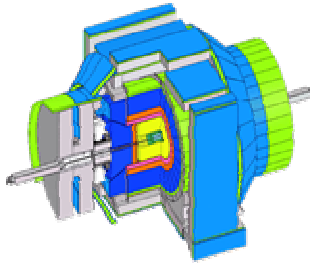


Inclusive and dijet b productions at CDF

Régis Lefèvre

IFAE Barcelona

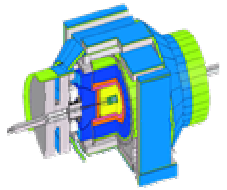
on behalf of the CDF Collaboration

DIS 2005

XIII International Workshop on Deep Inelastic Scattering

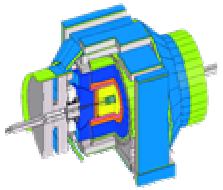
April 27th – May 1st 2005, Madison, Wisconsin, U.S.A.

Outline

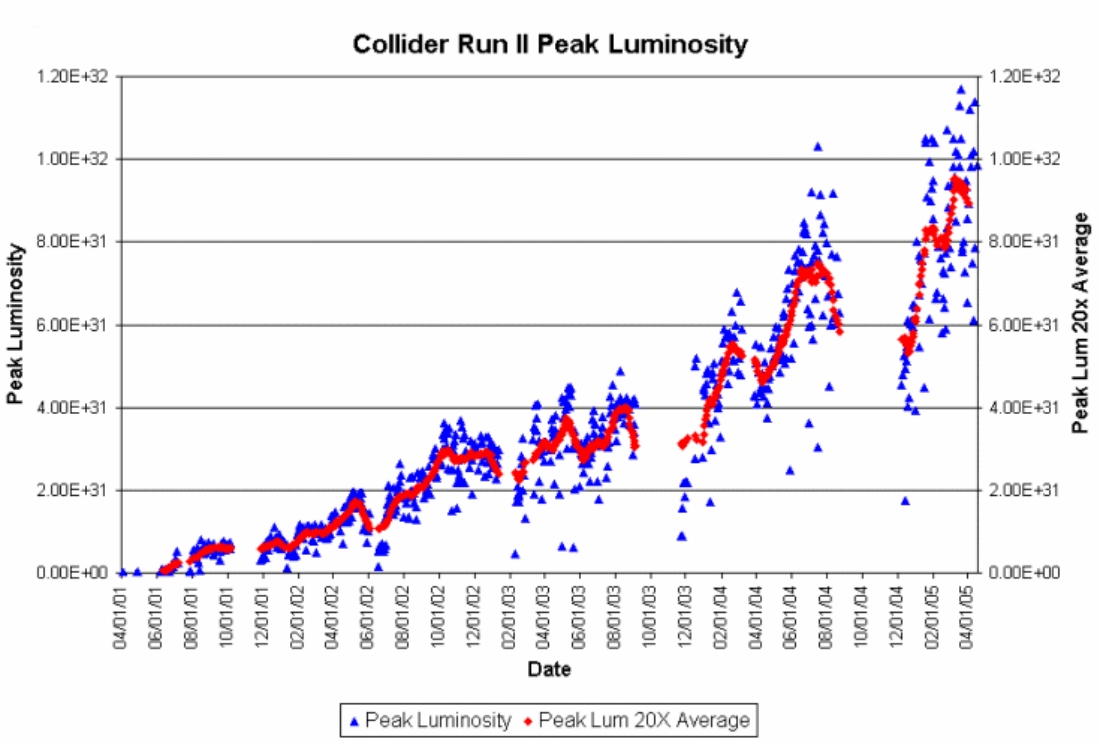


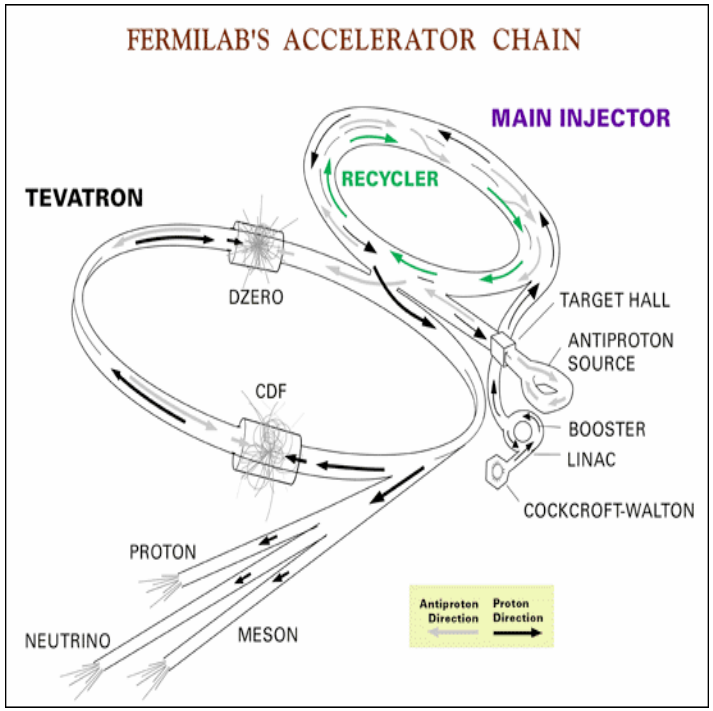
- Introduction
  - Tevatron
  - CDF
  - Motivation
- b fragmentation study in $B_s \rightarrow D_s \pi$
- Inclusive b-jet production
  - b-jet tagging
  - b-jet fraction
  - Results
- Dijet b production
- Conclusions

Tevatron



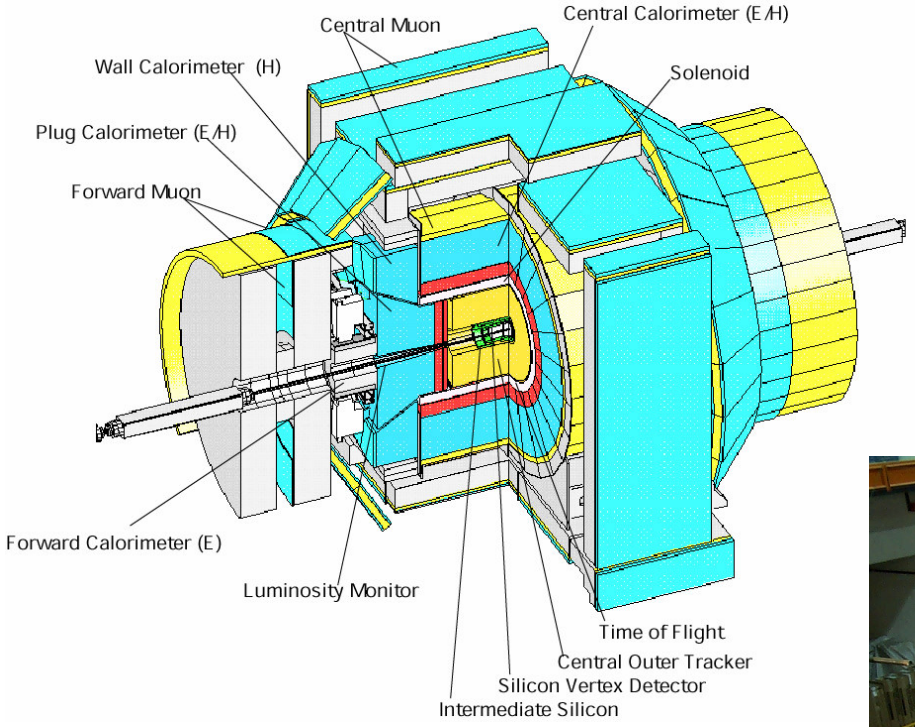
- proton-antiproton collisions
- $\sqrt{s} = 1.96$ TeV
- 36 bunches: 396 ns crossing time
- Peak luminosity is now ~ 10^{32} cm^{-2} s^{-1}





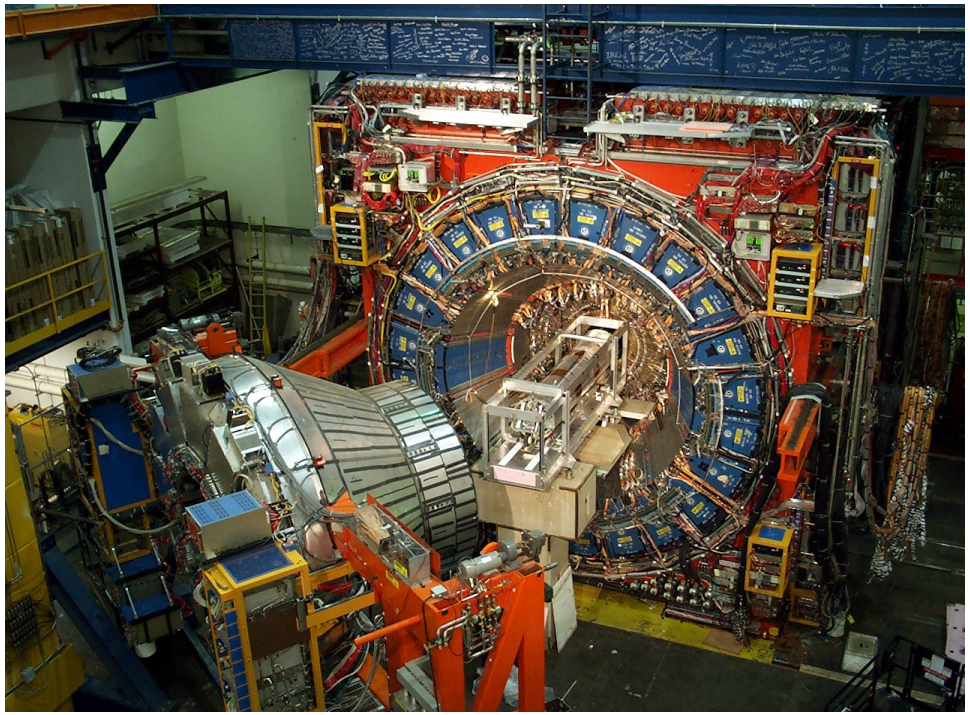
- Long term luminosity goal
  – Base 4.4 fb^{-1}, Design 8.5 fb^{-1} by the end of 2009

CDF



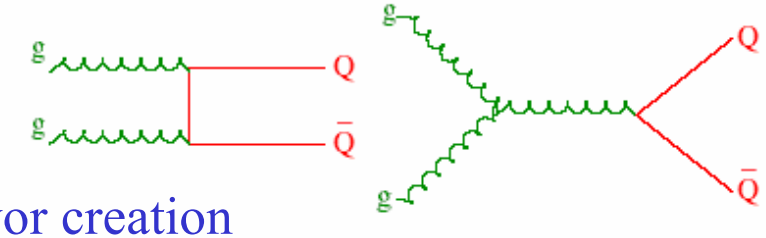
Highly upgraded for run II

- New silicon tracking
- New drift chamber
- Upgraded muon chambers
- New plug calorimeters
- New TOF

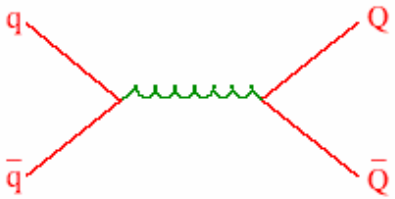


- Data taking efficiency > 80 %
- Already on tape ~ 0.7 fb^{-1}

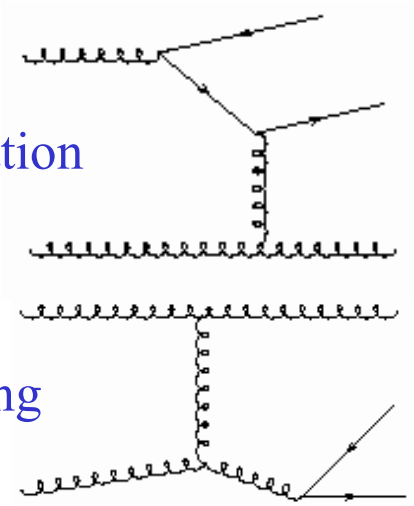
Motivation: probe pQCD



LO: Flavor creation



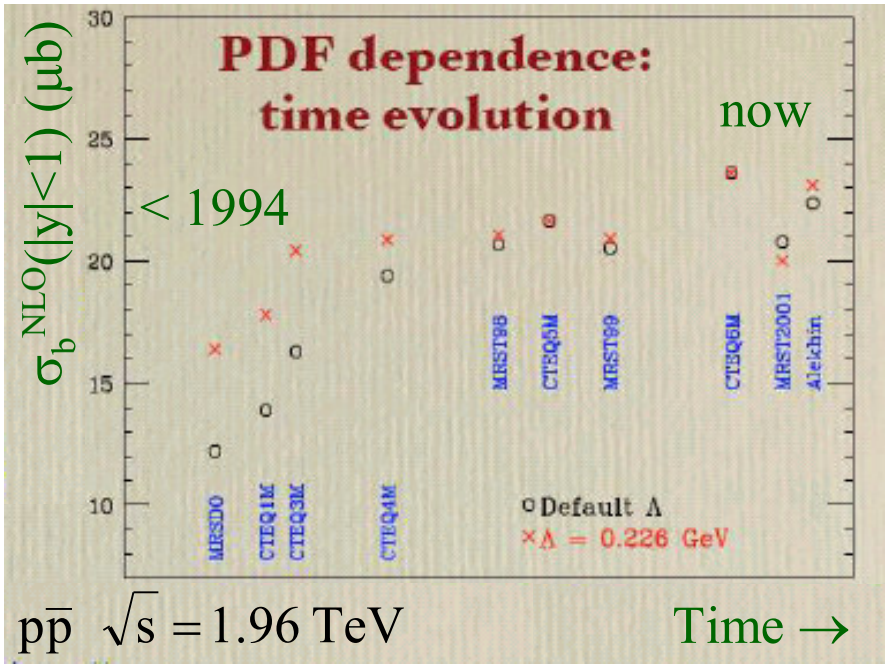
NLO: Flavor excitation



NLO: Gluon splitting

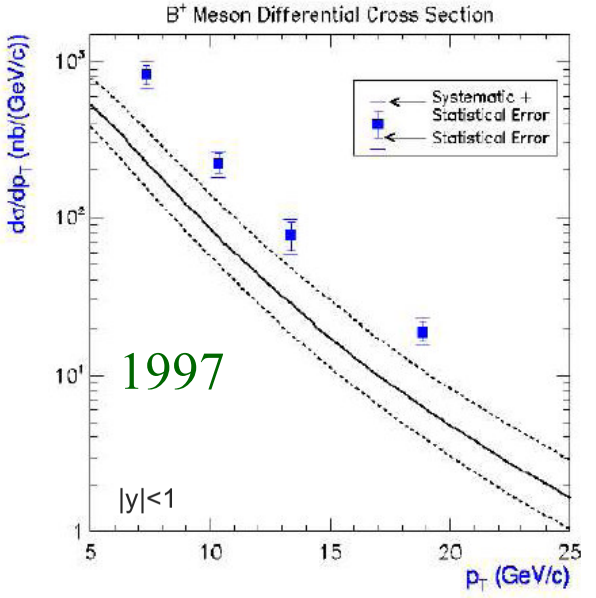
Many theoritical developments in the past years

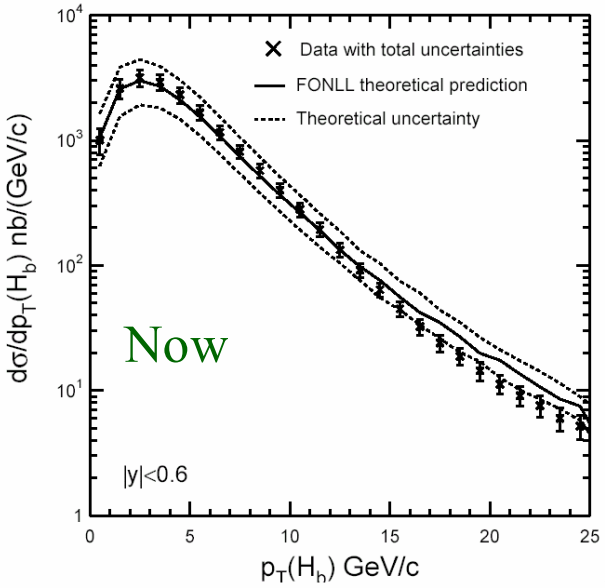
- FONLL = Fixed Order pQCD NLO (FO) + resummation of Next-to-Leading Logs (NLL) [2001]
- Moment analysis (Mellin transformation) to extract fragmentation function from LEP data [2002]
- New PDF's



B hadrons production

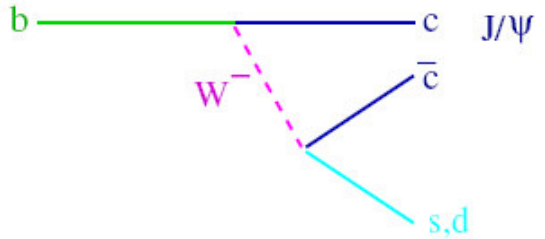
$$\underbrace{\frac{d\sigma(p\bar{p}\to BX)}{dp_T(B)}}_{\text{Observed}} = \underbrace{\frac{d\sigma(qq/gg/qg\to bX)}{dp_T(b)}}_{\text{pQCD}} \otimes \underbrace{f^{p,\bar{p}}}_{\text{PDF's}} \otimes \underbrace{D^{b\to B}}_{\text{Fragmentation}}$$



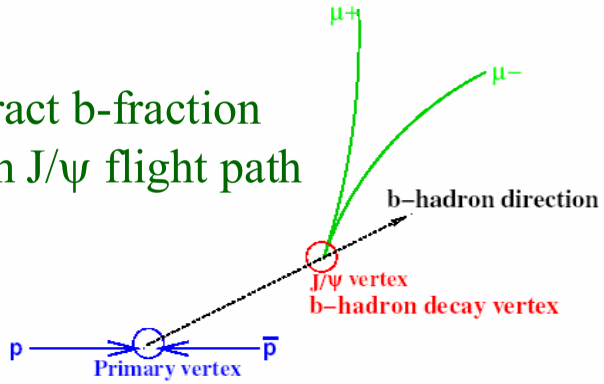


From J/ψ→μμ assuming

- BR(H_b→ J/ψX) = 1.116 ± 0.10 %
- BR(J/ψ→μμ) = 5.88 ± 0.10 %



Extract b-fraction from J/ψ flight path



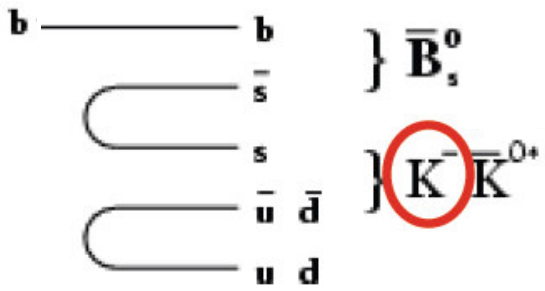
Here: use b-jets

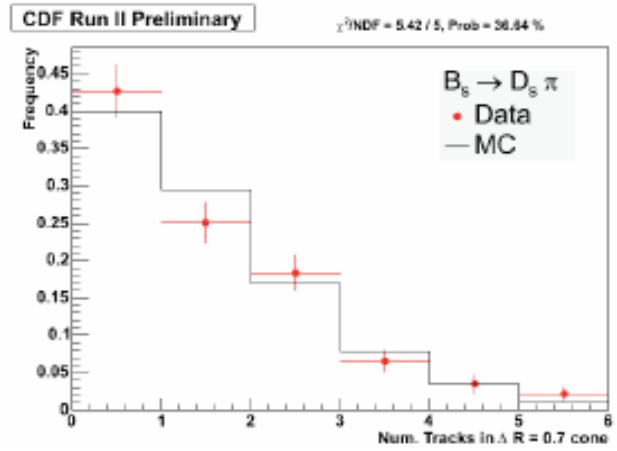
– b-jets include most of quark fragmentation remnants

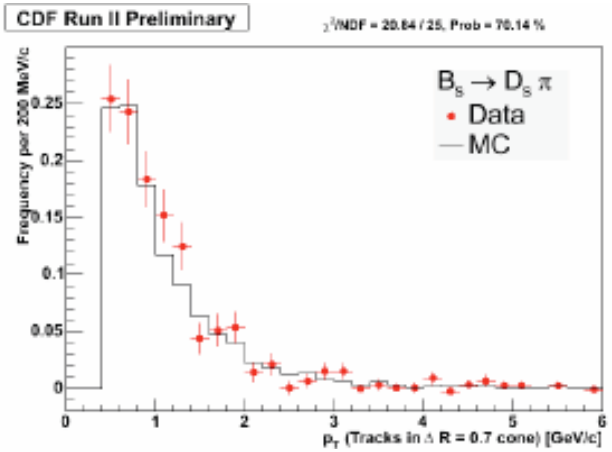
→ Small dependence on fragmentation

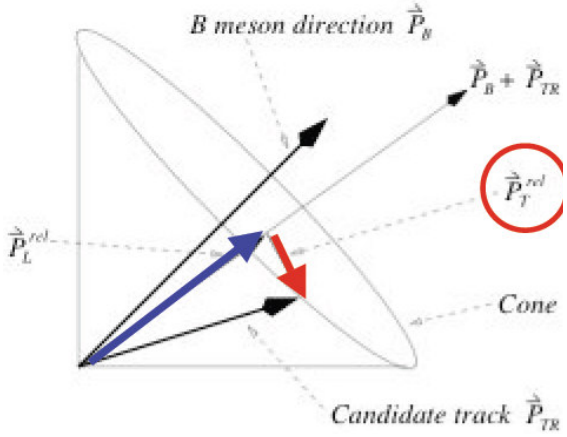
b fragmentation study in $B_s \rightarrow D_s \pi$

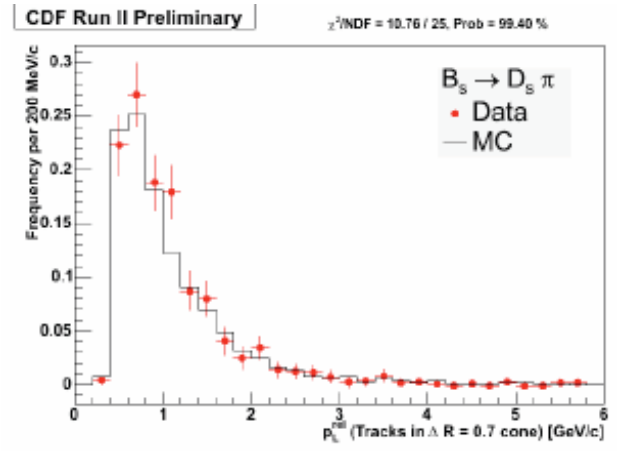
- Context = same side Kaon tagging
  - B_s expected to have a Kaon in the vicinity

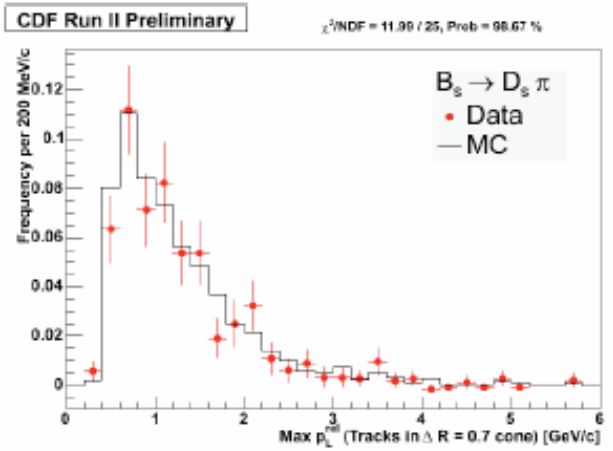








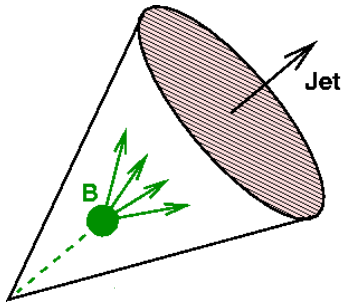


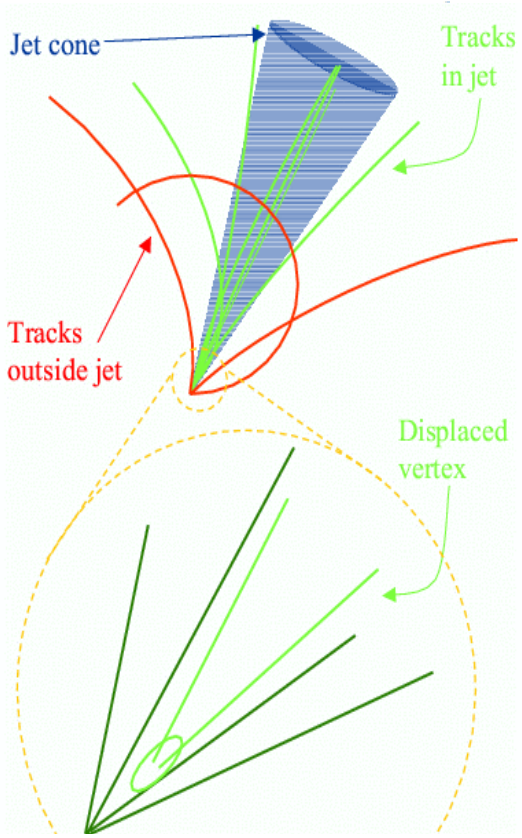


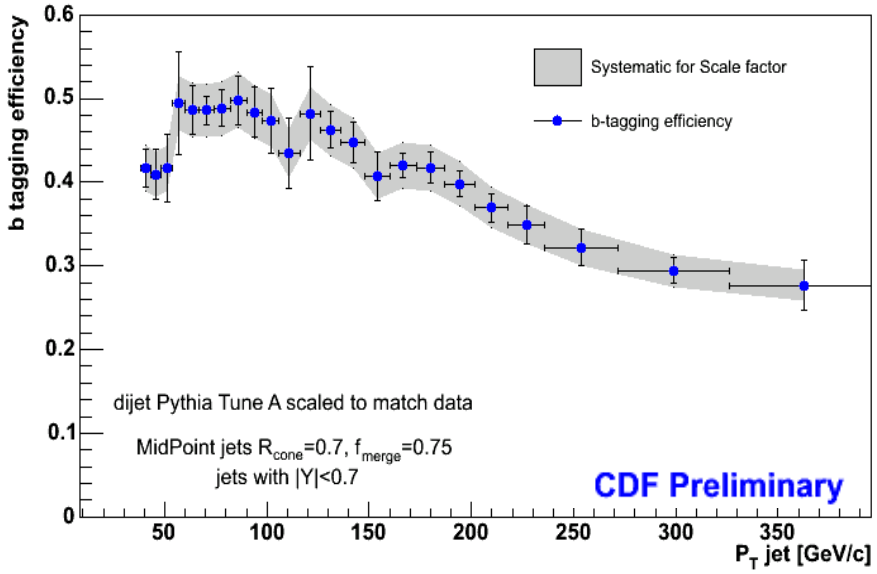
- Good agreement between Data and MC
  - Good agreement also observed on Kaon identification and selected Kaons

Inclusive b-jet production

- Midpoint jet algorithm
  - Cone size $R_{cone} = 0.7$
  - Merging fraction $f_{merge} = 75\ \%$
- Kinematical range
  - $|y_{jet}| < 0.7$
  - Jet P_T from 38 to 400 GeV/c
    - Integrated luminosity ~ 300 pb^{-1}
- b tagging
  - Take advantage of the long life-time of B hadrons
    - $c\tau \sim 450$ mm
  - Use displaced tracks inside jets to reconstruct secondary vertices
  - Selection based on
    - L_{xy} = distance primary-secondary vertex in r-ϕ space
    - L_{xy} direction with respect to jet axis



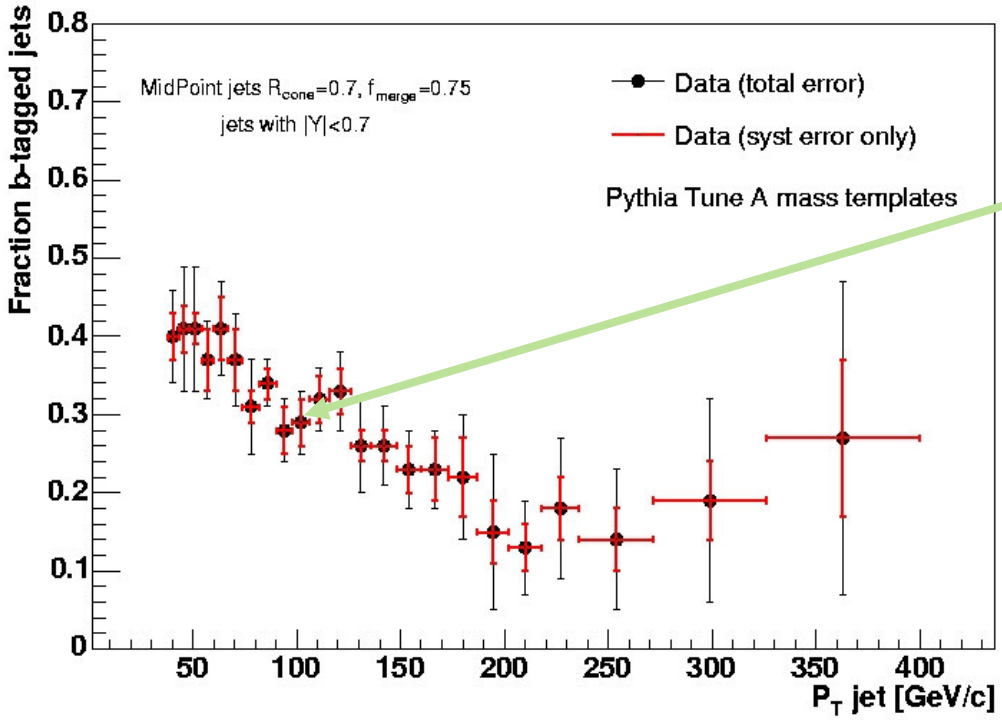


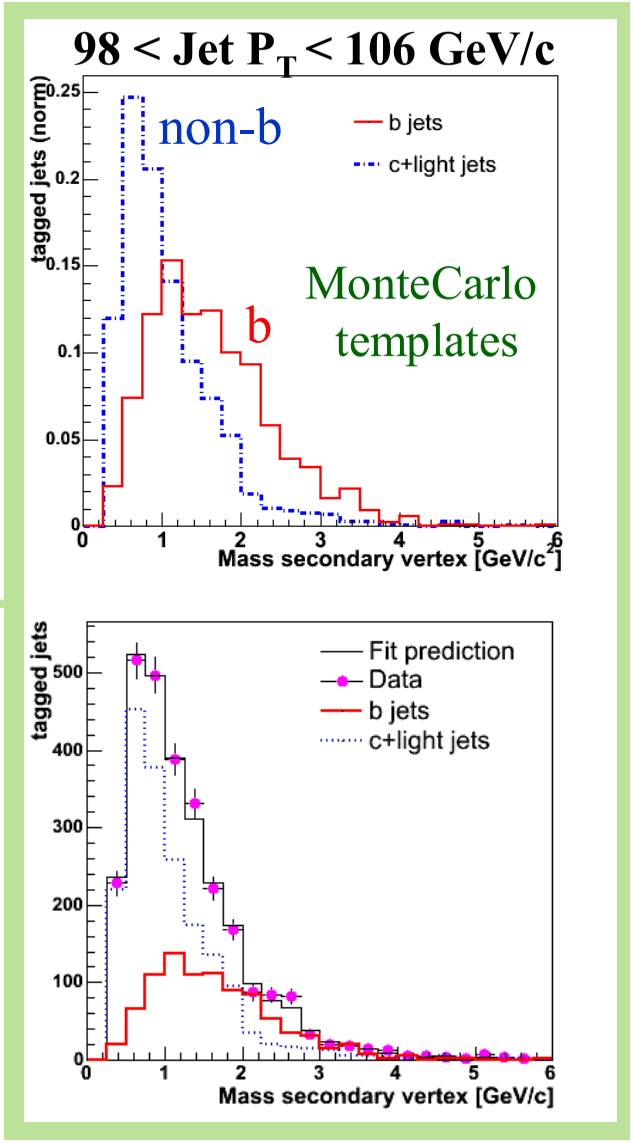


b-jet fraction

Fraction of b-tagged jets extracted from data

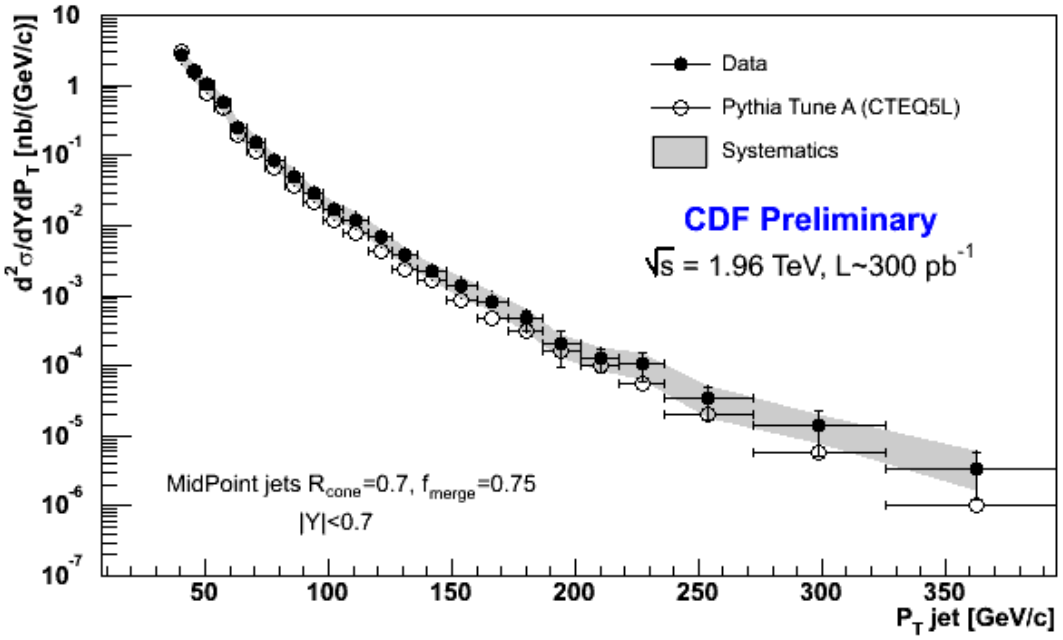
- Take advantage of high masses of B hadrons
- Use shape of mass of secondary vertex
  - Get b-jet fraction fitting MC templates to the data
    - For each jet P_T bin
    - Fits well reproduce the data

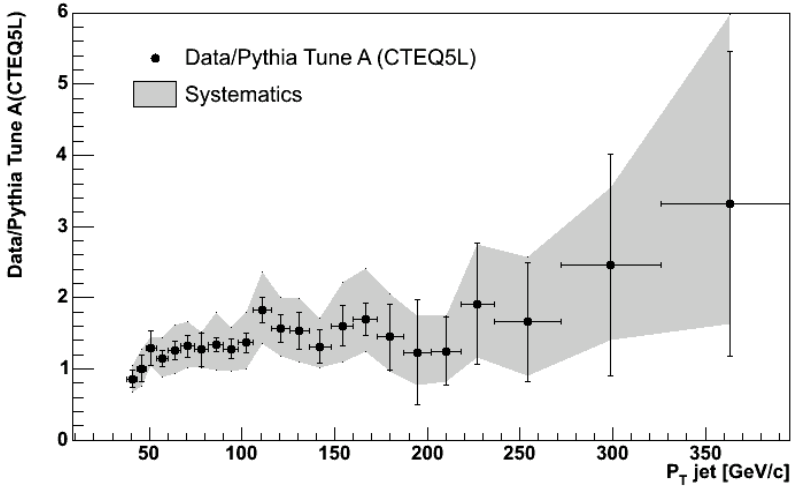




Inclusive b-jet production: results

Systematic Error	low P_T	high P_T
Luminosity	6%	6%
Absolute Energy Scale	15-20%	40%
Jet energy resolution	6%	6%
B-tagging efficiency	10%	15%
B-tagged jets fraction	10-15%	40%
Unfolding	8%	8%



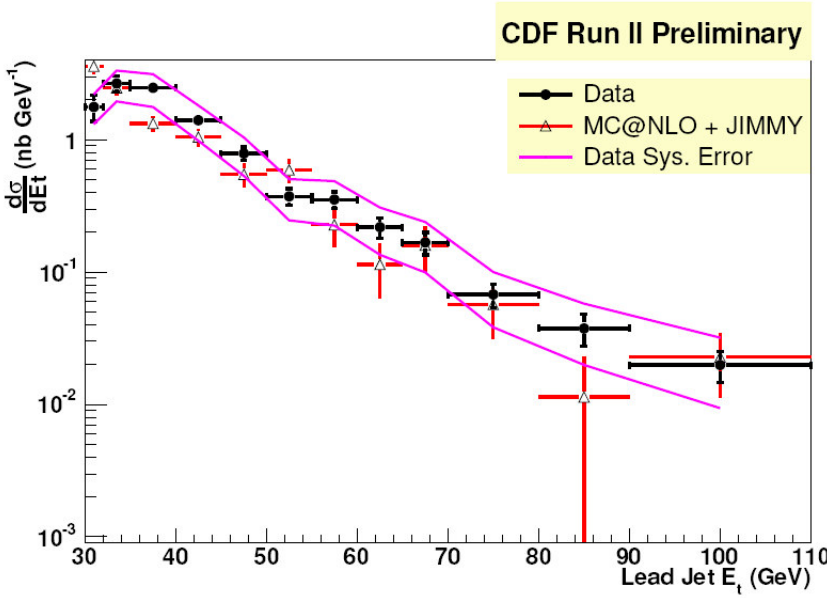


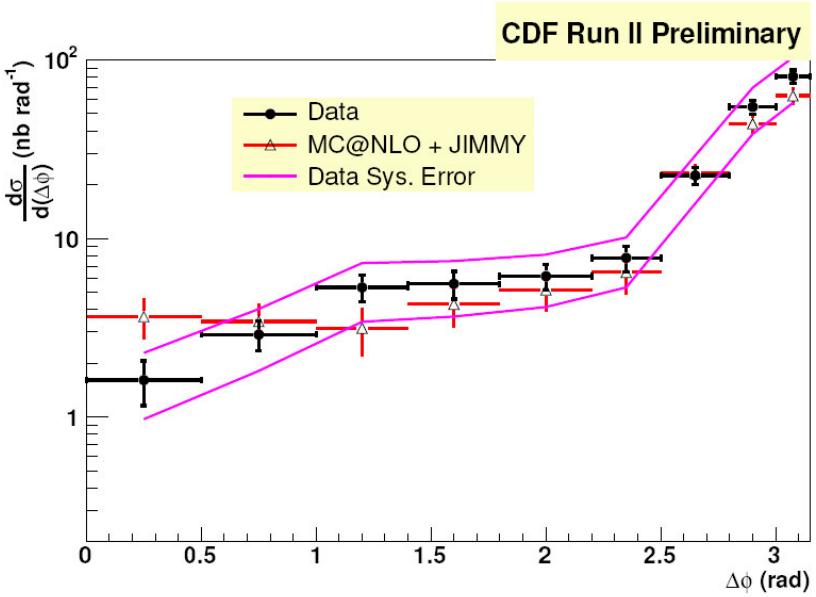
b-jet cross section versus jet P_T

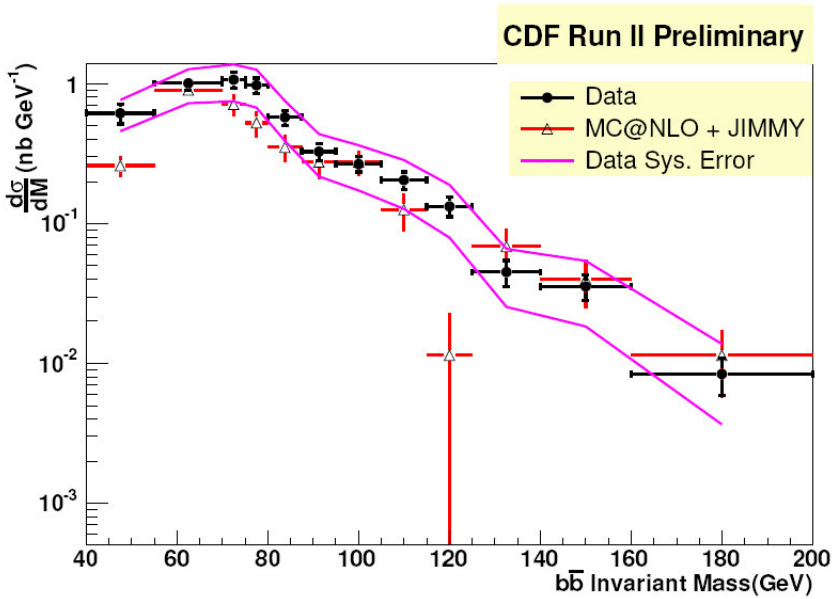
- 38-400 GeV/c
- No comparison to NLO yet
  - Data / Pythia Tune A ~ 1.4
    - In agreement with expectations

Dijet b production

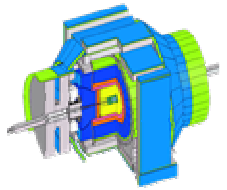
- Jet algorithm: JetClu with $R_{cone} = 0.7$
- Kinematical range
  - 2 b-jets within $|\eta| < 1.2$
  - $E_T^{1st\ b\text{-}jet} > 30$ GeV, $E_T^{2nd\ b\text{-}jet} > 20$ GeV
- Data sample: 65 pb^{-1}
  - Jet 20 only (prescaled trigger)
- Comparison to MC@NLO ⊕ JIMMY
  - Default JIMMY – Small MC sample







Conclusions



- b fragmentation study in $B_s \rightarrow D_s \pi$
  - Good agreement between Data and MC
    - Same side Kaon tagging well on track for B_s mixing
- Inclusive b-jet production
  - Comparison with MC (LO ME $\oplus$ PS) as expected
    - Comparison with NLO (and beyond) will come soon
- Dijet b production
  - Reasonable agreement with predictions
    - More data still to be included in the analysis
- Related issue: jet shape of b-jets
  - Difficult measurement
    - Hope to have something soon

Backup

Dijet b production

→ other comparisons