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# Status of the $Y(3940) \rightarrow J/\psi \omega$ analysis

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June 01, 2006

# Simulation and reconstruction

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- 12k  $ppbar \rightarrow J/\psi \text{ omega}$  events ( $E_{\text{CMS}} = 3940 \text{ MeV}$ )  
( $J/\psi \rightarrow e^+e^-$ ,  $\text{omega} \rightarrow \pi^0 \text{ gamma}$ ,  $\pi^0 \rightarrow \text{gamma gamma}$ )
- for background studies
  - ▶ 1M  $ppbar \rightarrow \pi^+\pi^- \text{ omega}$ ,  $\text{omega} \rightarrow \pi^0 \text{ gamma}$
  - ▶ 1M  $ppbar \rightarrow \pi^+\pi^- \pi^0 \pi^0$
  - ▶ 20k  $ppbar \rightarrow \pi^0 \pi^0 \pi^0$ ,  $2\pi^0 \rightarrow 2(e^+e^- \text{ gamma})$
- events from Simulation Production (release 0.10.3)
  - ▶ simulation: (almost) complete detector
  - ▶ reconstruction: tracking of  $e^+e^-$  only w/ Stt

- $\omega \rightarrow \pi^0 \gamma$  selection
  - ▶  $\pi^0 \rightarrow \gamma\gamma$  (pi0VeryLoose list from CompositionSequences)  
 $E(\gamma) > 30 \text{ MeV}$ ,  $m(\gamma\gamma)$  within  $[115; 150] \text{ MeV}$
  - ▶  $m(\pi^0 \gamma) - m(\gamma\gamma) + m_{\text{PDG}}(\pi^0)$  within  $[750; 850] \text{ MeV}$
- $J/\psi \rightarrow e^+ e^-$  selection
  - ▶ electron cands. from electronCombinedLHVeryLoose list  
(electron identification w/ DIRC and EMC,  $p > 20\%$ )
  - ▶ kinematic fit, require common vertex,  $CL > 0.1\%$
  - ▶  $m(e^+ e^-)$  within  $[2.85; 3.25] \text{ MeV}$

- $Y(3940) \rightarrow J/\psi \omega$  selection

- ▶ difference to nominal beam momentum  $p_b$

$$|p(J/\psi\omega)_z - p_{b,z}| < 0.2 \text{ GeV}, |p(J/\psi\omega)_{xy} - p_{b,xy}| < 0.1 \text{ GeV}$$

- ▶ select **only one  $Y(3940)$  candidate per event**

(take candidate w/ minimal difference to  $p_b$ )

- ▶ improve signal resolution exploiting mass differences

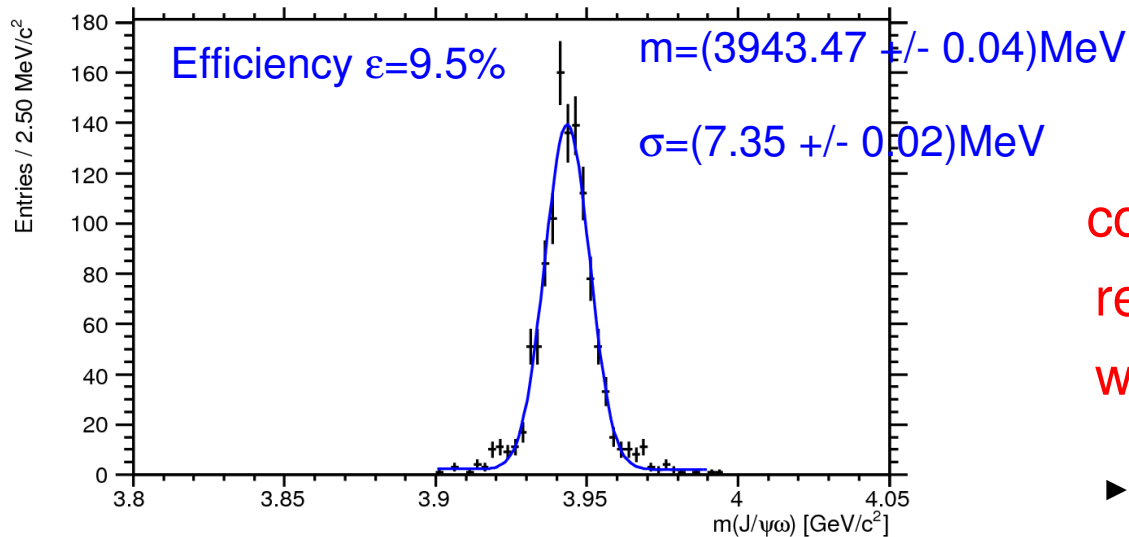
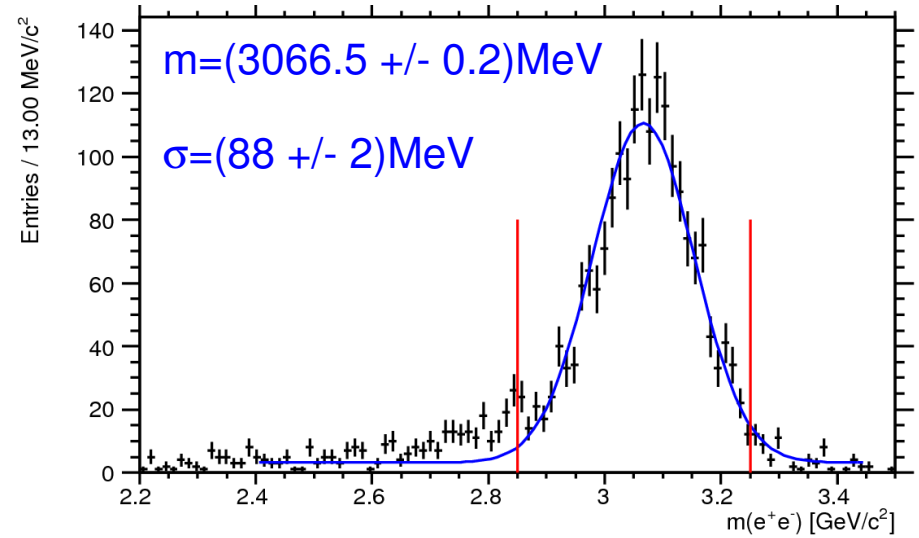
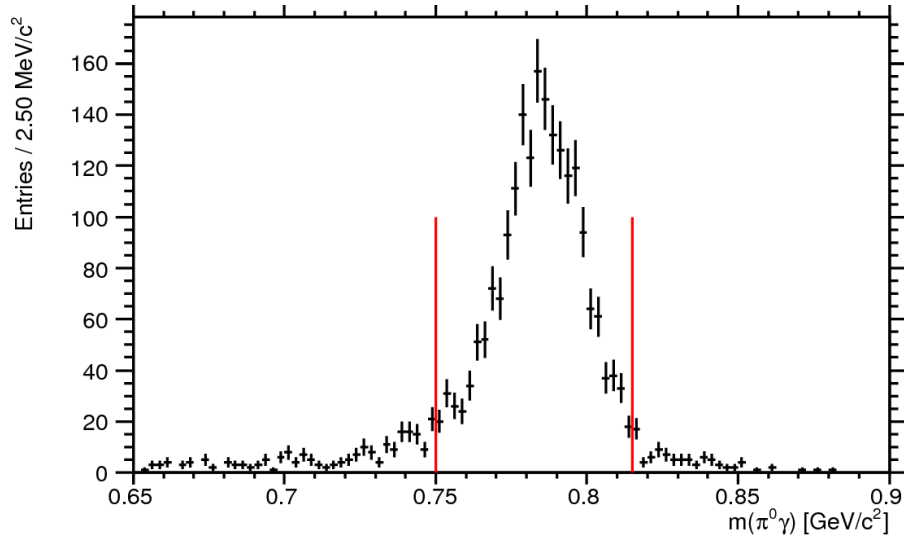
$$m(J/\psi\omega) - m(J/\psi) - m(\omega) + m_{\text{PDG}}(J/\psi) + m_{\text{PDG}}(\omega)$$

- for signal MC events apply truth match

- ▶ match between reconstructed candidates and G4Tracks

- ▶ ask final state particles / resonances to originate from correct mother, e.g. single  $\gamma$  from  $\omega \rightarrow \pi^0 \gamma$  decay

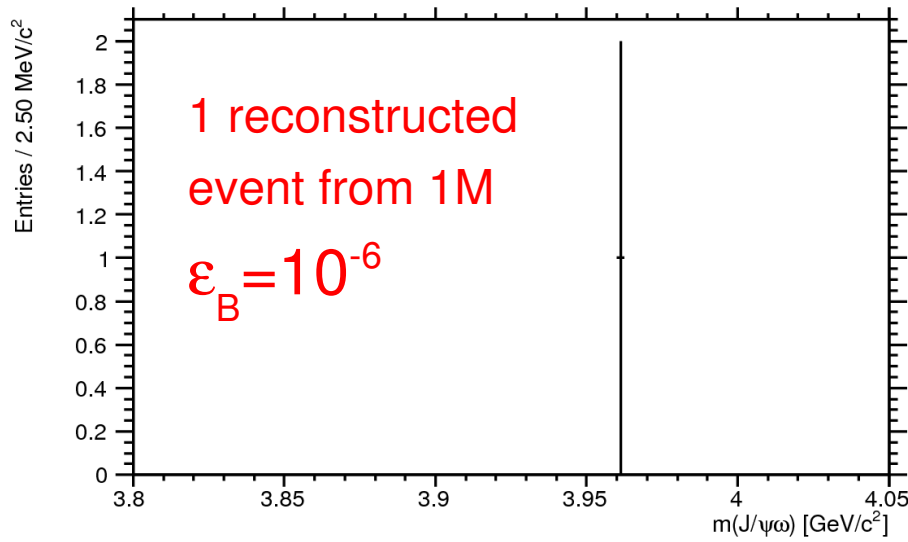
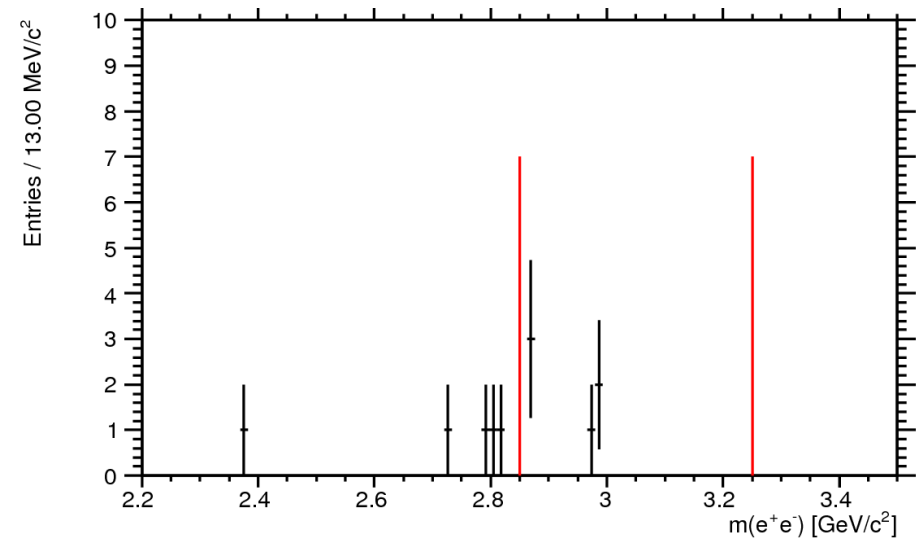
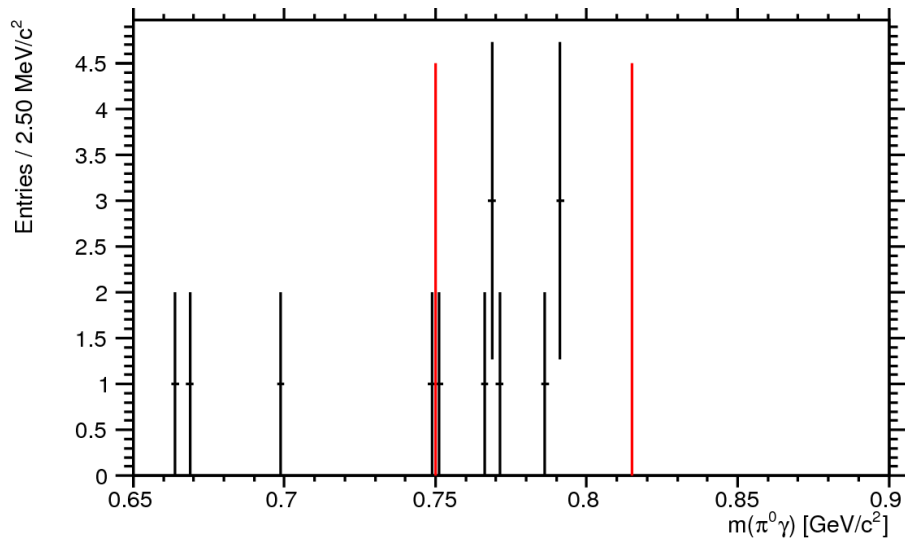
# First results for singal



combined Mvd+Stt+Dch track  
reconstruction (envisaged for 0.10.4)  
will improve

- ▶  $J/\psi$  resolution and
- ▶ selection efficiency

- ppbar->pi+pi- omega, omega->pi0 gamma



Assumptions:

$$\sigma_B(\text{ppb} \rightarrow \pi^+ \pi^- \omega) \sim 10 \mu\text{b}$$

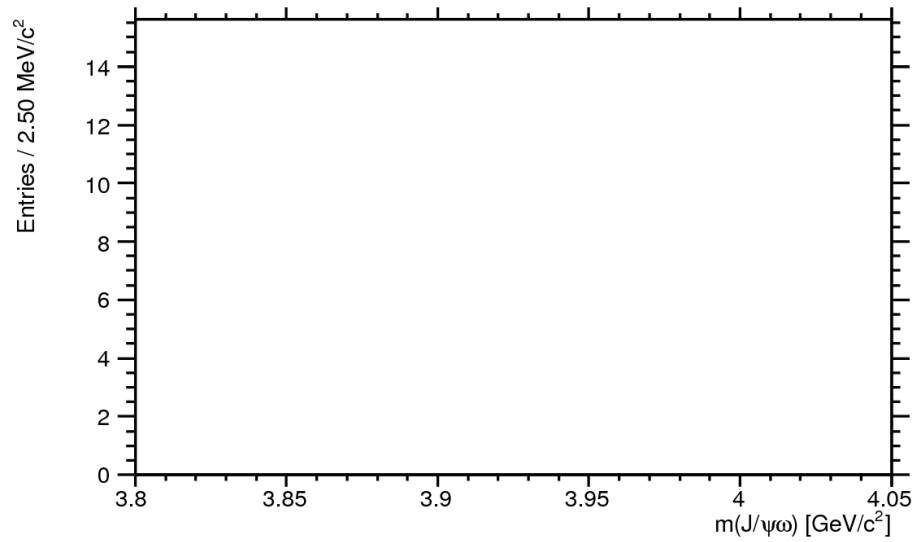
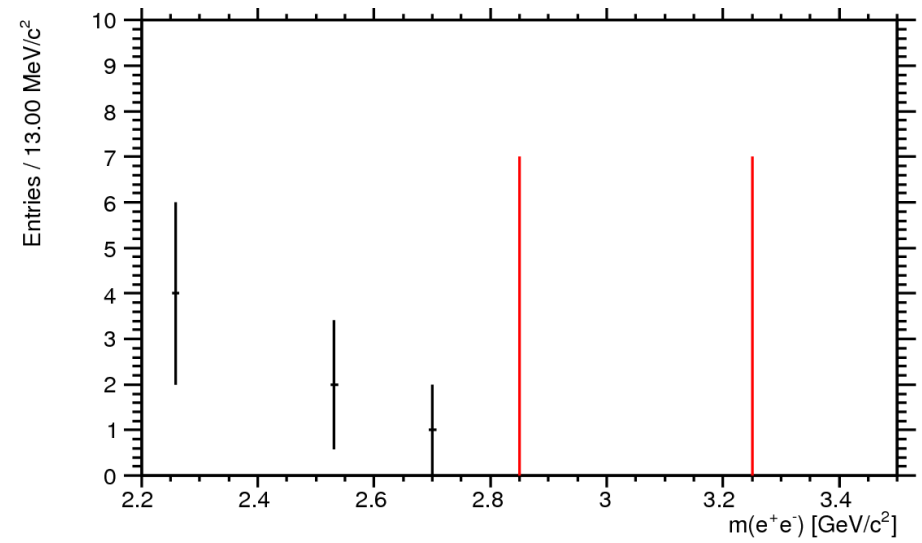
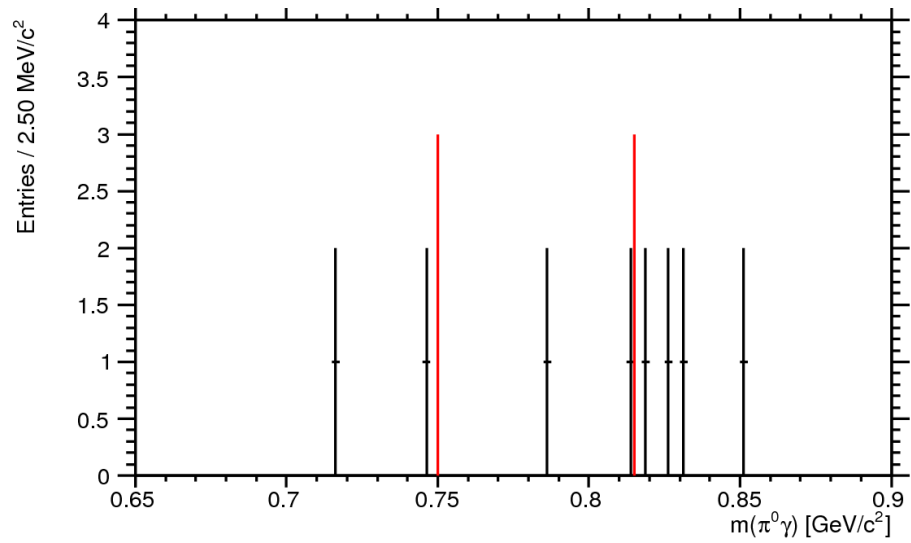
$$\text{BR}_B(Y \rightarrow J/\psi \omega) \sim 10\%$$

$$\sigma_S(\text{ppb} \rightarrow Y) \sim 10 \text{nb}$$

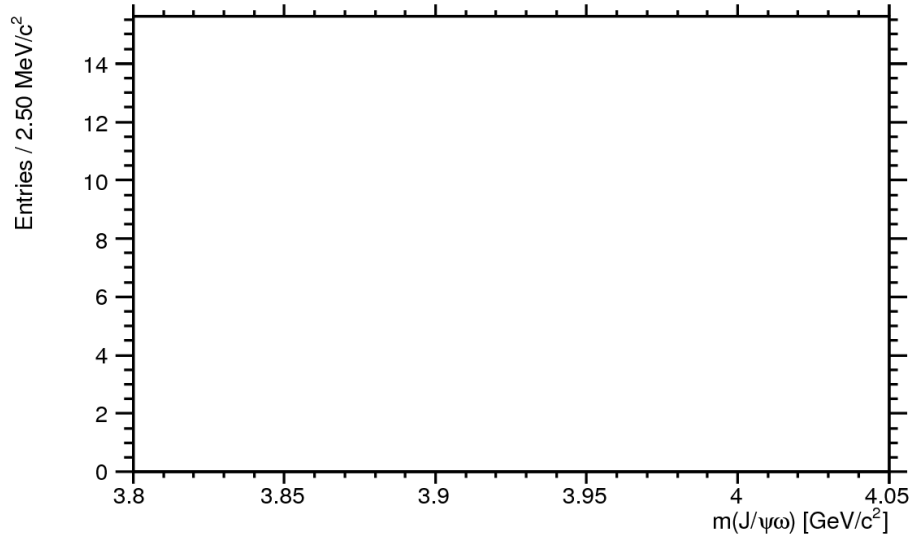
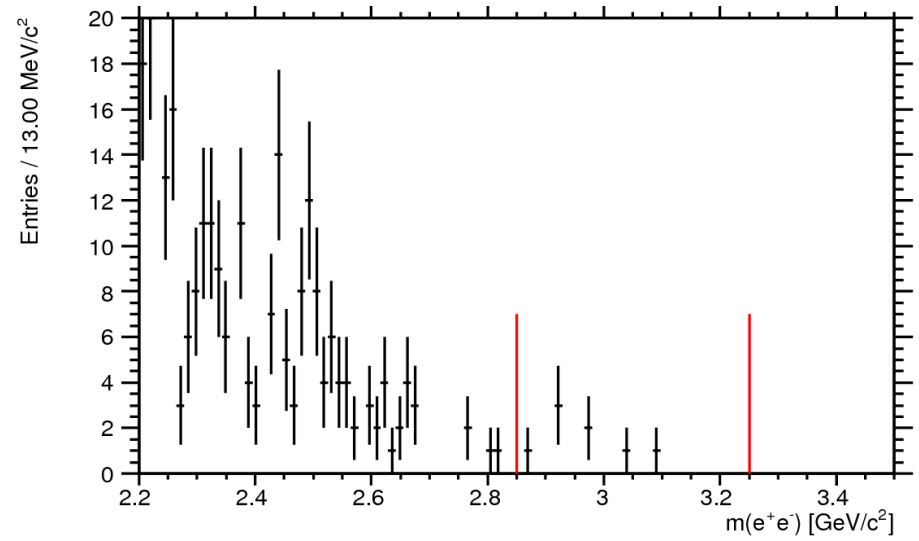
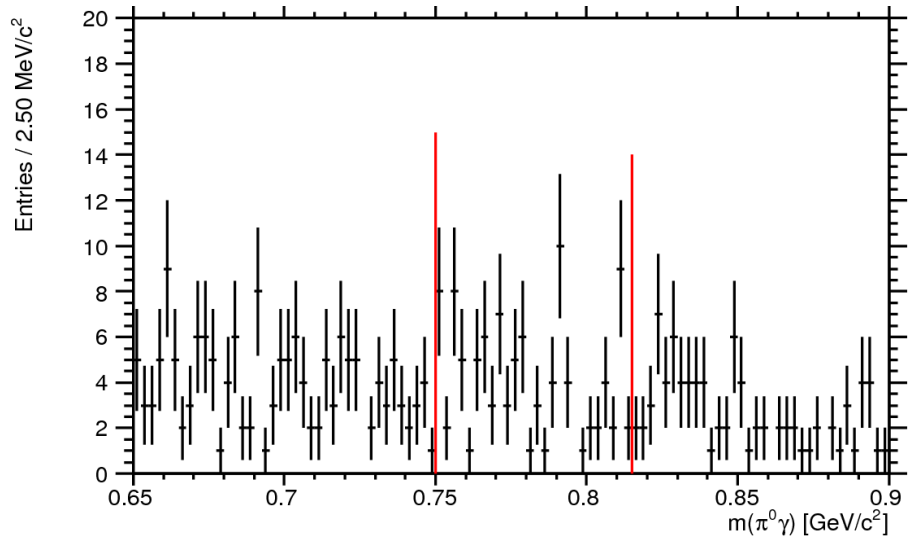
Expected S/B ratio:

$$(\sigma_S / \epsilon_S * \text{BR}_S) / (\sigma_B / \epsilon_B) \sim 10^{-3}$$

# ppbar->pi+pi- pi0 pi0



- $ppbar \rightarrow \pi^0 \pi^0 \pi^0$ ,  $2\pi^0 \rightarrow 2(e^+e^- \gamma)$





- add  $J/\psi \rightarrow \mu^+ \mu^-$  decay channel
- re-analyze w/ re-reconstructed data
  - ▶ release 0.10.4 will (hopefully) contain reconstruction for complete target spectrometer
  - ▶ expect improvement for resolution and selection efficiency
- background studies
  - ▶ more  $\pi^+ \pi^- \omega$  events required
  - ▶ tighter electron PID criteria necessary?
  - ▶ further background channels?
- simulate signal with different quantum numbers ( $J=0,1,2$ )