Dijet mass spectrum

QCD Meeting, February 7, 2003

Alexander Kupčo

Institute of Physics, Academy of Sciences of the Czech Republic
Center for Particle Physics, Prague

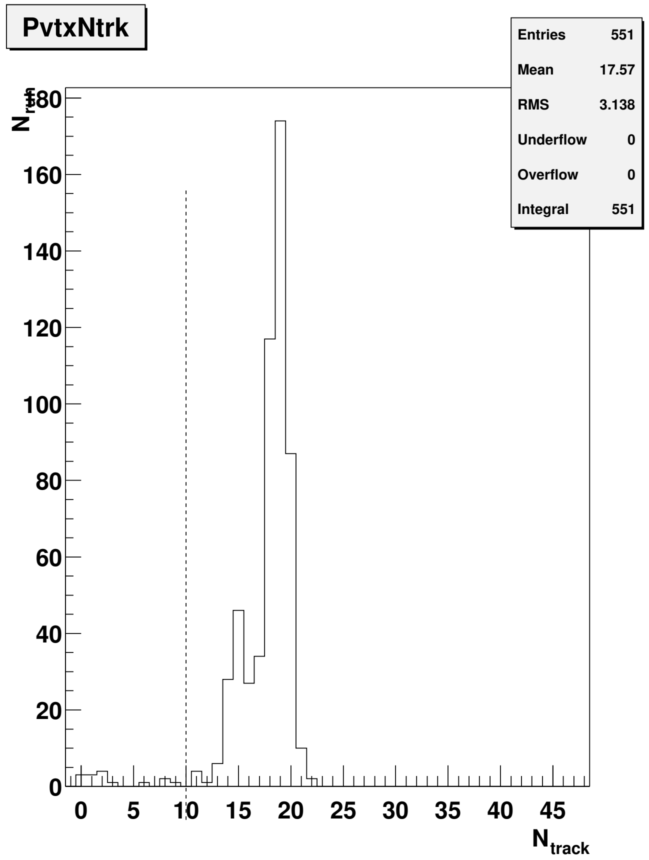
Data sample

- stripped p13.04, p13.05 and p13.06 thumbnails (single jet triggers)
- stripping done by QcdSkim code (`qcd_tools` package)
- trigger versions 8, 9, and 10
- integrated luminosity is $\mathcal{L} = 53.9\,\mathrm{pb}^{-1}$
  - $12.0\,\mathrm{pb}^{-1}$ in p13.04
  - $38.8\,\mathrm{pb}^{-1}$ in p13.05
  - $3.1\,\mathrm{pb}^{-1}$ in p13.06
- still there is few pb^{-1} comming that can be stripped

Run selections

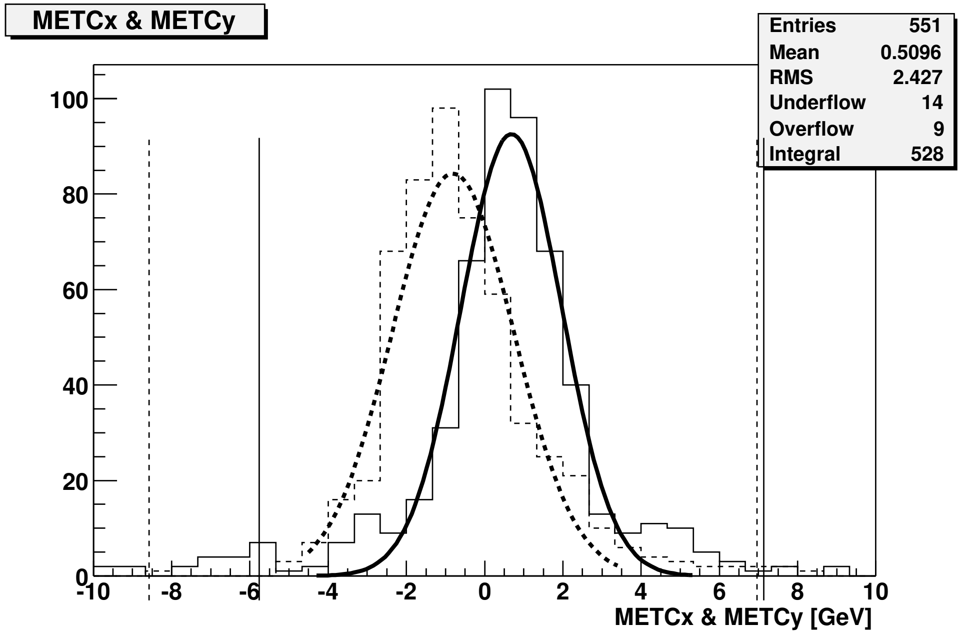
- run selection based on MET, METx, METy, SET

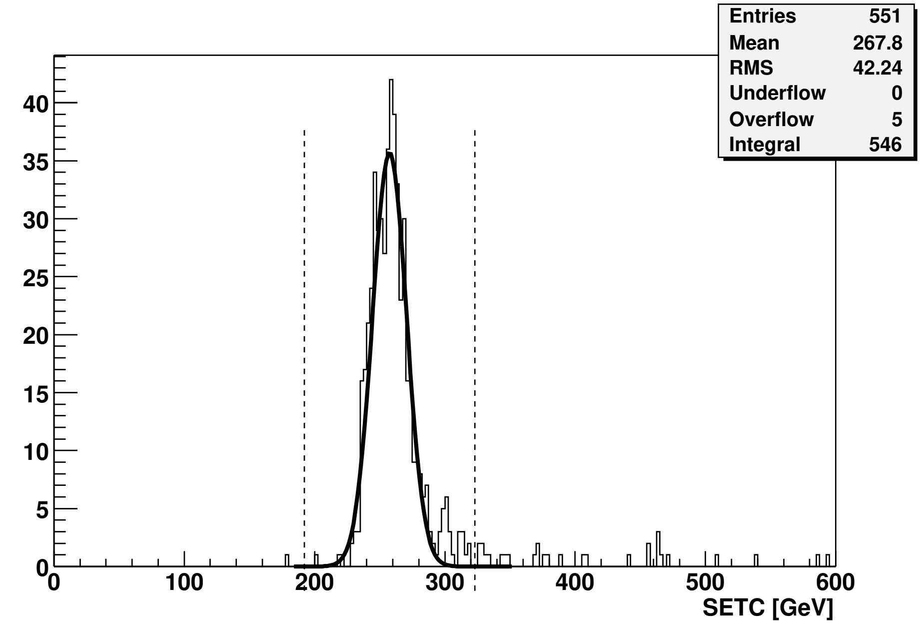
  + runs with spikes in jet φ distribution were removed
- slightly loose the selection criteria - 5σ condition
- at least 50 events in trigger JT_65TT

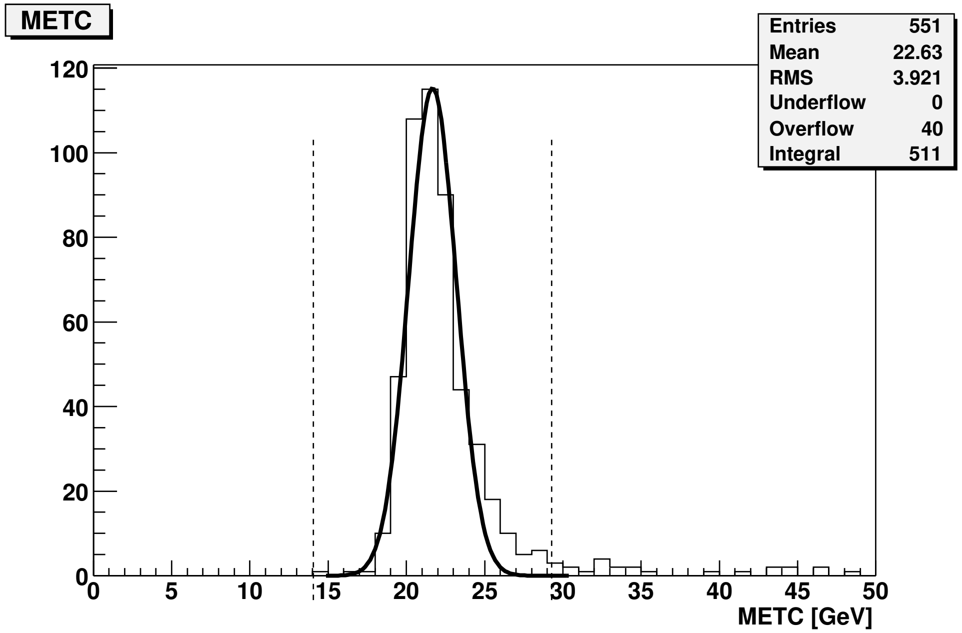


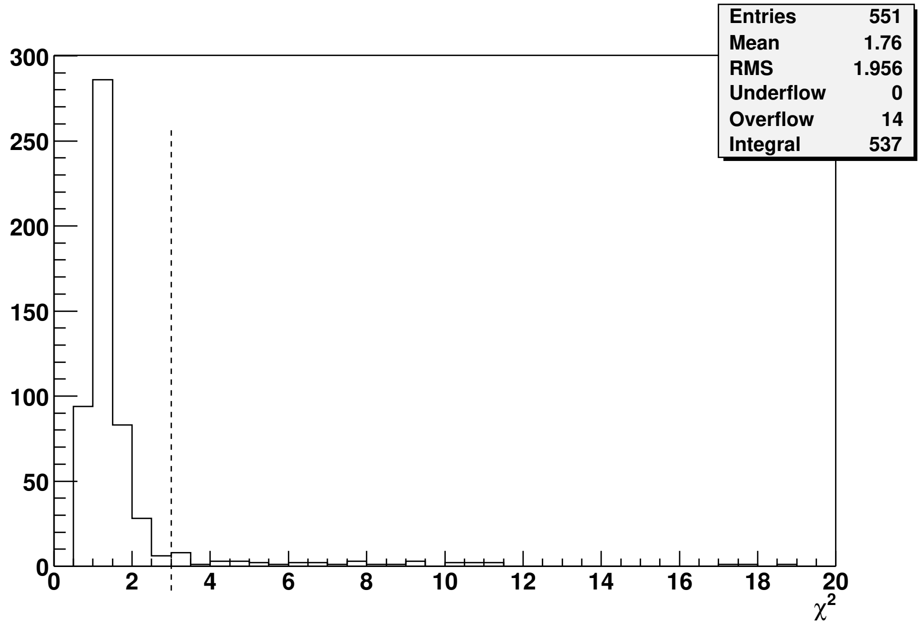
- check on number of tracks associated to the vertex
- $41.2\,\mathrm{pb}^{-1}$ survives

Run selection variables

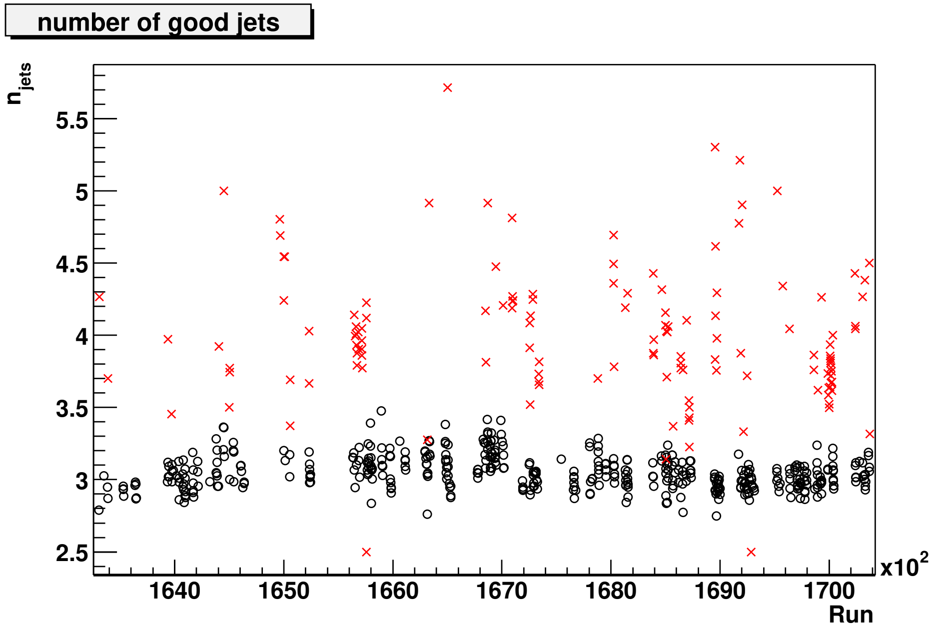


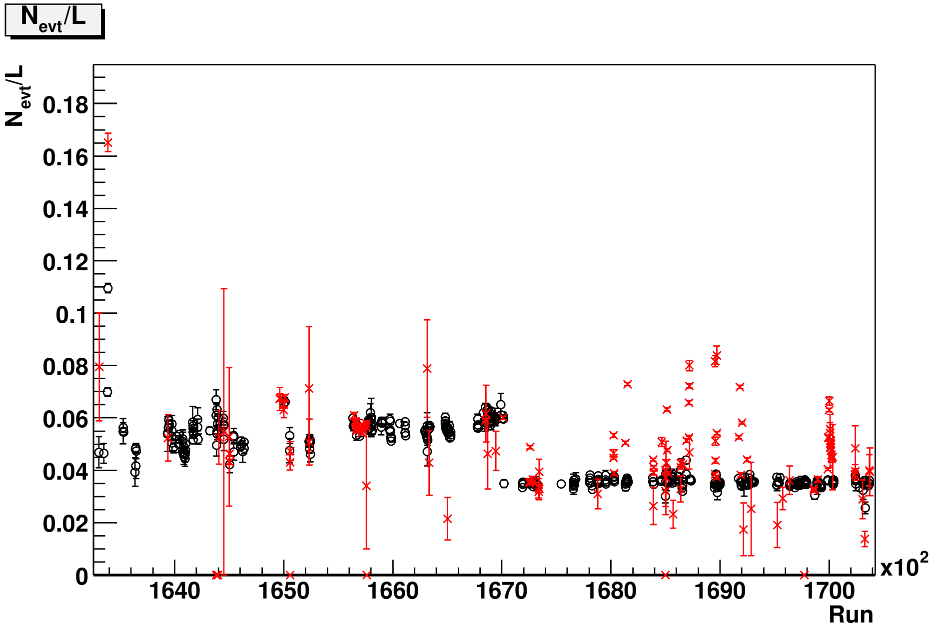


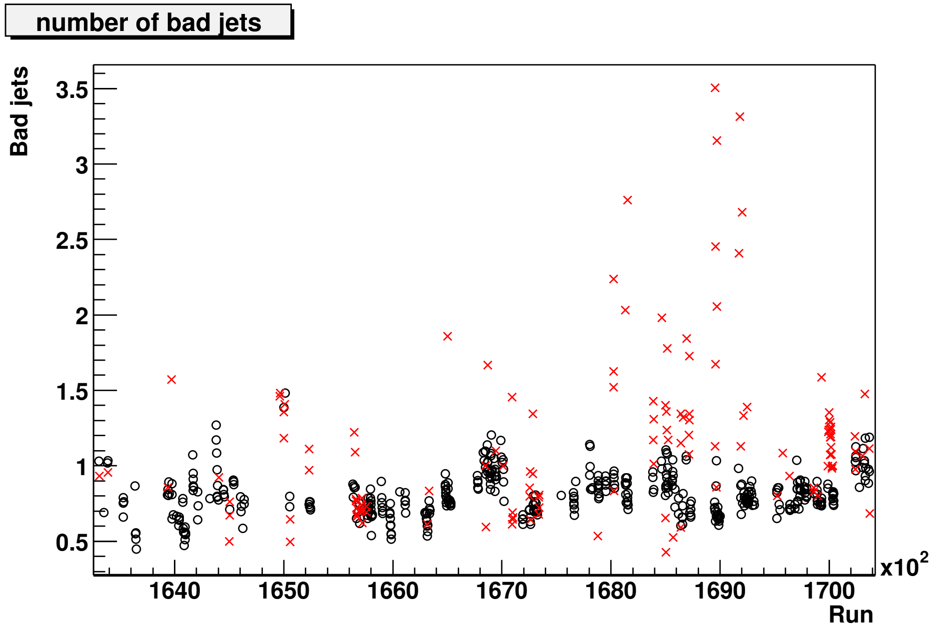


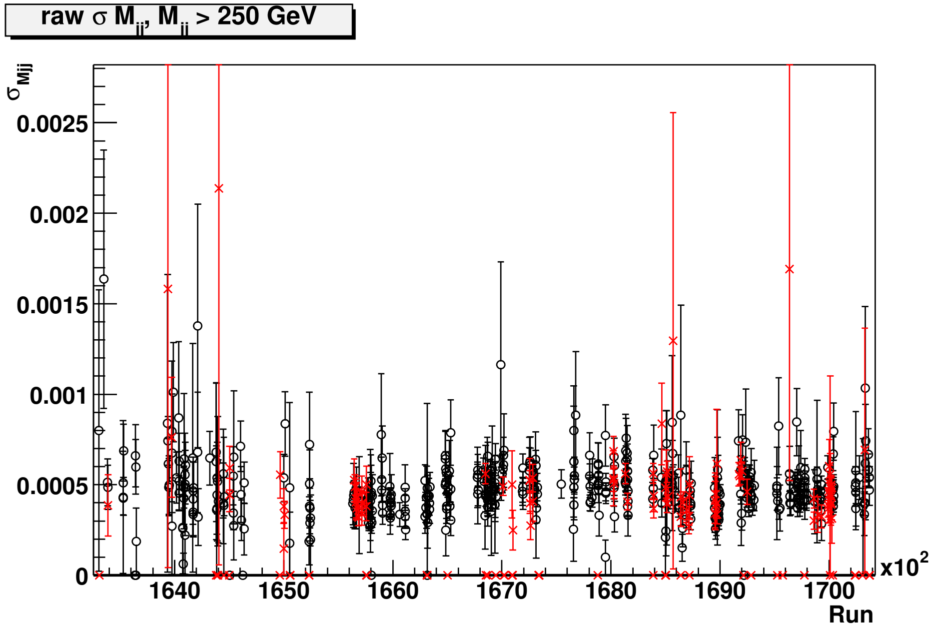


Run selection check









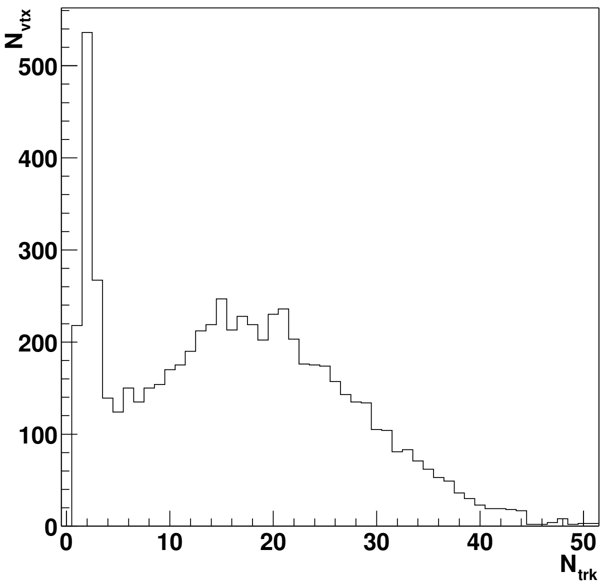
Event Selection

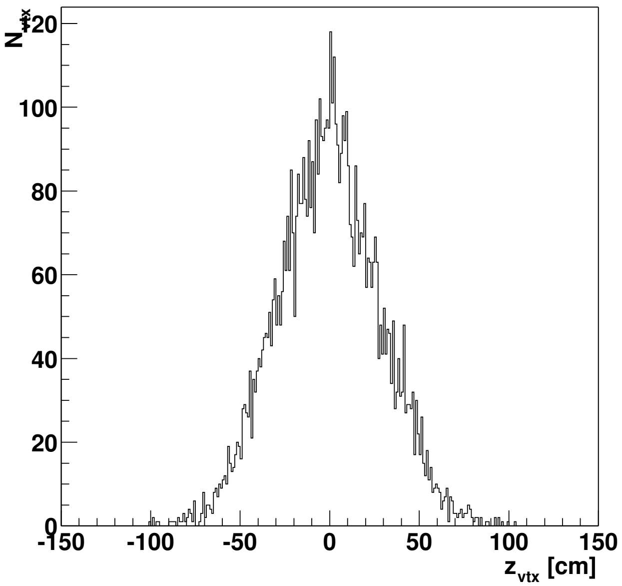
- p13 JES correction applied (`jetcorr v04-01-00`)
- p13 jetID criteria

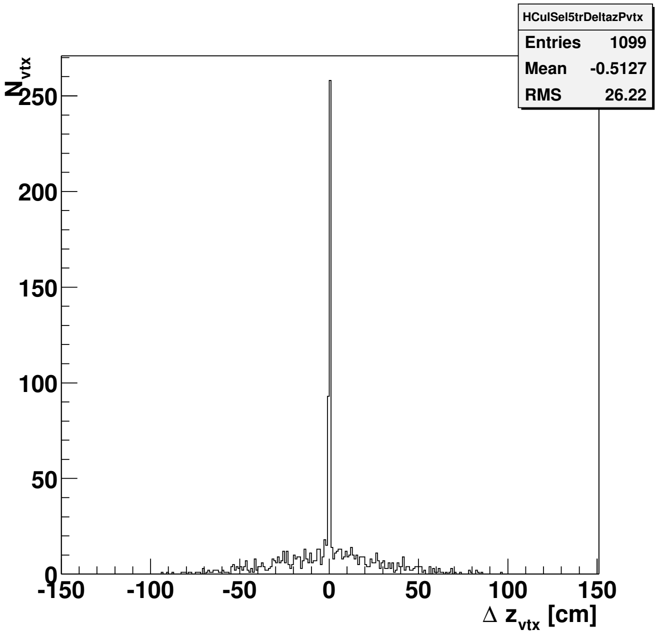
Event selection criteria

- MET $< 0.7 p_T^{1st\ jet}$ (no JES and MET corrections)
- at least 5 tracks pointing to the primary vertex and $|z_{vtx}| < 50\,\mathrm{cm}$
- the two leading jets should be good and within $|\eta| < 0.5$ region

Vertex cut

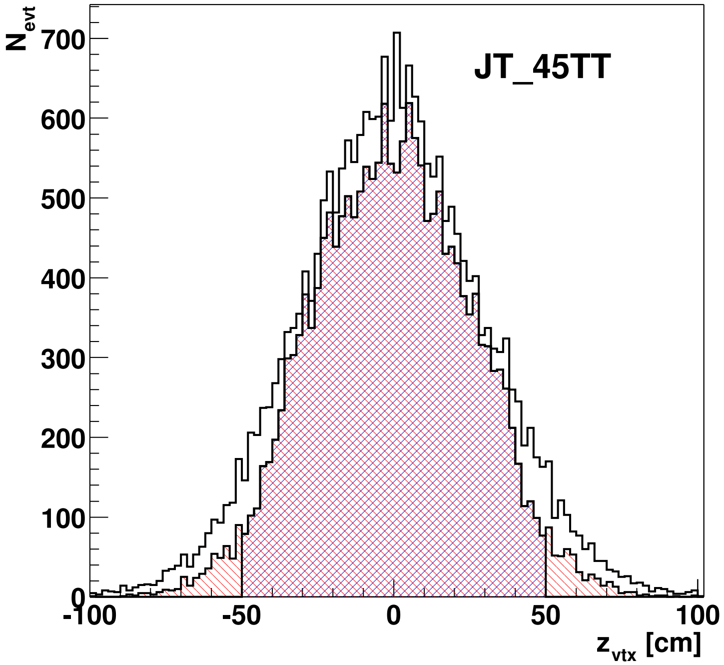






- 15% percent of events show another primary vertex
- 59% of them show $|\Delta z| > 5\,\text{cm}$
- 20% events has probably misidentified vertex associated with the hard interaction

Vertex cut efficiency

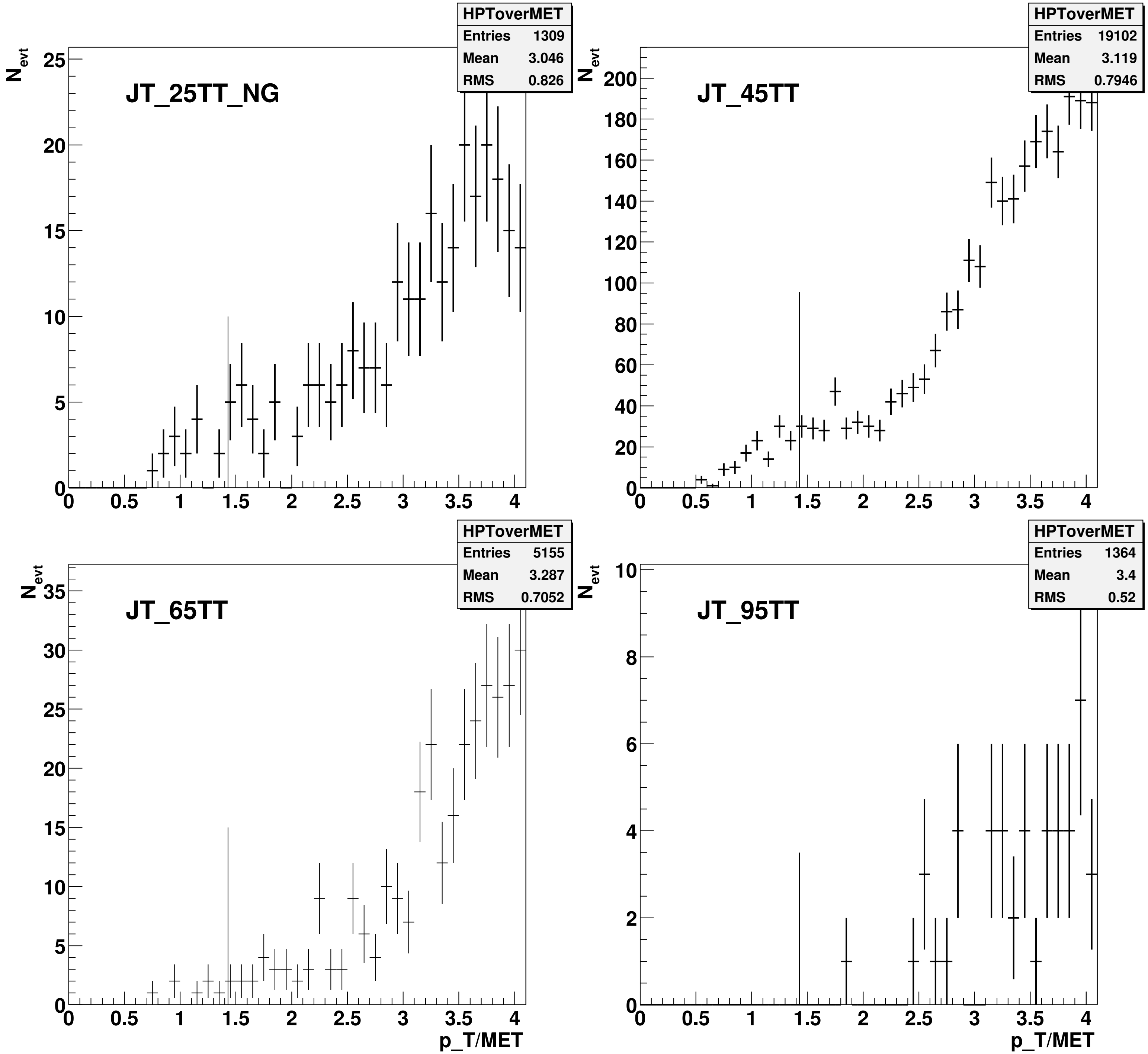


$$\varepsilon = \frac{N_{good}}{N_{all}}, \quad \Delta\varepsilon = \sqrt{\frac{\varepsilon\,(1-\varepsilon)}{N_{all}}}$$

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

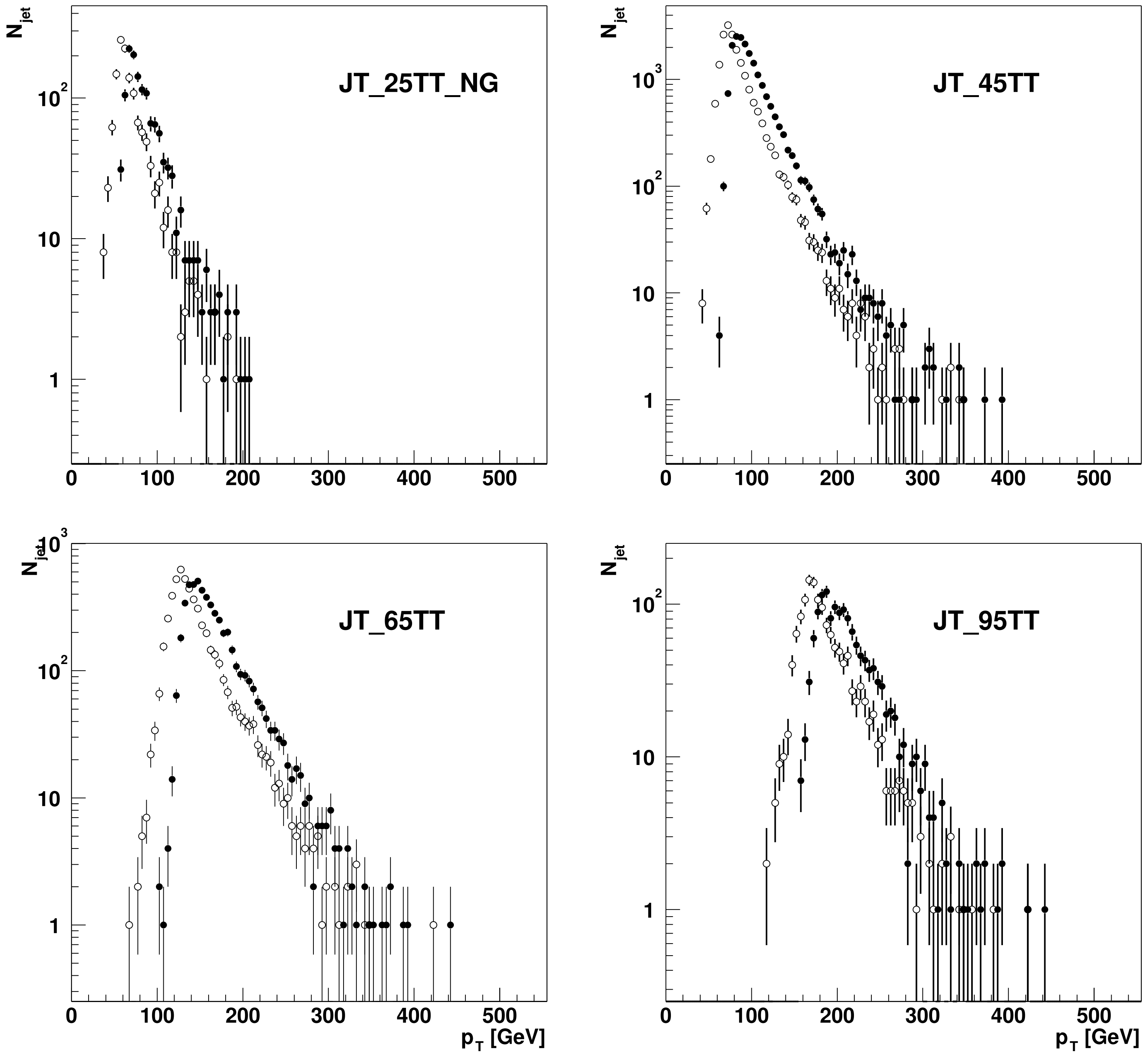
trigger	M_{jj}^{cut}	ε_1	ε_2	ε_3
JT_25TT_NG	150 GeV	0.959	0.815	0.782
JT_45TT	180 GeV	0.949	0.823	0.781
JT_65TT	300 GeV	0.963	0.819	0.788
JT_95TT	390 GeV	0.965	0.796	0.768

MET cut

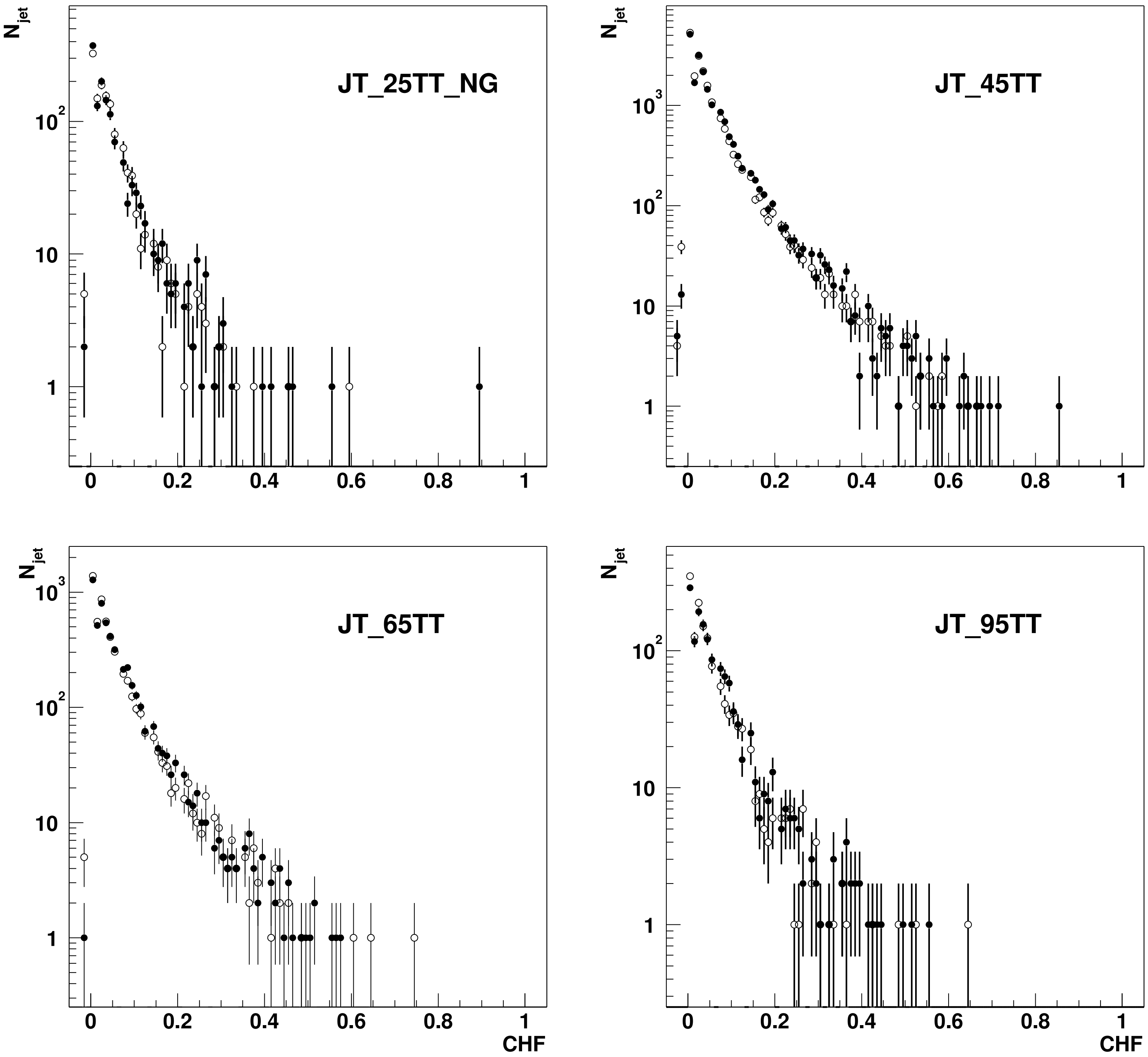


HPToverMET
Entries 1309
Mean 3.046
RMS 0.826
JT_25TT_NG
N_{evt}
HPToverMET
Entries 19102
Mean 3.119
RMS 0.7946
JT_45TT
N_{evt}
HPToverMET
Entries 5155
Mean 3.287
RMS 0.7052
JT_65TT
N_{evt}
p_T/MET
HPToverMET
Entries 1364
Mean 3.4
RMS 0.52
JT_95TT
N_{evt}
p_T/MET

jet p_T

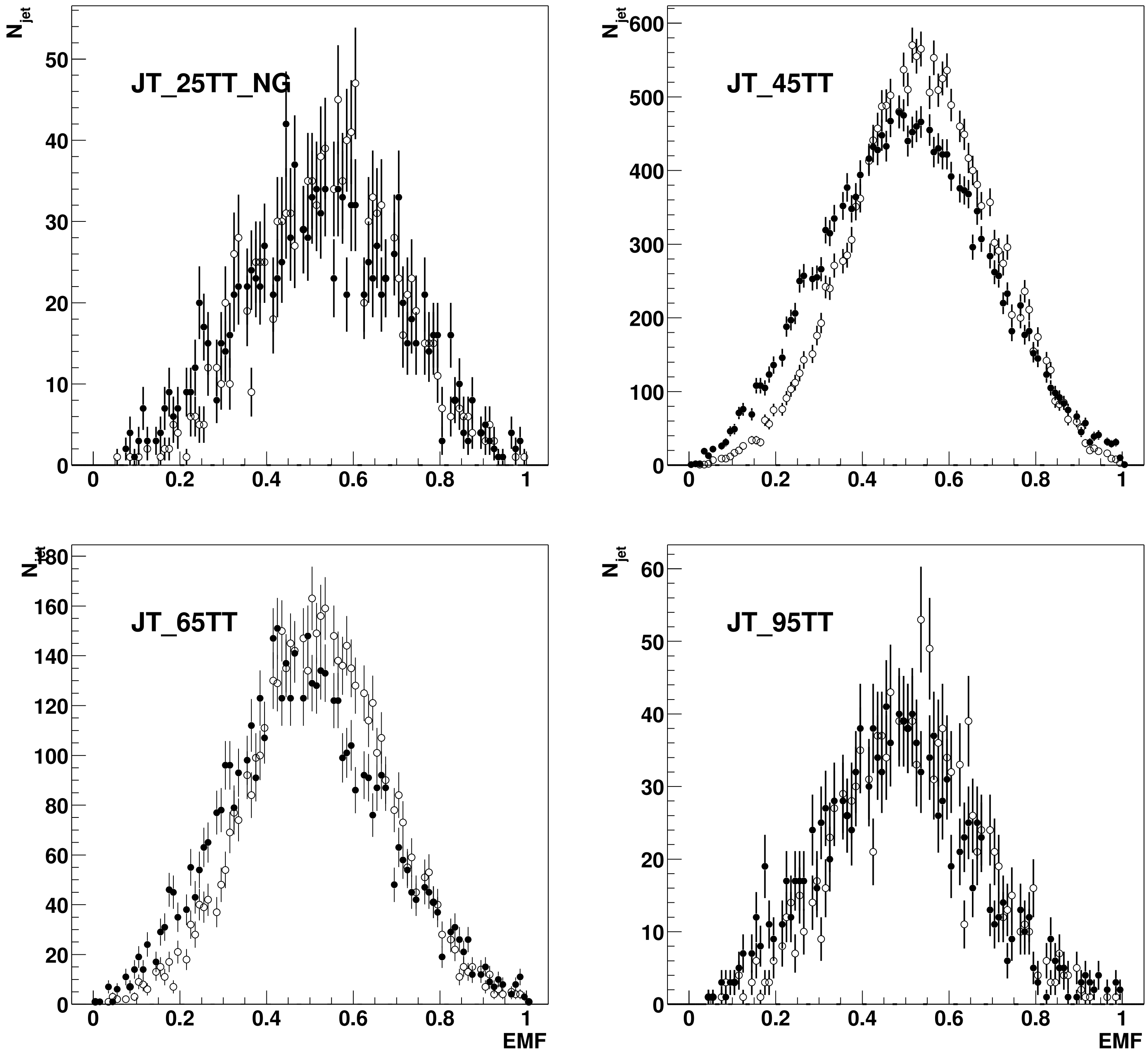


CHF

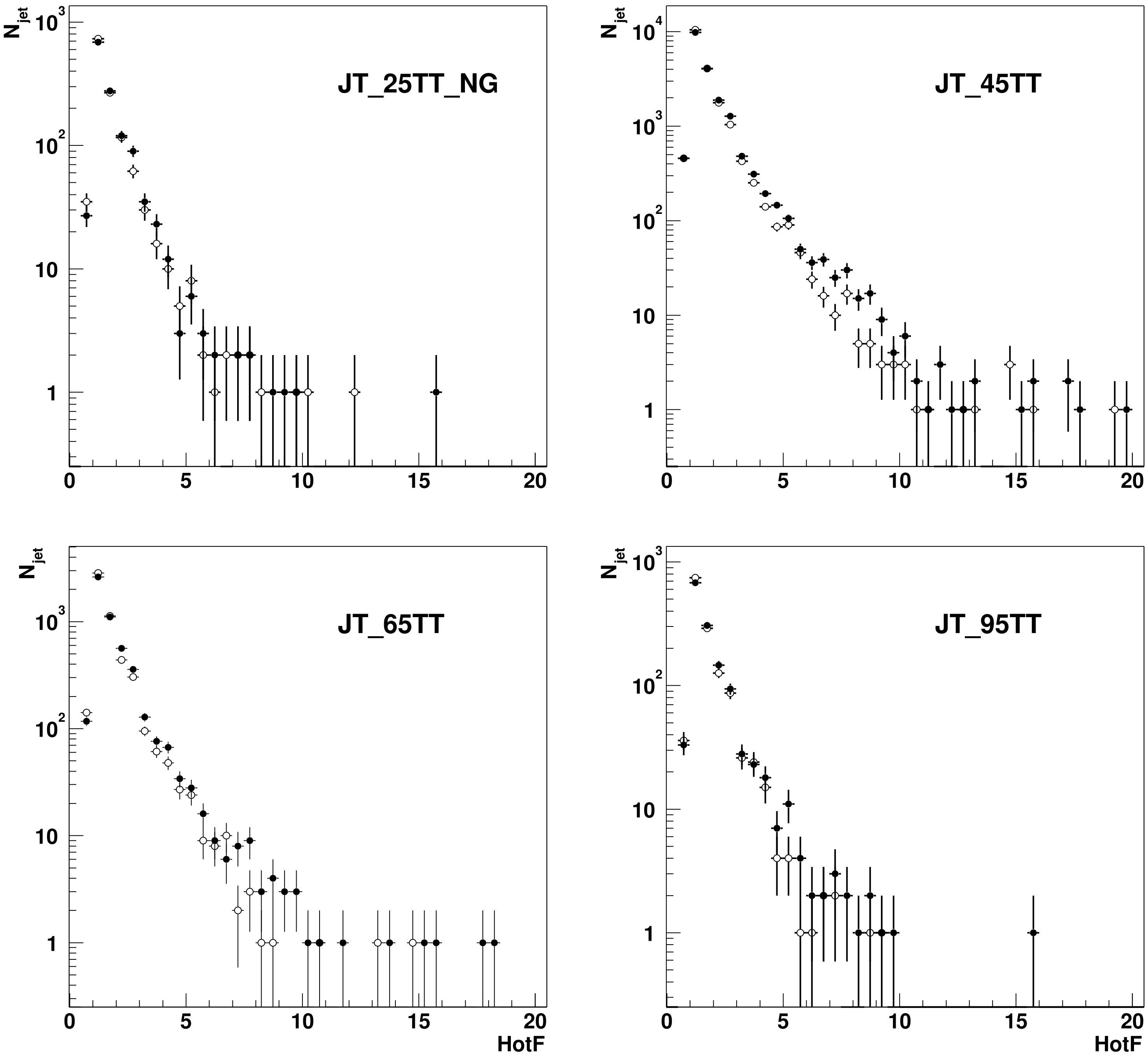


N_jet
JT_25TT_NG
10²
10
1
0
0.2
0.4
0.6
0.8
1
N_jet
JT_45TT
10³
10²
10
1
0
0.2
0.4
0.6
0.8
1
N_jet
JT_65TT
10³
10²
10
1
0
0.2
0.4
0.6
0.8
1
CHF
N_jet
JT_95TT
10²
10
1
0
0.2
0.4
0.6
0.8
1
CHF

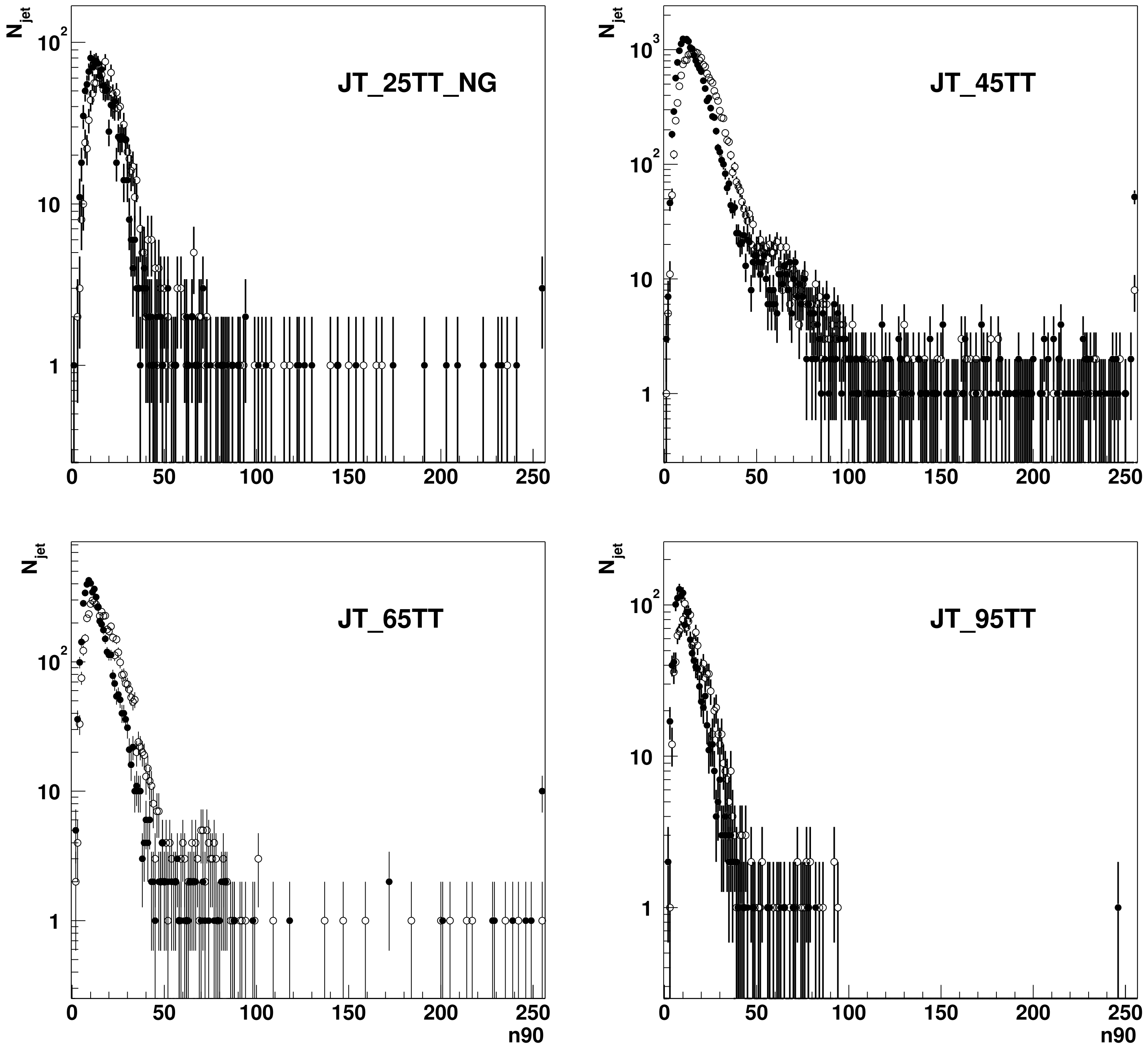
EMF



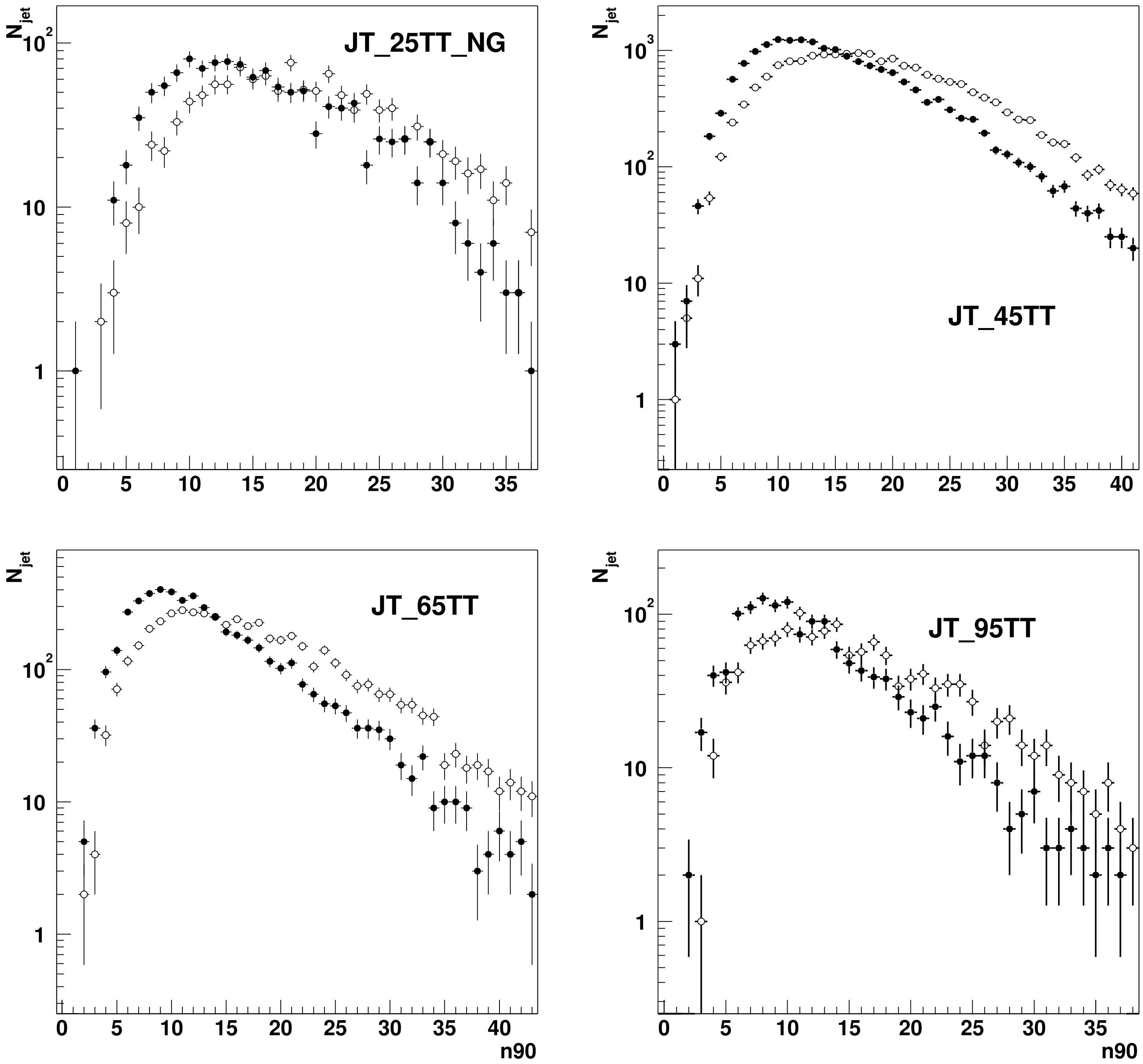
HotF



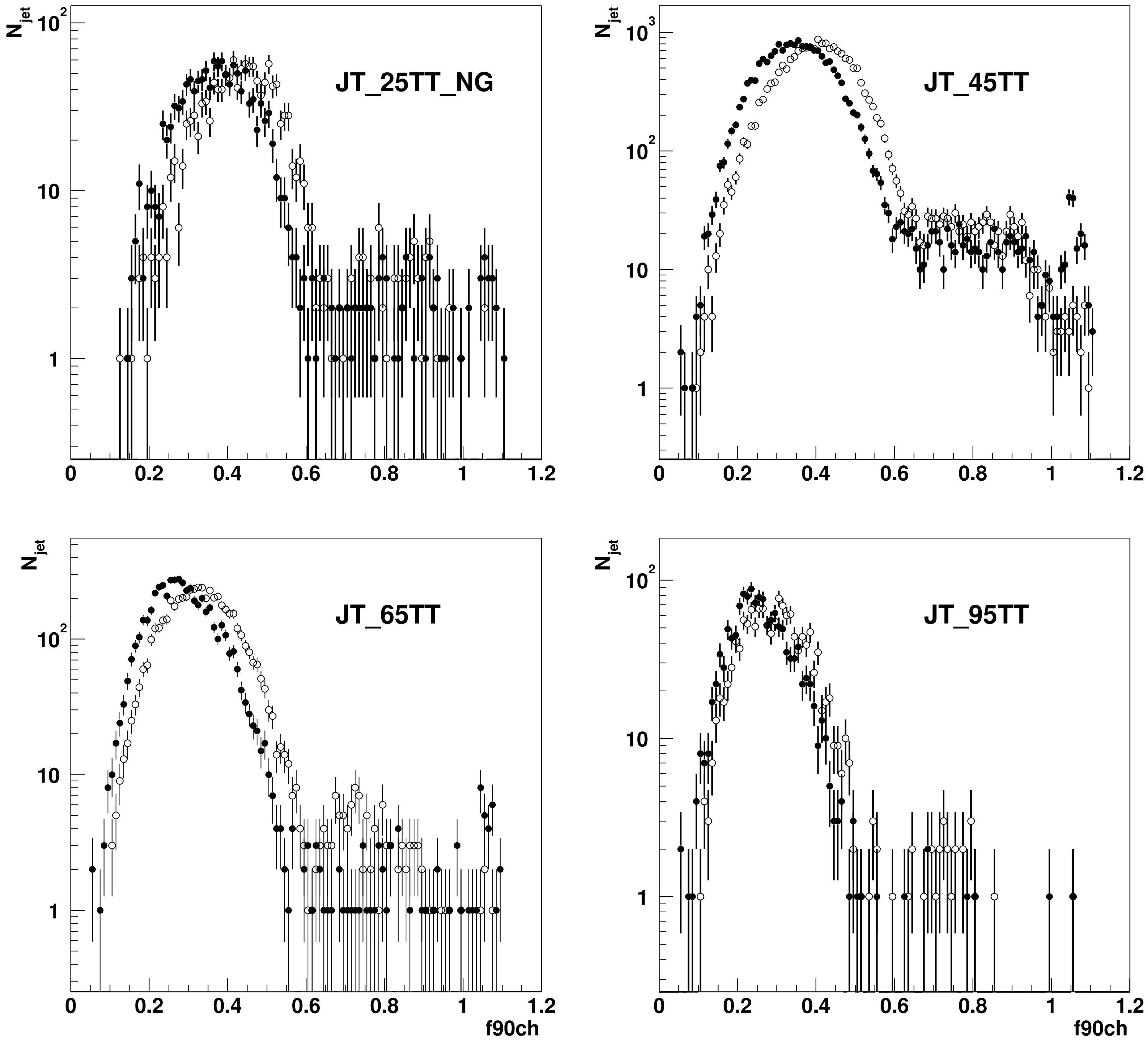
n90



n90 at low end



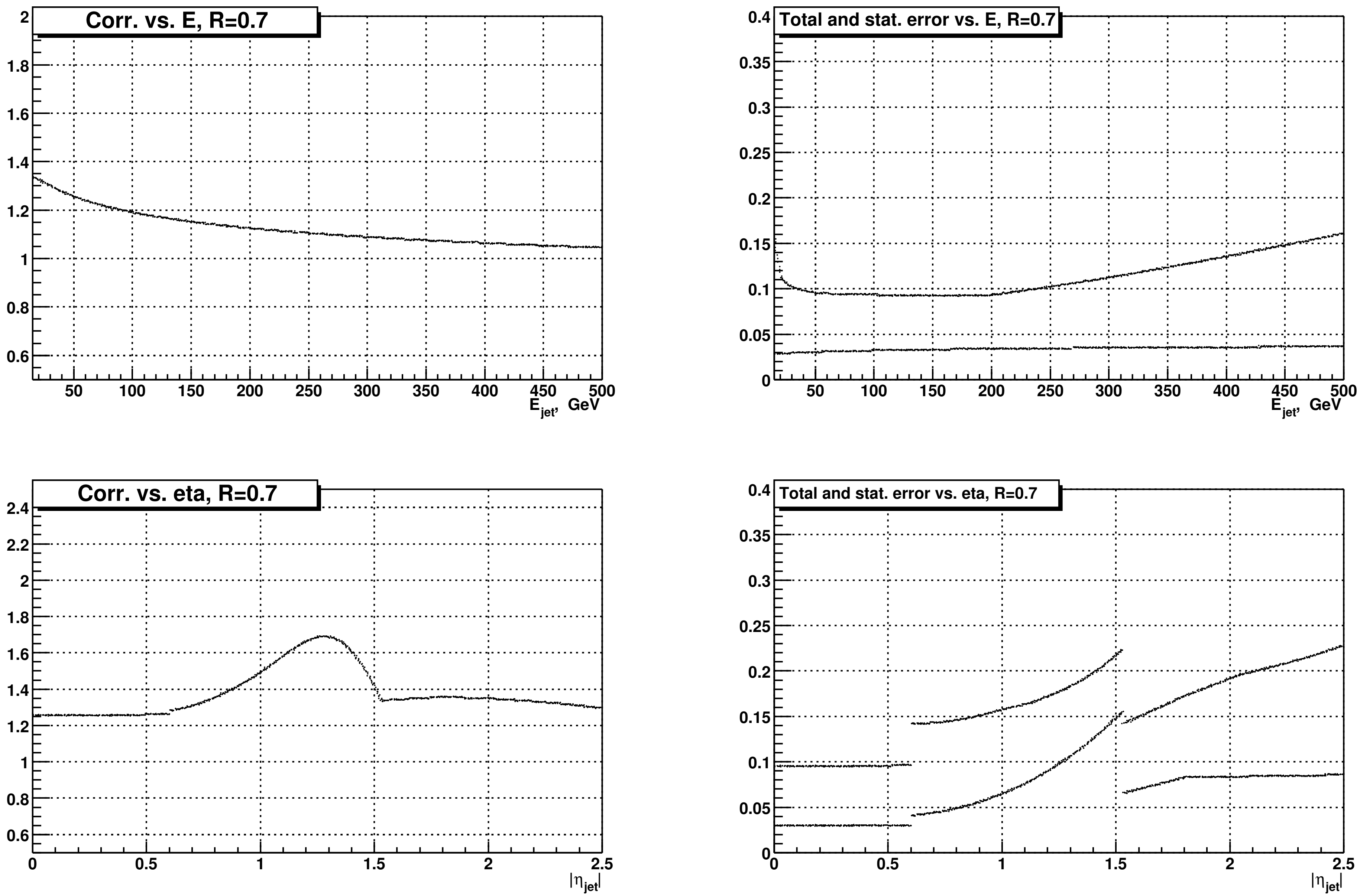
f90ch



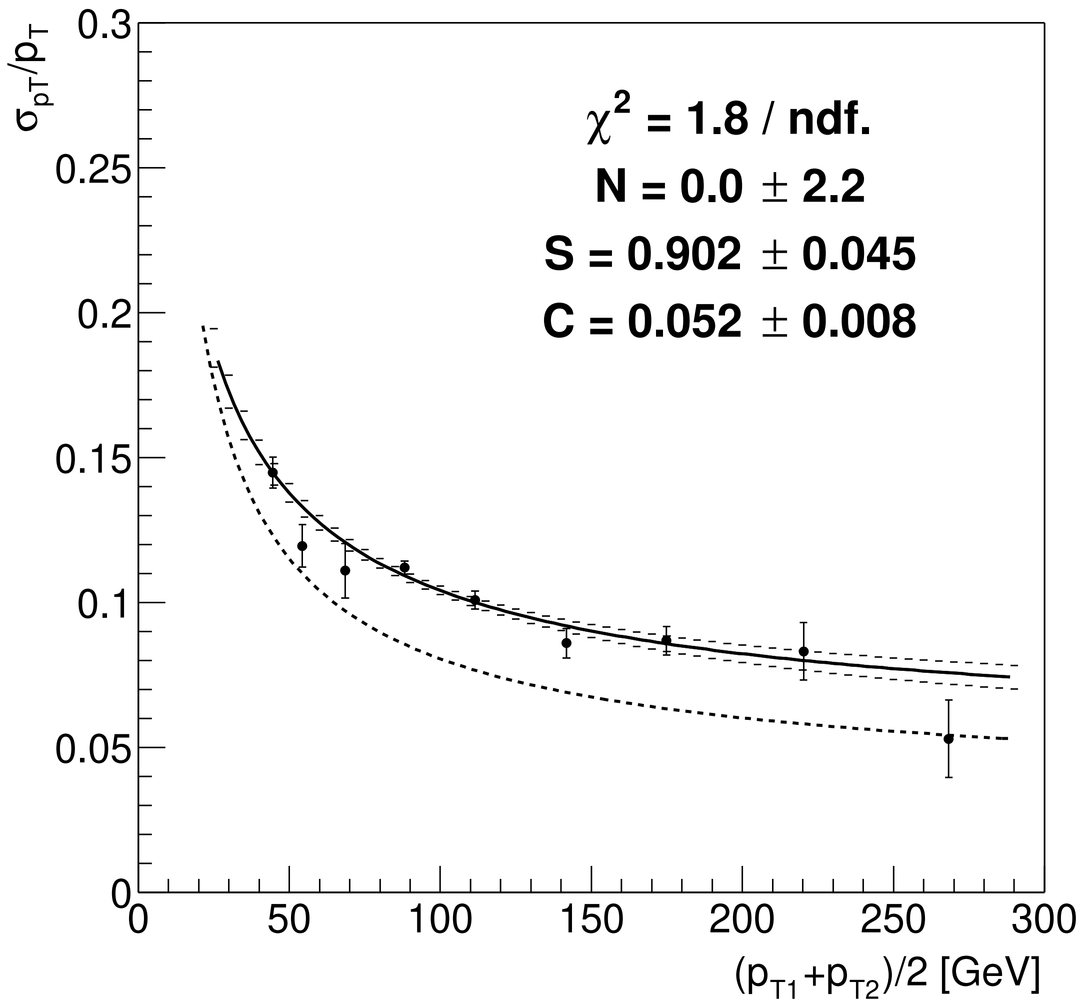
jetID cuts efficiencies (Pavel Demine)

	30 – 60	60 – 90	90 – 125	125 – 160	160 – 250	250 –
EMF	0.993 ± 0.006 ± 0.0	0.993 ± 0.003 ± 0.001	0.993 ± 0.003 ± 0.002	0.993 ± 0.005 ± 0.002	0.993 ± 0.008 ± 0.001	0.993 ± 0.03 ± 0.001
CHF	0.999 ± 0.001 ± 0.0	1.000 ± 0.0 ± 0.0	1.000 ± 0.0 ± 0.0	0.999 ± 0.001 ± 0.0	0.999 ± 0.002 ± 0.0	0.998 ± 0.012 ± 0.0
HotF	0.999 ± 0.0 ± 0.001	0.999 ± 0.0 ± 0.0	0.999 ± 0.0 ± 0.0	0.999 ± 0.0 ± 0.0	1.000 ± 0.0 ± 0.0	0.999 ± 0.002 ± 0.0
n90	1.000 ± 0.0 ± 0.0	1.000 ± 0.0 ± 0.001	1.000 ± 0.0 ± 0.001	0.999 ± 0.0 ± 0.0	0.999 ± 0.0 ± 0.0	0.998 ± 0.003 ± 0.005
f90ch	0.97 ± 0.001 ± 0.03	0.98 ± 0.0 ± 0.02	0.98 ± 0.0 ± 0.02	0.98 ± 0.001 ± 0.02	0.99 ± 0.002 ± 0.01	0.99 ± 0.014 ± 0.01
Total	0.96 ± 0.006 ± 0.03	0.97 ± 0.003 ± 0.02	0.97 ± 0.003 ± 0.02	0.97 ± 0.005 ± 0.02	0.98 ± 0.01 ± 0.01	0.98 ± 0.03 ± 0.01

Jet energy scale



Jet p_T resolution - final result



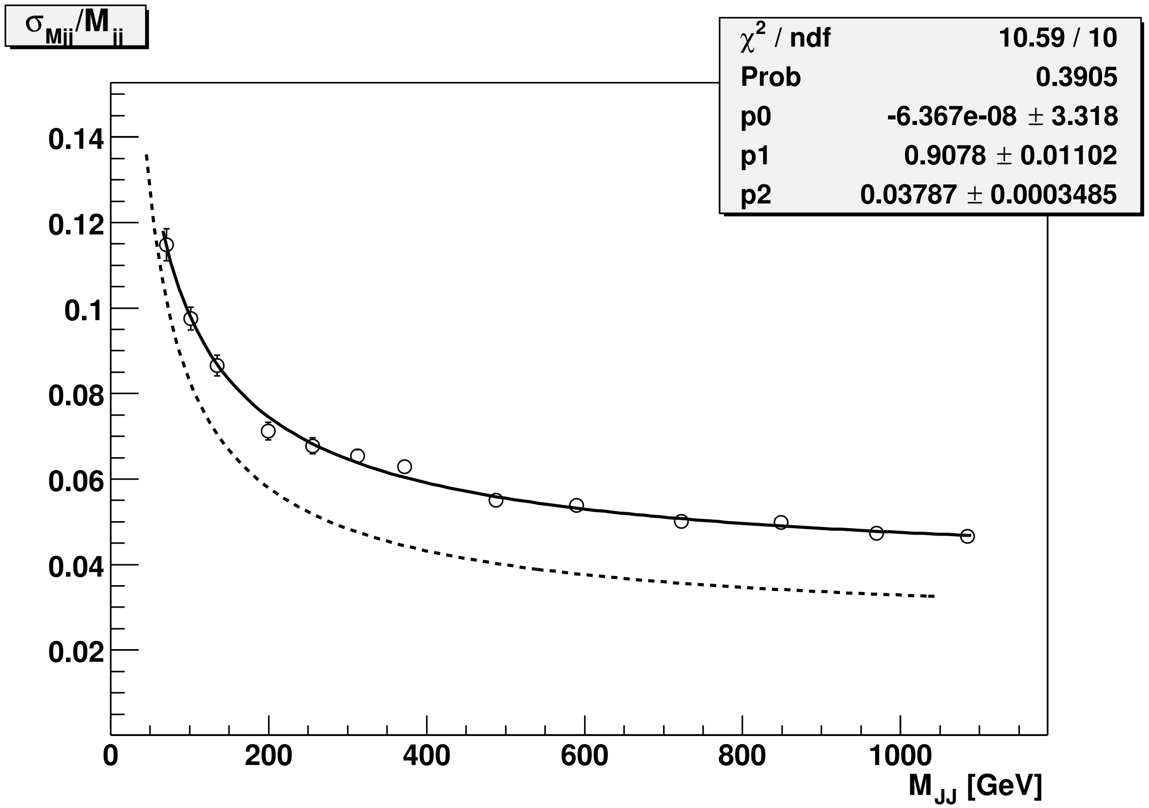
Correlation matrix

	N	S	C
N	1.000	-0.002	0.001
S	-0.002	1.000	-0.936
C	0.001	-0.936	1.000

- JES correction
- soft radiation correction
- particle jet imbalance correction

- central region of calorimeter, $|\eta| < 0.5$
- event selection cuts constistent with those used in dijet mass analysis
- for more detailed information see my talk on next JES group meeting

Dijet mass resolution - final result

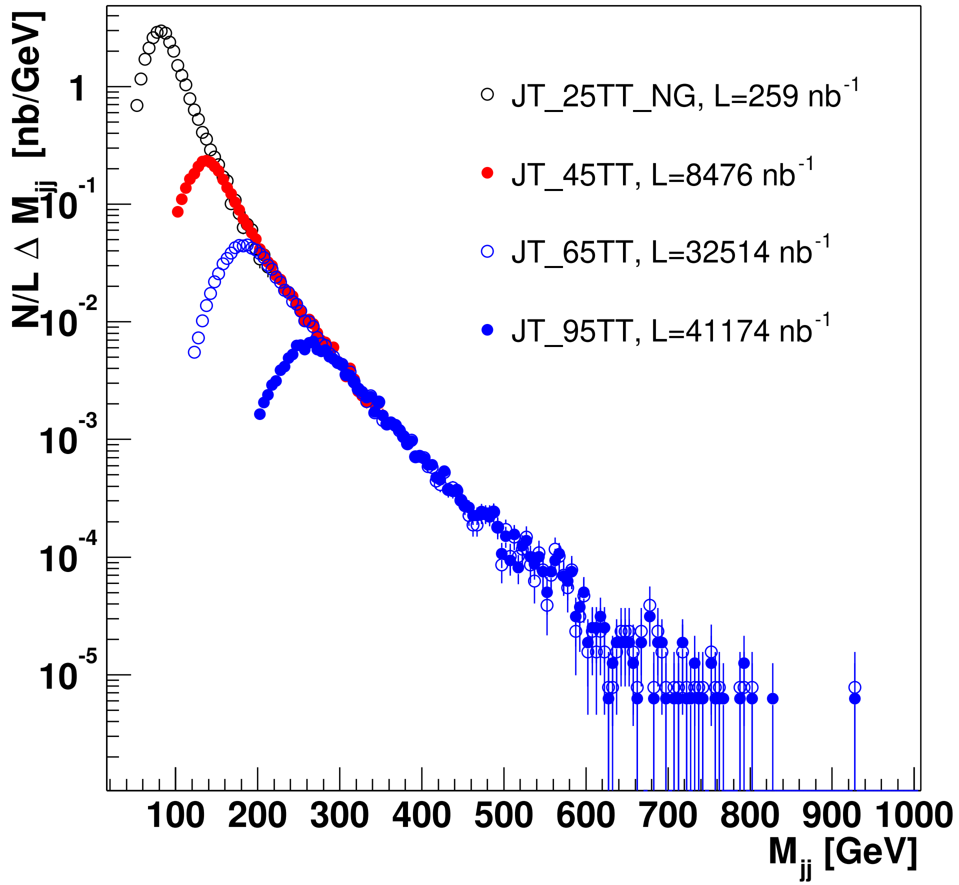


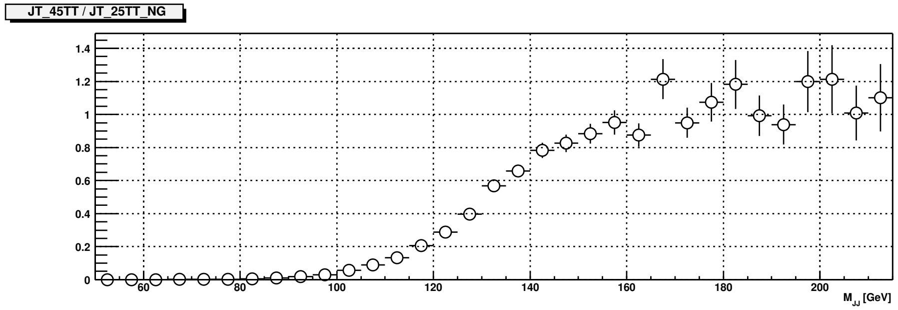
Fitted function

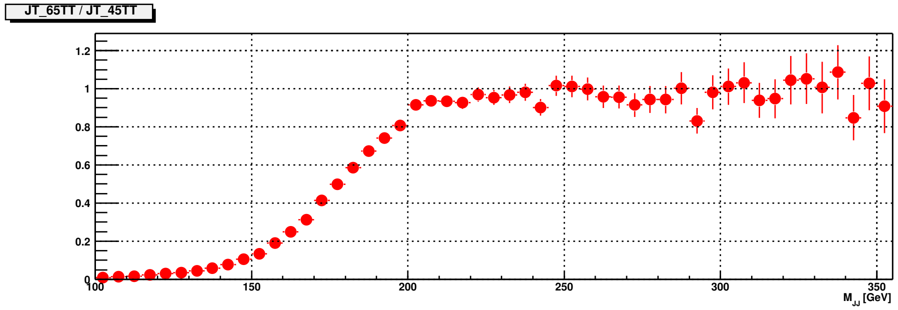
$$\frac{\sigma_{p_T}}{p_T} = \sqrt{\frac{N^2}{p_T^2} + \frac{S^2}{p_T} + C^2}$$

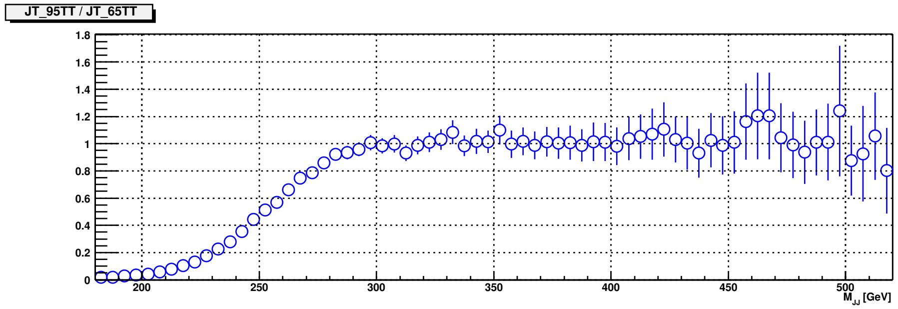
- from the QCD MC sample - the particle jet energies were smeared using measured jet p_T resolution
- dashed line is for corresponding RunI curve

Raw dijet mass spectrum



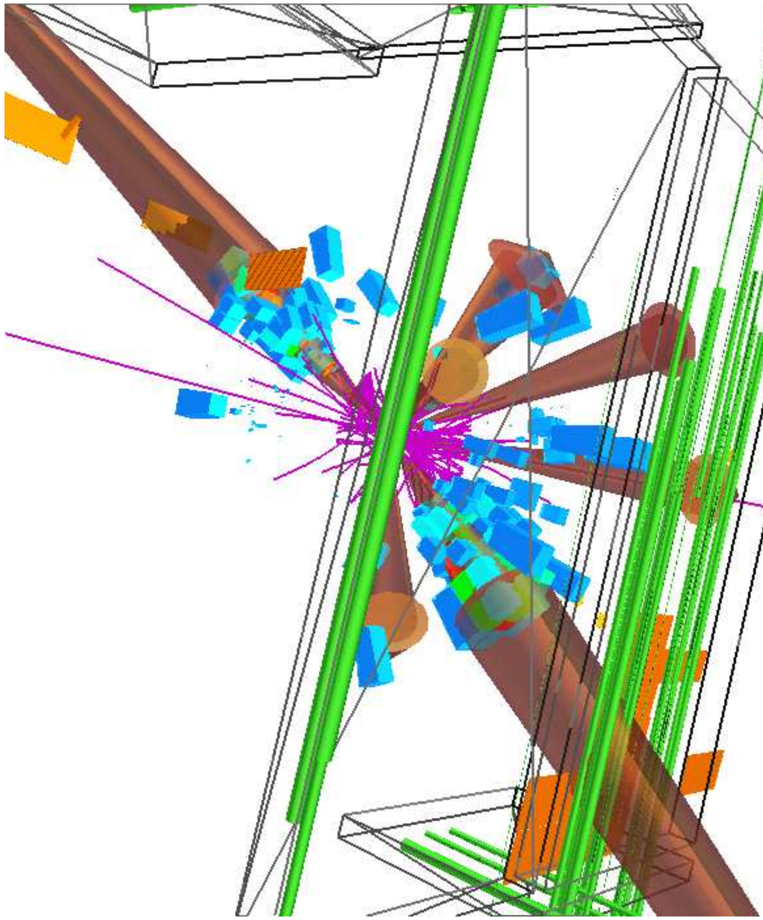


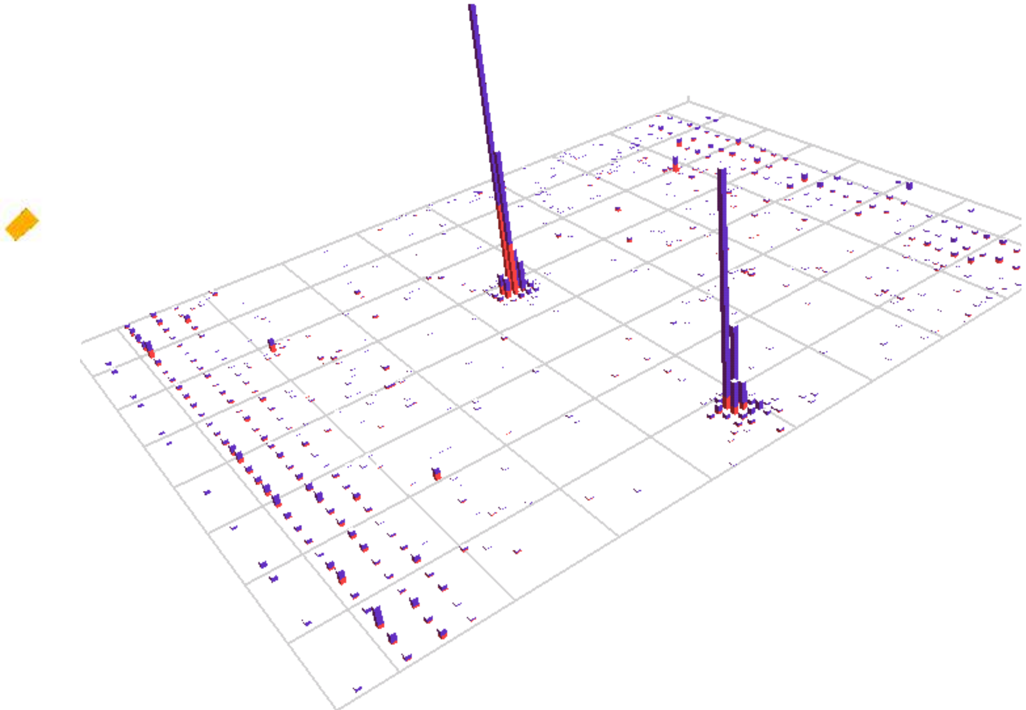




- JES correction v04-01-00
- vertex cut efficiency correction

Event display (Laurent Duflot)





- $M_{JJ} = 926\,\mathsf{GeV}$
- missing E_T is $28\,\mathsf{GeV}$

Unsmearing - method

- ansatz function

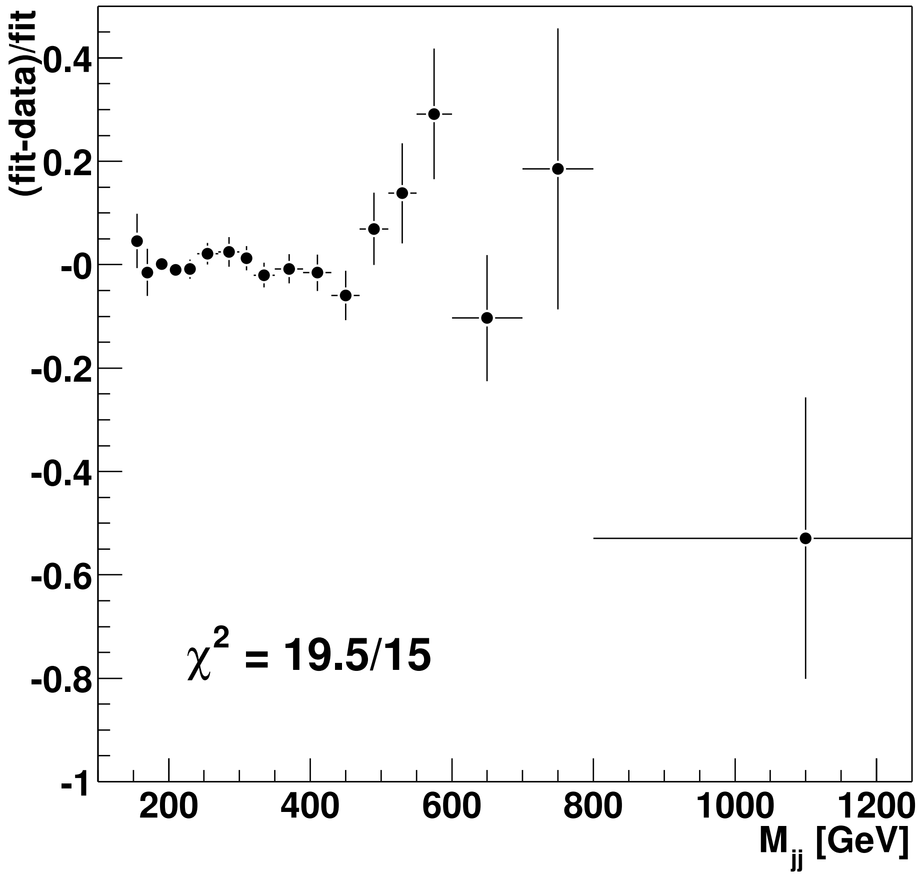
$$f = N M_{jj}^{-\alpha} \left(1 - \frac{M_{jj}}{\sqrt{s}}\right)^{-\beta}$$

- for a given set of parameters
  - convolute function f with the dijet mass resolution

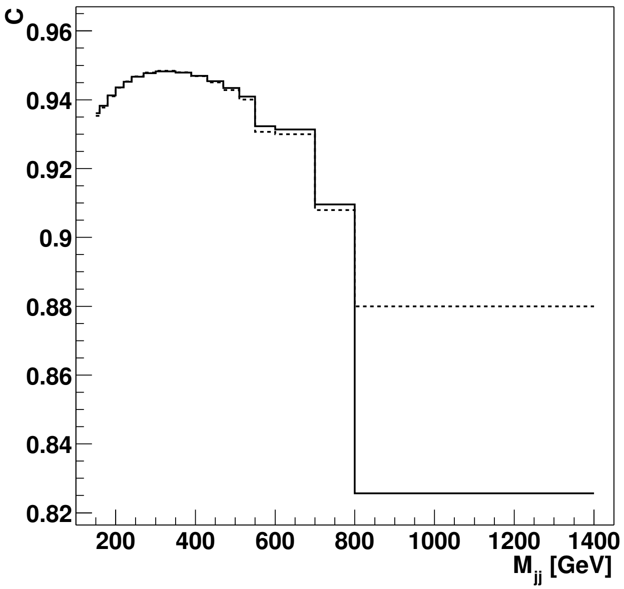
$$F(M) = \int \mathrm{d}M' f(M') G(M - M')$$

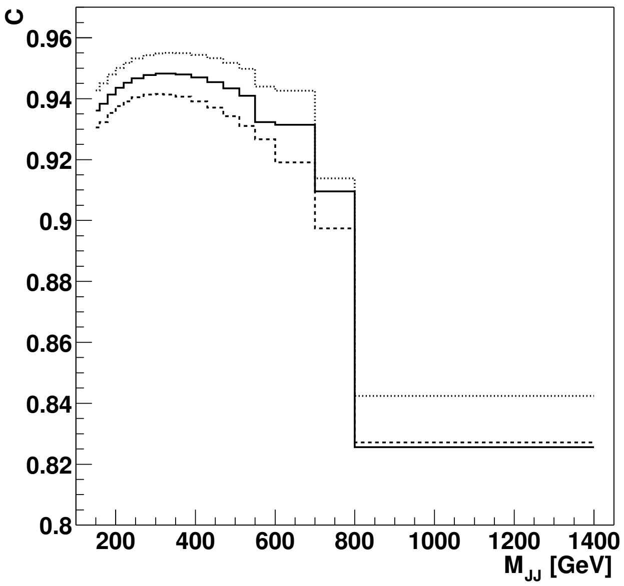
  - make prediction on dijet mass cross section for all bins
  - calculate χ^2 for the prediction
- use Minuit to find the best fit
- unsmearing correction

$$C_{bin} = \frac{\int_{bin} \mathrm{d}M \, f(M)}{\int_{bin} \mathrm{d}M \, F(M)}$$



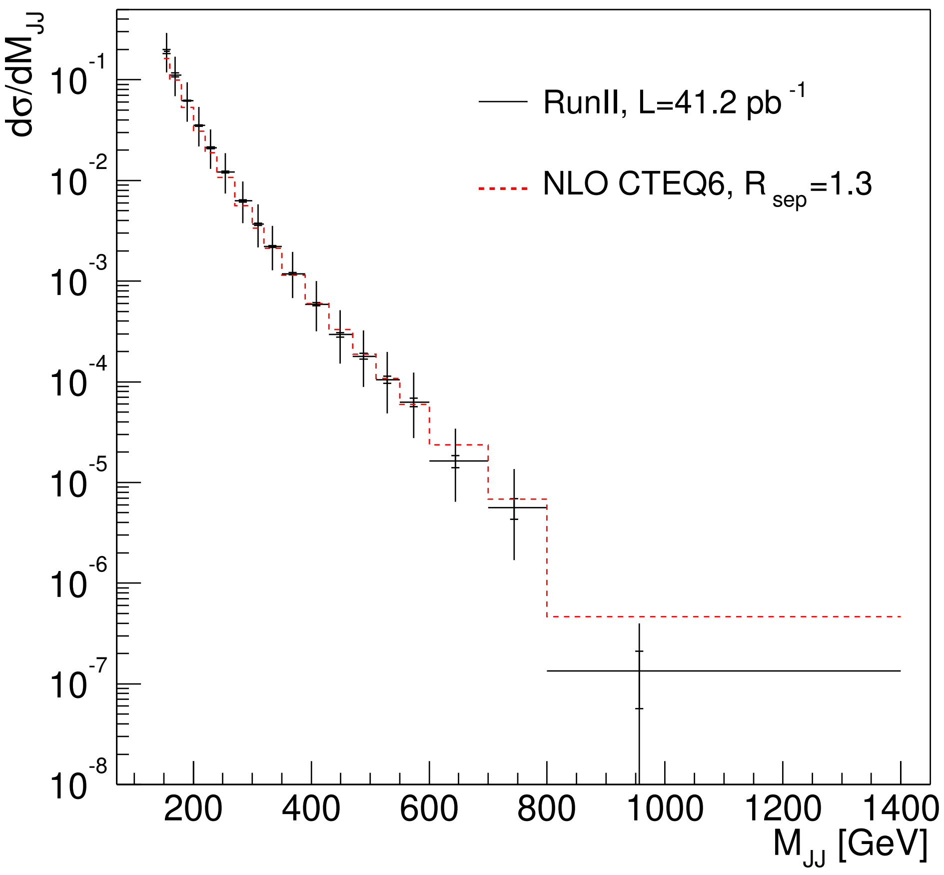
Unsmearing correction

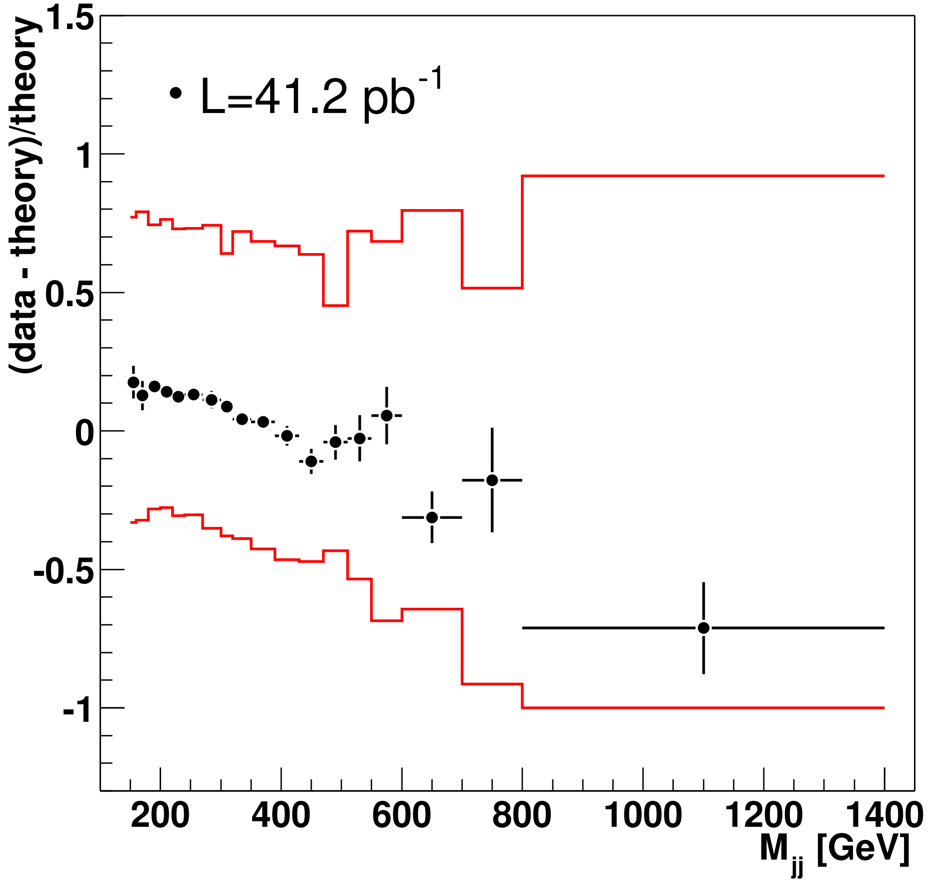




- same binning as in RunI
- slightly higher than in RunI
- the same shape
- systematic error
  - different ansatz functions
  - error from jet resolution

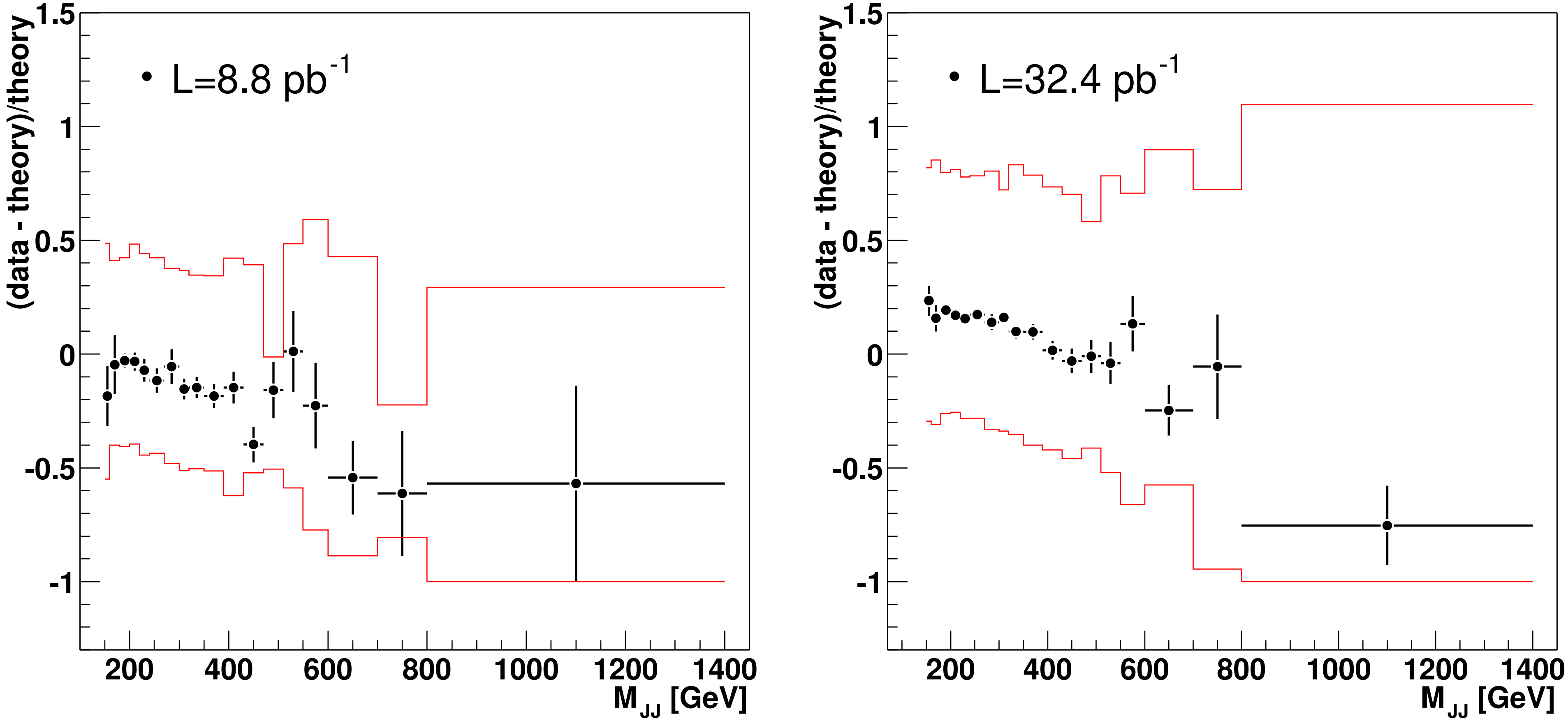
Inclusive dijet mass cross section





- an agreement with the theory curve
- red lines shows the distribution for the upper and lower value of JES
  - JES errors are still large

p13.04.00 versus p13.05.00



- the difference in cross section is 20% arround 200 GeV
- corresponds to $3-4\%$ difference in JES