

SLD Collaboration Meeting (Kirkwood)

Bs Mixing Using Ds + Tracks

Cheng-Ju Lin

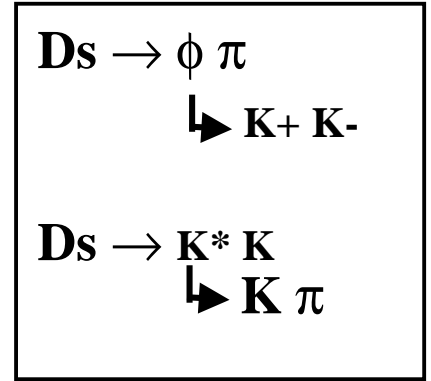
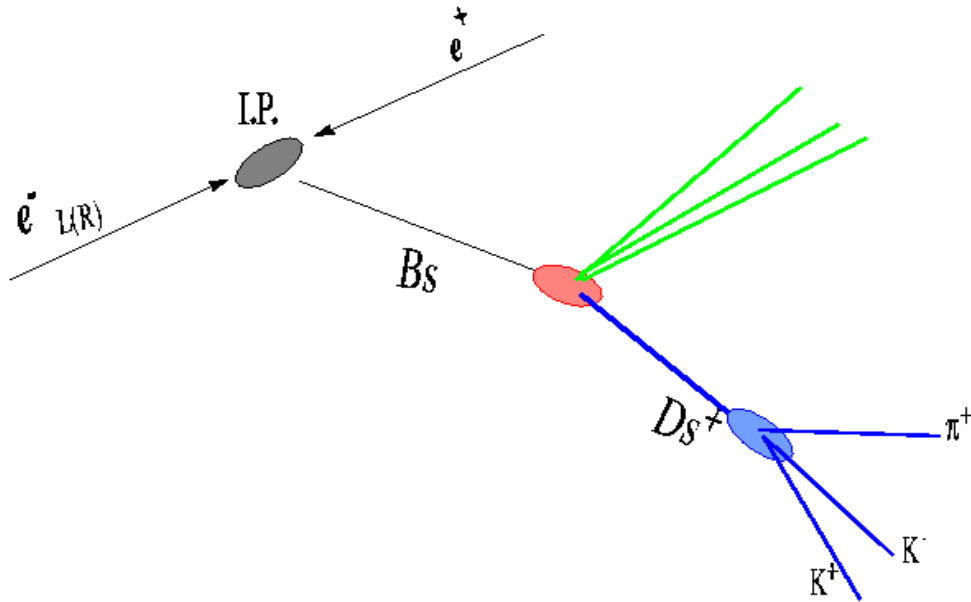
University of Massachusetts, Amherst

March 22, 2000

OUTLINE:

- Review of Ds+Tracks
- Analysis improvements: NN Ds selection, initial state tag, boost reconstruction, new fitting function, and Bs purity enhancements
- Amplitude fit studies and preliminary results
- Summary and outlook

Ds + Tracks Analysis

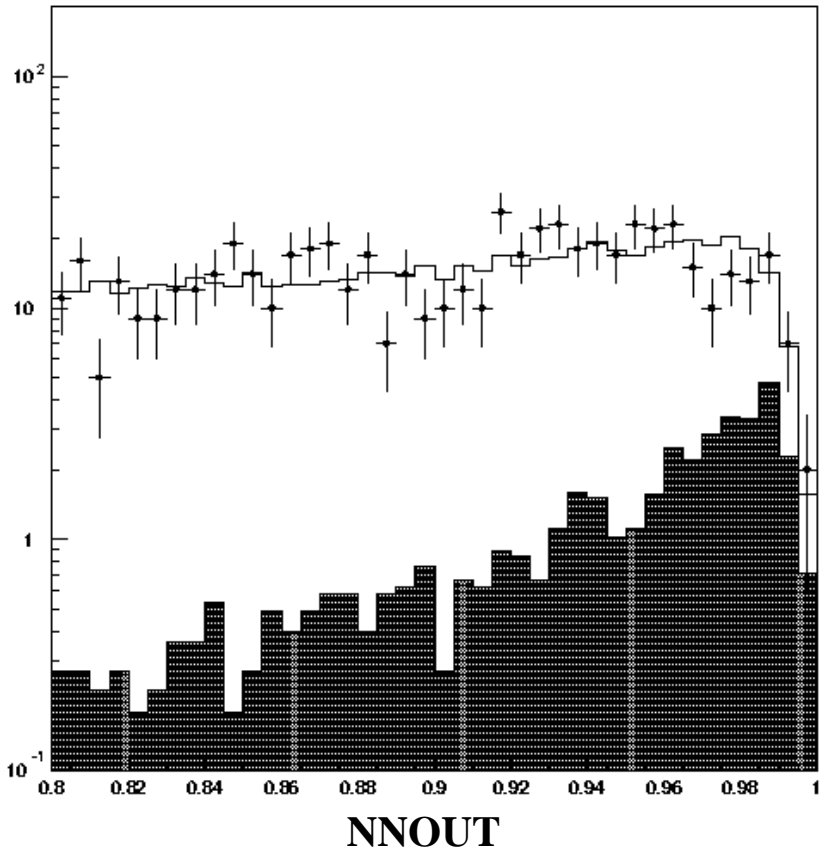
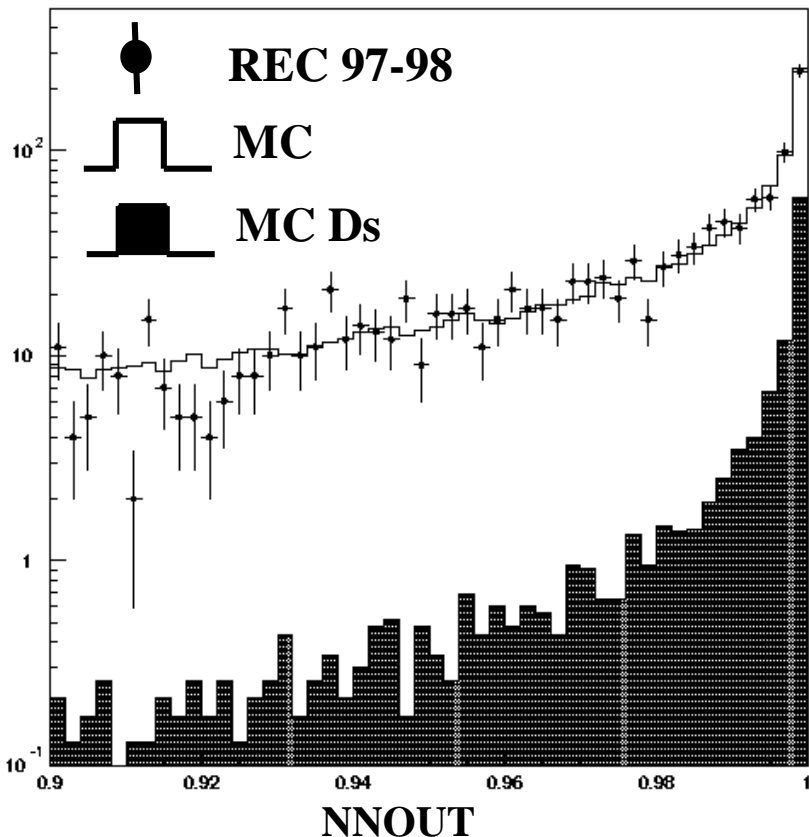


- Tag the B_s final state using the fully reconstructed D_s
- High purity B_s sample and excellent decay length resolution
- Use the D_s flight direction to pin down the decay vertex of the B_s meson

Neural Net Ds Selection

$\phi\pi$ Mode

K^*K Mode



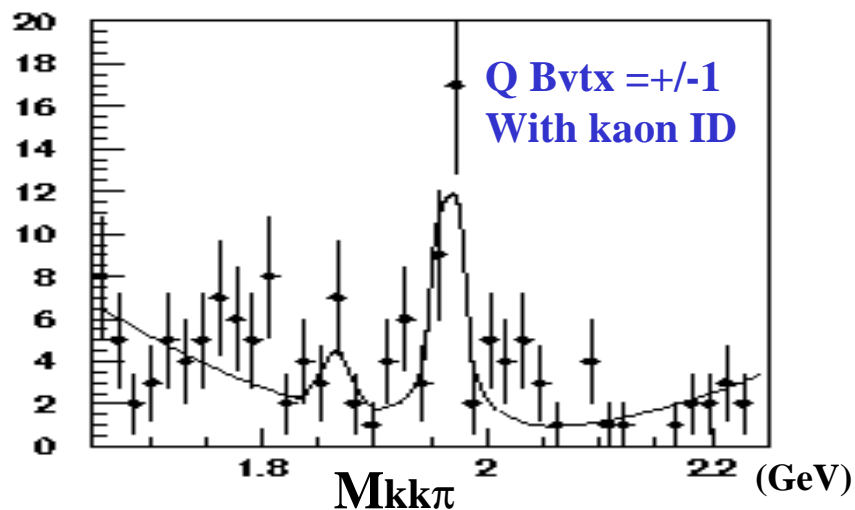
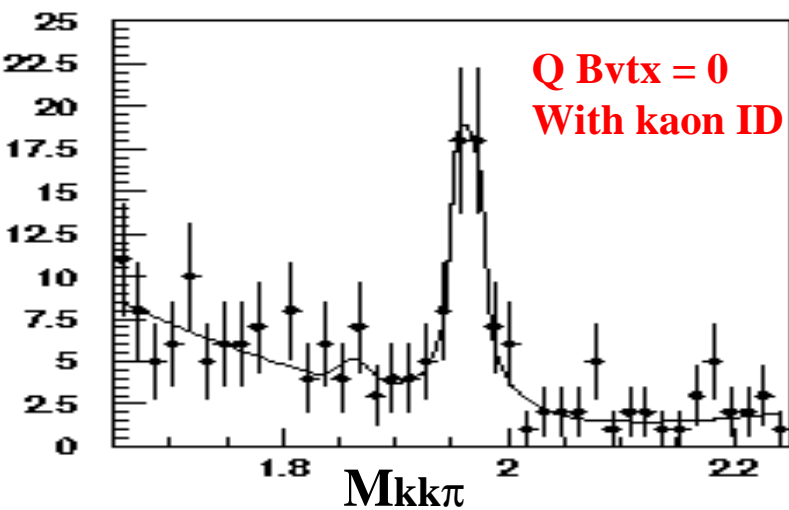
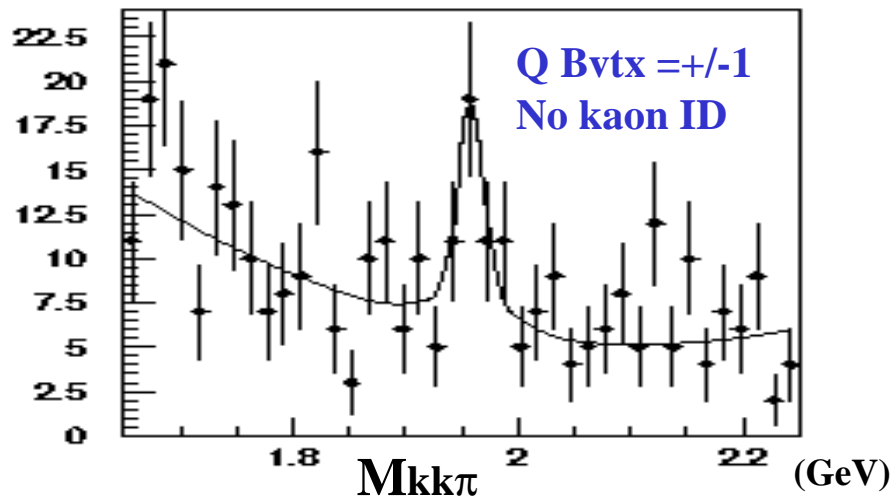
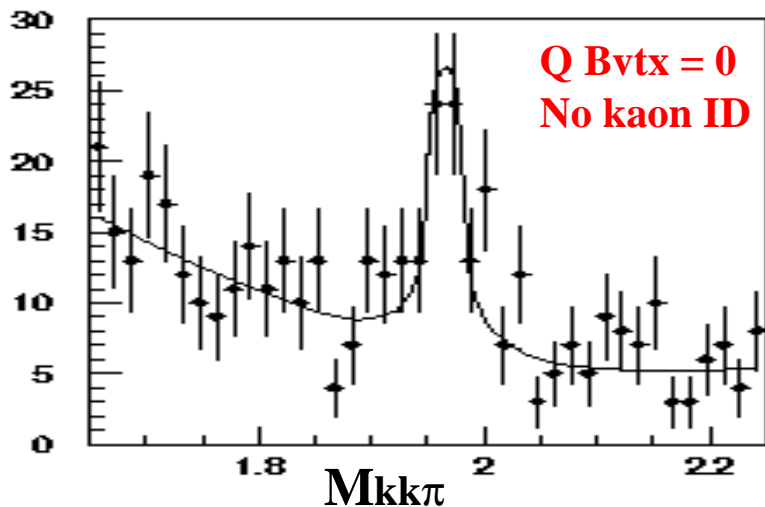
- Neural net improves Ds selection efficiency by ~ 50%

Note: Ds invariant mass cuts are not imposed for the above plots
(very loose selection cuts)

$D_s \rightarrow \phi \pi$ Invariant Mass Plots

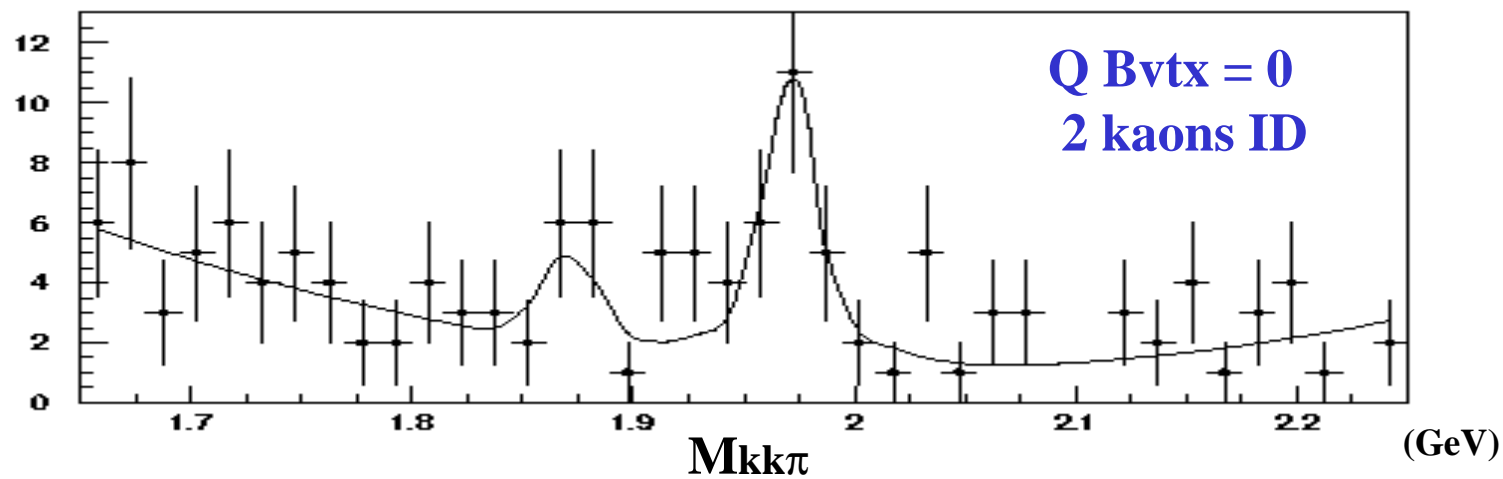
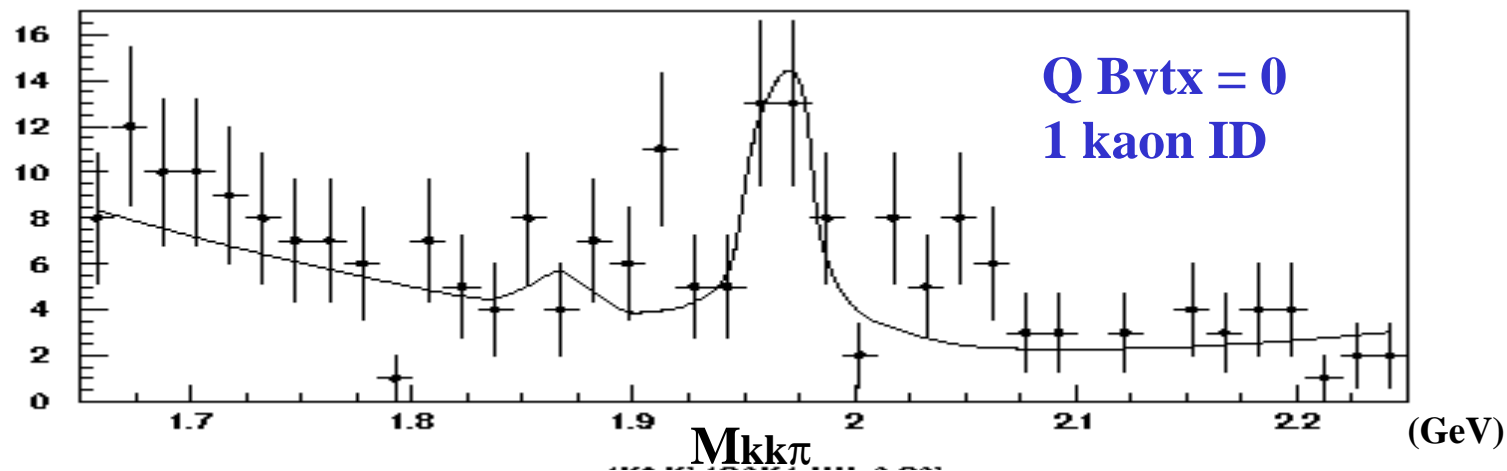
REC 97-98R17 DATA with NNOUT>0.90

(B vertex charge is from T. Wright's NN)



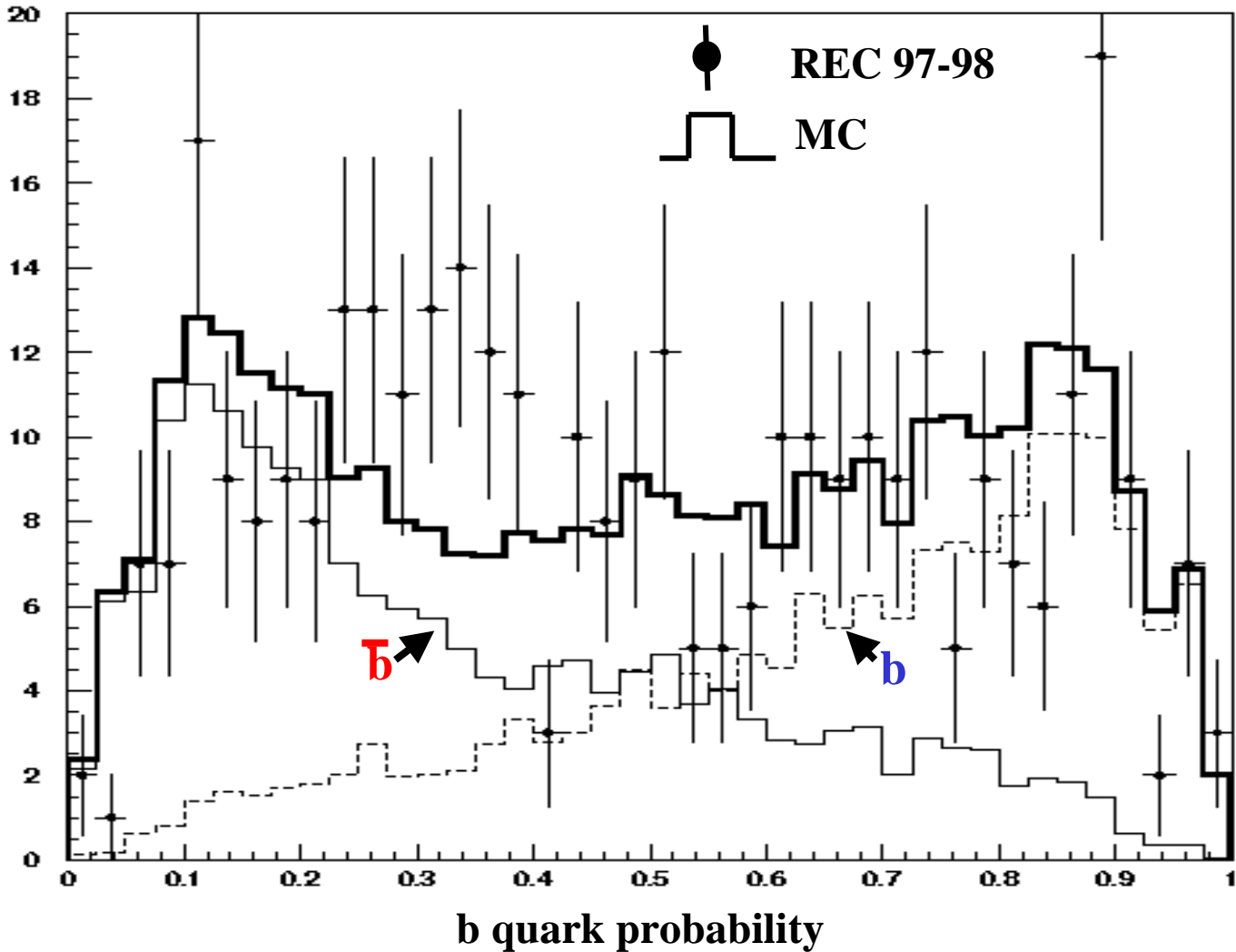
Ds \rightarrow K*K Invariant Mass Plots

REC 97-98R17 DATA with NNOUT>0.80



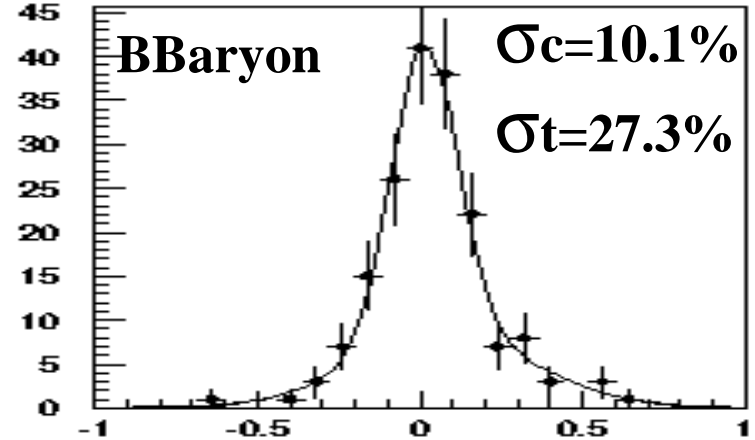
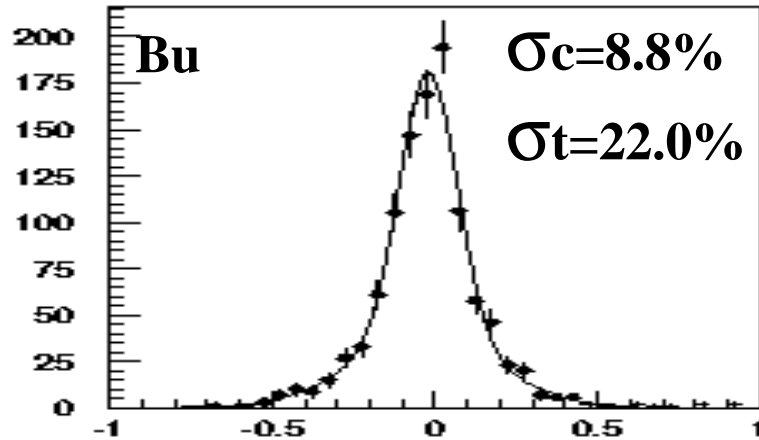
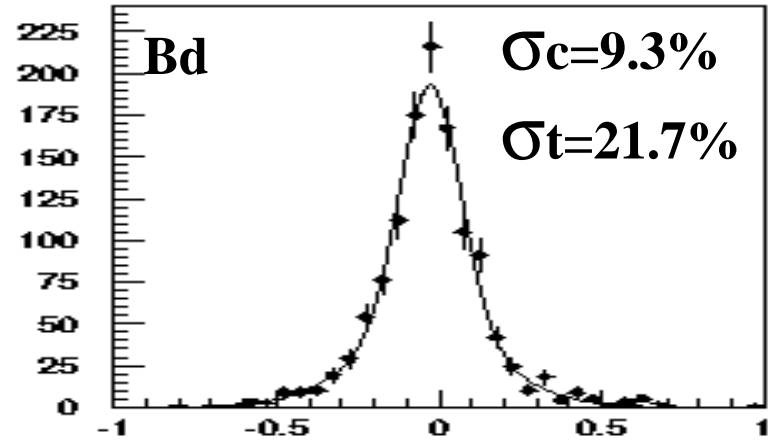
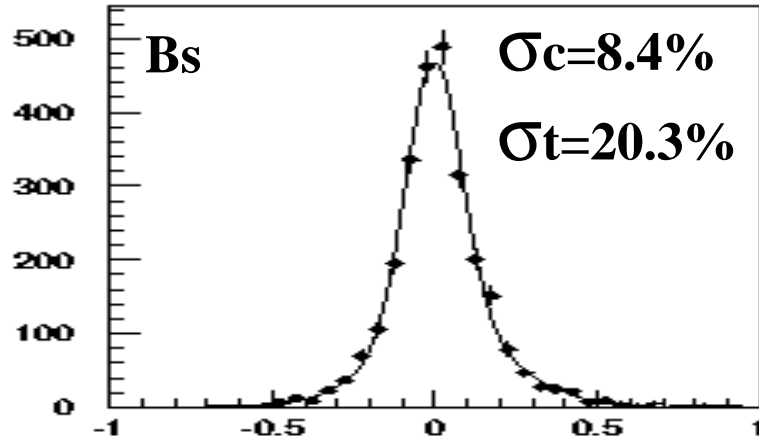
Initial State Tag (Blistag routine)

- Tags: Polarization, jet charge, dipole, vertex charge, lepton
- Average correct initial state tag fraction = 74.6%



Boost Resolution

- Using D. Dong's routine to average the 4 boost reconstruction algorithms
- For Bs events: $\sigma(\text{core})$ improves from $\sim 10\%$ to $\sim 8\%$

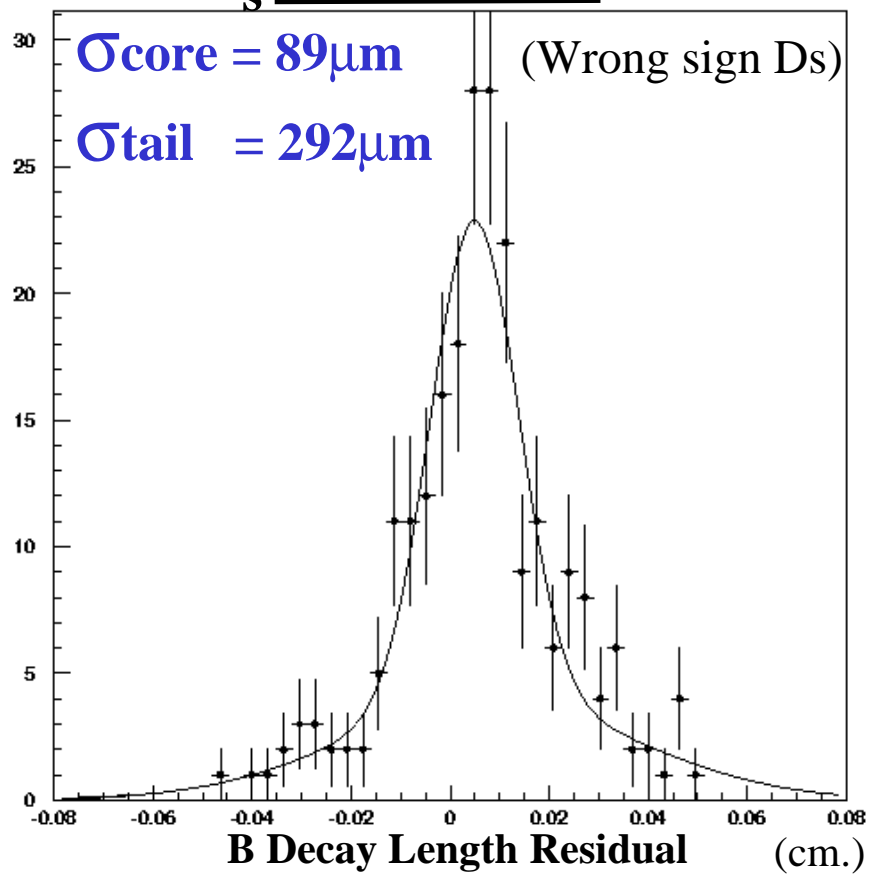
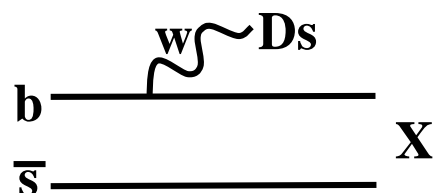
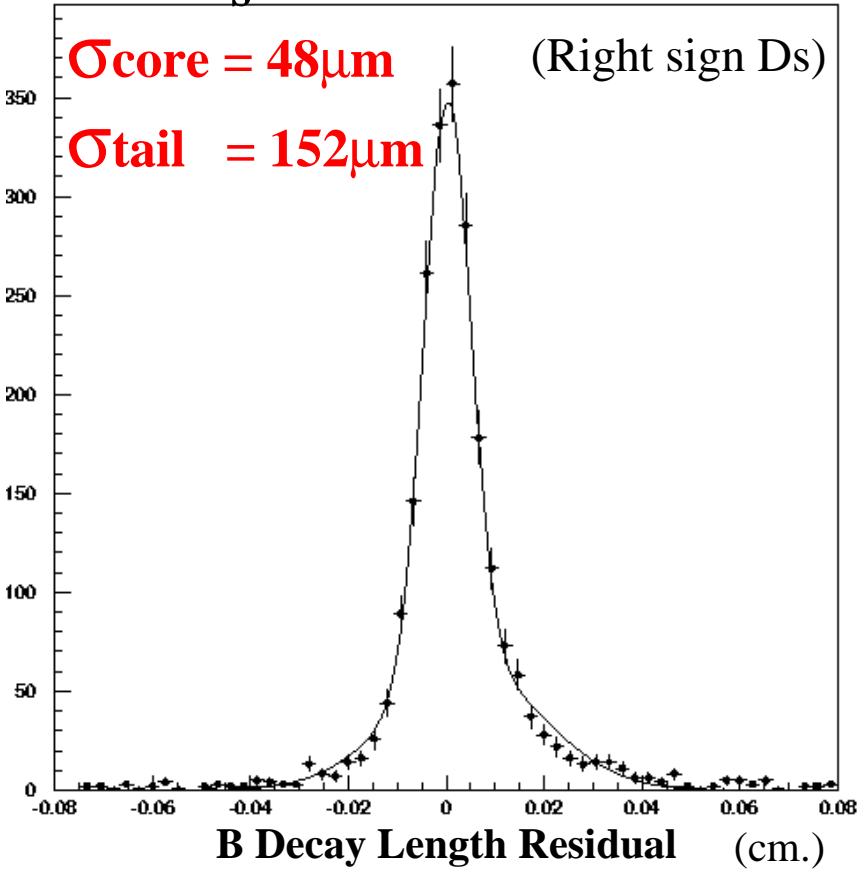
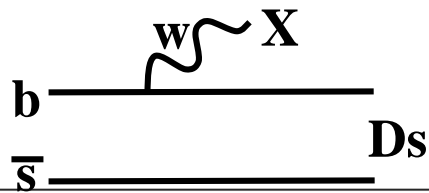


Relative Boost Residual

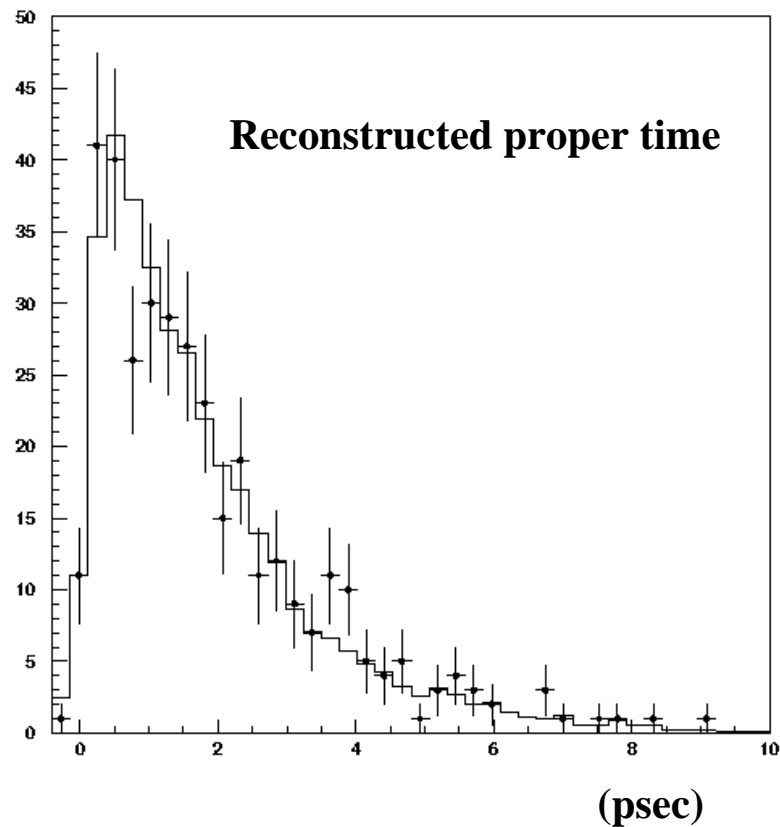
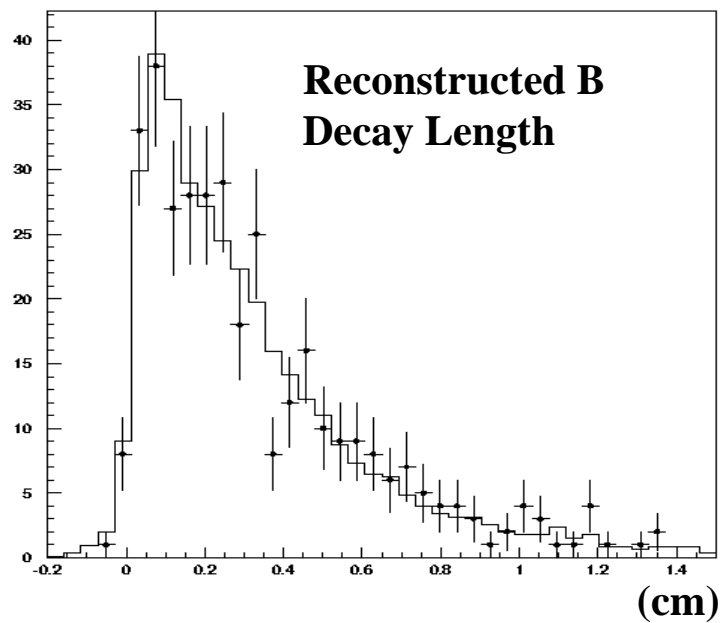
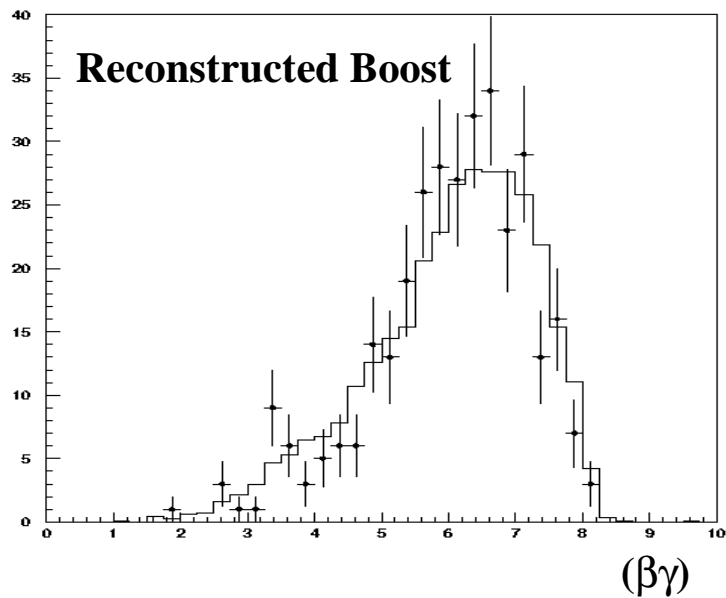
Relative Boost Residual

B Decay Length Resolution

- B decay vertex is found by vertexing the Ds trk with other B daughter tracks
- Parameterizing Bs resolution separately for Ds from $b \rightarrow c$ and Ds from W



Data and MC Comparisons



Likelihood Function for Ds+Tracks Analysis

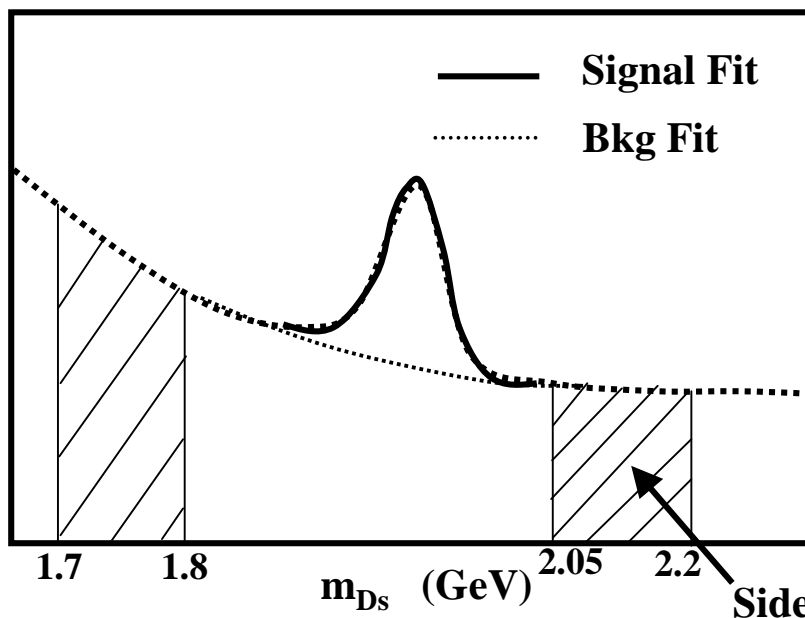
Goal: reduce dependence on MC

$$P^{mixed} = (1 - f_{comb}) \left\{ f_{Bs_sig} \cdot P_{Bs}^{mixed} + f_{Bd_sig} \cdot P_{Bd}^{mixed} + f_{Bu_sig} \cdot P_{Bu}^{mixed} + f_{BB_sig} \cdot P_{BB}^{mixed} + f_{cc_sig} \cdot P_{cc} \right\} + f_{comb} \cdot P_{comb}$$

f_{comb} is estimated directly from the data (on event-by-event basis)

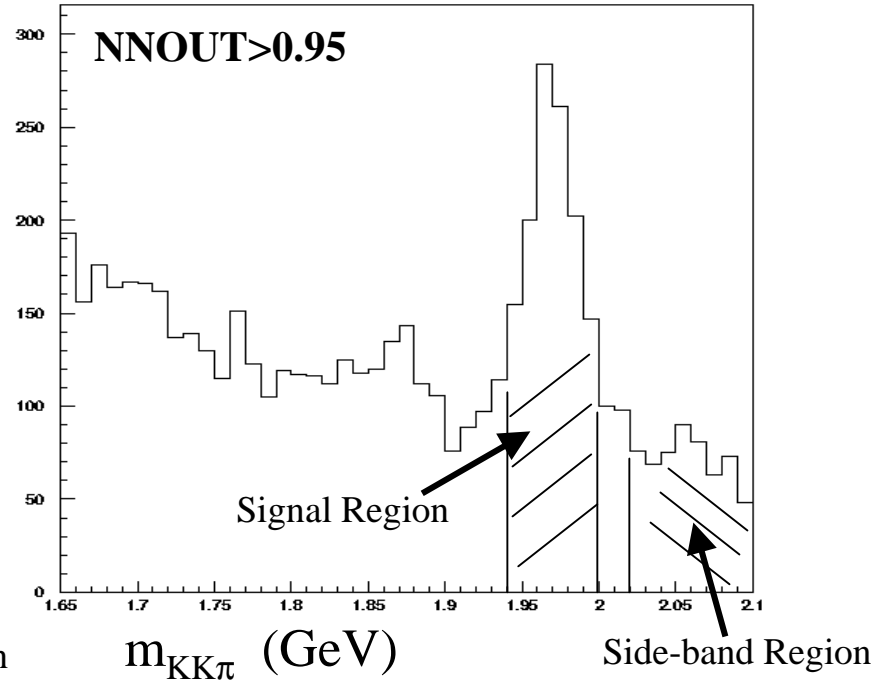
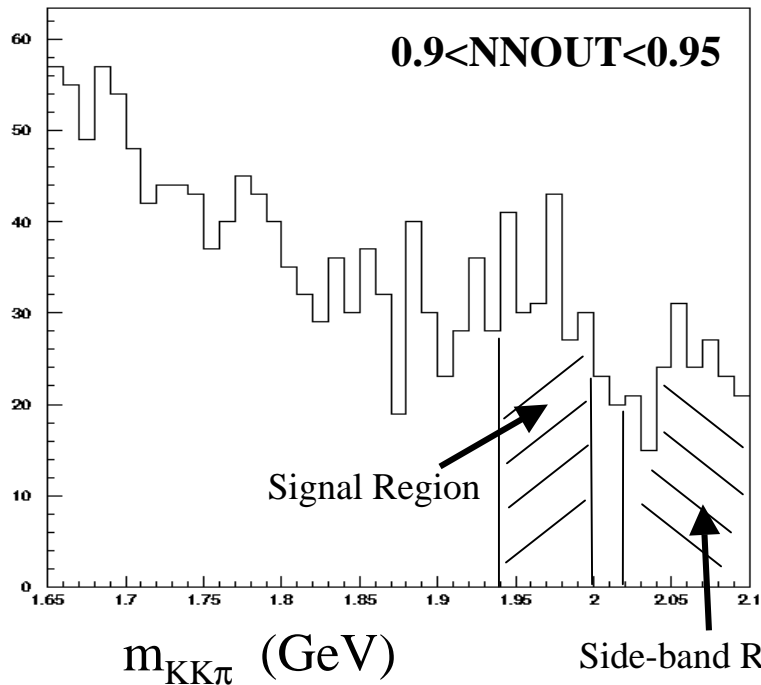
Signal distributions and fractions are taken from MC

Combinatorial proper time distribution is taken from data (side-band regions)



$$f_{comb}(m_{D_s}) = \frac{Bkg(m_{D_s})}{Sig(m_{D_s}) + Bkg(m_{D_s})}$$

Signal and Side-band Combinatorial Compositions



Combinatorial Compositions

0.9 < NNOUT < 0.95

	Frac Bs	Frac Bd	Frac Bu	Frac BBary
Under Signal Region	19±3%	42±4%	34±4%	5±2%
Side-Band Region	17±3%	41±4%	34±4%	8±2%

NNOUT > 0.95

	Frac Bs	Frac Bd	Frac Bu	Frac BBary
Under Signal Region	18±2%	38±2%	37±2%	8±1%
Side-Band Region	21±2%	38±2%	35±2%	6±1%

Final State Mistag for Combinatorial Events

0.9 < NNOUT < 0.95

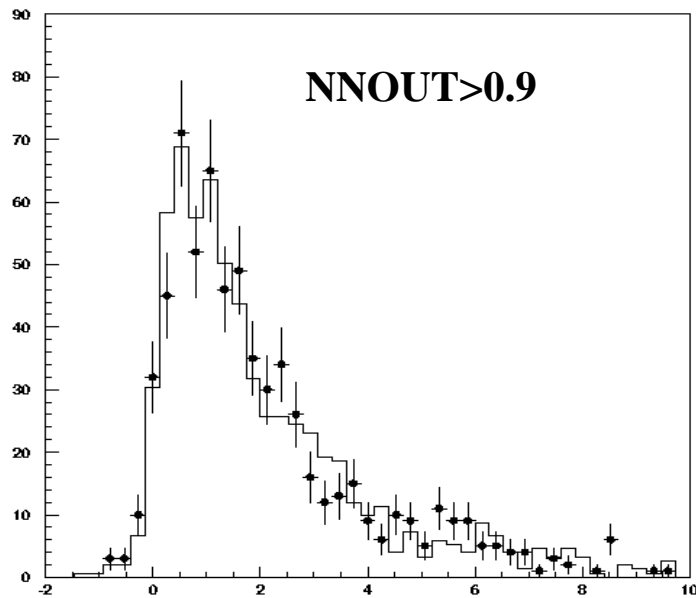
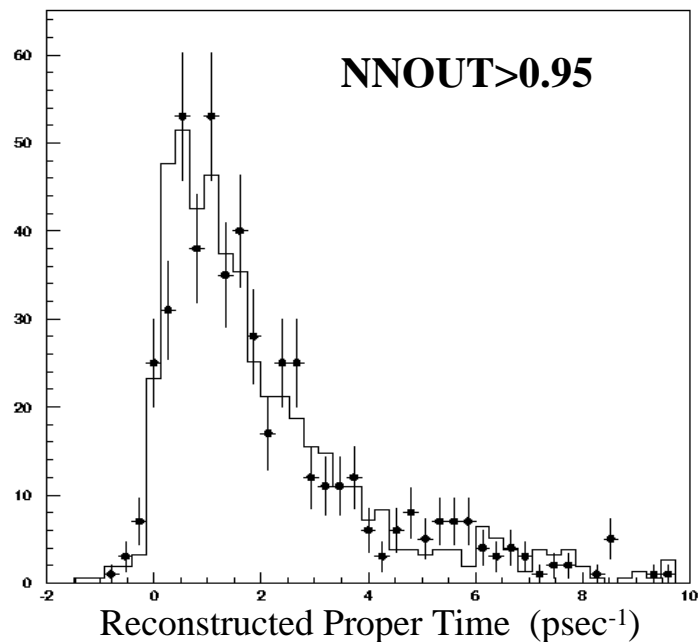
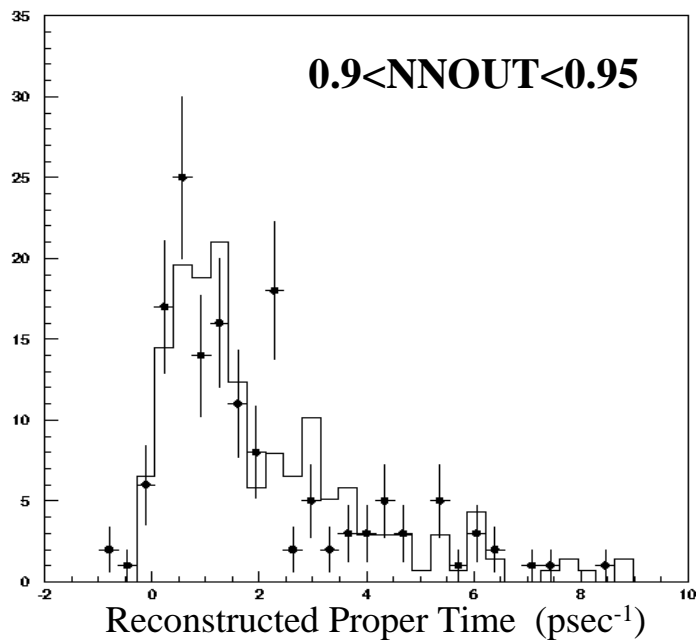
	Bs Final State η	Bd Final State η	Bu Final State η	Bbary Final State η
Under Signal Region	41 \pm 9%	46 \pm 6%	32 \pm 7%	60 \pm 22%
Side-Band Region	58 \pm 9%	43 \pm 6%	40 \pm 6%	72 \pm 12%

NNOUT > 0.95

	Bs Final State η	Bd Final State η	Bu Final State η	Bbary Final State η
Under Signal Region	52 \pm 5%	41 \pm 3%	35 \pm 4%	48 \pm 7%
Side-Band Region	48 \pm 5%	49 \pm 4%	59 \pm 4%	55 \pm 9%

Final state mistag rate for Bs combinatorial events is ~ 50%

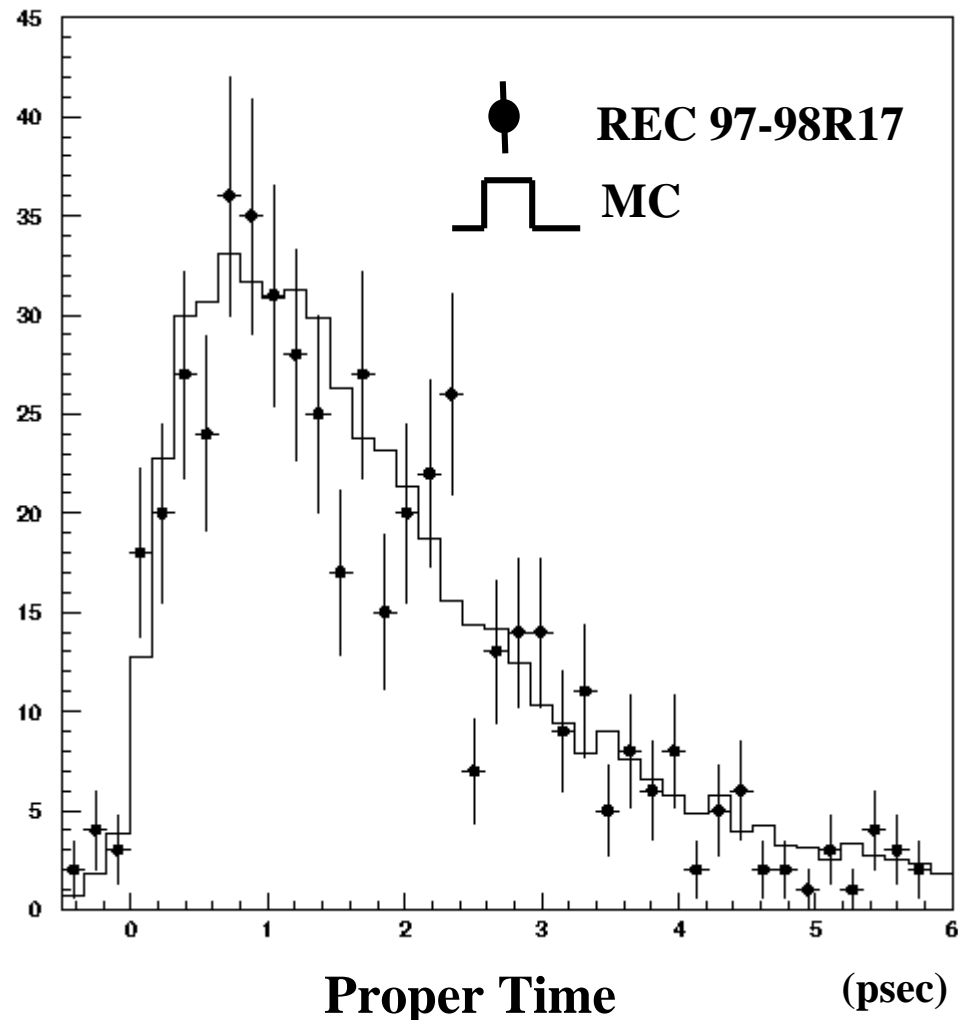
MC Combinatorial Proper Time Distributions



● Under Signal Region
▮ In side-band region

**** Good agreement between the proper time distributions in the side-band and in the signal region**

Proper Time Distributions for sideband events (REC vs MC)



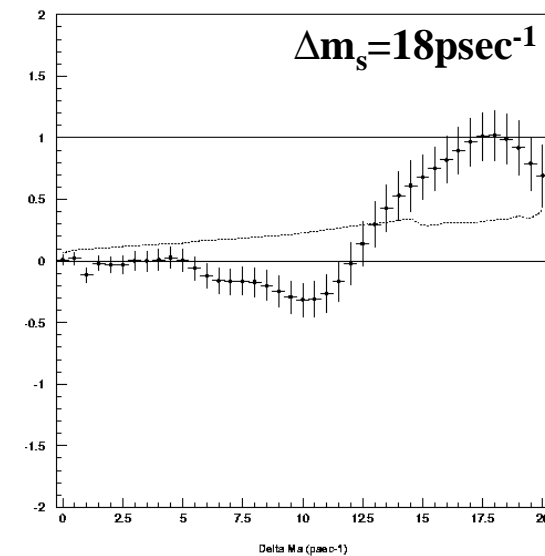
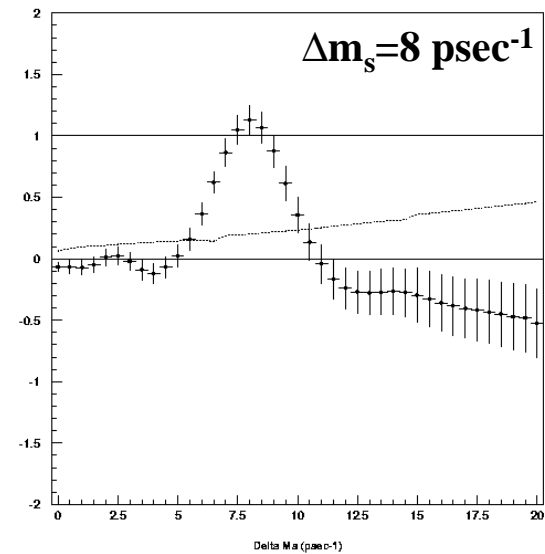
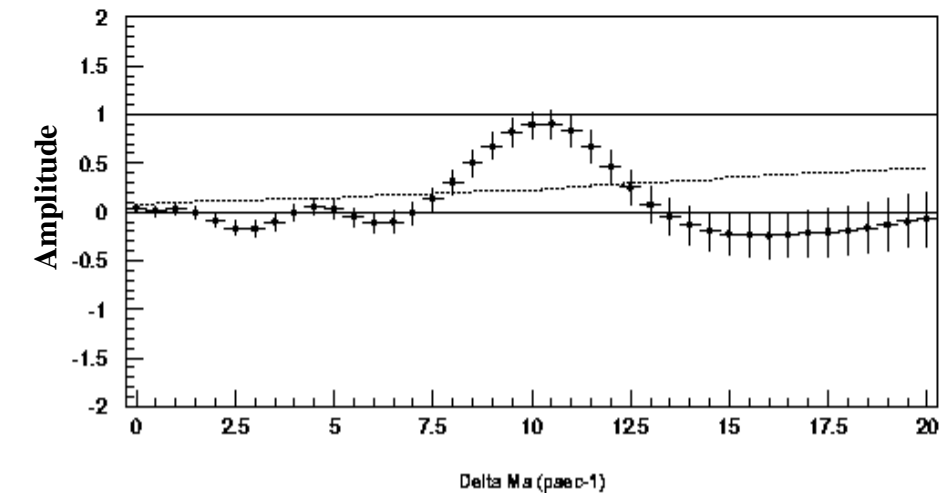
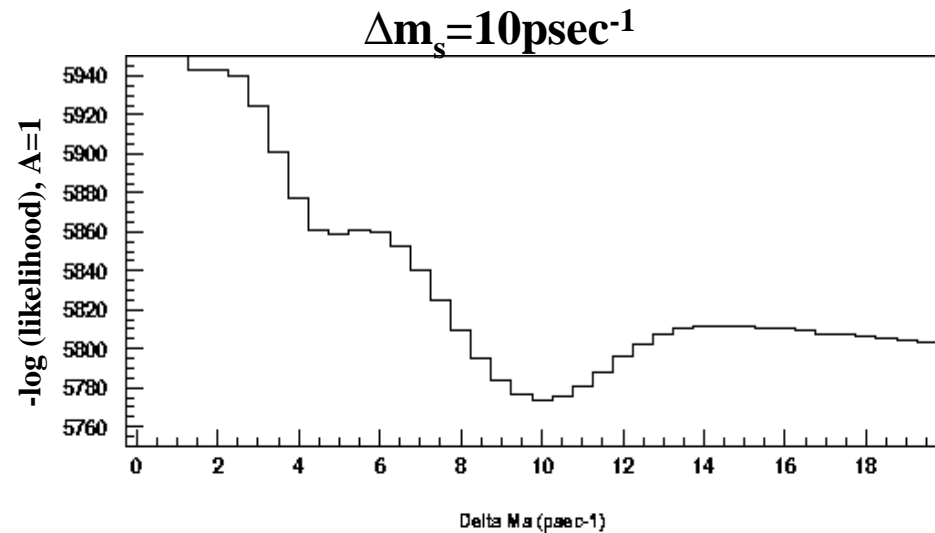
Sideband regions:
1.7 - 1.8 GeV
2.05 - 2.2 GeV

MC and data are in good agreement!!!

AMPLITUDE FIT (Bs Signal events only)

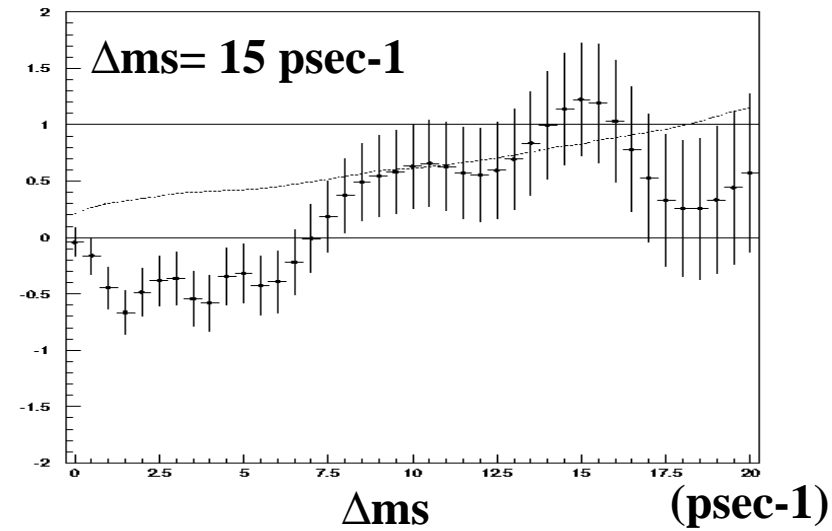
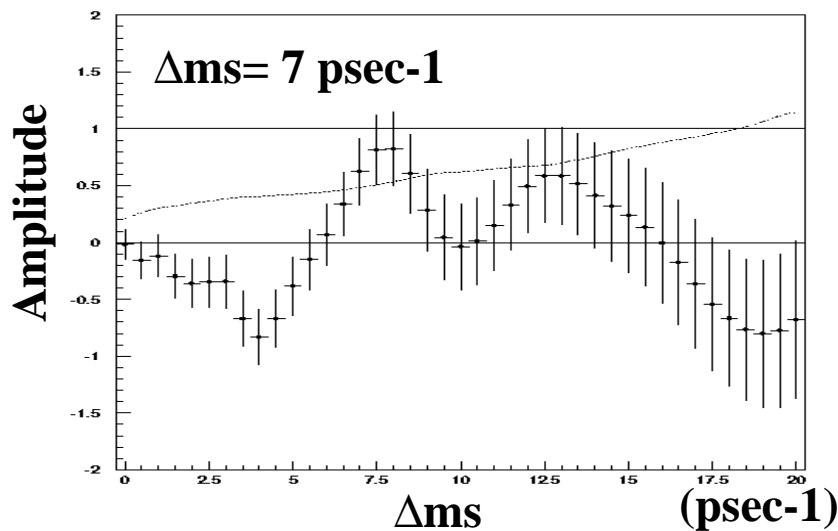
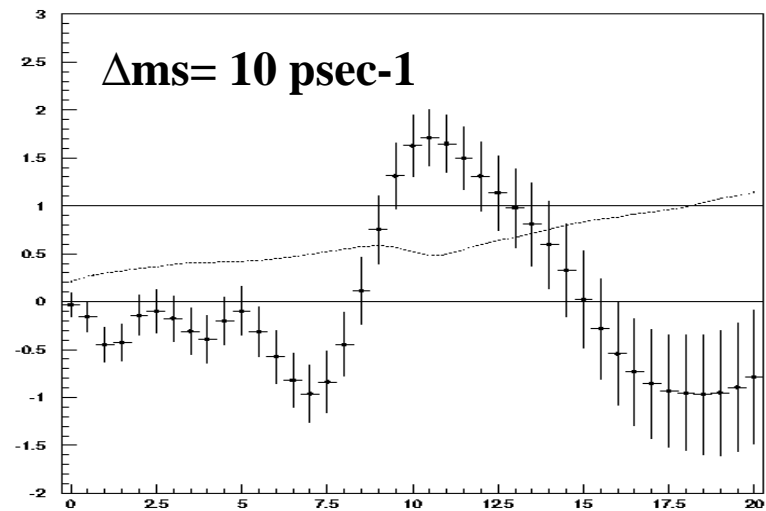
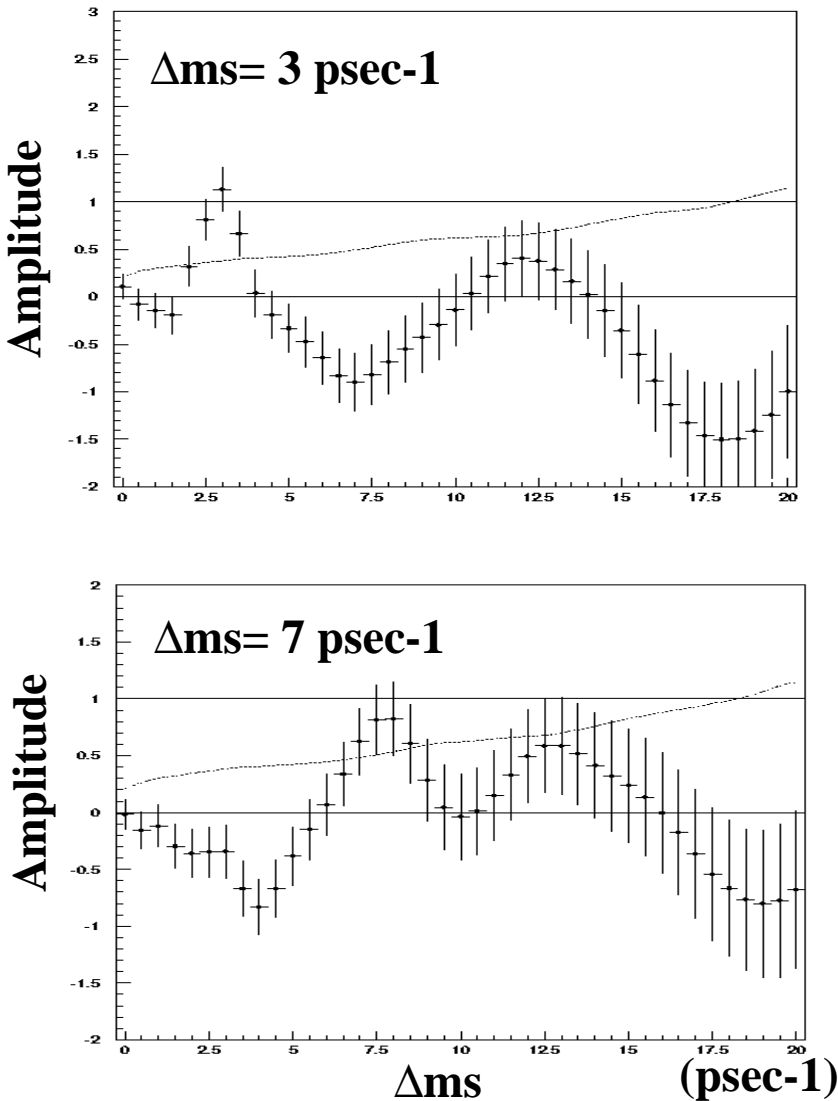
Parameterizations include:

σ_L (R17), $\sigma_{\beta\gamma}$ (R16), Pinit(pol+jetQ), Final state tag (R17)

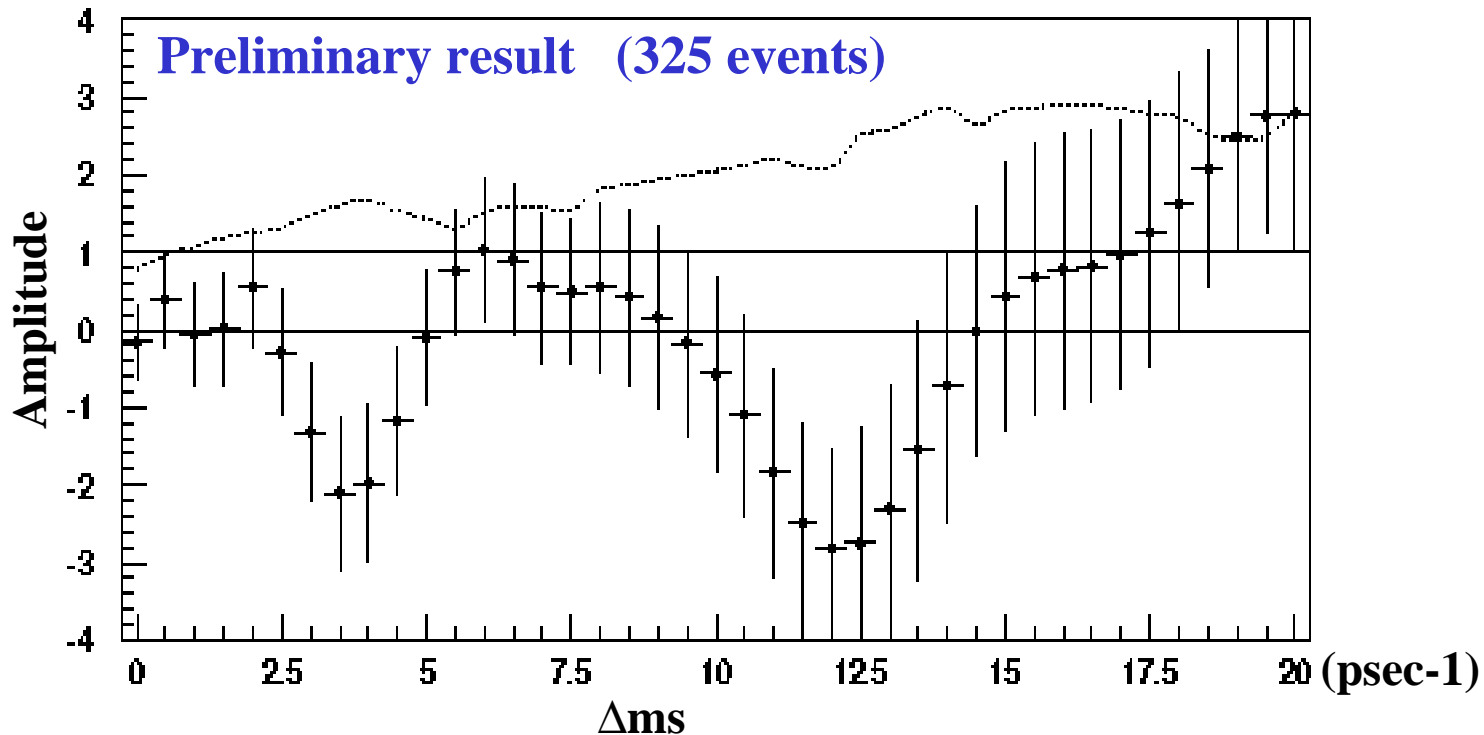


MC74bb 97-98R17 Full Amplitude Fit ($\phi\pi+K^*K$)

- Including lepton enhancement



REC97-98R17 Amplitude Fit ($\phi\pi+K^*K$)



Sensitivity :

~0.5 psec⁻¹ (a year ago)

~0.7 psec⁻¹ (now)

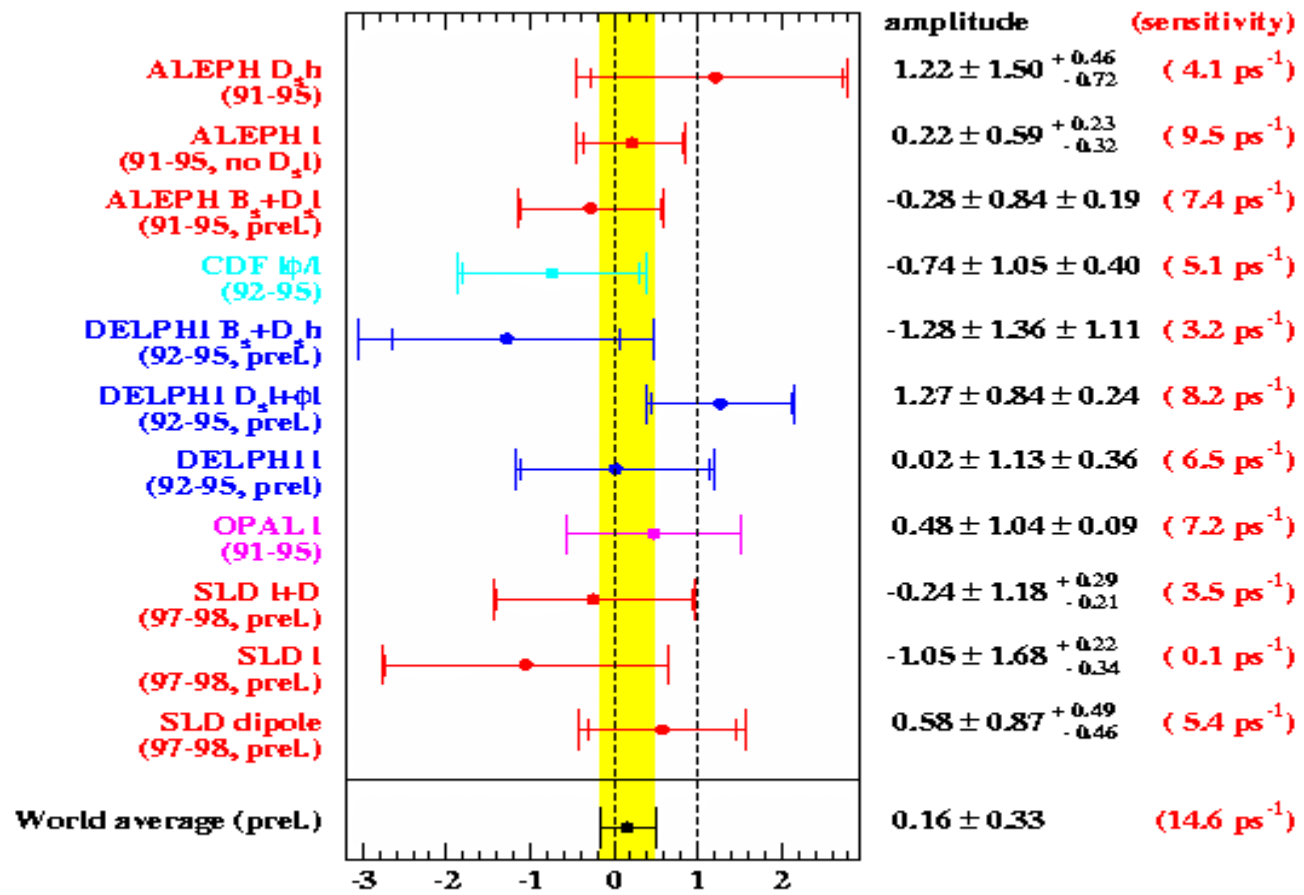
Amplitude error @ $\Delta m_s=15\text{psec}^{-1}$:

~2.4 (a year ago)

~1.7 (now)

$\Delta m_s = 10 \text{ ps}^{-1}$

Bs Mixing Analyses (Moriond 2000)

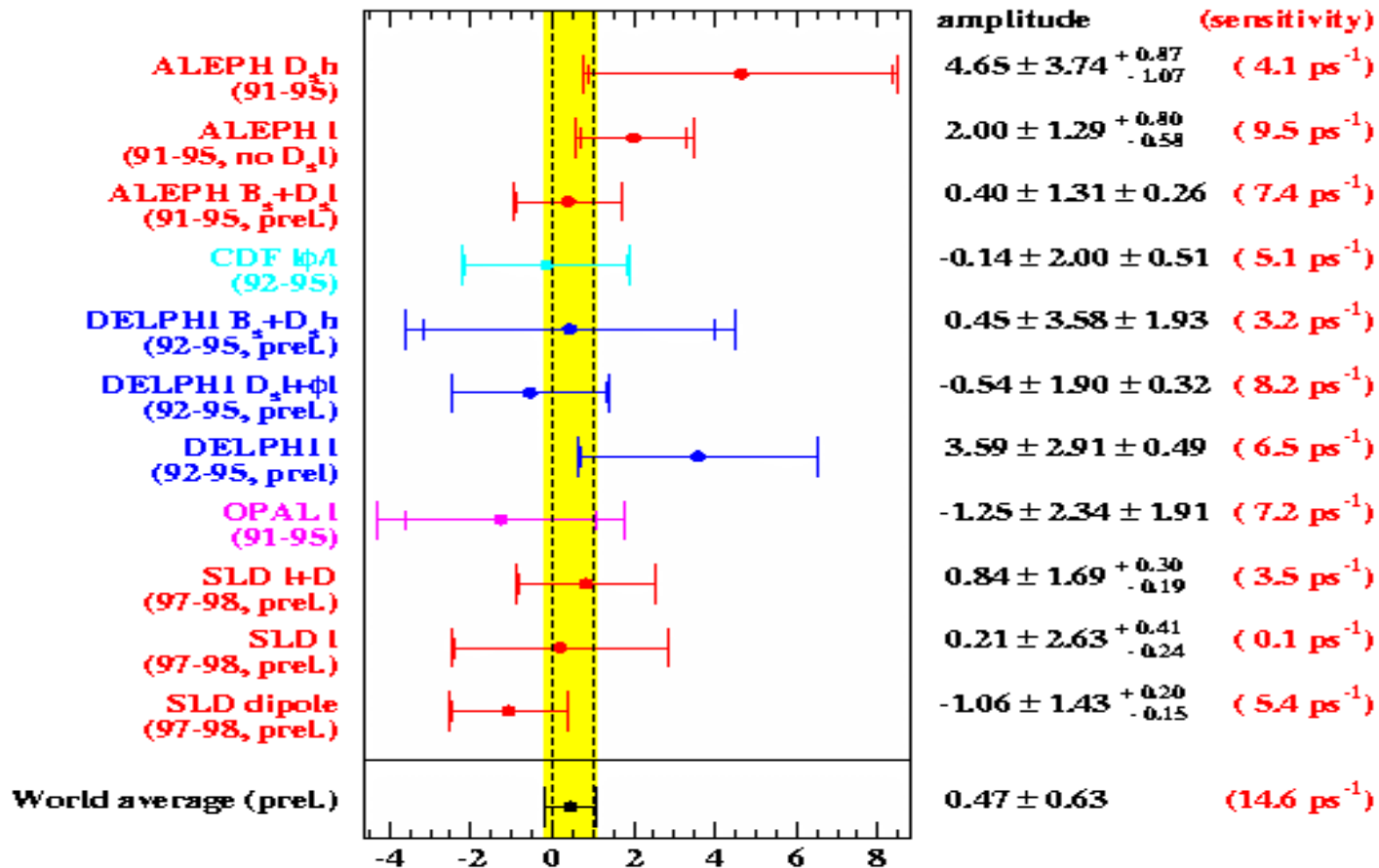


B Oscillations Working Group

SLD $D_s + \text{trks}$  -0.56 ± 1.25 ($\sim 0.7 \text{ ps}^{-1}$, stat only)

$\Delta m_s = 15 \text{ psec}^{-1}$

Bs Mixing Analyses (Moriond 2000)



B Oscillations
Working Group

SLD D_s+trks



0.44 ± 1.72 (~0.7 ps⁻¹, stat only)

Summary and Outlook

- **The sensitivity of the analysis has improved slightly. The most significant change is in the region of high Δm_s**
- **Will add in the 96 data after Kirkwood**
- **Systematic error analysis is the next major item on the agenda**
- **Plan to release preliminary result at ICHEP and DPF**