B mixing @CDF: quoi de neuf

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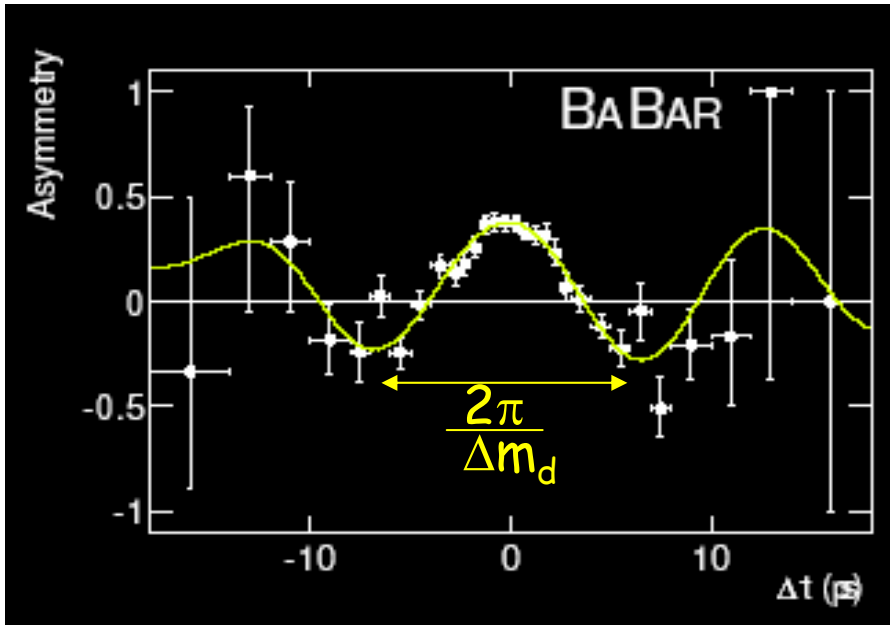
Several progress in the latest months and many more expected for the summer !

Here new results for:

- ✓ B_s yields
- ✓ Flavor tagging
- ✓ First attempt to perform a B_d mixing measurements

News on proper time resolution and the PID from Alex

Introduction: what are we talking about



$\Delta m_d = 0.502\ ps^{-1}$

Current limit:
$\Delta m_s > 14.5\ ps^{-1}$ @95% C.L.
$\rightarrow\ x_s > 20.8$
B_s oscillation ~30 times faster than B_d

Number of reconstructed B_s

Tagging figure of merit

$$Sig(\Delta m_s) = \sqrt{\frac{N\varepsilon D^2}{2}} \exp\left(\frac{-(\Delta m_s \sigma_{ct})^2}{2}\right) \sqrt{\frac{S}{1+S}}$$

Proper time resolution

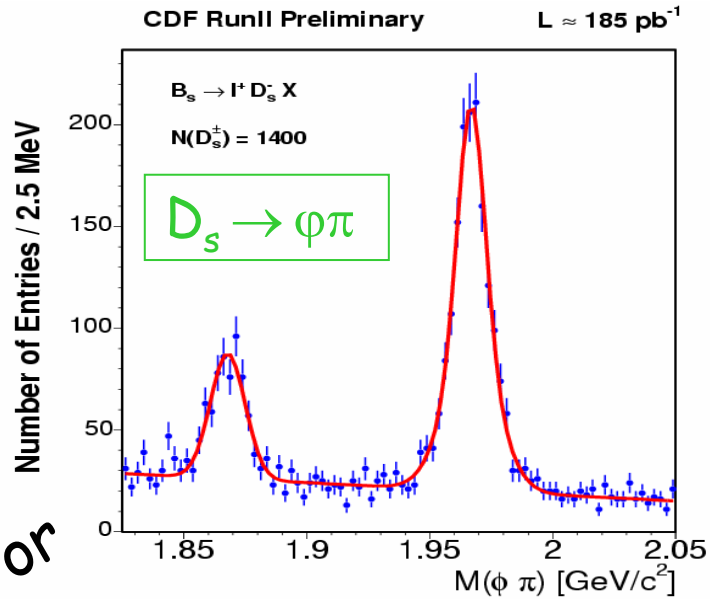
S/B

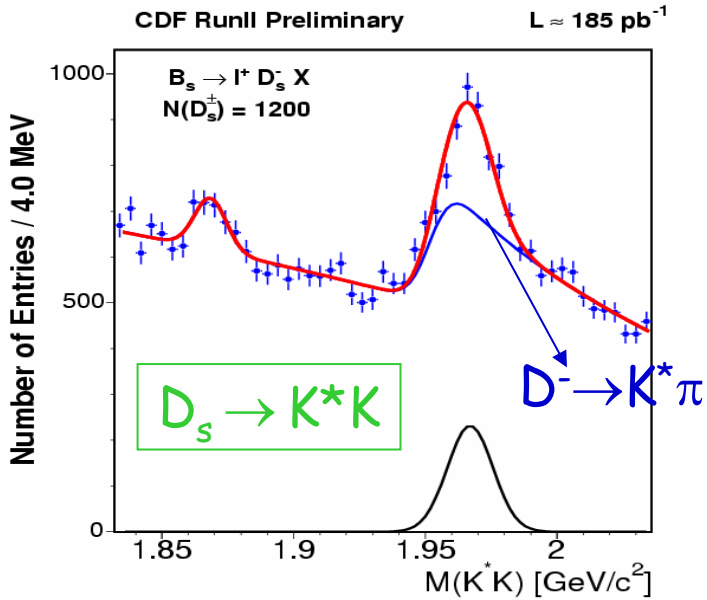
B_s Yields: Semileptonic Decays

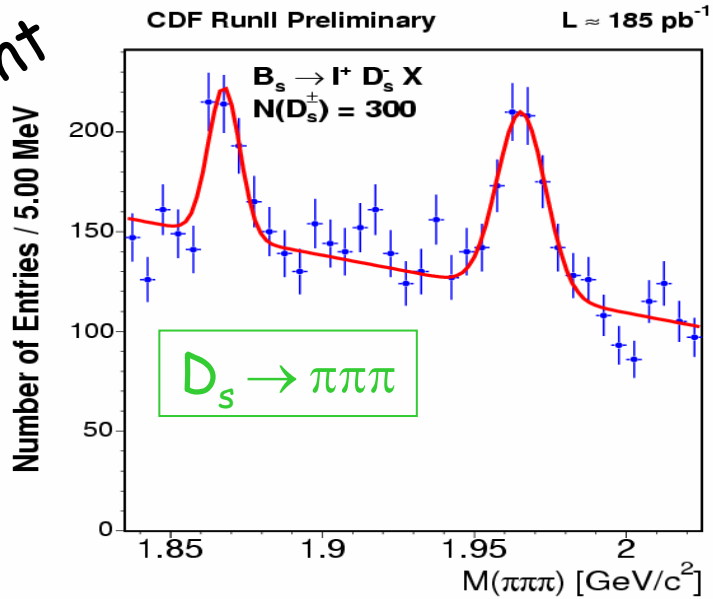
G. Bauer, G. Gomez-Ceballos, I. Kravcenko, N. Leonardo, C. Paus, J. Piedra, S. Rakitin, A. Ruiz, I. Vila

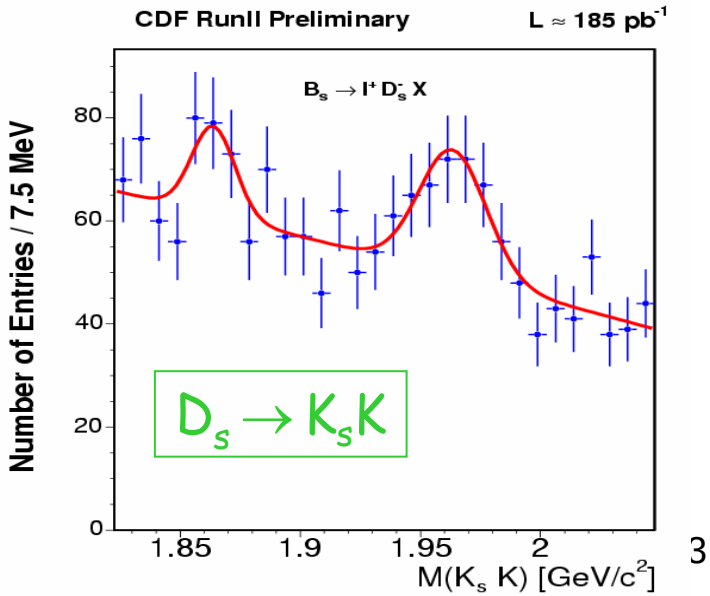
First limit from these decays ?!

Only yields for the moment









B_s Yields: Fully Reconstructed Decays

A. Cerri, D. Lucchesi, S. Da Ronco, P. Squillacioti, I. Furic, A. Belloni

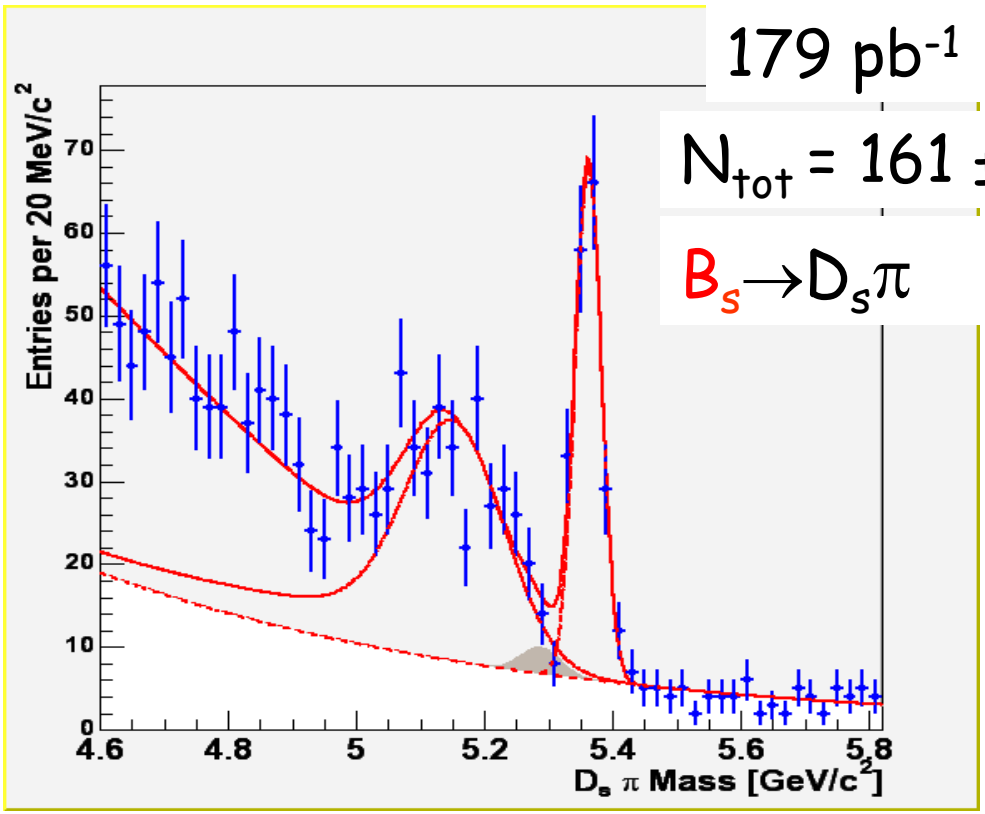
$B_s \to D_s \pi$ $D_s \to \varphi\pi$ $\varphi \to kk$

$B_s \to D_s \pi$ $D_s \to \pi\pi\pi$

$B_s \to D_s \pi$ $D_s \to k^*k$ $k^* \to k\pi$

} Done !

$B_s \to D_s \pi\pi\pi$ In progress



179 pb^{-1}

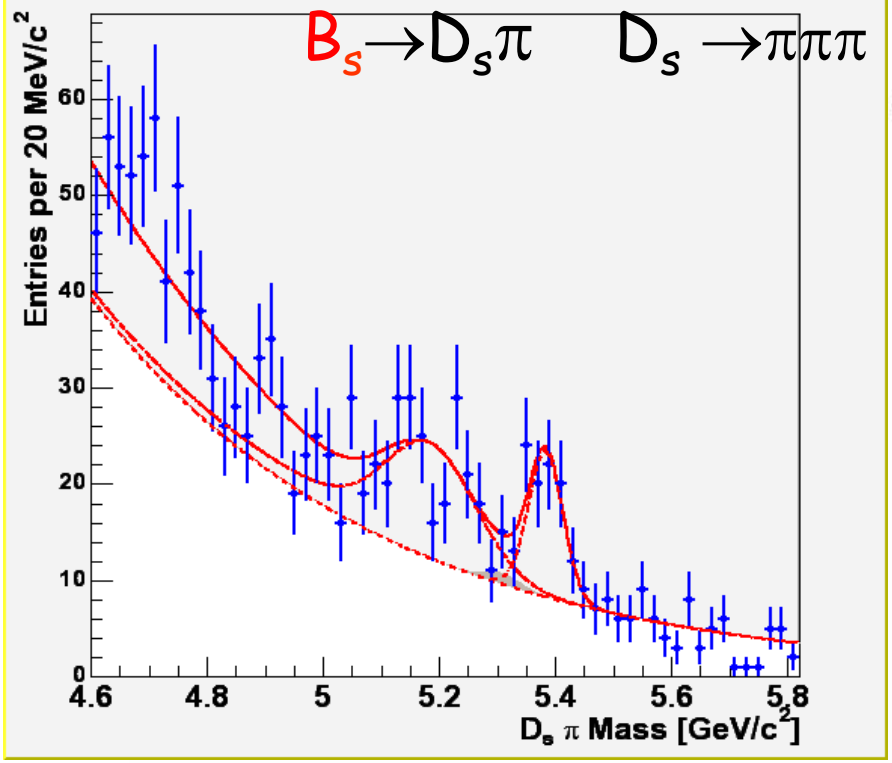
$N_{tot} = 161 \pm 14$

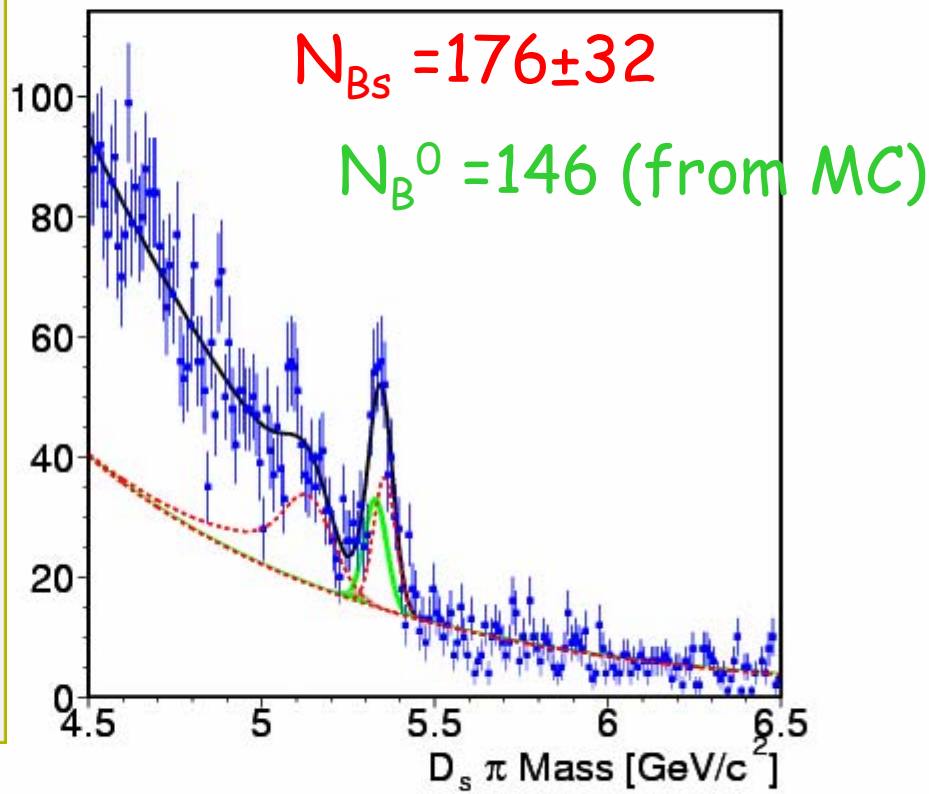
$B_s \to D_s \pi$ $D_s \to \varphi\pi$

B_s Yields: Fully Reconstructed Decays cont'd

124 pb^{-1} $N_{tot} = 57 \pm 11$

$B_s \rightarrow D_s\pi$ $D_s \rightarrow \pi\pi\pi$

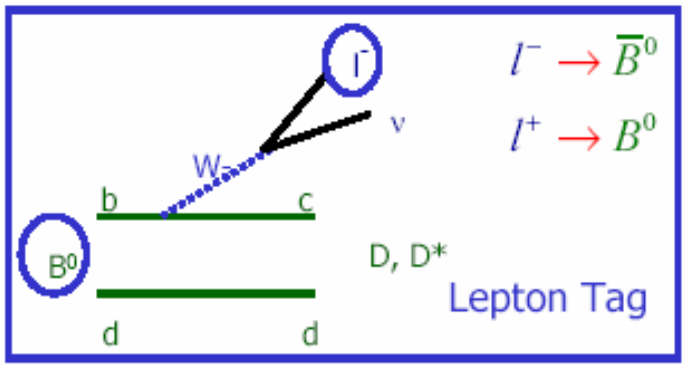


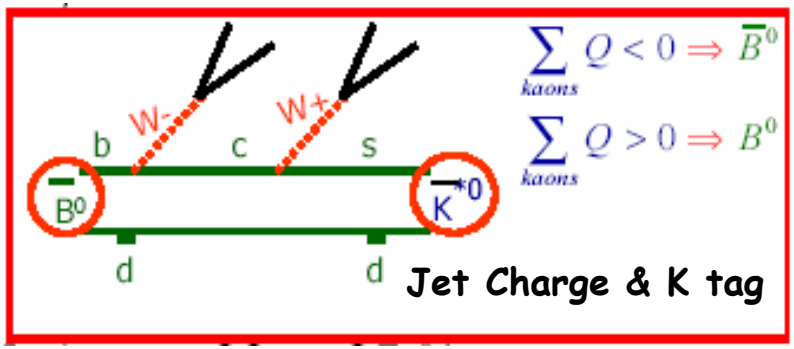


B Tagging: A quick Introduction

Opposite side tagging

Flavor of the B at production time from the other B

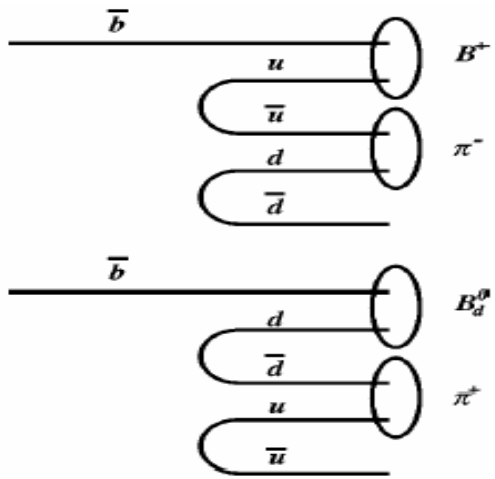




Same side Tagging

Flavor of the B at production time from particle charge produced "close" to the B:

- fragmentation tracks
- $B^{**} \rightarrow B^0 \pi$



B Tagging: CDF heavy flavor samples

Trigger based on displaced tracks:

- Lepton + displaced track
  - High statistics
  - Lepton charge → B flavor
  - High background



- Two displaced tracks
  - grant access to fully reconstructed B^0 and B^+
  - not so high statistics


Trigger based on dimuons: J/ψ

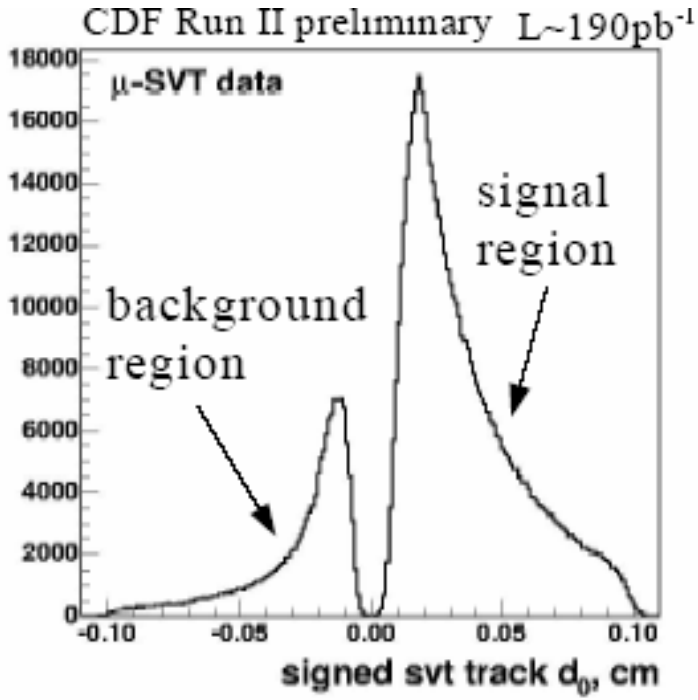
- J/ψ
  - Low statistics
  - Low background

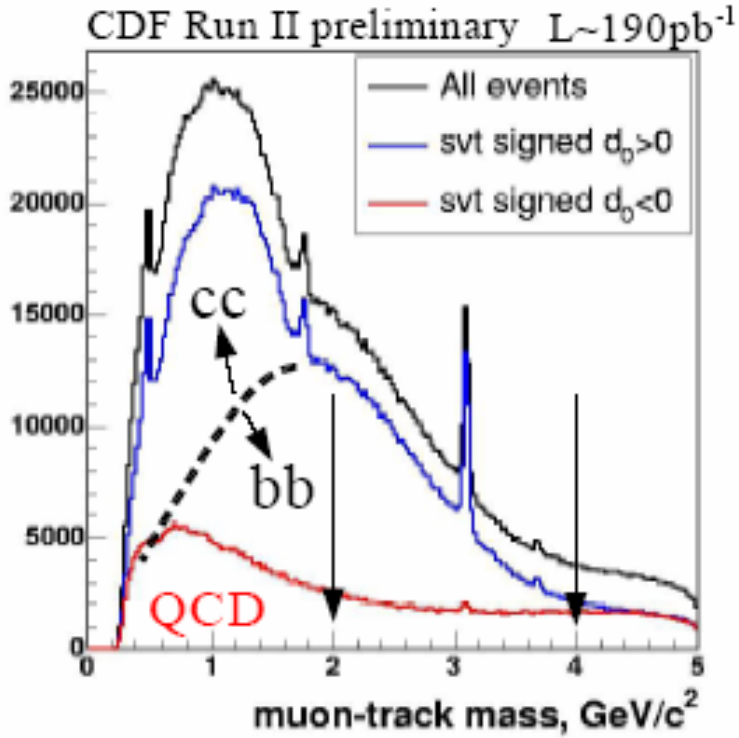

B Tagging: CDF heavy flavor samples cont'd

Background suppression:

- QCD background: removed by signed IP subtraction ($p\bar{p} \rightarrow u\bar{u}$, $d\bar{d}$, $s\bar{s}$ events, displaced tracks from Ks/Λ and mismeasured track)

- Charm background: removed by 2<M(track-lepton)<4 GeV





Soft Muon Tagging

M. Jones, J. Kroll, A. Wicklund, D. Usynin V. Tiwari, G. Giurgiu, M. Paulini, J. Russ, B. Wicklund

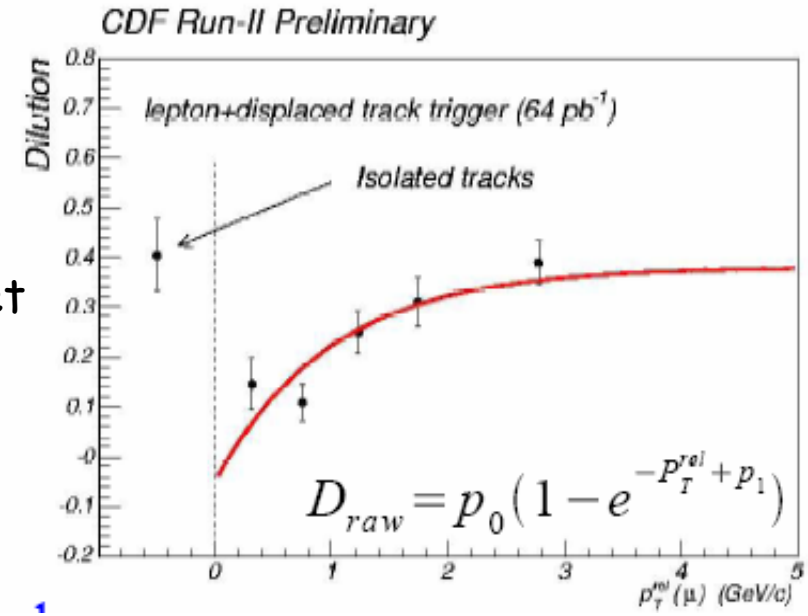
- Average between e and μ trigger data
- Dilution corrected from mixing and sequential
- $\Sigma\varepsilon D^2$ for all sub samples

Muon Type	D_{raw}, %	ϵ, %	ϵD^2, %
CMUP	34.8±3.9	0.73±0.03	0.098±0.021
CMU only	13.2±3.5	1.23±0.04	0.050±0.017
CMP only	23.9±5.9	0.39±0.02	0.022±0.011
CMX	24.8±3.9	0.74±0.03	0.060±0.016
BMU	31.4±5.8	0.30±0.02	0.034±0.013

$\varepsilon = N_{tagged}/N_{total}$

$D = N_{rs}-N_{ws}/N_{rs}+N_{ws}$

P_t^{rel} Pt of the μ respect to the track jet associated with him

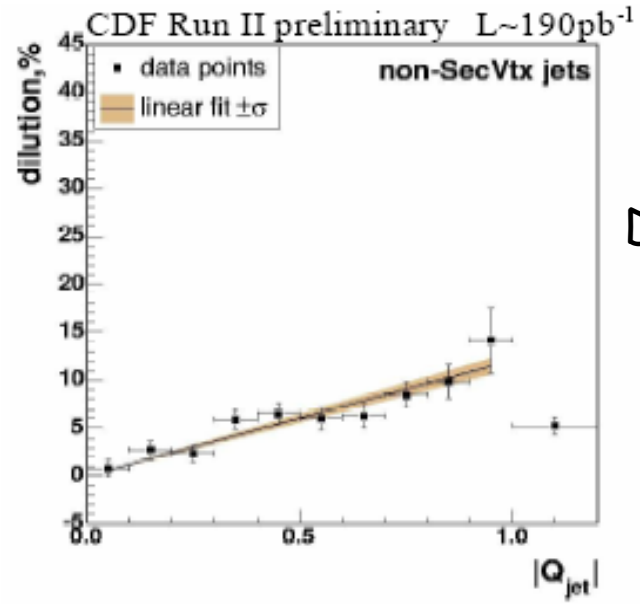


$\varepsilon D^2 = 0.660 \pm 0.193$ (stat) %

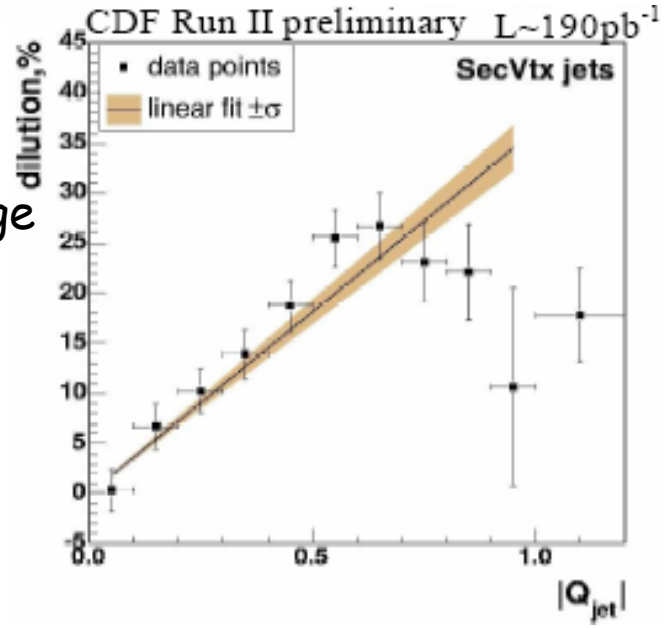
Jet Charge Tagging

Ilya Kravchenko

- Find track jet: cone clustering
- Select best jets: jet with secondary vertex or highest-Pt
- Calculate the jet charge: $Q_{jet} = \frac{\sum_{tracks} q_i (\vec{P}_i \cdot \vec{P}_{jet})}{\sum_{tracks} (\vec{P}_i \cdot \vec{P}_{jet})}$



D depends on jet charge



Measured on e trigger data

Dilution corrected from mixing and sequential

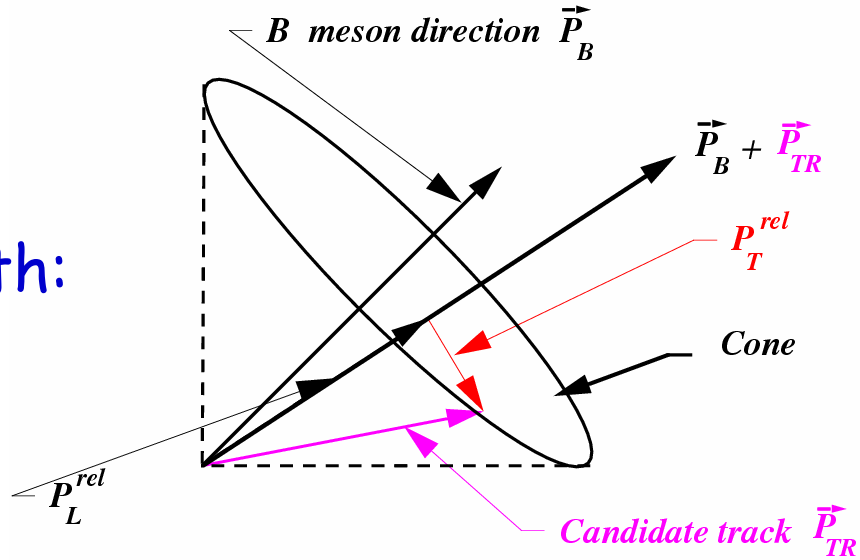
$\Sigma \varepsilon D^2$ for all sub samples

$\varepsilon D^2 = 0.415 \pm 0.017$ (stat) %

Same Side Tagging

G. Bauer, G. Gomez-Ceballos, I. Kravcenko, N. Leonardo, C. Paus, J. Piedra, S. Rakitin, A. Ruiz, I. Vila, G.J. Barker, M. Feindt, U Kerzel, C. Lecci

Use the Run I algorithm

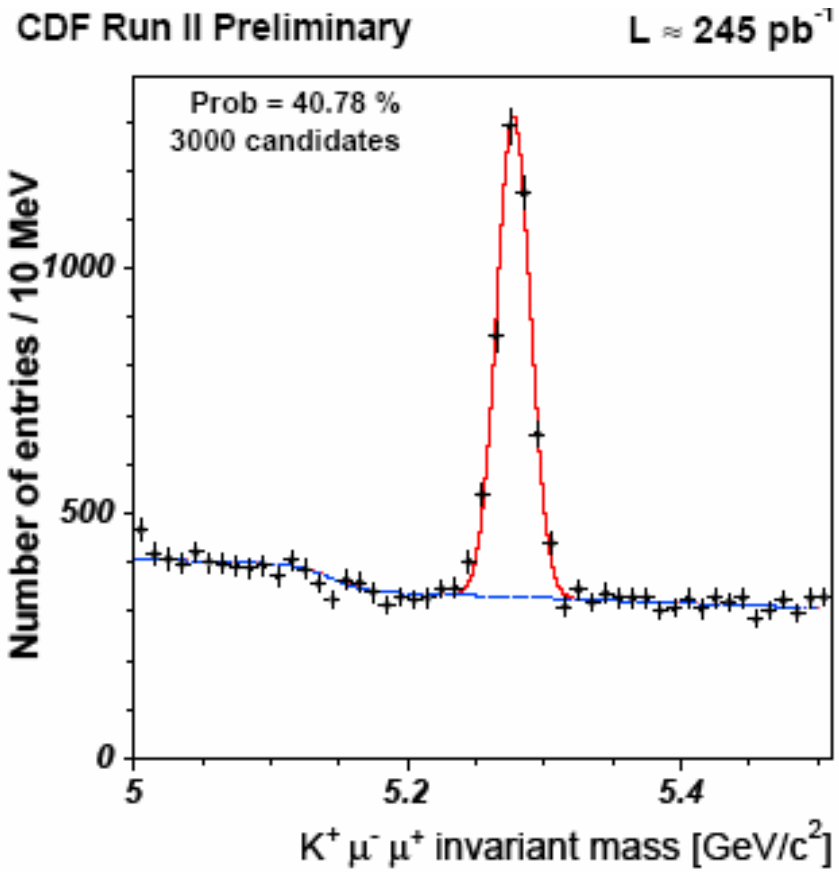


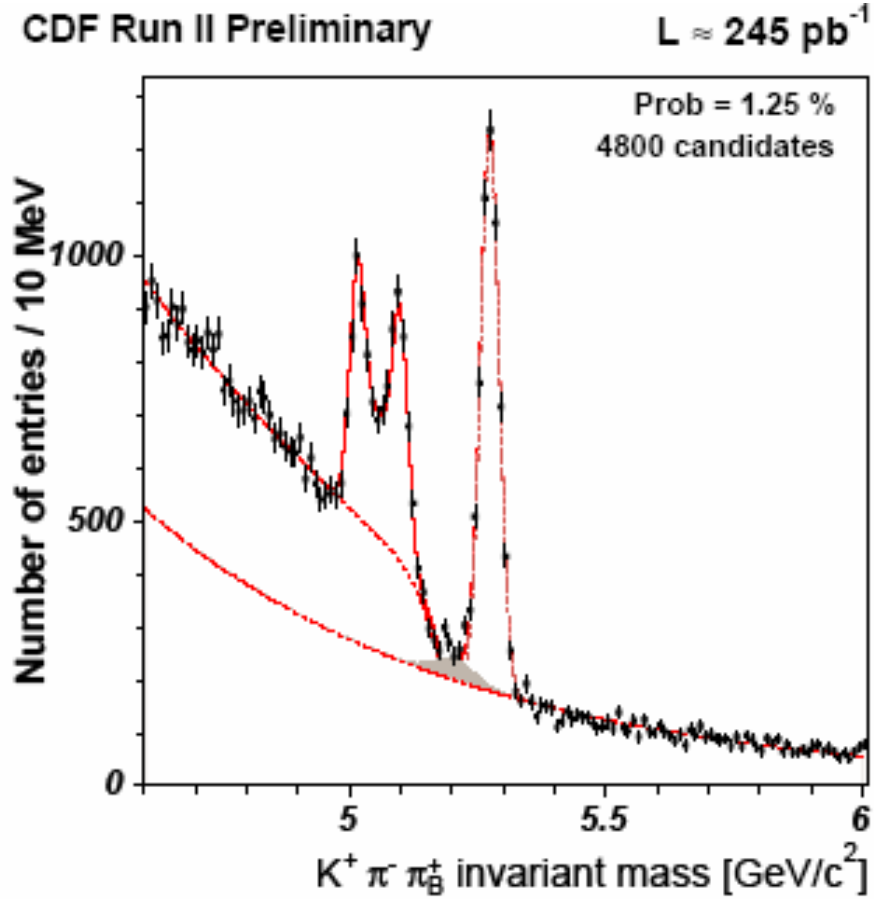
Tracks close to the B meson with:

- $p_T > 350$ MeV/c
- $|d_0/s(d0)| < 3$ (from PV)

If multiple track candidates, select the one with minimum p_T^{rel} as tag

Same Side Tagging cont'd





$B^+ \rightarrow J/\psi\ K^+$

$B^+ \rightarrow D^0\pi^+$

Same Side Tagging: results

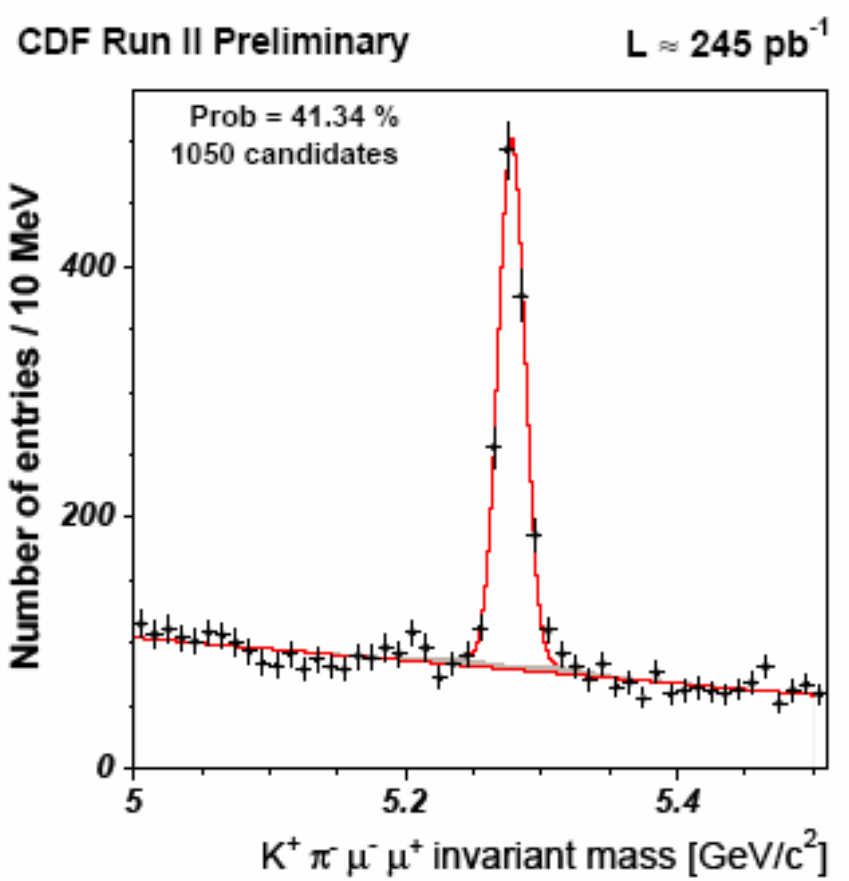
	$\varepsilon(\%)$	D(%)	$\varepsilon D^2(\%)$
$B^+ \to J/\psi K^+$	63.5±1.2	22.2±3.4	3.1±1.0
$B^+ \to D^0\pi^+$	62.4±0.8	20.2±2.4	2.5±0.6

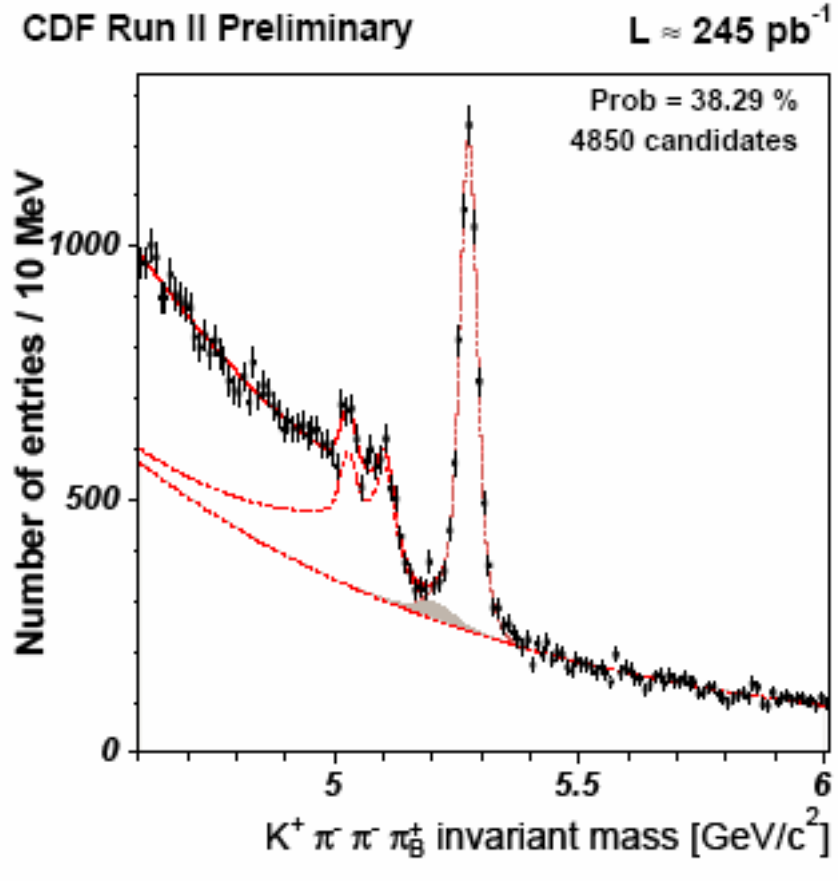
Final results combines the two decay channels:

$$\varepsilon D^2 = 2.8 \pm 0.5 \text{ (stat)}$$

B^0 mixing with SST

See Jonatan Piedra talk for details





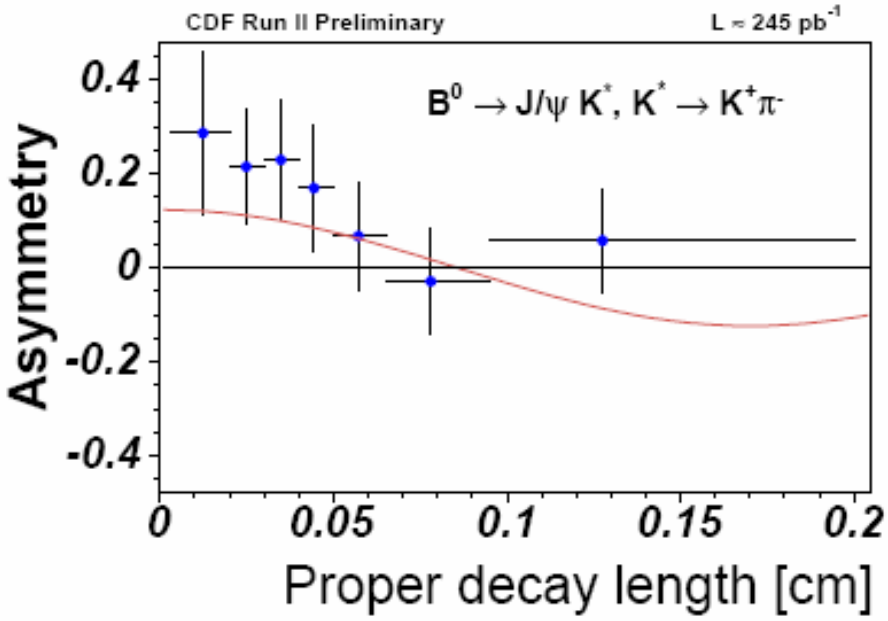
$B^0 \rightarrow J/\psi\ K^{0*}$

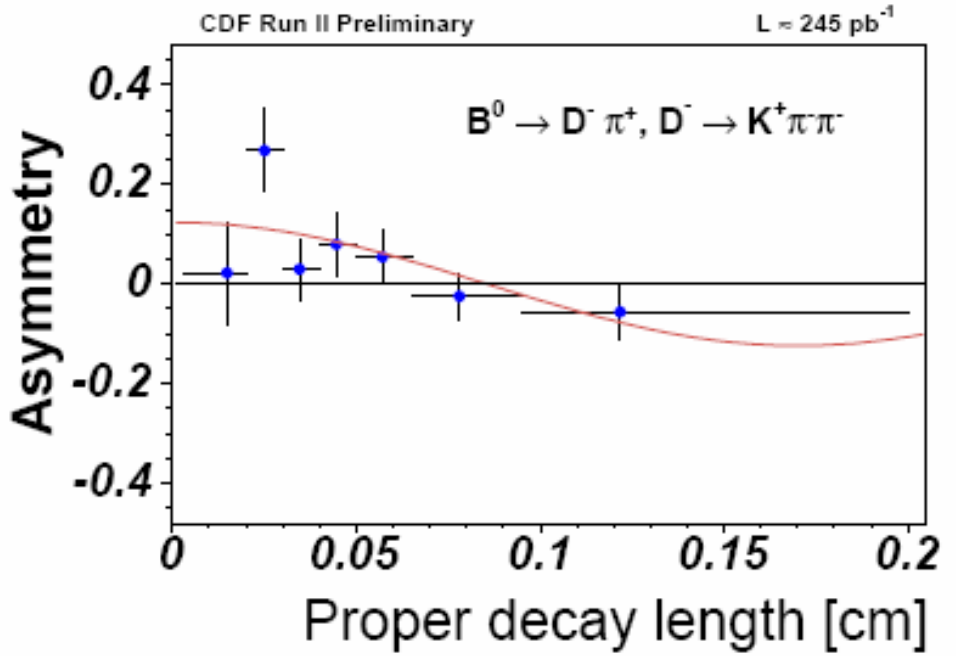
$B^0 \rightarrow D^-\pi^+$

B^0 mixing with SST: results

Fitting function: $$A^{meas}(t) = \frac{Gaus \otimes [e^{-t'/\tau} D \cos \Delta m_d t]}{Gaus \otimes e^{-t'/\tau}}$$

χ^2 combined binned fit





D(%)	εD^2(%)	$\Delta m_d (ps^{-1})$
12.4±3.3	1.0±0.5(stat)±0.1(syst)	0.55±0.10(stat)±0.01(syst)

Conclusions

CDF is moving as fast as possible to measure (or set a limit) the B_s mixing.

Several improvements already reached for the winter Conferences

Many other studies are in progress to learn what we are doing and what we can reach listen to the Alex talk