

The PDG meson team

Christoph Hanhart

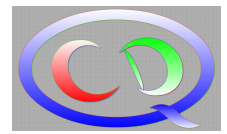
Forschungszentrum Jülich

Meson Team

Claude Amsler	Bern, Vienna	Database
Michael Doser	CERN	Management, Database
Simon Eidelman	Novosibirsk	Literature, Database
Thomas Gutsche	Tübingen	Theory, notes
Christoph Hanhart	Jülich	Theory, notes
Brian Heltsley	Cornell	Database
Juan J. Hernández-Rey	Valencia	Database
Alberto Masoni	Cagliari	Database
Ryan Mitchell	Bloomington	Database
Sergio Navas	Granada	$c\bar{c}$ fit, Database
Claudia Patrignani	Bologna	$c\bar{c}$ fit, Database
Stefan Spanier	Knoxville	Database
Nils Törnqvist	Helsinki	Theory, notes
Graziano Venanzoni	Frascati	Database

- We are all “encoders” and “overseers” (LBL terminology) for **unstable mesons decaying via strong interactions** (**criteria for inclusion of data below**)
- Everybody takes care of specific J^{PC} (vectors, scalars, heavy quark,)
- We are **authors and reviewers of our minireviews**, therefore have to consider also papers on theory/phenomenology
- **Merge data, when appropriate** (e.g. $Z(3900)$ in $J/\psi\pi$ and $D^*\bar{D}$; **join different charge channels into one node**)
- Regular meetings at CERN twice a year (autumn, spring)

- Papers are selected **via literature** search (**every 2 months**)
- Those are assigned to a **first reader (encoder)** who prepares data for the database
- **second reader (overseer)** (randomly assigned within the team) adds his/her criticism and comments.
- Iterations continue until **both readers agree**
- The reader checks the appearance in the data base
- An **author** is contacted to verify
- In special cases, the whole group discusses the subject



Activities for RPP16

- 247 (217 in 2014, 161 in 2012) papers selected
- 572 (461, 531) new measurements:
 - ▷ 107 (83, 111) light unflavored mesons
 - ▷ 6 (3, 12) strange mesons
 - ▷ 65 (18, 24) charmed mesons
 - ▷ 73 (4, 0) beauty mesons
 - ▷ 240 (265, 247) $c\bar{c}$ mesons
 - ▷ 81 (88, 137) $b\bar{b}$ mesons
- 14 minireviews and notes in the listings: (5 updated, 5 unchanged, 4 old hidden)
- Additional activities for whole PDG:
 - ▷ 3 reviews co-authored
 - ▷ S. Eidelman does literature search for whole PDG

We do **NOT** include data (in the averaging), if

- it is **preliminary** or **not yet properly published** (although it can be included if a corresponding paper is already accepted by a peer-reviewed journal);
- **systematic uncertainties are not estimated**;
- the parameters reported in the paper are **not consistent** (e.g. different parametrization) with those of other measurements in the node;
- analysis has **obvious flaws** recognized by its authors or PDG;
- a **central value is strongly inconsistent** with other measurements resulting in a **large scaling factor** (**very qualitative**).

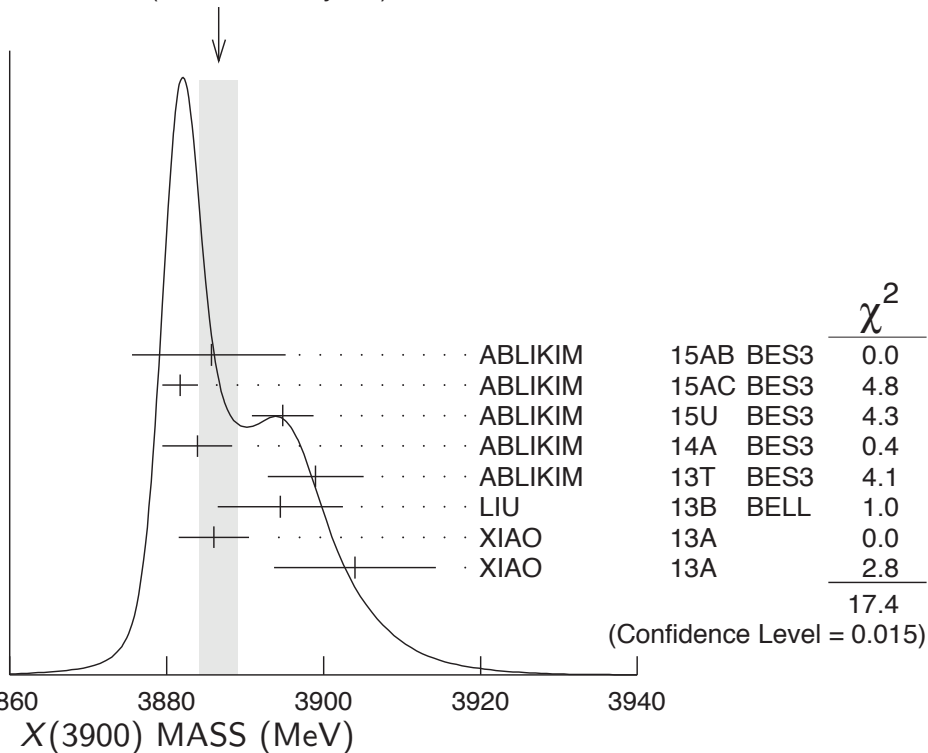
Scaling factor

To render mean and uncertainty **statistically consistent**

Example: Mass of $Z(3900)^+$

with $w_i = (\delta x_i)^{-2}$: $\bar{x} \pm \delta \bar{x} = \sum_i w_i x_i / \sum_i w_i \pm (\sum_i w_i)^{-1/2}$:

WEIGHTED AVERAGE
3886.6±2.4 (Error scaled by 1.6)



$$S = \left[\left(\sum w_i (\bar{x} - x_i)^2 \right) / (N - 1) \right]^{1/2}$$

→ $S \lesssim 1$: **accept**

→ $1 < S \lesssim 2$: **rescale δx**
 $\delta \mathbf{x} \rightarrow \mathbf{S} \delta \mathbf{x}$

→ $2 \lesssim S$:
**do not average or
remove inconsistent data**

For details see **Introduction of RPP of the PDG**

Future Tasks

- New naming scheme for XYZ states needs to be implemented
 - e.g. $X(3872) \rightarrow '\chi_{c1}(3872)$ also known as $X(3872)'$
 - $Z(3900)^+ \rightarrow 'Z(3900)^+'$
- The listings need to be cleaned up and checked for consistency
- Move from Breit-Wigner parameters to T-matrix poles
(like it was consistently done for the $f_0(500)$)

Thank you very much for your attention

Necessary additions

- We need to account for new charged states
- We want to prepare for possible new discoveries

$$J^{PC} = \begin{cases} 0^{-+} & 1^{+-} & 1^{--} & 0^{++} \\ 2^{-+} & 3^{+-} & 2^{--} & 1^{++} \\ \vdots & \vdots & \vdots & \vdots \end{cases}$$

minimal $q\bar{q}$ content

$u\bar{d}, u\bar{u} - d\bar{d}, d\bar{u}$ ($I = 1$)	π	b	ρ	a
$d\bar{d} + u\bar{u}$ and/or $s\bar{s}$ } ($I = 0$)	η, η'	h, h'	ω, ϕ	f, f'
$c\bar{c}$	η_c	h_c	ψ^\dagger	χ_c
$b\bar{b}$	η_b	h_b	Υ	χ_b
$I = 1$ with $c\bar{c}$	Π_c	Z_c	R_c	A_c
$I = 1$ with $b\bar{b}$	Π_b	Z_b	R_b	A_b

- Keep established names (Request from community)
- e.g., ' $\psi(4260)$ also known as $Y(4260)$ '