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# Group 2

- Tools
  - Dalitz
  - MVA
  - Tagging
- Physics
  - Alpha
  - Beta
  - Gamma
  - Sides
  - B -> Charm
  - B -> Charmless
  - B -> leptonic
  - B -> Radiative

# Papers

| Section | Babar papers | Belle papers | BFLB Pages |
|---|---|---|---|
| MVA | 0 | 0 | 10 |
| Dalitz Methods | (17) | (22) | 20 |
| Tagging | 0? | 1? | 30 |
| $\alpha/\phi 2$ | | 12 | 15 |
| $\beta/\phi 1$ | >11 | >? | 24-30 |
| $\gamma/\phi 3$ | 25 | 25 | 25 |
| Radiative | 28 | 27 | 30 |
| Charmless | 20 | 20 | 20 |
| Leptonic | | | |
| B -> charm | | | |
| Sides | | | |
| | | | |
| | | | |

# Tools – New sections

1) PID and Reconstruction efficiency and systematics methodology.
2) Flavor tagging
3) Vertexing
4) Time-dependent analyses
5) B-reco
6) MV/Optimization
7) ML fits
8) Dalitz
9) Angular analysis
10) Blind analysis

# Re-Order Section

1. Move 11.8, 11.9, 11.11 (mixing and lifetimes, EPR)
2. after 11.2

3. Move 11.11 (CPT) after 11.5

4. In tools, add Angular Analysis after Dalitz

# MVA

- Formalism of fitting distributions with resolution models conditional on per---event errors.
- Simultaneous fitting techniques (control vs. signal, and splitting in bins of e.g. tagCat).
- Techniques involved in multi---dimensional model use (including likelihood ratio plots)
- Subtraction of background events in the likelihood and calculation of errors for those cases
- Something on RooFit
- SPLots
- Parallelization and other computational techniques for 'exact' optimizations.

# Dalitz

- Introductory part
  - Concept of a DP, the general ideas behind DP fits.
  - Physics motivations behind DP analyses: searches for new states, measuring resonance properties, CP violation, B and D mixing, resolving ambiguities.

- Formalisms - isobar, K matrix.
  - Lineshapes, angular terms, barrier factors.
  - Different ways of parameterising the complex coefficients.

- Extensions:
  - Square Dalitz plot (various forms).
  - Time-dependence.
  - Non-scalar particles in the final state.

- Effects of efficiency, backgrounds, self cross feed, resolution.

  - Technical issues

  Binned vs unbinned fits, approaches for normalisation, adaptive binning, nonparametric backgrounds, local minima.

# Tagging

- - Introduction to tagging
  - * definitions
  - * physics sources of tagging information
  - * multivariate methods used
  - * things we tried, what worked, what didn't?
- - Flavor tagging algorithms
  - * BaBar and Belle algorithms
  - * only most recent algorithms
  - * categories etc
- - Measuring flavor tagging performance
  - * history of tagging performance in Belle and BaBar
- - Systematic effects
  - * tag side interference

# Section subdivision – beta/$\phi 1$

1) Intro/overview
2) ccbars (J/psi $K^0$, …)
3) ccbard (J/psi □$^0$, DDbar)
4) cubard ($D^0h^0$)
5) Charmless qqbars
   a) Q2b
   b) 3-body, non-Dalitz
   c) 3-body, Dalitz
6) Review of methods to break discrete ambiguity (J/psiK*, 3K, …).
7) sin(□□□□)
8) Future prospects (at LHCB and Super B factories)
9) Summary

For each subsection
- CKM context for measurement. How it fits into bigger picture. (0.5 - 1.0 p)
- Experimental methods (1 - 2 p)
- Results including experimental limitations. (0.5 p)
- Interpretation including theoretical limitations. (0.5 - 1.0 p)
- Future prospects (here or all together at the end?) (0.5 p)

Typical subsection page count: 3 - 5 p.

Approximate expected # pages needed for whole section: 24 - 40 p

# Alpha/$\phi 2$

- Introduction (1p)
- Isospin analyses (1p)
- B→ππ (3p)
  - (includes description of Kπ) – inter-section with charmless decays
- B→ρρ (3p)
  - Angular analyses
- B→ρπ (3p)
- B→a1π (2p)
- Conclusion (1p)

# Gamma/ϕ3

- Many papers related to γ (variety of methods and channels)
- Overview on approaches to measure γ
- Focus on GLW, ADS and Dalitz methods on B+ →D(*)K(*)+ decays
  - GLW B-→D0K-, B-→D*0K-, B-→D0K*-
  - ADS B-→D0K-, B-→D*0K-, B-→D0K*-
  - Dalitz/GGSZ B-→D0K-, B-→D*0K-, B-→D0K*-
- B0→D0K*0 modes (ADS,Dalitz) do not bring much information at B factories
  - Will include but short
- sin(2β+γ) measurements (full and partial reco) will be included
  - Shorter than subsections for GLW+ADS+Dalitz with charged modes
- Too early yet to consider “Model Independent” Dalitz measurement
  - Belle is working on it, BaBar did not consider it (so far)
- Combination of results (from main methods)

# Sections

- B->Radiative/EW

Section Radiative & Electroweak Penguin Decays (30 pages)
- Subsection Theory (4 pages)
  - Subsubsection Heavy Quark OPE
  - Subsubsection Form Factors (sum rules & SCET)
  - Subsubsection New Physics
- Subsection Inclusive b->sgamma (6 pages)
  - Subsubsection Fully inclusive (+ lepton-tagged)
  - Subsubsection BRECO tagged
  - Subsubsection Sum of exclusives
  - Subsubsection Direct CP and $A_I$
  - Subsubsection Spectral shape, moments, extrapolation
  - Subsubsection World averages
- Subsection Exclusive b->sgamma (4 pages)
  - Subsubsection B->K*gamma (BF, $A_{CP}$, $A_I$)
  - Subsubsection Other exclusive b->sgamma
  - Subsubsection $B_s$ ->phigamma
- Subsection b->dgamma (3 pages)
  - Subsubsection B->rho(omega)gamma (BF, $A_{CP}$, $A_I$)
  - Subsubsection Inclusive b->dgamma
  - Subsubsection Extraction of Vtd/Vts?

- Subsection Time-dependent CP violation (3 pages)
  - Subsubsection B->Kspi0gamma, B->Ksetagamma
  - Subsubsection B->Ksrhogamma, B->Ksphigamma
  - Subsubsection B->rhogamma
- Subsection b->sll (6 pages)
  - Subsubsection B->K(*)ll (BF, $A_{CP}$, $A_I$, $R_L$)
  - Subsubsection B->K*ll angular analysis
  - Subsubsection b->sll sum of exclusives
- Subsection b->svv (2 pages)?
  - Subsubsection B->K(*)vv, pivv?
- Subsection Searches for other decays (2 pages)
  - Subsubsection B->gammagamma
  - Subsubsection B->pill
  - Subsubsection Lepton flavour violation

# Charmless

Section Charmless Decays
- Subsection(Introduction)
  - Subsubsection (Dalitz)
    - Resonances
    - LASS
    - sigma/Kappa
    - non-resonance
    - Backgrounds
    - K-matrix
    - alpha/beta/gamma
    - CP Violation
  - Subsubsection (2-body)
    - BF
    - Polarisation
    - Asymmetries
    - Theory
    - alpha/beta/gamma

- subSection (Results)
- SubSubsection(Dalitz Results)
  - Branching Fractions
  - Phases
  - Asymmetries
  - G-parity
  - Combined results

- SubSubsection(2-body Results)
  - BF
  - Polarisation
  - Asymmetries
  - G-Parity
  - Broken down as VV/VT/AV...

# Inter-correlations

# Inter-correlations

- MVA
- Dalitz Methods
  - Physics that use it.
  - ML fits
  - Unbinned fits
- Flavor Tagging
  - Tagging Performance -> Mixing
  - Tag-size interference -> sin 2 beta
  - Tagging for background suppression -> analysis specific.
  - Belle updating flavor tagging -> comparisons.
  - Define notation early.
- $\alpha/\phi 2$:
  - priorities on analyses that need to be finished.
  - Belle needs to find some effort to update results;
  - BaBar more or less covered.
  - Interaction with charmless K pi/pi pi.

# Inter-correlations

- β/ϕ1
  - TDCPV analysis section in tools
  - Tag-side interference: here or in tools
  - 2beta+gamma: here or in beta
  - Charmless qqbars: describe selection in charmless
  - Charmless Dalitz: refer to Dalitz section where possible
  - J/psi K* TD angular analysis: section in tools.

# Inter-correlations

- γ/ϕ3
  - Physics sections that contain Dalitz analysis results:
    - Hadronic B decays to charm (for r estimation for B→D S (*)h, D*π0)
    - D mixing and CPV (for D0→K S hh Dalitz models)
    - Global CKM fits
  - Relies on the following Tools sections:
    - Dalitz plot analyses
    - Maximum likelihood fits
    - Tagging and Vertexing (for exclusive and inclusive B reconstruction)
    - Multivariate discriminants, Blind analysis

# Inter-correlations

Charmless

- Alpha/beta/gamma
- Flavour tagging and MVAs
- Charm Dalitz and K-Matrix formalism
- Theory

# Inter-correlations

- B Radiative/EW:
  - where to put theory description. TDCPV measurements are similar to other TDCPV (refer back to phi1?).
  - B->s nu nubar could be in leptonic section.
  - Vtd/Vts into rho gamma section?
  - Angular analysis. Move LFV in another section, is there a LFV theory section.
  - Dark physics, higgs, here or elsewhere (K*ll).
  - Is Fragmentation/jetset described here (most people use recoil methods so not a problem for them).
  - Bs->phi gamma; B->p lambda-bar gamma (here of elsewhere).
- B leptonic:
  - K* nu nubar;
  - recoil b reconstruction.
  - LFV (same question as B Radiative);B->gg, B->emu, B->invisible, B->Kl'l: an exotic search section?

# Conclusion

- Physics identified
- Overlaps identified
- New sections identified.
- Re-ordering of some sections would help
- Some people identified to help (even if they don't know it yet)
- Theory help still needs to clarified.