Search for $B^0 \to p\bar{\Lambda}^0\pi^-$ and $B^0 \to p\bar{\Sigma}^0\pi^-$ at Belle experiment

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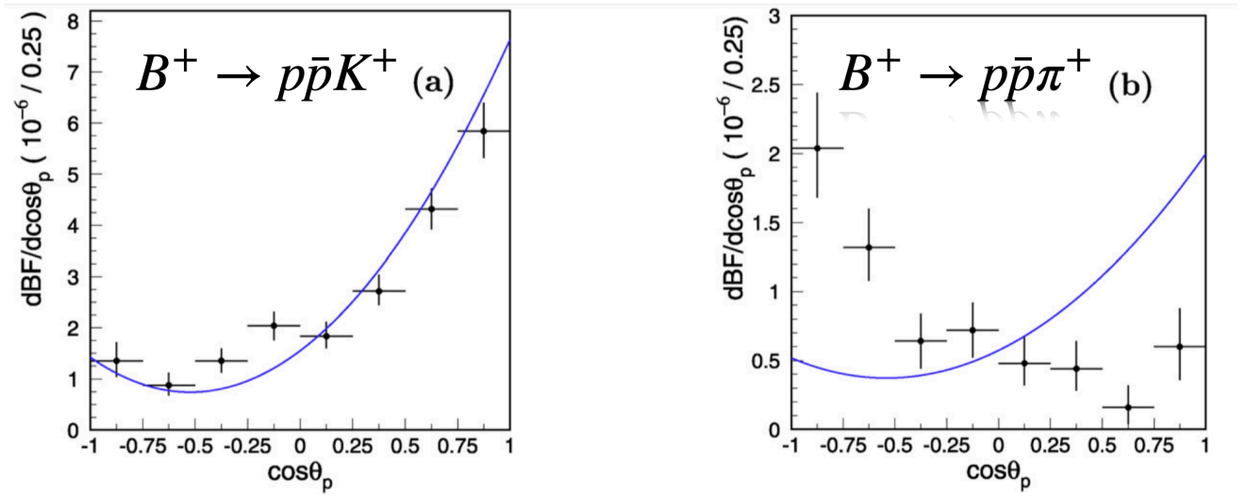
Motivation :

1. Theoretic Prediction :

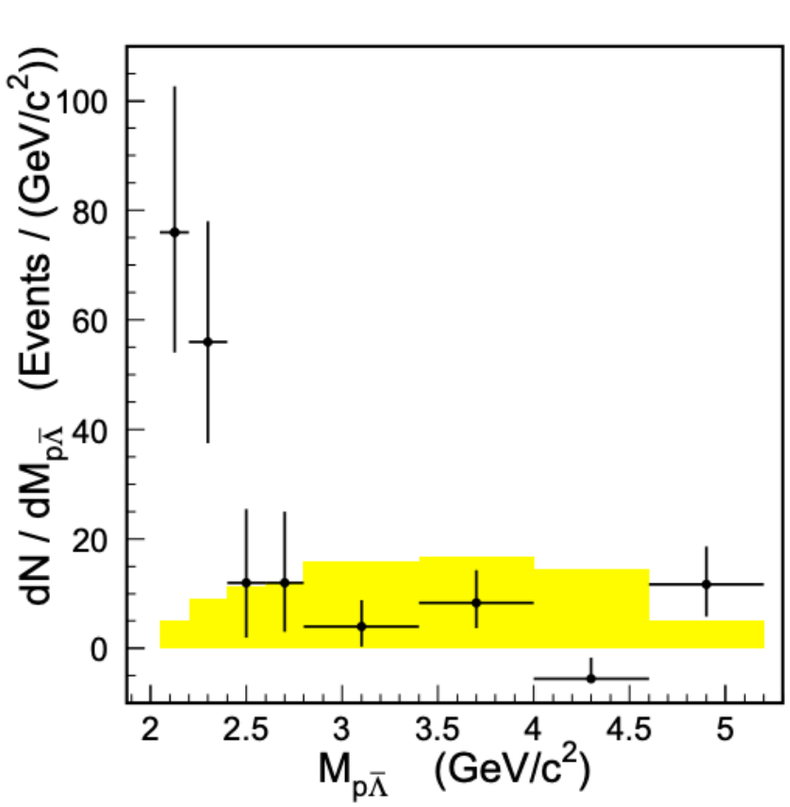
Discover more $b \to s$ physics information by studying the baryonic decay like $B^0 \to p\bar{\Lambda}^0\pi^-$ and $B^0 \to p\bar{\Sigma}^0\pi^-$ with full Belle dataset and compare with theoretic prediction.

2. Angular distribution confirm



J.-T. Wei, M.-Z. Wang, et al. https://doi.org/10.1016/j.physletb.2007.11.063

3. Threshold enhancement check



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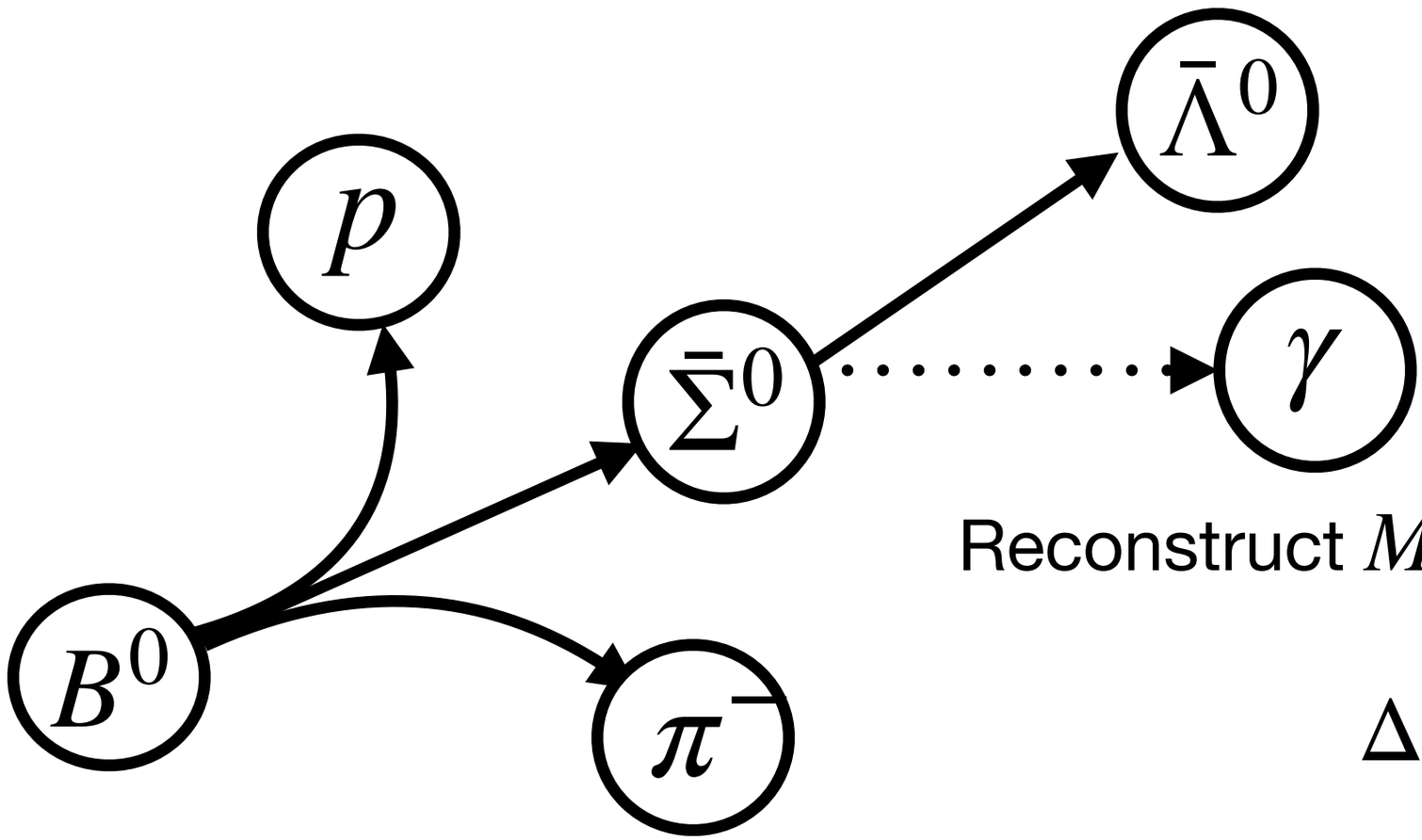
Strategy of study:

0. Generate Signal and Background MC
1. Candidate Reconstruction
2. Event Selection
3. Background Suppression with MVA
4. PDF(Probability Distribution Function) Modeling
5. Using control sample to obtain possible systematic error
6. Measuring Belle data with 2D fitting

Candidate Reconstruction :



Reconstruct $M_{bc} = \sqrt{E_{beam}^2 - p_{recon}^2}$

$\Delta E = E_{recon} - E_{beam}$

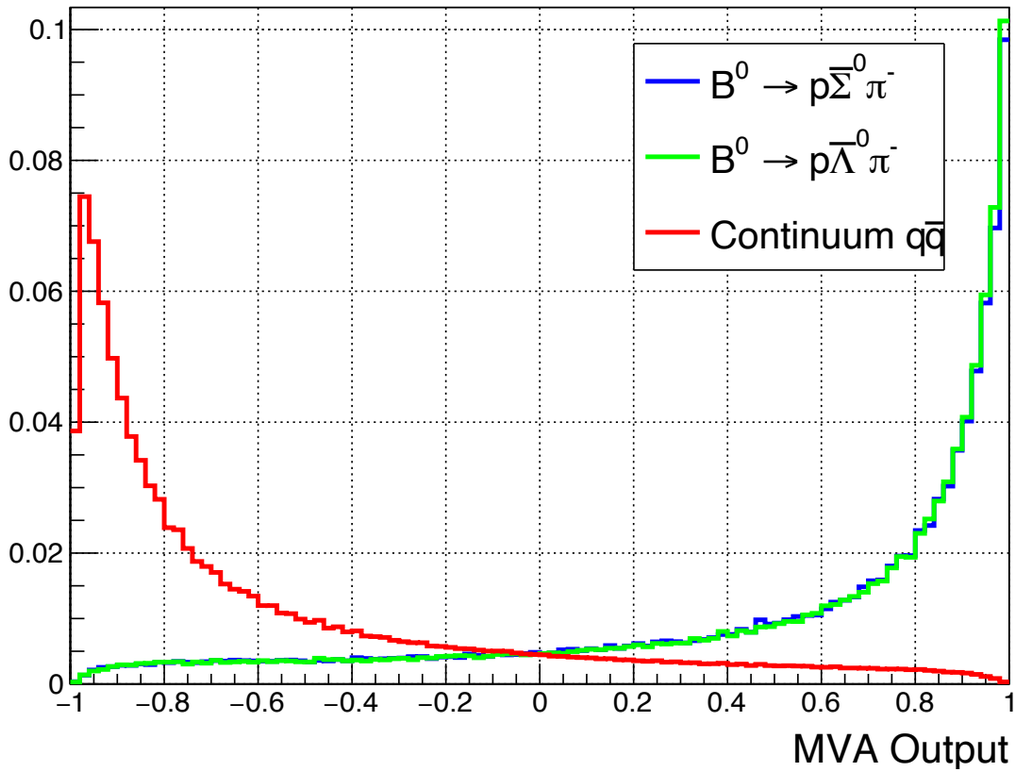
To do 2D fitting

Because the energy of photon is very low(It's hard to collect),
we decide to reconstruct our signal only with $p\bar{\Lambda}^0\pi^-$,
and measure $B^0 \to p\bar{\Lambda}^0\pi^-$ simultaneously.

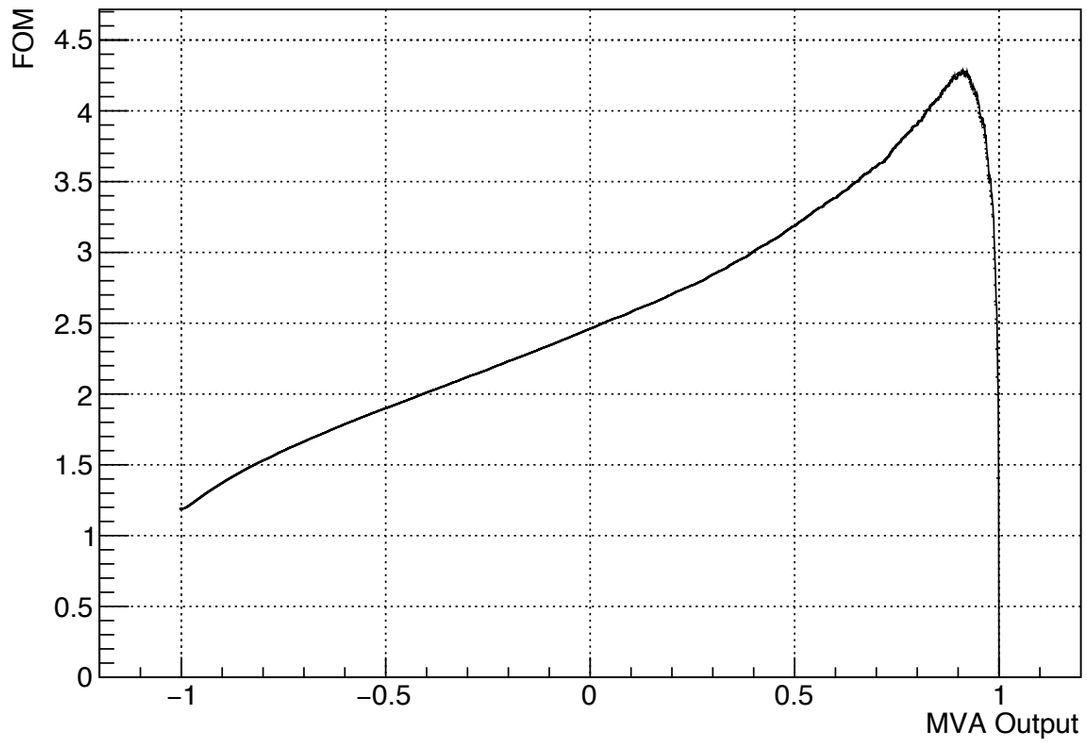
Continuum Suppression :

Our dominated background is continuum background ($e^+e^- \rightarrow q\bar{q}$)

We hired the package Neurobayes to do the suppression



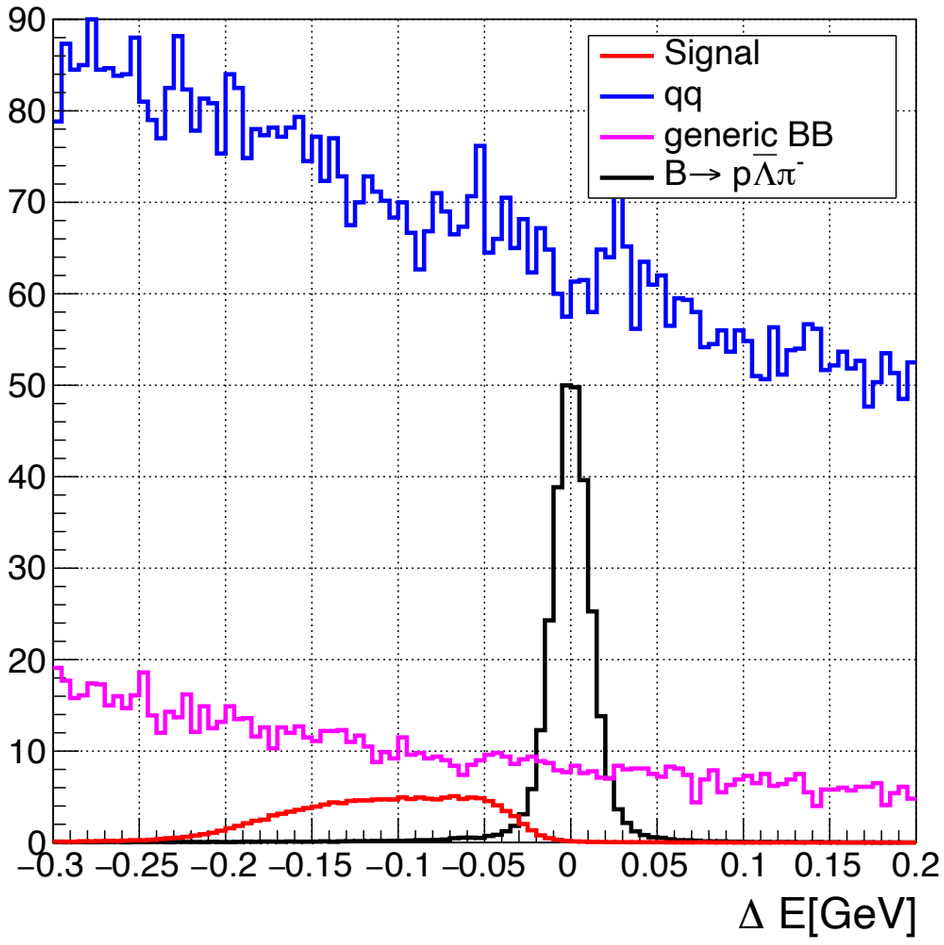
(a) MVA output of continuum suppression

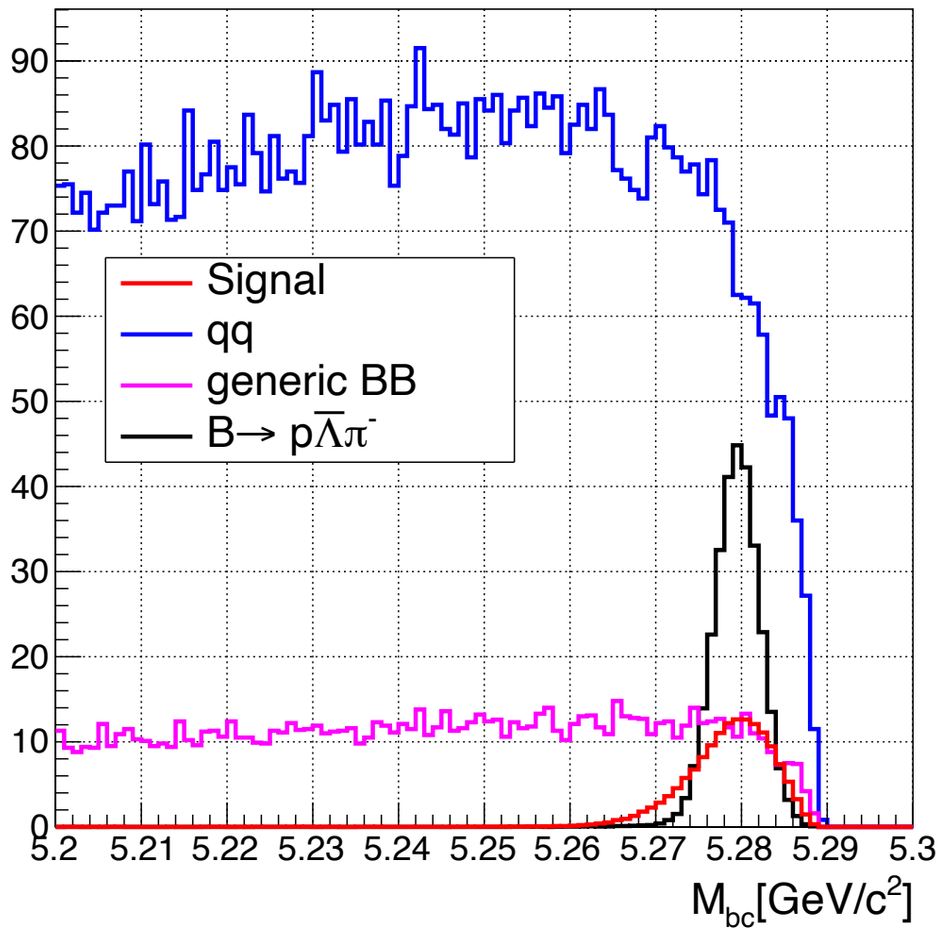


(b) FOM of $B^0 \rightarrow p\bar{\Sigma}^0\pi^-$

$$FOM\ (Figure\ of\ Merit) = \frac{N_s}{\sqrt{N_s + N_b}}$$

MC Distribution:



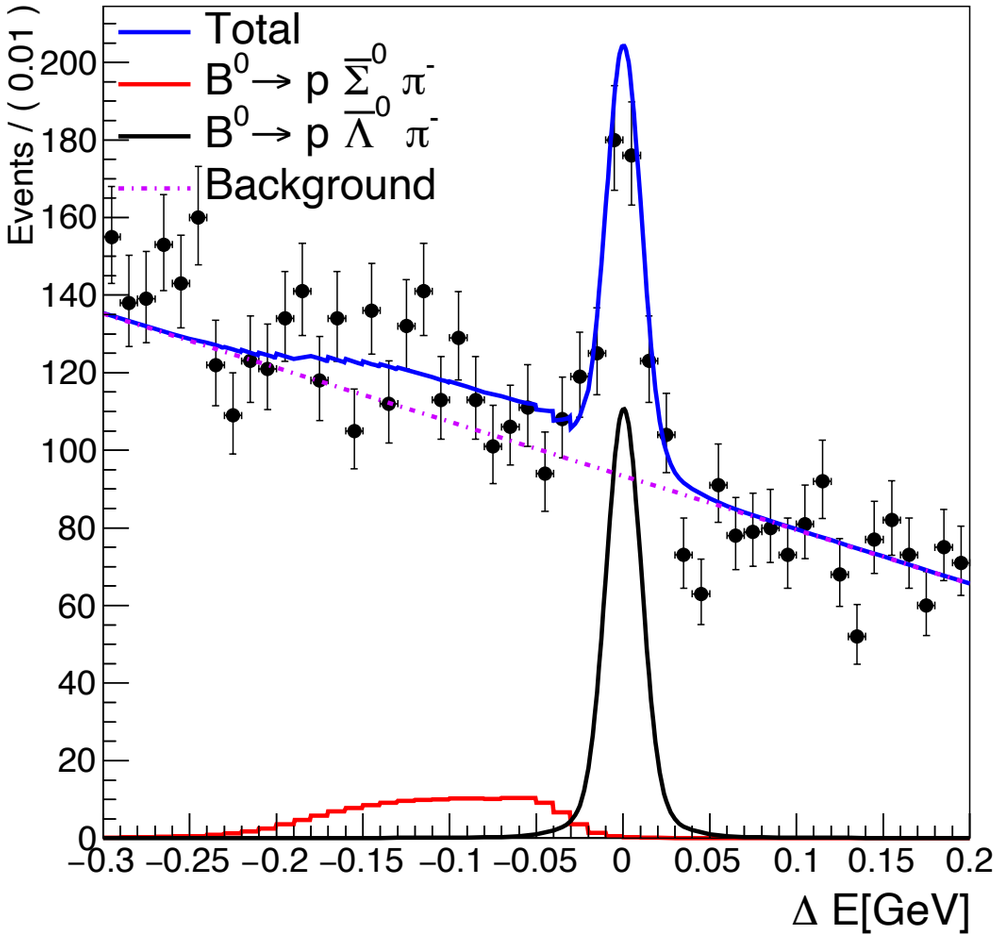


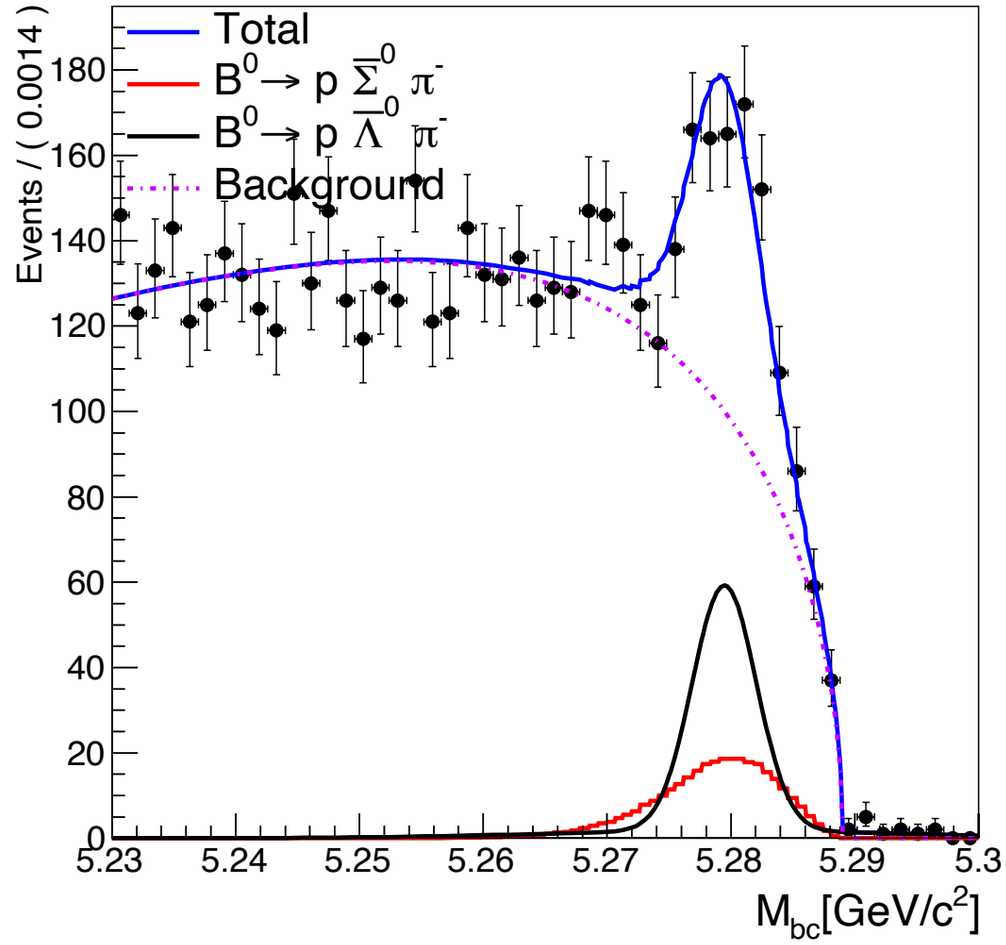
We will measure $B^0 \to p\bar{\Sigma}^0\pi^-$ (Signal) and $B^0 \to p\bar{\Lambda}^0\pi^-$ simultaneously also make sure the precision of signal yield with $B^0 \to p\bar{\Lambda}^0\pi^-$

PDF Modeling :

Data sample : MC simulation

Background : Continuum $q\bar{q}$ + Generic BB





Summary :

1.The partial reconstruction method is promising .

2.The performance of two modes under the MVA training are same

3. More systematic error studies in progress

Back Up

Event Selection:

Proton : $\mathscr{L}_{p/K} > 0.6$, $\mathscr{L}_{p/\pi} > 0.6$, $|\Delta r| < 0.3$ (cm) , $|\Delta z| < 2$ (cm)

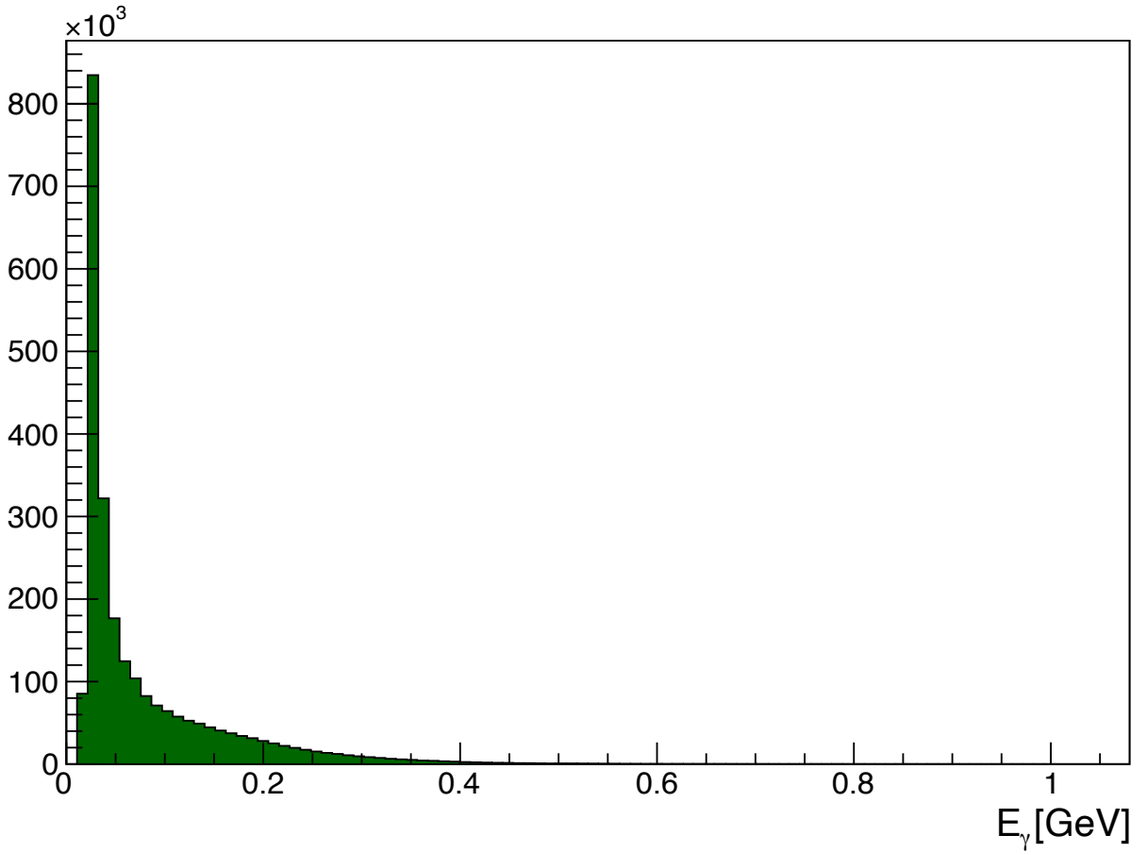
π^- : $\mathscr{L}_{K/\pi} < 0.4$, $|\Delta r| < 0.3$ (cm) , $|\Delta z| < 4$ (cm)

Λ^0 : $1.11 < M_{\Lambda^0} < 1.121$ (GeV/c^2) , good$\Lambda > 0$

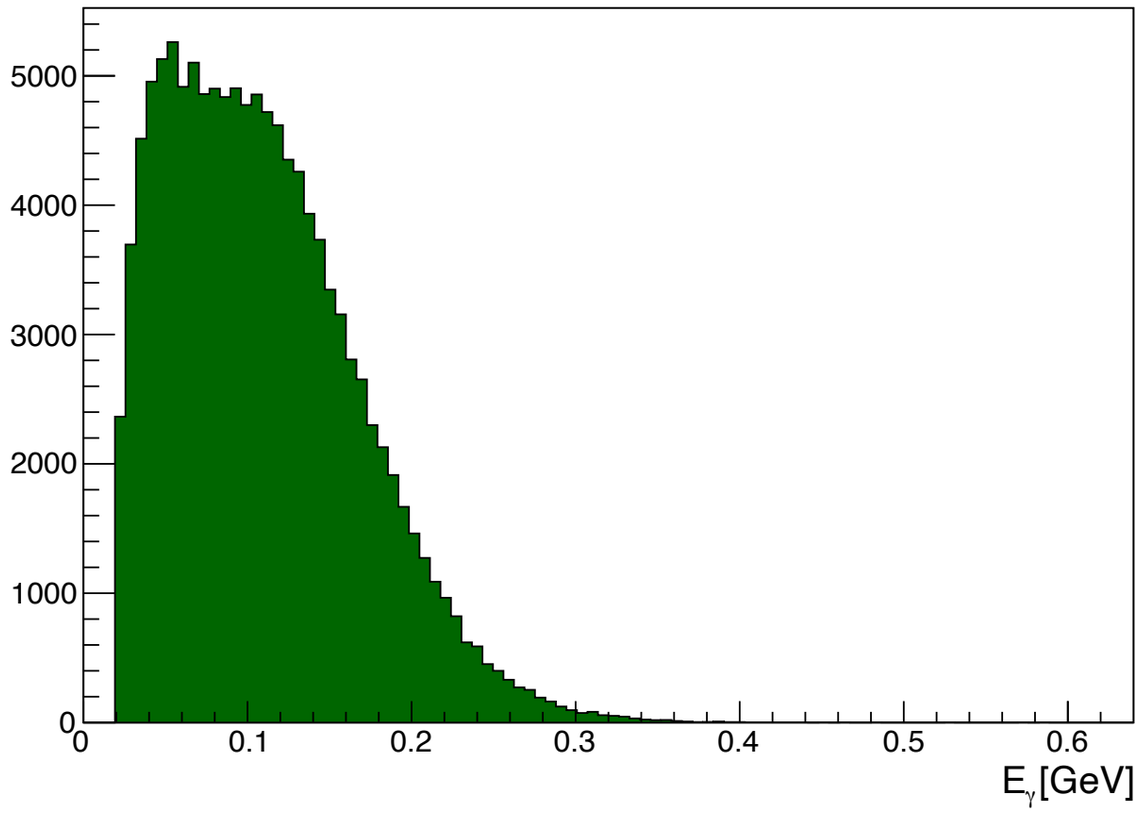
e : $\mathscr{L}_e < 0.95$

μ : $\mathscr{L}_\mu < 0.95$

E_γ :



(a) Background



(b) Signal