QCD results for Moriond 2003

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on behalf of QCD group

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Topics

- inclusive dijet mass cross section
- inclusive jet p_T cross section
- new results from the Forward Proton Detector
  - elastic scattering
  - diffractive scattering

Acknowledgement

- physics analysis is the last step in the chain of measurement process
- credit and thanks go to the whole DØ collaboration

Data sample and run selection

- trigger versions 8, 9, and 10 (September 3, 2002 – January 12, 2003)
- stripped p13.04, p13.05 and p13.06 thumbnails (single jet triggers)
  - JT_25TT_NG, JT_45TT, JT_65TT, JT_95TT
- integrated luminosity is $\mathcal{L} = 55.9\,\text{pb}^{-1}$

	p13.04	p13.05	p13.06
$\mathcal{L}$ [pb^{-1}]	12.0	38.8	5.1

Run selection

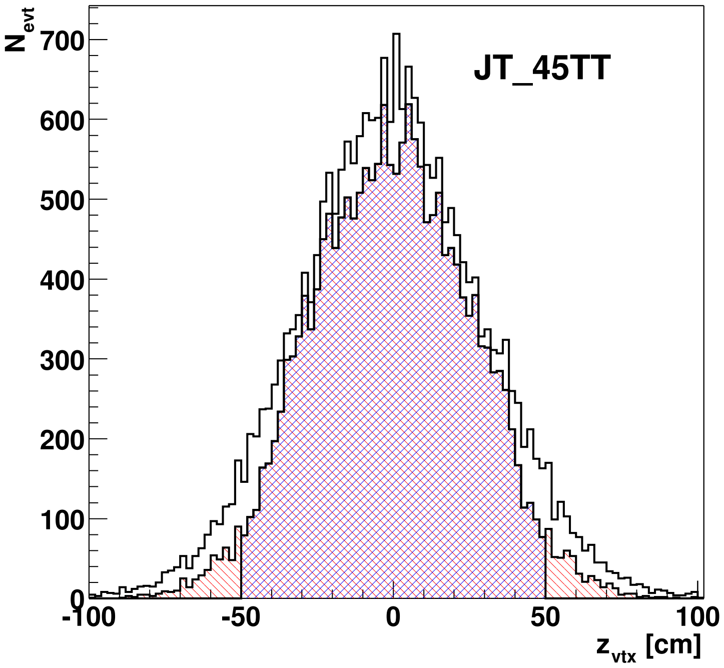
- based on monitoring MET, METx, METy, SET per run in triggers JT_25TT_NG and JT_65TT
- runs with spikes in jet φ distribution were removed
- check on number of tracks associated to the vertex
- selection is pretty conservative – $43.0\,\text{pb}^{-1}$ survive

Dijet Sample

$$\left\langle \frac{\mathrm{d}\sigma}{\mathrm{d}M_{JJ}} \right\rangle = \frac{N_{evt}}{\mathcal{L}} \frac{1}{\varepsilon_{eff}} C_{unsmear} \frac{1}{\Delta M_{JJ}}$$

- event contains at least 2 jets (RunII cone R=0.7)
- both the two leading jets are within $|\eta| < 0.5$ region
- MET $< 0.7 p_T^{1st\ jet}$
- at least 5 tracks pointing to the primary vertex and $|z_{vtx}| < 50$ cm
- both the two leading jets satisfy p13 jetID criteria
  - $0.05 <$ EMF < 0.95, CHF < 0.4, HotF < 10, n90 > 1
  - if $($CHF $> 0.1)$ then f90ch $=$ n90/nItem $+ 0.5$ CHF > 0.8
- dijet sample is very clean
  - no peculiar behaviour observed in jet ID variables distributions
  - efficiencies for jet ID cuts are close to one

Vertex cut efficiency

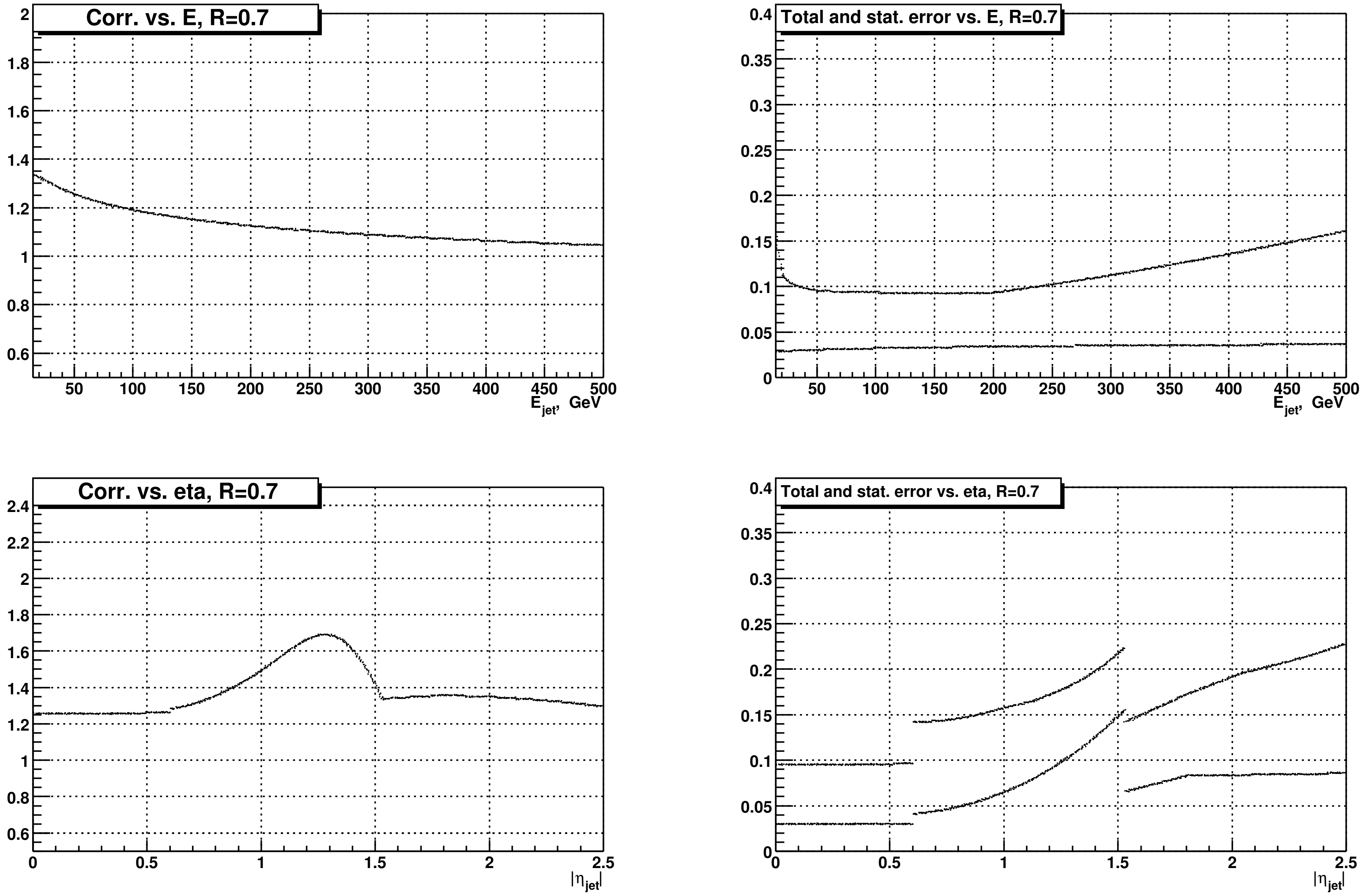


$$\varepsilon = \frac{N_{good}}{N_{all}}, \quad \Delta\varepsilon = \sqrt{\frac{\varepsilon\,(1-\varepsilon)}{N_{all}}}$$

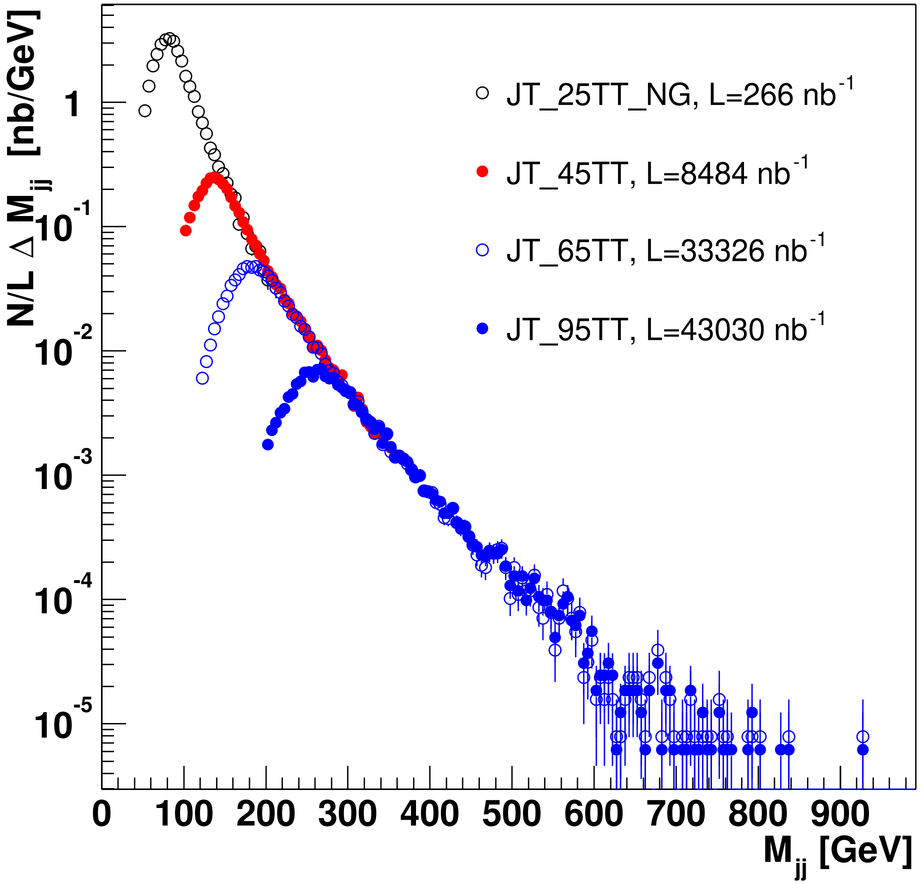
- ε_1 - cut on $|z_{vtx}| < 50\,\mathrm{cm}$
- ε_2 - cut on number of tracks

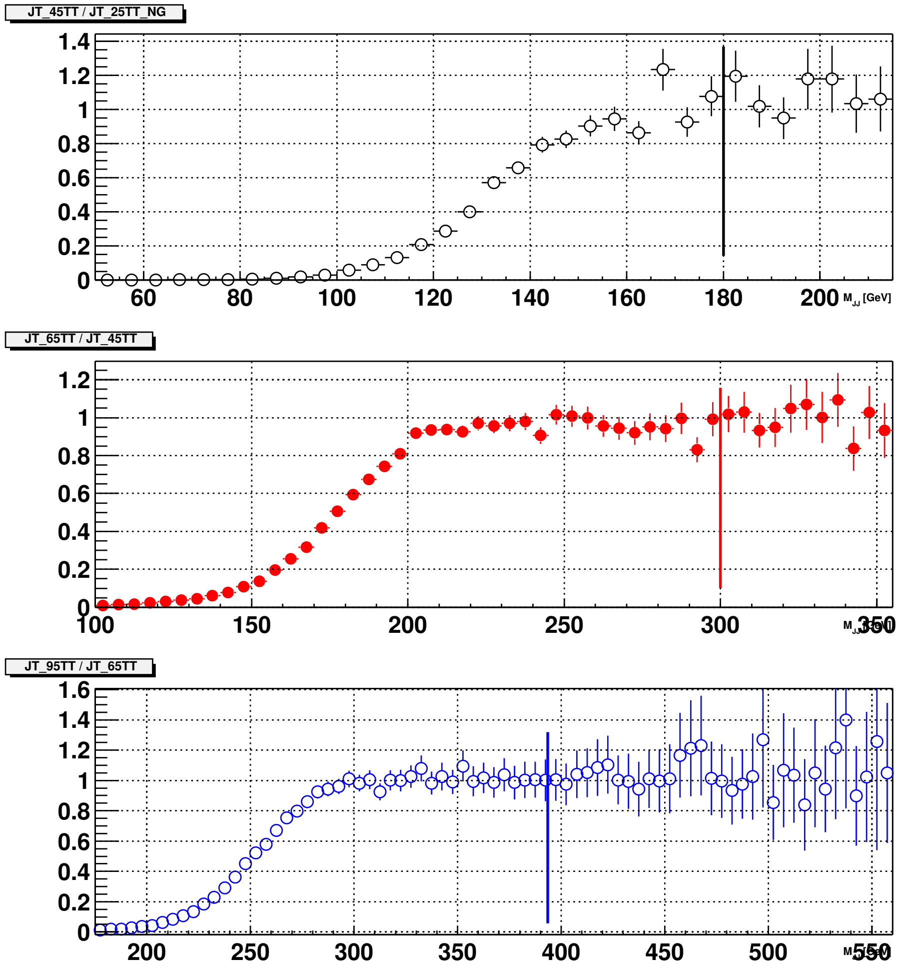
trigger	M_{jj}^{cut}	ε_1	ε_2	ε
JT_25TT_NG	150 GeV	0.959	0.815	0.782
JT_45TT	180 GeV	0.949	0.823	0.781
JT_65TT	300 GeV	0.963	0.819	0.788
JT_95TT	390 GeV	0.965	0.796	0.768

Jet energy scale



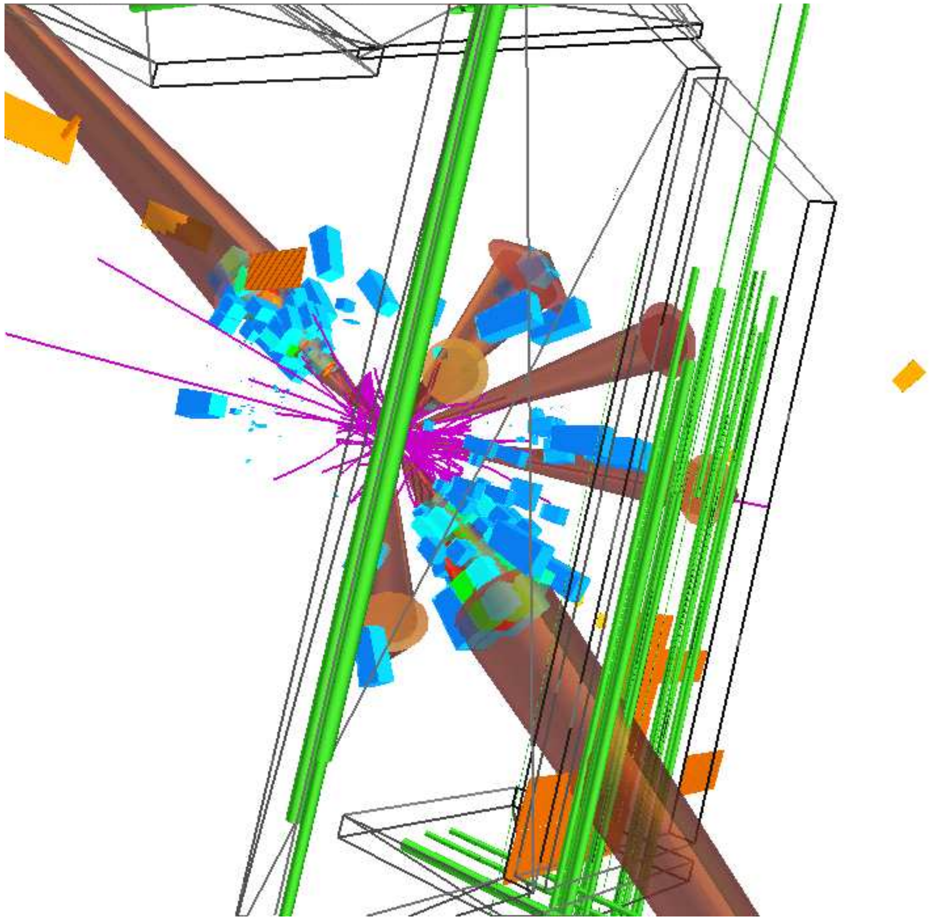
Raw dijet mass spectrum

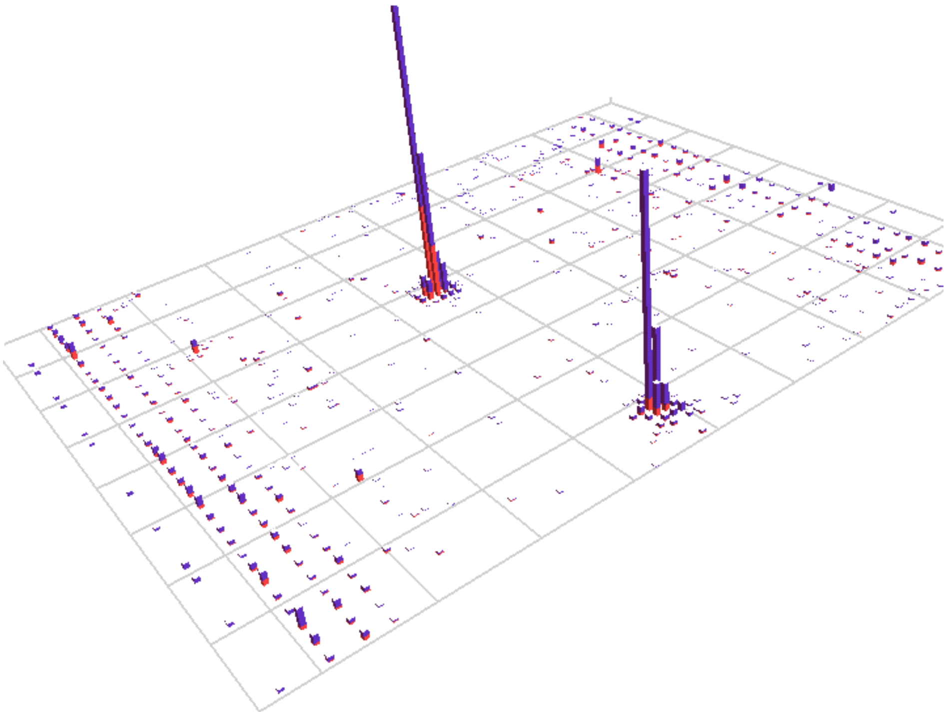




- JES correction v04-01-00
- event and jetID cuts efficiency corrections

Event display

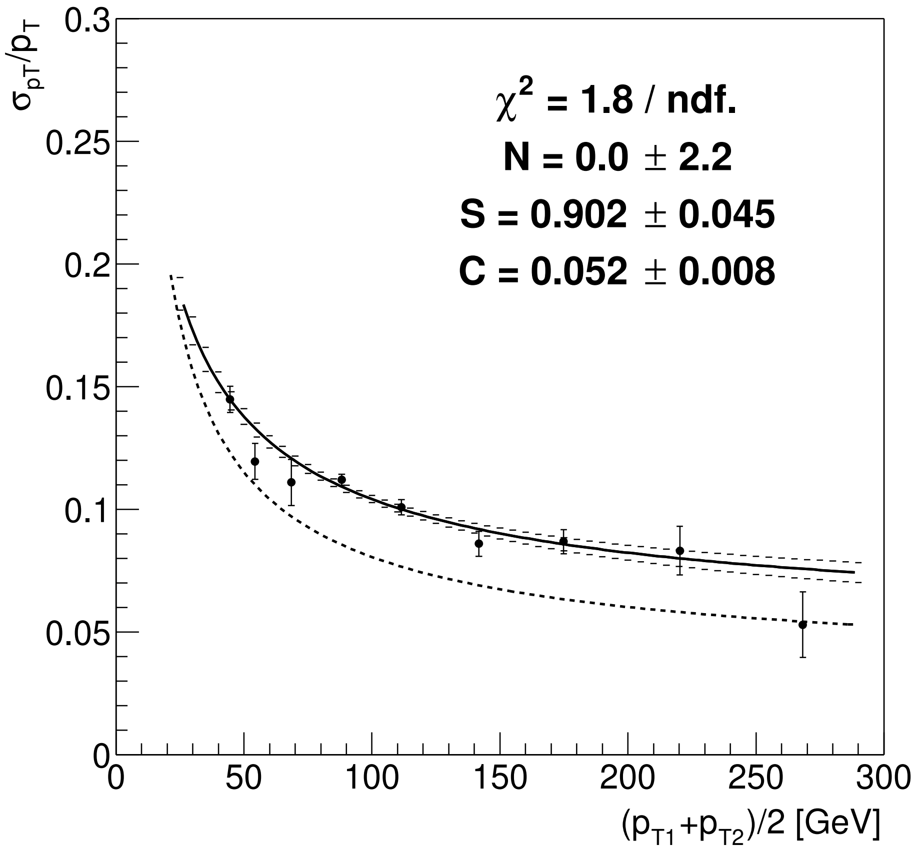




- jet1 : $p_T = 475$ GeV, EMF $= 0.42$, CHF $= 0.05$, n90 $= 10$
- jet2 : $p_T = 442$ GeV, EMF $= 0.11$, CHF $= 0.17$, n90 $= 12$
- $M_{JJ} = 926$ GeV
- missing E_T is 28 GeV

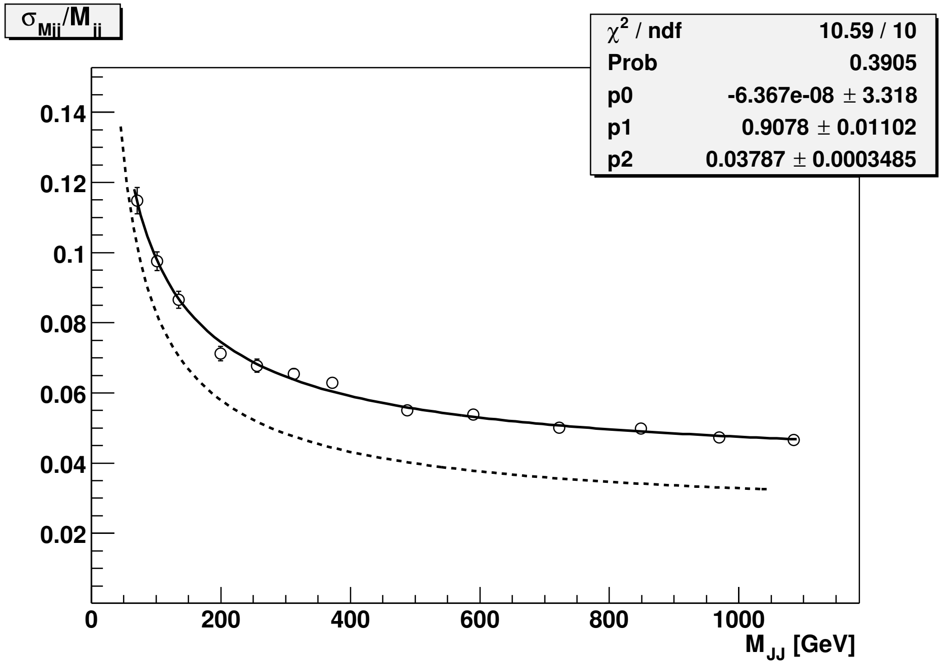
Dijet mass resolution

jet p_T resolution



- measured from p_T imbalance in dijet events

dijet mass resolution



$$\frac{\sigma_{M_{JJ}}}{M_{JJ}} = \sqrt{\frac{N^2}{M_{JJ}^2} + \frac{S^2}{M_{JJ}} + C^2}$$

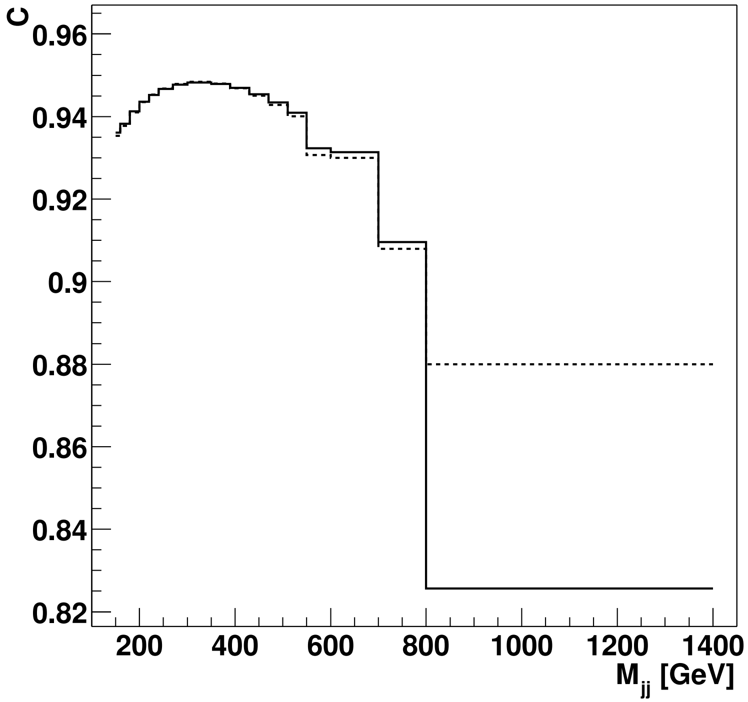
- derived from jet p_T resolution
- smearing MC particle jets

Unsmearing - method

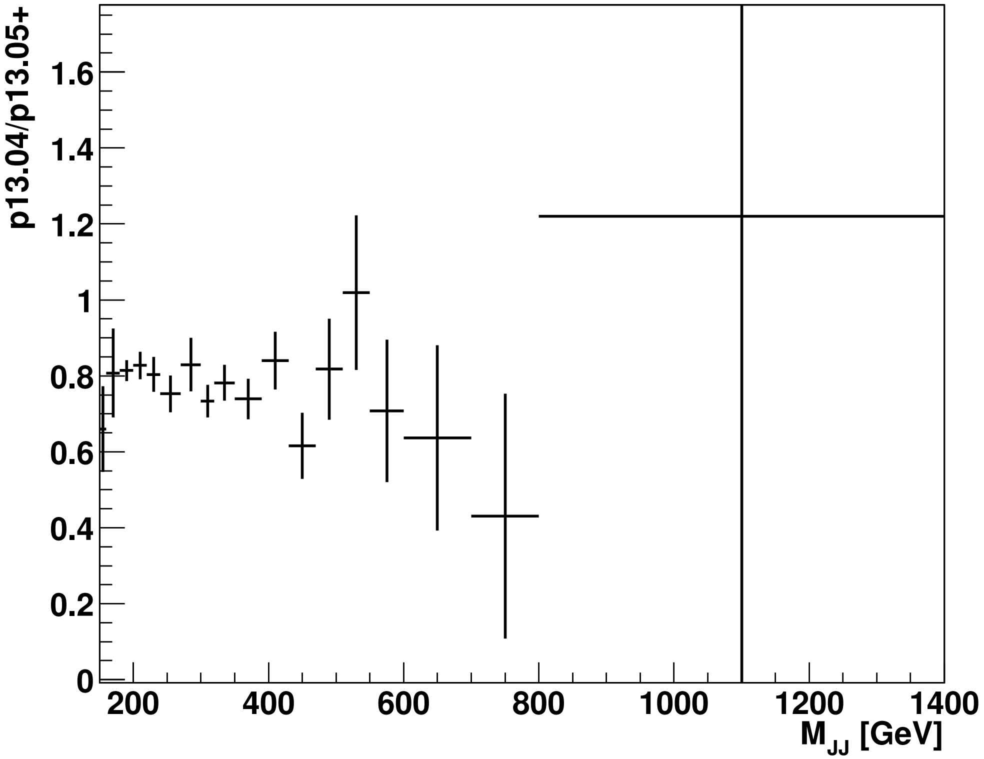
- ansatz function

$$f = N M_{jj}^{-\alpha} \left(1 - \frac{M_{jj}}{\sqrt{s}}\right)^{-\beta}$$

- unsmearing correction is small
- slightly bigger than in RunI

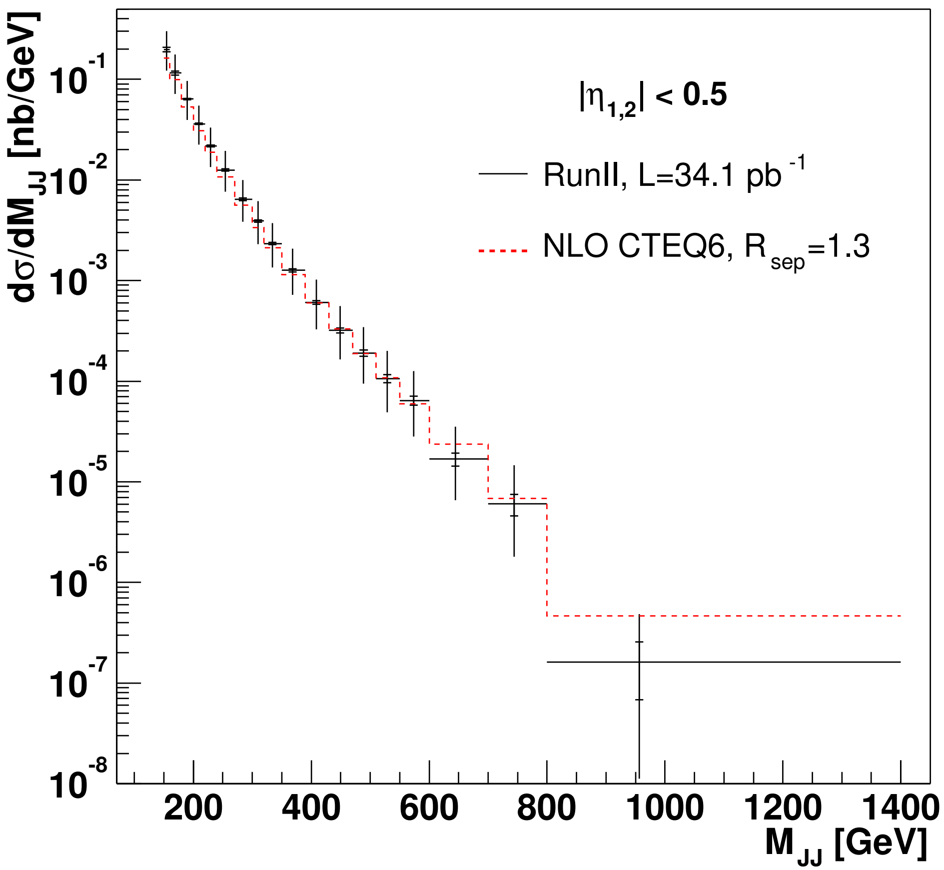


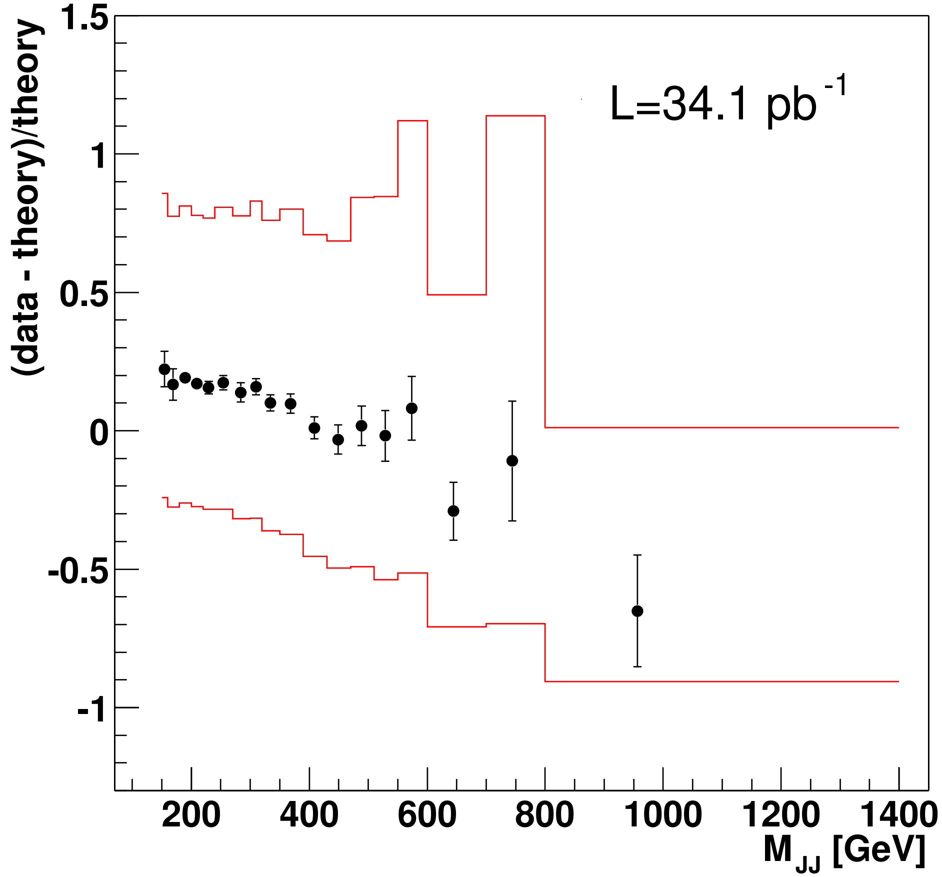
p13.04.00 versus p13.05.00



- the difference in cross section is 20% arround $200\,$GeV
- corresponds to $3-4\%$ difference in JES
- reprocess p13.04 data with the latest version of p13

Inclusive dijet mass cross section

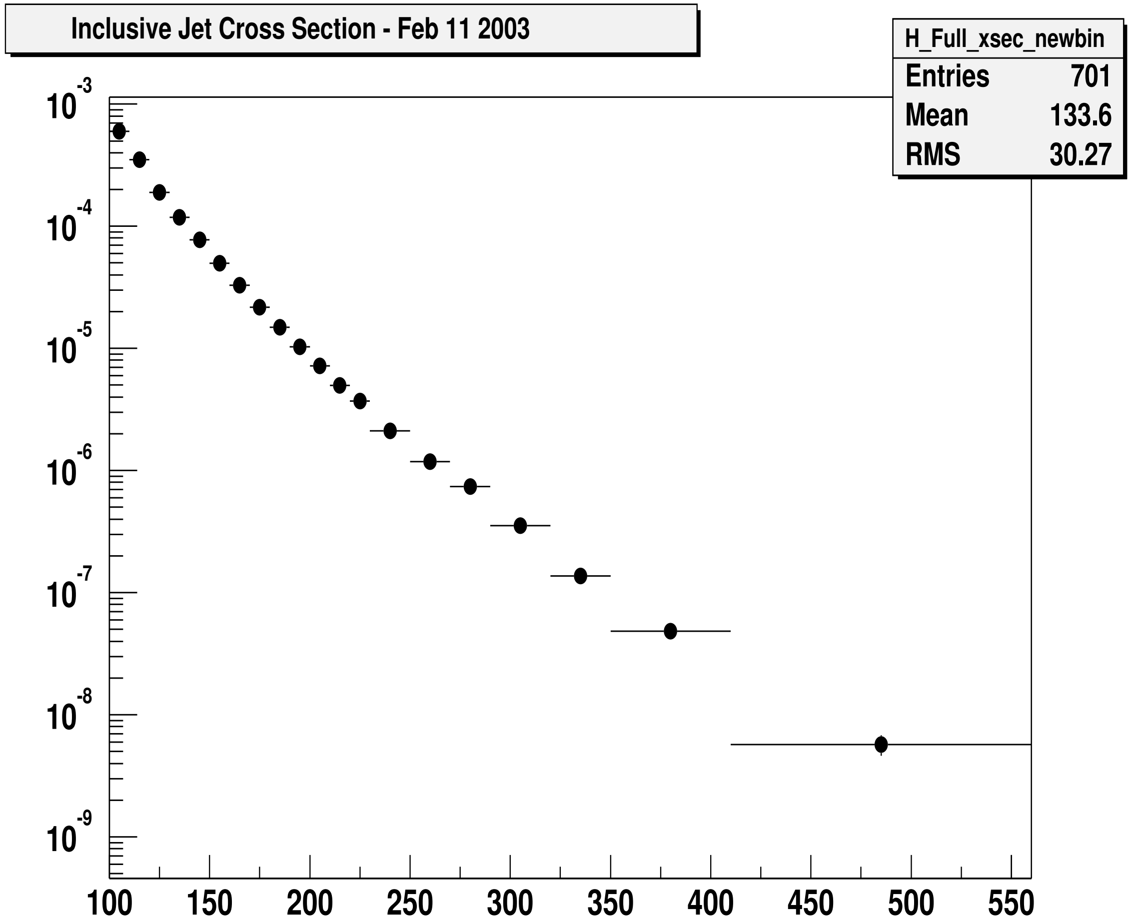




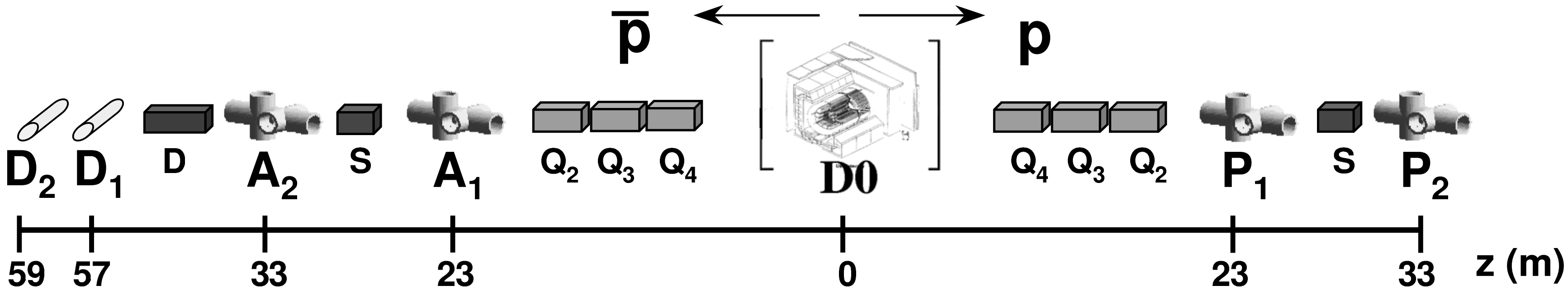
- only p13.05 and p13.06 data
- overall 10% uncertainty on luminosity
- an agreement with the QCD prediction
- dominant source of systematic error comes from JES

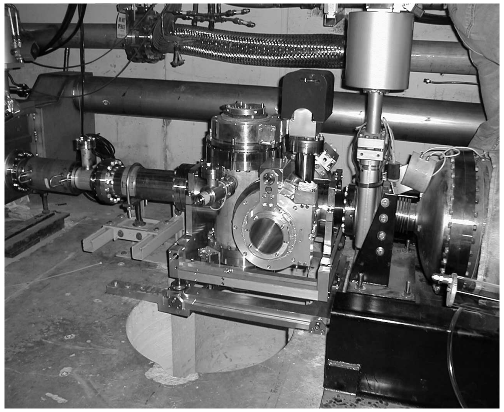
Inclusive jet p_T cross section

- analysis is in progress
- inclusive jet sample not that clean as the dijet sample
- need to understand high p_T fake jets



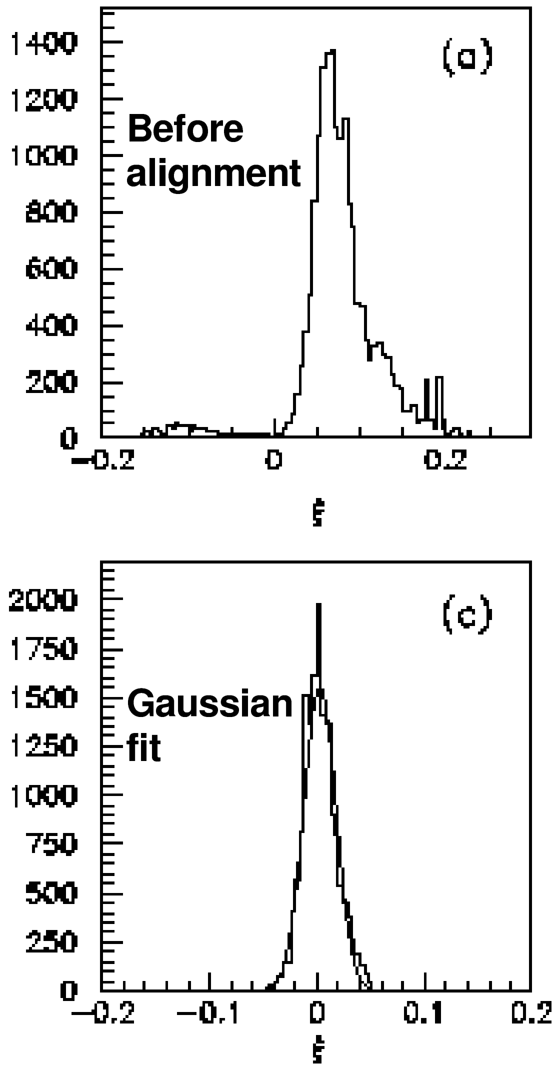
Forward Proton Detector



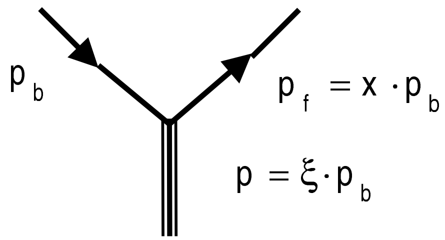


- 9 Momentum Spectrometers composed of 18 Roman Pots are installed at 23 to 59 meters from DØ interaction point inside the Tevatron tunnel
- Scintillating fiber detectors installed in Roman Pots can be remotely brought close (~ 6 mm) to the beam to track the scattered protons and antiprotons
- The reconstructed track is used to calculate the momentum and scattering angle of protons and antiprotons
- Cover a t region ($0 < t < 4.5$ GeV^2) that was never explored before at Tevatron energies
- Allows combination of proton tracks with high p_T scattering in the central detector

ξ and t Distributions for Elastic Events (Preliminary)

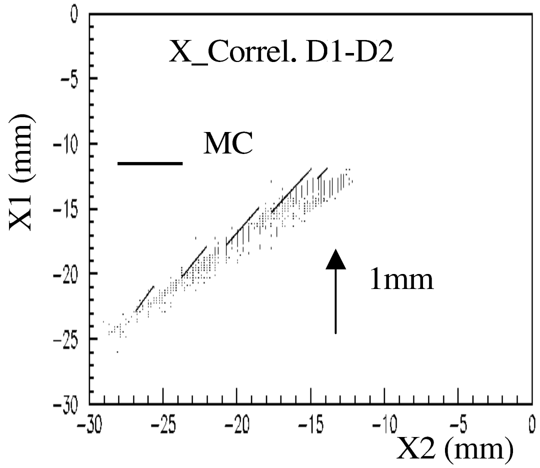


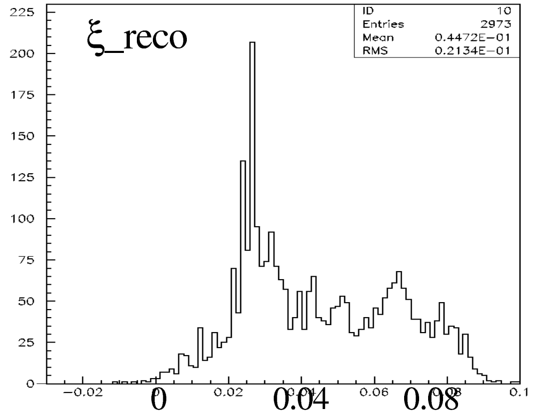
AU-PD Configuration

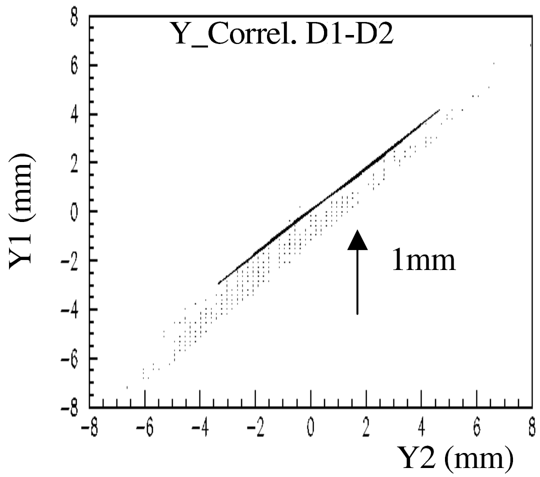


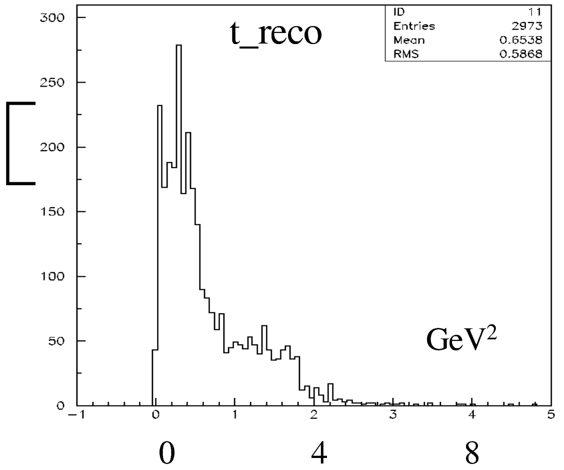
$$\xi = 1 - x$$
$$t = (p_b - p_f)^2$$

ξ and t Distributions for Diffractive Events (Very Preliminary)









D1-D2 Configuration

- Dipole Data are not corrected for Acceptance.
- Note the complementarity of the t-ranges of the two types of spectrometers.

Summary

- dijet mass cross section measurement using $\mathcal{L} = 34.1\,\mathrm{pb}^{-1}$ was presented
  - analysis is in good shape and approved by QCD group
  - preliminary version of the note available
    http://www-d0.fnal.gov/~kupco/d0_private/dijetmass.ps
- inclusive p_T spectrum measurement is well under way
- new promising results from Forward Proton Detector on elastic and diffractive events
  - after shutdown you can expect also results on high p_T diffractive events
- future needs - understand and reduce the errors on JES
- further ongoing analysis
  - dijet angular distribution, jet substructure, photons