Rare B decays

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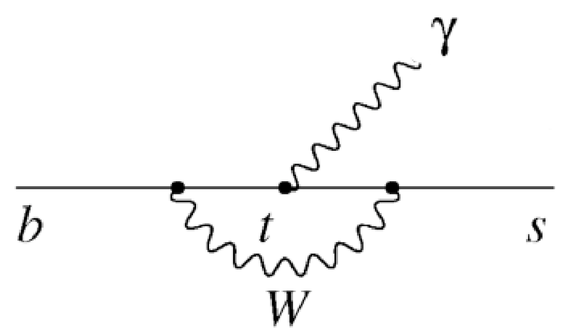
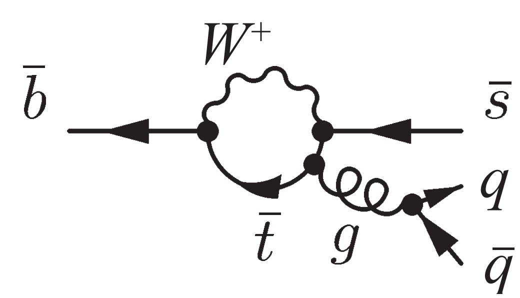
on behalf of the Belle and BaBar Collaborations

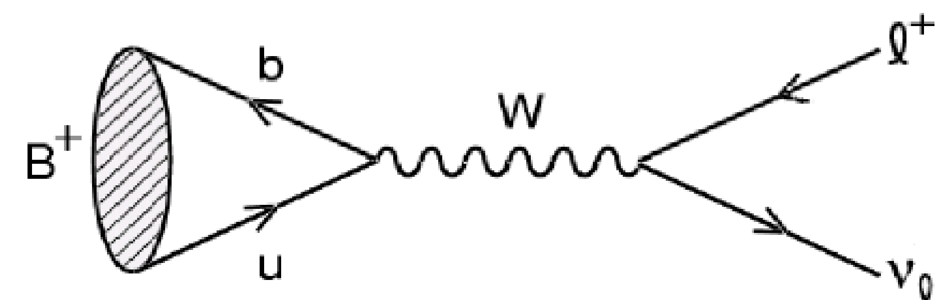
Symposium on Prospects in the Physics of Discrete Symmetries (DISCRETE' 08), Valencia, 11-16 December 2008

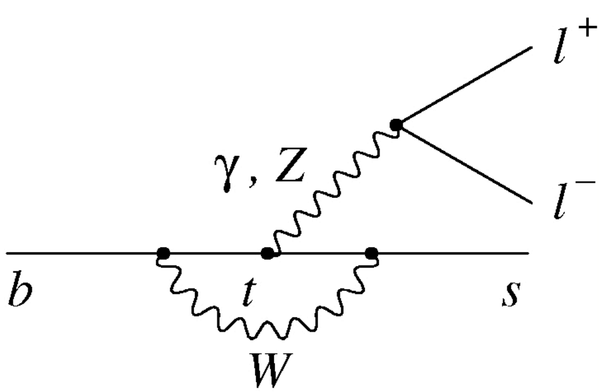
Rare Decays Probe NP

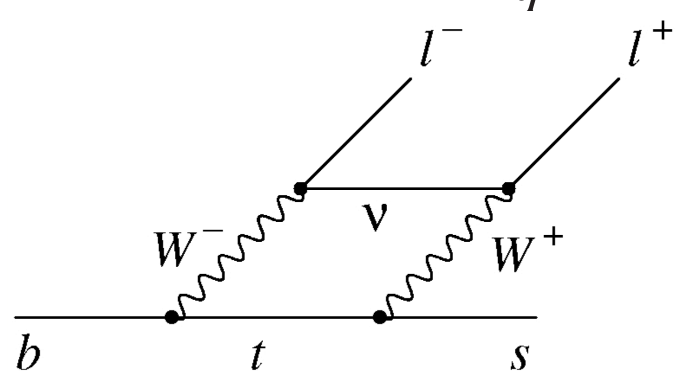
- Decays across generations are suppressed
- "Rare" means decays not via the dominant $b \to c$ transition
- Flavor Changing Neutral Current (FCNC) decays are forbidden at tree level (allowed via loop)





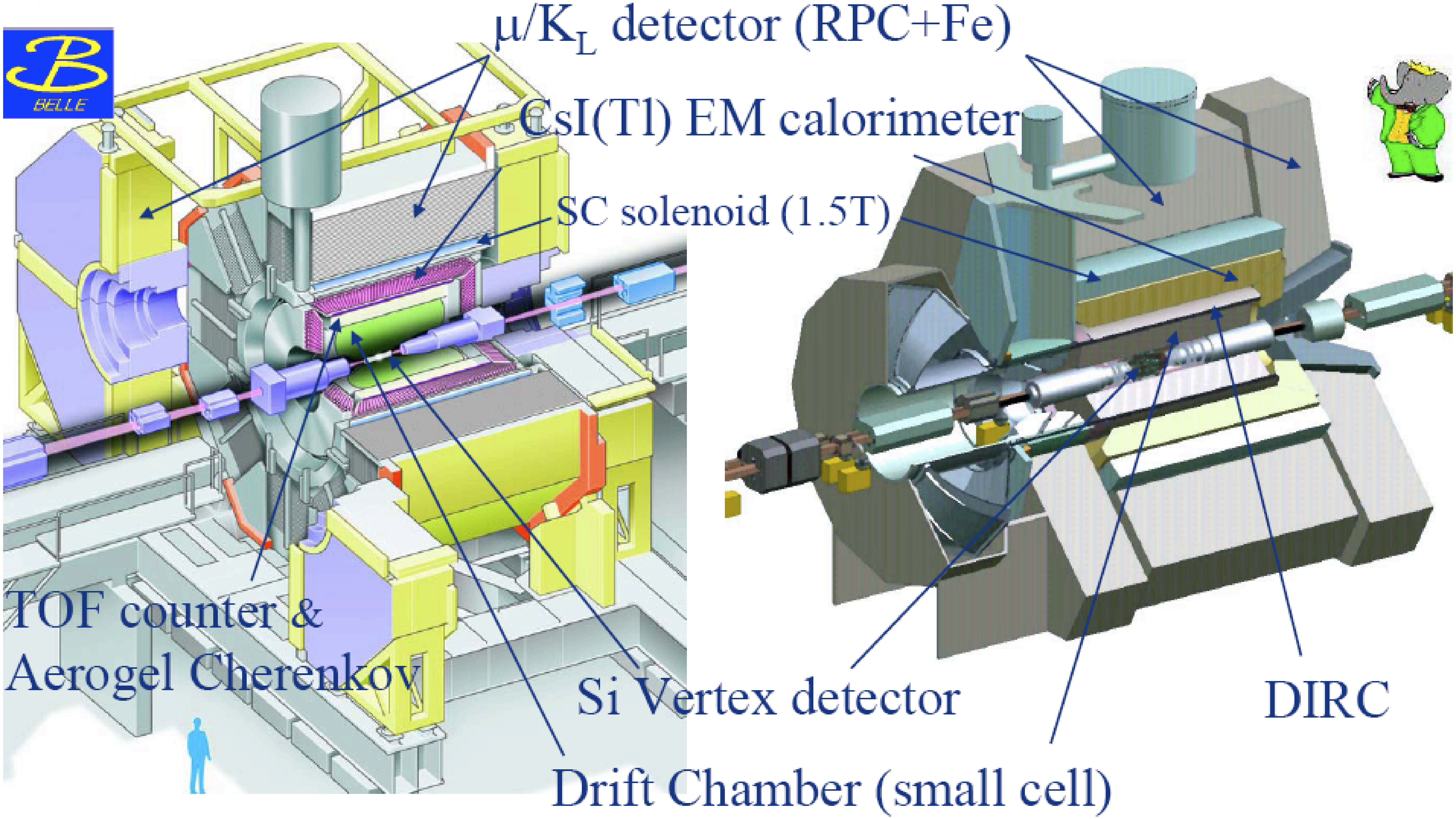






- Leptonic modes such as $B \to \tau\nu$ are also sensitive to charged Higgs mass

Belle and BaBar Detectors



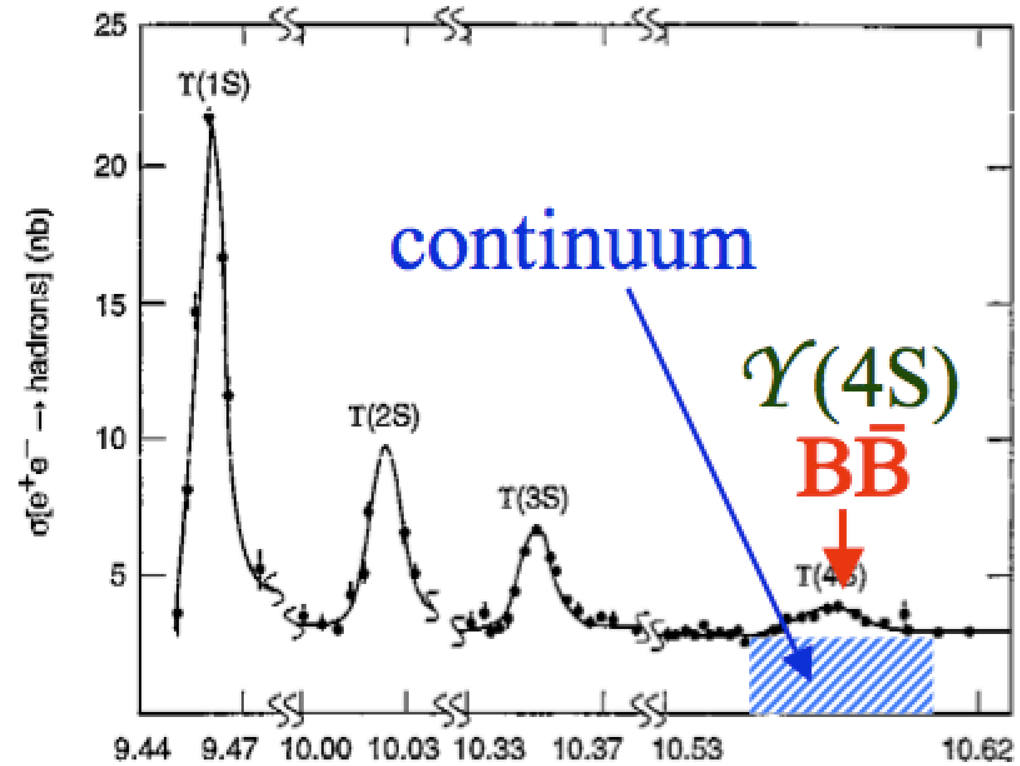
Kinematic Variables

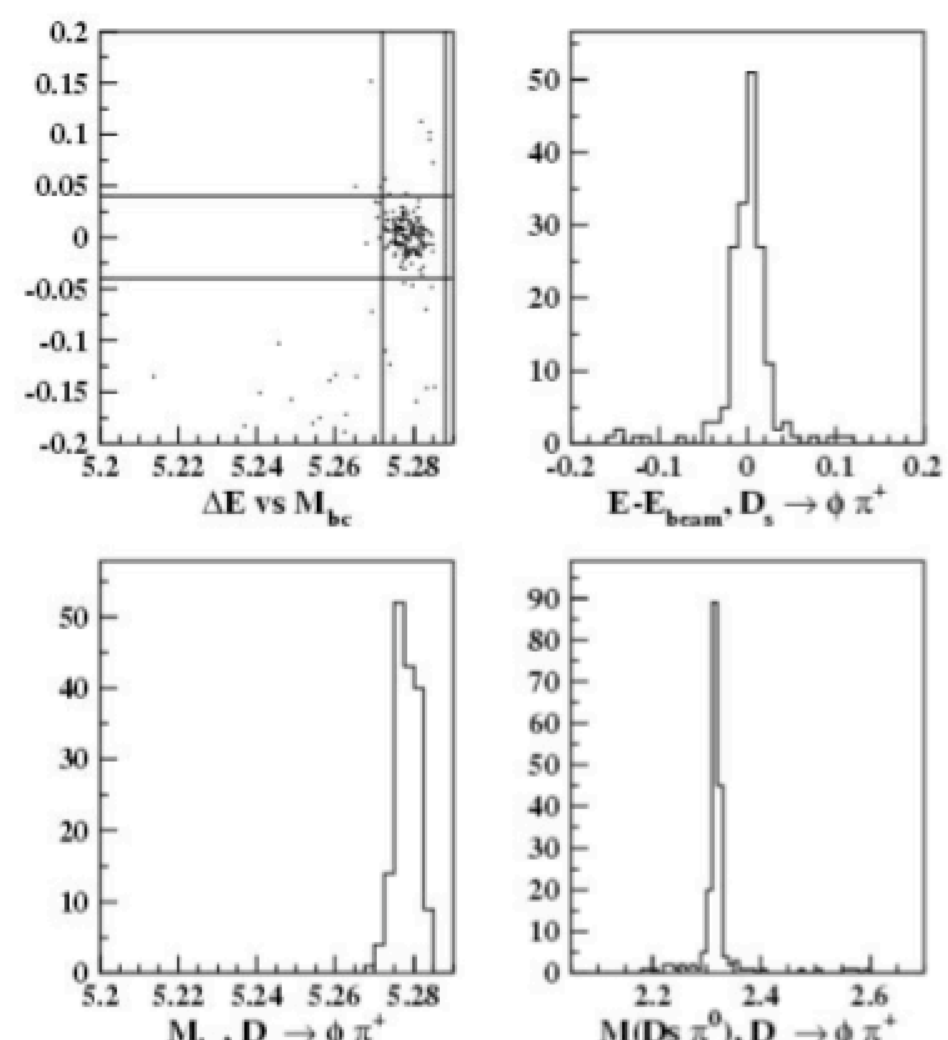
- At the $\Upsilon(4S)$, $B\bar{B}$ are produced at threshold
- This allows to
  - Select a B signal using two nearly independent variables

$$M_B = \sqrt{(E^{*}_{beam})^2 - (\Sigma P_i)^2}$$

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

  - Determine the 4-momentum of one B by reconstructing the other
  - Distinguish $B\bar{B}$ (spherical) from continuum events (jet-like)





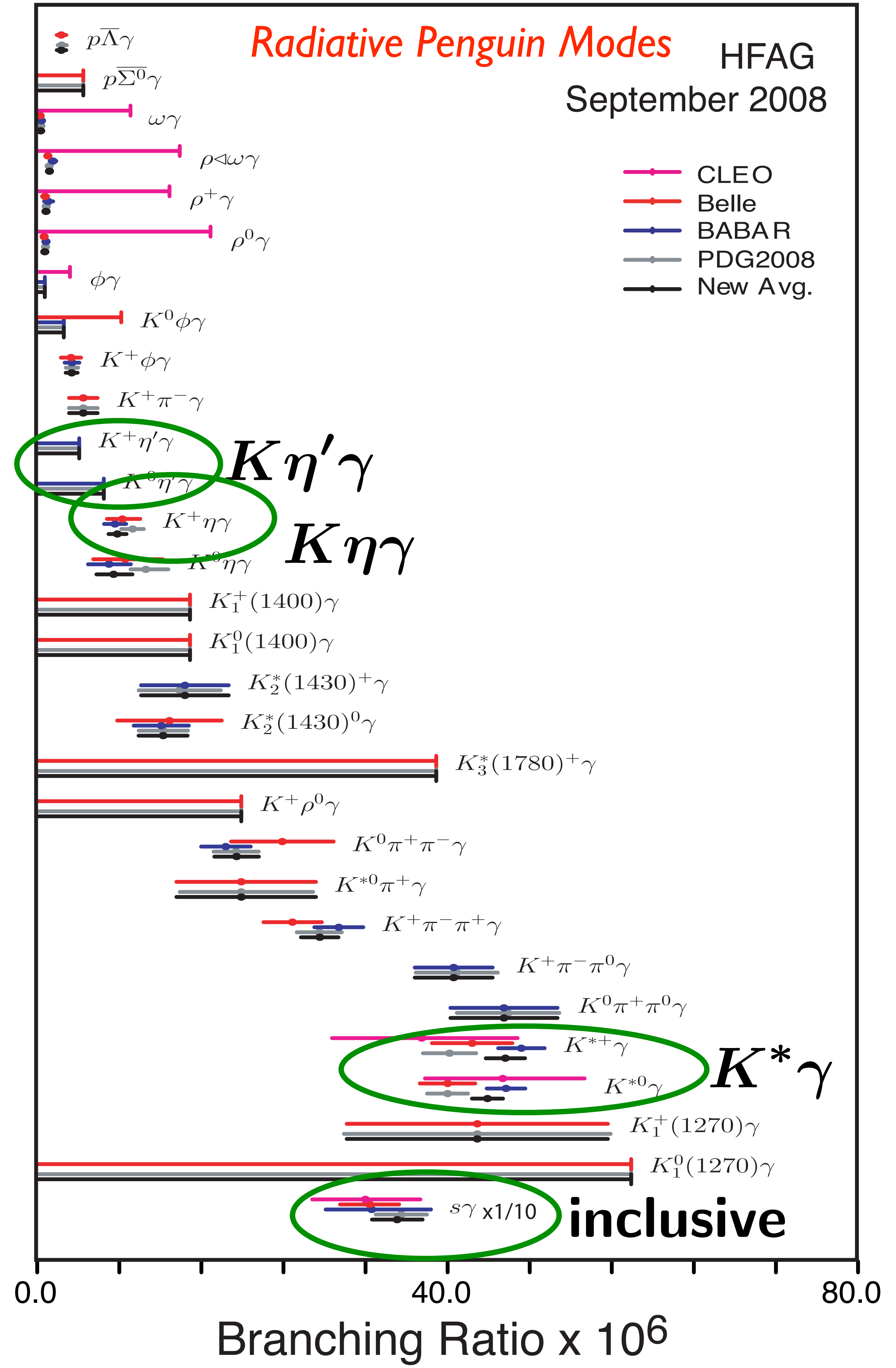
Many exclusive $b \to s\gamma$ modes have been observed by CLEO, Belle, and BaBar.

Hadronic form factor uncertainties make predictions of exclusive branching ratios imprecise.

New results have been recently reported:

$$B \to K\eta\gamma$$
$$B \to K\eta'\gamma$$
$$B \to K^*\gamma$$

and inclusive $b \to s\gamma$



Branching ratio for fully inclusive $B \to X_s\gamma$:

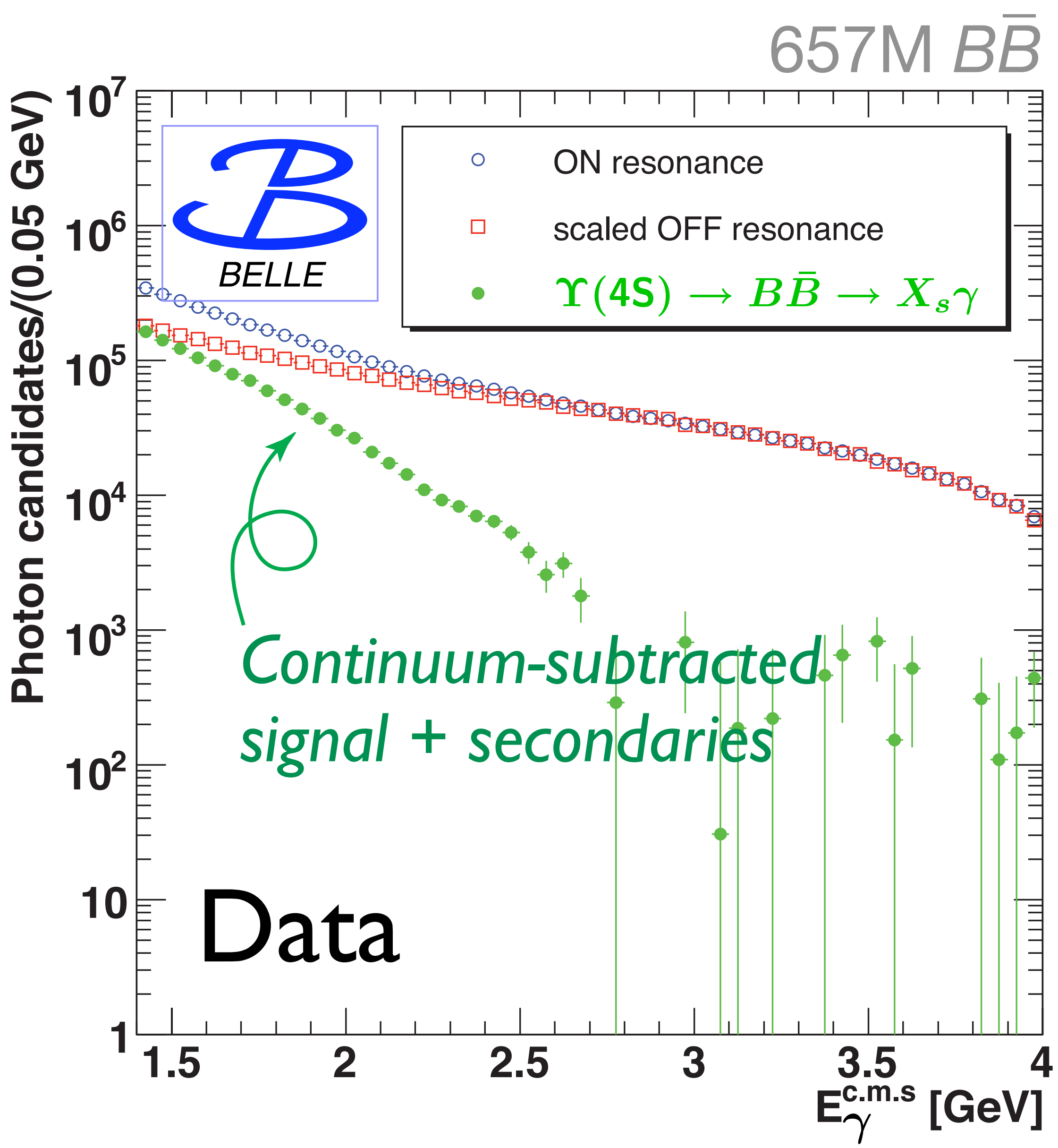
Fully-inclusive method:

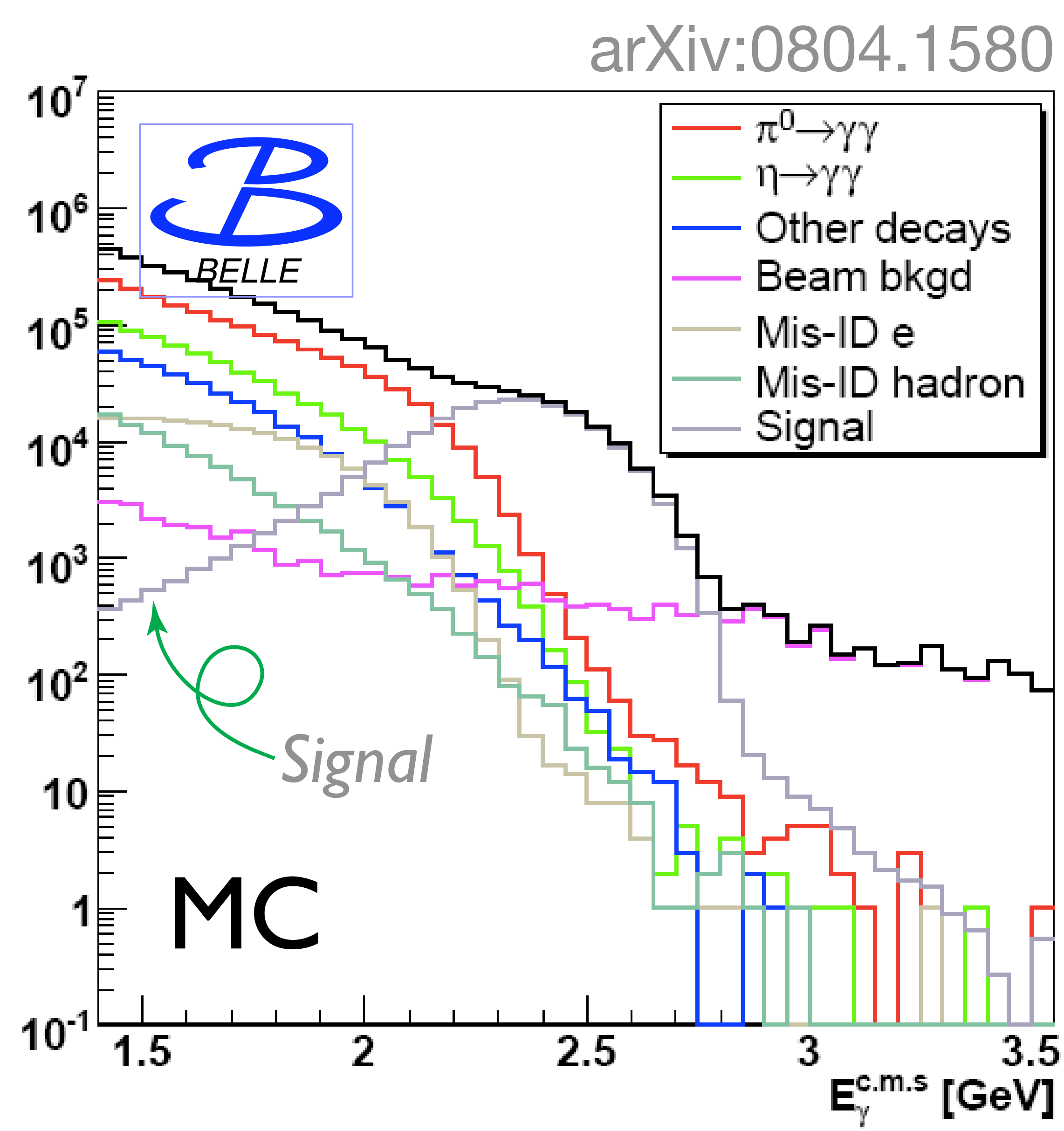
Find isolated clusters in calorimeter with $E_\gamma^{cm} > 1.4$ **GeV**

Veto photon from π^0`s , $\eta$ `s , and Bhabha`s

Suppress continuum background using topology; subtract remainder.

Subtract non-primary photons *using data to correct MC spectra*.

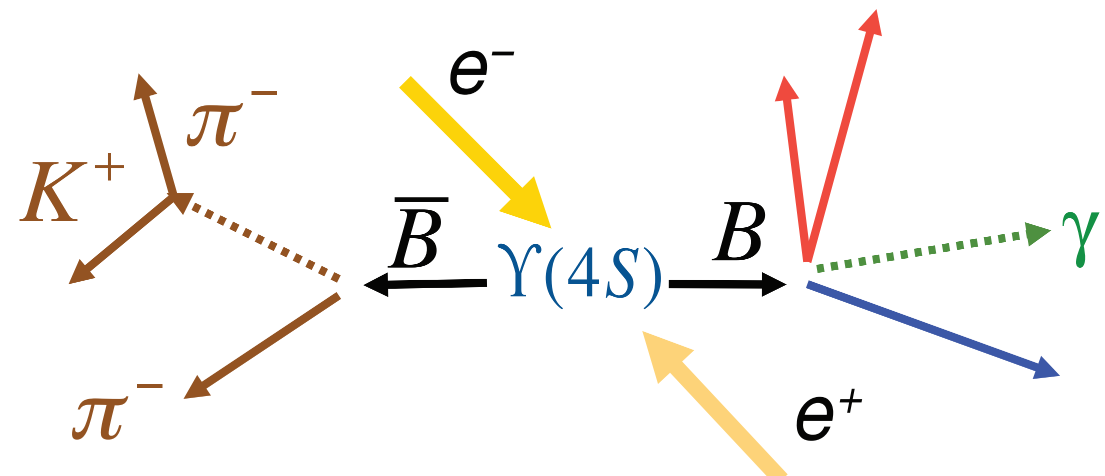




Branching ratio for fully inclusive $B \to X_s\gamma$:

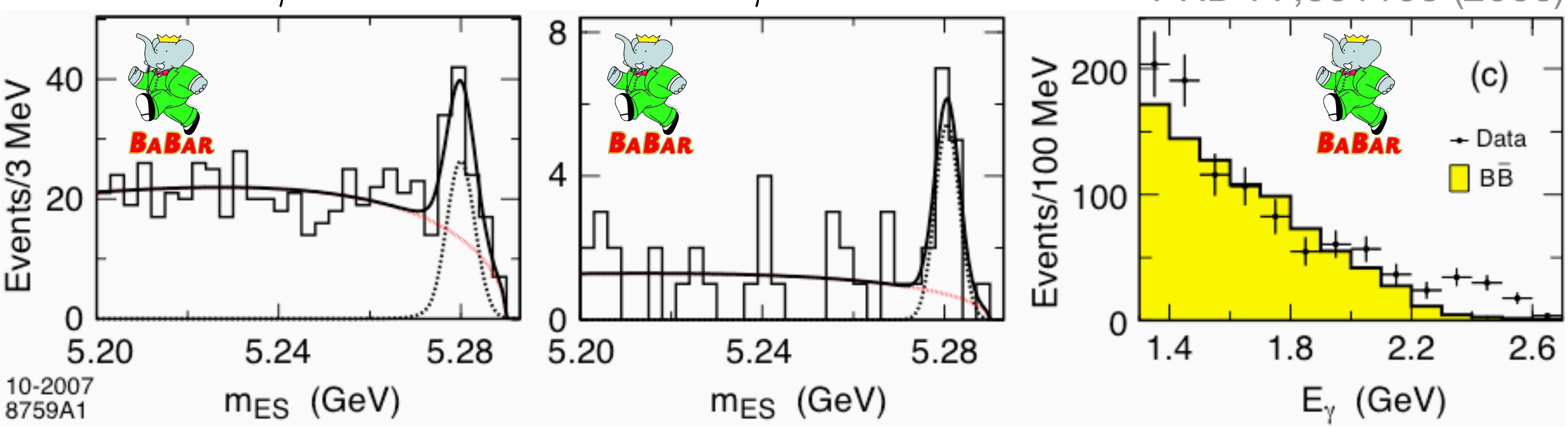
B-recoil method:

Reconstruct tag B to hadronic states.
Search for isolated photon in the rest of the event.
Subtract non-primary photons from B decays.



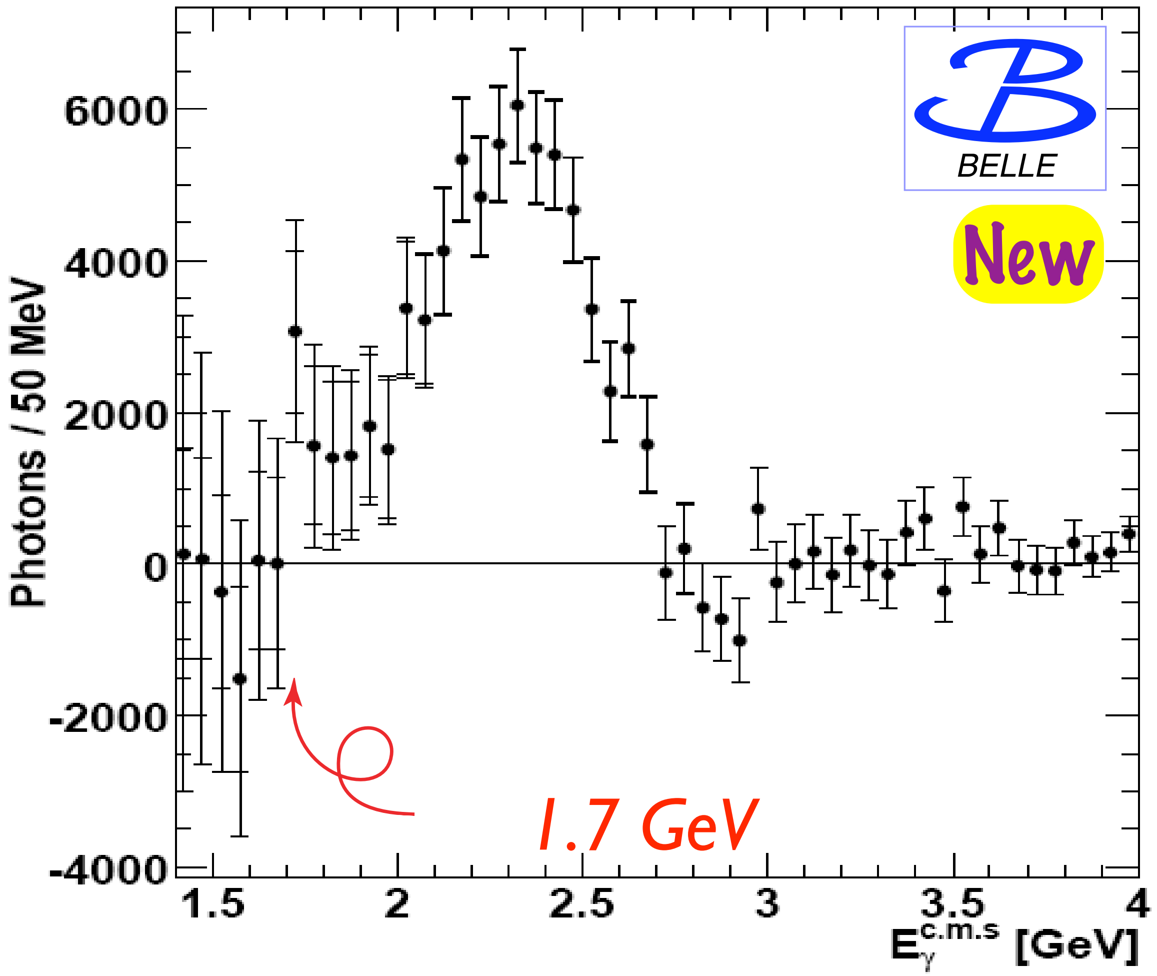
Provides B rest frame, B flavor/charge; suppresses continuum.

$1.6 < E_\gamma < 1.7$ GeV　　$2.3 < E_\gamma < 2.4$ GeV　　PRD 77,051103 (2008)



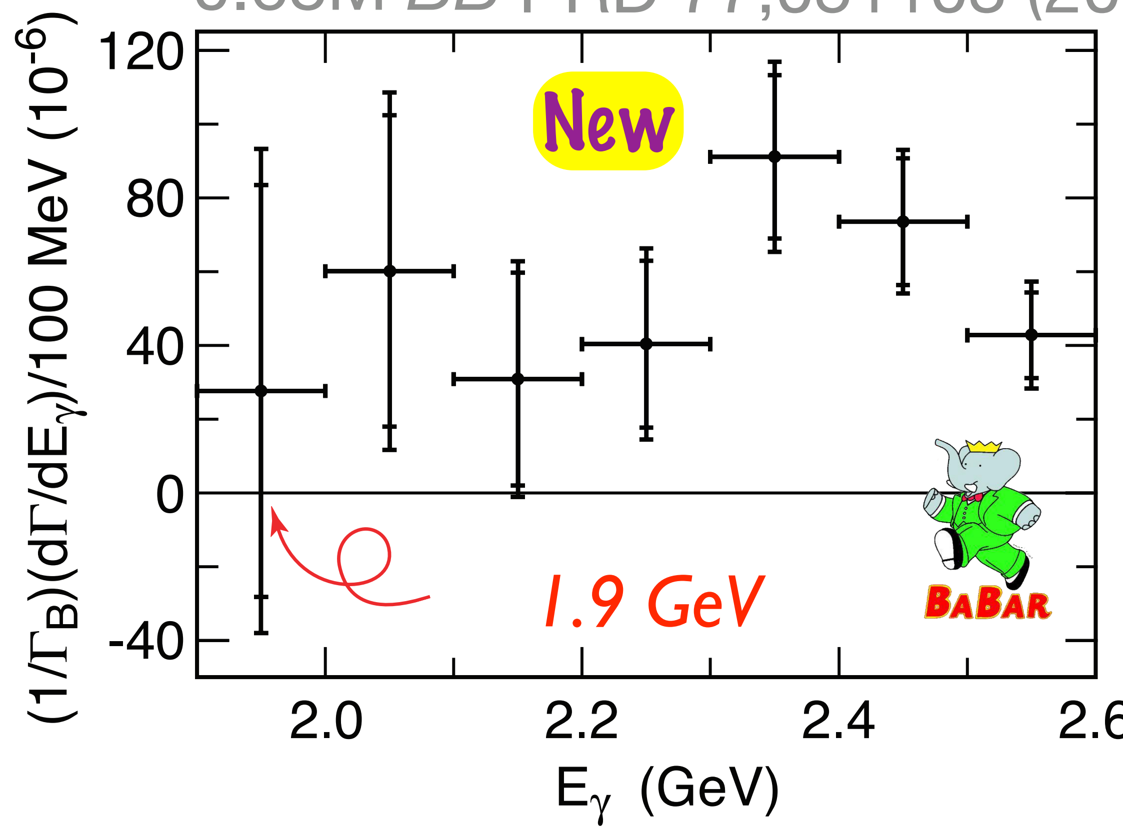
Branching ratio for fully inclusive $B \to X_s\gamma$:

657M *BB* arXiv:0804.1580



Fully-inclusive

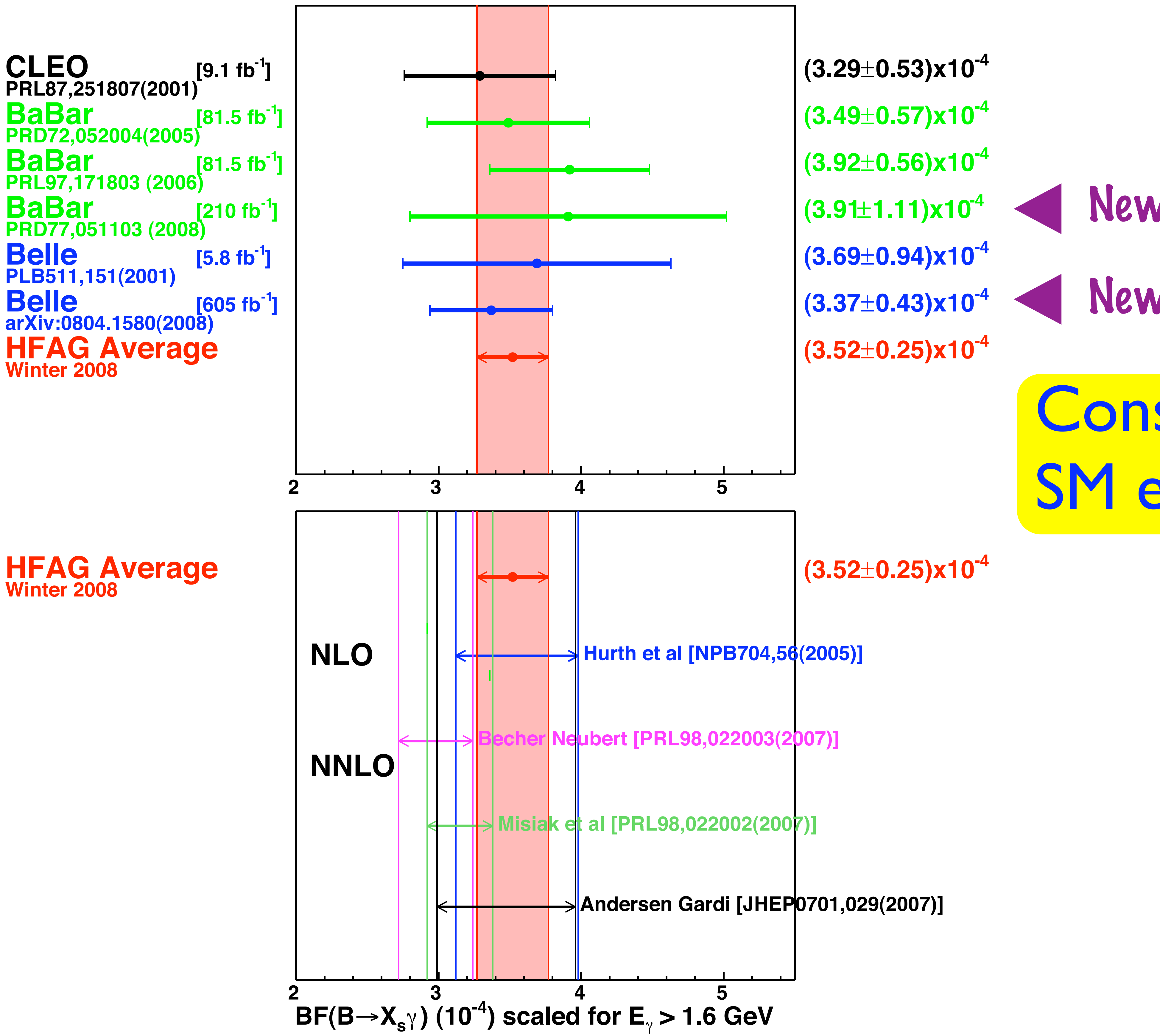
0.68M *BB* PRD 77,051103 (2008)



B-recoil

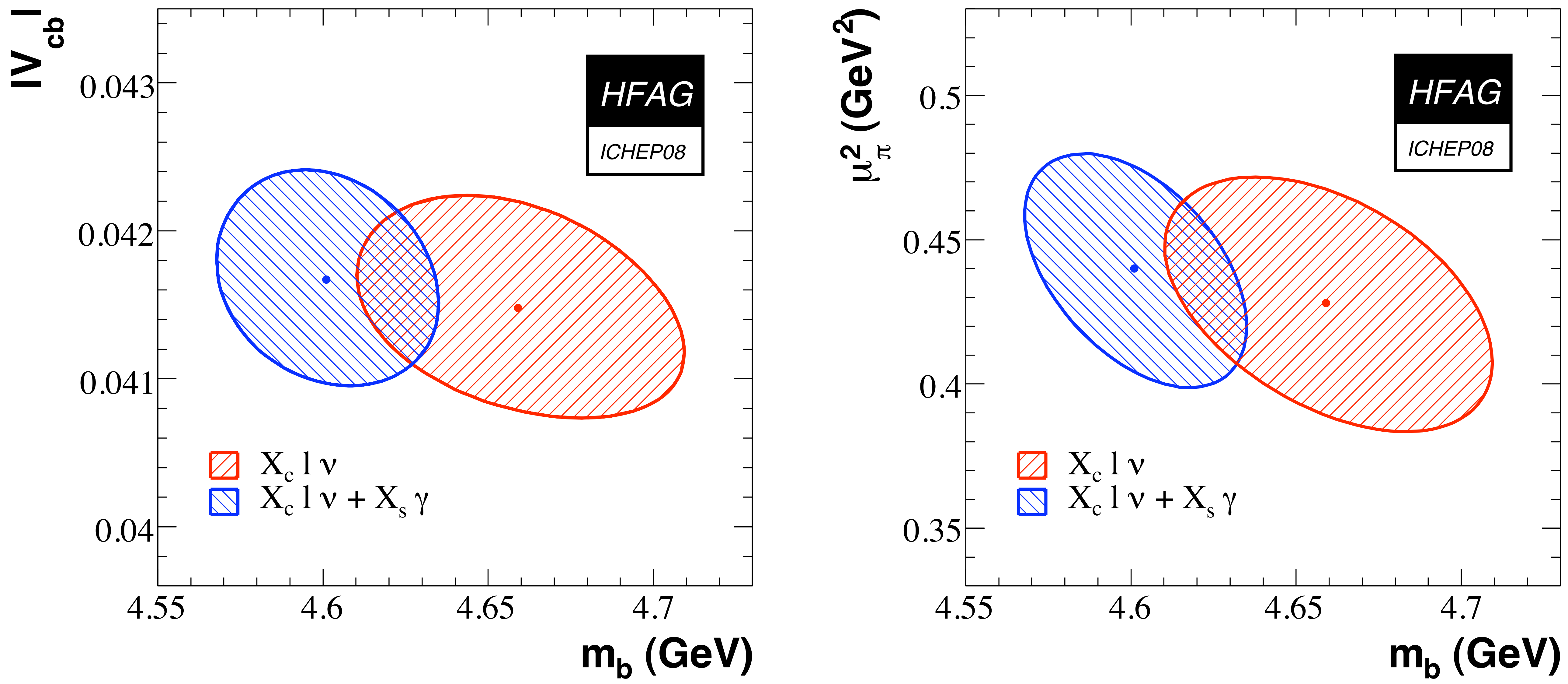
	$E_\gamma > 1.7$ GeV	$E_\gamma > 1.9$ GeV
$\mathcal{B}(B \to X_s\gamma)\ (\times 10^{-4})$	$3.31 \pm 0.19 \pm 0.37$	$3.66 \pm 0.85 \pm 0.60$
$\langle E_\gamma \rangle$ (GeV)	$2.281 \pm 0.032 \pm 0.053$	$2.289 \pm 0.058 \pm 0.027$
$\langle E_\gamma^2 \rangle - \langle E_\gamma \rangle^2$ (GeV^2)	$0.040 \pm 0.016 \pm 0.021$	$0.033 \pm 0.012 \pm 0.006$

Branching ratio for fully inclusive $B \to X_s\gamma$:



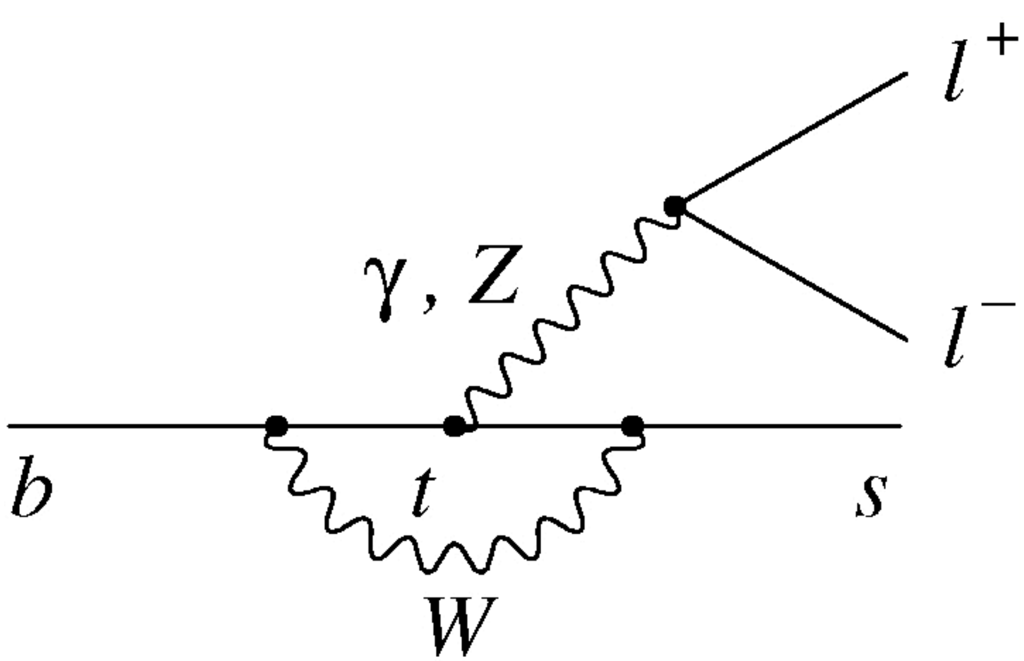
Consistent with SM expectations

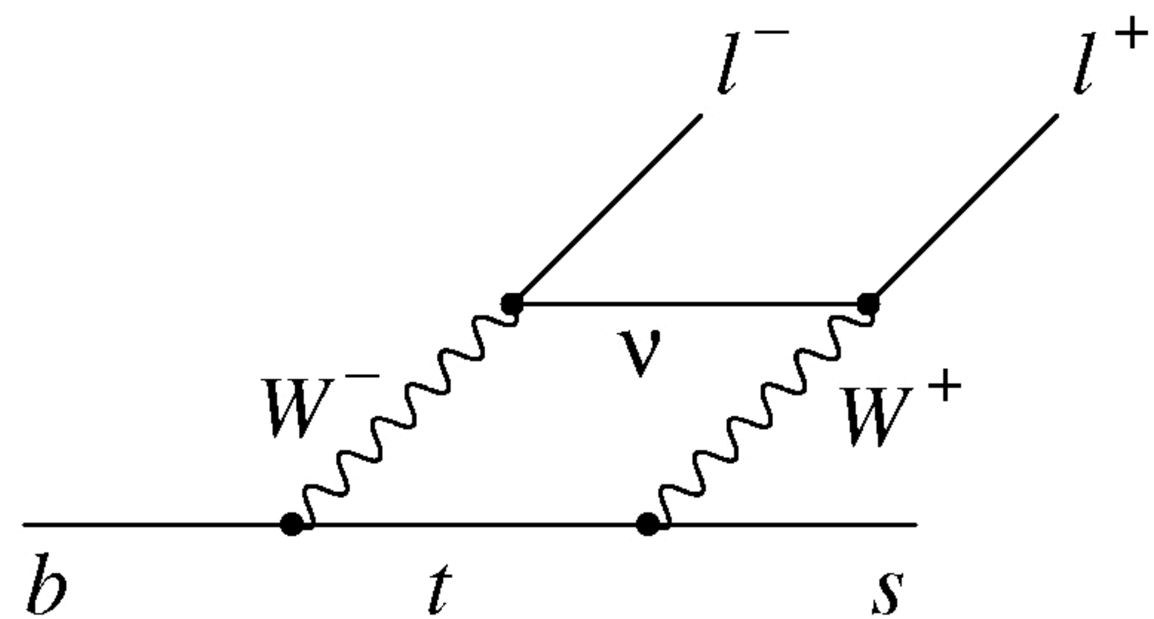
Photon spectrum moments from $B \to X_s\gamma$ contribute to determination of $|V_{cb}|$, *b*-quark mass, and mean squared momentum of the *b*-quark:



Operator product expansion for $b \to s l^+ l^-$:

$$\mathcal{H}_{\text{eff}} \propto \sum_{i=1}^{10} C_i \mathcal{O}_i$$





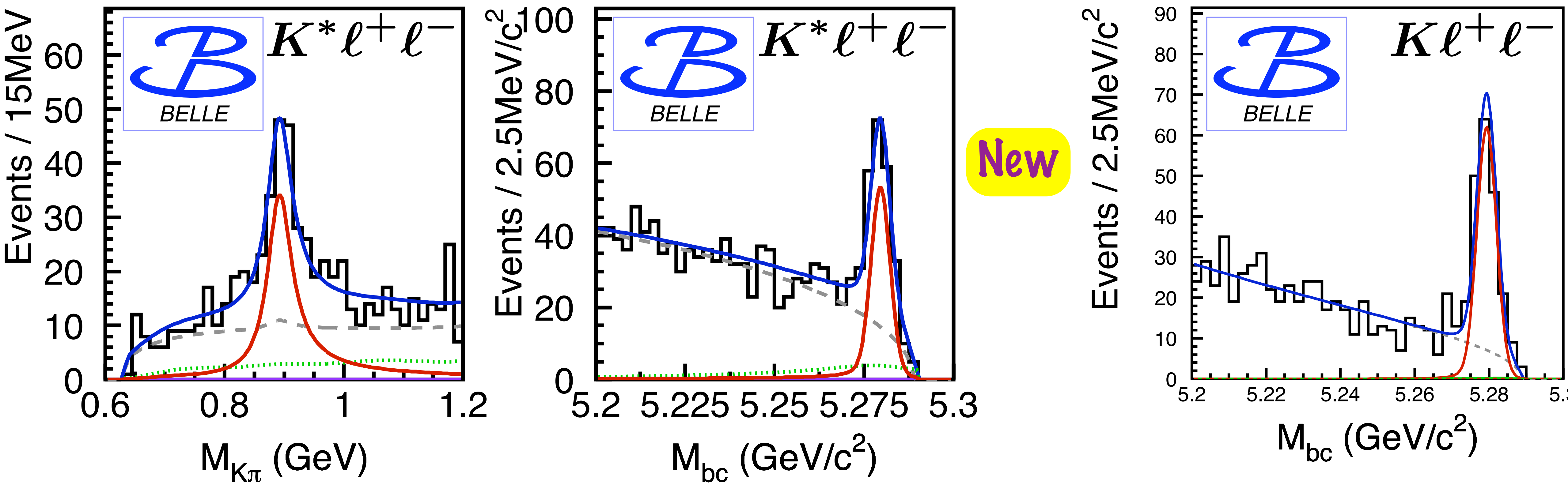
Short-distance Wilson coefficients:

$C_7^{\text{eff}} \approx 0.33$ from photon penguin

C_9^{eff} (C_{10}^{eff}) from vector (axial-vector) part of box

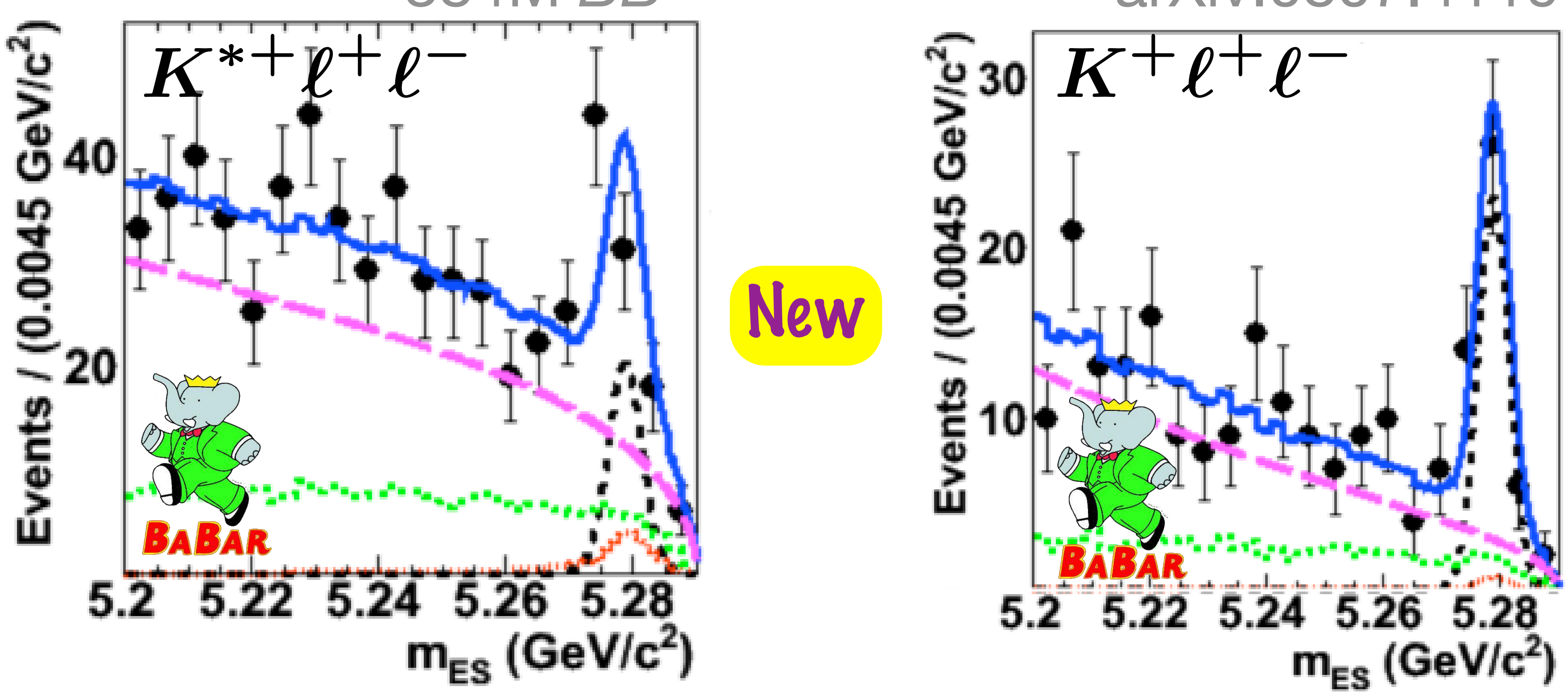
Branching ratios for $B \to K^{(*)} l^+ l^-$:

657M $B\bar{B}$ arXiv:0810.0335



New

384M $B\bar{B}$ arXiv:0807.4119



New

Branching ratios for $B \to K^{(*)} l^+ l^-$:

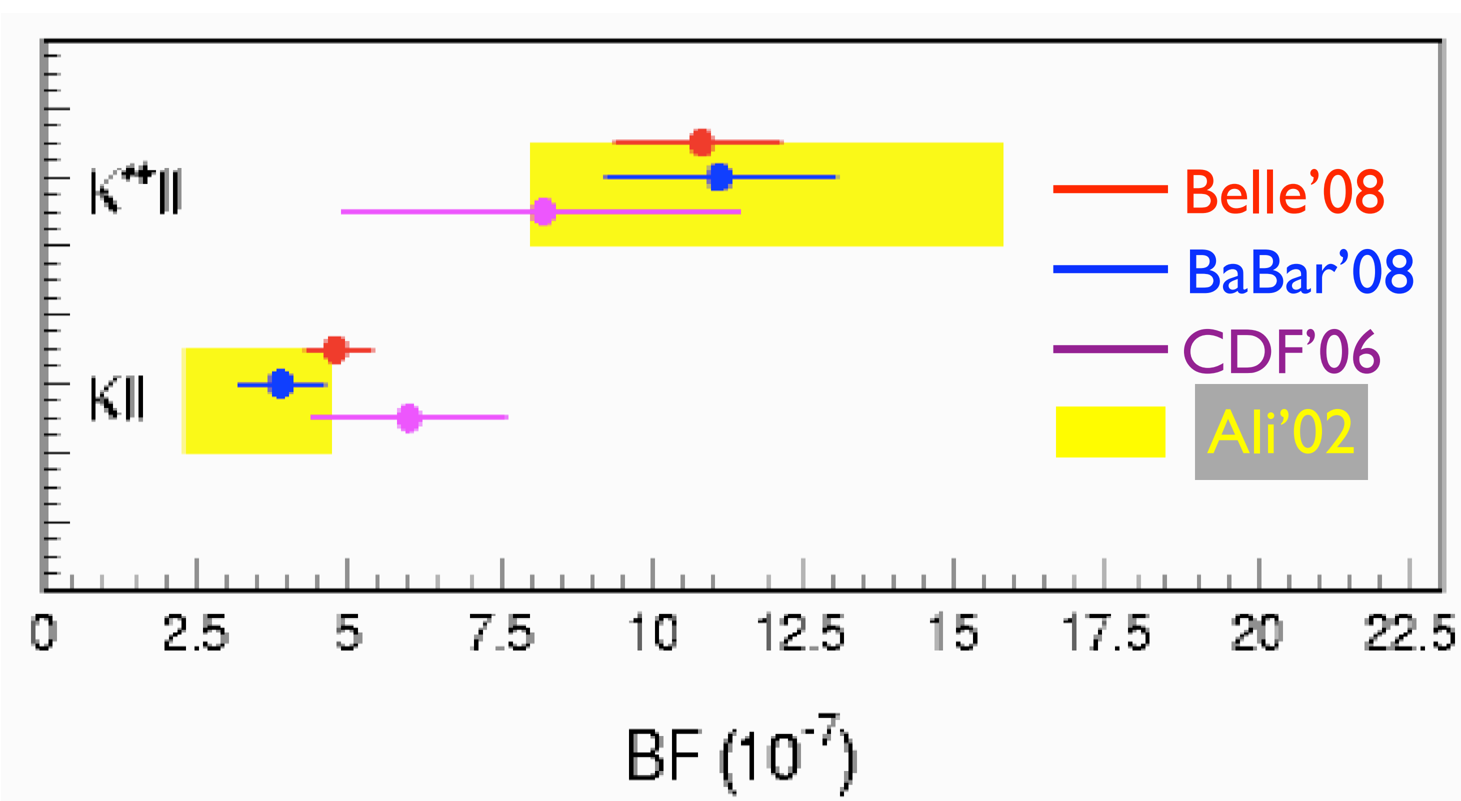
BELLE

657M $B\bar{B}$ New
arXiv:0810.0335 (2008)

BABAR

384M $B\bar{B}$ New
arXiv:0807.4119 (2008)

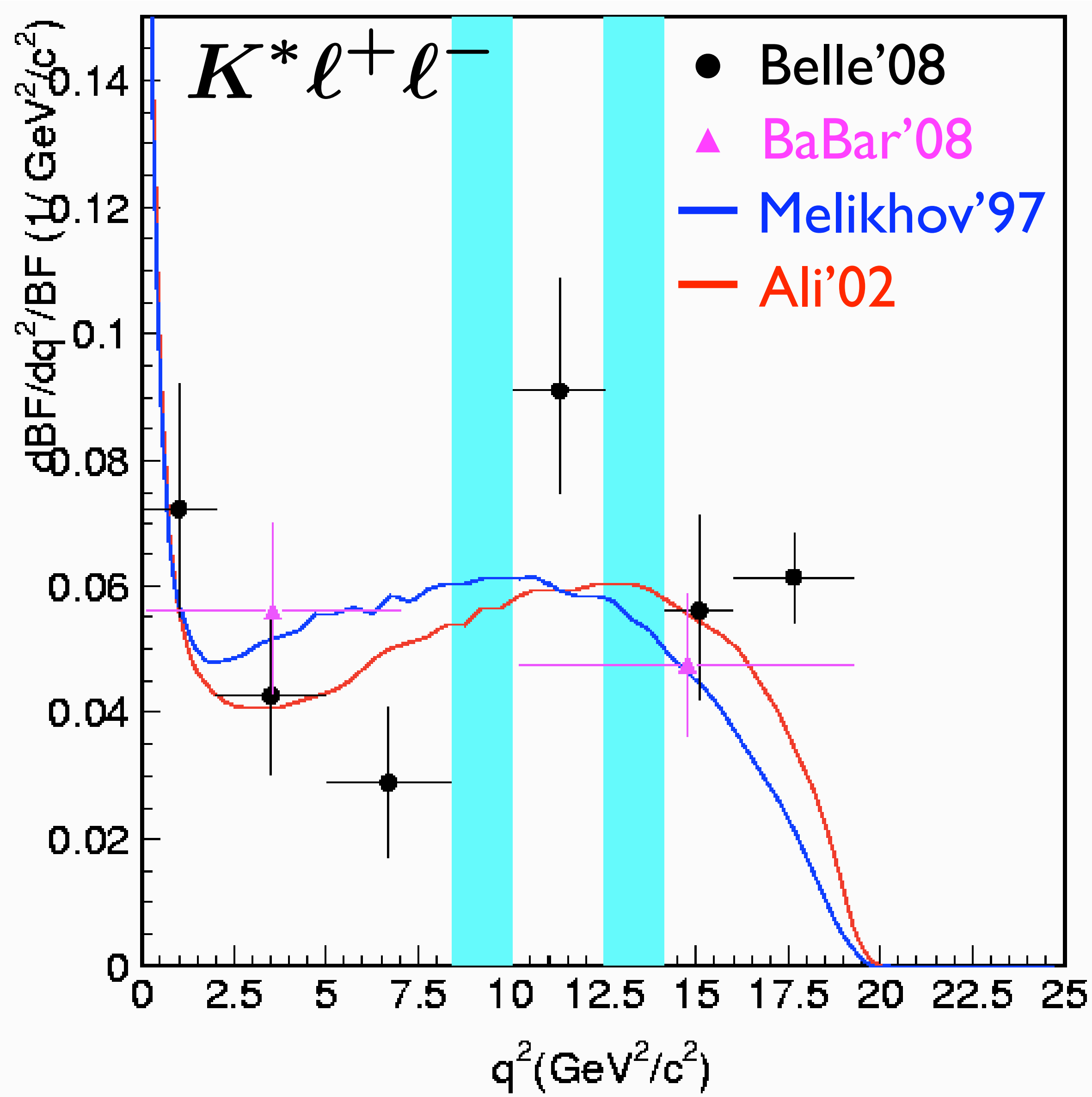
Mode	$\mathcal{B}(\times 10^{-7})$	$\mathcal{B}(\times 10^{-7})$
$K^* \ell^+ \ell^-$	$10.8 \pm 1.0 \pm 0.9$	$11.1 \pm 1.9 \pm 0.7$
$K \ell^+ \ell^-$	$4.8 \pm ^{0.5}_{0.4} \pm 0.3$	$3.9 \pm 0.7 \pm 0.2$

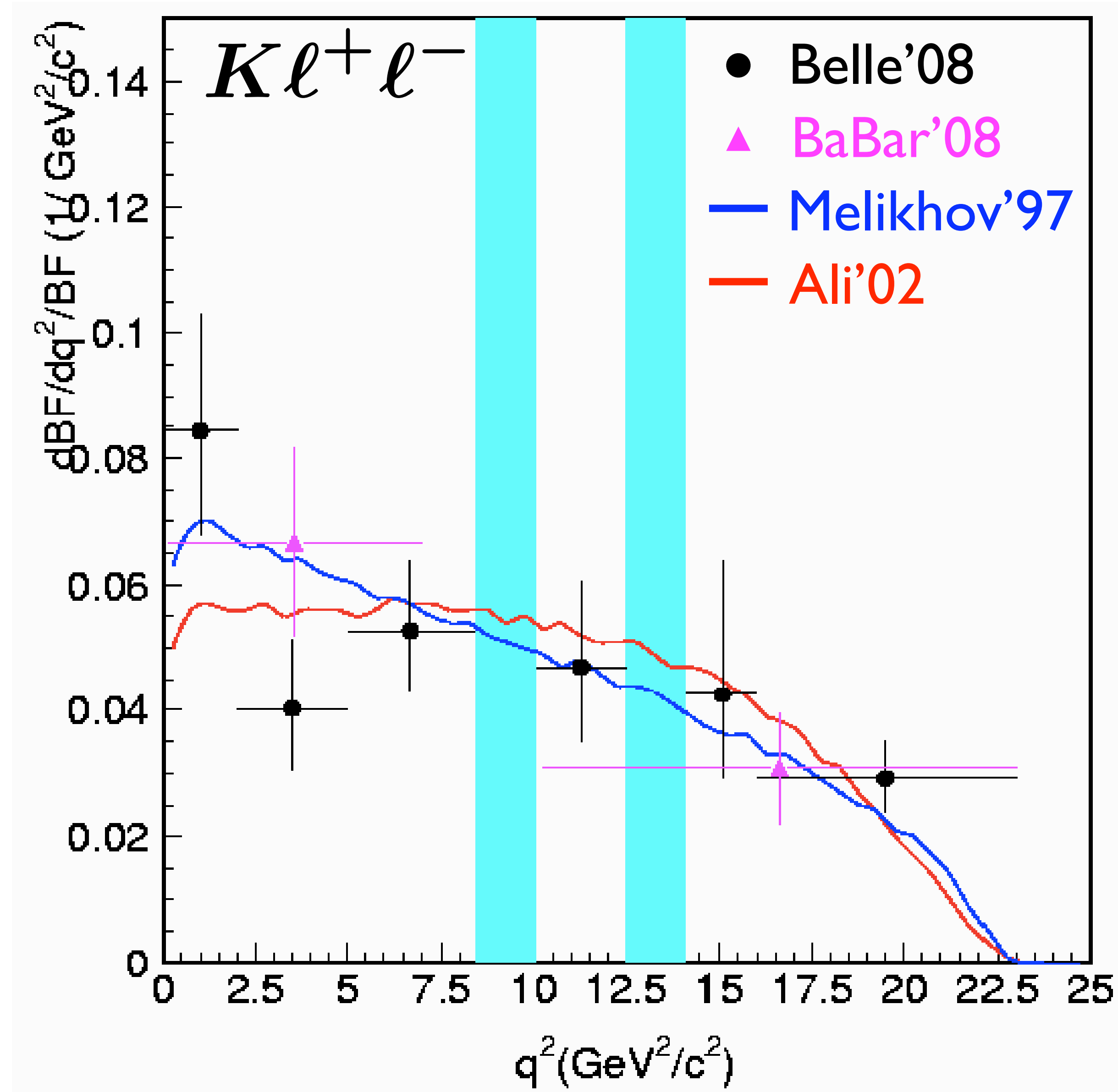


Consistent with SM expectations

Ali et al: PRD 66, 034002 (2002)
Zhong et al: IJMO A18, 1959 (2003)

q^2 distributions in $B \to K^{(*)} l^+ l^-$:





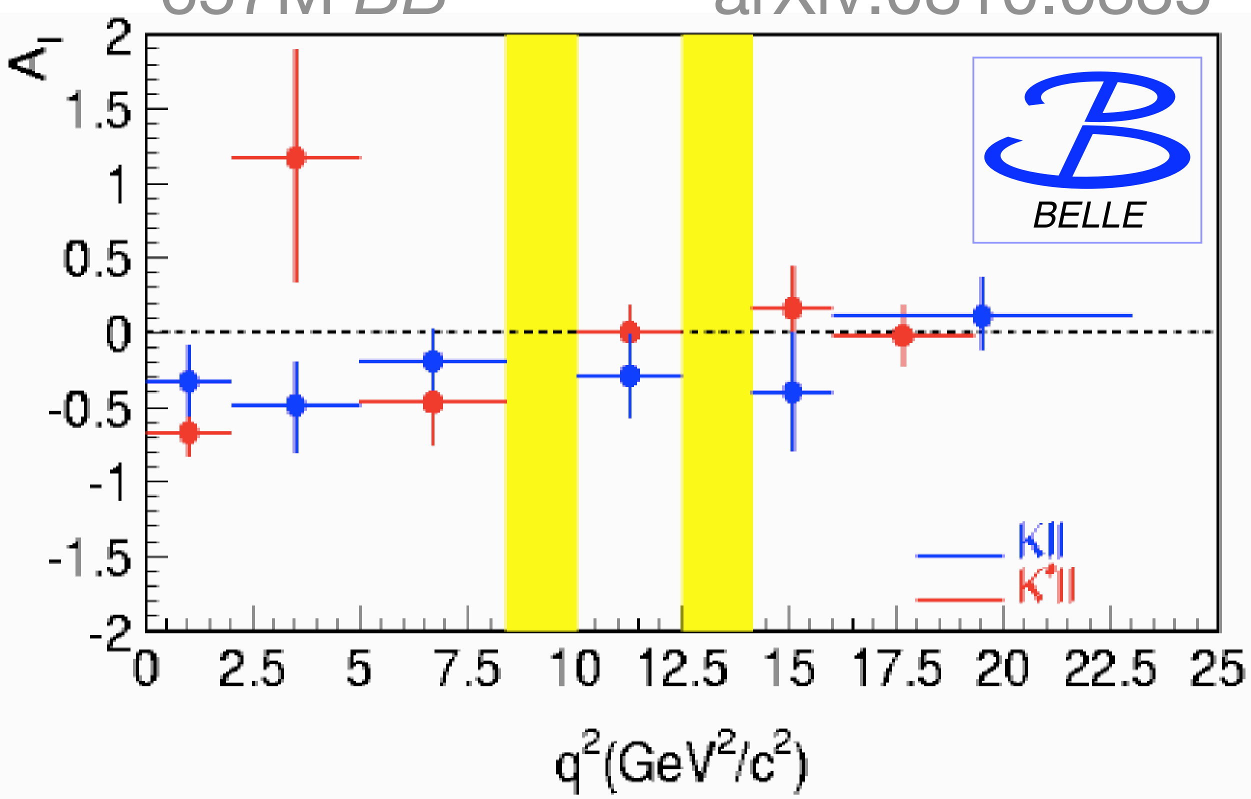
Consistent with SM expectations

Ali et al: PRD 66, 034002 (2002)
Melikhov et al: PLB 410, 290 (1997)

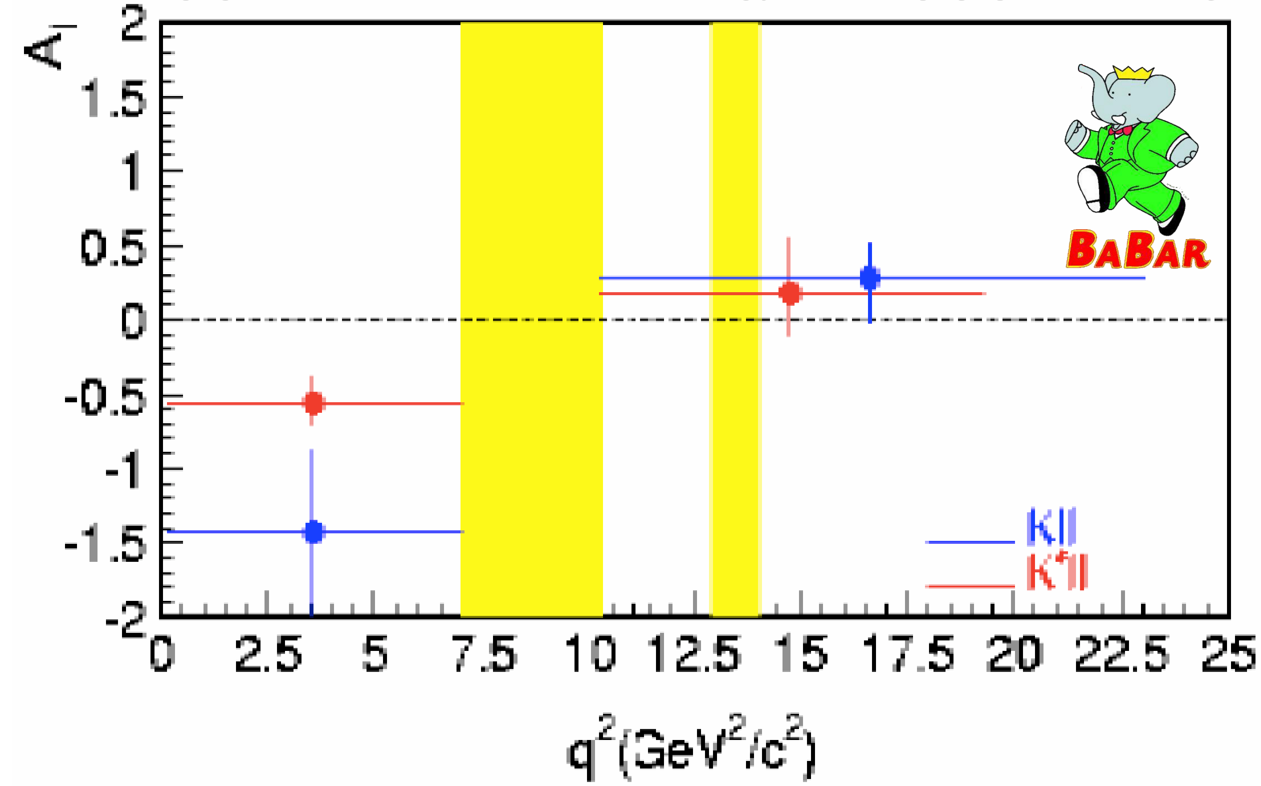
Isospin asymmetry in $B \to K^{(*)} l^+ l^-$:

$$A_I = \frac{1.071\,\mathcal{B}(K^{(*)0}\ell\ell) - \mathcal{B}(K^{(*)\pm}\ell\ell)}{1.071\,\mathcal{B}(K^{(*)0}\ell\ell) - \mathcal{B}(K^{(*)\pm}\ell\ell)}$$

657M $B\bar{B}$ arXiv:0810.0335

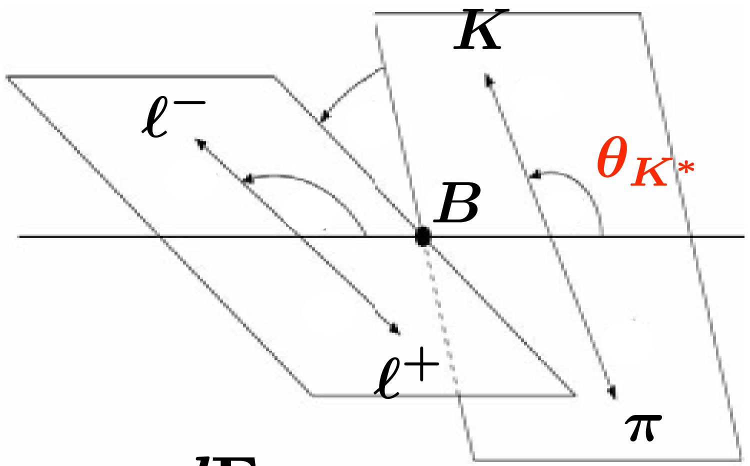


384M $B\bar{B}$ arXiv:0807.4119



Mode	BELLE all q^2	BABAR all q^2
$K^*\ell\ell$	$-\ 0.29 \pm 0.16 \pm 0.03$	$-\ 0.12 \pm ^{0.18}_{0.16} \pm 0.04$
$K\ell\ell$	$-\ 0.31 \pm ^{0.17}_{0.14} \pm 0.05$	$-\ 0.37 \pm ^{0.27}_{0.34} \pm 0.04$
$K^{(*)}\ell\ell$	$-\ 0.30 \pm ^{0.12}_{0.11} \pm 0.04$	$-\ 0.18 \pm 0.15 \pm 0.03$

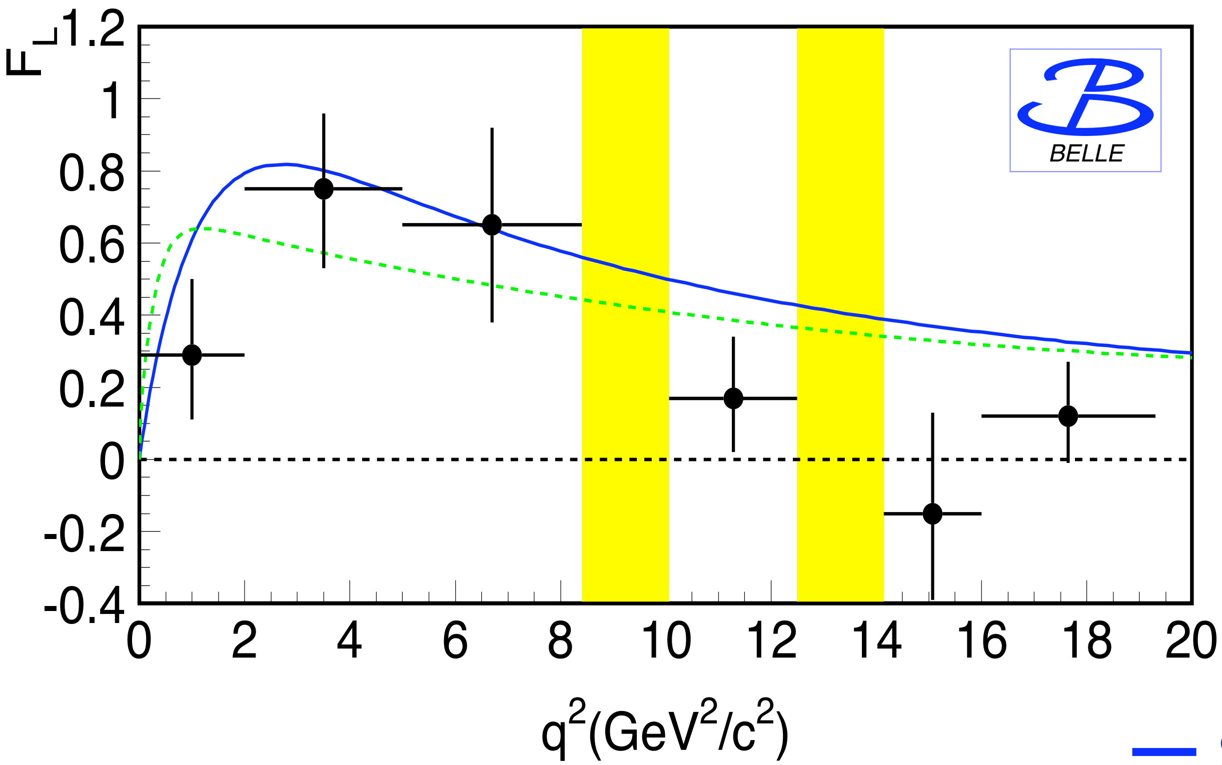
K^* longitudinal polarization in $B \to K^* l^+ l^-$:



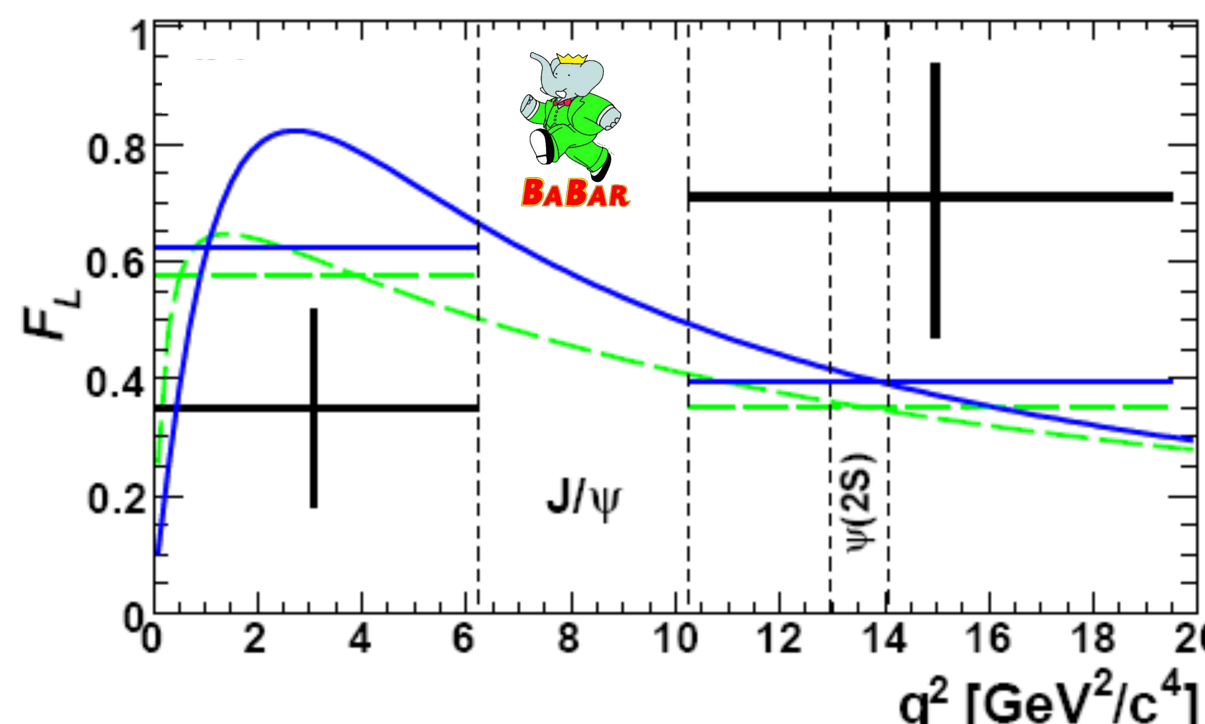
Extracted from angular fit to θ_{K^*} in each q^2 bin.

$$\frac{d\Gamma}{d\cos\theta_{K^*}} = \frac{3}{2} F_L \cos^2\theta_{K^*} + \frac{3}{4}(1 - F_L)\sin^2\theta_{K^*}$$

657M $B\bar{B}$ arXiv:0810.0335



384M $B\bar{B}$ arXiv:0804.4412

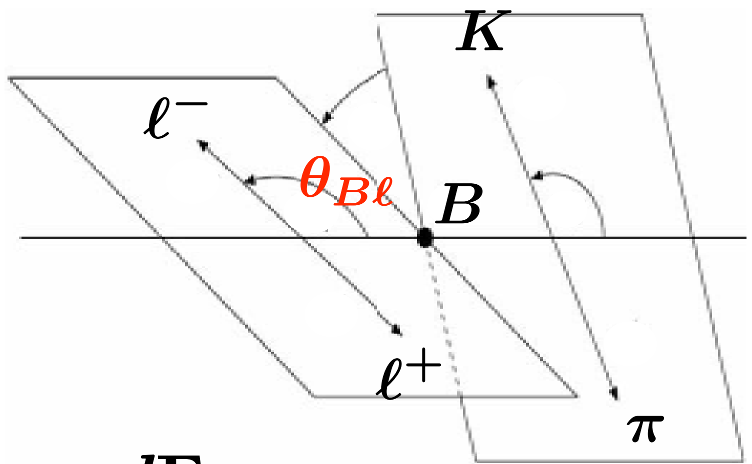


— Standard Model

— $C_7 = -C_7^{SM}$

Kruger and Matias: PRD 71, 094009 (2005)

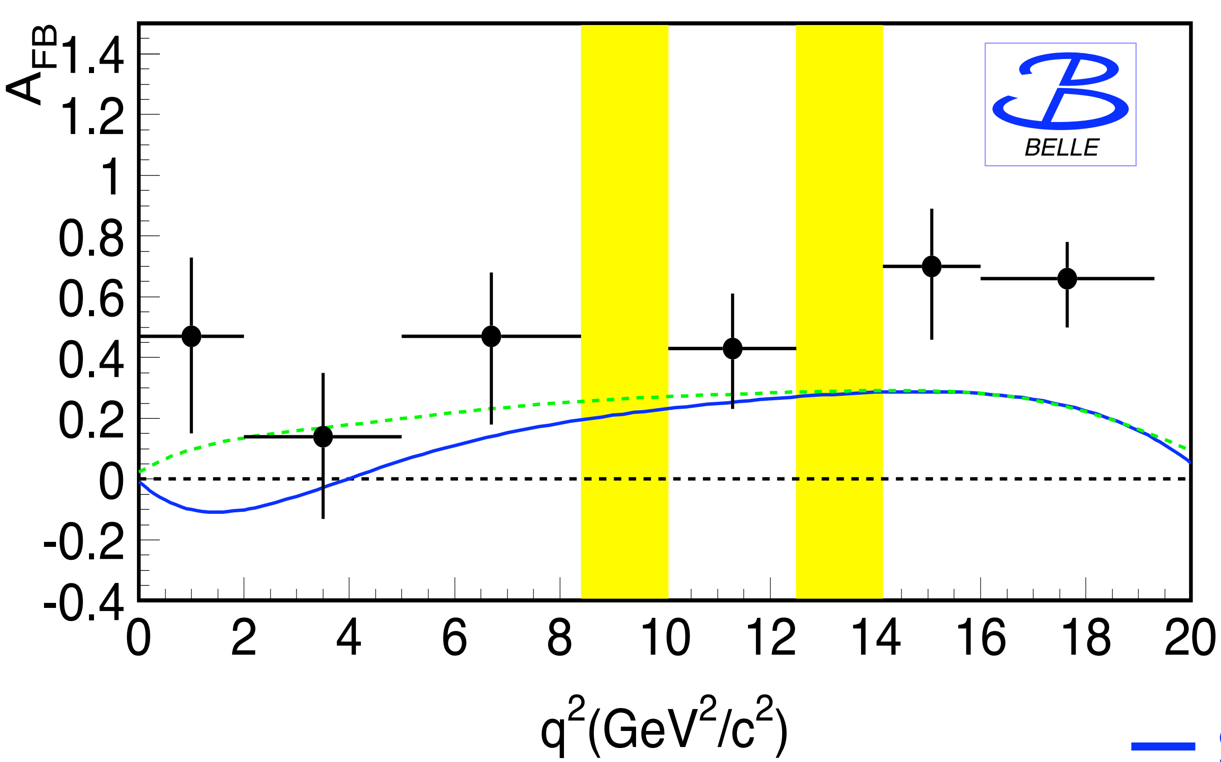
Forward-backward asymmetry in $B \to K^* l^+ l^-$:



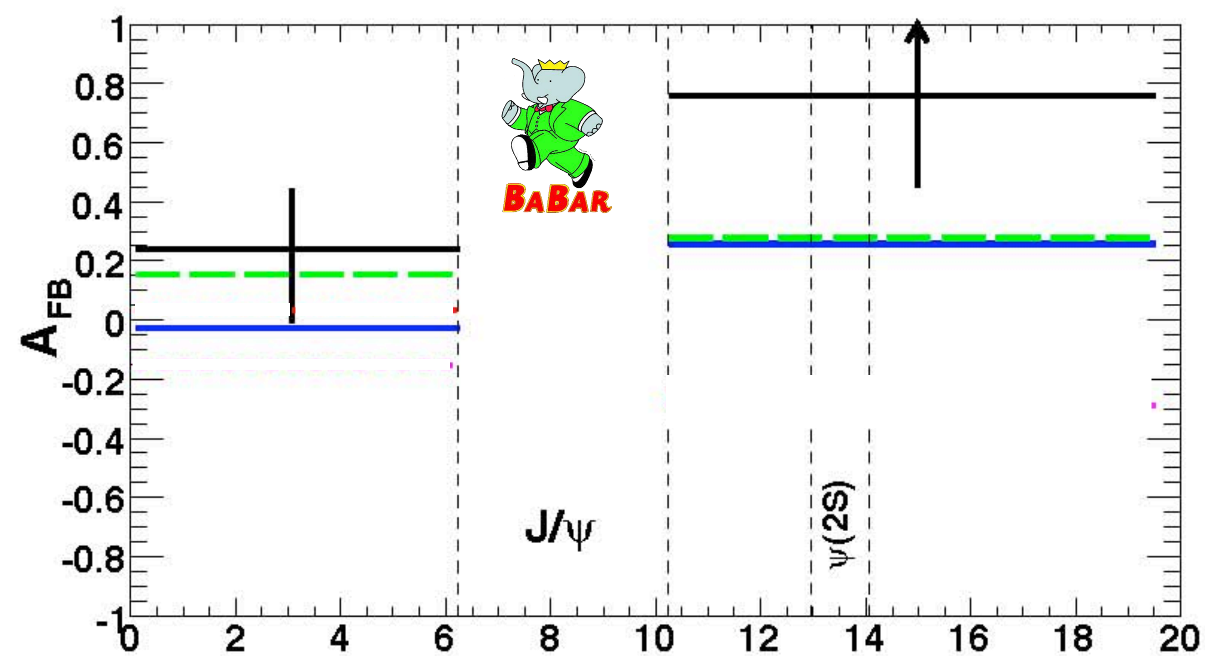
Extracted from angular fit to $\theta_{B\ell}$ in each q^2 bin.

$$\frac{d\Gamma}{d\cos\theta_{B\ell}} = \frac{3}{4}F_L \sin^2\theta_{B\ell} + \frac{3}{8}(1-F_L)(1+\cos^2\theta_{K^*}) + A_{FB}\cos\theta_{B\ell}$$

657M $B\bar{B}$ arXiv:0810.0335



384M $B\bar{B}$ arXiv:0804.4412

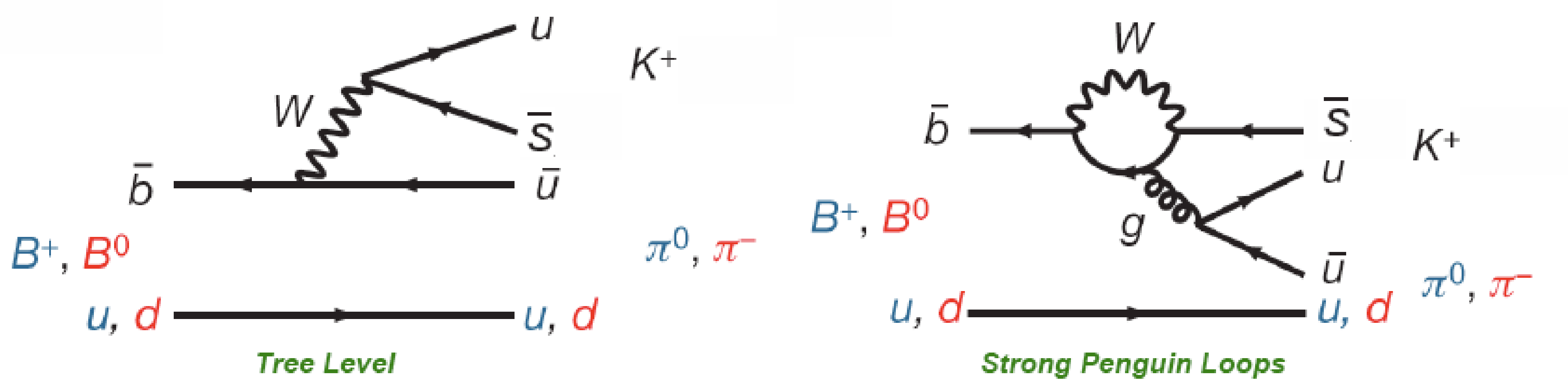


— Standard Model

— $C_7 = -C_7^{SM}$

Kruger and Matias: PRD 71, 094009 (2005)

Hadronic Rare B: Direct CP violation in $B \to K\pi$



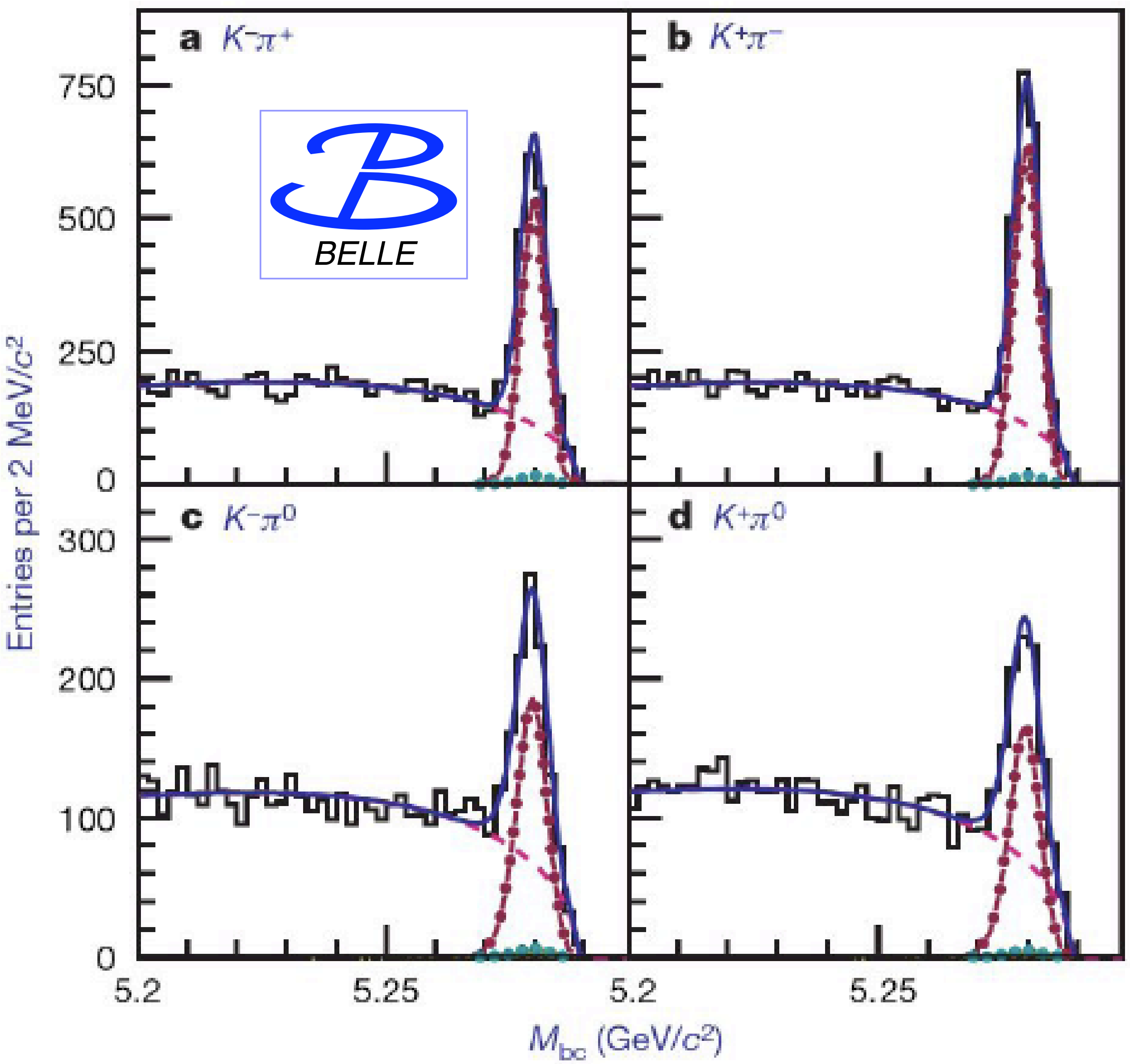
$$\Delta\mathcal{A} \equiv \mathcal{A}_{K^{\pm}\pi^{0}} - \mathcal{A}_{K^{\pm}\pi^{\mp}}$$

$$\mathcal{A}_{K^{\pm}\pi^{\mp}} \equiv \frac{N(\bar{B}^0 \to K^-\pi^+) - N(B^0 \to K^+\pi^-)}{N(\bar{B}^0 \to K^-\pi^+) + N(B^0 \to K^+\pi^-)}$$

- Standard Model predicts $\Delta A = 0$

ΔA puzzle in $B \to K\pi$

Nature 452, 332 (2008)



M_{bc} Projections for 535×10^6 BB pairs (*Belle: Nature 452, 332 (2008)*).

$A(B\to K^+\pi^-)$	
-0.107 ± 0.016 ± 0.006	▪BaBar
-0.094 ± 0.018 ± 0.008	▪Belle
-0.086 ± 0.023 ± 0.009	▪CDF
-0.04 ± 0.16 ± 0.02	▪CLEO
☞ **-0.098 ± 0.012 at 8.1σ**	▪**AVG**
$A(B\to K^+\pi^0)$	
+0.030 ± 0.039 ± 0.010	▪BaBar
+0.07 ± 0.03 ± 0.01	▪Belle
-0.29 ± 0.23 ± 0.02	▪CLEO
☞ **0.050 ± 0.025 at 2.0σ**	▪**AVG**

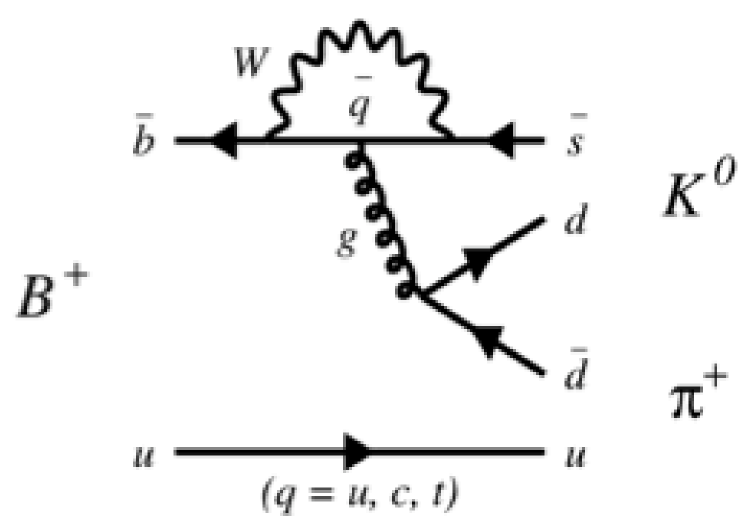
☞ **ΔA=-0.147 ± 0.028 at 5.3σ**

Model independent checks for New Physics

M. Gronau, PLB 627, 82 (2005); D. Atwood & A. Soni, Phys. Rev. D 58, 036005(1998).

$$\mathcal{A}_{CP}(K^+\pi^-) + \mathcal{A}_{CP}(K^0\pi^+)\frac{\mathcal{B}(K^0\pi^+)}{\mathcal{B}(K^+\pi^-)}\frac{\tau_0}{\tau_+} = \mathcal{A}_{CP}(K^+\pi^0)\frac{2\mathcal{B}(K^+\pi^0)}{\mathcal{B}(K^+\pi^-)}\frac{\tau_0}{\tau_+} + \mathcal{A}_{CP}(K^0\pi^0)\frac{2\mathcal{B}(K^0\pi^0)}{\mathcal{B}(K^+\pi^-)}$$

$B^+ \to K^0 \pi^+$



$A_{cp}(K^0\pi^+) \sim 0$

World Average

$A_{cp}(K^0\pi^+) = 0.009 \pm 0.025$

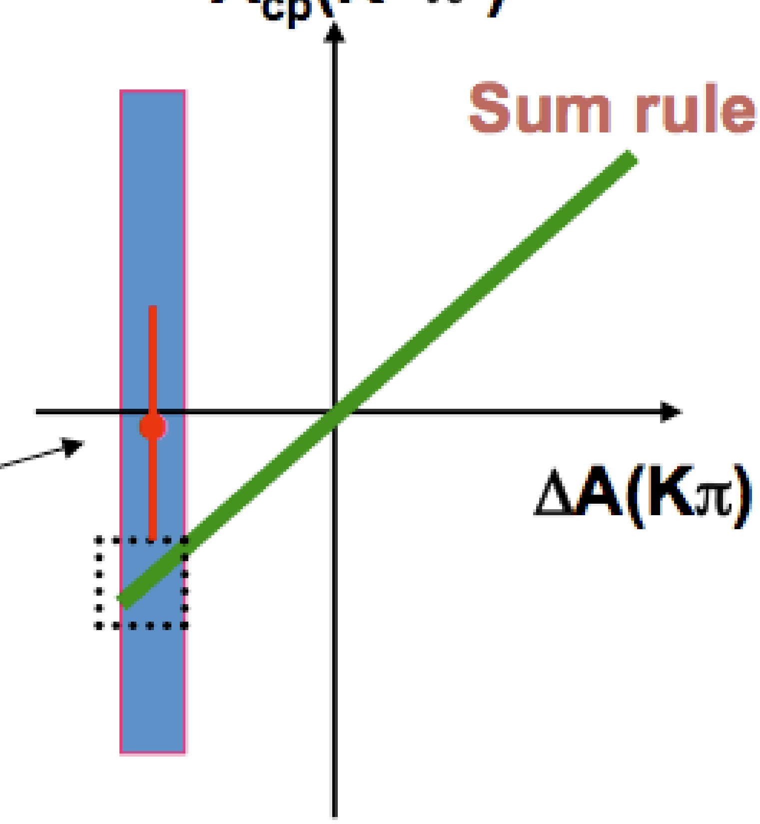
$B^0 \to K^0 \pi^0$ **New**

A = -0.13 ± 0.13 ± 0.03

A = +0.14 ± 0.13 ± 0.06

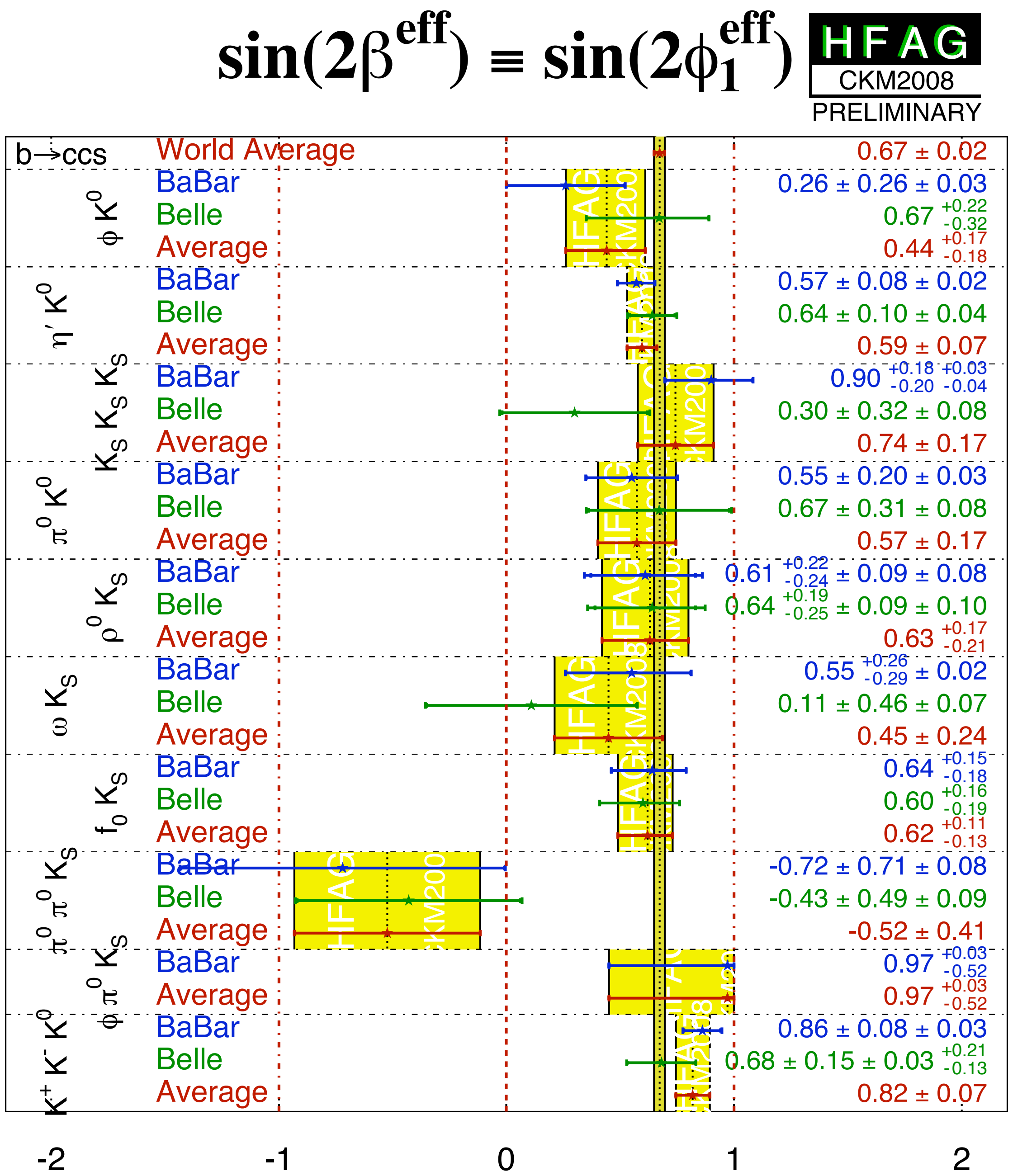
HFAG AVG: -0.01 ± 0.10

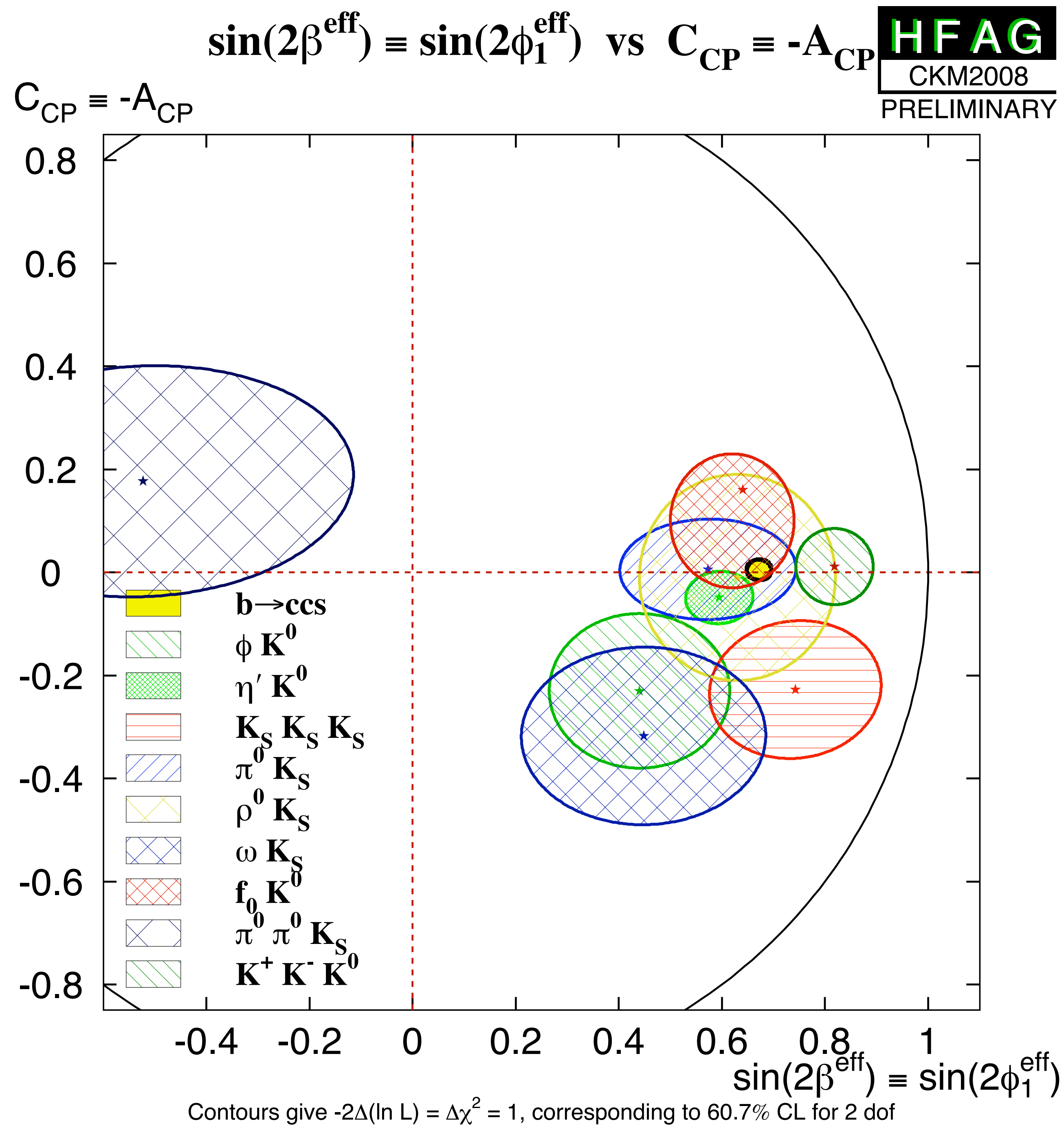
Important topic for Super B factory



Sum rule predicts
$A_{cp}(K^0\pi^0) = -0.151 \pm 0.043$

Time-dependent *CP* asymmetry in $b \to s q \bar{q}$:

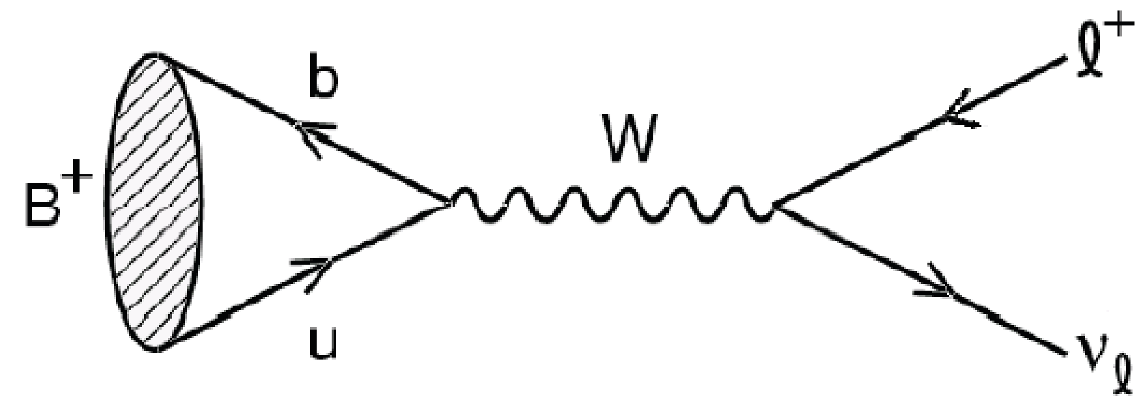




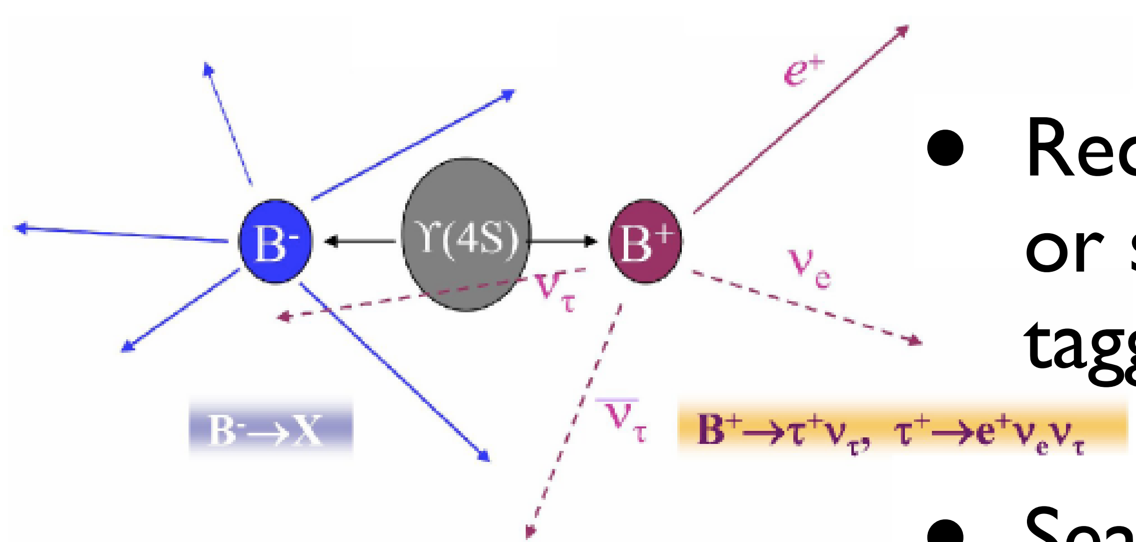
For details please check K.F Chen’s Talk

Leptonic B decays: $B \to \tau\nu$

- Leptonic decay through W annihilatio
- Decay rate related to |Vub| and fB

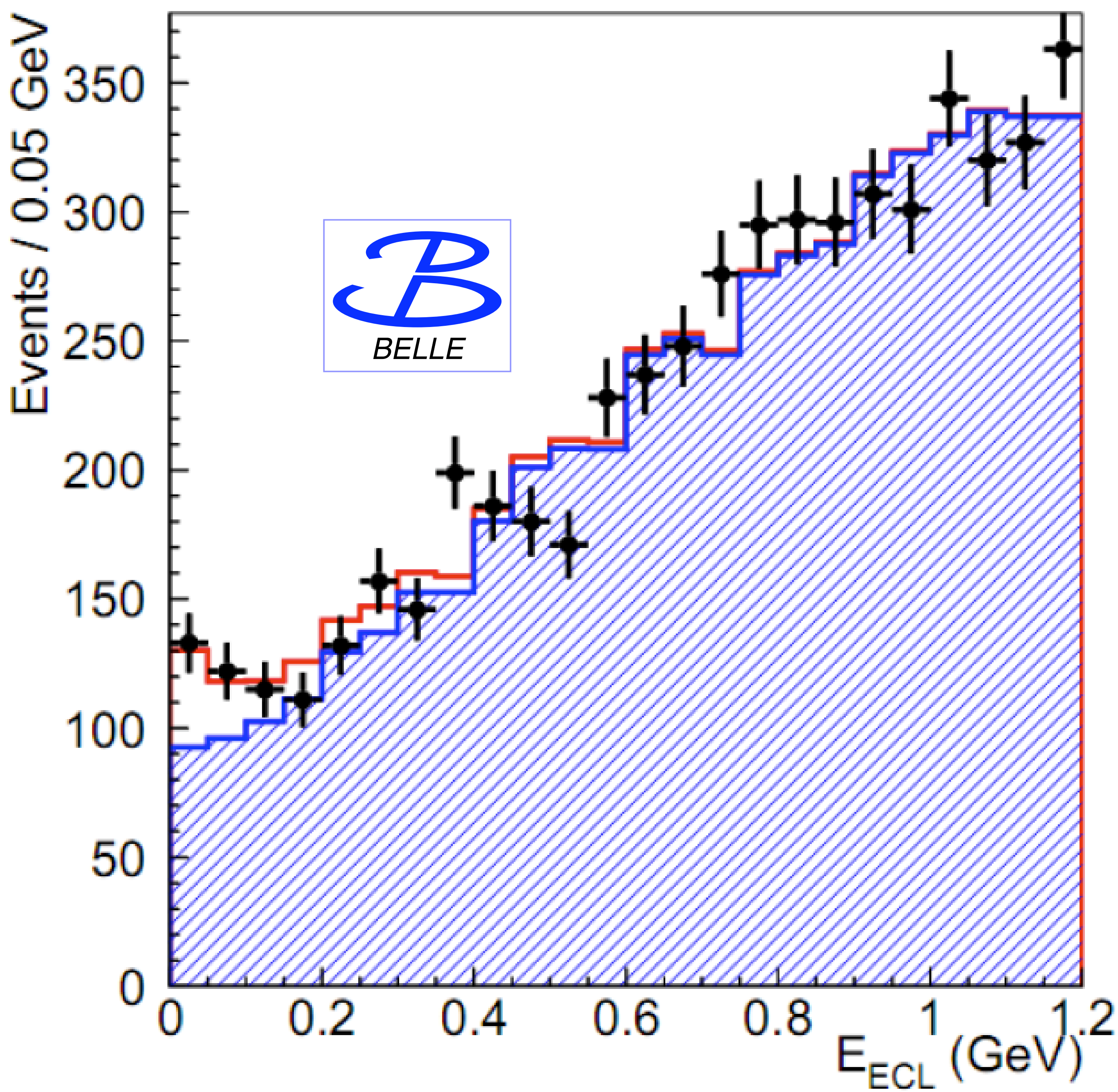


$$\mathcal{B}(B \to \ell\nu) = \frac{G_F^2 m_B}{8\pi} m_\ell^2 (1 - \frac{m_\ell^2}{m_B^2})^2 f_B^2 |V_{ub}|^2 \tau_B$$



- Reconstruct either hadronic $B^- \to D^{*0}X^-$ or semi-leptonic $B^- \to D^0 l\nu X^-$ on the tagged side
- Search for recoil signal $B^+ \to \tau^+\nu_\tau$

Leptonic B decays: $B \to \tau\nu$



Preliminary

$$N_{sig} = 154^{+36}_{-35}(stat)^{+21}_{-22}(syst)$$

$$\mathcal{B}(B \to \tau\nu) = [1.65^{+0.38}_{-0.37}(stat)^{+0.35}_{-0.37}(syst)] \times 10^{-4}$$

Dominant systematic error for $\mathcal{B}(B \to \tau\nu)$:
BG MC Statistics (12%), Tagging Efficiency(12%)
Peaking BG Uncertainty (8%)

Consistent with previous Belle result with hadronic tags using 449×10^6 BB pairs

$$\mathcal{B}(B \to \tau\nu) = [1.79^{+0.56}_{-0.49}(stat)^{+0.46}_{-0.51}(syst)] \times 10^{-4}$$

1.4 σ from SM expectation from other experimental constraints

$$\mathcal{B}(B \to \tau\nu)_{SM} = [0.93^{+0.11}_{-0.12}] \times 10^{-4}$$

[CKMfitter http://ckmfitter.in2p3.fr/]

Leptonic B decays: $B \to \tau\nu$

- Charged Higgs contribution may enhance/reduce the branching ratio

$$\mathcal{B}(B \to \tau\nu) = \mathcal{B}(B \to \tau\nu)_{\text{SM}} \times r_H$$

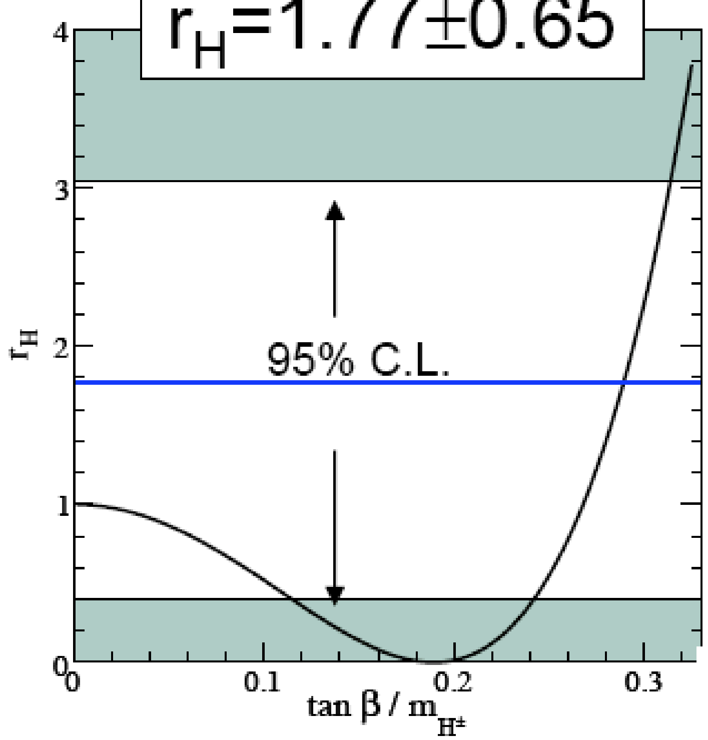
$$r_H = (1 - \frac{m_B^2}{m_H^2}\tan^2\beta)^2$$

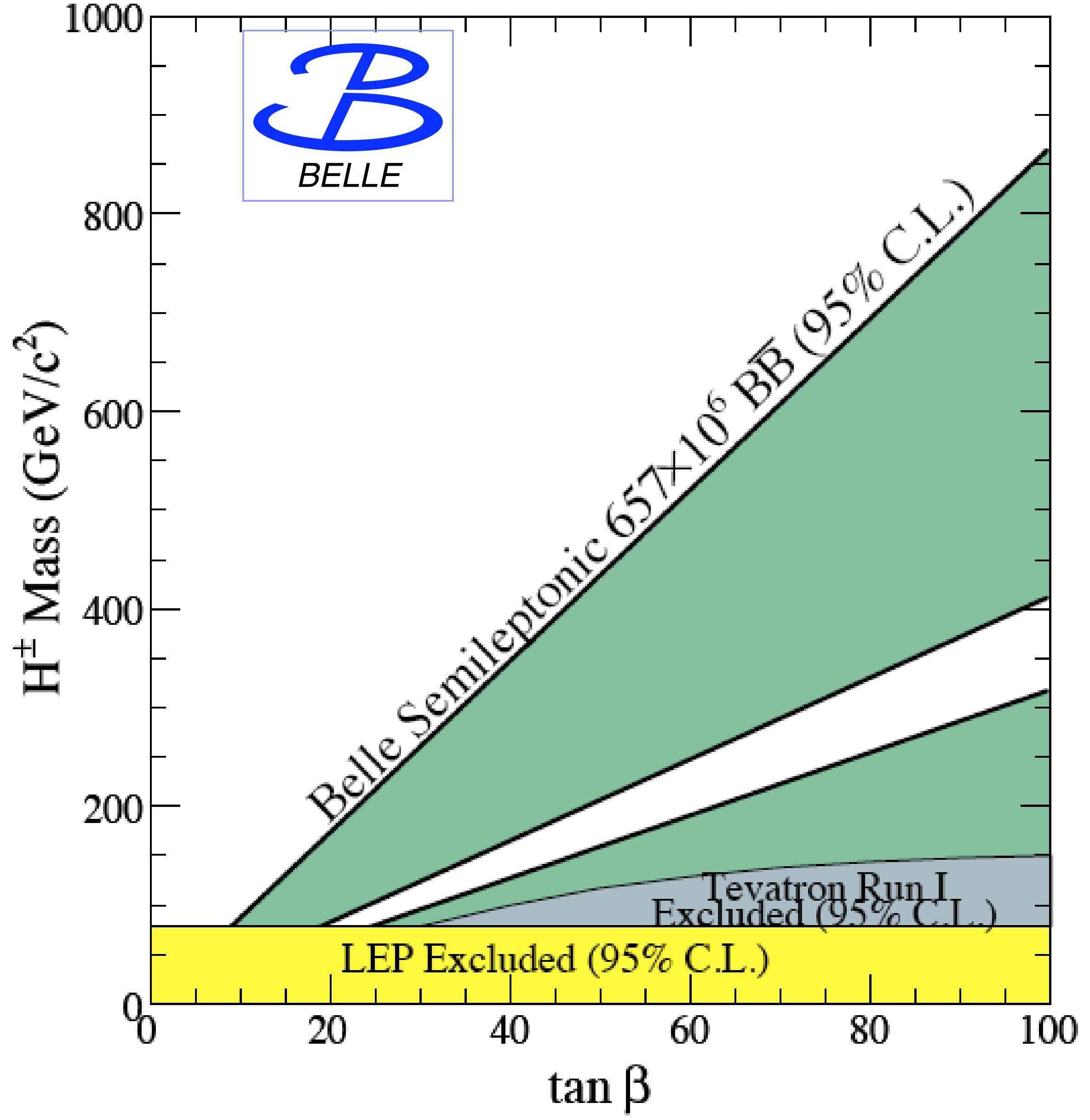
$$\mathcal{B}(B \to \tau\upsilon) = (1.65^{+0.38+0.35}_{-0.37-0.37}) \times 10^{-4}$$

$$\mathcal{B}(B \to \tau\upsilon)_{SM} = (0.93^{+0.12}_{-0.11}) \times 10^{-4}$$

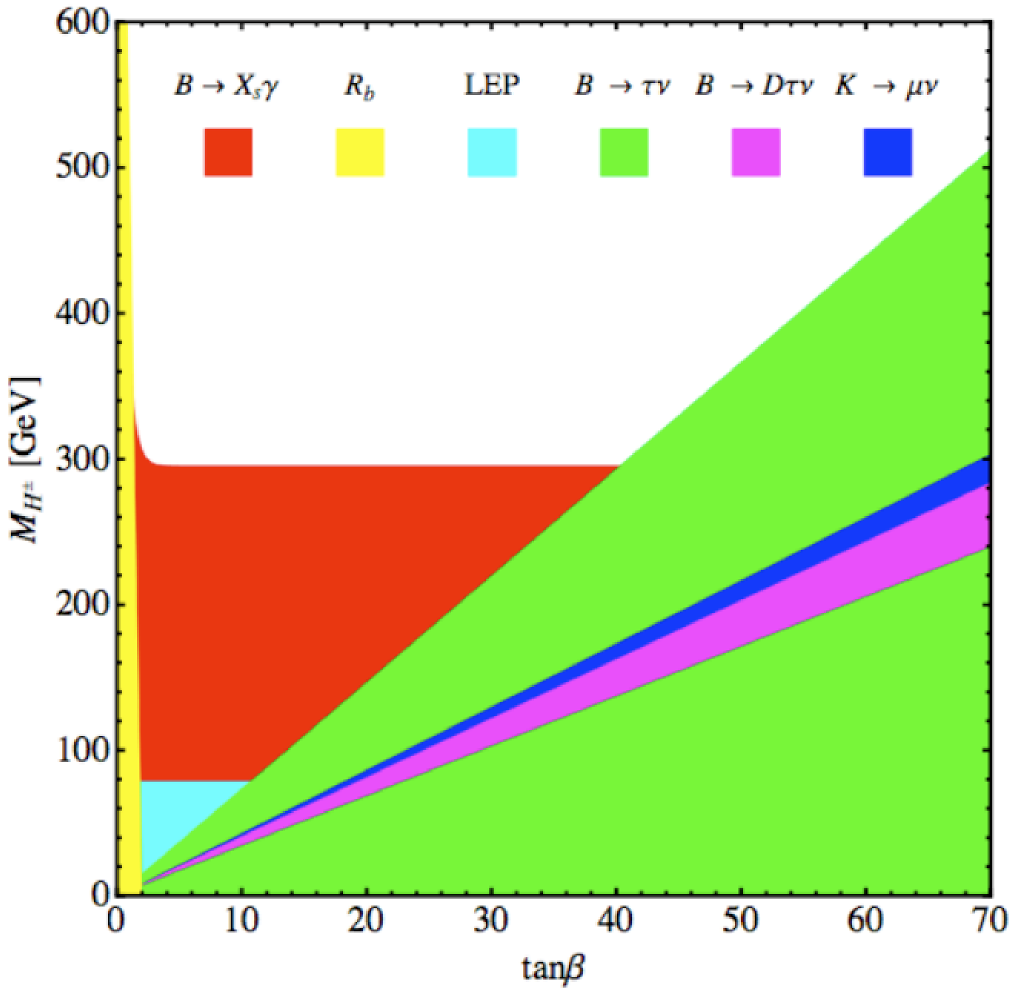
SM expectation from other experimental constraints by CKMfitter

$r_H = 1.77 \pm 0.65$





Leptonic B decays: $B \to \tau\nu$



[U.Haisch, arXiv:0805.2141]

Decay mode	BF[%]	signif.	Ref.
$B^0 \to D^{*-}\tau^+\nu_\tau$	$2.02^{+0.40}_{-0.37}(stat) \pm 0.37(syst)$	5.2σ	
	$1.11 \pm 0.51(stat) \pm 0.04(syst) \pm 0.04(norm)$	2.7σ	
$B^- \to D^{*0}\tau^+\nu_\tau$	$2.25 \pm 0.48(stat) \pm 0.22(syst) \pm 0.17(norm)$	5.3σ	
$B^0 \to \overline{D}^0\tau^+\nu_\tau$	$1.04 \pm 0.35(stat) \pm 0.15(syst) \pm 0.10(norm)$	3.3σ	
$B^- \to D^0\tau^+\nu_\tau$	$0.67 \pm 0.37(stat) \pm 0.11(syst) \pm 0.07(norm)$	1.8σ	

Belle [PRL 99, 191807 (2007)] BaBar [PRL 100, 021801 (2008)]

Conclusion

- Rare B decays are probing the Standard Model deeper and deeper for new Physics
- Need an order of magnitude more luminosity to pin down some of these NP effects
- Super B-factory will be advantageous for modes with photons and neutrinos which are sensitive to new physics

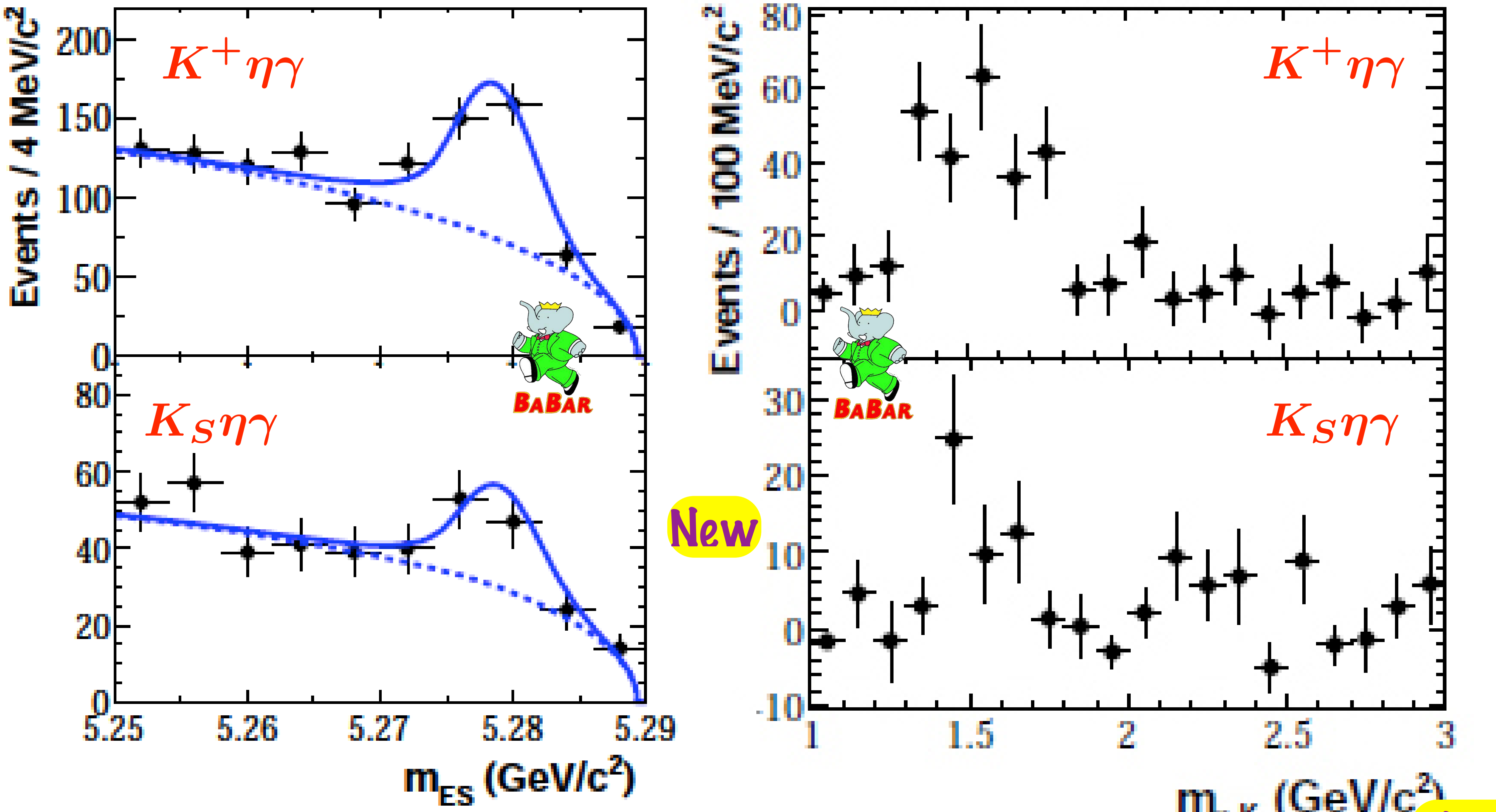
e^+e^- is advantageous in…	LHCb is advantageous in…
CPV in $B\to\phi K_S$, $\eta' K_S$,…	CPV in $B\to J/\psi K_S$
CPV in $B\to K_S\pi^0\gamma$	Most of B decays not including ν or γ
$B\to K\nu\nu$, $\tau\nu$, $D^{(*)}\tau\nu$	Time dependent measurements of B_S
Inclusive $b\to s\mu\mu$, *see*	$B_{(s,d)}\to\mu\mu$
$\tau\to\mu\gamma$ and other LFV	B_c and bottomed baryons
$D^0\overline{D}^0$ mixing	

Thank you all

(sorry if I missed your topics of interest)

I am indebted to Leo Piilonen, Paoti Chang, K. Hara and Iliya Osipenkov, from whose talks at ICHEP and BNL forum the material presented here was obtained.

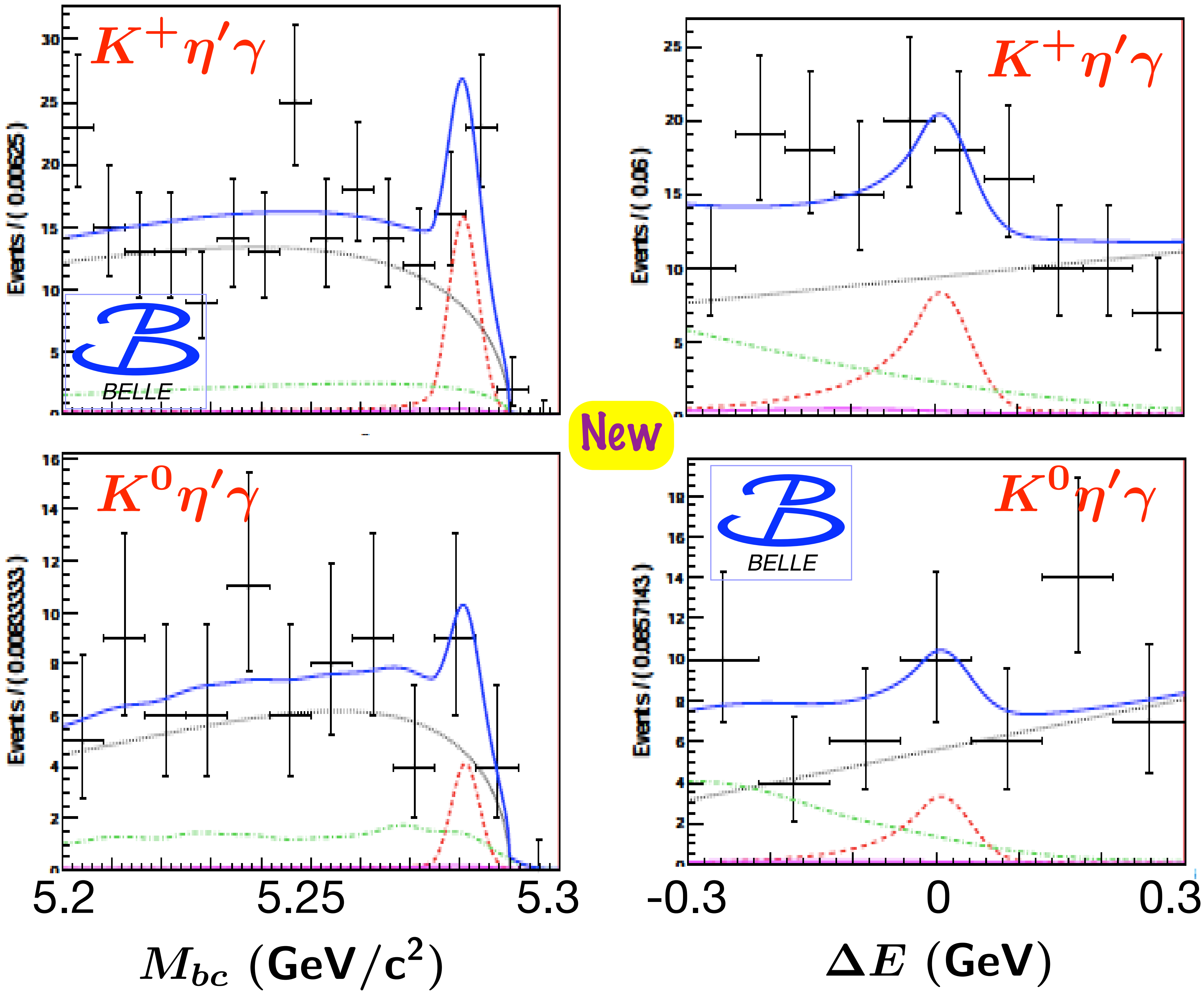
Branching ratios for $B \to K\eta\gamma$:



Mode	BELLE 275M BB PLB 610, 23 (2005)	BABAR 465M BB arXiv:0805.1317 (2008) New
	$\mathcal{B}(\times 10^{-6})$	$\mathcal{B}(\times 10^{-6})$
$K^0\eta\gamma$	$8.7 \pm ^{3.1}_{2.7} \pm ^{1.9}_{1.6}$	$7.1 \pm ^{2.1}_{2.0} \pm 0.4$
$K^+\eta\gamma$	$8.4 \pm 1.5 \pm ^{1.2}_{0.9}$	$7.7 \pm 1.0 \pm 0.4$

Branching ratios for $B \to K\eta'\gamma$:

657M $B\bar{B}$ arXiv:0810.0804



$\mathcal{S} = 3.3\sigma$

First evidence!

$\mathcal{S} = 1.3\sigma$

Branching ratios for $B \to K\eta'\gamma$:

	BELLE 657M $B\bar{B}$ arXiv:0810.0804 (2008)	BABAR 232M $B\bar{B}$ PRD 74, 031102 (2006)
Mode	$\mathcal{B}(\times 10^{-6})$	$\mathcal{B}(\times 10^{-6})$
$K^0\eta'\gamma$	$2.4 \pm^{2.4}_{0.9} \pm^{0.4}_{0.5}$	
	< 6.3	< 6.6
$K^+\eta'\gamma$	$3.2 \pm^{1.2}_{1.1} \pm 0.3$	< 4.2

90% confidence level upper limits

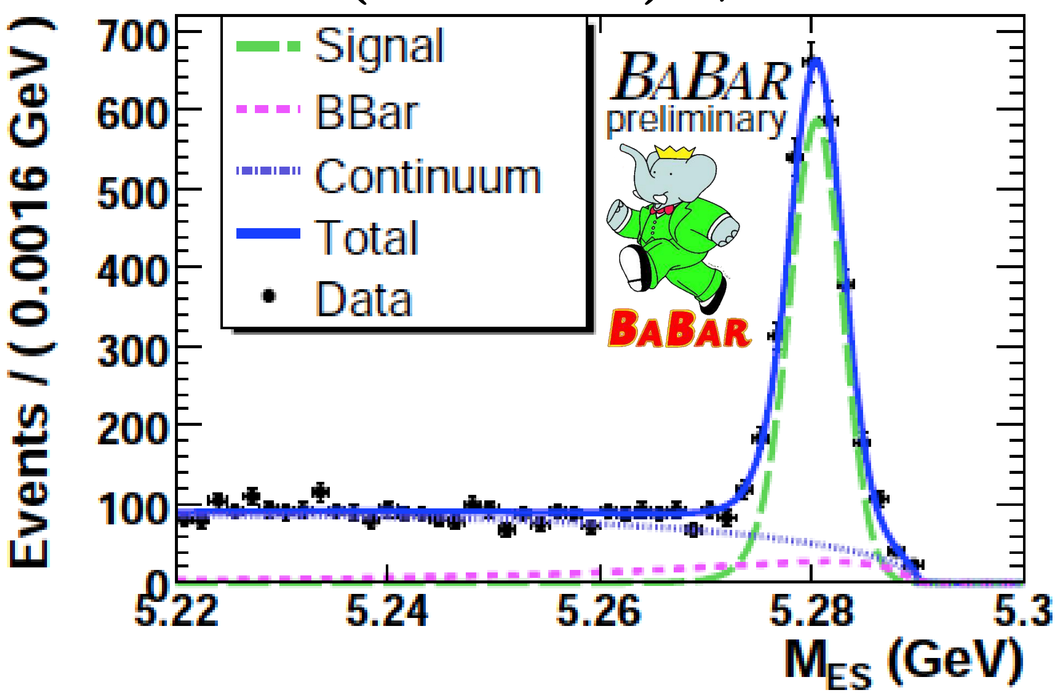
$B \to K\eta'\gamma$ may be suppressed relative to $B \to K\,\eta\,\gamma$ due to destructive interference of two penguin diagrams.

Lipkin: PLB 254, 247 (1991)

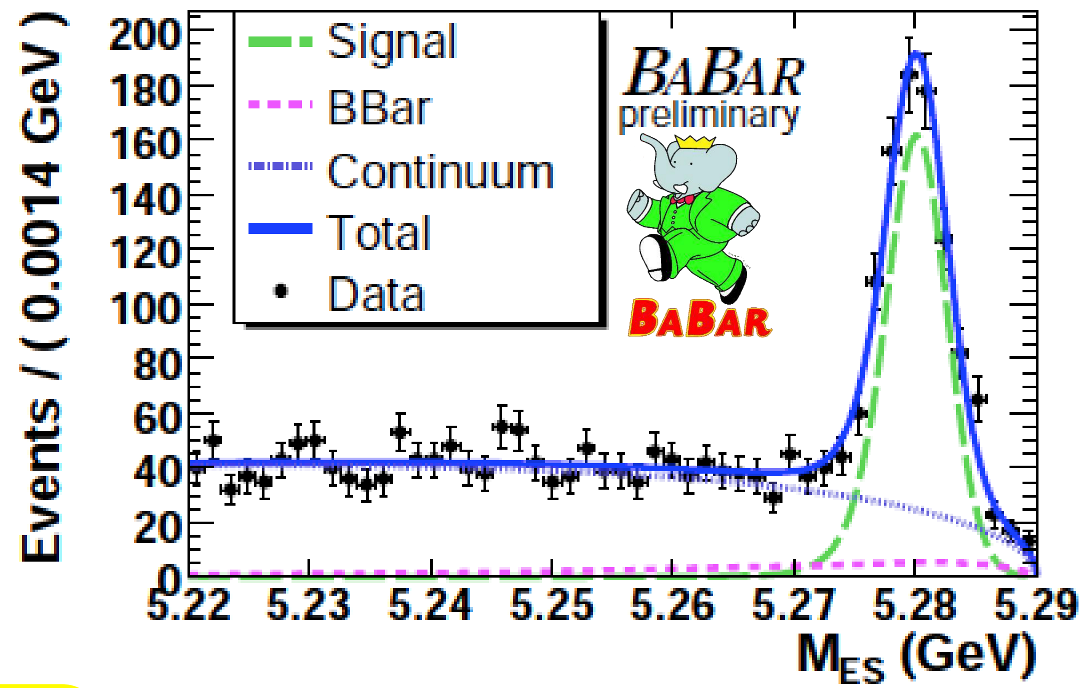
Branching ratios for $B \to K^*\gamma$:

383M $B\bar{B}$ arXiv:0808.1915

$K^{*0}(K^+\pi^-)\,\gamma$

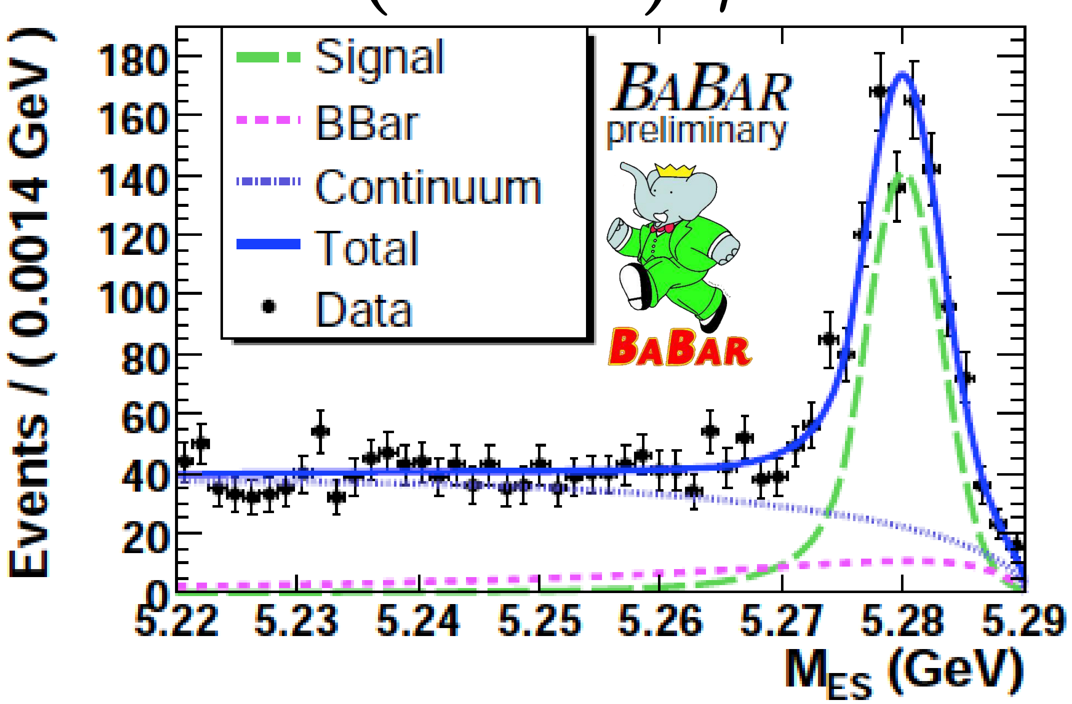


$K^{*+}(K_S\pi^+)\,\gamma$

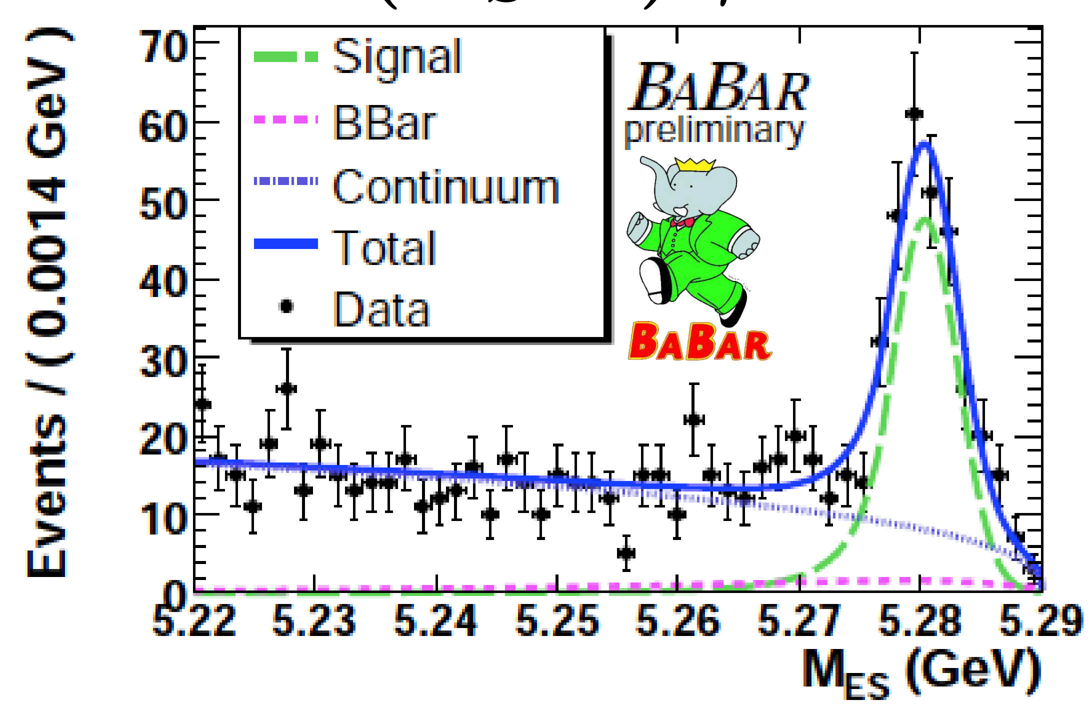


New

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



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



Branching ratios for $B \to K^*\gamma$:

	85M $B\bar{B}$ PRD 69, 112001 (2004)	New 383M $B\bar{B}$ arXiv:0808.1915 (2008)
Mode	$\mathcal{B}(\times 10^{-5})$	$\mathcal{B}(\times 10^{-5})$
$(K^+\pi^-)\,\gamma$	4.13 ± 0.22 ± 0.18	4.55 ± 0.11 ± 0.16
$(K_S\pi^0)\,\gamma$	2.57 ± 0.69 ± 0.20	5.01 ± 0.40 ± 0.37
$K^{*0}\,\gamma$	**4.01 ± 0.21 ± 0.17**	**4.58 ± 0.10 ± 0.16**
$(K^+\pi^0)\,\gamma$	4.19 ± 0.48 ± 0.28	5.05 ± 0.22 ± 0.27
$(K_S\pi^+)\,\gamma$	4.31 ± 0.41 ± 0.29	4.56 ± 0.20 ± 0.17
$K^{*+}\,\gamma$	**4.25 ± 0.31 ± 0.24**	**4.73 ± 0.15 ± 0.17**

Charge asymmetry (direct $\not{C}\not{P}$) in $B \to K^*\gamma$:

$$A_{CP} = \frac{\Gamma(\overline{B} \to \overline{K}^*\gamma) - \Gamma(B \to K^*\gamma)}{\Gamma(\overline{B} \to \overline{K}^*\gamma) + \Gamma(B \to K^*\gamma)}$$

BABAR

$$A_{CP} = -0.009 \pm 0.017 \pm 0.011$$

New

arXiv:0808.1915 (2008) 347M $B\overline{B}$

BELLE

$$A_{CP} = -0.015 \pm 0.044 \pm 0.012$$

PRD 69, 112001 (2004) 85M $B\overline{B}$

... consistent with SM expectation of $A_{CP} < 0.01$

Greub, Simma, Wyler: Nucl Phys B 434, 39 (1995)

Isospin asymmetry in $B \to K^*\gamma$:

$$\Delta_{0+} = \frac{\Gamma(B^0 \to K^{*0}\gamma) - \Gamma(B^+ \to K^{*+}\gamma)}{\Gamma(B^0 \to K^{*+}\gamma) + \Gamma(B^+ \to K^{*+}\gamma)}$$

Assuming $f_+/f_0 = 1.020 \pm 0.034$ *for the* B^+/B^0 *production ratio,*

$$\Delta_{0+} = +0.029 \pm 0.019 \pm 0.016 \pm 0.018$$ **New**

BaBar

arXiv:0808.1915 (2008)   347M $B\bar{B}$

Assuming $f_+/f_0 = 1.044 \pm 0.050$ *for the* B^+/B^0 *production ratio,*

$$\Delta_{0+} = +0.034 \pm 0.044 \pm 0.026 \pm 0.025$$

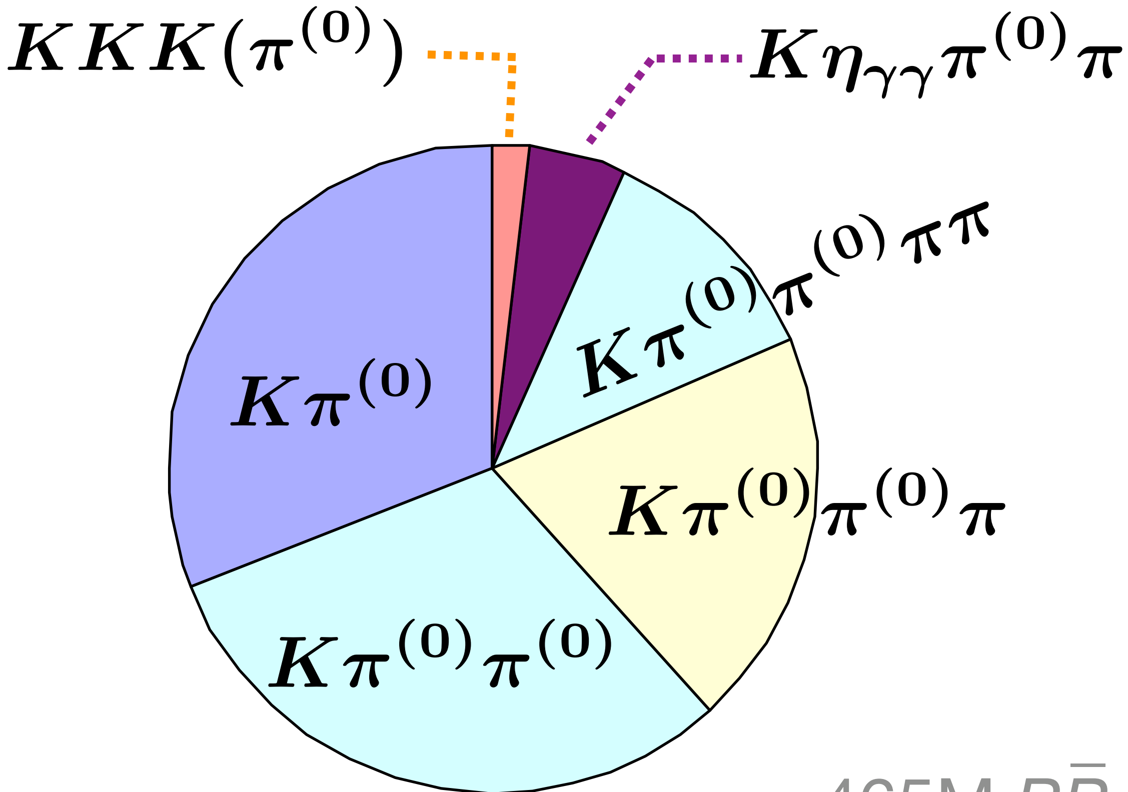
BELLE

PRD 69, 112001 (2004)   85M $B\bar{B}$

... consistent with SM exp of $\Delta_{0+} = +0.026 \pm 0.008$

Matsumori, Sanda, Keum: PRD 72, 014013 (2005)

Time-integrated *CP* asymmetry in $B \to X_s\gamma$:

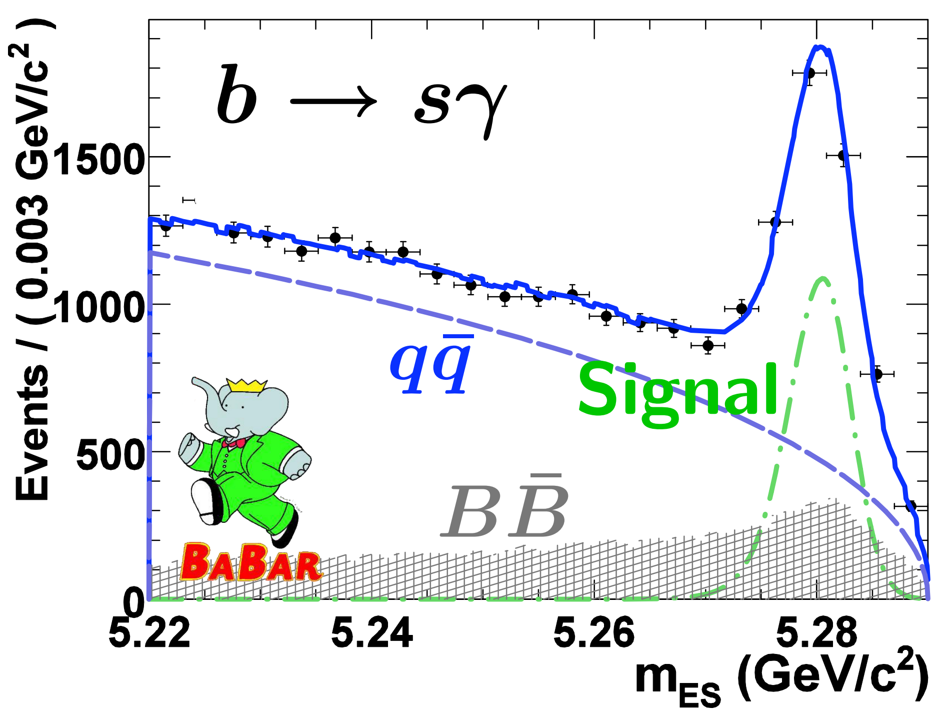


Reconstruct X_s using 16 exclusive final states (~55% of all possible X_s states).

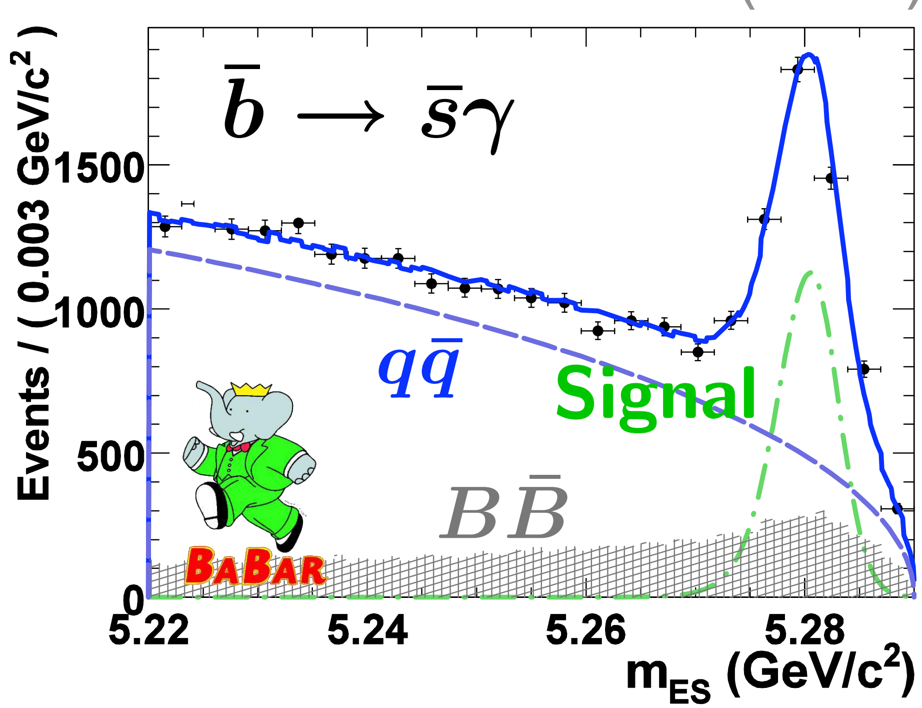
Self-tagging.

465M $B\bar{B}$

arXiv:0805.4796 (2008)



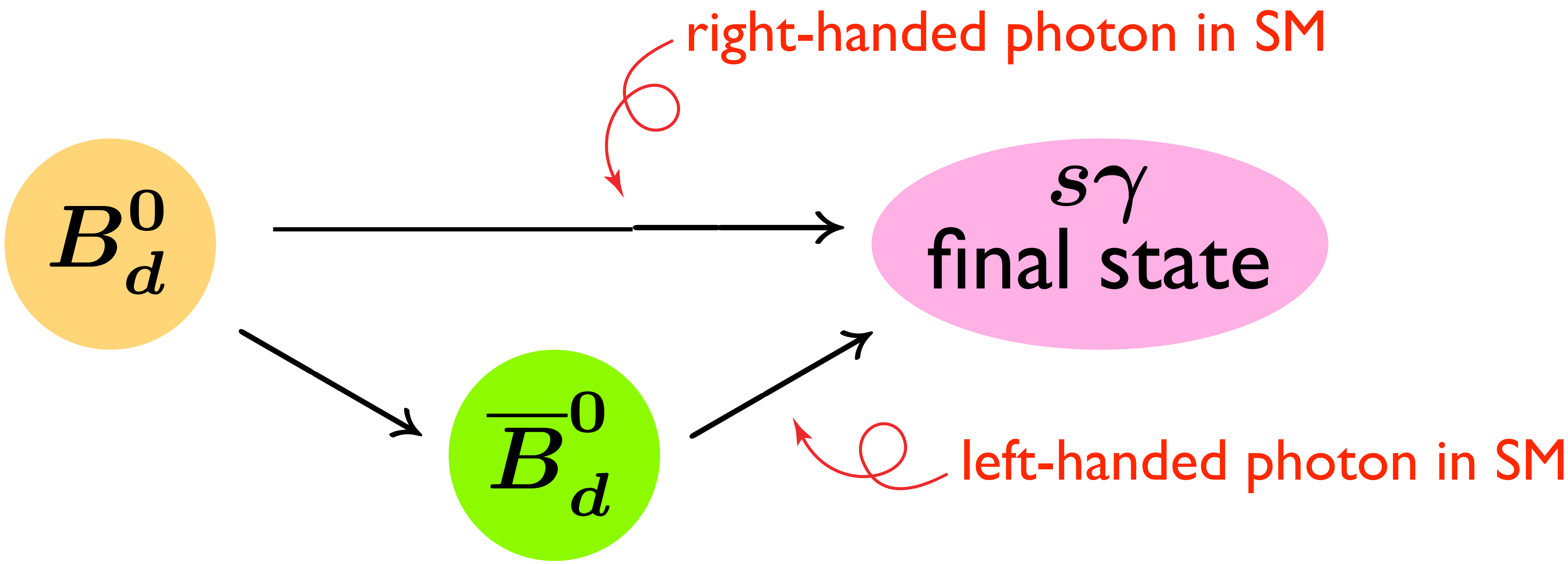
New



$$A_{CP} = -0.011 \pm 0.030 \pm 0.014$$

Consistent with no $\not{CP}$

Time-dependent *CP* asymmetry in $b \to s\gamma$:

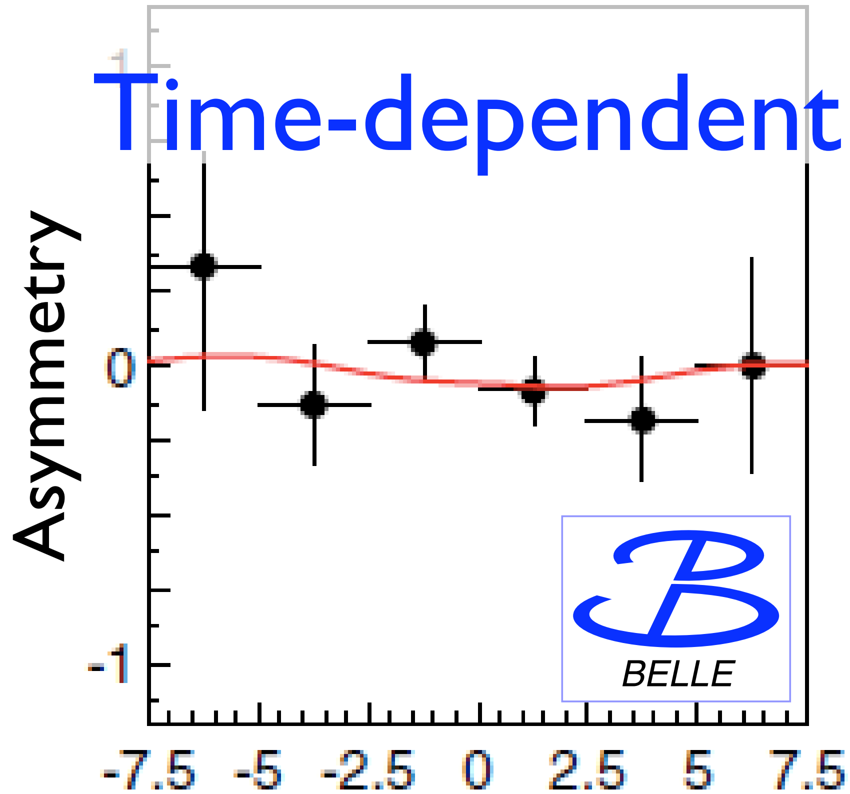


For 100% photon polarization, there is no common $s\vec{\gamma}$ final state $\Rightarrow$ no time-dependent $\not{CP}$ in SM.
For $B^0 \to K_S \pi^0 \gamma$, $S \approx -2(m_s/m_b)\sin(2\phi_1)$.

New physics with alternate helicity structure can give time-dependent $\not{CP}$ without affecting $\Gamma(b \to s\gamma)$.

Atwood, Soni, Gronau: PRL 79, 185 (1997)
Atwood, Gershon, Hazumi, Soni: PRD 71, 076003 (2005)

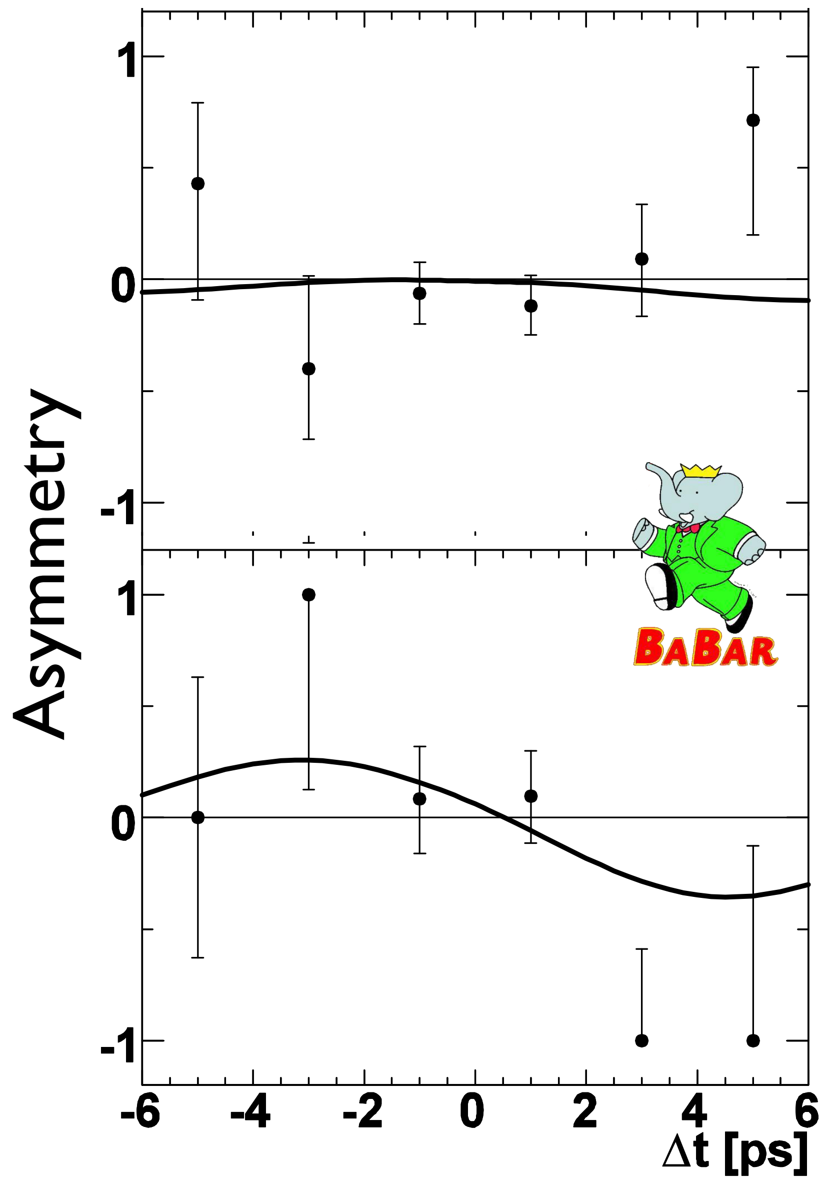
Time-dependent *CP* asymmetry in $B^0 \to K_S \pi^0 \gamma$:



K^* and non$-K^*$ region ($M_{K\pi} < 1.8$ GeV)

$$K^*\gamma \begin{cases} S = -0.10 \pm 0.31 \pm 0.07 \\ A = -0.20 \pm 0.20 \pm 0.06 \end{cases}$$

535M $B\bar{B}$ PRD 74, 111104(R) (2006)



K^* region ($0.8 < M_{K\pi} < 1.0$ GeV)

New

$$K^*\gamma \begin{cases} S = -0.03 \pm 0.29 \pm 0.03 \\ C = -0.14 \pm 0.06 \pm 0.03 \quad \equiv -A \end{cases}$$

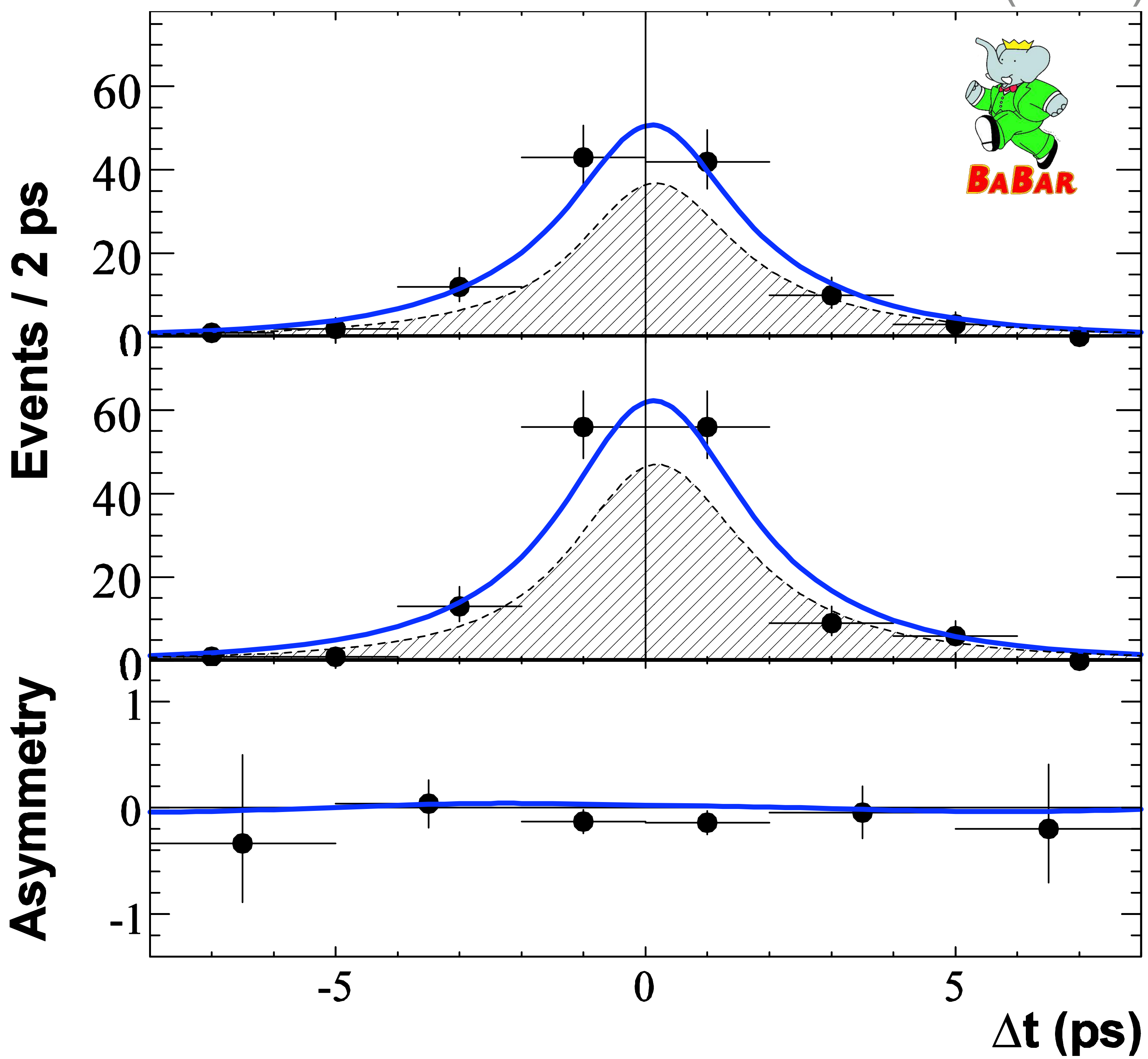
465M $B\bar{B}$ arXiv:0807.3103 (2008)

non$-K^*$ region ($1.1 < M_{K\pi} < 1.8$ GeV)

Consistent with no $\not{CP}$

Time-dependent *CP* asymmetry in $B^0 \to K_S\,\eta\,\gamma$:

465M $B\bar{B}$ arXiv:0805.1317 (2008)



New

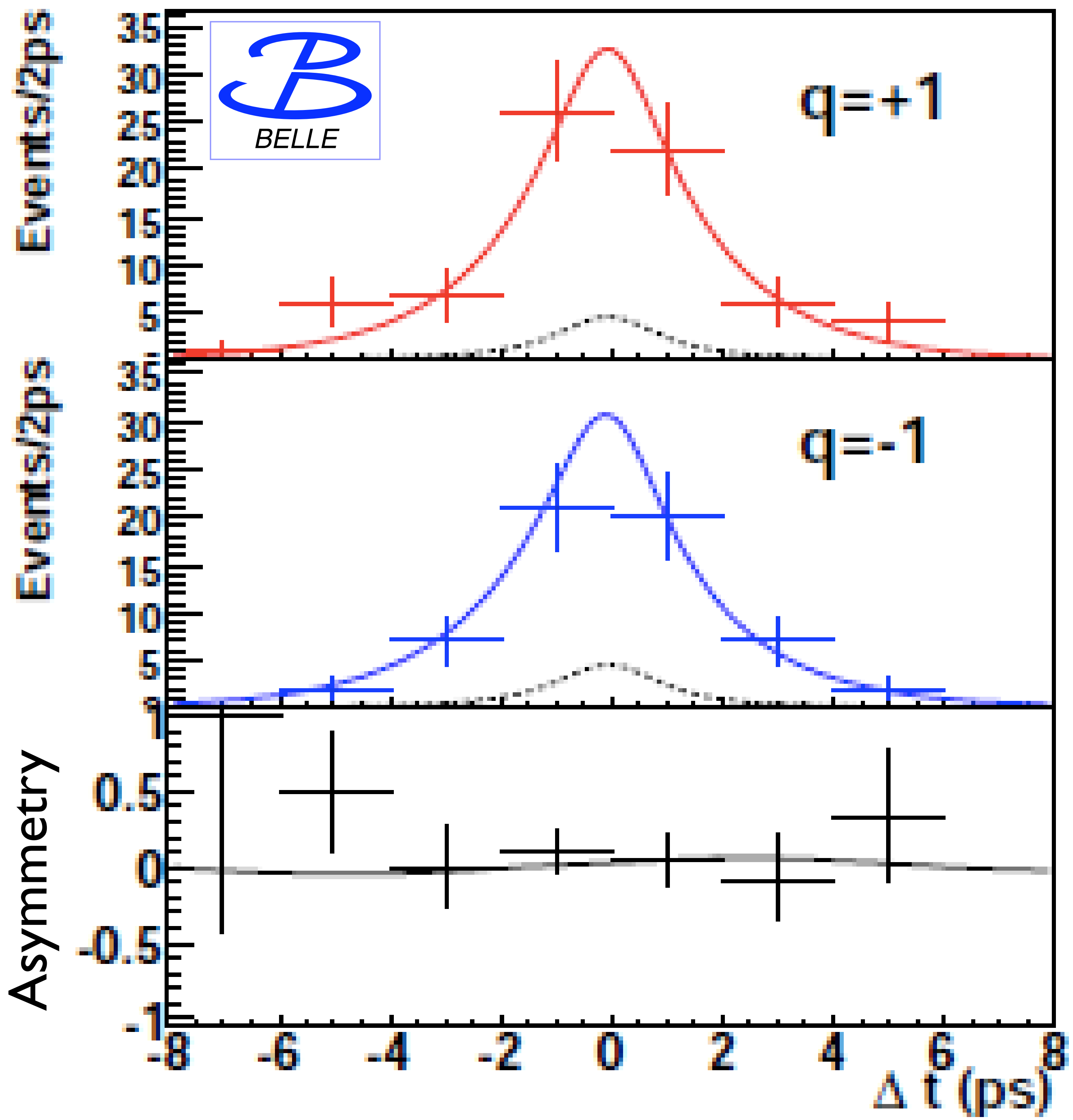
$$S = 0.18 \pm^{0.49}_{0.46} \pm 0.12$$

$$C = -0.32 \pm^{0.40}_{0.39} \pm 0.07$$

Consistent with no $\not{CP}$

Time-dependent *CP* asymmetry in $B^0 \to K_S\,\rho^0\,\gamma$:

657M $B\bar{B}$ arXiv:0806.1980 (2008)



For events in the region

$$M_{K\pi^+\pi^-} < 1.8\ \text{GeV}$$

$$0.6 < M_{\pi^+\pi^-} < 0.9\ \text{GeV}$$

$$S_{\text{eff}} = 0.09 \pm 0.27 \pm^{0.04}_{0.07}$$

$$A_{\text{eff}} = 0.35 \pm 0.18 \pm 0.06$$

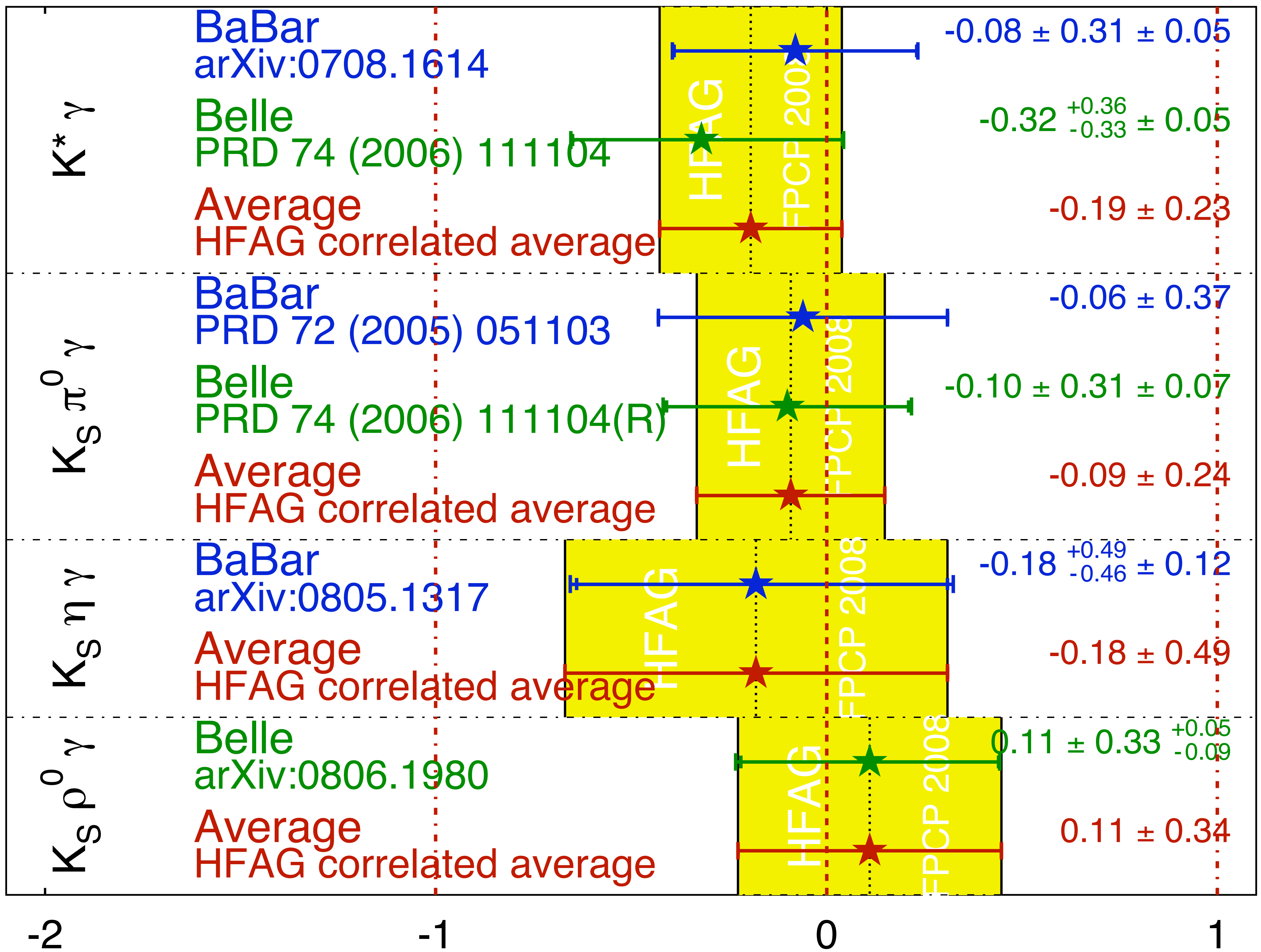
$$S = 0.11 \pm 0.33 \pm^{0.05}_{0.09}$$

New

Consistent with no $\not{C}\!\not{P}$

$b \to s\gamma$ S_{CP}

HFAG
FPCP 2008
PRELIMINARY



$-0.03 \pm 0.29 \pm 0.03$

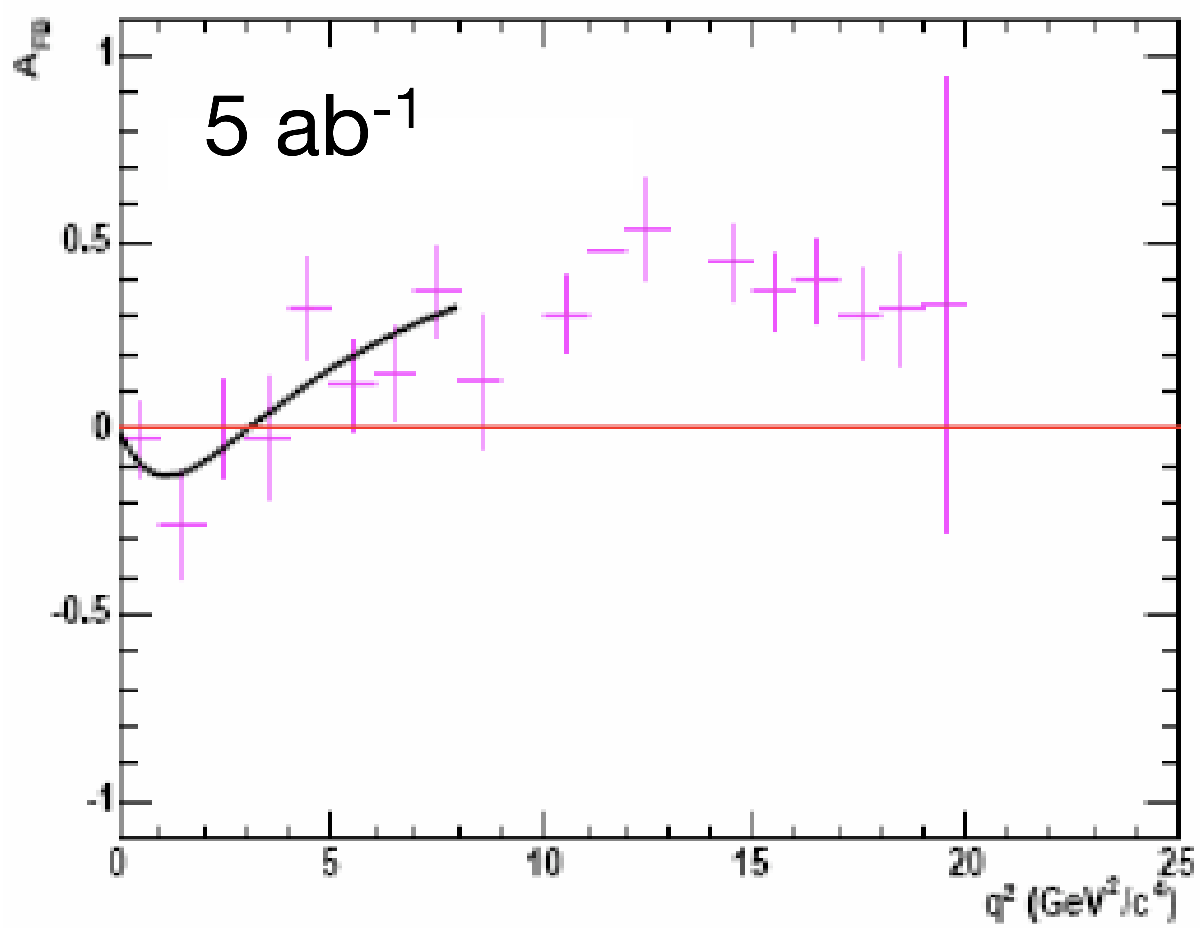
arXiv:0807.3103 (2008)

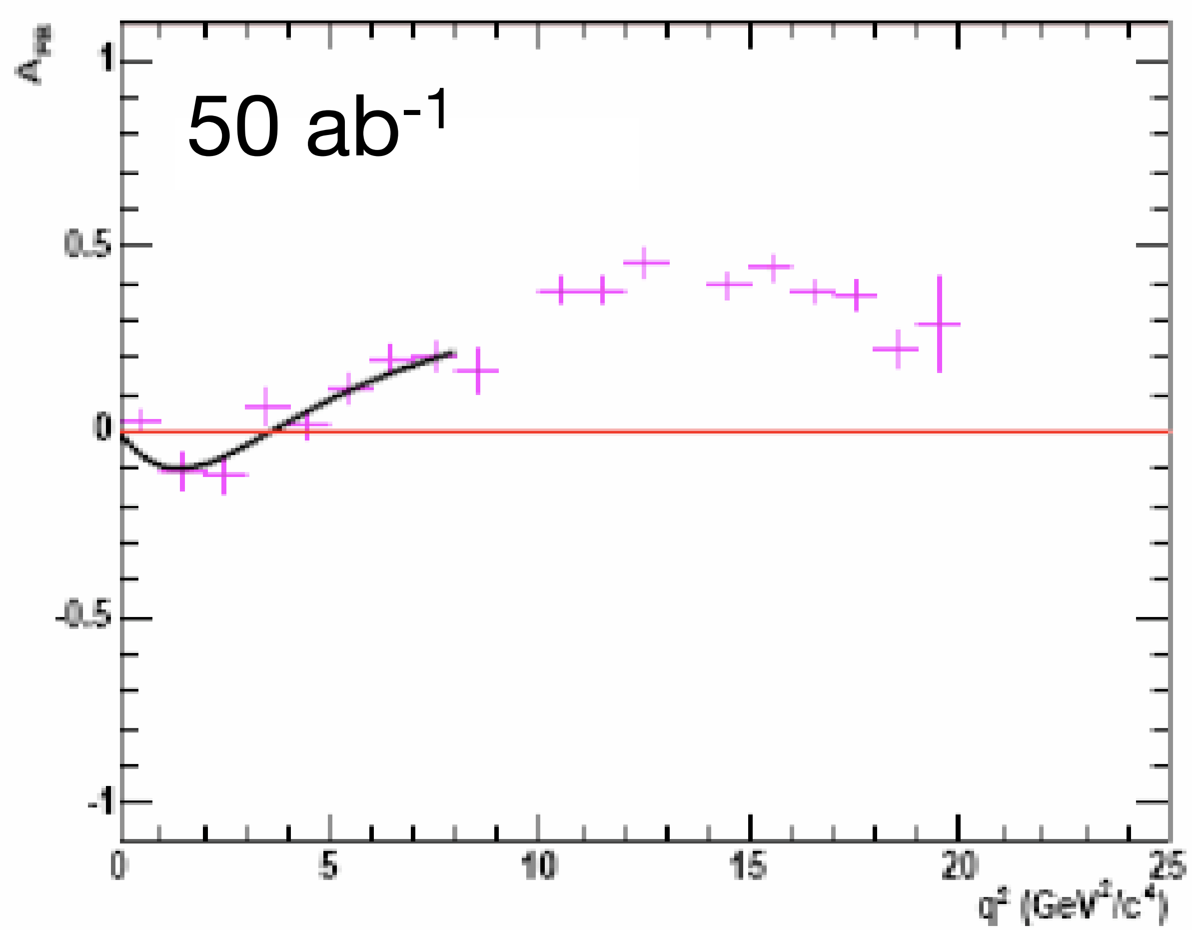
$0.18 \pm ^{0.49}_{0.46} \pm 0.12$

arXiv:0805.1317 (2008)

Forward-backward asymmetry in $B \to K^* l^+ l^-$:

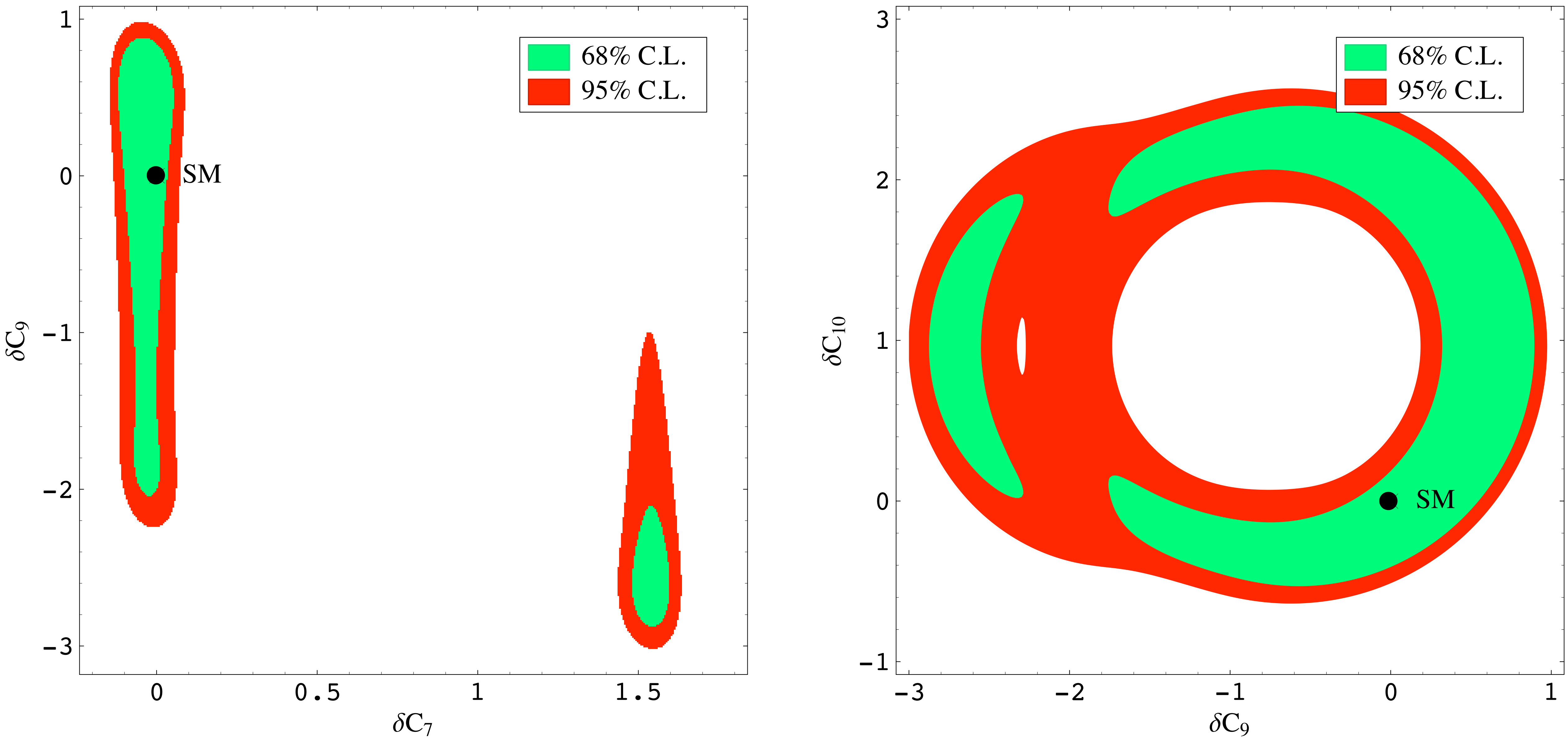
Future prospects at a Super-B Factory:





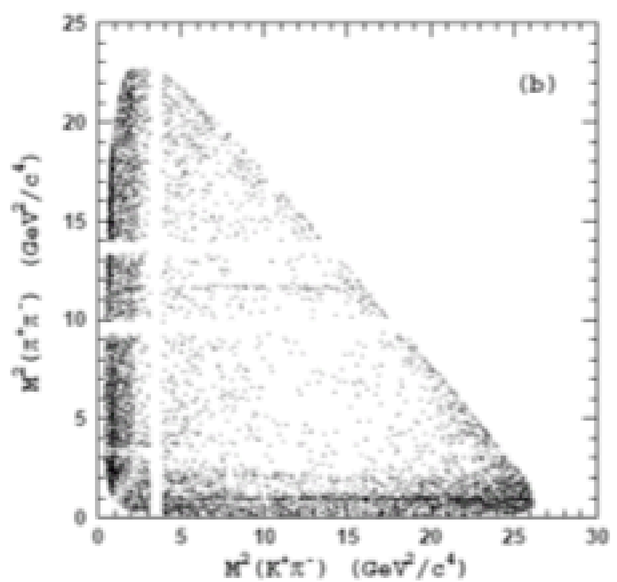
Correlations of C_7, C_9, and C_{10} new-physics shifts

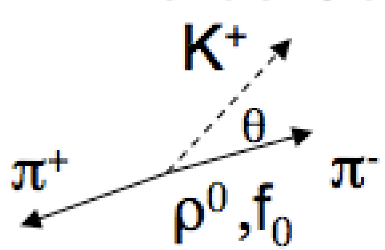
Kamenik: arXiv 0805.2363 (2008)



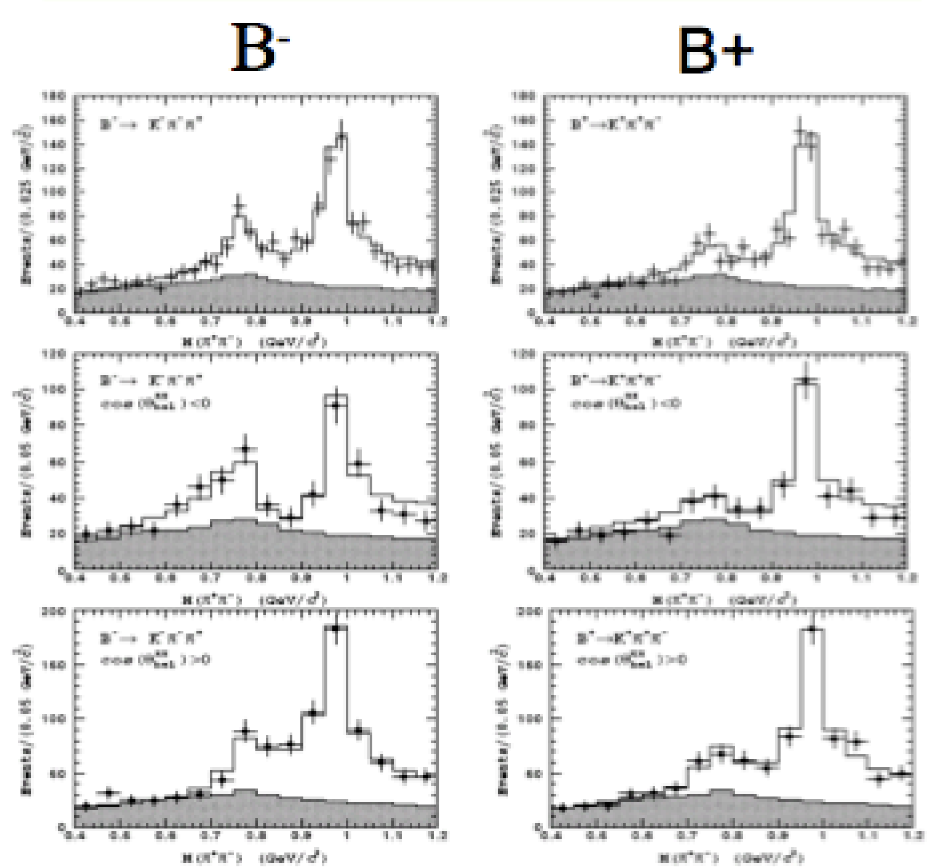
First observation of direct CP violation in charged B decays

- Dalitz analysis on $B^+ \to K^+\pi^+\pi^-$

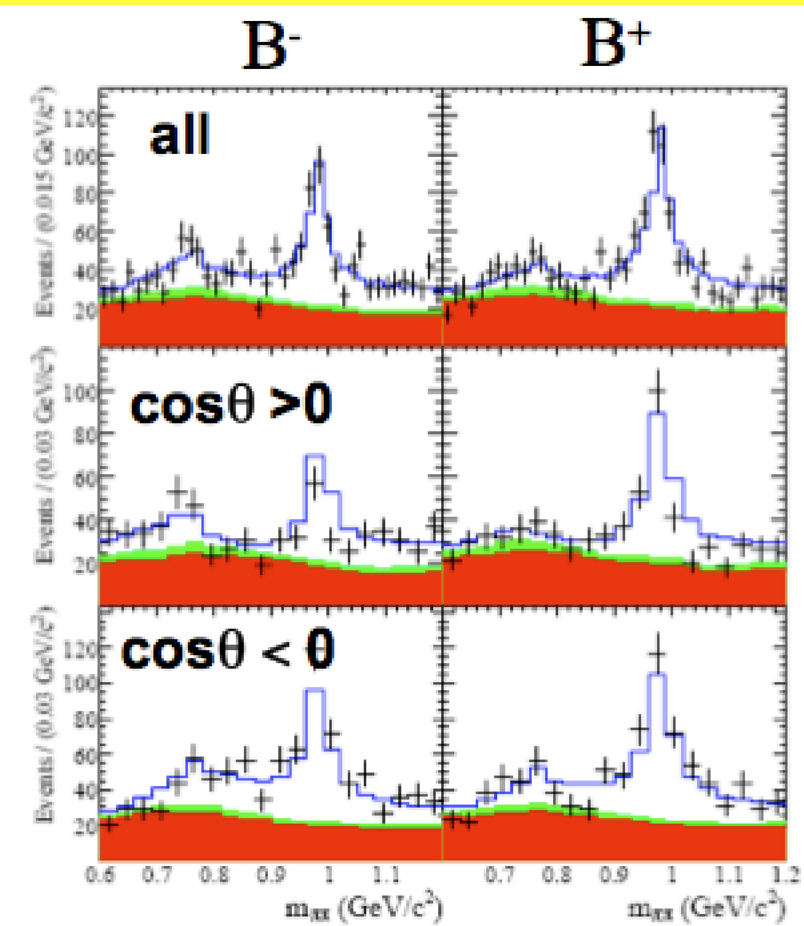




657M $B\bar{B}$, BELLE-CONF-0827



383M $B\bar{B}$, PRD78, 012004, 08



$A_{CP}(B^\pm \to \rho^0 K^\pm) = (+41 \pm 10 \pm 3^{+3}_{-7})\%$ @4.0σ

$A_{CP}(B^\pm \to \rho^0 K^\pm) = (+44 \pm 10 \pm 4^{+5}_{-13})\%$ @3.7σ

Leptonic B decays: $B \rightarrow \tau\nu$

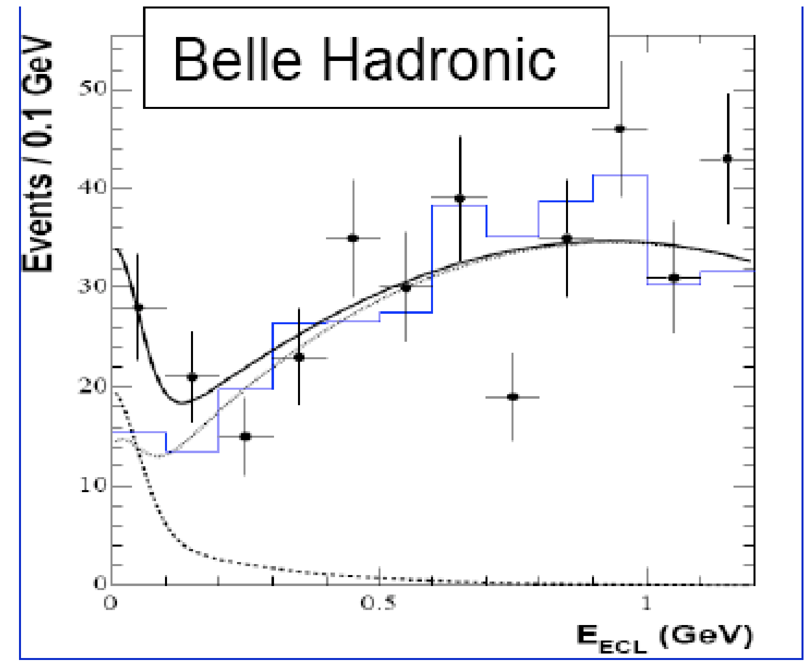
Old Results

Belle Hadronic B tag (449x10^6 $B\bar{B}$ pairs)

[PRL 97, 251802 (2006)]

- 3.5σ evidence

$\mathcal{B}(B\rightarrow\tau\nu)=[1.79\ ^{+0.56}_{-0.49}\ (\text{stat})\ ^{+0.46}_{-0.51}\ (\text{syst})\ ]\times 10^{-4}$



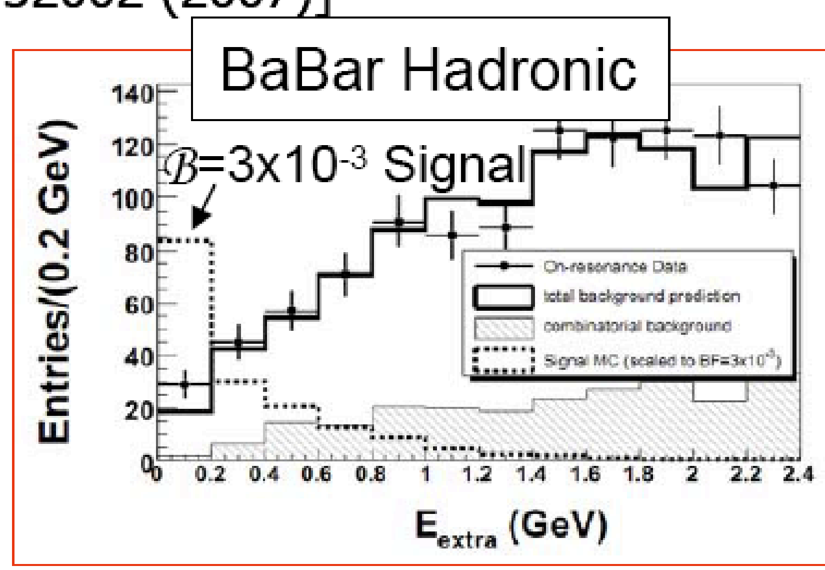
BaBar (383 x 10^6 $B\bar{B}$ pairs)

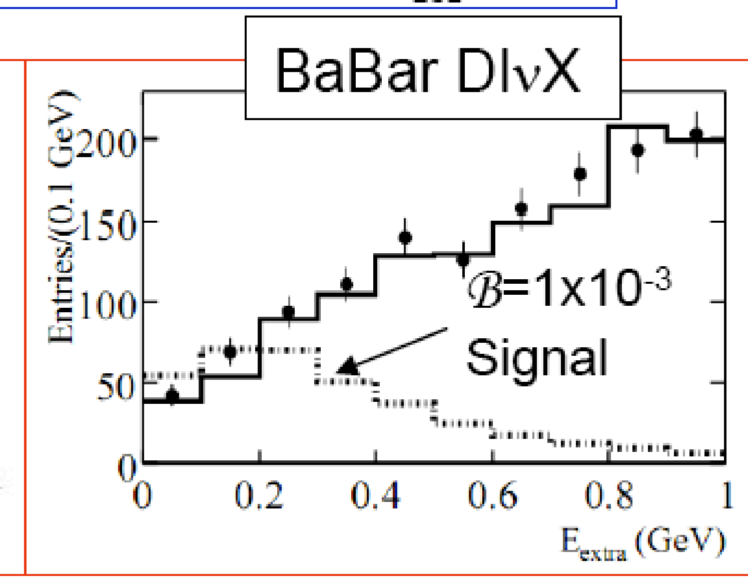
[PRD 77, 011107(R) (2008)], [PRD 76, 052002 (2007)]

- Hadronic B Tag
- Semileptonic (B→Dlν X) Tag

X: γ, π^0,

not reconstructed explicitly





- 2.6σ excess

$\mathcal{B}(B\rightarrow\tau\nu)=[1.2\pm0.4(\text{stat})\pm0.3(\text{bkg})\pm0.2(\text{syst})]\times 10^{-4}$