

Short report on Group 4

Results: Charm, Quarkonia, Tau, QED/ISR, Two photon, QCD
B-mixing, $Y(5S)$

Tools: Dalitz analyses

- Some sections will be covered tomorrow with long plenary talks (as Conventional/Exotic charmonium, D-mixing, Dalitz)
- for other sections no people available for discussion

Charm Physics (a)

1. D-Mixing and CPV ([B.Golob](#), [B.Meadows](#), [I.Bigi](#))
 - 1. Theory
 - 2. General Exper. remarks
 - 3. decays to CP eigenstates
 - 4. Hadronic WS decays
 - 5. time-dependent Dalitz
 - 6. Semileptonic
 - 7. time-integrated CPV measurements
 - 8. time-dependent CPV measurements
 - 9. summary
- cross references/inter-correlations
- Several references to Tools Section and charm decays
- Dalitz plot/ angular analysis
- TD analysis

Charm Physics (b) (J.Brodzicka, A.Palano, S.Fajfer)

cross references/inter-correlations

- 1) Charm spectroscopy.
 - a) Introduction.
 - * i) Overview;
 - * ii) Quark model for ground states;
 - * iii) Review of the phenomenological models.
 - b) D mesons;
 - * i) Review of past work on D meson spectroscopy;
 - * ii) Recent results from inclusive e^+e^- ;
 - * iii) Results from B decays.
 - c) D_s mesons.
 - * i) Review of past work on D_s meson spectroscopy;
 - * ii) Recent results from inclusive e^+e^- ;
 - * iii) Results from B decays.
- 2) Hadronic charm decays.
 - a) Introduction.
 - * i) Overview;
 - * ii) Review of the phenomenological models.
 - b) Two-body decays.
 - c) Three-body decays.
 - * i) Methods. Dalitz plot analysis, Model Independent Partial Wave analysis.
 - * ii) Experimental results.
 - * iii) Light meson spectroscopy in three-body charm decays.
 - d) Multi-body decays.
- 3) Semileptonic charm decays.
- 4) Leptonic charm decays.
- 5) Rare decays.

WS/RS 2-body and DA 3-body decays needed for D-mixing. Discussion on-going on moving those channels to D-mixing section

Ordering charm physics section

- present section order:
 - a. D Mixing and CPV
 - b. Charm meson spectroscopy and decays
 - c. Charm baryon spectroscopy and decays

- new proposal:
 1. Charm Meson decays
 2. D Mixing
 3. Meson Spectroscopy
 4. charm baryon spectroscopy and decays

Charm Physics (c)

1. Charm Baryon spectroscopy and Decays ([R.Mizuk](#), [M.Charles](#))
 1. Spectroscopy
 1. Introduction/phenomen.
 2. results
 3. conclusions
 2. Weakdecays
 1. introduction
 2. results and discussion
 3. Applicationsto light baryonspectr.
 1. introduction
 2. results and conclusions
 4. Outlook

Tau Physics (H.Hayashii, M.Roney, T.Pich)

TOPIC	Potential Contributors	No. Pages
Intro	Roney/Hayashii	1
Event Selection	Roney/Hayashii	1
Cross section	Roney/Hayashii	0.5
Static properies: Mtau, lifetime	Lusiani Belle++	3
Lepton Univesality	Roney	1
Hadronic studies Spectral functions	Sobie Roney, Pich(theory)	3
Rtau high multiplicity	Lafferty Hayashii Hast	3 1
2nd Class currents	Belle++	2
LFV	Banerjee Igokina Hayashii	4
Vus	Roney Cervelli Banerjee Hayashii Pich(theoy)	4
CPV	Sobie	1
EDM	Hayashii	1
TOTAL		25.5

QED/ISR section outline (G.Pakhlova, F.Anulli)

- | | | | |
|--|--------|------|---|
| 1. The ISR method | -----> | 3p | cross references/inter-correlations |
| 2. Exclusive hadronic cross sections | | | |
| 1. hadronic contribution to $(g-2)_\mu$ | -----> | 1p | refer to g-2 from TAU decays
spectral functions |
| 2. high precision measurement to $\pi^+\pi^-$ | | 3p | |
| 3. discussion on g-2 | -----> | 2-3p | |
| 4. other multi-hadron final states | -----> | 4p | |
| 1. light hadrons spectroscopy | | | Y(2175) better to present here: no intermediate charmonium involved |
| 2. discovery of Y(2175) $\rightarrow \phi f_0$ | | | |
| 5. baryons' time-like Form Factors | -----> | 3p | measurements presented here. |
| 3. Open-charm production | -----> | ~8p | Reference to charmonium
(conventional/exotic) |
| 1. $D(^*)D(^*)$ | | | |
| 2. $DD(^*)\pi$ | | | also baryon FF? |
| 3. $\Lambda_c + \Lambda_c^-$ | | | |
| 4. Search for exotic charmonium | | ??? | here the analysis, interpretation in exotic Charmonium section? |
| 1. discovery of "Y"-family states | | | |
| 5. search for multileptons final states | | ?? | not discussed yet |

Two Photon physics (S.Uehara)

1. A detailed outline will be provided soon
2. Section editor from Babar not yet available
 1. however contributions for Babar analyses will be covered
 1. single tagging analyses ($gg \rightarrow$ pseudoscalar mesons) \Rightarrow V. Druzhini
 2. $gg \rightarrow$ charm

QCD Fragmentation section outline

cross references/inter-correlations

1. Fragmentation functions (R.Seidl, F.Anulli) (theory: Kumano or Stratman)

1. Theory introduction -----> 5p

2. unpolarized FF

1. Light Hadrons -----> 2-3p

2. Charmed hadrons -----> 3p

relations with Charmed baryons/
Baryonic B decays sections

3. polarized FF

1. Collins Functions -----> 3p

2. Interference FF -----> 3P

not discussed yet

2. Search for Pentaquarks-----> ??p (W.Dunwodie, B.Yabsley)

not discussed yet

3. exclusive final states at 10.6 GeV--> ??p

Main discussion coming out from the PS

- There is a proposal to change the order of the sections in the physics results:
 - move ISR, two-photons and QCD/Fragmentation BEFORE (at least) quarkonium section
 - motivations:
 - ISR and $\gamma\gamma$ are a sort of “experimental techniques” used to study very different topics at different energies (light hadrons, heavy hadrons, $g-2$, exotic charmonium states,...)
 - it would be probably easier to introduce the technique and then discussing the results (like the new exotic charmonium states) in the proper section
 - a possibility would be to “reverse the order, going from light to heavy particle physics, so the last section before the “Global interpretation” would be B-physics stuff
 - not general consensus reached during the parallel session, but we feel is something that deserve to be discussed with all of you

Bottomonium (R.Mussa, S.Sekula, N.Brambilla)

cross references/inter-correlations

1. Common techniques
2. Energy scans
3. Spectroscopy
4. Transitions
5. Decays
6. PhysicsBeyond SM
 1. Light Higgssearches
 2. Light DM searches
 3. LFV searches
 4. LeptonUniversalitytests