ALICE3 HF Meeting

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

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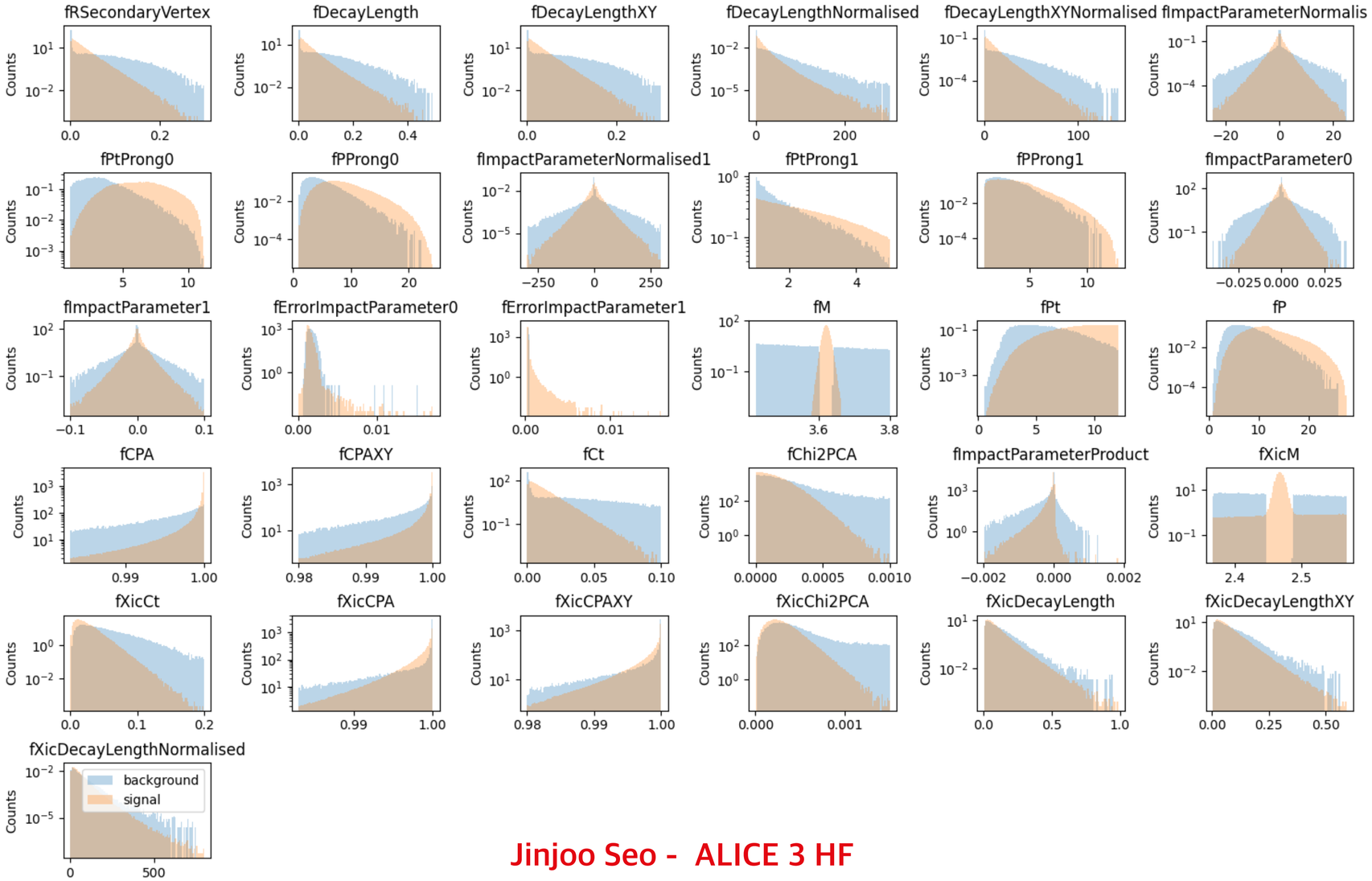
Status

- **Pre-selection**
  - **2(3)prong pre-selection**
    - 2 prongs
      - min_dcaxytoparimary : 0.001 ~ 0
      - max_dcaxytoparimary : 10
    - 3 prongs
      - min_dcaxytoparimary : 0.002 ~ 0.001
      - max_dcaxytoparimary : 10
  - Related to topological selection of Xicc and Xic
  - Decided by distributions of signal and background
  - **PID selections are not considered!**

```
preselection = [
    '-1.44 < fY < 1.44',
    'fRSecondaryVertex < 0.3',
    'fDecayLength < 0.5',
    'fDecayLengthXY < 0.3',
    'fDecayLengthNormalised < 300',
    'fDecayLengthXYNormalised < 150',
    '-0.04 < fImpactParameter0 < 0.04',
    '-0.1 < fImpactParameter1 < 0.1',
    '-0.002 < fImpactParameterProduct < 0.002',
    '-25 < fImpactParameterNormalised0 < 25',
    '-300 < fImpactParameterNormalised1 < 300',
    '-0.02 < fErrorImpactParameter0 < 0.02',
    '-0.02 < fErrorImpactParameter1 <0.02',
    'fCt < 0.1',
    'fChi2PCA < 0.001',
    '0.5 < fPtProng0 < 20',
    '1 < fPtProng1 < 5',
    '0.983 < fCPA < 1',
    '0.98 < fCPAXY < 1',
    '0.983 < fXicCPA < 1',
    '0.98 < fXicCPAXY < 1',
    '0 < fChi2PCA < 0.15',
    '3.4 < fM < 3.8',
    '2.367 < fXicM < 2.567',
    'fXicChi2PCA < 0.0015',
    'fXicDecayLength < 1',
    'fXicDecayLengthXY < 0.6',
    'fXicDecayLengthNormalised < 800',
    'fXicCt < 0.2'
#     '-5 < fNSigmaTOFPi < 5'
]
```

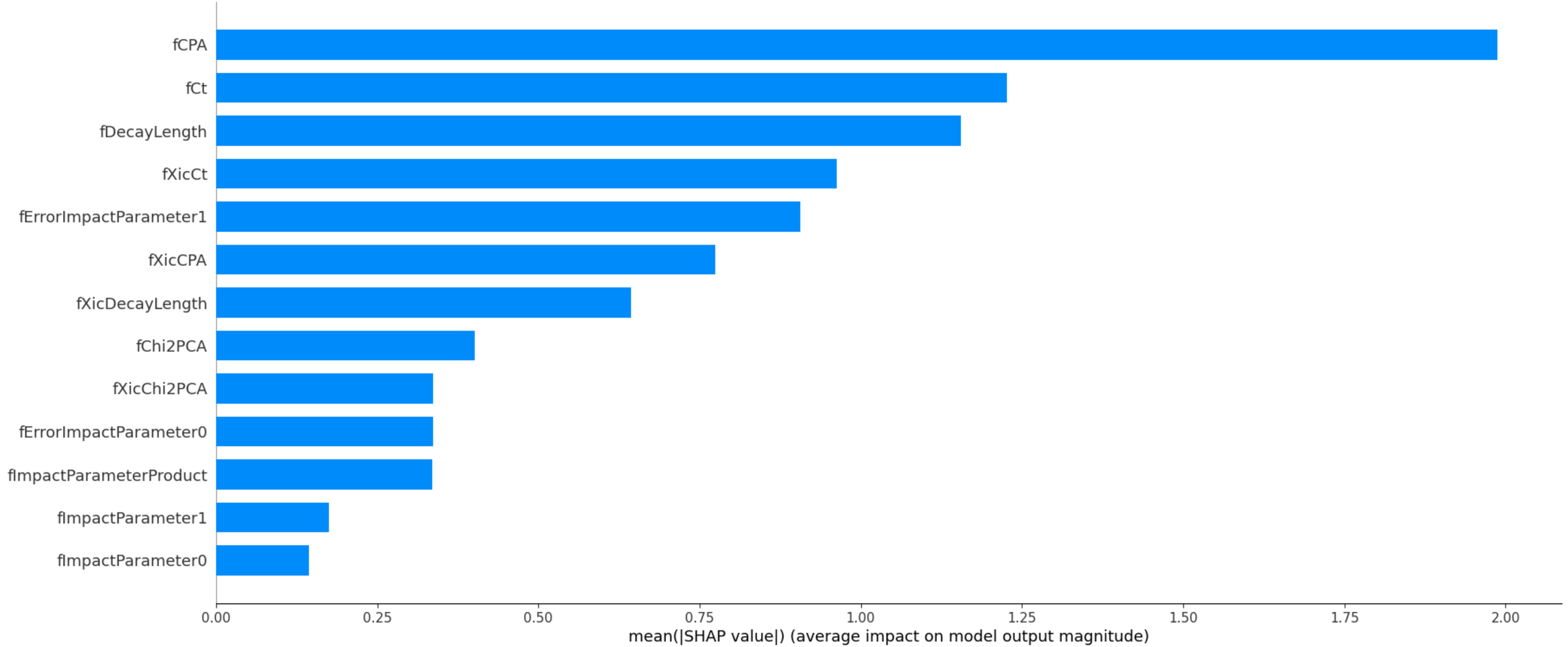
Status

- **Signal vs background distribution** $(0 \leq p_{\mathrm{T}} < 12\,\mathrm{GeV}/c)$



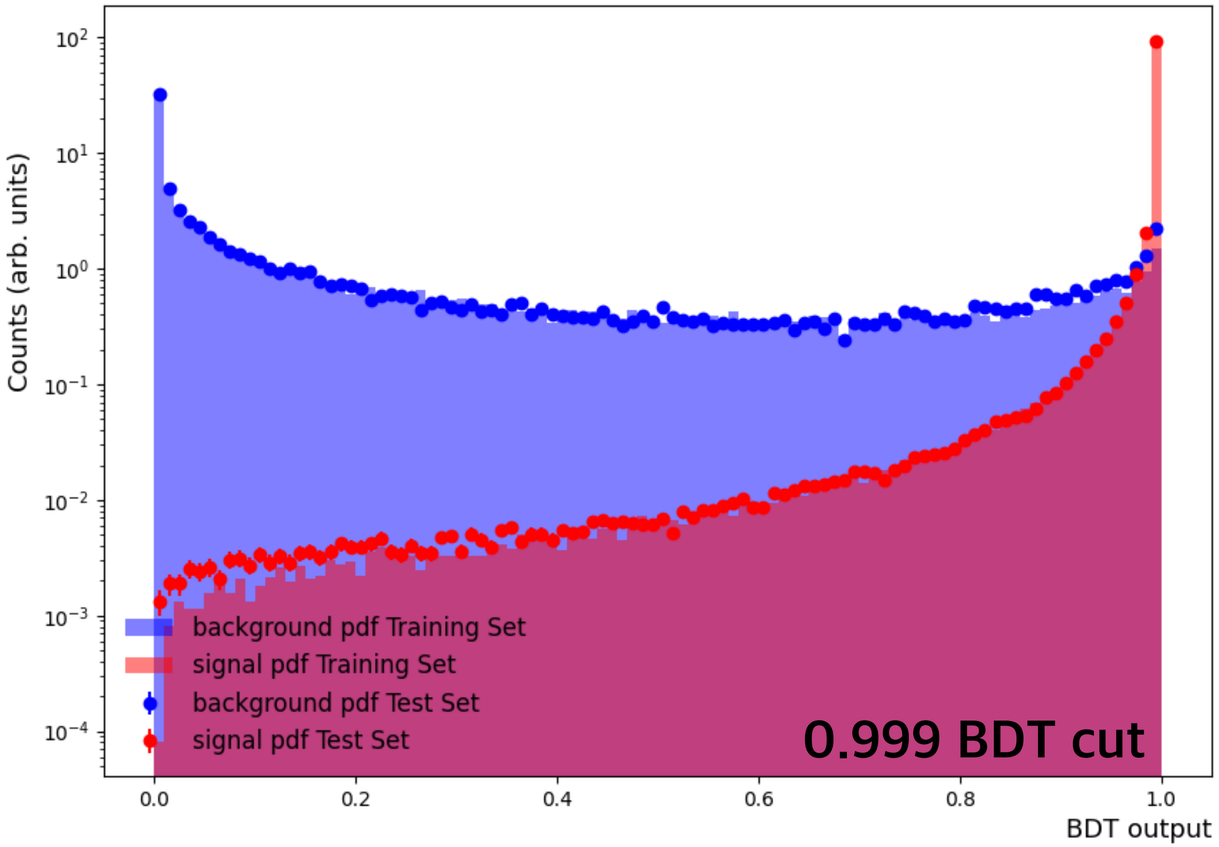
Status

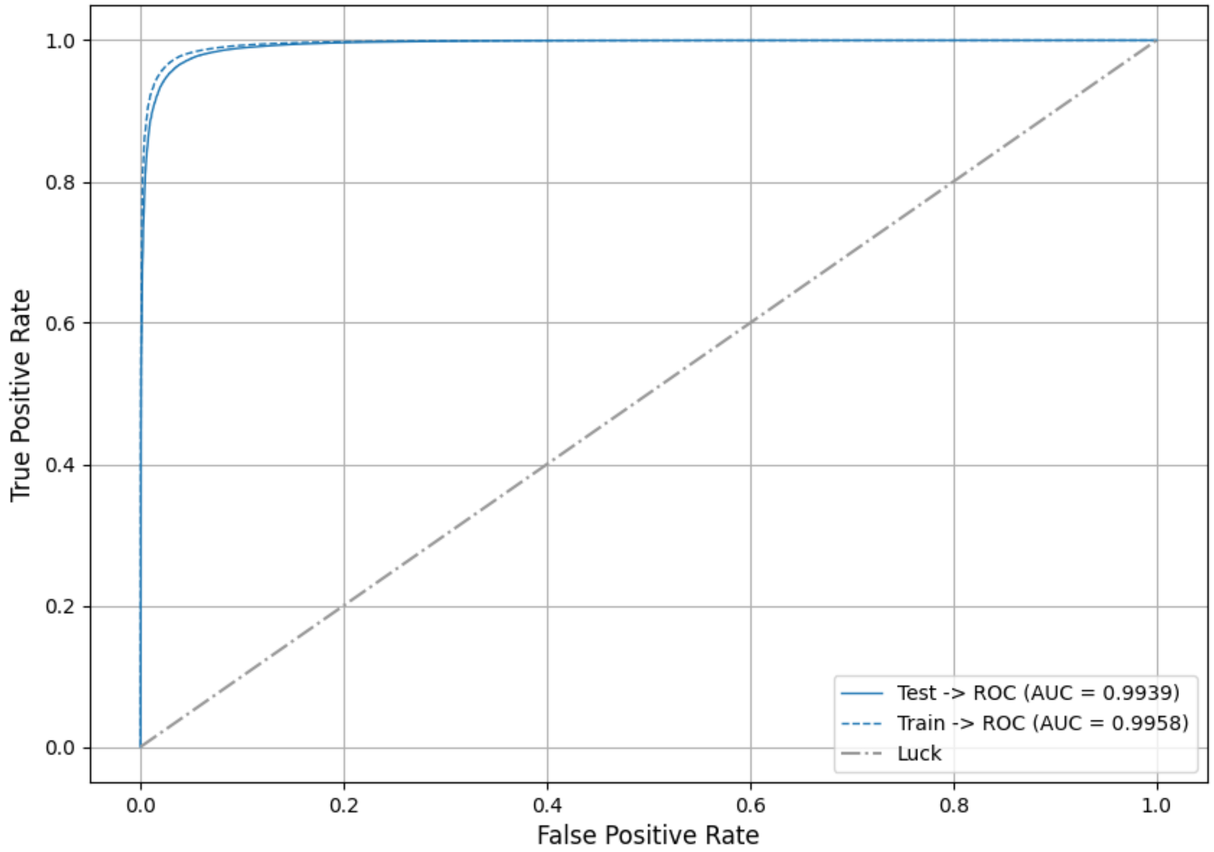
- **Training variable and feature importance** $(0 \leq p_{\mathrm{T}} < 12\,\mathrm{GeV}/c)$



Status

- **Model output and ROC curve** $(0 \leq p_{\mathrm{T}} < 12\,\mathrm{GeV}/c)$

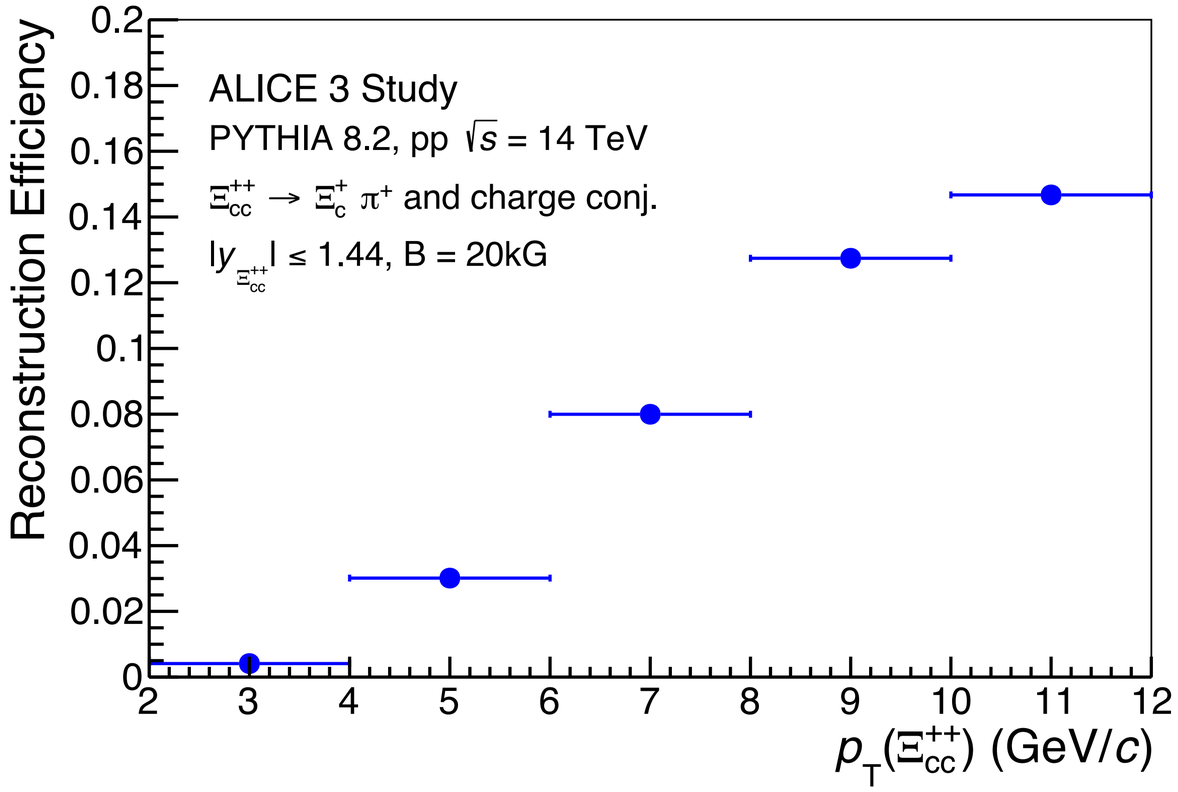


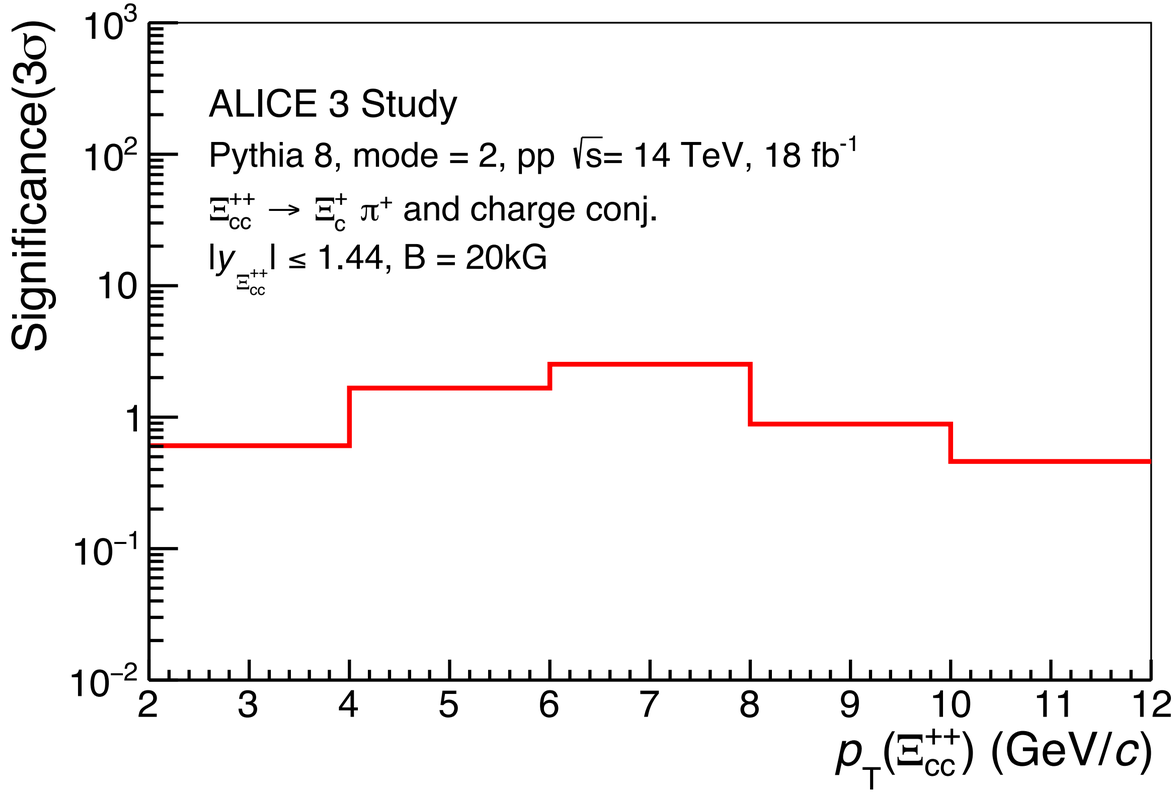


Status

- **Performance study : Ξ_{cc}^{++} on non-strangeness decay** $\Xi_{cc}^{++} \rightarrow \Xi_c^+ \pi^+ \rightarrow (pK^-\pi^+)\pi^+$
  - **Efficiency** : Increases with p_T due to higher momentum π^+
  - **Significance**
    - Signal/event : Theoretical expectation(cross section, 39 nb) + PYTHIA 8 (p_T shape) + efficiency + BR(0.03%)

arXiv:hep-ph/9710339





Status

- **Comparison**

	Bkg/evt	Efficiency	S/B	S/sqrt(B)	BR	L_{int}	Significance
Jinjoo	1E-09	9E-02	9E+07	2848	3.1E-04	18fb^{-1}	~ 1
Bernhard	3.3E-11	2E-03	6E+07	348	1.4E-03	18fb^{-1}	4.96
LHCb	1E-12	3E-04	3E+08	300	8.8E-02	1.7fb^{-1}	~ 10

To estimate the BR in LHCb, use the branching ratio fraction

$$\frac{\mathcal{B}(\Xi_{cc}^{++} \to \Xi_c^+ \pi^+) \times \mathcal{B}(\Xi_c^+ \to pK^-\pi^+)}{\mathcal{B}(\Xi_{cc}^{++} \to \Lambda_c^+ K^-\pi^+\pi^+) \times \mathcal{B}(\Lambda_c^+ \to pK^-\pi^+)} = 0.035 \pm 0.009\,(\text{stat}) \pm 0.003\,(\text{syst}).$$

Back up