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Measurements of the branching fraction for $\Xi^- \rightarrow \Lambda e^- \nu$

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Data sets

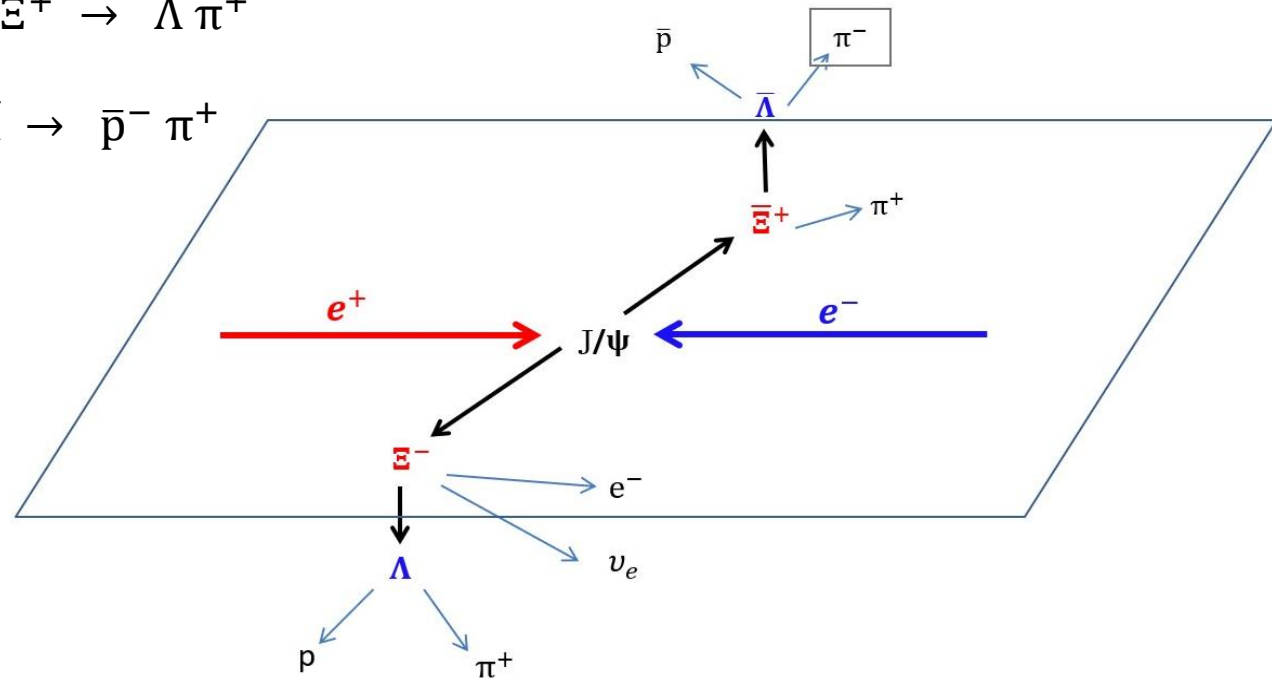


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$$J/\psi \rightarrow \Xi^- \bar{\Xi}^+,$$

$$\Xi^- \rightarrow \Lambda e^- \nu, \quad \bar{\Xi}^+ \rightarrow \bar{\Lambda} \pi^+$$

$$\Lambda \rightarrow p^+ \pi^-, \quad \bar{\Lambda} \rightarrow \bar{p}^- \pi^+$$



➤ Charged Tracks

- ✓ No vertex requirement; $|\cos \theta| < 0.93$; $N_{good} \geq 6$;

➤ PID

- ✓ Proton: $p > 0.32 \text{ GeV}/c$;
- ✓ Pion: $p < 0.32 \text{ GeV}/c$;
- ✓ Electron: $\text{prob_e} > \text{prob_K} \&\& \text{prob_e} > \text{prob_}\pi$; $\text{ie.size()} == 1$;

➤ Vertex fit for $\Lambda/\bar{\Lambda}$, $\bar{E}^+$

- ✓ For $\bar{\Lambda}$, $\bar{E}^+$, primary and secondary vertex fit used for the $\bar{p}\pi^+$ for $\bar{\Lambda}$, $\bar{\Lambda}\pi^+$ for $\bar{E}^+$.

Loop all the pairs, select combination by minimizing

$$\chi^2 = (M(\bar{p}\pi^+) - M(\Lambda_{\text{PDG}}))^2 + (M(\bar{\Lambda}_{\bar{p}\pi^+\pi^+}) - M(E_{\text{PDG}}))^2$$

Event selection



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➤ Vertex fit for Λ , Ξ^-

- ✓ For Λ , primary and secondary vertex fit used for the $p\pi^-$ for Λ , Λ for Ξ^- .
- ✓ For Ξ^- , primary vertex fit used for the Λe^- for Ξ^- .

Loop all the pairs, select combination by minimizing

$$\chi^2 = \text{chi}_{p\pi^-} + \text{chi}_{\Lambda} + \text{chi}_{\Lambda e^-}$$

Main background

Ξ^- DECAY MODES

	Mode	Fraction (Γ_i/Γ)	Confidence level
Γ_1	$\Lambda\pi^-$	$(99.887 \pm 0.035) \%$	
Γ_2	$\Sigma^- \gamma$	$(1.27 \pm 0.23) \times 10^{-4}$	
Γ_3	$\Lambda e^- \bar{\nu}_e$	$(5.63 \pm 0.31) \times 10^{-4}$	
Γ_4	$\Lambda \mu^- \bar{\nu}_\mu$	$(3.5^{+3.5}_{-2.2}) \times 10^{-4}$	
Γ_5	$\Sigma^0 e^- \bar{\nu}_e$	$(8.7 \pm 1.7) \times 10^{-5}$	
Γ_6	$\Sigma^0 \mu^- \bar{\nu}_\mu$	$< 8 \times 10^{-4}$	90%
Γ_7	$\Xi^0 e^- \bar{\nu}_e$	$< 2.3 \times 10^{-3}$	90%

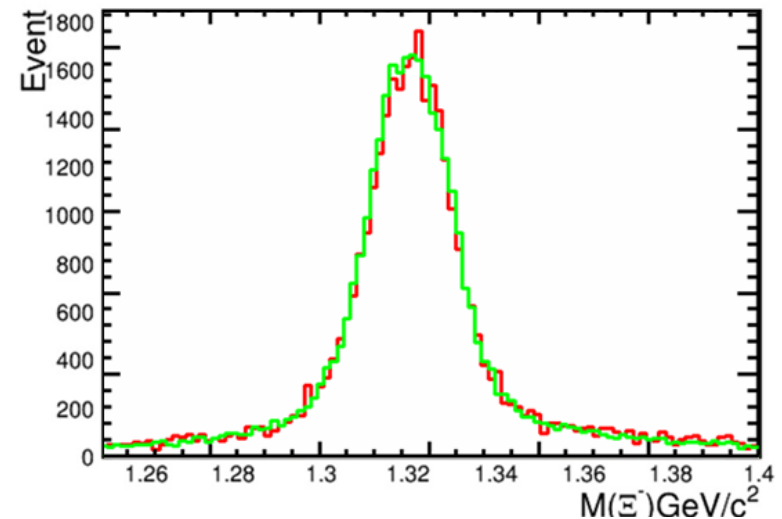
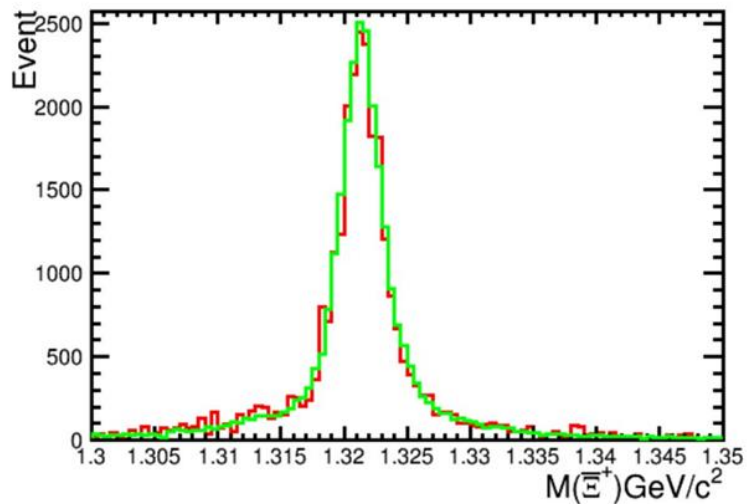
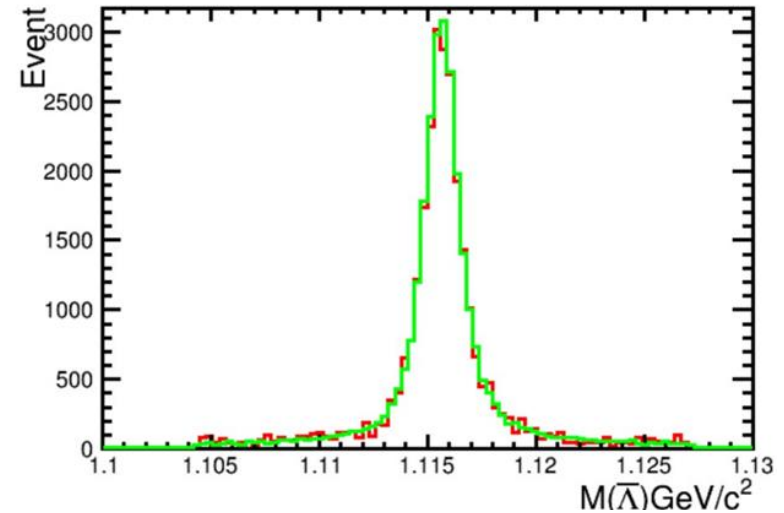
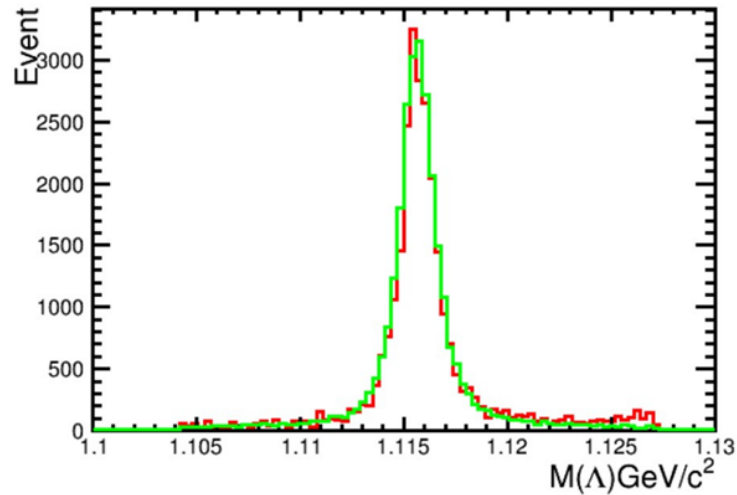
$$\Xi^- \rightarrow \Lambda \pi^-$$

Background analysis



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Signal Background

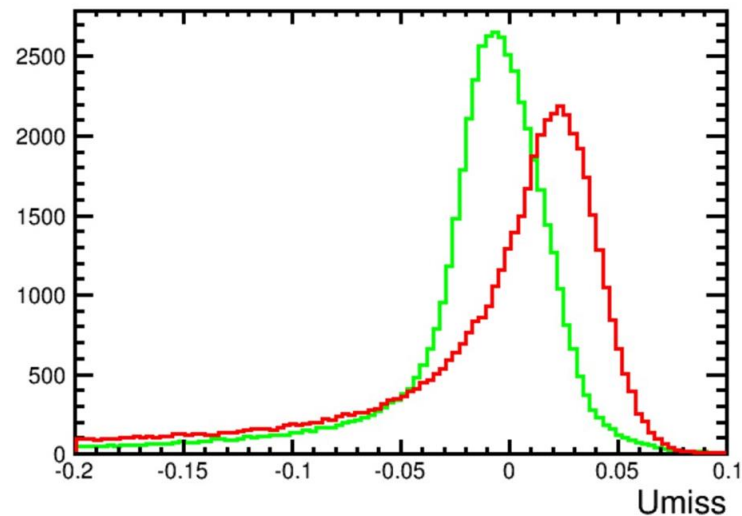
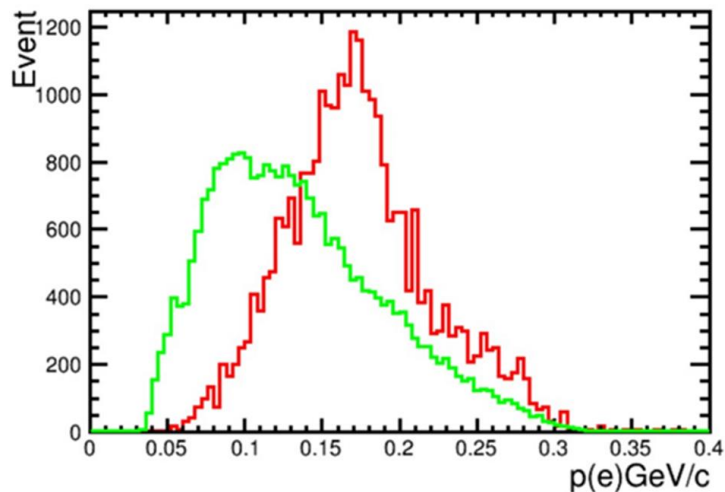
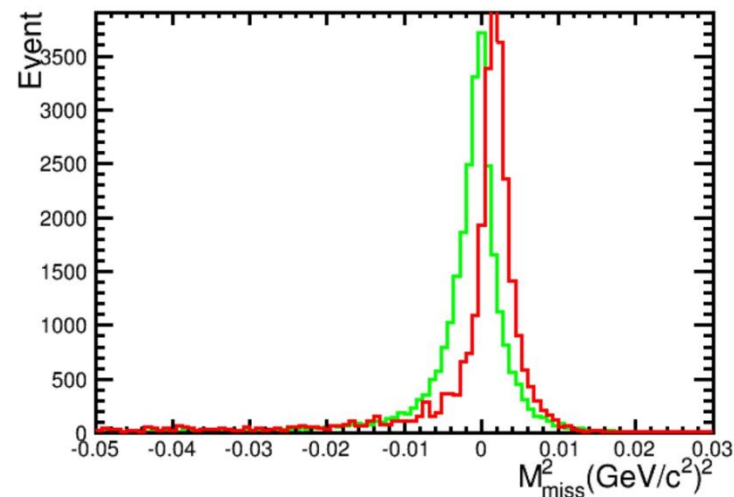
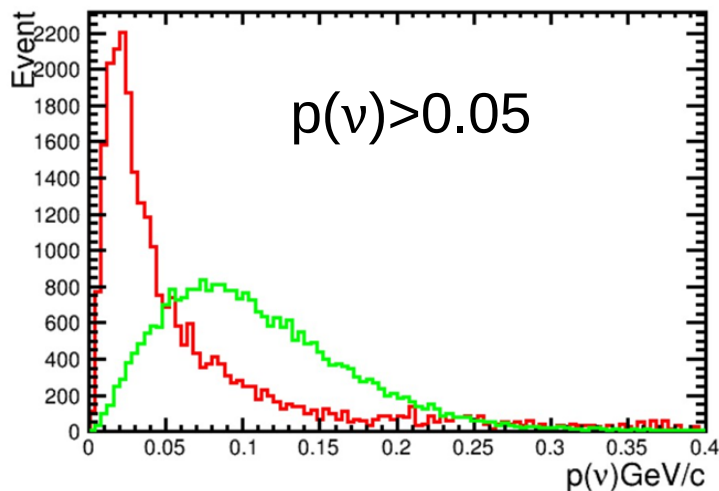


Background analysis



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Signal Background

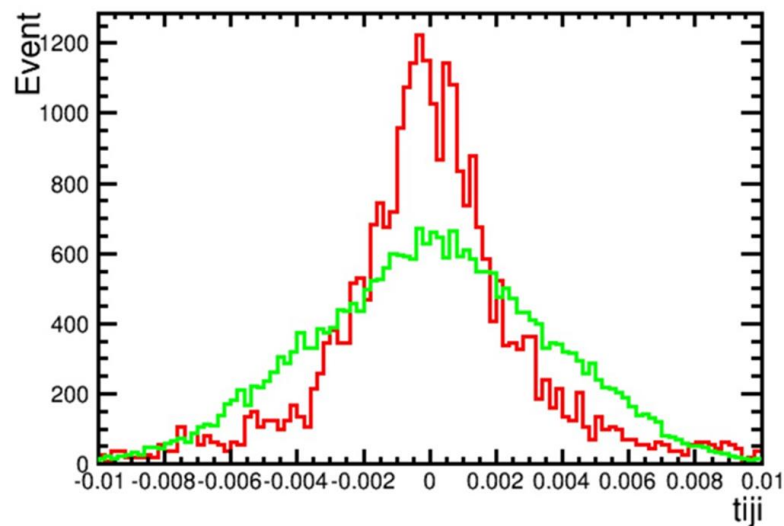
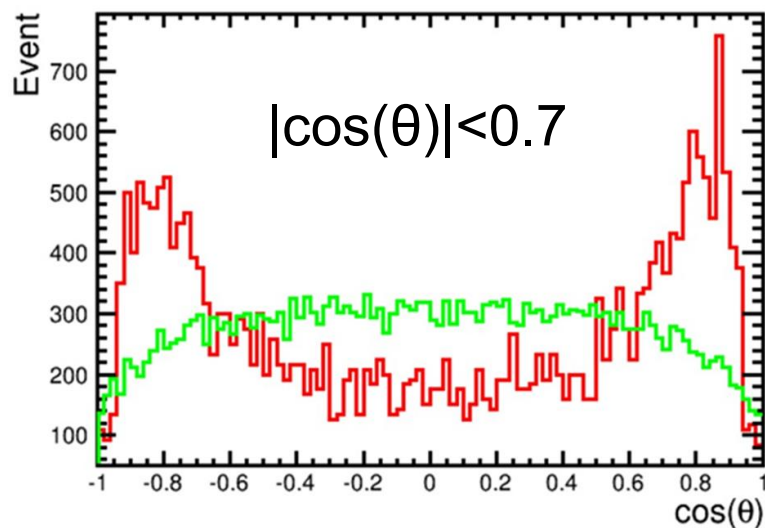
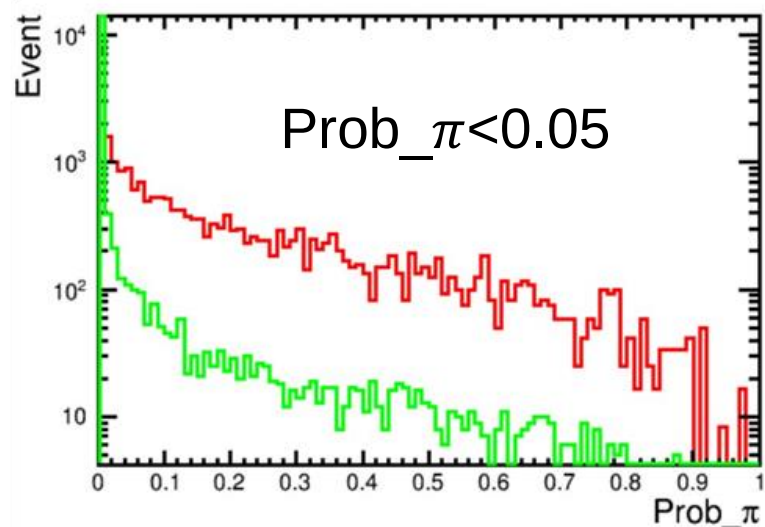
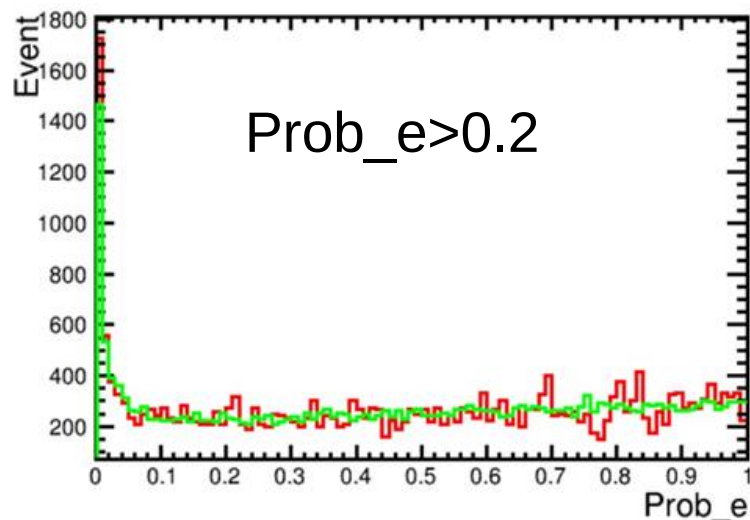


Background analysis



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Signal Background

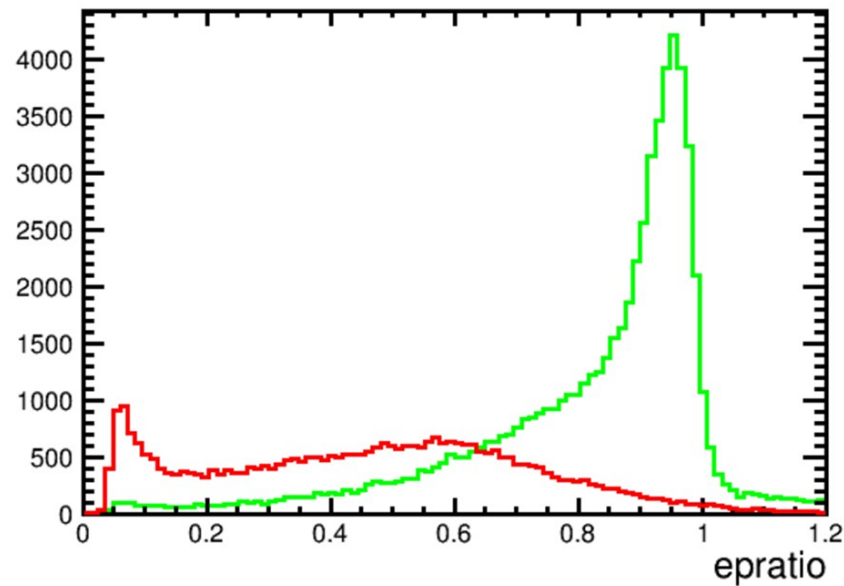
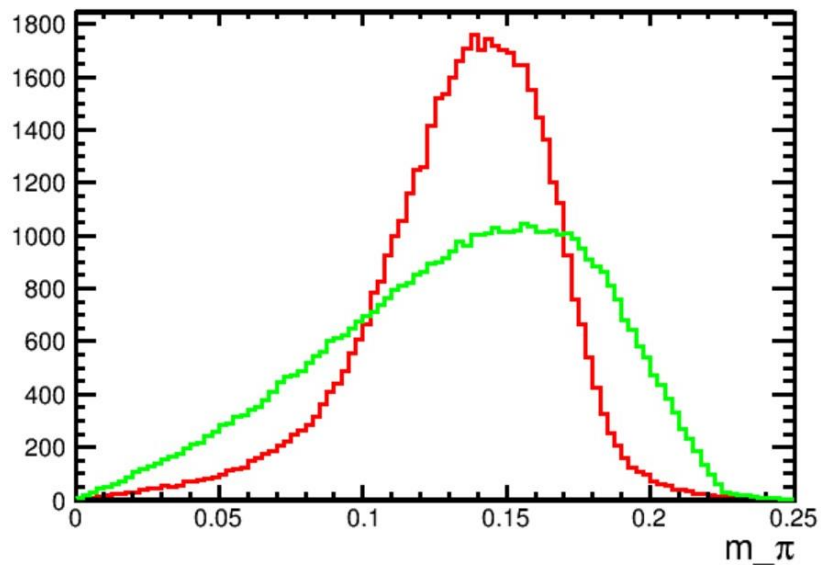


Background analysis



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Signal Background

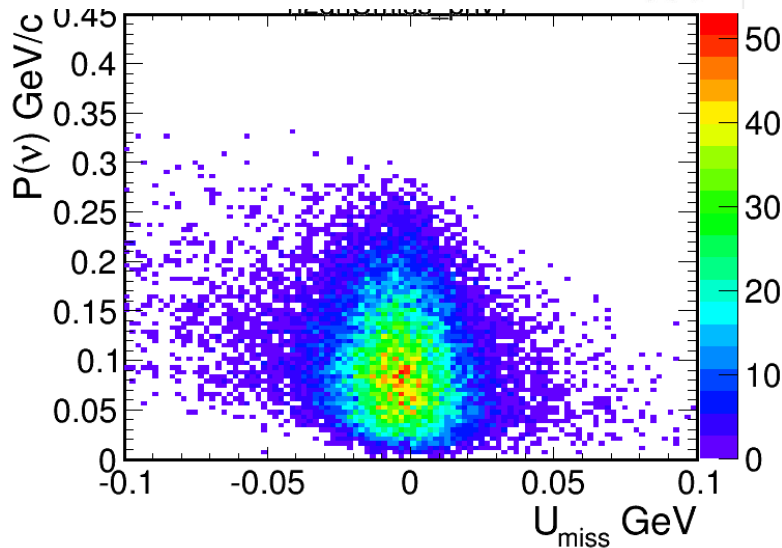
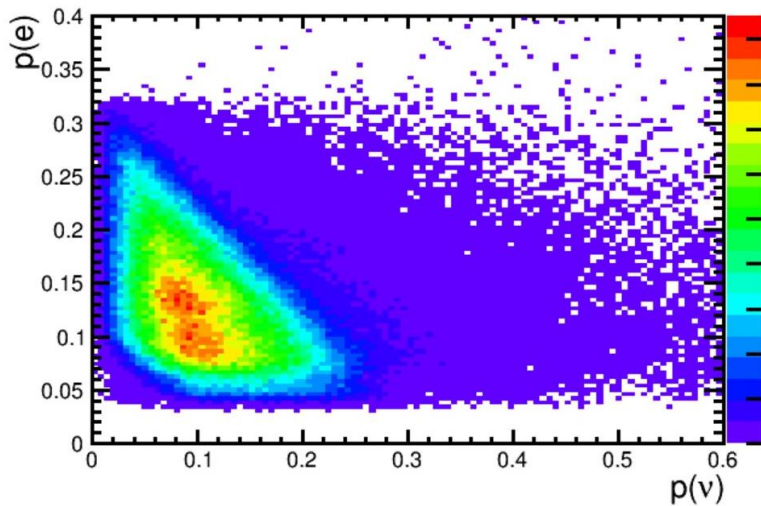


Background analysis

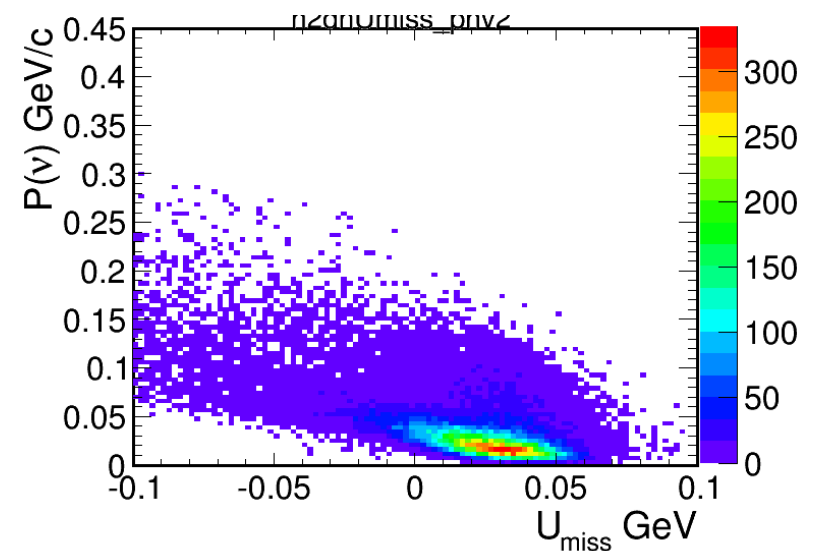
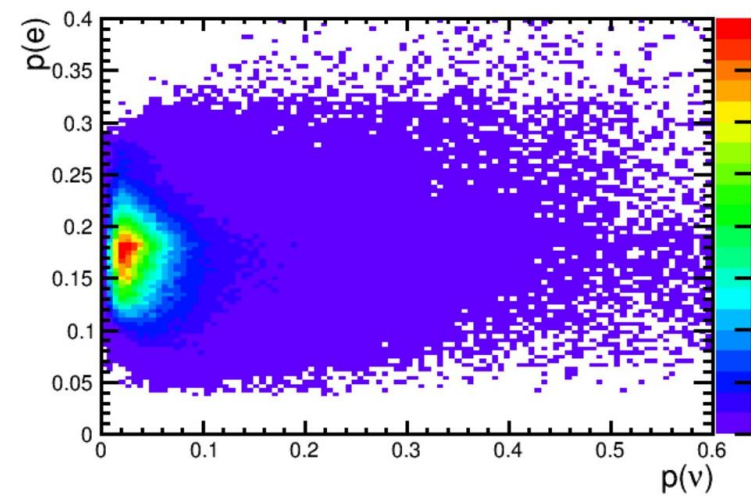


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Signal



Background

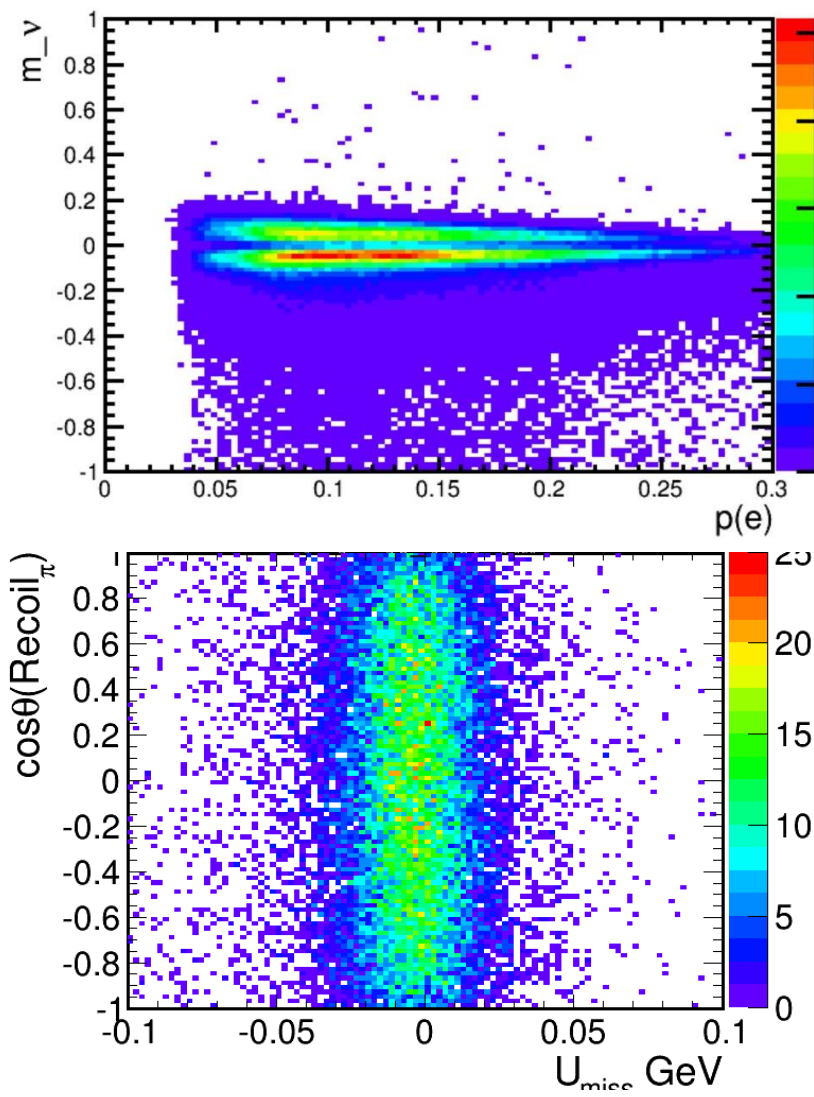


Background analysis

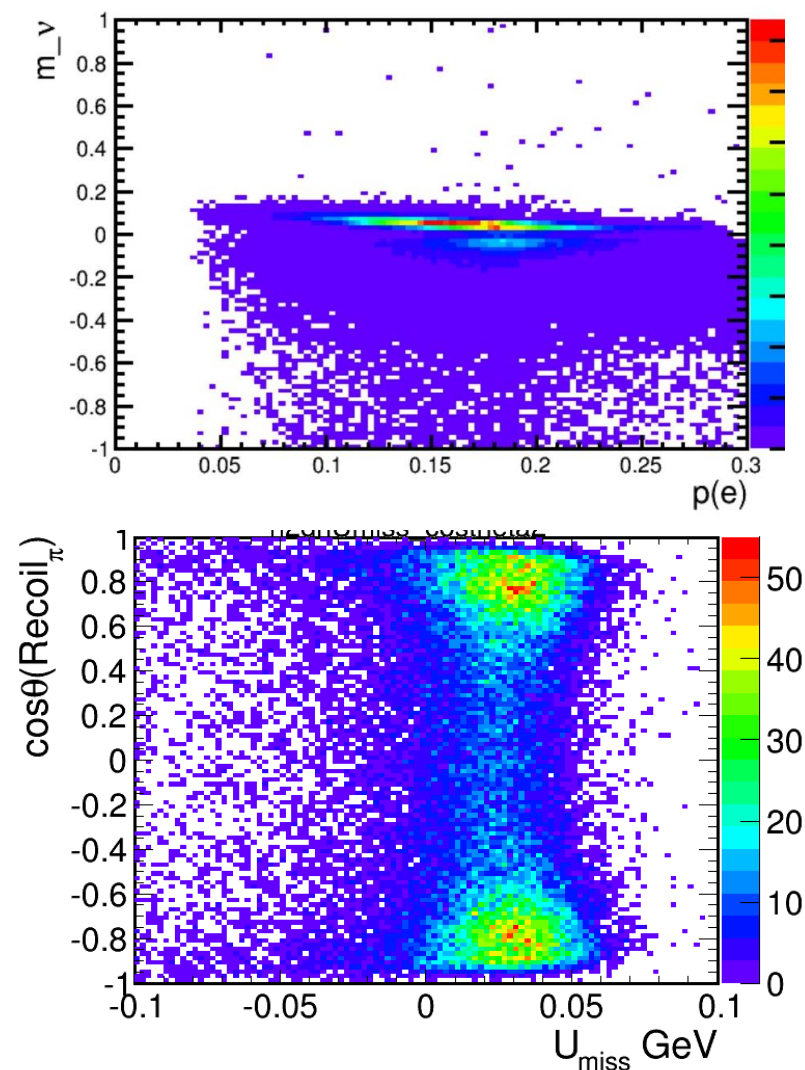


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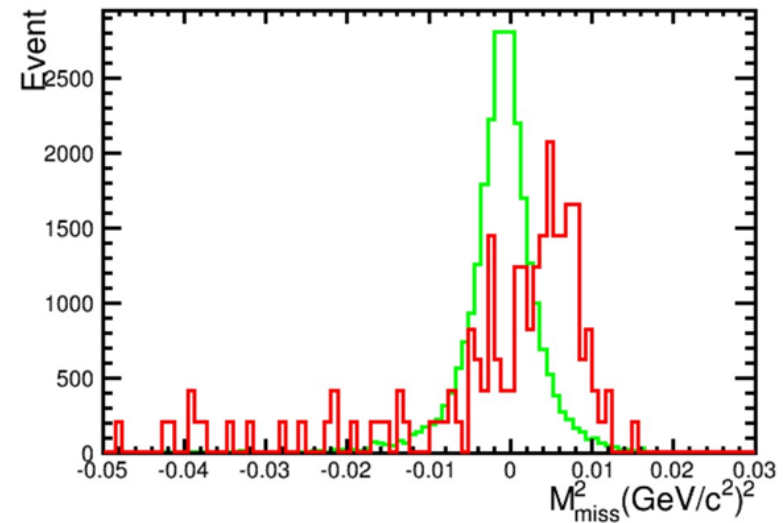
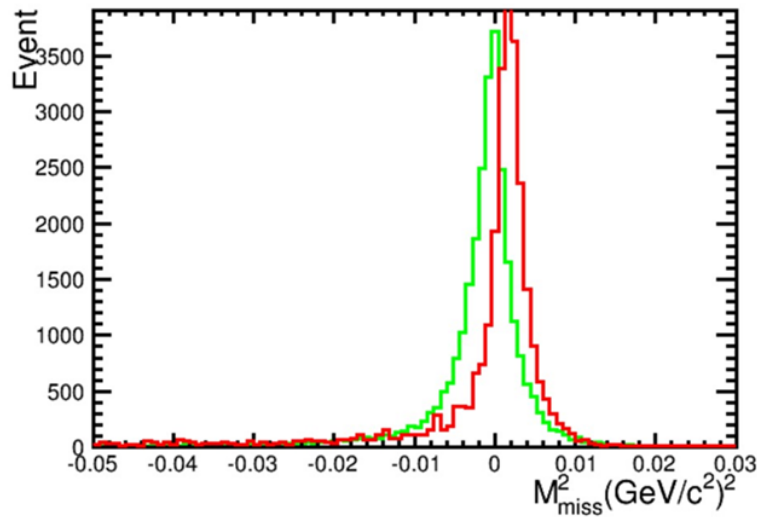
Signal



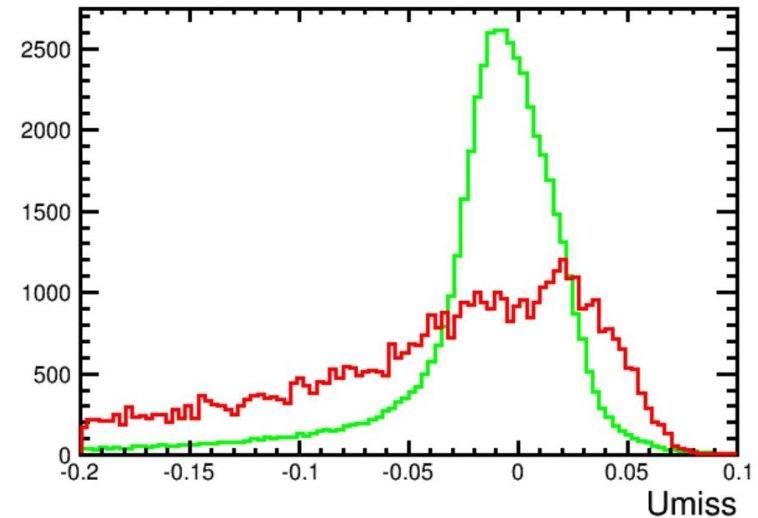
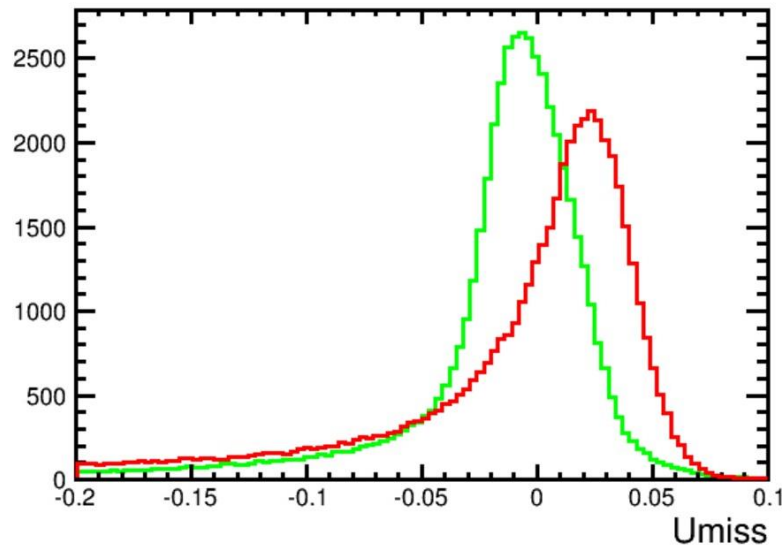
Background



After applying all event selections,

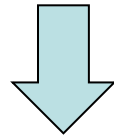


After applying all event selections,



200000 MC signal cases remain 12486 at last.

200000 MC background cases remain 205 at last.



the ratio of background and signal is 29: 1