A beautiful surprise!

In 50 pb^{-1} we expect:

- ~ 0.5M $D^0 \to K^- \pi^+$
- ~ 44K $D^0 \to KK$
- ~ 16K $D^0 \to \pi\pi$
- ~ 150 $D^0 \to K^+ \pi^-$

To be compared with:

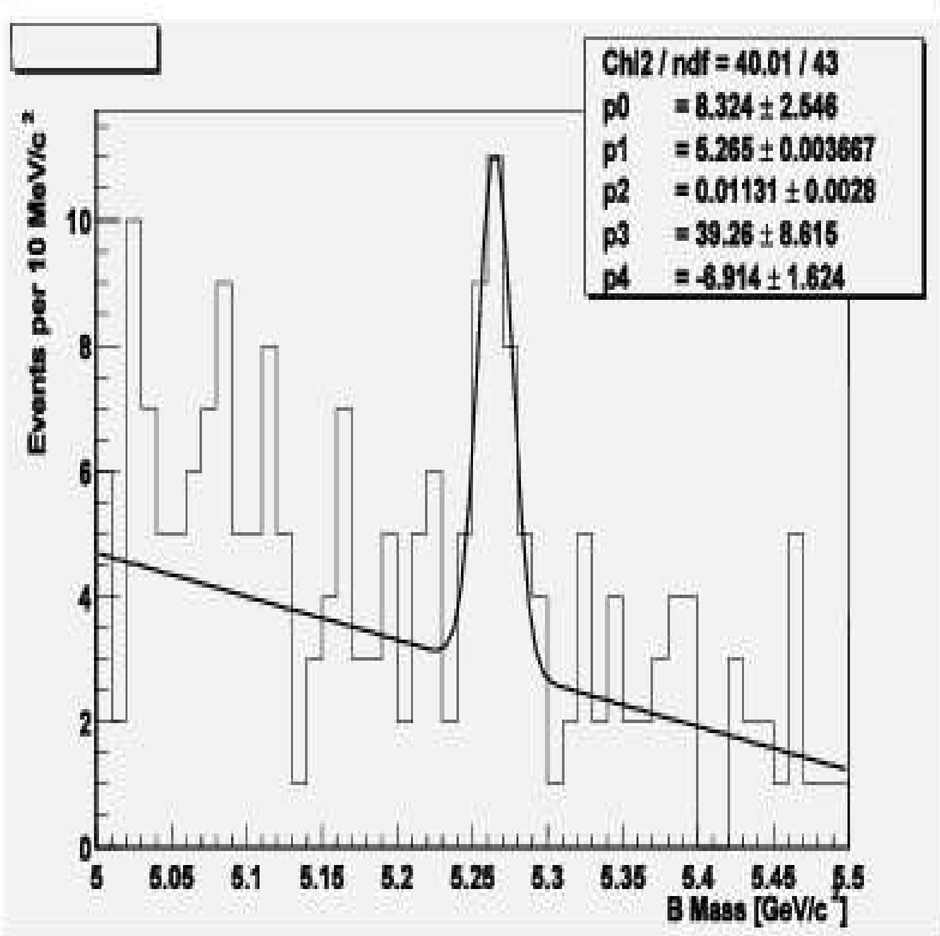
- Fixed target experiments:
  - E791 200K fully reconstr. D
  - FOCUS 1M
  - SELEX almost barions
- CLEO (similar statistic to FOCUS)
- Belle and Babar (better statistic)

Even with a VERY low luminosity we can measure:

- charm meson cross section
- $c\bar{c}$ cross section
- $D^0 - \bar{D}^0$ mixing
- $c\bar{c}/b\bar{b}$ cross section

Beauty reconstruction:

$B^{\pm} \rightarrow D^0 \pi^{\pm}$ $D^0 \rightarrow K^- \pi^+$



S=24±5 events

B=19±4 events

S/B~1.3

σ=11±3 MeV/c^2

Signal compatible with expectations

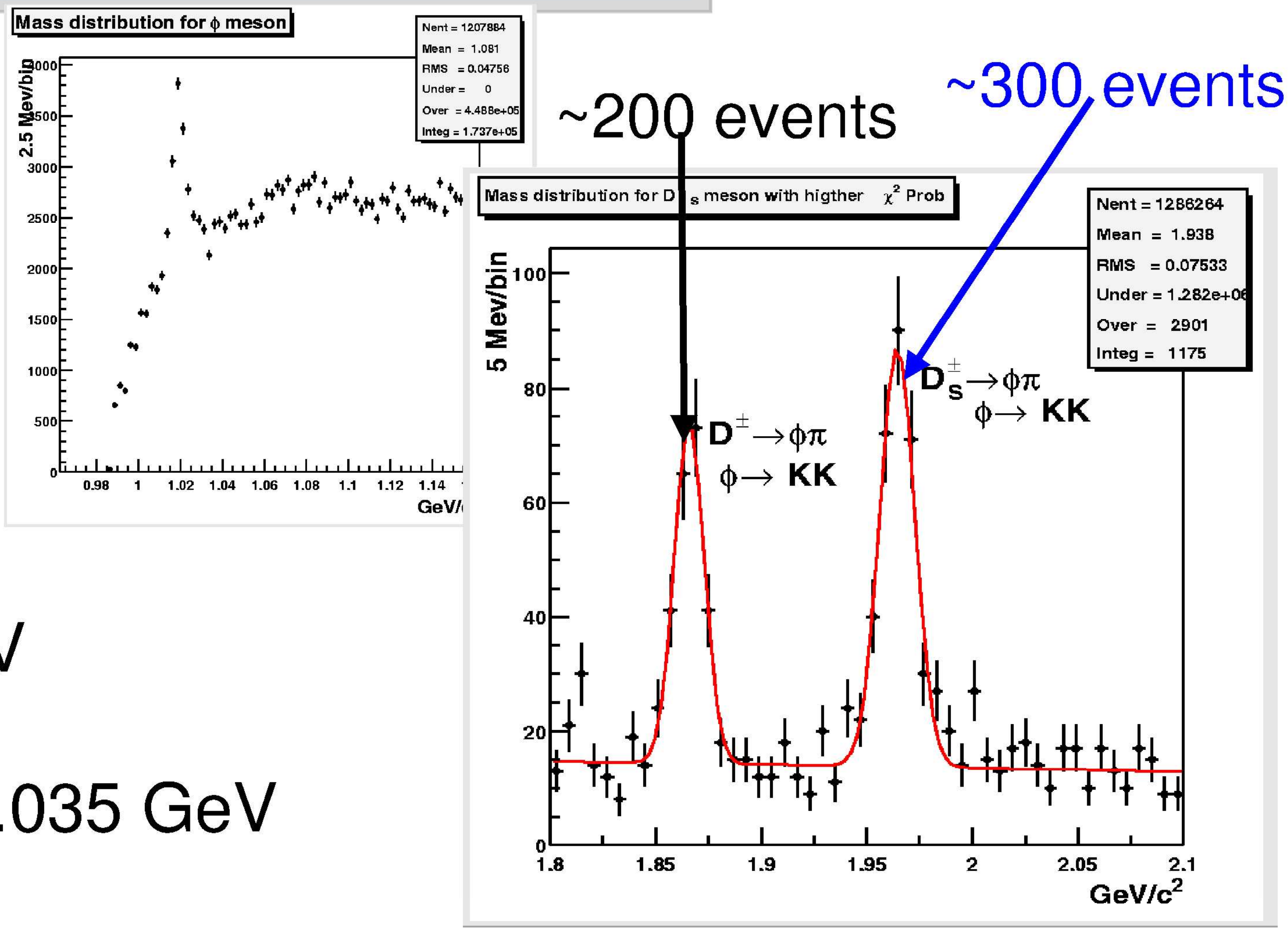
- ➔ SVT efficiency 0.70 instead 0.95
- ➔ SVXII coverage from 0.30 to 0.60
- ➔ Reconstruction efficiency 0.50

We may expect improvements on all this sources of inefficiency by now

Towards B_s: $D_s^{\pm} \to \phi\pi^{\pm}$ reconstruction

Cleanest decay:

$D_s^{\pm} \to \phi\pi^{\pm}$ $\phi \to K^+K^-$



2 tracks Pt>2 GeV

|d|>100 mm

3rd track Pt>0.5 GeV

Lxy>0

1.01GeV<m(KK)<1.035 GeV

Here in Padova we are working on it and also $D_s^{\pm} \to f^0(980)\pi^{\pm}$

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Towards B_s: $D_s^{\pm} \to K^{*0} K^{\pm}$ reconstruction

Less clean but with higher Branching fraction

2 tracks Pt>2 GeV

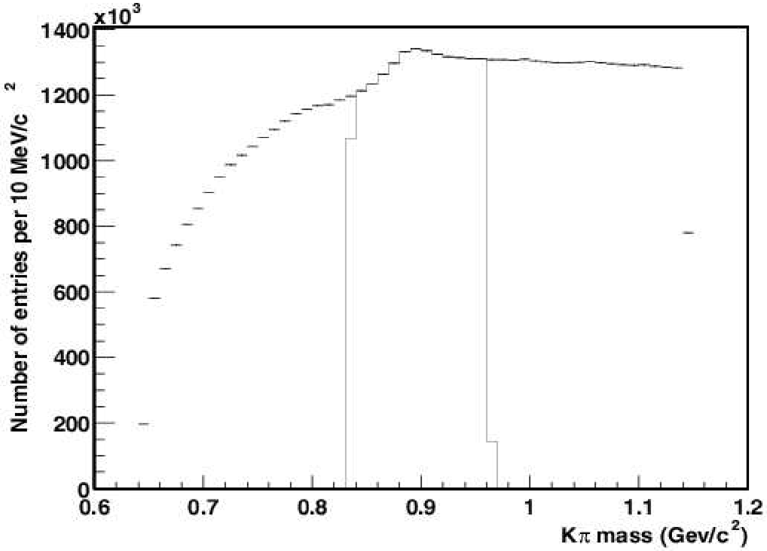
|d|>100 μm

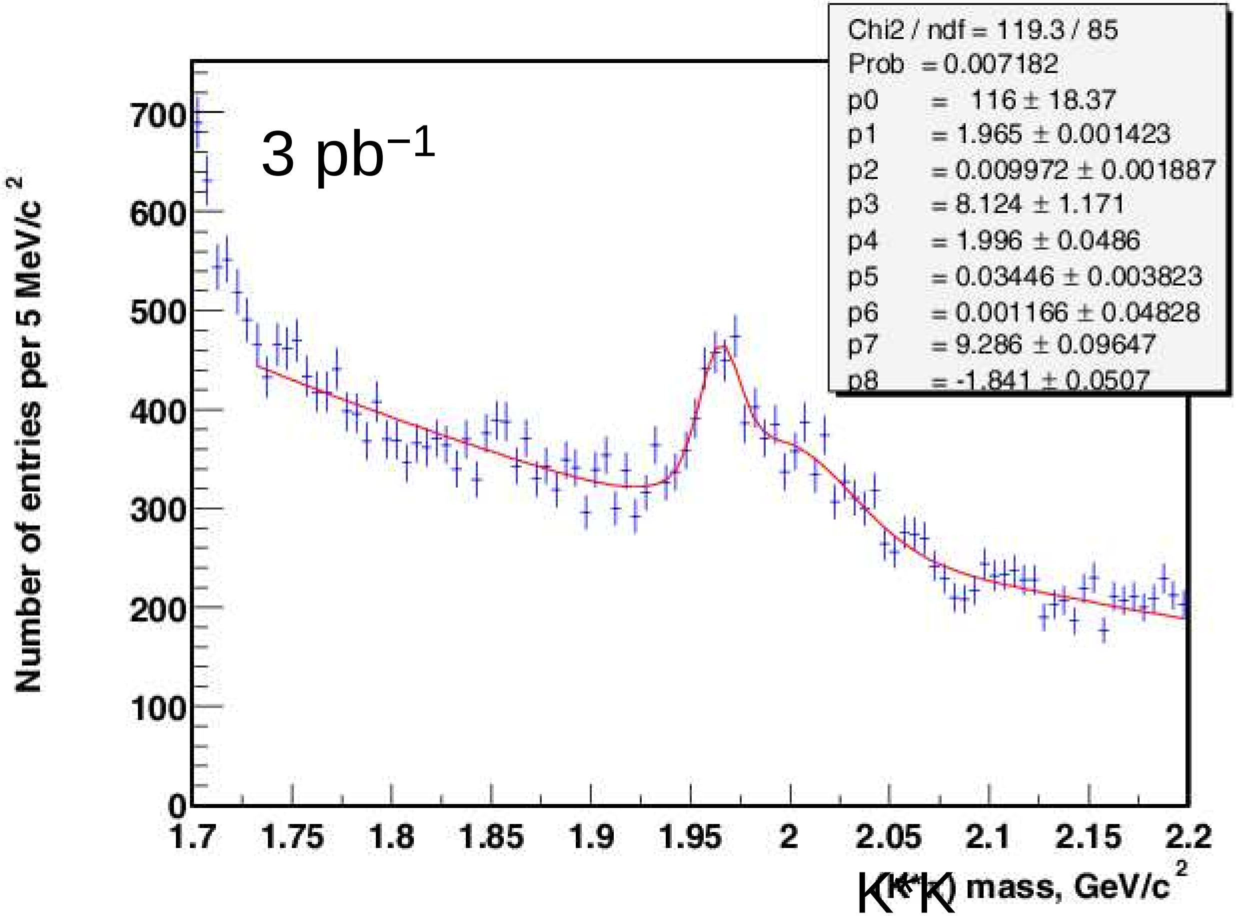
3rd track Pt>0.4 GeV

Lxy>50 μm

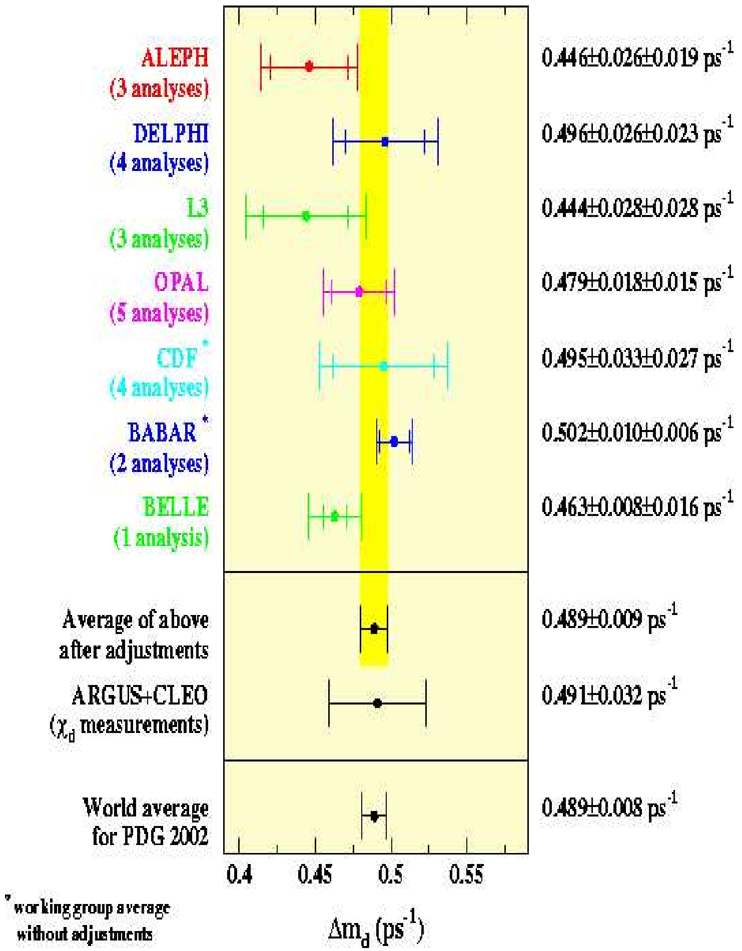
831<m(Kπ)<961 MeV

several angular cuts





The future: $B_{s,d}$ mixing



By measuring both: $$\frac{V_{td}}{V_{ts}} \propto \frac{\Delta m_d}{\Delta m_s}$$

Basic ingredients:

- ➔ Reconstruct decay time
- ➔ Tag B flavor at production and decay time

$$Sig(\Delta m_s)=\sqrt{(N\varepsilon D^2/2)}\,e^{-(\Delta m_s \sigma_t)^2/2}\sqrt{(S/S+B)}$$

Proper time resolution:45 fs achiavable with fully reconstructed decay

↓

Hadronic decay

$\Delta m_s > 13.1\ ps^{-1}$

$X_s > 19.0$

95% C.L

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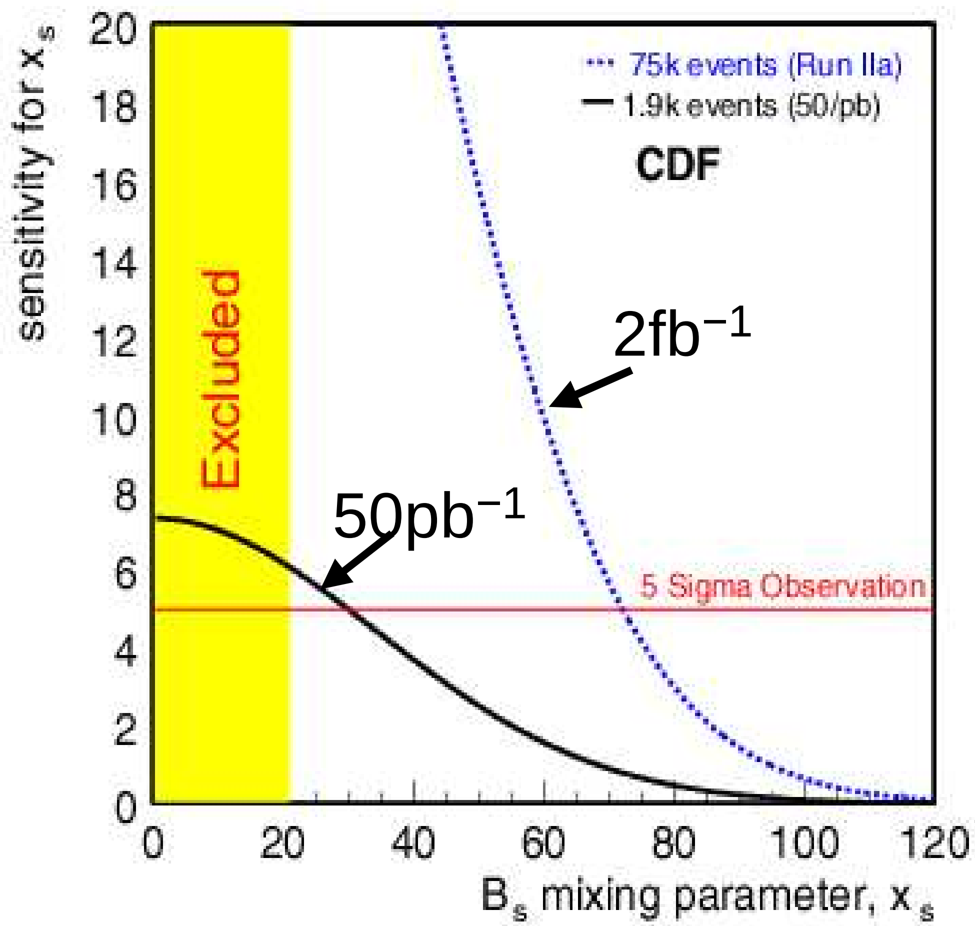
The future: $B_{s,d}$ mixing

Tagging figure of merit: εD^2

Method	Run I	RunII
SLT	1.7%	1.7%
JQT	3.0%	3.0%
SST	1.0%	4.2%
OSK	–	2.4%
Total	5.7%	11.3%

Decay Channel	$N(2fb^{-1})$
$B_s \to D_s \pi$	37K
$B_s \to D_s \pi\,\pi\pi$	38K
$B_s \to D_s D_s$	2,5K
$B_s \to D_s^* D_s$	5,7K
$B_s \to D_s^* D_s^*$	5,2K

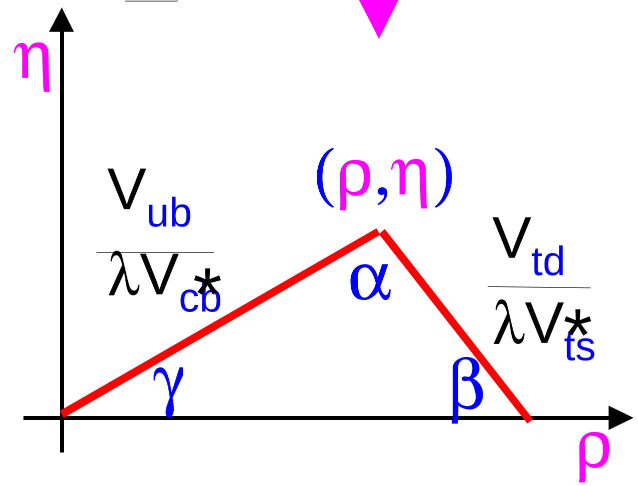
Ongoing calibration on lepton+SVT track



Which $\not{C}\!\!\not{P}$ measurement in B hadronic decays?

$$\text{CKM} \quad \begin{pmatrix} V_{ud} & V_{us} & V_{ub} \\ V_{cd} & V_{cs} & V_{cb} \\ V_{td} & V_{ts} & V_{tb} \end{pmatrix} \approx \begin{pmatrix} 1-\lambda^2/2 & \lambda & A\lambda^3(\rho-i\eta) \\ -\lambda & 1-\lambda^2/2 & A\lambda^2 \\ A\lambda^3(1-\rho-i\eta) & -A\lambda^2 & 1 \end{pmatrix}$$

unitarity



γ

1. $B^0_s \rightarrow D_s^- K^+$
2. $B^- \rightarrow D^0 K^-$
3. $B^0 \rightarrow h^+ h^-$

$B^0 \rightarrow \pi^+\pi^- \Rightarrow \sin 2(\beta+\gamma)$ $(= \sin 2(\alpha)$ if $\alpha+\beta+\gamma=\pi)$

but "penguin pollution" can be large

$B^0_s \to D_s^- K^+$

R. Aleksan, et al. Z Phys. C54 653 (1992) proposal:

$B^0_s \to D_s^- K^+$ $B^0_s \to D_s^+ K^-$ time dependent decay rate

$$\Gamma(B_s^0 \to D_s^- K^+) = \frac{|A_f|^2 e^{-\Gamma_s t}}{2}\Big\{(1+|\lambda_f|^2)\cosh(\Delta\Gamma_s t/2) + (1-|\lambda_f|^2)\cos(\Delta m_s t) - 2|\lambda_f|\cos(\delta+\gamma)\sinh(\Delta\Gamma_s t/2) - 2|\lambda_f|\sin(\delta+\gamma)\sin(\Delta m_s t)\Big\},$$

$$\Gamma(B_s^0 \to D_s^+ K^-) = \frac{|A_f|^2 e^{-\Gamma_s t}}{2}\Big\{(1+|\lambda_f|^2)\cosh(\Delta\Gamma_s t/2) - (1-|\lambda_f|^2)\cos(\Delta m_s t) - 2|\lambda_f|\cos(\delta-\gamma)\sinh(\Delta\Gamma_s t/2) + 2|\lambda_f|\sin(\delta-\gamma)\sin(\Delta m_s t)\Big\},$$

$$\Gamma(\bar{B}_s^0 \to D_s^- K^+) = \frac{|A_f|^2 e^{-\Gamma_s t}}{2}\Big\{(1+|\lambda_f|^2)\cosh(\Delta\Gamma_s t/2) - (1-|\lambda_f|^2)\cos(\Delta m_s t) - 2|\lambda_f|\cos(\delta+\gamma)\sinh(\Delta\Gamma_s t/2) + 2|\lambda_f|\sin(\delta+\gamma)\sin(\Delta m_s t)\Big\},$$

$$\Gamma(\bar{B}_s^0 \to D_s^+ K^-) = \frac{|A_f|^2 e^{-\Gamma_s t}}{2}\Big\{(1+|\lambda_f|^2)\cosh(\Delta\Gamma_s t/2) + (1-|\lambda_f|^2)\cos(\Delta m_s t) - 2|\lambda_f|\cos(\delta-\gamma)\sinh(\Delta\Gamma_s t/2) - 2|\lambda_f|\sin(\delta-\gamma)\sin(\Delta m_s t)\Big\}.$$

Best case:
2−fold ambiguity

Δm_s too large
4−fold ambiguity

$\Delta\Gamma/\Gamma$ too small
8−fold ambiguity

Theoretically clean
Reasonable Branching Ratio(0.2,0.1x10^{-3})

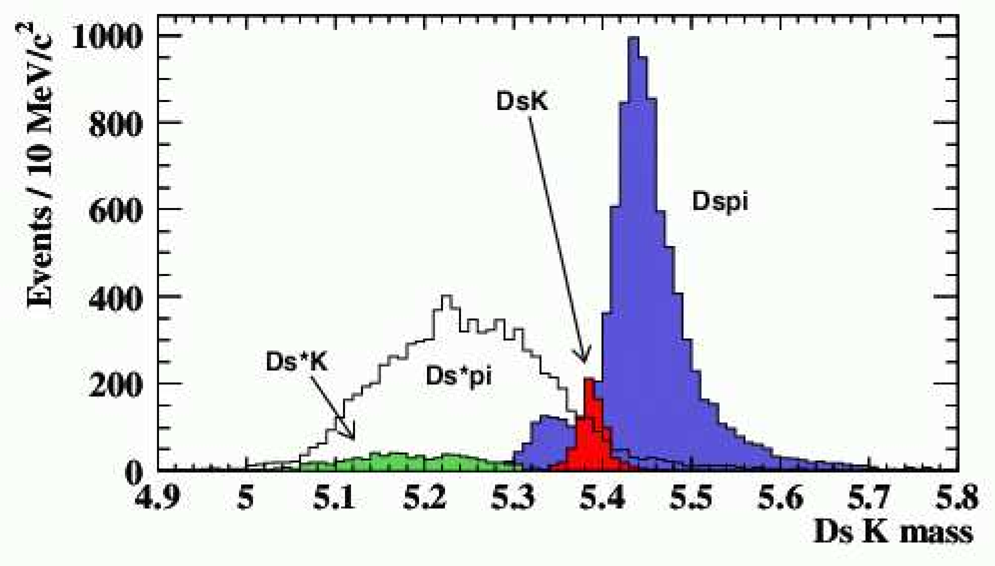
$B^0_s \rightarrow D_s^- K^+$

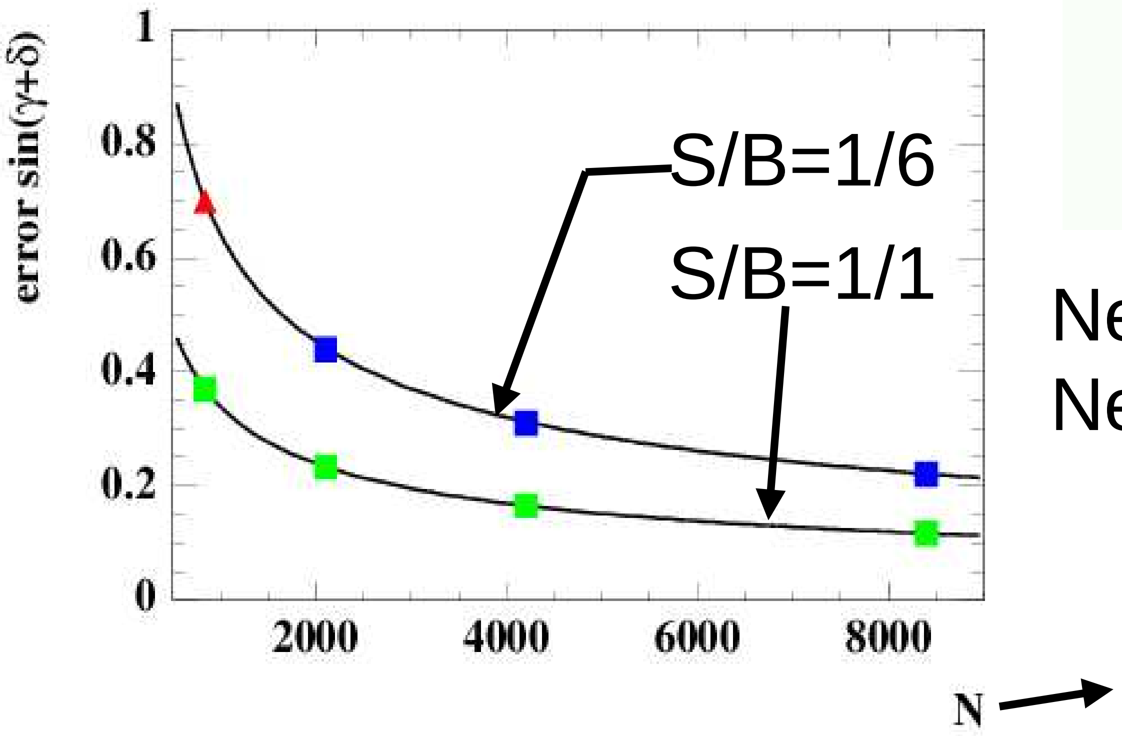
Two track trigger: N~850 events/2fb^{-1}

Difficult background separation

S/B=1/1(physics)

S/B=1/3 −1/10 (combinatorial)





pre−tagged signal events

Need time dependent analysis

Need tagging: εD^2=11.3%

$B^- \to D^0 K^-$

Atwood,Dunietz and Soni Phys. Rev. Lett. 78, 3257 (1997)

$$a = \mathcal{B}(B^- \to K^- D^0)$$
$$b = \mathcal{B}(B^- \to K^- \bar{D}^0)$$
$$c(f_1) = \mathcal{B}(D^0 \to f_1), \qquad c(f_2) = \mathcal{B}(D^0 \to f_2)$$
$$c(\bar{f}_1) = \mathcal{B}(D^0 \to \bar{f}_1), \qquad c(\bar{f}_2) = \mathcal{B}(D^0 \to \bar{f}_2)$$
$$d(f_1) = \mathcal{B}(B^- \to K^- f_1), \qquad d(f_2) = \mathcal{B}(B^- \to K^- f_2)$$
$$\bar{d}(f_1) = \mathcal{B}(B^+ \to K^+ f_1), \qquad \bar{d}(f_2) = \mathcal{B}(B^+ \to K^+ f_2)$$

$$d(f_1) = a \times c(f_1) + b \times c(\bar{f}_1) + 2\sqrt{a \times b \times c(f_1) \times c(\bar{f}_1)} \cos(\xi_1 + \gamma)$$
$$\bar{d}(f_1) = a \times c(f_1) + b \times c(\bar{f}_1) + 2\sqrt{a \times b \times c(f_1) \times c(\bar{f}_1)} \cos(\xi_1 - \gamma)$$
$$d(f_2) = a \times c(f_2) + b \times c(\bar{f}_2) + 2\sqrt{a \times b \times c(f_2) \times c(\bar{f}_2)} \cos(\xi_2 + \gamma)$$
$$\bar{d}(f_2) = a \times c(f_2) + b \times c(\bar{f}_2) + 2\sqrt{a \times b \times c(f_2) \times c(\bar{f}_2)} \cos(\xi_2 - \gamma)$$

No time dependent analysis
No tagging
Two tracks Trigger: ~130 events/2fb^{-1}
S/B=1:9(physics)
$\delta\gamma \sim 15^o$ IF:
1. combinatorial background negligible
2. $\mathcal{B}(B^+ \to K^+ D^0)$ known at 20%