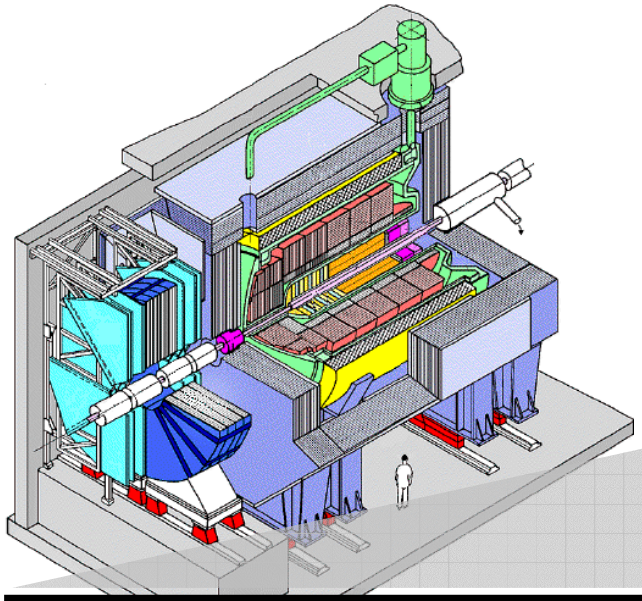
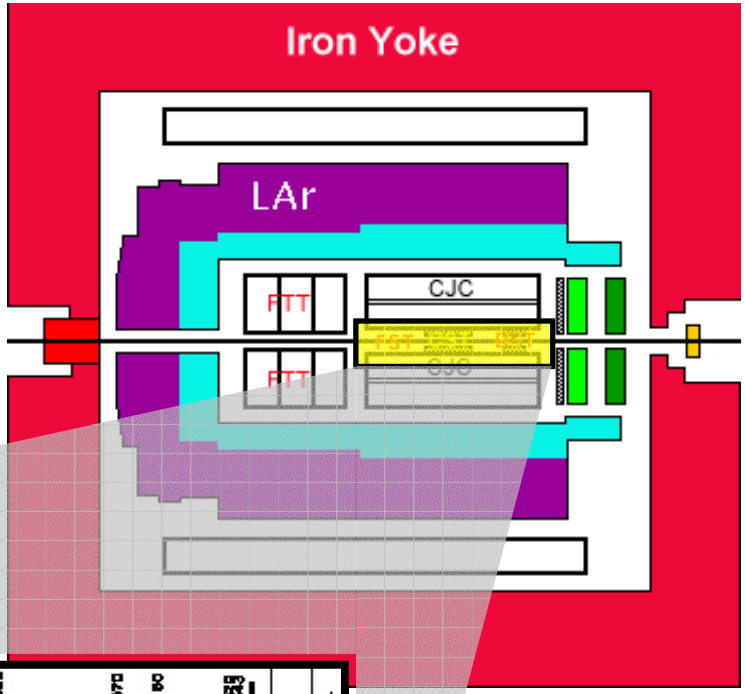
J/Ψ Studies with The Forward Silicon Tracker of H1

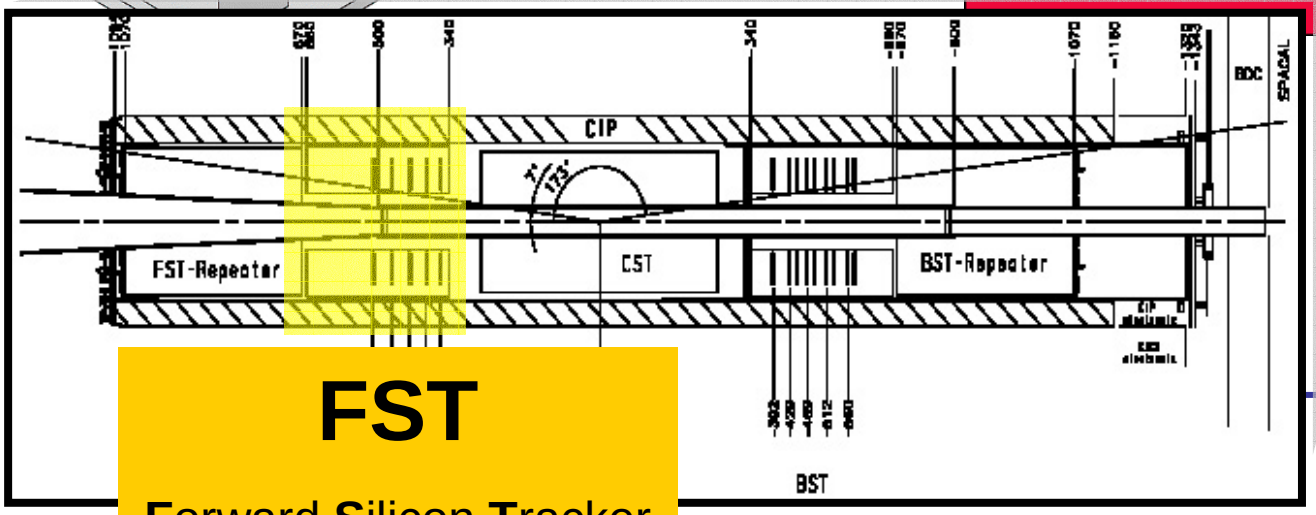
DESY Summer Student Programme 2006

Peter Steinbach

From Pontius to Pilatus







FST

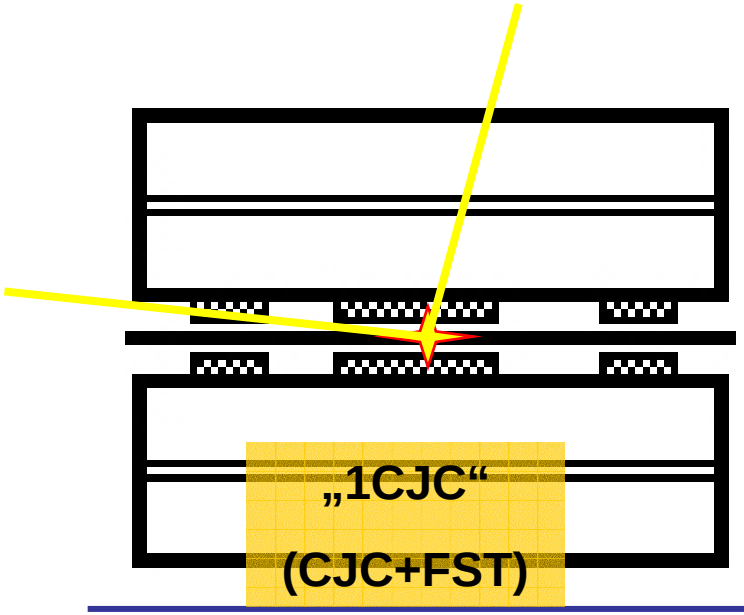
Forward **S**ilicon **T**racker

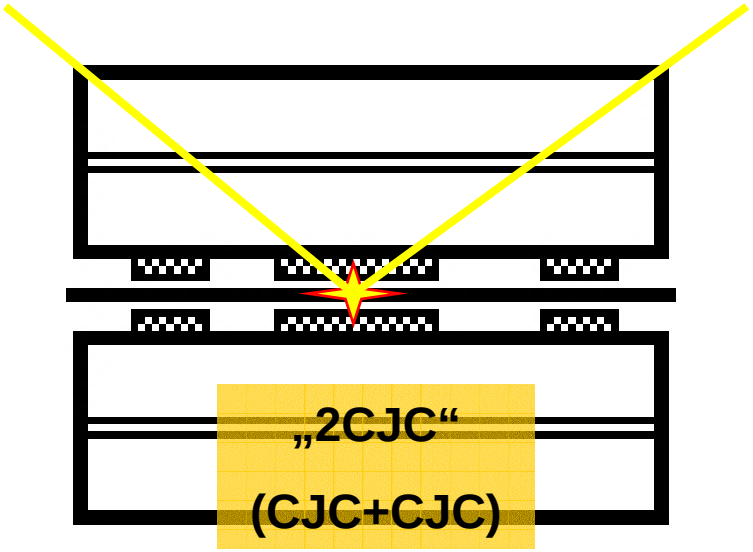
The J/Ψ Particle

- Found November 1974 by Burton Richter (SLAC) and Simon Ting (BNL)
- Vector meson: c $\bar{c}$ pair
- Here: Elastic Production (Q2 = 0)

mass m	$3096.916 \pm 0.011 MeV$
Full Width Γ	$93.4 \pm 2.1 keV$
calculated lifetime $\tau = \frac{\hbar}{\Gamma}$	$7.04 \pm .14 \cdot 10^{-22} s$
$c\tau$	$2.11 \pm .04 \cdot 10^{-13} m$
Prominent decay channels with Branching ration $\frac{\Gamma_i}{\Gamma}$	
Hadronic	(87.7 ± 0.5) %
e^+e^-	(5.94 ± 0.06) %
$\mu^+\mu^-$	(5.93 ± 0.06) %

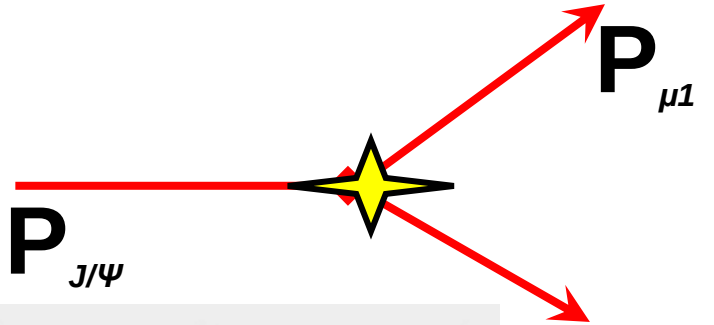
Table 1.1: Key Parametes of the J/Ψ Vector Meson



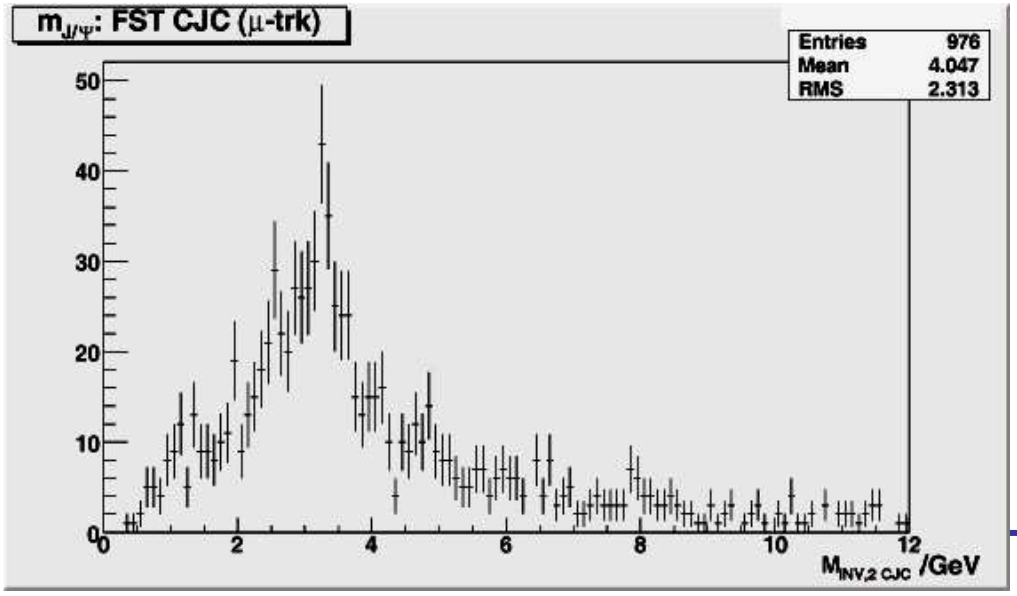


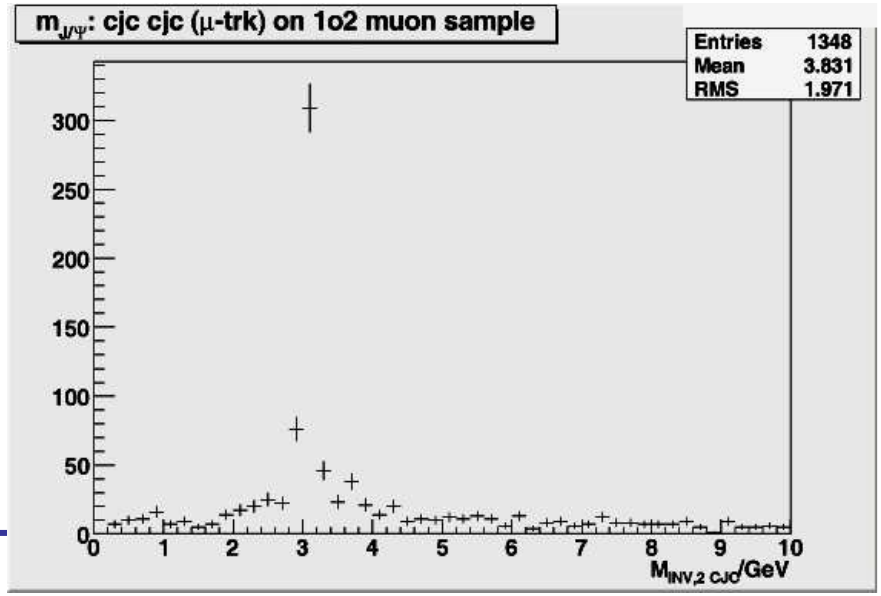
J/Ψ in DATA

$$\mathbf{P}^2_{J/\Psi} = [P_{\mu_1} + P_{\mu_2}]^2$$



$$\mathbf{P}^2_{J/\Psi} = E^2_{J/\Psi} - \vec{p}^{\,2}_{J/\Psi} * c^2 = m^2_{J/\Psi} * c^4$$





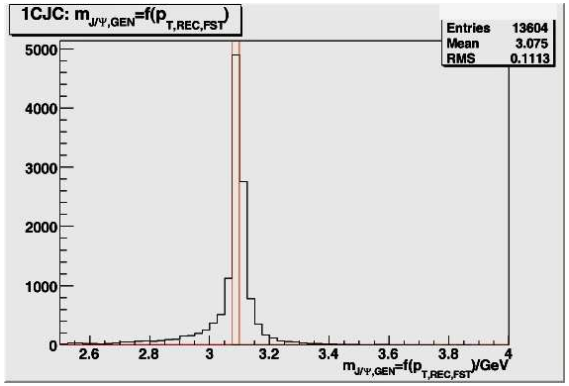
Methods

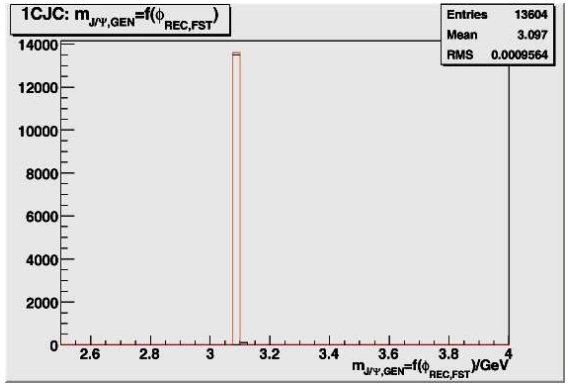
Monte Carlo Simulation	**Generator** (Theory)	*Digitization ,* *Non-fitted Tracks, Alignment …*	**Reconstruction**
DATA (Reality)	?		**Reconstruction**

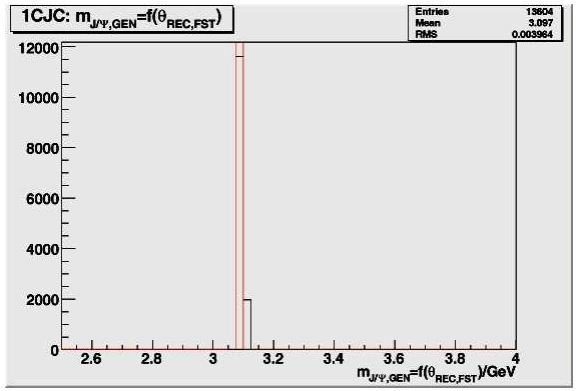
Impact on Mass

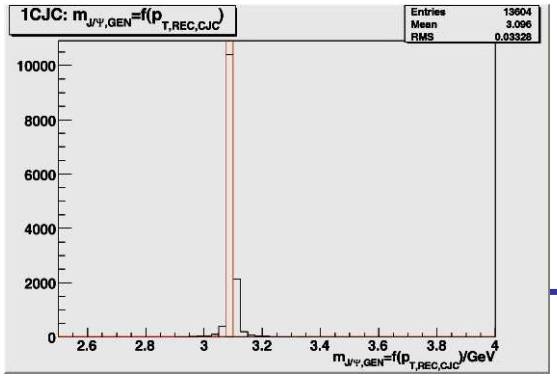
(compute Generator J/Ψ invariant mass with ONE reconstructed variable)

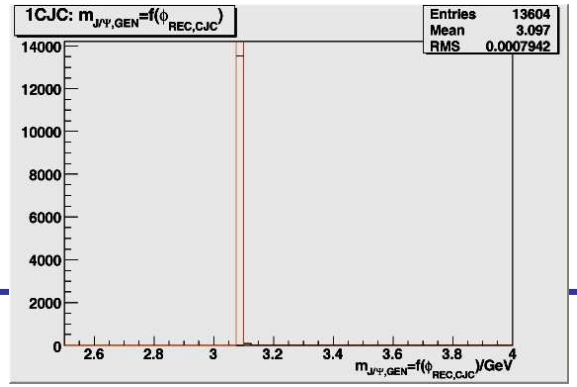
$P_{T,REC}$ $\varphi_{T,REC}$ θ_{REC}

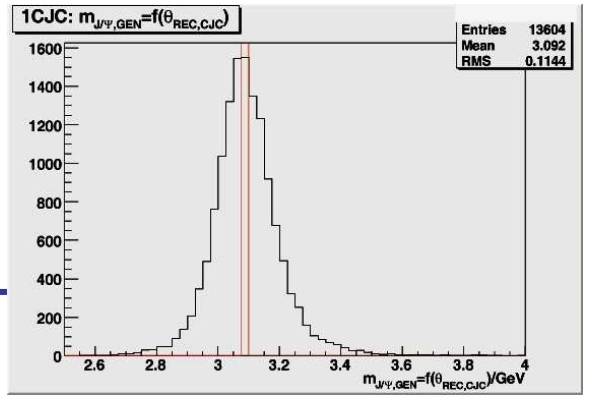




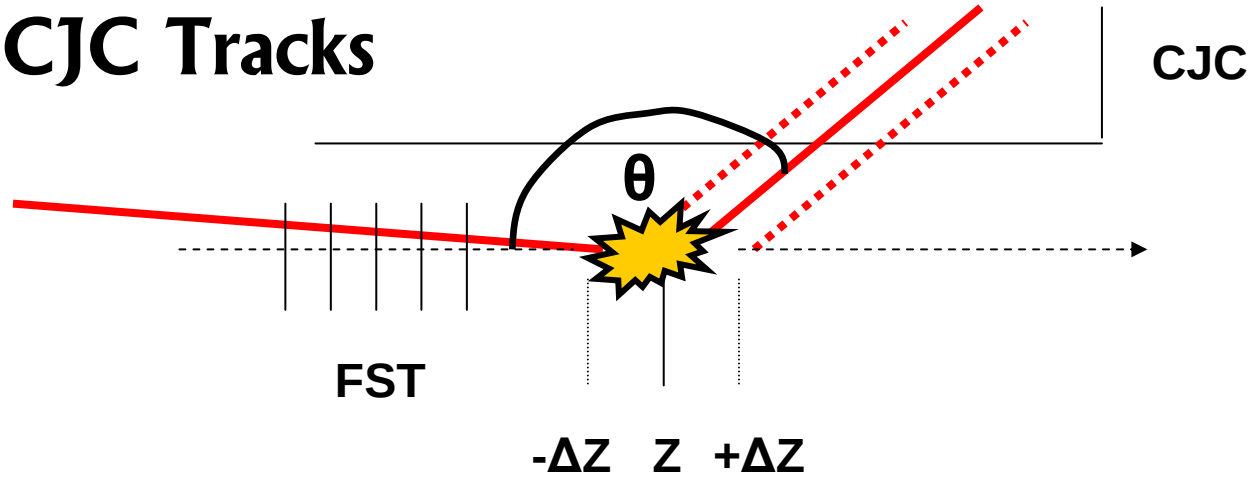








Improving CJC Tracks



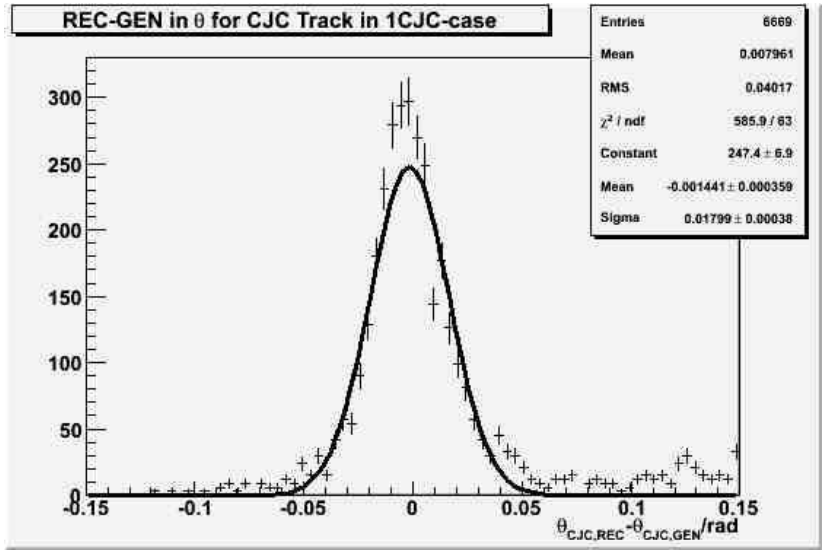
High CJC error of vertex z coordinate (**ΔZ** ≈ 2.5 cm)

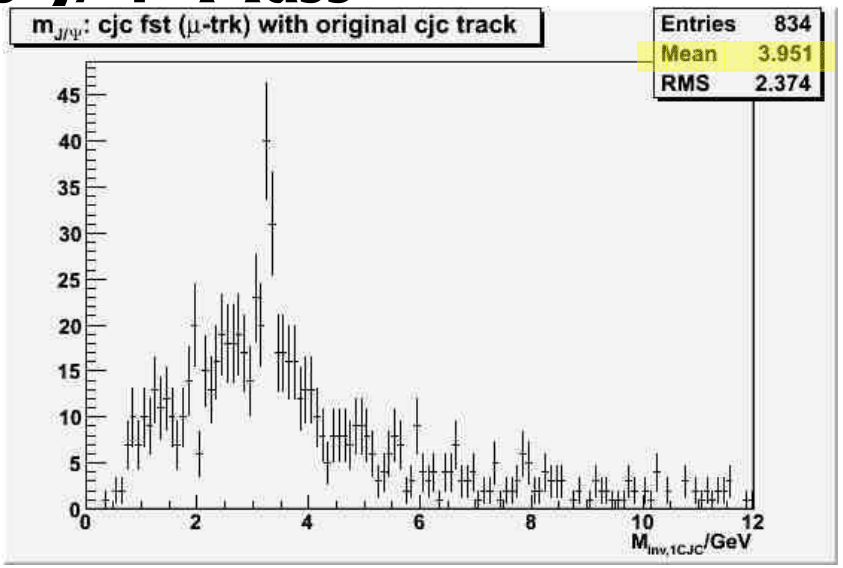
High error in CJC θ reconstruction

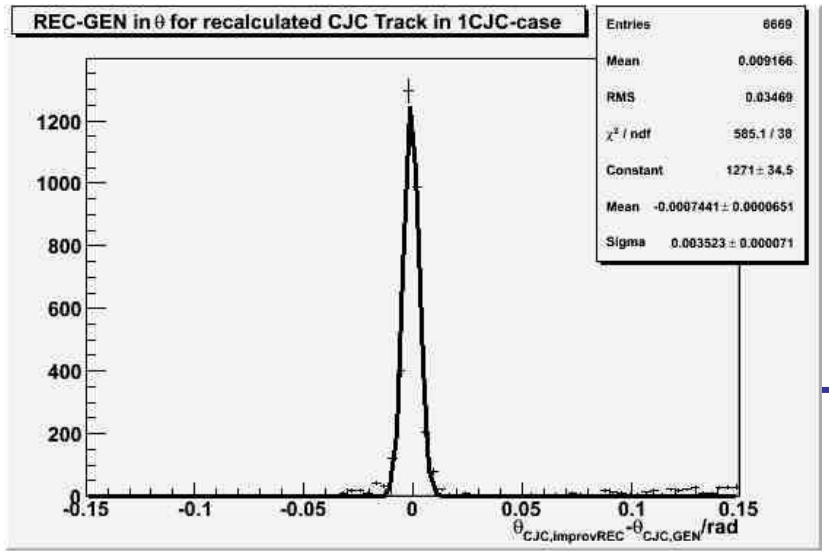
USE FST z vertex position for CJC track improvement (**ΔZ** ≈ 100 µm)

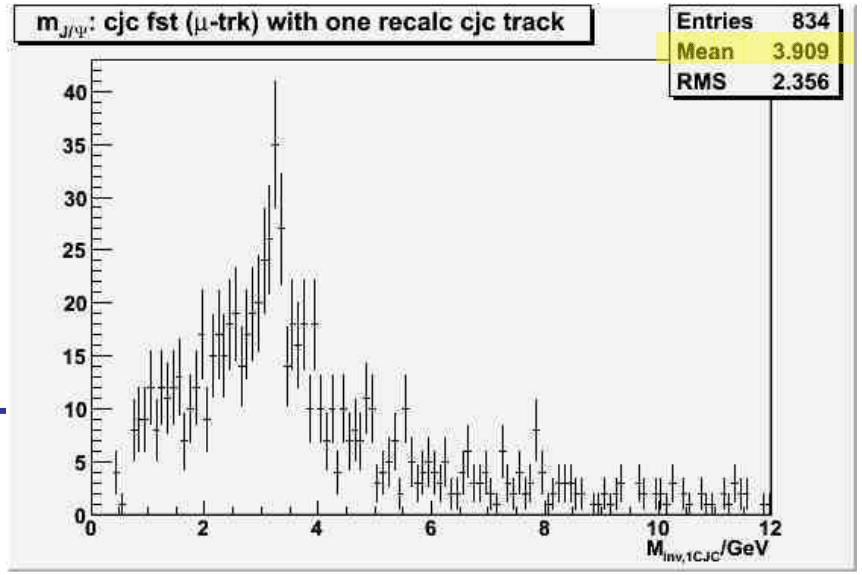
$$\theta^{improved} = \theta + \kappa * \left(\frac{\sigma_{\theta_{FST}}}{\sigma_{z^{CJC}}}\right) * \left(z_{FST} - z_{CJC}\right)$$

Improvement to CJC tracks J/Ψ Mass









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Thank you for your attention!!