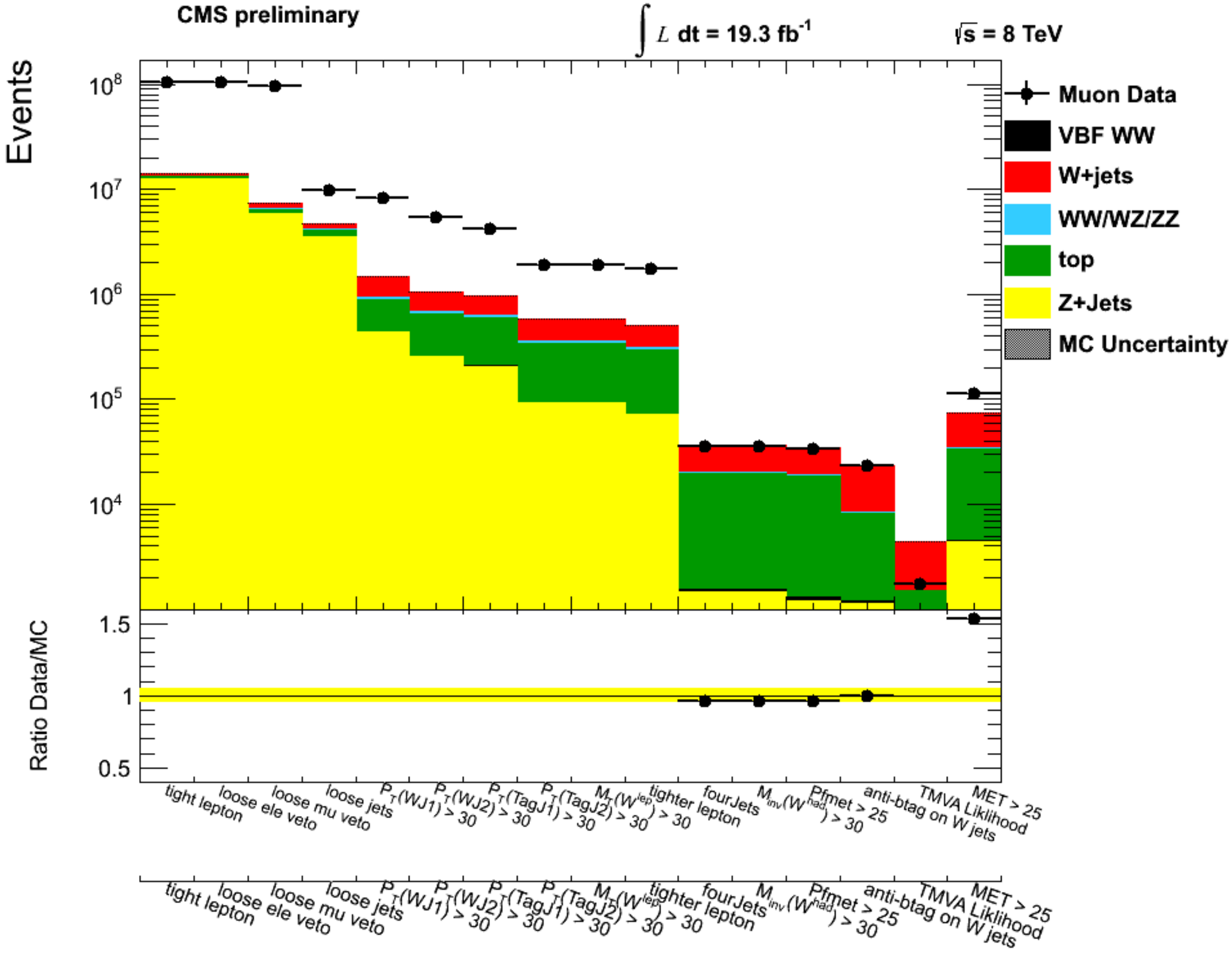
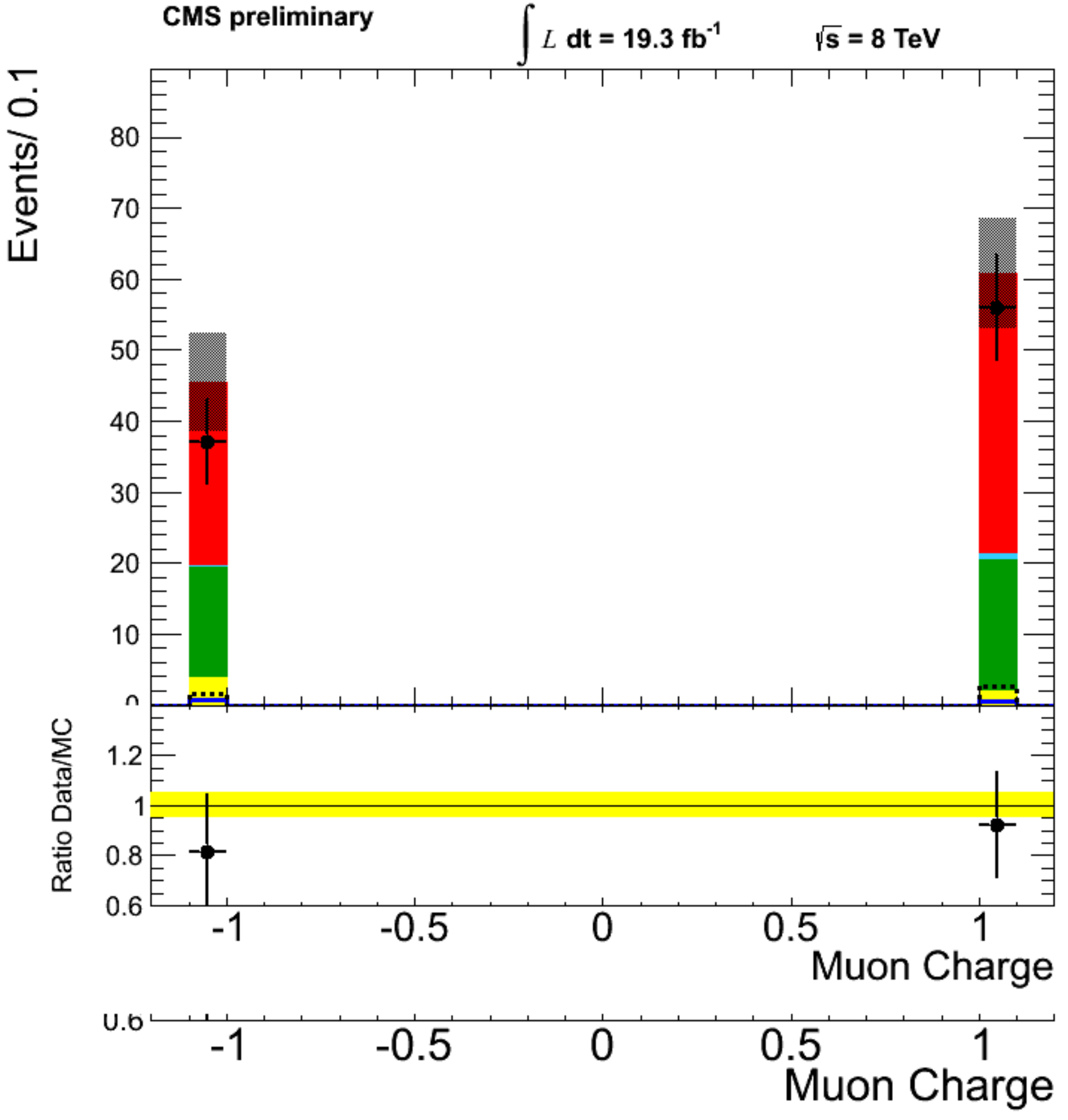
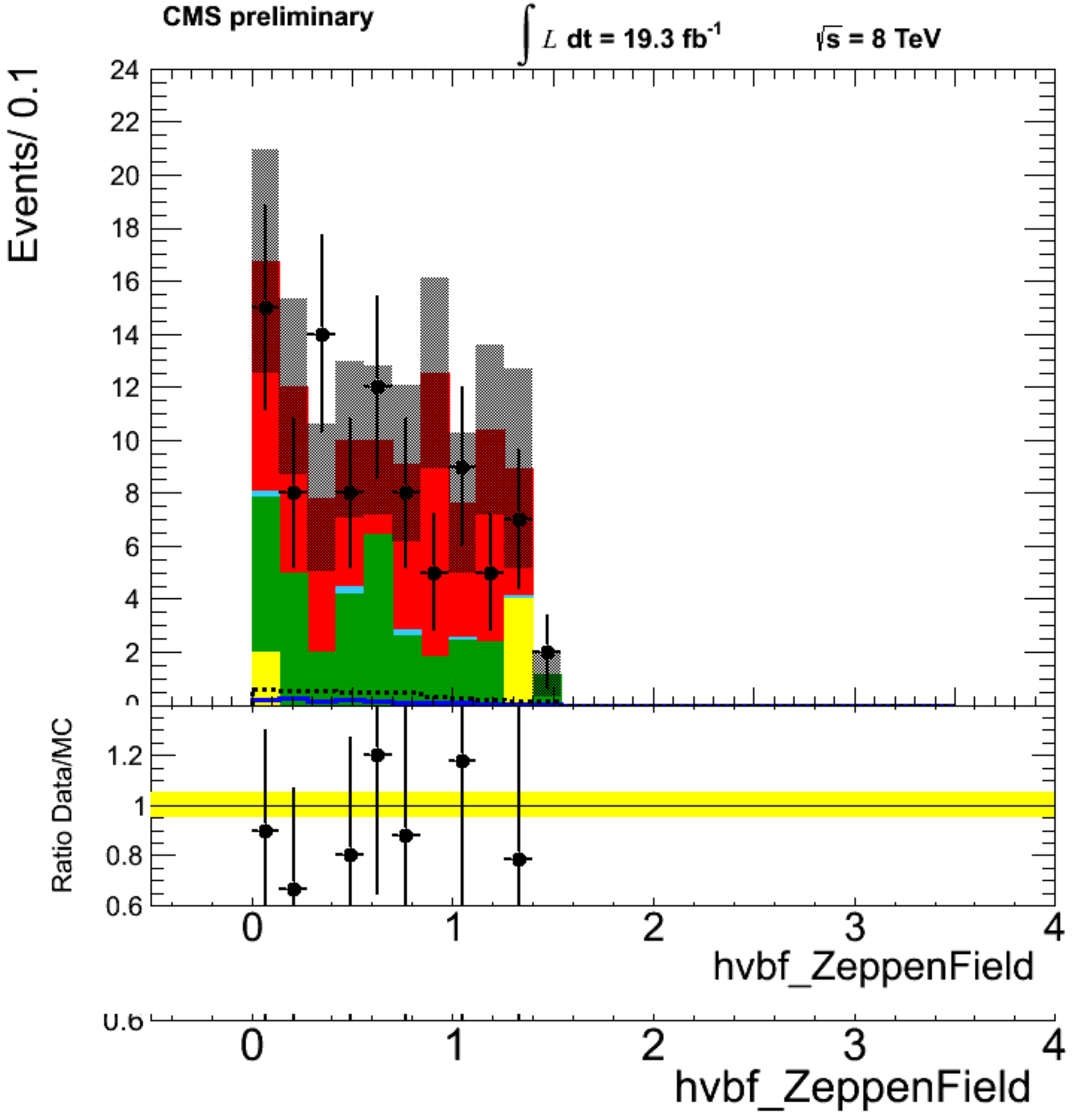
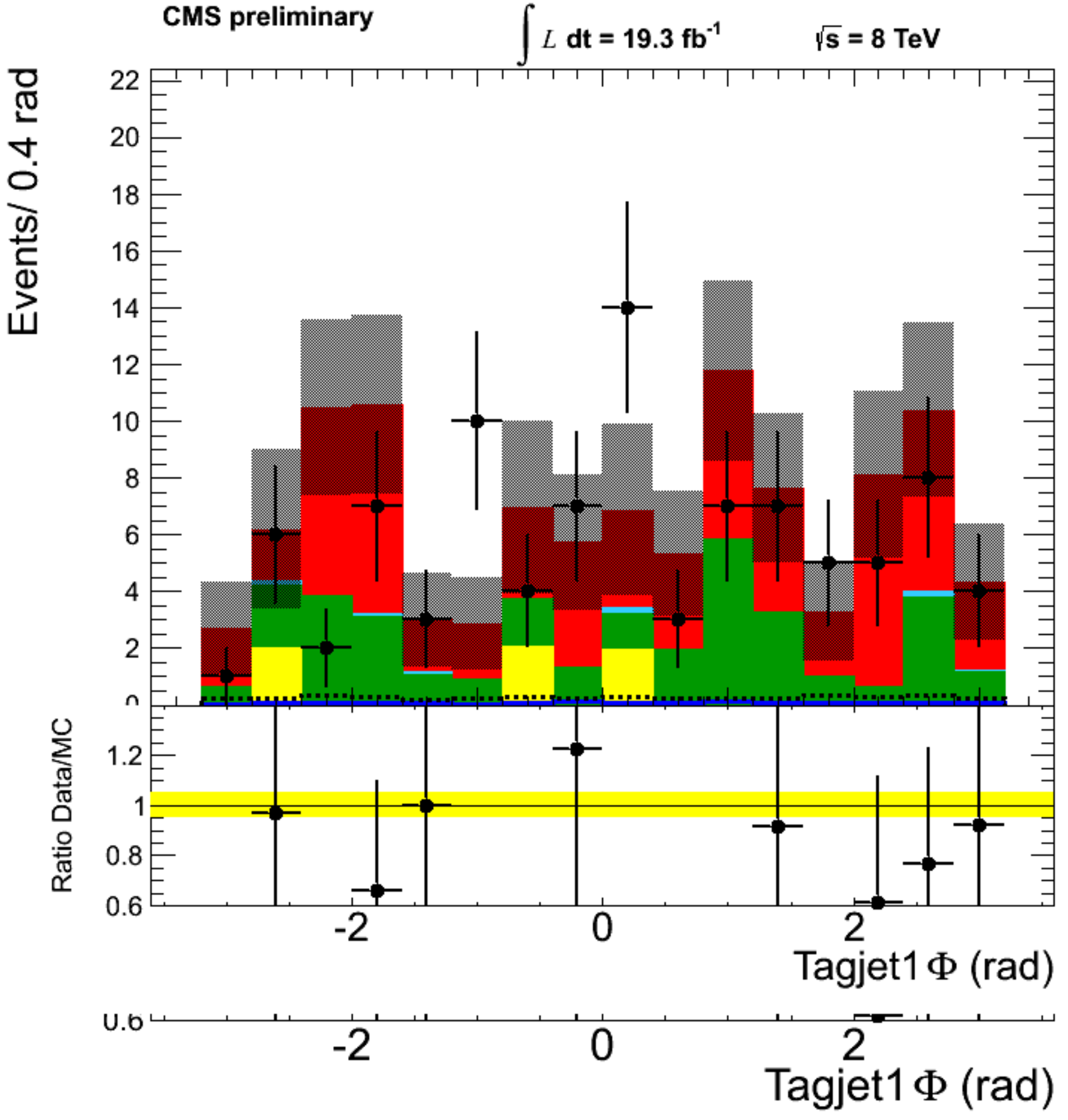
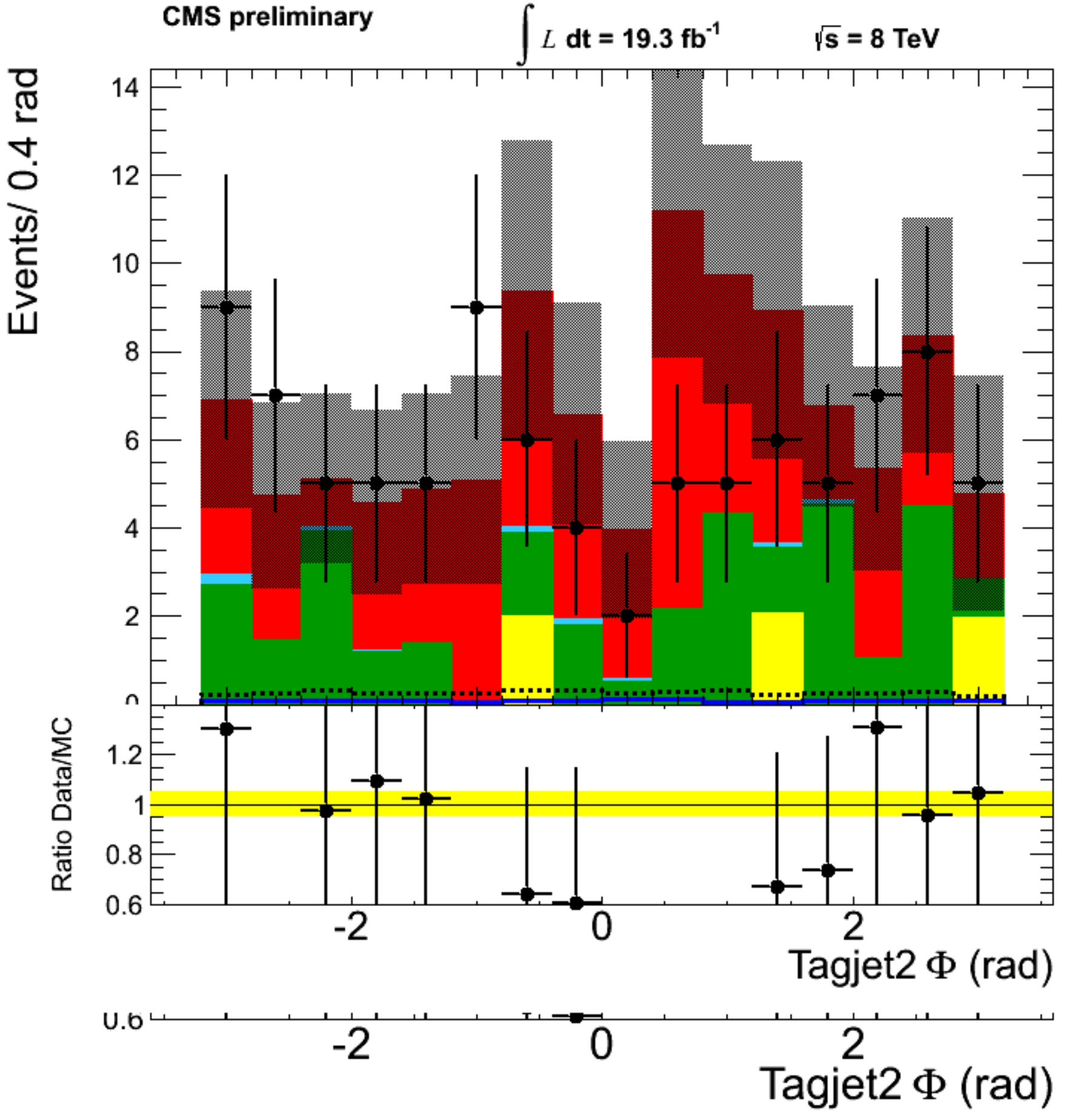
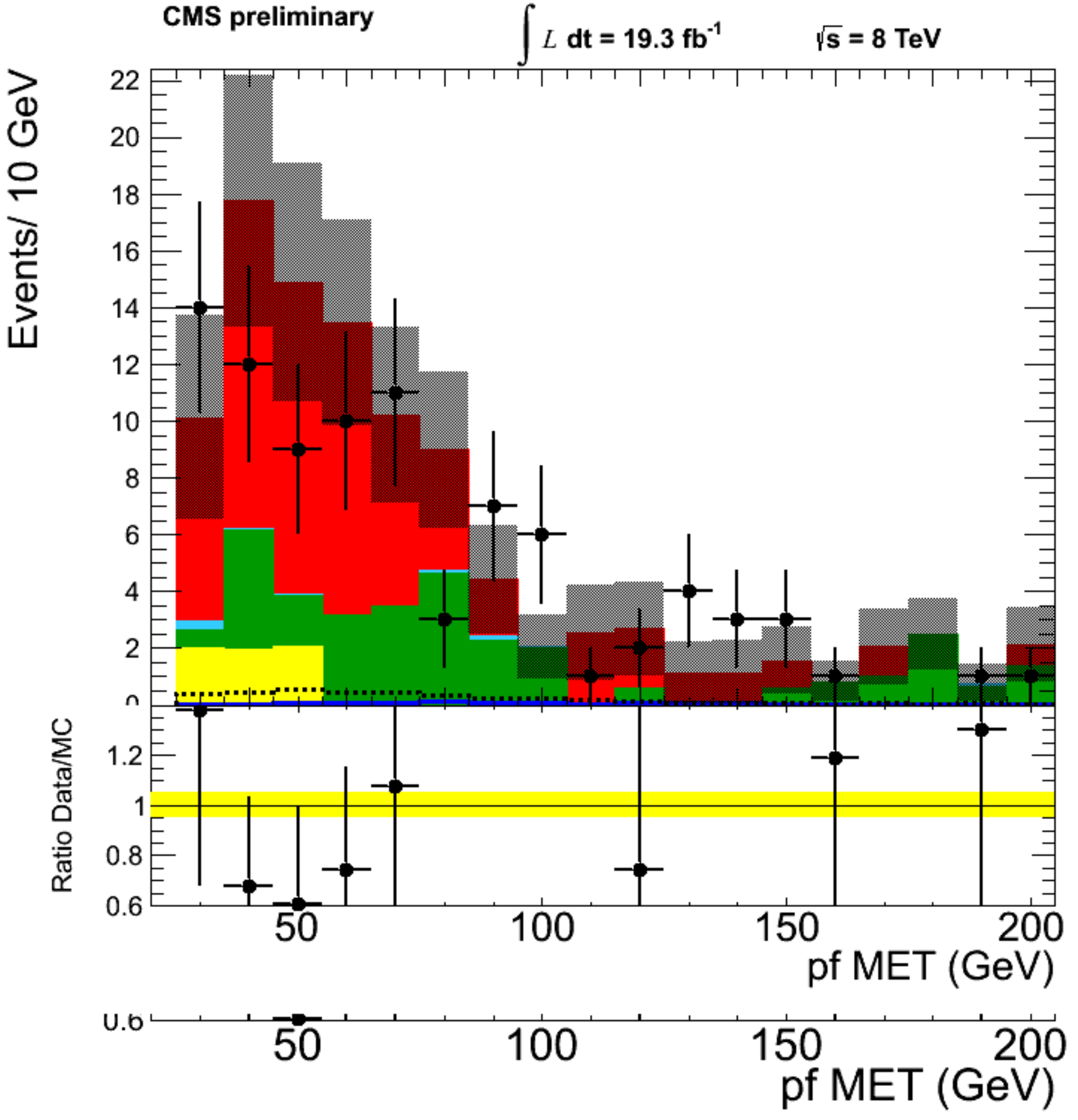

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s}$ = 8 TeV
Events
Ratio Data/MC
Muon Data
VBF WW
W+jets
WW/WZ/ZZ
top
Z+Jets
MC Uncertainty
tight lepton
loose ele veto
loose mu veto
loose jets
$P_T(WJ1) > 30$
$P_T(WJ2) > 30$
$P_T(TagJ1) > 30$
$P_T(TagJ2) > 30$
$M_T(W^{lep}) > 30$
tighter lepton
fourJets
$M_{inv}(W^{had}) > 30$
Pfmet > 25
anti-btag on W jets
TMVA Liklihood
MET > 25

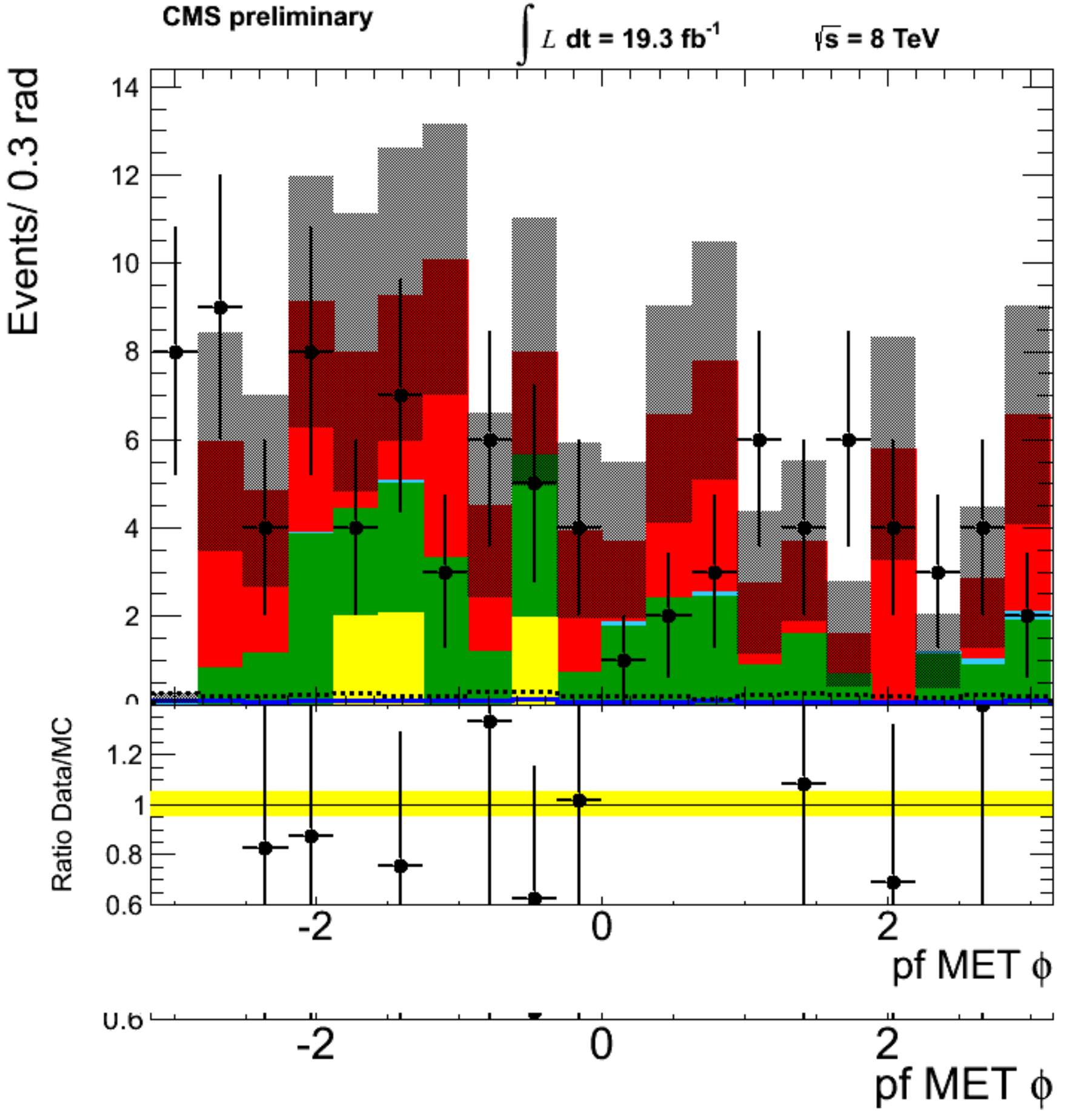

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.1
80
70
60
50
40
30
20
10
0
Ratio Data/MC
1.2
1
0.8
0.6
-1
-0.5
0
0.5
1
Muon Charge
0.6
-1
-0.5
0
0.5
1
Muon Charge

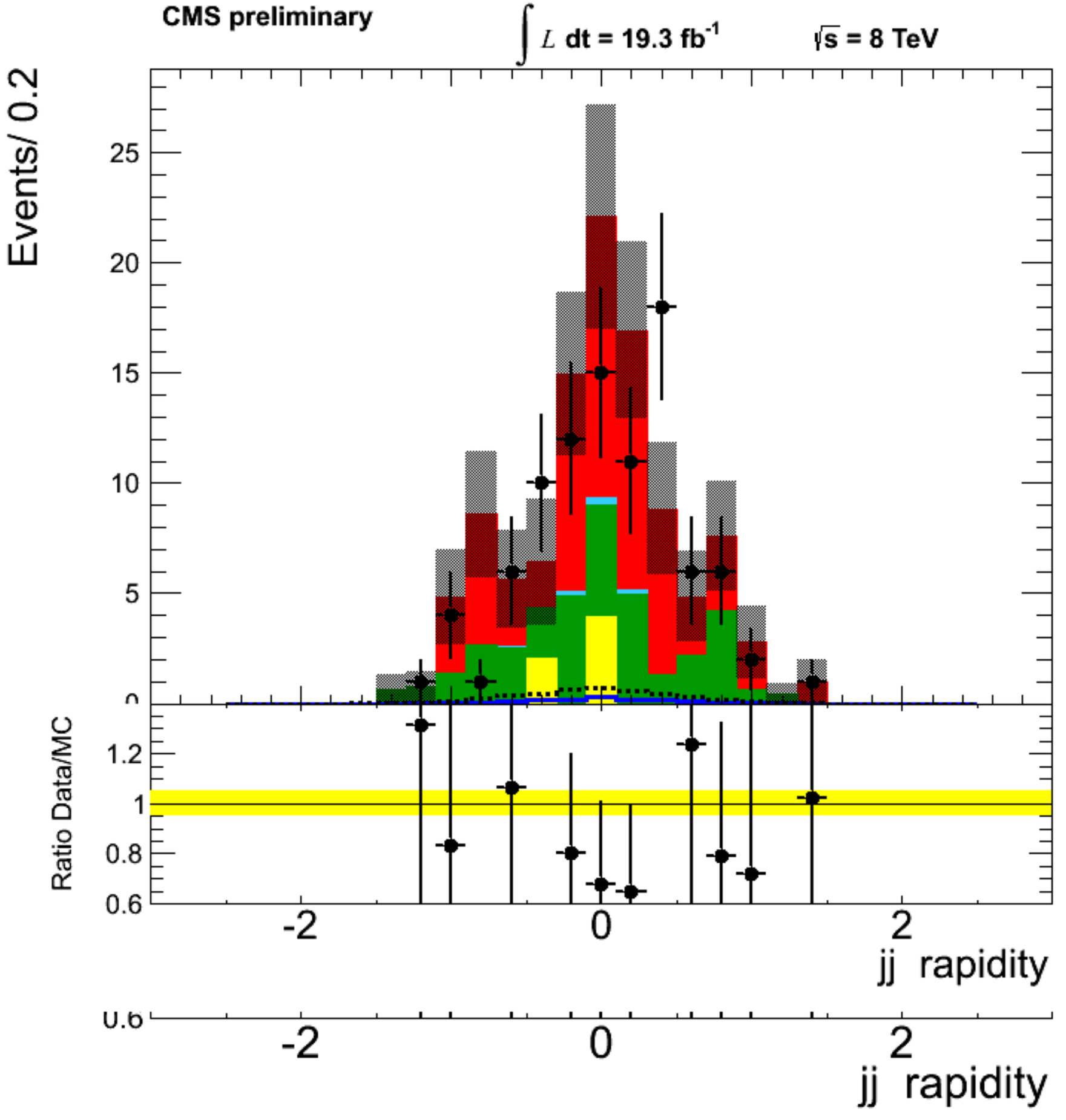

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.1
Ratio Data/MC
hvbf_ZeppenField
hvbf_ZeppenField

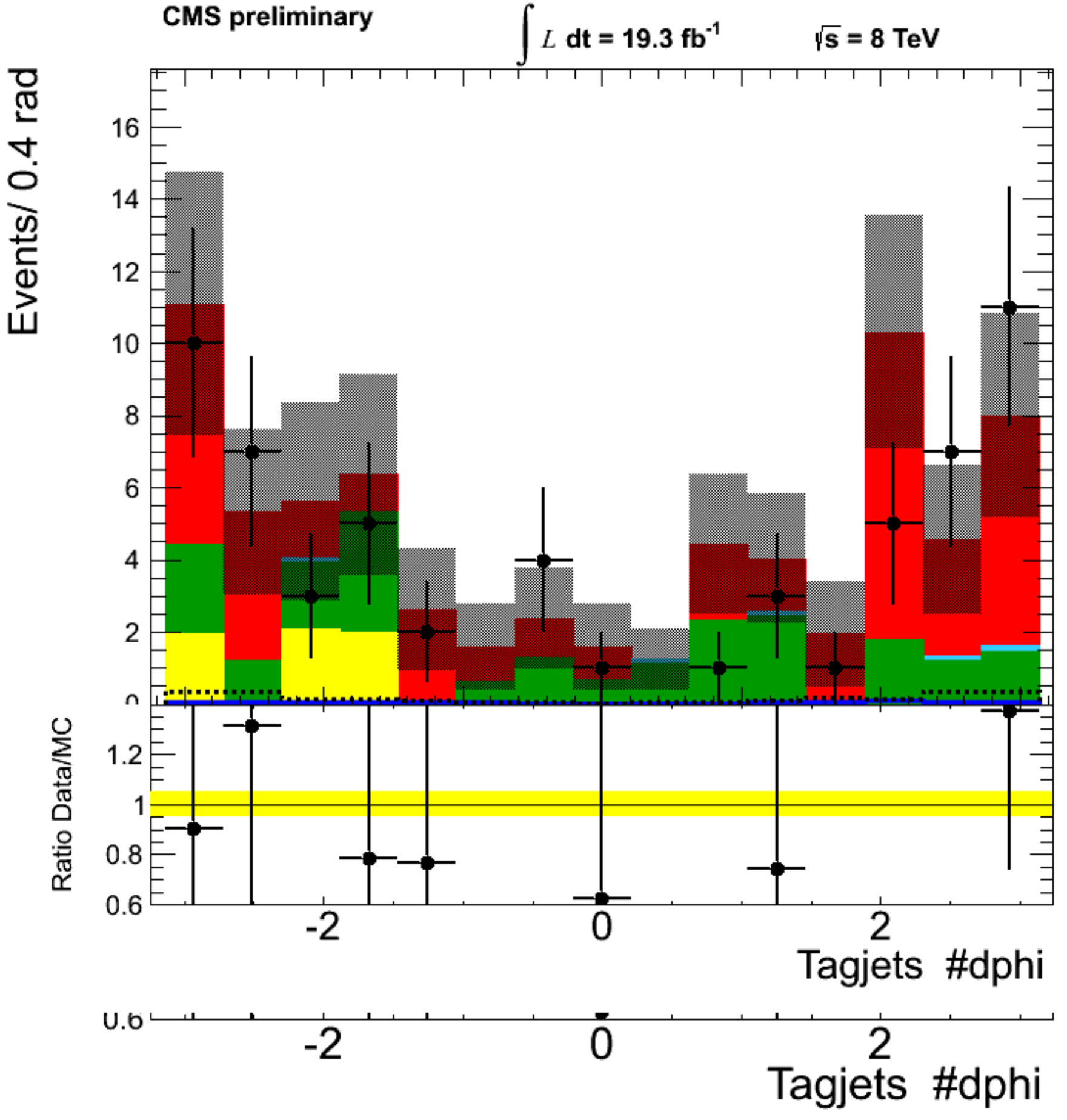

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.4 rad
Ratio Data/MC
Tagjet1 Φ (rad)
Tagjet1 Φ (rad)

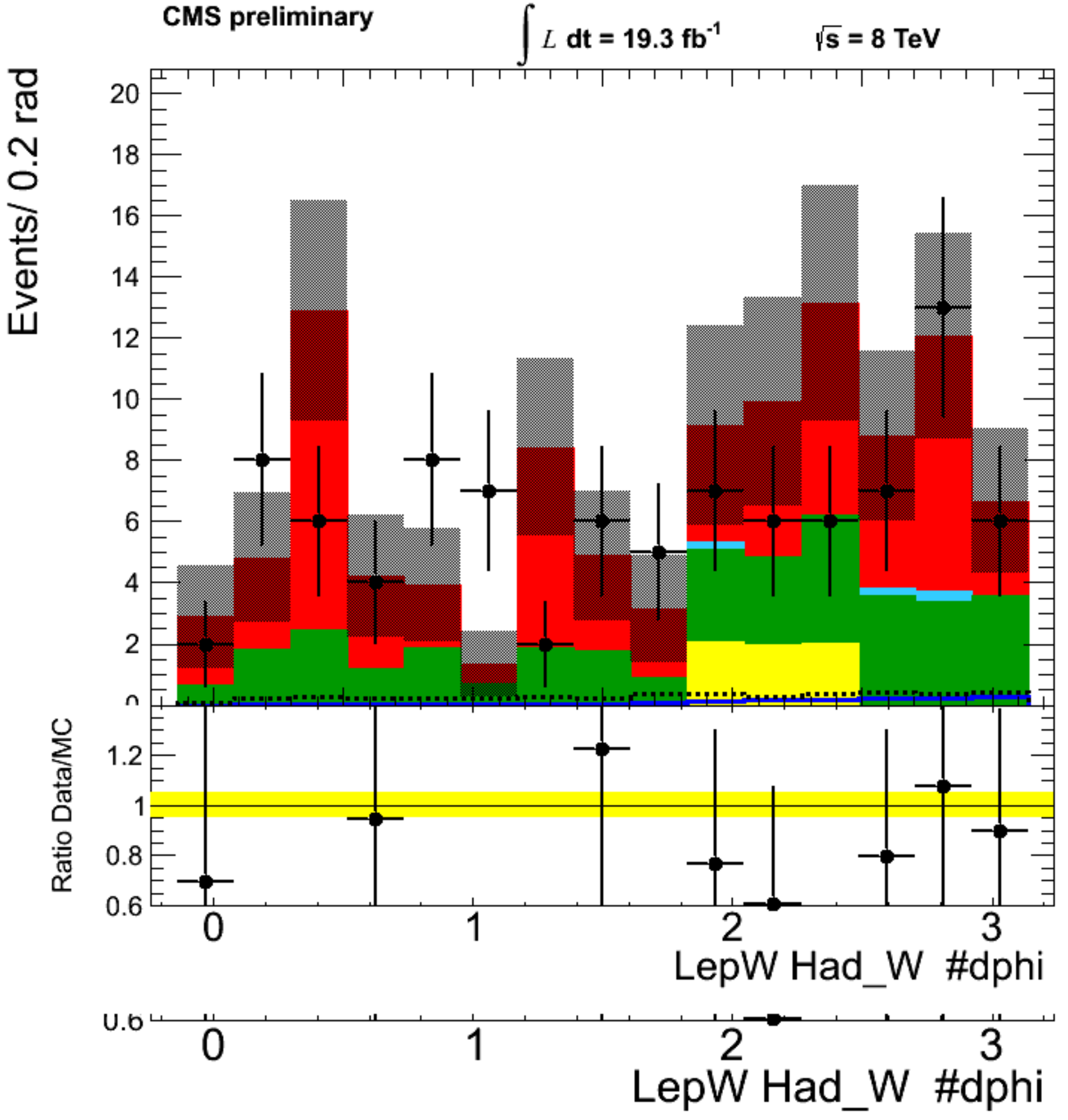

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4 rad
Ratio Data/MC
Tagjet2 Φ (rad)
Tagjet2 Φ (rad)

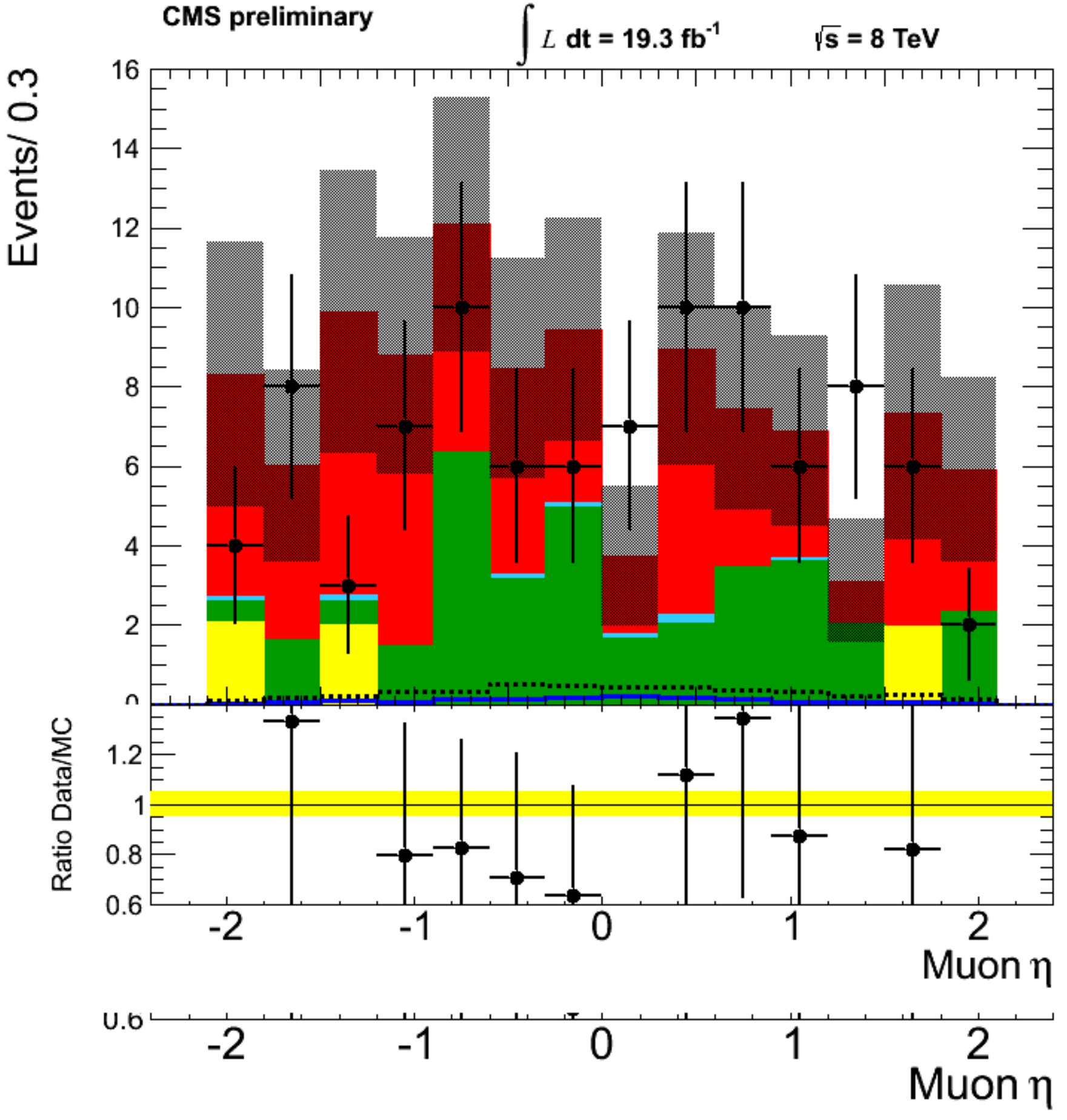

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 10 GeV
Ratio Data/MC
pf MET (GeV)
pf MET (GeV)

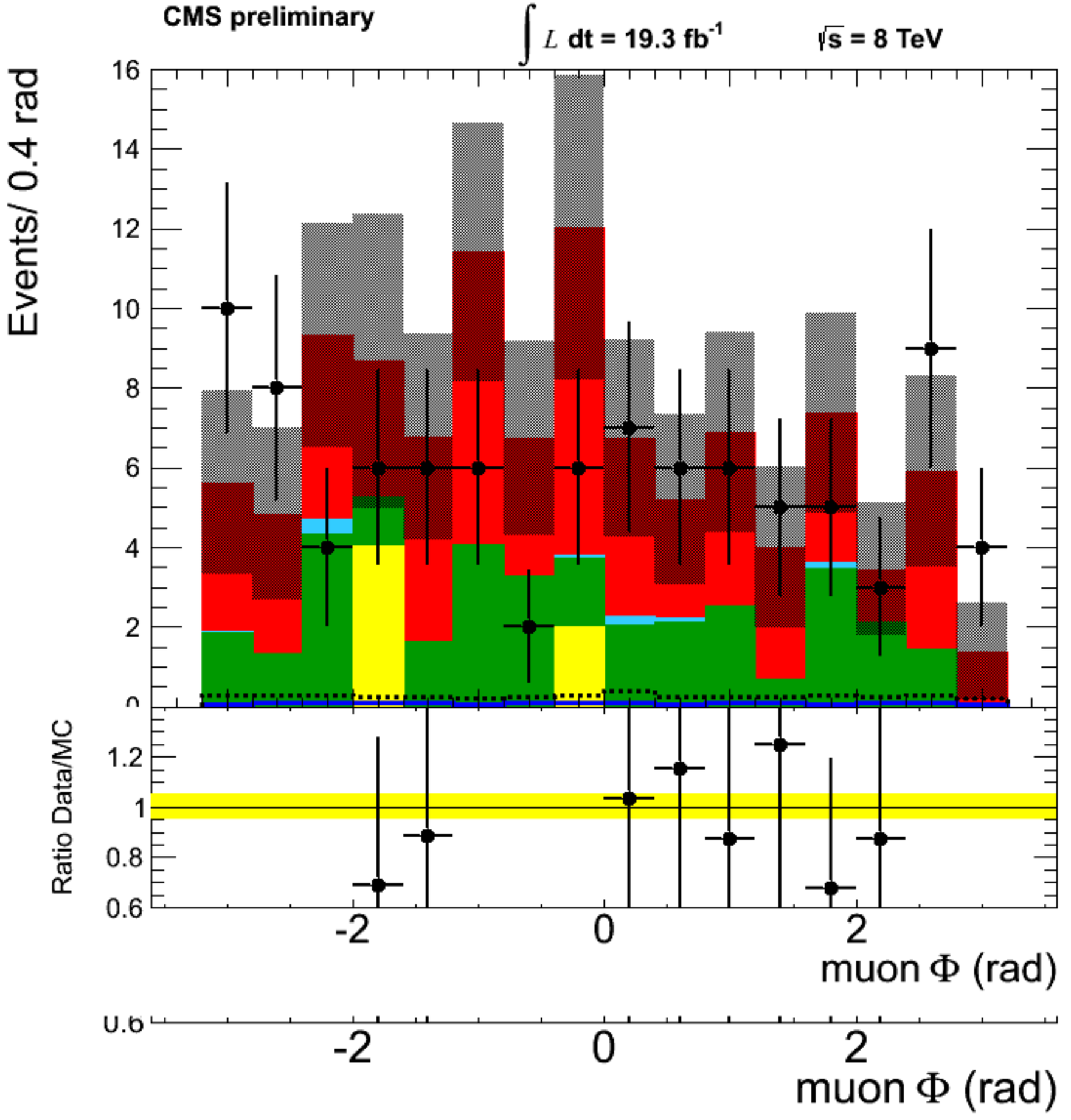

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.3 rad
Ratio Data/MC
pf MET ϕ
pf MET ϕ

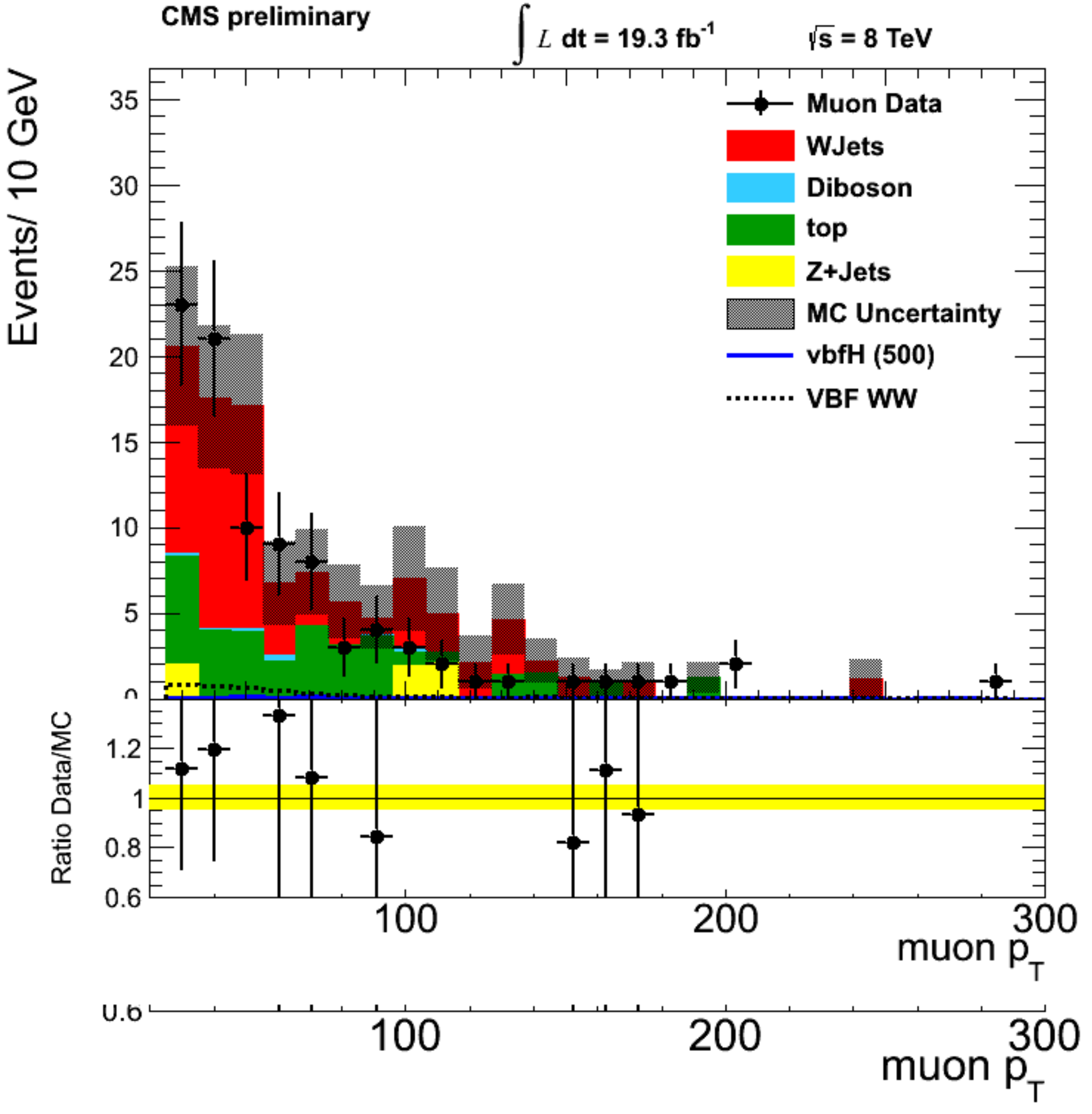

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.2
25
20
15
10
5
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
jj rapidity
0.6
-2
0
2
jj rapidity

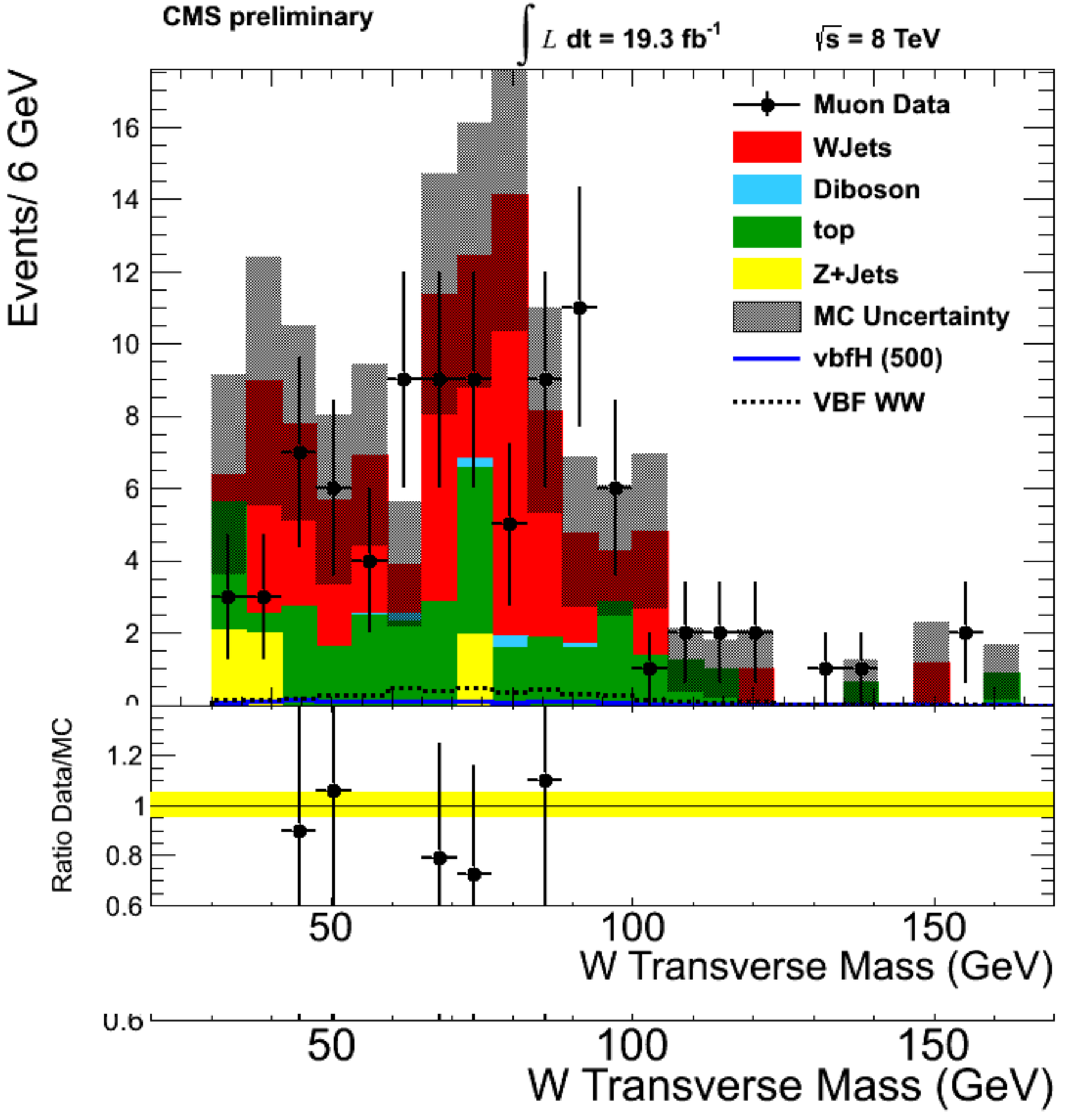

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.4 rad
16
14
12
10
8
6
4
2
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
Tagjets #dphi
0.6
-2
0
2
Tagjets #dphi

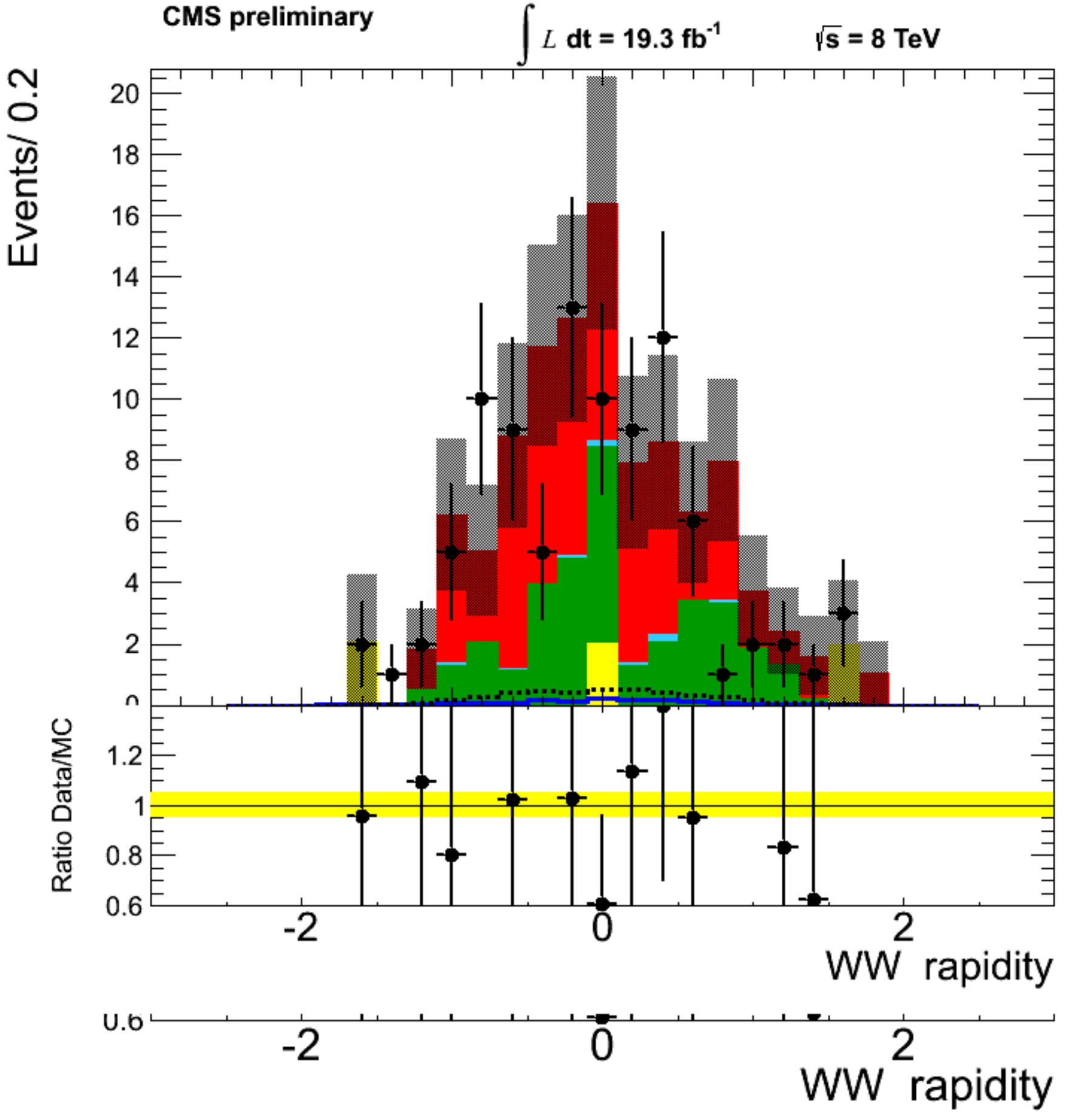

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.2 rad
Ratio Data/MC
LepW Had_W #dphi
LepW Had_W #dphi

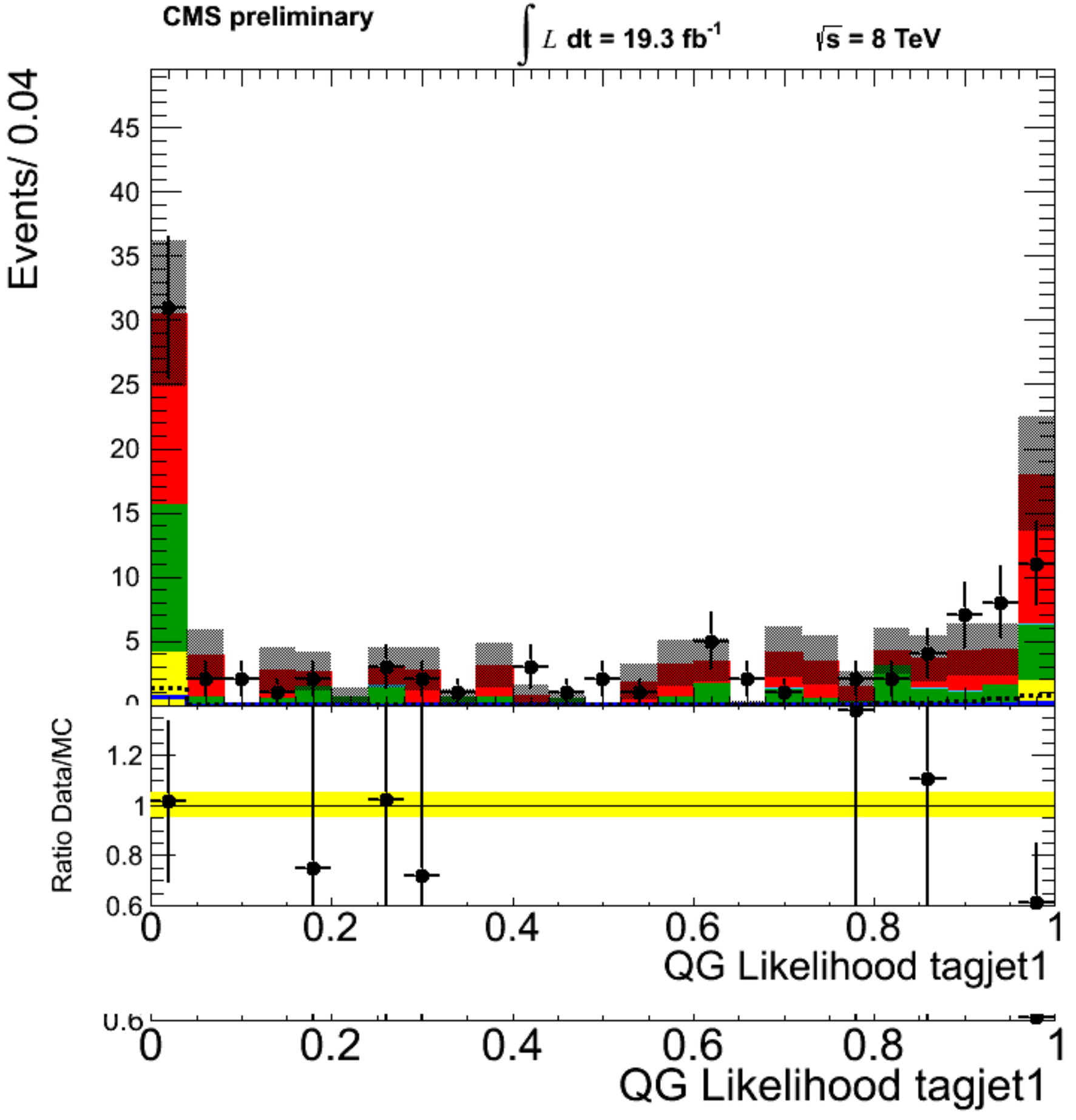

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.3
Ratio Data/MC
Muon η
Muon η

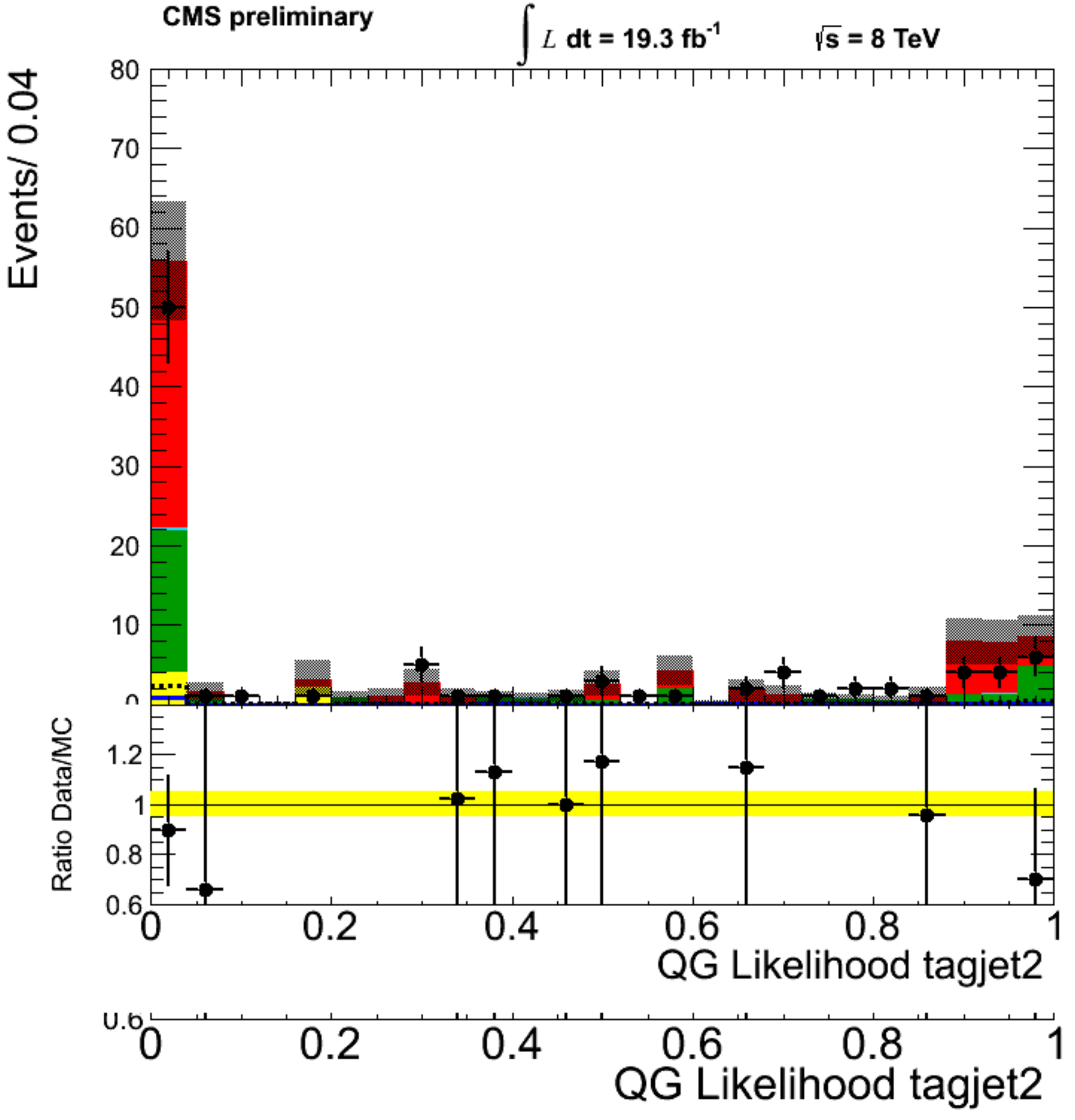

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4 rad
Ratio Data/MC
muon Φ (rad)
muon Φ (rad)

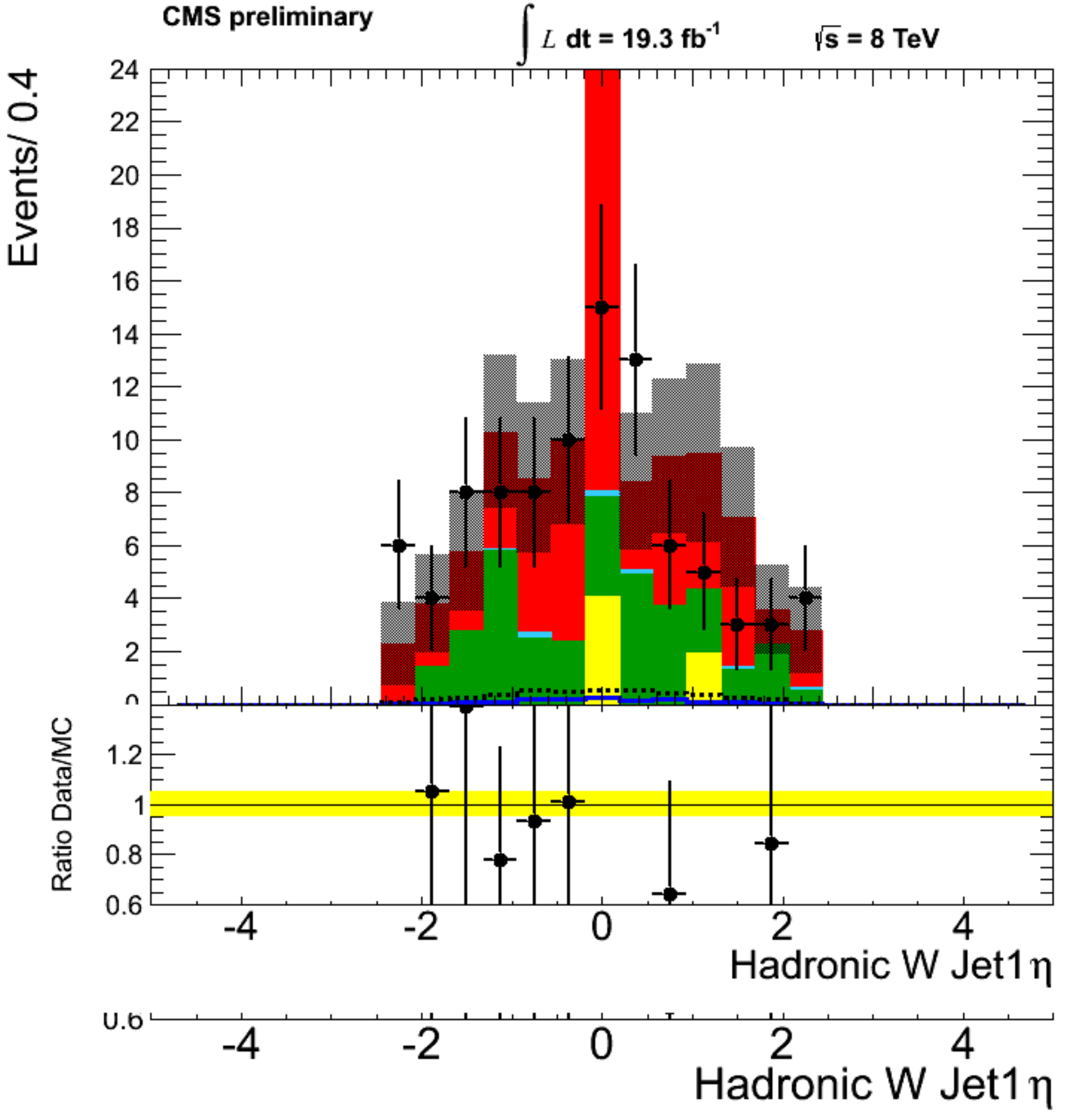

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 10 GeV
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
muon p_T
muon p_T

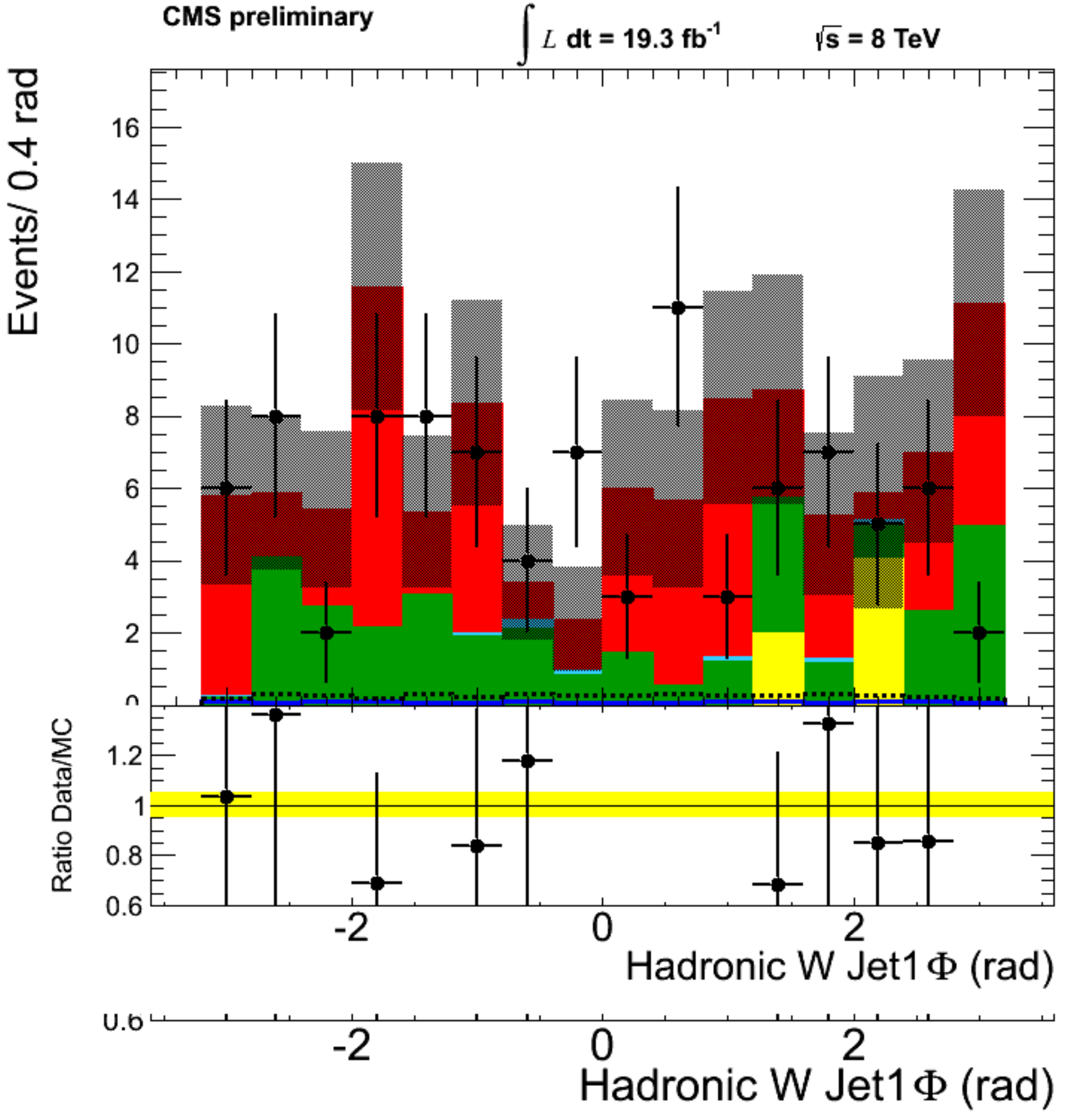

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 6 GeV
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
W Transverse Mass (GeV)
W Transverse Mass (GeV)

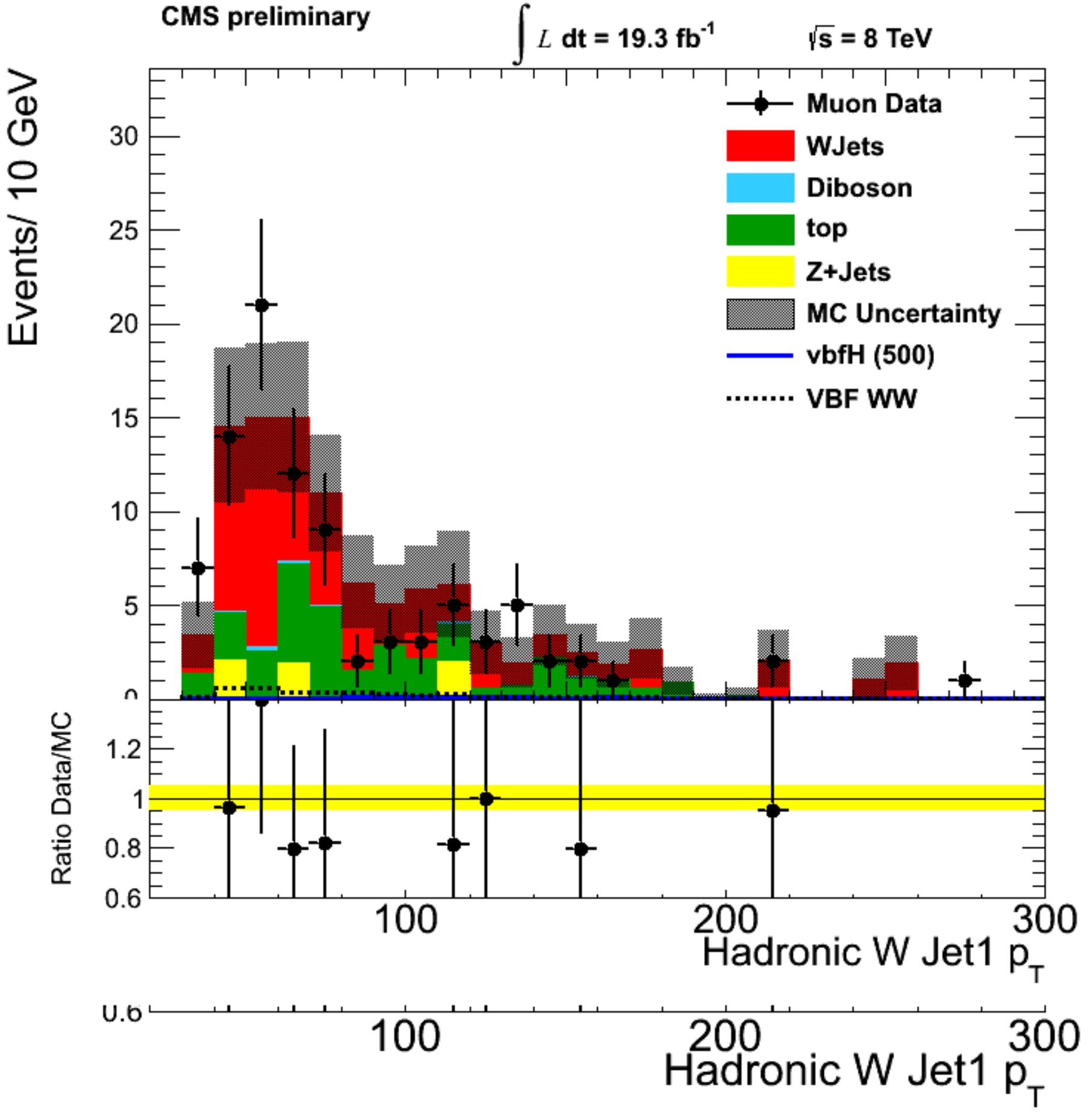

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s}$ = 8 TeV
Events/ 0.2
Ratio Data/MC
WW rapidity
WW rapidity

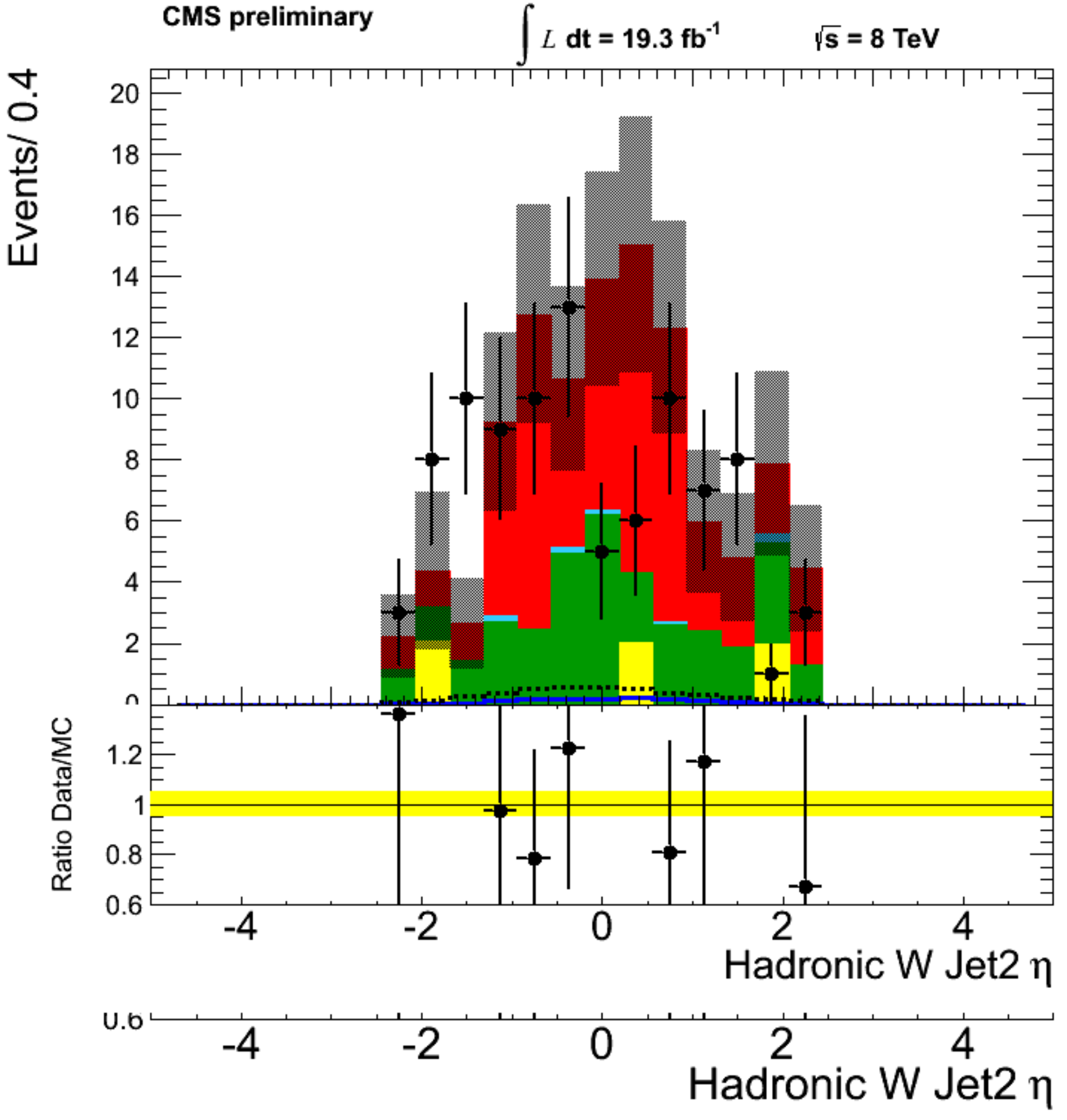

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.04
Ratio Data/MC
QG Likelihood tagjet1
QG Likelihood tagjet1

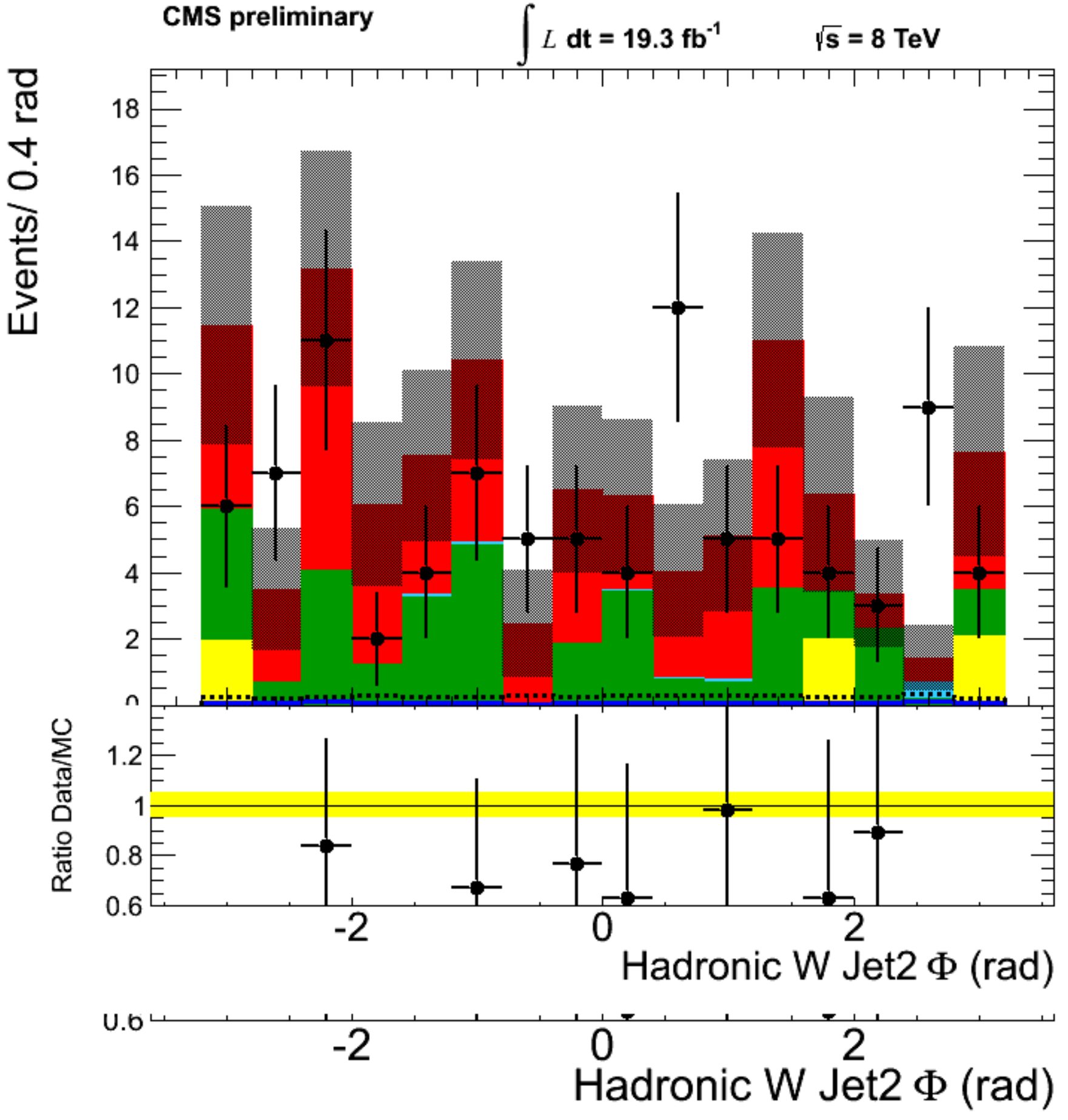

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.04
Ratio Data/MC
QG Likelihood tagjet2
QG Likelihood tagjet2

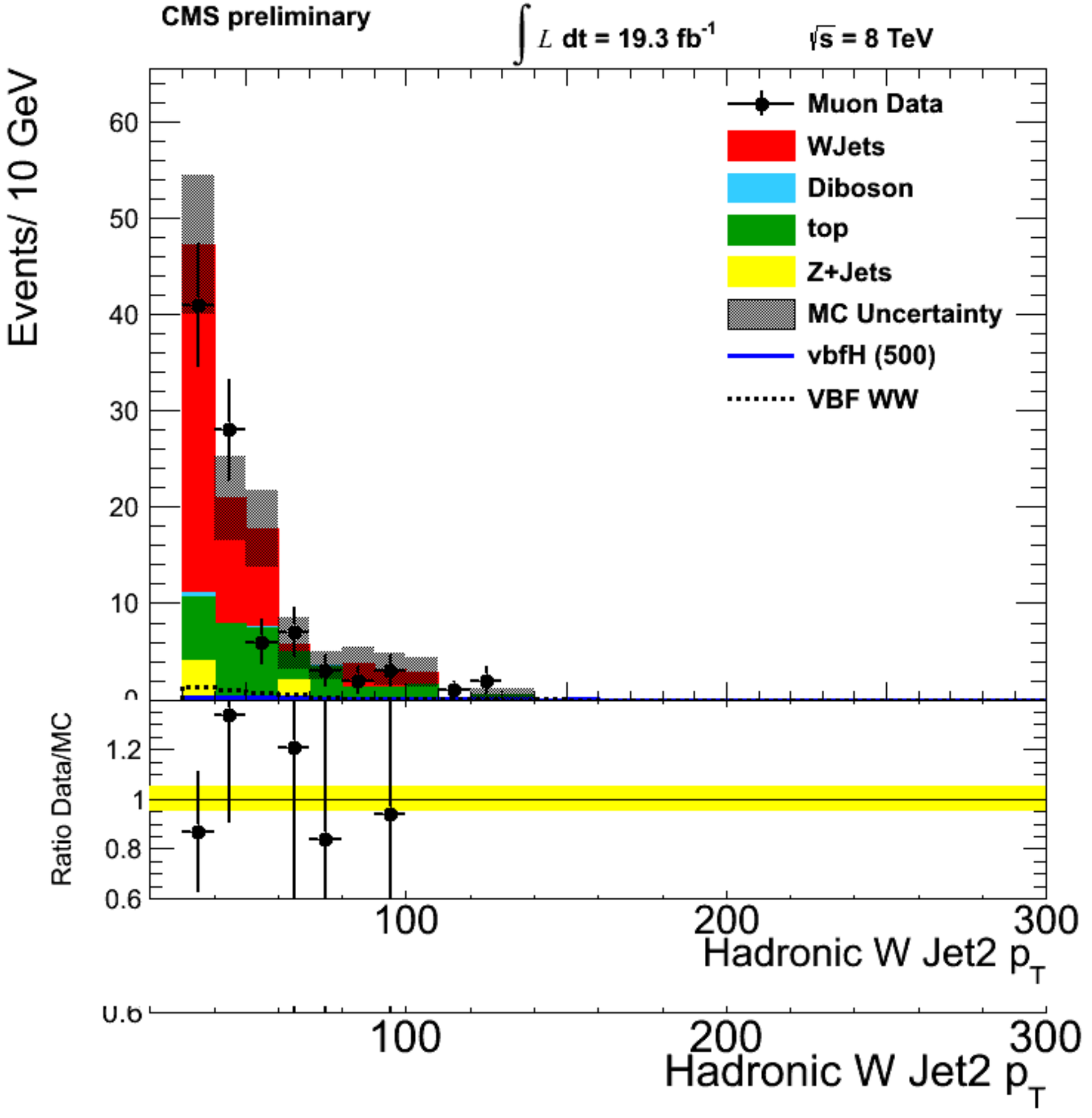

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.4
Ratio Data/MC
Hadronic W Jet1 η
Hadronic W Jet1 η

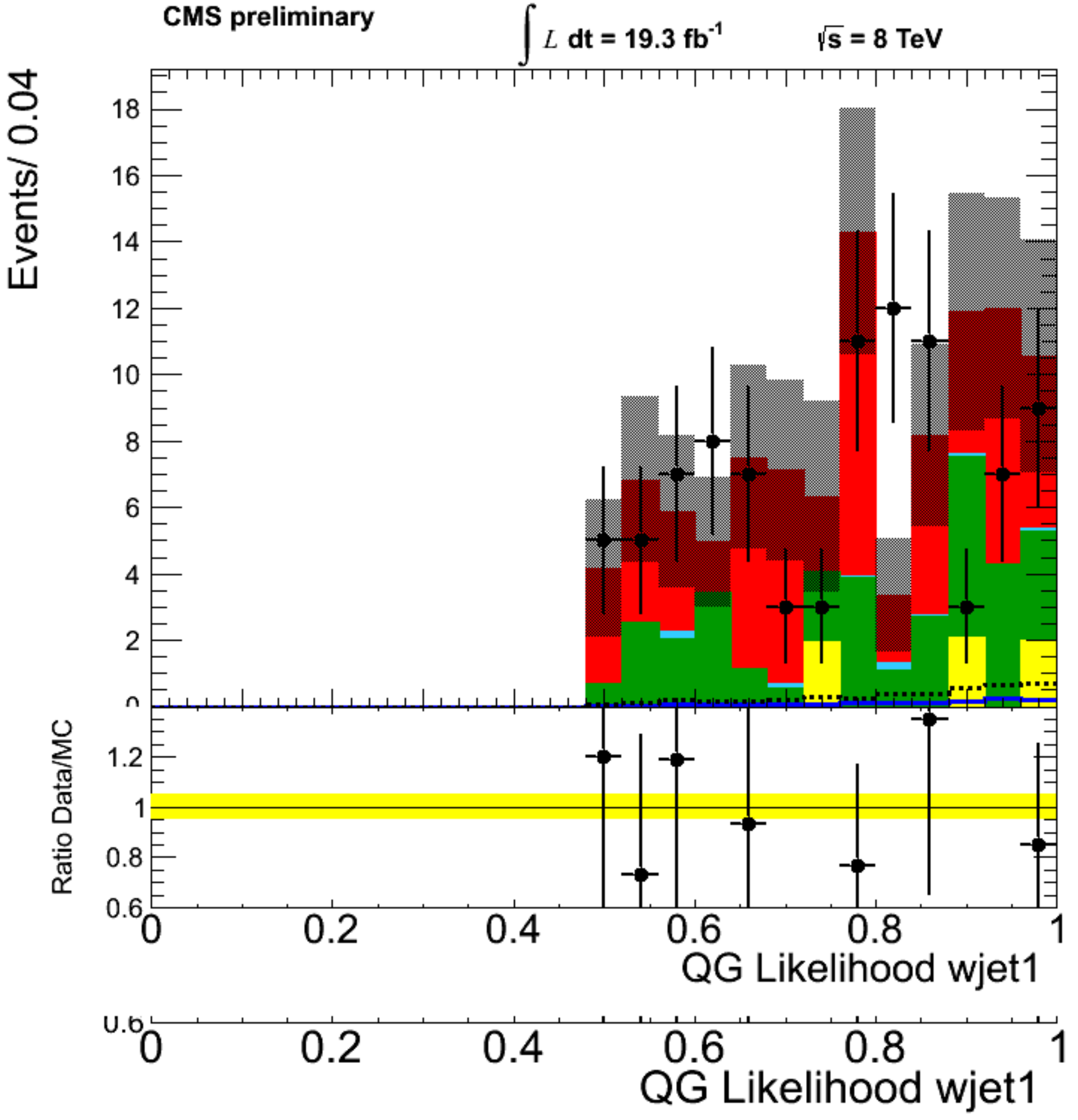

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4 rad
Ratio Data/MC
Hadronic W Jet1 Φ (rad)
Hadronic W Jet1 Φ (rad)

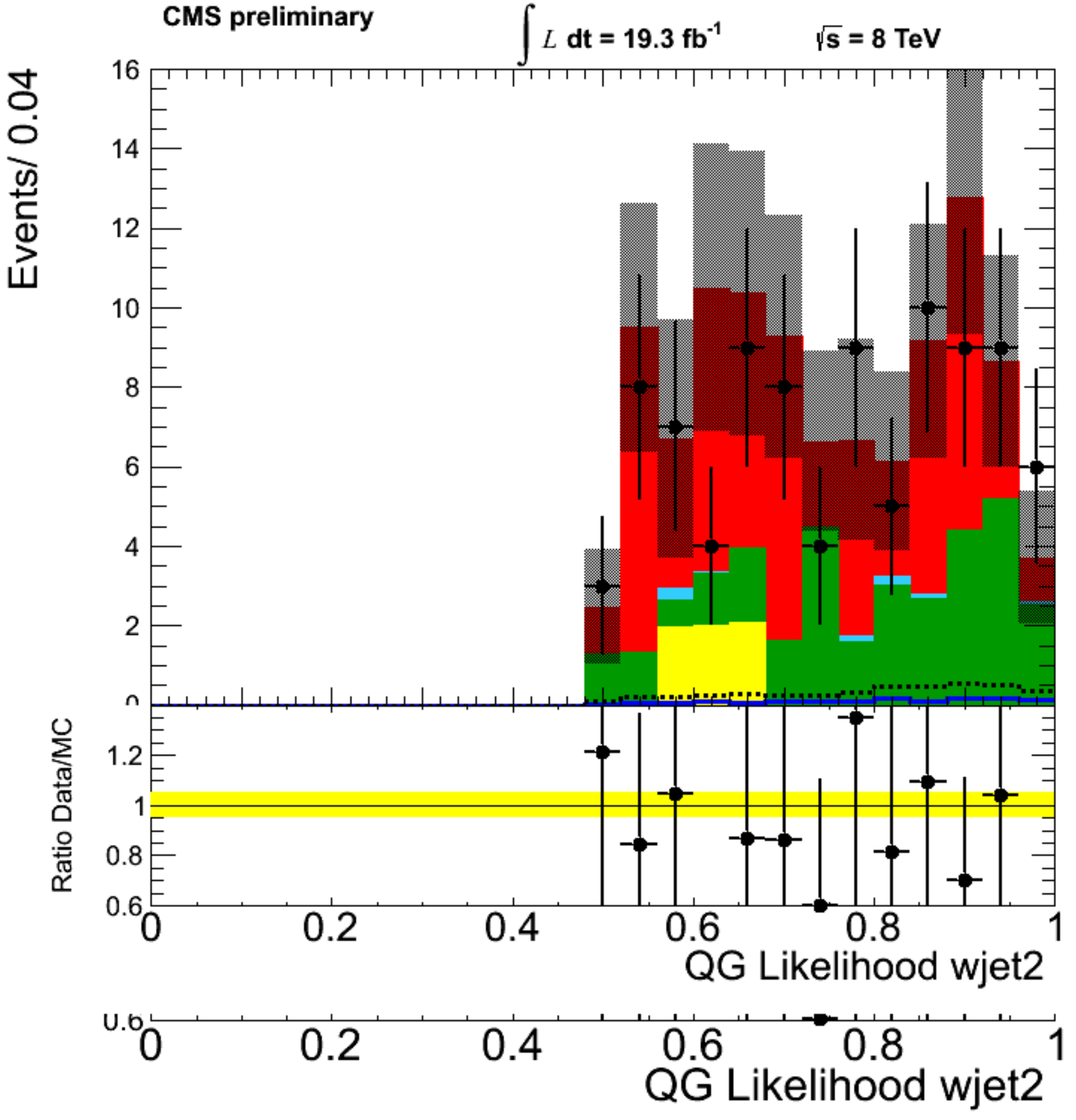

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 10 GeV
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
Hadronic W Jet1 p_T
Hadronic W Jet1 p_T

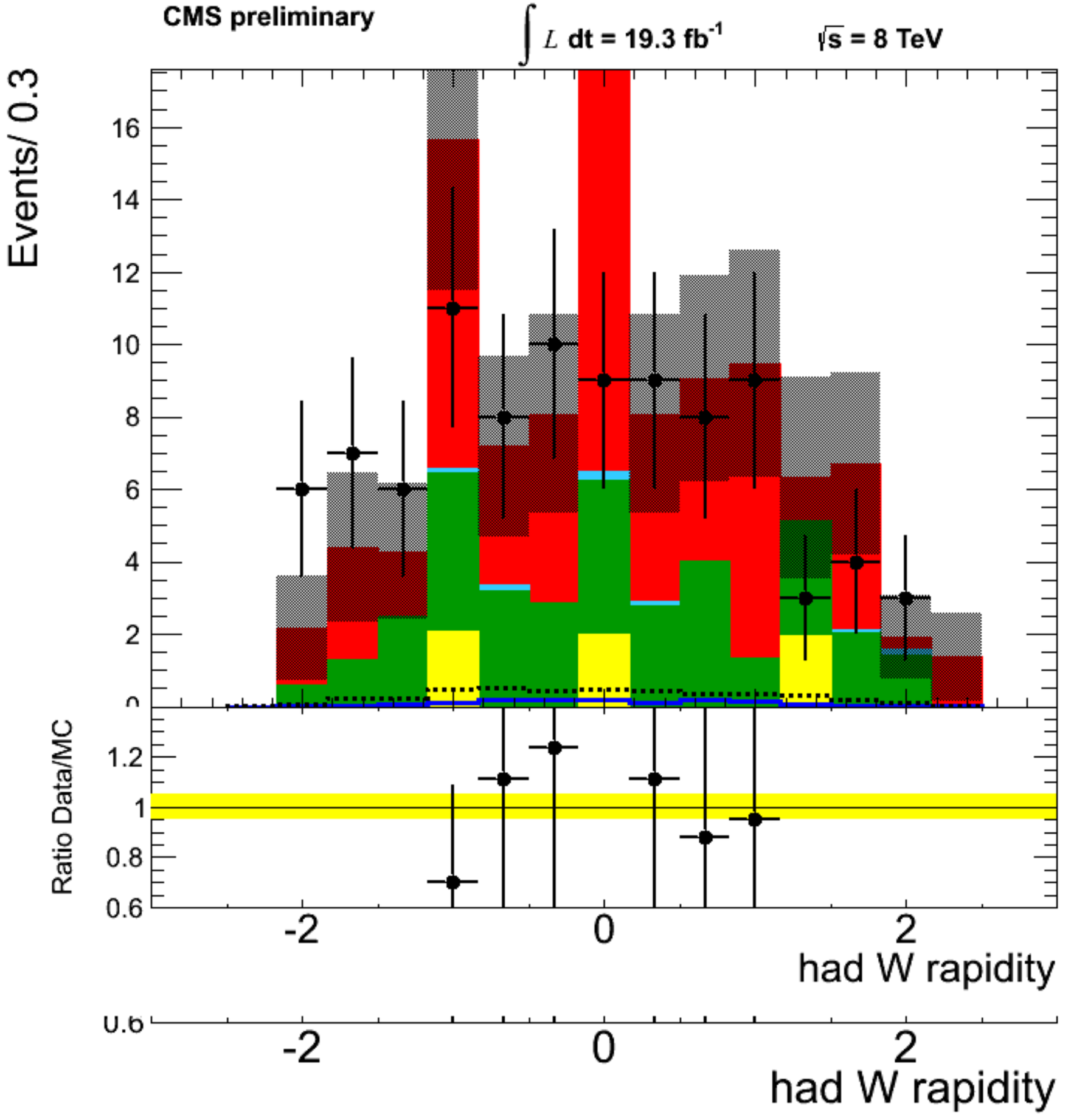

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.4
Ratio Data/MC
Hadronic W Jet2 η
Hadronic W Jet2 η

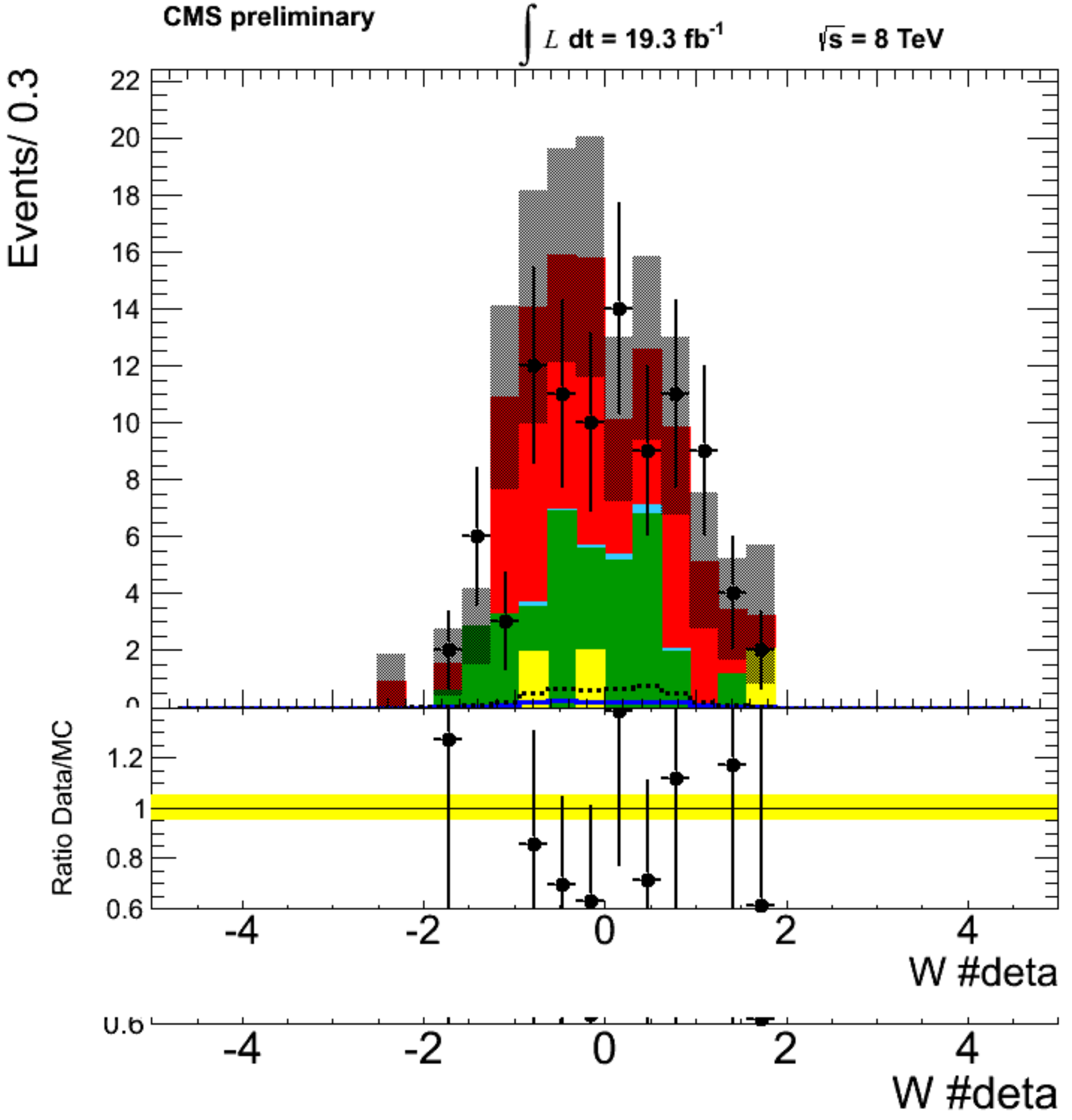

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4 rad
Ratio Data/MC
Hadronic W Jet2 Φ (rad)
Hadronic W Jet2 Φ (rad)

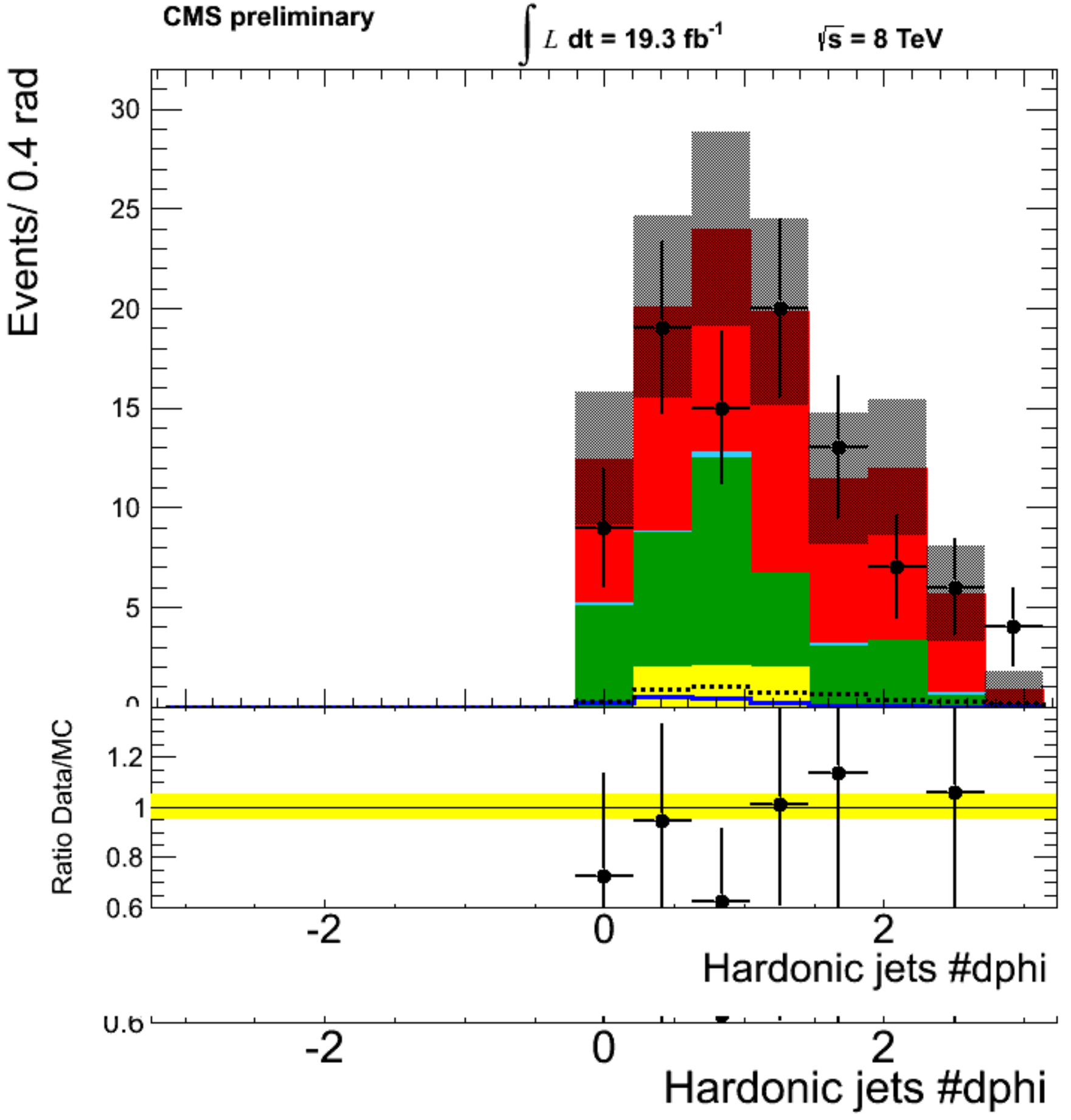

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 10 GeV
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
Hadronic W Jet2 p_T
Hadronic W Jet2 p_T

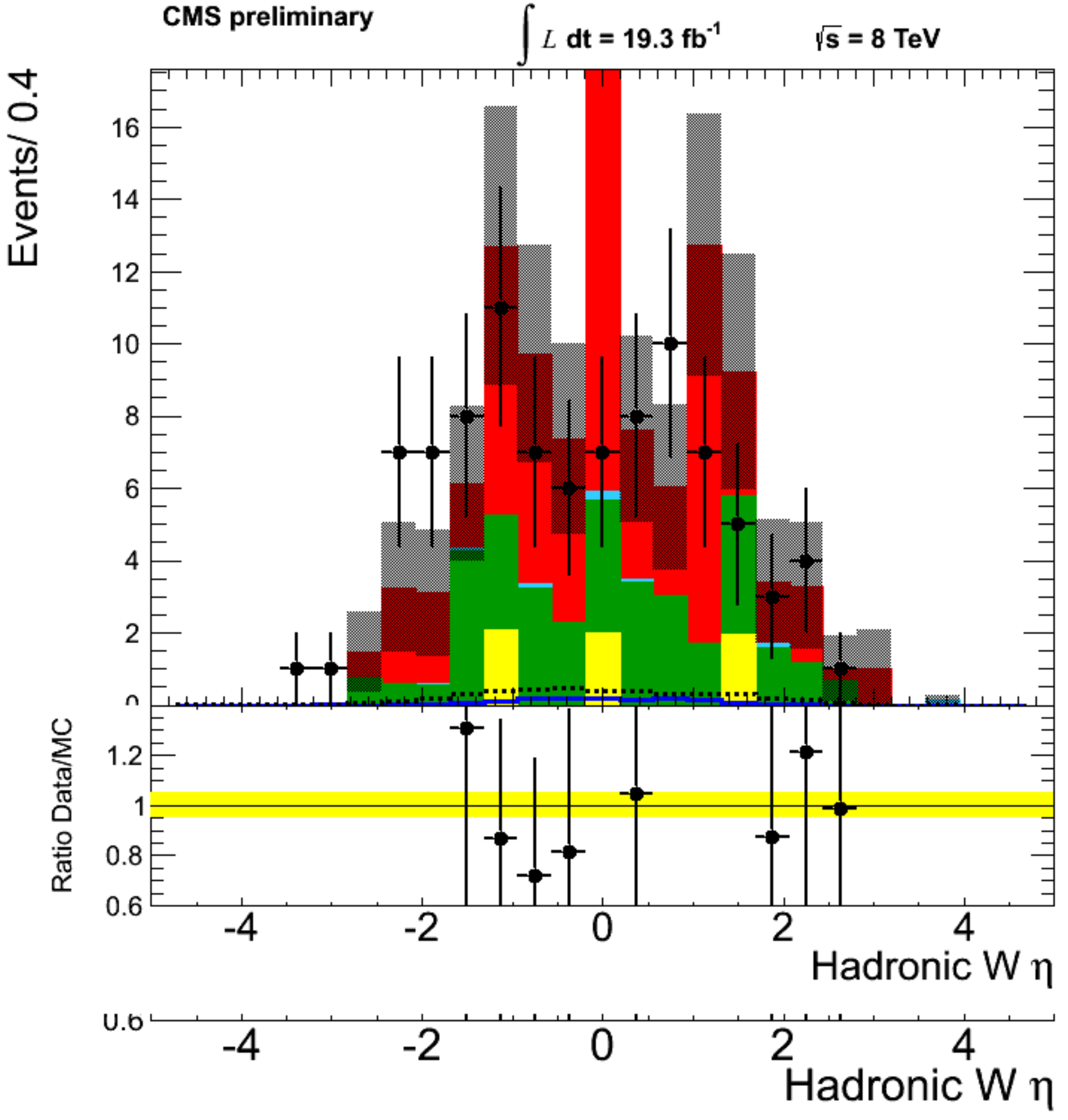

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.04
Ratio Data/MC
QG Likelihood wjet1
QG Likelihood wjet1

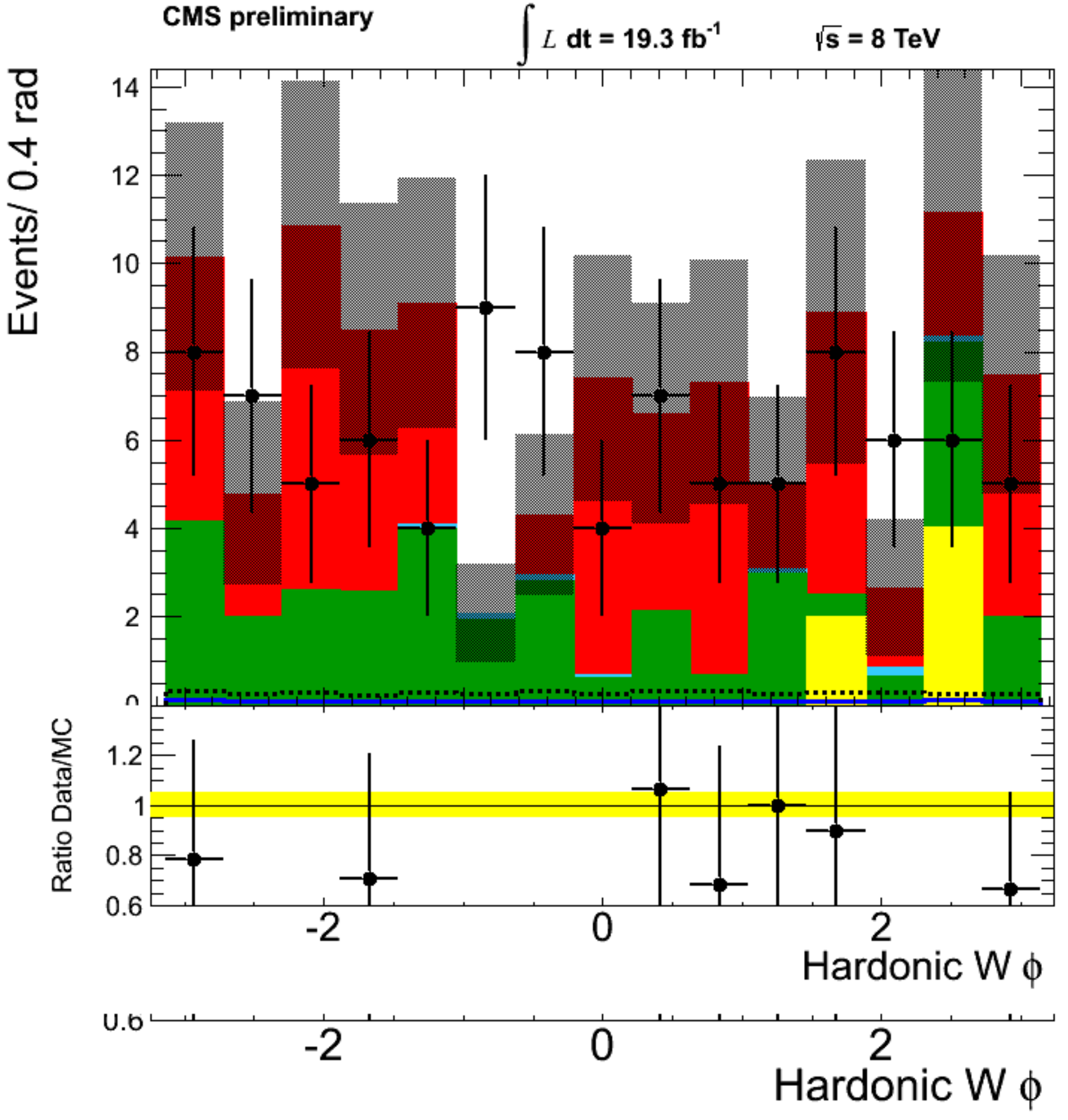

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.04
Ratio Data/MC
QG Likelihood wjet2
QG Likelihood wjet2

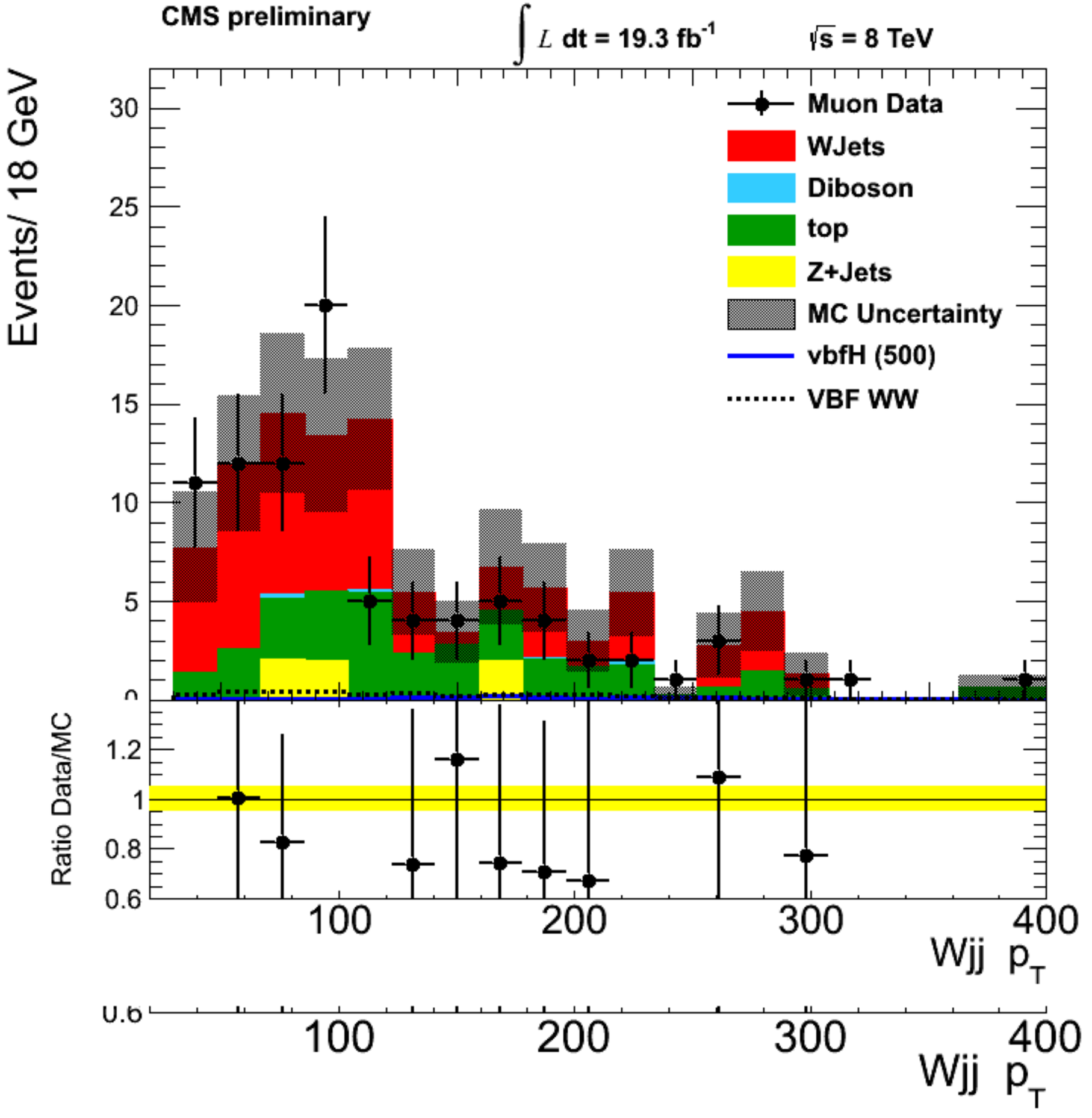

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.3
Ratio Data/MC
had W rapidity
had W rapidity

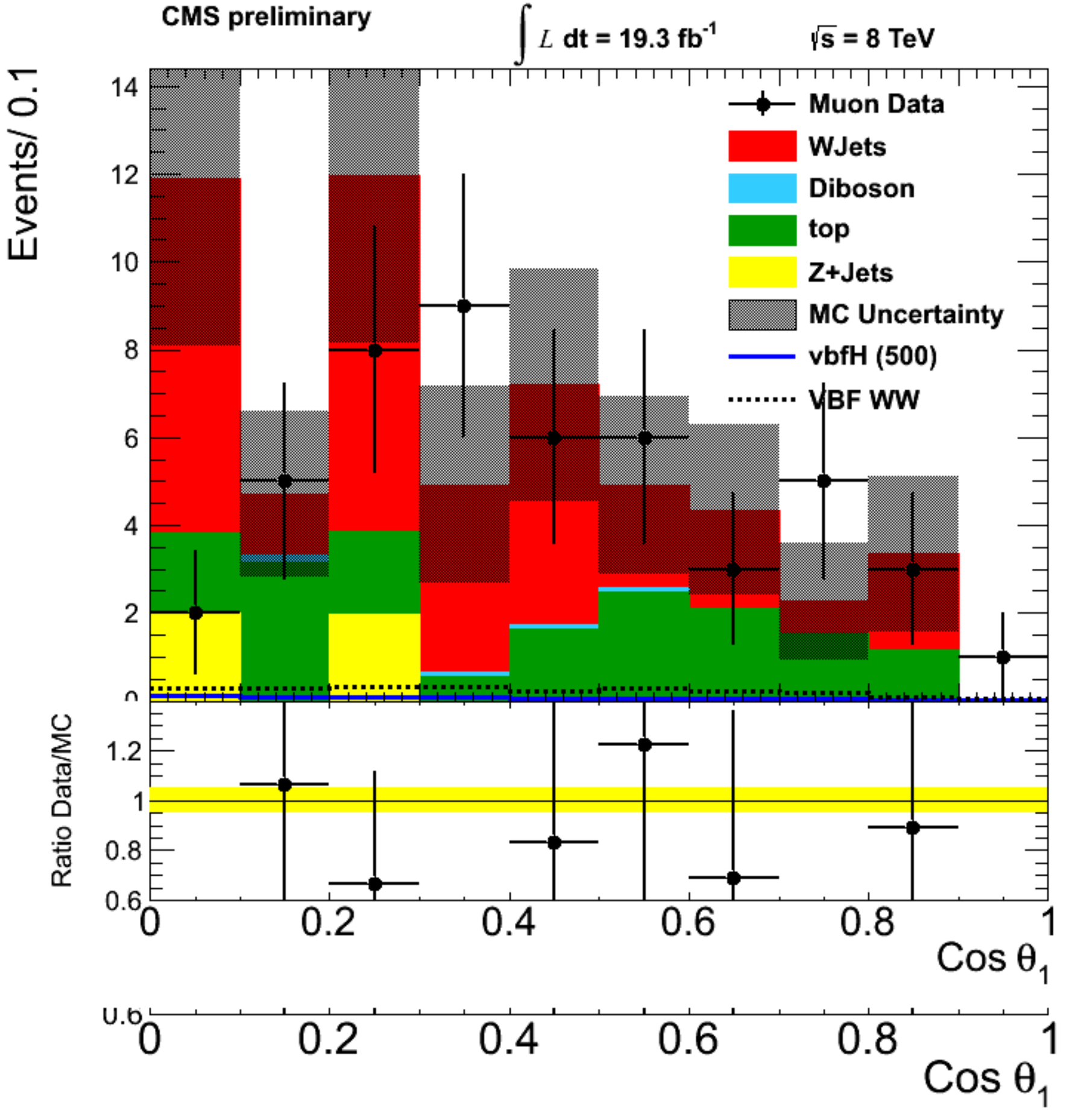

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.3
Ratio Data/MC
W #deta
W #deta

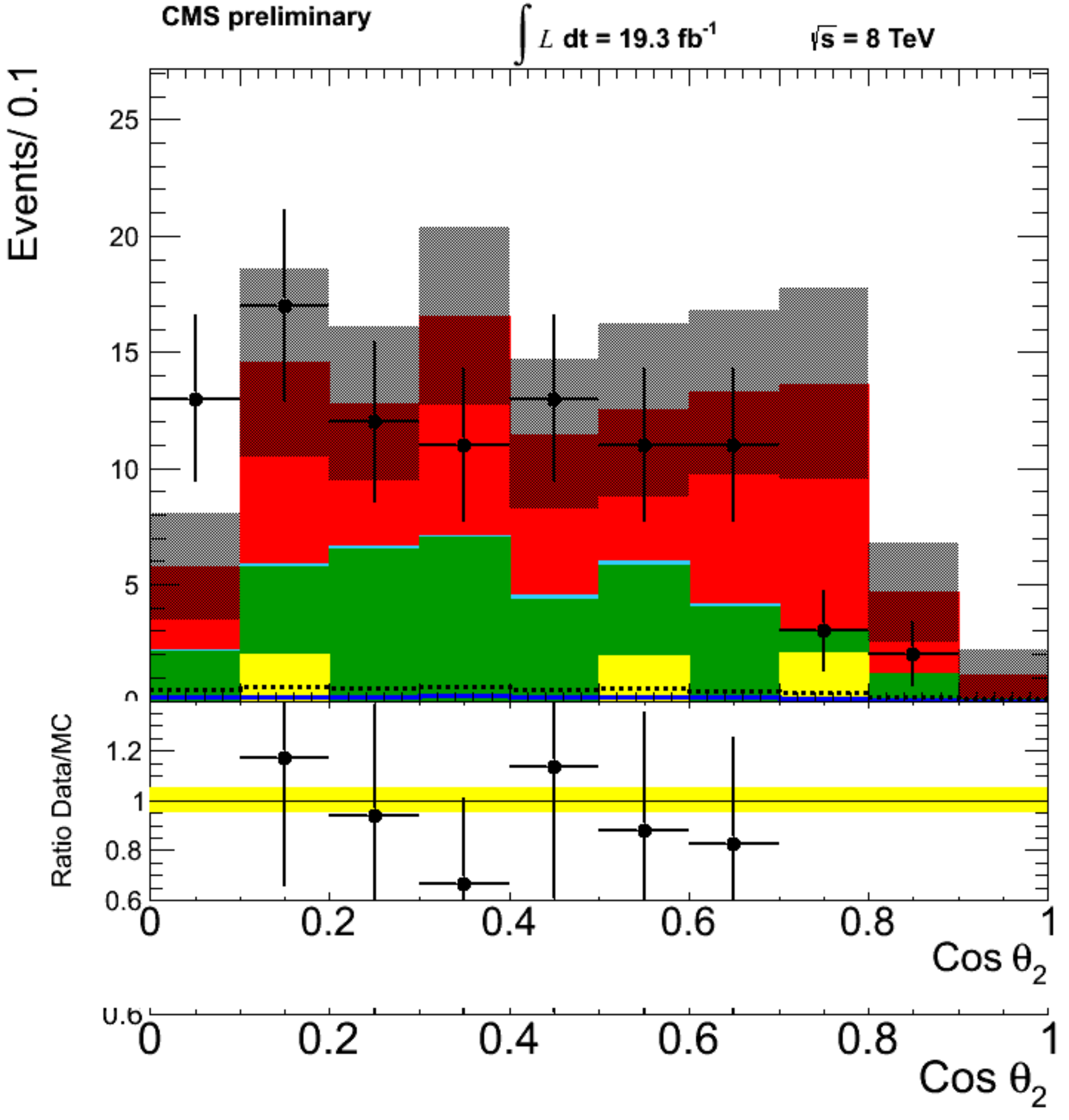

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4 rad
30
25
20
15
10
5
Ratio Data/MC
1.2
1
0.8
0.6
-2
0
2
Hardonic jets #dphi
0.6
-2
0
2
Hardonic jets #dphi

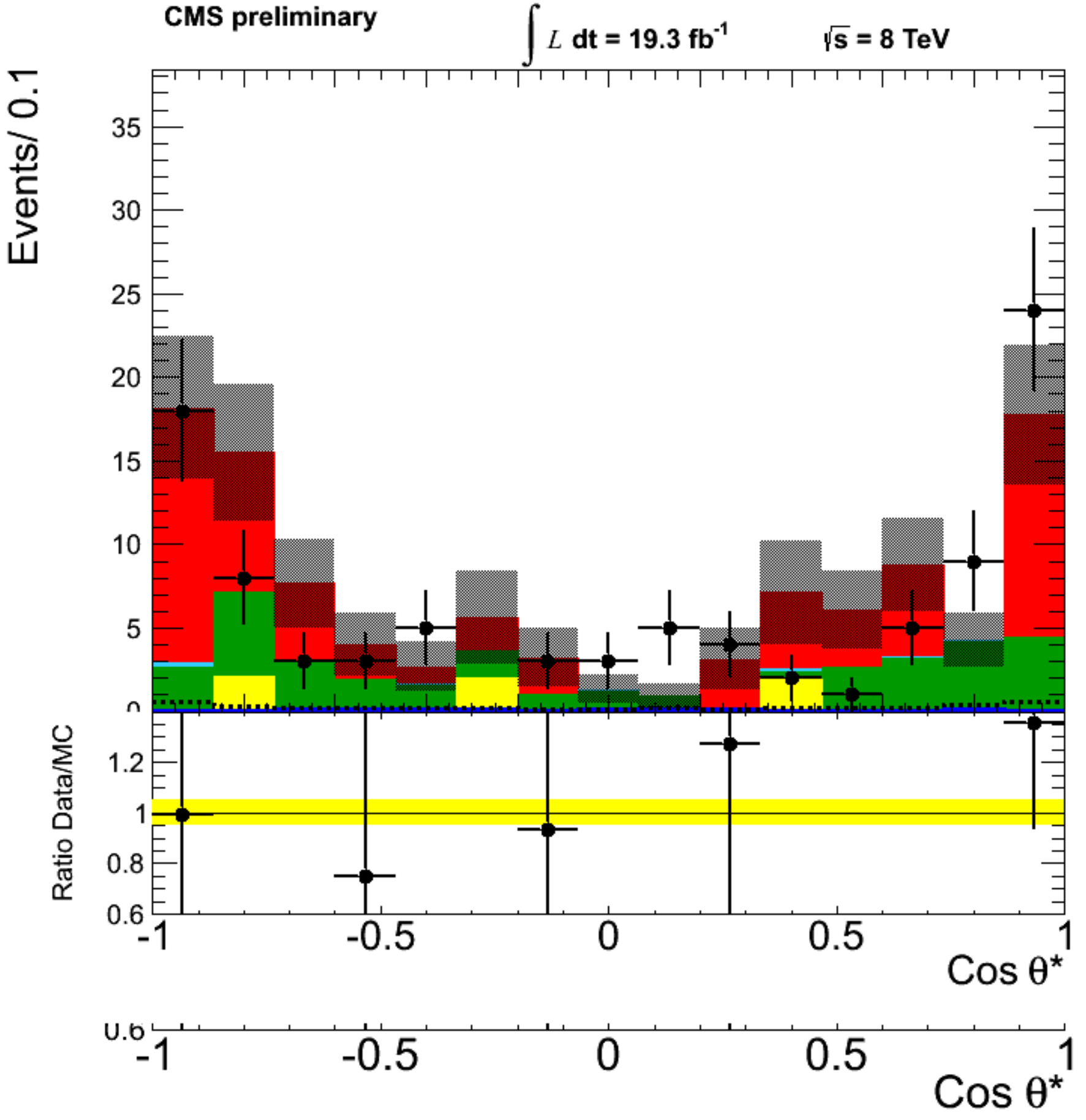

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4
Ratio Data/MC
Hadronic W η
Hadronic W η

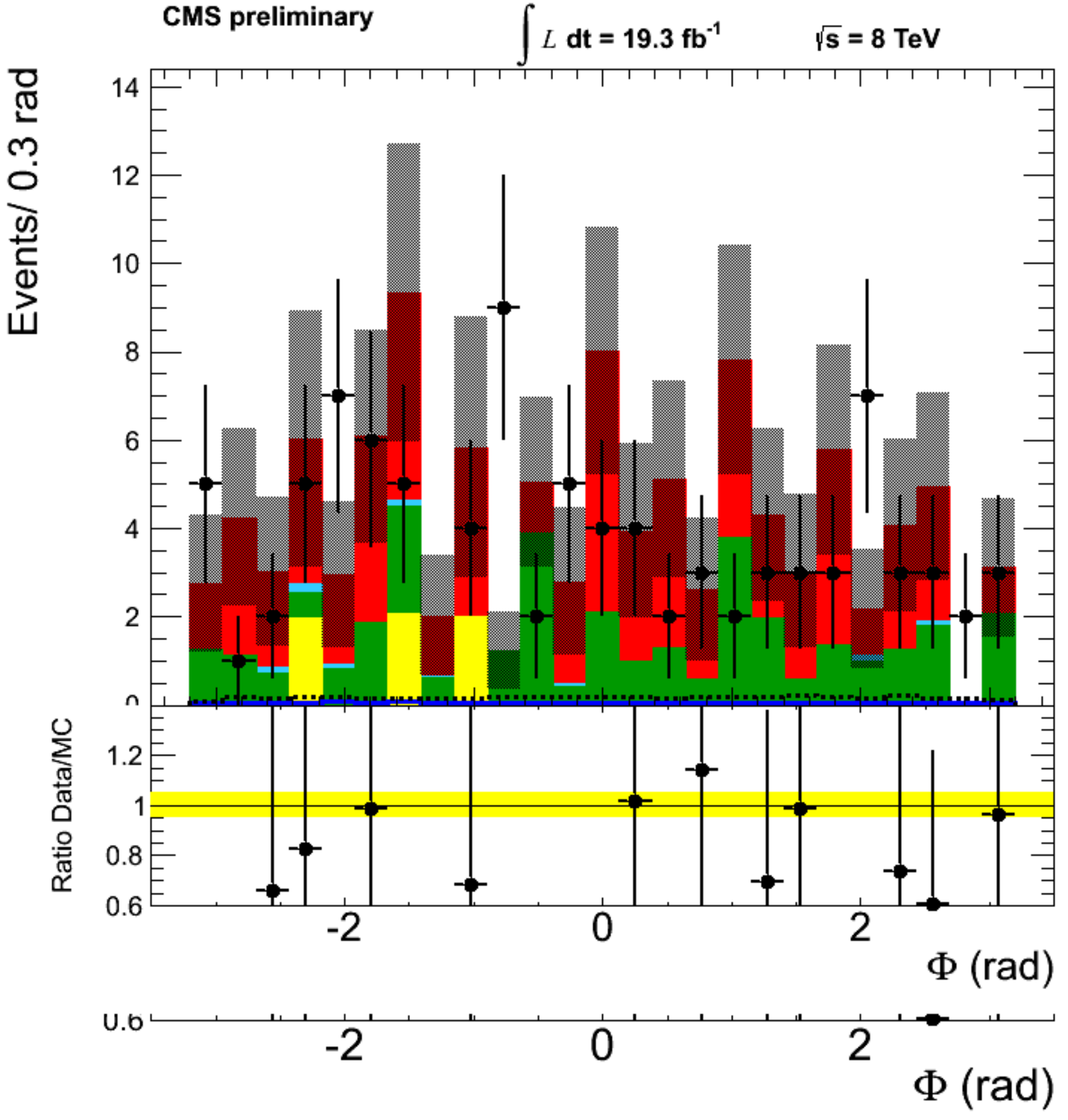

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.4 rad
Ratio Data/MC
Hardonic W ϕ
Hardonic W ϕ

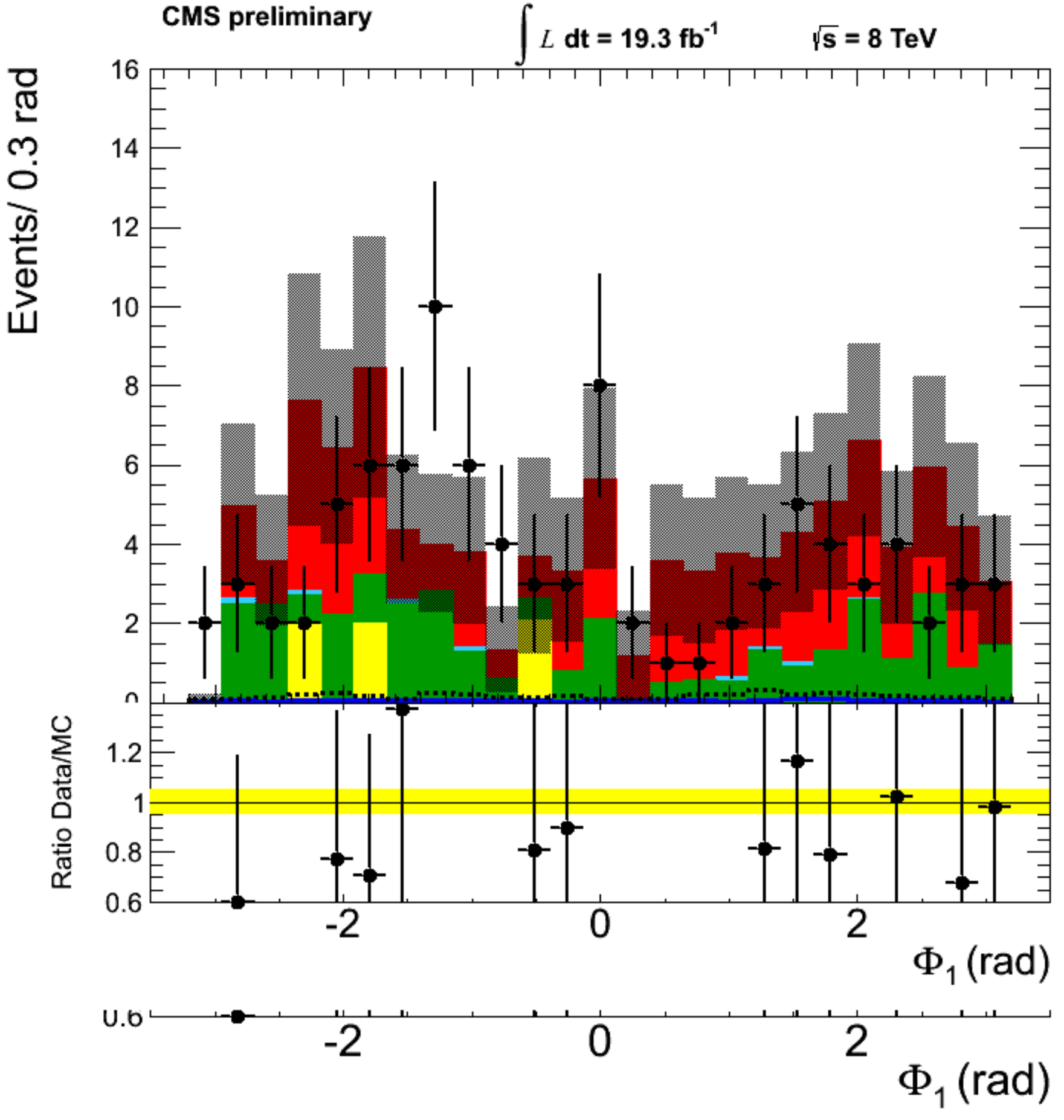

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 18 GeV
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
Wjj p_T

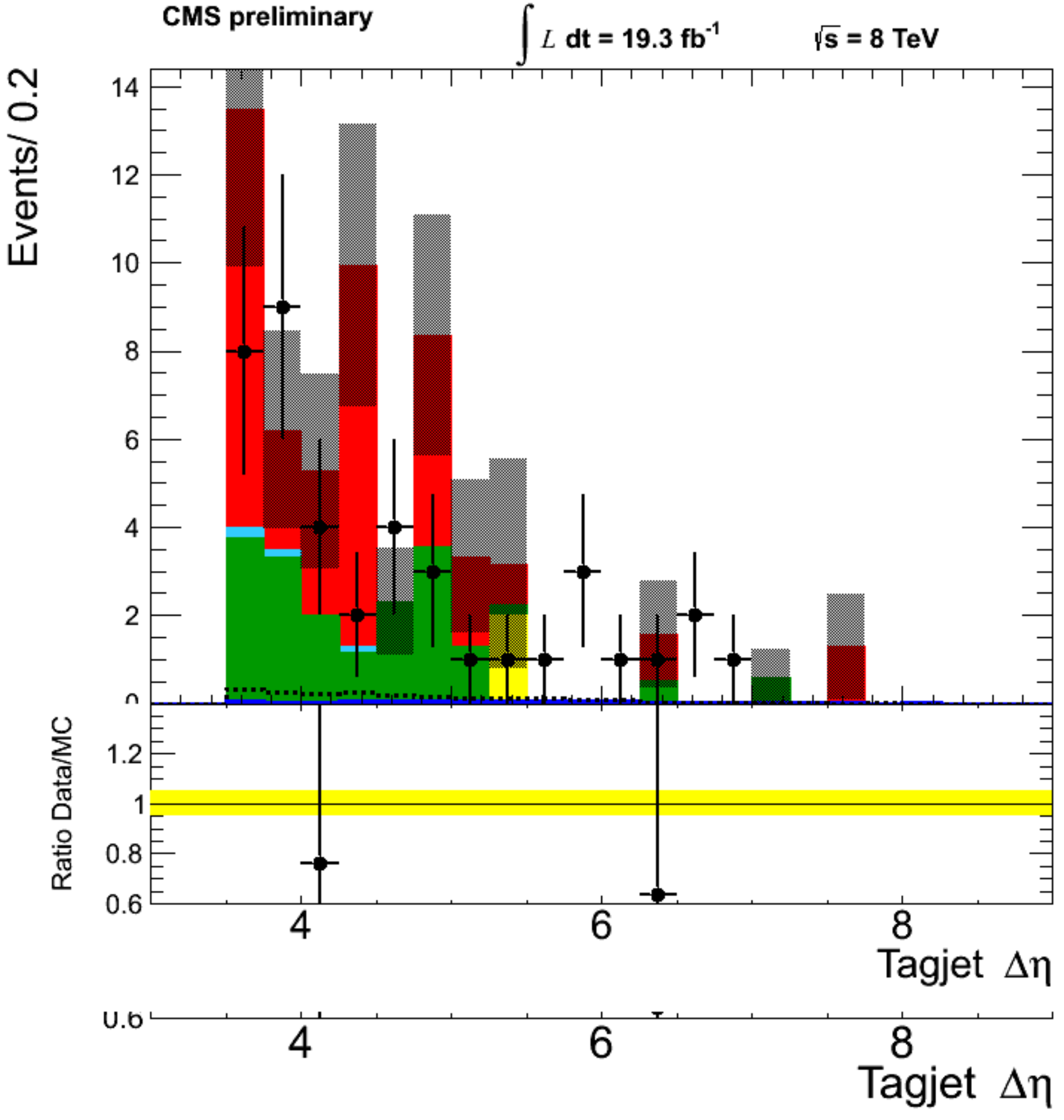

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s}$ = 8 TeV
Events/ 0.1
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
Cos θ_1
Cos θ_1

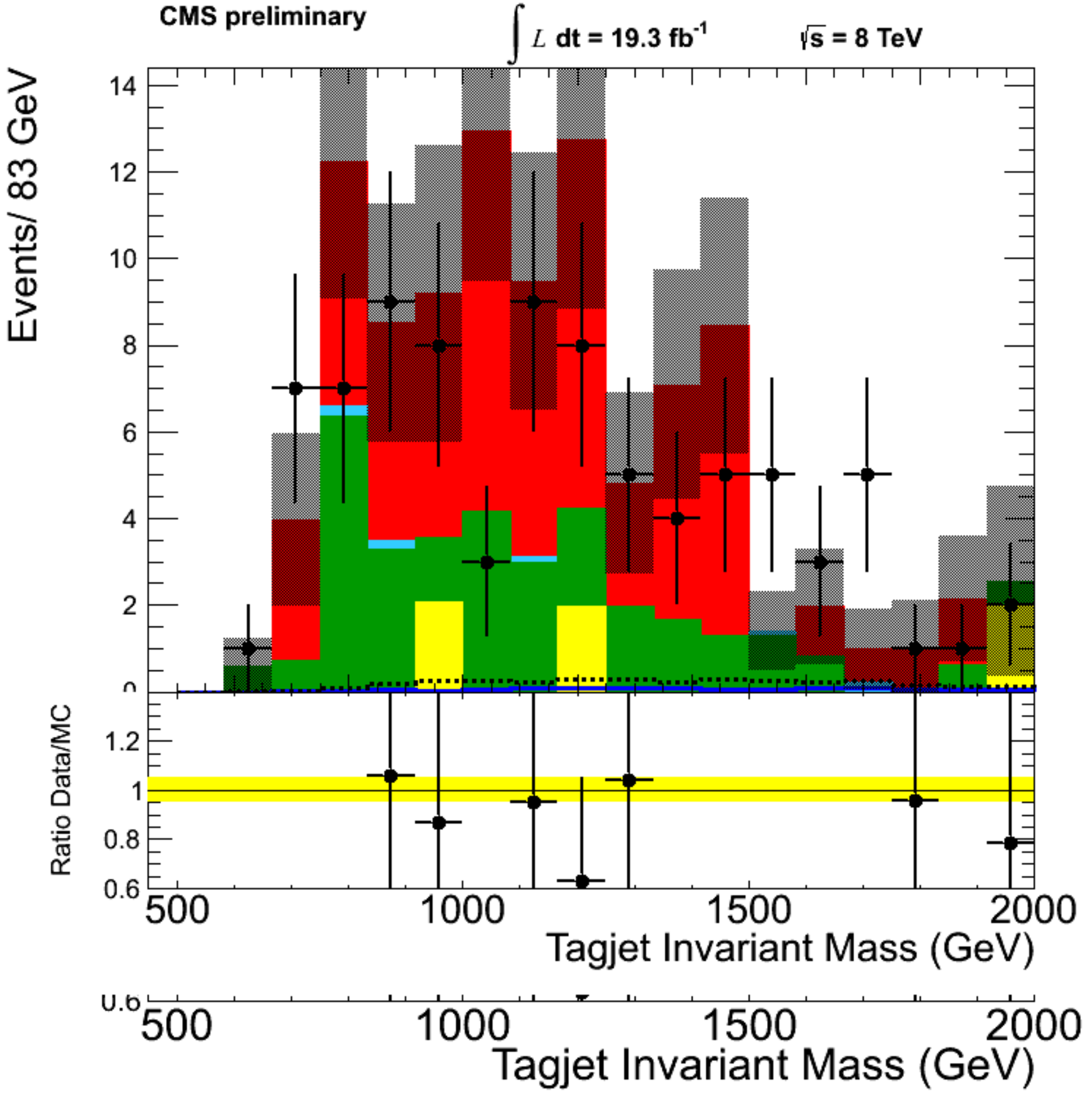

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.1
Ratio Data/MC
Cos θ_2
Cos θ_2

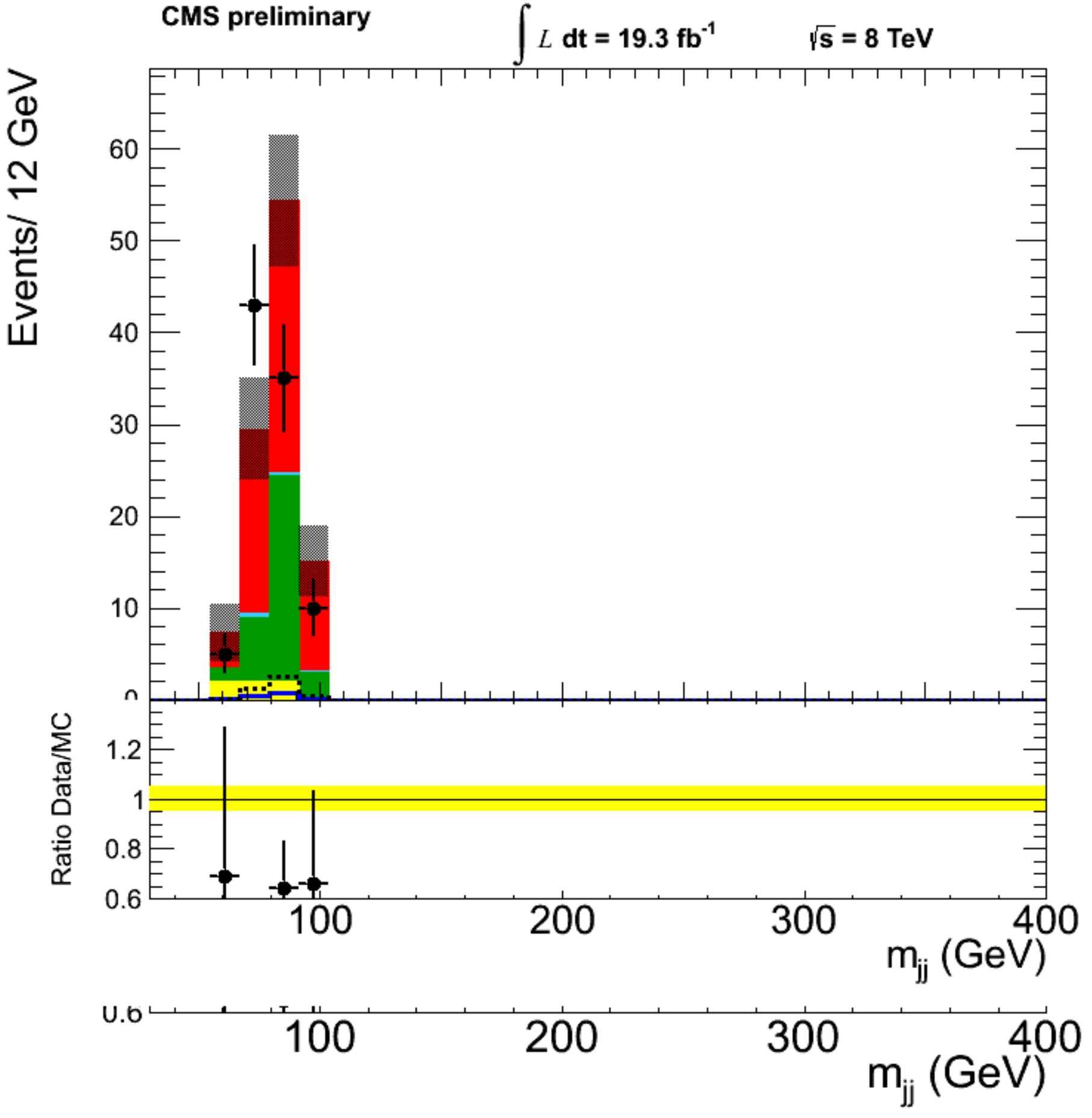

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.1
35
30
25
20
15
10
5
0
Ratio Data/MC
1.2
1
0.8
0.6
-1
-0.5
0
0.5
1
Cos θ*
0.6
-1
-0.5
0
0.5
1
Cos θ*

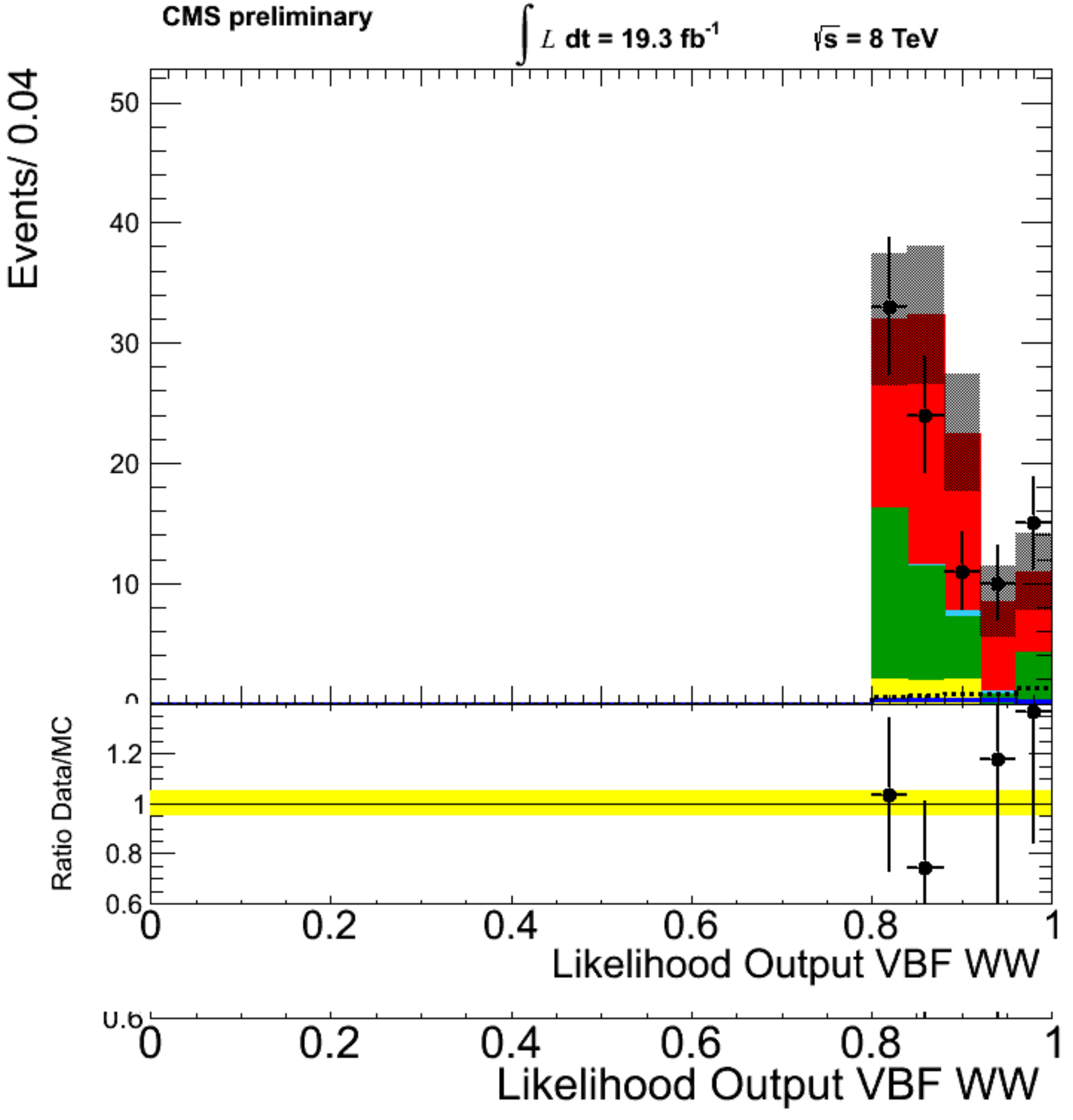

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.3 rad
Ratio Data/MC
Φ (rad)
Φ (rad)

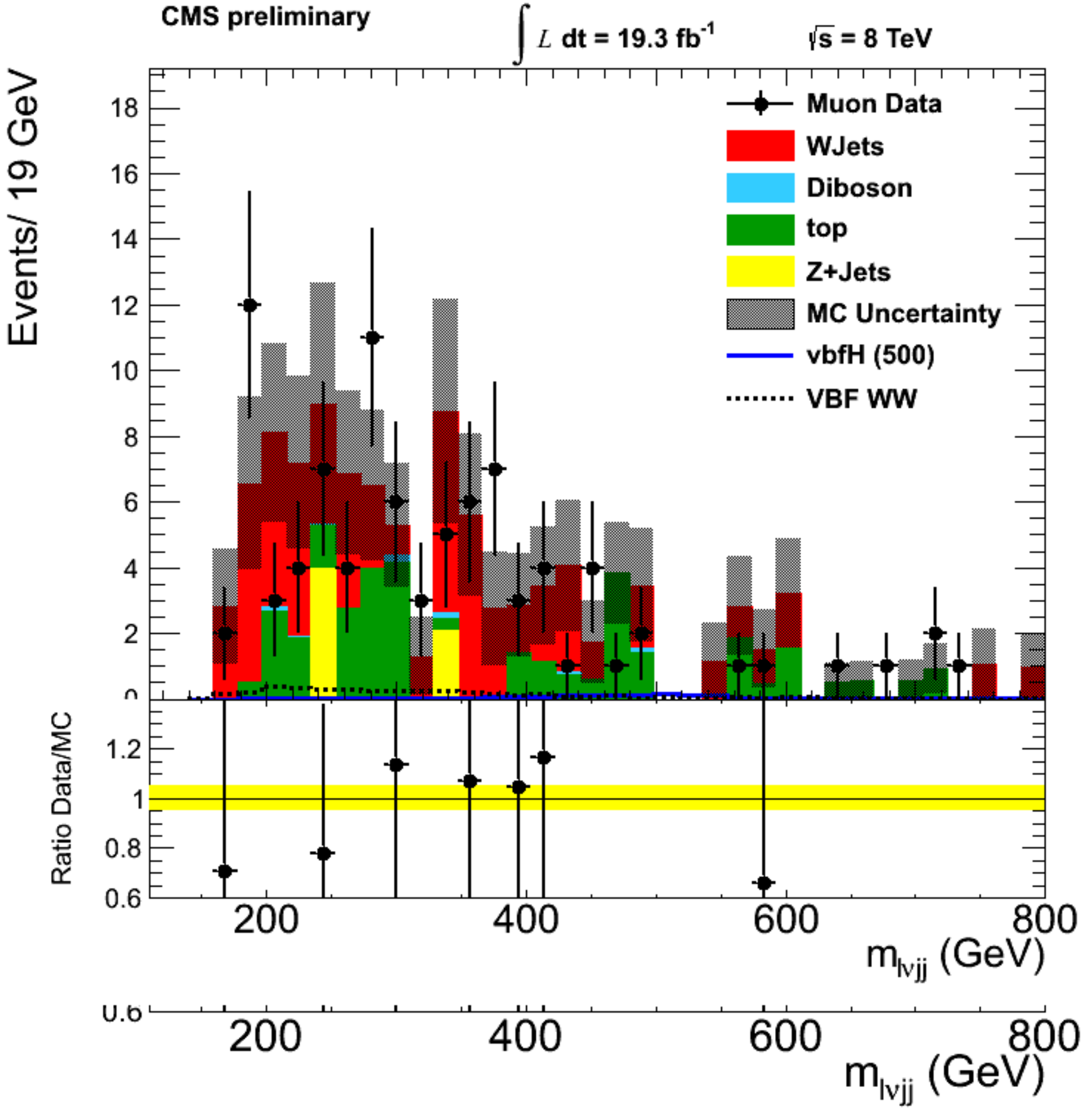

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.3 rad
Ratio Data/MC
Φ_1 (rad)
Φ_1 (rad)

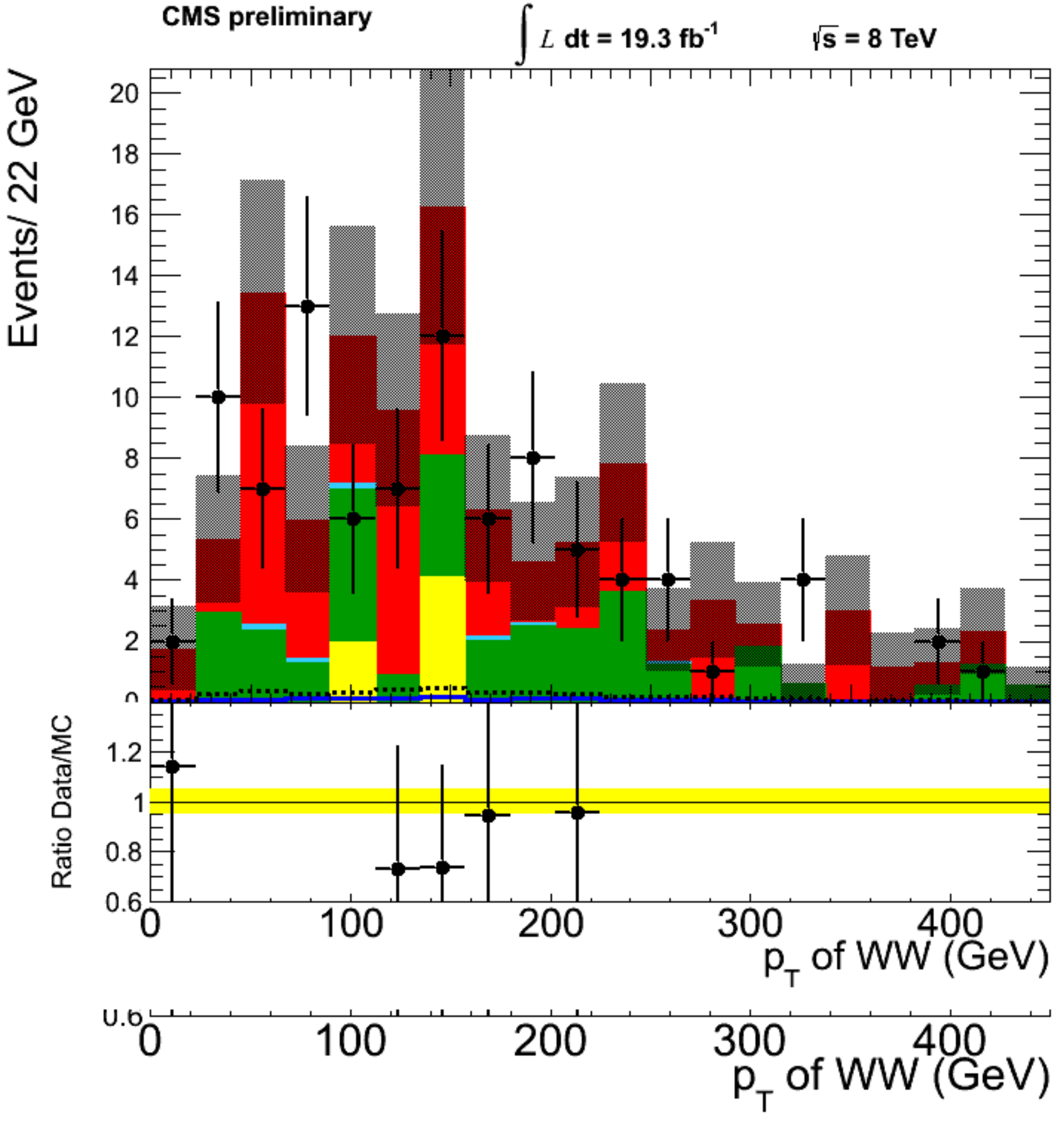

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.2
Ratio Data/MC
Tagjet Δη
Tagjet Δη

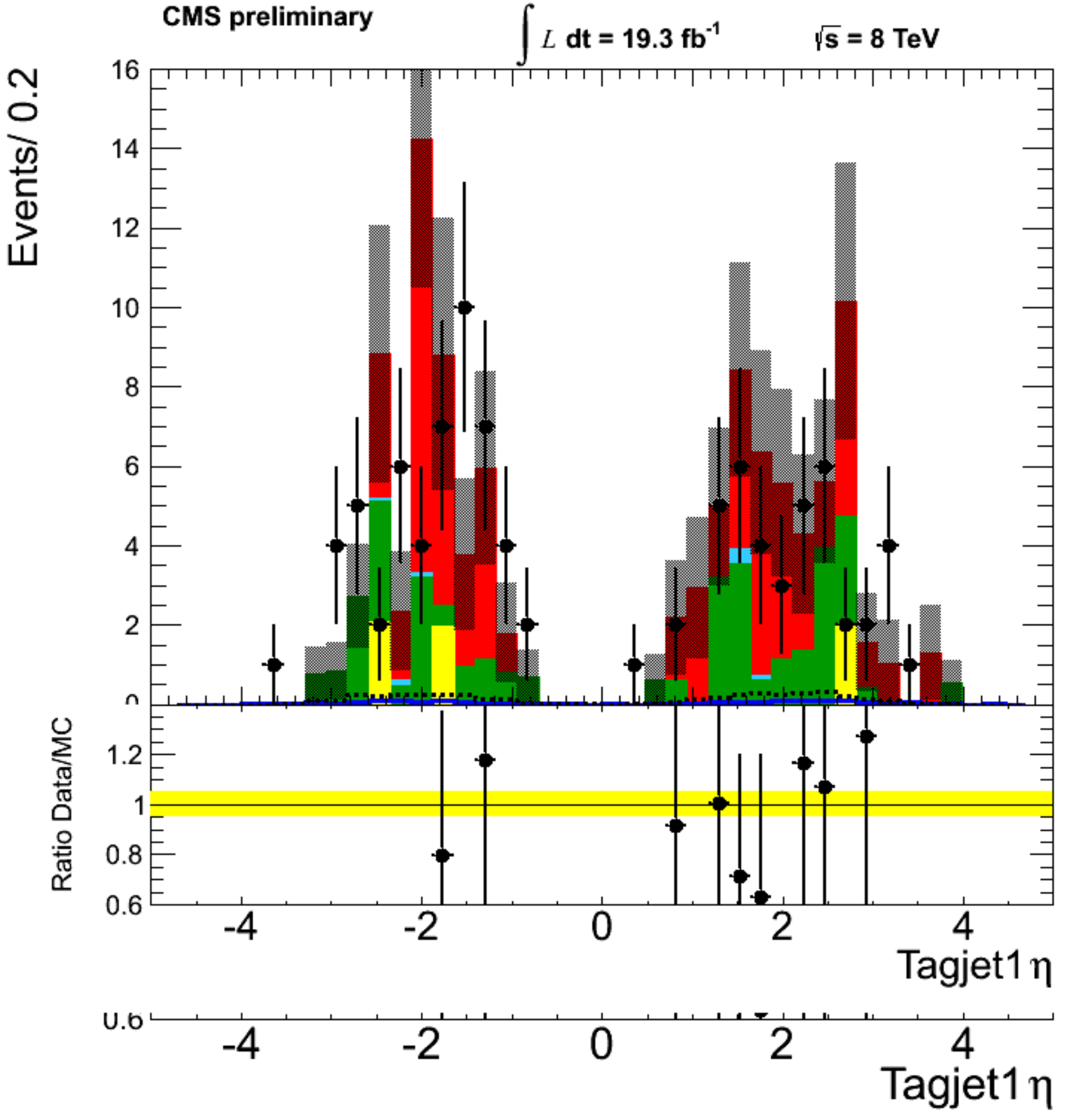

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 83 GeV
Ratio Data/MC
Tagjet Invariant Mass (GeV)
Tagjet Invariant Mass (GeV)

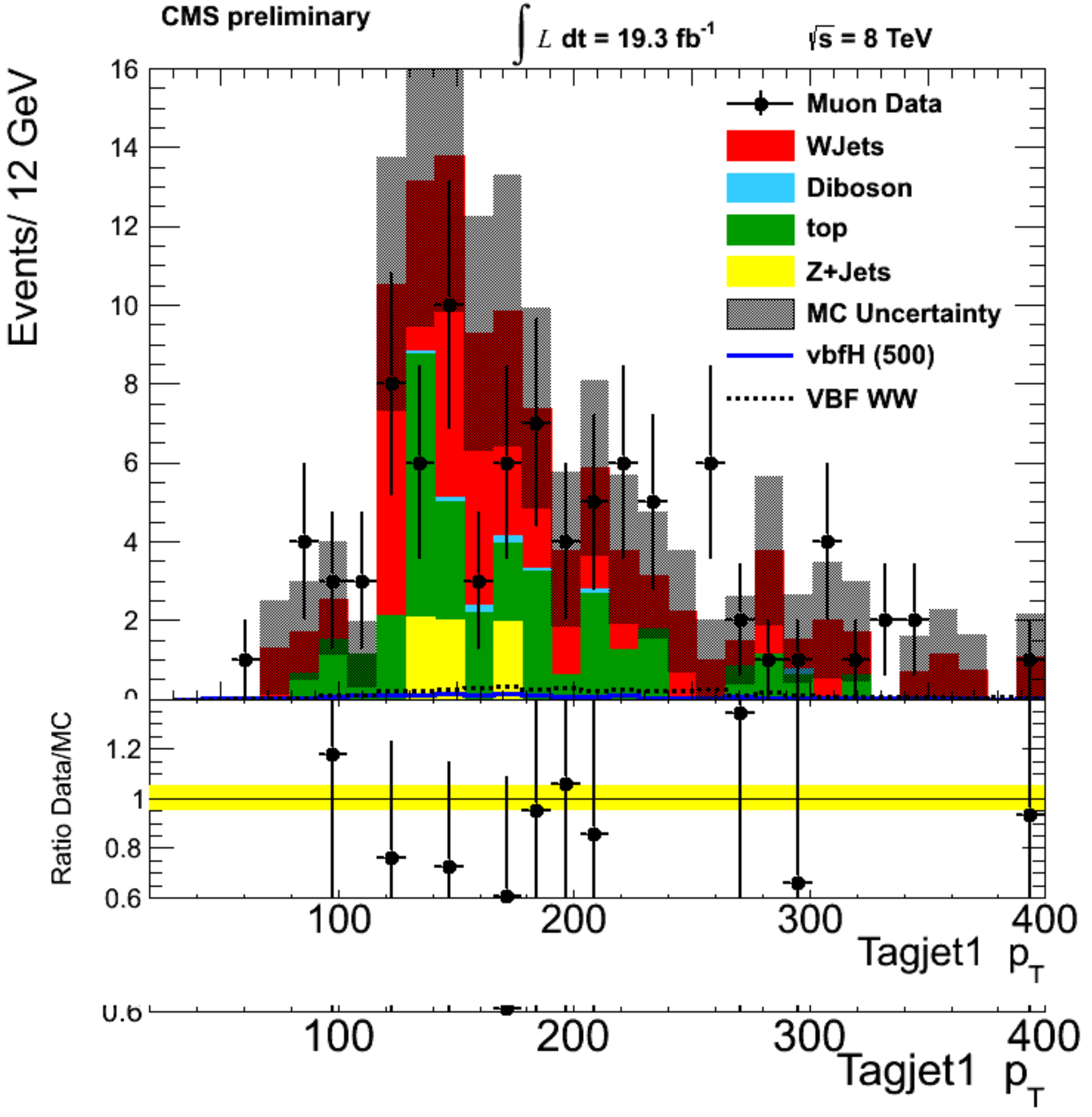

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 12 GeV
60
50
40
30
20
10
0
Ratio Data/MC
1.2
1
0.8
0.6
100
200
300
400
mjj (GeV)
0.6
100
200
300
400
mjj (GeV)

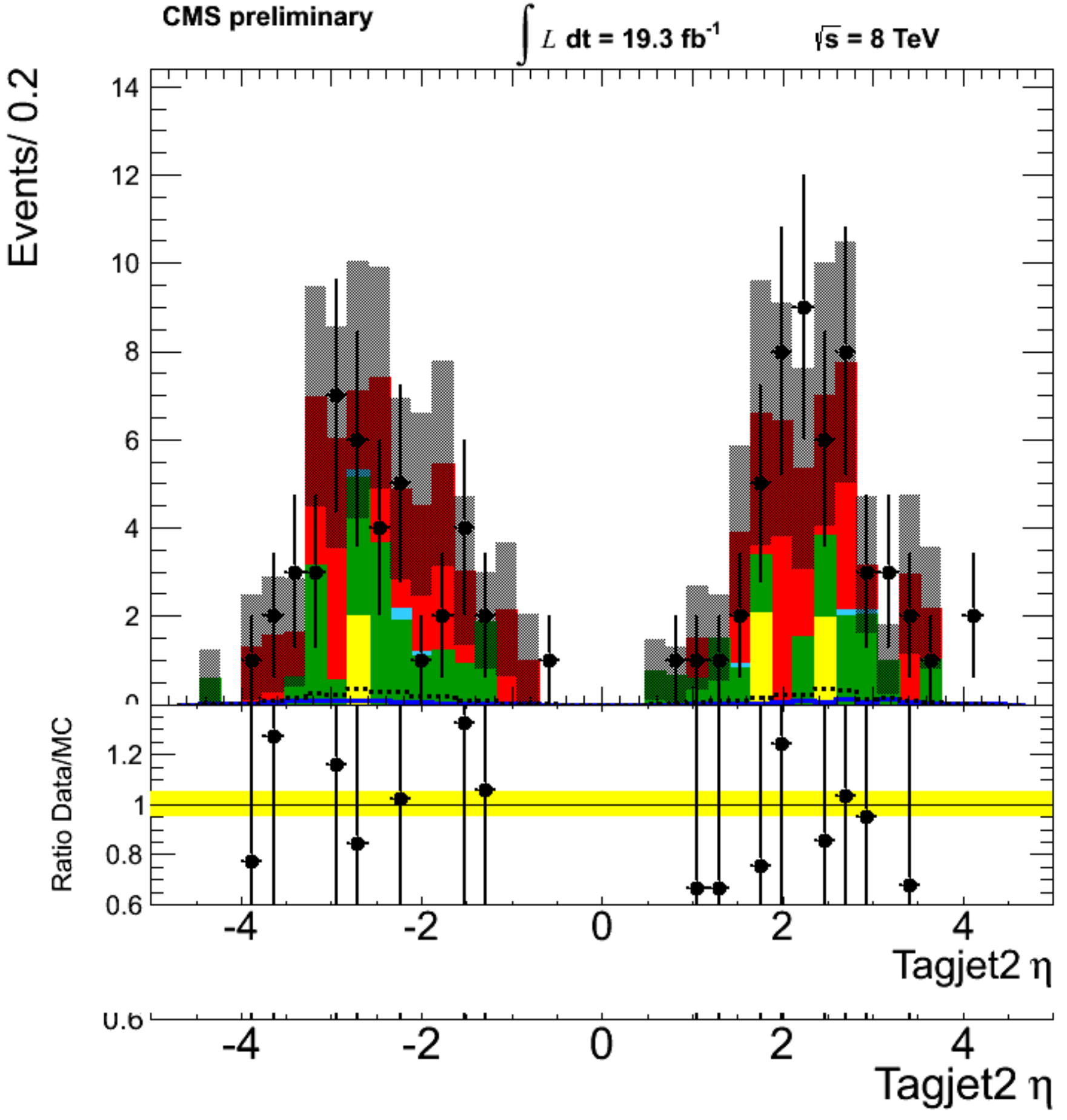

CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.04
50
40
30
20
10
0
Ratio Data/MC
1.2
1
0.8
0.6
0
0.2
0.4
0.6
0.8
1
Likelihood Output VBF WW
0.6
0
0.2
0.4
0.6
0.8
1
Likelihood Output VBF WW

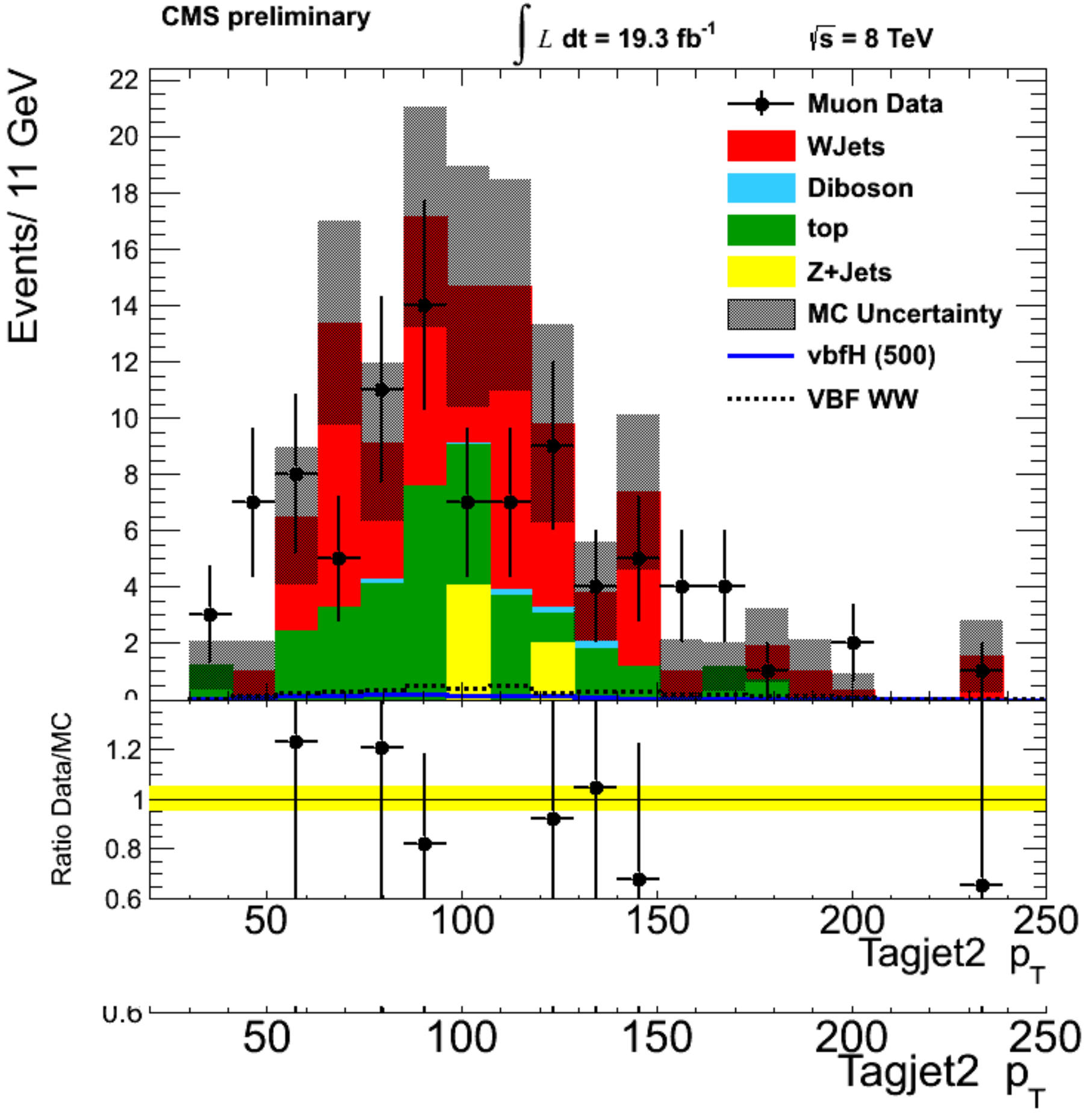

CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 19 GeV
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
$m_{l\nu jj}$ (GeV)


CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 22 GeV
Ratio Data/MC
pT of WW (GeV)
pT of WW (GeV)


CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s} = 8$ TeV
Events/ 0.2
Ratio Data/MC
Tagjet1 η
Tagjet1 η


CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s}$ = 8 TeV
Events/ 12 GeV
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
Tagjet1 p_T
Tagjet1 p_T


CMS preliminary
∫ L dt = 19.3 fb-1
√s = 8 TeV
Events/ 0.2
Ratio Data/MC
Tagjet2 η
Tagjet2 η


CMS preliminary
$\int L\,dt = 19.3\ fb^{-1}$
$\sqrt{s}$ = 8 TeV
Events/ 11 GeV
Muon Data
WJets
Diboson
top
Z+Jets
MC Uncertainty
vbfH (500)
VBF WW
Ratio Data/MC
Tagjet2 p_T
Tagjet2 p_T