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OUTLINE

- ver1 of ’charm meeting slides’ (Page 1 to Page 15)
- List of things to be done
Reconstruction and Event selection

- $\pi^0$ candidates
  - mdstpi0

- $K_S$ candidates
  - mdstvee2
  - $dr > 0.25$, $d\phi < 0.1$, $dz < 1$
  - $0.486 < M_{K_S}^{rec}(k0sp\bar{i}) < 0.510$
  - $0.491342 < M_{K_S}^{rec}(k0spipi) < 0.504038$
  - plots
Reconstruction and Event selection conti....

- $K_L$ candidates
  - $K_L$ reconstruction technique
    take $K_L$ direction (mdst0kl), reconstructed $\pi^0$ ($\pi^+$ and $\pi^-$ in case of $D^0 \rightarrow K_L\pi\pi$)
    fix $K_L$ and $D^0$ mass to PDG value
    quadratic equation(2 solutions) for $p_{K_L}$
  - which solution to be taken?
    I do a fom study in MC (and data+MC) for both solutions
    conclusion: increased yield with better fom if both solutions taken together
    results shown in detail in later slides
Reconstruction and Event selection conti....

- \( K^*^- \) candidates

\[
0.89166 \text{GeV} - 3\sigma < M_{K^*^-}^{rec} < 0.89166 \text{GeV} + 3\sigma
\]
Reconstruction and Event selection conti....

- $D^0$ candidates
  - $1.75 GeV < M_{D^0}^{rec}(k0\pi^0) < 1.9 GeV$
  - $1.8649 GeV - 3\sigma < M_{D^0}^{rec}(k0\pi^0\pi^0) < 1.8649 GeV + 3\sigma$
  - $M_{D^0}$ is fixed to PDG value for $K_L$ modes
Reconstruction and Event selection conti....

- tagging the signal

- \( 0.144 < \Delta M(k0\pi0) < 0.147, 0.143 < \Delta M(k0\pi\pi) < 0.148 \)

- \( M_{D^*+}^{\text{rec}} \) within \( \pm 3\sigma \) of mean for \( K_L \) modes
Useful studies in signal MC

- **study1:** fom study for choosing between 2 solutions for \( p_{K_L} \)
- **study2:** efficiency study in bins of momentum

**study1:** fom statistics for the solutions

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Signal</th>
<th>Background</th>
<th>fom</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1750.8</td>
<td>2555.4</td>
<td>26.6802</td>
</tr>
<tr>
<td>2</td>
<td>620.21</td>
<td>1602.1</td>
<td>13.1564</td>
</tr>
<tr>
<td>Both</td>
<td>2402.8</td>
<td>4123.2</td>
<td>29.7436</td>
</tr>
</tbody>
</table>
MINUIT $x^2$ Fit to Plot 10/0
D*+ mass from sol1
File: solboth.formnf.hbk 19-OCT-2004 05:09
Plot Area Total/Fit 8446.0 / 8446.0
E.D.M. 6.99E-06
$\chi^2 =$ 9.4 for 20 - 8 d.o.f., C.L. = 66.7%

Errors Parabolic Minos
Function 1: Threshold
NORM 3.8031E+07 8.0043E+07 0. + 3.4125E+08
OFFSET 0.3428 0.3619 0. + 0.
POWER 0.78034 0.7486 - 0. + 0.3619
COEFF1 -103.07 74.84 - 0. + 0.
COEFF2 1165.6 1638. - 0. + 2151.

Function 2: Gaussian (sigma)
AREA 1754.6 115.1 - 0. + 0.
MEAN 2.0100 5.1212E-05 - 5.1277E-05 + 5.1412E-05
SIGMA 1.1429E-03 6.2794E-05 - 0. + 0.

MINUIT $x^2$ Fit to Plot 20/0
D*+ mass from sol2
File: solboth.formnf.hbk 19-OCT-2004 05:09
Plot Area Total/Fit 4950.0 / 4950.0
E.D.M. 6.85E-06
$\chi^2 =$ 10.3 for 20 - 7 d.o.f., C.L. = 67.0%

Errors Parabolic Minos
Function 1: Threshold
NORM 1.54136E+07 1.4427E+07 0. + 2.5297E+07
OFFSET 2.0040 0. - 0. + 0.
POWER 0.69935 0.1383 - 0.1383 + 0.1380
COEFF1 -112.43 46.72 - 46.72 + 48.73
COEFF2 2275.9 1442. - 1442. + 1395.

Function 2: Gaussian (sigma)
AREA 623.09 89.17 - 89.17 + 103.6
MEAN 2.0100 1.1766E-04 - 1.1584E-04 + 1.1966E-04
SIGMA 1.23268E-03 1.4872E-04 - 1.4872E-04 + 1.6950E-04

MINUIT $x^2$ Fit to Plot 30/0
D*+ mass from both sol
File: solboth.formnf.hbk 19-OCT-2004 05:10
Plot Area Total/Fit 13396. / 13396.
E.D.M. 1.647E-06
$\chi^2 =$ 16.1 for 20 - 7 d.o.f., C.L. = 24.3%

Errors Parabolic Minos
Function 1: Threshold
NORM 2.43678E+07 1.0826E+07 - 1.0826E+07 + 1.9537E+07
OFFSET 2.0040 0. - 0. + 0.
POWER 0.63113 8.2369E-02 - 8.2369E-02 + 8.3340E-02
COEFF1 -81.795 28.76 - 28.76 + 29.09
COEFF2 1019.5 878.2 - 878.2 + 868.0

Function 2: Gaussian (sigma)
AREA 2409.6 145.4 - 145.4 + 148.3
MEAN 2.0100 4.7759E-05 - 4.7417E-05 + 4.7861E-05
SIGMA 1.1729E-03 4.7861E-05 - 4.7861E-05 + 6.1440E-05

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Useful studies in signal MC continues.....

study1: We saw taking both solutions more profitable, better yield better fom. Now are there 2 competing solutions in 1 event?
study 2: efficiency in bins of momentum 
we have to verify the following assumptions
\[ \epsilon_{D \to K \pi}(p_K, p_\pi, p_{\pi_s}) = \epsilon_K(p_K) \times \epsilon_\pi(p_\pi) \times \epsilon_{\pi_s}(p_{\pi_s}) \]
\[ \epsilon_{D \to K \pi^+ \pi^-}(p_K, p_{\pi^+}, p_{\pi^-}, p_{\pi_s}) = \epsilon_K(p_K) \times \epsilon_{\pi^+}(p_{\pi^+}) \times \epsilon_{\pi^-}(p_{\pi^-}) \times \epsilon_{\pi_s}(p_{\pi_s}) \]

Our strategy is to show that there is no correlation in the 3D efficiency functions on the LHS of the factorisation equation by looking at the efficiency functions of the arguments in a pair wise fashion.
Useful studies in signal MC continues....

study2: 1D efficiency functions of $\pi^0$s and $\pi^\pm$s
Useful studies in signal MC continues....

study2: 1D efficiency functions $K^0$s
Useful studies in signal MC continues....

study2: 1D efficiency functions $\pi_{ss}$
study2: 2D efficiency functions
\[ \epsilon_{D \rightarrow K_S \pi}(p_K, p_\pi) \]
\[ \epsilon_{D \rightarrow K_S \pi}(p_\pi, p_{\pi_s}) \]
\[ \epsilon_{D \rightarrow K_S \pi}(p_K, p_{\pi_s}) \]
There are 15 more such 2D functions in all 4 modes besides the \( K_S \pi \) modes shown here.
list of things to do (and done)

More sig MC is being produced
Now is the time for:
remove double counting from $K_L$ modes
fix event by event comparison of the 2 solutions
Fix other coding issues (if any) and copy for ’cc’ modes