

Wei-Ming Yao (LBNL) PDG Collaboration/Advisory Meeting, CERN, October 6-7, 2012

- What's new in RPP 2012
- Minireviews
- Issues
- Heavy Flavor Averaging Group Activities (HFAG)
- Prospects for 2014 Edition

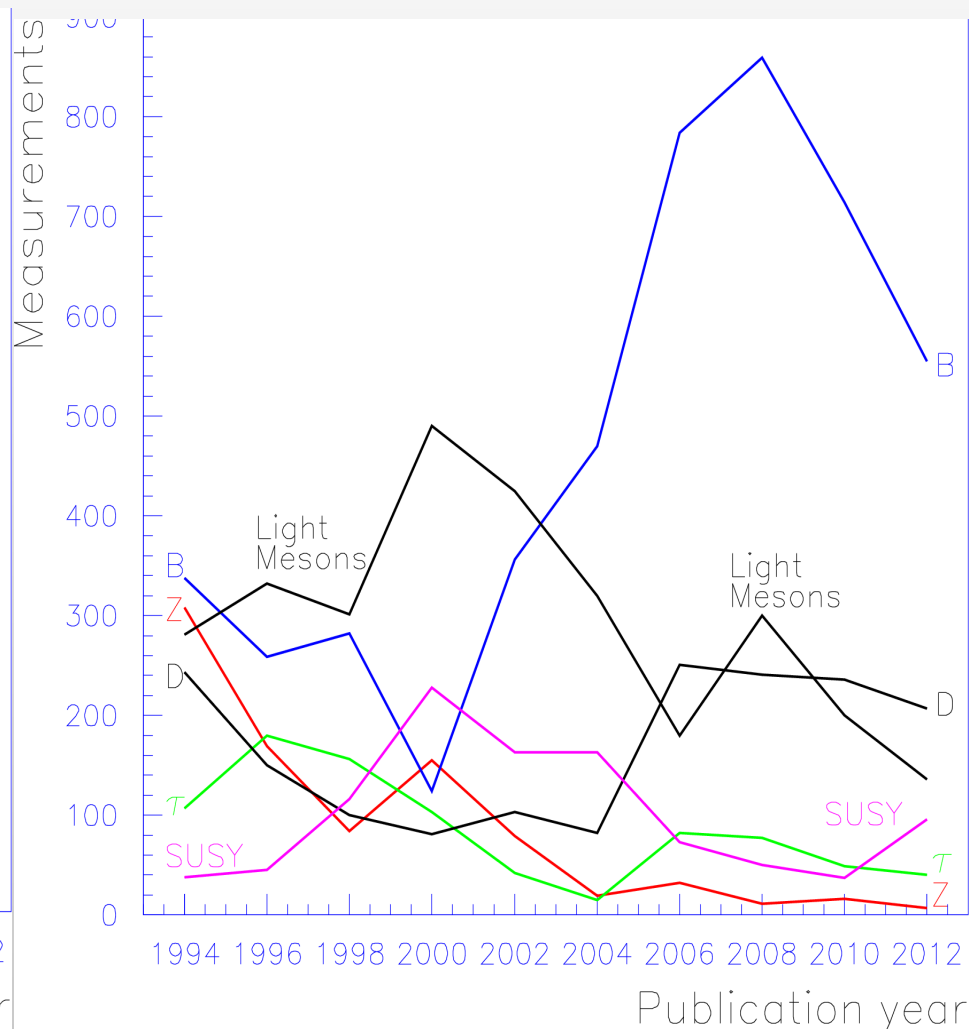
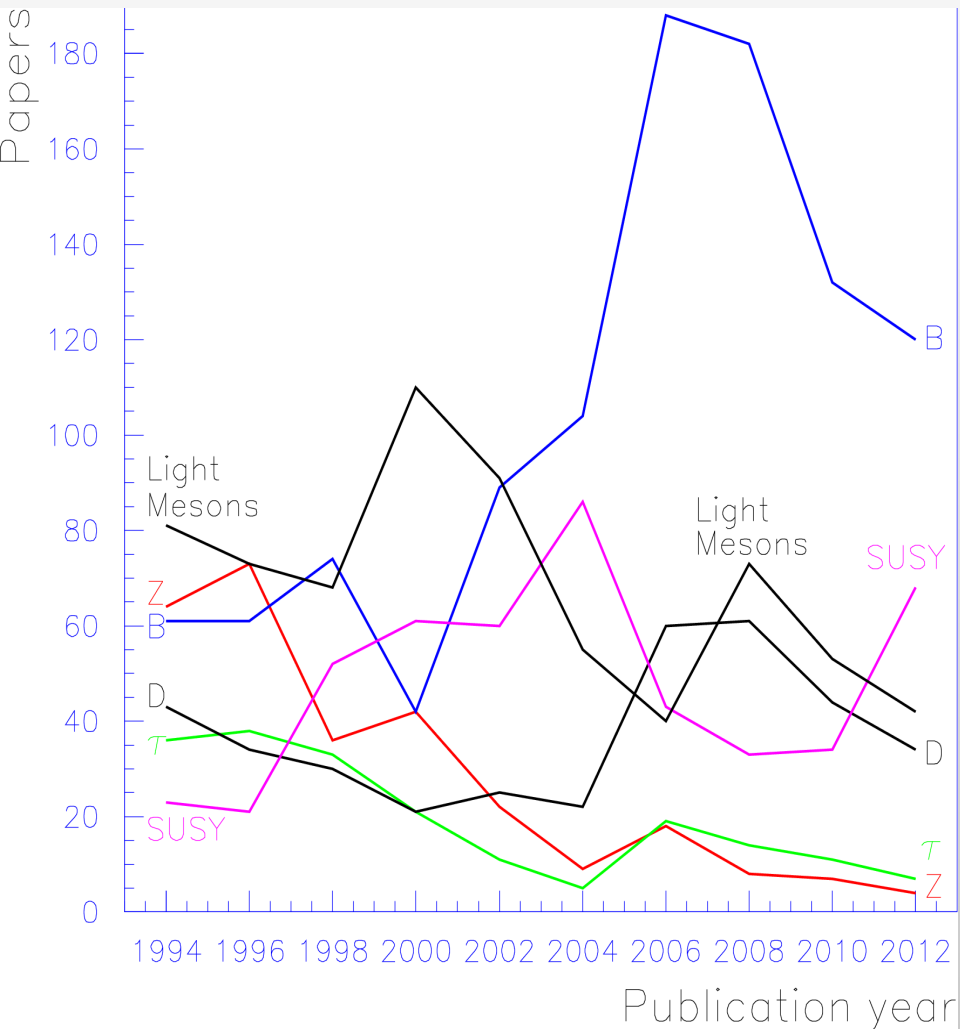
Overseers: Wei-Ming Yao, Jean-Francois Arguin(out), and Alex Cerri(in)

Encoders:

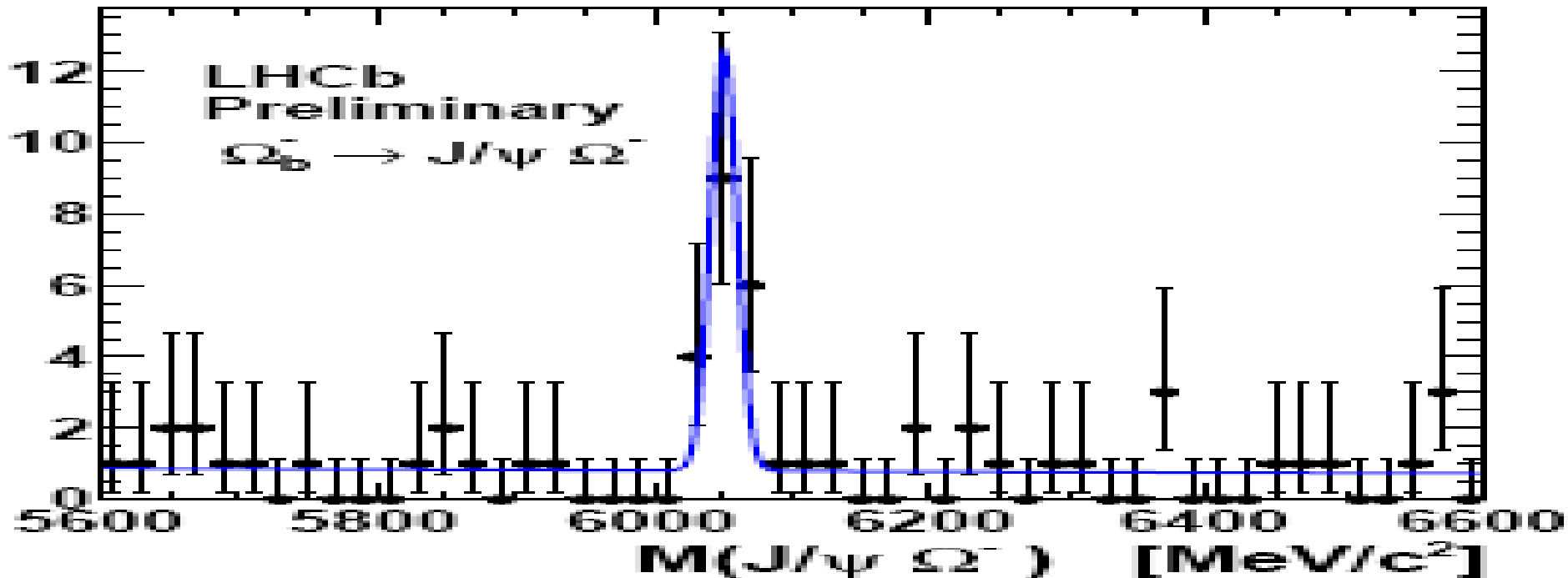
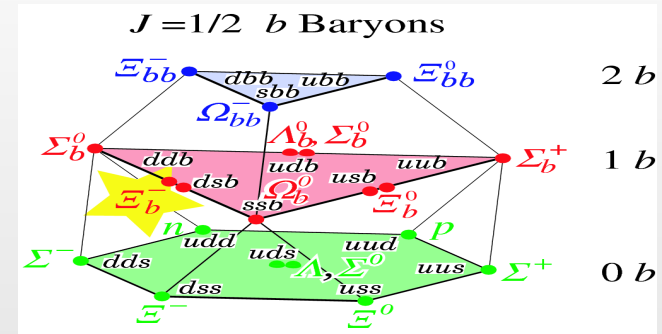
- Y. Kwon (Yonsei, Korea), J. Smith(Colorado, USA), M. Kreps(Warwick,UK)
- With the help of HFAG

- B physics continues to be one of the most productive fields in RPP.
- 120 papers and 550 measurements were encoded for this edition.
- **Highlights:**
 - Including first LHCb results, stringent limits on $B_s \rightarrow \mu^+ \mu^-$ from LHCb and CMS approaching to the SM expectation.
 - Much more precised measurements and fewer anomalies.
 - **Unfortunately, all data are consistent with SM.**
- **Excellent mini reviews:**
 - B production and decays (Kwon, Kreps, and Smith)
 - $B\bar{B}$ mixing (Schneider)
 - V_{cb}/V_{ub} determinations (Kowalewski and Mannel)
 - B Polarization (Gritsan and Smith)

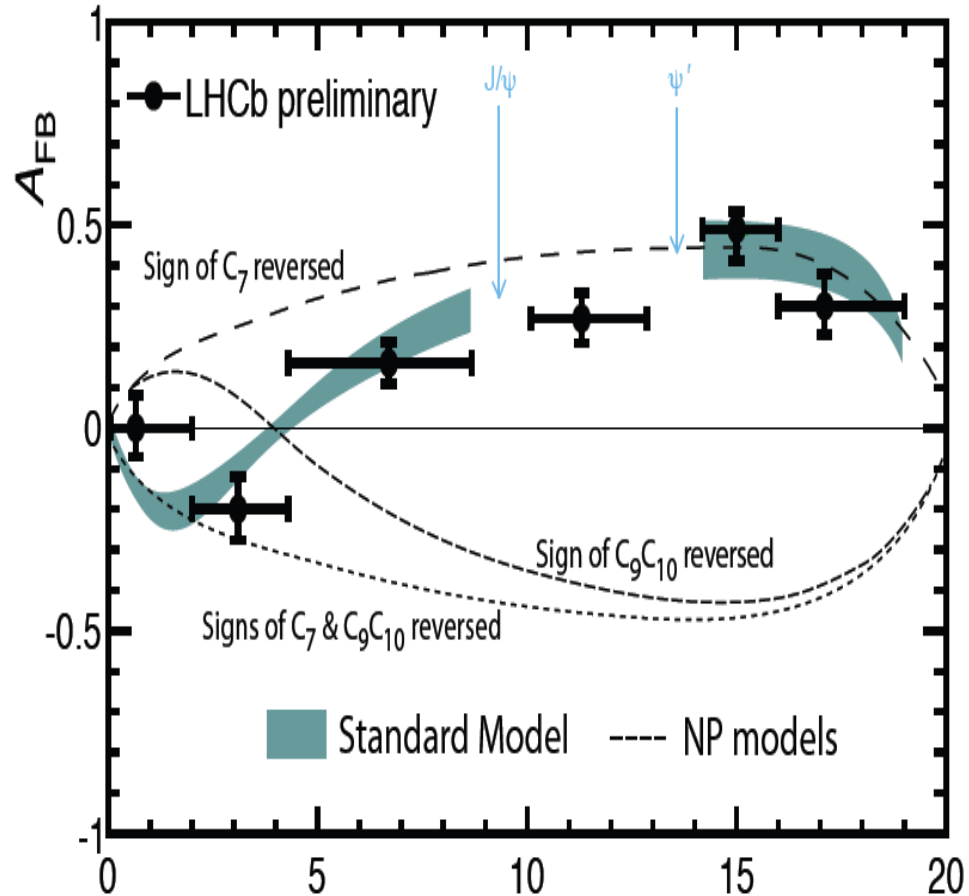
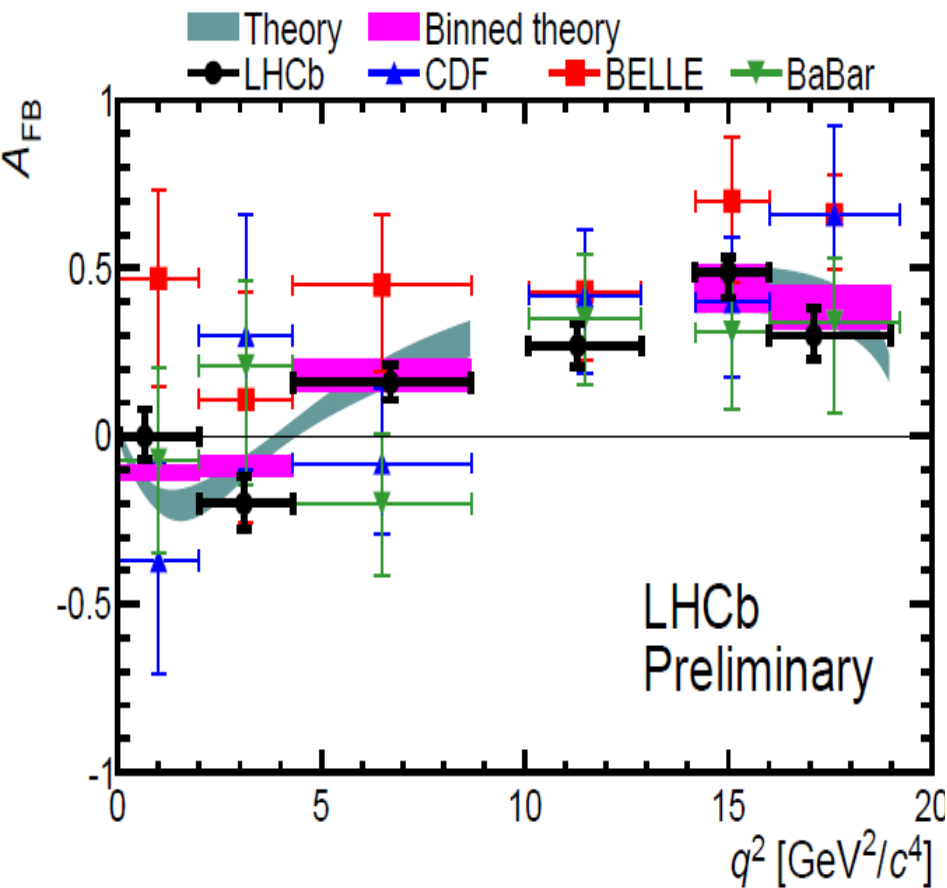
- B's still outperform the rest, but at a slower pace.



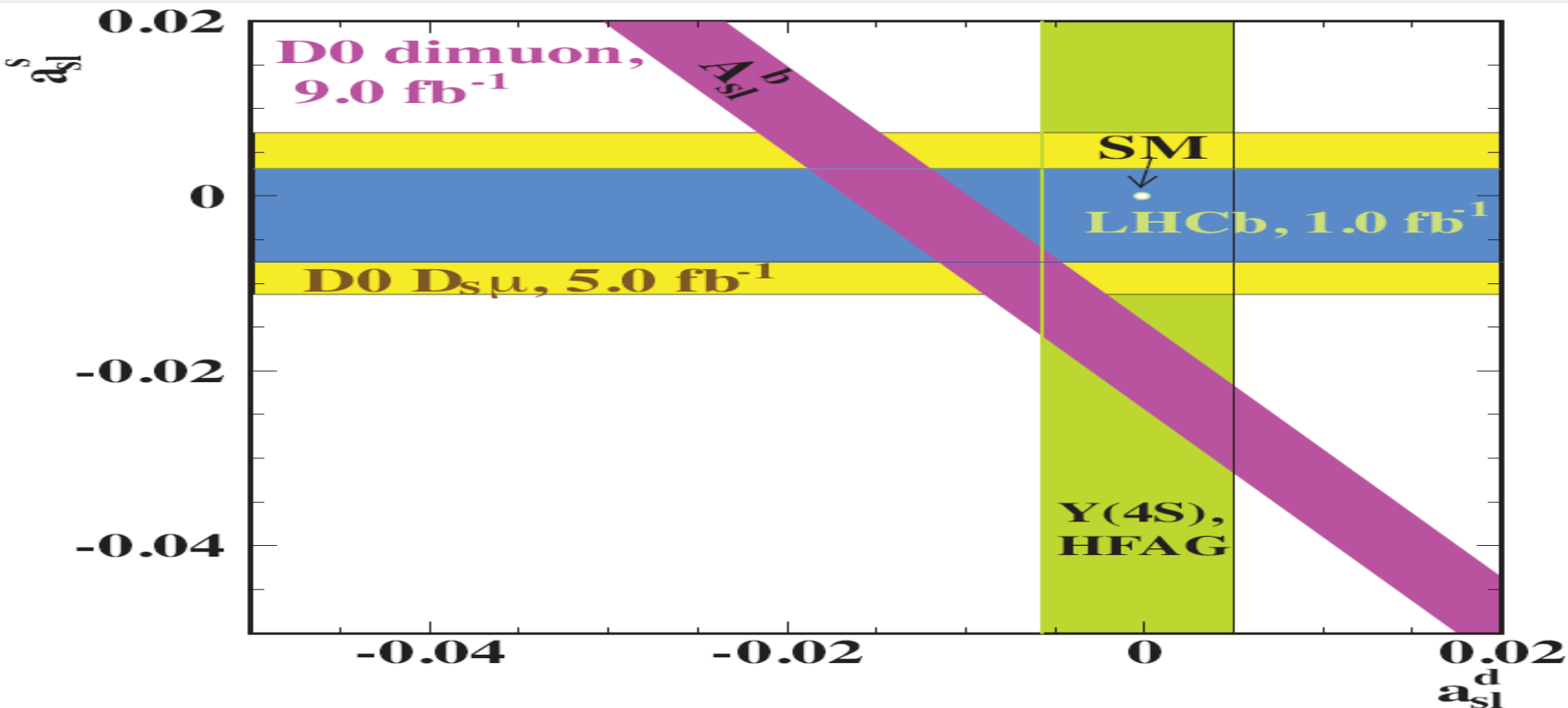
- Completing b-Baryon sector containing 1b.
- Ω_b^- mass discrepancy resolved:
 - CDF: $6054.4 \pm 6.8 \pm 0.9$ MeV
 - D0 : $6165 \pm 10 \pm 13$ MeV
 - LHCb: $6050.3 \pm 4.5 \pm 2.2$ MeV (preliminary)



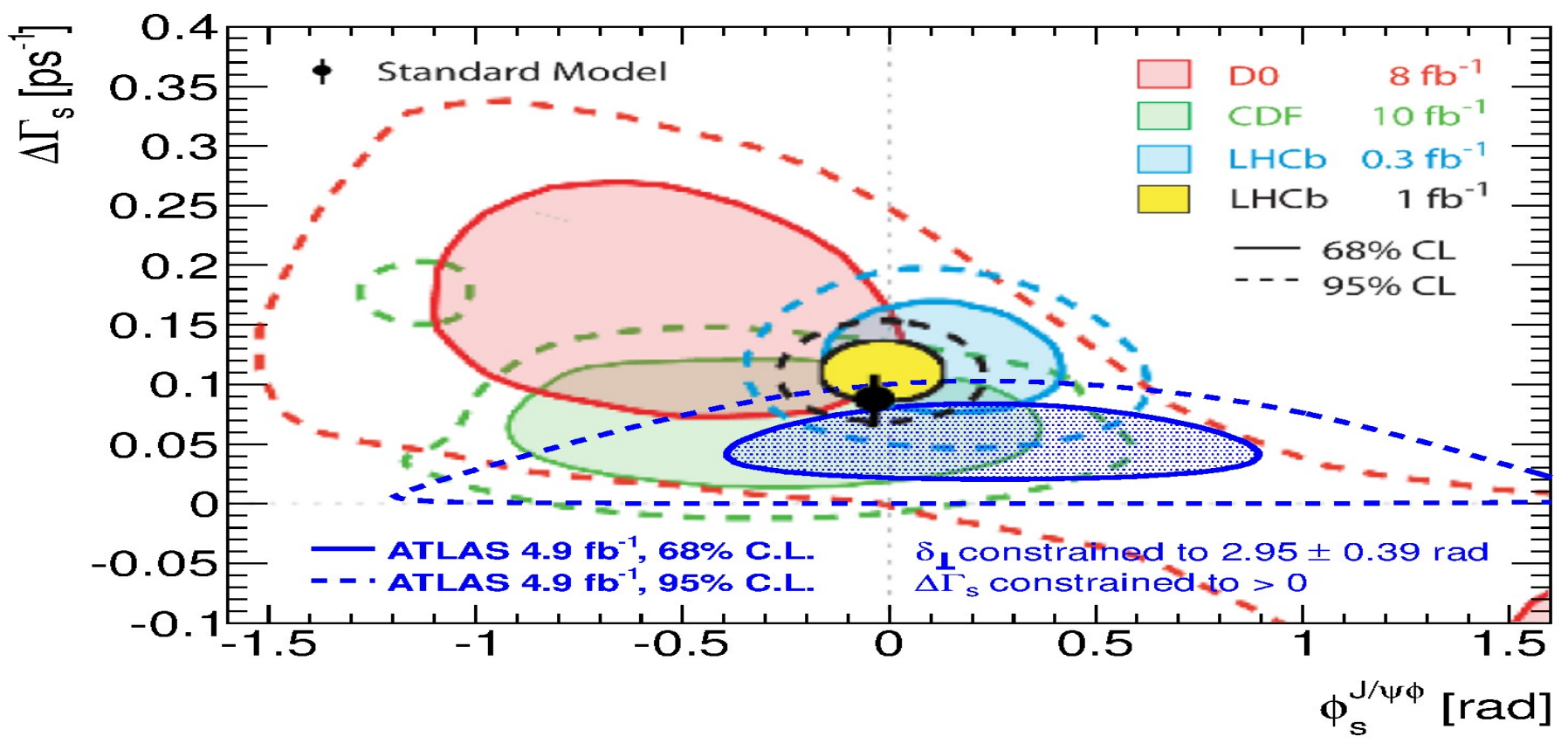
- Belle reported 2.7σ deviation from SM in F_{AB} using $B \rightarrow K^* l^+ l^-$.
- **LHCb data: no evidence of deviation from SM predictions.**



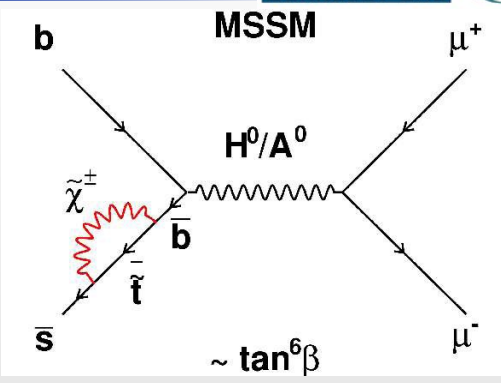
- $a_{sl}^s = (N^{++} - N^{--}) / (N^{++} + N^{--})$
- D0 measurements is $\sim 3\sigma$ from SM predictions, PRL 105, 081801 (2010).
- LHCb $B_s \rightarrow D_s \mu X$ measurement consistent with SM.



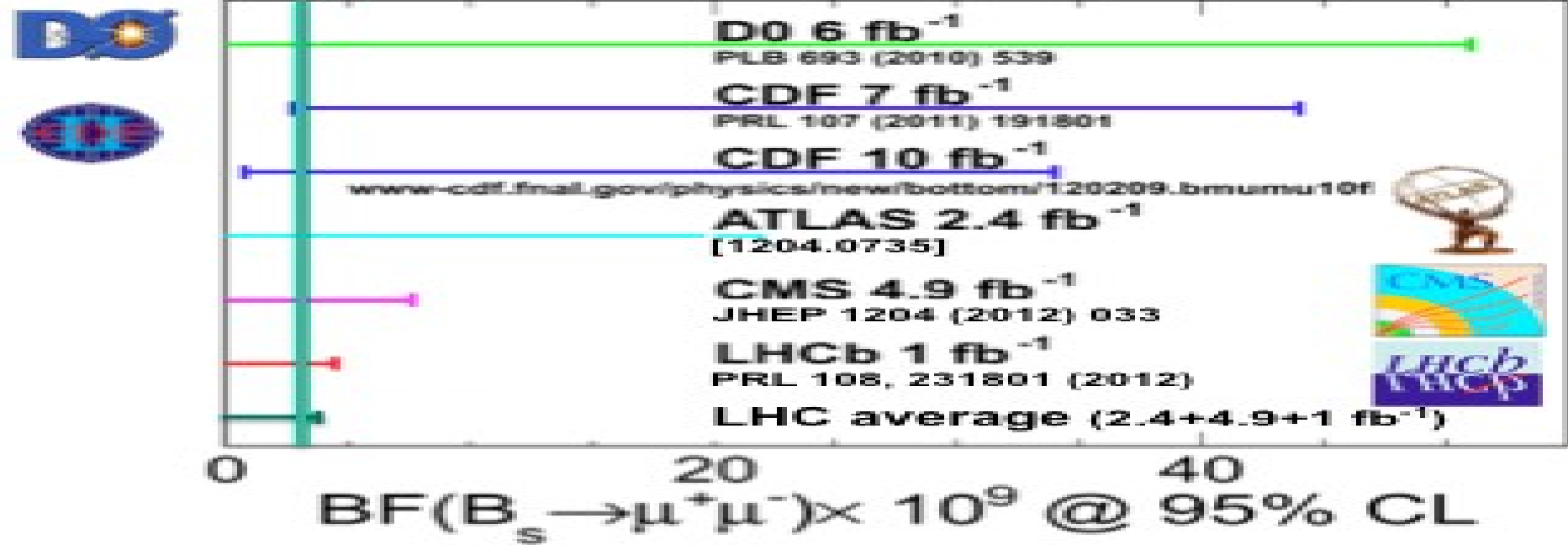
- $B_s \rightarrow J/\psi \phi$ measures CPV B_s mixing phase $-2\beta_s(\phi_s)$, **Sensitive to NP at loop.**
- CDF, D0, LHCb, and ATLAS updated results and their combination is consistent with SM.



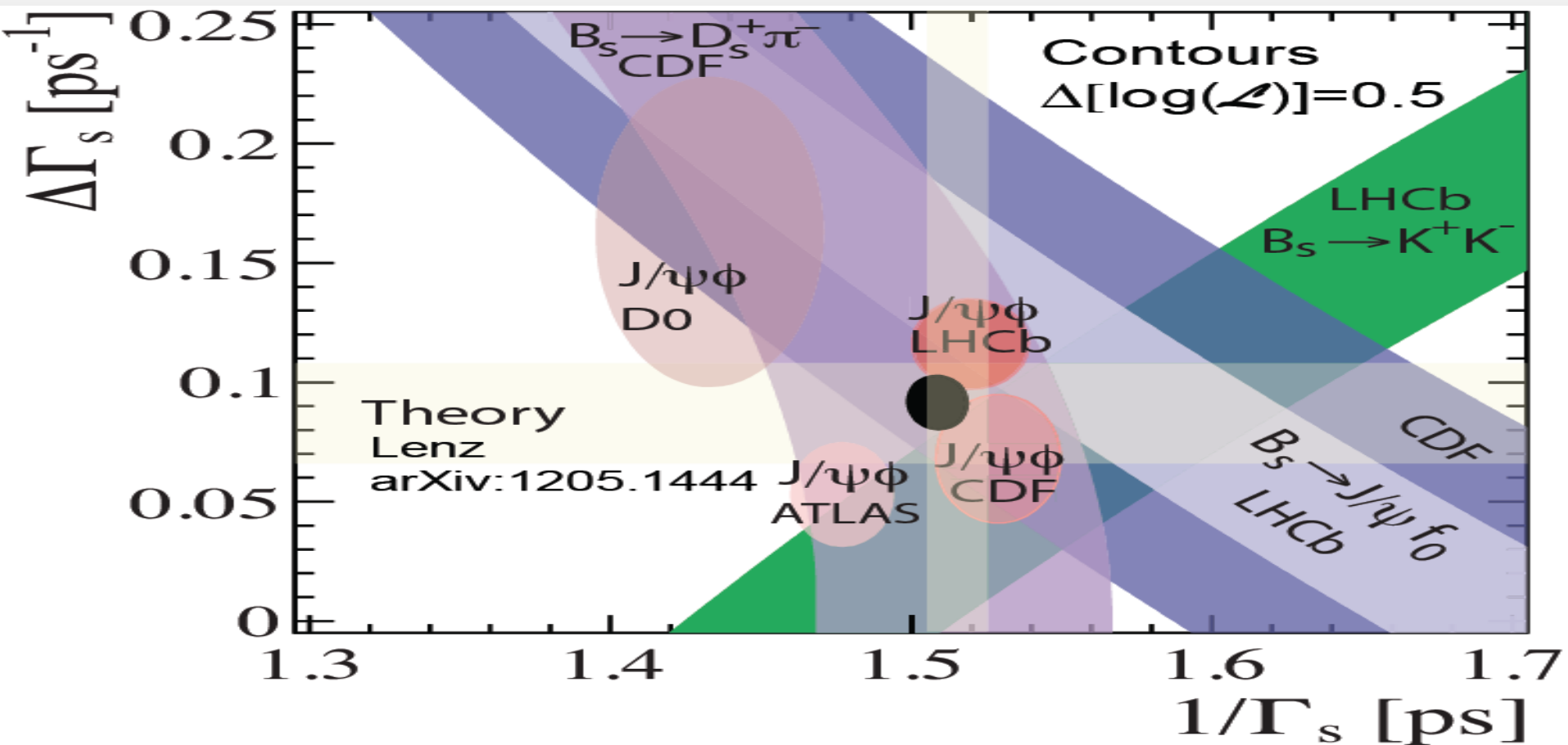
- $B_{s(d)} \rightarrow \mu^+ \mu^-$ is highly suppressed in SM, sensitive to NP ($\sim \tan^6 \beta$).
- LHC combination set an upper limit at 95% CL (10^{-9}):
 - Observed 4.2 for B_s and 0.81 for B_d
 - Close to SM predictions: $3.2 \pm 0.03 (B_s) \& 0.11 \pm 0.01 (B_d)$



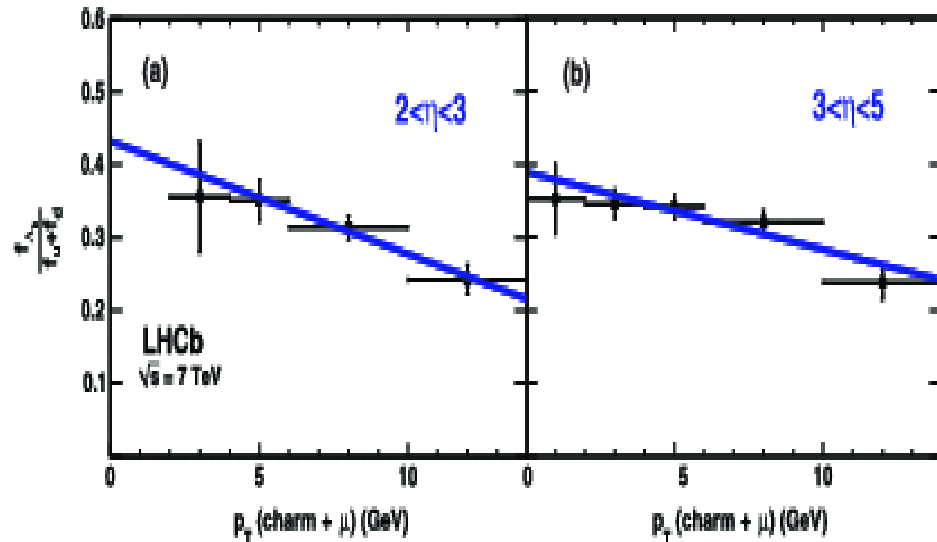
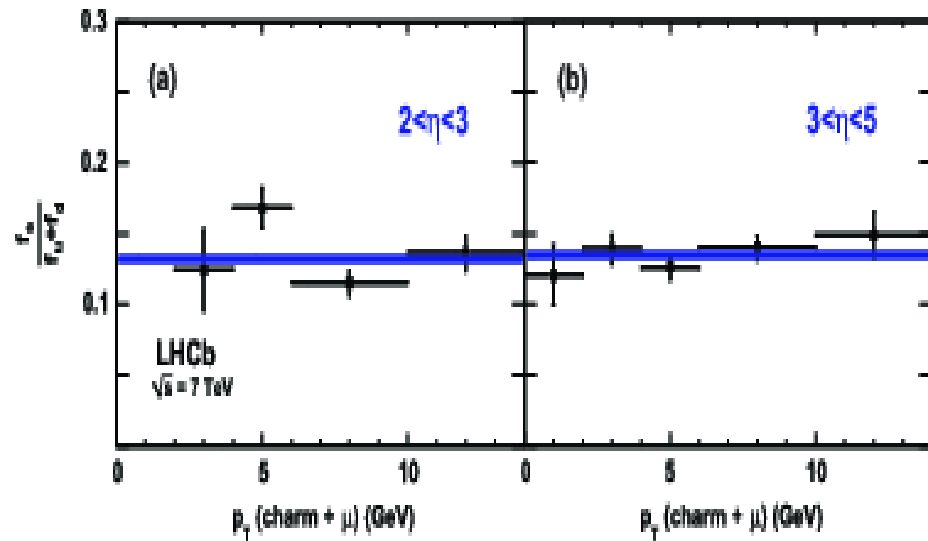
SM prediction



- B_s short and long states have different lifetimes(6.7±0.9%).
- Do we want to list it separately in the listing as B_s(short), B_s(long), admixture ?

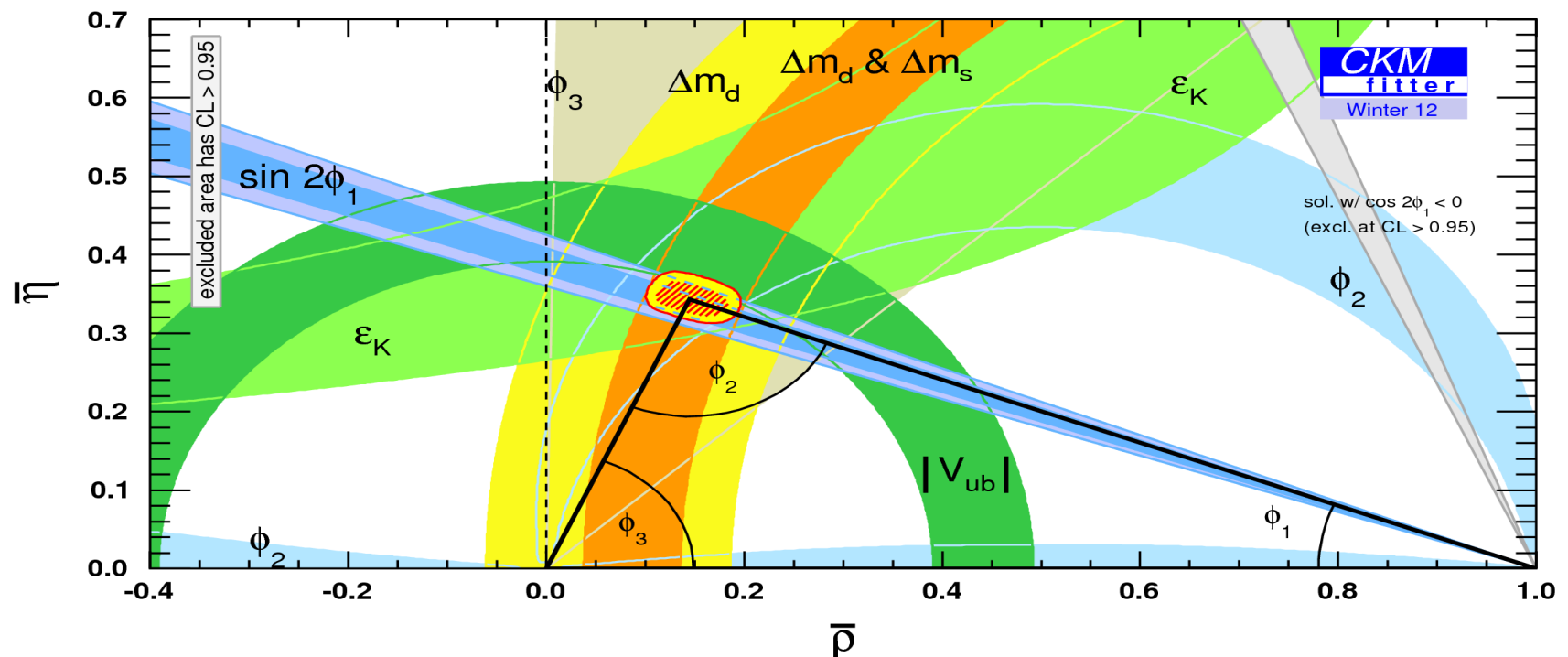


- The B production fractions are required for precision measurement of BR.
- At B factories: $f = B(Y(4S) \rightarrow B^+B^-) / B(Y(4S) \rightarrow B^0B^0)$ is measured to be 1.055 ± 0.025 , about 2σ higher than what is assumed 1.0 in the listing. We may have to rescale the existing measurements once the value of f is 3σ from 1.0.
- At LEP, Tevatron and LHC: the b fractions might be collider dependent (Pt).



- CP violation has been experimentally established in K, D, and B meson decays, which are summarized by David and Yossi in the CPV review.
- All measurements of CPV so far are consistent with SM predictions and search for additional sources of CPV will be continue at LHCb and future super B-factories.
- David has recently moved his research interests toward astrophysics and agrees to hand the responsibility to someone for the next edition.
- After consulting with the PDG Rep board, we have Dr. Tim Gershon from Warwick, UK agreed to be the co-authors of CP review with Yossi Nir.
- We will make sure the review updated thoroughly in coming years.

- Most CKM elements are measured based on branching ratios or decay asymmetry with some help of theoretical assumptions.
- B section provides: Δm_d , Δm_s , ϕ_1 , ϕ_2 , ϕ_3 , V_{cb} , V_{ub}
- They are discussed in mini-review or CKM review



- The PDG averaging method is not designed for handling correlations in statistical and systematic errors between measurements and experiments.
- Have to rely heavily on the outside working groups and their expertise to provide the best averages for PDG that use only published results.
- **HFAG provided their averages for PDG for many years**, whose combination procedure takes all known correlations into account as well as re-scaling each individual measurements using the common set of input parameters before averaging.
- **HFAG consists of 7 subgroups**: B lifetime/Mixing, Semileptonic B decays, Unitarity Triangle, Rare B Decays, $b \rightarrow c$ Decays, Charm, and τ physics.
- **Details see the slides from HFAG (Alan Schwartz, Tim Gershon).**

- Continue to work with HFAG providing the world best B decay parameters.
- Planning for data driven minireviews:
 - Vcb and Vub CKM Elements
 - Production and Decay of b-flavor Hadrons
 - BBbar Mixing
 - Polarization in B decay
- All the data are consistent with SM.
- This is an exciting time for flavor physics and we will continue to meet the challenges in 2014.

D^+ , D^0 (except D^0 mixing), D_s^+

Encoder: Steve Blusk. New data entries: 169.

- Not a lot exciting. Most of the measurements are of limits on forbidden modes or of searches for CP violation. There is some evidence for CP violation in

$$\begin{aligned}\Delta A_{CP} &\equiv A_{CP}(D^0 \rightarrow K^+K^-) - A_{CP}(D^0 \rightarrow \pi^+\pi^-) \\ &= -(0.65 \pm 0.18)\% ,\end{aligned}$$

our average of four measurements. A short header note tells why this is an interesting combination of asymmetries to measure. At least one other measurement supporting a nonzero value has appeared since we published.

- David Asner and Christoph Hanhart revised the note “Dalitz Plot Analysis Formalism.”
- Jon Rosner and Sheldon Stone revised the note “Decay Constants of Charged Pseudoscalar Mesons.”

Charm baryons

Encoder: Steve Blusk. New data entries: 21.

- There are 17 of these baryons, and they make a nice study in spectroscopy (you can practically read off the spin-parity values from the level diagram; see the mini-review), but all that is new this edition are a few better masses and widths, and a few new limits on forbidden modes.
- The great need here is for a good measurement of a Λ_c^+ branching fraction. For more than a decade, we have been stuck getting all Λ_c^+ fractions relative to a cobbled-together $pK^-\pi^+$ fraction of $(5.0 \pm 1.3)\%$.

`\charm\2012 PDG meeting\1-of-1\cgwohl`