HFLAV subgroup report: b-hadron lifetimes and mixing parameters

Olivier Schneider

EPFL

olivier.schneider@epfl.ch

Members and meetings

- Current membership:
  - Marcella Bona (Queen Mary, ATLAS), since Jan 28, 2021
  - Martino Margoni (Padova, CMS), since Nov 16, 2020
  - Veronika Chobanova (Santiago de Compostela, LHCb), since Oct 28, 2020
  - Olivier Leroy (CPPM Marseille, LHCb)
  - Olivier Schneider (EPFL Lausanne, BELLE/LHCb)

- 7 (!) sub-group meetings since last conveners' meeting on Feb 24:
  - March 5, 2021
  - March 12, 2021
  - March 18, 2021
  - March 25, 2021
  - March 29, 2021

  } PDG 2021 averages

  - April 13, 2021
  - April 22, 2021

  } Spring 2021 averages

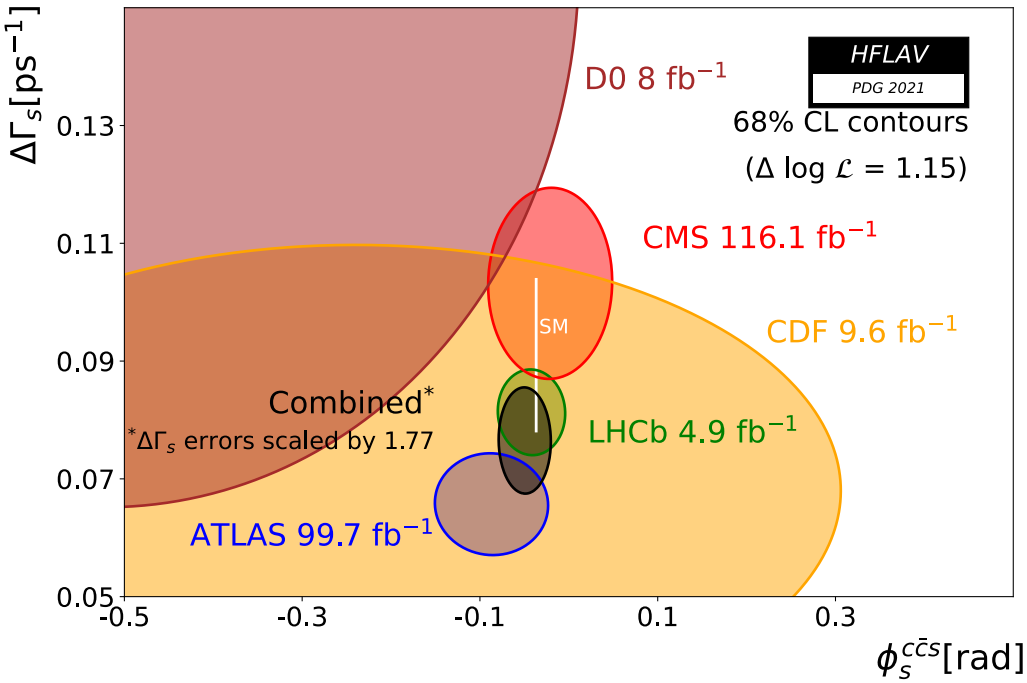
PDG 2021 averages

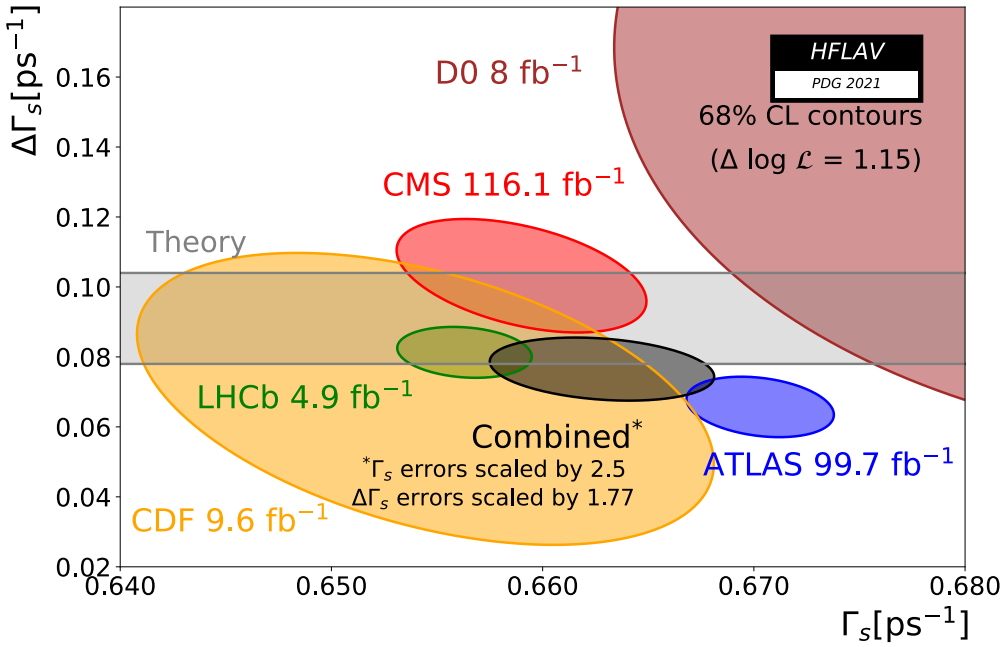
- Timeline:
  - original deadline was March 25, extended on our request
  - averages sent to PDG on April 4
  - feedback on PDG listing provided on April 13
- Averages available on HFLAV web site
  - https://hflav-eos.web.cern.ch/hflav-eos/osc/PDG_2021/
- New results included:
  - ATLAS Bs -> J/psi KK analysis using Run1 + partial Run2 (2015–2017)
    - https://arxiv.org/abs/2001.07115, now published in Eur. Phys. J. C 81 (2021) 342
  - CMS analysis of Bs -> J/psi KK with 96.4 fb-1 of Run2 data (2017–2018) combined with Run1 results
    - https://arxiv.org/abs/2007.02434, PLB 816 (2021) 136188
  - CMS Bs -> mu+mu- effective lifetime
    - https://arxiv.org/abs/1910.12127, JHEP 04 (2020) 188

PDG 2021 averages: phi_s, ...

- New truely-multi-dimensional average of Bs -> J/psi KK + other phi_s modes
  - significant tensions between Bs -> J/psi KK analyses
  - applied the PDG prescription separately in each dimension of these analyses, obtaining separate scale factors for phi_s, DG_s, G_s and the other physics parameters
  - scale factors are used in the multi-dimensional fit, preserving the correlation matrices of the input measurements:
    - e.g. 1 for phi_s, 1.77 for DG_s and 2.5 for G_s
  - this spoils the significant increase in precision that these averages would show otherwise
- Average repeated with external contraints from effective lifetimes (Bs→ CP-odd, Bs→ CP-even, Bs→ flavour specific):
  - additional (less severe) tensions exist; no additional scale factors used

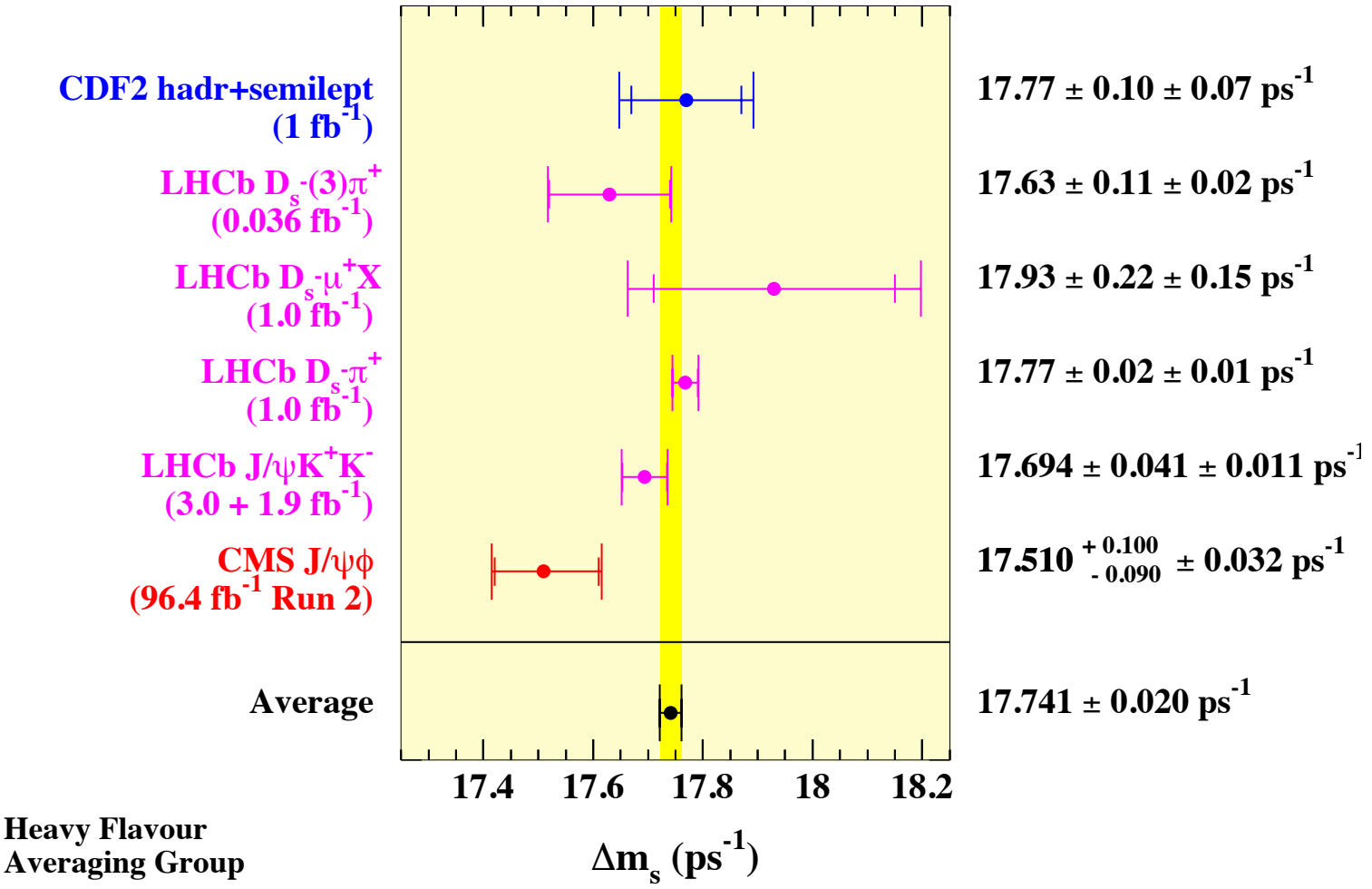
HFLAV PDG 2021 averages: phi_s, ...





- phi_s = -0.050 ± 0.019 rad
  - was -0.053 ± 0.023 for PDG 2020
- DG_s = +0.082 ± 0.005 ps–1 and G_s = 0.6597 ± 0.0026 ps–1
  - were +0.085 ± 0.004 and 0.6600 ± 0.0016 ps_1 for PDG 2020

PDG 2021 averages: dms



Heavy Flavour
Averaging Group

Spring 2021 averages

- Plan to revisit the phi_s averages
  - can we do better than the "multi-dimensional" PDG scale factors ?
  - we think the prescription may be "overdoing" it
  - make additional plot (e.g. tau_H vs tau_L) and averages (e.g. Bs -> J/psi KK only)

- New dms measurements:
  - LHCb using Bs -> Ds3pi events in 9 fb-1 of data (7, 8 and 13 TeV)
    - https://arxiv.org/abs/2011.12041, JHEP 03 (2021) 137
  - LHCb using Bs -> Dspi events in 6 fb-1 of Run2 data (2015-2018)
  - https://arxiv.org/abs/2104.04421, submitted to Nature Physics
- Massive improvement in precison:
  - average needs to be done more carefully (systematic correlations, …)
  - very preliminary dms average = 17.7650 ± 0.004 (stat) ± 0.004 (syst) ps–1
    - previous dms average = 17.741 ± 0.019 (stat) ± 0.007 (syst) ps–1