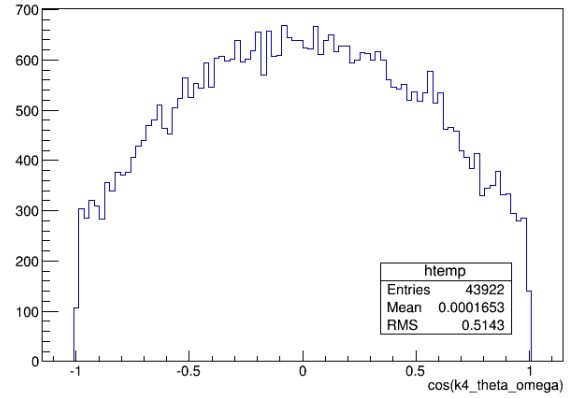


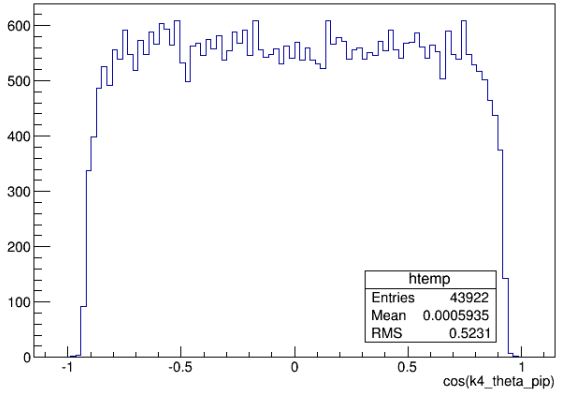


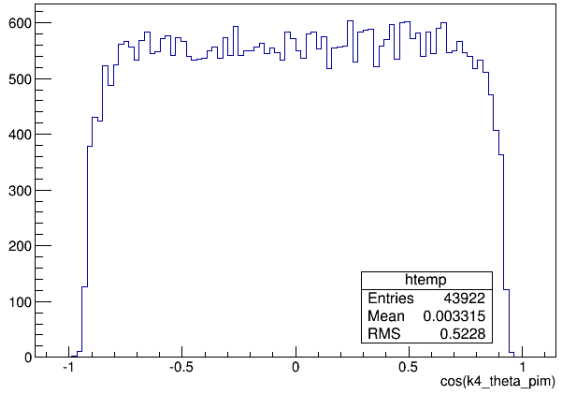


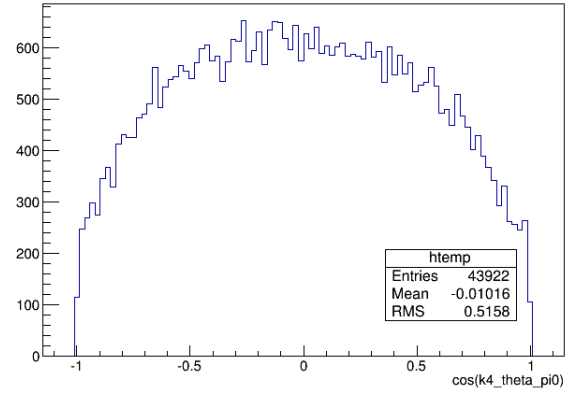
Cos(Theta) distribution

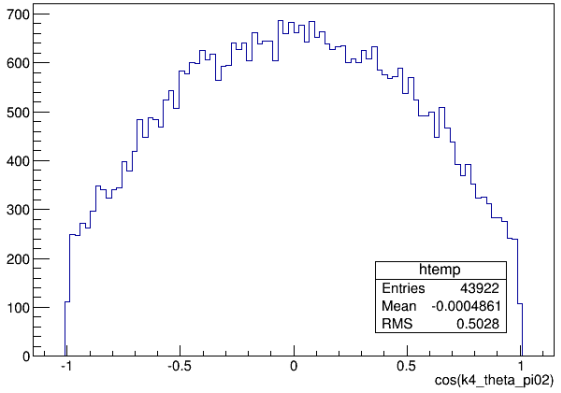
[Real Data]

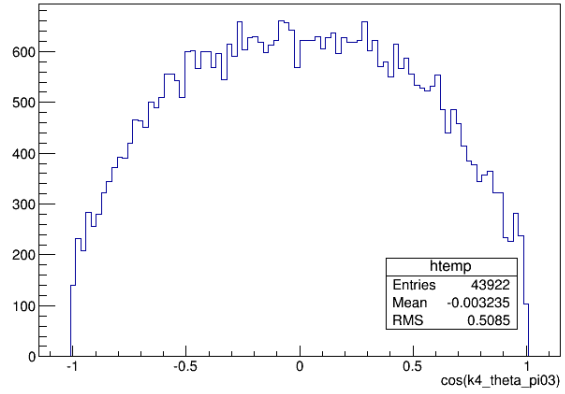








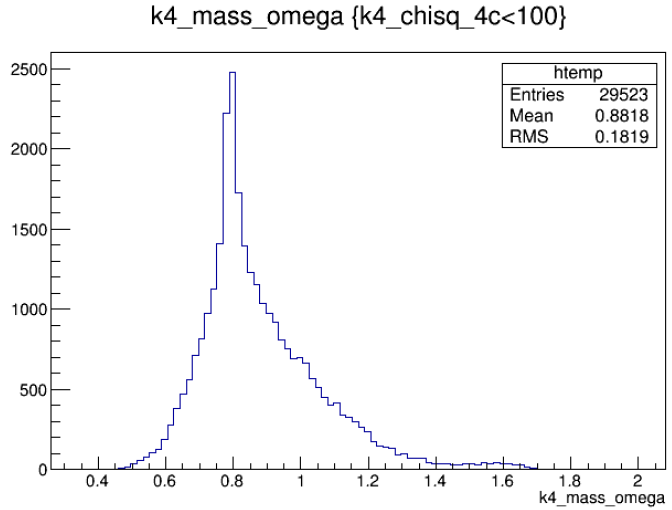


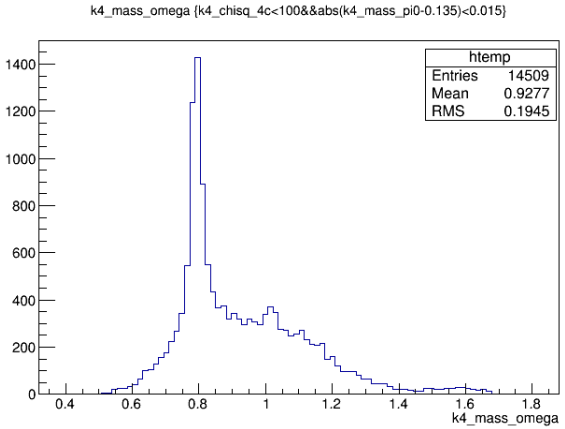


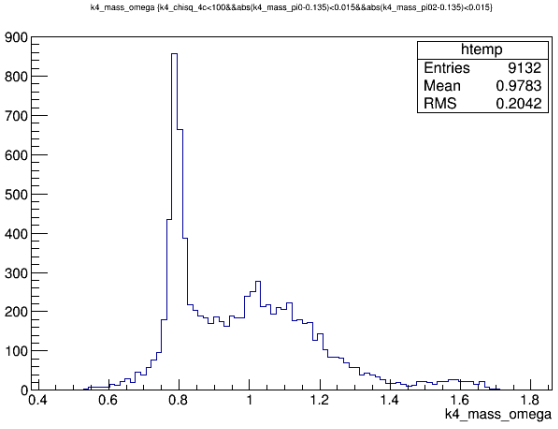
Mass distribution

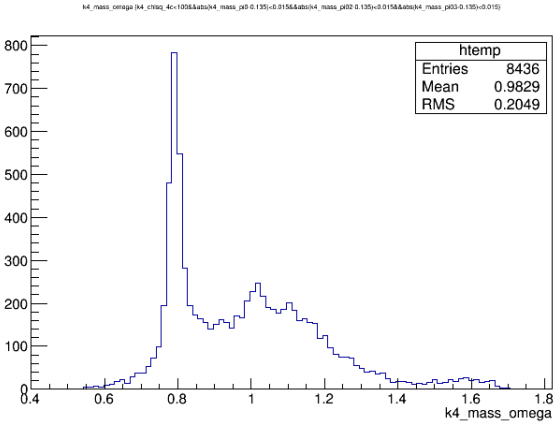
[Real Data]

1. $\chi^2 < 100$
2. |mp0-0.135|<0.015 GeV
3. |mp02-0.135|<0.015 GeV
4. |mp03-0.135|<0.015 GeV







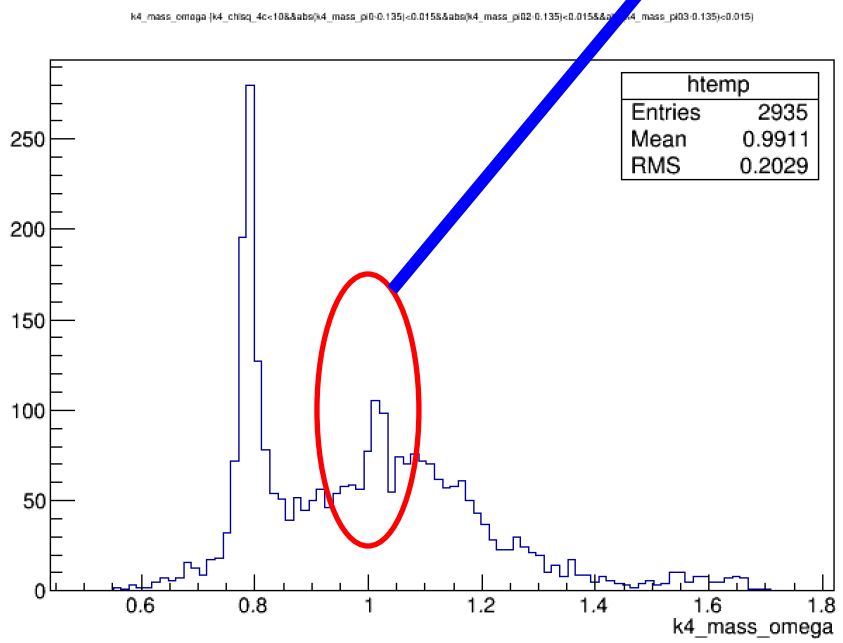


Mass distribution

[Real Data]

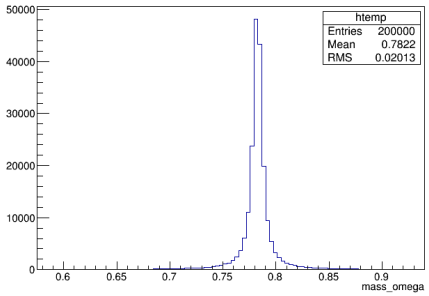
1. $\chi^2 < 10$
2. |mp0-0.135|<0.015 GeV
3. |mp02-0.135|<0.015 GeV
4. |mp03-0.135|<0.015 GeV

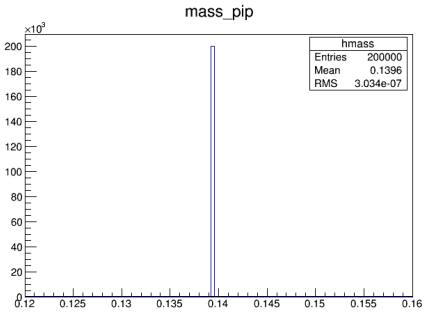
$$\phi \rightarrow \pi^+\pi^-\pi^0$$

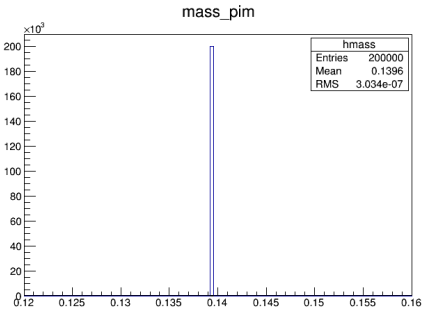


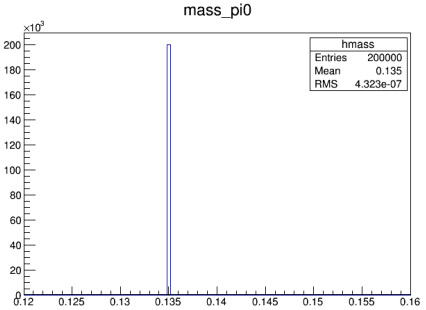
Backup

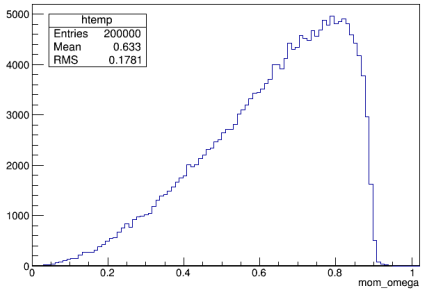
MC Truth

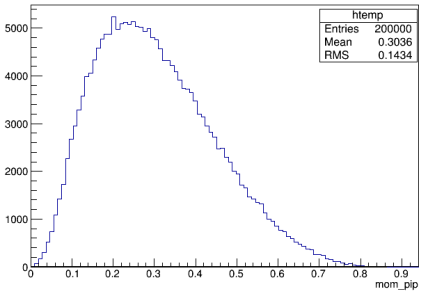

htemp
Entries 200000
Mean 0.7822
RMS 0.02013
mass_omega

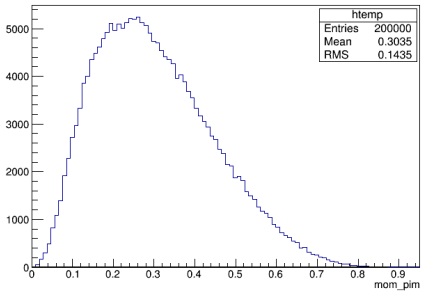

mass_pip
hmass
Entries 200000
Mean 0.1396
RMS 3.034e-07

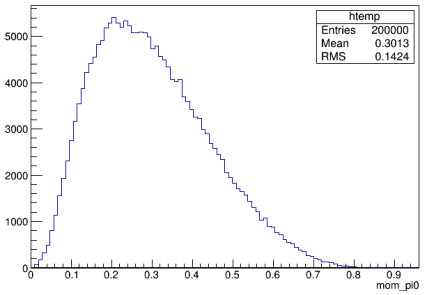

mass_pim
hmass
Entries 200000
Mean 0.1396
RMS 3.034e-07


mass_pi0
hmass
Entries 200000
Mean 0.135
RMS 4.323e-07

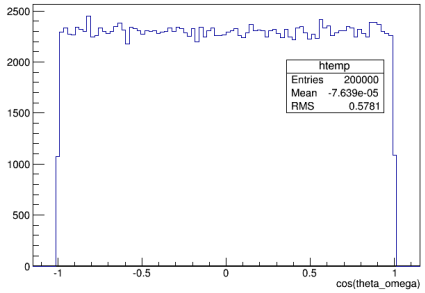

htemp
Entries 200000
Mean 0.633
RMS 0.1781
mom_omega


htemp
Entries 200000
Mean 0.3036
RMS 0.1434
mom_pip


htemp
Entries 200000
Mean 0.3035
RMS 0.1435
mom_pim


htemp
Entries 200000
Mean 0.3013
RMS 0.1424
mom_pi0

MC Truth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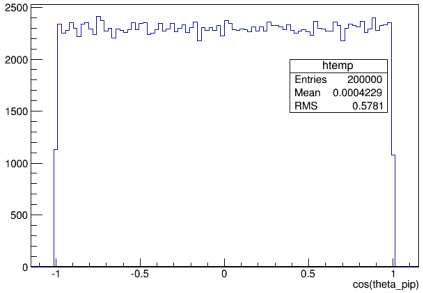
Entries 200000
Mean -7.639e-05
RMS 0.5781
cos(theta_omega)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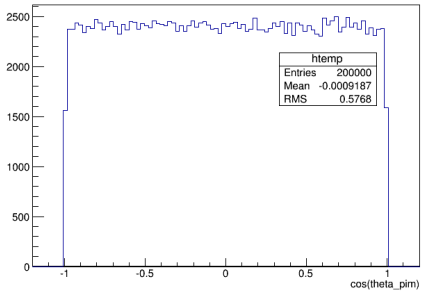
RMS 0.5781
cos(theta_pip)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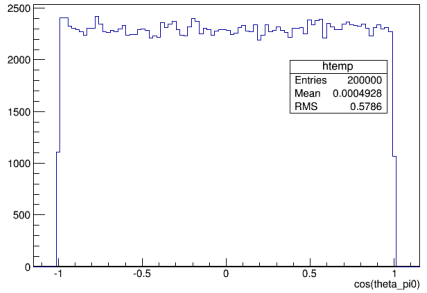
Mean -0.0009187
RMS 0.5768
cos(theta_pim)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RMS 0.5786
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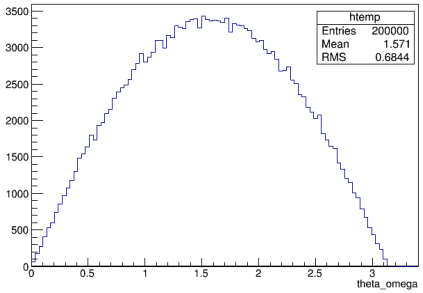
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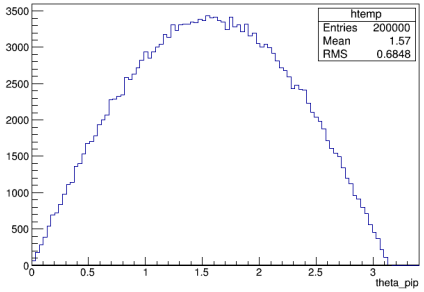
Mean 1.571
RMS 0.6844
theta_omega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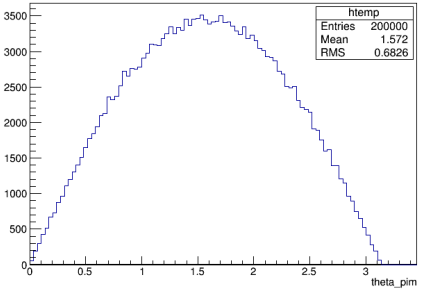
Mean 1.57
RMS 0.6848
theta_pip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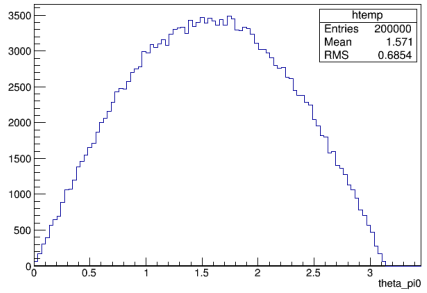
Mean 1.572
RMS 0.6826
theta_pim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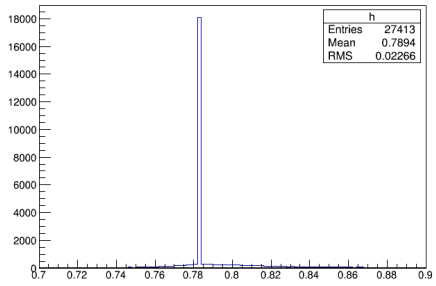
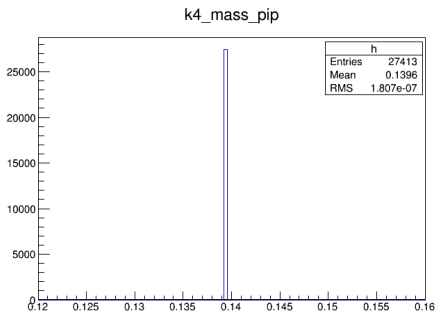
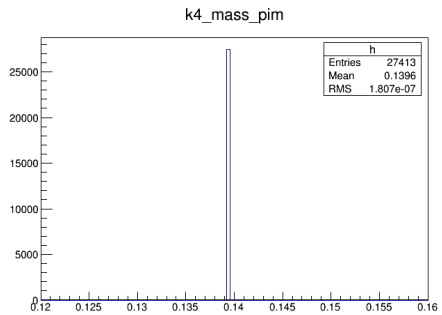
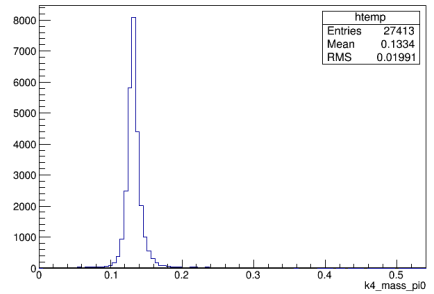
RMS 0.6854
theta_pi0

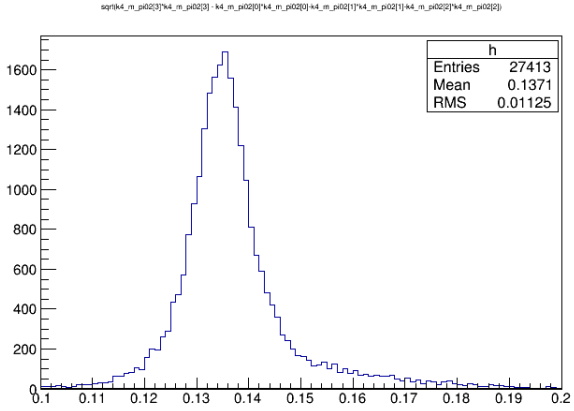
After event selections

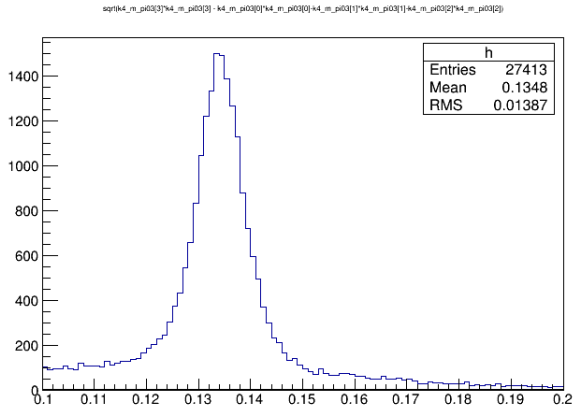












After event selections