Other B Decays at Belle

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on behalf of the Belle Collaboration
2011/7/22

Outline

- $B^- \to \bar{p}\Lambda D^{(*)0}$
- $B^0 \to J/\Psi\eta^{(')}$
- Summary

A test for generalized factorization

- Three-body baryonic B decays with a $D^{(*)}$ meson
- Under generalized factorization:
  - Current type
  - Transition type
  - Hybrid type

  Understand b → c in order to disentangle b → u & b → s in $B^+ \to p\bar{p}K^+$ decays

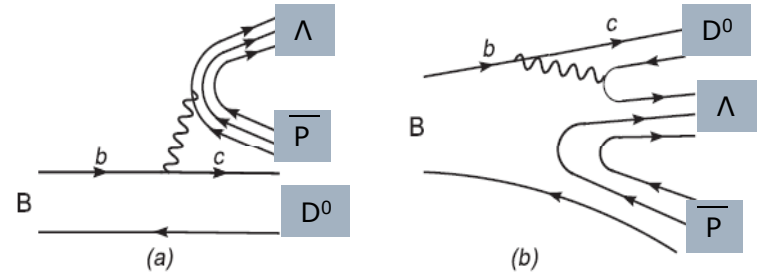


FIG. 1. Two types of the $B^- \to \bar{p}\Lambda D^0$ decay process: (a) current type and (b) transition type.

- Prediction:

$$\mathcal{B}(B^- \to \bar{p}\Lambda D^0) = 1.14 \pm 0.26 \times 10^{-5}$$

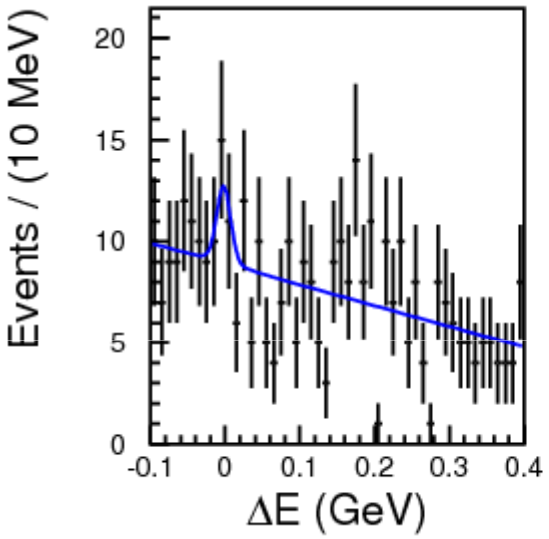
$$\mathcal{B}(B^- \to \bar{p}\Lambda D^{*0}) = 3.23 \pm 0.32 \times 10^{-5}$$

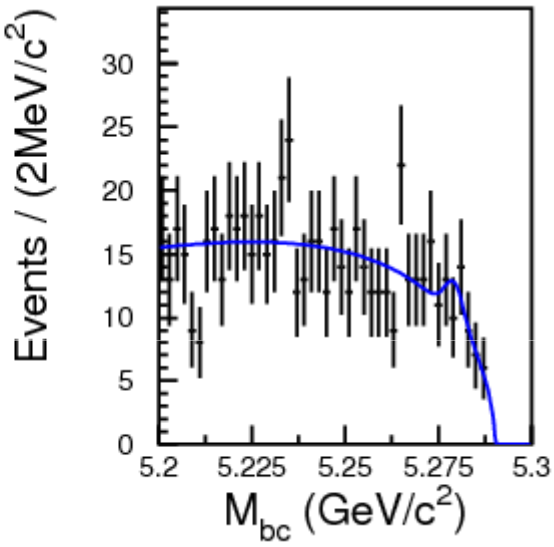
C.-H. Chen, H.-Y. Cheng
C.Q. Geng and Y.K. Hsiao
PRD 78:054016(2008)

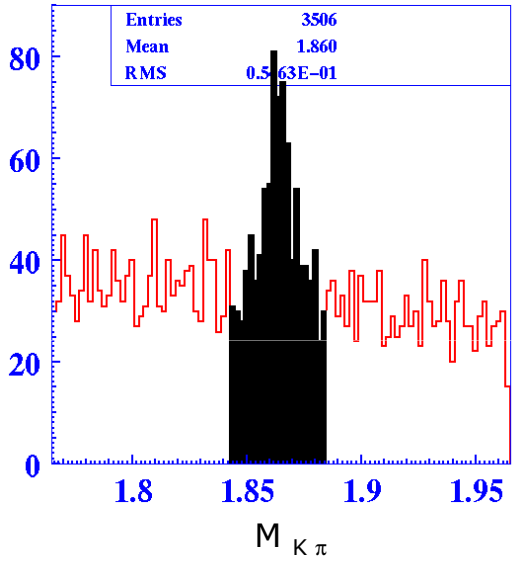
Check B yield from D^0 side band

preliminary

- with good Λ tag







Yield = 9.37 ± 5.20

Under signal region $|M_{K\pi} - 1.863| < 10$ MeV
Yield= 1.17 ± 0.65

Sideband definition :
$1.765 < M_{K\pi} < 1.965$ GeV
excluding D^0 signal region
$|M_{K\pi} - 1.863| < 20$ MeV

Result for $B^- \to \bar{p}\Lambda D^0$

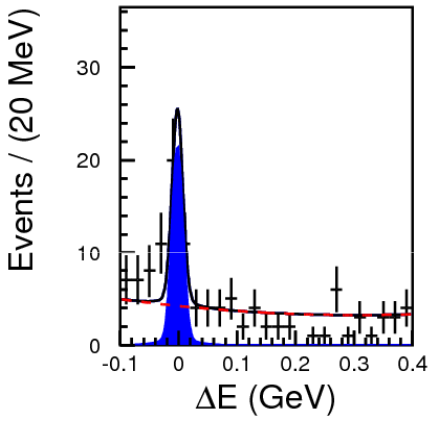
657M $B\bar{B}$

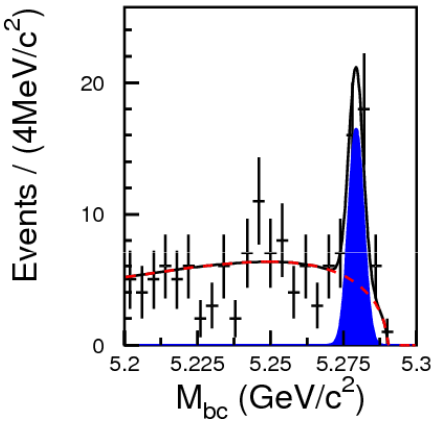
preliminary

:signal $B^- \to \bar{p}\Lambda D^0$

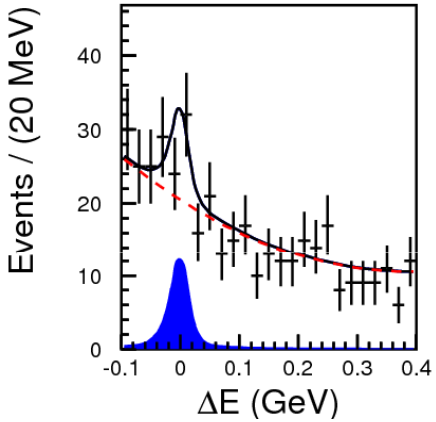
:continuum

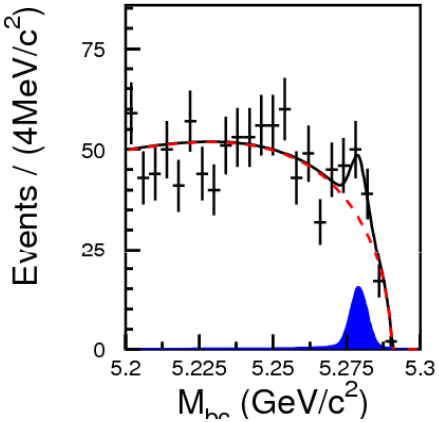
$D^0 \to K^-\pi^+$





$D^0 \to K^-\pi^+\pi^0$





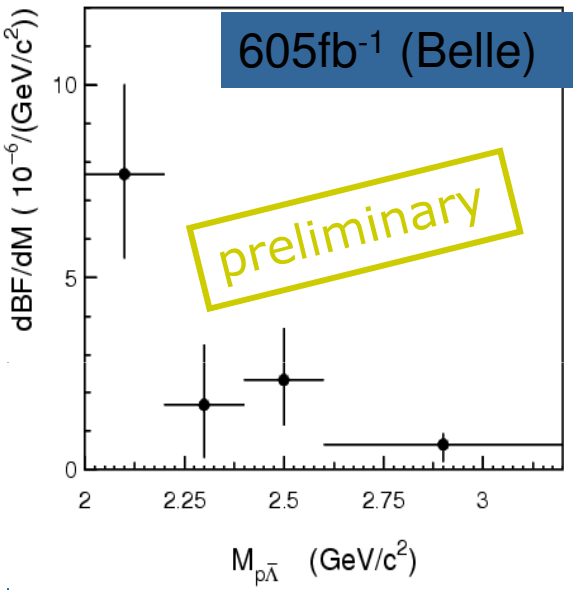
Modes	N_{signal}	$\mathcal{S}$	$\varepsilon(\%)$	$\mathcal{B}(\times 10^{-5})$
$\bar{p}\Lambda D^0_{K^-\pi^+}$	$26.5^{+6.3}_{-5.6}$	7.4	11.7	$1.39^{+0.33}_{-0.29} \pm 0.16$
$\bar{p}\Lambda D^0_{K^-\pi^+\pi^0}$	$35.6^{+11.7}_{-10.7}$	3.4	4.0	$1.54^{+0.50}_{-0.46} \pm 0.44$
$B^- \to \bar{p}\Lambda D^0$		8.1		$1.43^{+0.28}_{-0.25} \pm 0.18$

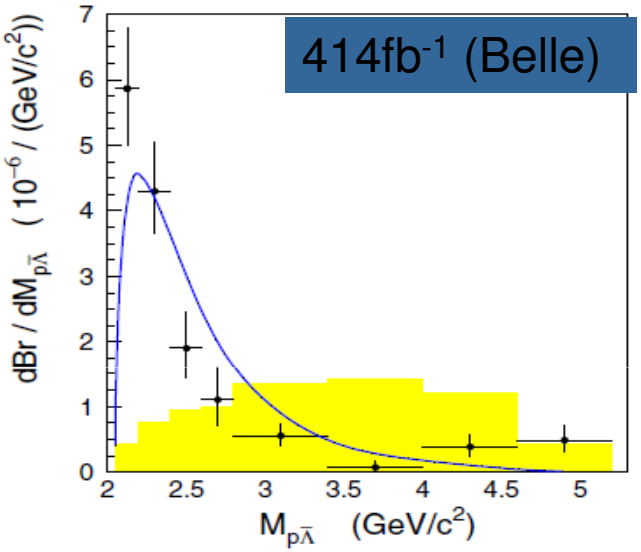
Consistent with prediction!

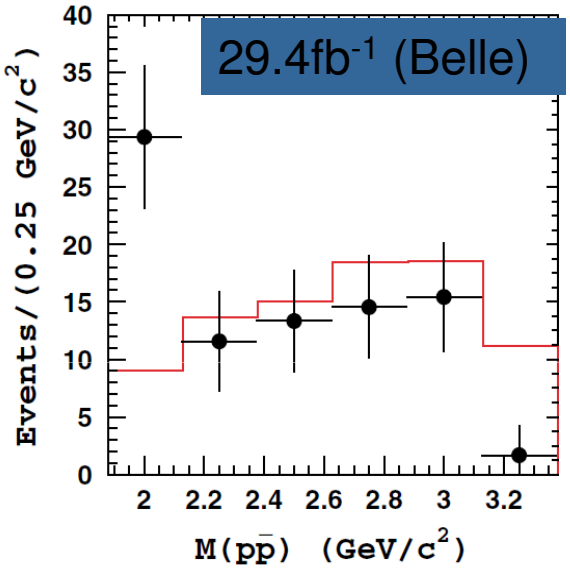
$B(B^- \to \bar{p}\Lambda D^0) = 1.14 \pm 0.26 \times 10^{-5}$

Comparison with similar modes

Threshold enhancement in the baryon-antibaryon invariant mass







$B^- \to \bar{p}\Lambda D^0$

$B(B^- \to \bar{p}\Lambda D^0) = (1.43^{+0.28}_{-0.25} \pm 0.18) \times 10^{-5}$

$B^0 \to p\bar{\Lambda}\pi^-$

$B(B^0 \to p\bar{\Lambda}\pi^-) = (3.23^{+0.33}_{-0.29} \pm 0.29) \times 10^{-6}$

M.-Z. Wang et al., PRD, 76,052004(2007)

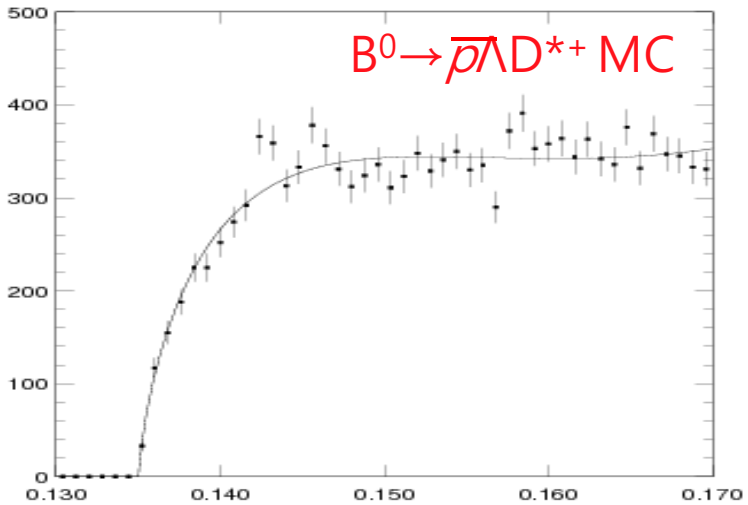
$B^0 \to p\bar{p}D^0$

$B(B^0 \to p\bar{p}D^0) = (1.18 \pm 0.15 \pm 0.16) \times 10^{-4}$

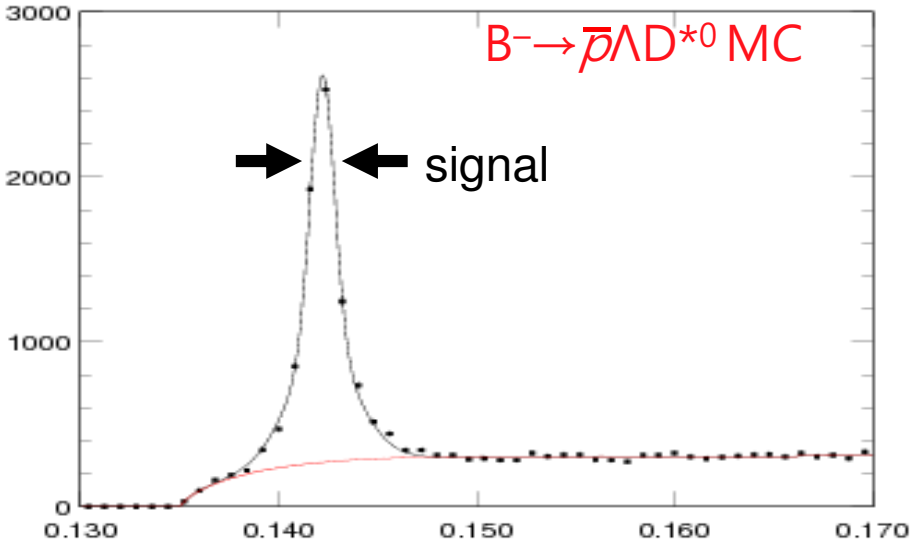
K. Abe. et al PRL. 89, 151802 (2002)

$B^- \to \bar{p}\Lambda D^{*0}$ background study

- Dominant background in $B^- \to \bar{p}\Lambda D^{*0}$; $D^{*0} \to D^0\pi^0$
  $B^0 \to \bar{p}\Lambda D^{*+}$; $D^{*+} \to D^0\pi^+$
- Missed the slow π^+ (π^0) from D^{*+} (D^{*0}) and form a π^0 candidate from two random photons to reconstruct the D^{*0}
- We denote these as CF (cross-feed) events



$\Delta M \equiv M_{D^{*0}} - M_{D^0}(GeV/c^2)$



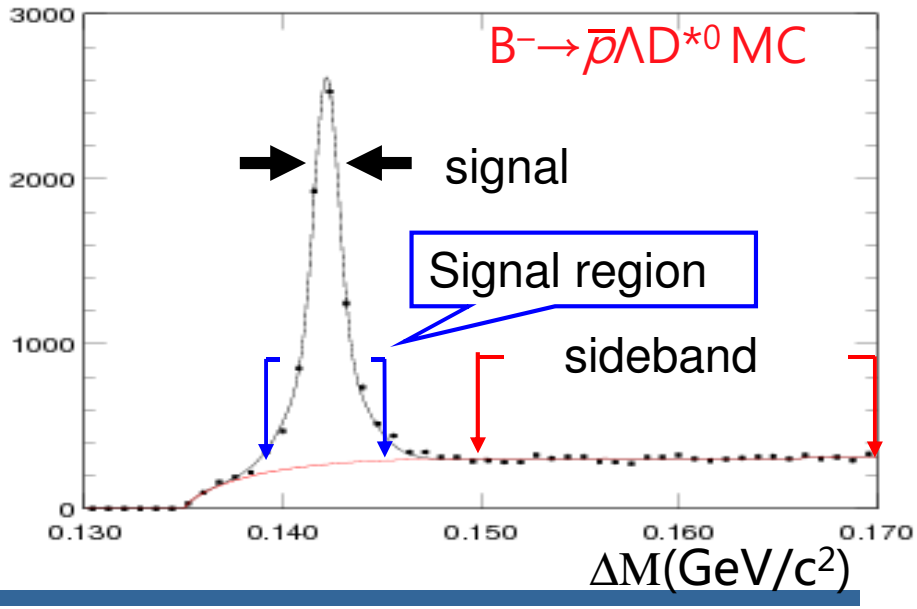
$\Delta M(GeV/c^2)$

$B^- \to \bar{p}\Lambda D^{*0}$ CF signal extraction

- Estimate CF from ΔM sideband region
- Fix the contribution of CF in ΔM signal region in order to extract true signal yield
- Fraction of CF in ΔM signal/sideband region is 0.26 ± 0.01

ΔM :[0.139,0.145] GeV/c^2 =>Signal region
ΔM :[0.150,0.170] GeV/c^2 =>Sideband region

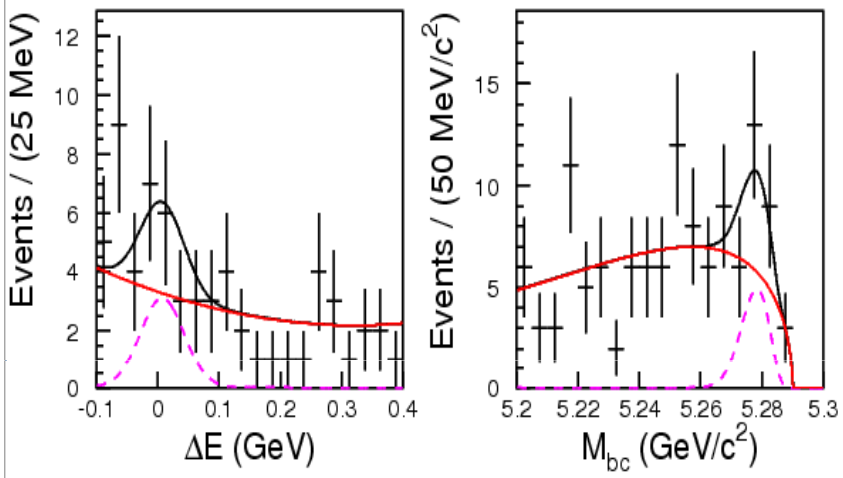
preliminary



Result for $B^- \to \overline{p}\Lambda D^{*0}$

:signal $B^- \to \overline{p}\Lambda D^{*0}$
:continuum
:CF

ΔM sideband region

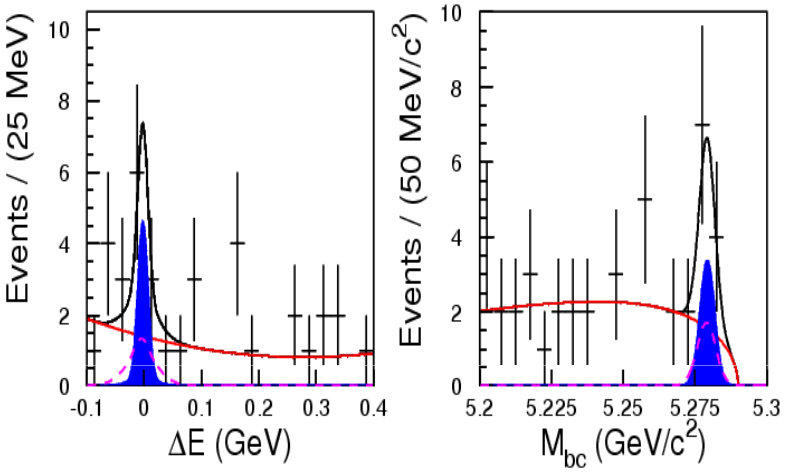


N_{CF} = 11.6 ± 5.4

preliminary

Scaled by the factor 0.26 into signal region
Fix $N_{CF'}$ = 3.0 ± 1.4 for signal extraction

ΔM signal region

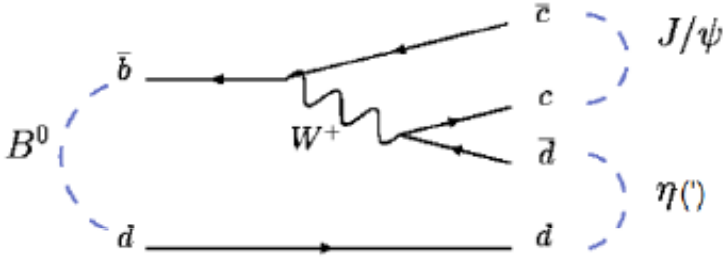


Modes	N_{signal}	S	$\varepsilon(\%)$	$\mathcal{B}(\times 10^{-5})$
$B^- \to \overline{p}\Lambda D^{*0}$	$4.3^{+3.2}_{-2.4}$	2.1	2.8	$1.53^{+1.12}_{-0.85} \pm 0.47$

$B(B^- \to \overline{p}\Lambda D^{*0}) < 4.6 \times 10^{-5}$ at 90% C.L
UL obtained using the Pole package
prediction: $B(B^- \to \overline{p}\Lambda D^{*0}) = (3.23 \pm 0.32) \times 10^{-5}$

Motivation to study $B^0 \to J/\psi \eta^{(')}$

It is Cabibbo-suppressed and color- suppressed



From η-η` mixing, it is possible to estimate the $B^0 \to J/\psi \eta'$ branching fraction

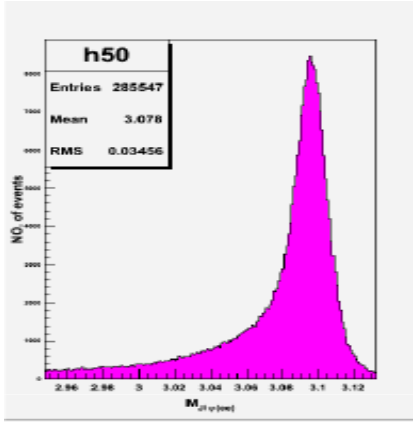
$$\begin{pmatrix} \eta \\ \eta' \end{pmatrix} = \begin{pmatrix} \cos\phi & -\sin\phi \\ \sin\phi & \cos\phi \end{pmatrix} \begin{pmatrix} \eta_q \\ \eta_s \end{pmatrix}$$

Effectively $\eta_q = 1$ $\eta_s = 0$

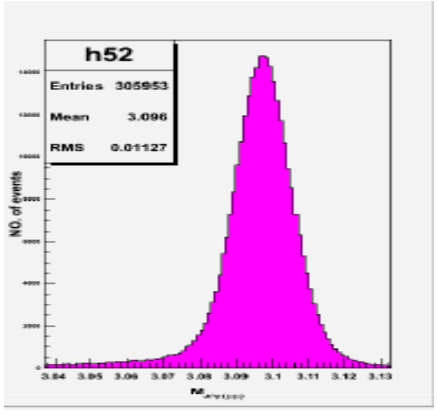
$$\frac{Br(B^0 \to J/\psi\eta')}{Br(B^0 \to J/\psi\eta)} = \frac{\sin^2\phi}{\cos^2\phi} = \tan^2\phi = \tan^2 40.4^\circ \sim 0.724$$

Clean J/ψ tagging

$J/\psi(e^+e^-)$

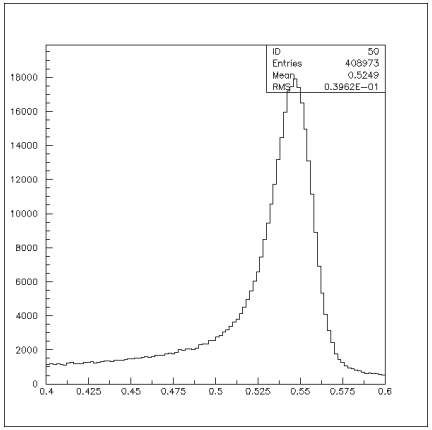


$J/\psi(\mu^+\mu^-)$



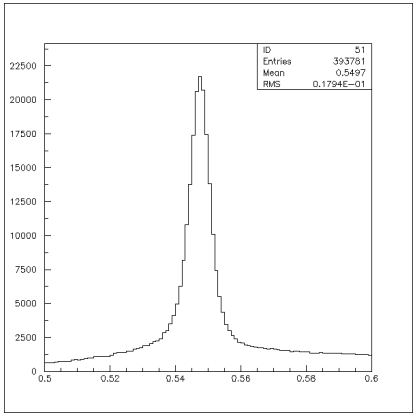
Signal MC

$\eta(\gamma\gamma)$



$M_{\gamma\gamma}$

$\eta(\pi^+\pi^-\pi^0)$

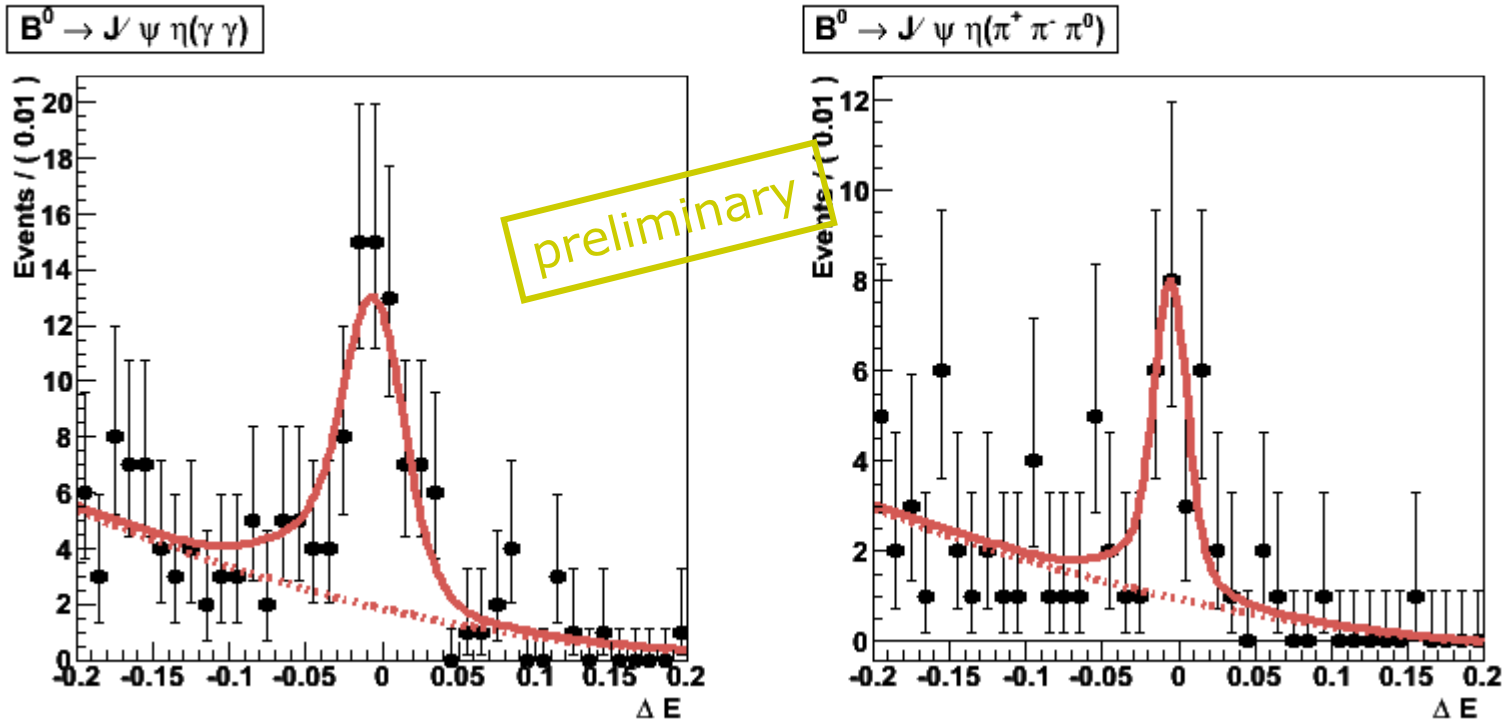


$M_{\pi^+\pi^-\pi^0}$

Study of $B^0 \to J/\psi\eta$

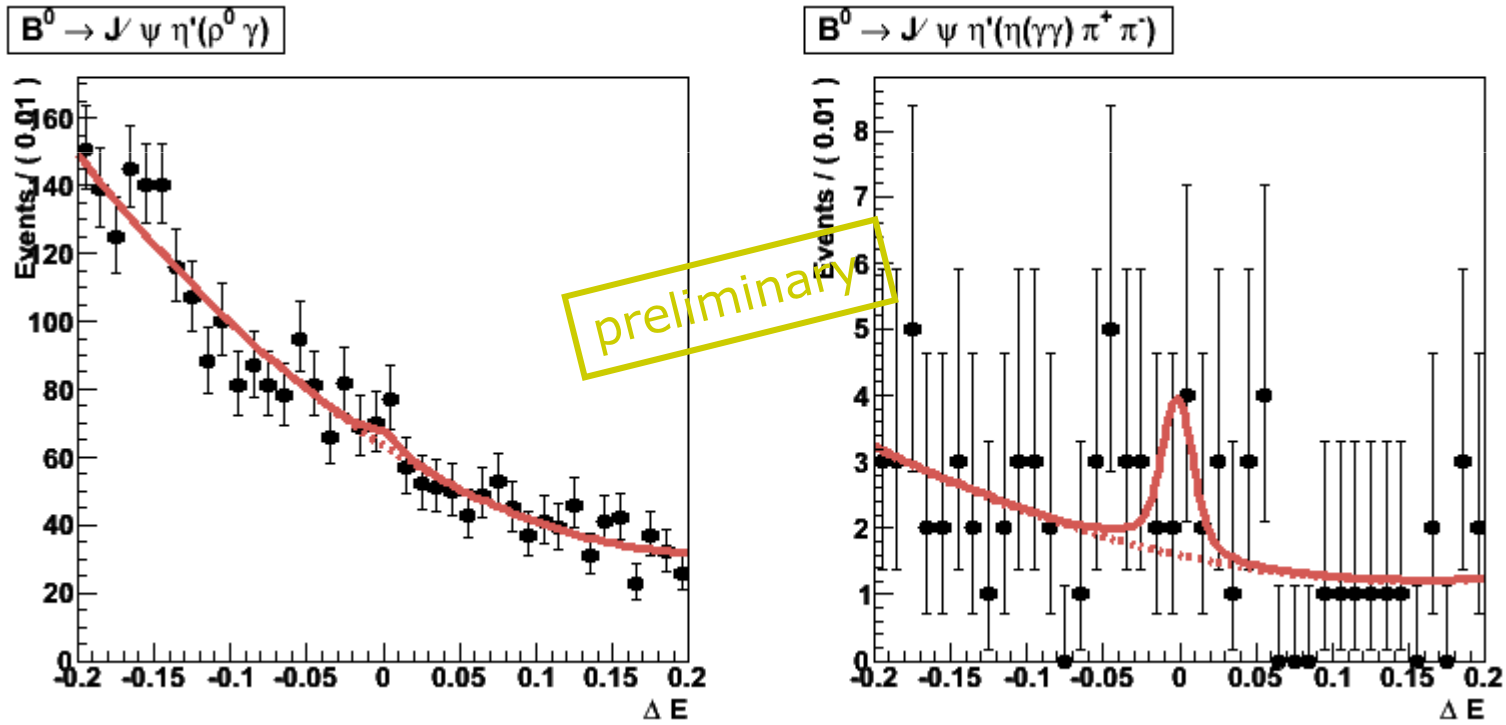
772M $B\bar{B}$

- Simultaneous 1d ΔE fits for different sub-decay processes
- Updated Branching fraction = $(12.2 \pm 1.7 \pm 0.9) \times 10^{-6}$
- Consistent with previous measurement $(9.5 \pm 1.7 \pm 0.8) \times 10^{-6}$ M.-C. Chang et al. Phys.Rev.Lett. 98:131803(2007)



A search for $B^0 \to J/\psi\eta'$

- **No significant signal**
- **Upper limit set at 90% C.L. < 1.1×10^{-5}**



Summary

- With the world's largest Y(4S) data set in hand, Belle has started updating measurements of many known rare B decay modes and continues its search for new physics
- First observation of $B^- \to \bar{p}\Lambda D^0$
- Upper limit set for $B^- \to \bar{p}\Lambda D^{*0}$ & $B^0 \to J/\psi\eta'$
- Many other decays will be shown in the near future with better statistics and reduced systematic uncertainties