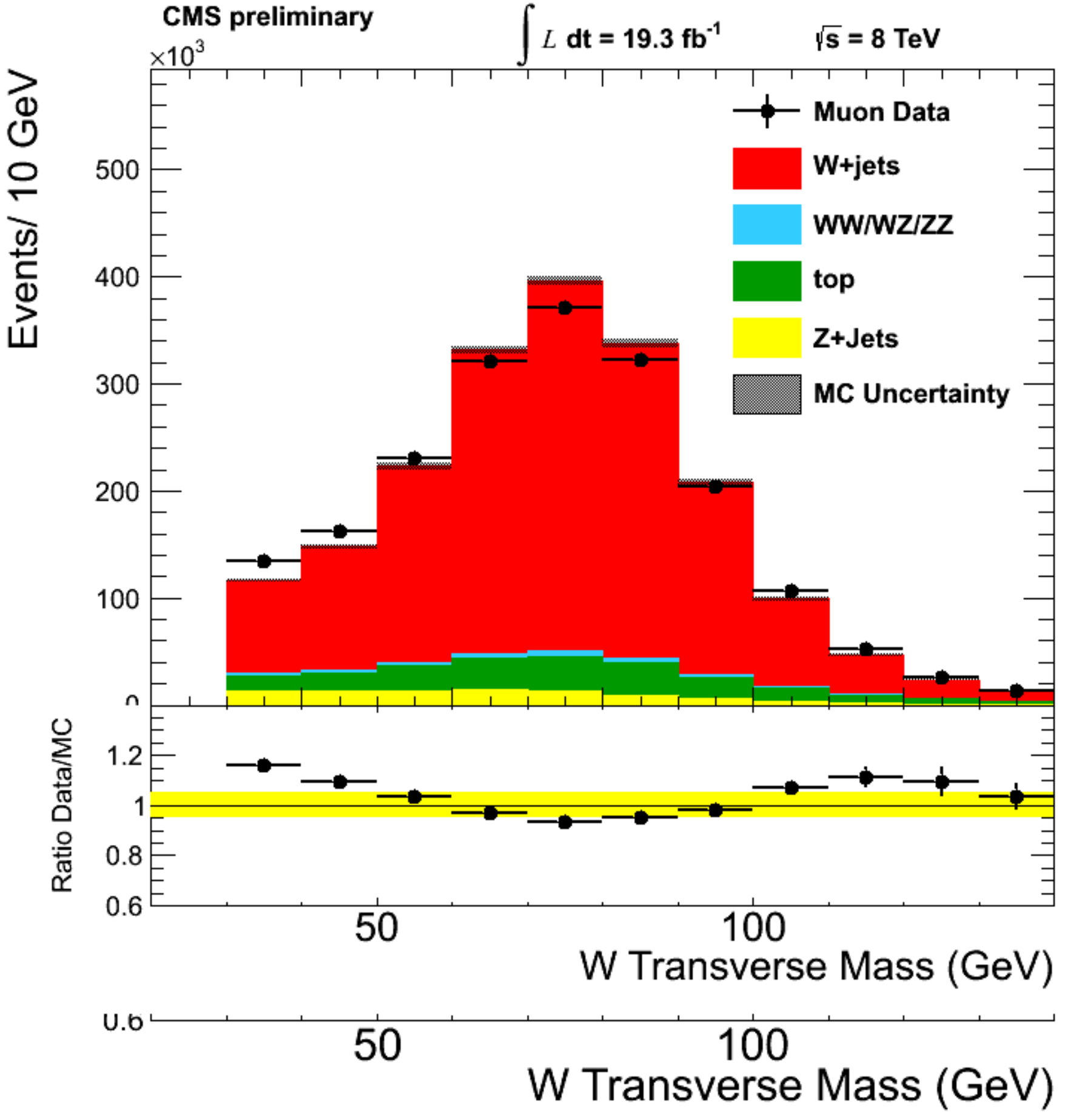
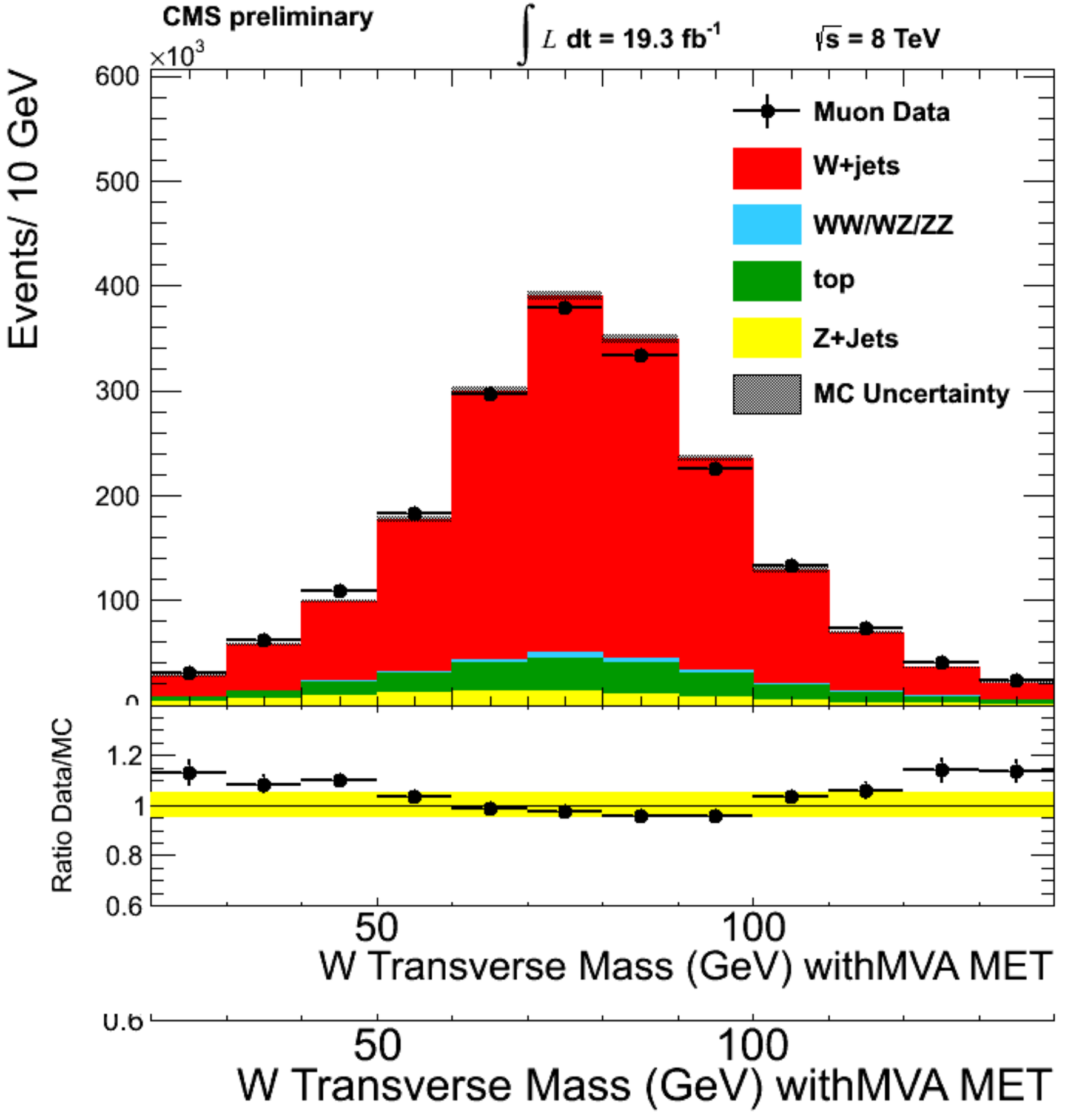
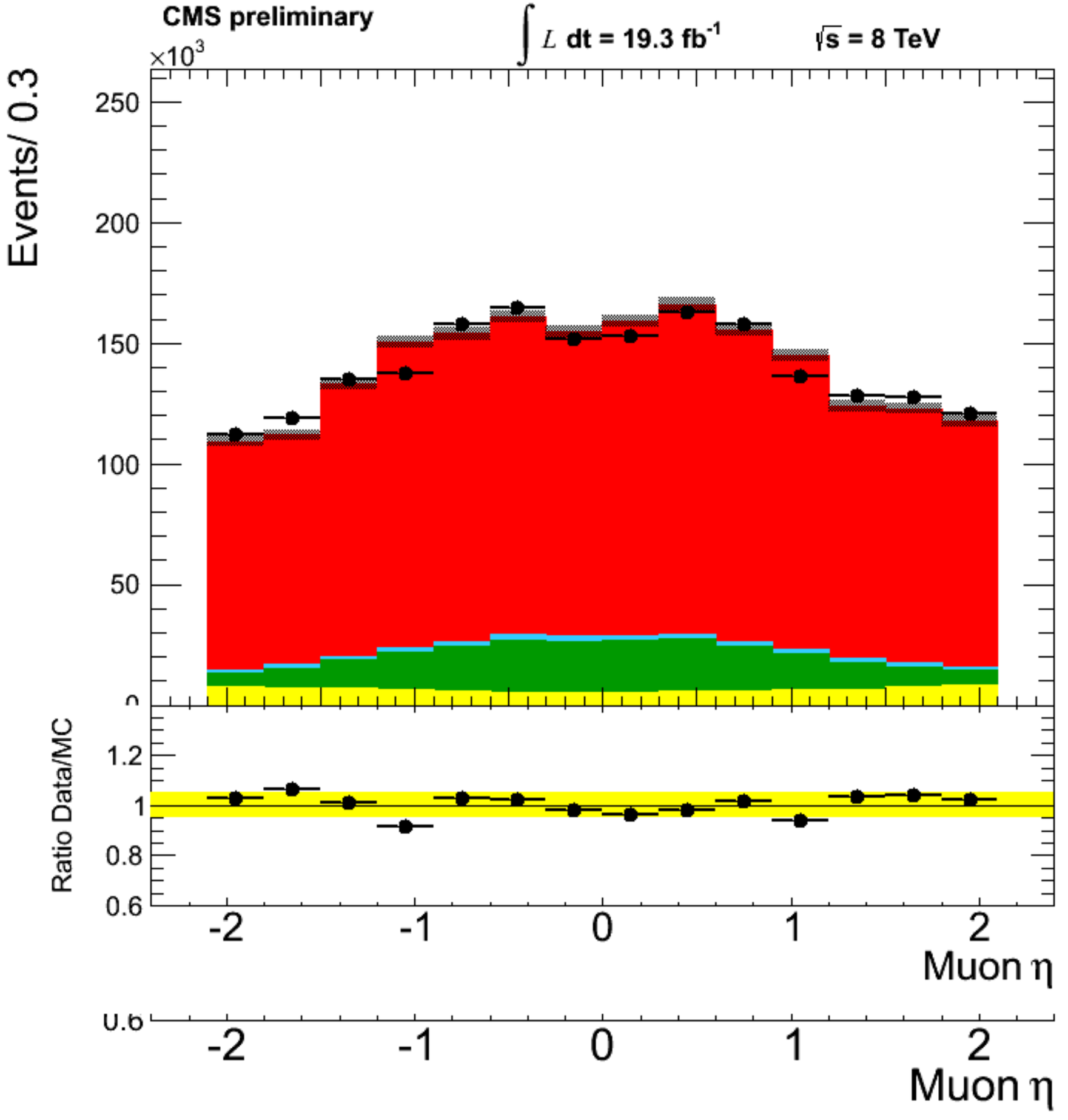
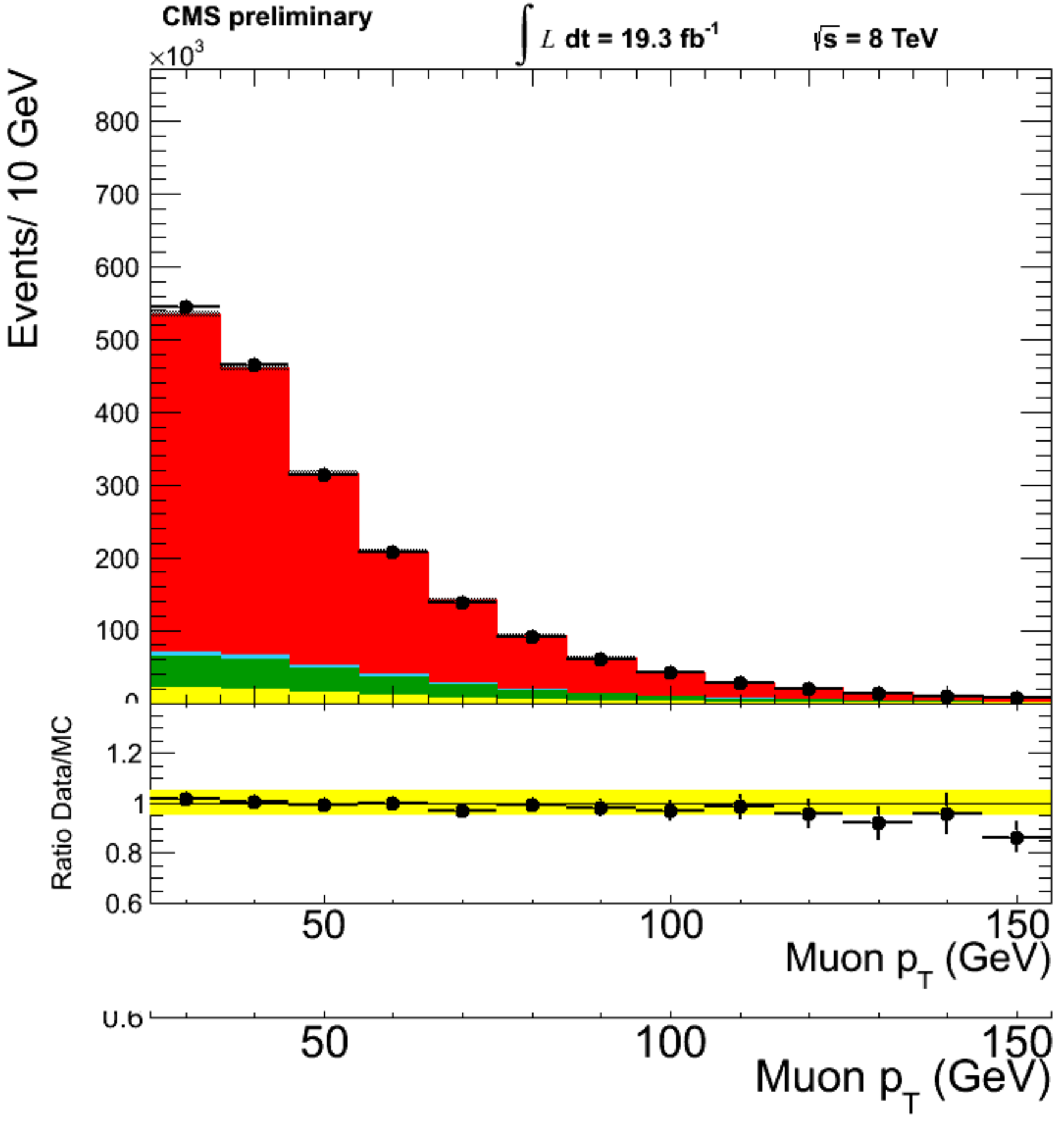
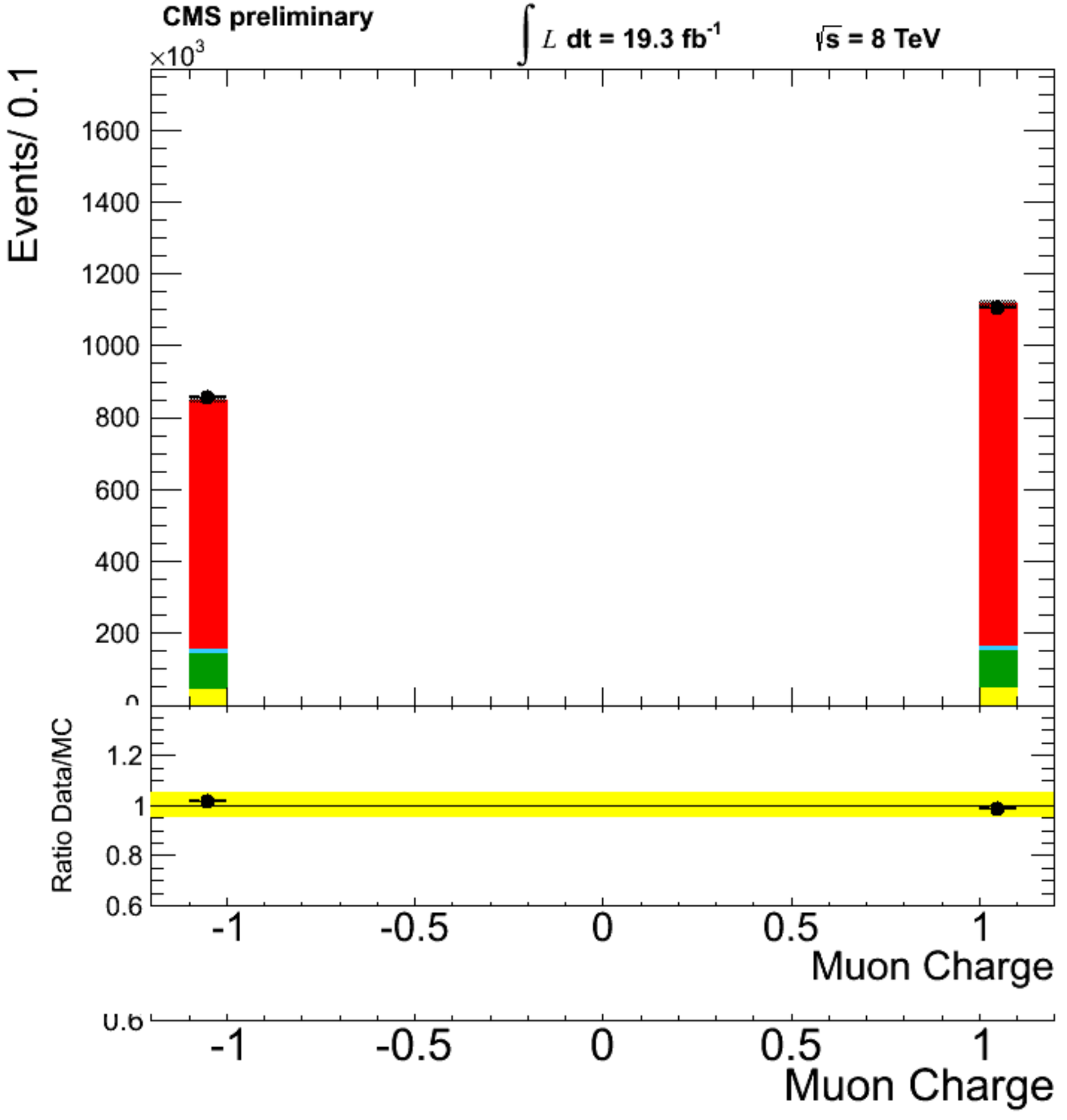
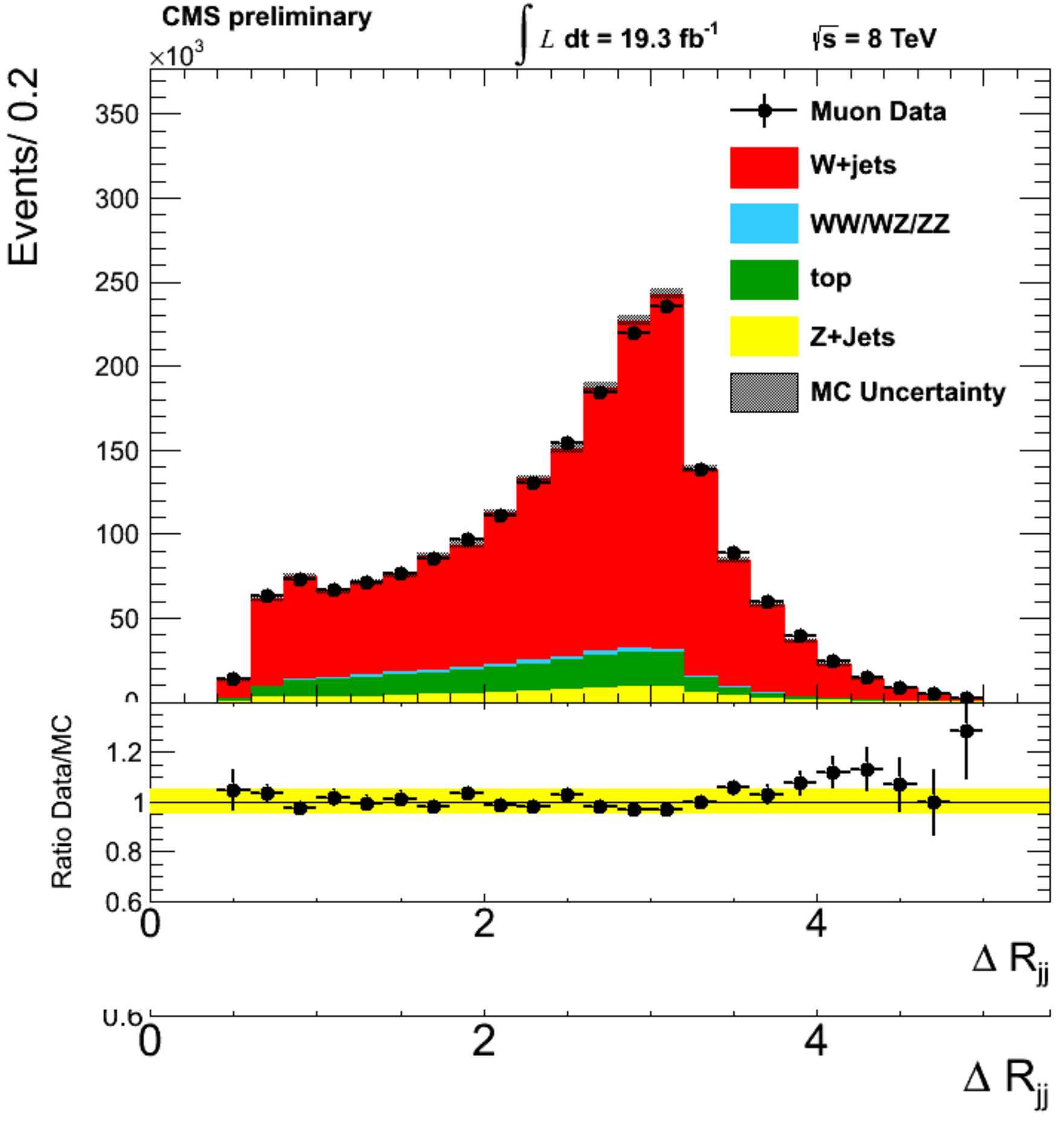

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 10 GeV
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
W Transverse Mass (GeV)
W Transverse Mass (GeV)

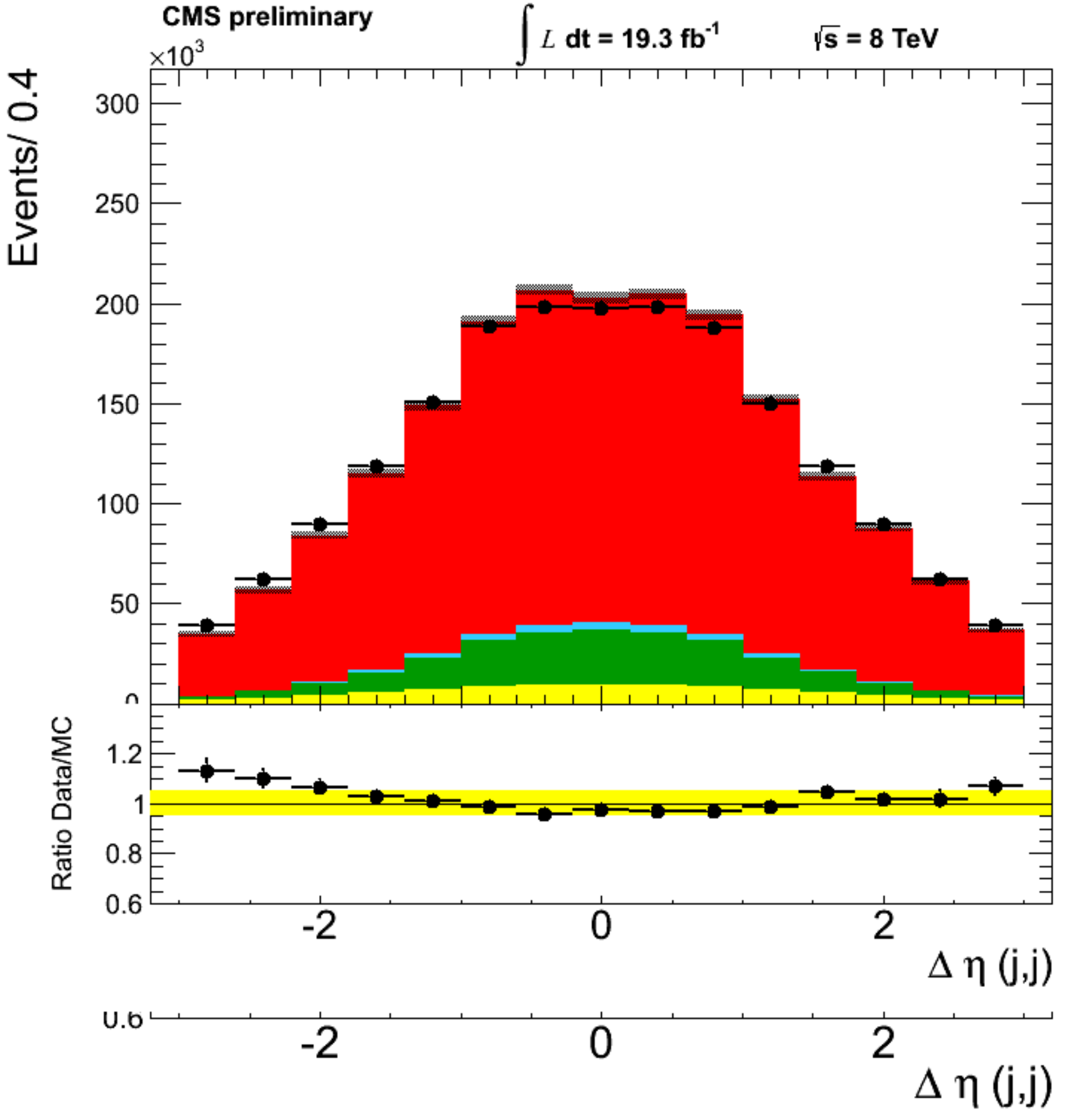

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s}$ = 8 TeV
Events/ 10 GeV
×10^3
600
500
400
300
200
100
0
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
1.2
1
0.8
0.6
50
100
W Transverse Mass (GeV) withMVA MET
0.6
50
100
W Transverse Mass (GeV) withMVA MET

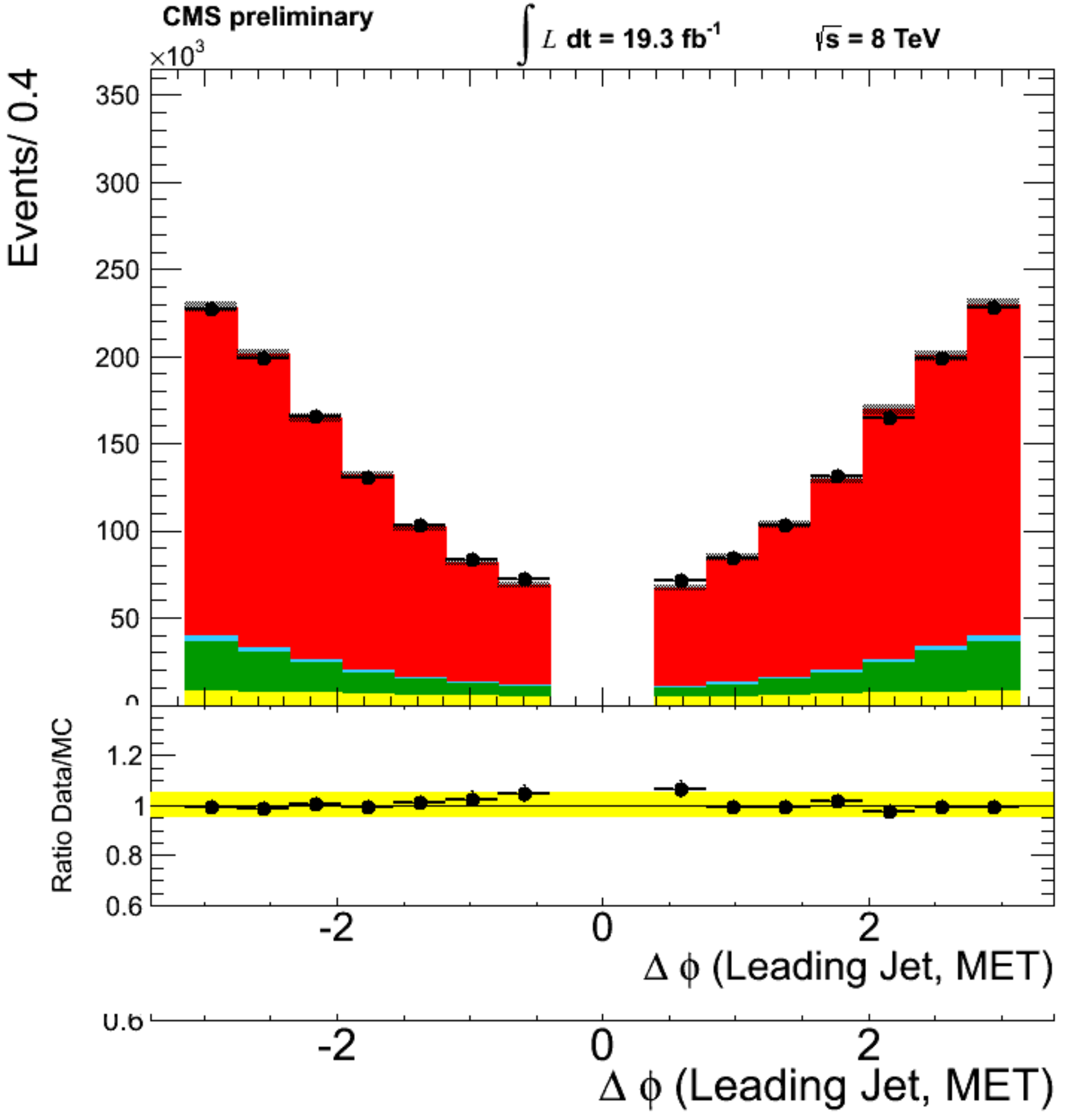

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.3
250
200
150
100
50
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
-1
0
1
2
Muon η
0.6
-2
-1
0
1
2
Muon η

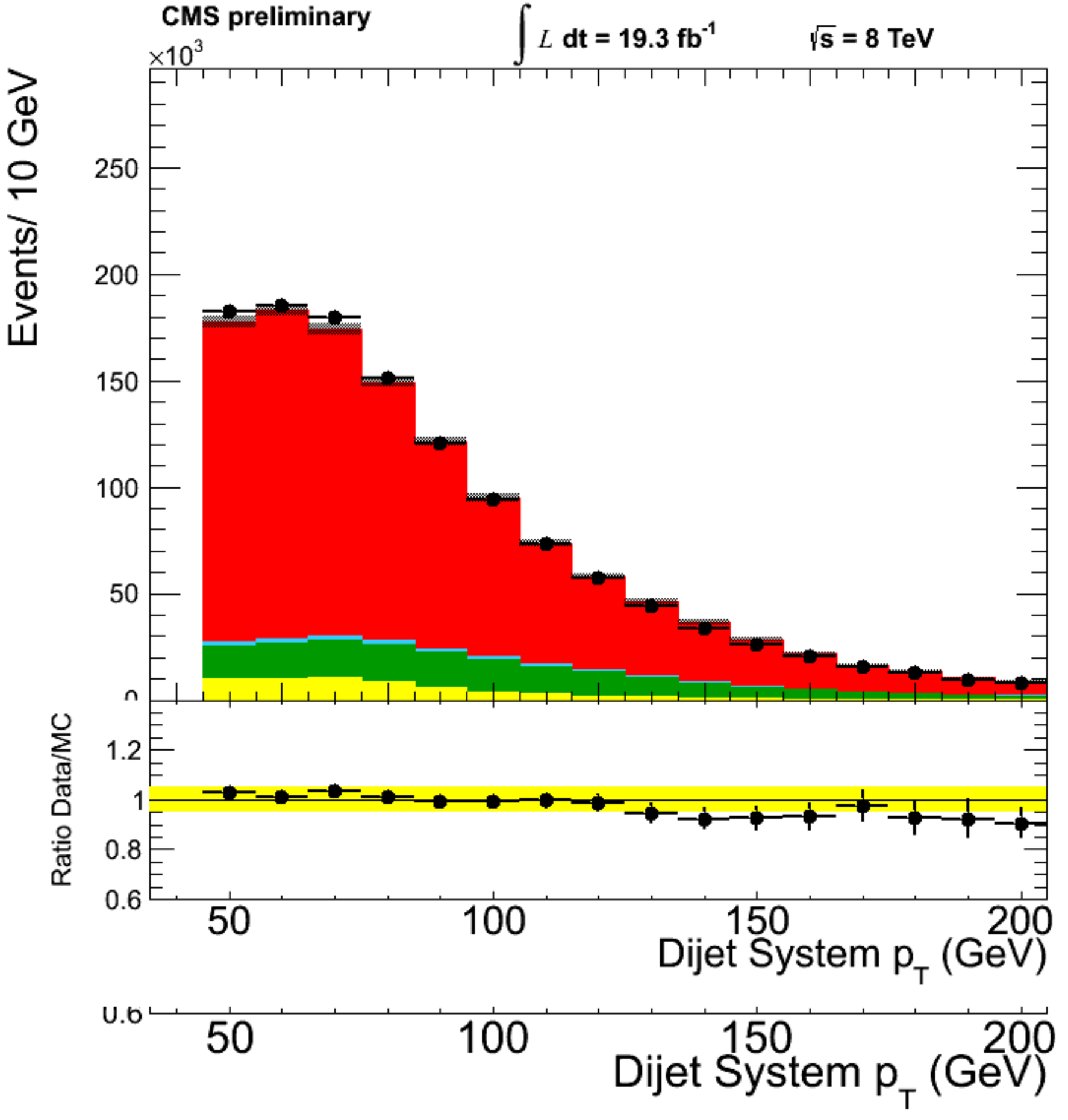

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 10 GeV
800
700
600
500
400
300
200
100
0
Ratio Data/MC
1.2
1
0.8
0.6
50
100
150
Muon $p_T$ (GeV)
0.6
50
100
150
Muon $p_T$ (GeV)

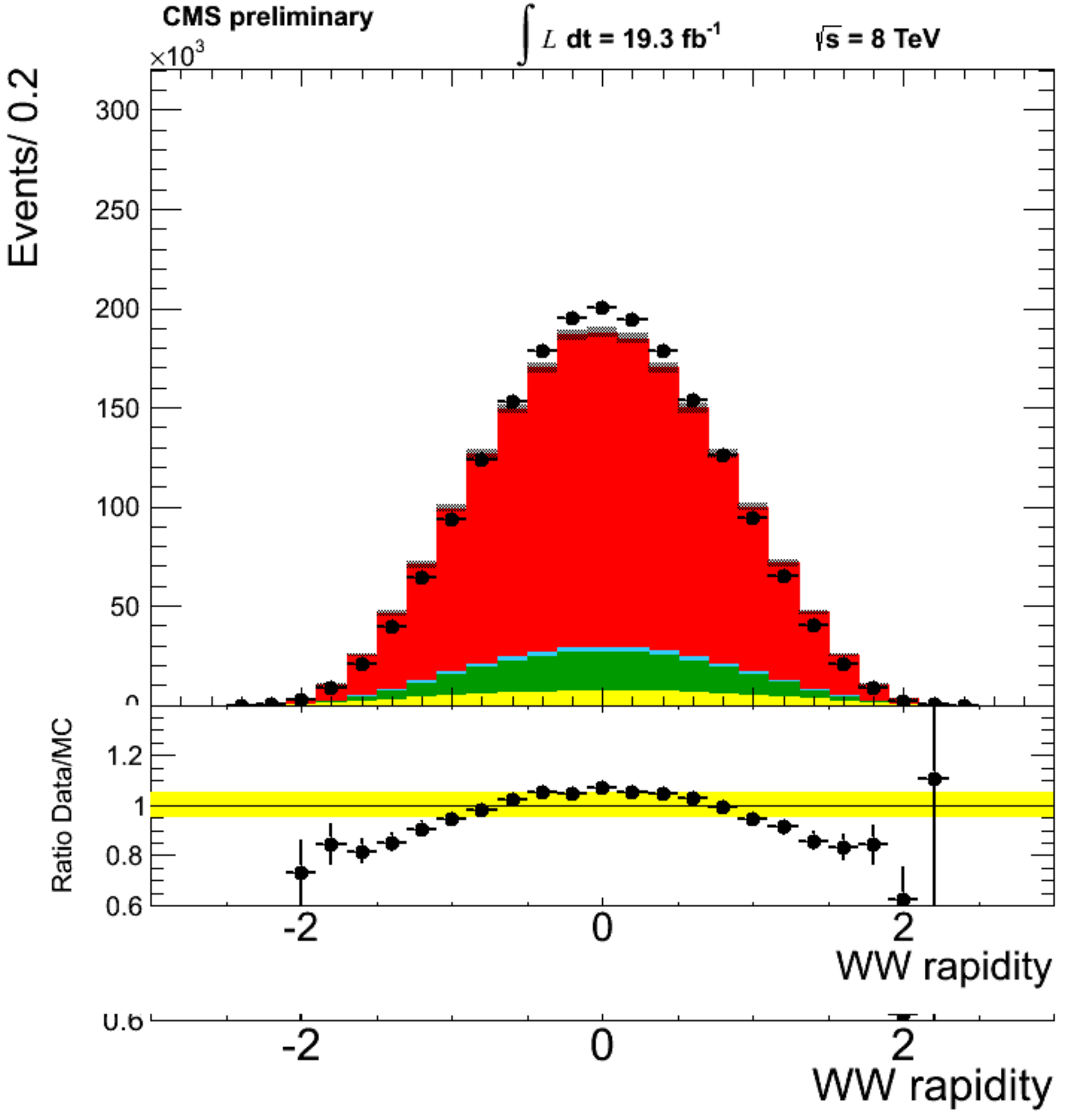

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.1
1600
1400
1200
1000
800
600
400
200
Ratio Data/MC
1.2
1
0.8
0.6
-1
-0.5
0
0.5
1
Muon Charge
Muon Charge

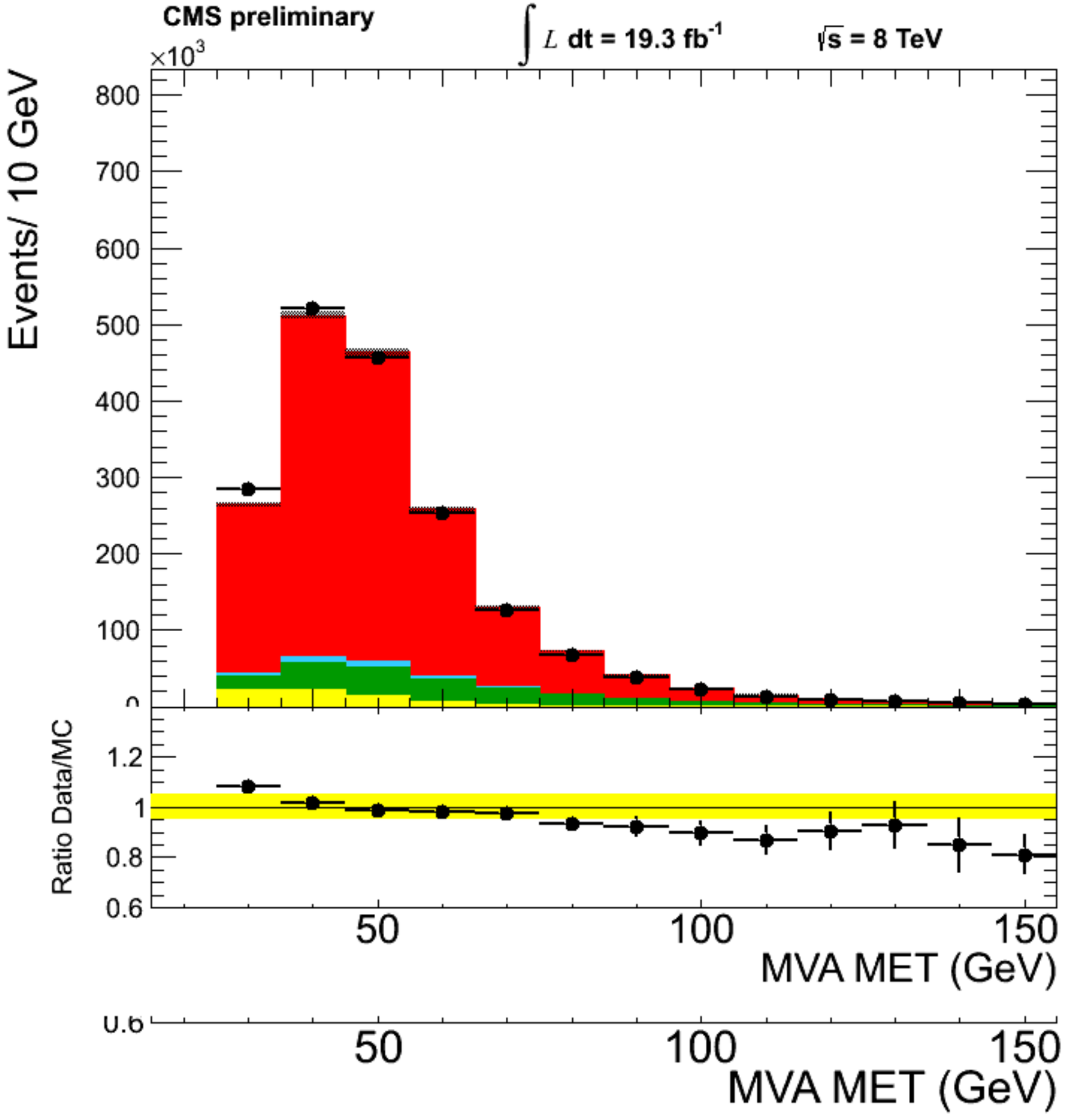

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.2
$\times 10^3$
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
$\Delta R_{jj}$

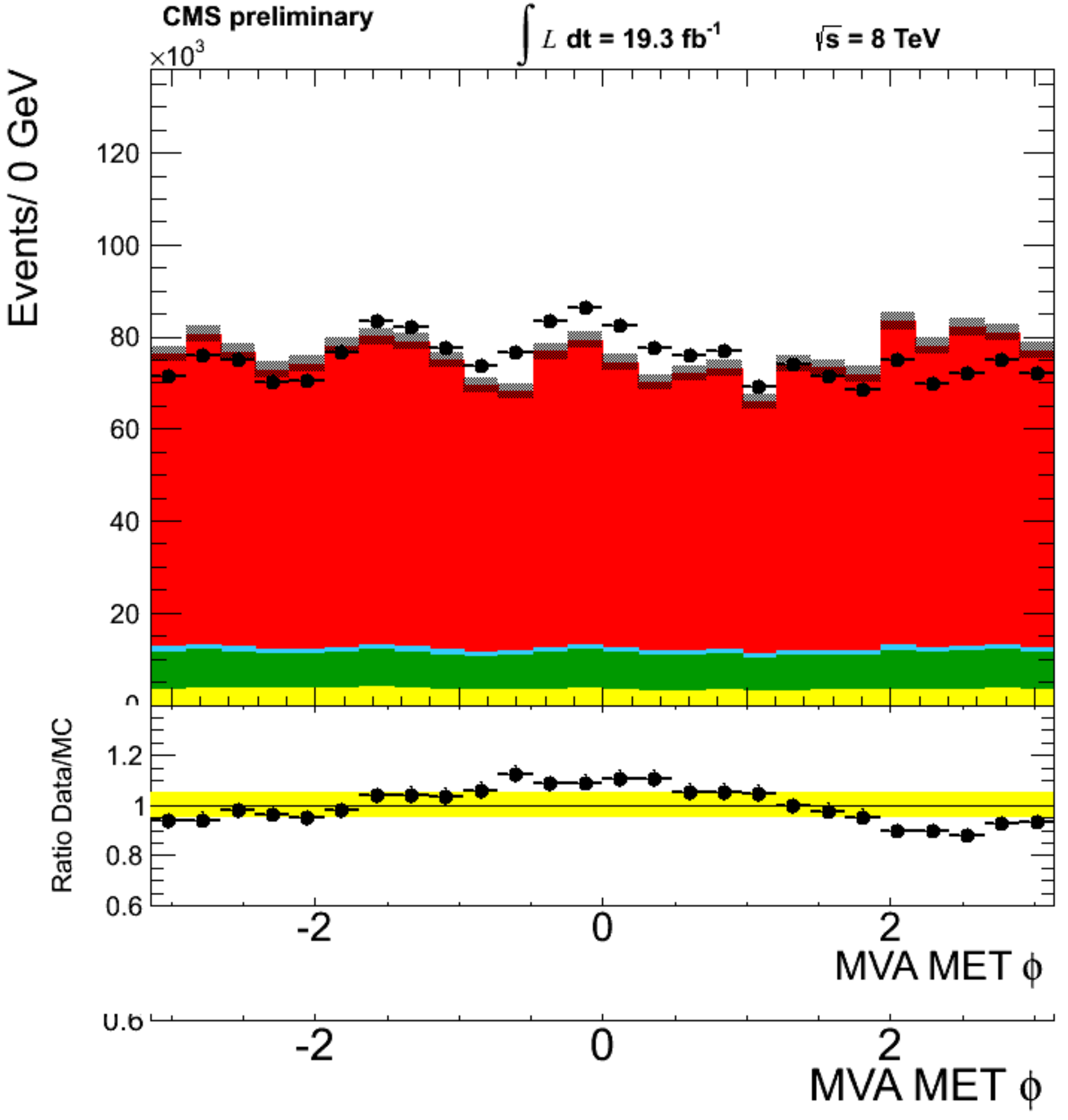

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4
$\times 10^3$
300
250
200
150
100
50
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
$\Delta\eta$ (j,j)

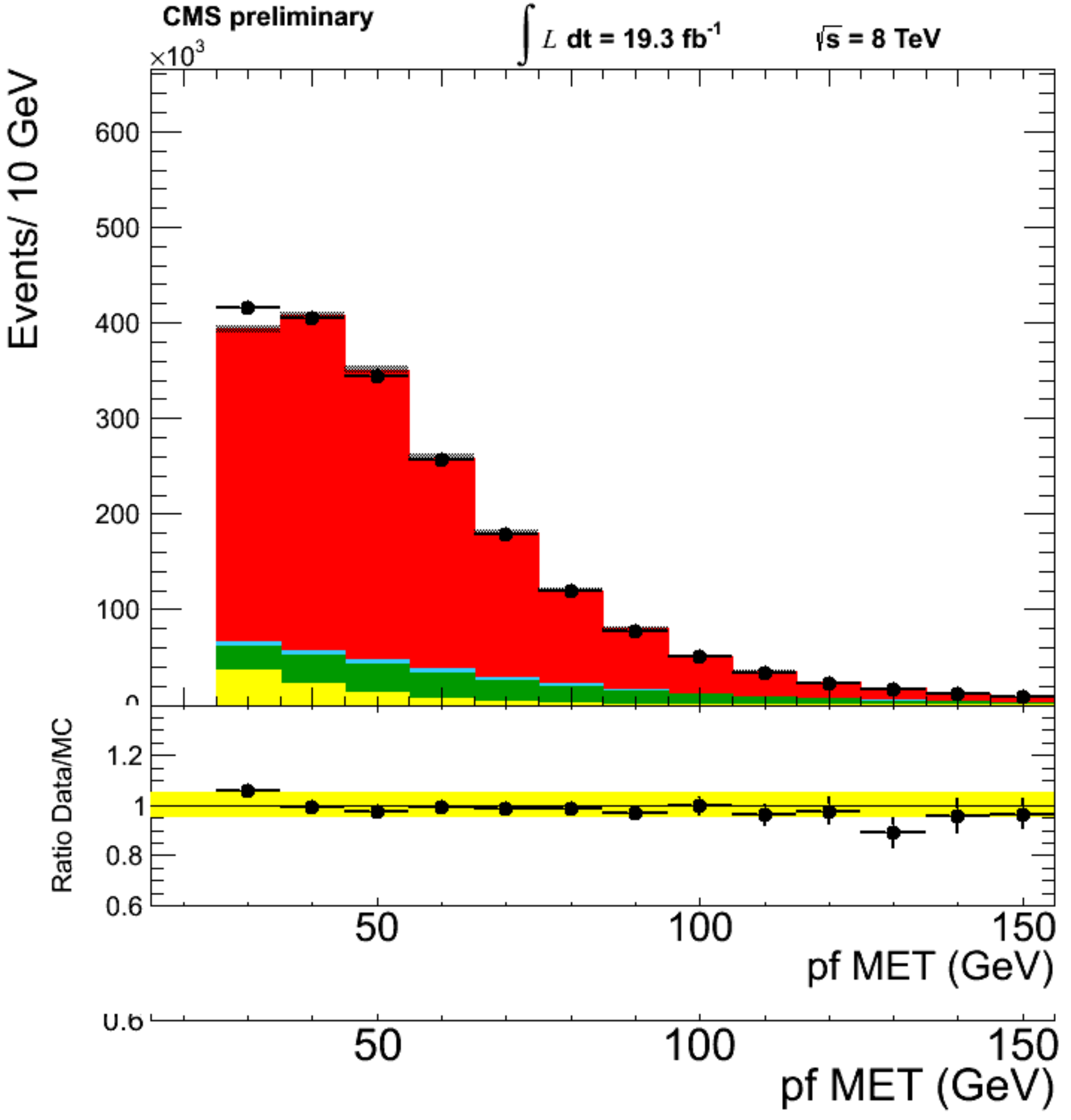

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.4
350
300
250
200
150
100
50
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
$\Delta\phi$ (Leading Jet, MET)
0.6
-2
0
2
$\Delta\phi$ (Leading Jet, MET)

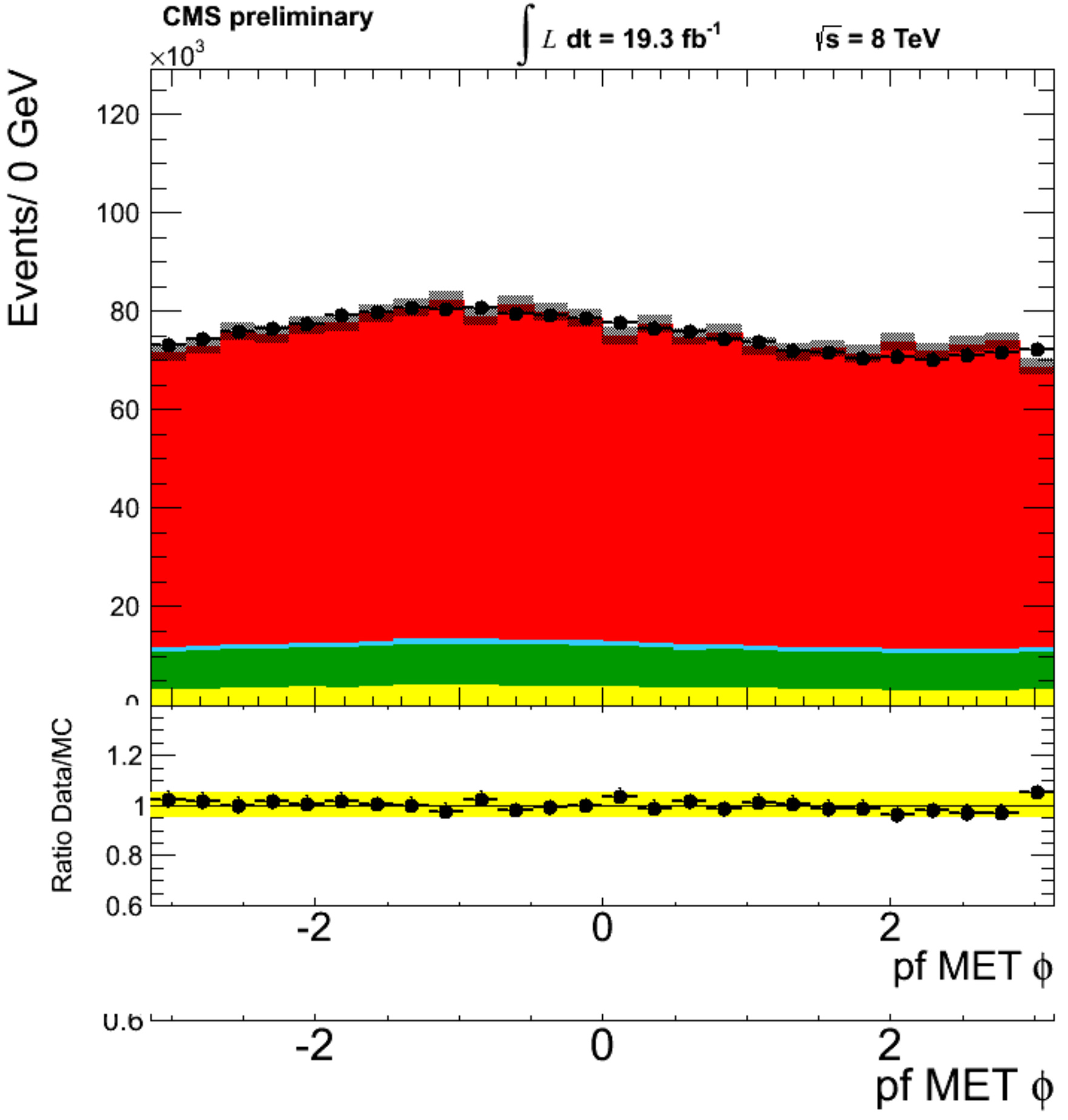

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 10 GeV
250
200
150
100
50
Ratio Data/MC
1.2
1
0.8
0.6
50
100
150
200
Dijet System $p_T$ (GeV)
0.6
50
100
150
200
Dijet System $p_T$ (GeV)

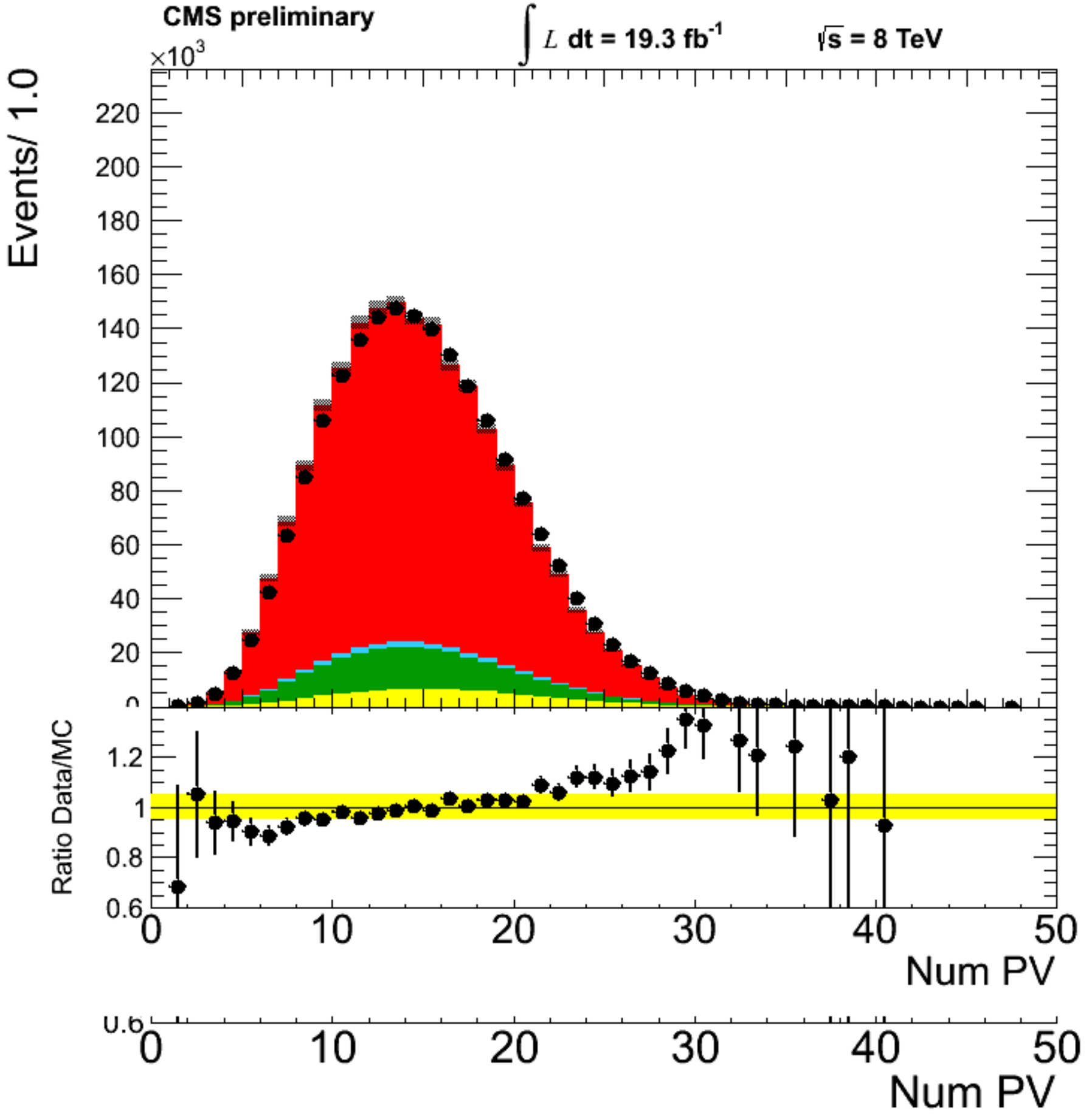

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.2
300
250
200
150
100
50
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
WW rapidity

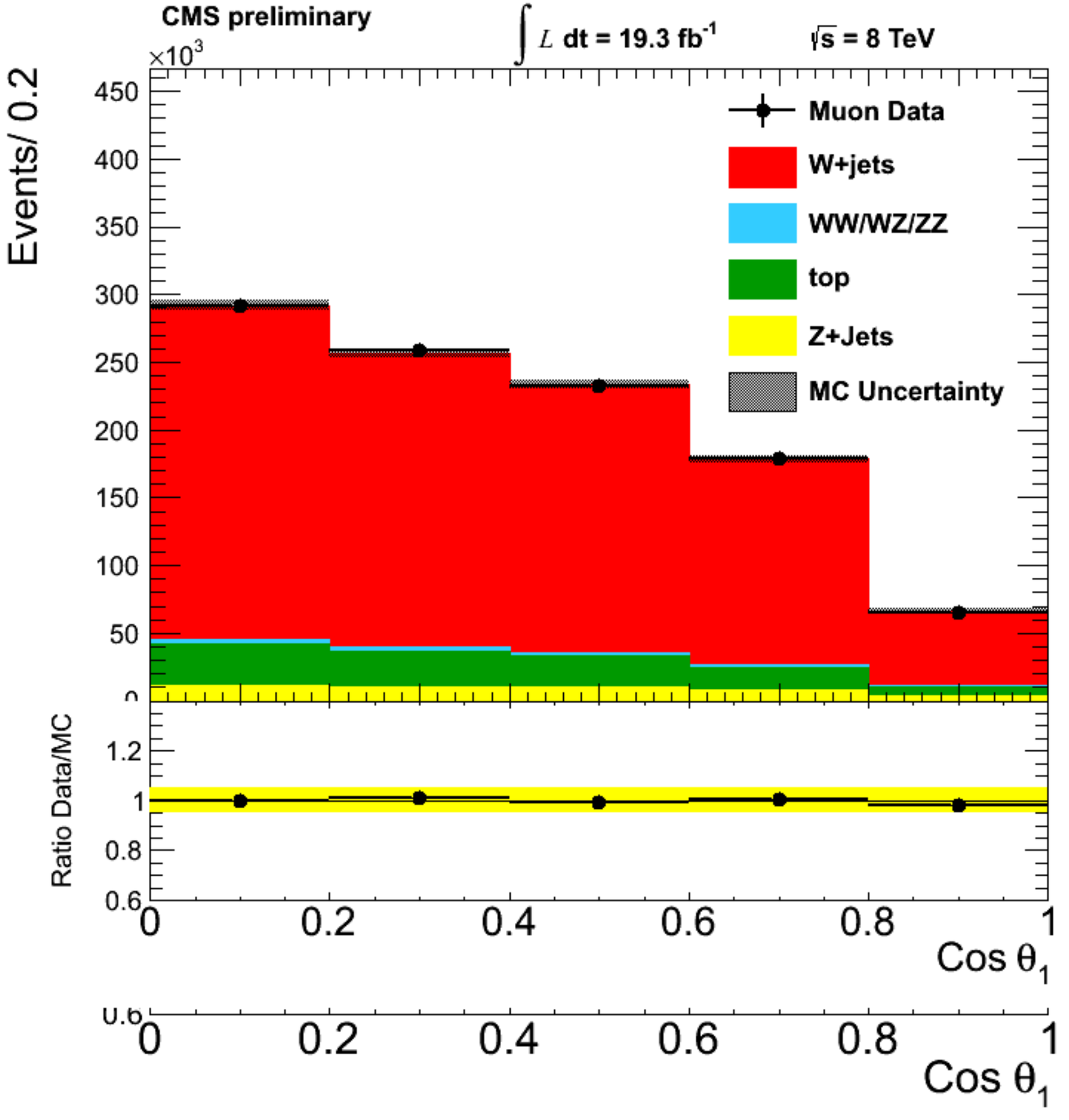

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 10 GeV
800
700
600
500
400
300
200
100
Ratio Data/MC
1.2
1
0.8
0.6
50
100
150
MVA MET (GeV)
0.6
50
100
150
MVA MET (GeV)

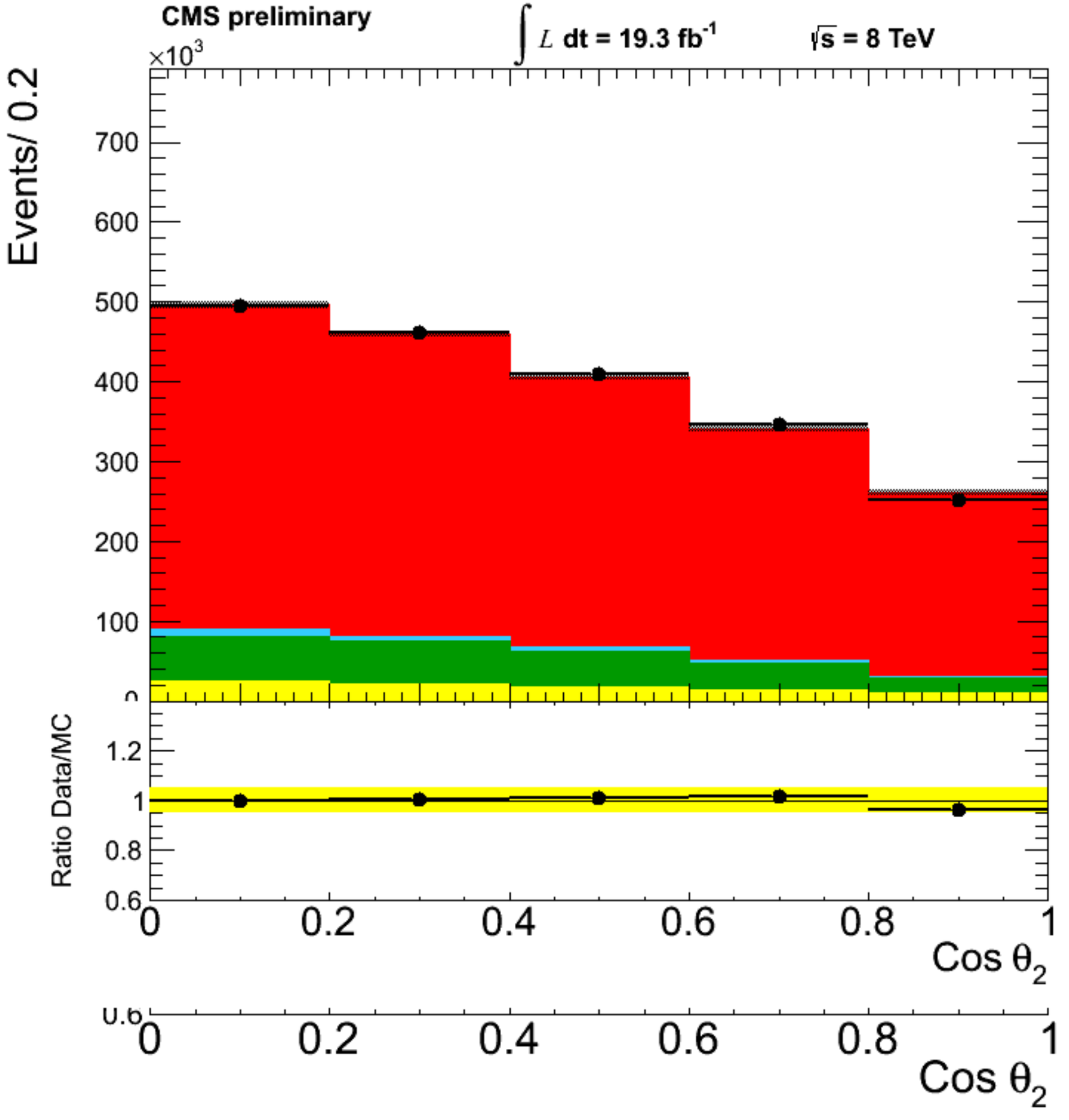

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0 GeV
120
100
80
60
40
20
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
MVA MET $\phi$
0.6
-2
0
2
MVA MET $\phi$

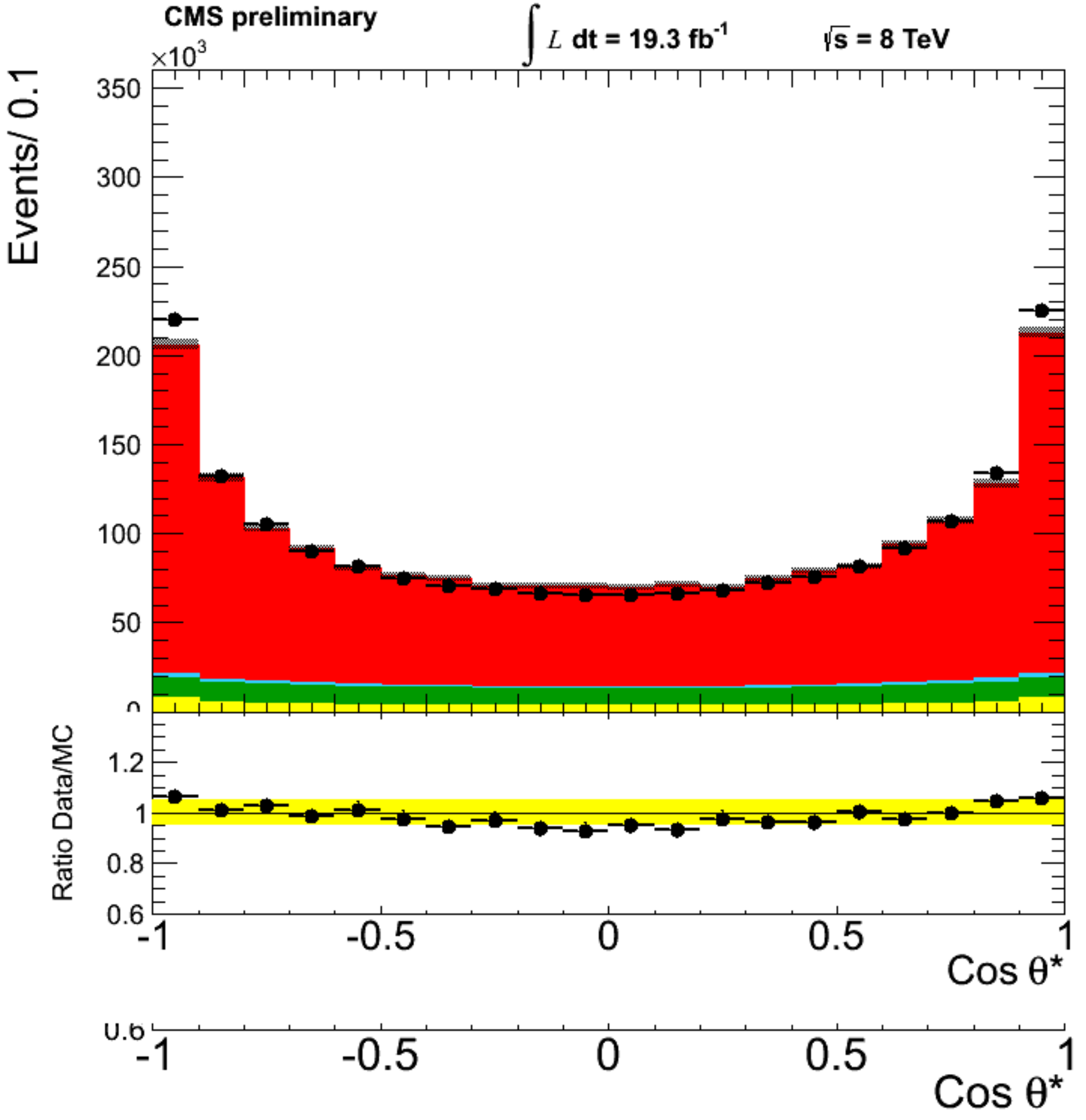

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 10 GeV
600
500
400
300
200
100
Ratio Data/MC
1.2
1
0.8
0.6
50
100
150
pf MET (GeV)

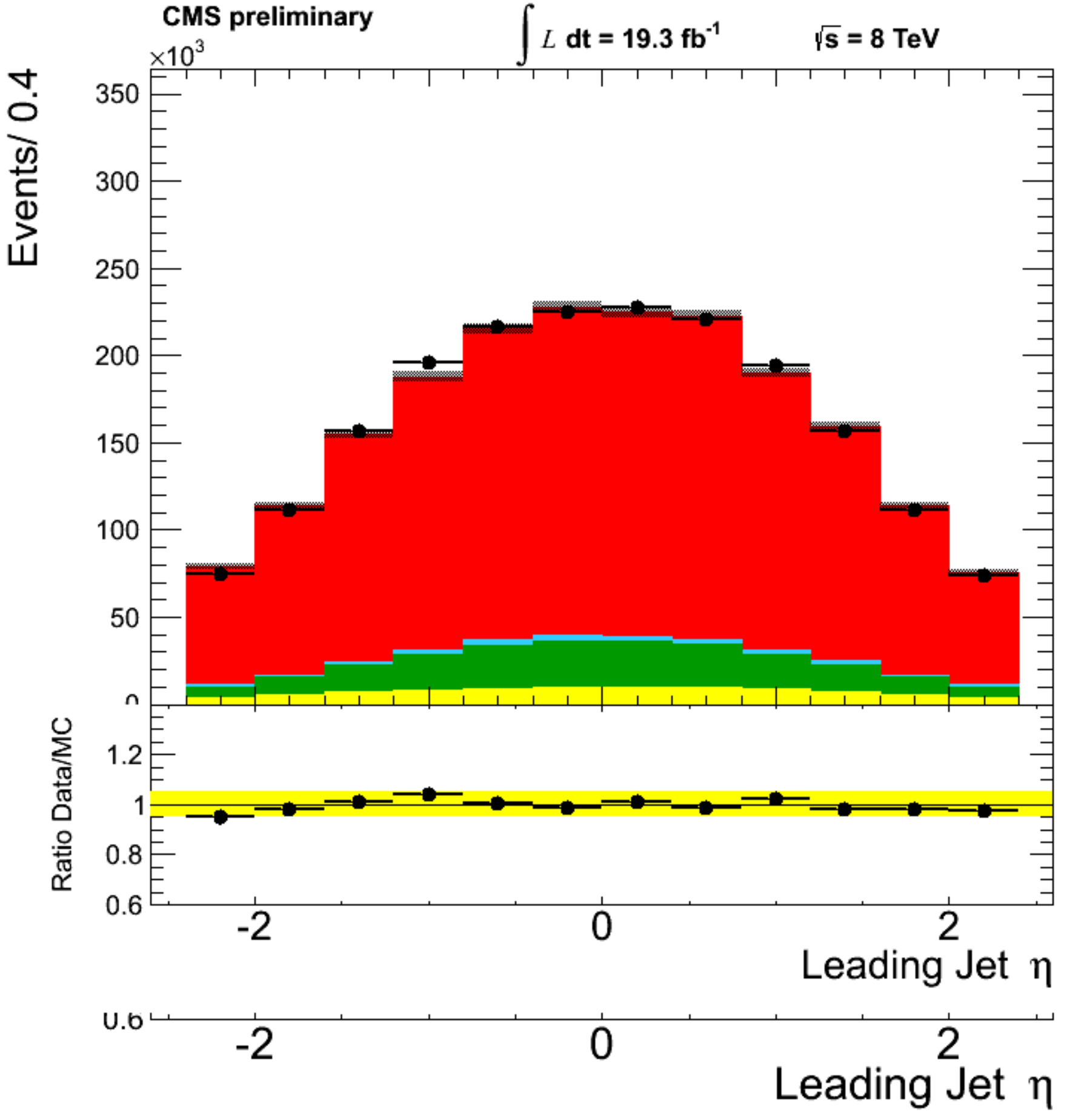

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0 GeV
120
100
80
60
40
20
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
pf MET $\phi$
0.6
-2
0
2
pf MET $\phi$

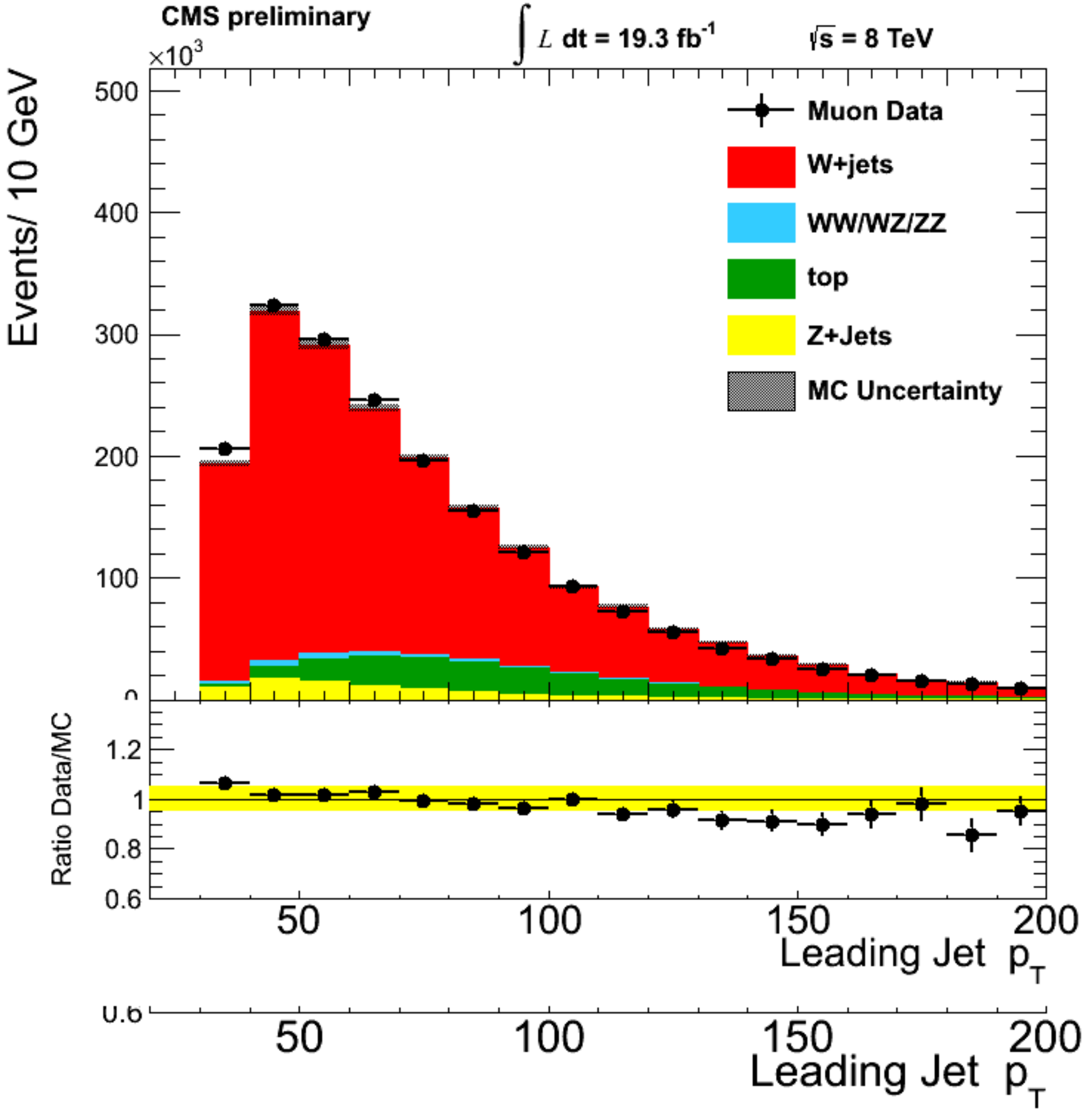

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 1.0
$\times 10^3$
220
200
180
160
140
120
100
80
60
40
20
0
Ratio Data/MC
1.2
1
0.8
0.6
0
10
20
30
40
50
Num PV

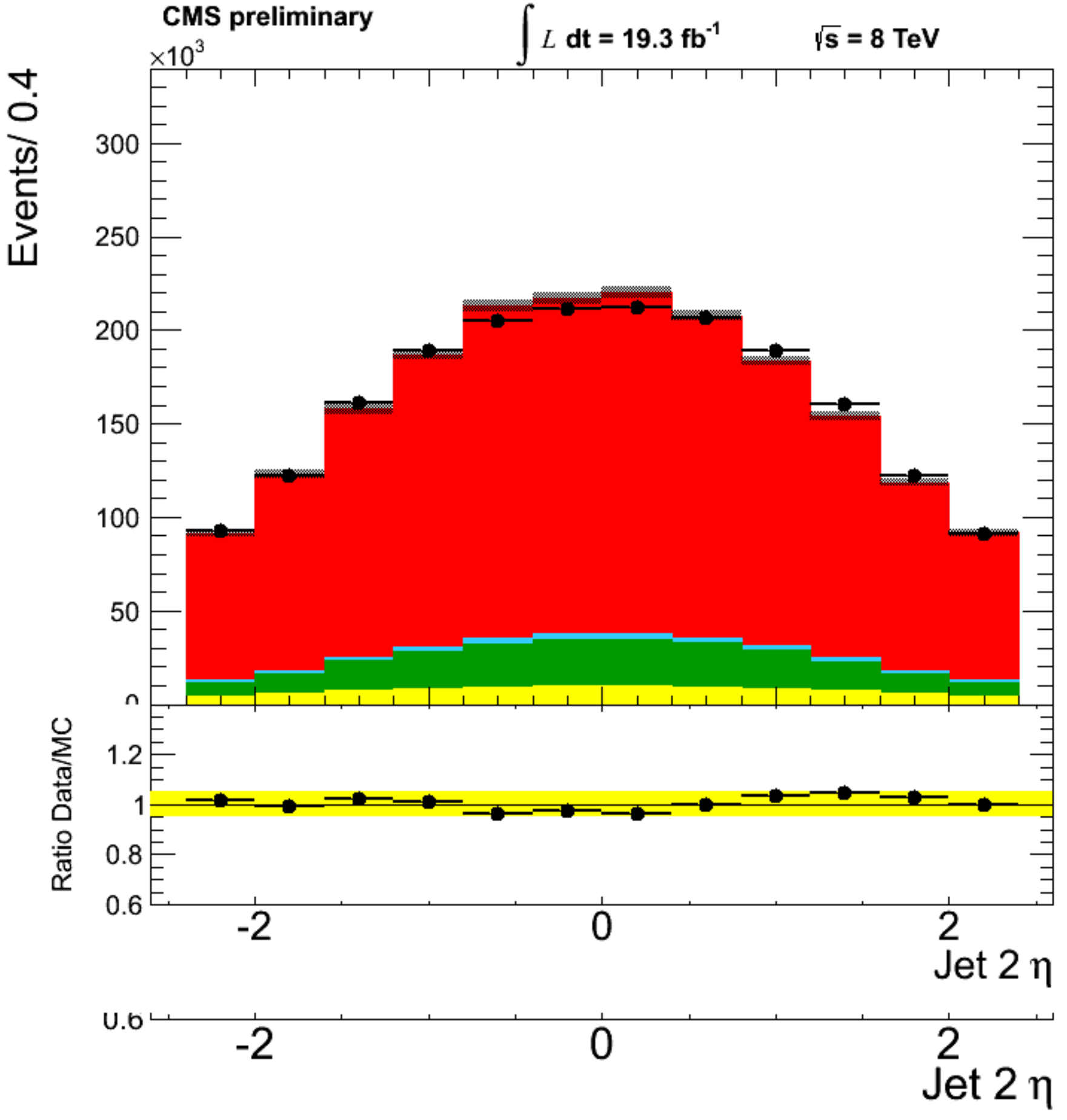

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.2
$\times 10^3$
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
Cos $\theta_1$
Cos $\theta_1$

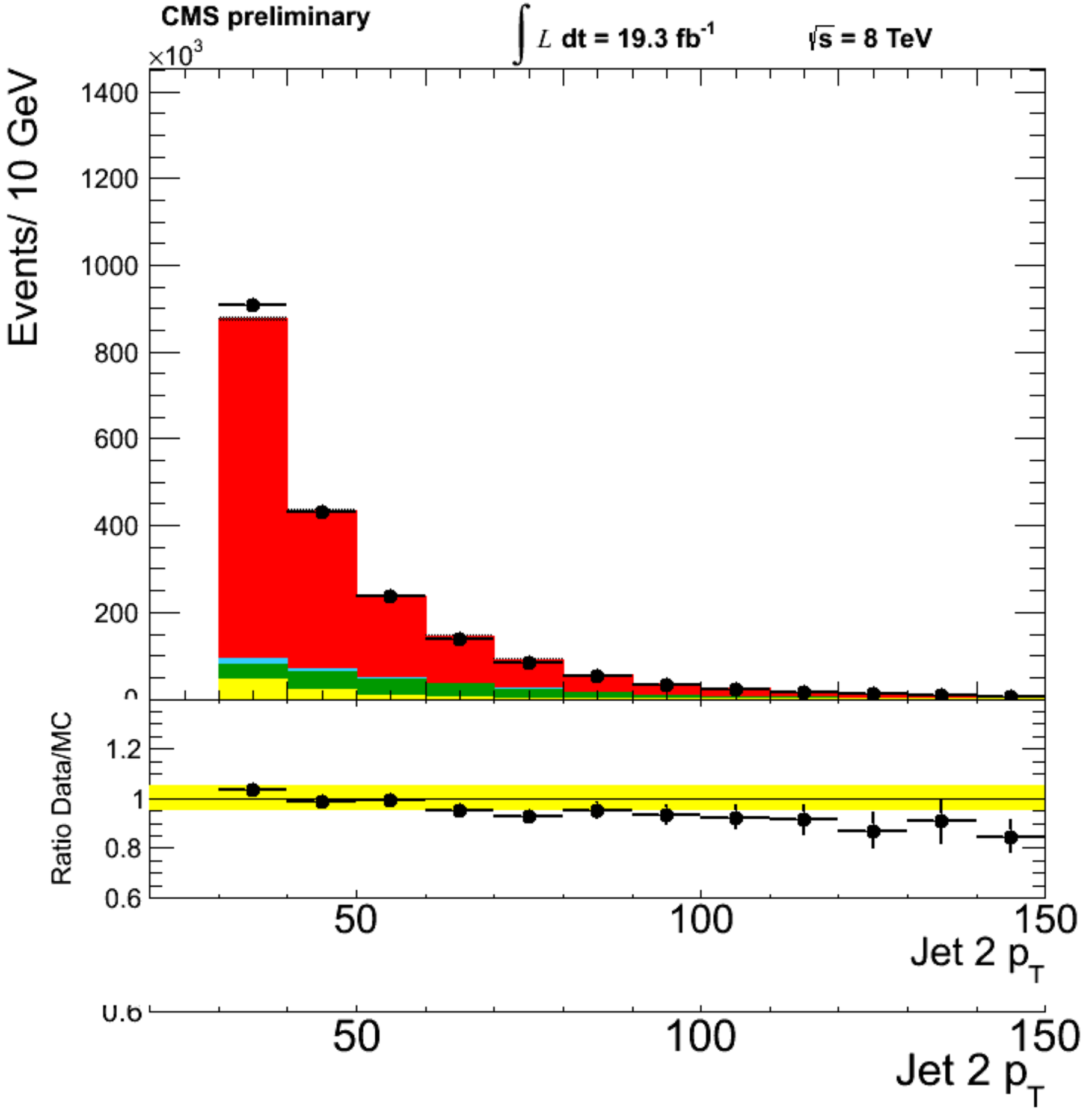

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.2
700
600
500
400
300
200
100
0
Ratio Data/MC
1.2
1
0.8
0.6
0
0.2
0.4
0.6
0.8
1
Cos $\theta_2$

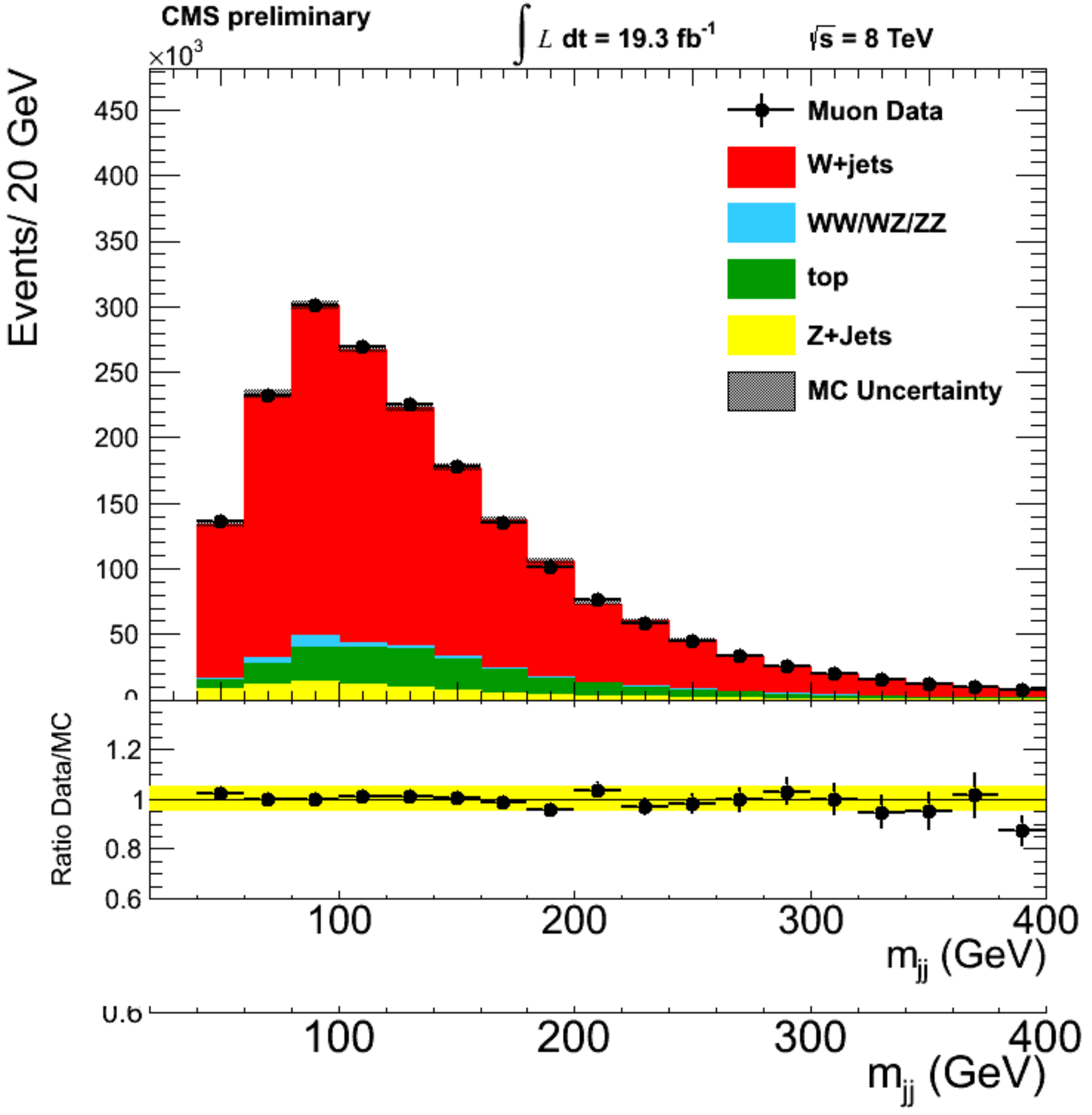

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.1
$\times 10^3$
350
300
250
200
150
100
50
0
Ratio Data/MC
1.2
1
0.8
0.6
-1
-0.5
0
0.5
1
Cos θ*

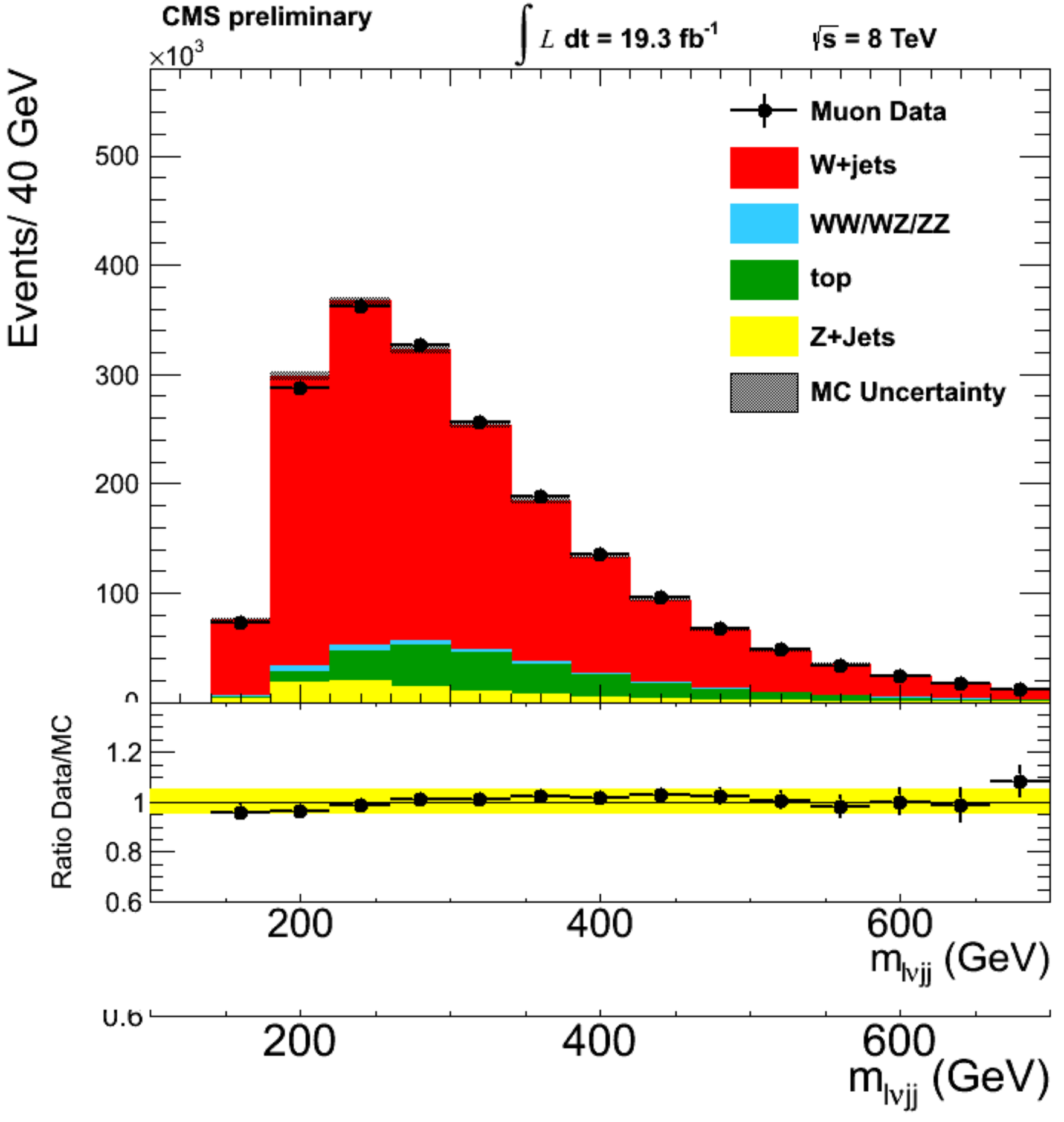

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4
$\times 10^3$
350
300
250
200
150
100
50
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
Leading Jet η

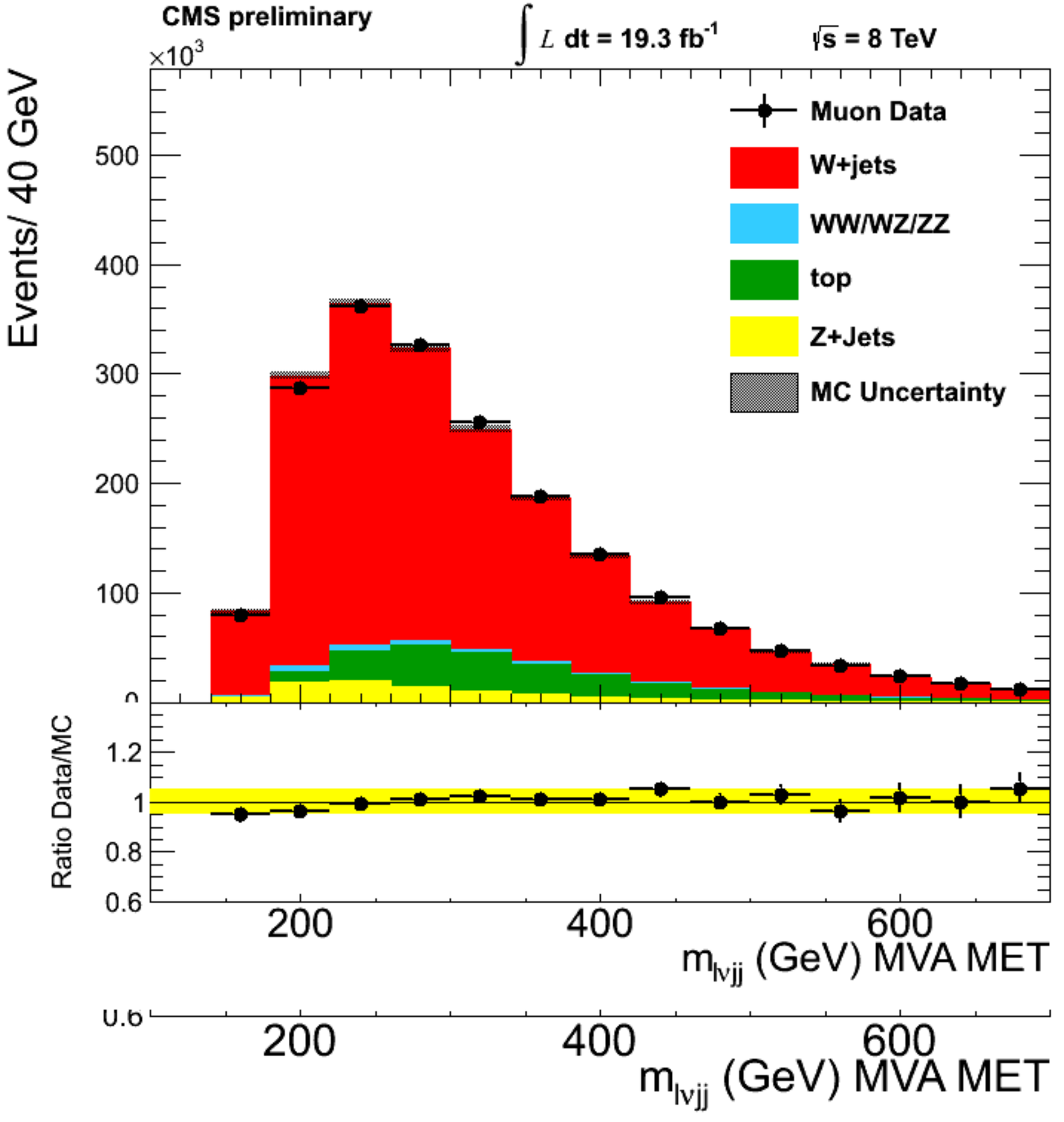

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 10 GeV
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
Leading Jet $p_T$
Leading Jet $p_T$

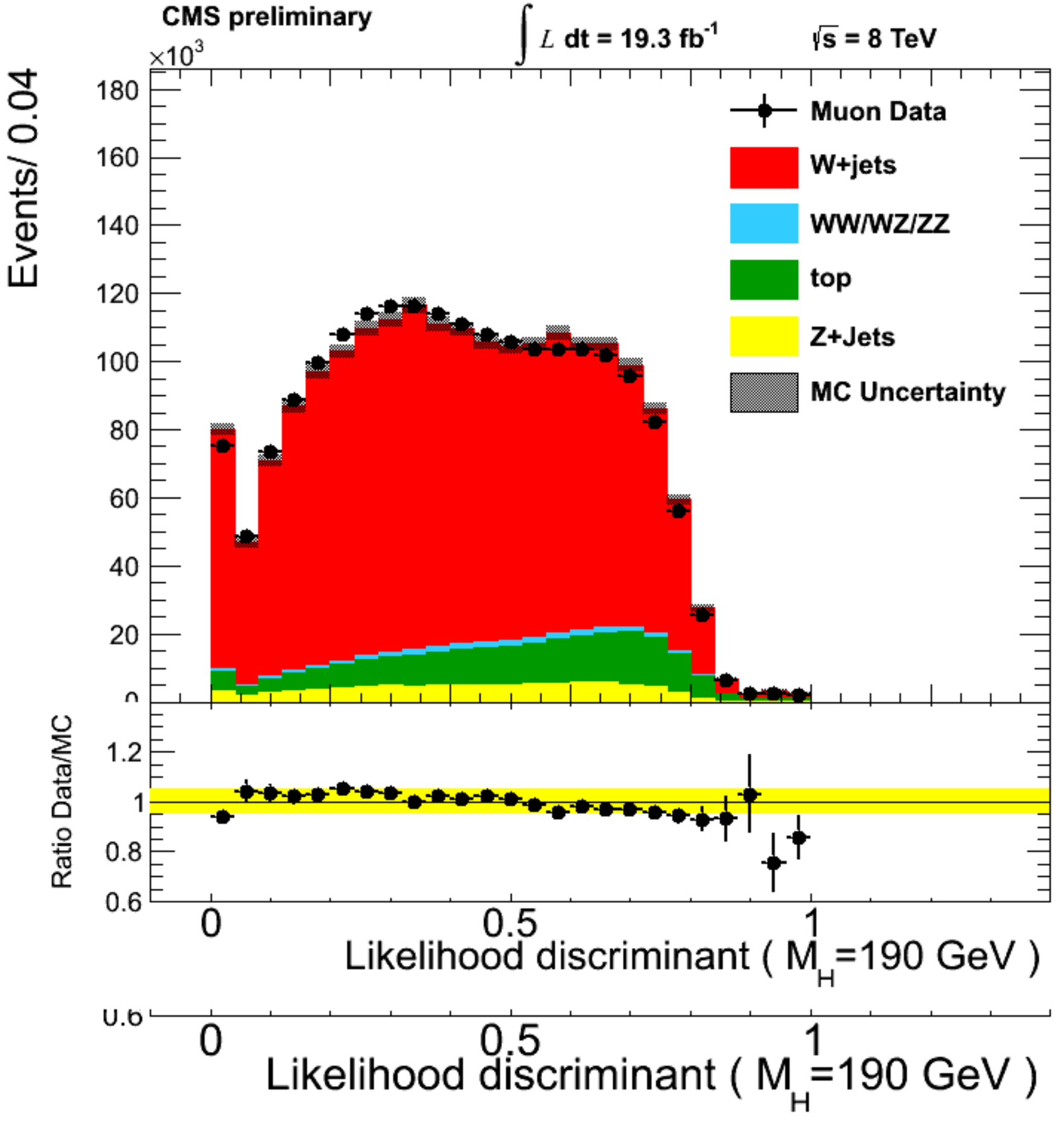

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.4
300
250
200
150
100
50
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
Jet 2 η
0.6
-2
0
2
Jet 2 η

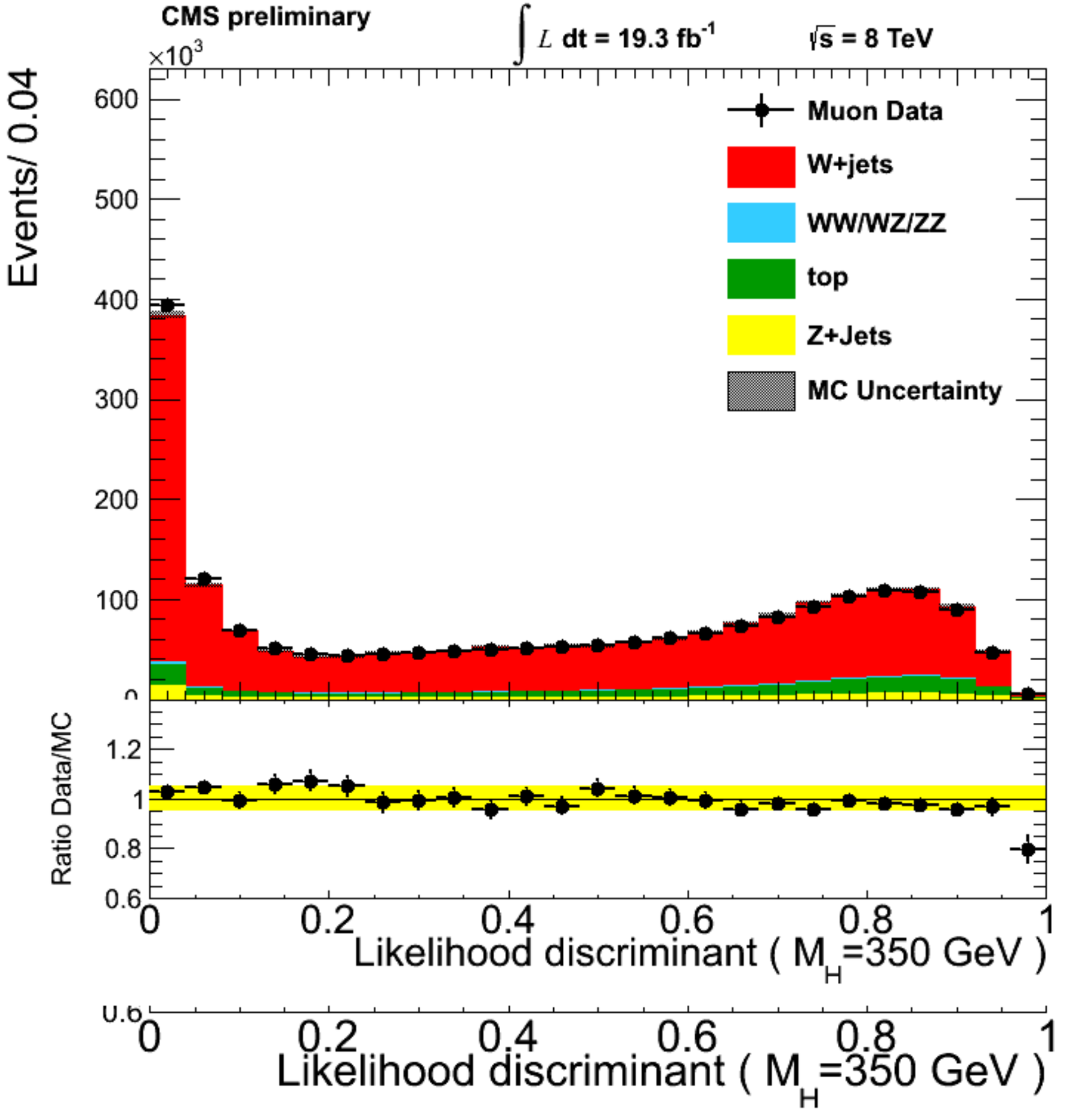

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 10 GeV
1400
1200
1000
800
600
400
200
0
Ratio Data/MC
1.2
1
0.8
0.6
50
100
150
Jet 2 $p_T$
0.6
50
100
150
Jet 2 $p_T$

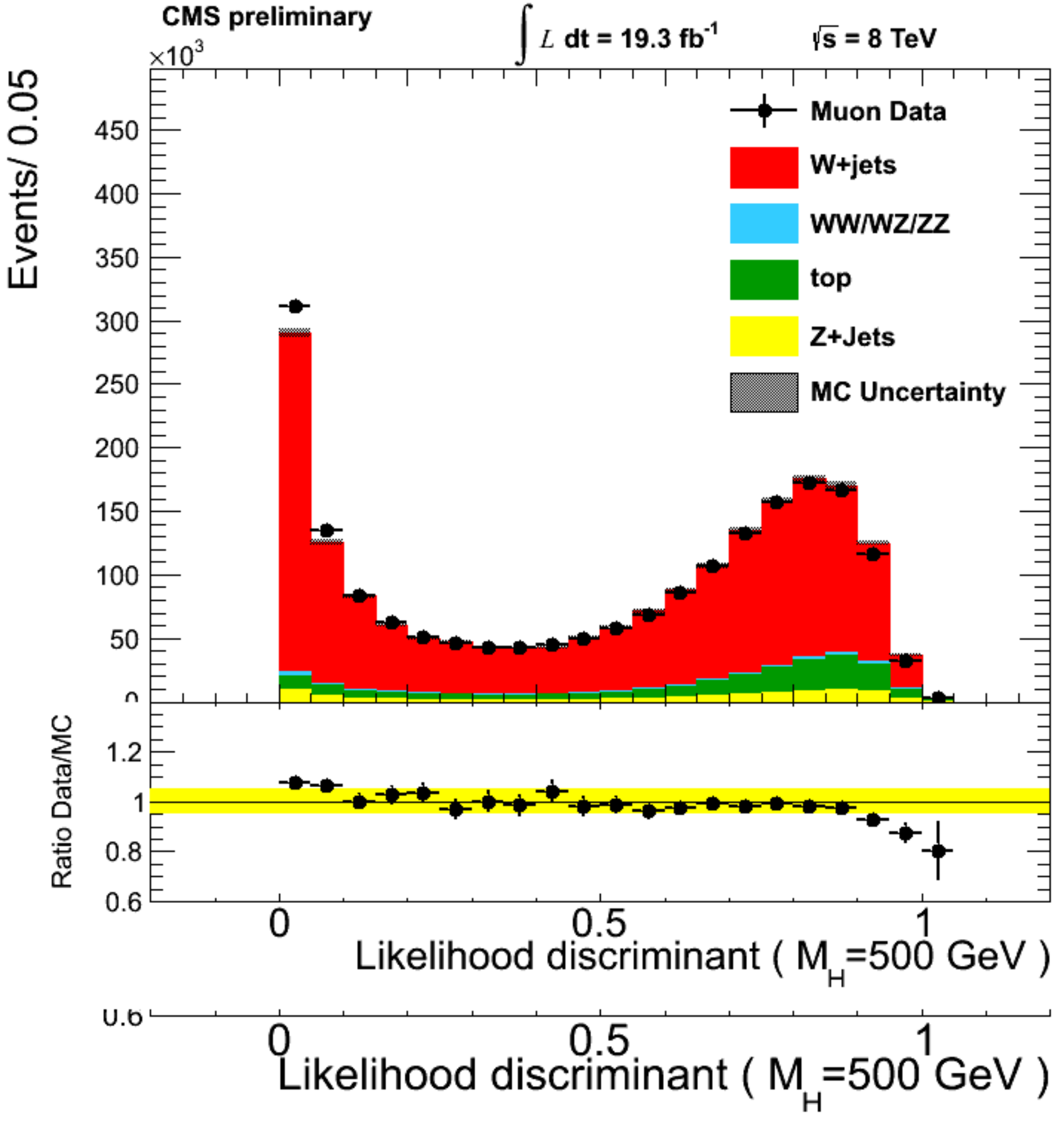

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 20 GeV
$\times 10^3$
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
$m_{jj}$ (GeV)

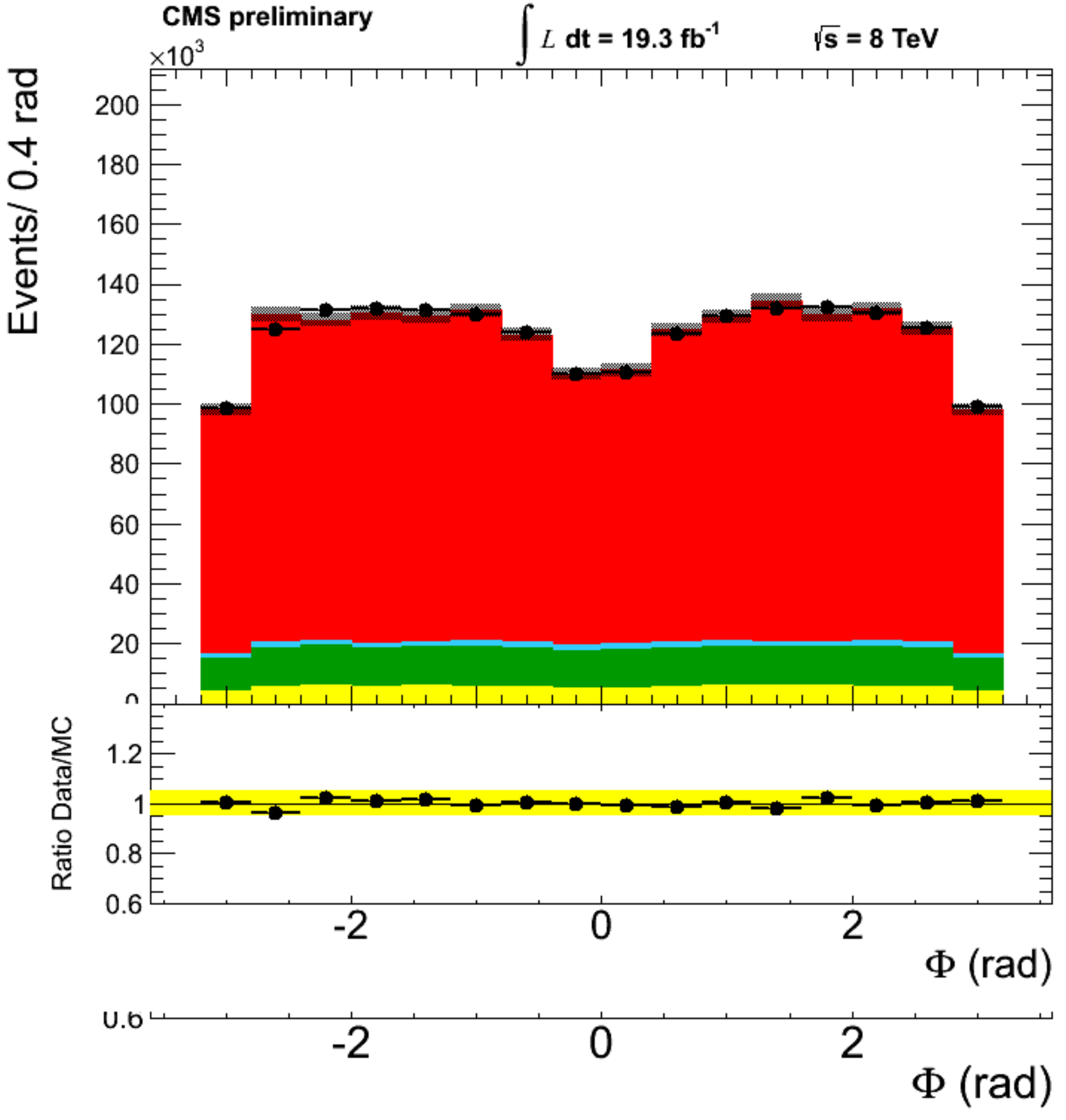

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 40 GeV
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
$m_{l\nu jj}$ (GeV)

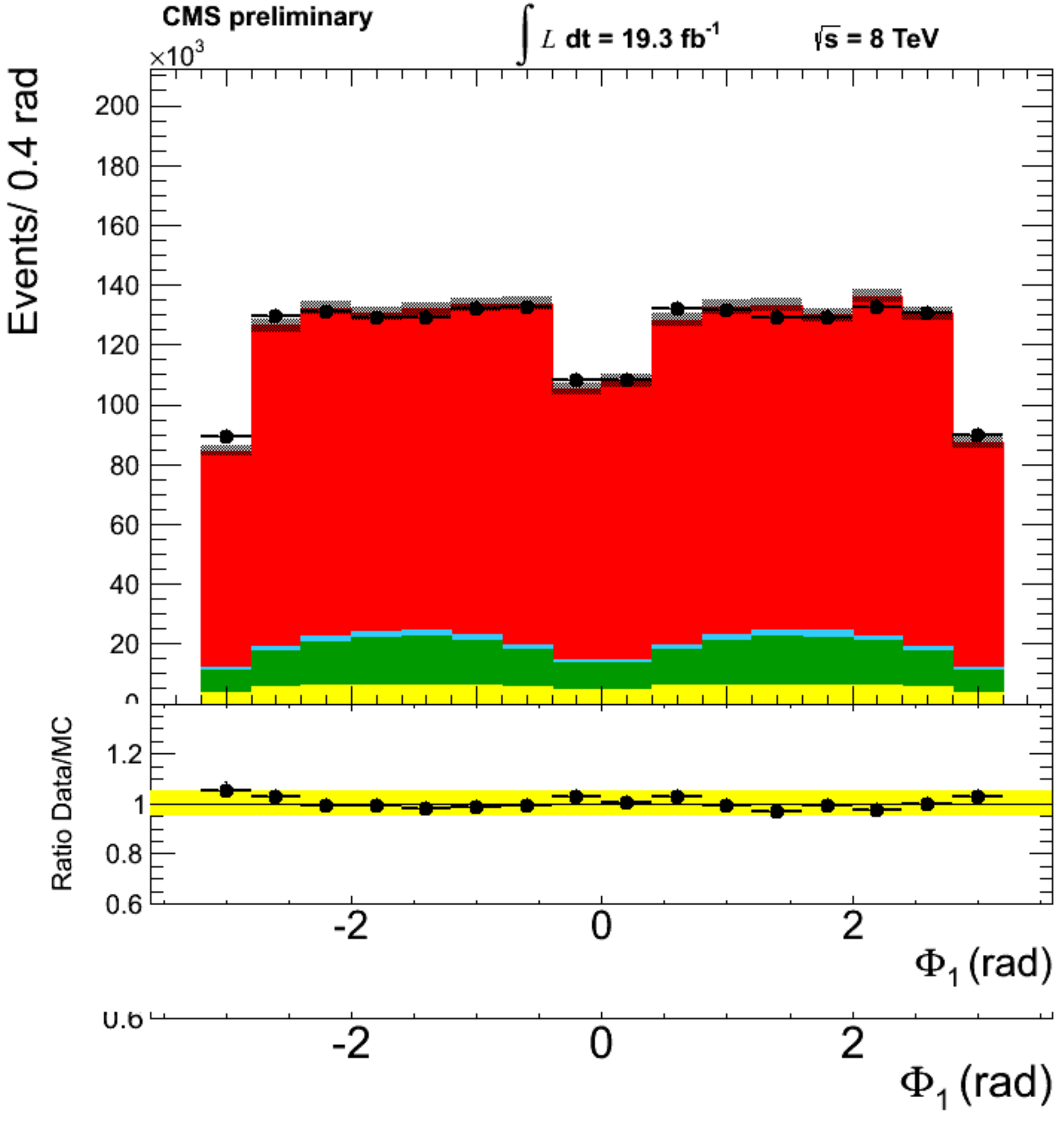

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 40 GeV
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
$m_{l\nu jj}$ (GeV) MVA MET

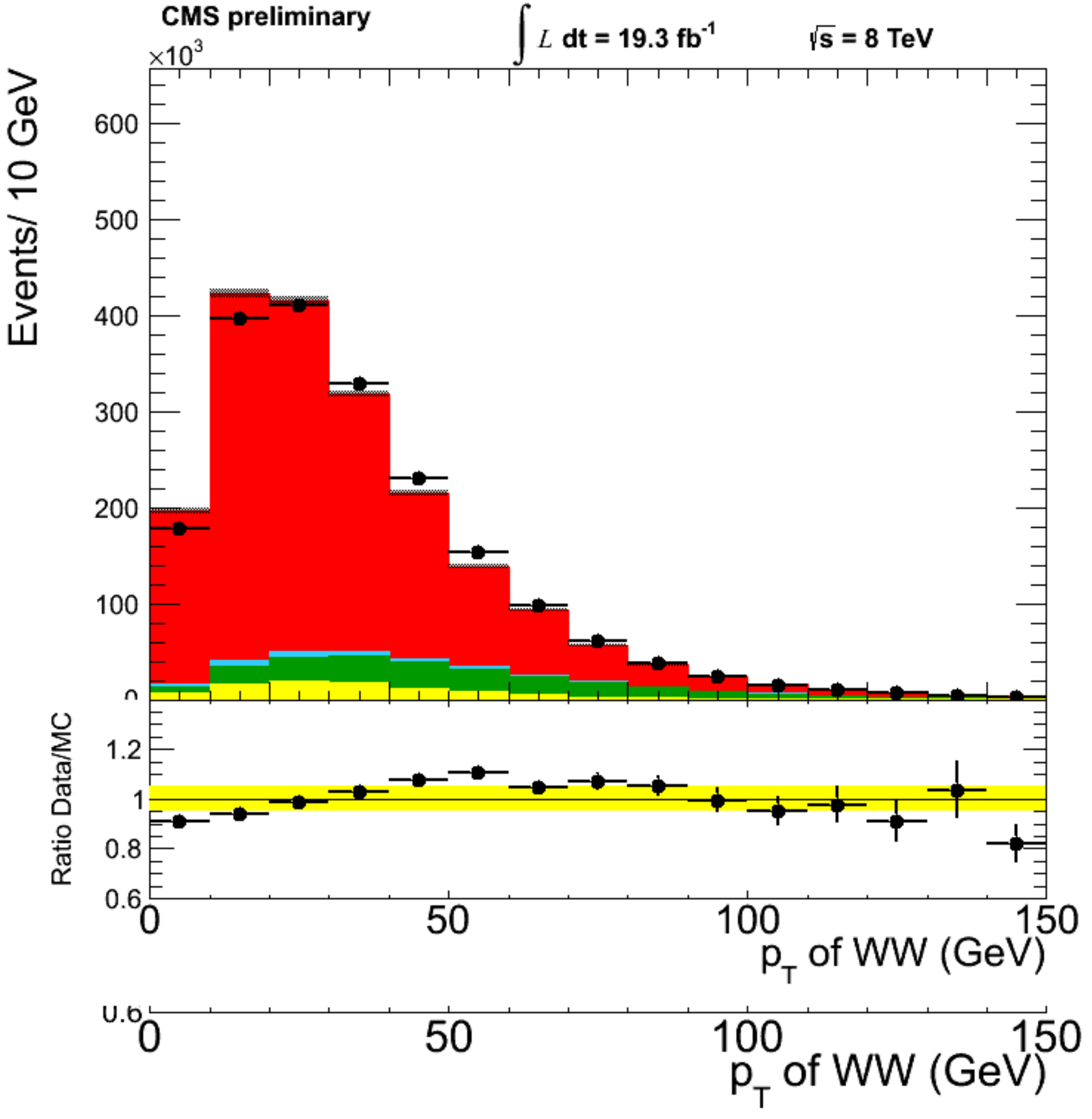

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s}$ = 8 TeV
Events/ 0.04
×10³
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
Likelihood discriminant ( $M_H$=190 GeV )
Likelihood discriminant ( $M_H$=190 GeV )


CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.04
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
Likelihood discriminant ( $M_H$=350 GeV )
Likelihood discriminant ( $M_H$=350 GeV )


CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.05
$\times 10^3$
Muon Data
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
Ratio Data/MC
Likelihood discriminant ( $M_H$=500 GeV )


CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.4 rad
200
180
160
140
120
100
80
60
40
20
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
Φ (rad)
0.6
-2
0
2
Φ (rad)


CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 0.4 rad
200
180
160
140
120
100
80
60
40
20
0
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
$\Phi_1$ (rad)
0.6
-2
0
2
$\Phi_1$ (rad)


CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
$\times 10^3$
Events/ 10 GeV
600
500
400
300
200
100
0
Ratio Data/MC
1.2
1
0.8
0.6
0
50
100
150
$p_T$ of WW (GeV)
0.6
0
50
100
150
$p_T$ of WW (GeV)