Issues for Dalitz Plot analyses

The grubby details

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Theory Issues

- What is a resonance?
- Which resonances need to be included?
- Can theorists calculate non-resonant contributions?

Weak Physics vs Hadron Physics

- Weak physics as "naive" quark model
  - treat rho and pi on same footing
  - valence quarks only
  - tack on rho decay at the end
- Hadron physics in general not calculable, but we know some things
  - Isospin is a good approximate symmetry
  - Breit Wigner is a reasonable approximation for most resonances
  - gets worse as resonances get wider or overlap

Experimental Issues

- How to parameterize a resonance
- Which resonances need to be included?
- Non-resonant contributions and backgrounds
- Number of fit parameters needed

With enough data many issues can be studied in the data.

Model Dependence –Resonances

- Detailed Shape of a broad resonance such as rho
  - e.g. $\Pi(s) = \frac{m_\rho^2 \Gamma_\rho}{\sqrt{(s)}} [\frac{s-4m_\pi^2}{m_\rho^2-4m_\pi^2}]^{\frac{3}{2}}$
- Is the resonance shape the same in B decay as in pi pi scattering?
  - See clever Babar analysis of K^* phase shift in $J/\psi K*$

Beware if the result lives in the tails of the resonances

odel Dependence –Non Resonant Contributio

- If you use a calculated rate and get a non-Standard value for "gamma" what would you conclude?
- In this sense no calculated rate or strong phase is reliable
- Theorists "range of possible values" also cannot be trusted

Plea: In quoting "theory prediction" distinguish "theory" and "models"

Isospin "Breaking"

- electroweak penguins
  - photon and Z have both $I = 1$ and $I = 0$ couplings to quarks
  - known ratios
  - gluon is pure I=0
- quark mass differences break isospin
  - most effects scale as $\frac{M_{up} - M_{down}}{\Lambda_{QCD}}$
  - phase space effects – small in B decays
  - $\rho - \omega$ mixing –a detail of ρ^0 shape that may eventually need inclusion