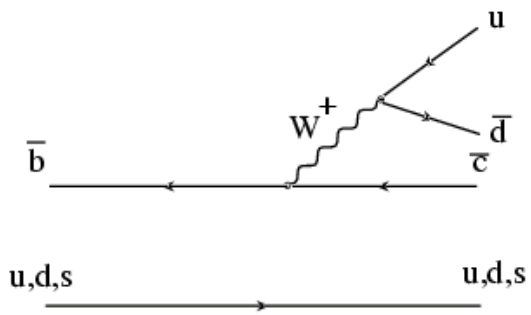
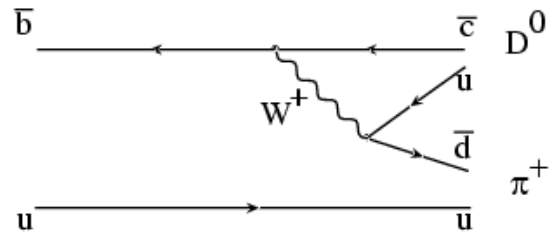
Bs/B0 yields

- A Combined Measurement of Br(Bs->Ds-pi+)/Br(B0->D-pi+): CDFnote: 6708
- Study of Bs Yields in the Hadronic Trigger: CDFnote: 6345
- Multibody Trigger Paths in the Two Track Trigger Data: CDFnote: 6526
- Study of Bs, B+, and B0 Yields in the Hadronic B Samples: CDFnote: 6614
- An Update to the Study of Bs Yields in the Hadronic Trigger: CDFnote: 6692

Hadronic $B^0/B^+/B_s$ Decays





- at tree level, driven by same spectator diagram
- internal spectator only for B^+
- zeroth order, expect ratios of BR to be 1
- corrections come from:
  - interference from internal spectator
  - SU(3) breaking
  - differences in B lifetimes

Branching Ratio Method

$$\frac{f_s}{f_d}\frac{Br(Bs \to D_s\pi)}{Br(Bd \to D\pi)} = \frac{N(Bs)}{N(Bd)} \cdot \frac{\epsilon(Bd)}{\epsilon(Bs)} \cdot \frac{Br(D \to K\pi\pi)}{Br(Ds \to \phi\pi, \phi \to KK)}$$

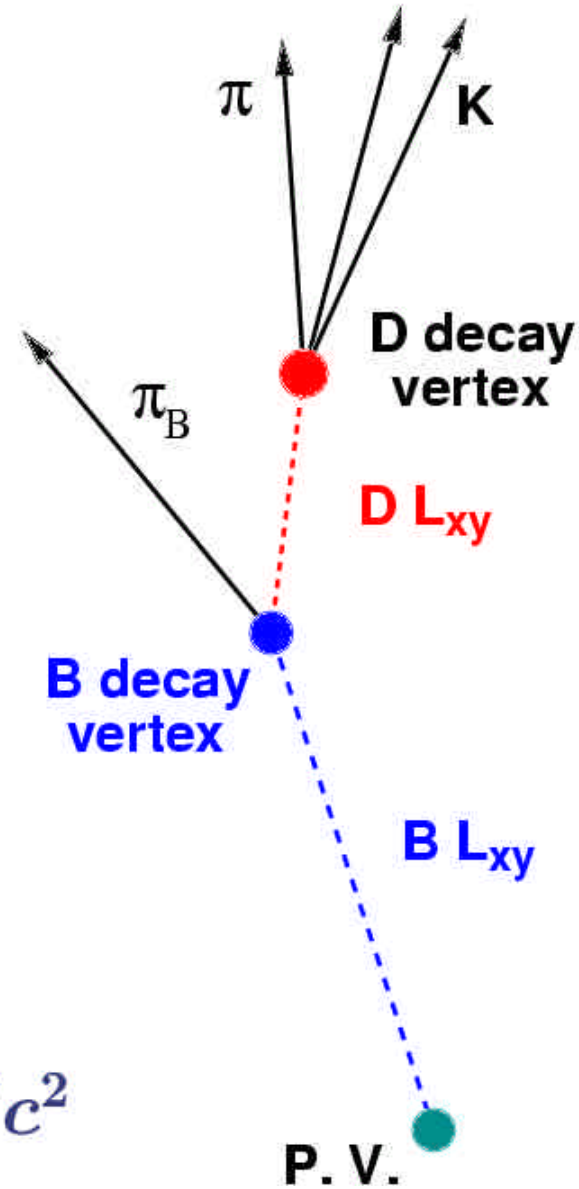
- $N(Bs)/N(Bd)$ is measured in data, for a specified trigger and set of analysis requirements
- $\epsilon(Bd)/\epsilon(Bs)$ is determined from MC, for the same trigger and analysis requirements
- $Br(D)/Br(D_s)$ is taken from PDG
- selection done on `hbot0h` and `hbot1i` samples
- the measurement is done in the `B_CHARM` trigger path

Common B meson selection cuts:

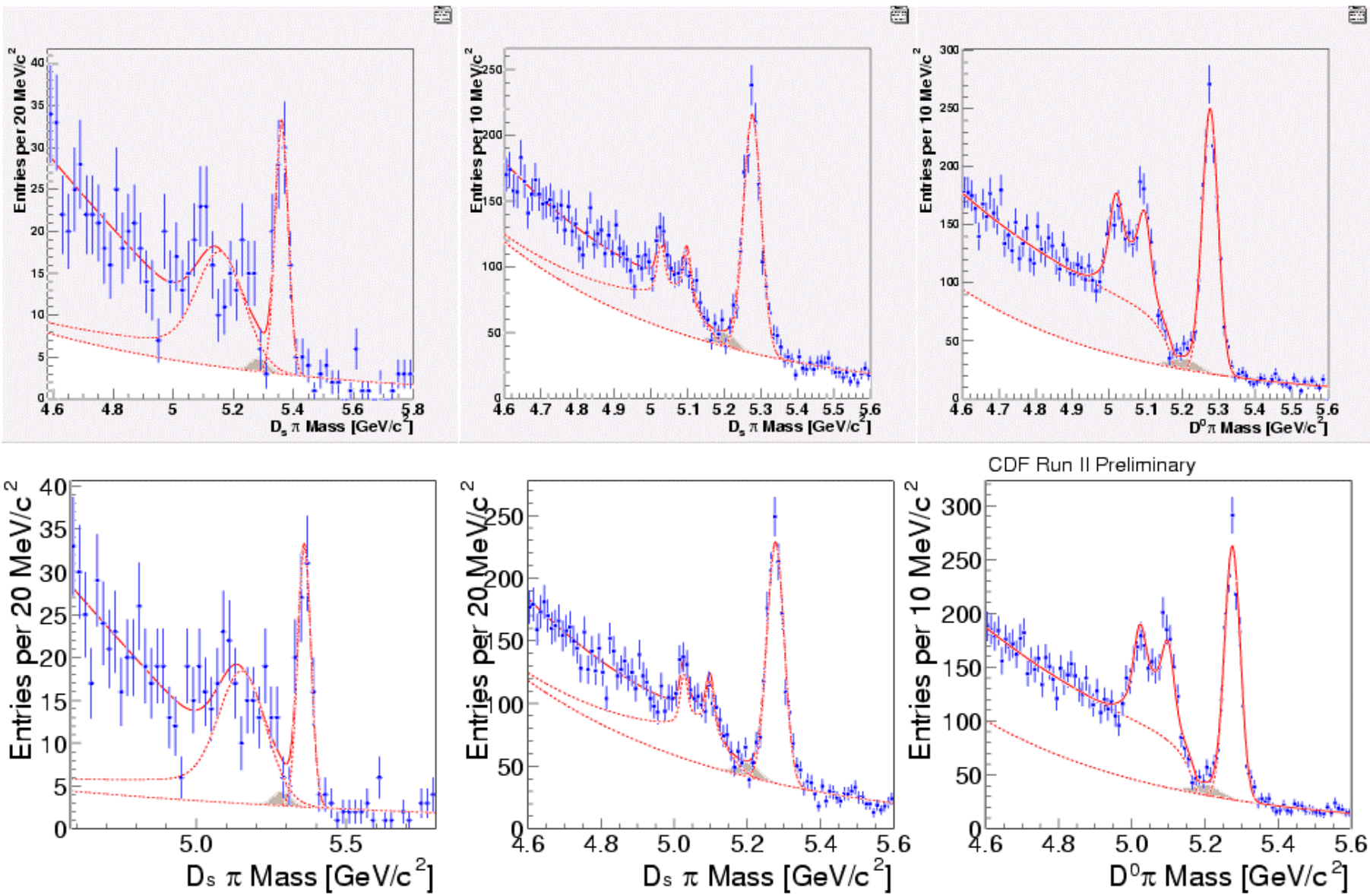
[cuts applied to all B decays:]

- $\chi^2_{r,\varphi}(D) < 14$
- $\chi^2_{r,\varphi}(B) < 15$
- $p_T(D) > 3.5$ GeV/c
- $p_T(B) > 5.5$ GeV/c
- $L_{xy}(D)$ not applied
- $L_{xy}(B) > 400\mu$m
- $L_{xy}(B \to D) > -150\mu$m
- $\Delta R(D, \pi_B) < 1.5$
- $p_T(\pi_B) > 1.6$ GeV/c
- $|d_0(B)| < 80\mu$m

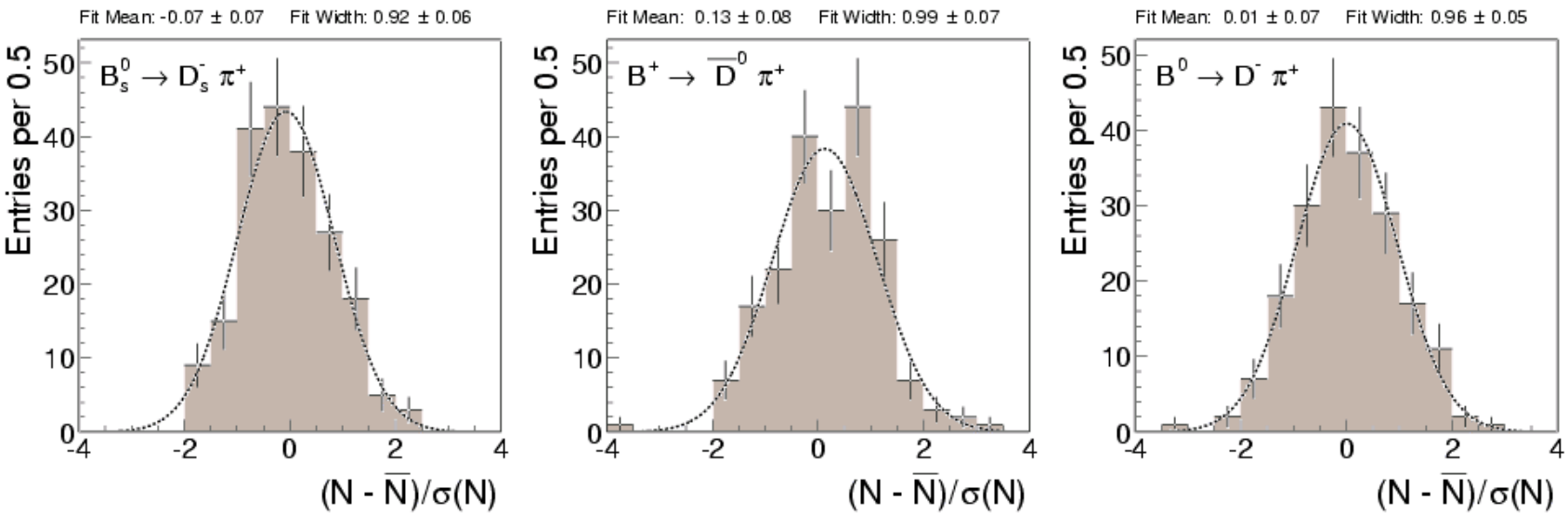
$1010 < m(\phi^0) < 1028$ MeV/c^2



Selection Results:

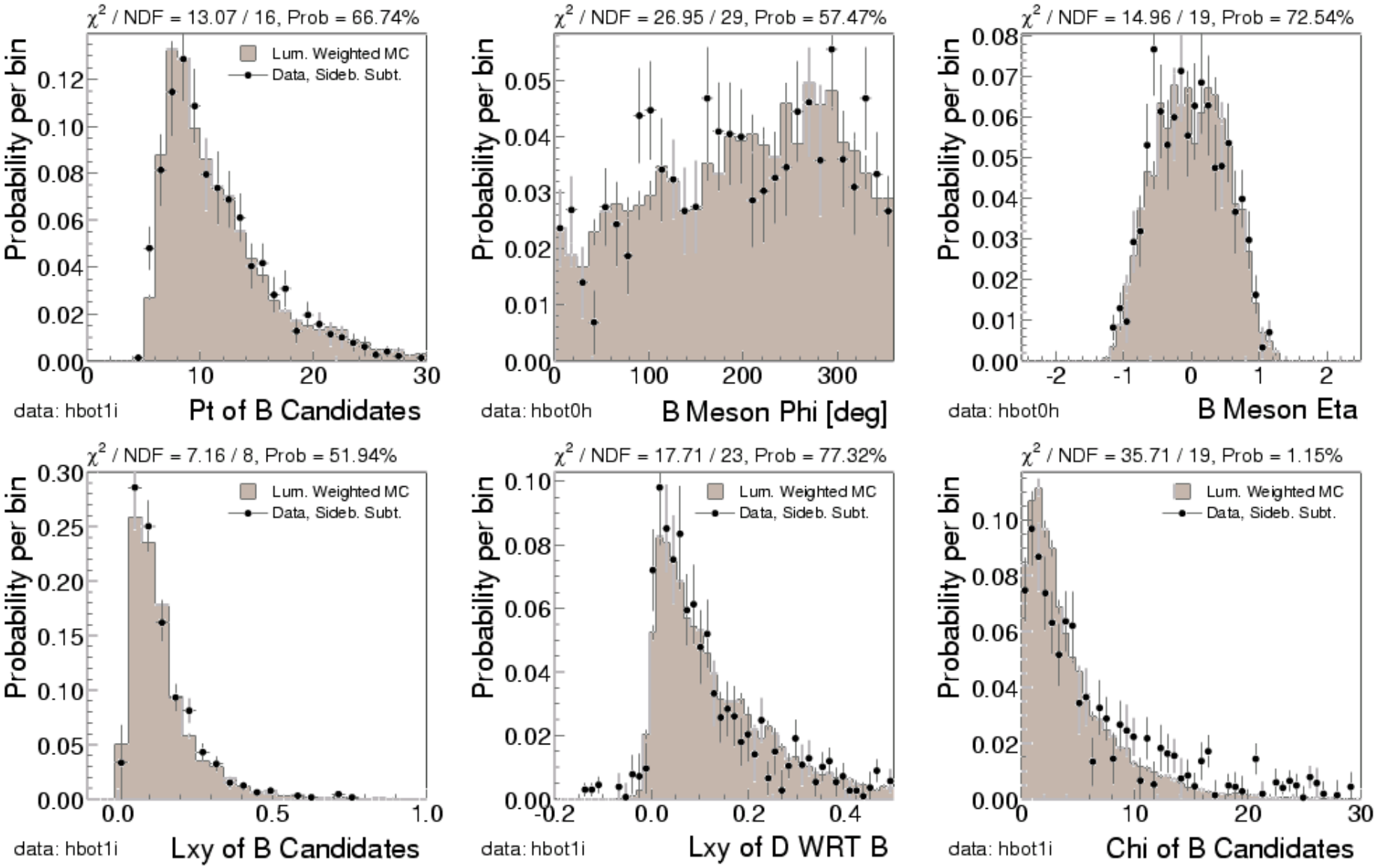


Yield fit: pulls



Monte Carlo

- ratios of efficiencies were determined using the realistic simulation package
- `Bgenerator`, NDE spectrum, $p_T(b) > 5.5$, $|\eta| < 1.3$
- meson decay done with EvtGen
- "trigger eff:" event passes simulated L2 trigger selection
- "recon. eff:" CTVMFT converges, m(B) m(D) inside loose window, two tracks matched to SVT
- "analysis eff:" event passes trigger confirmation, track quality and selection cuts


χ^2 / NDF = 13.07 / 16, Prob = 66.74%
Lum. Weighted MC
Data, Sideb. Subt.
Probability per bin
data: hbot1i
Pt of B Candidates
χ^2 / NDF = 26.95 / 29, Prob = 57.47%
Probability per bin
data: hbot0h
B Meson Phi [deg]
χ^2 / NDF = 14.96 / 19, Prob = 72.54%
Probability per bin
data: hbot0h
B Meson Eta
χ^2 / NDF = 7.16 / 8, Prob = 51.94%
Lum. Weighted MC
Data, Sideb. Subt.
Probability per bin
data: hbot1i
Lxy of B Candidates
χ^2 / NDF = 17.71 / 23, Prob = 77.32%
Lum. Weighted MC
Data, Sideb. Subt.
Probability per bin
data: hbot1i
Lxy of D WRT B
χ^2 / NDF = 35.71 / 19, Prob = 1.15%
Lum. Weighted MC
Data, Sideb. Subt.
Probability per bin
data: hbot1i
Chi of B Candidates

Efficiencies

dataset	$B_s(\phi\pi)(\%)$	$B_u(D^0\pi)(\%)$	$B_d(K\pi\pi)(\%)$
hbot0h	1.20±0.01	1.42±0.02	1.36±0.02
hbot1i	1.50±0.02	1.81±0.02	1.67±0.02
total	1.33±0.01	1.59±0.01	1.49±0.01

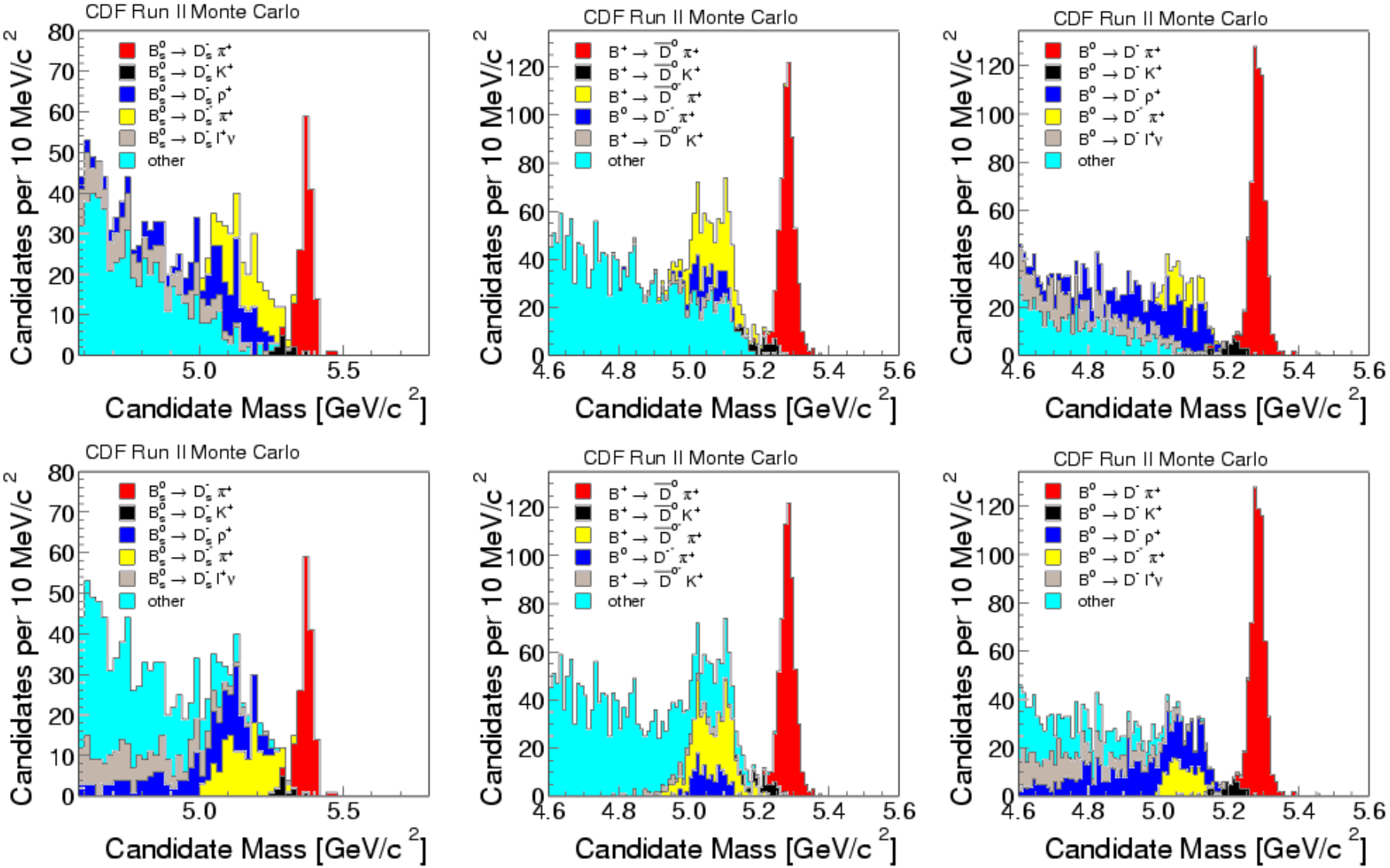
Table 5: Trigger efficiency for the two different datasets.

dataset	$B_s(\phi\pi)(\%)$	$B_u(D^0\pi)(\%)$	$B_d(K\pi\pi)(\%)$
hbot0h	54.1±0.6	52.5±0.6	44.4±0.6
hbot1i	55.0±0.6	53.9±0.6	47.3±0.6
total	54.6±0.4	53.2±0.4	45.8±0.4

Table 6: Reconstruction cuts efficiency of the two datasets.

dataset	$B_s(\phi\pi)(\%)$	$B_u(D^0\pi)(\%)$	$B_d(K\pi\pi)(\%)$
hbot0h	61.1 ± 0.8	66.8 ± 0.7	67.4± 0.8
hbot1i	59.4 ± 0.8	65.3 ± 0.7	63.2± 0.8
total	60.3 ± 0.6	66.0 ± 0.5	65.3± 0.6

Table 7: Analysis cuts efficiency.


CDF Run II Monte Carlo
Candidates per 10 MeV/c 2
Candidate Mass [GeV/c 2]
other

Systematic Uncertainties:

Effect	Syst. Unc. (%)	Source
B p_T spectrum	$+1.5$ / -1.5	CDF6614
XFT simulation	$+0.1$ / -0.1	CDF6692
ϕ^0 mass cut	$+1.0$ / -1.0	CDF6614
cut efficiencies	$+5.0$ / -5.0	CDF6614
B_s^0 lifetime	$+1.40$ / -1.40	CDF6692
D_s^+ lifetime	$+0.30$ / -0.30	CDF6692
B^0 lifetime	$+0.40$ / -0.40	CDF6692
D^+ lifetime	$+0.04$ / -0.04	CDF6692
B_s^0 fitting	$+4.00$ / -5.00	CDF6614
B^0 fitting	$+4.60$ / -3.80	CDF6614
Total	$+8.1$ / -8.4	—

$$\frac{f_s}{f_d} \cdot \frac{Br(B_s^0 \to D_s^- \pi^+)}{Br(B^0 \to D^- \pi^+)} = 0.35 \pm 0.05(stat)$$
$$\pm 0.03(syst) \pm 0.09(BR)$$
$$\frac{Br(B_s^0 \to D_s^- \pi^+)}{Br(B^0 \to D^- \pi^+)} = 1.4 \pm 0.2(stat)$$
$$\pm 0.1(syst) \pm 0.4(BR) \pm 0.2(PR)$$

Comment:

The result assumes that the value of the Peterson fragmentation parameter ϵ_B is the same for B_s^0 and B^0 mesons.