# Global Fit for BF and FF in B->Dlnu decay

Current status

# Motivation

- B -> Dlnu Branching Fraction (BF)/Branching Ratio (BR) problems :
  - B0 -> D*- l nu problem : a lot of variation
    - 0.0459 +- 0.0063 (BELLE 2002)
    - 0.0490 +- 0.0042 (Babar 2005)
    - 0.0590 +- 0.0072 (DELPHI 2004)
    - 0.0609 +- 0.0059 (CLEO2 2003)
  - Inclusive and exclusive discrepancy
    - Inclusive B0 -> Xc l nu : 0.103 +- 0.008 (PDG)
    - Exclusive B0 ->D- l nu : 0.0213 +- 0.0018
      ->D*- I nu : 0.0520 +- 0.0024
      -> Others are small <0.01
    - Does not add up to inclusive BR
- Form Factor (FF) parameters
  - B -> Dlnu FF is not well measured.

# Method

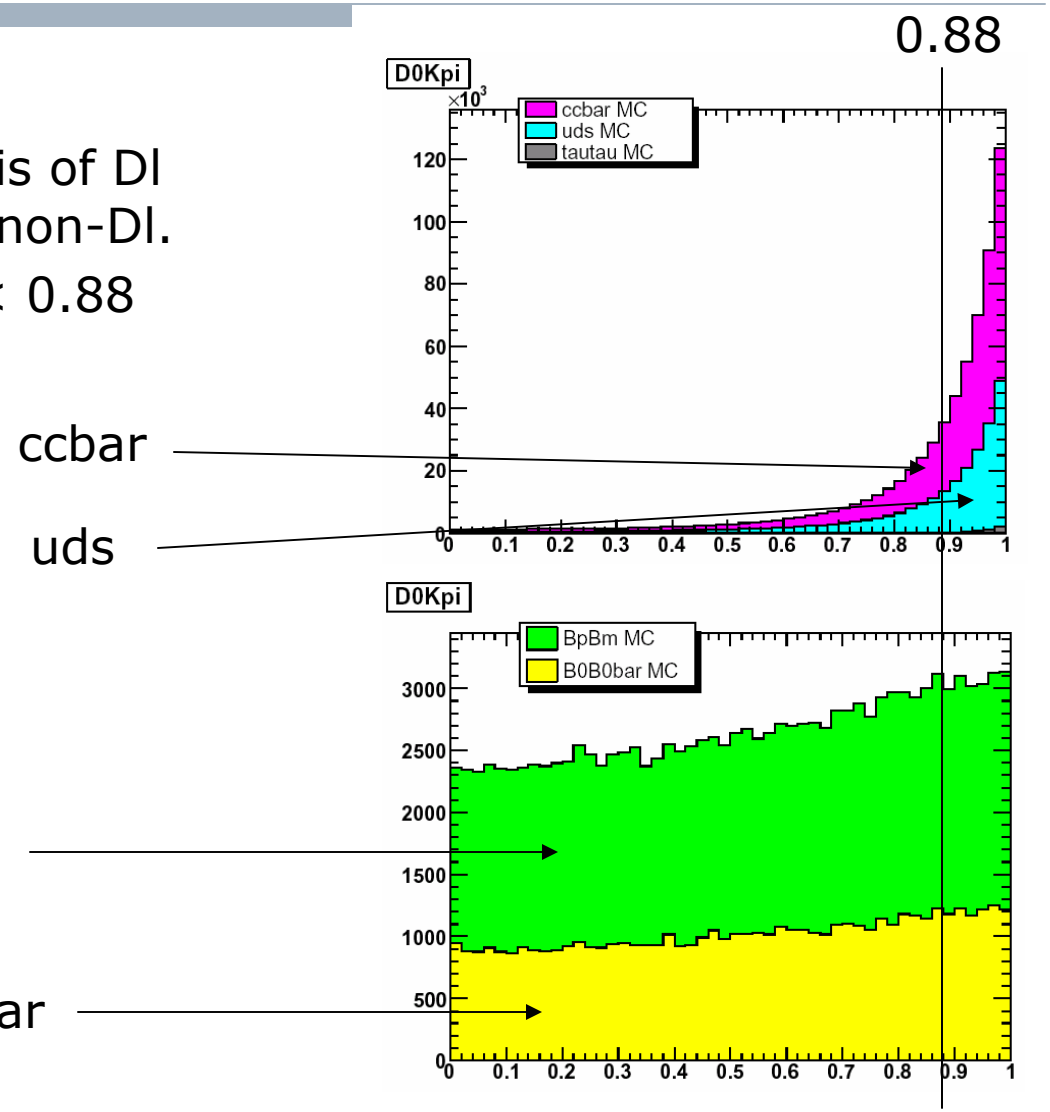
- Reconstruct only D0 l and D+ l
- Fit to BToDlnu events to determine BFs of all B->Dlnu decay modes at once.
- Using 3-D fit by D momentum, Lepton momentum and cosThetaBY.
- Do not have to reconstruct D*/D** explicitly.
  - D* and D** feed down to D0 or D+.
  - All B->Xc decay modes are covered by looking at D0 and D+. (Well, B->Ds is quite small)
  - Do not have to worry about slow Pi or Pi0 reconstruction.
- Can be sensitive to FF parameters.
- D+ have never been used in this kind of global fitting analysis.

# Event Selection (1)

- BToDlnu skim
  - Select events including B->D/D*lnu candidates.
- Bhabha veto
  - Reject radiative Bhabha events.
- kaon selection
  - In reconstruction of D0, there was no kaon selection.
  - I applied a KMicroNotPionGTL.
- Vertexing (TreeFitter)
  - D vertexing and B vertexing
  - Cut in both vertexing : probab > 0.01
- Use only D0->KPi and D+->KPiPi modes.

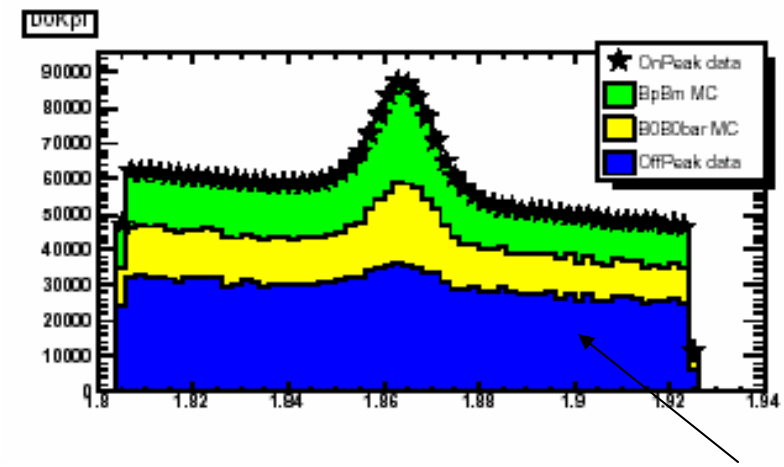
# Event Selection (2)

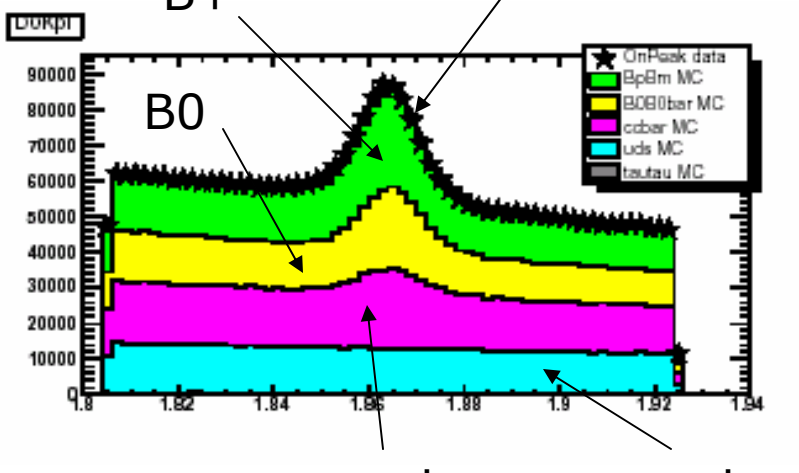
- Thrust cut
  - Use the thrust axis of Dl candidate and of non-Dl.
  - |cos(Dl-nonDl)| < 0.88



# D Mass Plot (after Bhabha veto)

D0 mass (KPi mode)



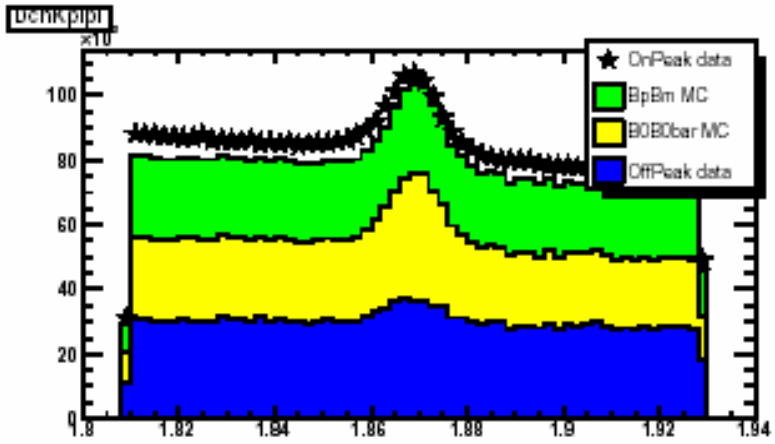



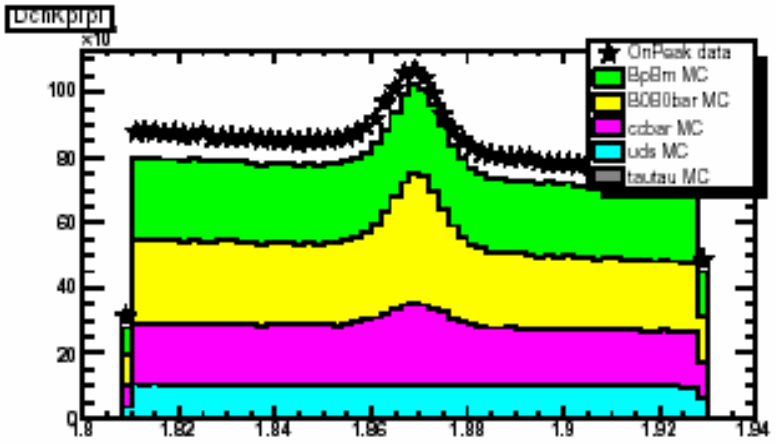

Off Peak

ccbar

uds

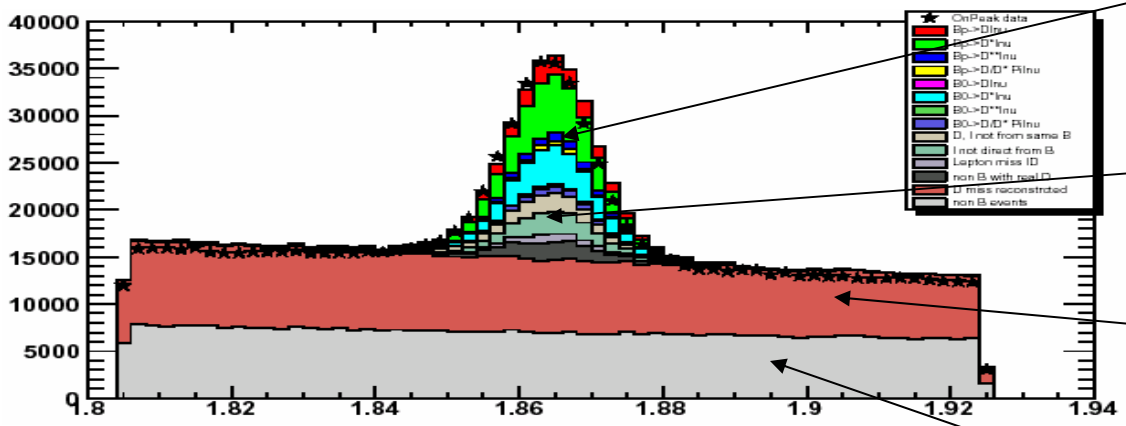
D+ mass (KPiPi mode)



# D mass plot after all selection

D0 mass (KPi mode)



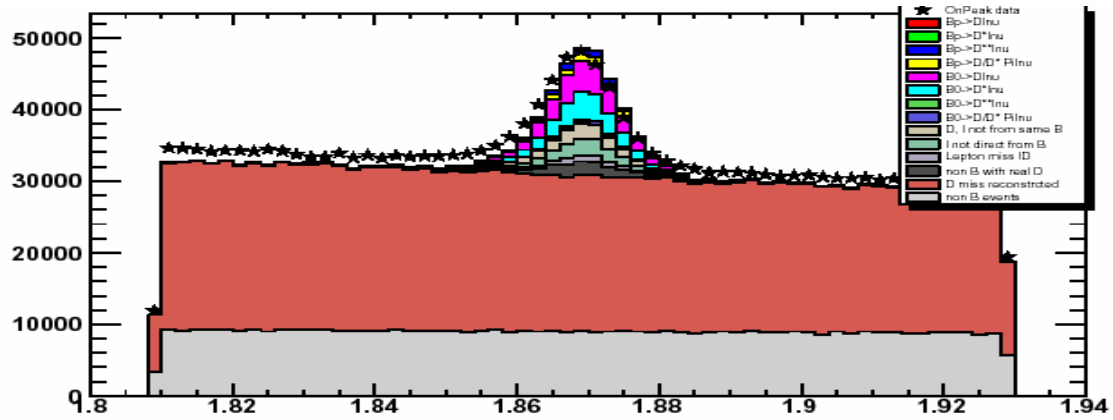

Signals

Peaking backgrounds from B and D

Combinatorial background from B

Continuum background from ccbar, uds and tau

D+ mass (KPiPi mode)




Do sideband subtraction to remove combinatorial and continuum background

# After sideband subtraction

Lepton momentum
for D0Kpi mode

Signals

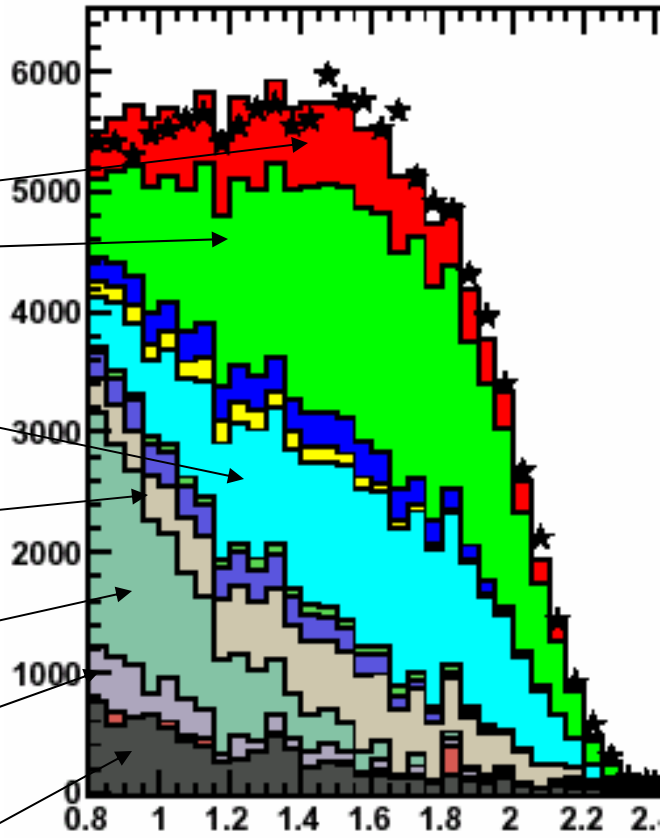
Background

D and l not from same B

Lepton not direct from B
(b -> c -> l)

Lepton miss ID

ccbar with real D



# Binning for 3D fit

- Lepton momentum bin (5 bins):
  - 1.0, 1.4, 1.6, 1.8, 2.0, 2.4 GeV
- D momentum bin (5 bins):
  - 0.5, 0.9, 1.3, 1.7, 2.1, 2.5 GeV
- cosBY bin (5 bins):
  - -10, -2.5, -1.1, 0.0, 1.1, 5
- Total 125 bins

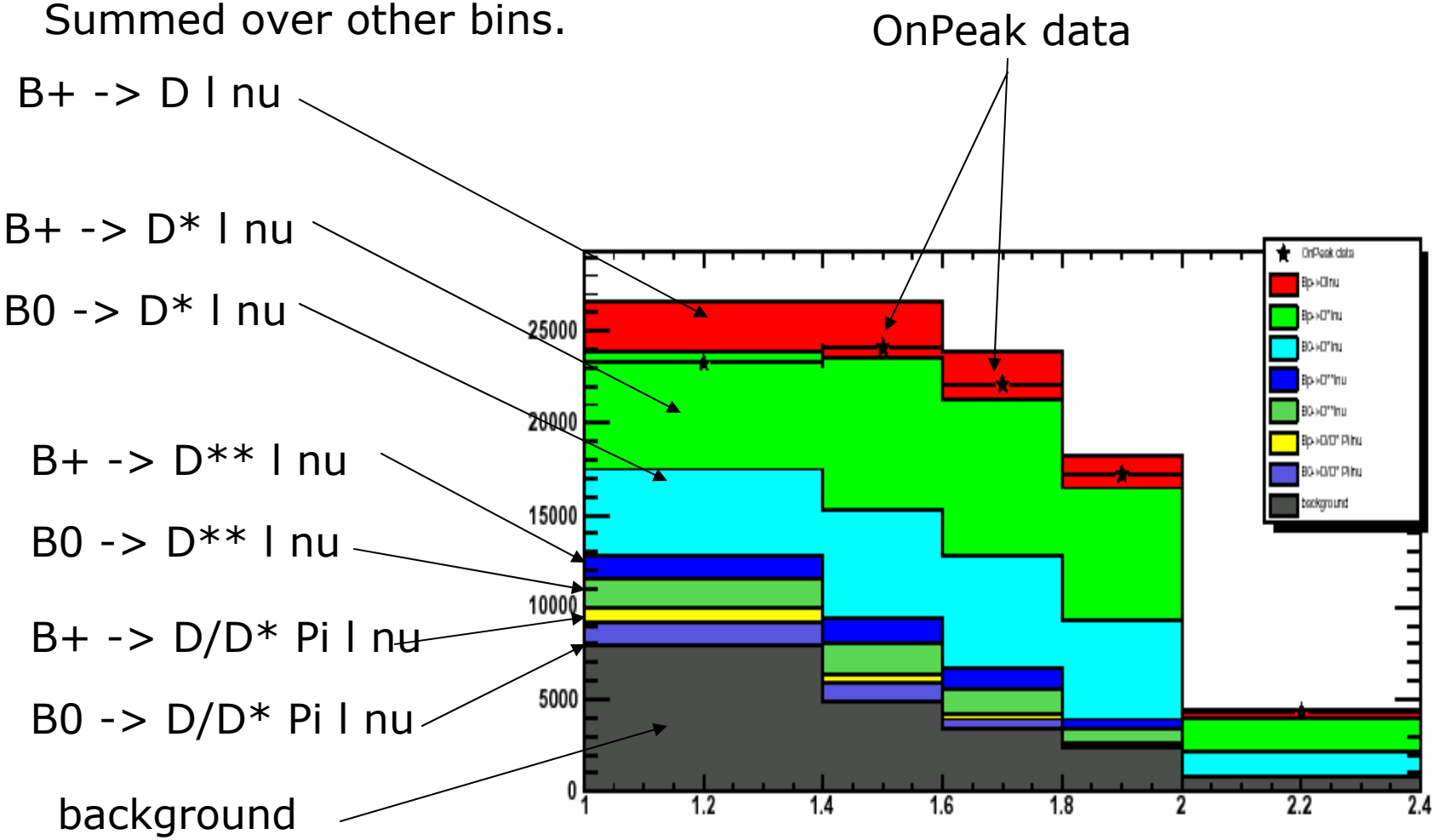
- Run 3 data (30.6 fb-1)

  and MC (~100 fb-1 of BBbar and ~50 fb-1 of others)

  was used.

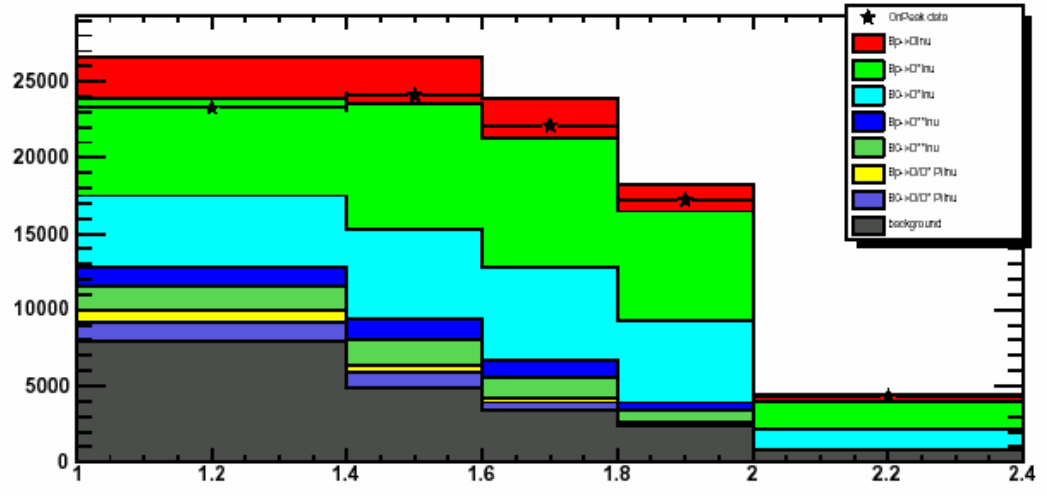
# Lepton momentum (D0 -> KPi)

D mass sideband subtracted.
Summed over other bins.

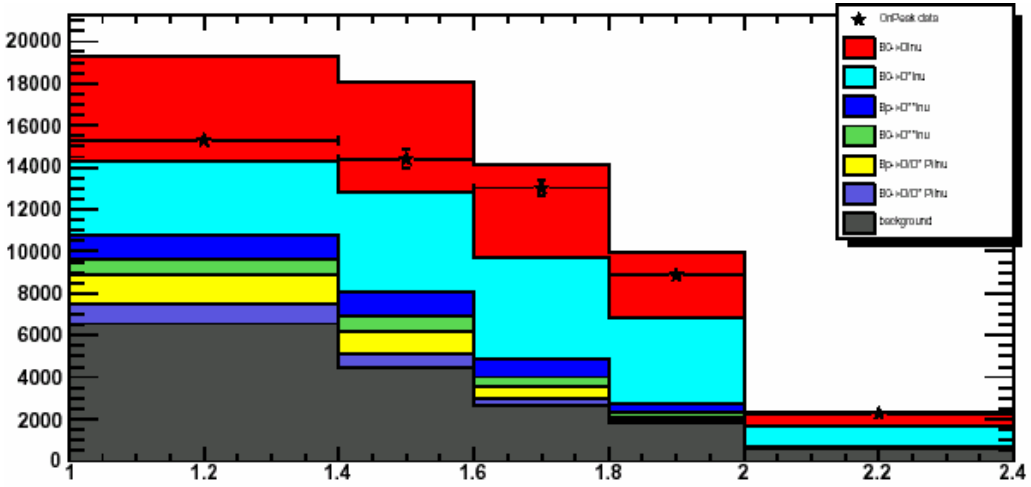


# Lepton Momentum

D0

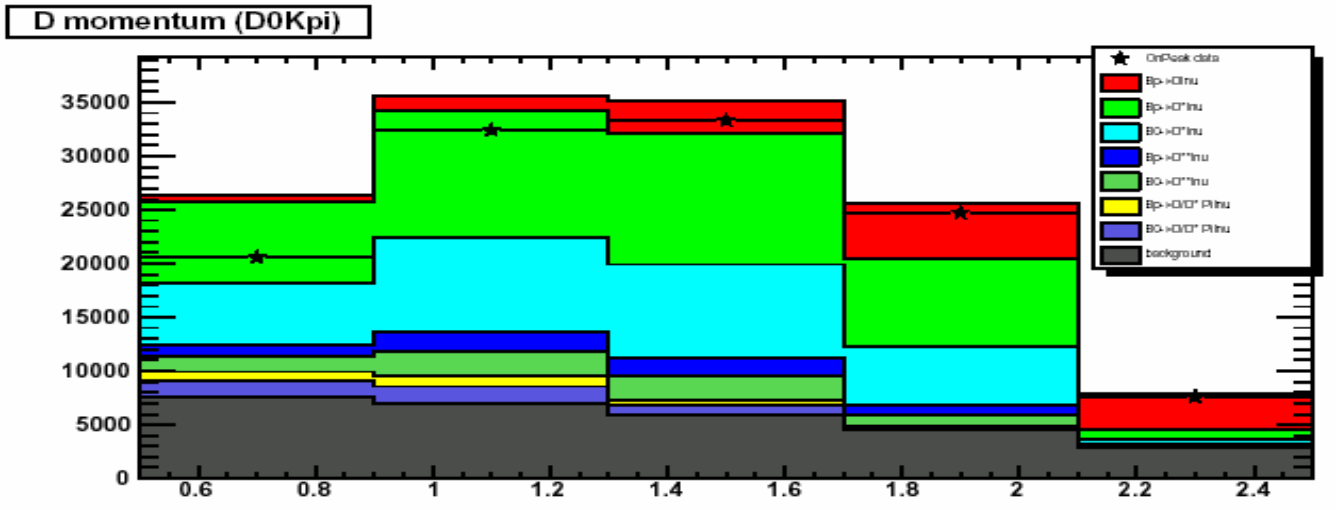



D+

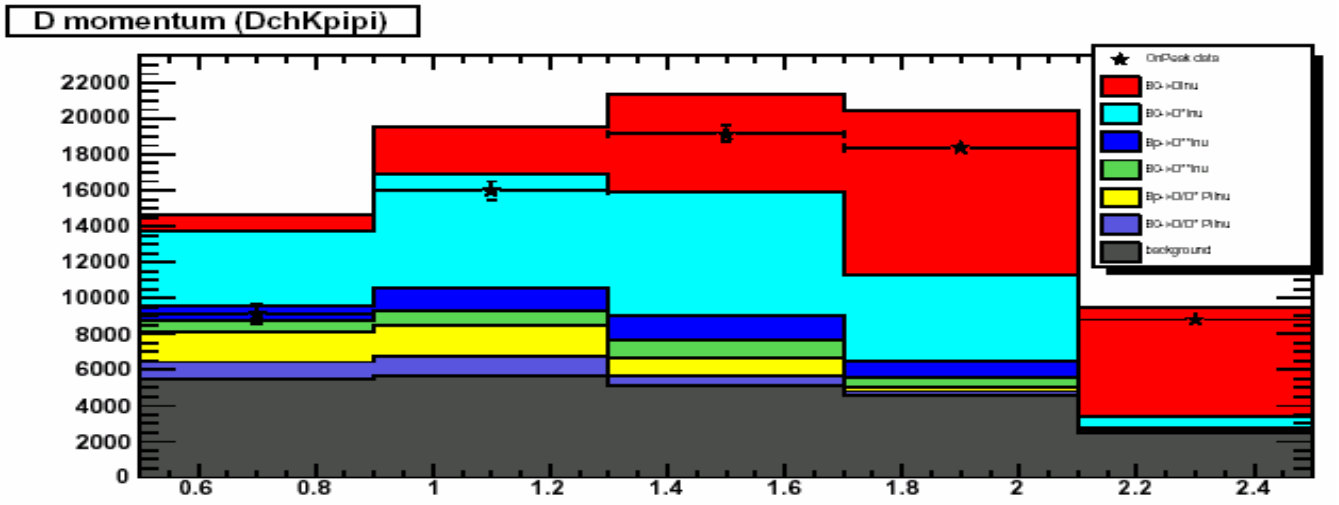


# D momentum

D0

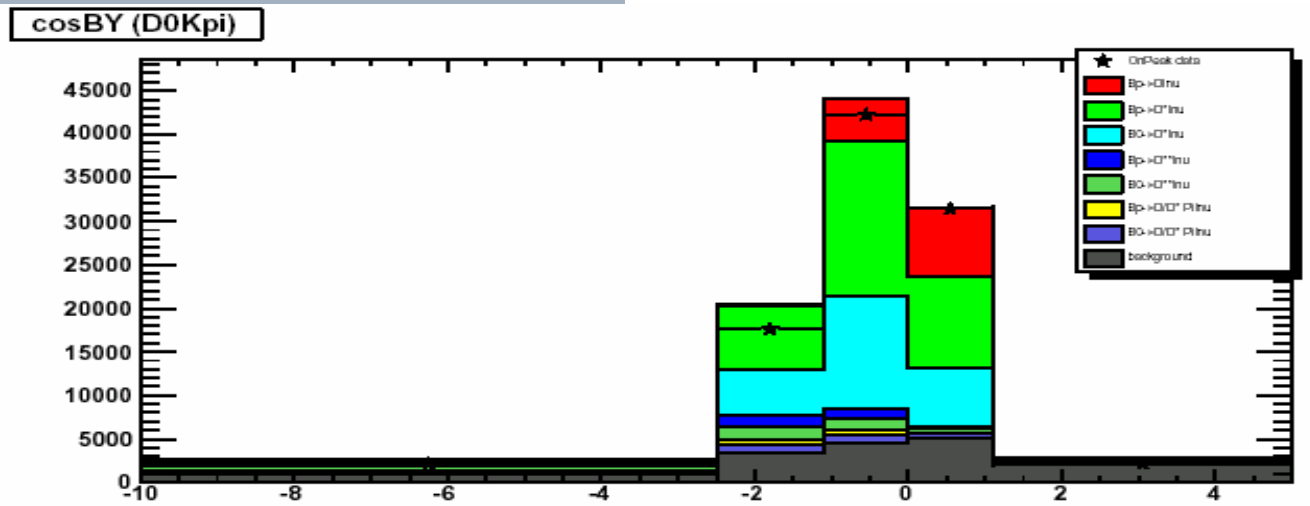



D+

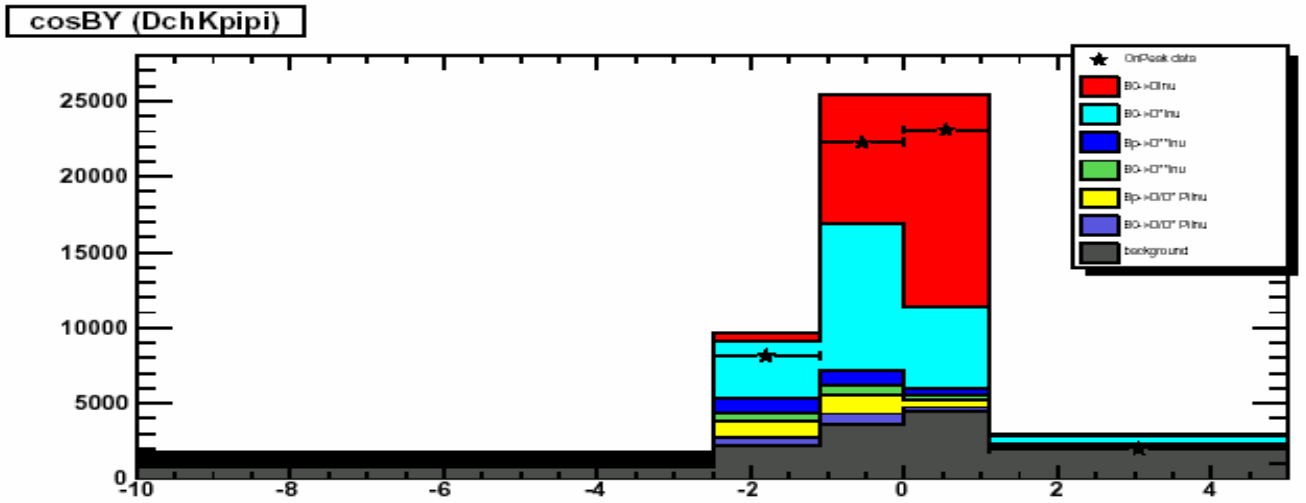


# cosThetaBY (Y=Dl)

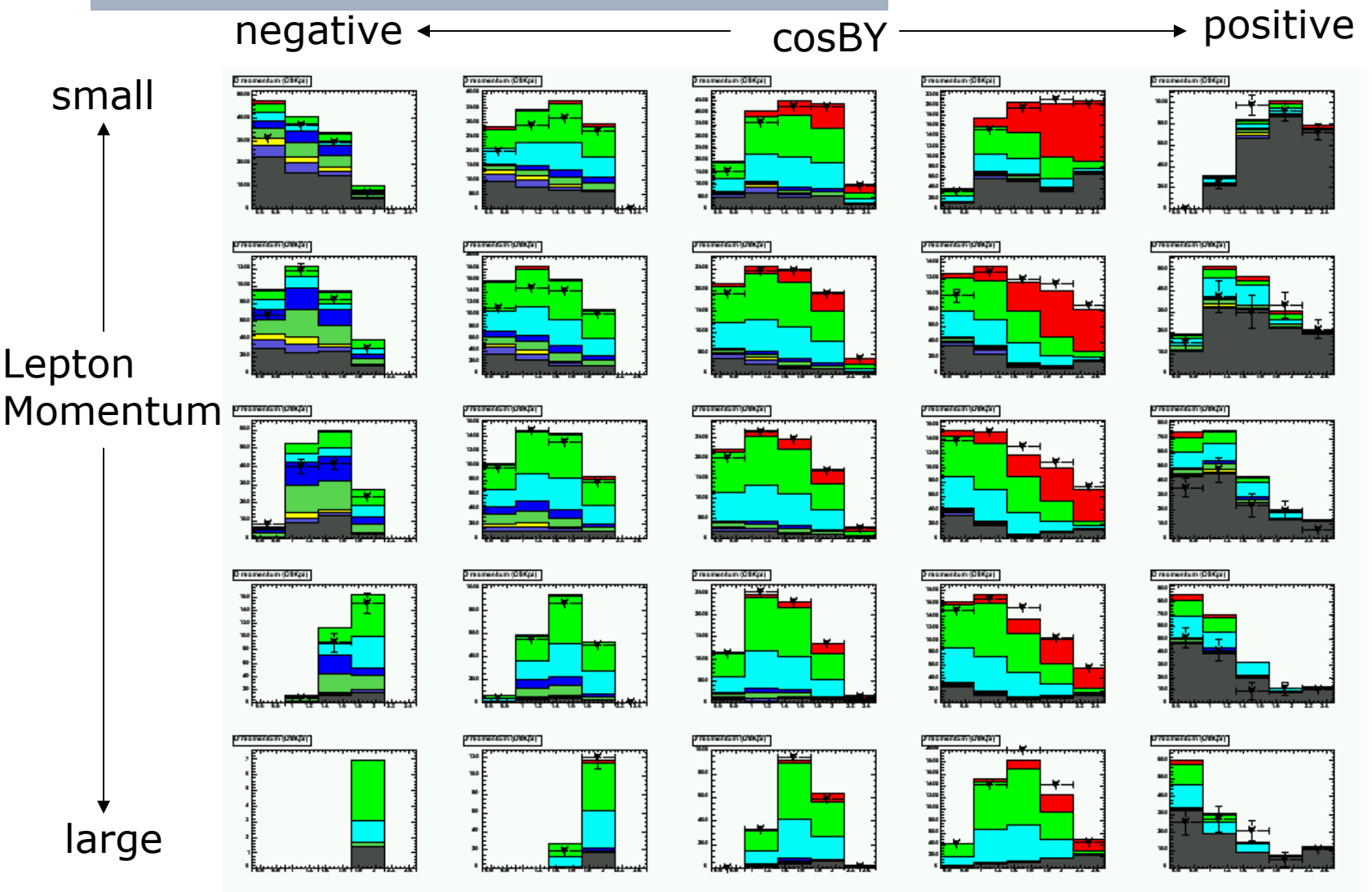
D0




D+



# D0 momentum – bin by bin



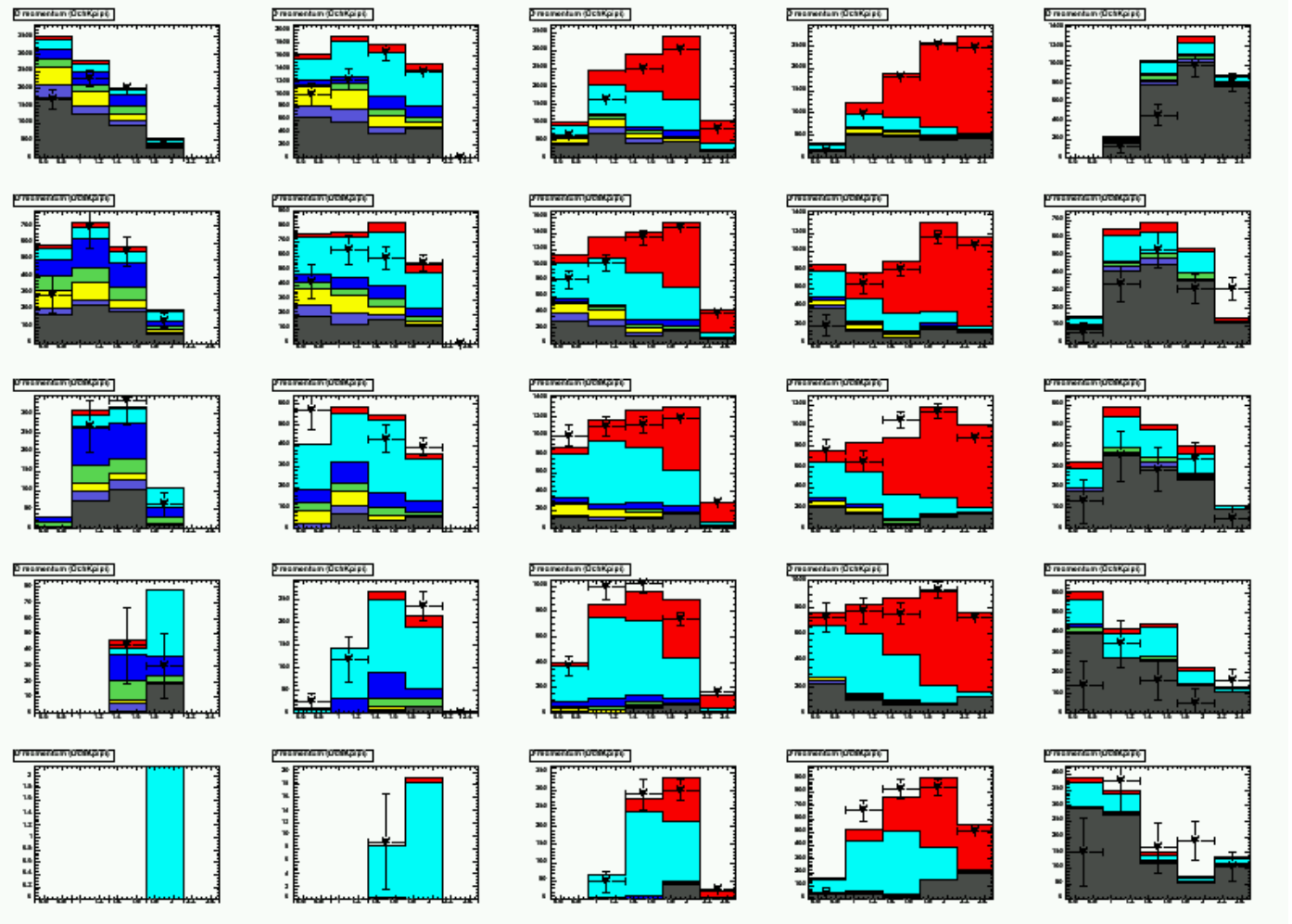
# D+ momentum – bin by bin

negative ← cosBY → positive

small

Lepton Momentum

large



# Sensitivity to BF

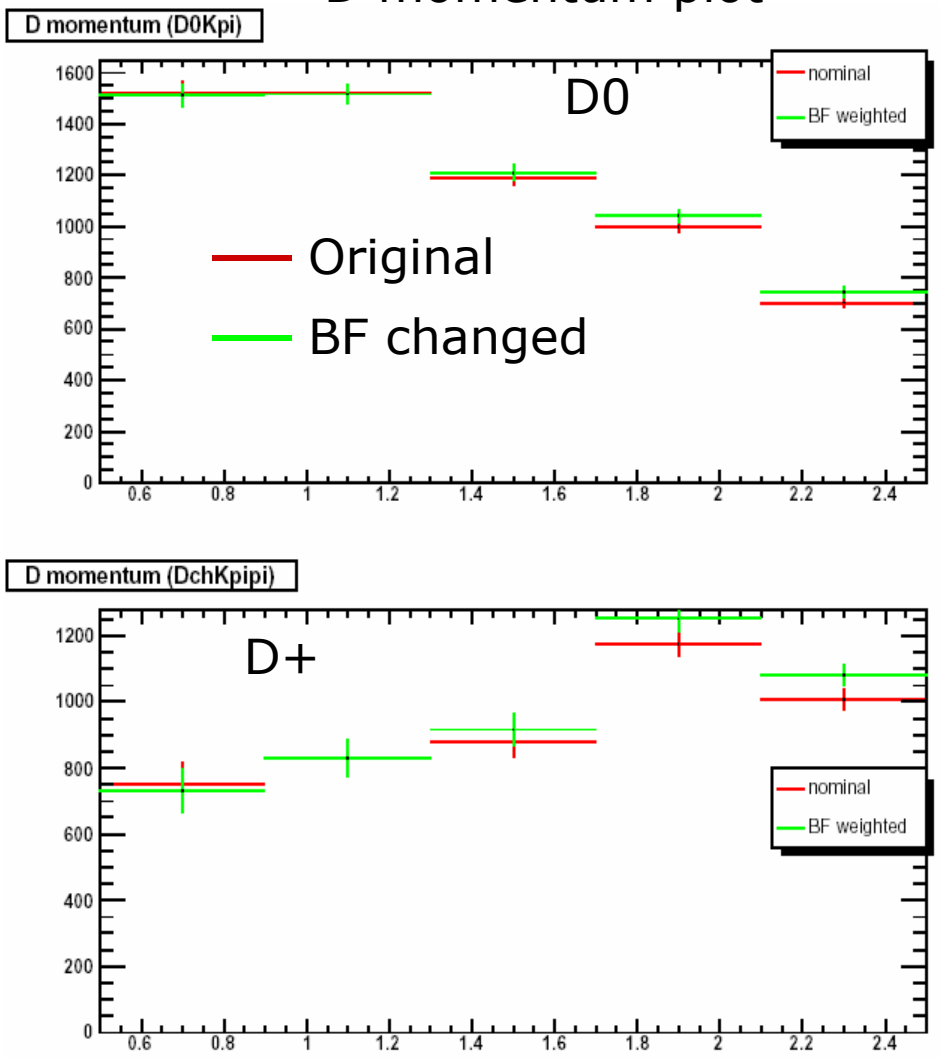
- Increase BF of B->Dlnu

  by 10 %
- Decrease other BF to get same number of total events
- Change is visible

  ~1 sigma

1.6 < Lep mom < 1.8
-1.1 < cosBY < 0

D momentum plot



# Next steps

- Apply D* FF parameters to MC.
- Reconsider
  - Binning
  - Variables to use : cosBY -> cosDl ?
  - We do not want 0 entry bins
- Perform fit to data.
  - Binned chi-square fit ?
- Try to extract BFs of
  - B -> D l nu
  - B -> D* l nu
  - B -> D** l nu
- And the slope of D FF ?