

Observation of $J/\psi \rightarrow \Xi^0 \bar{\Xi}^0$

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Data sets and MC simulation

1. BOSS664p01.

2. J/ψ data sets: (2009 and 2012)

➤ /besfs2/offline/data/664-1/jpsi/dst

time	run	data
2009	9947 --- 10878	090612--- 090728
2012	27255 --- 28236	120410 --- 120522

3. **100K** Signal MC by “KKMC” at 3.096 GeV.

Event selection

- **Good Charged Track:**

$N_{\text{Good}} == 4$ and $N_{\text{Charge}} = 0$;

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

Pion: $\text{prob}_{\pi} > \text{prob}_K \ \&\& \ \text{prob}_{\pi} > \text{prob}_p$;

$N(\pi^+) = N(\pi^-) = 1$;

Kaon: $\text{prob}_p > \text{prob}_K \ \&\& \ \text{prob}_p > \text{prob}_{\pi}$;

$N(p) = N(\bar{p}) = 1$;

- **Good Photon:**

$E_{\text{barrel}} > 25 \text{ MeV}$; $E_{\text{endcap}} > 50 \text{ MeV}$; $0 \leq \text{Time} \leq 14$;

$N_{\gamma} \geq 4$.

- **Vertex fit ($p\pi^- \bar{p}\pi^+$) and Second vertex fit**

- **4C kinematic fit ($p\bar{p}\pi^+\pi^- \gamma \gamma \gamma \gamma$):**

Decay Model

✓ $J/\psi \rightarrow \Xi^0 \bar{\Xi}^0 \rightarrow \Lambda^0 \pi^0 \bar{\Lambda}^0 \pi^0 \rightarrow p \pi^- \bar{p} \pi^+ \gamma \gamma \gamma \gamma$

- $\Xi^0 \rightarrow \Lambda^0 \pi^0$
- $\bar{\Xi}^0 \rightarrow \bar{\Lambda}^0 \pi^0$
- $\Lambda^0 \rightarrow p \pi^-$
- $\bar{\Lambda}^0 \rightarrow \bar{p} \pi^+$
- $\pi^0 \rightarrow \gamma \gamma$

```

Decay J/psi
1.0   Xi0 anti-Xi0 J2BB1;
Enddecay

Decay Xi0
1.0000   Lambda0   pi0           PHSP;
Enddecay

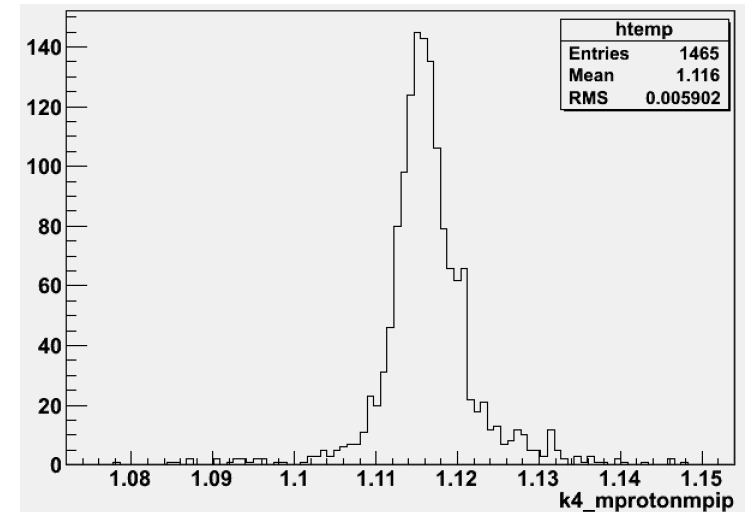
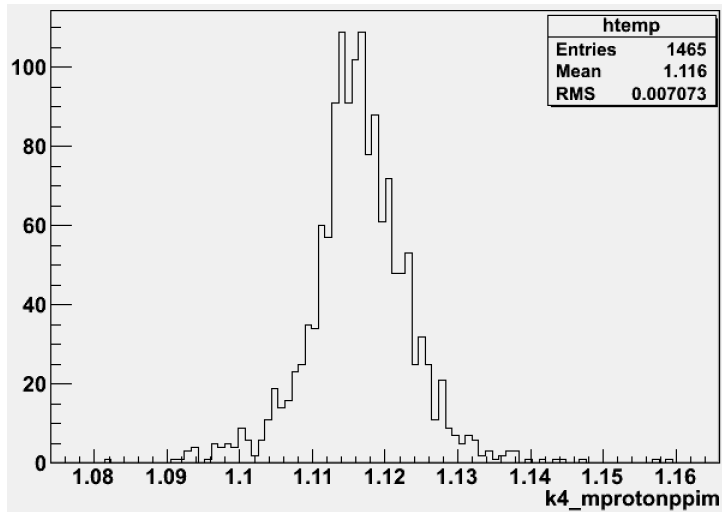
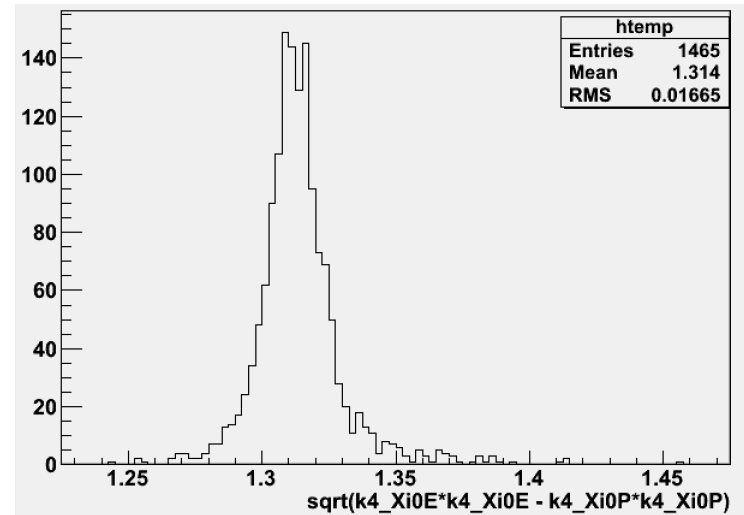
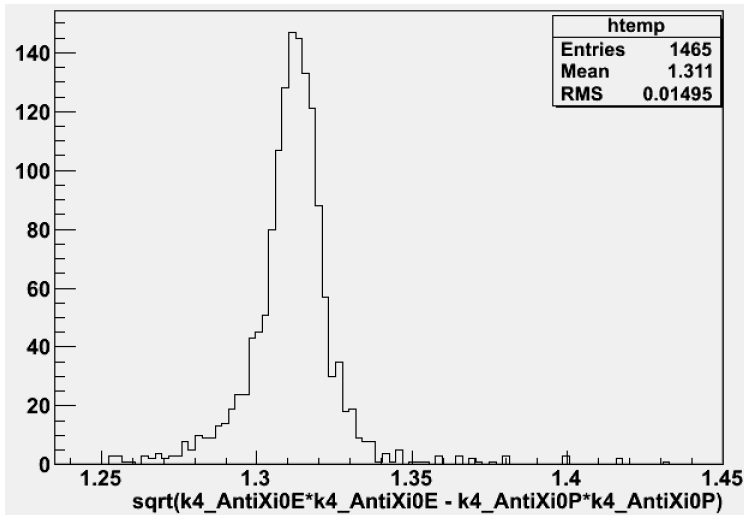
Decay anti-Xi0
1.0000   anti-Lambda0 pi0       PHSP;
Enddecay

Decay Lambda0
1.0   p+           pi-           PHSP;
Enddecay

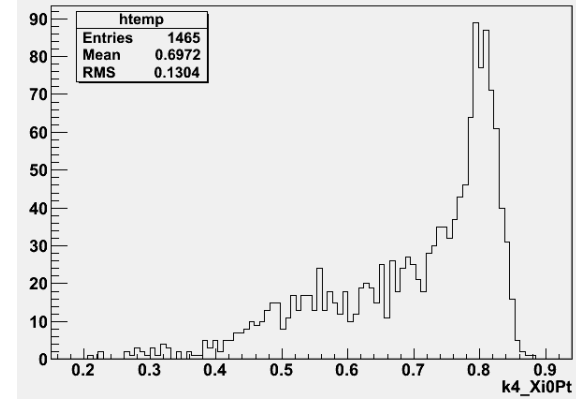
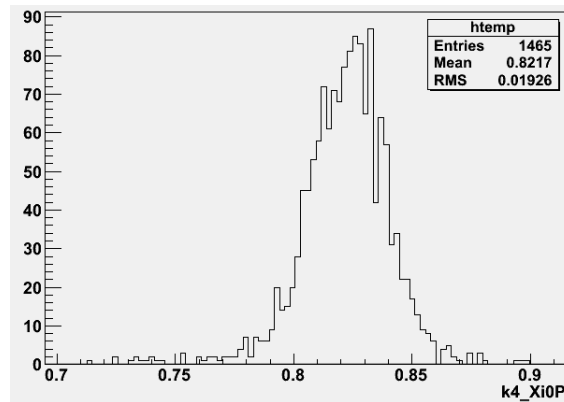
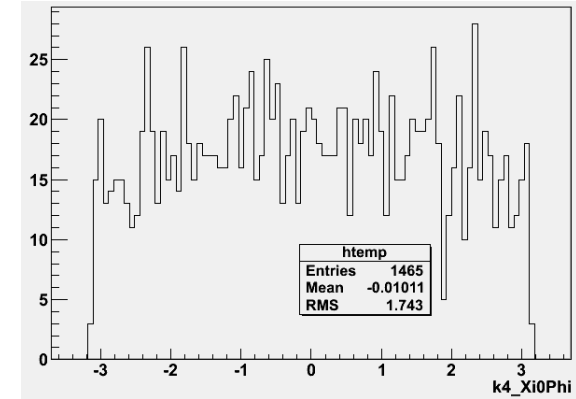
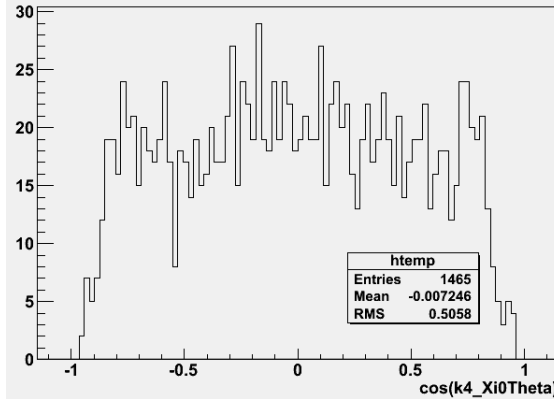
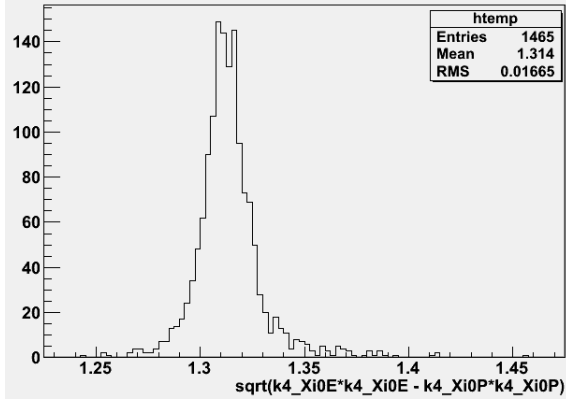
Decay anti-Lambda0
1.0   anti-p-     pi+           PHSP;
Enddecay

End
    
```

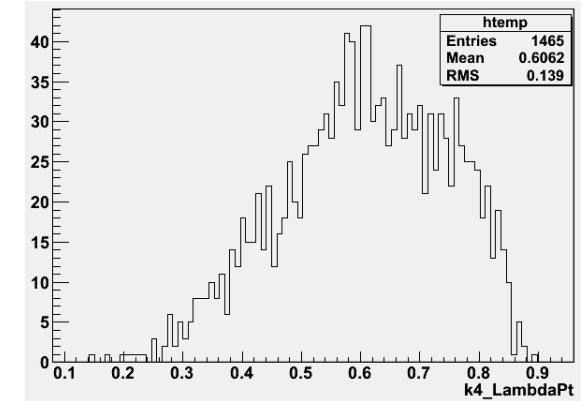
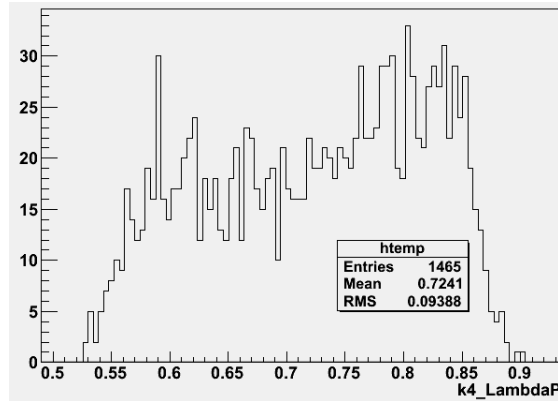
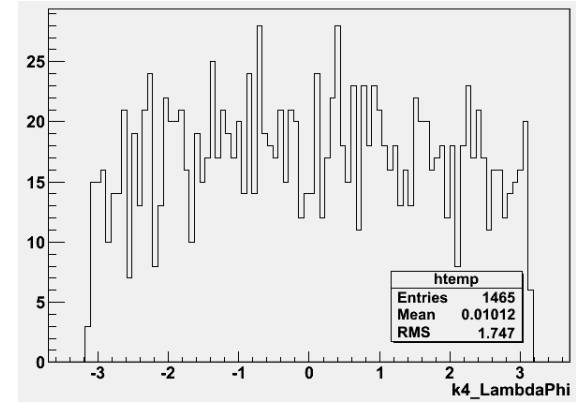
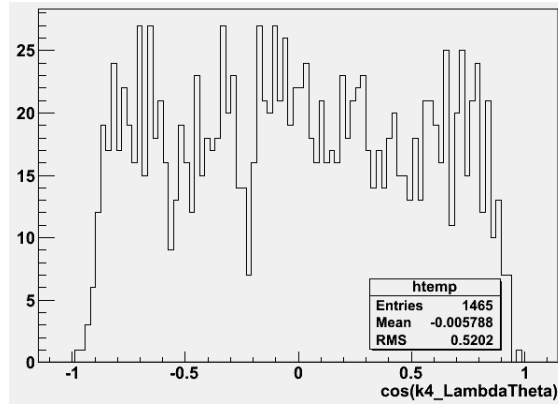
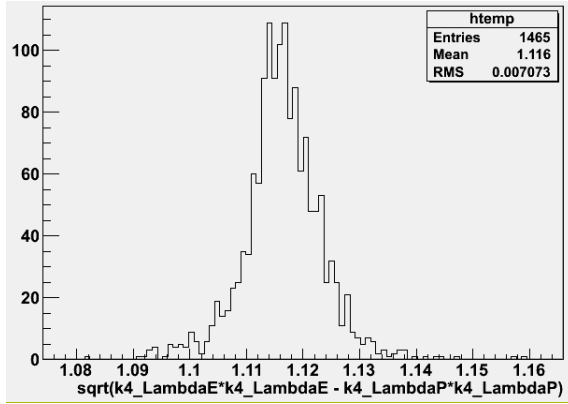
Invariant-Mass distribution



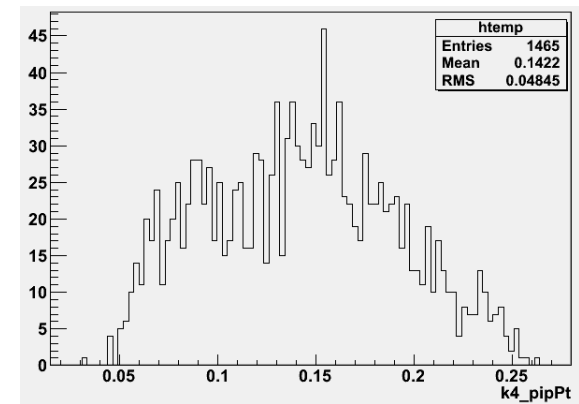
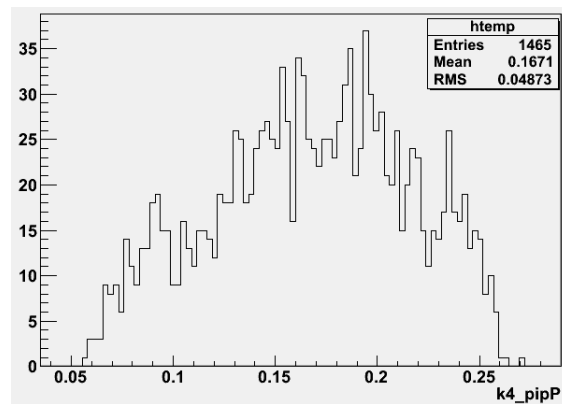
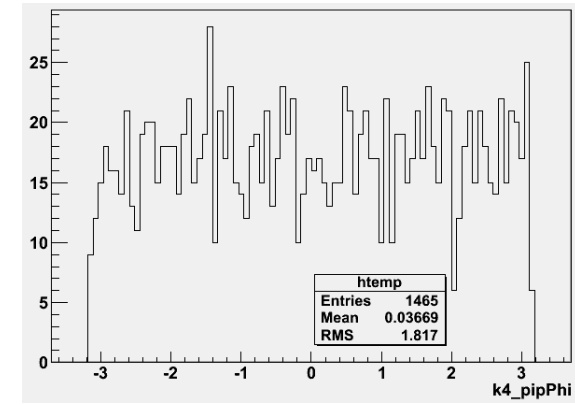
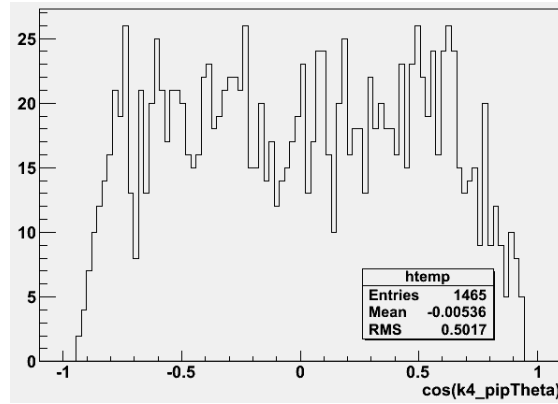
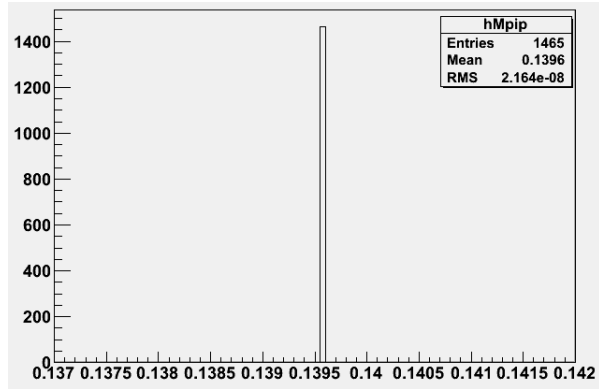
Distribution of Xi0



Distribution of Lambda



Distribution of pi+



Branching fraction

$$\checkmark J/\psi \rightarrow \Xi^0 \bar{\Xi}^0 \rightarrow \Lambda^0 \pi^0 \bar{\Lambda}^0 \pi^0 \rightarrow p \pi^- \bar{p} \pi^+ \gamma \gamma \gamma \gamma$$

$$\bullet \Xi^0 \rightarrow \Lambda^0 \pi^0 \quad \mathcal{B}r = 0.99524$$

$$\bullet \bar{\Xi}^0 \rightarrow \bar{\Lambda}^0 \pi^0 \quad \mathcal{B}r = 0.99524$$

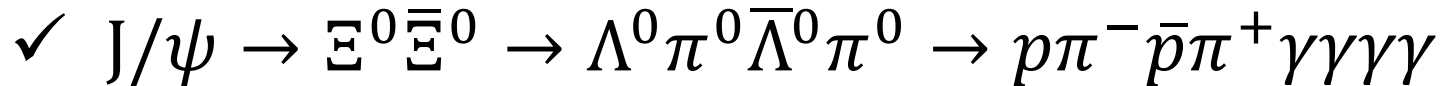
$$\bullet \Lambda^0 \rightarrow p \pi^- \quad \mathcal{B}r = 0.639$$

$$\bullet \bar{\Lambda}^0 \rightarrow \bar{p} \pi^+ \quad \mathcal{B}r = 0.639$$

$$\bullet \pi^0 \rightarrow \gamma \gamma \quad \mathcal{B}r = 0.988$$

$$\mathcal{B}r(\text{total}) = 1.2 \times 10^{-3} \times 0.99524^2 \times 0.639^2 \times 0.988^2 = 4.74 \times 10^{-4}$$

Estimation of signal event



$$Br(\text{total}) = 1.2 \times 10^{-3} \times 0.99524^2 \times 0.693^2 \times 0.988^2 = 4.74 \times 10^{-4}$$

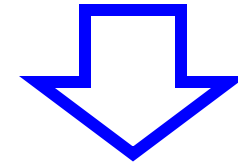
➤ *1.3 Billion*

$$N^{Obs} = \begin{cases} \epsilon = 1\% \rightarrow 6162 \\ \epsilon = 4\% \rightarrow 24648 \end{cases}$$

➤ *10 Billion*

$$N^{Obs} = \begin{cases} \epsilon = 1\% \rightarrow 47385 \\ \epsilon = 4\% \rightarrow 189543 \end{cases}$$

```
*****
Total Number:      10000
Good Track Sel.:   5214
Good Photon Sel.:  4476
PID:               2531
2pi0:              626
6C Fit:            138
*****
```



$\epsilon \sim 1.4\%$

Backup

Path or Dir

✓ Set environment into boss.6.6.4.p01

- Ssh -Y sunyk@lxslc701.ihep.ac.cn
- Lxs5
- Tcsh

✓ Path of Real data

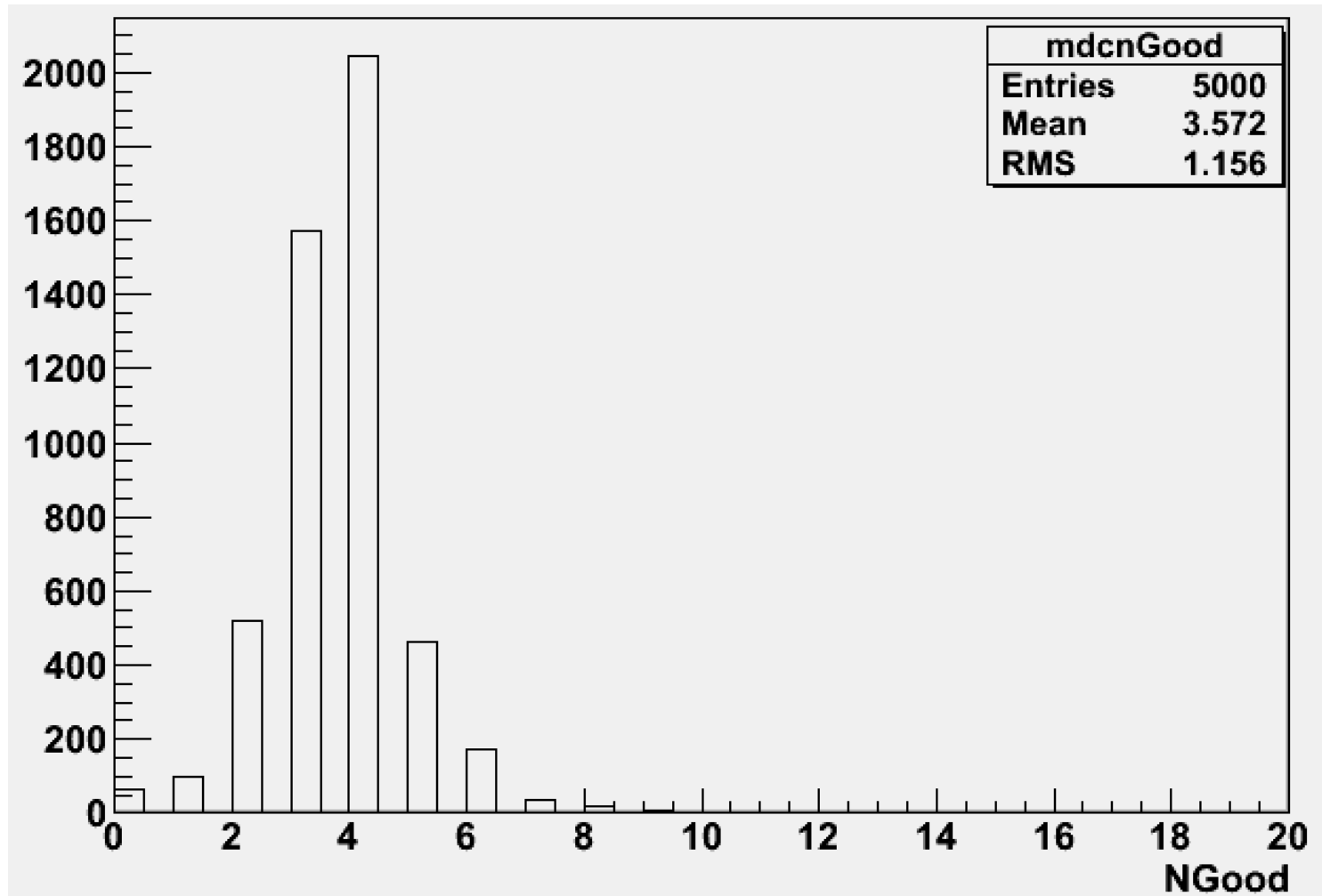
- /bes3fs/offline/data/raw/round02
- /bes3fs/offline/data/raw/round05

➤ Inclusive MC of Jpsi

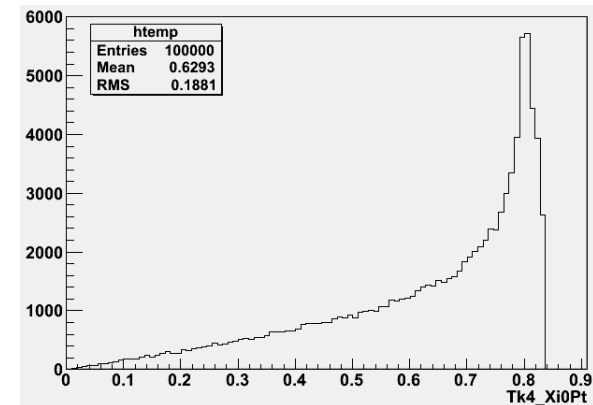
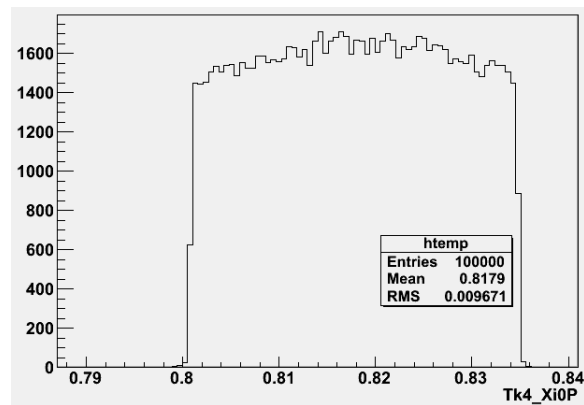
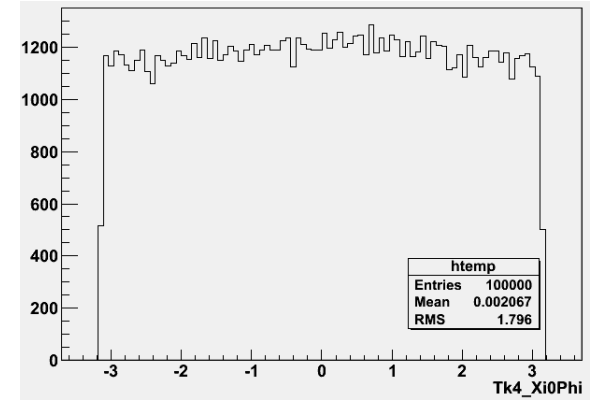
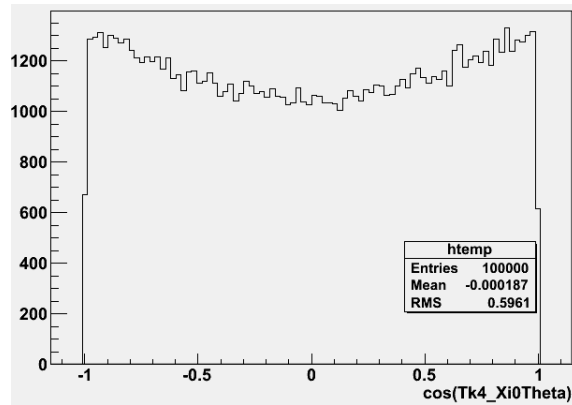
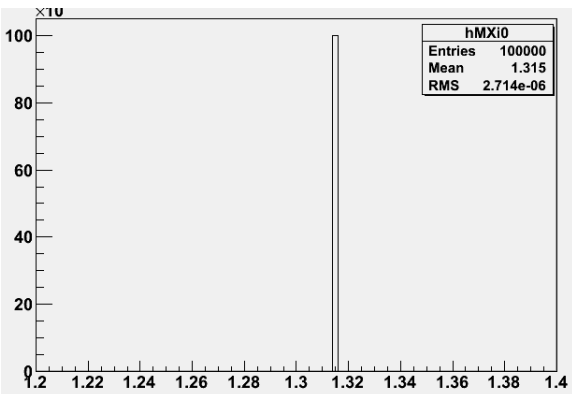
Path or Dir

- MC dst
/scratchfs/bes/sunyk/boss.664.p01/KKMC/JpsiXi0AntiXi0/Test/result
- Analysis code
- Run dst into root
/scratchfs/bes/sunyk/boss.664.p01/Physics/JpsiXi0AntiXi0/MCData/run
- Roof file>>
/scratchfs/bes/sunyk/boss.664.p01/Physics/JpsiXi0AntiXi0/MCData/root

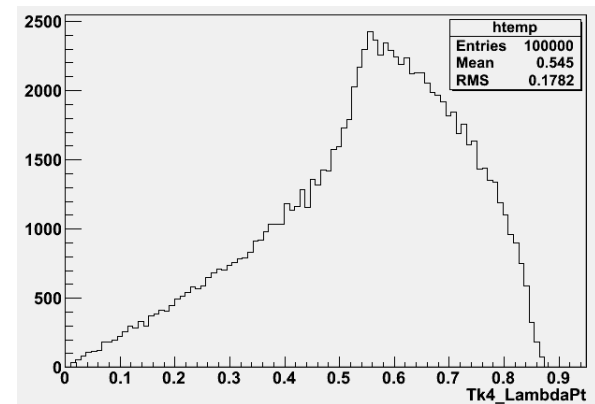
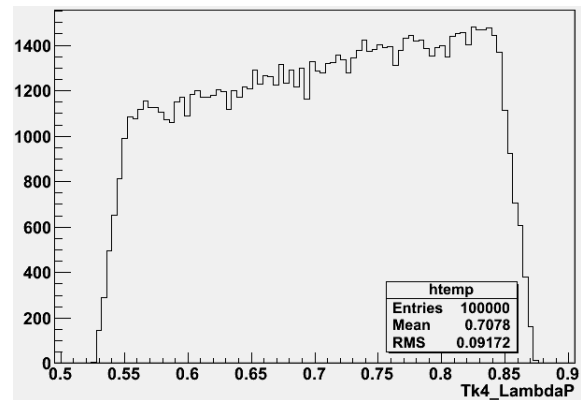
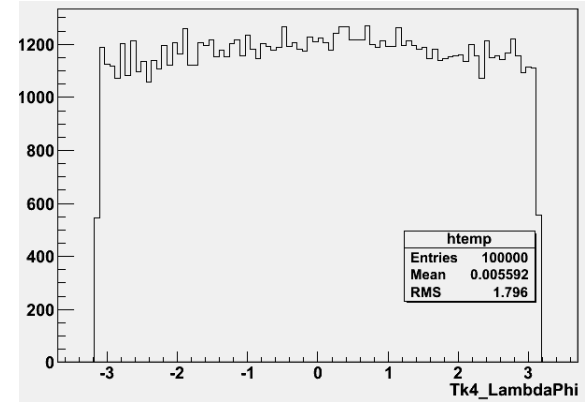
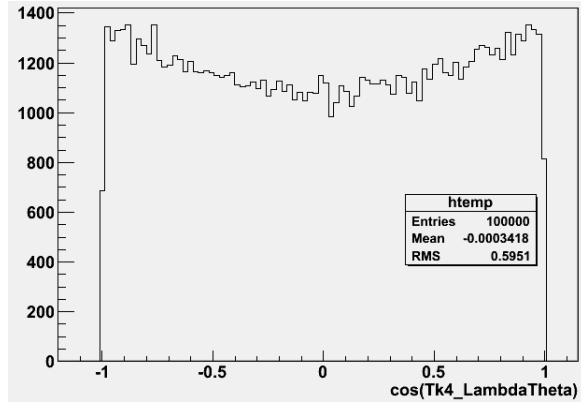
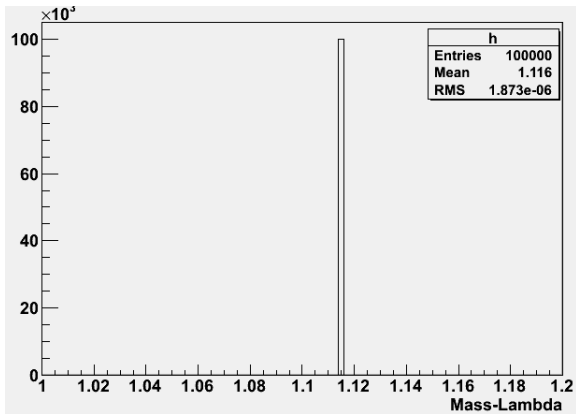
MC Truth



MC Truth of Ξ^0



MC Truth of Λ



MC Truth of pi+

