

Update

Anil Panta

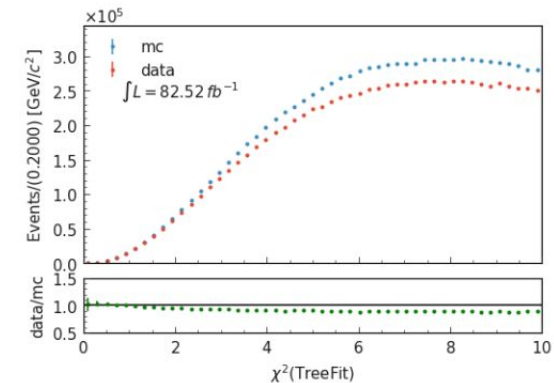
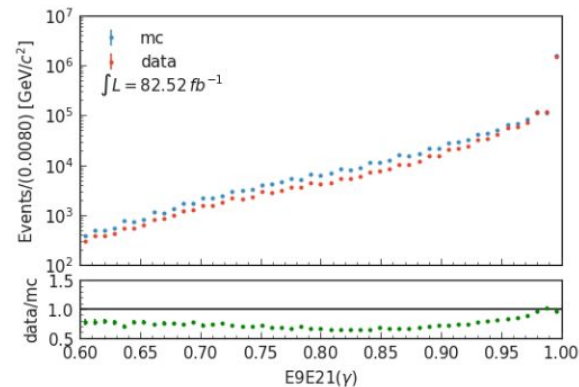
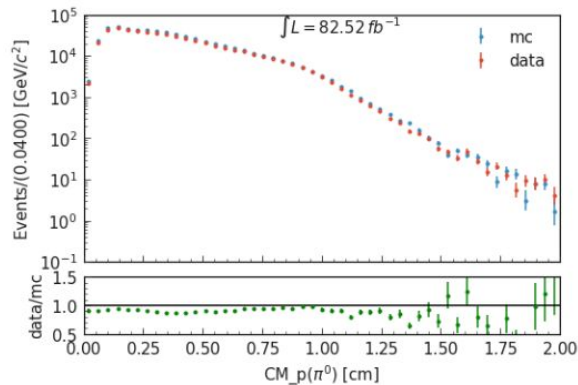
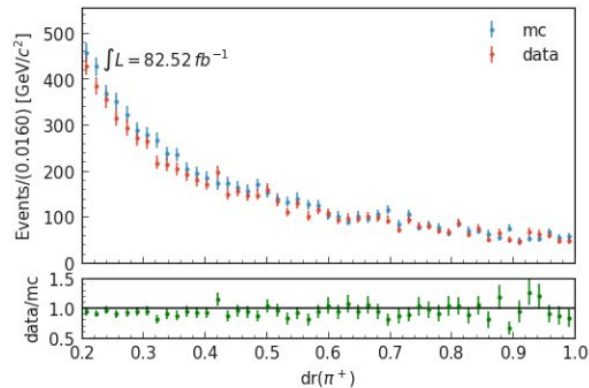
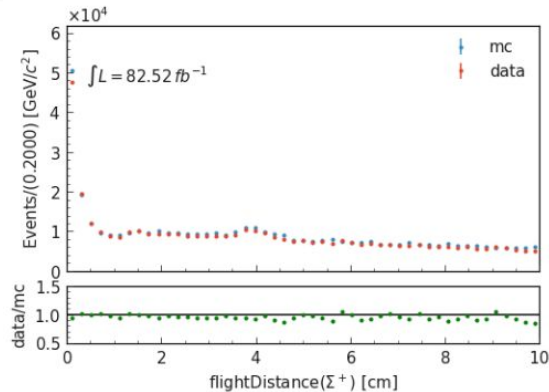
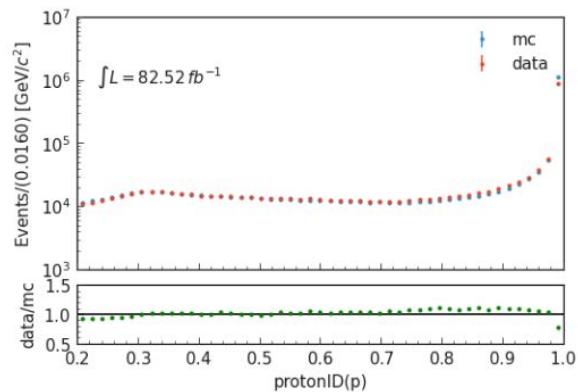
UM-BNL

July 27, 2021



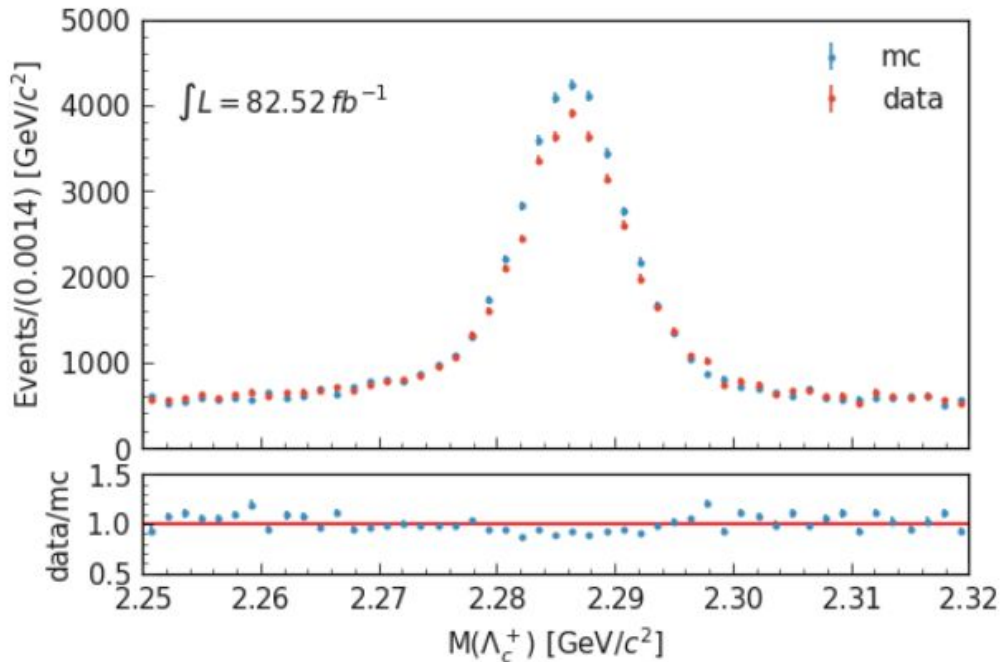
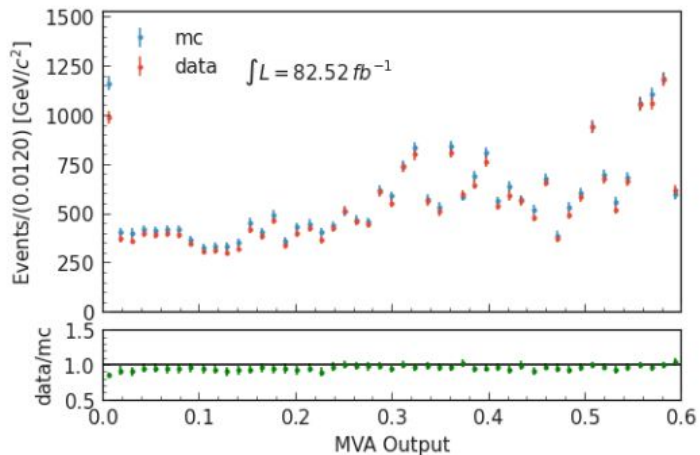
THE UNIVERSITY *of*
MISSISSIPPI

Look at Data/MC in $\Lambda_c^+ \rightarrow \Sigma^+ \pi^+ \pi^-$



Look at Data/MC in

$$\Lambda_c^+ \rightarrow \Sigma^+ \pi^+ \pi^-$$



MVA > 0.36 (NOT Optimized)

Possible systematics:

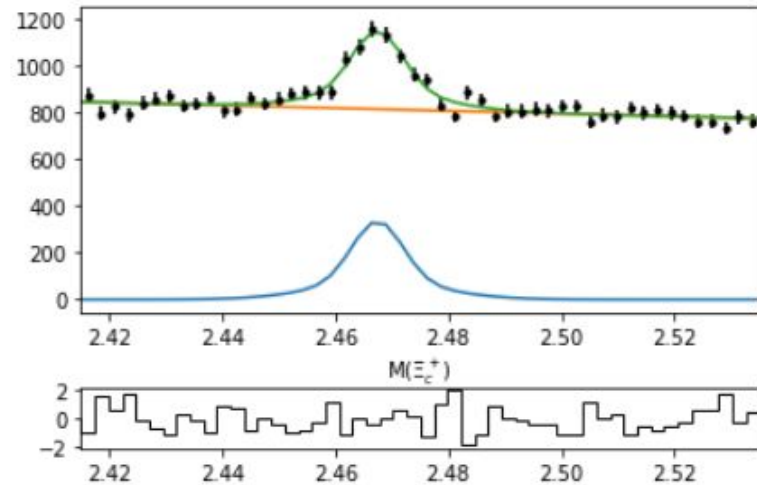
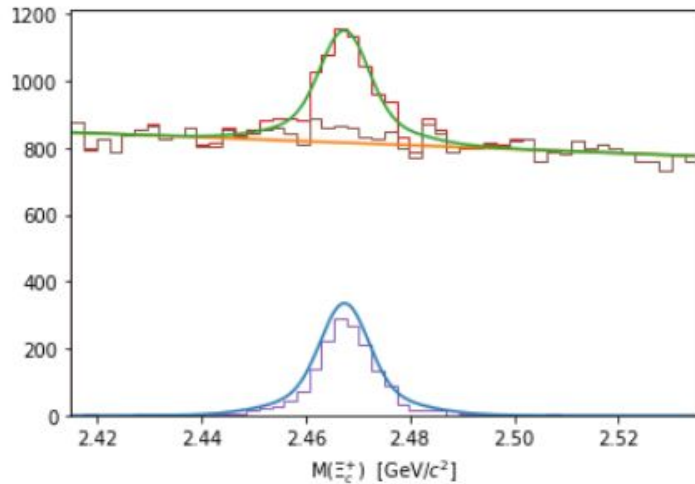
1. **Integrated Luminosity** : Relative BF -> cancels out.
2. **Cross Section of $e^+e^- \rightarrow c\bar{c}$** : Relative BF -> cancels out.
3. **Tracking efficiency** : $\pi^+\pi^-p$ Relative BF -> cancels out.
4. π^0 **Detection efficiency** : From neutral performance group.
5. **Signal Efficiency due to MC statistics** :
6. **Signal Shape PDF:**
 - Vary parameters within uncertainty obtained from fit
 - Get maximum deviation in the signal yield
7. **BDT training:**
 - How ? Looking at some paper.

Look at CP asymmetry:

- MC14_ria 200 /fb
- Applied FastBDT training that was used before.

	# total	#sig	# bkg
Ξ_c^+	42655	1691	40964
Ξ_c^-	37075	1516	35559

Particle:

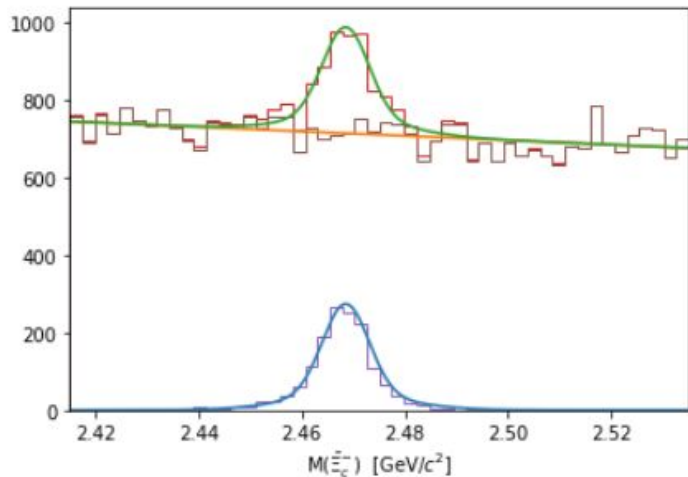


MC truth matched: # sig 1691

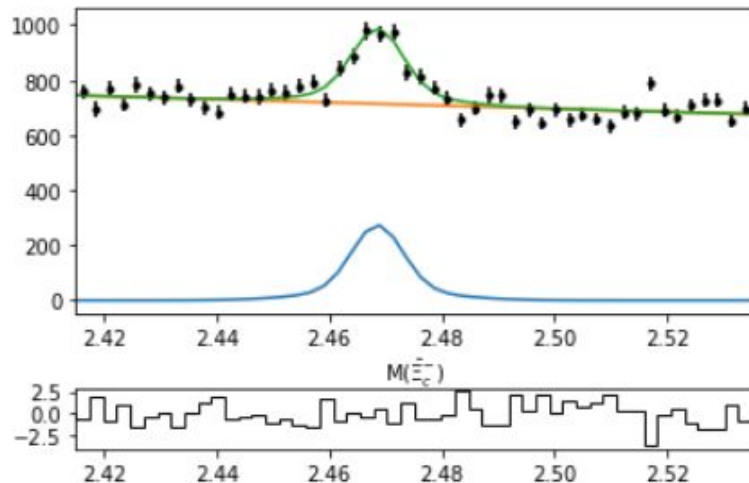
- Over-estimation.

name	value	minuit_hesse
sig_yield	2089	+/- 1.7e+02
bkg_yield	40570	+/- 2.6e+02
fg1	0.4157	+/- 0.1
mul	2.467	+/- 0.00038
a	-0.04351	+/- 0.0088

anti-Particle:



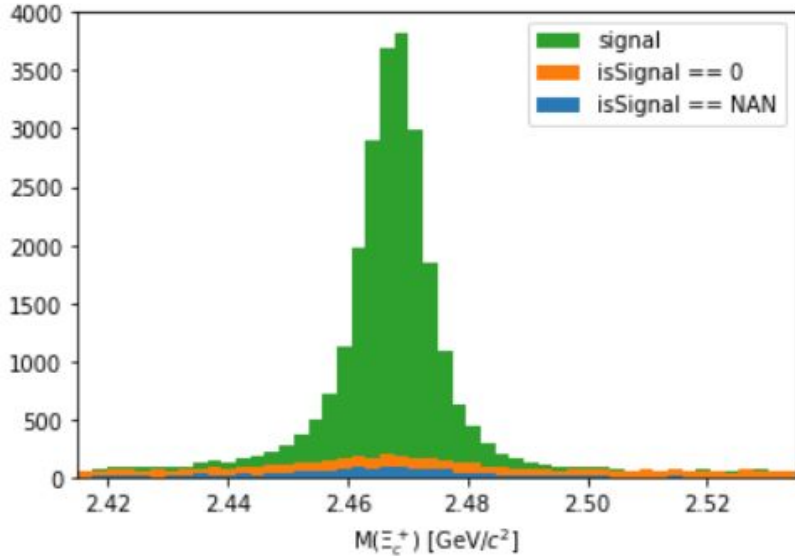
MC truth matched: # sig 1516



name	value	minuit_hesse
sig_yield	1558	+/- 1.6e+02
bkg_yield	35520	+/- 2.4e+02
fg1	0.2988	+/- 0.13
mul	2.469	+/- 0.00041
a	-0.04826	+/- 0.0093

Failed MC truth Match:

- Small Peak in signal range.
- Coming from **Failed MC match**.
- Still got no idea on how to deal with this.



Signal MC (254000 events)

CP Asymmetry:

- CP Asymmetry:
 - Calculate Raw asymmetry.
 - Take into account inbuilt asymmetry.

$$A_{CP}(f) = \frac{\Gamma(f) - \Gamma(\bar{f})}{\Gamma(f) + \Gamma(\bar{f})} \quad \Longrightarrow \quad A_{\text{Raw}} = \frac{N(f) - N(\bar{f})}{N(f) + N(\bar{f})}$$

- Proton/antiproton interaction asymmetry with the detector material.
 - Is this studied before?
 - Which channel to take for this study?

$$A_{\text{Reco.}}(p) = \frac{\epsilon_{\text{Reco.}}(p) - \epsilon_{\text{Reco.}}(\bar{p})}{\epsilon_{\text{Reco.}}(p) + \epsilon_{\text{Reco.}}(\bar{p})}$$

Proton / antiproton asymmetry:

- Proton/antiproton interaction asymmetry with the detector material.
 - Is this studied before?
 - Which channel to take for this study?

$$A_{\text{Reco.}}(p) = \frac{\epsilon_{\text{Reco.}}(p) - \epsilon_{\text{Reco.}}(\bar{p})}{\epsilon_{\text{Reco.}}(p) + \epsilon_{\text{Reco.}}(\bar{p})}$$

Other Asymmetry:

- Production asymmetry: asymmetry in production of Ξ_c^+ and anti- Ξ_c^+
- Detection asymmetry: asymmetry in π^\pm
- Any other ??

OR measure ΔA_{CP}

- CP asymmetry difference between decay dictated by U-spin sum rule.

Reference: [arxiv:1811.11188](https://arxiv.org/abs/1811.11188)

$$A_{CP}(\Lambda_c^+ \rightarrow pK^-K^+) + A_{CP}(\Xi_c^+ \rightarrow \Sigma^+\pi^-\pi^+) = 0,$$

$$A_{CP}(\Lambda_c^+ \rightarrow \Sigma^+\pi^-K^+) + A_{CP}(\Xi_c^+ \rightarrow pK^-\pi^+) = 0,$$

$$A_{CP}(\Lambda_c^+ \rightarrow p\pi^-\pi^+) + A_{CP}(\Xi_c^+ \rightarrow \Sigma^+K^-K^+) = 0.$$

- Theorist may be interested in just A_{CP} rather than ΔA_{CP} .