



ALICE



ALICE3 HF Meeting

Multi-Charm baryons :
 Ξ_{cc}^{++} in non-strangeness decays

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Status

- **ML package**

- **MachineLearningHEP** : <https://github.com/ginnocen/MachineLearningHEP>
 - Not working for Xicc study, need to fix the issue?
- **hipe4ml** : <https://github.com/hipe4ml/hipe4ml>
 - BDT algorithm : XGBoost

- **Input sample**

- **Signal** : /home/mmazzill/pp14TeV_XiccGun_2T_Dipole_40M_23092021
- **Background** : **LHC21d9i_pp** on hyperloop
 - First run of tree creator on hyperloop!
 - hf-tree-creator-xicc-topkpipi is running!

Status

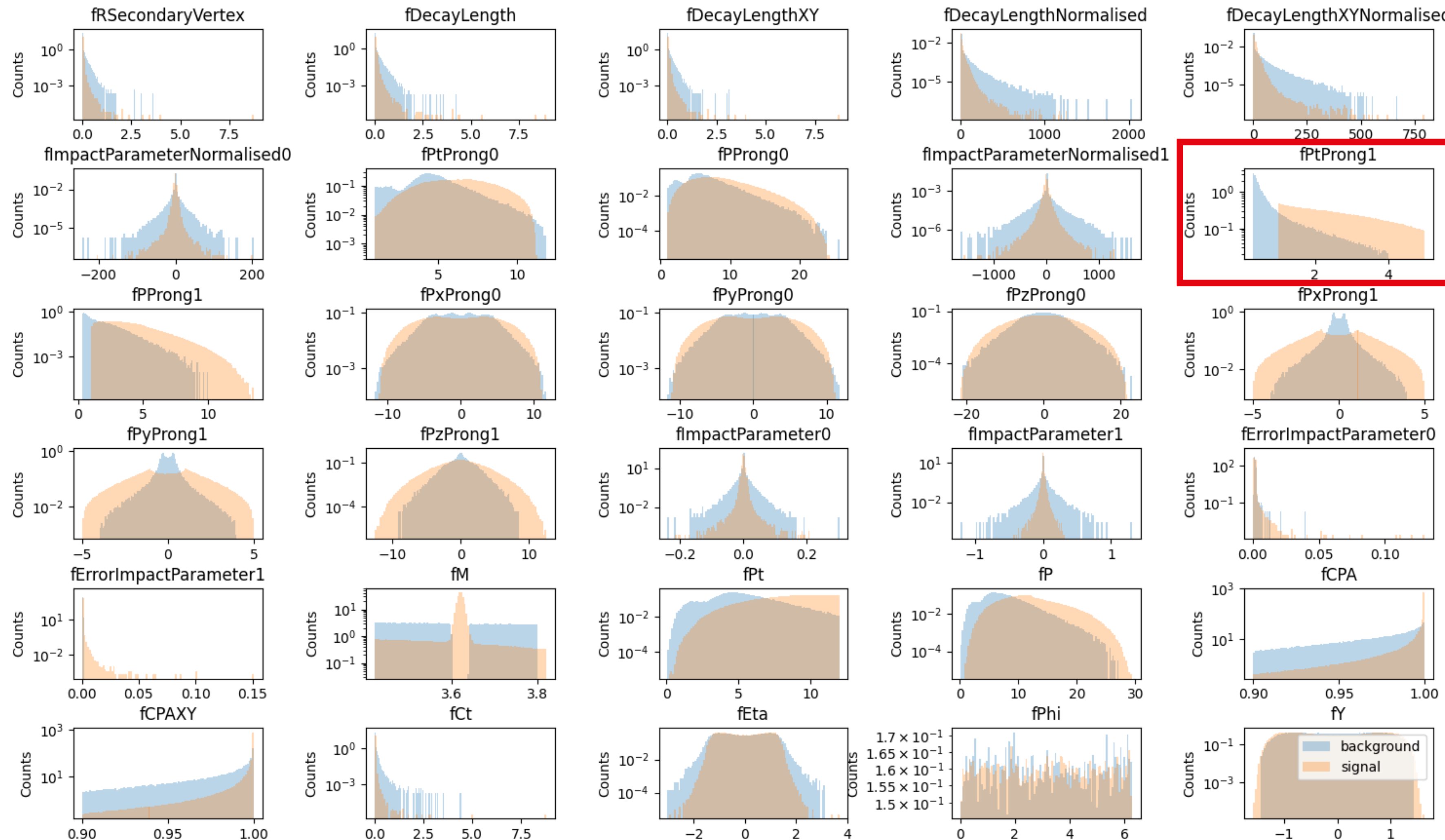
- **Pre-selection**

- Very loose cuts

```
#loose preselection
preselection = [
    '-1.44 < fY < 1.44',
    '0.00 < fDecayLength < 10',
    '-10 < fImpactParameter0 < 10',
    '-10 < fImpactParameter1 < 10',
    '0.5 < fPtProng0 < 20',
    '0.3 < fPtProng1 < 20',
    '0.90 < fCPA < 1',
    '0.90 < fCPAXY < 1',
    '3.4 < fM < 3.8',
    '0 < fPt < 12'
]
```

Status

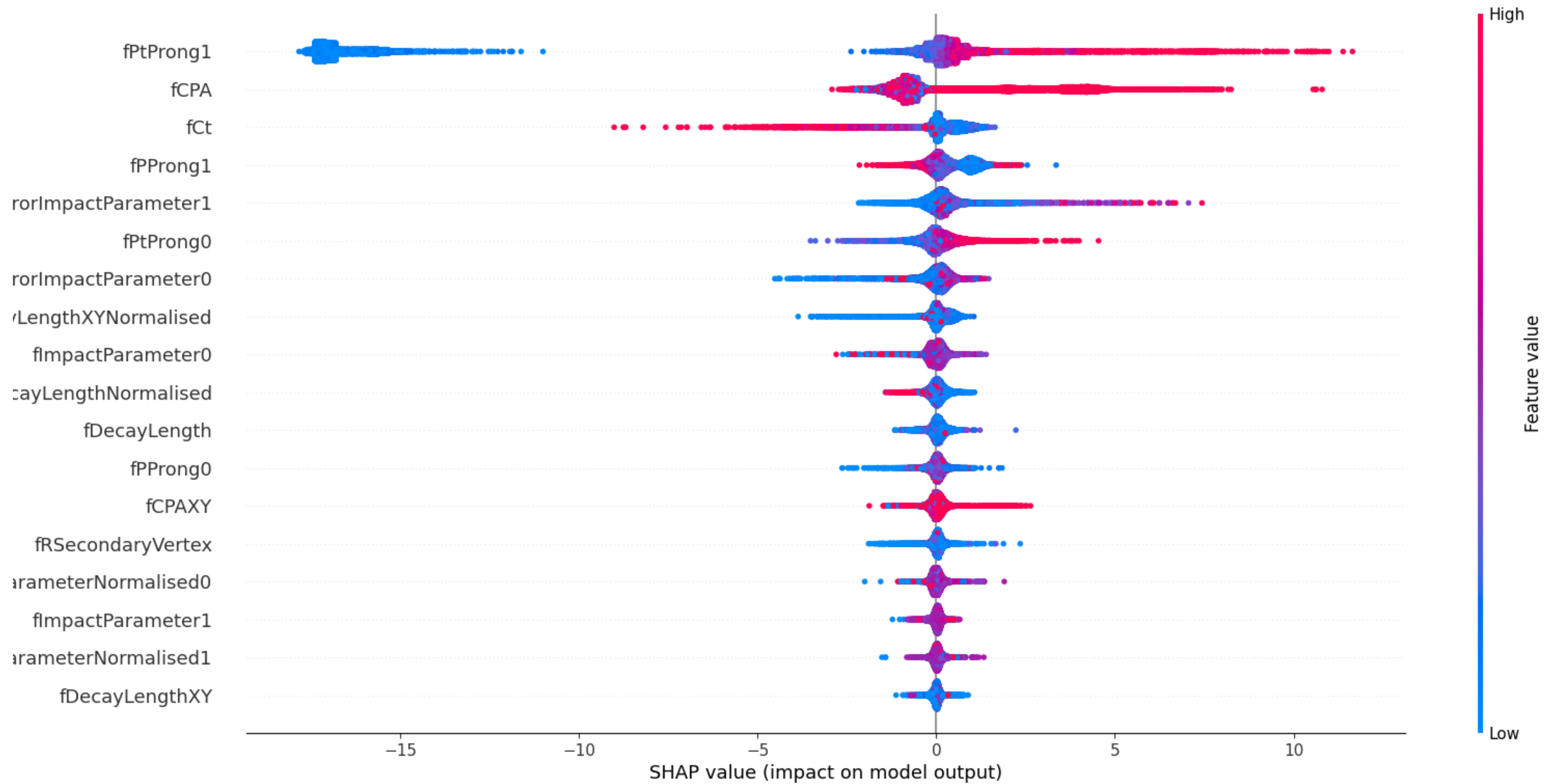
- Signal vs background distribution ($0 < p_T < 12 \text{ GeV}/c$)



pT of pion

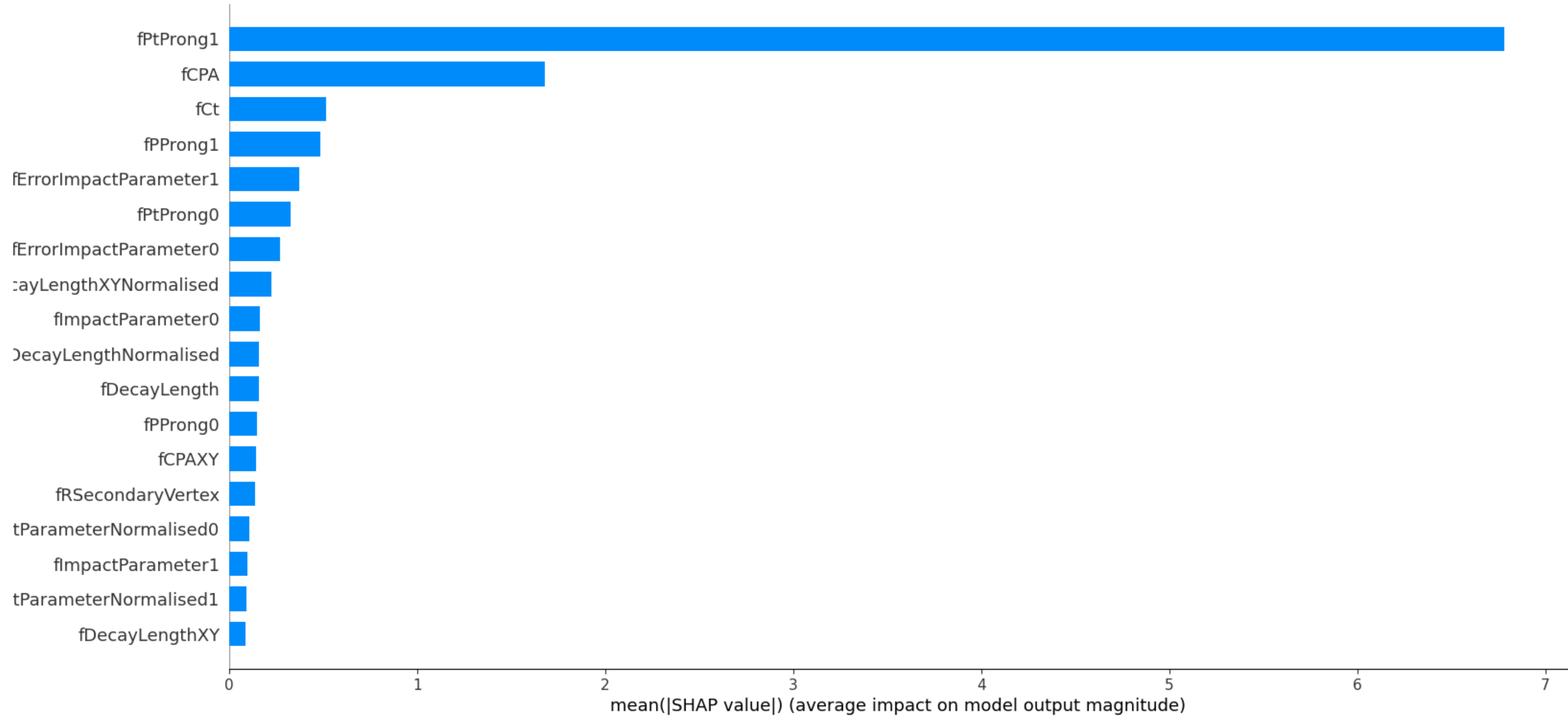
Status

- Training variable and feature importance



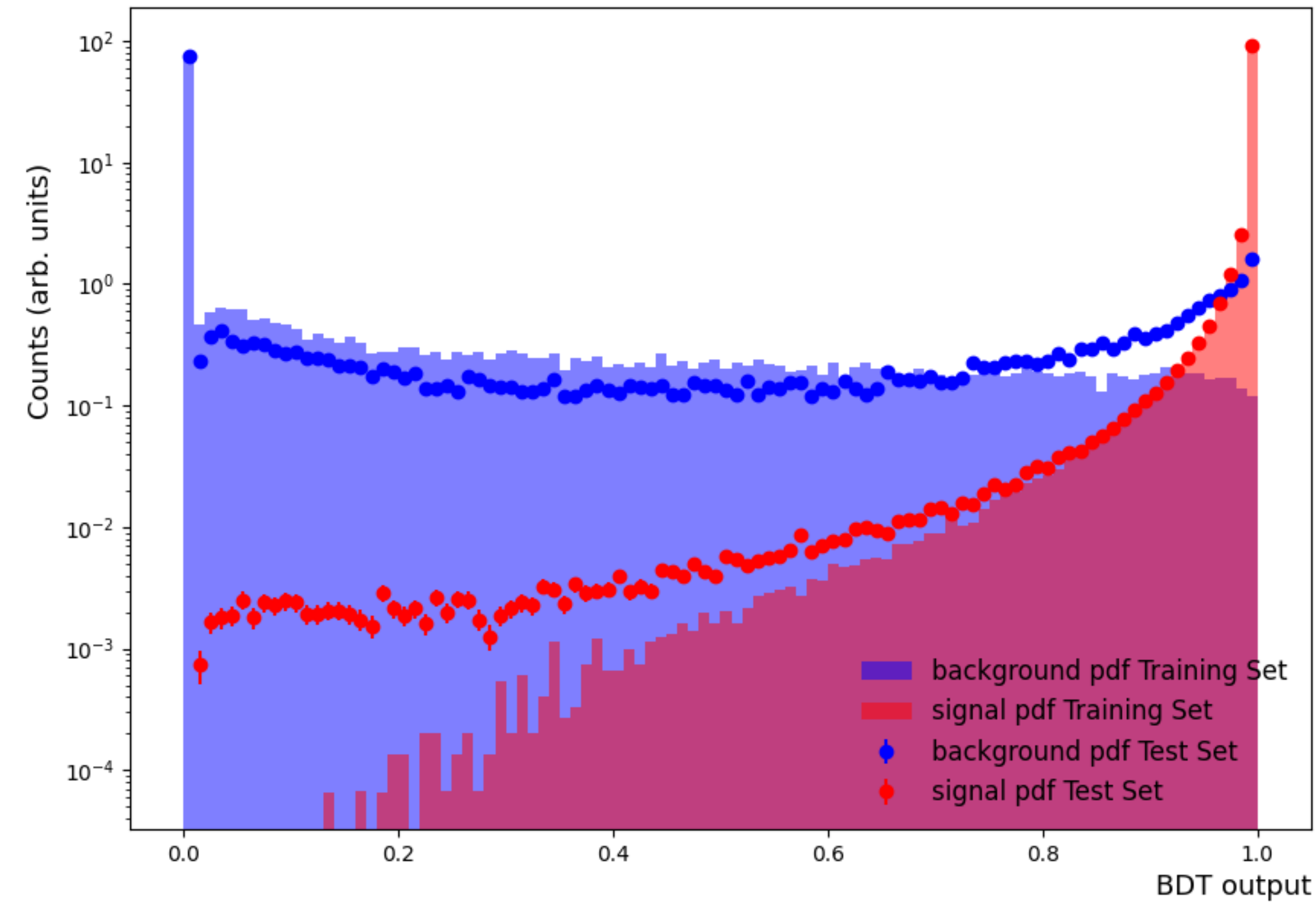
Status

- **Training variable and feature importance**

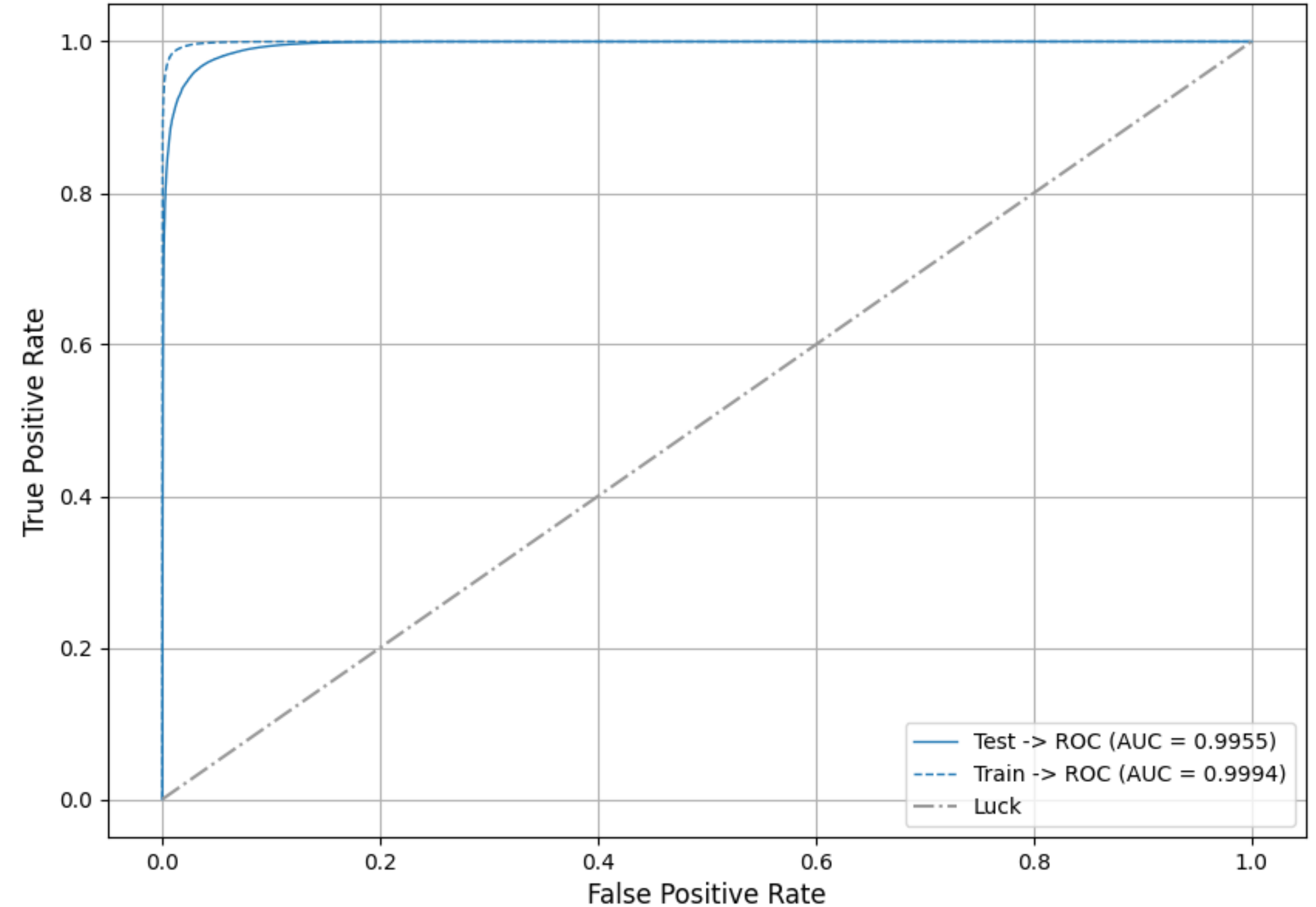


Status

- Model output and ROC curve

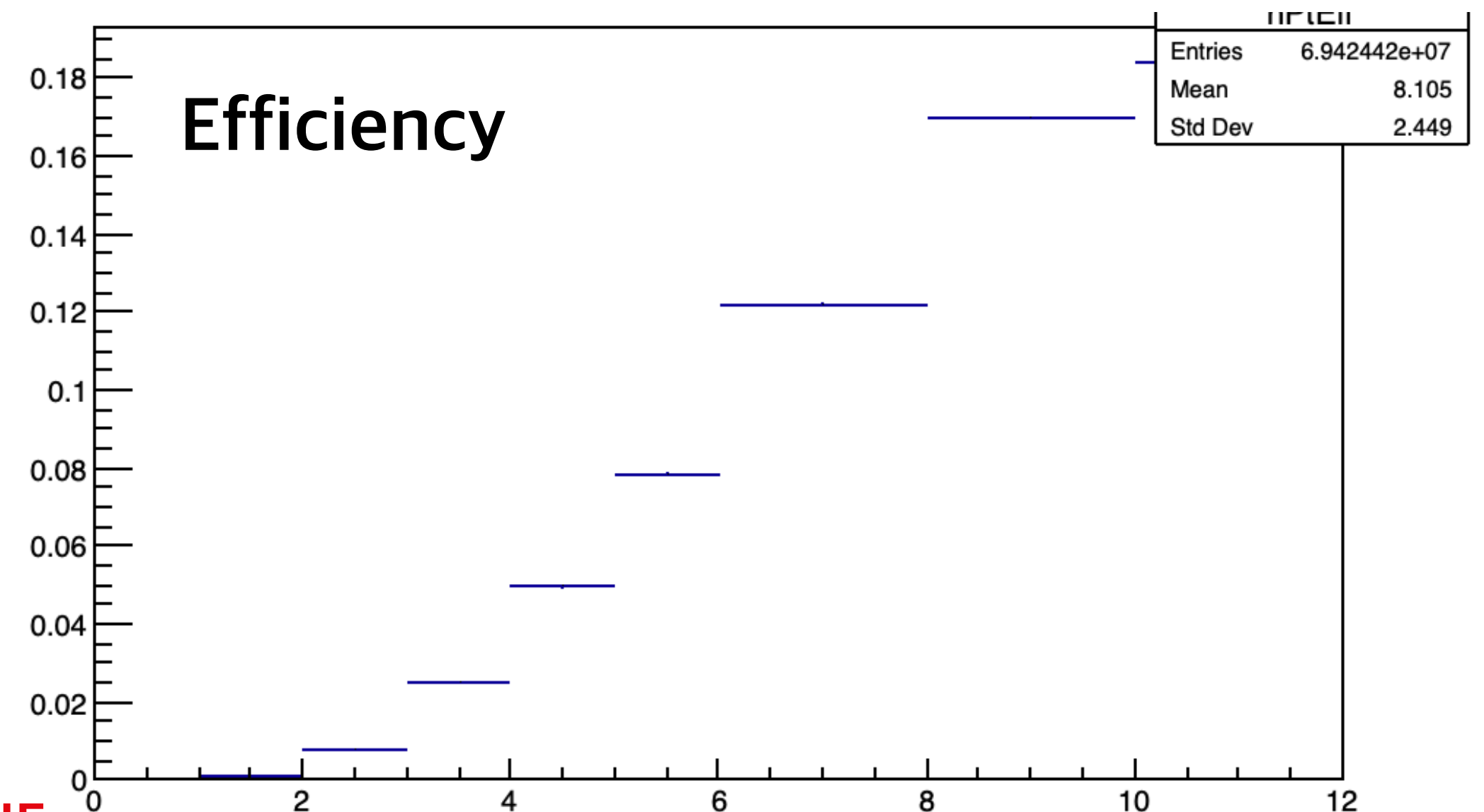
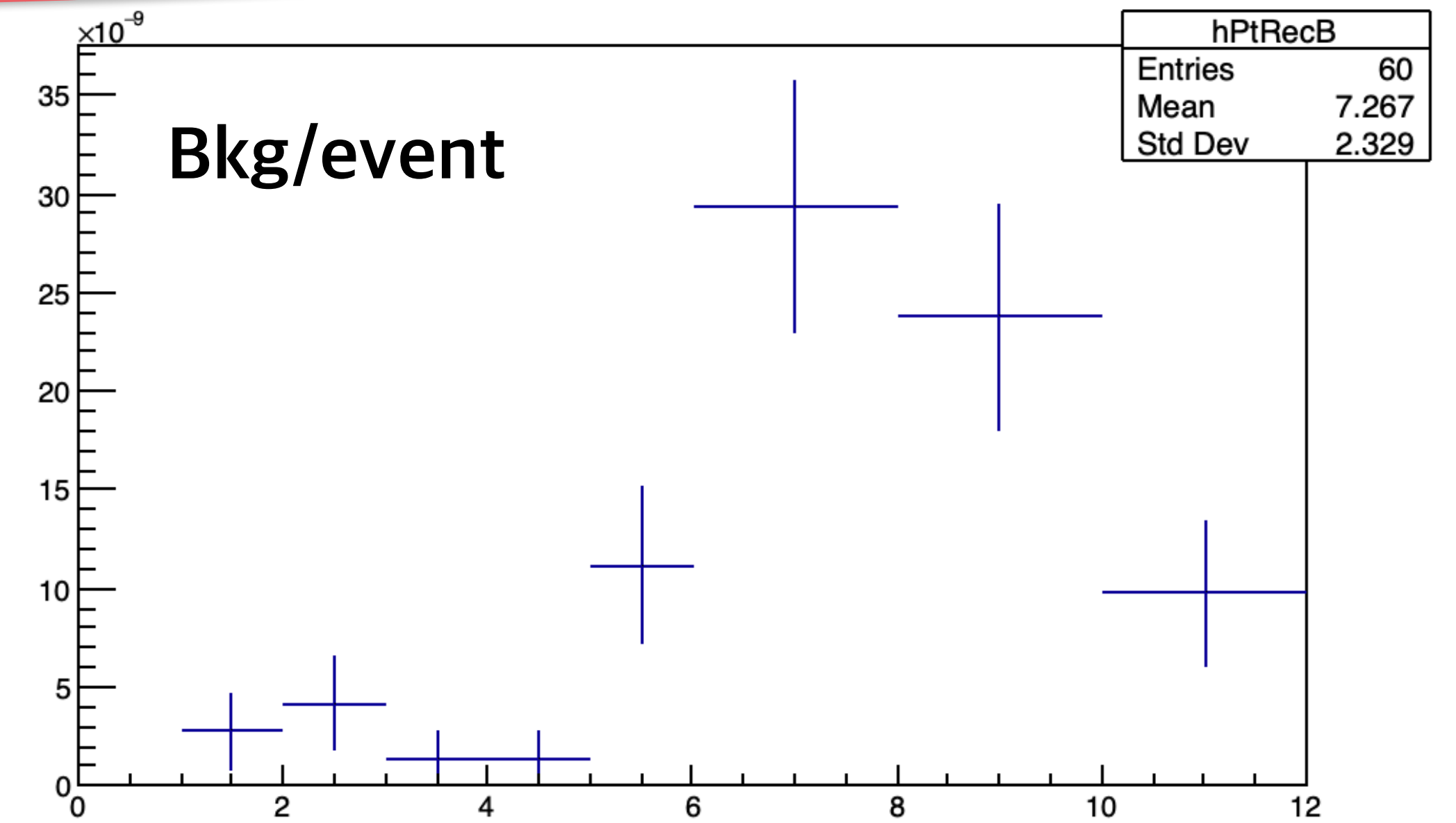
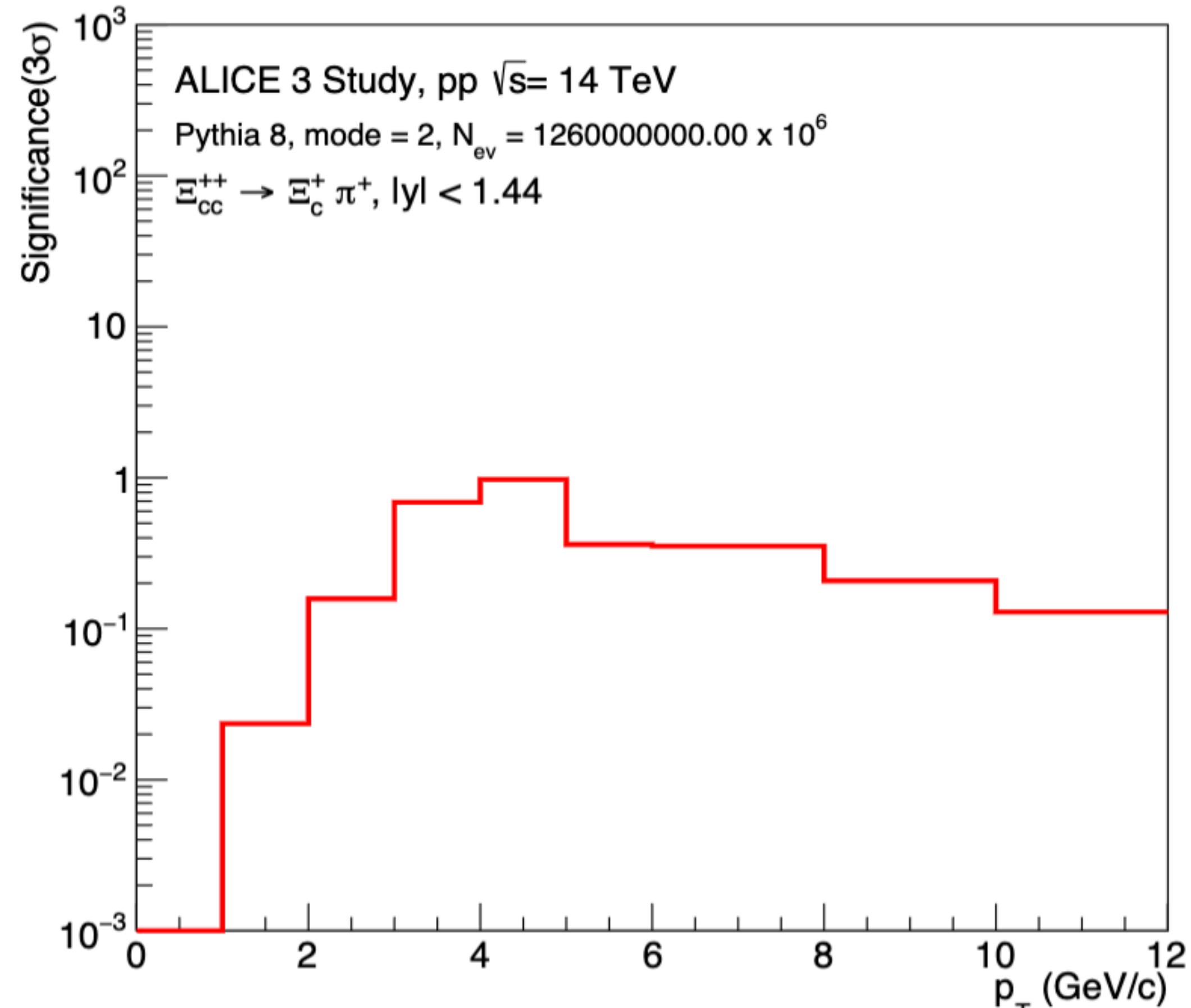


0.99 BDT score cut



Status

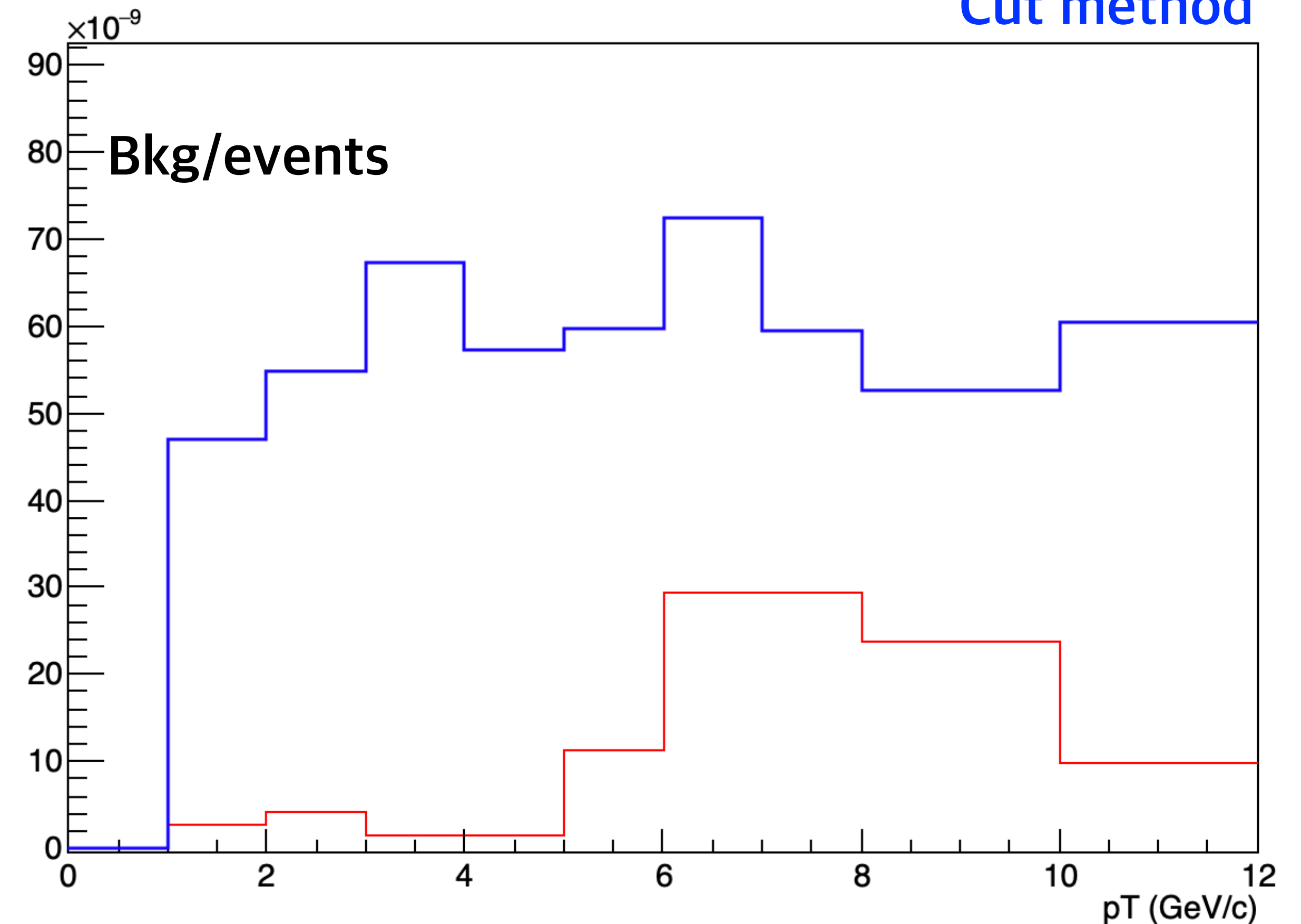
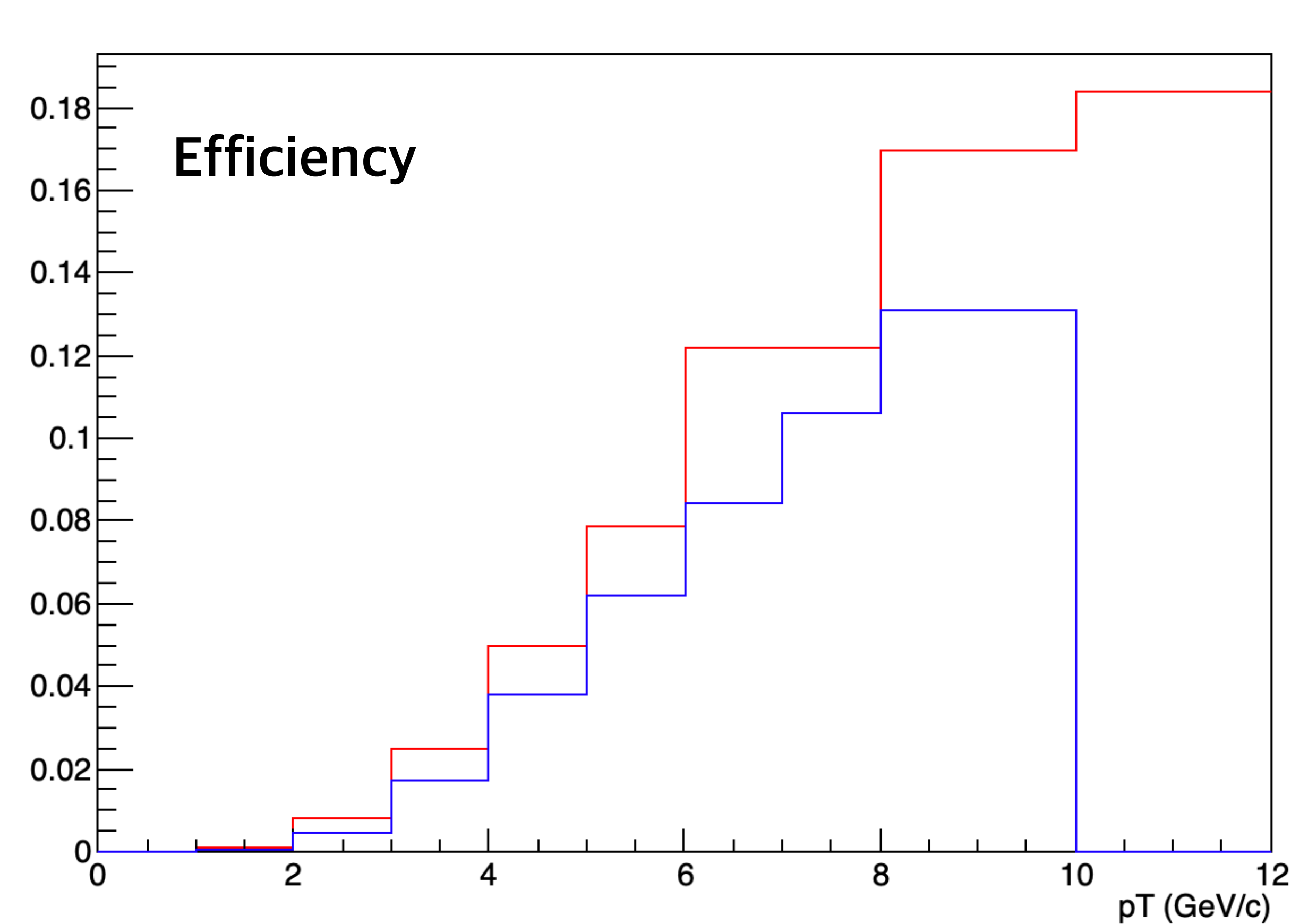
- **First look of ML optimization for Xicc study**
 - **Efficiency** : ML output is $\sim 40\%$ higher than Cut method output
 - **Significance** : Possibility to improve with pT separating ML



Status

- **First look of ML optimization for Xicc study**
 - **Efficiency** : ML output is $\sim 40\%$ higher than Cut method output
 - **Bkg/events** : ML output is 50~90% lower than Cut method output

ML application
Cut method





Back up

Status

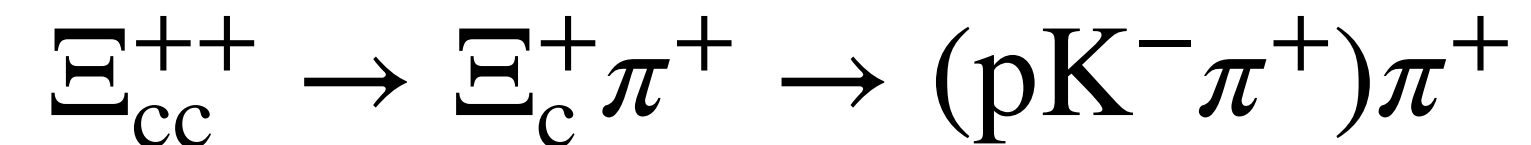
- Comparison

$\Gamma(\Xi_c^+ \pi^+, \Xi_c^+ \rightarrow p K^- \pi^+) / \Gamma(\Lambda_c^+ K^- \pi^+ \pi^+)$	Γ_2 / Γ_1		
<small>VALUE (units 10^{-3})</small>	<small>DOCUMENT ID</small>	<small>TECN</small>	<small>COMMENT</small>
$2.2 \pm 0.6 \pm 0.1$	⁴ AAIJ	18BA LHCb	Ratio 91 over 289 events

	ALICE 3	LHCb
Efficiency	~ 0.1	~ 0.0001
Bkg/evts	20M	TBA
BR	0.002	1
Significance	~ 0.1	~ 10

Multi-Charm baryon

- **Performance study** : Ξ_{cc}^{++} on non-strangeness decay

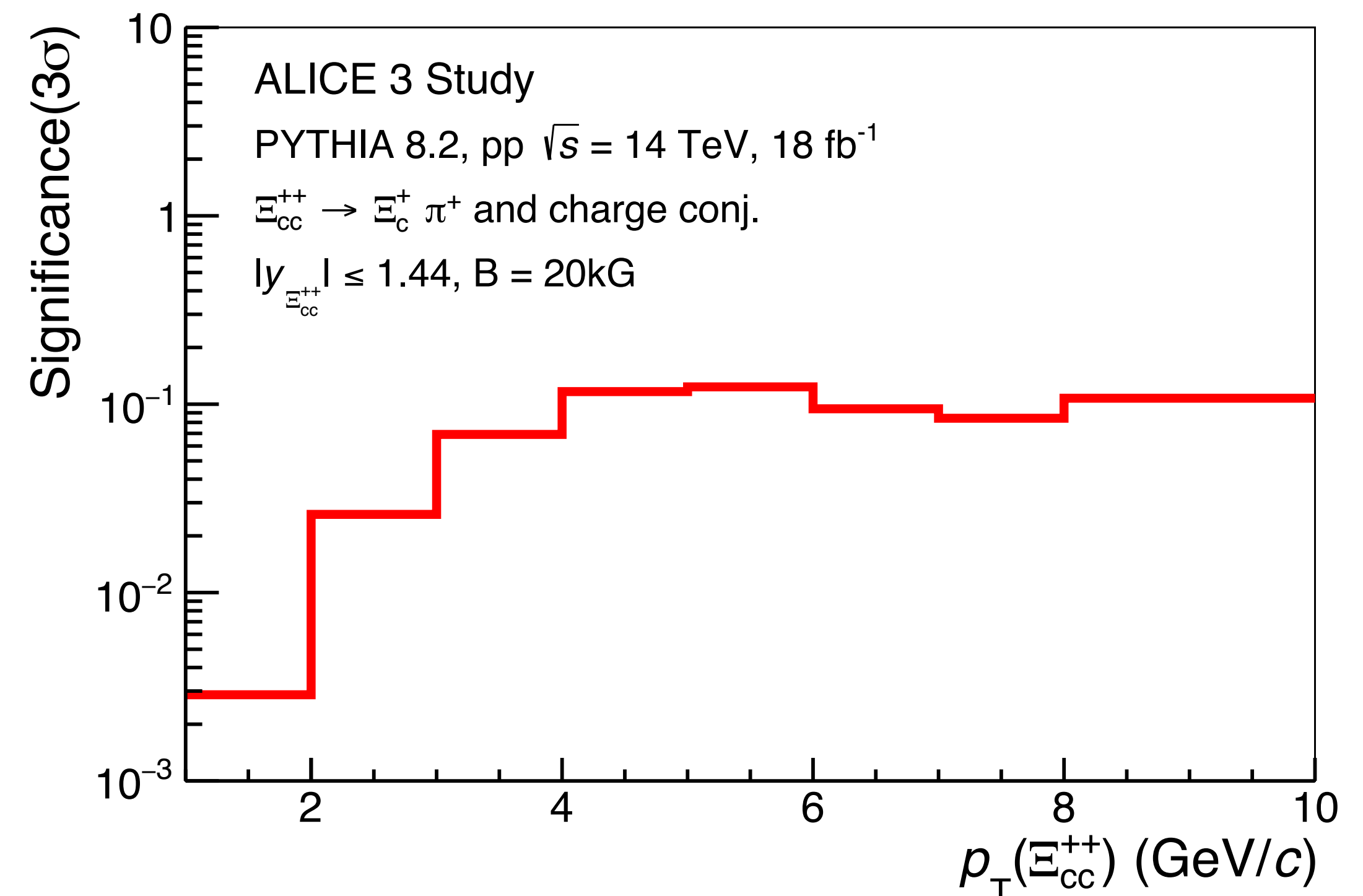
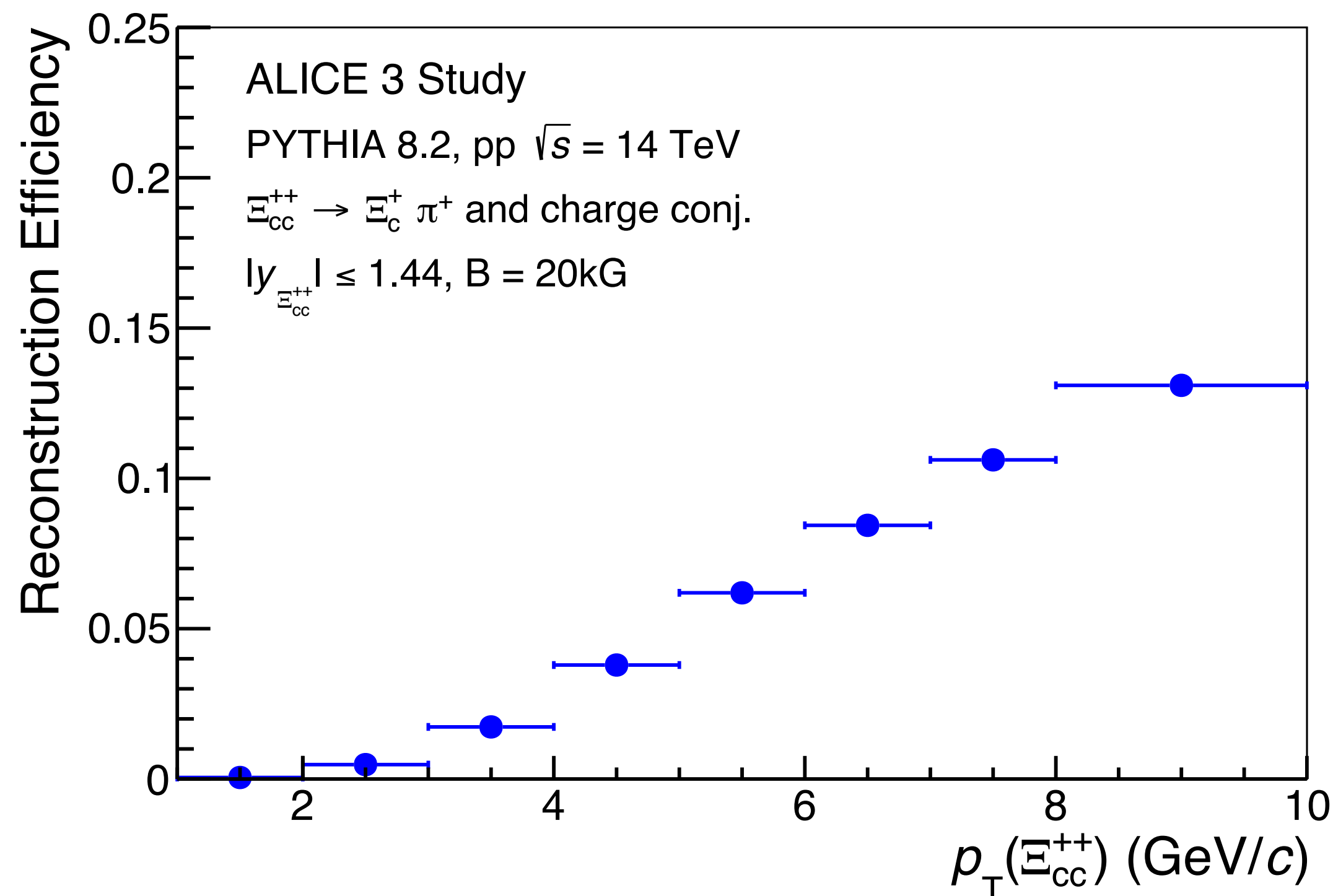


- **Efficiency** : Increases with p_T due to higher momentum π^+

- **Significance**

[arXiv:hep-ph/9710339](https://arxiv.org/abs/hep-ph/9710339)

- Signal/event : Theoretical expectation(cross section, 39 nb) + PYTHIA 8 (p_T shape) + efficiency + BR(0.03%)
- Large uncertainty on production cross section(factor 200) and branching ratio(factor 5)



Status

- **First look of ML optimization for Xicc study**
 - **Efficiency** : comparison with cut method in the next slide
 - **Significance** : not reasonable since background is null

