Recent results on the full simulation of charmonium-like decays

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Outline

1. Motivation.

2. The PANDA detector.

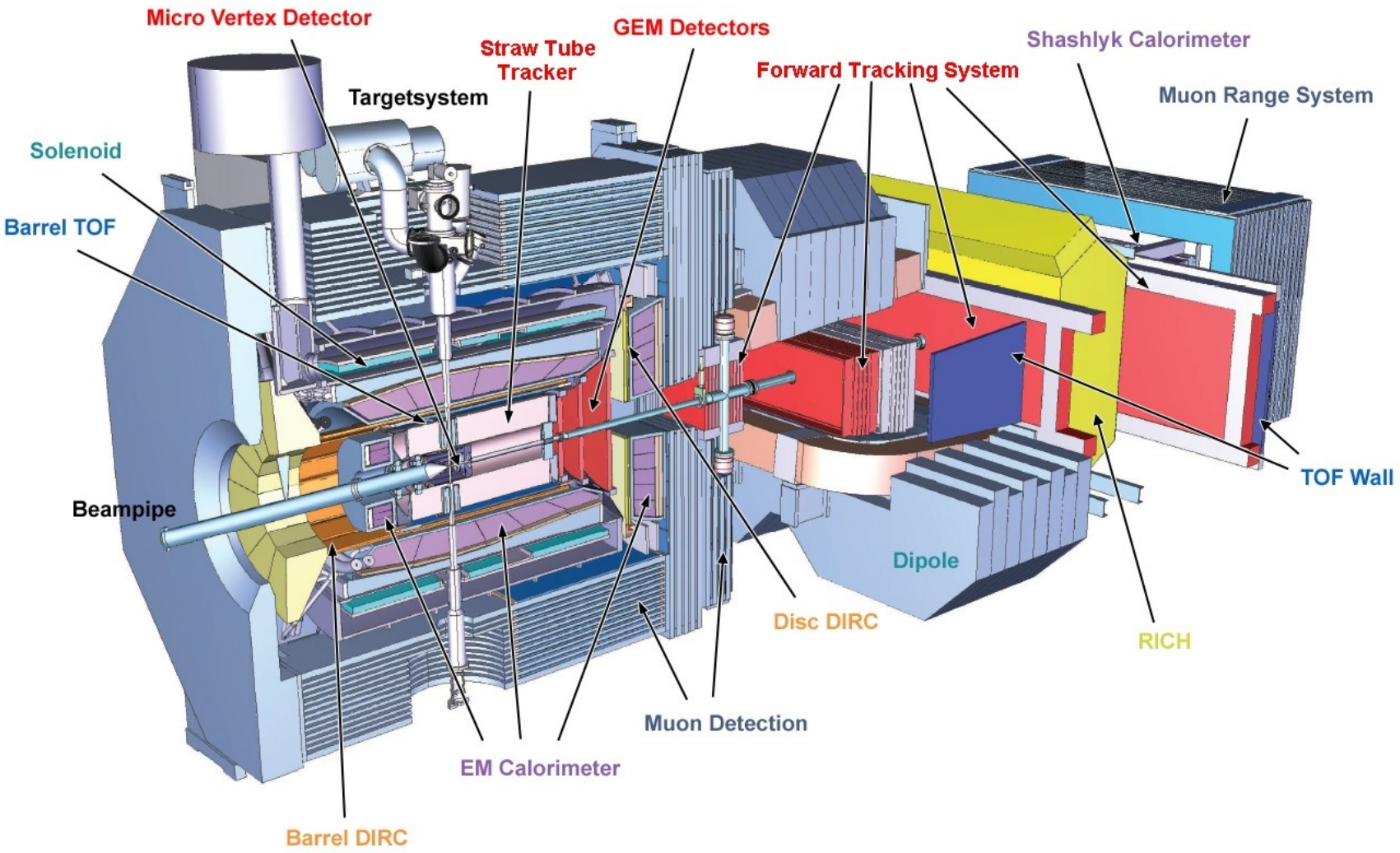
3. Performance evaluation for some benchmark channels.

4. Summary.

Motivation

To evaluate PandaRoot current status of particle reconstruction and identification for the full simulation of charmonium-like object decays.

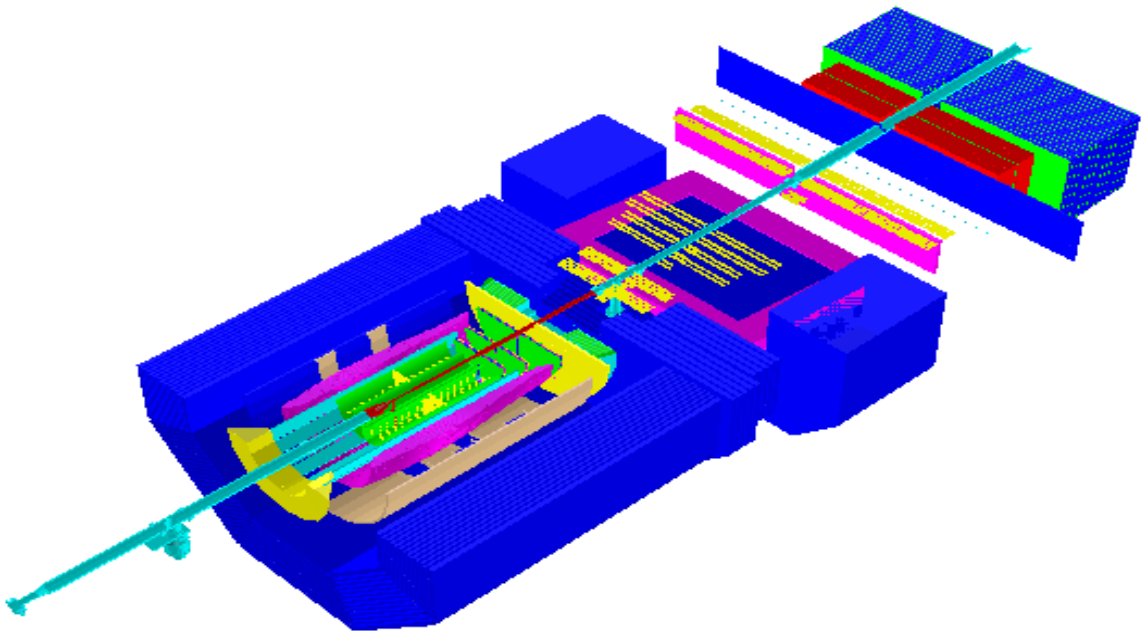
The PANDA detector – full view



Software

1. *PandaRoot (recent trunk version in comparison with mar15 Release)*
2. *EvtGen generator*
3. *Rho analysis package*

The PANDA detector – MC view



Y(4260) → J/ψ π+π- analysis

ppbar → Y(4260) → J/ψ π+π-

X-section = 1012 pb (→ e+e-π+π- 60 pb from PANDA Physics Book)

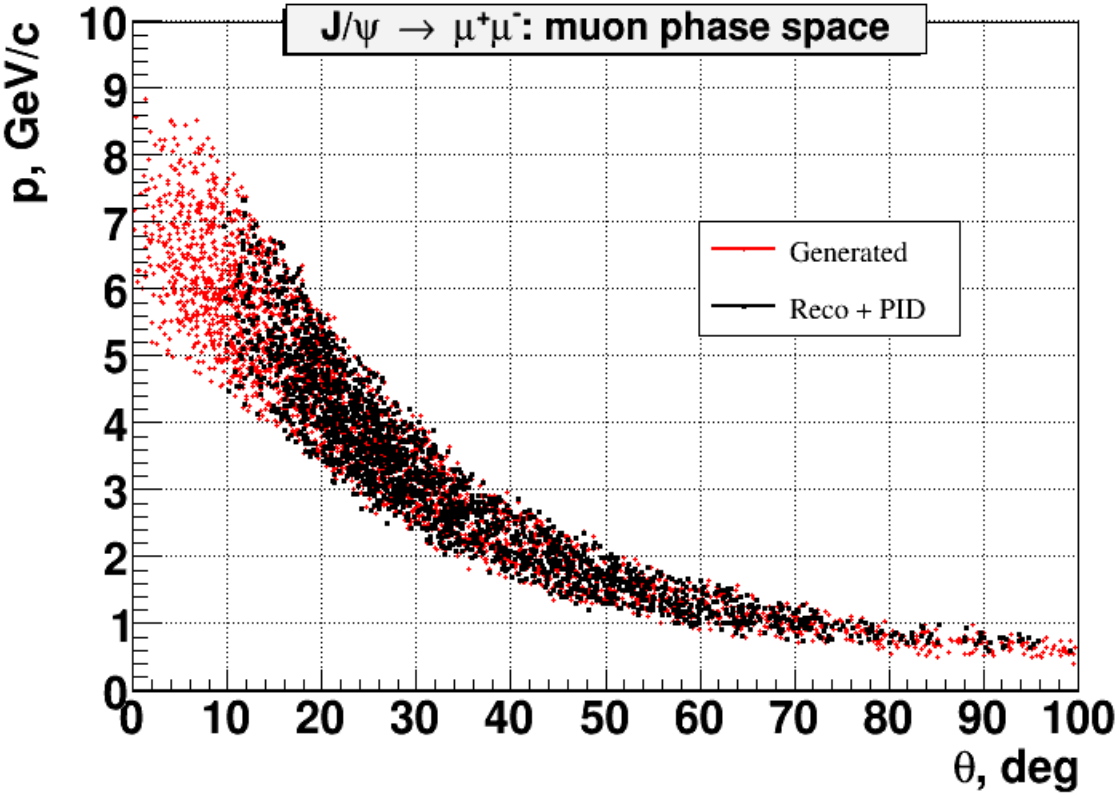
30k events EvtGen:
2 days for High-Luminosity mode ($2 \cdot 10^{32}$ $cm^{-2}s^{-1}$)
20 days for High-Resolution mode ($2 \cdot 10^{31}$ $cm^{-2}s^{-1}$)

J/ψ → e+e- (Electron ID ("ElectronLoose","PidAlgoEmcBayes"))
J/ψ → μ+μ- (Muon ID ("MuonTight","PidAlgoMdtHardCuts"))
Pion ID ("PionAll")

J/ψ - vertex constrained fit (prob > 0.01)
Mass constraint 1 GeV

Y(4260) → J/ψ π+π- analysis

J/ψ → μ+μ-: muon phase space



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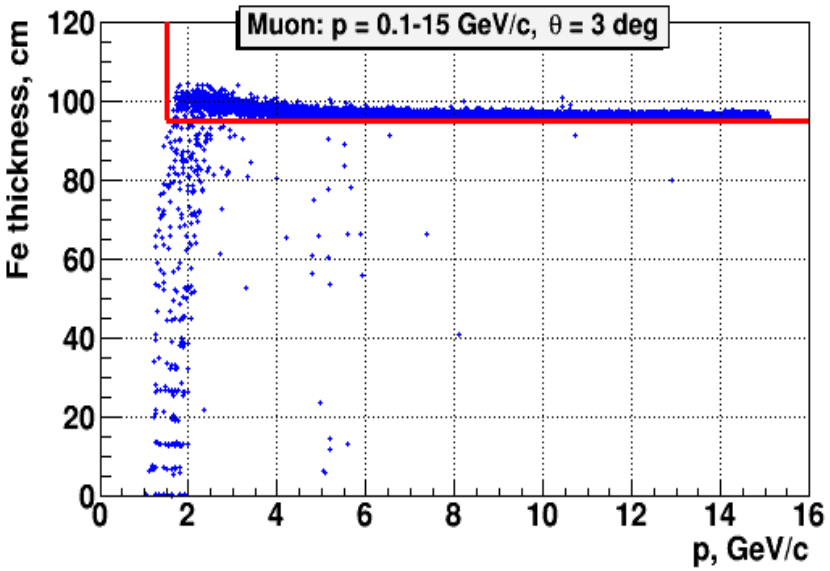
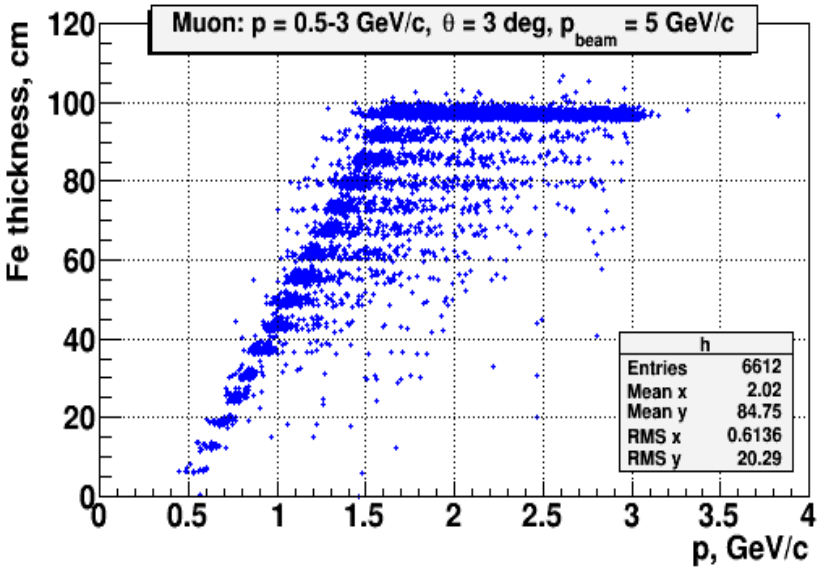
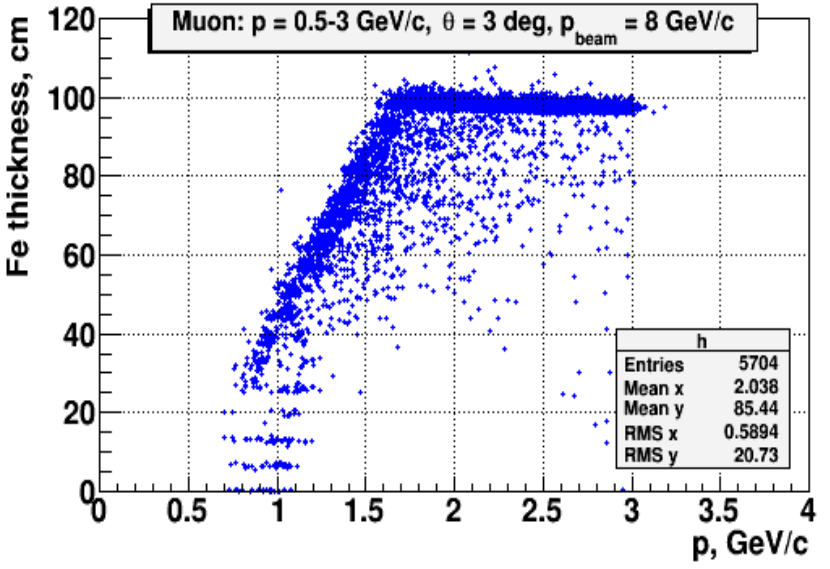
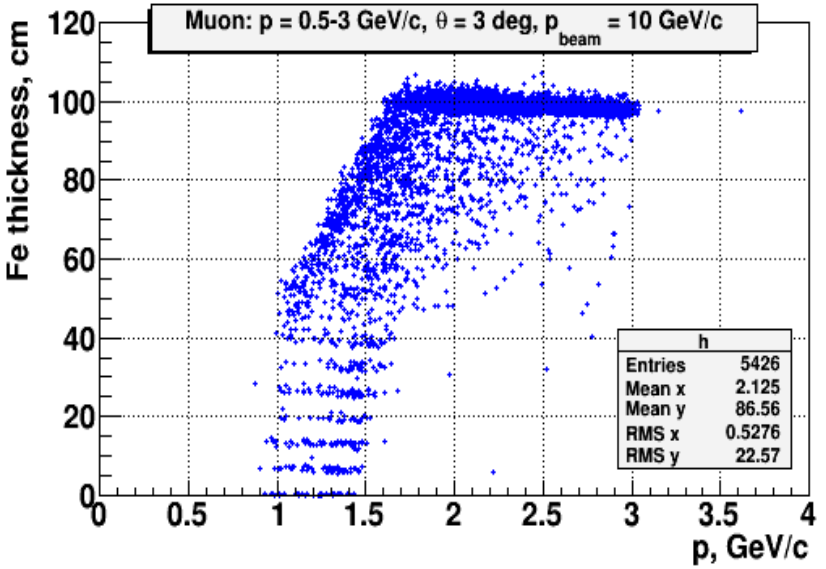
Muon identification: box generator



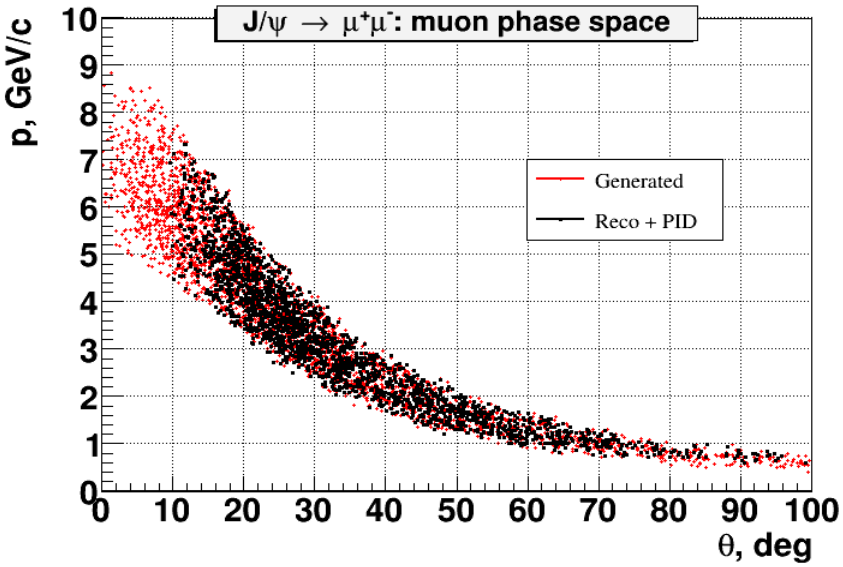






Y(4260) → J/ψ π+π- analysis

J/ψ → μ+μ-: muon phase space



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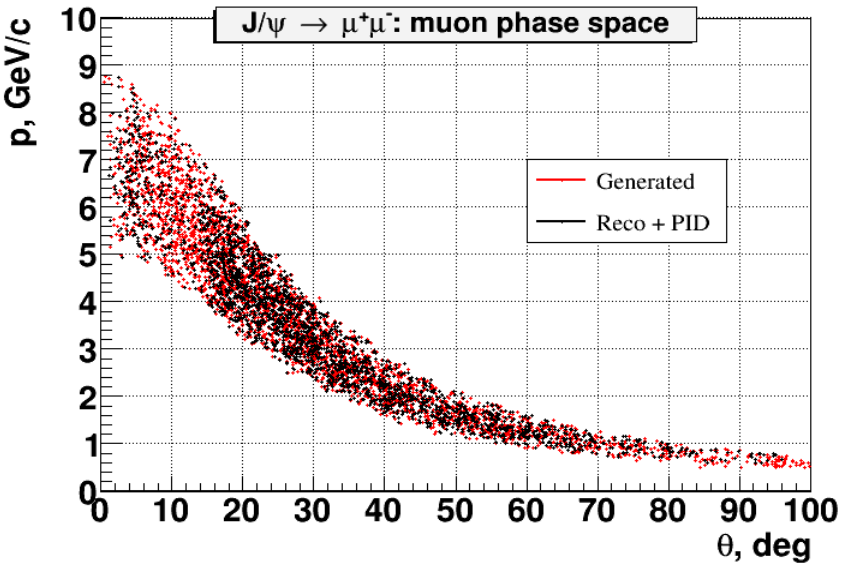
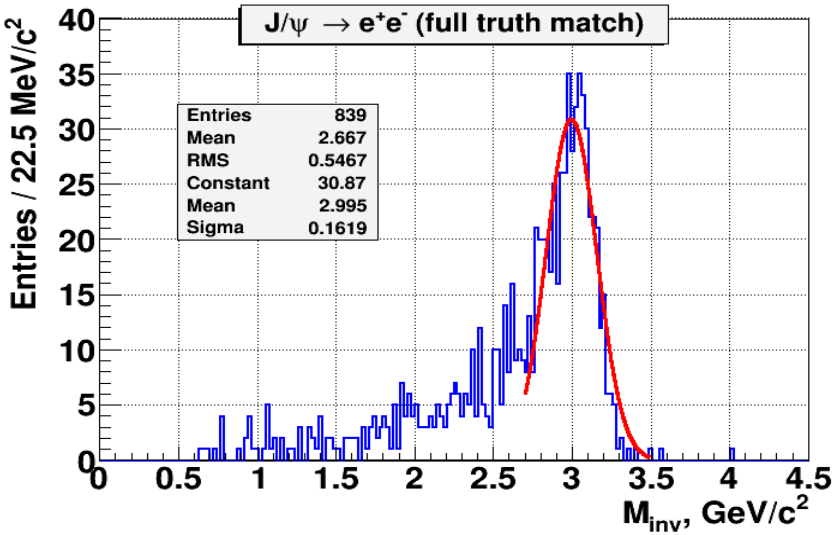
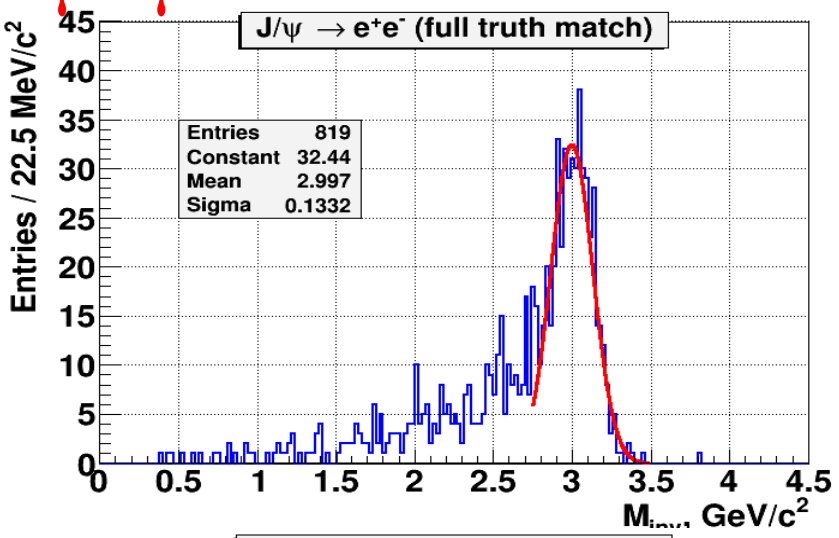


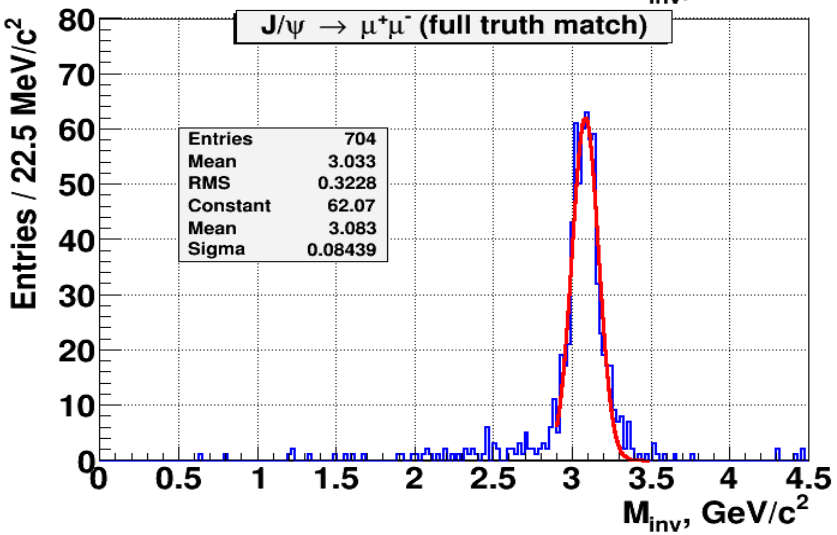
now

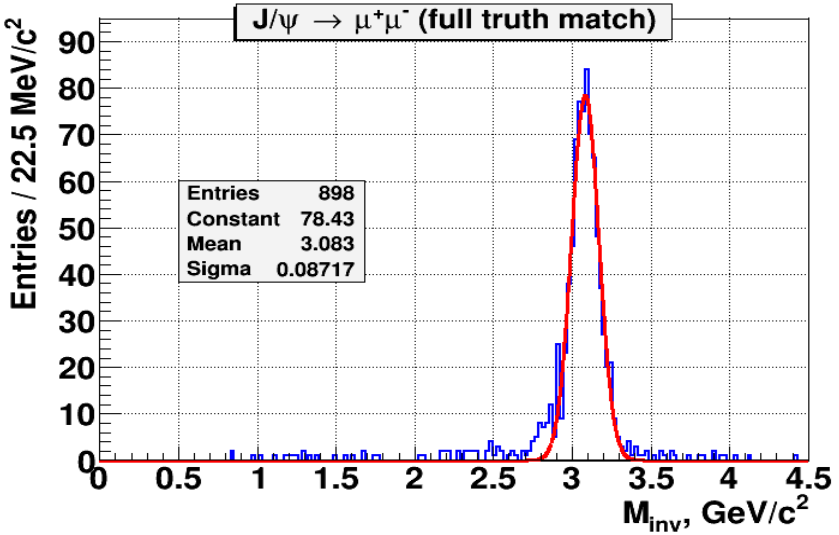
Y(4260) → J/ψ π+π- reco

J/ψ → e+e- and J/ψ → μ+μ- invariant mass









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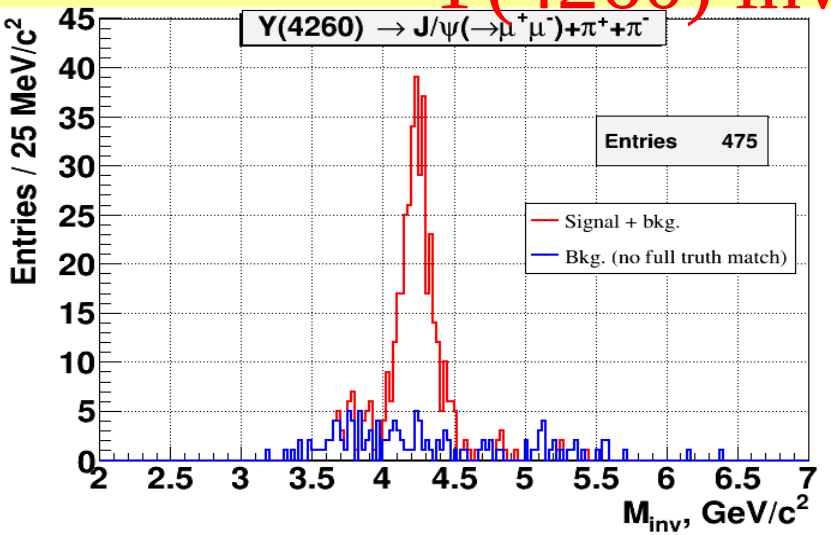
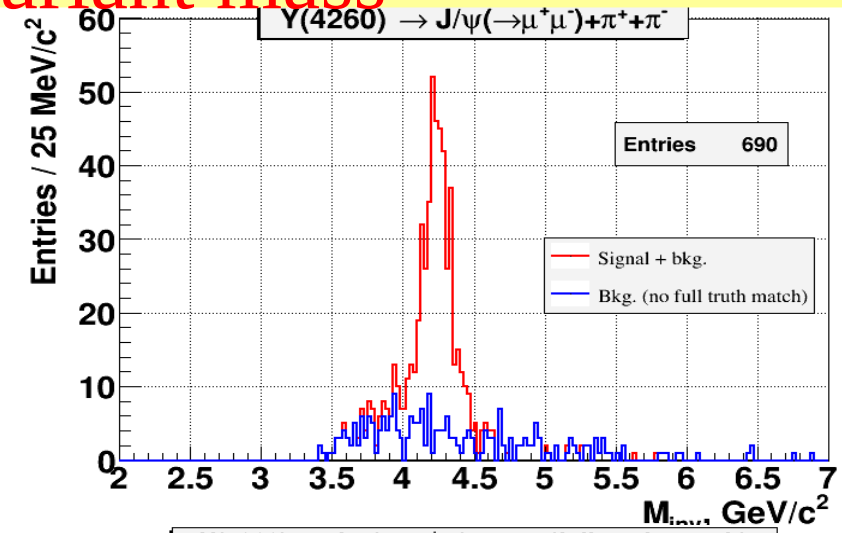
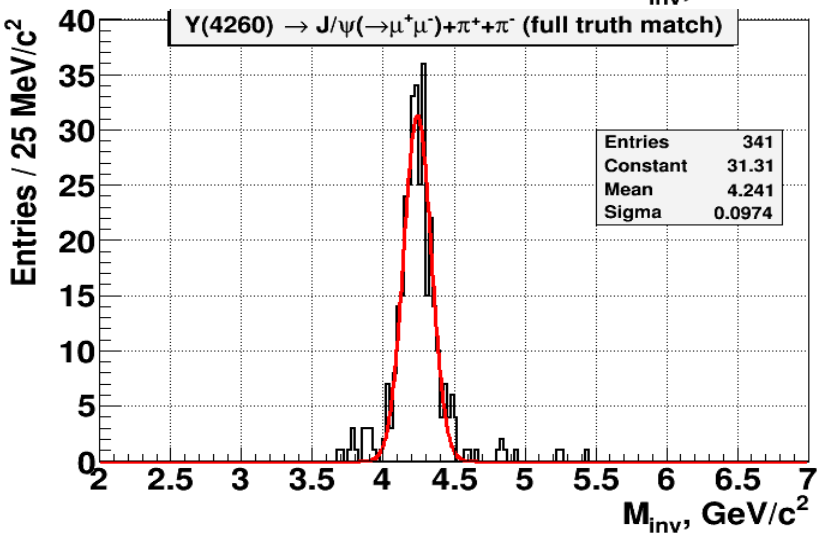
Now

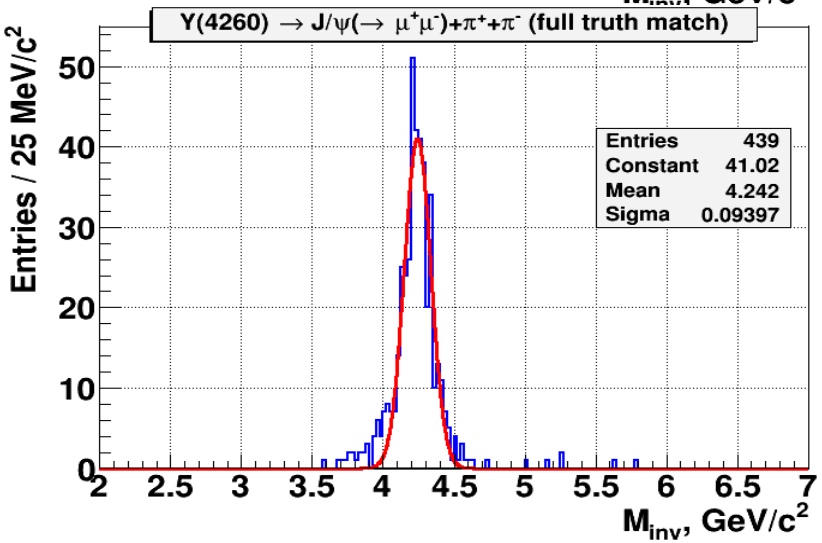
Y(4260) → J/ψ (→μ+μ-) π+π- reco

Y(4260) invariant mass









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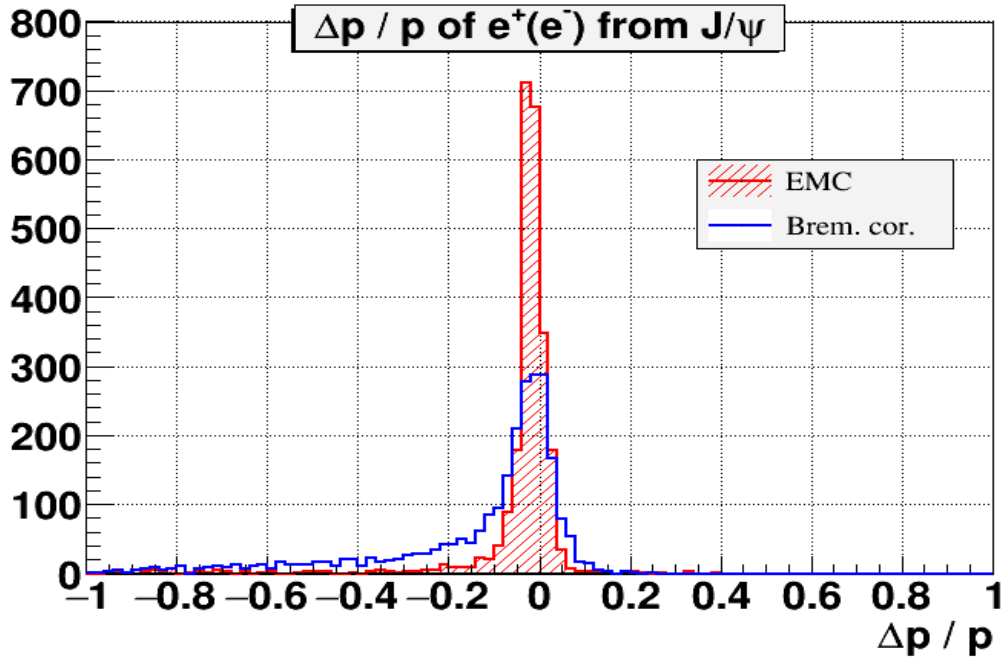
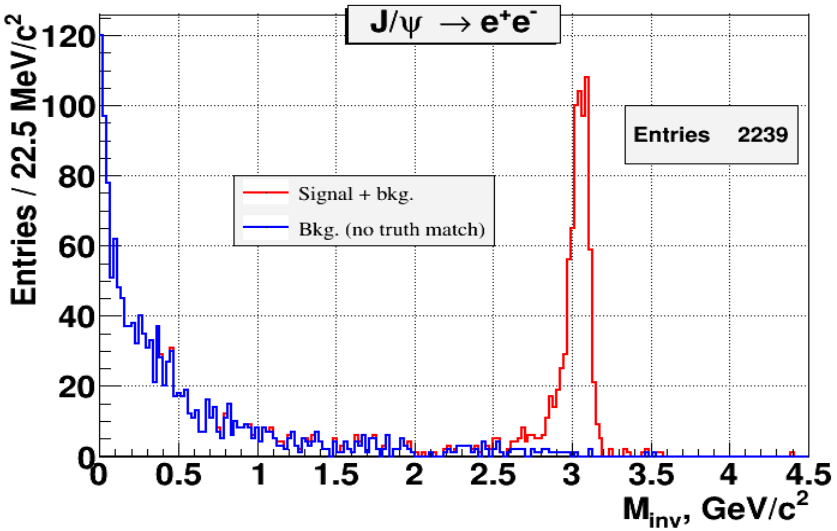
Now: Eff. = 439 / (30000*0.0593) = 24.7%

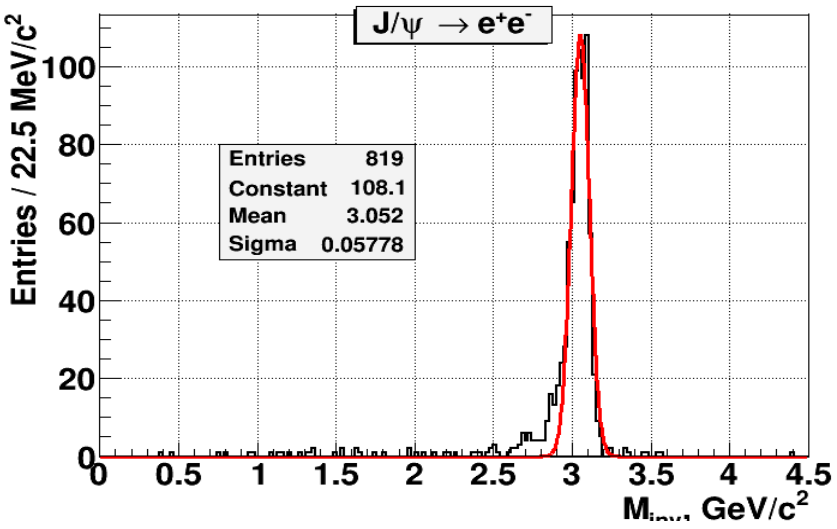
Y(4260) → J/ψ (→e+e-) π+π- reco

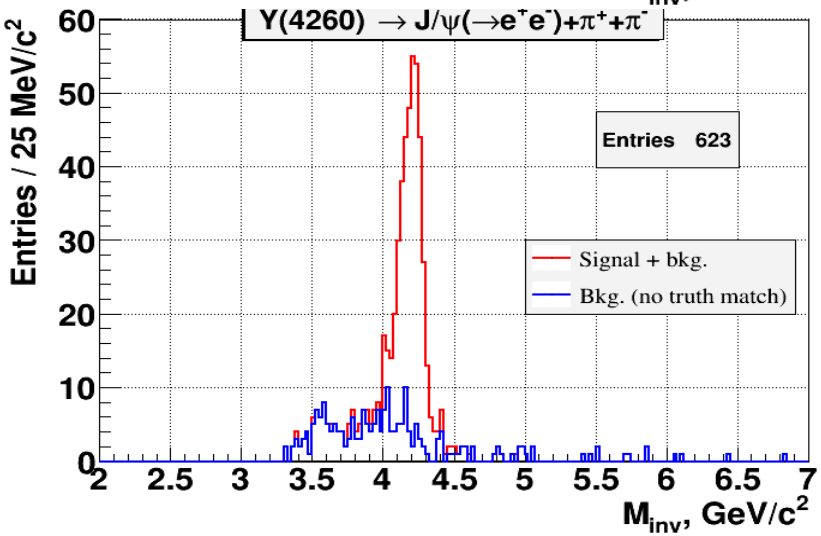
Electron energy

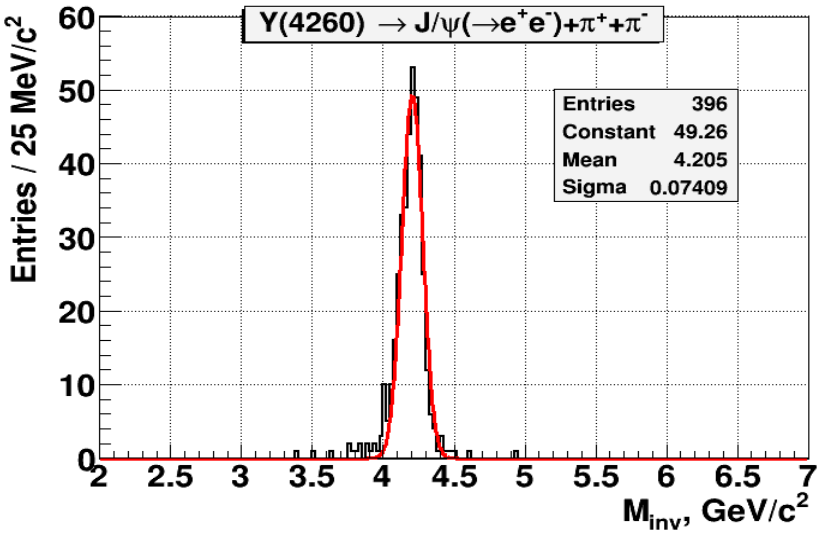


Y(4260) → J/ψ (→e+e-) π+π- reco









Now: Eff. = 396 / (30000*0.0594) = 22.2%

$Y(4260) \to J/\psi\, \pi^0\pi^0$ analysis

ppbar $\to$ Y(4260) $\to$ J/ψ $\pi^0\pi^0$

X-section = 506 pb ($\to$ e+e-4γ 30 pb from PANDA Physics Book)

30k events EvtGen:
4 days for High-Luminosity mode ($2\cdot10^{32}$ $cm^{-2}s^{-1}$)
40 days for High-Resolution mode ($2\cdot10^{31}$ $cm^{-2}s^{-1}$)

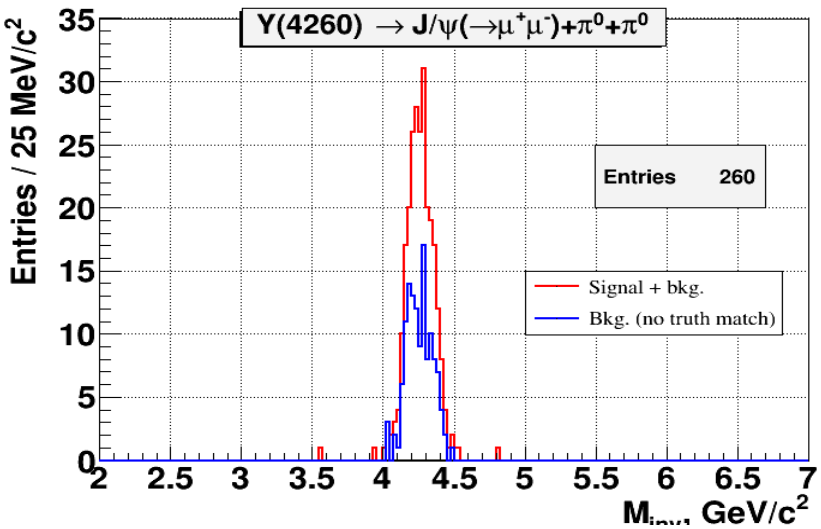
J/ψ $\to$ μ+μ- (Muon ID ("MuonTight","PidAlgoMdtHardCuts"))
J/ψ $\to$ e+e- (Electron ID ("ElectronLoose","PidAlgoEmcBayes"))
J/ψ - vertex constrained fit (prob > 0.01)

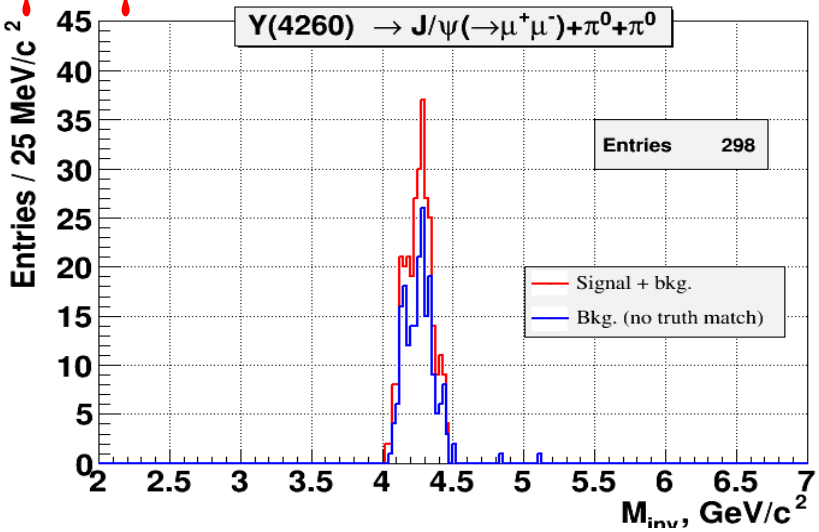
Photon ID (RhoGoodPhotonSelector – criterion "loose")

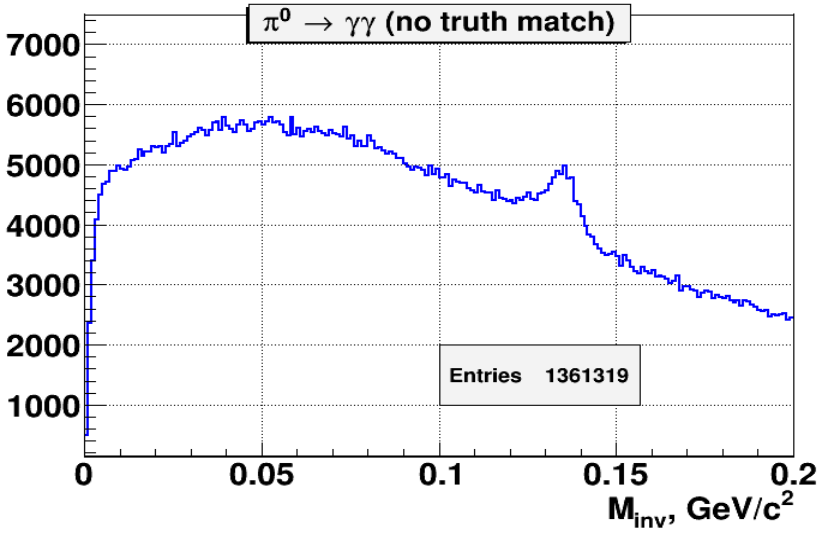
4C-fit of J/ψ $\pi^0\pi^0$ combination (prob > 0.001)
Mass constraint: m(J/ψ) = 3.06-3.14 GeV, m(π^0) = 0.12-0.15 GeV

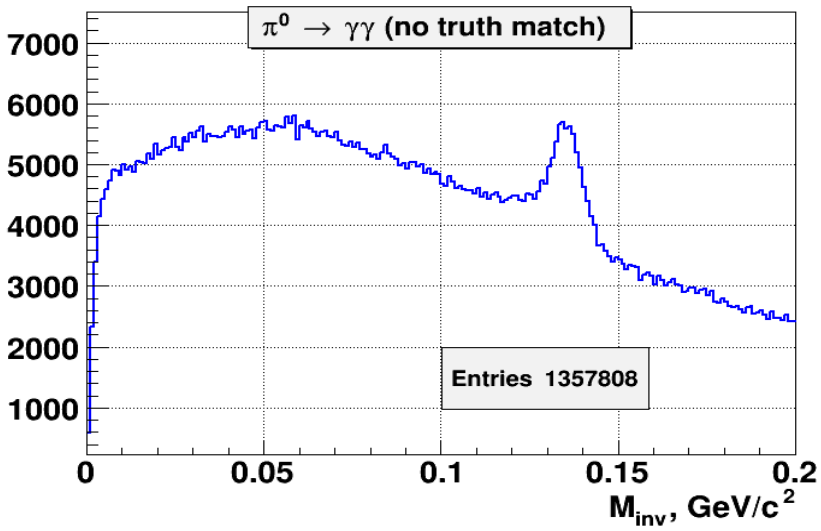
Y(4260) → J/ψ $\pi^0\pi^0$ reco

J/ψ → μ+μ-









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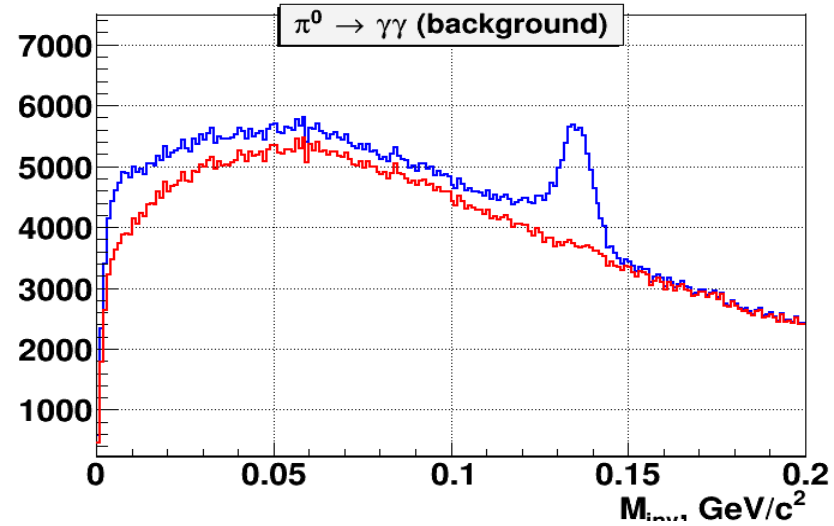
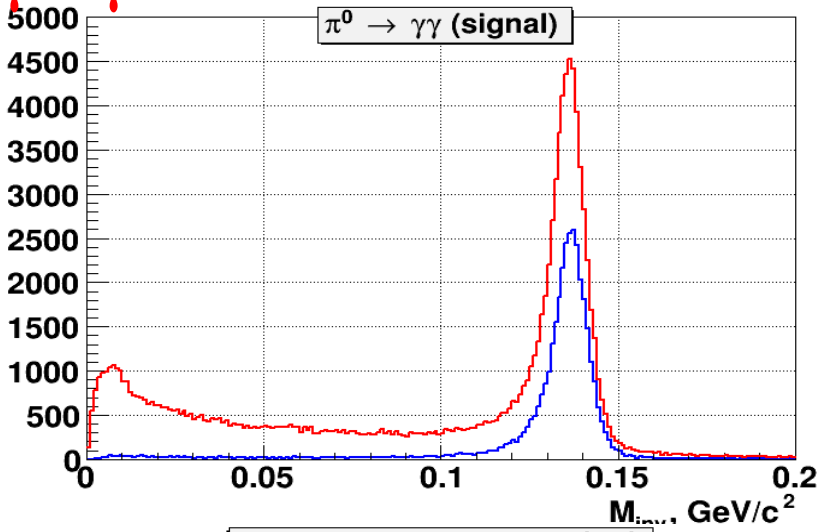
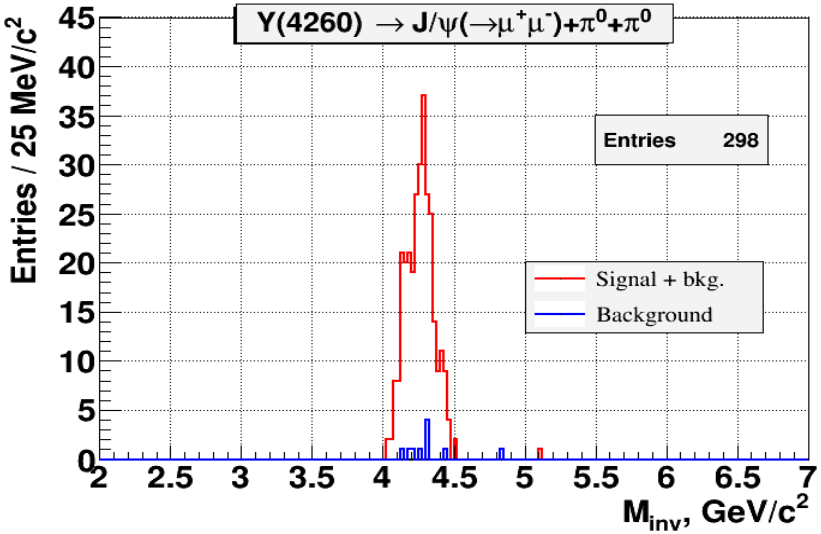
Now

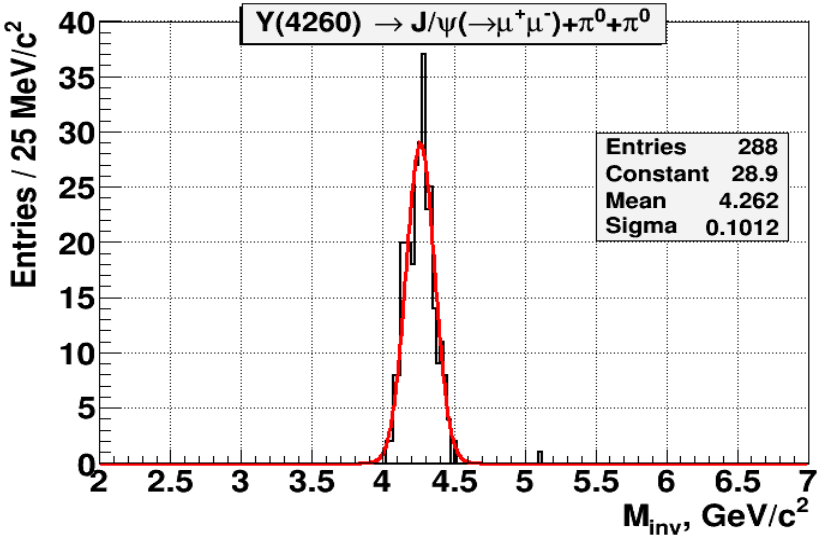
$\Upsilon(4260) \to J/\psi\ \pi^0\pi^0$ reco

$J/\psi \to \mu^+\mu^-$









Eff. = 288 / (30000*0.0593) = 16.2%

Summary

1. Muon coverage has been extended to the small-angle region (Muon Range System) due to muon identification code implementation (first approximation).

2. Electron energy from the bremsstrahlung correction package doesn't look very impressive – the EMC associated cluster energy looks better.

3. “Standard” MC truth association for photons does not work well (not very useful) - needs some “hand crafting”.