WORK PLAN IN PROGRESS

Manmohan Dash

Virginia Tech

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OUTLINE

- A. What Are We Trying To Measure?
- B. Yield in $D^0 \to {K_L}^0\pi^0$ and $D^0 \to {K_S}^0\pi^0$
  1.Choosing Monte Carlo Sample
  2.Signal Shape and Control in Signal M.C.
  3.Background Study
  4.Yield in Data
- C. Calibration Analysis in $D^0 \to ({K_L}^0\pi)\pi$ and $D^0 \to ({K_S}^0\pi)\pi$
  1.Choosing M.C. Sample
  2.Signal Shape and Control
  3.Background Study
  4.Relative Reconstruction Efficiency in M.C.
  5.Relative Reconstruction Efficiency in Data
- D. Remarks

What Are We Trying To Measure?

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

$$A = \frac{(\Gamma_{D^0 \to {K_L}^0 \pi^0}) - (\Gamma_{D^0 \to {K_S}^0 \pi^0})}{(\Gamma_{D^0 \to {K_L}^0 \pi^0}) + (\Gamma_{D^0 \to {K_S}^0 \pi^0})}$$
$$= \frac{\Delta\Gamma}{2\Gamma_{av}}$$
$$= \frac{\Delta\mathcal{B}}{2\mathcal{B}_{av}}$$
$$= \frac{\mathcal{B}(D^0 \to {K_L}^0 \pi^0) - \mathcal{B}(D^0 \to {K_S}^0 \pi^0)}{\mathcal{B}(D^0 \to {K_L}^0 \pi^0) + \mathcal{B}(D^0 \to {K_S}^0 \pi^0)}$$
$$if\ \alpha = [\int dt\mathcal{L}] \times \sigma_{c\bar{c}} \times D(c \to D^*, inclusive) \times \mathcal{B}(D^{*+} \to D^0\pi^+)$$
$$N^{obs}_{K_L\pi} = \alpha \times \mathcal{B}(D^0 \to {K_L}^0\pi^0) \times \epsilon_{K_L\pi}$$
$$N^{obs}_{K_S\pi} = \alpha \times \mathcal{B}(D^0 \to {K_S}^0\pi^0) \times \epsilon_{K_S\pi}$$
$$A = \frac{N^{obs}_{K_L\pi}/\epsilon_{K_L\pi} - N^{obs}_{K_S\pi}/\epsilon_{K_S\pi}}{N^{obs}_{K_L\pi}/\epsilon_{K_L\pi} + N^{obs}_{K_S\pi}/\epsilon_{K_S\pi}}\ as\ \alpha\ cancels\ out$$
$$= \frac{N^{obs}_{K_L\pi} - (\epsilon_{K_L\pi}/\epsilon_{K_S\pi})N^{obs}_{K_S\pi}}{N^{obs}_{K_L\pi} + (\epsilon_{K_L\pi}/\epsilon_{K_S\pi})N^{obs}_{K_S\pi}}$$
$$= \frac{N^{obs}_{K_L\pi} - (\epsilon_{rel})N^{obs}_{K_S\pi}}{N^{obs}_{K_L\pi} + (\epsilon_{rel})N^{obs}_{K_S\pi}}$$

B. Yield in $D^0 \to {K_L}^0\pi^0$ and $D^0 \to {K_S}^0\pi^0$

- Choosing Monte Carlo Sample

Generation of Signal MC for $D^0 \to {K_L}^0\pi^0$ and $D^0 \to {K_S}^0\pi^0$
$e^+e^- \to c\bar{c} \to fragmentation \to single\ D^{*+} \to filter\ module$
$\to D^{*+} \to D^0\pi^+_{slow}\, , D^0 \to K^0_L\pi^0$(by evtGen)

Monte Carlo for background study already available
Skimmed uds,charm,charged,mixed MC in diffrent channels
to start with charm MC for devising cuts
???Huge amount of MC, any preselection procedure???

B. Yield in $D^0 \to {K_L}^0\pi^0$ and $D^0 \to {K_S}^0\pi^0$

- Signal Shape and Control Analysis in Signal MC

  Reconstruct $D^0 \to {K_L}^0\pi^0$
  - π^0 : $mdst\_pi0$
  - ${K_L}^0$:neutral clusters, D^0 mass constraint, $E_{ECL} > 300MeV$
    - excludes K and π decays in flight
  - D^0: $x_p > 0.6$, $-0.95 < \cos(\angle D^0 k^0) < 0.2$
    - excludes combinatorics and random pion backgrounds
  - $D^{*+} \to D^0\pi^+_{slow}$ tag, look at D^{*+} mass distribution

  Reconstruct $D^0 \to {K_S}^0\pi^0$
  - ${K_S}^0$: $mdst\_vee2$,apply track quality cuts
  - D^0: same cuts as in case of $D^0 \to {K_L}^0\pi^0$
  - $D^{*+} \to D^0\pi^+_{slow}$ tag, look at D^{*+} mass distribution

  Reconstruct $D^0 \to (pseudo\ {K_L}^0)\pi^0$ for control
  - $(pseudo\ {K_L}^0)$: ${K_S}^0$ reconstructed as K^0_L after resolution matching

B. Yield in $D^0 \to {K_L}^0\pi^0$ and $D^0 \to {K_S}^0\pi^0$

- Background study
  Study charmed background first
  Reconstruct $D^0 \to {K_L}^0\pi^0$same selection as earlier, wide D^{*+} mass cut
  Tag decays in evtGen for entire event set
  Plot their mass(for no of bkg events and spectrum of bkg)
  Study event topology to get potential bkg source
  Do the same for $D^0 \to {K_S}^0\pi^0$
  Devise and optimise cuts

- Skim data for $D^0 \to {K_L}^0\pi^0$ and $D^0 \to {K_S}^0\pi^0$
  reconstruct $D^0 \to {K_L}^0\pi^0$ and $D^0 \to {K_S}^0\pi^0$
  fit signal and background for yield in D^{*+} mass i.e, $N^{obs}_{K_L\pi}$ and $N^{obs}_{K_L\pi}$

C. Calibration Analysis in $D^0 \to (K_L{}^0\pi)\pi$ and $D^0 \to (K_S{}^0\pi)\pi$

- Choosing MC sample
  Similar as in case of $D^0 \to K_L{}^0\pi^0$ and $D^0 \to K_S{}^0\pi^0$
- Signal Shape Analysis and Control
  Same selection criteria as $D^0 \to K_L{}^0\pi^0$, $D^0 \to (\textit{pseudo}\ K_L{}^0)\pi^0$ etc
- Background Study
  Same as for $D^0 \to K_L{}^0\pi^0$,$D^0 \to K_S{}^0\pi^0$ modes
  Devise cuts and optimise
- Relative Reconstruction Efficiency in M.C
  Reconstruct $D^0 \to (K_L{}^0\pi)\pi,\ D^0 \to (K_S{}^0\pi)\pi$ with earlier selection
  In Sig + bkg MC...leaving steps such as skimming MC???...
  Relative reconstruction efficiency $(\epsilon_{K_L\pi\pi}/\epsilon_{K_S\pi\pi})$
  e.g. ratio of (signal-bkg) for $N^{obs}_{K_L\pi\pi}$ in momentum bins to no in MC
- Relative Reconstruction Efficiency in Data
  Skim data and reconstruct $D^0 \to (K_L{}^0\pi)\pi,\ D^0 \to (K_S{}^0\pi)\pi$
  Measure relative reconstruction efficiency in Data

C. Remarks

- My View
  1)Clean up codes I already have for part B. and continue with calibration
  2)Start up part A. and proceed together with part B.
  3)Start analysis immediately

- Bruce's feedback
  1)Skimming in part A and part B should be together.Hence some integration in steps
  my view, skimming can be done together, rest in parallel
  2)Bruce's suggestion $\rightarrow$ tentative cuts after signal analysis before background study(part A)
  skim background MC based on above cuts and refine cuts
  3)Keeping in view my outlines and a discussion Bruce agrees its a good point to start analysis