B_s decay and Charmed Hadronic B decay

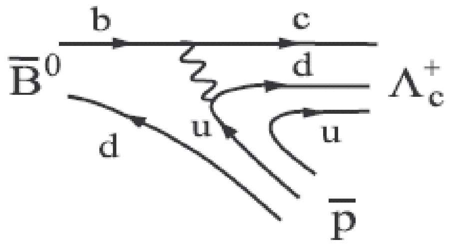
Jin Li

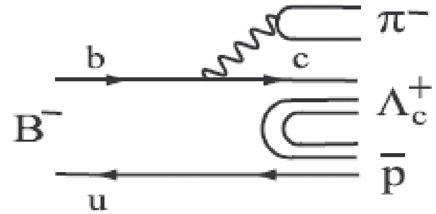
University of Hawaii

FPCP09, May 2009, Lake Placid, NY

- Charmed Baryonic B decay ($b \to c\bar{u}d$ + diquark popping)
- Doubly charmed B decay ($b \to c\bar{c}s$).
- Singly charmed B decay ($b \to c\bar{u}d$ + $s\bar{s}$ popping).
- **B_s decay results.**

$\overline{B}^0 \to \Lambda_c^+ \overline{p}$; $B^- \to \Lambda_c^+ \overline{p} \pi^-$





Two body baryon modes are supressed due to large energy release, according to the pole model

PRD 78, 112003(2008)

$$\frac{\mathcal{B}(B^- \to \Lambda_c^+ \overline{p} \pi^-)}{\mathcal{B}(\overline{B}^0 \to \Lambda_c^+ \overline{p})} = 15.4 \pm 1.8 \pm 0.3.$$

	$\text{BF}(\overline{B}^0 \to \Lambda_c^+ \overline{p})(\times 10^{-5})$	$\text{BF}(B^- \to \Lambda_c^+ \overline{p} \pi^-)(\times 10^{-4})$
Babar	1.89±0.21±0.06±0.49	3.38±0.12±0.12±0.88
Belle	$2.19^{+0.56}_{-0.49} \pm 0.32 \pm 0.57$	2.01±0.15±0.20±0.52

PRL 90, 121802(2003)

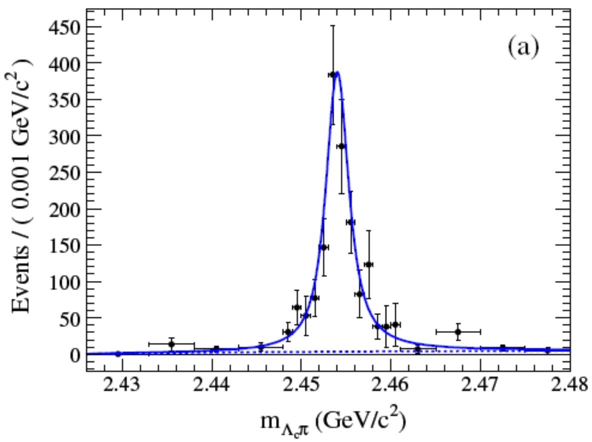
PRL 97,242001(2006)

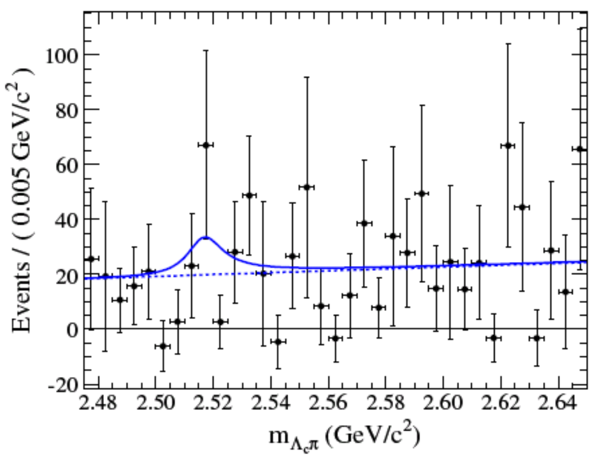
Resonant structure in $\Lambda_c^+\pi^-$

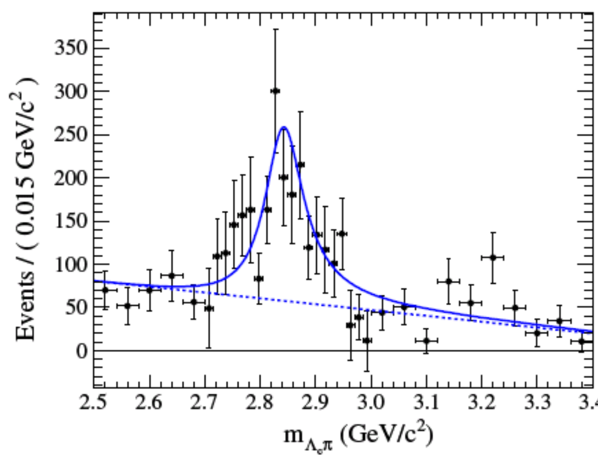
$$\frac{\mathcal{B}(B^- \to \Sigma_c(2455)^0\overline{p})}{\mathcal{B}(B^- \to \Lambda_c^+\overline{p}\pi^-)} = (12.3 \pm 1.2 \pm 0.8) \times 10^{-2}$$

$$\frac{\mathcal{B}(B^- \to \Sigma_c(2520)^0\overline{p})}{\mathcal{B}(B^- \to \Lambda_c^+\overline{p}\pi^-)} < 0.9 \times 10^{-2} \text{ (90\%C.L.}$$

$$\frac{\mathcal{B}(B^- \to \Sigma_c(2800)^0\overline{p})}{\mathcal{B}(B^- \to \Lambda_c^+\overline{p}\pi^-)} = (11.7 \pm 2.3 \pm 2.4) \times 10^{-2}$$

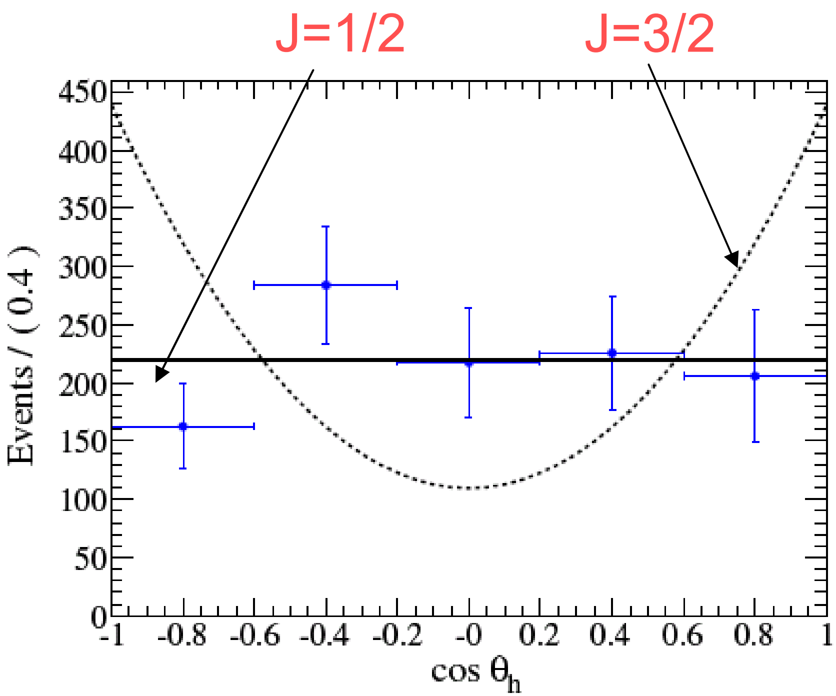




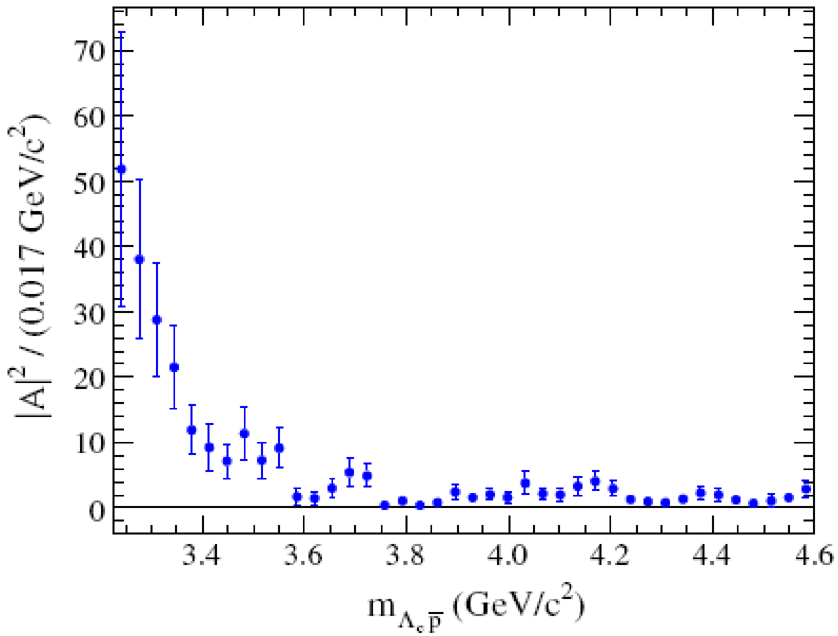


- Large $\Sigma_c(2455)^0$ signal in $B^- \to \Lambda_c^+\overline{p}\pi^-$.
- First observation of $\Sigma_c(2800)^0$. M=(2846±8±10) MeV and $\Gamma = 86^{+33}_{-22}$ MeV.

Spin of $\Sigma_c(2455)^0$ and Λ_c^+p Threshold Enhancement



Phase space corrected:



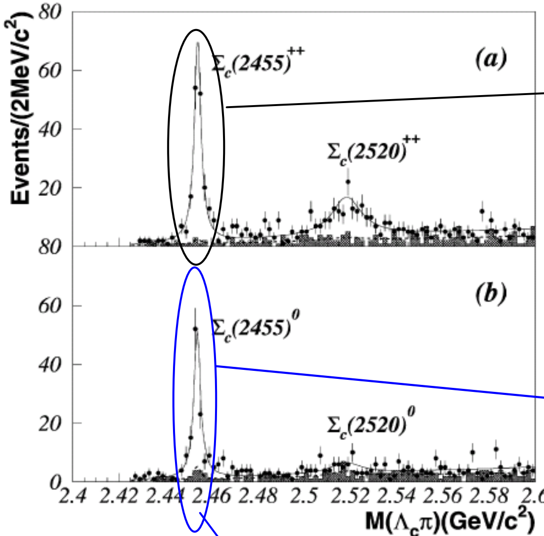
- $\Sigma_c(2455)^0$ is consistent with J=1/2, with J=3/2 excluded at >4σ level.
- Threshold enhancement common in other baryonic modes as:

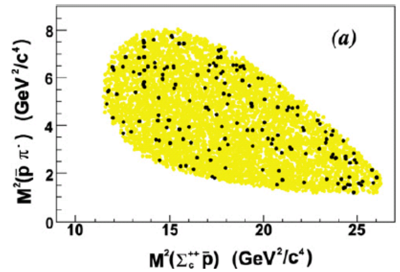
$$B \to p\bar{p}K \text{ and } B \to Dp\bar{p}(\pi)$$

$\overline{B}^0 \to \Sigma_c(2455)^0 \overline{p} \pi^+$

Previously studied in PRD75,011101 (2007)

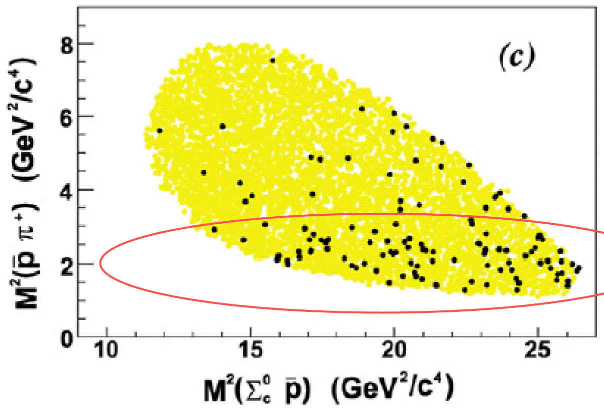
Reconstruct $\overline{B}^0 \to \Lambda_c \overline{p} \pi^+ \pi^-$

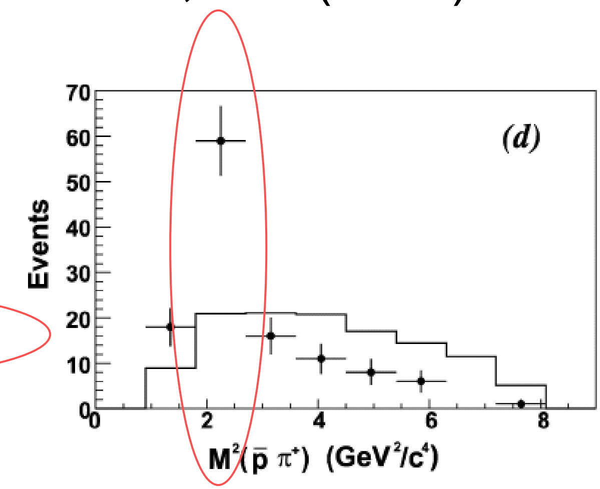


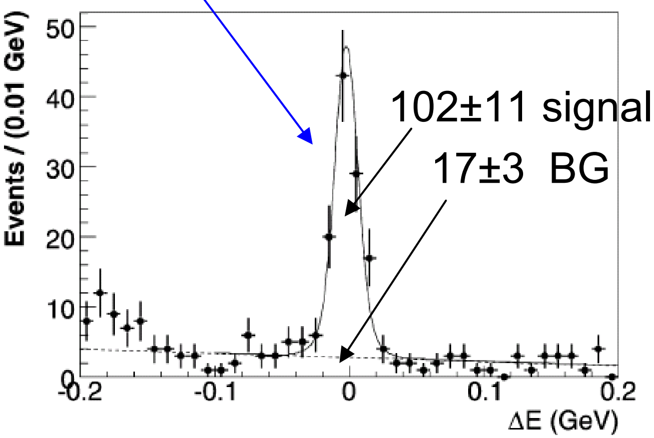


$\Sigma_c(2455)^{++} \overline{p} \pi^-$: no structure.

PLB 669, 287 (2008)







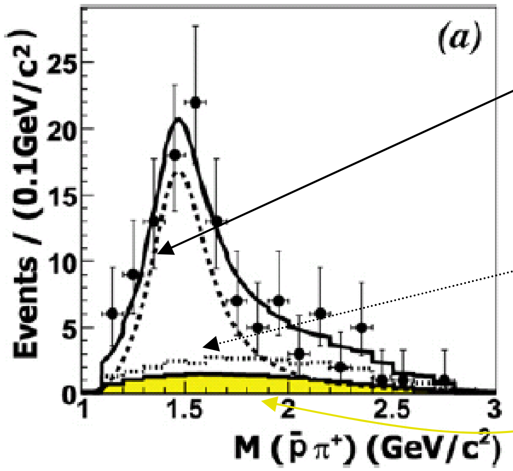
Detailed study now:

Concentrate on structure in $\Sigma_c(2455)^0 \overline{p} \pi^+$

Study of $\overline{B}^0 \to \Sigma_c(2455)^0 \overline{N}^0$

Fit to $M(\bar{p}\pi^+)$ and $\cos(\theta_p)$

One $\bar{p}\pi^+$ resonance



$\overline{N}^0$ P-Wave Breit-Wigner

70±11, 6.1 σ

M=1516±29±14 ,Γ=365±97±90 (MeV)

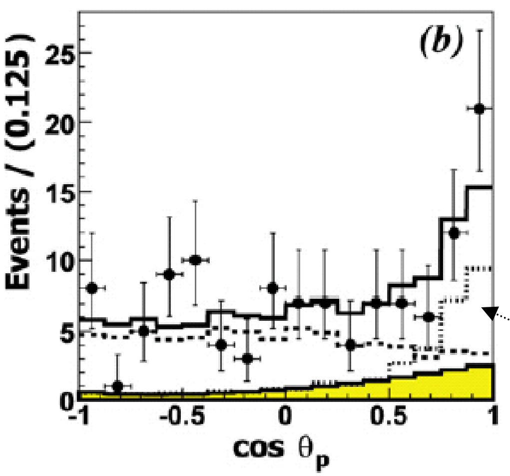
$X^+_{\Sigma_c^0\pi^+}$ resonance from $m(\Sigma_c\pi^+)$

32 ± 9

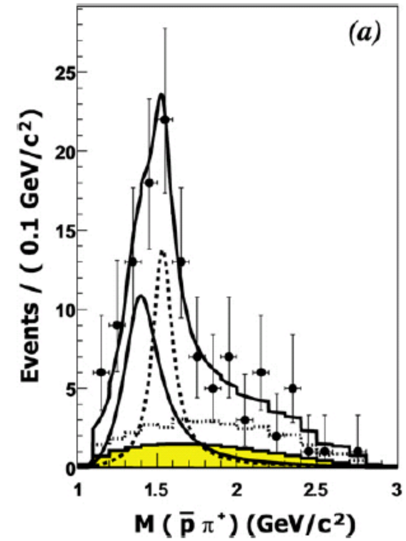
Normalized BG from M_{bc} sideband

PLB 669, 287 (2008)

$$\mathcal{B}(\overline{B}^0 \to \Sigma_c(2455)^0\,\overline{N}^0) \times \mathcal{B}(N^0 \to \bar{p}\pi^+) =$$
$$(0.80 \pm 0.15(stat.) \pm 0.14(syst.) \pm 0.21) \times 10^{-4}$$



Peaking from $X^+_{\Sigma_c^0\pi^+}$



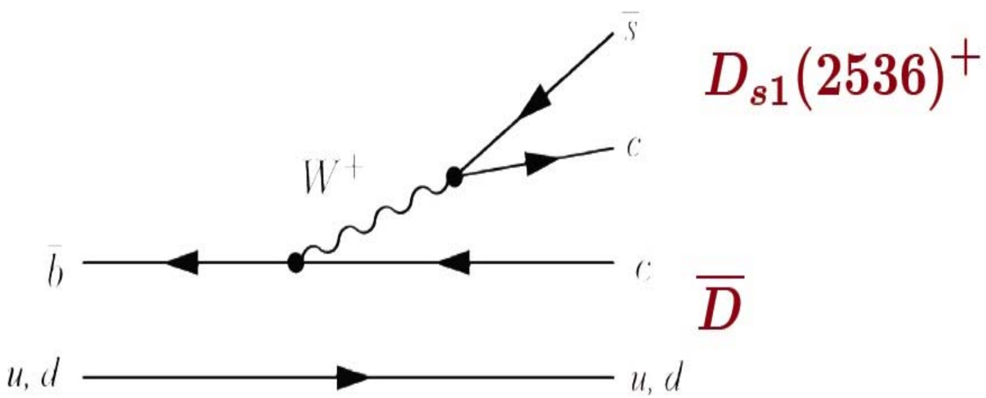
Also consistent with two states in pπ.

$N(1440)P_{11}+N(1535)S_{11}$

Double Charmed decay $B \to D_{s1}(2536)^+ D^{(*)}$

- $D_{s1}(2536)^+$: narrow P-wave $J^P=1^+$
- Production of $D_{s1}(2536)^+$ in B decay previously observed by BaBar

PRD77,011102 (2008)



Belle

Reconstructed modes:

$D_{s1}(2536)^+ \to D^{*0}K^+$
  $\hookrightarrow D^0\gamma$ & $D^0\pi^0$
$D_{s1}(2536)^+ \to D^{*+}K_s$
  $\hookrightarrow D^0\pi^+_{slow}$

$D^{(*)}$: D^0, D^+, D^{*+}

No peaking found in any of

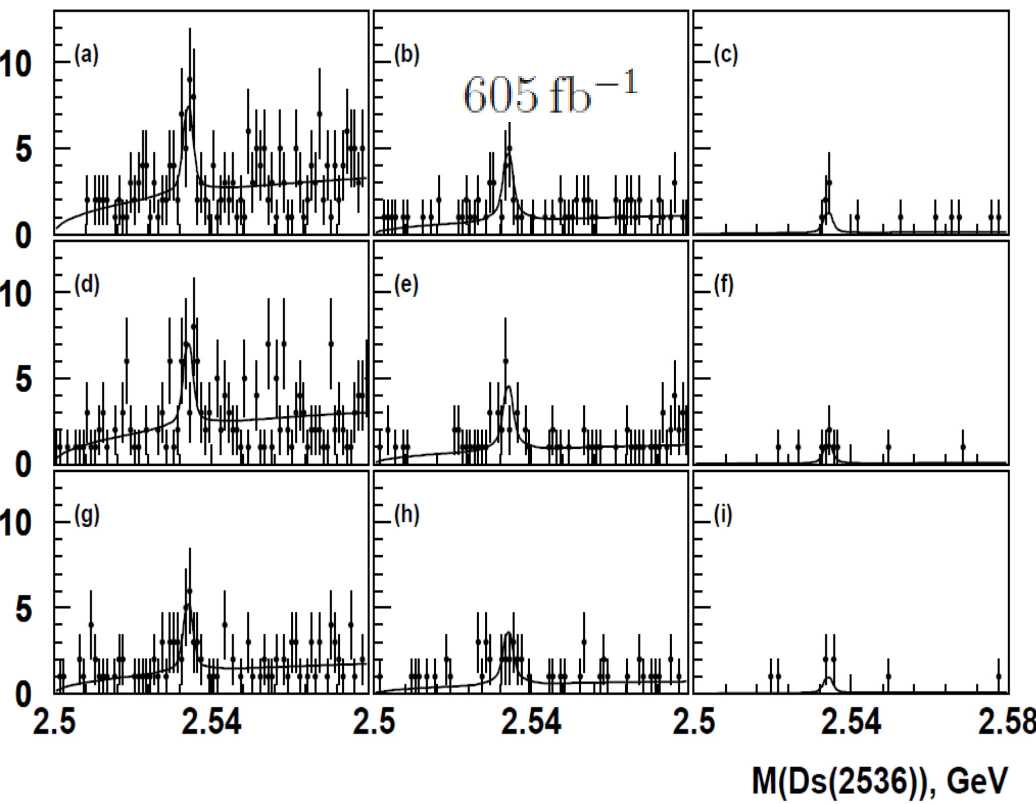
ΔE, M_{bc}, D^0, D^* sidebands

$B \to D_{s1}(2536)^+ D^{(*)}$ results

Simultaneous fit to $M(D_{s1})$ distribution

$D_{s1} \to$ 3 sub-channels

$D^{*0}(D^0\gamma)K^+$ $D^{*0}(D^0\pi^0)K^+$ $D^{*+}(D^0\pi^+)K_S$



Sum of two D_{s1} modes ($D^{*0}K^+$, $D^{*+}K^0$)

Belle Preliminary

BaBar

$\mathcal{B}(B^+ \to D_{s1}^+ \overline{D}^0)(\times 10^{-4})$

$3.99 \pm 0.84 \pm 0.57$ $4.45 \pm 1.11 \pm 0.62$

7.0σ

$\mathcal{B}(B^0 \to D_{s1}^+ D^-)(\times 10^{-4})$

$2.76 \pm 0.63 \pm 0.35$ $4.32 \pm 1.14 \pm 0.45$

6.9 σ

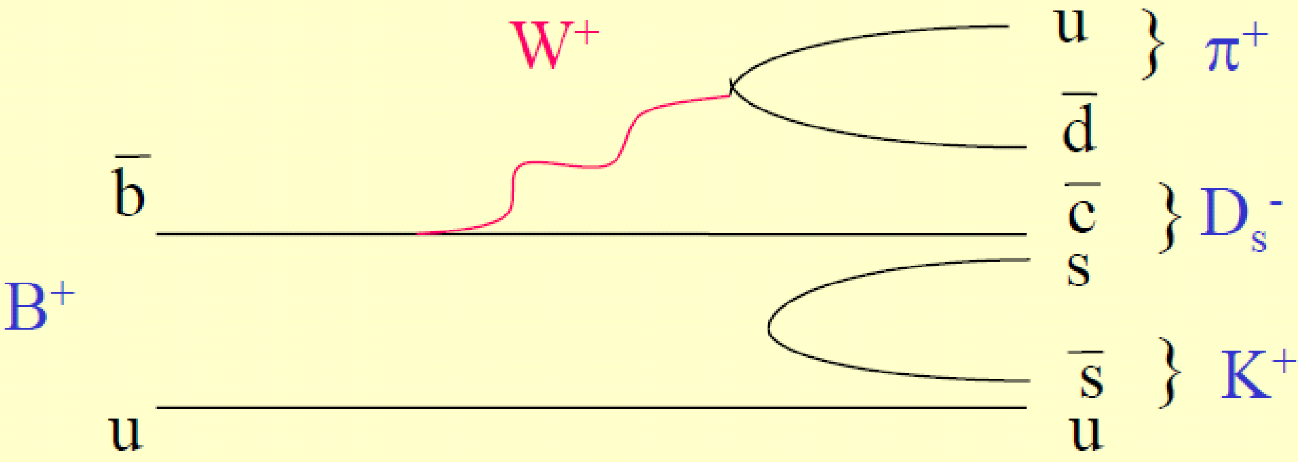
$\mathcal{B}(B^0 \to D_{s1}^+ D^{*-})(\times 10^{-4})$

$5.03 \pm 1.21 \pm 0.68$ $8.32 \pm 1.75 \pm 0.94$

6.3 σ

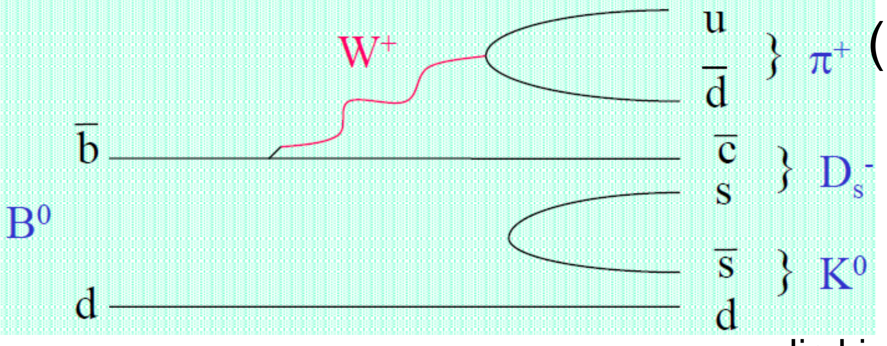
Belle and BaBar results are consistent.

$B^+ \to D_s^{(*)-} K^+ \pi^+$ measurement

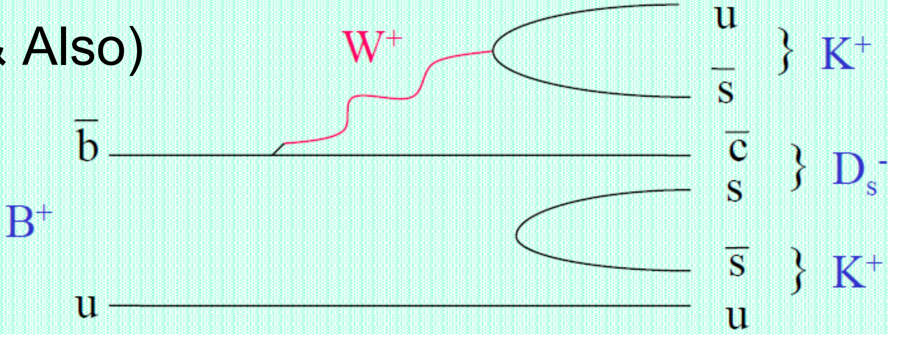


Correlated $B^+ \to D_s^{(*)-}X$ decays require ≥3 body decay + $s\bar{s}$ pair

- $D_s^{(*)-}K^+$ pair can be from charm resonance.
- $D_s^{(*)-}\pi^+$ and $K^+\pi^+$ cannot be from normal $q\bar{q}'$ resonance.



(& Also)



$B^+ \to D_s^{(*)-} K^+ \pi^+$ at Belle

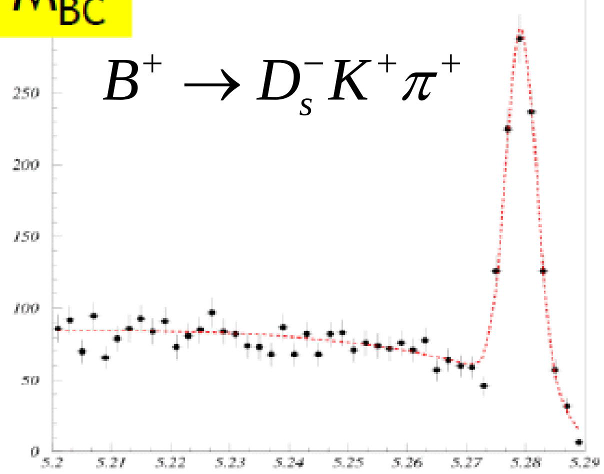
Recon: $D_s^- \to \phi\pi^-, K^{*0}K^-, K_s^0 K^-$

Ds peaking BG included.

Perform 3-D unbinned fit on (M_{BC}, ΔE, $M(Ds^{(*)})$)

M_{bc} projection in (ΔE, M(Ds(*))'s signal region:

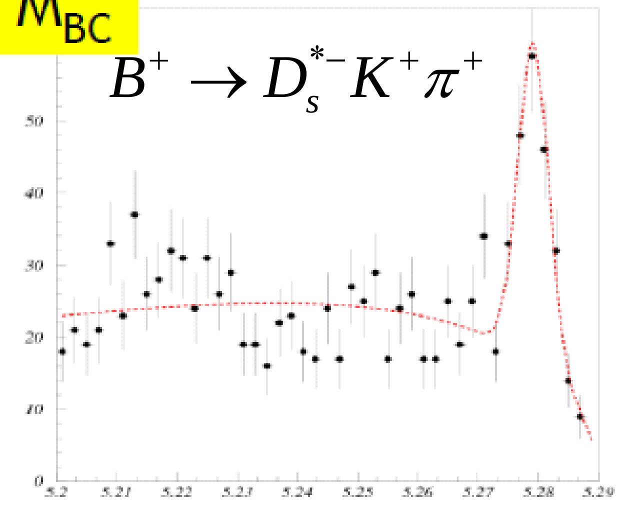
M_{BC}



ArXiv: 0903.4956

657M $B\bar{B}$

M_{BC}



Intermediate BF

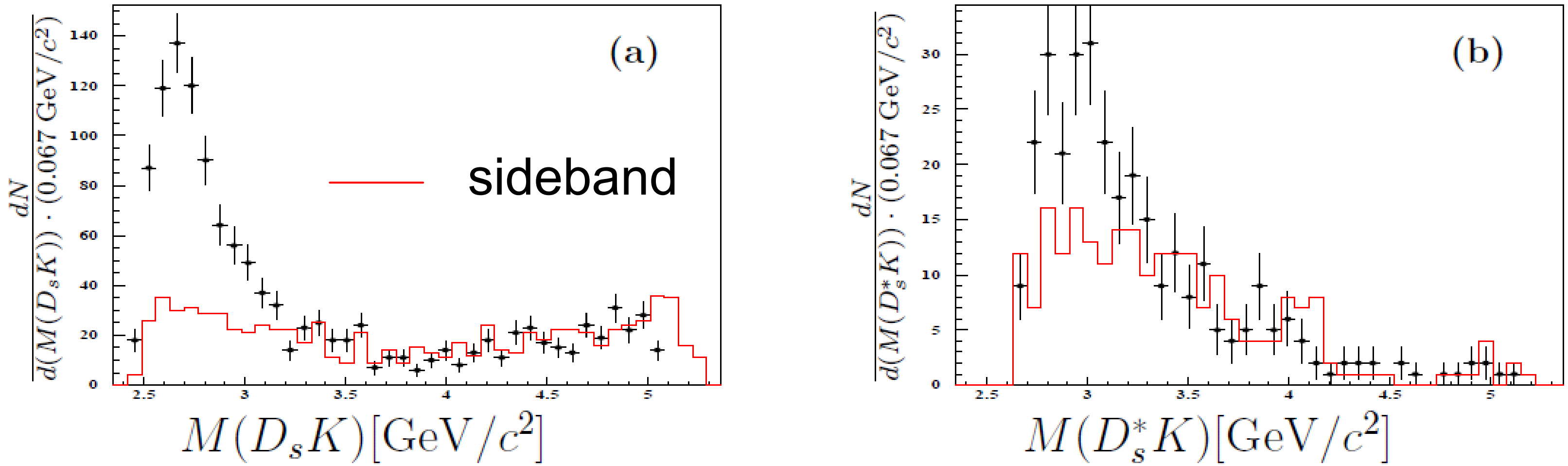
$\mathcal{B}(B^+ \to D_s^- K^+ \pi^+)(\times 10^{-4})$

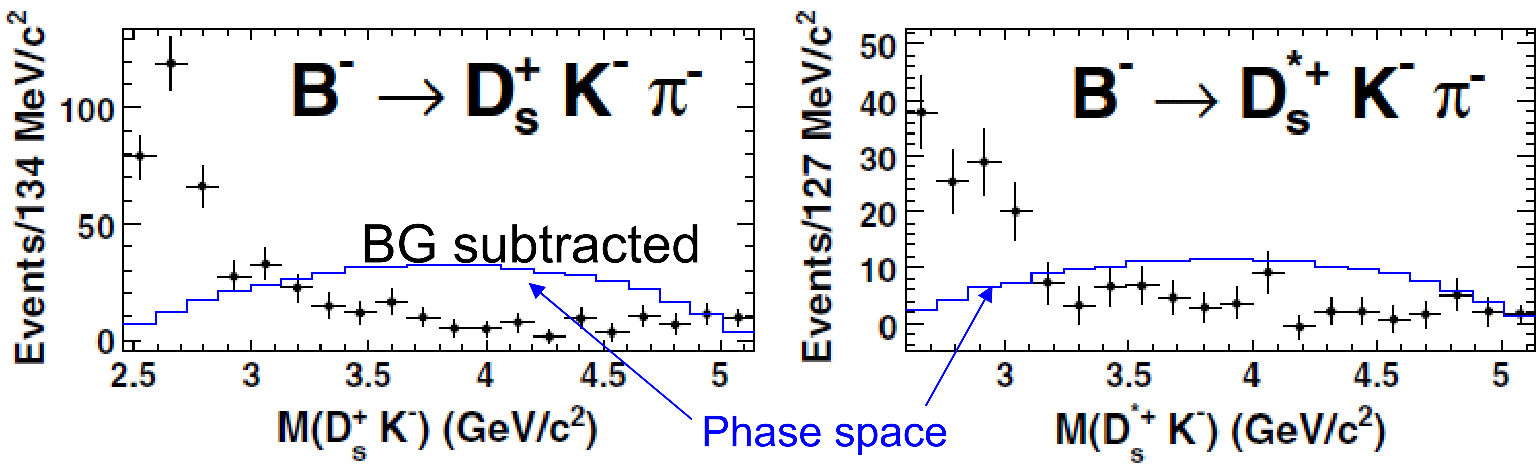
$\mathcal{B}(B^+ \to D_s^{*-} K^+ \pi^+)(\times 10^{-4})$

	Belle	
$1.94^{+0.09}_{-0.08}(\text{stat.})^{+0.20}_{-0.20}(\text{syst.}) \pm 0.17(\mathcal{B}_{\text{int}})$	Belle	$1.47^{+0.15}_{-0.14}(\text{stat.})^{+0.19}_{-0.19}(\text{syst.}) \pm 0.13(\mathcal{B}_{\text{int}})$
$2.02 \pm 0.13(\text{stat.}) \pm 0.38(\text{syst.})$	BaBar: PRL 100,171803 (2008)	$1.67 \pm 0.16(\text{stat.}) \pm 0.35(\text{syst.})$

$M(D_s^{(*)-}K^+)$ in $B^+ \to D_s^{(*)-}K^+\pi^+$

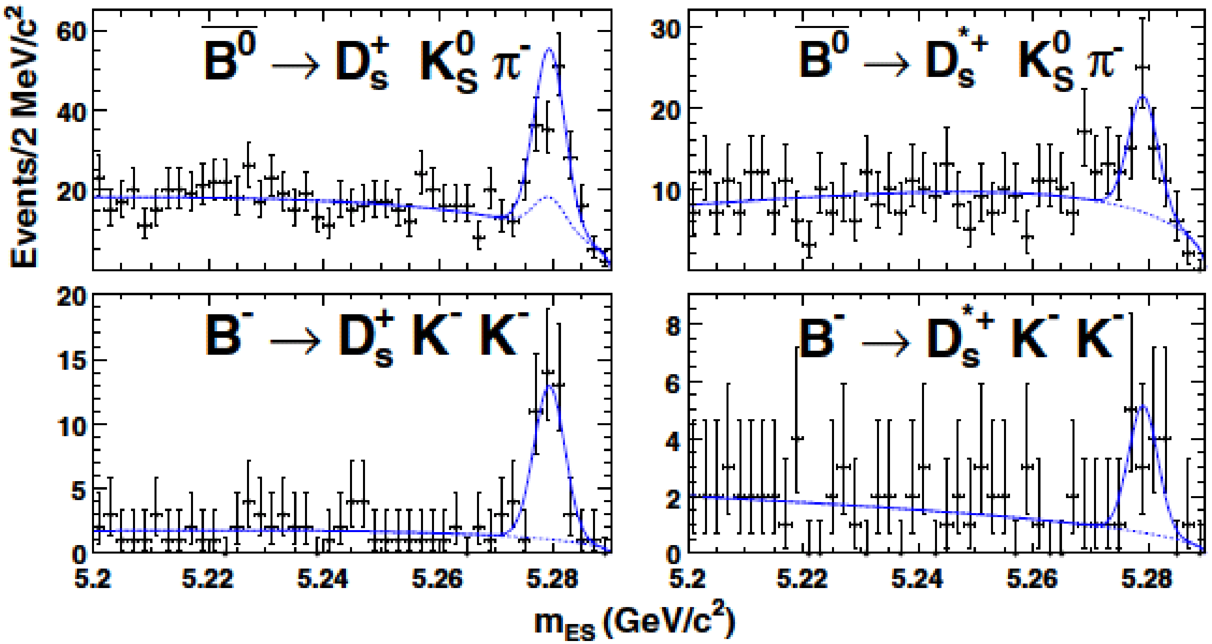
Enhancement in low mass region seen, may due to a $D_s^{(*)}K$ resonance.





$B^0 \rightarrow D_s^{(*)-} K_s^0 \pi^+, B^+ \rightarrow D_s^{(*)-} K^+ K^+$

peaking BG from M(Ds) sideband
and subtracted



PRL 100, 171803 (2008)

$$\mathcal{B}(B^0 \rightarrow D_s^- K_s^0 \pi^+) = (0.55 \pm 0.13 \pm 0.10) \times 10^{-4} \qquad < 1/2\mathcal{B}(B^0 \rightarrow D_s^- K^+ \pi^+)$$

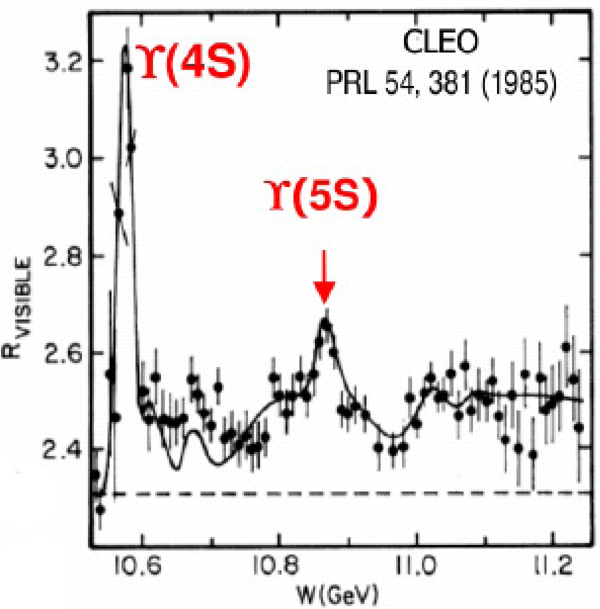
$$\mathcal{B}(B^0 \rightarrow D_s^{*-} K_s^0 \pi^+) = (0.29 \pm 0.18 \pm 0.07) \times 10^{-4}$$

$$\mathcal{B}(B^0 \rightarrow D_s^- K^+ K^+) = (0.11 \pm 0.04 \pm 0.02) \times 10^{-4} \qquad \sim \sin^2\theta_c \mathcal{B}(B^0 \rightarrow D_s^- K^+ \pi^+)$$

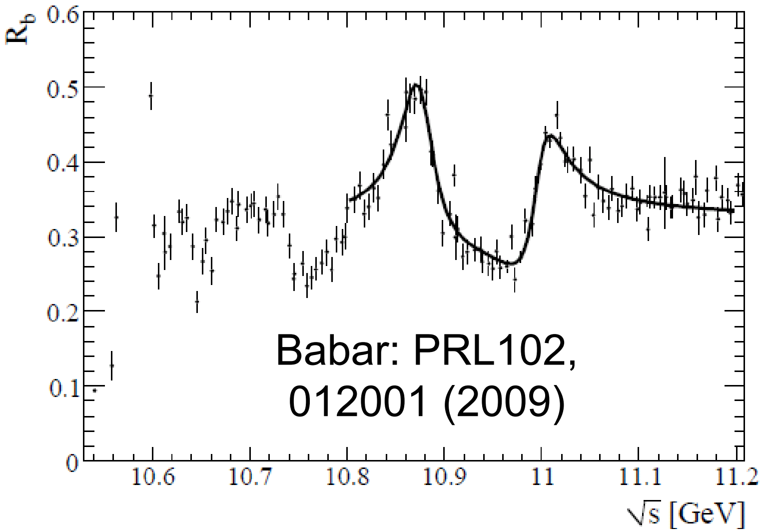
$$\mathcal{B}(B^0 \rightarrow D_s^{*-} K^+ K^+) = (0.07 \pm 0.06 \pm 0.02) \times 10^{-4}$$

Y(5S) and B_s results

e^+e^- hadronic cross section



1^{--} Bottonium: $b\bar{b}$



PDG:

M(Υ(5S)) = 10865±8 MeV/c^2

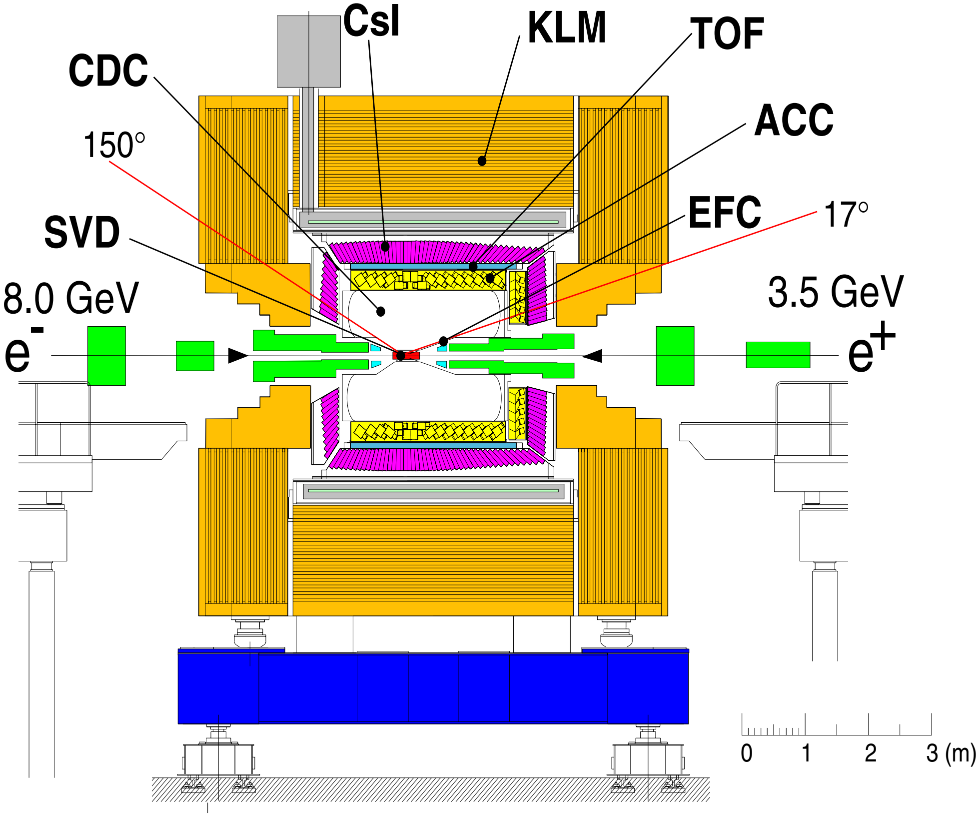
Γ(Υ(5S)) = 110±13 MeV/c^2

$e^+e^- \rightarrow \Upsilon(4S) \rightarrow B\bar{B}$ ($B = B_u^+, B_d^0$)

Υ(5S): Analogous to Υ(4S), but with more modes

$e^+e^- \rightarrow b\bar{b}(\Upsilon(5S)) \rightarrow B^{(*)}\bar{B}^{(*)}, B\bar{B}, B\bar{B}\pi\pi, Bs^{(*)}\bar{B}s^{(*)}, \Upsilon(1S)\pi\pi$, …

Υ(5S) data at Belle



KEKB &Belle runs very smoothly in Υ(5S)

Keep the same boost β=0.425 as in Υ(4S) case

- $E(e^+)$: 3.500 GeV→3.595 GeV
- $E(e^-)$: 7.996 GeV→8.211 GeV

2005: 1.86 fb^{-1}

2006: 21.7 fb^{-1}

2009: 50+ fb^{-1}

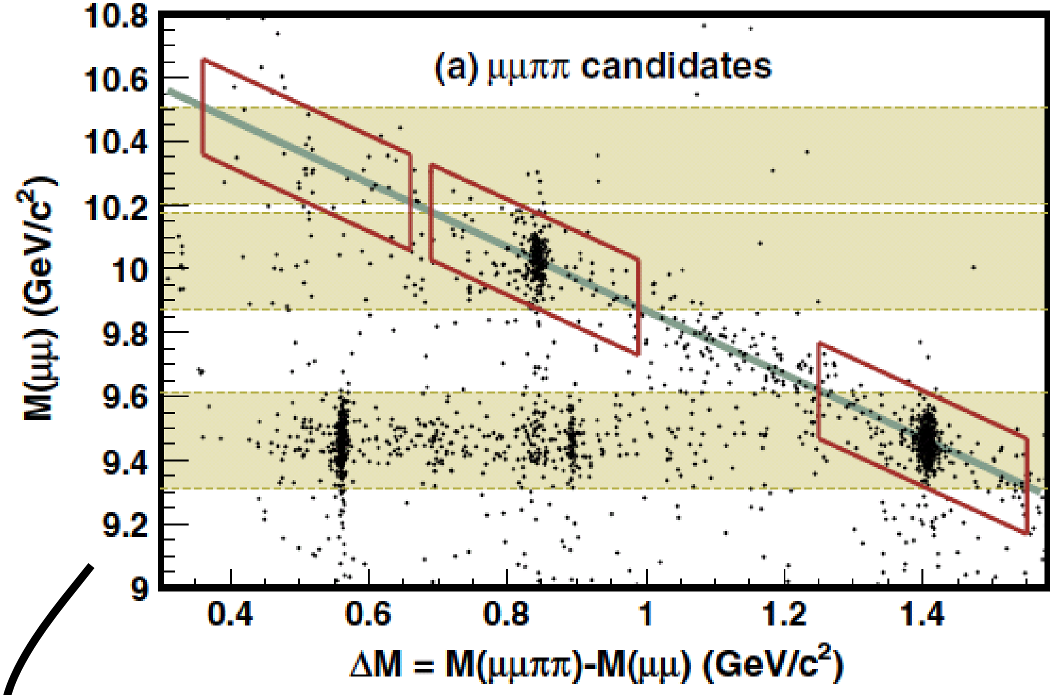
Goal ~ 100 fb^{-1}

New luminosity record: 1.96×10^{34} $cm^{-2}sec^{-1}$ (May.6)

CLEO 2003: 0.42 fb^{-1}

Integrated Lum record: 1.33fb^{-1}/day, 7.75fb^{-1}/week

Υ(5S): large branching fraction to Υ(1/2S)ππ



Process	$\Gamma_{\Upsilon(1S)\pi^+\pi^-}$
$\Upsilon(2S) \to \Upsilon(1S)\pi^+\pi^-$	0.0060 MeV
$\Upsilon(3S) \to \Upsilon(1S)\pi^+\pi^-$	0.0009 MeV
$\Upsilon(4S) \to \Upsilon(1S)\pi^+\pi^-$	0.0019 MeV
$\Upsilon(10860) \to \Upsilon(1S)\pi^+\pi^-$	0.59 MeV

$e^+e^- \to \Upsilon(1S/2S)\ \pi^+\pi^-$

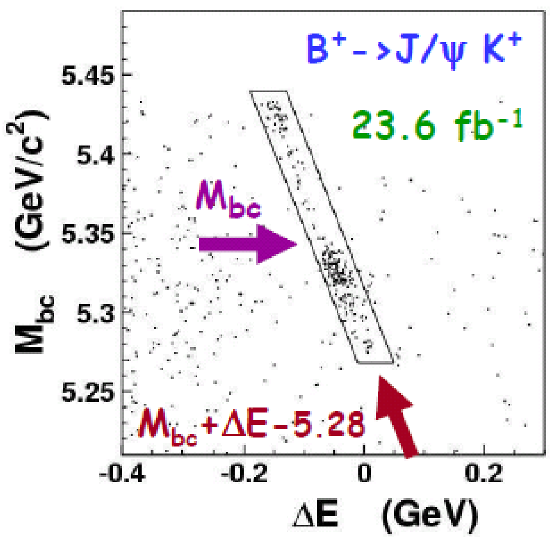
Υ(5S) result:

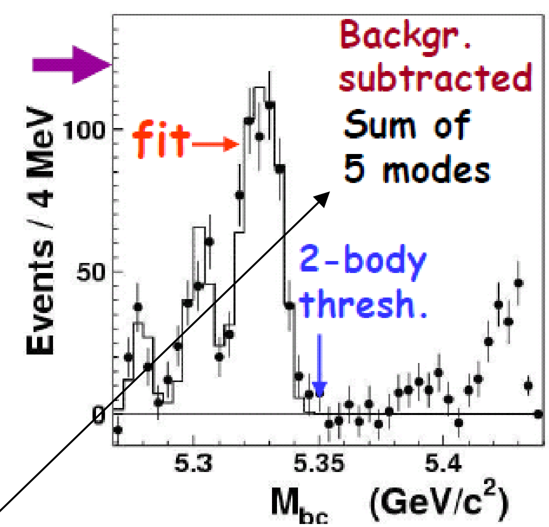
Process	σ (pb)	Γ (MeV)
$\Upsilon(1S)\pi^+\pi^-$	$1.61 \pm 0.10 \pm 0.12$	$0.59 \pm 0.04 \pm 0.09$
$\Upsilon(2S)\pi^+\pi^-$	$2.35 \pm 0.19 \pm 0.32$	$0.85 \pm 0.07 \pm 0.16$
$\Upsilon(3S)\pi^+\pi^-$	$1.44^{+0.55}_{-0.45} \pm 0.19$	$0.52^{+0.20}_{-0.17} \pm 0.10$
$\Upsilon(1S)K^+K^-$	$0.185^{+0.048}_{-0.041} \pm 0.028$	$0.067^{+0.017}_{-0.015} \pm 0.013$

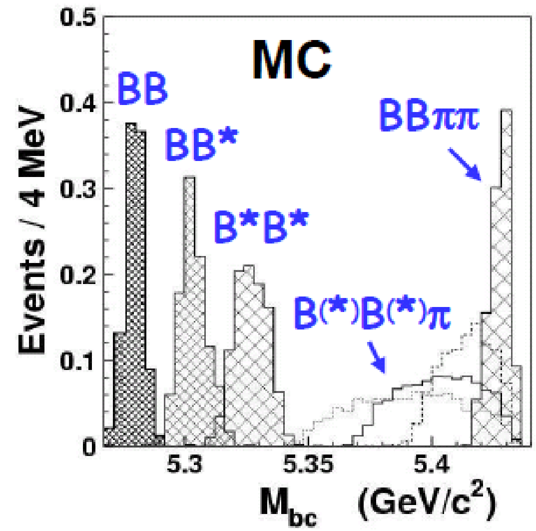
BELLE

K.F. Chen et al.
PRL 100, 112001 (2008)

Y(5S): large branching fraction to 3/4 body $B^{+/0}$ decays

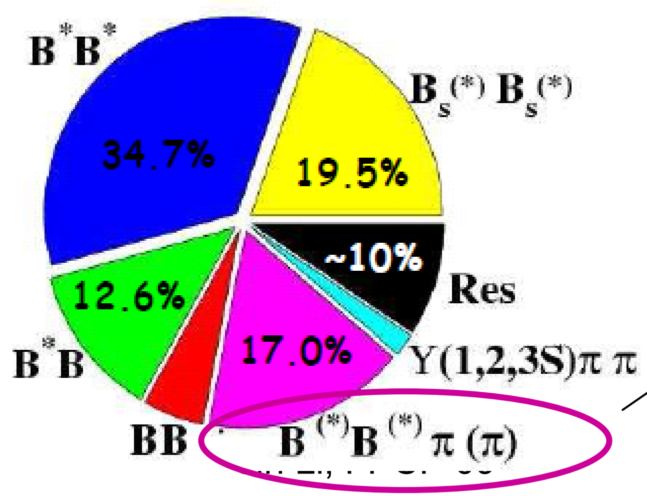






$B^{(*)}B^{(*)}\pi(\pi)$: $17.0 \pm ^{1.6}_{1.5} \pm 2.7$ %

- $B^+ \to J/\psi K^+$
- $B^+ \to D^0(K\pi)\pi^+$
- $B^+ \to D^0(K3\pi)\pi^+$
- $B^0 \to J/\psi K^{*0}$
- $B^0 \to D^-(K^+\pi^-\pi^-)\pi^+$



Not predicted by theory:

Yu.Simonov et al., arxiv:0805.4518

~ 0.03%

B_s production

All results from 23.6 fb^{-1}

- $e^+e^- \rightarrow \Upsilon(5S) \rightarrow B_s^*B_s^*, B_s^*B_s, B_sB_s$; $B_s^* \rightarrow B_s\gamma$; γ not reconstructed.

- Two kinematic variables:

$$M_{bc} = \sqrt{E^{*\,2}_{beam} - P^{*\,2}_{B}}$$

$$\Delta E = E^*_B - E^*_{beam}$$

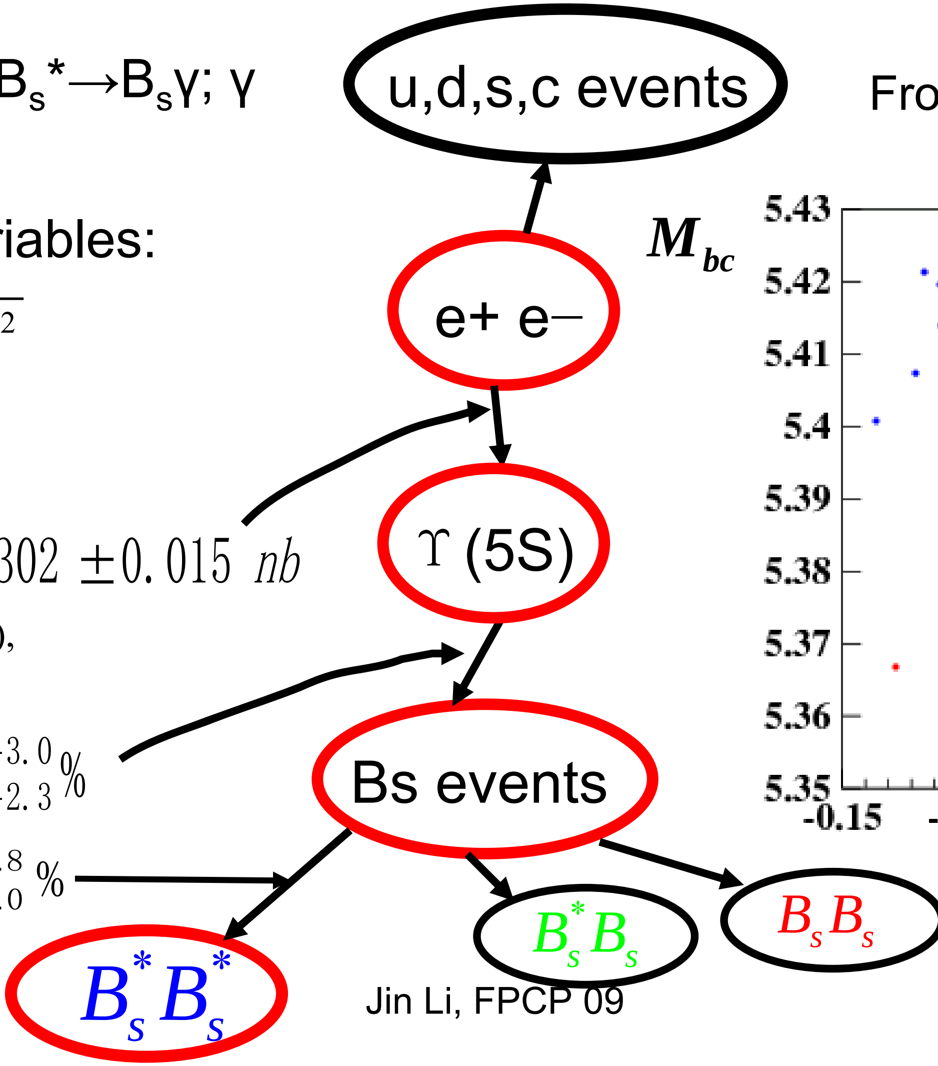
$$\sigma^{5S}_{b\bar{b}} = 0.302 \pm 0.015\ nb$$

A. Drutskoy et al. (Belle), PRL 98, 052001 (2007)

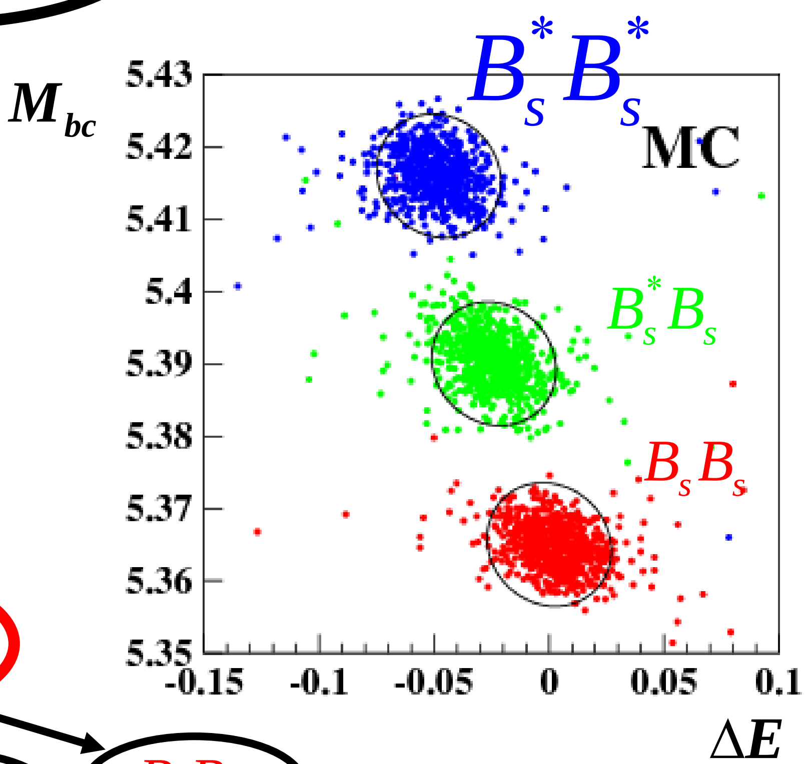
$$f_s = 19.5^{+3.0}_{-2.3}\,\%$$

$$f_{B_s^*B_s^*} = 90.1^{+3.8}_{-4.0}\,\%$$

PRL 102,021801

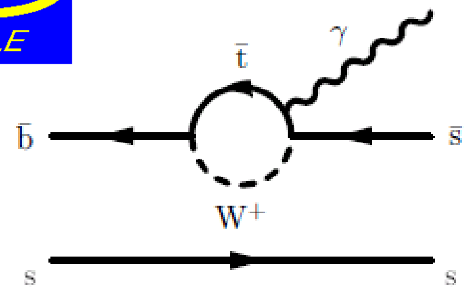


From MC of $B_s \rightarrow D_s^- \pi^+$

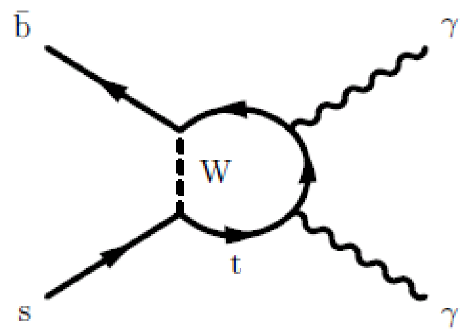


Observation of $B_s \to \Phi\gamma$; BF for $B_s \to \gamma\gamma$

J.Wicht *et.al*, PRL 100, 121801(2008)

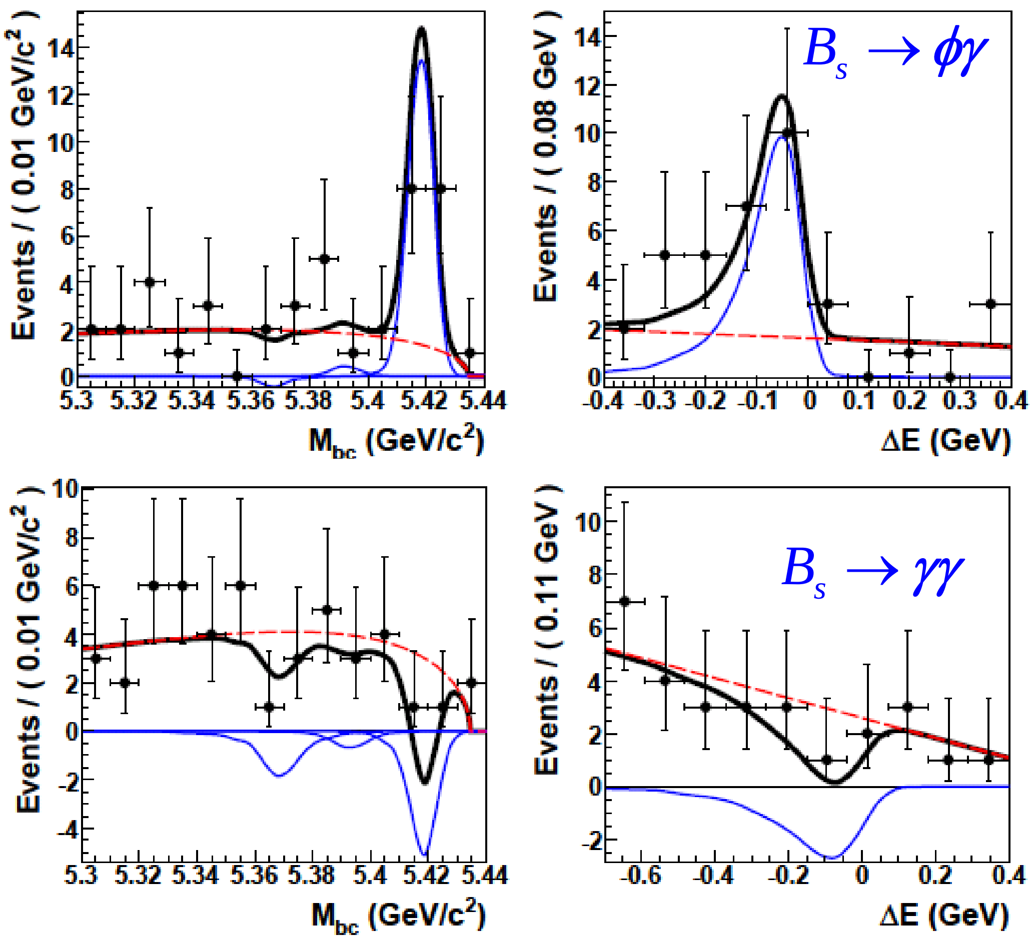


$$\mathcal{B}(B_s \to \phi\gamma) = (5.7^{+1.8+1.2}_{-1.5-1.1}) \times 10^{-5}$$



$$\mathcal{B}(B_s \to \gamma\gamma) < 8.7 \times 10^{-6}$$

SM: ~1.0×10^{-6}
JHEP 0208,054 (2002)



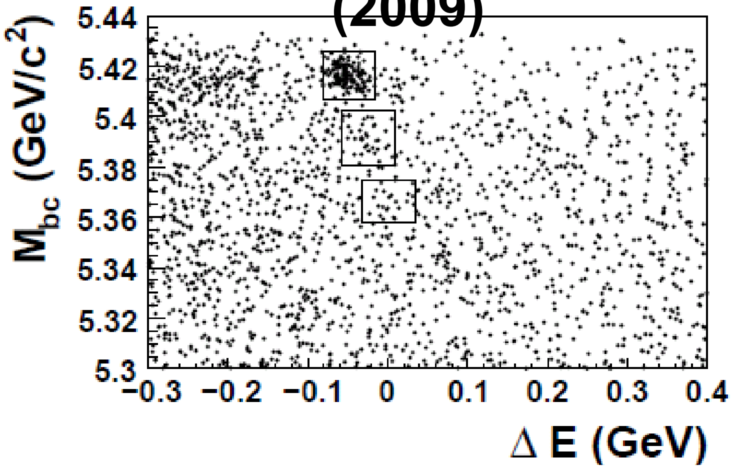
Measurement of $B_s \to D_s^+ h^-$ decays

Three Ds sub-modes.

$$\mathcal{B}(B_s \to D_s \pi^-) = (3.67^{+0.35}_{-0.33} \pm 0.65) \times 10^{-3}$$

As a reference BF for hadron colliders.

R.Louvot *et al*, PRL102,021801 (2009)

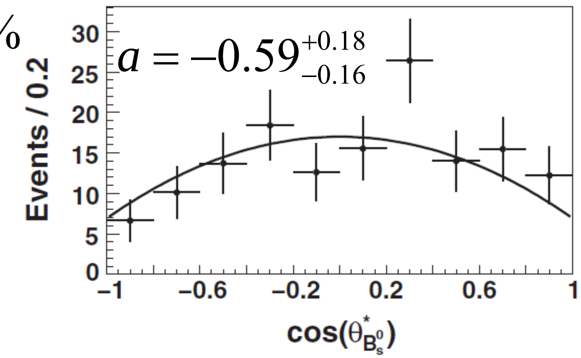


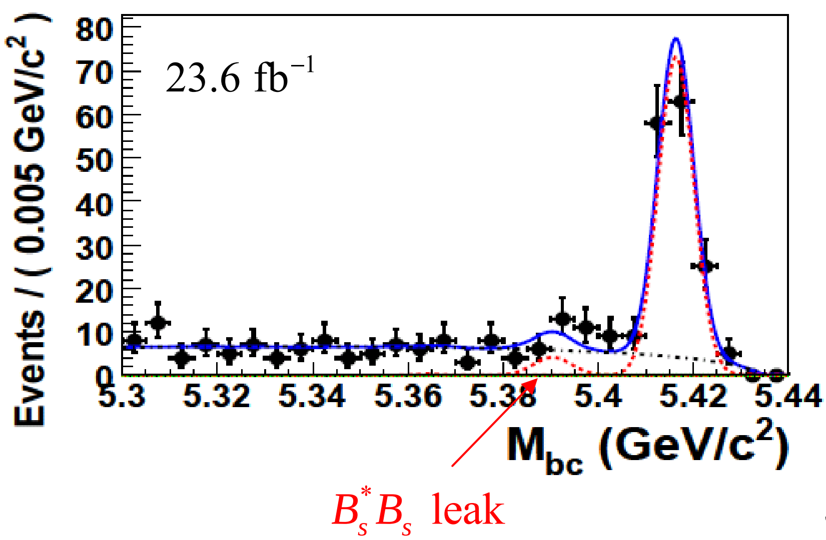
M(Bs*)=5416.4±0.4±0.5 MeV/c²

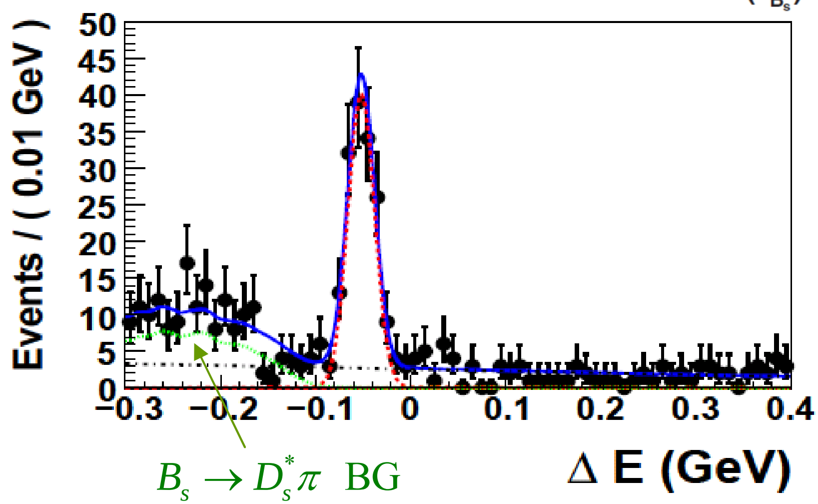
$$f(B_s^* B_s^*) = (90.1^{+3.8}_{-4.0} \pm 0.2)\%$$

$$f(B_s^* B_s) = (7.3^{+3.3}_{-3.0} \pm 0.1)\%$$

$$f(B_s B_s) = (2.6^{+2.6}_{-2.5})\%$$



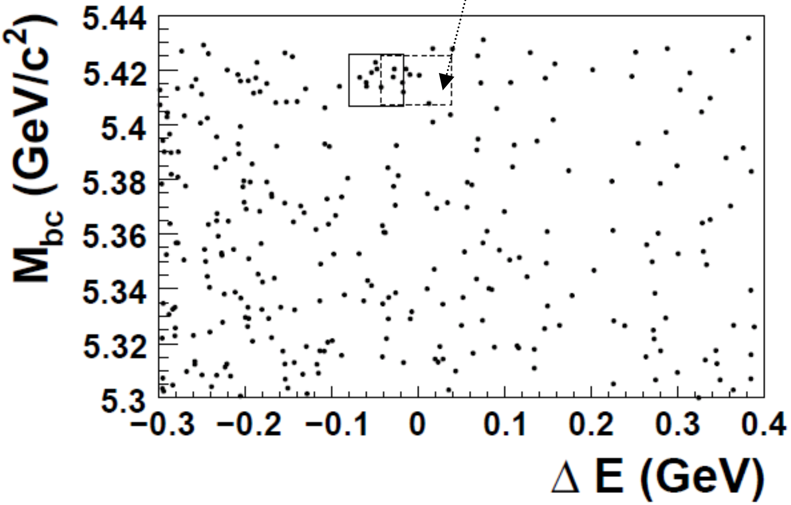




Measurement of $B_s \to D_s^+ K^-$ decays

Dsπ cross-feed fixed

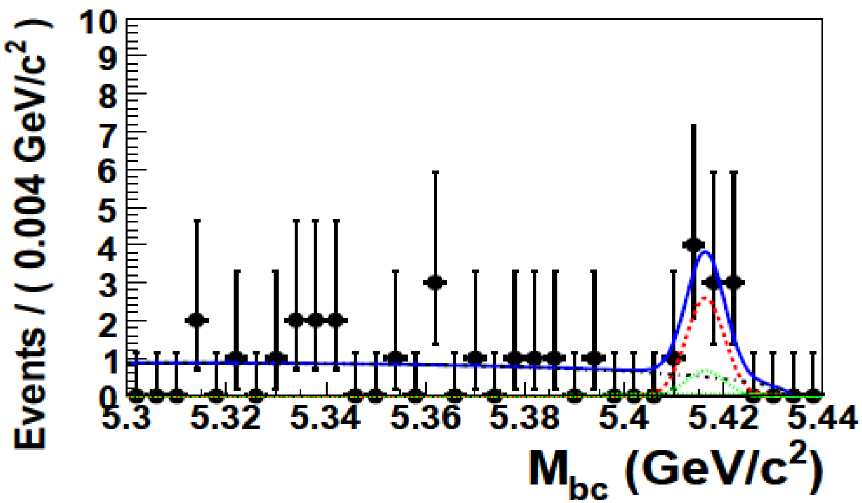
R.Louvot *et al*, PRL102,021801 (2009)

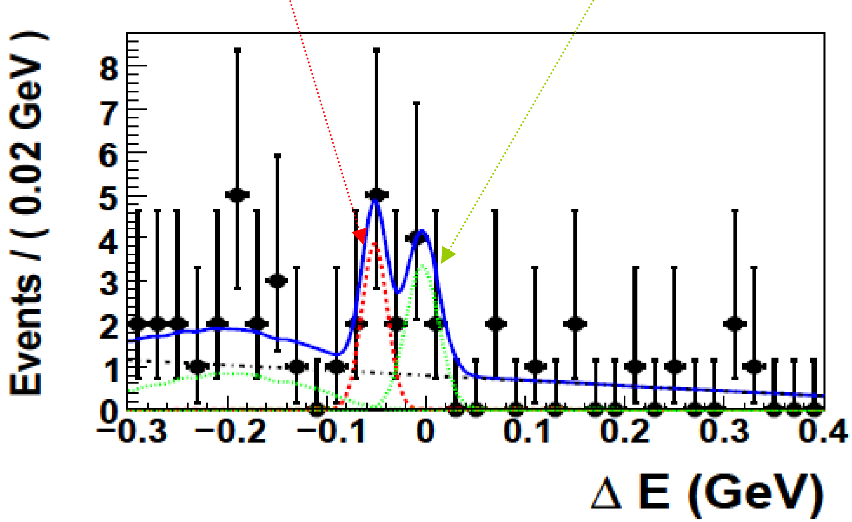


$$\mathcal{B}(B_s \to D_s^+ K^-) = (2.4^{+1.2}_{-1.0} \pm 0.4)\times 10^{-4}$$

$$\frac{\mathcal{B}(B_s \to D_s K)}{\mathcal{B}(B_s \to D_s \pi)} = (6.5^{+3.5}_{-2.9})\ \%$$ 3.5 σ

CDF: (9.7±2.0)%, ArXiv: 0809.0080

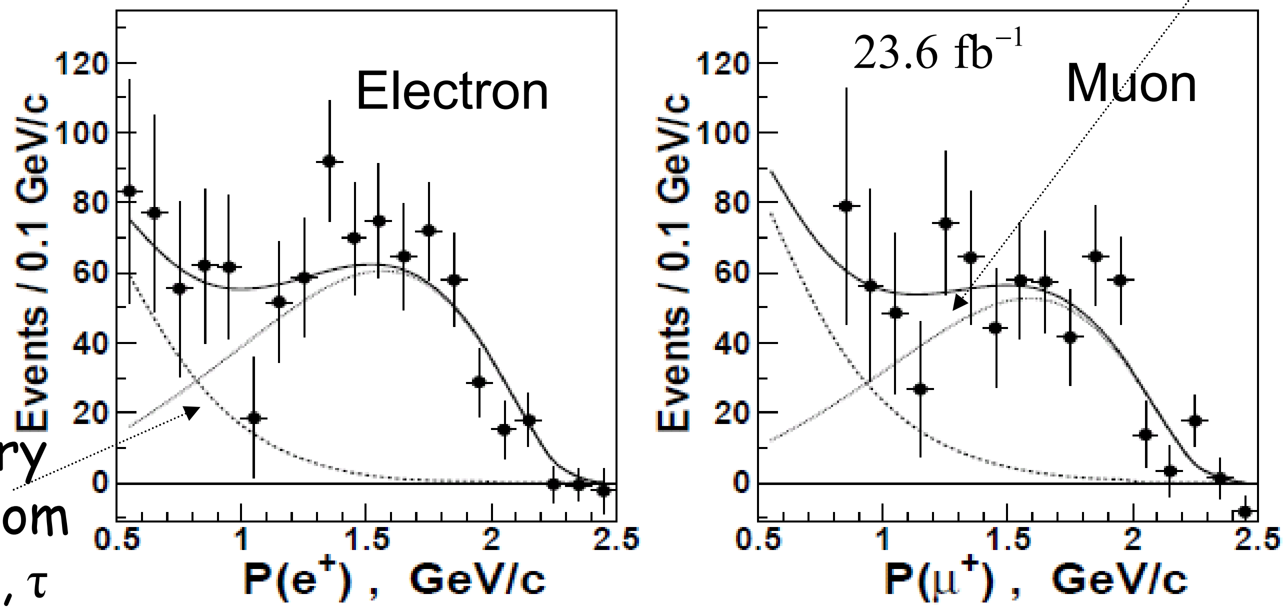




First measurement of $B_s \to X^+ l^- \nu$

$D_s^+ \to \phi\pi^+$ Select same sign D_s and lepton.

Fit in D_s spectrum in $P(l^+)$ bins, subtracting BB from normalized Y(4S) .



arXiv: 0710.2548

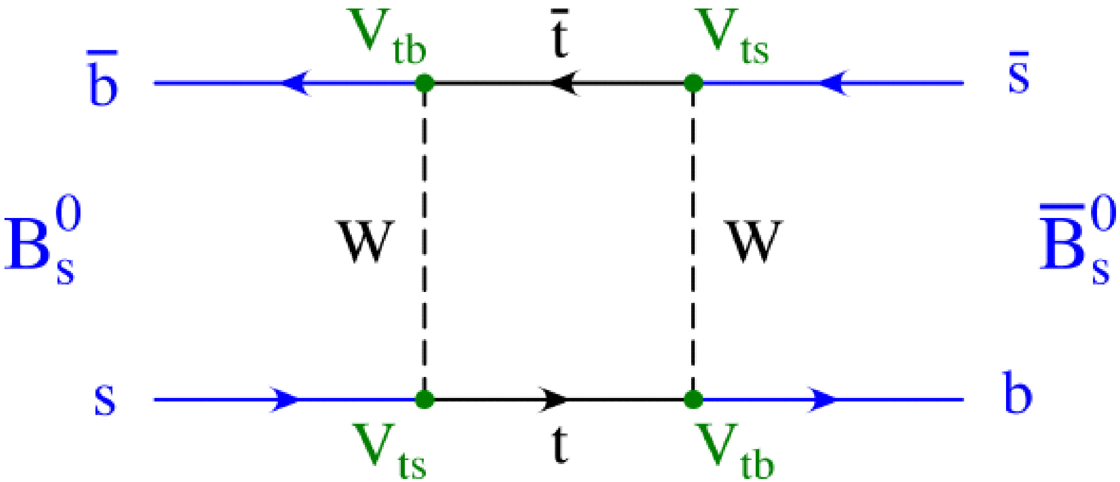
$BF(B_s \to X^+ e^- \nu) = (10.9 \pm 1.9 \pm 0.9)\%$ $BF(B_s \to X^+ \mu^- \nu) = (9.2 \pm 1.0 \pm 0.8)\%$

Combined: $BF(B_s \to X^+ l^- \nu) = (10.2 \pm 0.8 \pm 0.9)\%$

Semileptonic width same for B^0, B^+, B_s.

C.F.: $BF(B^0 \to X^+ l^- \nu) = (10.33 \pm 0.28)\%$ (PDG 2008)

The B_s^0 system



$\Gamma_{12} << M_{12}$

$\Downarrow$

$$\Delta\Gamma = \Gamma_L - \Gamma_H \simeq 2|\Gamma_{12}|\cos\phi$$

$$\Delta m = m_H - m_L \simeq 2|M_{12}|$$

$$i\frac{d}{dt}\begin{pmatrix} |B_s^0(t)\rangle \\ |\bar{B}_s^0(t)\rangle \end{pmatrix} = \left(M - \frac{i}{2}\Gamma\right)\begin{pmatrix} |B_s^0(t)\rangle \\ |\bar{B}_s^0(t)\rangle \end{pmatrix}$$

$$|B_{sL}\rangle = p|B_s\rangle + q|\bar{B}_s\rangle$$

$$|B_{sH}\rangle = p|B_s\rangle - q|\bar{B}_s\rangle$$

CP violating phase:

$\Phi = \arg(-M_{12}/\Gamma_{12})$

SM: $\Phi = 0.004$

$B_s^0 \rightarrow$ CP eigenstates

$Bs \rightarrow J/\psi\Phi$

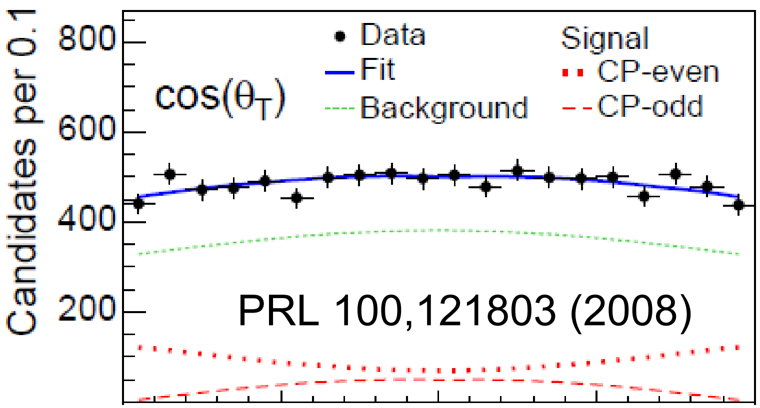
Longitudinal, parallel ($A_0, A_\parallel$): CP even

Transverse ($A_\perp$): CP odd

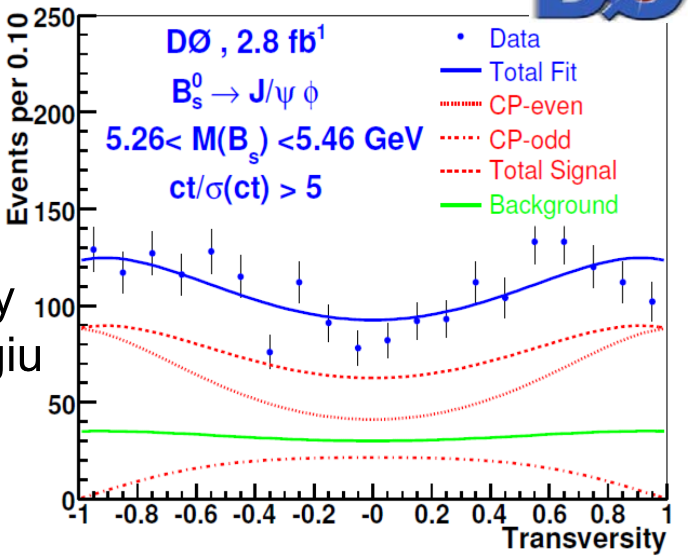
Need to disentangle CP states by 3D angular distribution

Example: transversity distribution

$1.7\ fb^{-1}$



See talk by Gavril Giurgiu



Or: Pure CP eigenstate:

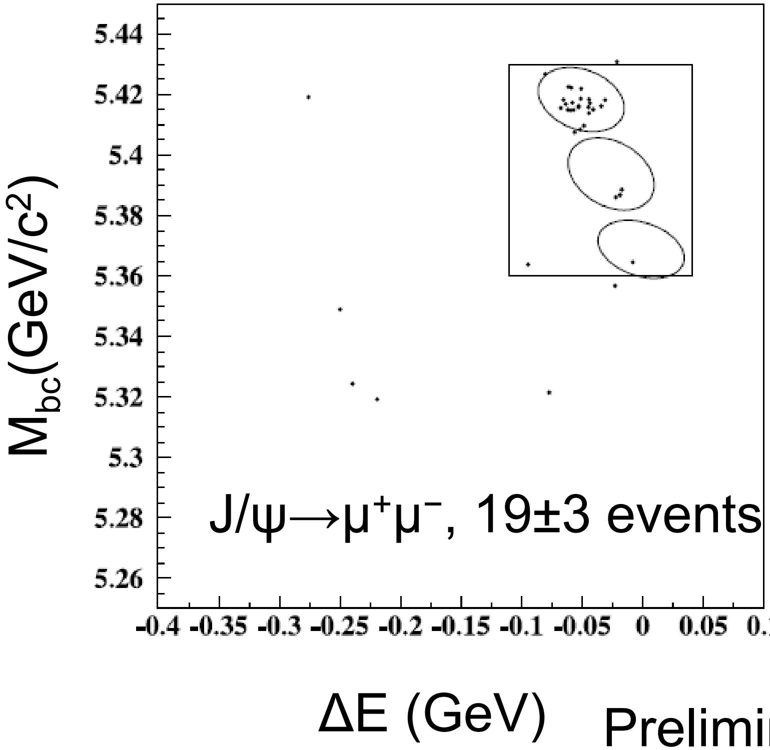
$B_s \rightarrow J/\psi\eta(')$ (CP=+1), $D_s^+ D_s^-$(CP=+1)

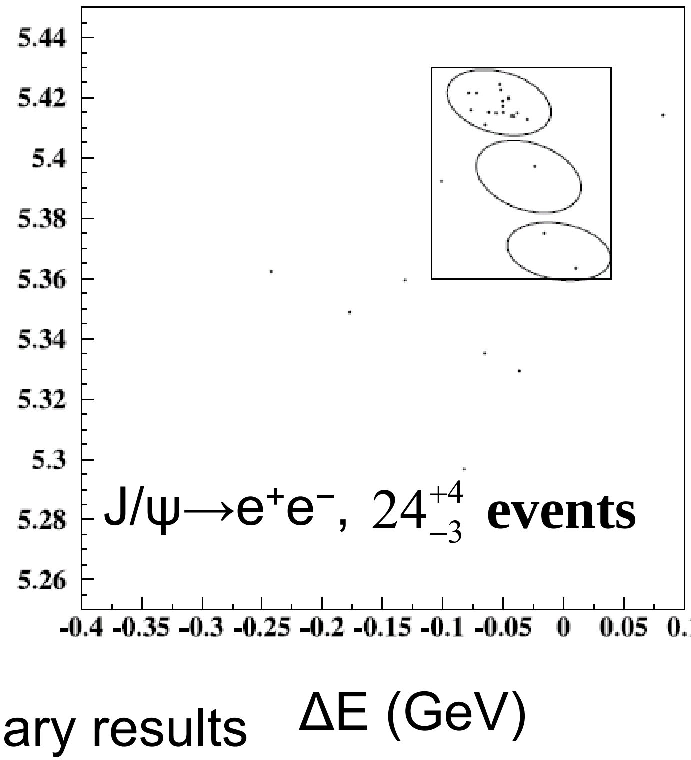
$$\left|\left\langle f_{CP+} \mid B_s^0 \right\rangle\right|^2 = \begin{cases} e^{-\Gamma_L \Delta t} & \Delta t > 0 \\ e^{-\Gamma_H \Delta t} & \Delta t < 0 \end{cases}$$

BF($B_s \to J/\psi\Phi$) measurement

$23.6\ fb^{-1}$

Very clean





Preliminary results

Muon mode: BF($B_s \to J/\psi\Phi$) = $(1.12 \pm 0.25\ ^{+0.21}_{-0.24}) \times 10^{-3}$

Electron mode: BF($B_s \to J/\psi\Phi$) = $(1.18 \pm 0.25\ ^{+0.22}_{-0.25}) \times 10^{-3}$

$$\mathcal{B}(B_s^0 \to J/\psi\phi) = (1.15^{+0.28}_{-0.30}) \times 10^{-3}$$

Observation of $B_s \to J/\psi\eta$

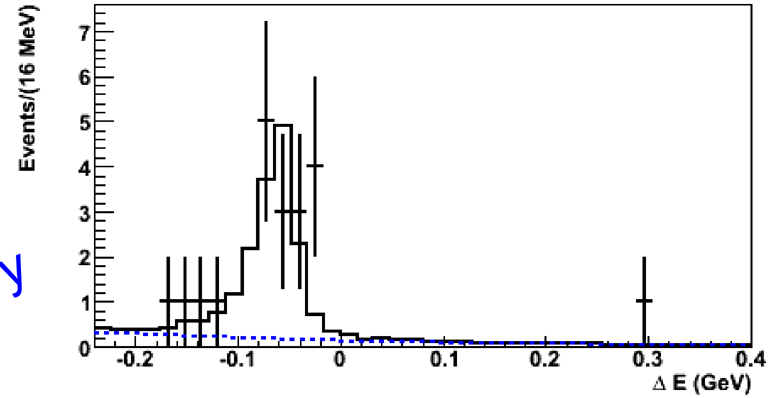
CP eigenstate

First Observation

$$\eta = (uu + dd - ss)/\sqrt{3}$$

$$\mathcal{B}(B_s \to J/\psi\eta) \approx 1/3\,\mathcal{B}(B \to J/\psi\phi)$$

Preliminary



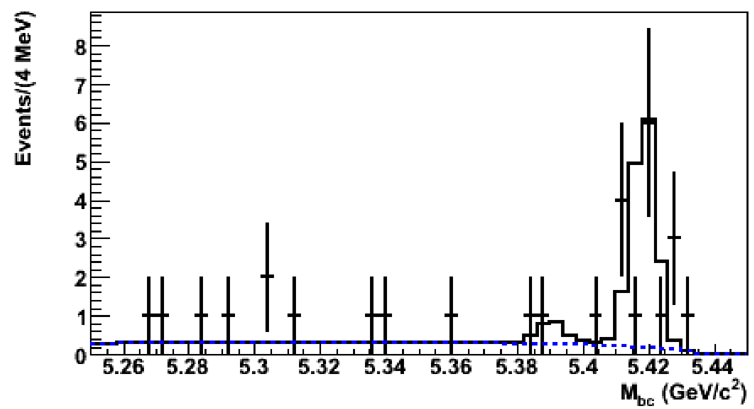
Measured $\mathcal{B}(B_s \to J/\psi\eta)$

$\eta \to \gamma\gamma$ 5.9σ

$(3.44 \pm 1.07(\text{stat.})\ ^{+0.62}_{-0.30}\ (\text{syst.}))\times 10^{-4}$

$\eta \to \pi^+\pi^-\pi^0$ 4.0σ

$(4.60 \pm 2.06(\text{stat.})\ ^{+0.89}_{-0.30}\ (\text{syst.}))\times 10^{-4}$



Combined

$(3.69 \pm 0.95(\text{stat.})\ ^{+0.65}_{-0.30}\ (\text{syst.}))\times 10^{-4}$

Summary

- Baryonic with diquark popping:

  $\overline{B}^0 \to \Lambda_c^+ \overline{p}$; $B^- \to \Lambda_c^+ \overline{p} \pi^-$: First obs $\Sigma_c(2800)^0$, threshold enhancement.

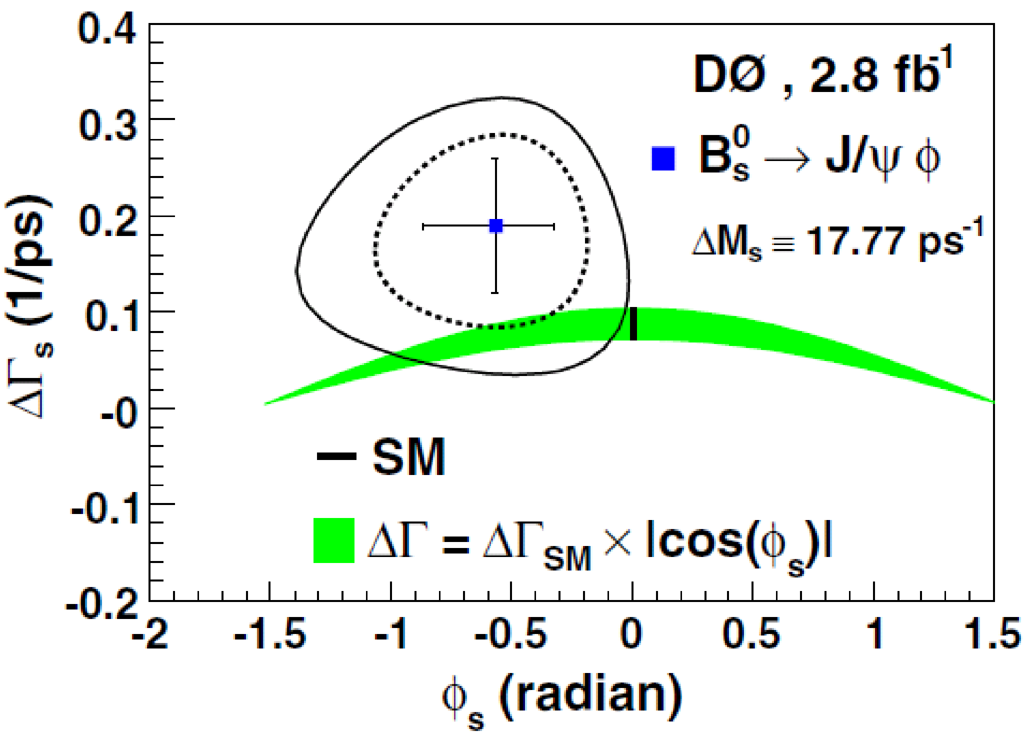
  $B \to \Sigma_c(2455)^0 \overline{p} \pi^+$: new resonance in $\overline{p}\pi^+$.

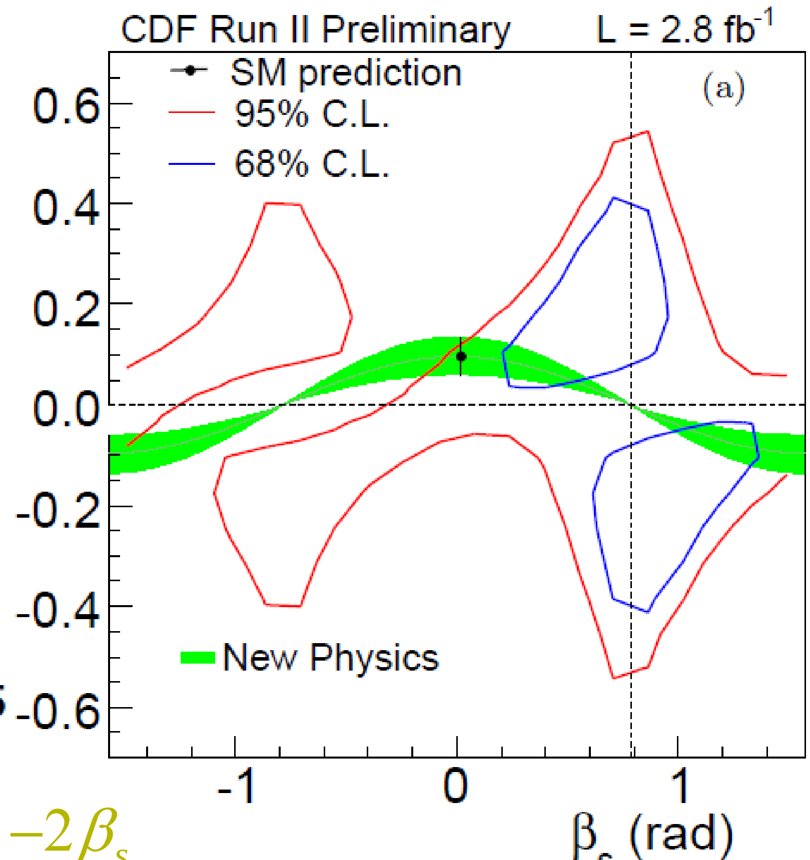
- Charmed:
  - $B \to D_{s1}(2536)^+ D^{(*)}$ Belle confirmation.
  - $s\overline{s}$ popping: $B^+ \to D_s^{(*)-} K^+ \pi^+$, $D_s^- K_s^0 \pi^+$, $D_s^- K^+ K^+$ measurement.
- B_s decay.
  - $Bs \to D_s^+ h^-$. Absolute BF. M(Bs*) measurement.
  - Bs→CP eigenstate. First observation of J/ψη.
  - More results will come with ~100 fb^{-1} $\Upsilon(5S)$ dataset from Belle.

BACKUP

Results from Bs→J/ψΦ

PRL 101, 241801





$\phi_s = -2\beta_s$

Strong phases constrained from B →J/ψK^{*0}

Feldman-Cousins method

$\Phi_s = -0.57^{+0.24}_{-0.30}$ (stat.) $^{+0.07}_{-0.02}$ (syst.)

$0.28 < \beta_s < 1.29$ @ 68% CL

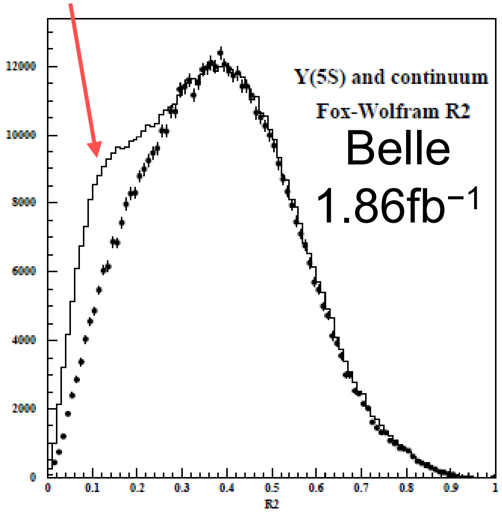
Will be covered by speaker.

Excess of spherical events

$$R_2 = \frac{\sum_{i,j} |p_i||p_j| P_2(\cos\theta)}{\sum_{i,j} |p_i||p_j| P_0(\cos\theta)}$$

Fox-Wolfram moments

B_u, B_d, B_s



R2

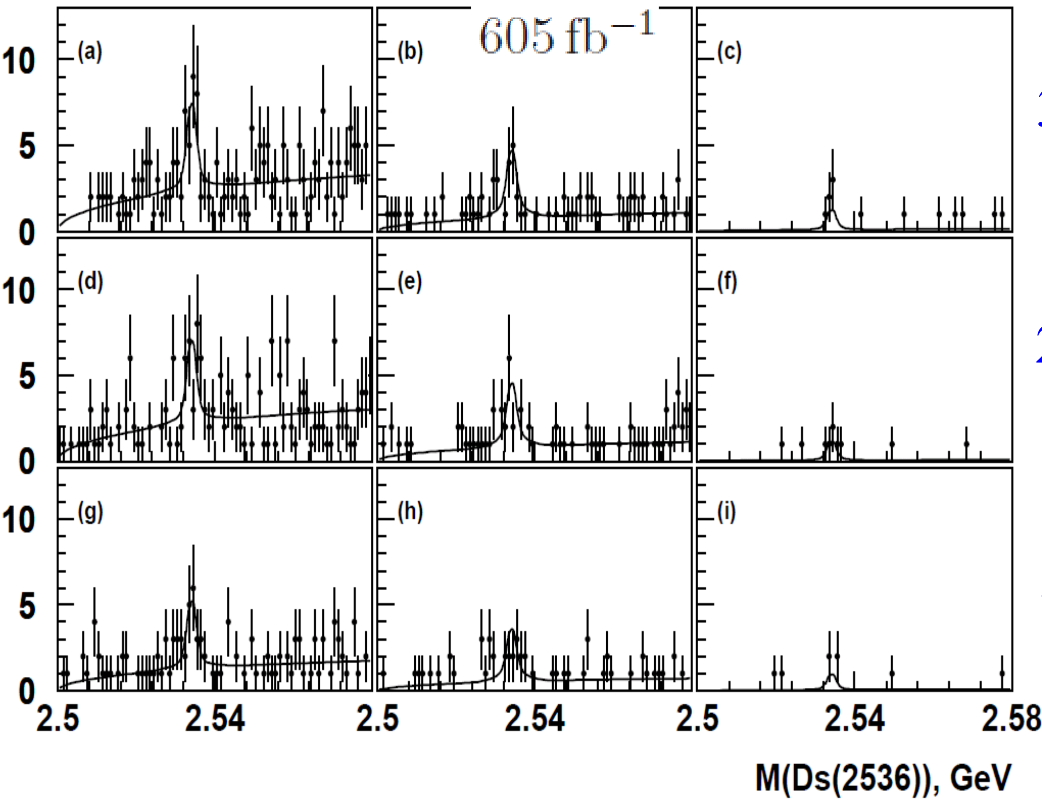
$B \to D_{s1}(2536)^+ D^{(*)}$ results

$D_{s1} \to$

Fit to $M(D_{s1})$ distribution simultaneously

Belle Preliminary

$D^{*0}(D^0\gamma)K^+$ $\quad$ $D^{*0}(D^0\pi^0)K^+$ $\quad$ $D^{*+}(D^0\pi^+)K_S$



Naive sum

BaBar

$$\mathcal{B}(B^+ \to D_{s1}^+ \bar{D}^0)(\times 10^{-4})$$

$3.99 \pm 0.84 \pm 0.57$ $\quad$ $4.45 \pm 1.11 \pm 0.62$

7.0σ

$$\mathcal{B}(B^0 \to D_{s1}^+ D^-)(\times 10^{-4})$$

$2.76 \pm 0.63 \pm 0.35$ $\quad$ $4.32 \pm 1.14 \pm 0.45$

6.9 σ

$$\mathcal{B}(B^0 \to D_{s1}^+ D^{*-})(\times 10^{-4})$$

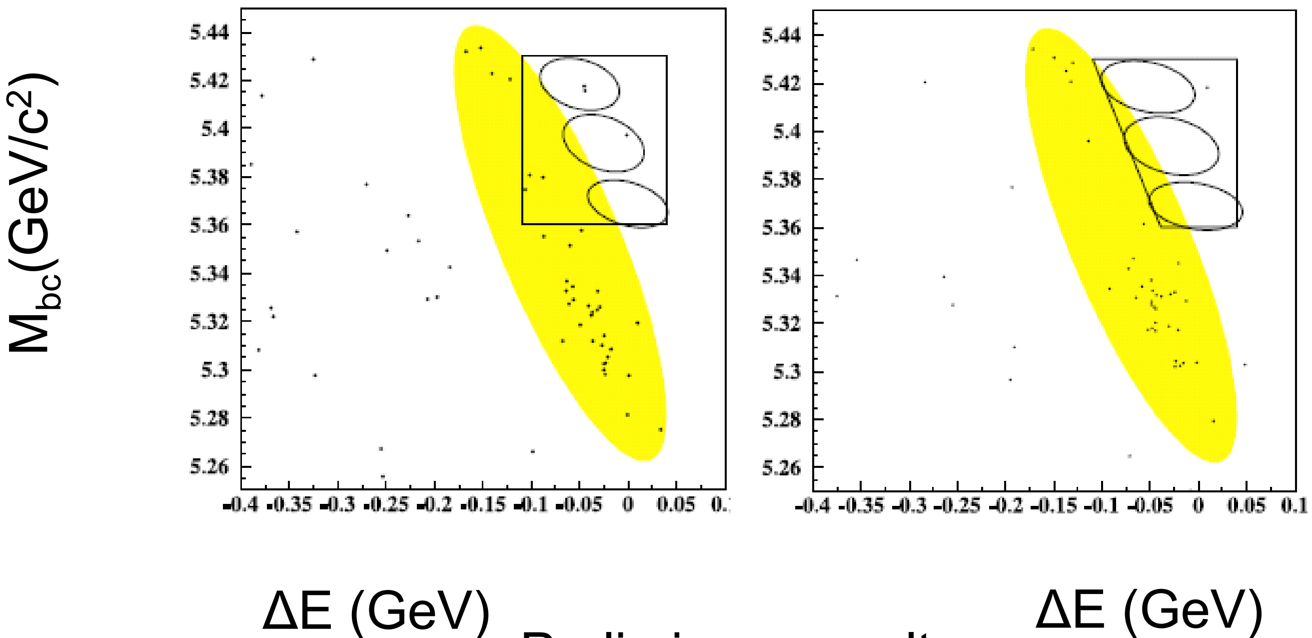
$5.03 \pm 1.21 \pm 0.68$ $\quad$ $8.32 \pm 1.75 \pm 0.94$

6.3 σ

Sum of two D_{s1} modes ($D^{*0}K^+$,$D^{*+}K^0$)

Belle and BaBar results are consistent.

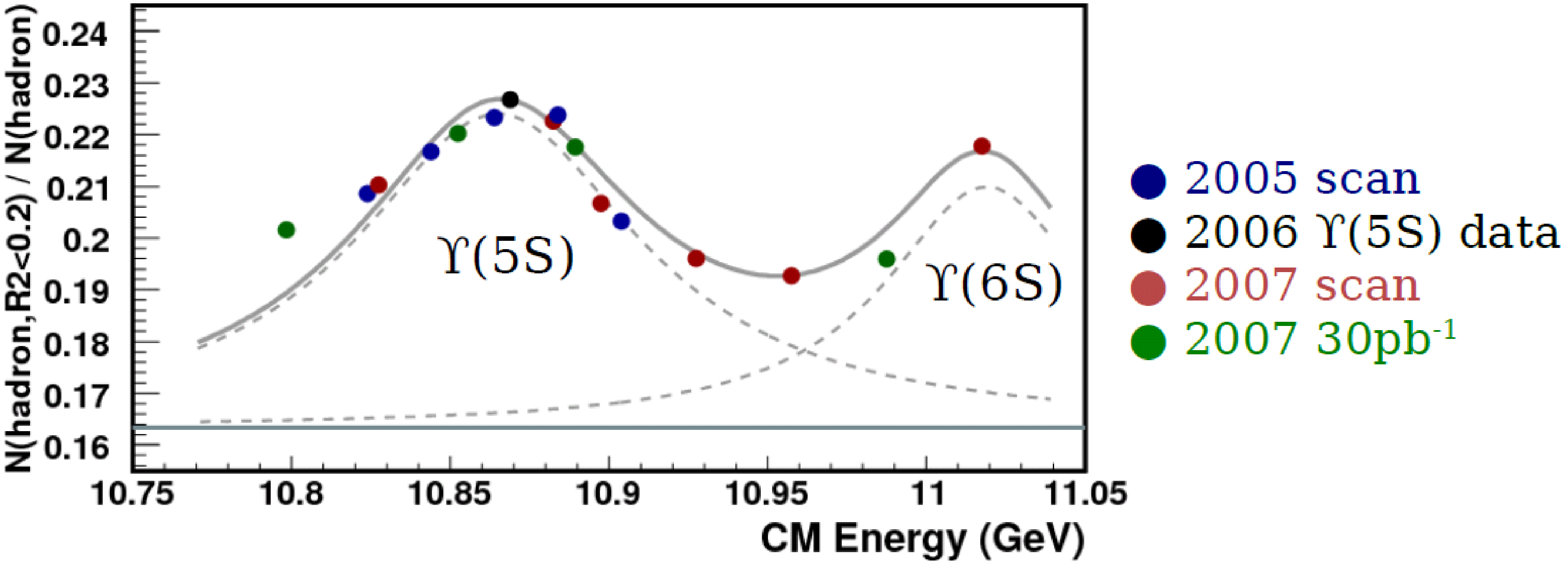
BF($B_s \rightarrow J/\psi K_s$) measurement



Preliminary results

No significant signal.

Belle Υ(5S) Scan



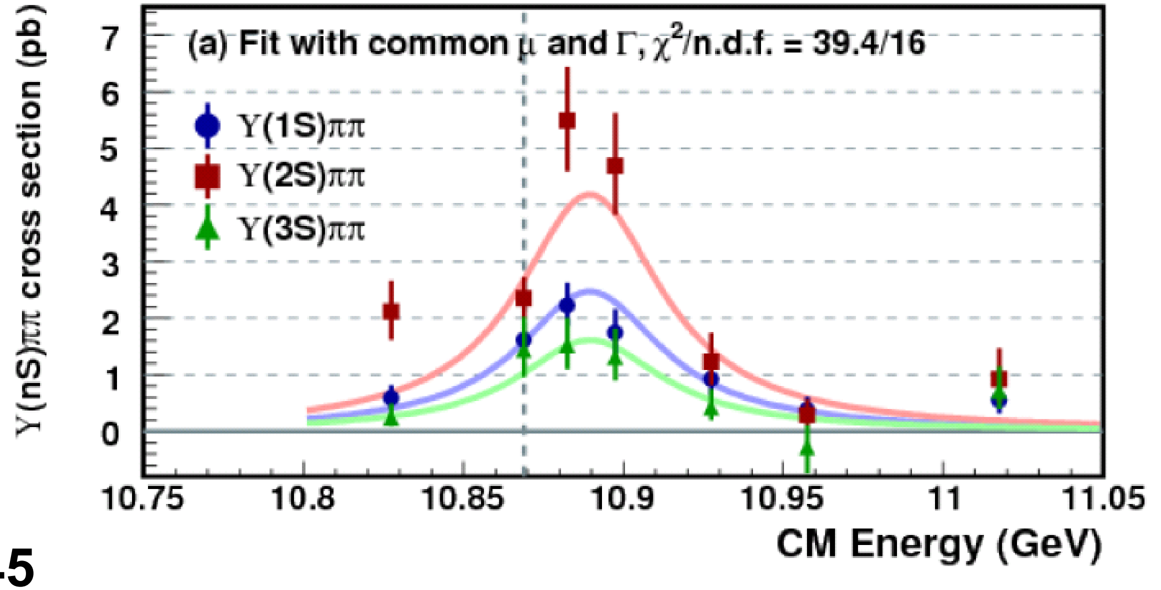
Fit with fixed PDG Breit-Wigners values for Υ(5S) and Υ(6S)

Υ(5S): (μ,Γ)=(10860,110) in MeV

Υ(6S): (μ,Γ)=(11019,79) in MeV

Agreement ✓

Belle $\Upsilon(nS)\pi\pi$ production



arXiv:0808.2445

Assume one new particle produce all final states ⇒
fit the three cross-sections with the same Breit-Wigner function:

	$\Upsilon(1S)\pi\pi$	$\Upsilon(2S)\pi\pi$	$\Upsilon(3S)\pi\pi$
Peak (pb)	$2.46^{+0.27}_{-0.25} \pm 0.18$	$4.18^{+0.49}_{-0.46} \pm 0.55$	$1.61^{+0.31}_{-0.28} \pm 0.21$
Mean (MeV)		$10889.6 \pm 1.8 \pm 1.5$	
Width (MeV)		$54.7^{+8.5}_{-7.2} \pm 2.5$	

20 MeV higher than the $\Upsilon(5S)$ and half the width!