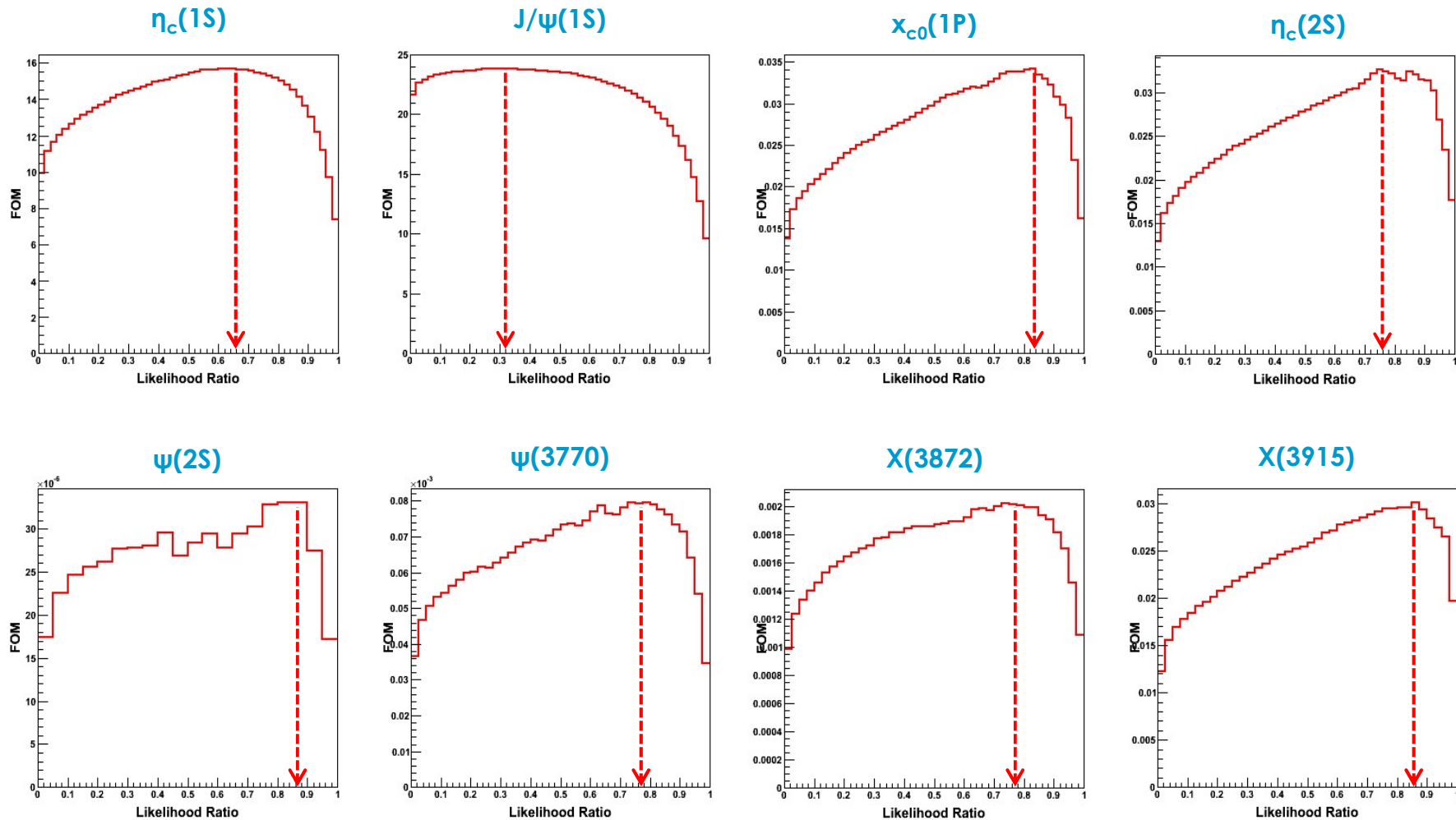


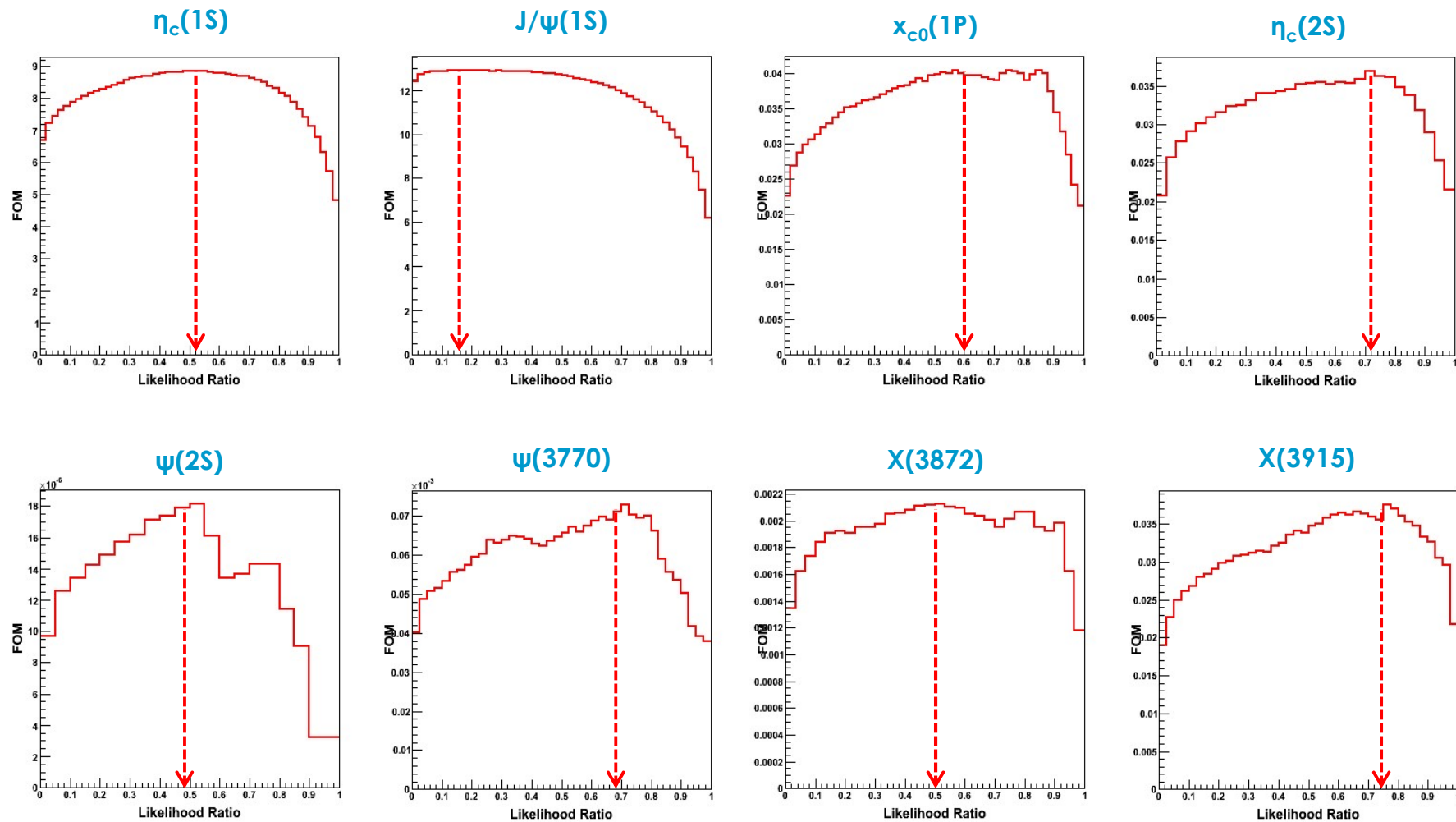
Optimization of LR Cut: FOM

- $B^+ \rightarrow (cc\bar{b})K^+ \rightarrow pp\bar{b}K^+$



Optimization of LR Cut: FOM

- $B^0 \rightarrow (cc\bar{b})K_S^0 \rightarrow pp\bar{b}K_S^0$



Signal Yield Extraction

- **Signal Yield Extraction** 3-Dimensional Unbinned Likelihood Fit on $M_{bc} - \Delta E - M_{pp}$ plane
- **Determination of Signal and Background PDFs**

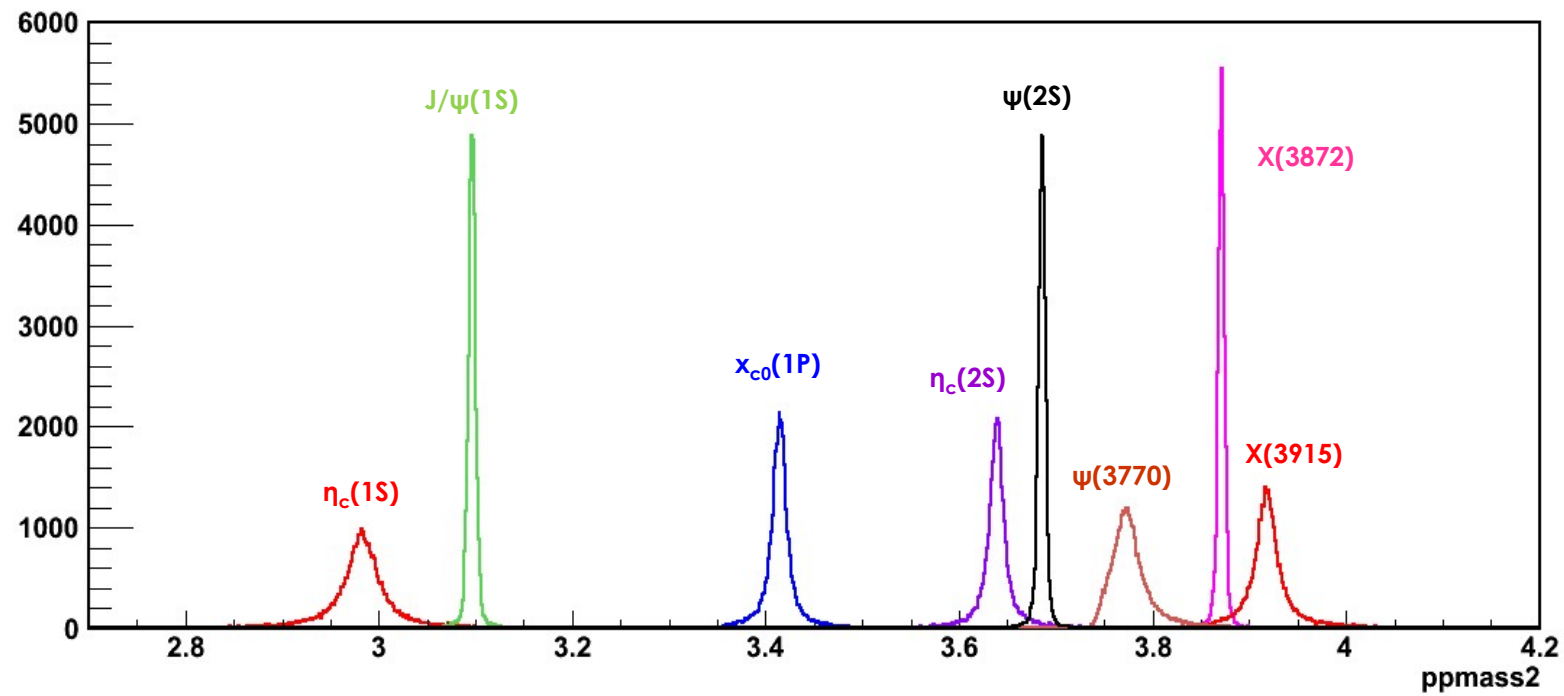
PDF	M_{bc}	ΔE	M_{pp}
Signal * resonant	Gaussian	double Gaussian	Signal PDF
Background 1 combinatoric	Argus	1 st order polynomial	2 nd order polynomial
Background 2 ** non resonant "peaking bkg"	Gaussian	double Gaussian	1 st order polynomial

Resonance	Signal PDF	Resonance	Signal PDF
$\eta_c(1S)$ *	Voigtian	$\psi(2S)$ **	Single Gaussian
$J/\psi(1S)$	Single Gaussian	$\psi(3770)$ **	Relativistic Breit-Wigner
$\chi_{c0}(1P)$ **	Voigtian	$X(3872)$ **	Single Gaussian
$\eta_c(2S)$ **	Voigtian	$X(3915)$ **	Voigtian

* $B^+ \rightarrow (cc) K^+ \rightarrow ppK^+$
 ** $B^+ \rightarrow ppK^+$

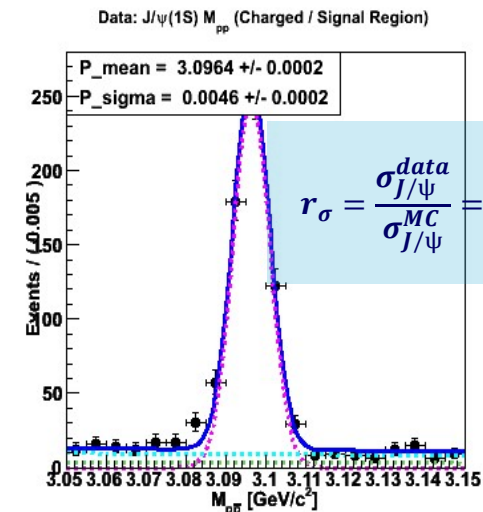
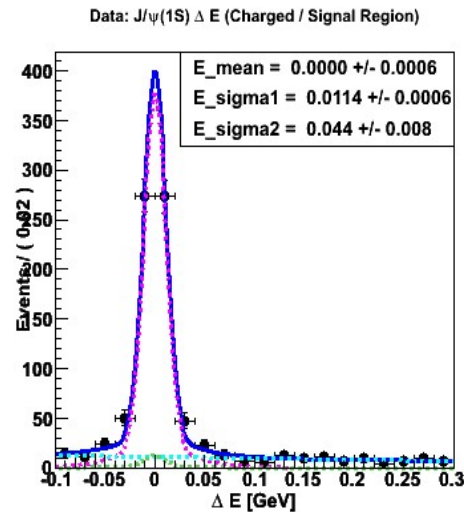
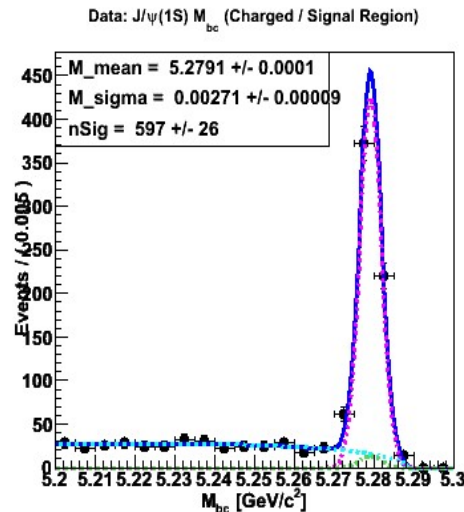
* σ fixed
 ** m, σ, Γ fixed

Signal Yield Extraction



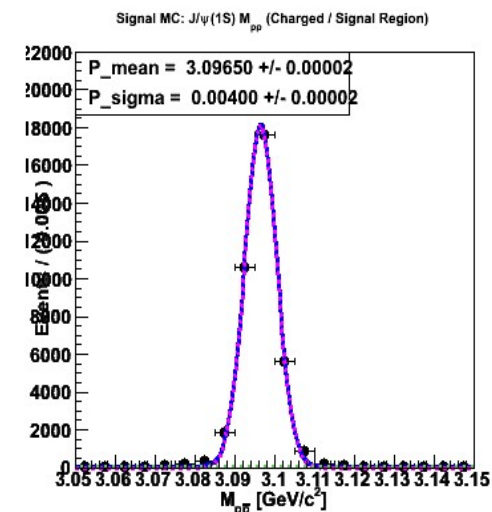
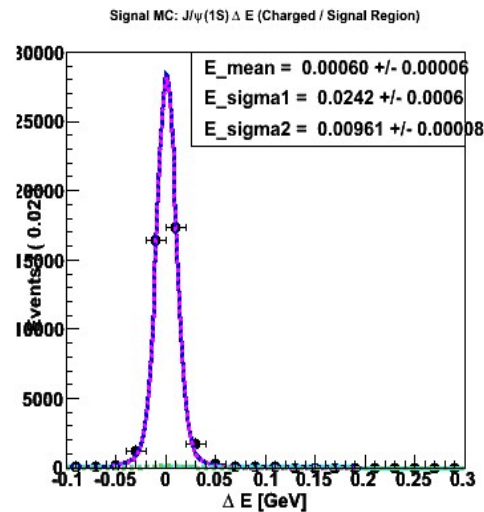
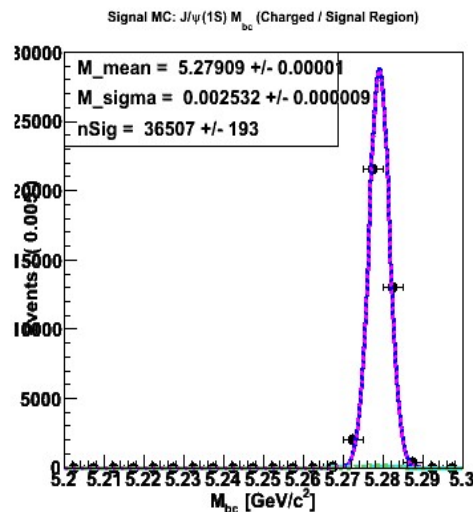
$$B^+ \rightarrow J/\psi(1S)K^+ \rightarrow p\bar{p}K^+$$

DATA

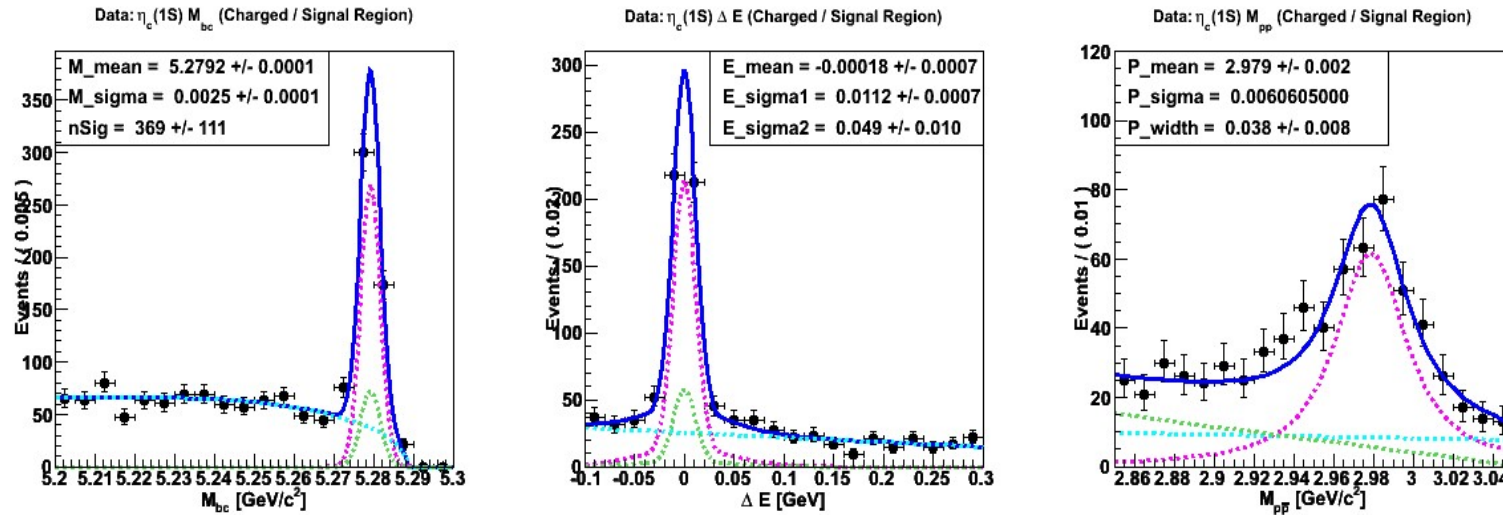


$$r_{\sigma} = \frac{\sigma_{J/\psi}^{\text{data}}}{\sigma_{J/\psi}^{\text{MC}}} = 1.15, 1.18$$

MC

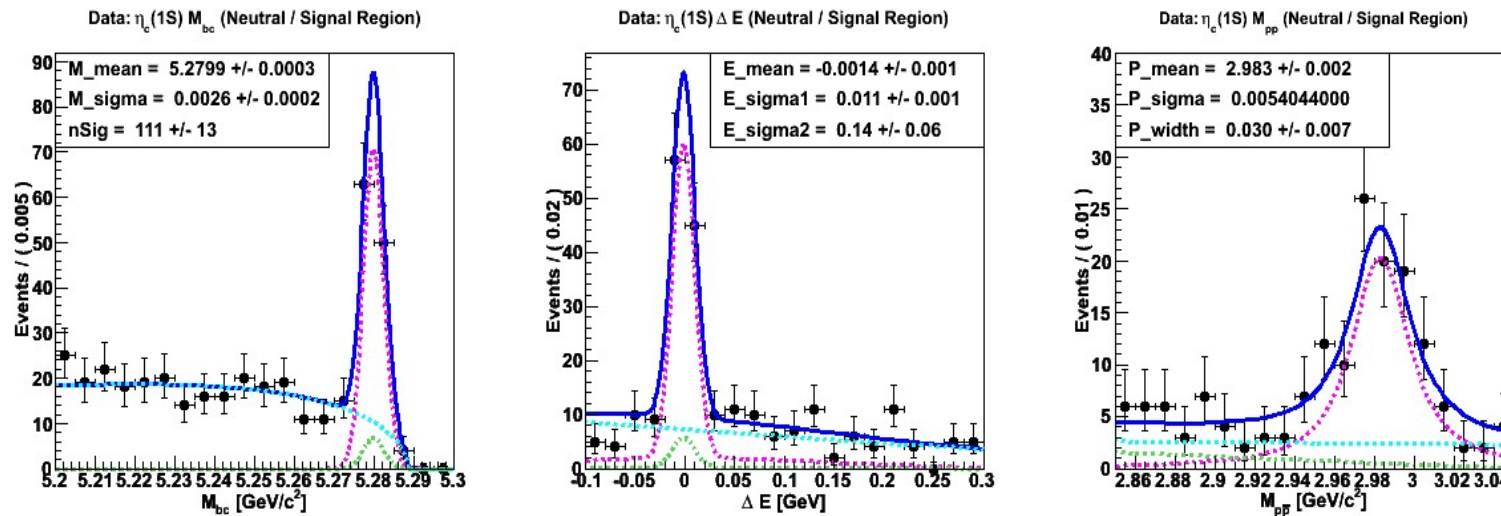


$$B^+ \rightarrow \eta_c(1S)K^+ \rightarrow p\bar{p}K^+$$



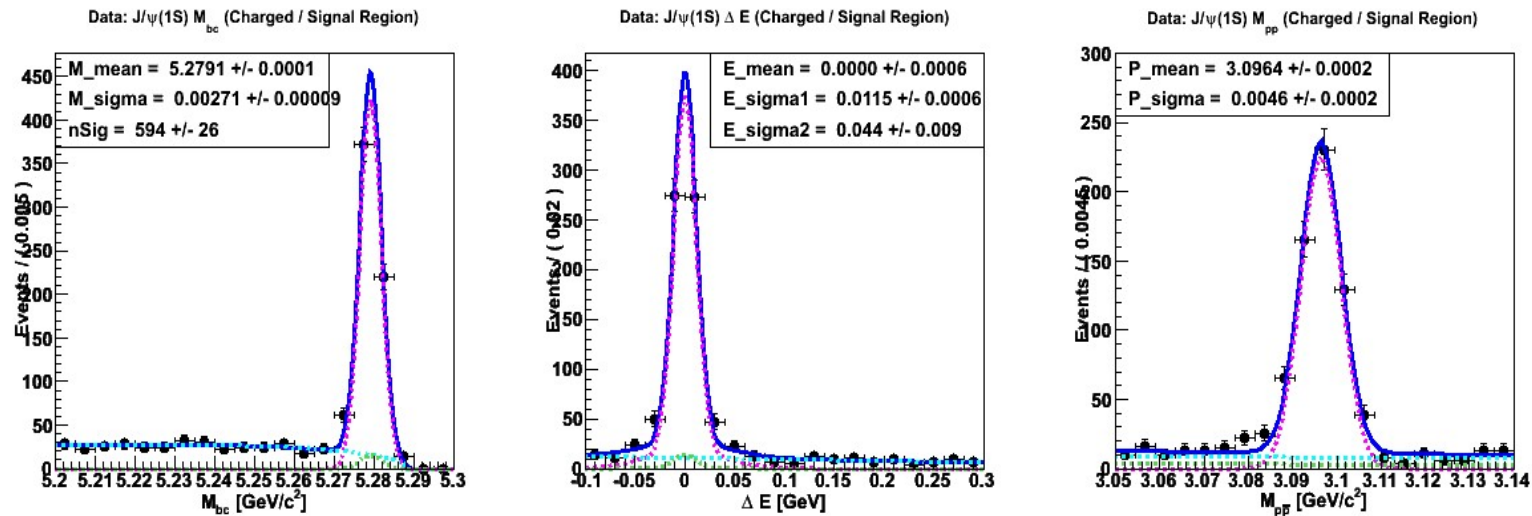
Yield	Eff. (%)	Significance (σ)	Mass (MeV/c ²)	Product BF (10 ⁻⁶)
368 $\pm$ 110	29.4	13.6	2978.63 $\pm$ 2.34	1.63 $\pm$ 0.49 $\pm$ 0.04
Mass (MeV/c ²)			Product Branching Fraction (10 ⁻⁶)	
measured*	PDG 2016		measured	PDG 2016
2978.63 $\pm$ 2.34	2983.4 $\pm$ 0.5		1.63 $\pm$ 0.49 $\pm$ 0.04	1.44 $\pm$ 0.23

$$B^0 \rightarrow \eta_c(1S) K_s^0 \rightarrow pp\bar{K}_s^0$$



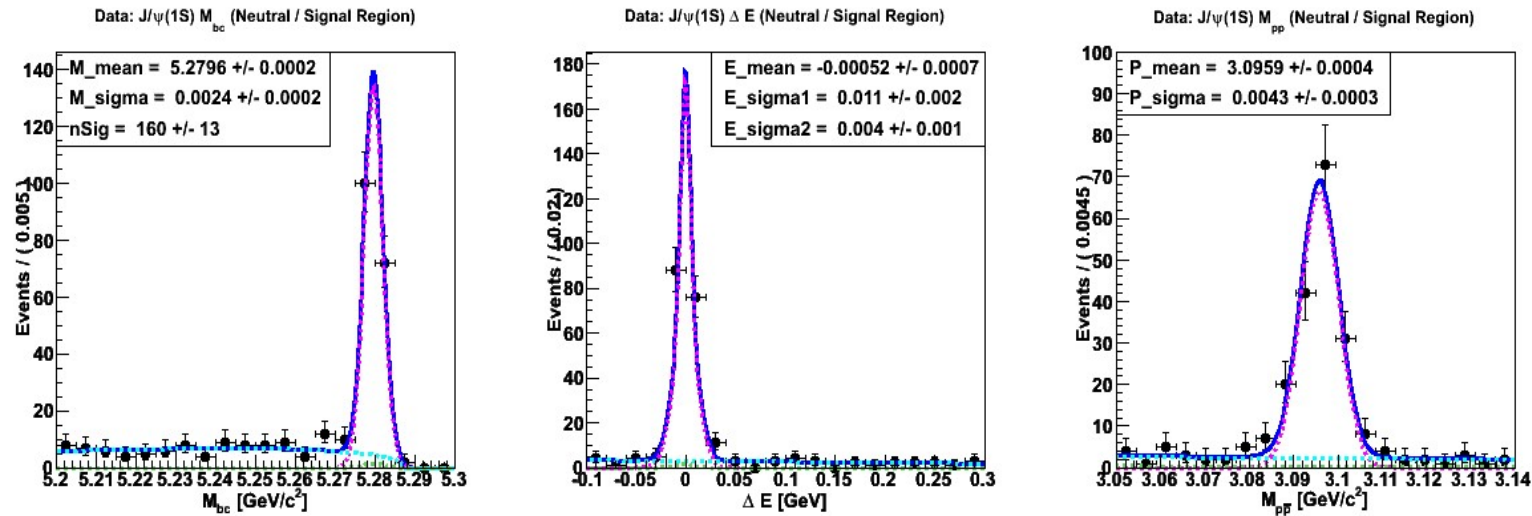
Yield	Eff. (%)	Significance (σ)	Mass (MeV/c ²)	Product BF (10 ⁻⁶)
111 $\pm$ 13	21.1	9.52	2983.02 $\pm$ 2.48	0.68 $\pm$ 0.08 $\pm$ 0.02
Mass (MeV/c ²)			Product Branching Fraction (10 ⁻⁶)	
measured*	PDG 2016		measured	PDG 2016
2983.02 $\pm$ 2.48	2983.4 $\pm$ 0.5		0.68 $\pm$ 0.08 $\pm$ 0.02	0.60 $\pm$ 0.11

$$B^+ \rightarrow J/\psi(1S)K^+ \rightarrow p\bar{p}K^+$$



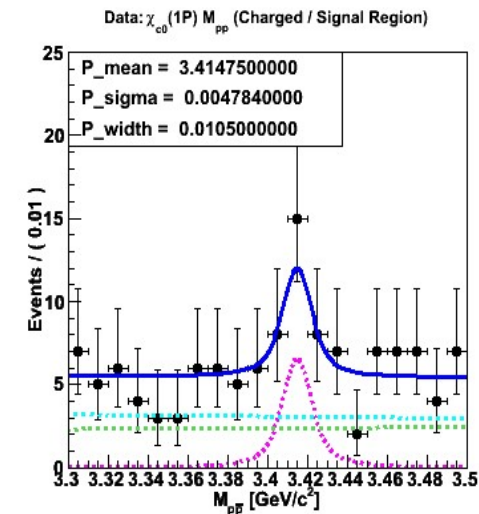
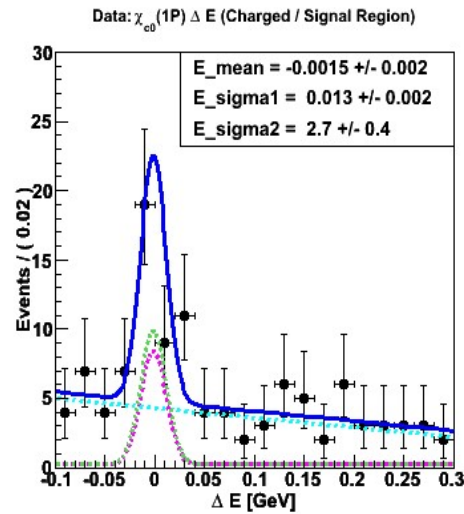
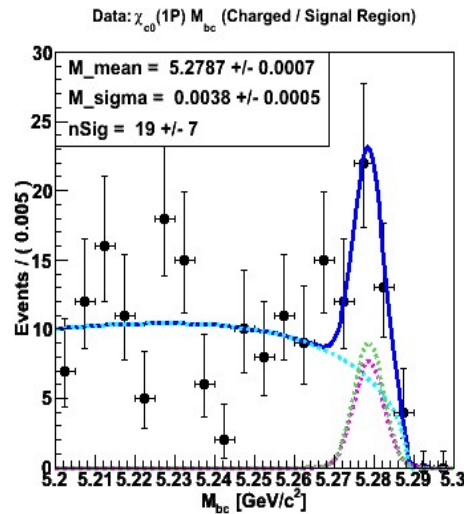
Yield	Eff. (%)	Significance (σ)	Mass (MeV/c ²)	Product BF (10 ⁻⁶)
594 $\pm$ 26	35.0	36.7	3096.42 $\pm$ 2.48	2.20 $\pm$ 0.10 $\pm$ 0.05
Mass (MeV/c ²)			Product Branching Fraction (10 ⁻⁶)	
measured*		PDG 2016	measured	PDG 2016
3096.42 $\pm$ 2.48		3096.900 $\pm$ 0.006	2.20 $\pm$ 0.10 $\pm$ 0.05	2.18 $\pm$ 0.07

$$B^0 \rightarrow J/\psi(1S)K_s^0 \rightarrow p\bar{p}K_s^0$$

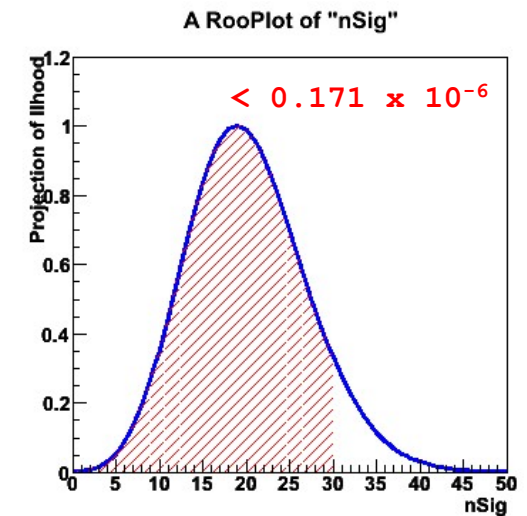
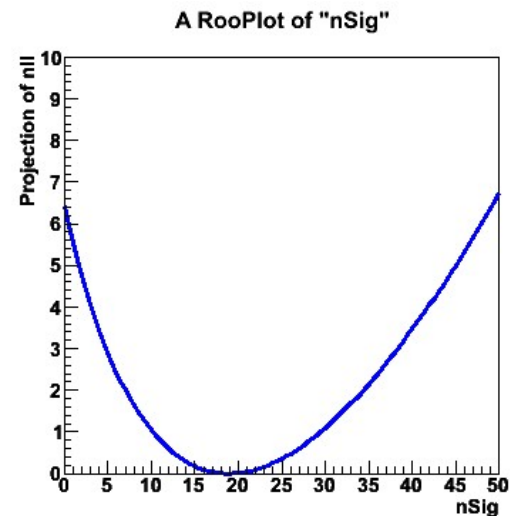


Yield	Eff. (%)	Significance (σ)	Mass (MeV/c ²)	Product BF (10 ⁻⁶)
160 $\pm$ 13	23.0	20.9	3095.91 $\pm$ 0.37	0.90 $\pm$ 0.07 $\pm$ 0.02
Mass (MeV/c ²)			Product Branching Fraction (10 ⁻⁶)	
Measured *	PDG 2016		measured	PDG 2016
3095.91 $\pm$ 0.37	3096.900 $\pm$ 0.006		0.90 $\pm$ 0.07 $\pm$ 0.02	0.93 $\pm$ 0.04

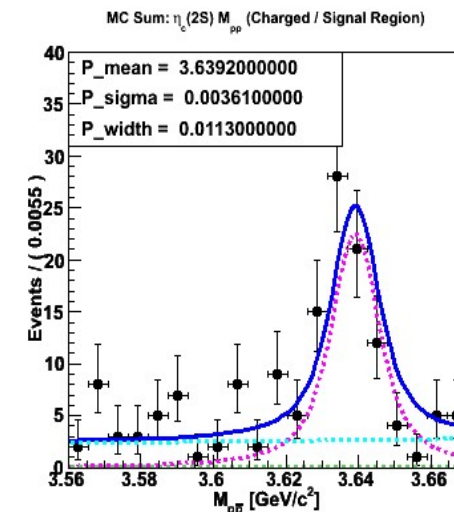
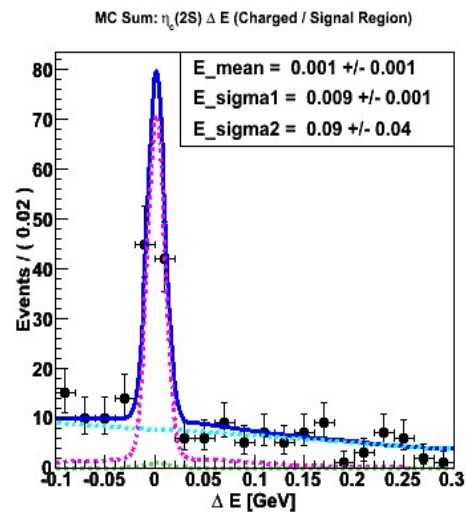
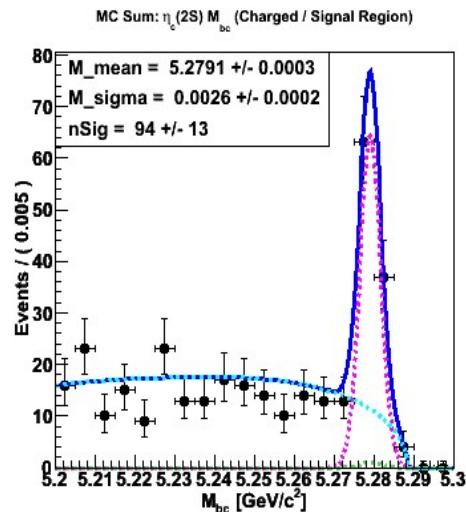
$$B^+ \rightarrow \chi_{c0}(1P)K^+ \rightarrow p\bar{p}K^+$$



Yield	Eff. (%)	Significance (σ)
19 ± 7	22.7	2.94
Product Branching Fraction (10^{-6})		
measured	PDG 2016	
0.108 ± 0.042	0.0338 ± 0.0036	

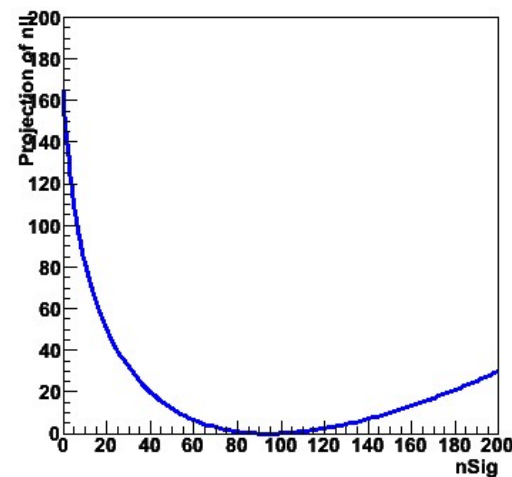


$$B^+ \rightarrow \eta_c(2S)K^+ \rightarrow pp\bar{K}^+$$

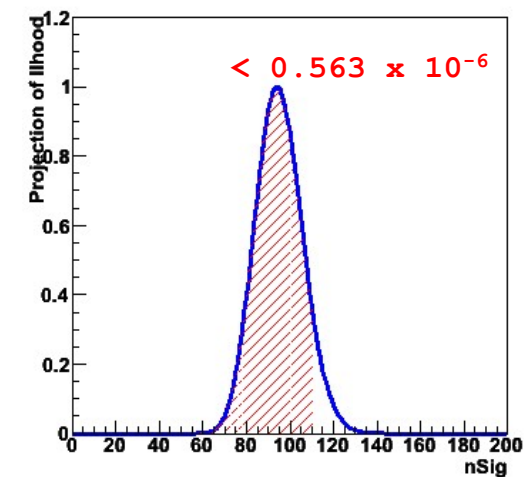


Yield	Eff. (%)	Significance (σ)
94 ± 13	25.3	2.37
Product Branching Fraction (10^{-6})		
measured	MC input	
0.481 ± 0.066	0.432	

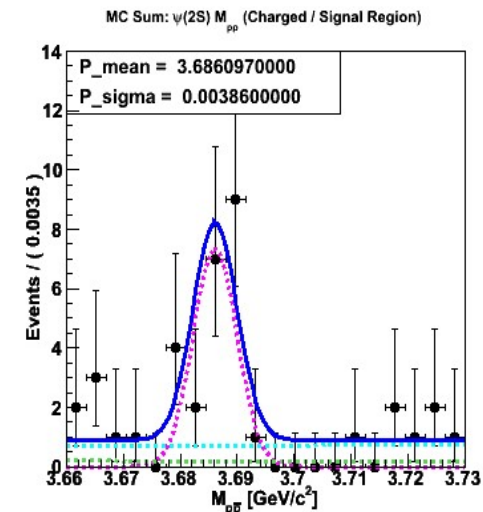
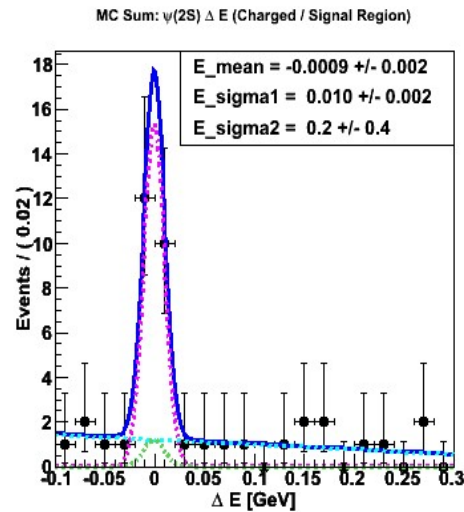
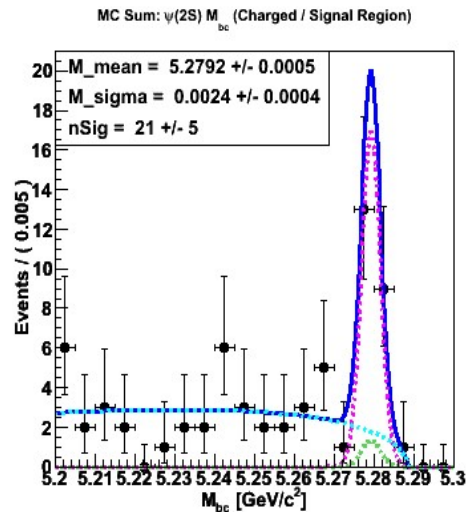
A RooPlot of "nSig"



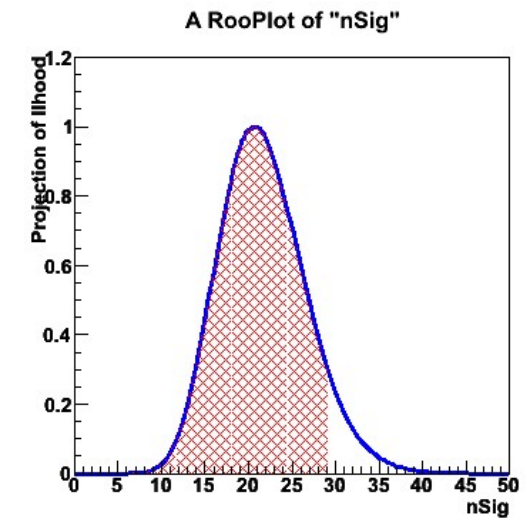
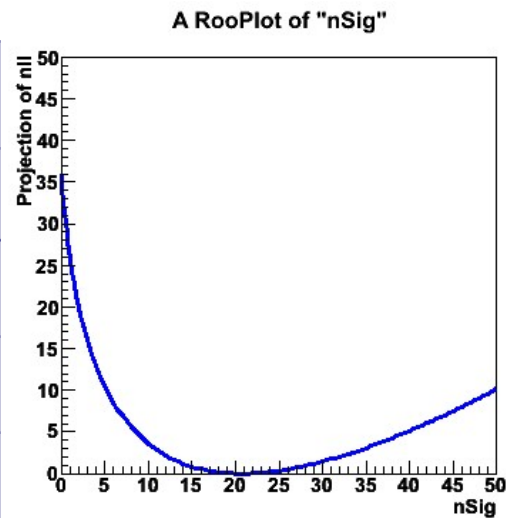
A RooPlot of "nSig"



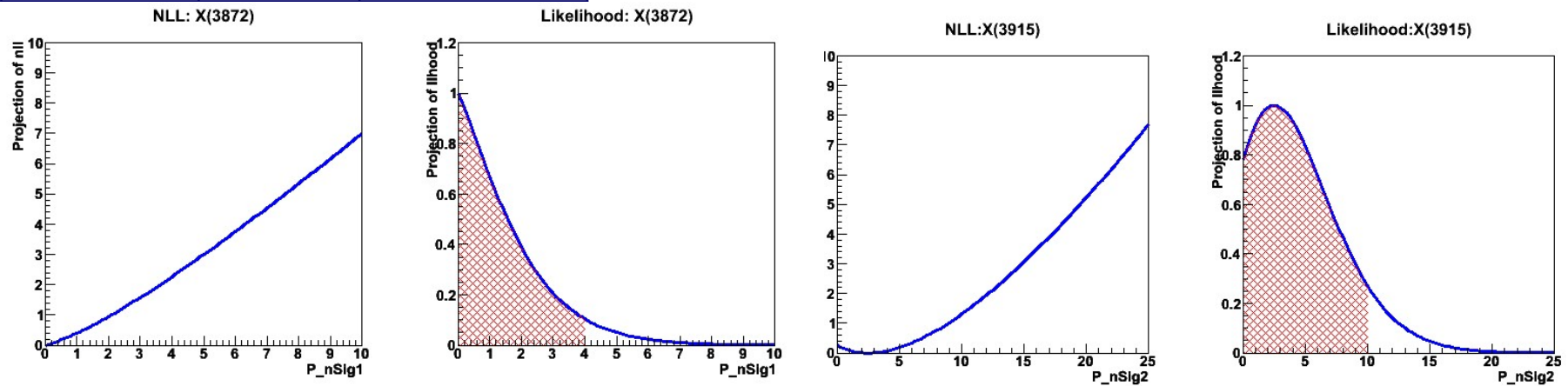
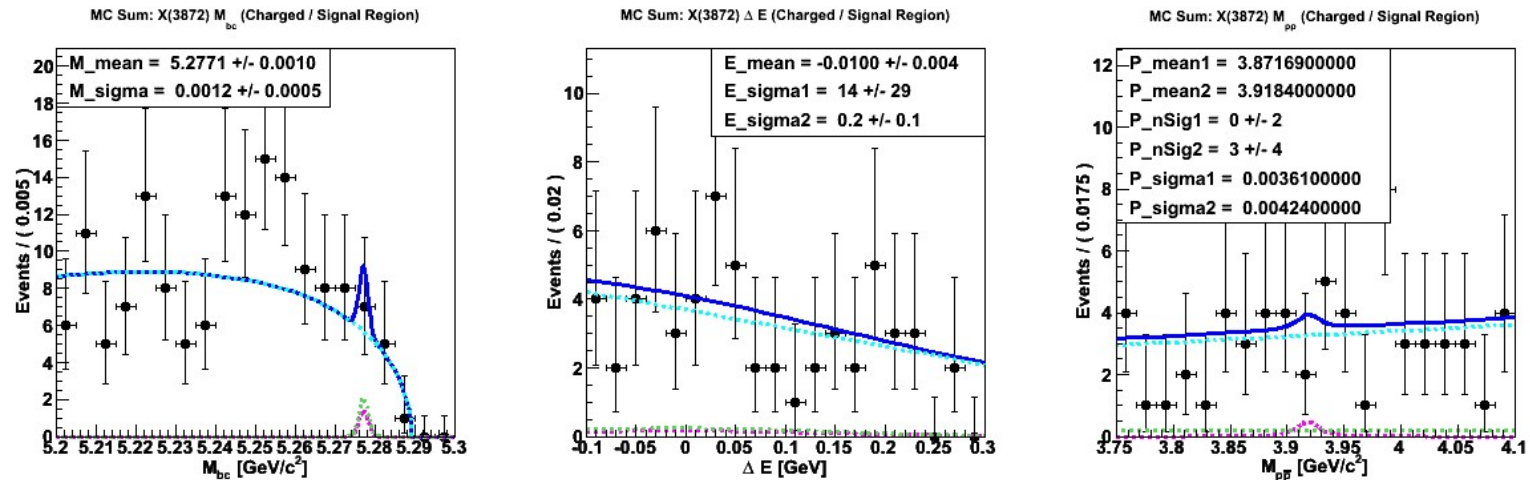
$$B^+ \rightarrow \psi(2S)K^+ \rightarrow pp\bar{K}^+$$



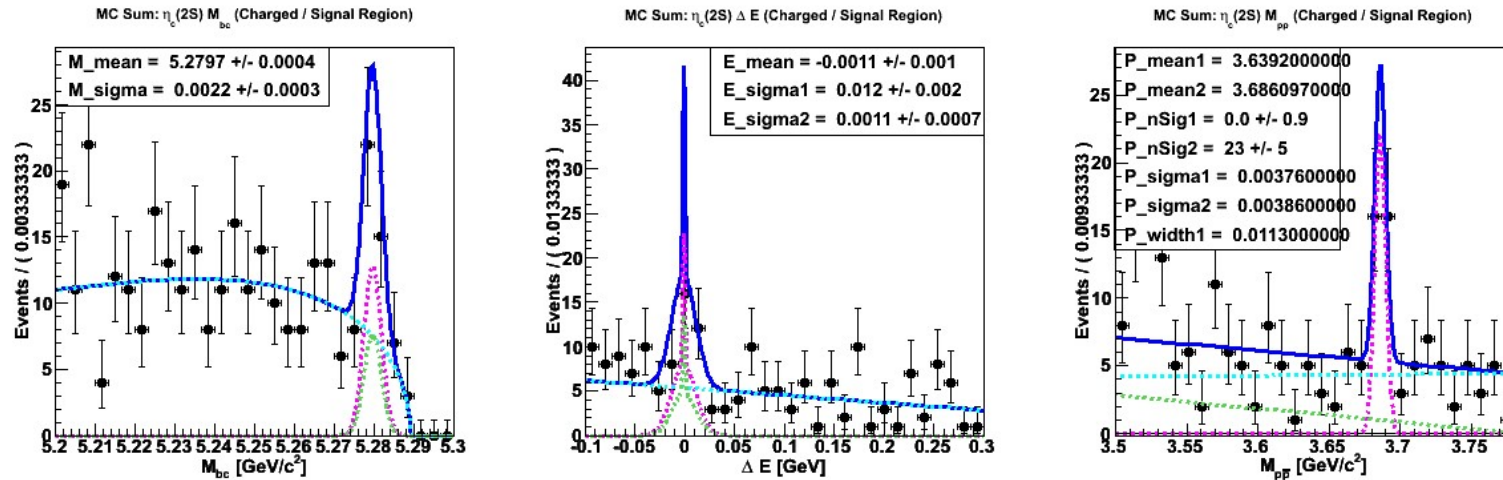
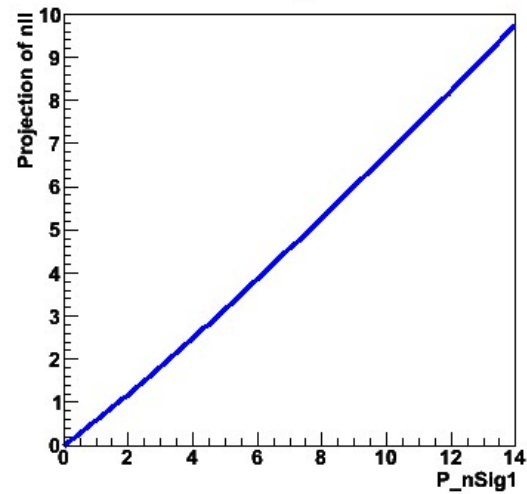
Yield	Eff. (%)	Significance (σ)
21 ± 5	19.3	6.00
Product Branching Fraction (10^{-6})		
measured	MC input	
0.139 ± 0.034	0.143	



$$B^+ \rightarrow (X3872, X3915) K^+ \rightarrow pp K^+$$



$$B^+ \rightarrow \eta_c(2S) K^+ \rightarrow p \bar{p} K^+$$

NLL: $\eta_c(2S)$ Likelihood: $\eta_c(2S)$ 