



Heavy Flavor Averaging Group (HFAG)

1st LHCHFWG meeting
November 10, 2015

Co-leaders (since 2010): ***Tim Gershon,*** *University of Warwick*
Alan Schwartz, *University of Cincinnati*
Email: T.J.Gershon@warwick.ac.uk, alan.j.schwartz@uc.edu

2007-2010	*Alan Schwartz, Gianluca Cavoto*
2005-2007:	*Soeren Prell, Simon Eidelman*
2002-2005:	*David Kirkby, Yoshihide Sakai*

Goal: ***provide up-to-date world averages for measurements of B, D, and τ meson related quantities. Results can be freely quoted by conference speakers, theorists, etc.***

Policy: ***We use the latest preliminary results in averages, if supported by publicly available written documentation; however, if a result is not submitted for publication within ~24 months (or if there are no plans to publish a result), it is excluded.***

For averages, we usually do not inflate errors. Exceptions to these policies are possible.

Organization

HFAG

7 semi-independent subgroups:

- B lifetimes and oscillation parameters,
- Semi-leptonic B decays,
- Rare B decays,
- Unitarity triangle parameters,
- B decays to charm final states,
- Charm Physics,
- Tau Physics.

One slide per group highlights in back up

Web pages: subgroups update their websites typically 2-3 times/year, e.g., after Moriond, ICHEP/LP, FPCP/CKM, etc.

(http://www.slac.stanford.edu/xorg/hfag/)

These provide world averages & plots for conference speakers, theorists, etc.

Preprint: every 1-2 years, all results are collected together in one paper and posted to arXiv (hep-ex). Most recent update 2014; next 2016. The most recent posting is:

Y. Amhis et al., "Averages of b-hadron, c-hadron, and τ-lepton Properties as of Summer 2014," arXiv:1412.7515 (125 INSPIRE citations)

Organization (cont.)

HFAG

HFAG co-leaders appointed by Belle (II) & LHCb managements

- ***Until 2015 was by managements of BaBar & Belle***

Subgroup representation from experiments contributing significantly in the appropriate area

- ***All members expected to contribute actively***
- ***New members appointed as necessary by appropriate collaboration's management; no forced retirement***
- ***Across all subgroups, representatives from BaBar, Belle (II), LHCb, CLEO-c, BESIII, CDF, D0***
  - ***no explicit ATLAS or CMS representation (yet); however, some ATLAS & CMS collaborators representing different experiments***
  - ***complete list at http://www.slac.stanford.edu/xorg/hfag/org/***

Face-to-face meetings at CKM workshops supplemented by occasional subgroup leader phone conferences

HFAG and the PDG

HFAG provides numerous averages to the PDG (contact: Weiming Yao)

The provided averages currently include:

A. Lifetimes and Oscillations:

- b lifetimes
- B mixing parameters
- b production fractions
- $\Delta\Gamma s$, ϕs

B. UT Triangle:

- sin2β (B0$\rightarrow$ ccbar K0)
- |λ | (B0$\rightarrow$ ccbar K0)

C. Charm:

- mixing parameters x, y
- strong phases $\delta K\pi$, $\delta K\pi\pi$
- CPV parameters |q/p|, ϕ

D. Semileptonic decays:

- |Vcb| x F(1) for B0$\rightarrow$ D*- l+ ν with ρ2 and correlation
- |Vcb| x F(1) for B0$\rightarrow$ D- l+ ν with ρ2 and correlation
- Inclusive and exclusive b $\rightarrow$ clν branching fractions and |Vcb|
- Inclusive and exclusive b $\rightarrow$ ulν branching fractions and |Vub|

"Note on HFAG activities" provided as a mini-review (extended for PDG 2015 edition)

HFAG and the LHCHFWG

We welcome the creation of the LHCHFWG and look forward to fruitful and positive interactions.

We hope that the LHCHFWG can help to increase the productivity of LHC experiments in heavy flavour physics, and ensure the inclusion of relevant results in HFAG compilations

- ***e.g. valuable to increase awareness in collaborations of best practice to allow results to be included in combinations (use of statistically well-behaved variables, reporting of correlations, treatment of nuisance parameters)***
- ***we welcome suggestions from the LHCHFWG (and others!) on how to improve HFAG procedures***

We must avoid wasteful duplication of effort

- ***community generally wants world averages; LHC-only averages useful in certain special circumstances or for particular quantities (production-mode-dependent)***

Summary

HFAG

- ***HFAG now a teenager, and remains very busy with many relevant new results still coming from BaBar, Belle, CDF, D0, CLEO-c***

- ***Wealth of data from LHCb + some relevant & valuable results from ATLAS, CMS & BES-III***
  - ***Transition of HFAG to the LHC-era has been successful***
  - ***Expect HFAG to remain busy and relevant for the foreseeable future (looking forward to Belle II & LHCb upgrade)***

- ***Looking forward to productive interaction with LHCHFWG***


BACK UP!

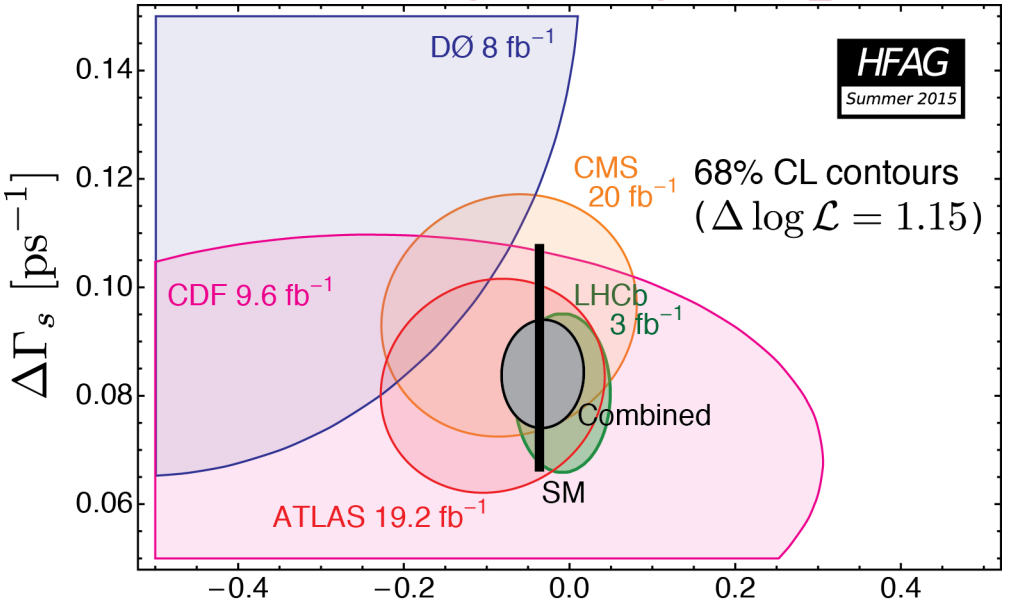
HFAG: Lifetimes and Mixing subgroup

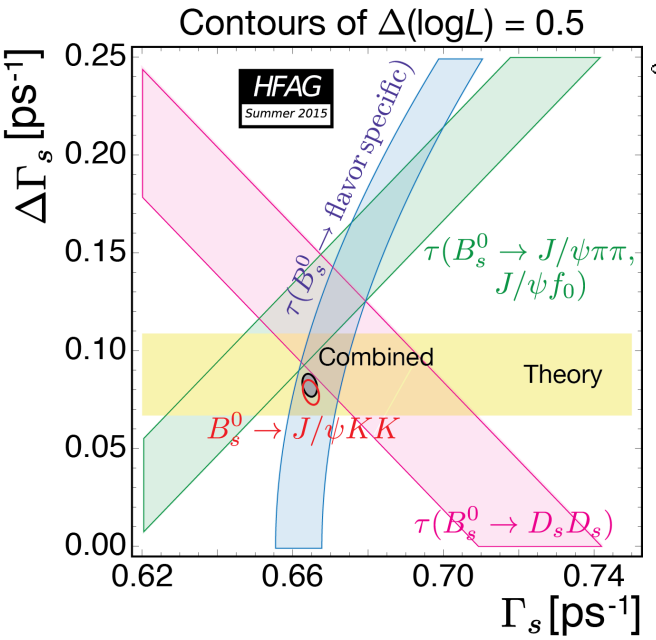
Active Members:

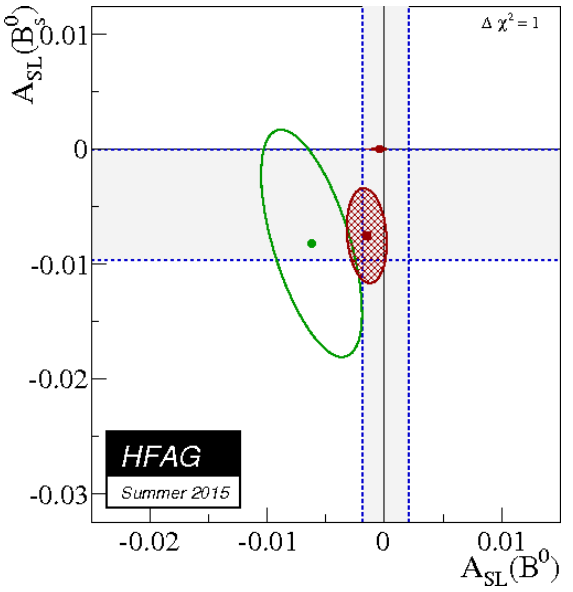
Olivier Leroy (LHCb)
Rick van Kooten (DØ)
Olivier Schneider (Belle/LHCb)
Rick Tesarek (CDF)

Tasks:

b-hadron lifetimes
b-hadron fractions
Bd mixing, CPV
(ΔΓ, Δm, \|q/p\|)
Bs mixing, CPV
(ΔΓs , Δms, \|q/p\|, βs)







HFAG: UT Triangle subgroup

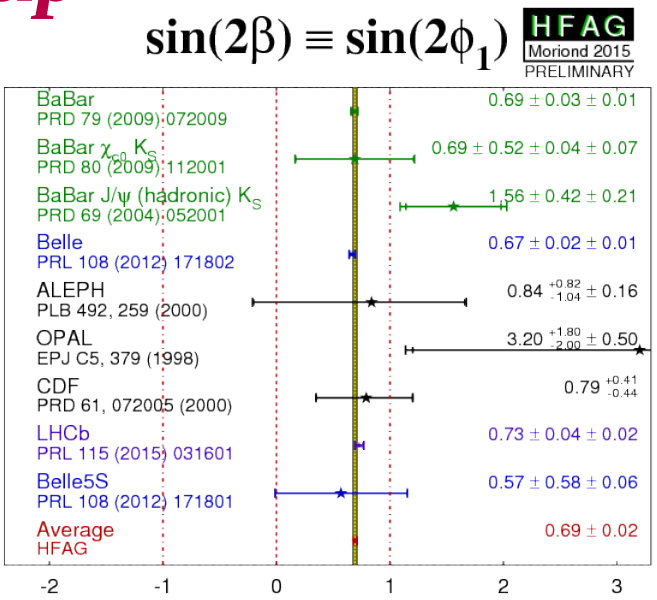
Active Members:

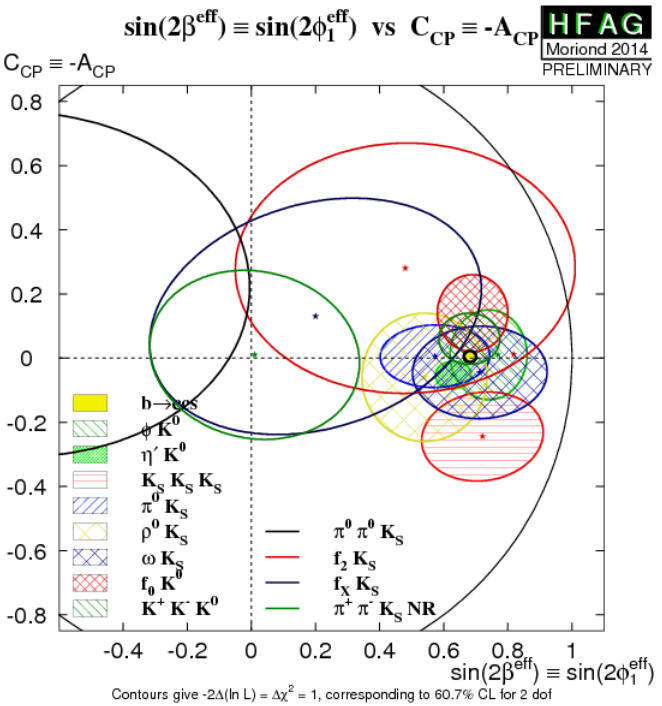
Angelo Carbone (LHCb)
Kenkichi Miyabayashi (Belle)
Tim Gershon (BaBar/LHCb)
Diego Tonelli (CDF)
Karim Trabelsi (Belle)

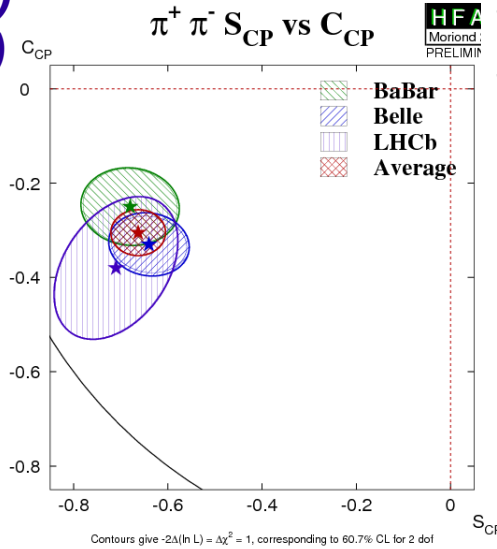
Tasks:

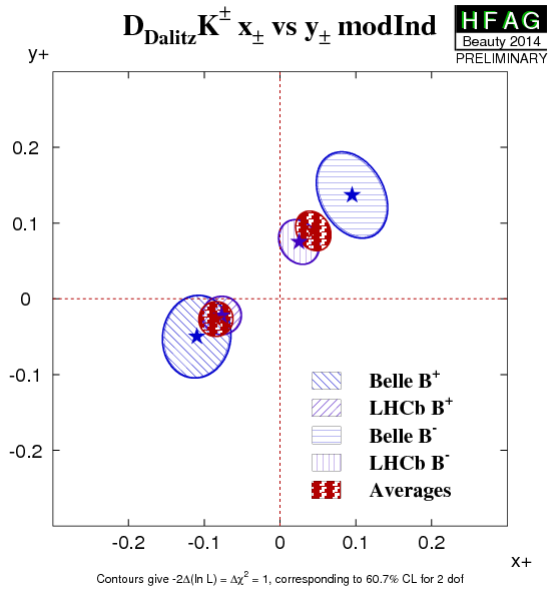
time-dependent CPV parameters,

$\phi 1$ (α)
$\phi 2$ (β)
$\phi 3$ (γ)









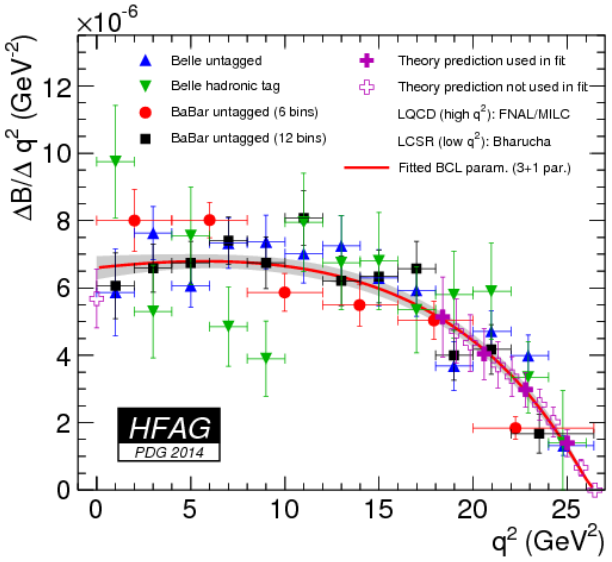
HFAG: Semileptonic subgroup

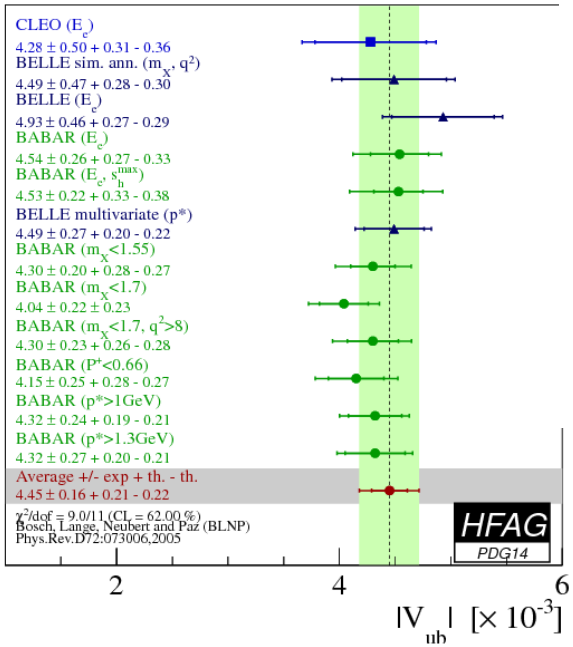
Active Members:

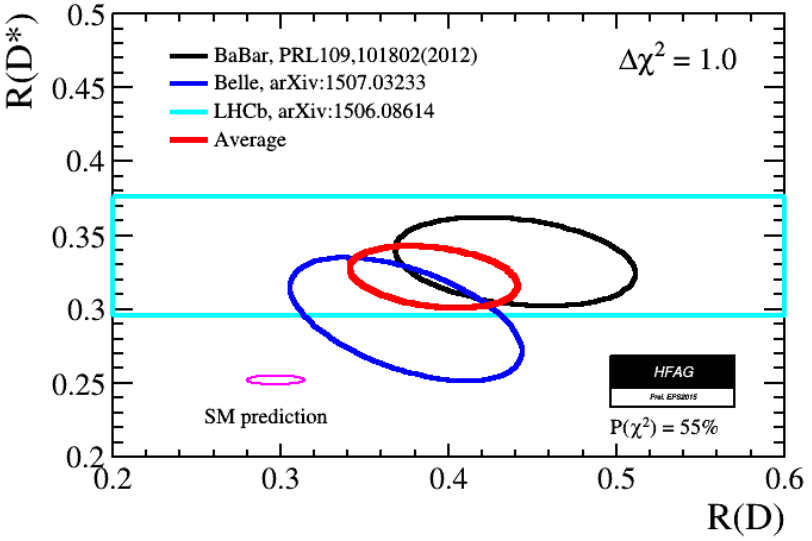
Concezio Bozzi (BaBar/LHCb)
Jochen Dingfelder (Belle)
Vera Lüth (BaBar)
Marcello Rotondo (Babar)
Christoph Schwanda (Belle)
Phillip Urquijo (Belle)

Tasks:

Branching fractions inclusive
Branching fractions exclusive
|Vcb| , |Vub|
Moments
R(D(*))



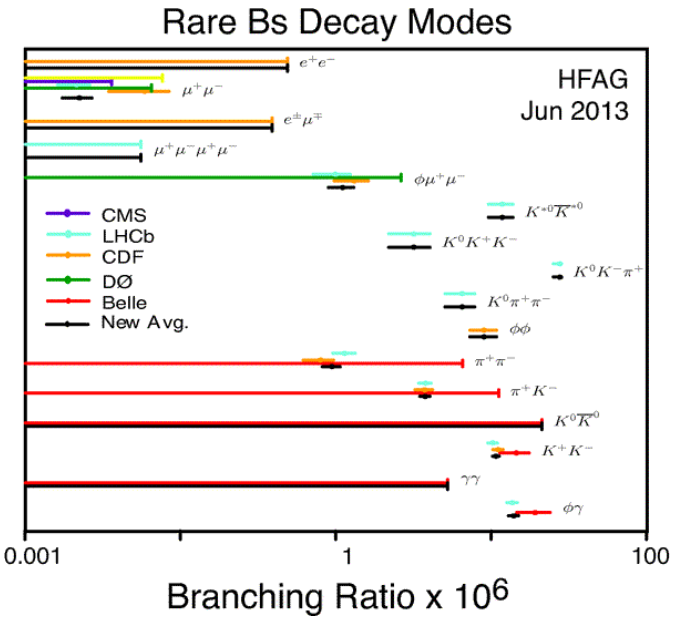


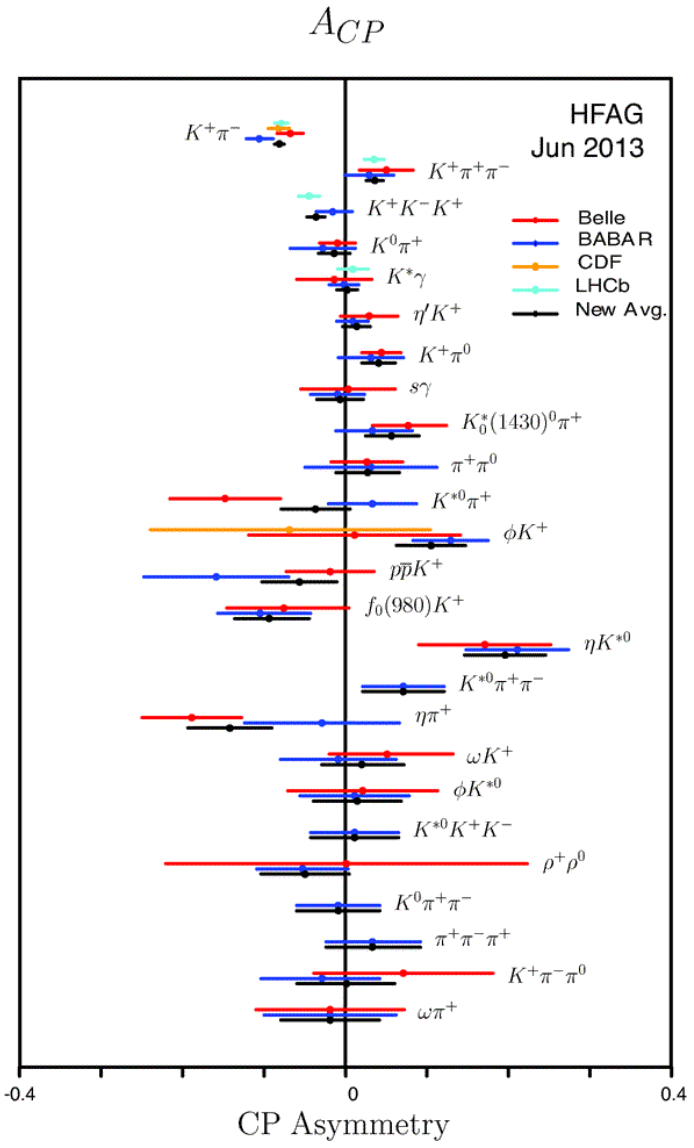


HFAG: Rare subgroup

Active Members:

Eli Ben-Haim (BaBar/LHCb)
Pablo Goldenzweig (Belle II)
Rob Harr (CDF)
Mitesh Patel (LHCb)
Justine Serrano (LHCb)





Tasks:

Charmless decays

mesonic, radiative, leptonic, baryonic

CP asymmetries

Polarization amplitudes

Differential distributions for K(*)μ+μ–

(BF, AFB, etc. in bins of q2)

Includes Bs mesons and b-baryons

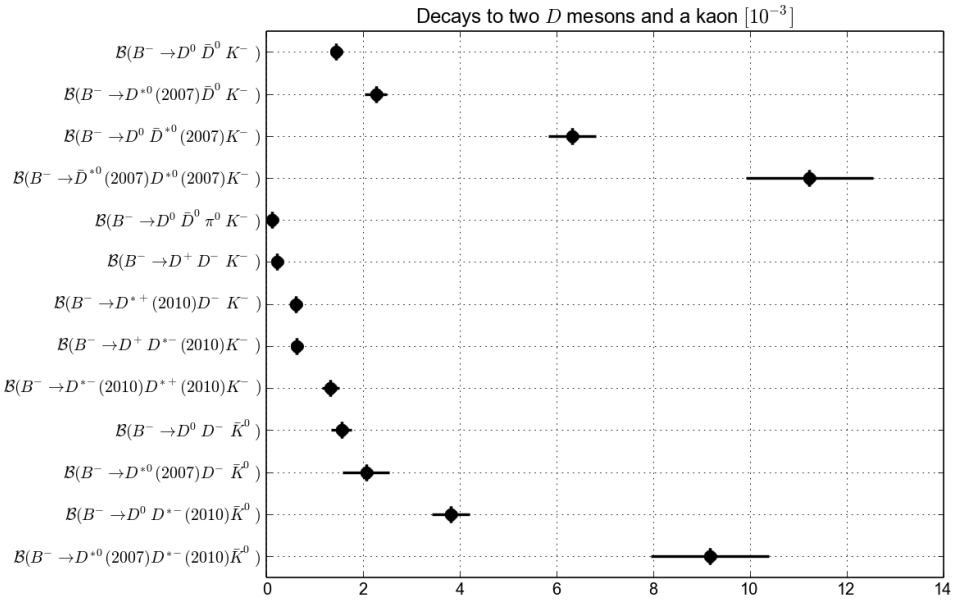
HFAG: b to charm subgroup

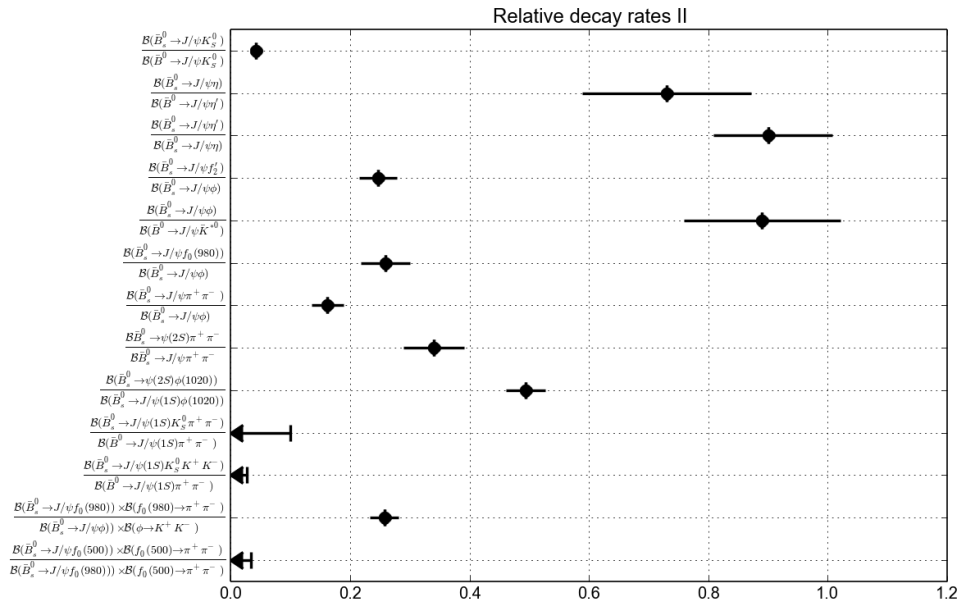
Active Members:

Yasmine Amhis (LHCb)
Simon Blyth (Belle)
Andrzej Bozek (Belle)
Gianluigi Cibinetto (BaBar)
Thomas Kuhr (Belle)
Matteo Rama (BaBar)

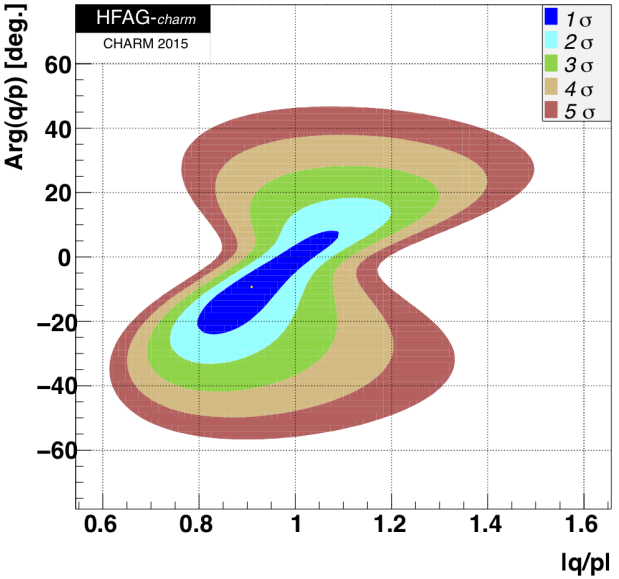
Tasks:

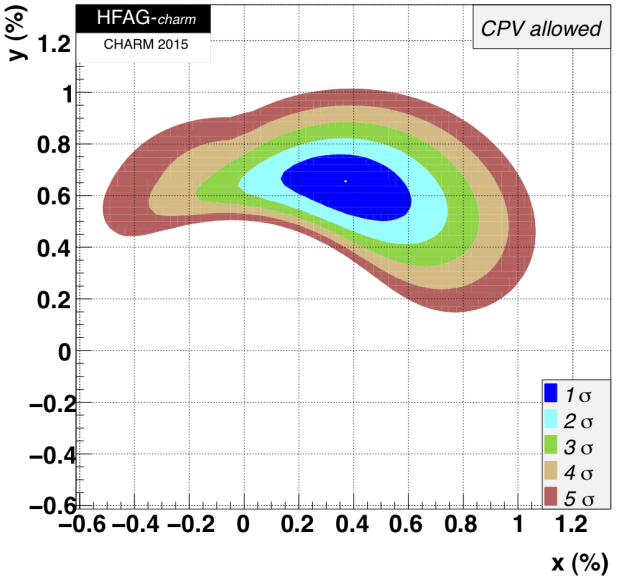
Branching fractions (with averages)
Includes Bs, Bc mesons and b-baryons
Polarisation amplitudes
CP asymmetries





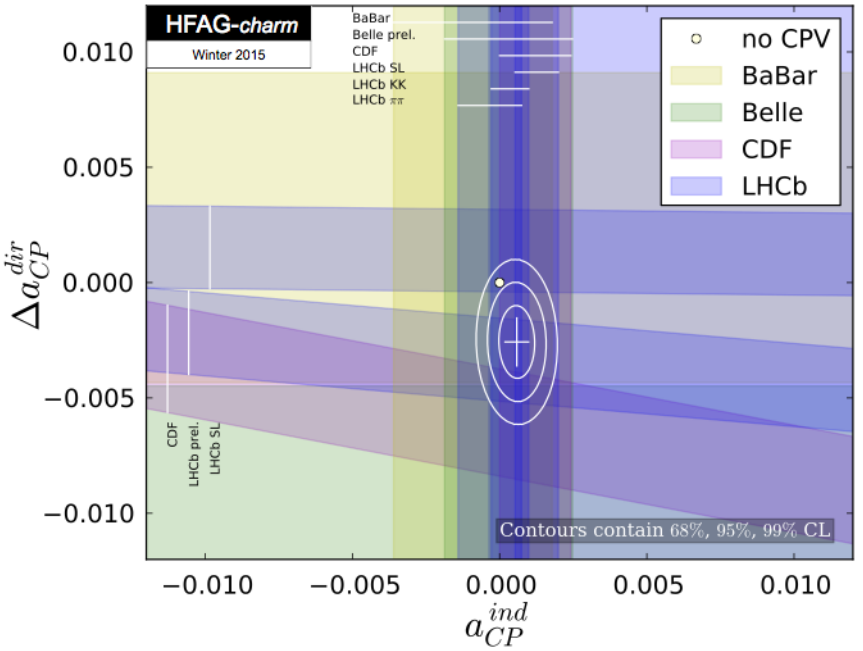
HFAG: Charm subgroup





Active Members:

Ruslan Chistov (Belle)
Marco Gersabeck (LHCb)
Lawrence Gibbons (CLEO-c)
Bostjan Golob (Belle)
Hai-bo Li (BES-III)
Brian Meadows (BaBar)
Paras Naik (LHCb)
Arantza Oyanguren Campos (BaBar)
Daniele Pedrini (FOCUS)
Alan Schwartz (Belle)
Anze Zupanc (Belle)



Tasks:

Mixing & CPV in mixing
Direct CPV
Semileptonic & leptonic decays
Charm meson & baryon spectroscopy
Rare decays

HFAG: Tau subgroup

Active Members:

Kiyoshi Hayasaka (Belle)
Boris Shwartz (Belle)
Hisaki Hayashii (Belle)
Alberto Lusiani (BaBar)
Mike Roney (BaBar)
Swagato Banerjee (BaBar)

Tasks:

Branching fractions
(separate report on global fit)
Tau lifetime
Lepton universality tests
Determination of |Vus|
Lepton-flavor-violation limits