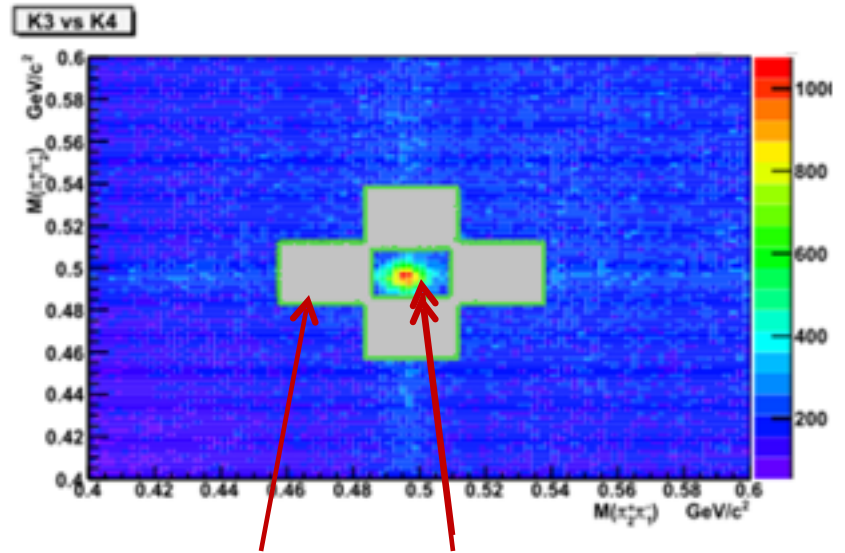
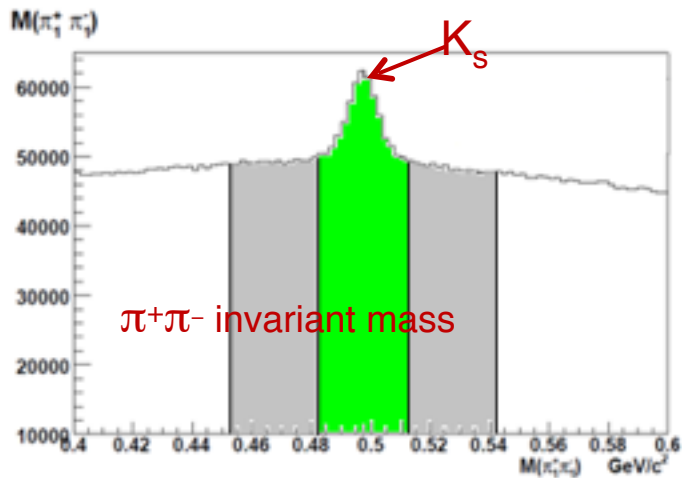
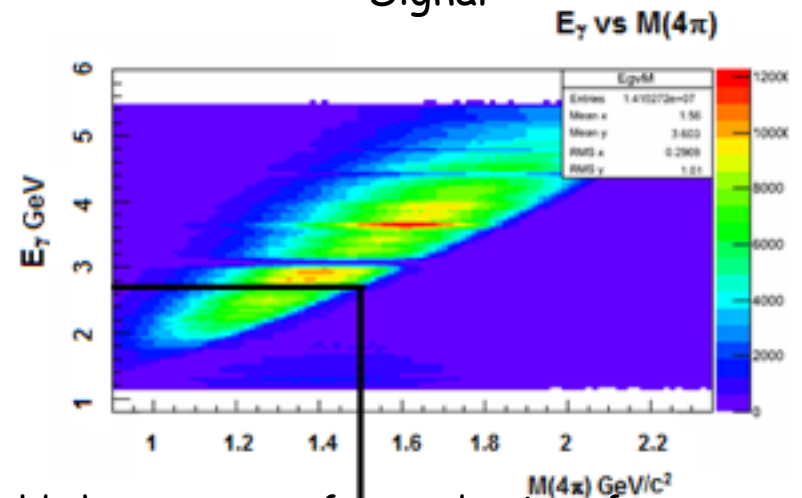
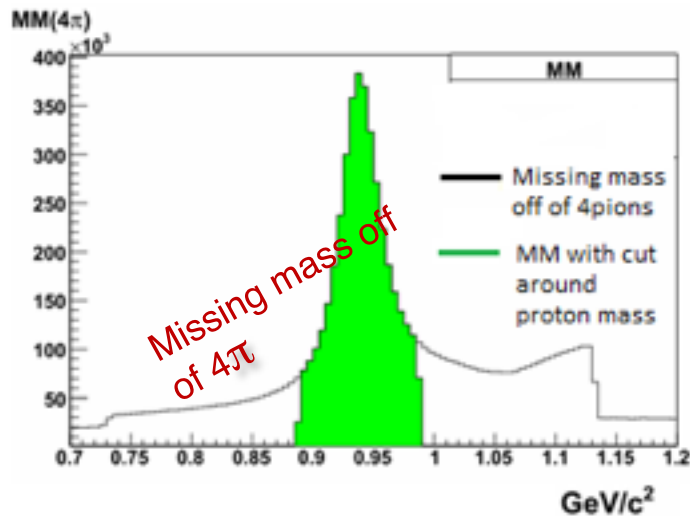


Photoproduction of scalar mesons with g12 data

g12 : Event selection

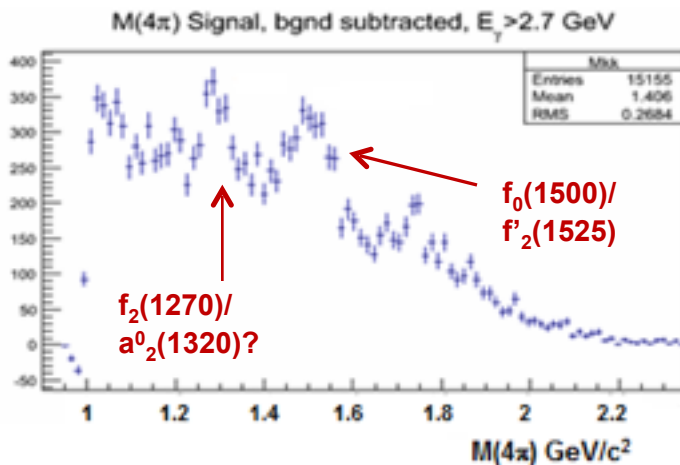
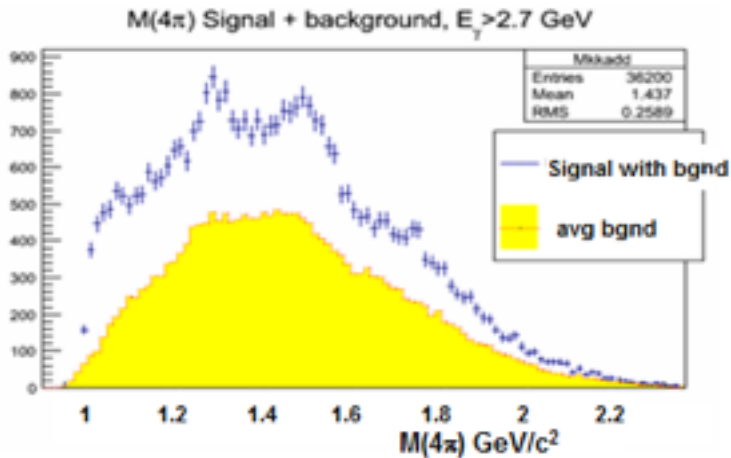


Sideband Signal



Threshold photon energy for production of $f_0(1500)$ is 2.7 GeV

$K_s^0 K_s^0$ Invariant mass spectrum



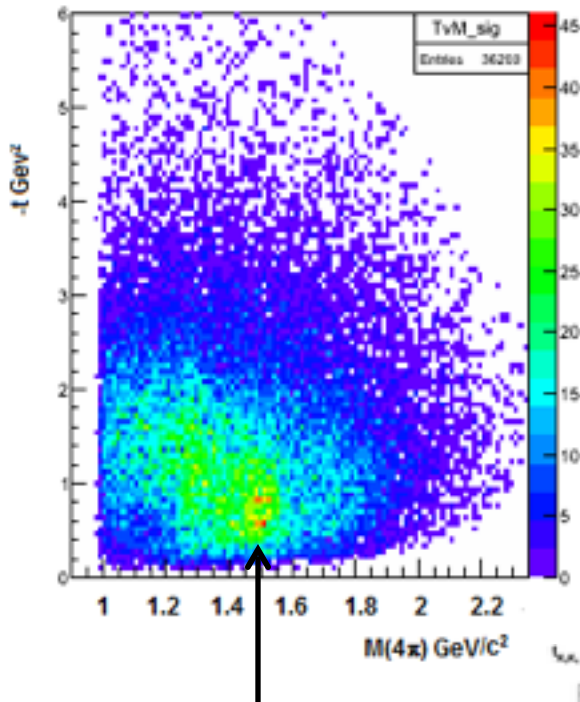
- Timing cuts for pion identification
- Standard e loss corrections
- Cut on Missing mass (proton)
- $E_\gamma > 2.7$ GeV
- $M(K_s)$ is within 16 MeV of the PDG value

The $K_s^0 K_s^0$ invariant mass spectrum has a peak around 1280 MeV and another around 1500 MeV.

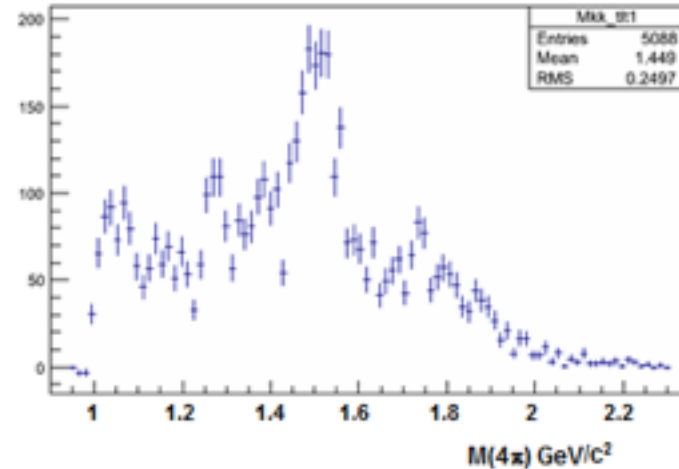
The 1280 peak, which may be the $f_2(1270)/a_2(1320)$ has a much narrower width than the PDG average value. Peak at 1500 either $f_0(1500)$ or $f_2(1525)$.

$K_S^0 K_S^0$ Invariant mass spectrum

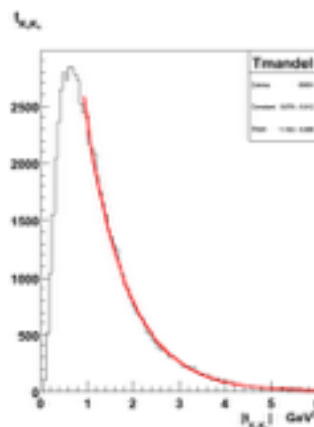
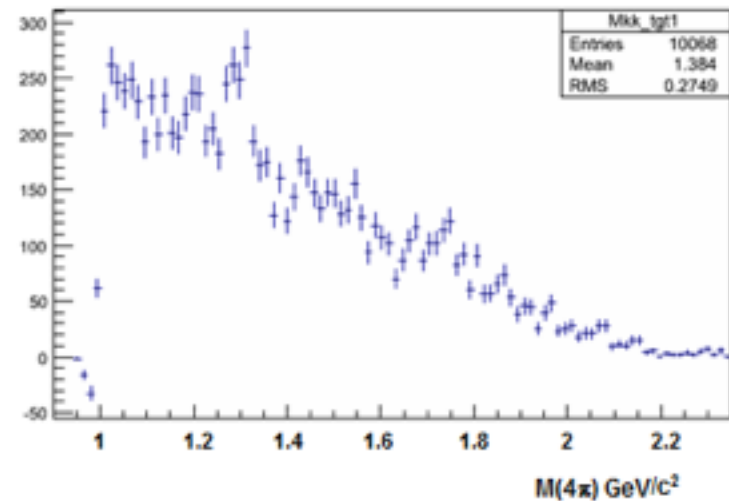
-t vs M(4 π), Signal, $E_\gamma > 2.7$ GeV



M(4 π) Bgnd subtracted signal, -t < 1 GeV

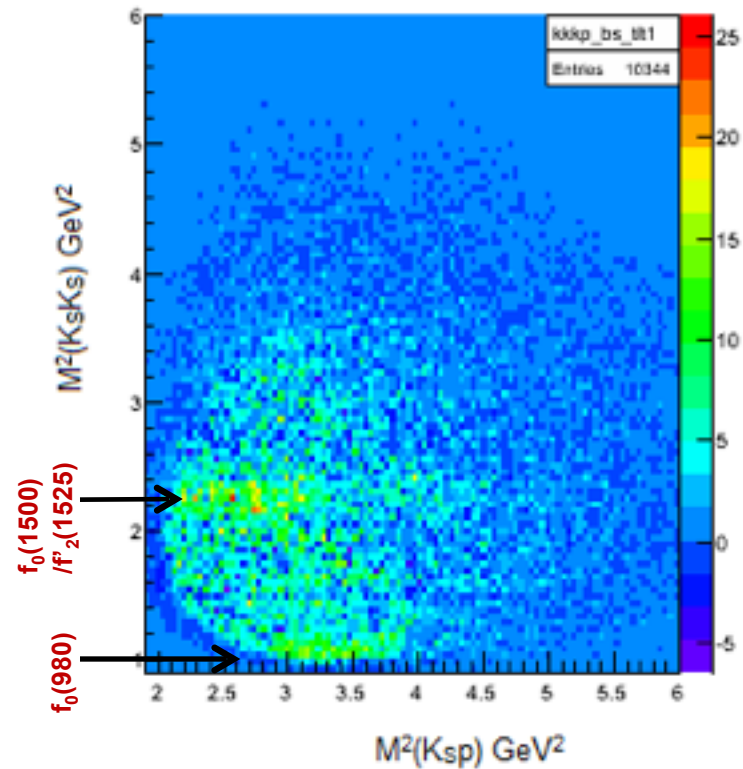


M(4 π) Bgnd subtracted signal, -t > 1 GeV

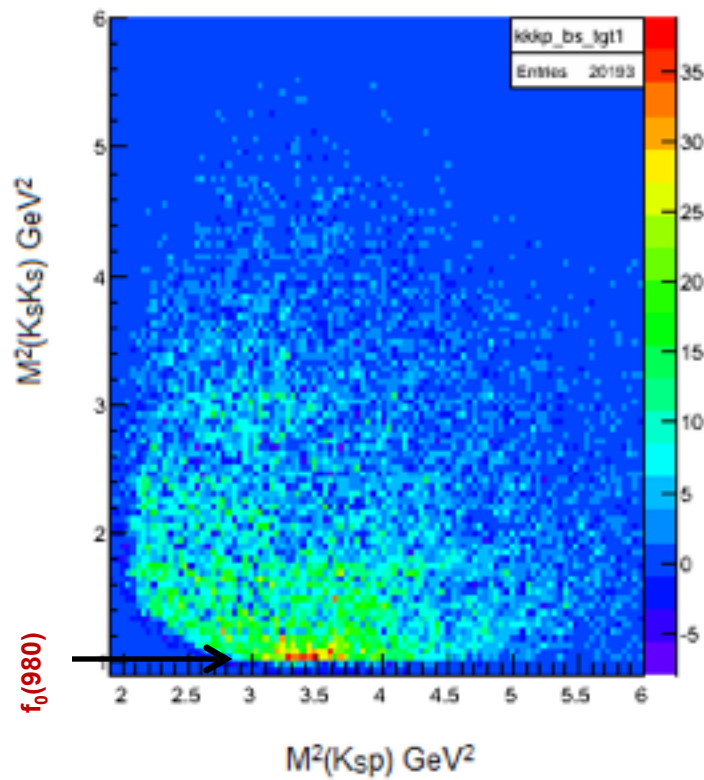


Dalitz Plots

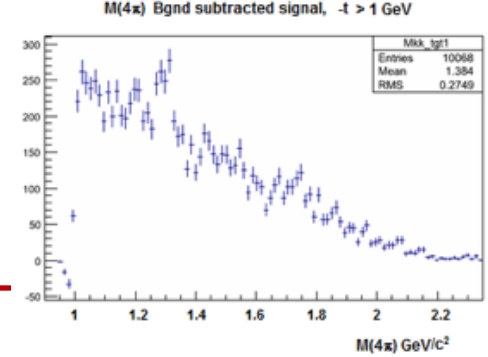
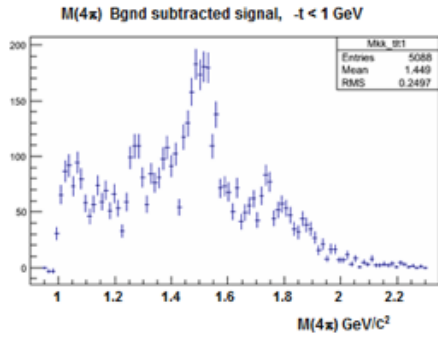
Dalitz plot of $K_S K_S$ vs K_{Sp} , $|t| < 1$



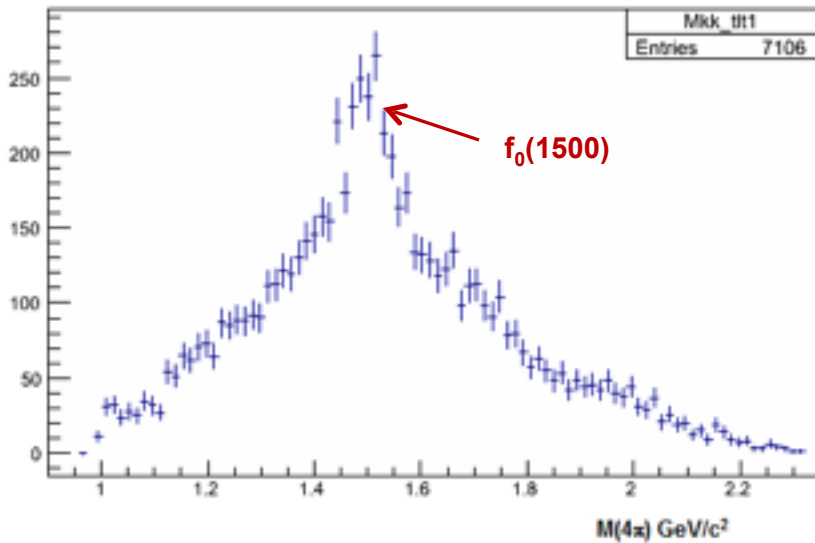
Dalitz plot of $K_S K_S$ vs K_{Sp} , $|t| > 1$



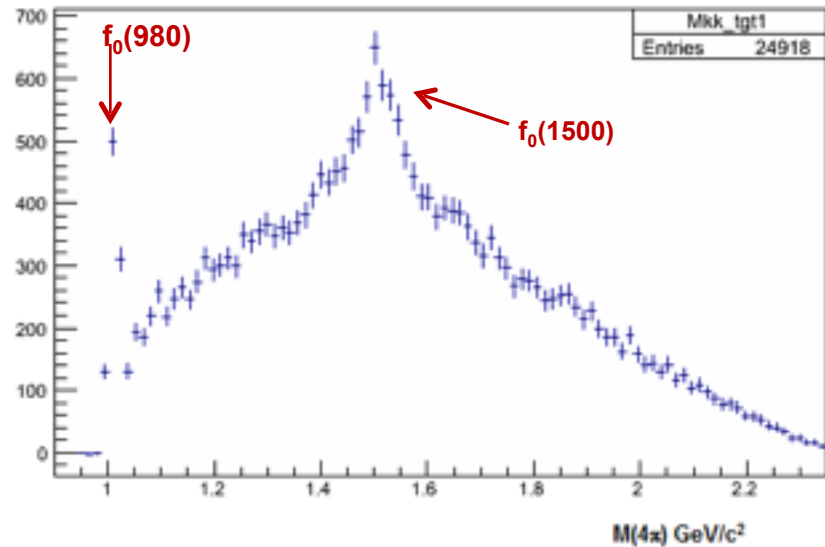
Simulations



M(4 π), $|t| < 1$, background subtracted signal, phase space + $f_0(980)$ + $f_0(1500)$



M(4 π), $|t| > 1$, background subtracted signal, phase space + $f_0(980)$ + $f_0(1500)$

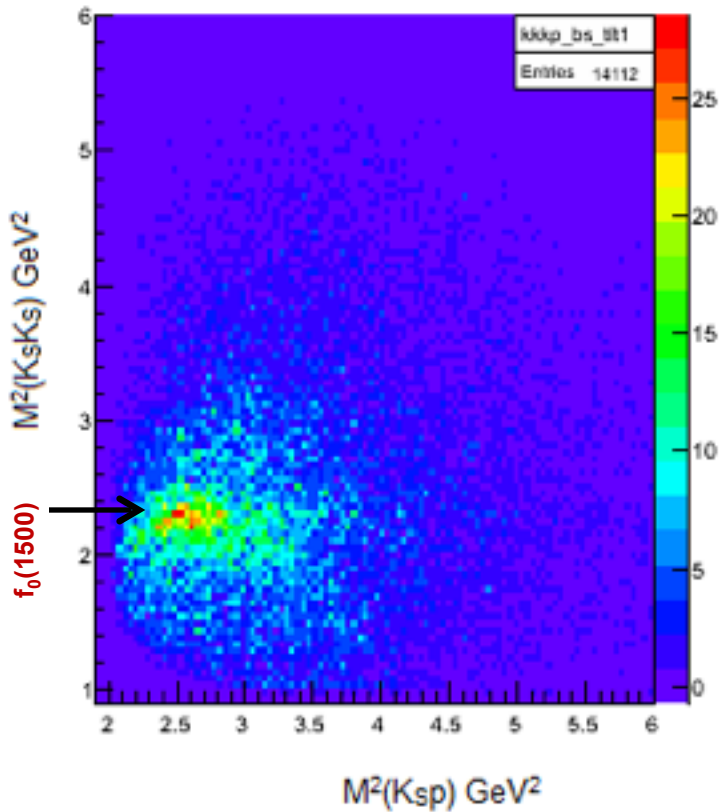


Simulation: $f_0(1500)$ in $-t < 1$ GeV², and $-t > 1$ GeV²,
 $f_0(980)$ in $-t > 1$ GeV²

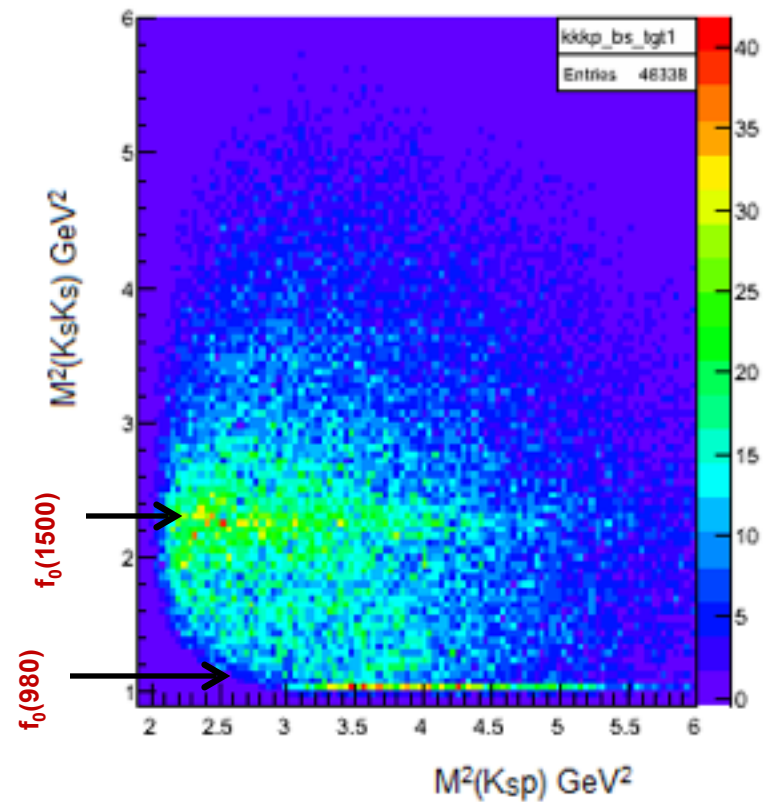
Compare with data: $f_0(1500)$ in $-t < 1$ GeV²,
 $f_0(980)$ in both. Greater contribution in $-t > 1$ GeV².

Simulations

Dalitz plot of $K_S K_S$ vs K_{Sp} , phase space + $f_0(1500)$ + $f_0(980)$, $|t| < 1$



Dalitz plot of $K_S K_S$ vs K_{Sp} , phase space + $f_0(1500)$ + $f_0(980)$, $|t| > 1$



$$\langle Y_{00} \rangle = N \left[|S|^2 + |P_-|^2 + |P_0|^2 + |P_+|^2 + |D_-|^2 + |D_0|^2 + |D_+|^2 \right]$$

$$\langle Y_{10} \rangle = N \left[SP_0^* + P_0 S^* + \sqrt{\frac{3}{5}} (P_- D_-^* + P_- S^* + P_+ D_+^* + D_+ P_+^*) + \sqrt{\frac{4}{5}} (P_0 D_0^* + D_0 P_0^*) \right]$$

$$\langle Y_{11} \rangle = N \left[\sqrt{\frac{1}{2}} (-P_- S^* - SP_-^* + P_+ S^* + SP_+^*) + \sqrt{\frac{1}{20}} (P_- D_0^* + D_0 P_-^* - P_+ D_0^* - D_0 P_+^*) + \sqrt{\frac{3}{20}} (-P_0 D_-^* - D_- P_0^* + P_0 D_+^* + D_+ P_0^*) \right]$$

$$\langle Y_{20} \rangle = N \left[SD_0^* + D_0 S^* + \sqrt{\frac{1}{5}} (2|P_0|^2 - |P_-|^2 - |P_+|^2 + |D_-|^2 + |D_+|^2) + \sqrt{\frac{5}{49}} (|D_-|^2 + |D_+|^2) + \sqrt{\frac{20}{49}} |D_0|^2 \right]$$

$$\langle Y_{21} \rangle = N \left[\frac{1}{2} (SD_+^* + D_+ S^* - SD_-^* - D_- S^*) + \sqrt{\frac{3}{20}} (P_0 P_+^* + P_+ P_0^* - P_- P_0^* - P_0 P_-^*) + \sqrt{\frac{5}{196}} (D_0 D_+^* + D_+ D_0^* - D_0 D_-^* - D_- D_0^*) \right]$$

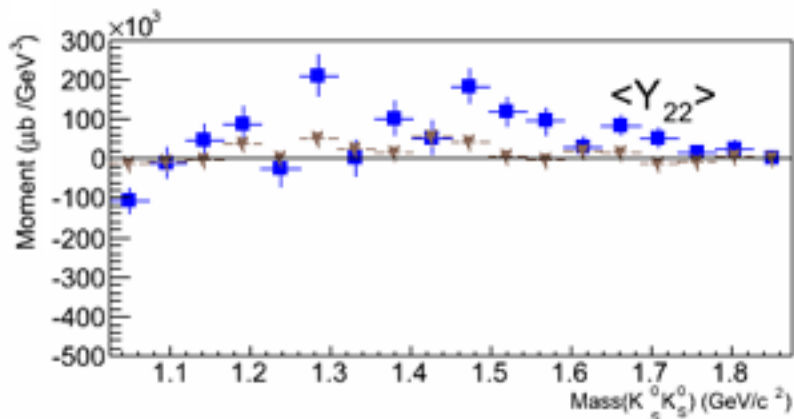
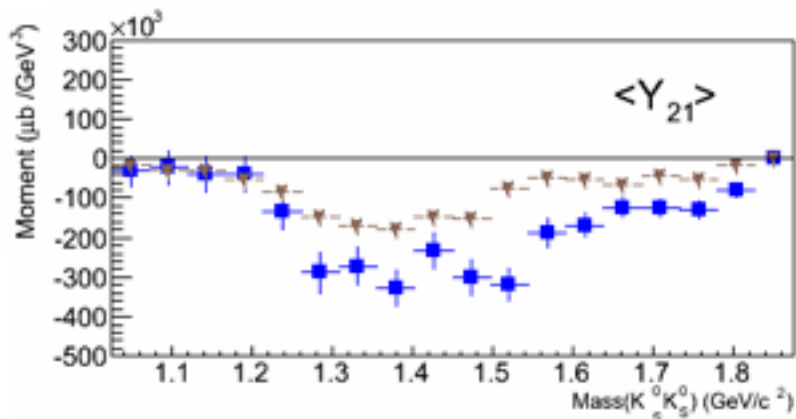
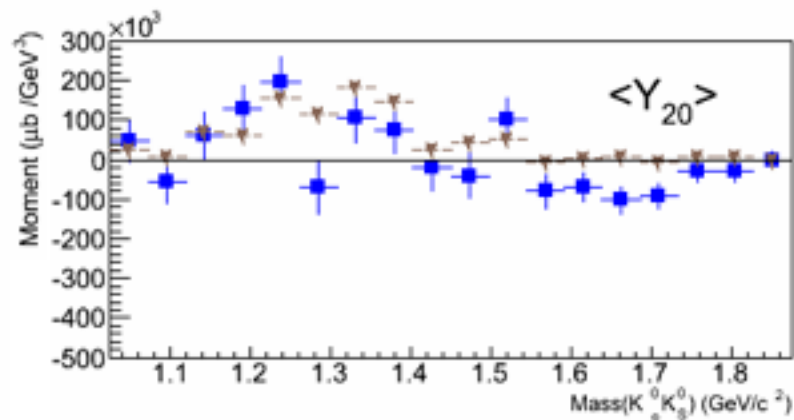
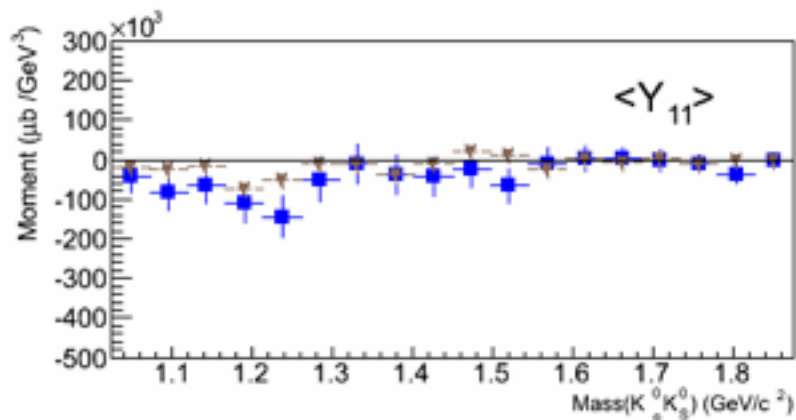
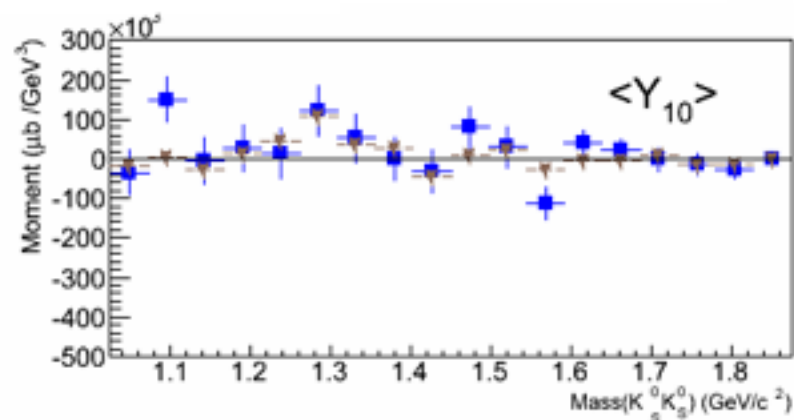
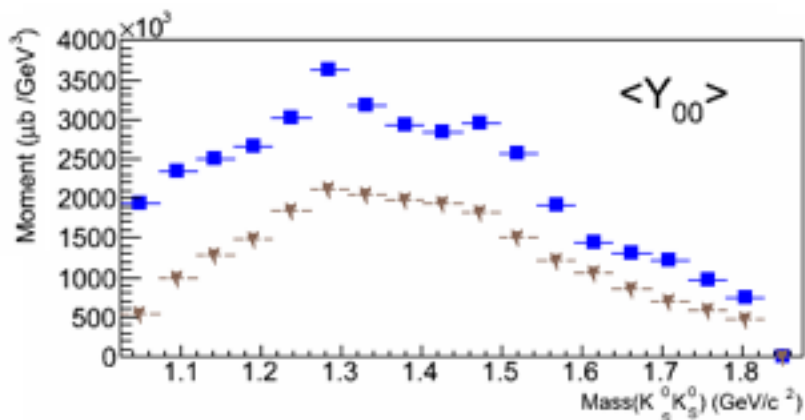
$$\langle Y_{22} \rangle = N \left[\sqrt{\frac{3}{10}} (P_- P_+^* + P_+ P_-^*) + \sqrt{\frac{3}{196}} (-D_- D_+^* - D_+ D_-^*) \right]$$

Moments

Analysis

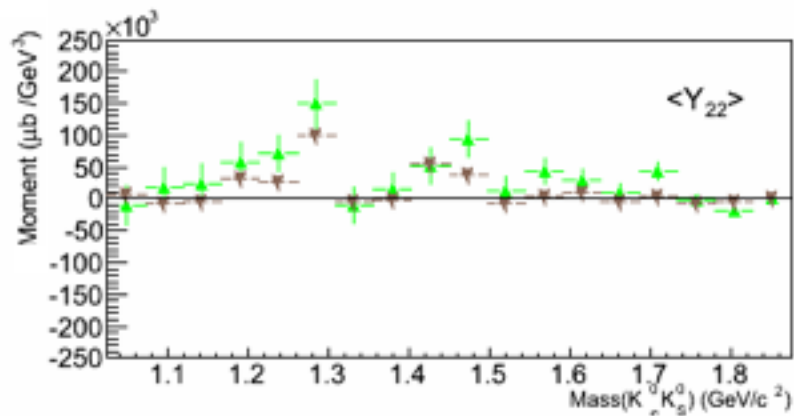
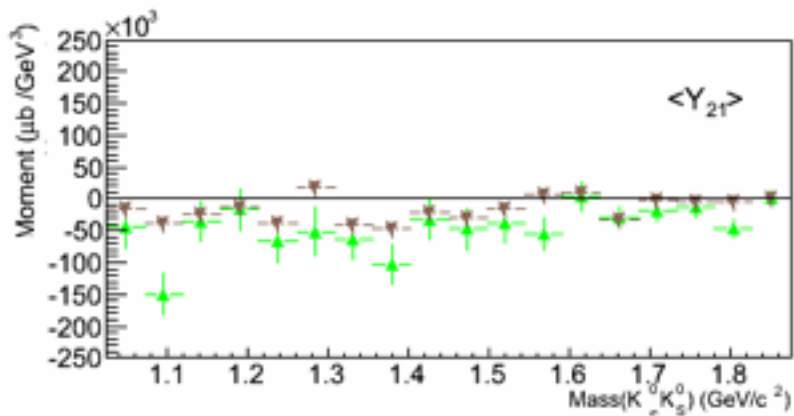
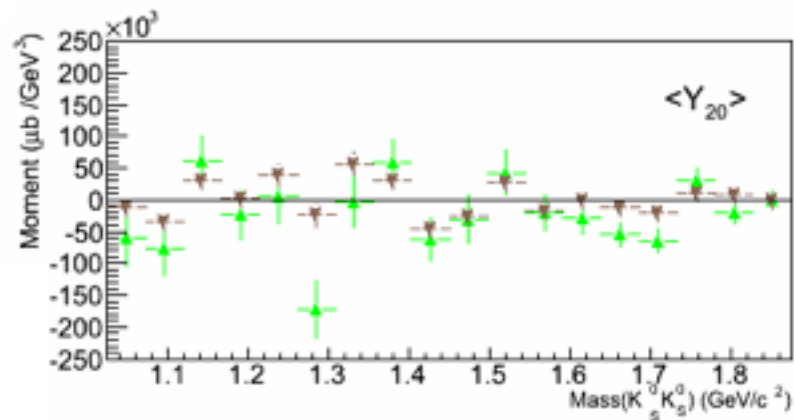
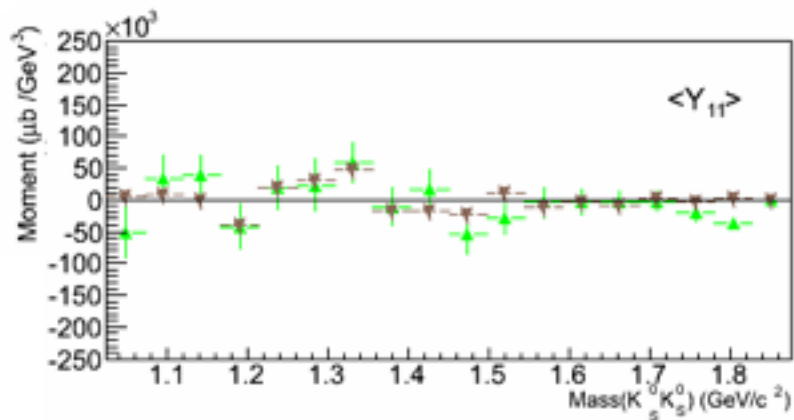
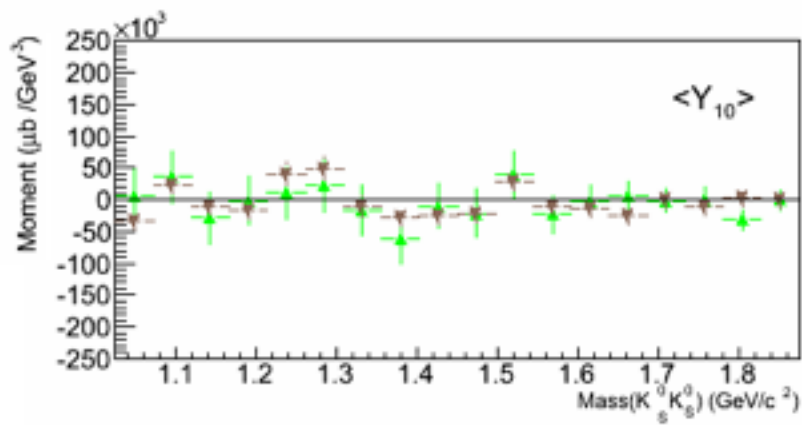
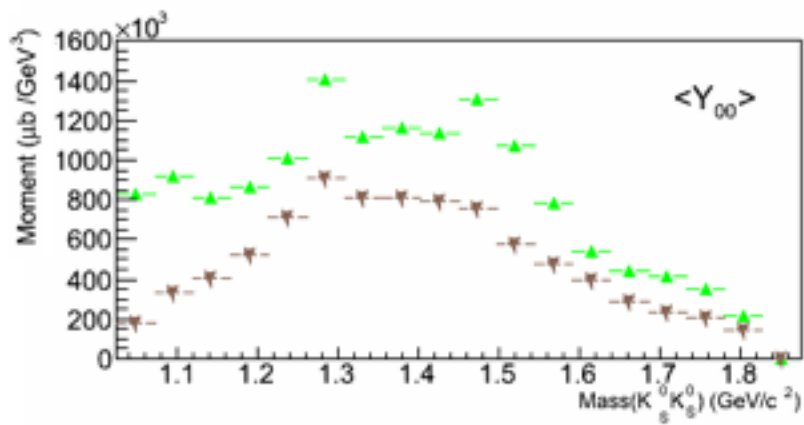
— Signal, no \dagger cut

— Background, no \dagger cut



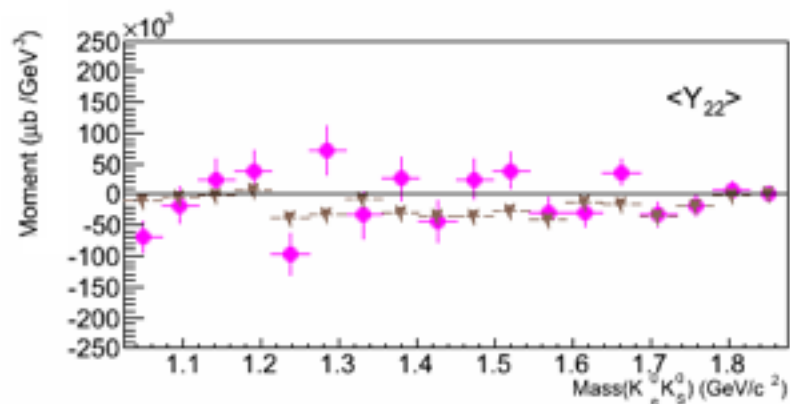
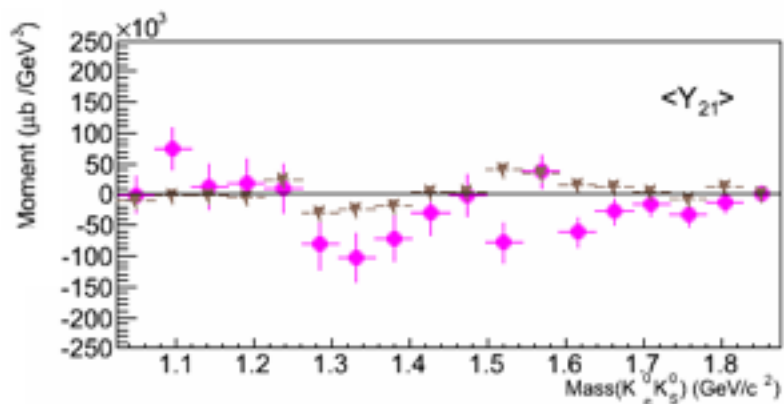
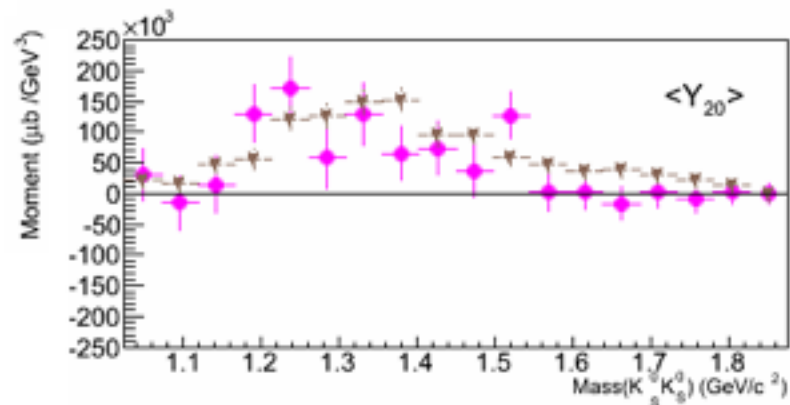
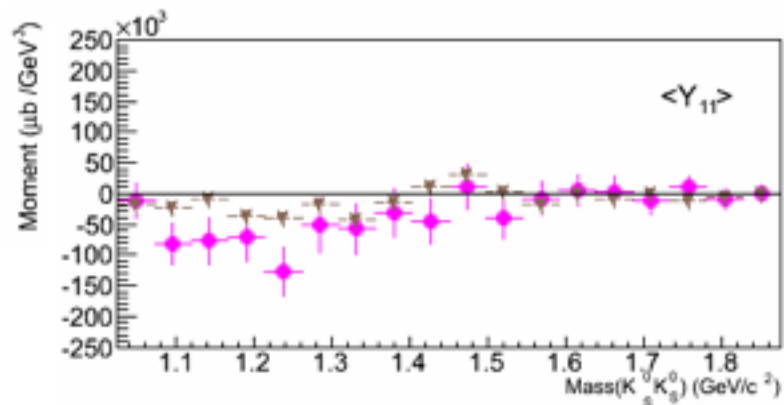
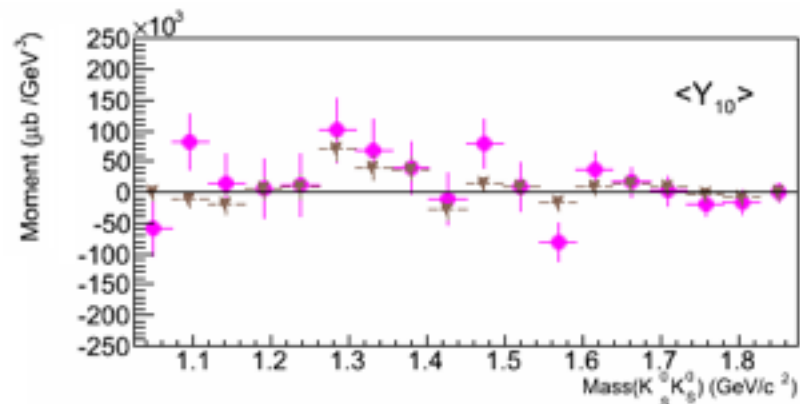
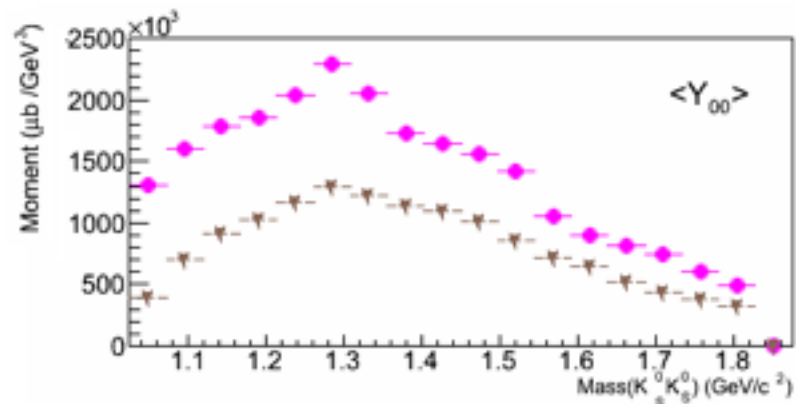
— Signal, $-t < 1$

— Background, $-t < 1$

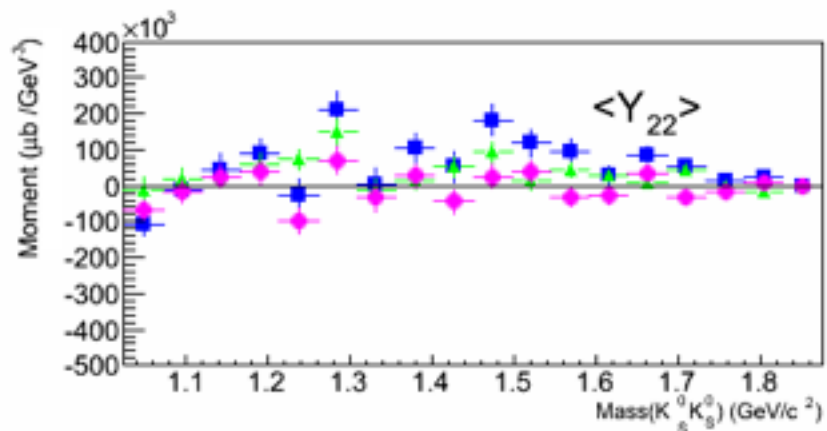
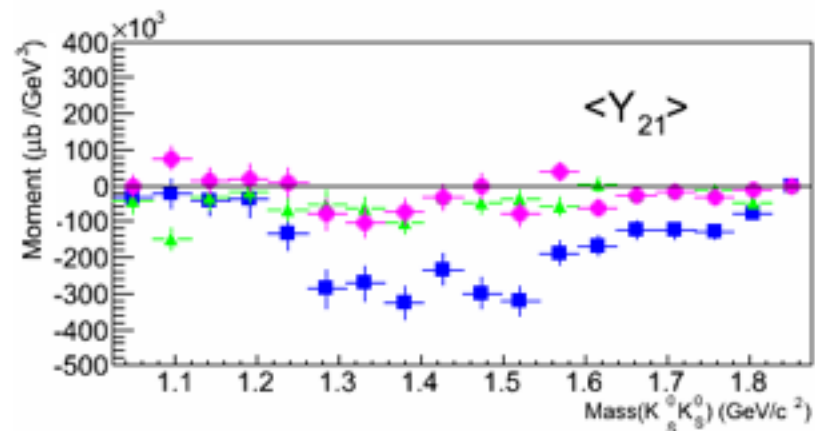
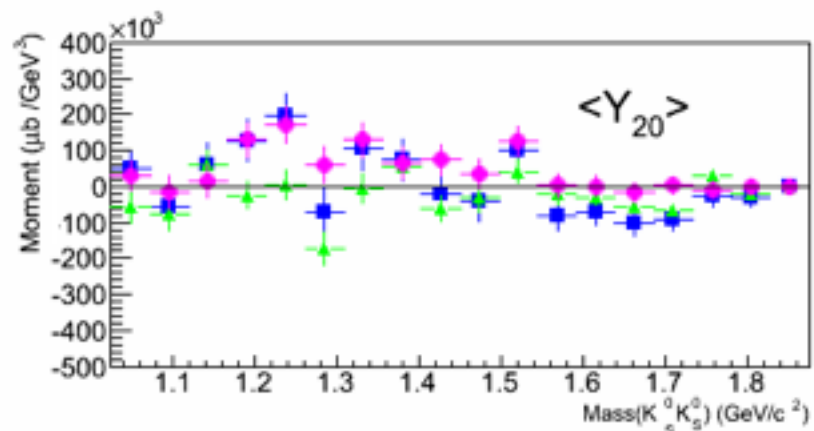
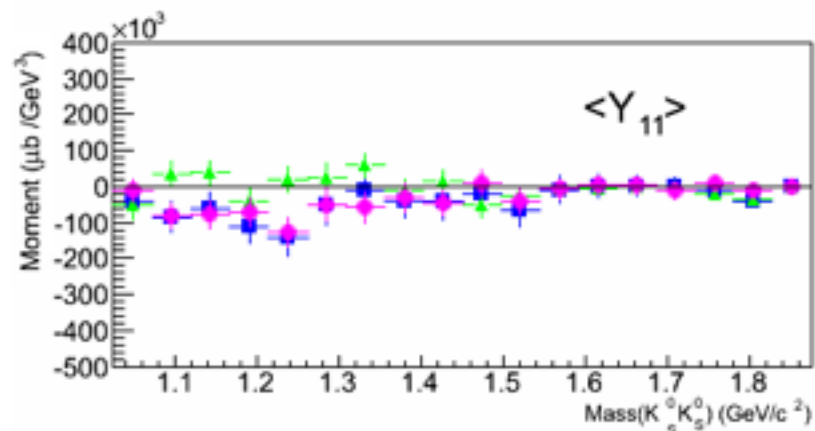
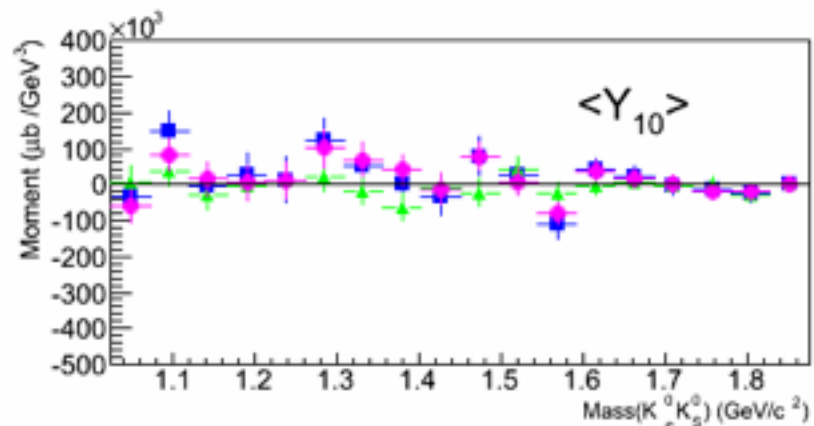
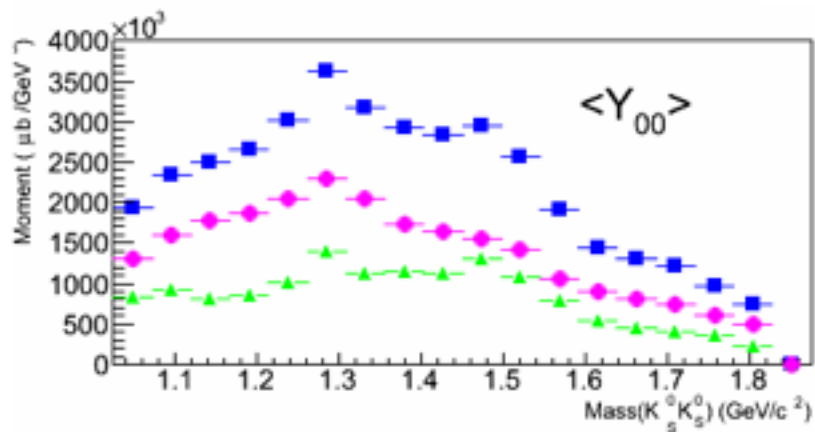


Signal, $-t \rightarrow 1$

Background, $-t \rightarrow 1$

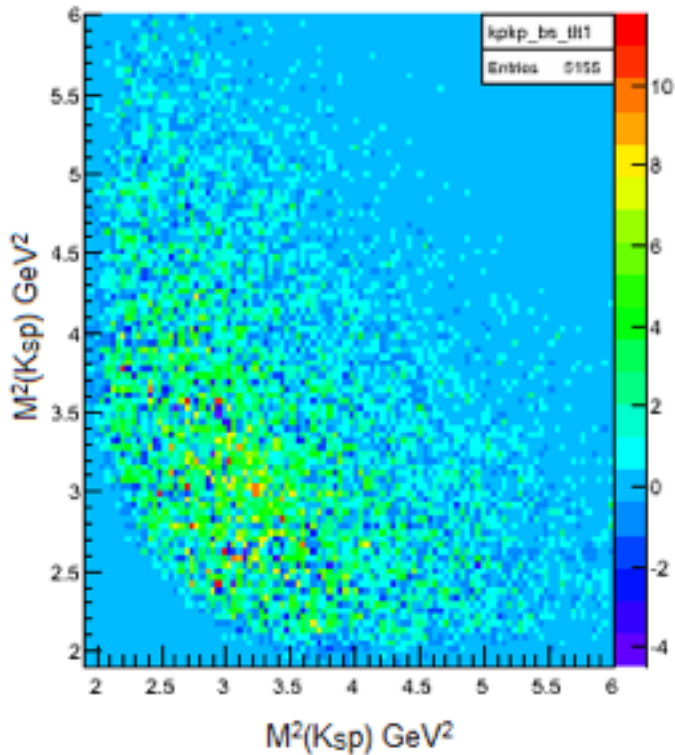


— No τ cut
 — $-\tau < 1$
 — $-\tau > 1$

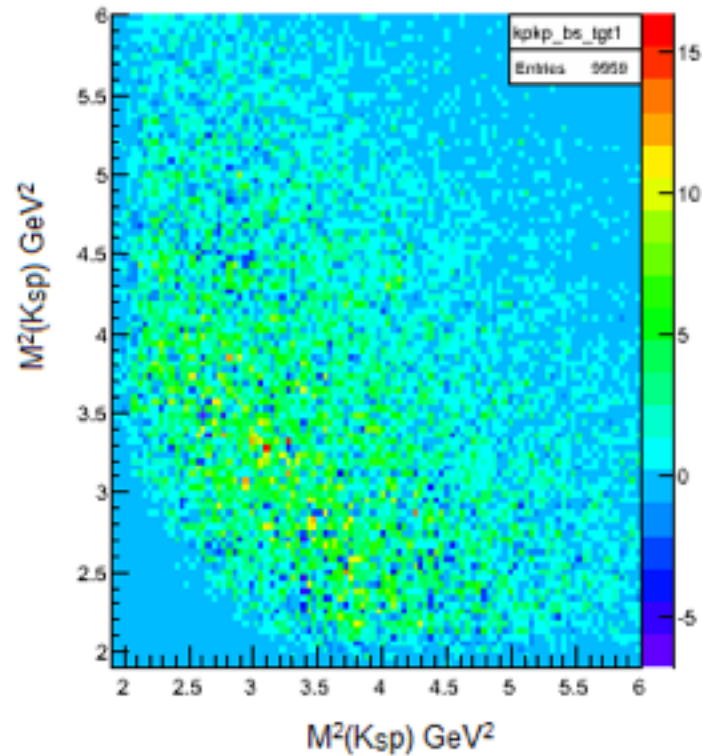


Dalitz Plots

Dalitz plot of K_{sp} vs K_{sp} , $|t| < 1$

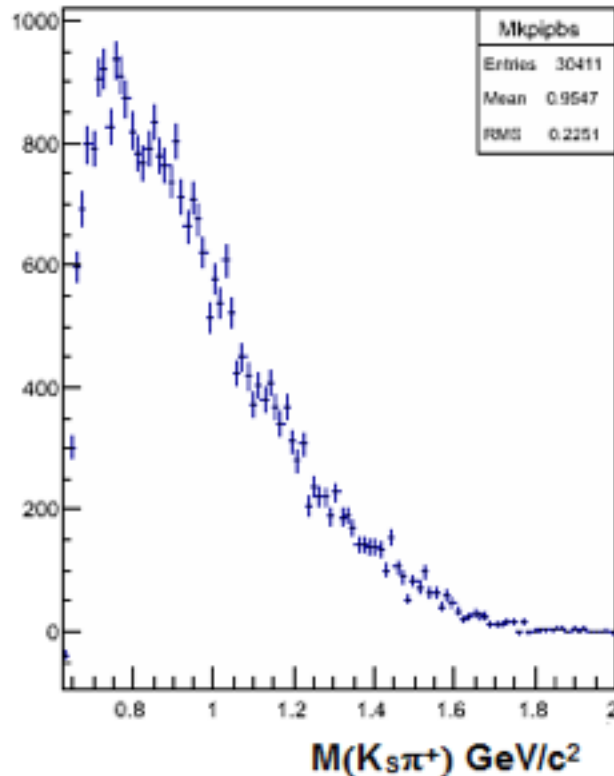


Dalitz plot of K_{sp} vs K_{sp} , $|t| > 1$

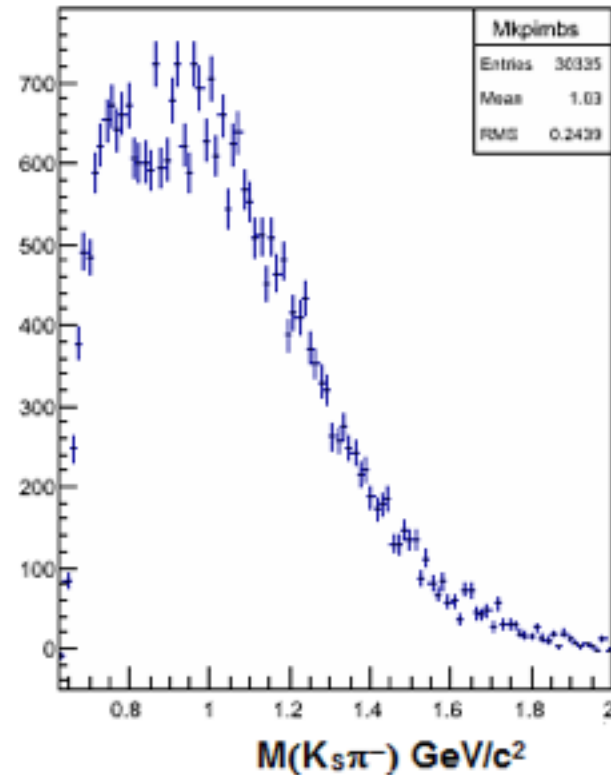


Background: $K_S + \pi$

$M(K_S\pi^+)$ Bgnd subtracted signal

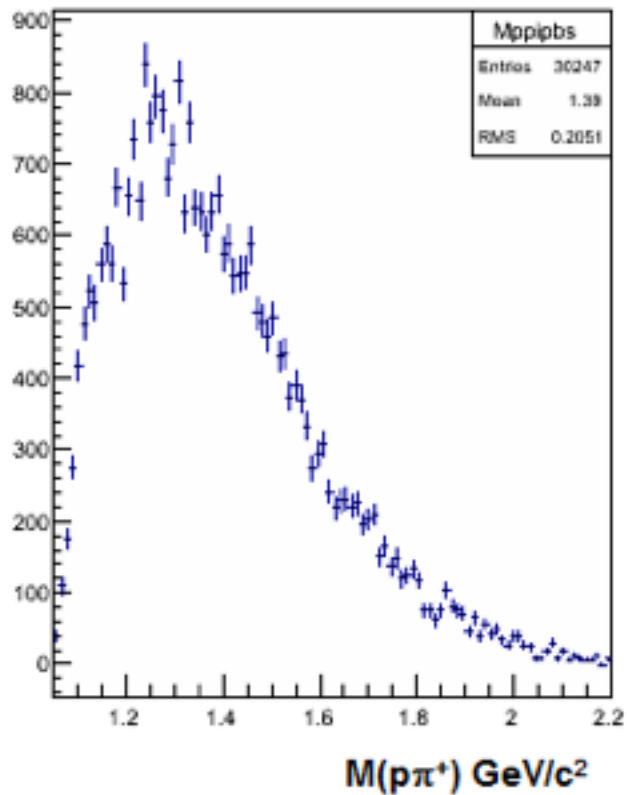


$M(K_S\pi^-)$ Bgnd subtracted signal

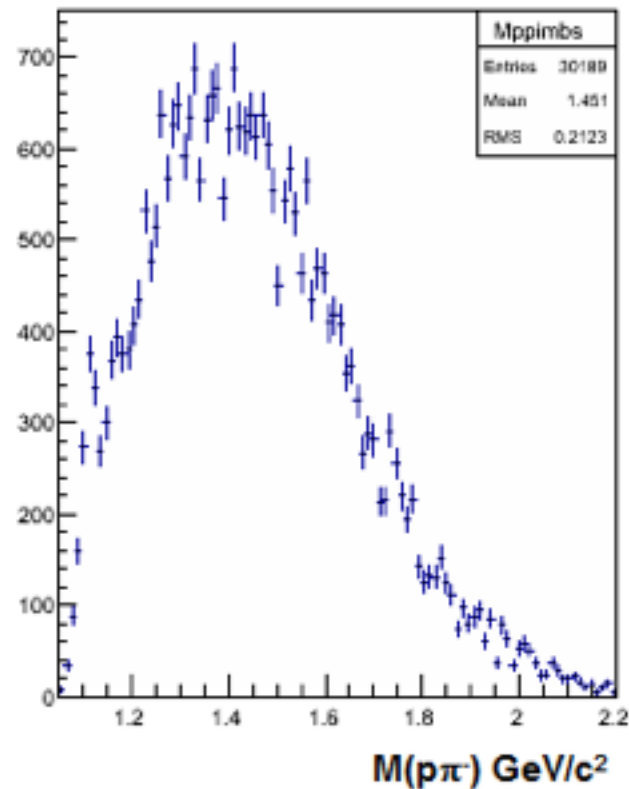


Background : $p+\pi$

$M(p\pi^+)$ Bgnd subtracted signal



$M(p\pi^-)$ Bgnd subtracted signal



Background : $p+K_s$

$M(K_s p)$, Bgnd subtracted signal, $E_\gamma > 2.7$ GeV

