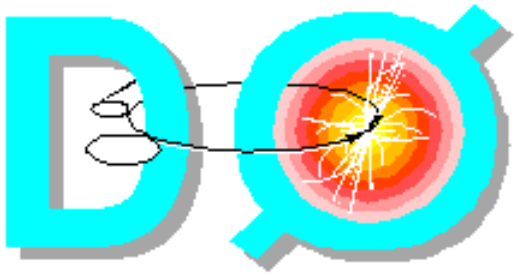
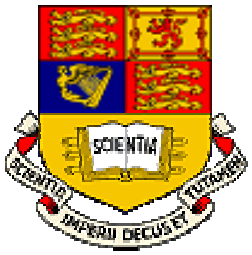


Heavy Flavour Production at DØ

Daniela Bauer

Imperial College London

for the DØ collaboration



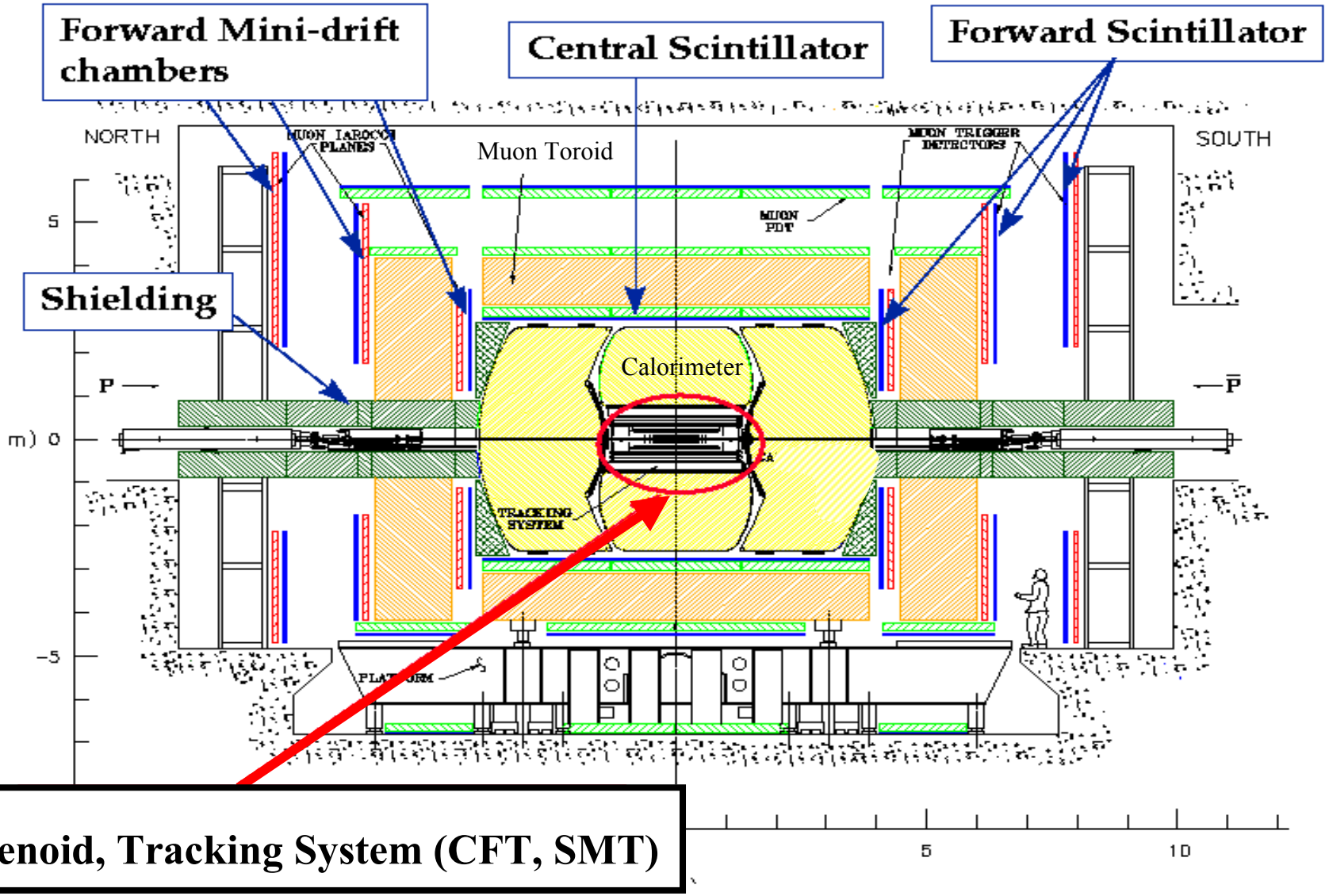
Hadron Collider Physics 2002

Karlsruhe 30/9-4/10 2002

DØ Run II programme

- $b\bar{b}$ production cross section and angular correlations
- J/ψ cross section and polarization
- Υ cross section
- Production and spectroscopy of B-mesons and baryons
- Lifetimes
- CP violation (SM and non-SM)
- CKM studies
- B_s mixing
- rare decays

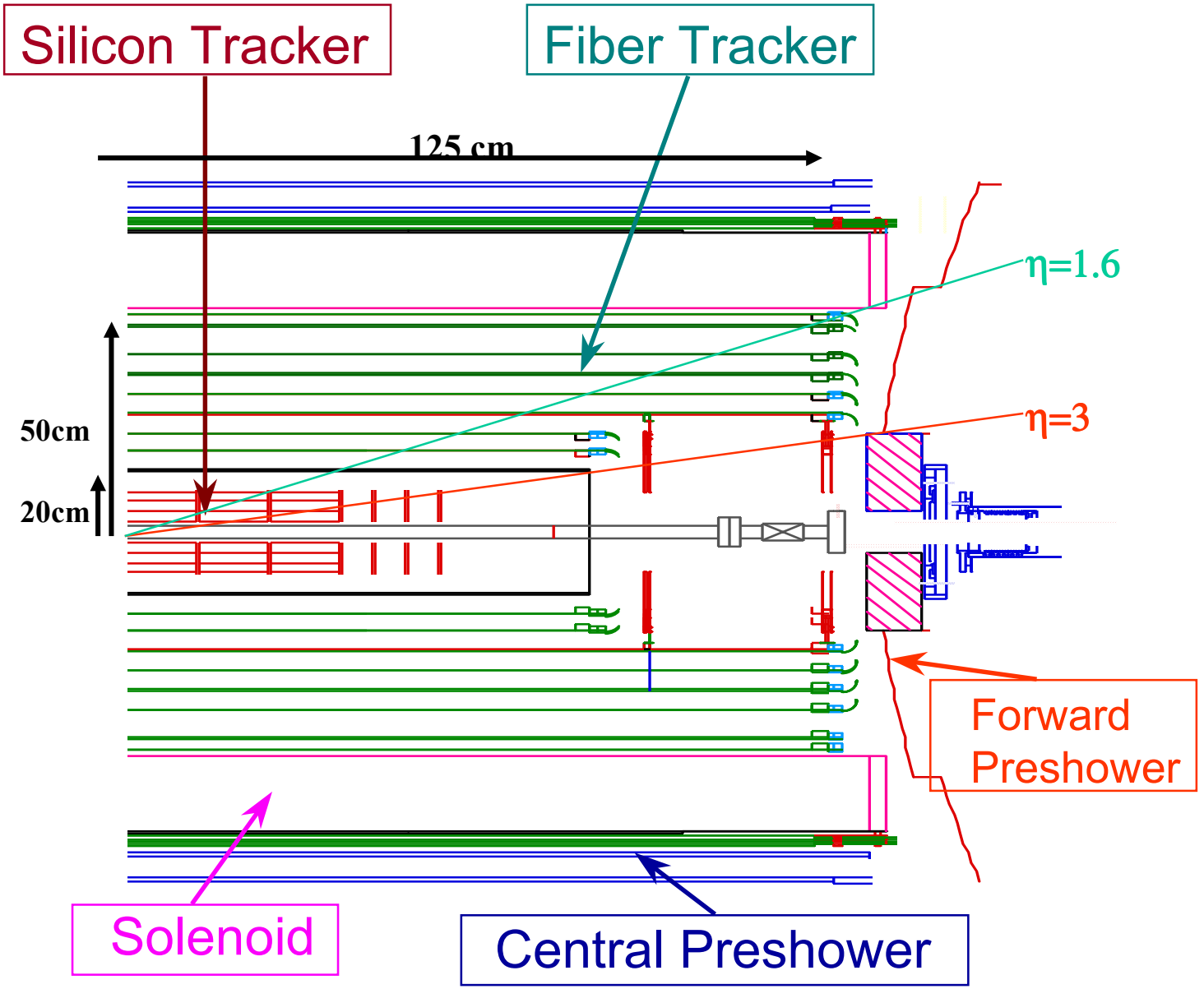
The upgraded DØ detector



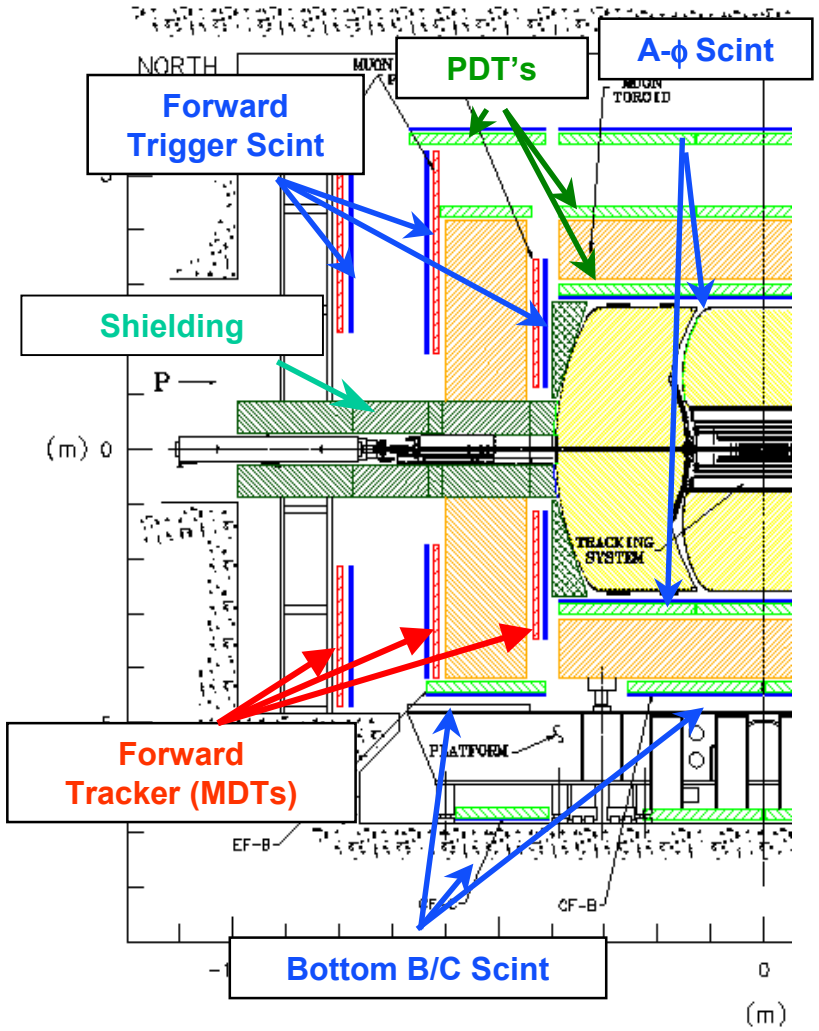
Solenoid, Tracking System (CFT, SMT)

+ New Electronics, Trig, DAQ

DØ tracking system



DØ - Muon detectors



Central region:
re-use Run I PDT
new scintillators for triggering

new shielding for beampipe

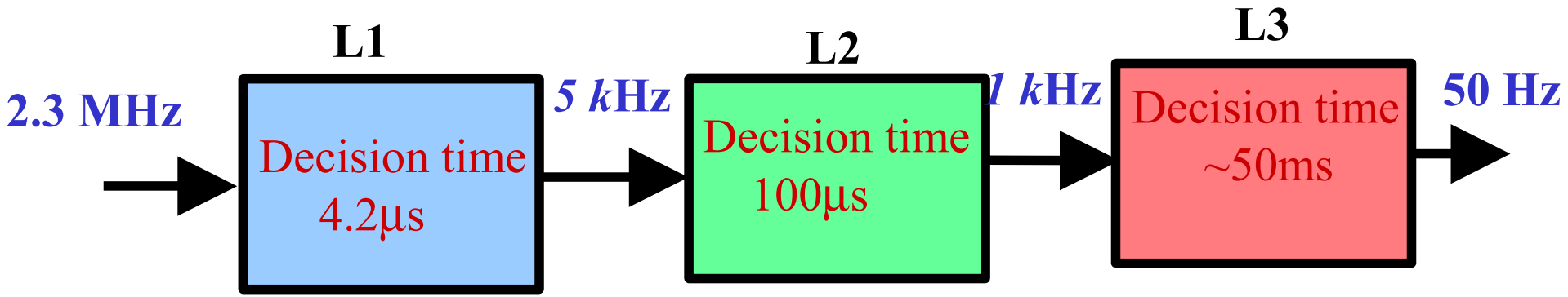
New forward system to replace Run I system:
mini drift tubes
scintillators for triggering

The DØ Trigger System

- Towers, Tracks, missing E_T
- Some correl's
- Single Sub-Det's
- Not quite deadtimeless

- Correlations
- Calibrated Data
- Physics Objects e,μ,jets,τ,missing E_T

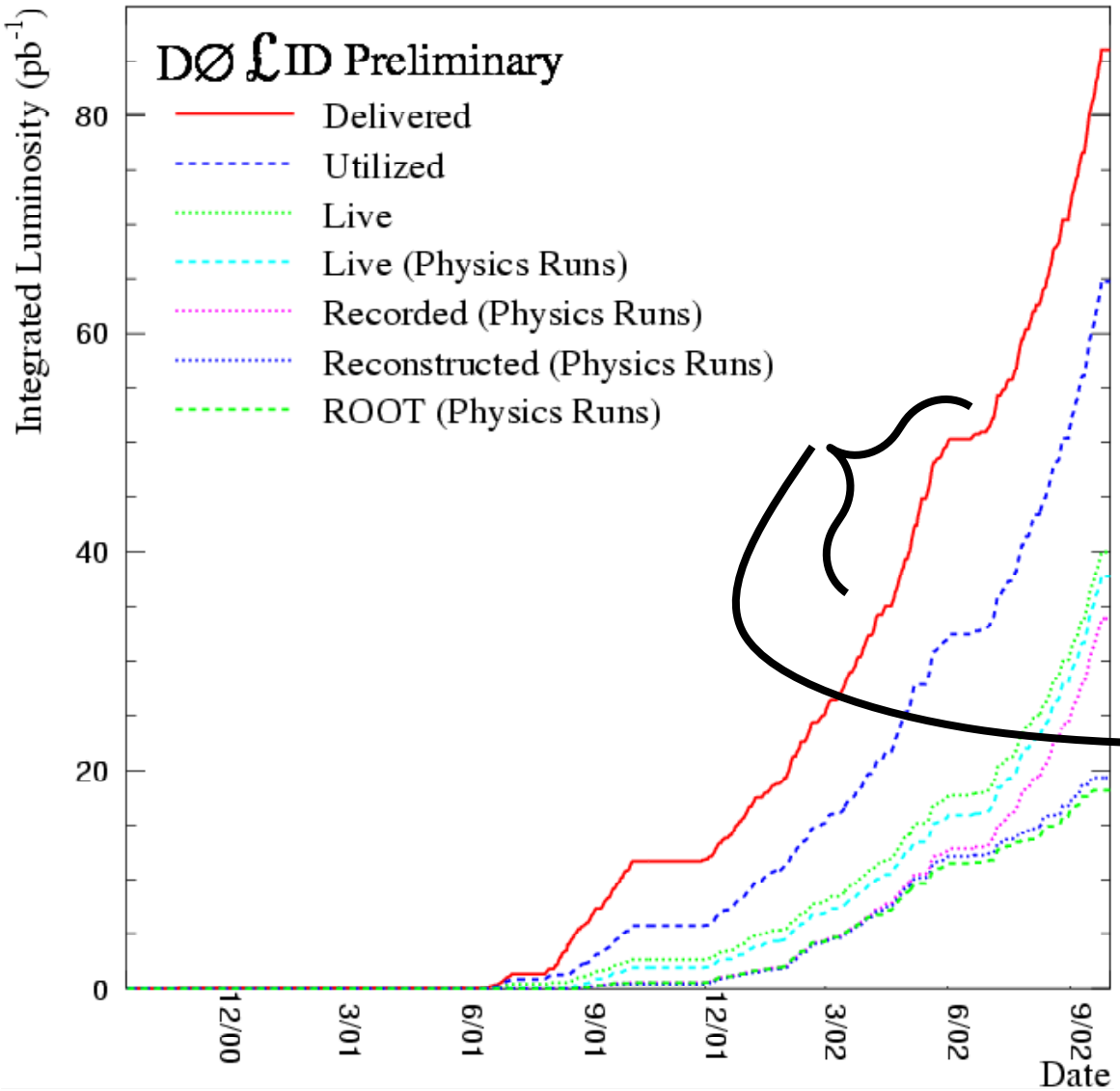
- Simple Reco
- Physics Algorithms



Current rates:

L1/L2/L3 = 500/200/50 Hz

Run II Luminosity

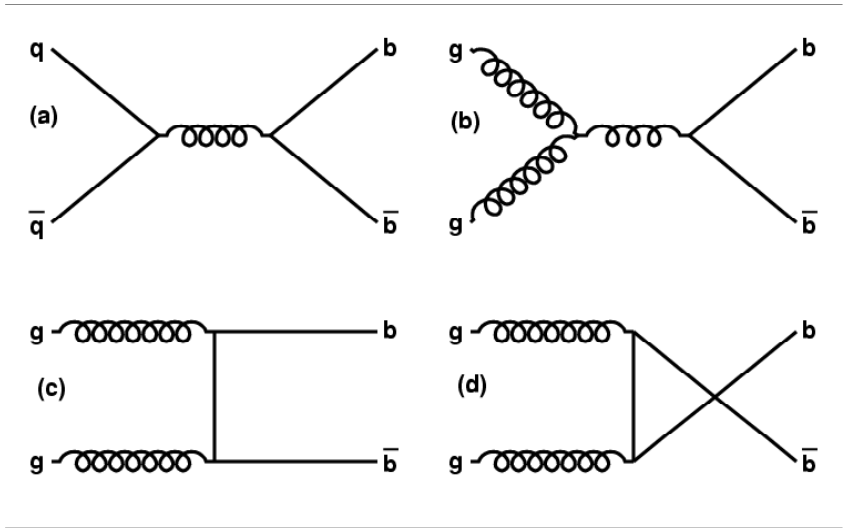


most data used for commissioning

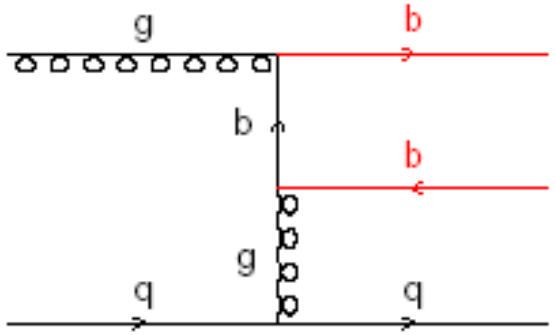
data used in analyses ~ 5 pb^{-1}

b-quark production

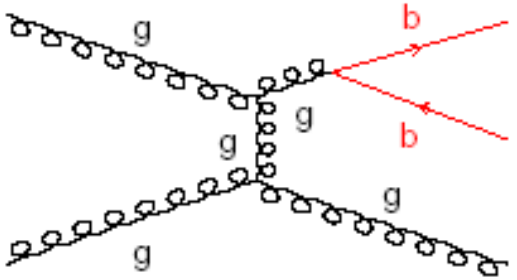
- LO/NLO/NNLO QCD including



- flavour excitation

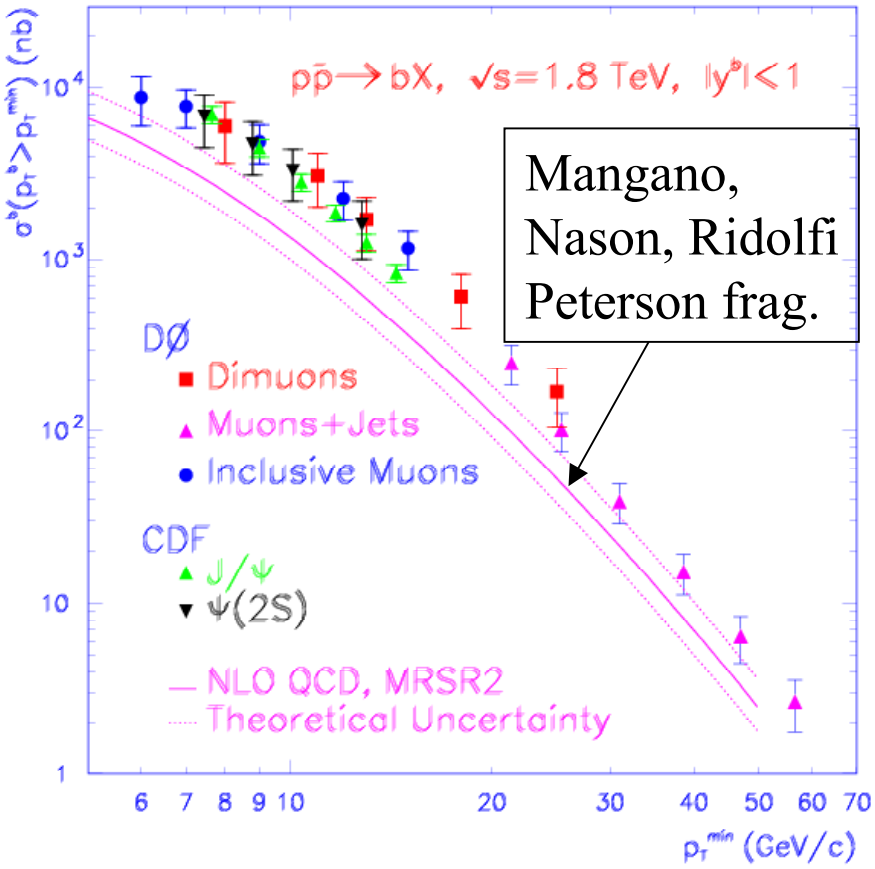


- gluon splitting



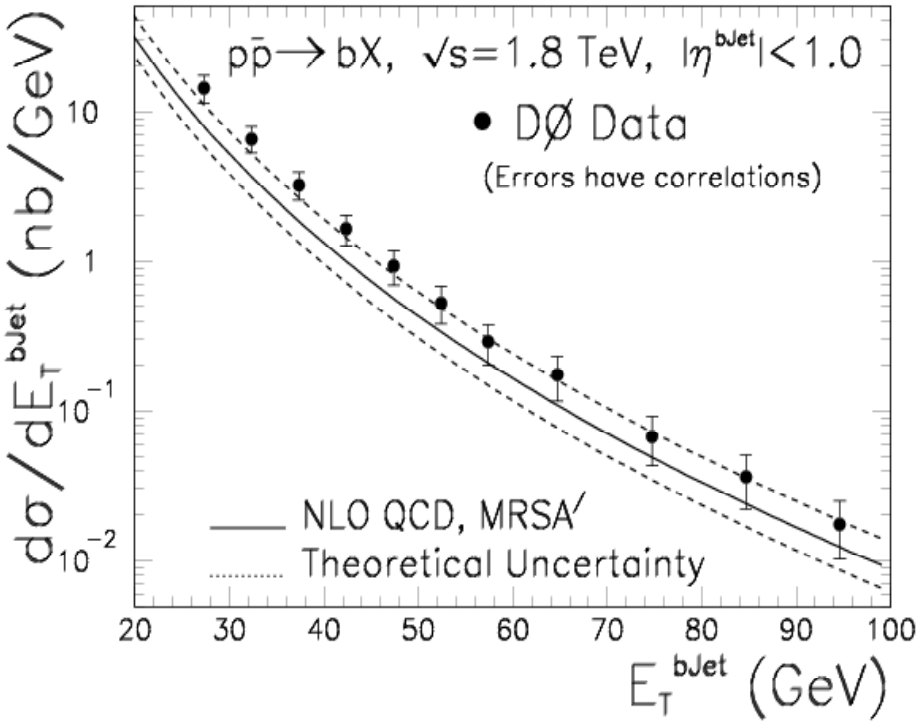
Run I *b*-quark production cross-section

b production cross section as a function of minimum p_t



Differential b-jet cross-section

PRL 85, 5068 (2000)

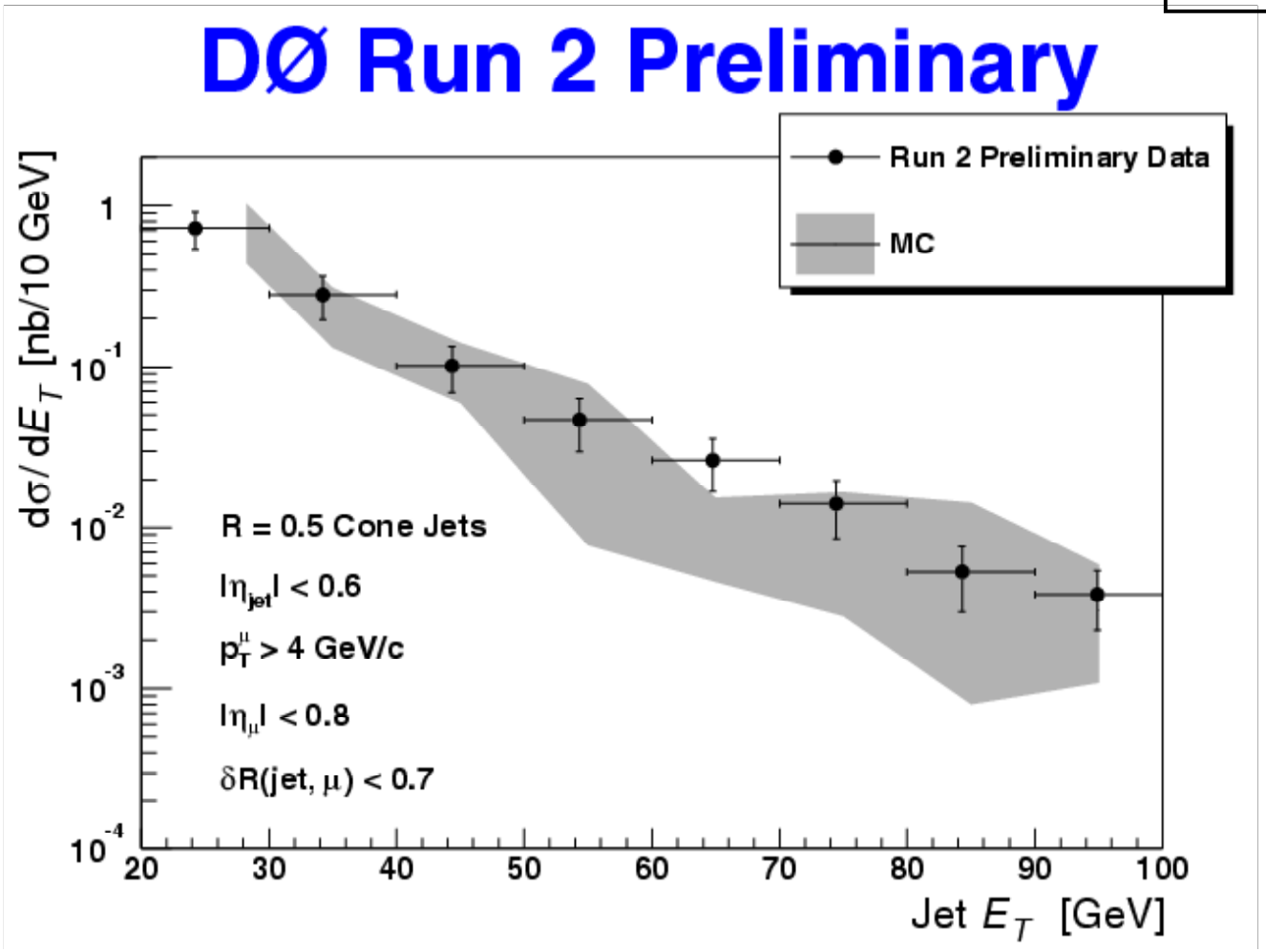


Is there a significant excess in B-meson production ?

- Binnewies, Kniehl, Kramer, hep-ph/9802231: correct treatment of B fragmentation functions
- similar approach from Cacciari, Nason, hep-ph/0204025
- Frixione: NNLO might explain differences ICHEP 2002
- Berger, hep-ph/0201229: SUSY

Run II mu+jet cross section - preliminary

4.8 pb^{-1}



b-tagging at DØ

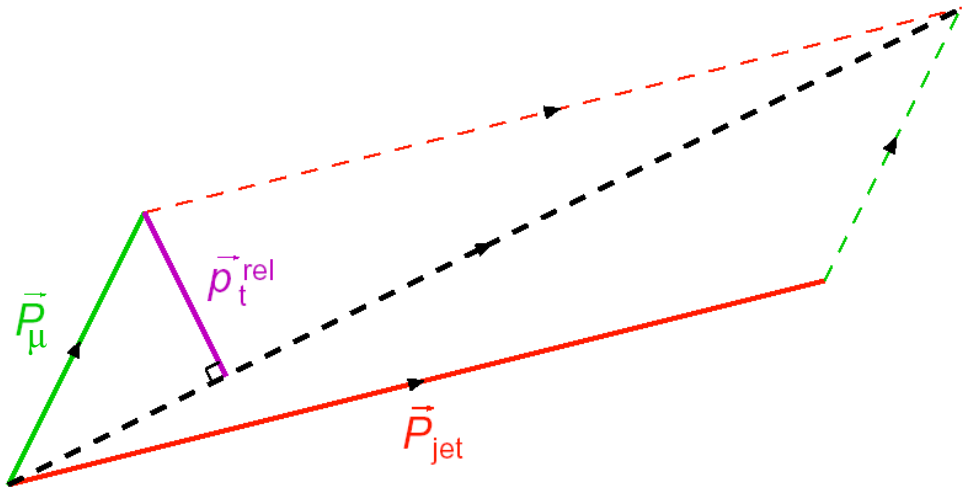
offline

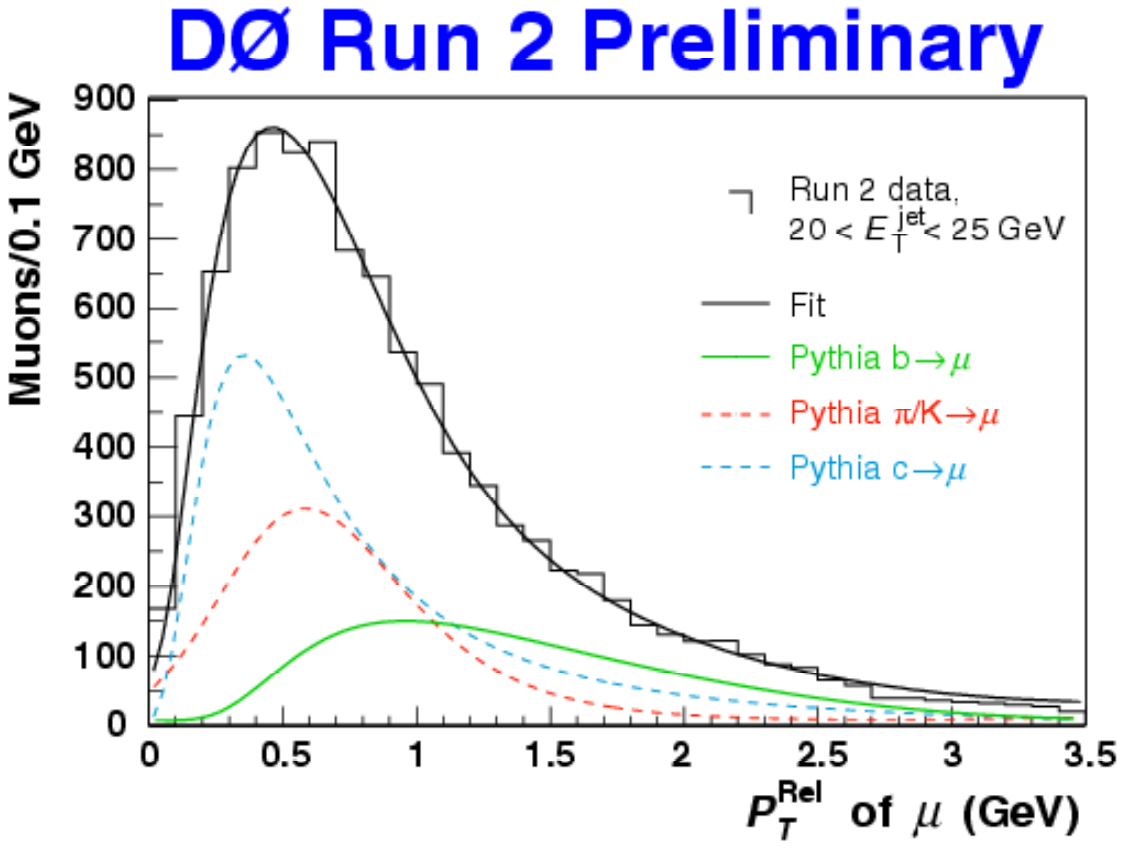
- p_t^{rel}
- impact parameter
- secondary vertexing

trigger level

- impact parameter at Level 3
- Silicon Track Trigger (STT) at Level 2

Tagging b-jets: p_t^{rel}

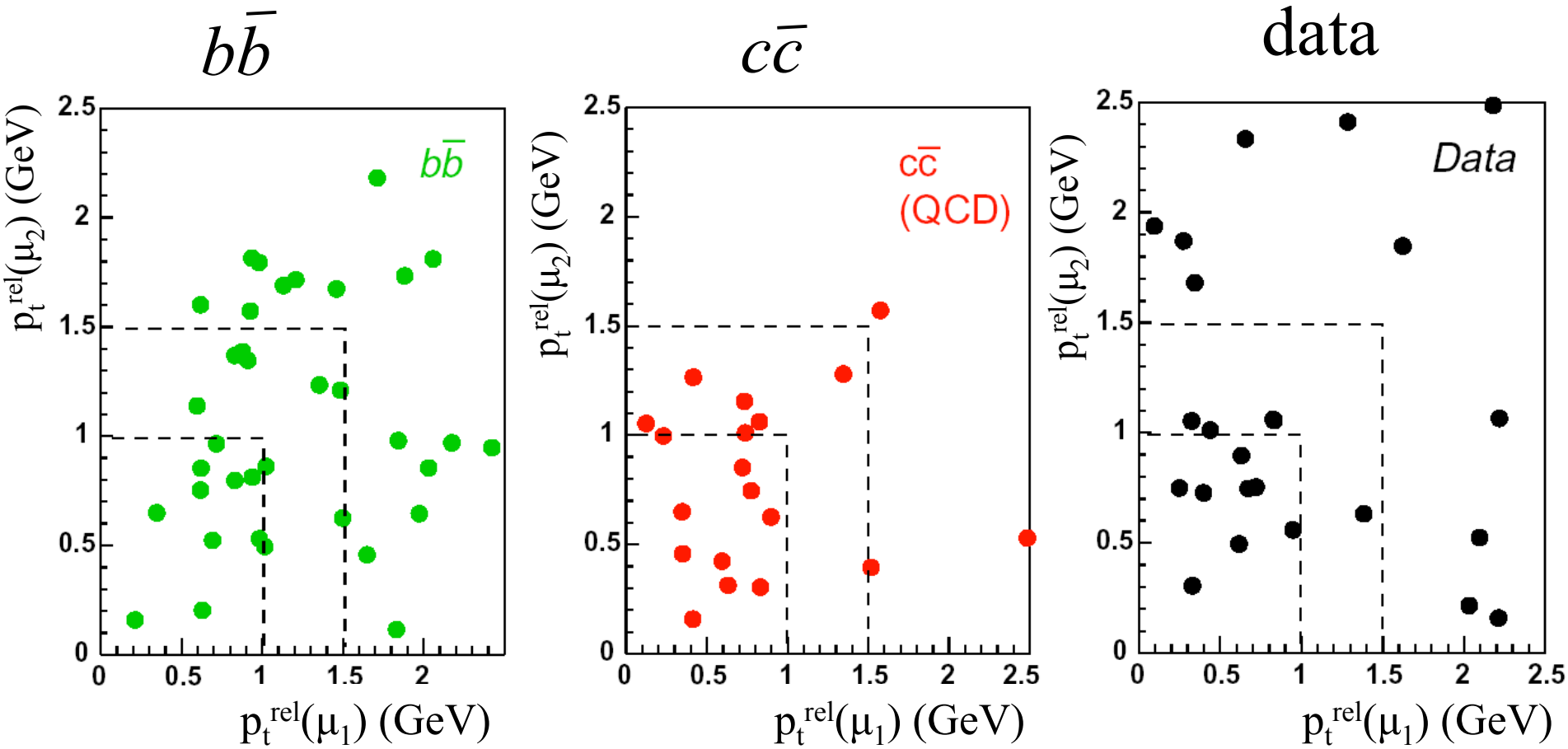




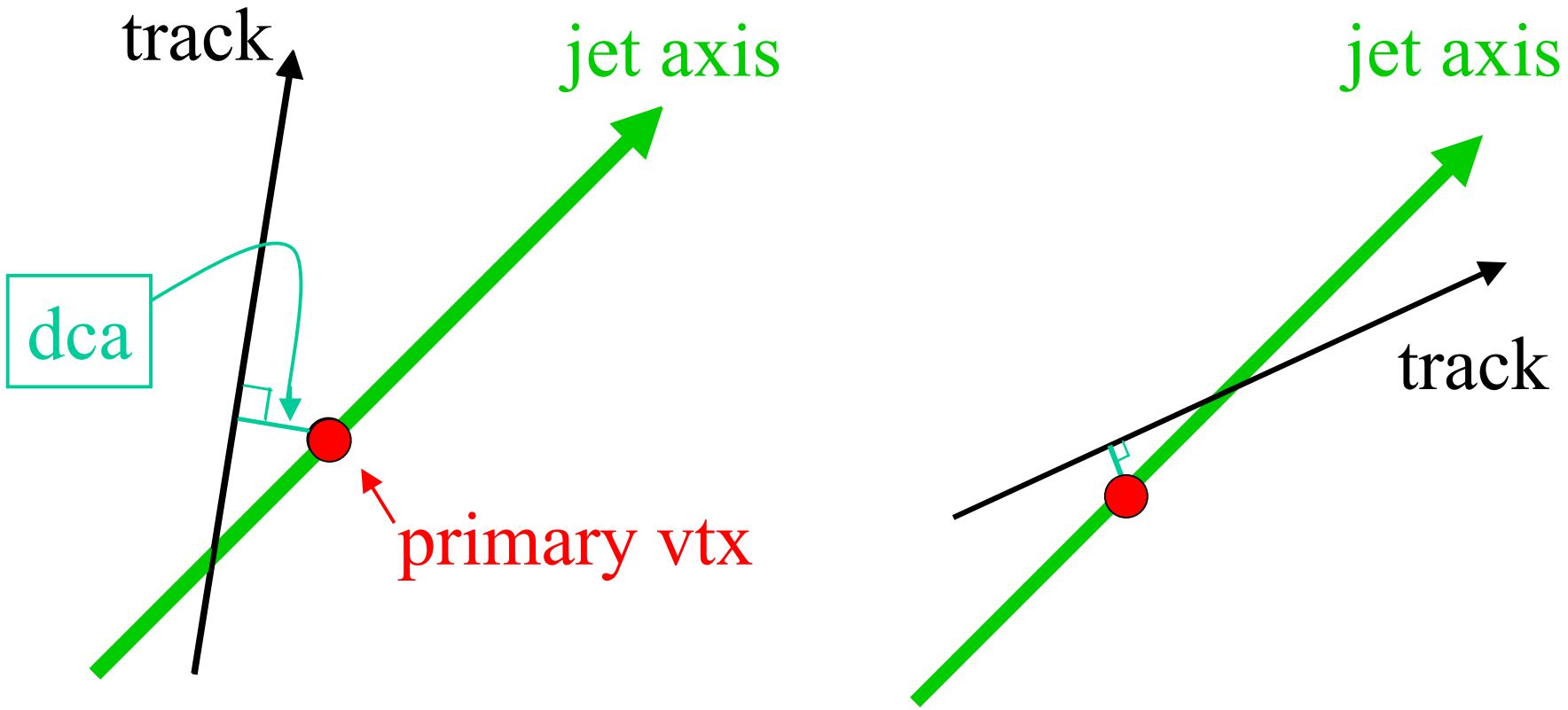
local muons only

Tagging b-jets: p_t^{rel}

di-muon sample



Tagging b-jets: impact parameter



negative IP

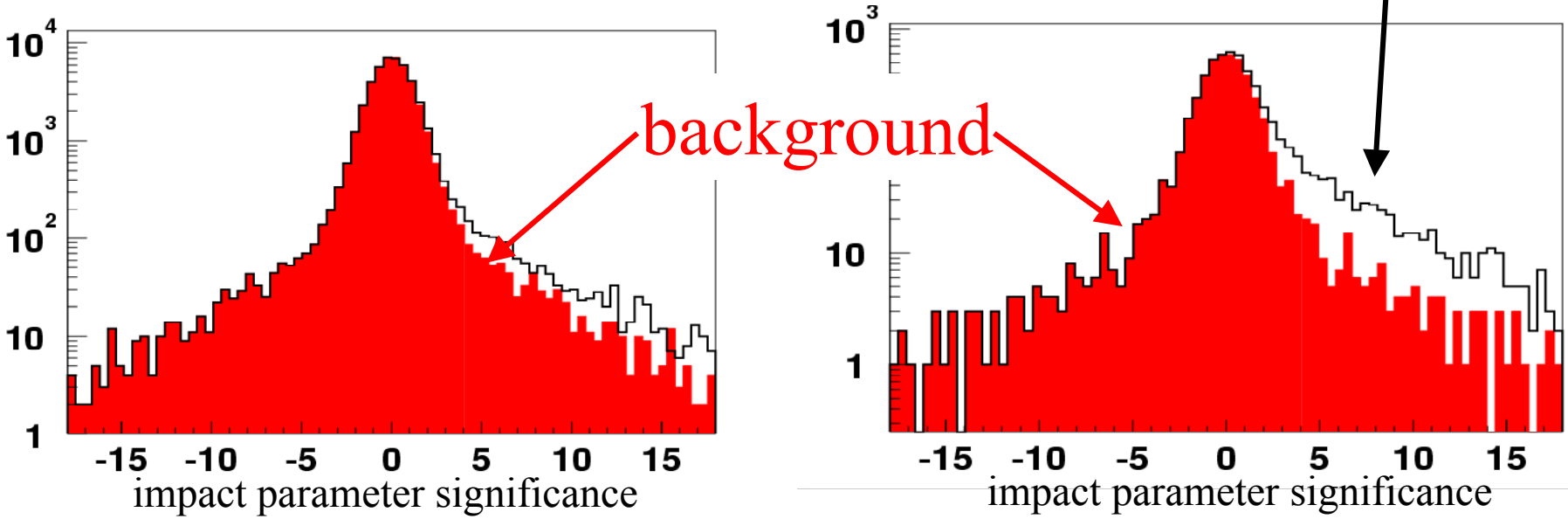
positive IP

Impact parameter tagging

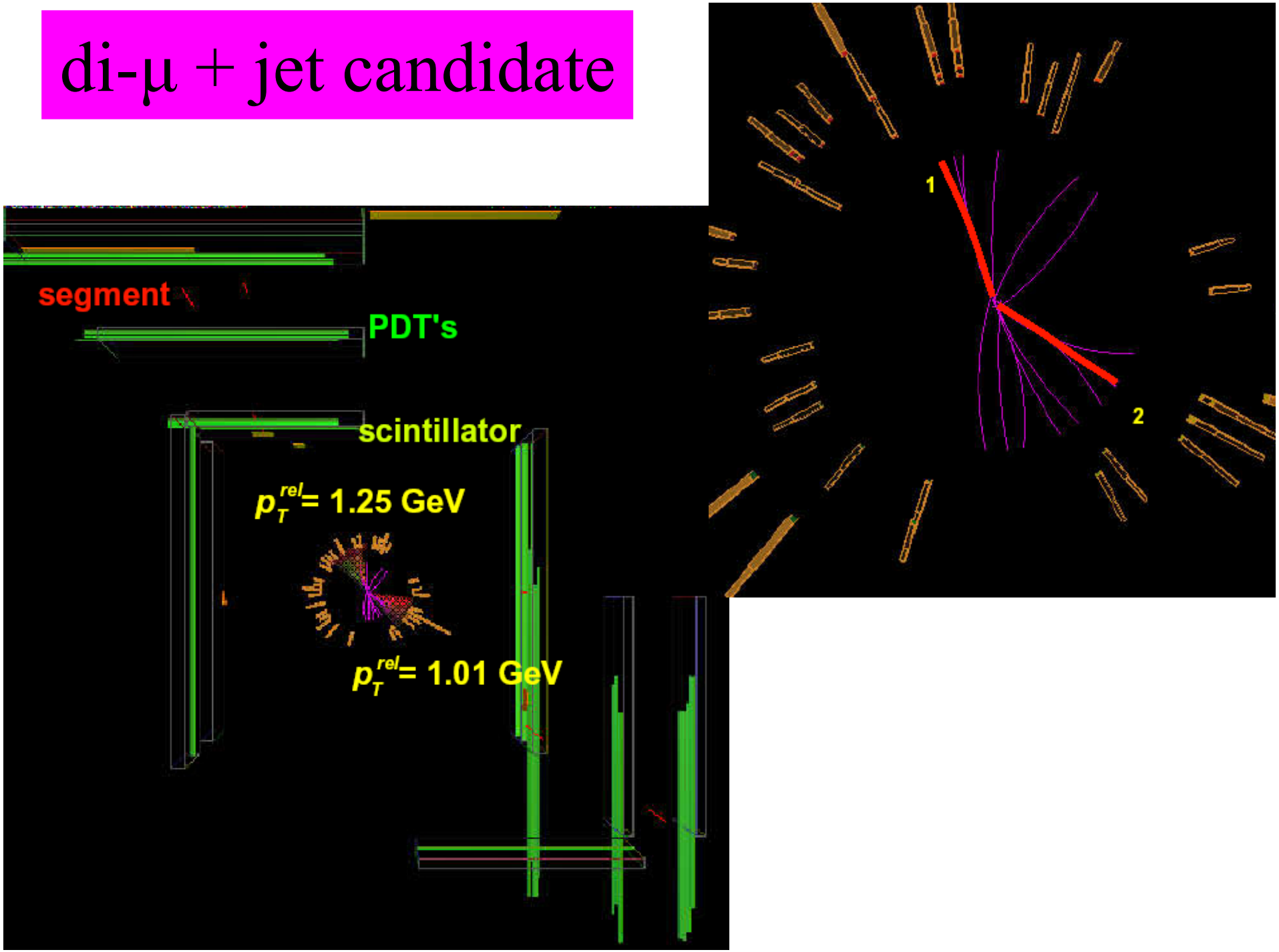
impact parameter significance =
impact parameter/sqrt(error^2(primary vtx)+error^2(vertex))

generic di-jet sample

high p_t^{rel} sample
(b-enriched)



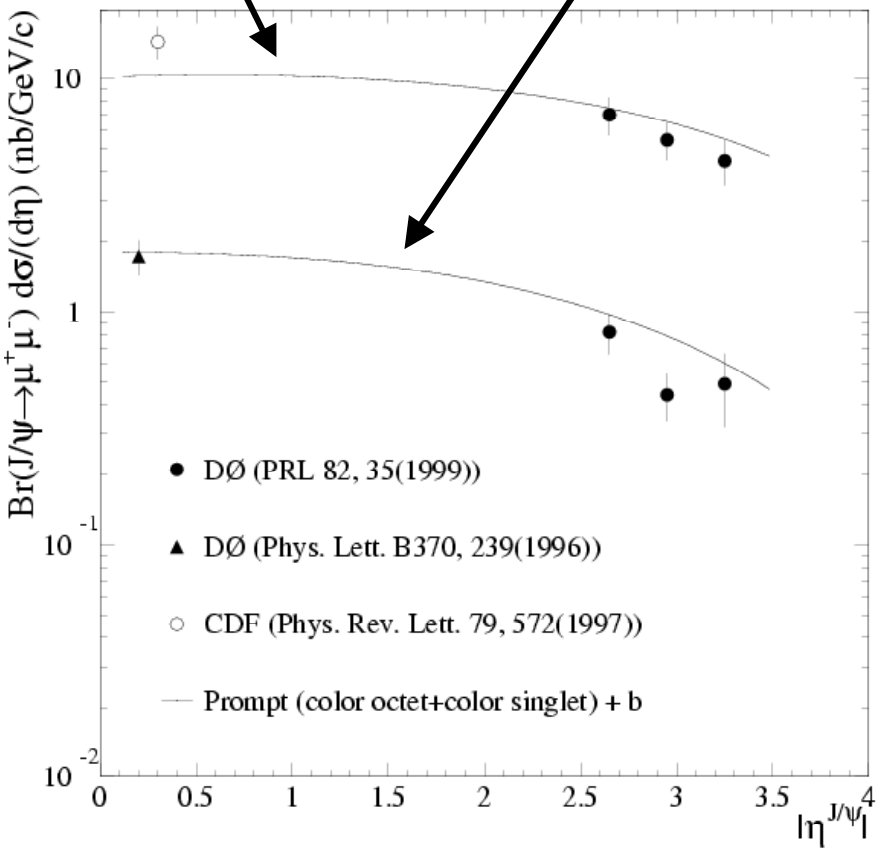
di-μ + jet candidate



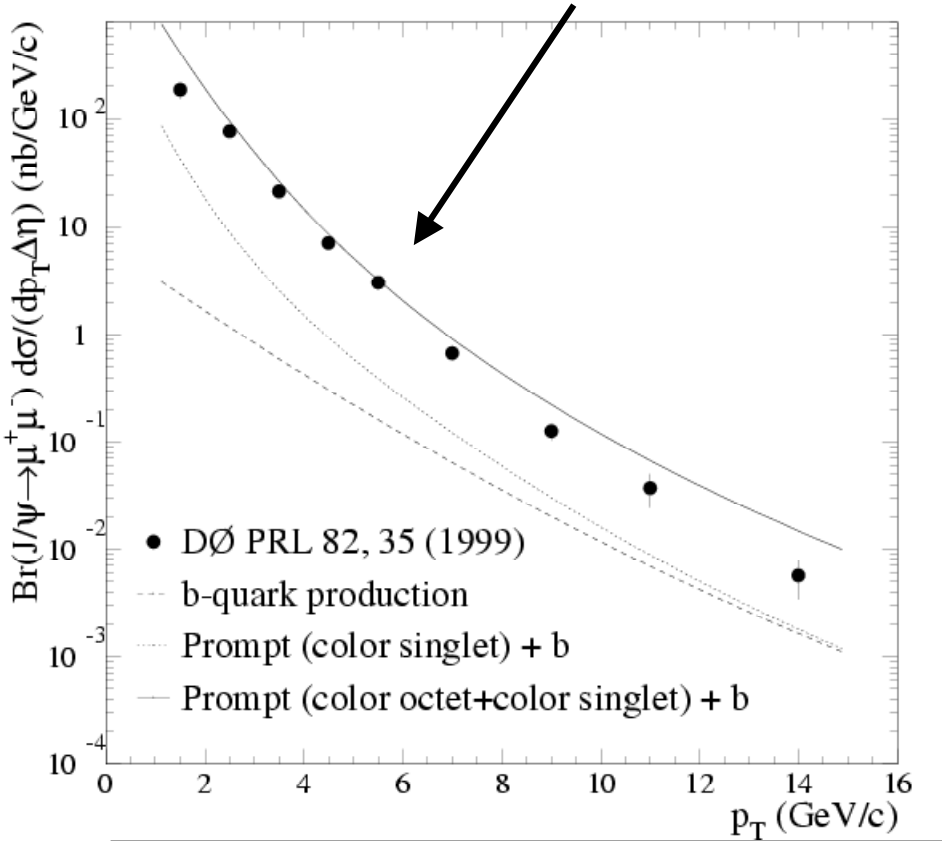
Run I J/ψ production cross section

pt > 5 GeV

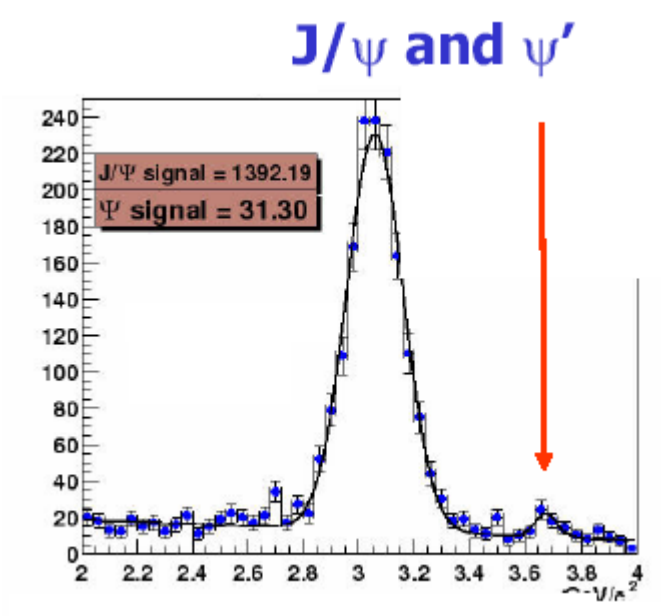
pt > 8 GeV



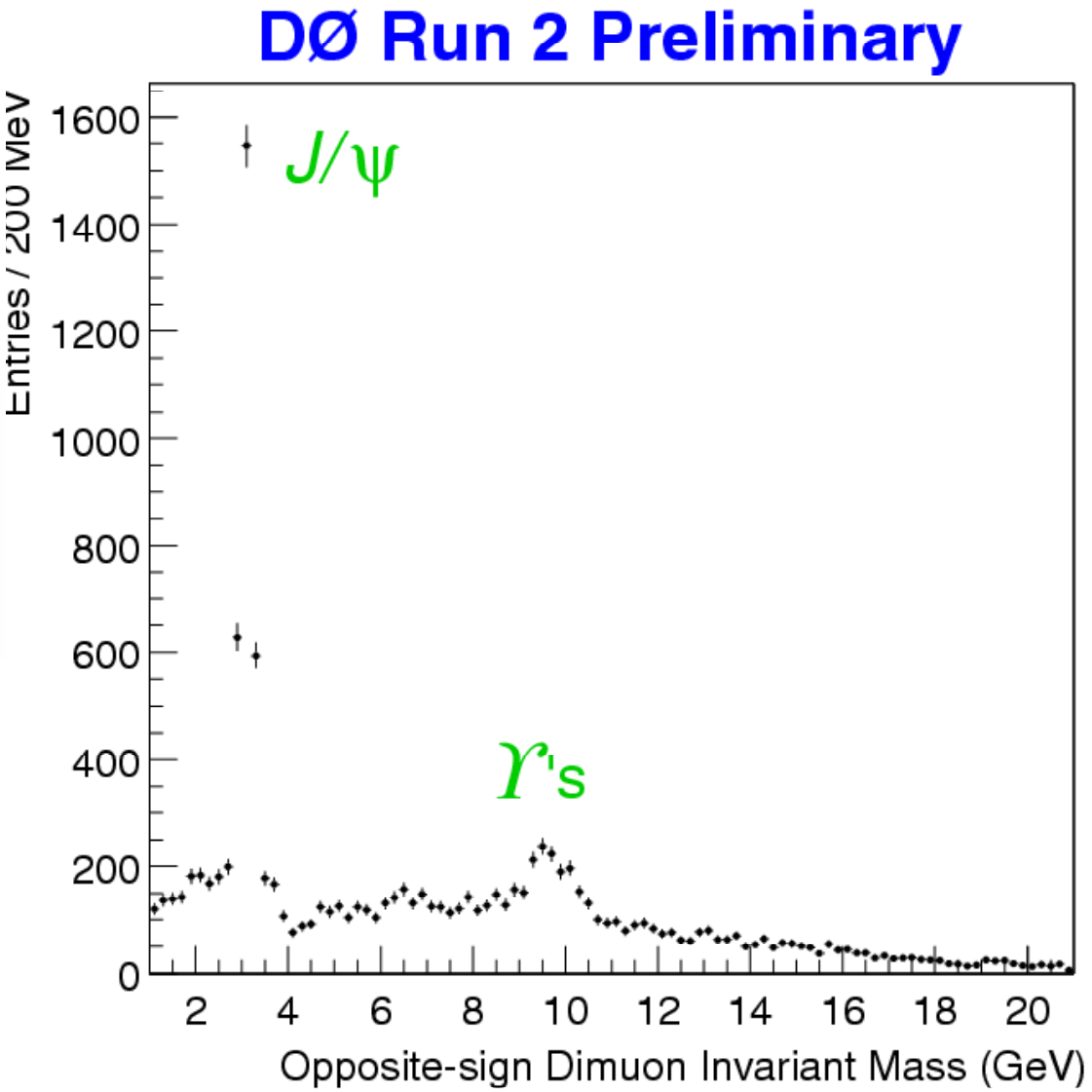
$2.5 \leq |\eta| \leq 3.7$



Run II J/ψ and Υ signal



$\sigma(J/\psi) = 88 \pm 3$ MeV



Run II J/ψ production cross section

$$\sigma(J/\psi) = \frac{N(J/\psi)}{L\ \varepsilon_{kine}\ \varepsilon_{reco}\ \varepsilon_{trigger}\ \varepsilon_{accept}\ \varepsilon_{track\text{-}match}}$$

L Luminosity 4.8 pb^{-1}

$\varepsilon_{trigger}$: di-muon trigger.

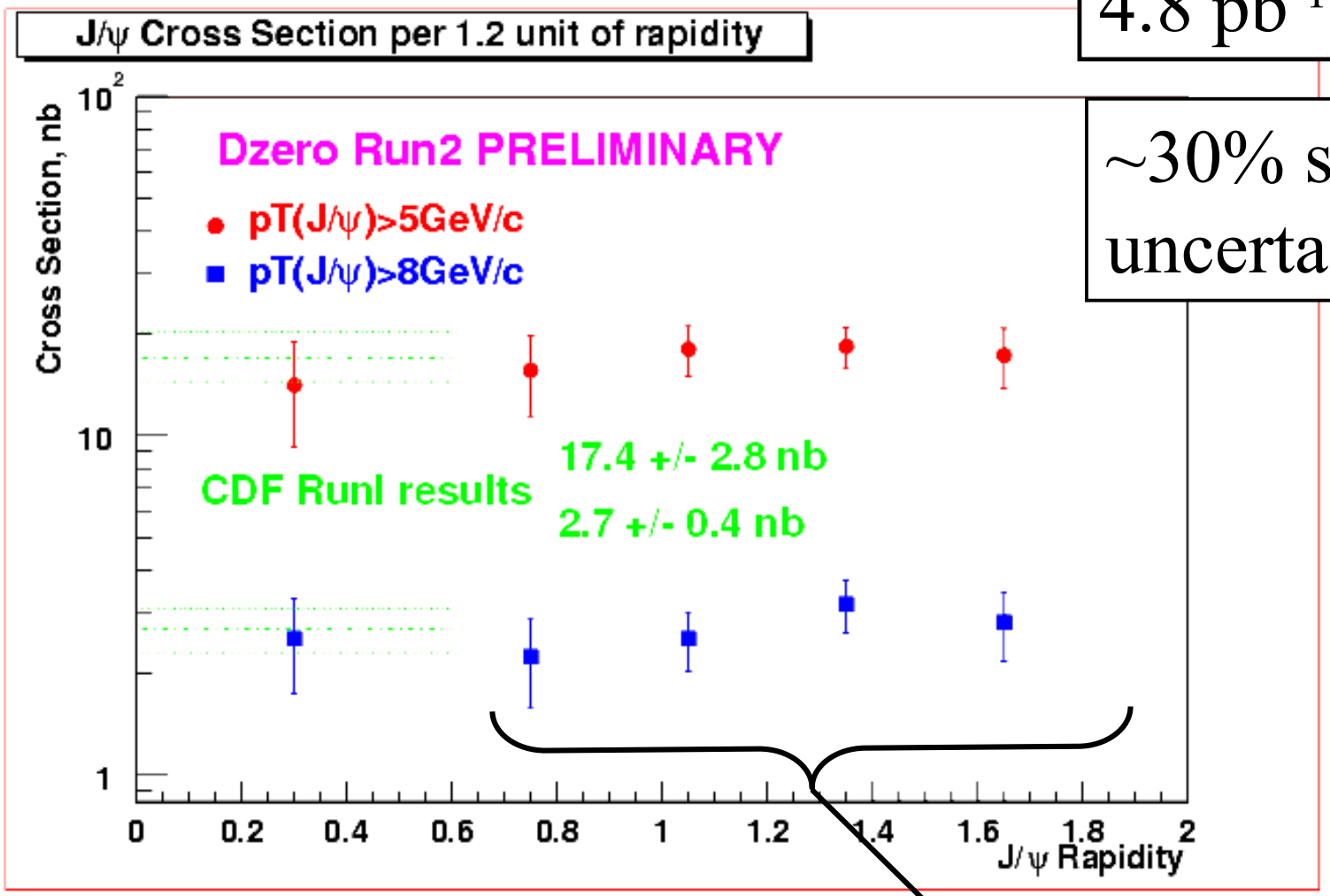
ε_{reco}: from scanning, muon system only

$\varepsilon_{track\text{-}match}$: muons matched to central track

ε_{kine}: only simulate muons which reach muon chamber

ε_{accept}: inactive material, etc.

Run II J/ψ production cross section-preliminary



4.8 pb^{-1} of data

~30% systematic uncertainty

region not measured in Run I

Future measurements: J/ψ polarization

θ = angle(J/ψ^{lab},$\mu^{J/\psi}$)

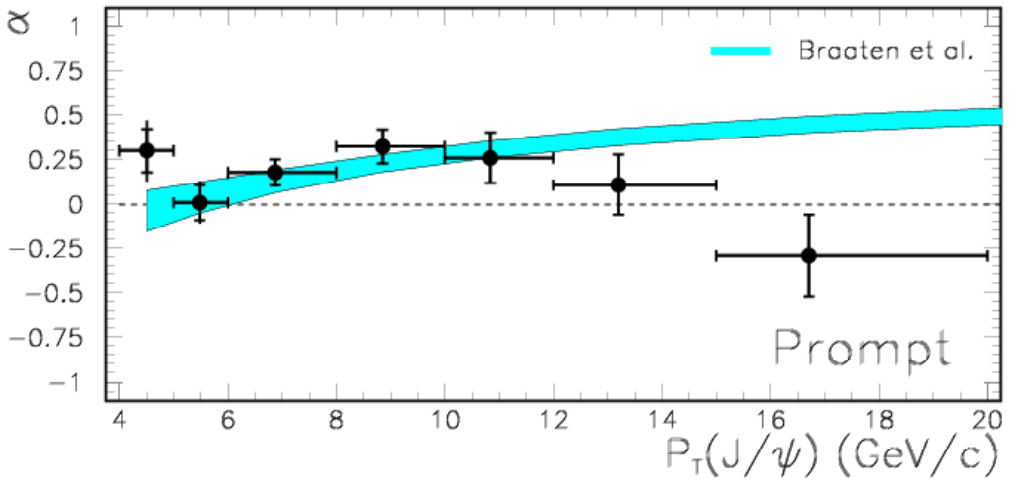
$I(\theta) = 3/2/(\alpha+3)$
$(1+ \alpha \cos^2 \theta)$

$$\alpha = (\sigma_T - 2\sigma_L)/(\sigma_T + 2\sigma_L)$$

CEM: No polarization
NRQCD: transverse at high pt

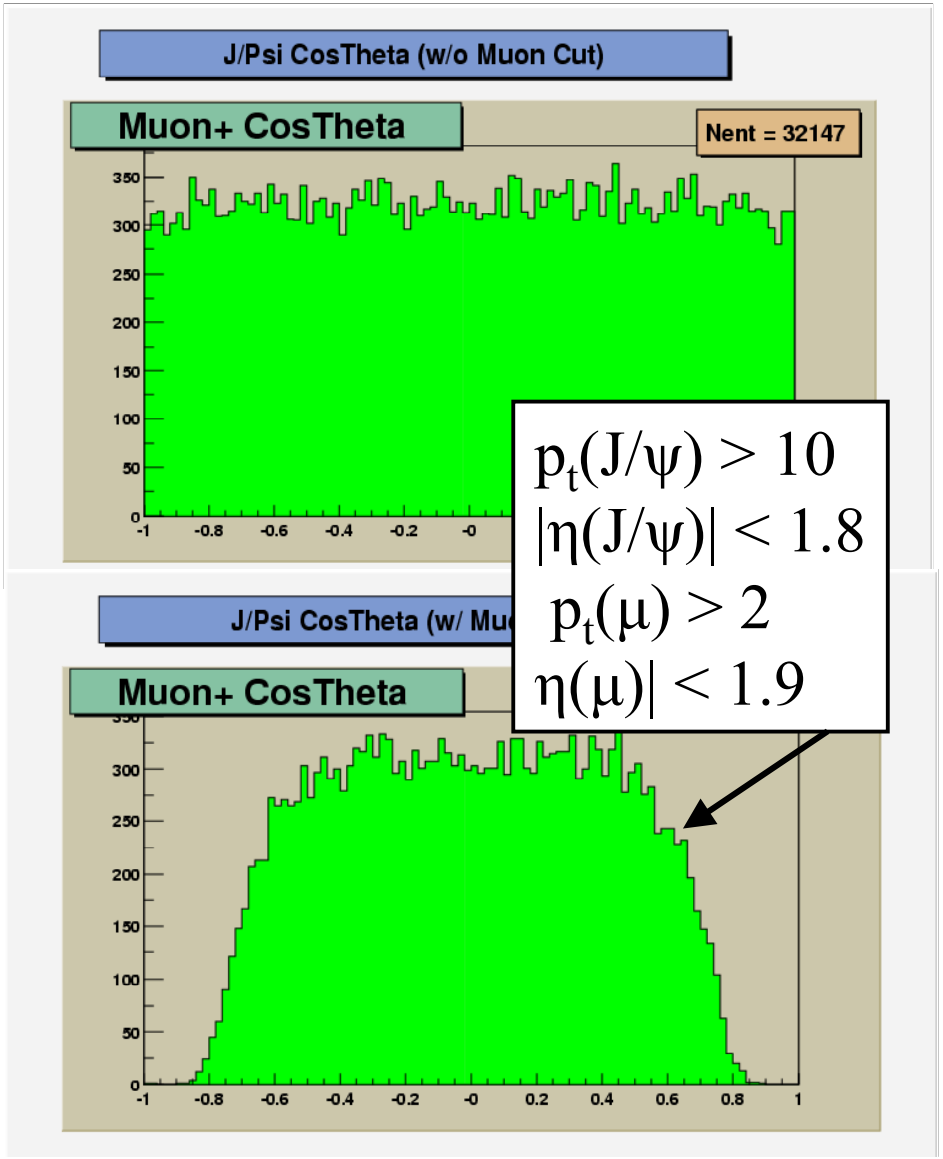
CDF Run I

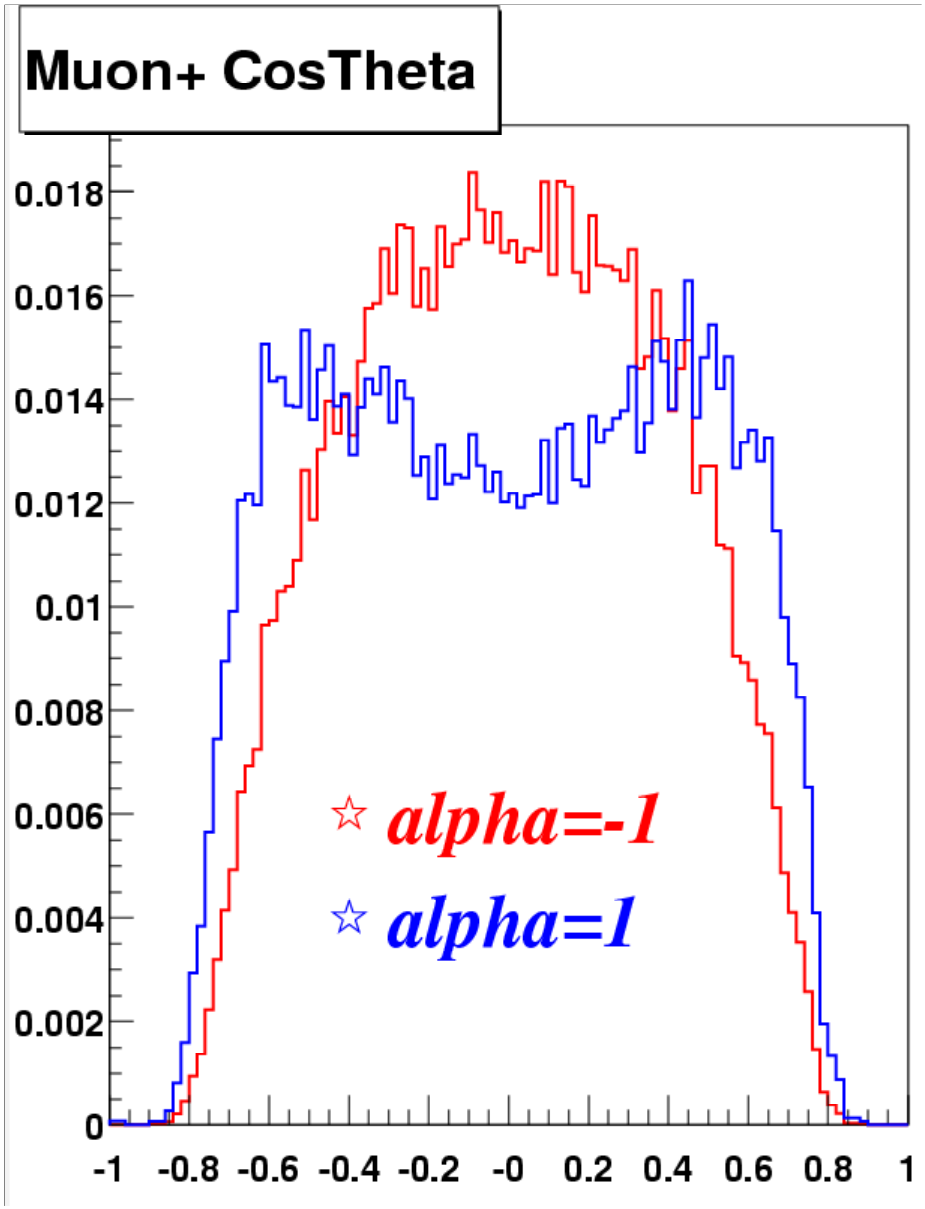
PRL 85, 2886(2000)



J/ψ Polarization

$\theta = \text{angle}(J/\psi^{lab}, \mu^{J/\psi})$





Conclusions

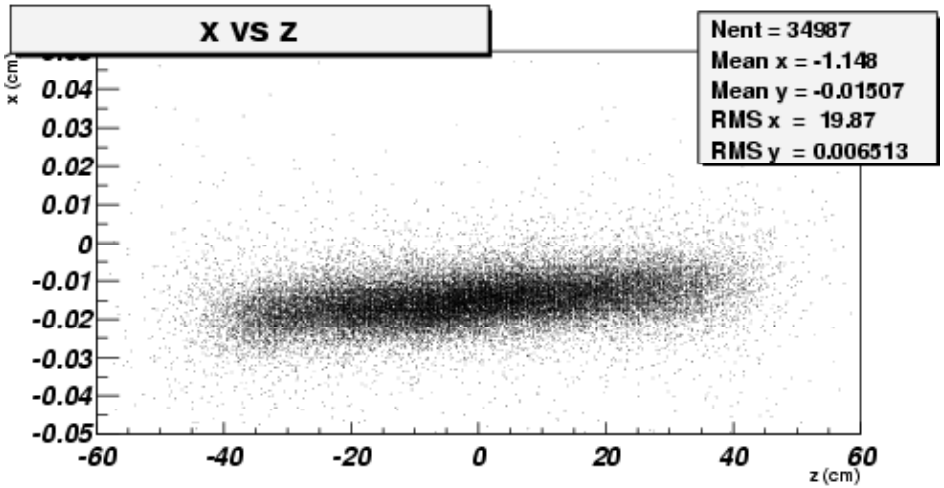
- Improved muon and new tracking systems
  ⇨ lower muon p_t threshold, better resolution, lower systematics

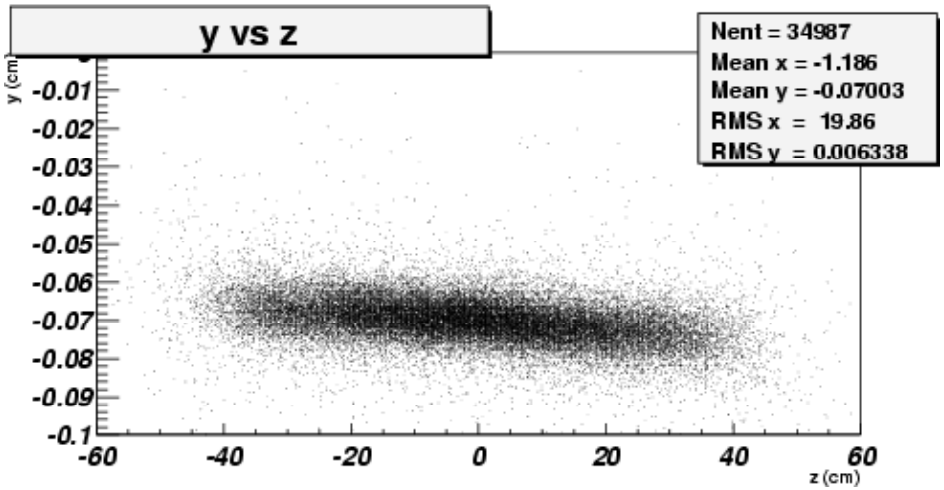
- The detector is (mostly) working as planned.

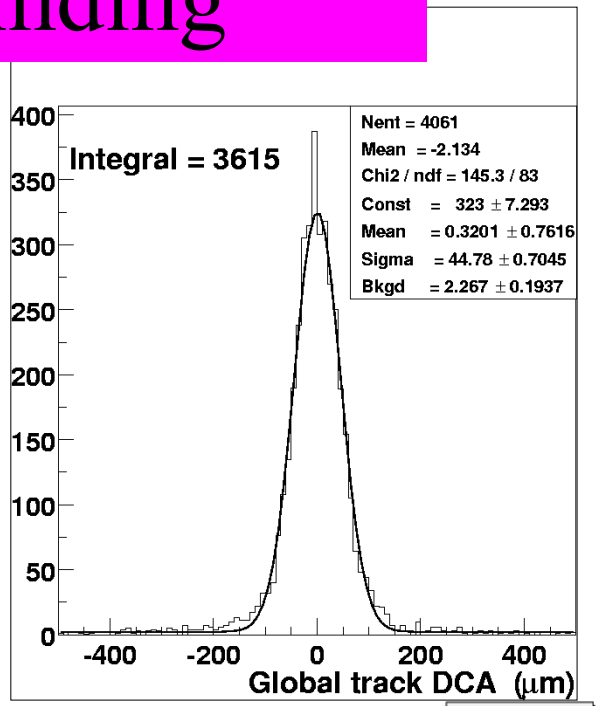
- The first analyses are well under way.

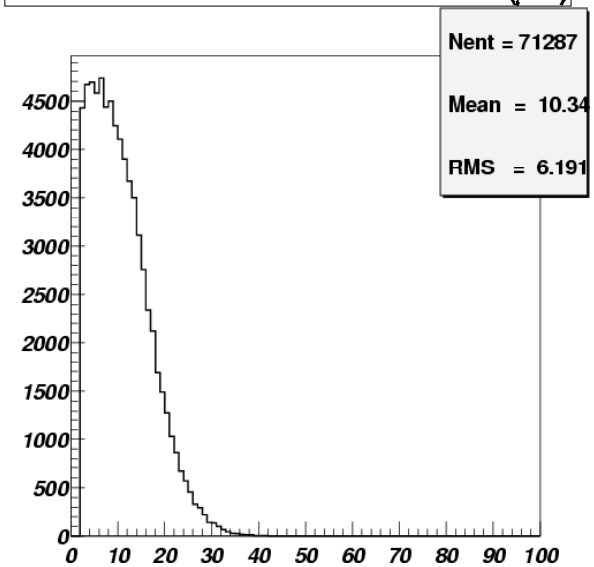
Primary Vertex Finding

Vertex distribution









num tracks in vtx