CDF $J/\psi\eta, \eta'$ in Run II

- $B^0_S \to J/\psi\eta$ is $CP = +1$, measure $\Delta\Gamma$

  BR$[B^0_S \to J/\psi\eta] < 3.8\ 10^{-3}$ (L3 97)

  Cabibbo Allowed

  Assume QQ Decay Table, BR$(J/\psi\eta) = 5\ 10^{-4}$

  BR$(J/\psi\eta') = \ 10^{-3}$

  $\Rightarrow J/\psi\eta^{(')}$ production comparable to $B^+ \to J/\psi K^+$, (BR=10^{-3})

  Expect $\mathcal{O}(50000)$ $J/\psi K^+$ in 2 fb^{-1}

  BR$(B^0 \to J/\psi\eta) < 0.49\ 10^{-4}$ (CLEO 99)

  Cabibbo suppressed

- Rate estimates done using PYTHIA generator

  Use $\eta \to \gamma\gamma, \eta' \to \eta\pi^+\pi^-$, also try $\eta' \to \pi^+\pi^-\gamma$

- Generator level comparison $J/\psi\eta$ with $J/\psi K^+$

  Similar trigger efficiencies, $J/\psi K^+$ rates are known

  $\Longrightarrow \mathcal{O}$ 1000's events in Run II

- Kinematics

  $p_T(\gamma) > 1$ GeV/c

  Measure $E(\gamma)$ in two calorimeter towers-$\frac{\sigma(E)}{E} = \frac{0.135}{\sqrt{E_T}}$

  $\Delta\eta - \Delta\phi = 0.10 \times 0.25$

  Measure photon positions at shower max- $\sigma(\eta, \phi) < 0.004$

  Minimum photon separation for 2 GeV $\eta \to \gamma\gamma = 0.4\ \ \Delta R$

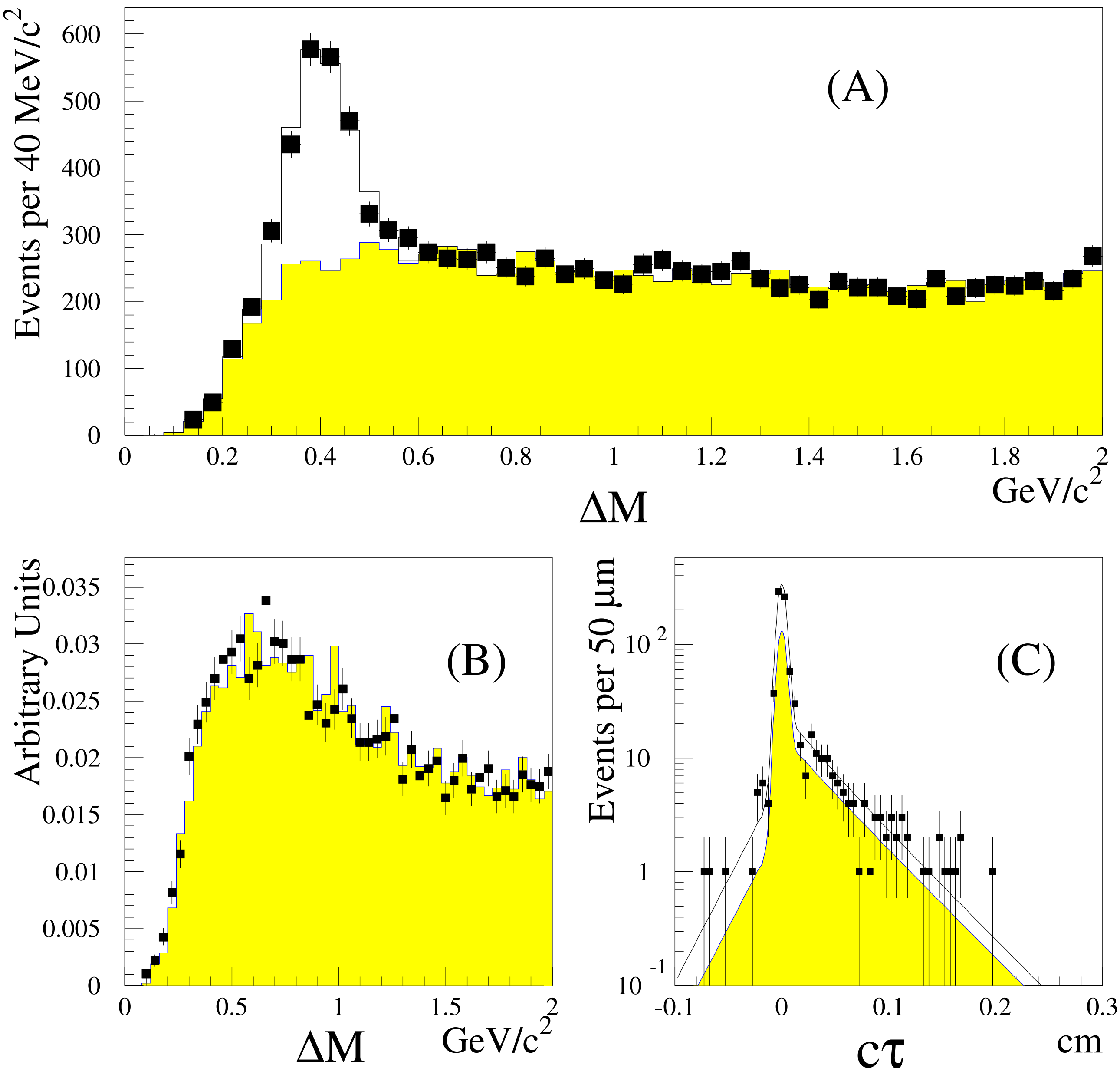
  With η mass constraint, B^0_S mass resolution= 30-40 MeV

- Work in Progress: Key Issue= background combinatorics

  Use Run I J/ψ sample to see how hopeless this is

  CDF has used calorimeter γ and conversion $\gamma \to e^+e^-$

  e.g., M. Tanaka, radiative decay using conversions- WG2



Events per 40 MeV/c^2
(A)
ΔM
GeV/c^2
Arbitrary Units
(B)
ΔM
GeV/c^2
Events per 50 μm
(C)
cτ
cm

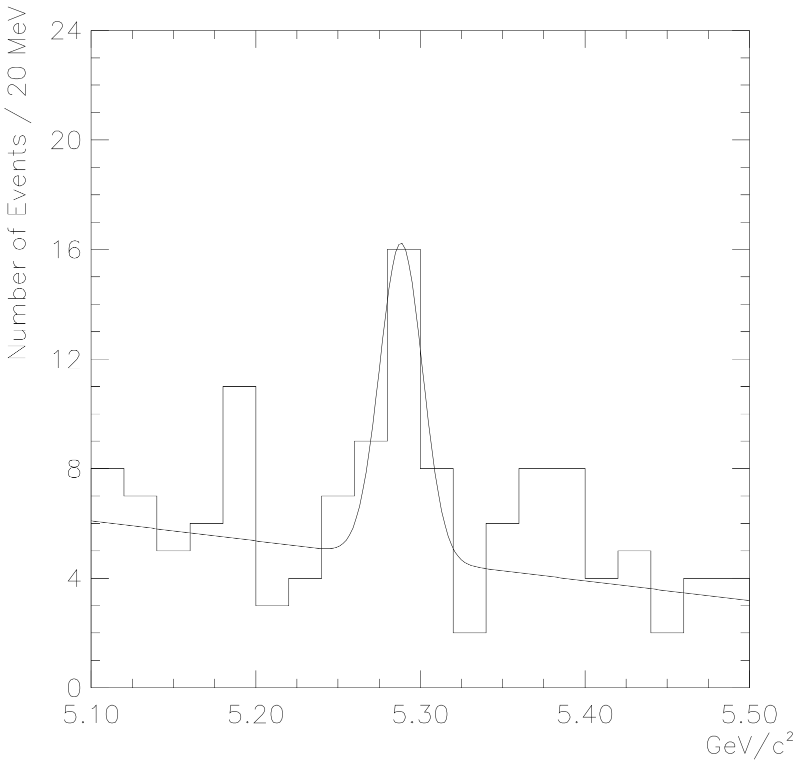
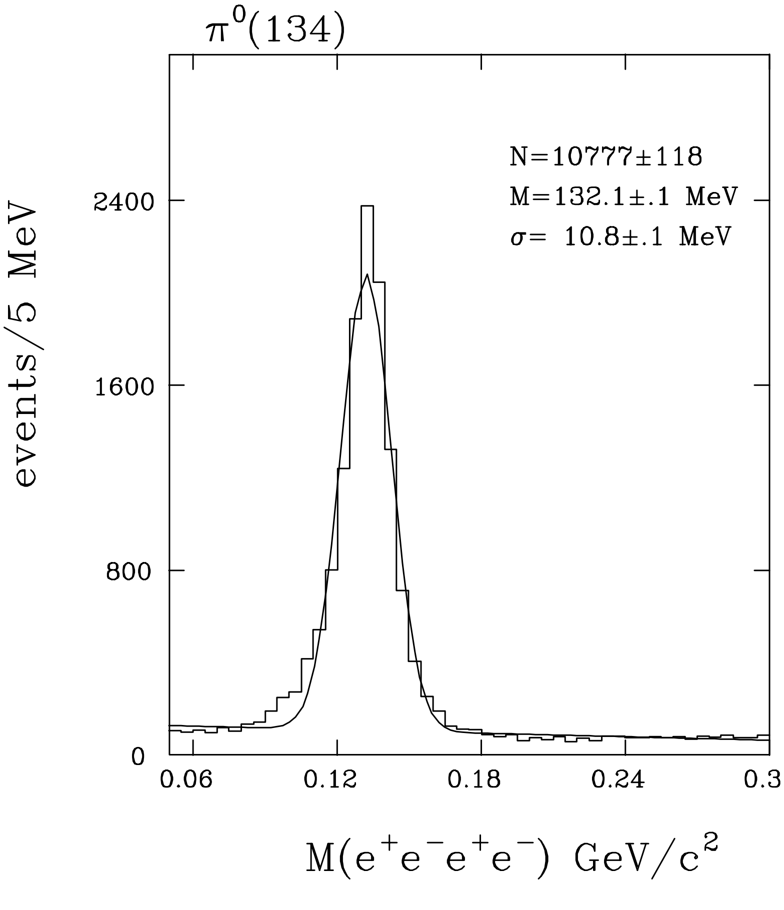
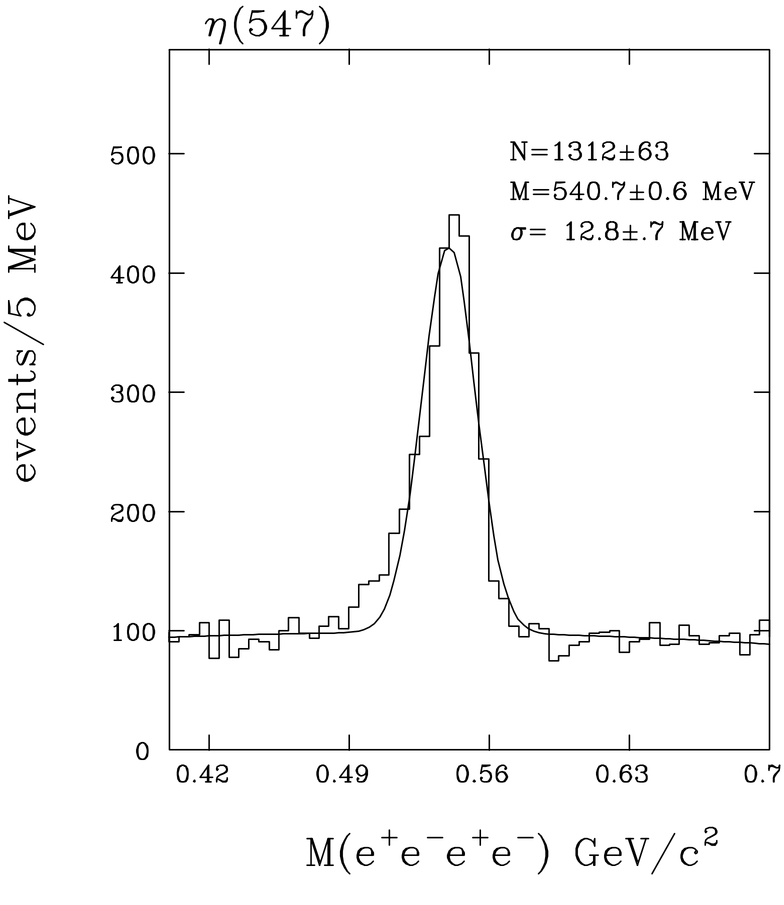


Figure 4: The invariant mass distribution of $J/\psi\gamma K$ from RunI data. The histogram is fitted with a gaussian signal and a linear background. The peak contains 18.8 ± 5.8 $B^+ \to \chi_{c1}(1P)K^+$ events.



Figure(6): Mass spectrum for double-conversions in the π^0 mass region.



Figure(7): Mass spectrum for double conversions in the η mass region.