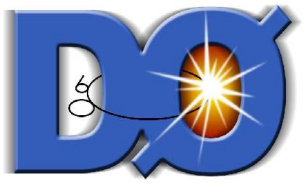

BOSONS AND JETS

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Kansas State University

The DØ Collaboration

AZ U. of Arizona
CA U. of California, Berkeley
U. of California, Riverside
Cal. State U., Fresno
Lawrence Berkeley Nat. Lab.
FL Florida State U.
IL Fermilab
U. of Illinois, Chicago
Northern Illinois U.
Northwestern U.
IN Indiana U.
U. of Notre Dame
Purdue U. Calumet
IA Iowa State U.
KS U. of Kansas
Kansas State U.
LA Louisiana Tech U.
MD U. of Maryland
MA Boston U.
Northeastern U.
MI U. of Michigan
Michigan State U.
MS U. of Mississippi
NE U. of Nebraska
NJ Princeton U.
NY Columbia U.
U. of Rochester
SUNY, Buffalo
SUNY, Stony Brook
Brookhaven Nat. Lab.
OK Langston U.
U. of Oklahoma
Oklahoma State U.
RI Brown U.
TX Southern Methodist U.
U. of Texas at Arlington
Rice U.
VA U. of Virginia
WA U. of Washington

U. de Buenos Aires

LAFEX, CBPF, Rio de Janeiro
State U. do Rio de Janeiro
State U. Paulista, São Paulo

U. of Alberta
McGill U.
Simon Fraser U.
York U.

IHEP, Beijing
U. of Science and Technology
of China

U. de los Andes, Bogotá

Charles U., Prague
Czech Tech. U., Prague
Academy of Sciences, Prague

LPC, Clermont-Ferrand
ISN, IN2P3, Grenoble
CPPM, IN2P3, Marseille
LAL, IN2P3, Orsay
LPNHE, IN2P3, Paris
DAPNIA/SPP, CEA, Saclay
IReS, Strasbourg
IPN, IN2P3, Villeurbanne

U. San Francisco de Quito

U. of Aachen
Bonn U.
U. of Freiburg
U. of Mainz
Ludwig-Maximilians U., Munich
U. of Wuppertal

Panjab U. Chandigarh
Delhi U., Delhi
Tata Institute, Mumbai

University College, Dublin

KDL, Korea U., Seoul
SungKyunKwan U., Suwan

CINVESTAV, Mexico City

FOM-NIKHEF, Amsterdam
U. of Amsterdam / NIKHEF
U. of Nijmegen / NIKHEF

JINR, Dubna
ITEP, Moscow
Moscow State U.
IHEP, Protvino
PNPI, St. Petersburg

Lund U.
RIT, Stockholm
Stockholm U.
Uppsala U.

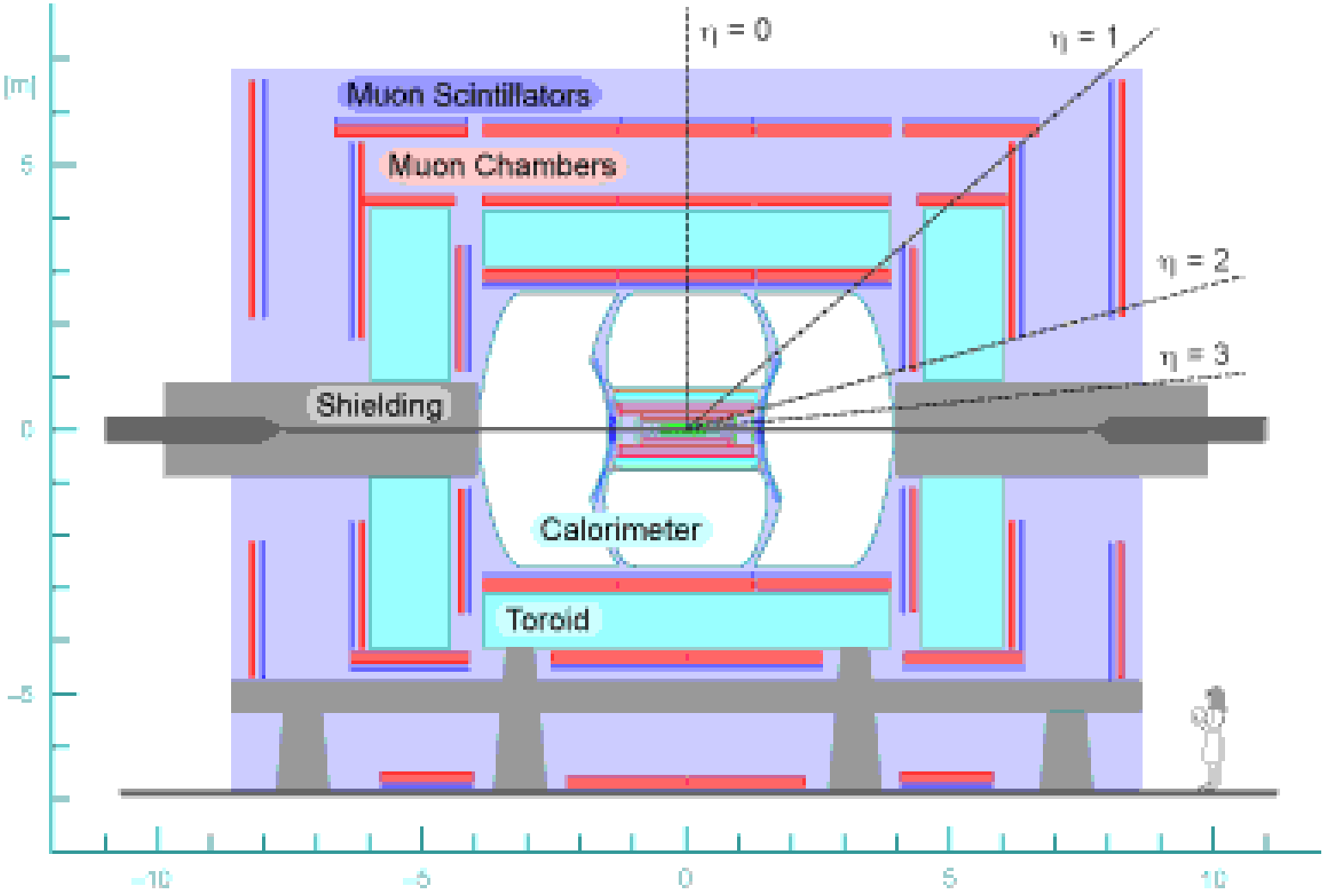
PI of the U. of Zurich

Lancaster U.
Imperial College, London
U. of Manchester

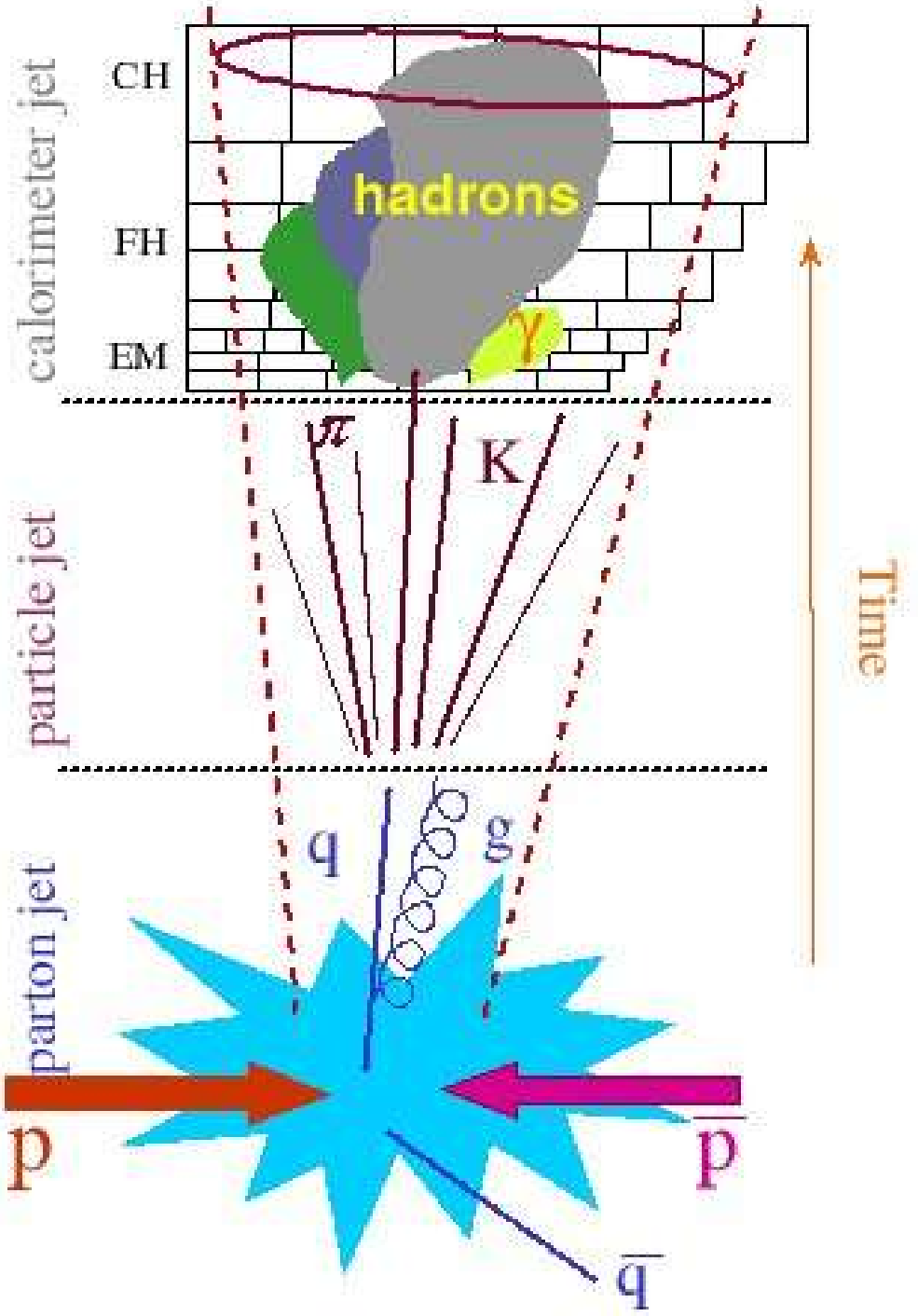
HCIP, Hochiminh City

Ann Heinson, UC Riverside

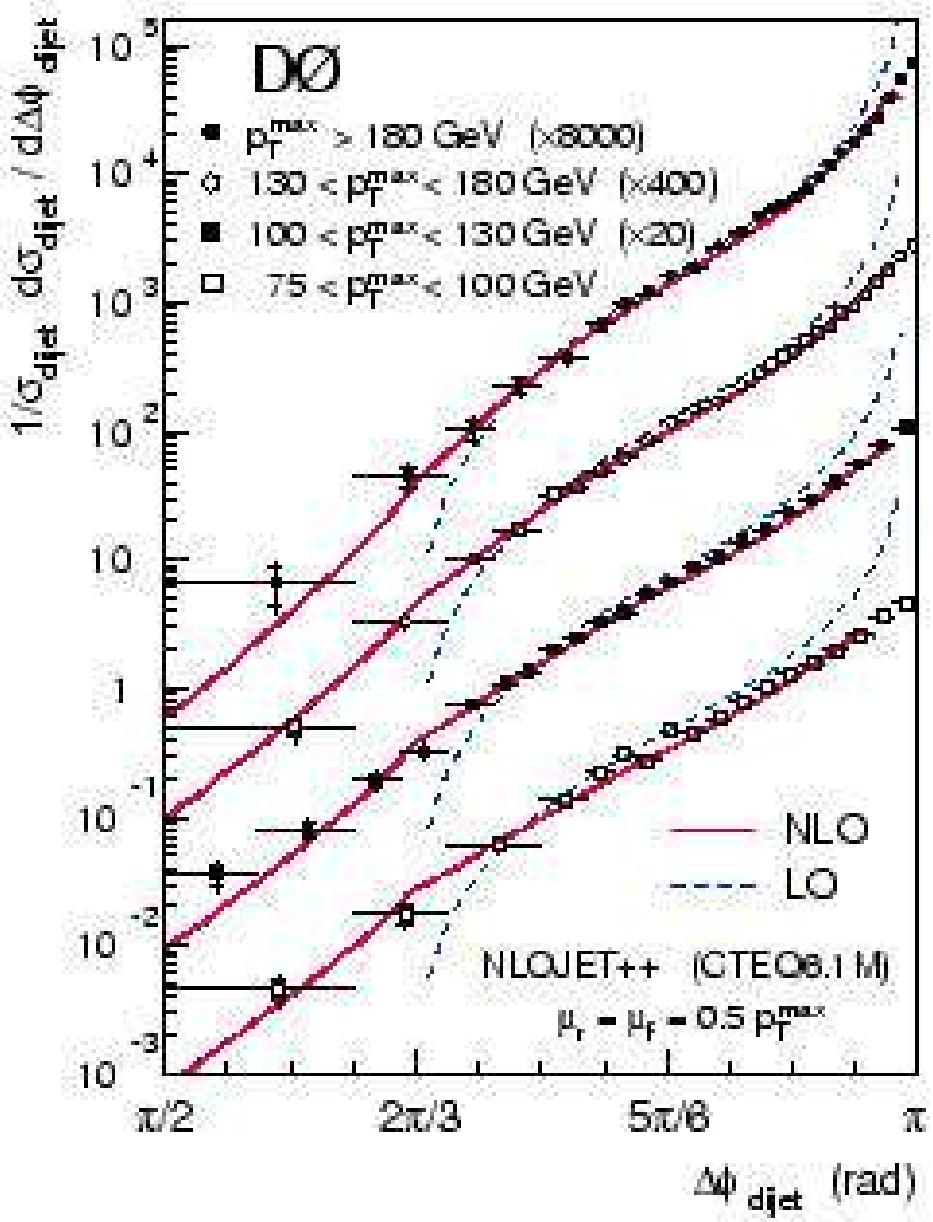
detector in Run II

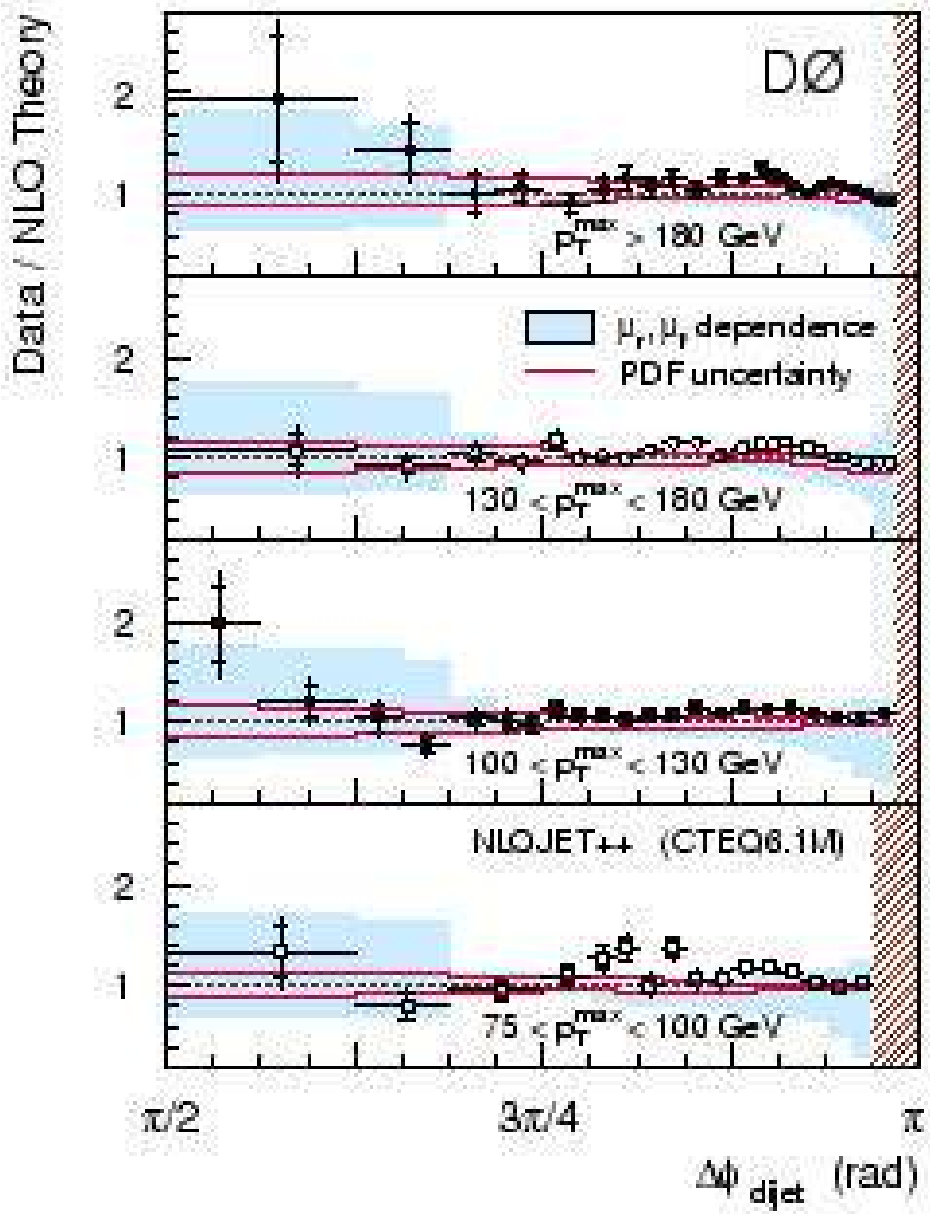


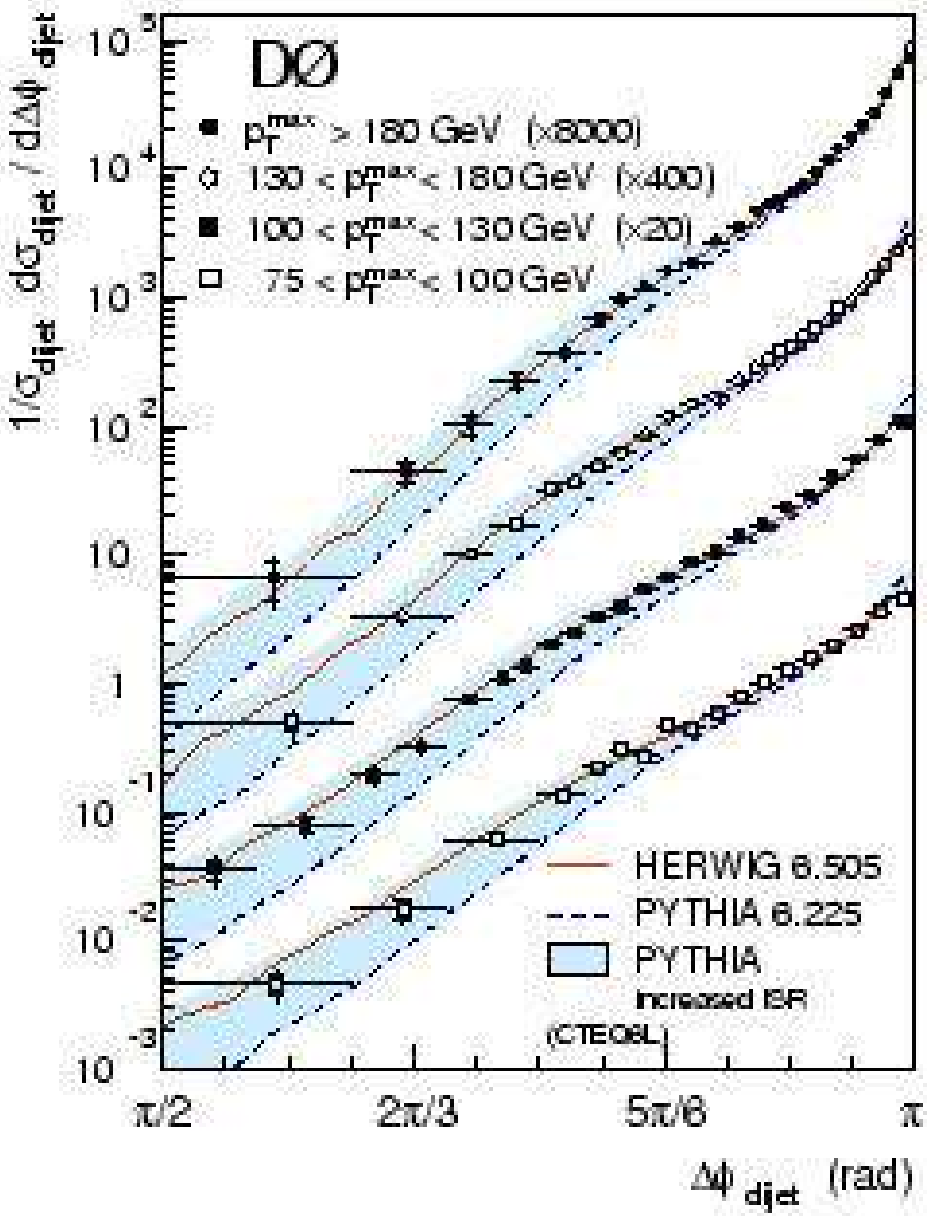
Run II Integrated Luminosity


calorimeter jet
CH
FH
EM
hadrons
γ
particle jet
π
K
Time
parton jet
q
g
p
p̄
q̄

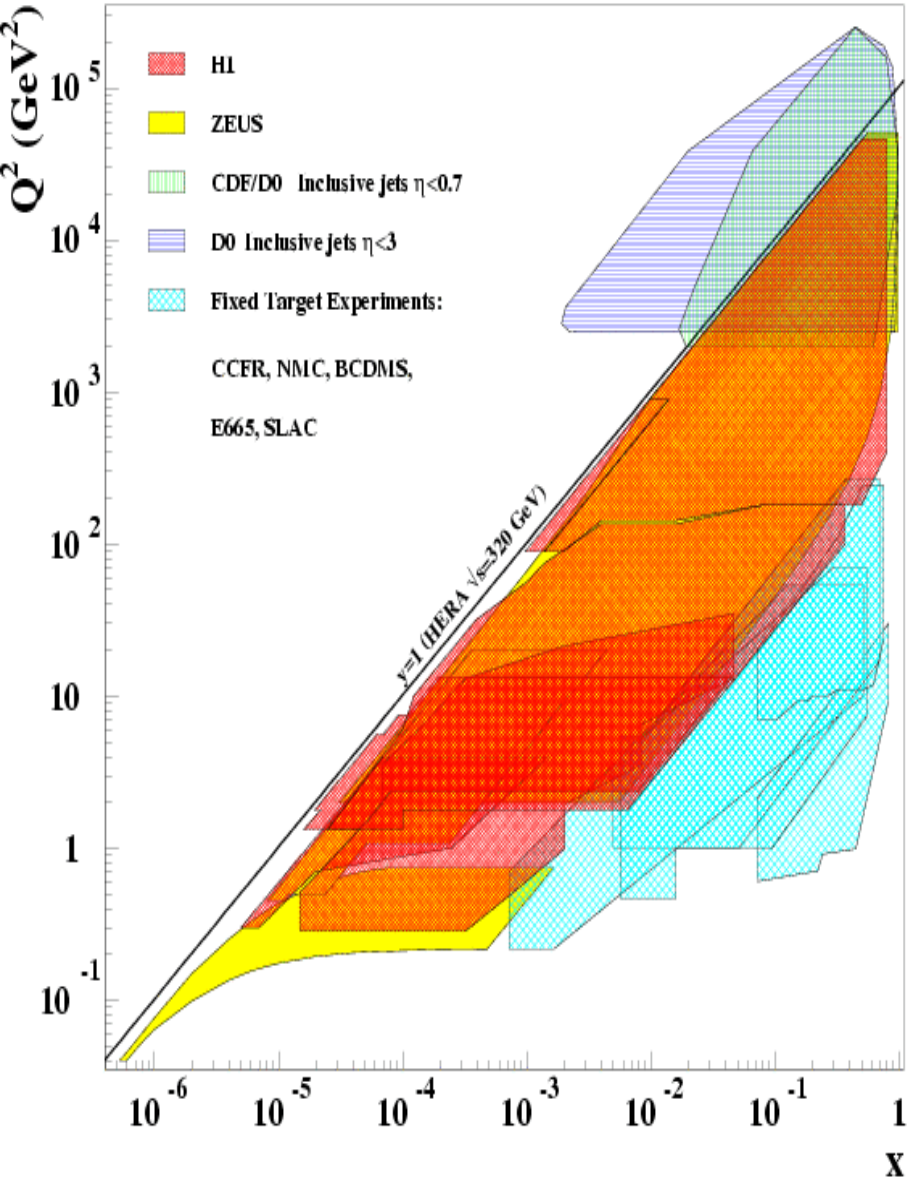
Di-jet Azimuthal Decorrelations



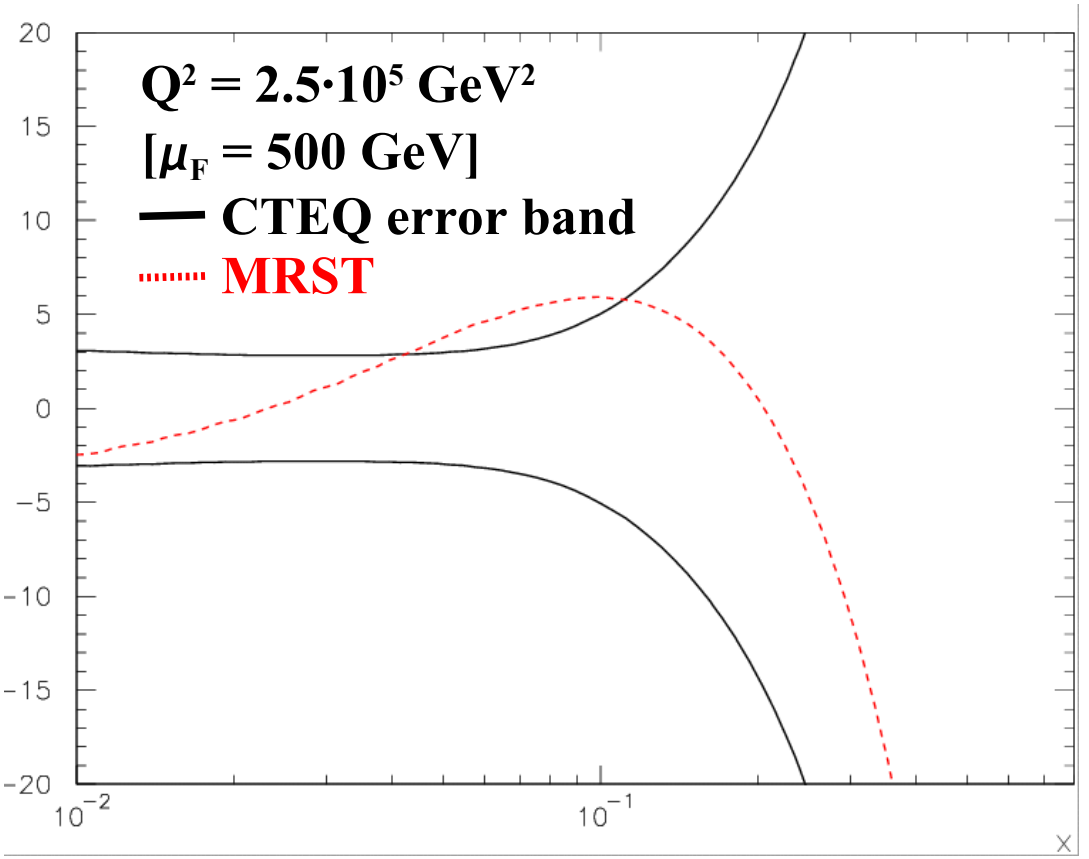

Data / NLO Theory
DØ
p_T^{max} > 180 GeV
μ_r, μ_f dependence
PDF uncertainty
130 < p_T^{max} < 180 GeV
100 < p_T^{max} < 130 GeV
NLOJET++ (CTEQ6.1M)
75 < p_T^{max} < 100 GeV
2
1
π/2
3π/4
π
$\Delta\phi_{djet}$ (rad)


DØ
p_T^{max} > 180 GeV (×8000)
130 < p_T^{max} < 180 GeV (×400)
100 < p_T^{max} < 130 GeV (×20)
75 < p_T^{max} < 100 GeV
HERWIG 6.505
PYTHIA 6.225
PYTHIA
increased ISR
(CTEQ6L)
$1/\sigma_{dijet}\ d\sigma_{dijet} / d\Delta\psi_{dijet}$
$\Delta\psi_{dijet}$ (rad)
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
π/2
2π/3
5π/6
π

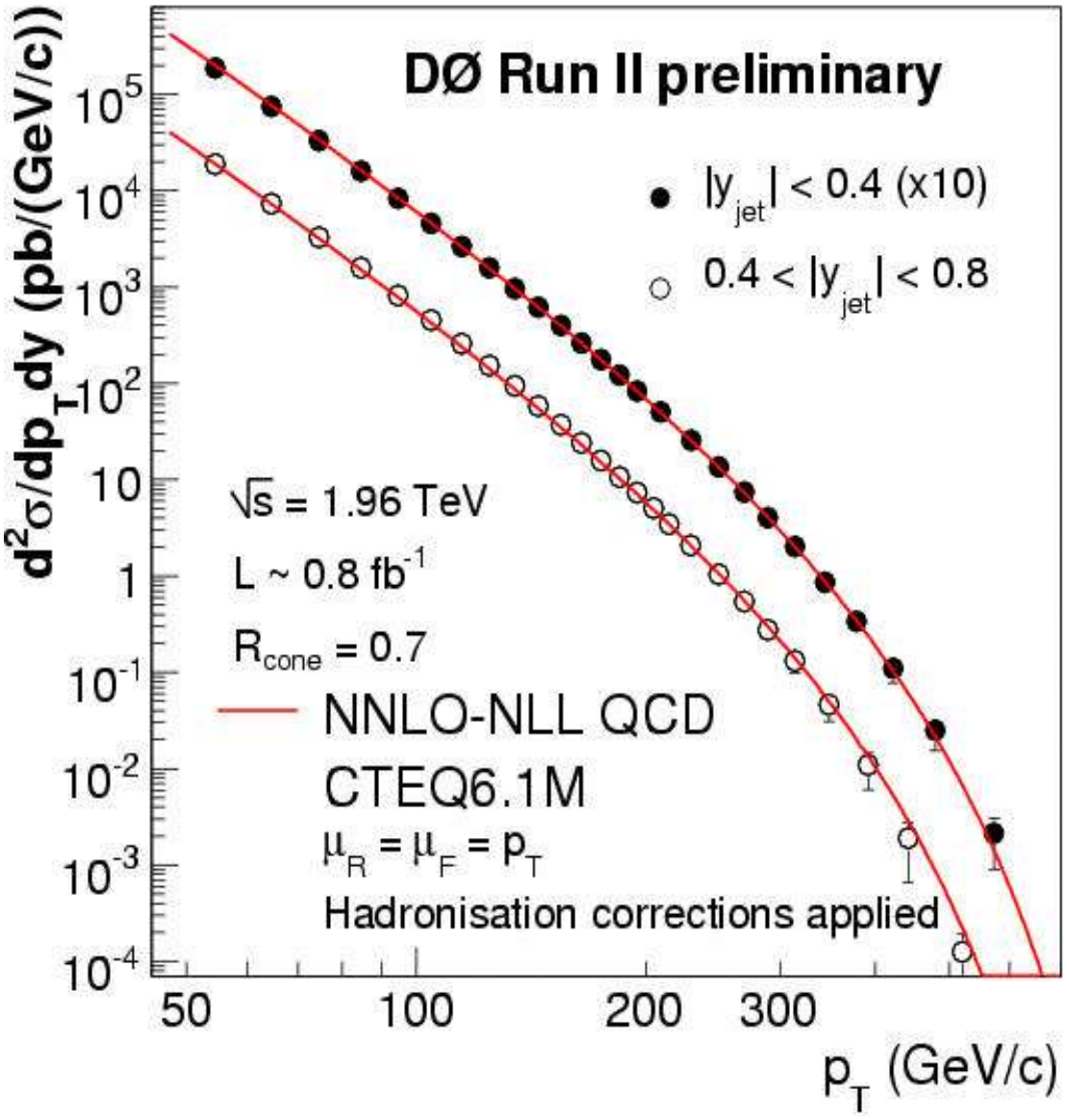
Motivation for inclusive jets



Gluon PDF uncertainty

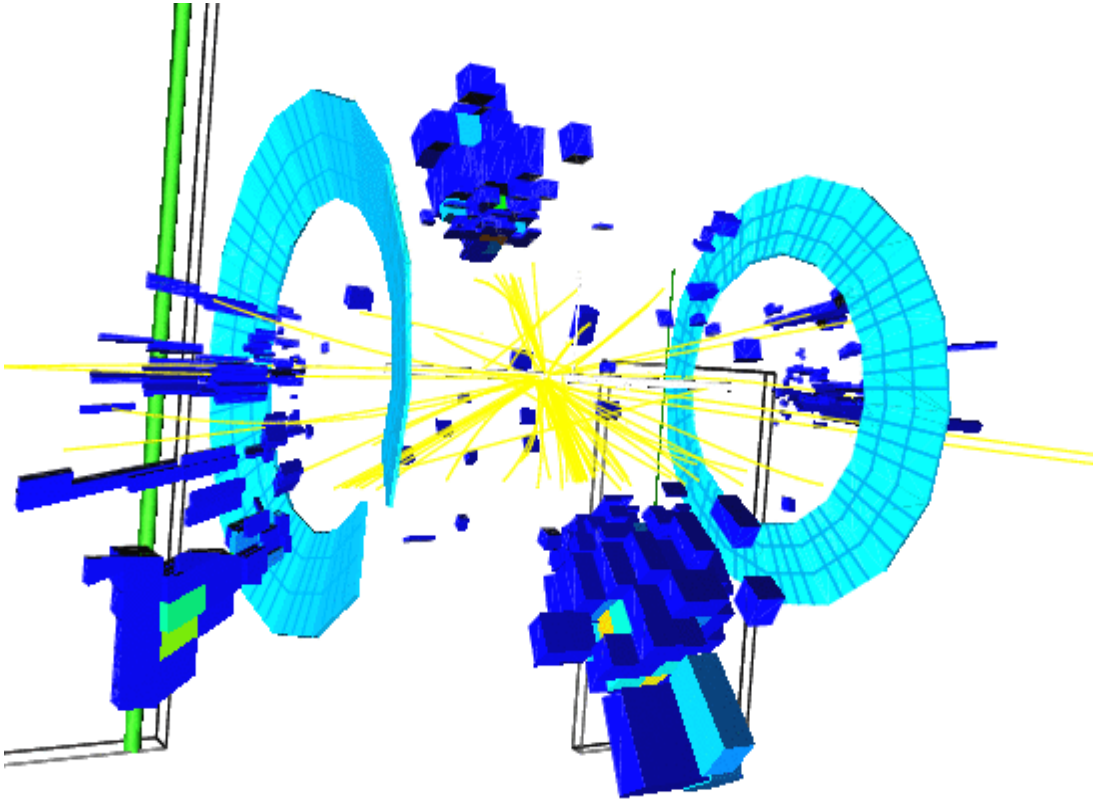


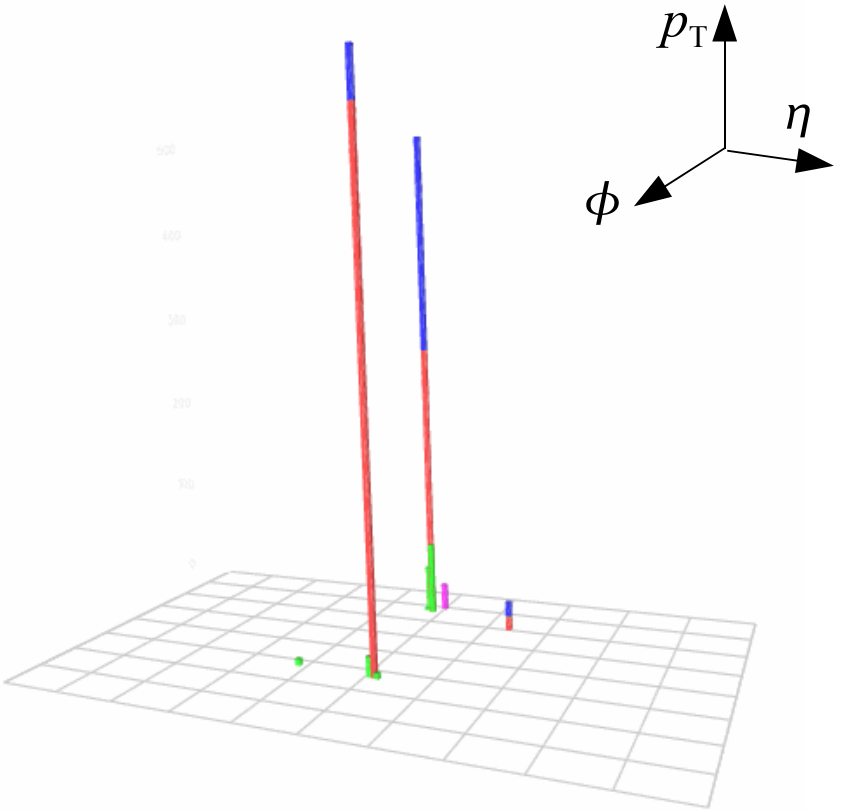
Inclusive jet cross section

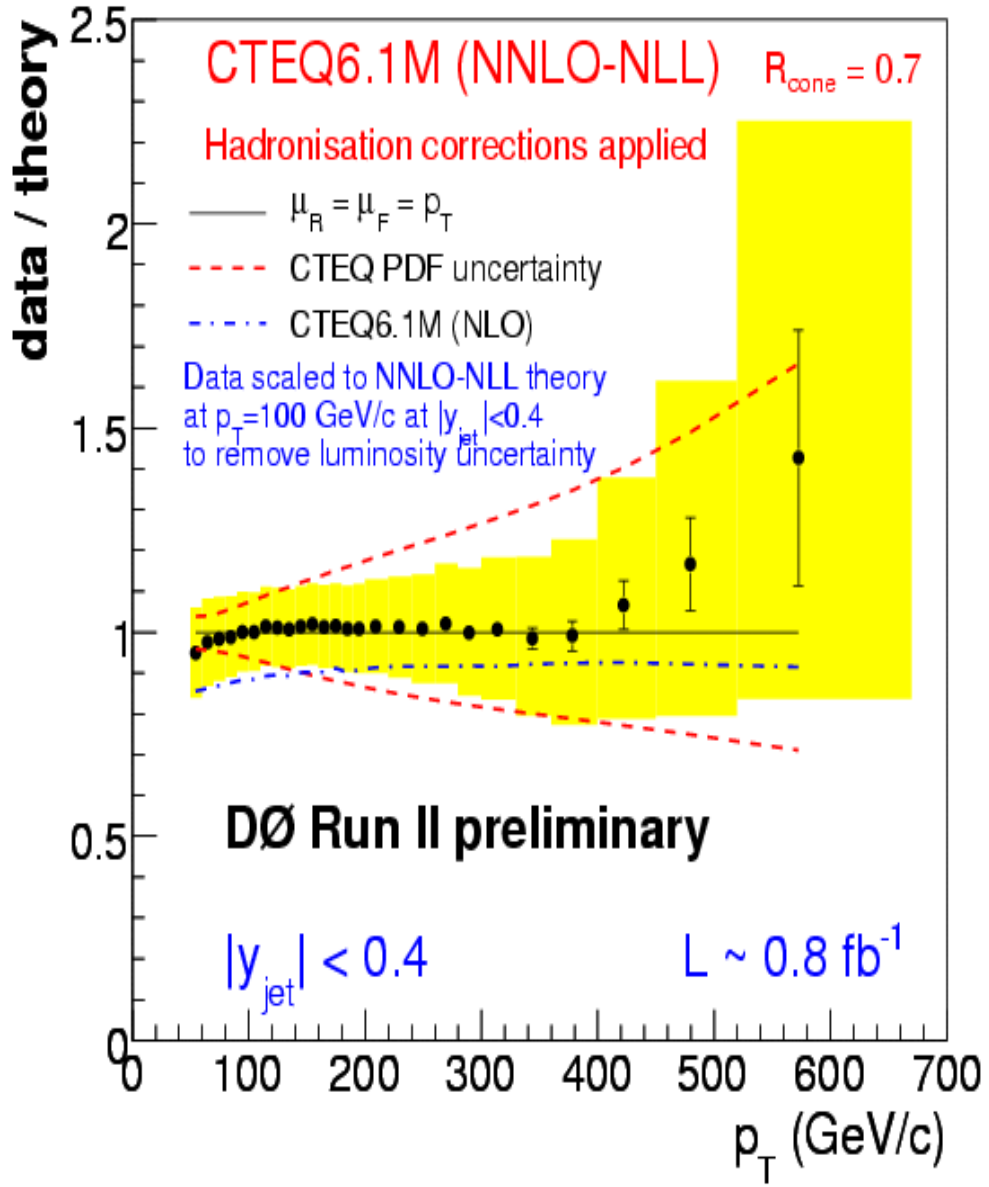


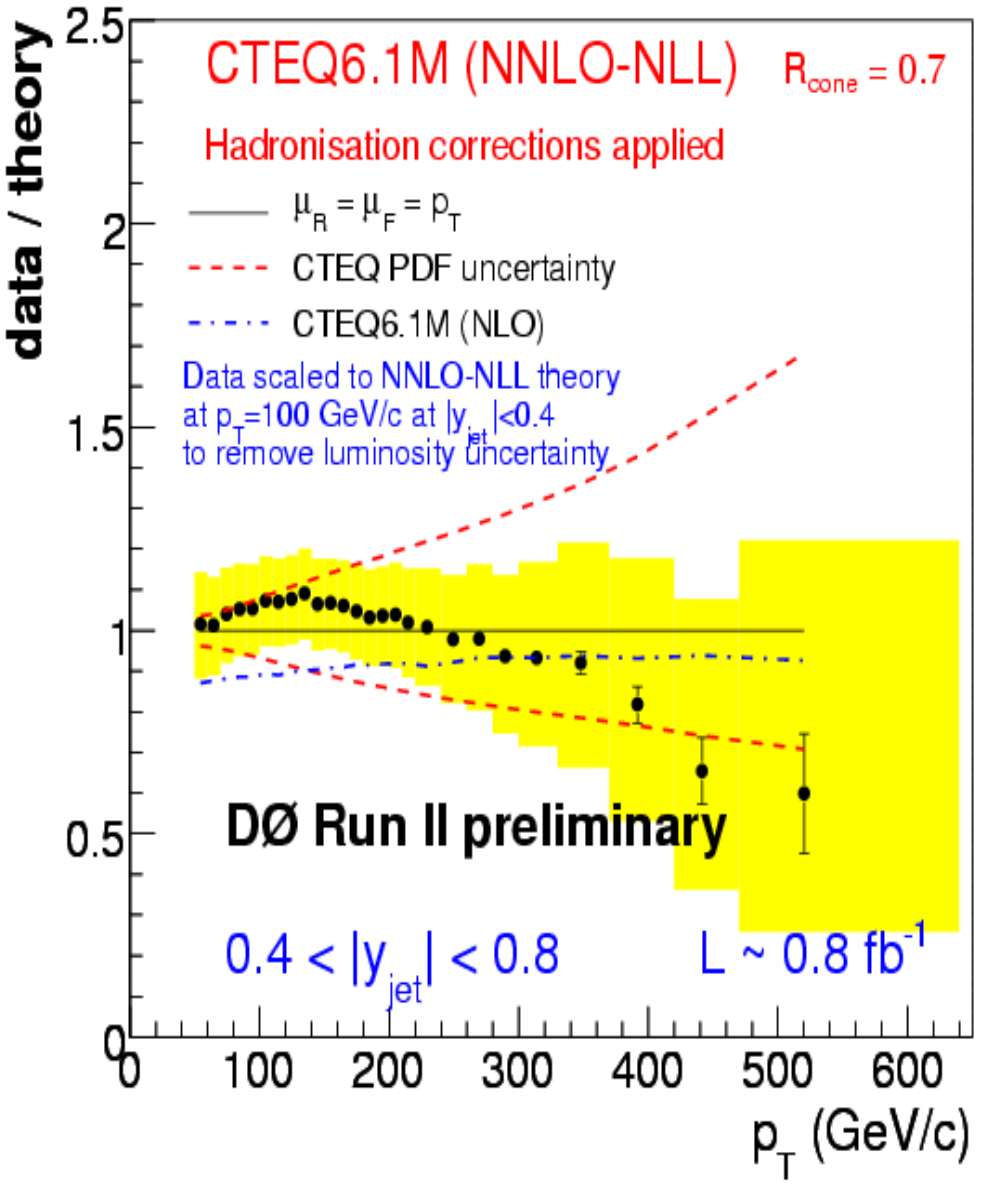
Highest pT event

first jet	second jet
p_T = 624 GeV	p_T = 594 GeV
y_{jet} = 0.14	y_{jet} = -0.17
ϕ_{jet} = 2.10	ϕ_{jet} = 5.27
M_{jj} = 1.22 TeV	






CTEQ6.1M (NNLO-NLL)
R_{cone} = 0.7
Hadronisation corrections applied
$\mu_R = \mu_F = p_T$
CTEQ PDF uncertainty
CTEQ6.1M (NLO)
Data scaled to NNLO-NLL theory
at p_T=100 GeV/c at $|y_{jet}|$<0.4
to remove luminosity uncertainty
DØ Run II preliminary
$|y_{jet}| < 0.4$
L ~ 0.8 fb^{-1}
data / theory
p_T (GeV/c)


CTEQ6.1M (NNLO-NLL)
R_{cone} = 0.7
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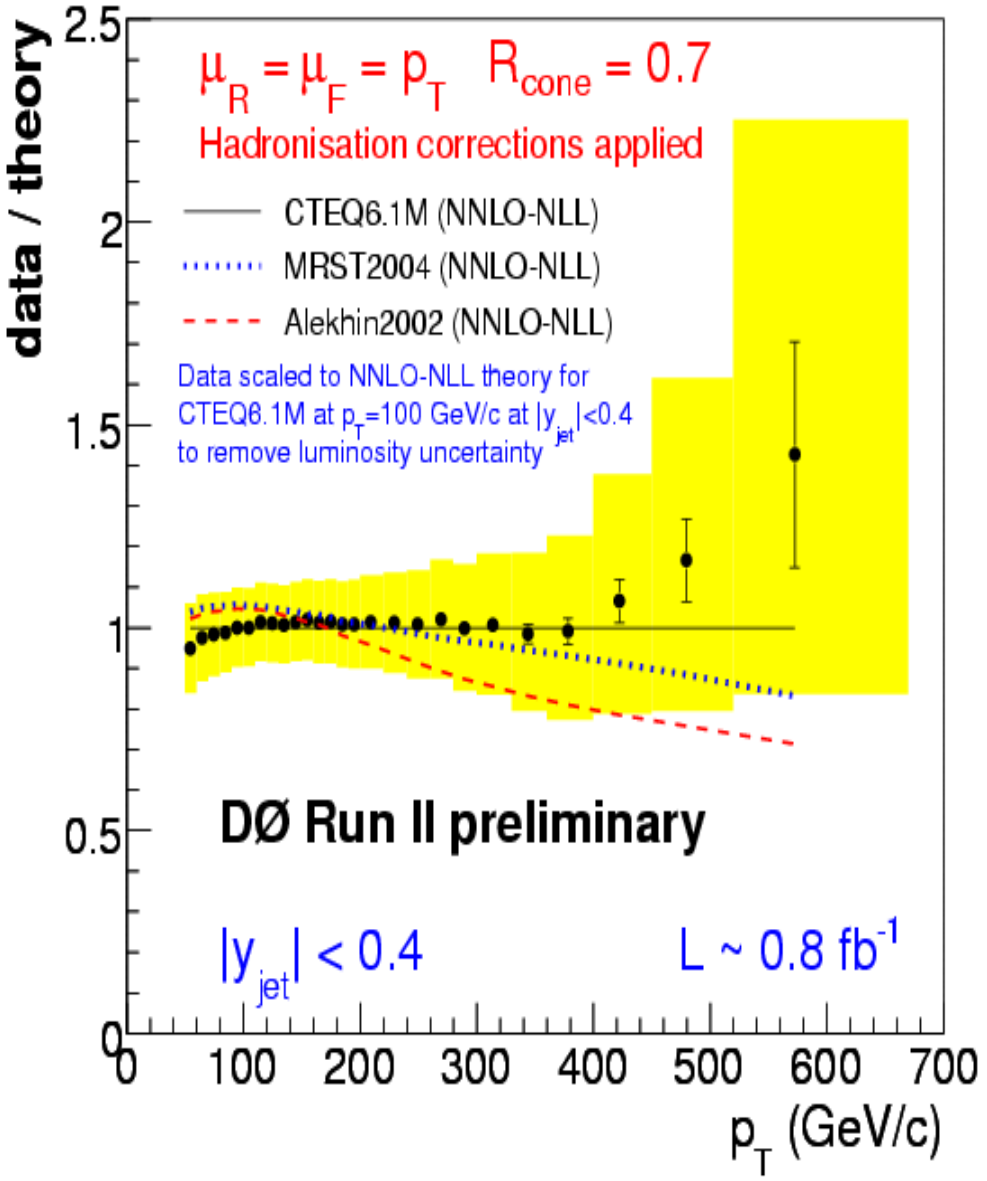
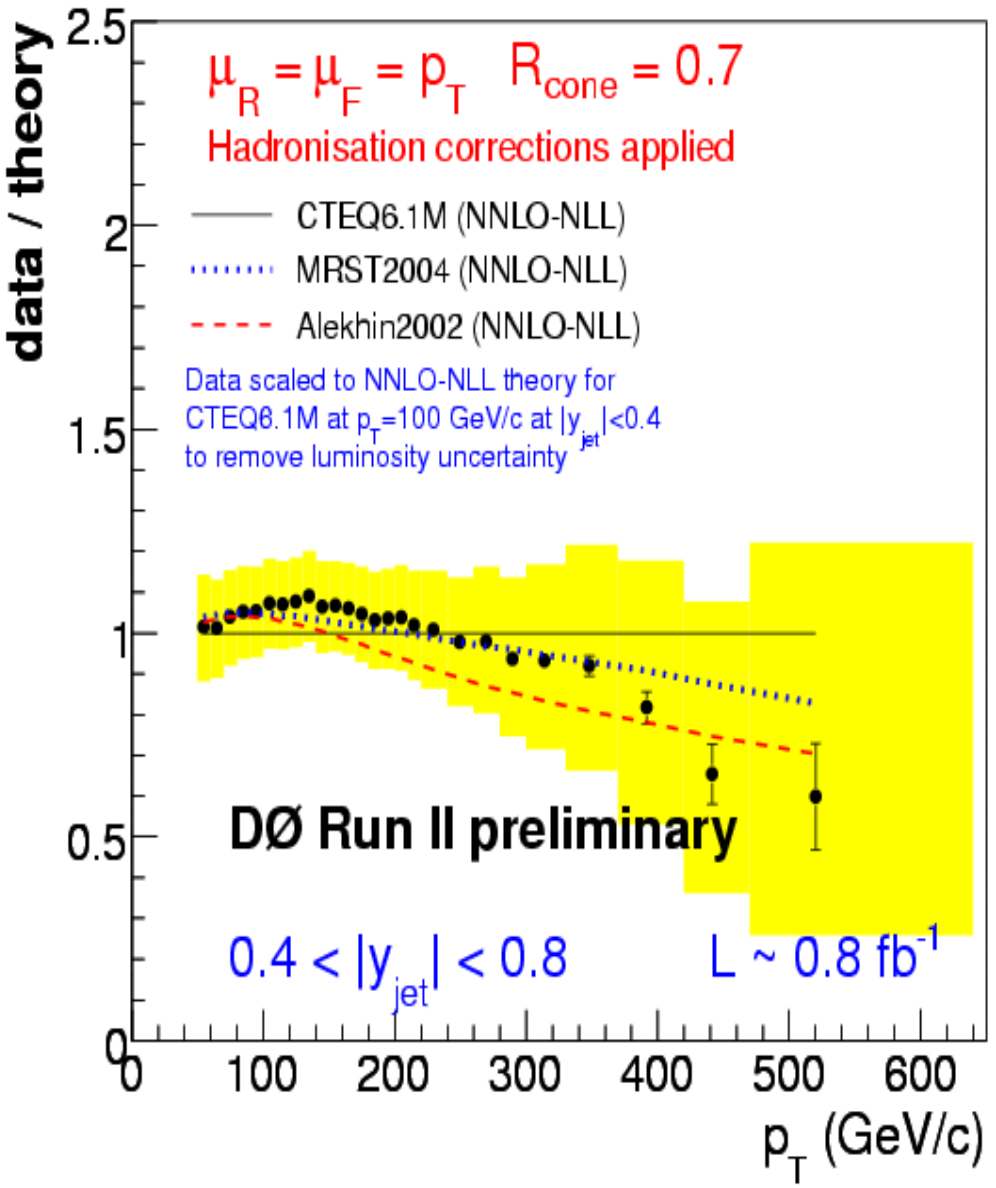
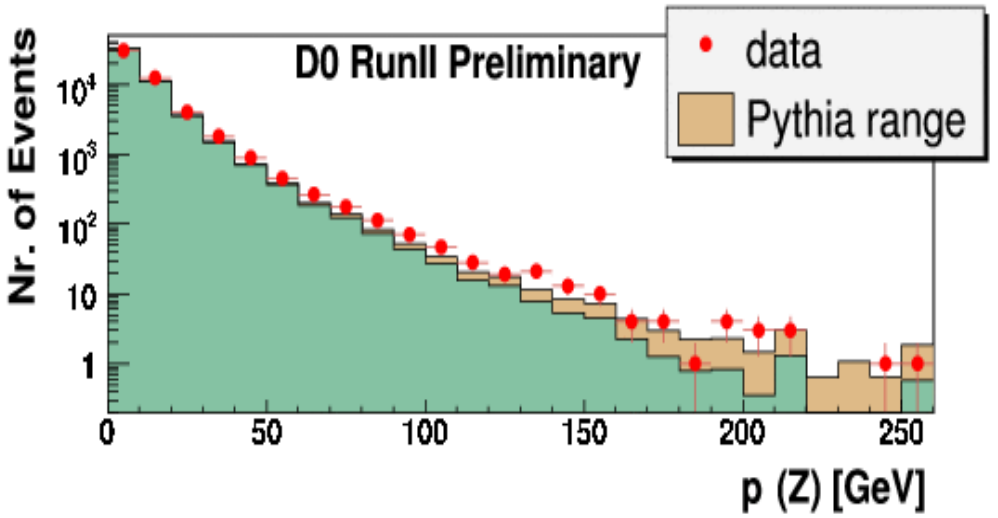
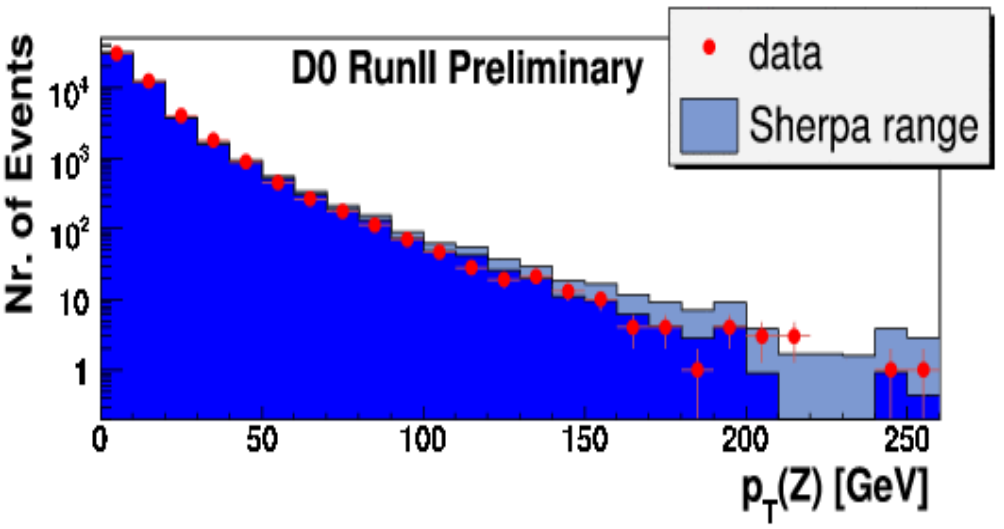
$\mu_R = \mu_F = p_T$
CTEQ PDF uncertainty
CTEQ6.1M (NLO)
Data scaled to NNLO-NLL theory
at p_T=100 GeV/c at $|y_{jet}|$<0.4
to remove luminosity uncertainty
DØ Run II preliminary
$0.4 < |y_{jet}| < 0.8$
L ~ 0.8 fb^{-1}
data / theory
p_T (GeV/c)

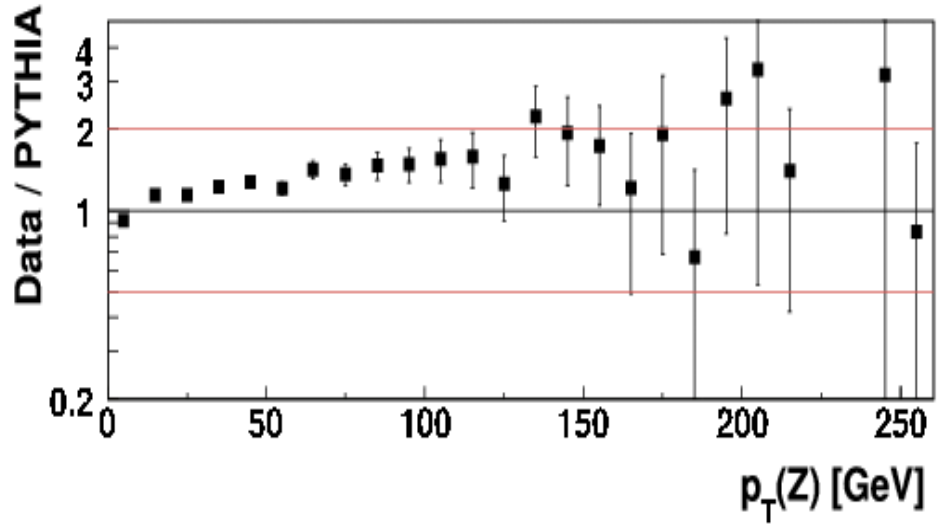

data / theory
$\mu_R = \mu_F = p_T$ $R_{cone} = 0.7$
Hadronisation corrections applied
CTEQ6.1M (NNLO-NLL)
MRST2004 (NNLO-NLL)
Alekhin2002 (NNLO-NLL)
Data scaled to NNLO-NLL theory for CTEQ6.1M at p_T=100 GeV/c at $|y_{jet}|$<0.4 to remove luminosity uncertainty
DØ Run II preliminary
$|y_{jet}| < 0.4$
$L \sim 0.8\ fb^{-1}$
p_T (GeV/c)

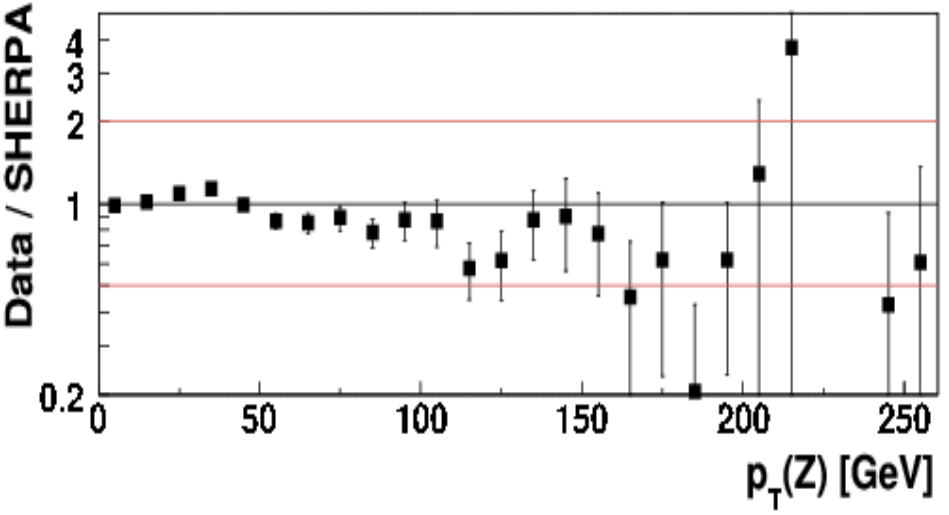

data / theory
$\mu_R = \mu_F = p_T$ $R_{cone} = 0.7$
Hadronisation corrections applied
CTEQ6.1M (NNLO-NLL)
MRST2004 (NNLO-NLL)
Alekhin2002 (NNLO-NLL)
Data scaled to NNLO-NLL theory for CTEQ6.1M at p_T=100 GeV/c at $|y_{jet}|$<0.4 to remove luminosity uncertainty
DØ Run II preliminary
$0.4 < |y_{jet}| < 0.8$
$L \sim 0.8\ fb^{-1}$
p_T (GeV/c)

Z+jet events properties



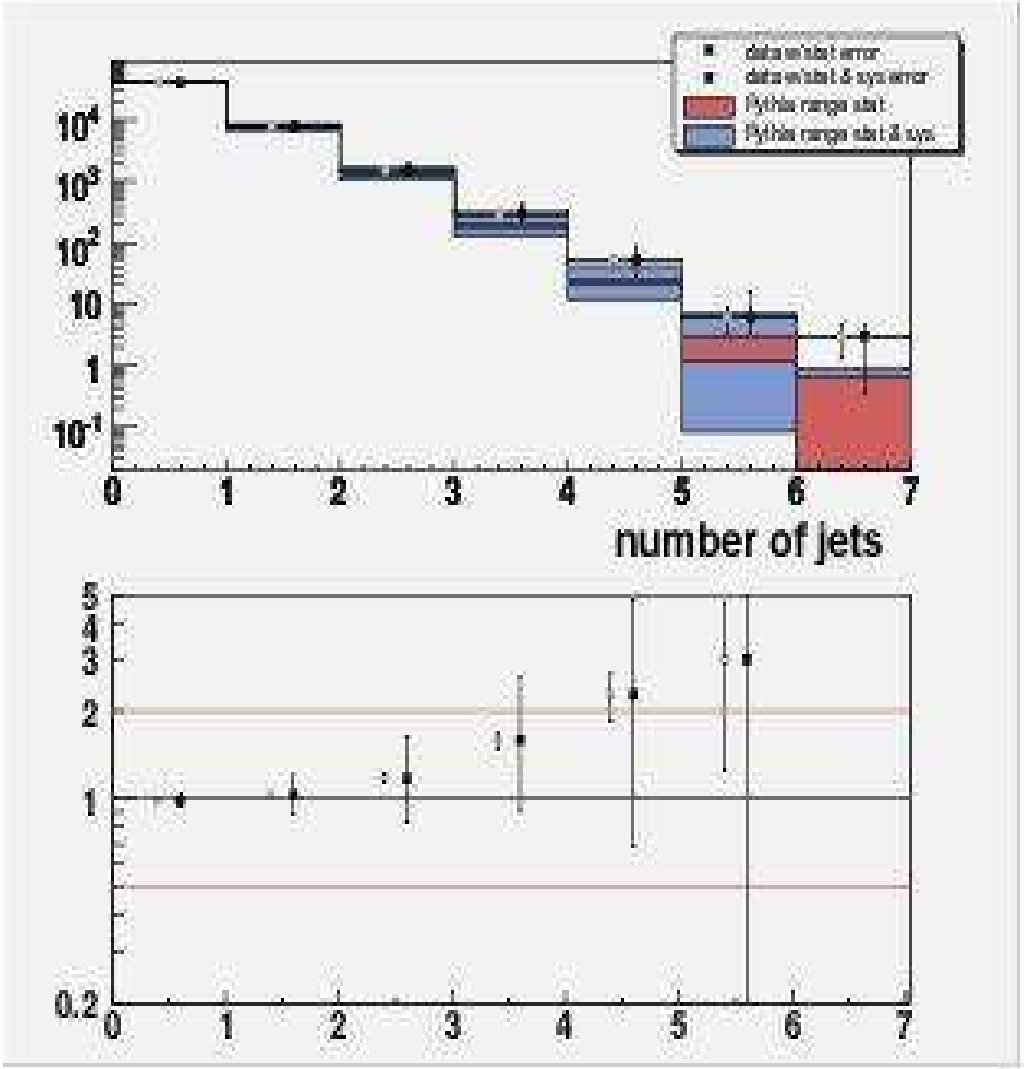




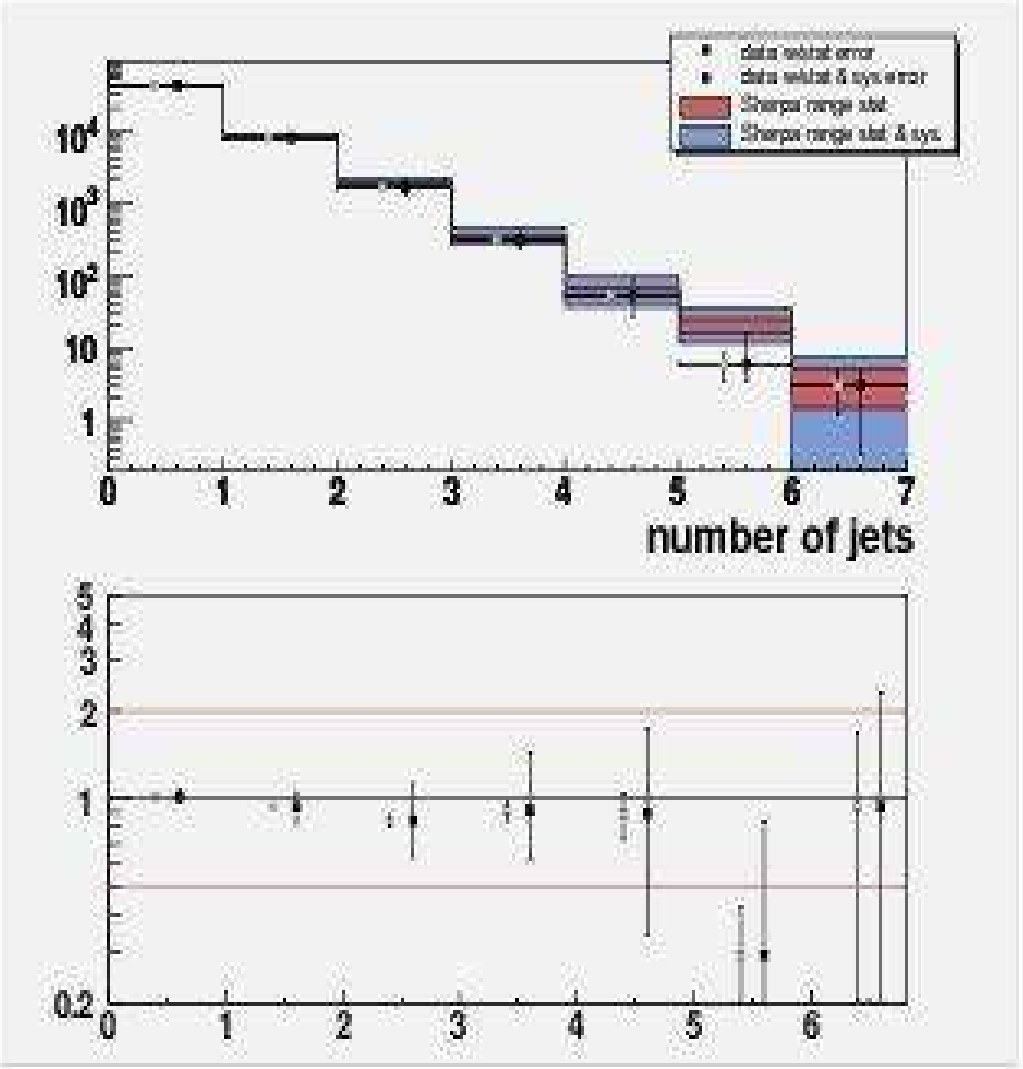


Jet multiplicities in Z+jet events

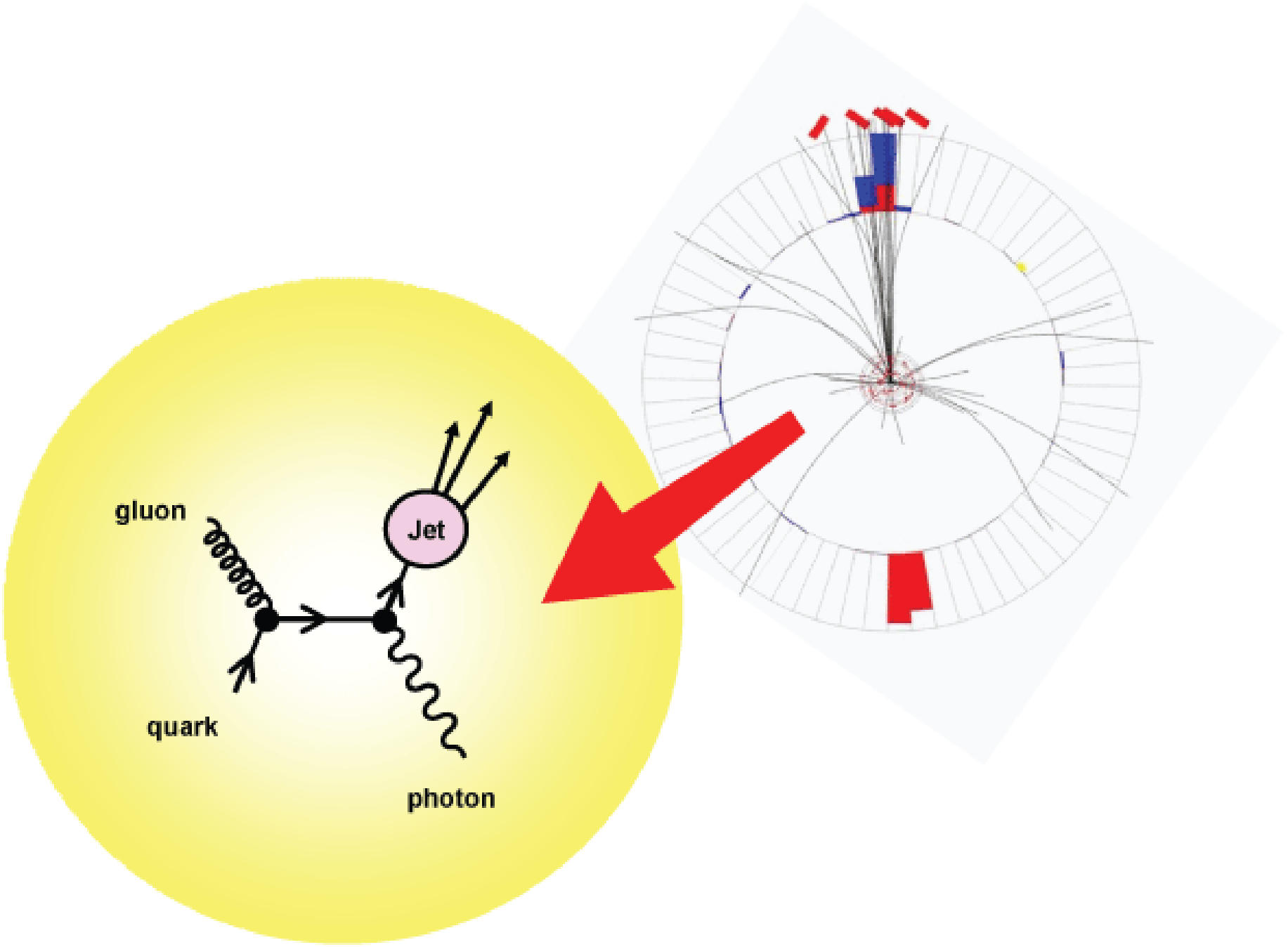
Data and Pythia



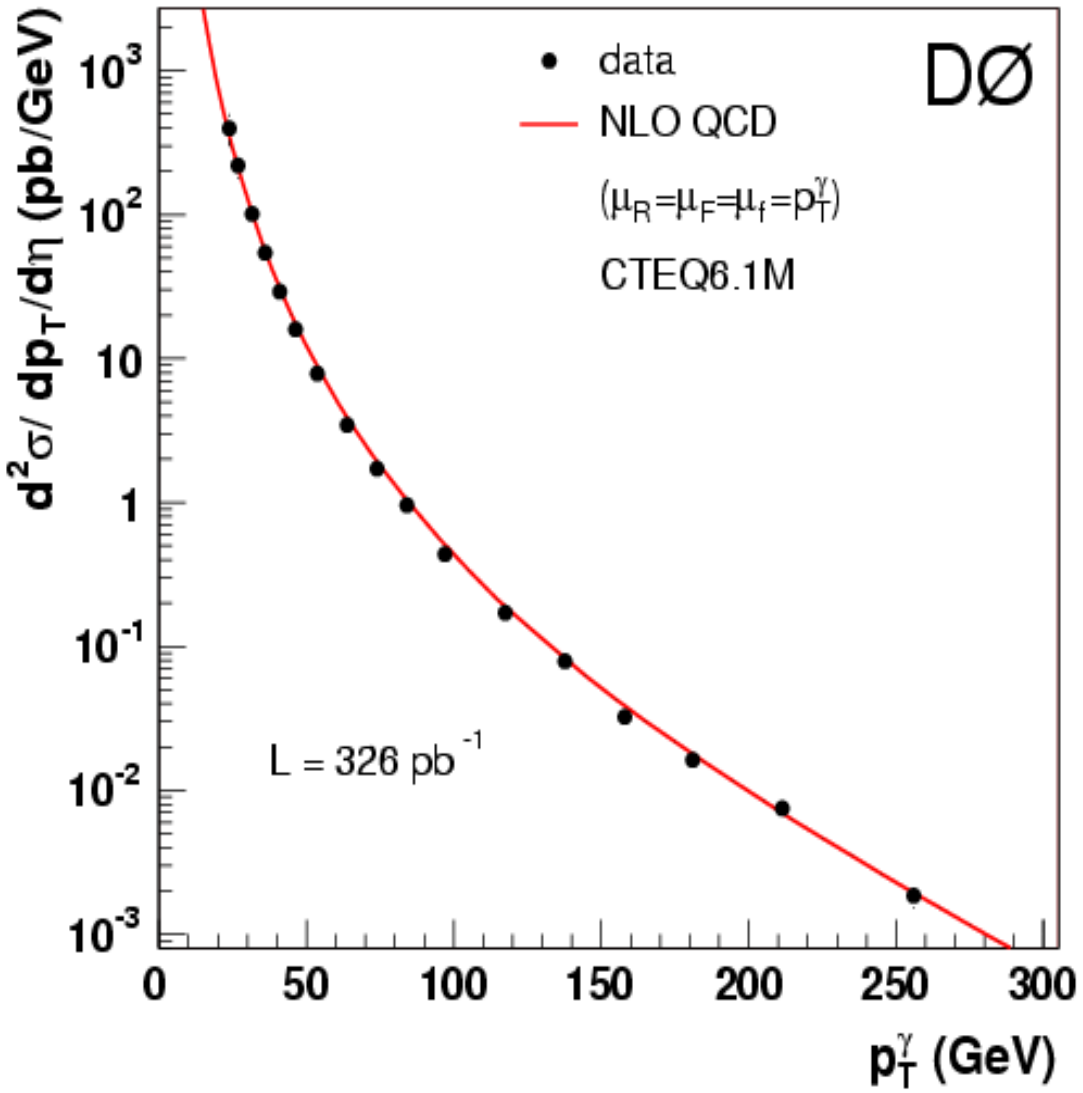
Data and Sherpa

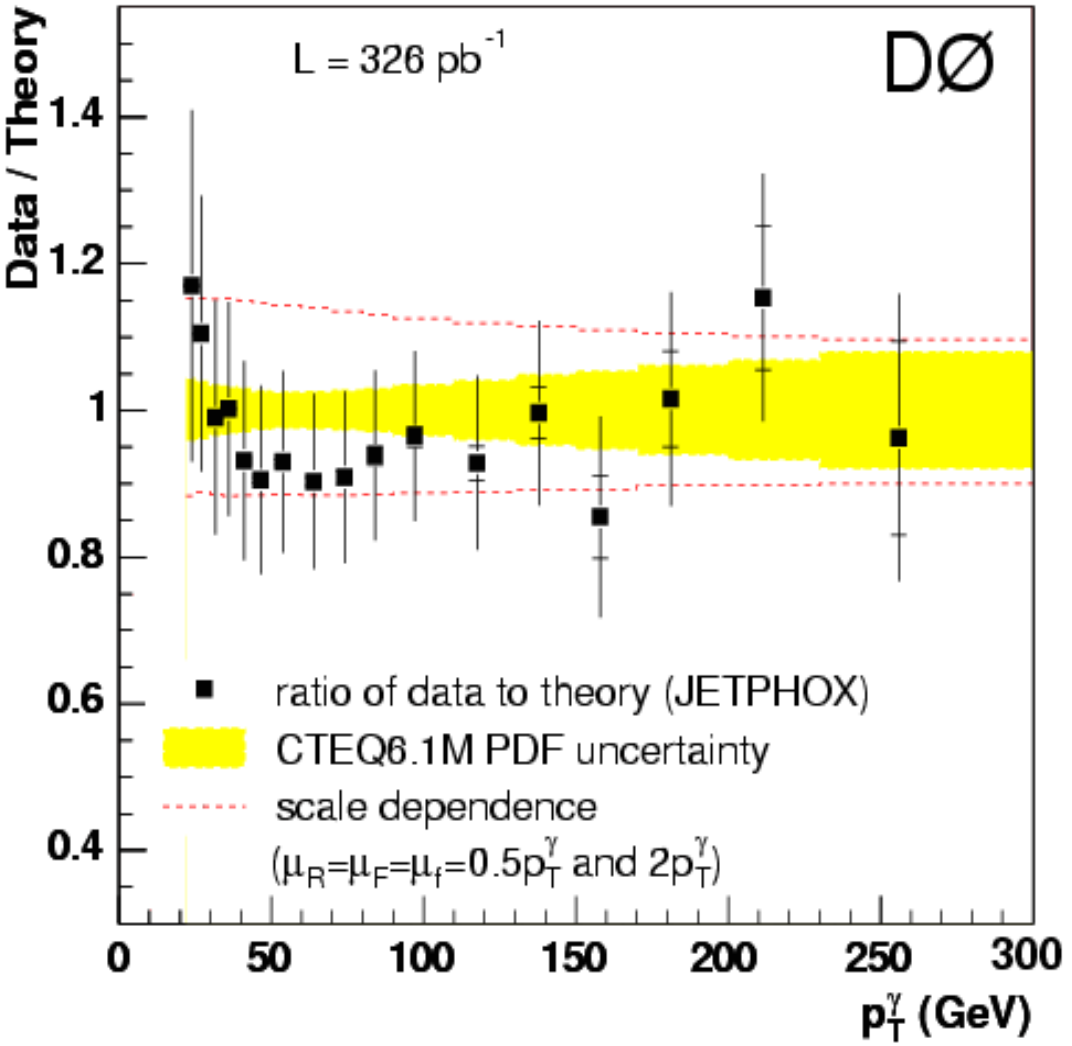


Shining a direct light on particle interactions



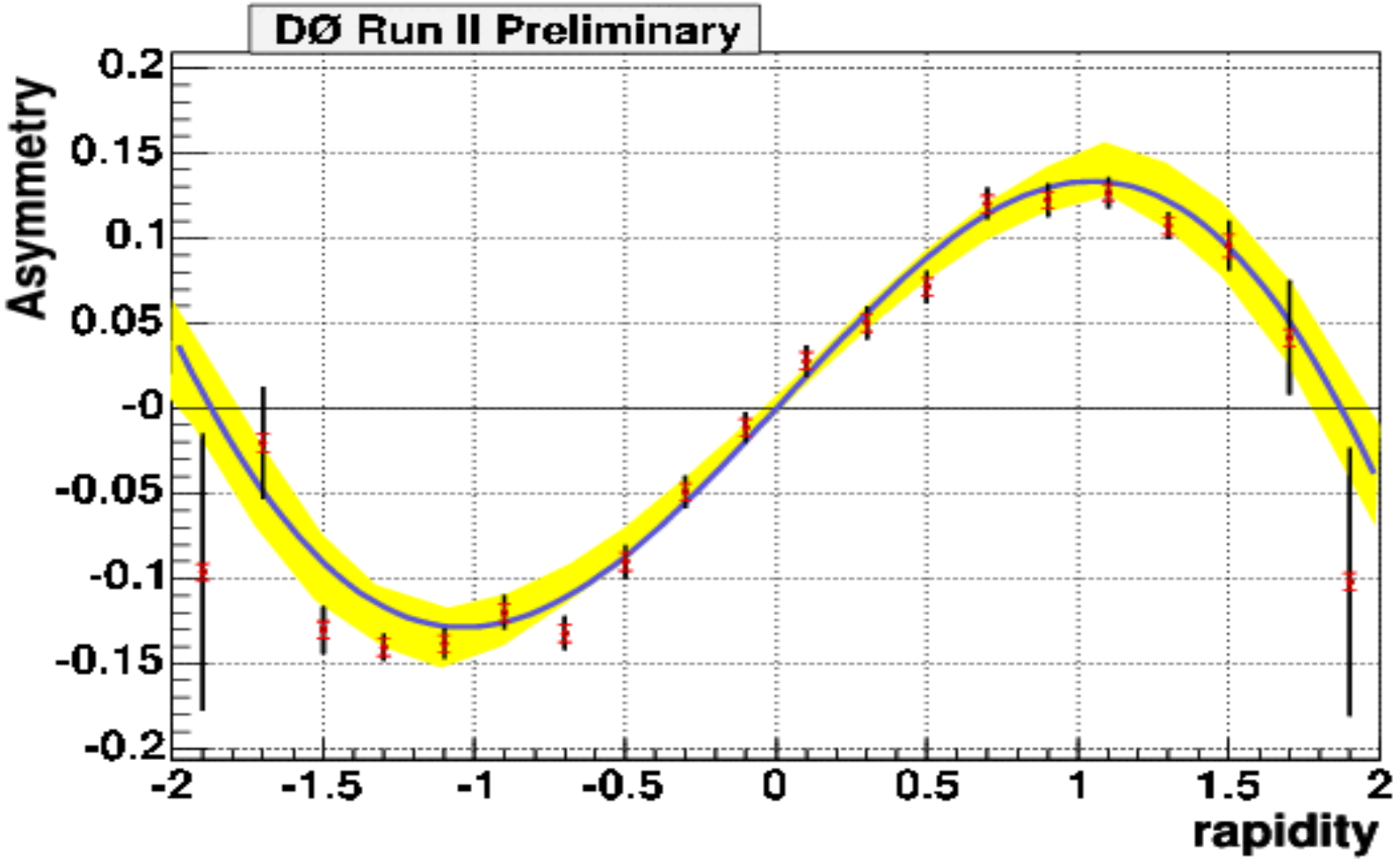
Inclusive photon cross section



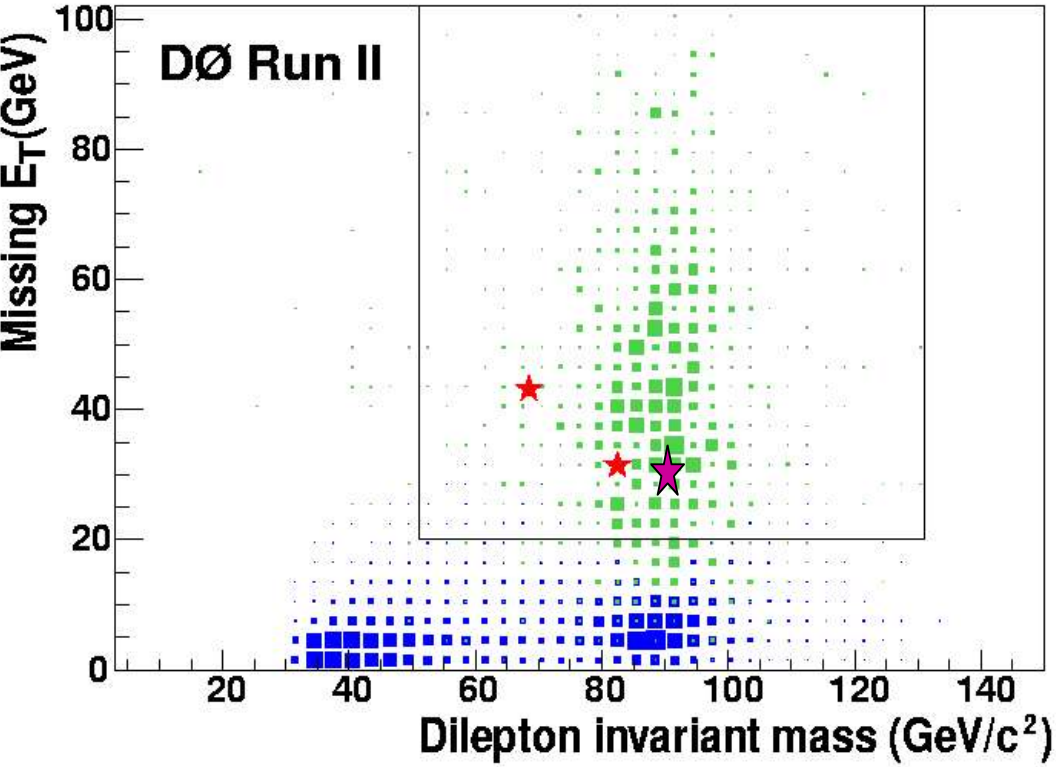

L = 326 pb^{-1}
DØ
Data / Theory
1.4
1.2
1
0.8
0.6
0.4
0
50
100
150
200
250
300
p_T^γ (GeV)
ratio of data to theory (JETPHOX)
CTEQ6.1M PDF uncertainty
scale dependence
($\mu_R=\mu_F=\mu_f=0.5p_T^\gamma$ and $2p_T^\gamma$)

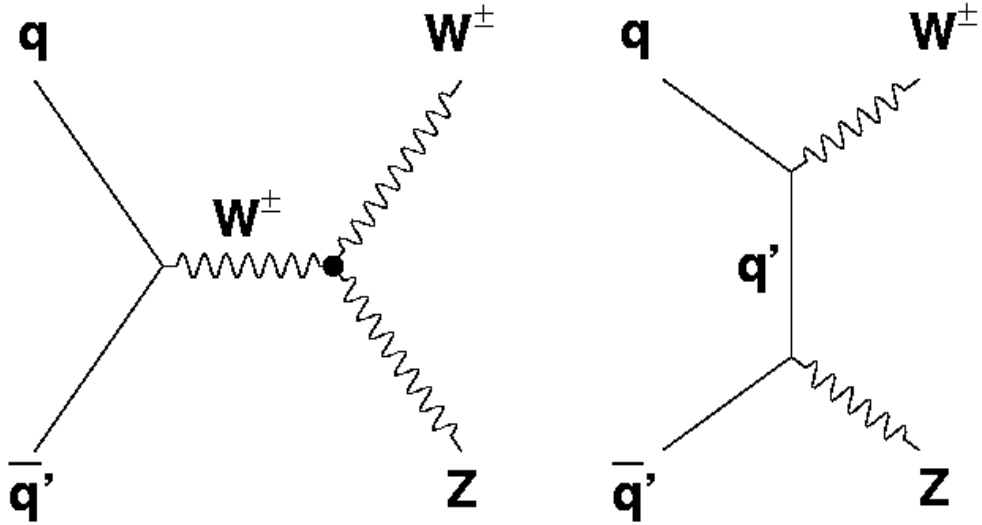
W charge asymmetry

$$A(y) = \frac{d\sigma(W^+)/dy - d\sigma(W^-)/dy}{d\sigma(W^+)/dy + d\sigma(W^-)/dy} \sim \frac{d}{u}$$



WZ pair production





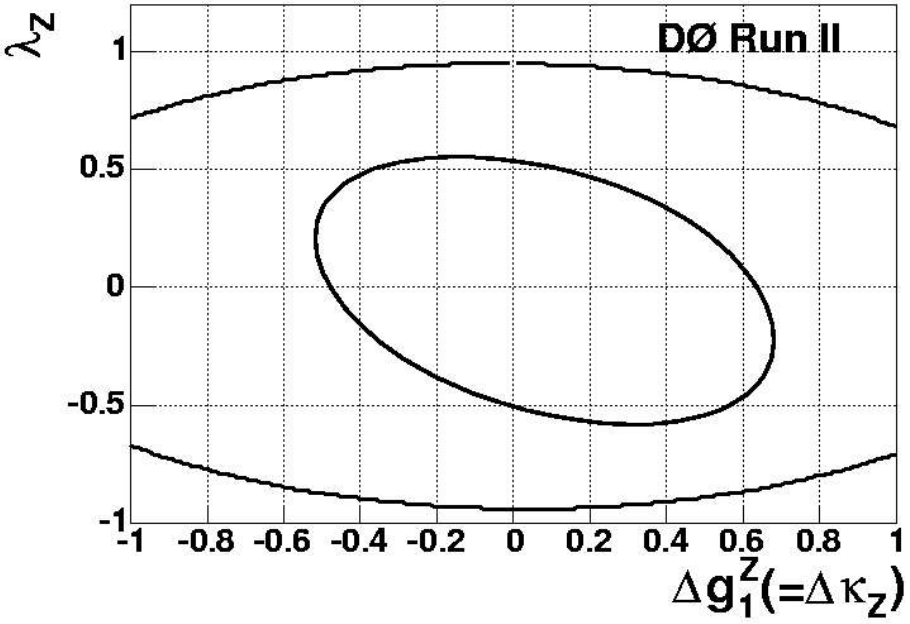
$L_{int} \approx 300$ pb^{-1} , lepton p_T>15 GeV, missing E_T>20 GeV, lepton pair mass consistent with Z mass

observed: 3 events with 0.71±0.08 backgrd events and 2.04 signal expectation

$$\sigma = 4.5^{+3.8}_{-2.6}(\text{stat}+\text{syst})\ \text{pb}$$ **σ** < 13.3 pb at 95%CL

WZ Anomalous Couplings Limits

As no deviation from the SM expectation observed:
set limit on anomalous couplings

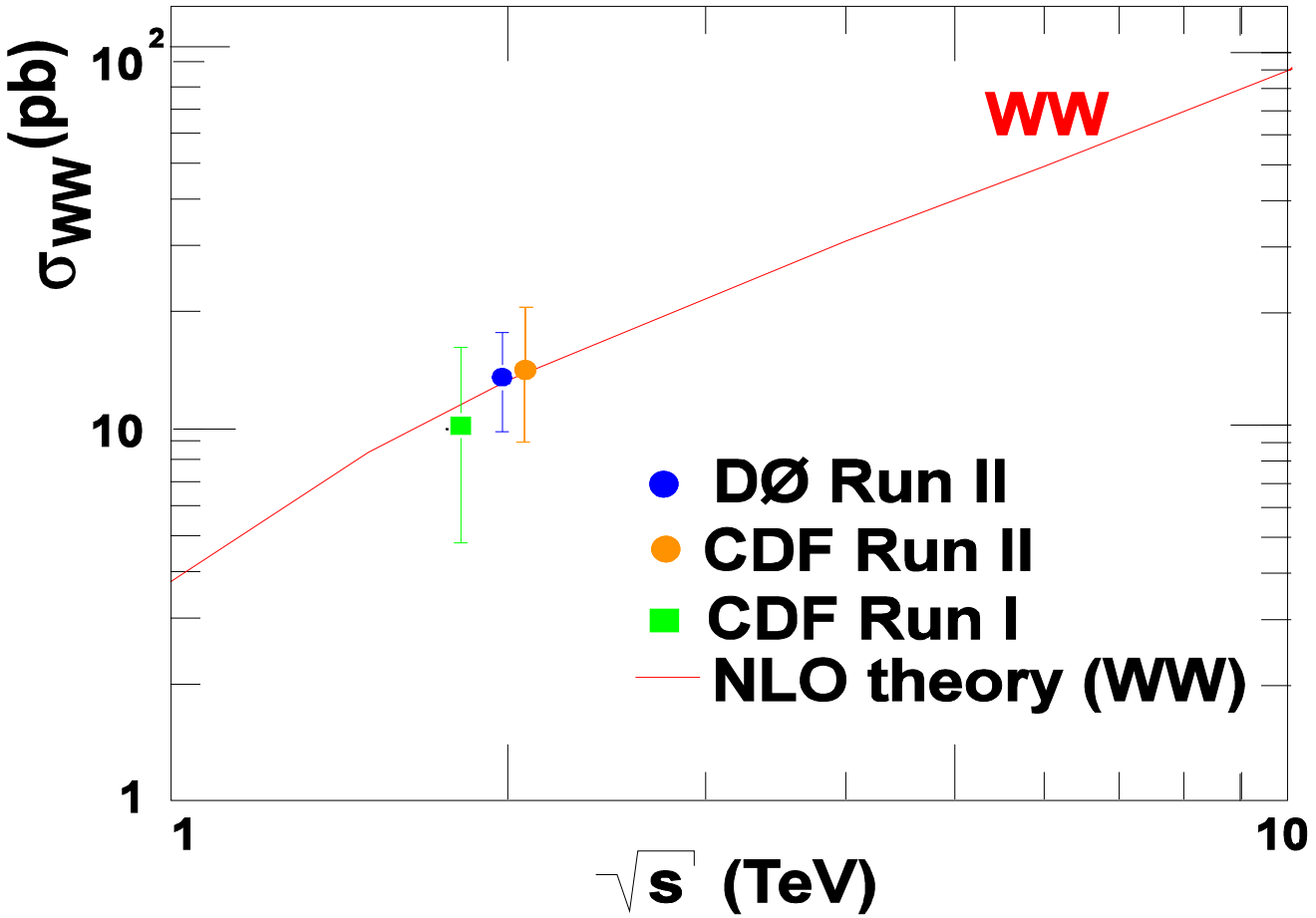


- inner limit from analysis at 95%CL for Λ = 1.5 TeV

- outer limit from S-matrix unitarity

	Λ = 1 TeV	Λ = 1.5 TeV
$\Delta g_1^Z = \Delta\kappa_Z = 0$	$-0.53<\lambda_Z<0.56$	$-0.48<\lambda_Z<0.48$
$\lambda_Z = \Delta\kappa_Z = 0$	$-0.57<\Delta g_1^Z<0.76$	$-0.49<\Delta g_1^Z<0.66$
$\lambda_Z = 0$	$-0.49<\Delta g_1^Z = \Delta\kappa_Z<0.66$	$-0.43<\Delta g_1^Z = \Delta\kappa_Z<0.57$
$\lambda_Z = \Delta g_1^Z = 0$	$-2.0<\Delta\kappa_Z<2.4$	-

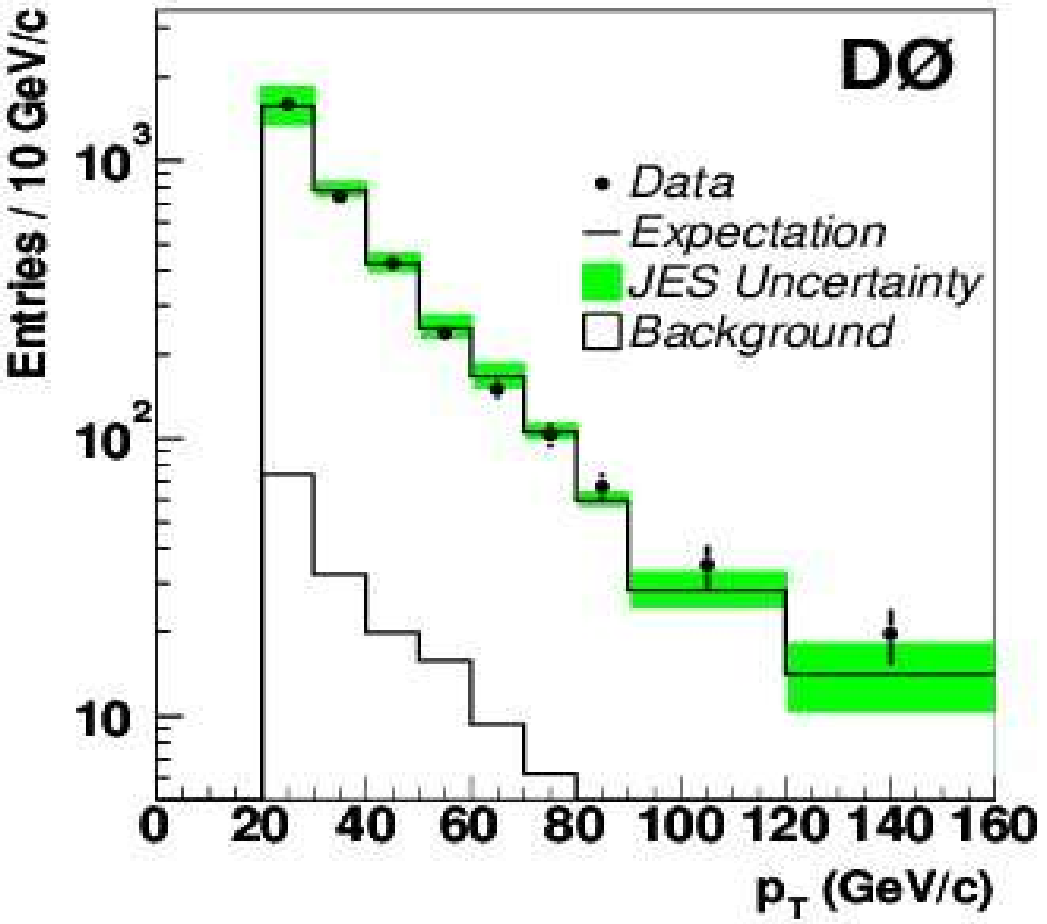
WW cross section



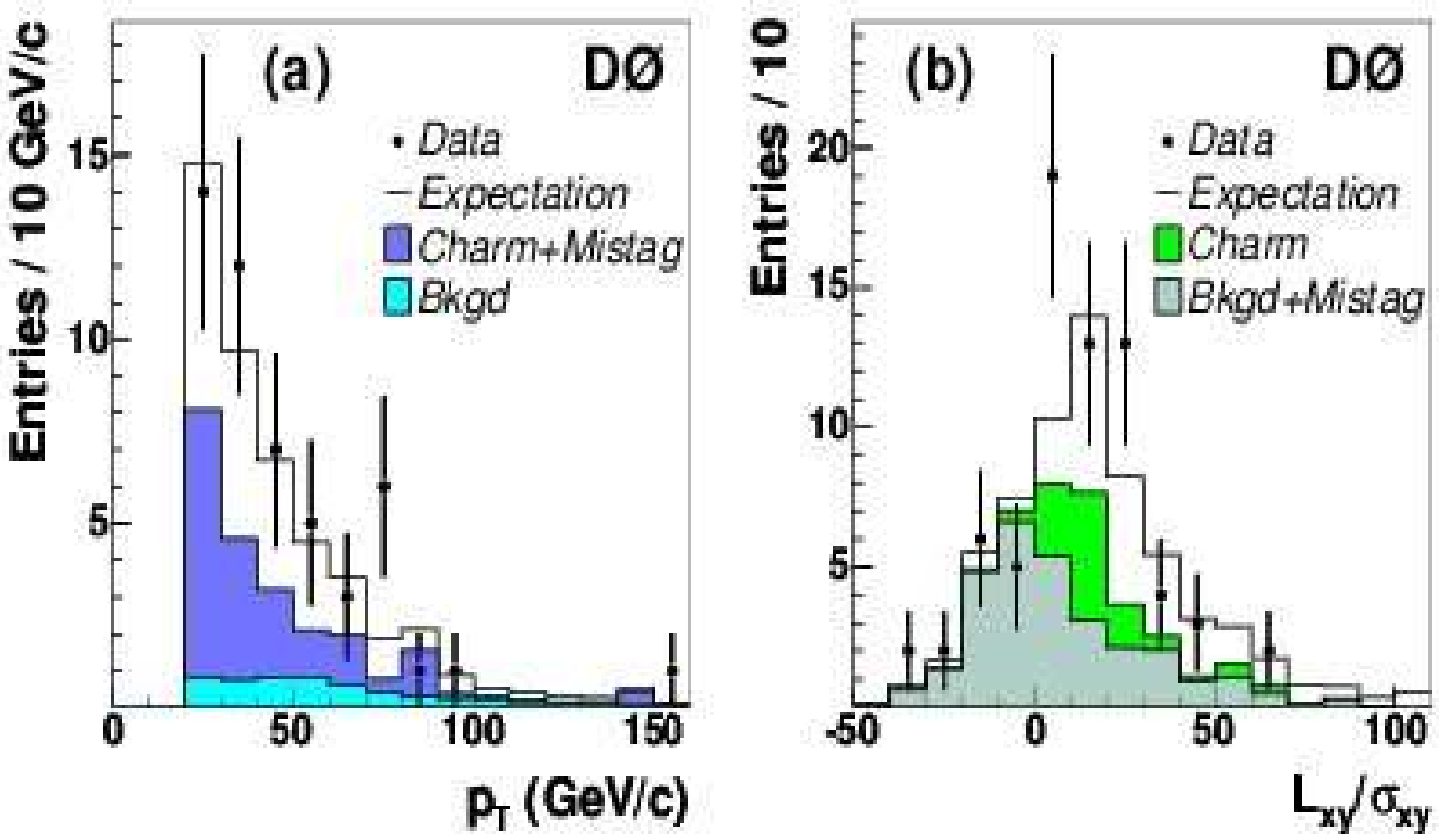
NLO cross section: 12.4 ± 0.8 pb

$$\sigma = 13.8^{+4.3}_{-3.8}(\text{stat})^{+1.2}_{-0.9}(\text{syst}) \pm 0.9(\text{lum})\ \text{pb}$$

Ratio of Z+b to Z+jet cross sections

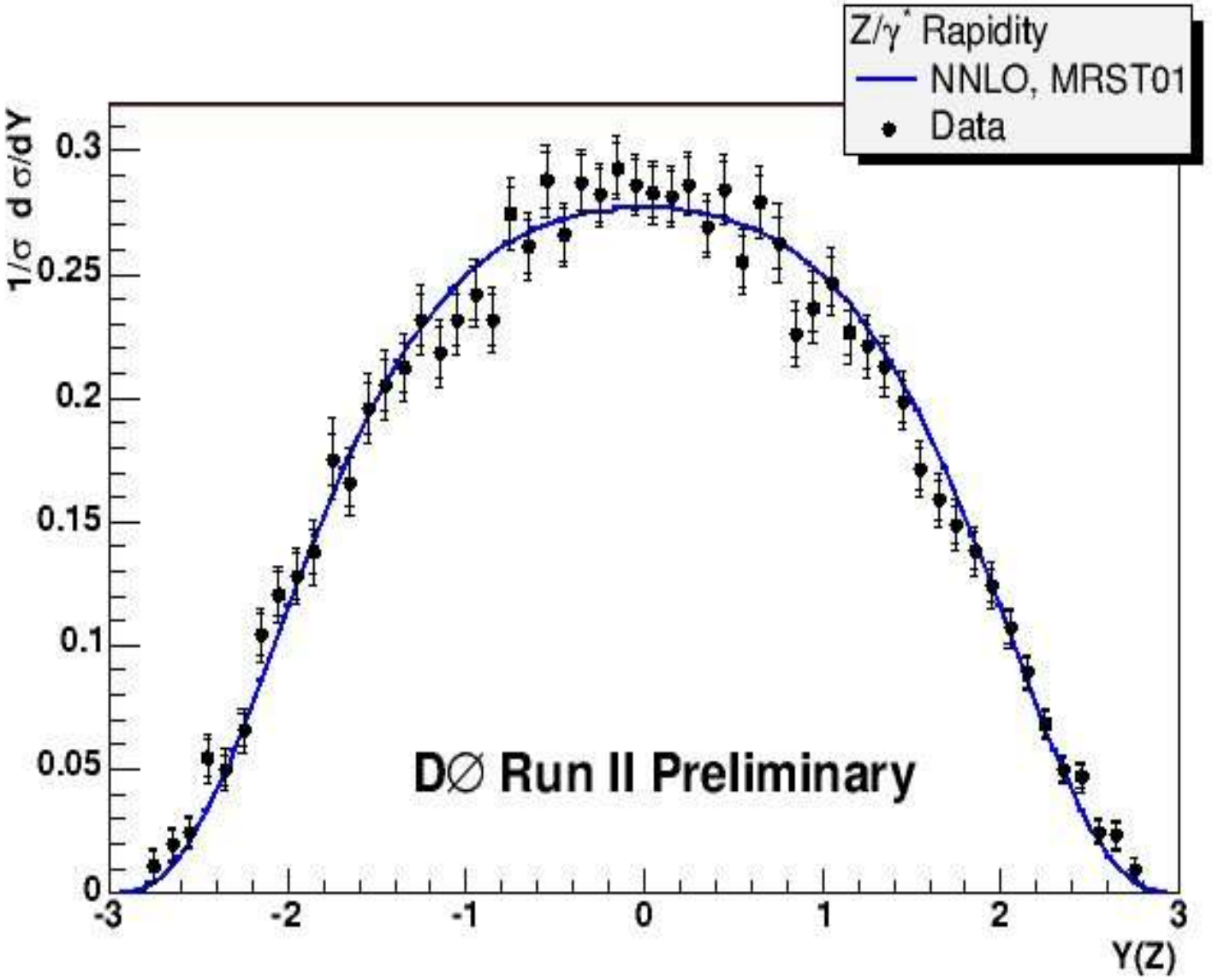
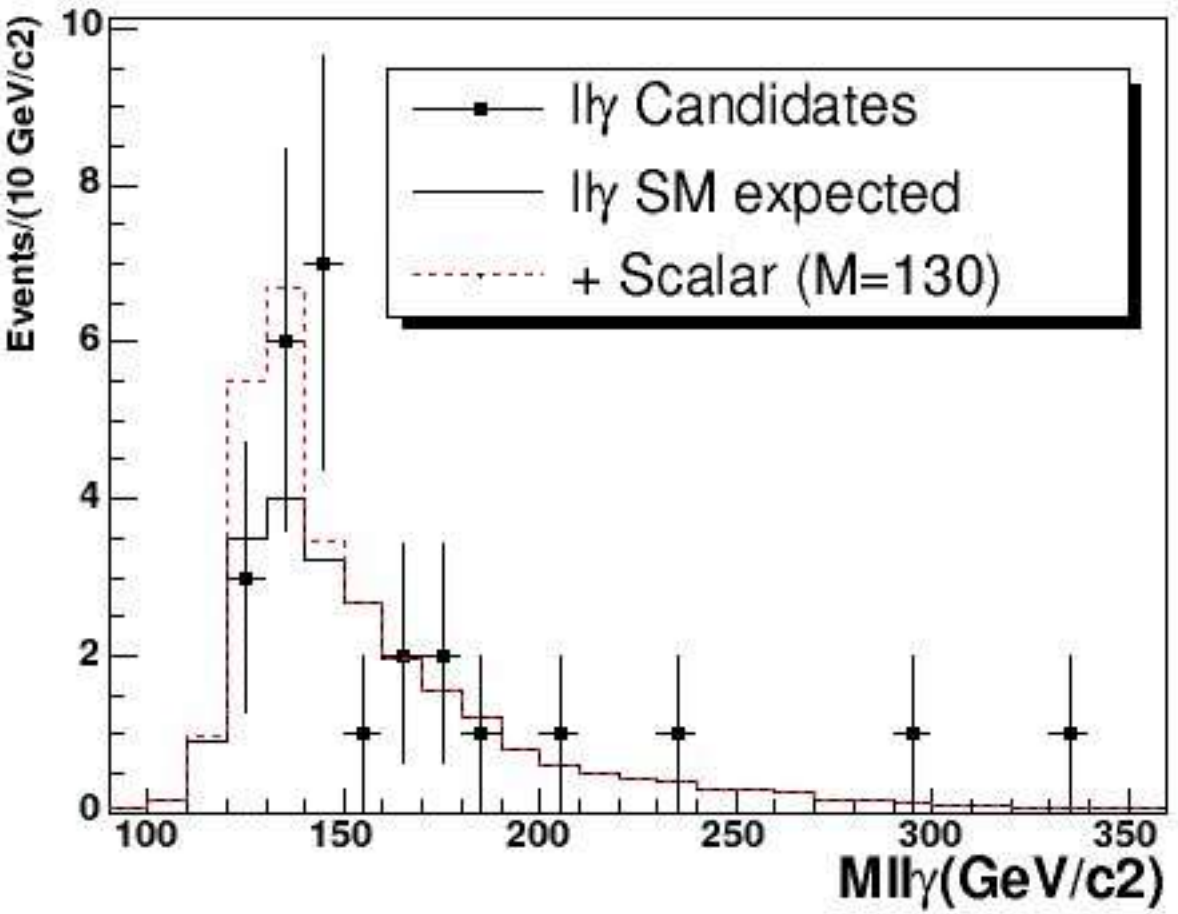


Ratio = 0.023 ± 0.005



(a) The pT spectrum of b-tagged jets. (b) Distribution in decay length significance of secondary vertices in the transverse plane.

Z rapidity distribution



Search for scalar particles decaying to Z+γ