$B^0 \to D^{*-}\, p\, \bar{n}$

Measurement at Belle II

TW HEP meeting

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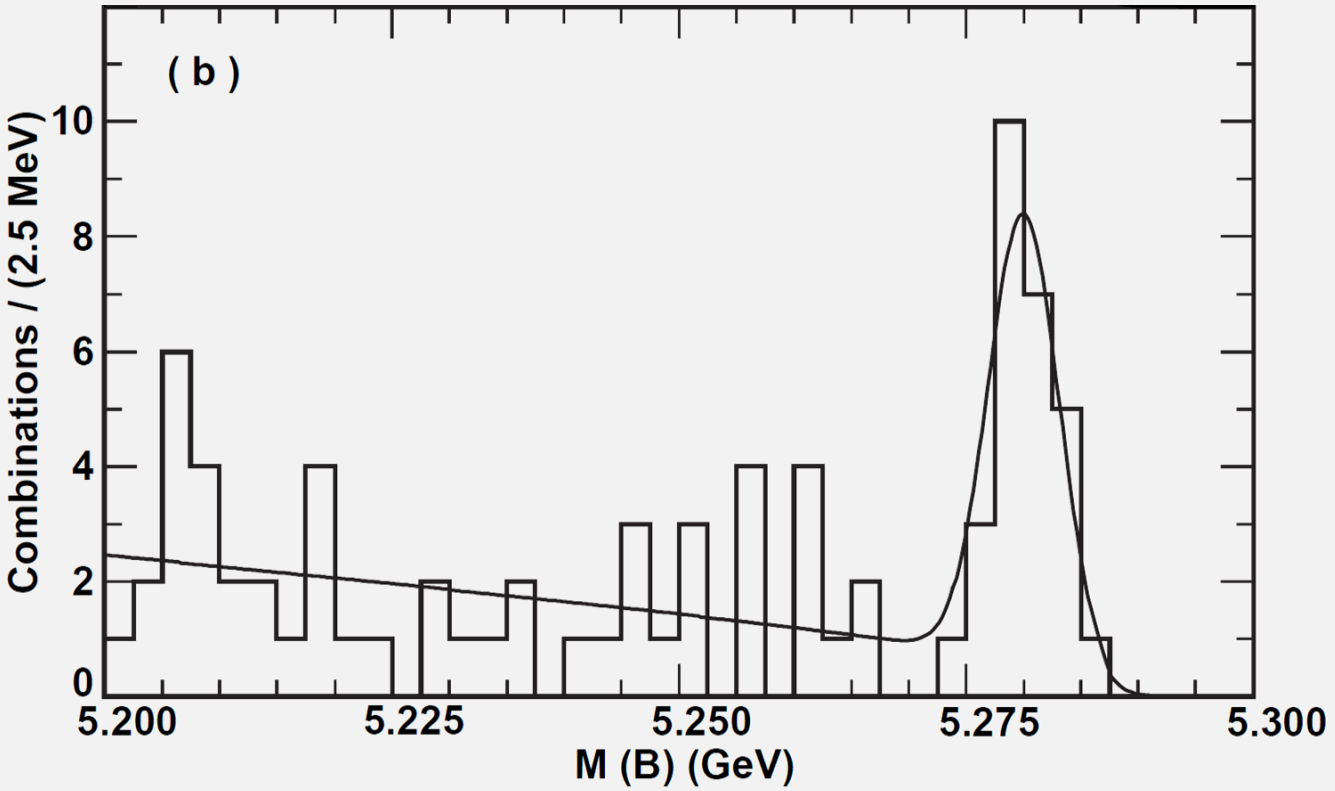
Motivation

- $\begin{cases} B^0 \to D^{*-} p\bar{n} & (1.4 \pm 0.4) \times 10^{-3} \\ B^0 \to D^{*0} p\bar{p} & (9.9 \pm 1.1) \times 10^{-5} \end{cases}$
- Confirm CLEO's measurement $9.7 \times 10^6 B\bar{B}$
- Belle II $62.4 fb^{-1} / 62.8 fb^{-1}$ $32 \times 10^6 B\bar{B}$
- $\bar{n}$ID established by NTU group

First Observation of $B^0 \to D^{*-} p\bar{n}$ by CLEO



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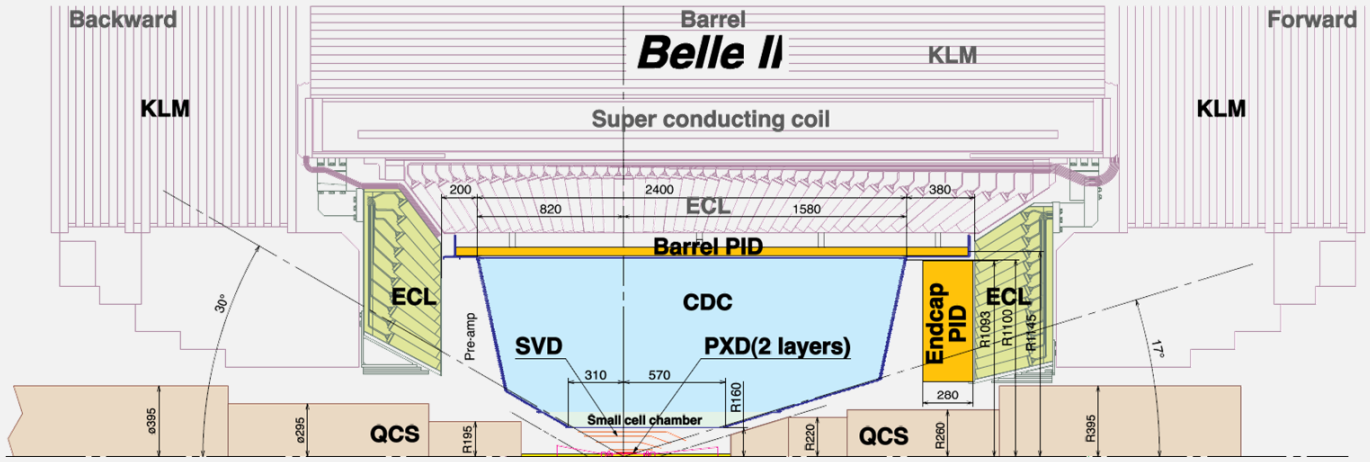
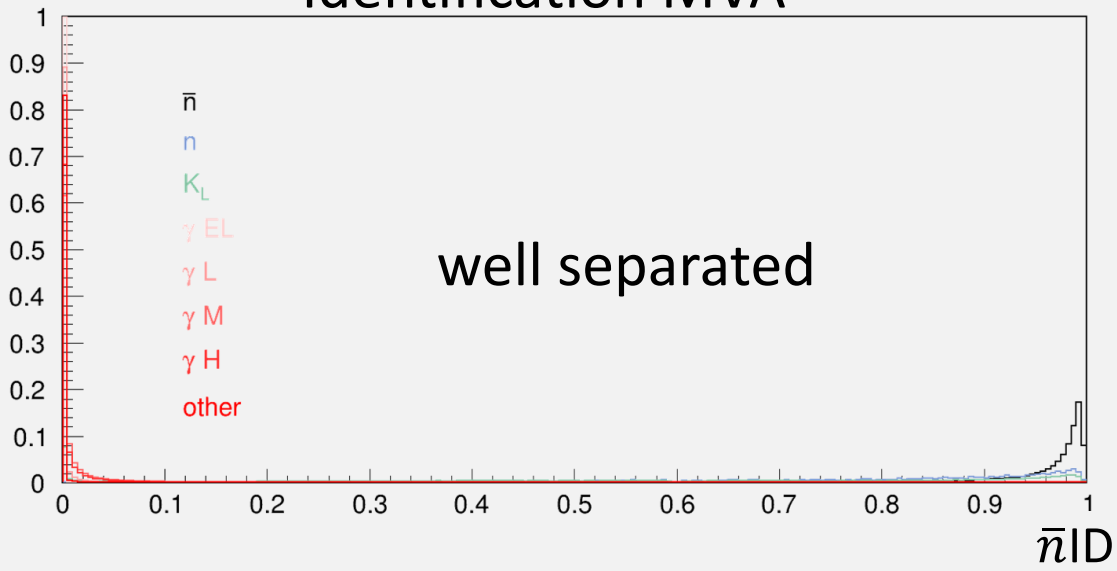
$\bar{n}$ Reconstruction and Identification

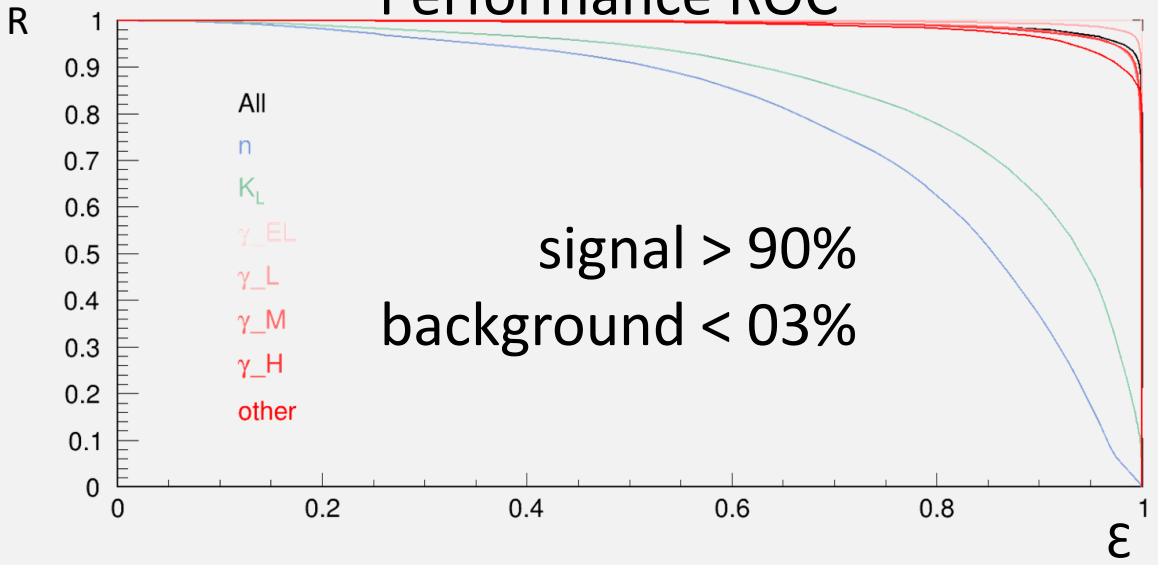
- Reconstruction from ECL electromagnetic calorimeter
- Position, ~~energy~~, identification
- Discrepancy < 3% in average



Identification MVA



Performance ROC



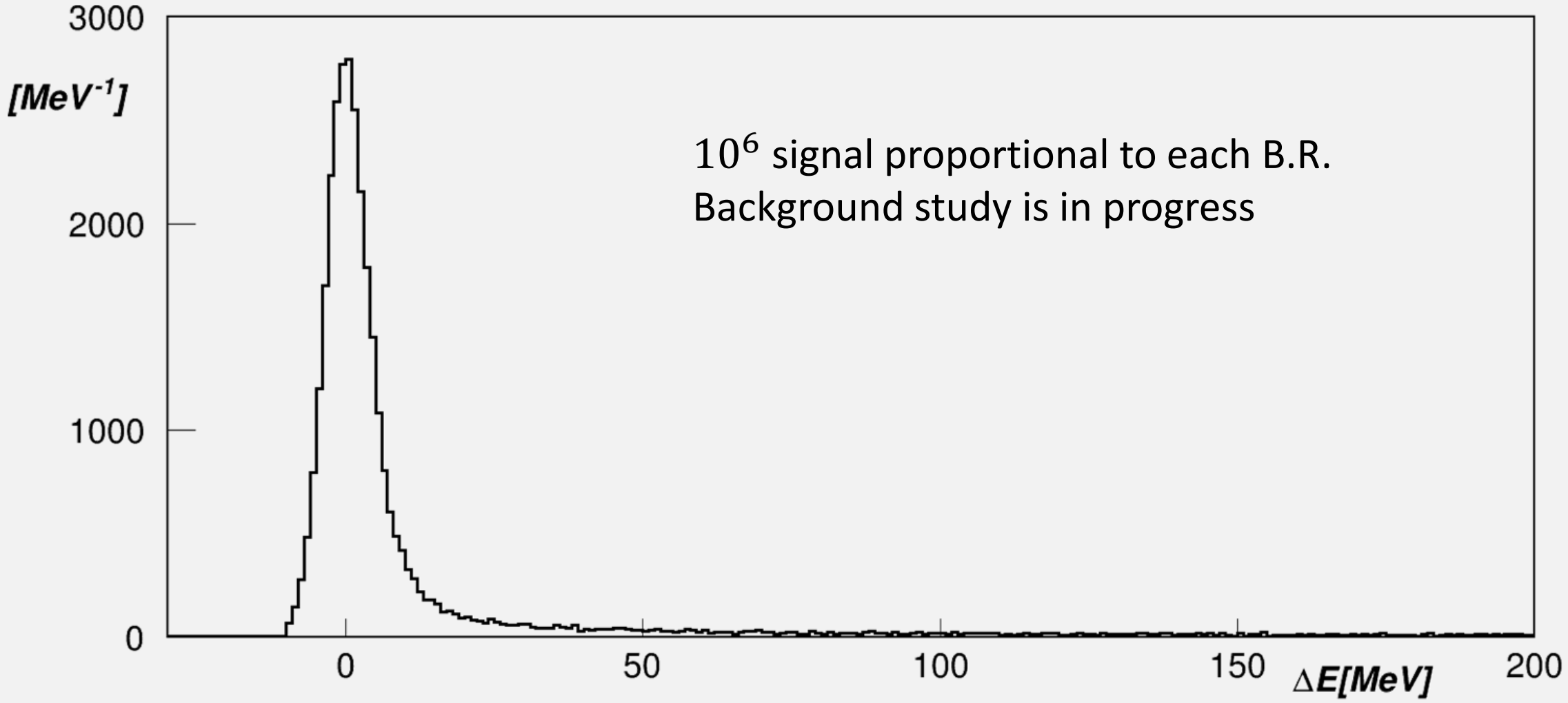
B Reconstruction and Mass Constraint

- $B^0 \to D^{*-}(\to \bar{D}^0\pi^-)p\bar{n}$
  - $\bar{D}^0 \to K^+\pi^-$
  - $\bar{D}^0 \to K^+\pi^-\pi^0(\to \gamma+\gamma)$
  - $\bar{D}^0 \to K^+\pi^-\pi^+\pi^-$
- B^0 can not be reconstructed by P^μ due to $\bar{n}$
- B^0 mass constraint

$$\begin{cases} E_n^2 = M_n^2 + p_n^2 \\ (E_n + E_x)^2 = M_B^2 + (\vec{p}_n + \vec{p}_x)^2 \end{cases}$$

- $\Delta E = E_n + E_x - E_{beam}/2$ @C.M. frame as fitting variable

Simulation Study



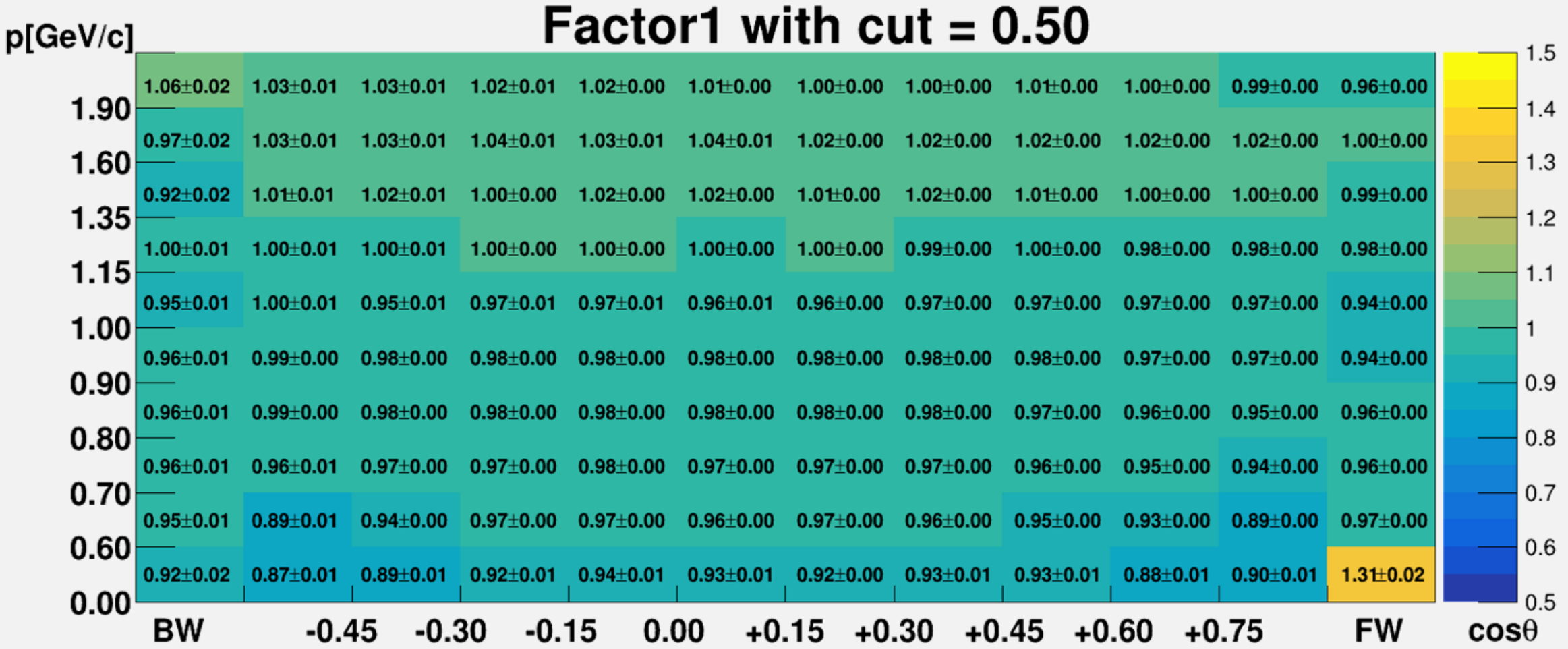
10^6 signal proportional to each B.R.
Background study is in progress

Summary

- Belle II has collected **3 times** more $B\bar{B}$ than CLEO.
- $\bar{n}$ is reconstructed with **good separation power** and **low discrepancy**.
- B^0 is reconstructed by **B mass constraint** method.
- More simulation studies are in progress.
- Measurement in **data** soon.

Efficiency Calibration

By using $\overline{\Lambda} \rightarrow \bar{p}\pi^{+}$



Pre-selection

(semi-) final state particle		
$p^+K^+\pi^\pm$	good track	loose selection
π^0	official γ	105 MeV < M_{π^0} < 150 MeV, ε = 50%
reconstructed particle		
$\bar{D}^0$	vertex fit	1.84 GeV < $M_{\bar{D}^0}$ < 1.88 GeV
D^{*-}	vertex fit	144 MeV < $M_{D^{*-}} - M_{\bar{D}^0}$ < 147 MeV
best candidate selection		
$\bar{n}$	highest score in event	