Status of the Simulation

Valentina Santoro
SLAC

Outline

Status of the simulation

$e^+e^- \rightarrow \gamma_{ISR} J/\psi \pi^+\pi^-$

Plans

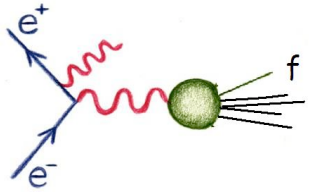
VERY PRELIMINARY STUDIES

Status of the simulation

- ✓ Fast simulation used for simulation of interesting Physics channels
- ✓ Some problems in the generation of continuum events partially fixed/need more investigation
- ✓ Some checks to adapt some BaBar code to SuperB
- ✓ $e^+e^- \rightarrow \gamma_{ISR} J/\psi \pi^+\pi^-$ studies

Why $e^+e^- \to \gamma_{ISR} J/\psi\pi^+\pi^-$ is interesting?

BaBar discovered in 2005 in $J/\psi\pi\pi$ events after ISR (233 fb^{-1})



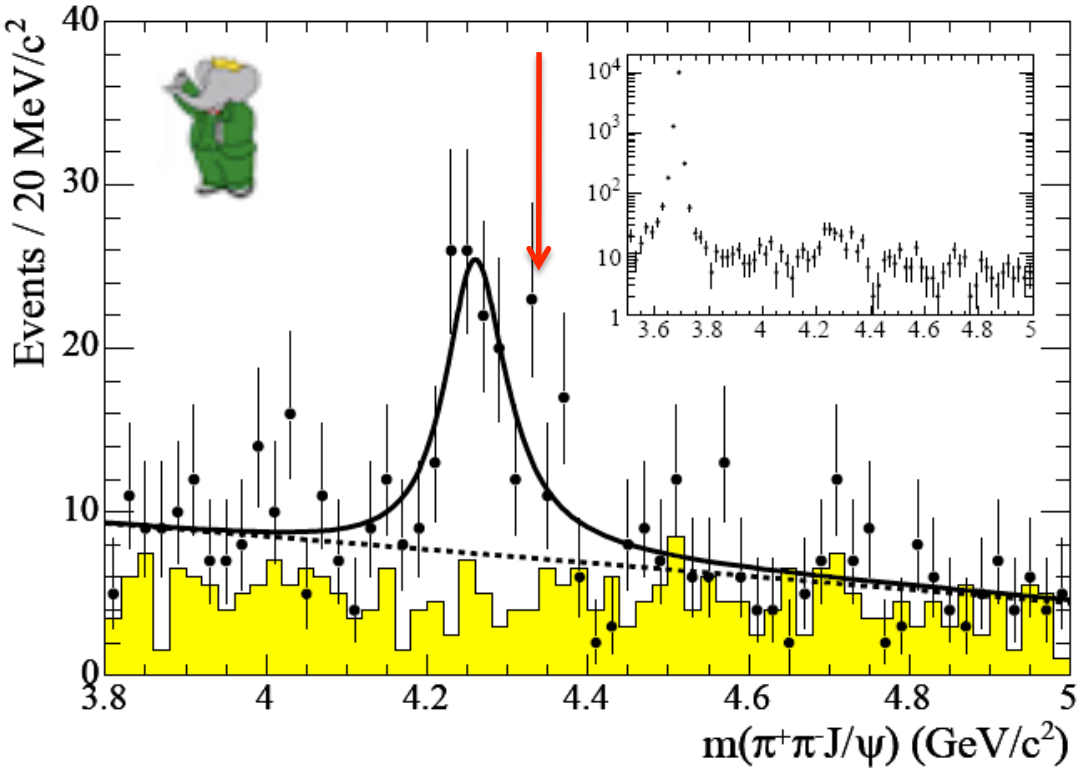
$J^{PC} = 1^{--}$

Phys. Rev. Lett. 95 (2005) 142001

Broad structure Y(4260)

$m_Y = (4259 \pm 8^{+2}_{-6})\ \mathrm{MeV/c^2}$

$\Gamma_Y = (88 \pm 23^{+6}_{-4})\ \mathrm{MeV}$

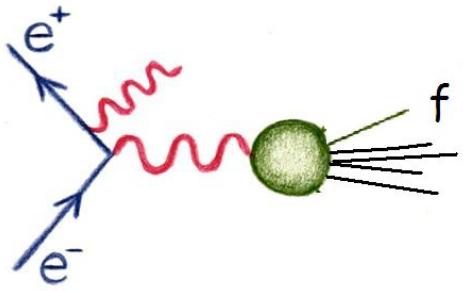


Confirmations from CLEO-c, CLEO-III and Belle with some spread in the resonance parameters.

All the 1^{--} slots in the charmonium spectrum are already filled

ISR production at B-factories

The ISR process provide access to e^+e^- annihilations to vector mesons for a continuous spectrum of energies below the nominal beam energy.

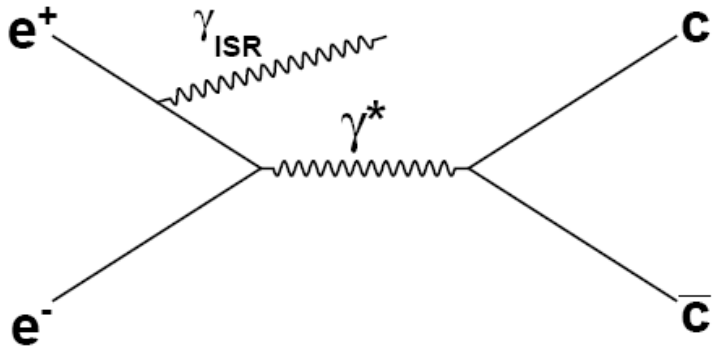


A large mass range is accessible in a single experiment, contrary to the case with fixed energy colliders, which are optimized only in a limited energy .

The ISR photon escapes through the beam pipe around the 85 % of the time and it is mainly emitted at small polar angle.

Analysis strategy

Study of the final state
$J/\psi\ \pi^+\pi^-$ after initial state radiation
with $J/\psi \to l^+l^-$



The analysis strategy look for :

- Small mass recoiling against final state
- Low missing transverse momentum
- γ_{ISR} detection not required

- ISR $\psi(2S) \to J/\psi\pi\pi$ will be used as control sample to check the consistency of the analysis

$e^+e^- \to \gamma_{ISR} J/\psi\pi^+\pi^-$

Analysis Enviroment

Release V0.1.2
Analysis Code PacUser
BtaTupleMaker to produce the ntuples

Final State Reconstruction

- J/ψ → e+e- and μ+μ- reconstruced from ChargedTracks
- J/ψ candidate is combined with two ChargedTracks indentified as a pions to reconstruct the $J/\psi\pi^-\pi^+$ final state.

Data sample

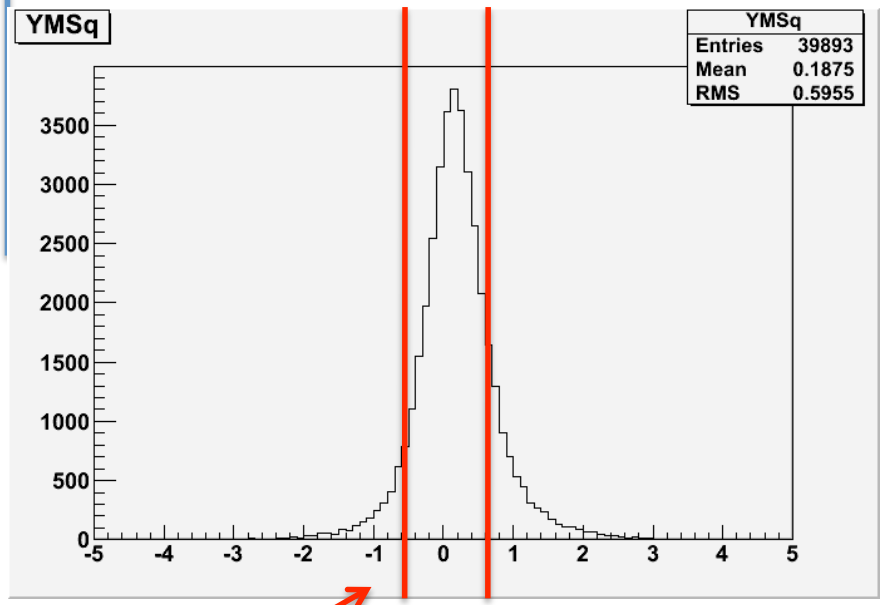
100K events of $e^+e^- \to \gamma_{ISR}$ Y(4260), Y(4260) $\to J/\psi\pi^+\pi$ (Γ=90 MeV, mass=4.260 GeV/c^2)
100K events of $e^+e^- \to \gamma_{ISR}$ ψ(2S), ψ(2S) $\to J/\psi\pi^+\pi$
100K events of $e^+e^- \to \gamma_{ISR}$ Y(4260), Y(4260) $\to J/\psi\pi^+\pi$ (Γ=0.0 MeV, mass=4.260 GeV/c^2) (Resolution studies)

M^2_{rec}

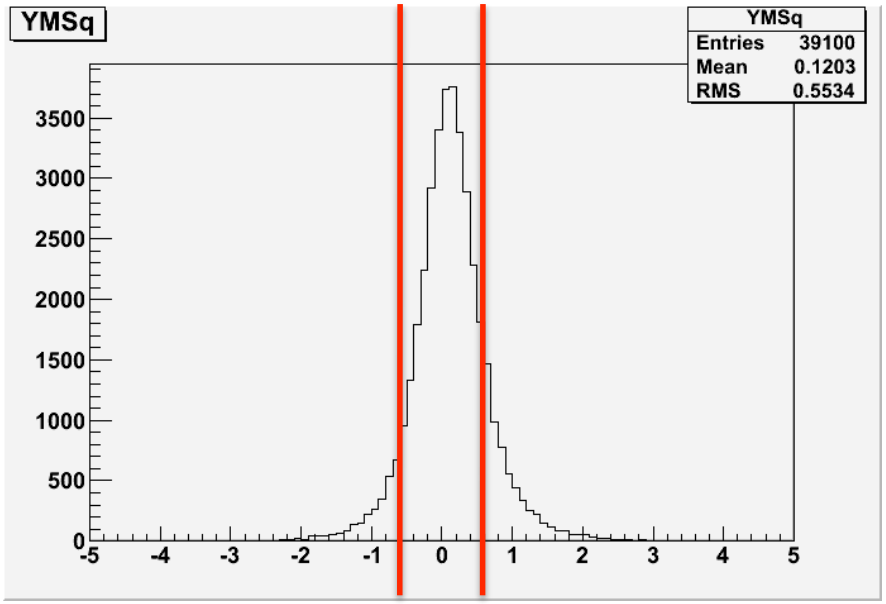
The mass recoiling against the $J/\psi\pi^+\pi^-$ system should be consistent with a photon

$$m^2_{rec} = (\sqrt{s} - E^*_{\pi^+\pi^- J/\psi})^2 - p^{*2}_{\pi^+\pi^- J/\psi}$$

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



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



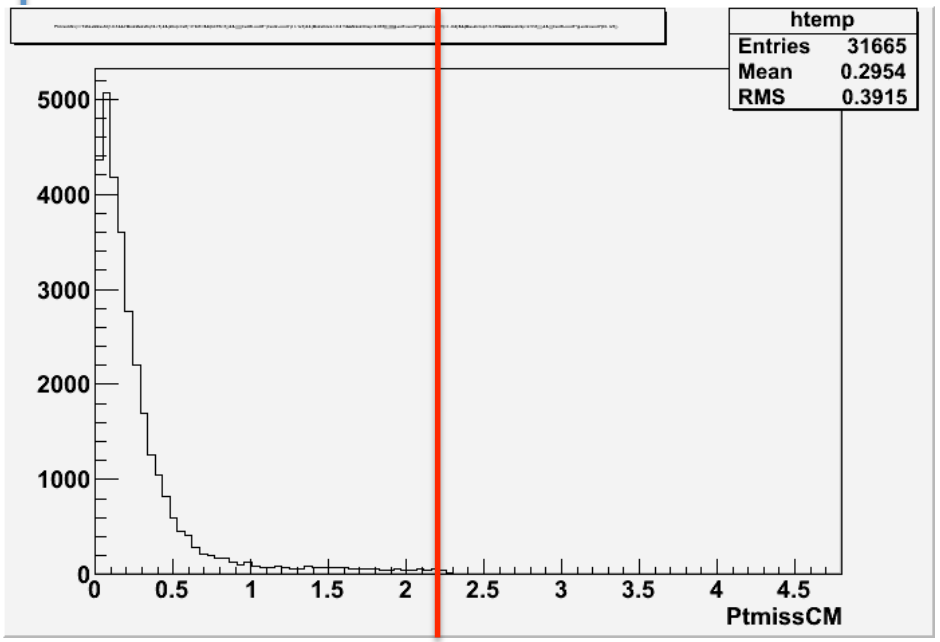
Selection criteria from BaBar analysis

Transverse component of the missing momentum: pt^*_{miss}

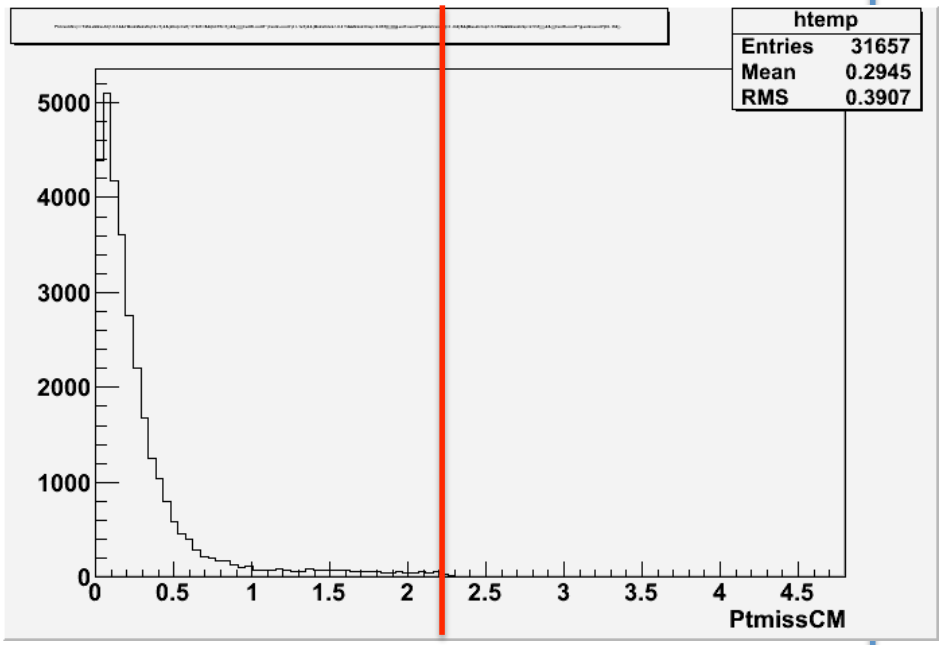
ISR photons emitted mainly along the beam pipe (low transverse momentum)

pt^*_{miss} is the transverse component of the missing momentum of the entire events in the C.M (including the ISR γ if detected)

$J/\psi \rightarrow e^+e^-$



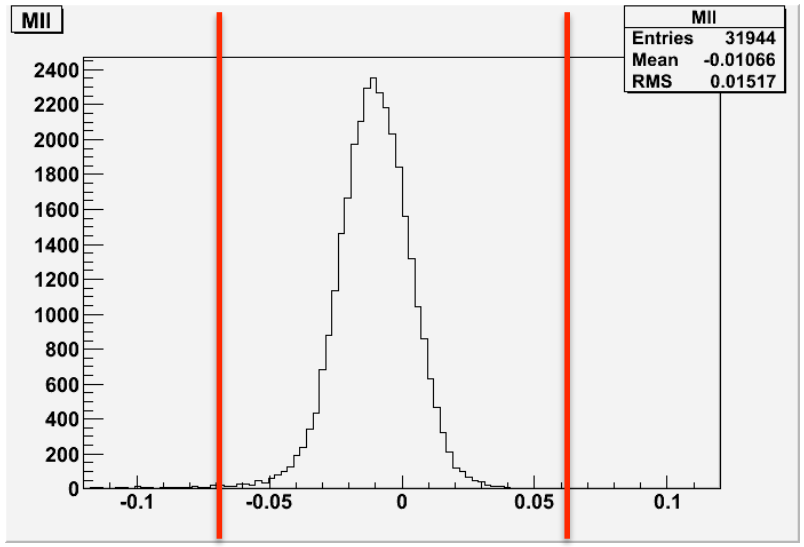
$J/\psi \rightarrow \mu^+\mu^-$



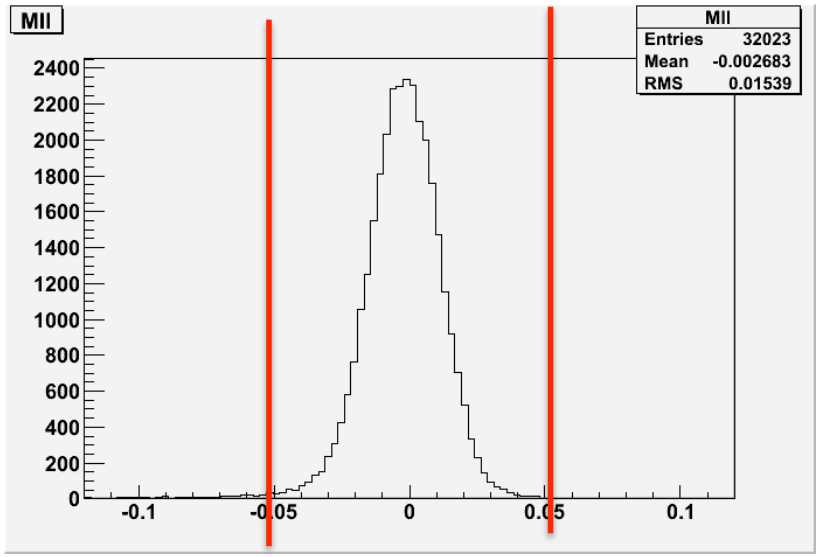
Di-lepton mass

The invariant mass of the J/ψ candidate $m(l^+l^-)$-$m(J/\psi)$

$J/\psi \rightarrow e^+e^-$



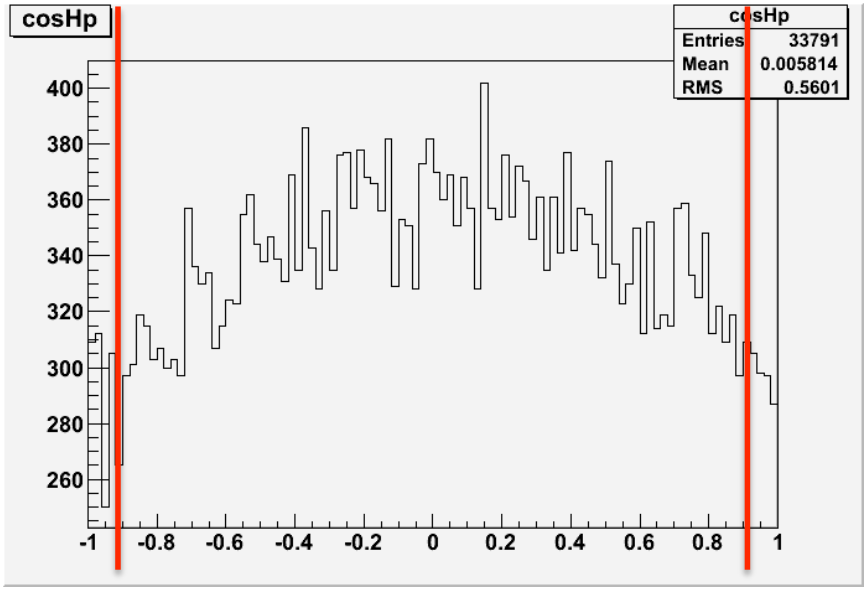
$J/\psi \rightarrow \mu^+\mu^-$



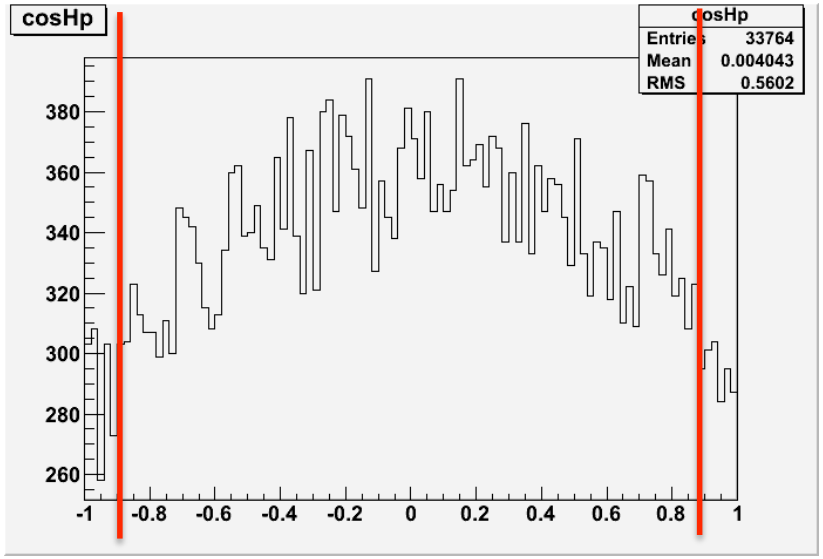
The helicity angle

$\cos\Theta_l$: is the angle between the lepton momentum direction in the J/ψ rest frame and the J/ψ momentum direction in the C.M. frame

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



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



Selection criteria

”$Mrec^2$>-0.5&&$Mrec^2$<0.75";

"PtmissCM<2.25";

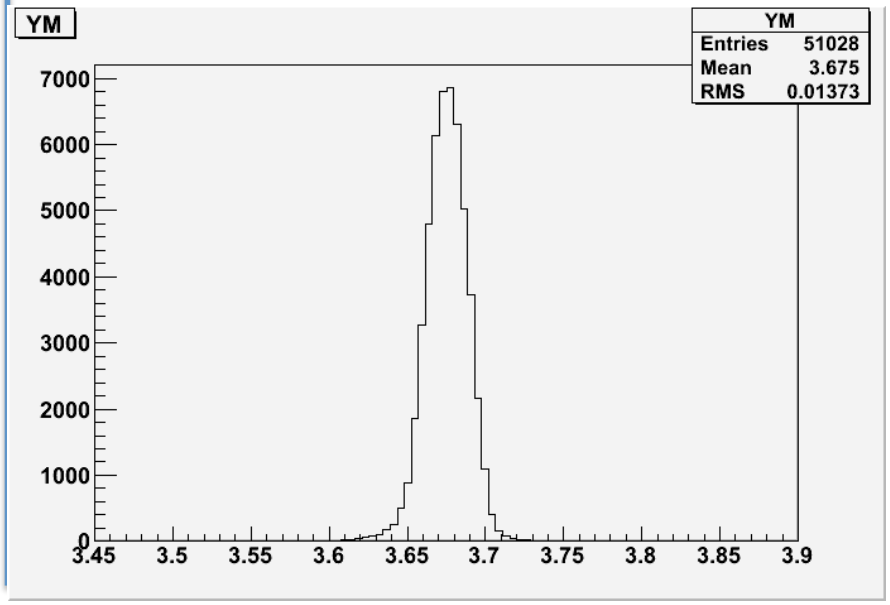
"abs(cosH)<0.925";

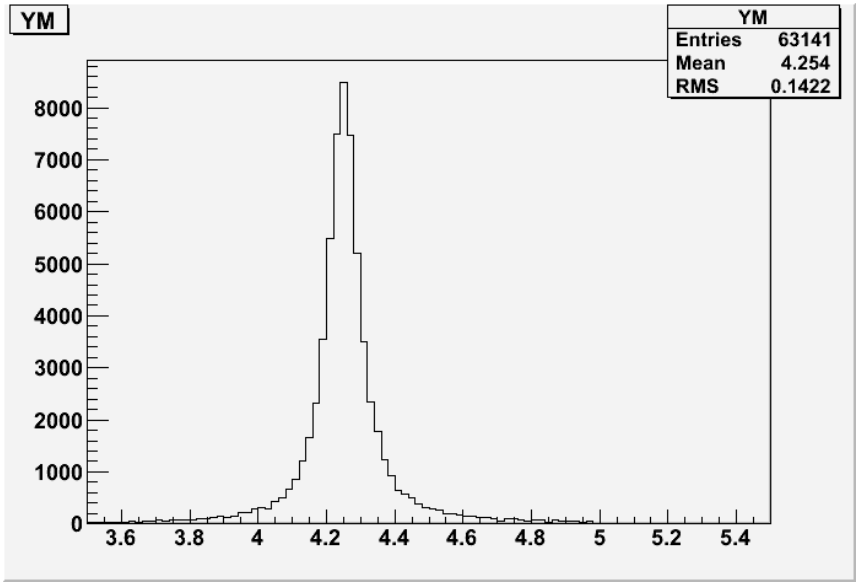
"nTRK<5"; Number of charged tracks

”JpsiMass>-0.075&&MassDilep<0.055"; $J/\psi \to e^+e^-$

”JpsiMass>-0.055&&MassDilep<0.055"; $J/\psi \to \mu^+\mu^-$

Efficiency





$e^+e^- \to \gamma_{ISR}\psi(2S)$

Efficiency ~ 5%

$e^+e^- \to \gamma_{ISR}Y(4260)$

Efficiency ~ 7%

Conclusion on $e^+e^- \to \gamma_{ISR} J/\psi \pi^+\pi^-$

$e^+e^- \to \gamma_{ISR} J/\psi \pi^+\pi^-$ events using SuperB fast simulation have been simulated

Additional studies needed (resolution, selection criteria …)

Results seems in agreement with previus analysis

Everything shown is very preliminary

Plans for the future

- ✓ Simulated events on $B^+ \to X K^+, X \to J/\psi \pi^+ \pi$
  - ✓ Some tests already done but there are some code problems that need to be fixed
- ✓ $Y(4260) \to D_s \overline{D}_s$
- ✓ $e^+e^- \to \gamma_{ISR} \psi(2S) \pi^+ \pi^-$