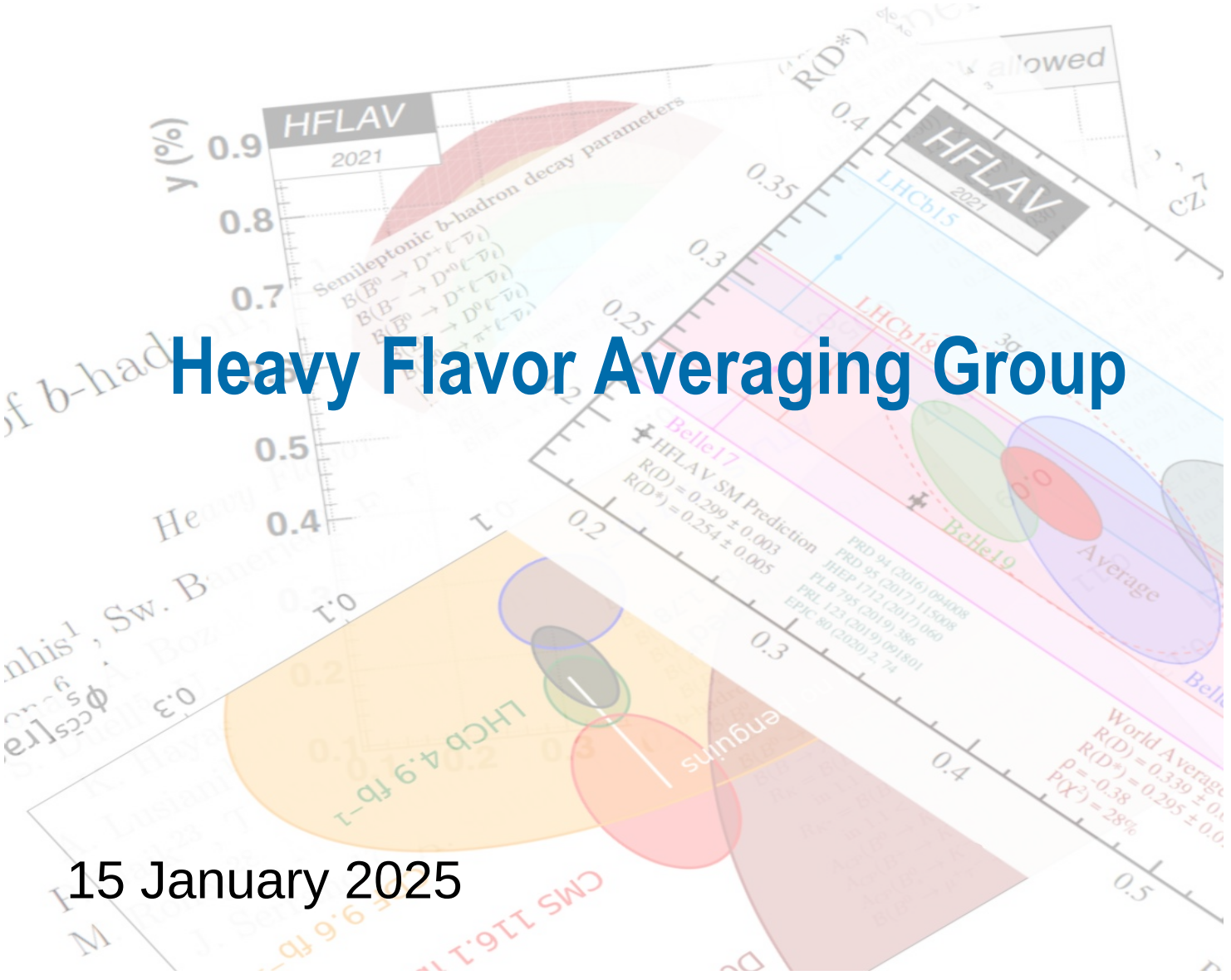


Heavy Flavor Averaging Group

15 January 2025

How to display result

- The documentation of results in PDG has improved

Old

$\Delta m_{B^0} = m_{B^0_H} - m_{B^0_L}$ INSPIRE sea

Δm_{B^0} is a measure of 2π times the $B^0 - \overline{B}^0$ oscillation frequency in time-dependent mixing experiments.

"OUR EVALUATION" is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFLAV) and are described at https://hflav.web.cern.ch/. The averaging/rescaling procedure takes into account correlations between the measurements and includes Δm_d calculated from χ_d measured at $\Upsilon(4S)$.

VALUE (10^{12} $\hbar$ s^{-1})		*DOCUMENT ID*	
0.5065 ± 0.0019	OUR EVALUATION		
0.5050 ±0.0021 ±0.0010		[1] AAIJ	2016AV
0.503 ±0.011 ±0.013		[2] AAIJ	2013CF
0.5156 ±0.0051 ±0.0033		[3] AAIJ	2013F

New

$\Delta m_{B^0} = m_{B^0_H} - m_{B^0_L}$ PDGID:S042D INSPIRE

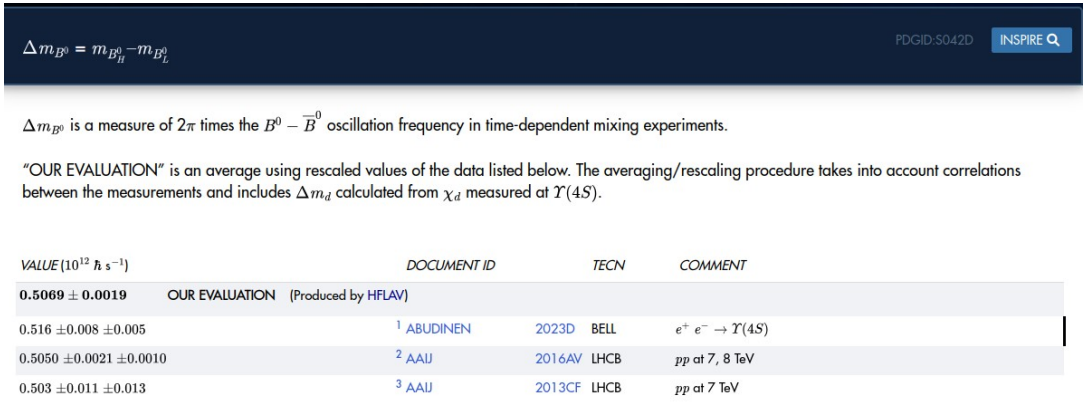
Δm_{B^0} is a measure of 2π times the $B^0 - \overline{B}^0$ oscillation frequency in time-dependent mixing experiments.

"OUR EVALUATION" is an average using rescaled values of the data listed below. The averaging/rescaling procedure takes into account correlations between the measurements and includes Δm_d calculated from χ_d measured at $\Upsilon(4S)$.

VALUE (10^{12} $\hbar$ s^{-1})		*DOCUMENT ID*		*TECN*	*COMMENT*
0.5069 ± 0.0019	OUR EVALUATION (Produced by HFLAV)				
0.516 ±0.008 ±0.005		[1] ABUDINEN	2023D	BELL	$e^+ e^- \to \Upsilon(4S)$
0.5050 ±0.0021 ±0.0010		[2] AAIJ	2016AV	LHCB	pp at 7, 8 TeV
0.503 ±0.011 ±0.013		[3] AAIJ	2013CF	LHCB	pp at 7 TeV

How to display result

- Link is still just to HFLAV webpage
  - Often many clicks away from a web page that gives the background to the result
  - Sometimes there is in fact nowhere to find the information about which papers were used, which theory parameters etc.



$\Delta m_{B^0} = m_{B^0_H} - m_{B^0_L}$ PDGID:S042D INSPIRE

Δm_{B^0} is a measure of 2π times the $B^0 - \overline{B}^0$ oscillation frequency in time-dependent mixing experiments.

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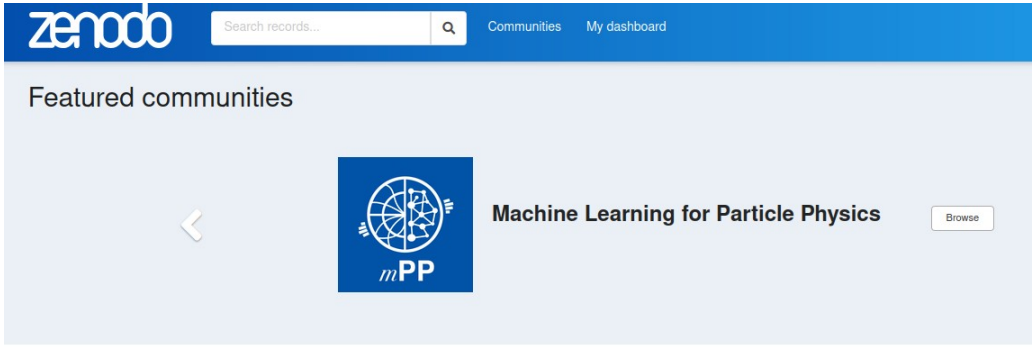
Making HFLAV FAIR

- From a purely scientific point of view it is unsatisfactory that specific HFLAV results are often hard to find full and accurate documentation for
- The steering group of the PDG has in addition made it clear that this situation is not acceptable if HFLAV is to continue to provide results for the PDG
  - PDG has itself made huge improvements in this area
- The principles we should aim for are encapsulated in the acronym “FAIR”

An explainer: Zenodo



- A digital repository that allows for the update of nearly any type of data.

About Zenodo

Passionate about Open Science!

Built and developed by researchers, to ensure that everyone can join in Open Science.

The OpenAIRE project, in the vanguard of the open access and open data movements in Europe was commissioned by the EC to support their nascent Open Data policy by providing a catch-all repository for EC funded research. CERN, an OpenAIRE partner and pioneer in open source, open access and open data, provided this capability and Zenodo was launched in May 2013.

In support of its research programme CERN has developed tools for Big Data management and extended Digital Library capabilities for Open Data. Through Zenodo these Big Science tools could be effectively shared with the long-tail of research.

Making HFLAV FAIR

- The FAIR principle implies that research should be:
- **F**indable
  - F1. (Meta)data are assigned a globally unique and persistent identifier
  - F2. Data are described with rich metadata (defined by R1 below)
  - F3. Metadata clearly and explicitly include the identifier of the data they describe
  - F4. (Meta)data are registered or indexed in a searchable resource
- **We can do this by registering individual (groups of) results in Zenodo where they will get a persistent DOI**

Making HFLAV FAIR

- The FAIR principle implies that research should be:
- **A**ccessible
  - A1. (Meta)data are retrievable by their identifier using a standardised communications protocol
  - A1.1 The protocol is open, free, and universally implementable
  - A1.2 The protocol allows for an authentication and authorisation procedure, where necessary
  - A2. Metadata are accessible, even when the data are no longer available
- **Zenodo gives us all this for free**

Making HFLAV FAIR

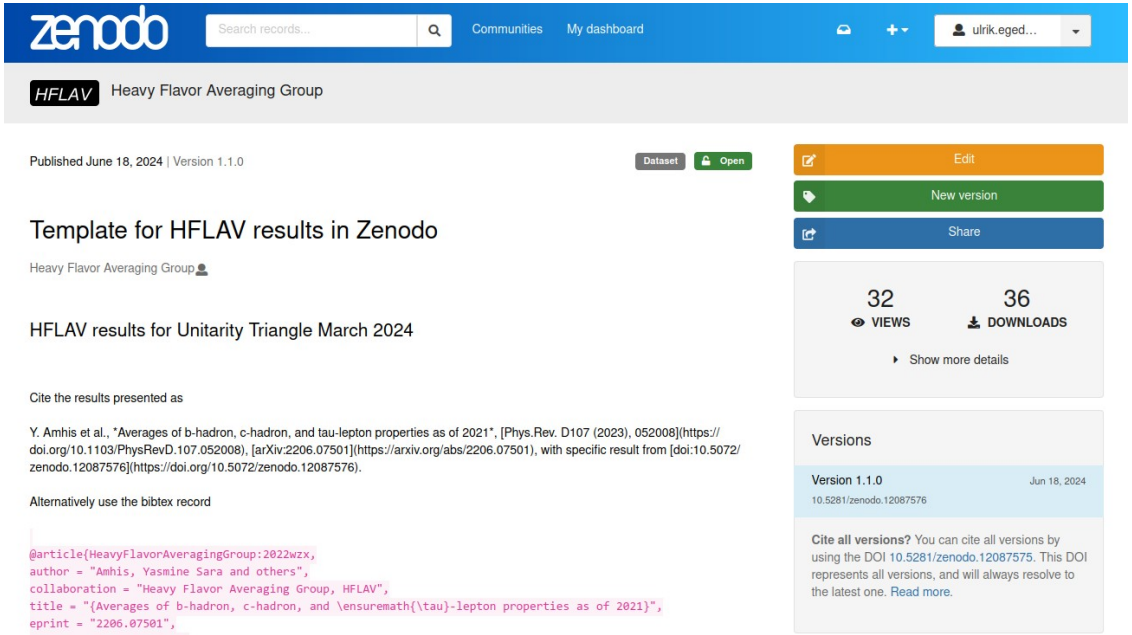
- The FAIR principle implies that research should be:
- Interoperable
  - I1. (Meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
  - I2. (Meta)data use vocabularies that follow FAIR principles
  - I3. (Meta)data include qualified references to other (meta)data
- **The use of JSON files is a good choice here and matches up with what the PDG is doing**

Making HFLAV FAIR

- The FAIR principle implies that research should be:
- **R**eusable
  - R1. (Meta)data are richly described with a plurality of accurate and relevant attributes
  - R1.1. (Meta)data are released with a clear and accessible data usage license
  - R1.2. (Meta)data are associated with detailed provenance
  - R1.3. (Meta)data meet domain-relevant community standards
- **The CC-BY-4 licence is good for this but we need to do better on software availability and documentation**

Gitlab CI for publishing results to Zenodo

- A template has been created to show how this is done
- Template can be forked for an individual set of measurements
- Upload to Zenodo works by simply creating a new “release” in Gitlab

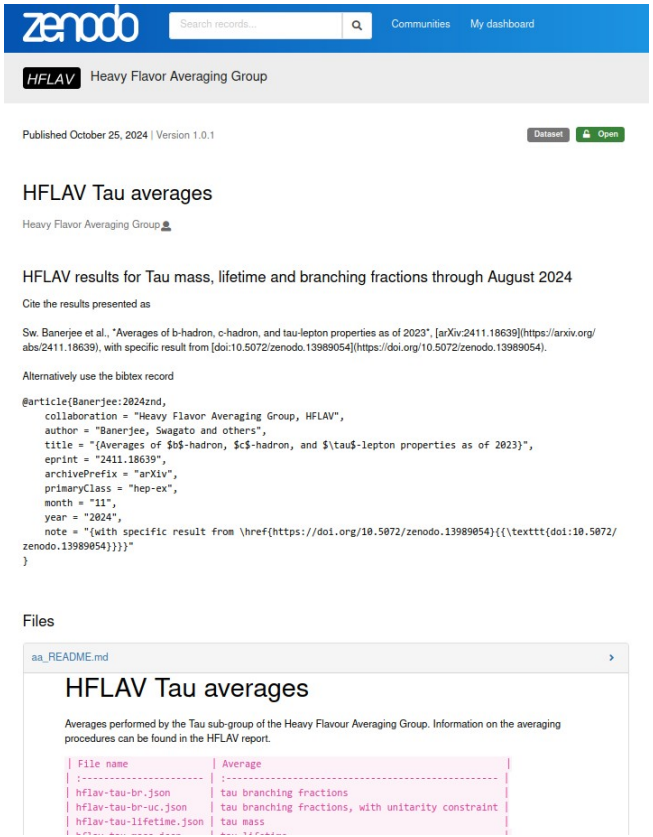


Use so far

- The tau results for the latest write-up has been uploaded here as doi:10.5072/zenodo.13989054
- Specific tau results can be cited as

  Sw. Banerjee et al., Averages of b-hadron, c-hadron, and tau-lepton properties as of 2023, [arXiv:2411.18639], with specific result from doi:10.5072/zenodo.13989054.

- No more "… and updates from web page" citations



Work to do

- Refinement of JSON format used for specifying results
- Plugins written to fitting code that allows results to be created in this format without manual editing
- Validator of json files to be created to ensure consistency