Measurement of Ab with Jet/Vertex-charge

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Ab from Jet/Vertex Charge

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SLD Collaboration Meeting
Chateau LaCresta, 10-12 February, 1998

• Status of:
  - Jet Charge 1993-95
  - Jet Charge 1996
  - Jet Charge 1997

• Jet Charge Summary and plans

• Vertex Charge
1993-95 $A_b$

- Analysis complete and final
  
  \[ A_b = 0.911 \pm 0.045 \pm 0.045 \]

- PRL draft
  
  - Paper reading done
  - Preparing final version
  - Send out by March

*Note*: 1st paper on $A_b$ with self-calibration
  (from SLD)
A Direct Measurement of Parity Violation in the Coupling of $Z^0$ Bosons to $b$ Quarks Using a Mass Tag and Momentum-Weighted Track Charge

The SLD Collaboration
Stanford Linear Accelerator Center
Stanford University, Stanford, CA 94309

Abstract

We present a direct measurement of the parity-violation parameter $A_b$ using a self-calibrating track-charge technique. The SLD experiment observes hadronic decays of $Z^0$ bosons produced in collisions between longitudinally polarized electrons and unpolarized positrons at the SLAC Linear Collider. A sample of $b\bar{b}$ events is selected using the topologically reconstructed mass of $B$ hadrons. From our 1993–1995 sample of 11,092 selected $e^+e^- \rightarrow Z^0 \rightarrow b\bar{b}$ events we obtain $A_b = 0.911 \pm 0.045(\text{stat}) \pm 0.045(\text{syst})$.

To be submitted to Physical Review Letters

DRAFT – DO NOT QUOTE!
Comments to SERBO@SLAC.Stanford.EDU
• Preliminary result was reported last time
  High purity measurement

• Result is still "local" - tag problems

• Wait for new reconstruction of '96 data
Jet-Charge 1996, VERY Preliminary

\[ A_b = 0.875 \pm 0.057 \text{(stat.)} \pm 0.053 \text{(syst.)} \]

Main $A_b$ systematic errors.

<table>
<thead>
<tr>
<th>Error Source</th>
<th>Variation</th>
<th>1993-95</th>
<th>1996</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-Calibration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\alpha_b$ Statistics</td>
<td>$1\sigma$</td>
<td>3.7%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Hem. Correlation</td>
<td>JETSET, HERWIG,</td>
<td>1.7%</td>
<td>1.7%</td>
</tr>
<tr>
<td>$p(Q_b)$ Shape</td>
<td>Triangular, other shapes</td>
<td>0.8%</td>
<td>0.8%</td>
</tr>
<tr>
<td>udsc Subtraction</td>
<td>50%</td>
<td>0.4%</td>
<td>0.1%</td>
</tr>
<tr>
<td>cos$\theta$ shape of $\alpha_b$</td>
<td>MC Shape vs Flat</td>
<td>0.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td><strong>Analysis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tag Composition</td>
<td>Mostly $\epsilon_c$</td>
<td>1.5%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Detector Systematics</td>
<td>Tr.Eff. Corrections,</td>
<td>1.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Smearing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>QCD</td>
<td>$\alpha_s \pm 0.02, 2^{nd}$ order</td>
<td>0.9%</td>
<td>0.9%</td>
</tr>
<tr>
<td>$P_e$</td>
<td>0.8%</td>
<td>0.8%</td>
<td>0.8%</td>
</tr>
<tr>
<td>$A_c$</td>
<td>$0.67 \pm 0.08$</td>
<td>0.8%</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>$A_{uds}$</td>
<td>$0.0 \pm 0.50$</td>
<td>0.1%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Gluon Splitting</td>
<td>100%</td>
<td>0.2%</td>
<td>0.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>4.9%</td>
<td>6.0%</td>
</tr>
</tbody>
</table>

* - Error not re-evaluated
Error on Purity: $\delta \Pi_b / \Pi_b$

- Total Error
- $\epsilon_s$ Systematics
- $Rc$ Systematics
- $\epsilon_{other}$ Systematics
- Statistics
- $Rb$ Systematics
- $\lambda_b$ Systematics
- $\lambda_c$ Systematics

mass cut

0.02
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
1.2
1.4
1.6
1.8
2
2.2

506
First look at 1994 Data

- Can go up to $|\cos \theta_{\text{thrust}}| < 0.8$
- Detailed study is needed.
  Multiplicity, Thrust axis determination
  Tracking eff. corrections, correlations

<table>
<thead>
<tr>
<th></th>
<th>MC truth</th>
<th>Data</th>
<th>$\Delta \theta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Corrections</td>
<td>0.283±0.002</td>
<td>0.292±0.013</td>
<td>3.3%</td>
</tr>
<tr>
<td>with Corrections</td>
<td>0.258±0.002</td>
<td>0.310±0.014</td>
<td>2.9%</td>
</tr>
</tbody>
</table>
1997 R15 DATA/MC Comparison

\[ \cos \theta_{\text{thrust}} \]

\[ E_{\text{vis}} \]

Multiplicity
$A_b$ from Jet-Charge, SLD 1997

![Graph showing tagged events vs. $\cos \theta_{\text{thrust}}$ for left and right hemispheres, with SLD Preliminary label.]
$A_b$, R15 97 DATA/MC

mass cut
\[
\begin{align*}
\text{Summary } j-c \text{ Ab} \\

\begin{array}{|c|c|c|c|}
\hline
\text{Year} & \text{Stat.} & \alpha_b \text{ Stat.} & \text{Syst.} \\
\hline
93-95 & 4.9\% & 3.7\% & 3.2\% \\
96 & 6.5\% & 4.9\% & <3.2\% \\
97 & 4.4\% & 2.5\% & <3.2\% \\
\hline
\text{Total:} & 2.9\% & 1.8\% & 3.2\% \\
\hline
\end{array}
\]

For 93-97: \( \frac{6_{\text{Ab}}}{\text{Ab}} = 5.5\% \)
$A_{b}$ from Vertex-Charge, SLD 1997

![Graph showing tagged events vs. $\cos\theta_{\text{thrust}}$ for left and right sides.](image)

SLD Preliminary