PDG Advisory Committee Meeting
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PDG Meson Team

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Outline

- **Team/responsibilities**
- **Activities for RPP2014**
- **$\bar{c}c$ fit**
- **Issues**
- **Conclusions**

Meson Team

Person	Affiliation	Responsibilities
Claude Amsler	Bern	Notes
Michael Doser	CERN	Management, notes
Simon Eidelman	Novosibirsk	Literature, notes
Thomas Gutsche	Tübingen	Theory, notes
Christoph Hanhart	Julich	Theory, notes
Brian Heltsley	Cornell	Notes
Juan-Jose Hernández-Rey	Valencia	Notes
Alberto Masoni	Cagliari	Notes
Sergio Navas	Granada	$c\bar{c}$ fit, notes
Claudia Patrignani	Genova	$c\bar{c}$ fit, notes
Stefan Spanier	Knoxville	Notes
Nils Törnqvist	Helsinki	Theory, notes
Graziano Venanzoni	Frascati	Notes

Responsibilities

- We are all "*encoders*" and "*overseers*" for unstable mesons (LBL terminology)
- In addition, everybody takes care of specific JPC (vectors, scalars, heavy quark states)
- We are also authors and reviewers of our minireviews
- Regular meetings at CERN twice a year (autumn, spring)

Notes – I

- Papers selected (literature search every 2 months) are assigned to a first reader who writes a note specifying what and how should go to the database
- The first reader sends the note to a randomly selected second reader who adds his/her criticism and comments. Iterations continue until both readers agree
- The note approved by both readers is sent to Piotr to be implemented in the database
- The reader checks the input
- In special cases, the whole group discusses the subject

Notes – II

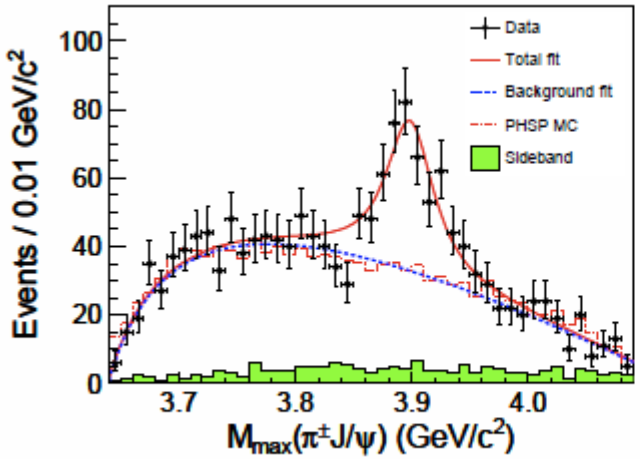
There are three types of papers:

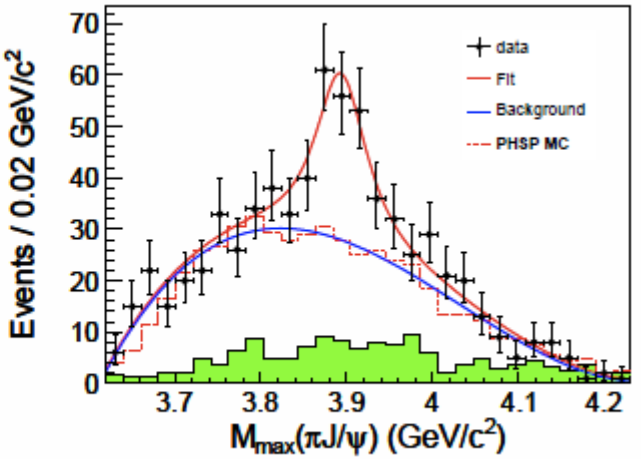
- **There are data to quote** – a usual note is written
- **No data to quote**, but may be useful for some minireview –a brief note to keep trace of the paper. Goes to a special ORP (Other related papers) file regularly checked by the minireview authors, but NOT to the database. This system replaced the old one with (often numerous) ORP's going to the database. A big flow of theory/phenomenology papers, reduces the length of the Book!
- **"Useless"** (selected by mistake) – declared empty

Activities for RPP14

- **217 papers selected** (161 in 2012, 300 in 2010, 302 in 2008), preliminary selection strongly decreased the number of "theory" papers
- **457** new measurements (they were 527, 684, 794) of which:
  - 80 unflavored mesons (they were 99, 161, 261)
  - 3 other mesons (they were 8, 12, 19)
  - 3 strange mesons (they were 12, 17, 27)
  - 18 charmed mesons (they were 24, 34, 39)
  - 265 $c\bar{c}$ mesons (they were 247, 300, 396)
  - 88 $b\bar{b}$ mesons (they were 137, 160, 52)
- **14 minireviews** and notes in the listings: (5 updated, 5 unchanged, 4 old hidden)

Highlights – I





BESIII discovers an exotic charged charmonium-like state in

$$e^+ e^- \rightarrow X(4260) \rightarrow X(3900) \pm \pi^{\mp} \rightarrow (J/\psi \pi^{\pm}) \pi^{\mp}$$

Immediately confirmed by Belle,

- M. Ablikim et al. (BESIII), Phys. Rev. Lett. 110, 252001 (2013), 194 citations,
- Z.Q. Liu et al. (Belle), Phys. Rev. Lett. 110, 252002 (2013) 165 citations

Highlights – II

- LHCb unambiguously determined the quantum numbers of the X(3872) to be $J^{PC} = 1^{++}$

  R. Aaij et al. (LHCb), Phys. Rev. Lett. 110, 222001 (2013)

- Belle constrains the quantum numbers of the Z(4430) to be $J^{P} = 1^{+}$

  K. Chilikin et al. (Belle), Phys. Rev. D88, 074026 (2013)

- LHCb confirms the Z(4430) and shows its resonant character

  R. Aaij et al. (LHCb), Phys. Rev. Lett. 112, 222002 (2014)

$c\bar{c}$ Fit

- Experiments measure a product (or a ratio) of the branching ratios, often involving more than one particle
- Values quoted by experiments are often based on RPP averages rather than direct measurements → Hidden non-trivial correlations
- RPP02 introduced a new fit using directly measured quantities → cross-particle fit, non-standard procedure, standalone fit
- When a branching fraction is measured in different products/ratios, it is necessary to include it as a new fit parameter
- New measurements of branching fractions by different techniques can result in reentering old measurements in the database
- The fit originally done by hand is now performed at LBNL, special thanks to Piotr and Orin!
- Discussion is ongoing about introducing new particles (e.g. J/ ψ, η_c and $b\bar{b}$ states)

Issues

- Meson Team has to start learning new PDG software in order to gradually move to direct work with the database
- Should current structure of the entries be expanded to add new "properties" to the listings?
- New $c\bar{c}$ states are referred to as X, Y, Z by the community, but are required to be X(mass) by PDG until J^{PC} are known

CONCLUSIONS

- STILL VERY ACTIVE FIELD
  - Slightly reduced (10%) number of measurements but…
  - Two confirmed non $q\bar{q}$ states (Z_c(3900), Z(4430))
  - Relevant contributions from BESIII & Belle as well as from LHC in studying $c\bar{c}$, $b\bar{b}$ and mixing of light states
  - BES-III provides a lot of info on $c\bar{c}$ from the huge samples of the J/ψ and ψ(2S) as well as on light mesons from the radiative decays of the J/ ψ
- NEW DATA COMING
  - BelleII (Super-KEKB) starts data taking in 2017
  - CMD-2 and SND (VEPP-2000) in Novosibirsk,
  - KLOE-2 (DAFNE) in Frascati and COMPASS at CERN
  - In the more distant future – GlueX (JLAB), PANDA (GSI)