WORK PLAN IN PROGRESS

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(26th May 2004)

OUTLINE

1. What Are We Trying To Measure?

2. Physics Analysis
   - Calculating N($K_L\pi$)
   - Calculating N($K_S\pi$)

3. Calibration Analysis
   - Calculating N($K_L\pi\pi$)
   - Calculating N($K_S\pi\pi$)

What Are We Trying To Measure?

- We are measuring the following asymmetry in the deacy of D^0

$$A = \frac{\Delta\Gamma}{2\Gamma_{av}}$$

$$= \frac{(\Gamma_{D^0 \to K_S{}^0 \pi^0}) - (\Gamma_{D^0 \to K_L{}^0 \pi^0})}{(\Gamma_{D^0 \to K_S{}^0 \pi^0}) + (\Gamma_{D^0 \to K_L{}^0 \pi^0})}$$

$$= \frac{\Delta\mathcal{B}}{2\mathcal{B}_{av}}$$ as branching fraction $\mathcal{B}_{K_L\pi} \;\alpha\; \Gamma_{K_L\pi}$ and so on

$$= \frac{N(K_L\pi)/N(K_L\pi + K_S\pi) - N(K_S\pi)/N(K_L\pi + K_S\pi)}{N(K_L\pi)/N(K_L\pi + K_S\pi) + N(K_S\pi)/N(K_L\pi + K_S\pi)}$$

$$= \frac{N(K_L\pi) - N(K_S\pi)}{N(K_L\pi) + N(K_S\pi)}$$

detector efficiency corrected by using decay $D^0 \to (\bar{K}^0\pi)\pi$ via K^{*-}

$$A = \frac{N(K_L\pi)/\epsilon_{K_L} - N(K_S\pi)/\epsilon_{K_S}}{N(K_L\pi)/\epsilon_{K_L} + N(K_S\pi)/\epsilon_{K_S}}$$

$$= \frac{N(K_L\pi)/N(K_L\pi\pi) - N(K_S\pi)/N(K_S\pi\pi)}{N(K_L\pi)/N(K_L\pi\pi) + N(K_S\pi)/N(K_S\pi\pi)}$$

- So we have the following numbers to calculate for this analysis

$$N(K_L\pi), N(K_S\pi), N(K_L\pi\pi), N(K_S\pi\pi)$$

Physics Analysis, calculating N($K_L\pi$)

- Create MC samples for $D^0 \to {K_L}^0\pi^0$ and $D^0 \to {K_S}^0\pi^0$

  Signal MC

  $e^+e^- \to c\bar{c} \to charm\ fragmentation \to single\ D^{*+}\ selection \to decay\ table$

  Generic MC

  $e^+e^- \to c\bar{c} \to charm\ fragmentation \to$ allow generic decay ? ? ?

- Reconstruct $D^0 \to {K_L}^0\pi^0$ (Signal MC)

  ${K_L}^0 by\ D^0\ mass\ constraint,\ E_{ECL} > 300MeV$

  for excluding $K and$ π decays in flight

  $D^0 by\ x_p > 0.6,\ -0.95 < \cos(\angle D^0 k^0) < 0.2$

  for excluding combinatorics, random pion backgrounds

  tag by $D^{*+} \to D^0\pi^+$ look at D^{*+} mass distribution

  fit signal and background (to be crosschecked with data later)

- Reconstruct $D^0 \to (pseudo\ {K_L}^0)\pi^0$ for control

  Signal MC of $D^0 \to {K_S}^0\pi^0$ is used here

  do a resolution study of ${K_S}^0 and {K_L}^0$

  reconstruct ${K_S}^0$ by D^0 mass constraint

  ${K_S}^0$ direction resolution smeared to match ${K_S}^0$ resolution

Physics Analysis, calculating N($K_L\pi$)

- Analyse generic MC sample to study the backgrounds
  reconstruct $D^0 \to {K_L}^0\pi^0$
  tag decays present in sample by evtgen, plot their mass distribution
  (to get no of background events for each decay and their spectrum)
  ??? is it correct/useful ???
  study the event topology to get the potential background sources
  ??? device cuts and optimise ???

- Skim data for $D^0 \to {K_L}^0\pi^0$
  reconstruct $D^0 \to {K_L}^0\pi^0$, fit signal, background in D*+ mass
  obtain N($K_L\pi$) and cross-check with signal MC

Physics Analysis, calculating N($K_S\pi$)

- Reconstruct $D^0 \rightarrow {K_S}^0\pi^0$ (Signal MC)
  ${K_S}^0$ from mdst-vee2, apply track quality cuts
  same cuts on D^0 etc as in case of $D^0 \rightarrow {K_L}^0\pi^0$
  fit signal and background for crosschecking with data later
- Analyse generic MC sample to study the backgrounds
  same procedure as in case of $D^0 \rightarrow {K_L}^0\pi^0$
- Skim data for $D^0 \rightarrow {K_S}^0\pi^0$
  reconstruct $D^0 \rightarrow {K_S}^0\pi^0$, fit signal, background in D*+ mass
  obtain N($K_S\pi$) and cross-check with signal MC

Calibration Analysis, calculating N($K_L\pi\pi$)

- Signal and Generic MC for $D^0 \to K_L\pi\pi$ and $D^0 \to K_S\pi\pi$ via K^{*-}
  reconstruct $D^{*+} \to D^0\pi^+, D^0 \to K^{*-}\pi^+, K^{*-} \to K_L\pi^-$(signal MC)
  apart from cuts for D^0 *and* K_L etc invariant mass cut on K^{*-}
  tag by $D^{*+} \to D^0\pi^+$ look at D^{*+} mass distribution
  fit signal and background (to be crosschecked with data later)
- Reconstruct $D^0 \to (pseudo\ {K_L}^0\pi)\pi$ for control
  use results from resolution study as earlier
- Do a background study in the generic MC sample as earlier
  device and optimise cuts
- Skim data for $D^0 \to K_L\pi\pi$
  reconstruct $D^0 \to K_L\pi\pi$, fit signal, background in D*+ mass
  obtain N($K_L\pi\pi$) and cross-check with signal MC

Calibration Analysis, calculating N($K_S\pi\pi$)

- Reconstruct $D^{*+} \to D^0\pi^+, D^0 \to K^{*-}\pi^+, K^{*-} \to K_S\pi^-$(signal MC)
  invariant mass cut on K^{*-}
  tag by $D^{*+} \to D^0\pi^+$ look at D^{*+} mass distribution
    fit signal and background and crosscheck with data later

- Do a background study in the generic MC sample as earlier
  device and optimise cuts

- Skim data for $D^0 \to K_S\pi\pi$
  reconstruct $D^0 \to K_S\pi\pi$, fit signal, background in D*+ mass
    obtain N($K_S\pi\pi$) and cross-check with signal MC