Ac using $D,D^*$ mesons

by M. Iwasaki
Measurement of $A_c$ with Charmed Mesons at SLD

6/14/99 M. Iwasaki
University of Oregon

First Look of '97-'98 R16 Data
In this analysis, we measure Ac with

1) Exclusive reconstruction of $D^{*\pm}/D^\pm/D^0$

$D^{*+} \rightarrow D^0 \pi_{s+}$

$D^0 \rightarrow K^-\pi$  \hspace{1cm} Br 4.0%  \\
$D^0 \rightarrow K^-\pi^+\pi^0$ (satellite) \hspace{1cm} 13.8%  \\
$D^0 \rightarrow K^-\pi^+\pi^+\pi^-$ \hspace{1cm} 8.1%  \\
$D^0 \rightarrow K^-l^+\nu$ (l=e,\mu) \hspace{1cm} 3.7%  \\
$D^+ \rightarrow K^-\pi^+\pi^+$

$D^0 \rightarrow K^-\pi^+$ (not from $D^{*+}$)

2) Inclusive Soft Pion analysis

$D^{*+} \rightarrow D^0 \pi_{s+}$

248
1) Exclusive reconstruction of $D^{*\pm}/D^\pm/D^0$

R15 -> R16

Tracking resolution .. 30% up
Acceptance .. increase

We expect to get
better efficiency & b/c separation
in the exclusive D reconstruction

I use R15 MC & R16 Exp. Data
(R16A .. not yet)
2-D impact parameter

R15

Exp.data

R16

Get better resolution with R16 !!
$D^* \rightarrow D^0 \pi_s$

$D^0 \rightarrow K\pi$

$R15 ('96-'98:400k)$  

$R16 ('97-'98:350k)$

$D^0 \rightarrow K\pi\pi^0$

- Exp. Data

MC:D$^*\pm$

MC:RCBG
$D^0 \rightarrow K\pi\pi$

R15 ('96-'98:400k)  

R16 ('97-'98:350k)

$D^0 \rightarrow Kl\nu$ (l=e,\mu)

Exp. Data  

\[ \text{MC:D}^*\pm \]  

\[ \text{MC:RCBG} \]
### R16 '97-'98 (350k) 3100 candidates

<table>
<thead>
<tr>
<th>c→D</th>
<th>b→D</th>
<th>RCBG</th>
</tr>
</thead>
<tbody>
<tr>
<td>2252.2</td>
<td>172.5</td>
<td>675.5</td>
</tr>
<tr>
<td>72.6%</td>
<td>5.6%</td>
<td>21.8%</td>
</tr>
<tr>
<td>(c/(c+b) = 92.9%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### R15 '96-'98 (400k) 3107 candidates

<table>
<thead>
<tr>
<th>c→D</th>
<th>b→D</th>
<th>RCBG</th>
</tr>
</thead>
<tbody>
<tr>
<td>2232.2</td>
<td>216.7</td>
<td>658.2</td>
</tr>
<tr>
<td>71.8%</td>
<td>7.0%</td>
<td>21.2%</td>
</tr>
<tr>
<td>(c/(c+b) = 91.2%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Purity**: \(R16 \sim R15\)
- **Efficiency**: \(R16 > R15\) .. 15% higher
- **b-rejection**: \(R16 > R15\)
'97-'98 R16

\[ Pe < 0 \] \hspace{1cm} \[ Pe > 0 \]

\[ q \cos \theta \]

Measured Ac value:

\[ Ac = 0.743 \pm 0.046 \text{(stat.)} \]

Stat error of R15 '96-'98: \( \pm 0.047 \)

Detail analysis tune .. not yet.

255
2) Inclusive Soft-Pion analysis

\[ \text{D}^* \rightarrow \text{D}^0 \pi_s \]

\( \pi_s : \) produce along the D* jet direction

Signal .... \( P_T \approx 0 \)
$\mathbf{P_T^2}$ distribution from $D^*$ jet axis

R15 '96-'98 (400k)

--- BG subtract

R16 '97-'98 (350k)

- Exp. Data
- BG(fitting)

\begin{tabular}{|c|c|c|c|c|}
\hline
$c \rightarrow D^*$ & \hline
\hline
$b \rightarrow D^*$ & \hline
\end{tabular}
R16 '97-'98(350k)  9551 candidates

**Signal**  
c -> D  b -> D  
2876.0  235.3  6439.7  
S:N = 1: 2.1,  c/(c+b) = 92.4%

**BG**

R15 '96-'98(400k)  9998 candidates

**Signal**  
c -> D  b -> D  
3074.2  364.4  6559.4  
S:N = 1: 1.9,  c/(c+b) = 89.4%

**Purity**  
R16 < R15

**Efficiency**  
R16 > R15  (7% up)

**b-rejection**  
R16 > R15
In this analysis, probability function of $b \rightarrow D^*$ and BG are obtained from MC

$P_T^2$ from $D^*$ jet axis

MC and Exp. data .. agree well
'97-'98 R16

Pe < 0

Pe > 0

Measured Ac value:

\[ Ac = 0.691 \pm 0.061 \text{(stat.)} \]

(Including '96 R15 ... ± 0.056)

Stat error of R15 '96-'98: ± 0.057

Fine cut-tuning needed
Summary

Using the R16 data, we get better performance

<table>
<thead>
<tr>
<th>Exclusive D*/D</th>
<th>Inclusive soft-pion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purity</td>
<td>R16 ~ R15</td>
</tr>
<tr>
<td>Efficiency</td>
<td>R16 &gt; R15 15%↑</td>
</tr>
<tr>
<td>b-rejection</td>
<td>R16 &gt; R15</td>
</tr>
</tbody>
</table>

We can expect to get better statistical error in both analyses.

To Do
1) Use the R16A exp. data
2) Change cut values .. need fine tuning
3) Soft-pion analysis:
   MC-based probability function
   -> Exp.data -based probability function by using exclusive D* data