Recent results from DØ and CDF

Christophe Royon
DAPNIA-SPP, CEA Saclay
on behalf of DØ and CDF collaborations

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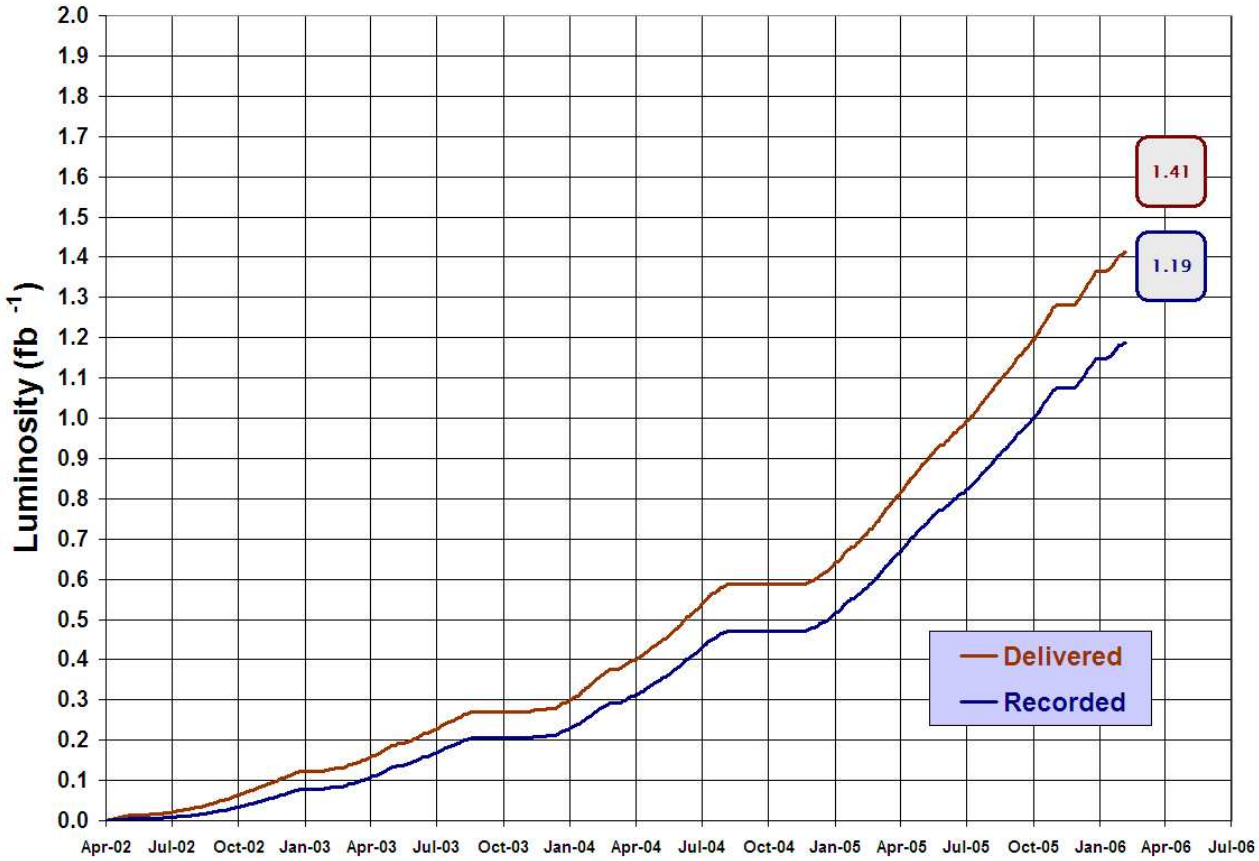
Contents:

- QCD and diffraction
- B physics
- New phenomena
- Electroweak and top
- Higgs

NB: See parallel session talks for more details and analyses not presented here

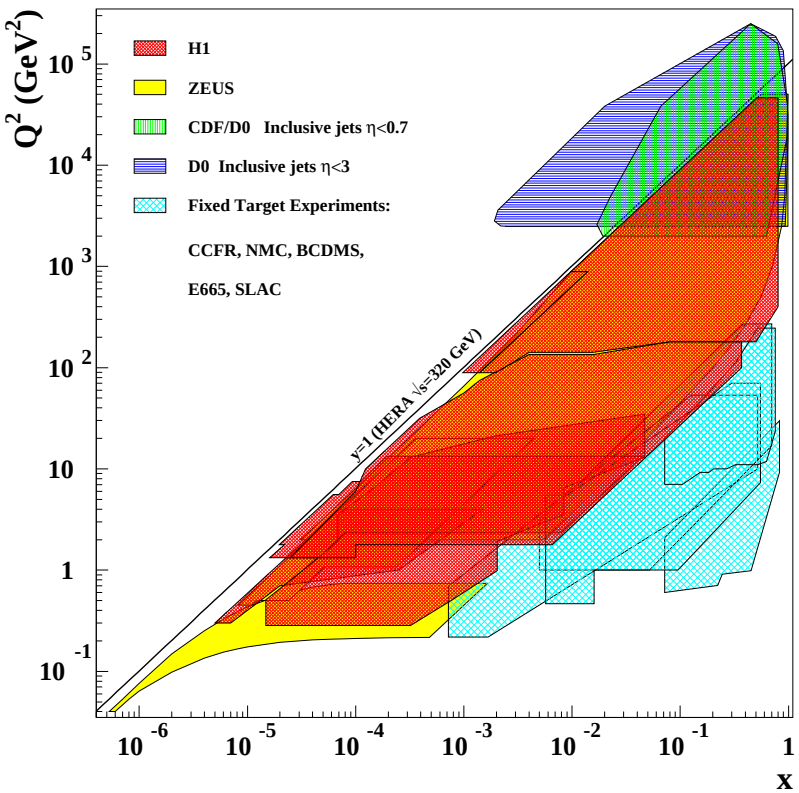
CDF and DØ luminosities

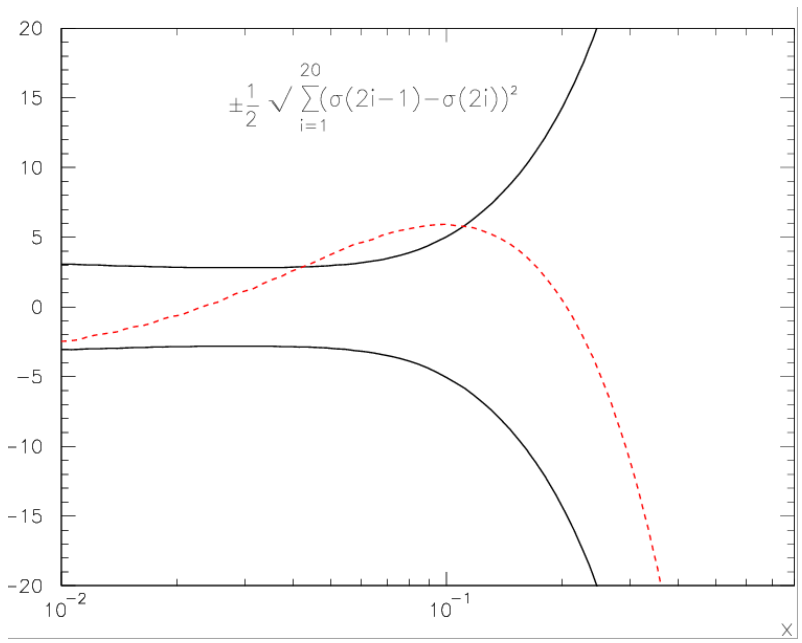
Luminosity accumulated by DØ and CDF experiments exceeds 1 fb^{-1} (DØ and CDF about 1.2 fb^{-1} recorded)



HERA and Tevatron kinematical planes

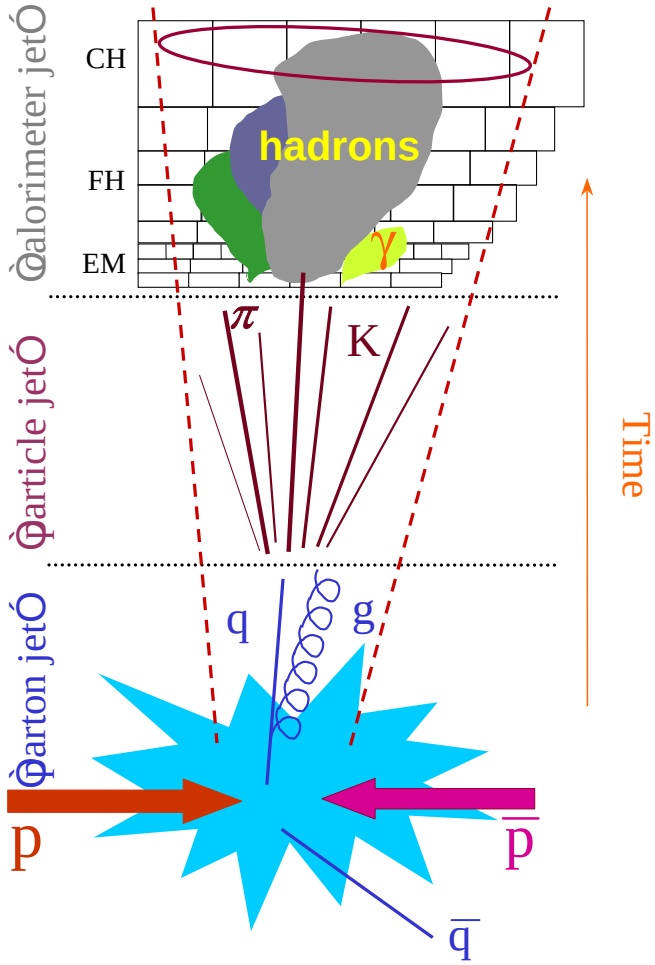
- Kinematical plane at HERA and Tevatron in (x, Q^2) compared to fixed target experiments
- Uncertainty on gluon distribution at high x for $Q^2 = 2.5 10^5$ GeV^2: plot gluon density for different 40 CTEQ fits, and difference with MRST





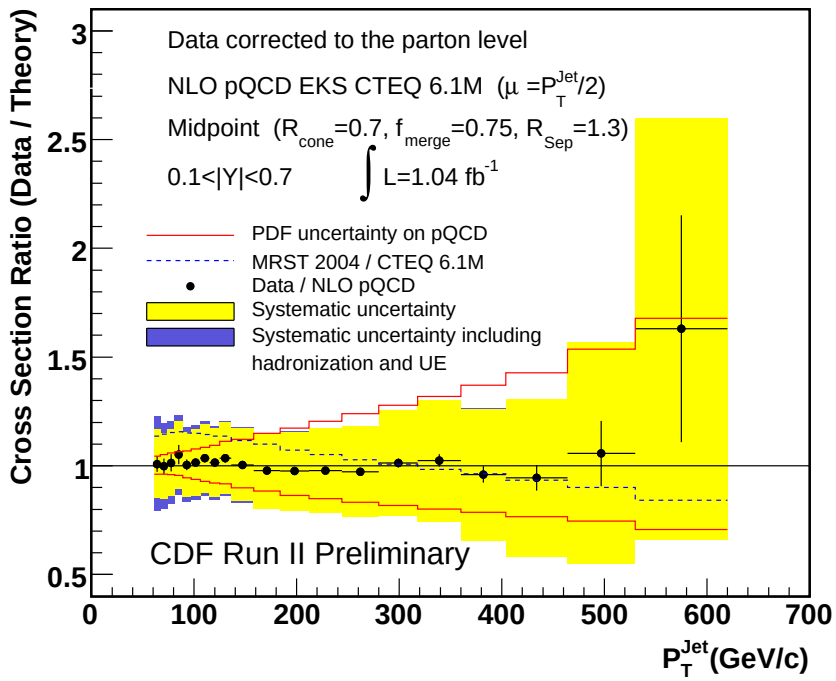
Jets at the Tevatron (and the LHC)

Dominant error: Determination of jet energy scale in calorimeter: use γ+jet at Tevatron, Z+jets at LHC



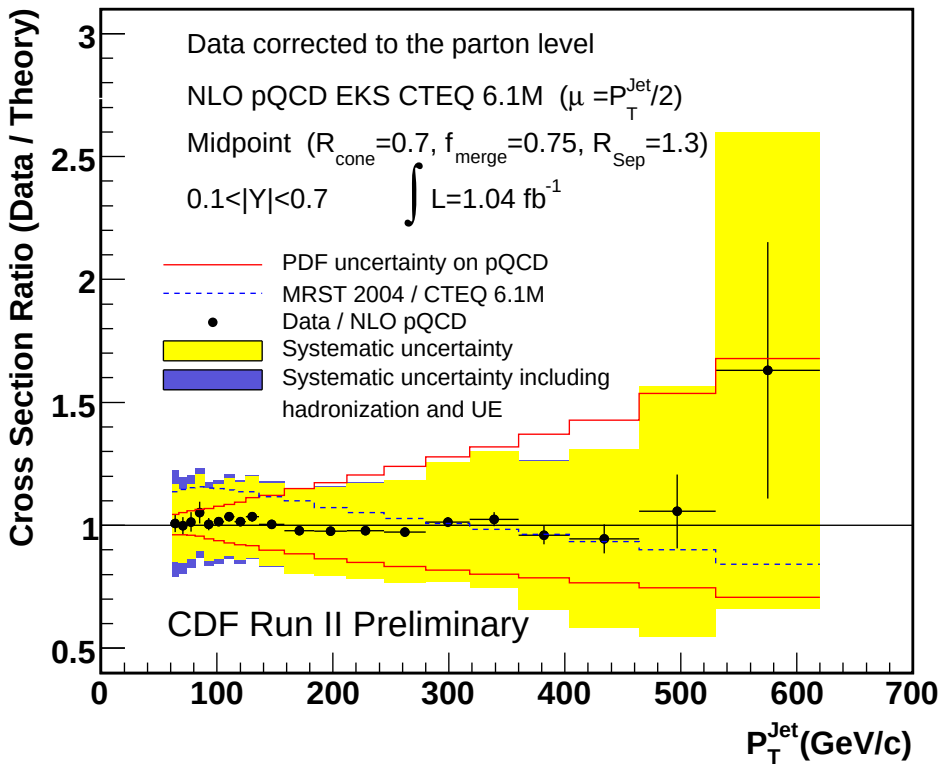
Jet inclusive p_T cross section (CDF)

- Measurement of the inclusive jet cross section as a function of p_T using the 0.7 cone algorithm for $0.1 < |y| < 0.7$
- Data corrected to parton level (corrected for underlying events and hadronisation) compared to NLO predictions
- Additional systematics of 6% due to luminosity uncertainties not shown on the figure



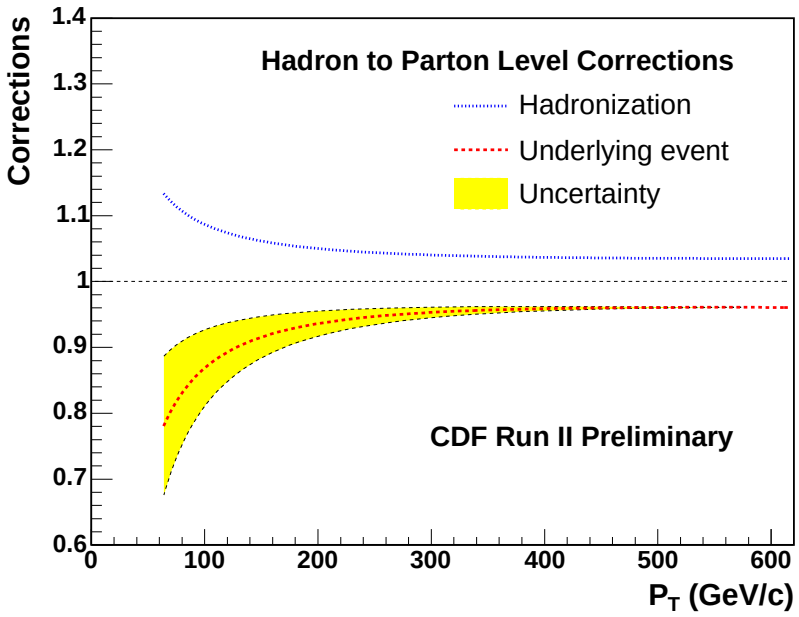
Systematics on jet inclusive p_T cross section (CDF)

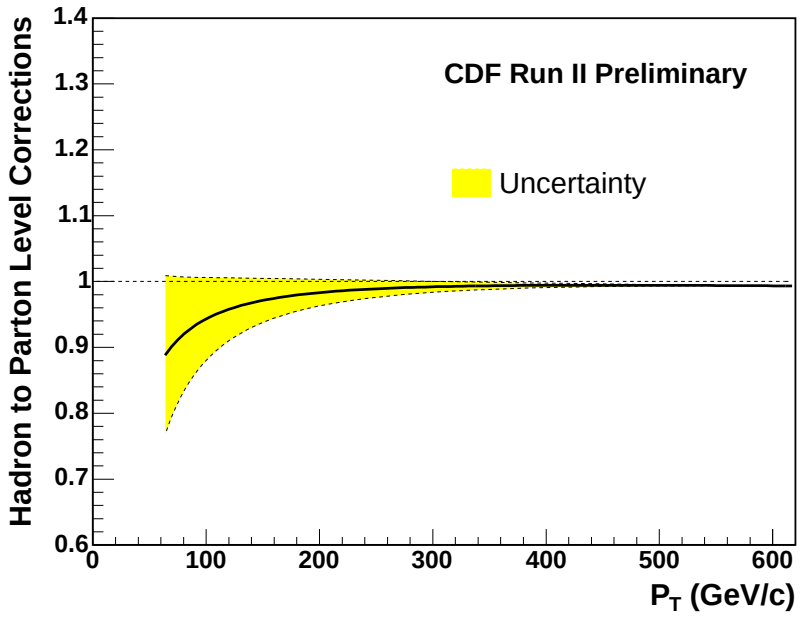
- Leading systematics due to JES
- Data systematics in the same order as differences between PDFs



Parton level corrections (CDF)

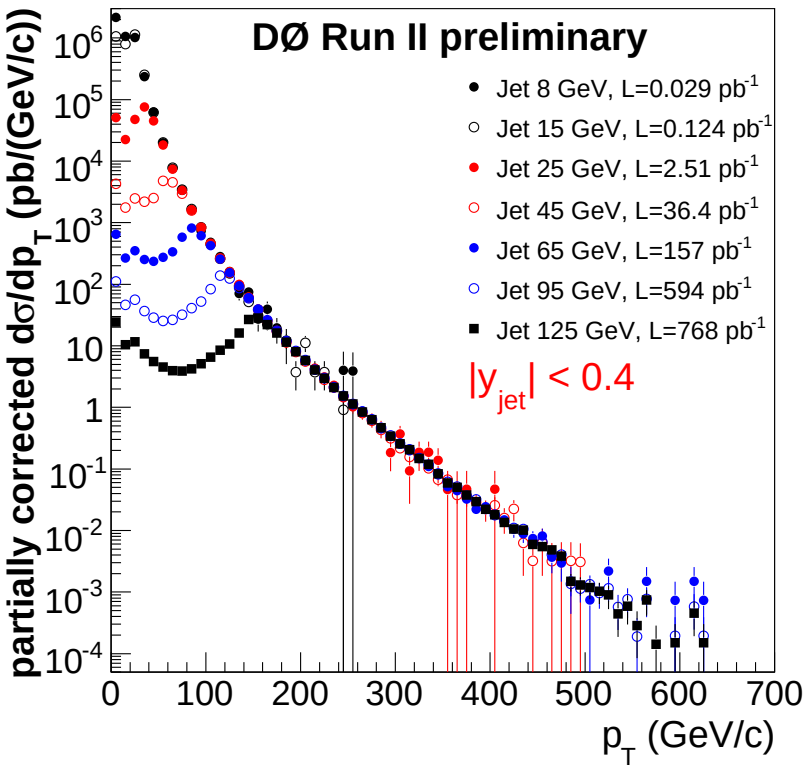
- Parton level corrections
- Corrections of the order of 10% at lower p_T with a 10% uncertainty

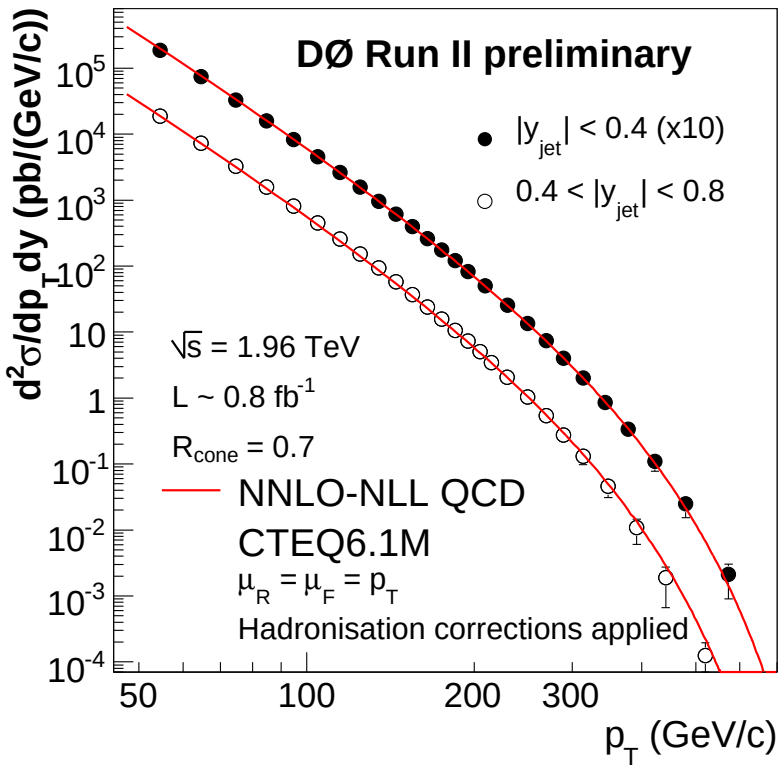




Jet inclusive p_T cross section (DØ)

- Measurement of the inclusive jet p_T cross section for 0.8 fb^{-1}
- Different jet p_T triggers used for the measurement

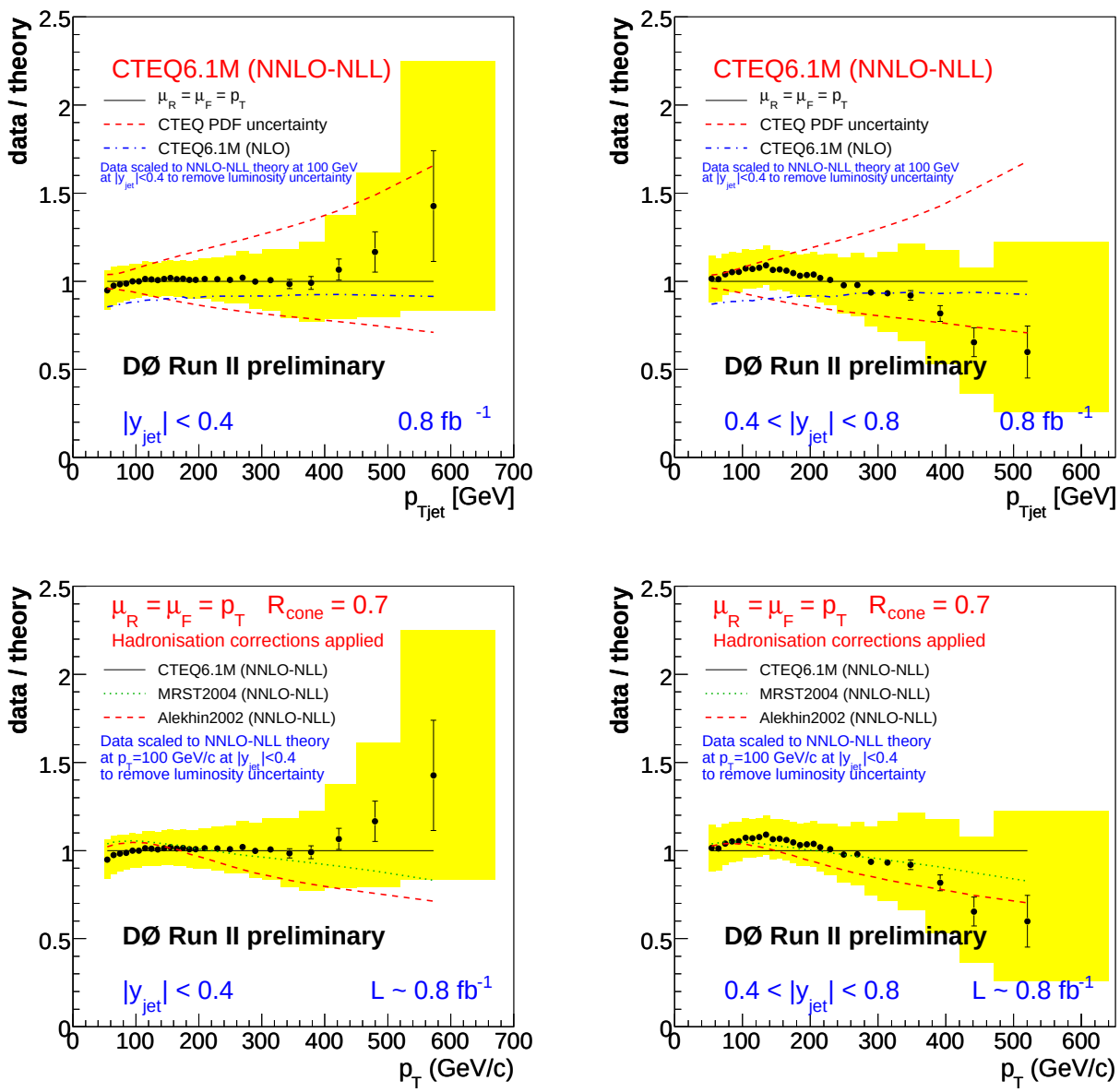




Jet inclusive p_T cross section (DØ)

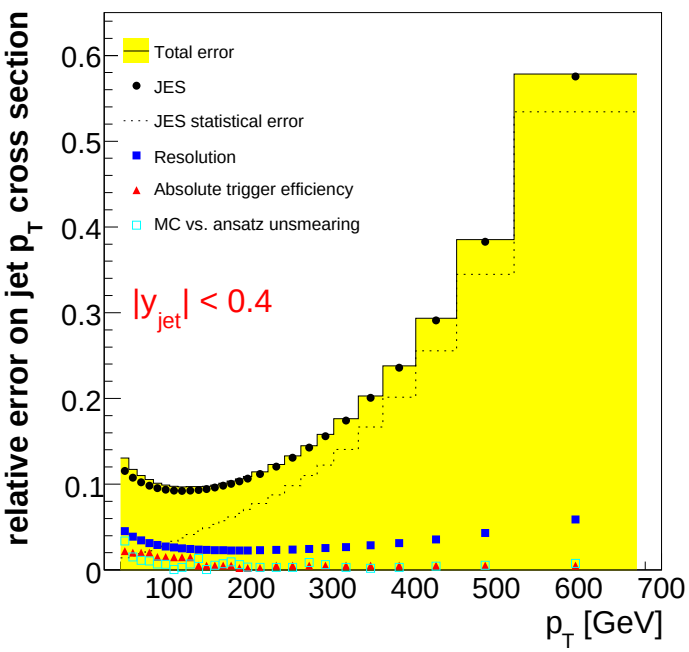
- Systematics improved by a factor 2
- Data compared to NNLO-NLL QCD calculations: NLO predictions computed using NLOJET++ with the CTEQ6.1M parametrisation, and NNLO-NLL corrections computed using threshold resummation techniques (Kidonakis et al.)
- Data have been scaled to NNLO-NLL predictions at p_T =100 GeV
- Difference in behaviour at high p_T due mainly to statistical effects, the two bins in y are not correlated
- uncertainties on data of the same order as uncertainties on PDFs from CTEQ, will allow to further constrain PDFs when normalisation determined
- Show data potential sensitivity with respect to MRST and Alekhin parametrisation

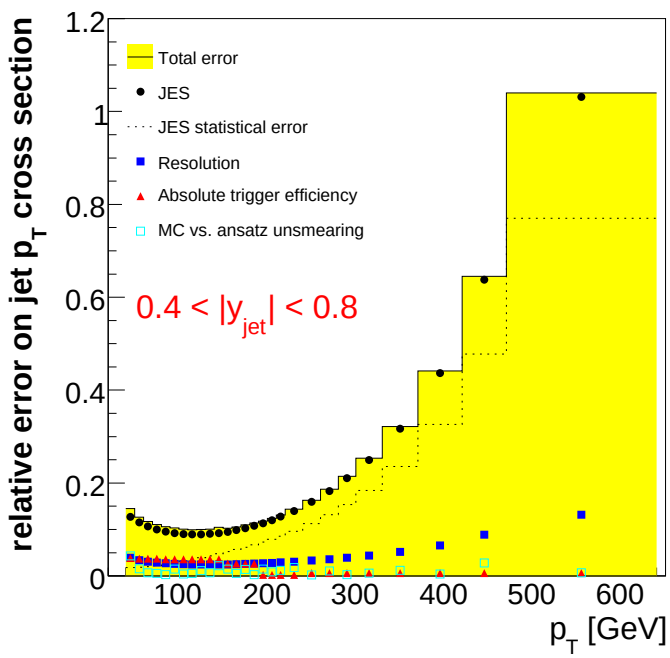
Jet inclusive p_T cross section (DØ)



Uncertainties on jet inclusive p_T cross section (DØ)

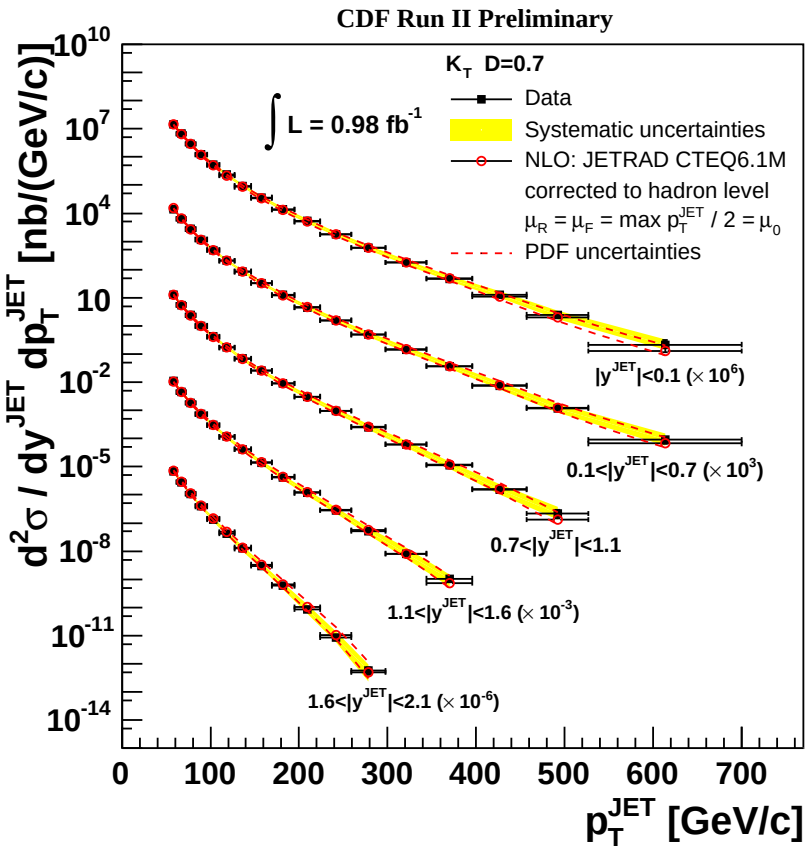
- Systematics dominated by JES uncertainties
- Large statistical error at high p_T due to JES determination (not full data set used), to be updated by Summer
- Substantial reduction of systematics by a factor 2 with respect to previous results (DIS 2005)





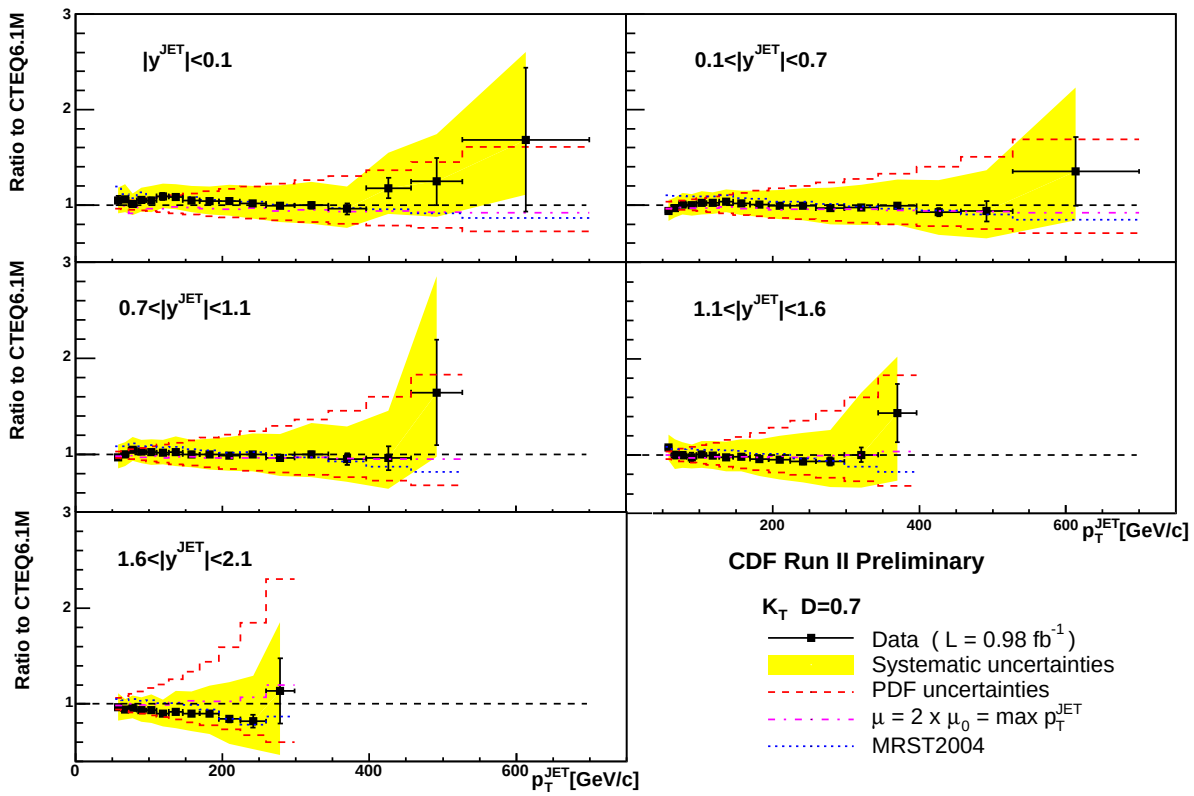
Jet inclusive p_T cross section using the k_T algorithm (CDF)

- Measurement performed in 5 rapidity bins for $|y| < 2.1$
- Measurement performed at hadron level, NLO calculations (JETRAD) corrected for hadronisation and underlying events



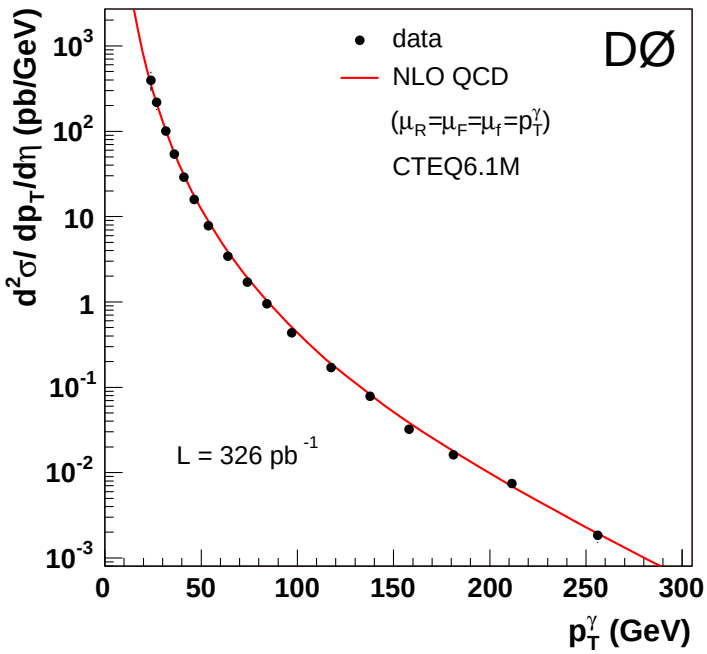
Jet inclusive p_T cross section using the k_T algorithm (CDF)

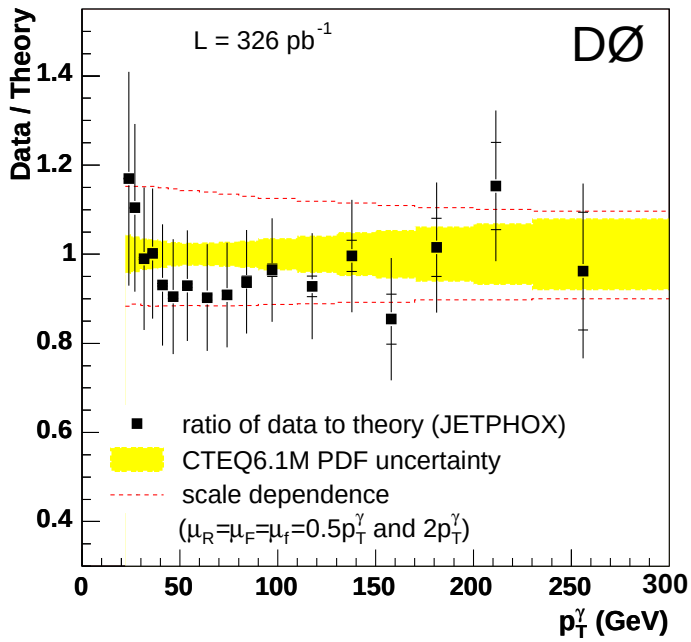
- Measurement in 5 rapidity bins
- Data will allow to constrain further PDFs specially at high rapidities



Measurement of isolated photon cross section (DØ)

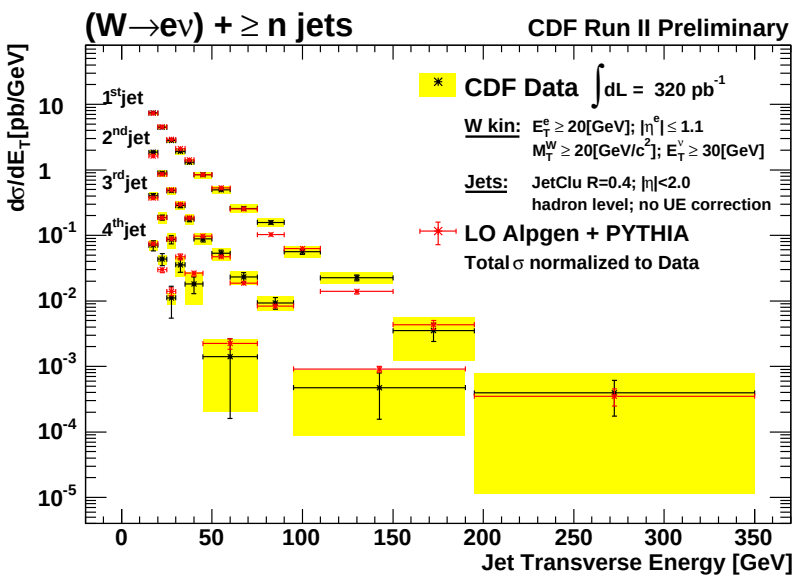
- Measurement of inclusive production cross section of isolated photons with $|\eta| < 0.9$
- Cross section in agreement with NLO QCD

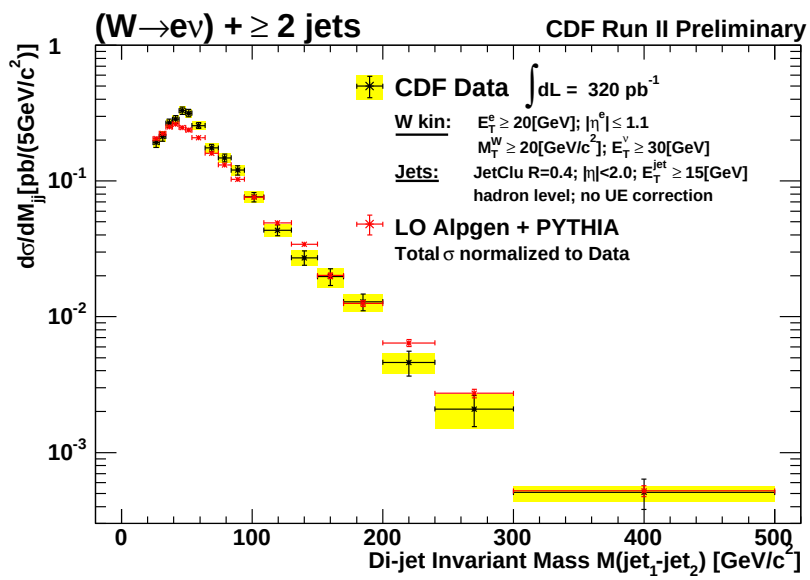




W+jets differential cross sections (CDF)

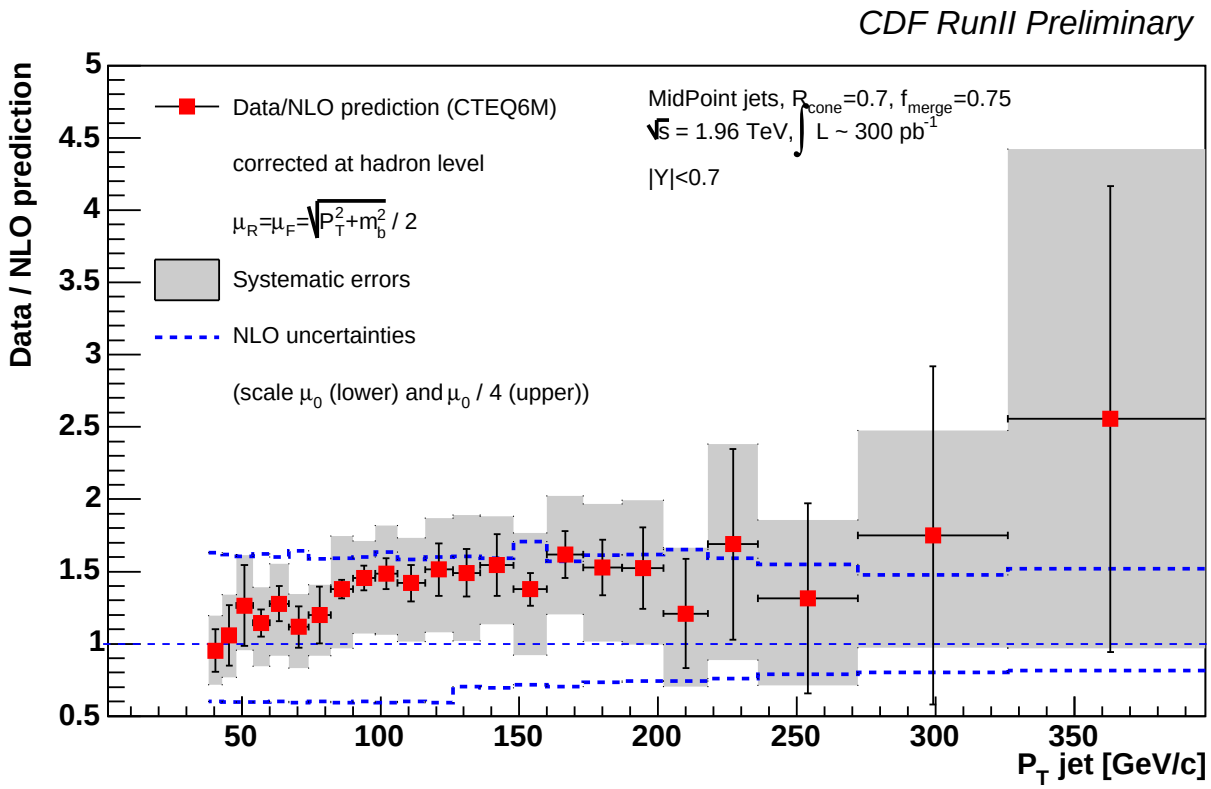
- Measurement of the W+n jets as a function of jet E_T, ΔR between jets, and jet-jet invariant mass
- Comparison with LO theory (ALPGEN+PYTHIA)
- Cross section measured for a restricted phase space for W to obtain a flat W acceptance as a function of jet E_T and not alter the shape of the cross section (reduce the dependence on MC acceptance for W)





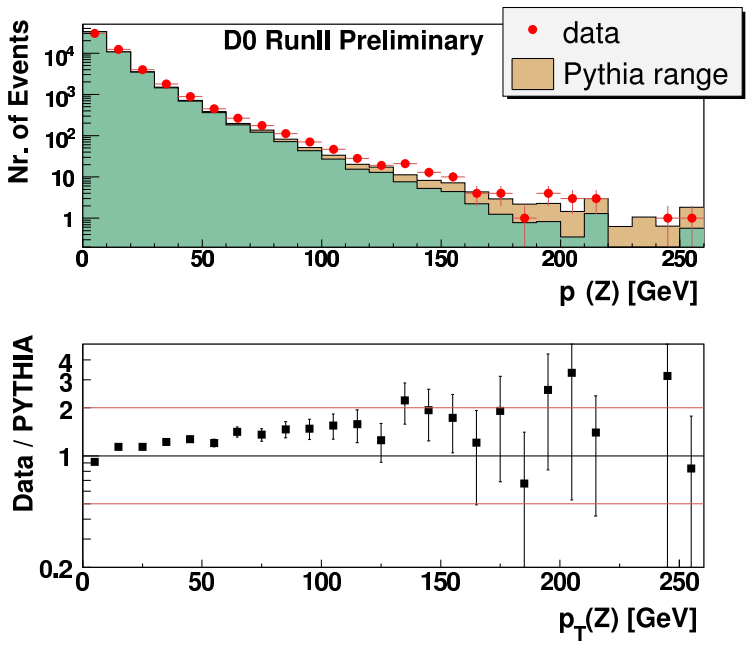
Inclusive b jet cross section (CDF)

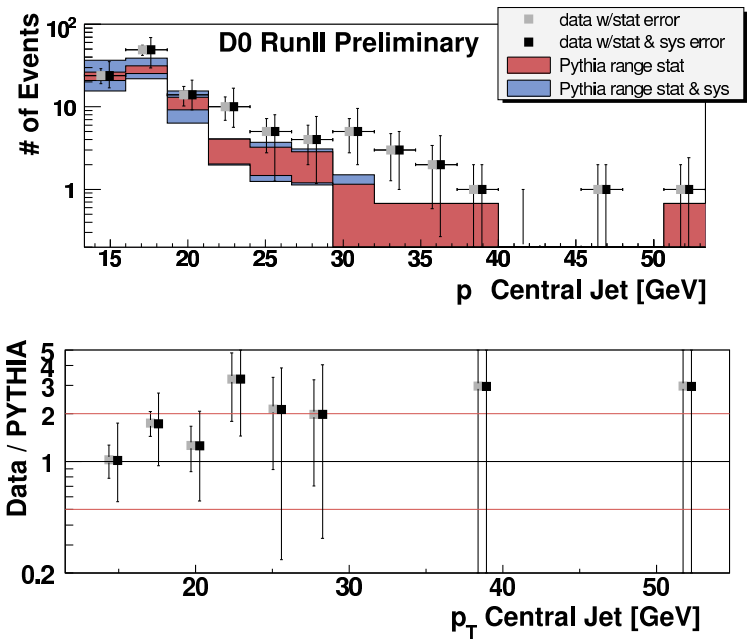
- Measurement of the b jet cross section in central region
- Big uncertainties related to renormalization and factorization scales $\longrightarrow$ not-included higher order contributions might play a major role in b-jet production calculations



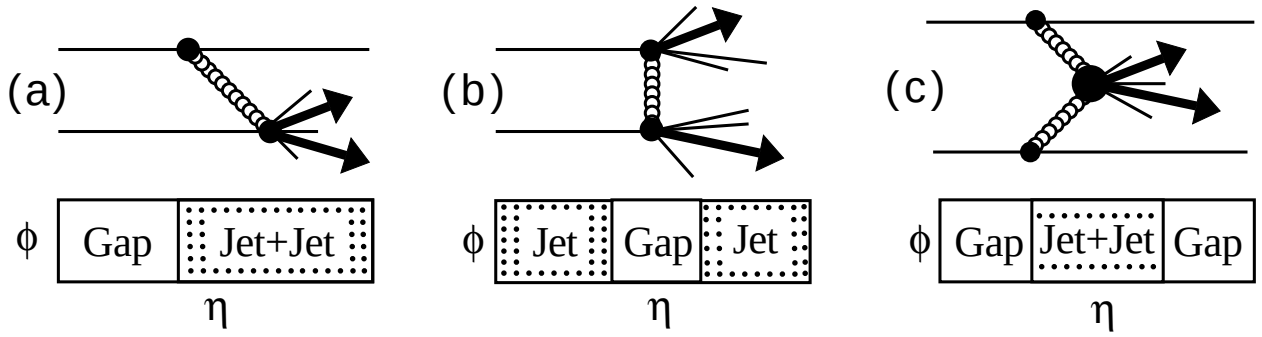
$Z+$ jet event properties (DØ)

- Compare jet and Z distributions between MC (pythia and sherpa) predictions and data: very useful to tune and check MC for the LHC
- In general, good agreement (except for third jet between the two leading jets p_T distributions)





Diffraction at the Tevatron

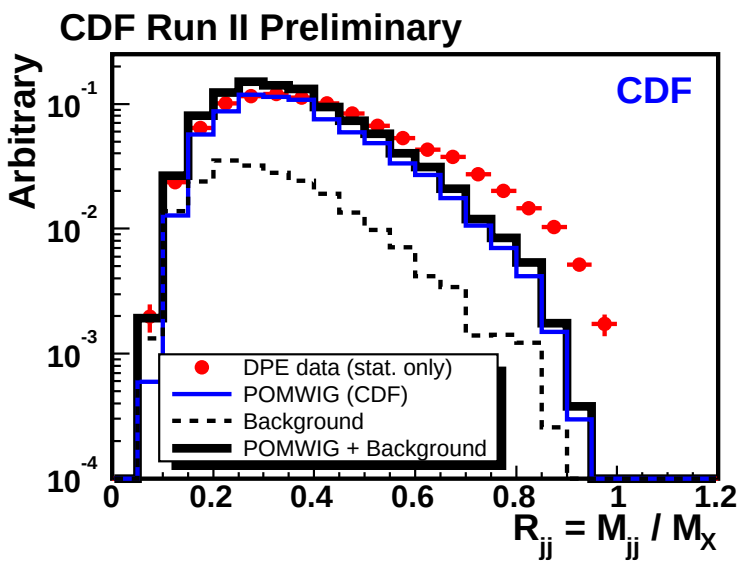


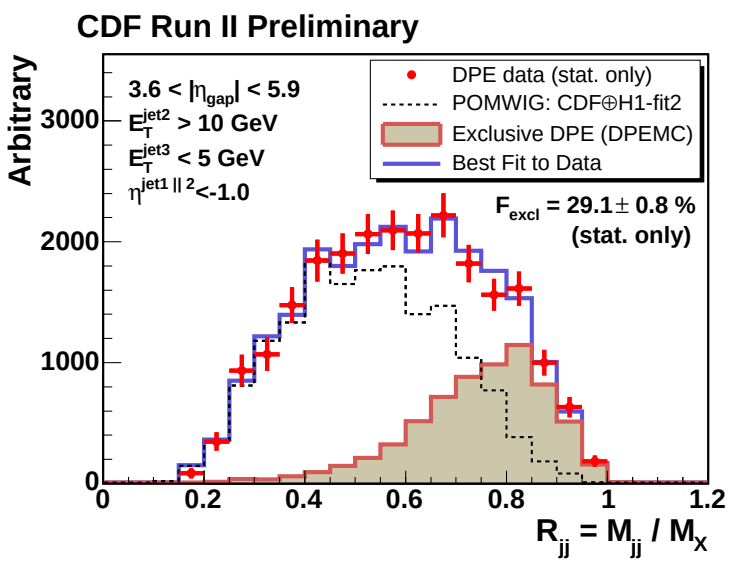
Kinematical variables

- t: squared momentum transferred
- ξ: proton momentum fraction carried out by the non-coloured object ("pomeron")
- $\beta = x_{Bj}/\xi$: Bjorken-x of the parton inside the pomeron
- $M^2 = s\xi$: diffractive mass produced
- $\Delta y \sim \Delta\eta \sim \log 1/\xi$: gap in rapidity

Look for exclusive events at the Tevatron

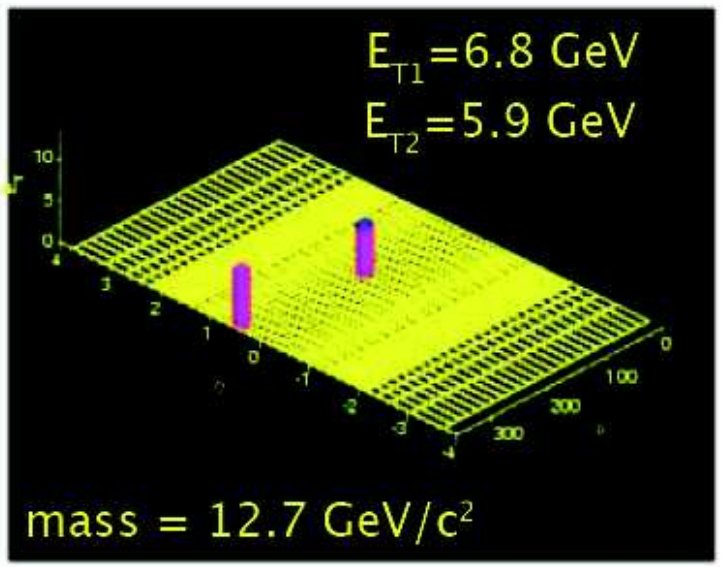
- Look for exclusive events (events where there is no pomeron remnants or when the full energy available is used to produce diffractively the high mass object)
- Select events with two jets only, one proton tagged in roman pot detector and a rapidity gap on the other side
- Comparison with POMWIG Monte Carlo using H1 gluon density in pomeron and DPEMC for exclusive signal
- Will be interesting to see the effect of new H1/ZEUS PDFs in pomeron on these results

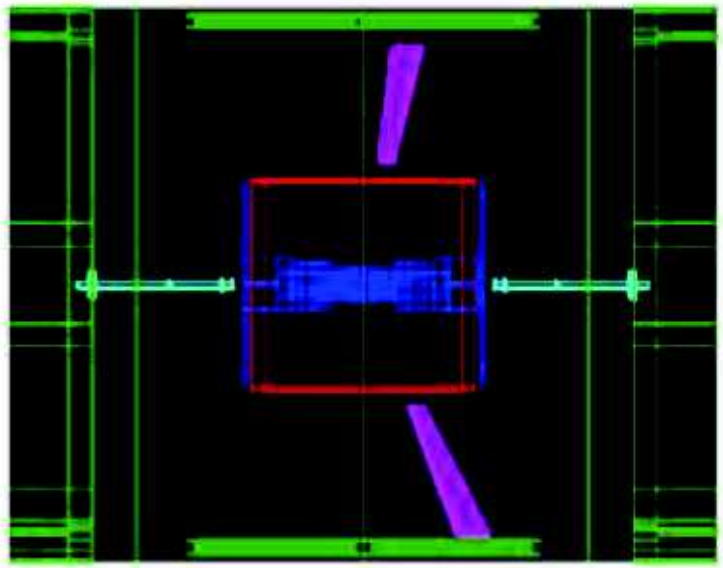




Search for exclusive events (CDF)

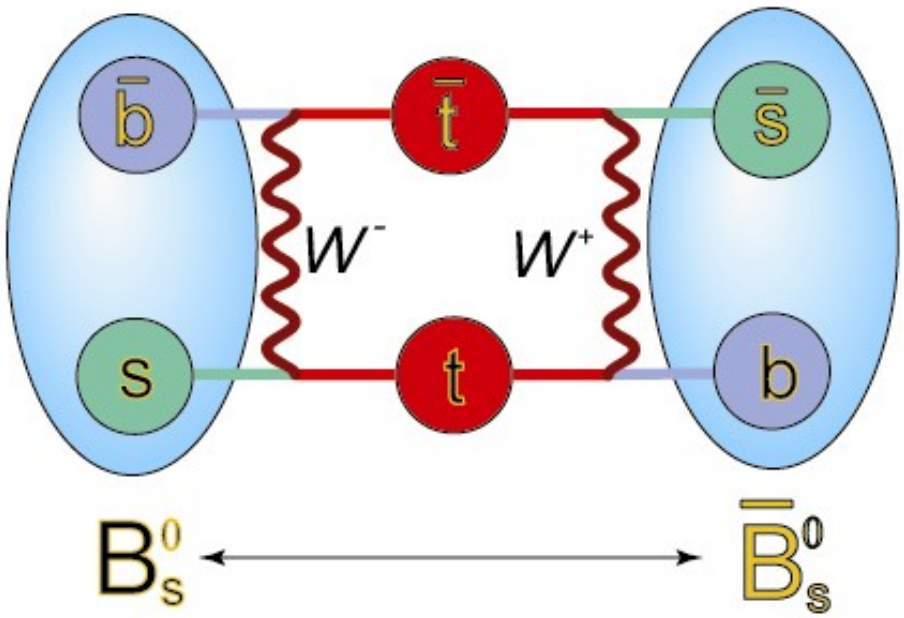
- Look for exclusive diphoton or dilepton production, dominated by QED events (photon exchanges) and not from pomeron exchanges
- Cross section for e^+e^- exclusiev production:
  $N_{candidates} = 16^{+5.1}_{-3.2}, N_{background} = 2.1^{+0.7}_{-0.3}$ (mainly dissociation events) in 46 pb^{-1}
  $\sigma = 1.6^{+0.5}_{-0.3}(stat) \pm 0.3(syst)$ pb
- Cross section for $\gamma\gamma-$ exclusive production:
  $N_{candidates} = 3^{+2.9}_{-0.9}, N_{background} = 0^{+0.2}_{-0.0}$ (mainly dissociation events) in 46 pb^{-1}
  $\sigma = 0.14^{+0.14}_{-0.04}(stat) \pm 0.03(syst)$ pb





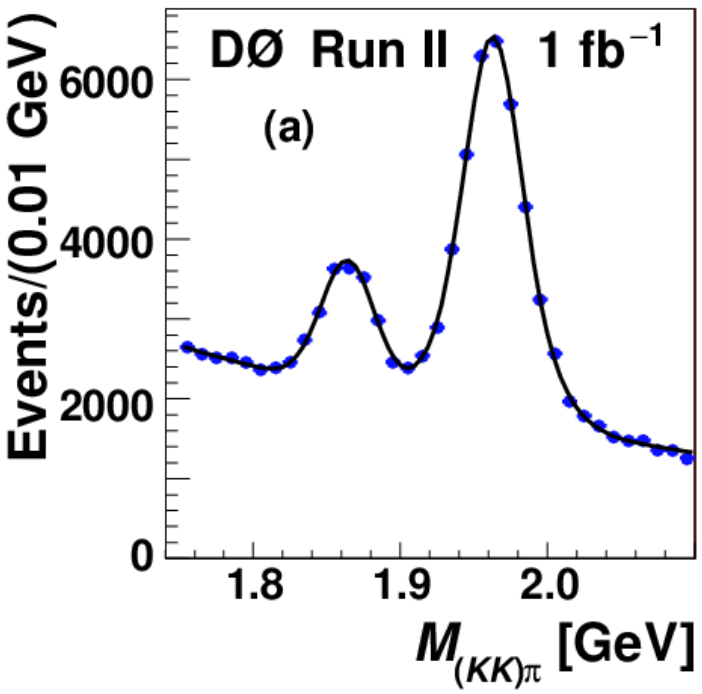
B physics: B_s^0 oscillation frequency

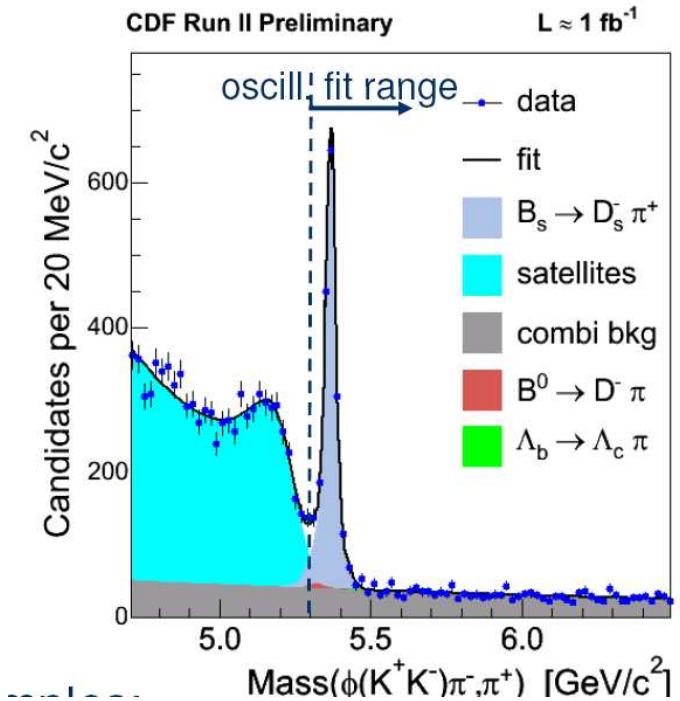
- Flavour mixing in B_S system still to be observed (higher frequency than for B_d)
- B_S mesons trnsform via the weak interaction between its own constituents: rate characterized by the mass difference between the 2 constituents called Δm_S
- Standard model prediction: $16.7 < \Delta m_S < 25.4$ ps^{-1}



B_s^0 oscillation frequency

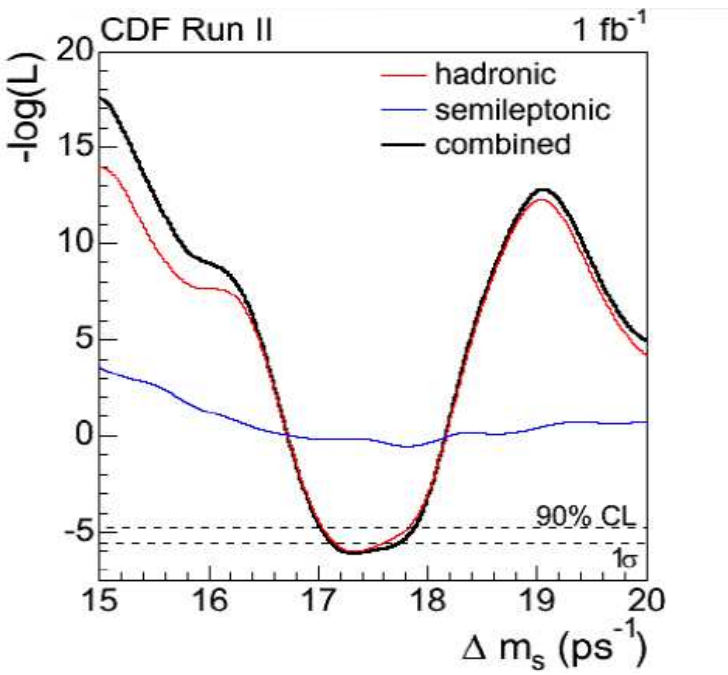
- Look for events where B_S decays in D_S mesons ($\bar{c}s$) and a muon and a neutrino
- $D_S \to \Phi\pi \to K^+K^-\pi$: display mass of $KK\pi$ system to get the D_S mass peak

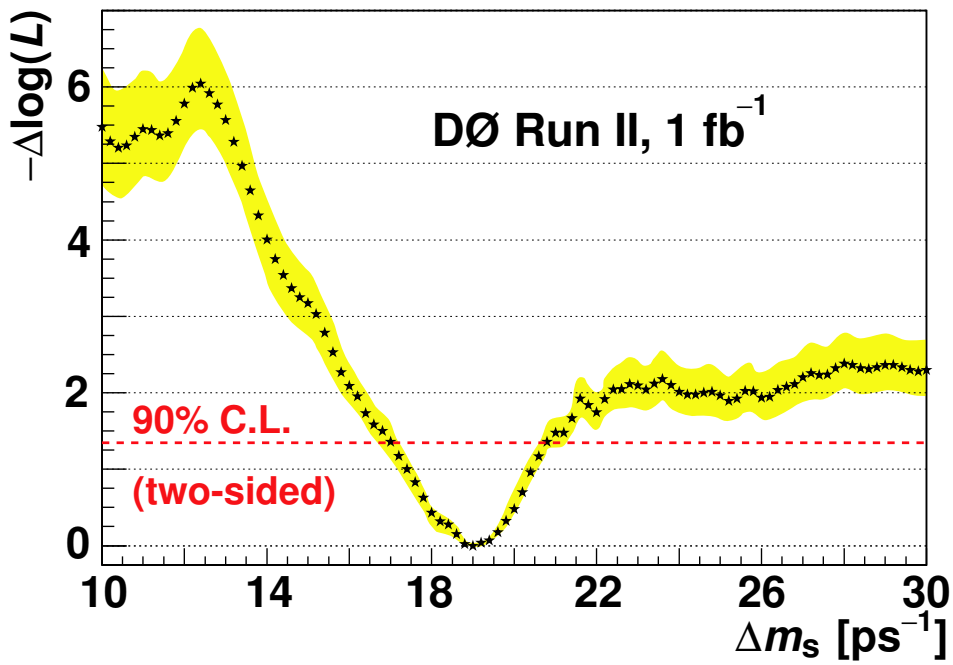




B_s^0 oscillation frequency

- The intersection of the reconstructed D_S flight path with that of the muon gives the distance the B_S meson travelled before it decayed, which leads to the lifetime of the B_S meson once its momentum is determined. The lifetime is directly related to Δm_S. The data amplitude is 0 for wrong values of Δm_S.
- $17 < \Delta m_S < 21$ ps^{-1} at 90% CL (DØ)
- $\Delta m_S = 17.33^{+0.42}(stat) \pm 0.07(syst) ps^{-1}$,
  $17.00 < \Delta m_S < 17.91$ ps^{-1} at 90% CL ,
  $16.94 < \Delta m_S < 17.97$ ps^{-1} at 95% CL (CDF)
  $(V_{td}/Vts = 0.208^{+0.008}_{-0.007})$

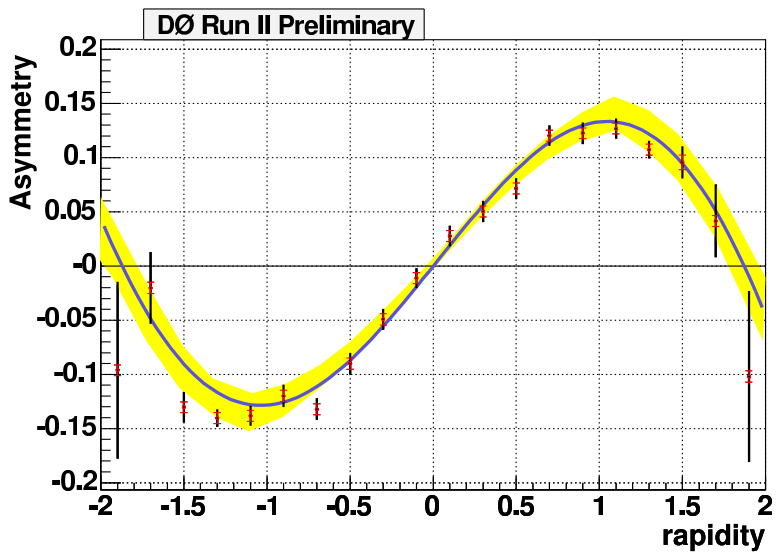




Electroweak physics

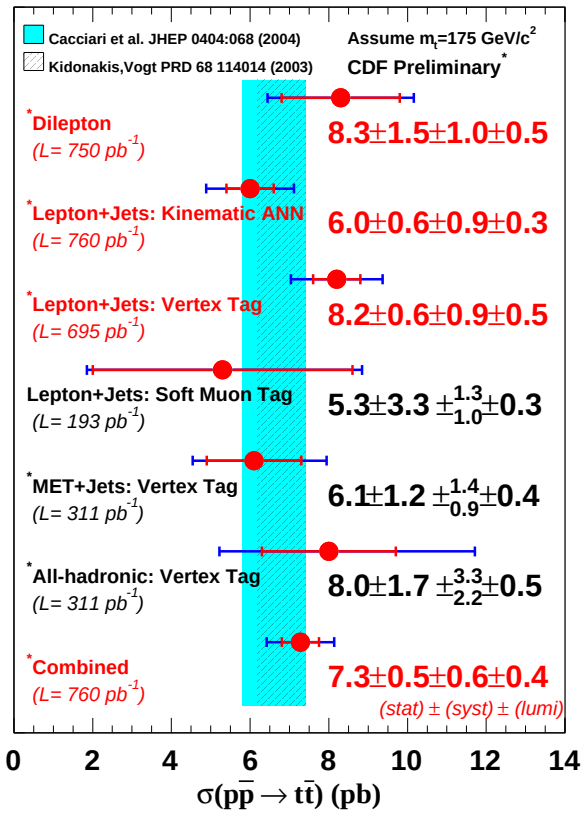
- Measurement of the W^+W^- production cross section in 825 pb^{-1}:
  $\sigma(p\bar{p} \to WW) = 13.6 \pm 2.8(stat) \pm 1.6(syst) \pm 1.2(lum)$ pb (CDF), (DØ published result with 220-250 pb^{-1}:
  $\sigma(p\bar{p} \to WW) = 13.8^{+4.3}_{-3.8}(stat)^{1.2}_{-0.9}(syst) \pm 0.9(lum)$ pb)
- Measurement of the $W \to \mu\nu$ charge asymmetry which can be used for future QCD fits (DØ)

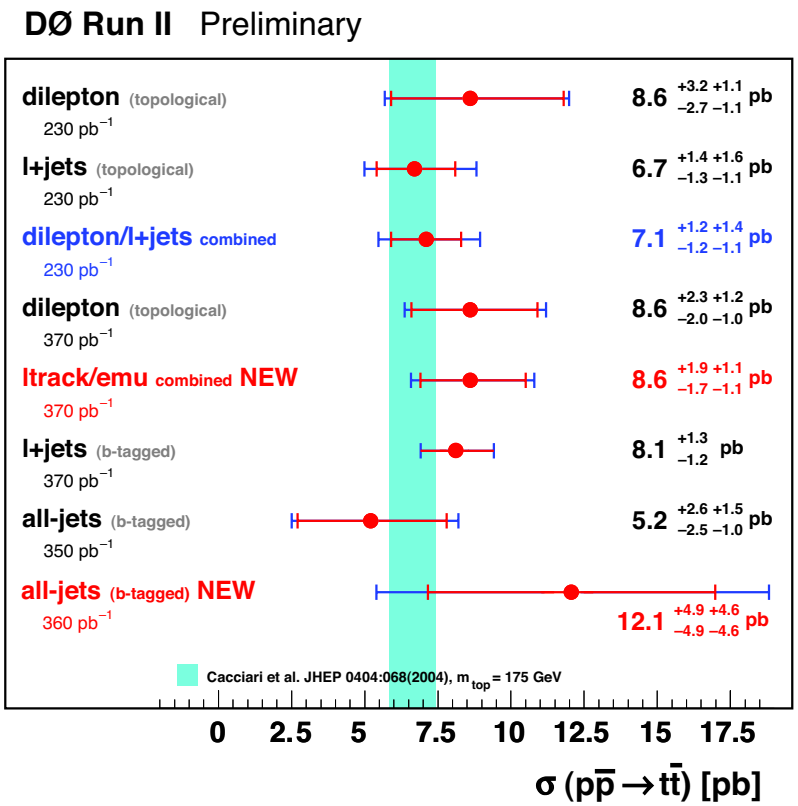
$$A(y) = \frac{d\sigma(W^+)/dy - d\sigma(W^-)/dy}{d\sigma(W^+)/dy + d\sigma(W^-)/dy} \sim \frac{d}{u}$$



Top production cross section

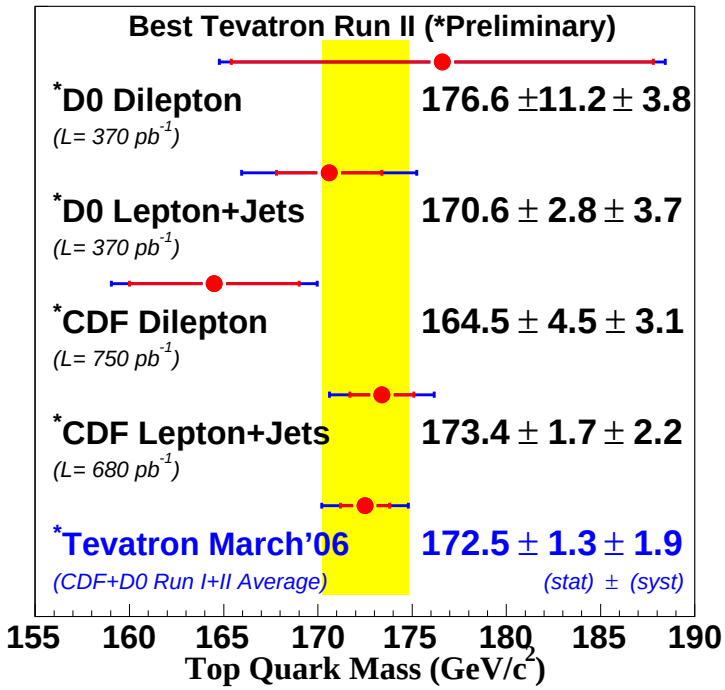
- Top production cross section and mass measurements: one of the main goal of Tevatron
- Measurement performed in different channels: $t \to bW$ instantly, and look in multijet, multilepton channels





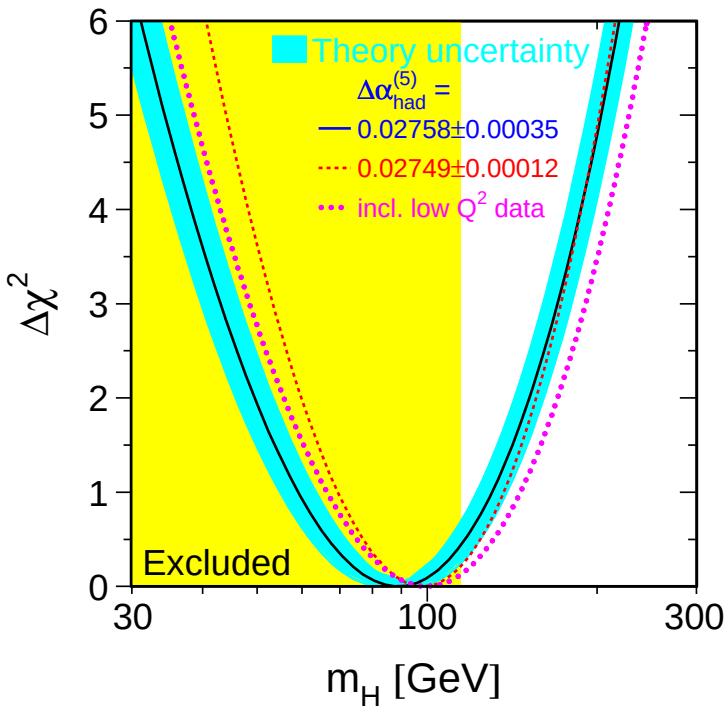
DØ and CDF new top mass measurement

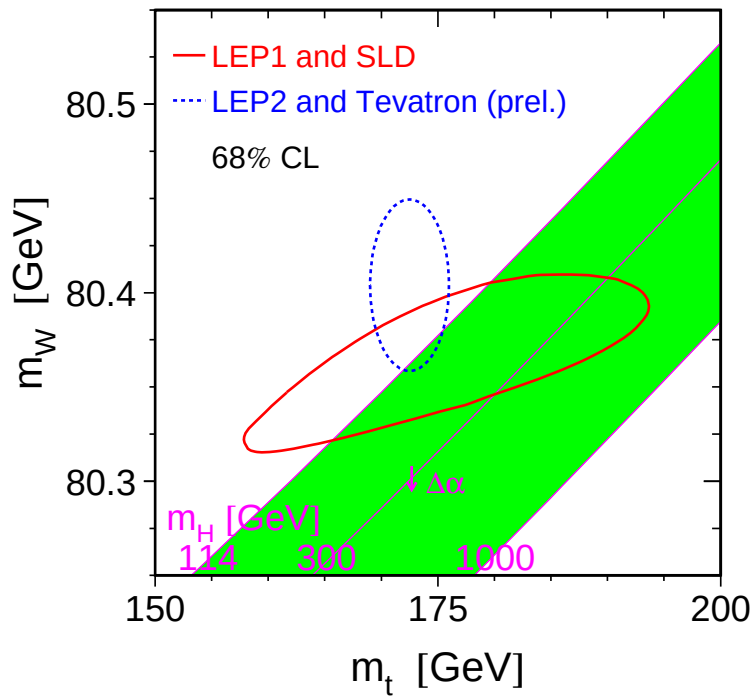
- Different methods to extract top mass: compare MC with different top masses to data
- Top mass fits use W mass constraints in lepton+jet channel: constrains absolute value of JES
- Precision on top mass measurement better than in run I (178.0 $\pm$ 4.4 GeV)
- $M_{top} = 172.5 \pm 1.3(stat.) \pm 1.9(syst.)$



Effect on electroweak fits and mass of Higgs boson

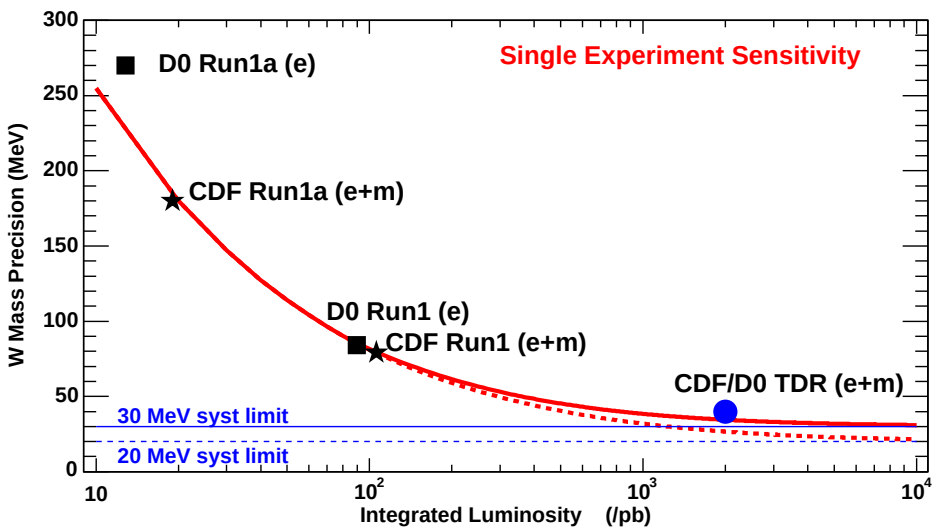
- Use new M_{top}, width of W boson from Tevatron and LEP, and mass of W from :EP
- $M_{Higgs} = 89 + 42 - 30$ GeV (68% CL), and $<$ 175 GeV at 95% CL

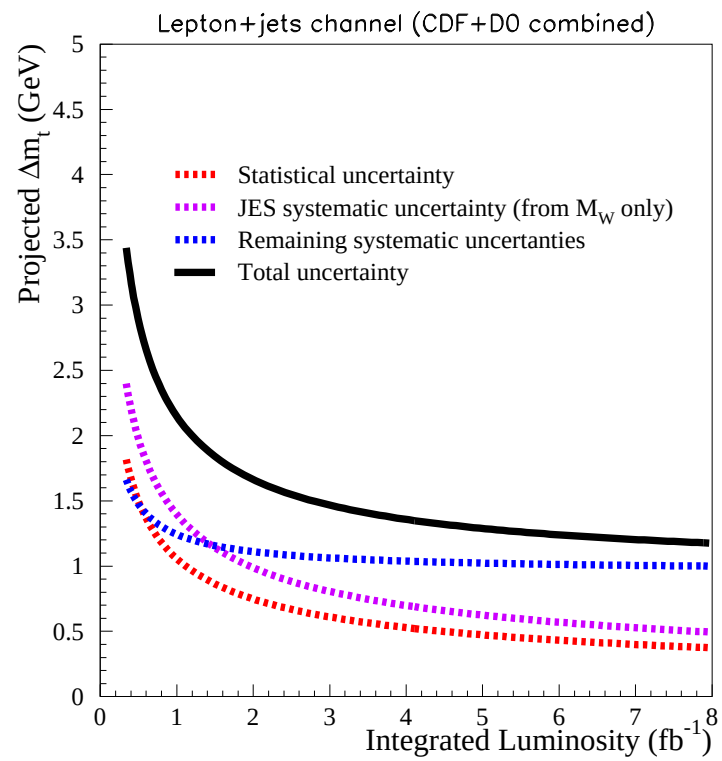




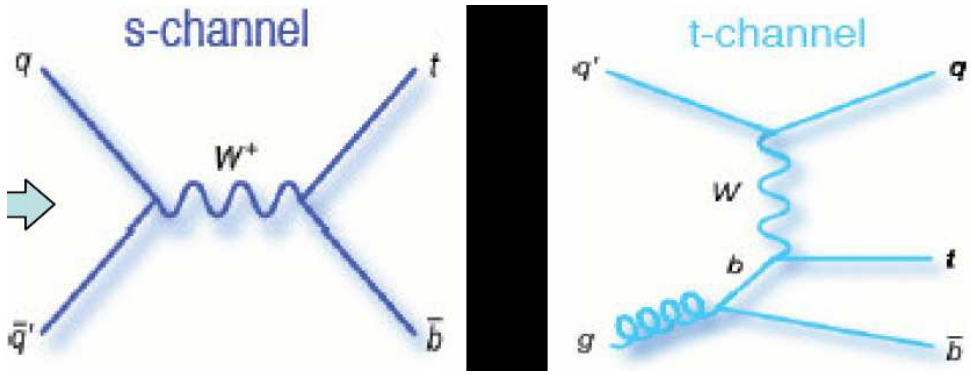
Future prospects on W and t masses

- Future prospects on M_W measurements: 20-30 MeV
- Future prospects on M_{top} measurements: other systematics: PDFs, Initial and Final state radiation, b-jet energy scale, b-tagging, background modeling, total error of the order of 1.5 GeV





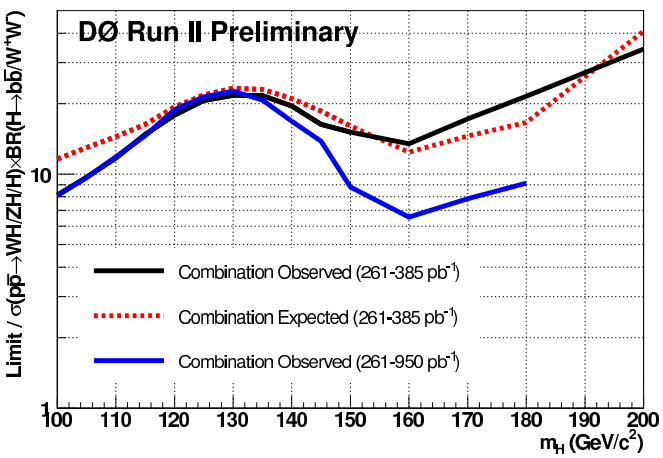
Search for single top production

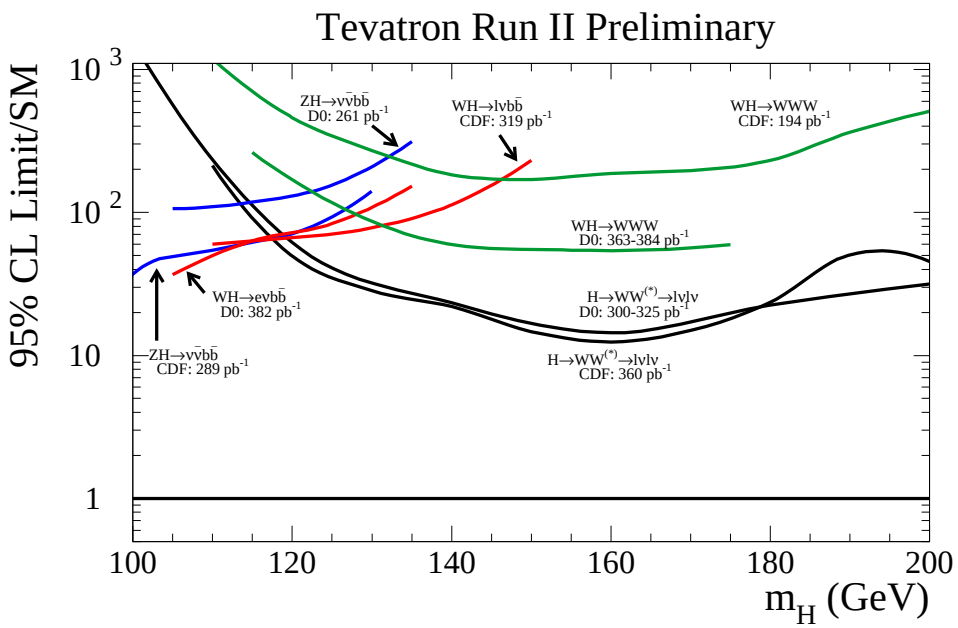


- Single top production: electroweak top production, sensitivity to beyond standard model physics
- Objectives: CKM matrix element V_{tb}, top width Γ_t, Wtb coupling
- DØ limit: 5.0 pb (s-channel production), 4.4 pb with a luminosity of 370 pb^{-1}
- CDF limit: 3.2 pb (s-channel production), 3.1 pb (t channel), 3.3 pb (both channels) with a lumi of 695 pb^{-1}
- SM observation expected at 3 σ with 1.5 fb^{-1}, and discovery at 5 σ with about 4 fb^{-1} with the same analysis techniques and performances

Search for SM Higgs boson

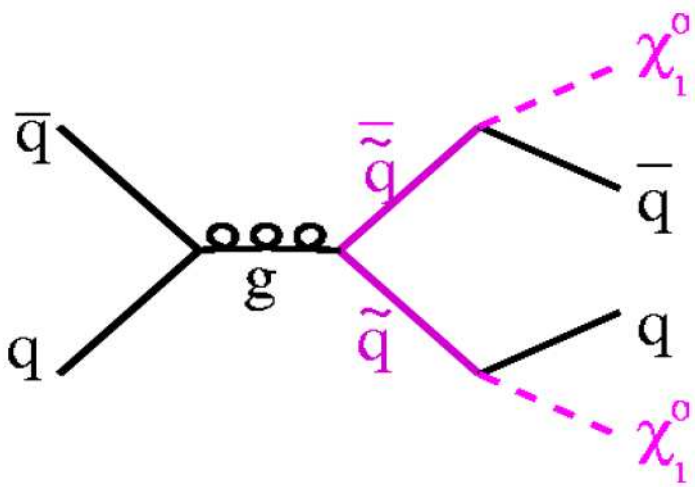
- Upper limit for SM Higgs bosons (DØ): includes the associated production ($WH \rightarrow e/\mu\nu b\bar{b}$, $ZH \rightarrow \nu\nu b\bar{b}$ and $WH \rightarrow WW^+W^-$ - 261 to 385 pb^{-1}) and gluon fusion ($H \rightarrow W^+W^-$- 950 pb^{-1})
- Combination plot of all present Higgs search limits divided by SM expectation (DØ and CDF): about one order of magnitude away from SM expectation (about 4-5 fb^{-1} needed)

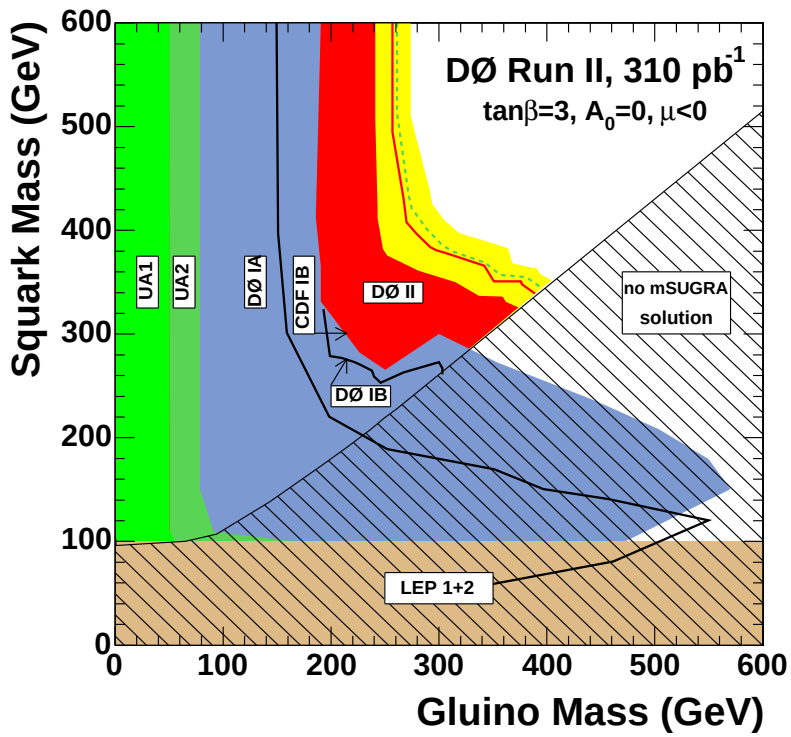




Squarks and gluinos in jets +MET (DØ)

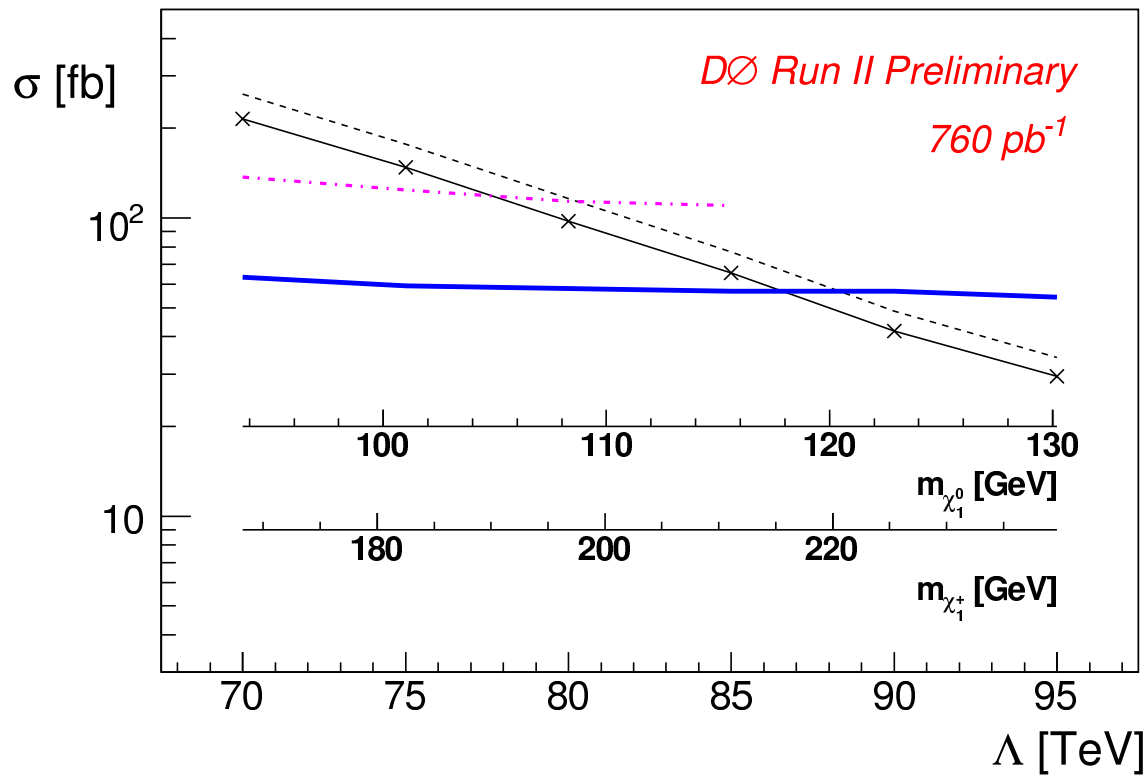
- Topology: N jets and MET: ($\tilde{q}\tilde{q}$: 2 jets and MET, $\tilde{q}\tilde{g}$: 3 jets and MET, $\tilde{g}\tilde{g}$: 4 jets and MET)
- Limits in the squark and gluino mass plane for the different scenarii
- Lower limits of 325 and 241 GeV at 95% CL for squark and gluino masses for $\tan\beta = 3$, $A_0 = 0$, and $\mu < 0$





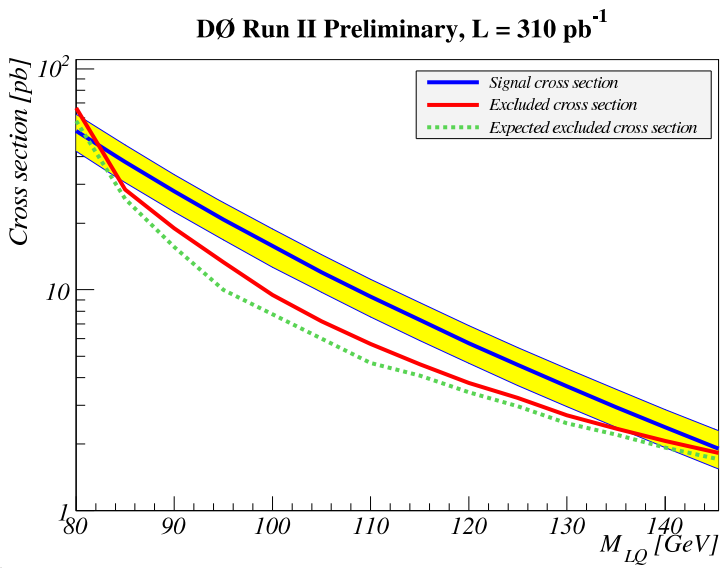
New phenomena: search for GMSB SUSY (DØ)

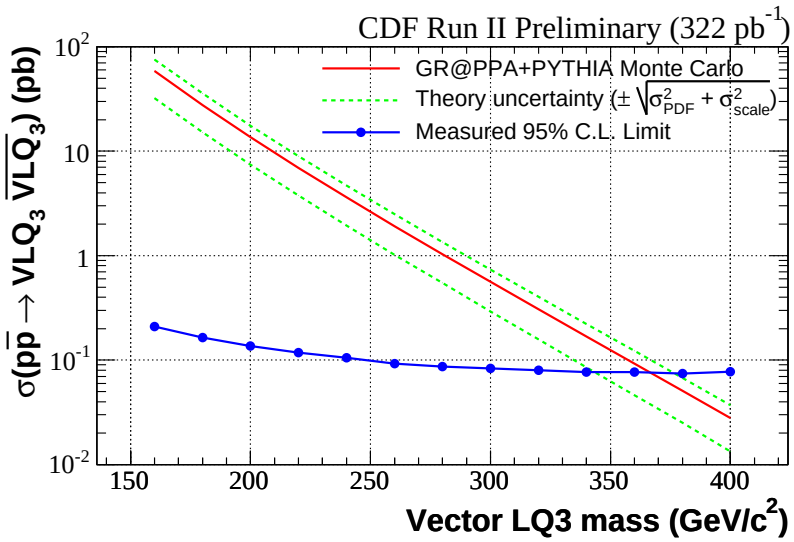
- Search for gauge mediated SUSY breaking in diphoton final states with 760 pb^{-1}
- No excess has been found, and a limit on neutralino (chargino) of 120 (220) has been put
- Limit on effective scale of SUSY breaking: Λ >88.5 TeV at 95% CL



New phenomena: Leptoquarks

- Search for scalar leptoquarks (DØ) in acoplanar jets and missing E_T: M >136 GeV for a leptoquark decaying into a quark and neutrino
- Search for 3rd generation vector leptoquarks (CDF), each decaying into $b\tau$: $\sigma < 76$ fb at 95% CL with 322 pb^{-1}, M >368 GeV if we assume a BR into $b\tau$ of 100%





Conclusion

- Jet cross section measurement with higher precision and higher rapidity reach, will be useful to constrain better quark and gluon densities in proton
- Other measurements sensitive to parton distributions: $Z, W+$ jets, W asymetry...
- New diffractive measurements from CDF: look for exclusive events, more studies expected using new H1 QCD fits
- Standard model results: New average top mass: $(172.5 \pm 1.3(stat.) \pm 1.9(syst.))$, leading to new electroweak fits; New Δm_s $(16.94 < \Delta m_S < 17.97$ ps^{-1} at 95% CL), New results on W mass expected by Summer
- Search for Higgs boson: studies in progress, will become a hot topic with the increase in luminosity
- Many new results from the Tevatron, many more expected by Summer/Winter see parallel session talks for more details

List of talks in parallel session

- Hadronic final states
  - Isolated photon cross section measurements from DØ , A. Kumar
  - Inclusive jet production at CDF, O. Norniella
  - Inclusive jet cross section measurements, M. Voutilainen
  - New results on jet fragmentation phenomena (CDF)
  - $W+$jet production at the Tevatron (CDF), A. Messina
- Diffraction and vector mesons
  - New results on diffraction from CDF, M. Gallinaro

List of talks in parallel session (cont.)

- Heavy flavour
  - Bottonium production and B_S mixing at DØ , T. Kuhl
  - B resonances and B hadron decays at DØ , D. Gelé
  - b-jets and $Z + b$ jets at CDF, D. Jeans
  - Observed and predicted $b\bar{b}$ production at Tevatron, F. Happacher
- Structure functions and low x
  - DØ jets, M. Voutilainen
  - Constraints on PDFs uncertainties from CDF, C. Issever
- Electroweak and beyond standard model
  - EW physics at the Tevatron, J. Garcia
  - Top properties, P. Schieferdecker
  - Top cross sections, S. Cabrera
  - BSM searches at Tevatron, J. Kim
  - Higgs results at Tevatron, M. Tomoto
  - SUSY results at Tevatron, F. Badaud