Branching fractions and charge asymmetries in charmless hadronic *B* decays at *BABAR*

Pietro Biassoni

Università degli Studi and INFN, Milano

On behalf of the *BABAR* Collaboration

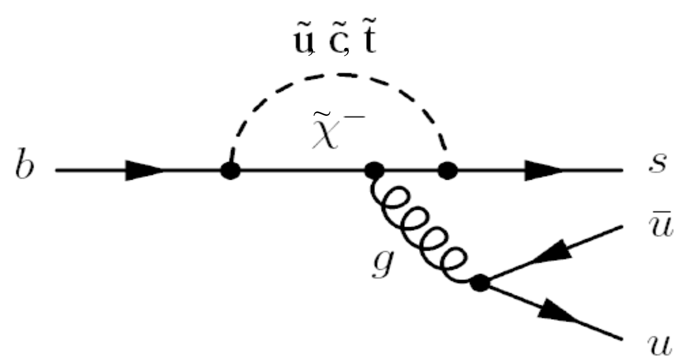
2009 Europhysics Conference on High Energy Physics

July 16-22, 2009

Krakow, Poland

Charmless Hadronic *B* decays

Branching fractions and charge asymmetries in charmless hadronic *B* decays are sensitive probes of the Standard Model (*SM*).



Contributions from New Physics (*NP*) processes can be as large as *SM* ones.

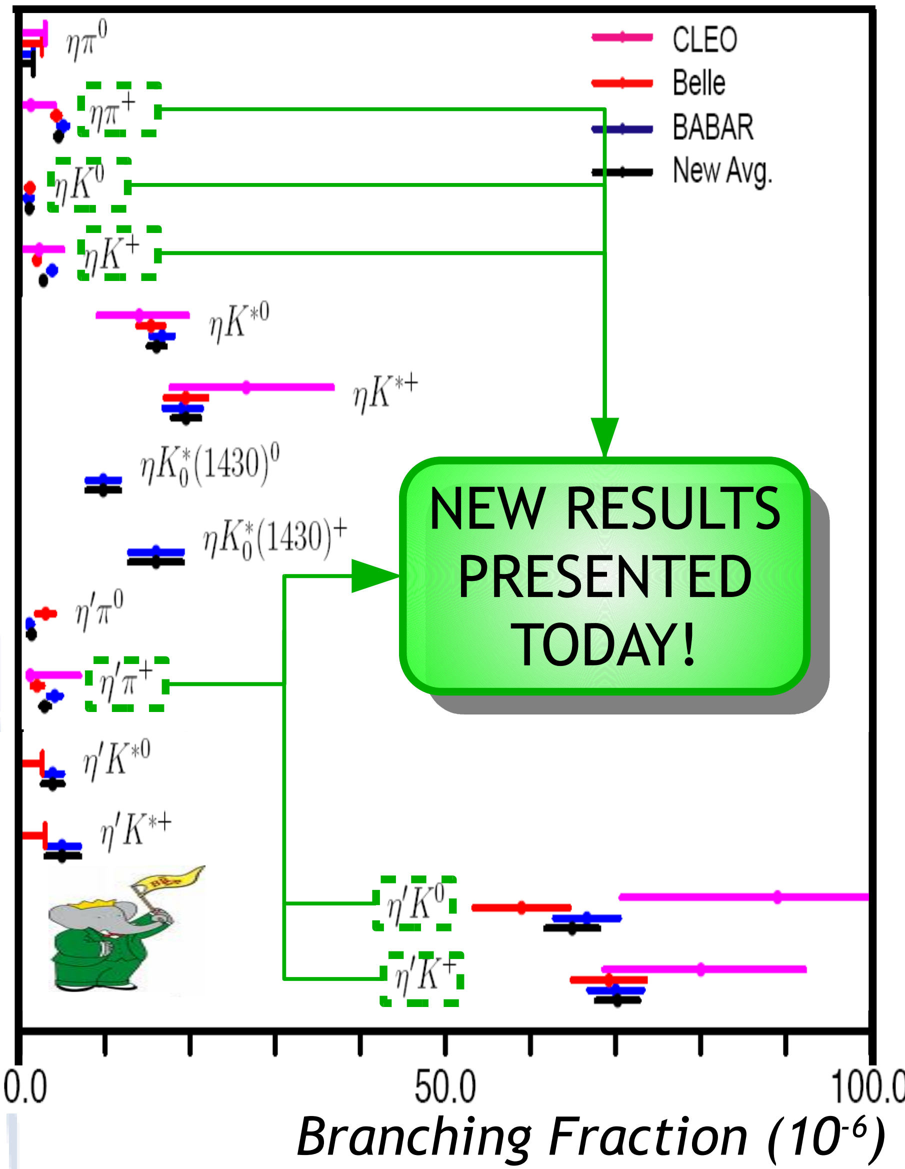
The presence of strong interaction implies large theoretical uncertainties, but allows testing different QCD models.

This talk covers (some) charmless quasi-two-body decay modes involving different theoretical interests:

- η-η' puzzle
- Direct *CP* violation
- Polarization puzzle
- Test of QCD models

For charmless three body decay modes see Thomas E. Latham's talk on Saturday 9 AM

Decays with η or η' in the final state



- *B→η' K* is unexpectedly large. Penguin diagram interference†, form factor enhancement‡ and higher α_s contributions‡ may explain this effect. Also predict small *B→ηK* and *B→η'K** and large *B→ηK**.
- Charge asymmetry is expected to be large in *B→ηK*, and suppressed in *B→η'K*¶ Prediction of the relative sign is opposite between *SU(3)* flavor symmetry# and QCD factorization‡○.

† H. J. Lipkin, PLB254, 247 (1991).
‡ M.Beneke and M.Neubert, NPB651, 225 (2003).
¶ S.Barshay and G.Kreyerhoff, PLB578, 330 (2004).
# C.W.Chiang *et. al*, PRD68, 074012 (2003), PRD70, 034020 (2004).
○ M.Beneke *et al.*, PRL83, 1914 (1999), NPB606, 245 (2001). M.Beneke and M.Neubert, NPB675, 333 (2003).

SU(3) Bound in $|S\text{-}\sin 2\beta|$ in $b \to s$ Transitions

For coherent *B* mesons, produced via Υ(4S) decays, the time-dependent asymmetry for the decay into a *CP* eigenstate *f* is

CP eigenvalue of *f*

$$A_f(t) = \frac{\Gamma(\overline{B^0}(t) \to f) - \Gamma(B^0(t) \to f)}{\Gamma(\overline{B^0}(t) \to f) + \Gamma(B^0(t) \to f)} = +\eta_f S_f \sin(\Delta m_B t) + C_f \cos(\Delta m_B t)$$

In penguin $b \to sq$ $(q = u,d,s)$ decays $\Delta S = S - \sin 2\beta$

Contributions to ΔS may come both from *SM* and *NP*, need to know magnitude of *SM* contributions to look for *NP* effects.

Different strategies to calculate upper bounds on $|\Delta S|$.

SU(3) flavor symmetry approach relates the bound to amplitudes of $B \to PP$ decays†

- Bound on ΔS in $B^0 \to \eta' K^0$ involves decays to $\pi^0\pi^0$, $\pi^0\eta$, $\pi^0\eta'$, $\eta\eta$, $\eta'\eta'$, $\eta\eta'$.
- Bound on ΔS in $B^0 \to \Phi K$ involves decays to $\eta\Phi$ and $\eta'\Phi$.

† Y.Grossman *et al.*, PRD68 015004 (2003).
C.W.Yang *et al.*, PRD68 074012 (2003);
M.Gronau *et al.*, PLB596 107 (2004).

NEW RESULTS PRESENTED TODAY!

Polarization in $B \to VV$ and $B \to VT$ Decays

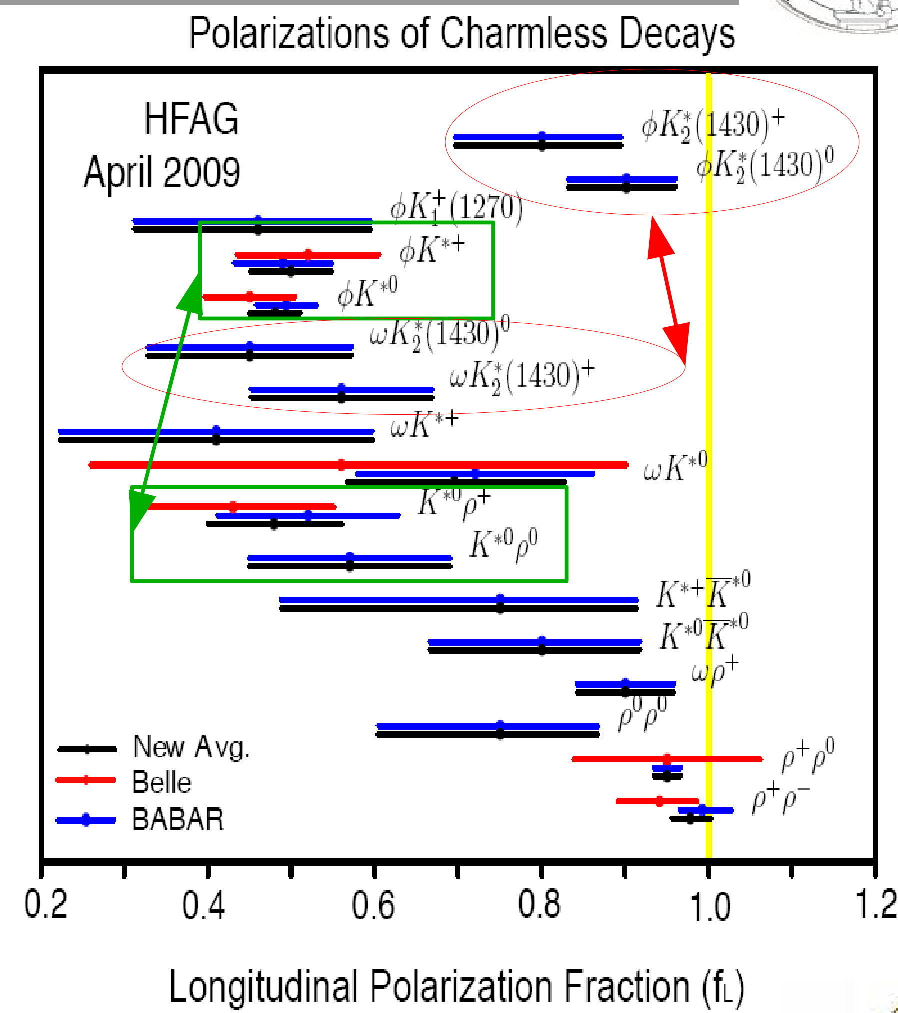
Helicity conservation suggests longitudinal polarization $f_L \approx 1$

In 2003 both BaBar and Belle found $f_L \approx 0.5$ in $B \to \Phi K^*$

- $f_L \approx 1$ seems to be respected for tree dominated decays ($\rho\rho$ and $\omega\rho$), but not in $b \to s$ penguin transitions.
- Different attempts to understand the effect both in *SM* and *NP* have improved the picture.
- No theoretical predictions for $B \to VT$ decays

Results of ωK^* and ρK^* $f_L \approx 0.5$.

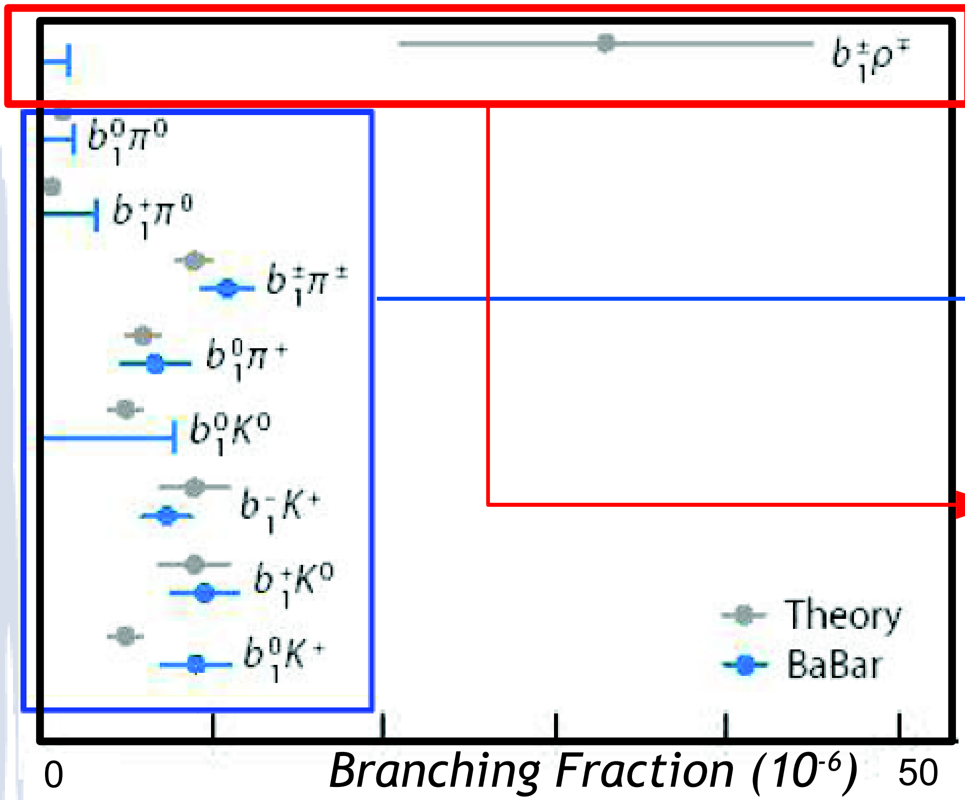
Results from *VT* modes $\Phi K^*_2(1430)$ and $\omega K^*_2(1430)$ disagree, why?



NO CLEAR UNDERSTANDING, YET

$B \to VA$ Decays

Few reliable theoretical predictions available for $B \to VA$ transitions.
Some modes are expected to have high branching fraction and may shed light on the polarization puzzle.
Many experimental results about these modes in past 2-3 years.



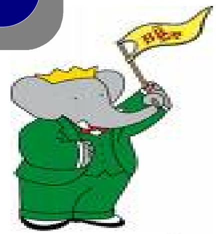
QCD factorization prediction
H.Y Cheng and K.C.Yang, PRD78 094001 (2008)

Really good agreement for b_1K and $b_1\pi$ decay modes.

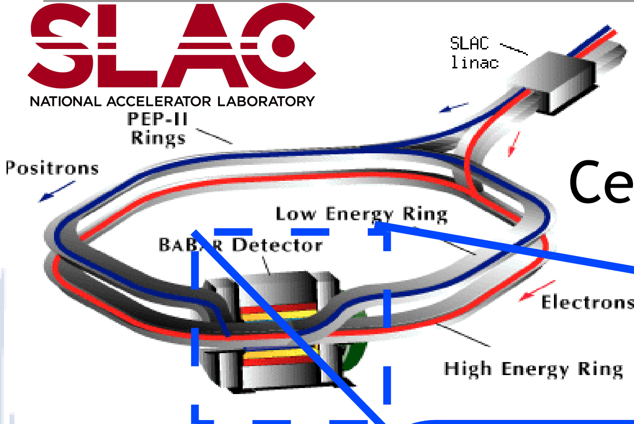
Disagreement with theory for $b_1\rho$

NO CLEAN UNDERSTANDING, YET

NEW RESULTS PRESENTED TODAY FOR b_1K^*!



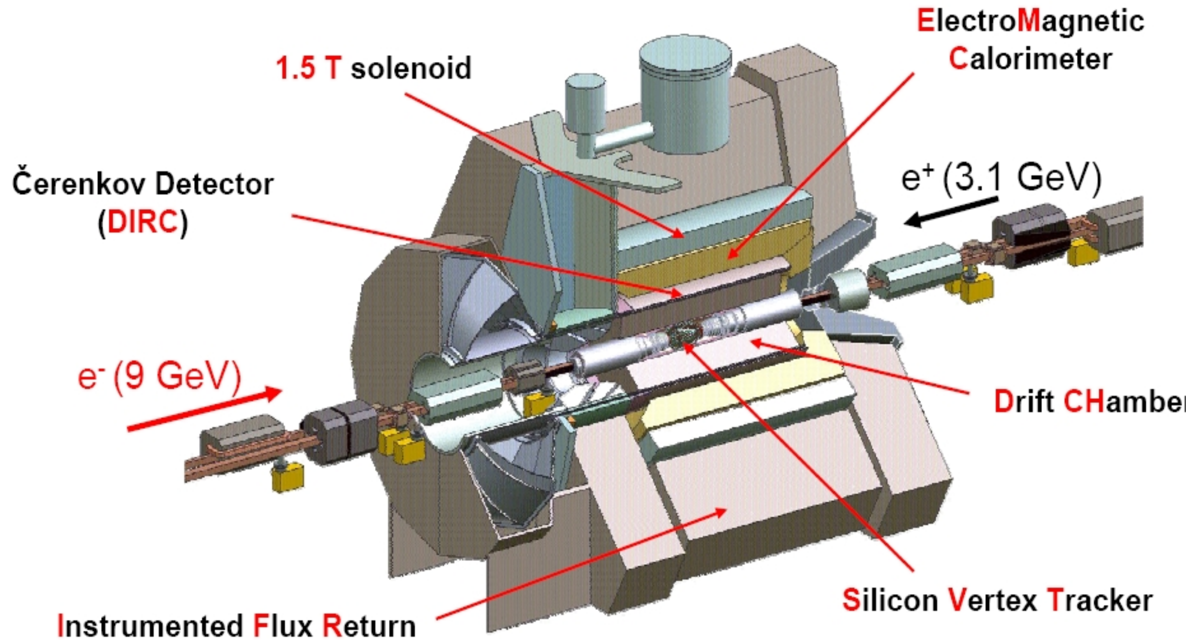
Detector and Dataset



PEP-II accumulation ring: 9.0 GeV e^- 3.1 GeV e^+

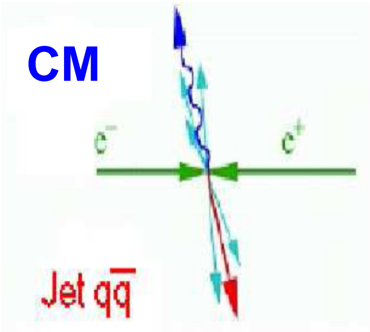
Center-of-mass energy: $\sqrt{s}$ = 10.58 GeV (Υ(4S) mass).

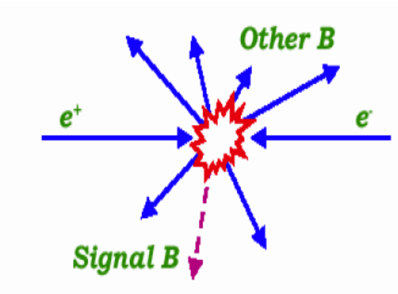
Final Sample
439.2 fb^{-1}
471 10^6 $B\bar{B}$ pairs



Topological Discriminating Variables

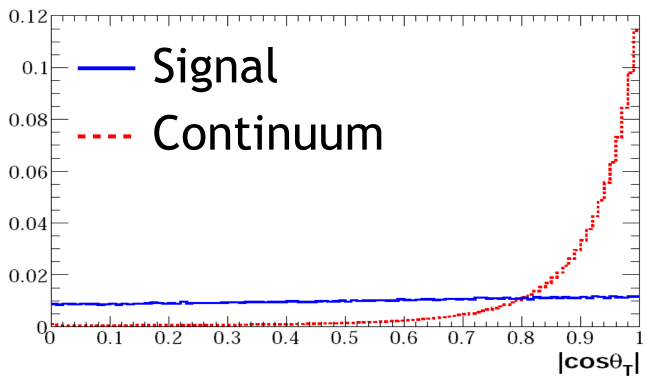
Main background source is continuum $q\bar{q}$ (q = u, d, s, c) production.

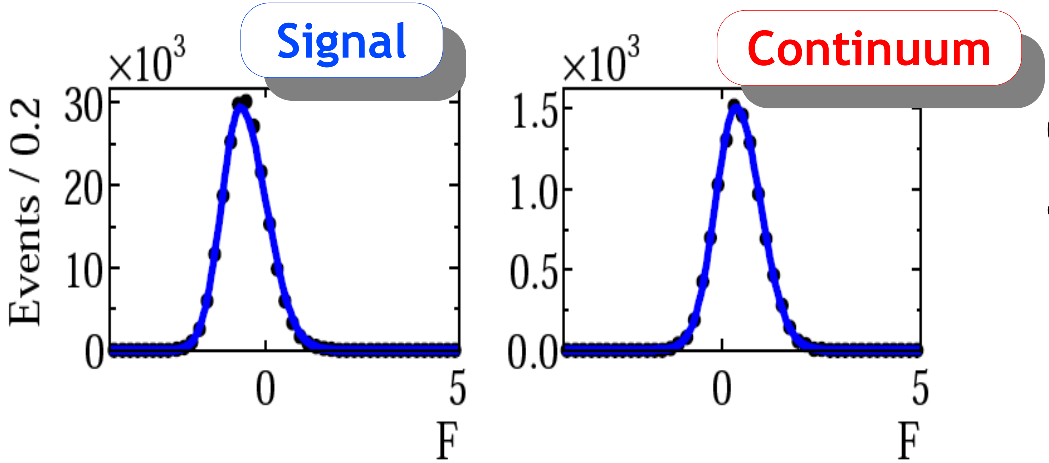




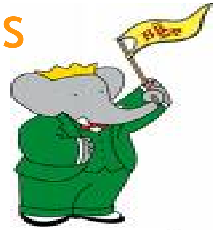
Due to the different masses of light quarks and B mesons, $q\bar{q}$ events have two back-to-back jets, while B decays are more spherical.

The cosine between the thrust axis of the B meson and the thrust axis of the rest of the event has great discriminating power.





Other topological variables are combined in multivariate discriminants (Fisher or NN).



Kinematics Discriminating Variables

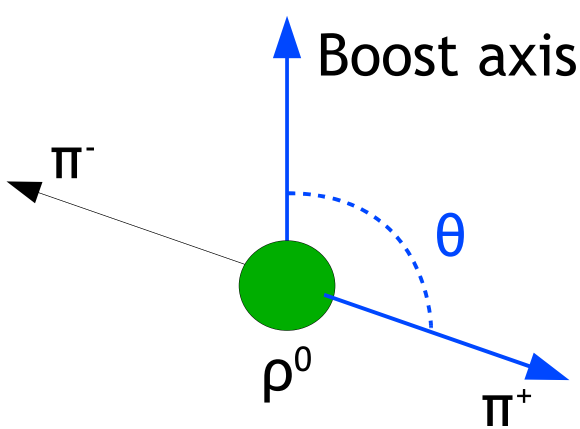
Kinematics discriminating variables can discriminate between signal and background from both continuum and other B decays:

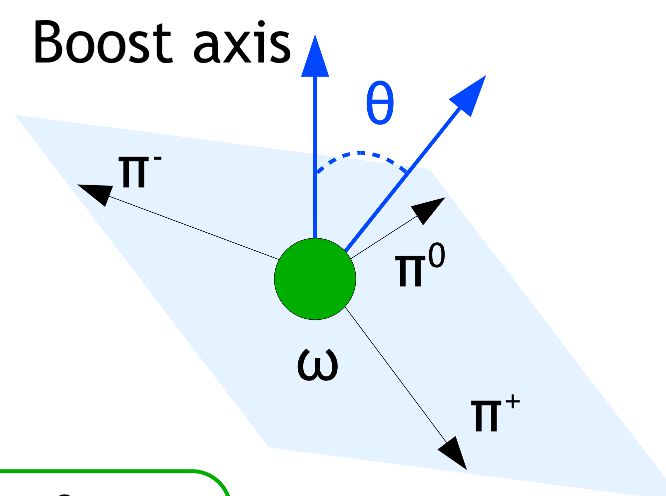
- Requirements on particles energies and momenta and on daughter resonances mass suppress combinatorial background from continuum and $b \to c$ events .
- Helicity angles are defined for both two and three body decays.
- m_{ES}: energy substituted mass of the B meson.
- ΔE: Difference between B measured energy and half of cms energy.

Kinematics Discriminating Variables

Kinematics discriminating variables can discriminate between signal and background from both continuum and other *B* decays:

- Requirements on particles energies and momenta and on daughter resonances mass suppress combinatorial background from continuum and $b \rightarrow c$ events .
- Helicity angles are defined for both two and three body decays.
- m_{ES}: energy substituted mass of the *B* meson.
- ΔE: Difference between *B* measured energy and half of cms energy.





In resonance rest frame

Kinematics Discriminating Variables

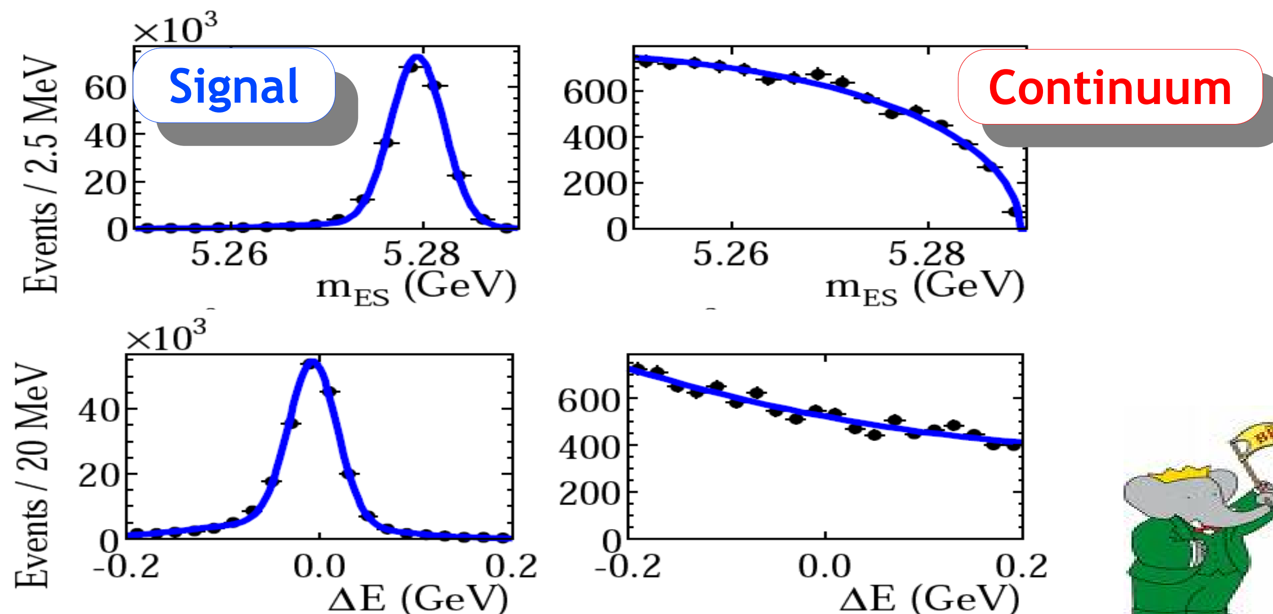
Kinematics discriminating variables can discriminate between signal and background from both continuum and other *B* decays:

Requirements on particles energies and momenta and on daughter resonances mass suppress combinatorial background from continuum and $b \to c$ events .

- Helicity angles are defined for both two and three body decays.
- m_{ES}: energy substituted mass of the *B* meson.
- ΔE: Difference between *B* measured energy and half of cms energy.

$$m_{ES} = \sqrt{\frac{1}{4}s - p_B^2}$$

$$\Delta E = E_B - \frac{1}{2}\sqrt{s}$$



Analysis Technique

Results obtained with extended unbinned maximum likelihood fit

$$\mathcal{L} = e^{-\sum_j n_j} \prod_{i=1}^{N} \sum_j n_j \times \mathcal{P}_j(\Delta E^i)\mathcal{P}_j(m_{ES}^i)\mathcal{P}_j(\mathcal{D}^i)$$

i events
j fit components

Where useful, daughter resonances mass are used in the fit.

In *B*→*VV* and *B*→*VT* decays polarization is extracted using angular information:

$$\frac{d\Gamma}{d\cos\theta_1 d\cos\theta 2} = \begin{cases} (1-f_L)\sin^2\theta_1\sin^2\theta_2 + 4f_L\cos^2\theta_1\cos^2\theta_2 & \text{for } B \to VV \\ (1-f_L)\sin^2\theta_1\sin^2\theta_2\cos^2\theta_2 + \frac{f_L}{3}\cos^2\theta_1(3\cos^2\theta 2-1)^2 & \text{for } B \to VT \end{cases}$$

θ_1 and θ_2 are the helicity angles of the two *B* meson daughters.

For charge decays we can also measure the charge asymmetry:

$$\mathcal{A}_{ch} \equiv \frac{\Gamma^- - \Gamma^+}{\Gamma^- + \Gamma^+} \qquad \Gamma^\pm = \Gamma(B^\pm \to f^\pm)$$

$B \to \eta^{(\prime)} K$, $B^+ \to \eta^{(\prime)} \pi^+$ Modes Results

Measurement of $B \to \eta' K$ branching fraction is now systematic limited due to uncertainties on the daughters branching fractions.

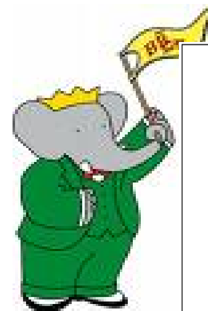
$B^+ \to \eta K^+$ and $B \to \eta \pi^+$ have similar kinematic and branching fraction: a joint fit is performed to extract signal yields and charge asymmetries.

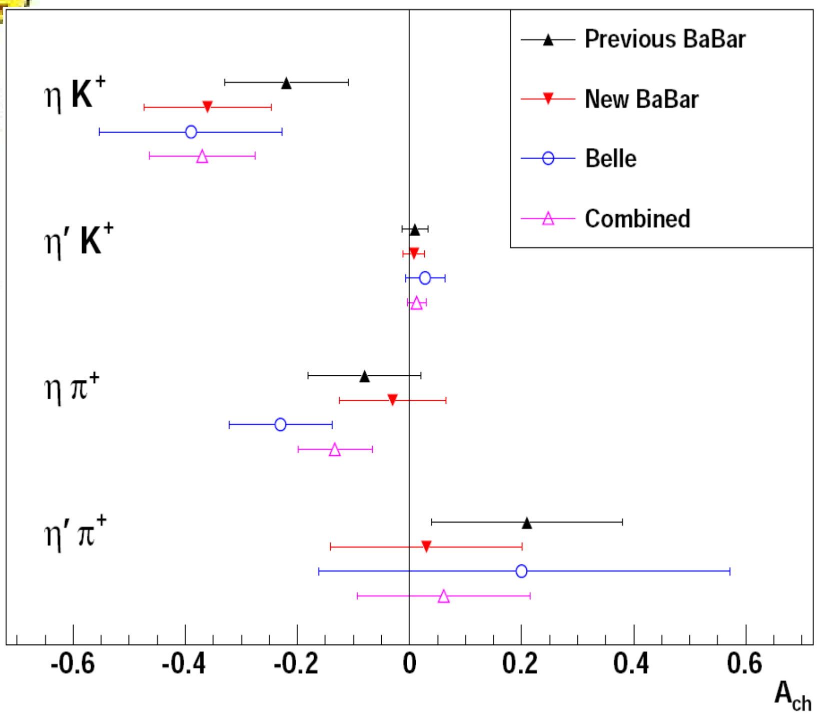
3.3σ evidence of direct *CPV* in $B^+ \to \eta K^+$, combining this result with Belle one, we have 4.1σ deviation from zero.

$A_{ch}(\eta K^+) = -0.36 \pm 0.11 \pm 0.03$

Charge asymmetry in $B^+ \to \eta' K^+$ is small: impossible to identify the sign.

B^0 decays have low branching fraction (except $\eta' K^0$); ηK^0, $\eta\omega$, and $\eta\omega$ have more than 3σ significance.



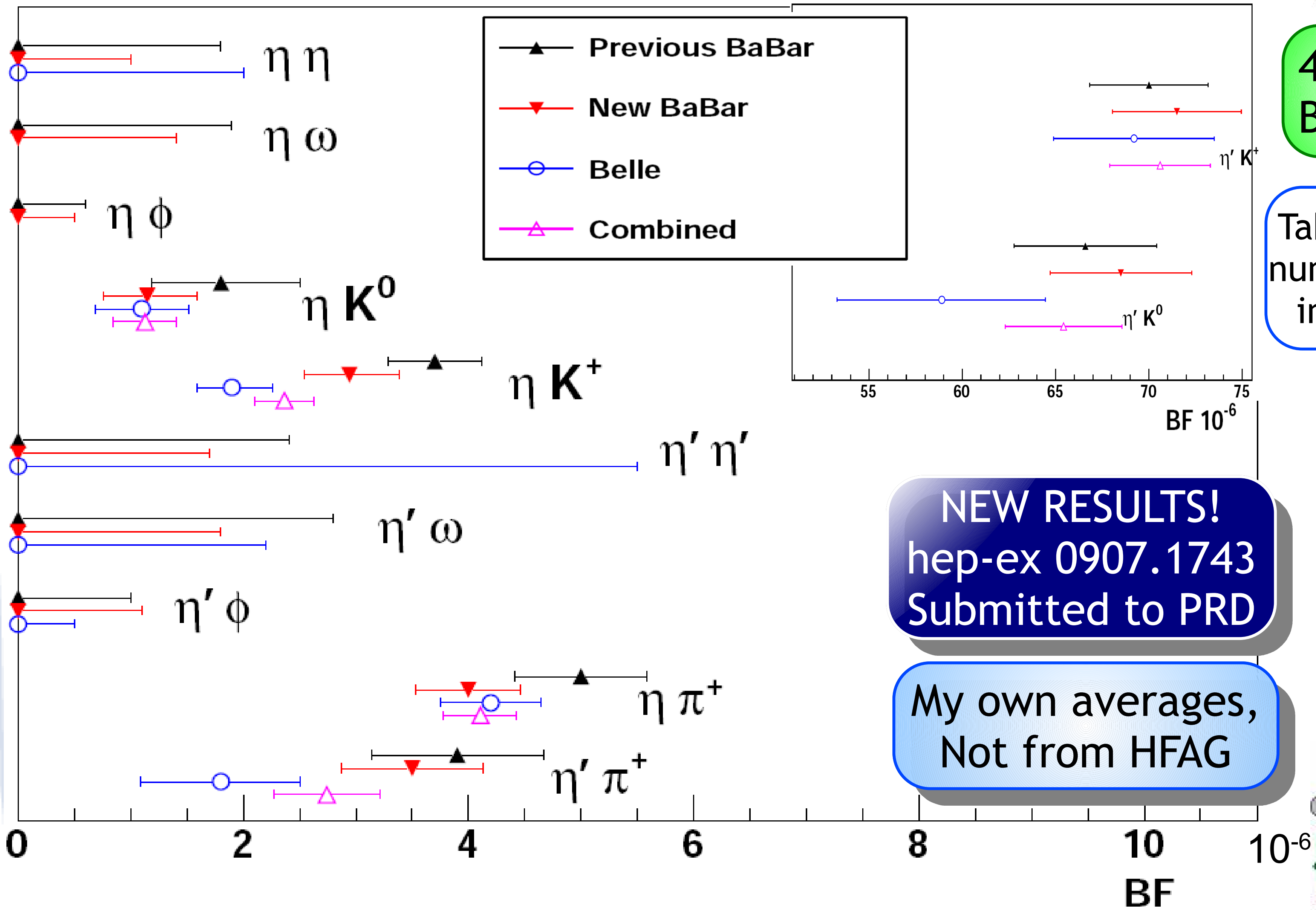


NEW RESULTS!
hep-ex 0907.1743
Submitted to PRD

467 10^6 $B\bar{B}$ pairs

My own averages,
Not from HFAG

Modes with η and η' Results



467 10^6 $B\bar{B}$ pairs

Tables with numbers are in backup

NEW RESULTS!
hep-ex 0907.1743
Submitted to PRD

My own averages, Not from HFAG

$B \to \omega V$ Branching Fraction Results

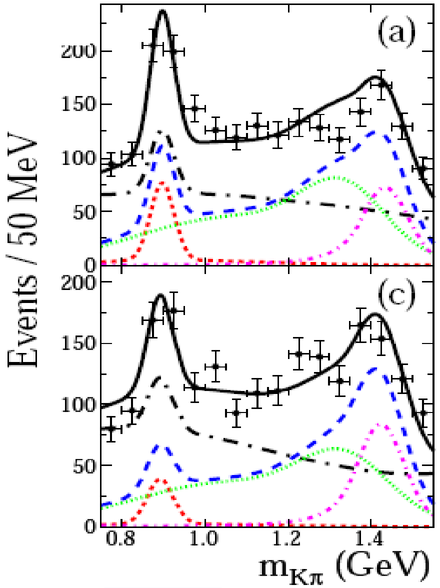
This study includes both B^+ and B^0 decay modes.

Mass of the $K\pi$ system includes $K^*(892)$, $(K\pi)^*_0$ and $K^*_2(1430)$.

First observation of four decay modes , with high branching fraction.

Mode	Y (events)	Y_0 (events)	S (σ)	$\mathcal{B}$ (10^{-6})	$\mathcal{B}$ U.L. (10^{-6})
ωK^{*0}	101 ± 25	8 ± 4	4.1	$2.2 \pm 0.6 \pm 0.2$	—
ωK^{*+}			2.5	$2.4 \pm 1.0 \pm 0.2$	7.4
$\omega K^{*+}_{K^+\pi^0}$	72 ± 24	3 ± 2	3.7	4.8 ± 1.7	
$\omega K^{*+}_{K^0_S\pi^+}$	8 ± 16	0 ± 1	0.5	0.6 ± 1.2	
$\omega(K\pi)^{*0}_0$	540 ± 47	49 ± 25	9.8	$18.4 \pm 1.8 \pm 1.7$	—
$\omega(K\pi)^{*+}_0$			9.2	$27.5 \pm 3.0 \pm 2.6$	—
$\omega(K^+\pi^0)^{*+}_0$	191 ± 36	18 ± 9	5.9	19.6 ± 4.1	
$\omega(K^0_S\pi^+)^{*+}_0$	357 ± 39	34 ± 17	10.6	37.1 ± 4.5	
$\omega K^*_2(1430)^0$	185 ± 32	19 ± 10	5.0	$10.1 \pm 2.0 \pm 1.1$	—
$\omega K^*_2(1430)^+$			6.1	$21.5 \pm 3.6 \pm 2.4$	—
$\omega K^*_2(1430)^+_{K^+\pi^0}$	182 ± 30	6 ± 3	7.2	31.0 ± 5.2	
$\omega K^*_2(1430)^+_{K^0_S\pi^+}$	64 ± 25	10 ± 5	2.4	11.2 ± 4.9	
$\omega\rho^0$	30^{+21}_{-18}	-3 ± 2	1.9	$0.8 \pm 0.5 \pm 0.2$	1.6
ωf_0	37^{+14}_{-12}	1 ± 1	4.5	$1.0 \pm 0.3 \pm 0.1$	1.5
$\omega\rho^+$	411 ± 43	27 ± 14	9.8	$15.9 \pm 1.6 \pm 1.4$	—

ωK^{*0}



ωK^{*+}

465 10^6 $B\bar{B}$ pairs

Signal
K*(982)
$(K\pi)^*_0$
$K^*_2(1430)$
bkg

PRD 79, 052005 (2009)

Main sources of systematic error are the presence of a fit bias and the uncertainties on the PDFs parametrization.

$B \to \omega V$ Polarization Results

Polarization is extracted for all the VV and VT modes, but ωK^{*+} ($K^{*+} \to K^0{}_S \pi^+$) and $\omega\rho^0$, where the signal yield is too small.

Results from different K^* sub-decays are combined summing the likelihood functions.

465 10^6 $B\bar{B}$ pairs

PRD 79, 052005 (2009)

Mode	Y (events)	Y_0 (events)	f_L
ωK^{*0}	101 ± 25	8 ± 4	$0.72 \pm 0.14 \pm 0.02$
ωK^{*+}			$0.41 \pm 0.18 \pm 0.05$
$\omega K^{*+}_{K^+\pi^0}$	72 ± 24	3 ± 2	0.37 ± 0.18
$\omega K^{*+}_{K^0_S\pi^+}$	8 ± 16	0 ± 1	0.5 fixed
$\omega(K\pi)^{*0}_0$	540 ± 47	49 ± 25	—
$\omega(K\pi)^{*+}_0$			—
$\omega(K^+\pi^0)^{*+}_0$	191 ± 36	18 ± 9	—
$\omega(K^0_S\pi^+)^{*+}_0$	357 ± 39	34 ± 17	—
$\omega K^*_2(1430)^0$	185 ± 32	19 ± 10	$0.45 \pm 0.12 \pm 0.02$
$\omega K^*_2(1430)^+$			$0.56 \pm 0.10 \pm 0.04$
$\omega K^*_2(1430)^+_{K^+\pi^0}$	182 ± 30	6 ± 3	0.52 ± 0.10
$\omega K^*_2(1430)^+_{K^0_S\pi^+}$	64 ± 25	10 ± 5	0.76 ± 0.26
$\omega\rho^0$	30^{+21}_{-18}	-3 ± 2	0.8 fixed
ωf_0	37^{+14}_{-12}	1 ± 1	—
$\omega\rho^+$	411 ± 43	27 ± 14	$0.90 \pm 0.05 \pm 0.03$

Penguin dominated (expected f_L~0.5): not enough sensible to discriminate

Penguin dominated: $f_L(\Phi K^*_2(1430))$ ~ 1

Tree dominated (expected f_L~1.0): OK!

$B \to b_1 V$ Results

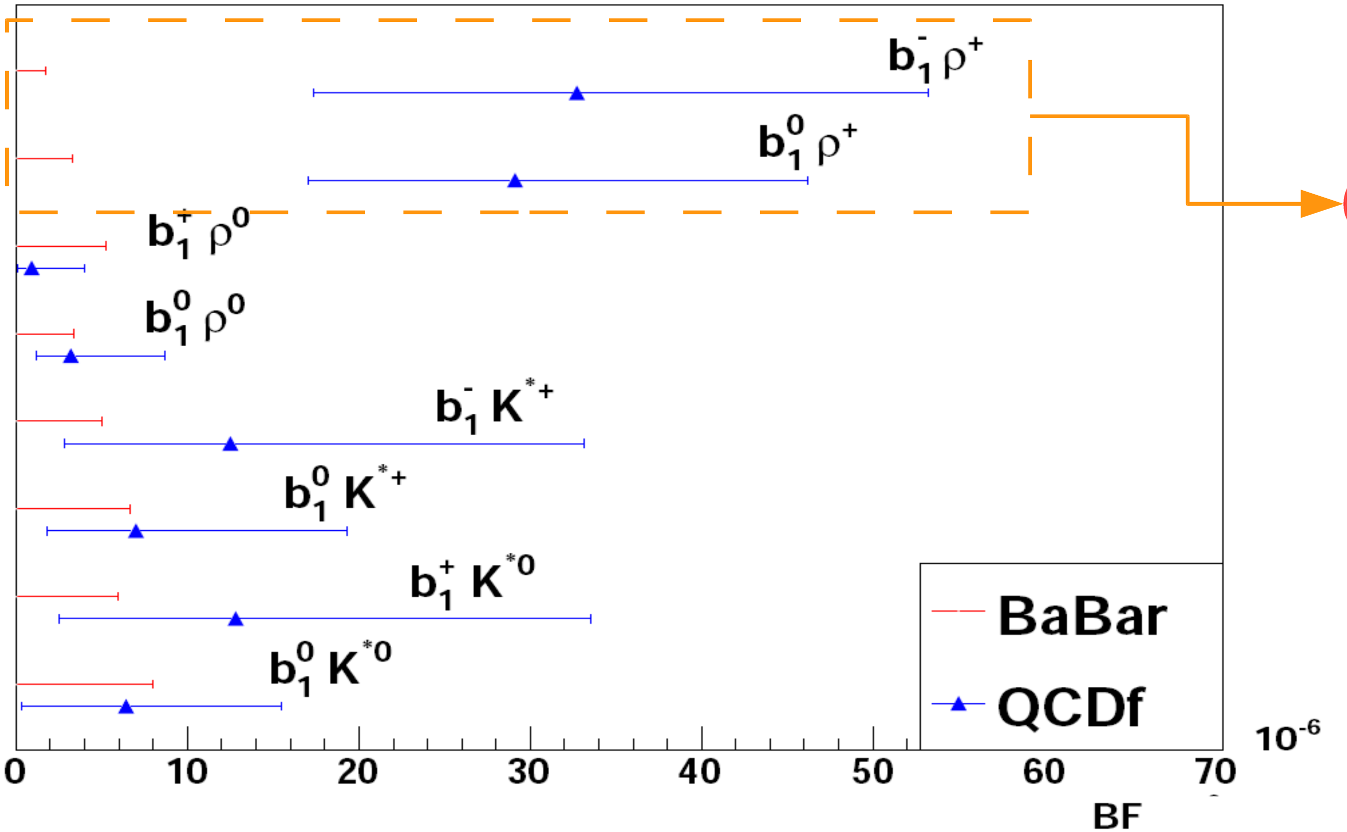
Both B^0 and B^+ decay modes considered, $V = \rho, K^*(892)$.

We assume $BF(b_1 \to \omega\pi) = 100\%$.

465 10^6 $B\bar{B}$ pairs

High branching fractions predicted by QCD factorization.

H.Y Cheng and K.C.Yang, PRD78 094001 (2008)



DISAGREEMENT!

PRELIMINARY!

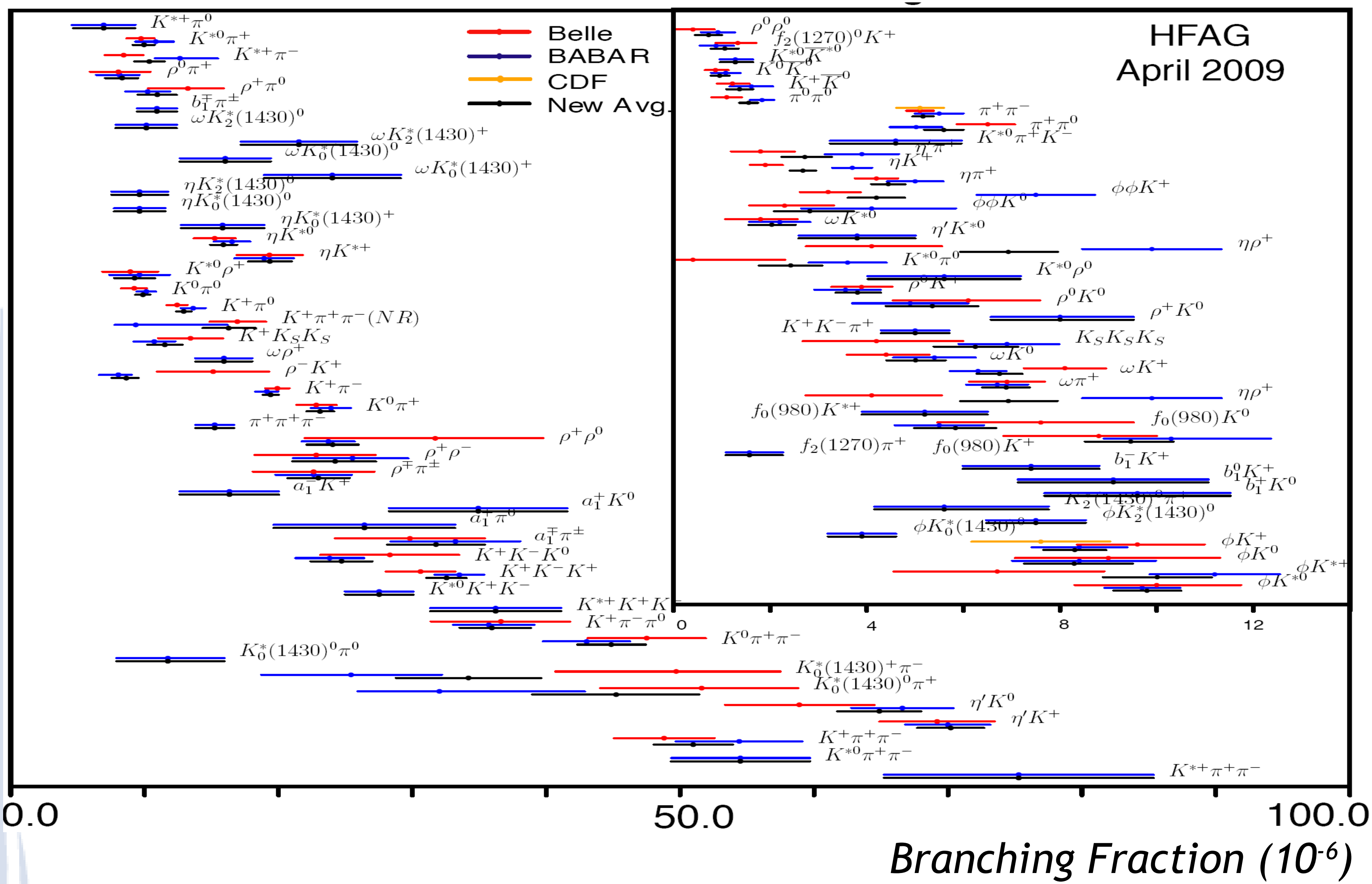
NEW RESULTS!

Conclusions

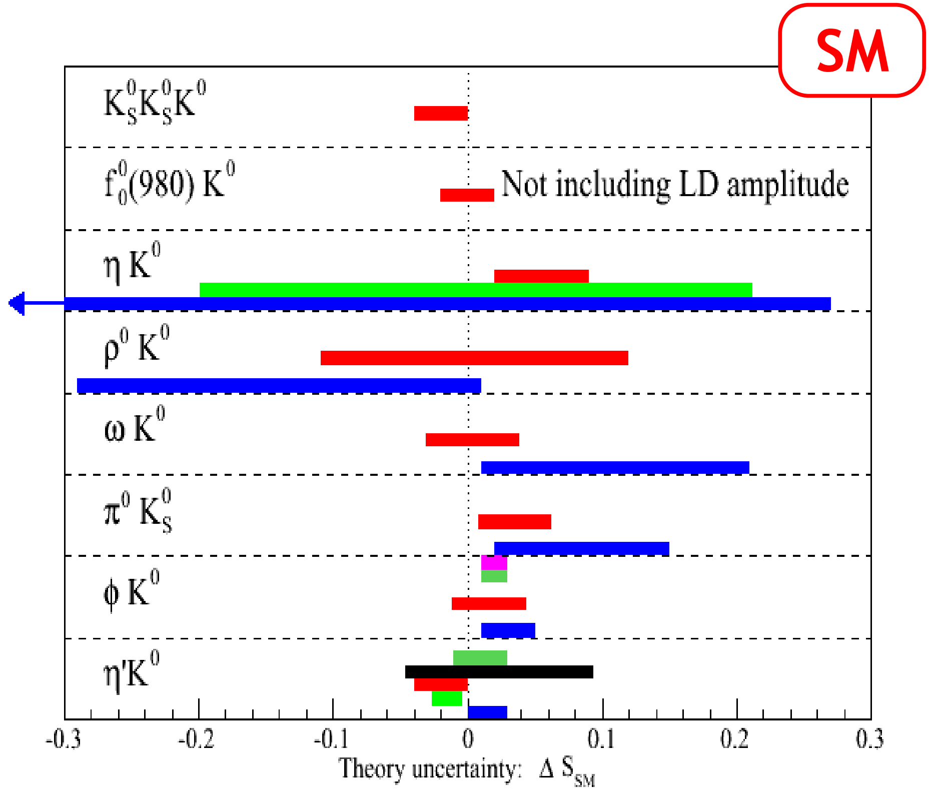
- Charmless hadronic B decays are a good place to test Standard Model and look for New Physics effects.
- The η-η' puzzle seems to be understood. ηK^+ have a 3.3σ evidence of direct *CPV*.
- The polarization puzzle is not understood, yet:
  - Tree-dominated decays seems to obey $f_L \approx 1$
  - Penguin-dominated *VV* modes have $f_L \approx 0.5$ (ΦK^*, ρK^*, ωK^* (?))
  - Disagreement in *VT* modes $f_L(\Phi K^*_2(1430)) \approx 1$, but $f_L(\omega K^*_2(1430)) \approx 0.5$
- QCD factorization explains well some *AP* decays (such as $b_1(a_1(1260))\pi$, $b_1(a_1(1260))K$), but overestimates some b_1V modes: insight needed.
- Penguin dominated $b \rightarrow s$ decay modes (such as ηK^0_S) may provide new independent measurement of $\sin 2\beta$: quest for New Physics!
- B factory sensitivity is now approaching the level required to observe these modes: ηK^0_S physics case should be considered at new super-flavor factories SuperKEKB/SuperB.

Backup

Experimental Status



Bounds on $|\Delta S - \sin 2\beta|$



- QCDF Beneke, PLB**620**, 143(2005)
- SCET/QCDF, Williamson and Zupan, PRD**74**, 014003 (2006)
- QCDF Cheng, Chua and Soni, PRD**72**, 014006 (2005), PRD**74** 094001 (2006)
- SU(3) Gronau, Rosner and Zupan, PRD**74**, 093003 (2006)
- QCDF Buchalla, Hiller, Nir and Raz, JHEP**09**, 075 (2005)
- pQCD Li and Mishima, PRD**74**, 094020 (2006)

- *ΔS* in SM may come from λ-suppressed contributions to the decay amplitude
- These contributions are expected to be small.
- Both SM and NP effects are channel-dependent: need to calculate bounds
- ΦK^0_S is a pure penguin mode and SM contributions are expected to be very small

Large *ΔS* would be a clear signal of NP

Neutral Modes with η and η' Results

TABLE II: Fitted signal event yield and fit bias in events (ev), detection efficiency ϵ, daughter branching fraction product $\prod \mathcal{B}_i$, significance $\mathcal{S}$, and measured branching fraction $\mathcal{B}$ with statistical error for each B^0 decay mode. For the combined measurements we give the significance (with systematic uncertainties included) and the branching fraction with the statistical and systematic uncertainties (in parentheses the 90% CL upper limit). Significances greater than 7 standard deviations (σ) are omitted.

Mode	Yield (ev)	Fit bias (ev)	ϵ (%)	$\prod \mathcal{B}_i$ (%)	$\mathcal{S}$ (σ)	$\mathcal{B}(10^{-6})$	
$\eta_{\gamma\gamma}K^0$	21^{+10}_{-9}	0	32.1	13.6	2.5	$1.03^{+0.49}_{-0.44}$	
$\eta_{3\pi}K^0$	12^{+7}_{-6}	0	20.6	7.9	2.5	$1.56^{+0.92}_{-0.79}$	
$\boldsymbol{\eta K^0}$					**3.5**	$\mathbf{1.15^{+0.43}_{-0.38} \pm 0.09}$	**(< 1.8)**
$\eta_{\gamma\gamma}\eta_{\gamma\gamma}$	13^{+10}_{-9}	+1	23.9	15.5	1.4	$0.7^{+0.6}_{-0.5}$	
$\eta_{\gamma\gamma}\eta_{3\pi}$	9^{+6}_{-5}	+1	18.0	17.9	1.5	$0.5^{+0.4}_{-0.3}$	
$\eta_{3\pi}\eta_{3\pi}$	$0.2^{+2.4}_{-1.7}$	−0.1	11.1	5.2	0.1	$0.1^{+0.9}_{-0.6}$	
$\boldsymbol{\eta\eta}$					**1.9**	$\mathbf{0.5 \pm 0.3 \pm 0.1}$	**(< 1.0)**
$\eta_{\gamma\gamma}\phi$	0^{+6}_{-5}	0	29.3	19.4	0.1	0.0 ± 0.2	
$\eta_{3\pi}\phi$	4^{+4}_{-3}	0	18.3	11.2	1.9	$0.4^{+0.4}_{-0.3}$	
$\boldsymbol{\eta\phi}$					**1.4**	$\mathbf{0.2 \pm 0.2 \pm 0.1}$	**(< 0.5)**
$\eta_{\gamma\gamma}\omega$	36^{+13}_{-12}	+3	18.7	35.1	3.4	$1.08^{+0.42}_{-0.39}$	
$\eta_{3\pi}\omega$	8^{+7}_{-5}	+1	13.1	20.2	1.8	$0.59^{+0.57}_{-0.40}$	
$\boldsymbol{\eta\omega}$					**3.7**	$\mathbf{0.94^{+0.35}_{-0.30} \pm 0.09}$	**(< 1.4)**
$\eta'_{\eta\pi\pi}K^0$	490^{+25}_{-24}	−2	26.6	6.1	–	$64.9^{+3.3}_{-3.2}$	
$\eta'_{\rho\gamma}K^0$	1003 ± 41	+27	28.3	10.2	–	72.4 ± 3.0	
$\boldsymbol{\eta' K^0}$					**–**	$\mathbf{68.5 \pm 2.2 \pm 3.1}$	
$\eta'_{\eta\pi\pi}\eta'_{\eta\pi\pi}$	$1.6^{+2.1}_{-1.1}$	0	19.9	3.1	2.2	$0.6^{+0.7}_{-0.3}$	
$\eta'_{\eta\pi\pi}\eta'_{\rho\gamma}$	8^{+9}_{-7}	+2	19.8	10.3	0.8	$0.6^{+0.9}_{-0.7}$	
$\boldsymbol{\eta'\eta'}$					**1.0**	$\mathbf{0.6^{+0.5}_{-0.4} \pm 0.4}$	**(< 1.7)**
$\eta'_{\eta\pi\pi}\phi$	-2^{+2}_{-1}	0	24.4	8.6	0.0	$-0.2^{+0.2}_{-0.1}$	
$\eta'_{\rho\gamma}\phi$	5^{+8}_{-7}	0	23.9	14.5	0.7	$0.3^{+0.5}_{-0.4}$	
$\boldsymbol{\eta'\phi}$					**0.5**	$\mathbf{0.2 \pm 0.2 \pm 0.3}$	**(< 1.1)**
$\eta'_{\eta\pi\pi}\omega$	14^{+7}_{-6}	+1	17.9	15.6	3.4	$1.03^{+0.54}_{-0.46}$	
$\eta'_{\rho\gamma}\omega$	16^{+17}_{-15}	−2	15.2	26.2	1.2	$0.94^{+0.91}_{-0.81}$	
$\boldsymbol{\eta'\omega}$					**3.6**	$\mathbf{1.01^{+0.46}_{-0.38} \pm 0.09}$	**(< 1.8)**

467 10^6
$B\bar{B}$ pairs

NEW RESULTS!
Hep-ex 0907.1743
Submitted to PRD

Charged Modes with η and η' Results

TABLE III: Fitted signal event yield and fit bias, detection efficiency ϵ, daughter branching fraction product $\prod \mathcal{B}_i$, measured branching fraction $\mathcal{B}$, charge asymmetry $\mathcal{A}_{ch}$ with statistical error, and significance $\mathcal{S}_{\mathcal{A}}$ of the charge asymmetry for each charged decay mode. For the combined measurements we give the branching fraction, the charge asymmetry and the significance of the charge asymmetry with the statistical and systematic uncertainties.

Mode	Yield (ev)	Fit bias (ev)	ϵ (%)	$\prod \mathcal{B}_i$ (%)	$\mathcal{B}(10^{-6})$	$\mathcal{A}_{ch}$	$\mathcal{S}_{\mathcal{A}}(\sigma)$
$\eta_{\gamma\gamma}\pi^+$	286^{+31}_{-30}	+18	35.1	39.3	$4.16^{+0.48}_{-0.47}$	$-0.02^{+0.10}_{-0.11}$	0.4
$\eta_{3\pi}\pi^+$	95^{+19}_{-18}	+7	23.4	22.7	$3.53^{+0.77}_{-0.73}$	$+0.06 \pm 0.18$	0.4
$\boldsymbol{\eta\pi^+}$					$\mathbf{4.00 \pm 0.40 \pm 0.24}$	$\mathbf{-0.03 \pm 0.09 \pm 0.03}$	**0.3**
$\eta_{\gamma\gamma}K^+$	215^{+31}_{-30}	+21	34.0	39.3	$3.11^{+0.50}_{-0.48}$	-0.37 ± 0.12	3.1
$\eta_{3\pi}K^+$	69^{+16}_{-15}	+6	22.9	22.7	$2.60^{+0.66}_{-0.62}$	-0.32 ± 0.22	1.5
$\boldsymbol{\eta K^+}$					$\mathbf{2.94^{+0.39}_{-0.34} \pm 0.21}$	$\mathbf{-0.36 \pm 0.11 \pm 0.03}$	**3.3**
$\eta'_{\eta\pi\pi}\pi^+$	96^{+20}_{-19}	+1	29.4	17.5	4.0 ± 0.8	-0.25 ± 0.19	1.3
$\eta'_{\rho\gamma}\pi^+$	111^{+31}_{-29}	+7	25.9	29.4	$2.9^{+0.9}_{-0.8}$	$+0.56^{+0.29}_{-0.27}$	2.1
$\boldsymbol{\eta'\pi^+}$					$\mathbf{3.5 \pm 0.6 \pm 0.2}$	$\mathbf{+0.03 \pm 0.17 \pm 0.02}$	**0.2**
$\eta'_{\eta\pi\pi}K^+$	1601^{+44}_{-43}	−5	28.7	17.5	$68.5^{+1.9}_{-1.8}$	-0.004 ± 0.027	0.2
$\eta'_{\rho\gamma}K^+$	2991^{+72}_{-71}	−10	29.3	29.4	74.6 ± 1.8	$+0.016 \pm 0.023$	0.7
$\boldsymbol{\eta' K^+}$					$\mathbf{71.5 \pm 1.3 \pm 3.2}$	$\mathbf{+0.008^{+0.017}_{-0.018} \pm 0.009}$	**0.4**

467 10^6
$B\bar{B}$ pairs

NEW RESULTS!
hep-ex 0907.1743
Submitted to PRD