B^0 Spectrum in Monte Carlo

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Simulation Meeting
2/26/04

B^0 P_T Spectrum

Reconstruct exclusive decay:

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

http://www-cdf.fnal.gov/internal/WebTalks/0402/040203_bgroup_montecarlo.html

Generate Monte Carlo sample and compare P_T spectra with data.

Bgenerator (single B)

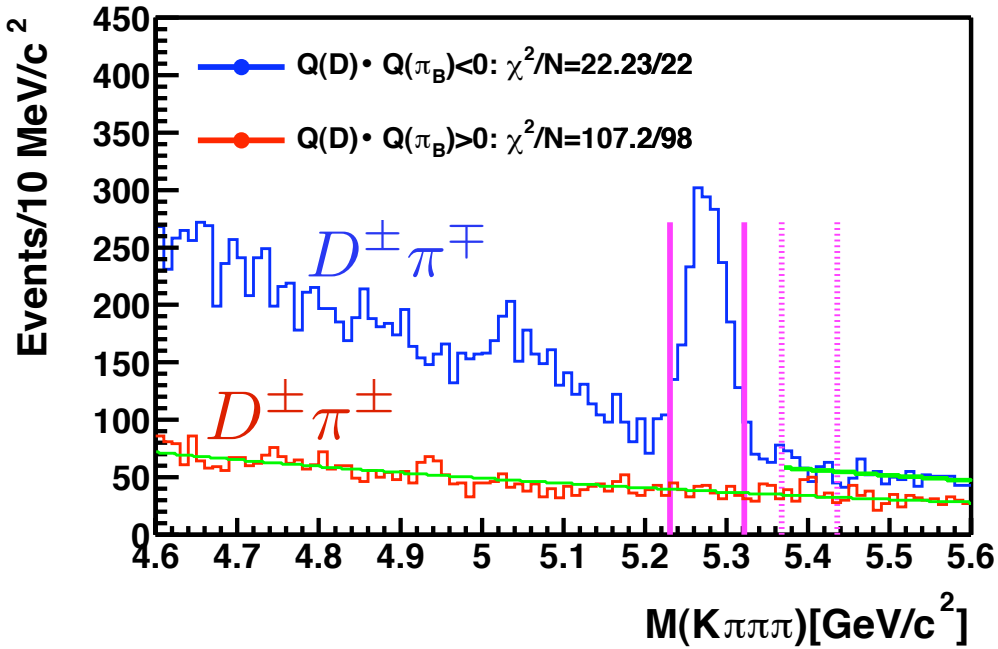
- NDE default (1)
- P_T(min) b-quark > 4 GeV/c
- $|\eta|$ < 2.5 (b-quark)

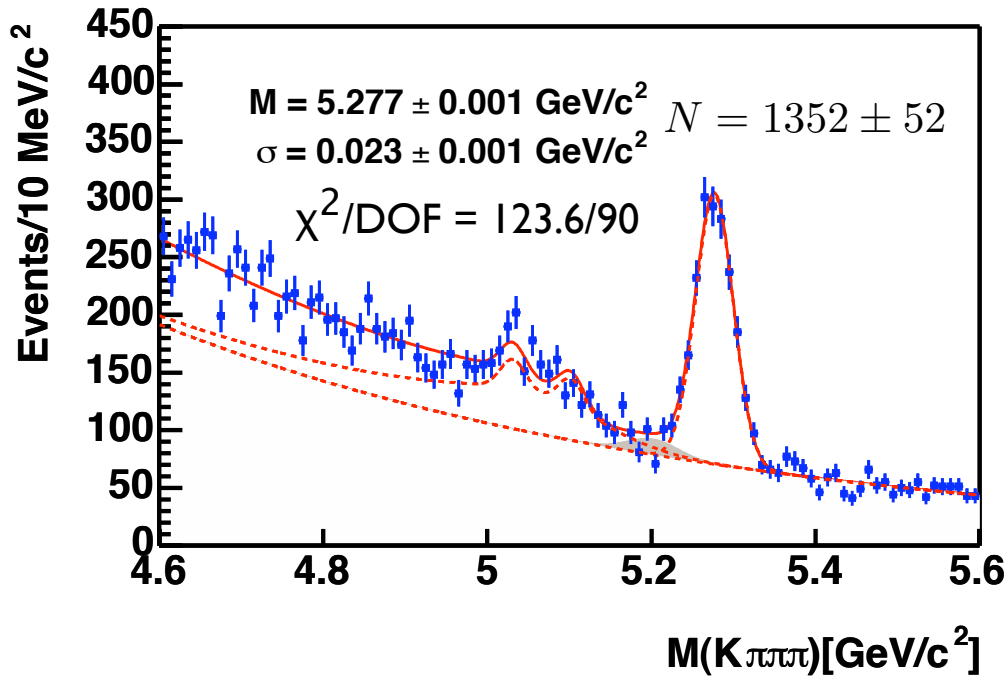
PYTHIA (MIT .tcl)

- msel=5
- cmEnergy 1960

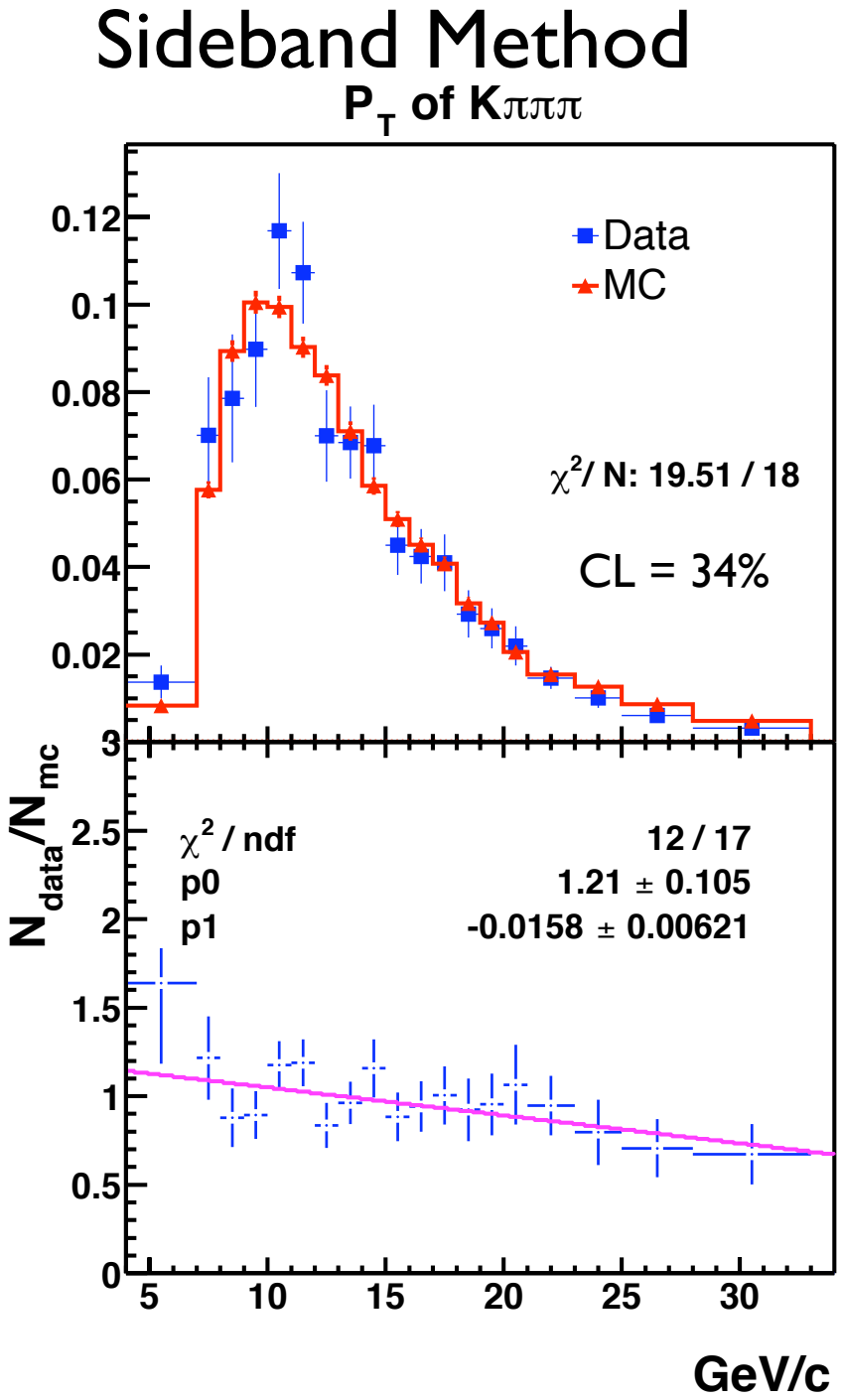
Pt Spectrum from 2 Methods

1. P_T(signal) - P_T(same sign)
   - O.S. signal
   - S.S. background
   - scale S.S. to match sidebands
2. N(signal) in P_T bin from fit
   - Template fit in P_T bins

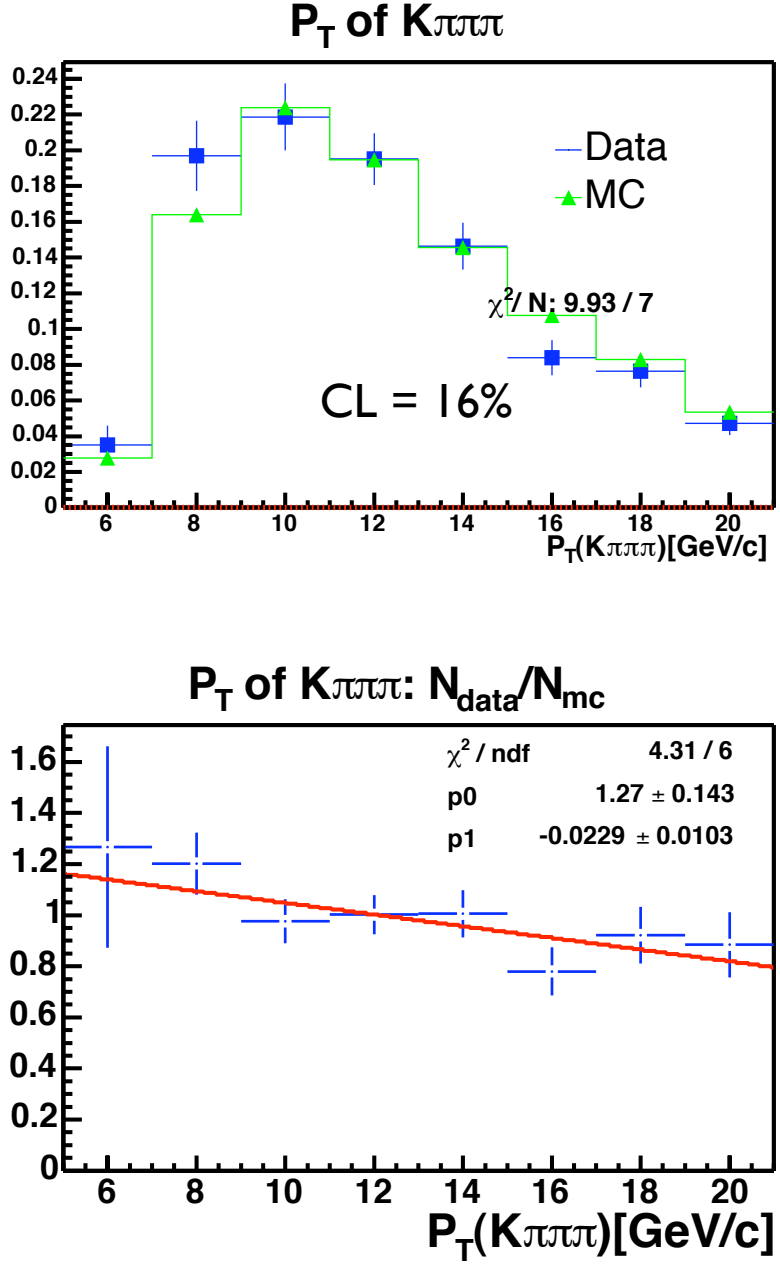




Sideband Method

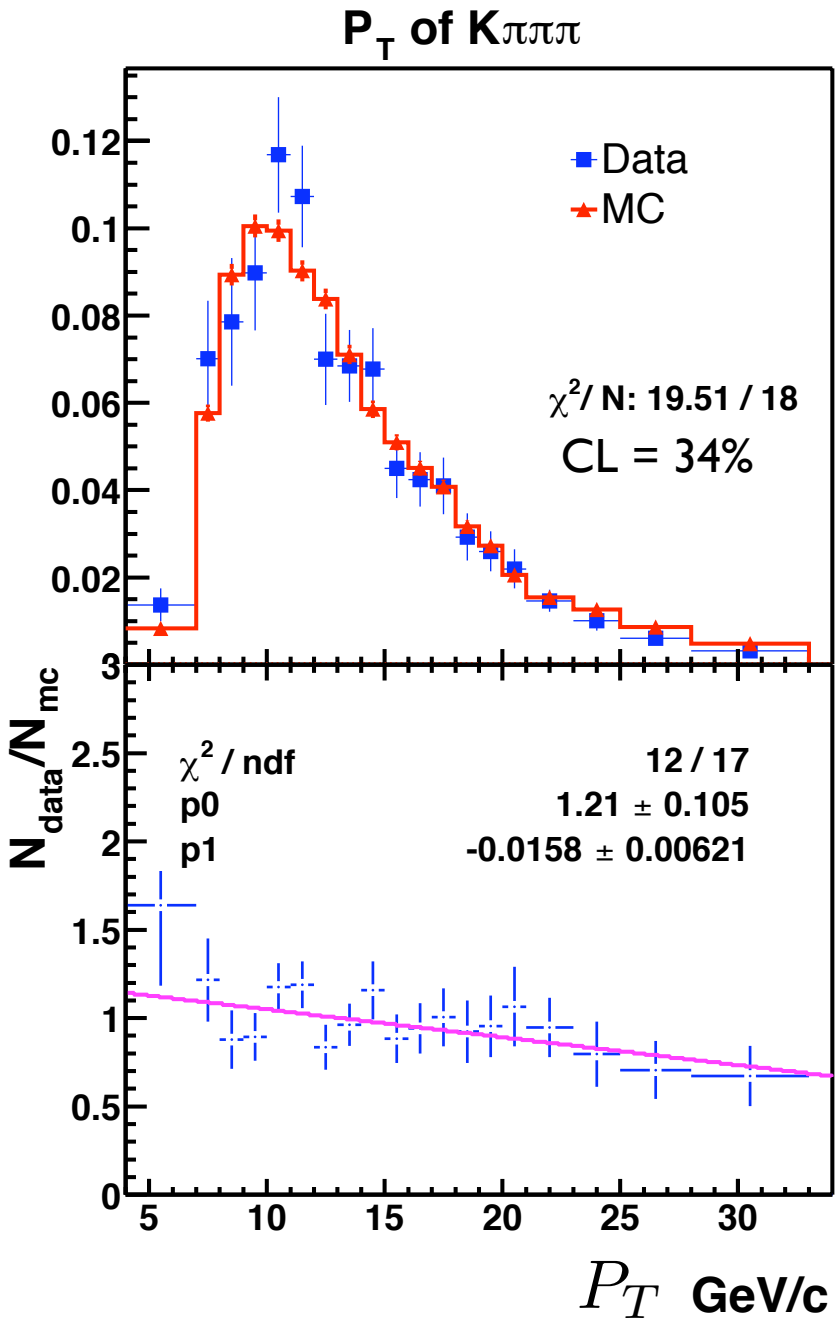


Fit Method

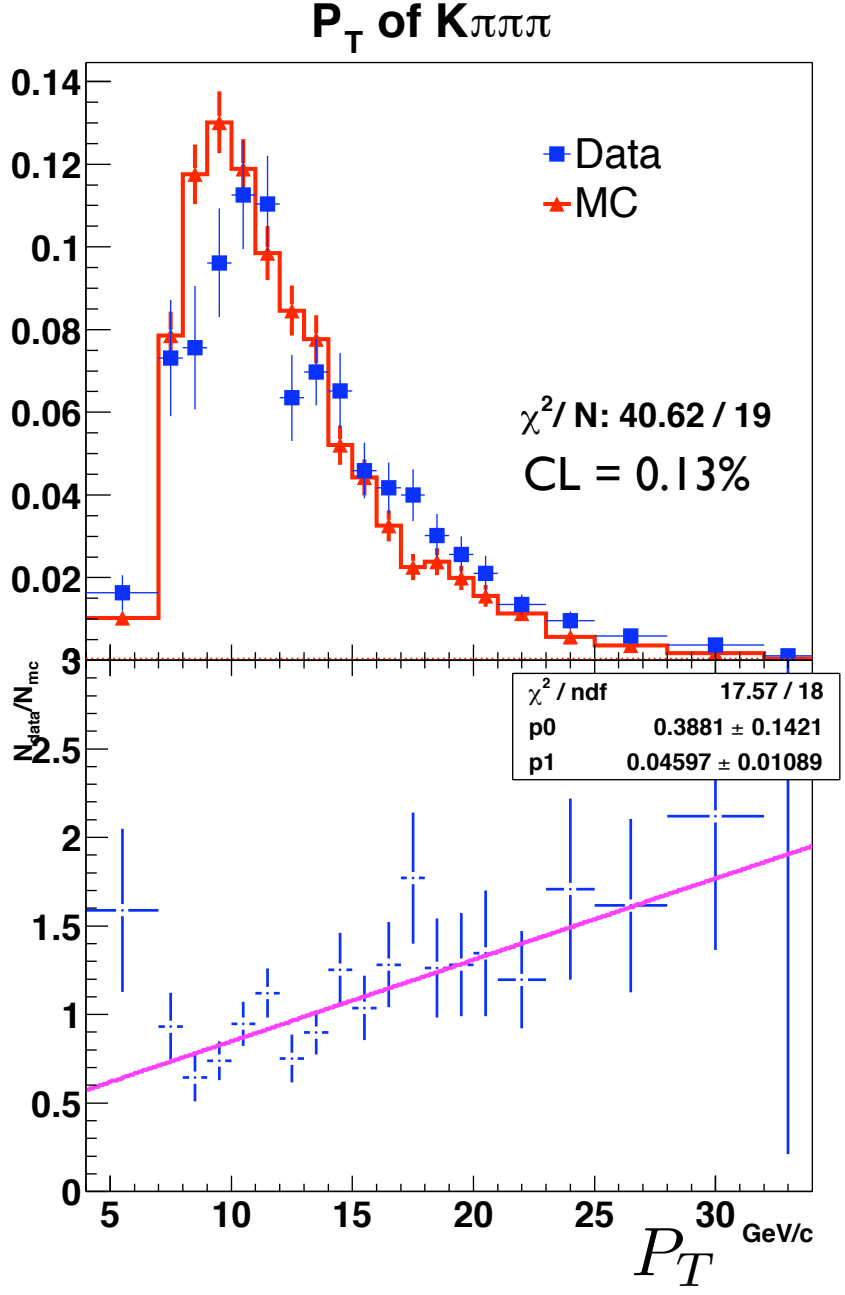


Methods yield consistent results => 2.2σ slope

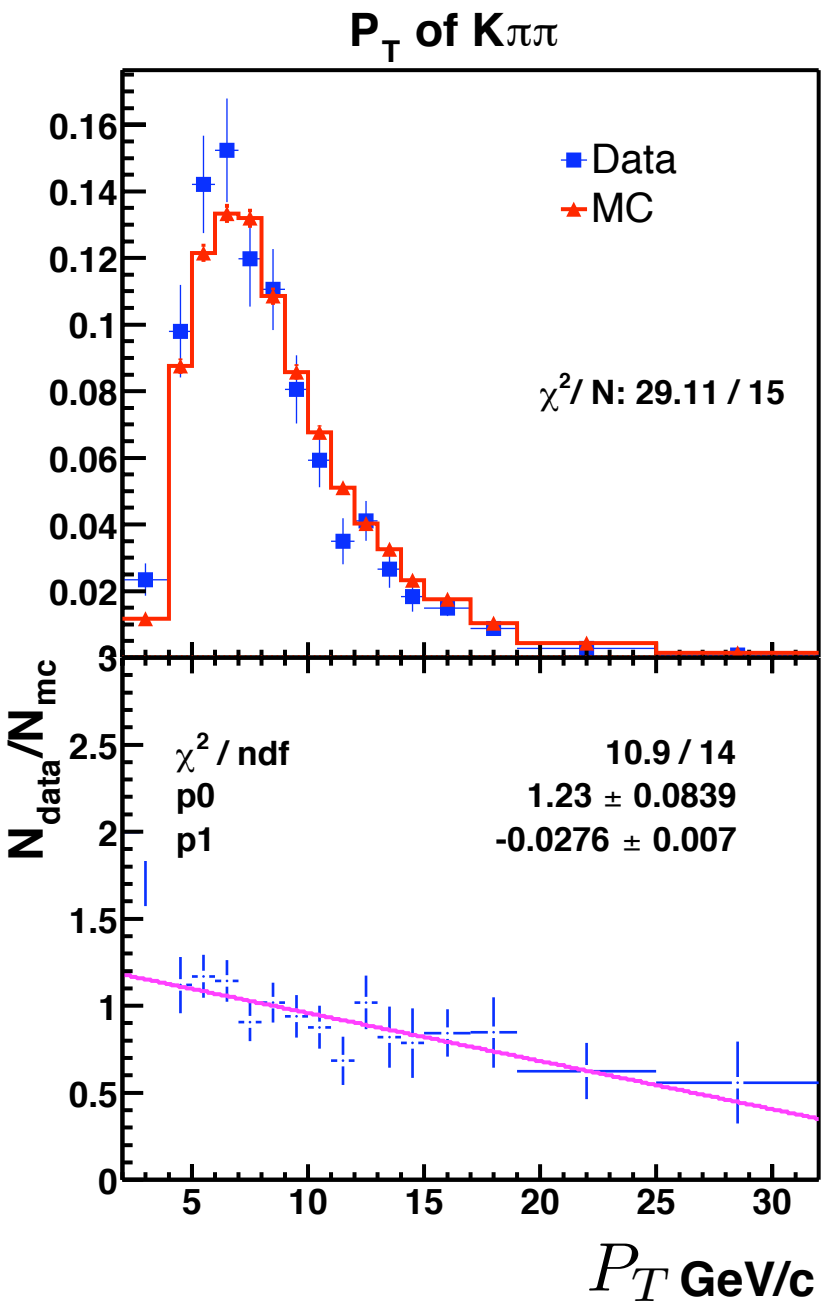
Bgenerator



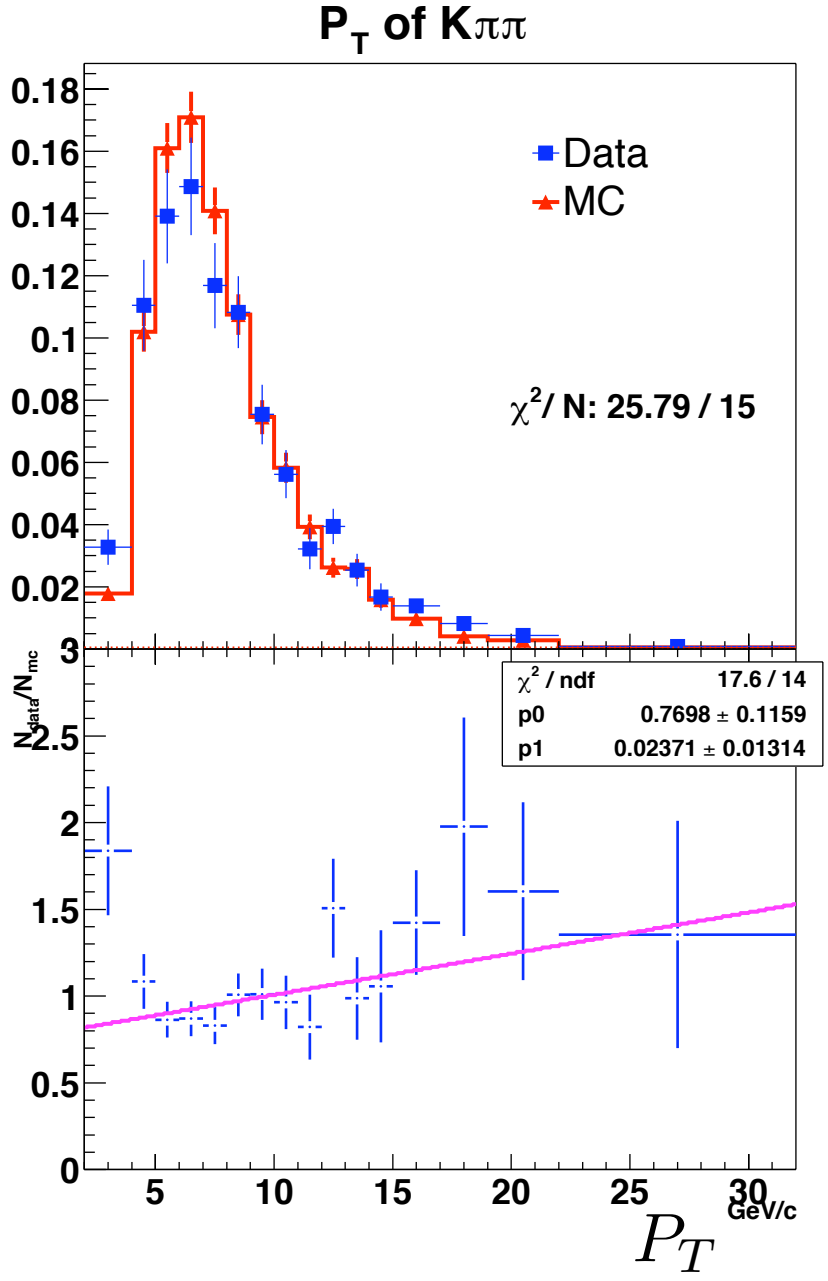
PYTHIA



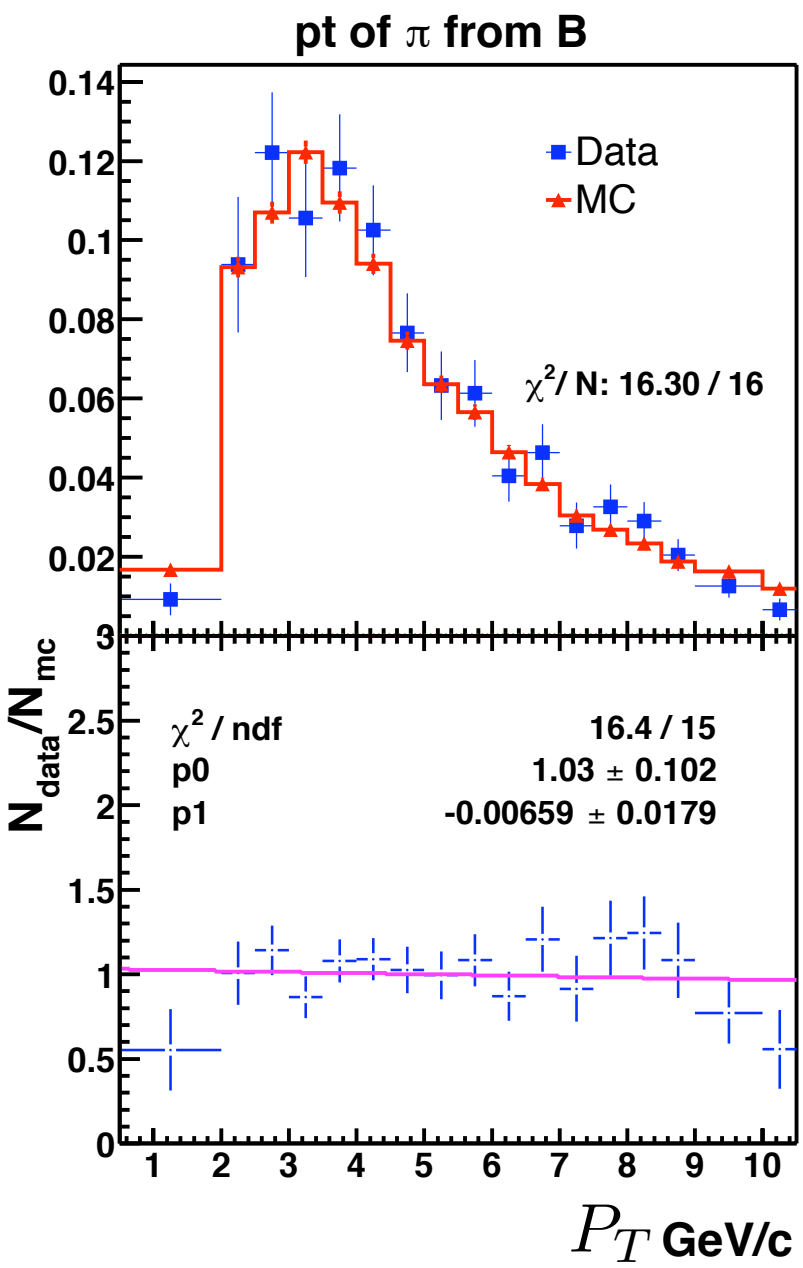
Bgenerator



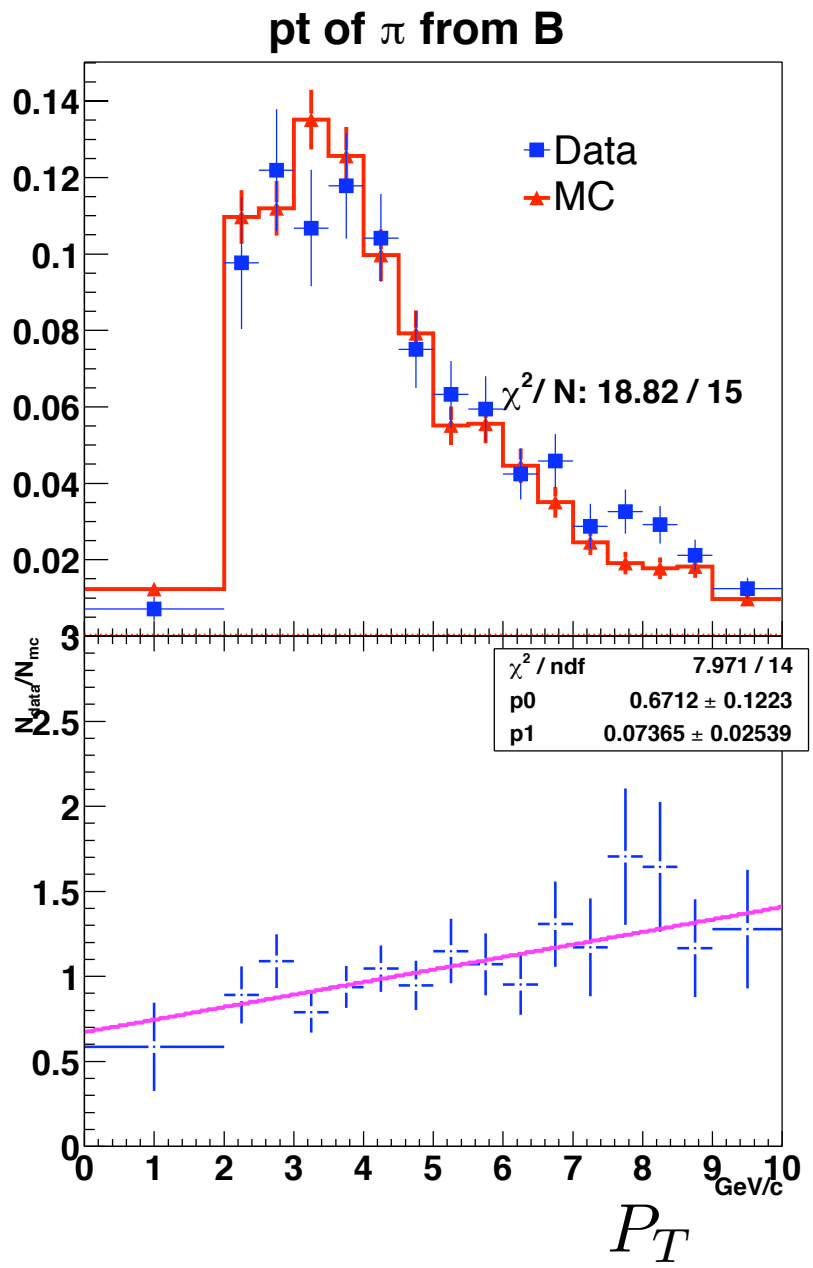
PYTHIA



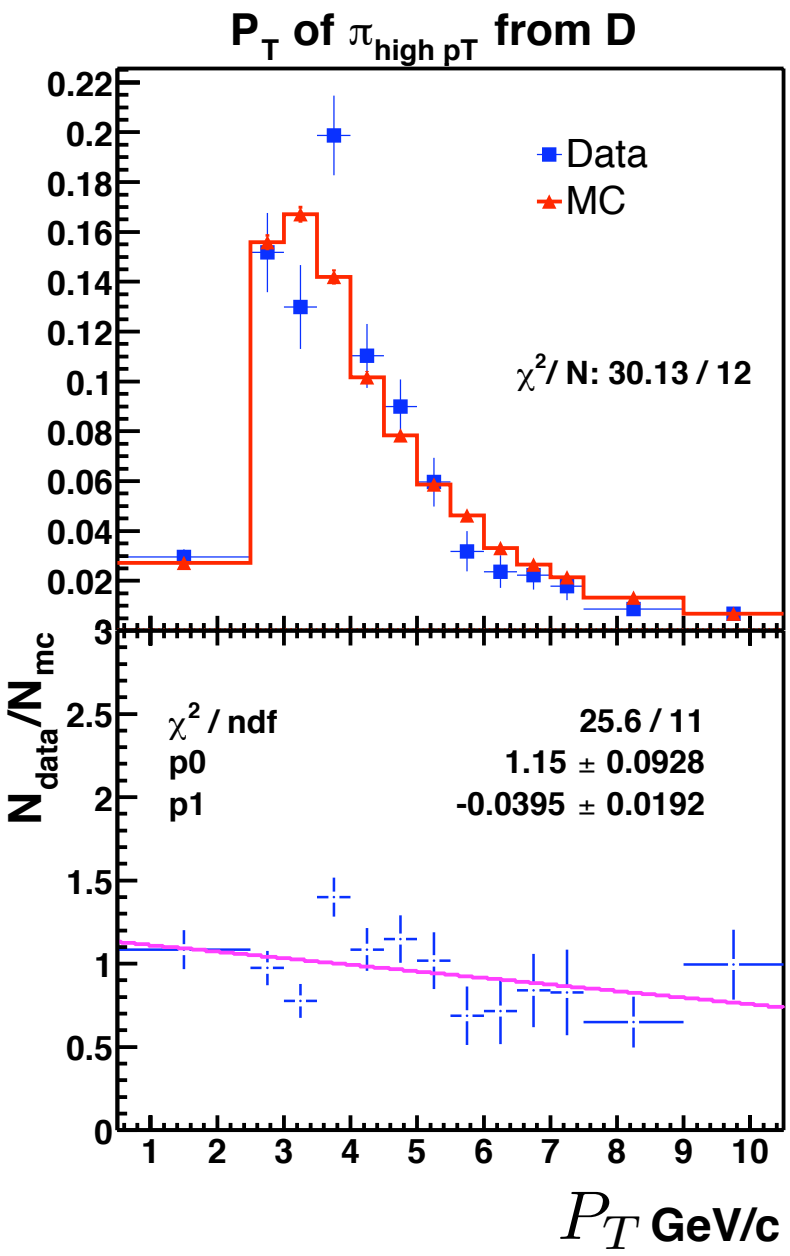
Bgenerator



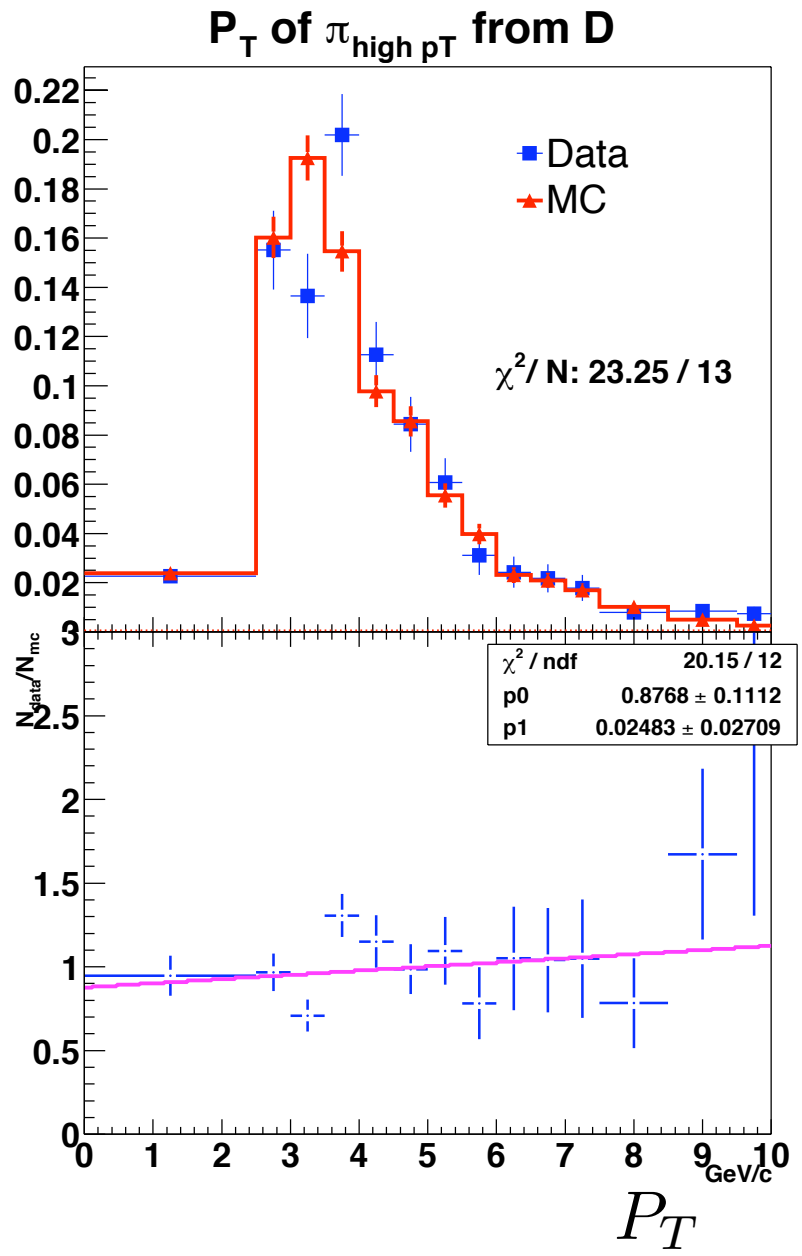
PYTHIA



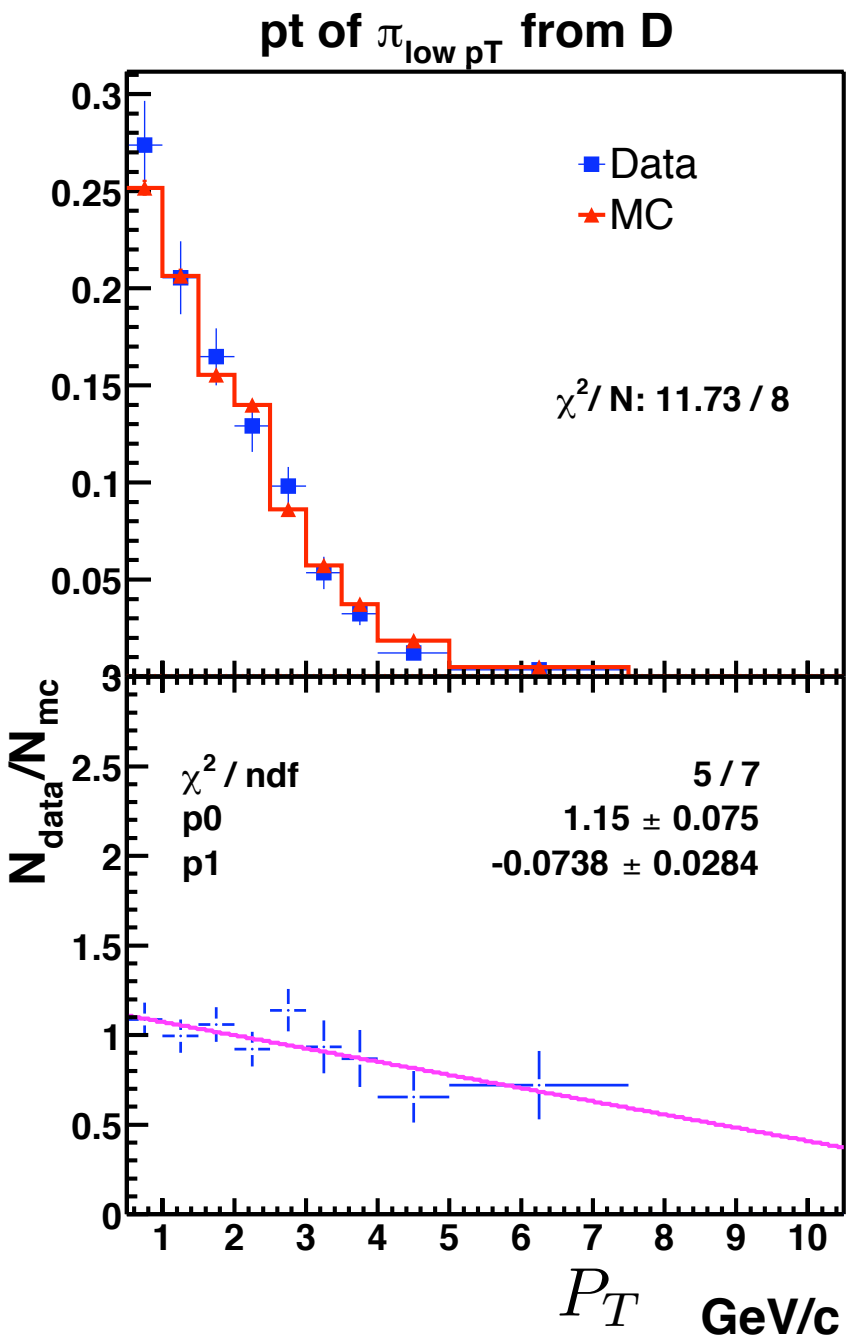
Bgenerator



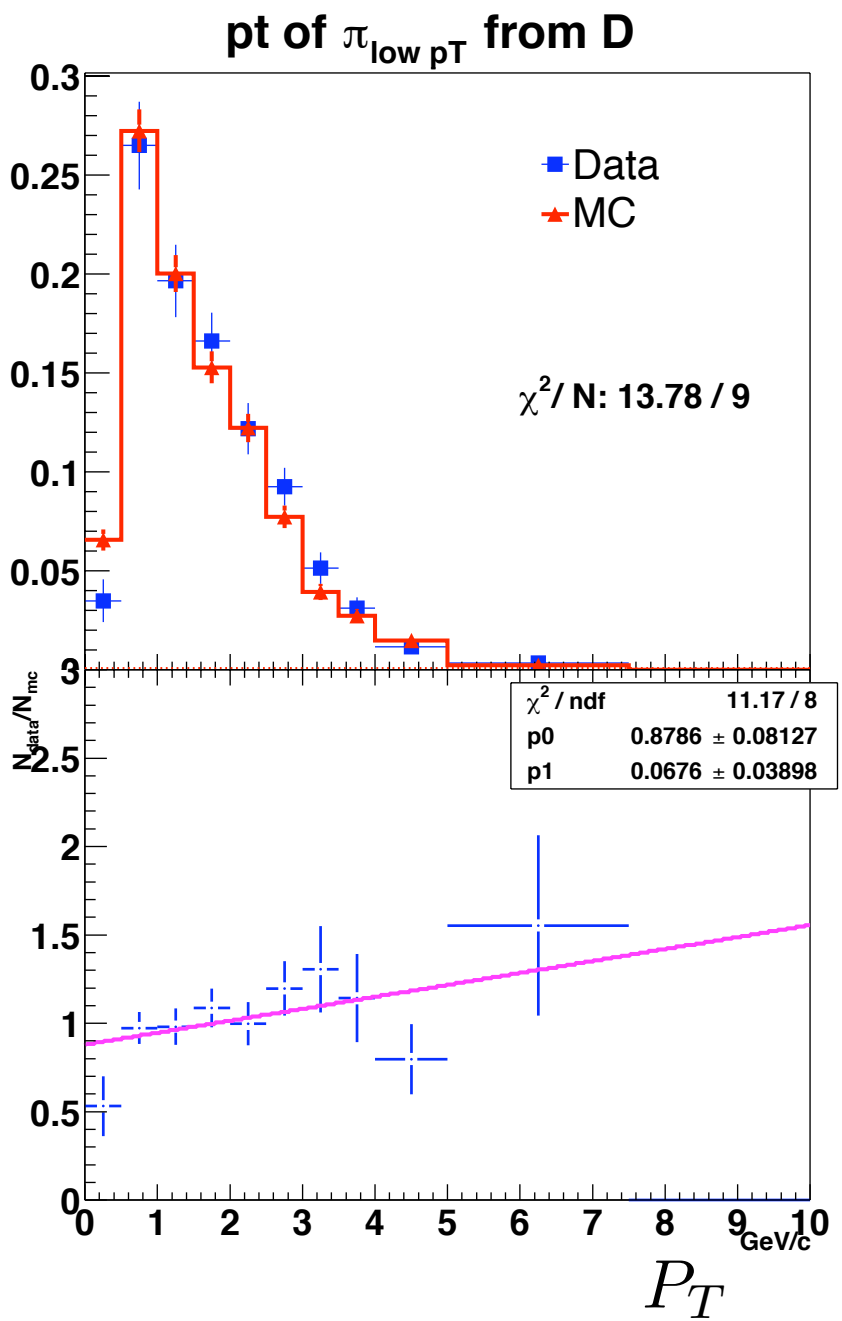
PYTHIA



Bgenerator



PYTHIA

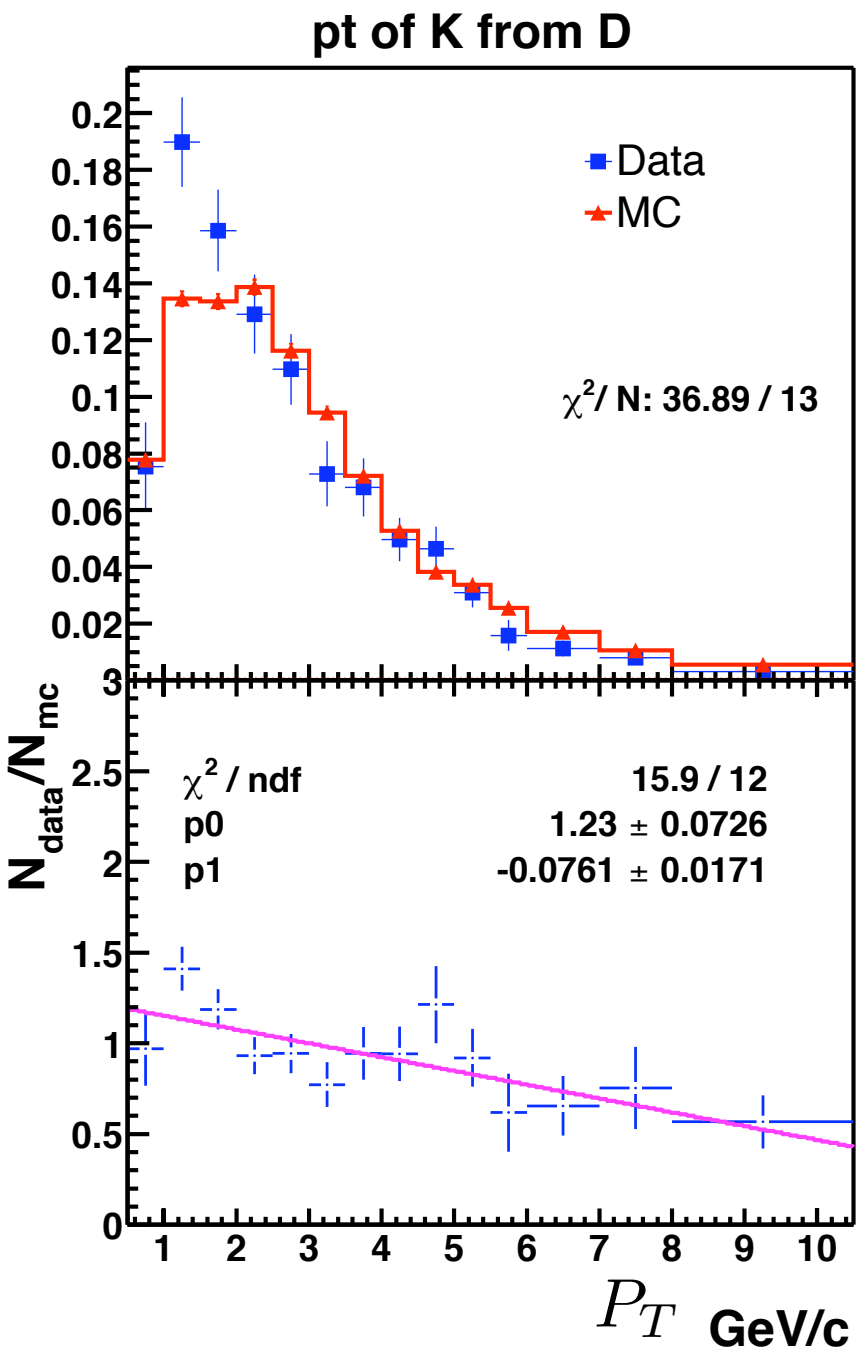


Summary

Shape of the B0 Pt spectrum in two MC generators disagrees with data.

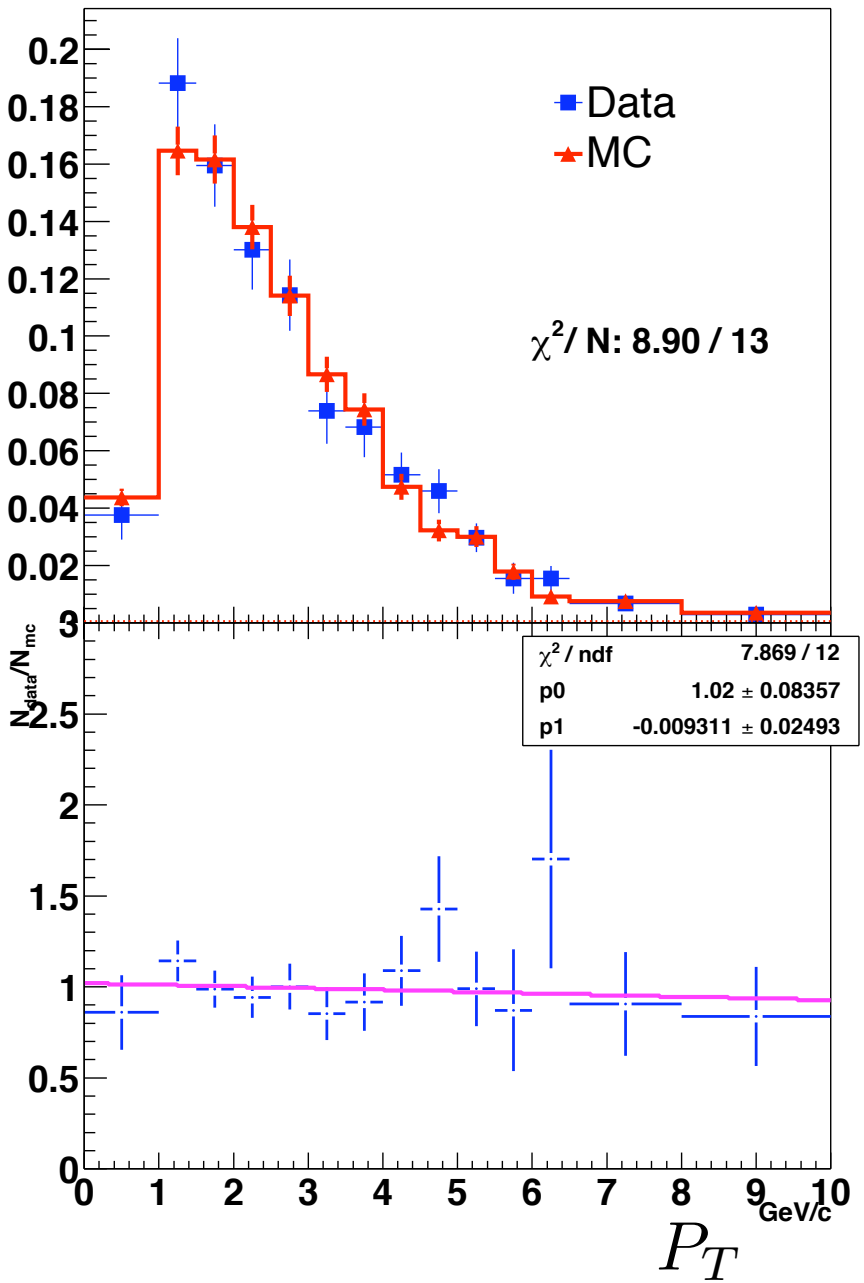
- Bgenerator:
  - 2.2 sigma effect (borderline)
  - size of effect reflected for D daughters
  -
- PYTHIA:
  - 4.4 sigma effect
  - effect in all B daughters

Bgenerator



PYTHIA

PT



pythia.tcl

```
module enable  Pythia
module talk    Pythia
  PythiaMenu
    #listFirst set 1
    #listLast  set 2
    cmEnergy  set 1960.
    msel      set 5
    commonMenu
      set_ckin -index=3 -value=5.
      set_ckin -index=4 -value=-1.
      #  Initial-State Radiation Max Scale Factor
      #  Old ISR setting with more initial-state radiation
      set_parp -index=67 -value=4.0
      #
      #  Underlying Event Parameters
      set_mstp -index=81 -value=1
      # Double Gaussian
      set_mstp -index=82 -value=4
      # MPI Cut-Off
      set_parp -index=82 -value=2.0
      #  Warm-Core: 50% of matter in radius 0.4
      set_parp -index=83 -value=0.5
      set_parp -index=84 -value=0.4
      # Almost Nearest Neighbor
      set_parp -index=85 -value=0.9
      set_parp -index=86 -value=0.95
      # Energy Dependence with E0=1.8 TeV
      # (do not vary this! - it is not beam E)
      set_parp -index=89 -value=1800.0
      set_parp -index=90 -value=0.25
      #set_mstp -index=51 -value=4046
      #set_mstp -index=52 -value=2
      set_mstp -index=51 -value=7
      set_mstp -index=52 -value=1
      set_parj -index=13 -value=0.7625
      set_parj -index=14 -value=0.32
      set_parj -index=15 -value=0.033
      set_parj -index=16 -value=0.099
      set_parj -index=17 -value=0.165
      set_pmas -masscode=10513 -mass=5.76 -width=0.020 -maxdev=0.05
      set_pmas -masscode=10511 -mass=5.65 -width=0.050 -maxdev=0.10
      set_pmas -masscode=20513 -mass=5.65 -width=0.050 -maxdev=0.10
      set_pmas -masscode=515   -mass=5.77 -width=0.024 -maxdev=0.05
      set_pmas -masscode=10523 -mass=5.76 -width=0.020 -maxdev=0.05
      set_pmas -masscode=10521 -mass=5.65 -width=0.050 -maxdev=0.10
      set_pmas -masscode=20523 -mass=5.65 -width=0.050 -maxdev=0.10
      set_pmas -masscode=525   -mass=5.77 -width=0.024 -maxdev=0.05
    exit
  exit
exit
```