Summary and plan

by S. Willocq
Bs MIXING SUMMARY & PLANS

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• MORIOND 99:

  Released 96-98 R15 data
  
  \{ \lepton+D
  
  \lepton+ tracks
  
  Charge Dipole
  
  John Ellis (CERN): "ENTICING HINTS" for Bs mixing

  \Rightarrow SLD contributes significantly to
  
  world average at \( \Delta m_s \geq 14 \text{ ps}^{-1} \)

• WHAT'S NEW?

  * R16 (97-98 data)
    
    \Rightarrow higher resolution
    
    \Rightarrow increased \( E \) (\( t \leq 0.5 \text{ ps} \))
    
    \Rightarrow final state tag purity, Qtx

  * New Charge Dipole: B/D separation in topol. vertex with ZTOP3 Ghost algo.

  * Inclusion of two newest analyses
    
    • Ds + tracks technique first presented @ APS 99
    
    • Lepton + Kaon (K)

  \Rightarrow ANALYSES reaching high level of sensitivity (\& complexity)
SLD and LEP(ICHEP98) average amplitudes:

SLD excludes at 95% CL
\[ \Delta m_s < 5.3 \text{ ps}^{-1} \]
\[ 6.0 < \Delta m_s < 11.5 \text{ ps}^{-1} \]

Exclusion probability
\[ 55\% \text{ at } \Delta m_s = 6.0 \text{ ps}^{-1} \]
\[ 26\% \text{ at } \Delta m_s = 11.5 \text{ ps}^{-1} \]

LEP average (prel.)
\[ \Delta m_s < 11.5 \text{ ps}^{-1} \]
at 95% CL

S. Willocq (UMass)
World average (prel.)

\[ \Delta m_s > 12.3 \text{ ps}^{-1} \quad (95\% \text{ C.L.}) \]
<table>
<thead>
<tr>
<th>Experiment</th>
<th>Amplitude (sensitivity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALEPH D1 (91-95)</td>
<td>$1.44 \pm 1.71^{+0.58}_{-0.53}$ (6.7 ps$^{-1}$)</td>
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<tr>
<td>ALEPH D h (91-95)</td>
<td>$4.65 \pm 3.74^{+0.87}_{-1.07}$ (4.1 ps$^{-1}$)</td>
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<tr>
<td>ALEPH 1 (91-95, no D)</td>
<td>$2.00 \pm 1.29^{+0.80}_{-0.58}$ (9.5 ps$^{-1}$)</td>
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<tr>
<td>CDF l/h (92-95, prel.)</td>
<td>$-0.14 \pm 2.00 \pm 0.51$ (5.1 ps$^{-1}$)</td>
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<tr>
<td>DELPHI B (92-95, prel.)</td>
<td>$2.76 \pm 3.08 \pm 1.24$ (0.0 ps$^{-1}$)</td>
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<tr>
<td>DELPHI D1 (92-95, prel.)</td>
<td>$-0.38 \pm 1.71 \pm 0.29$ (8.4 ps$^{-1}$)</td>
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<tr>
<td>DELPHI D h (92-95, prel.)</td>
<td>$-2.37 \pm 6.98 \pm 1.92$ (2.0 ps$^{-1}$)</td>
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<tr>
<td>DELPHI 1 (92-95, prel.)</td>
<td>$3.59 \pm 2.91 \pm 0.49$ (6.5 ps$^{-1}$)</td>
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<tr>
<td>OPAL l/Qe (91-94)</td>
<td>$8.90 \pm 3.01 \pm 2.30$ (4.8 ps$^{-1}$)</td>
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<tr>
<td>SLD l+D (96-98, prel.)</td>
<td>$2.89 \pm 1.65^{+0.37}_{-0.27}$ (4.5 ps$^{-1}$)</td>
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<tr>
<td>SLD 1 (96-98, prel.)</td>
<td>$2.34 \pm 2.49^{+0.91}_{-0.47}$ (0.2 ps$^{-1}$)</td>
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<tr>
<td>SLD dipole (96-98, prel.)</td>
<td>$-0.05 \pm 3.85^{+1.19}_{-0.50}$ (0.0 ps$^{-1}$)</td>
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<tr>
<td>World average (prel.)</td>
<td>$1.79 \pm 0.68$ (14.3 ps$^{-1}$)</td>
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</tbody>
</table>

**LEP B Oscillations Working Group**

Amplitude at $\Delta m_s = 15.0$ ps$^{-1}$
Statistical overlap between analyses NOT taken care of
$B_s$ mixing \textit{significance} = \frac{1}{\sigma_A}$

SLD Pre-Preliminary 1997-98 R16 Data

$\Delta m_s$ (ps$^{-1}$) vs. significance
SLD $B_s$ Mixing Reach - 350K $Z^0$ VXD3

Significance

- SLD combined
- LEP combined (1997)

1. Lepton + D
2. Lepton + tracks
3. Dipole
4. $D_s$ + tracks

95% CL Lower Limit

$\Delta m_s$ (ps$^{-1}$)

492
SIGNIFICANCE PER EVENT

SLD Pre-Preliminary 1997-98 Data

# ev's
8654
1436
441
11540
200

493
• **SHORT-TERM PLANS:**

**GOAL:** Preliminary results for July 7-8 SLD week
- 5 analyses + SLD average

- Deal with overlap between 5 analyses
- Redo parametrizations after overlap removal
- Redo cross-checks
- Refine systematic uncertainty studies
- Study high $\Delta m_s$ region
  - fast MC exp\textsuperscript{ts}
  - part of phase space with most sensitivity
    (e.g. short decay length)
- Write SLD notes + conference papers

• **LONG-TERM PLANS:**

**GOAL:** First draft of paper(s) by end of year

- Further improvements fragmentation kaons, extended $\mu$ ID, Kalman method, boost recon,...
- Better handle of systematics (e.g. boost, $\Sigma$, ...)