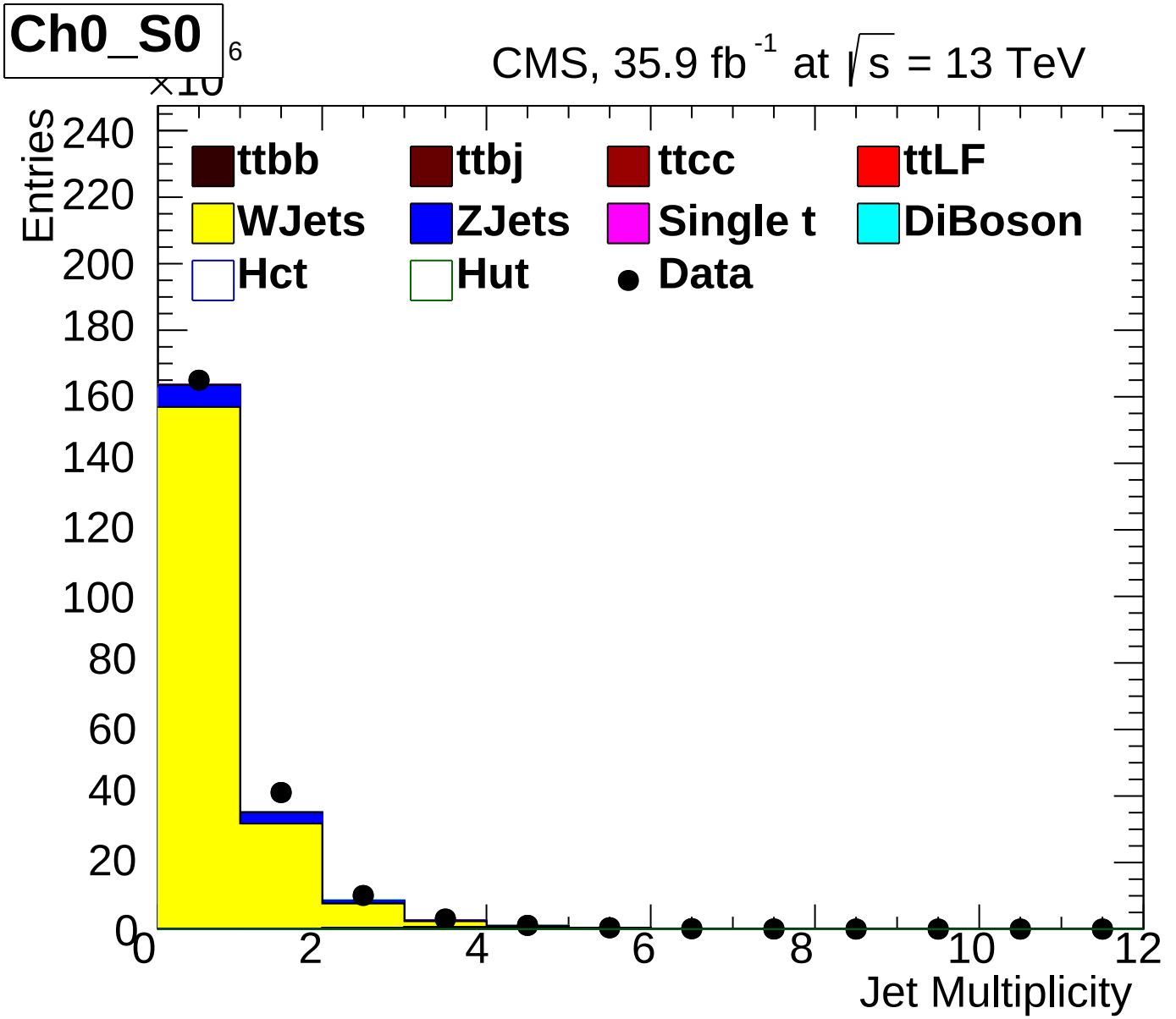
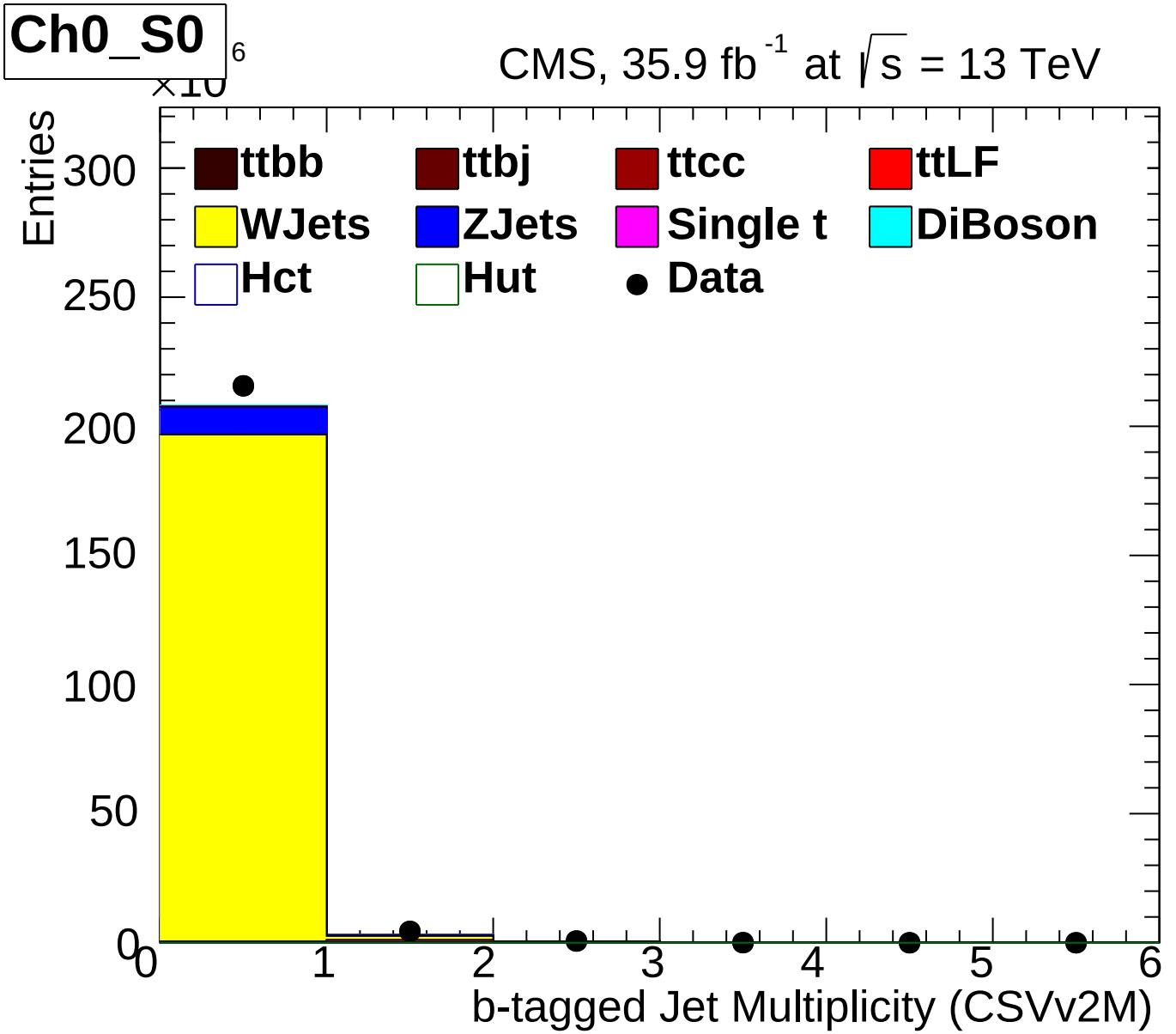

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
240
0
2
4
6
8
10
12
Jet Multiplicity


Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
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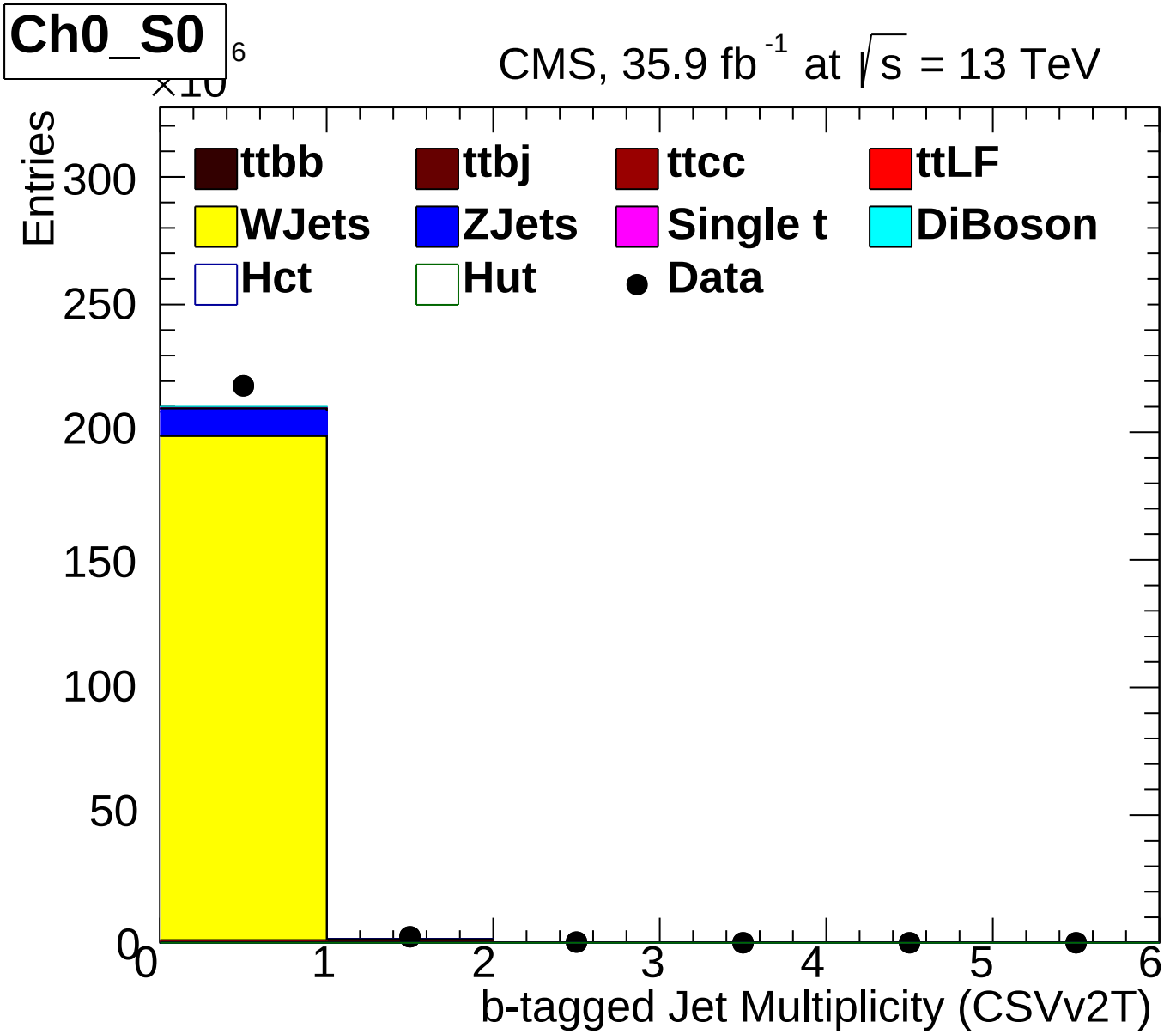
150
200
250
300
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
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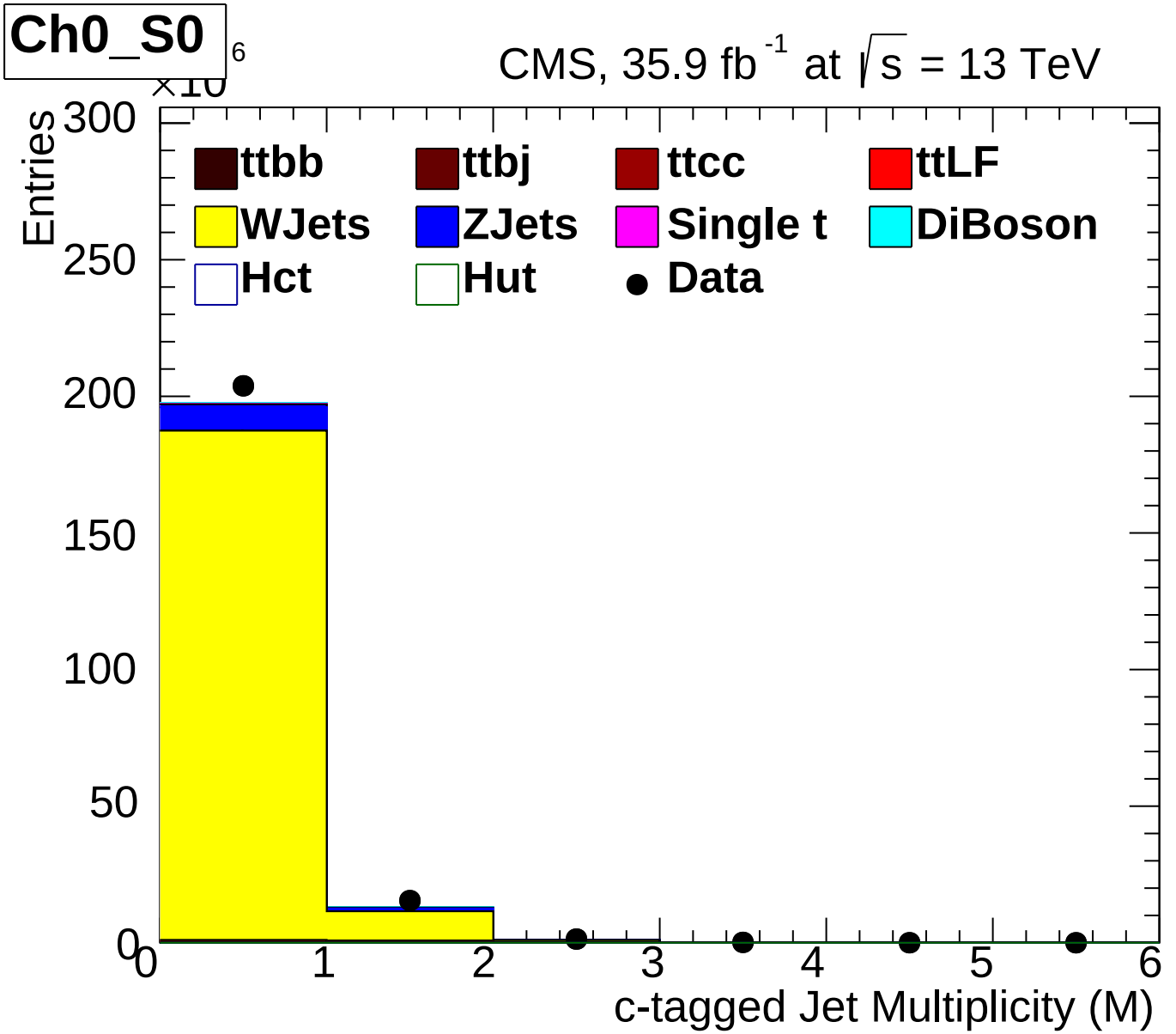
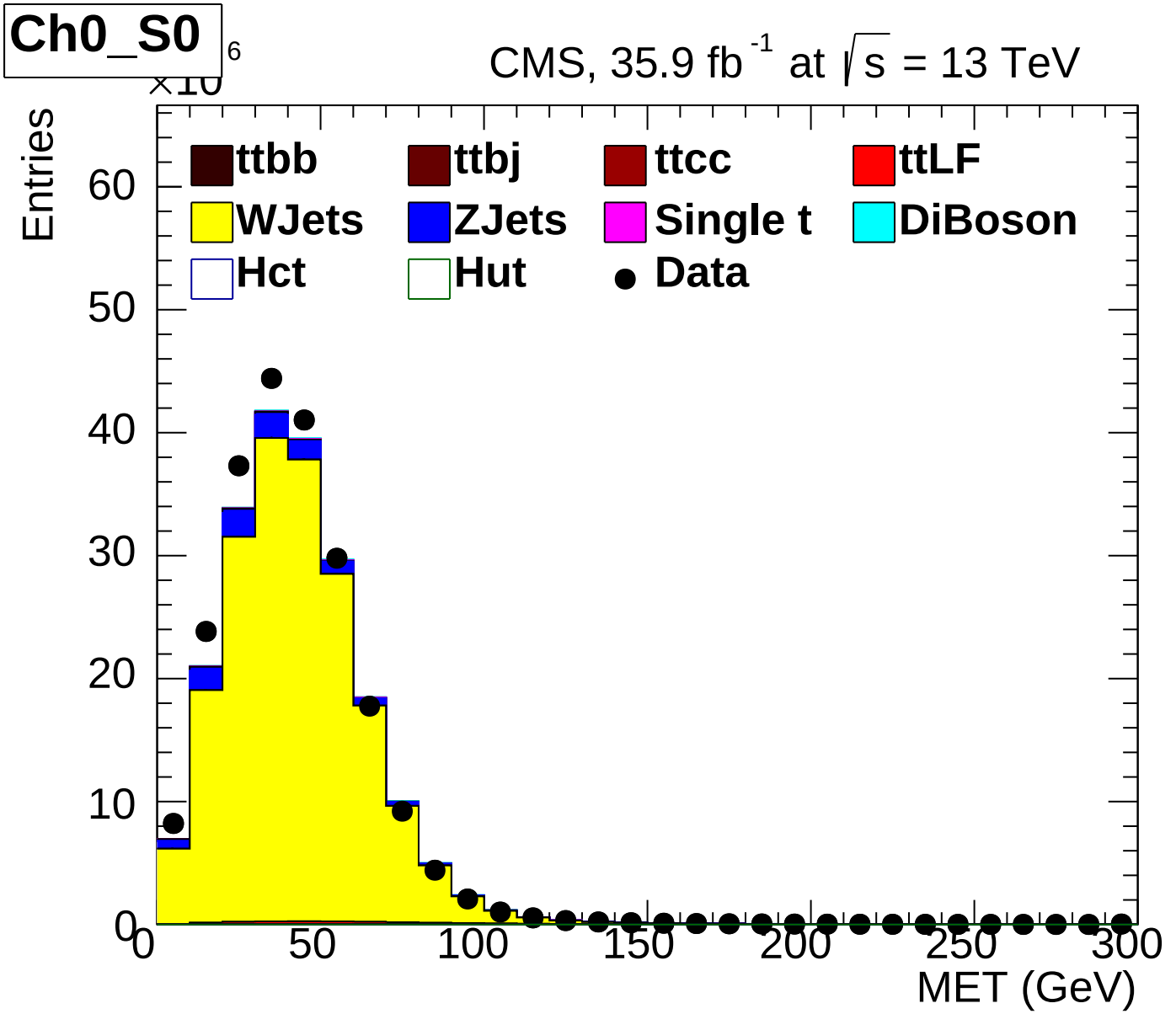
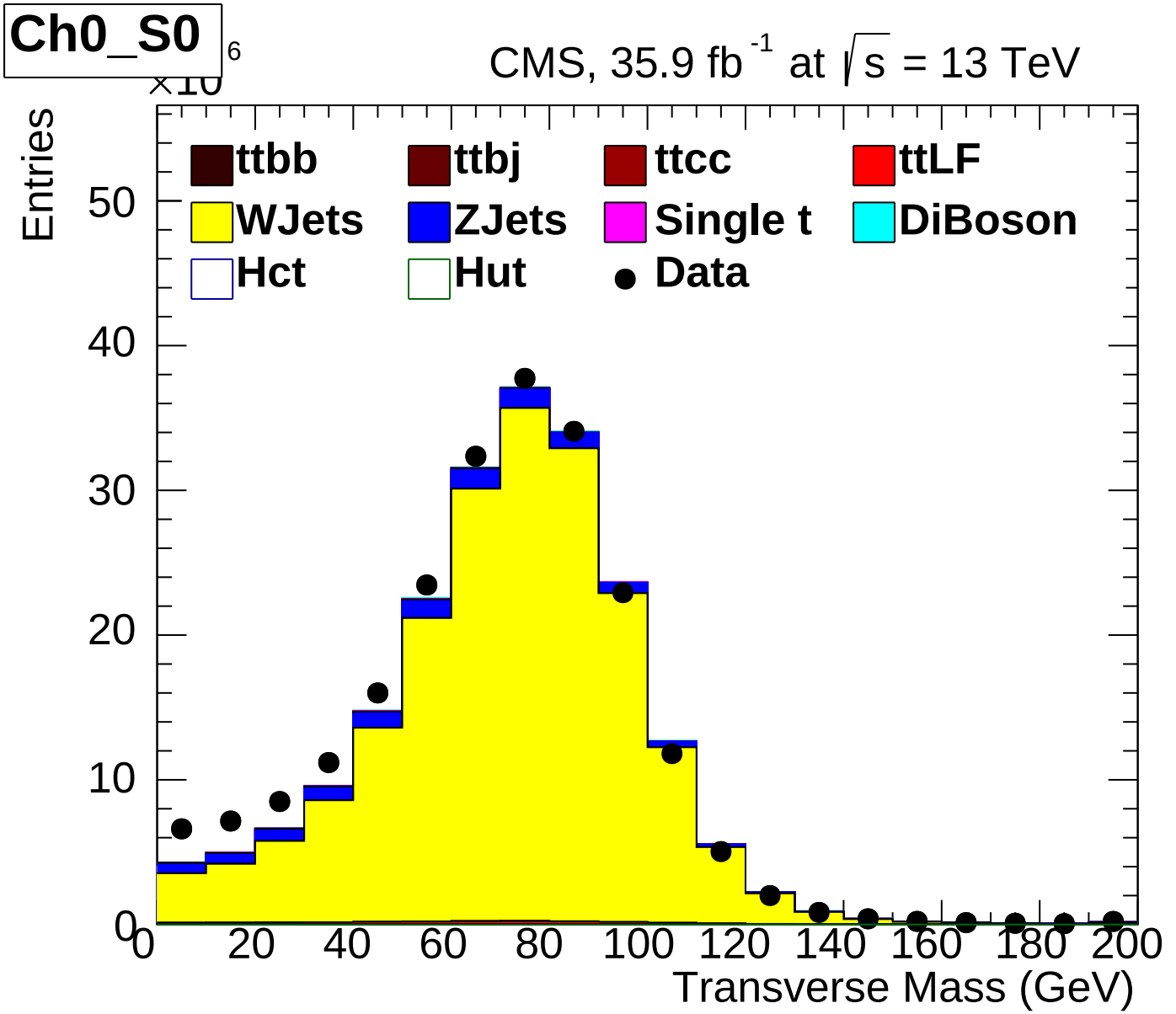
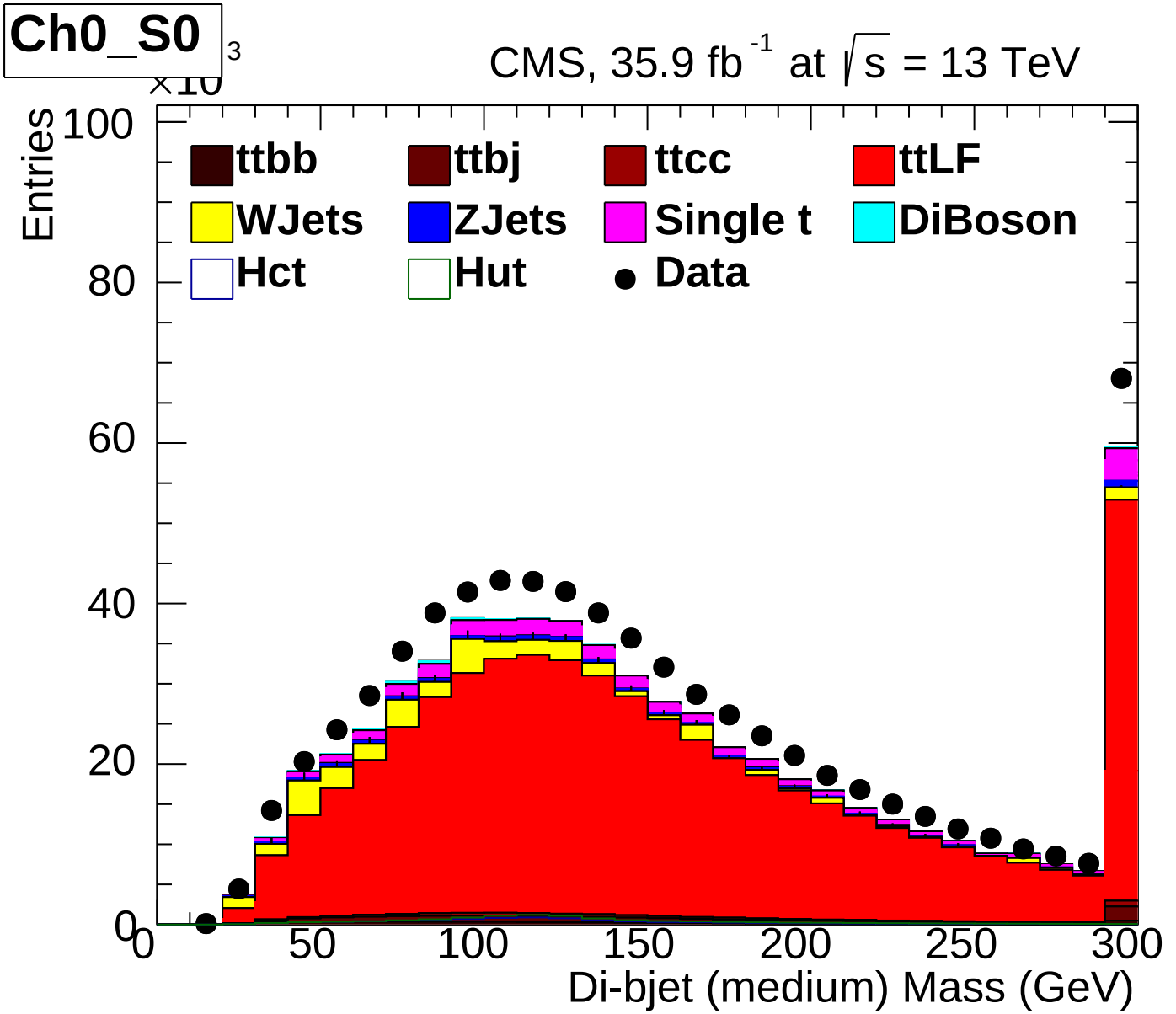
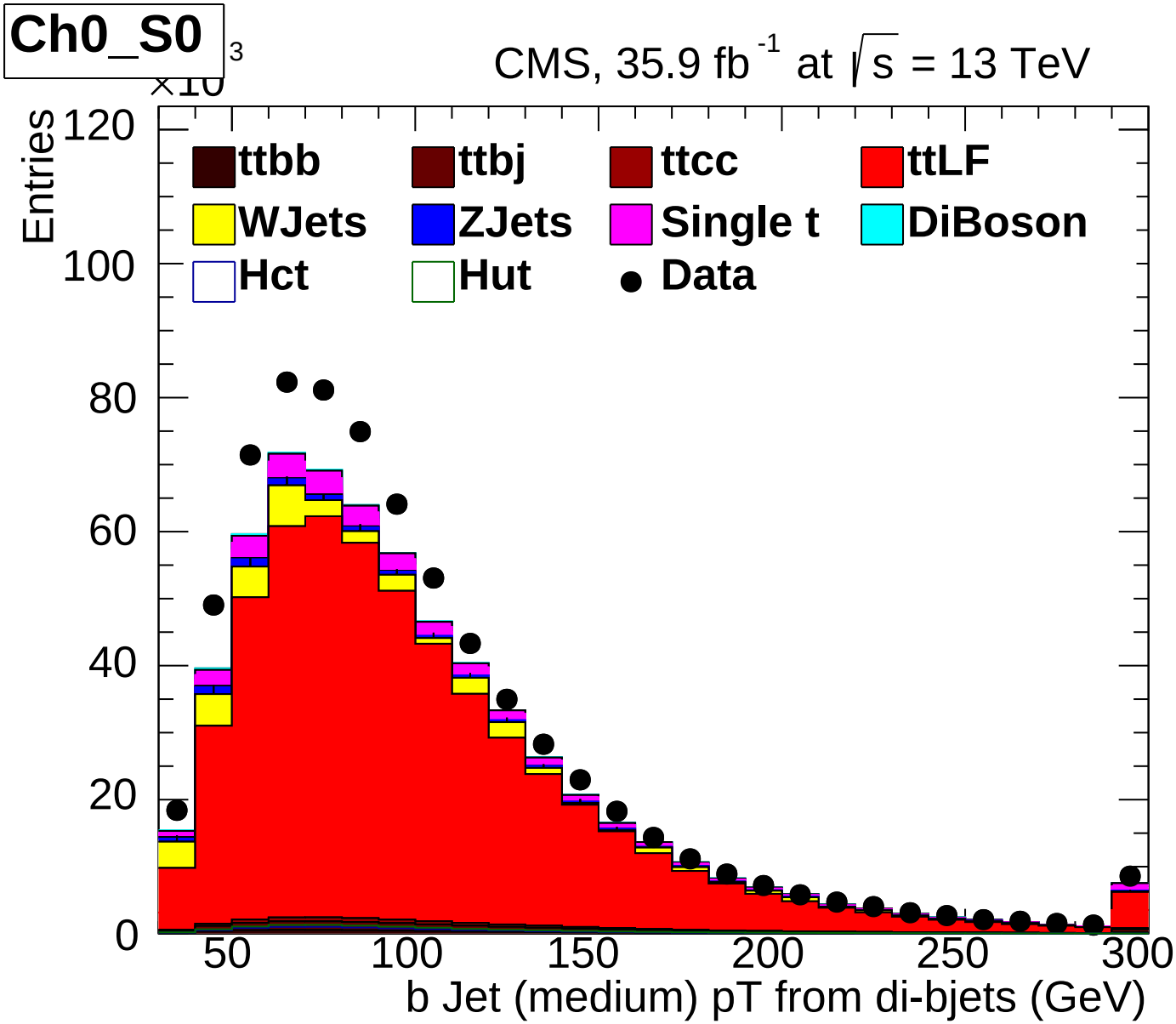
150
200
250
300
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

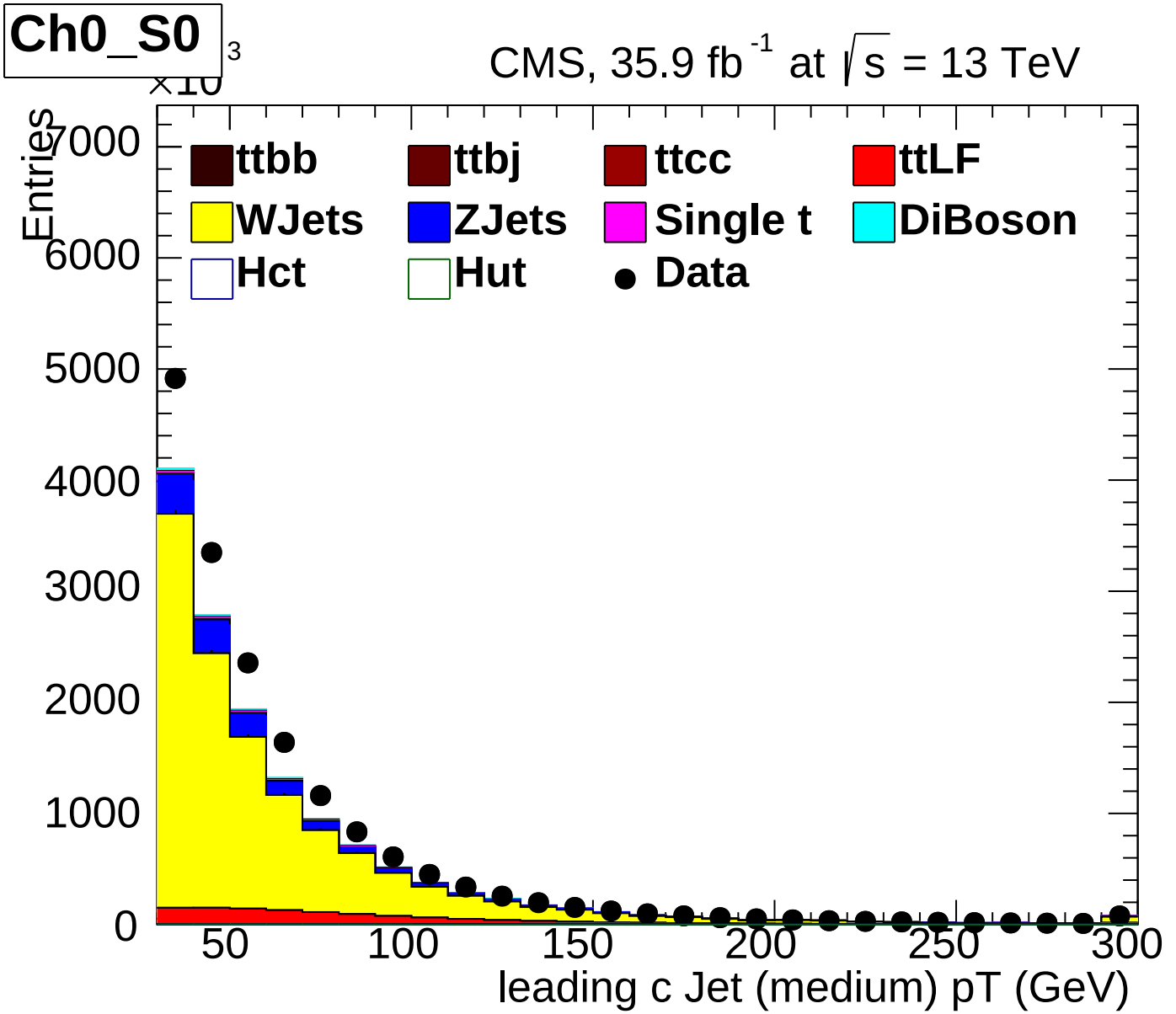

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^6$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
300
250
200
150
100
50
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

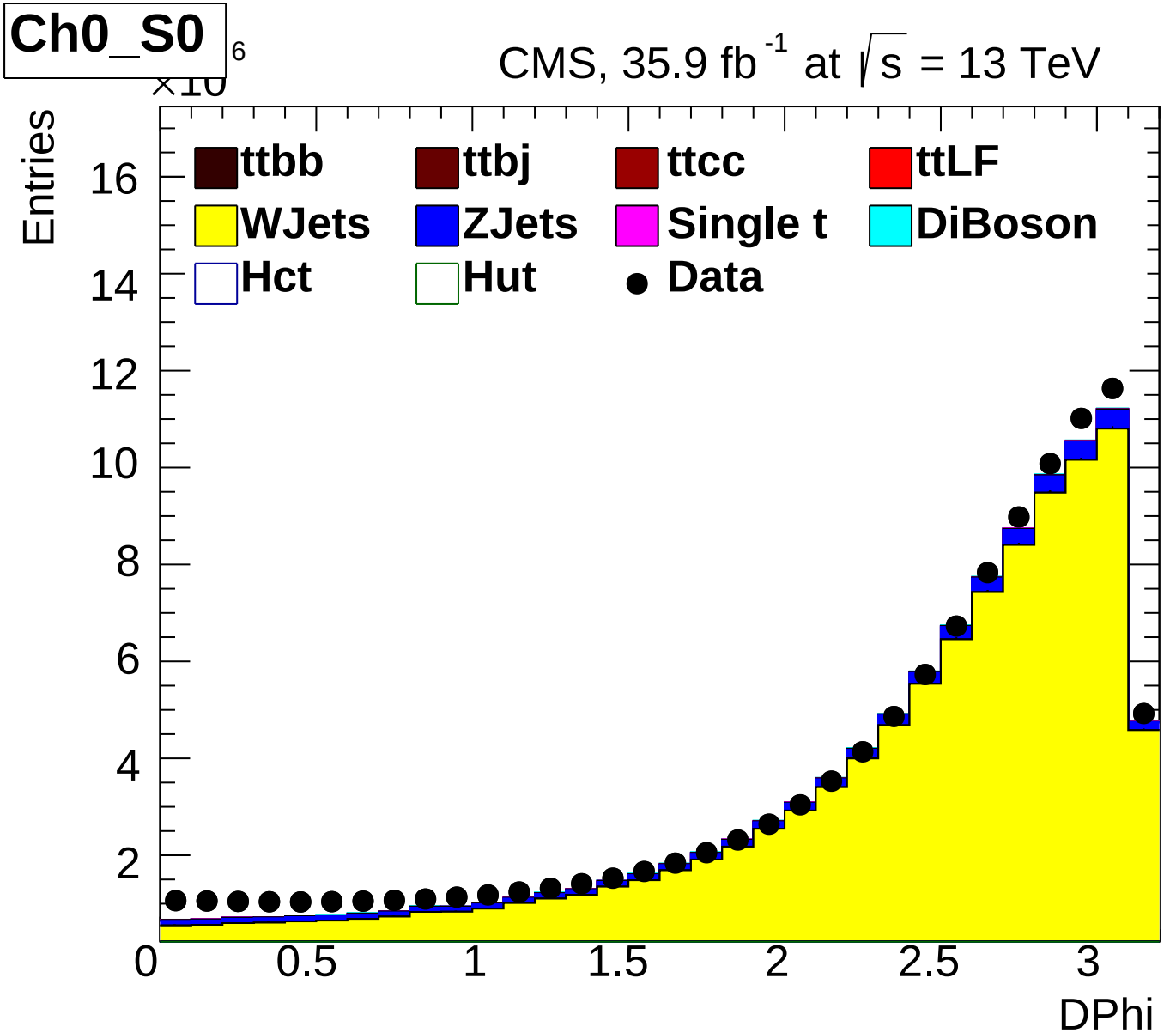

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^6$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10
20
30
40
50
60
0
50
100
150
200
250
300
MET (GeV)

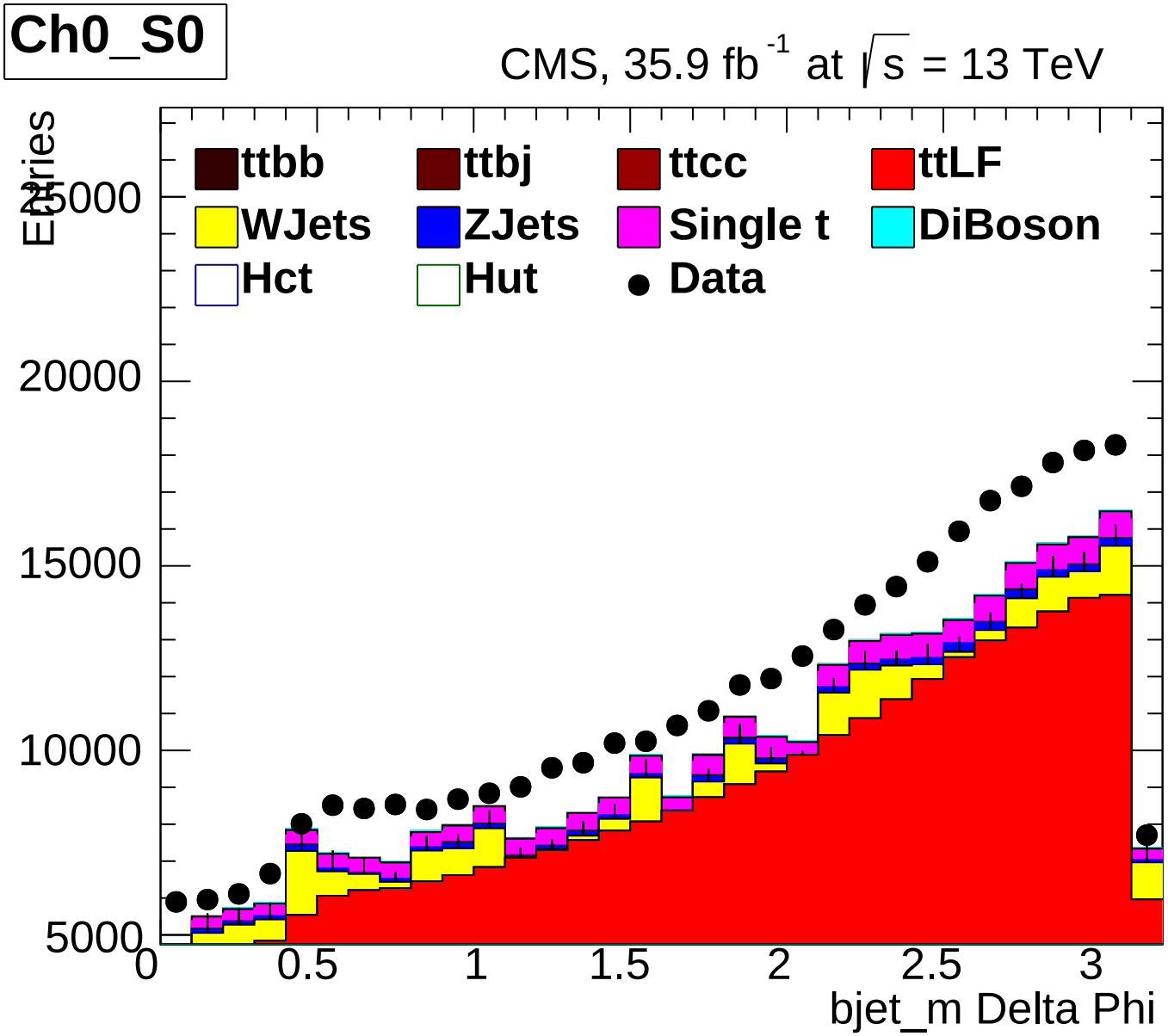

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10
20
30
40
50
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

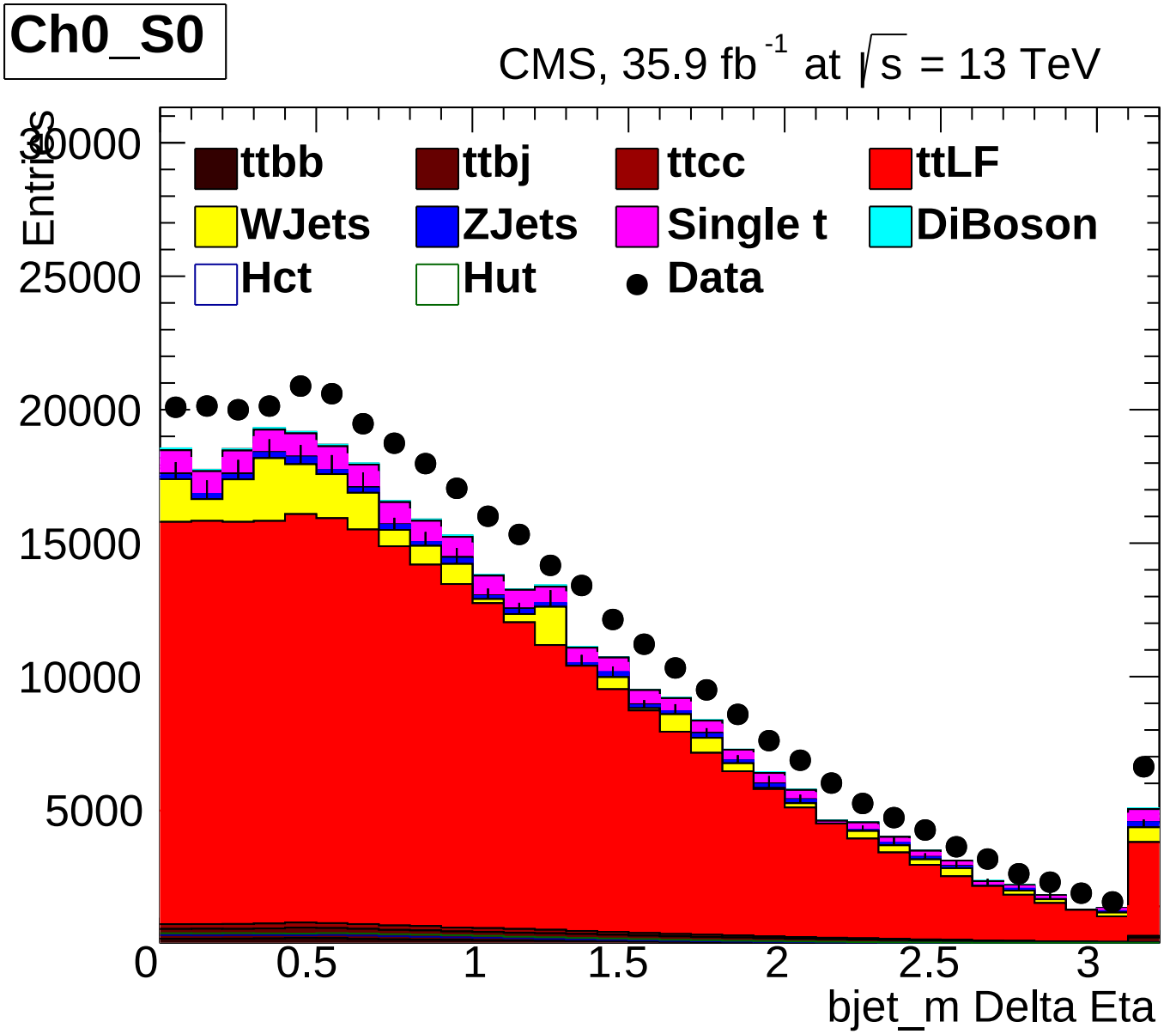

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

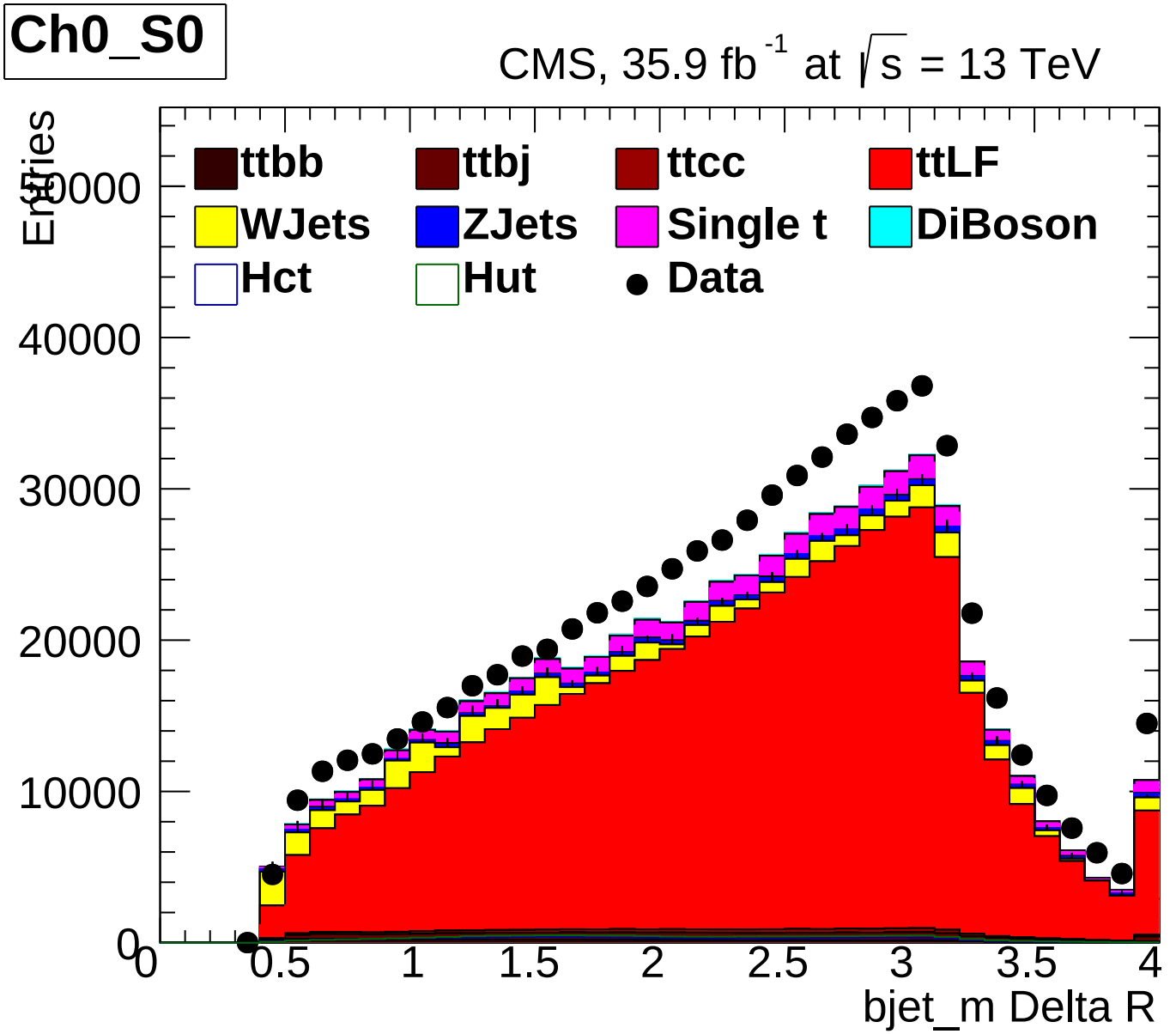

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

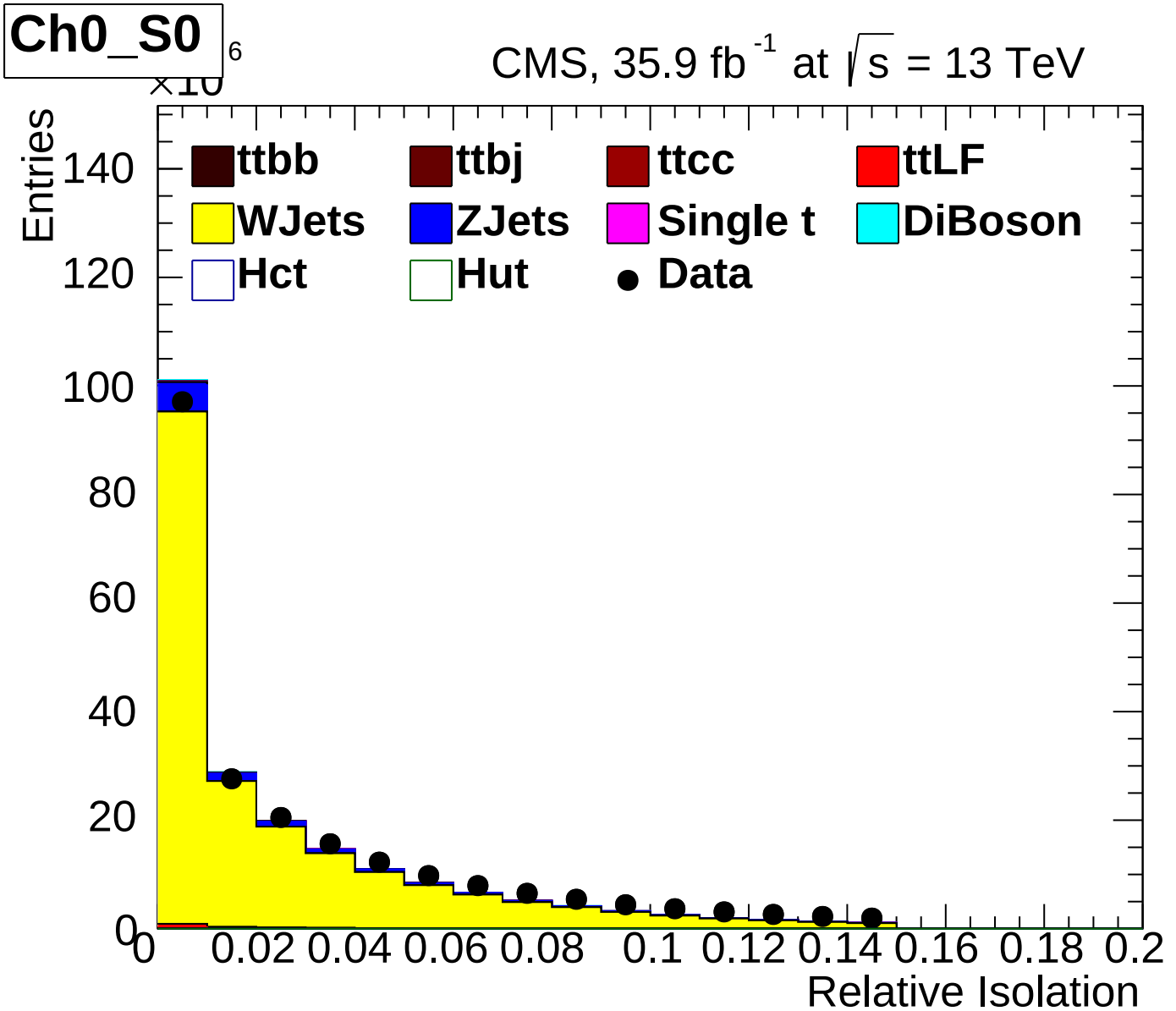

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
7000
6000
5000
4000
3000
2000
1000
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

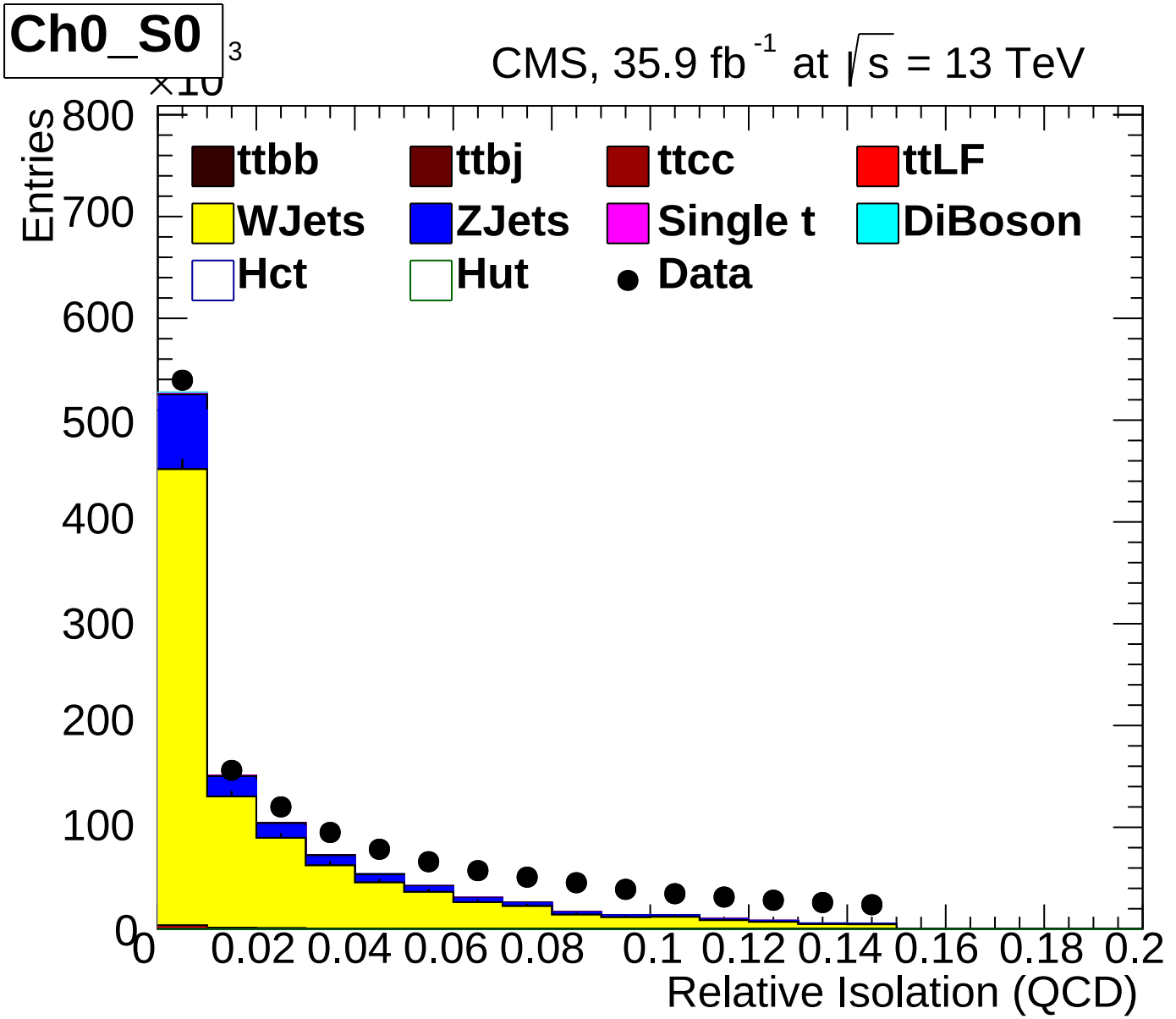

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^6$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
16
14
12
10
8
6
4
2
0
0.5
1
1.5
2
2.5
3
DPhi

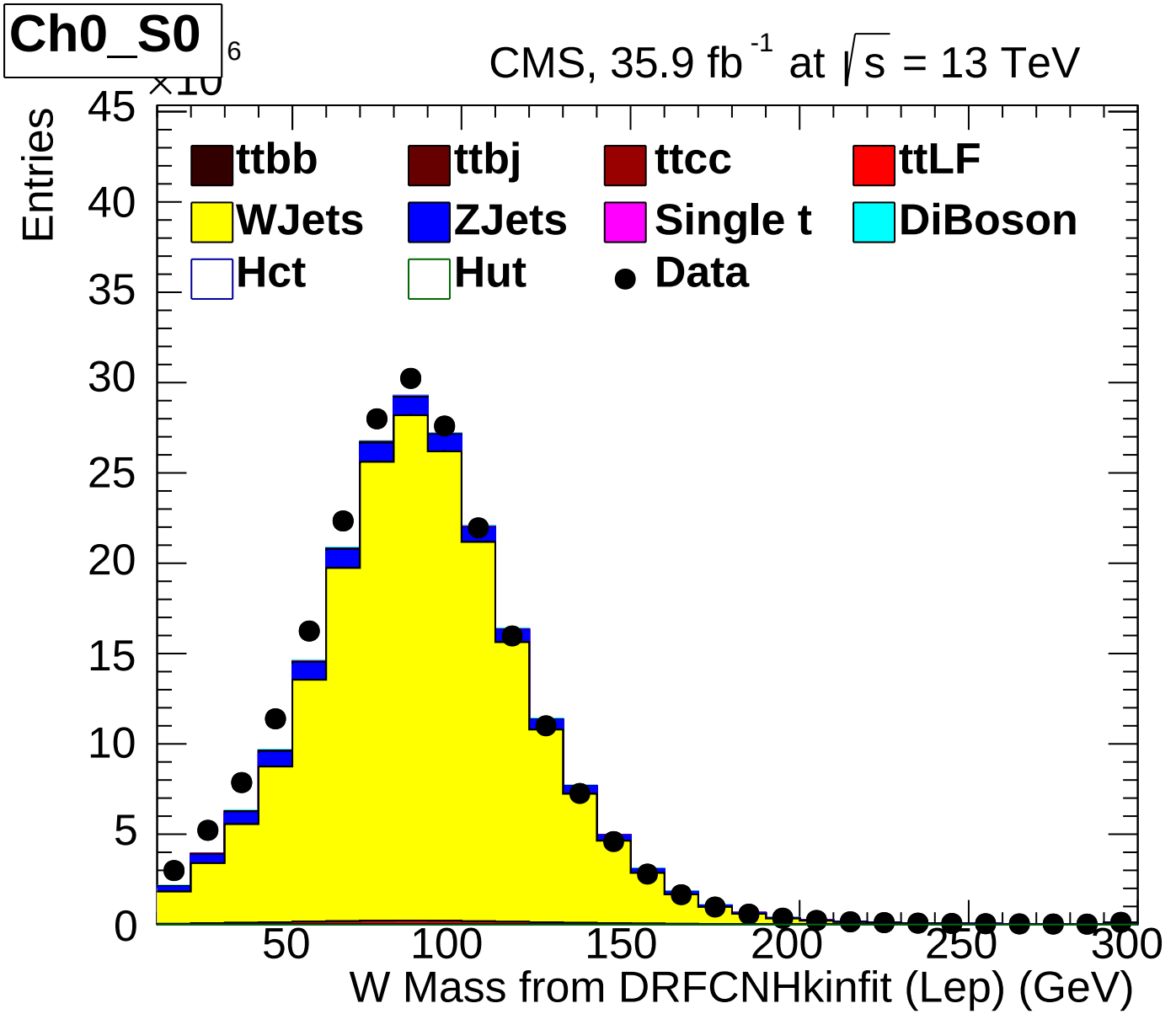

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

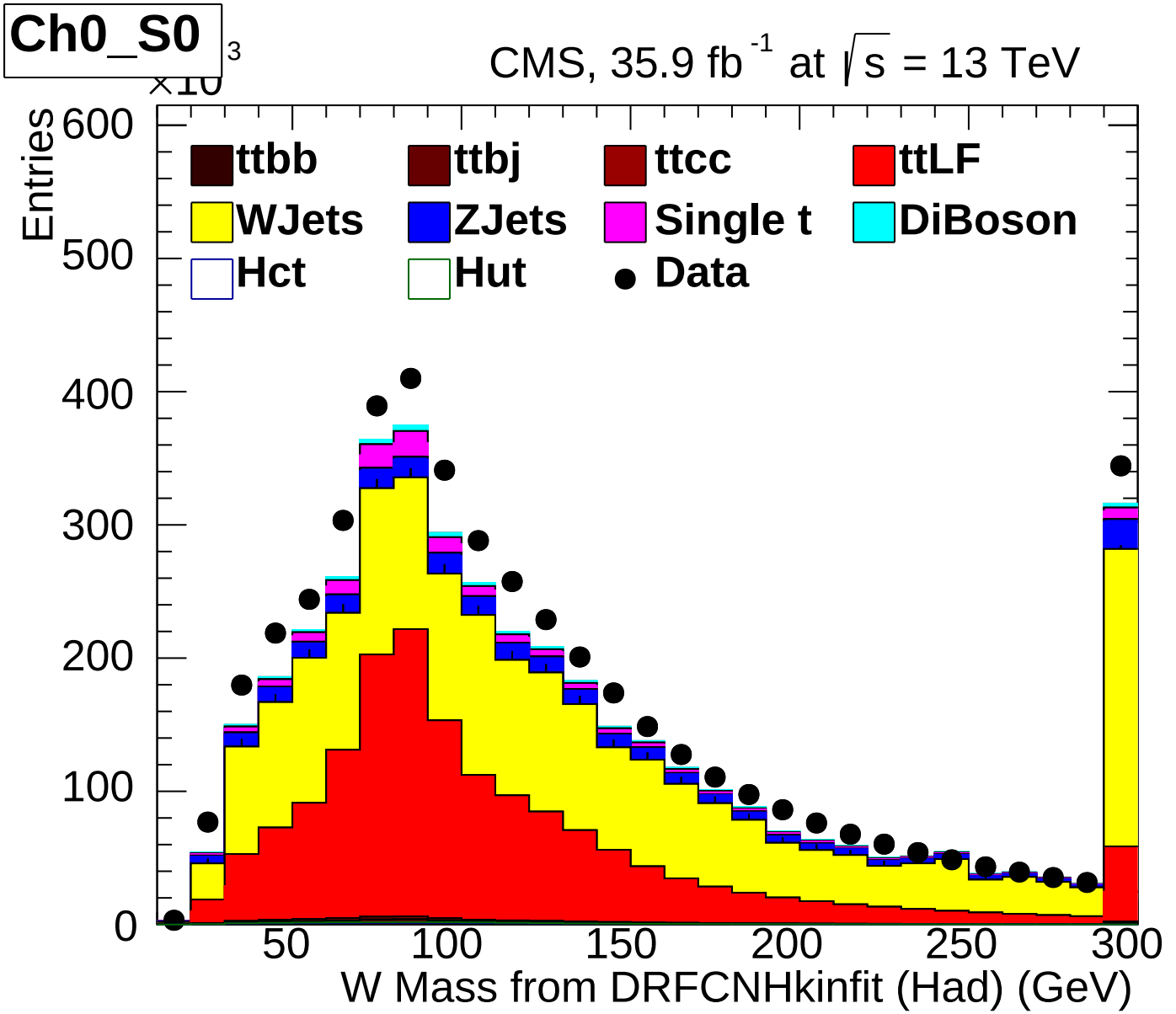

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

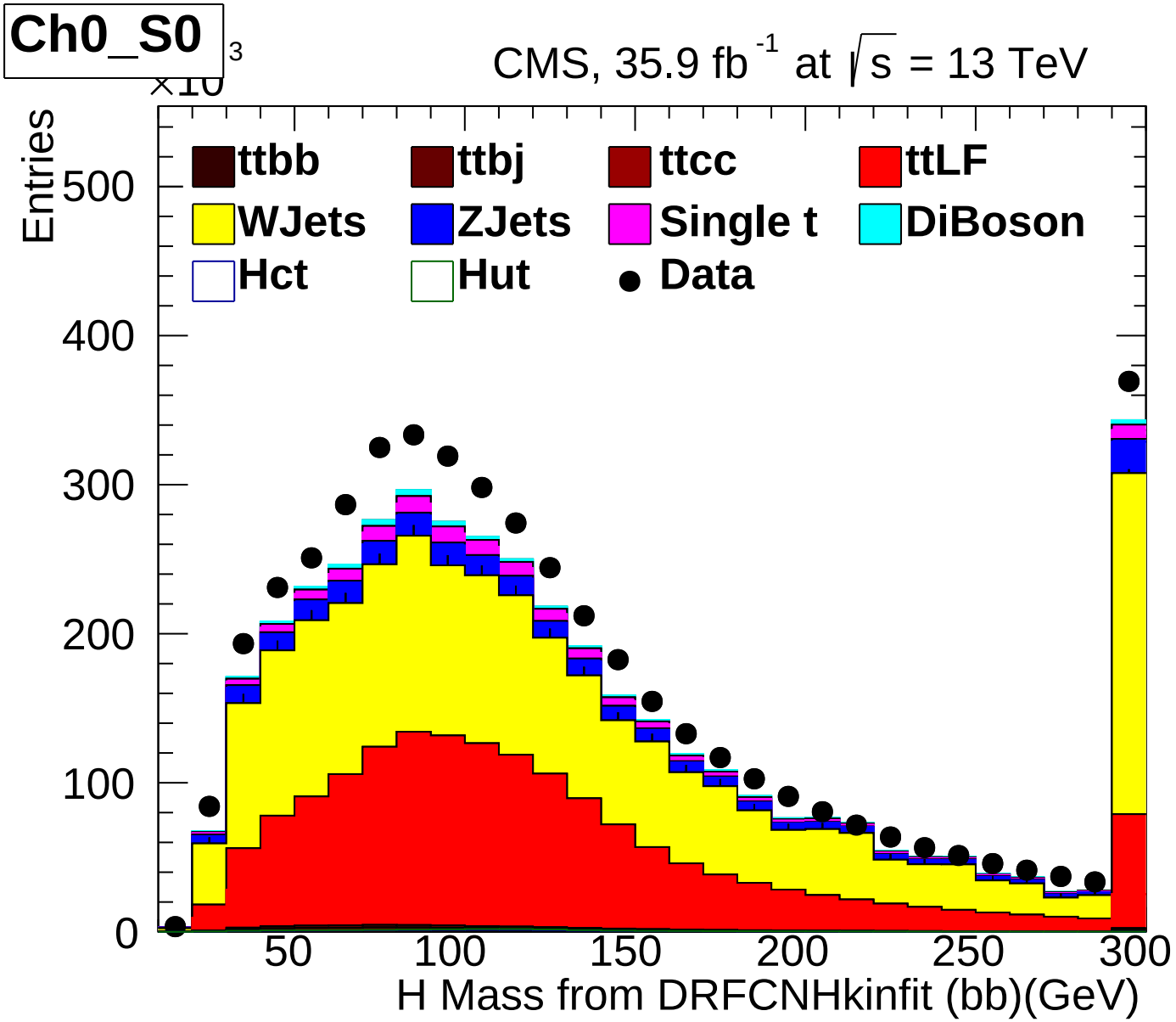

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

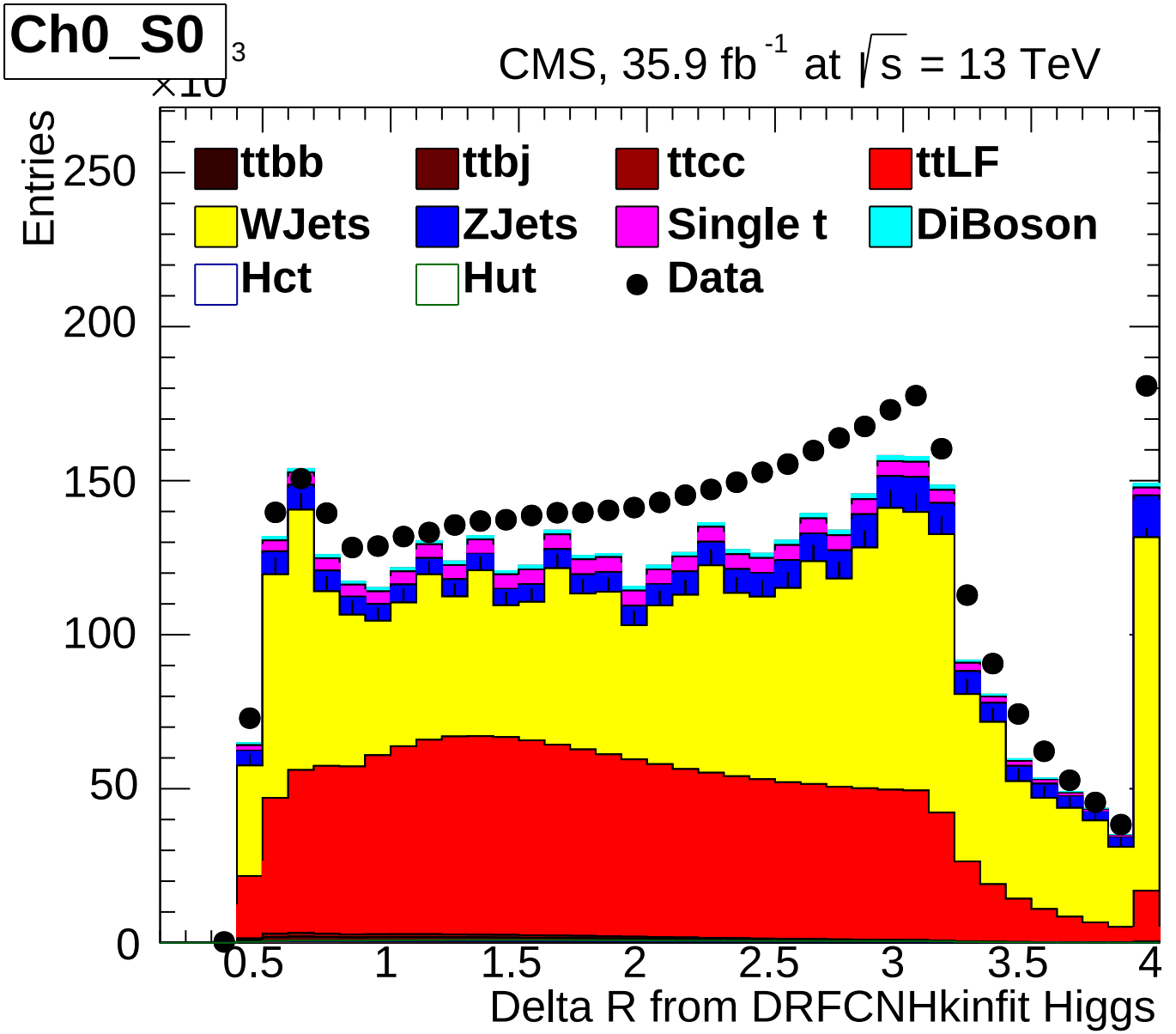

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

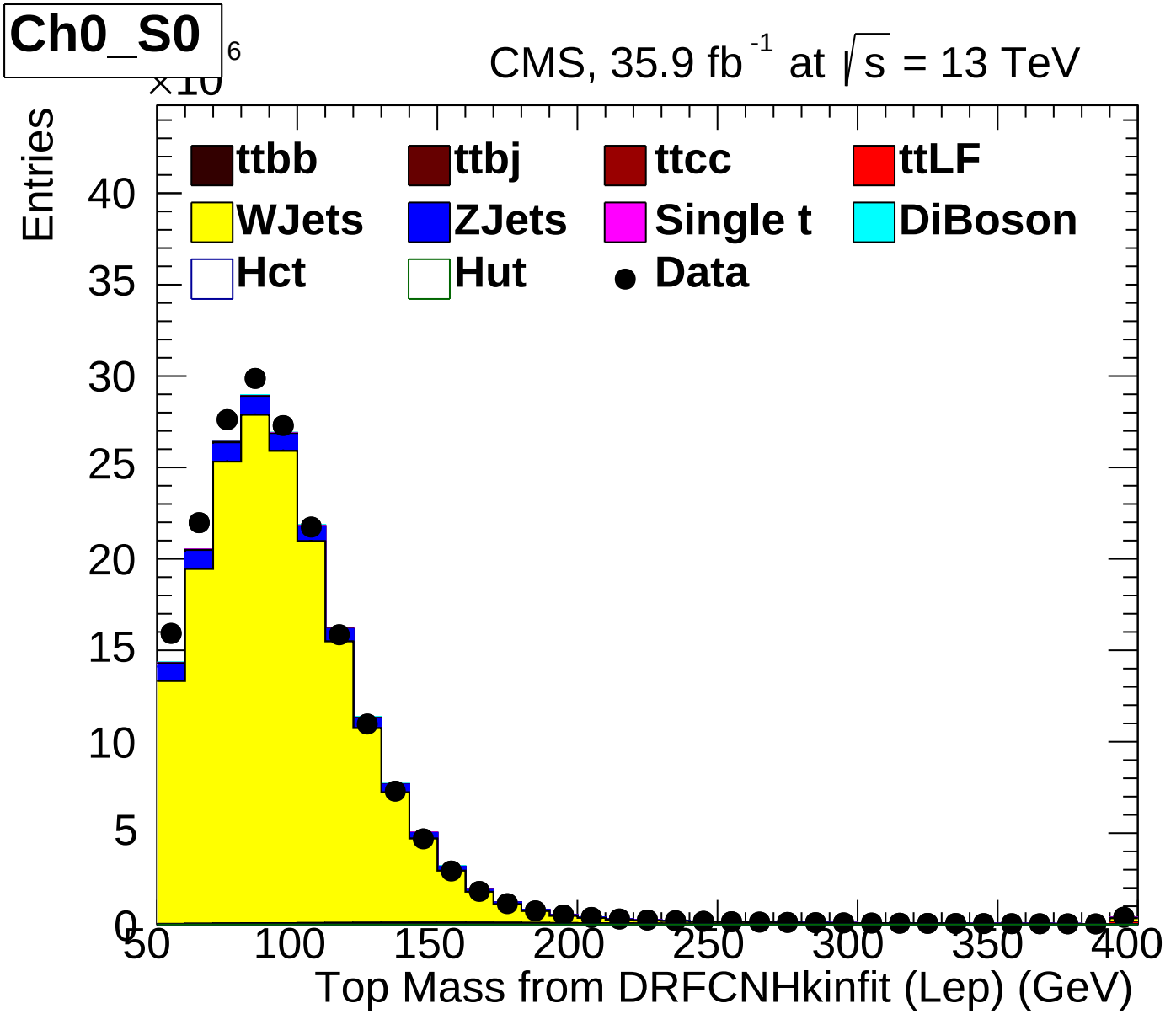

Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
800
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^6$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
5
10
15
20
25
30
35
40
45
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^6$
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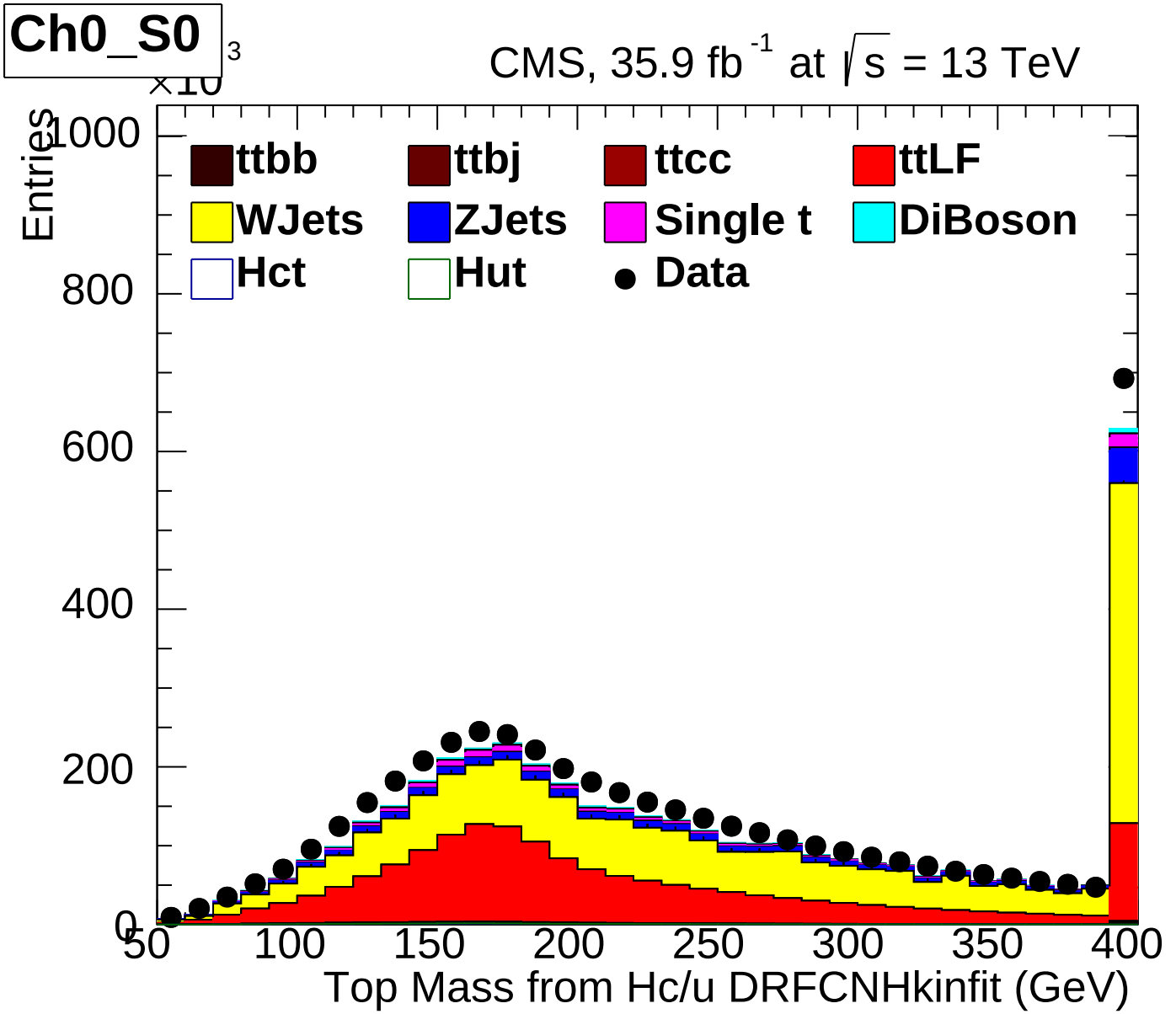
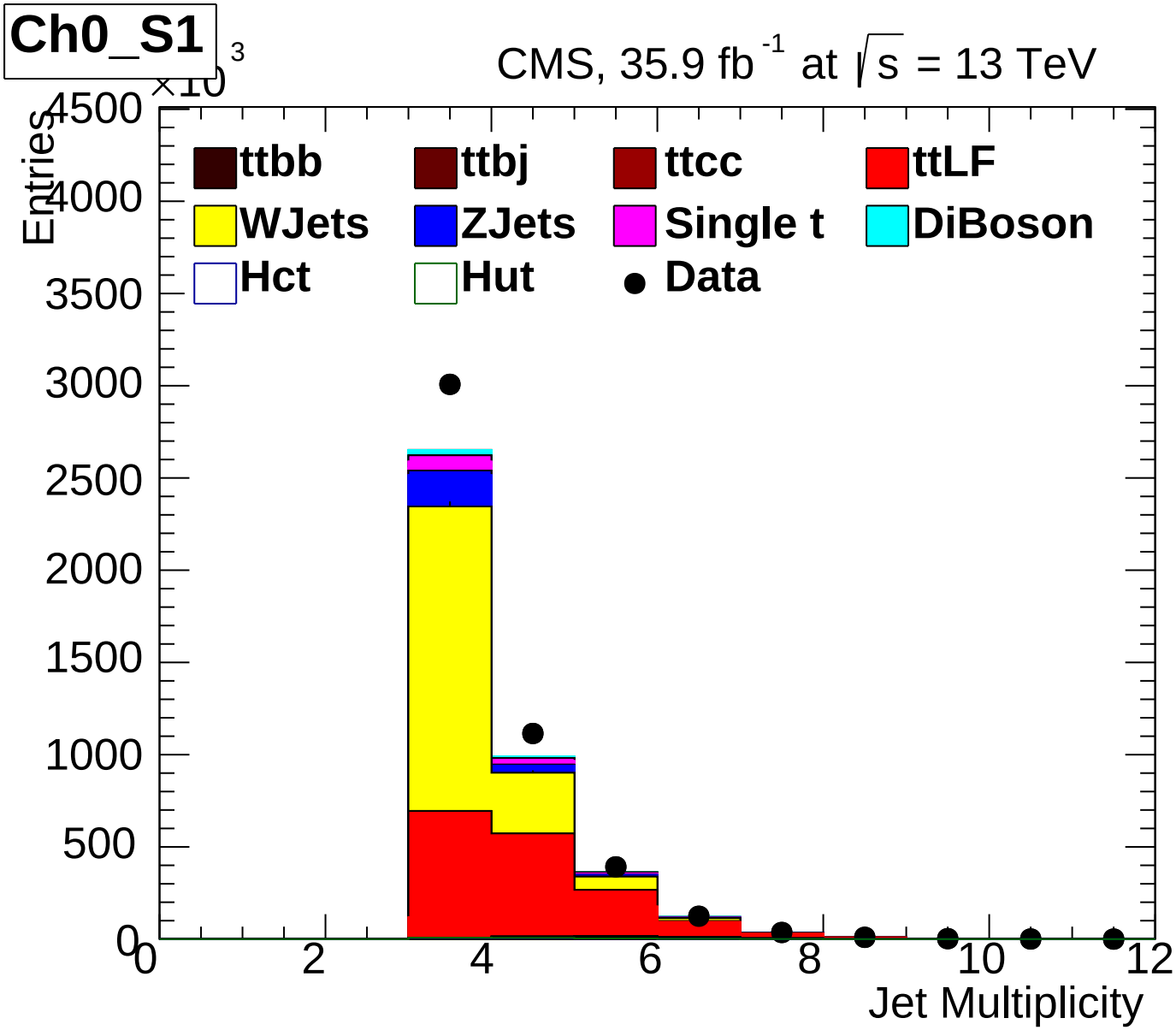
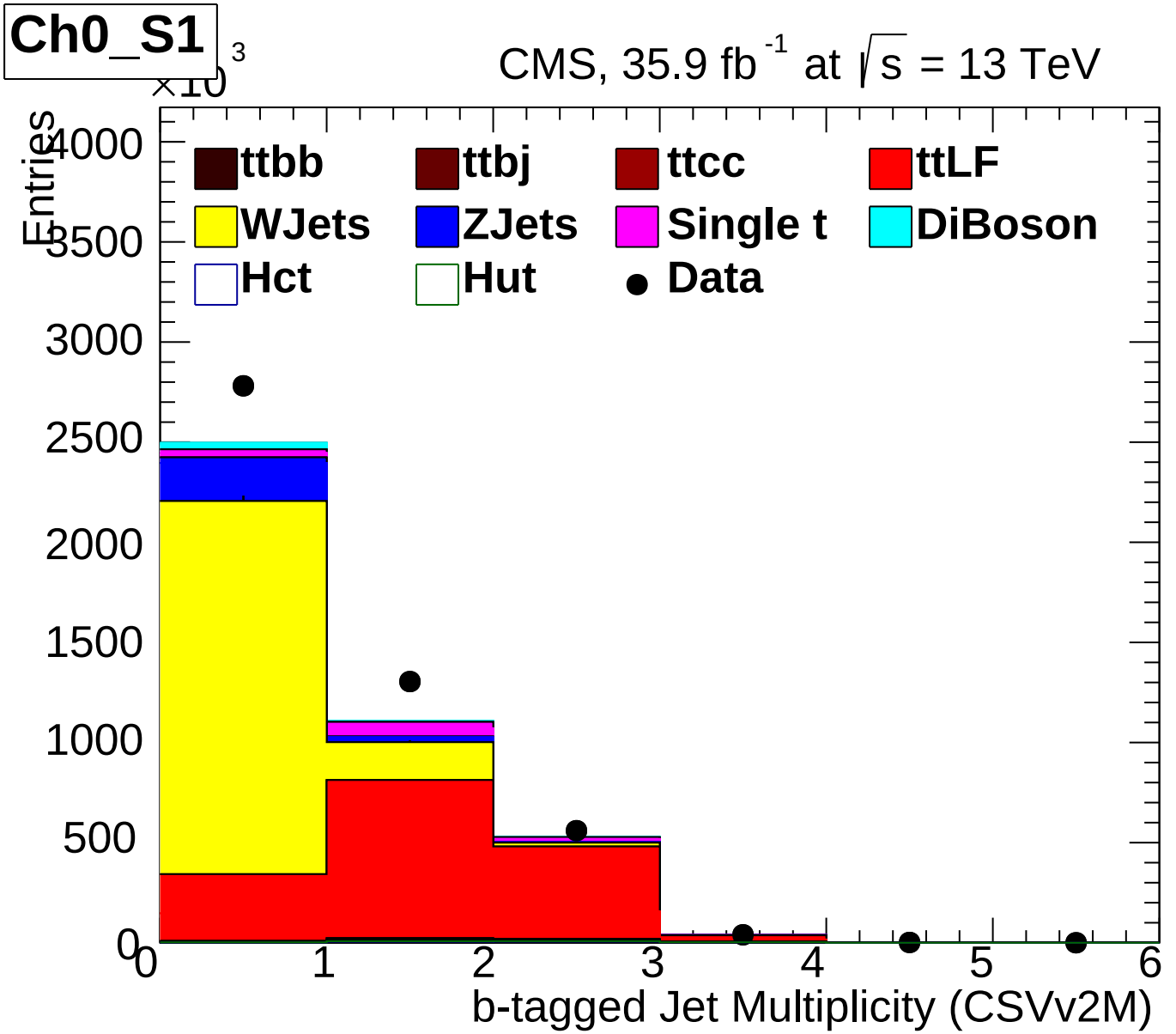
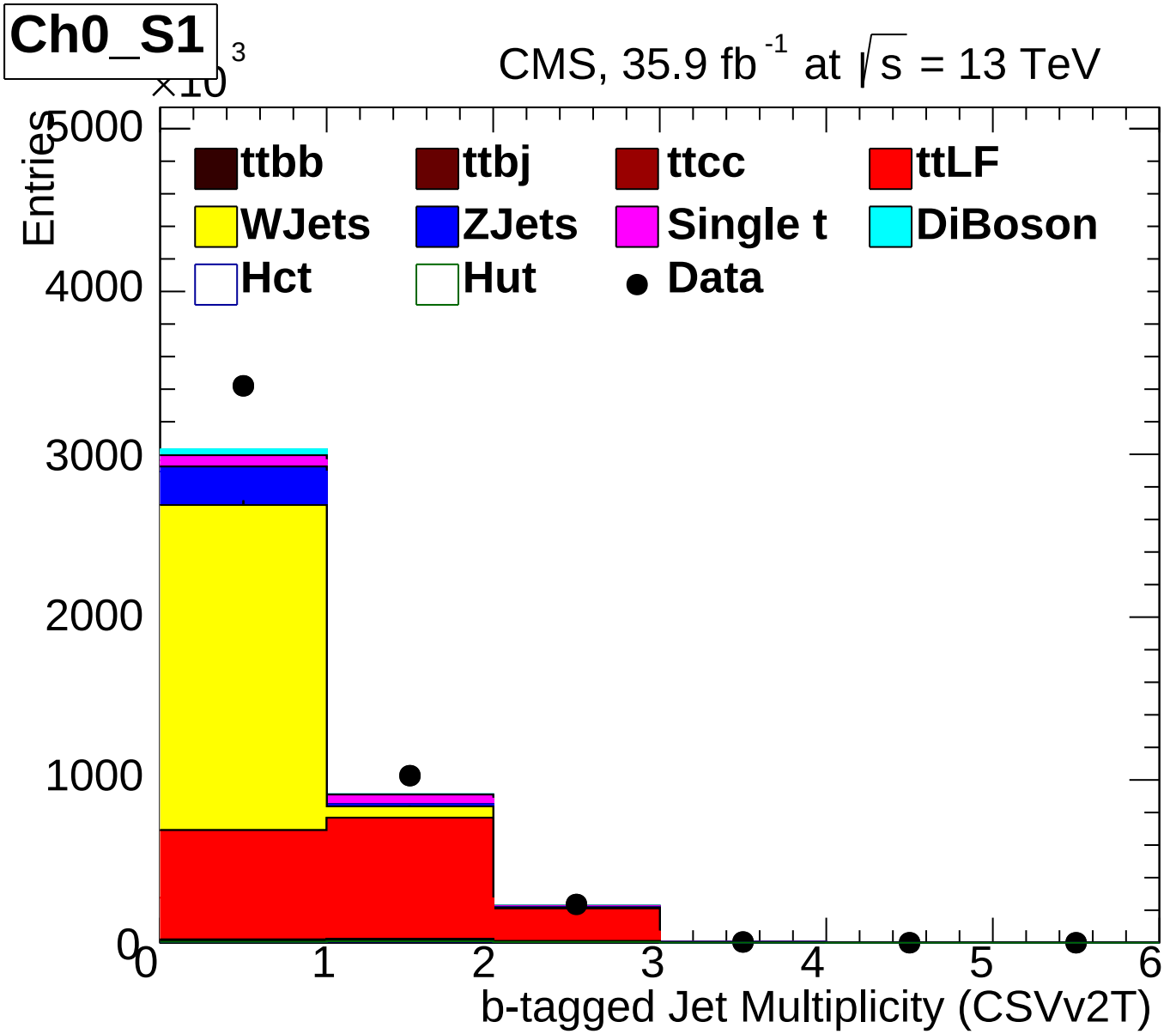
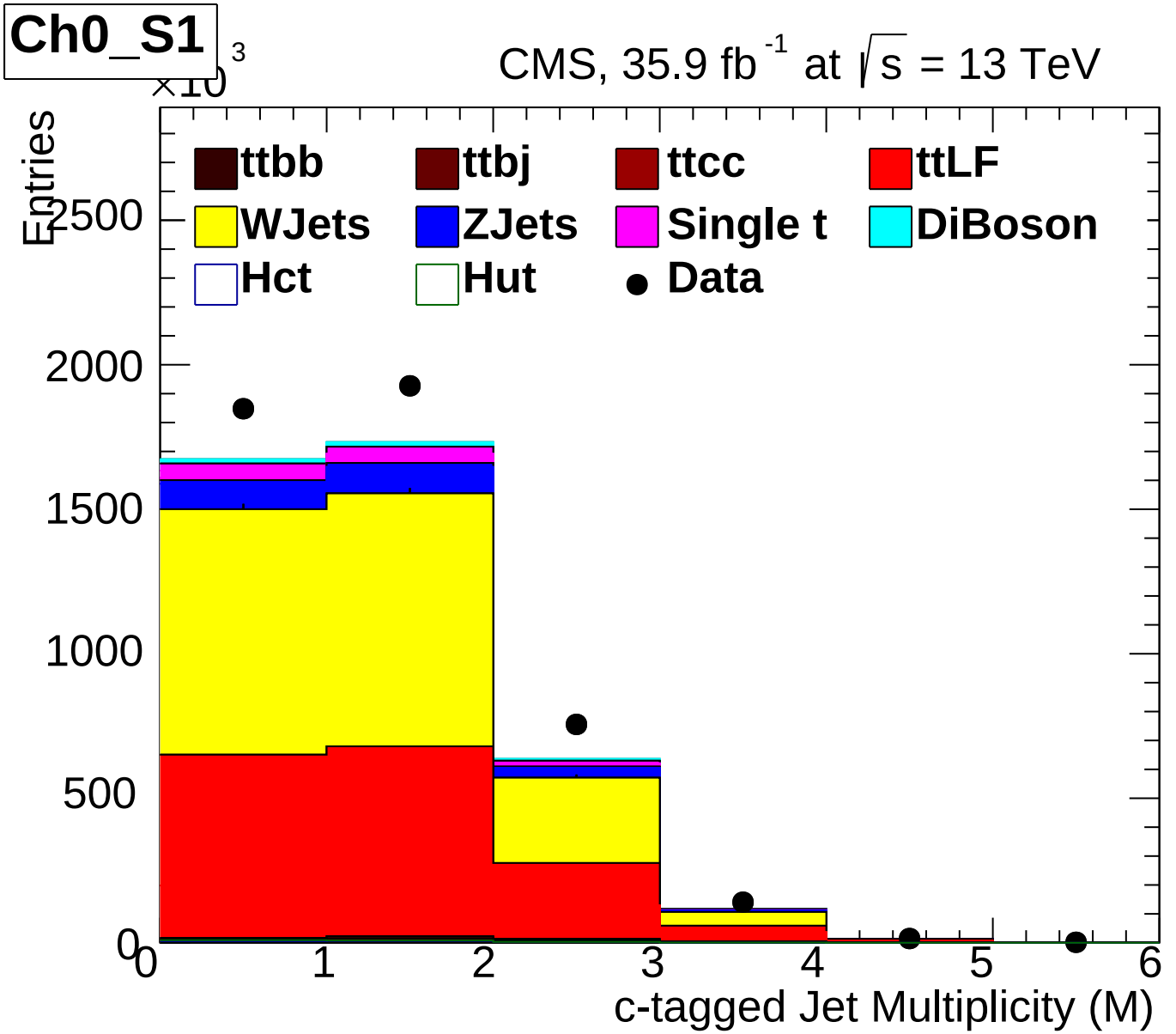
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
5
10
15
20
25
30
35
40
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
1000
800
600
400
200
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
Jet Multiplicity


Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
4000
3500
3000
2500
2000
1500
1000
500
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
5000
4000
3000
2000
1000
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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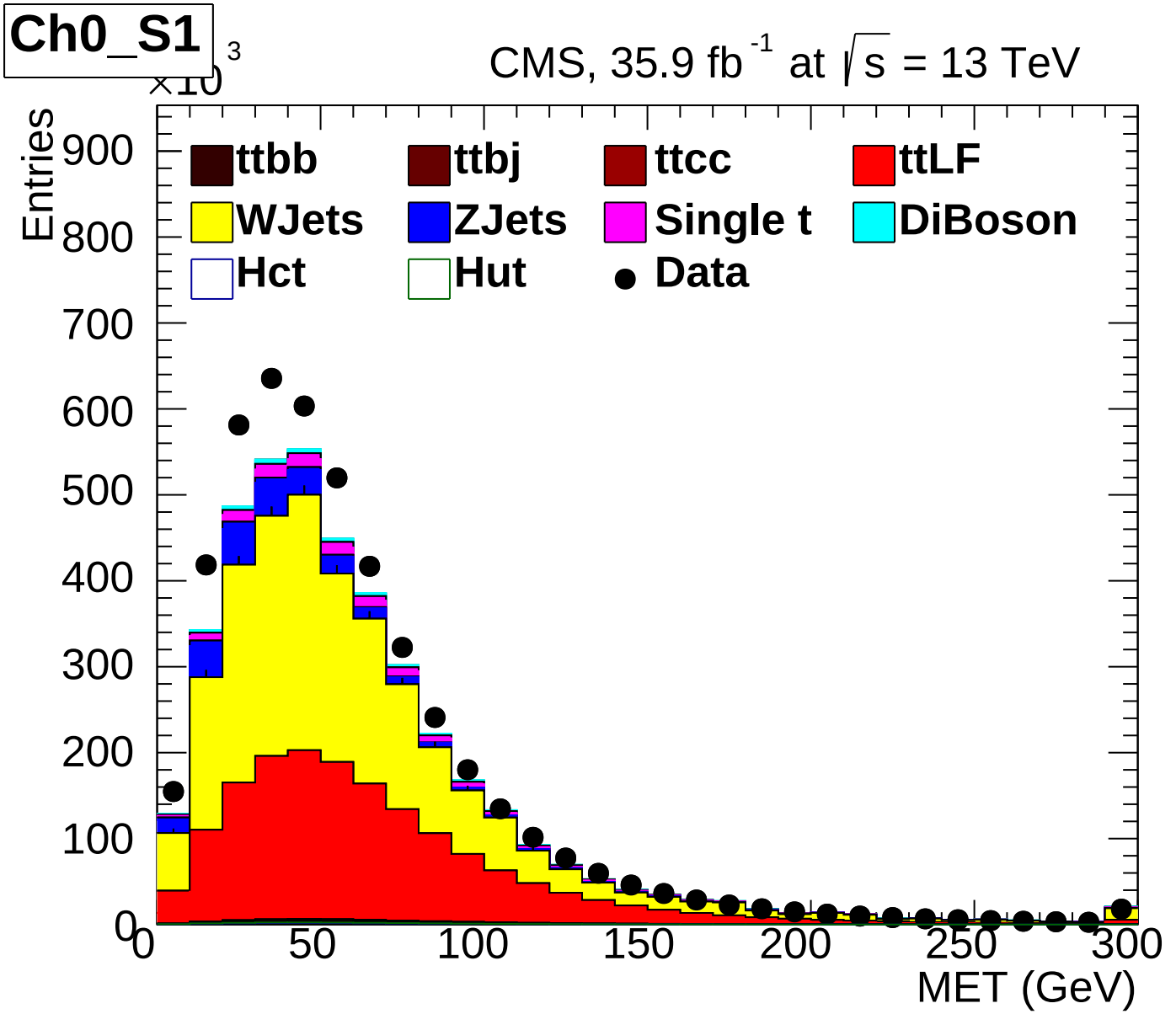
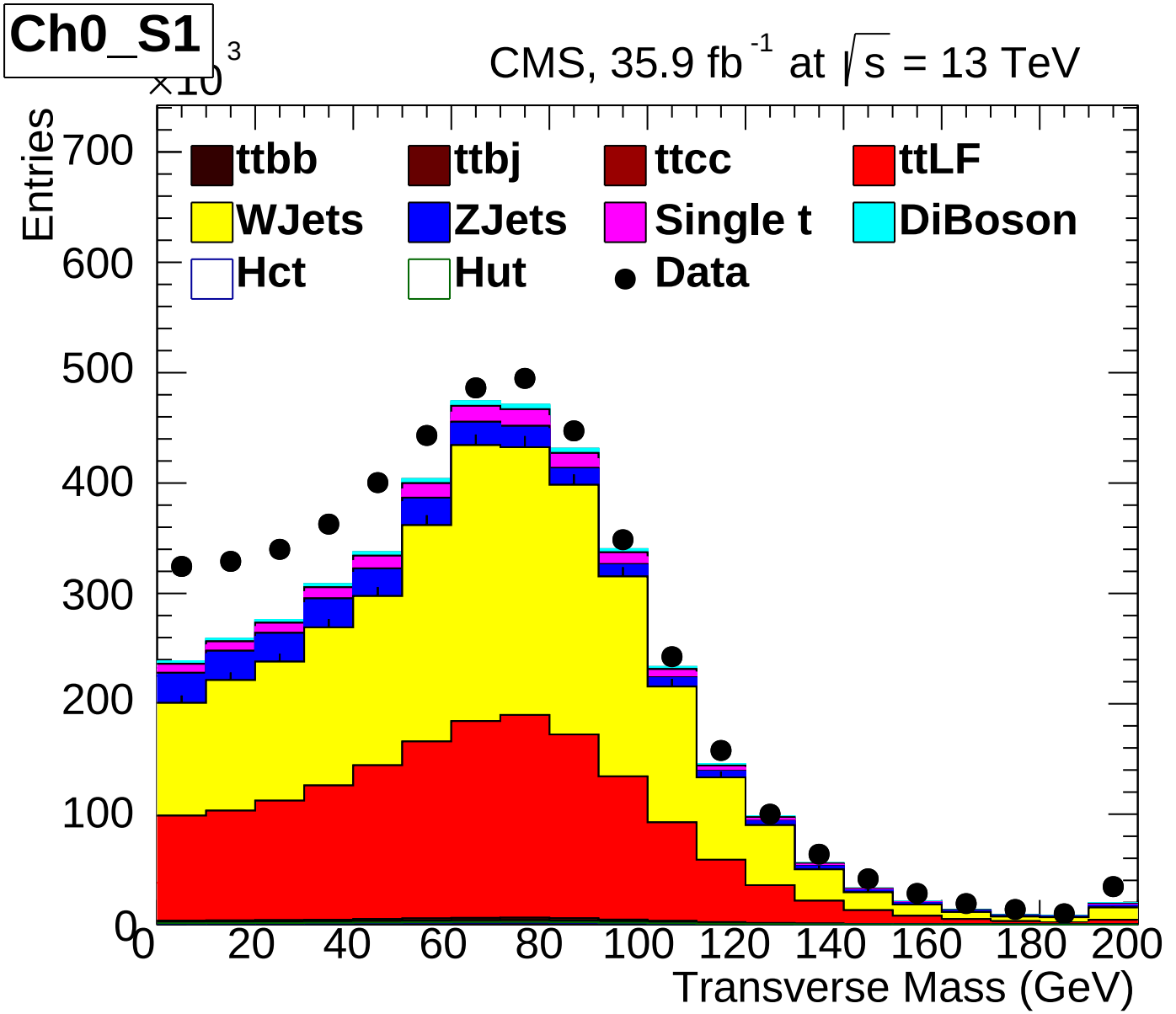
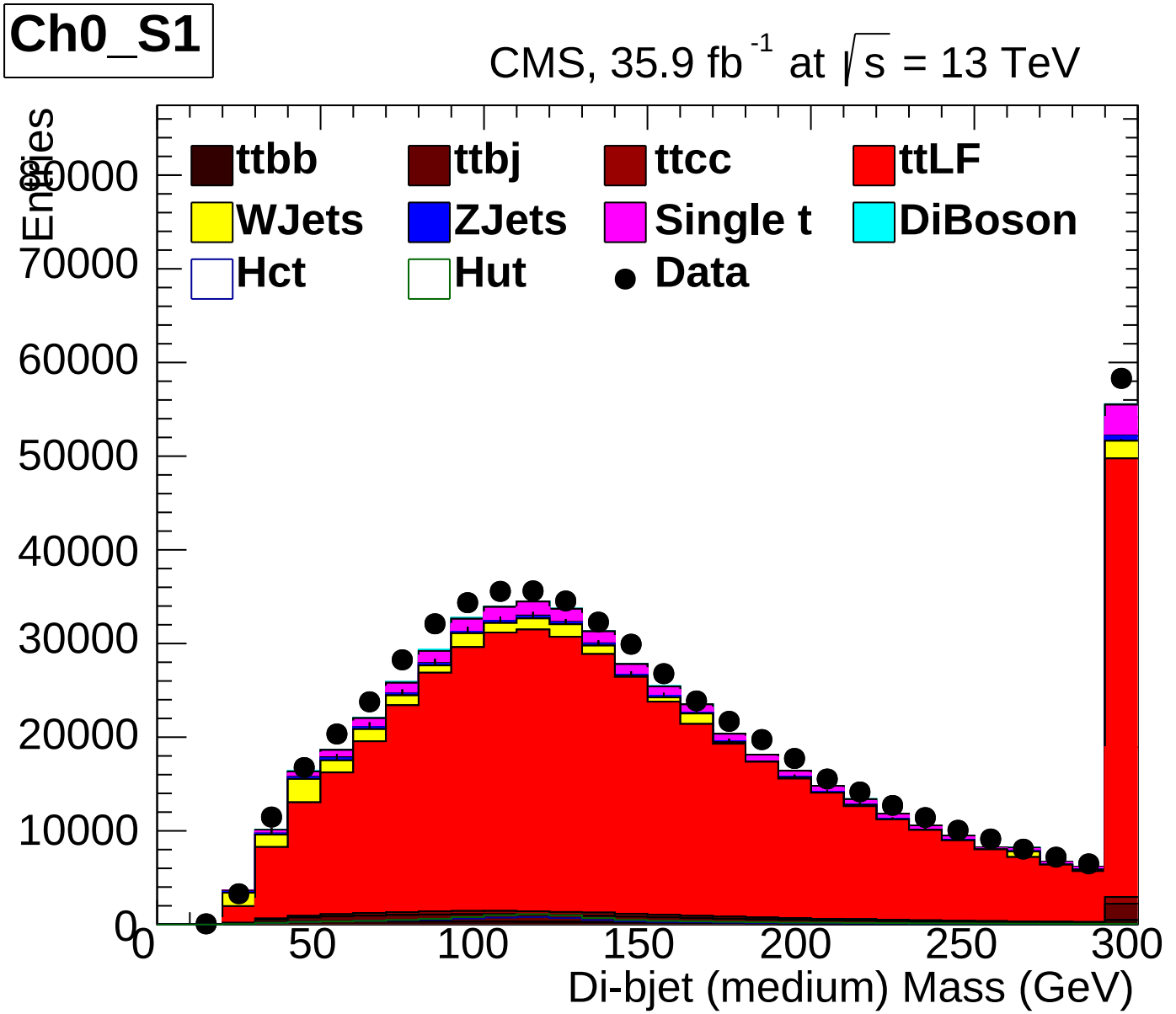
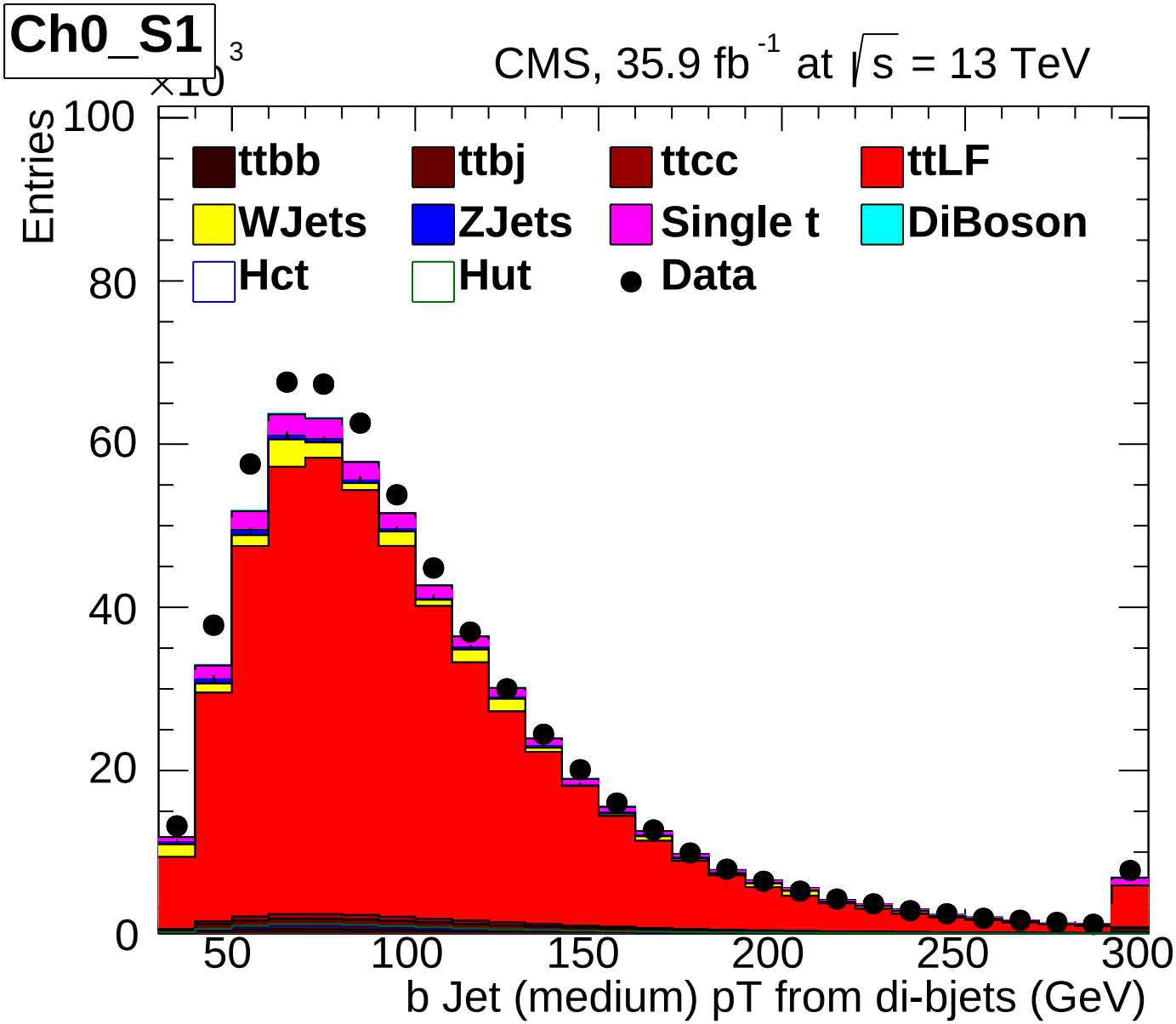
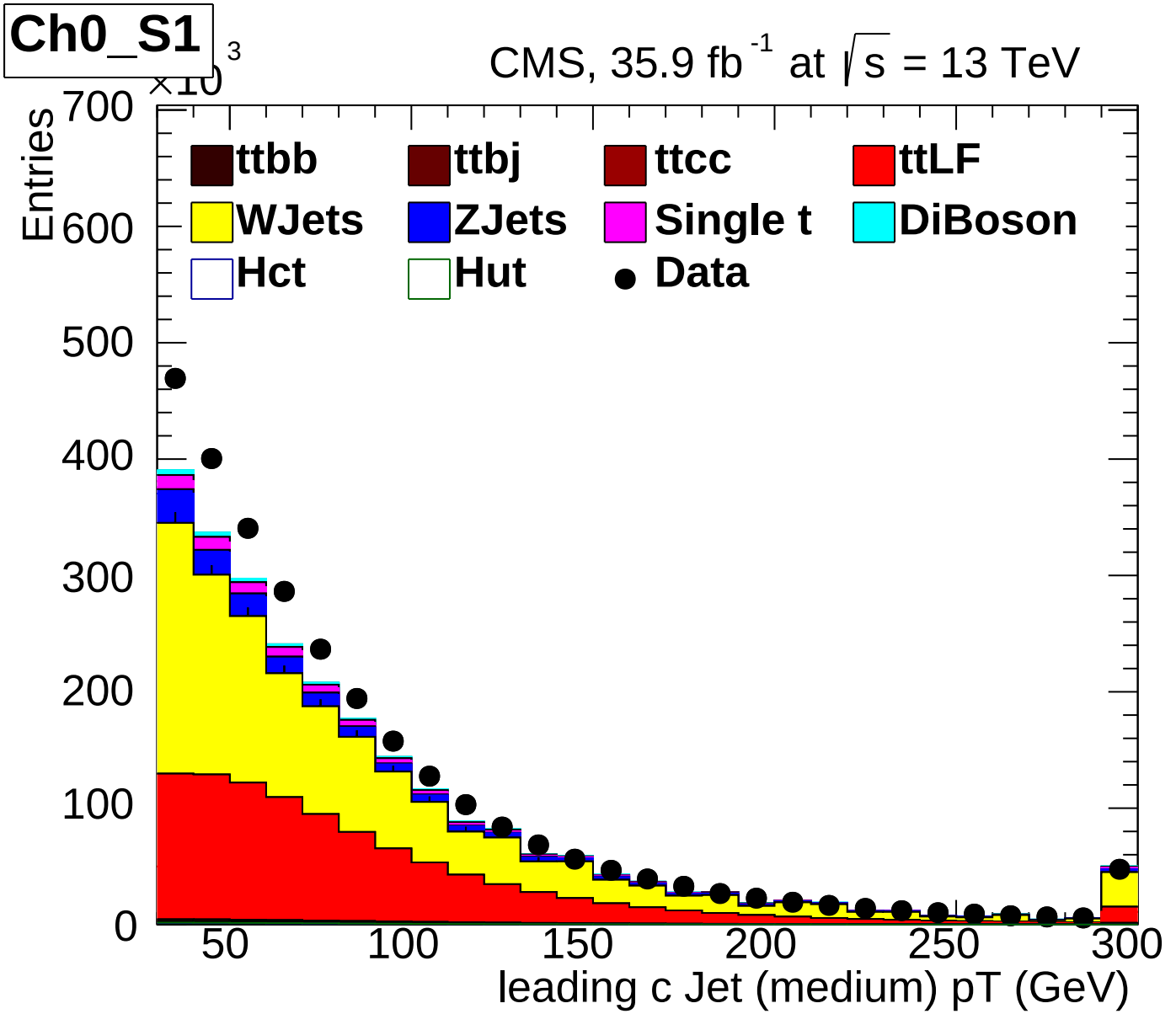
2000
1500
1000
500
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

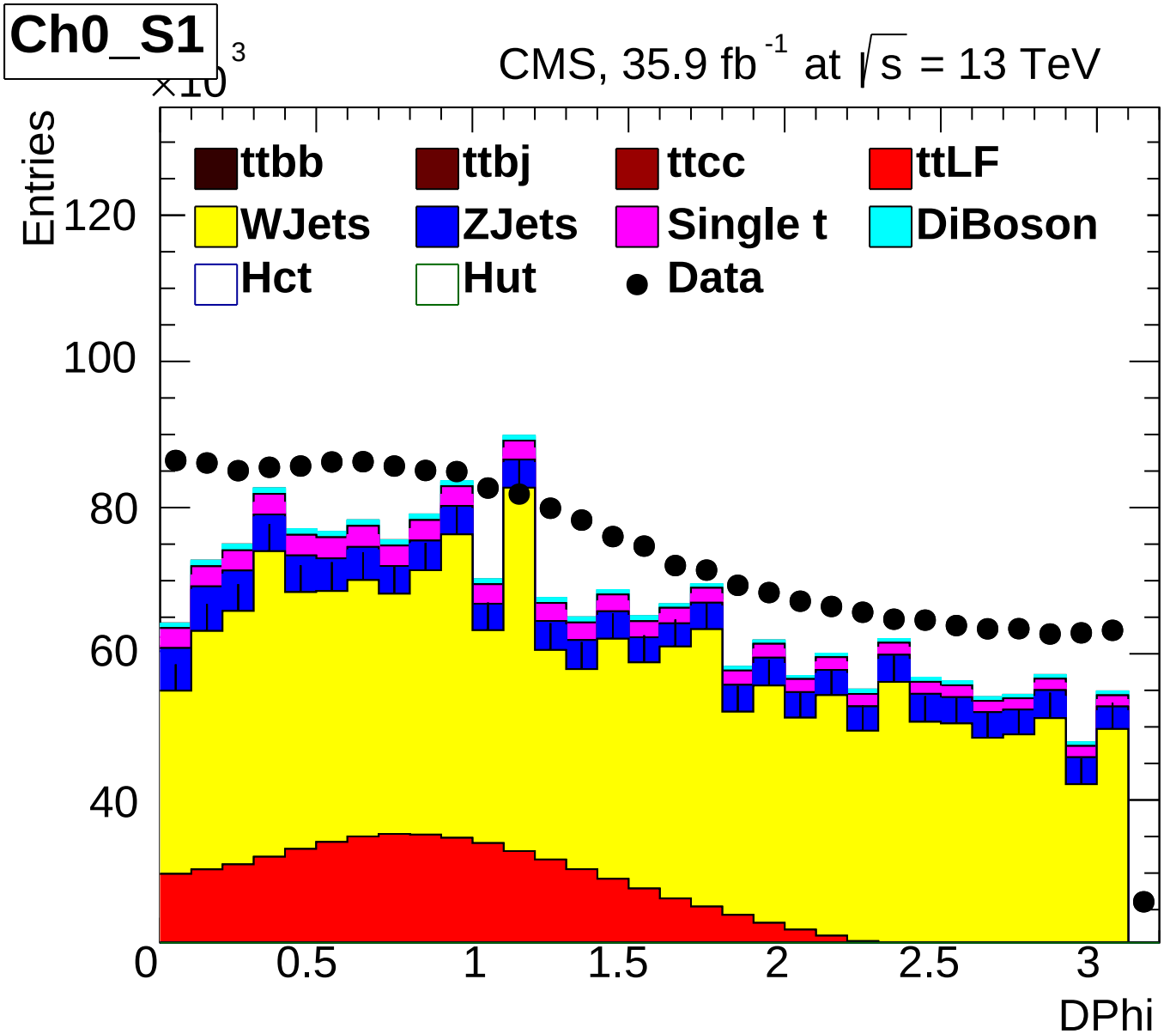

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
900
800
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
MET (GeV)

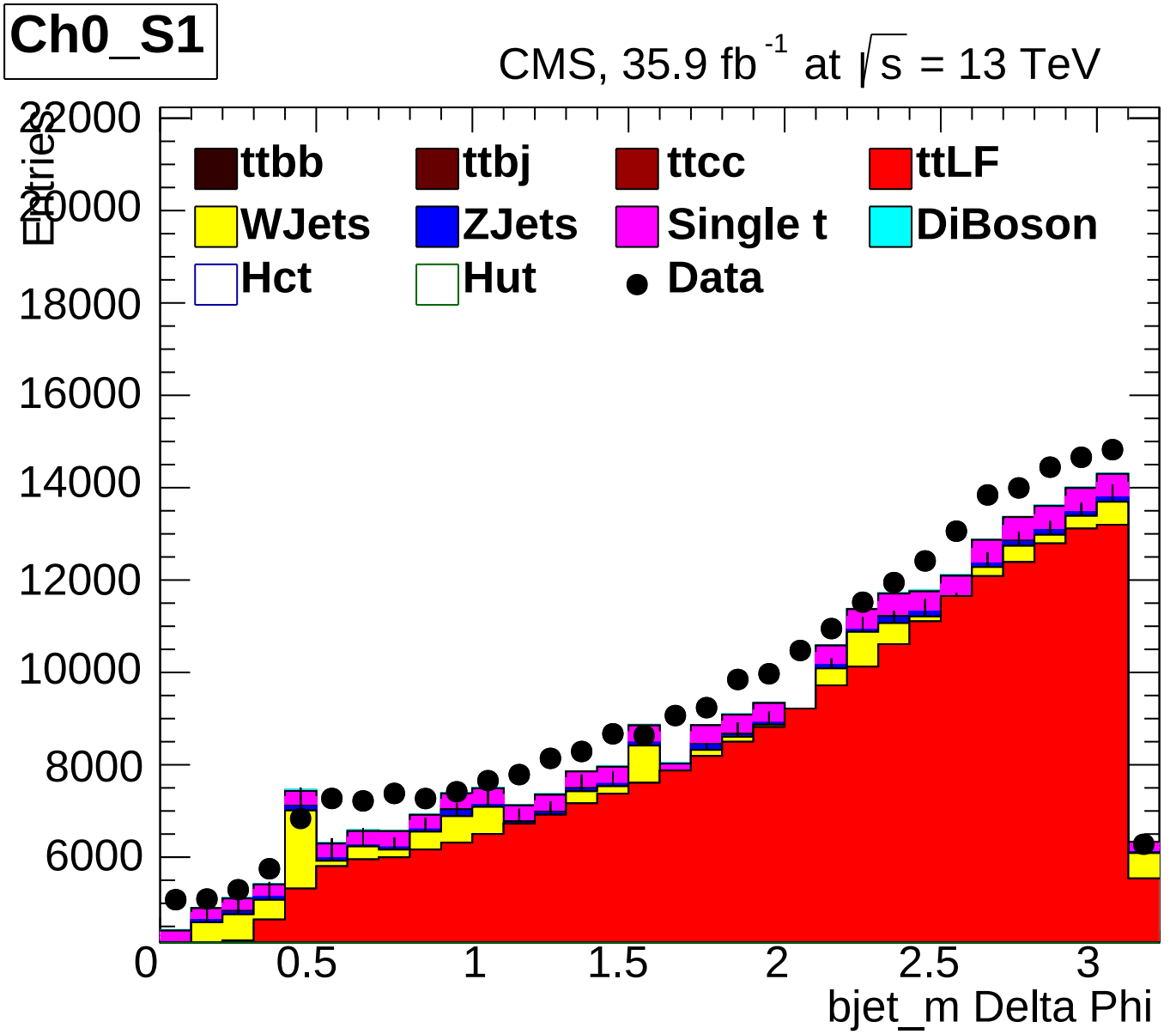

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

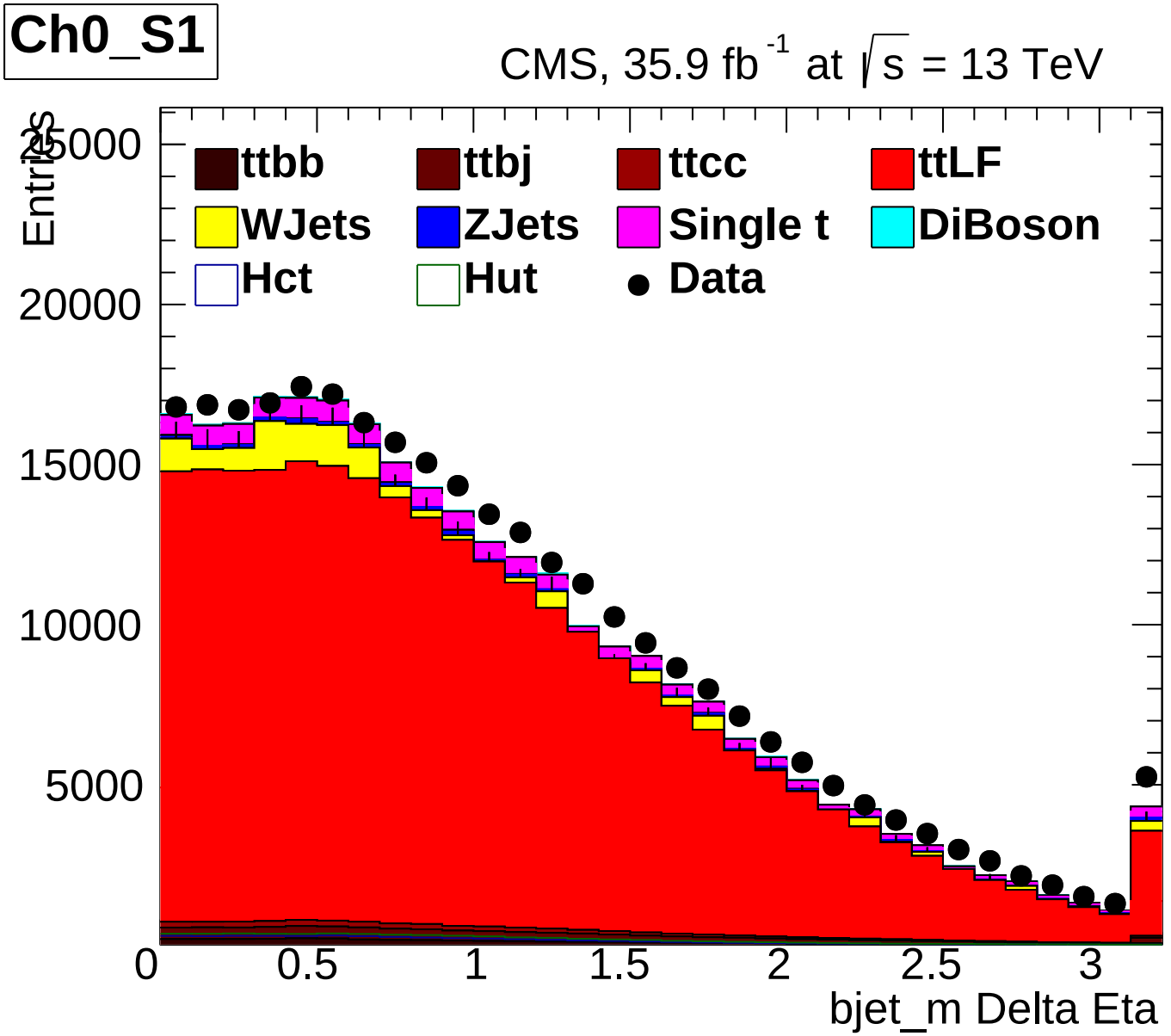

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
80000
70000
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

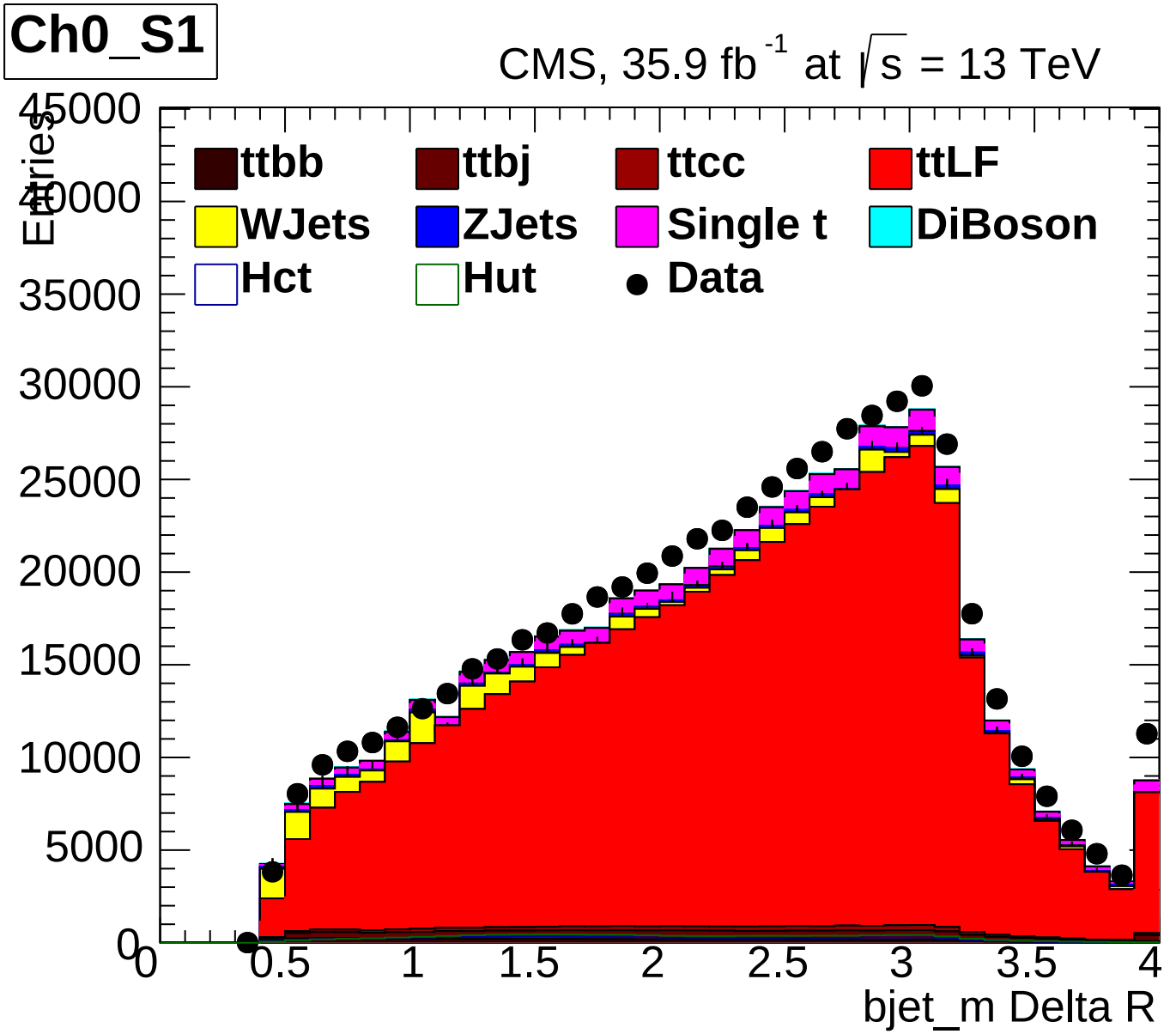

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

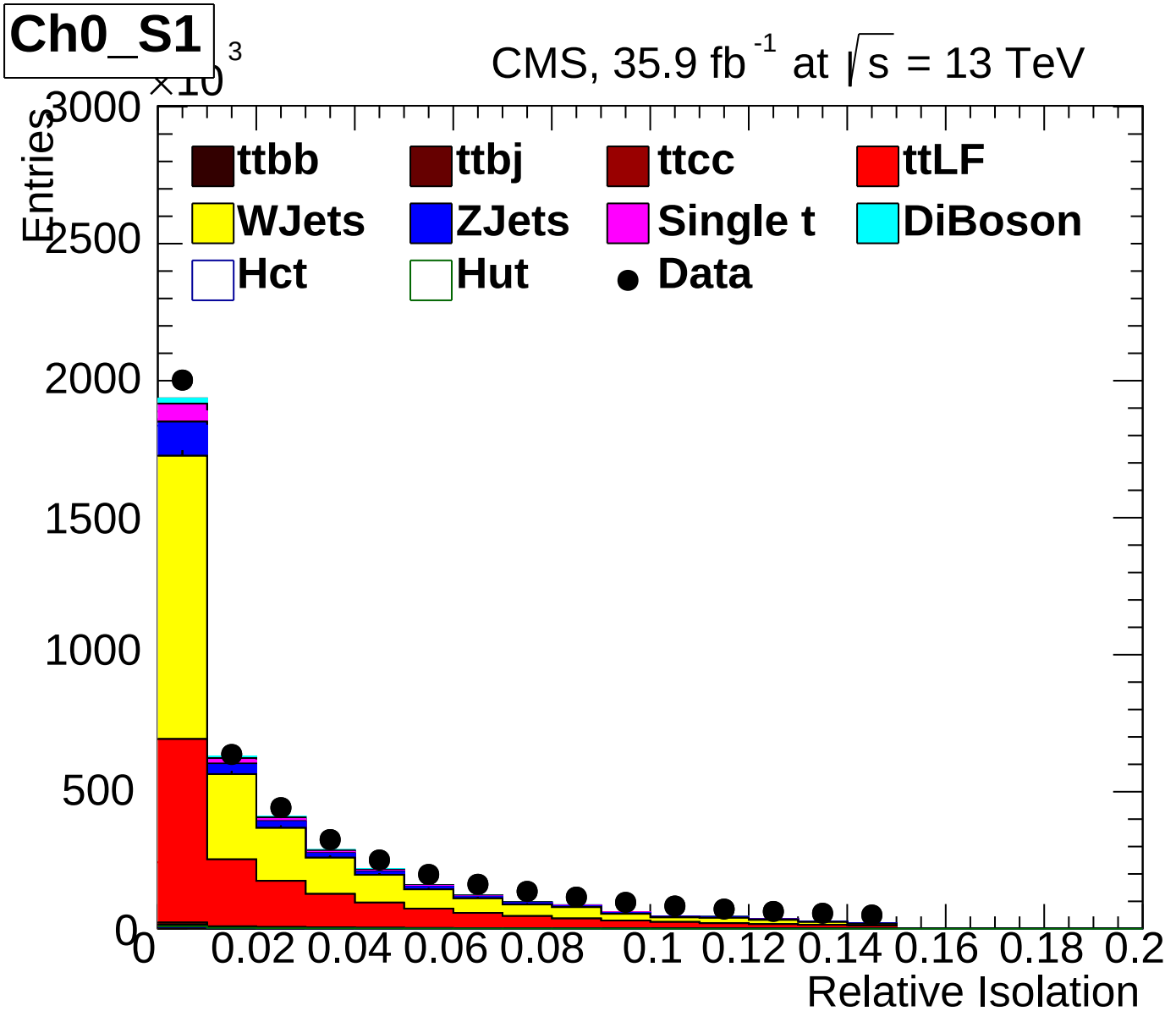

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

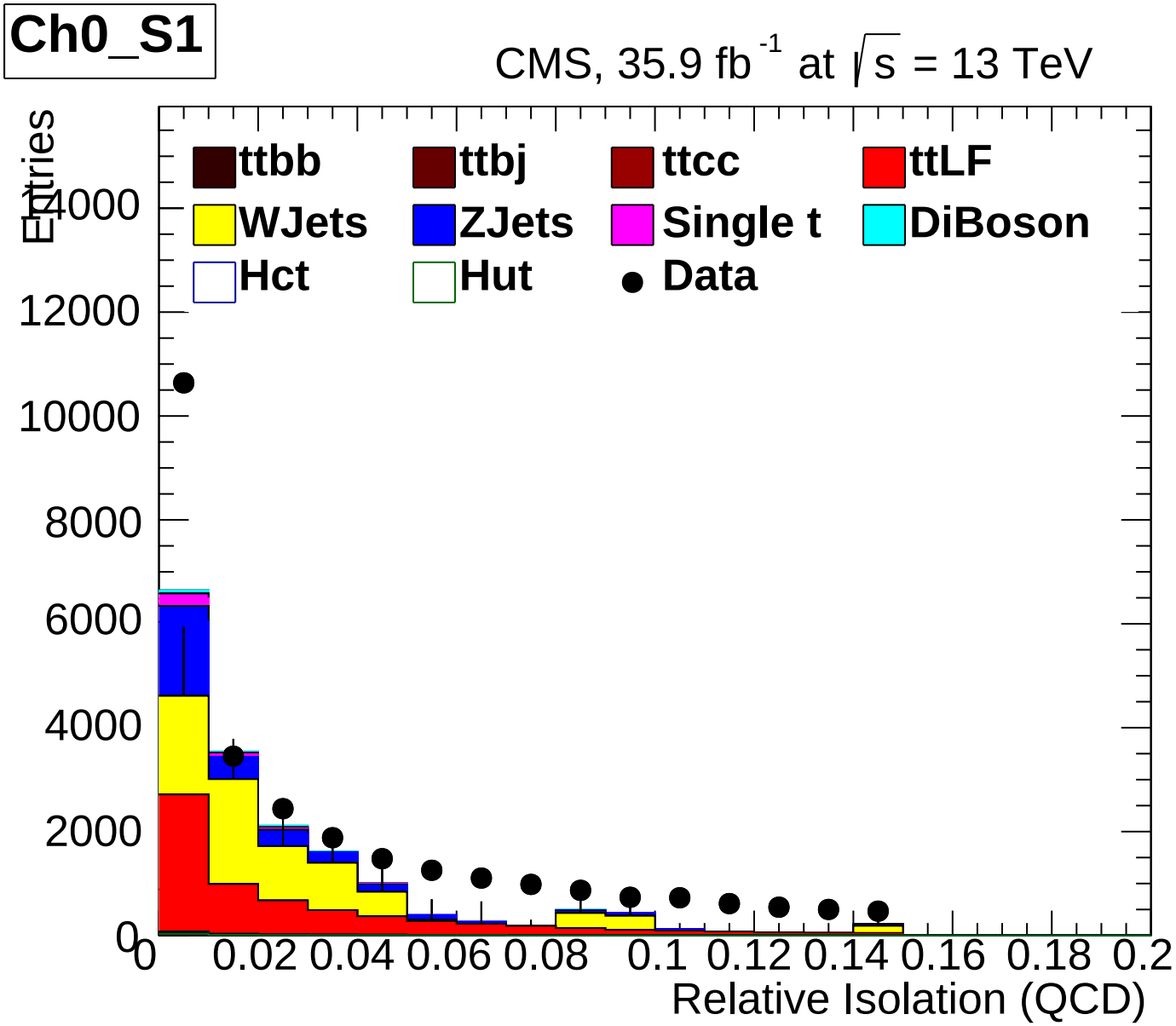

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
120
100
80
60
40
0
0.5
1
1.5
2
2.5
3
DPhi

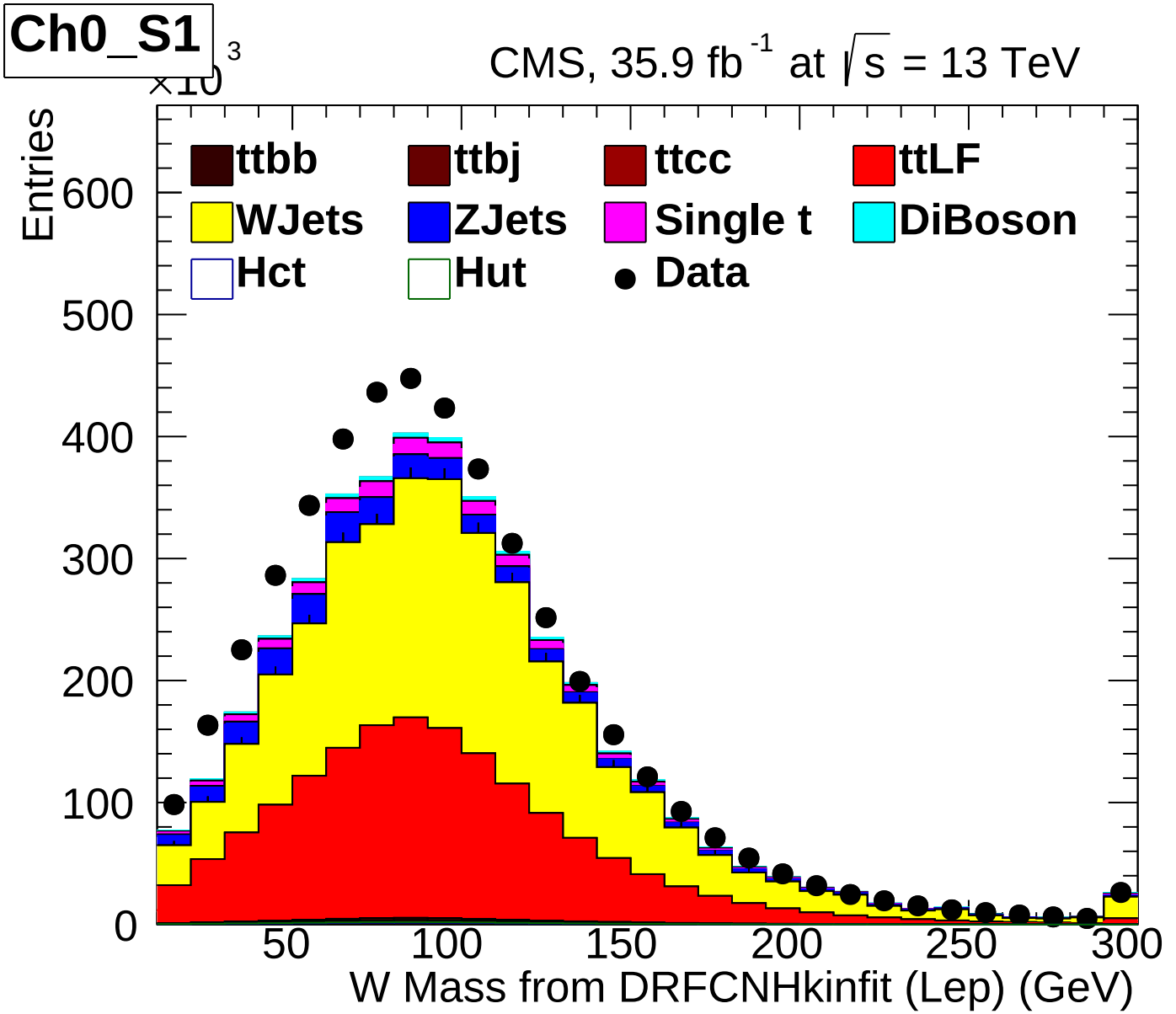

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
22000
20000
18000
16000
14000
12000
10000
8000
6000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

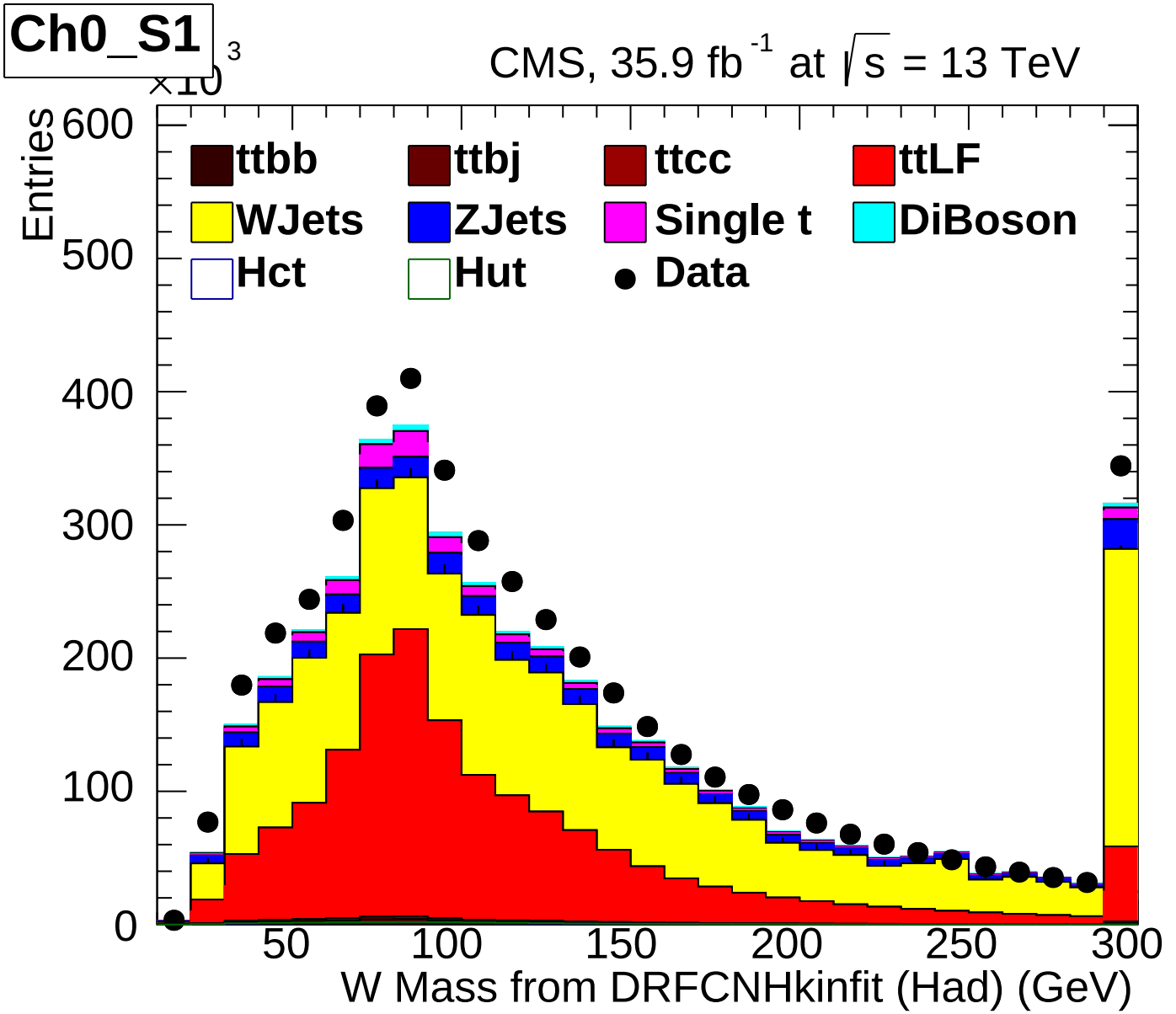

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

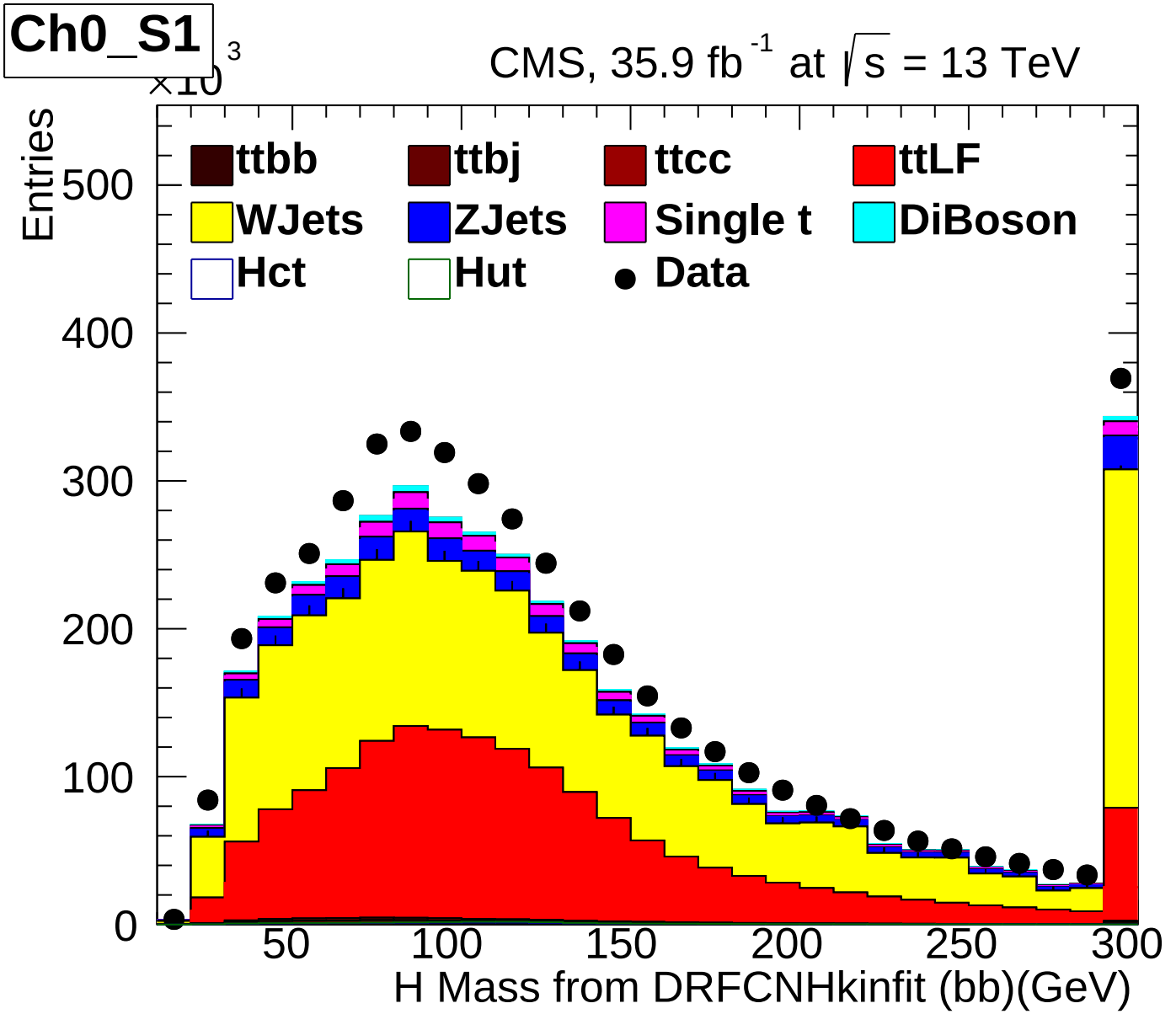

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

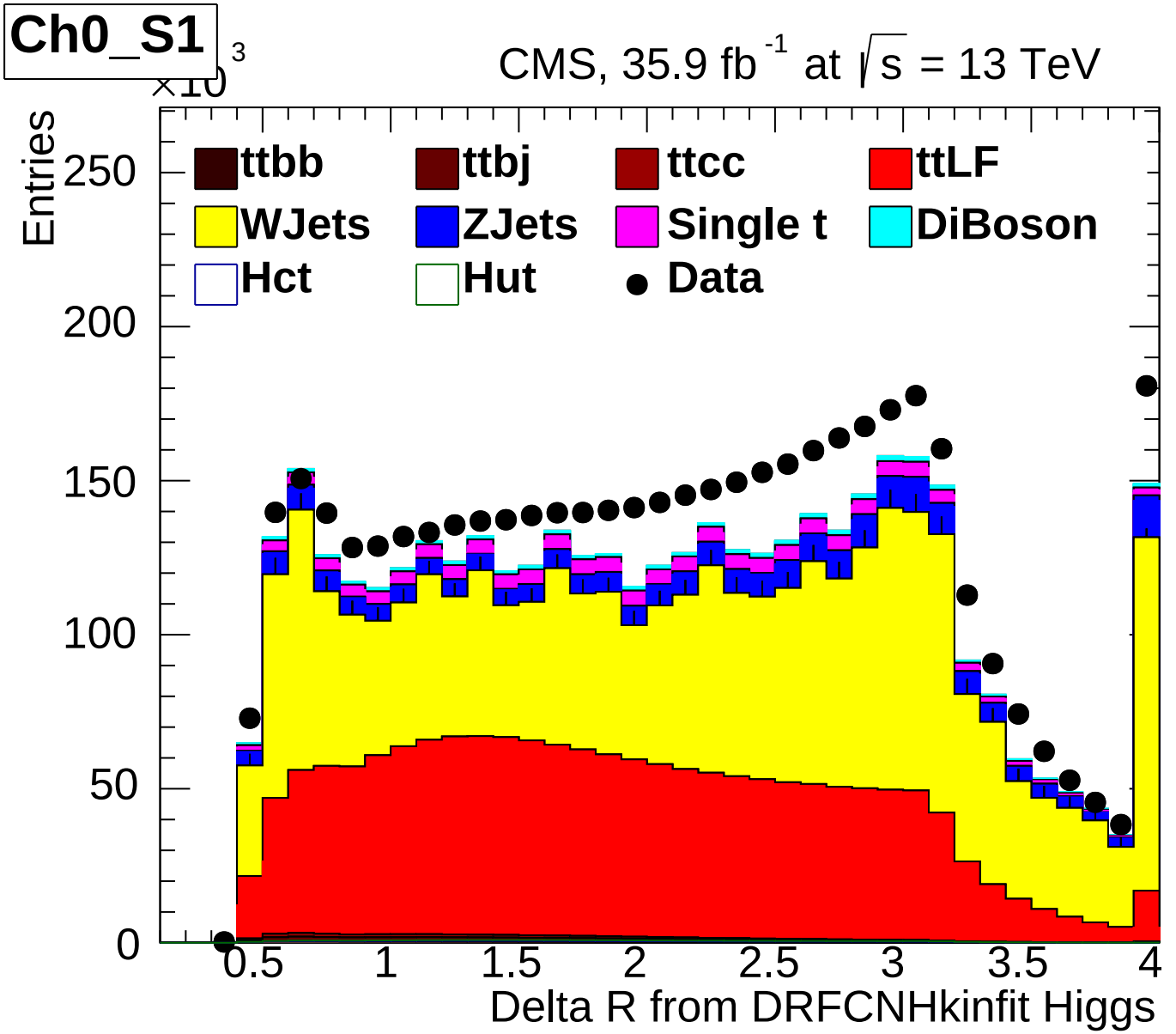

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
3000
2500
2000
1500
1000
500
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

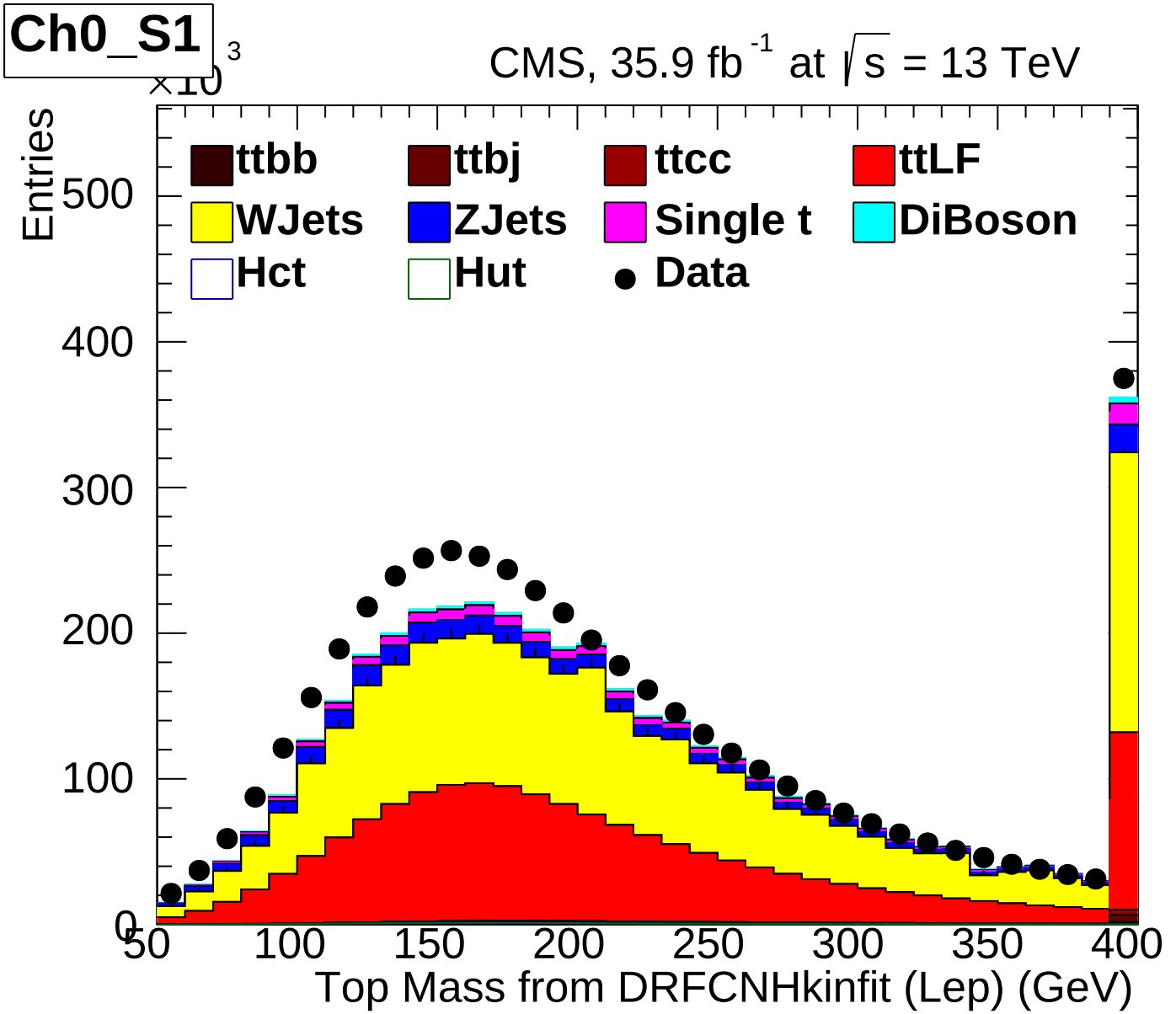

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

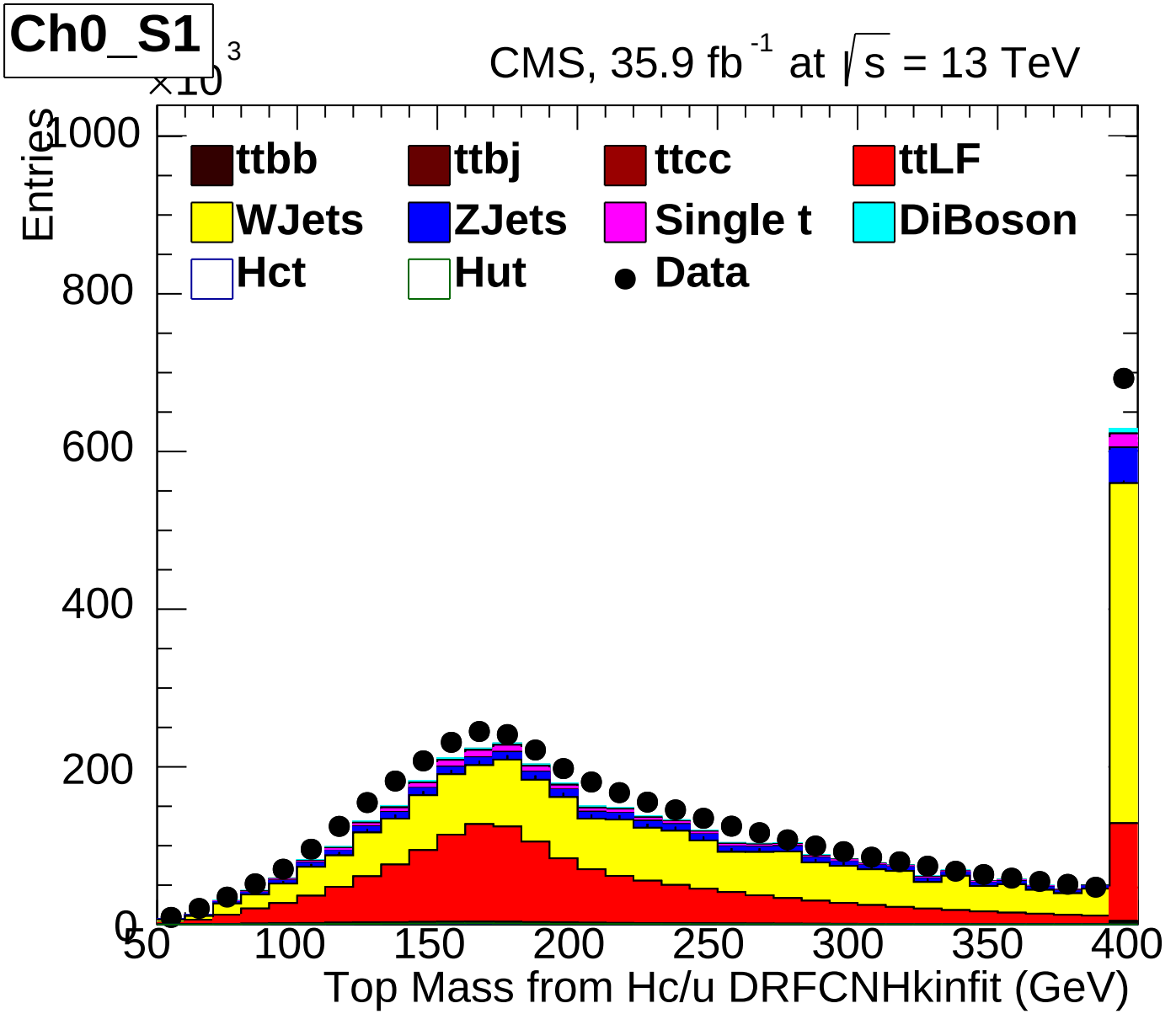

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

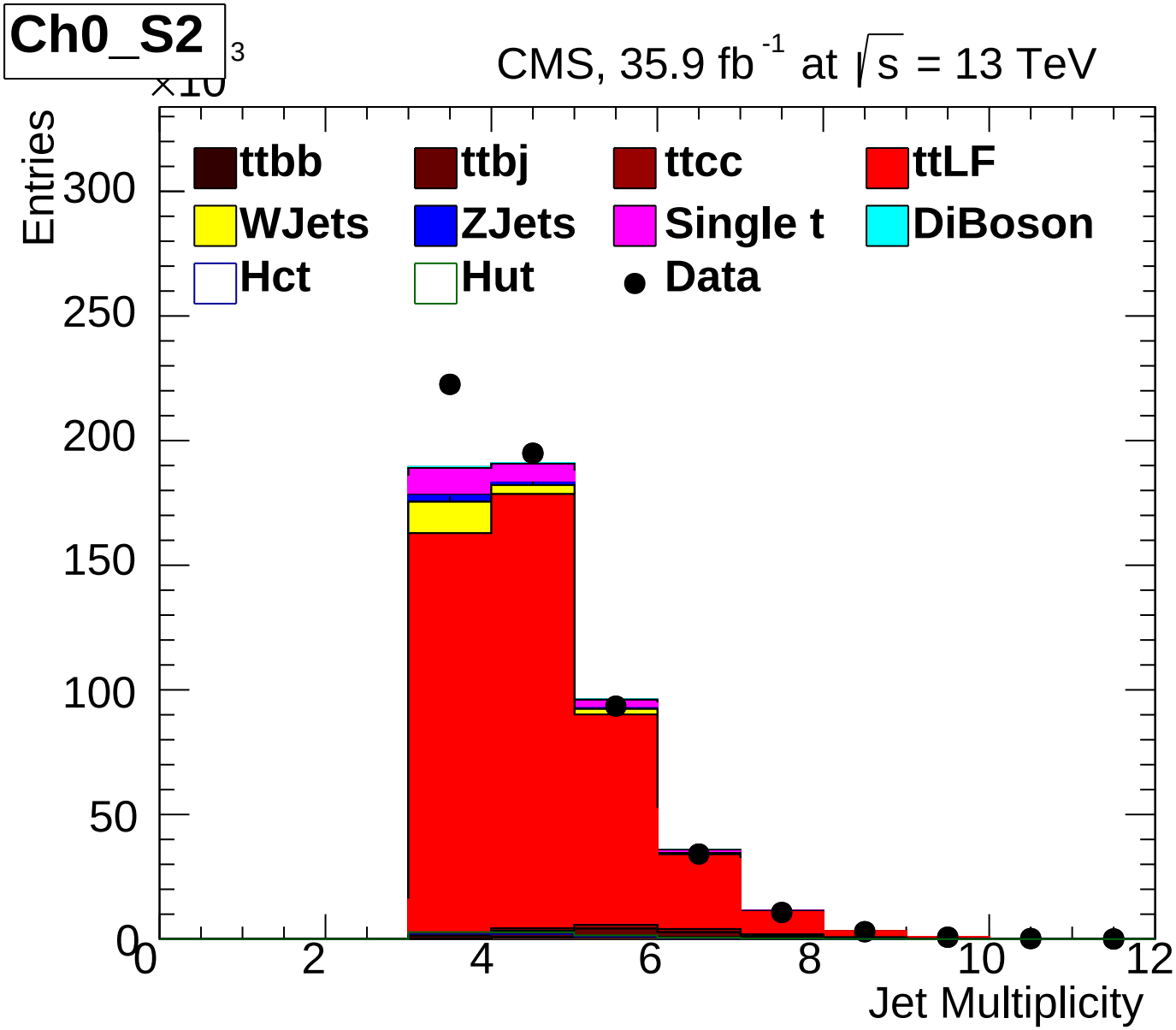

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

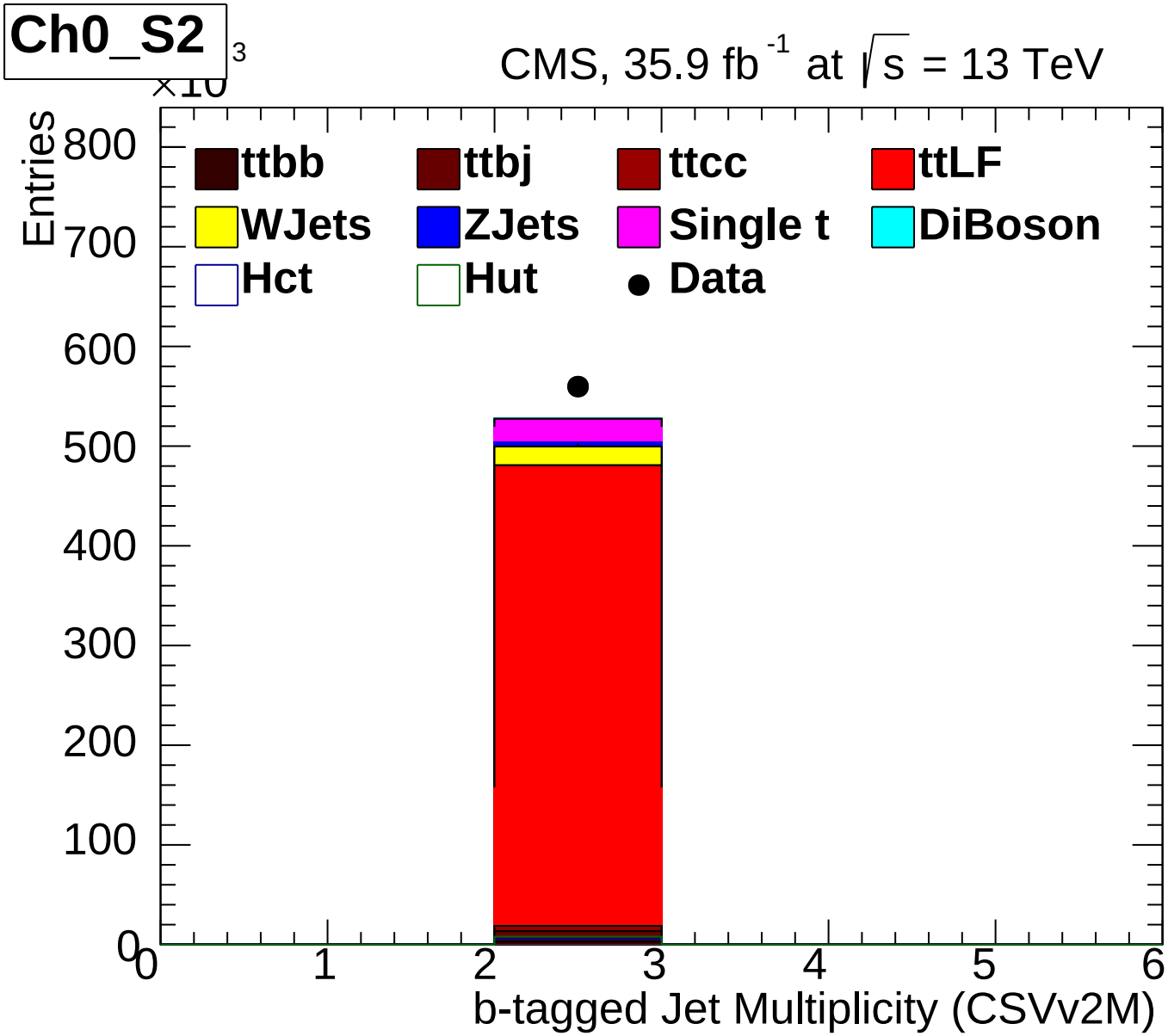

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

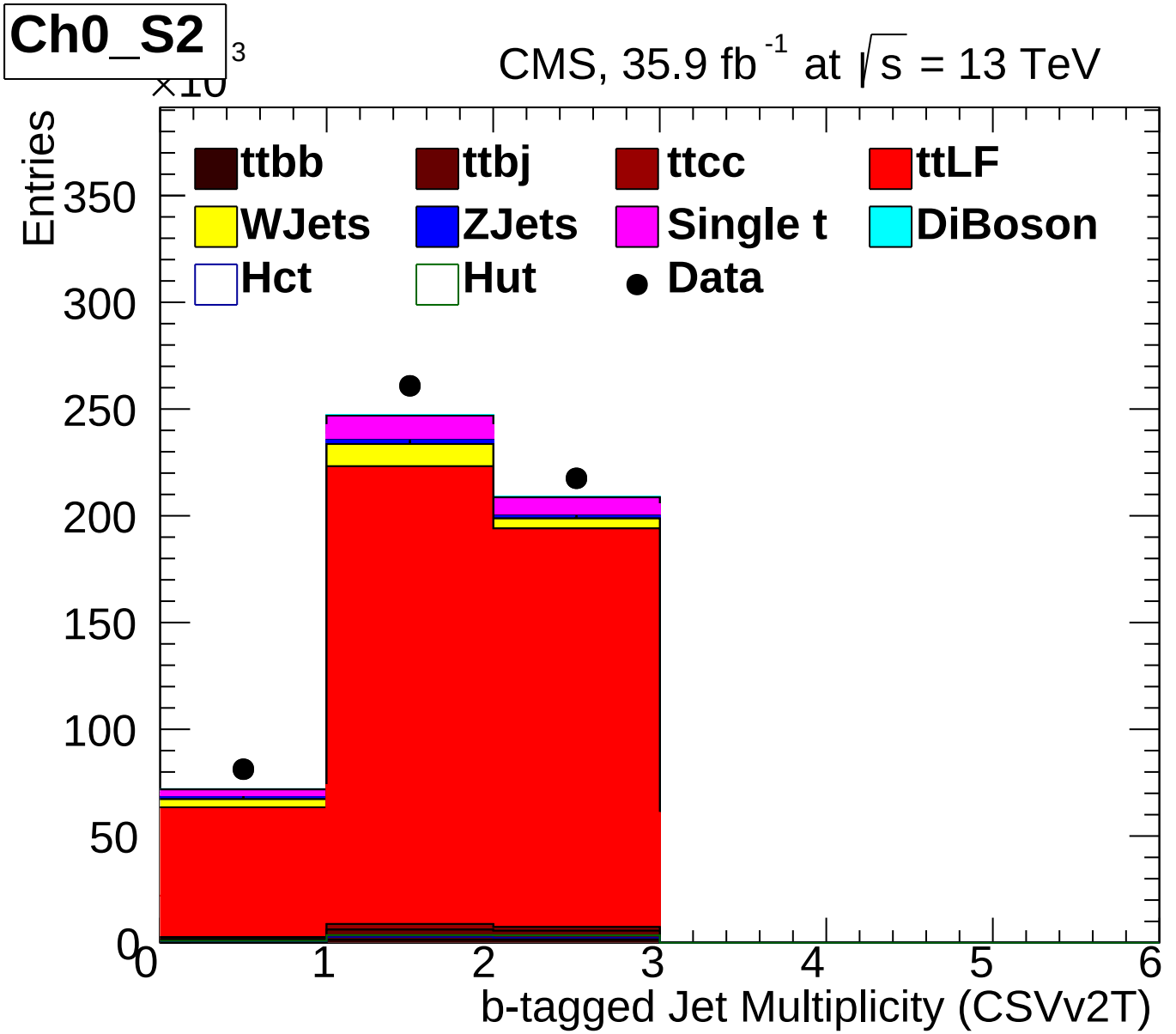

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

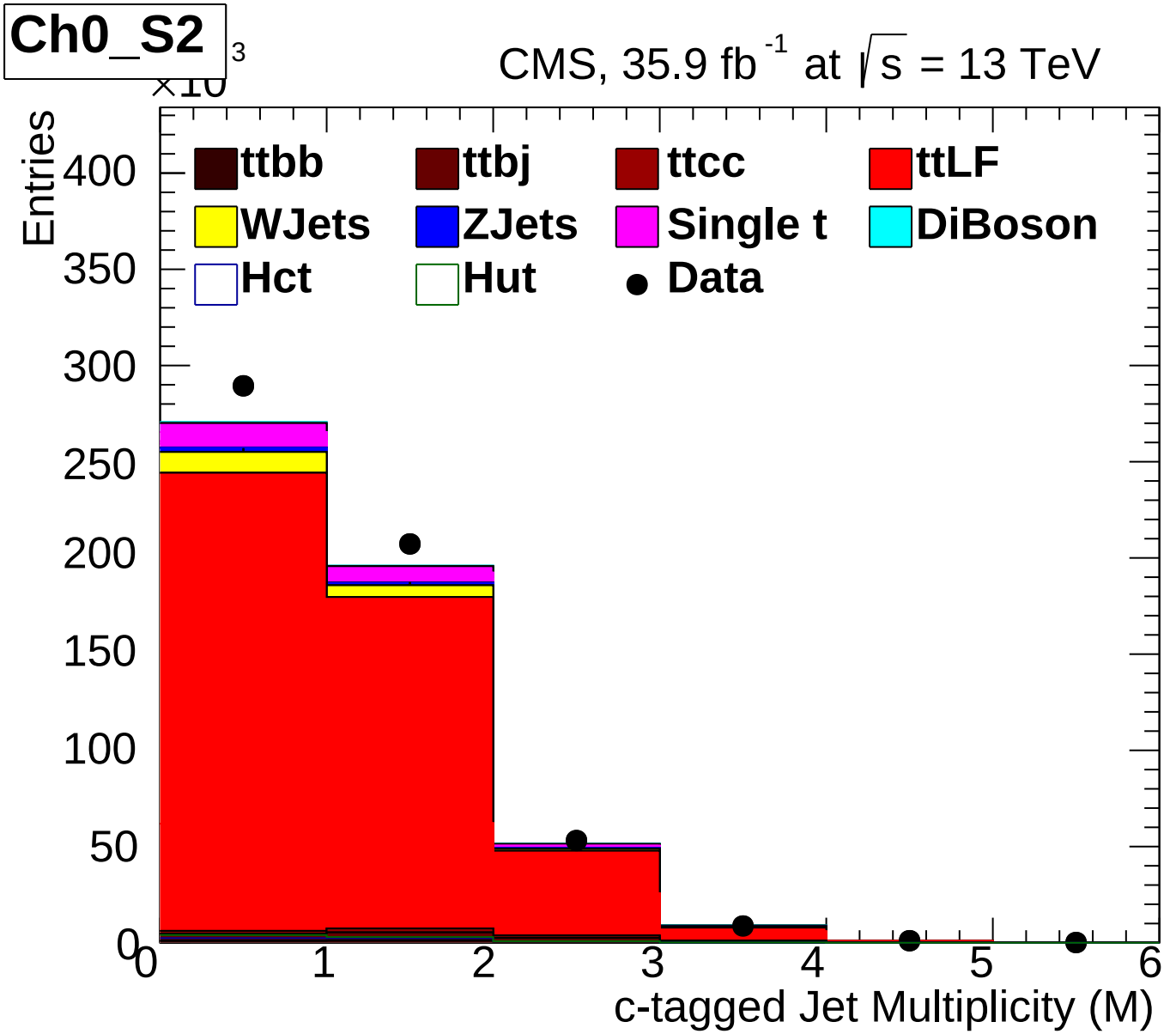

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

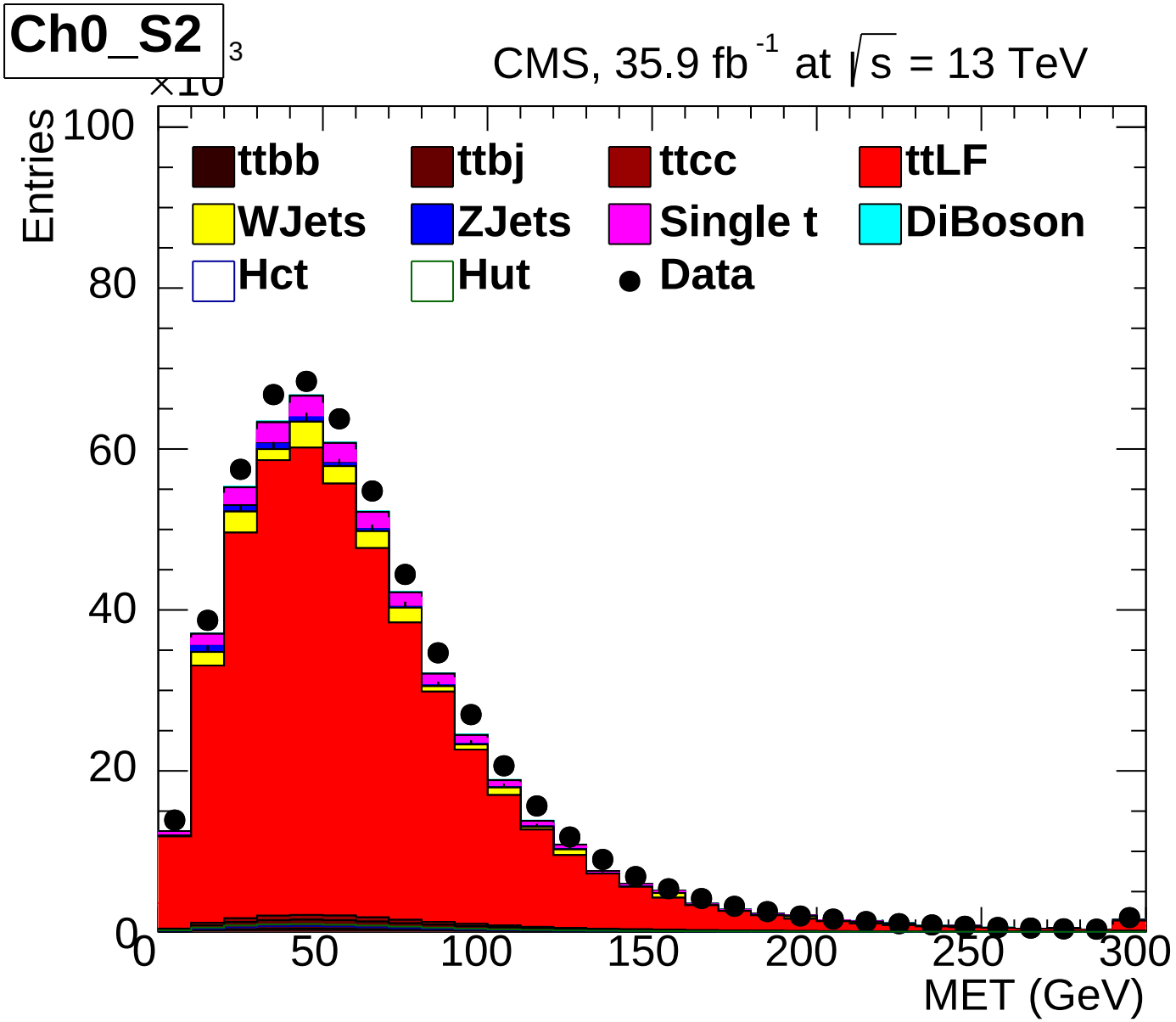

Ch0_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
1000
800
600
400
200
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

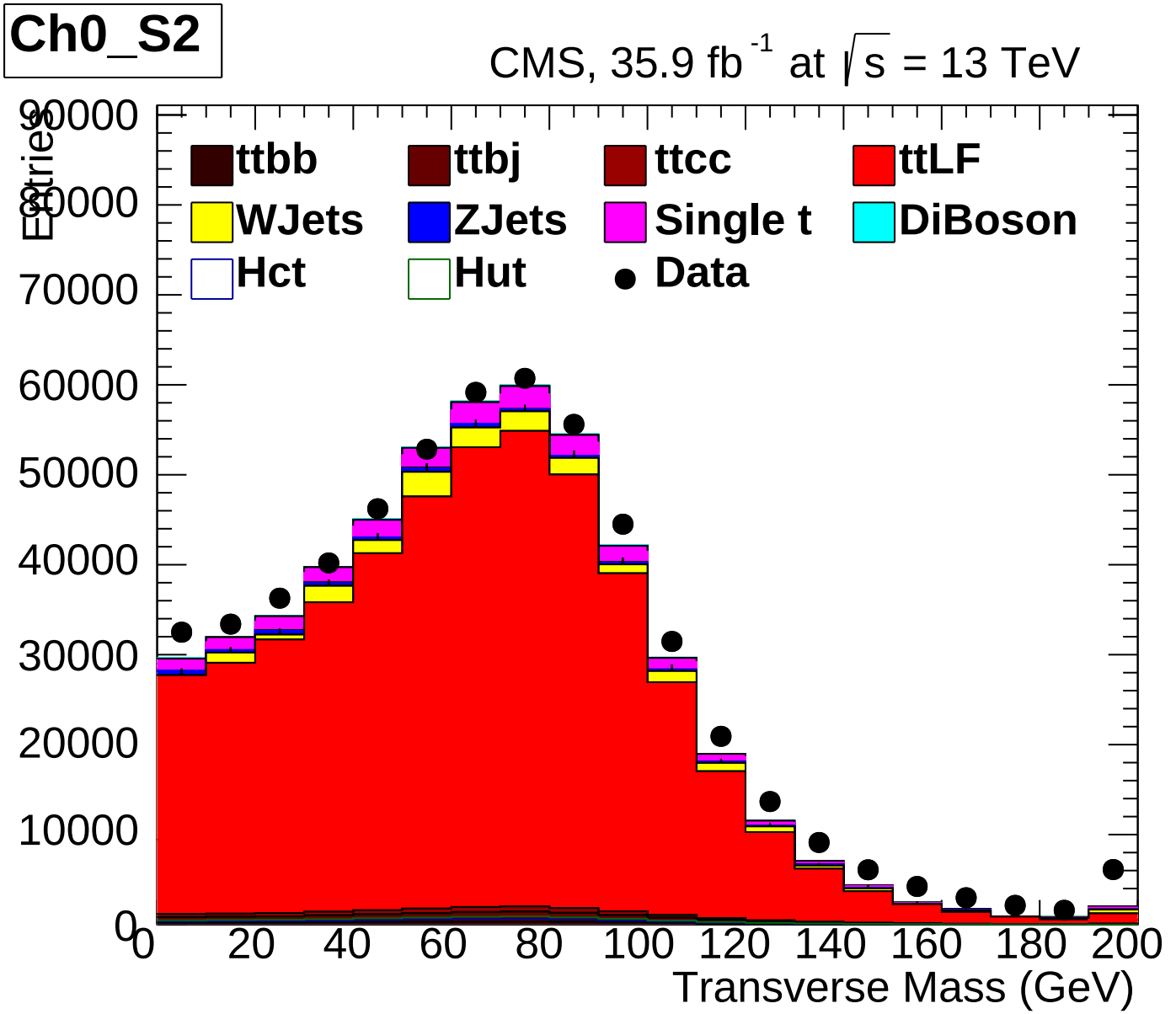

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
0
2
4
6
8
10
12
Jet Multiplicity

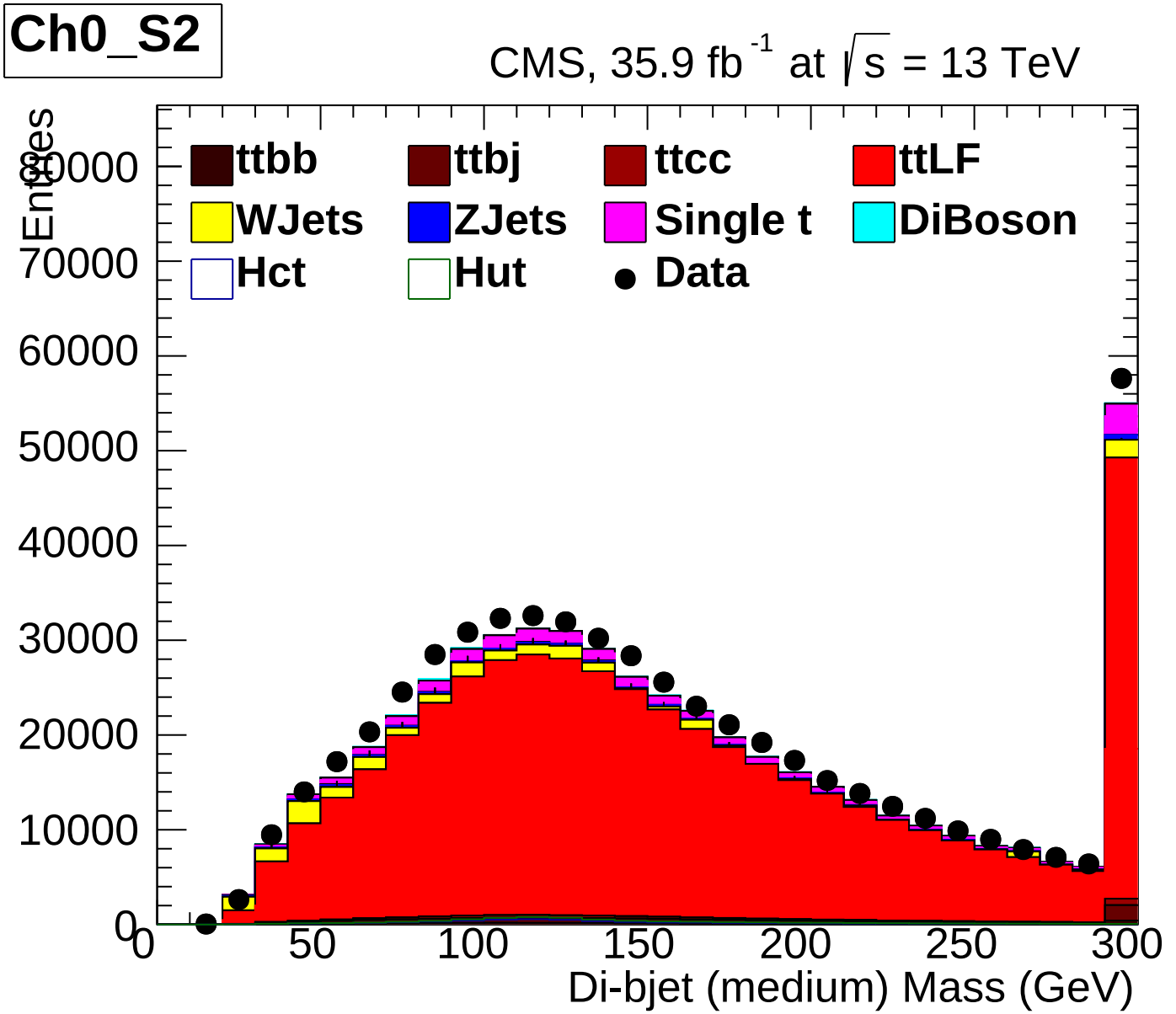

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

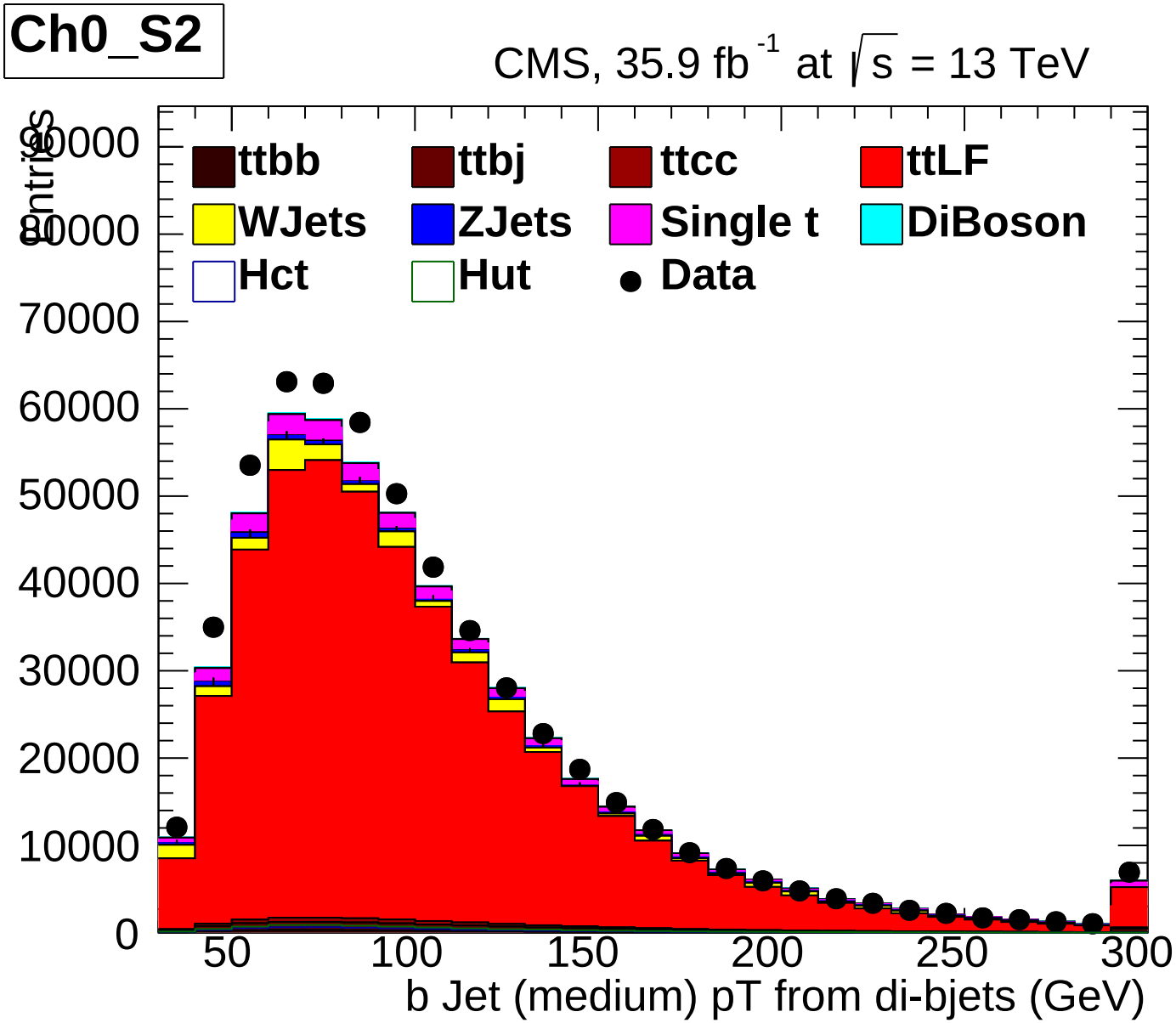

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

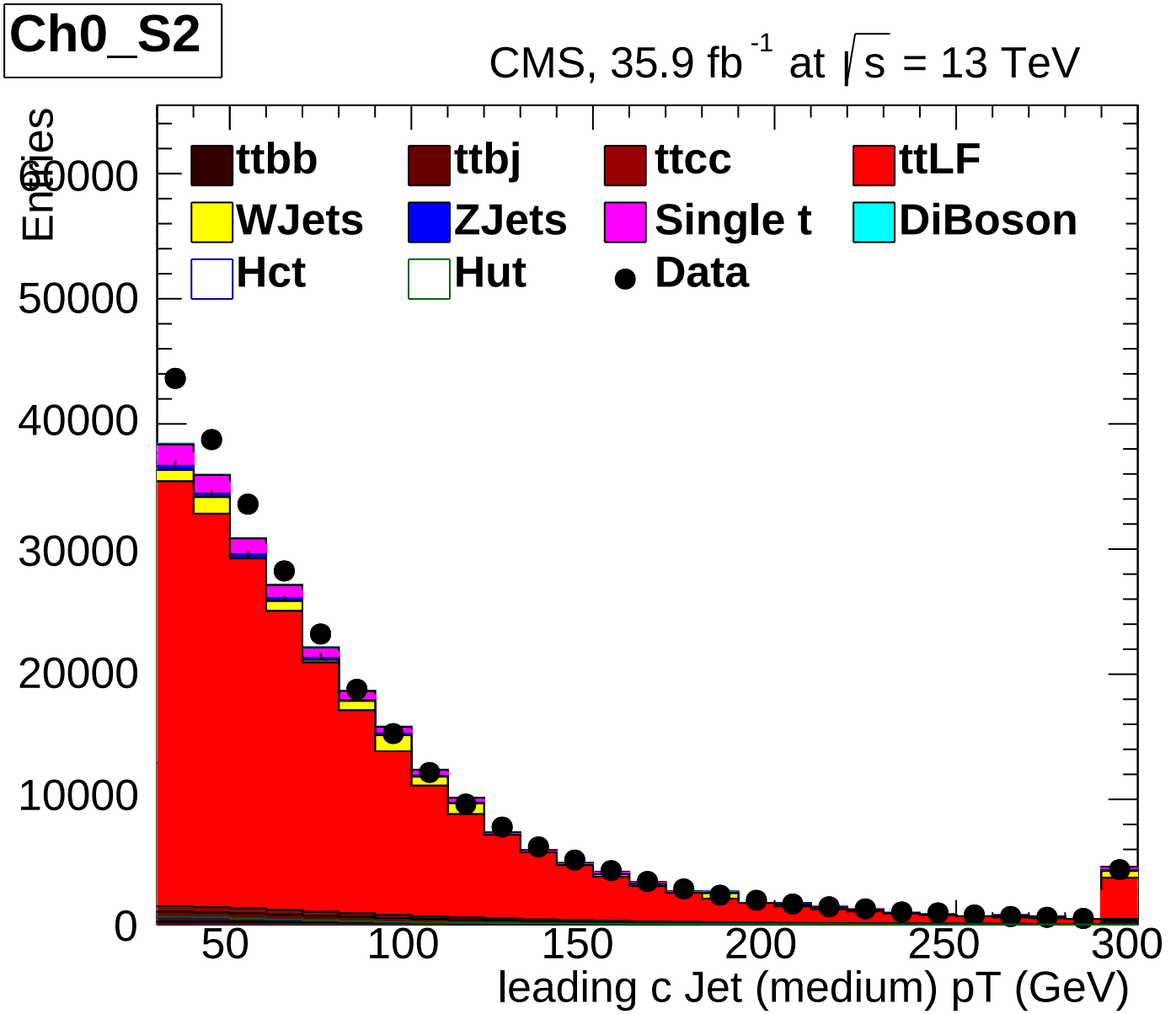

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
400
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

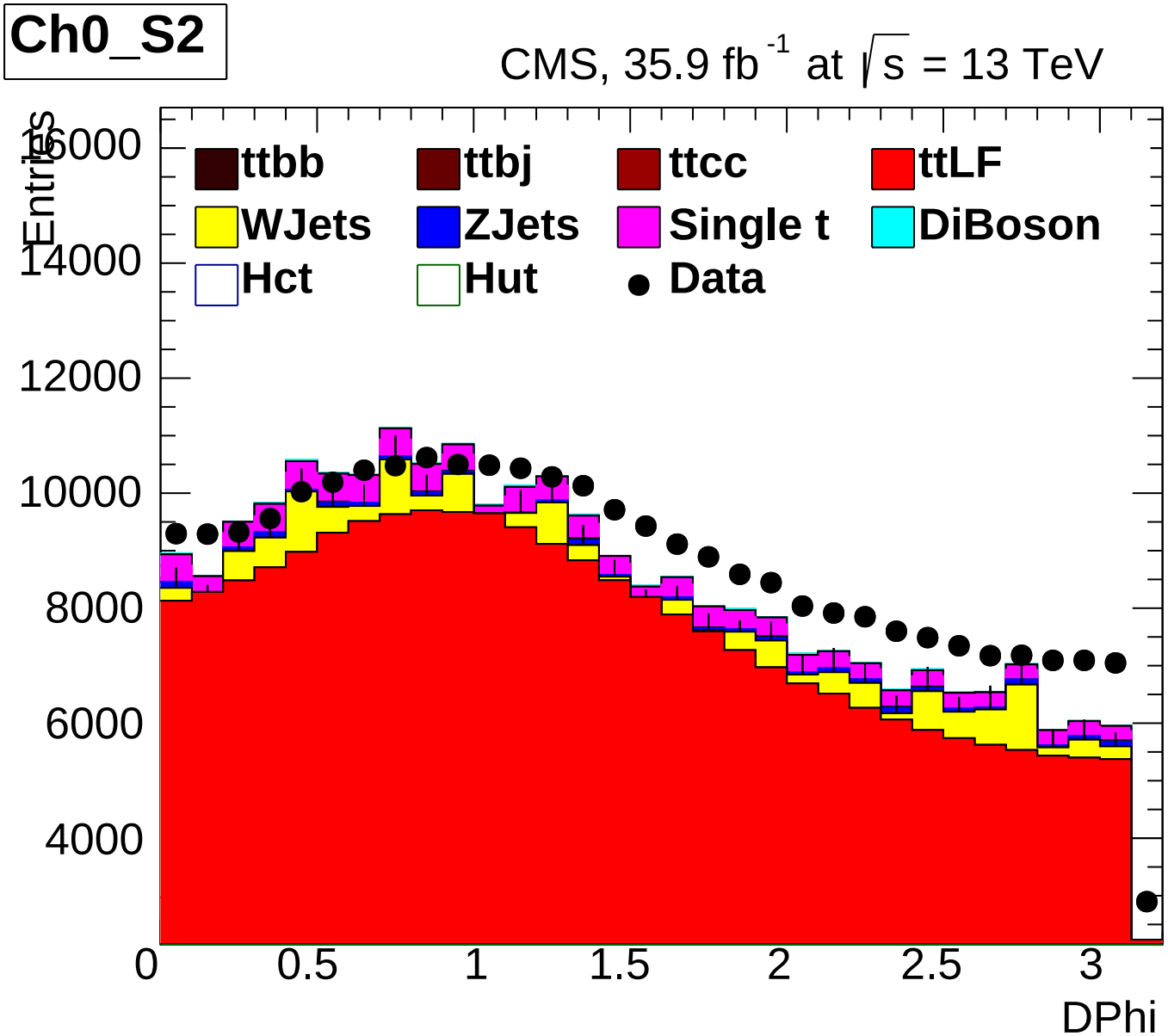

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
0
50
100
150
200
250
300
MET (GeV)

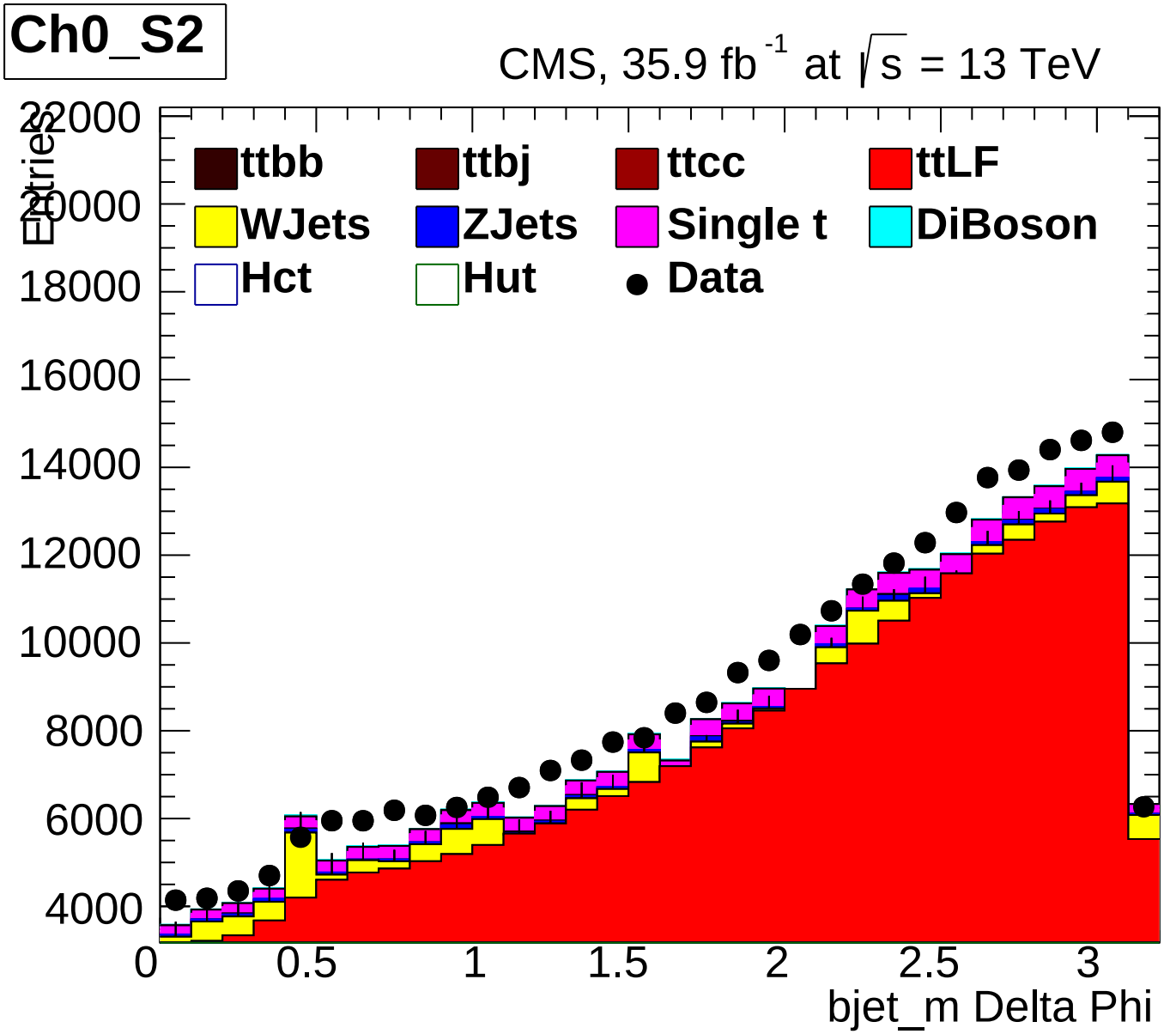

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

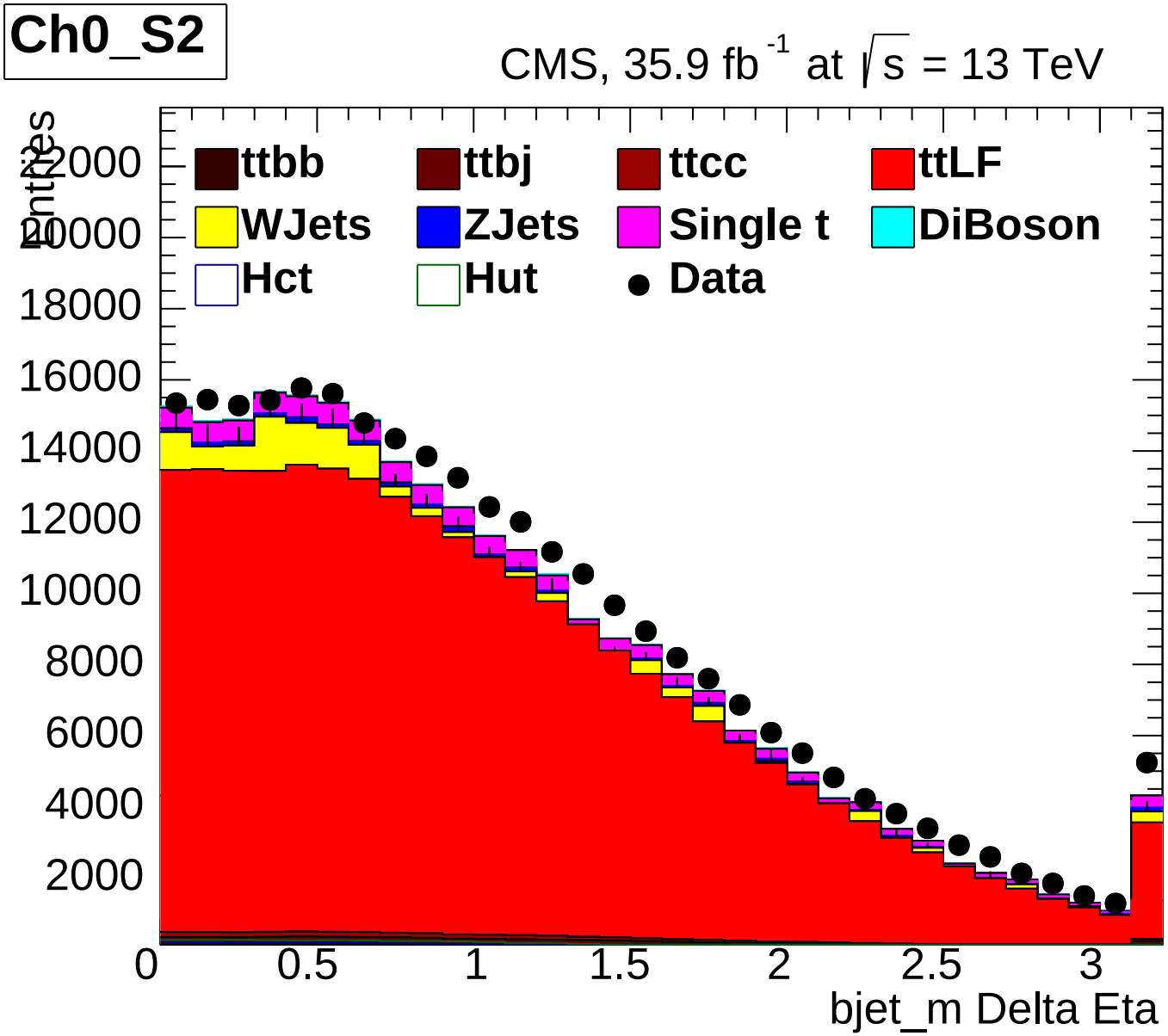

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
80000
70000
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

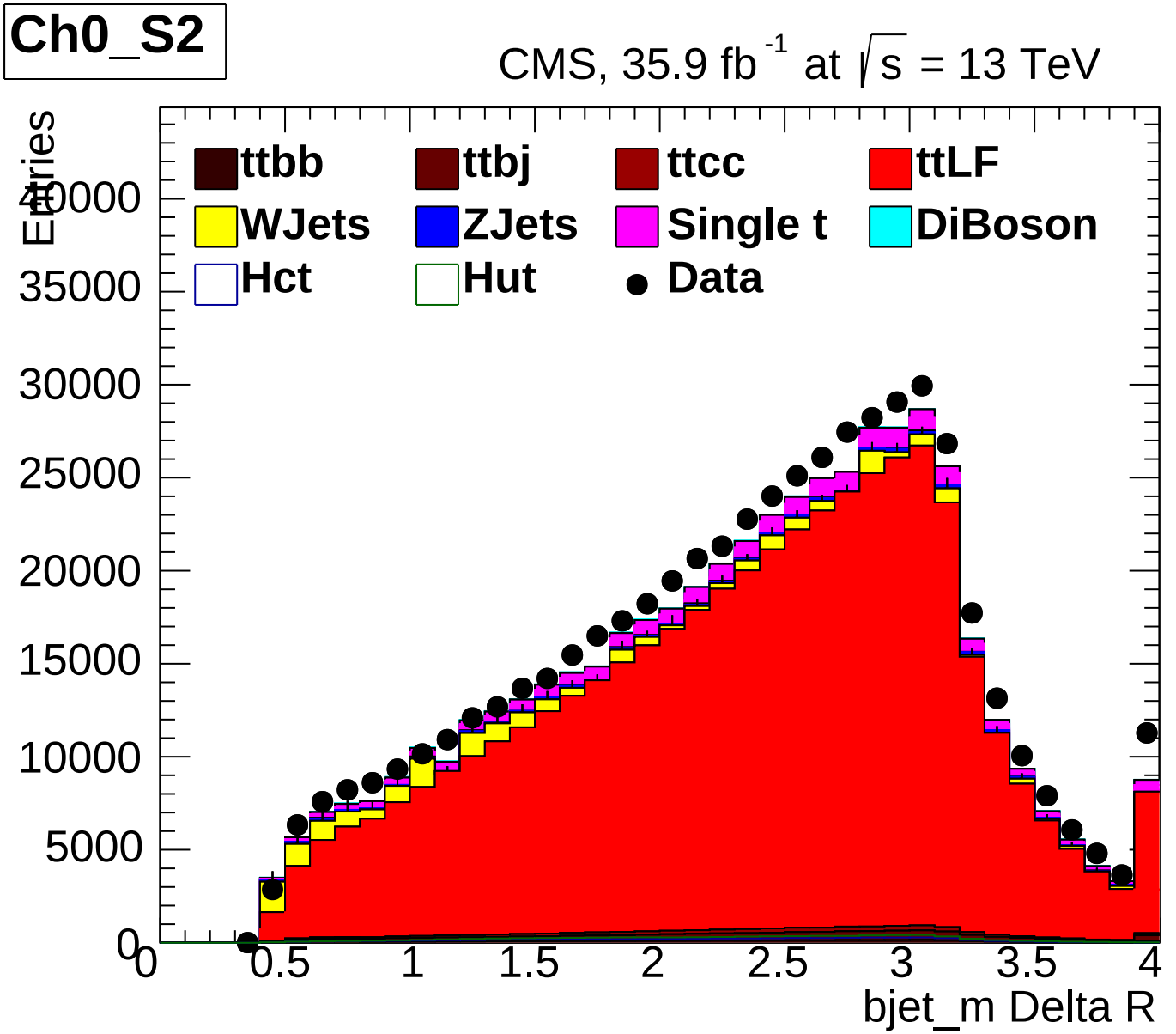

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
entries
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

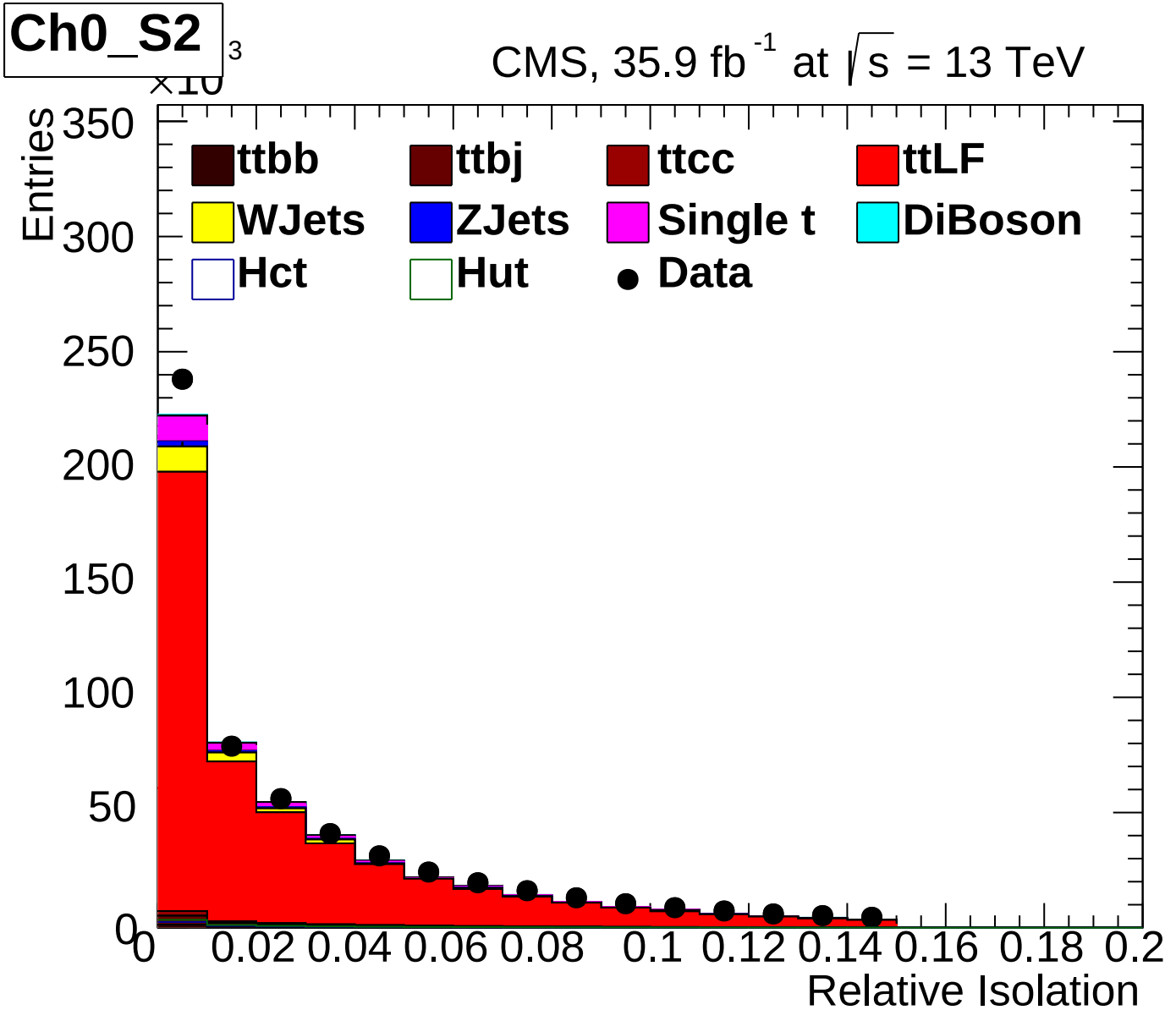

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

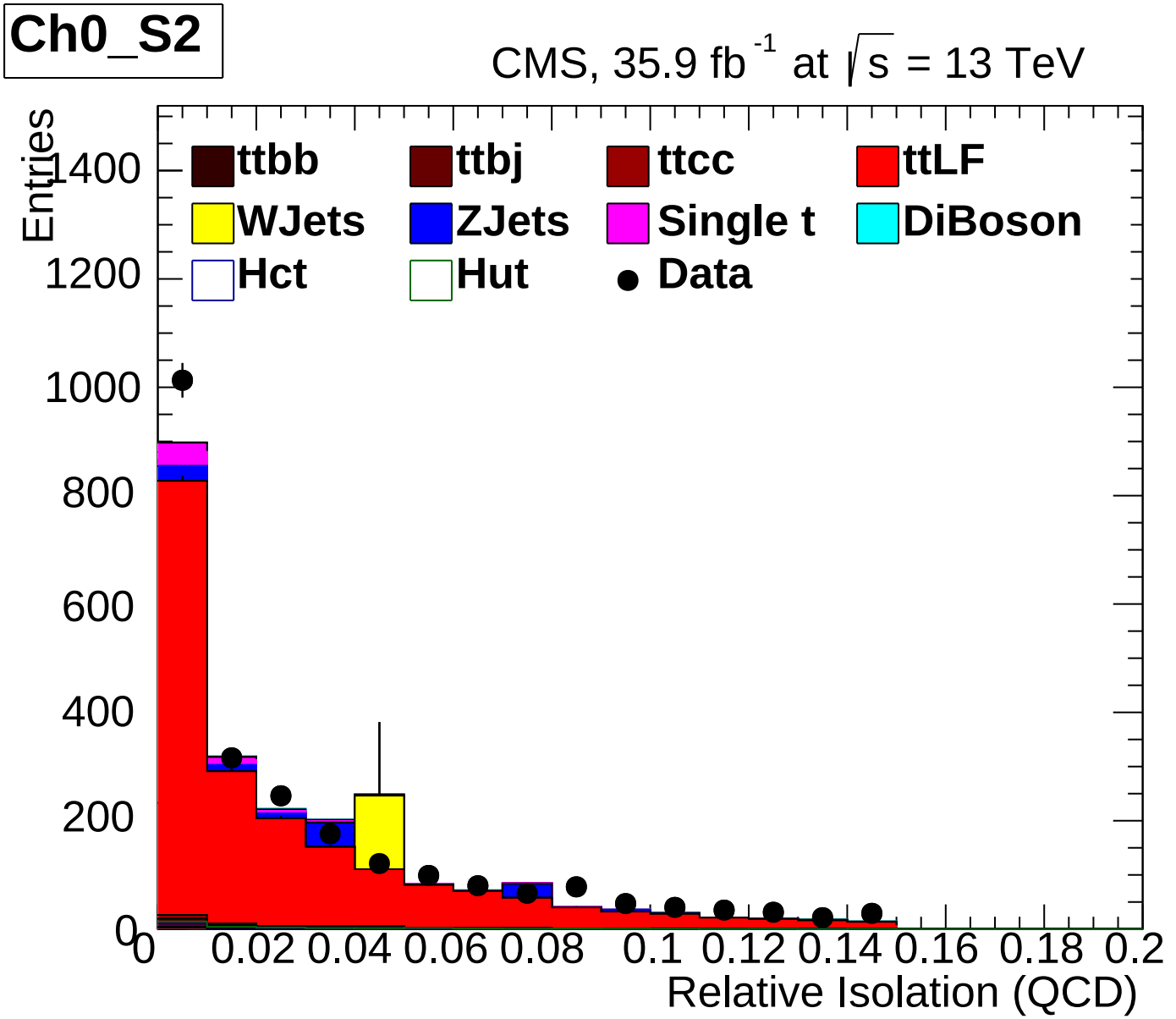

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
16000
14000
12000
10000
8000
6000
4000
0
0.5
1
1.5
2
2.5
3
DPhi

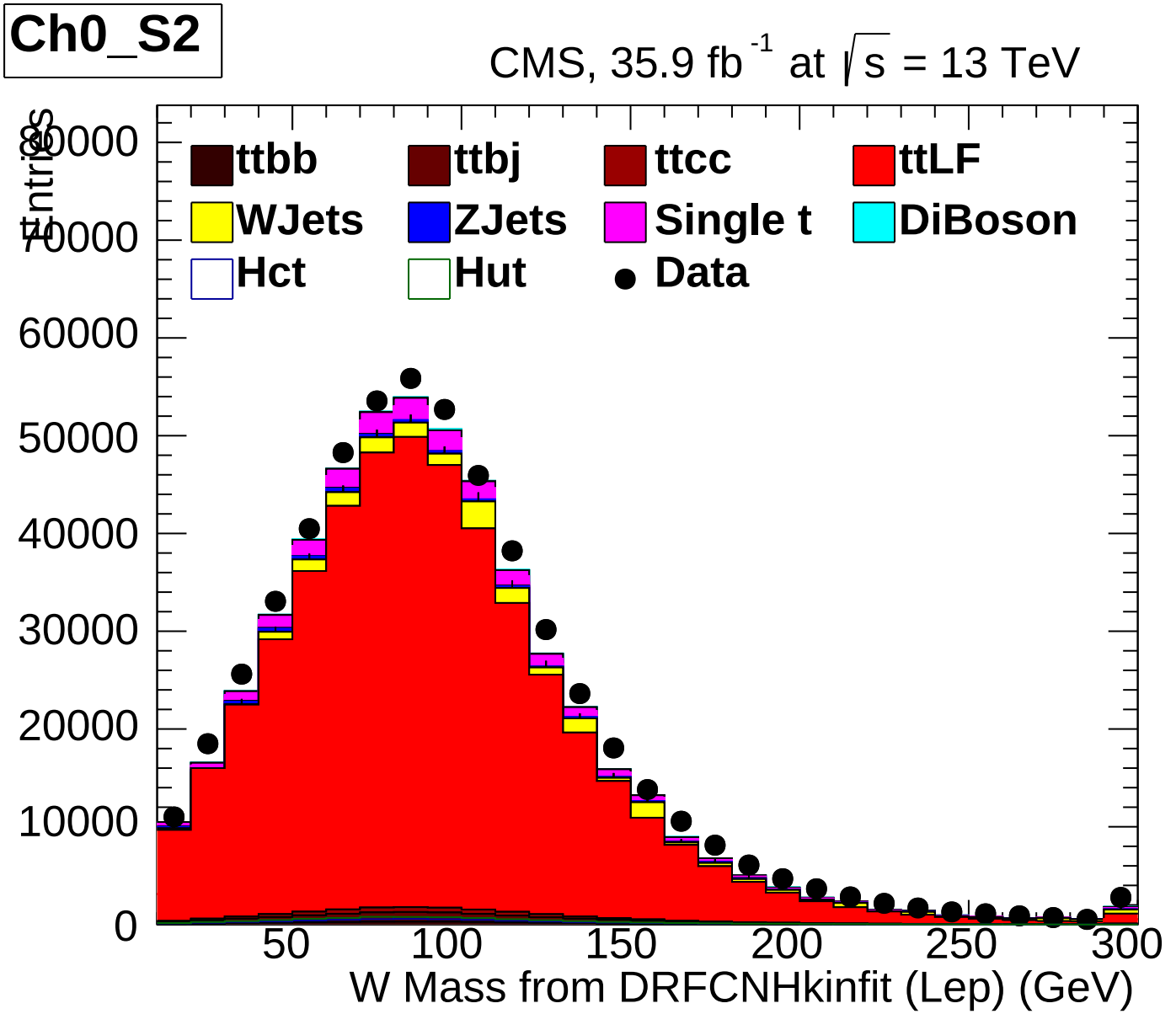

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

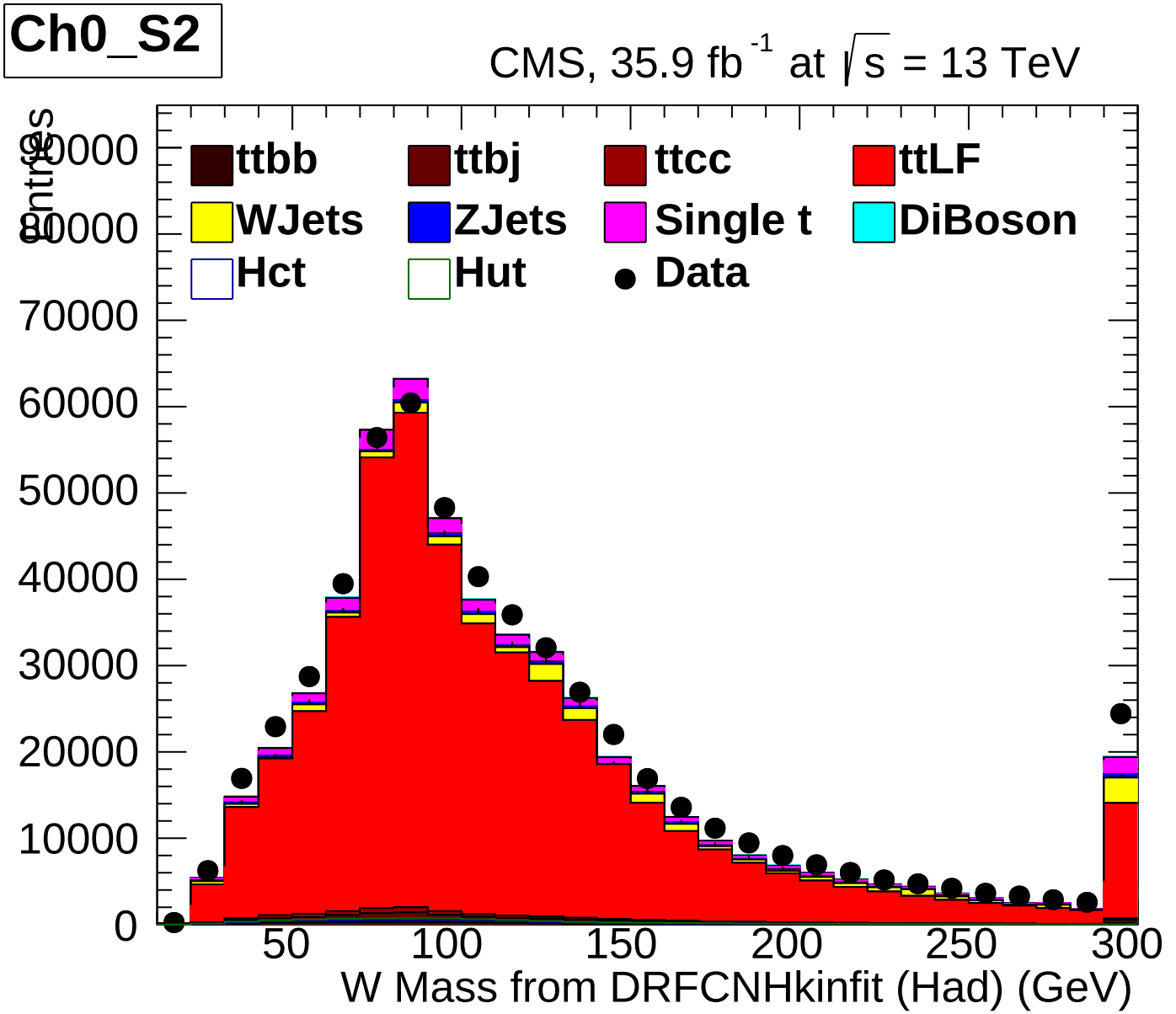

Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
350
300
250
200
150
100
50
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
80000
70000
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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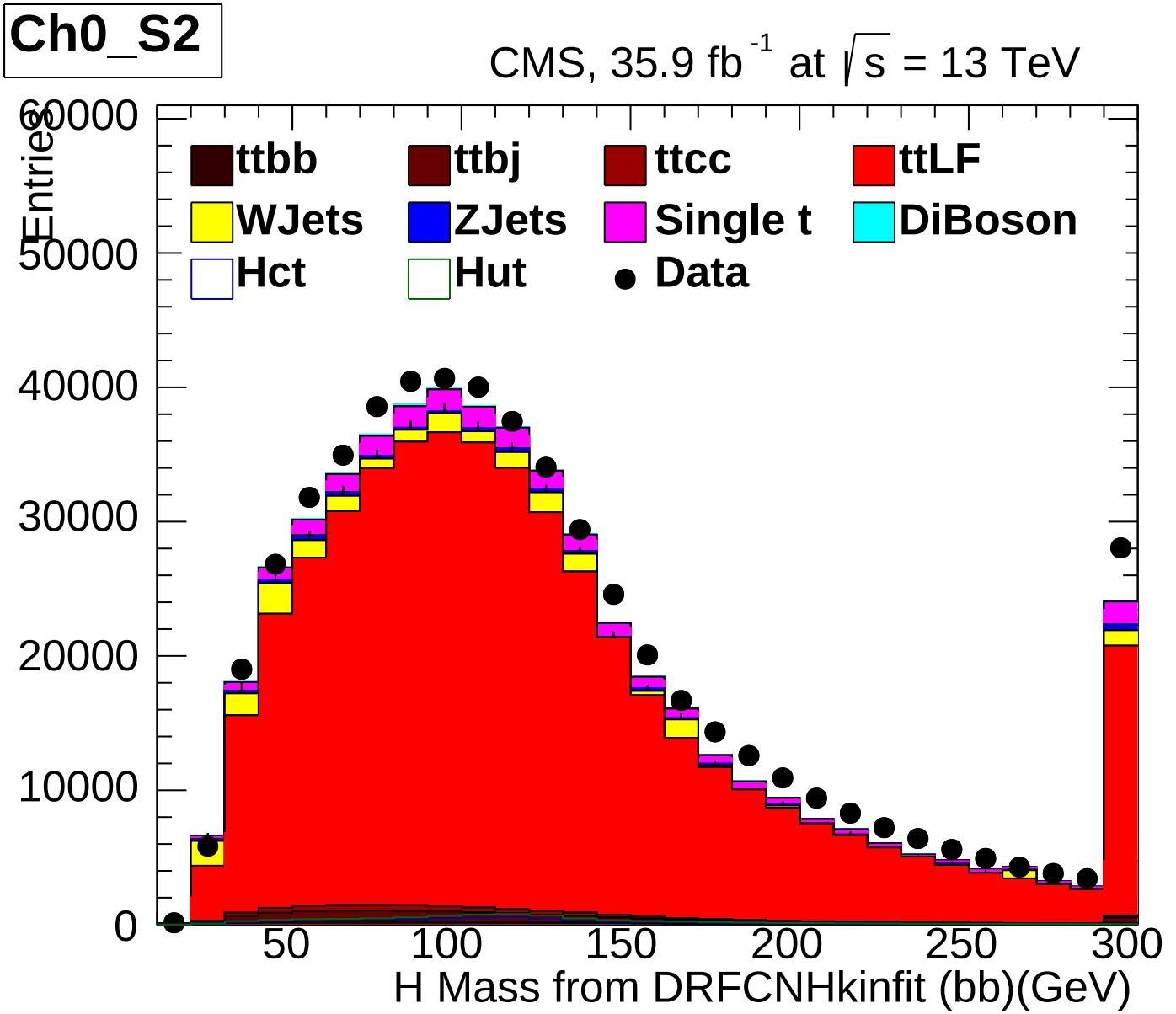
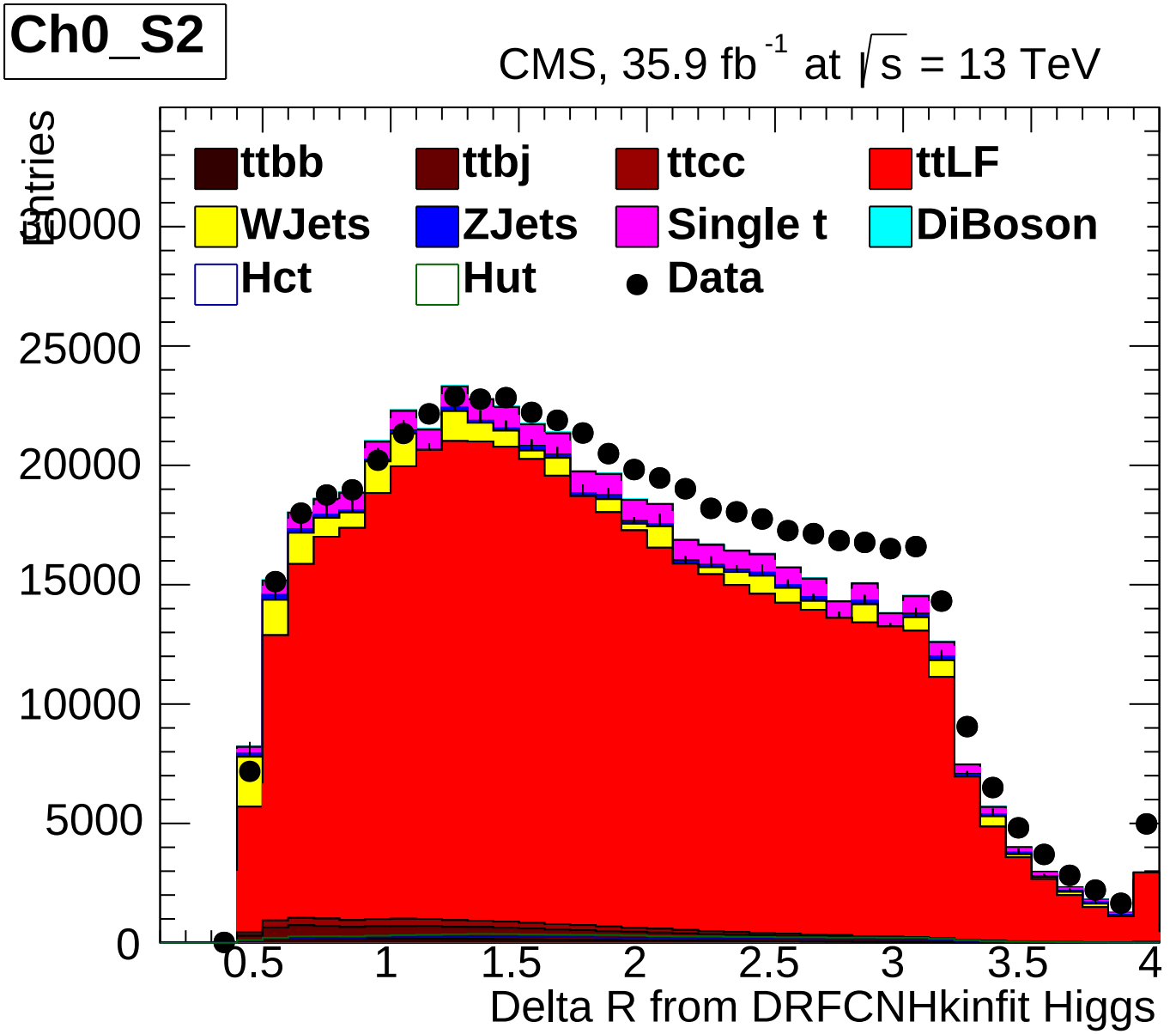
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
entries
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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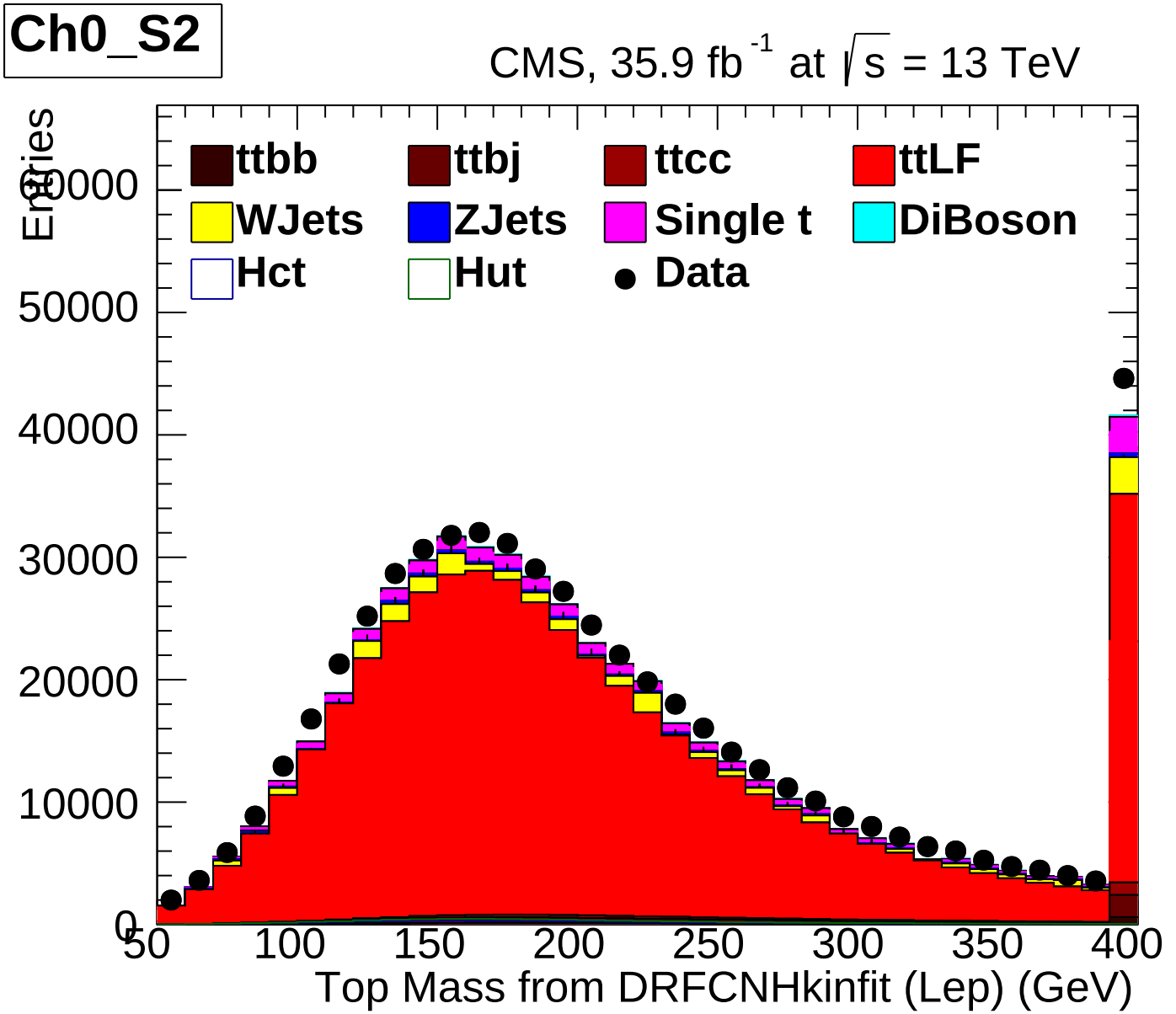
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
30000
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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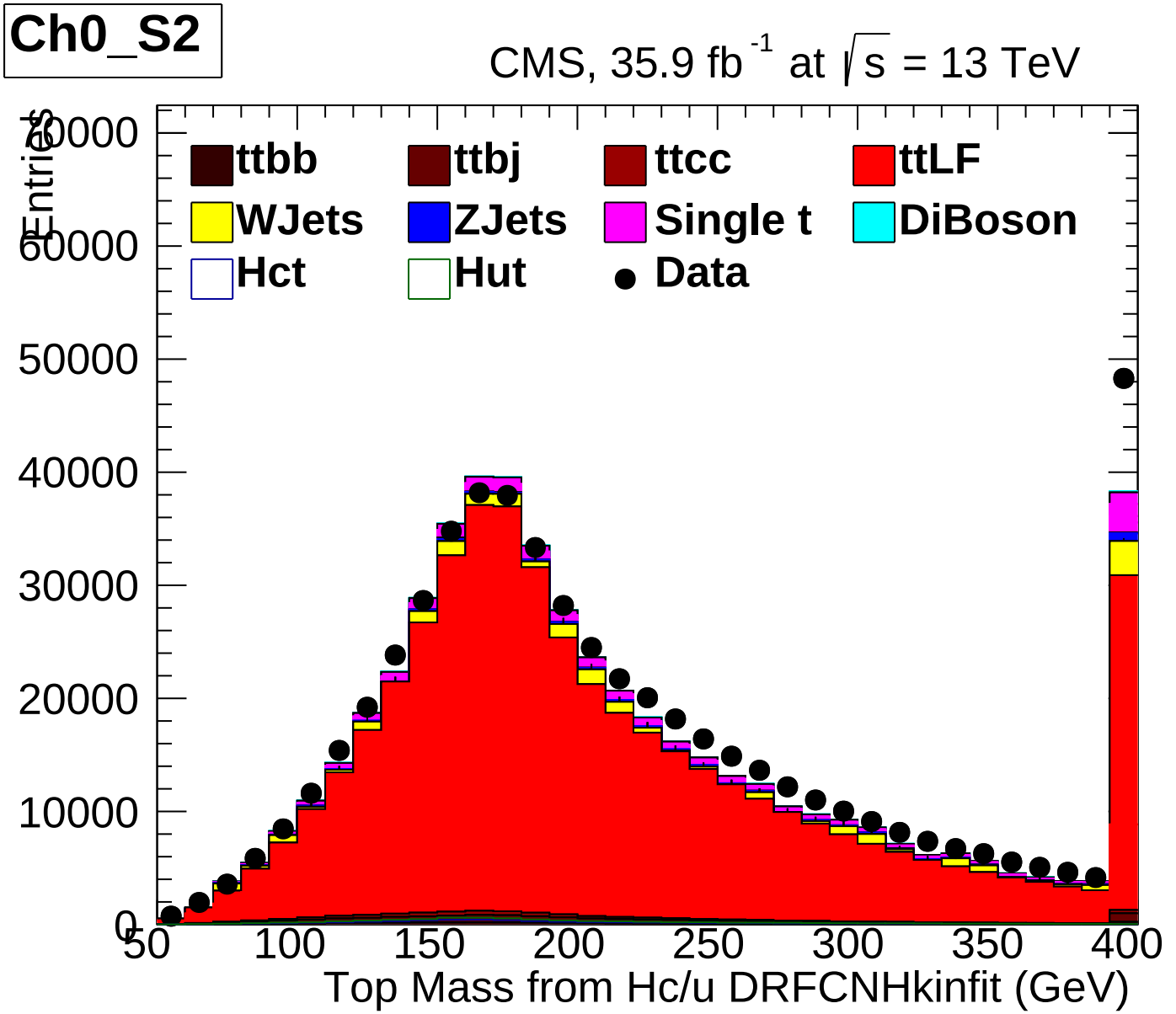
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
10000
20000
30000
40000
50000
60000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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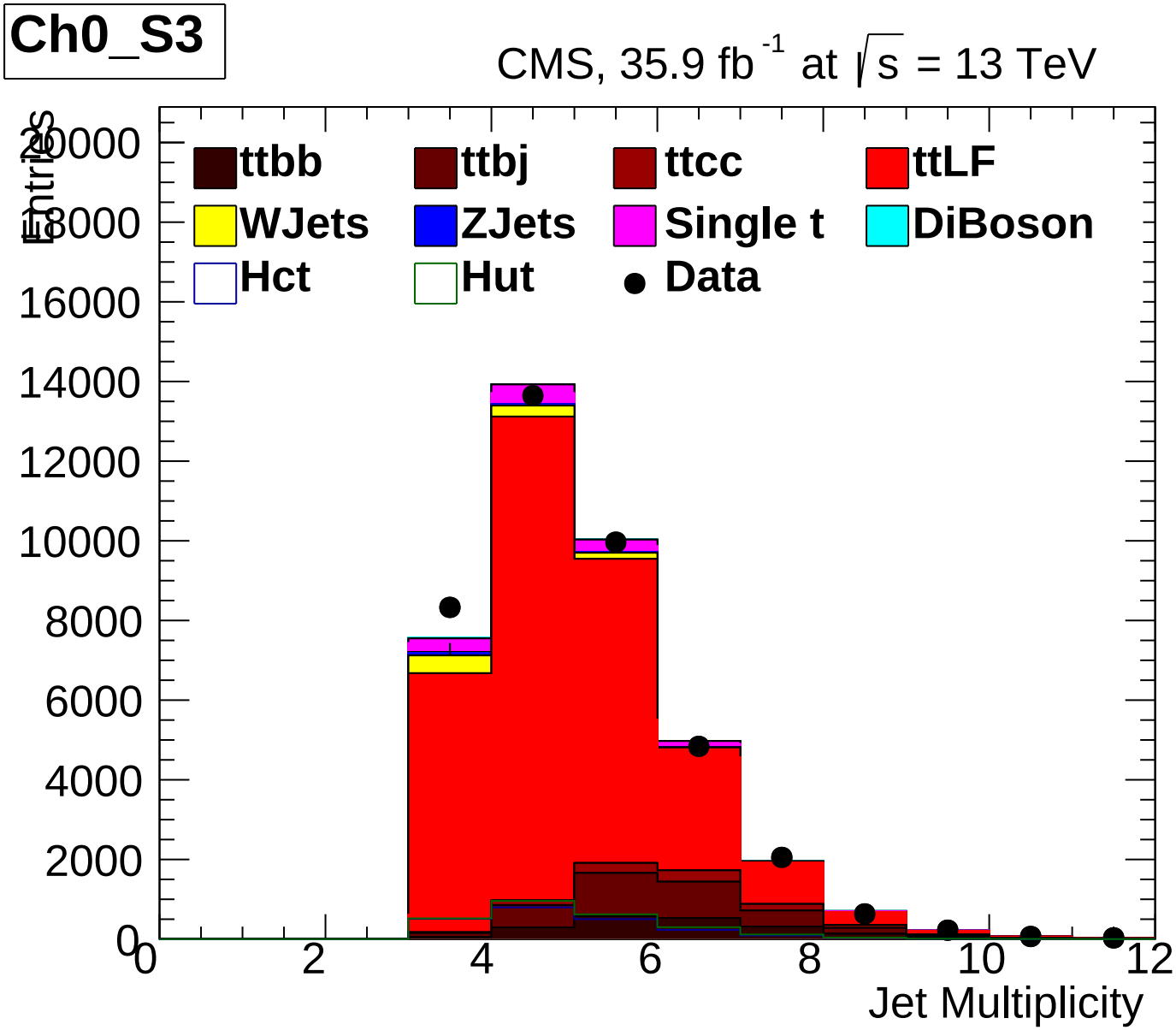
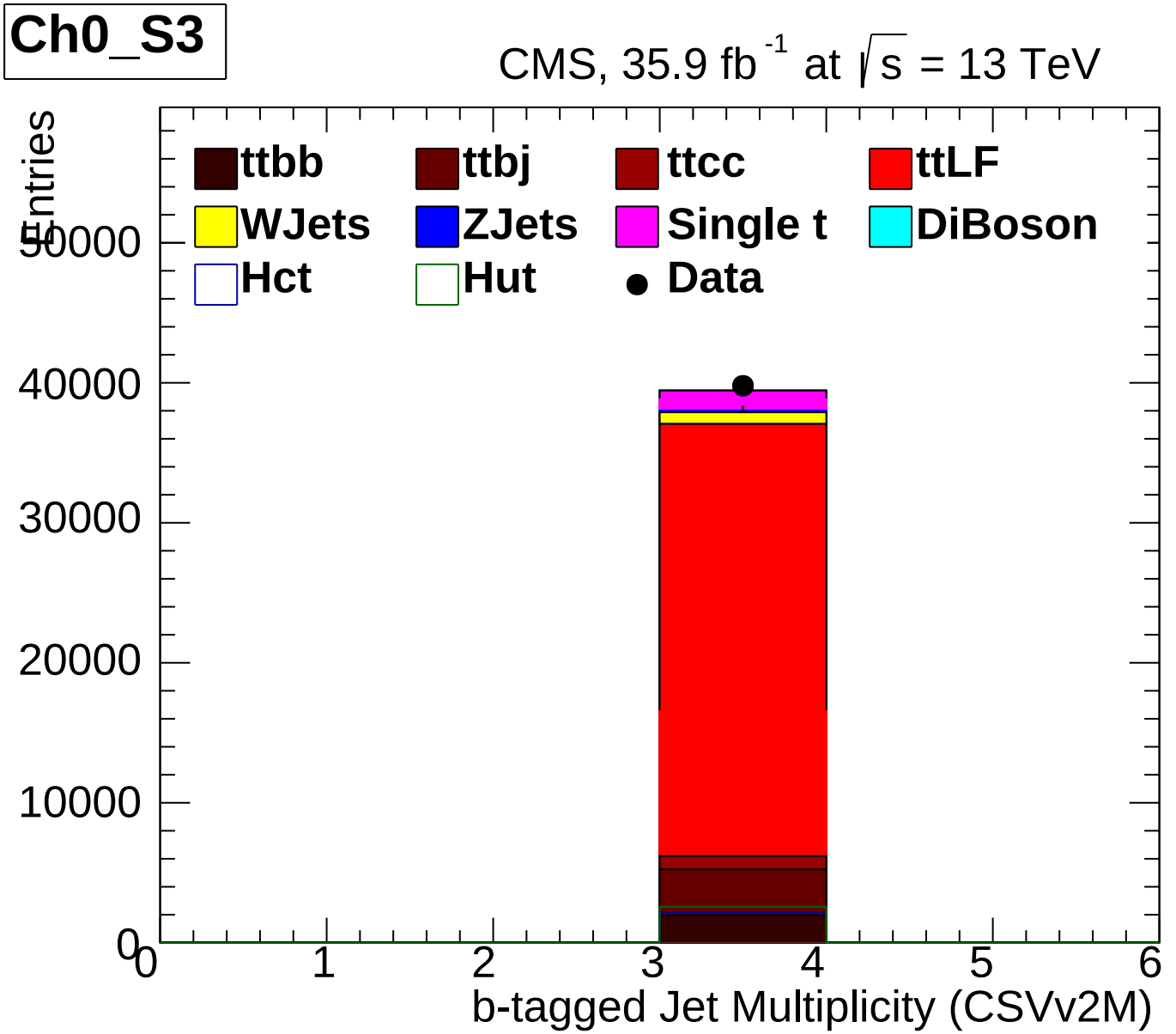
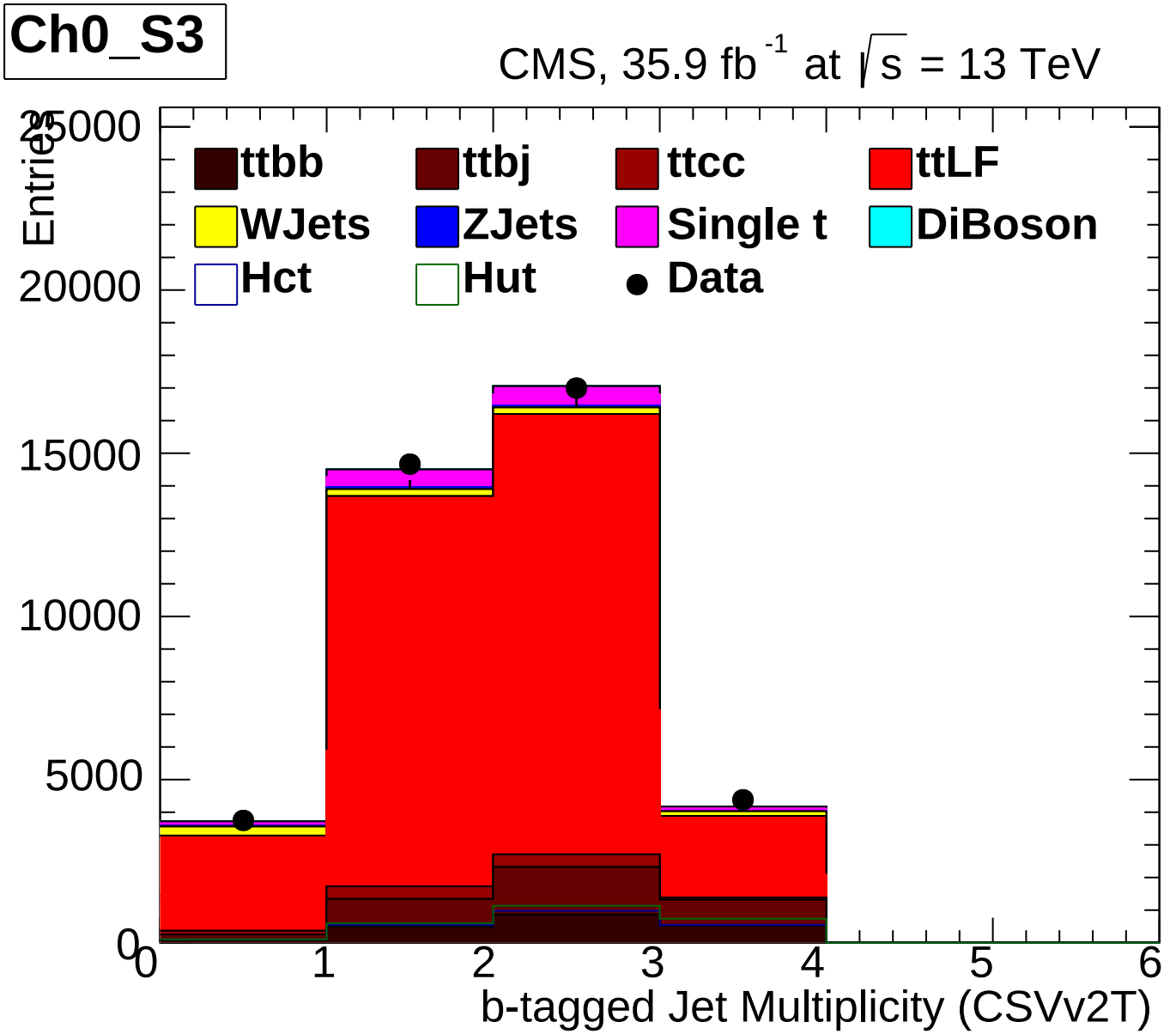
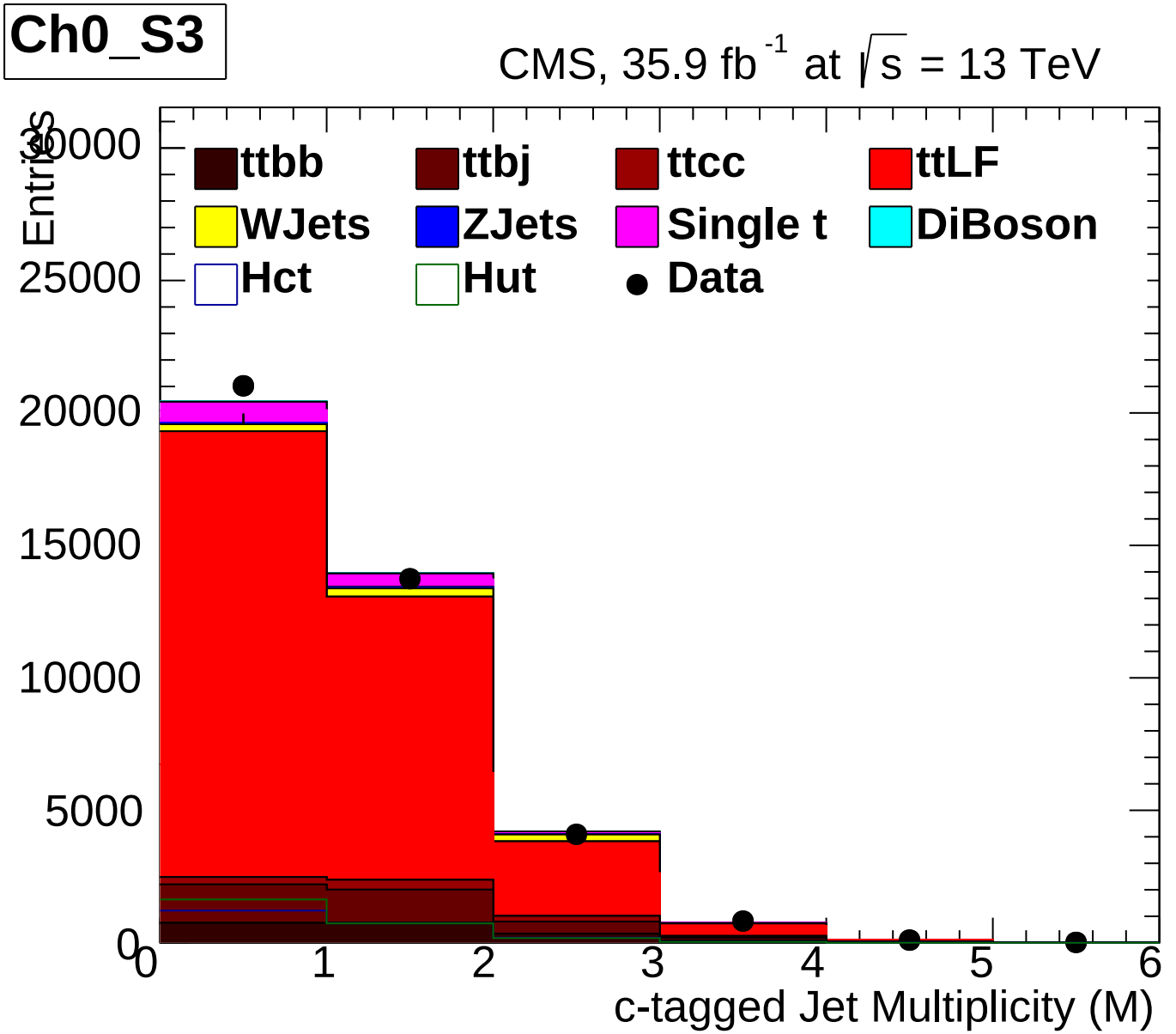
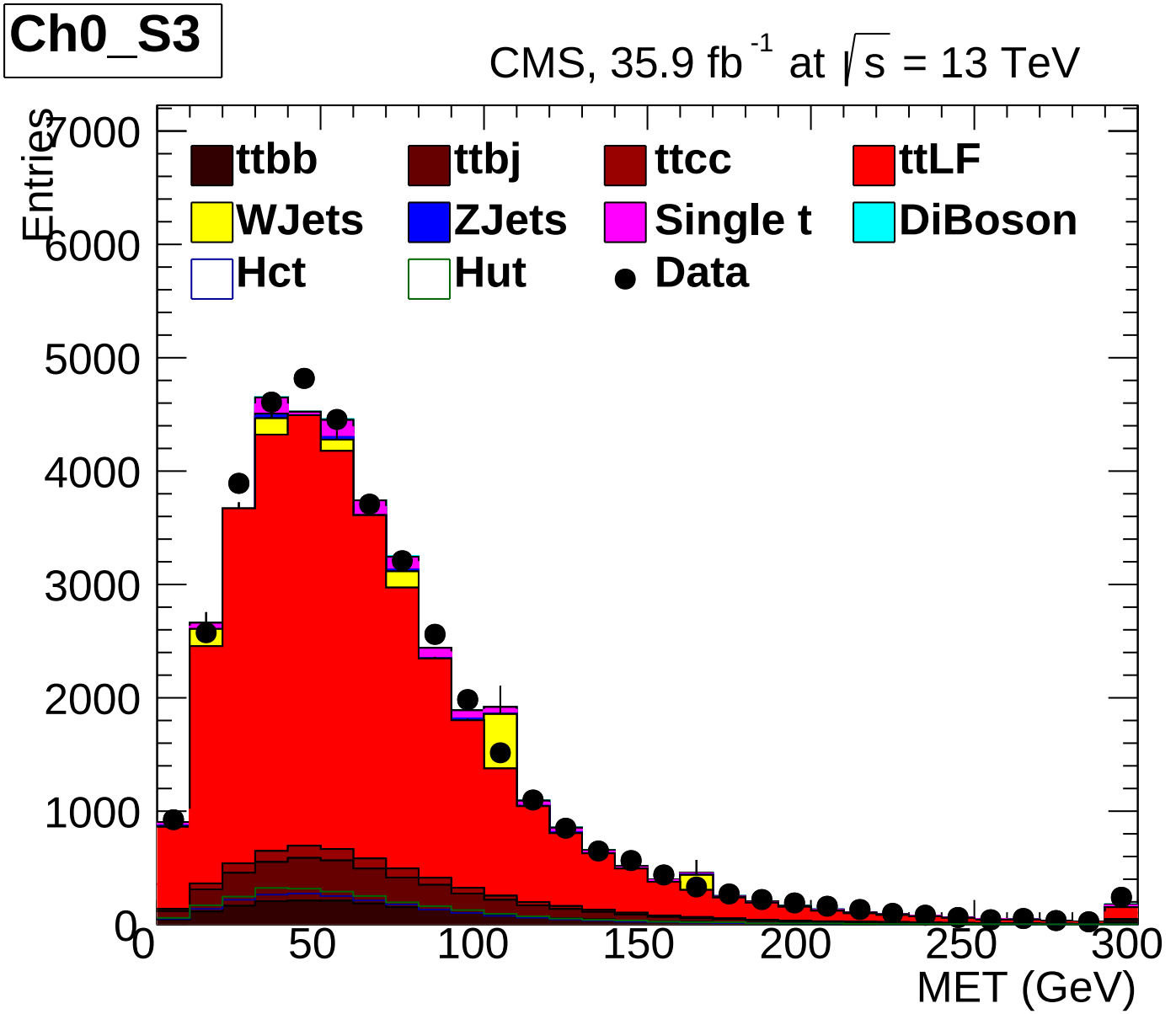
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
70000
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

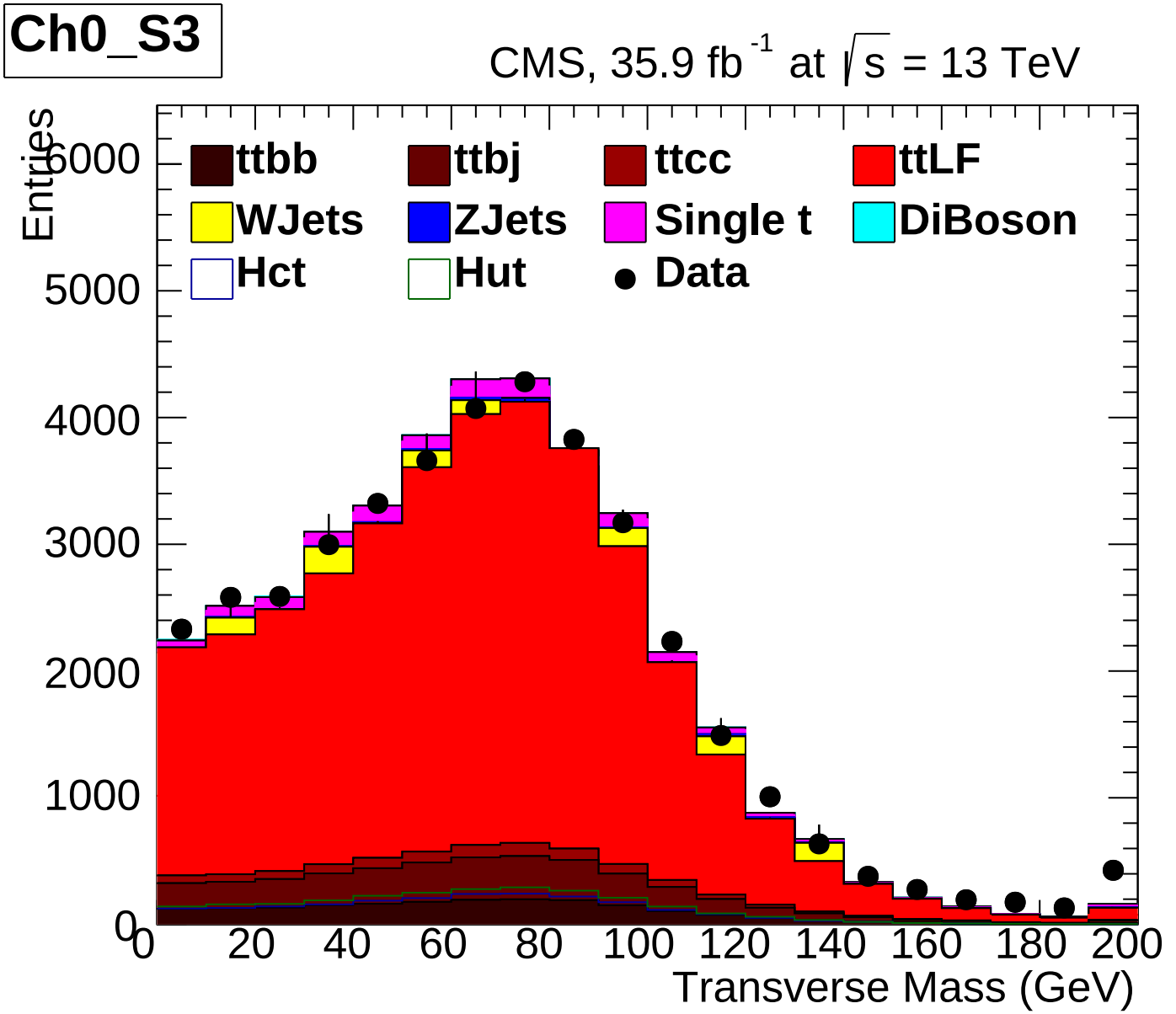

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
Jet Multiplicity
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
0
2
4
6
8
10
12

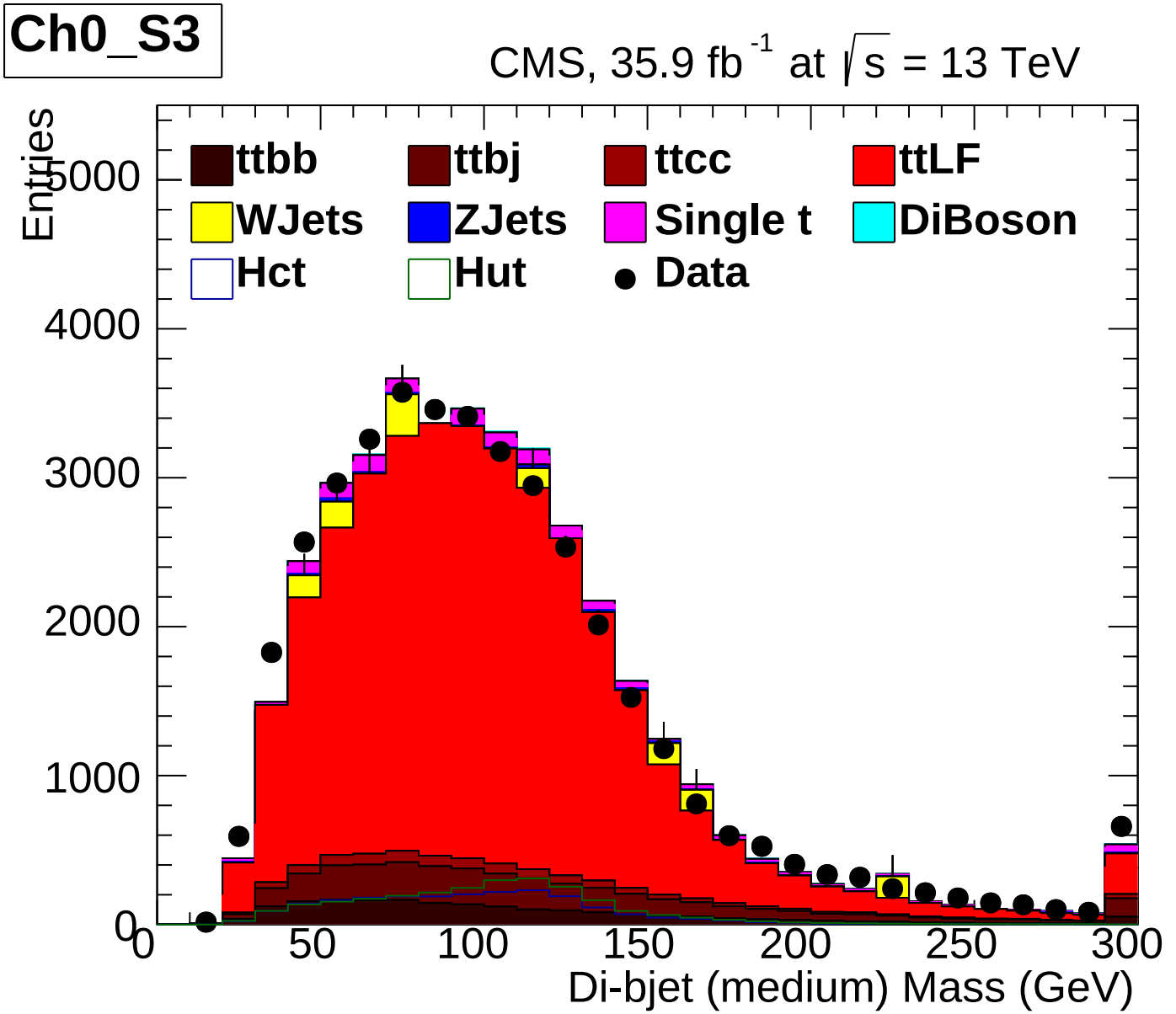

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

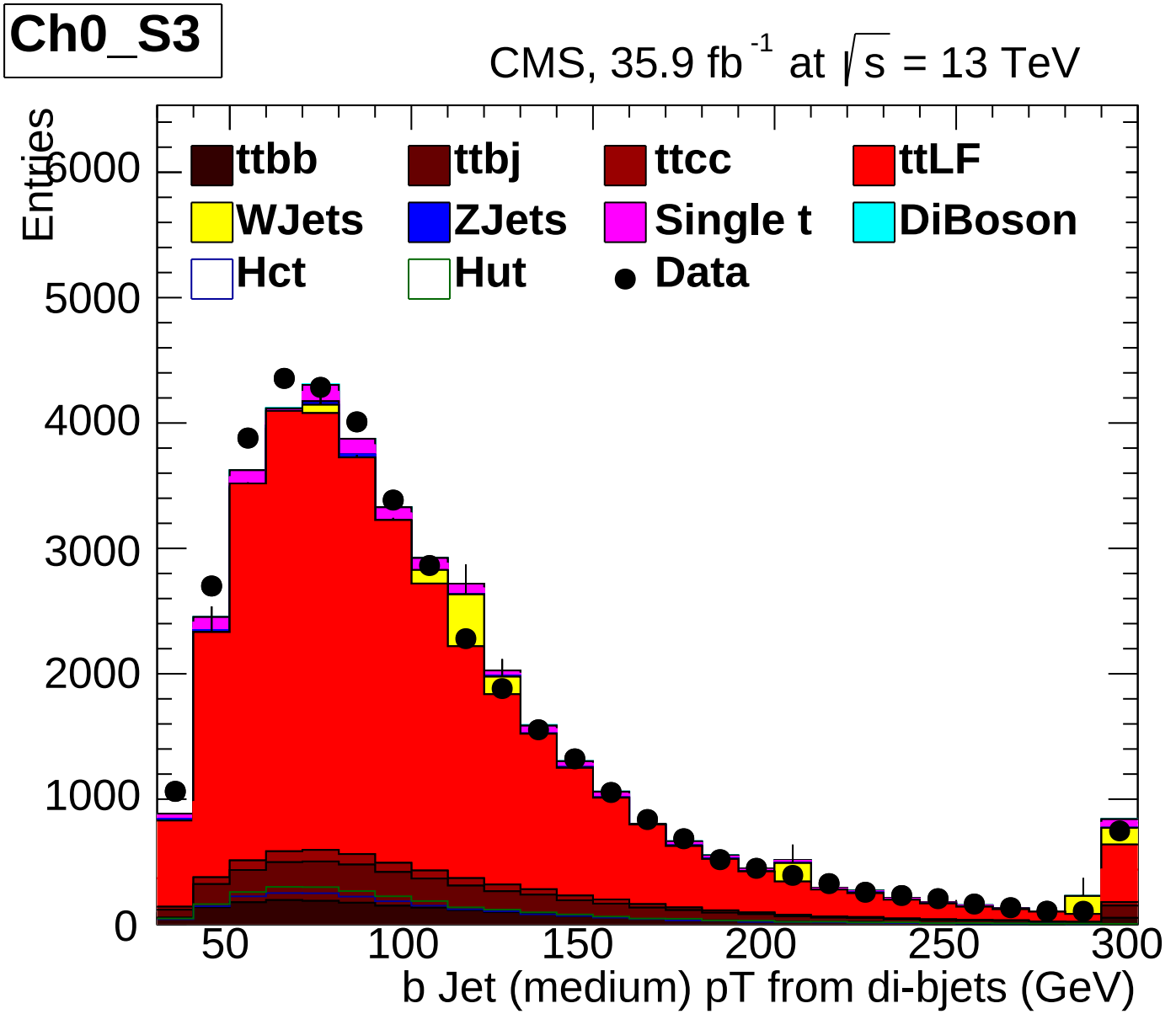

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

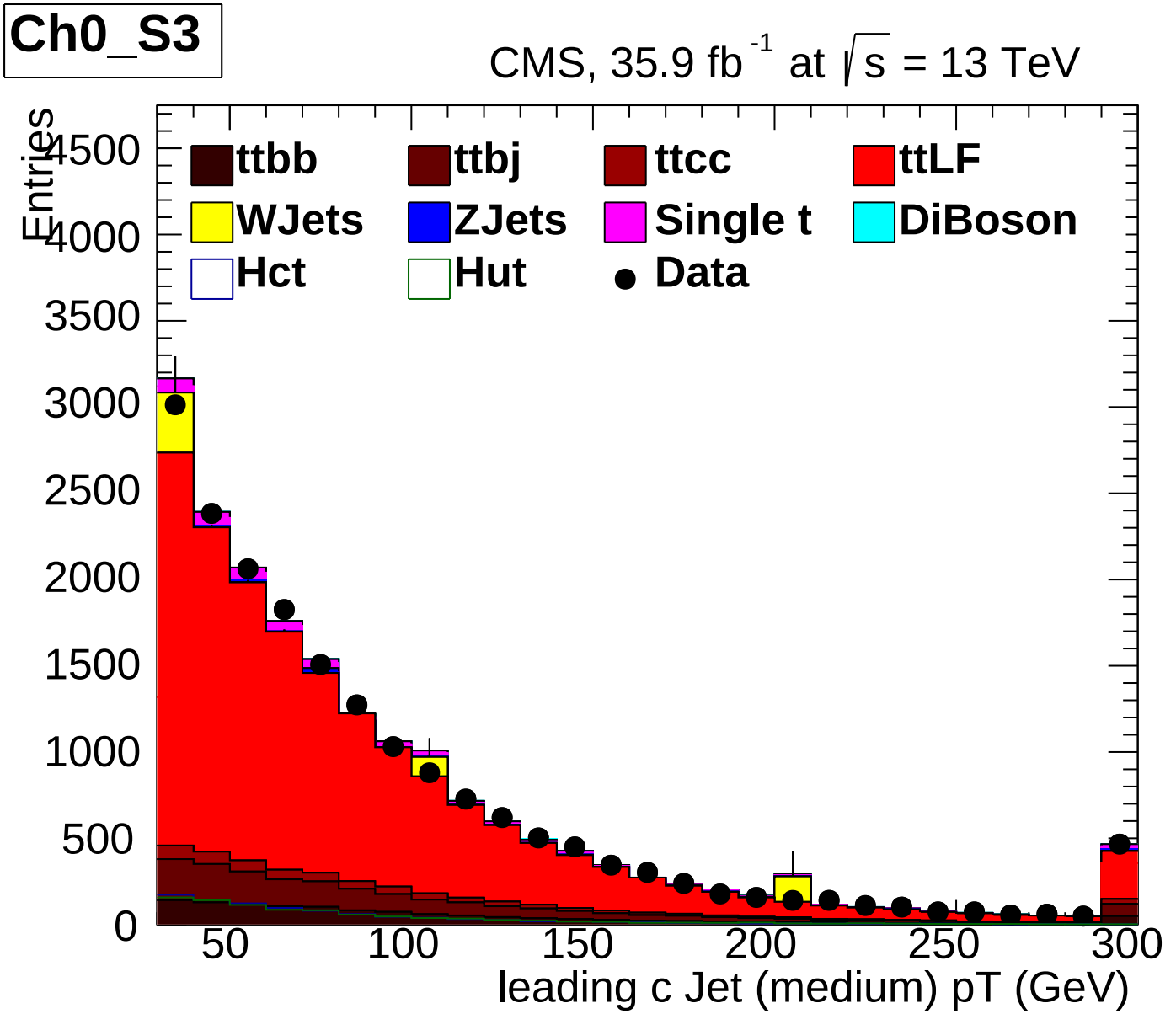

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

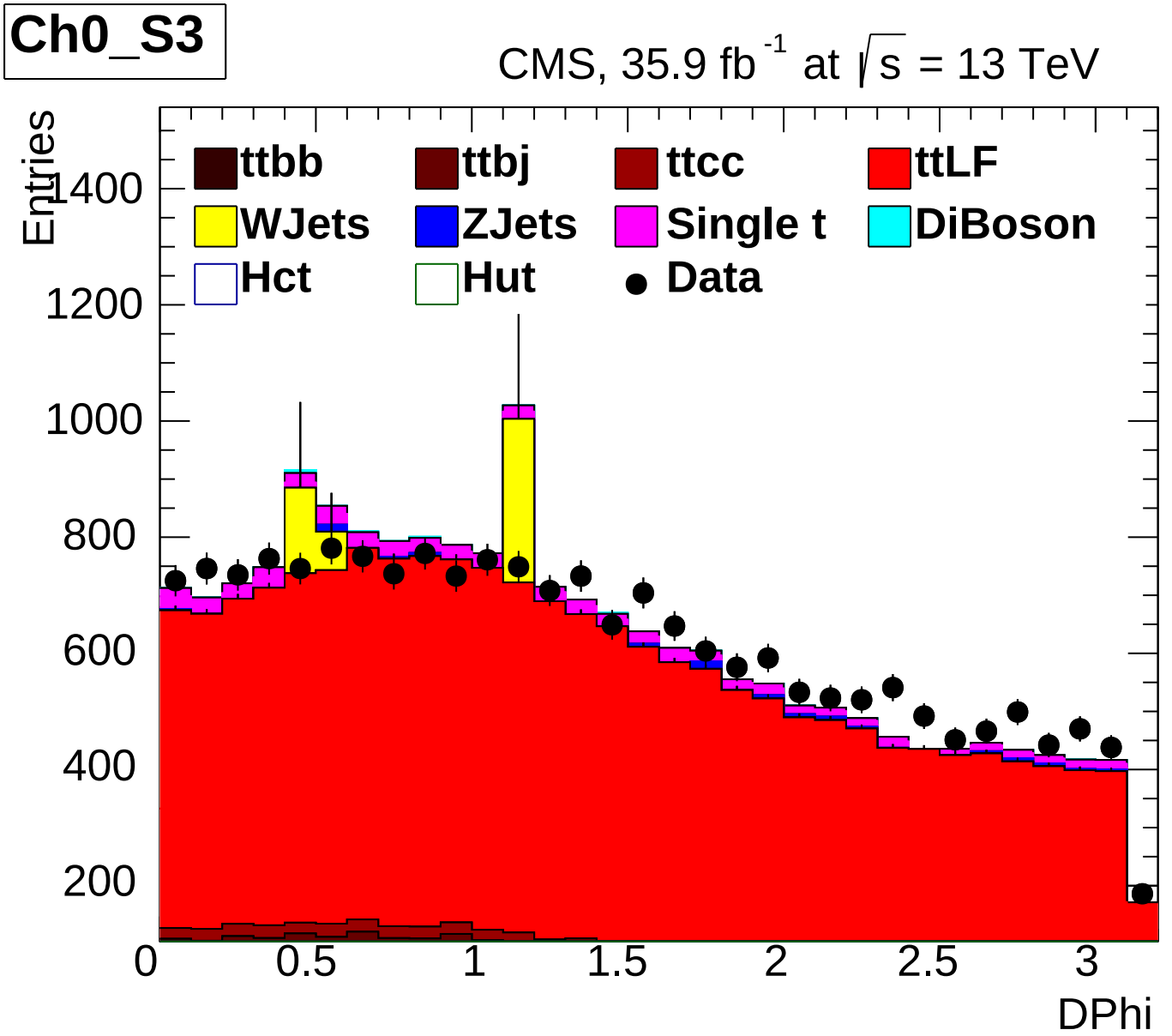

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
0
50
100
150
200
250
300
MET (GeV)

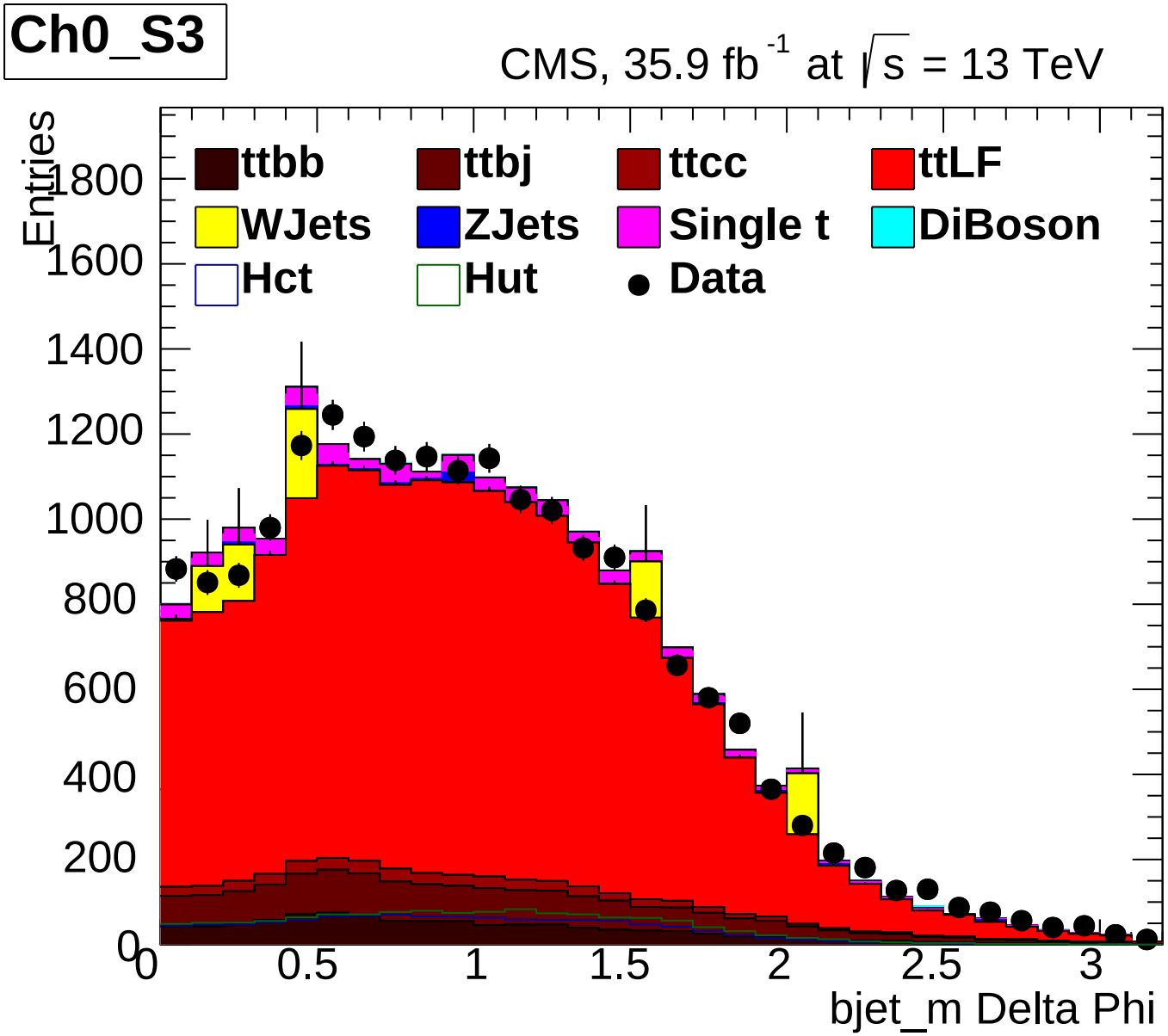

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1400
1200
1000
800
600
400
200
0
0.5
1
1.5
2
2.5
3
DPhi


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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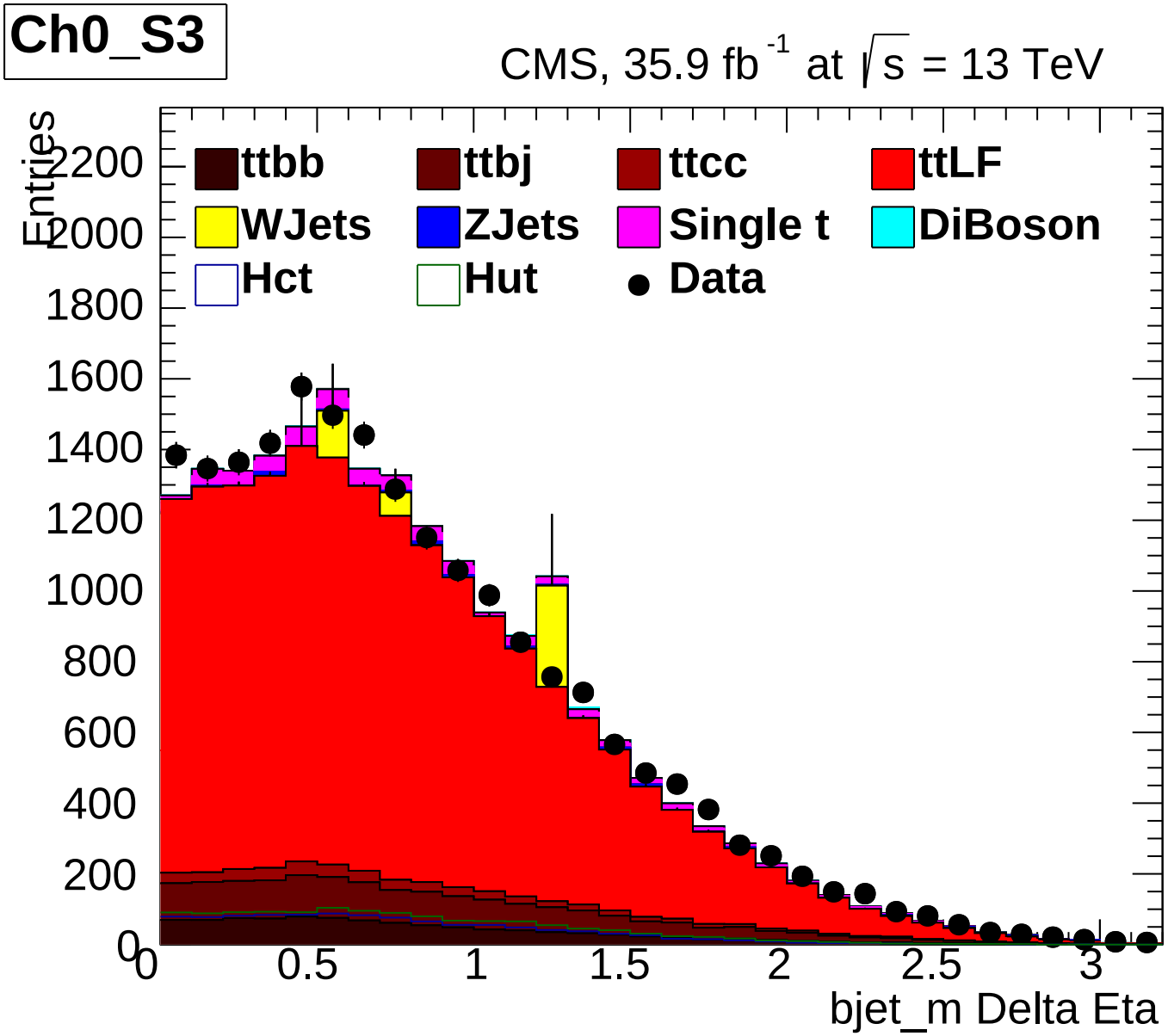
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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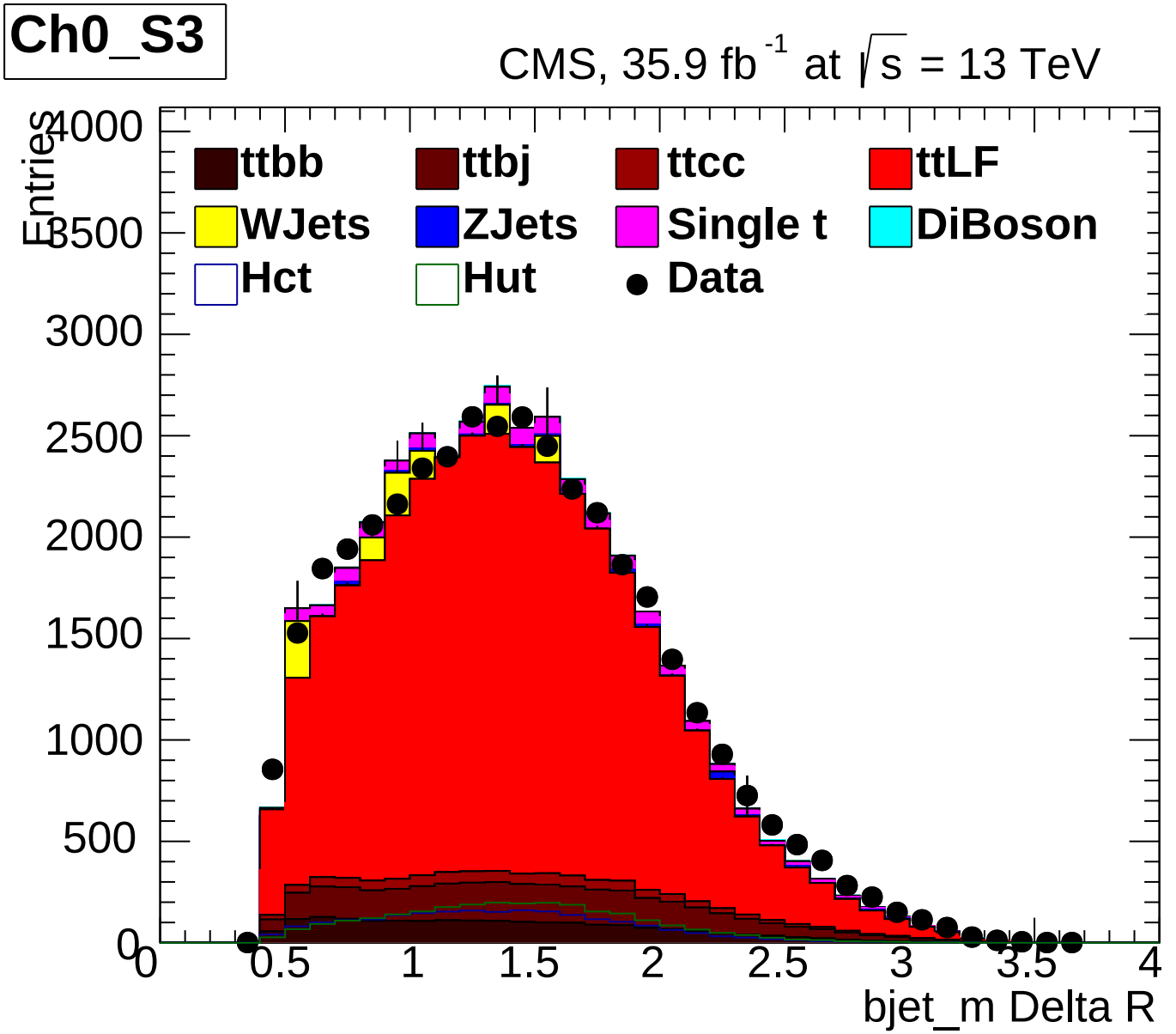
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
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2500
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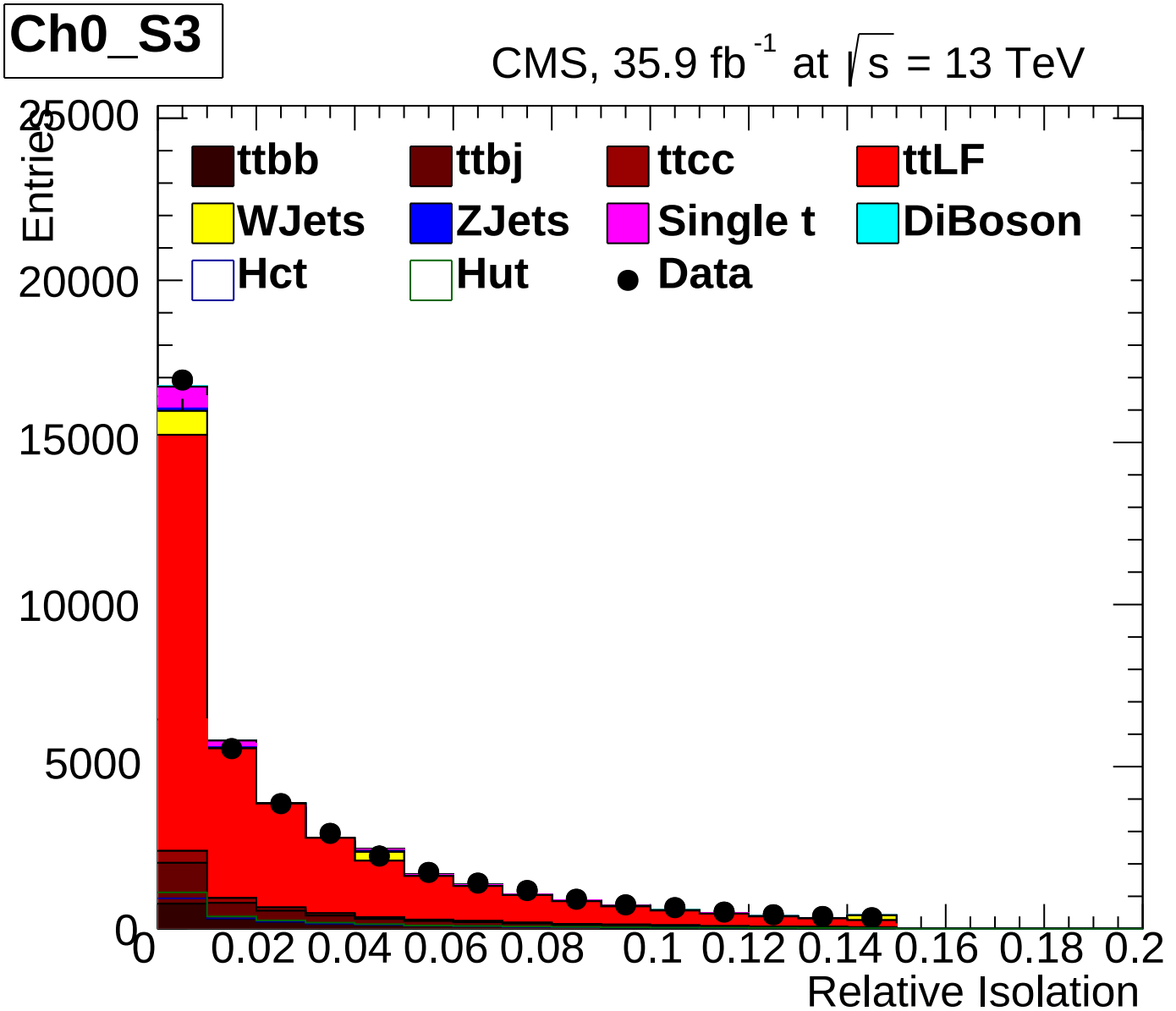
3500
4000
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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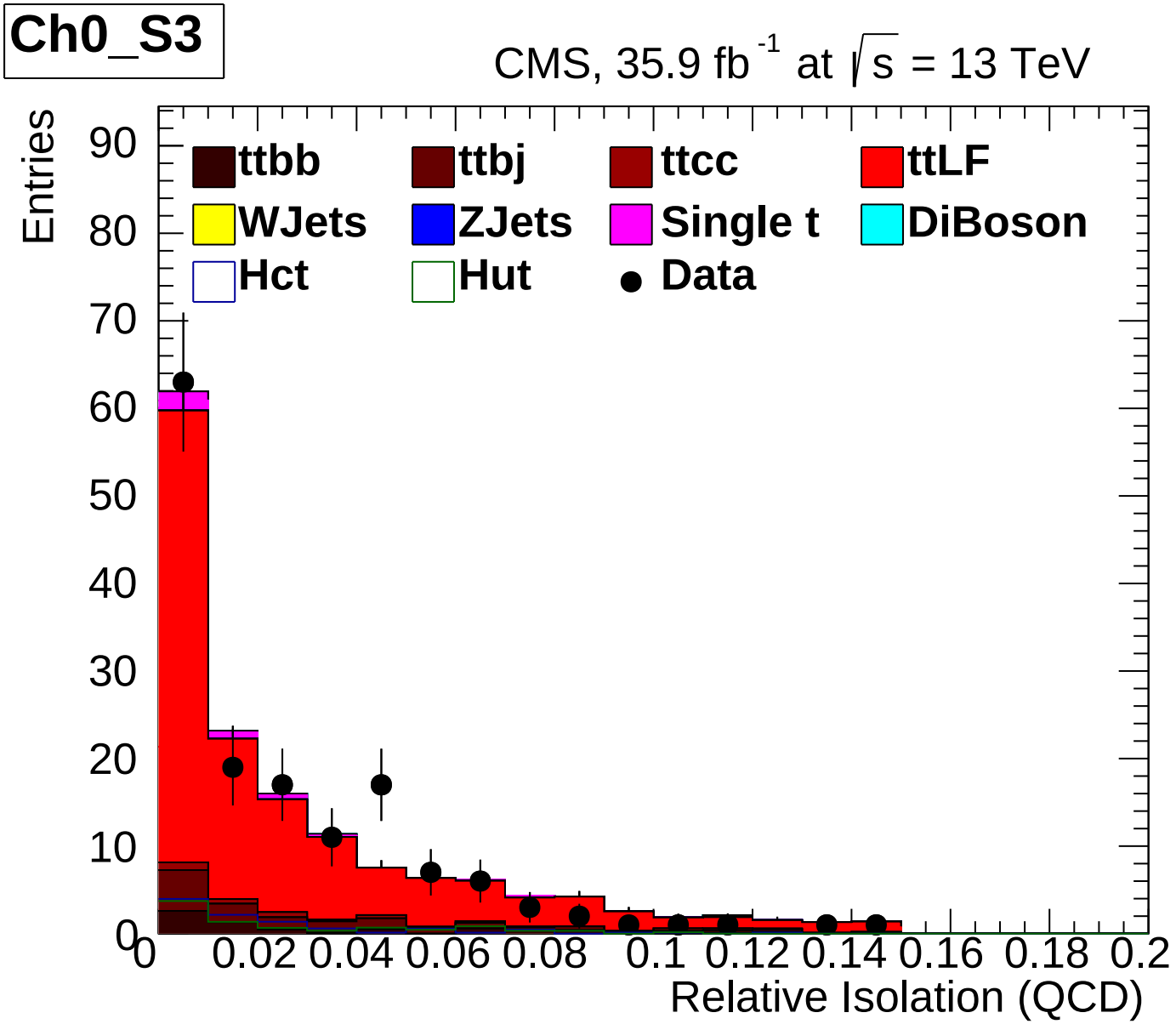
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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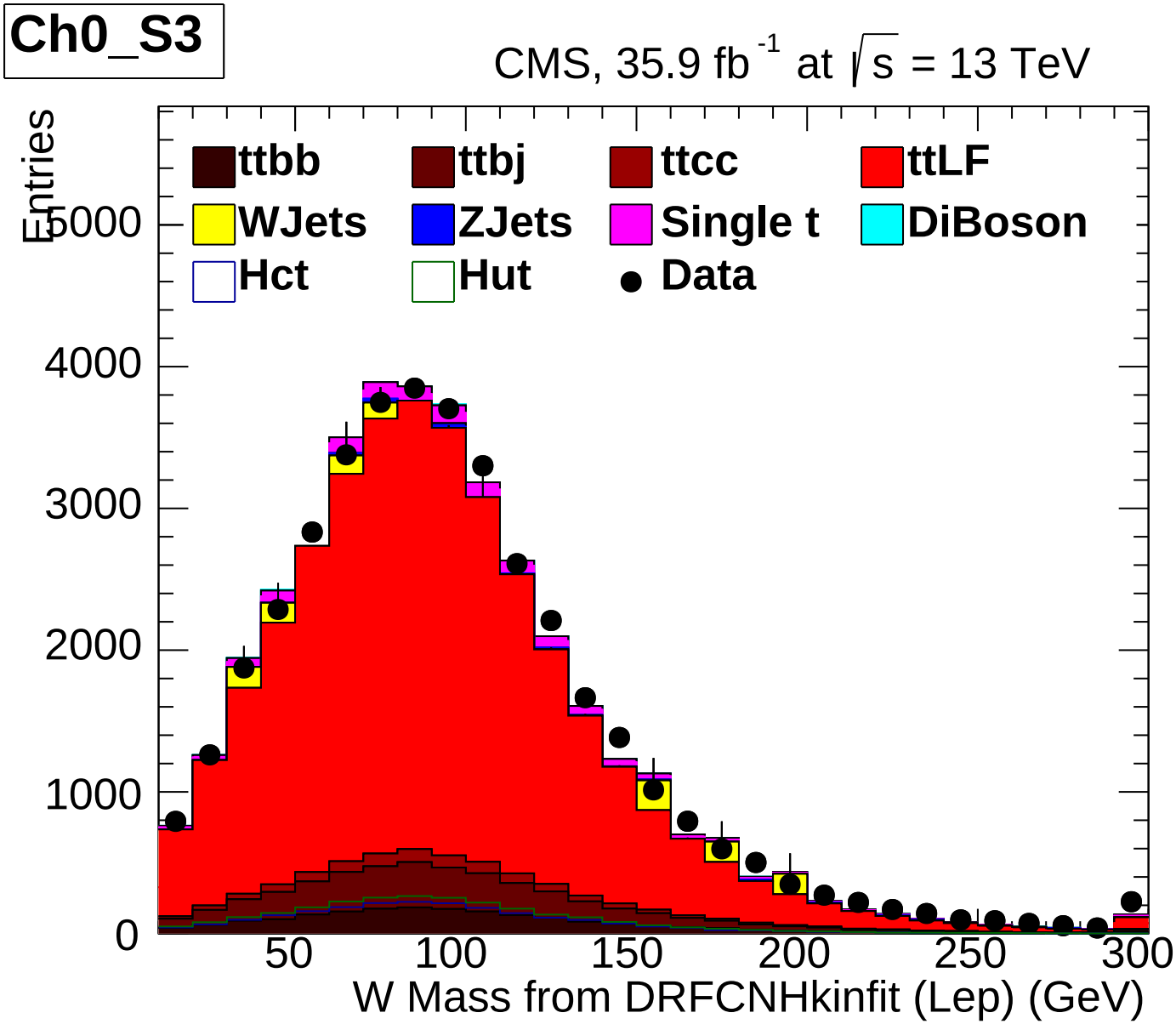
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10
20
30
40
50
60
70
80
90
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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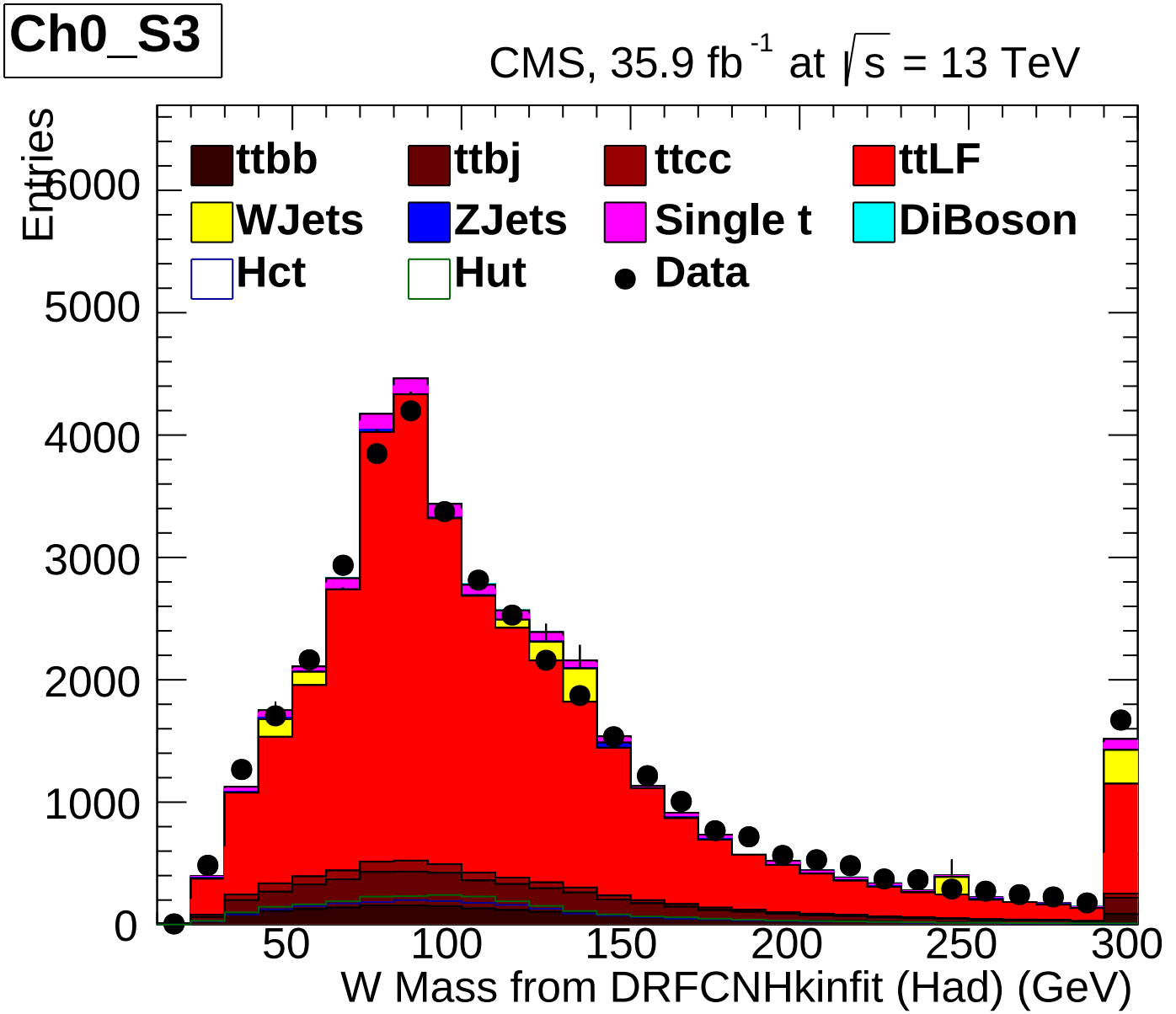
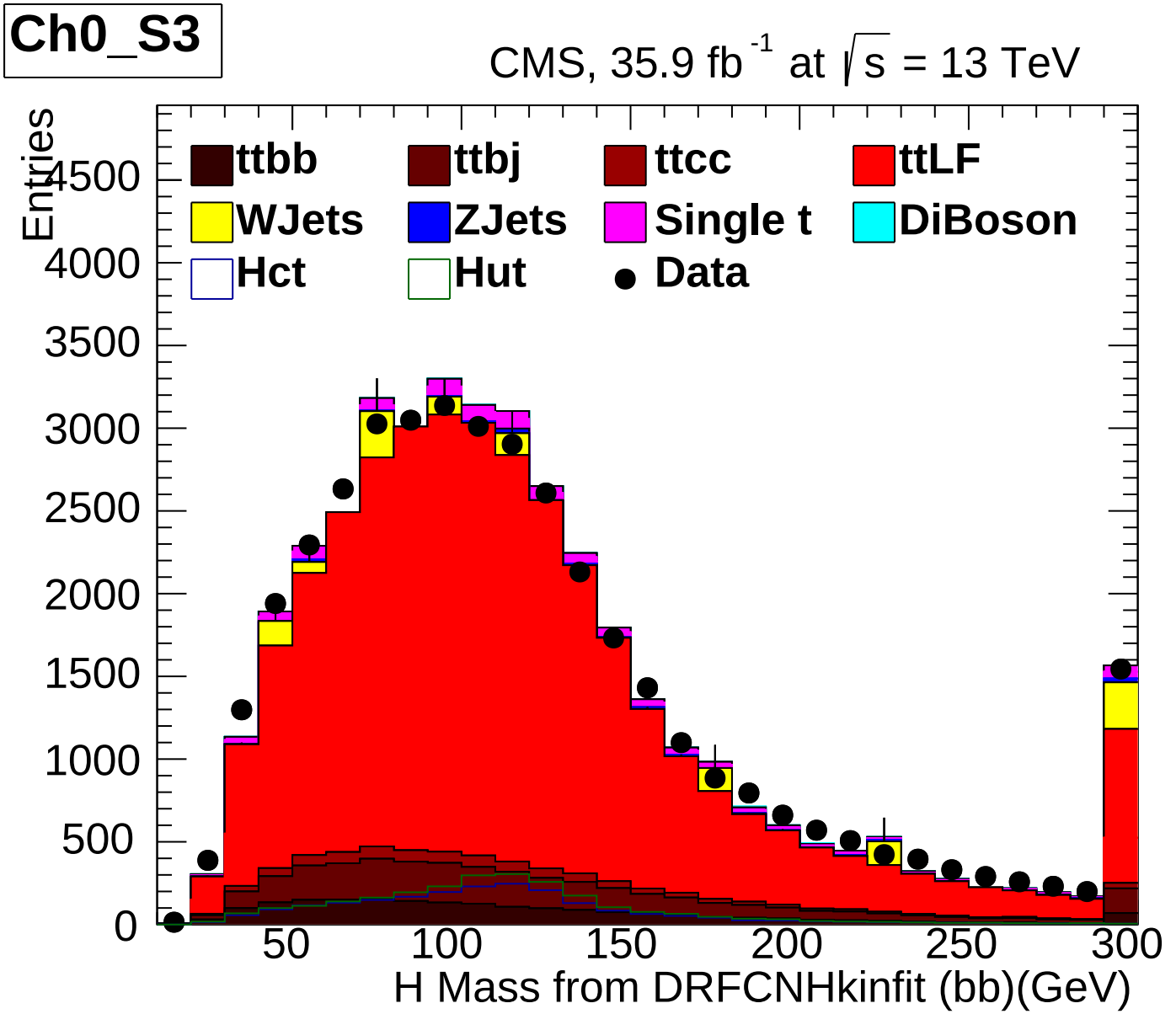
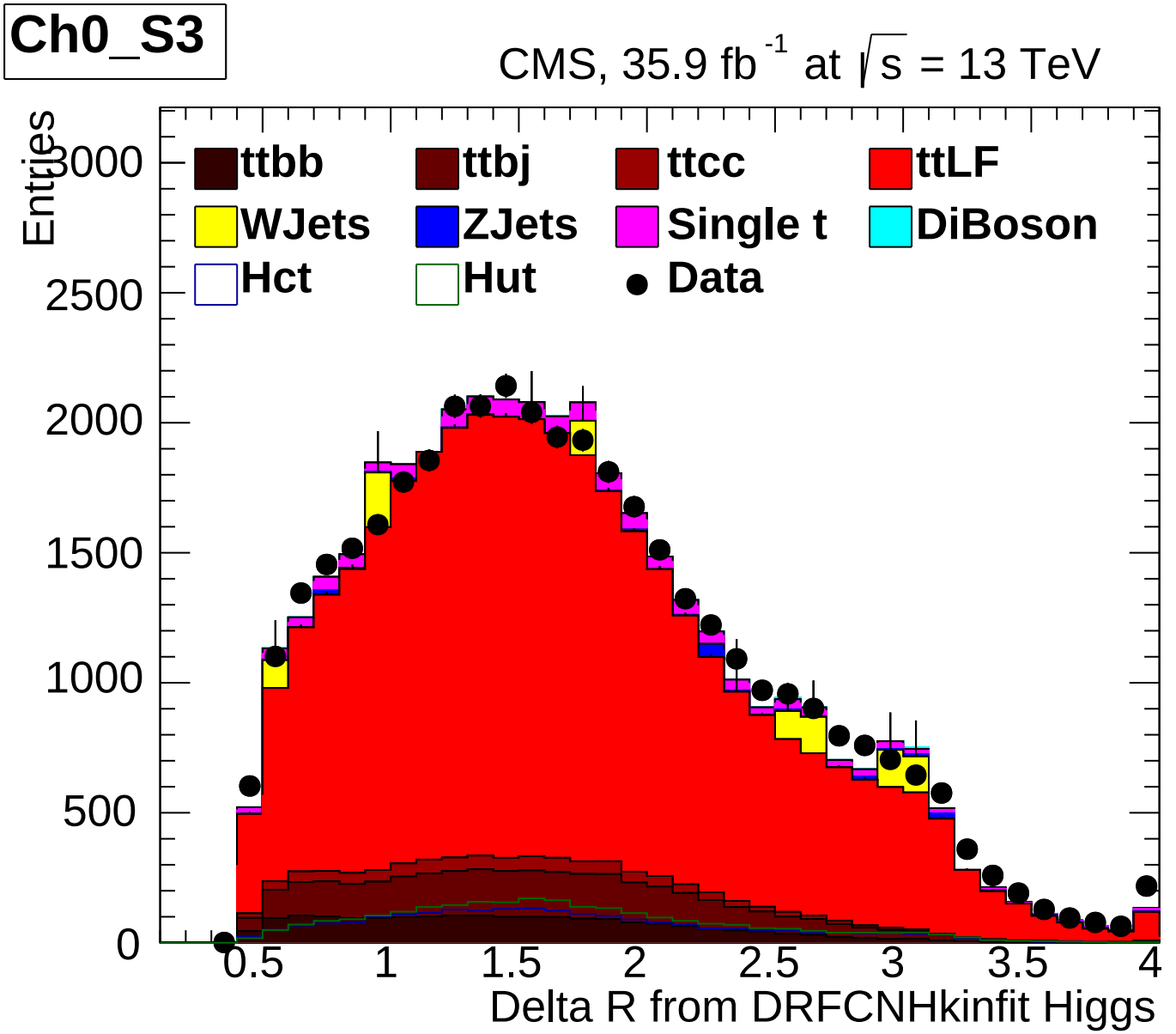
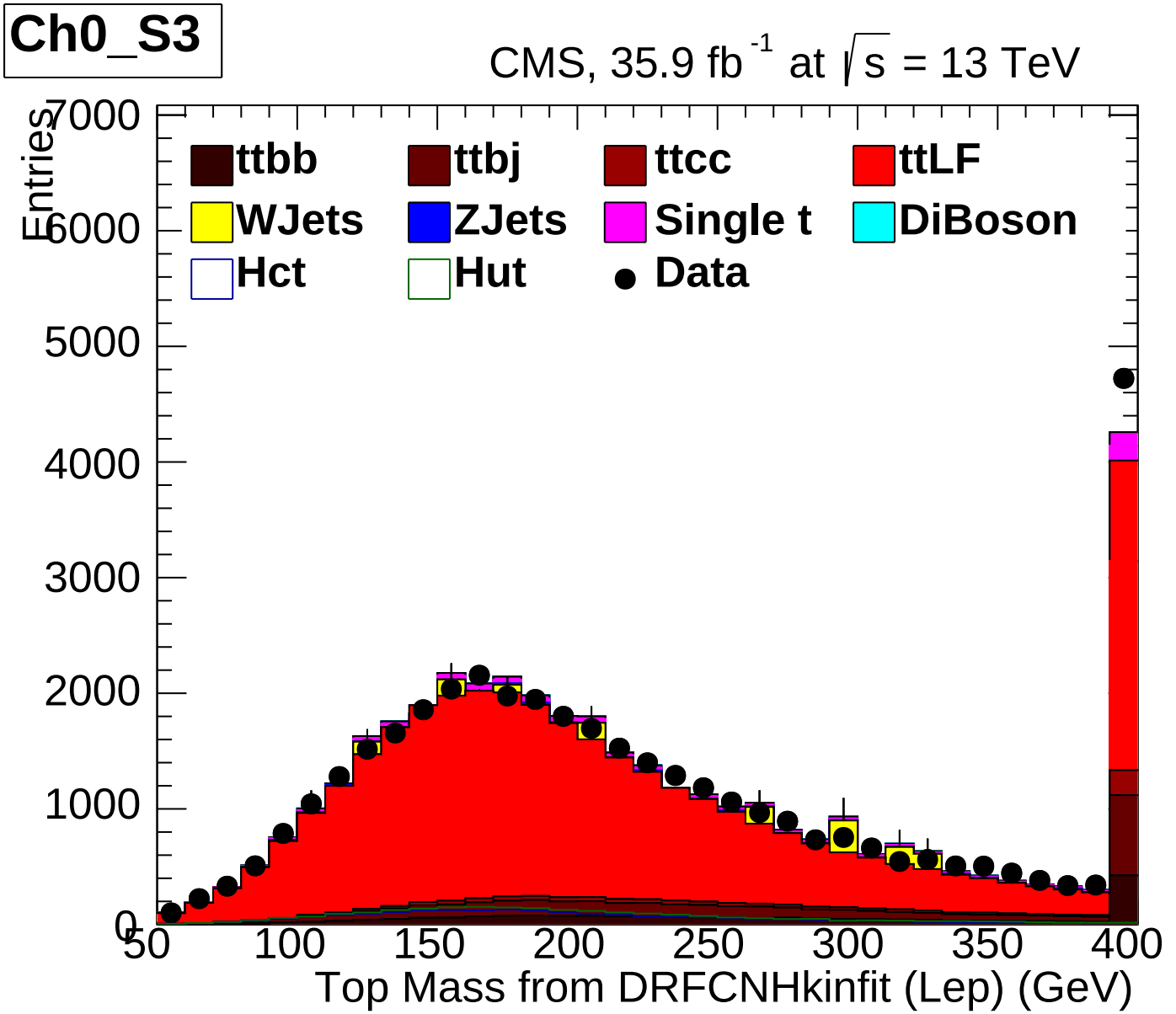
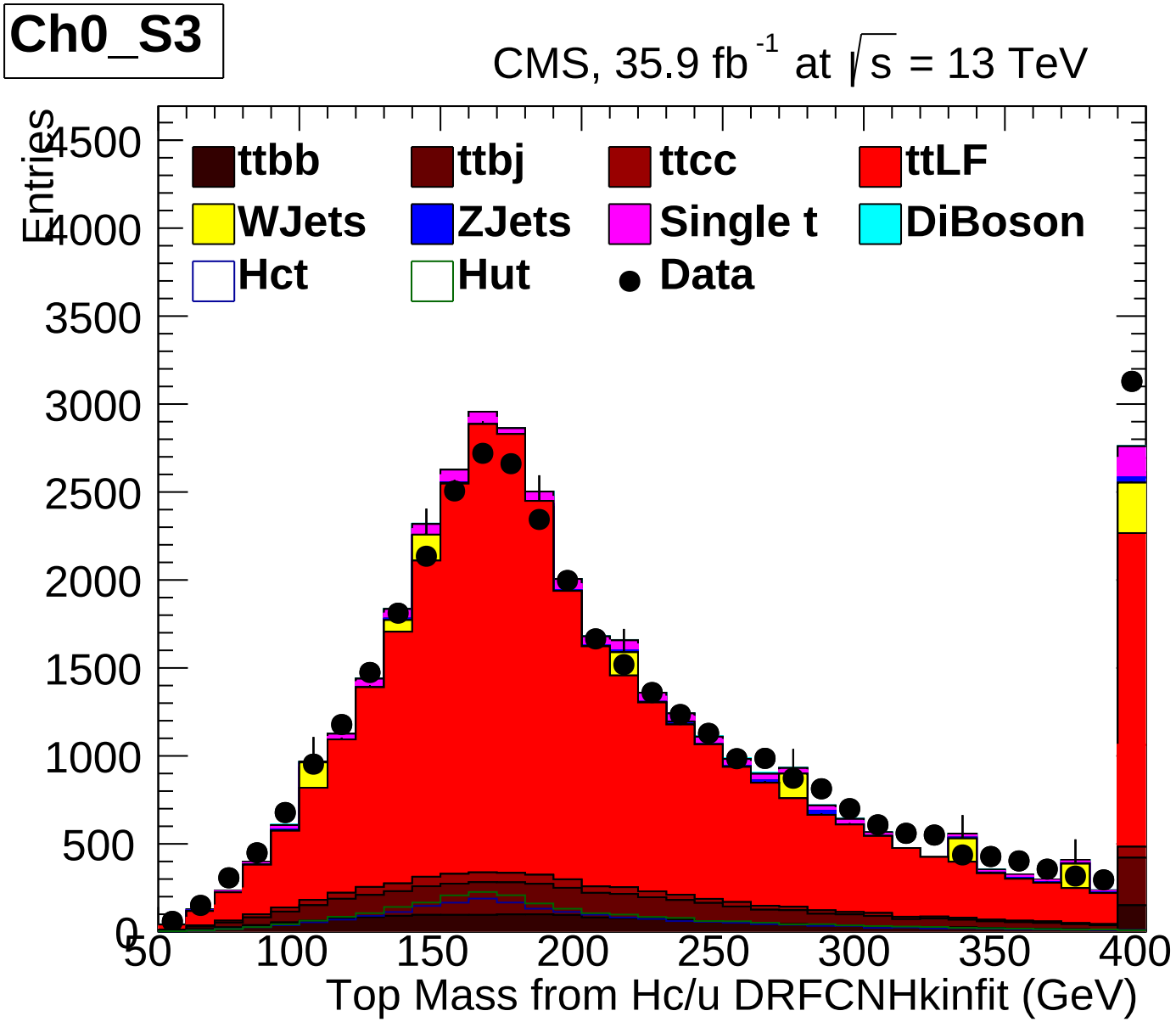
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

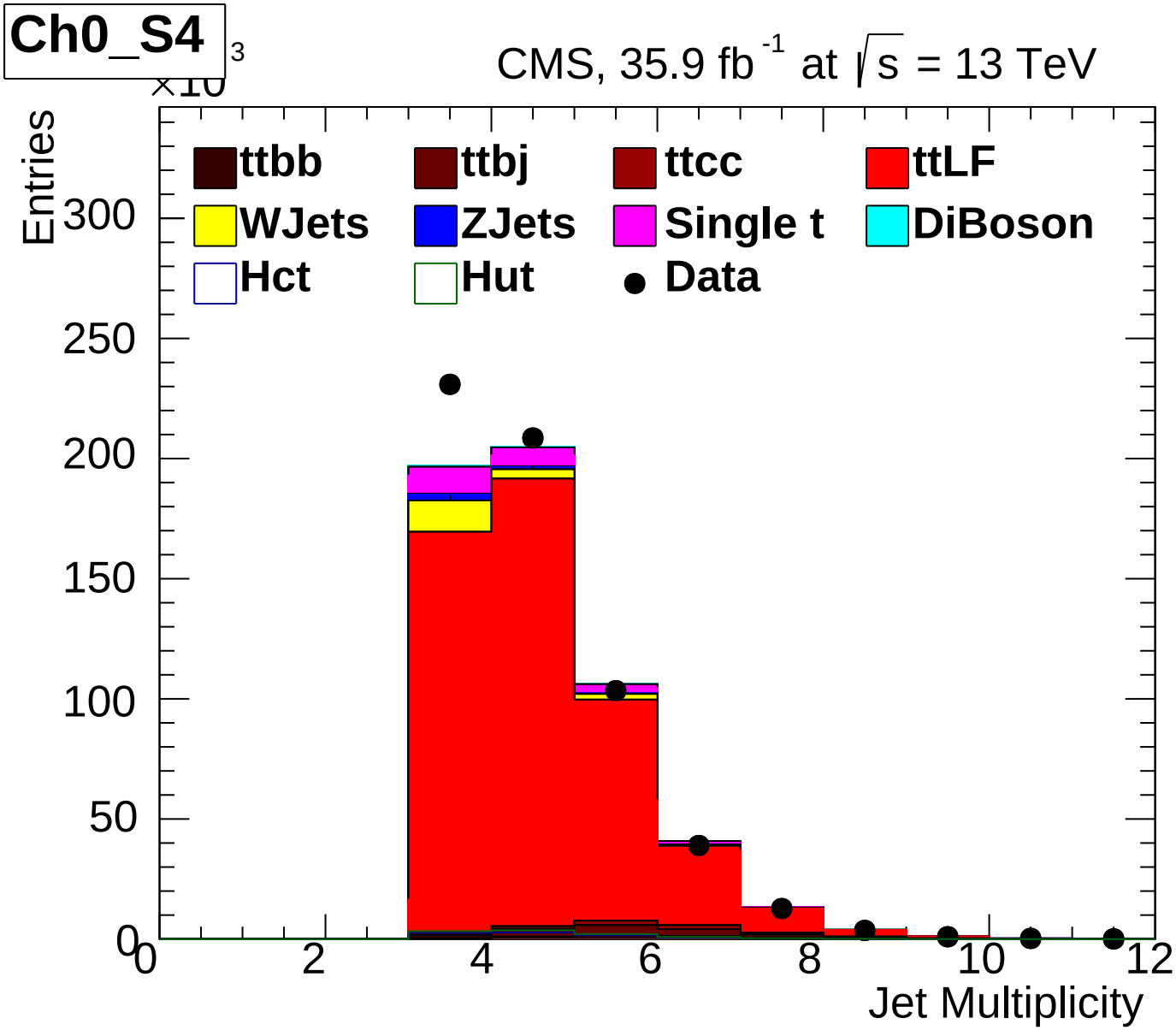

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

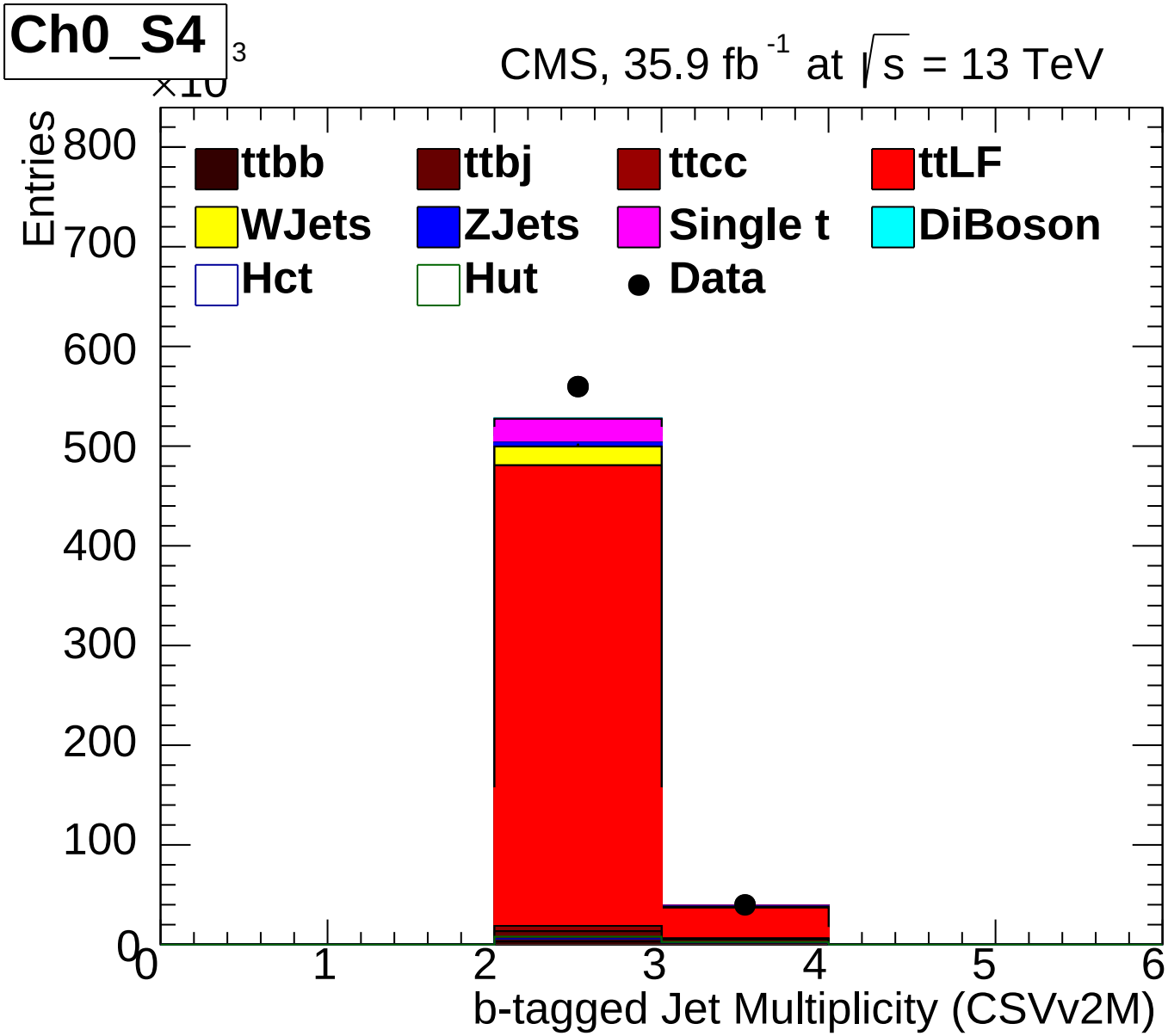

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

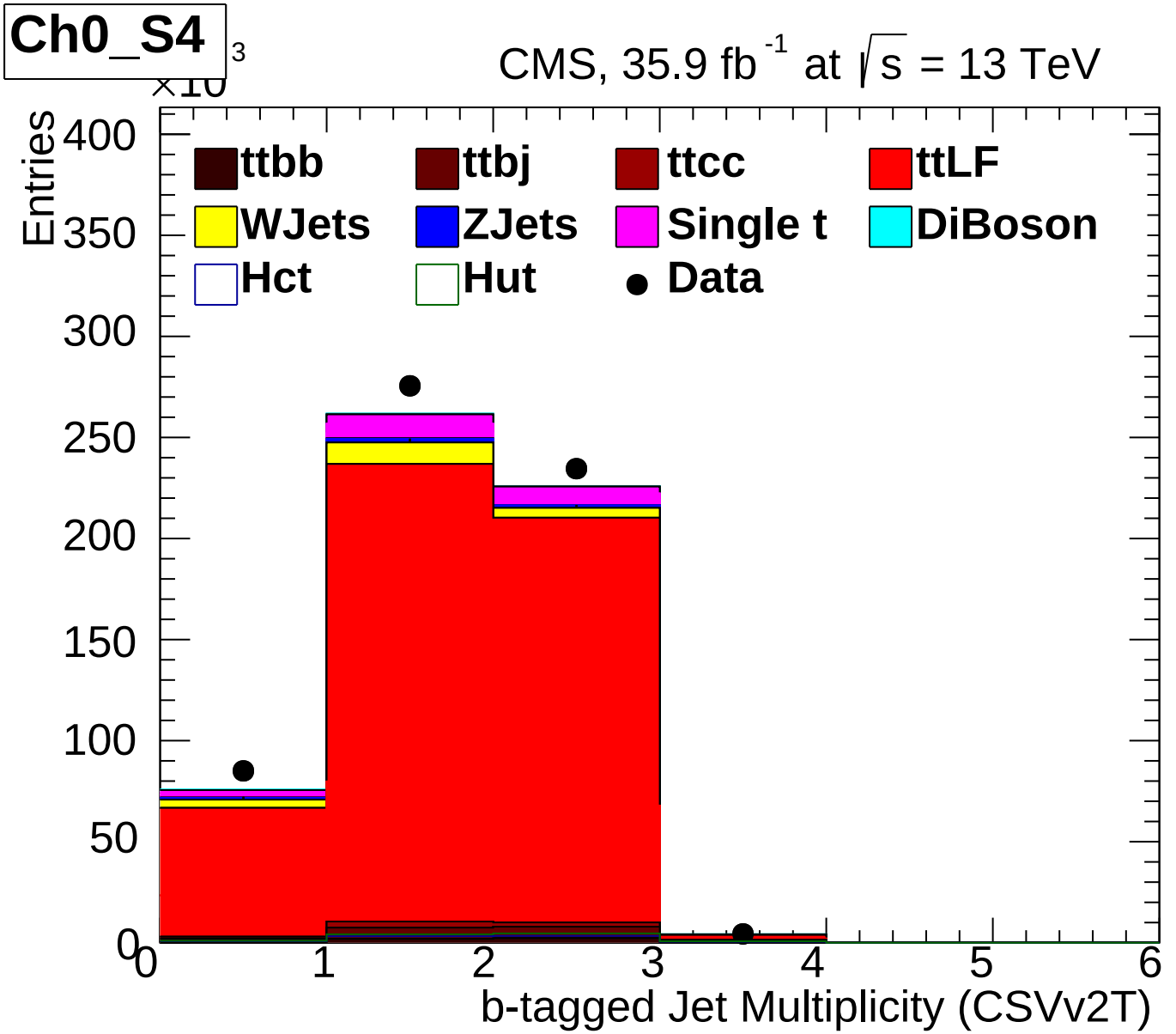

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

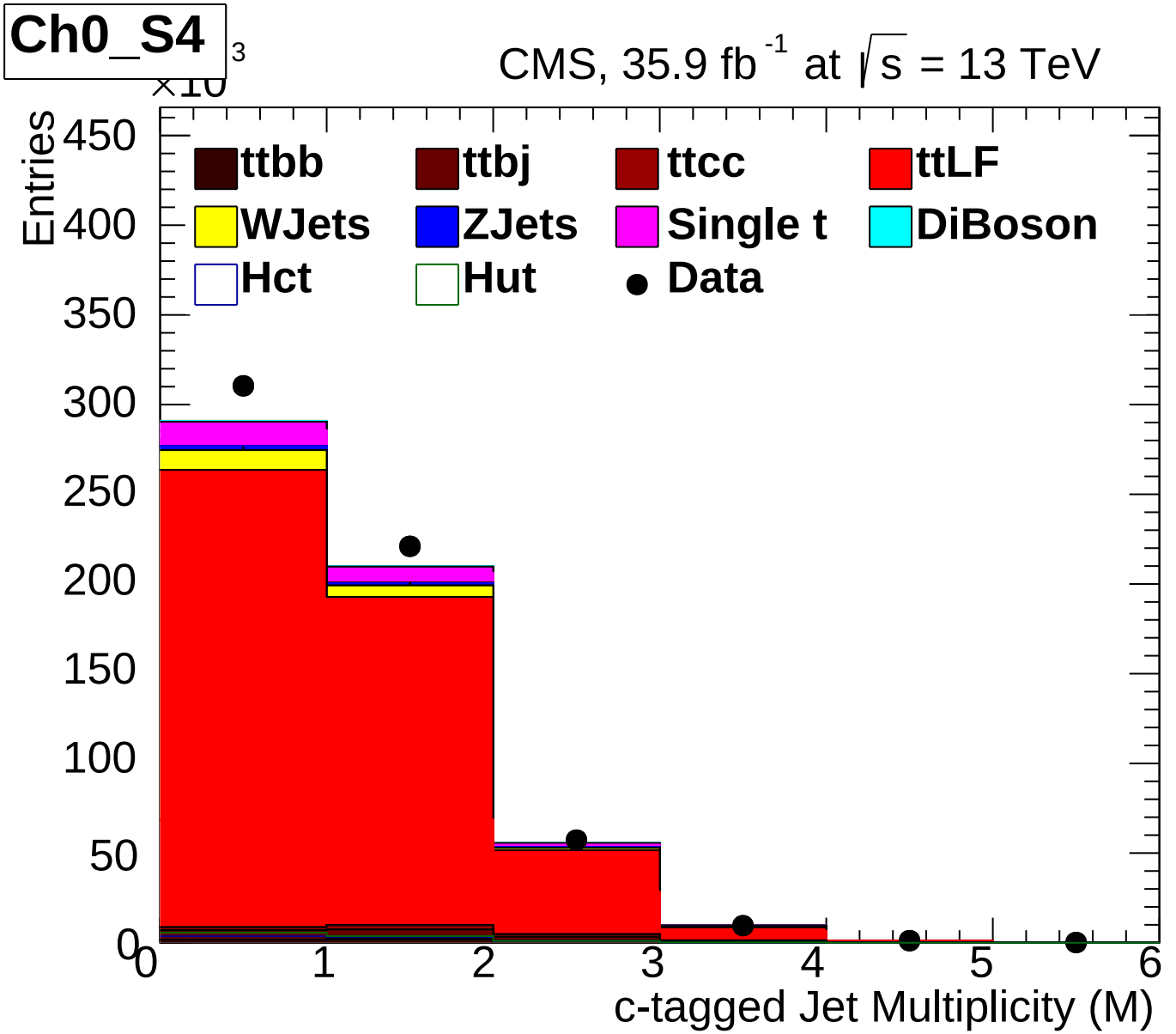

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

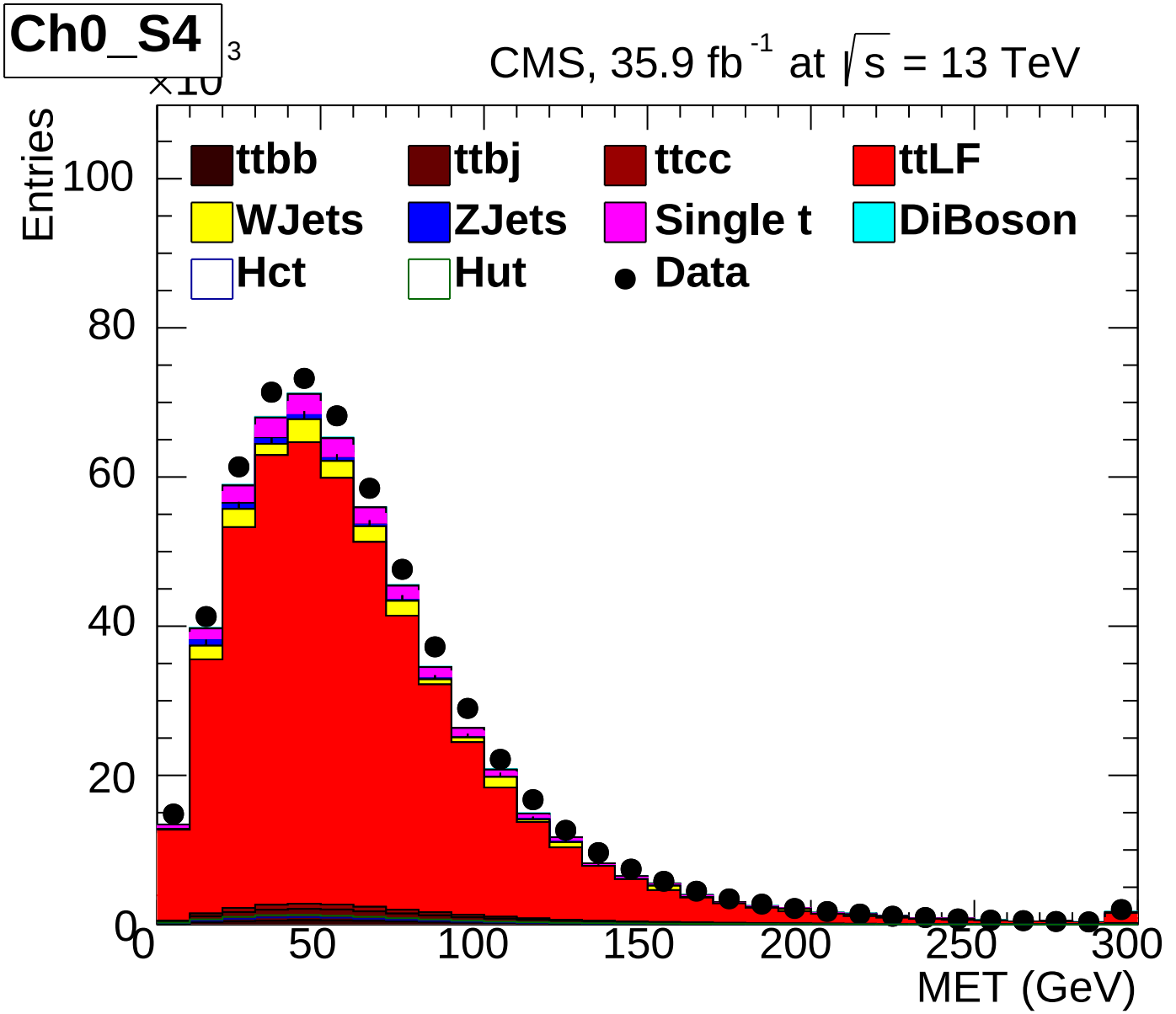

Ch0_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

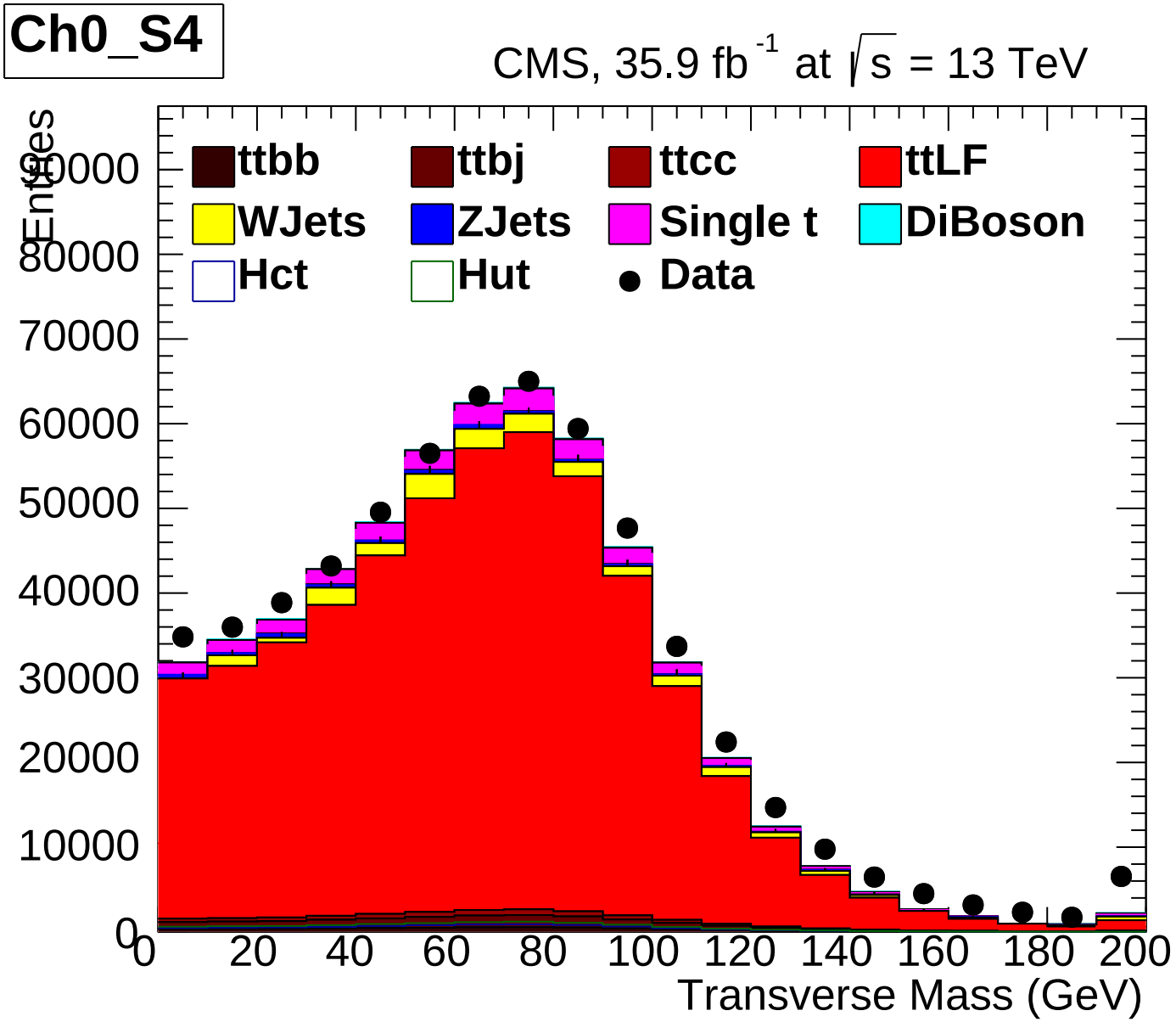

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
0
2
4
6
8
10
12
Jet Multiplicity

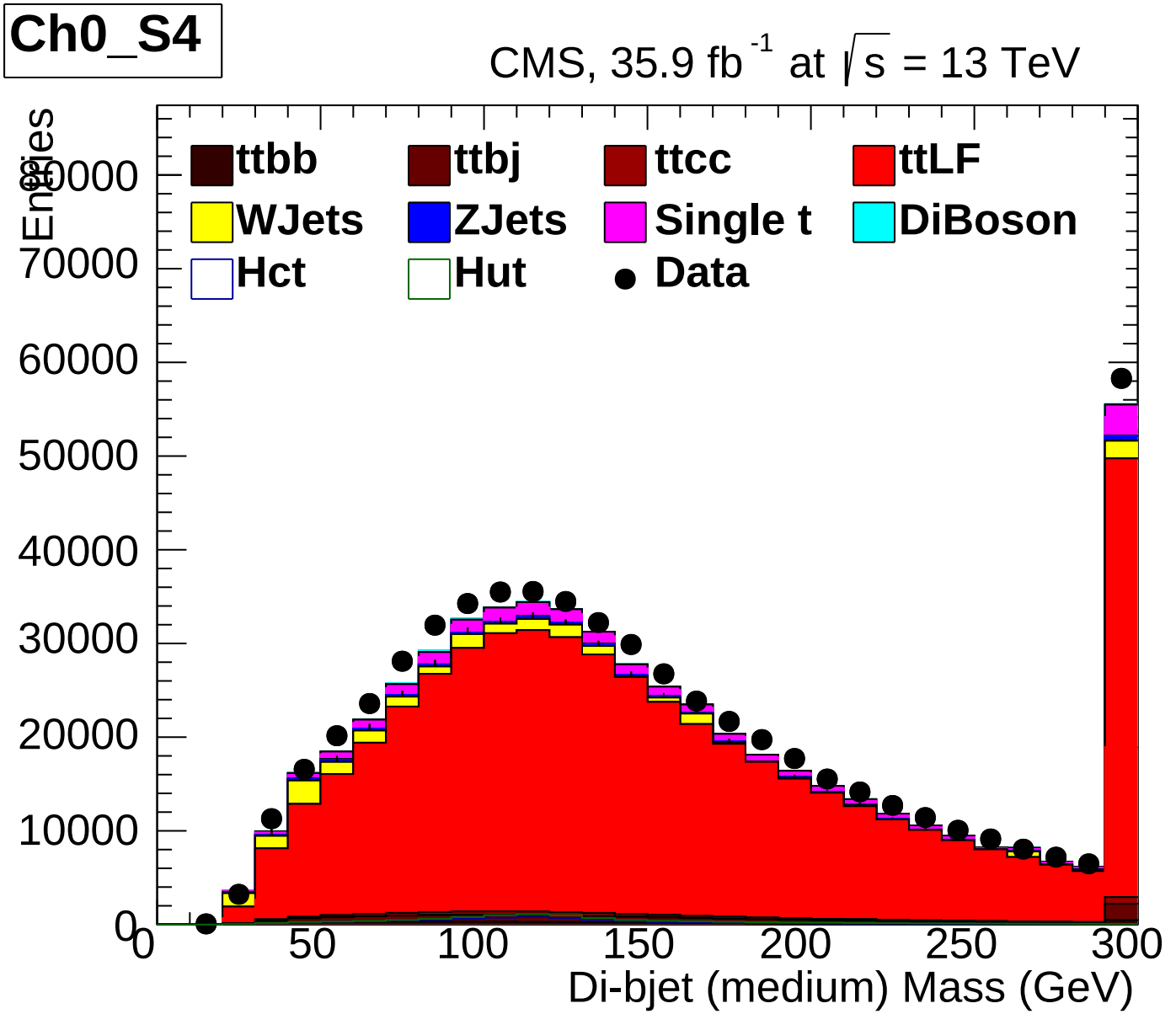

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
400
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
c-tagged Jet Multiplicity (M)


Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
0
50
100
150
200
250
300
MET (GeV)


Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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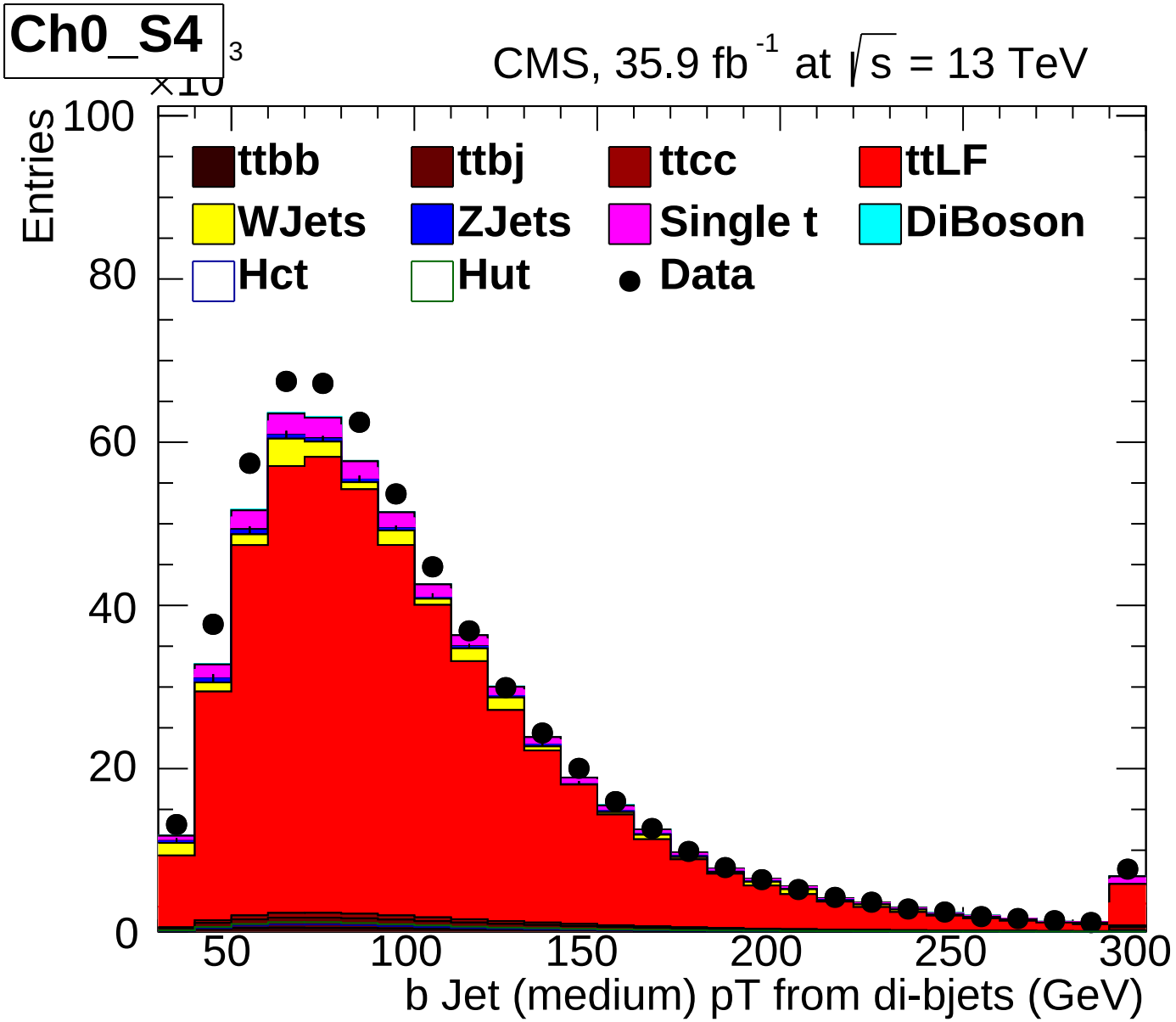
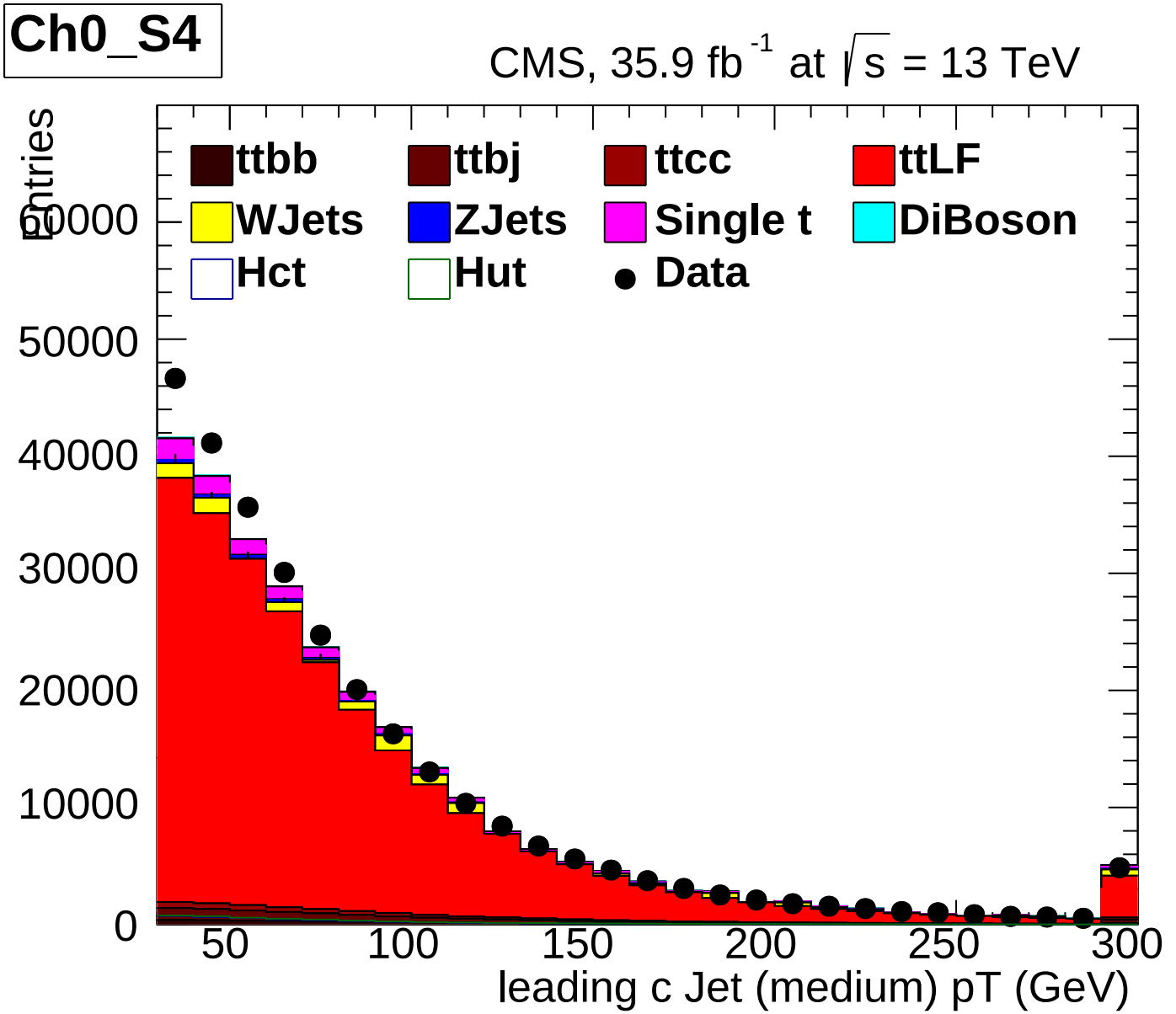
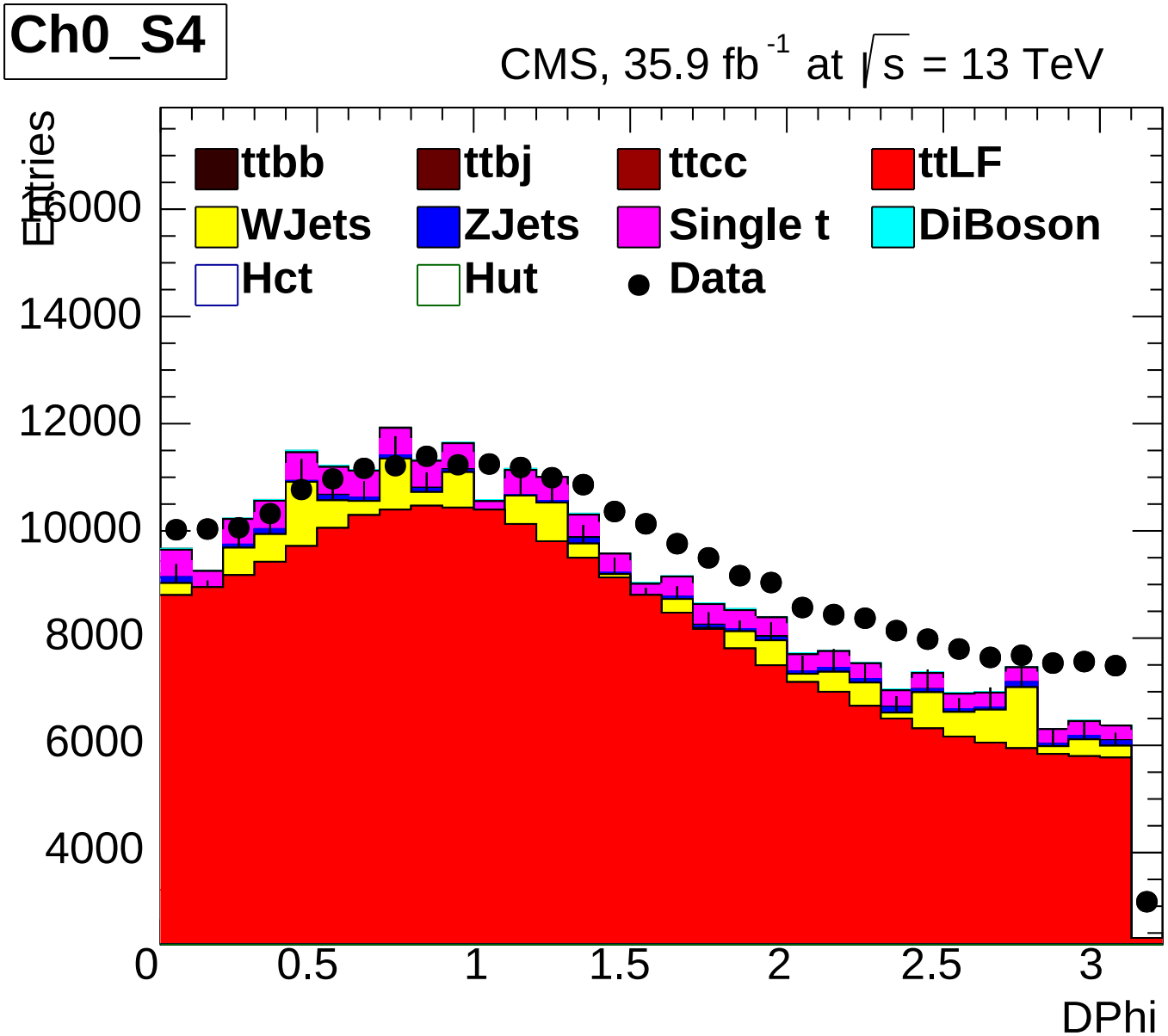
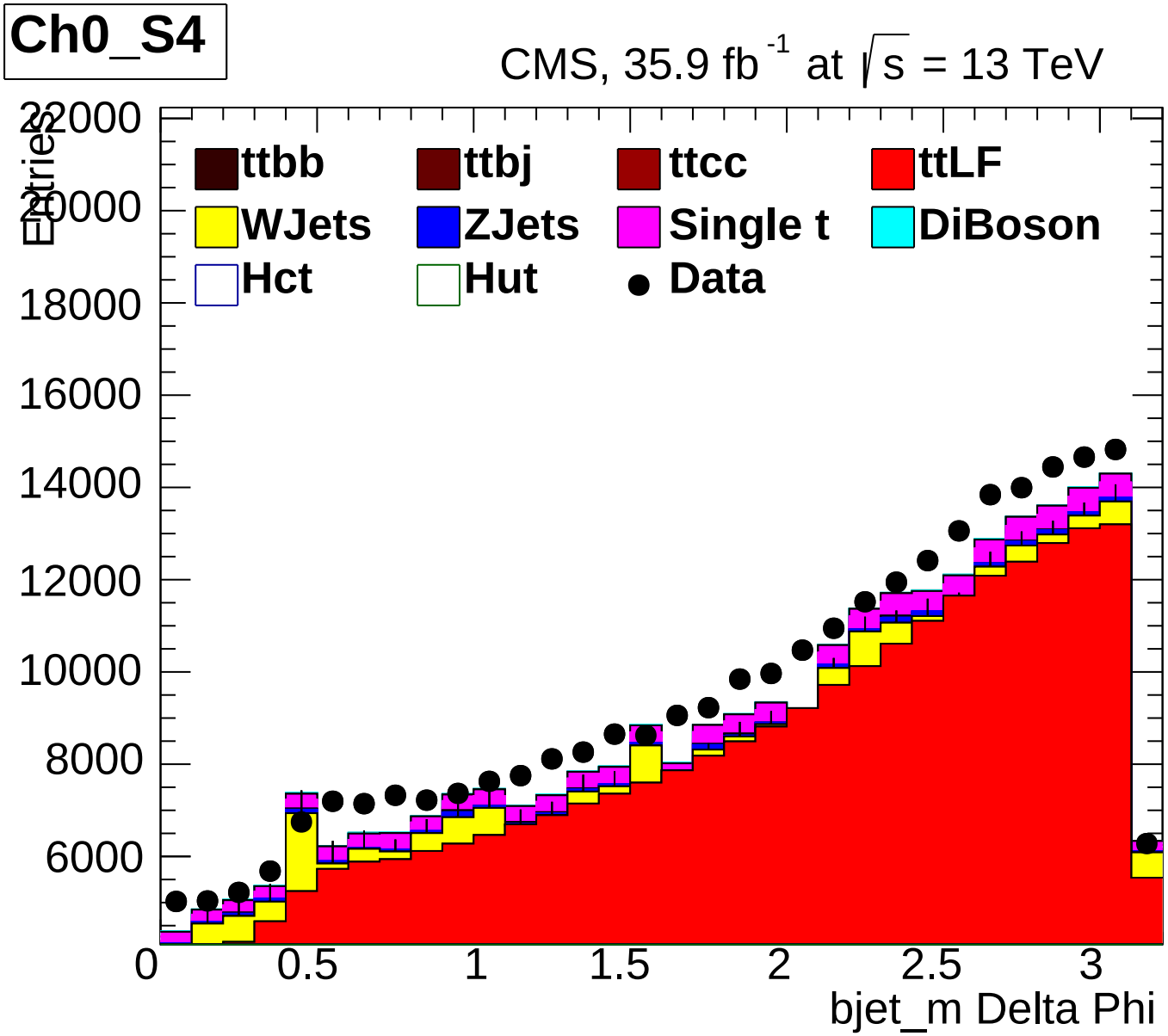
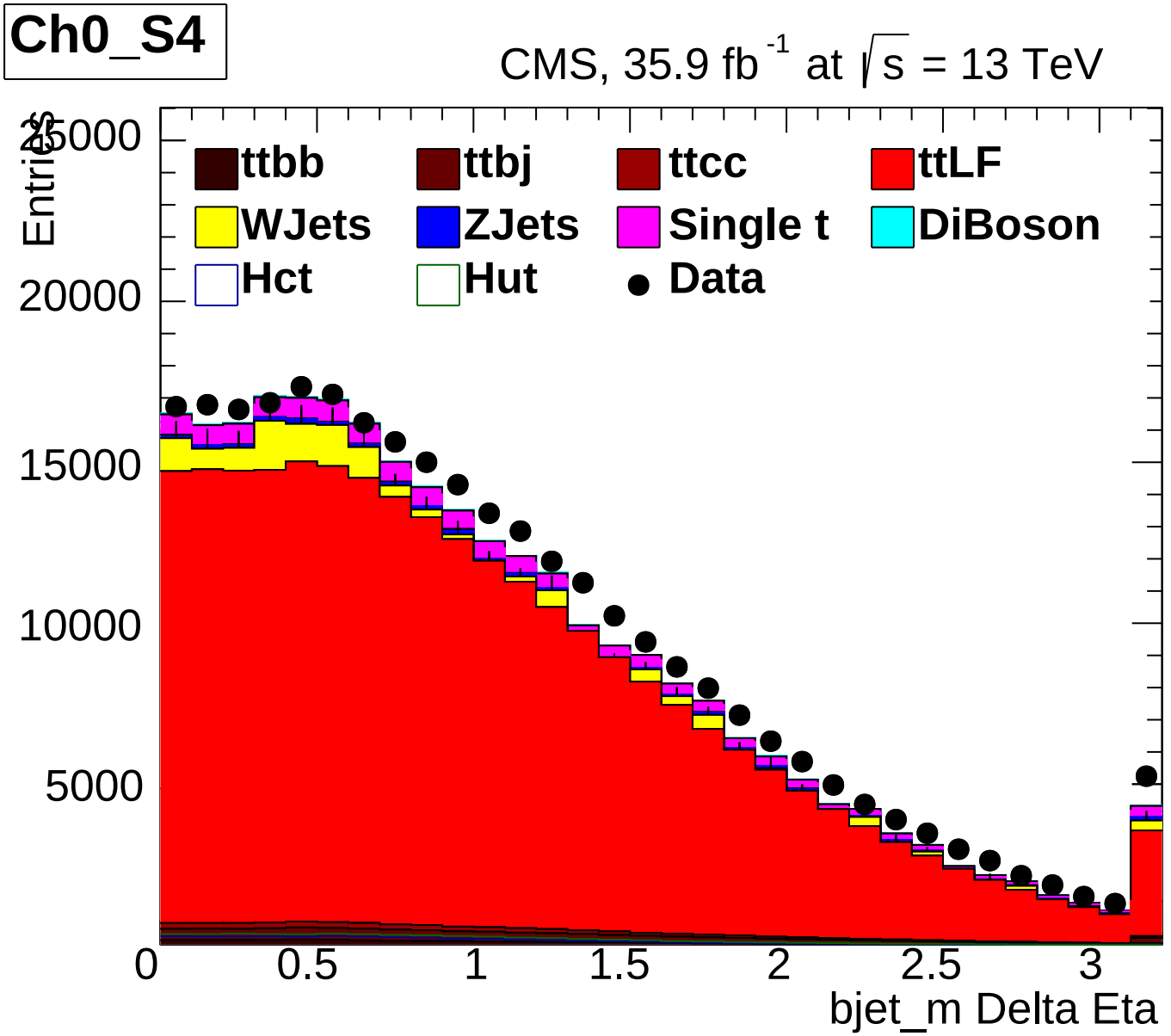
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
80000
70000
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

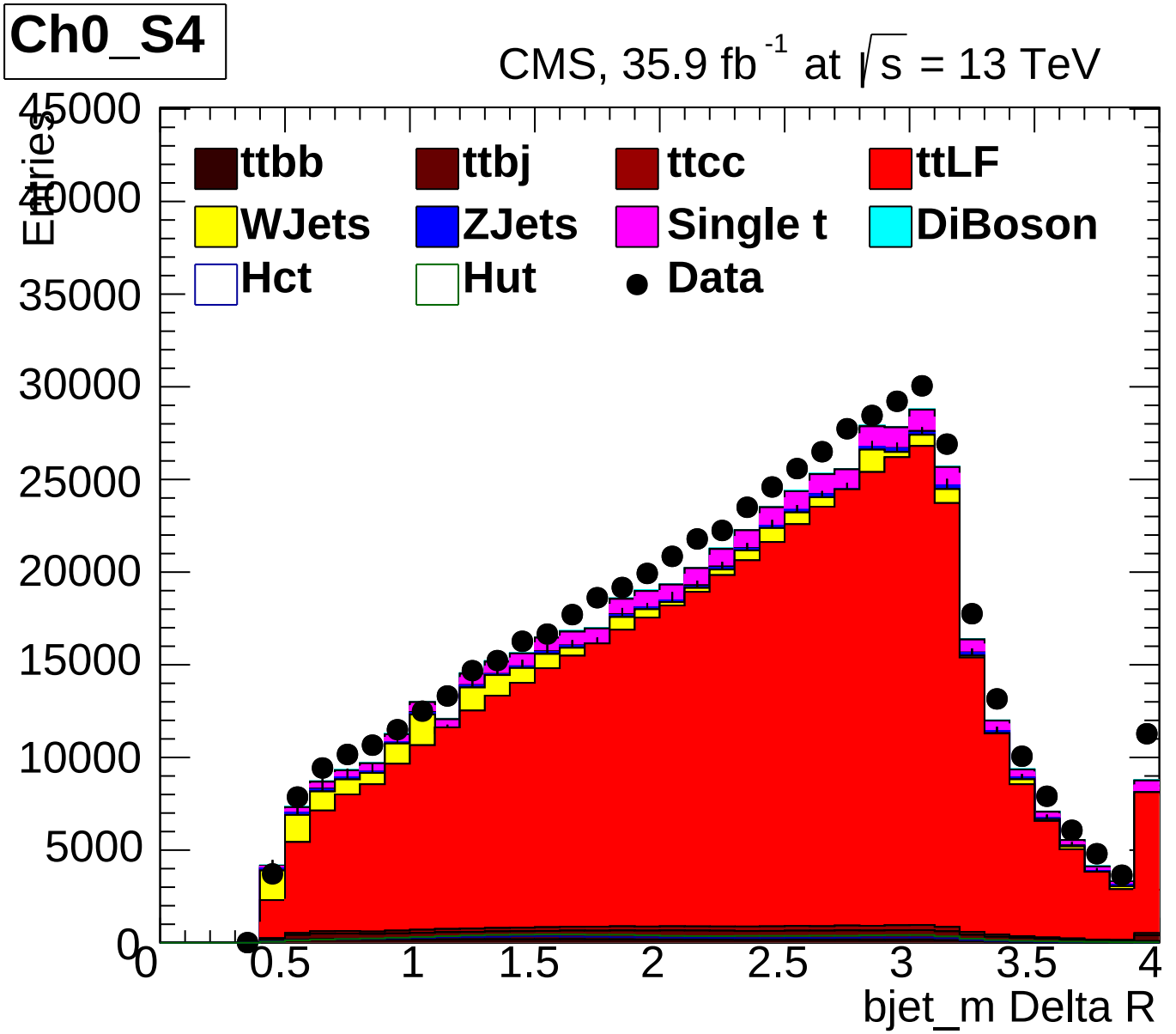

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

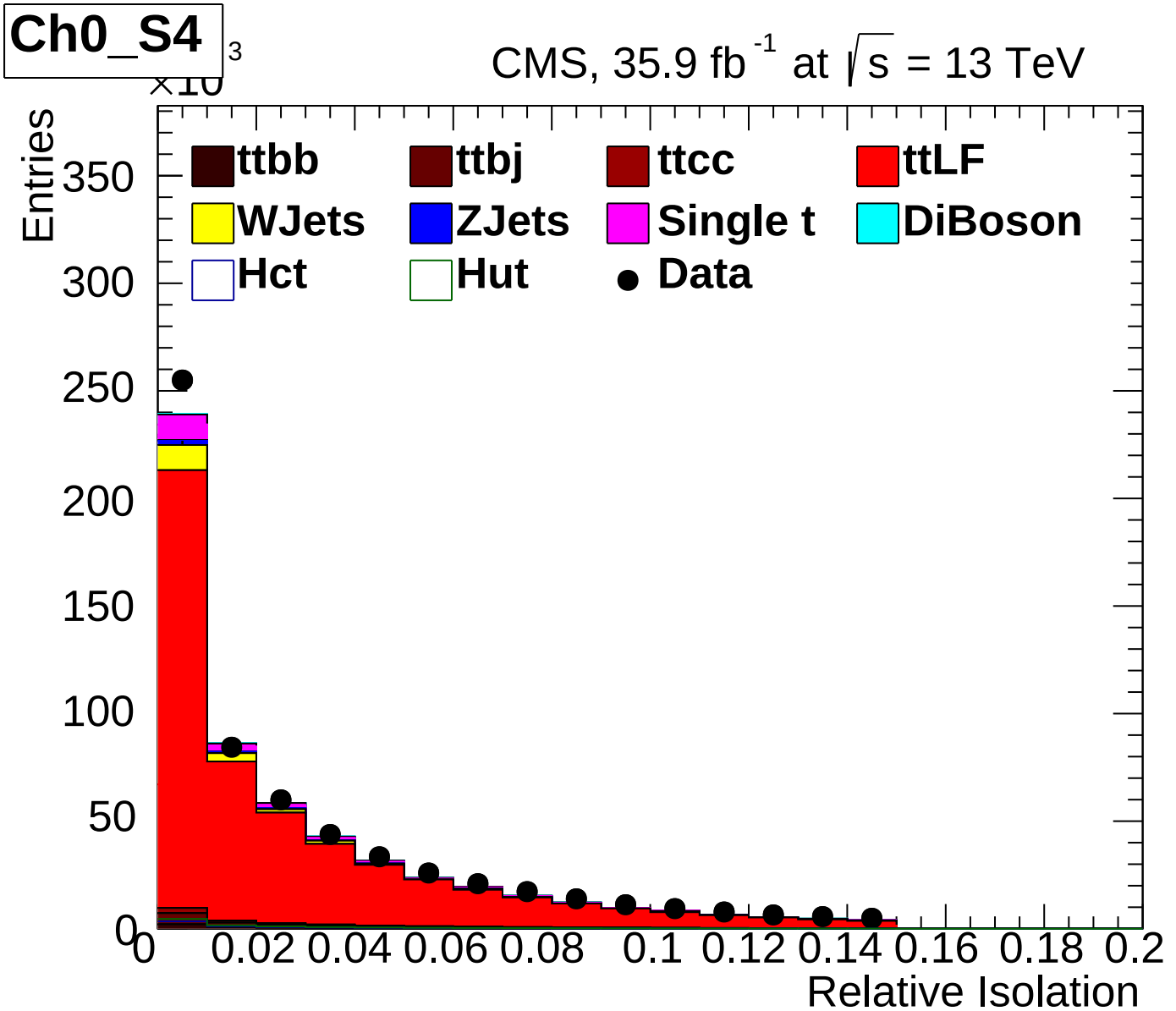

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

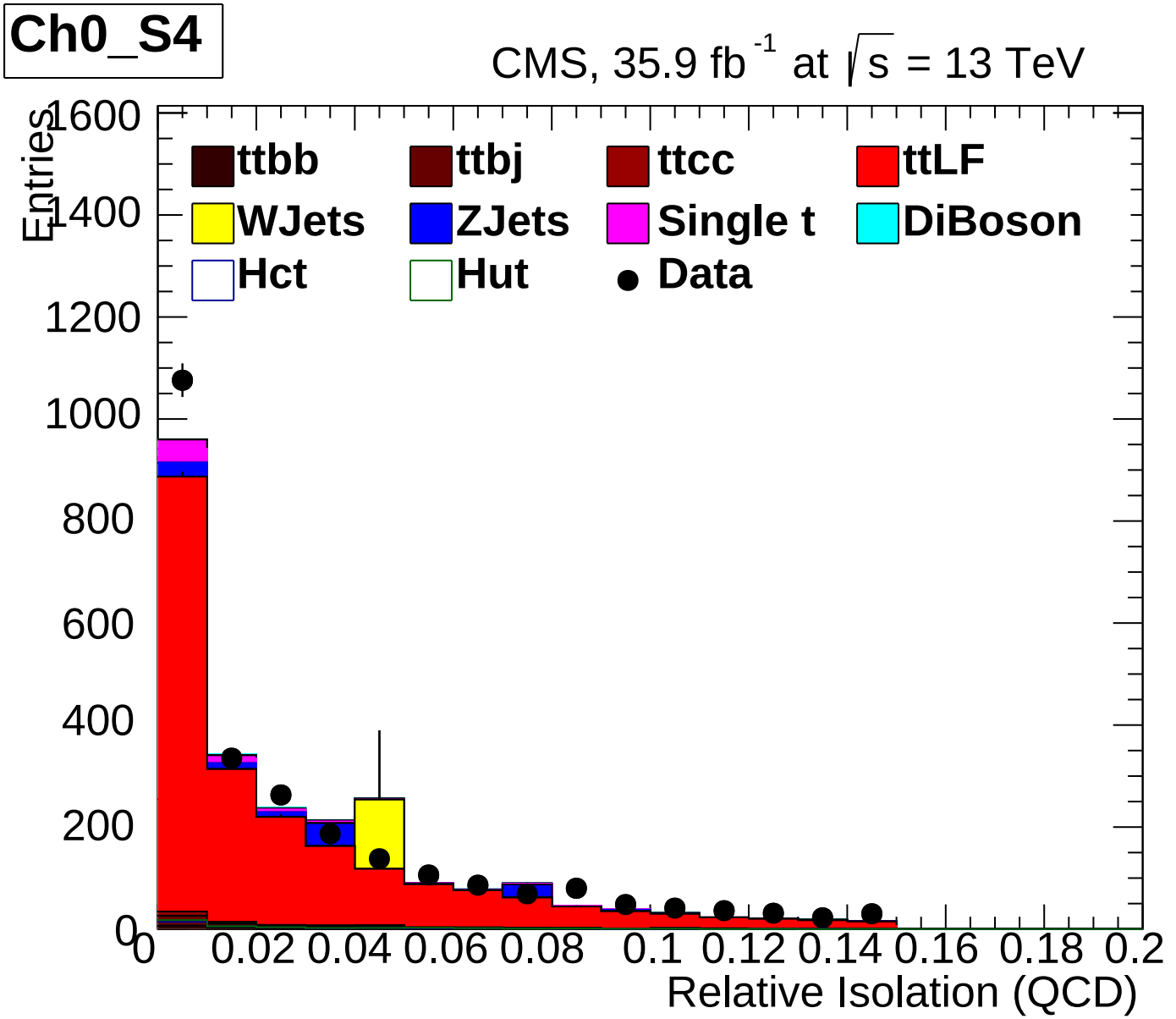

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
16000
14000
12000
10000
8000
6000
4000
0
0.5
1
1.5
2
2.5
3
DPhi

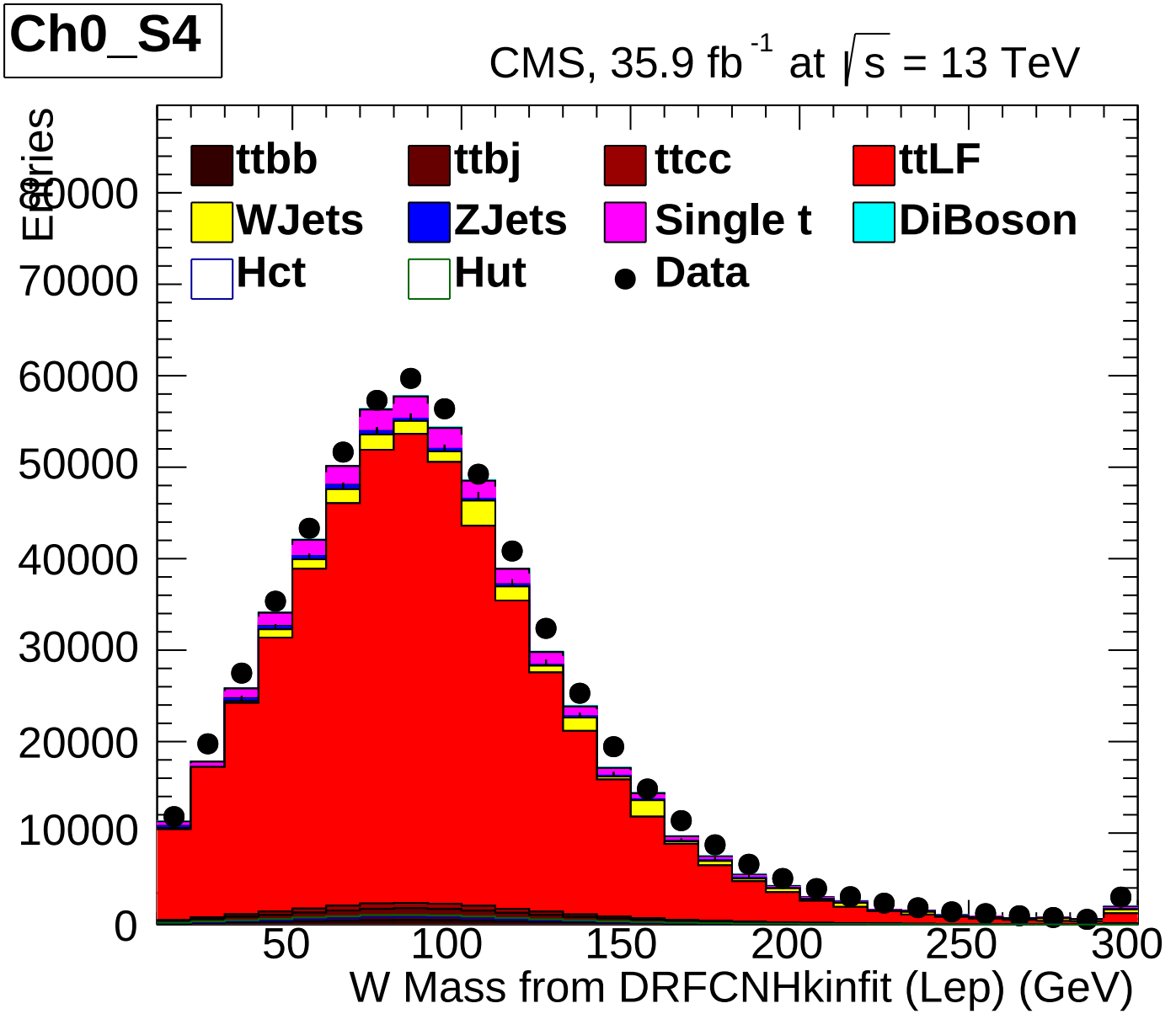

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
22000
20000
18000
16000
14000
12000
10000
8000
6000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

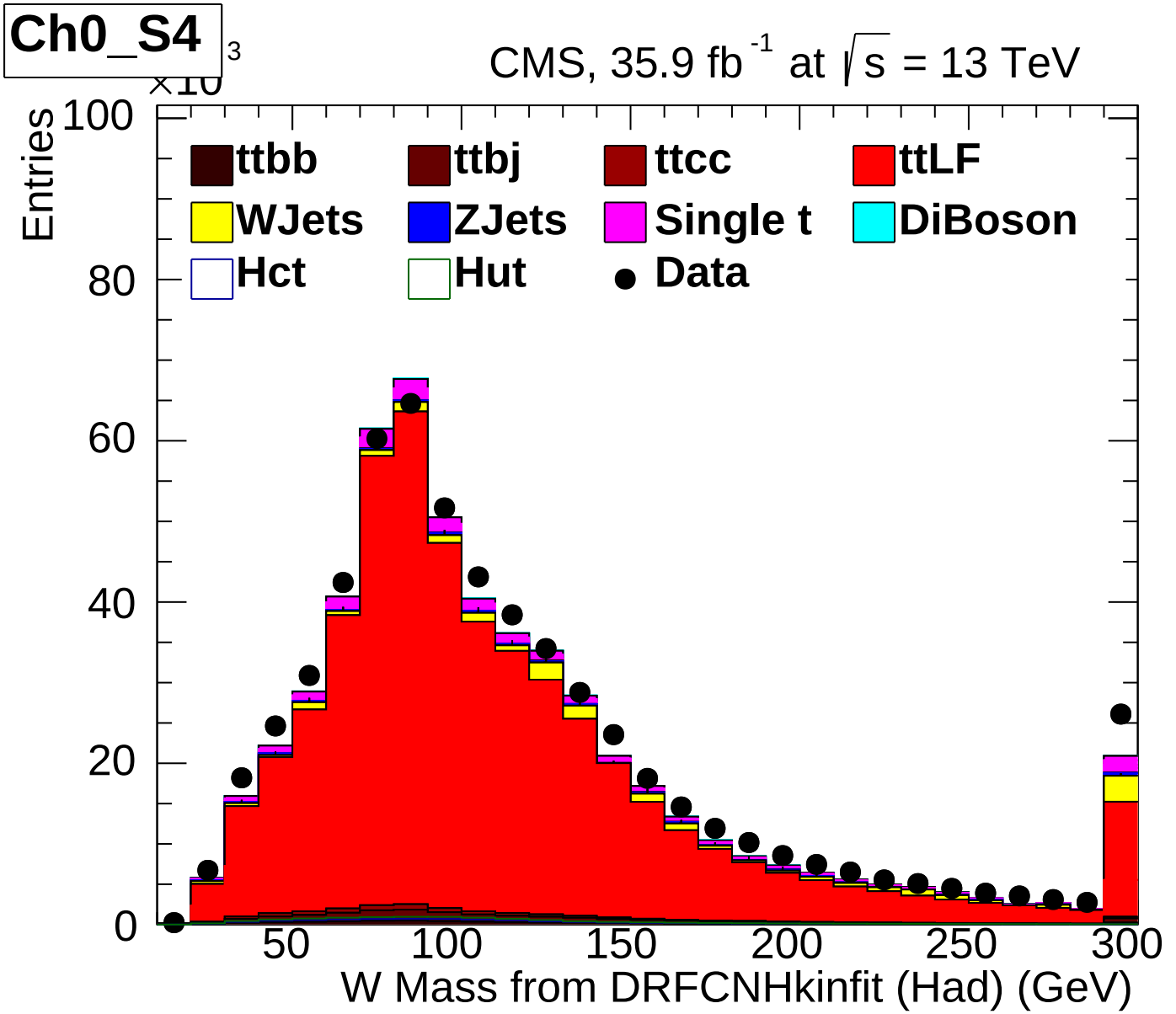

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

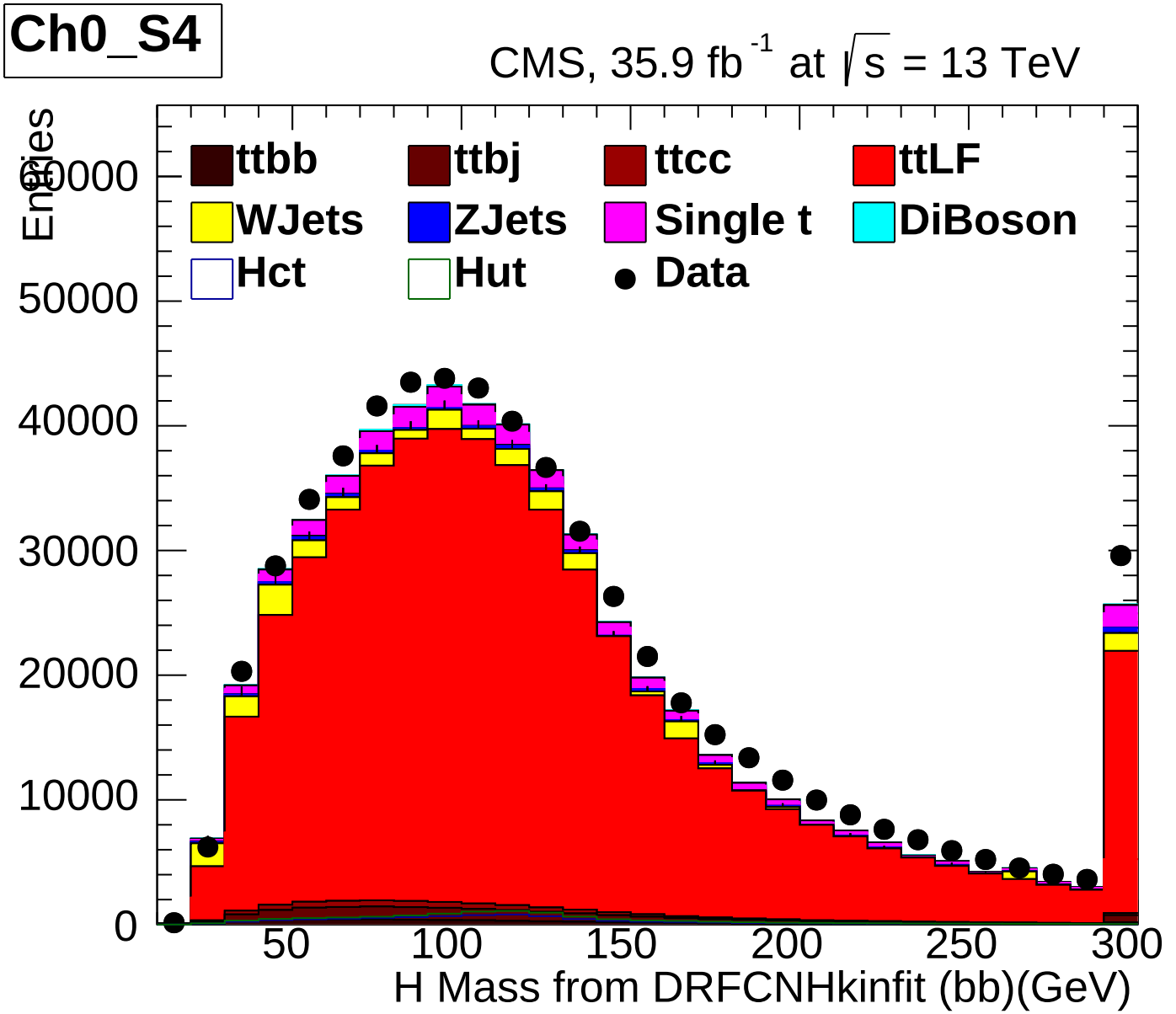

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

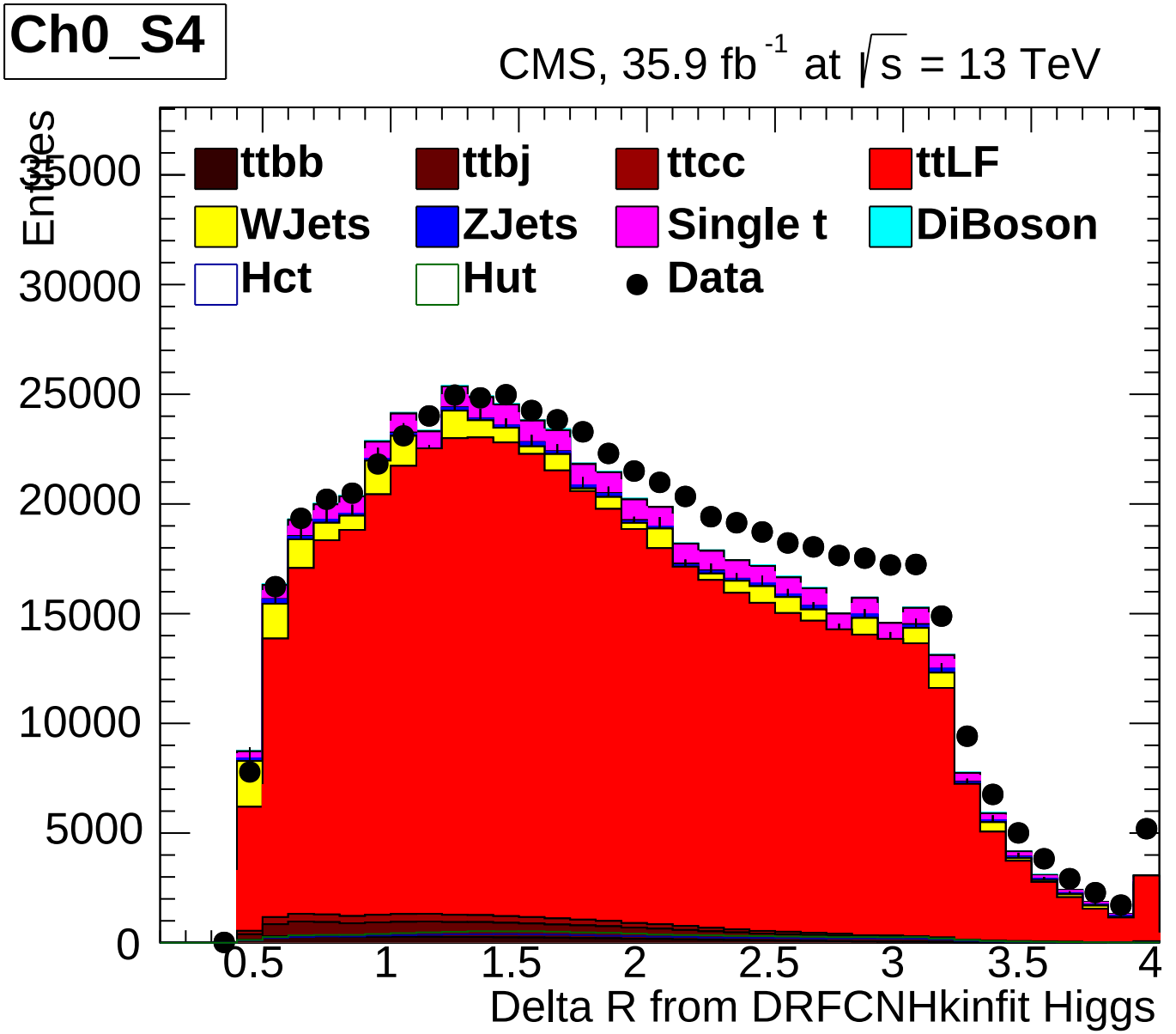

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
350
300
250
200
150
100
50
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

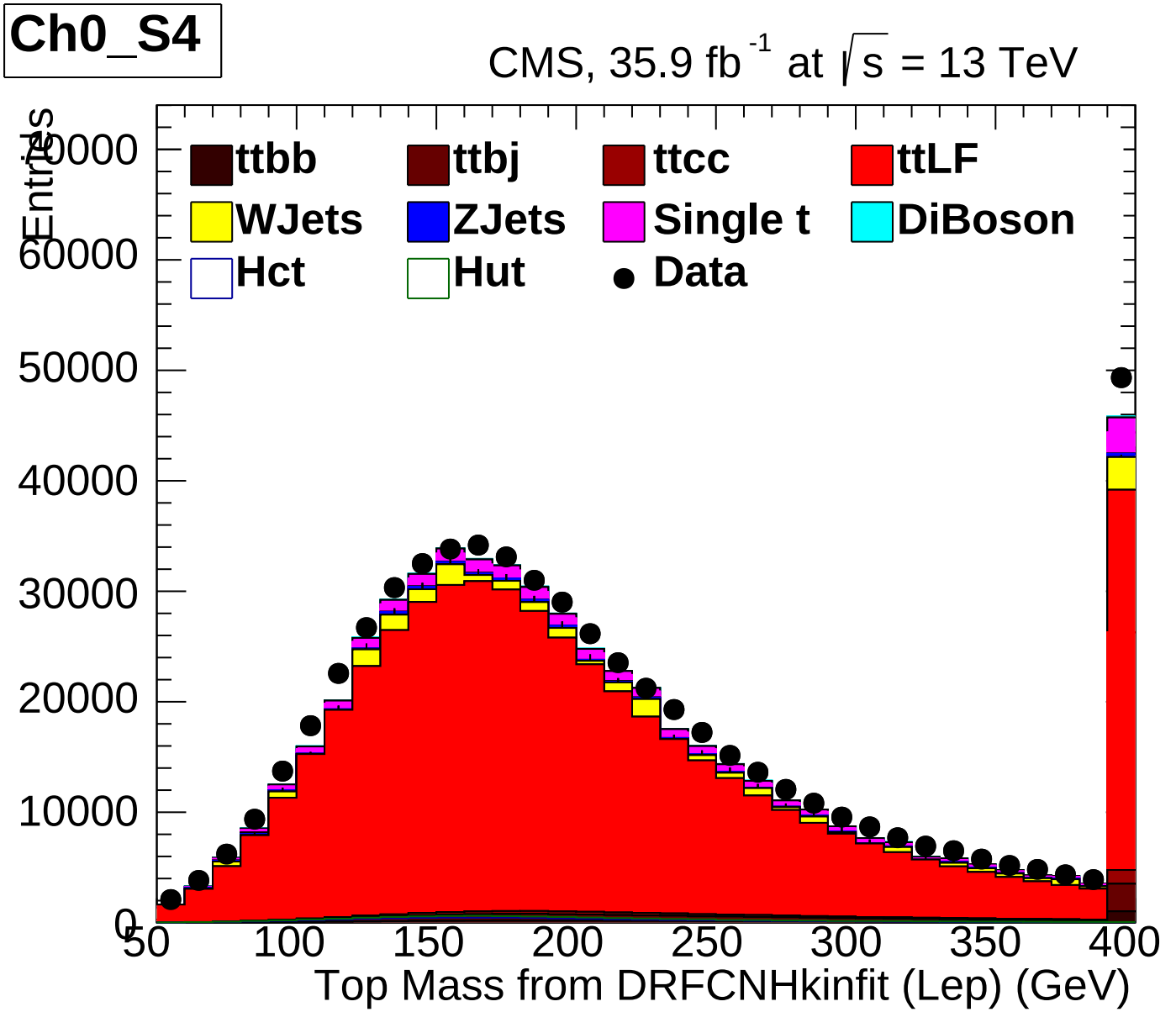

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1600
1400
1200
1000
800
600
400
200
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

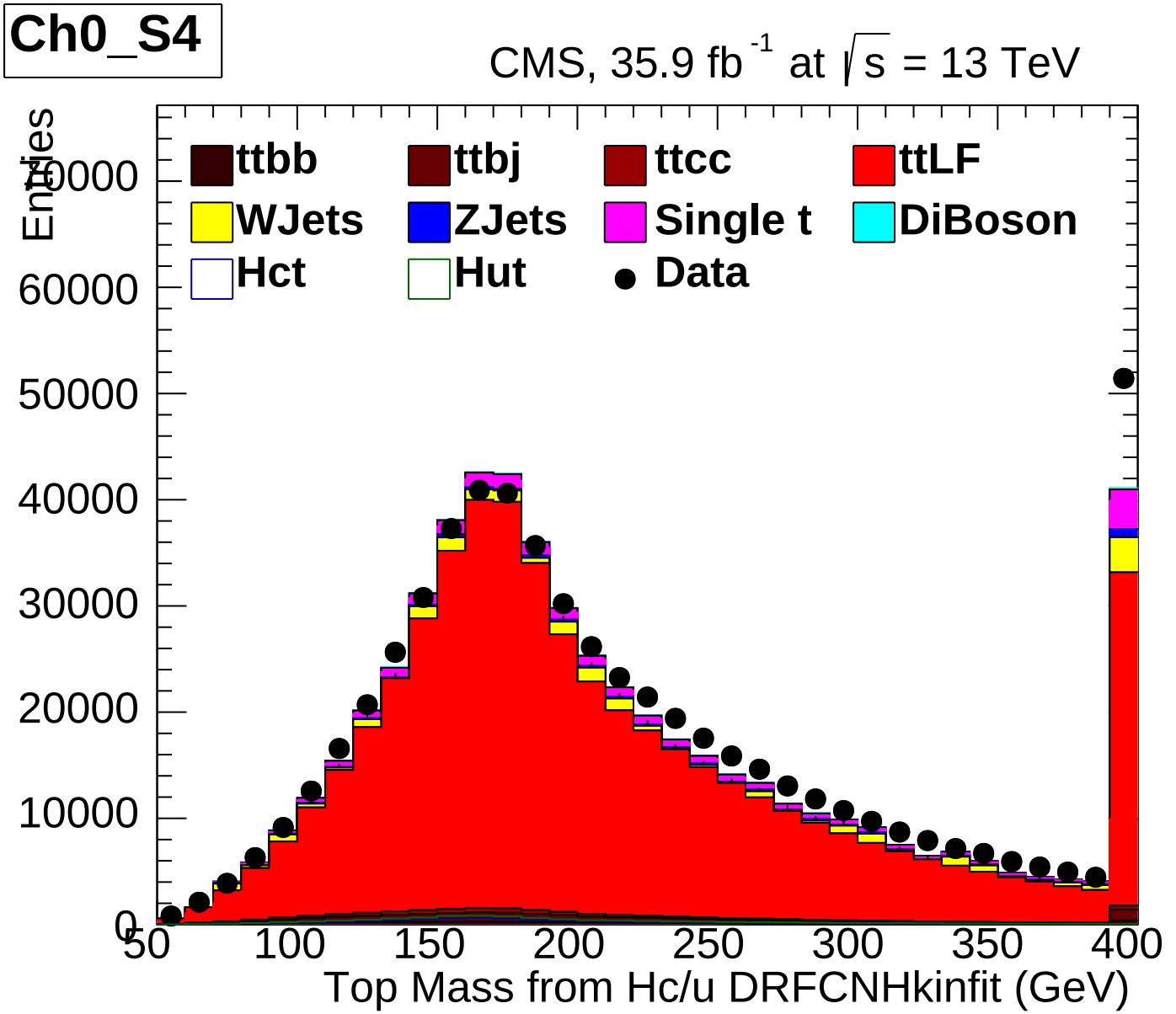

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
80000
70000
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

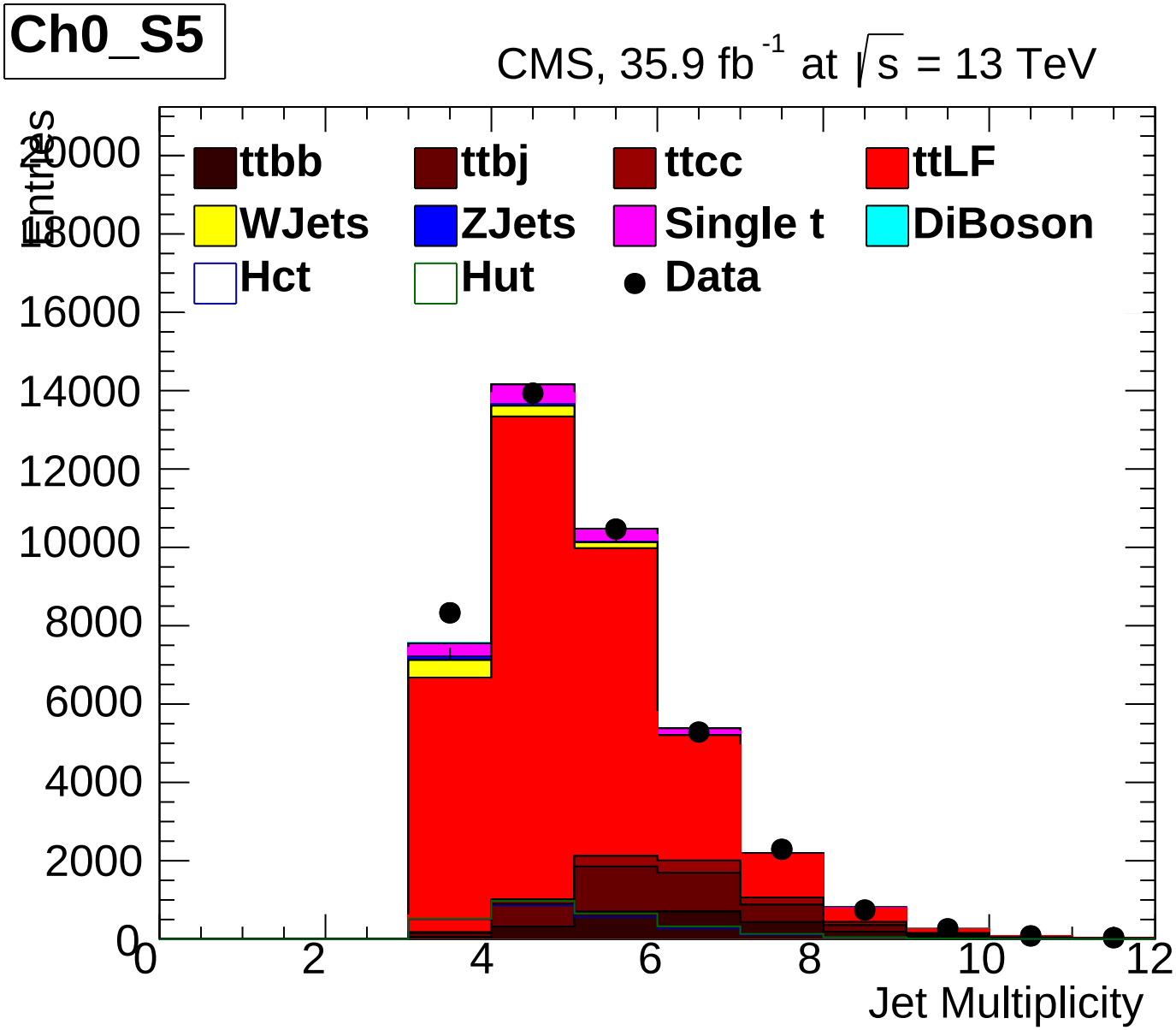

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

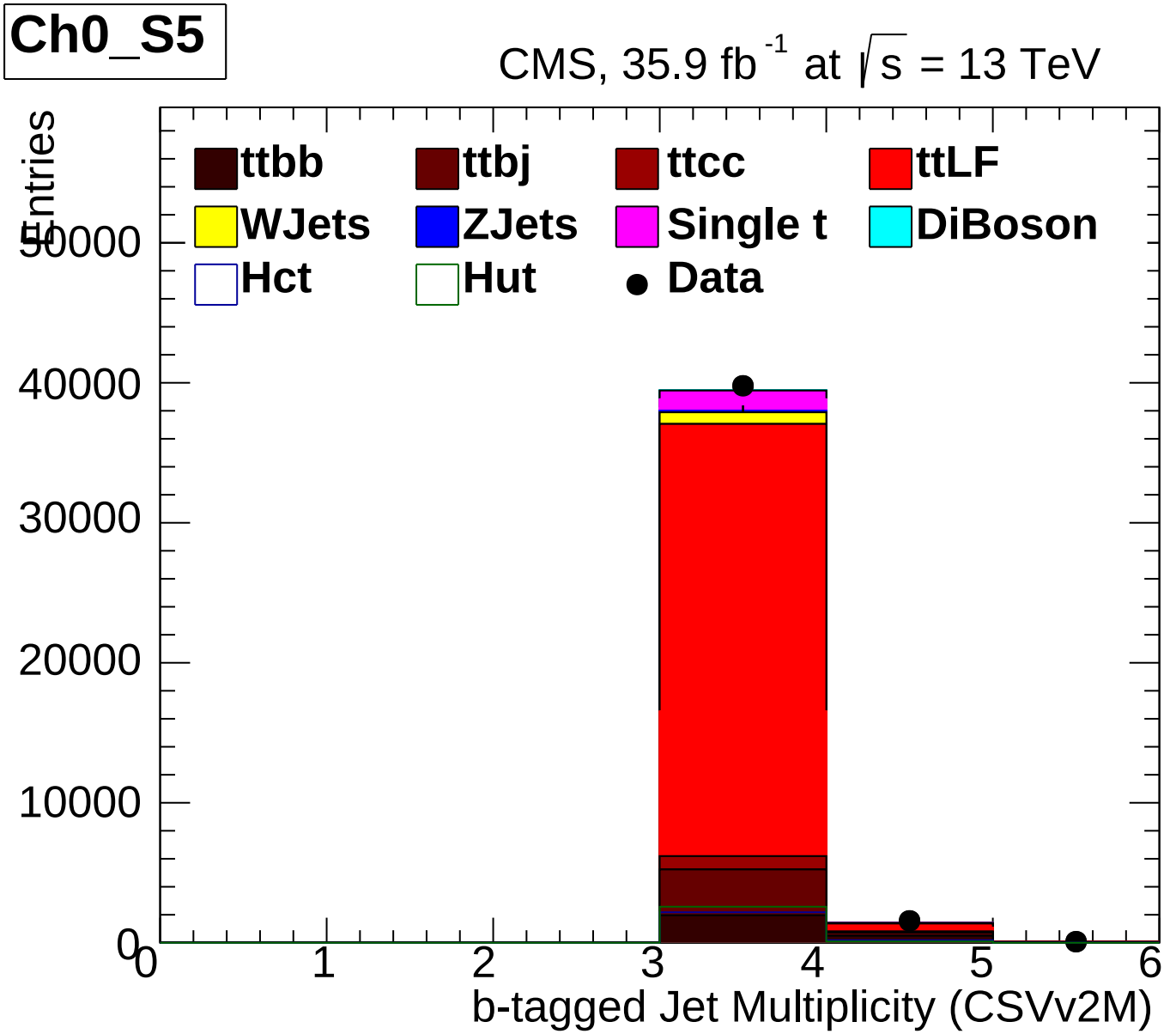

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
10000
20000
30000
40000
50000
60000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

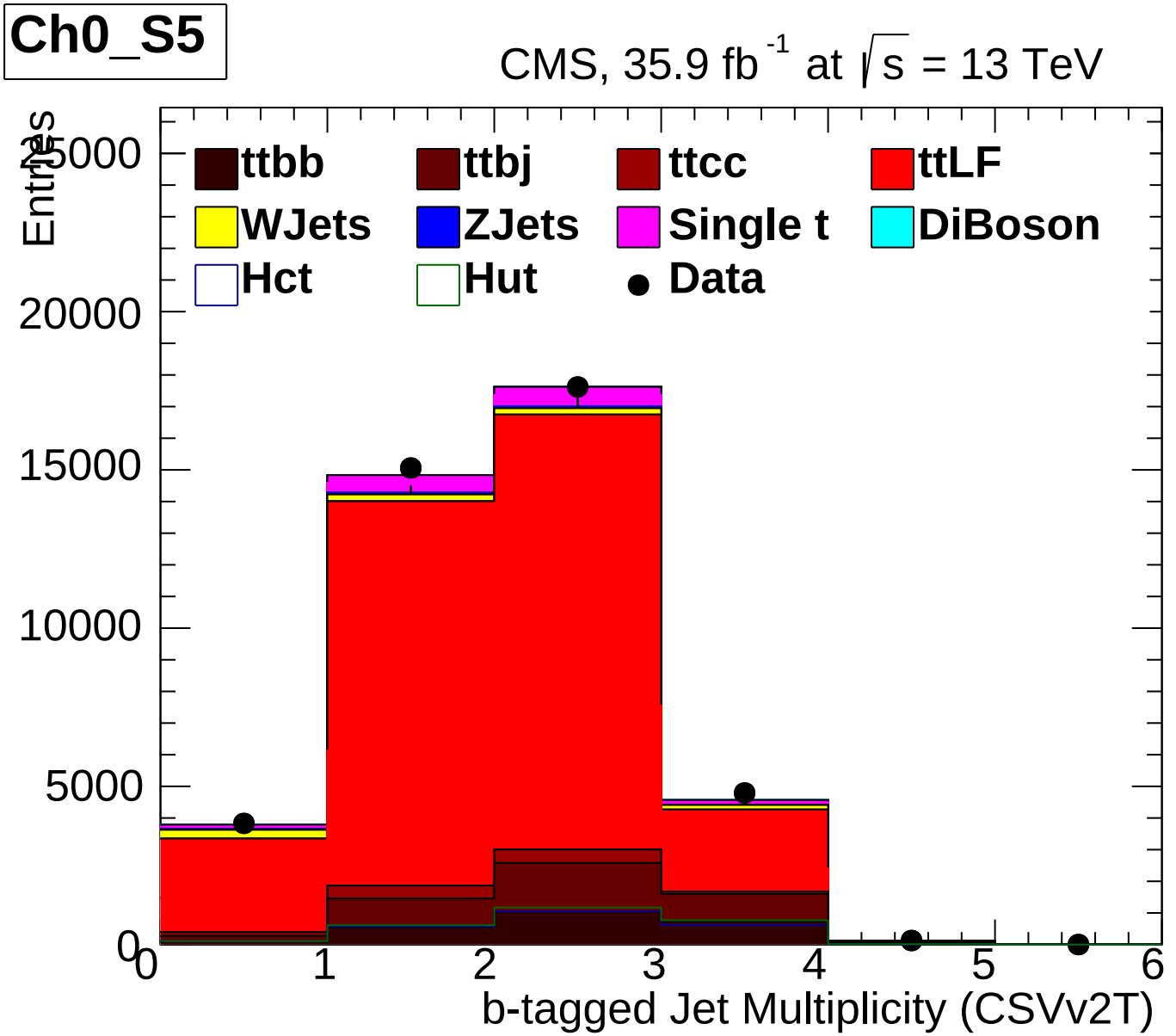

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
35000
30000
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

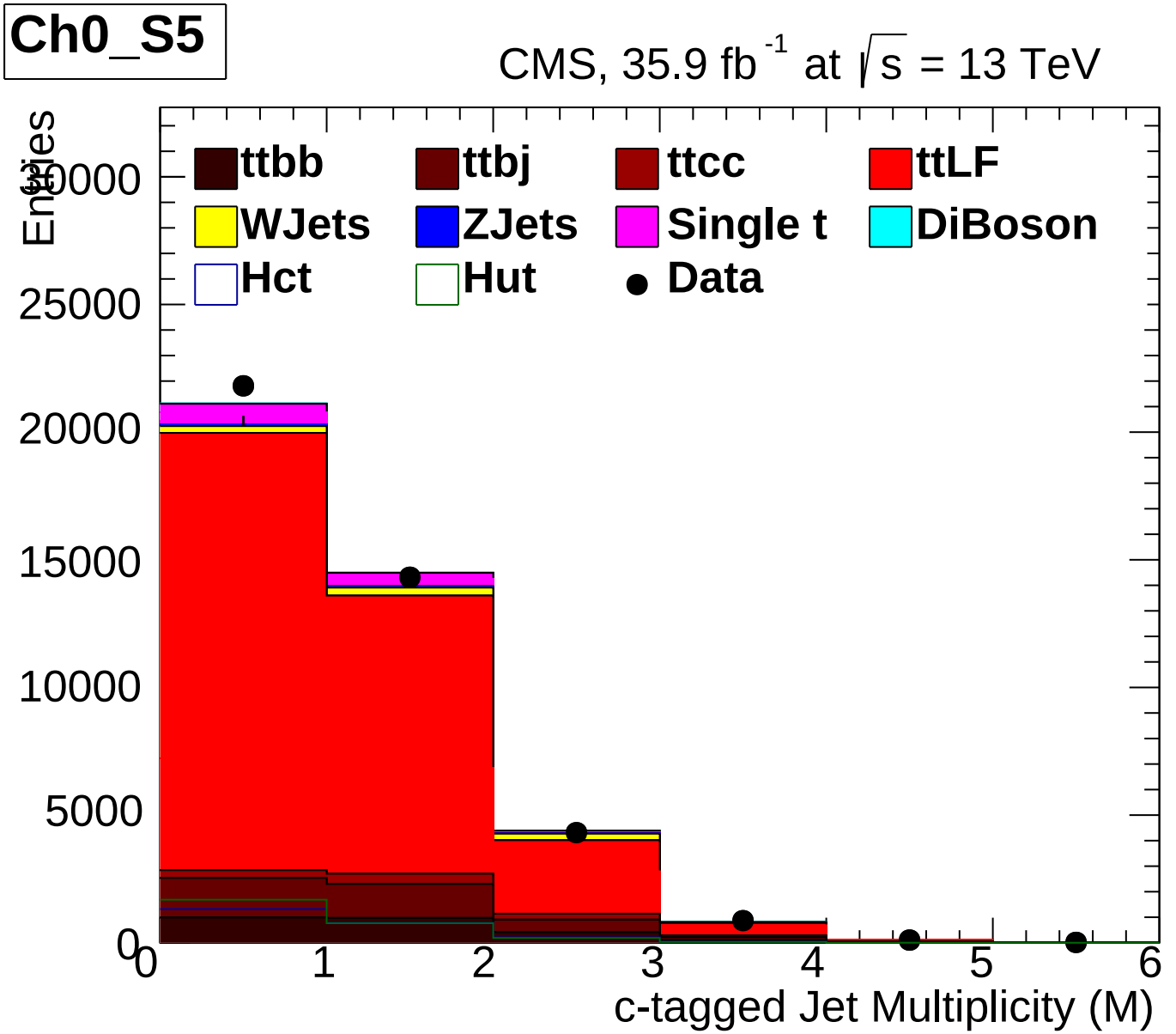

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
70000
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

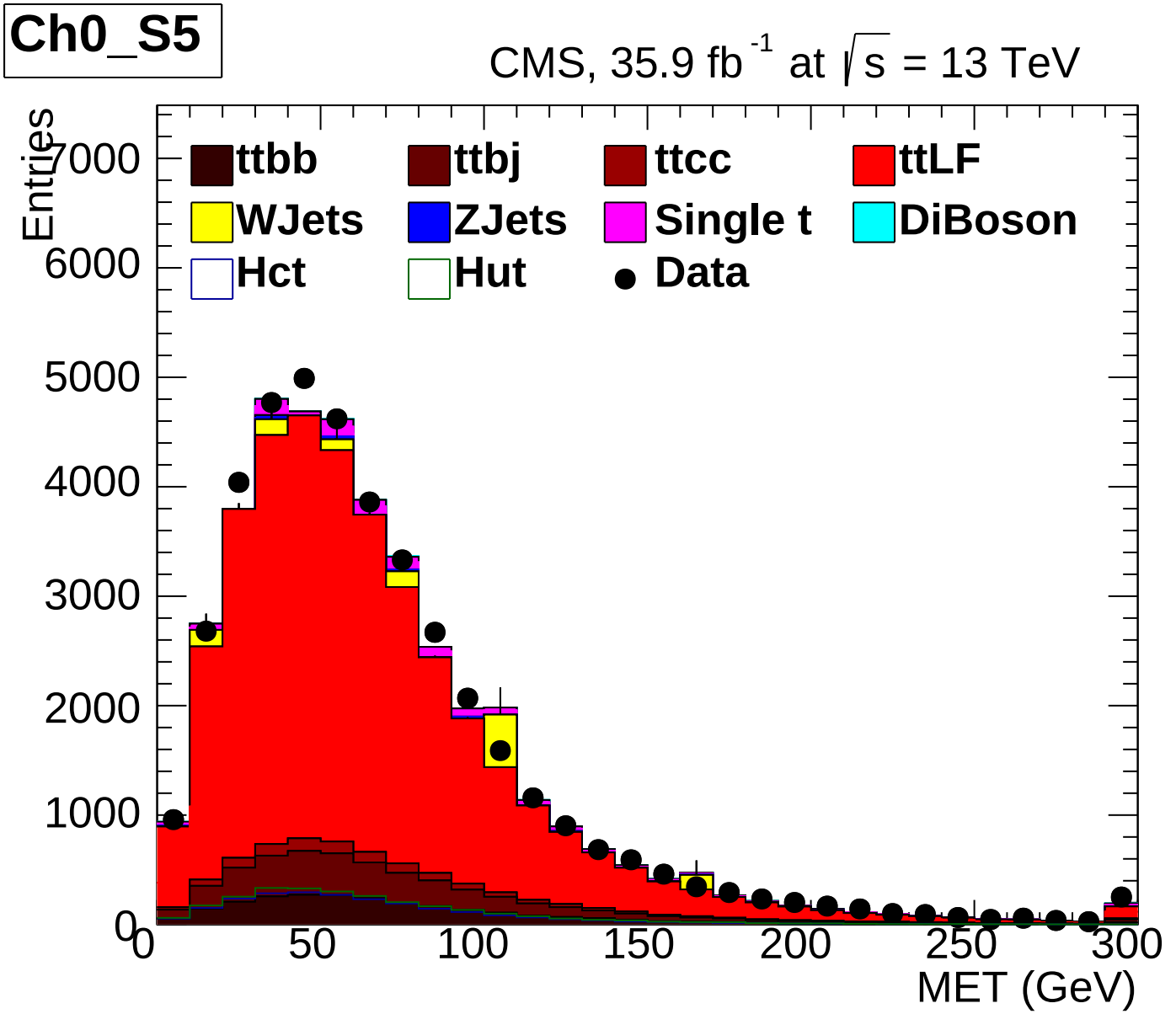

Ch0_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
10000
20000
30000
40000
50000
60000
70000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

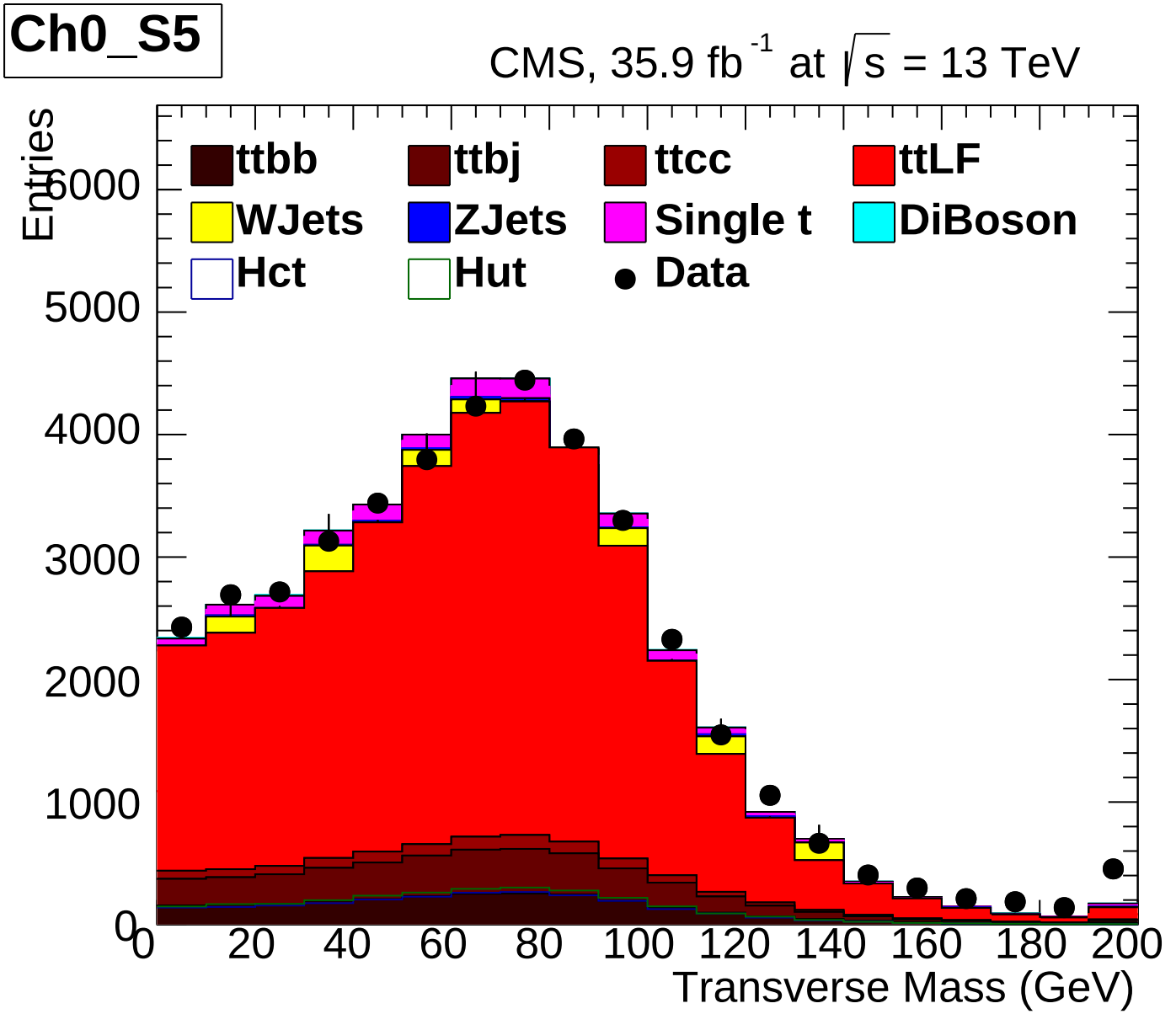

Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
2
4
6
8
10
12
Jet Multiplicity

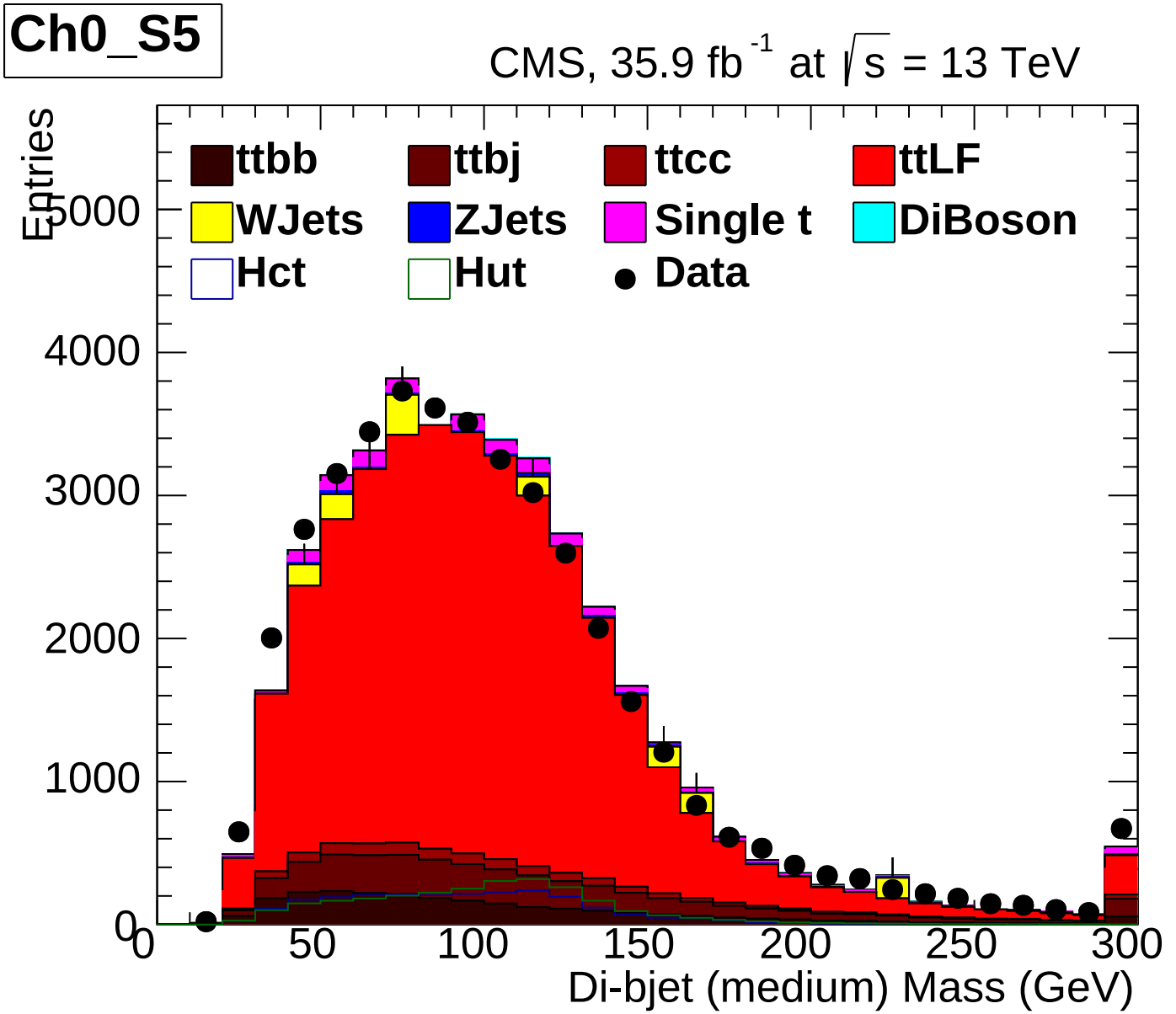

Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

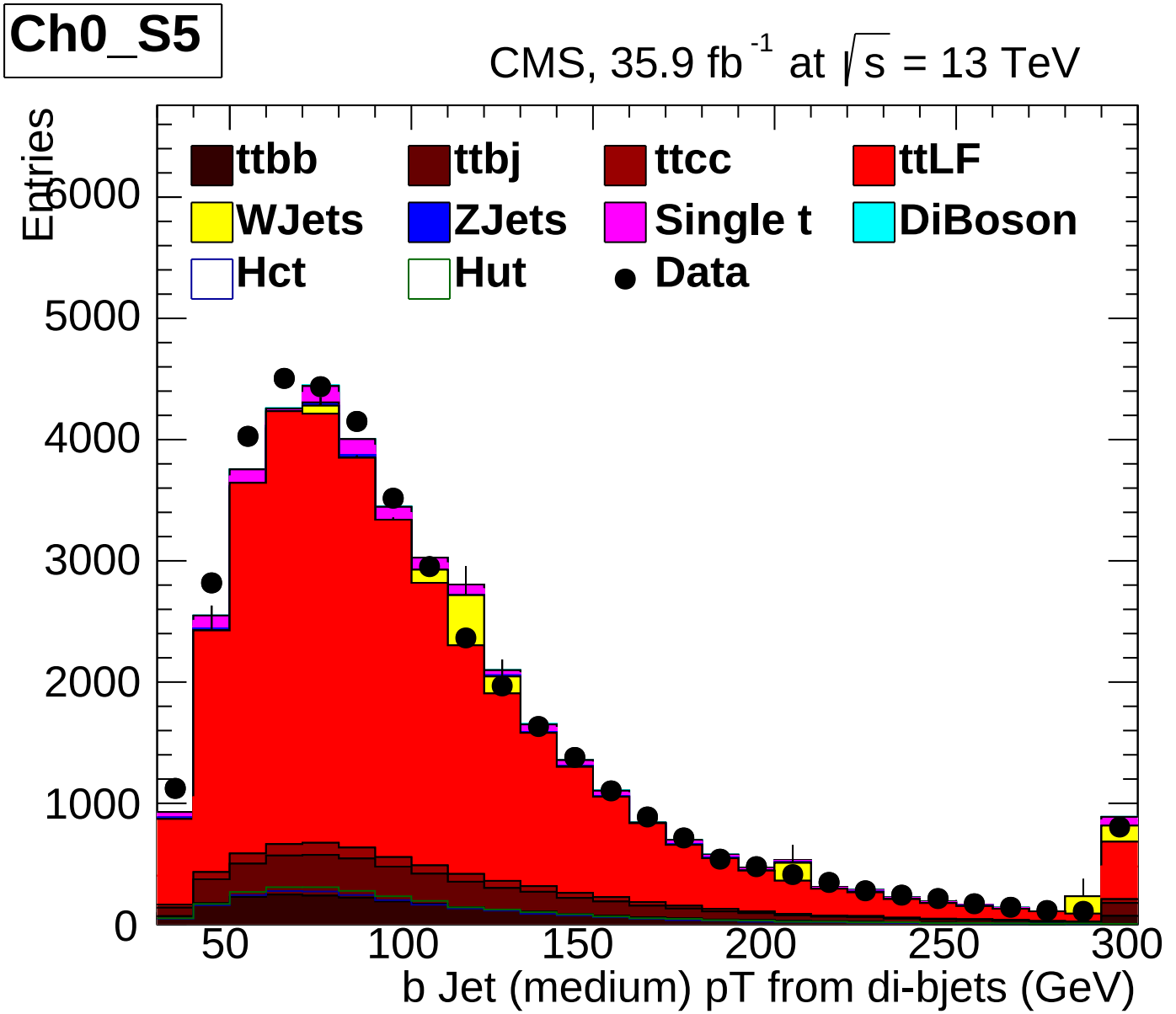

Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

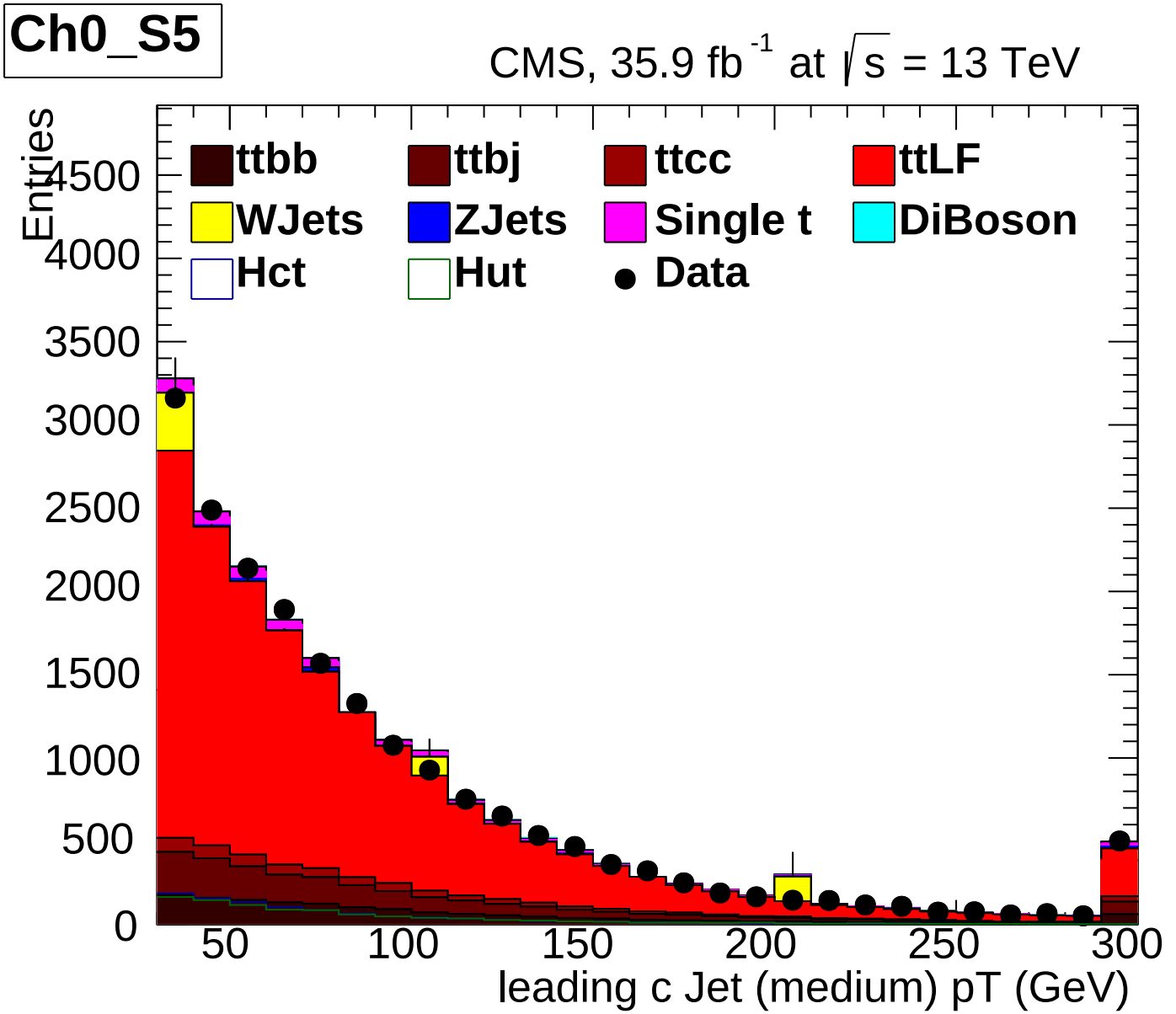

Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
5000
10000
15000
20000
25000
30000
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

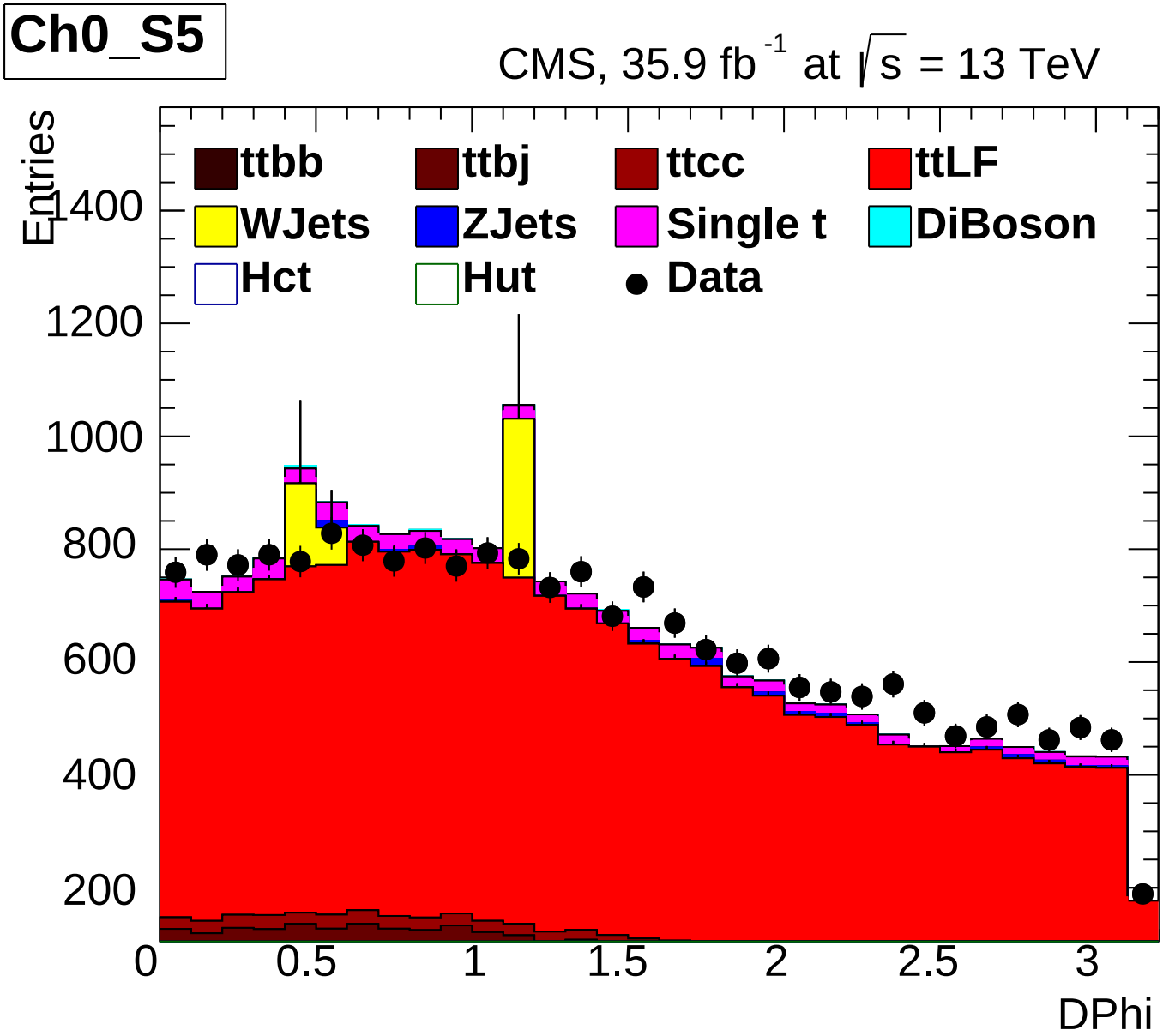

Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
0
50
100
150
200
250
300
MET (GeV)

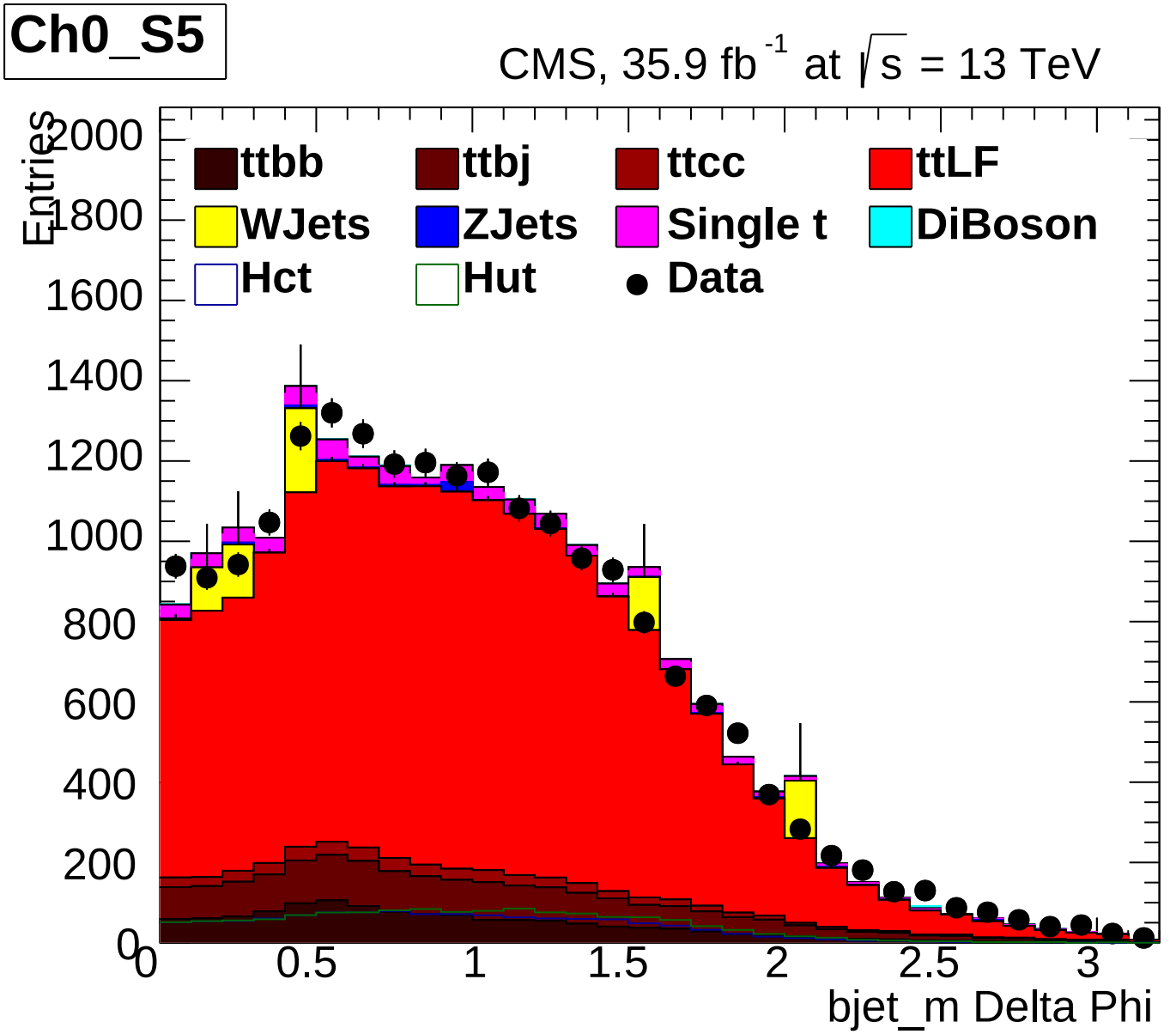

Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
1000
2000
3000
4000
5000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1400
1200
1000
800
600
400
200
0
0.5
1
1.5
2
2.5
3
DPhi


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
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1200
1400
1600
1800
2000
0
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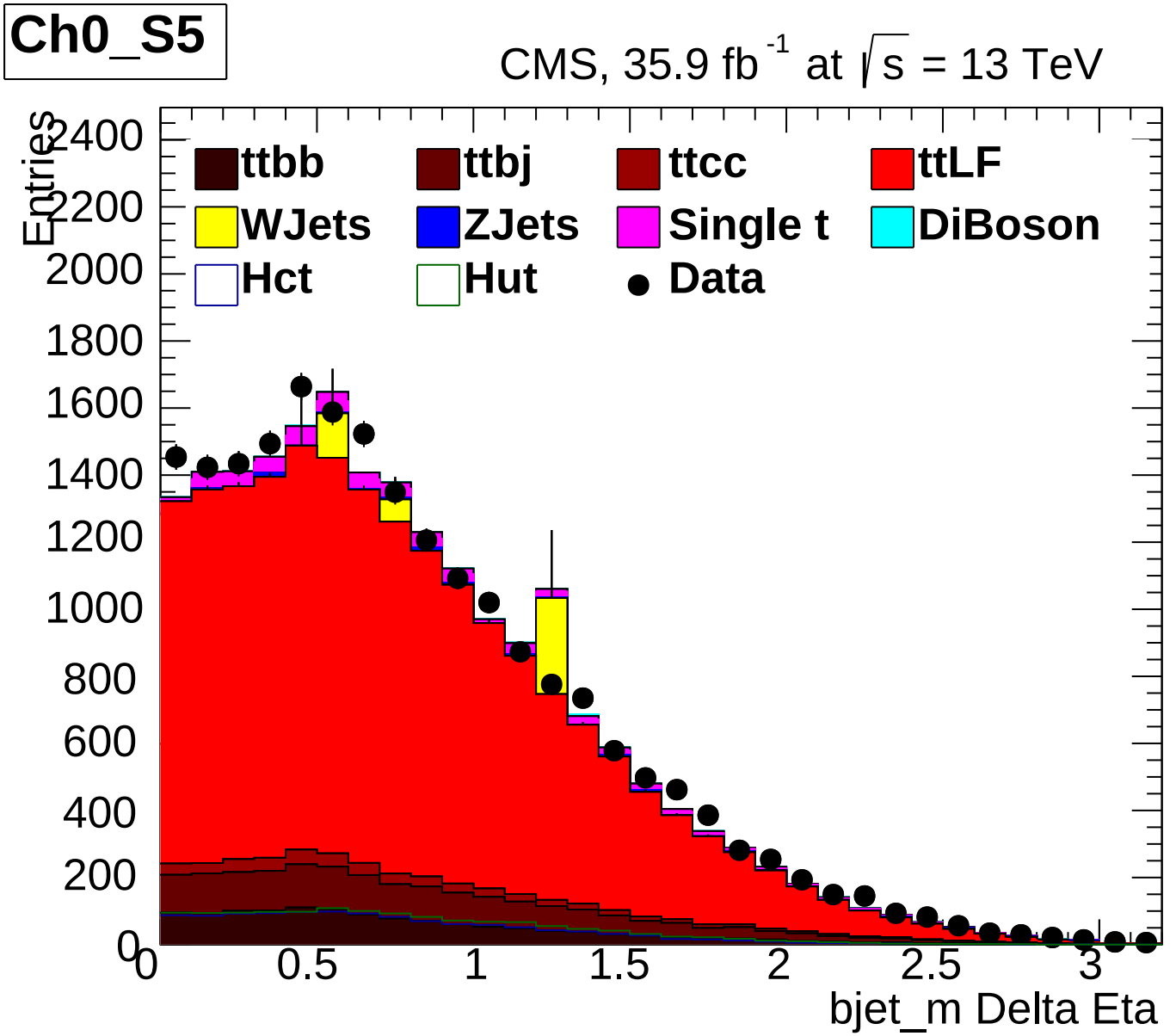
1
1.5
2
2.5
3
bjet_m Delta Phi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ZJets
Single t
DiBoson
Hct
Hut
Data
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800
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0
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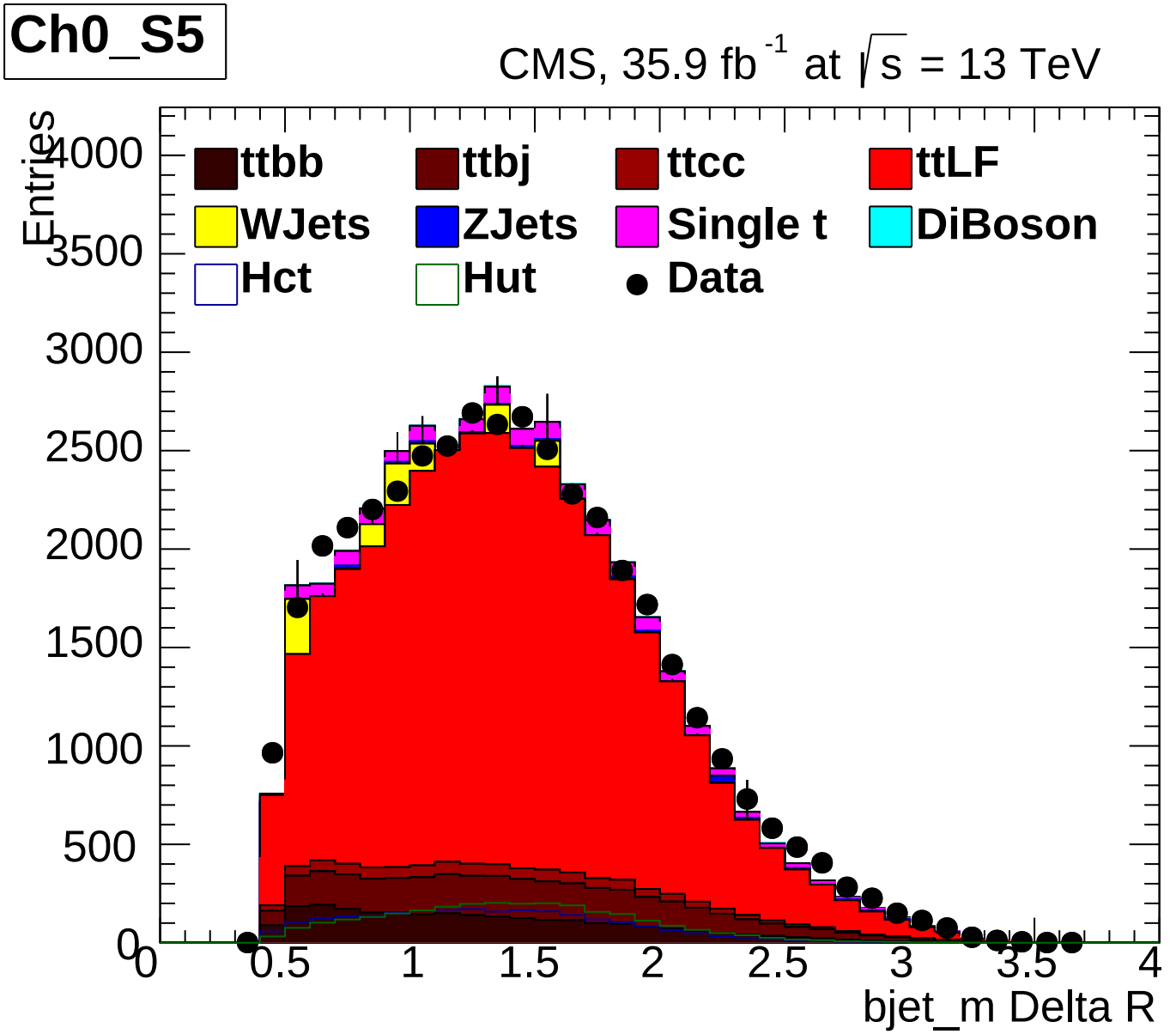
1.5
2
2.5
3
bjet_m Delta Eta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ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
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4000
0
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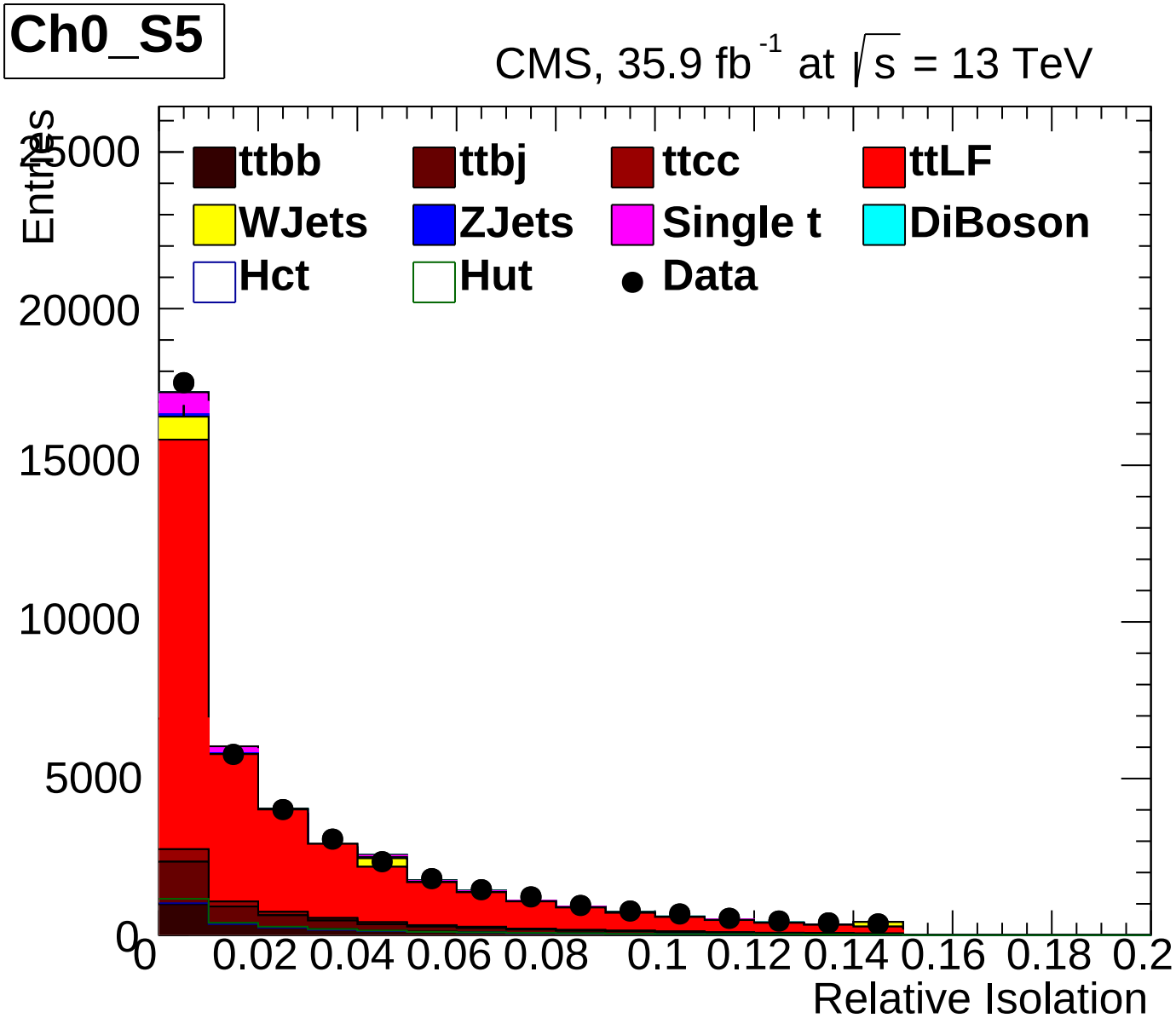
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R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CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ZJets
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Hct
Hut
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20000
15000
10000
5000
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0
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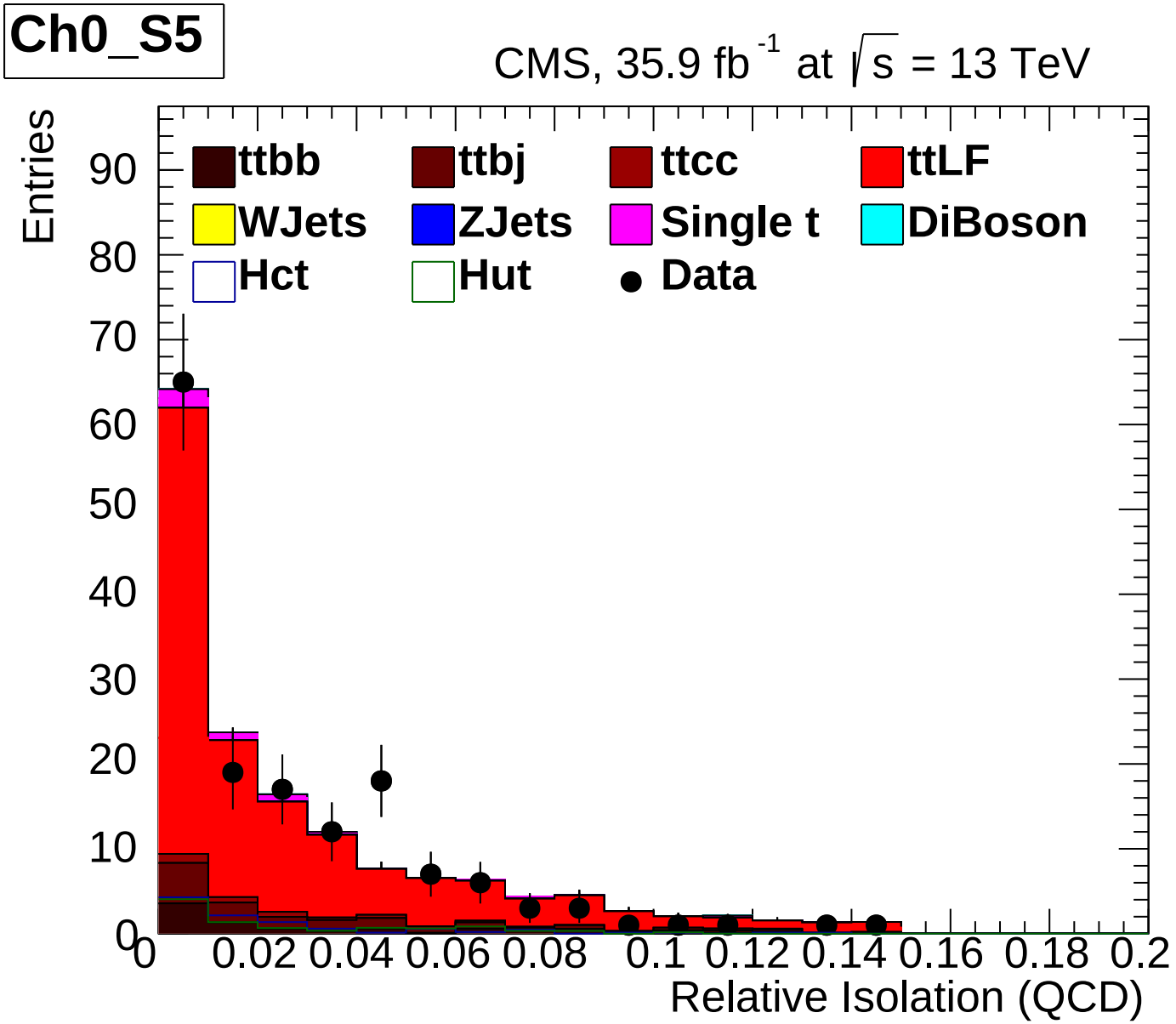
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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30
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60
70
80
90
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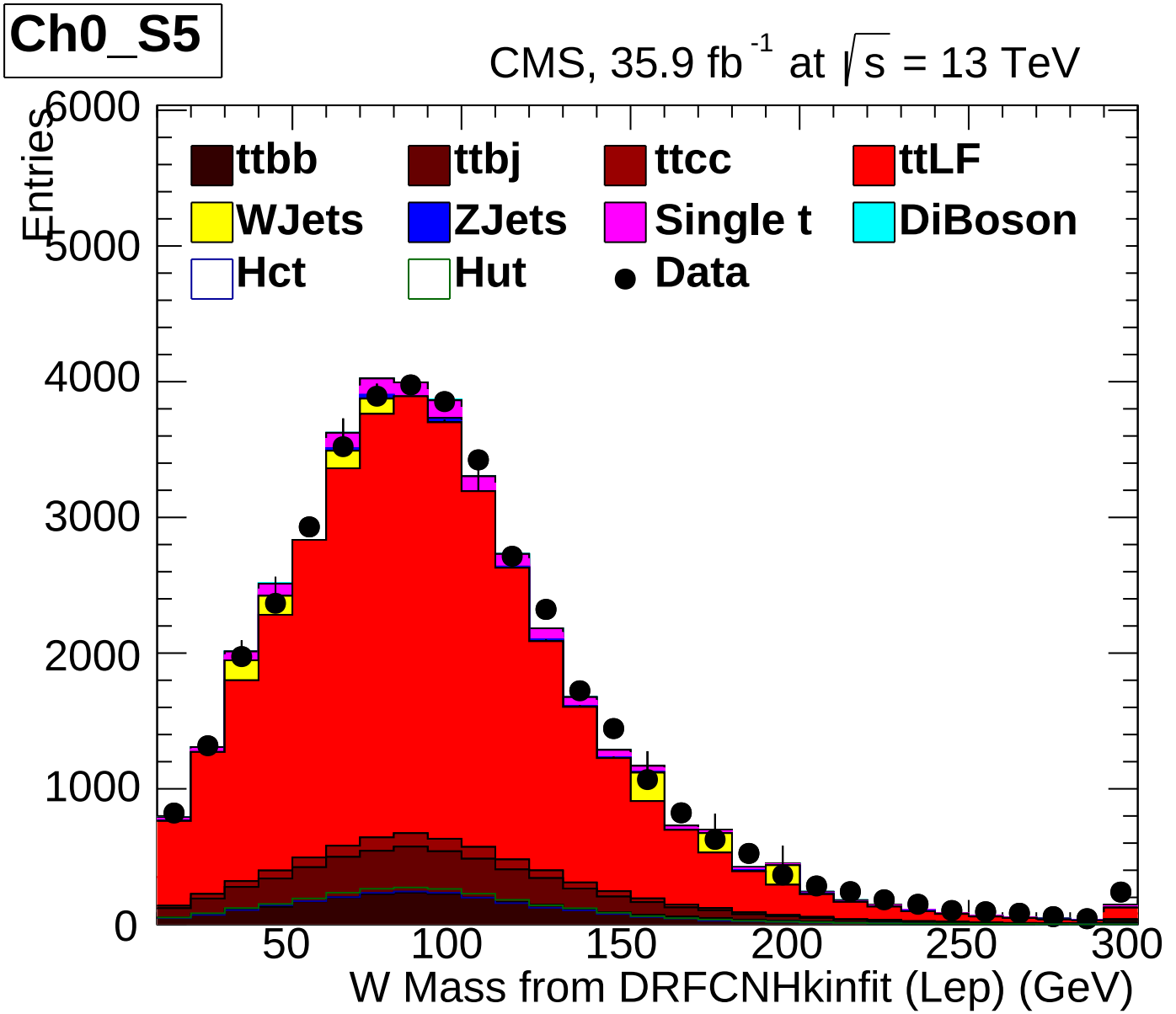
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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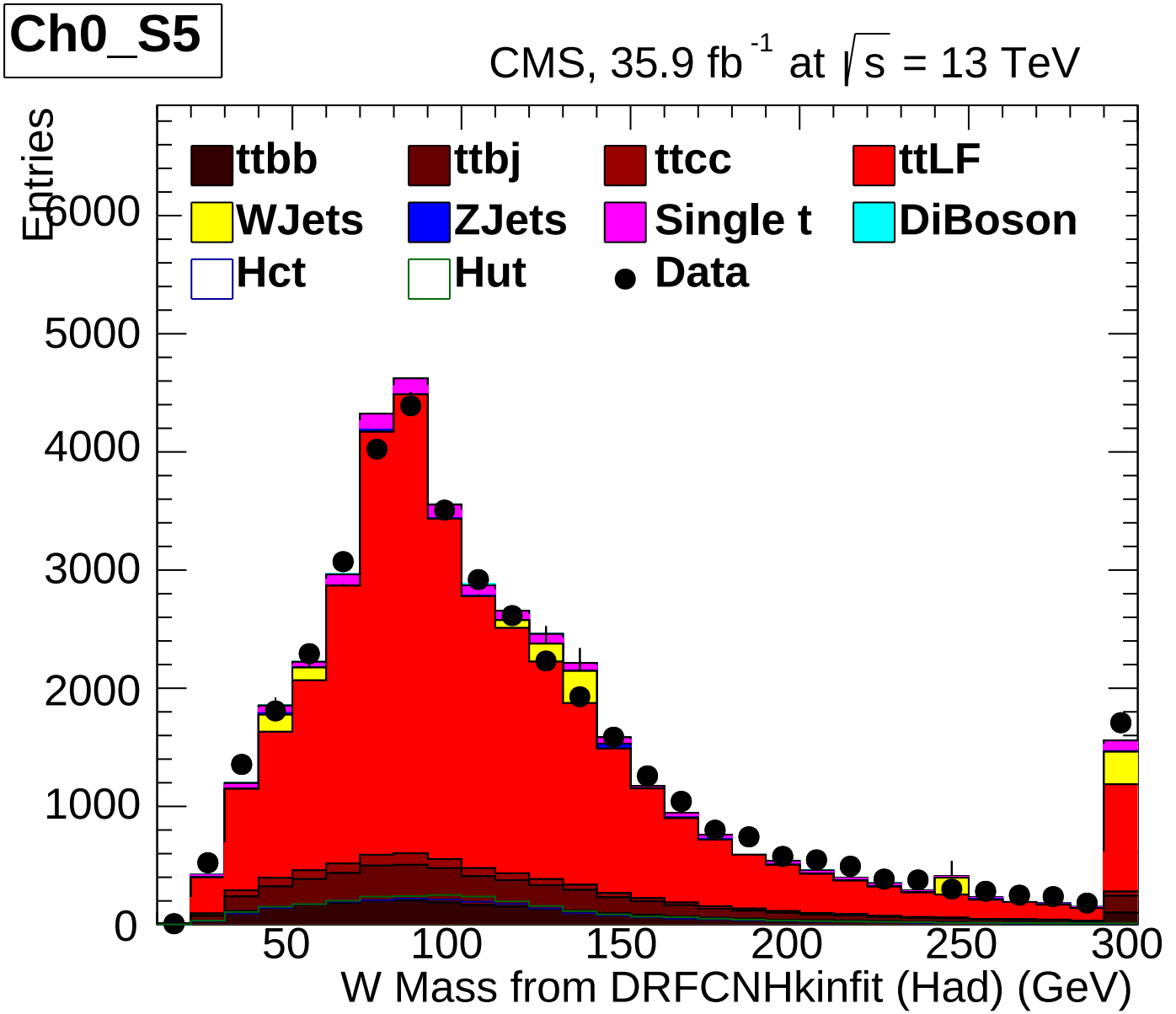
2000
3000
4000
5000
6000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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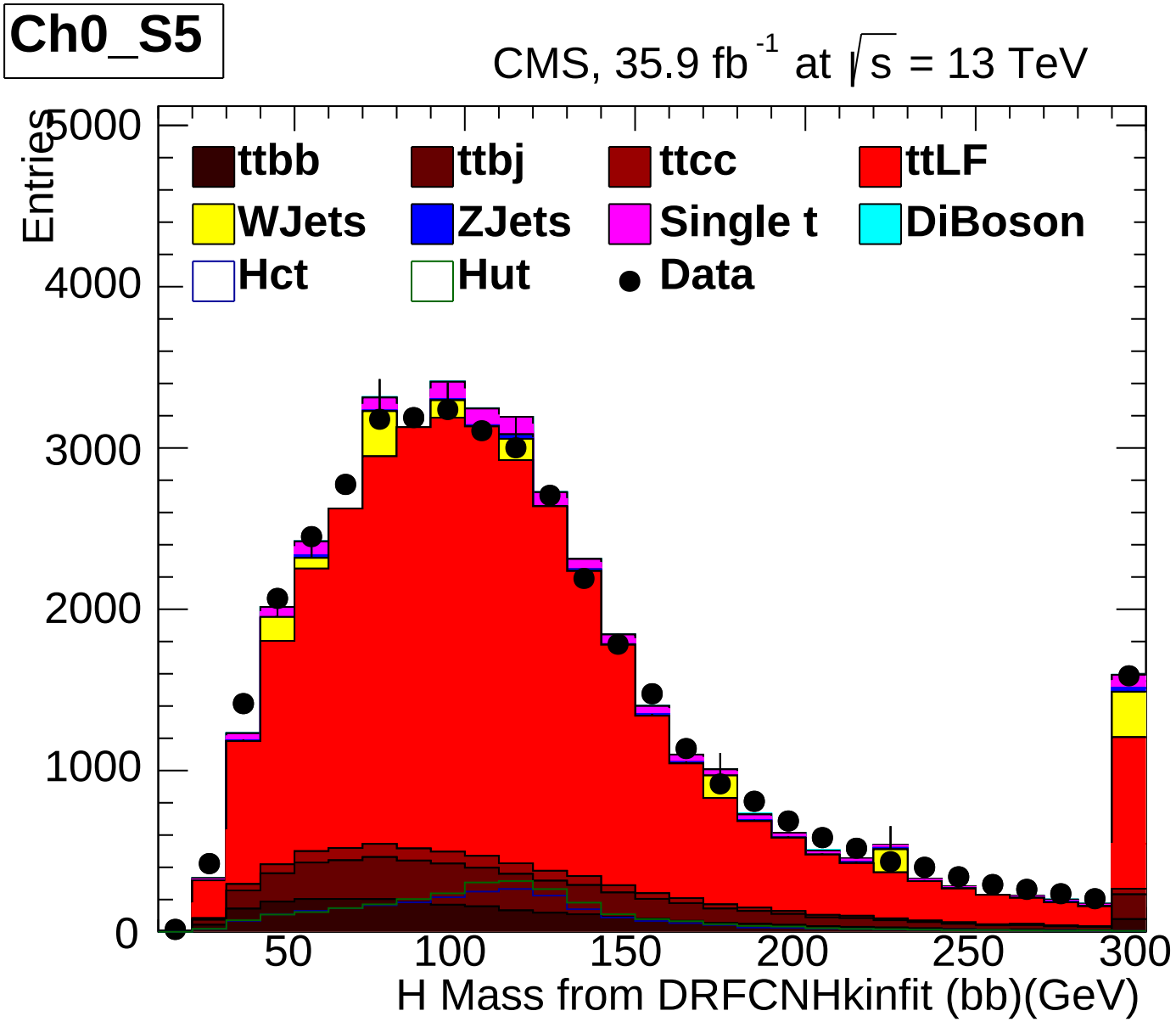
2000
3000
4000
5000
6000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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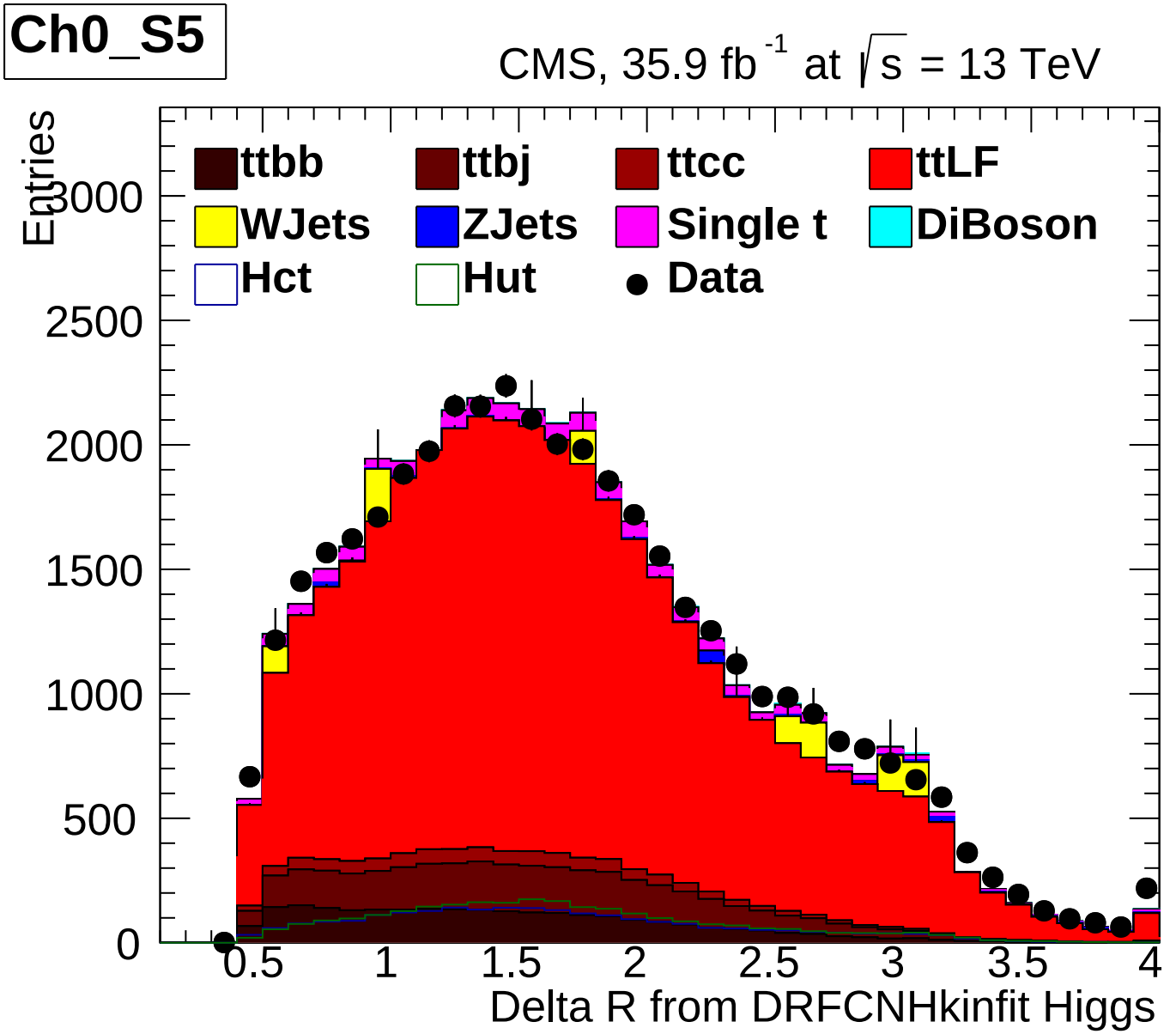
1000
2000
3000
4000
5000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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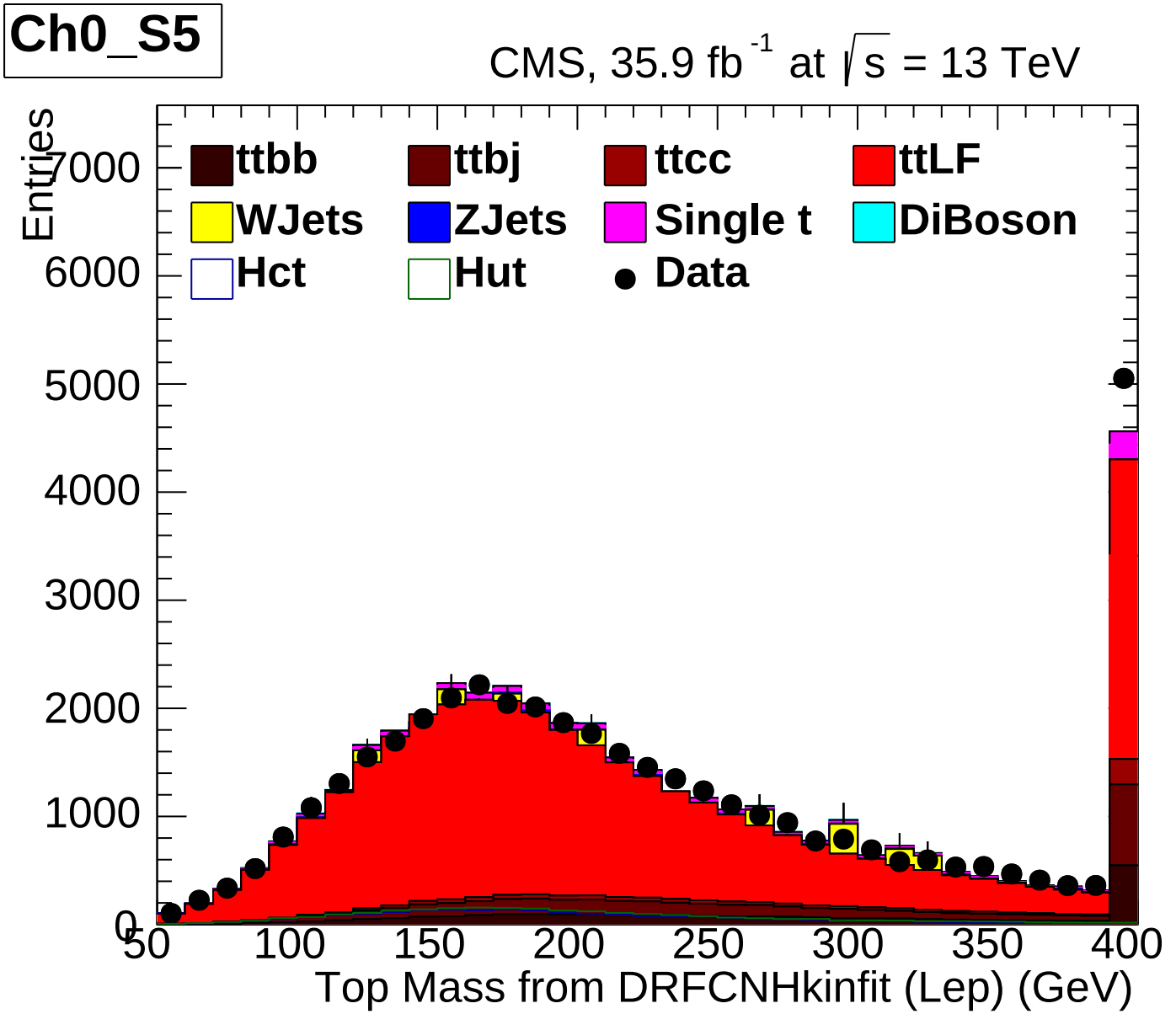
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
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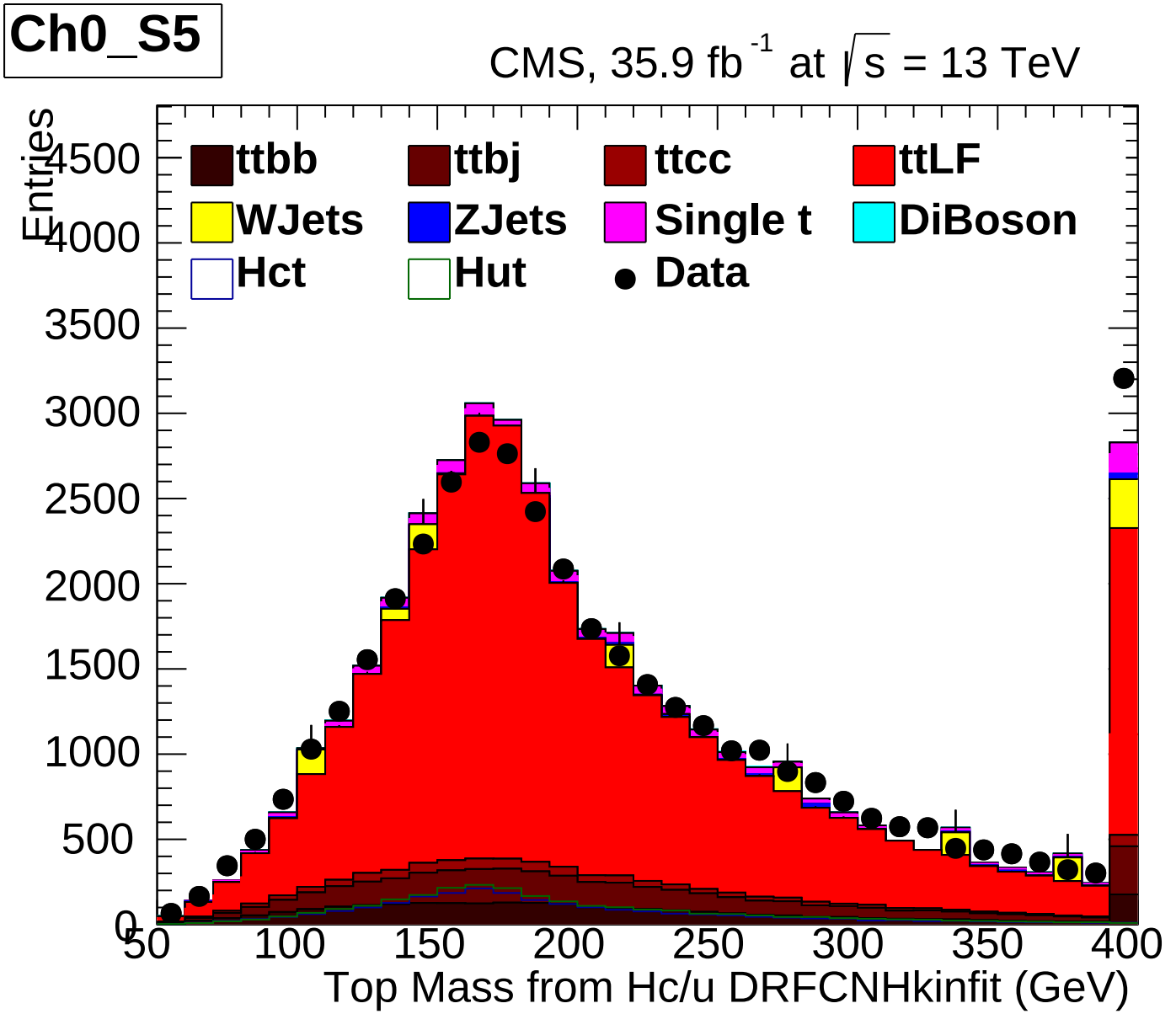
6000
7000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
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3000
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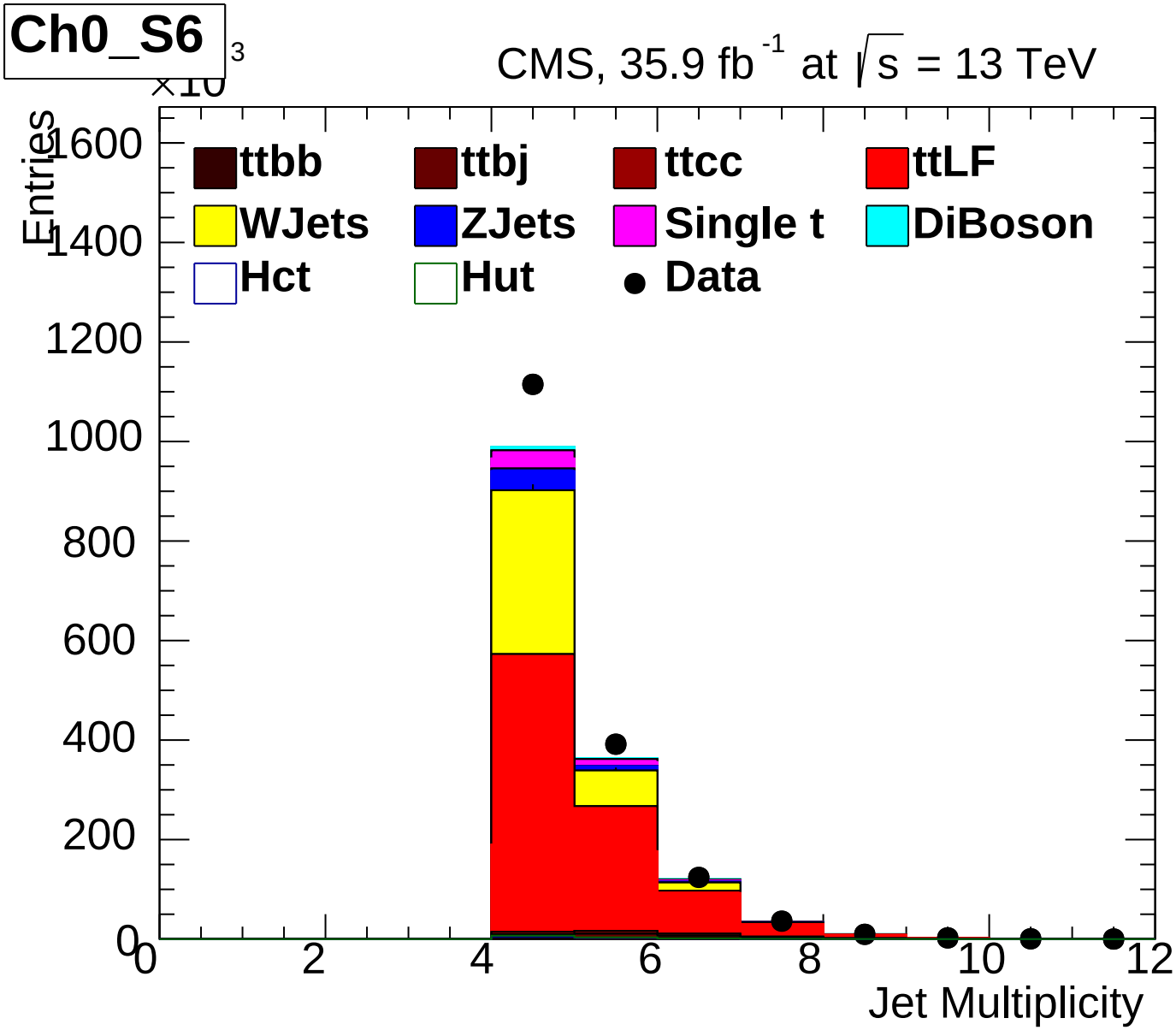
4000
4500
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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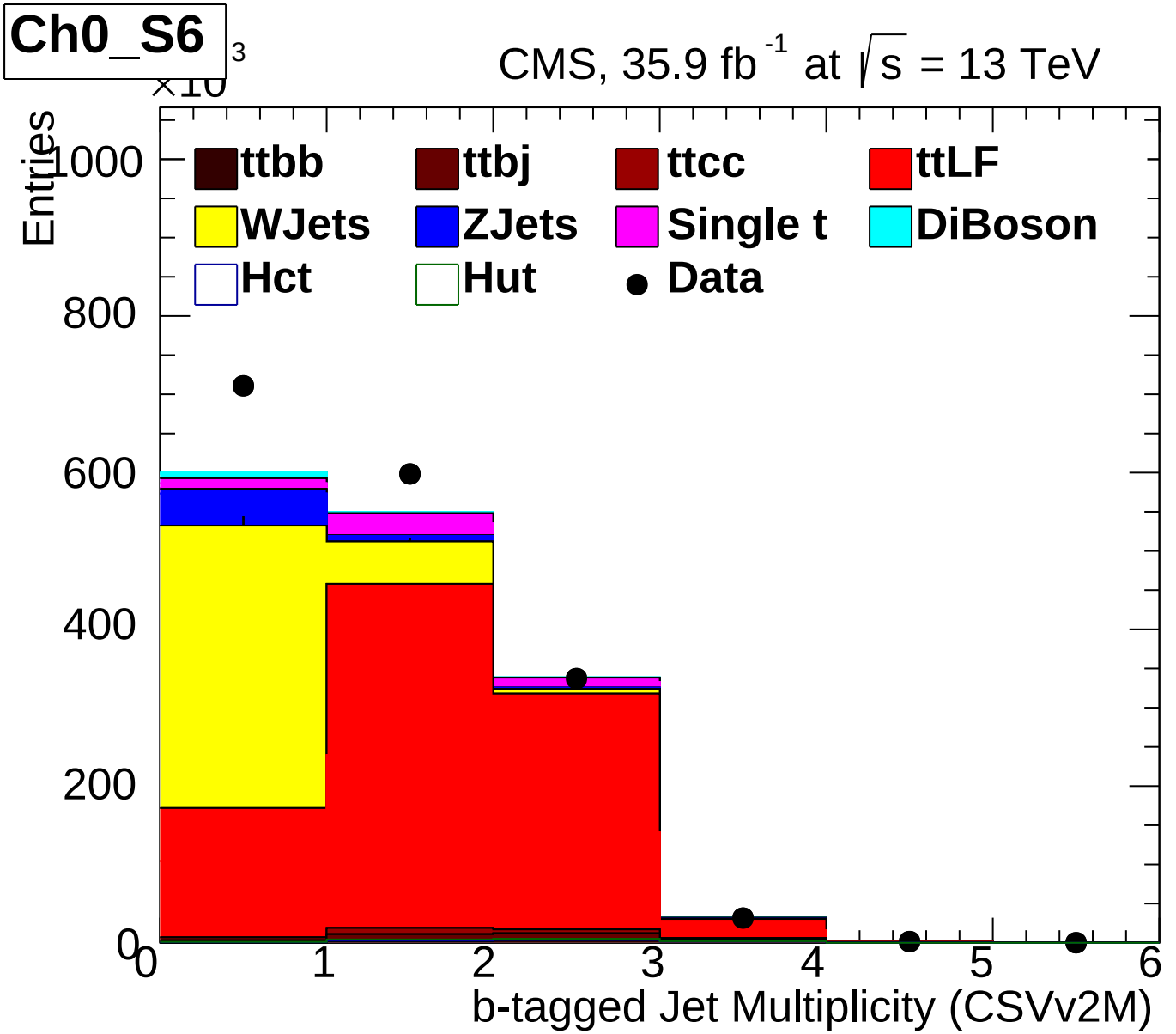
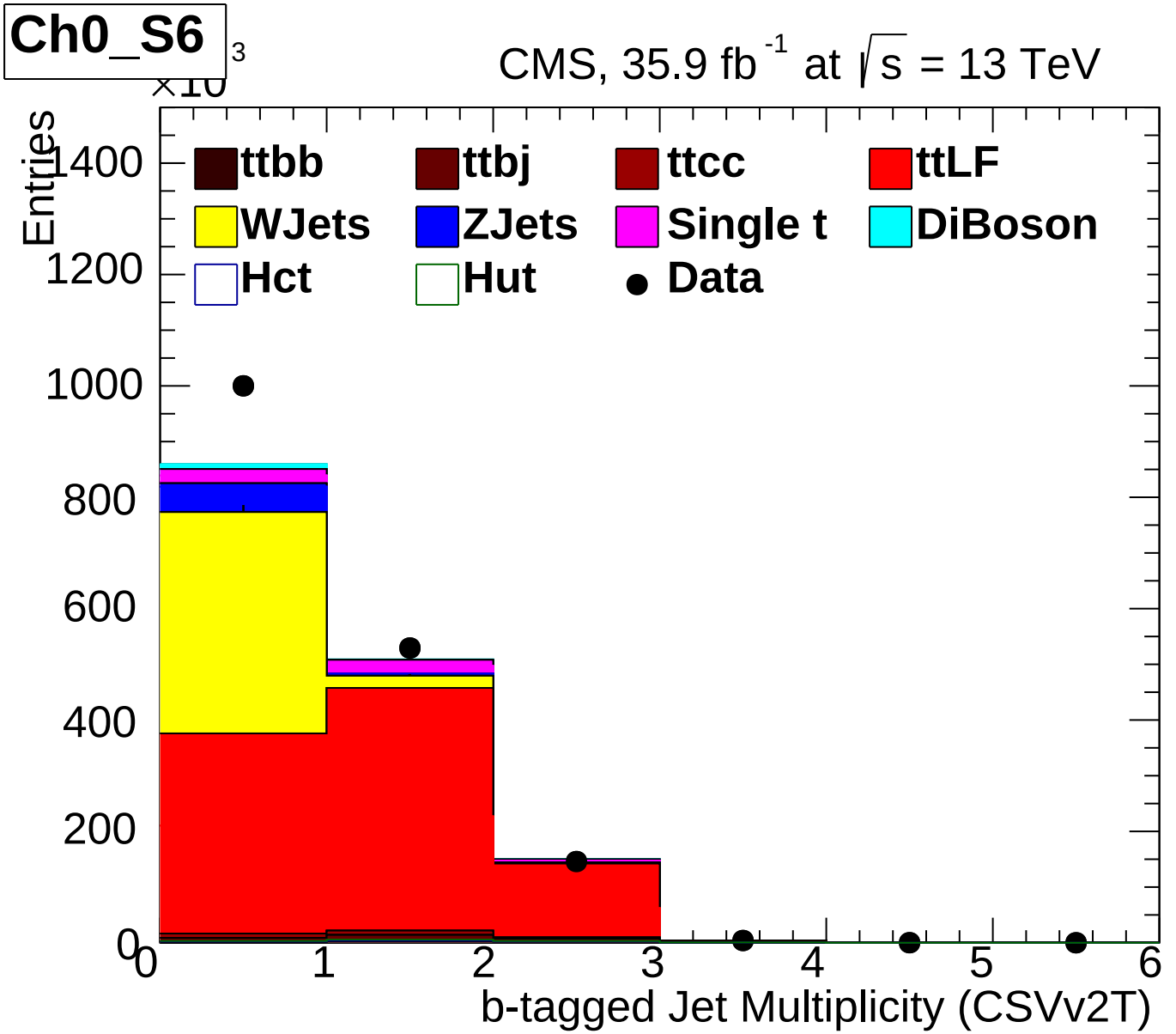
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
0
2
4
6
8
10
12
Jet Multiplicity


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
1000
800
600
400
200
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
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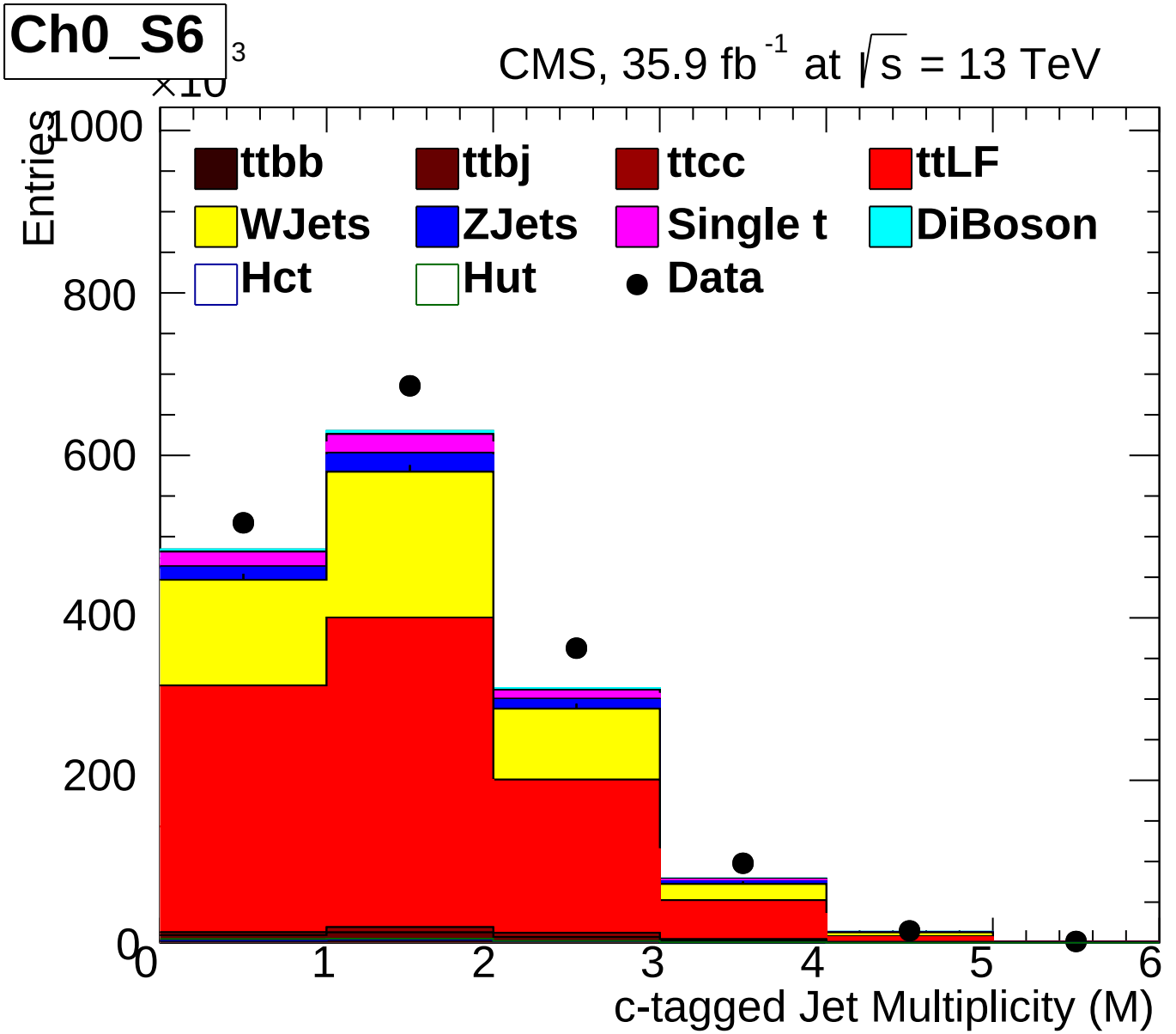
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1400
1200
1000
800
600
400
200
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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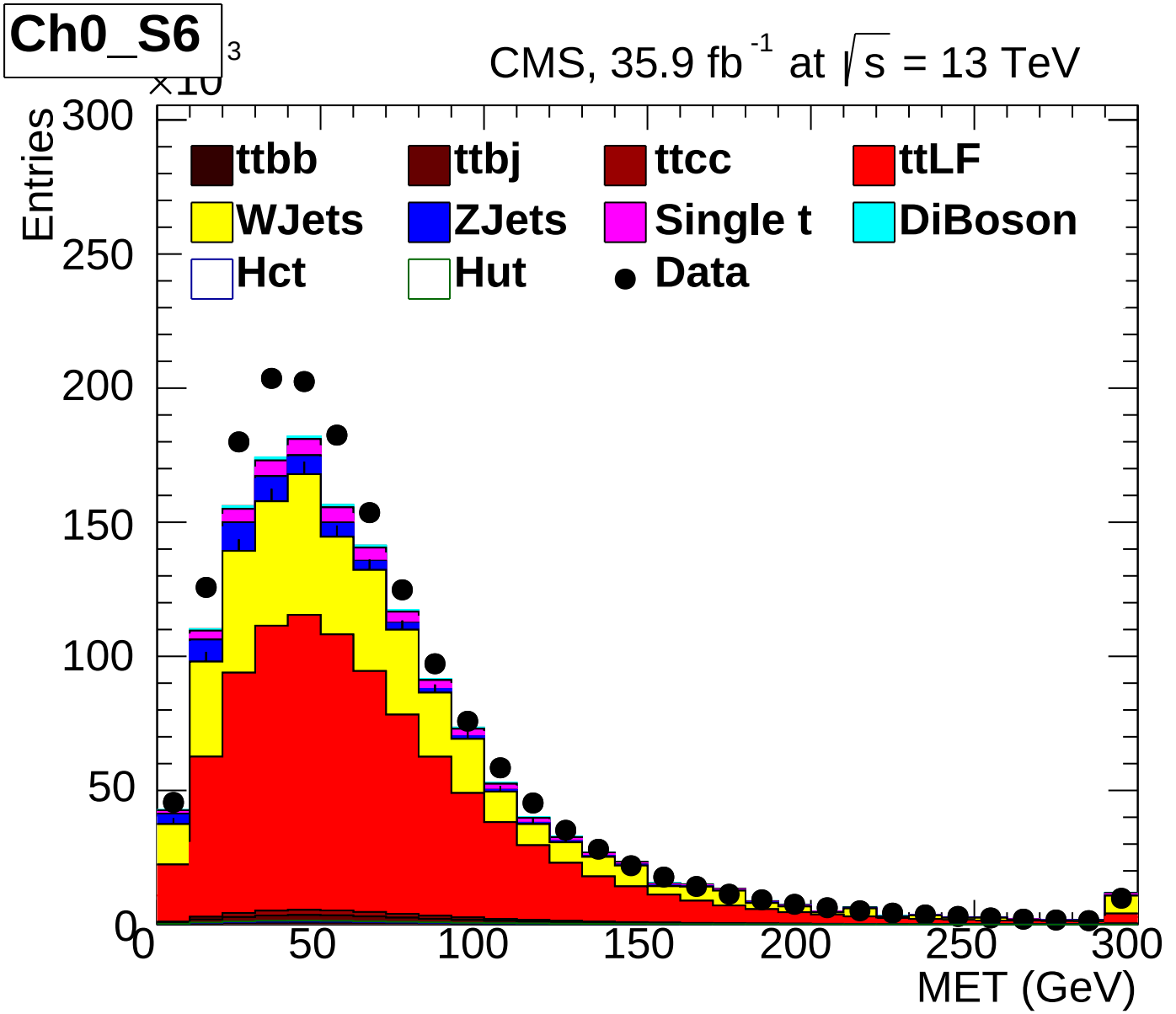
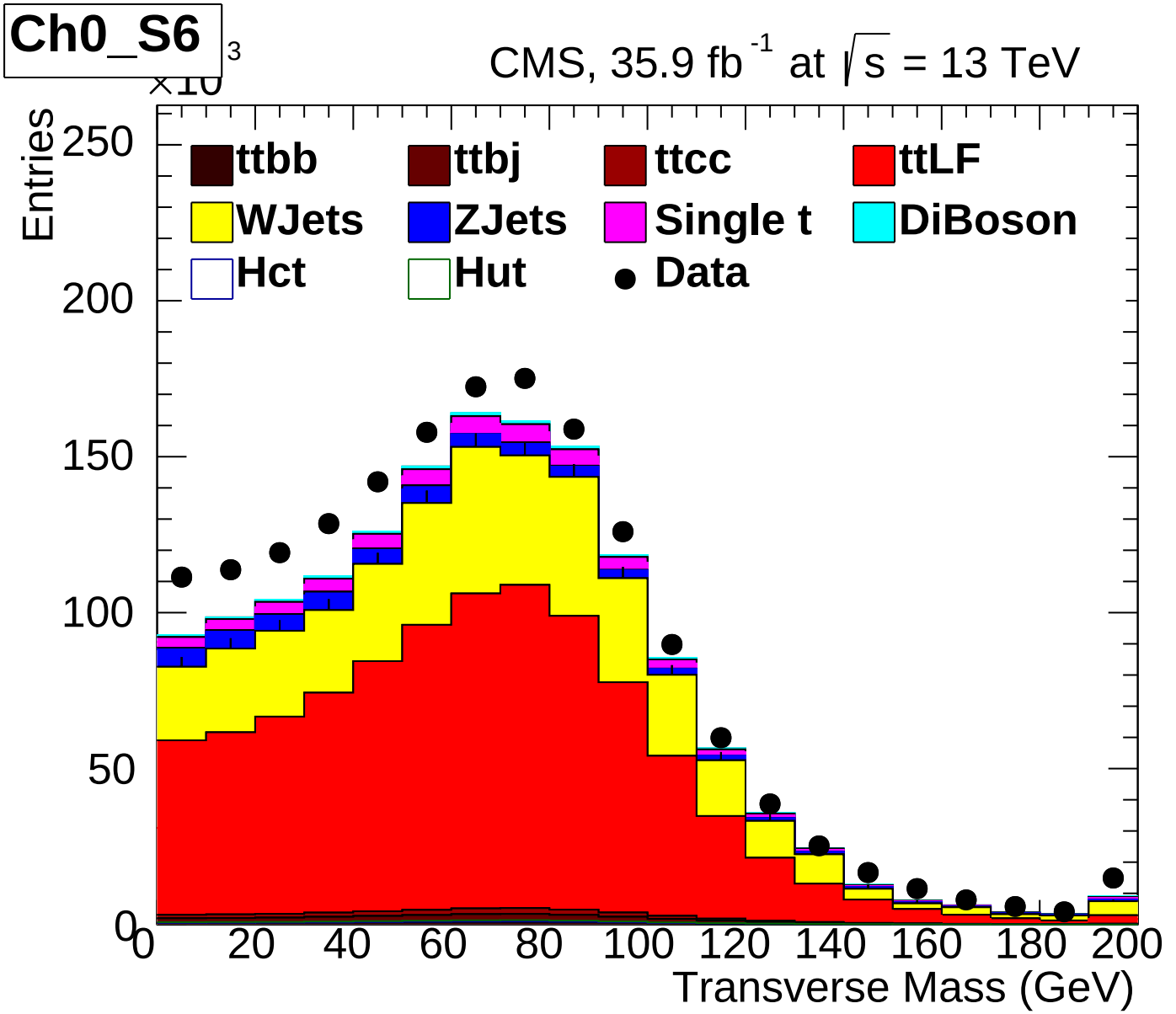
800
600
400
200
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
MET (GeV)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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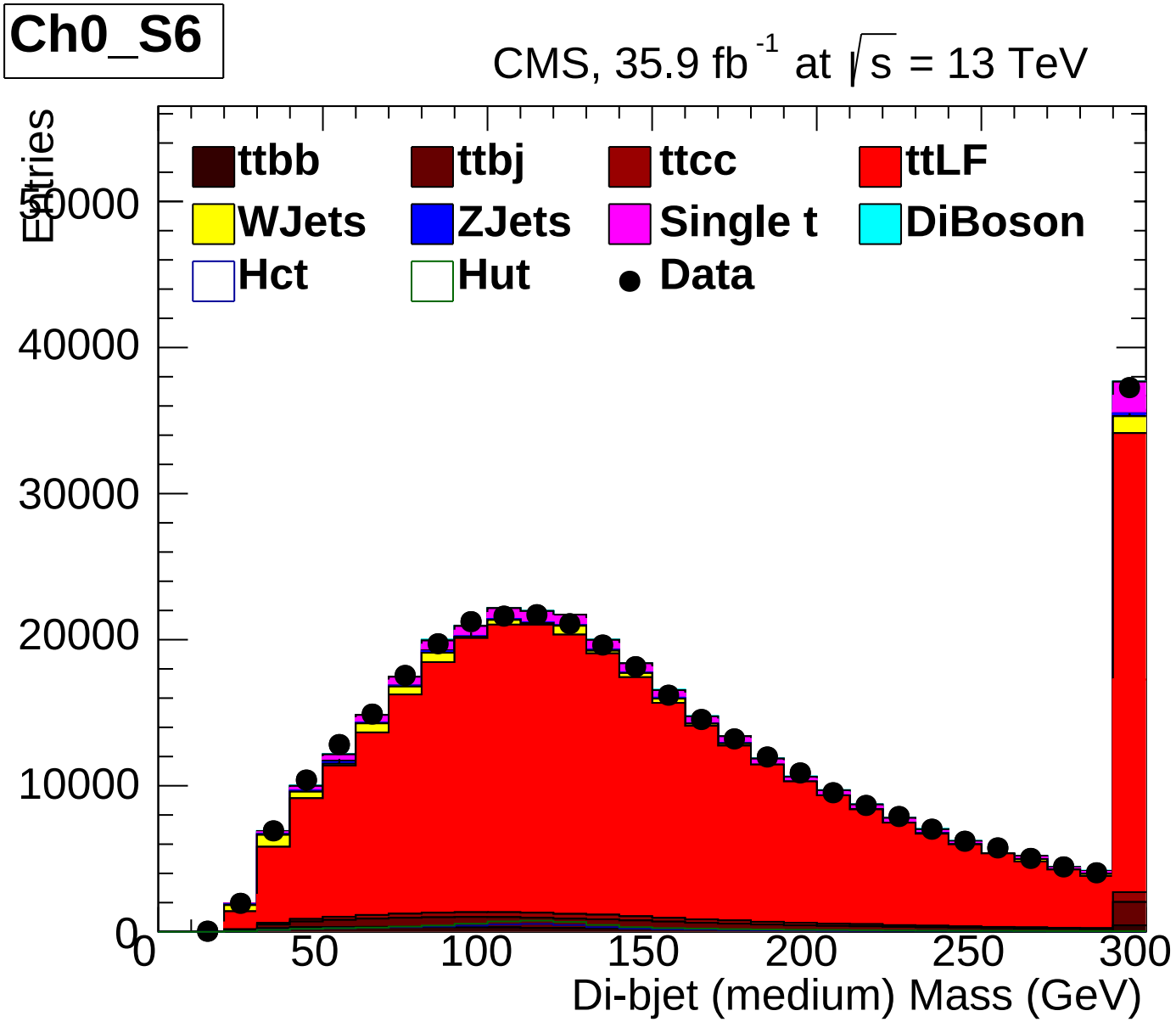
200
250
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
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40000
30000
20000
10000
0
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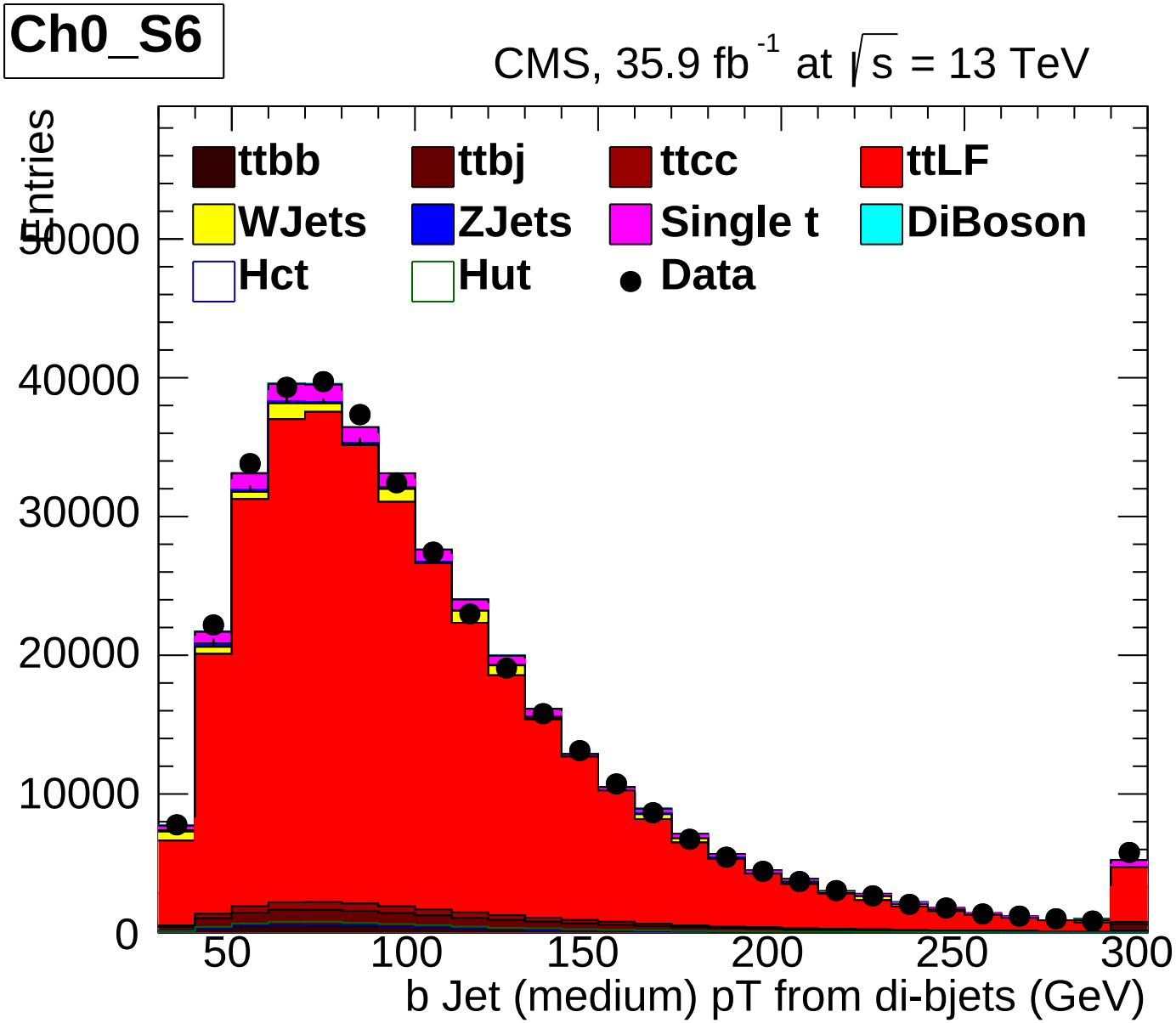
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch0_S6
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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30000
20000
10000
0
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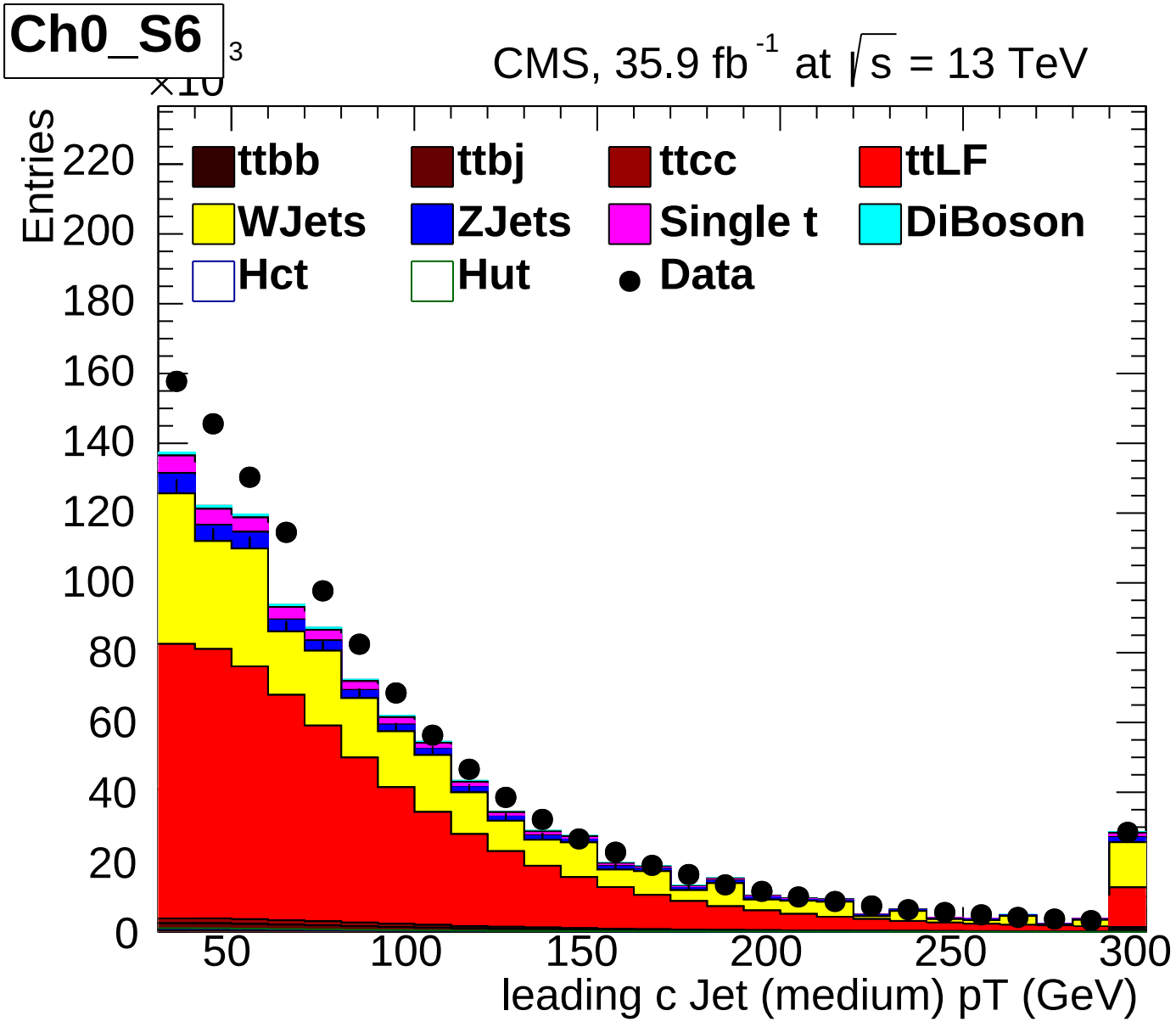
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
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120
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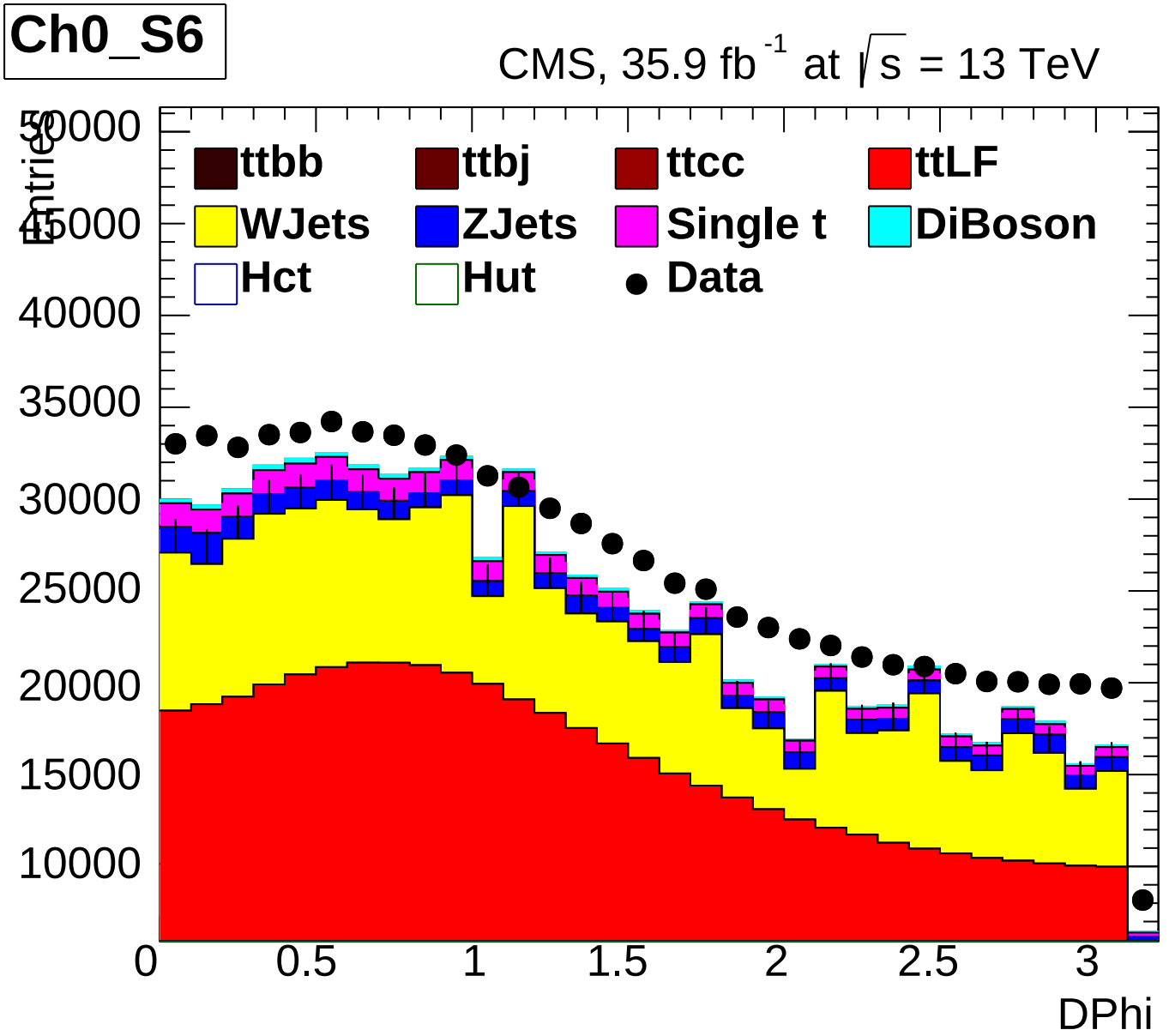
160
180
200
220
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
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40000
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30000
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20000
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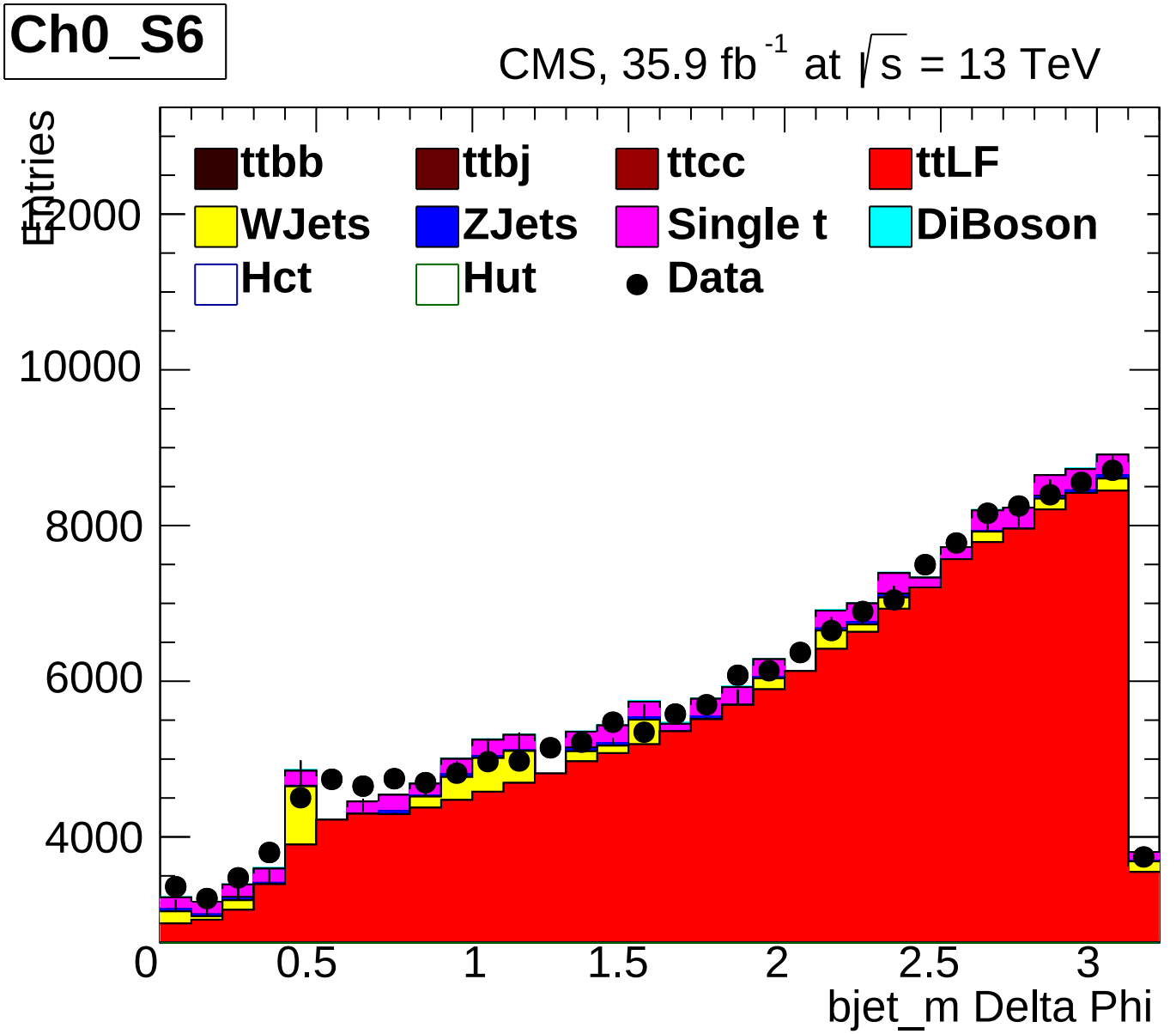
1
1.5
2
2.5
3
DPhi


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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WJets
ZJets
Single t
DiBoson
Hct
Hut
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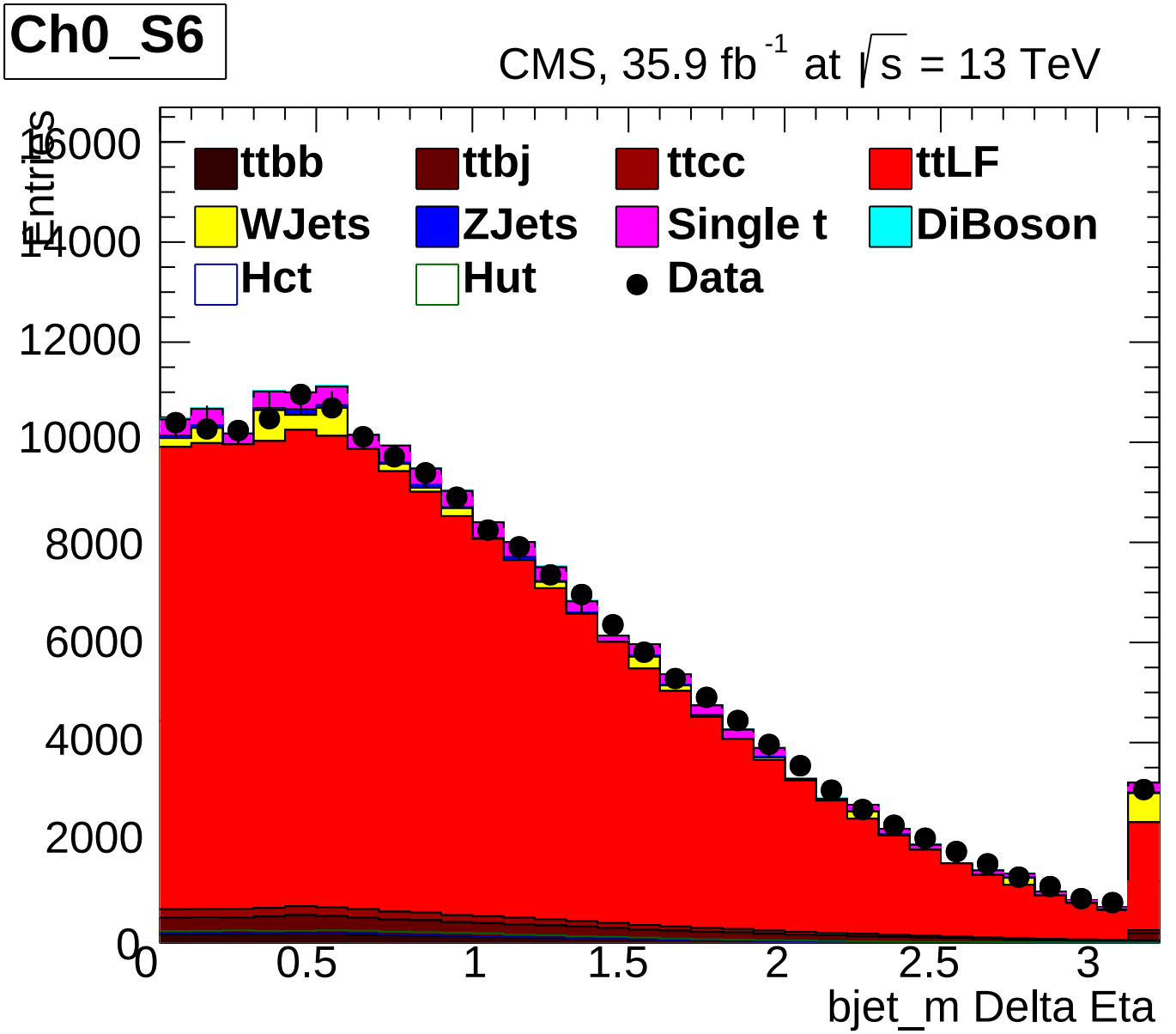
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
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2000
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0.5
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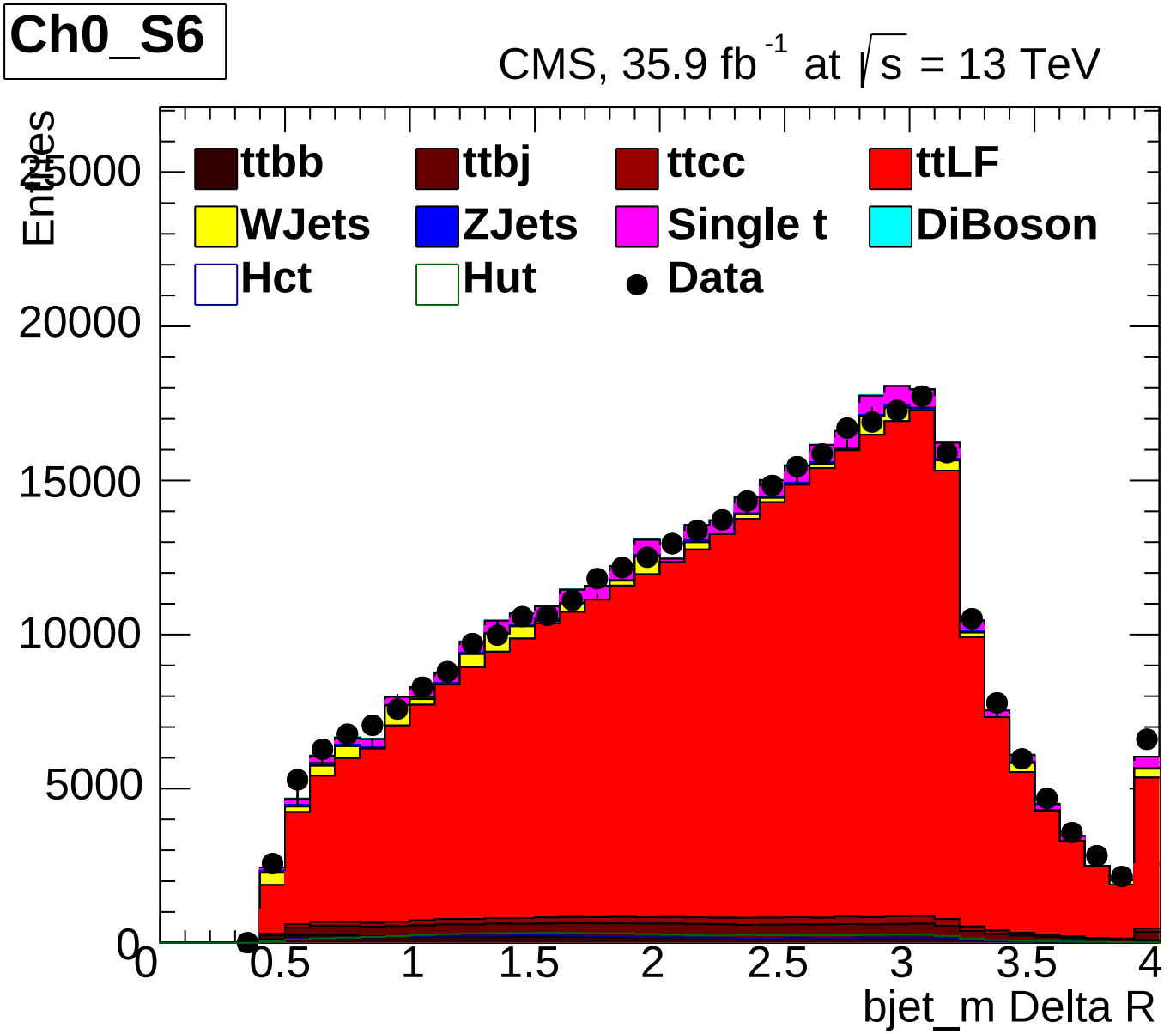
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
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1.5
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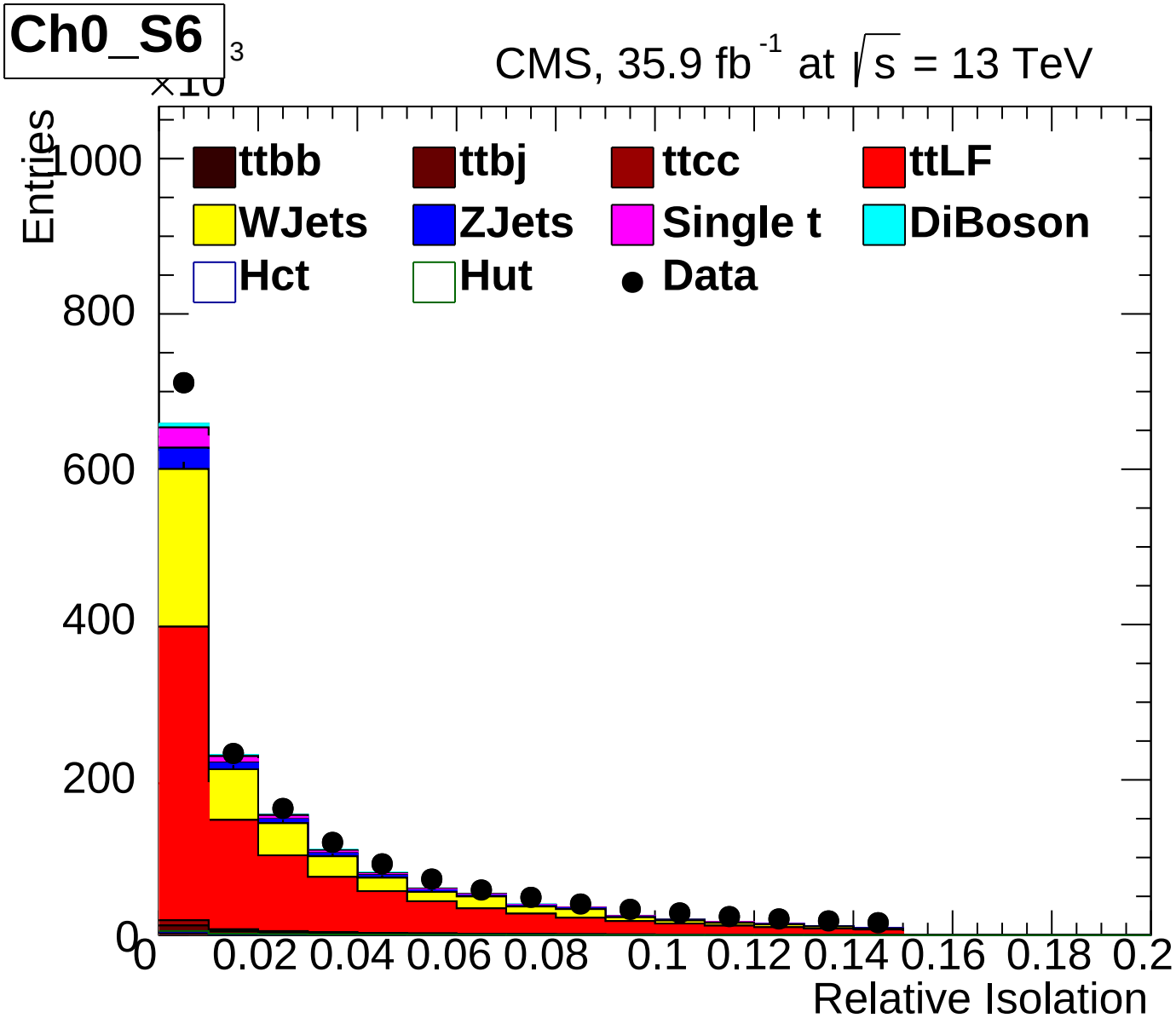
2.5
3
3.5
4
bjet_m Delta R


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
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600
400
200
0
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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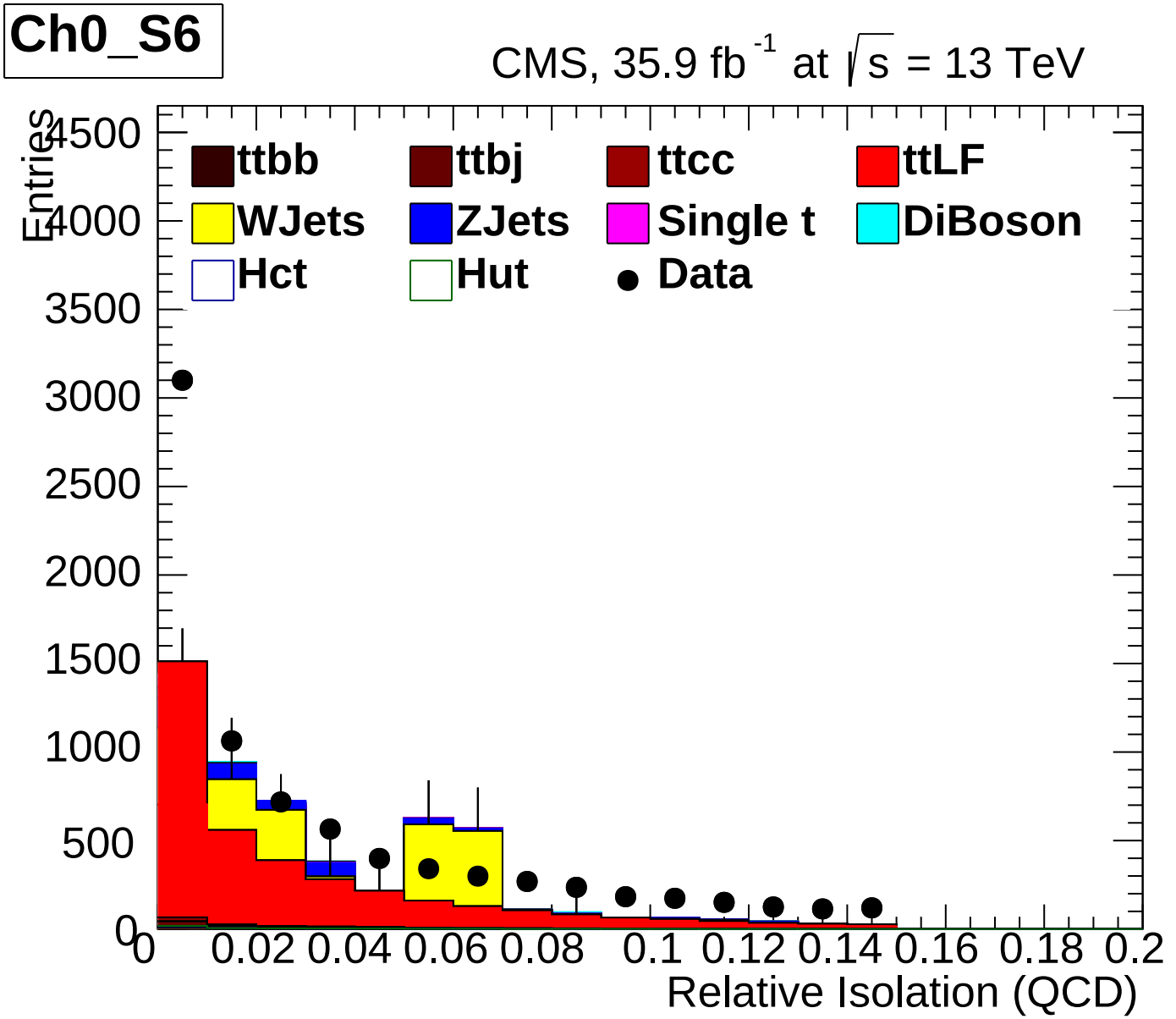
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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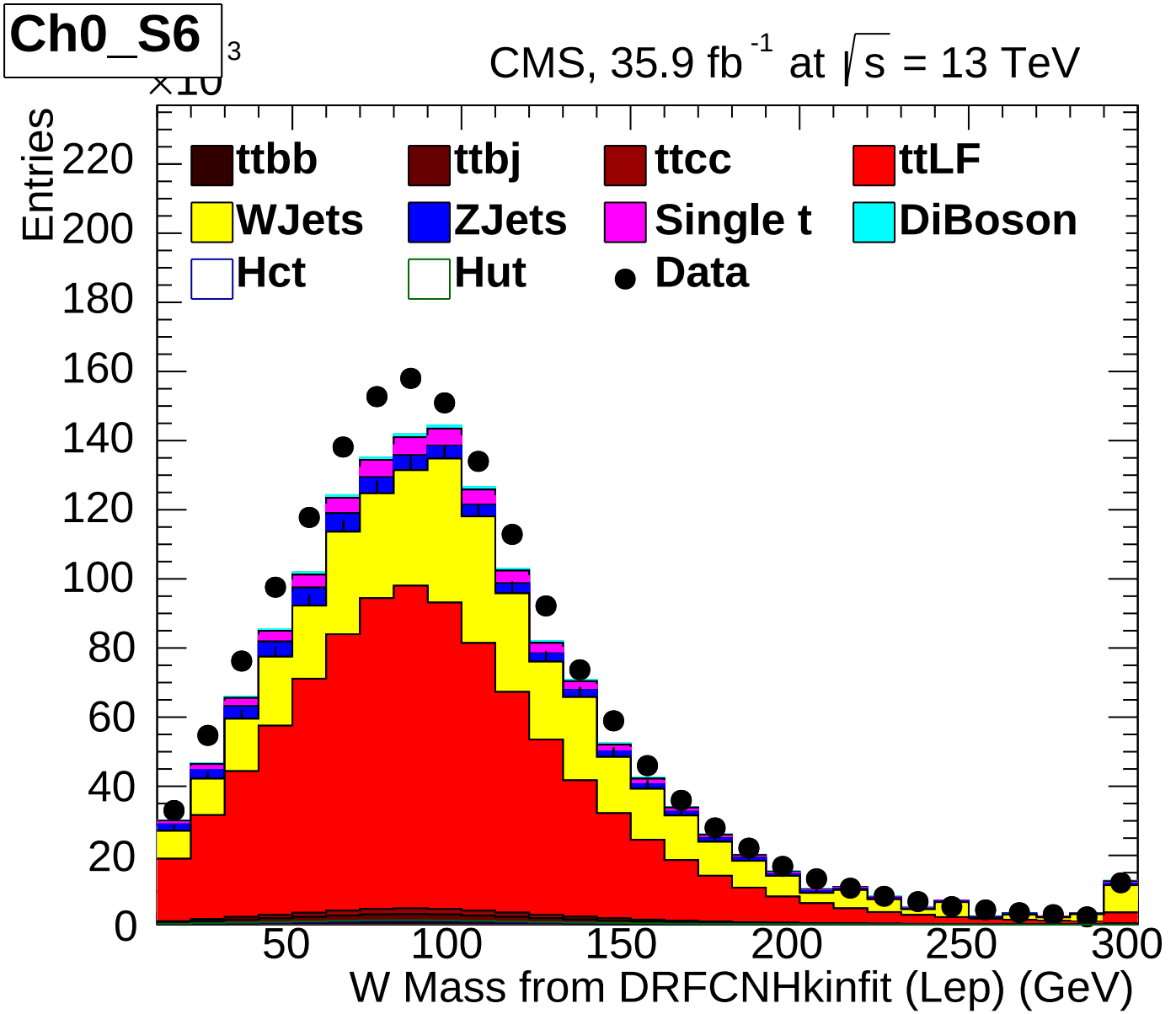
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
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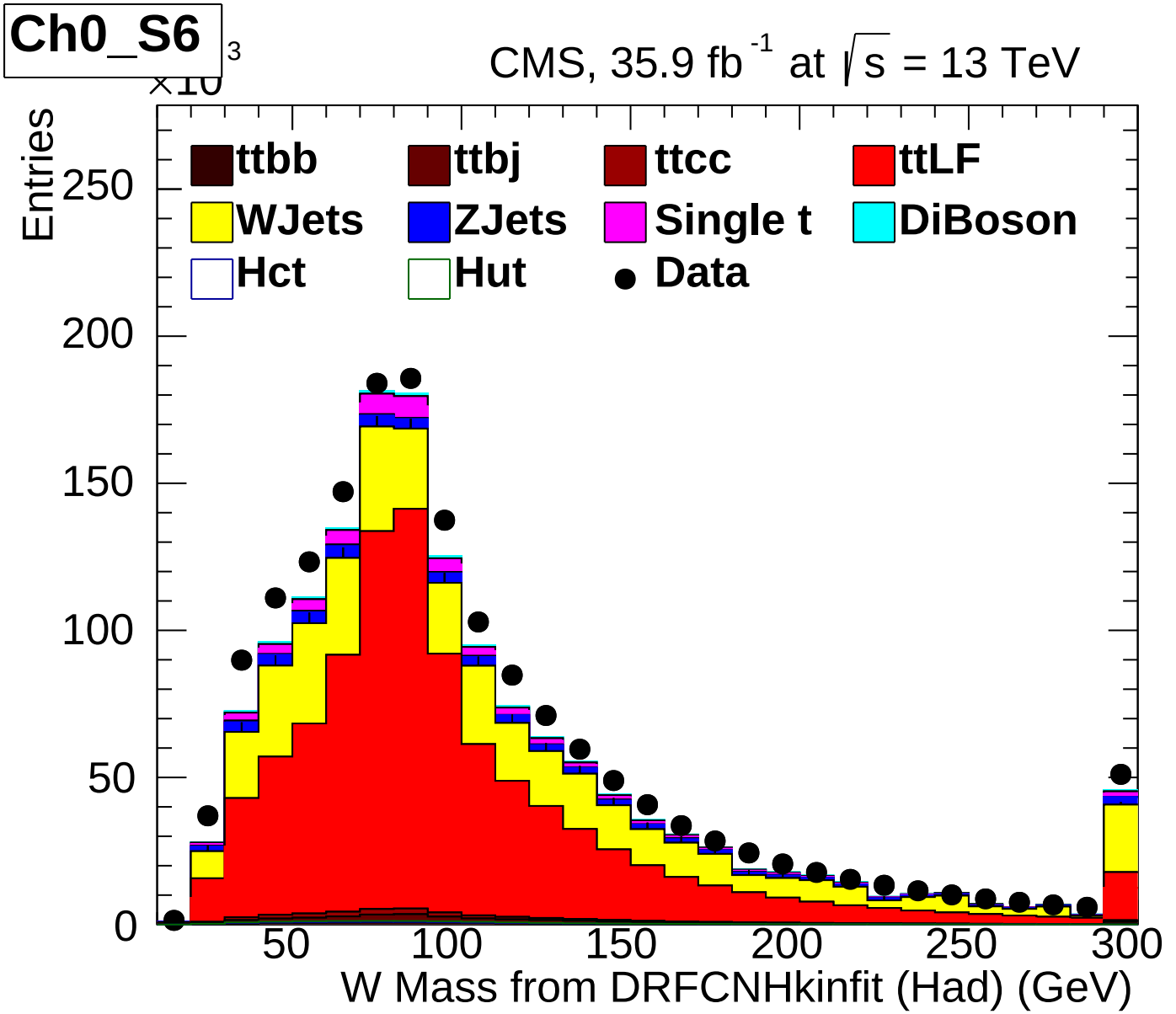
160
180
200
220
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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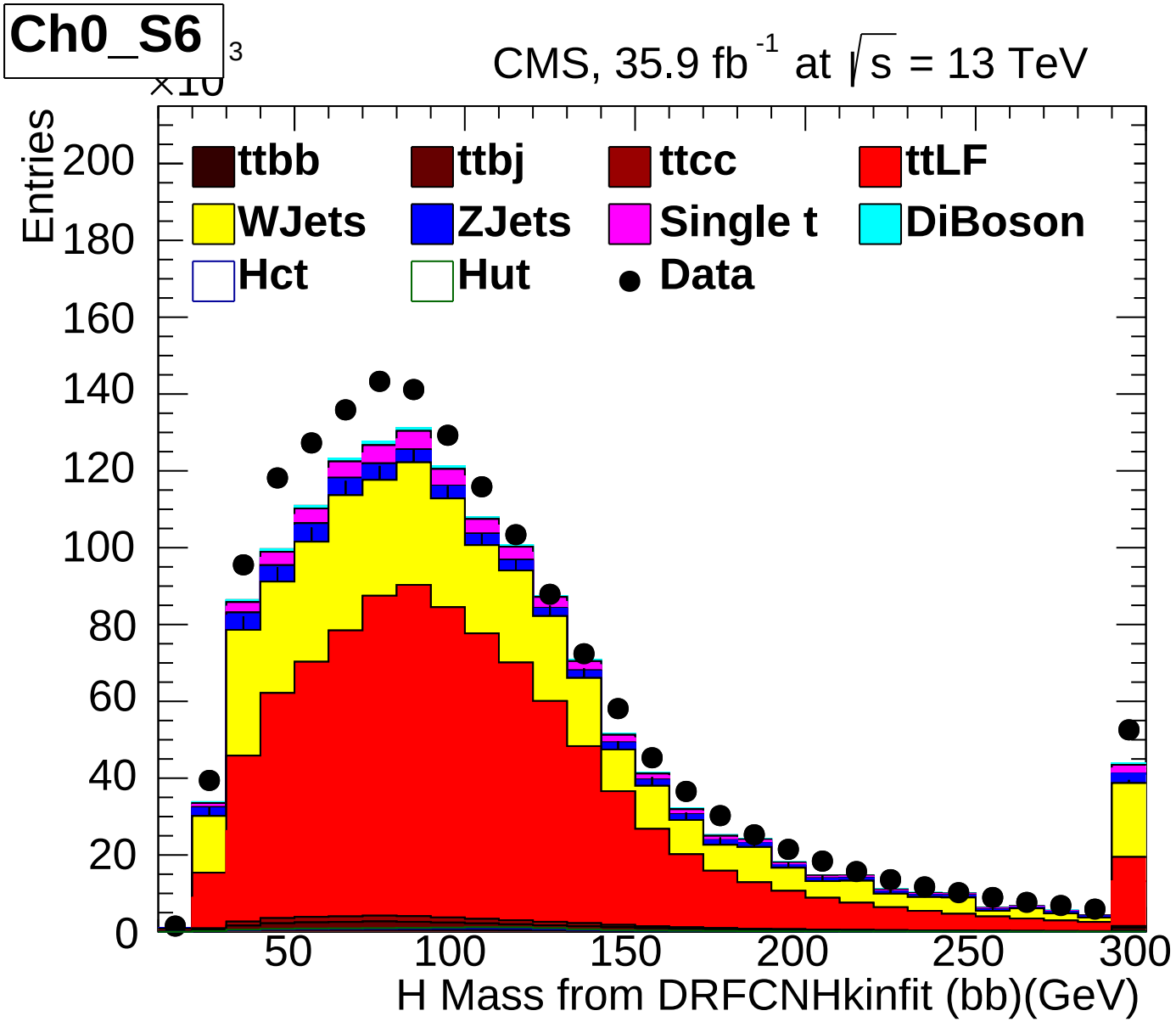
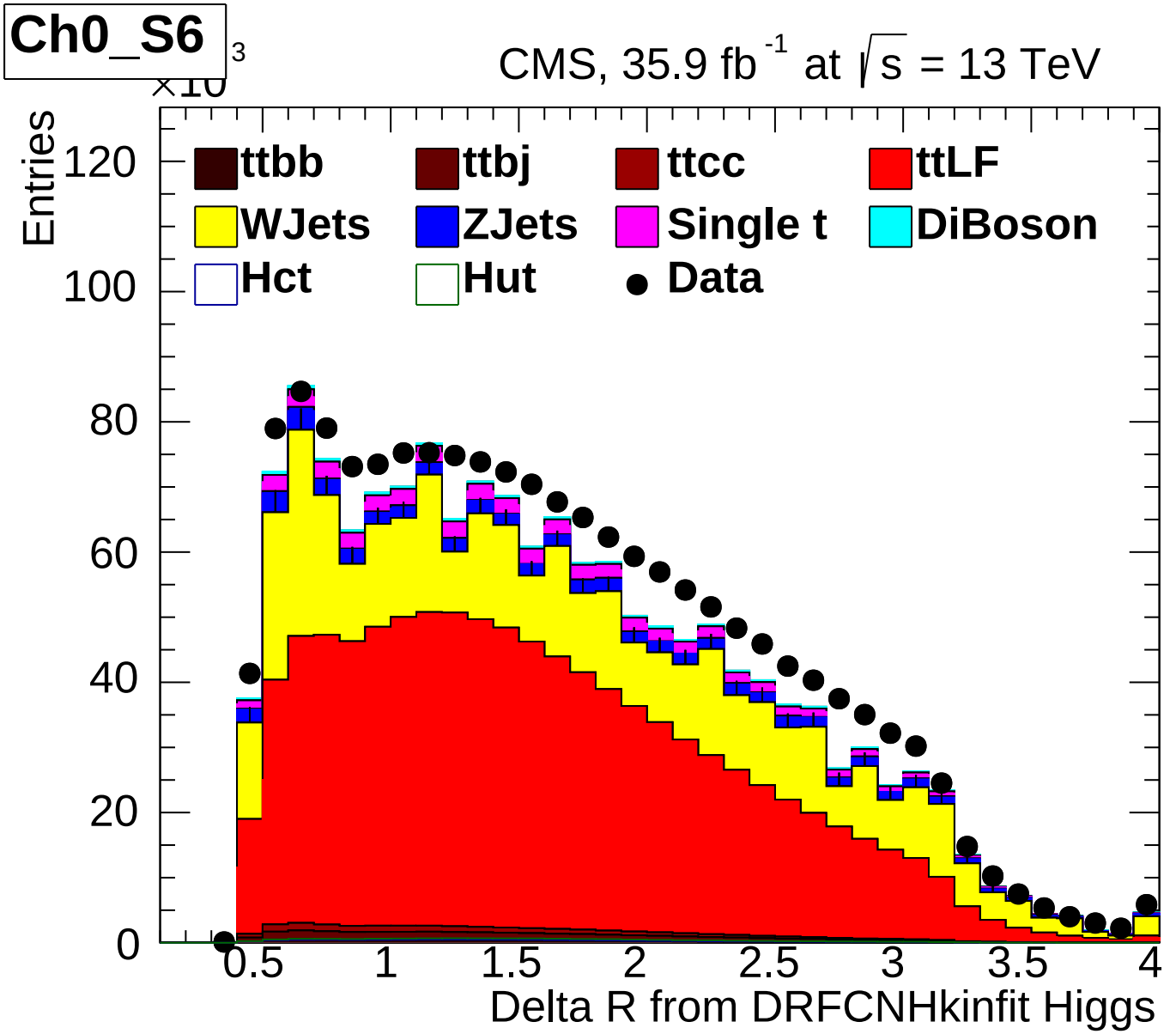
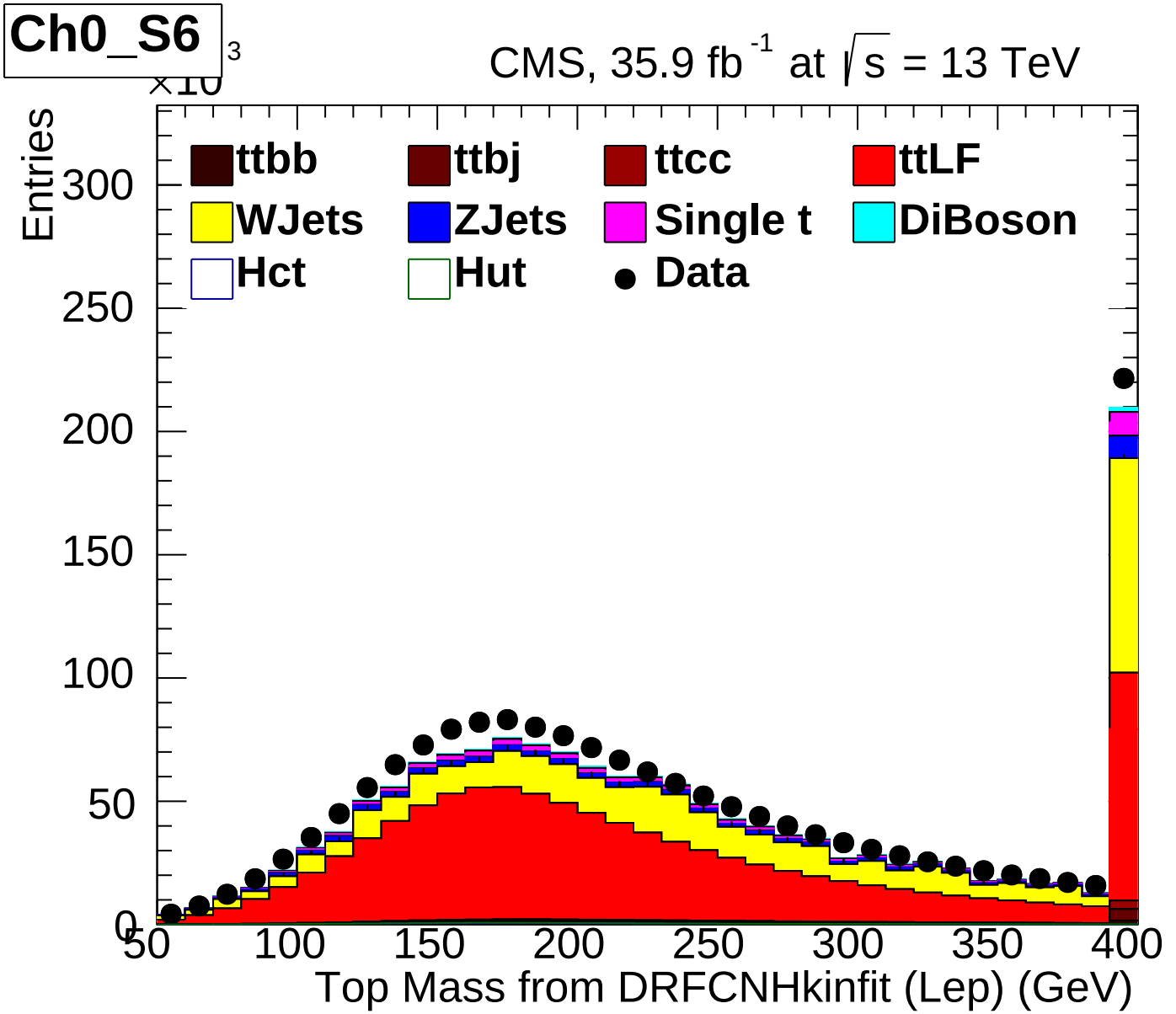
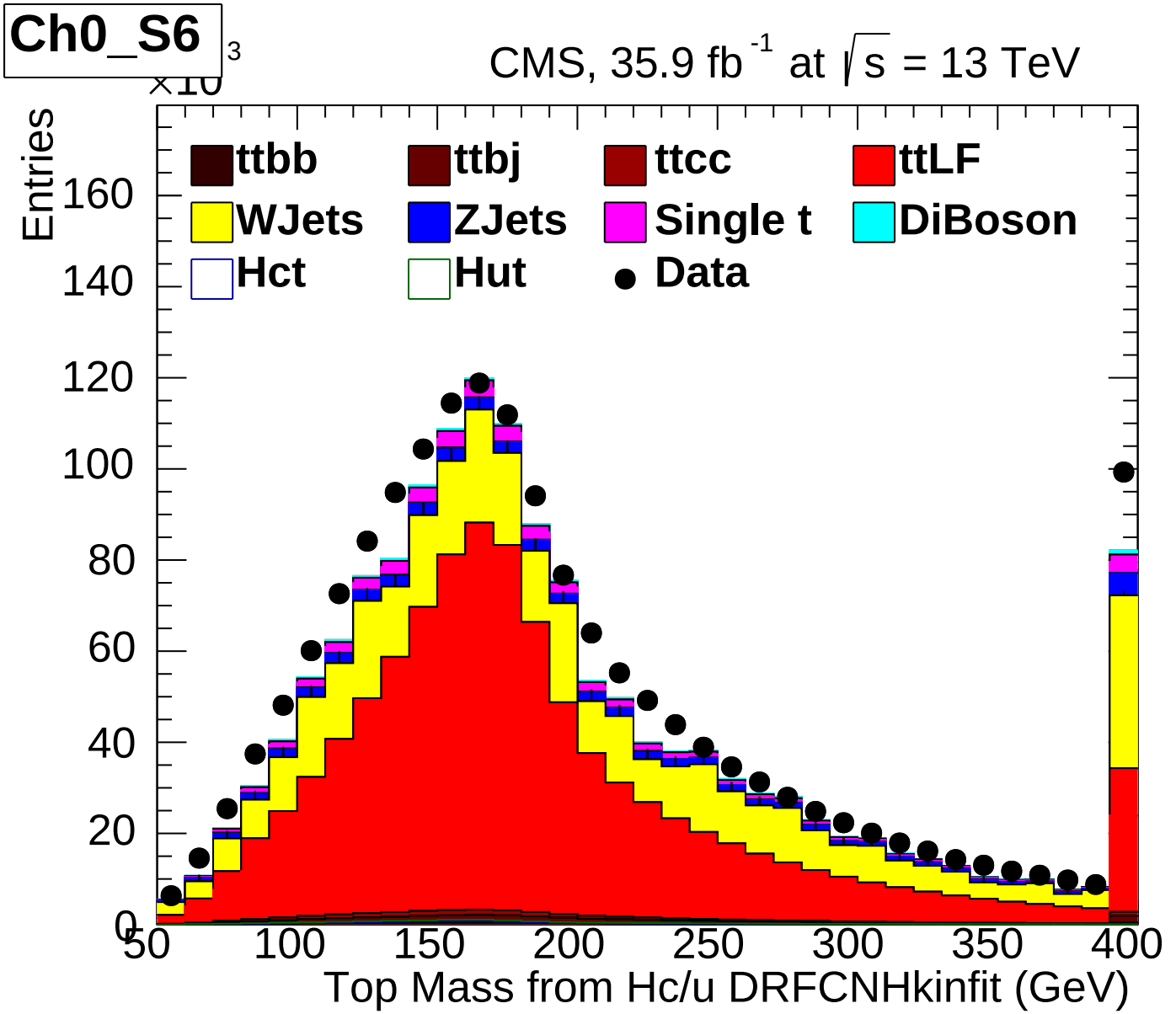
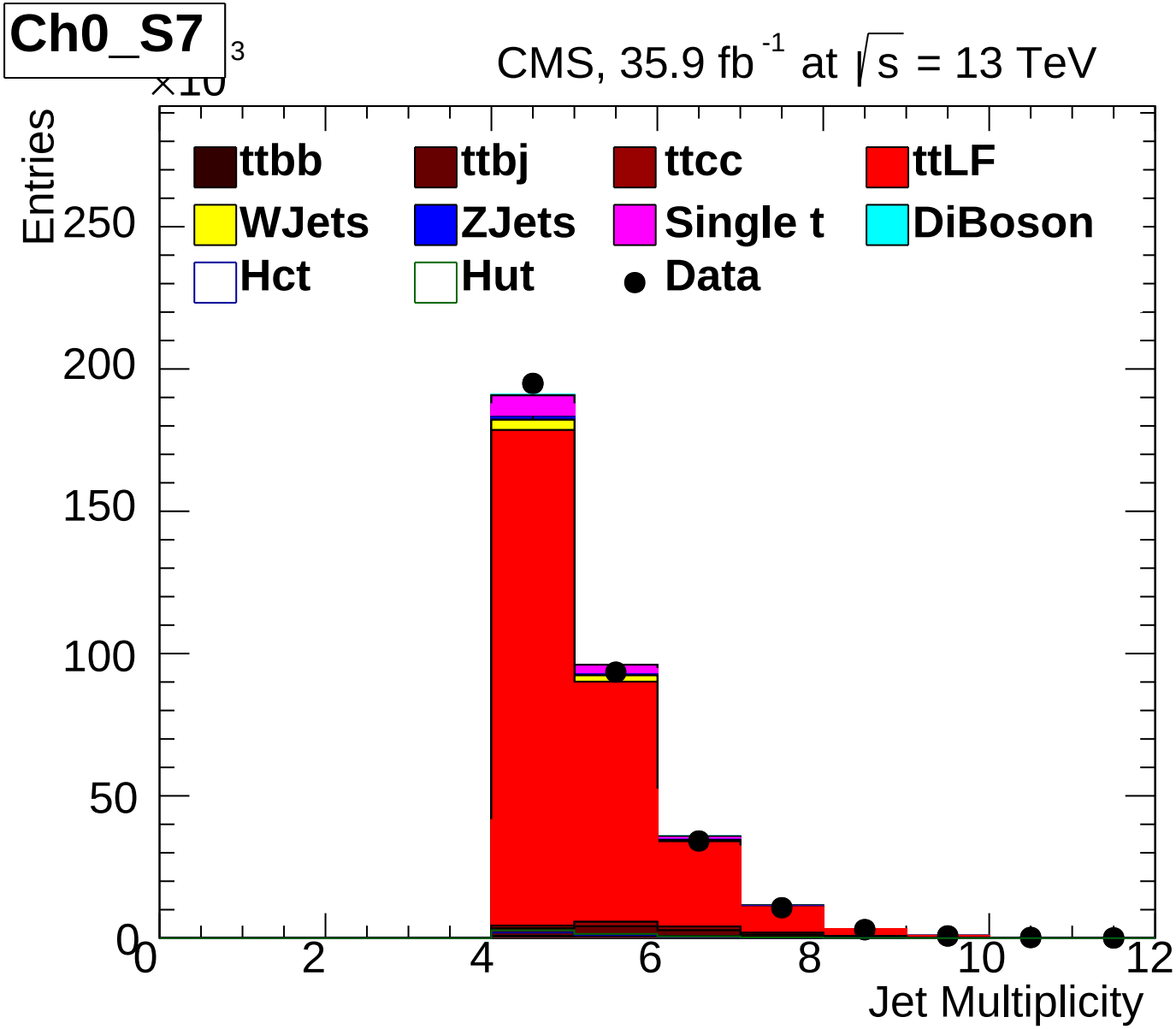
100
150
200
250
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

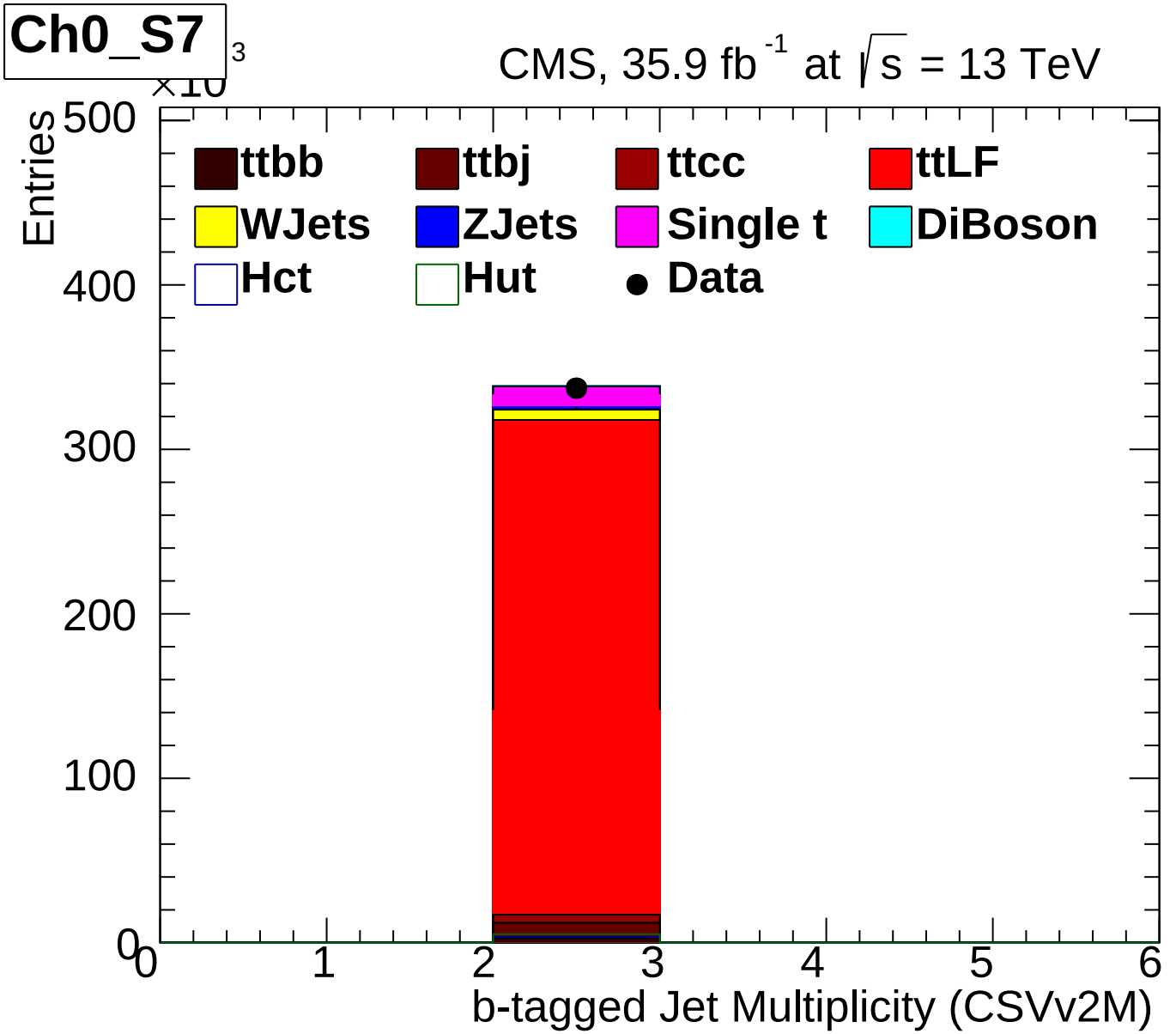

Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

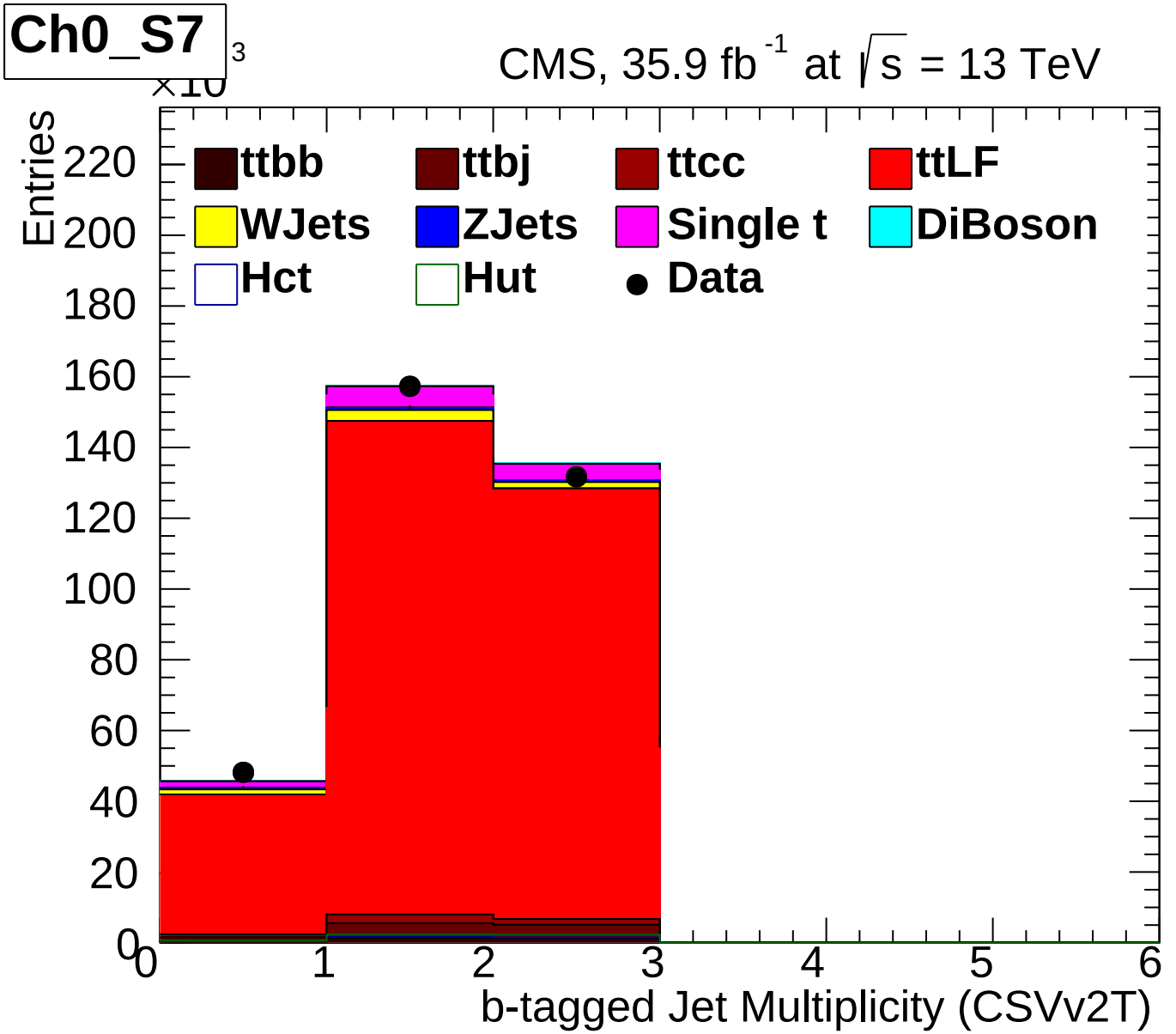

Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

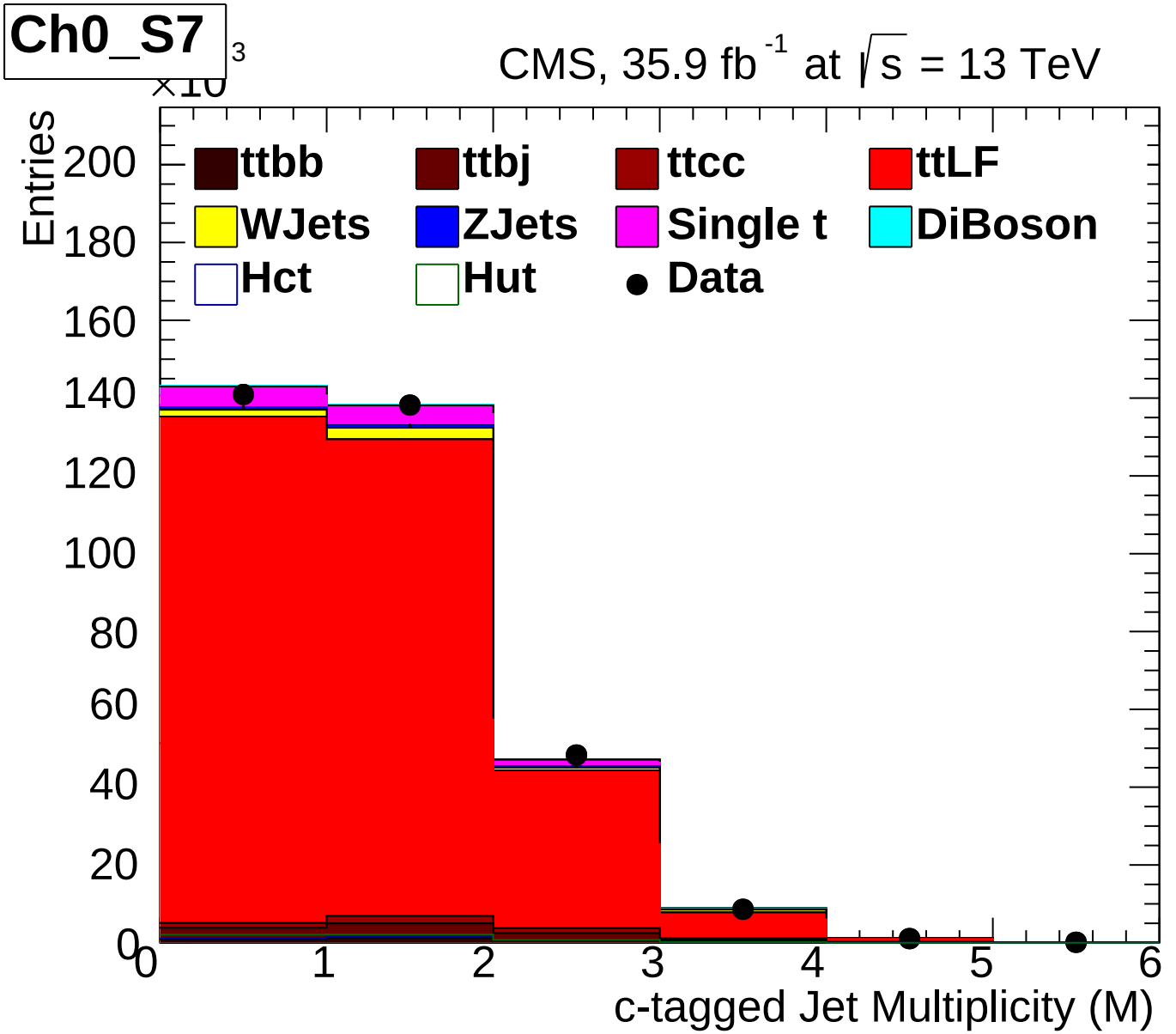

Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

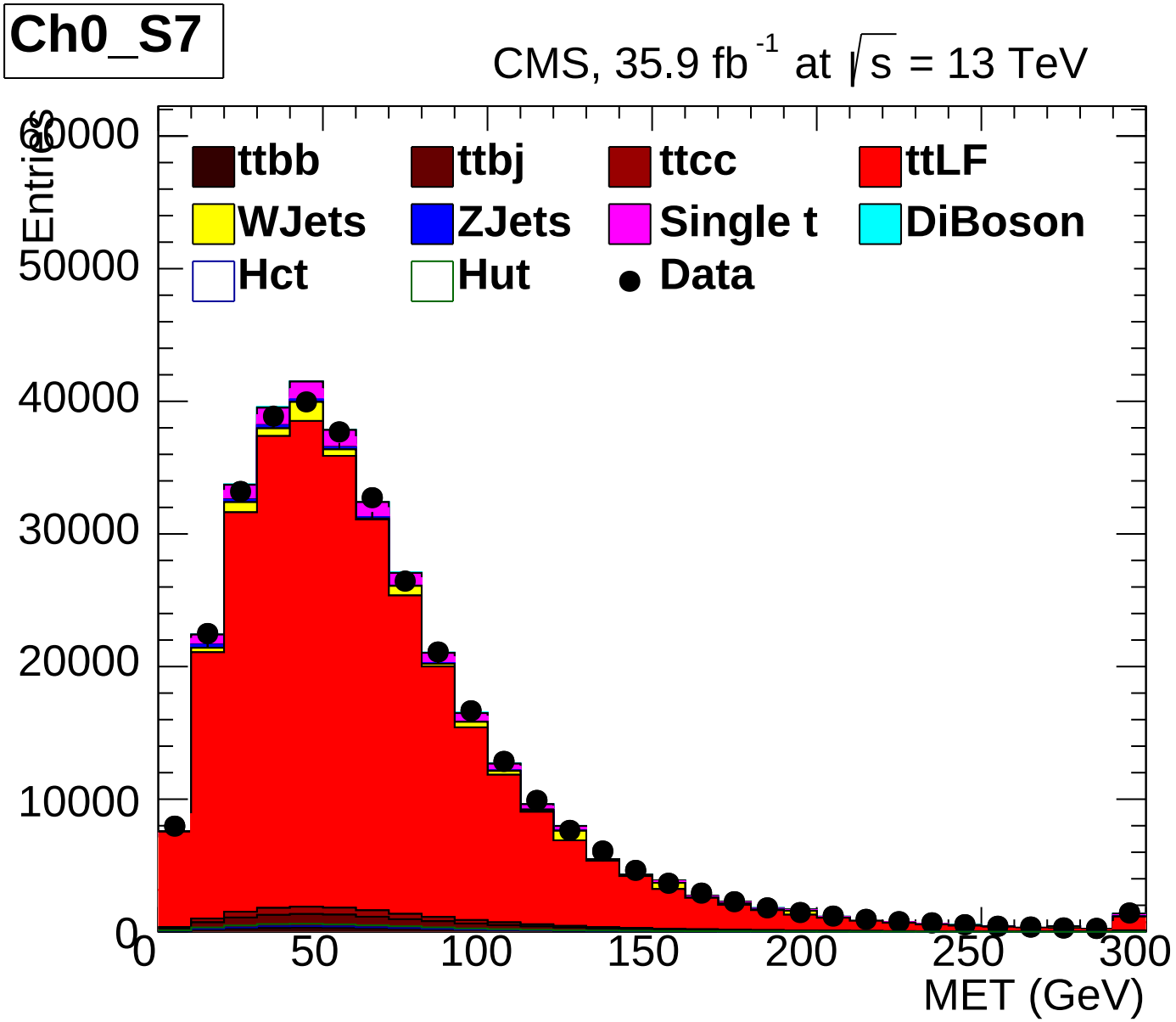

Ch0_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

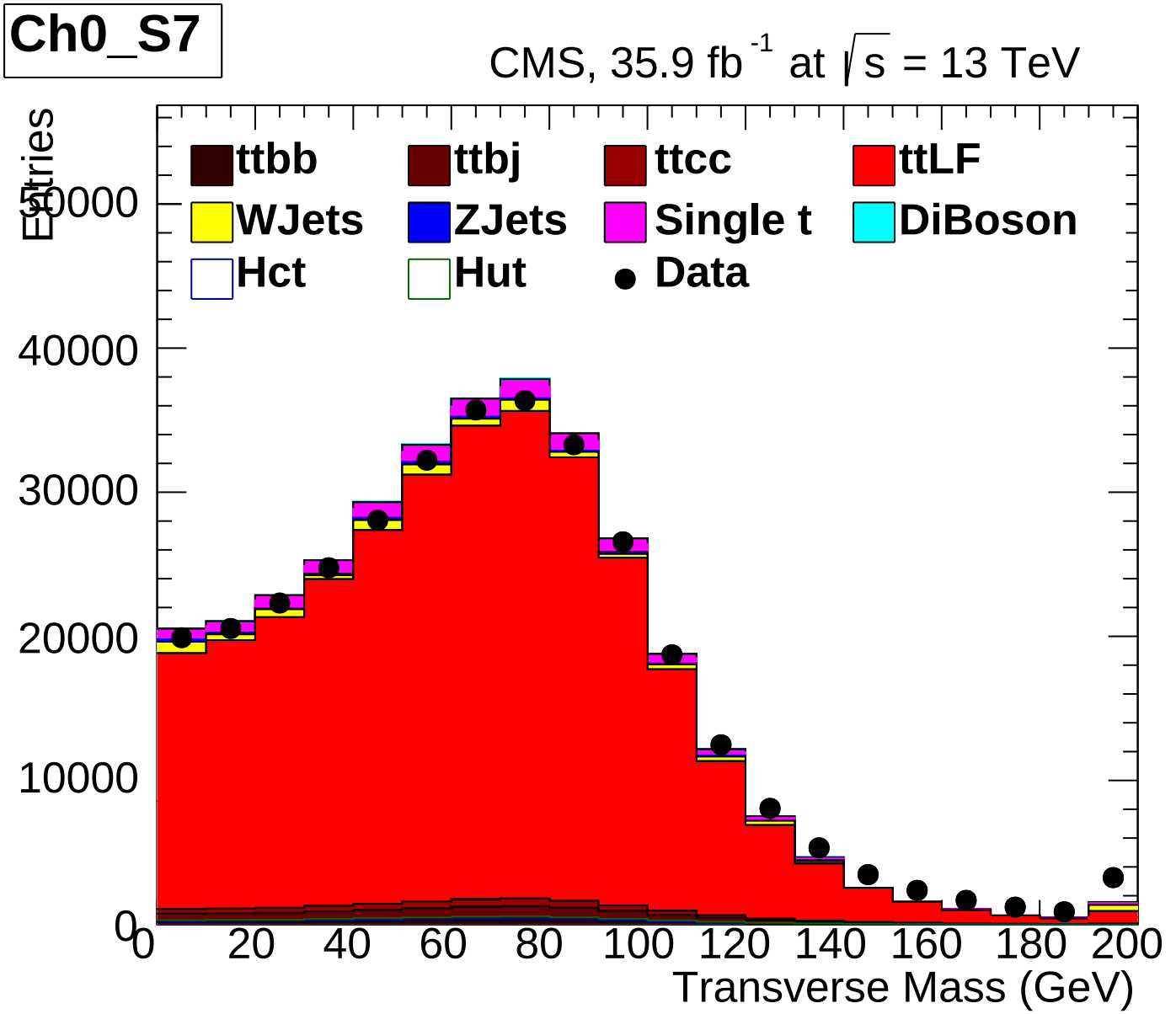

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
0
2
4
6
8
10
12
Jet Multiplicity

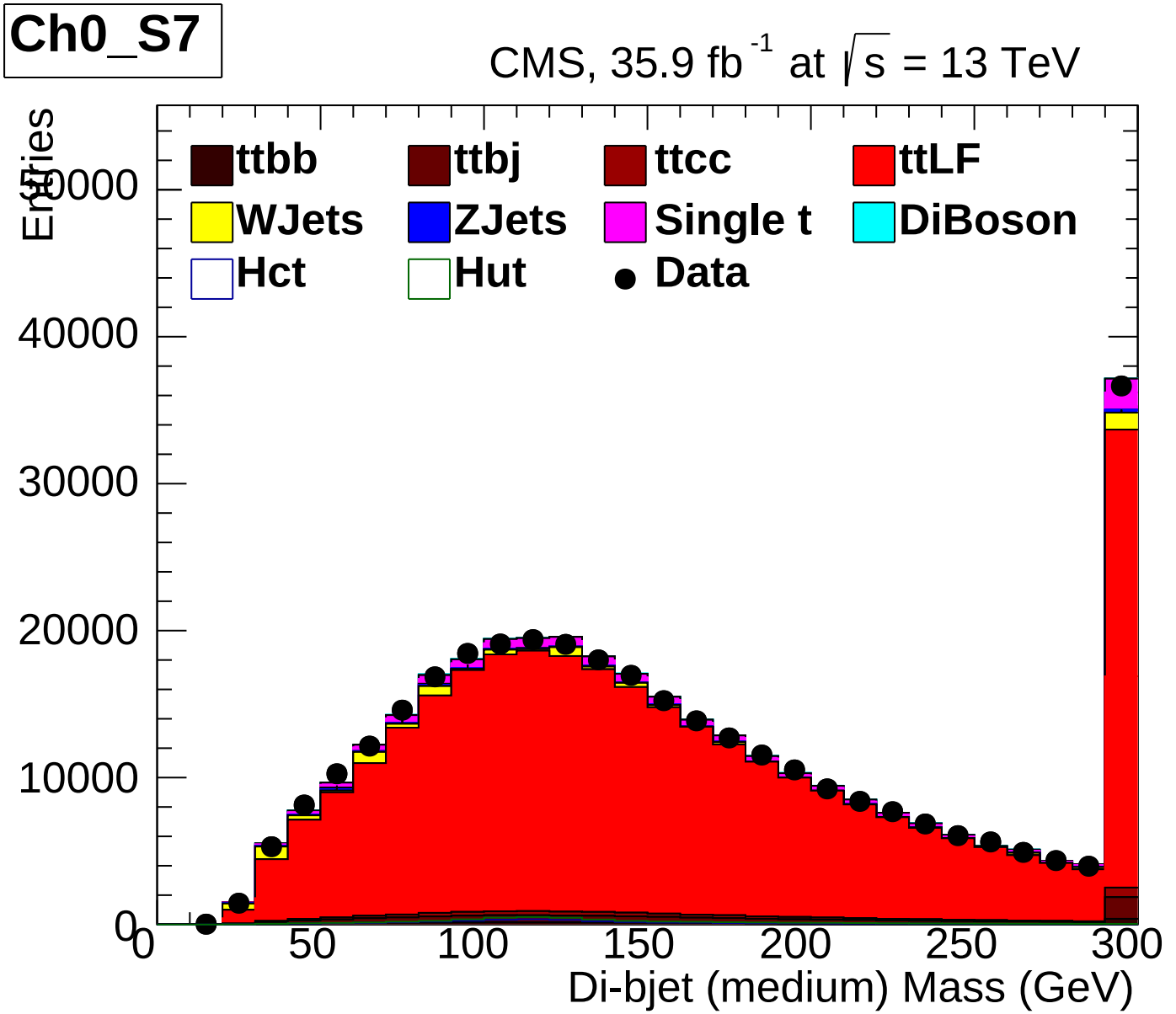

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

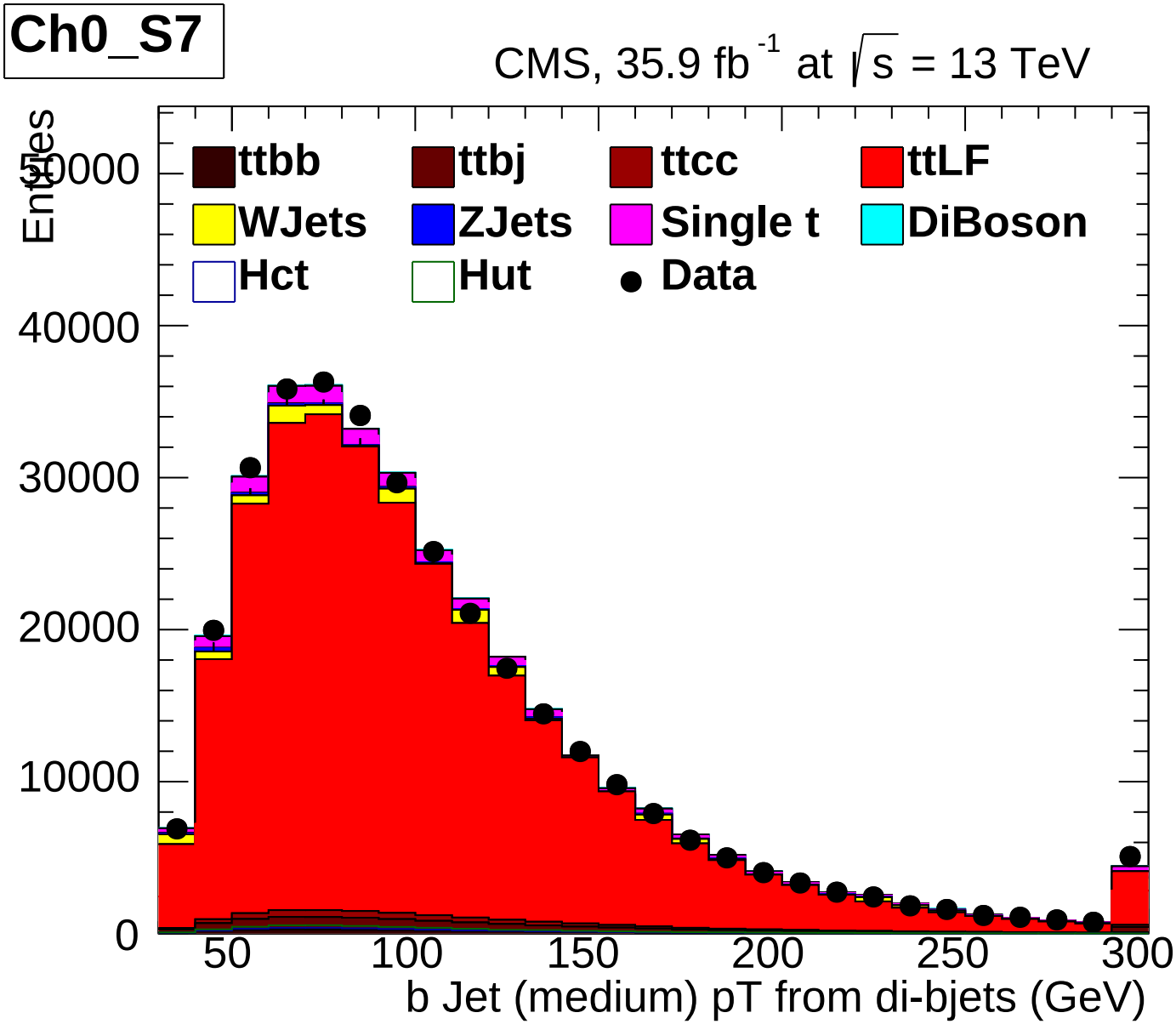

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

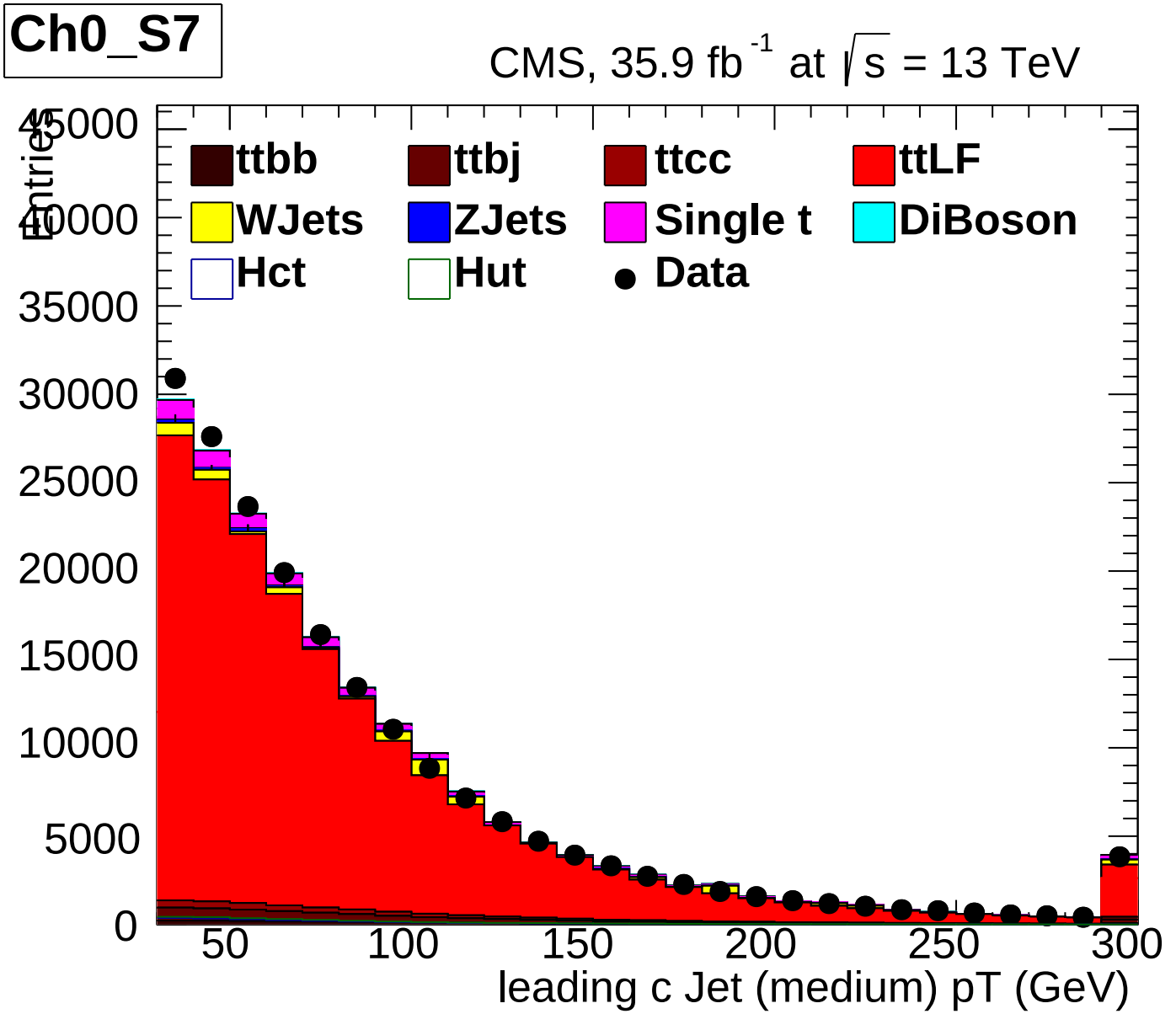

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

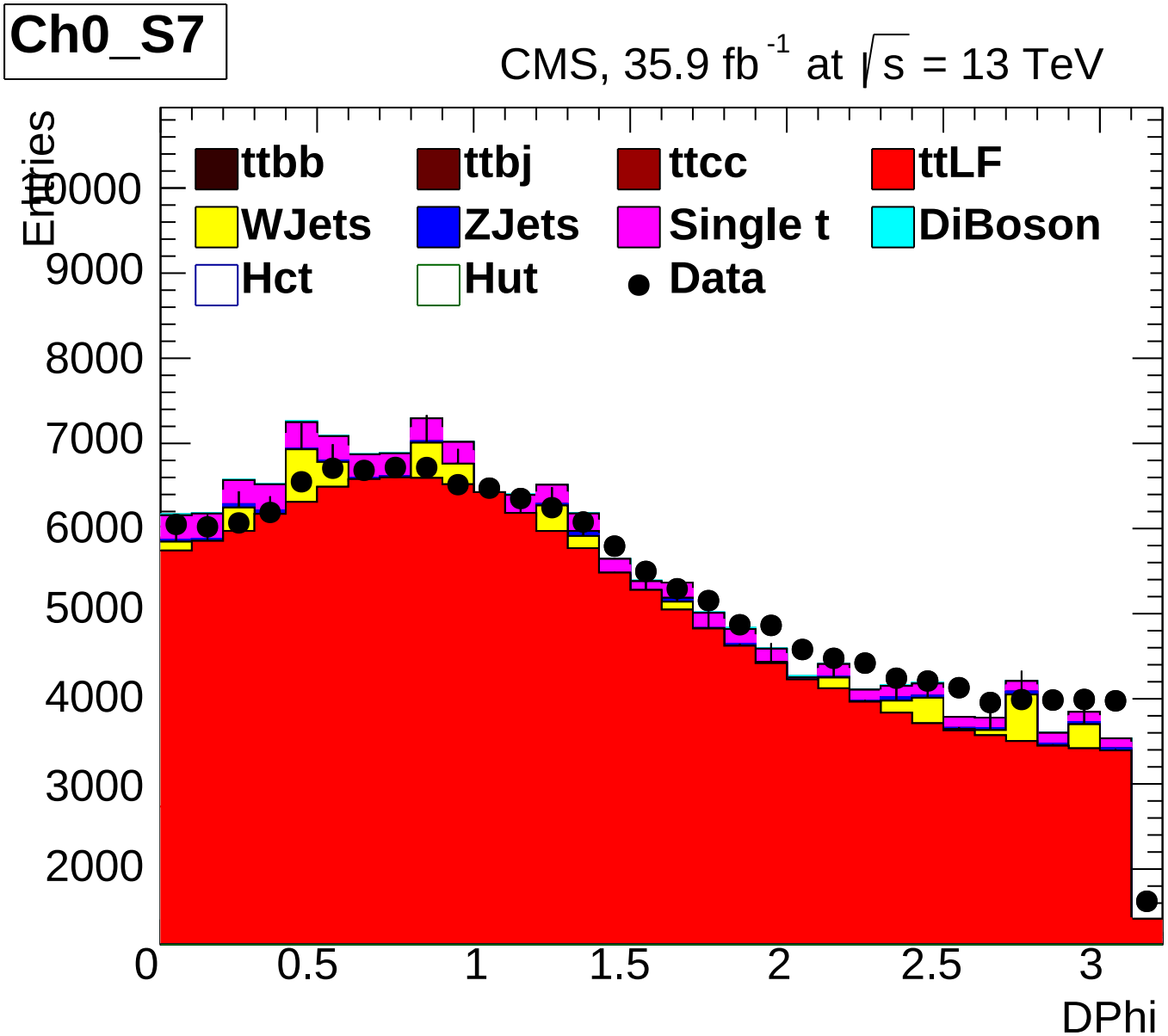

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
MET (GeV)

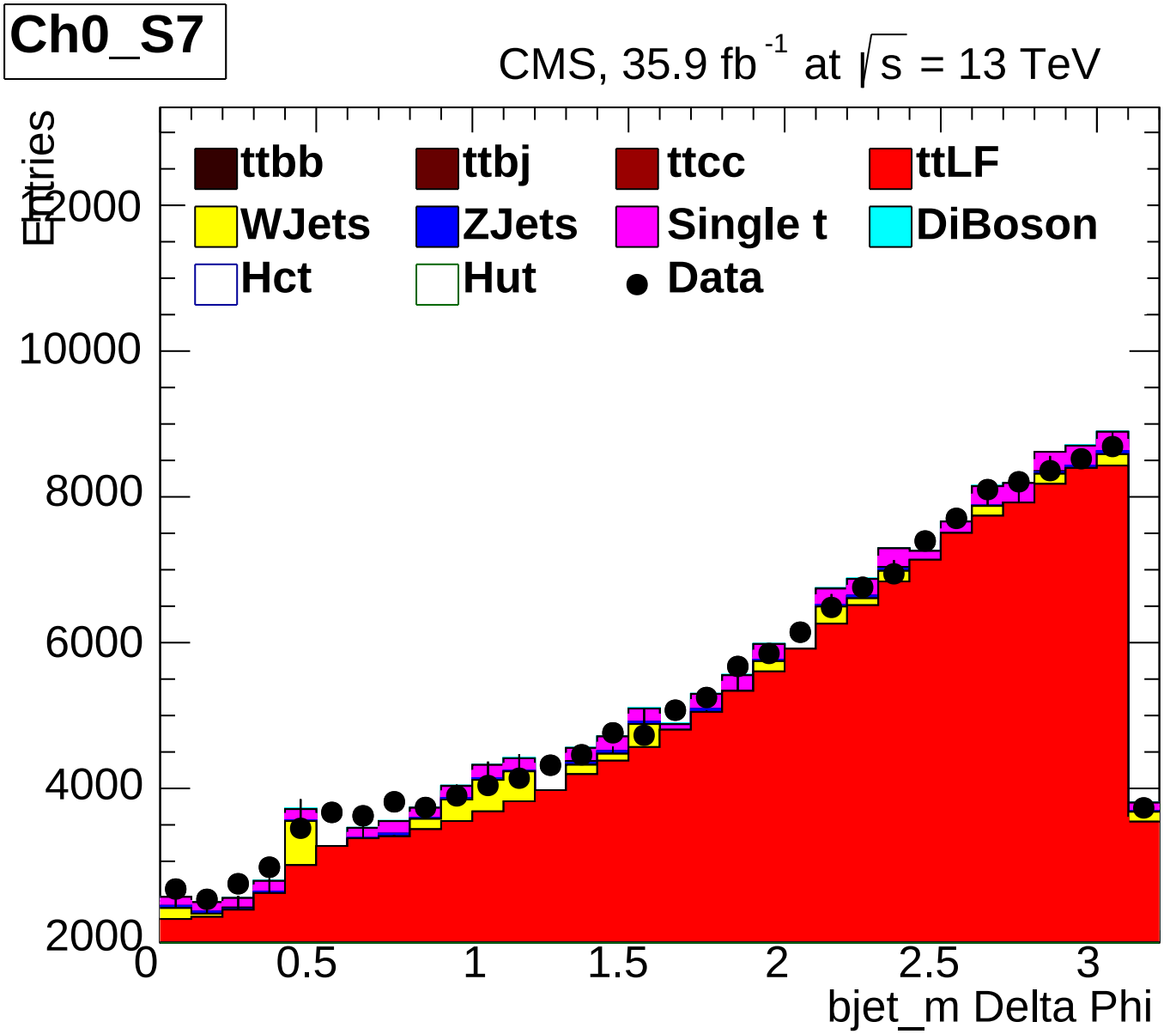

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

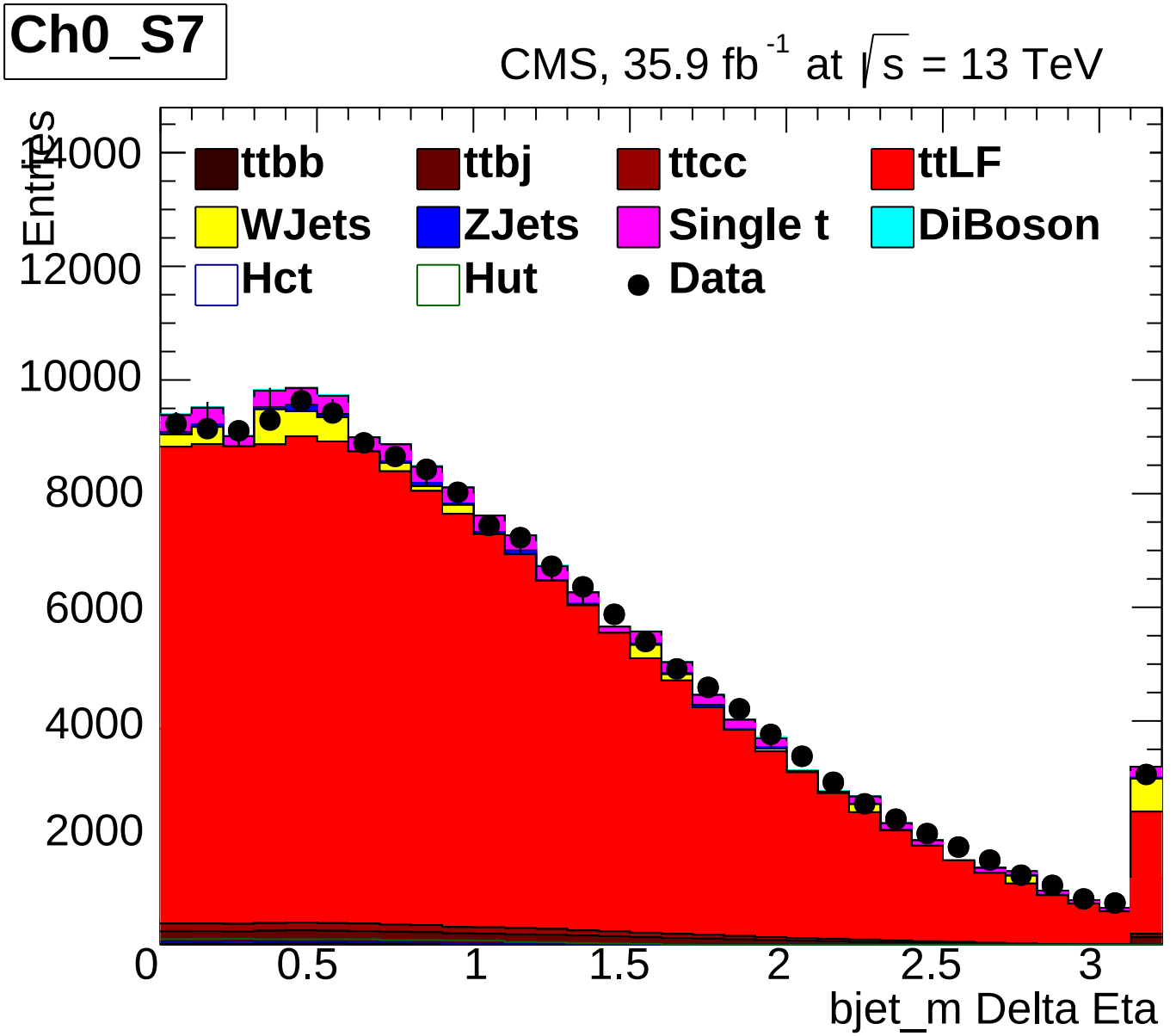

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
10000
20000
30000
40000
50000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

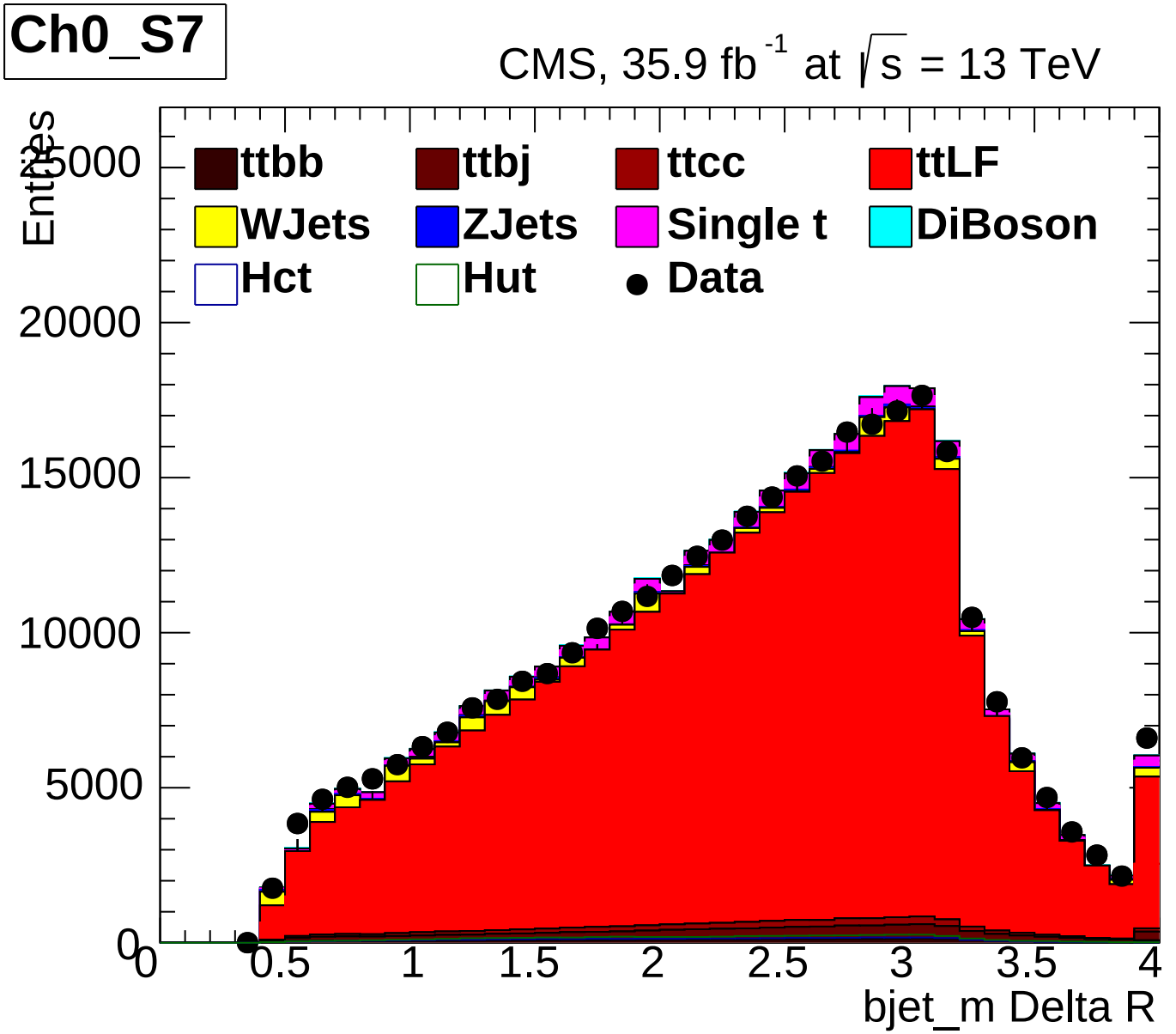

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

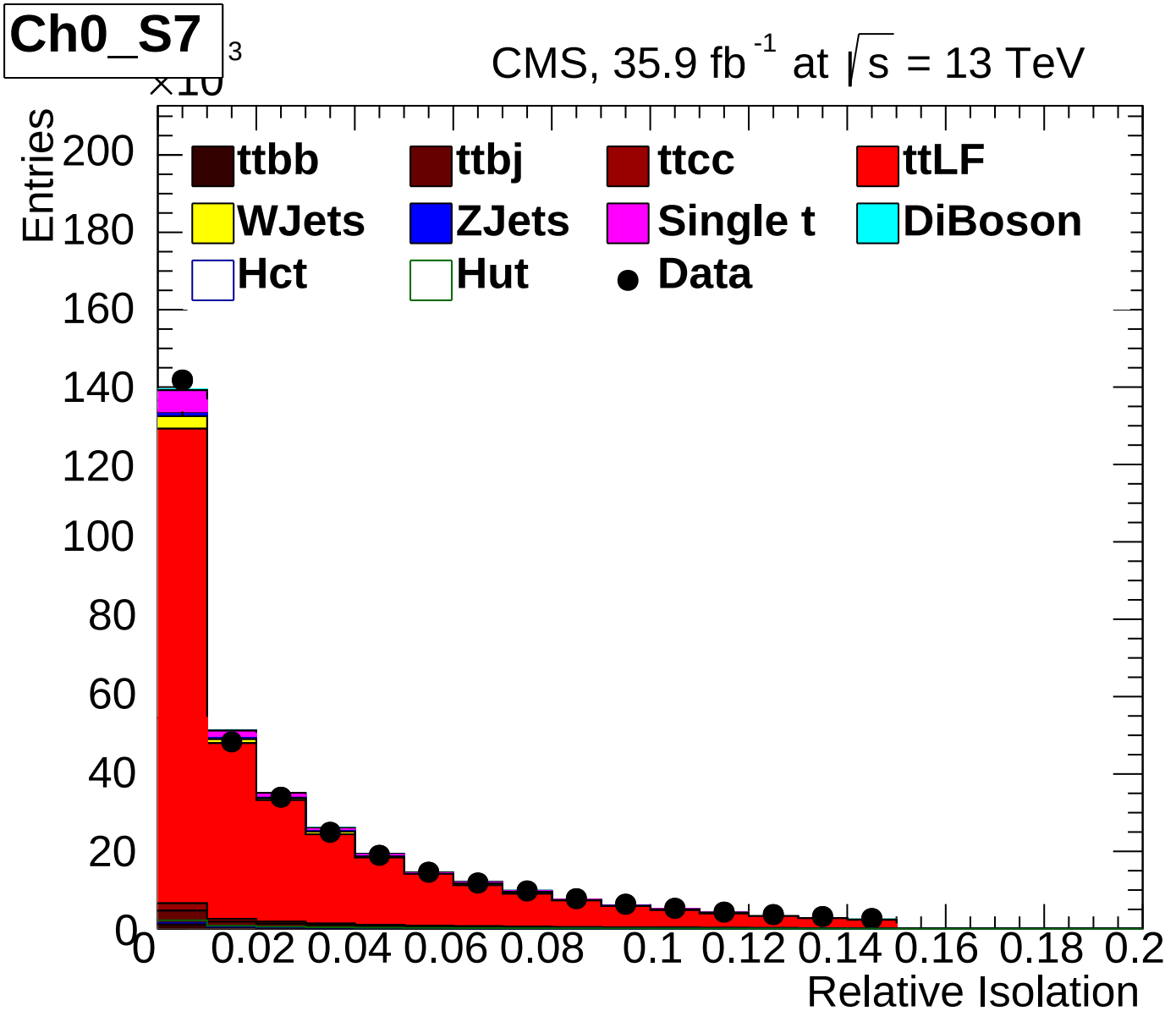

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

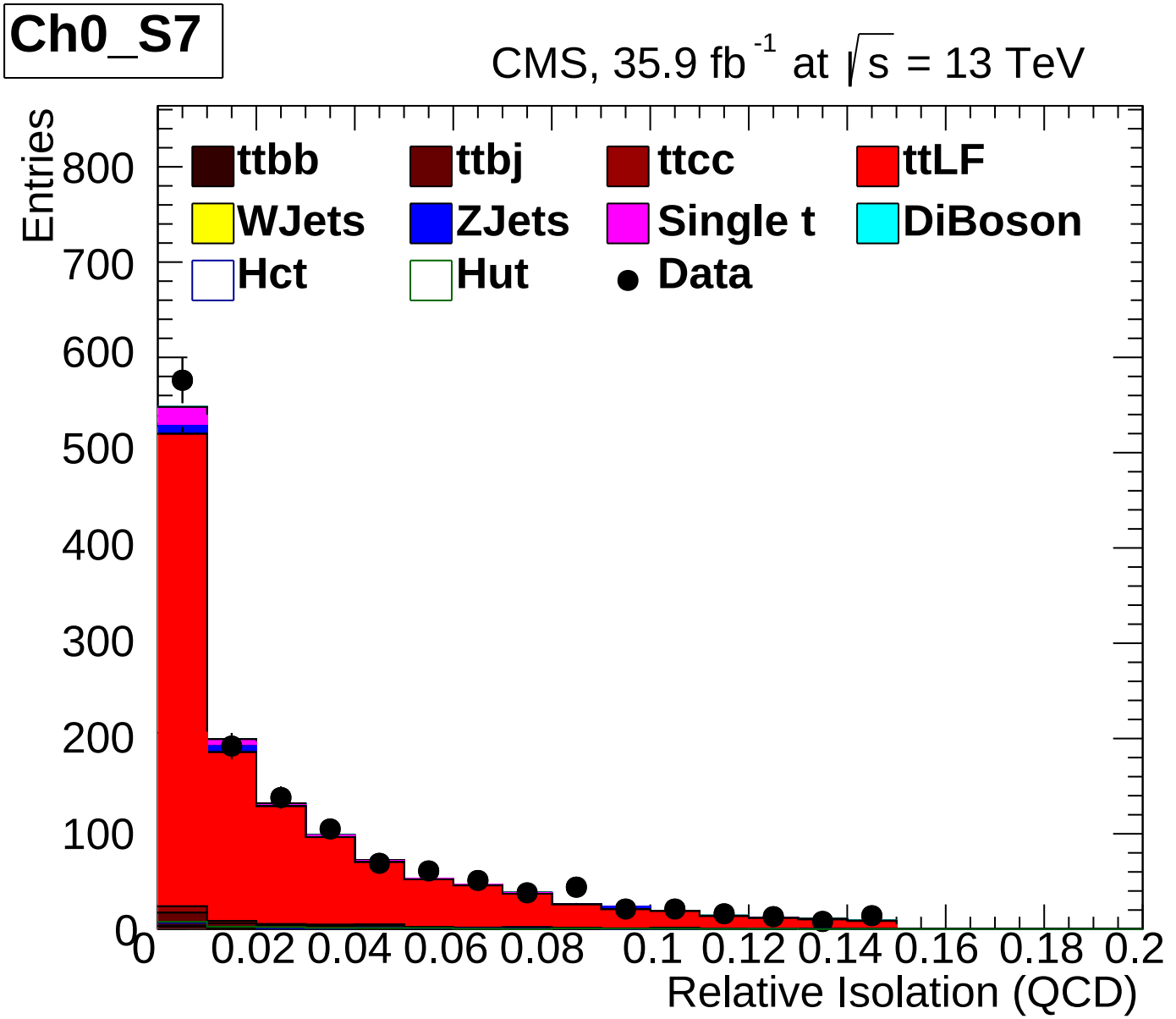

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
10000
9000
8000
7000
6000
5000
4000
3000
2000
0
0.5
1
1.5
2
2.5
3
DPhi

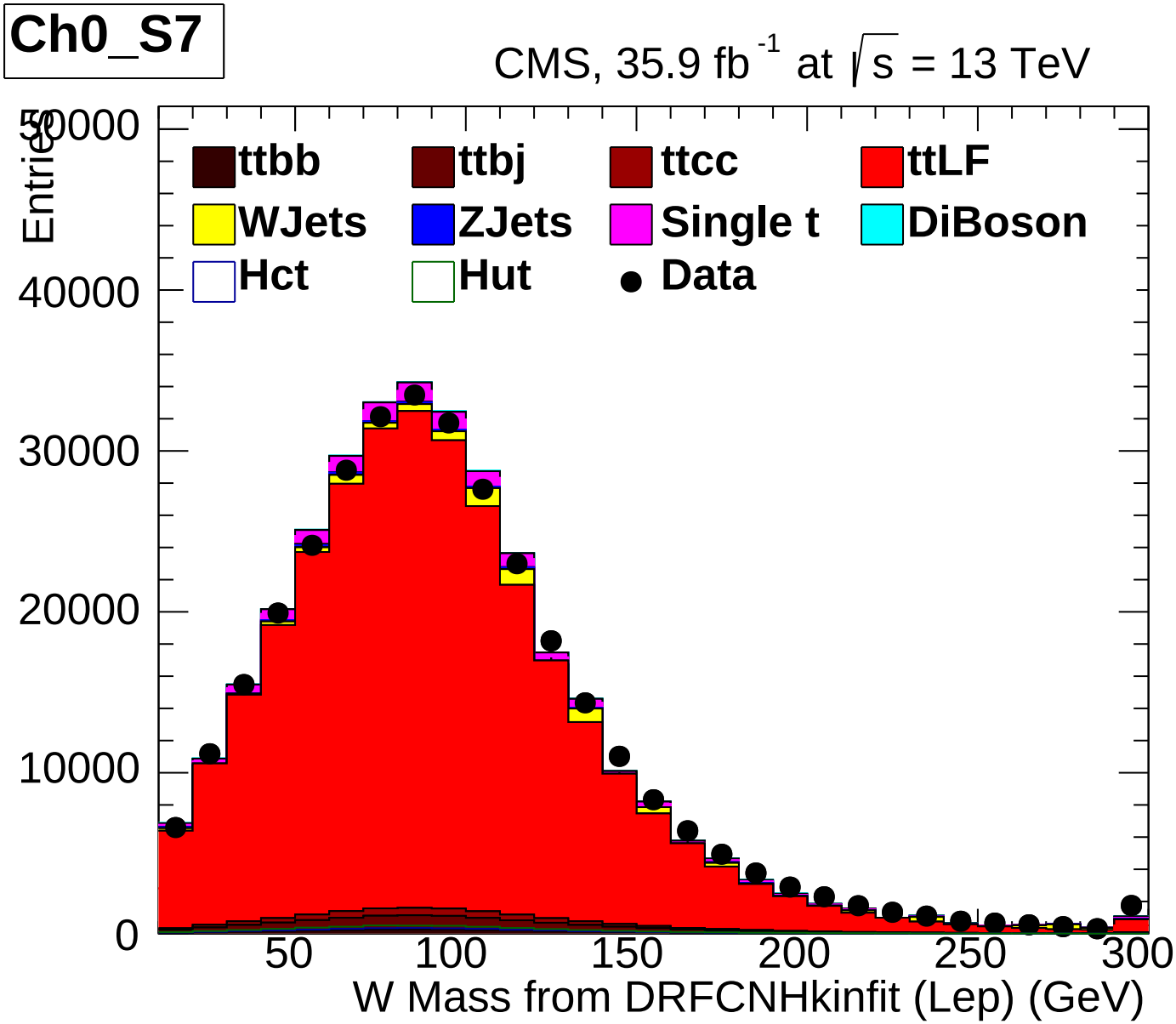

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

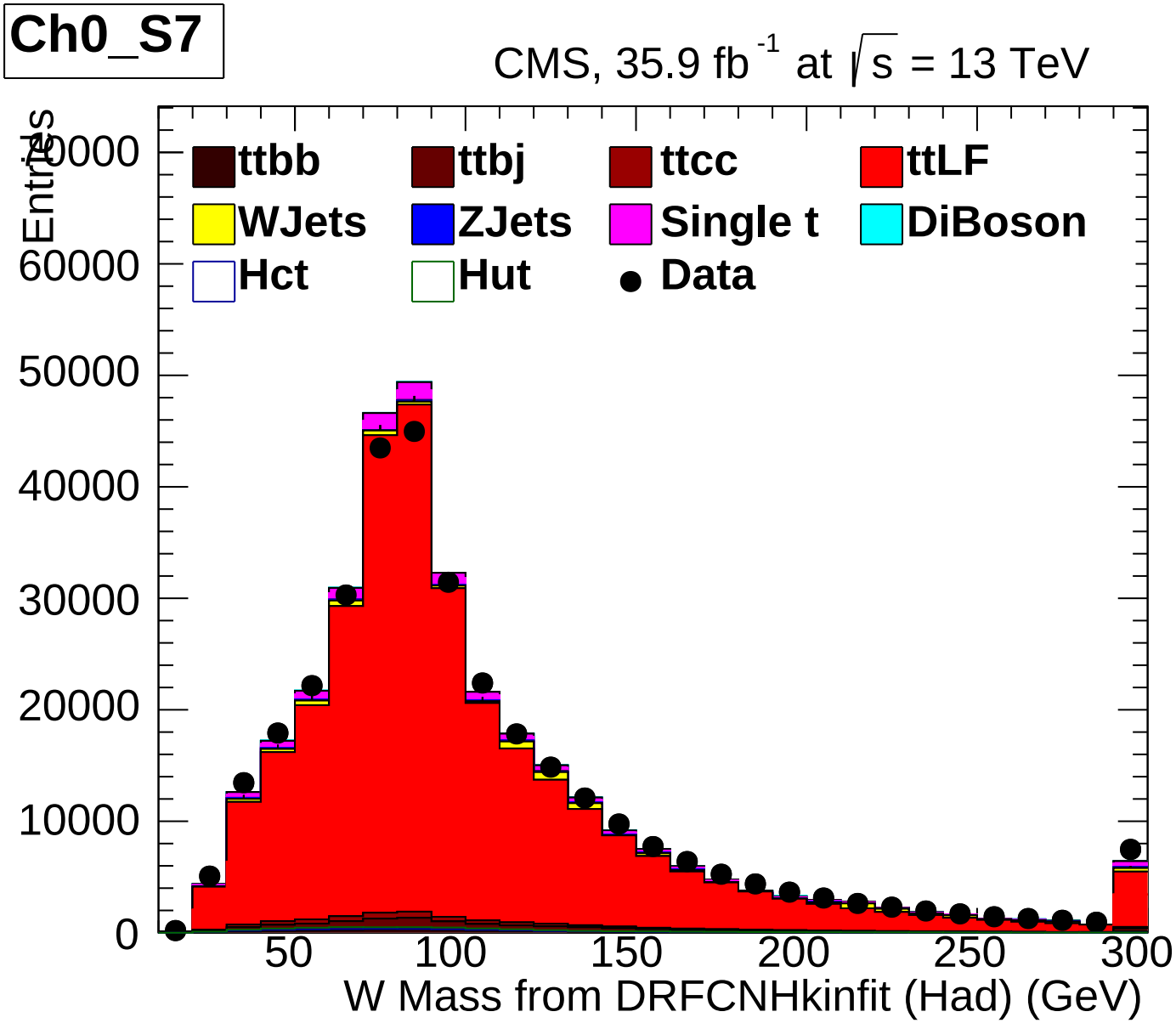

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
14000
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

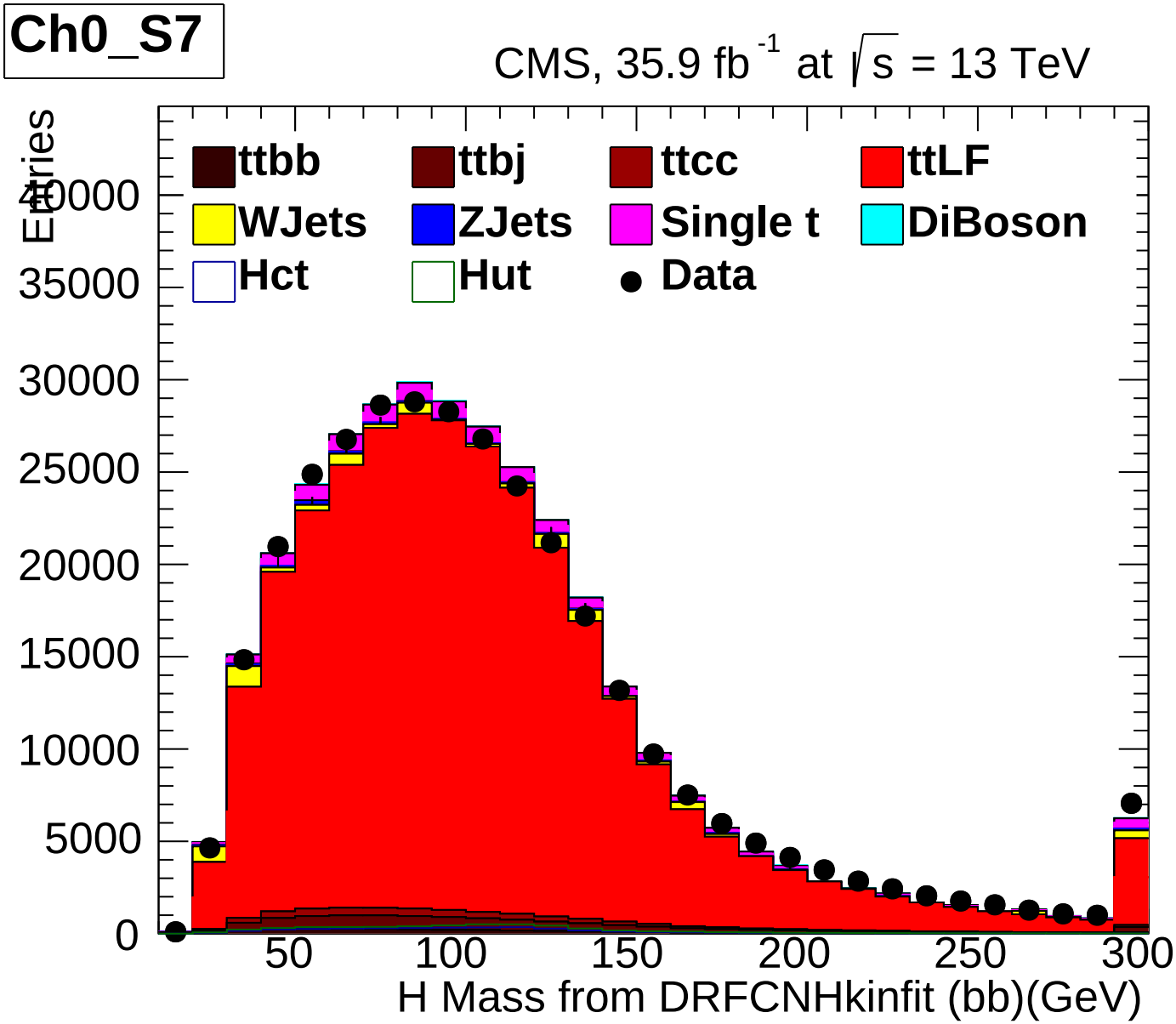

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

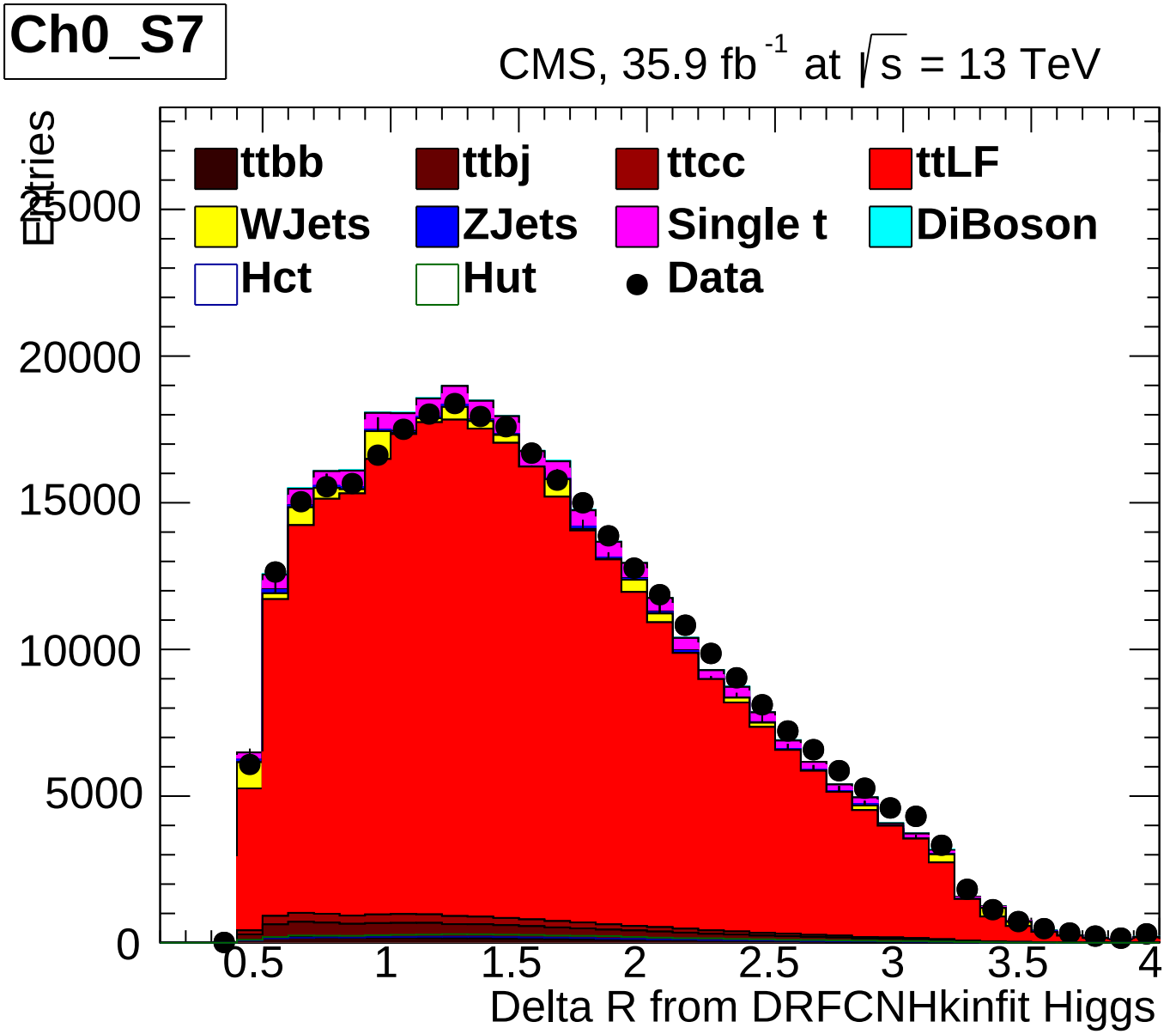

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

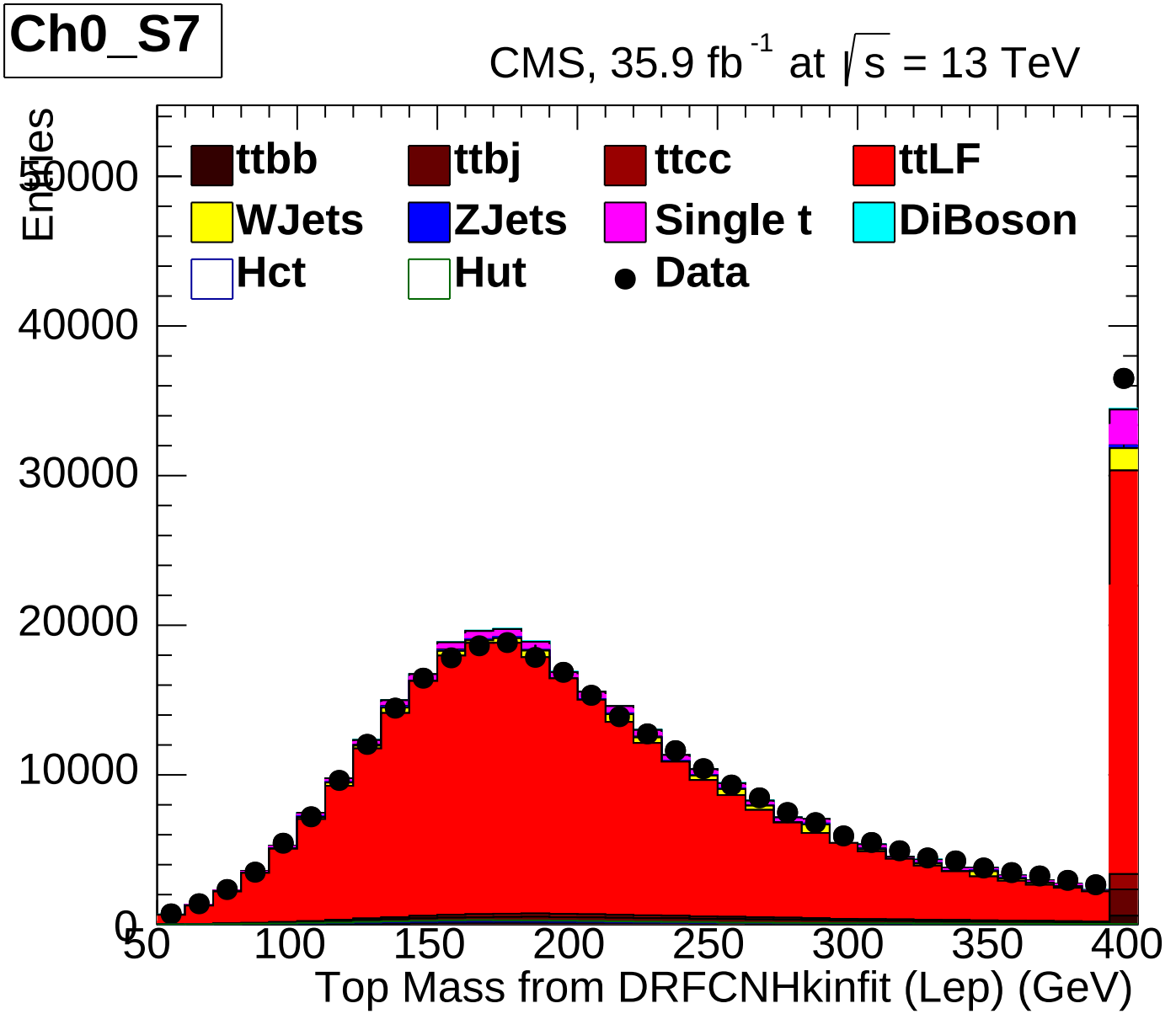

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

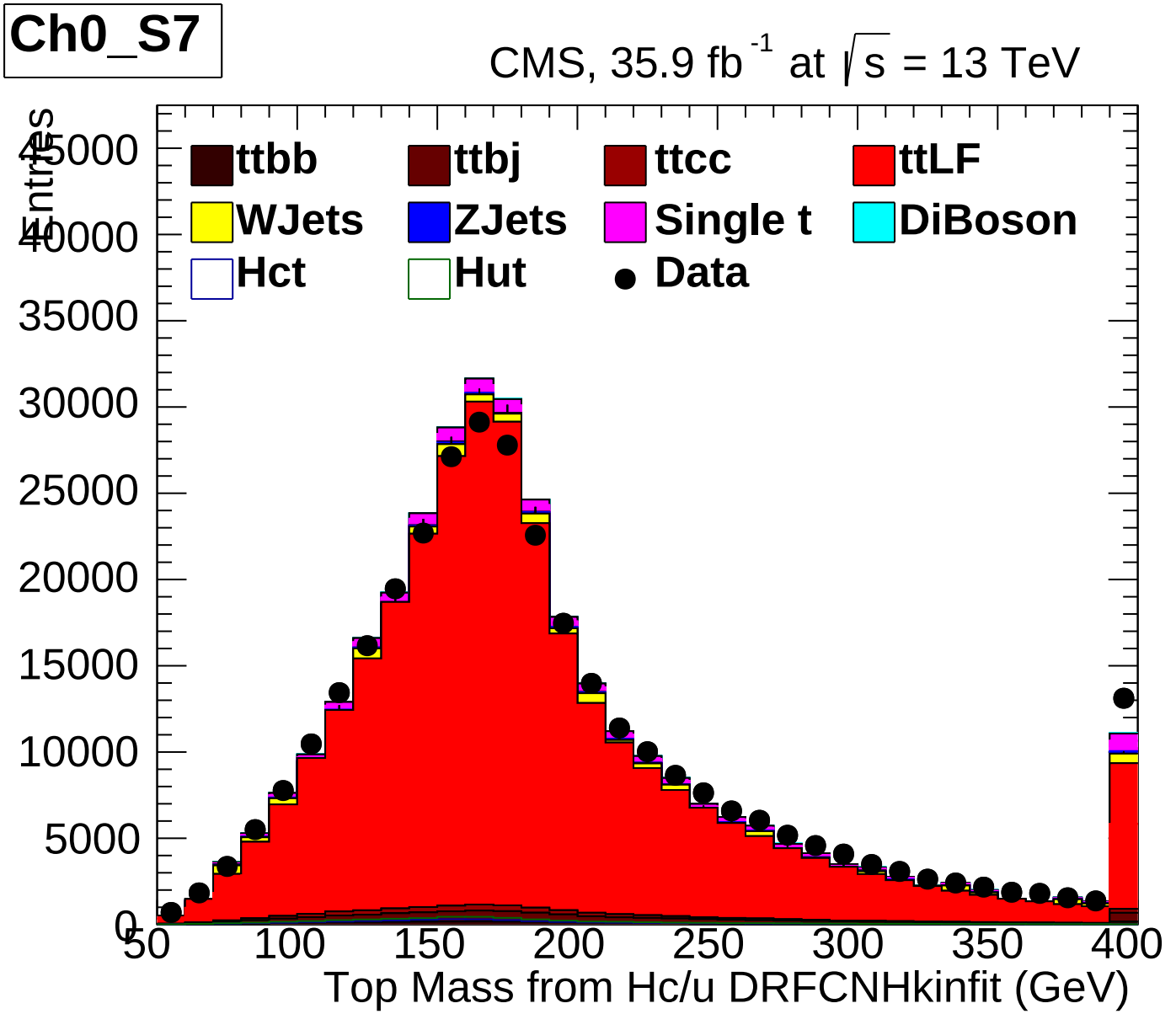

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

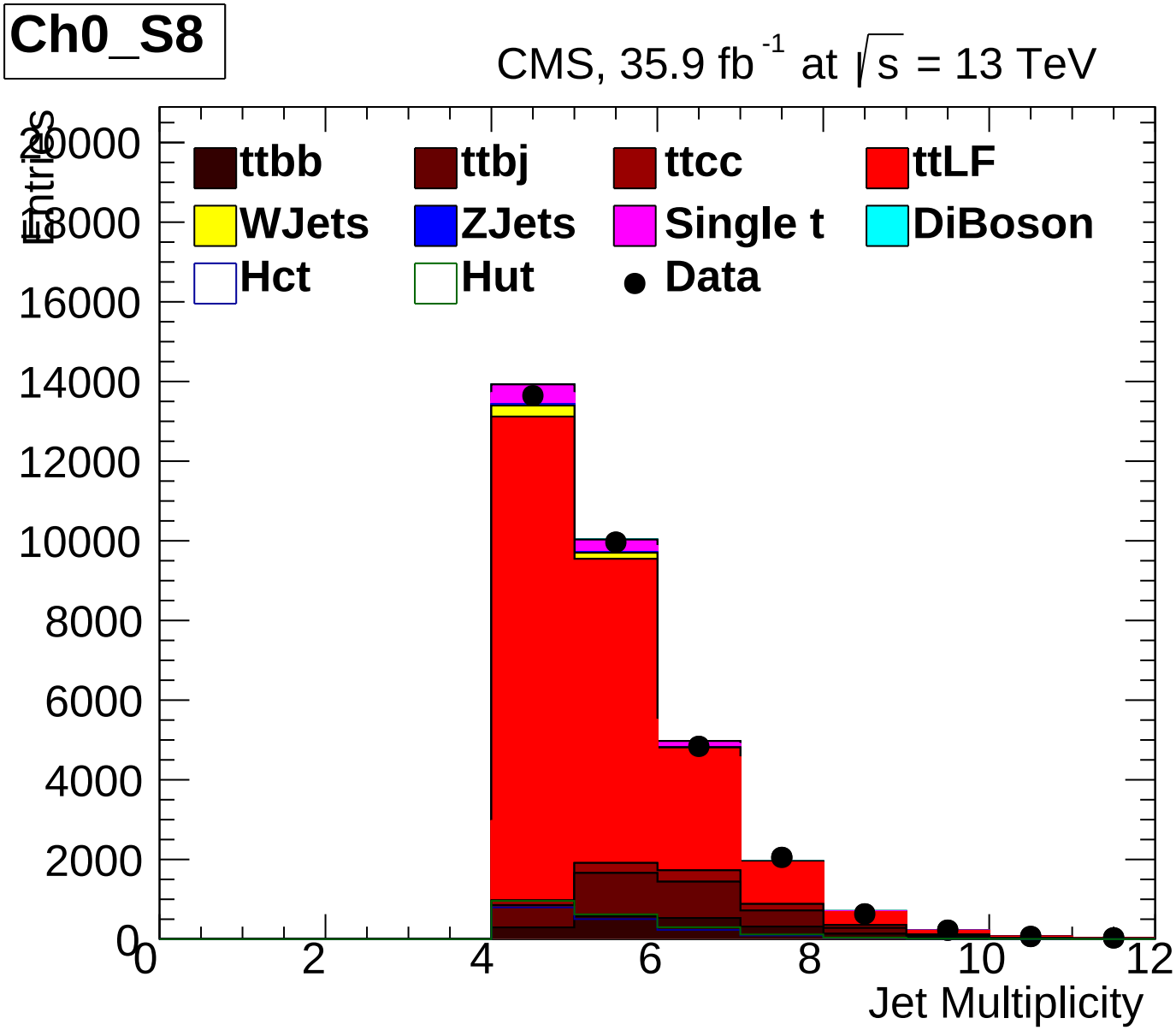

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
70000
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

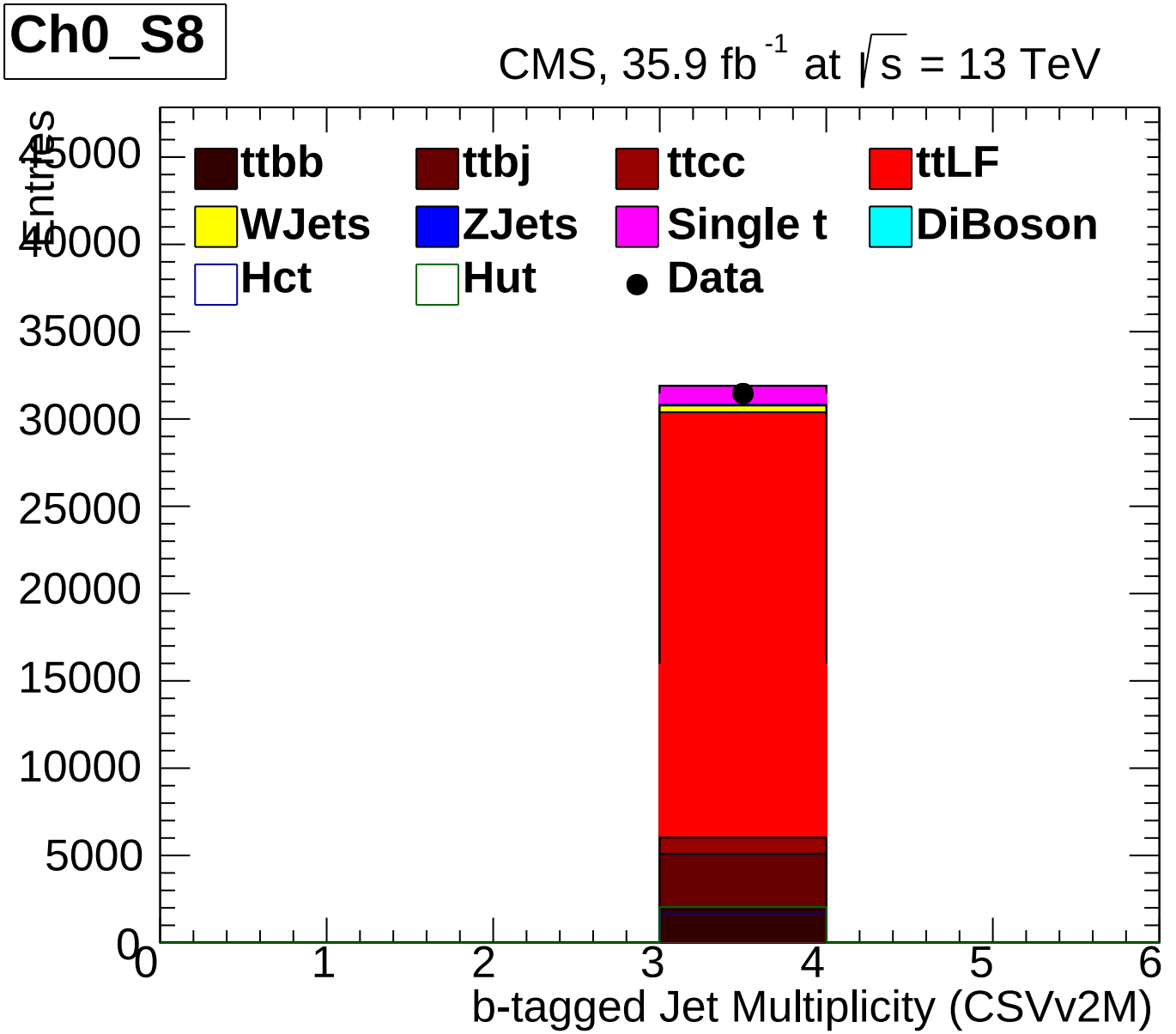

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

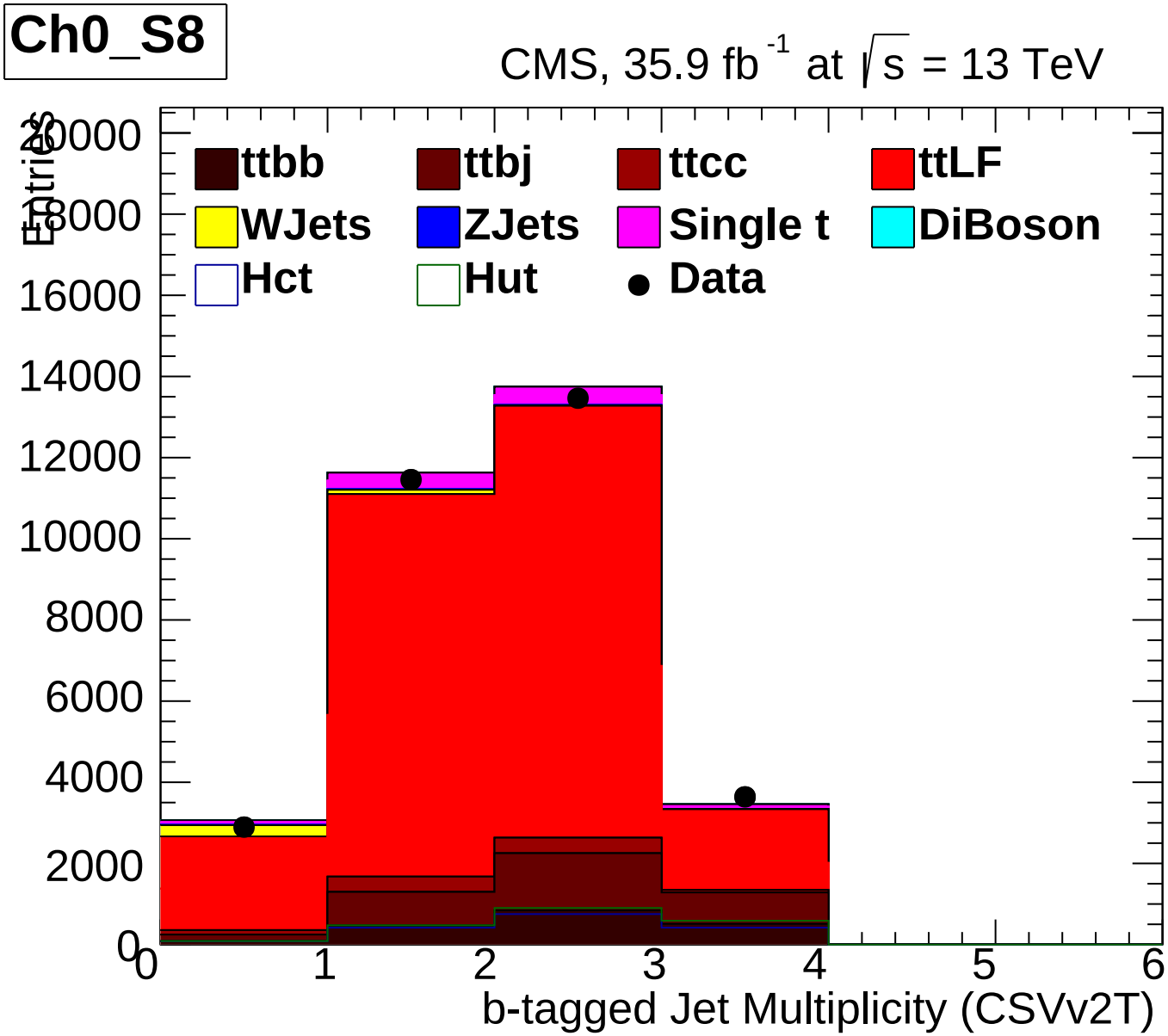

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

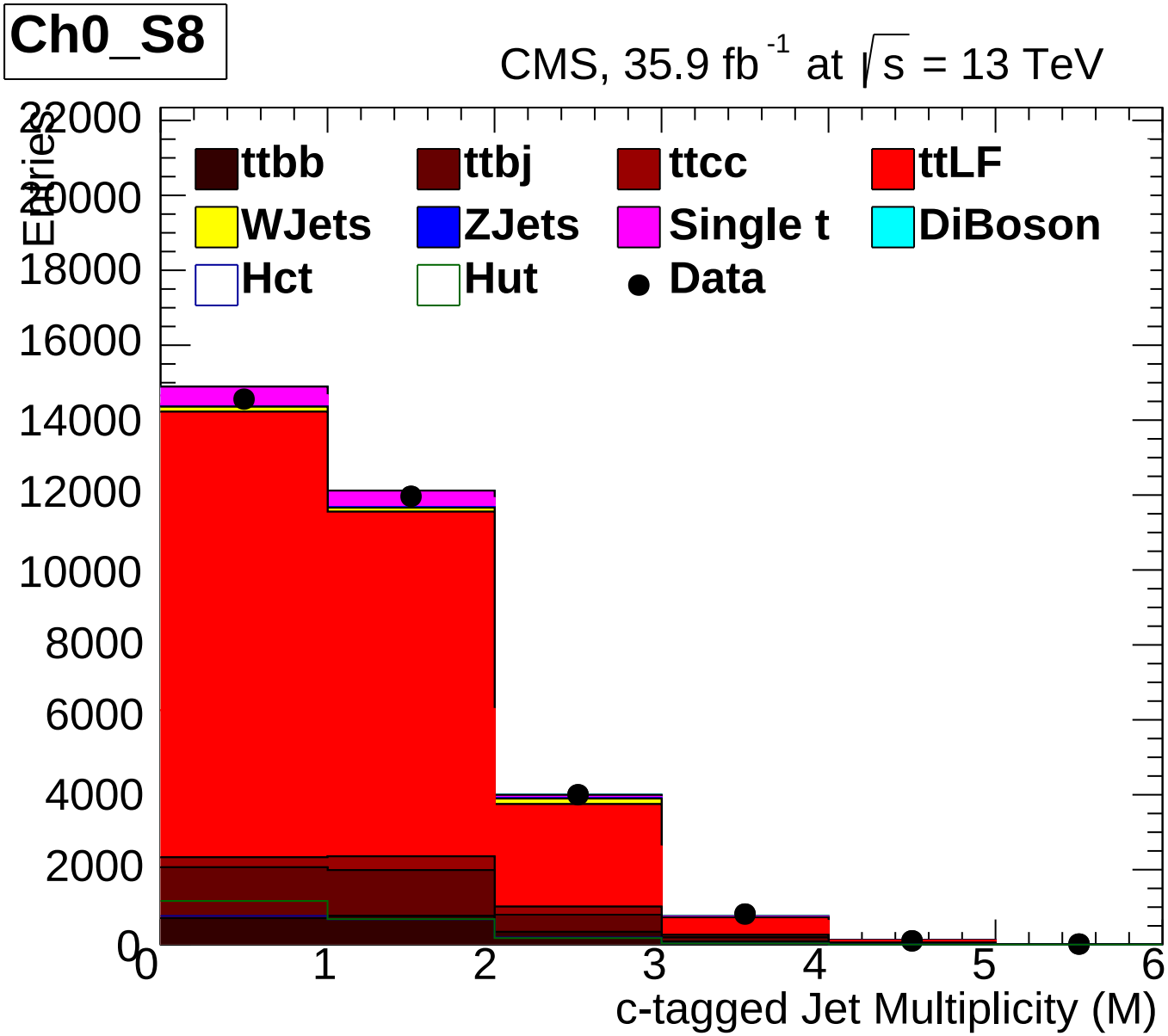

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

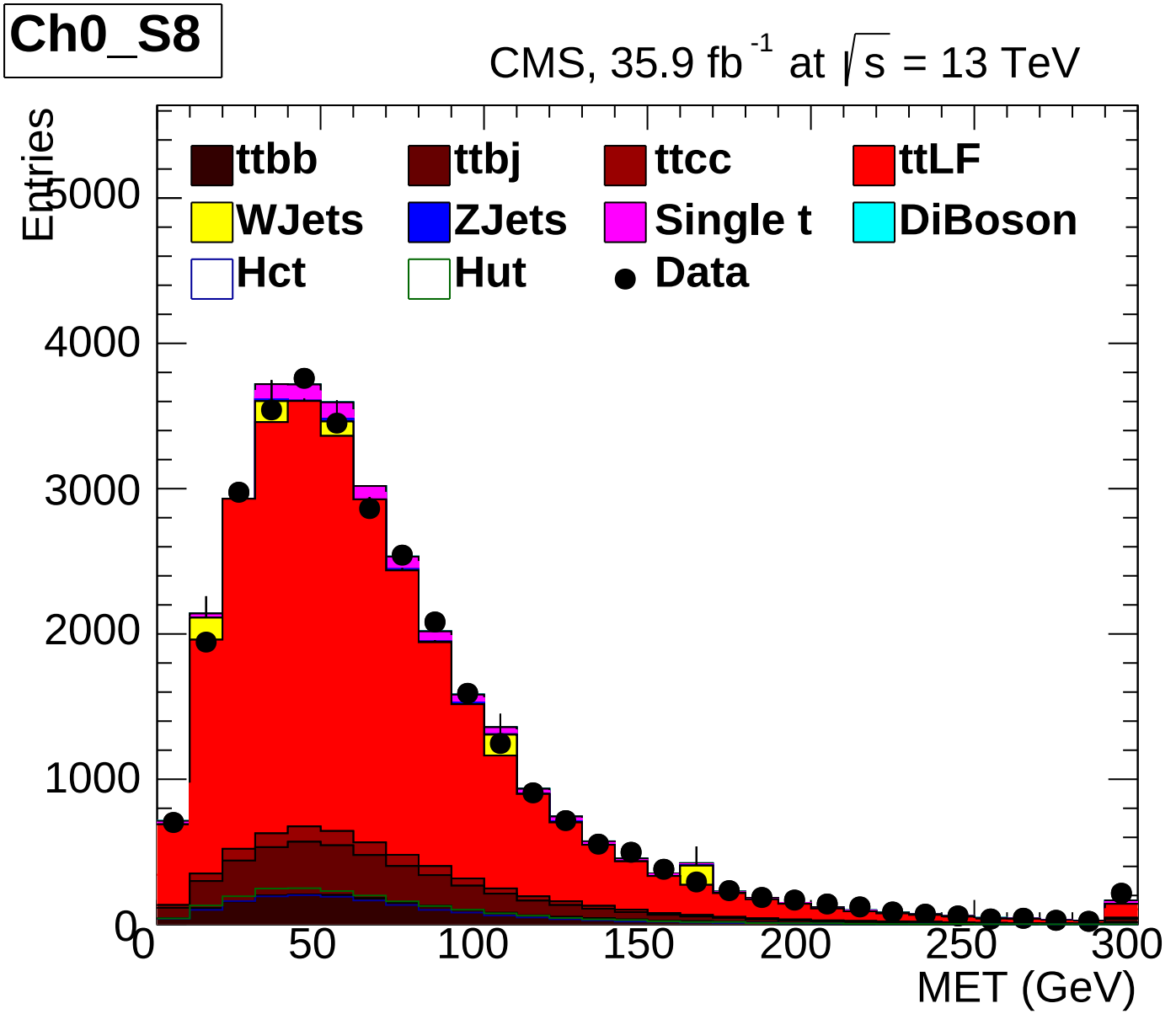

Ch0_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

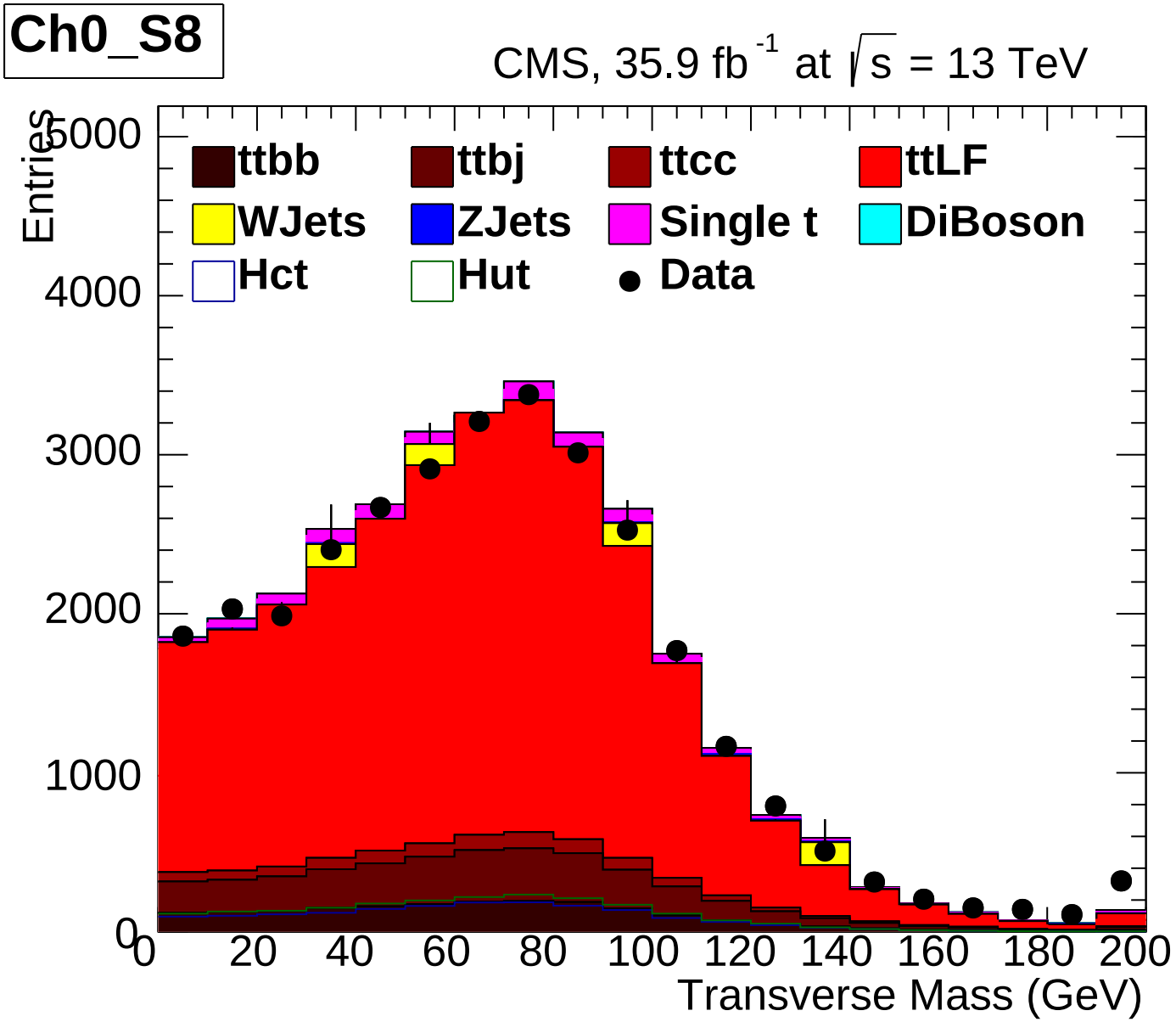

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
Jet Multiplicity
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
0
2
4
6
8
10
12

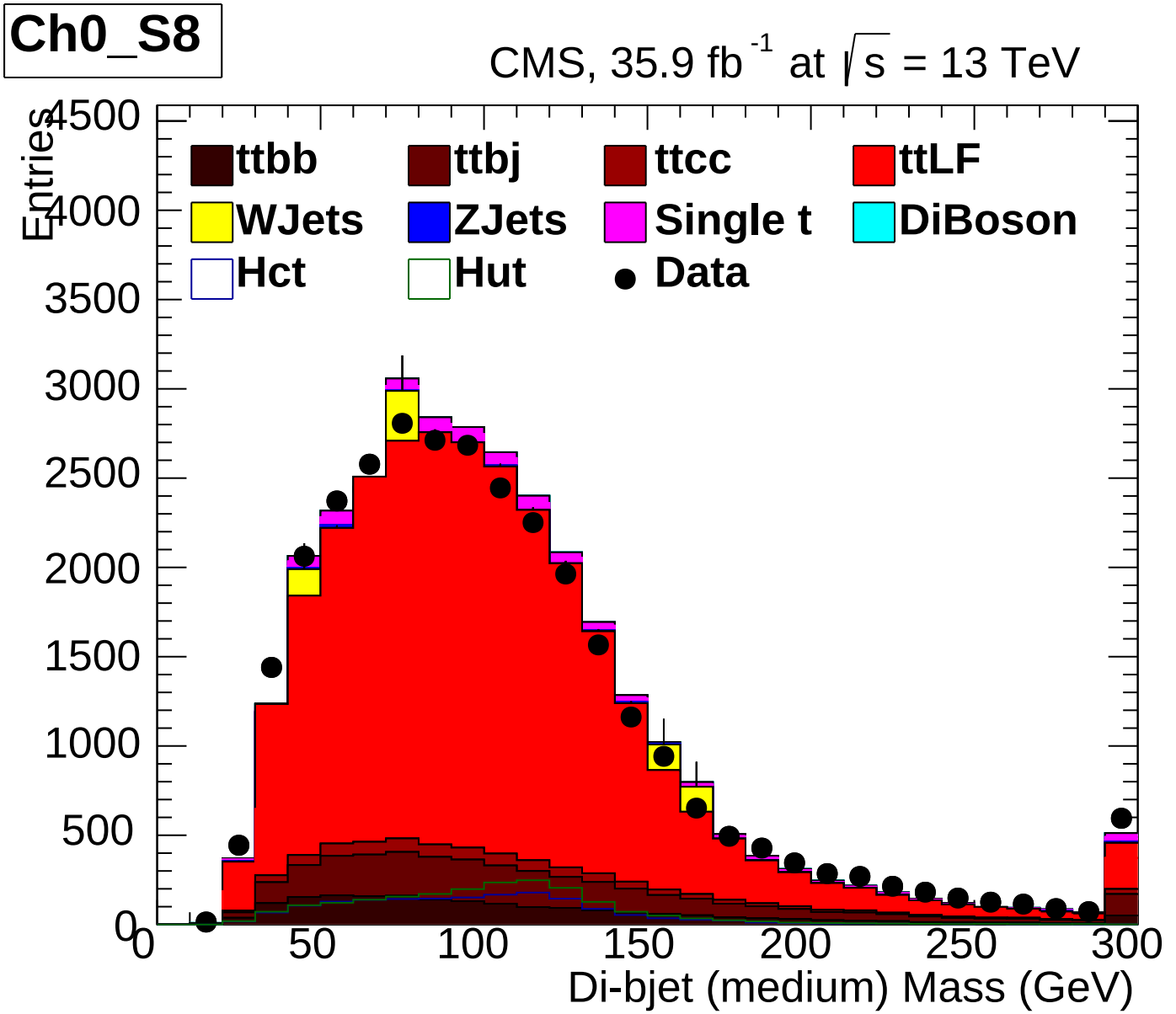

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

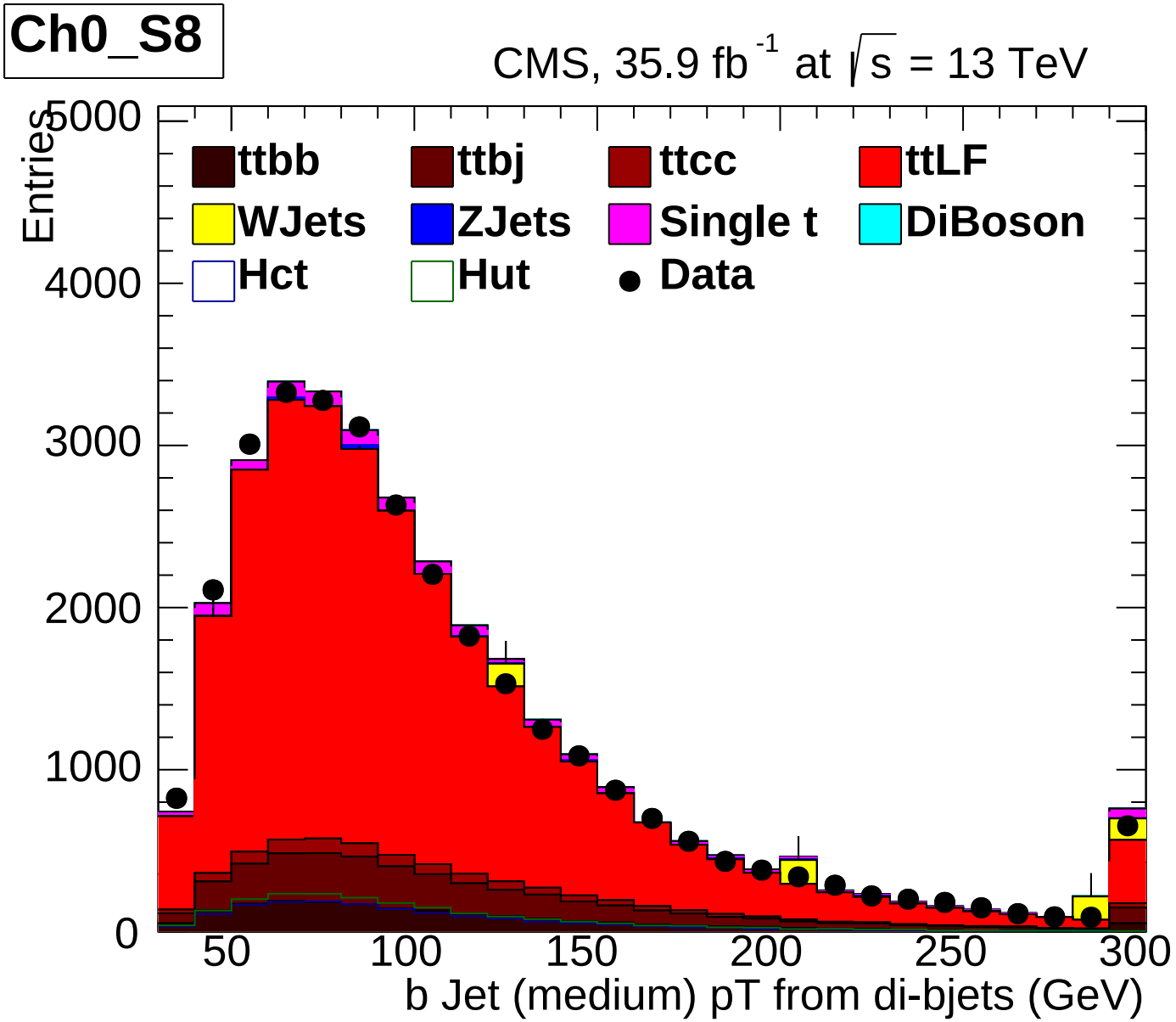

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

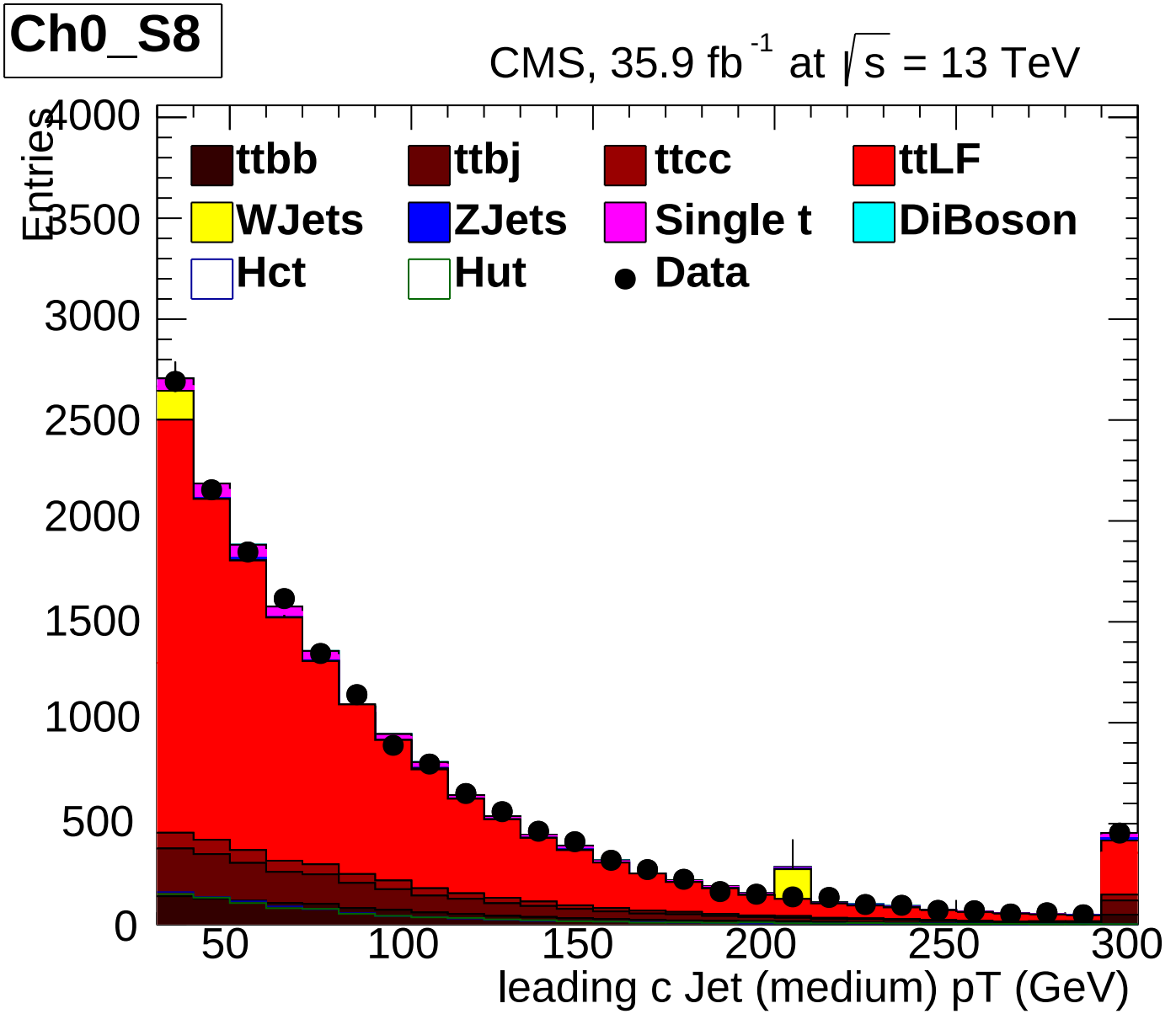

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

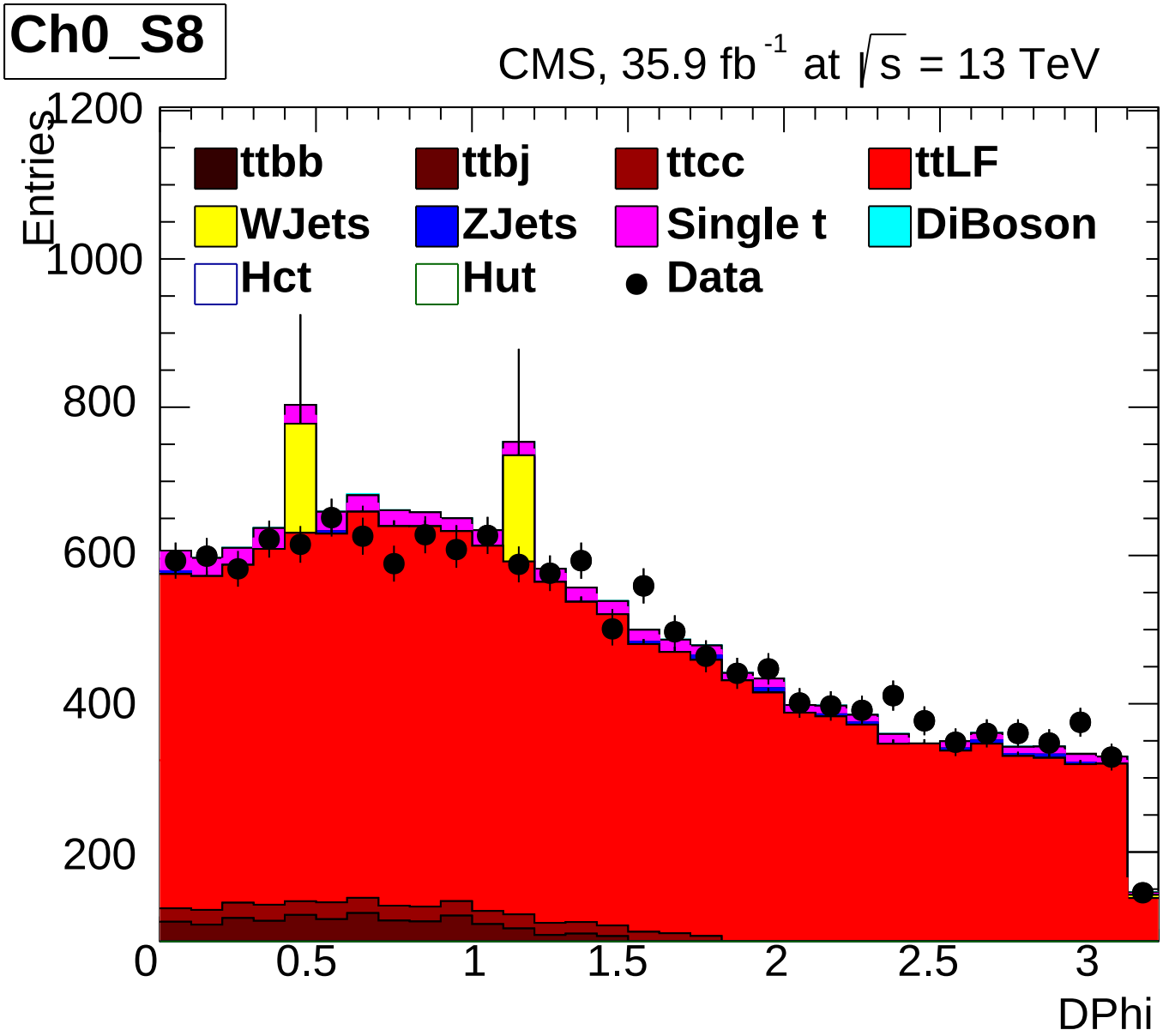

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
50
100
150
200
250
300
MET (GeV)

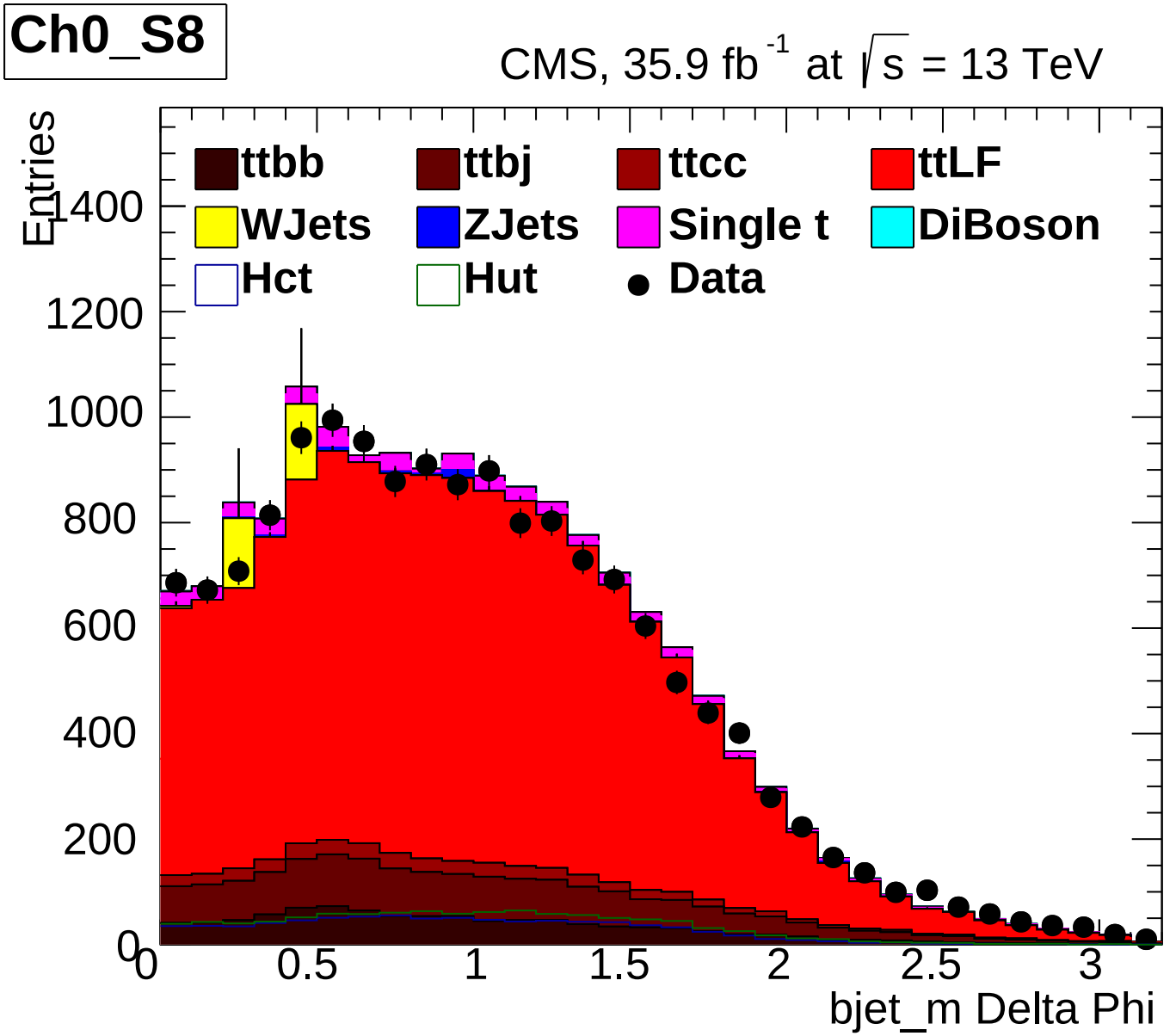

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

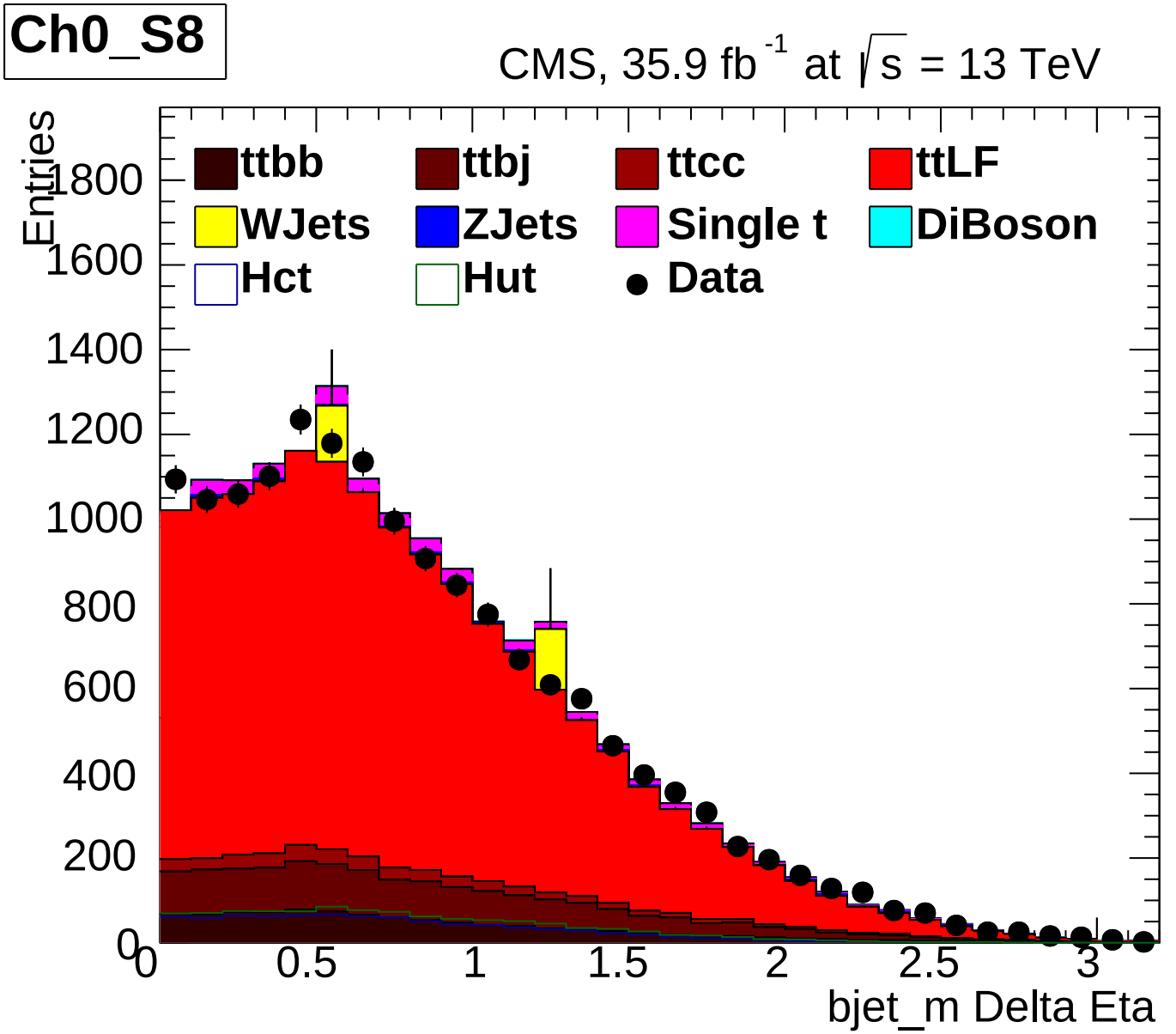

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

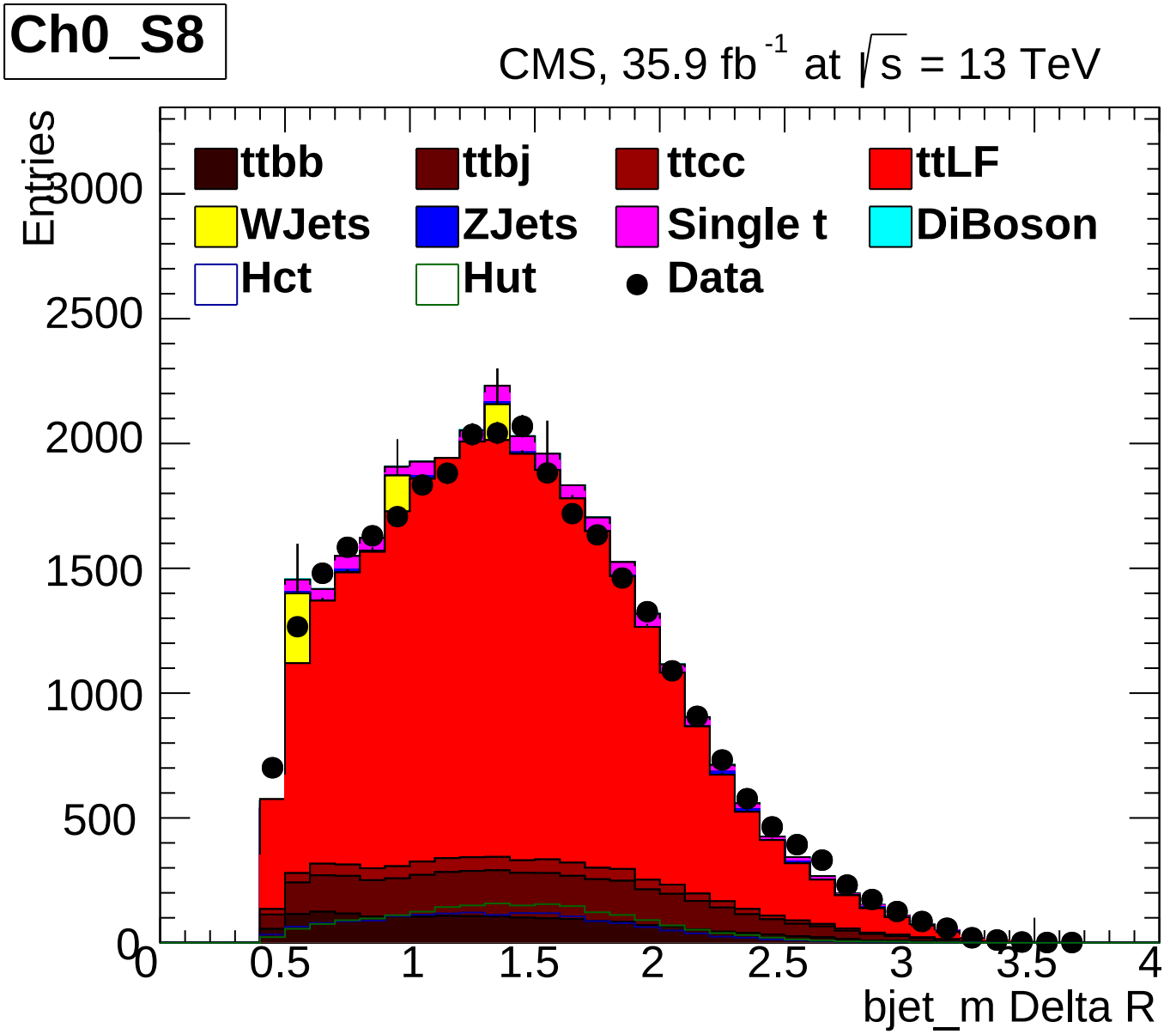

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1200
1000
800
600
400
200
0
0.5
1
1.5
2
2.5
3
DPhi


Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
200
400
600
800
1000
1200
1400
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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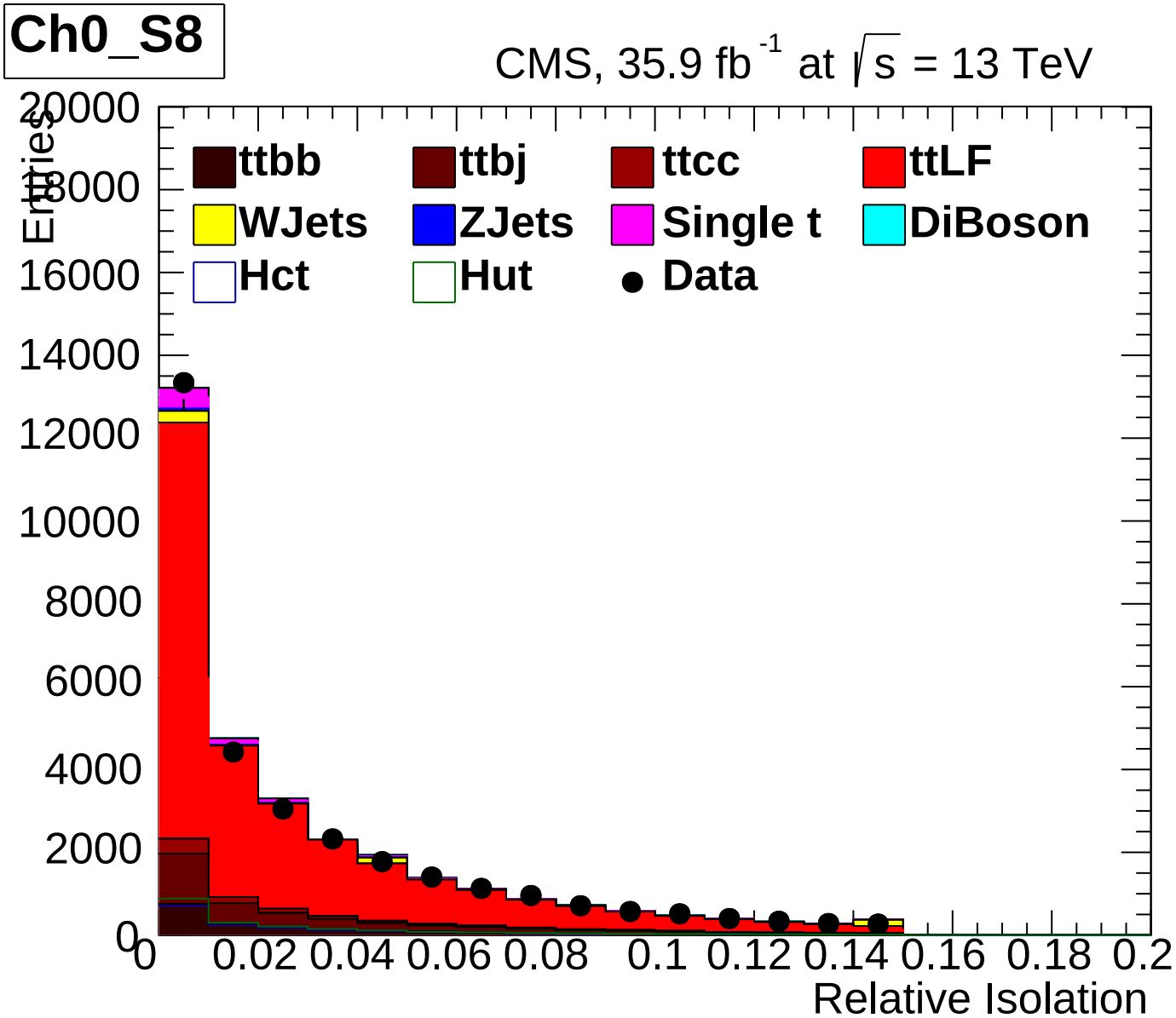
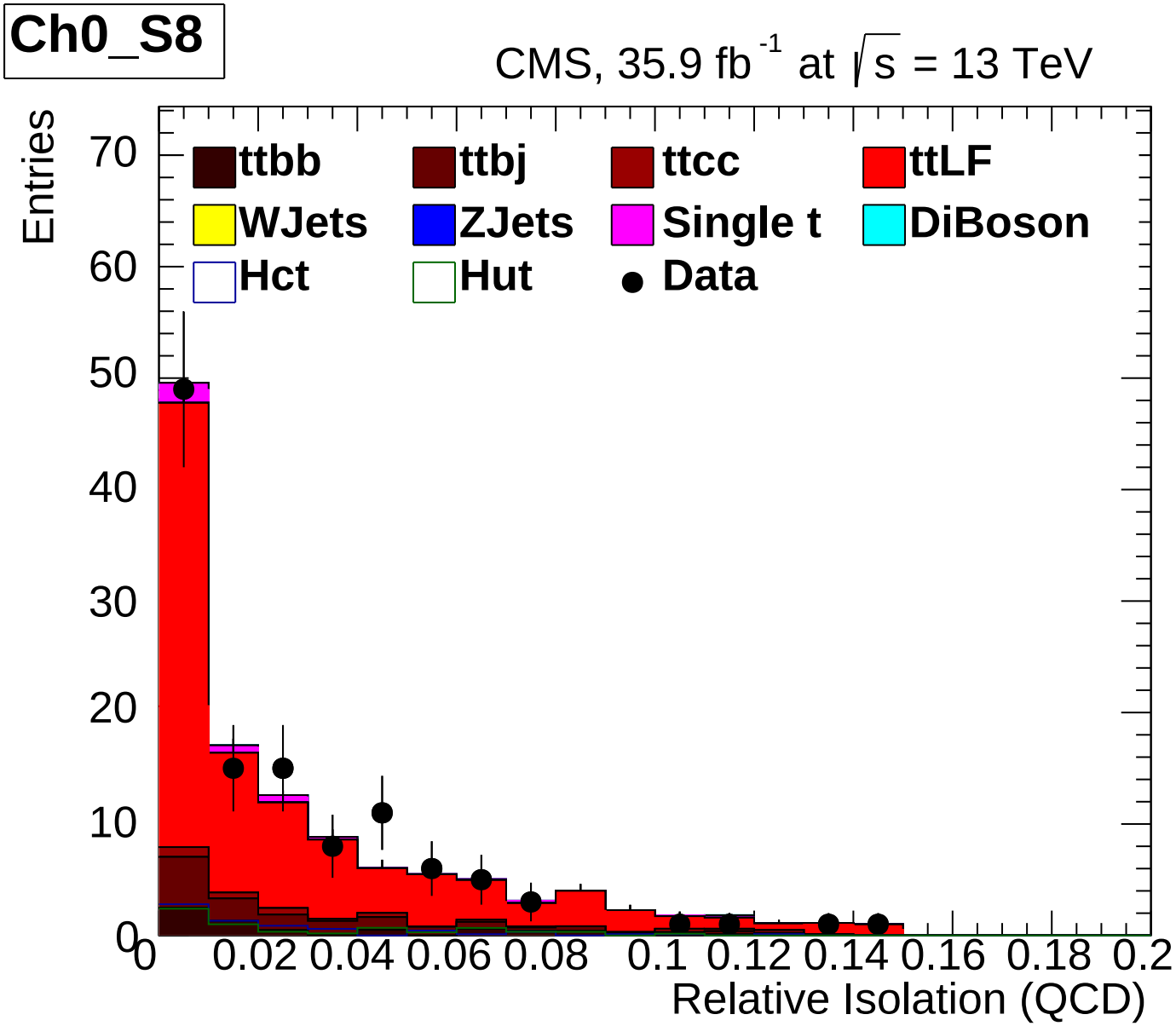
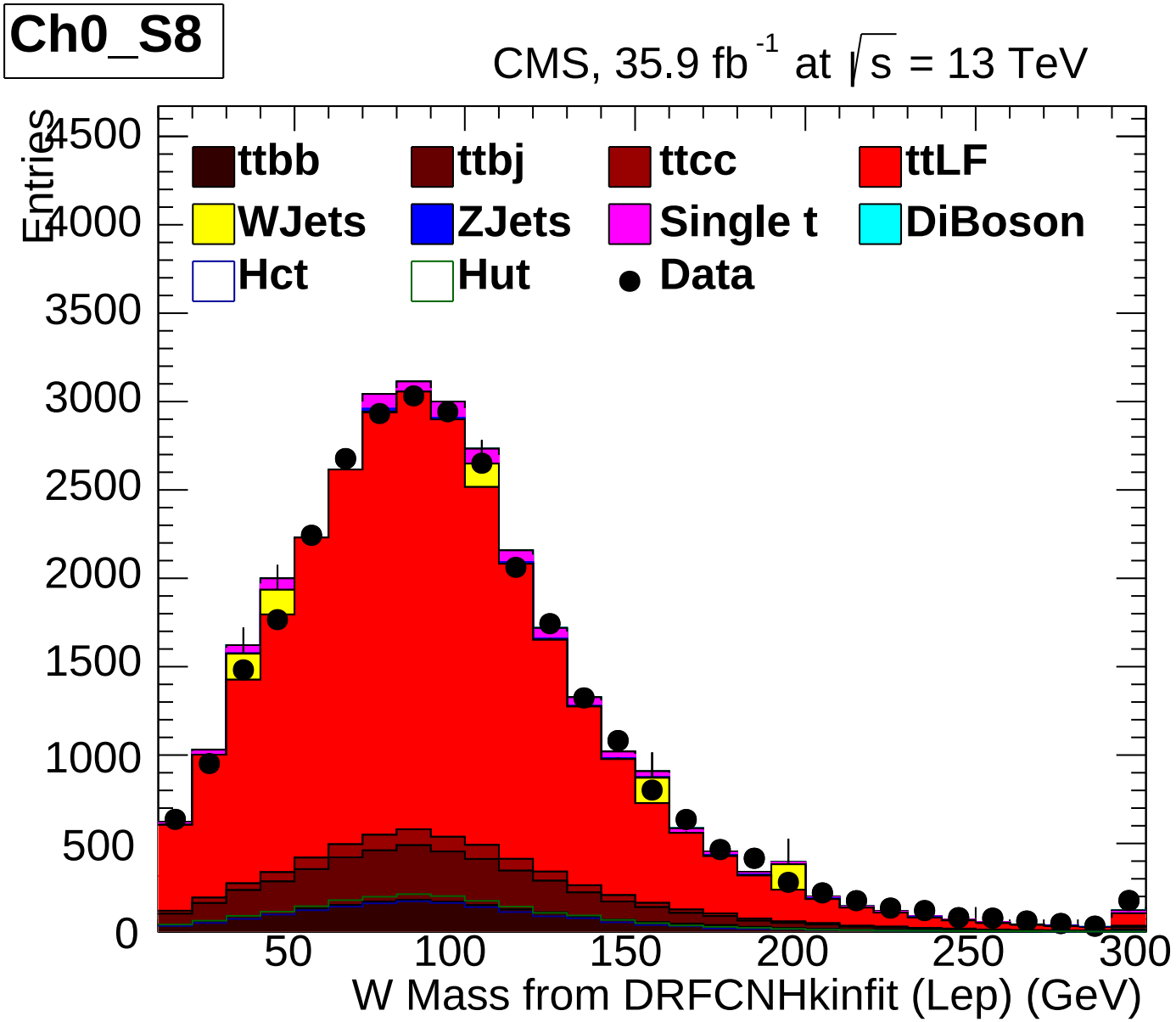
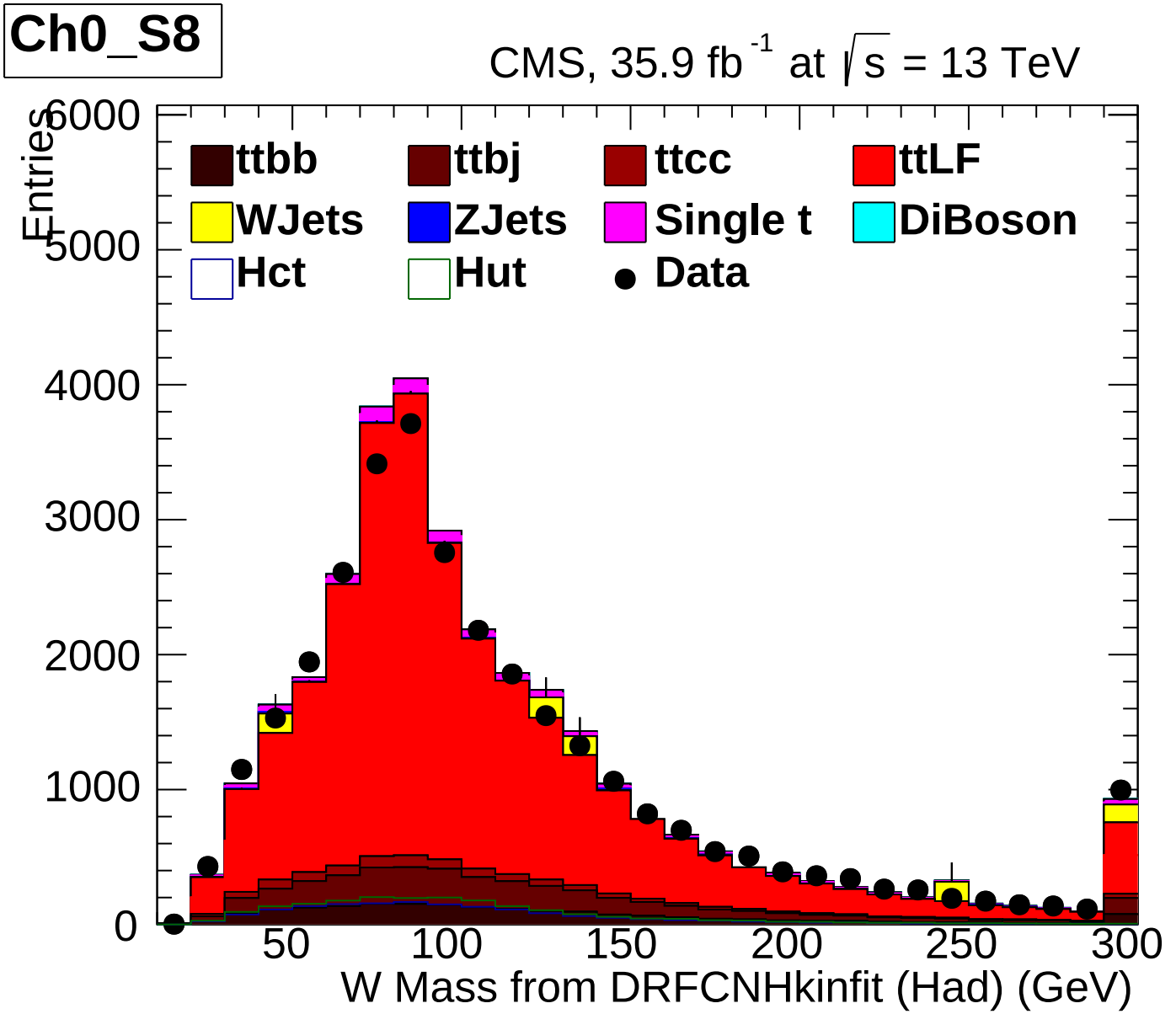
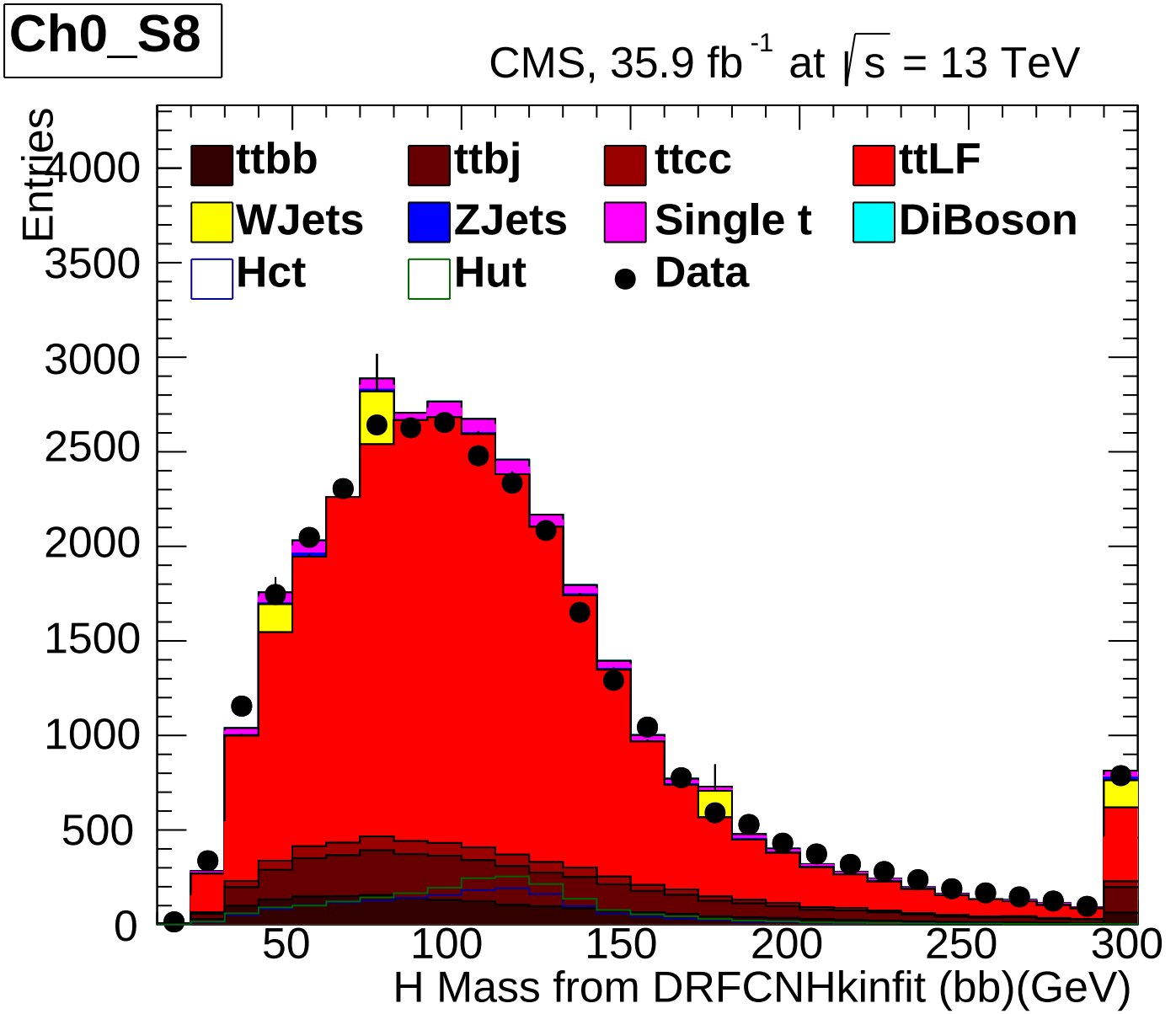
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

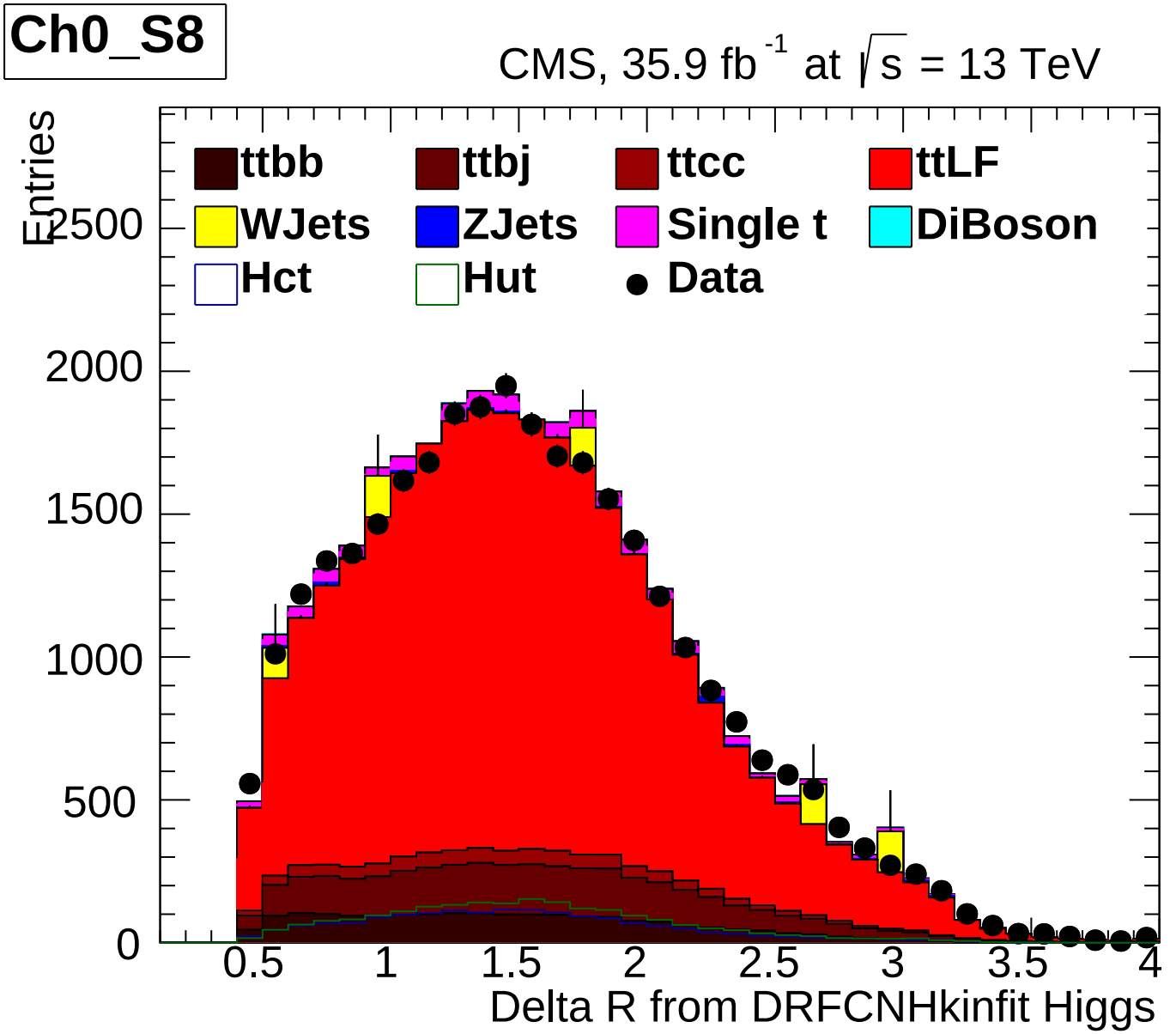

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

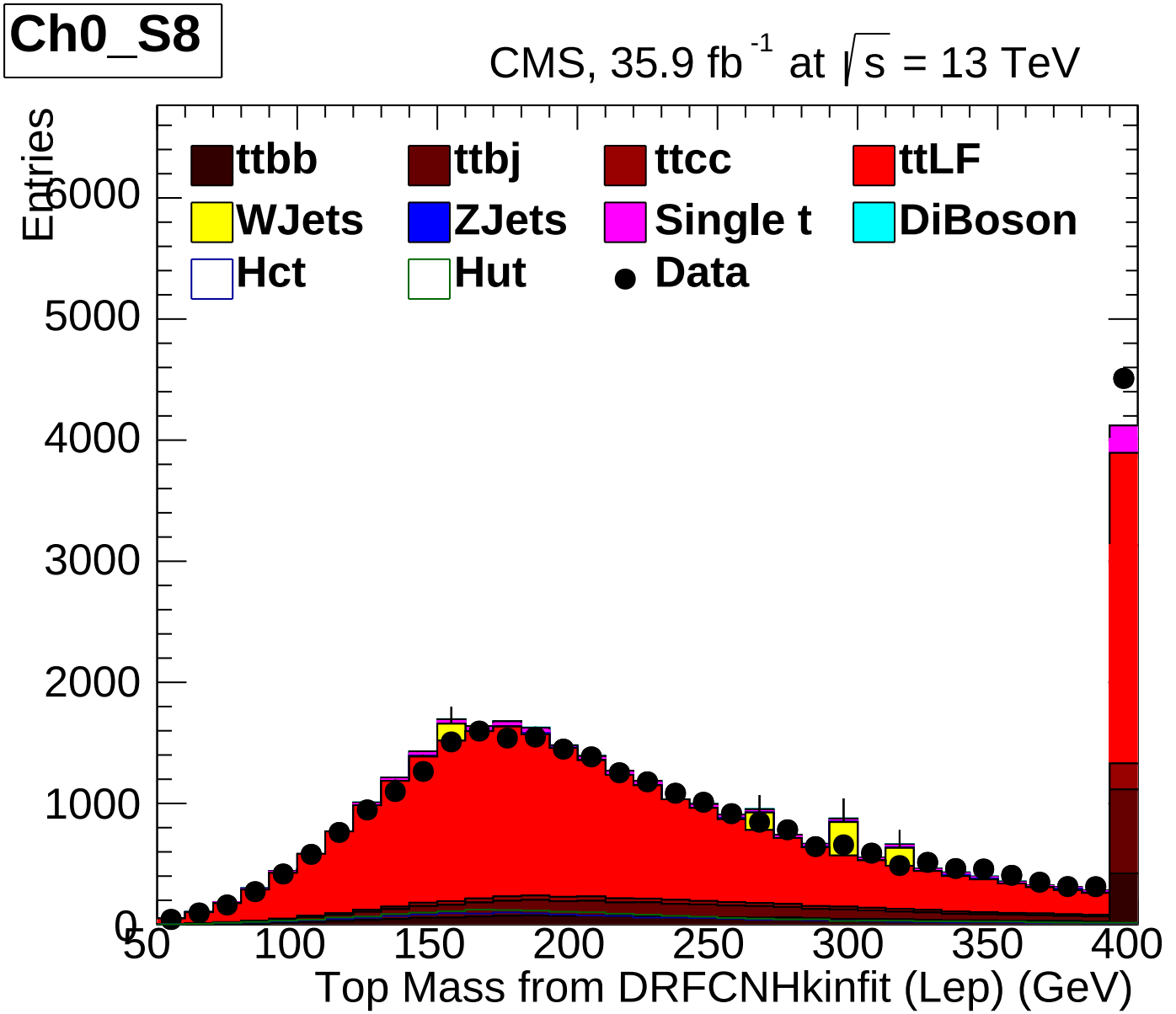

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10
20
30
40
50
60
70
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

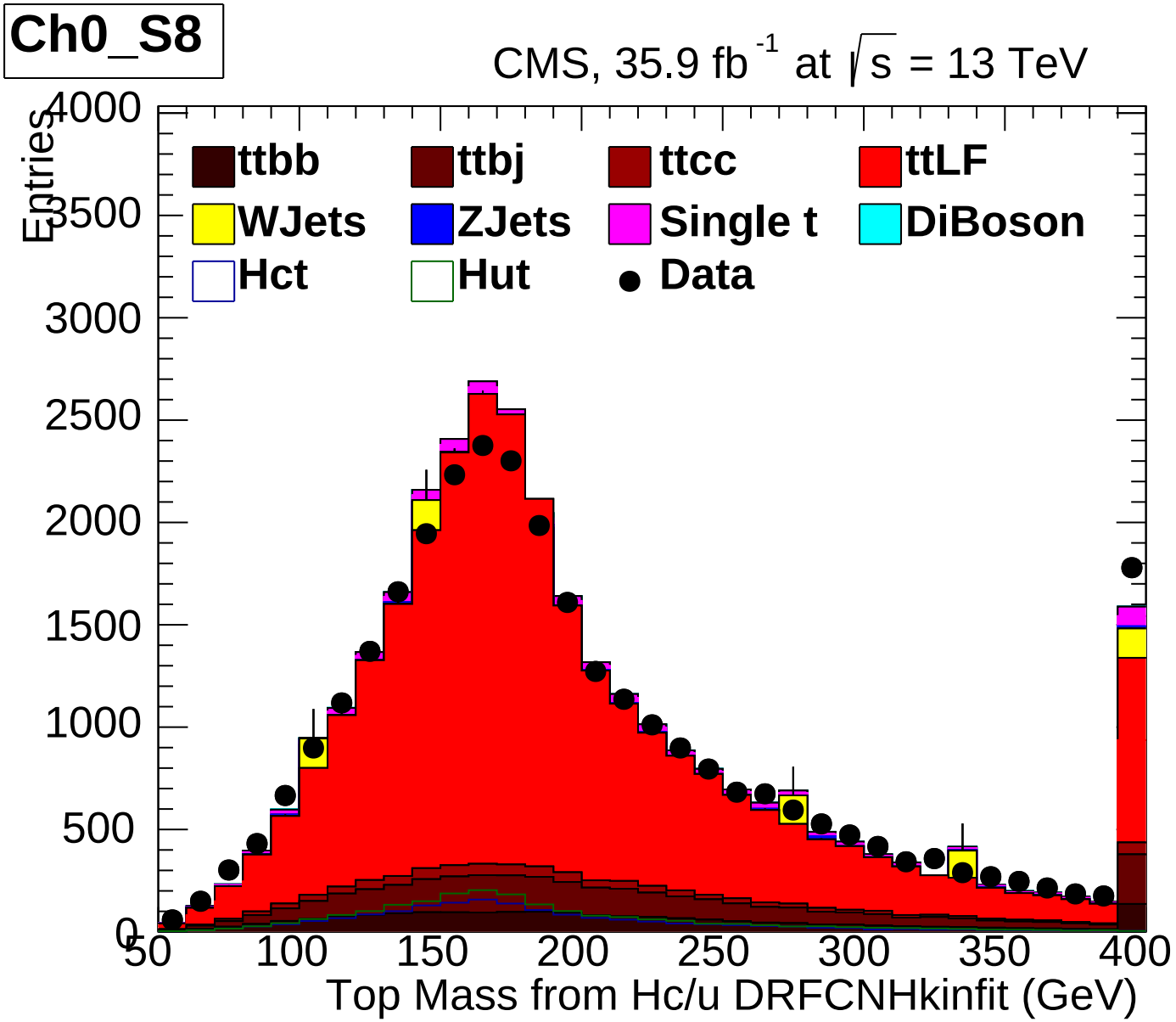

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

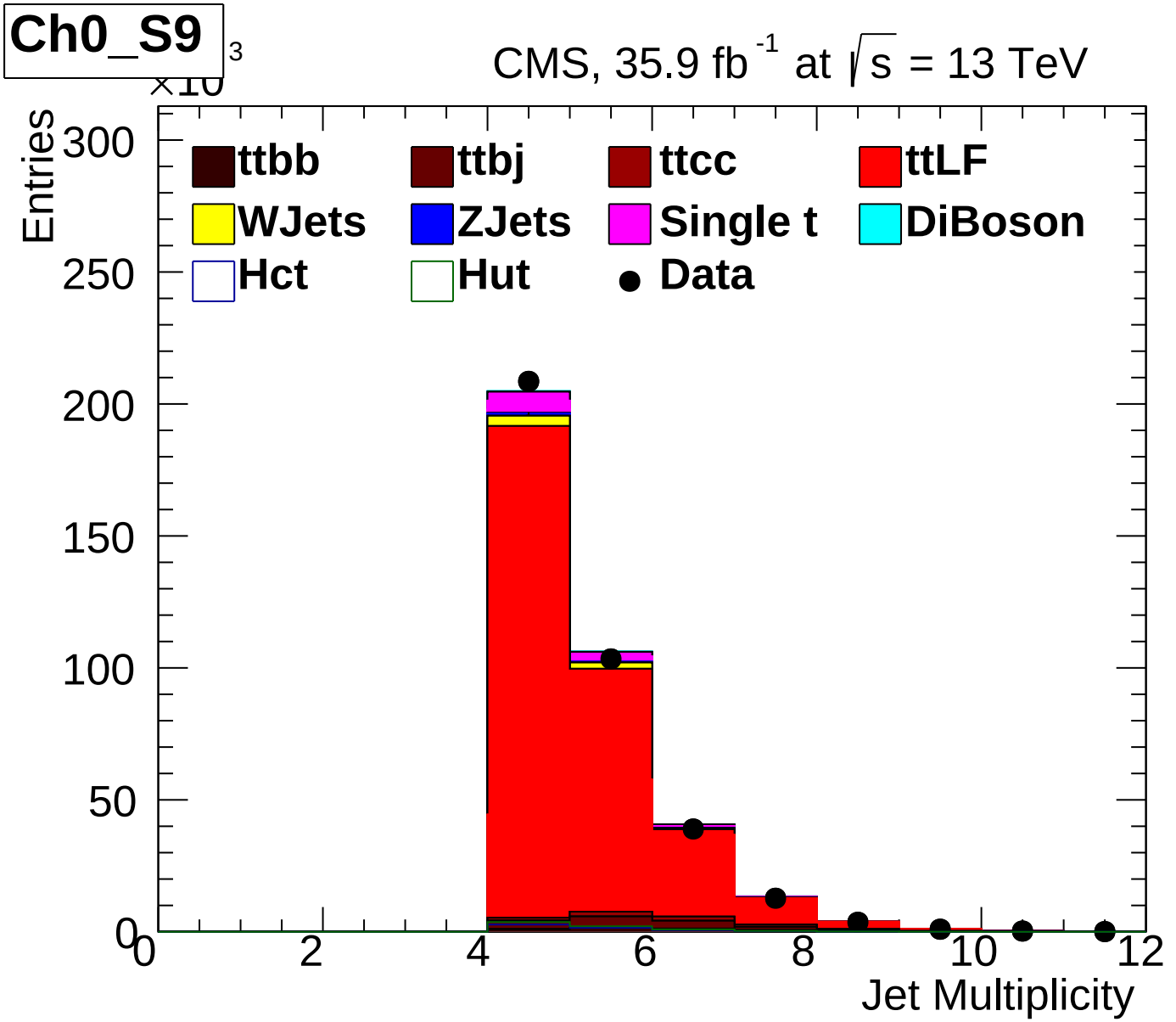

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

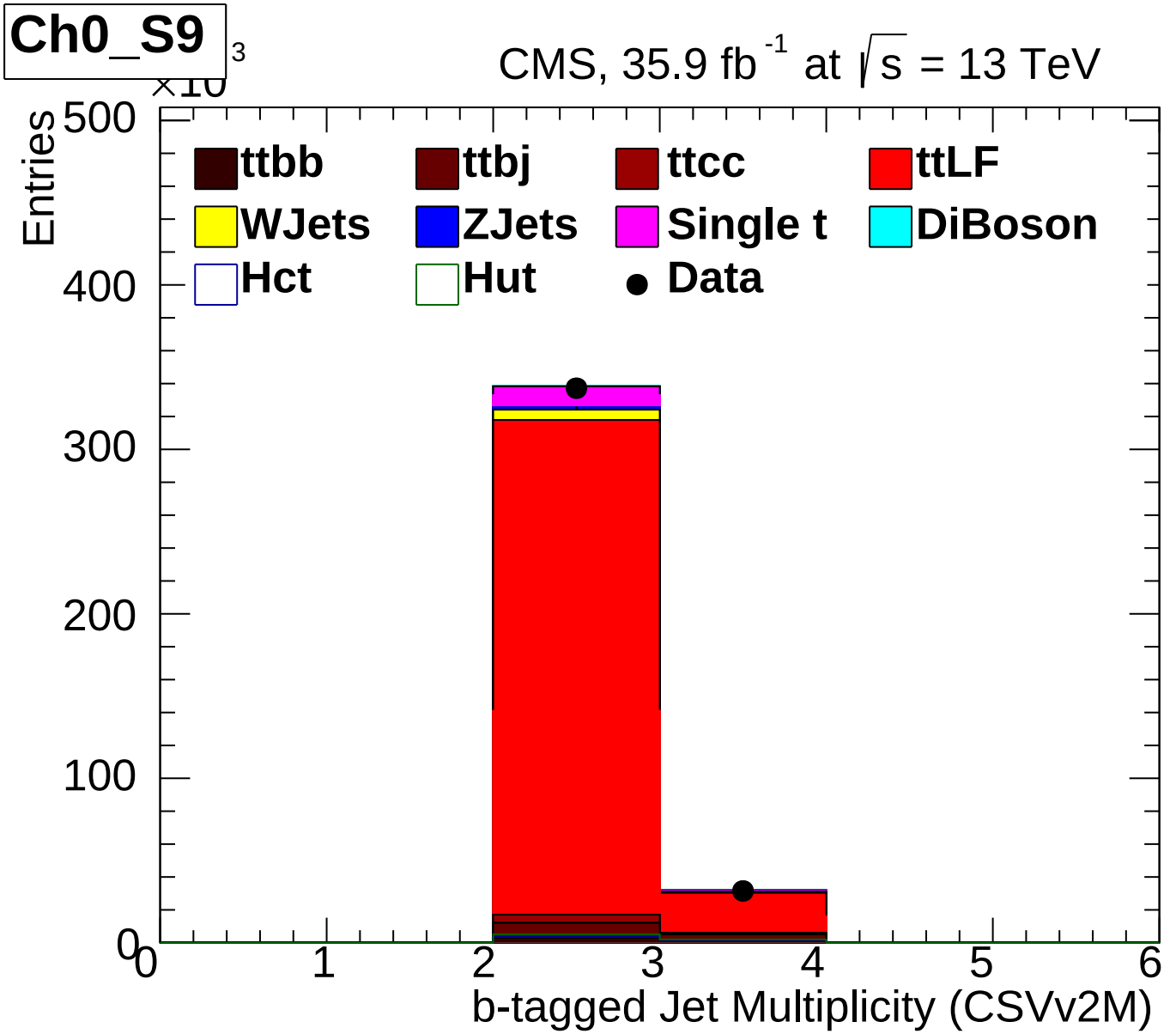

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

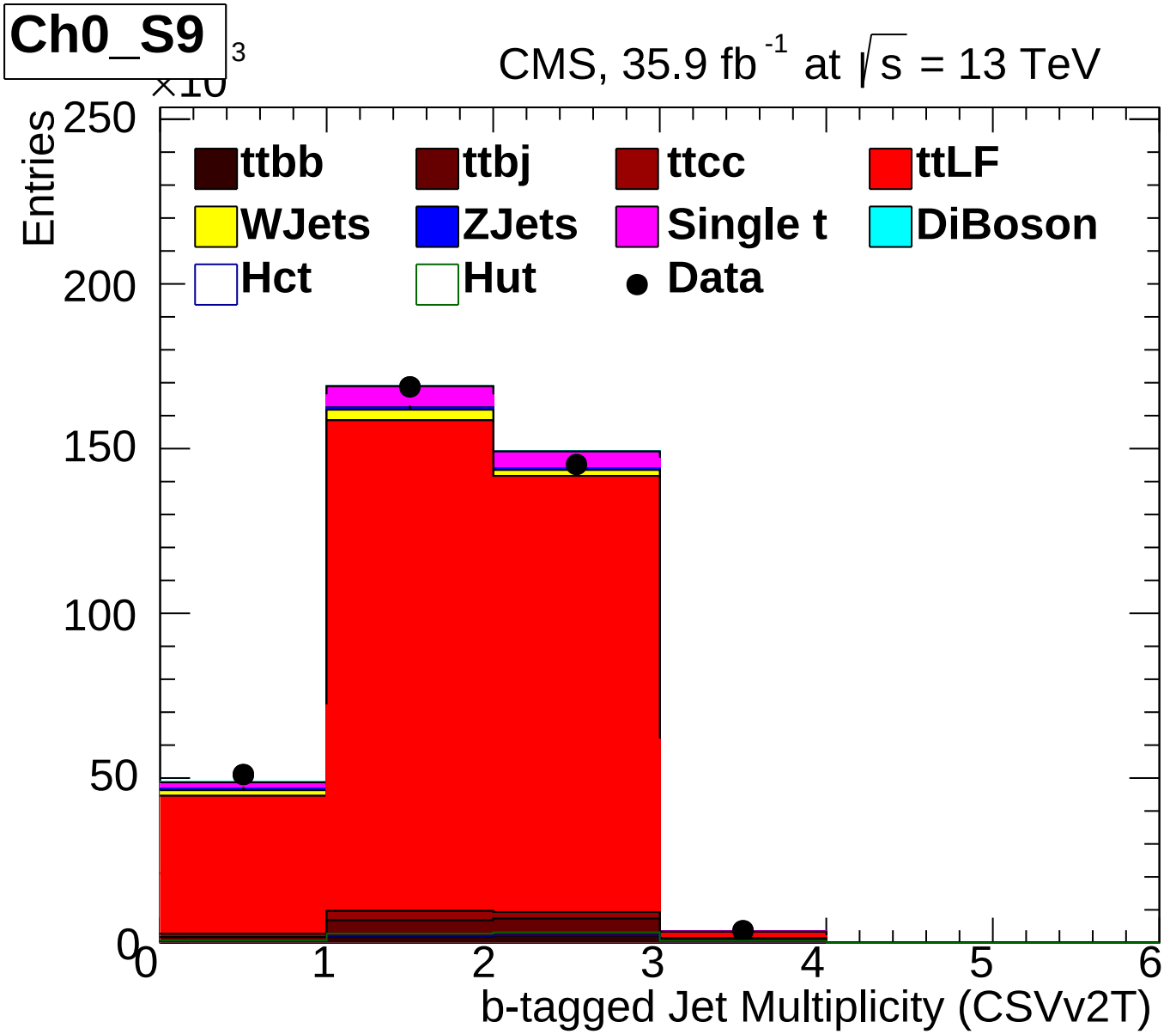

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

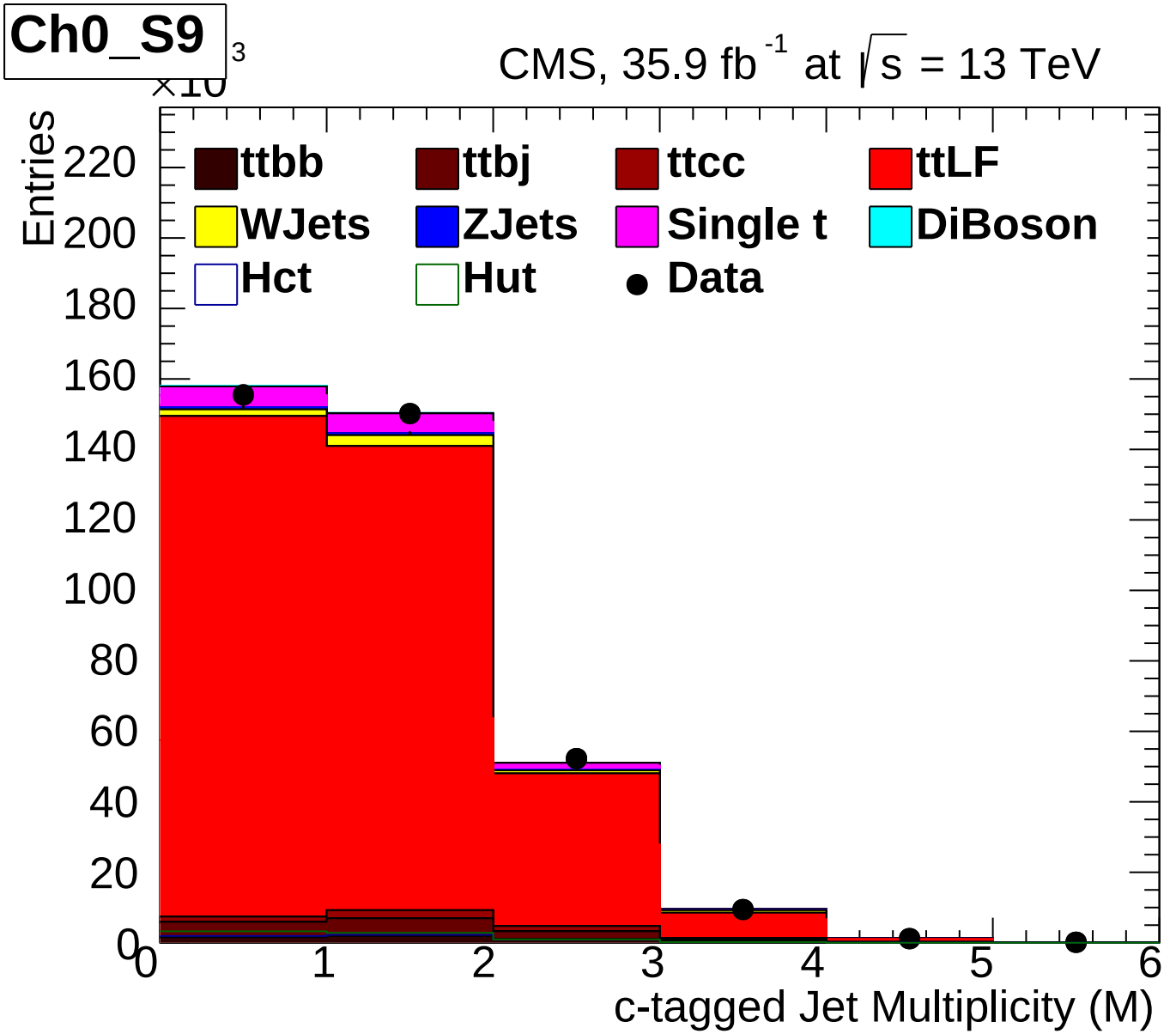

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

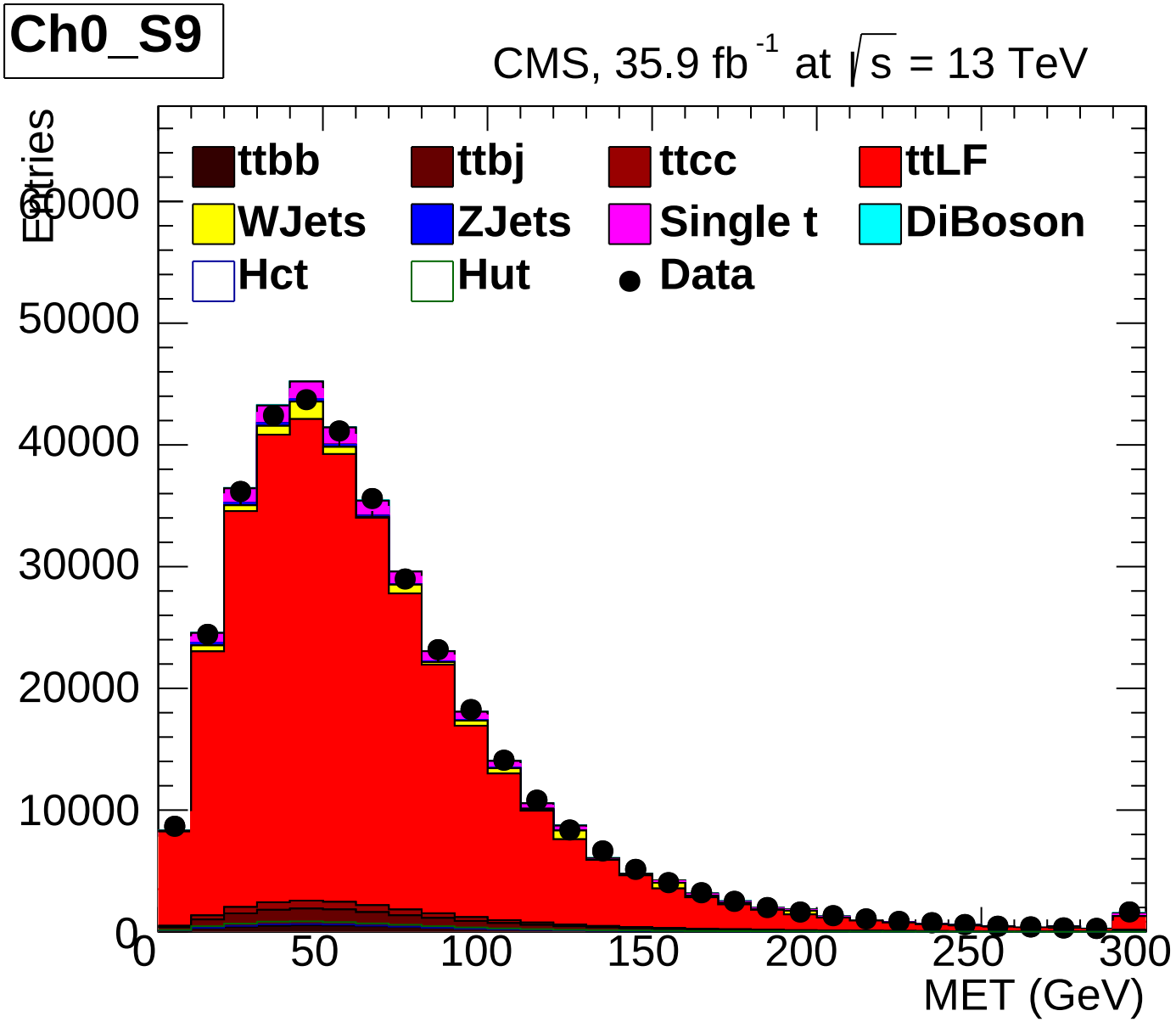

Ch0_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

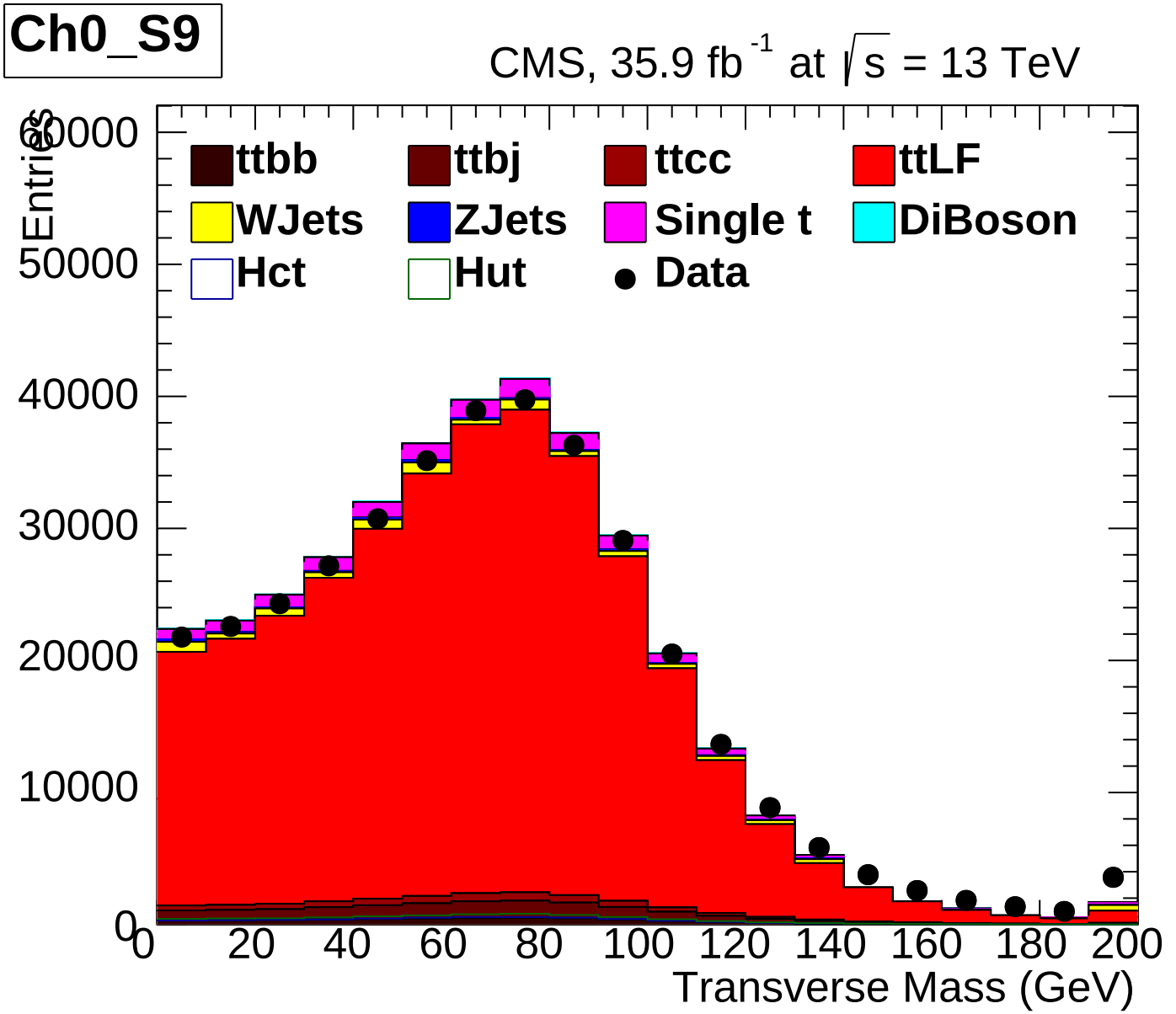

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
0
2
4
6
8
10
12
Jet Multiplicity

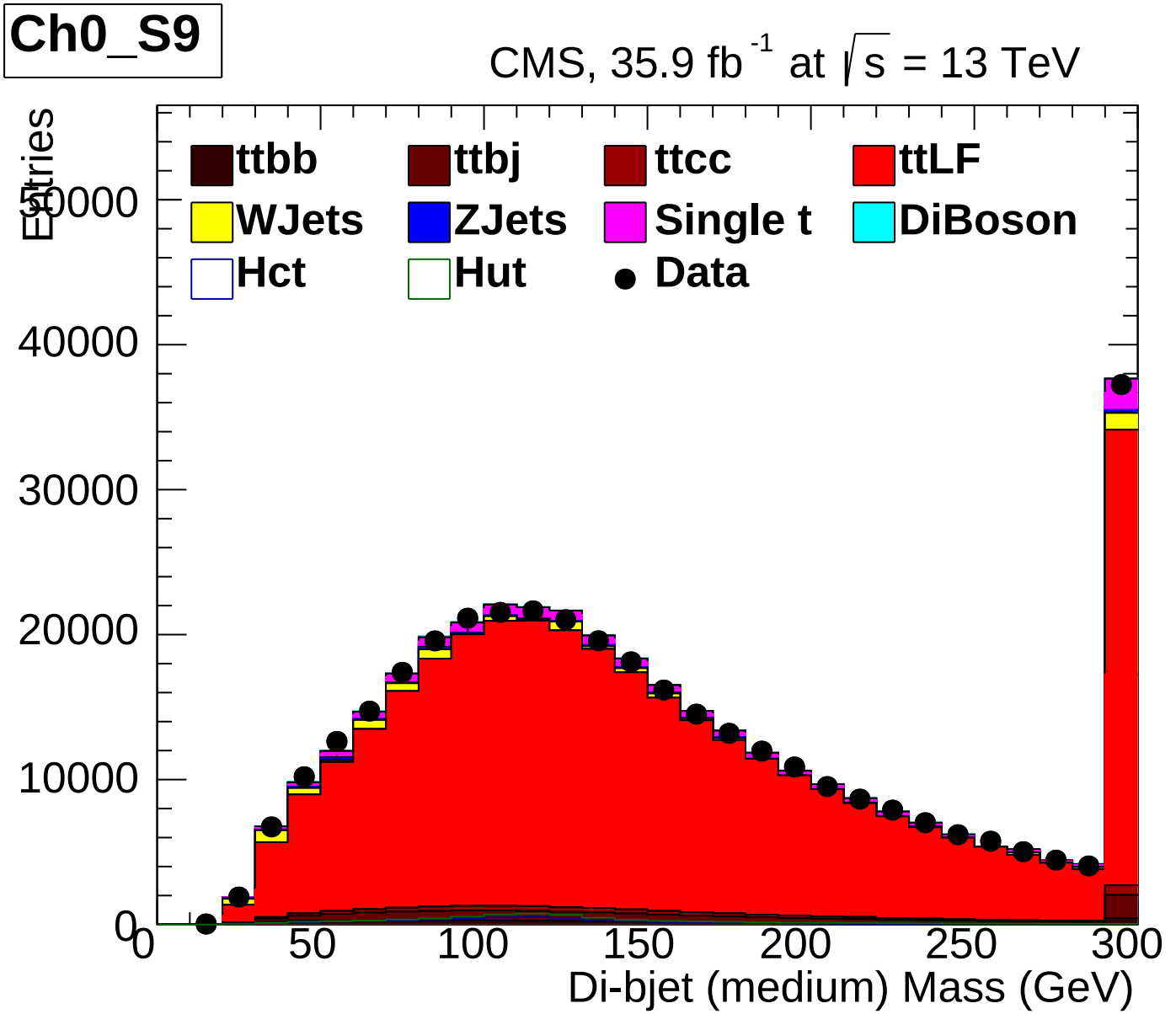

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

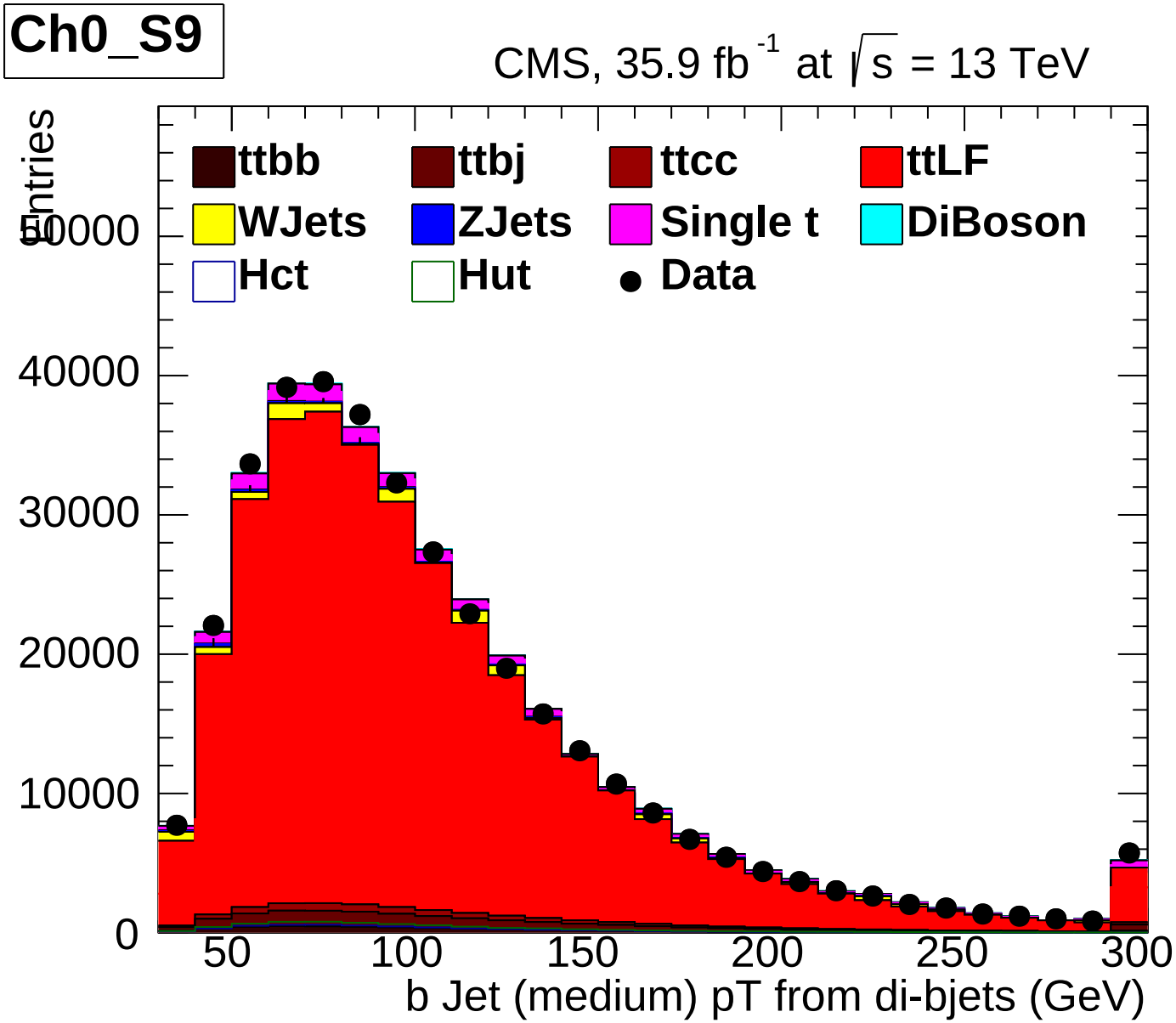

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
250
200
150
100
50
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

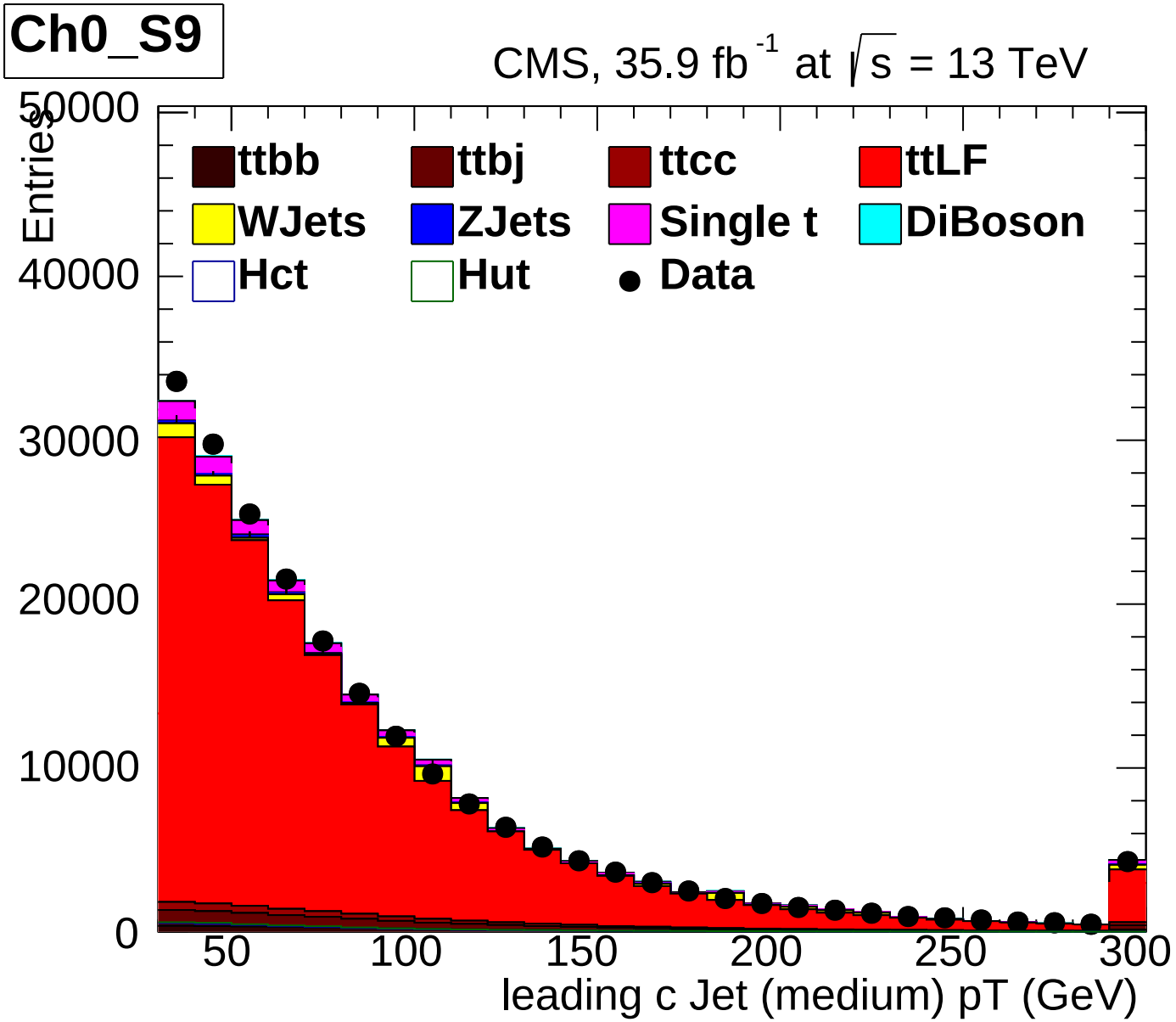

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

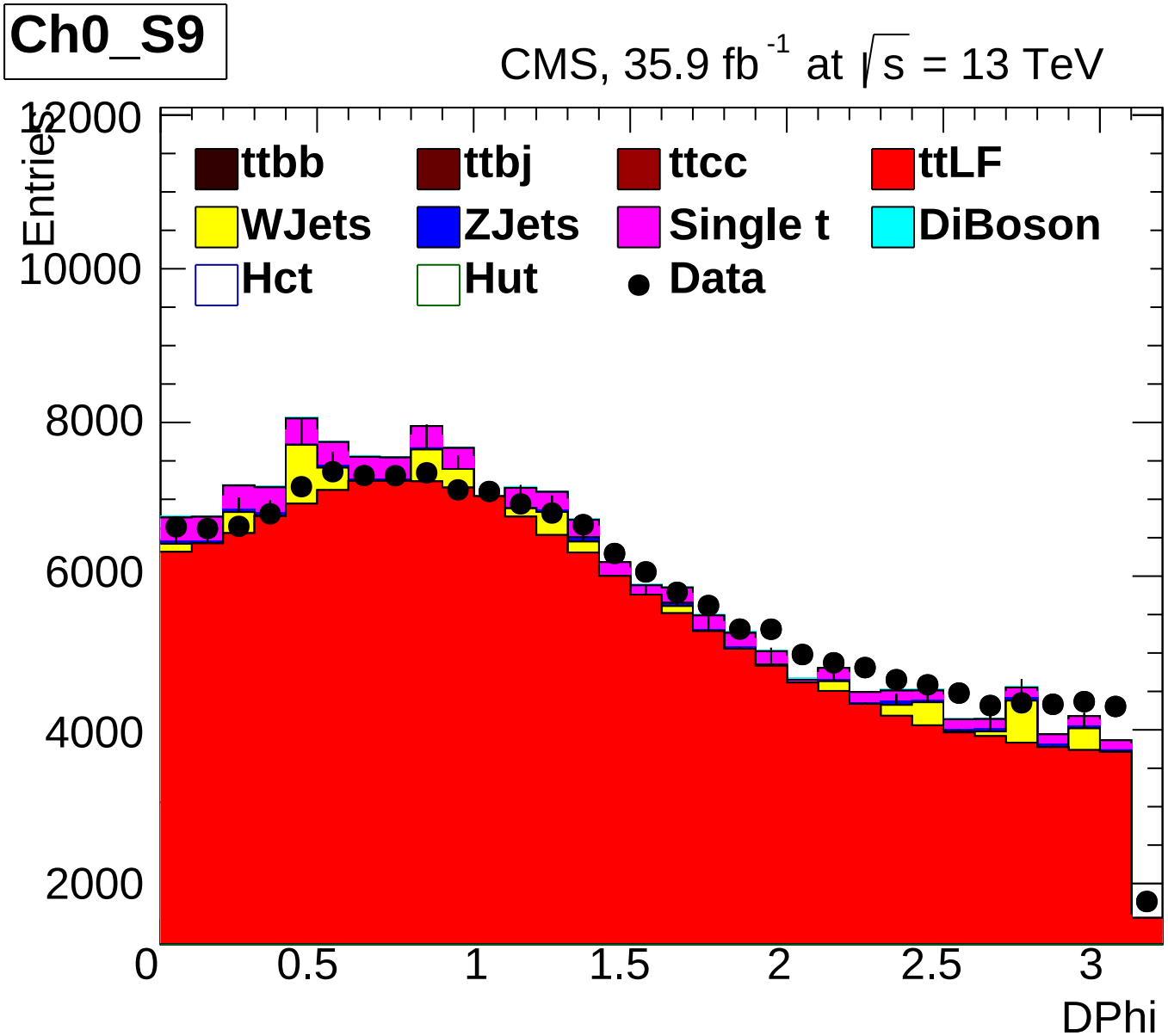

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
MET (GeV)

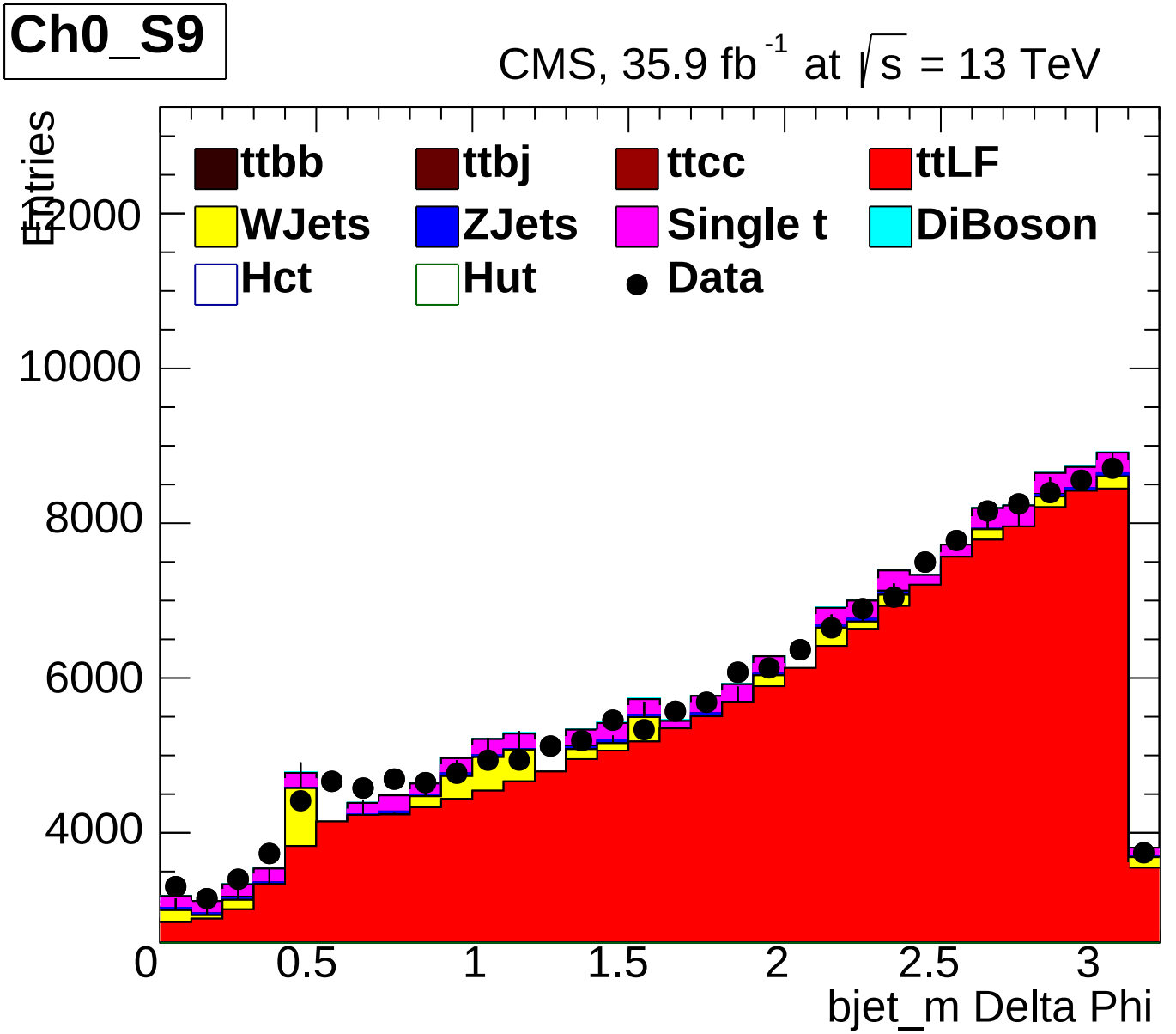

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
60000
50000
40000
30000
20000
10000
0
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

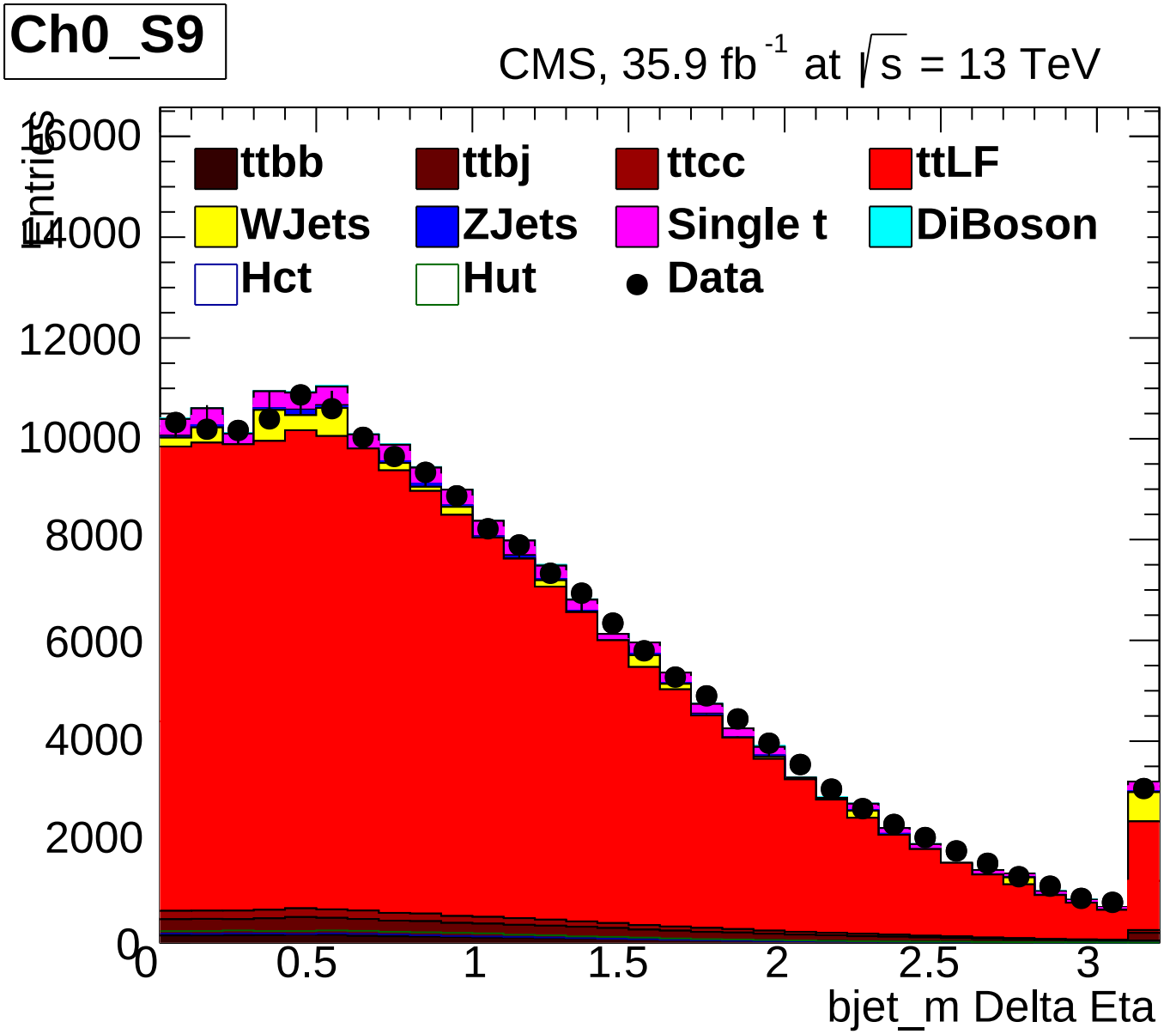

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

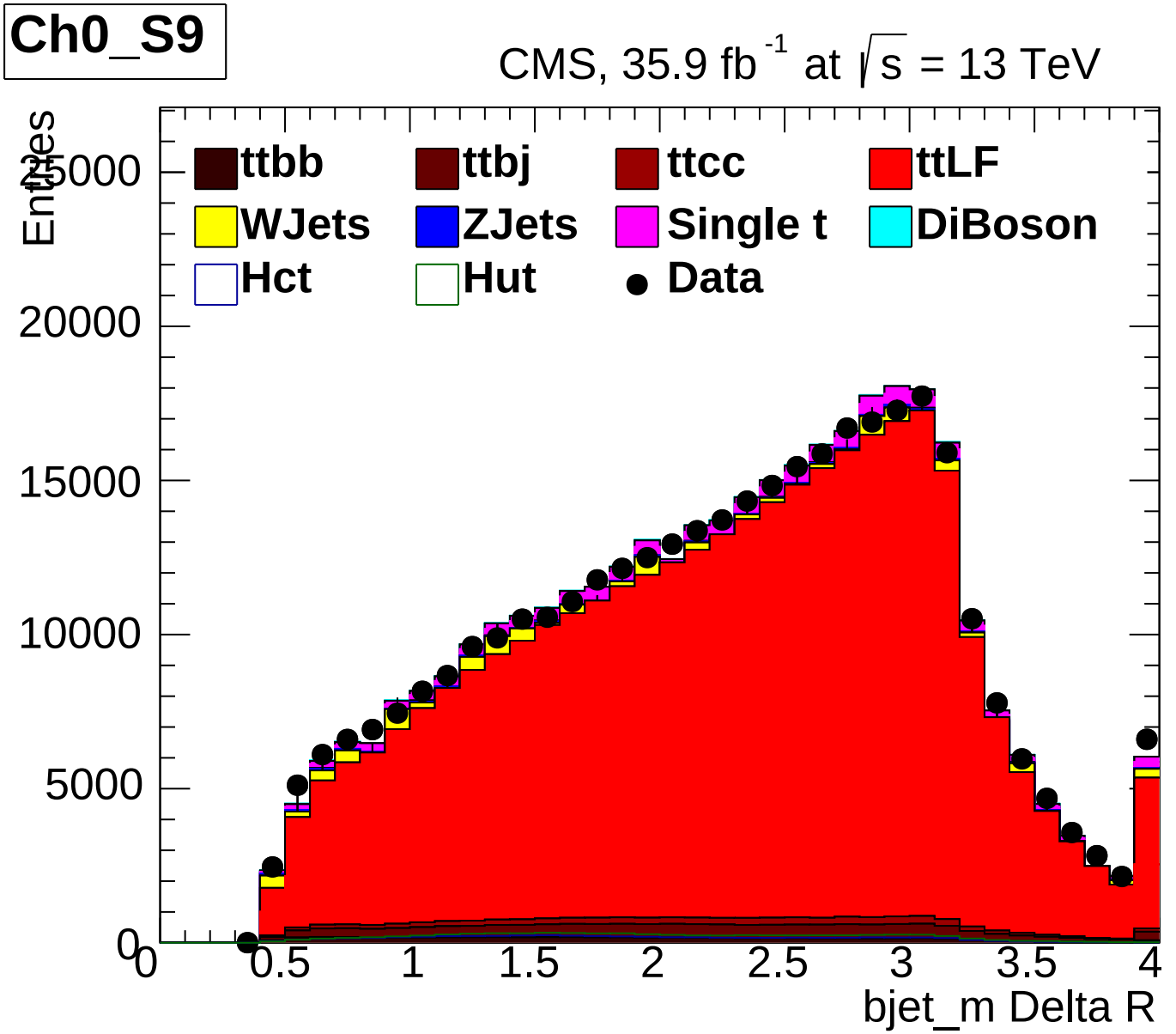

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

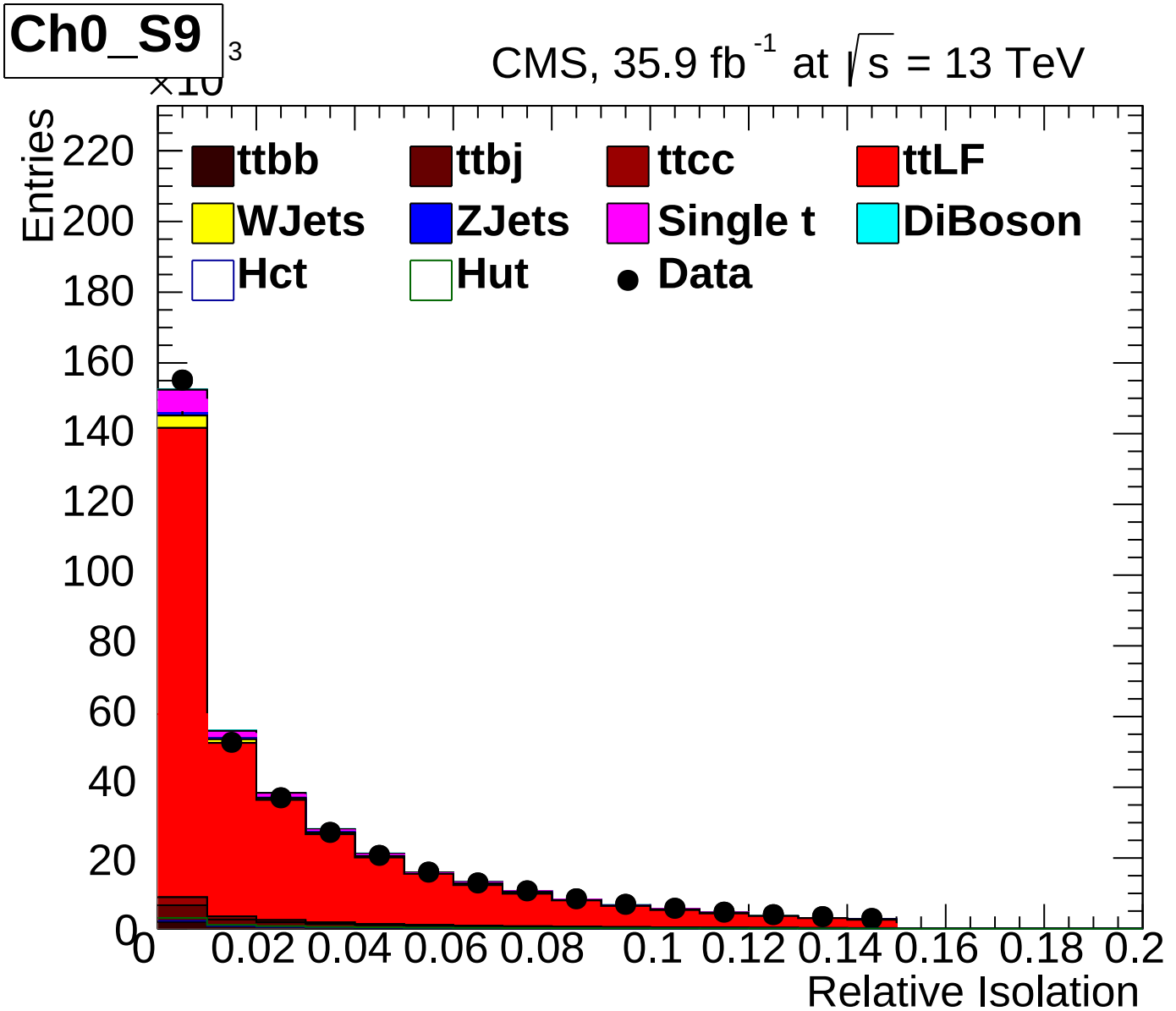

Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
DPhi


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
12000
10000
8000
6000
4000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
25000
20000
15000
10000
5000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
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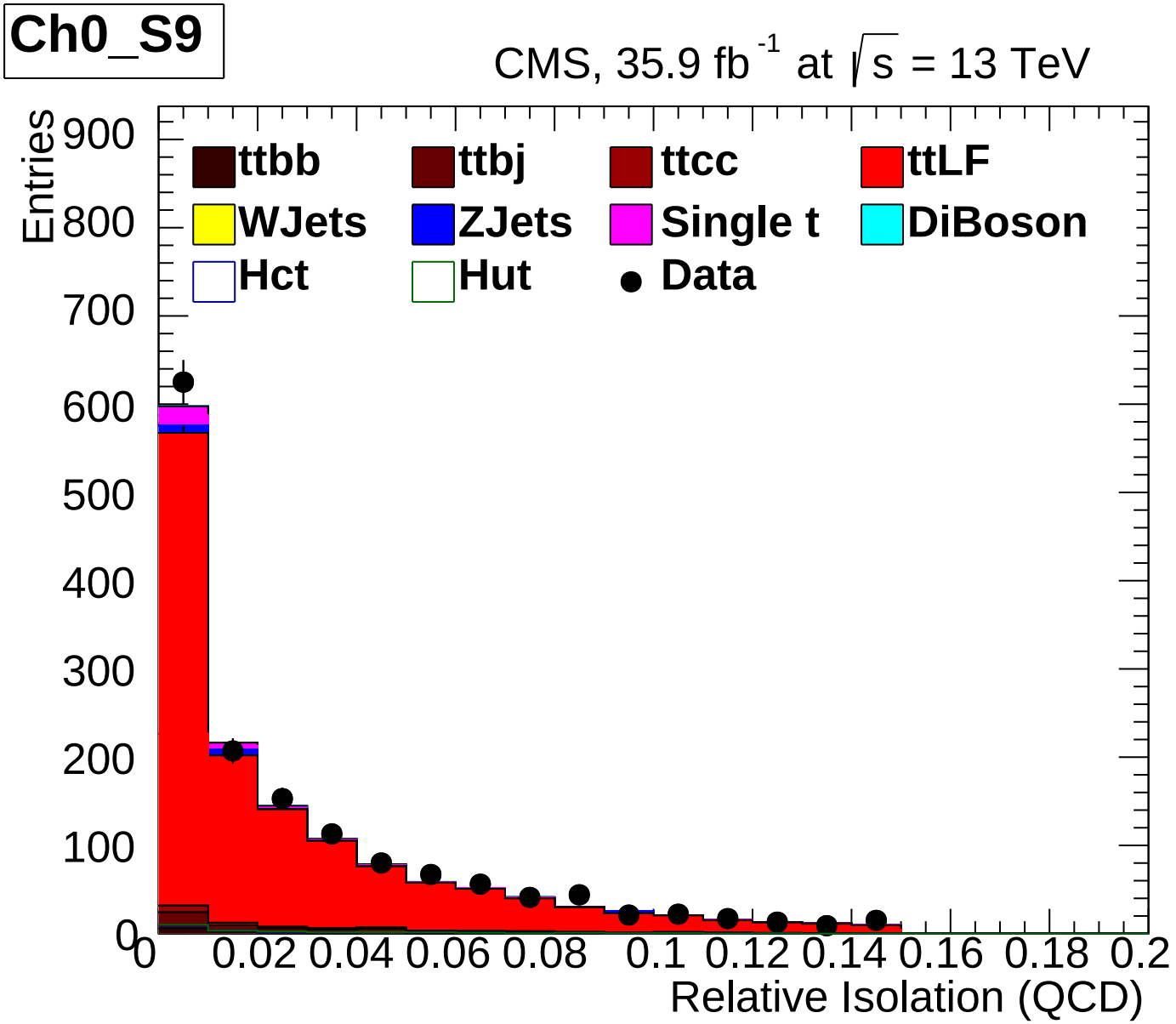
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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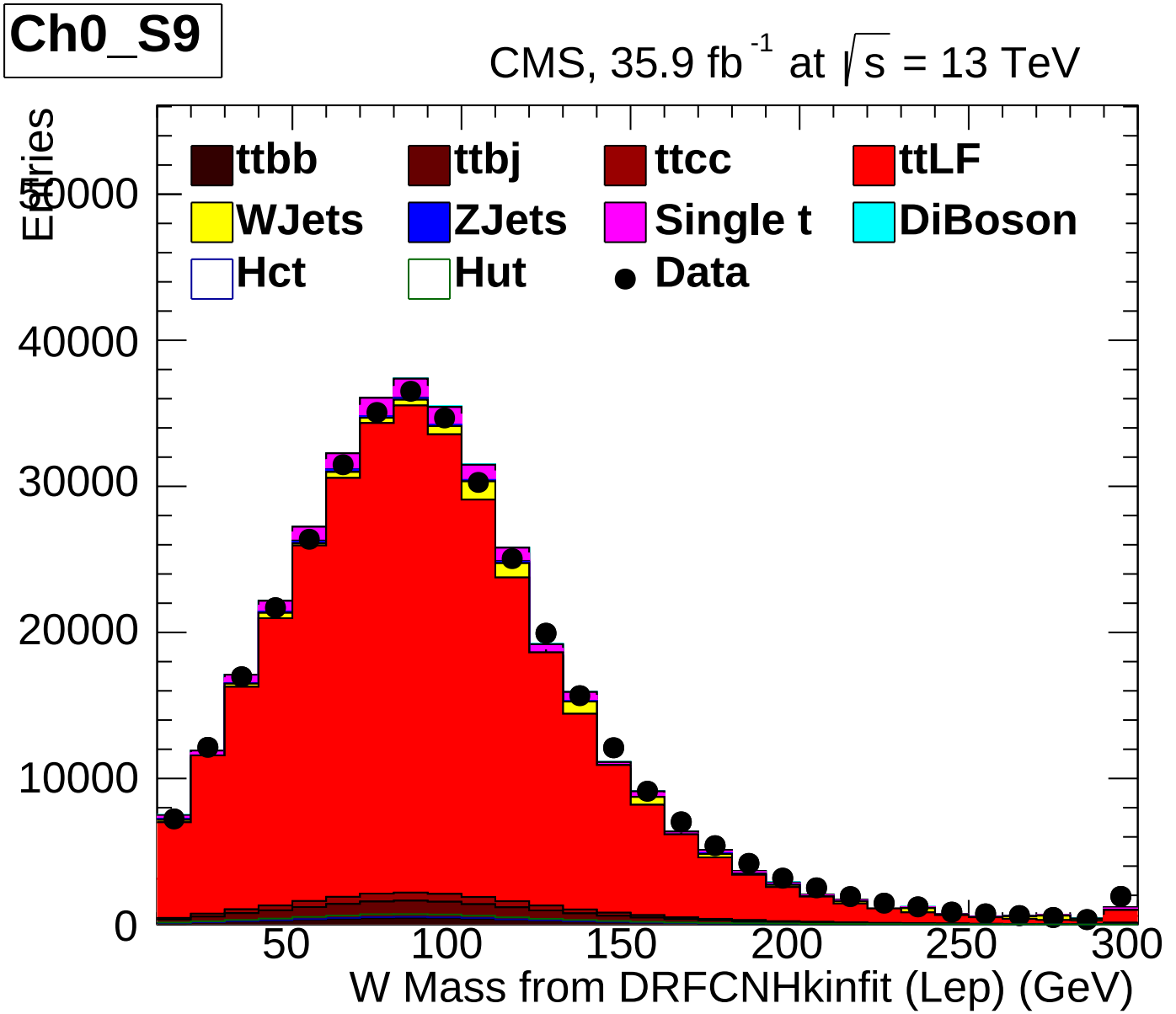
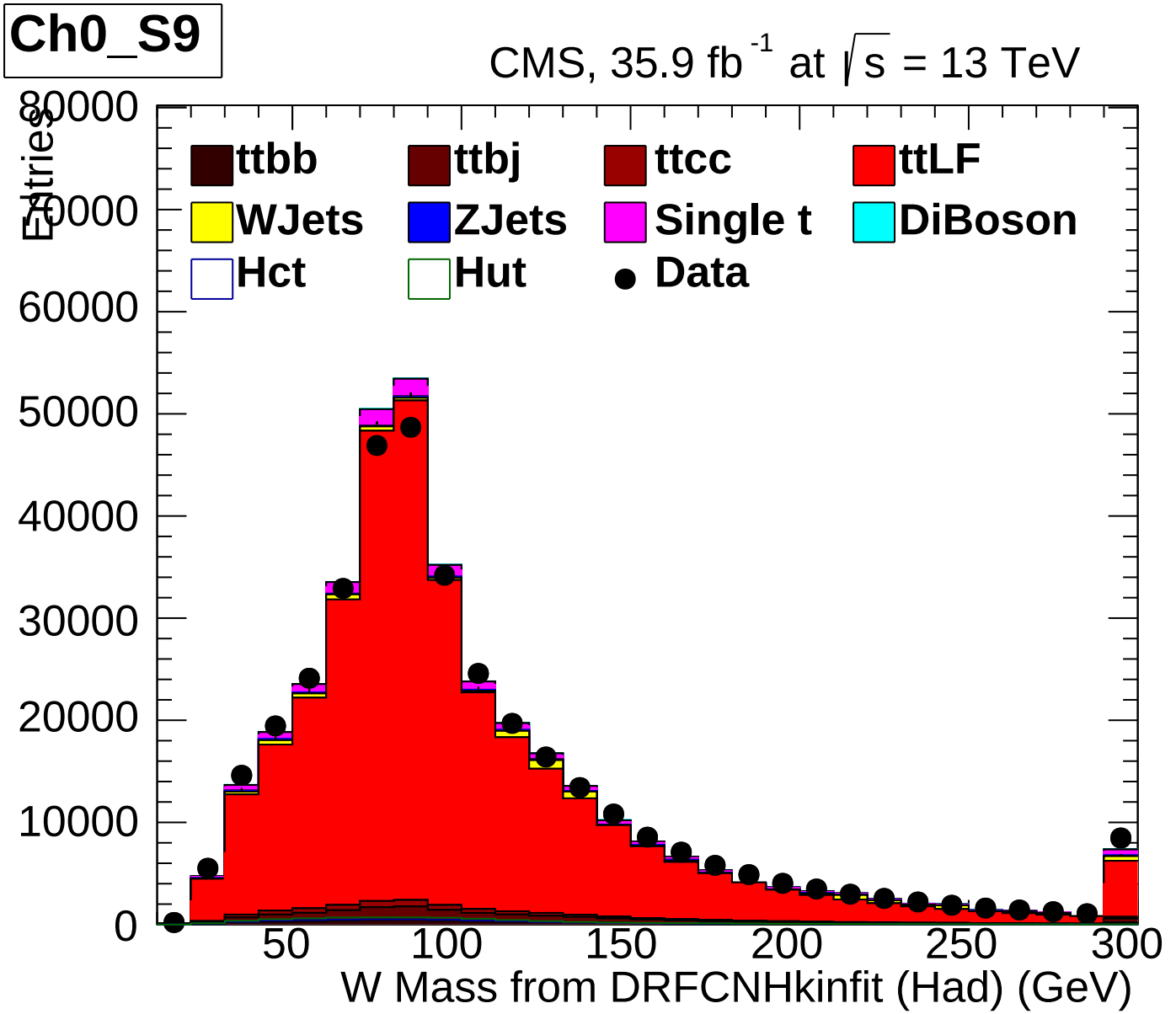
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
900
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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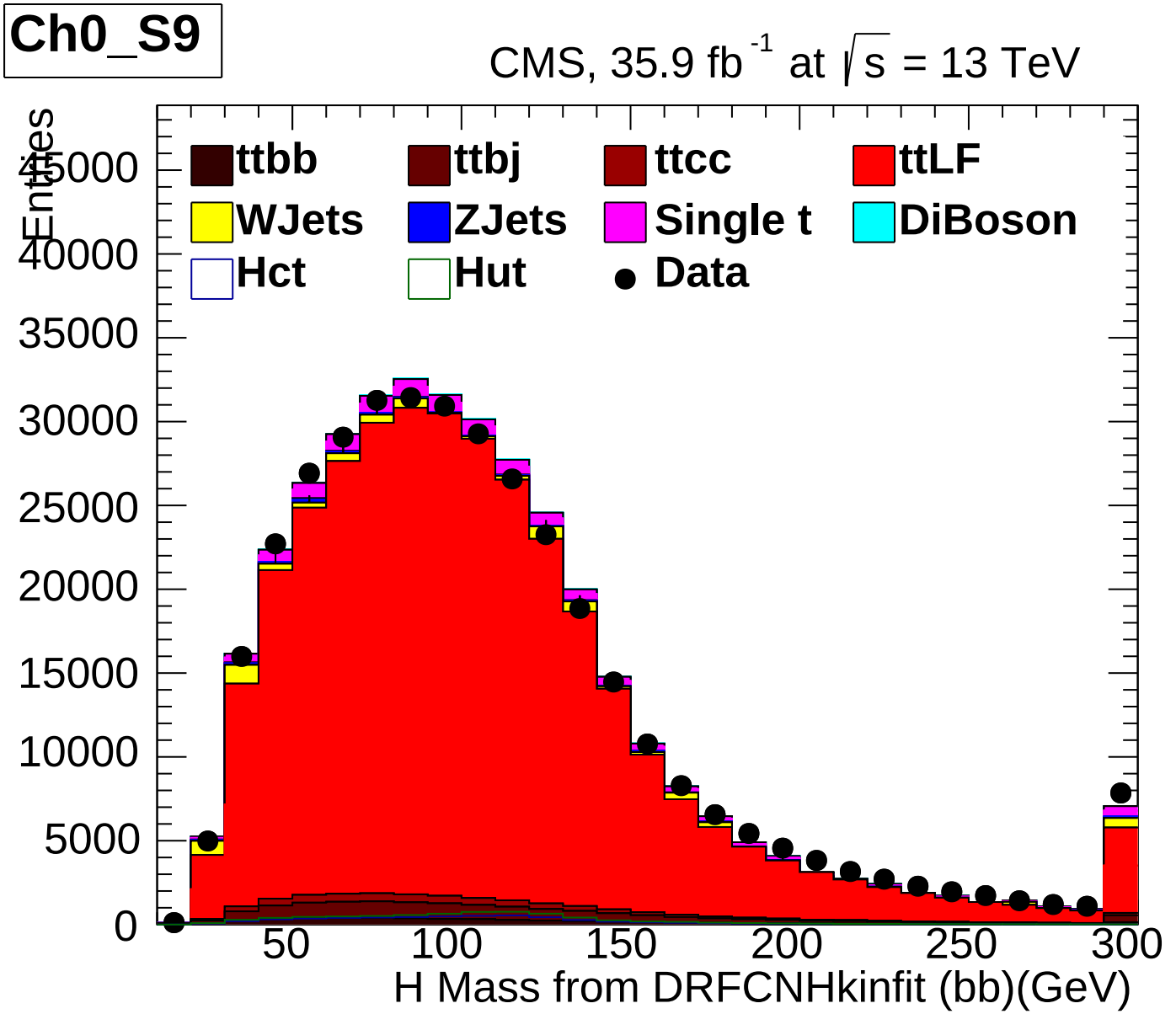
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
80000
70000
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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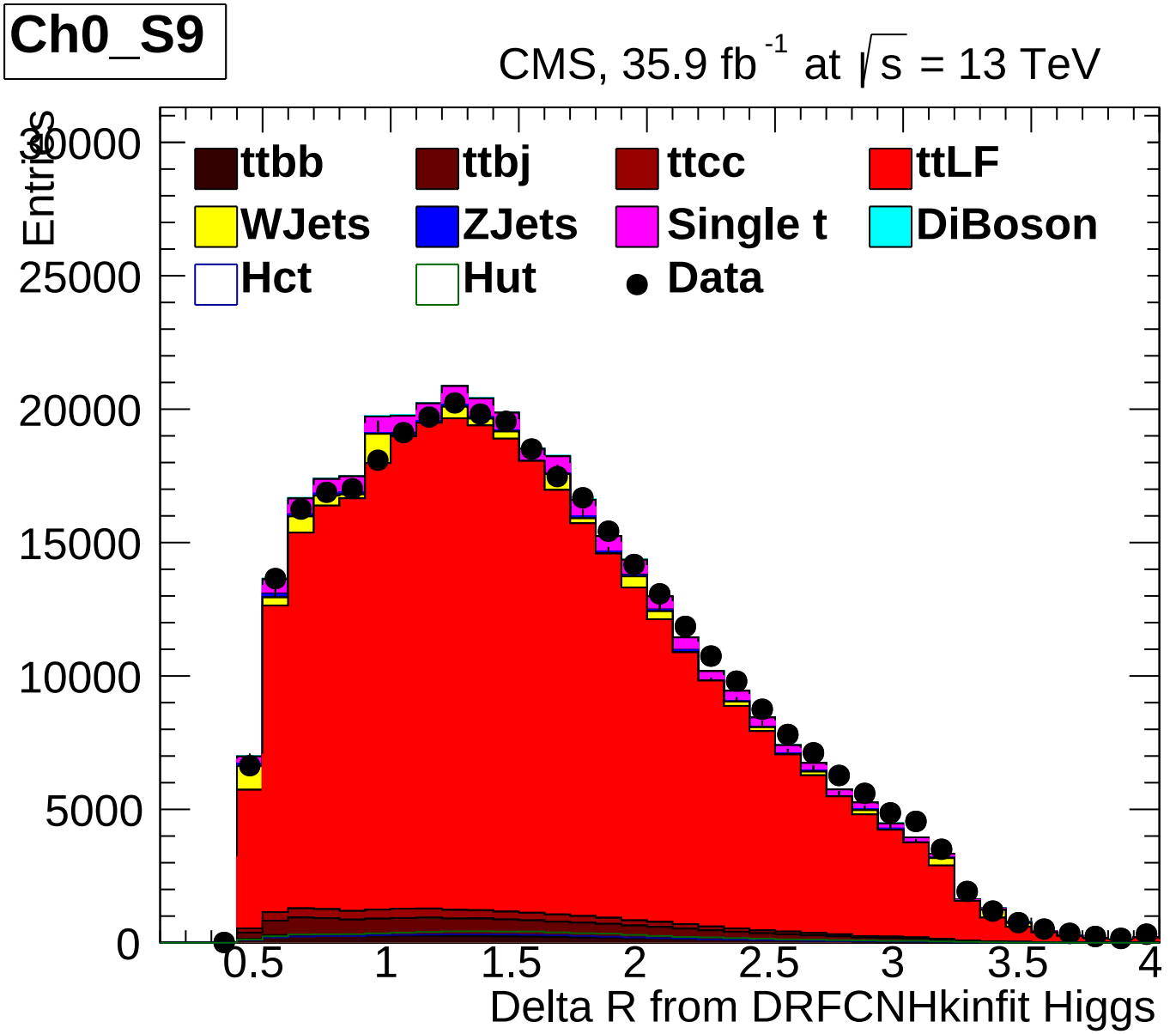
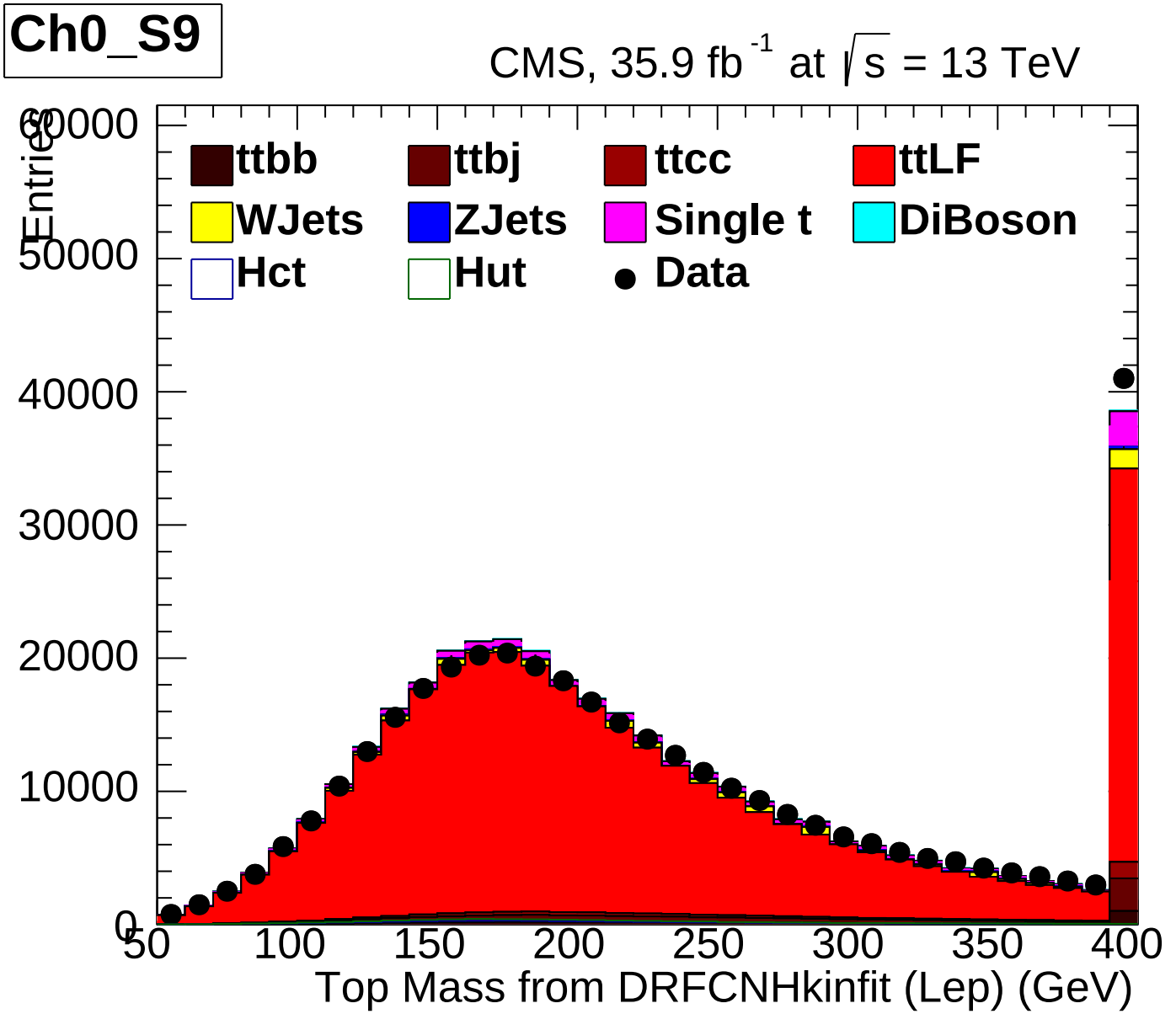
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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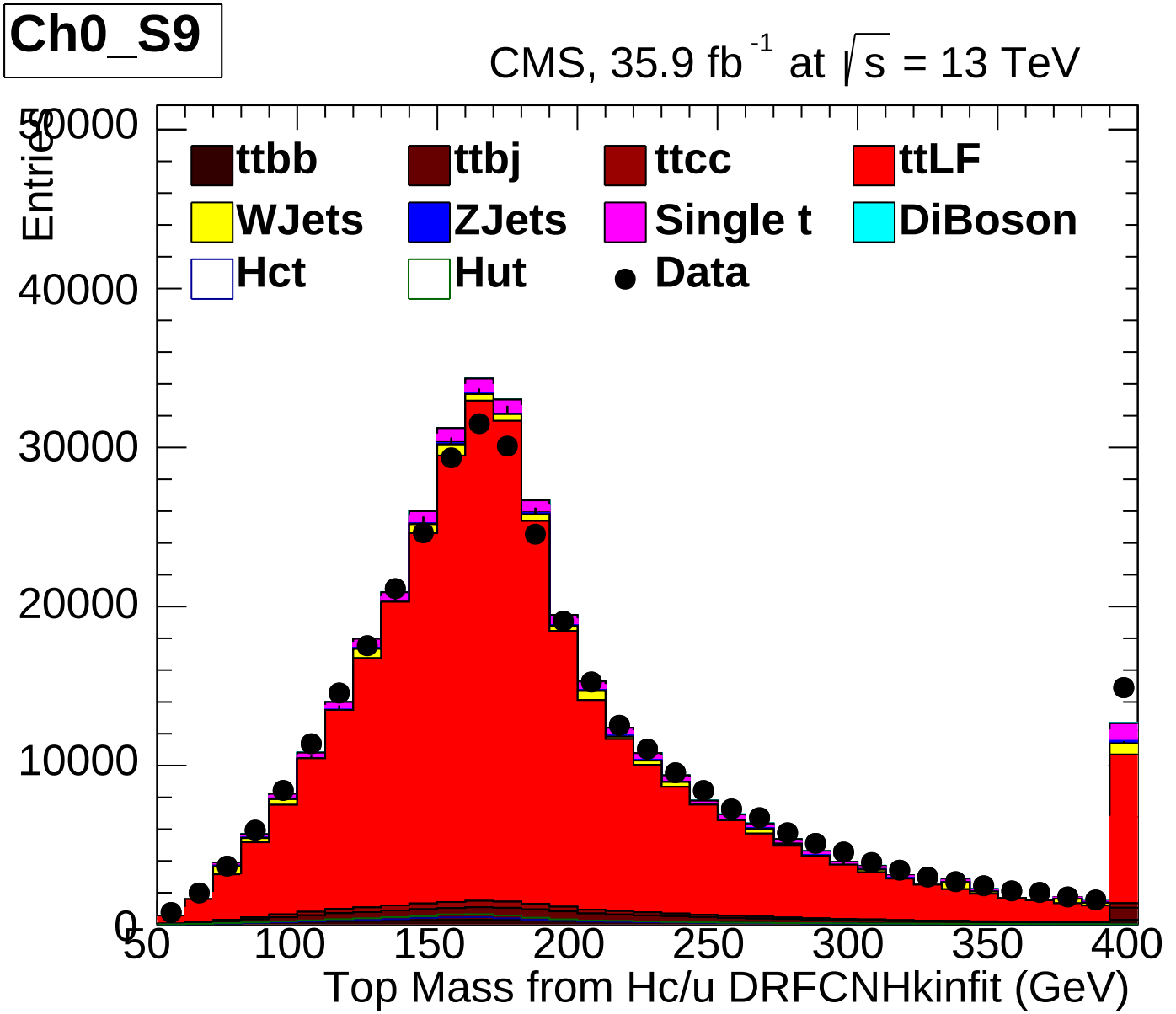
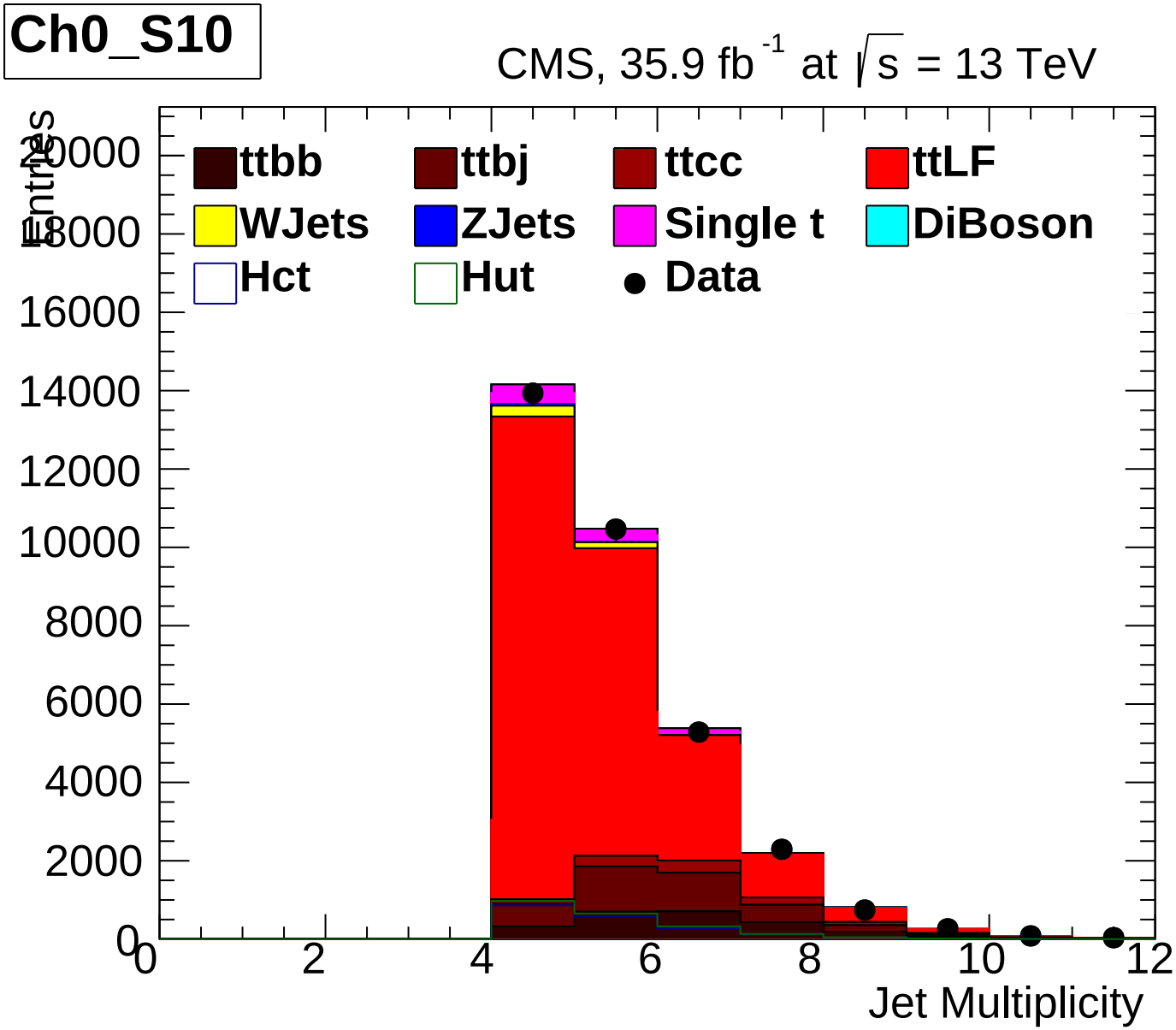
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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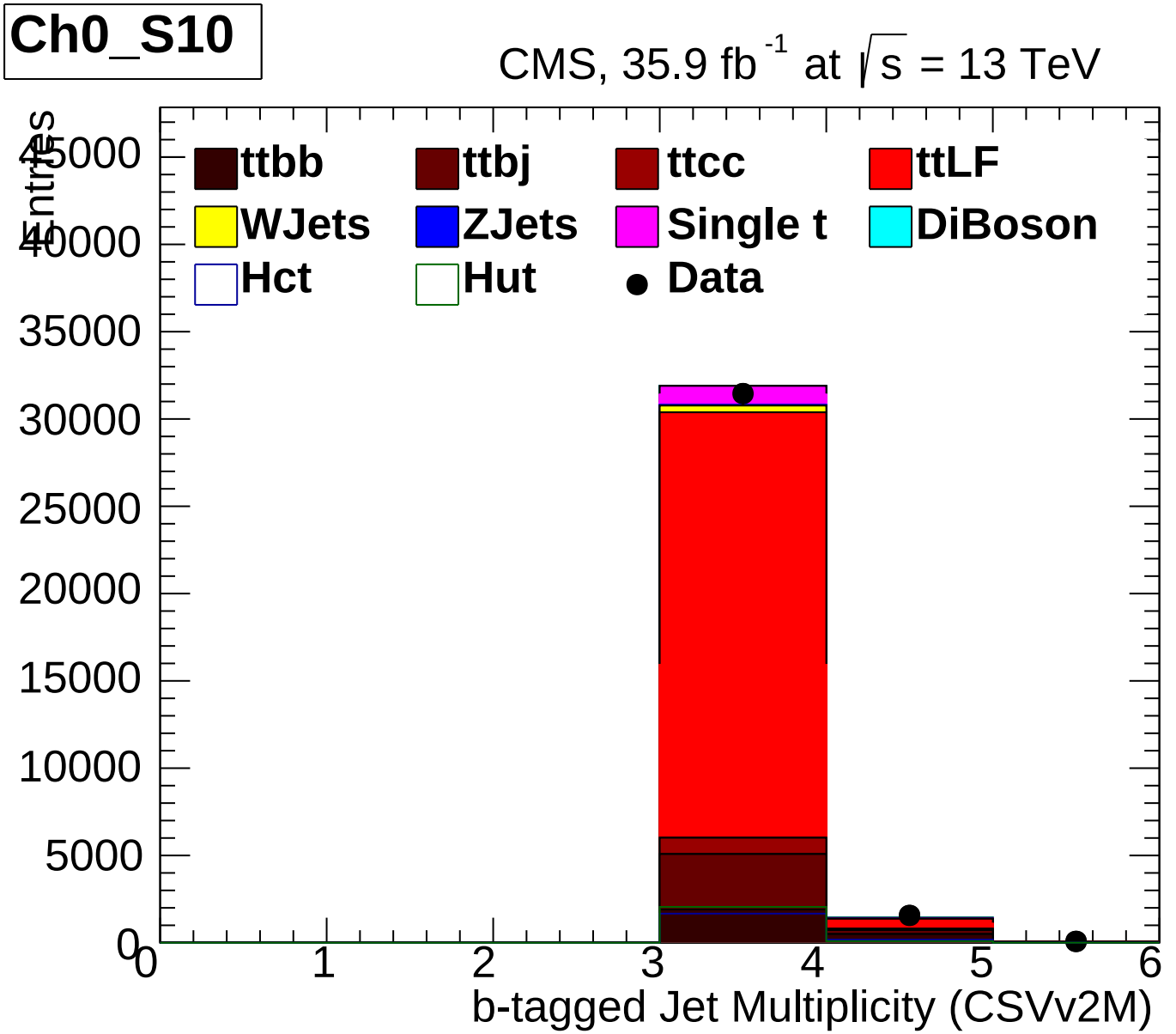
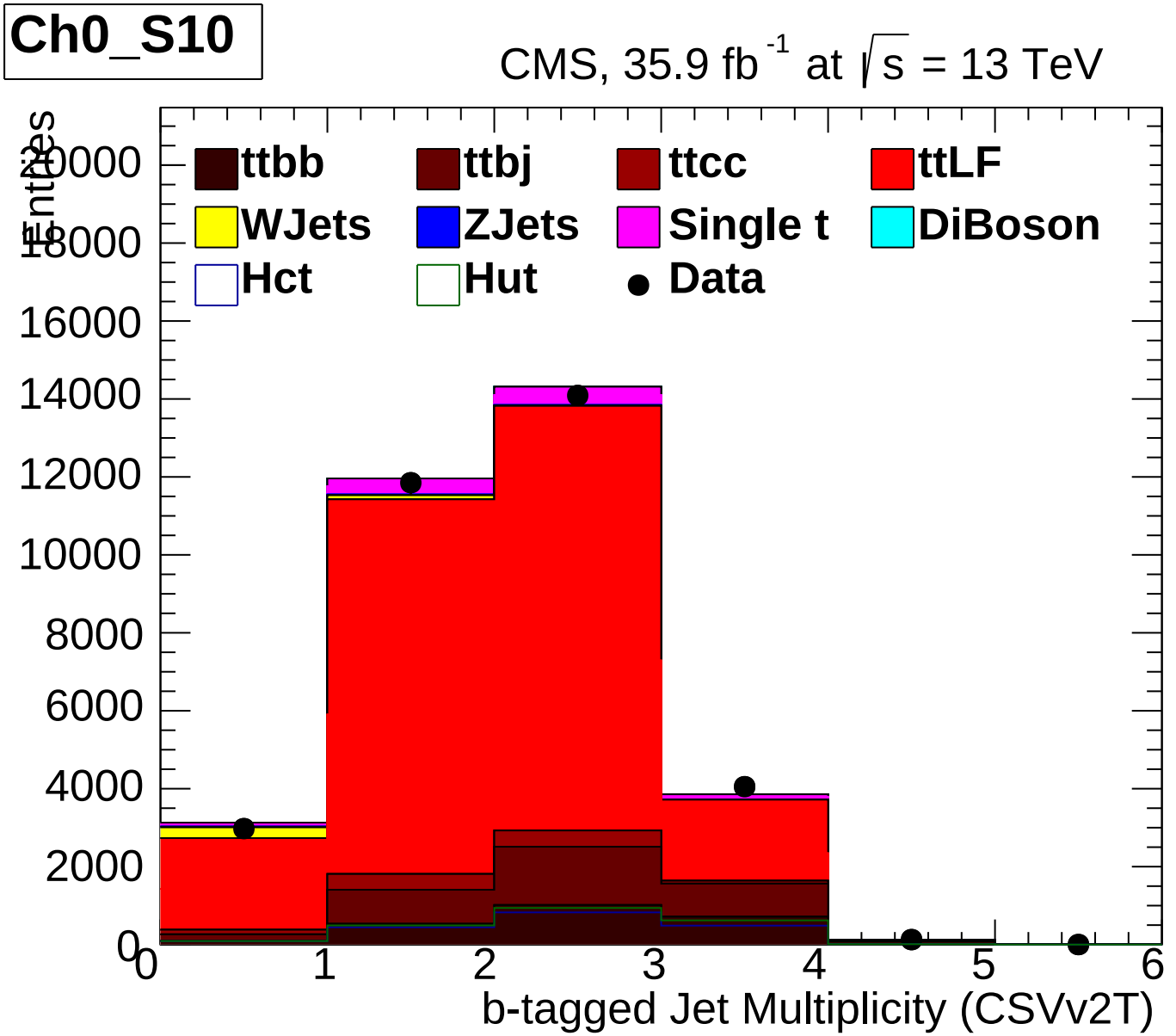
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
2
4
6
8
10
12
Jet Multiplicity


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
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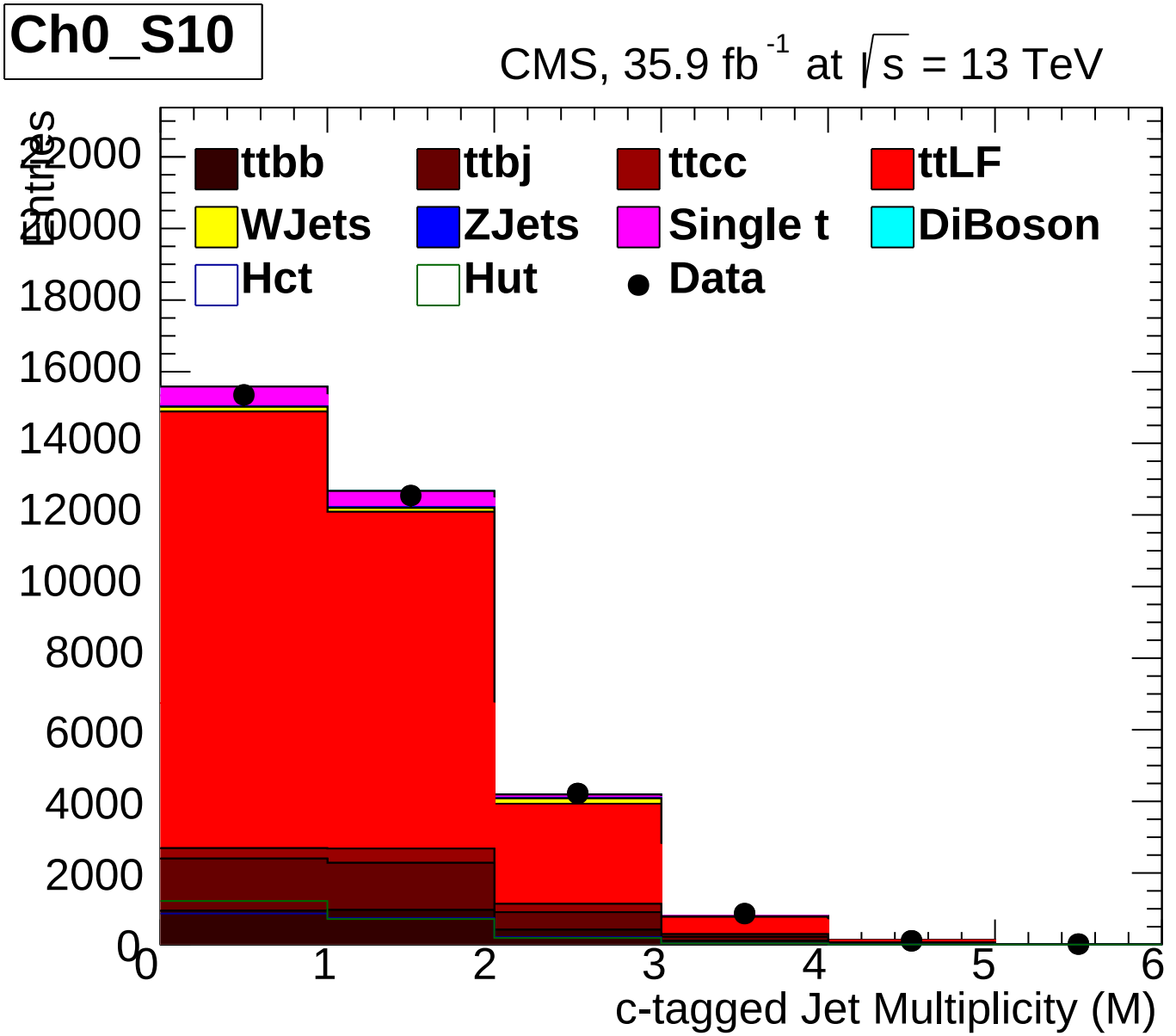
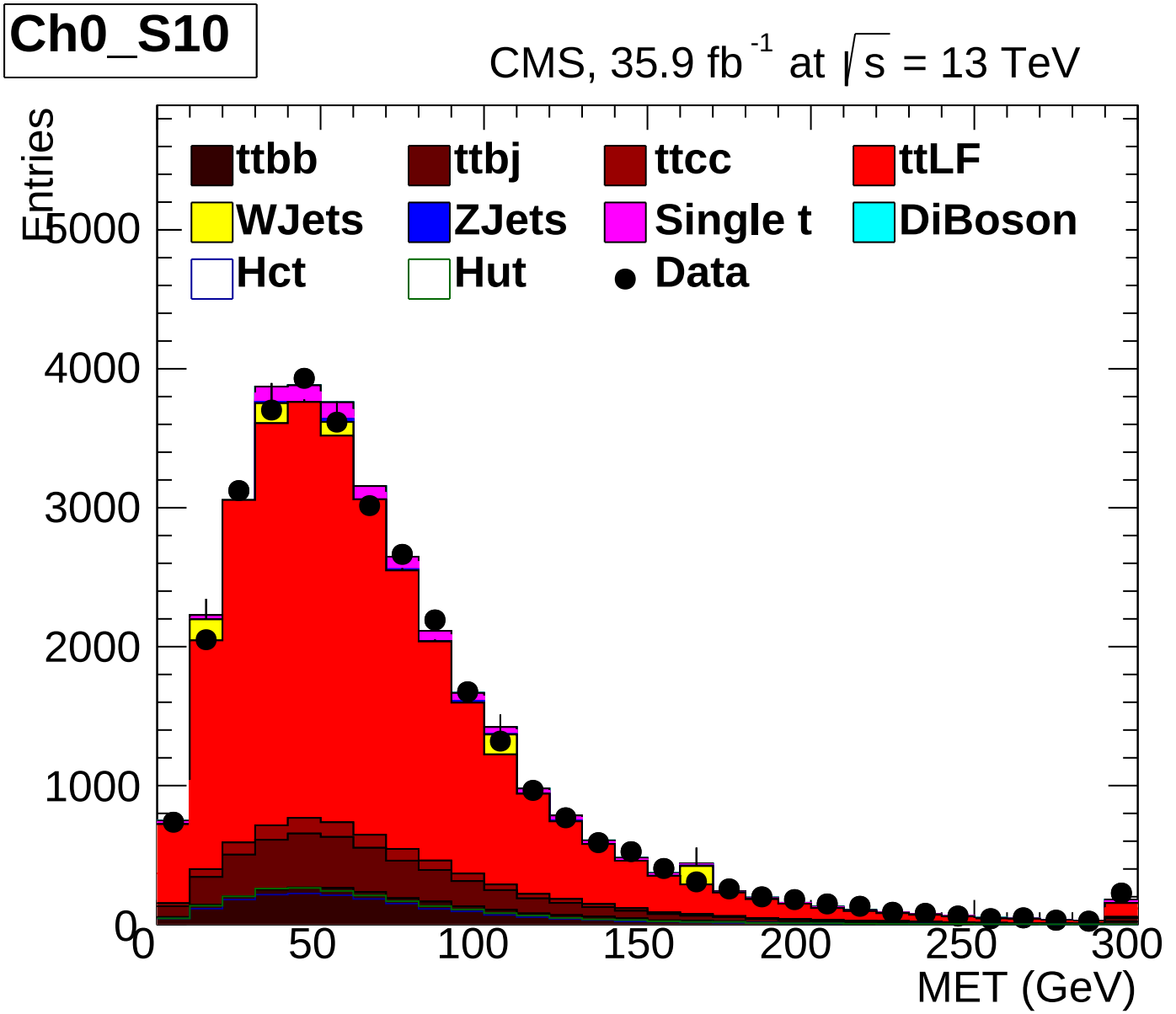
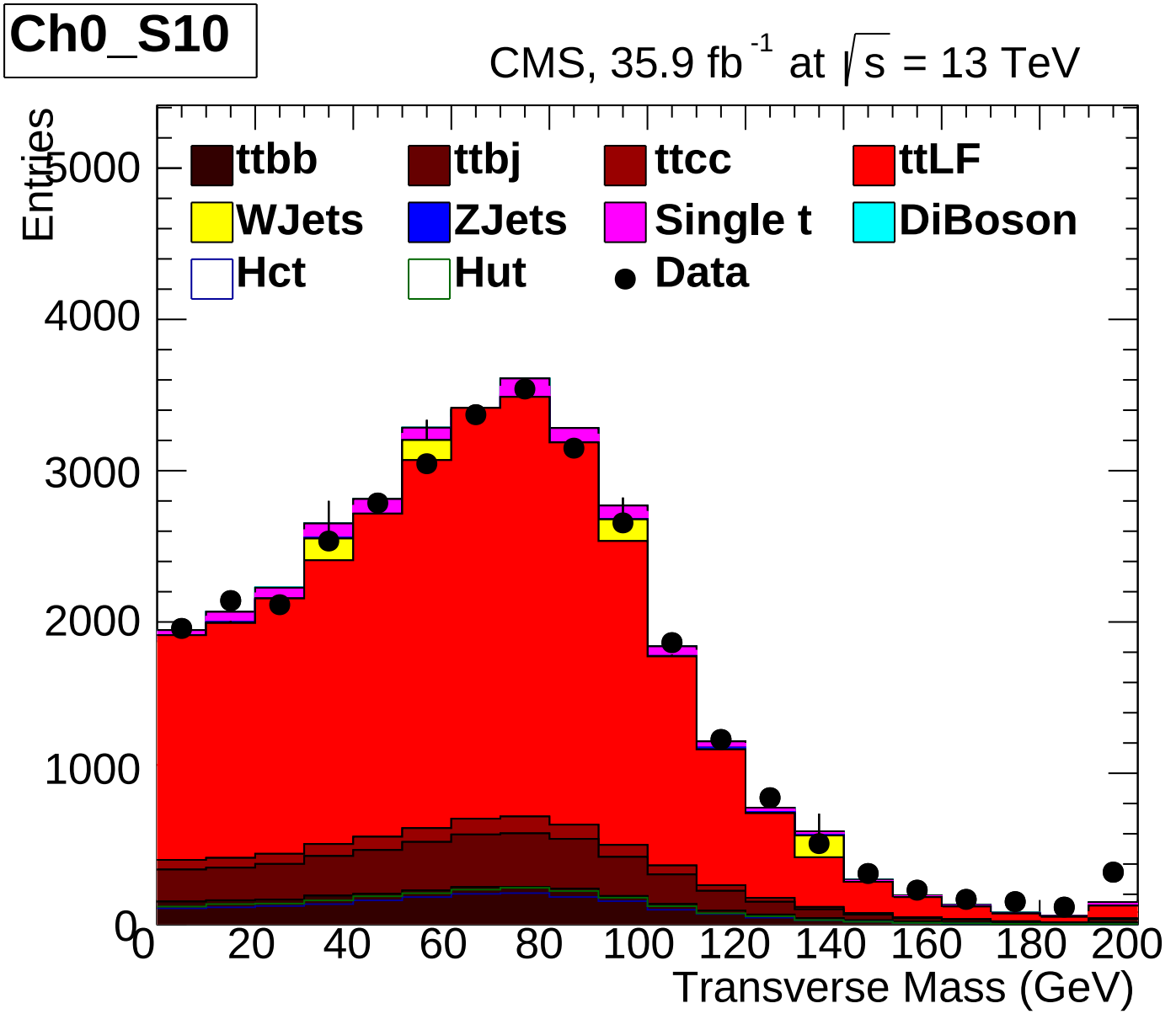
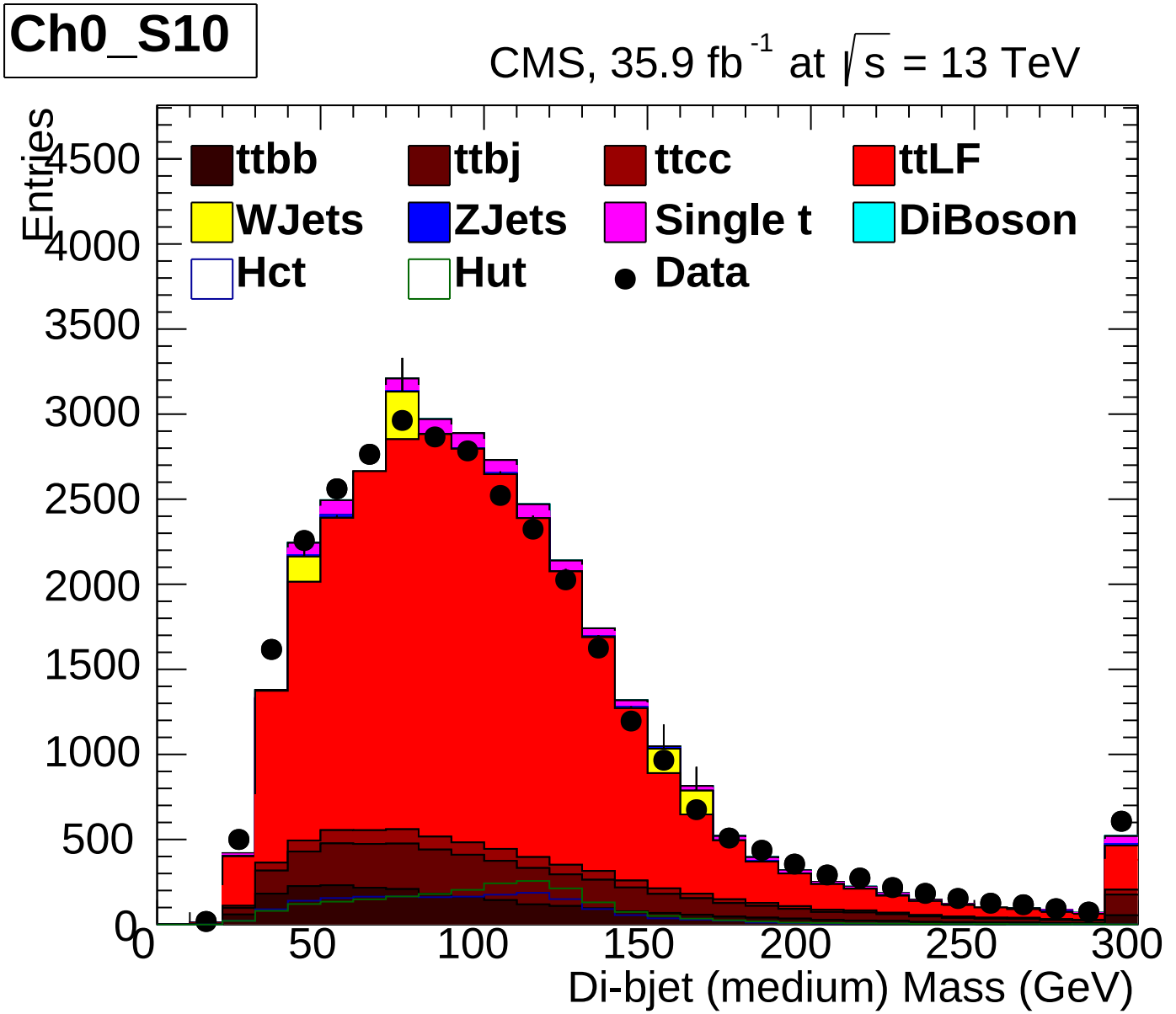
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
22000
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
1000
2000
3000
4000
5000
0
50
100
150
200
250
300
MET (GeV)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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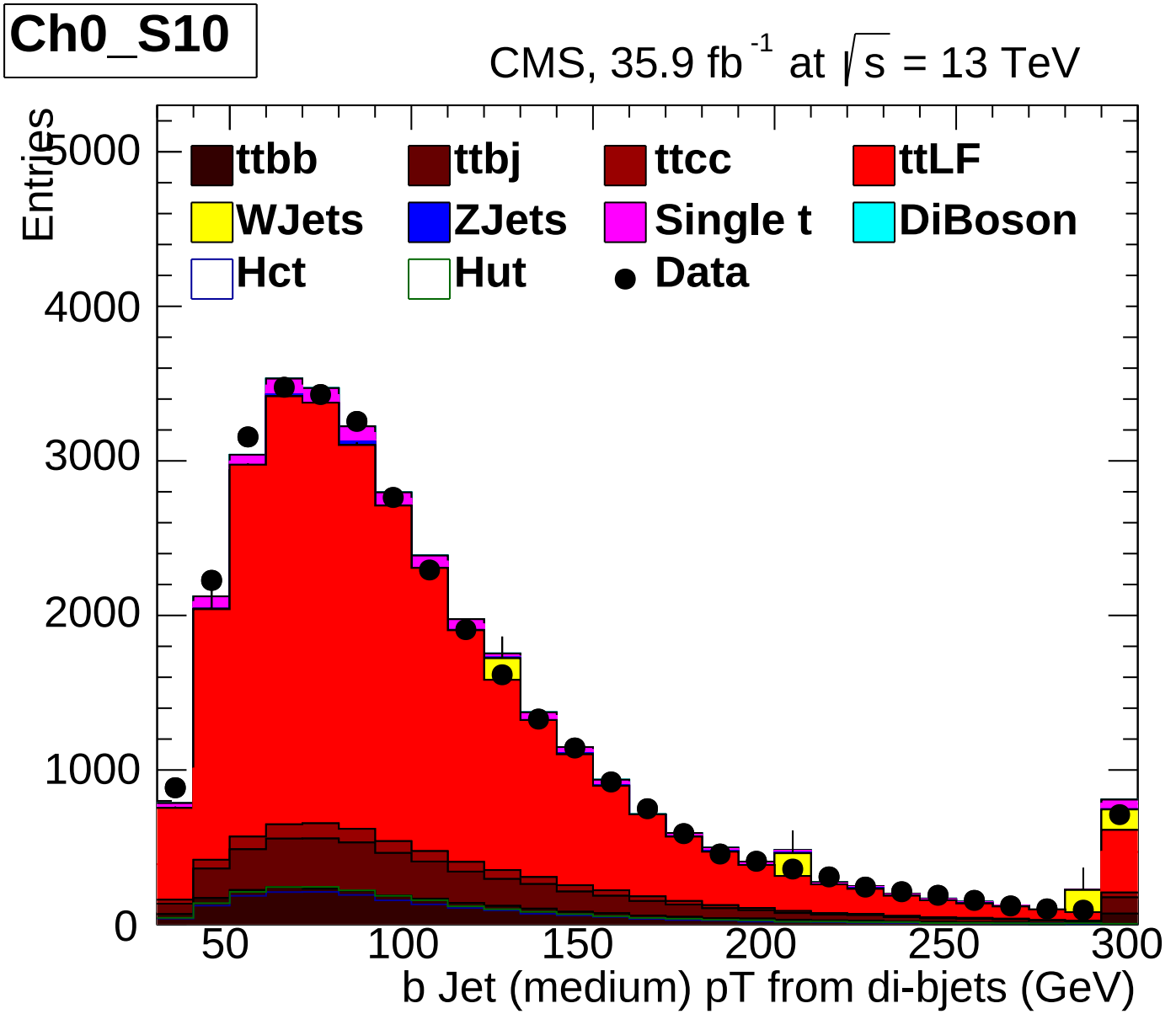
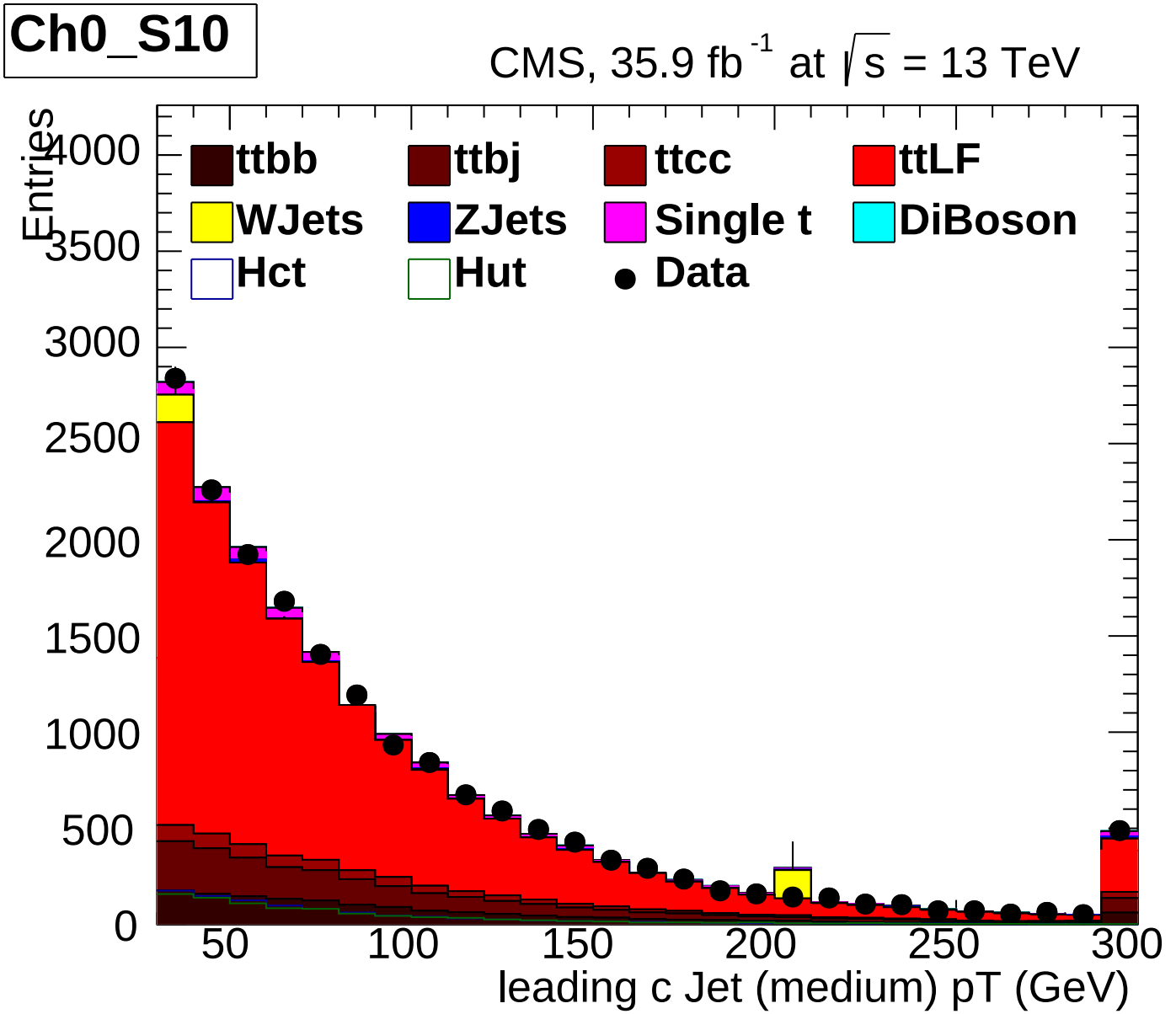
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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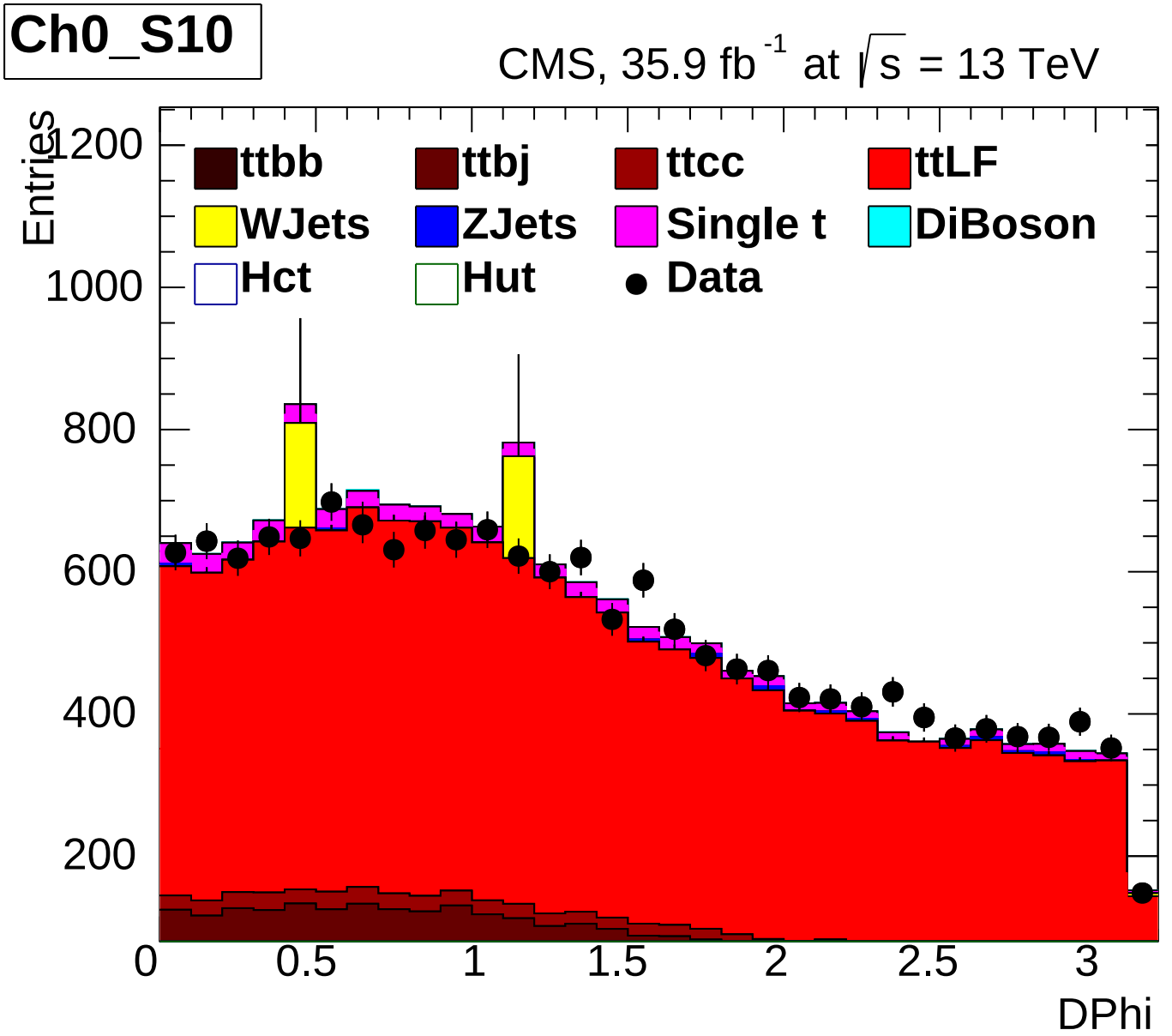
500
1000
1500
2000
2500
3000
3500
4000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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800
600
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0
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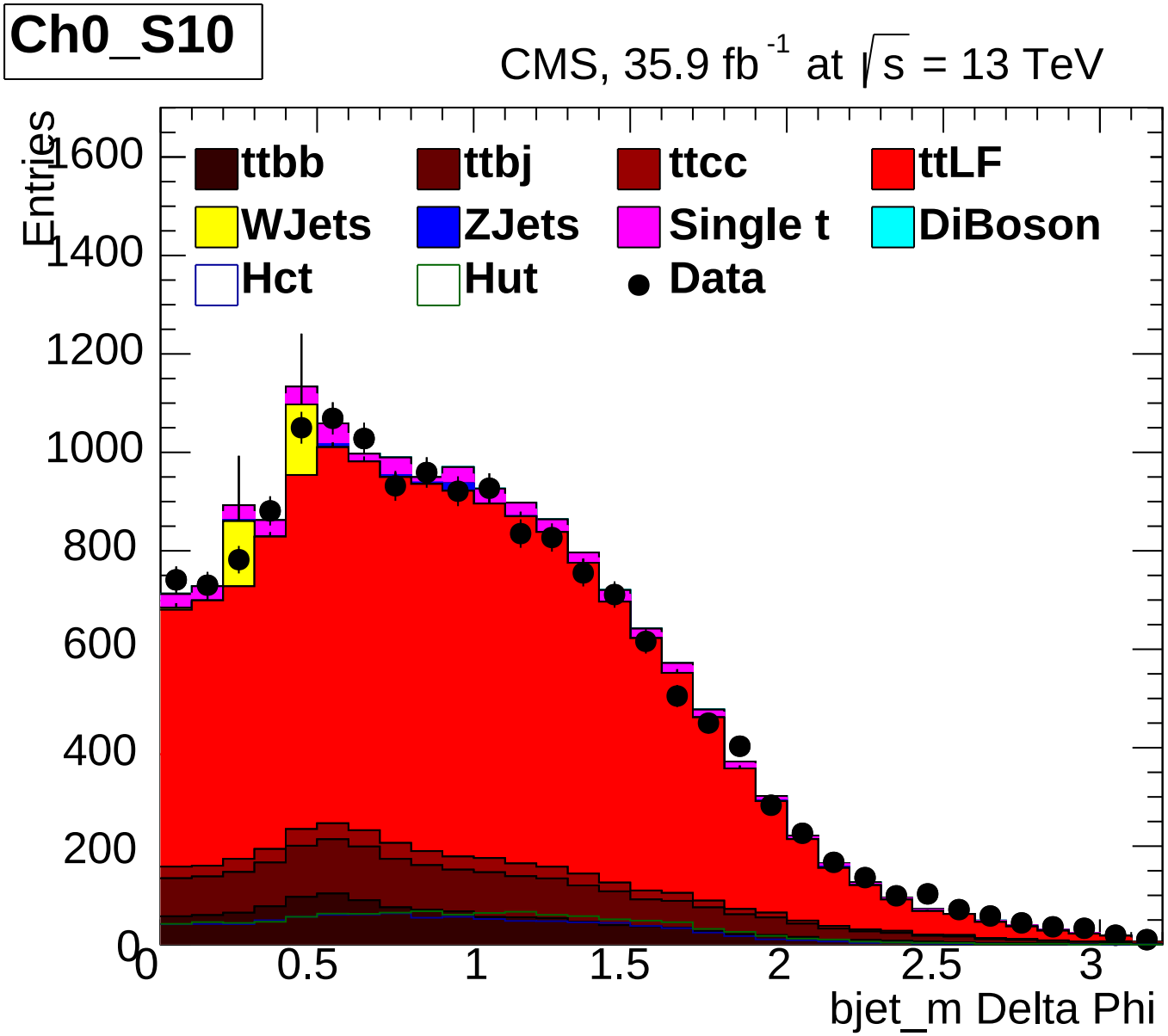
1
1.5
2
2.5
3
DPhi


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
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1000
1200
1400
1600
0
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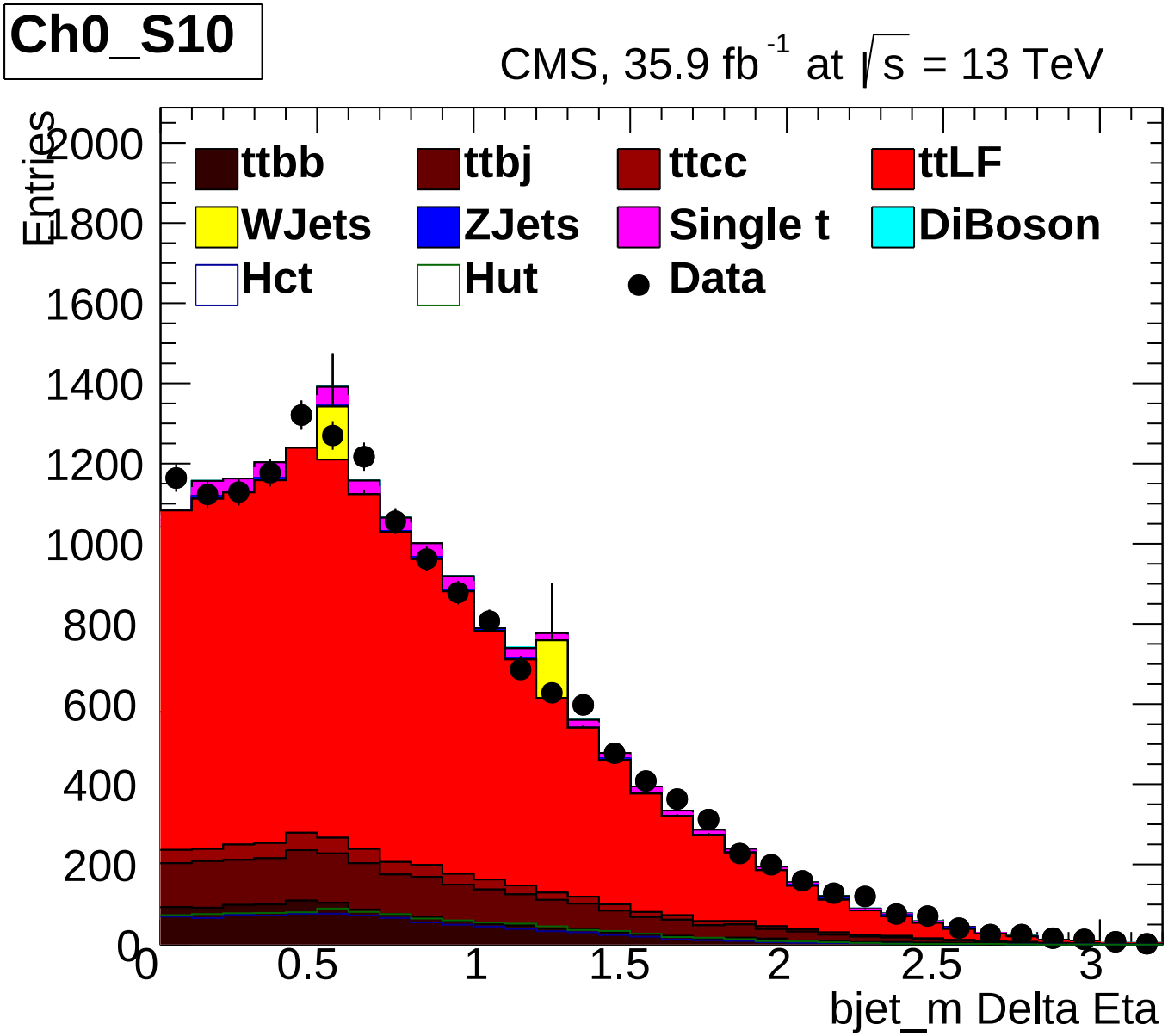
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
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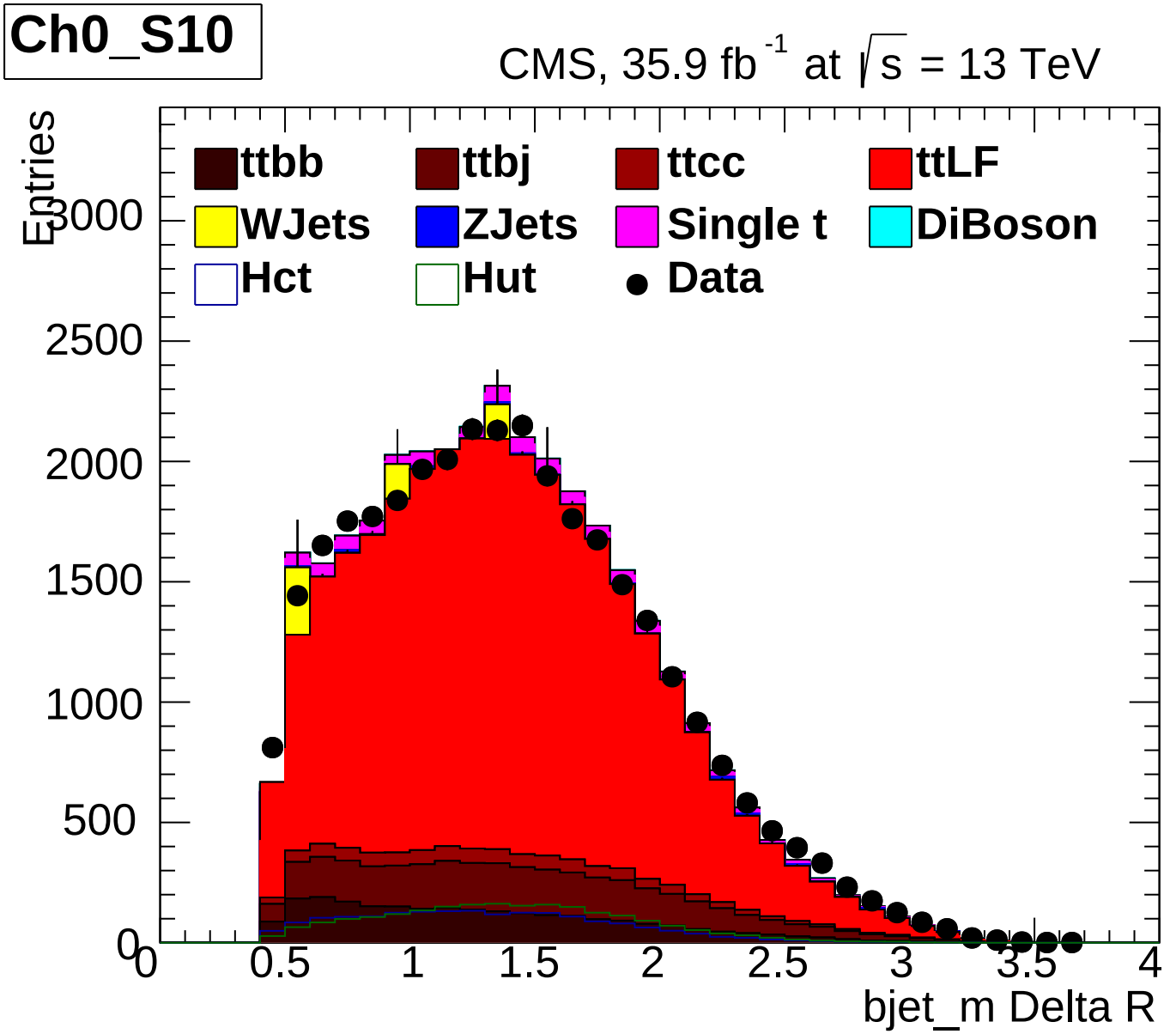
800
1000
1200
1400
1600
1800
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
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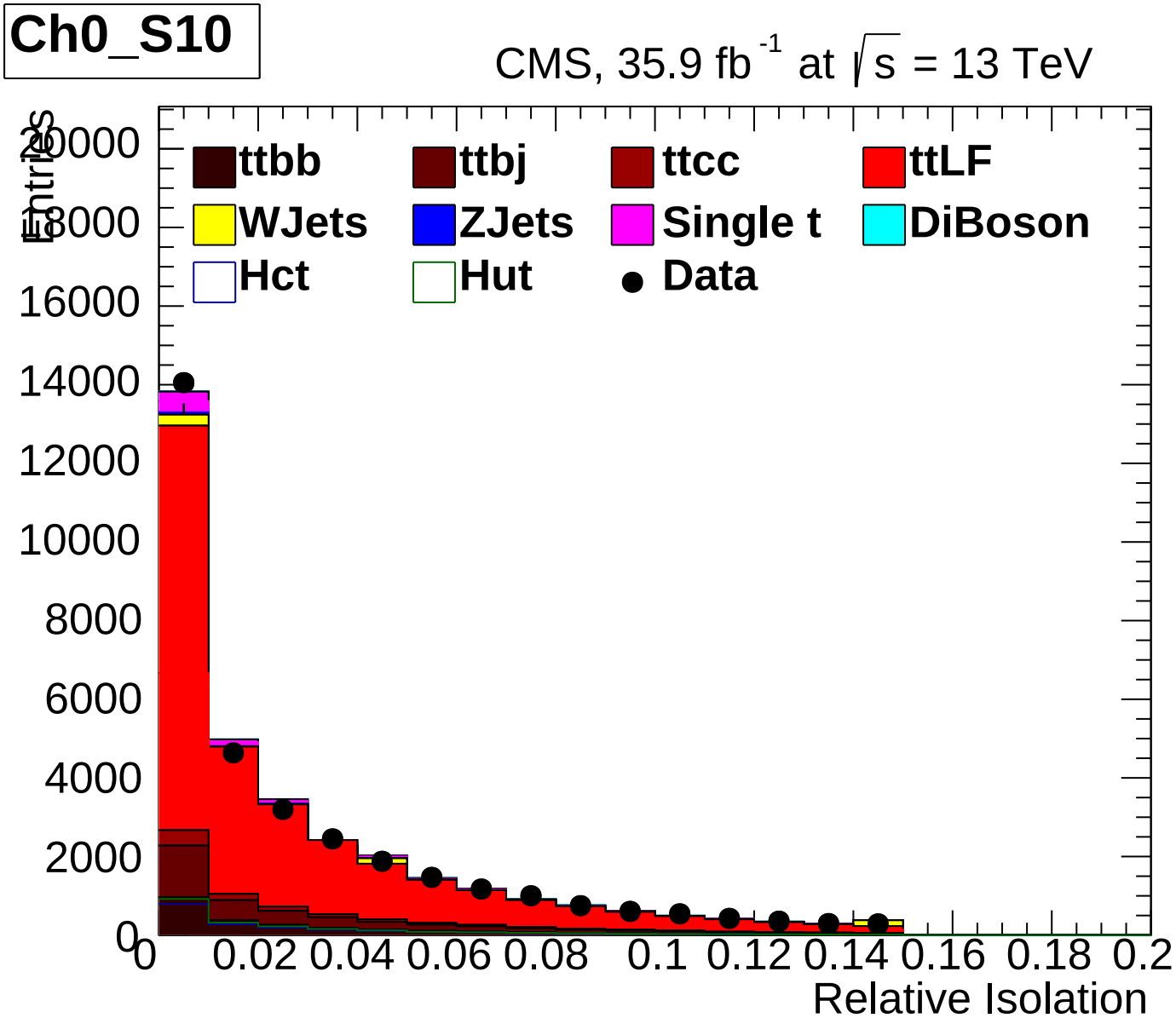
3000
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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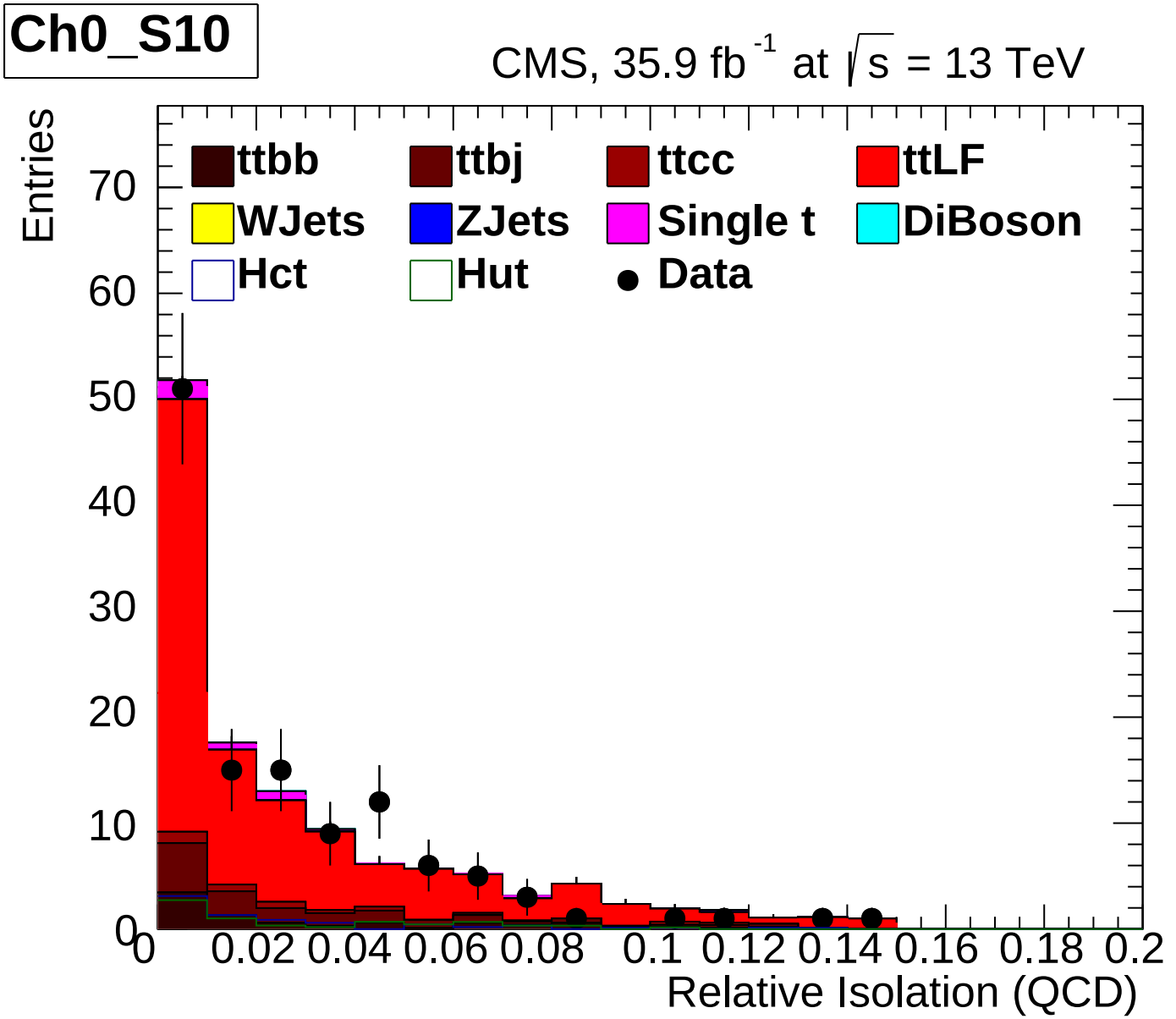
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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10
20
30
40
50
60
70
0
0.02
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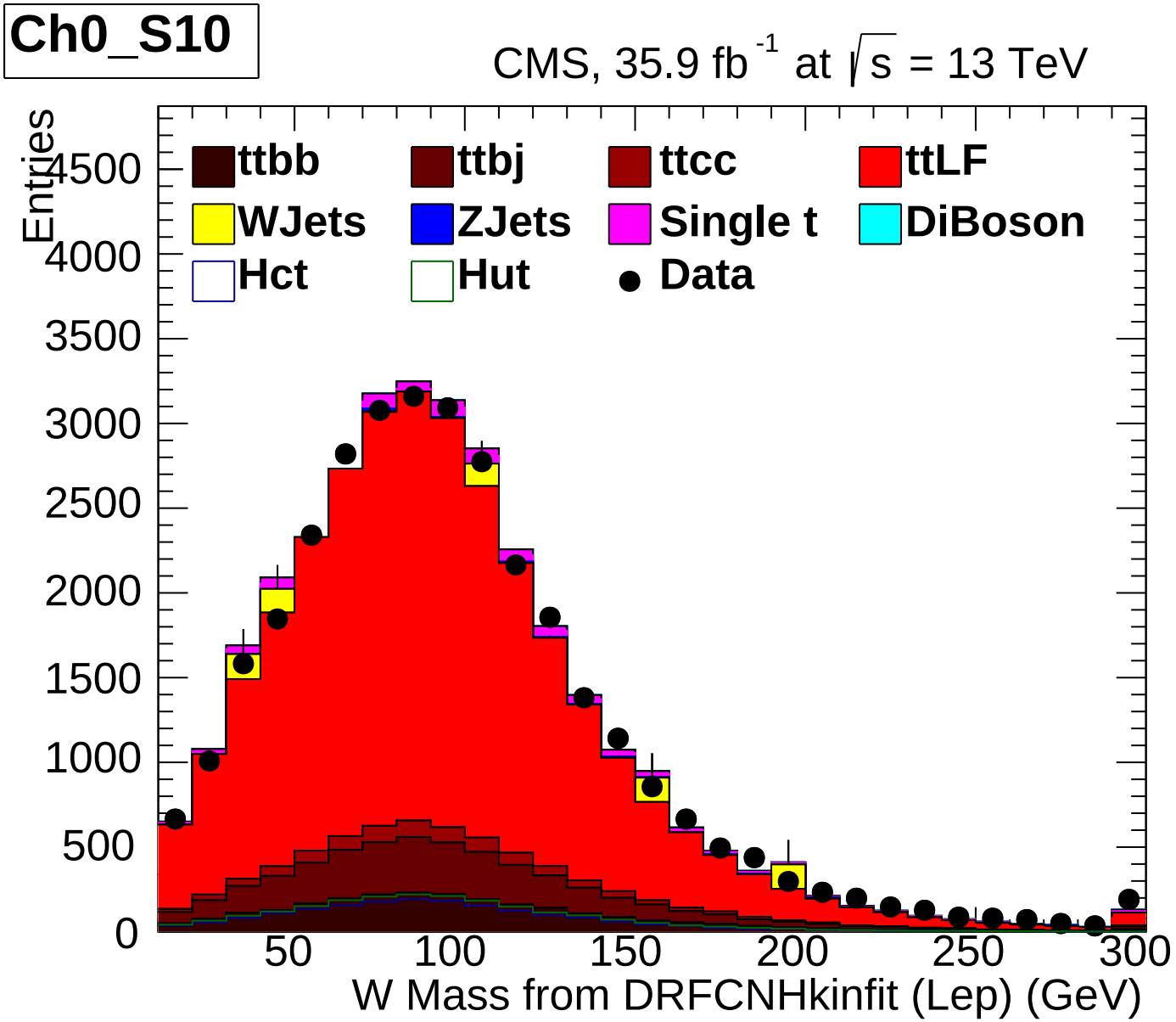
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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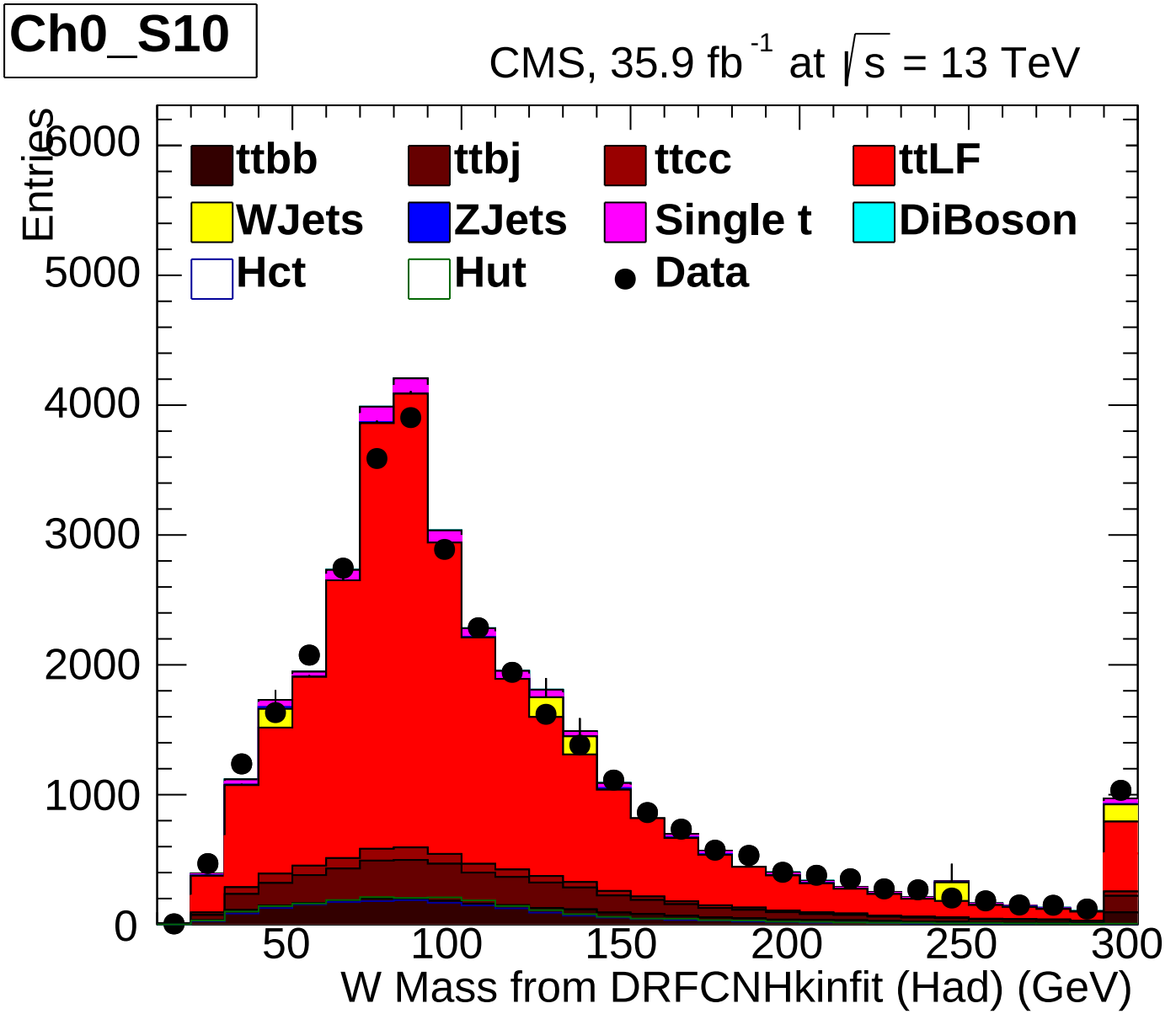
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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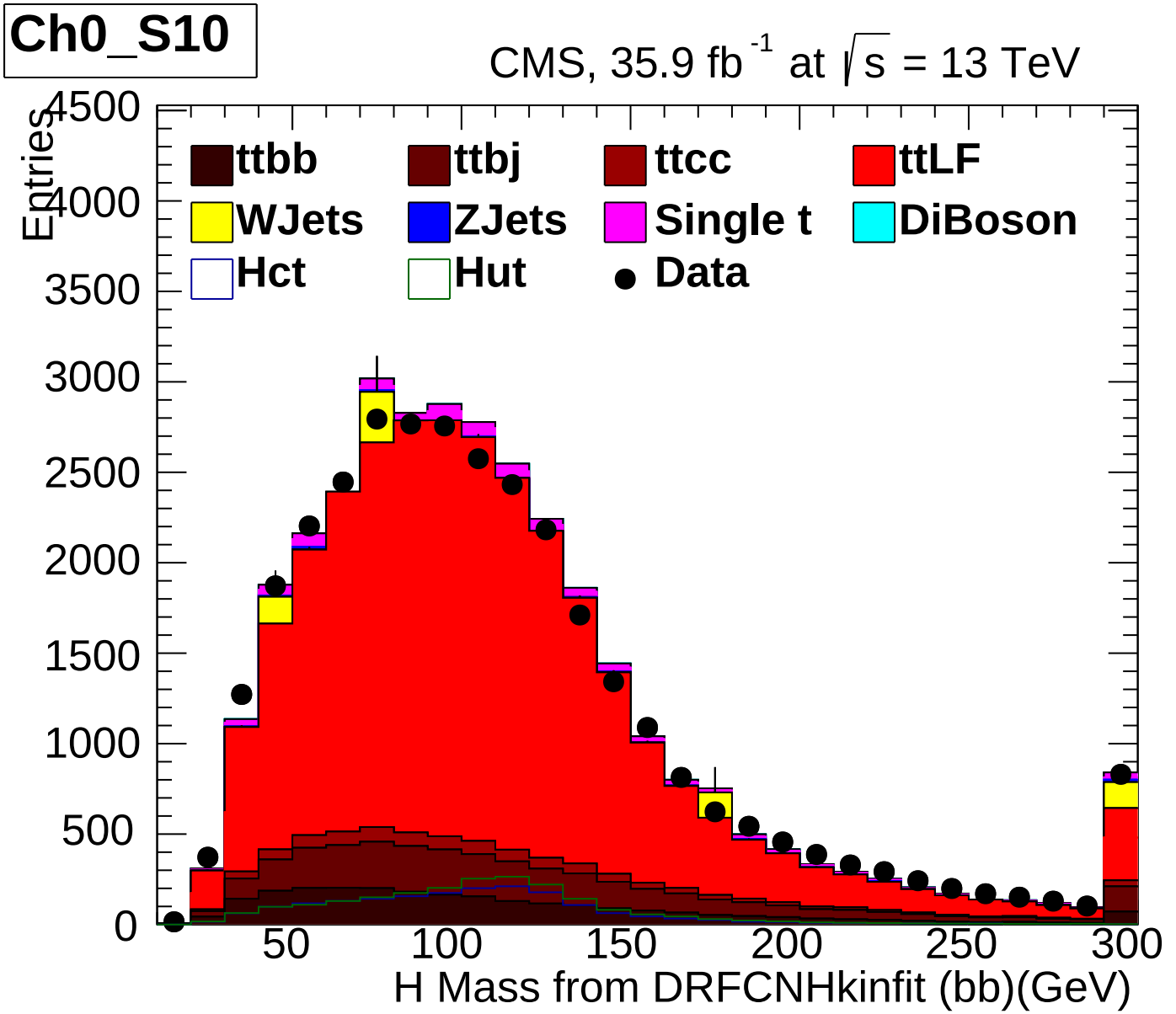
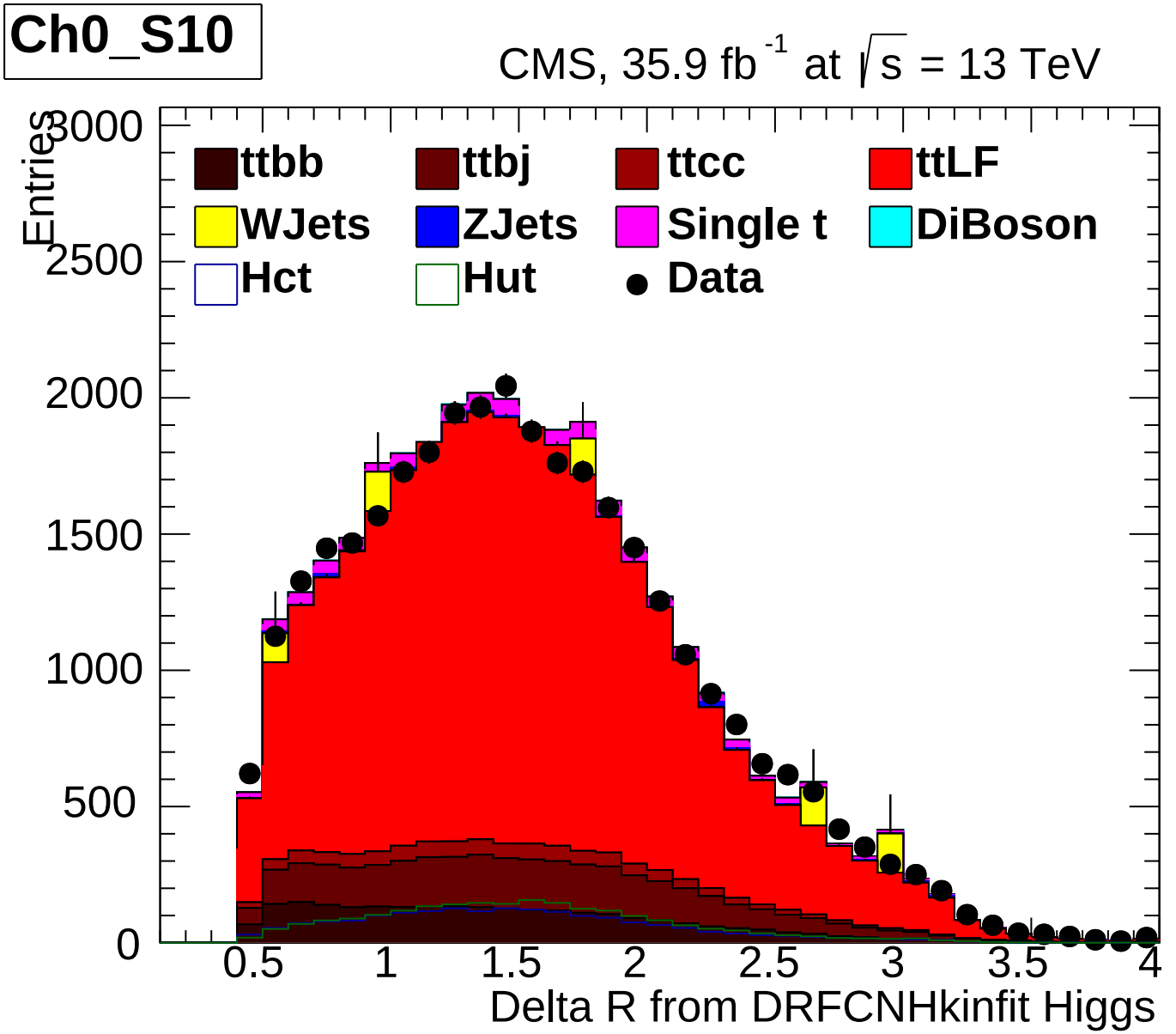
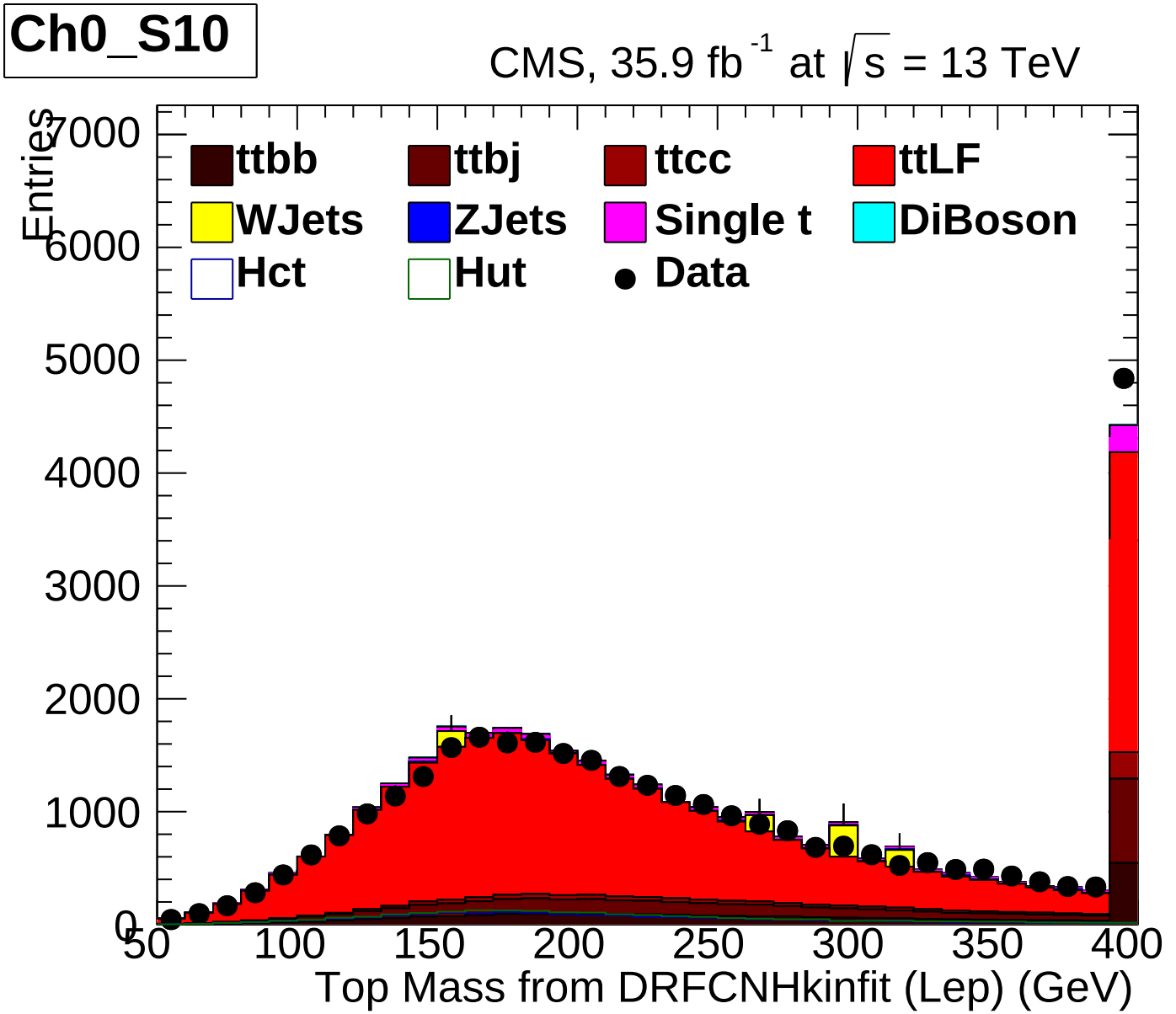
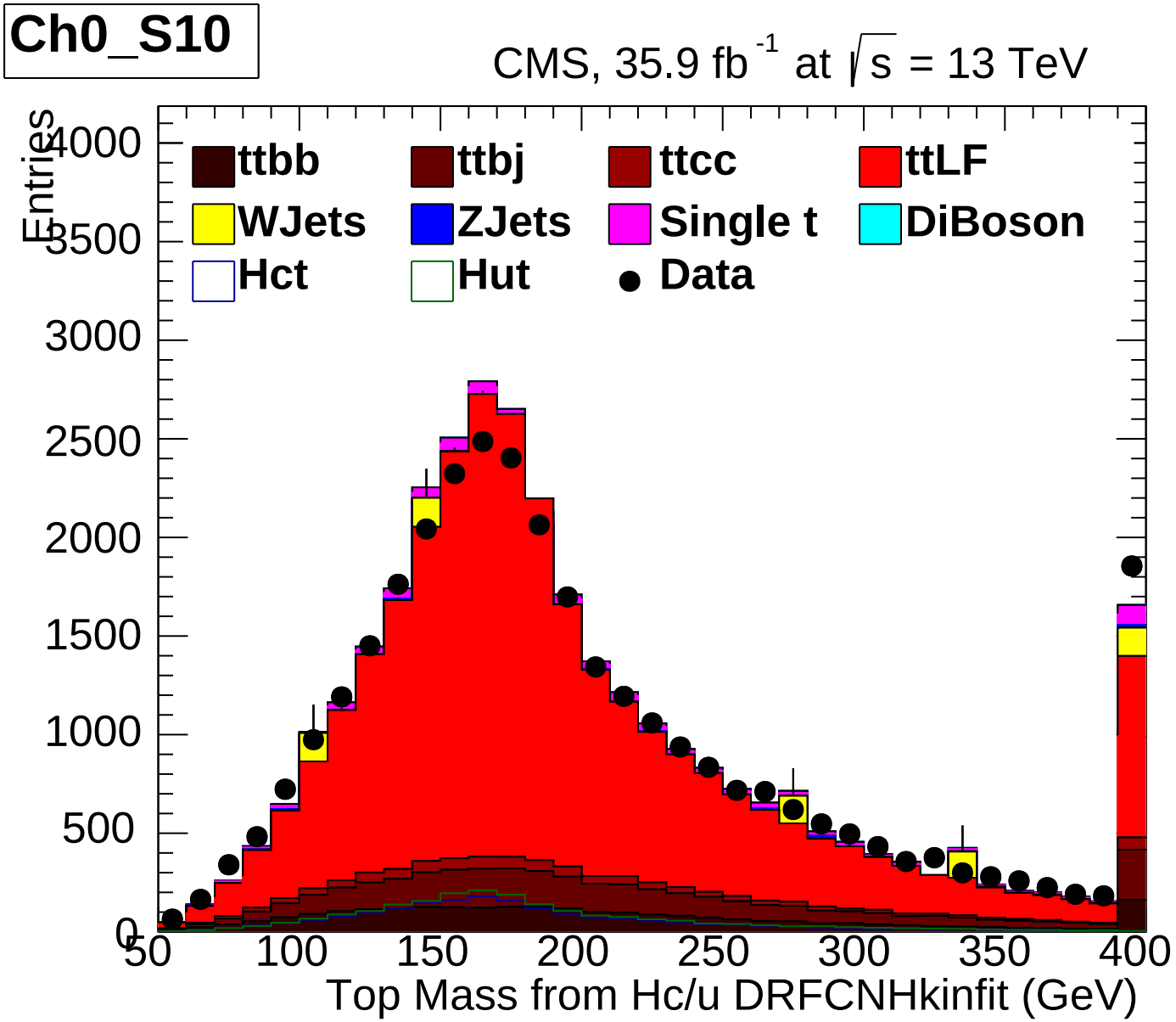
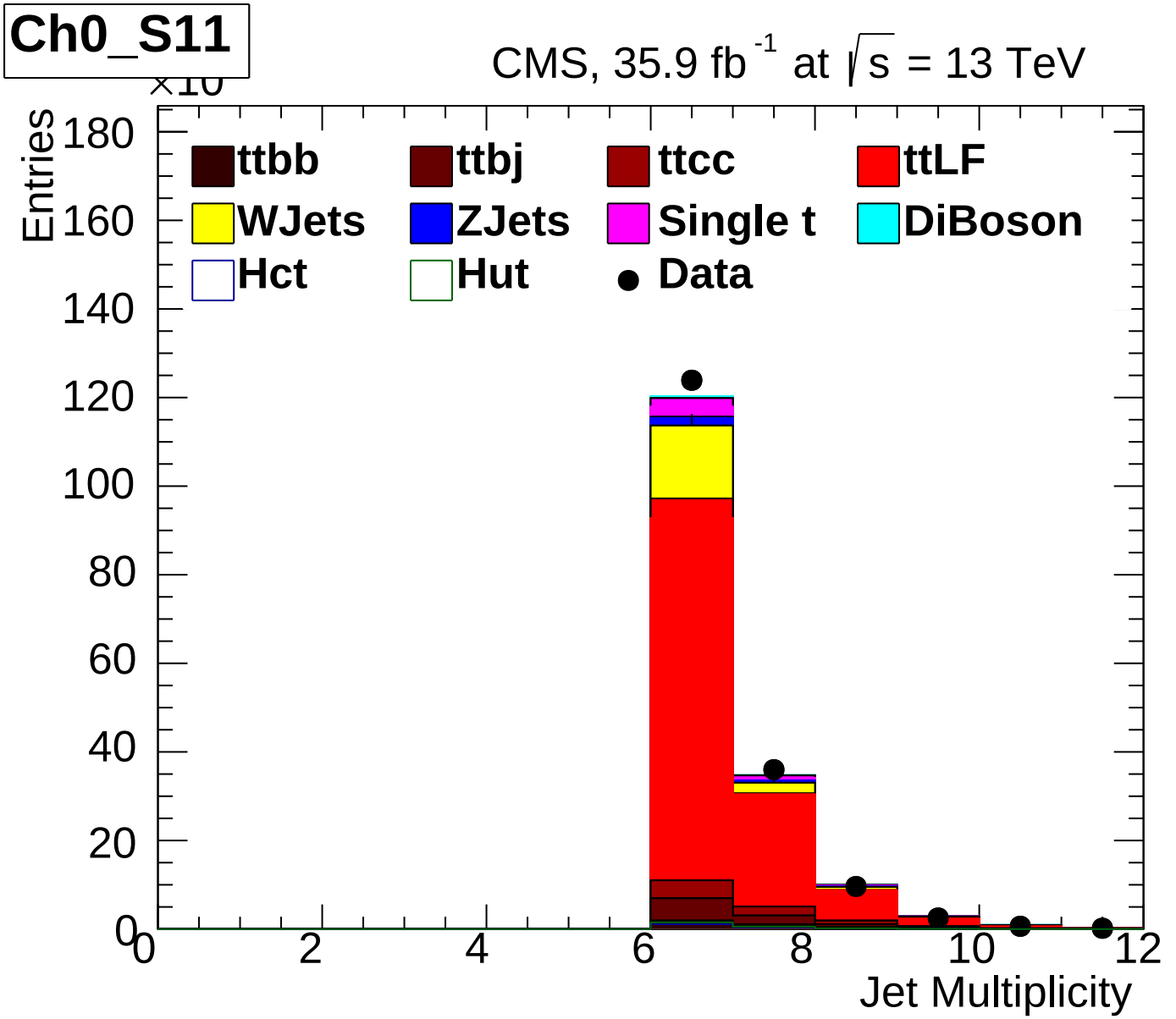
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

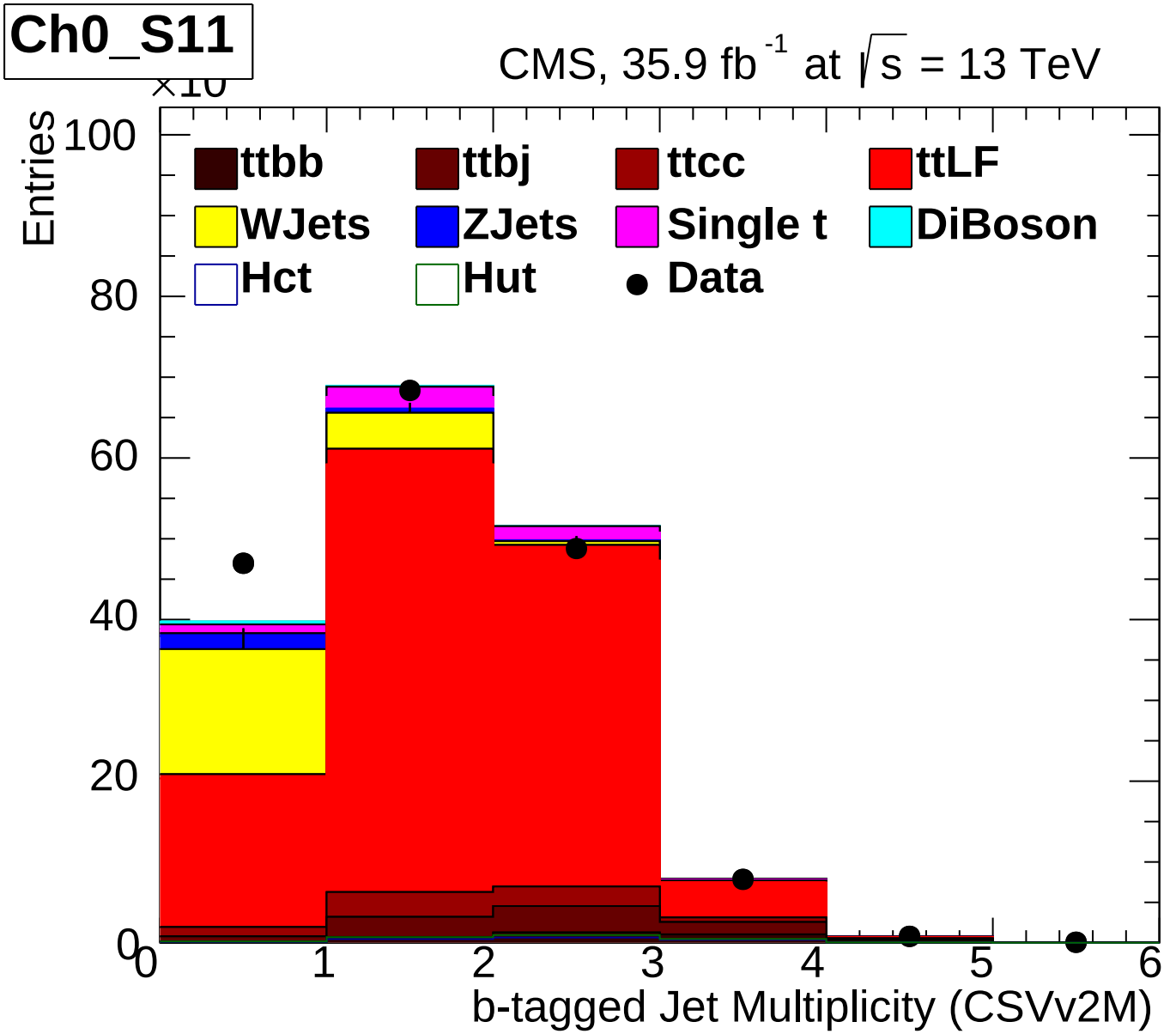

Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

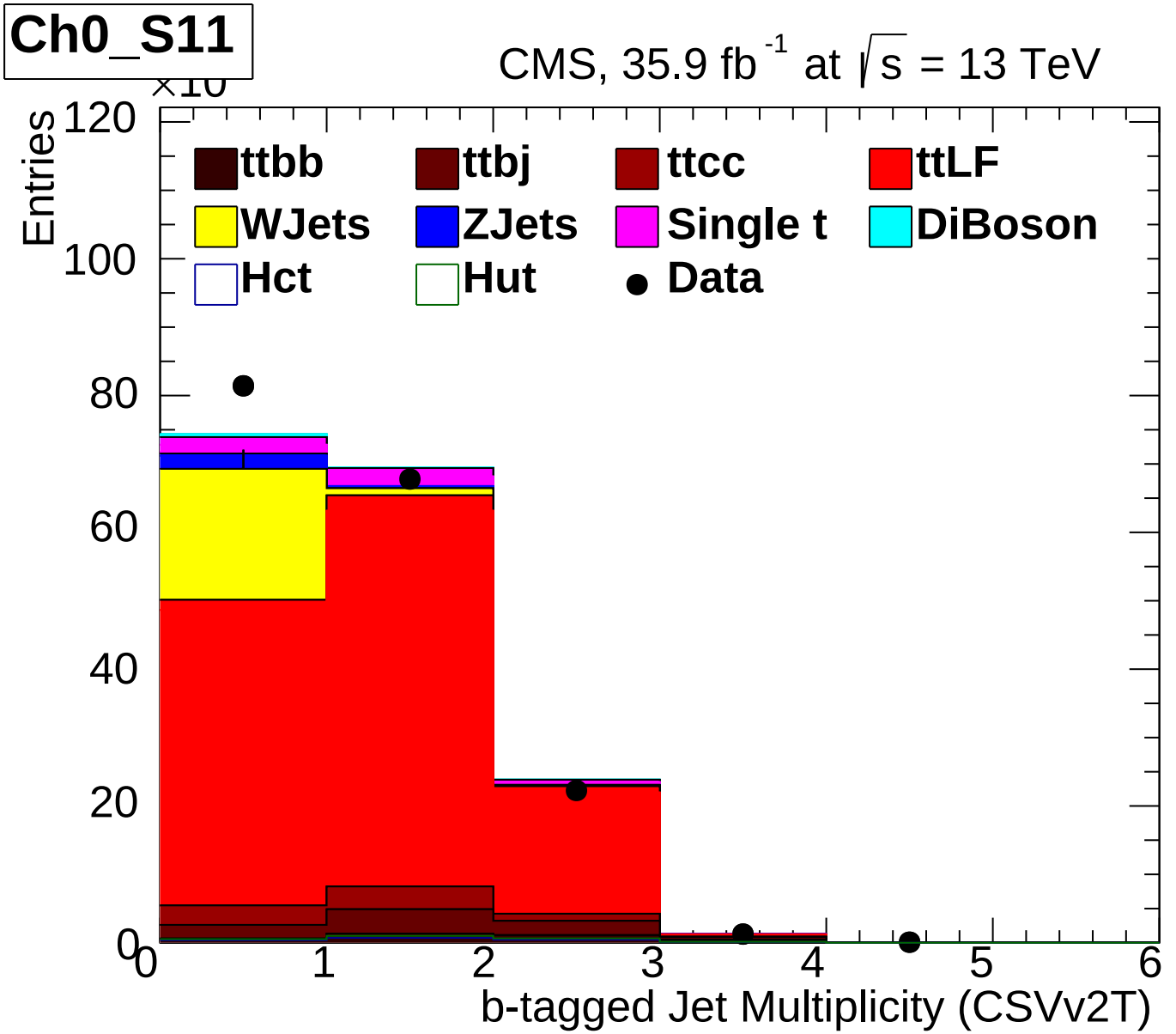

Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

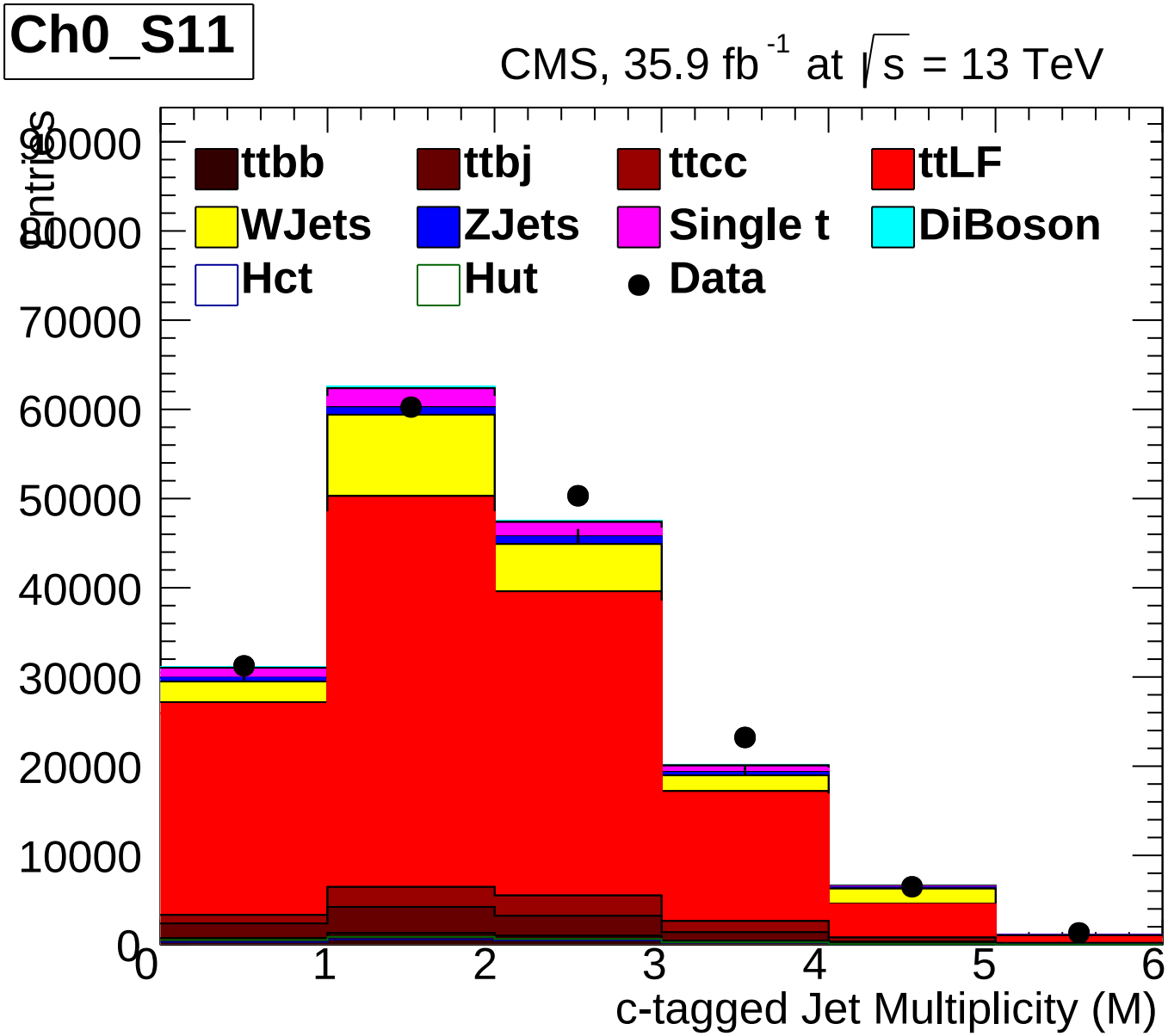

Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

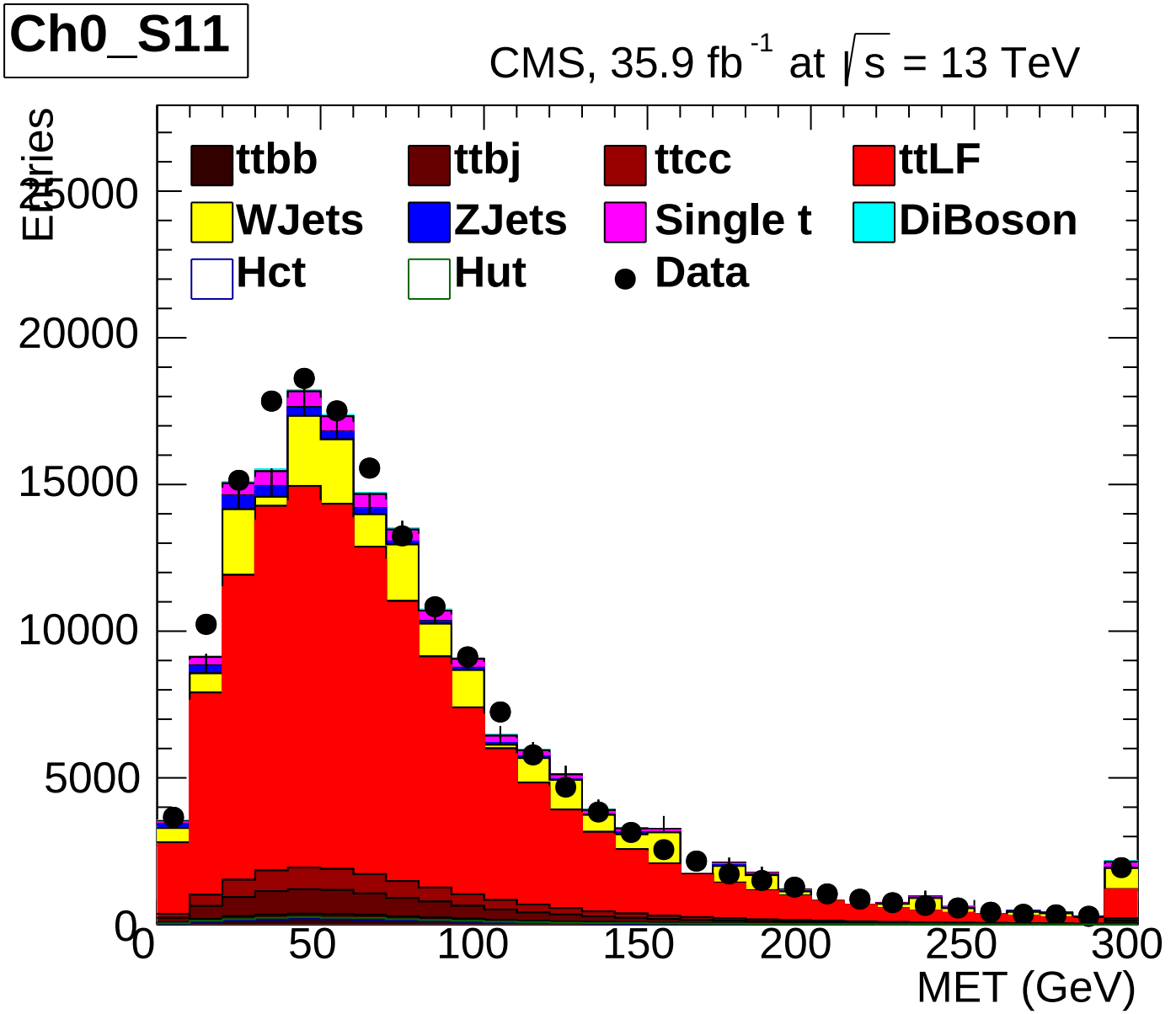

Ch0_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

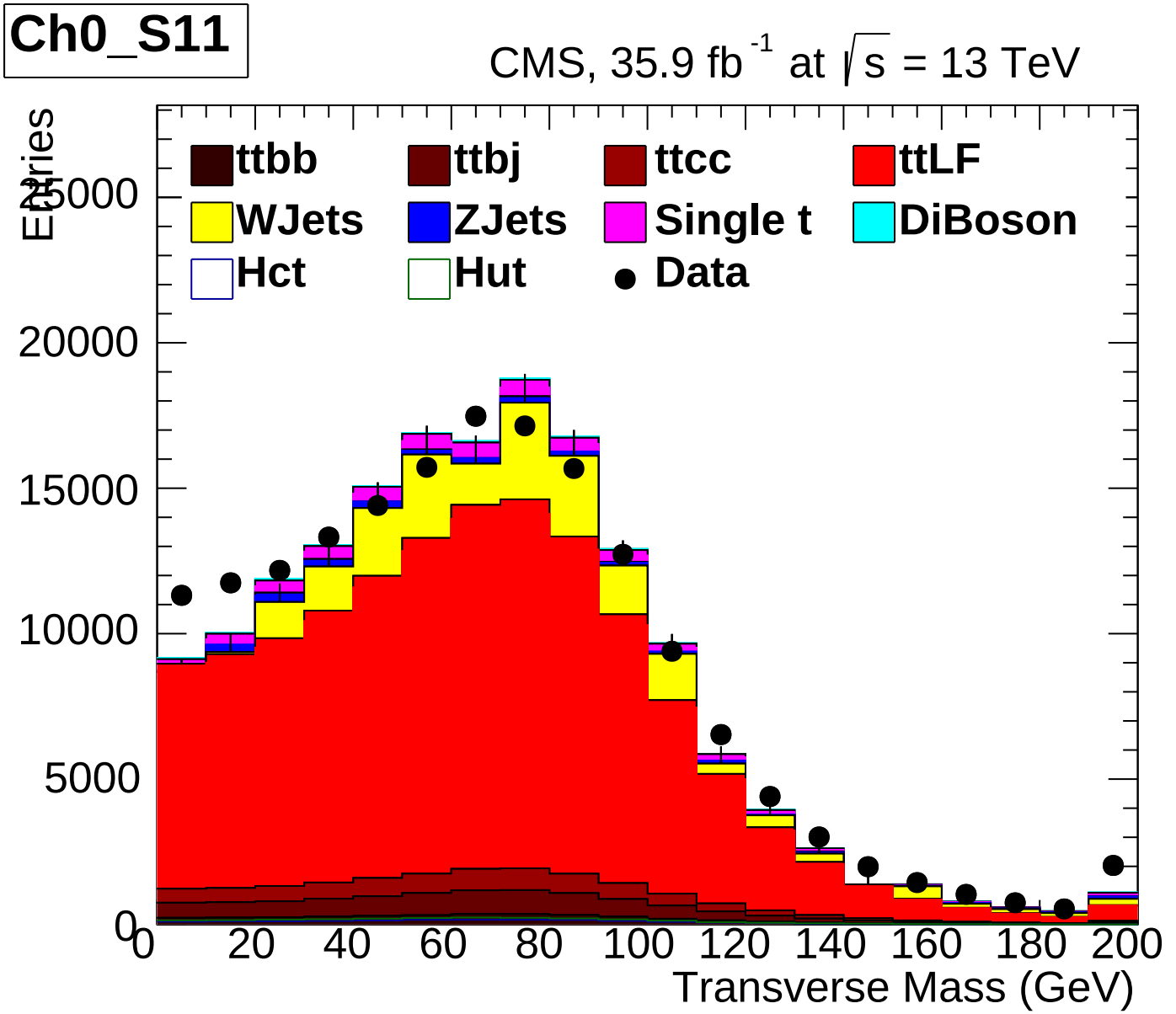

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10
Entries
180
160
140
120
100
80
60
40
20
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2
4
6
8
10
12
Jet Multiplicity

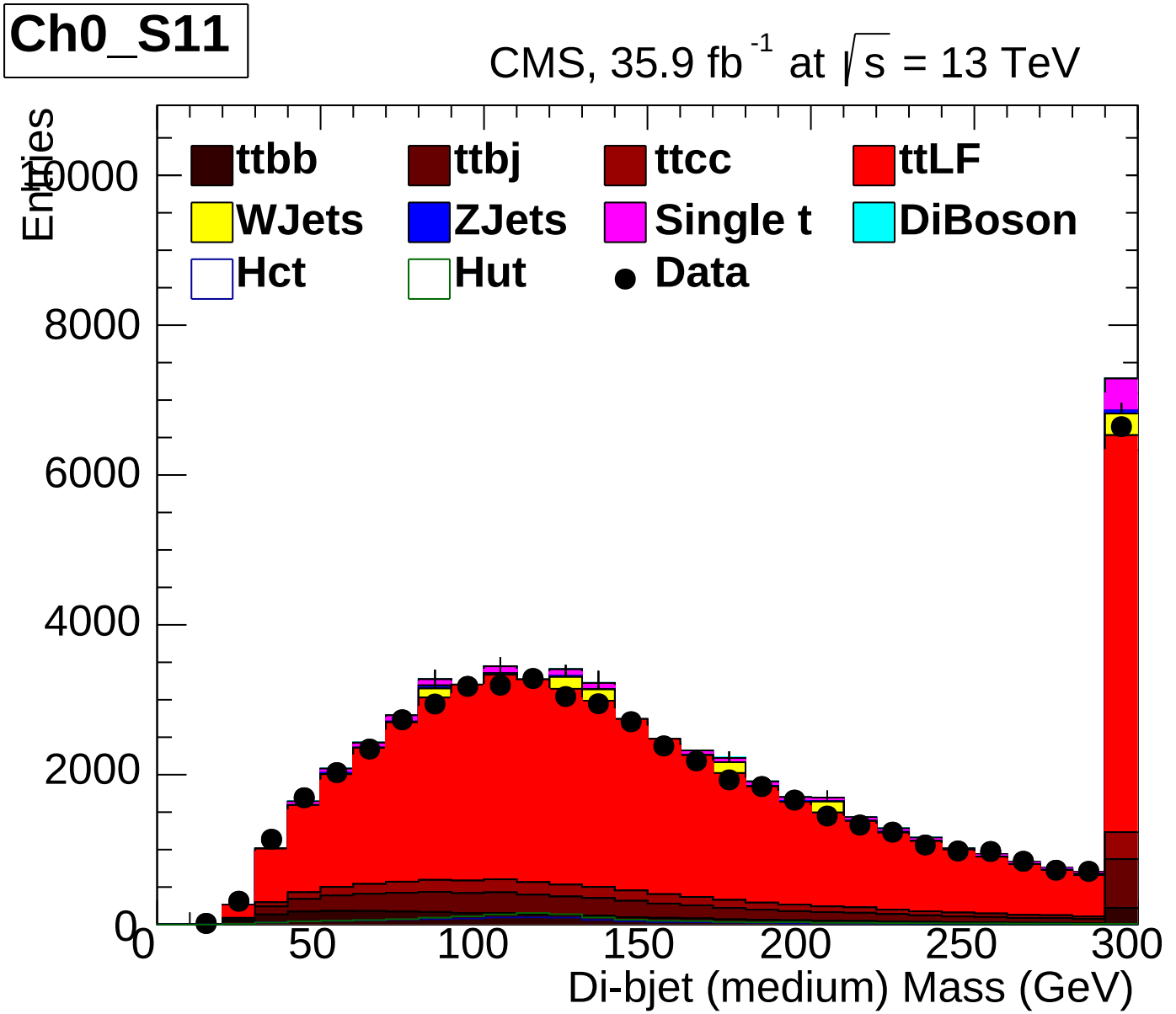

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10
Entries
100
80
60
40
20
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

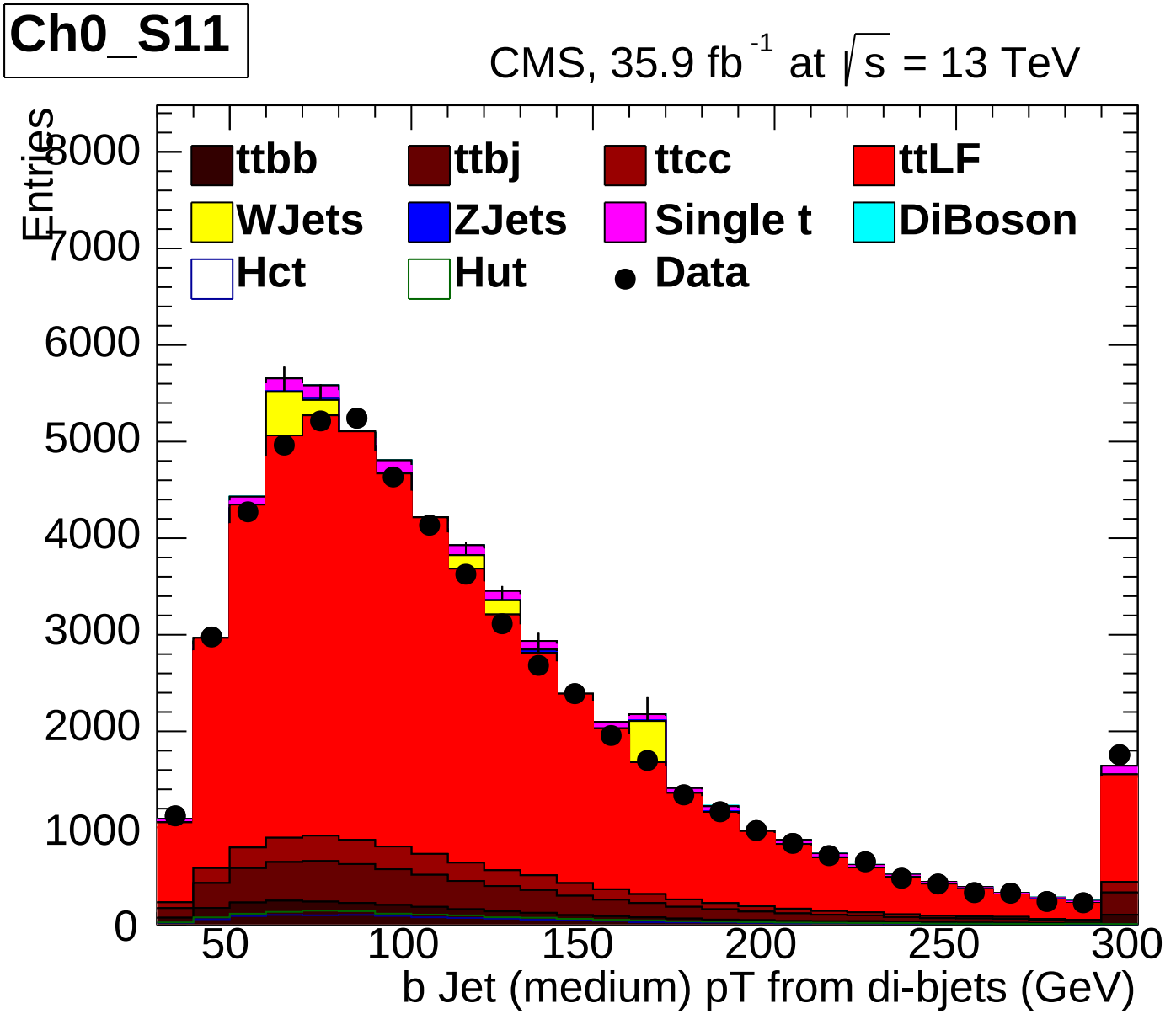

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10
Entries
120
100
80
60
40
20
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

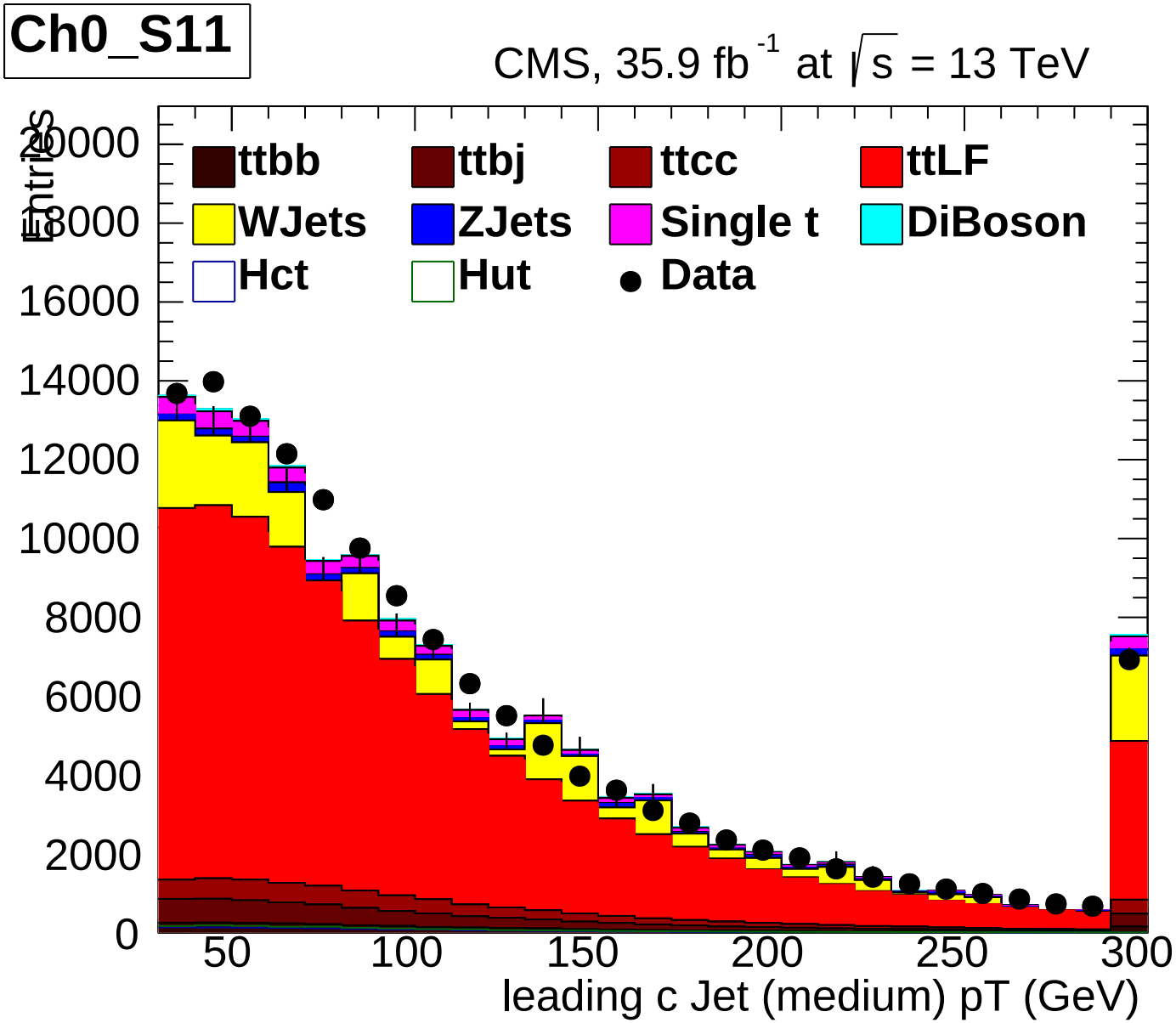

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
entries
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

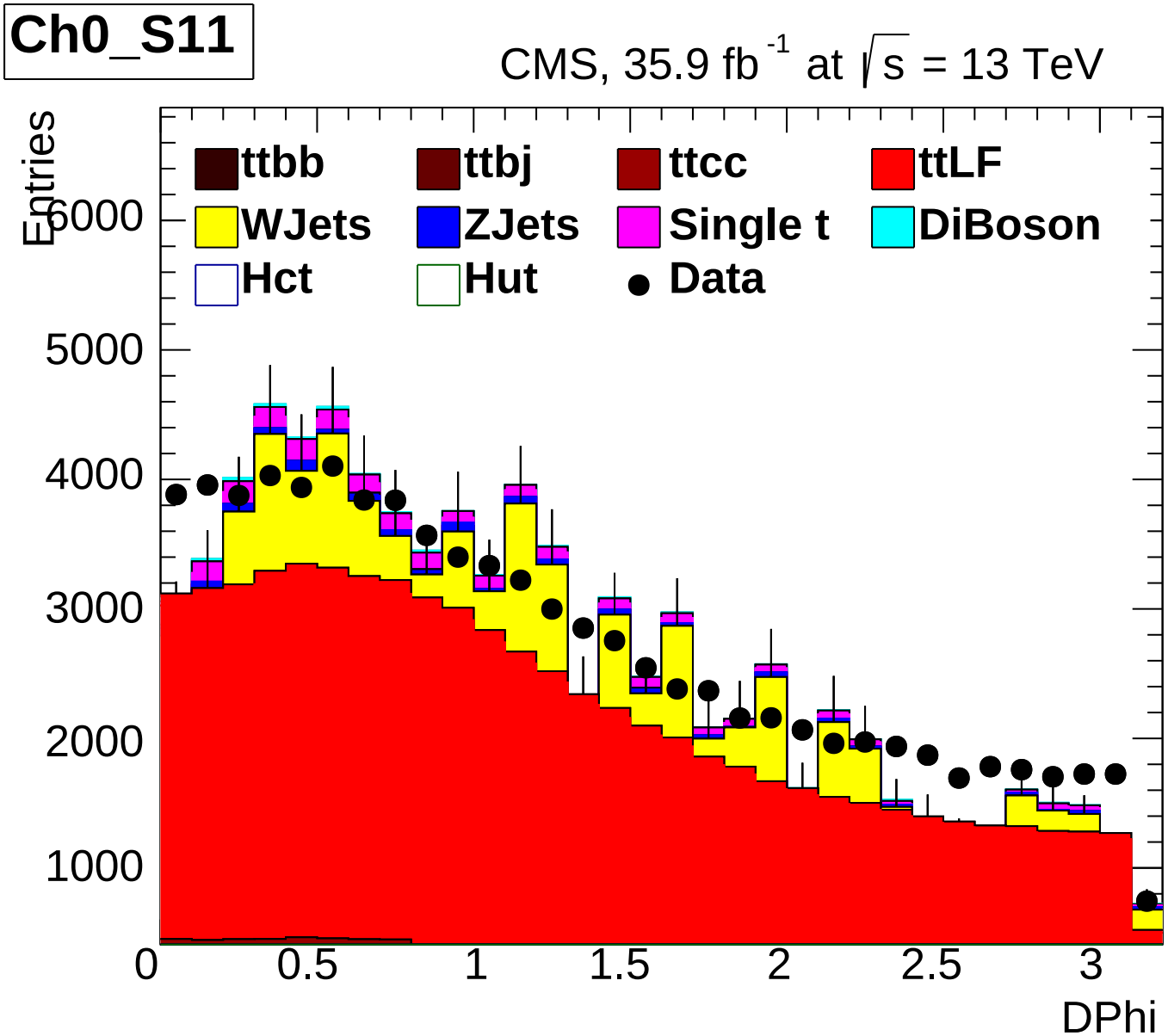

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
5000
10000
15000
20000
25000
0
50
100
150
200
250
300
MET (GeV)

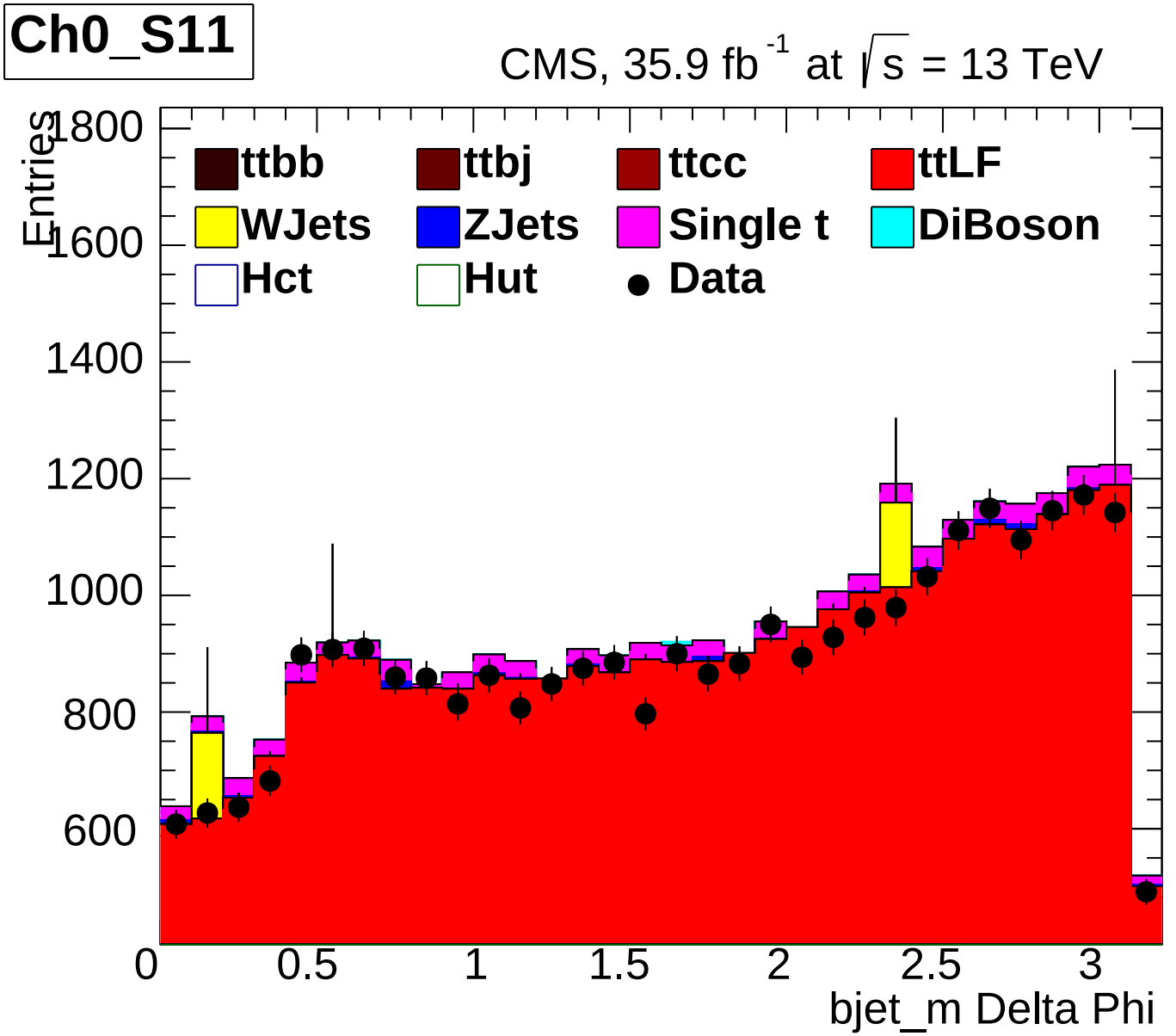

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
5000
10000
15000
20000
25000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

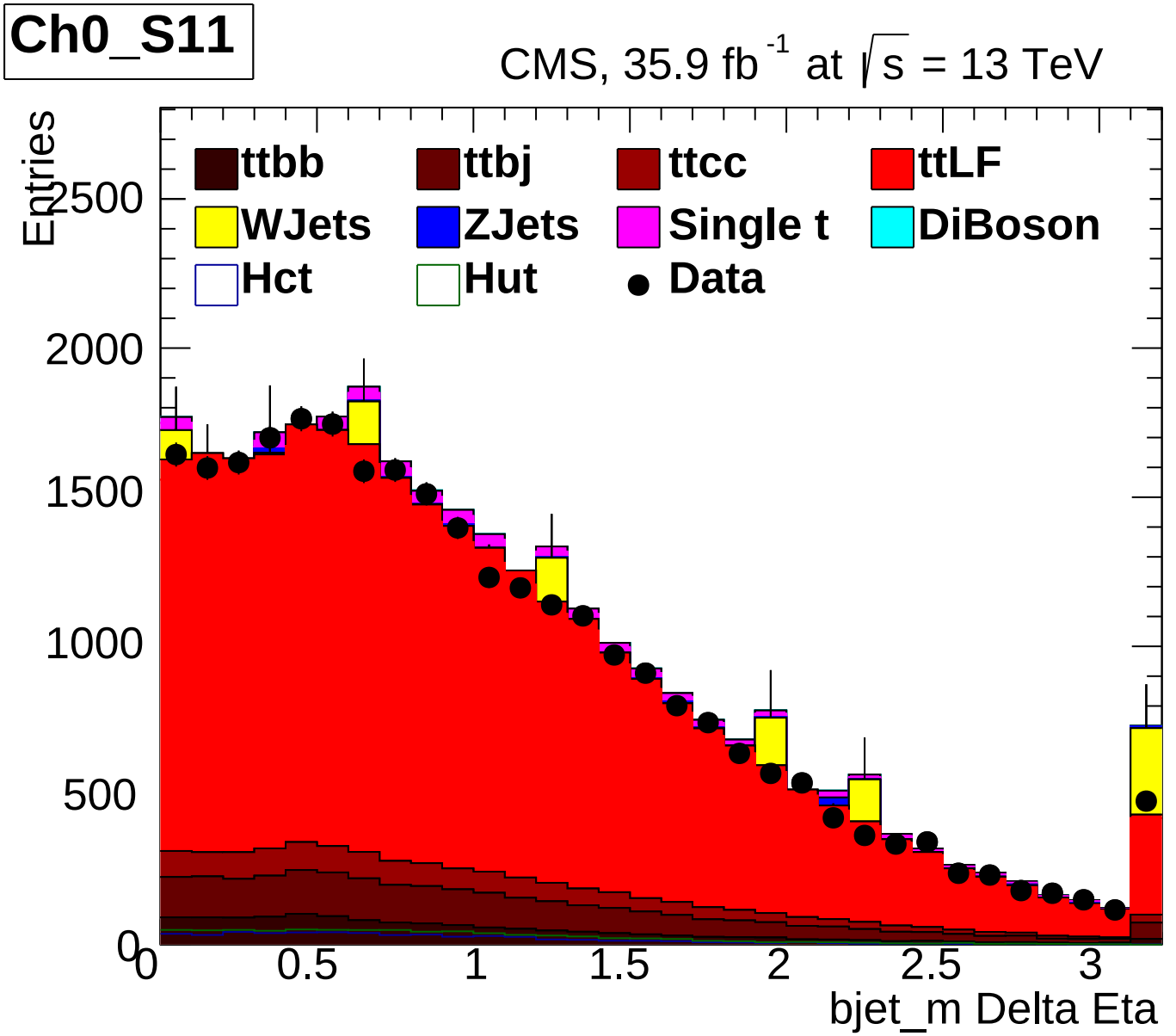

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
10000
8000
6000
4000
2000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

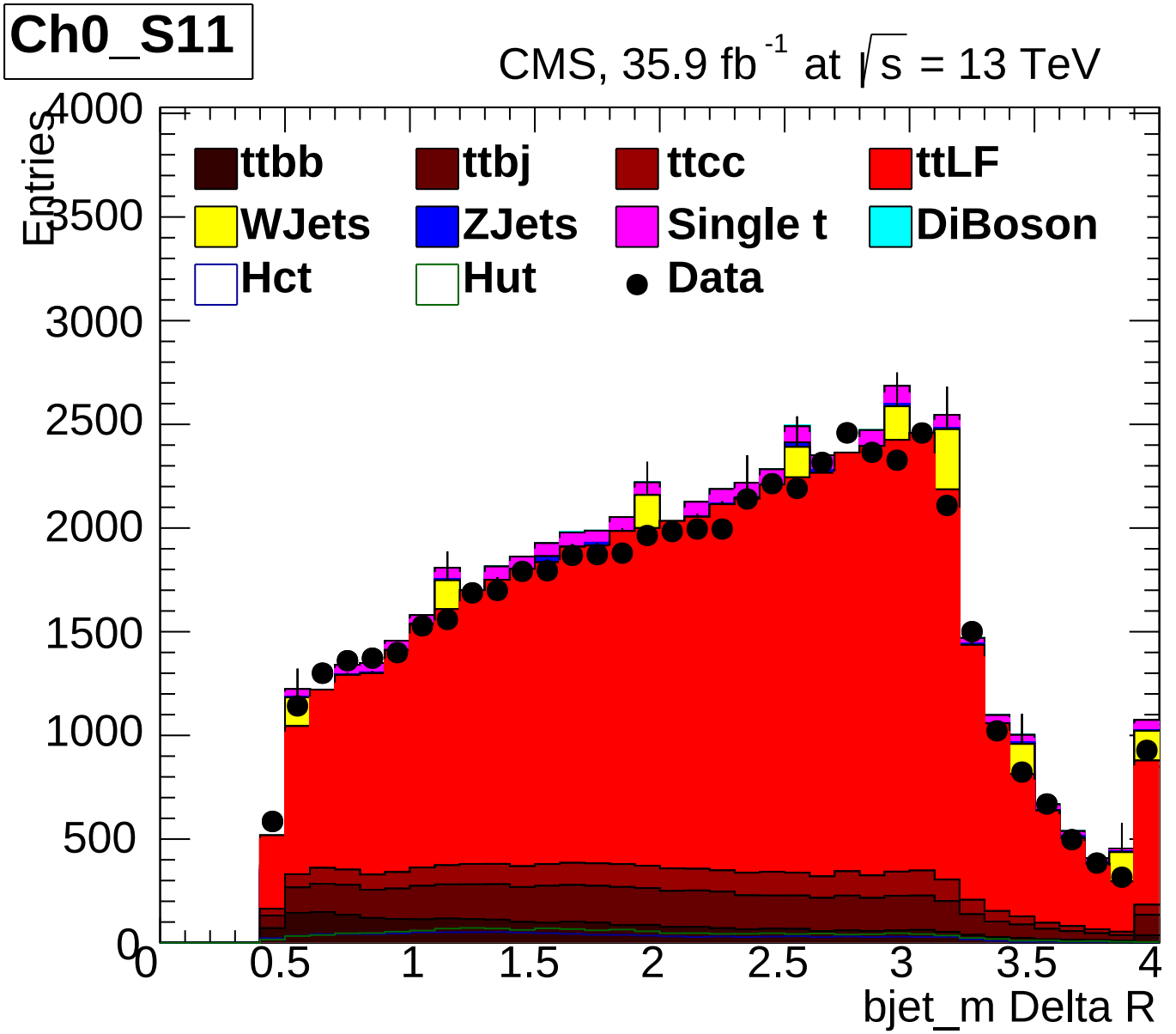

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

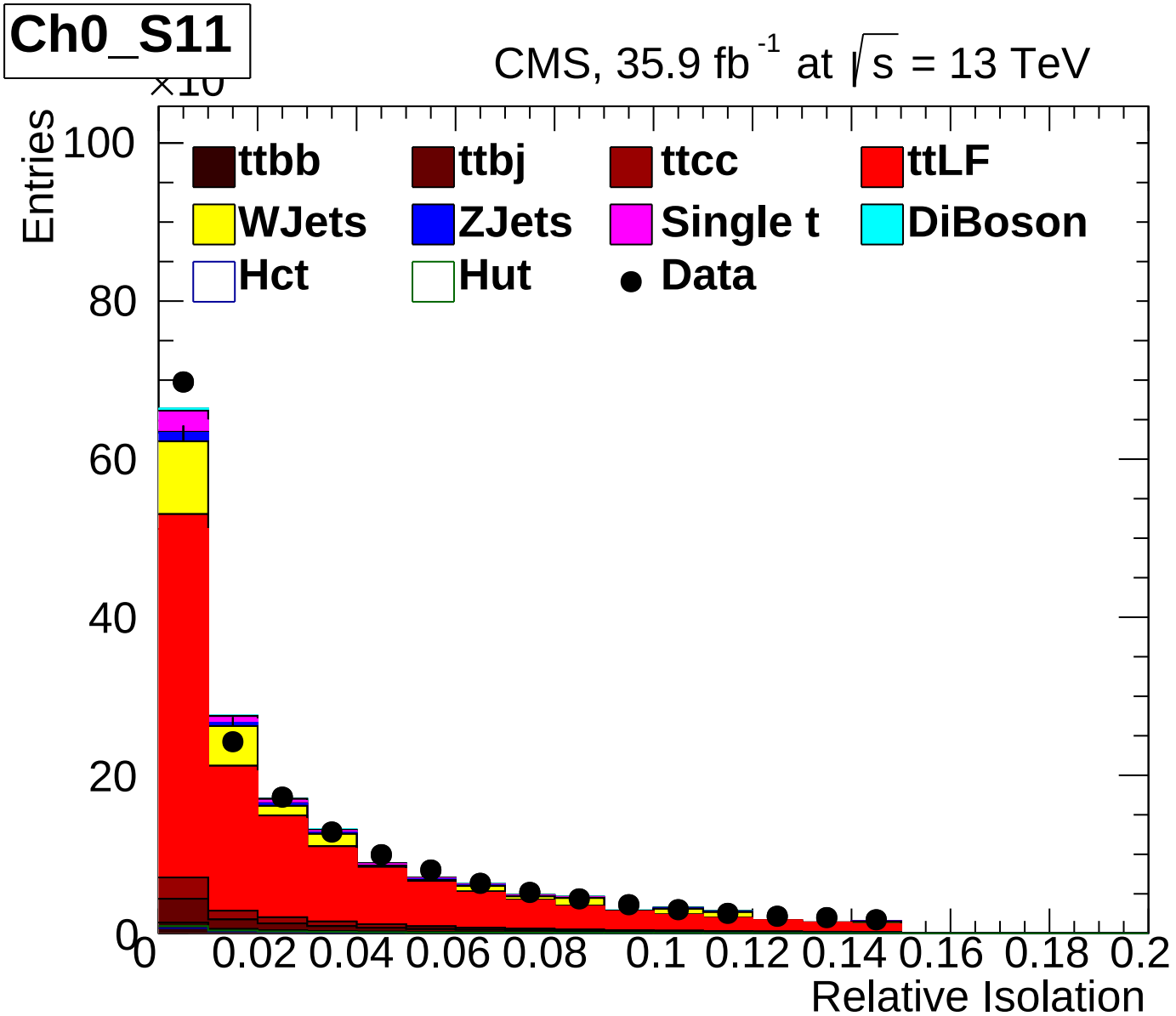

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

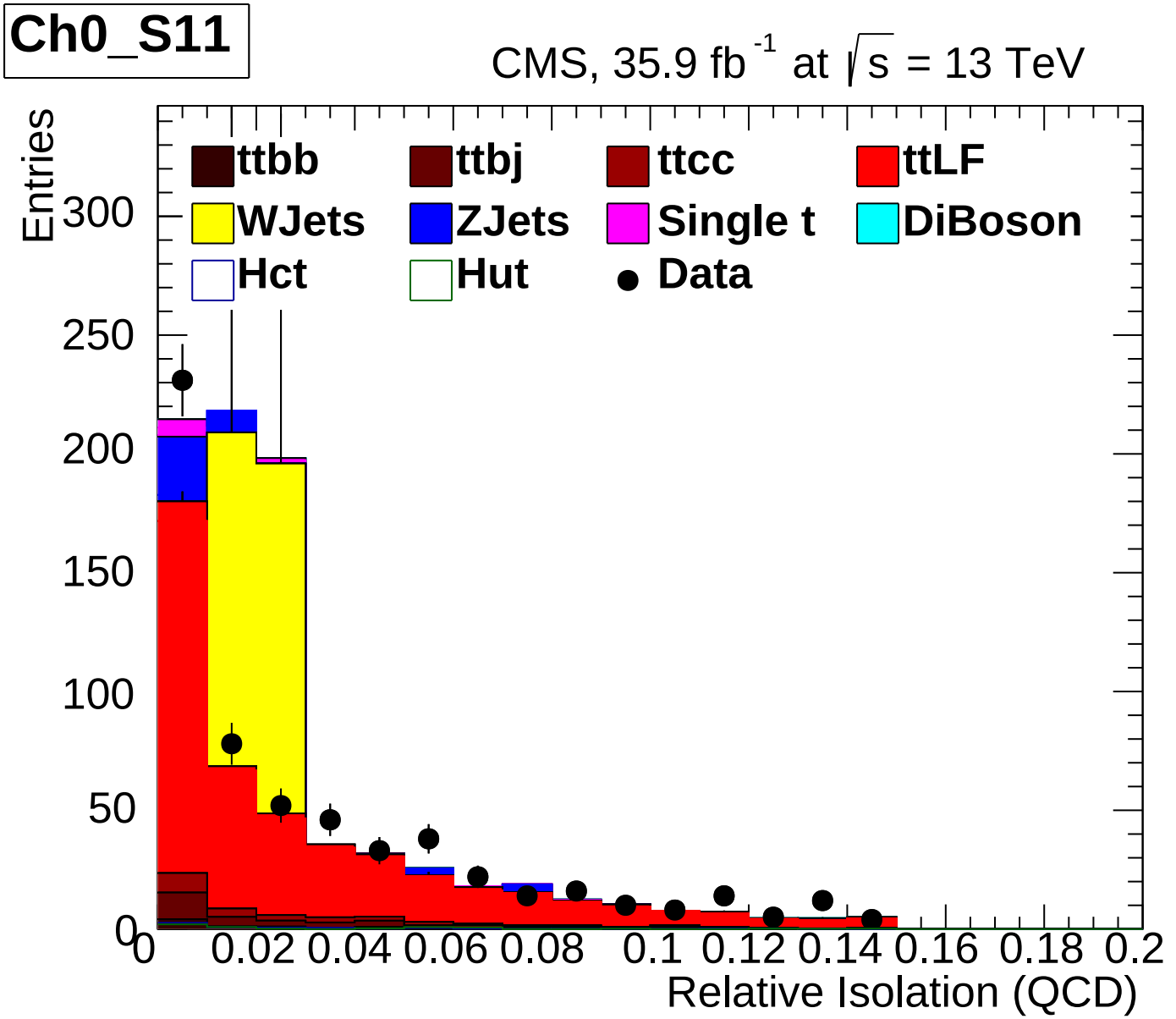

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
6000
5000
4000
3000
2000
1000
0
0.5
1
1.5
2
2.5
3
DPhi

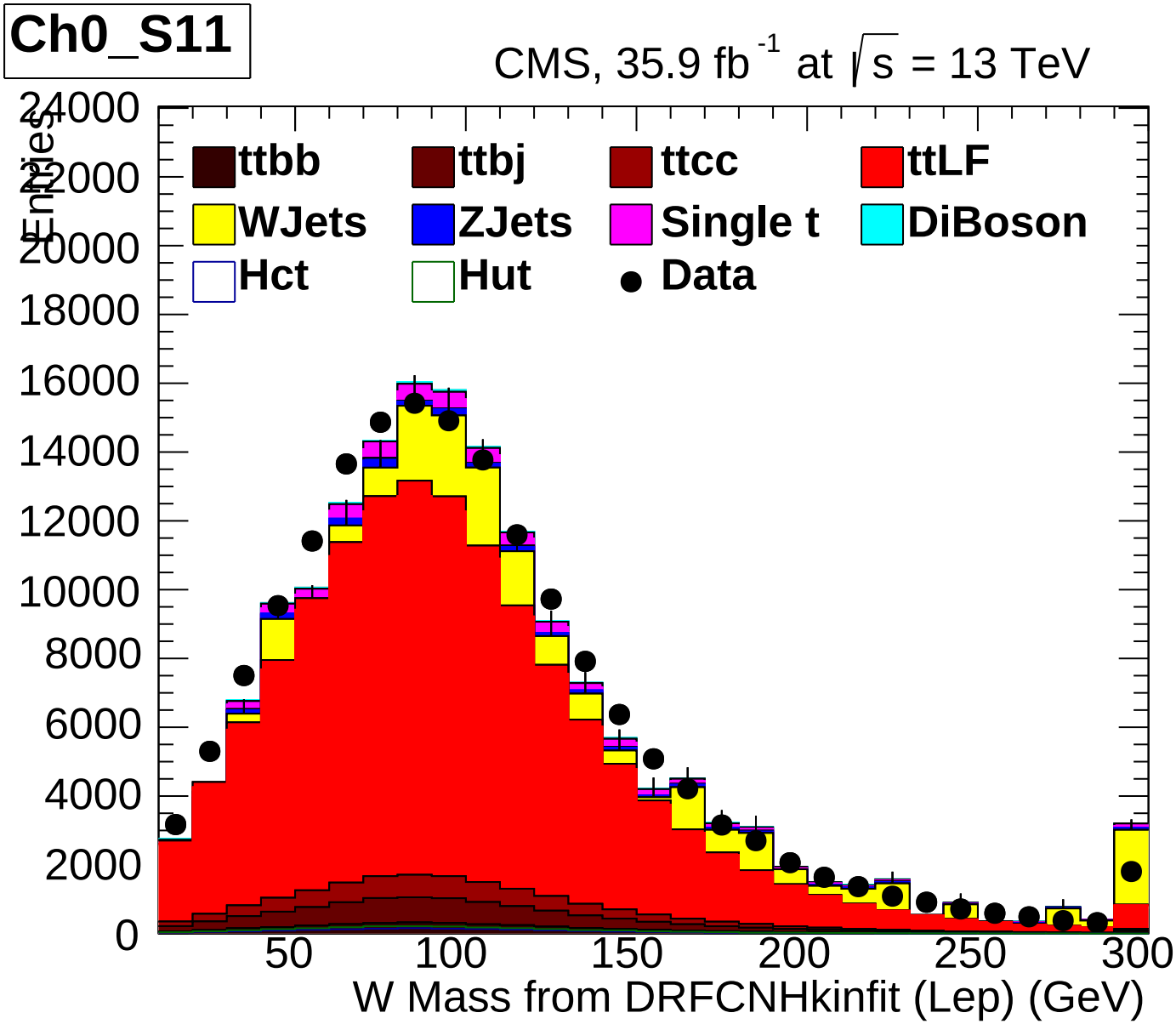

Ch0_S11
CMS, 35.9 fb -1 at √s = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1800
1600
1400
1200
1000
800
600
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

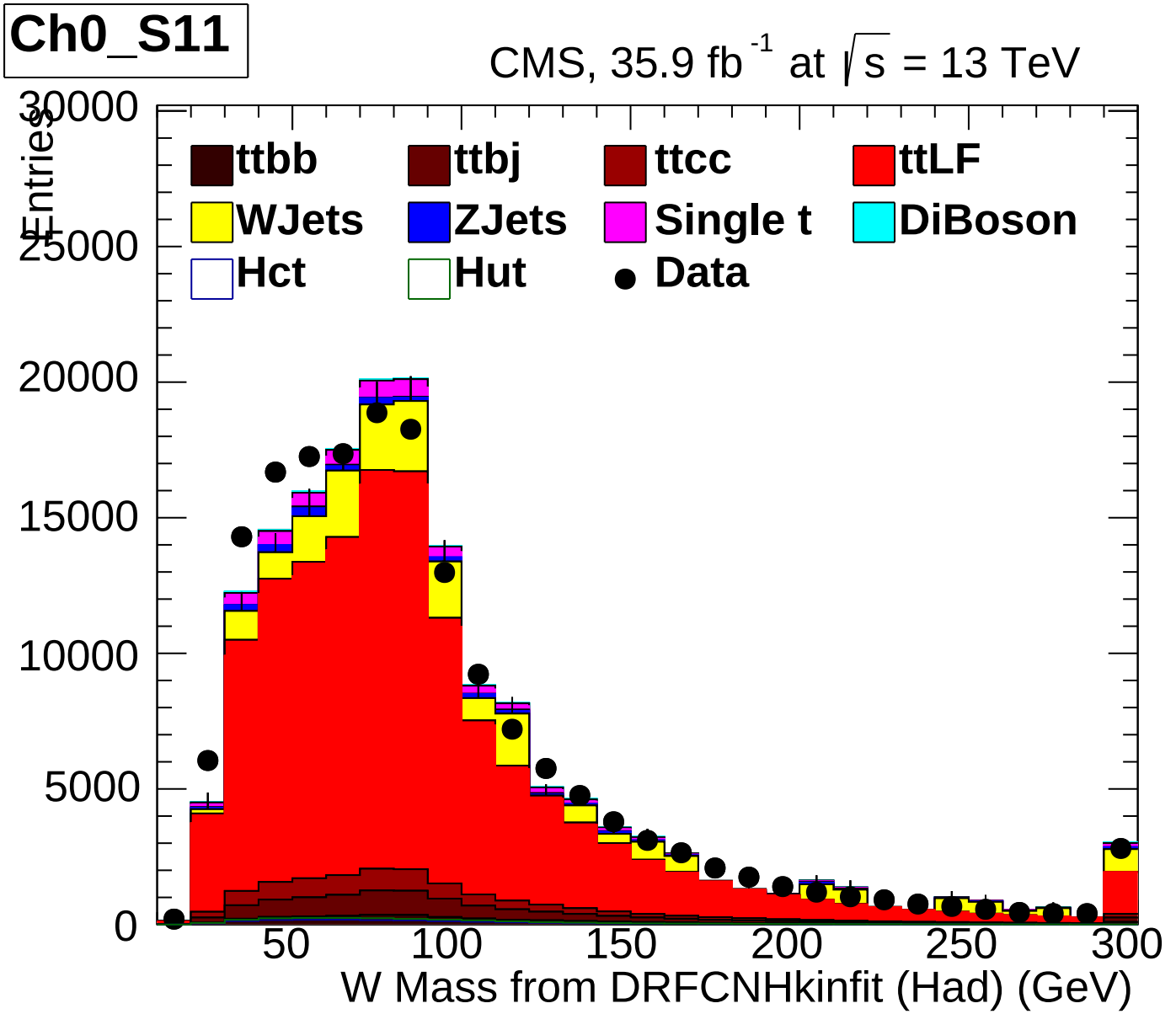

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

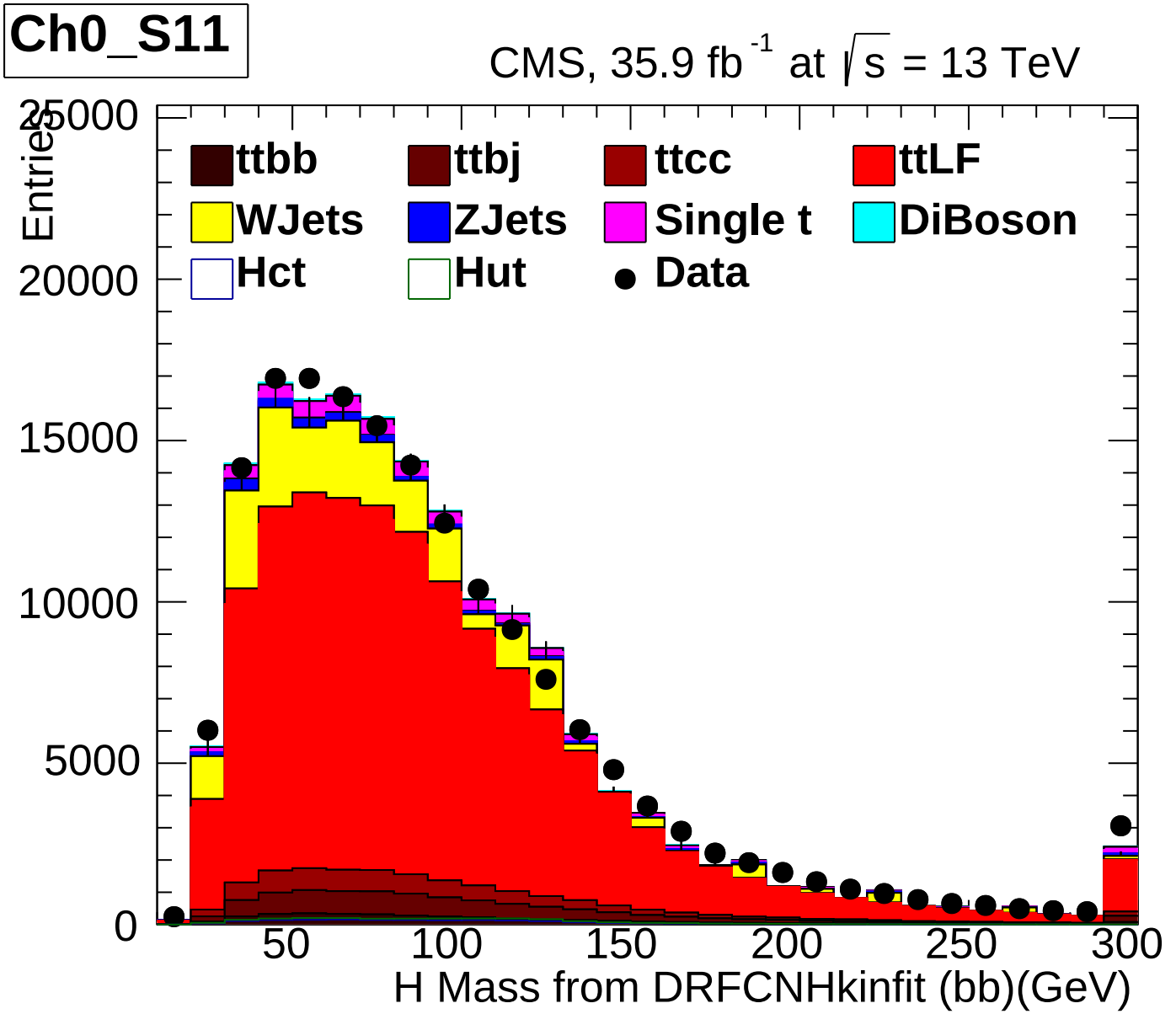

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

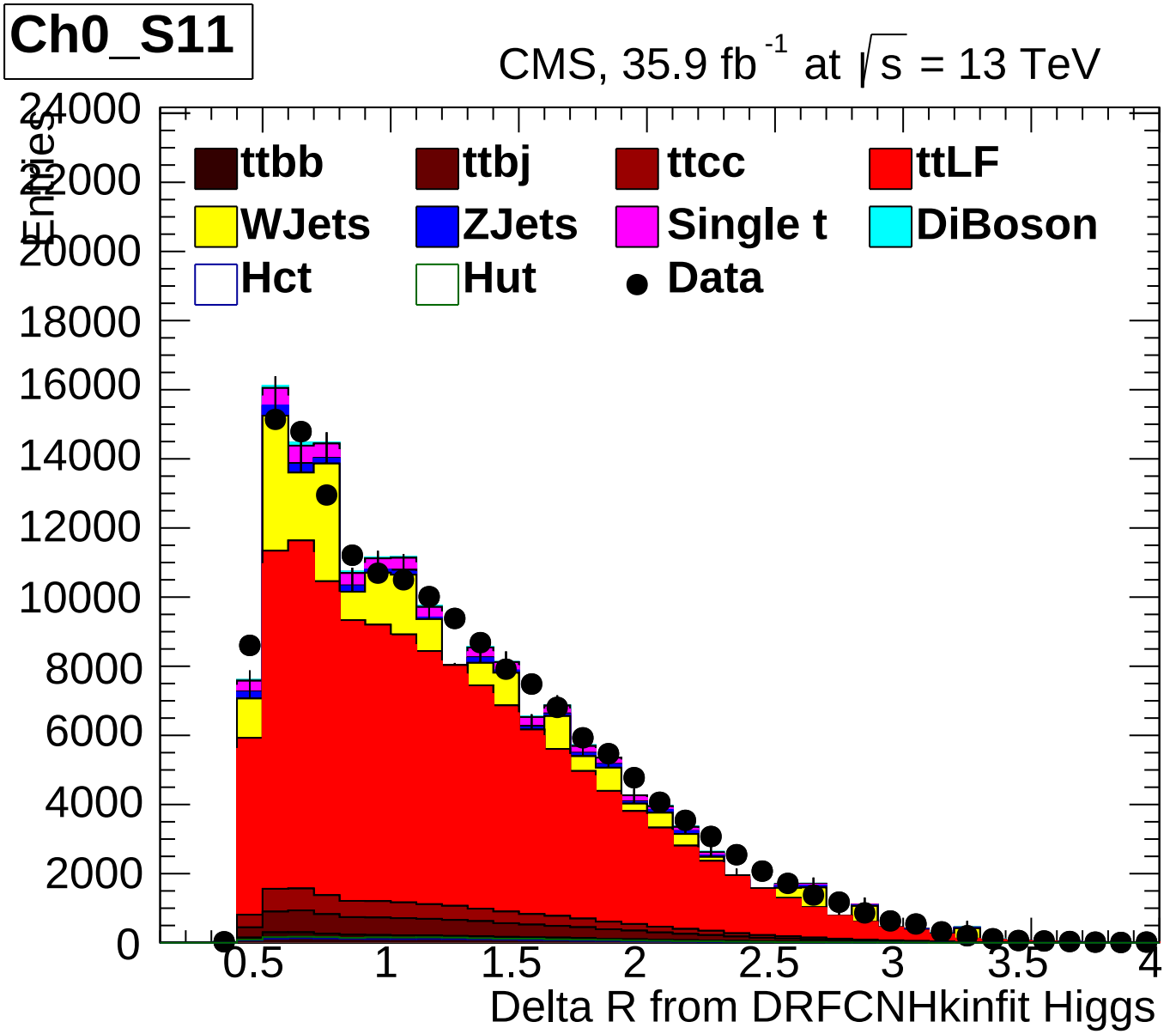

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10
Entries
100
80
60
40
20
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

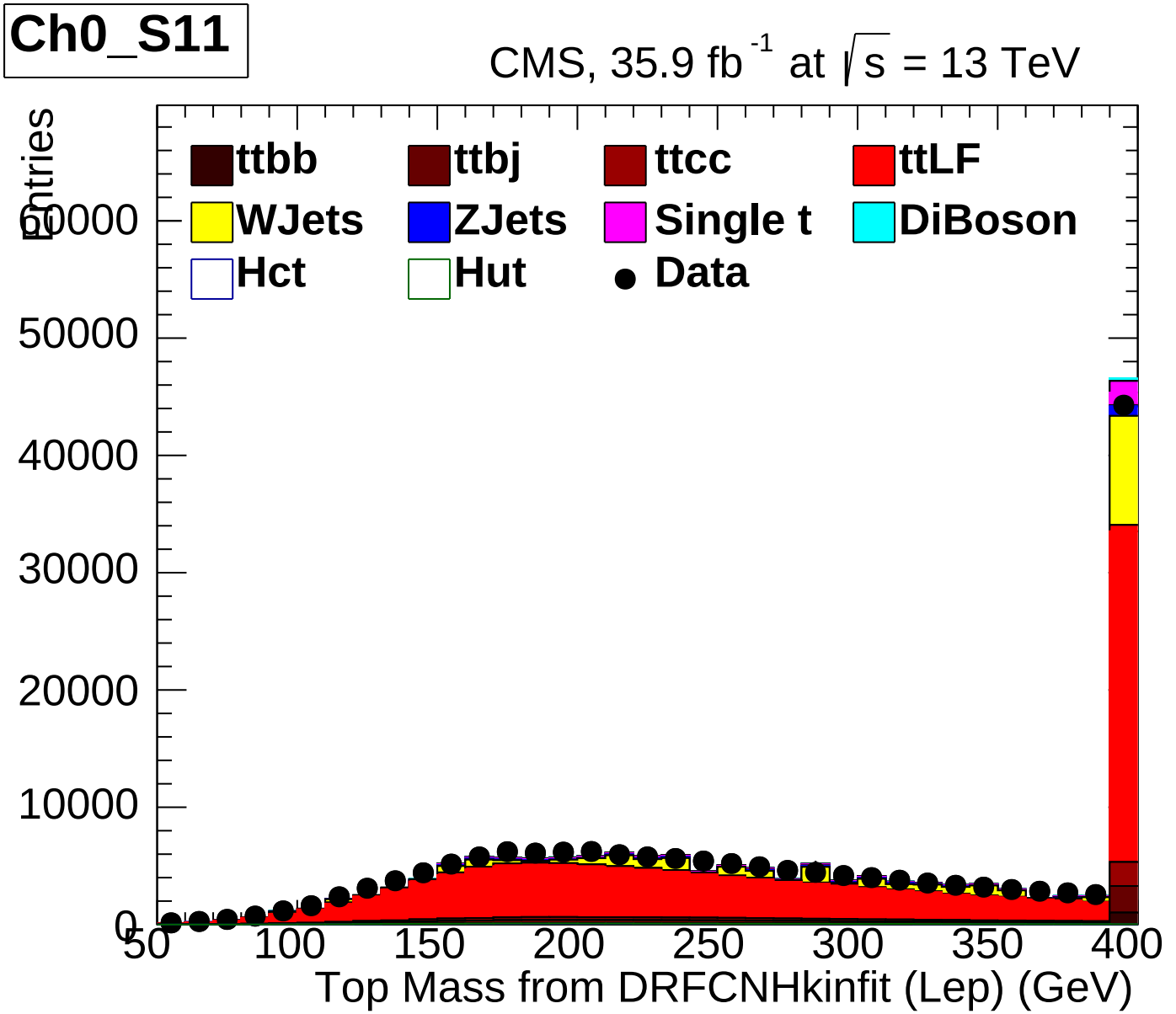

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

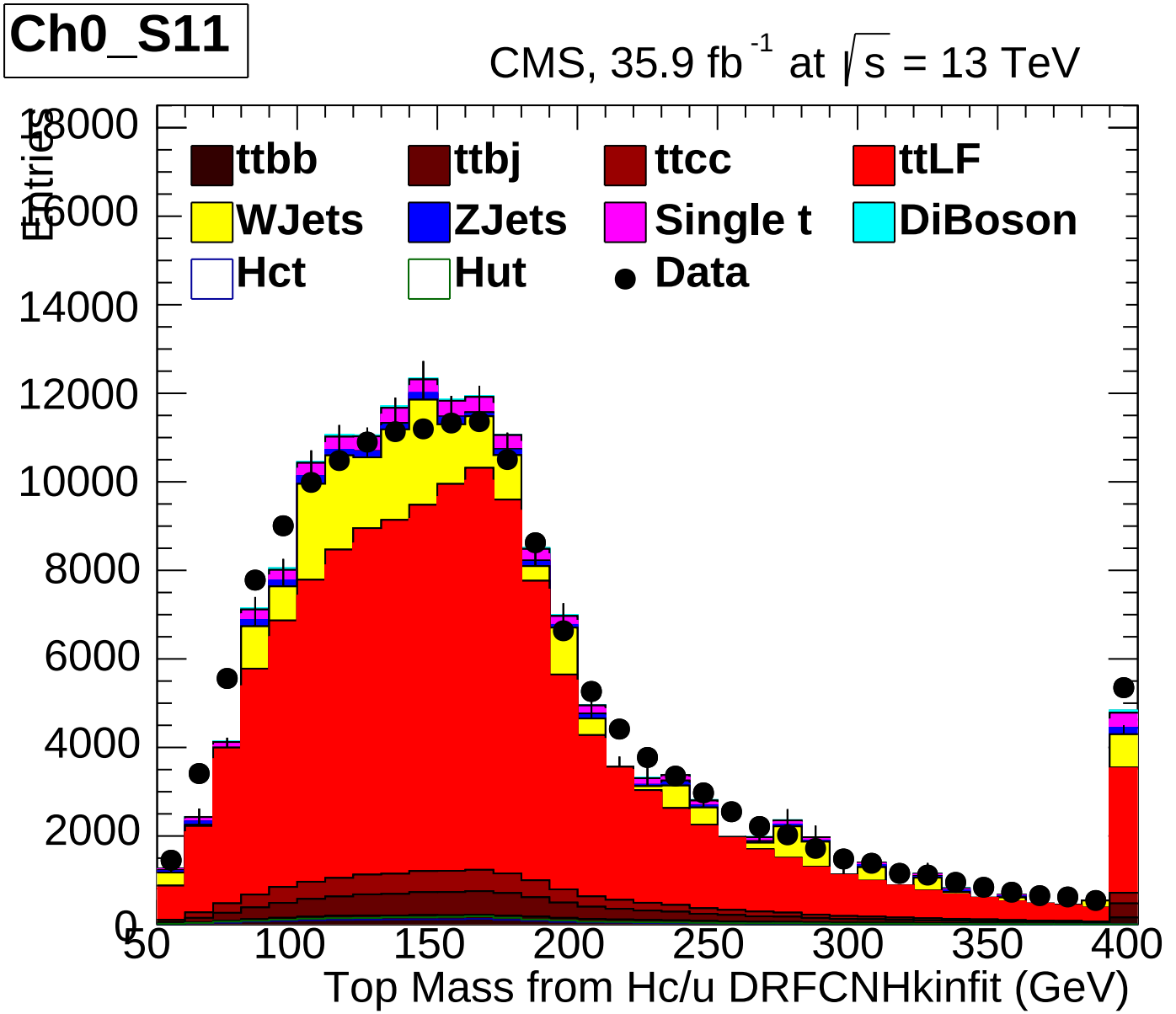

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

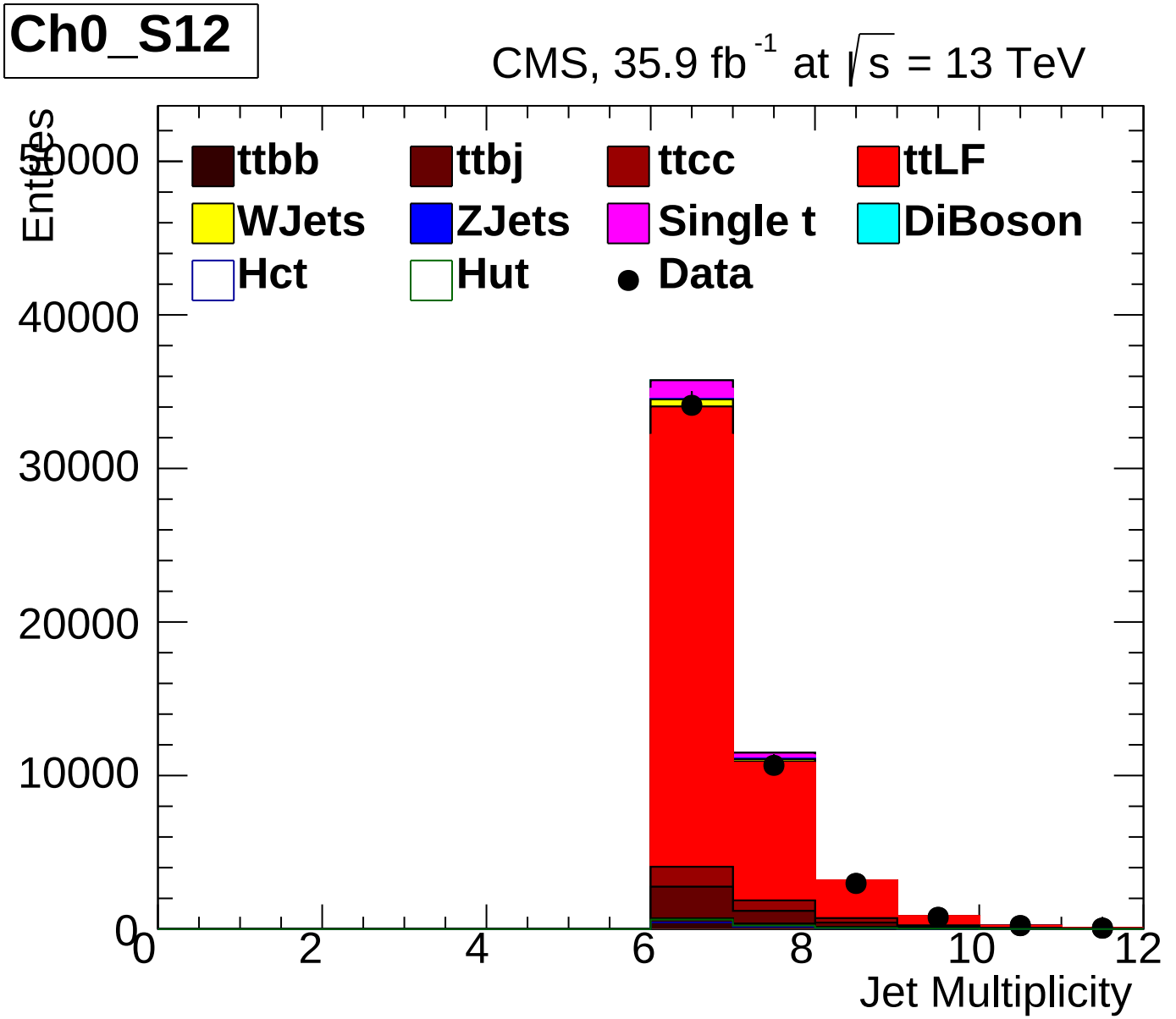

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

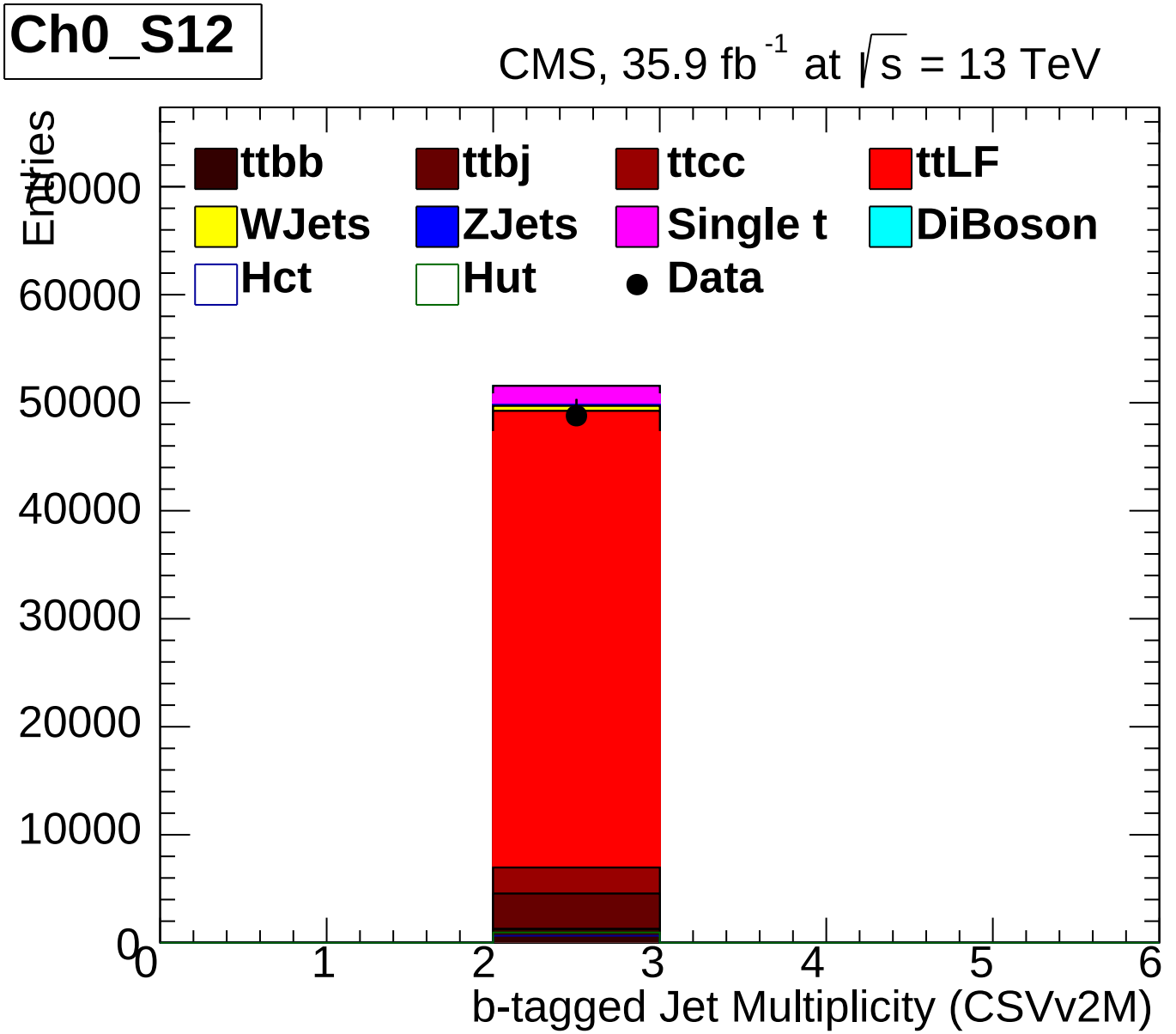

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

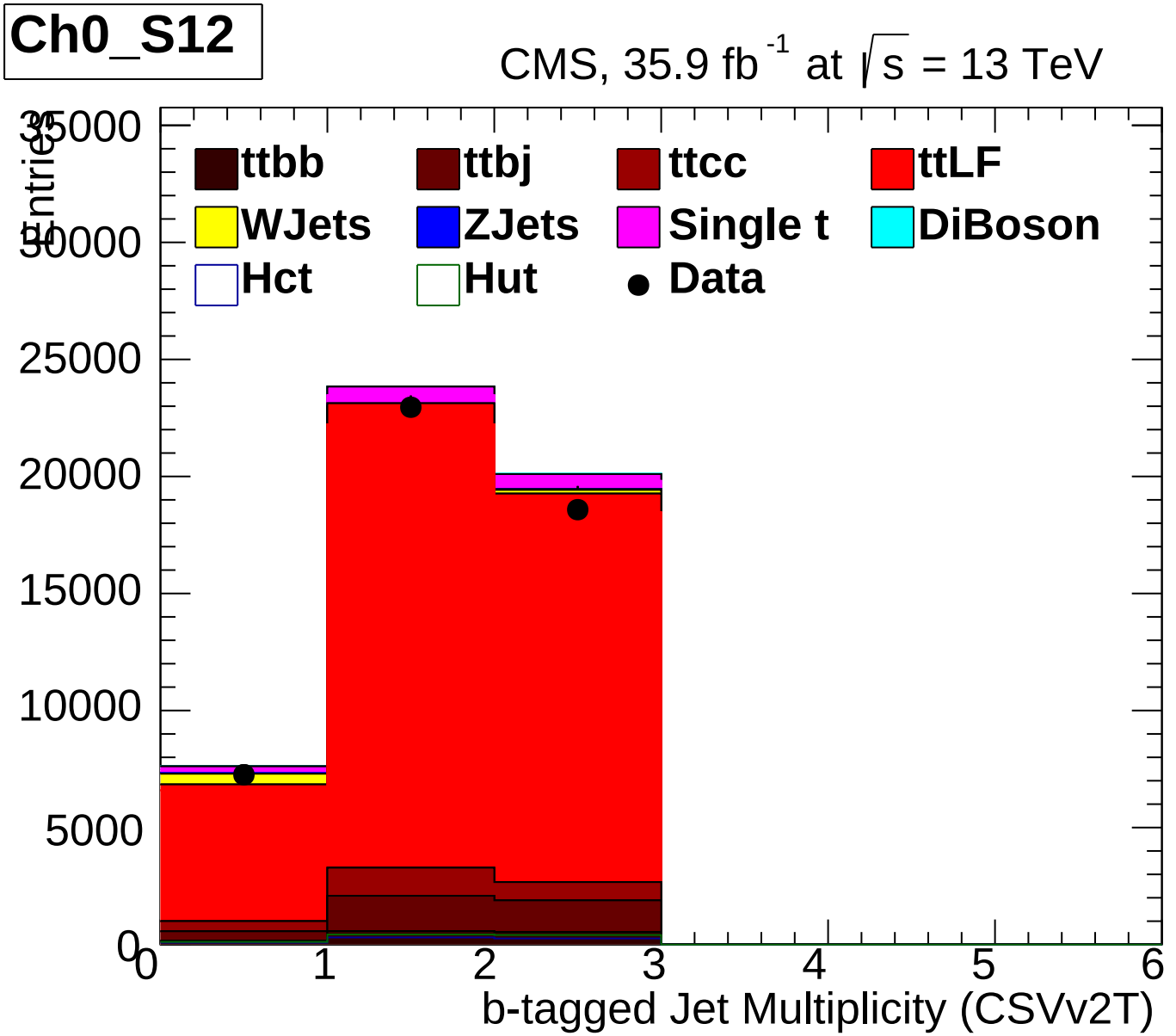

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

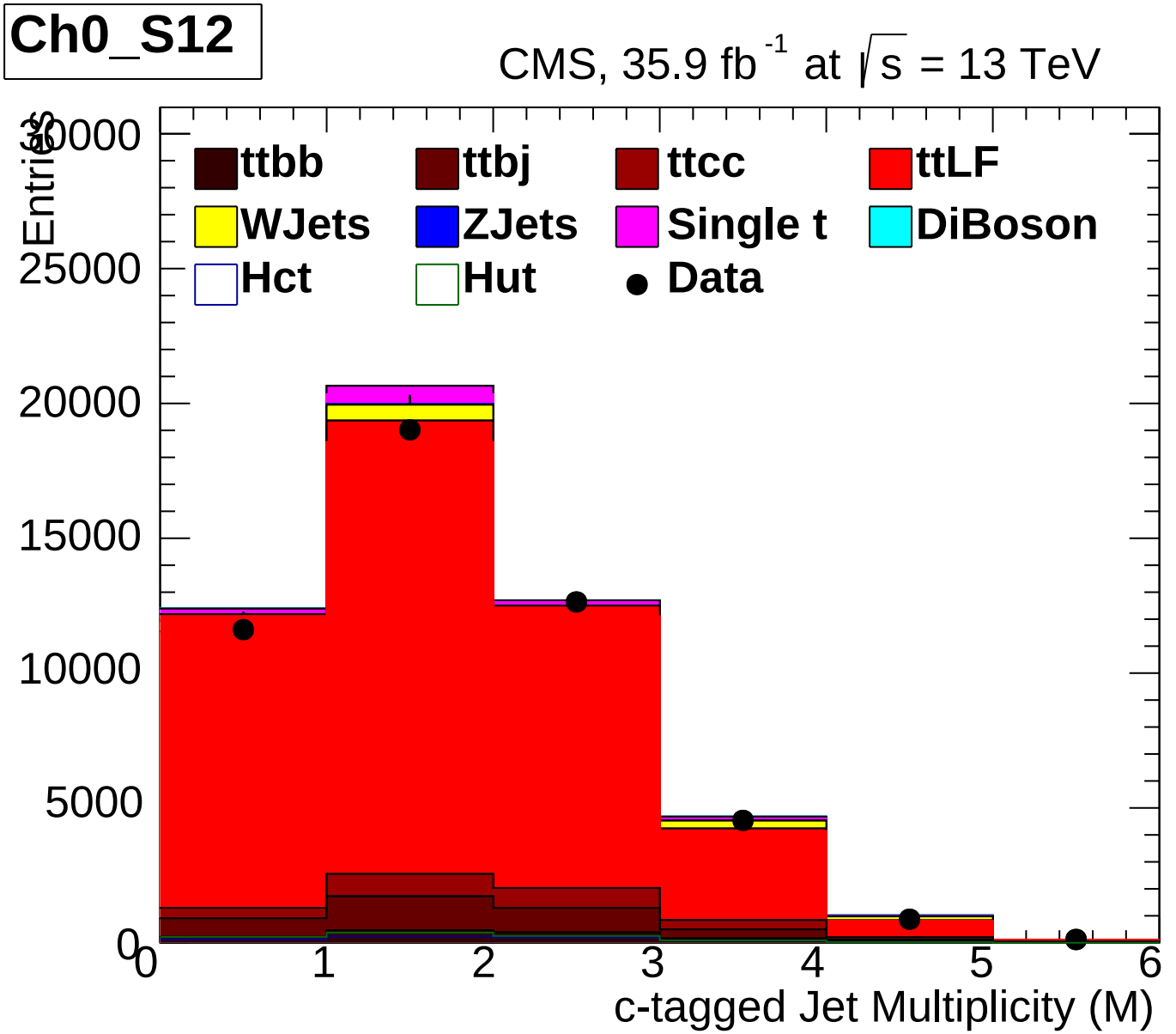

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

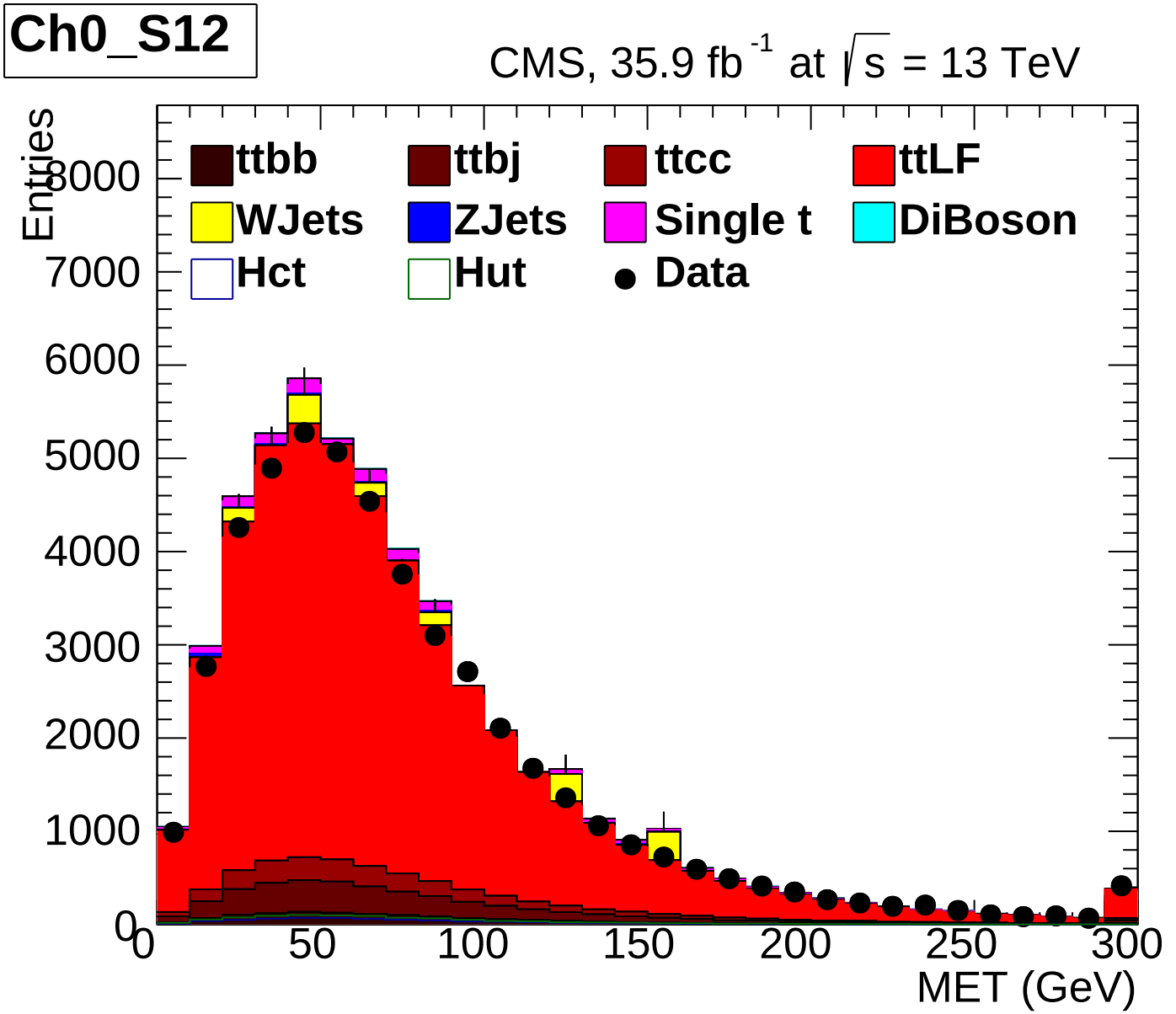

Ch0_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

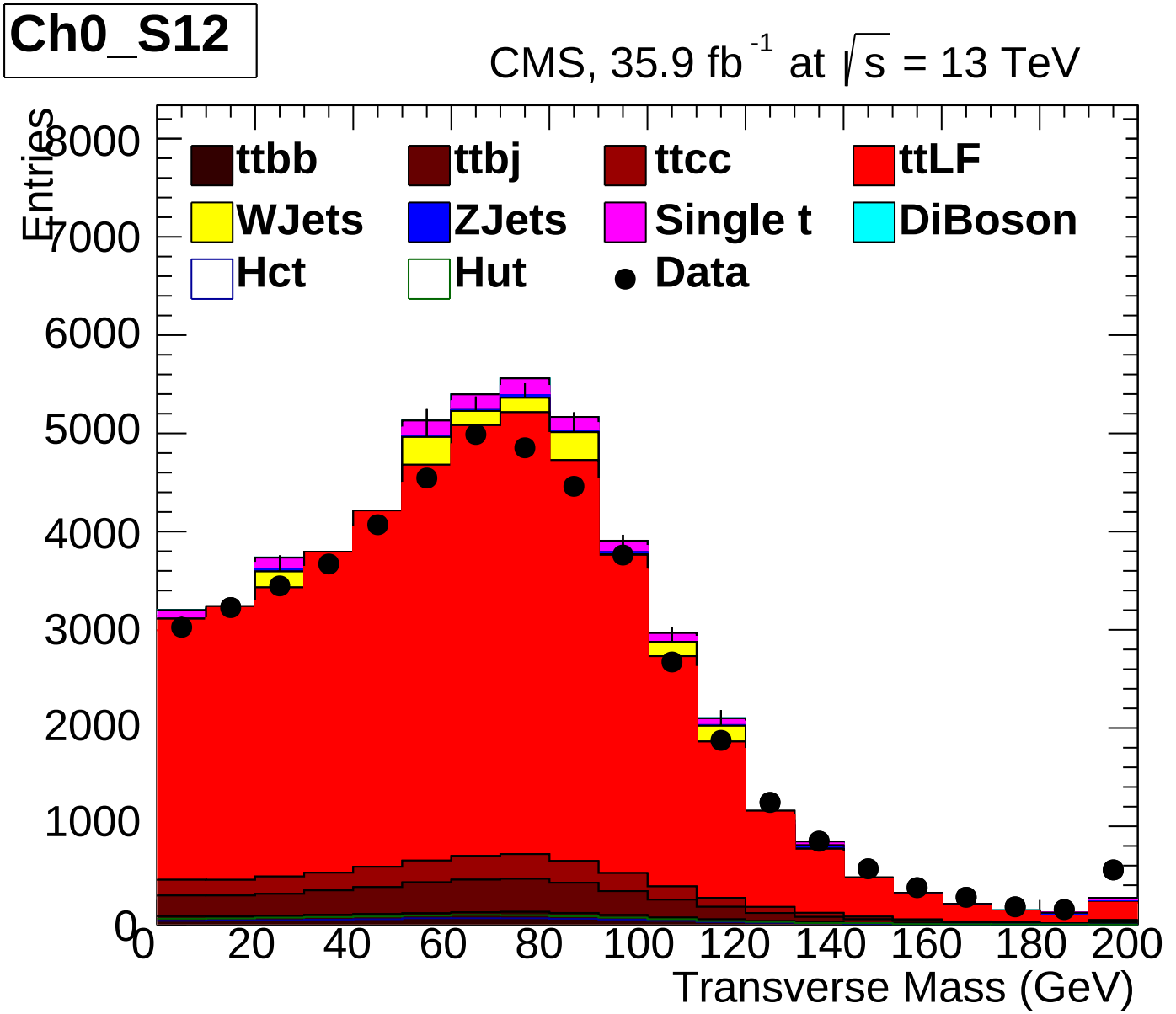

Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
0
2
4
6
8
10
12
Jet Multiplicity

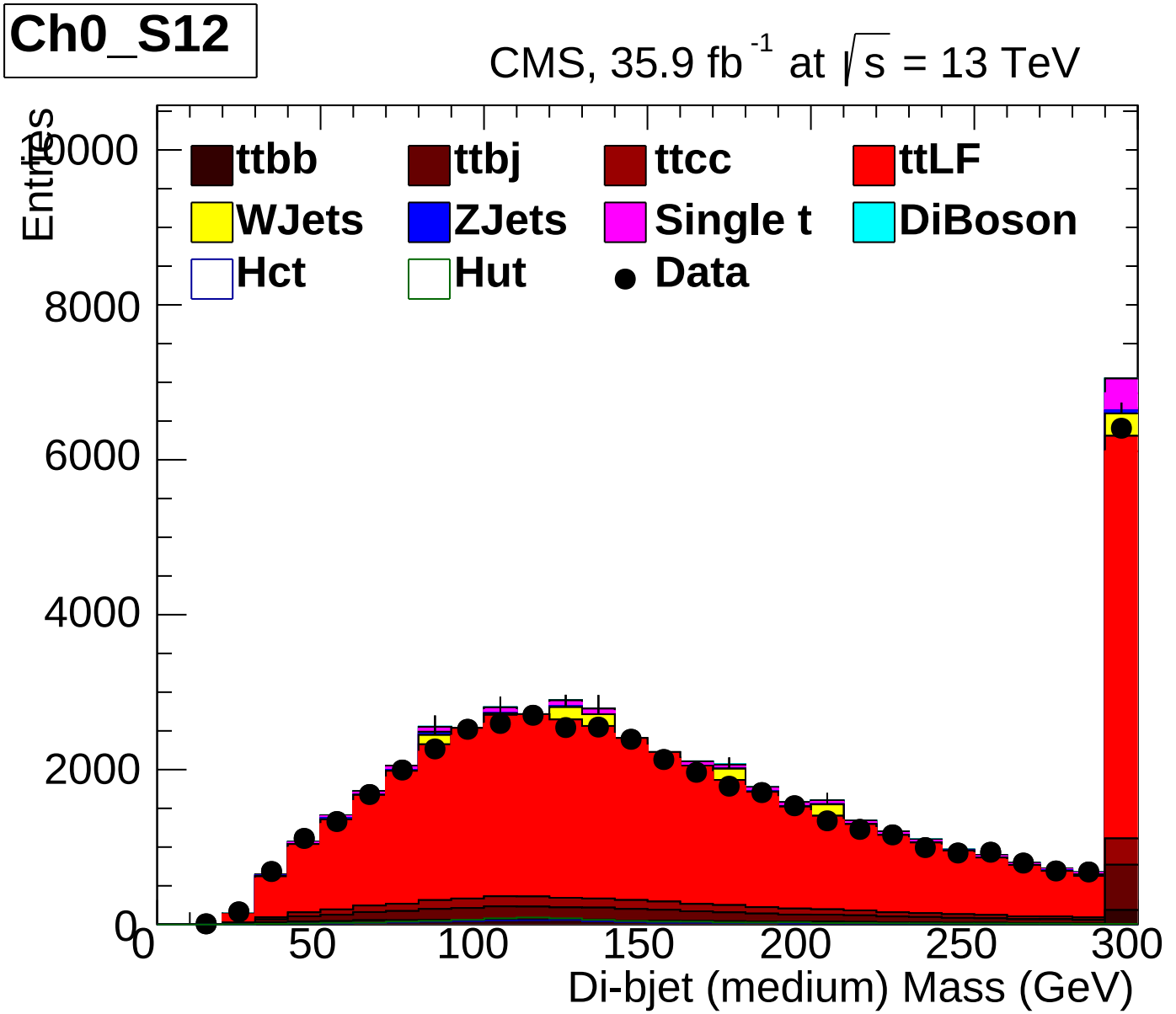

Ch0_S12
CMS, 35.9 fb -1 at √s = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
70000
60000
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

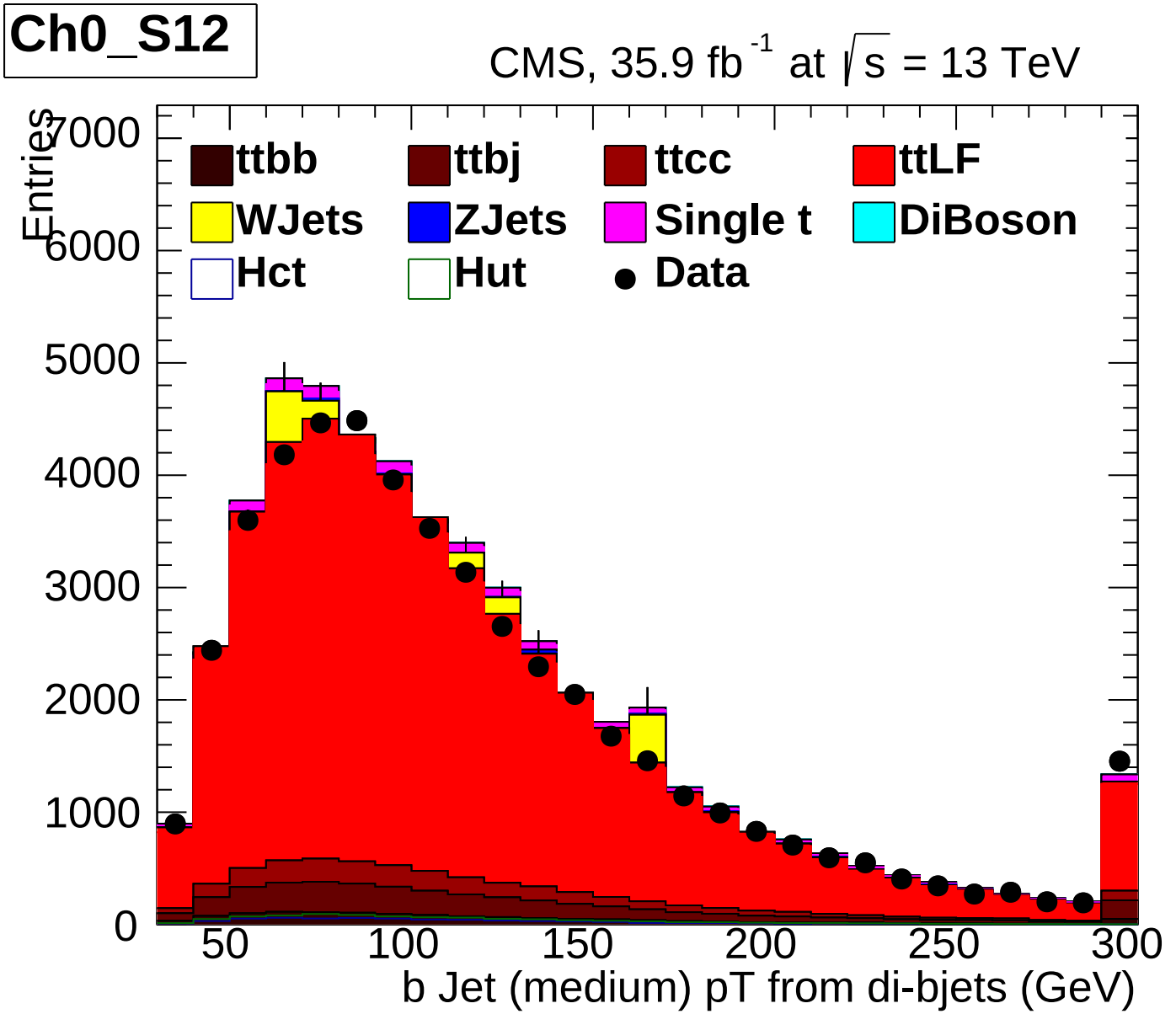

Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
0
50
100
150
200
250
300
MET (GeV)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
10000
8000
6000
4000
2000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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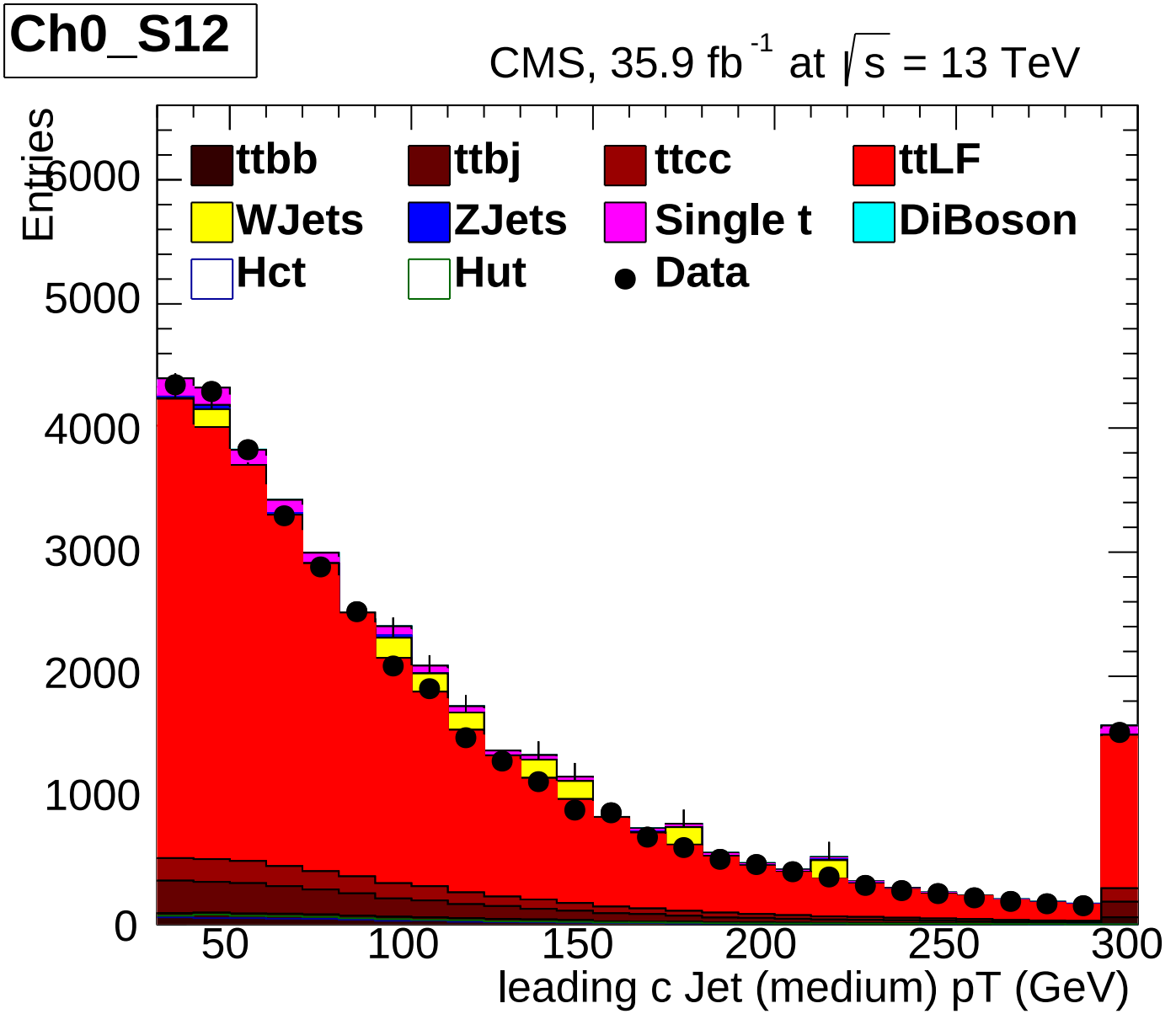
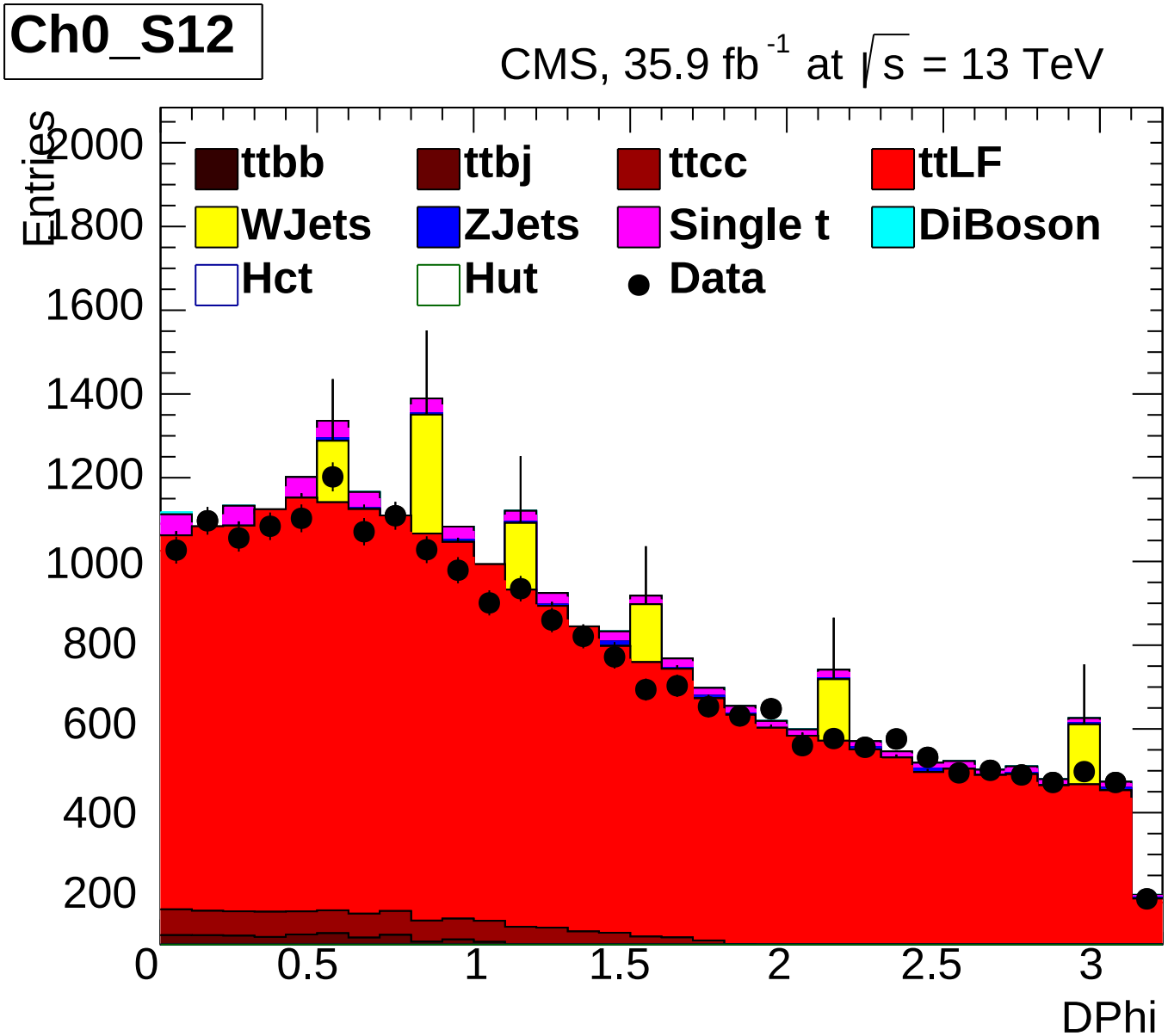
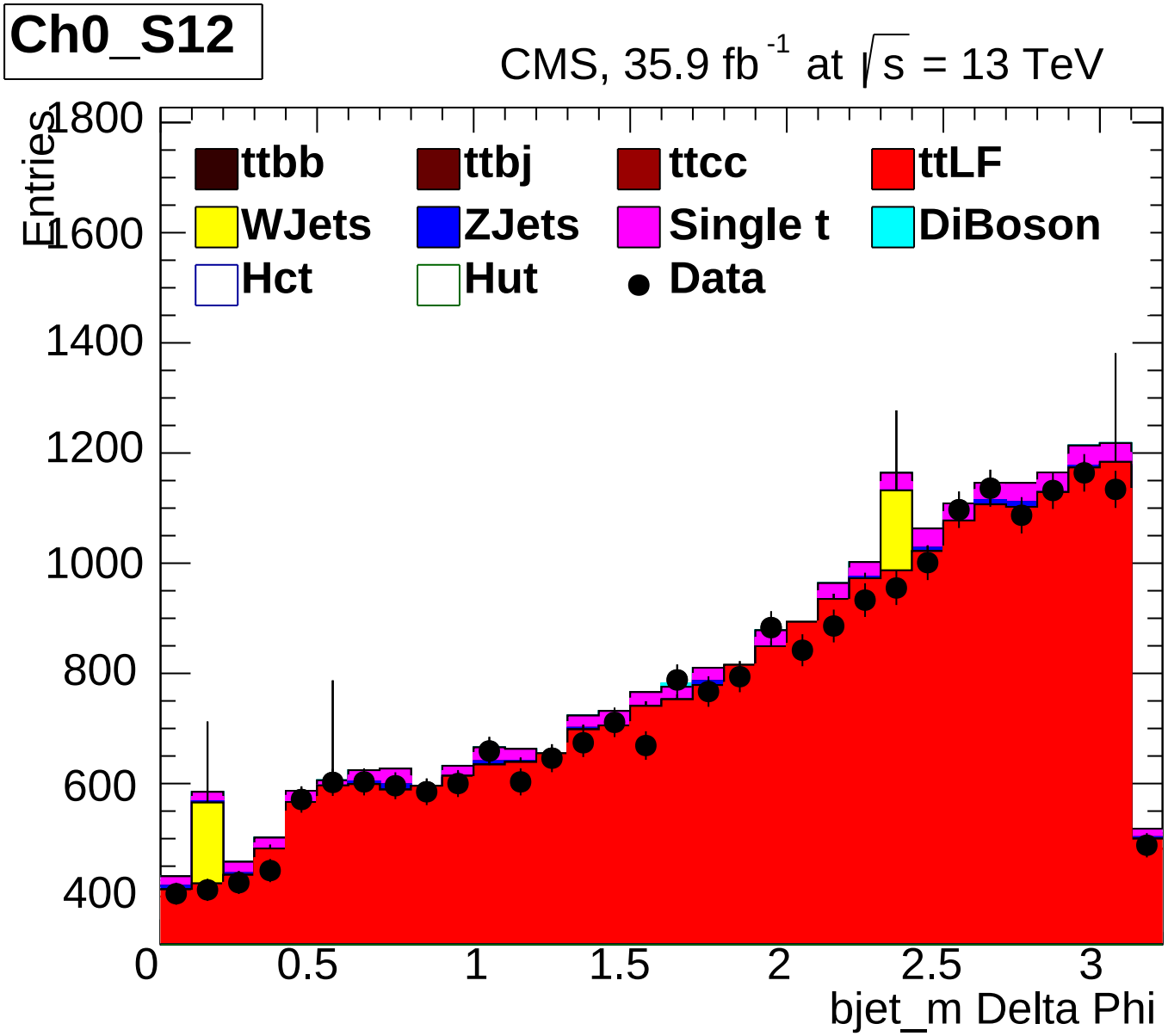
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S12
CMS, 35.9 fb -1 at √s = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.5
1
1.5
2
2.5
3
DPhi


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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1600
1400
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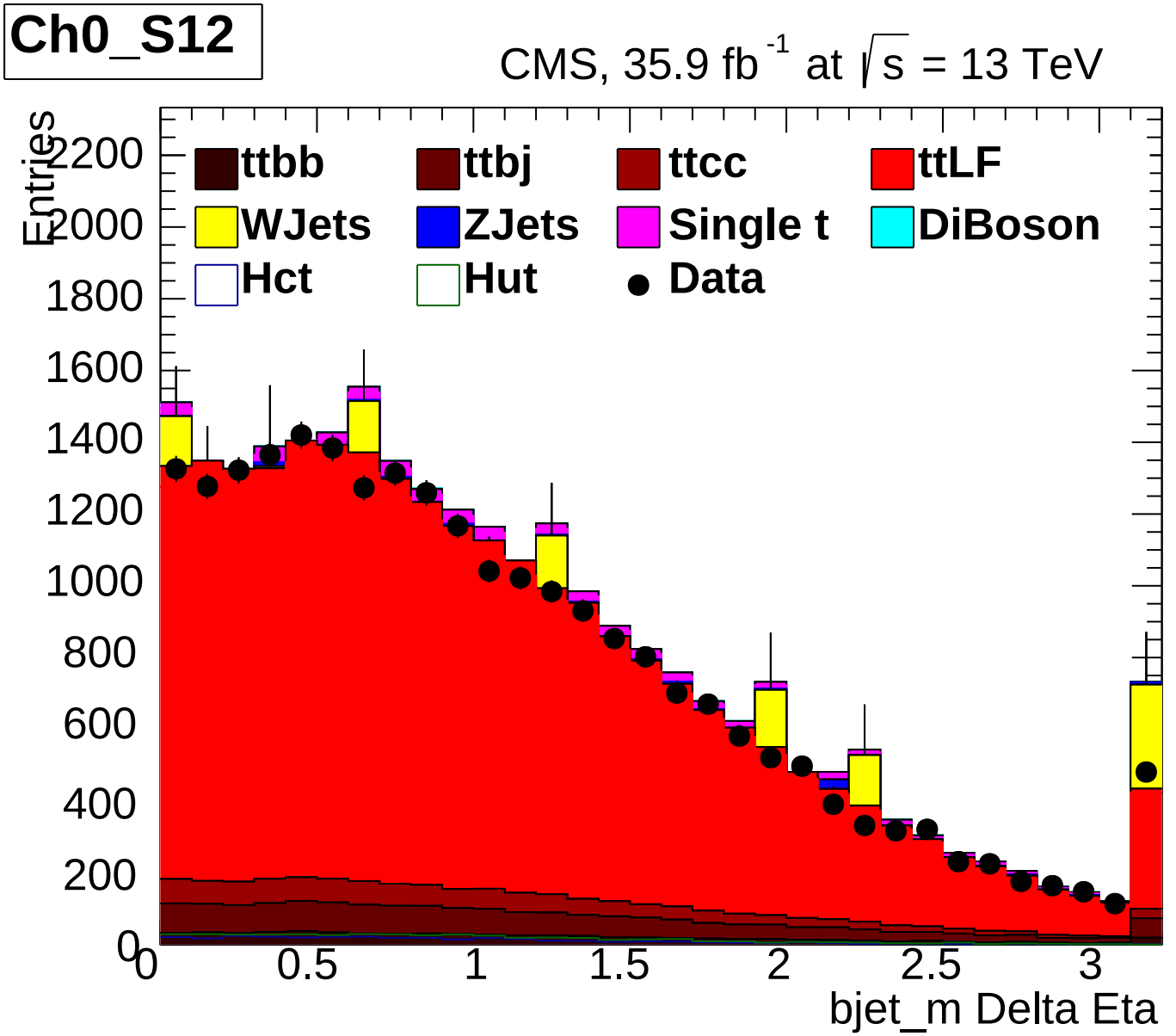
800
600
400
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S12
CMS, 35.9 fb -1 at √s = 13 TeV
Entries
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
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1200
1400
1600
1800
2000
2200
0
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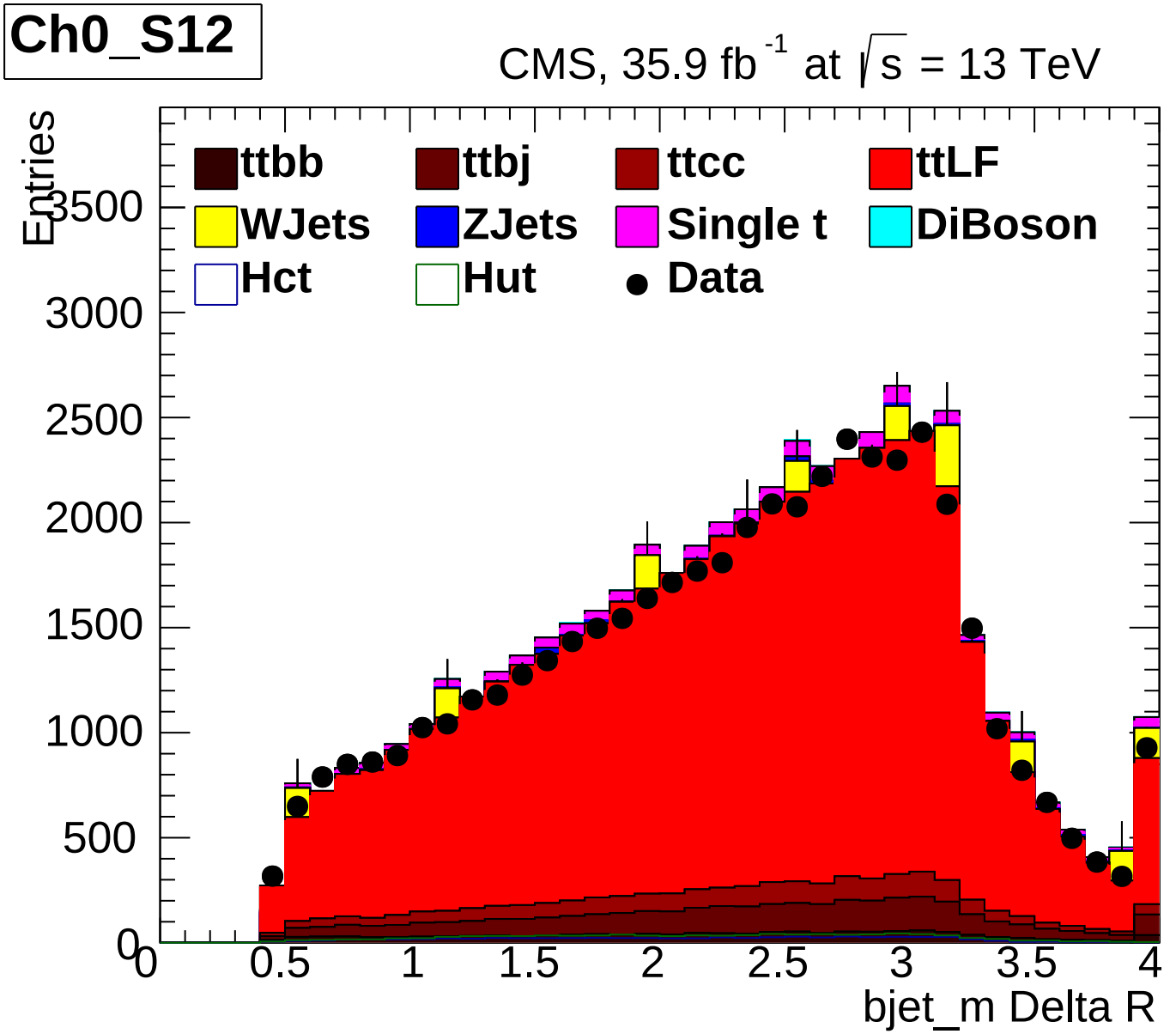
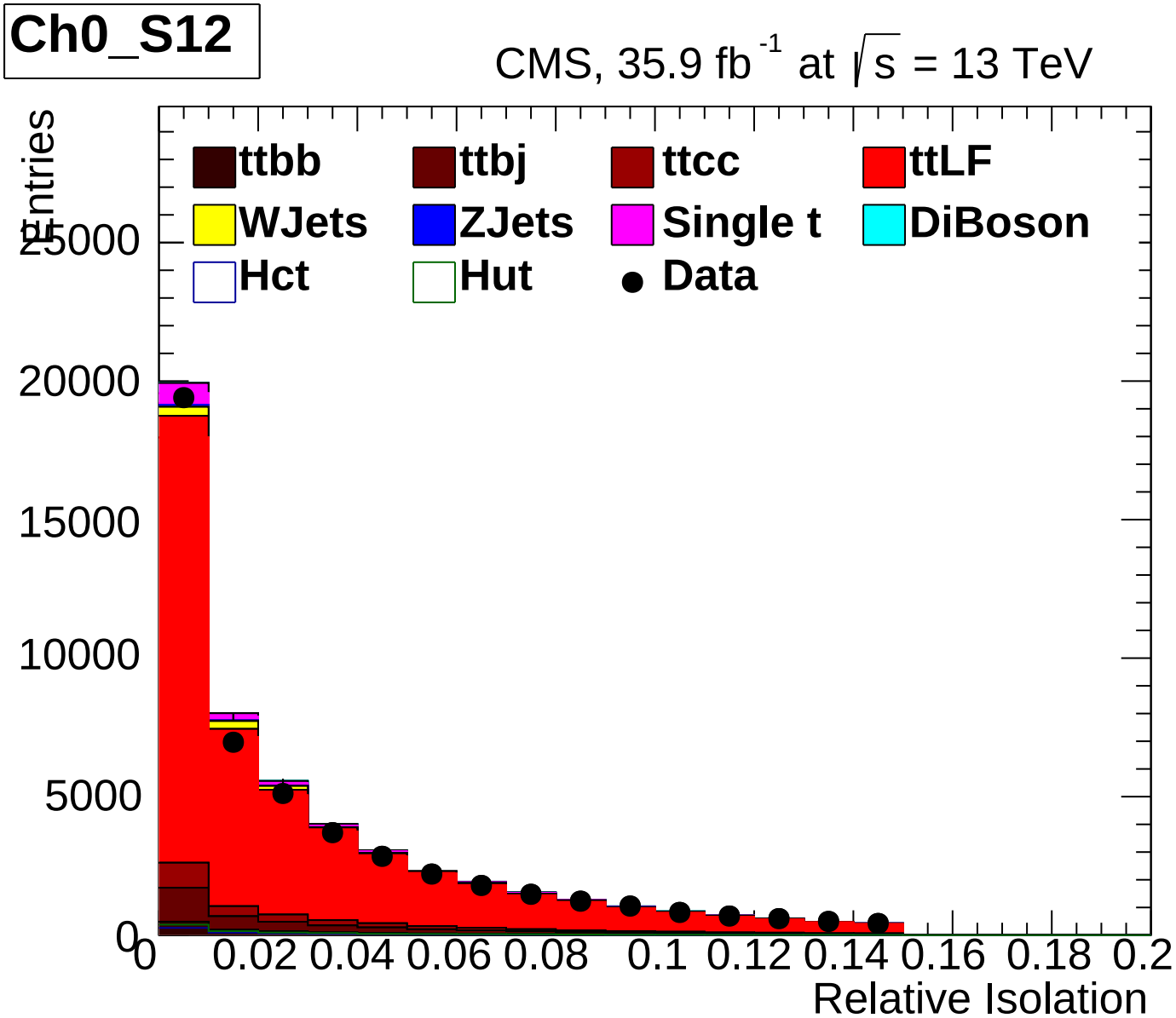
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
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Hct
Hut
Data
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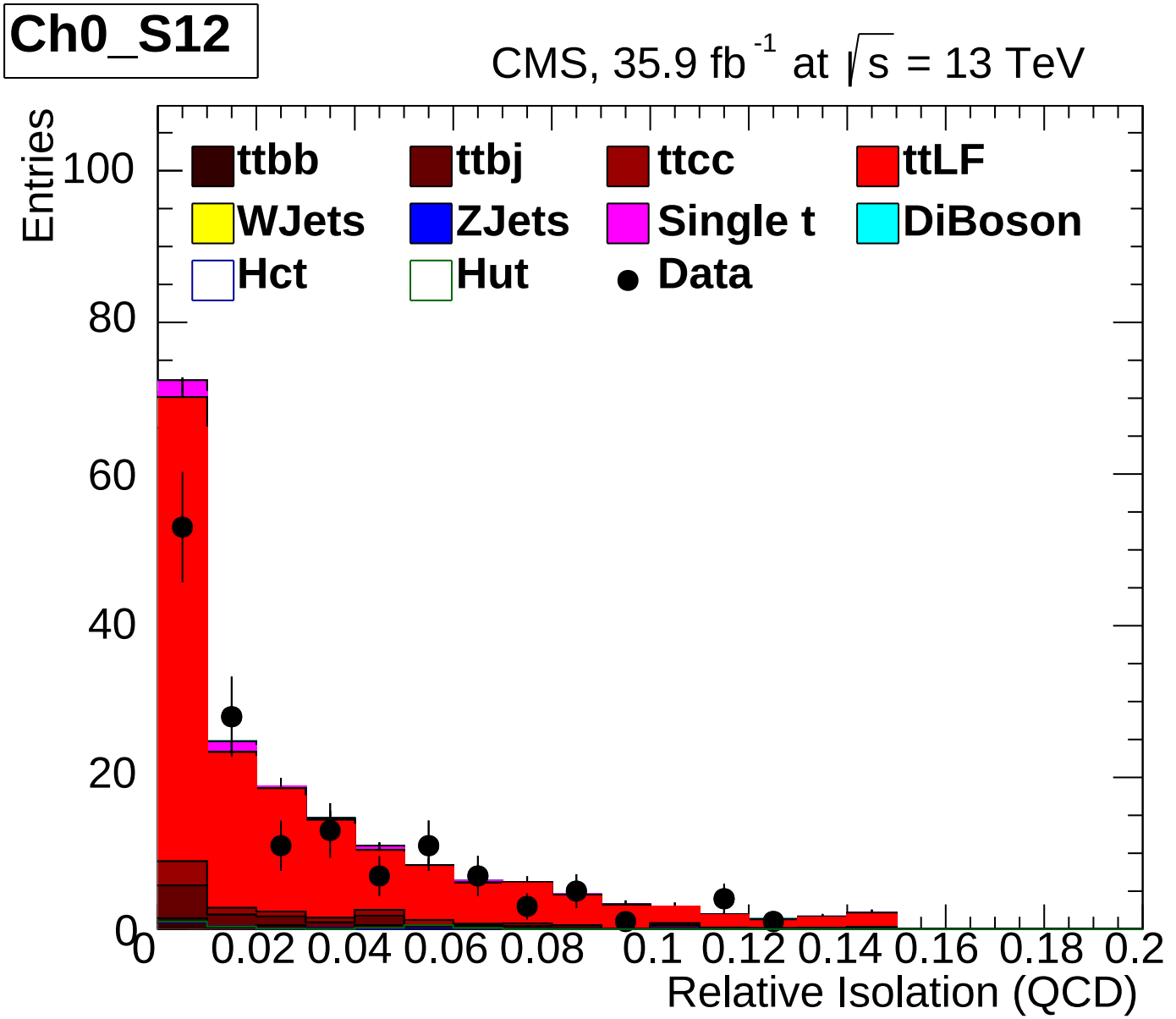
20000
15000
10000
5000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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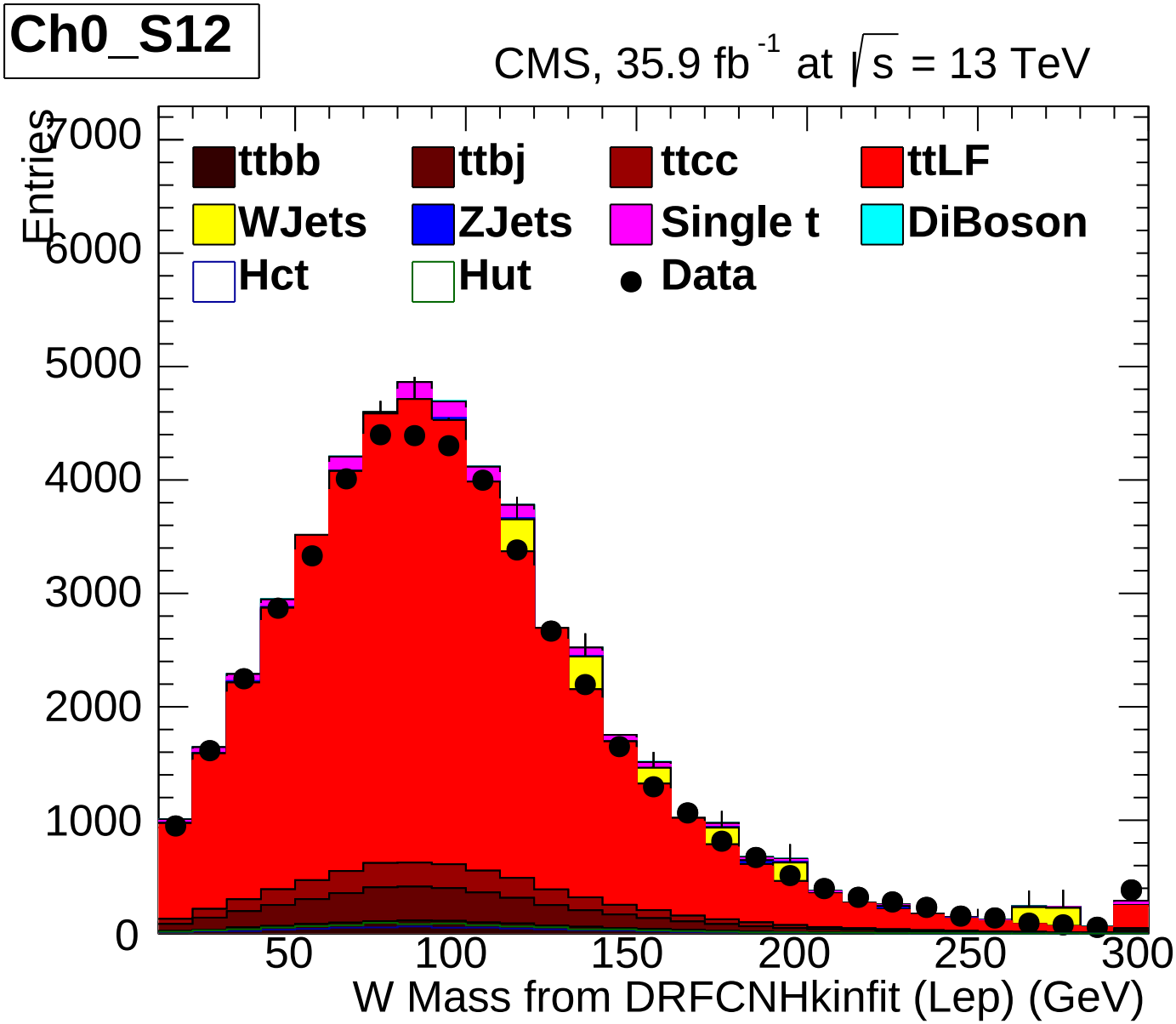
20
40
60
80
100
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
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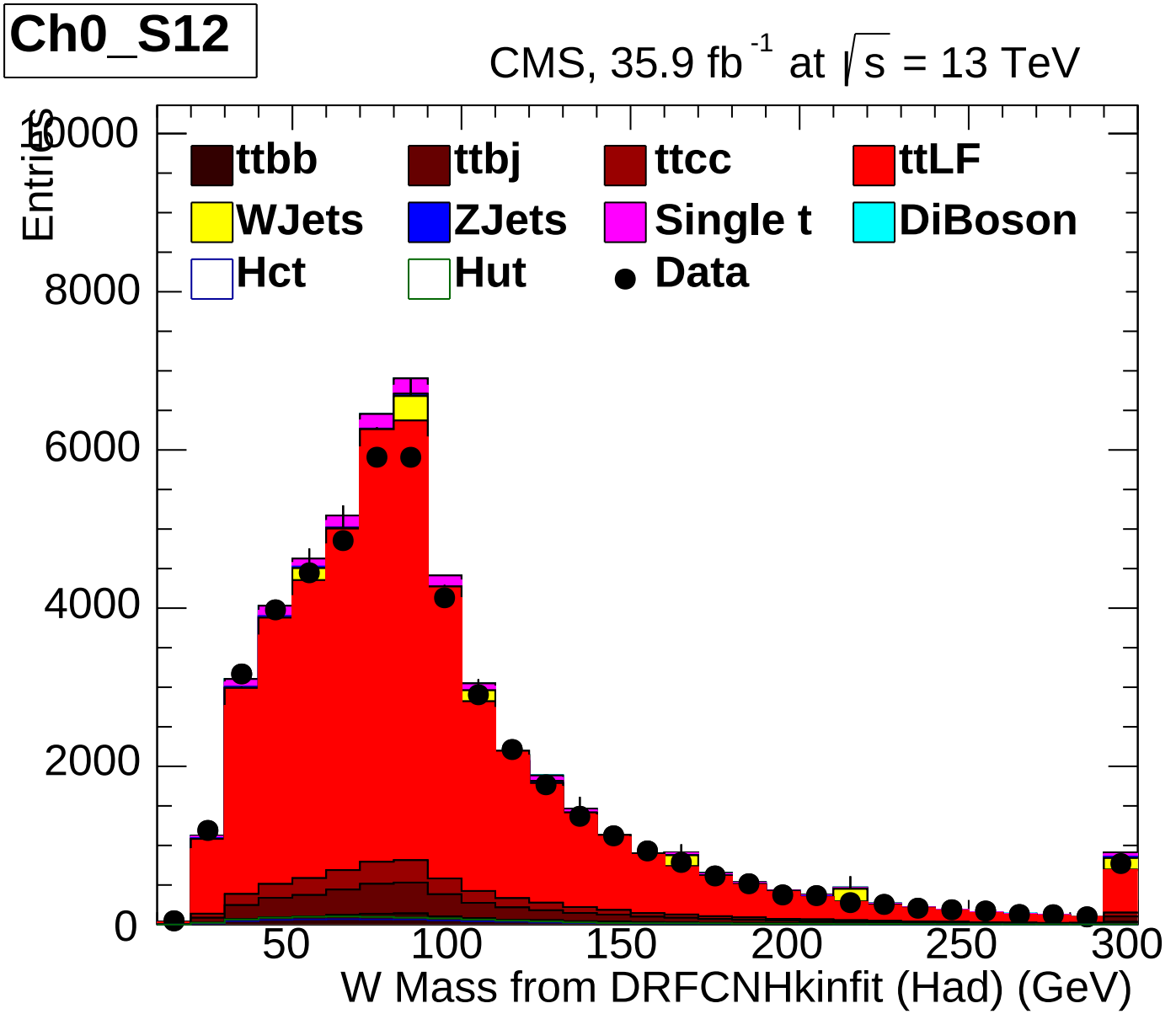
4000
5000
6000
7000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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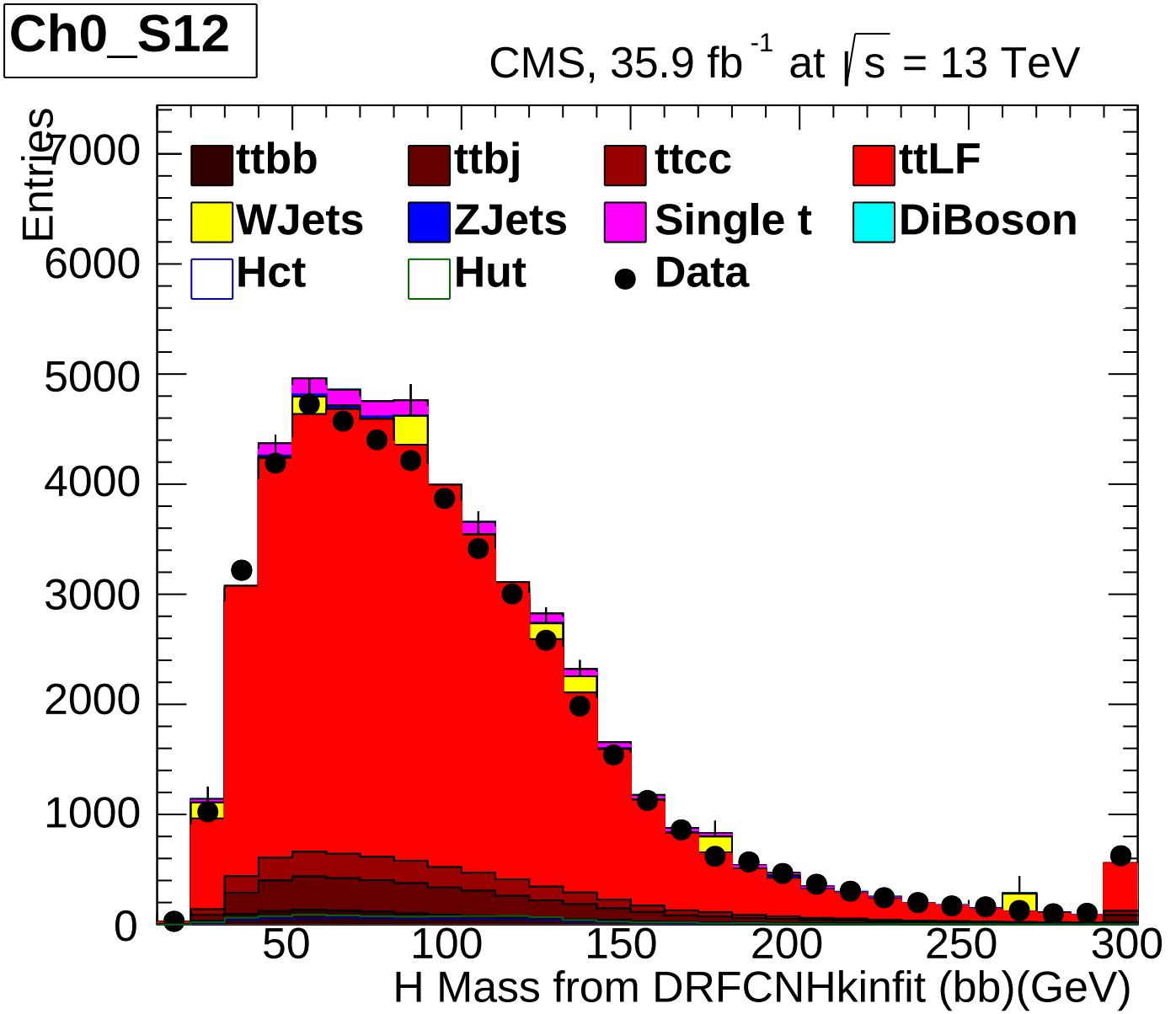
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
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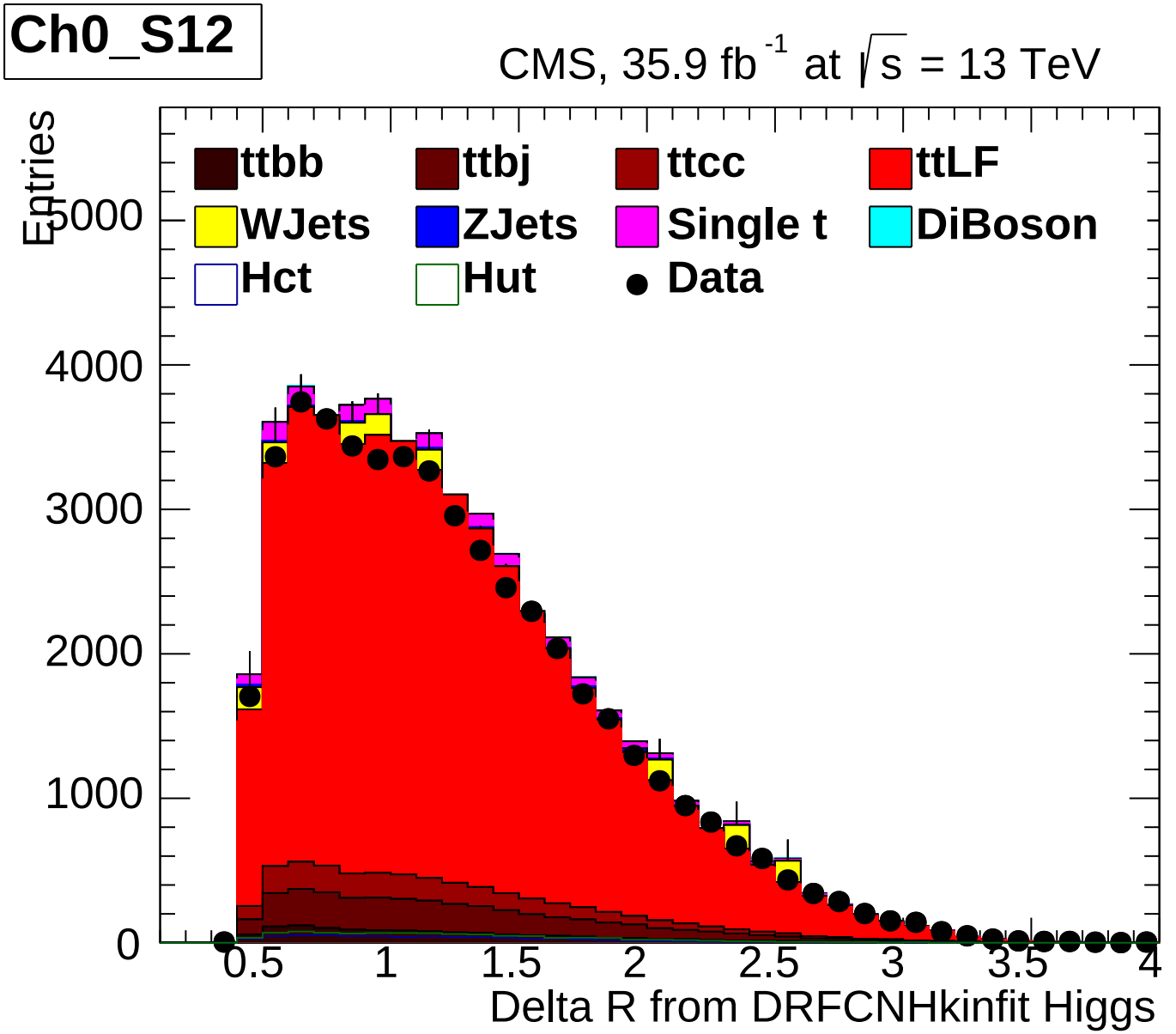
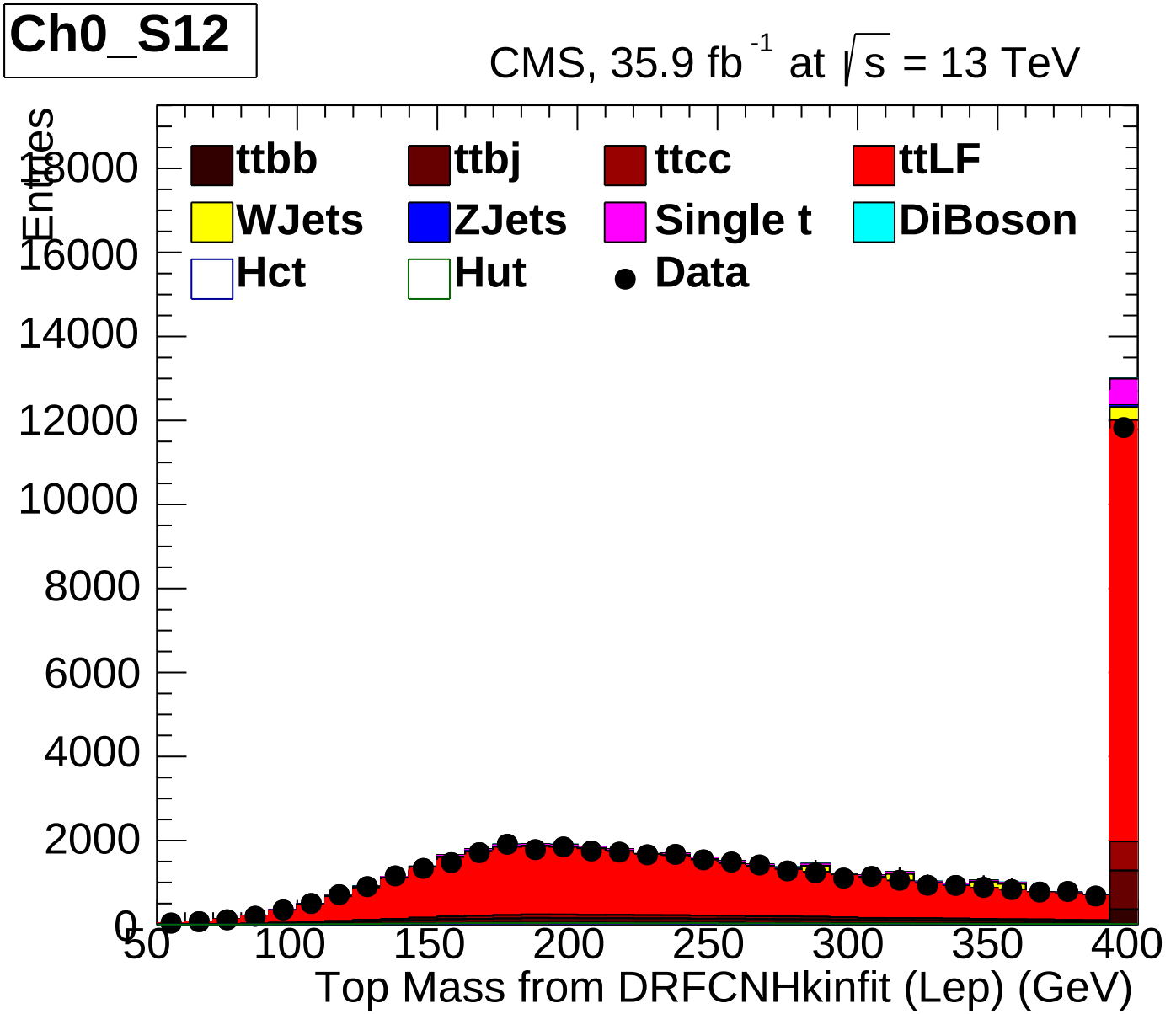
3000
4000
5000
6000
7000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
5000
4000
3000
2000
1000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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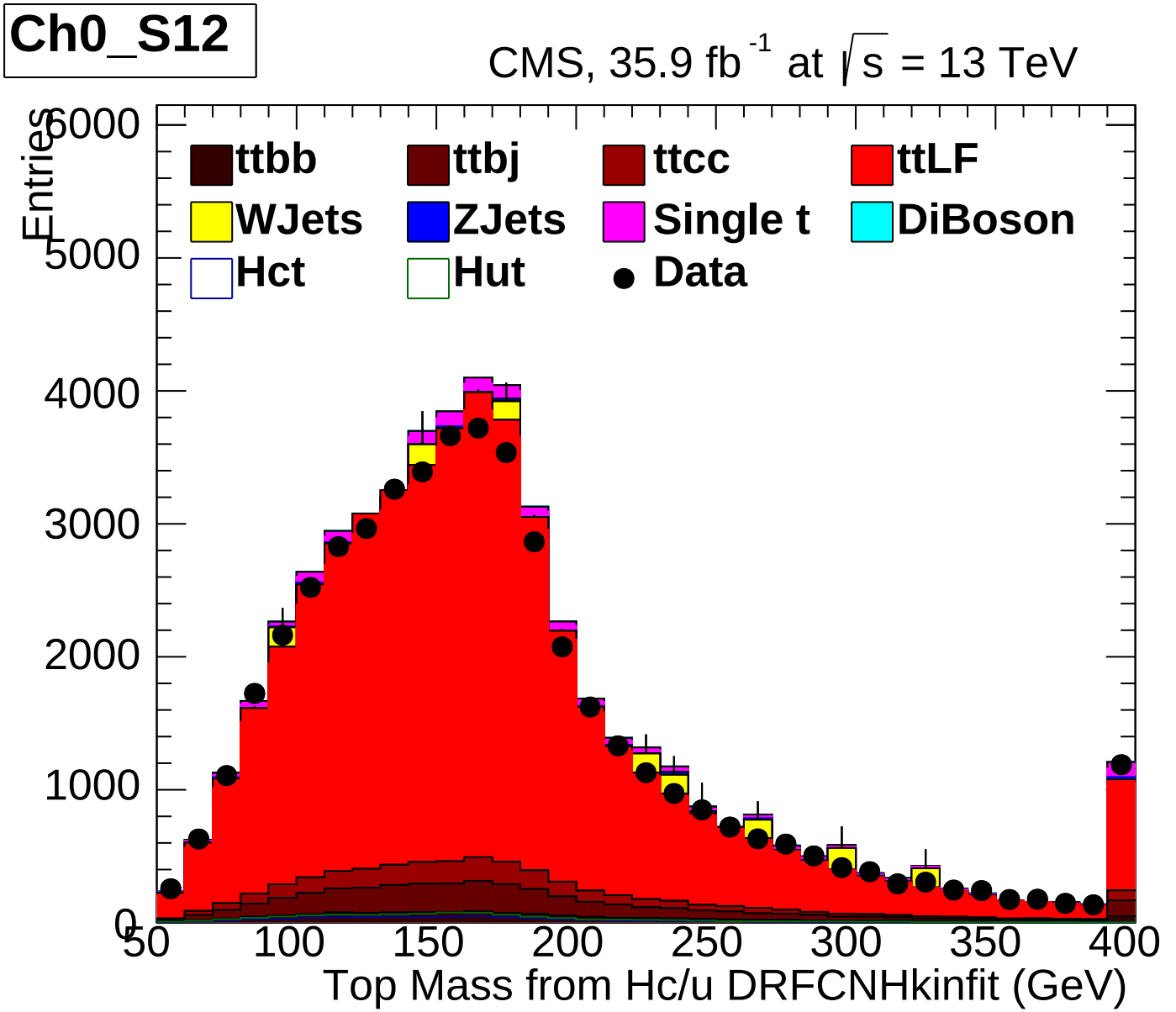
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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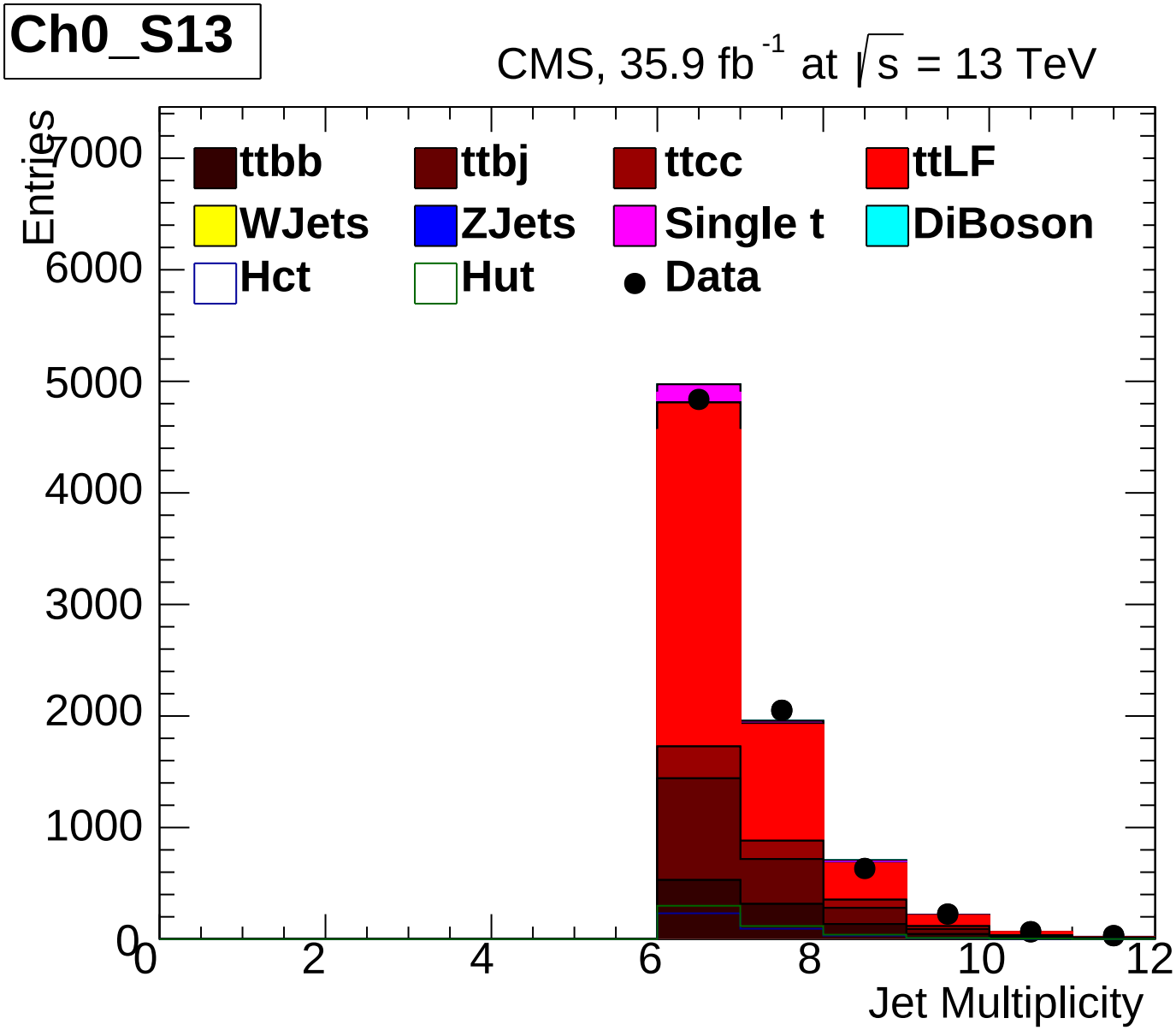
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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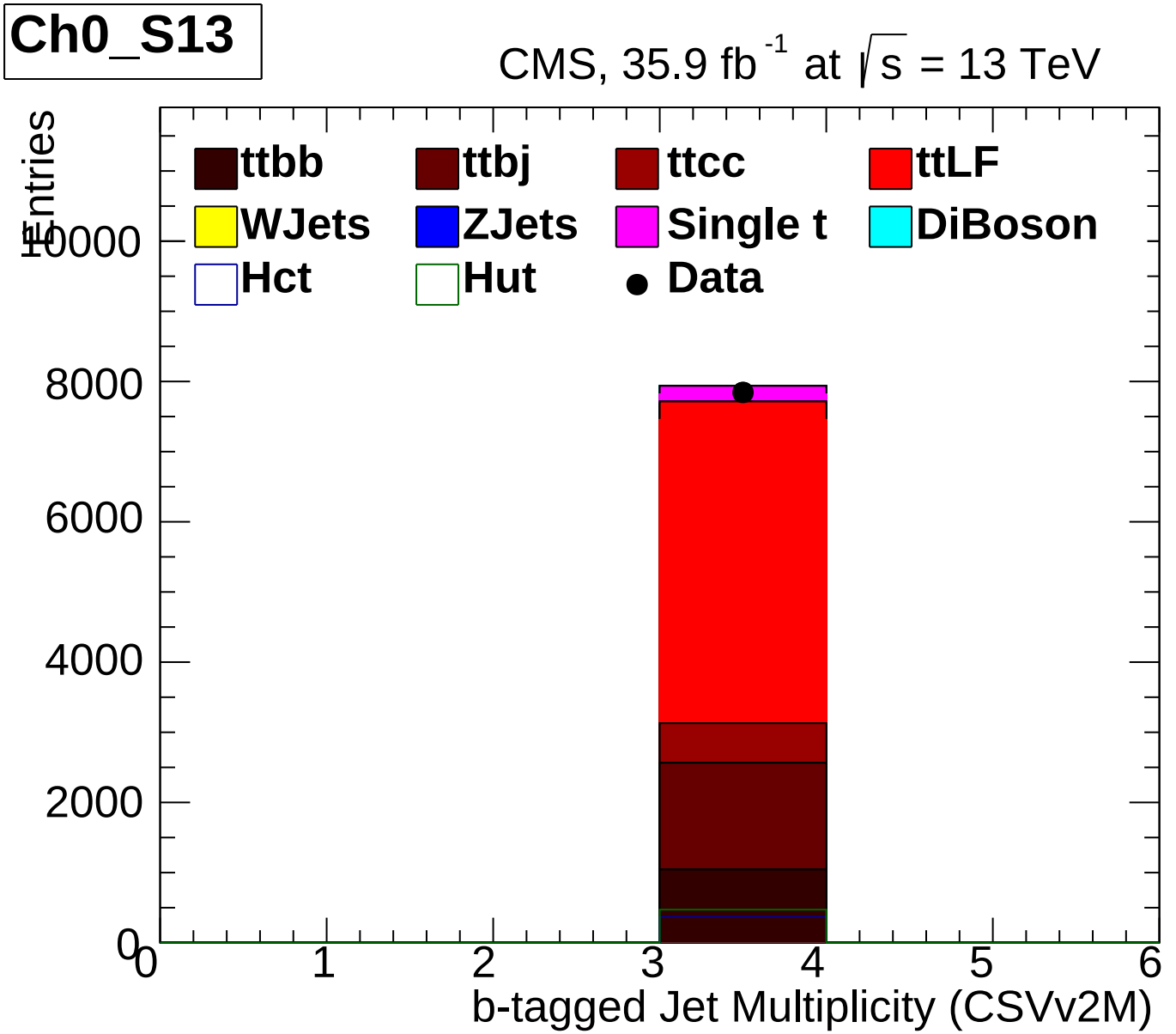
6000
5000
4000
3000
2000
1000
0
0
2
4
6
8
10
12
Jet Multiplicity


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
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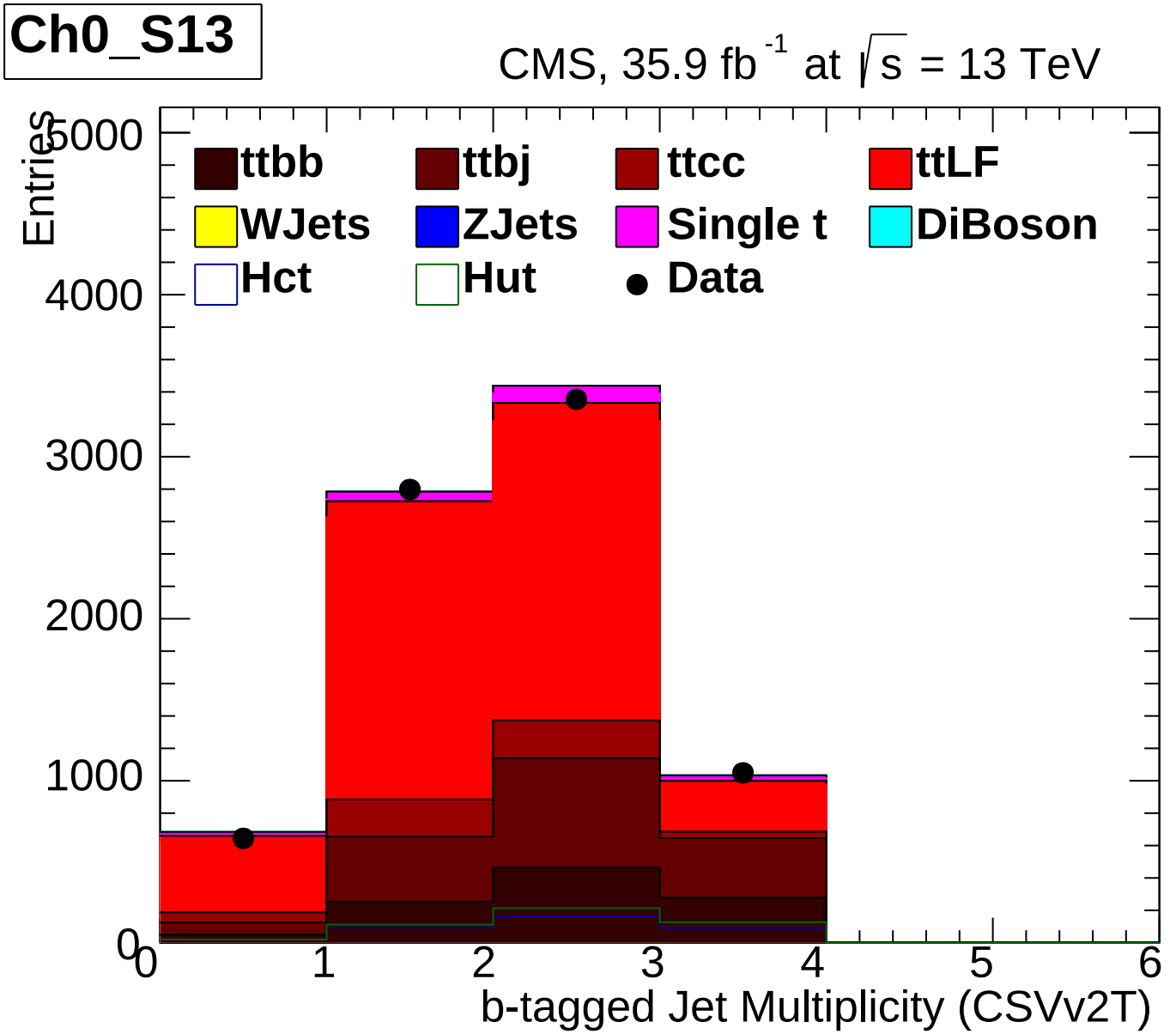
8000
6000
4000
2000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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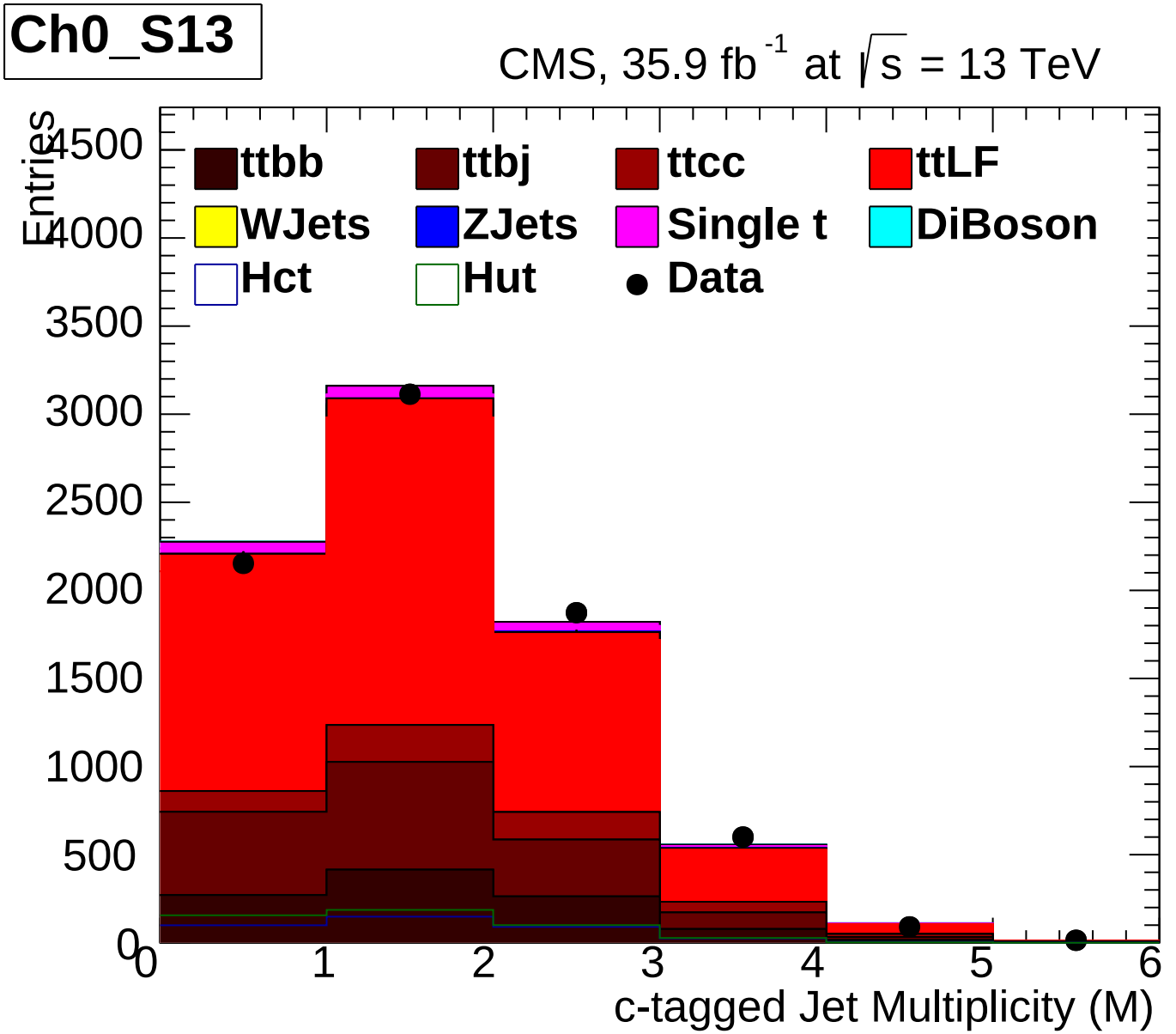
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
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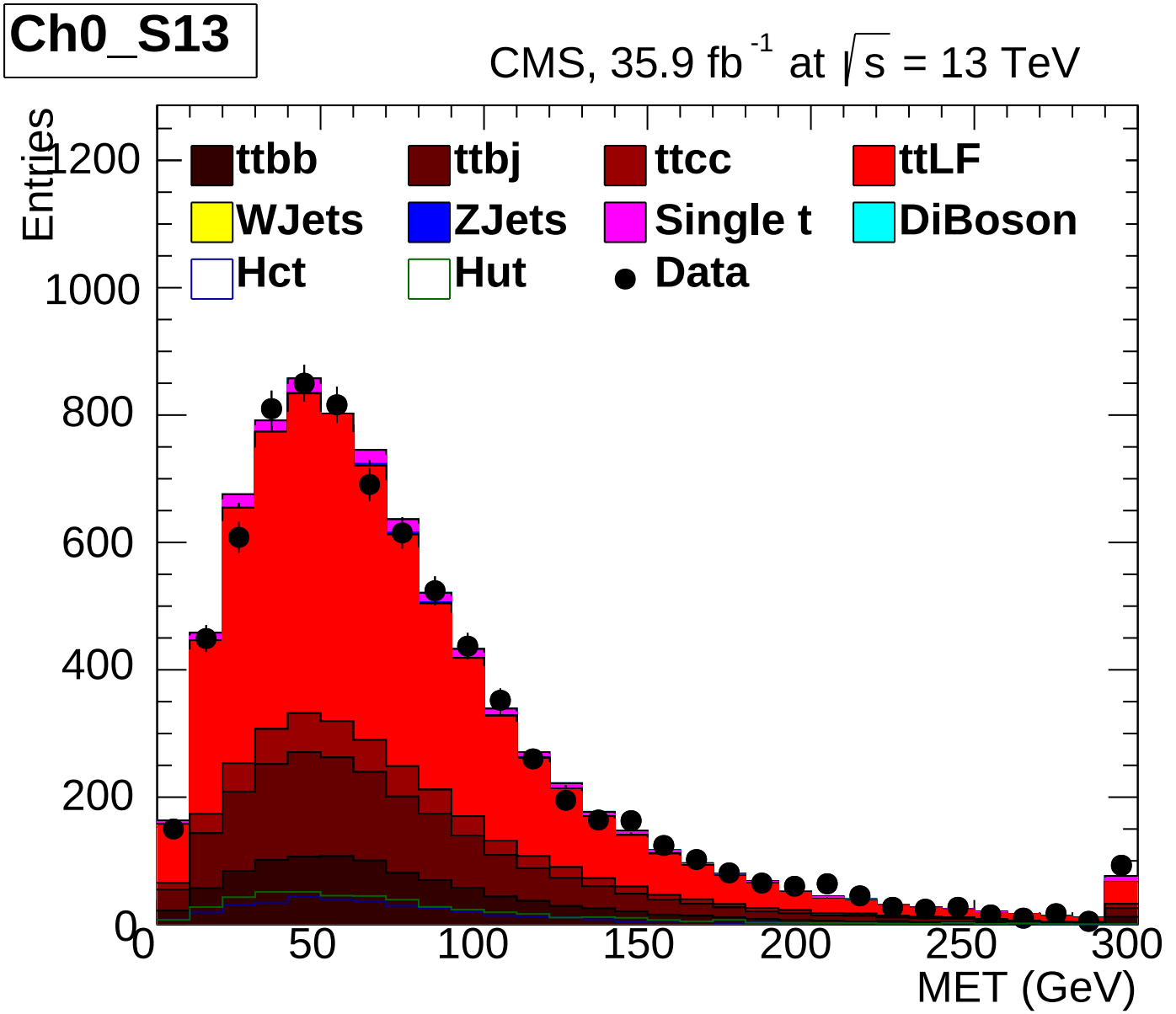
1000
1500
2000
2500
3000
3500
4000
4500
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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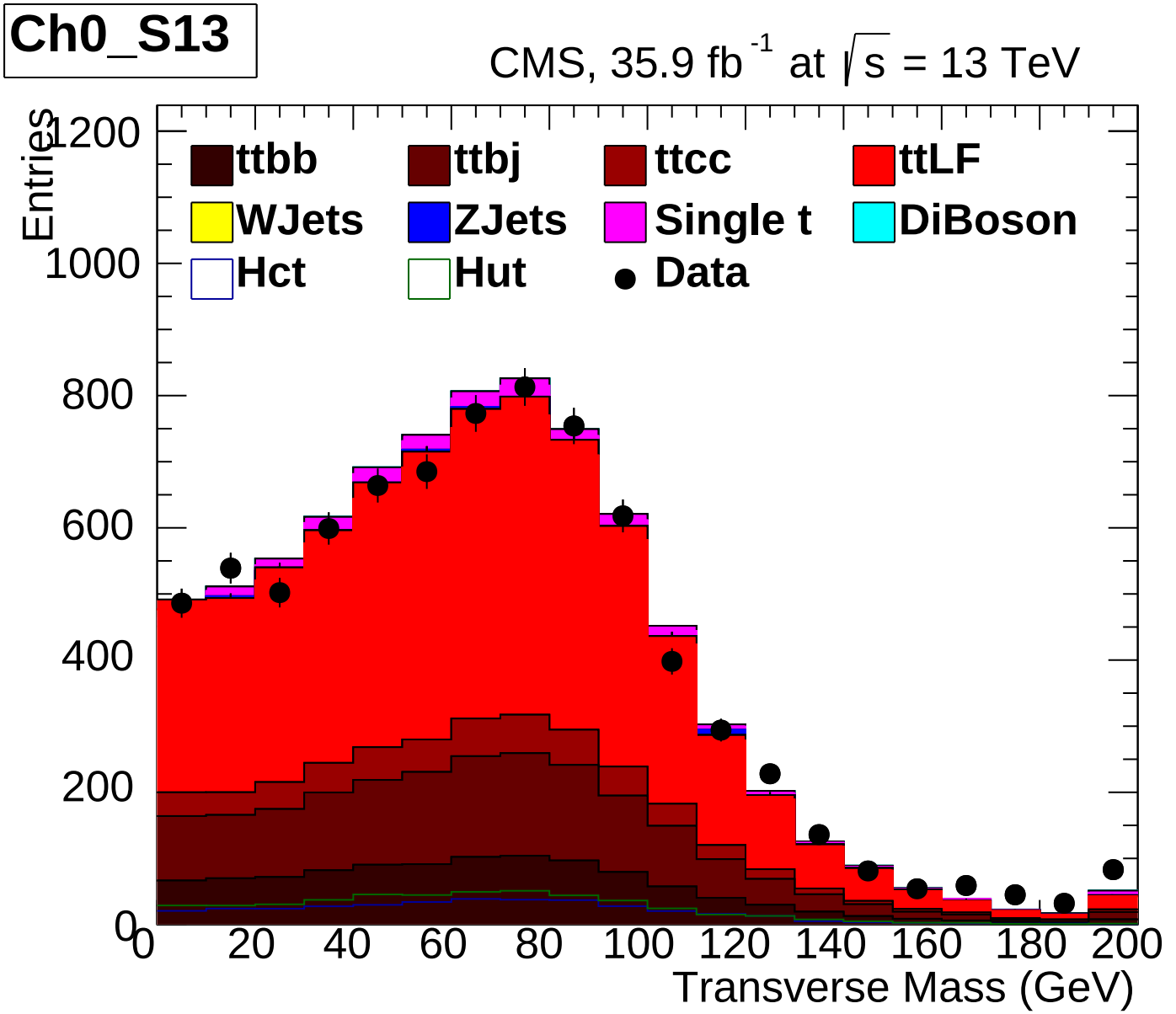
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
0
50
100
150
200
250
300
MET (GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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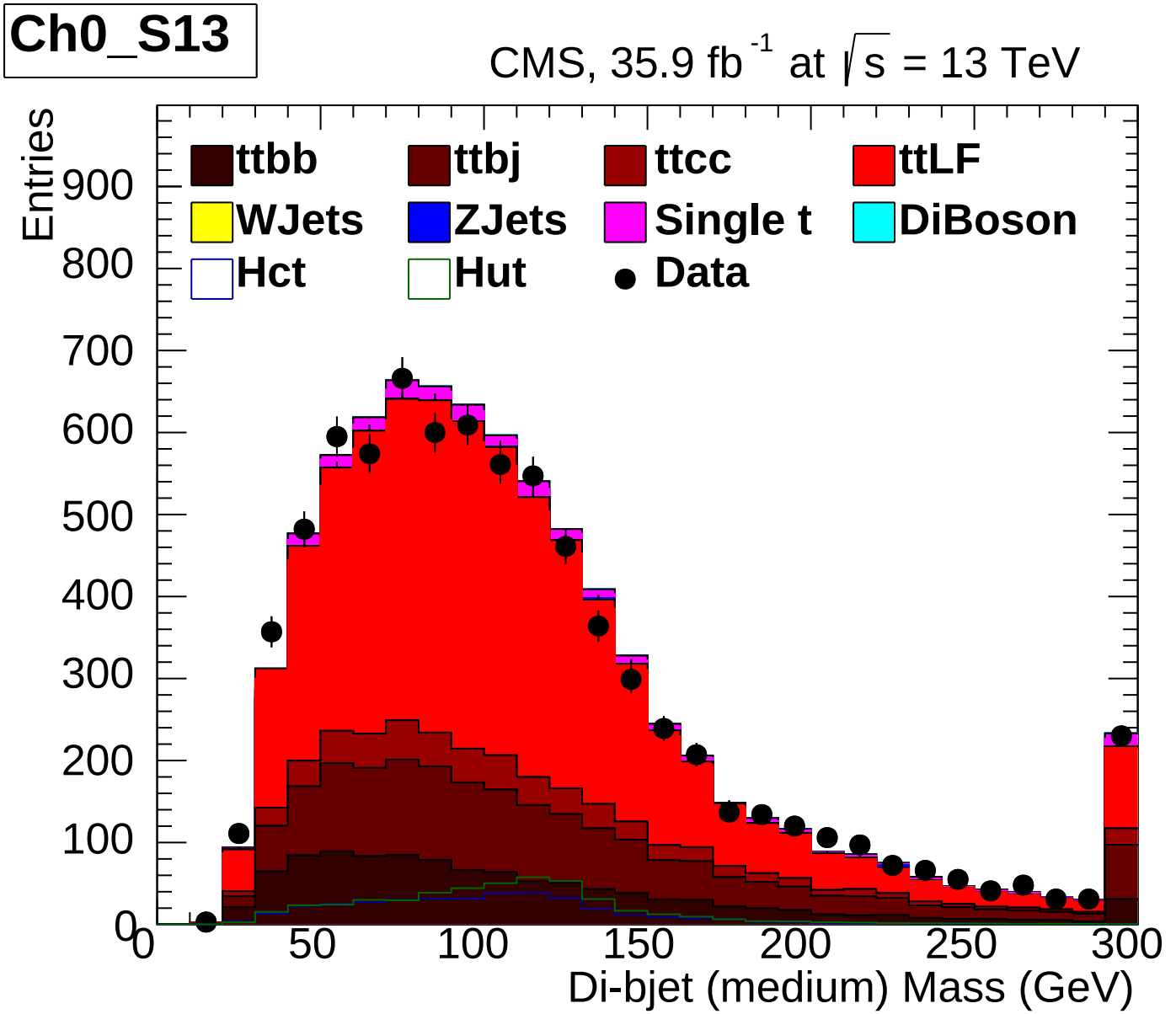
1000
1200
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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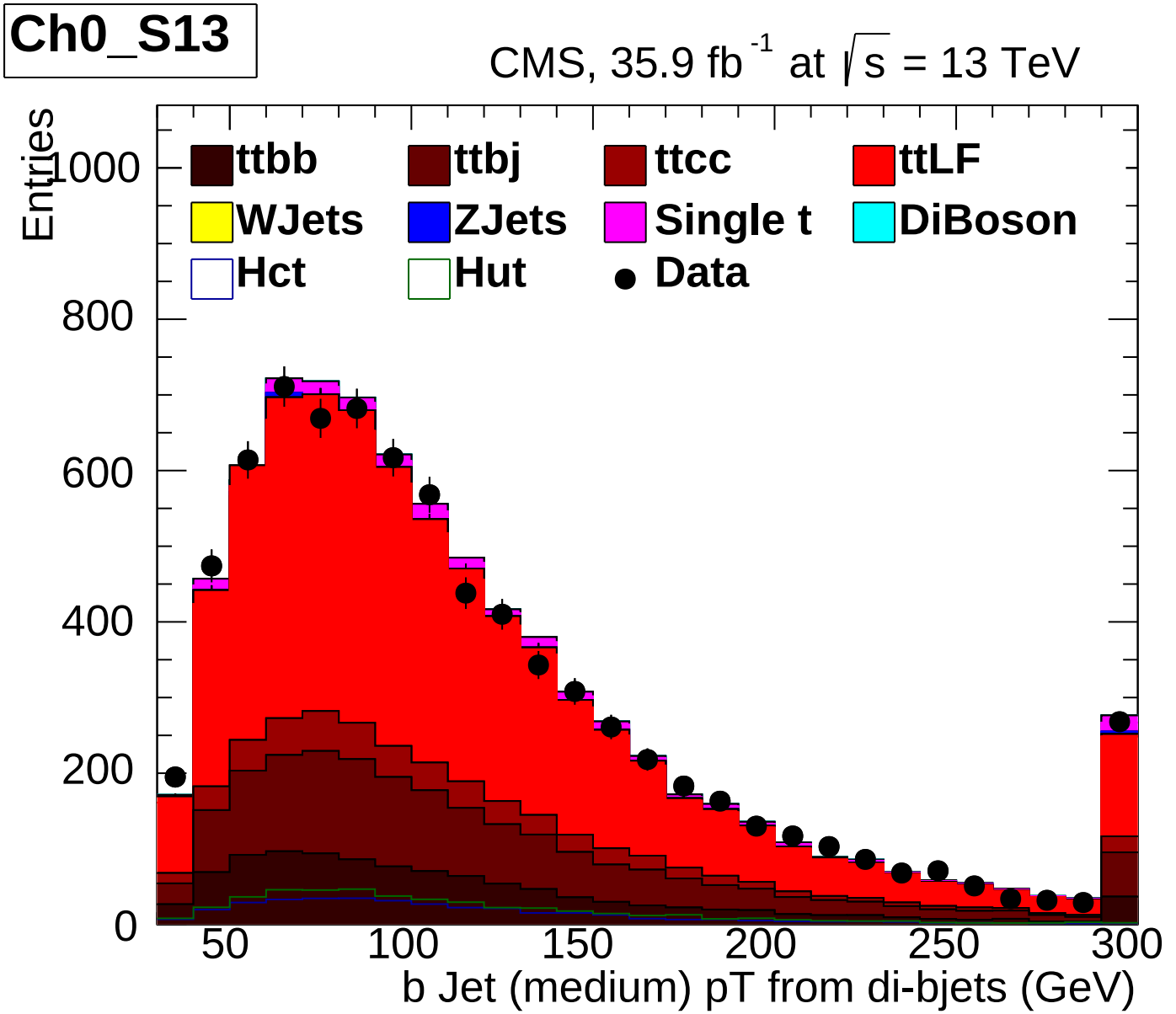
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
100
200
300
400
500
600
700
800
900
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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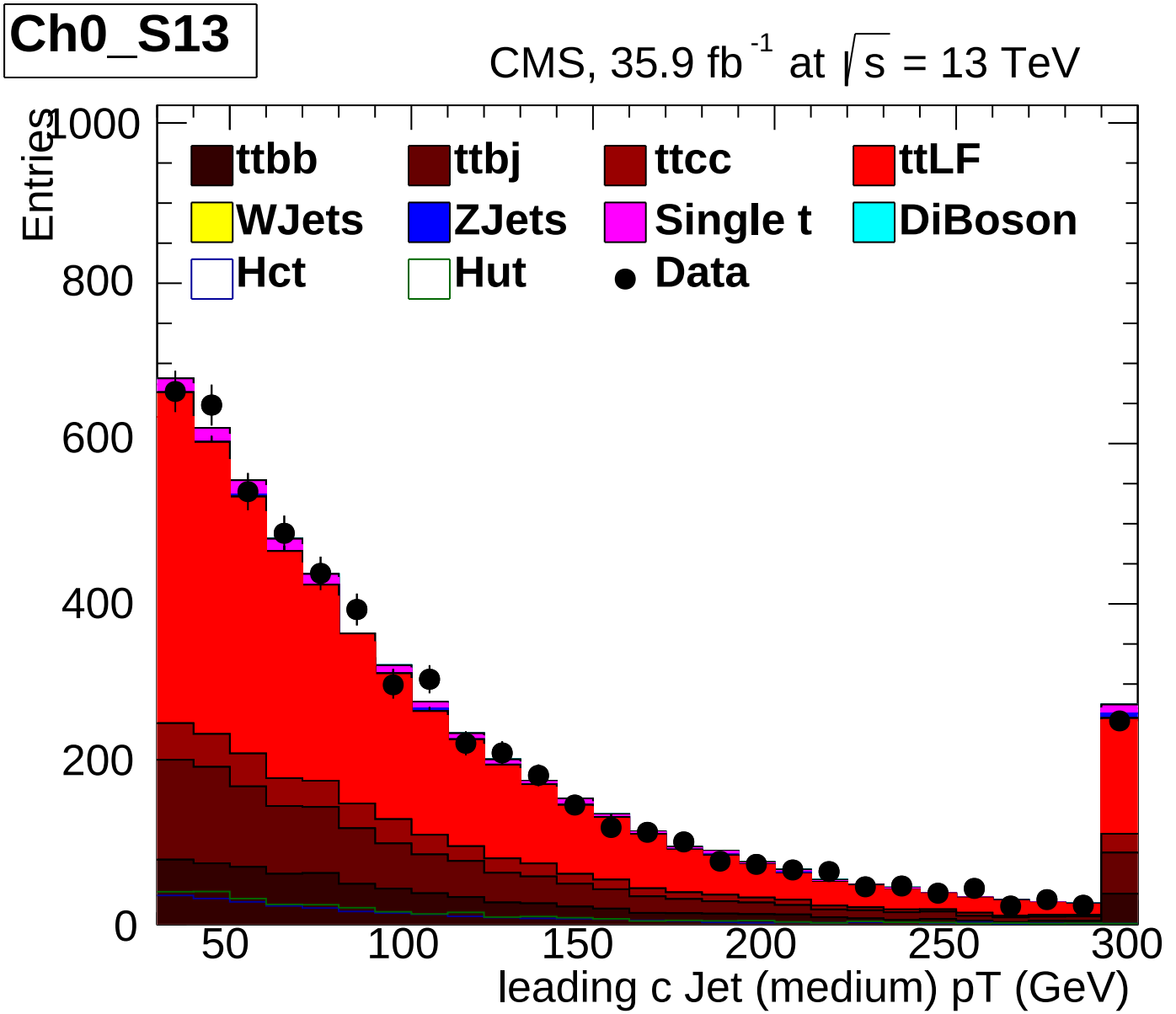
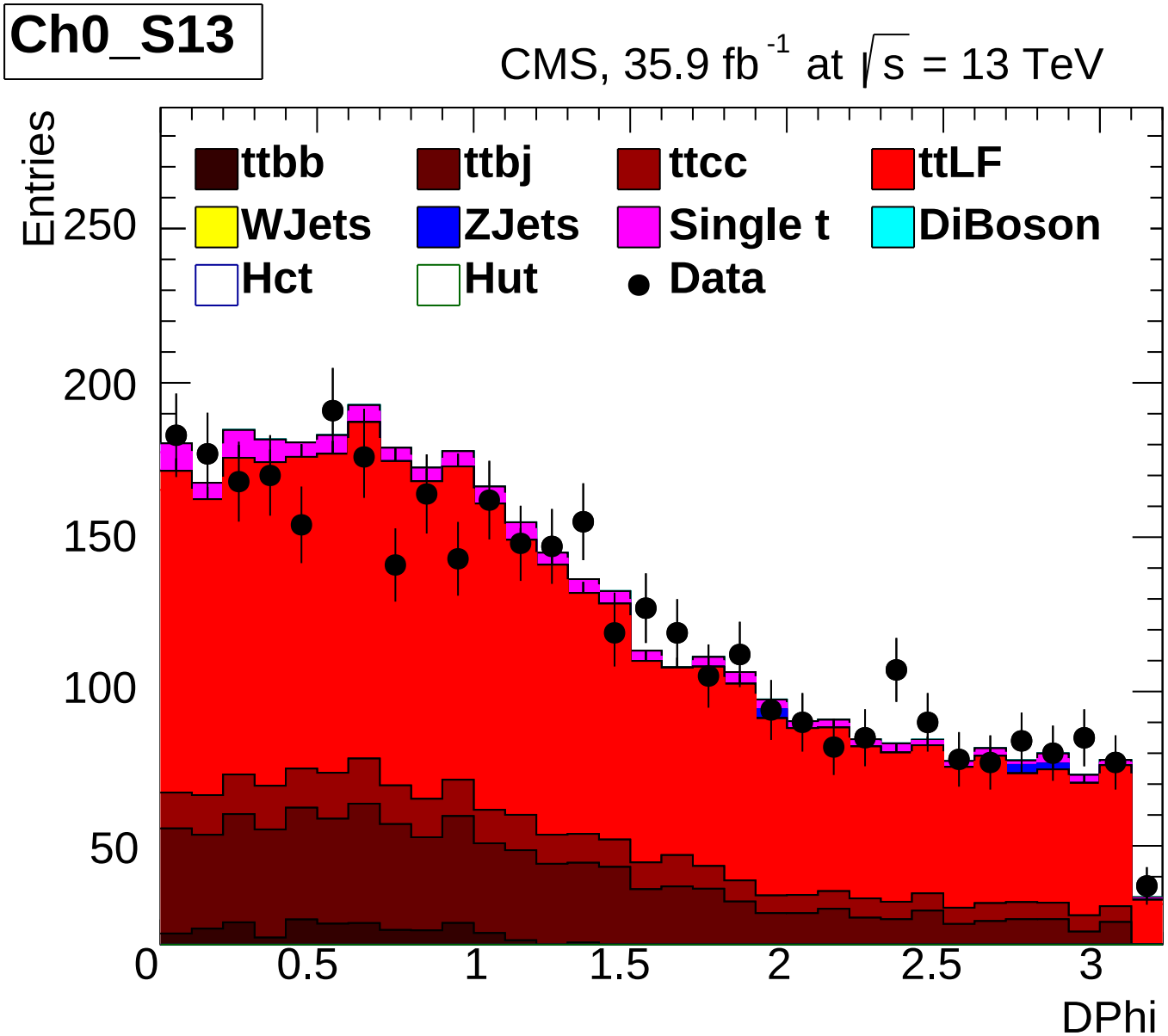
200
400
600
800
1000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
1000
800
600
400
200
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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200
150
100
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0
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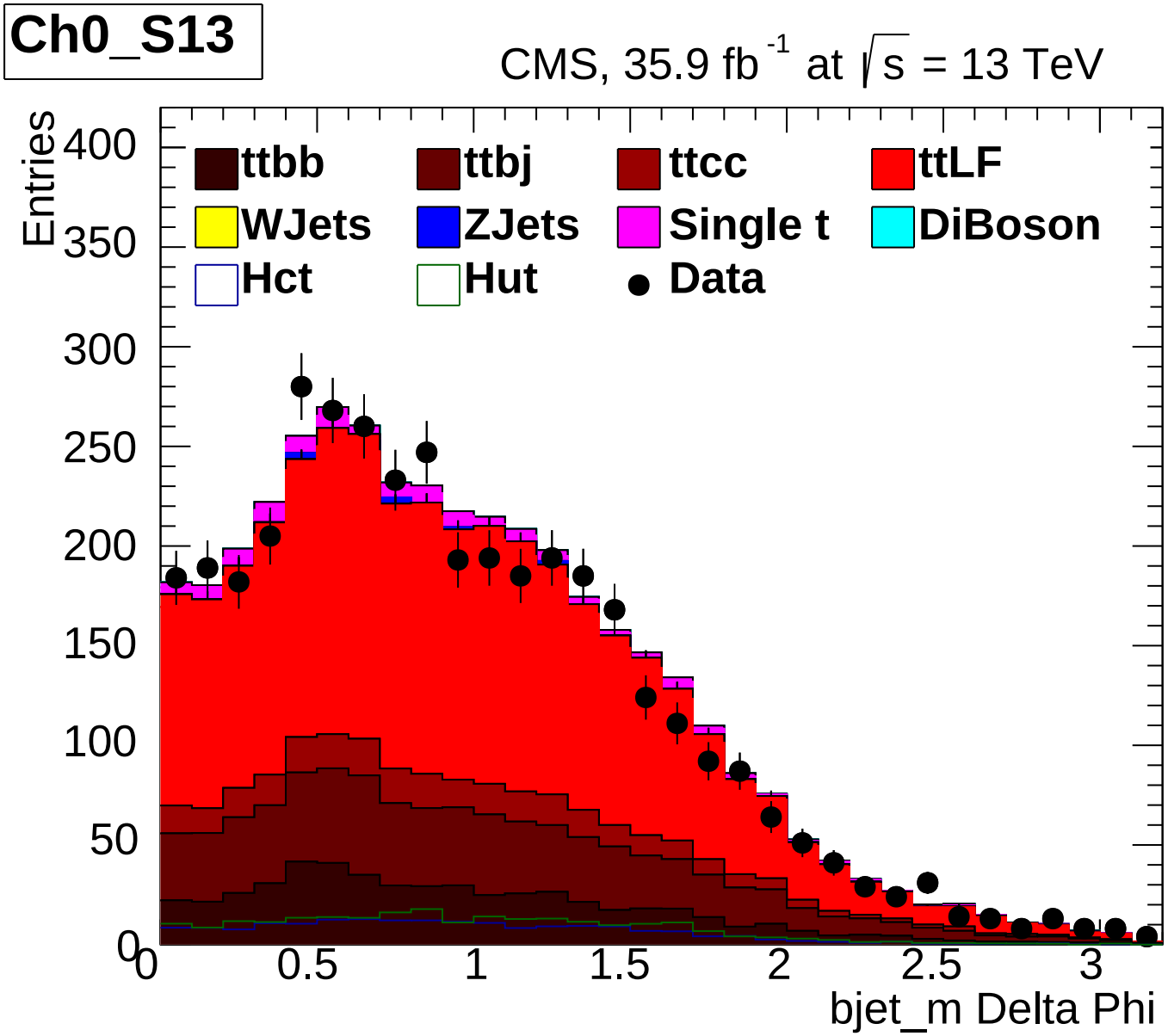
1
1.5
2
2.5
3
DPhi


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
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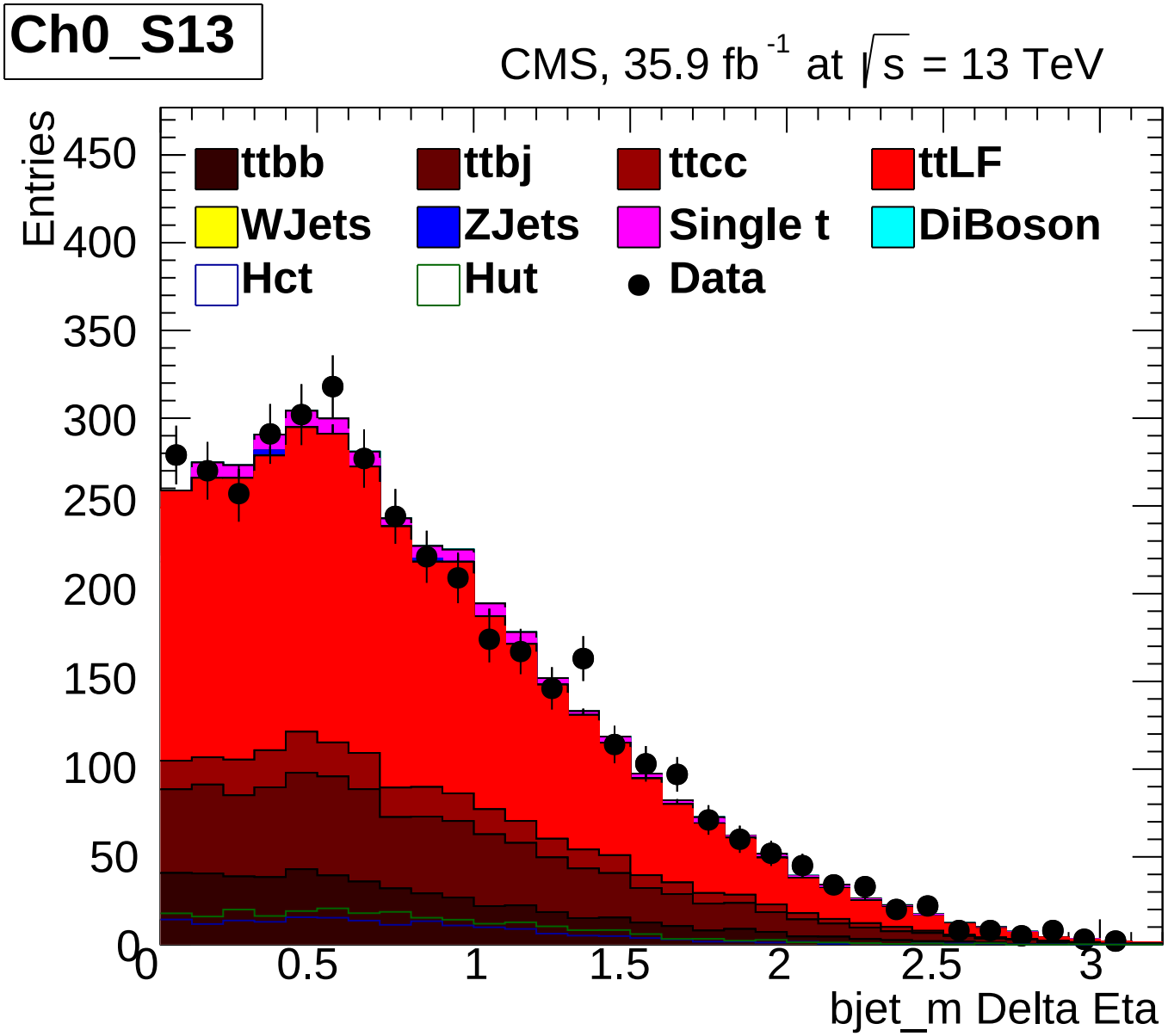
300
350
400
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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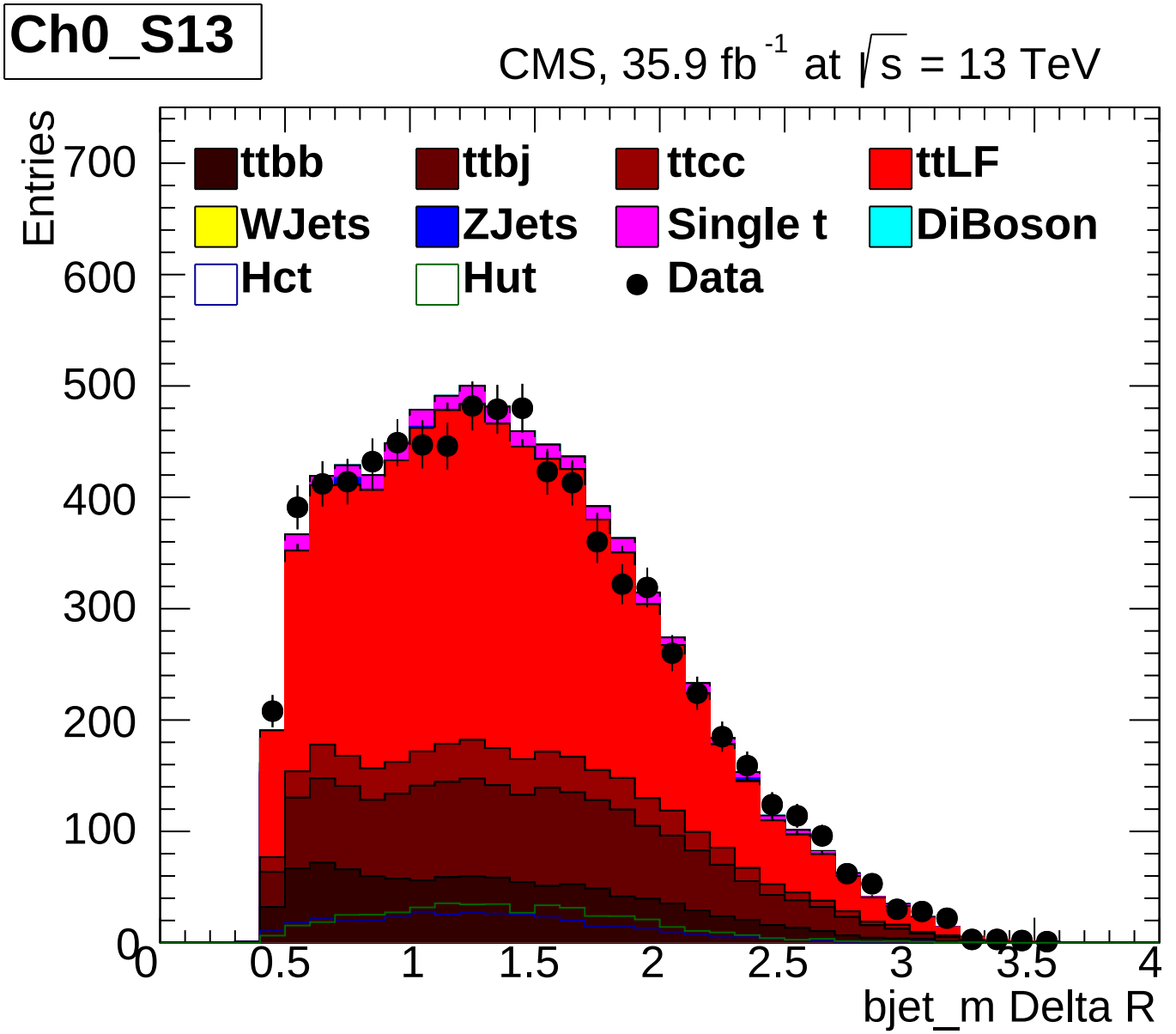
300
350
400
450
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
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300
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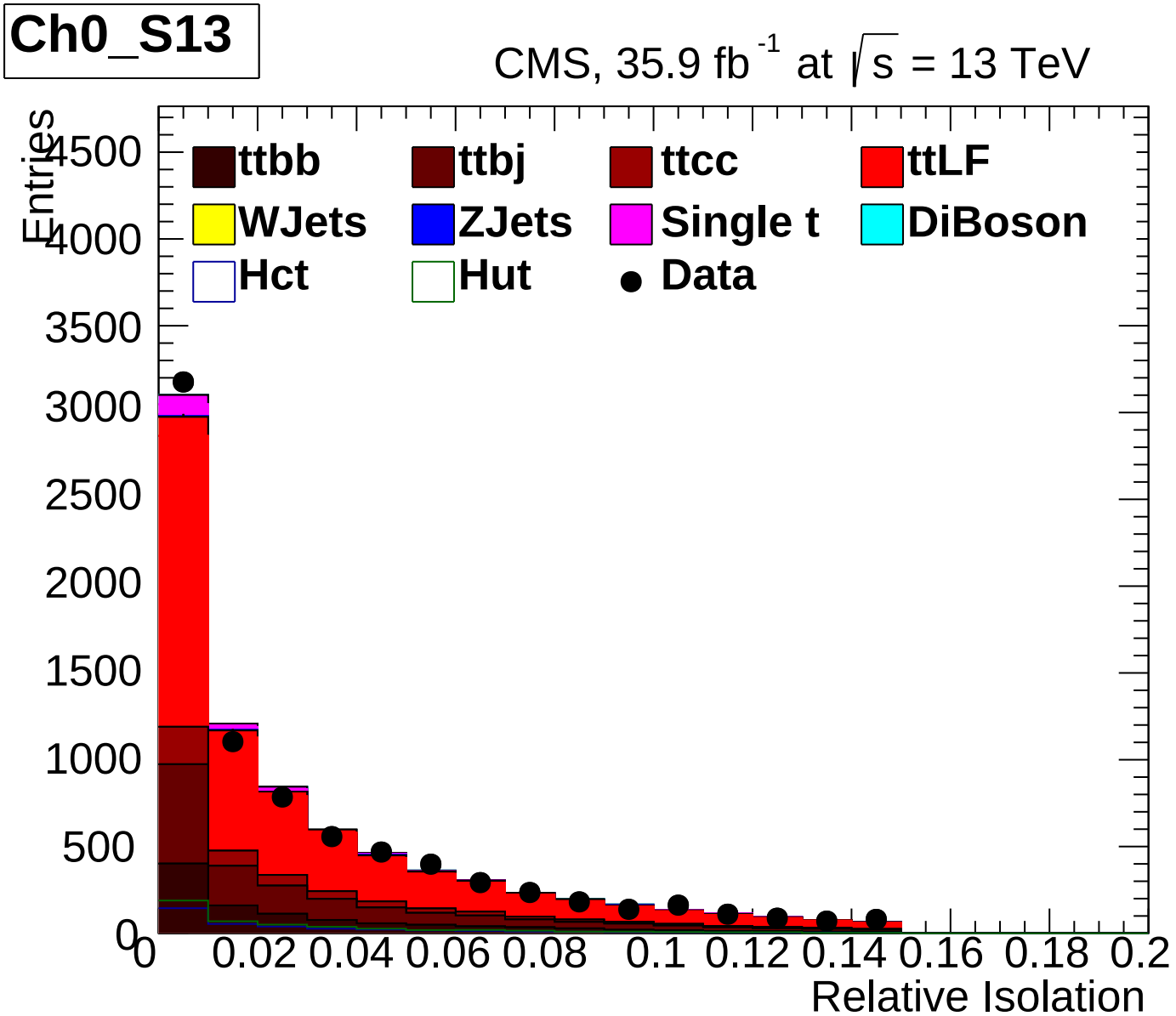
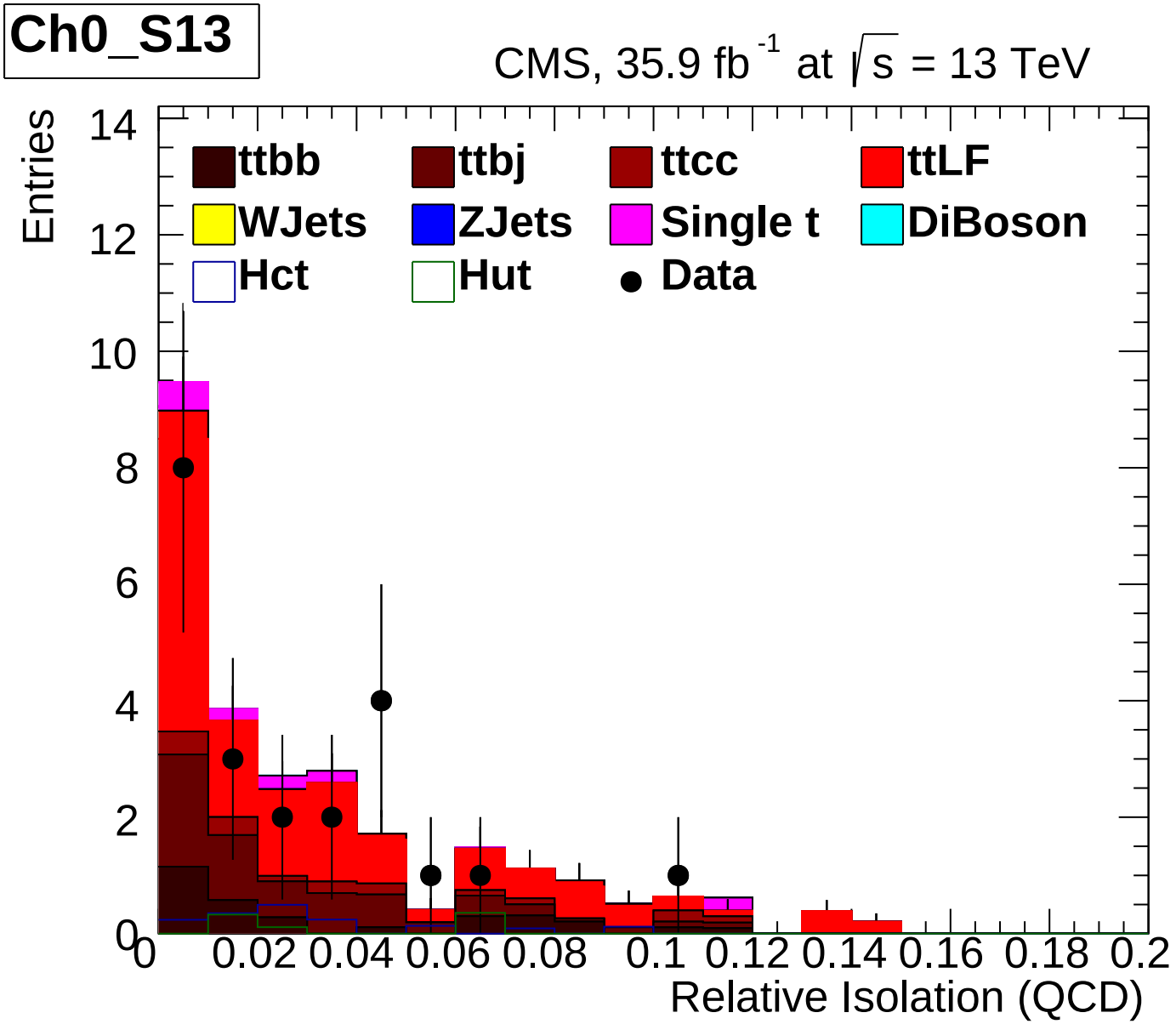
600
700
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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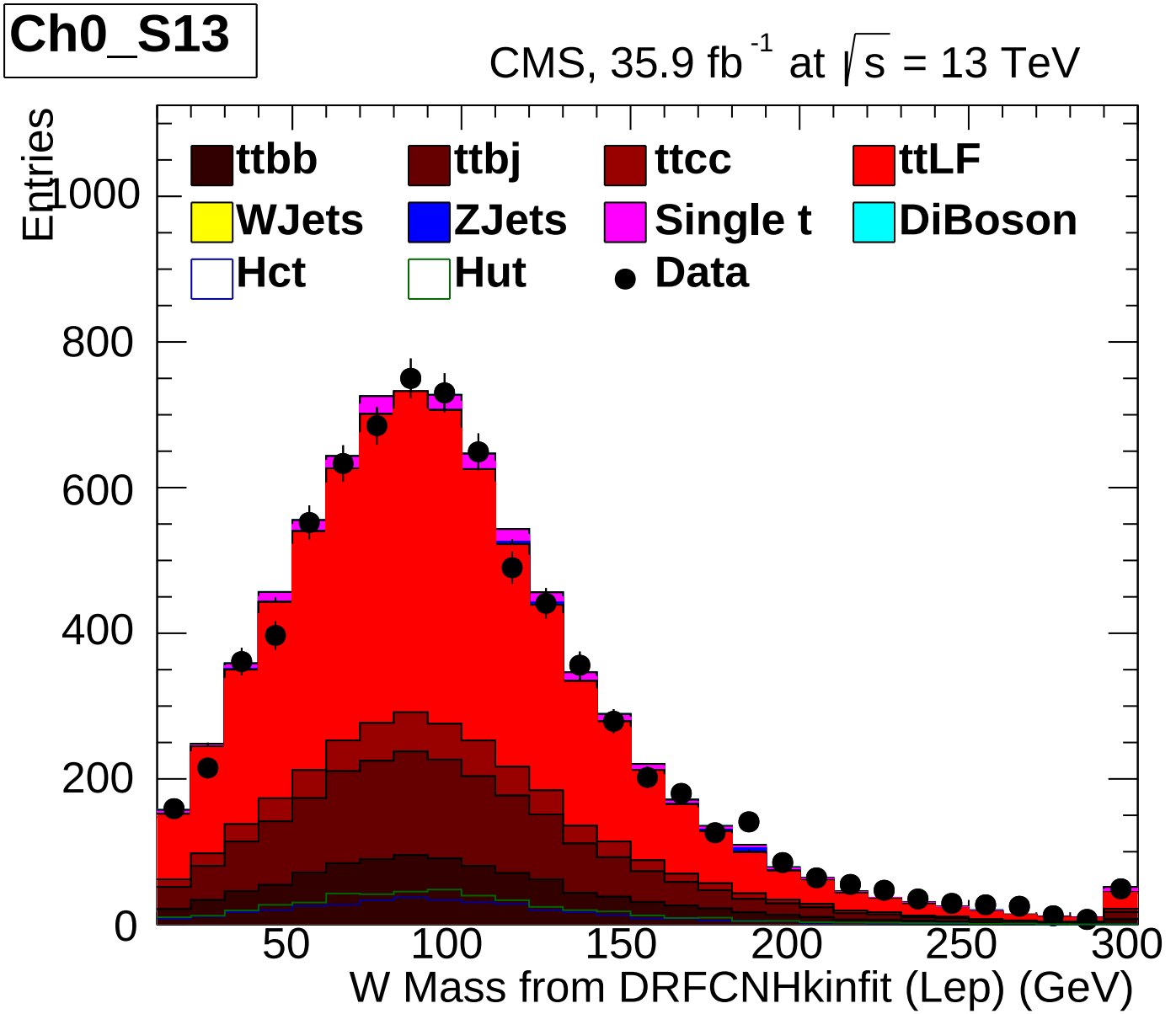
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2
4
6
8
10
12
14
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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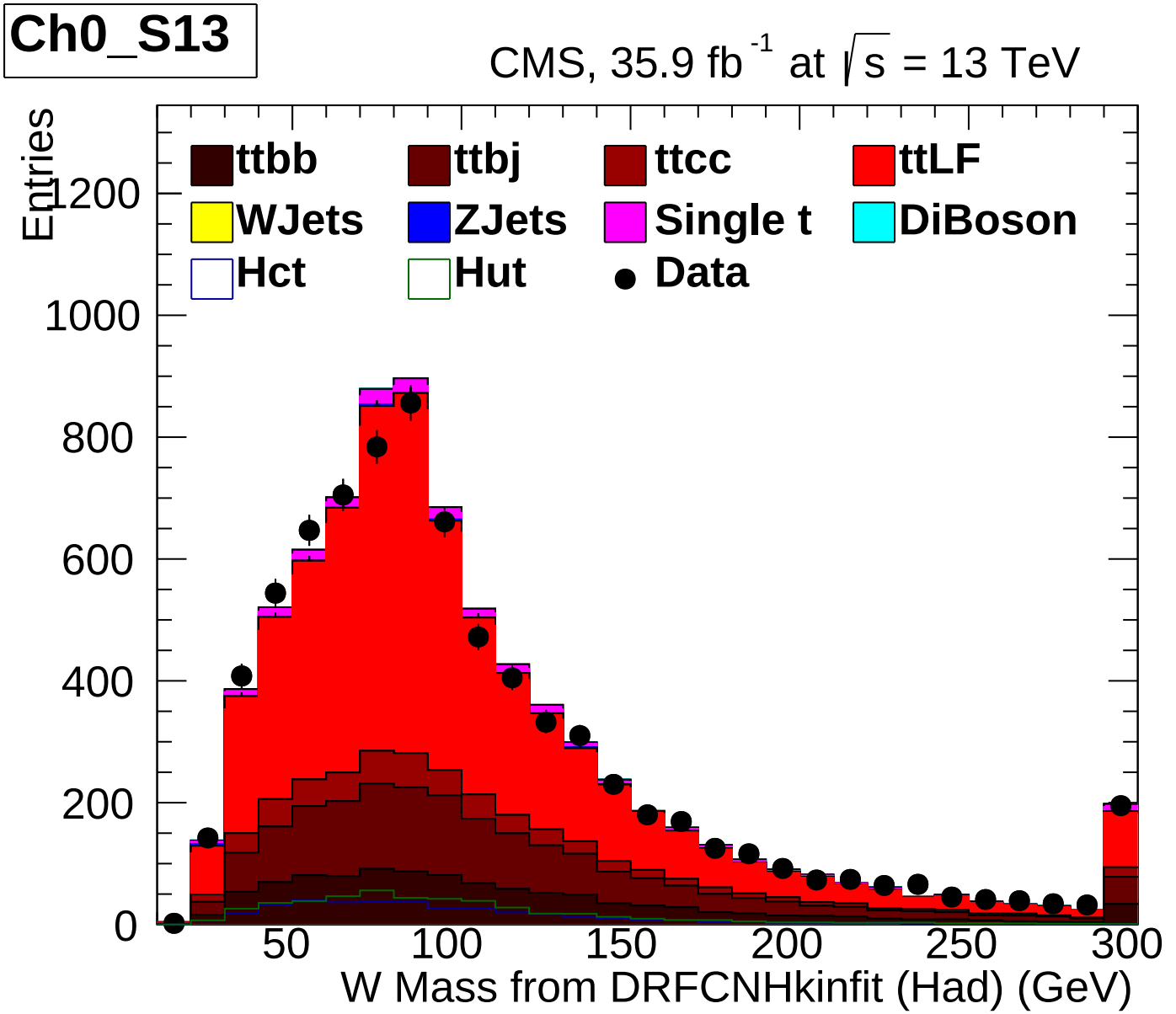
600
800
1000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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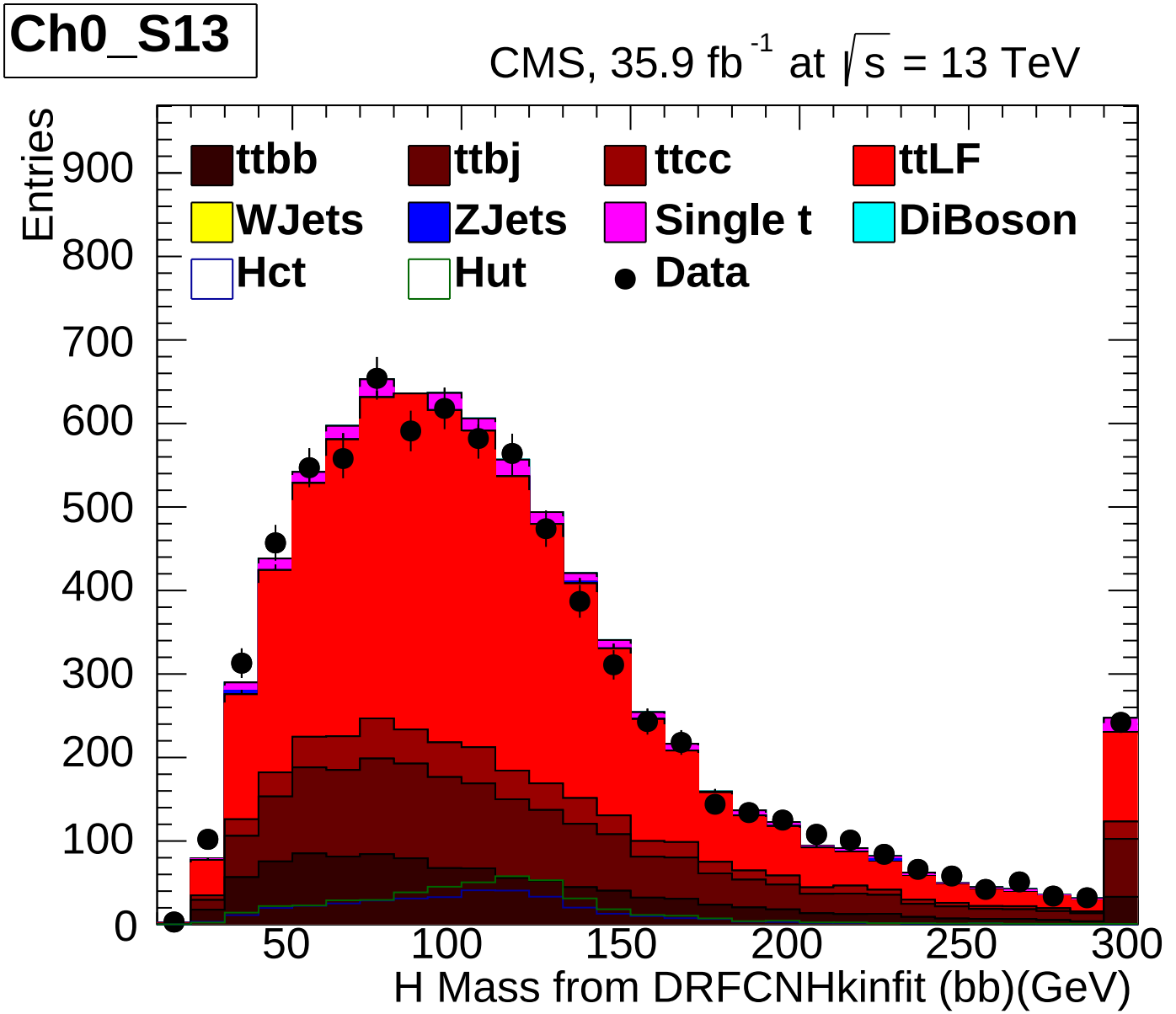
600
800
1000
1200
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
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300
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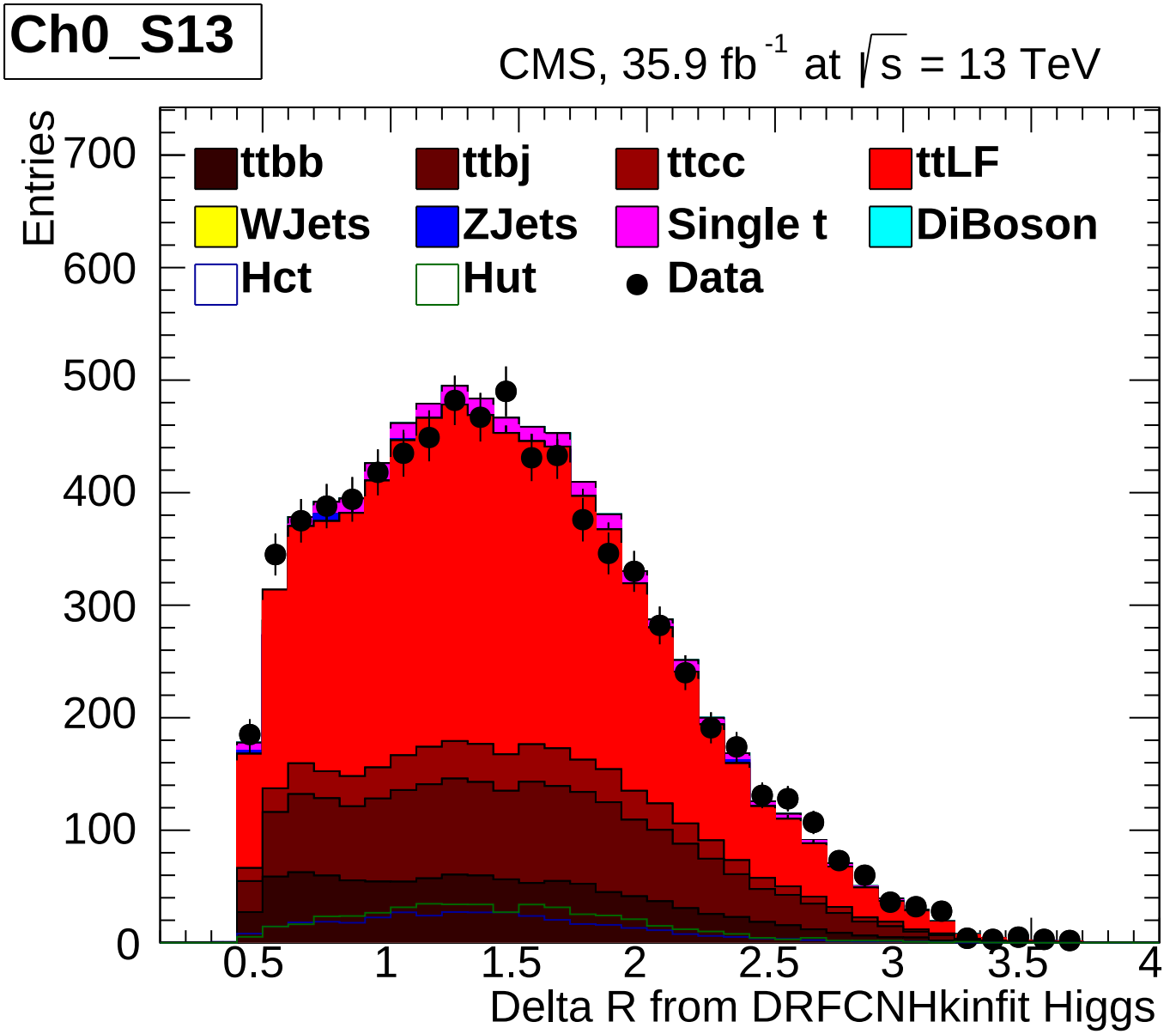
500
600
700
800
900
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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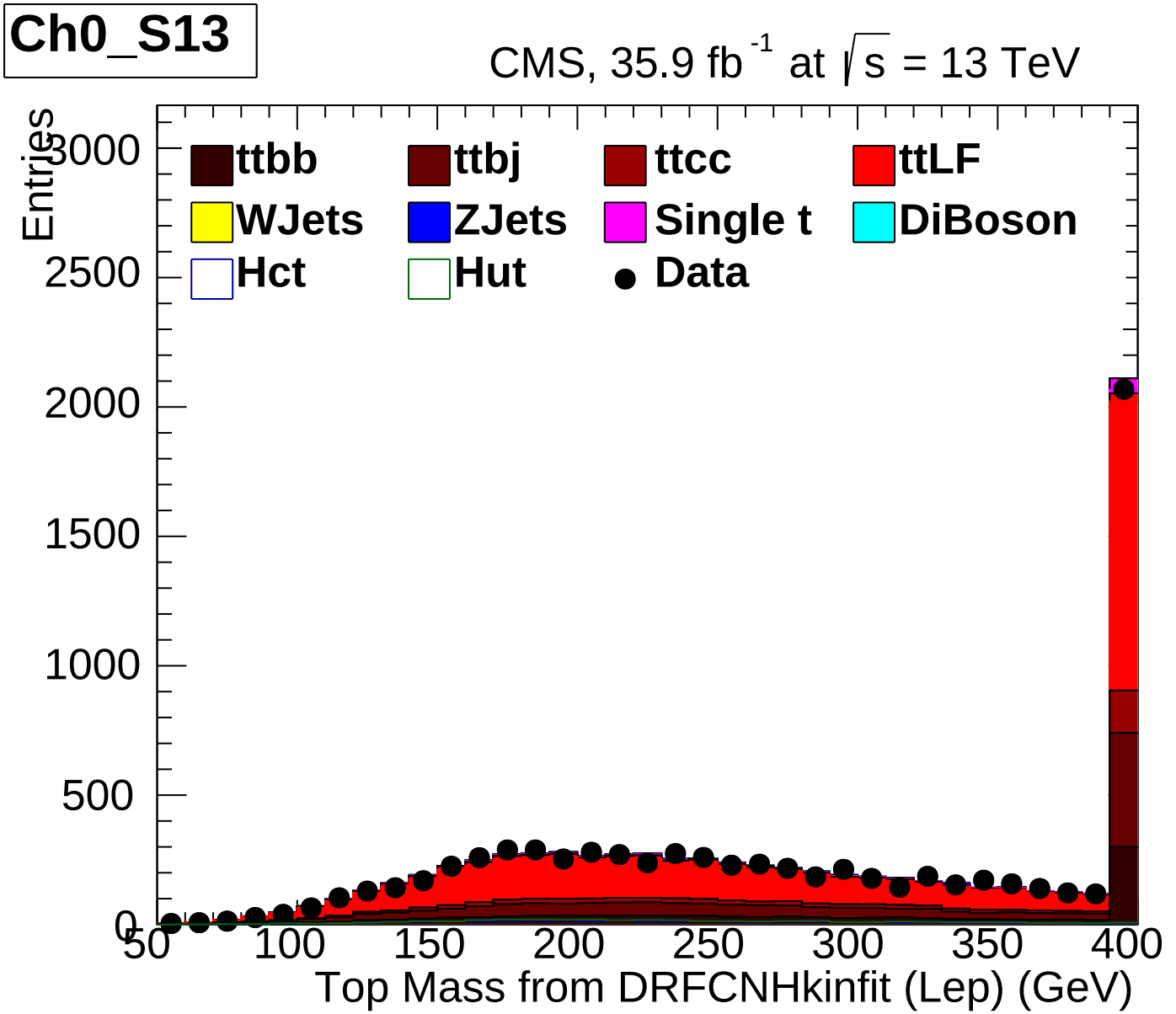
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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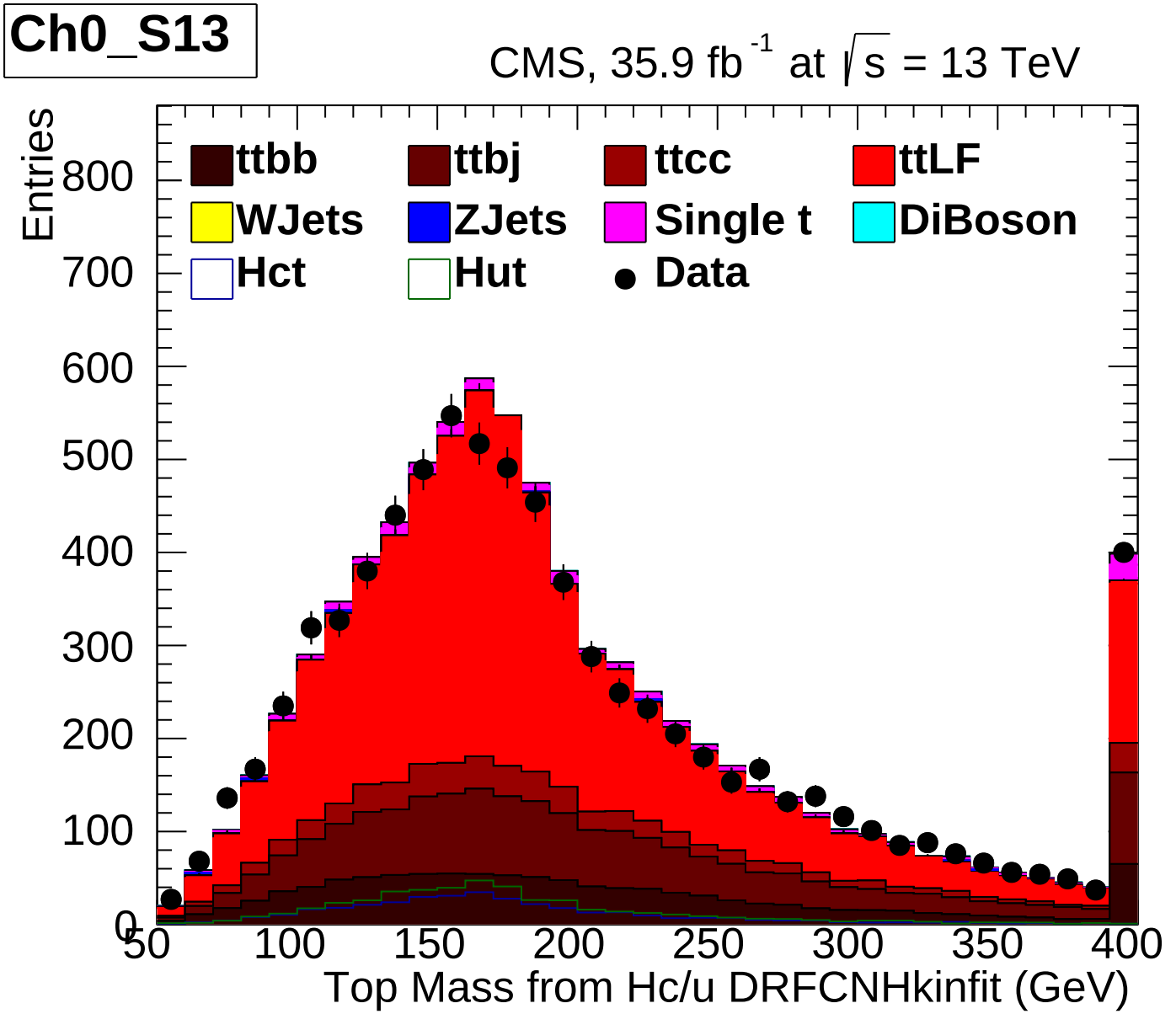
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
3000
2500
2000
1500
1000
500
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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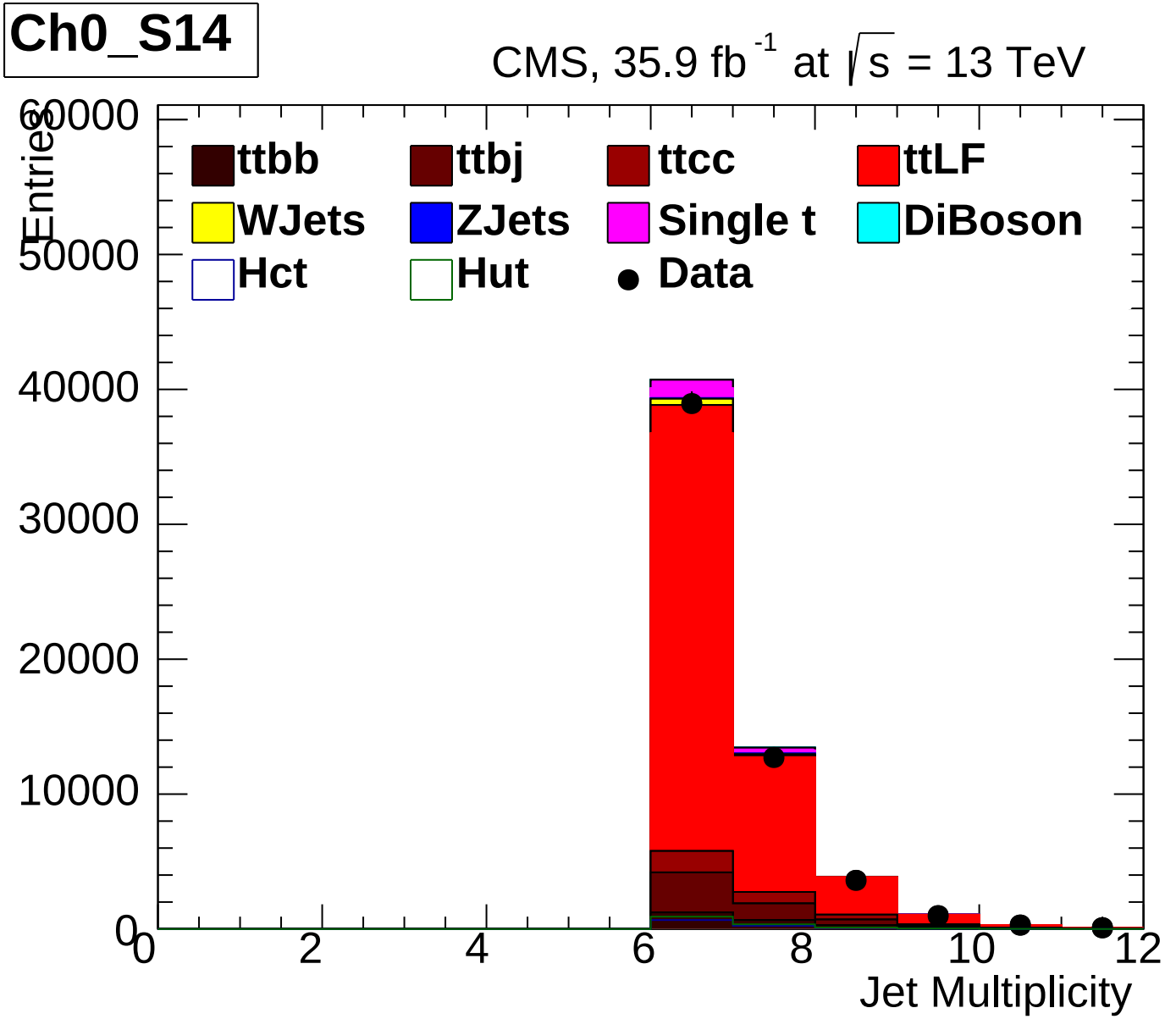
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
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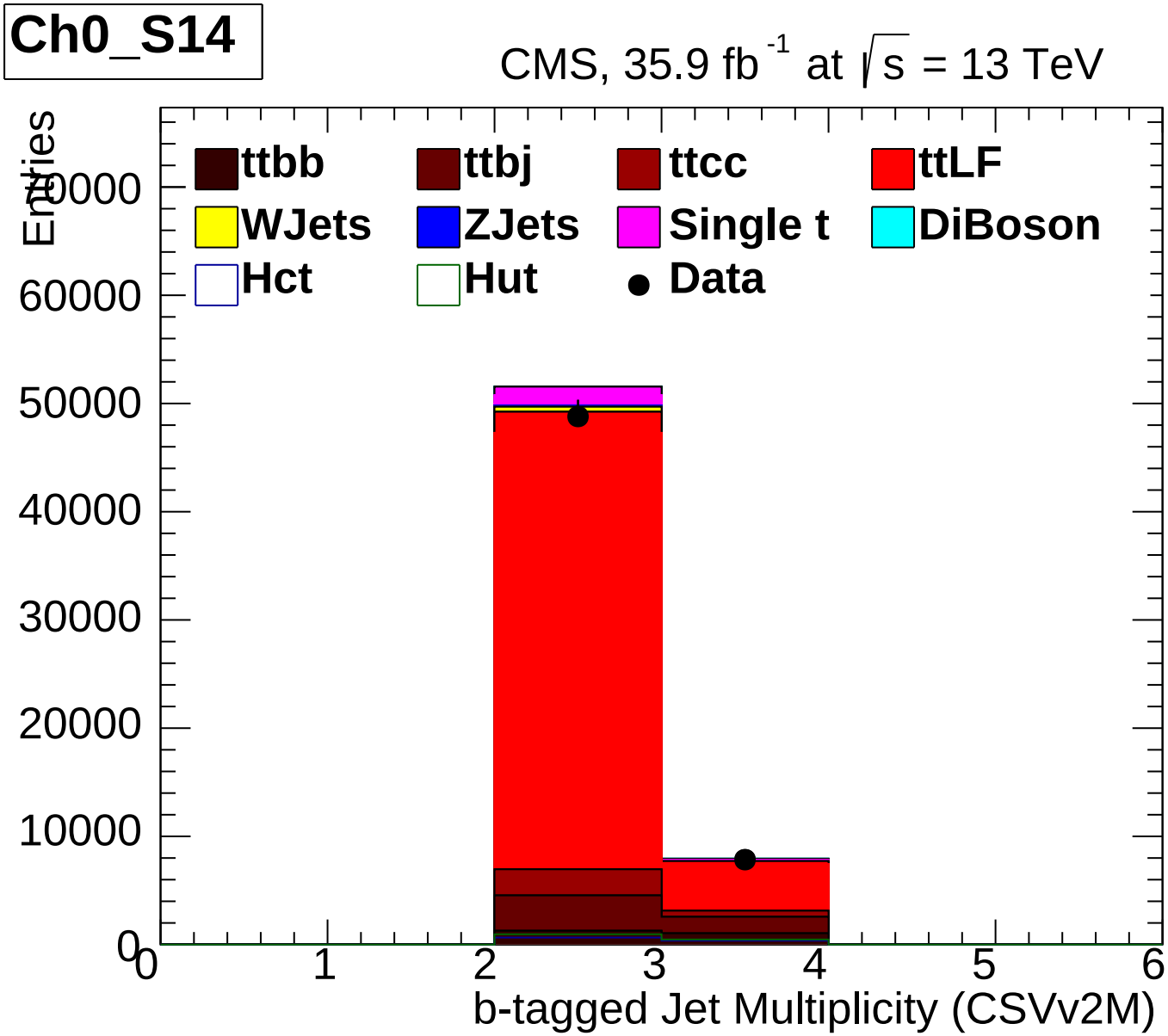
50000
40000
30000
20000
10000
0
0
2
4
6
8
10
12
Jet Multiplicity


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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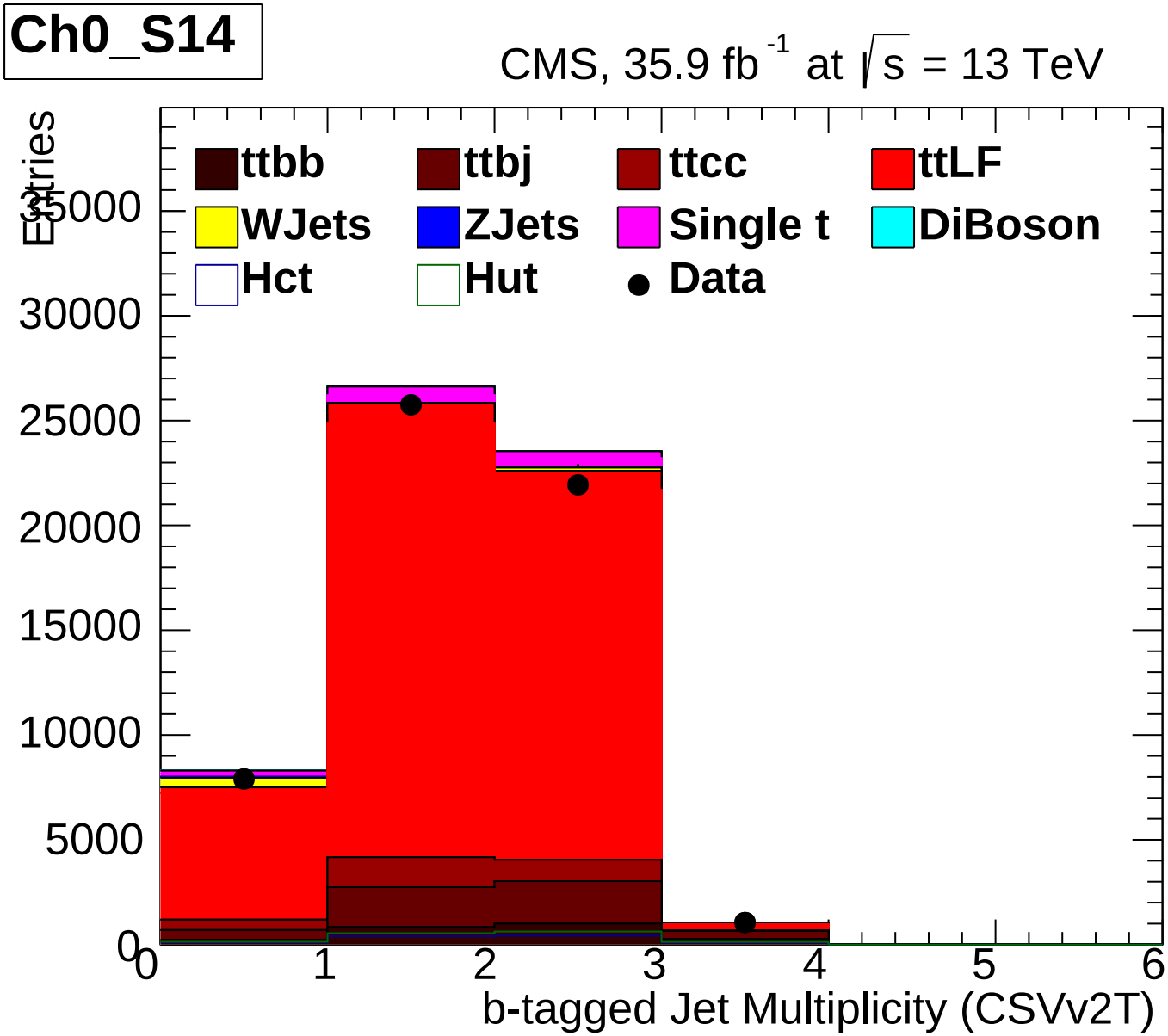
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
70000
60000
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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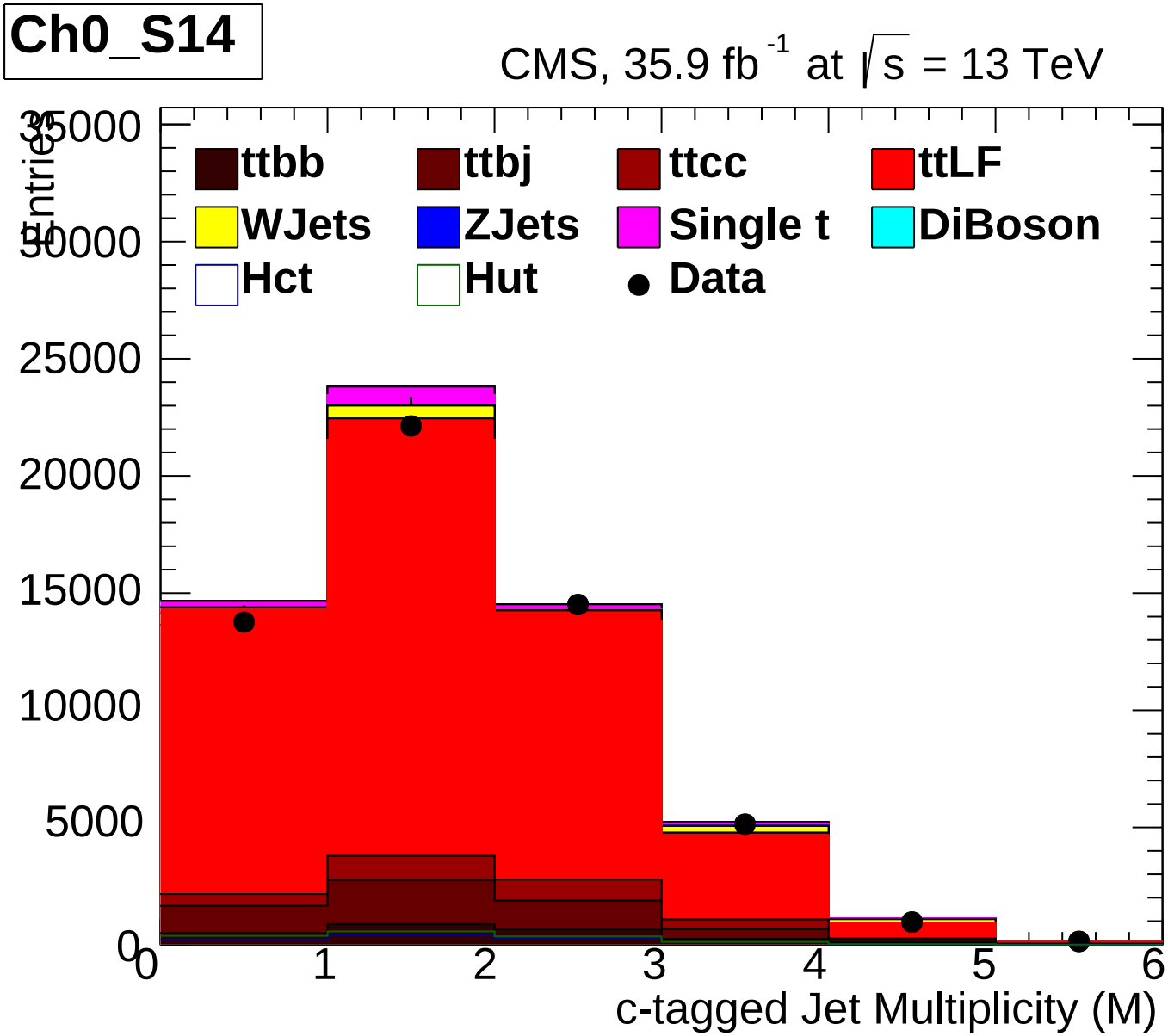
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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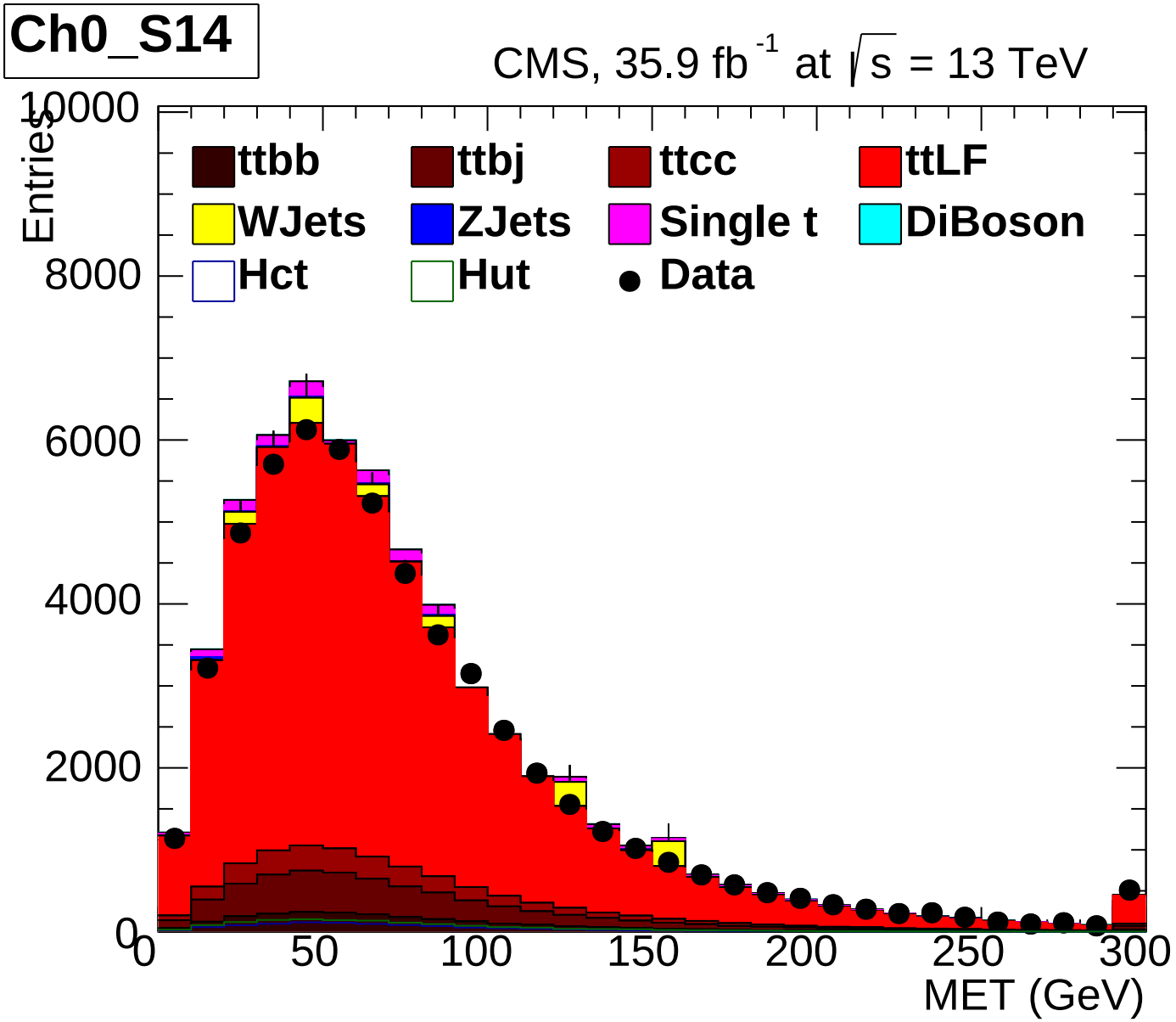
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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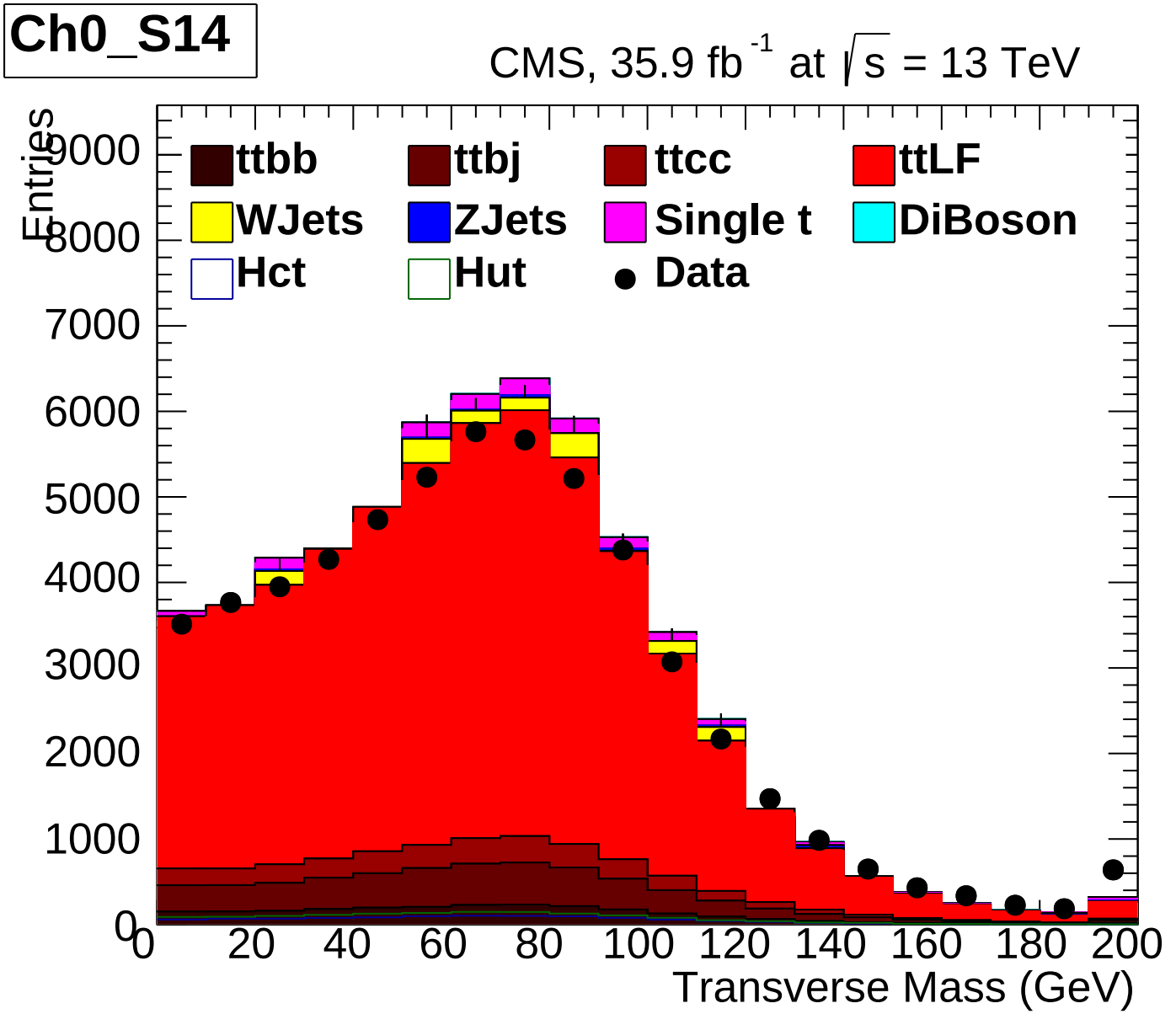
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
10000
8000
6000
4000
2000
0
0
50
100
150
200
250
300
MET (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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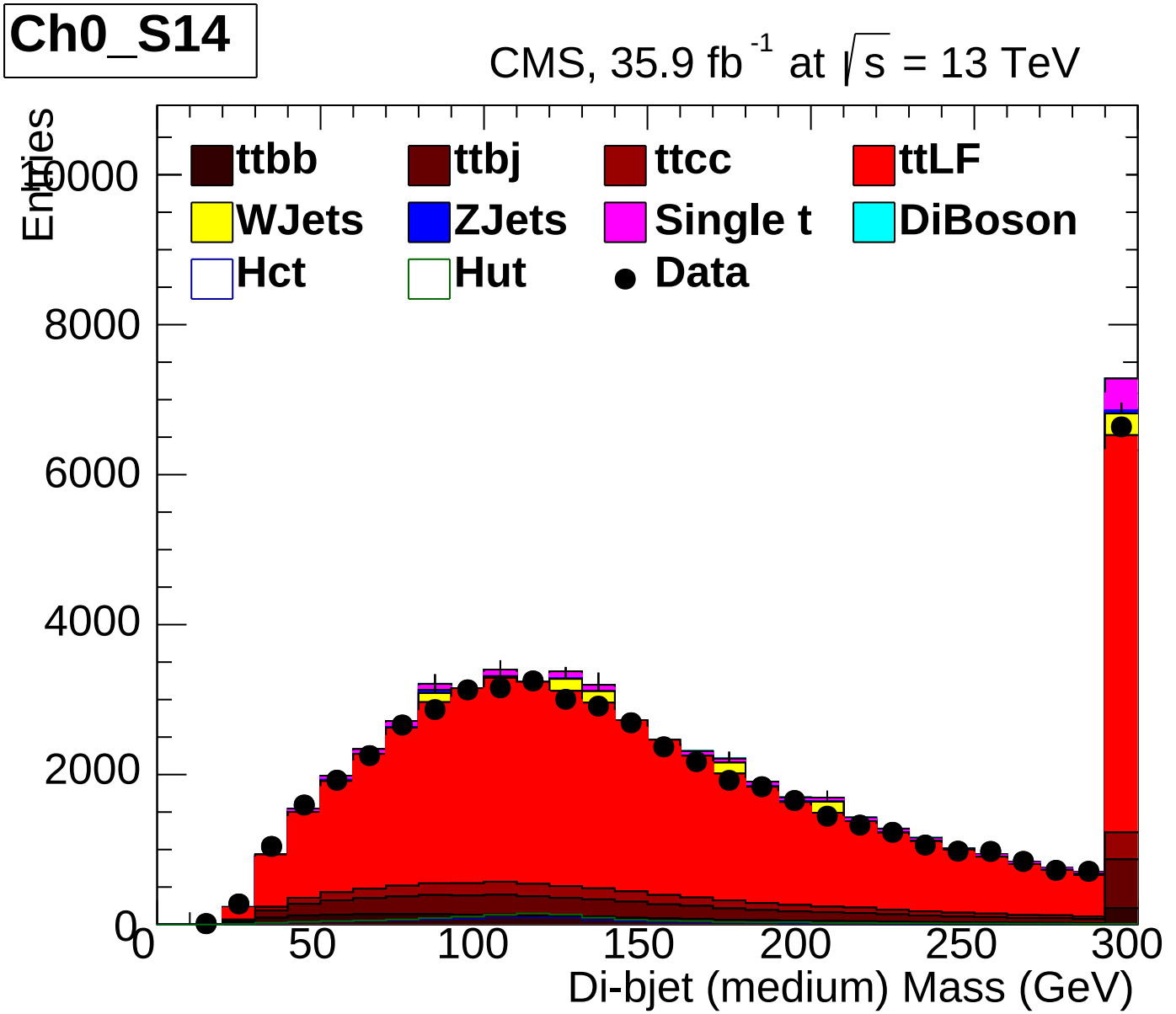
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
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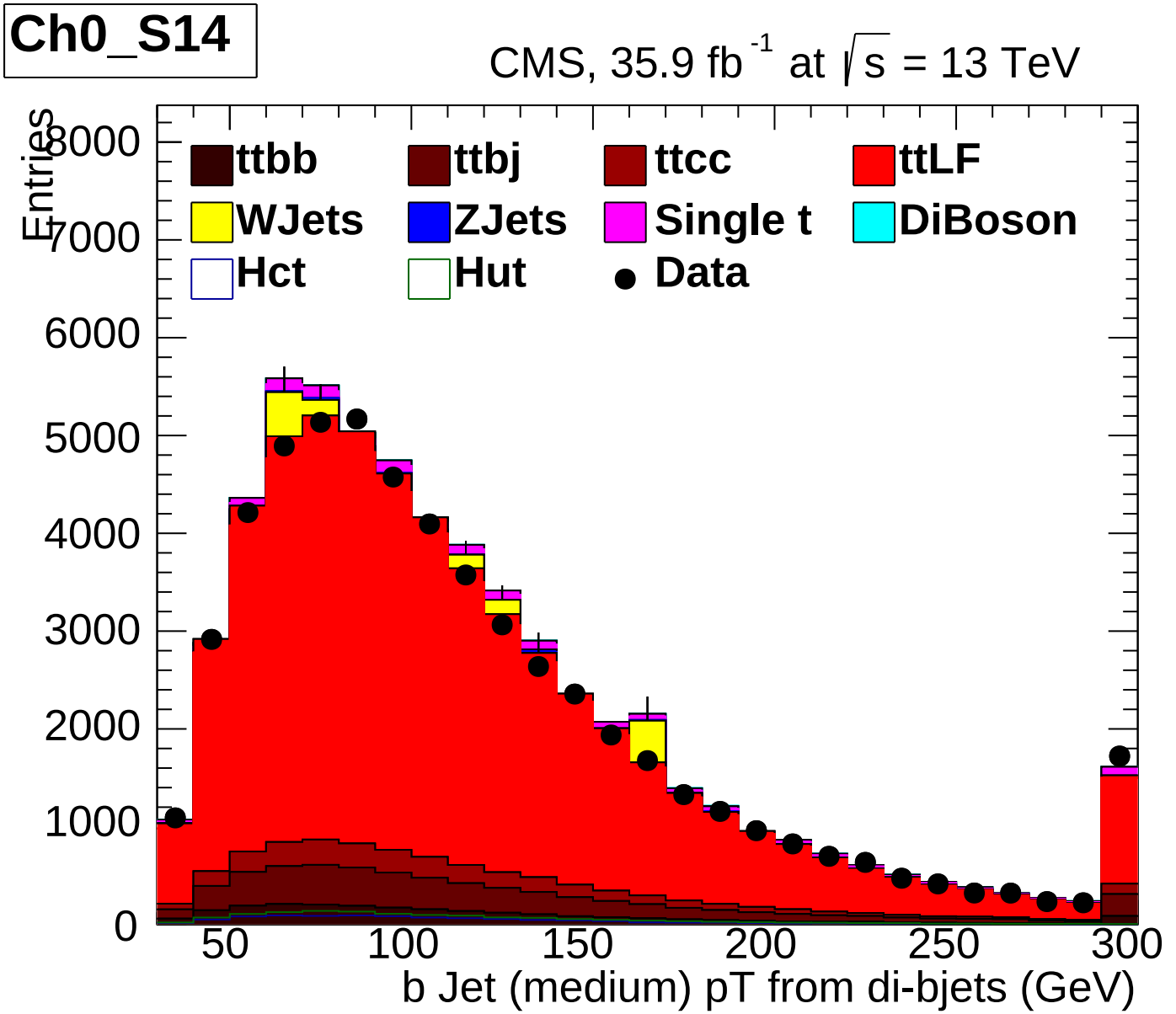
8000
6000
4000
2000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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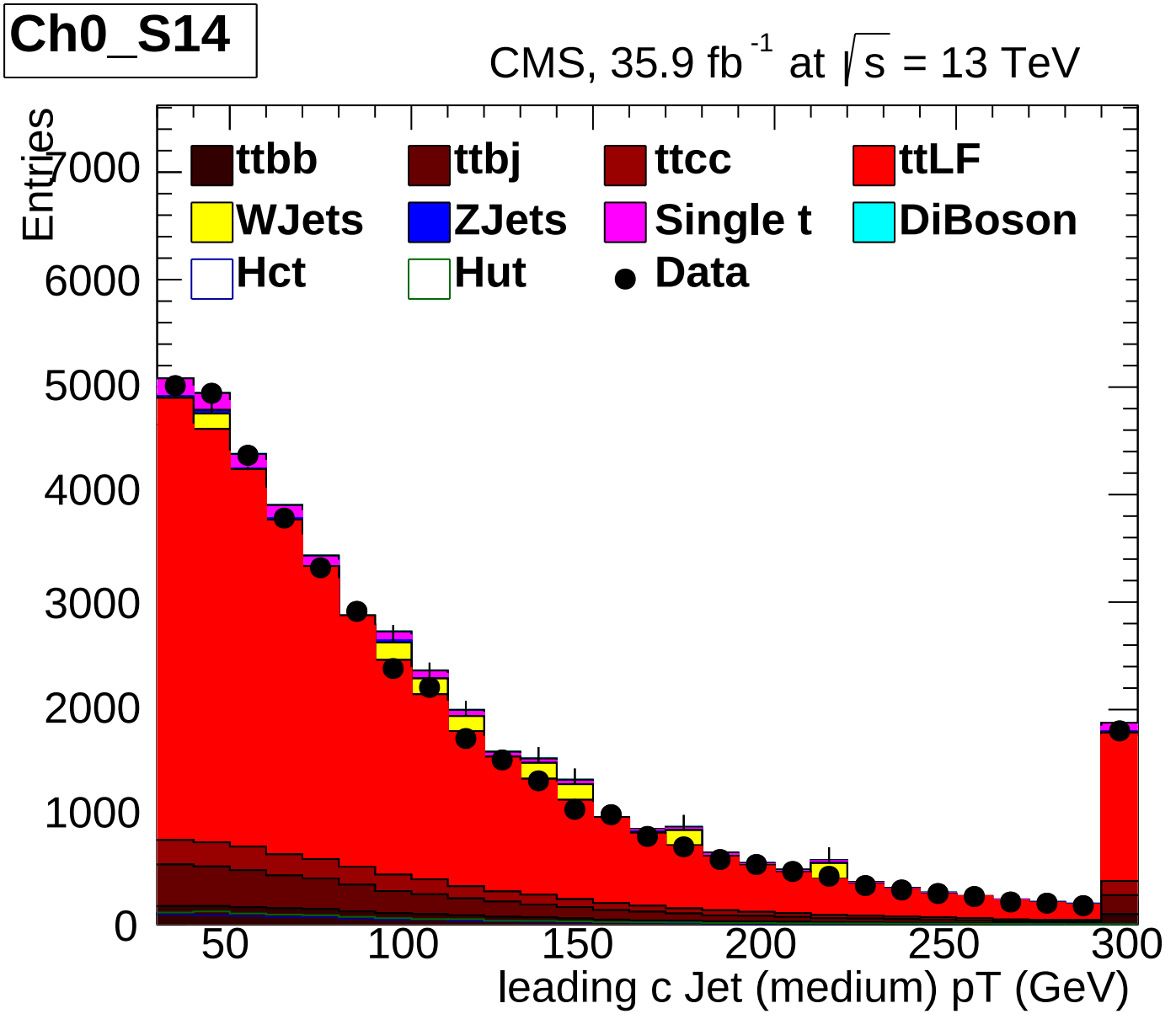
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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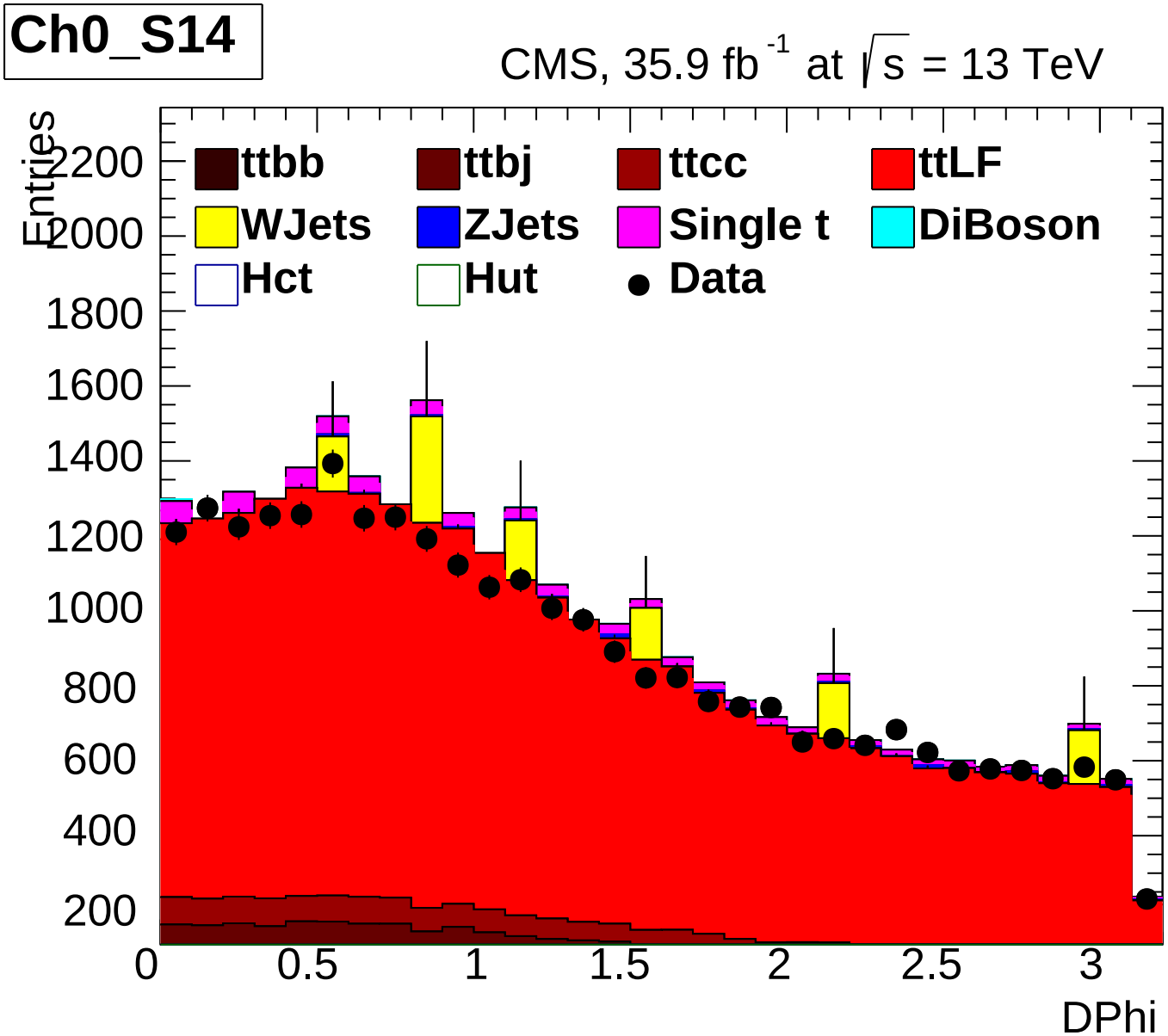
2000
3000
4000
5000
6000
7000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
2200
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1200
1000
800
600
400
200
0
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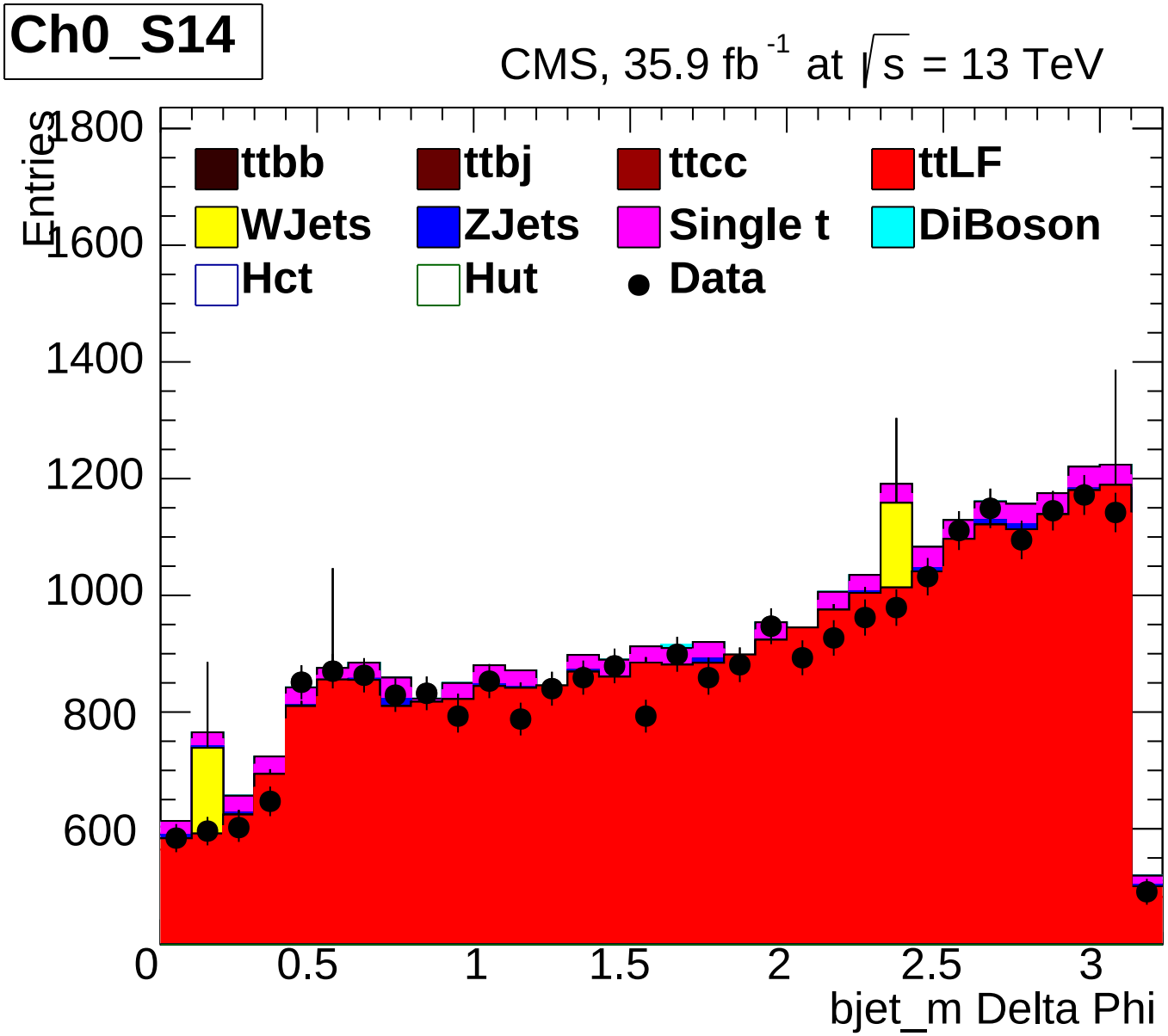
1
1.5
2
2.5
3
DPhi


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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1200
1000
800
600
0
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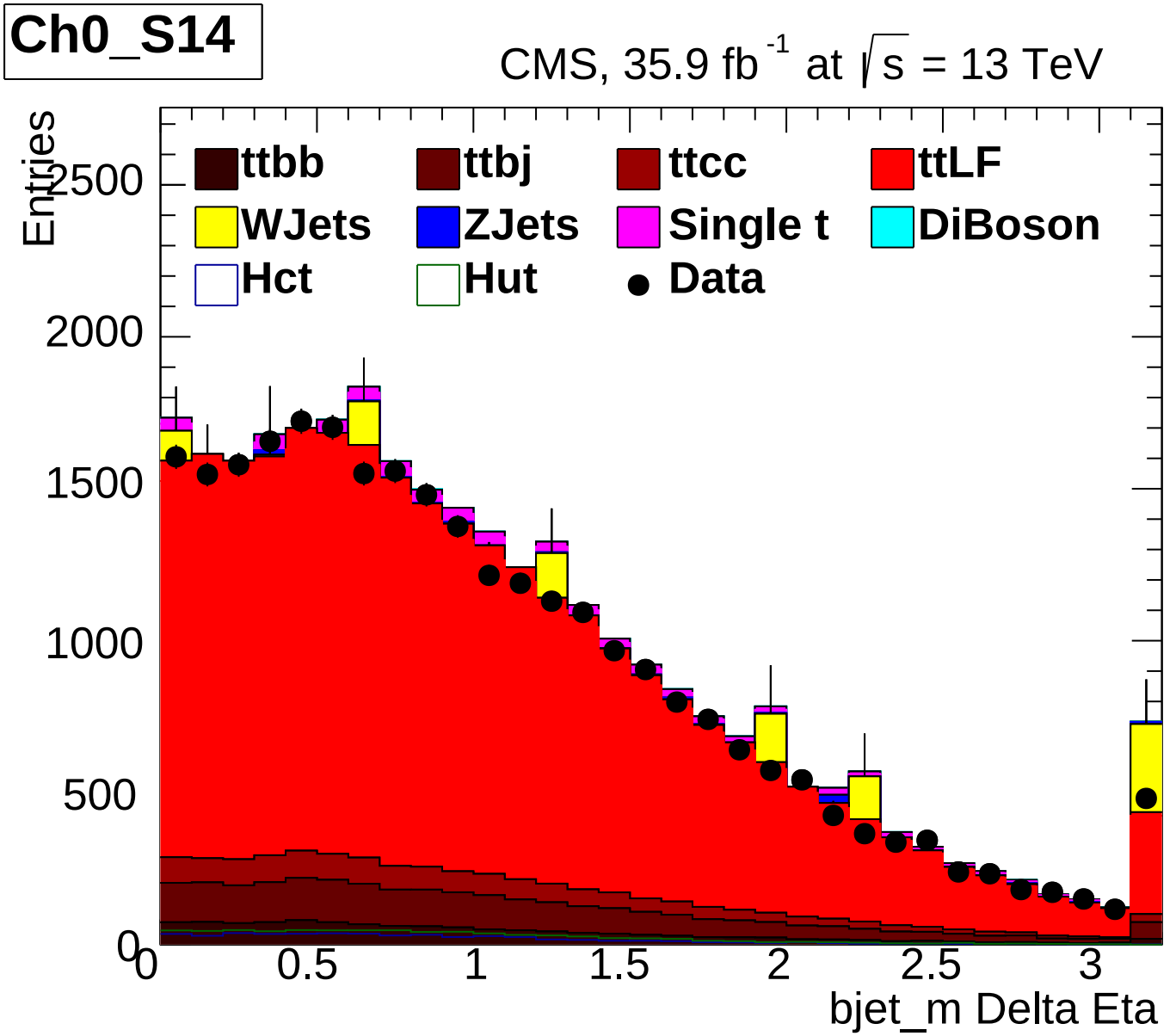
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ZJets
Single t
DiBoson
Hct
Hut
Data
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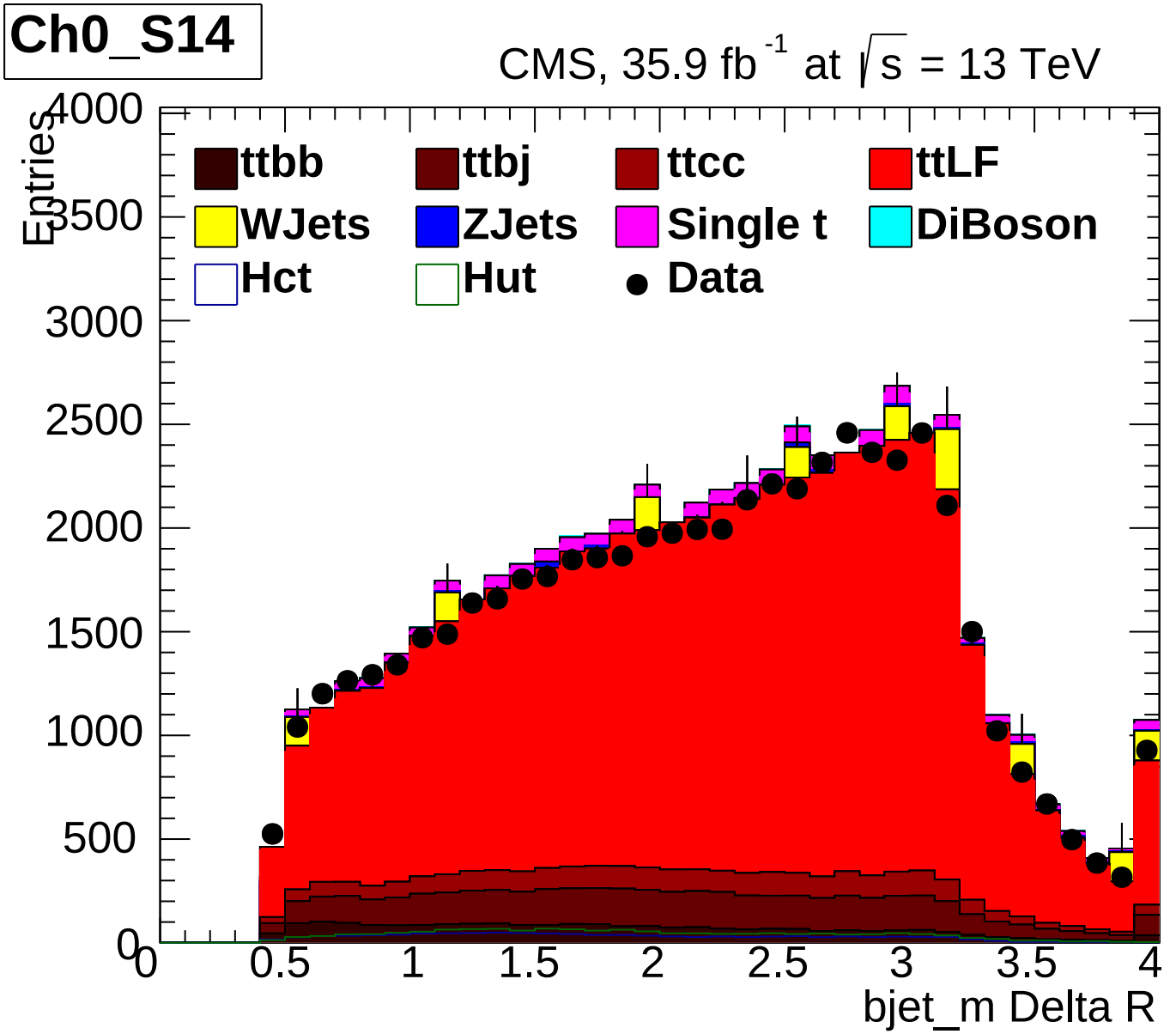
1500
2000
2500
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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1000
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4000
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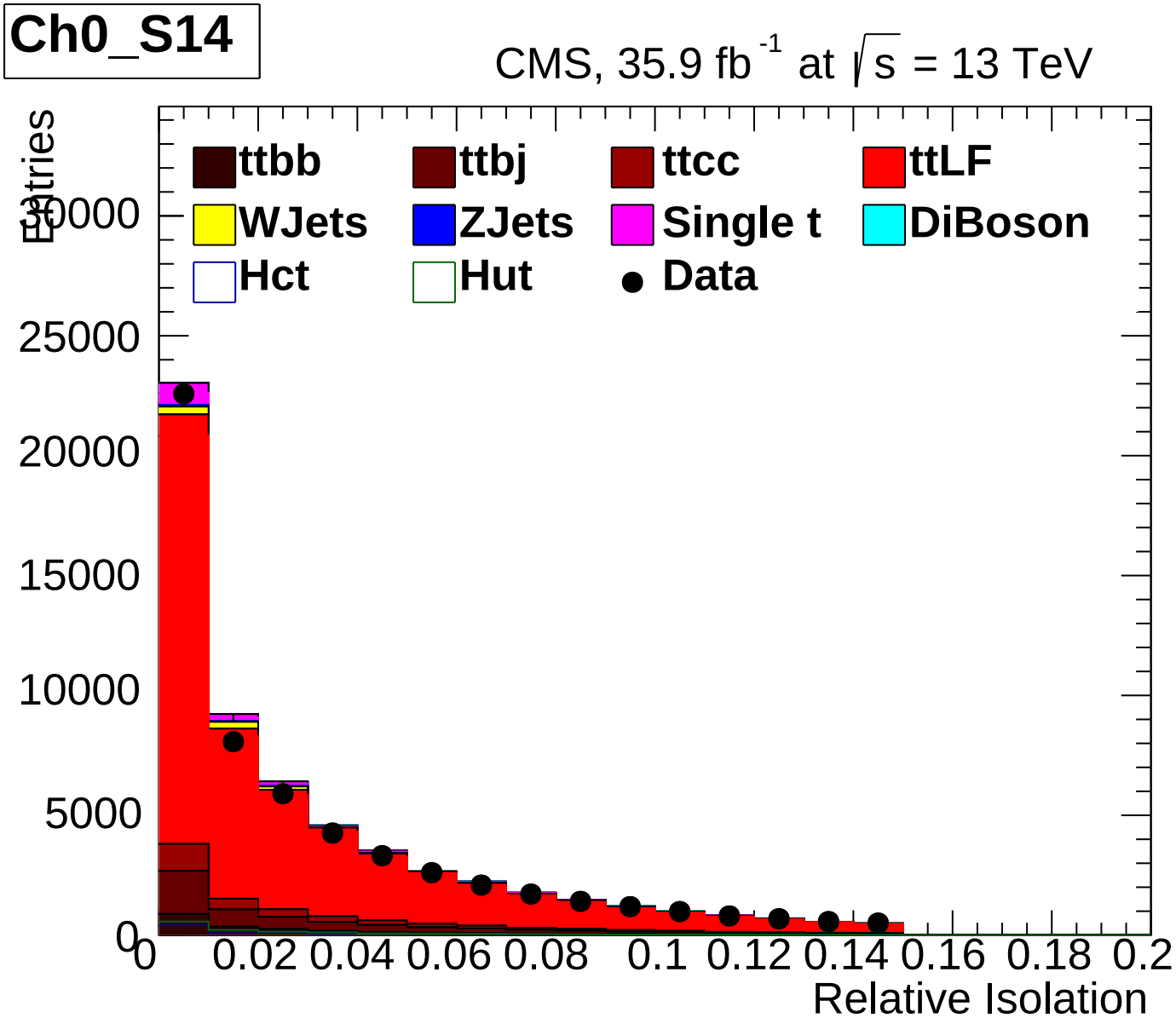
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
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Hct
Hut
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20000
15000
10000
5000
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0
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0.06
0.08
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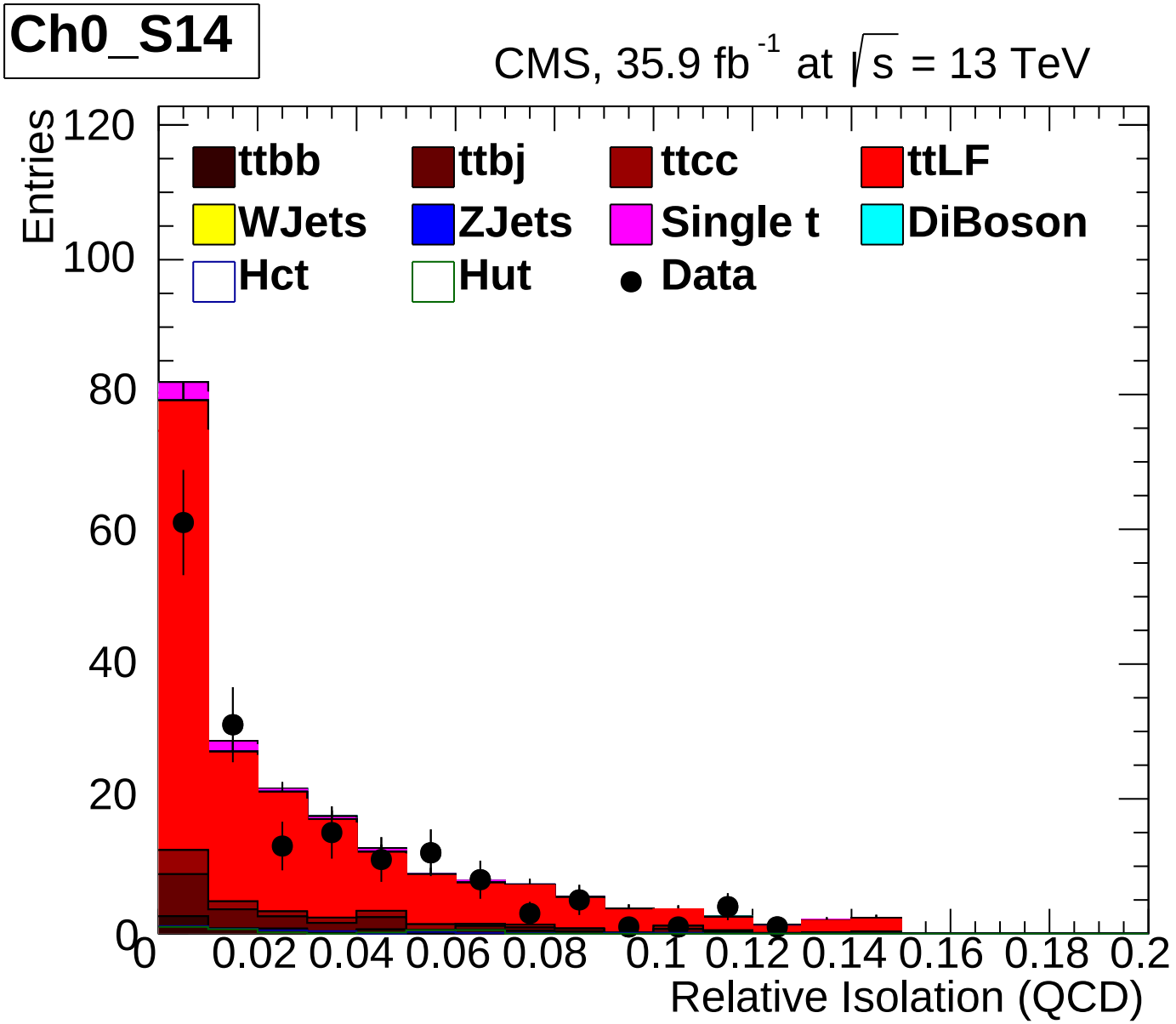
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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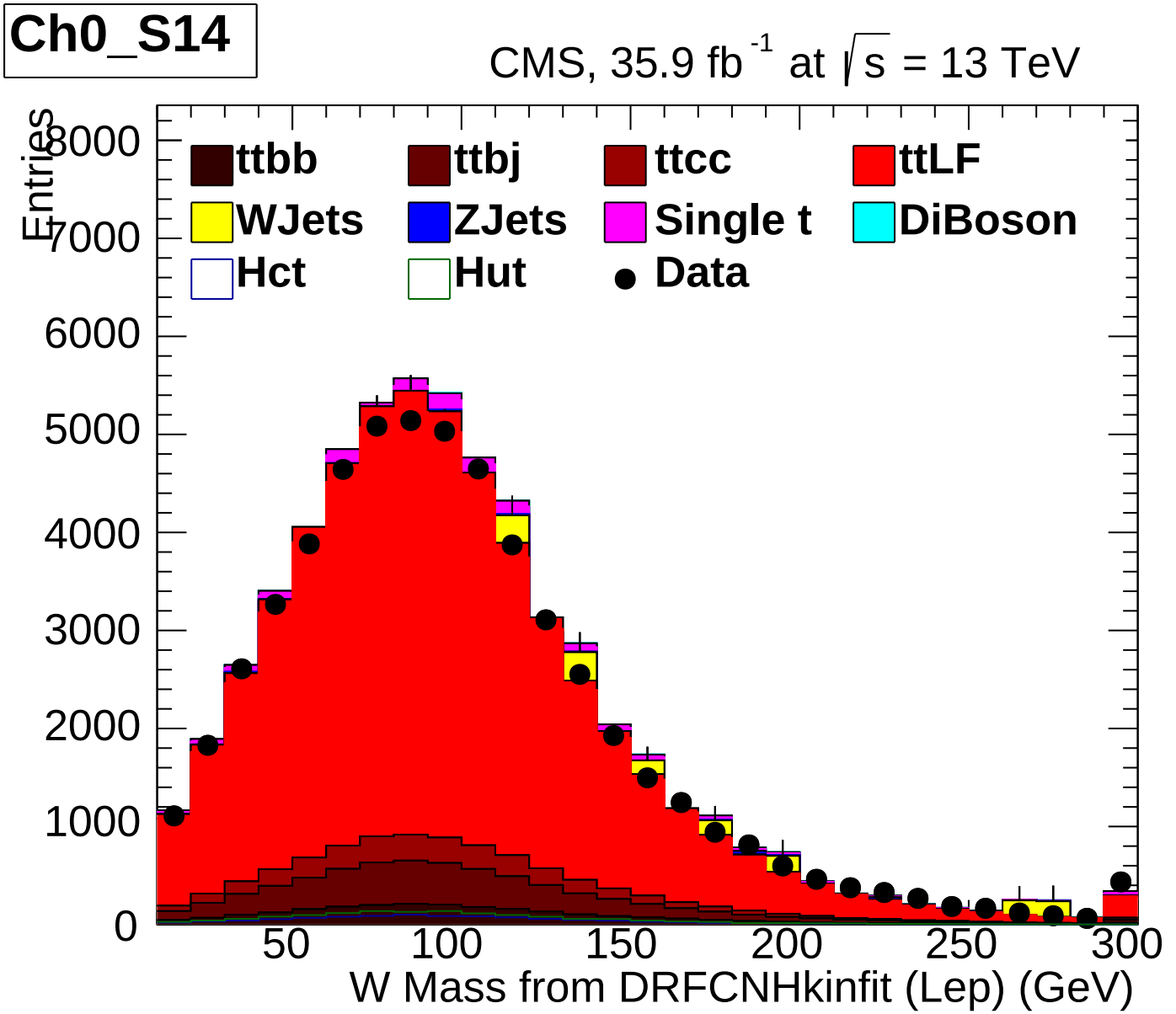
20
40
60
80
100
120
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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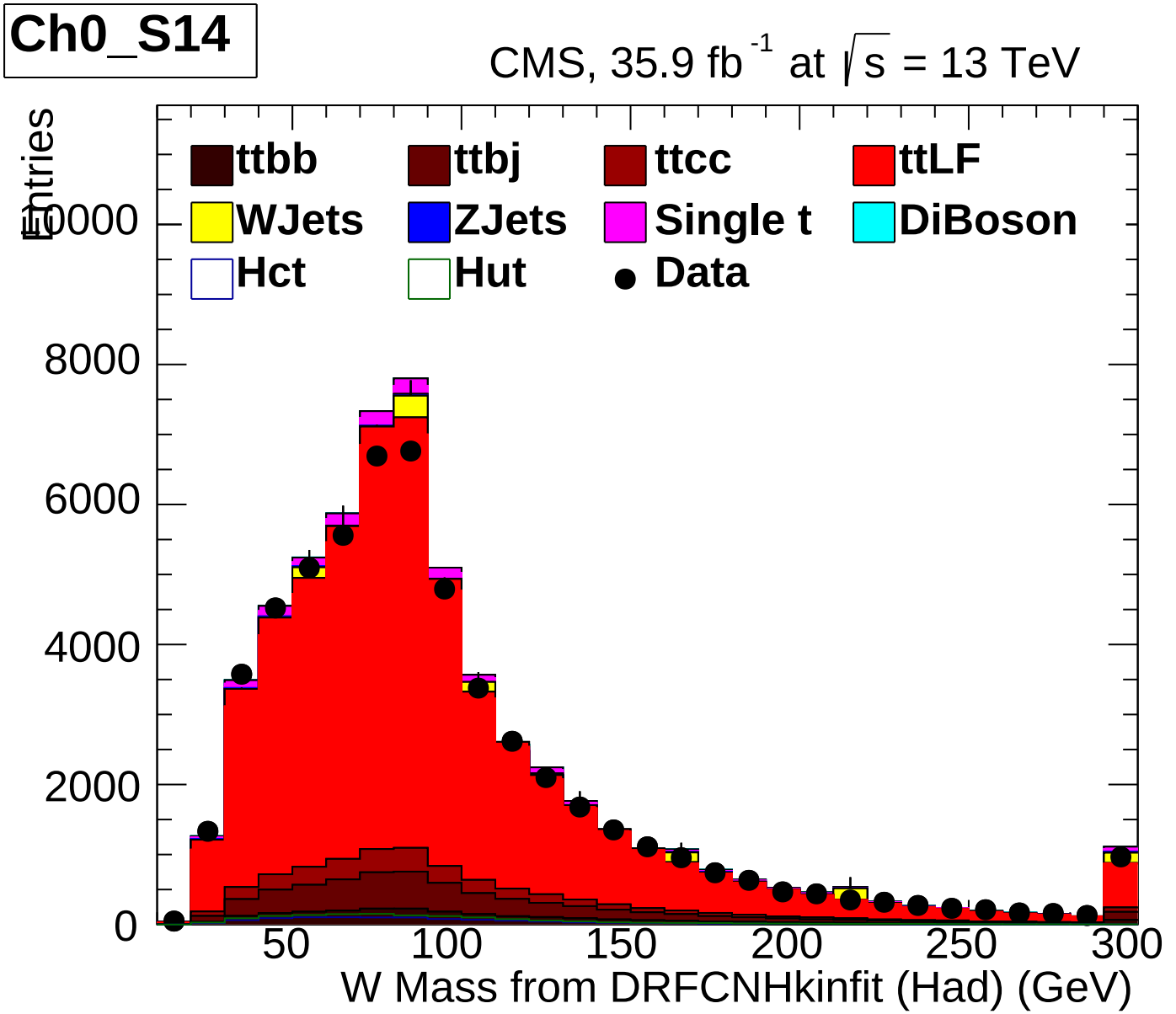
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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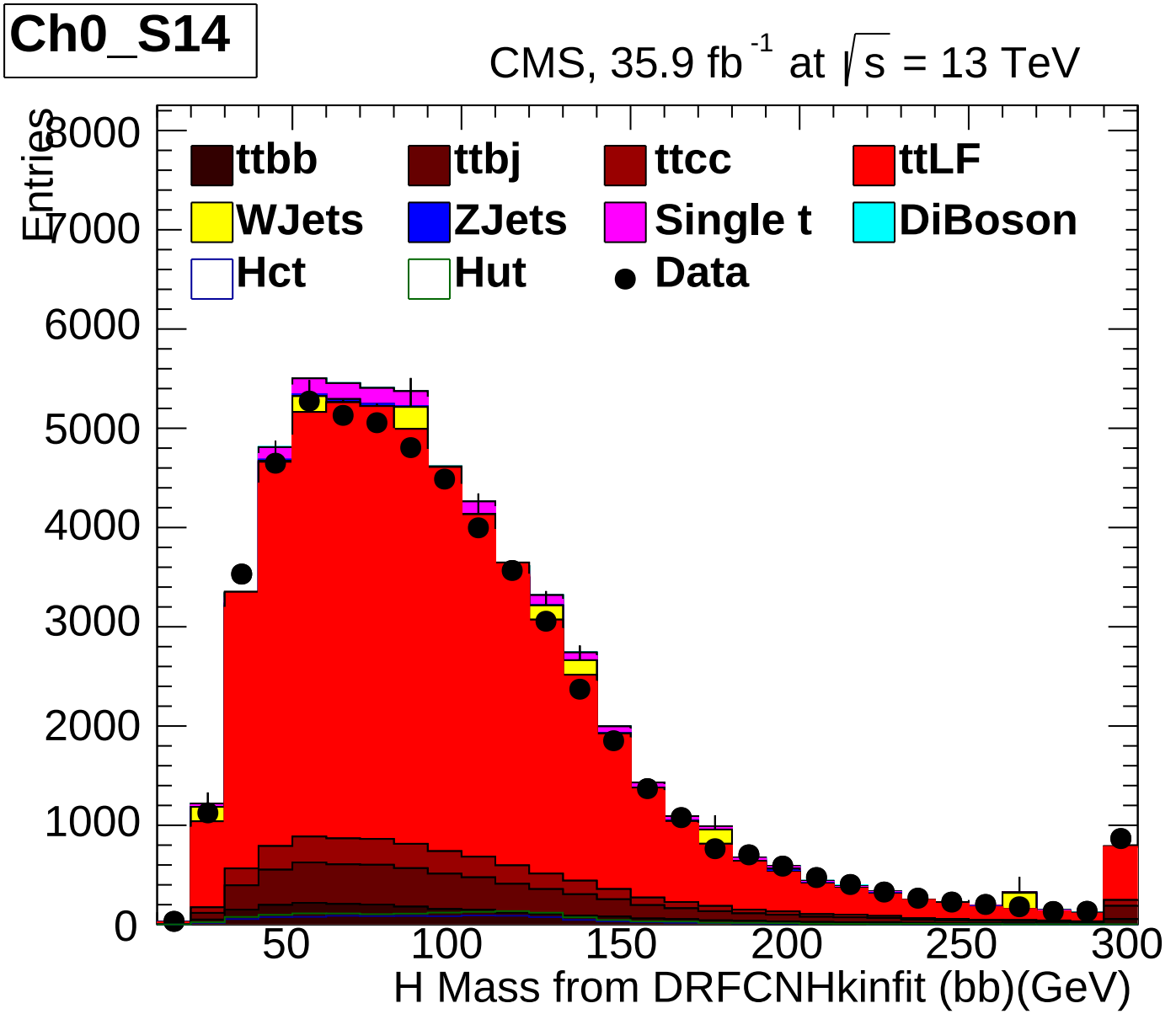
8000
6000
4000
2000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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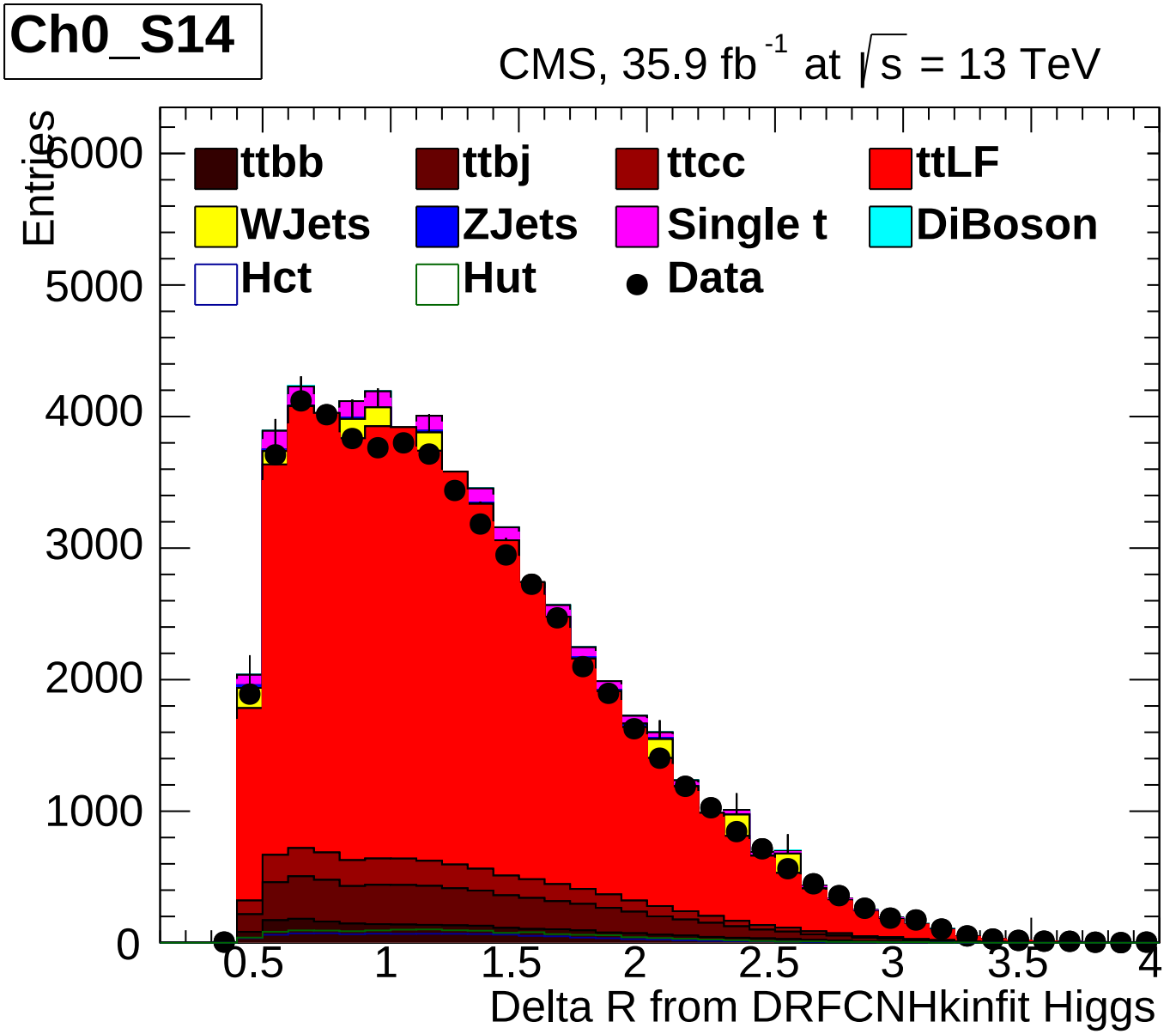
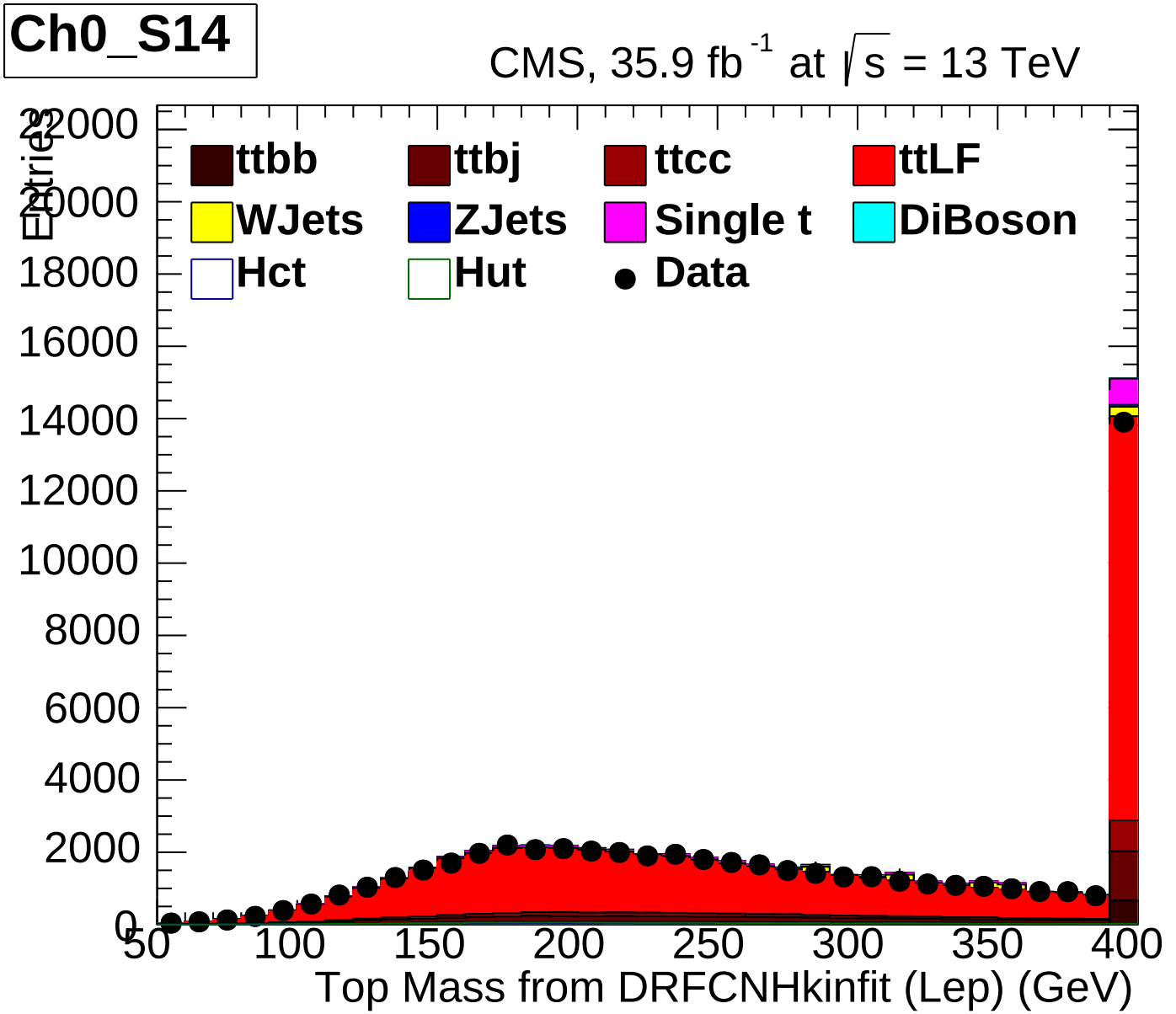
5000
6000
7000
8000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
22000
20000
18000
16000
14000
12000
10000
8000
6000
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2000
0
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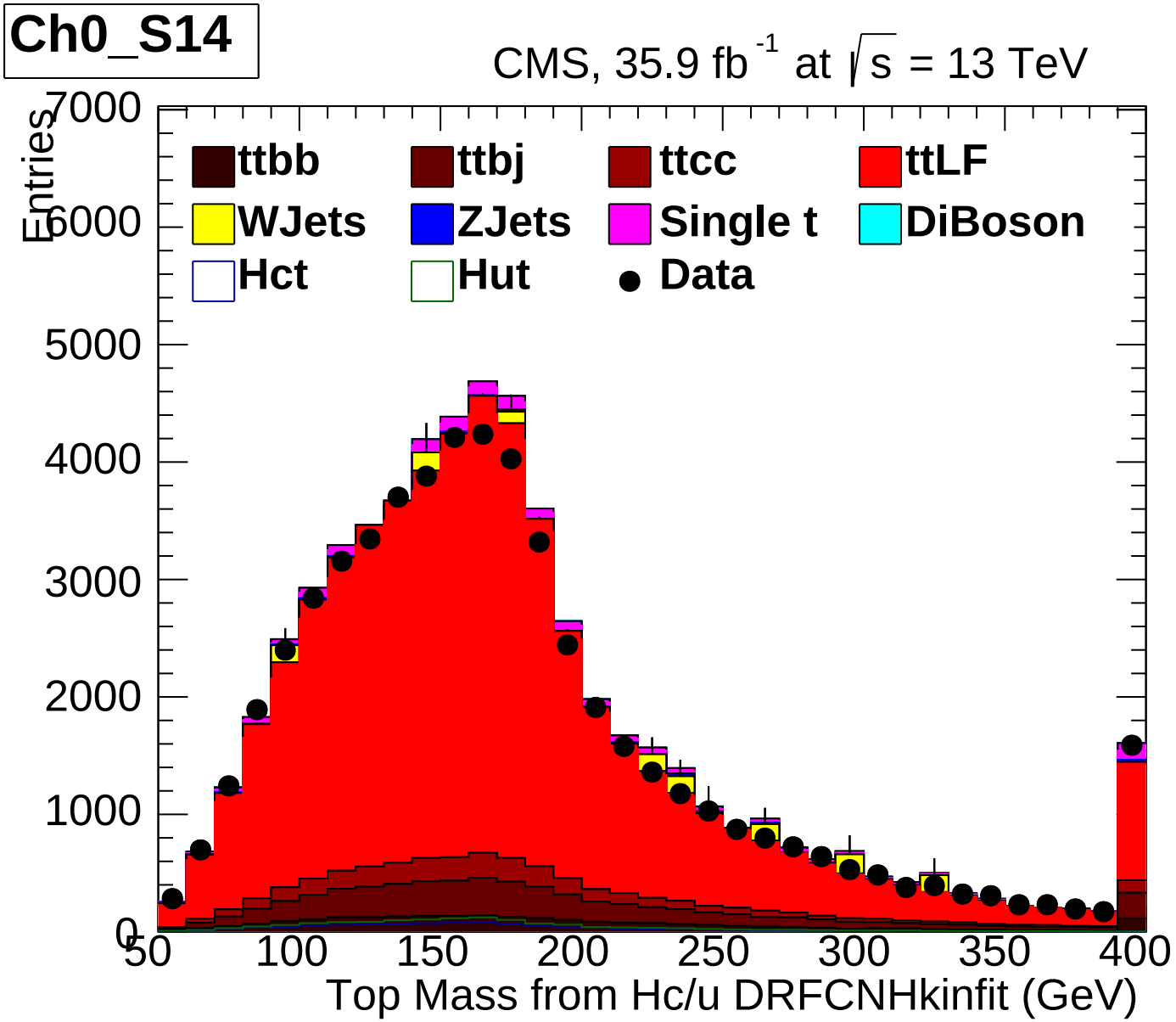
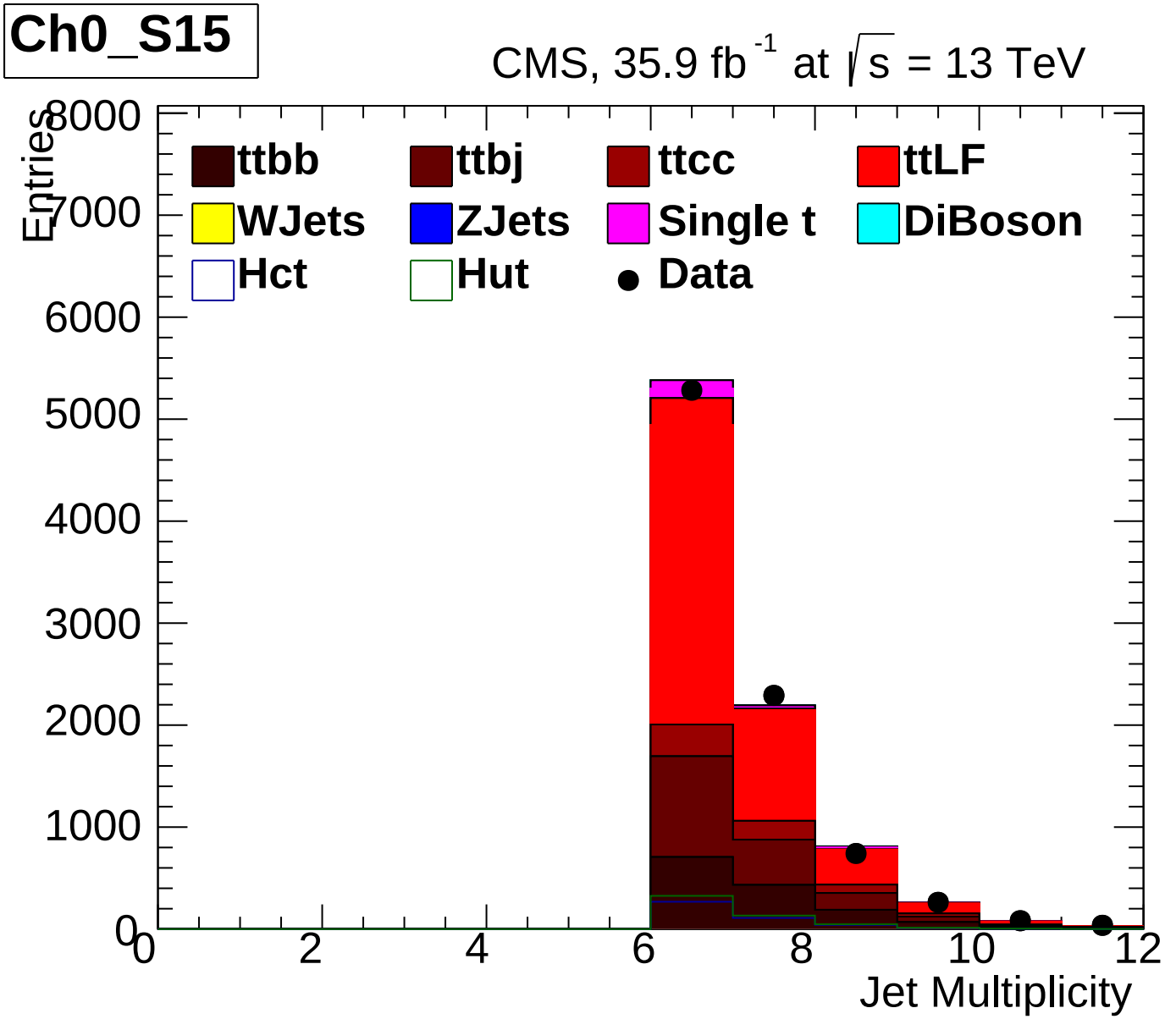
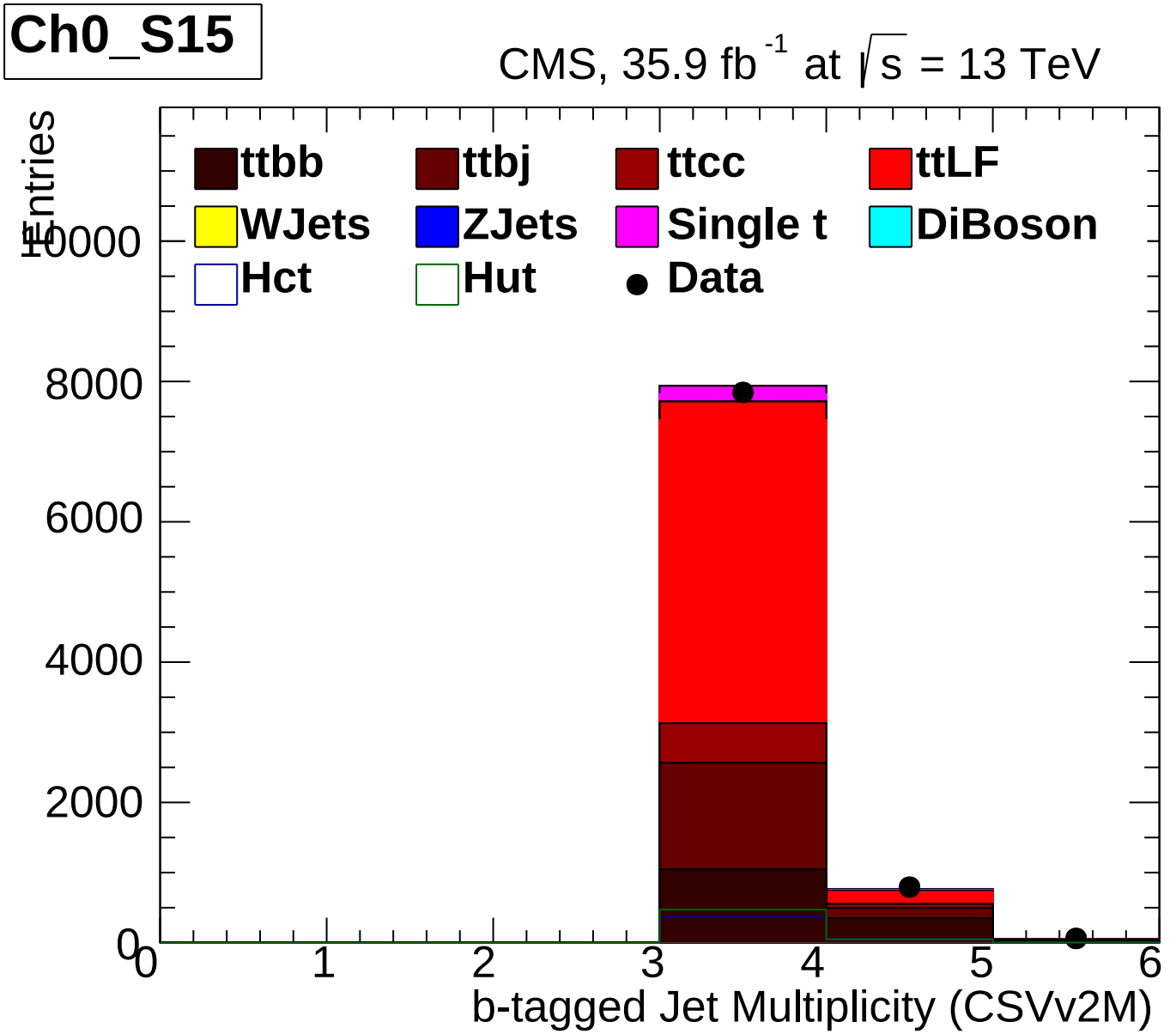
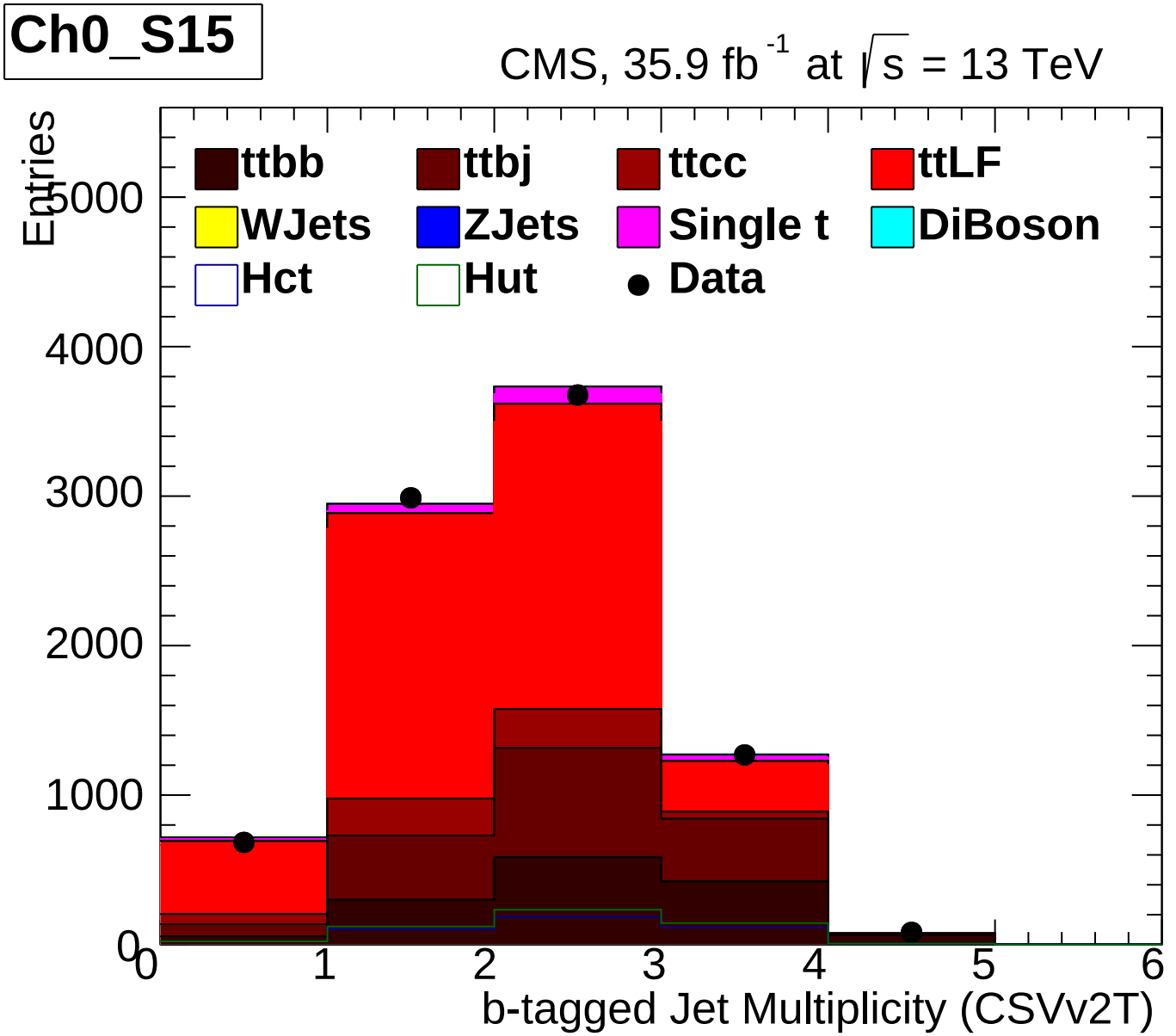
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
0
2
4
6
8
10
12
Jet Multiplicity


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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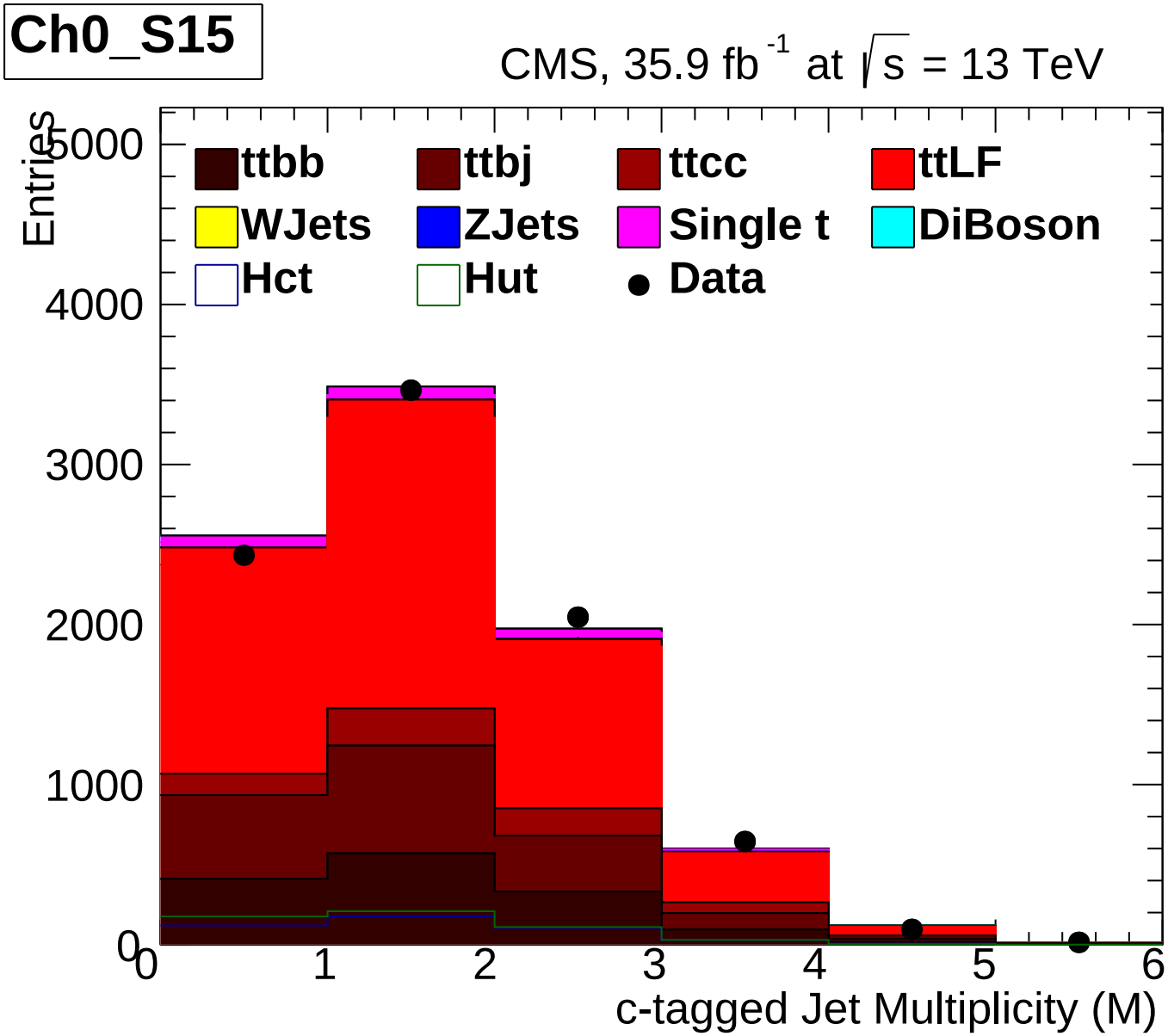
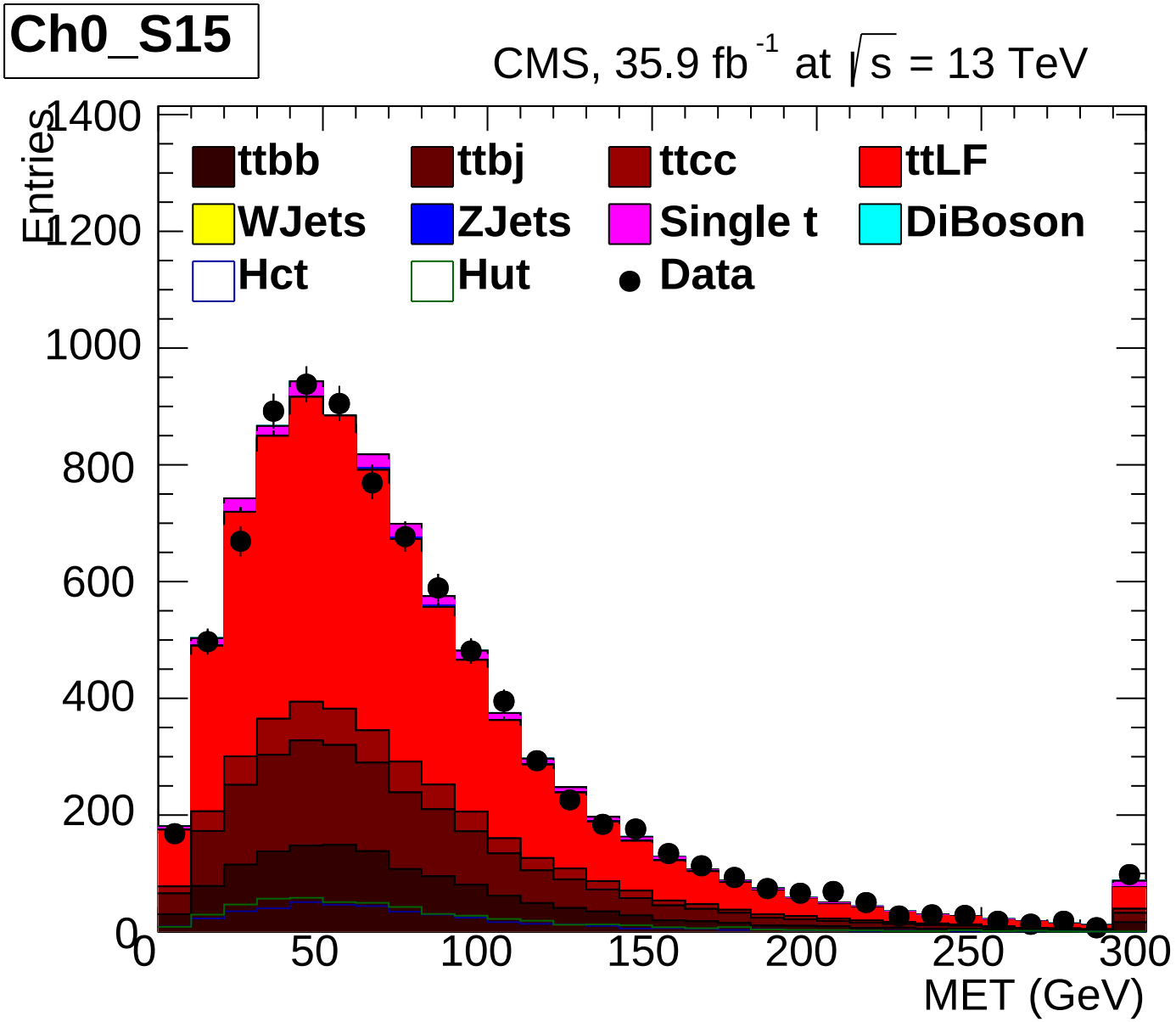
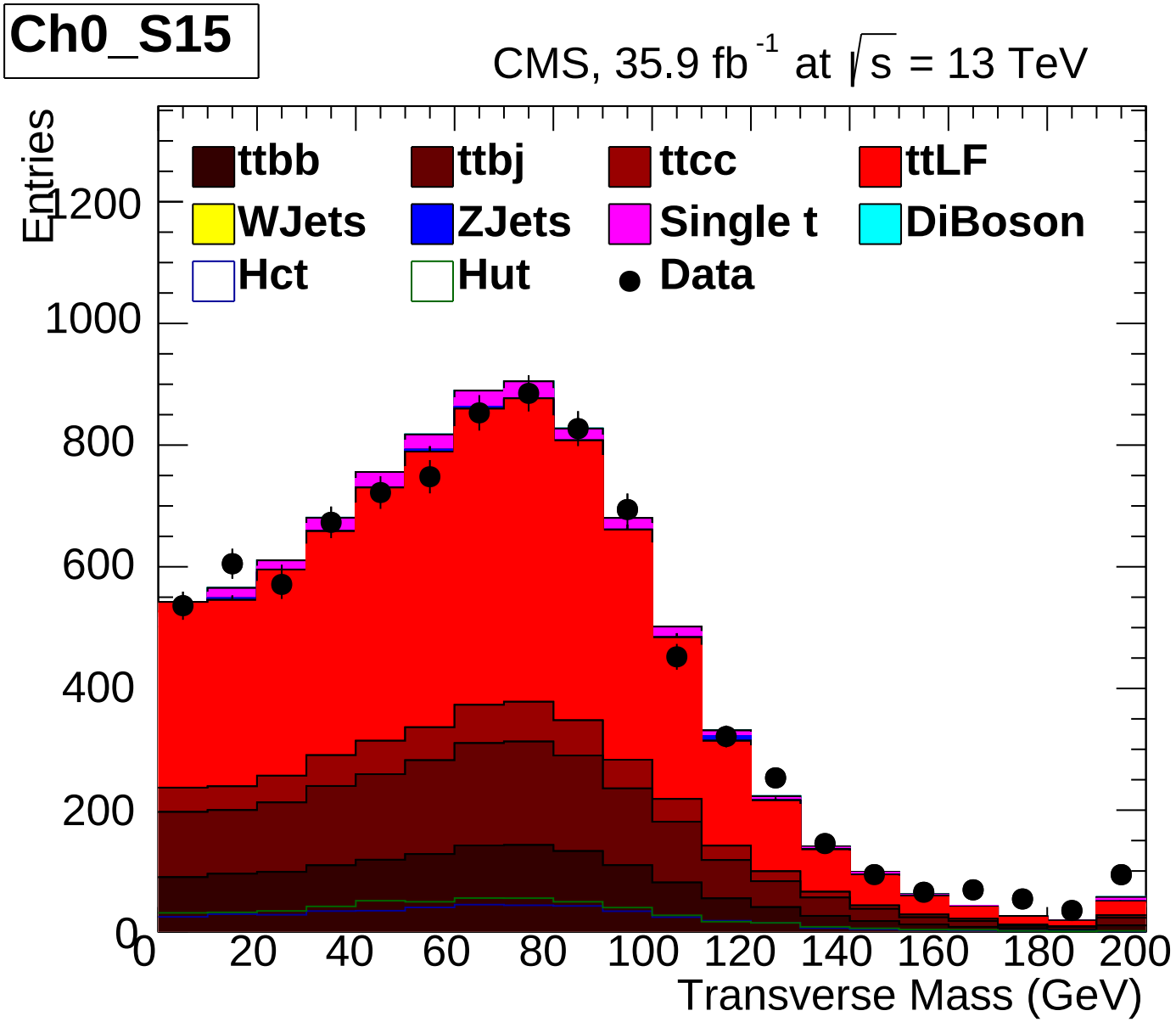
2000
3000
4000
5000
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
0
50
100
150
200
250
300
MET (GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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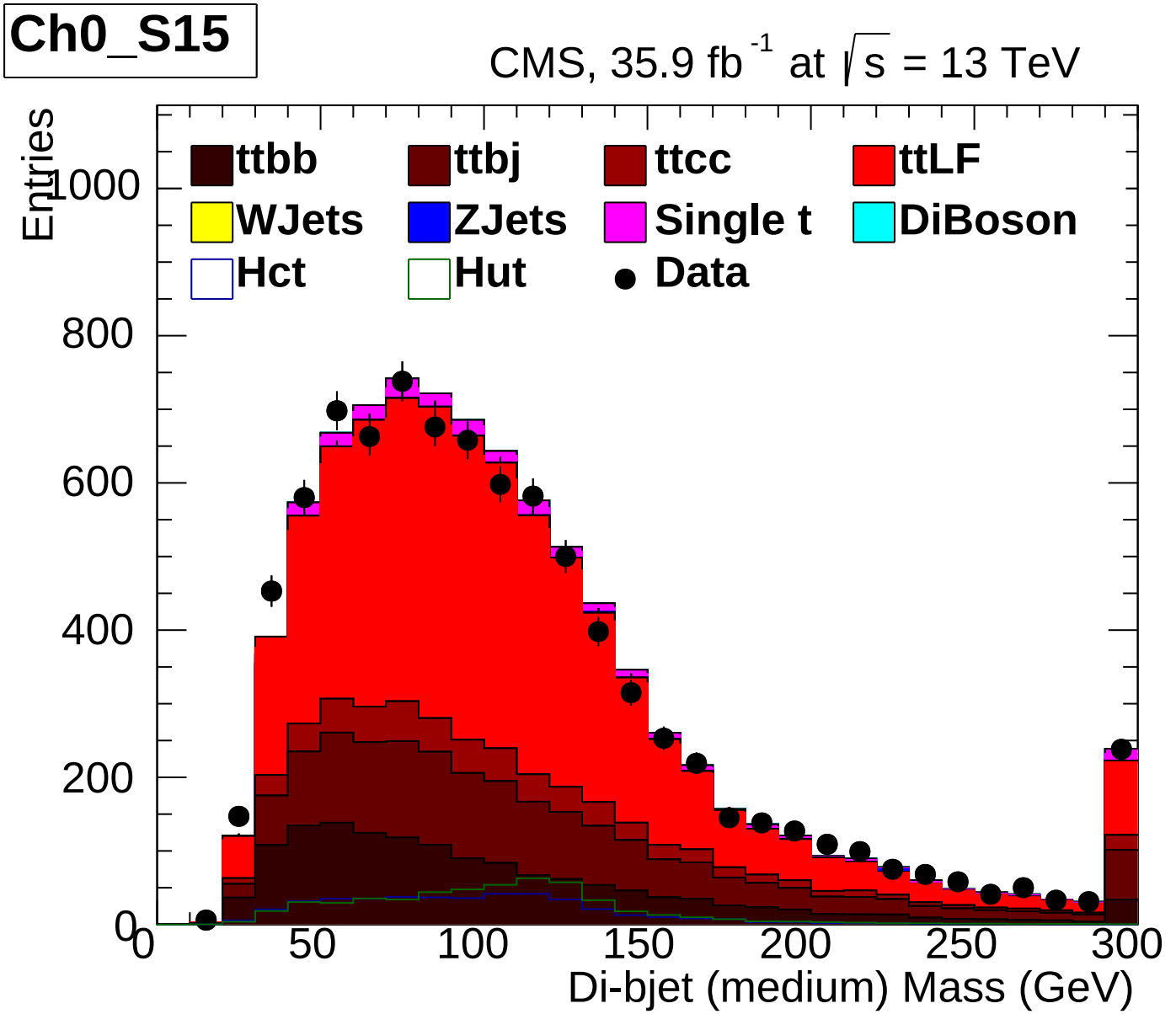
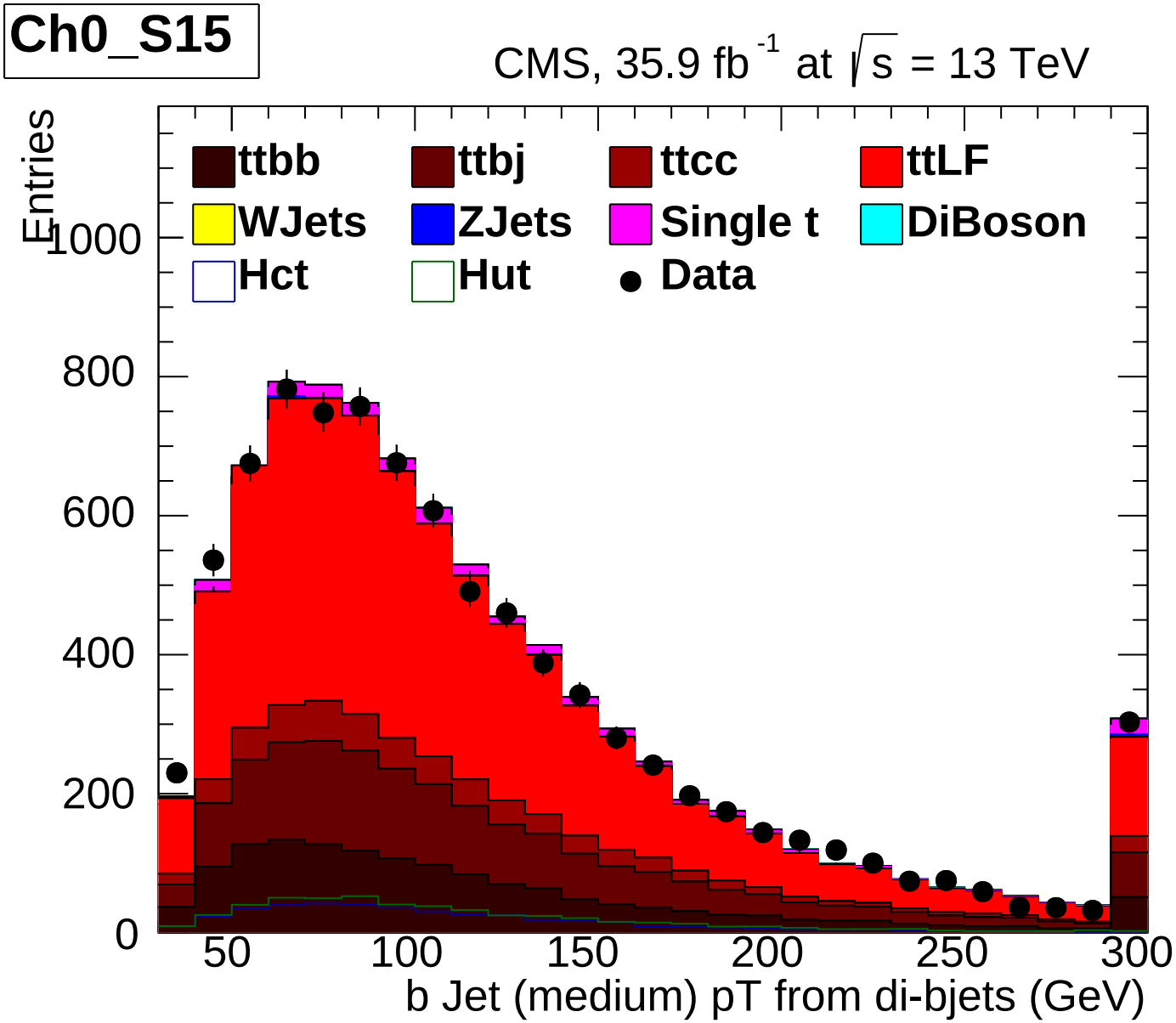
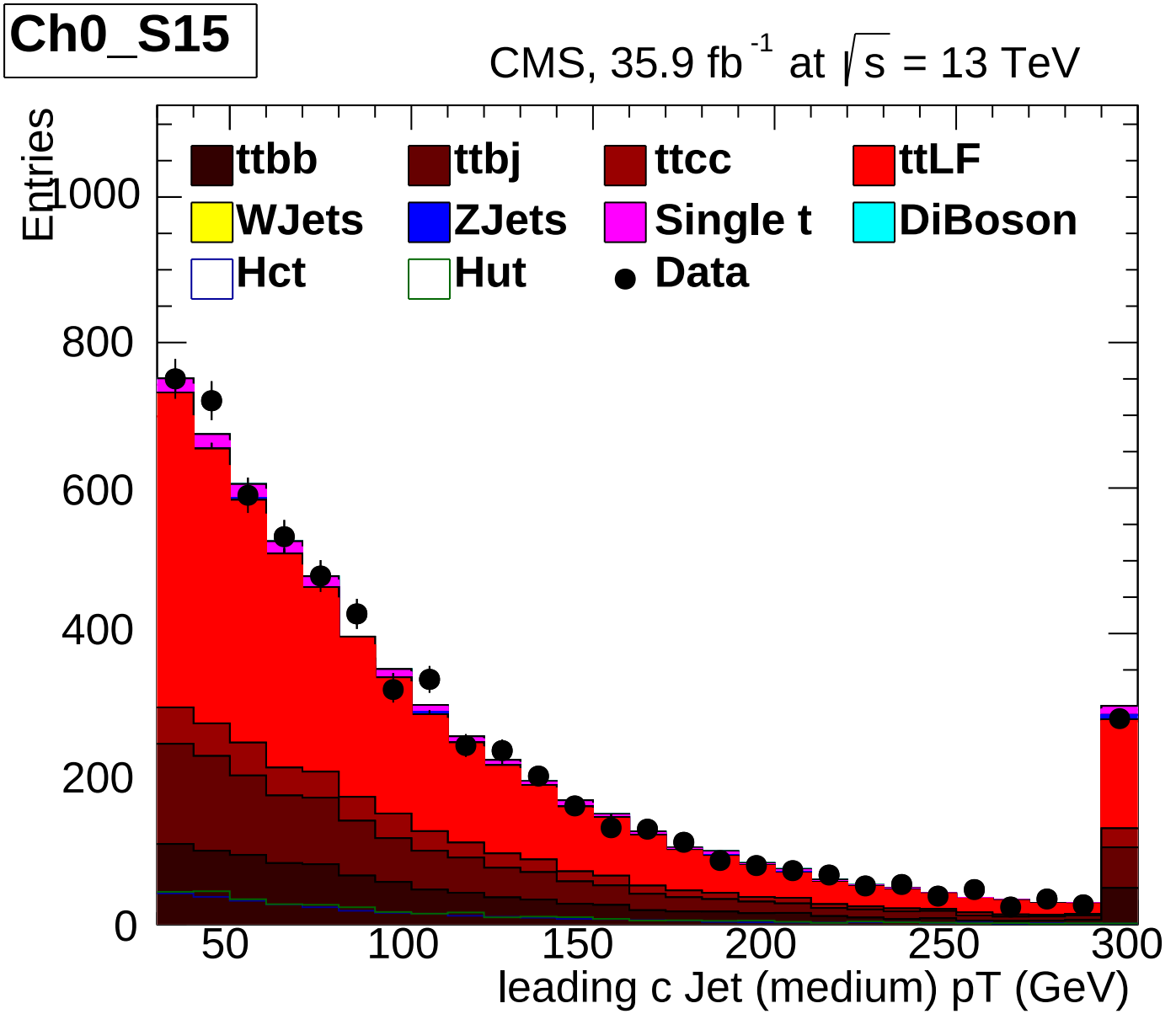
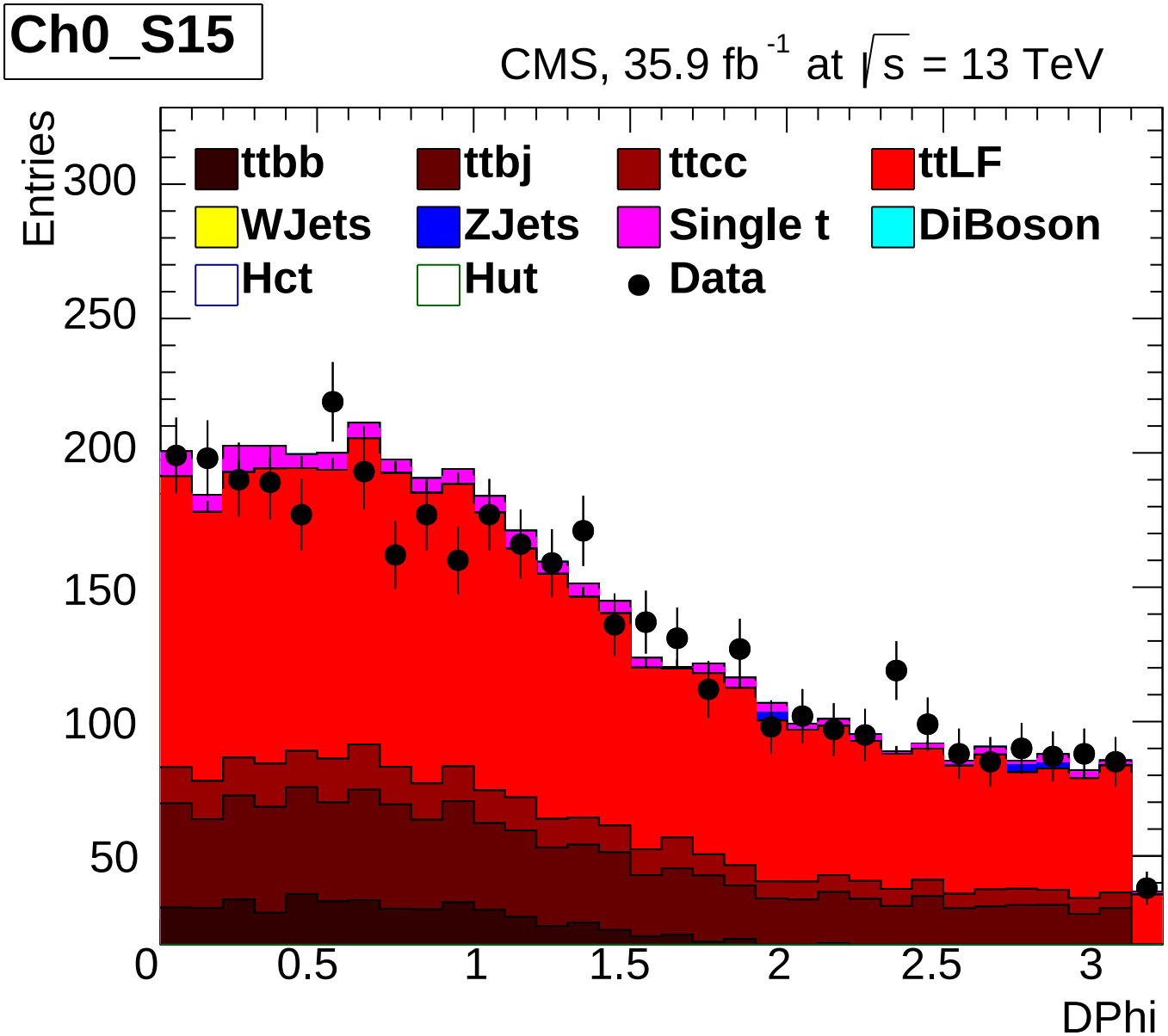
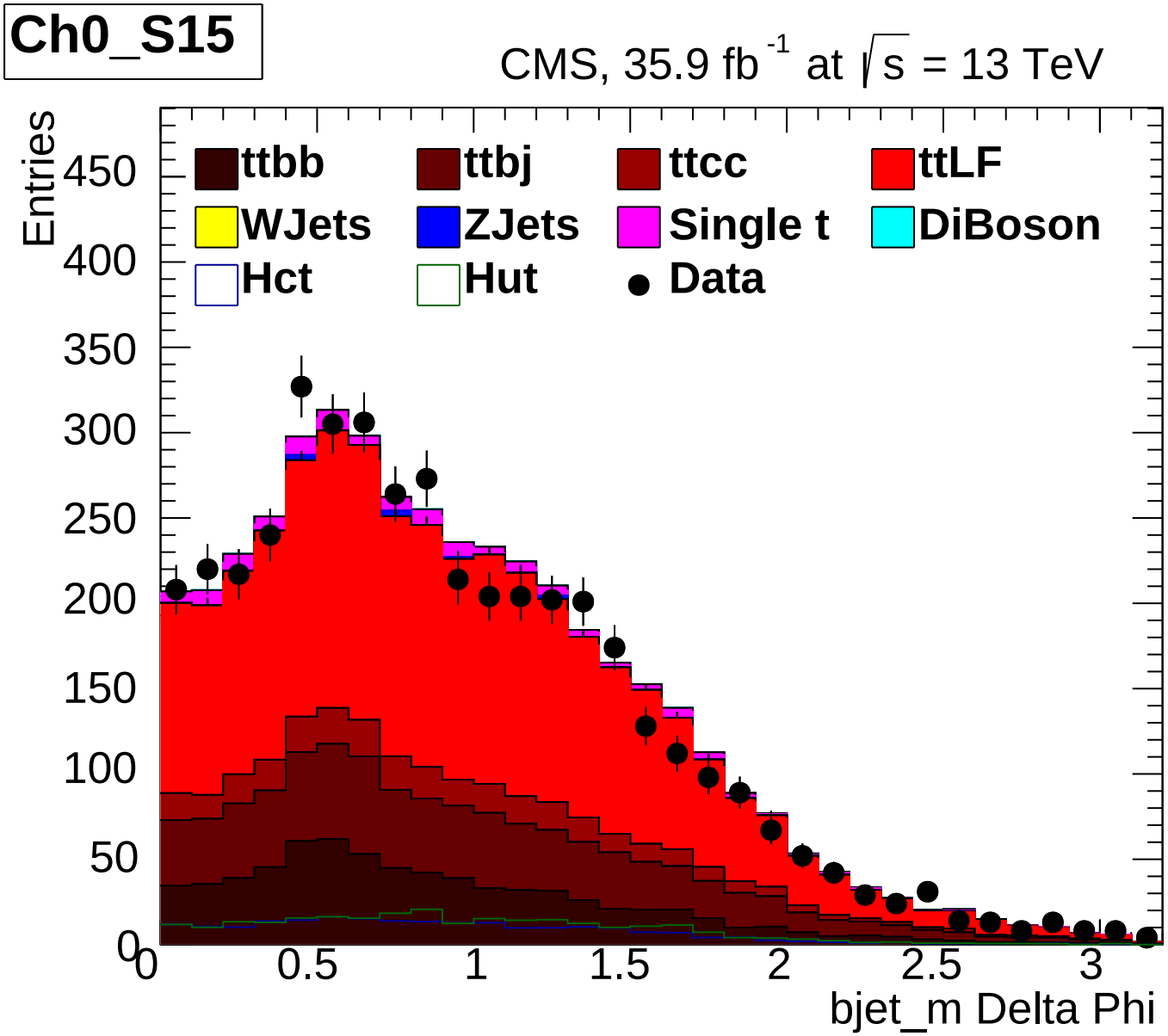
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
200
400
600
800
1000
1200
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

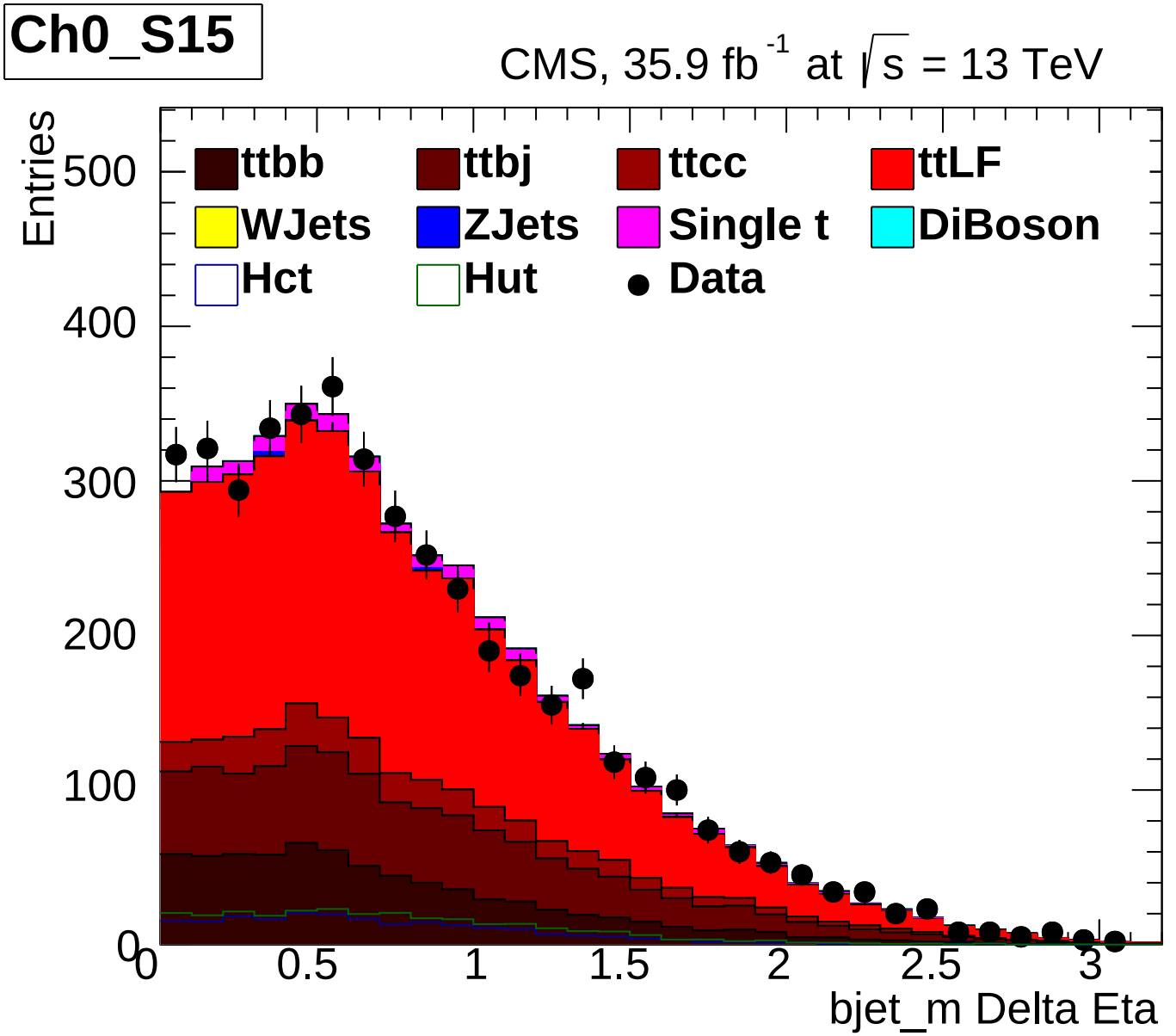

Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
200
400
600
800
1000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
200
400
600
800
1000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
300
250
200
150
100
50
0
0.5
1
1.5
2
2.5
3
DPhi


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
400
450
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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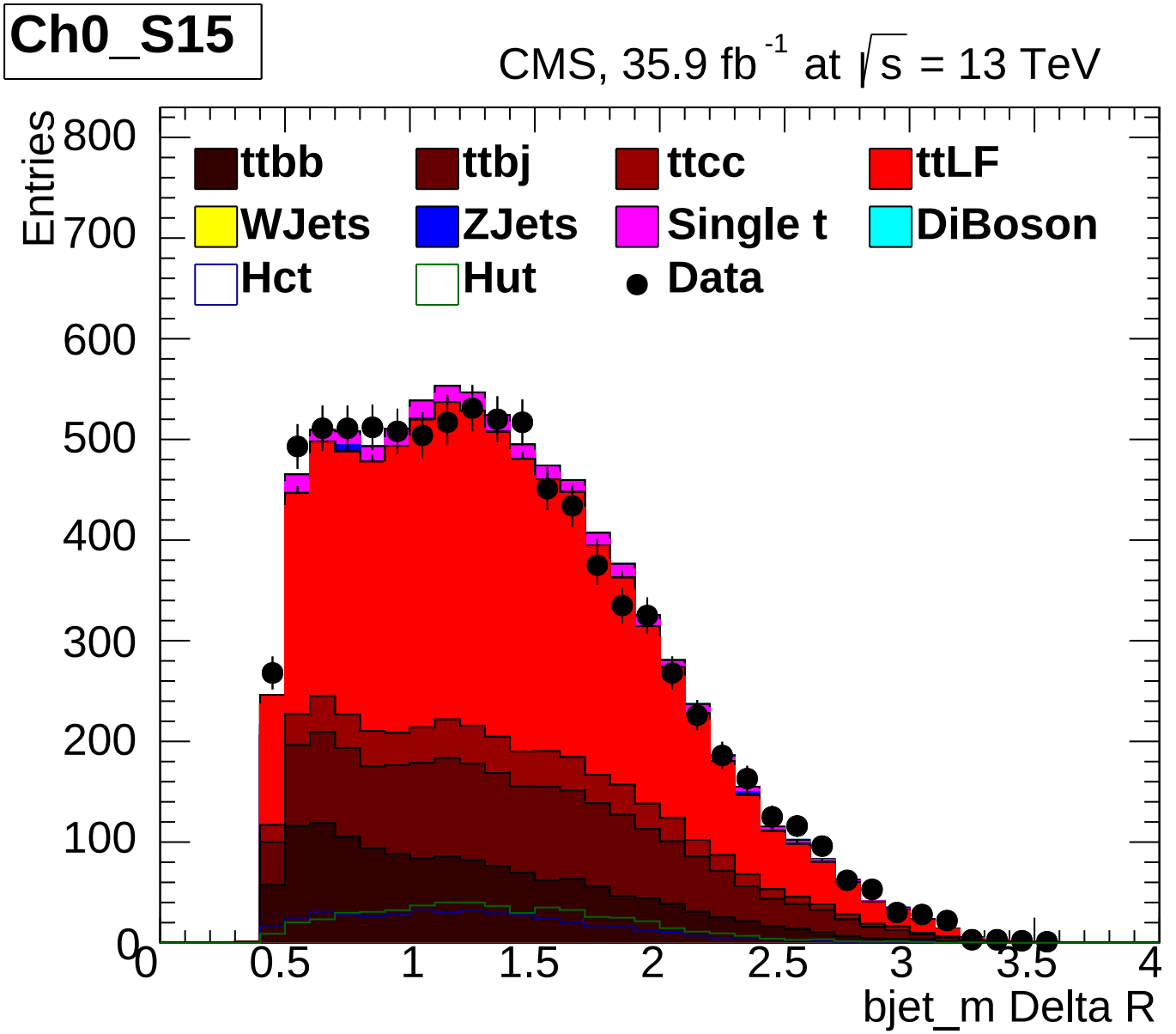
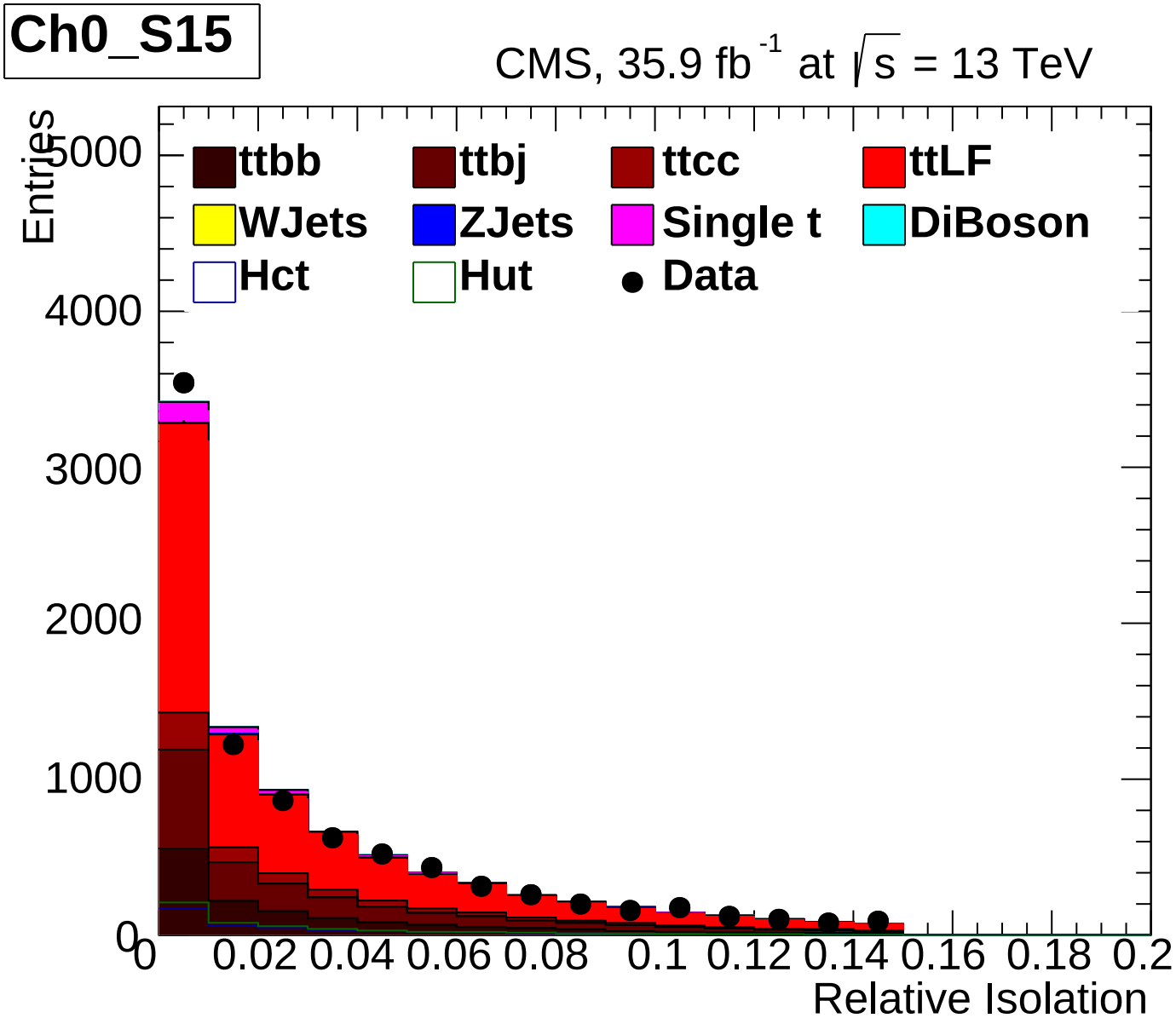
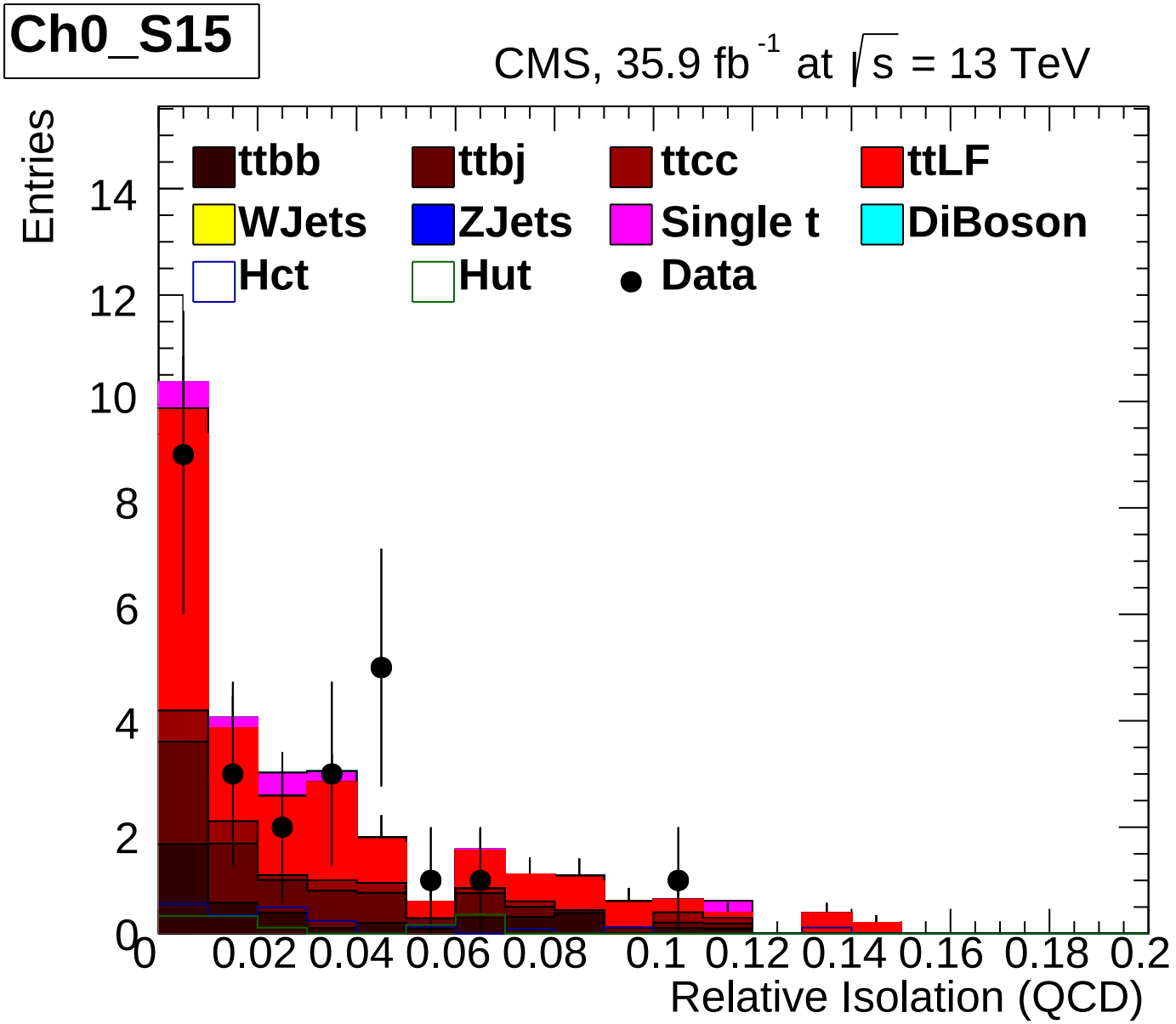
300
400
500
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
5000
4000
3000
2000
1000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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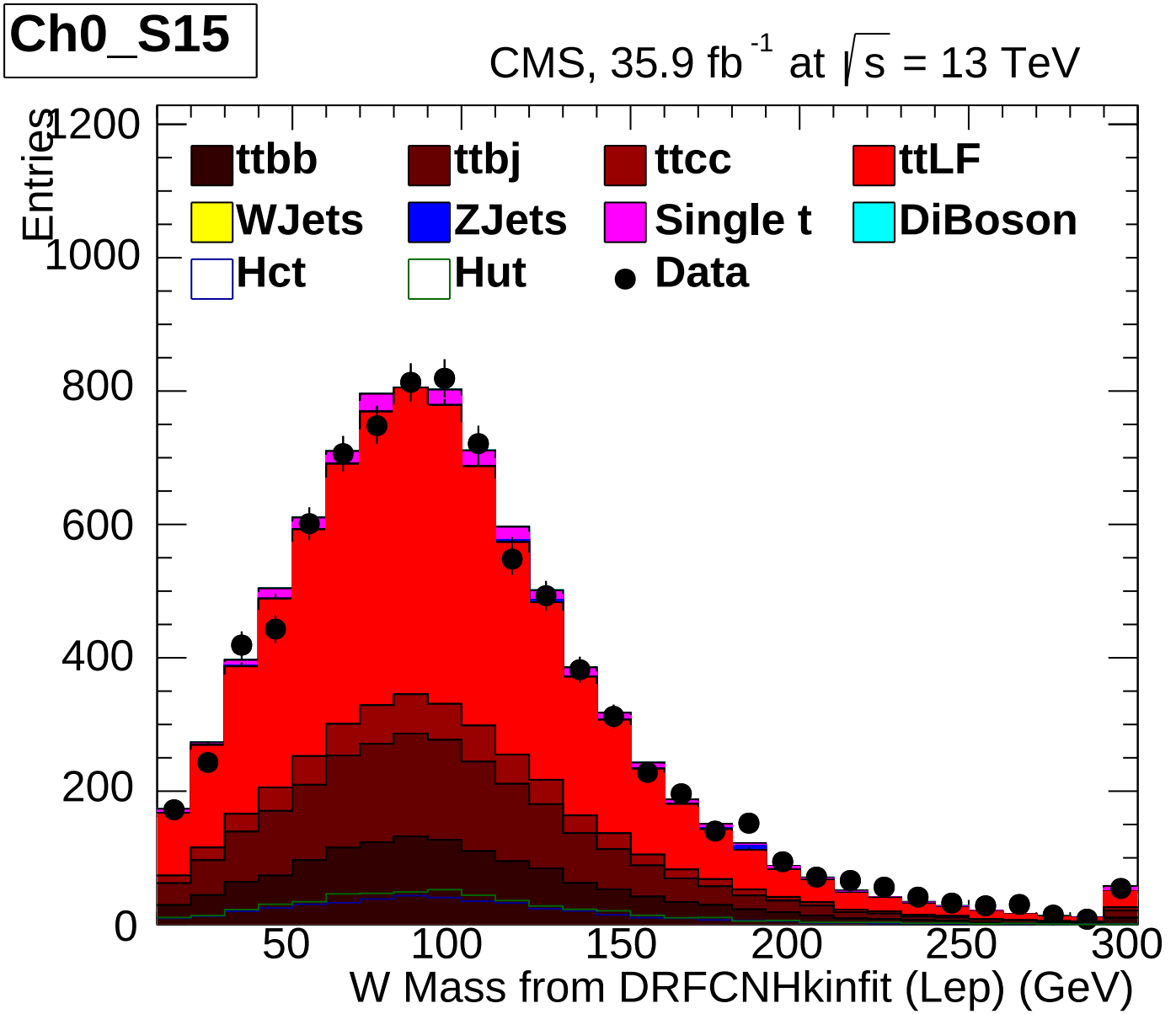
2
4
6
8
10
12
14
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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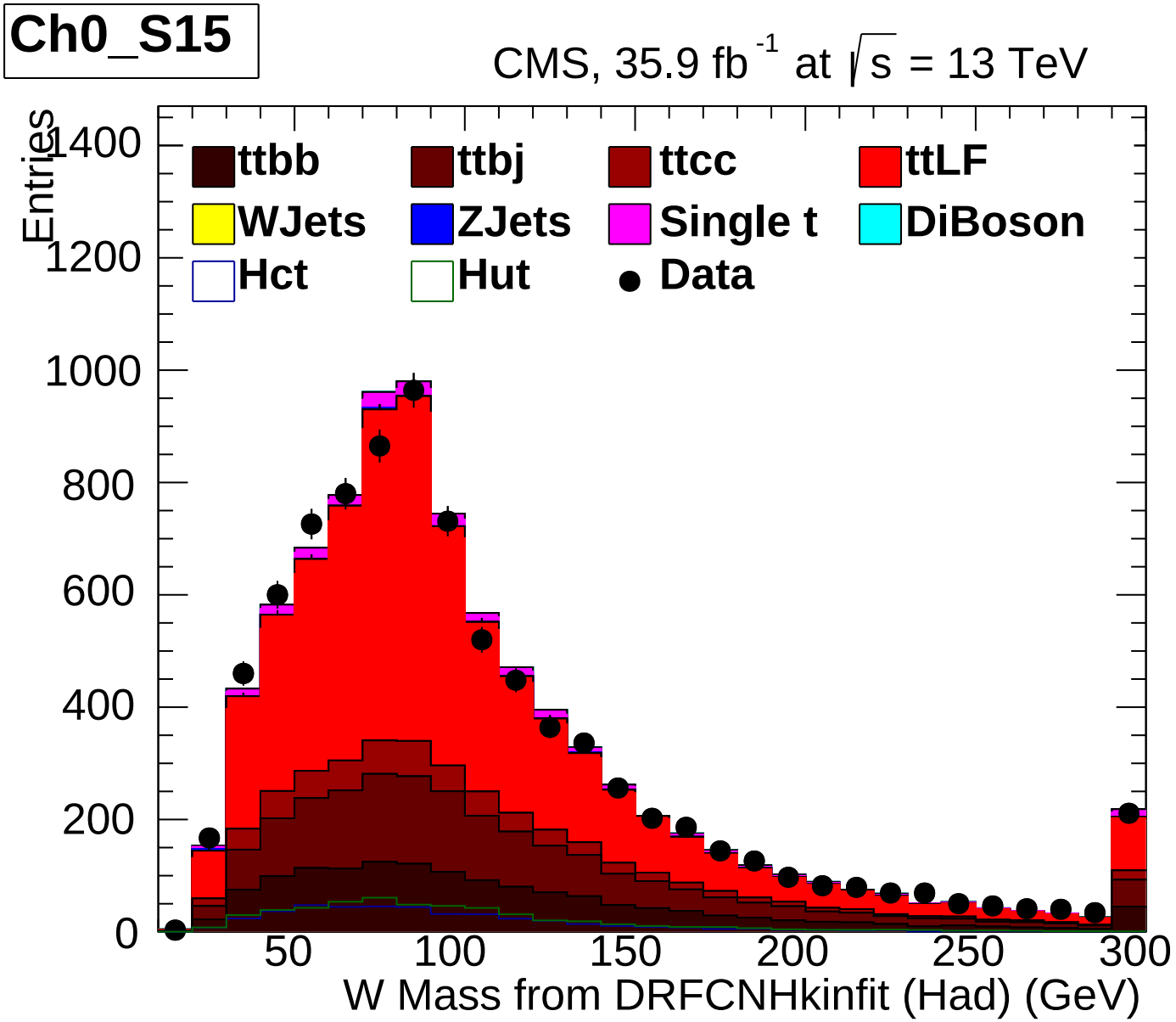
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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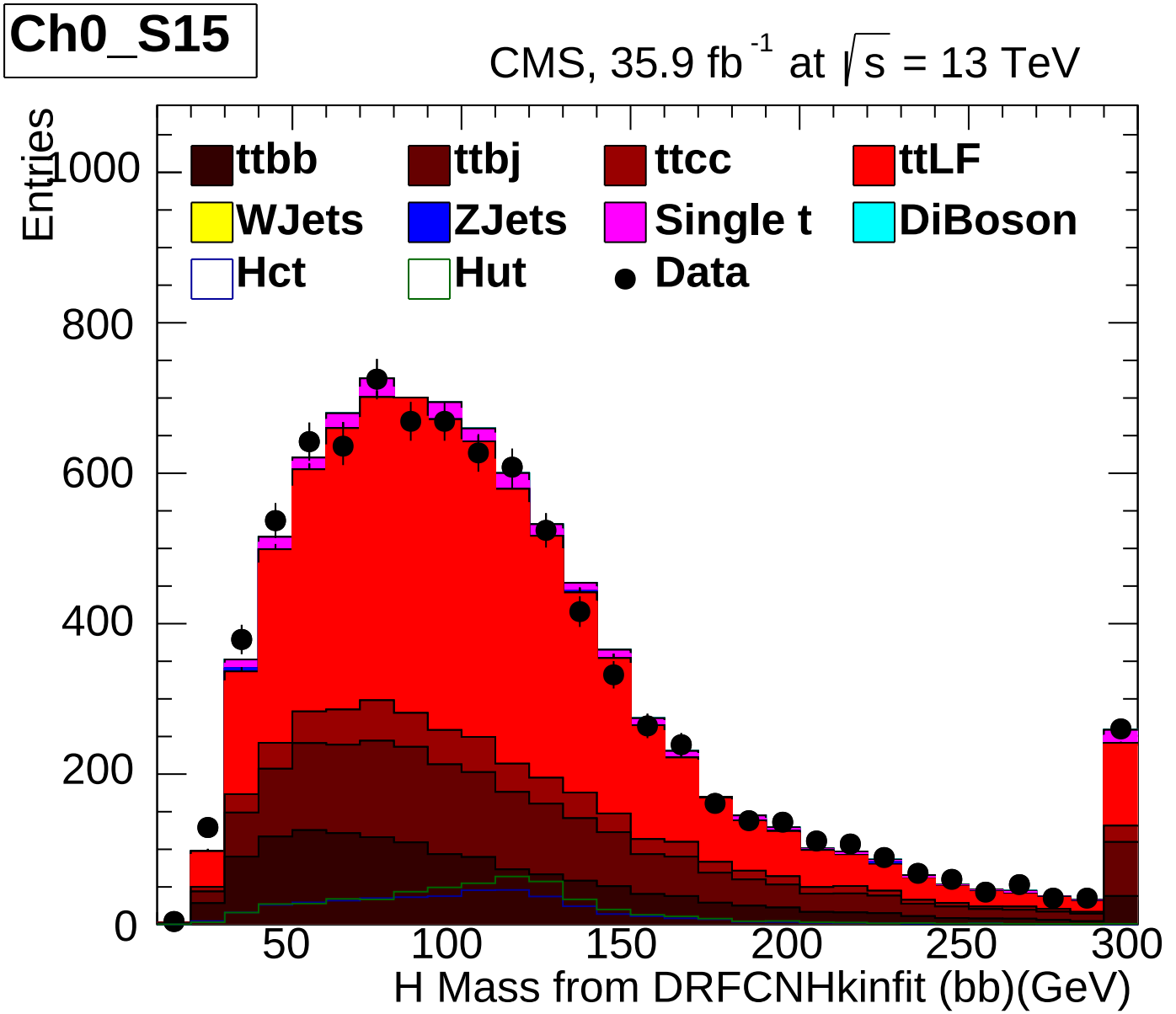
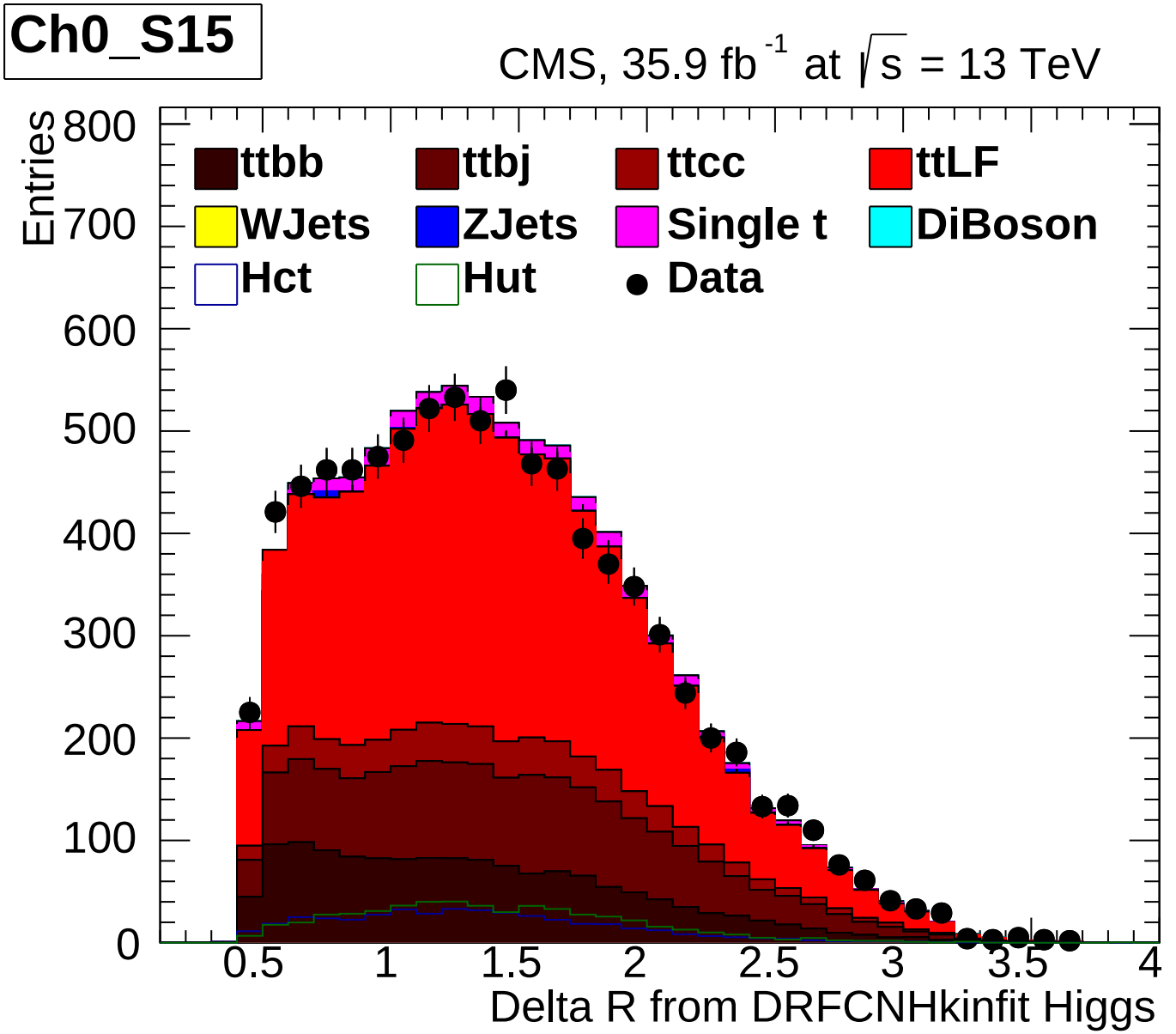
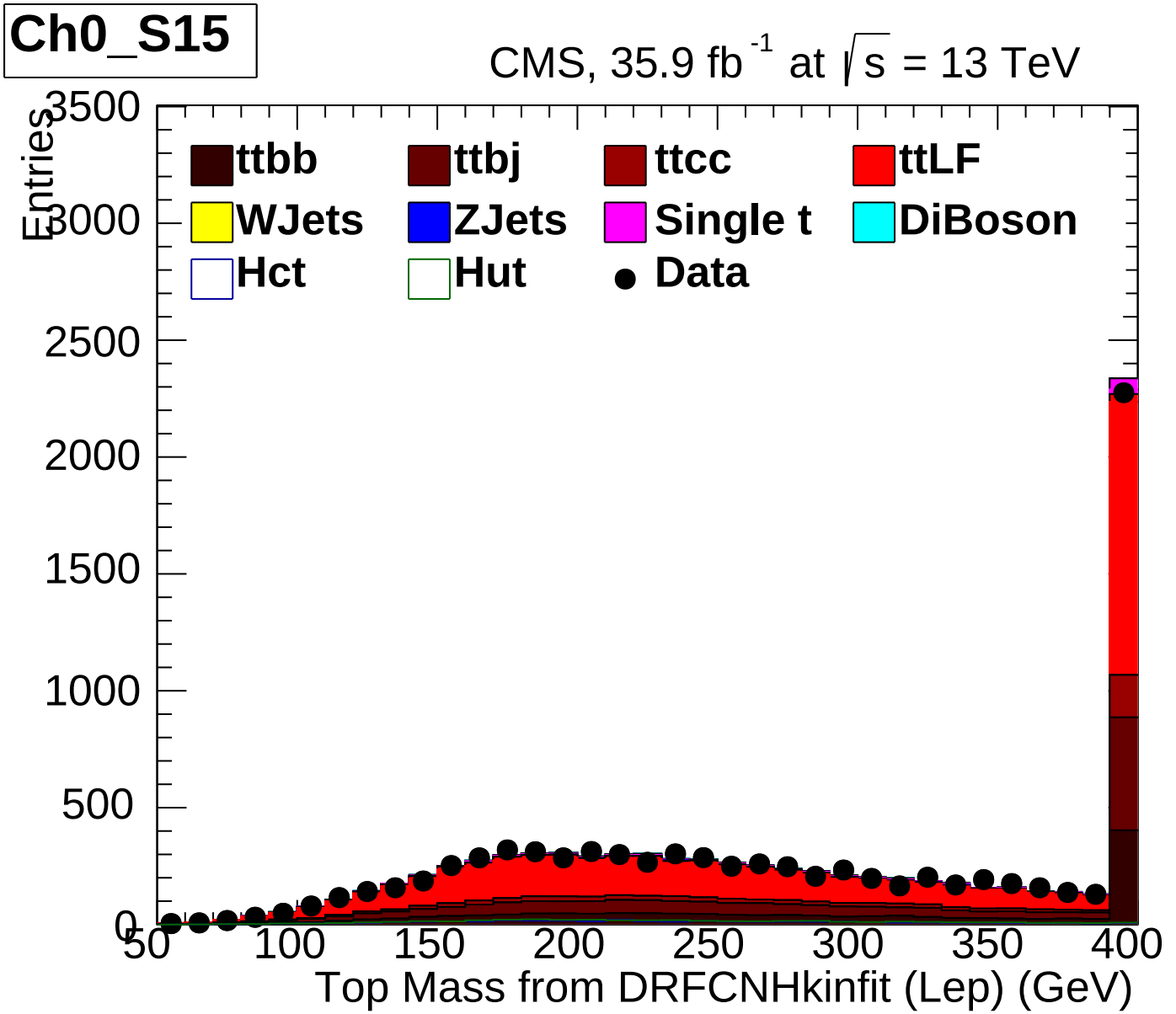
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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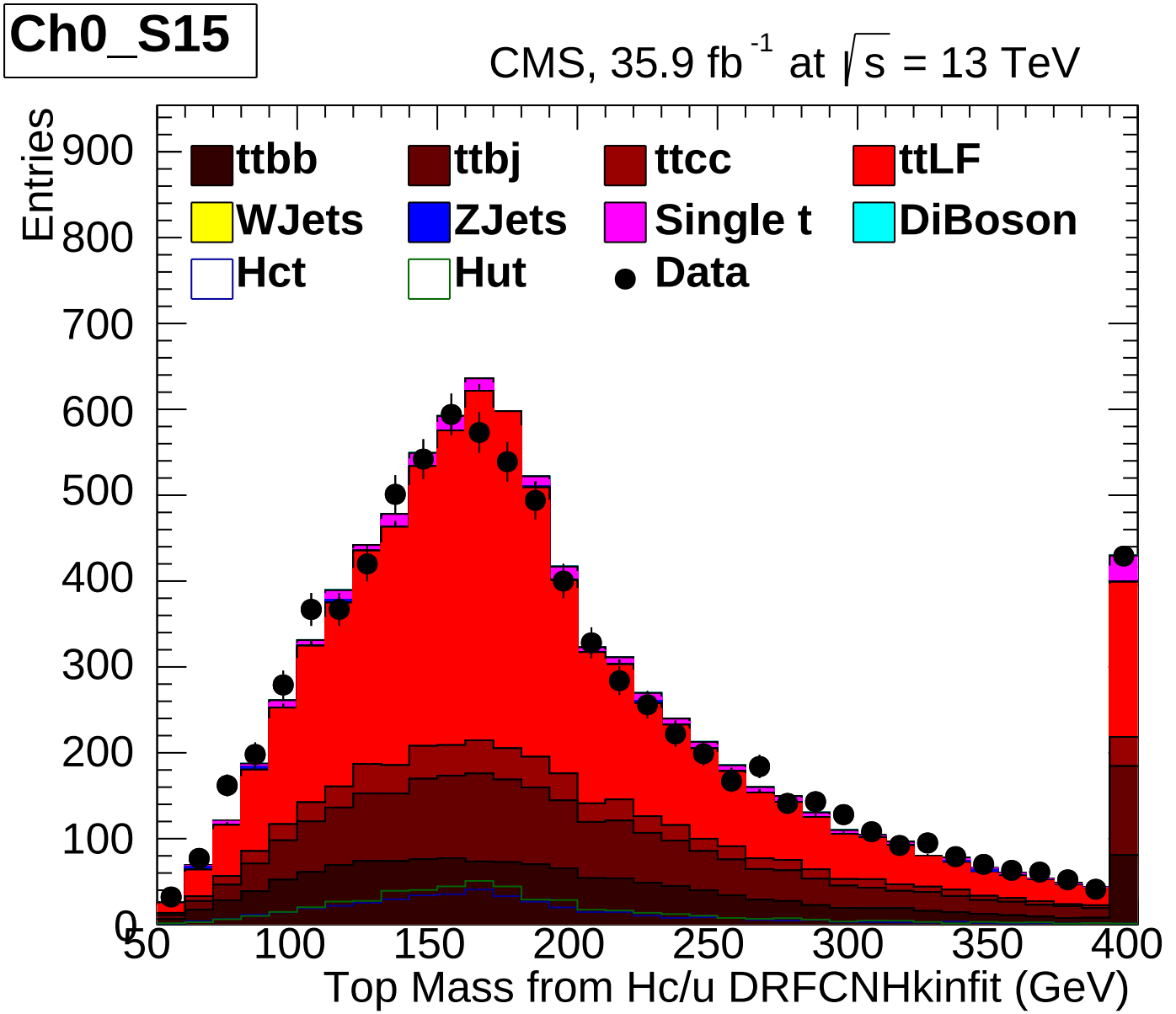
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
3500
3000
2500
2000
1500
1000
500
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch0_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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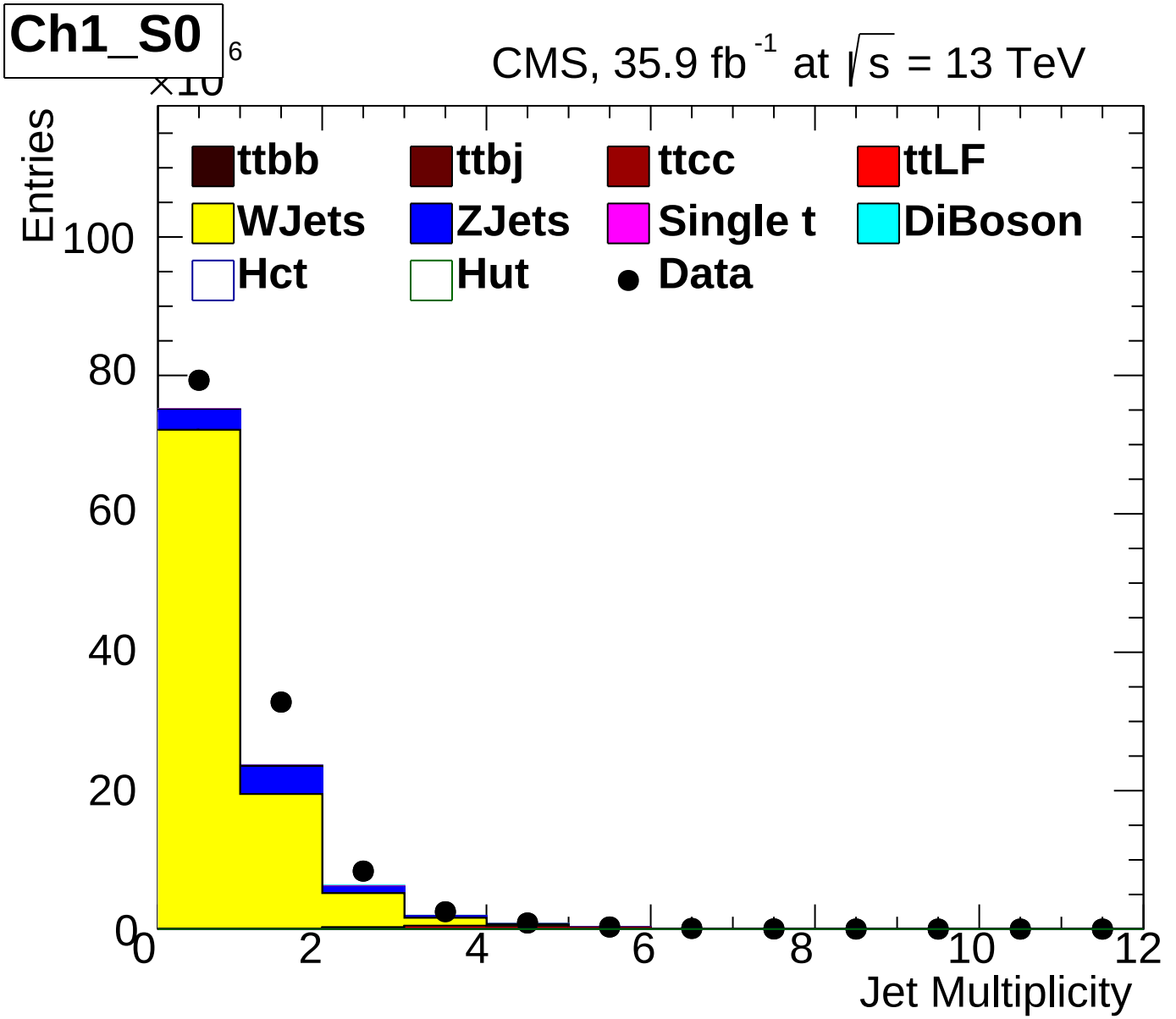
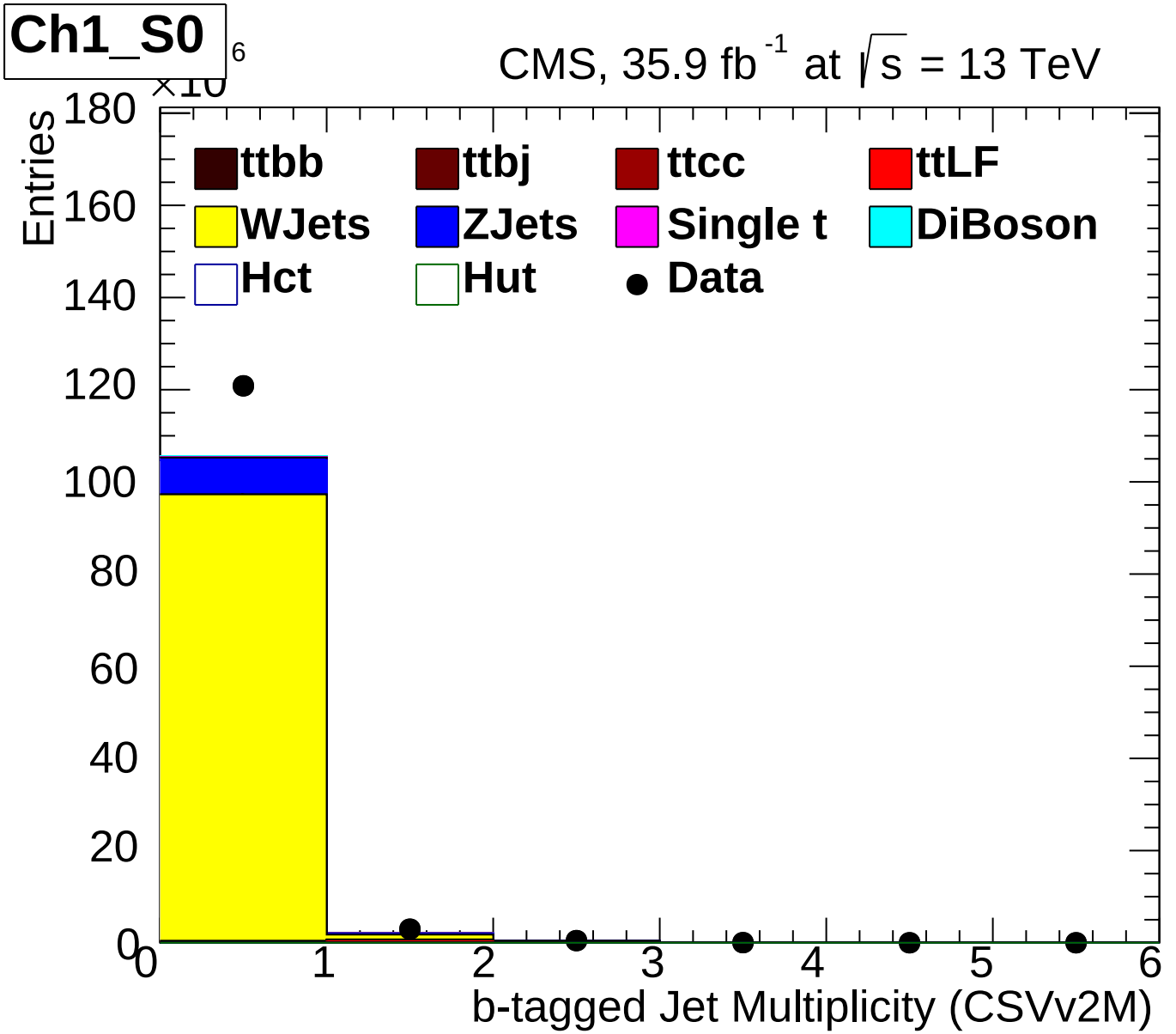
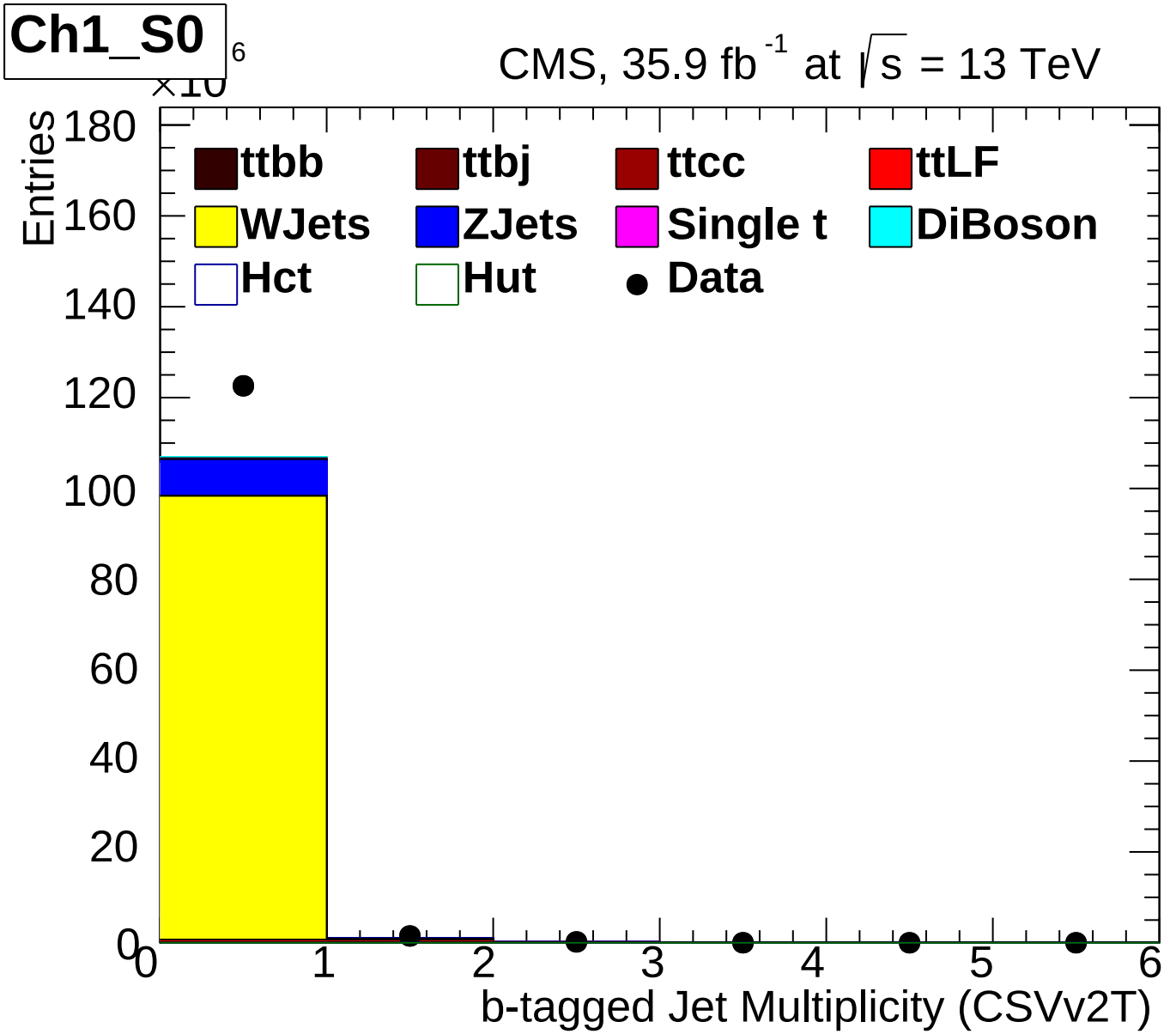
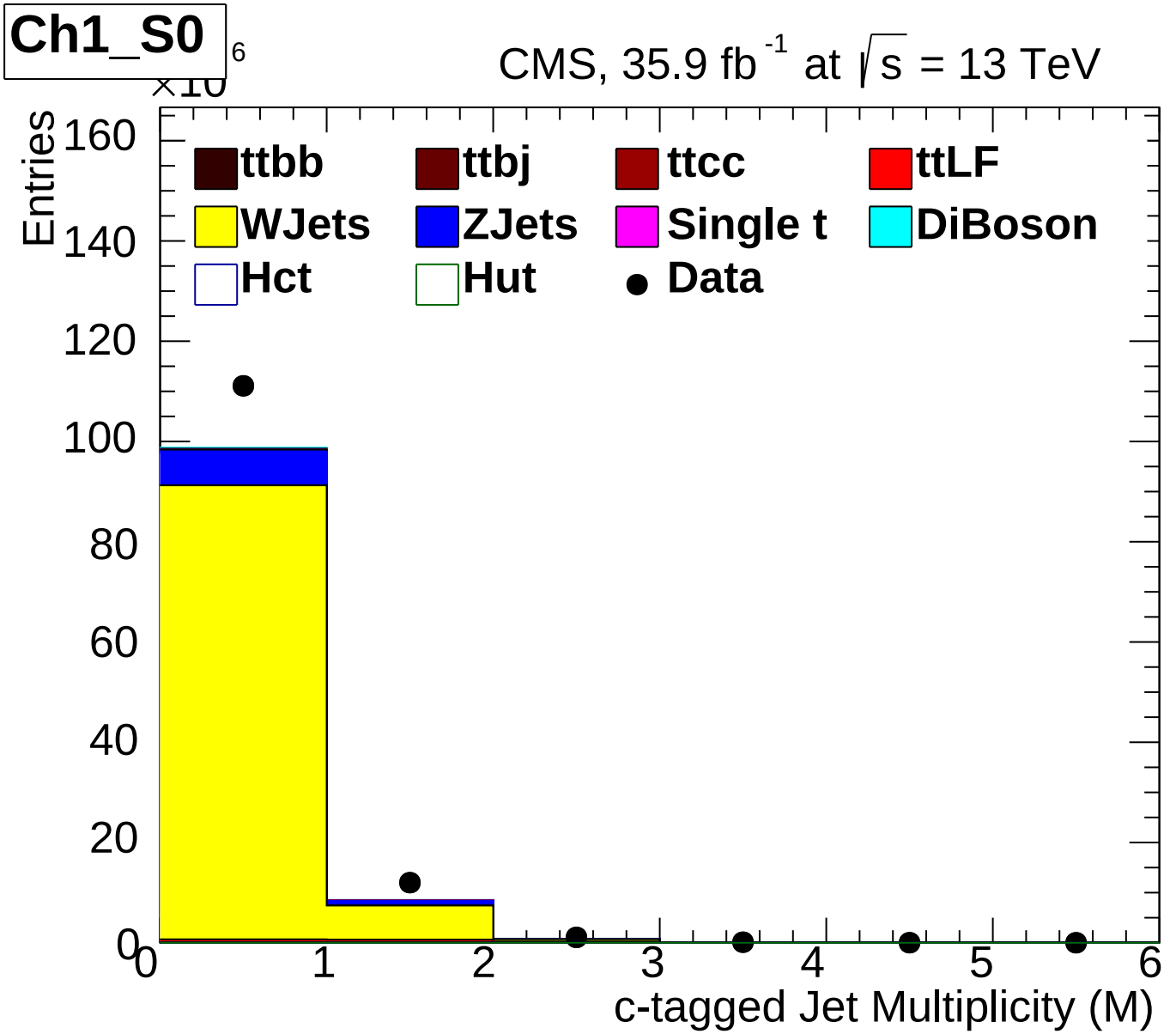
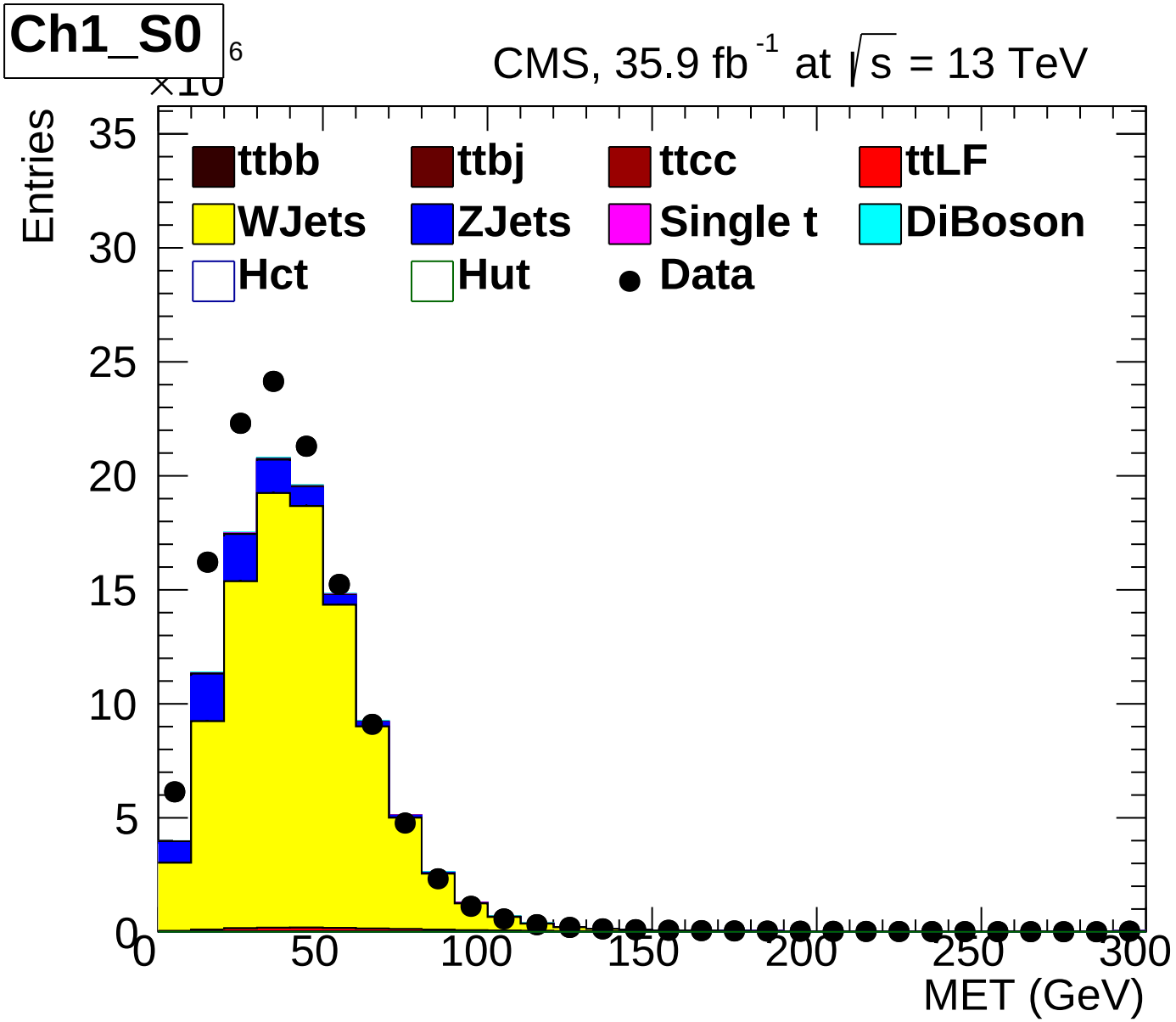
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
900
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

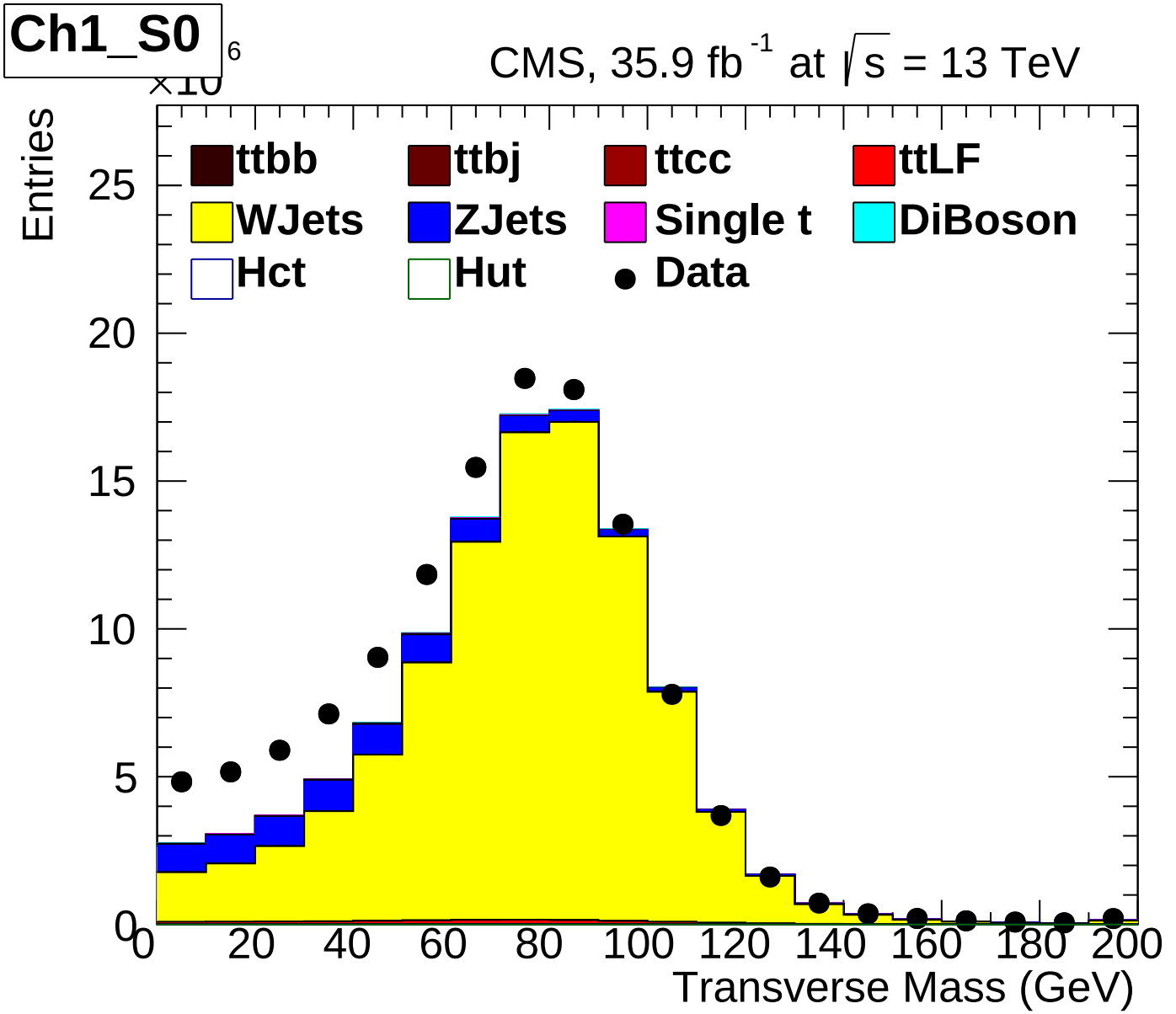

Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^6$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
0
2
4
6
8
10
12
Jet Multiplicity

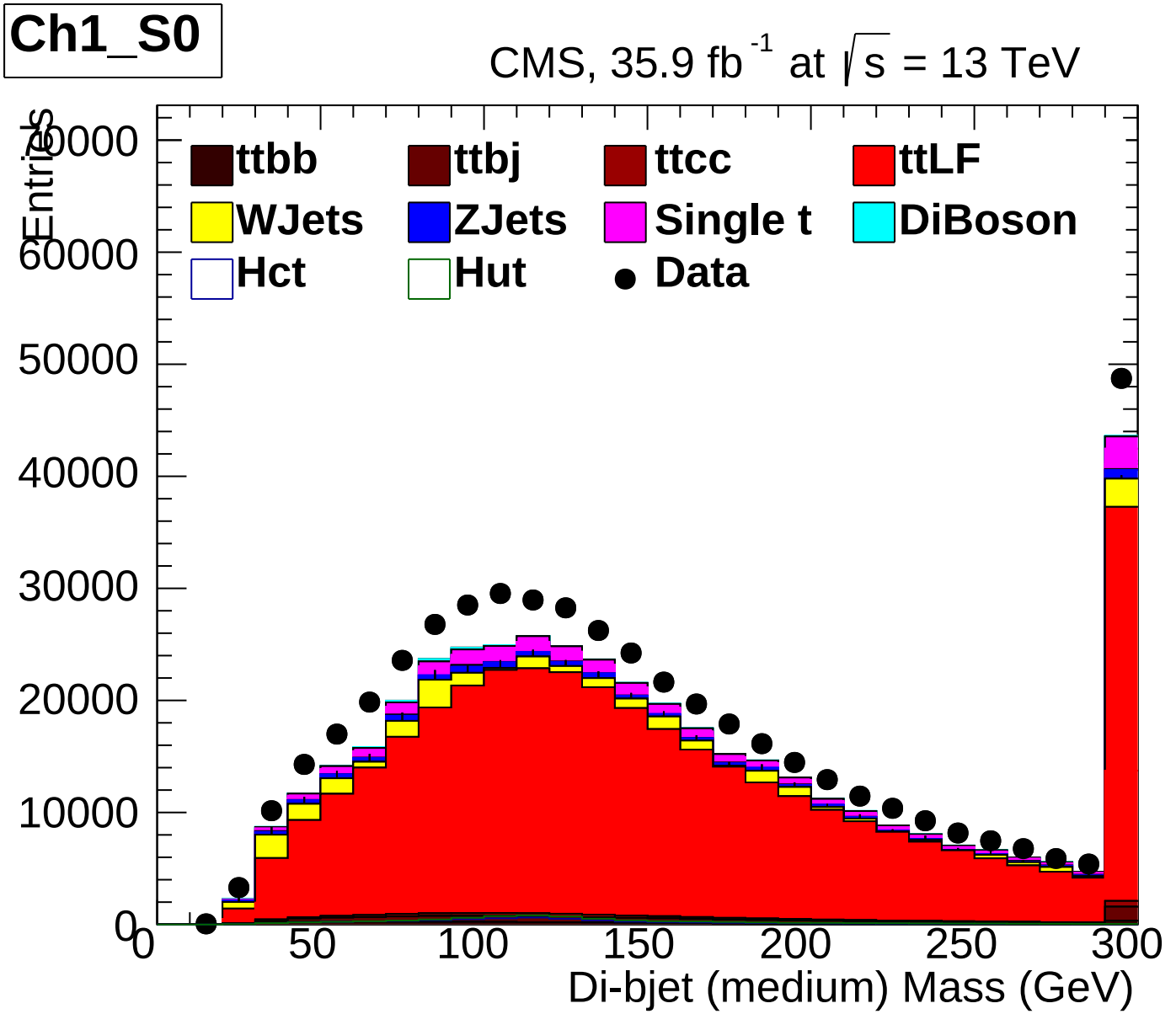

Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

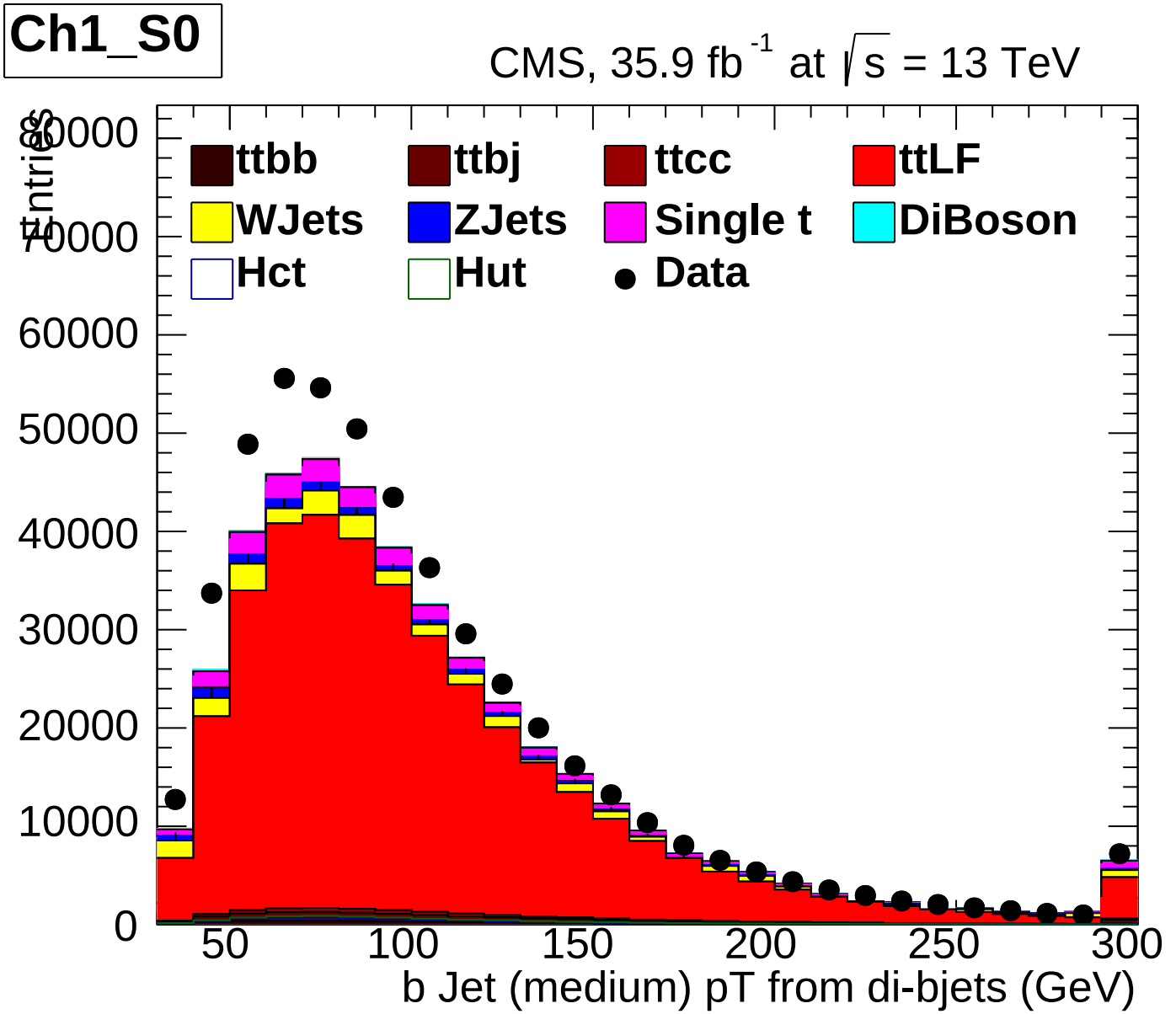

Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

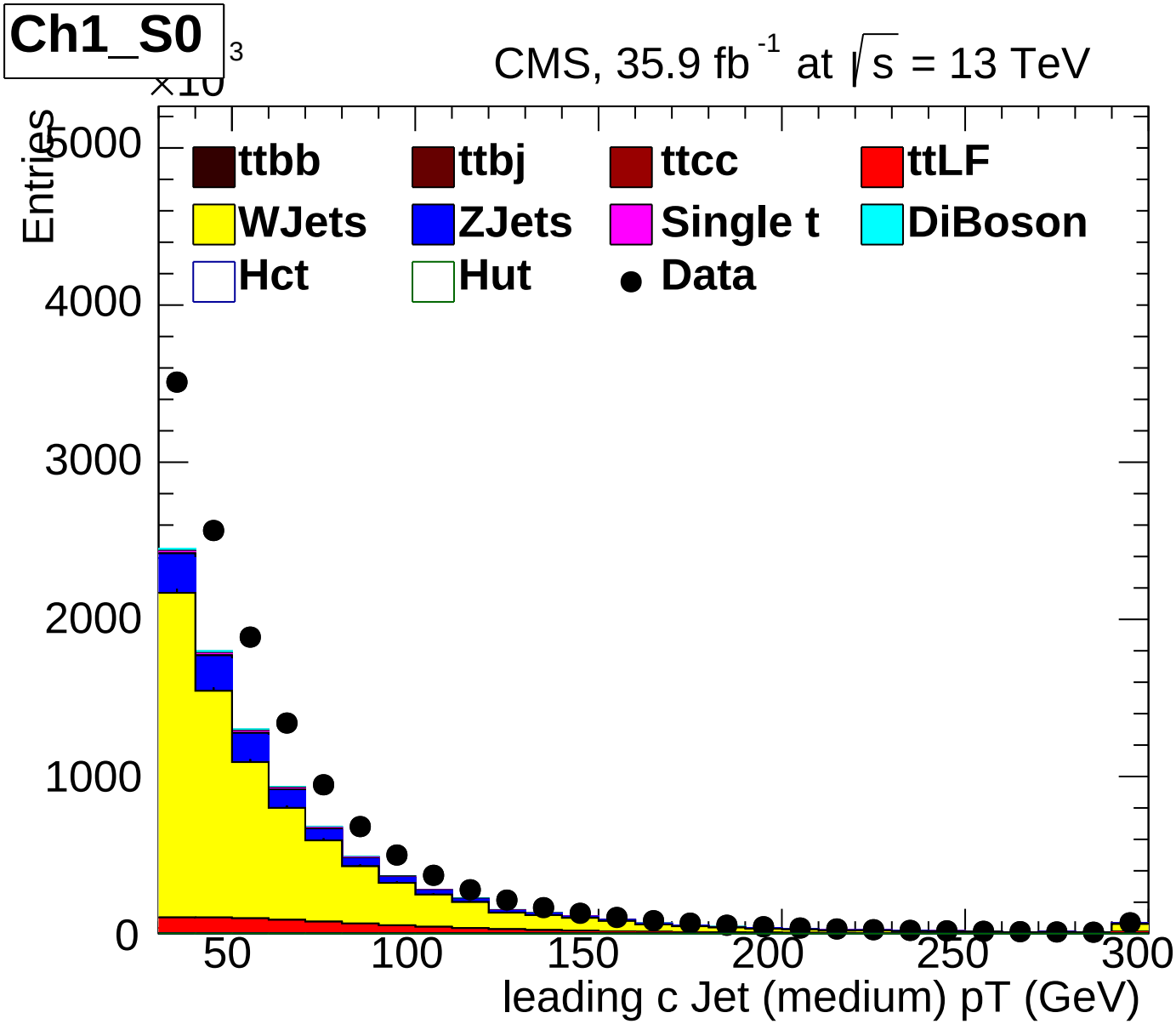

Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

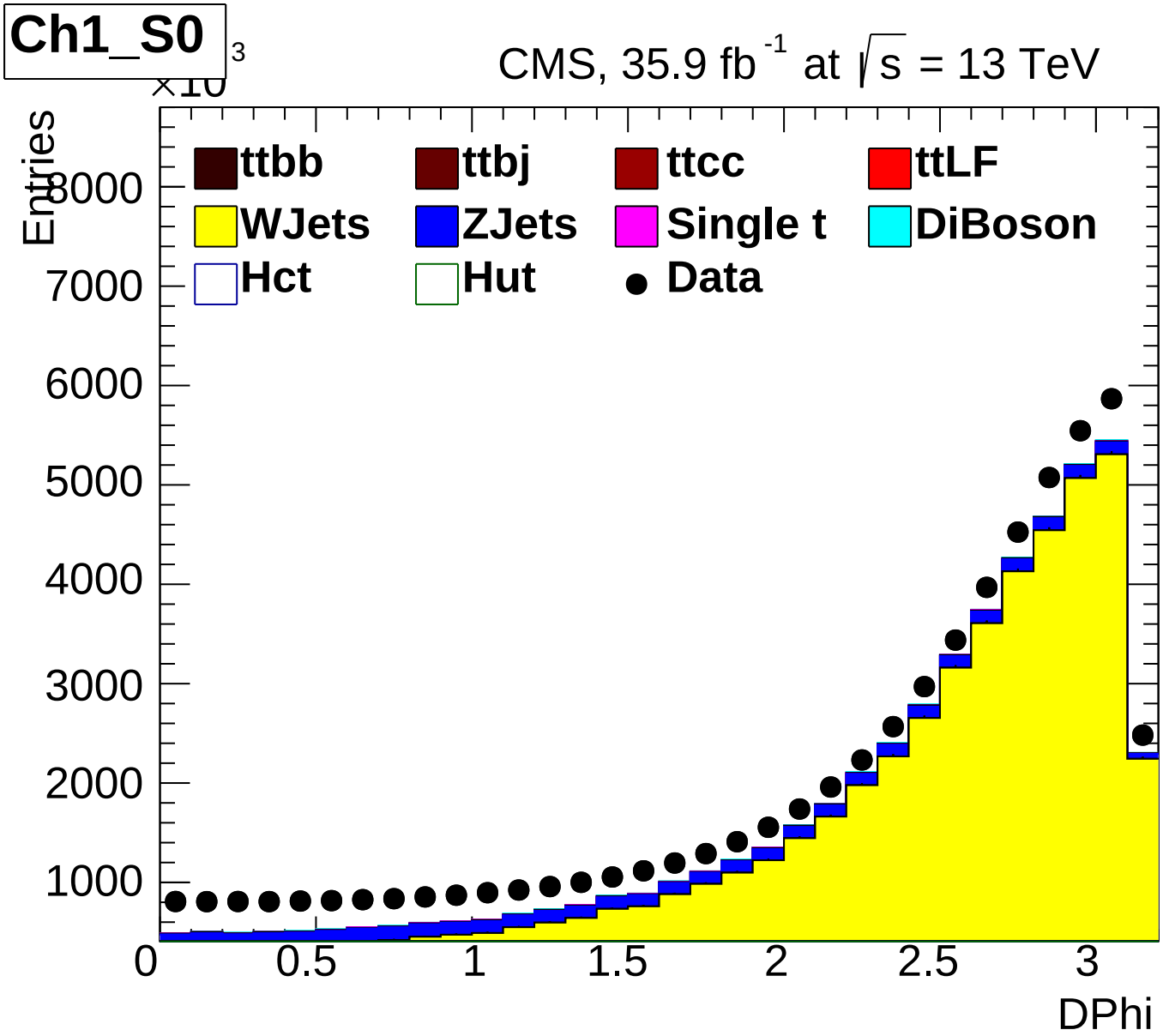

Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^6
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
5
10
15
20
25
30
35
0
50
100
150
200
250
300
MET (GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
5
10
15
20
25
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10000
20000
30000
40000
50000
60000
70000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
80000
70000
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
5000
4000
3000
2000
1000
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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6000
5000
4000
3000
2000
1000
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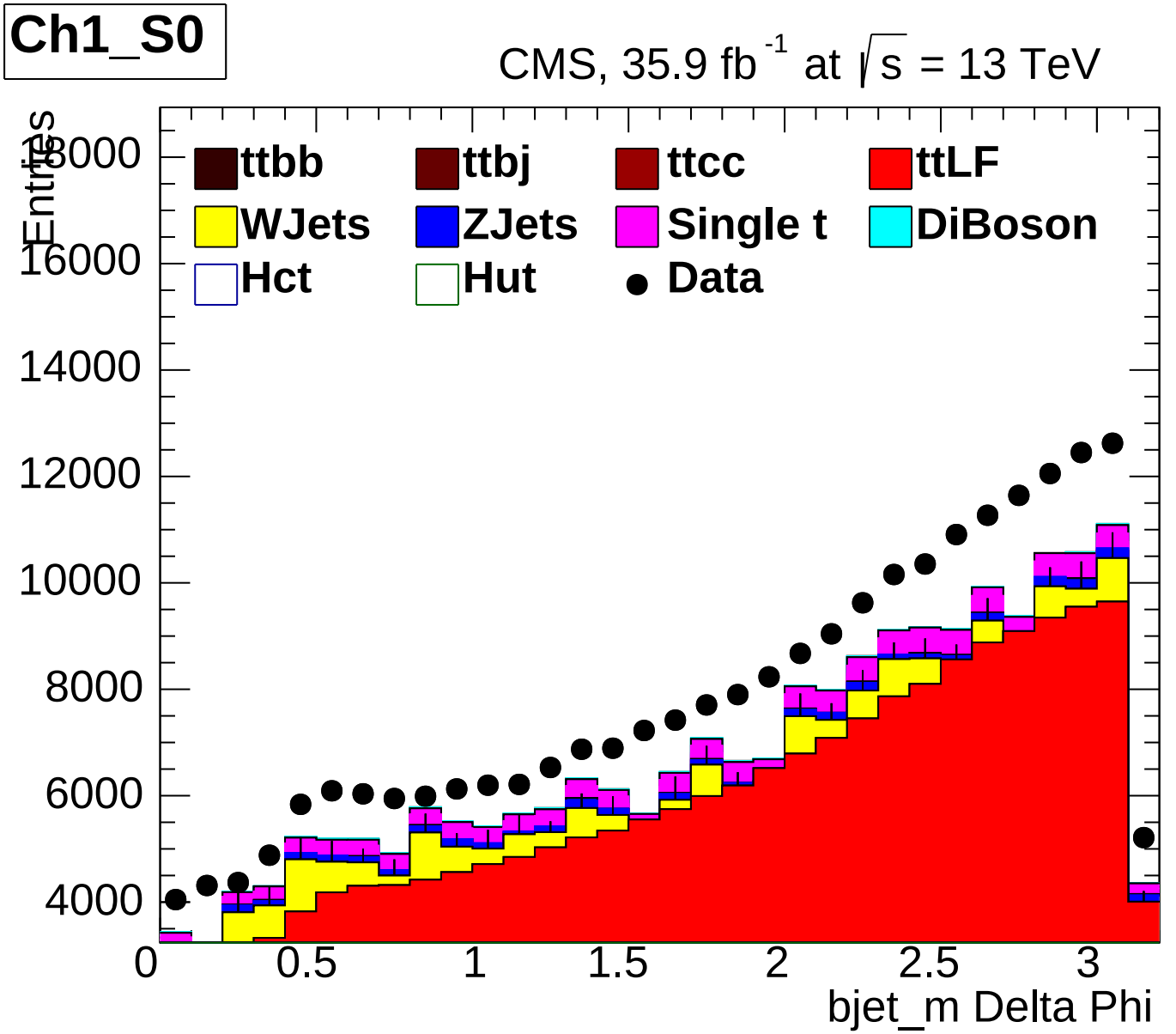
1
1.5
2
2.5
3
DPhi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CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
18000
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12000
10000
8000
6000
4000
0
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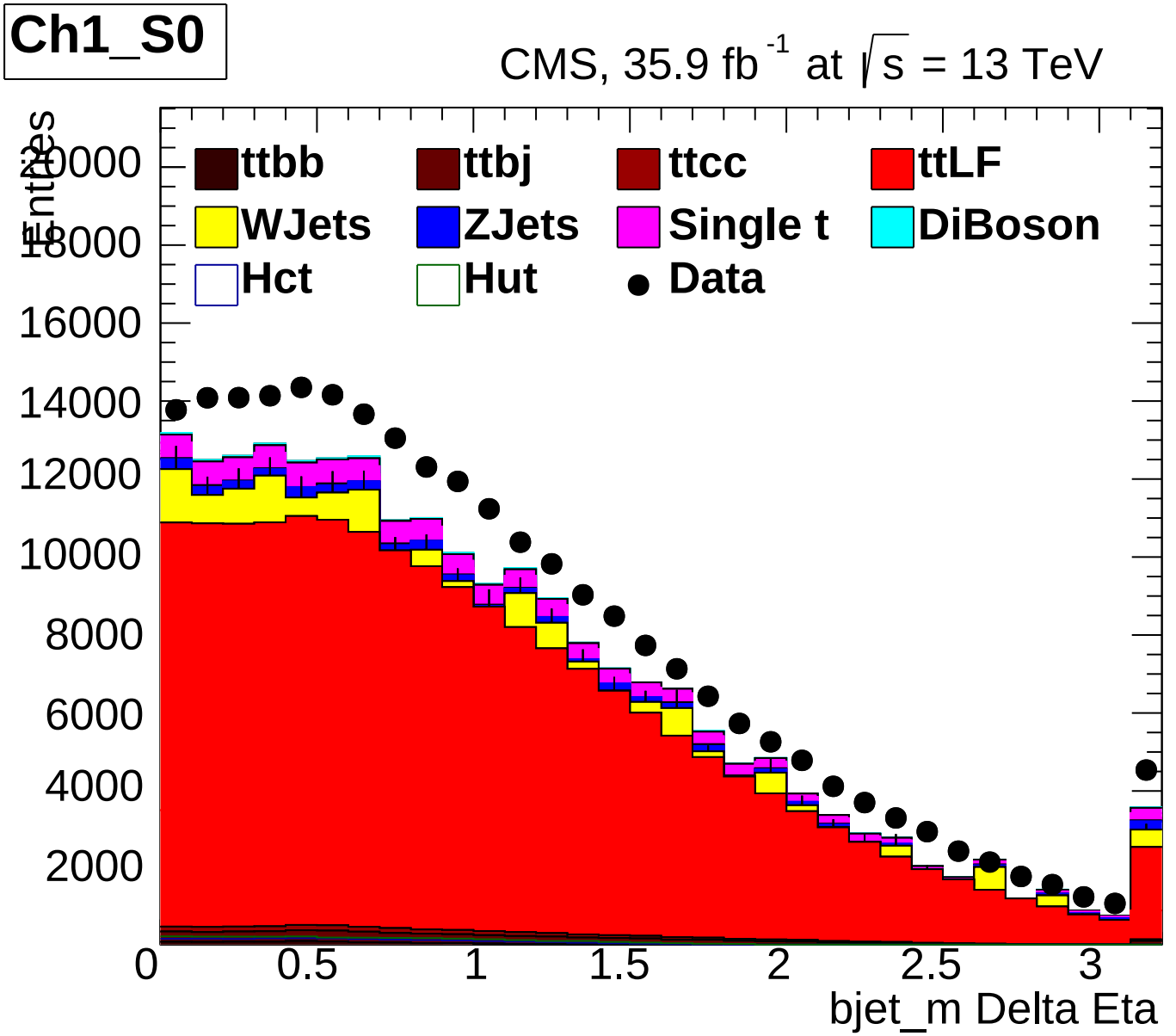
1
1.5
2
2.5
3
bjet_m Delta Phi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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
20000
18000
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0
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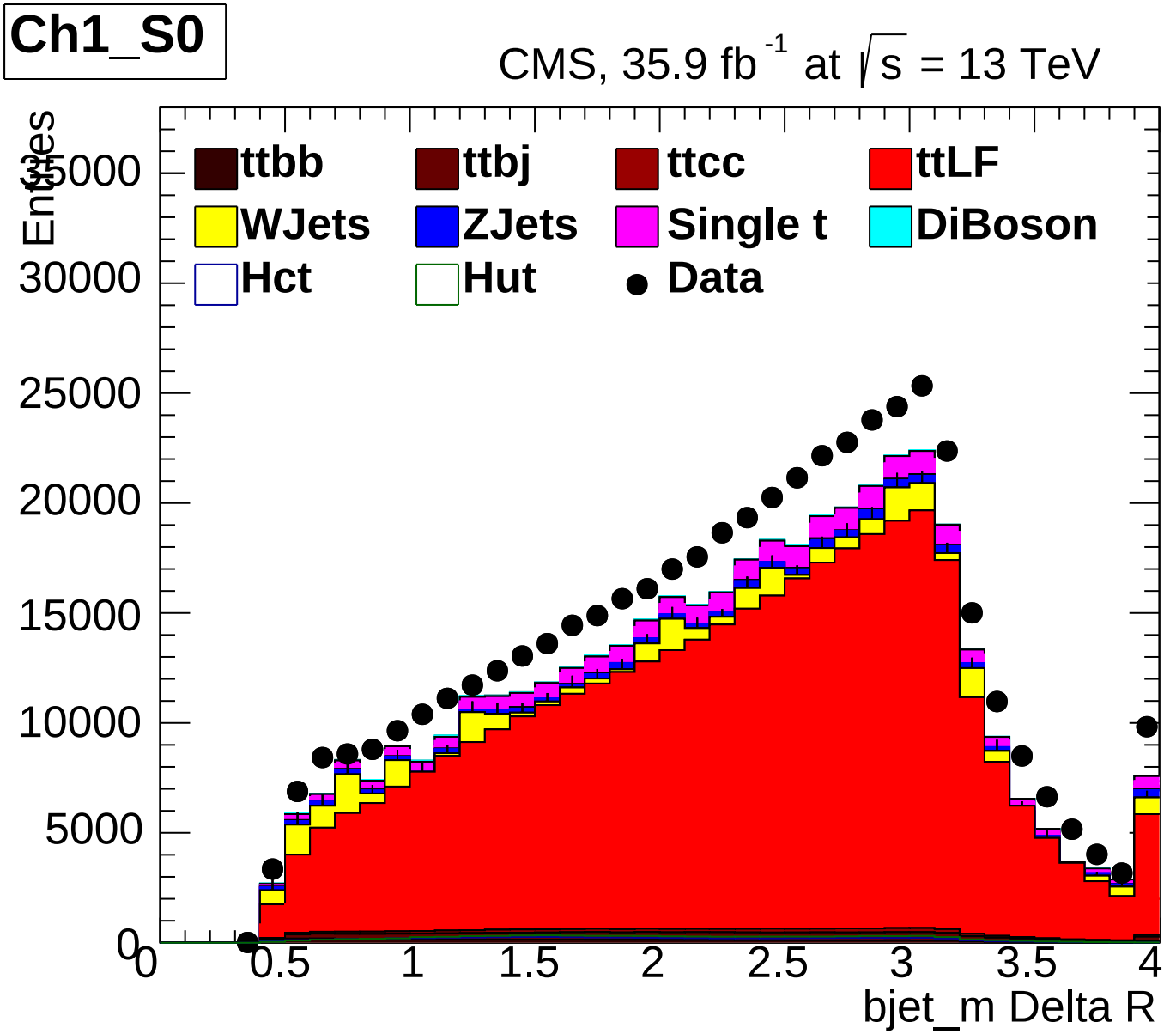
1.5
2
2.5
3
bjet_m Delta Eta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ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
35000
30000
25000
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1.5
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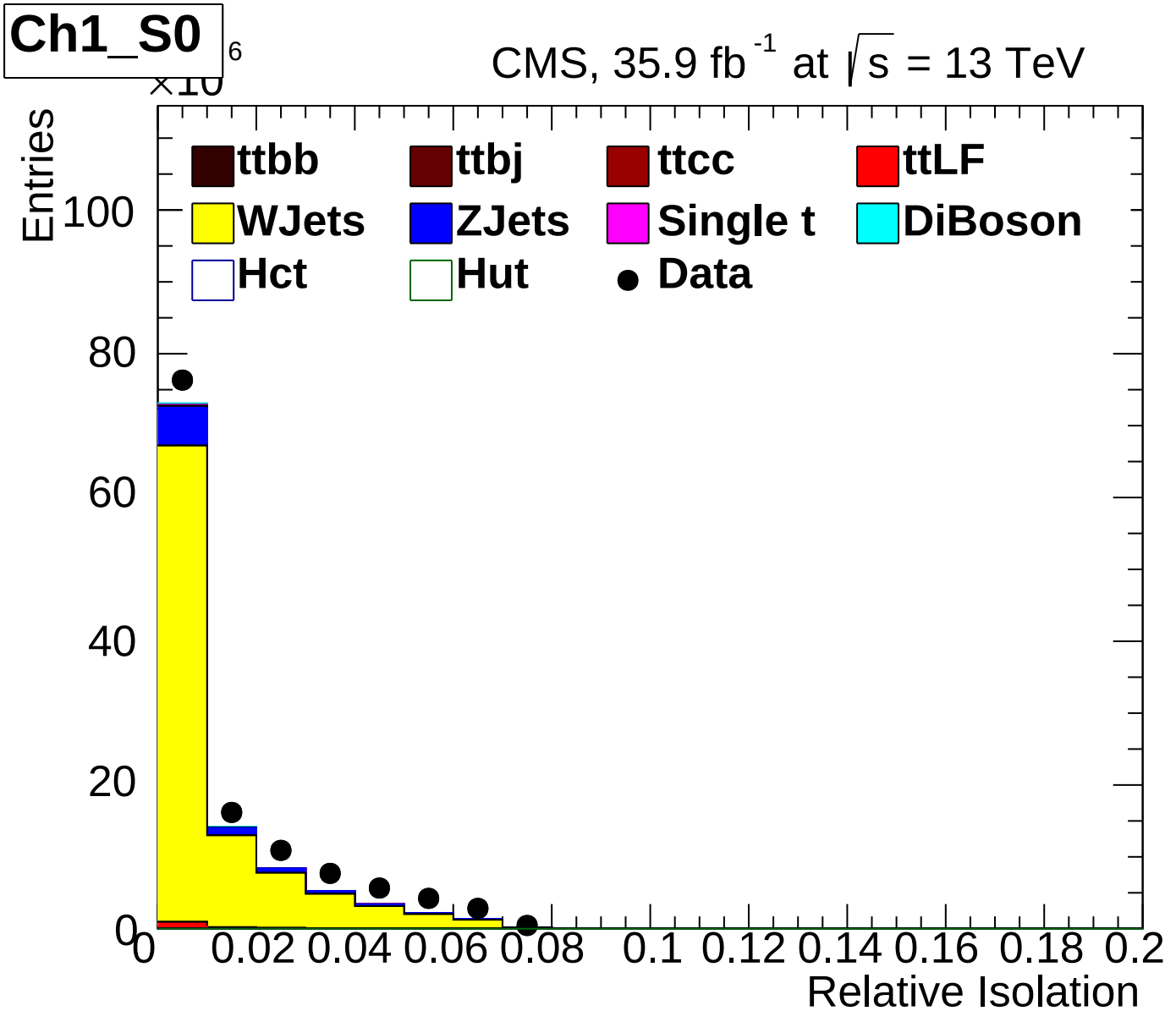
2.5
3
3.5
4
bjet_m Delta R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$\times 10^{6}$
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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40
60
80
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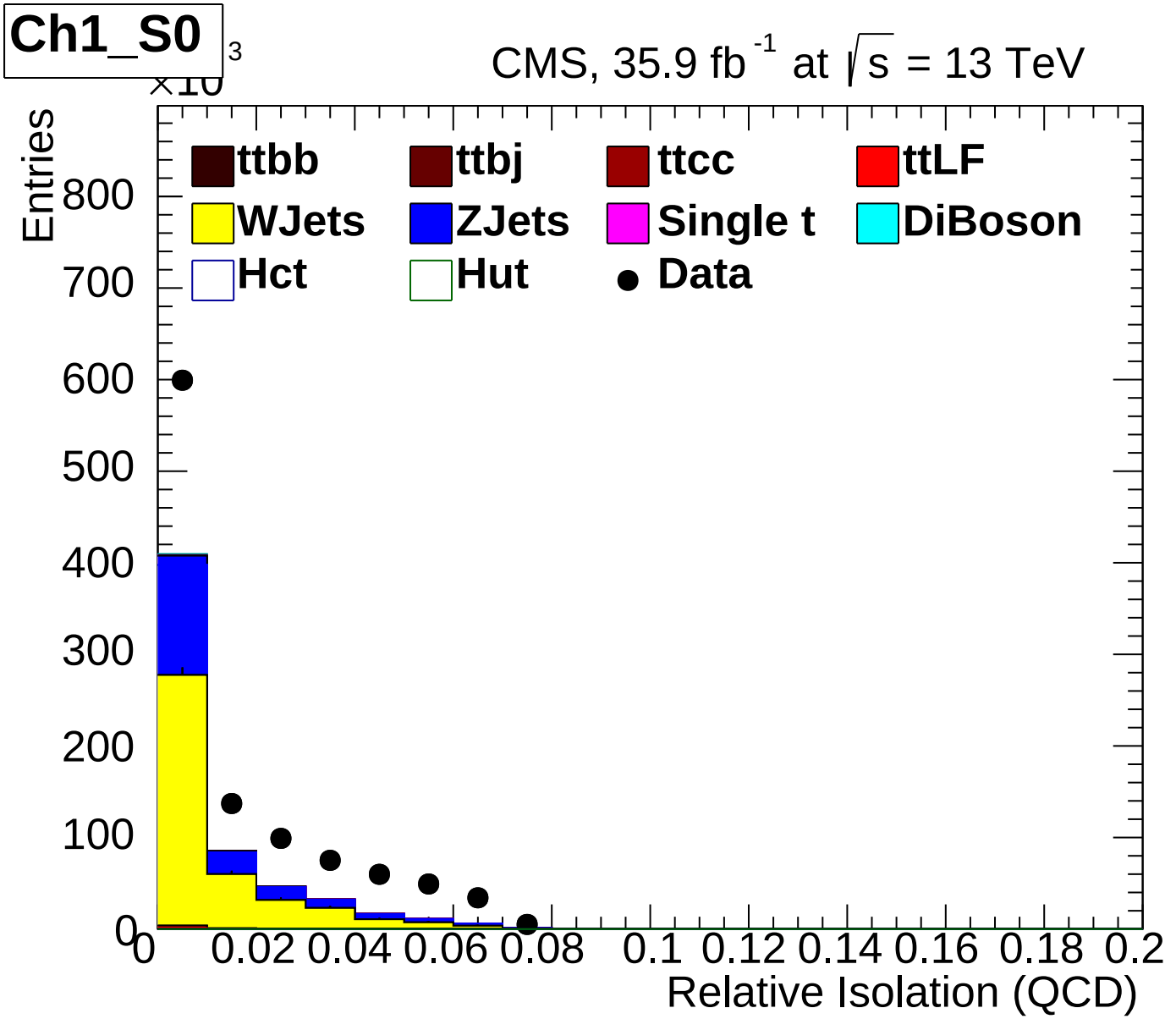
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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300
200
100
0
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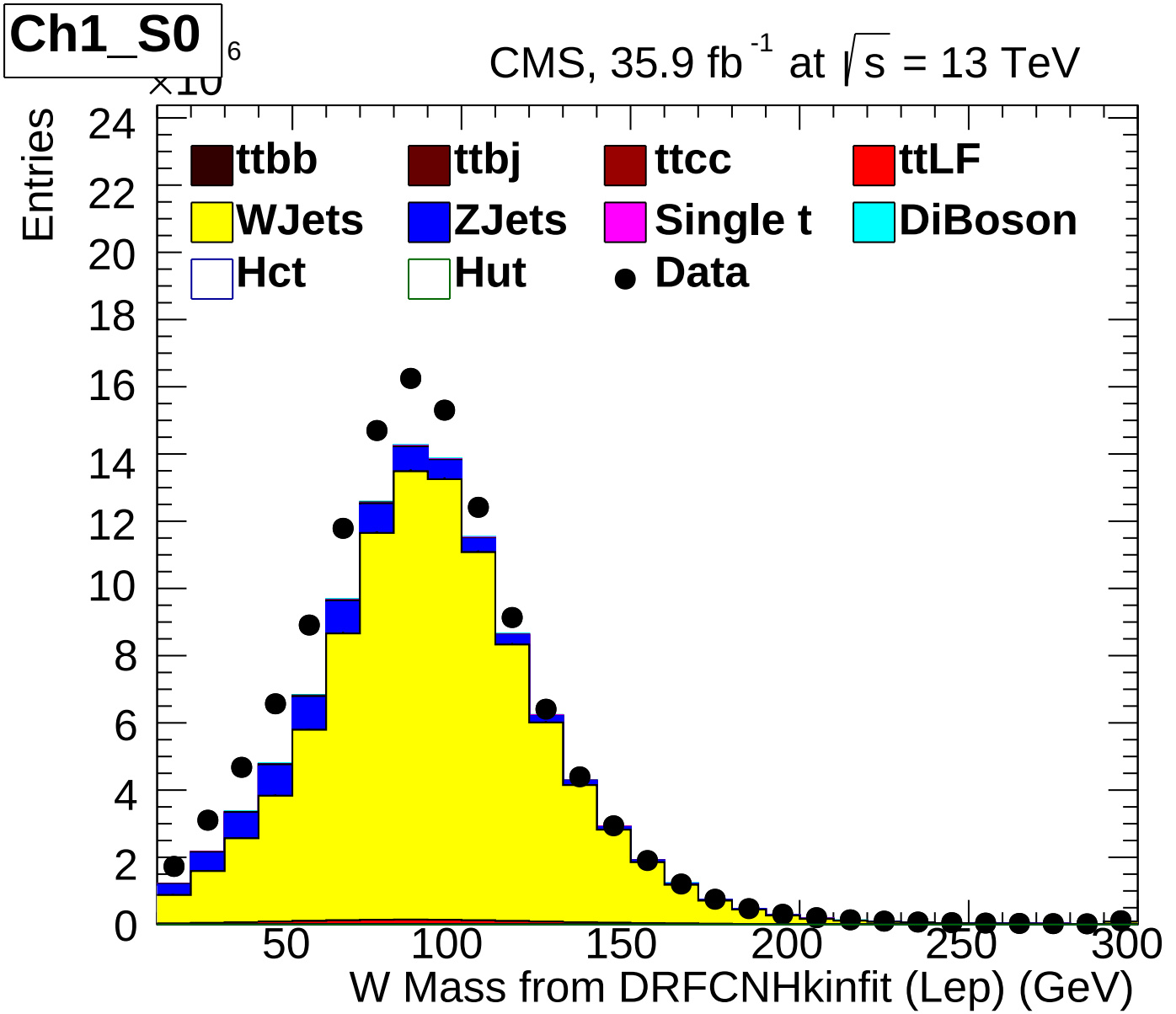
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)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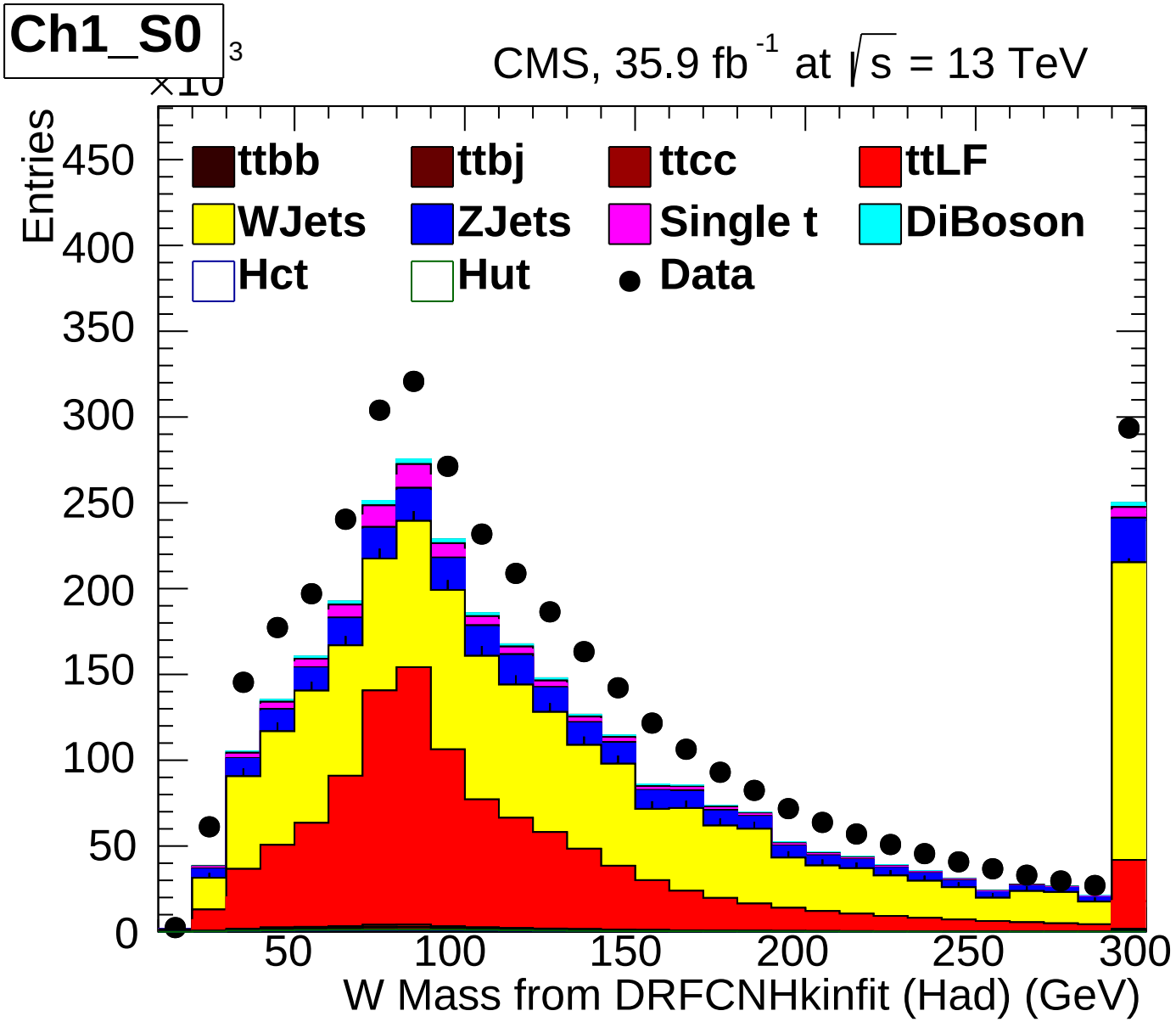
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2
4
6
8
10
12
14
16
18
20
22
24
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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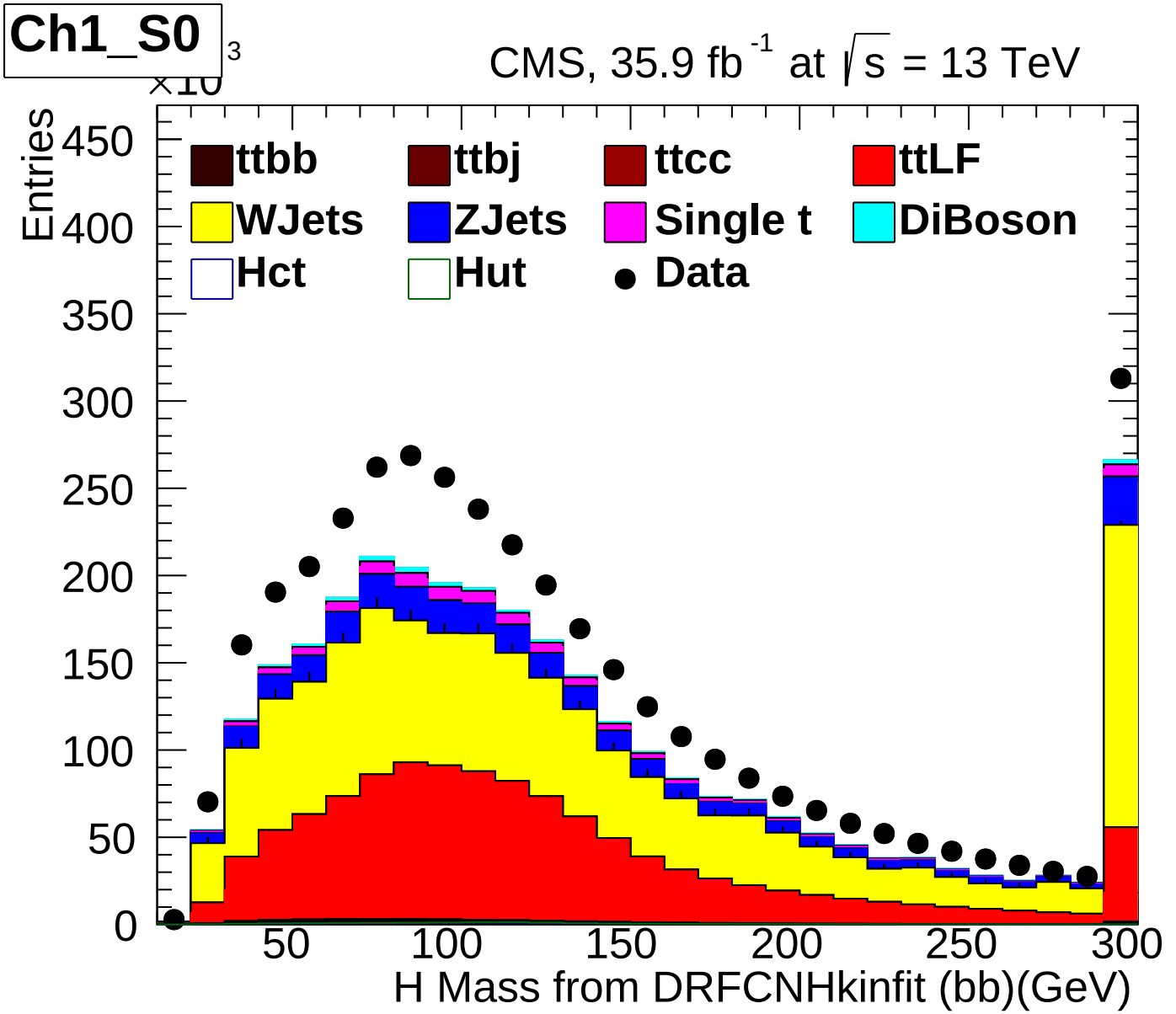
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
400
450
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
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100
150
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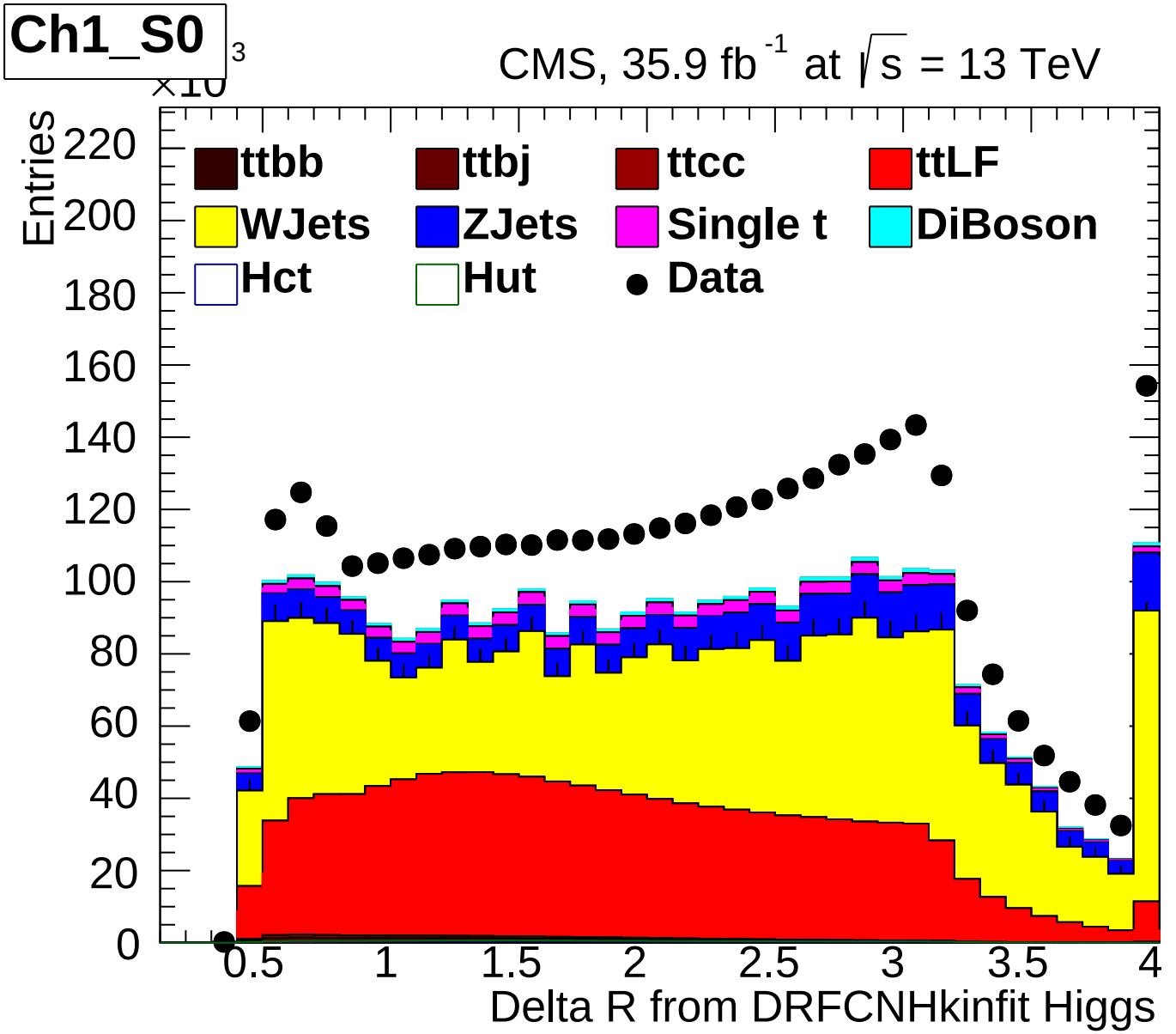
250
300
350
400
450
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
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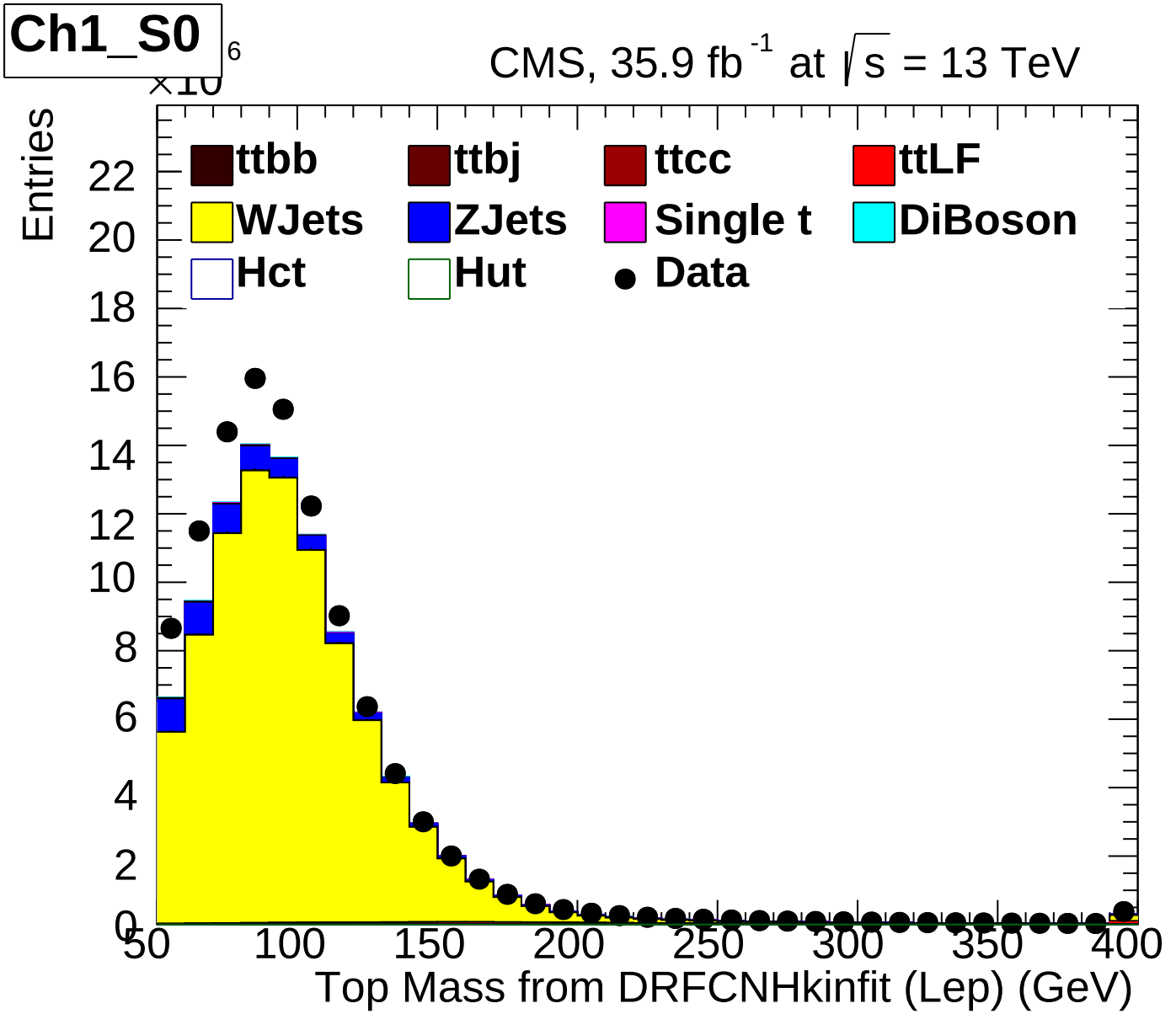
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^{6}$
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2
4
6
8
10
12
14
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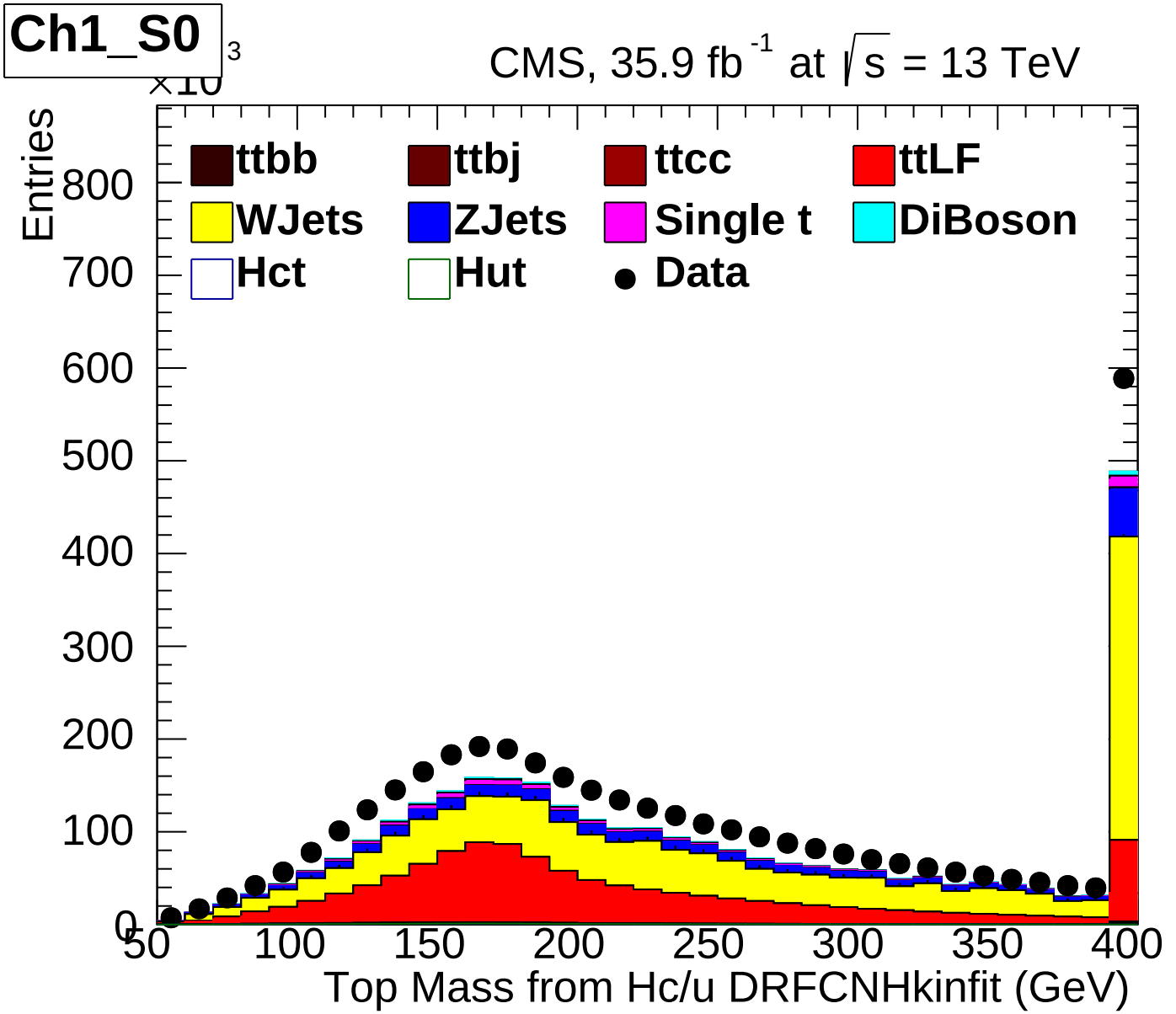
18
20
22
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S0
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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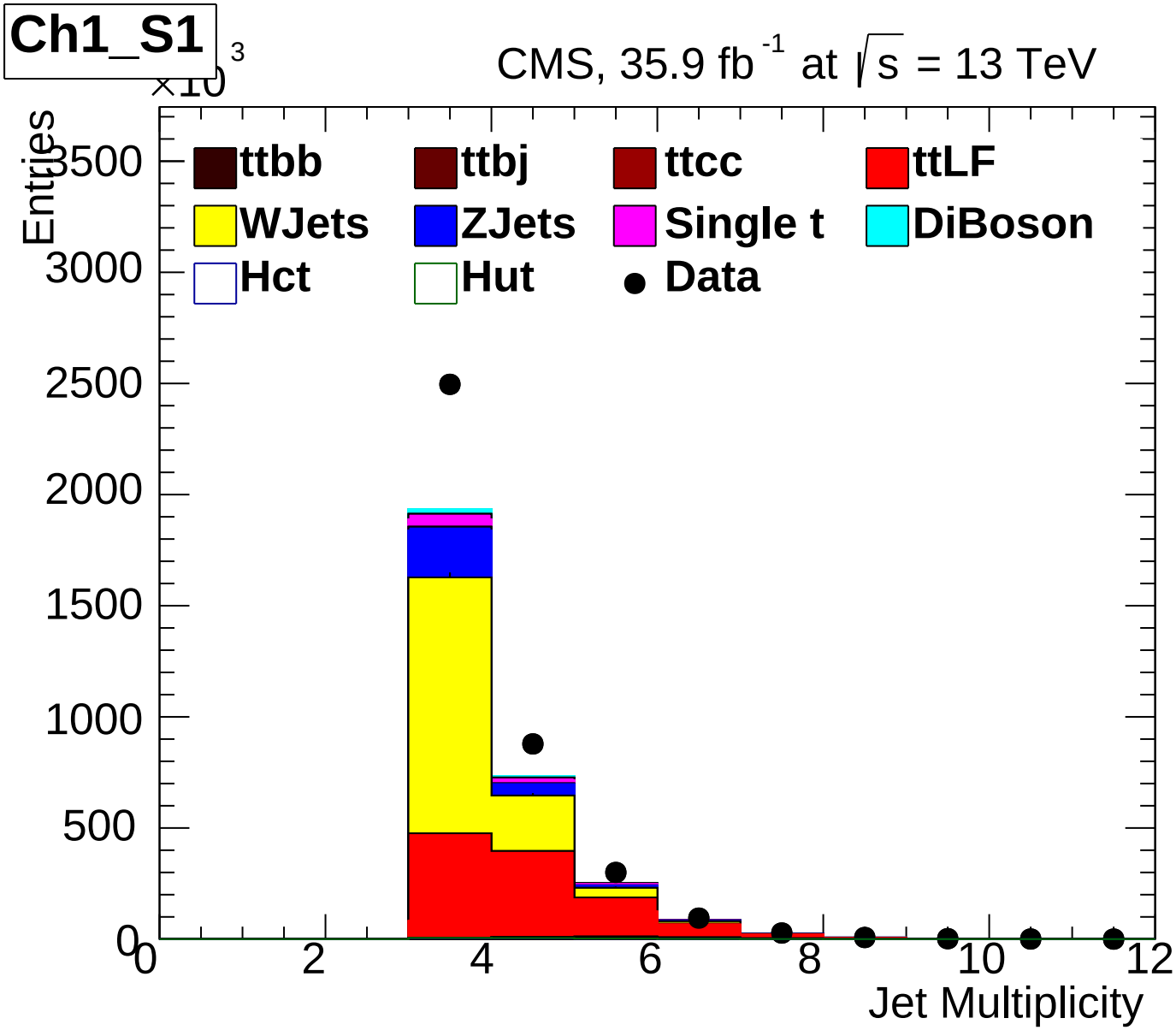
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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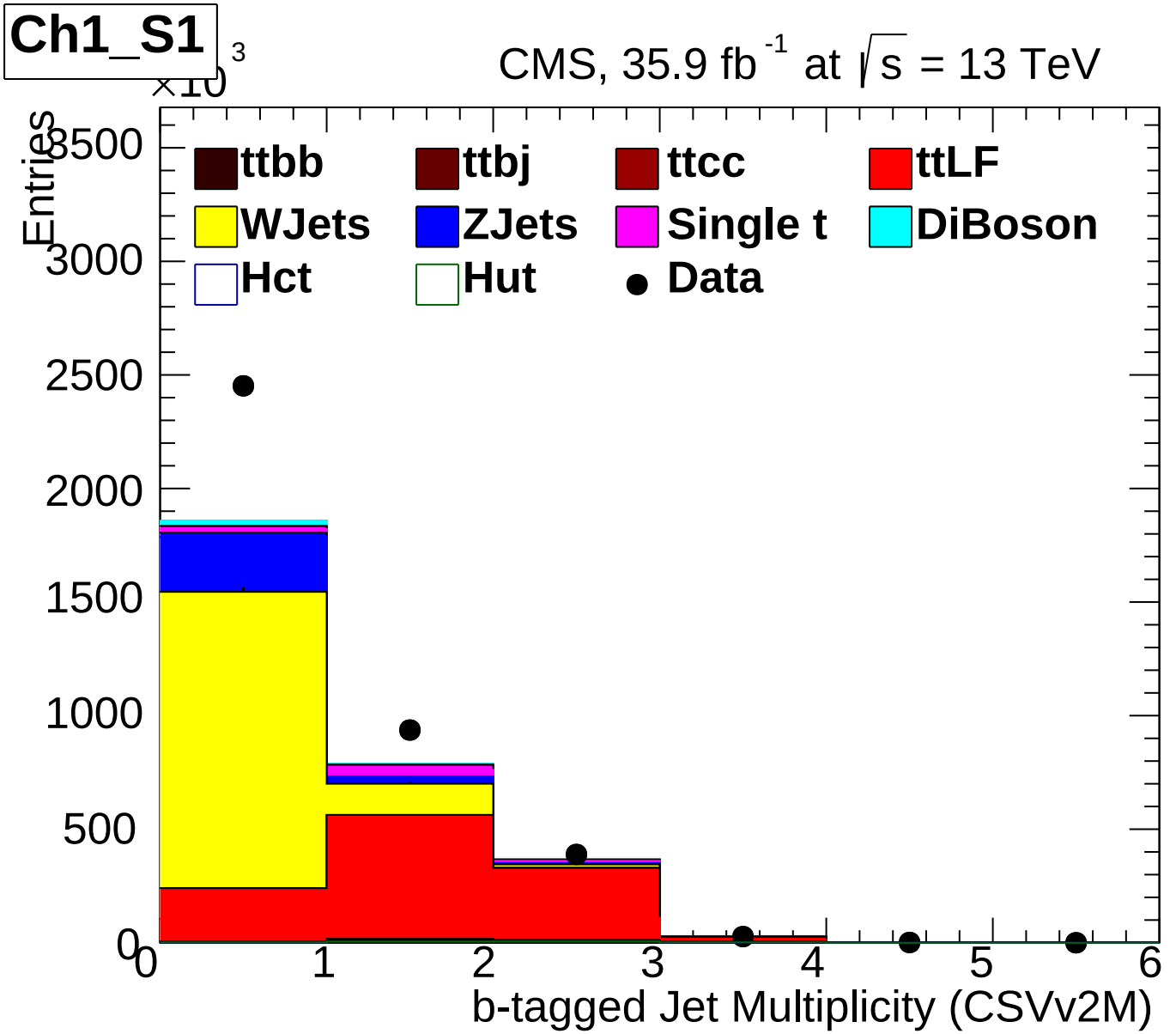
3000
2500
2000
1500
1000
500
0
0
2
4
6
8
10
12
Jet Multiplicity


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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2500
2000
1500
1000
500
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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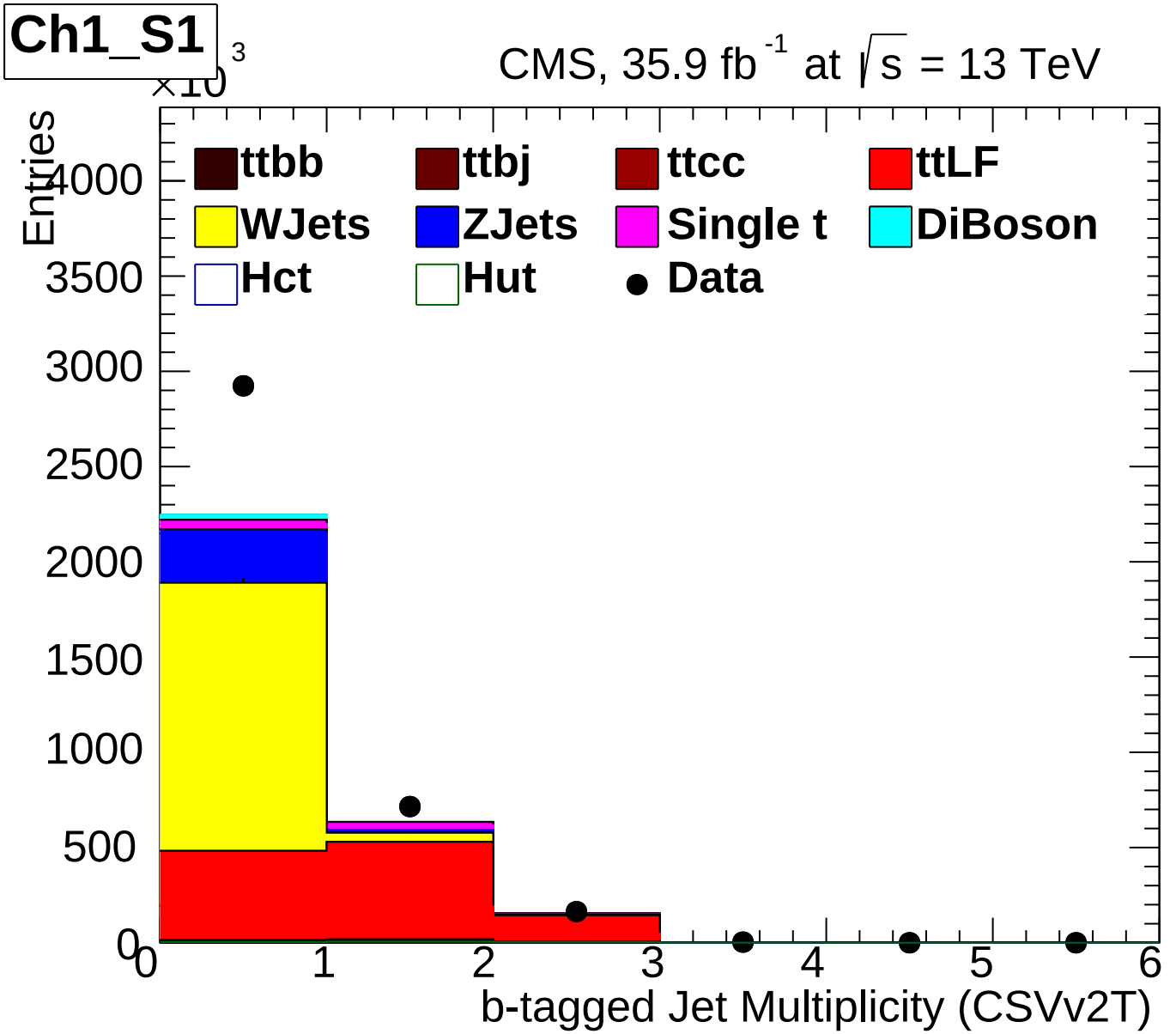
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
4000
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3000
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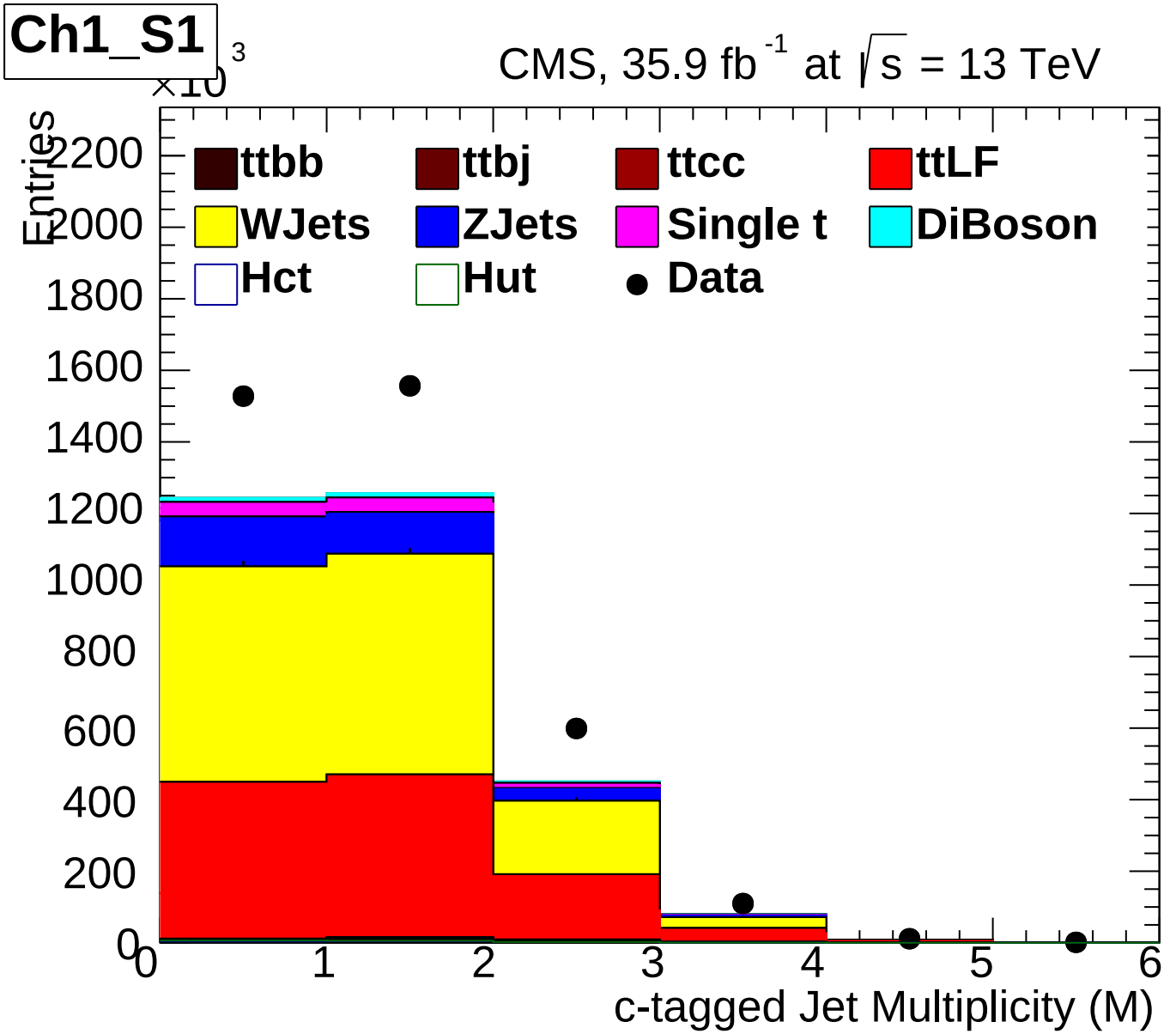
1500
1000
500
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
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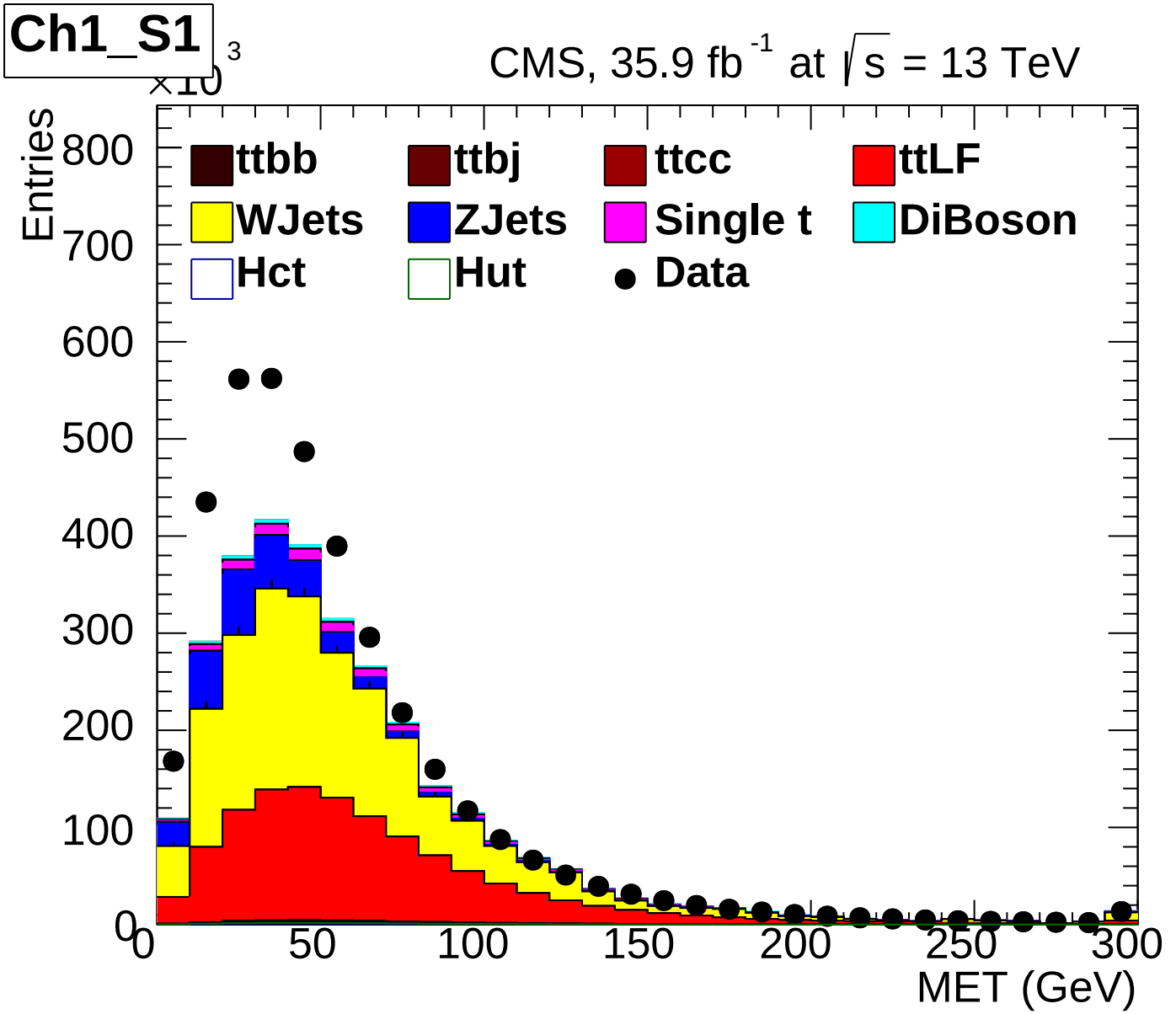
1400
1600
1800
2000
2200
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
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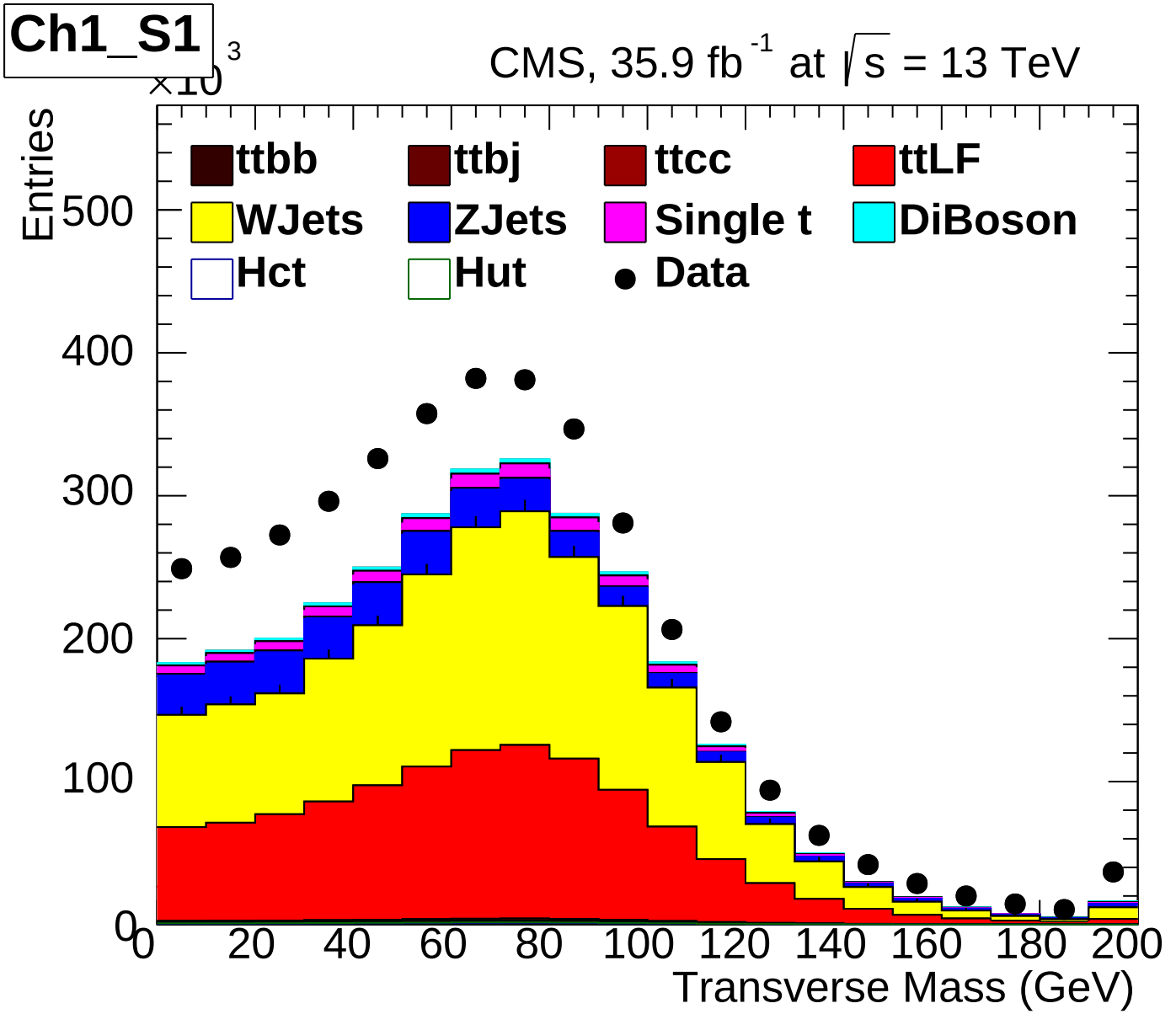
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
MET (GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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120
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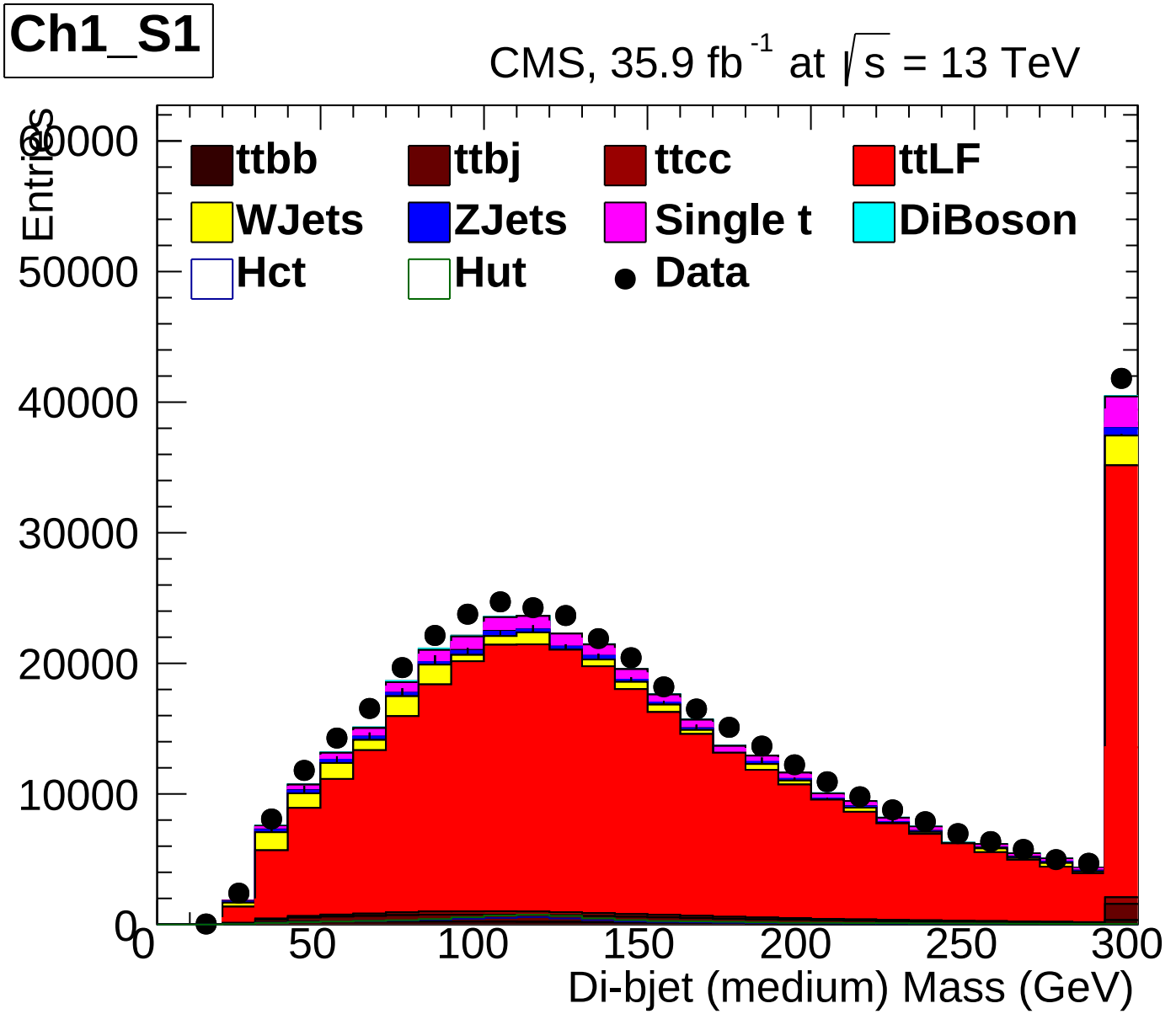
200
Transverse Mass (GeV)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CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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20000
10000
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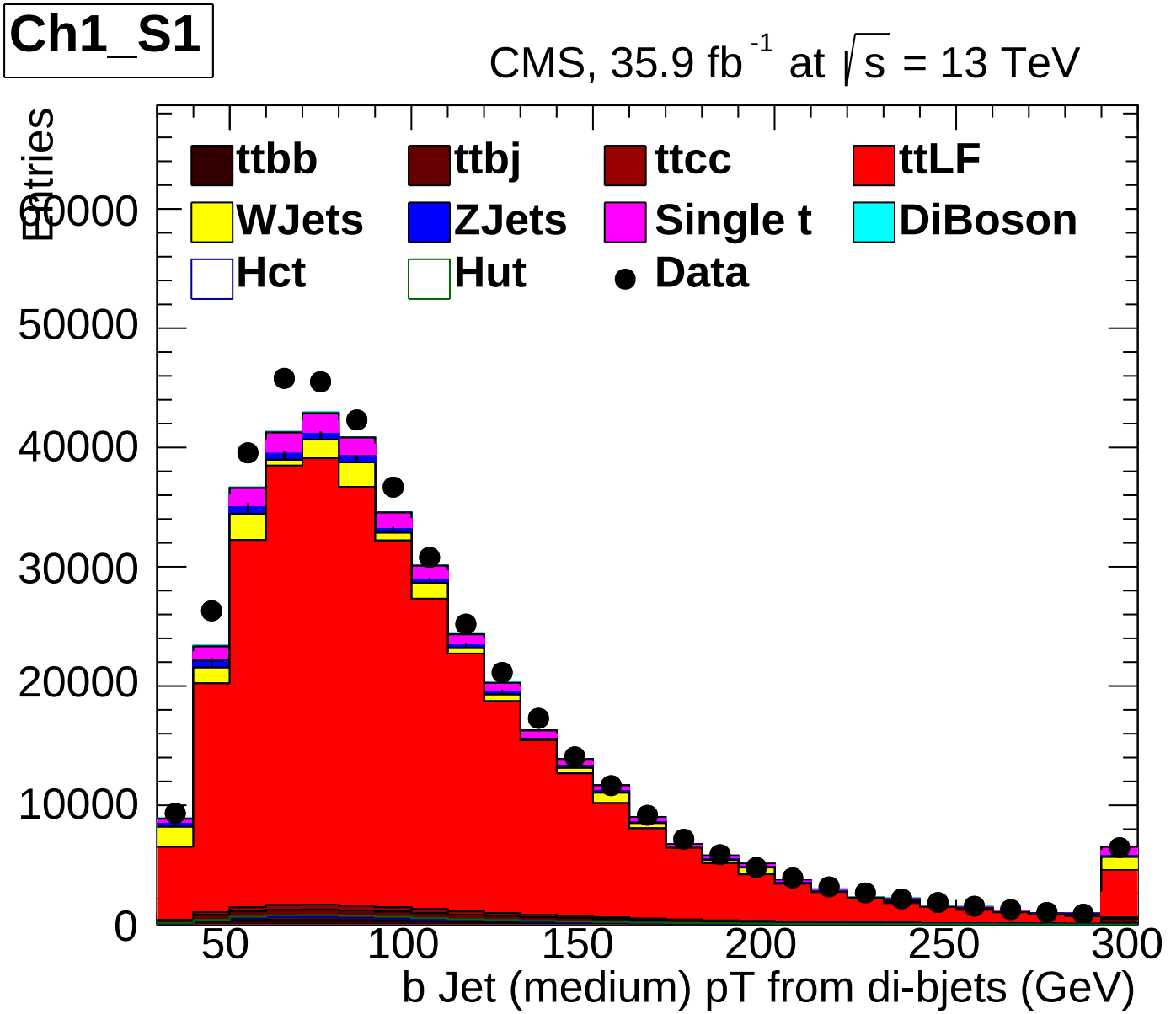
250
300
Di-bjet (medium) Mass (GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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50000
60000
50
100
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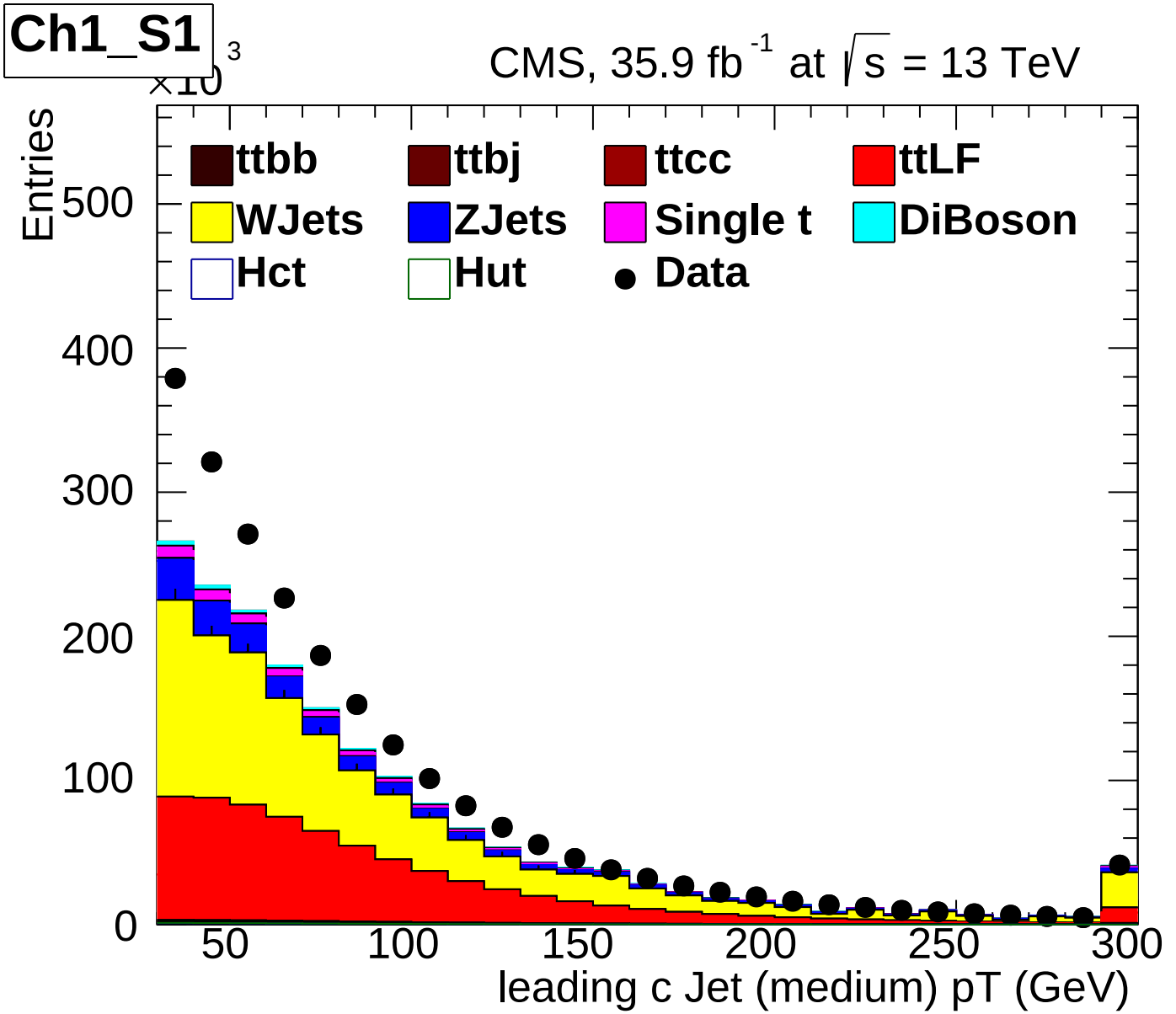
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
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50
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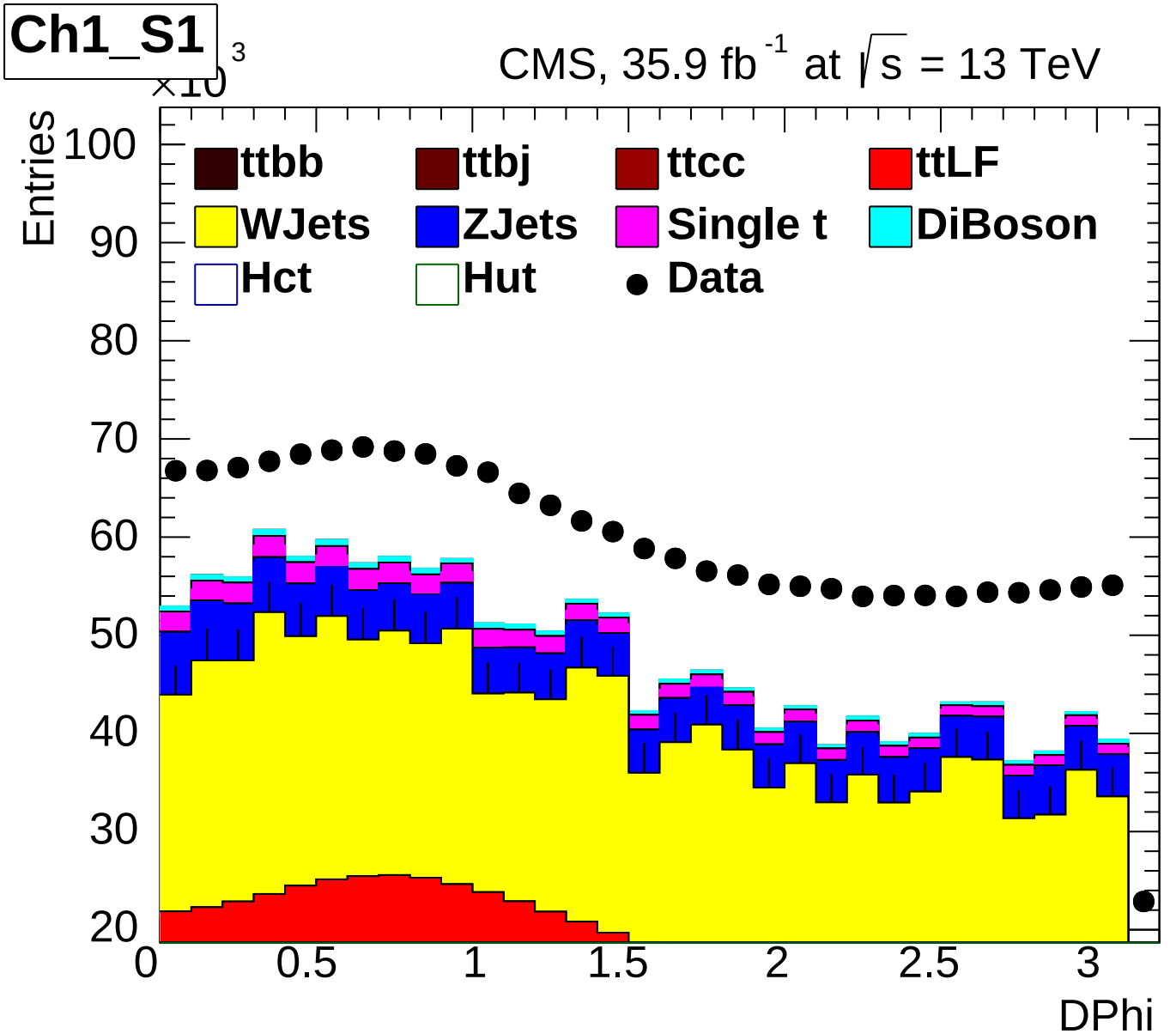
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
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30
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0
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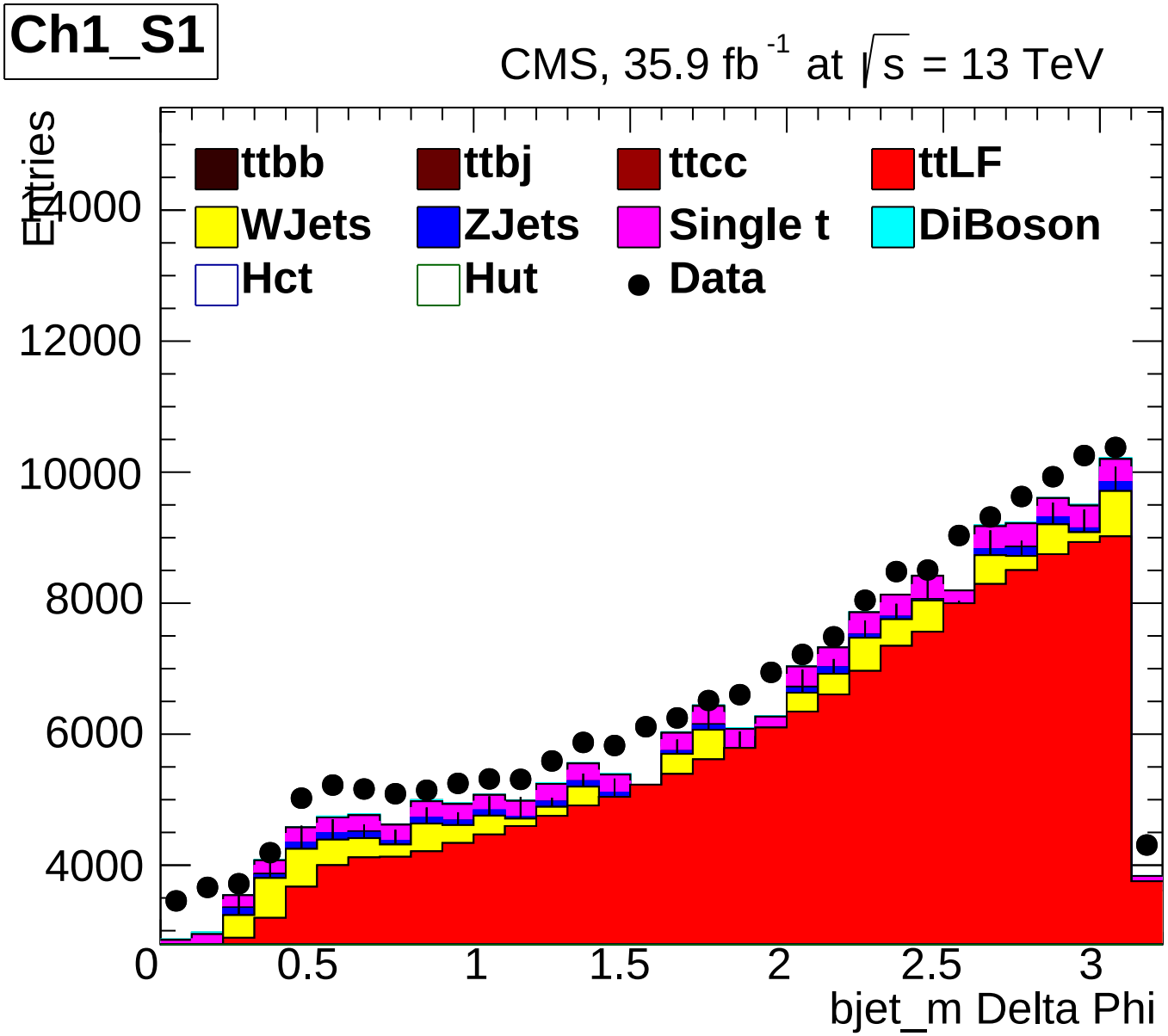
1
1.5
2
2.5
3
DPhi


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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WJets
ZJets
Single t
DiBoson
Hct
Hut
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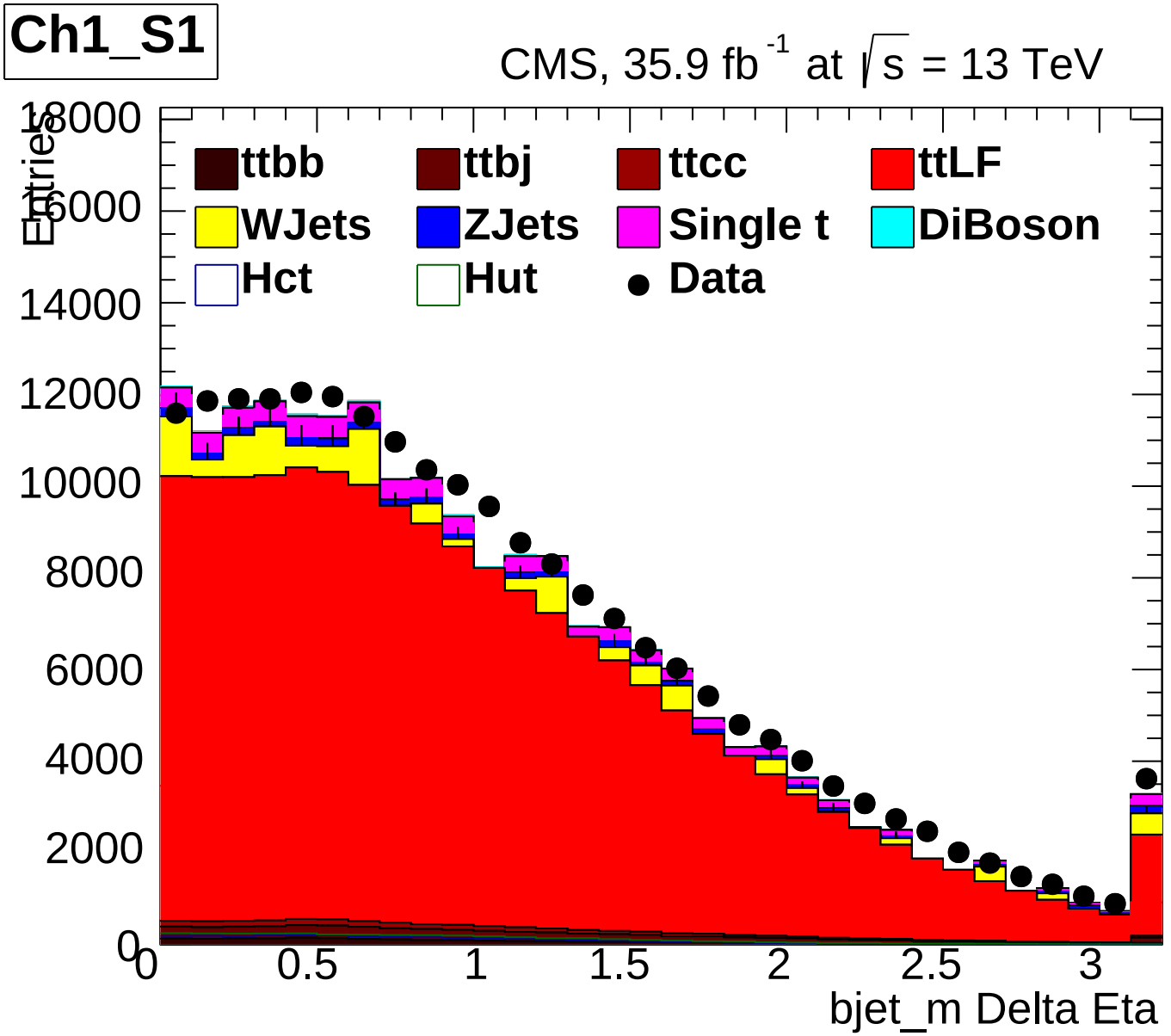
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
18000
16000
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6000
4000
2000
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0
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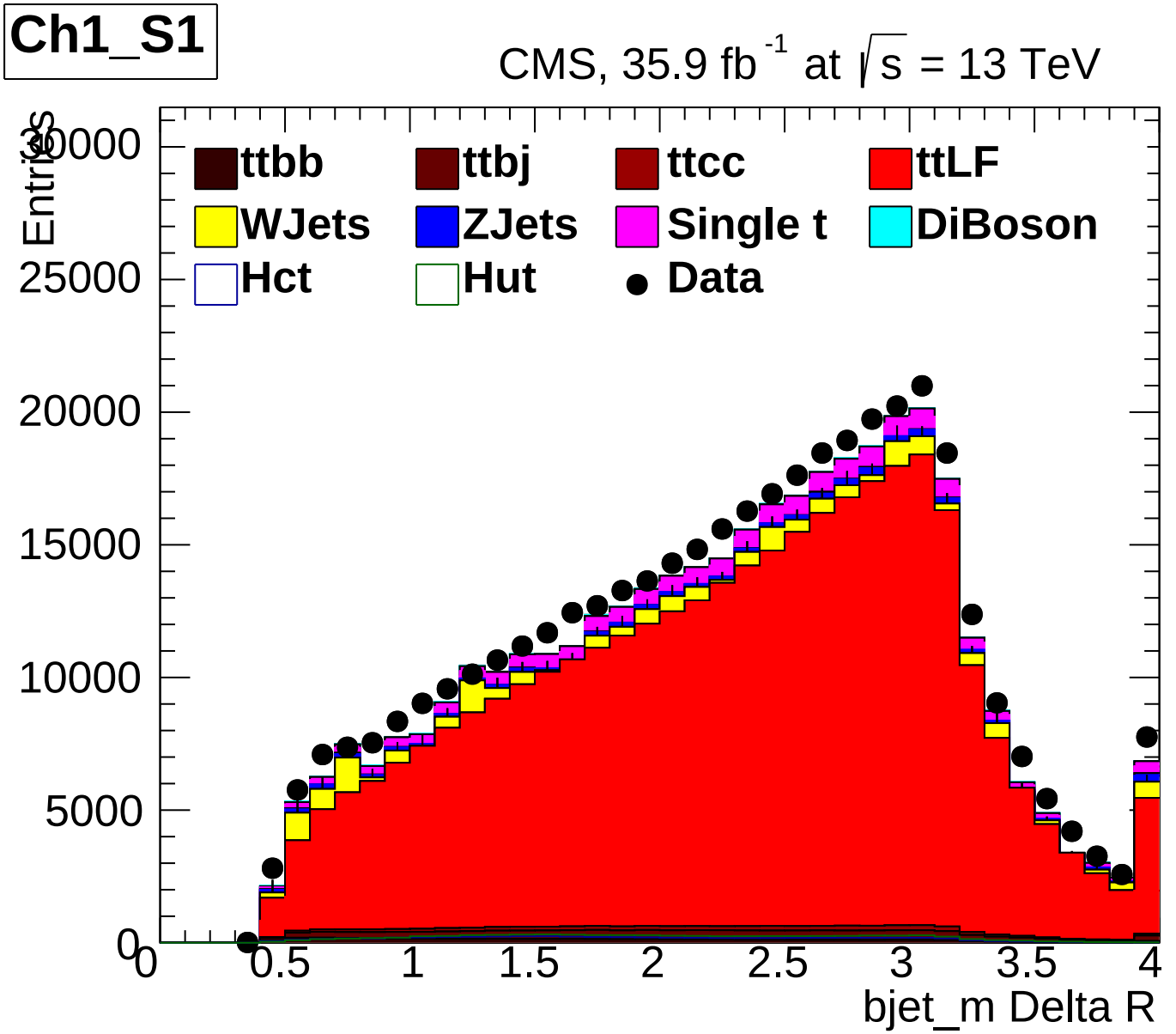
1.5
2
2.5
3
bjet_m Delta Eta


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
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0
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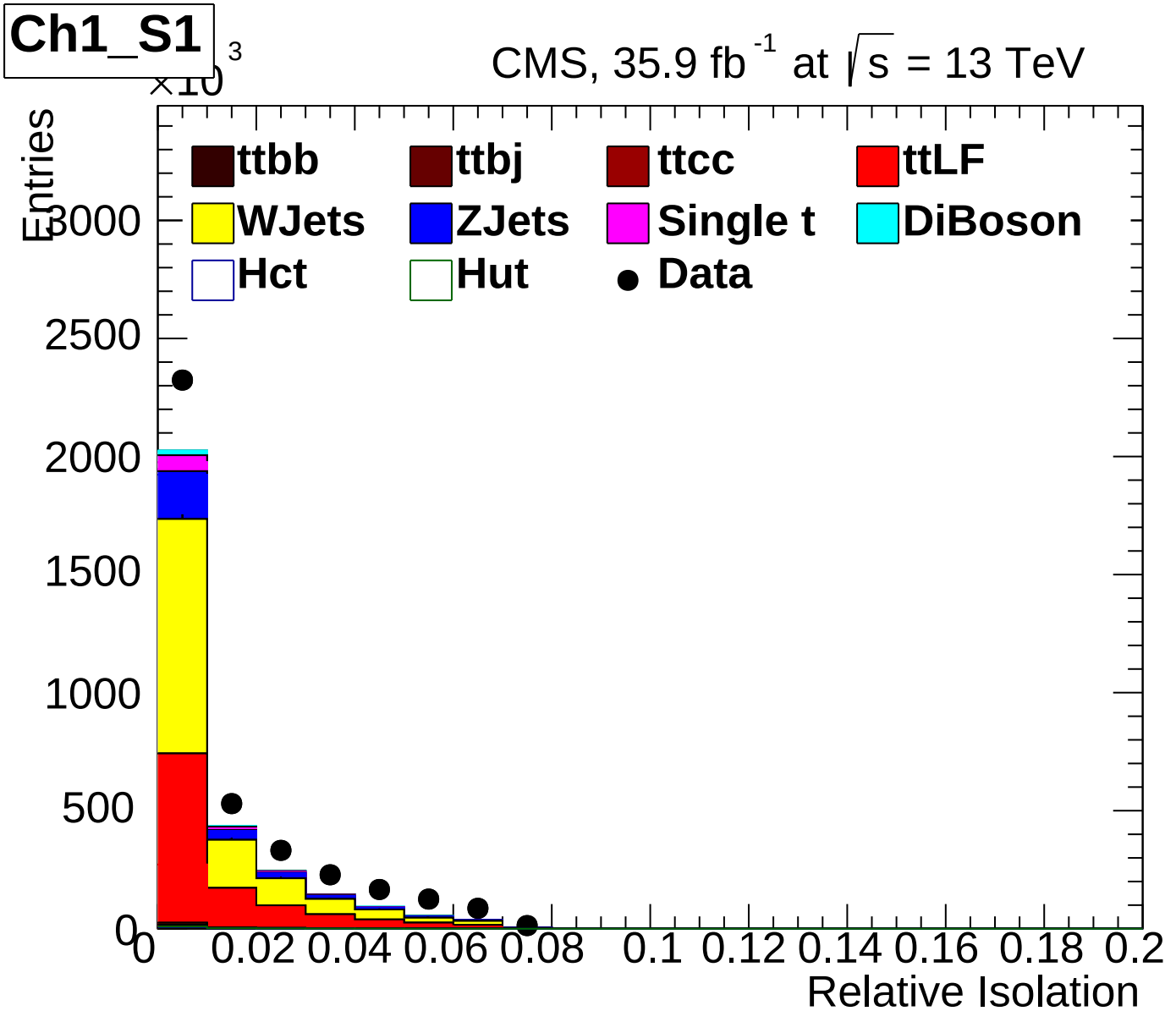
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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ttcc
ttLF
WJets
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Single t
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Hct
Hut
Data
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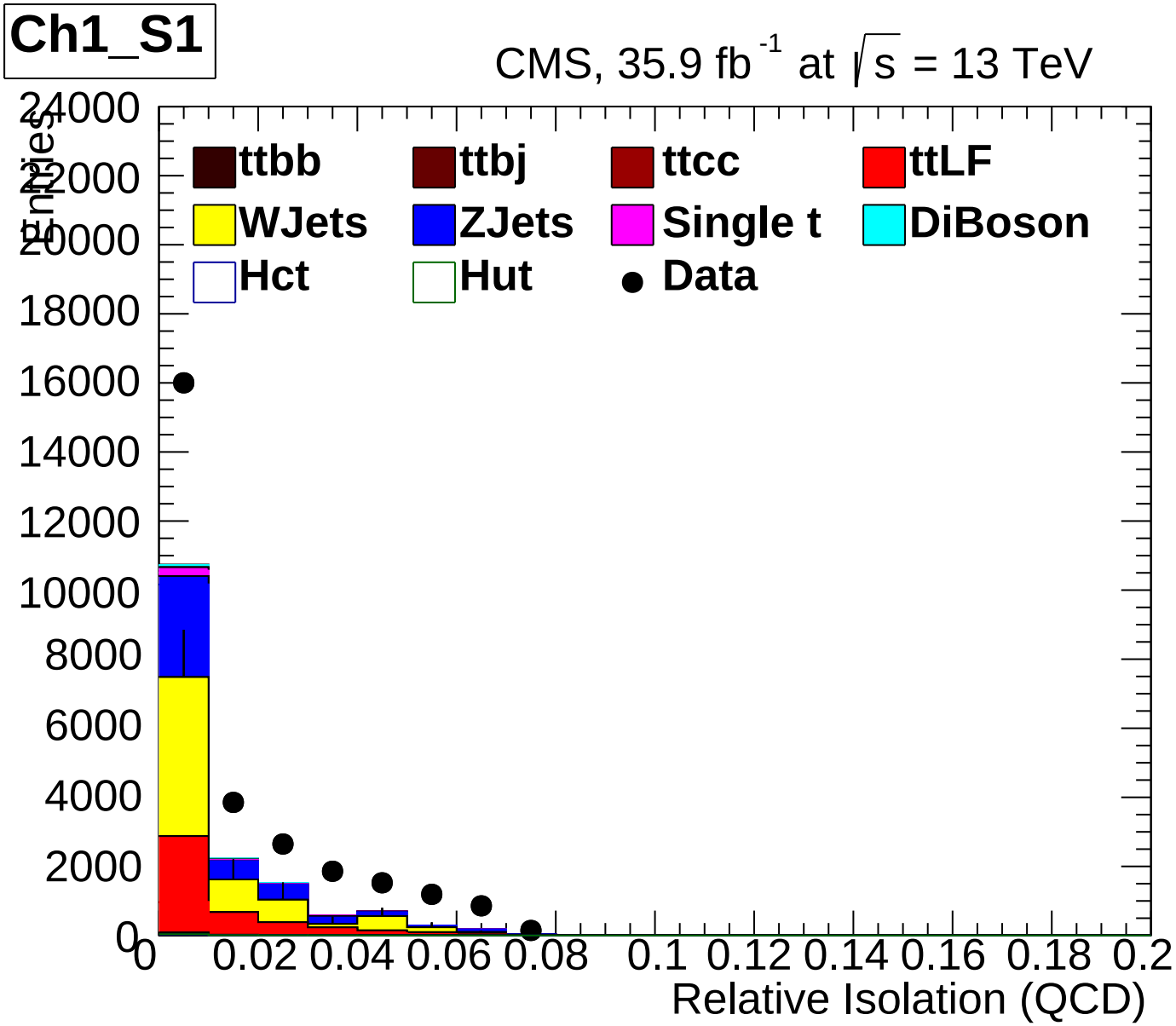
2500
2000
1500
1000
500
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.02
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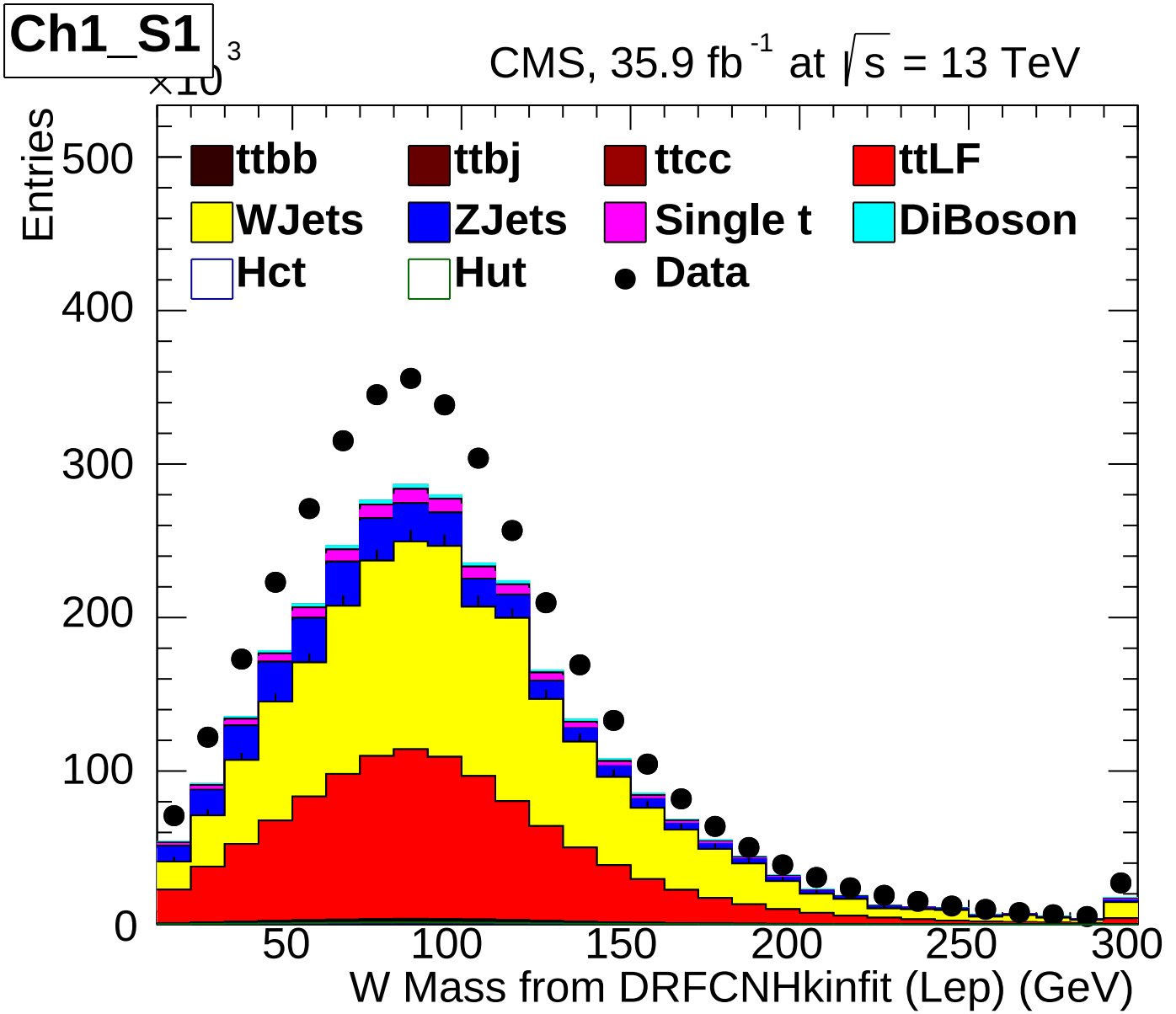
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
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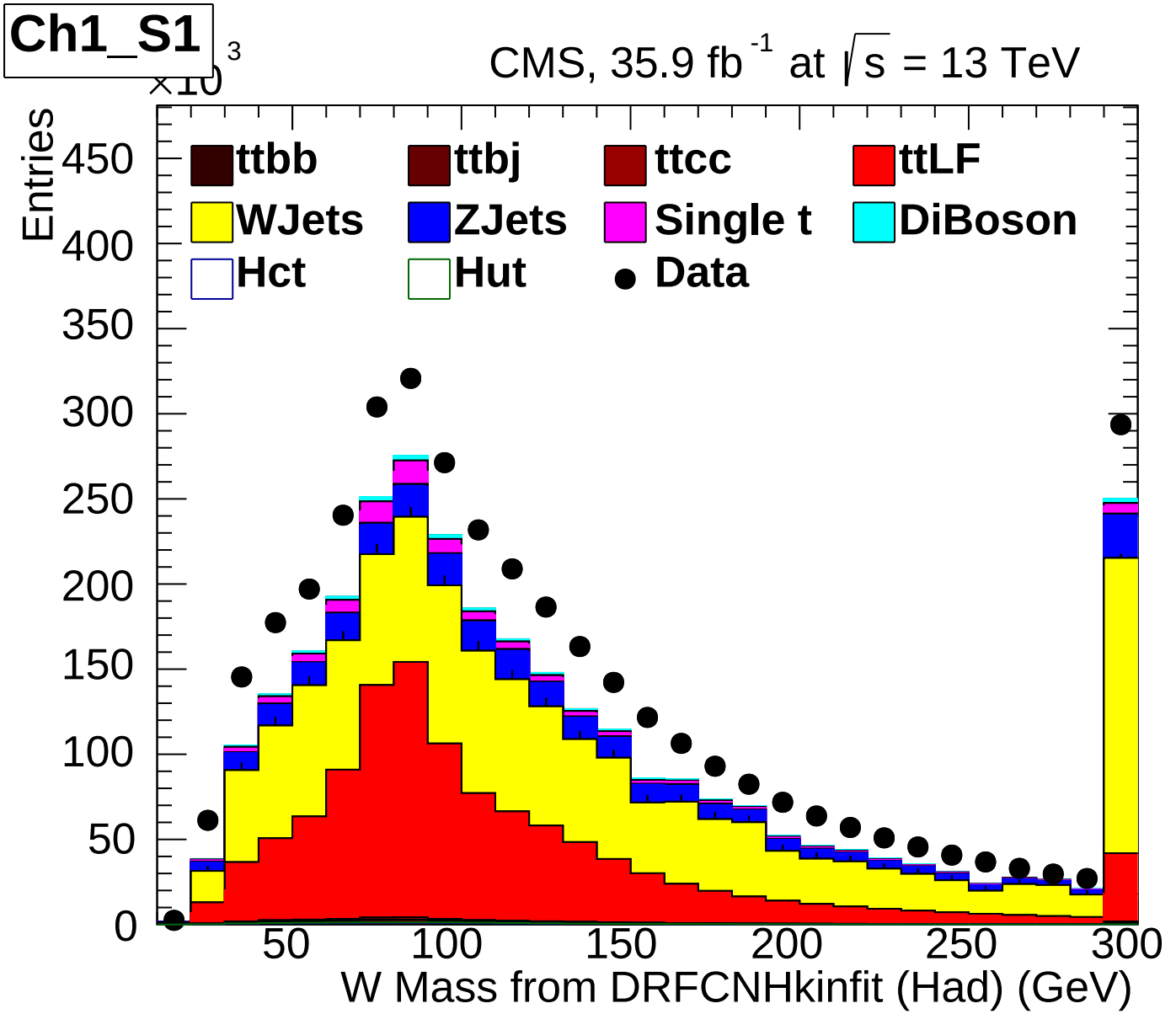
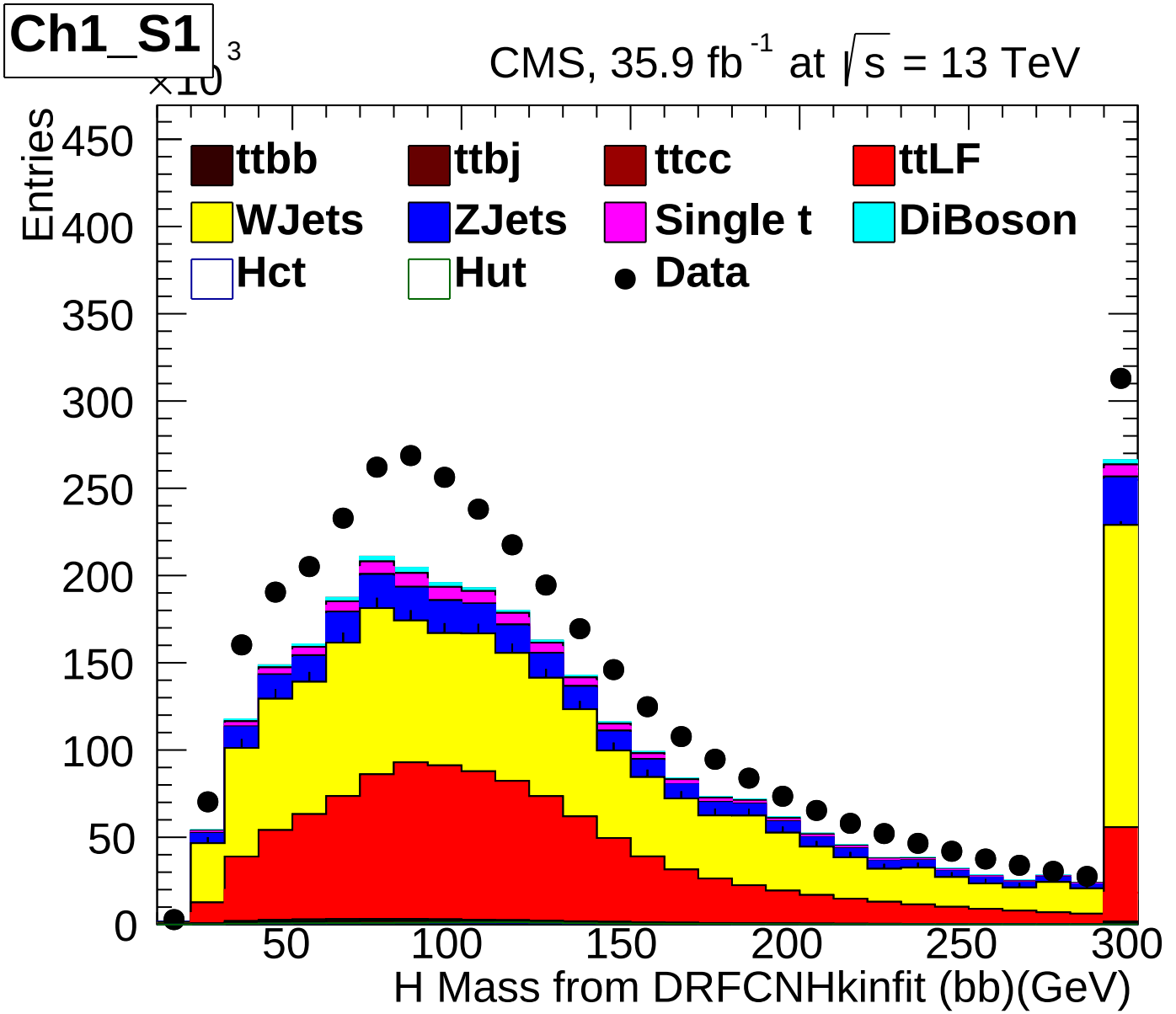
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
400
450
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
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ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
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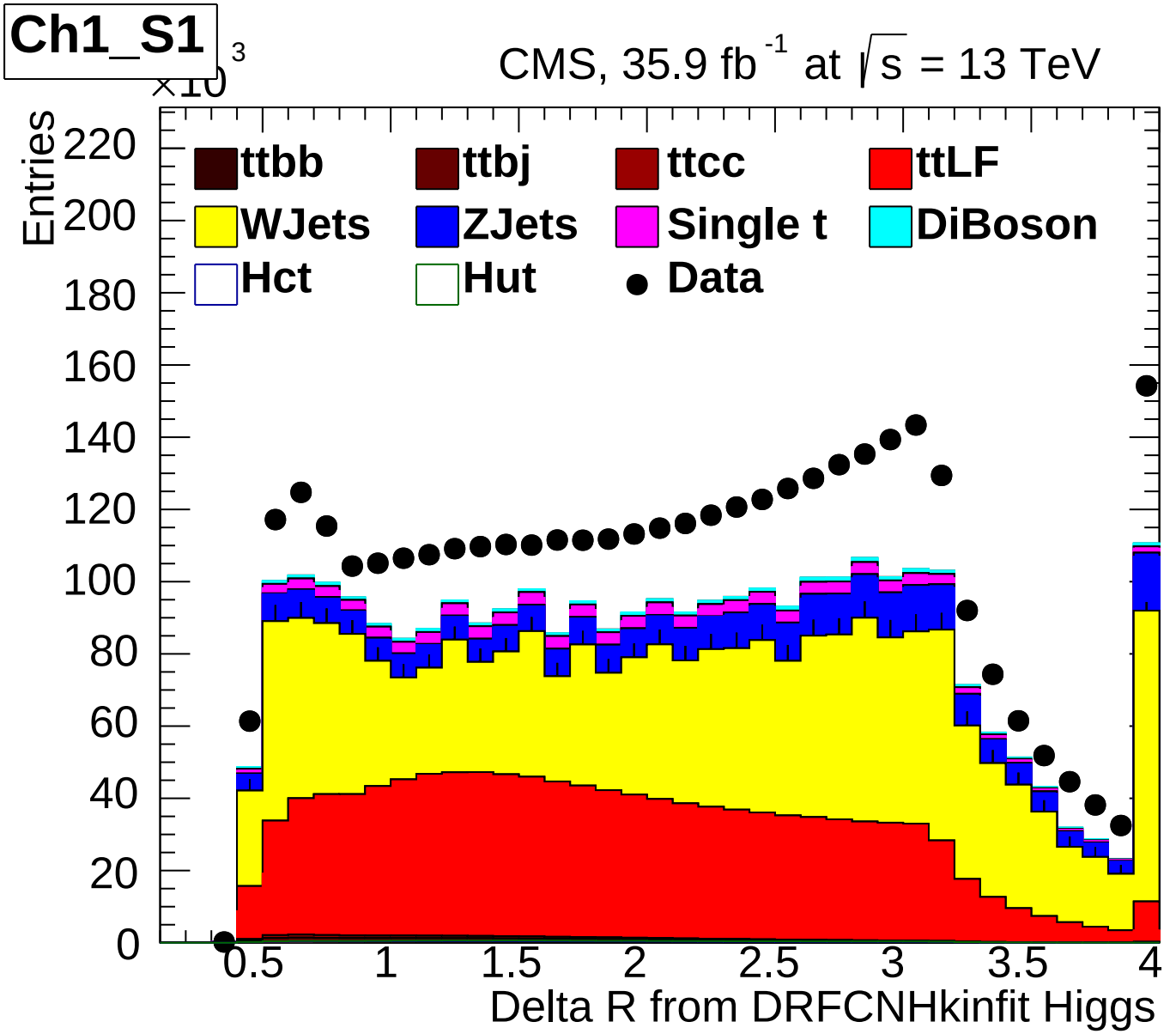
300
350
400
450
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
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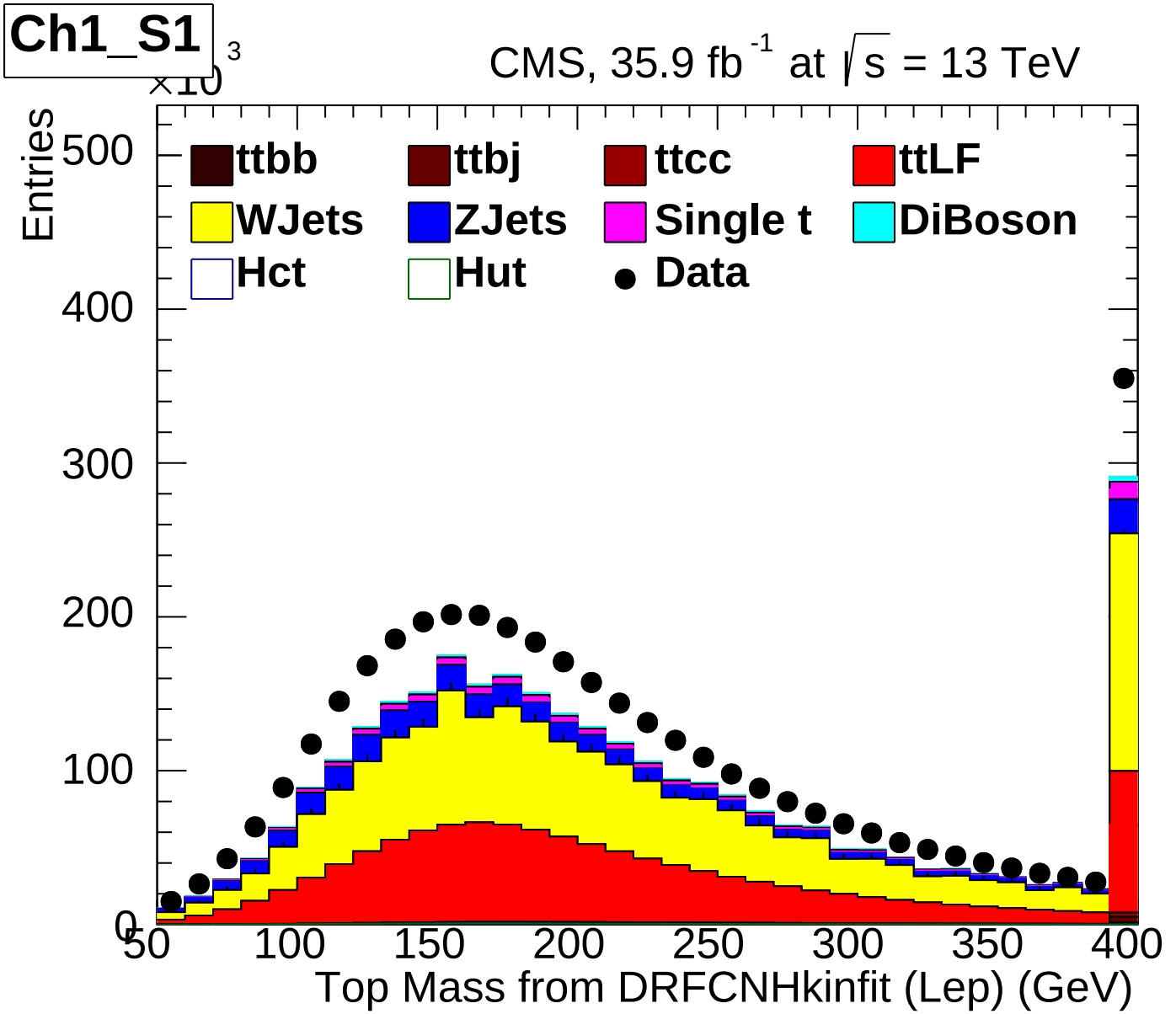
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
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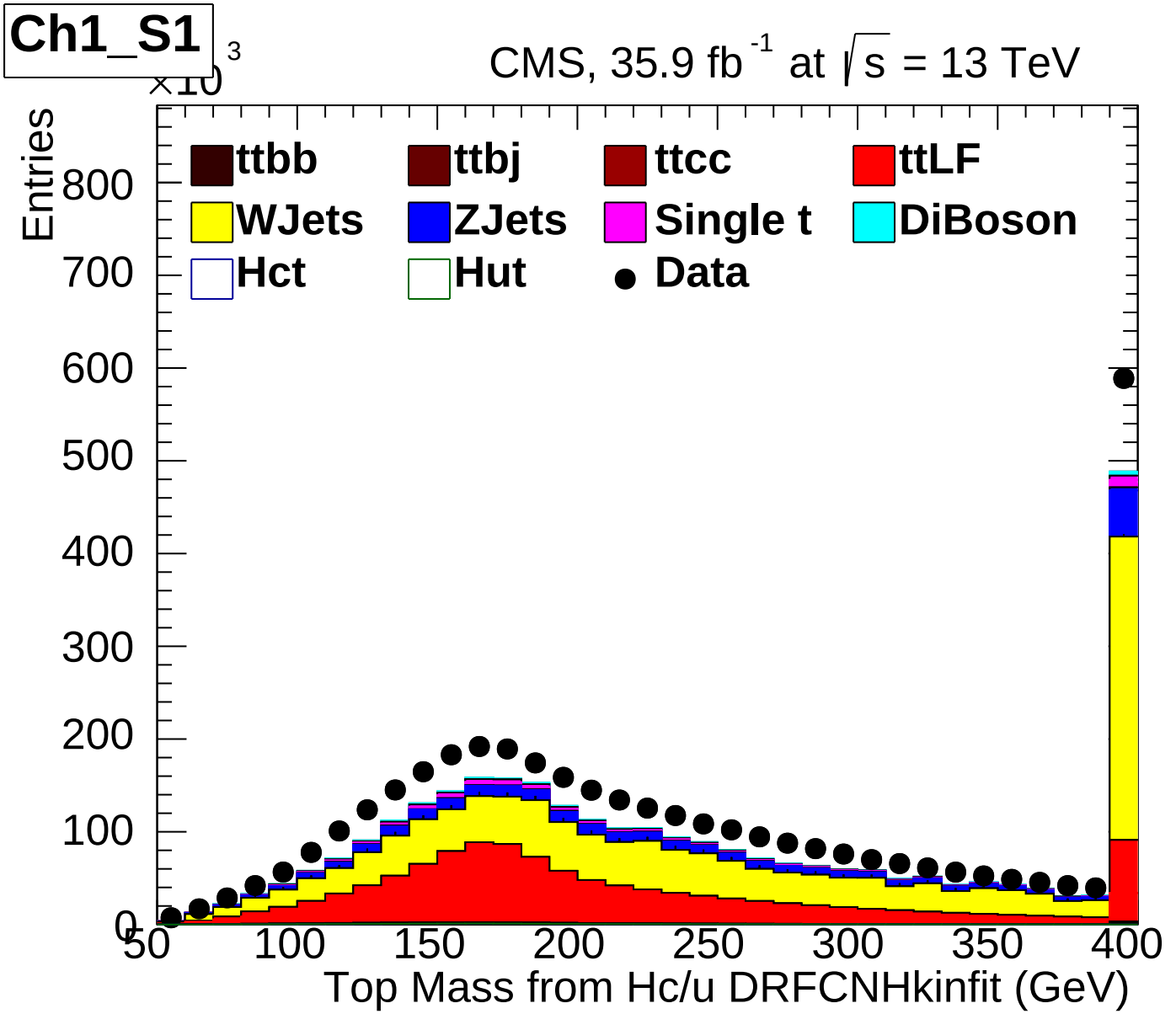
400
500
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S1
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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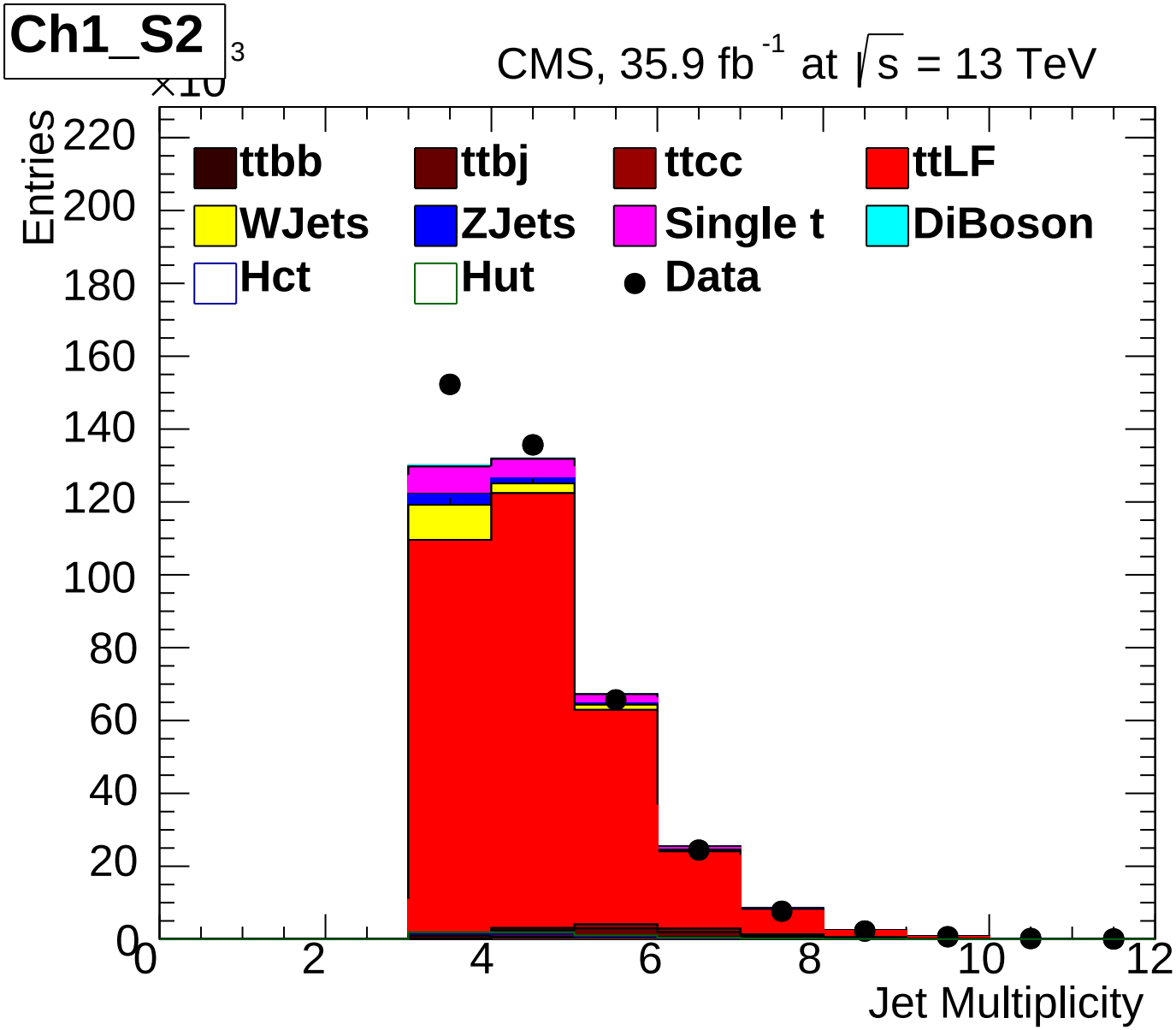
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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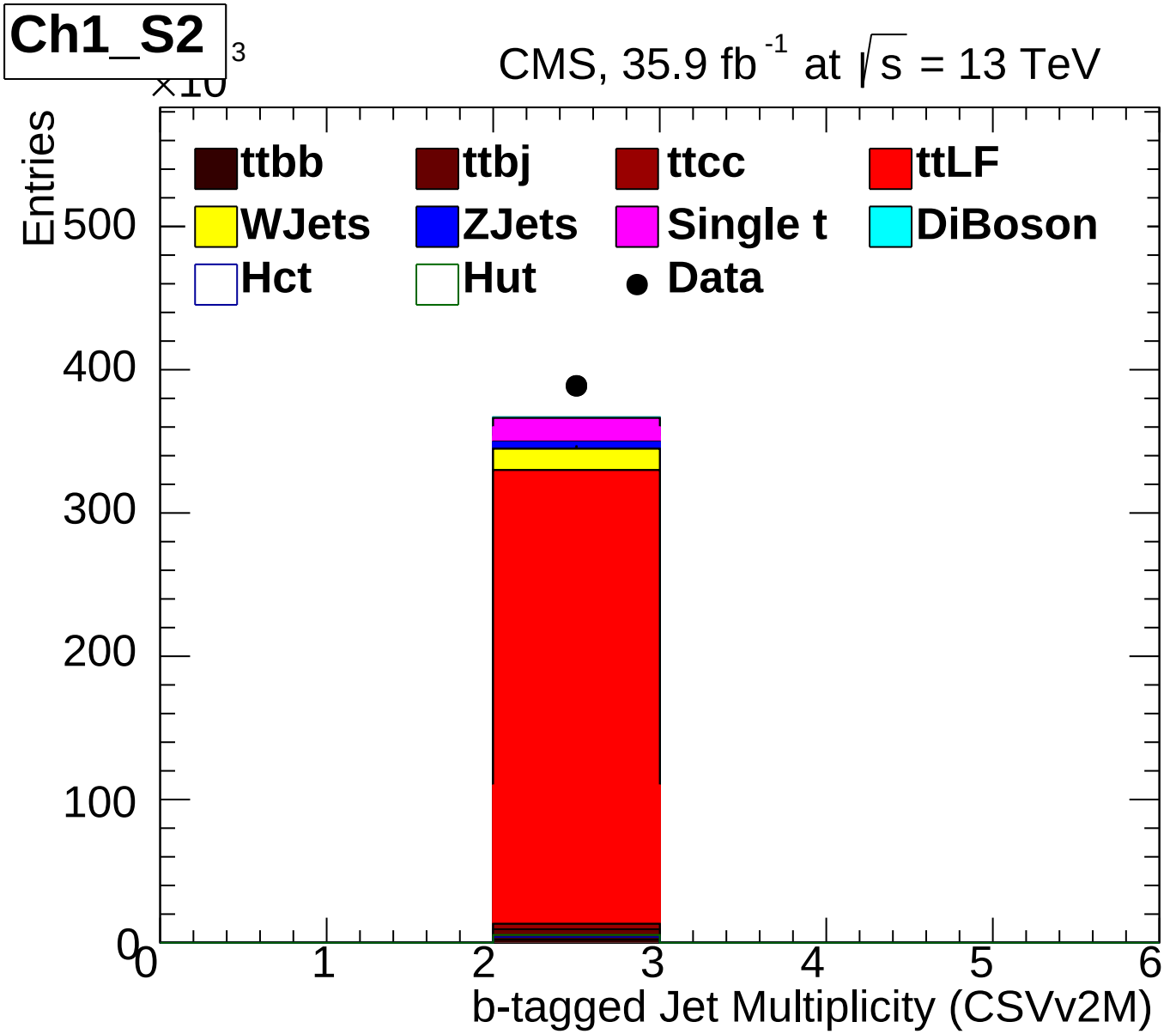
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
0
2
4
6
8
10
12
Jet Multiplicity


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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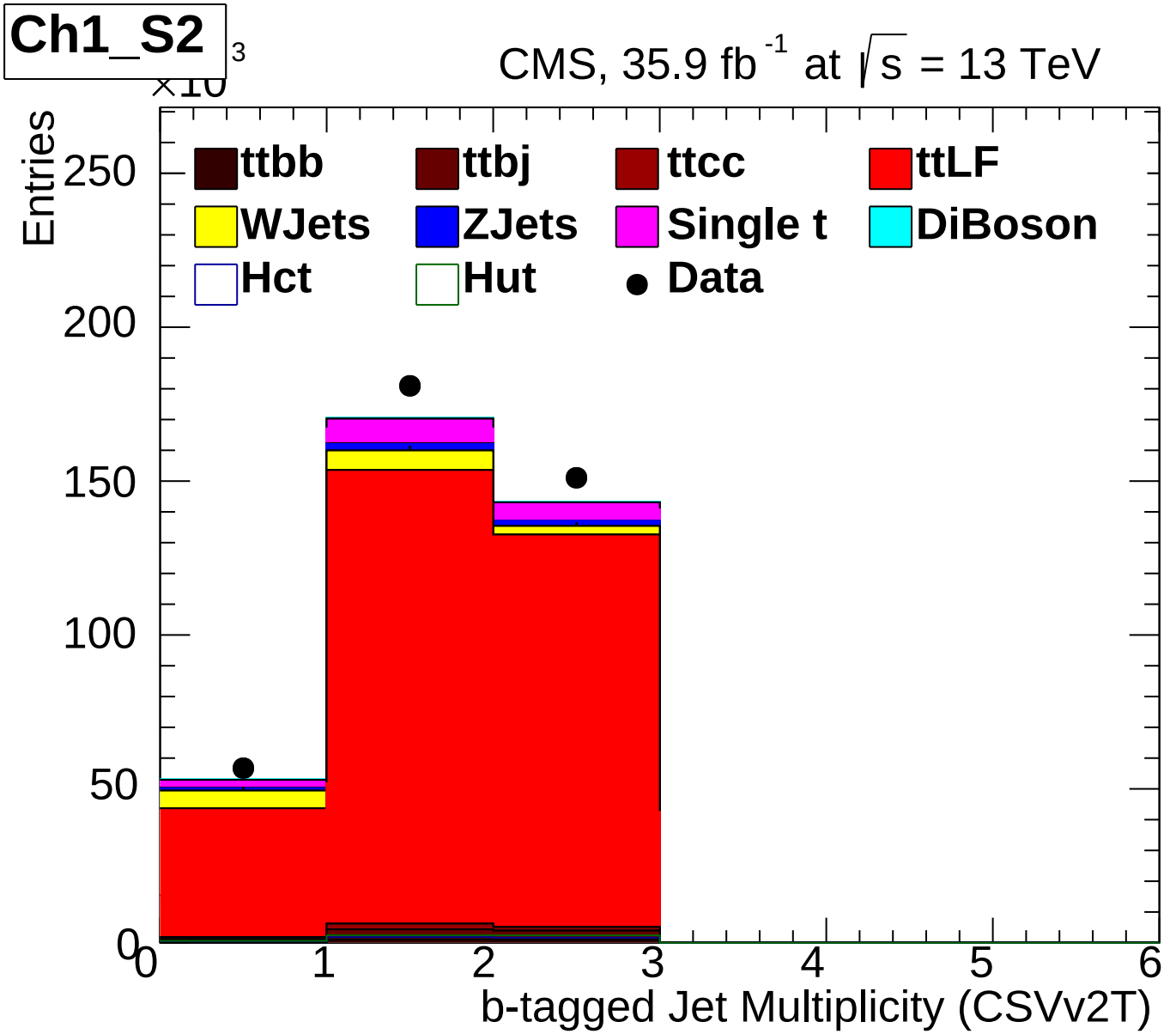
100
200
300
400
500
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
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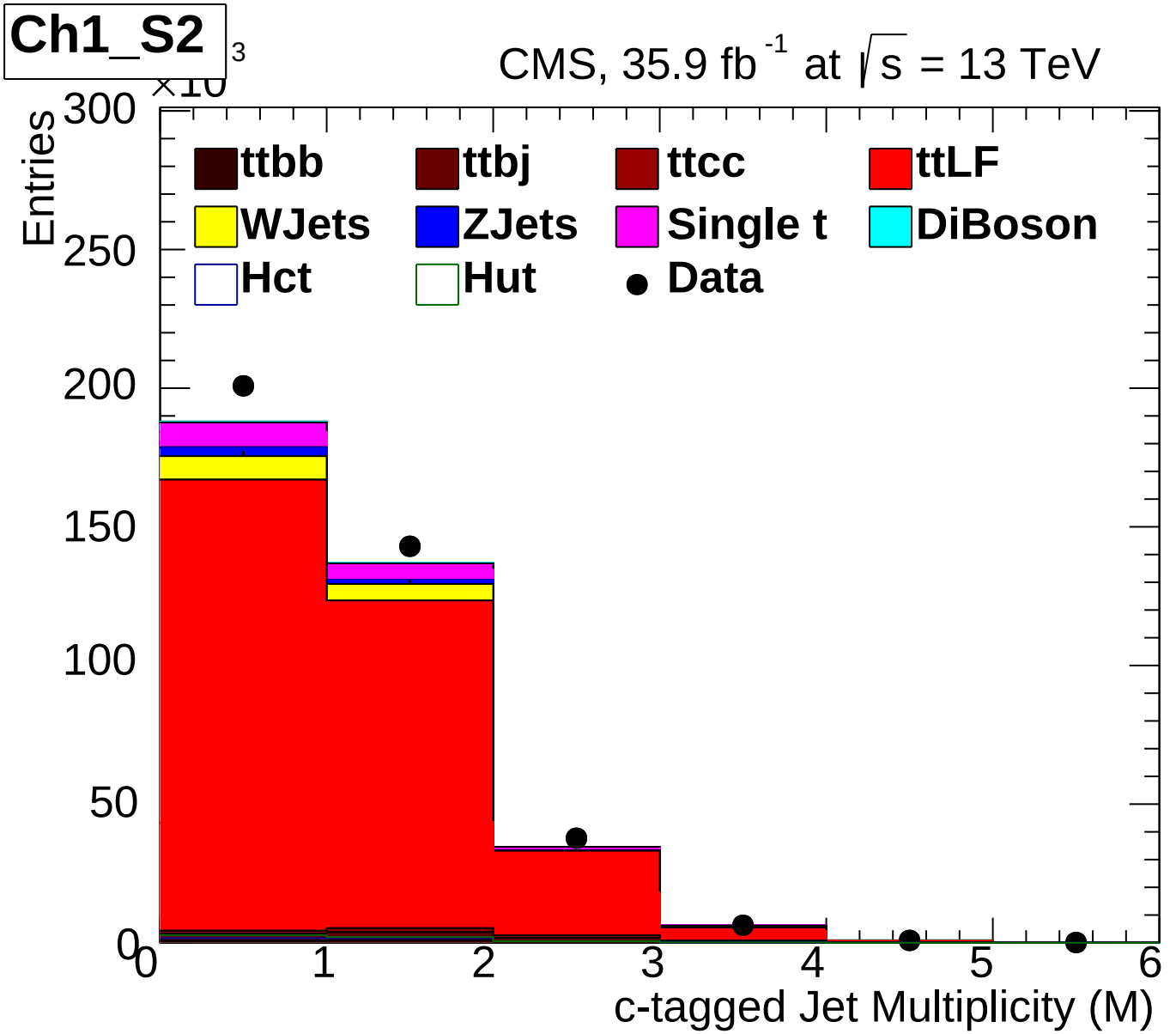
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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ttbb
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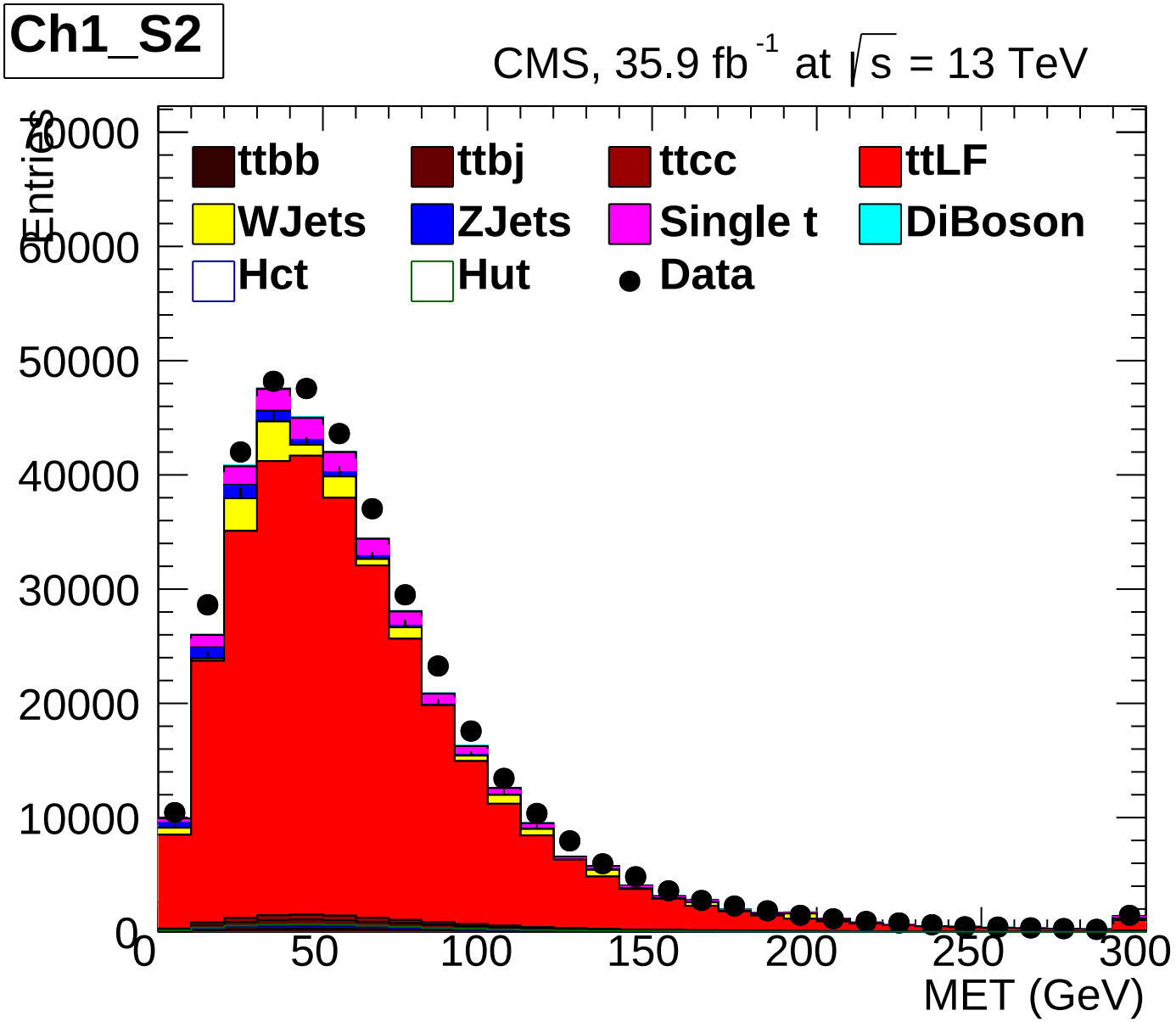
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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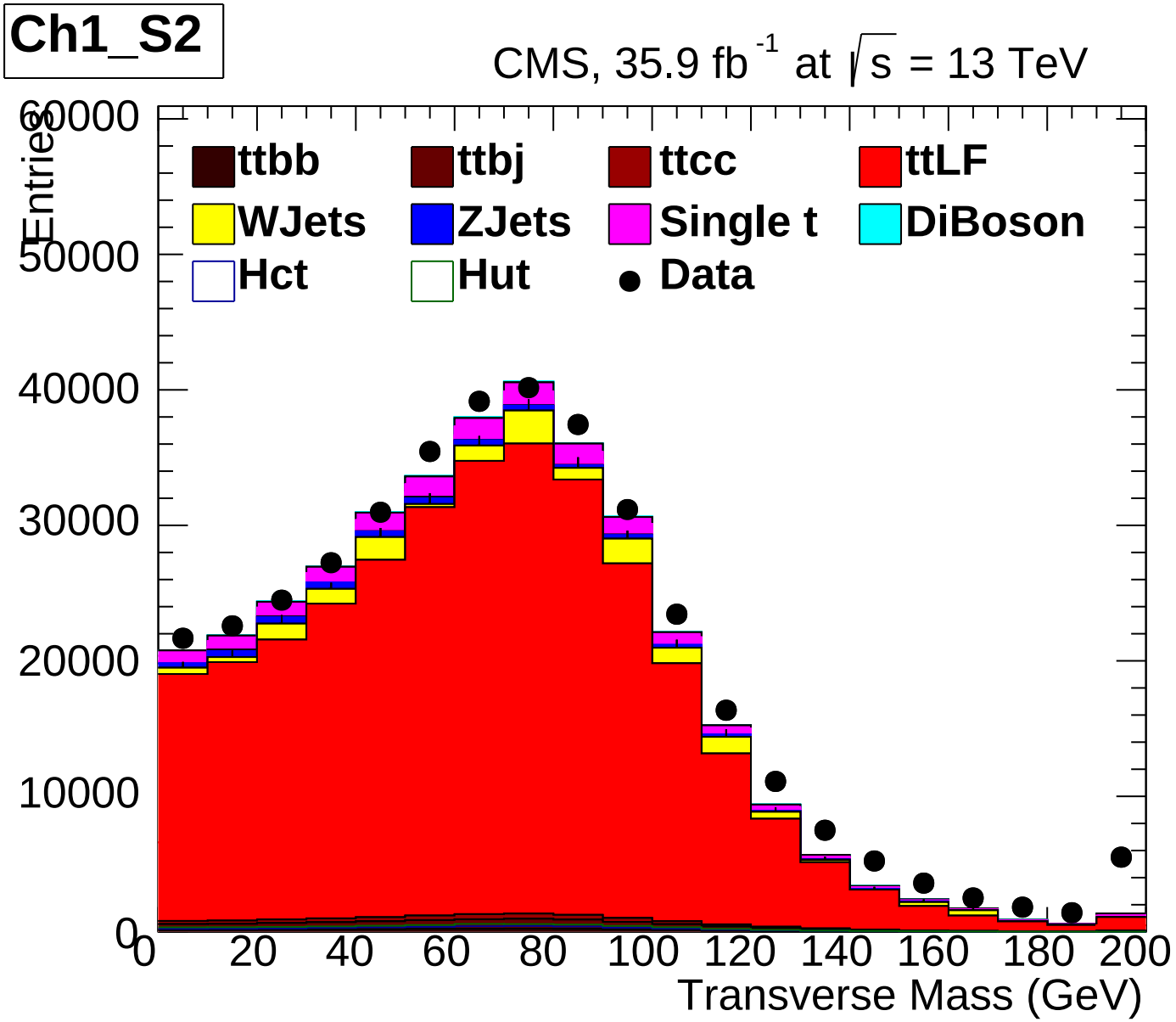
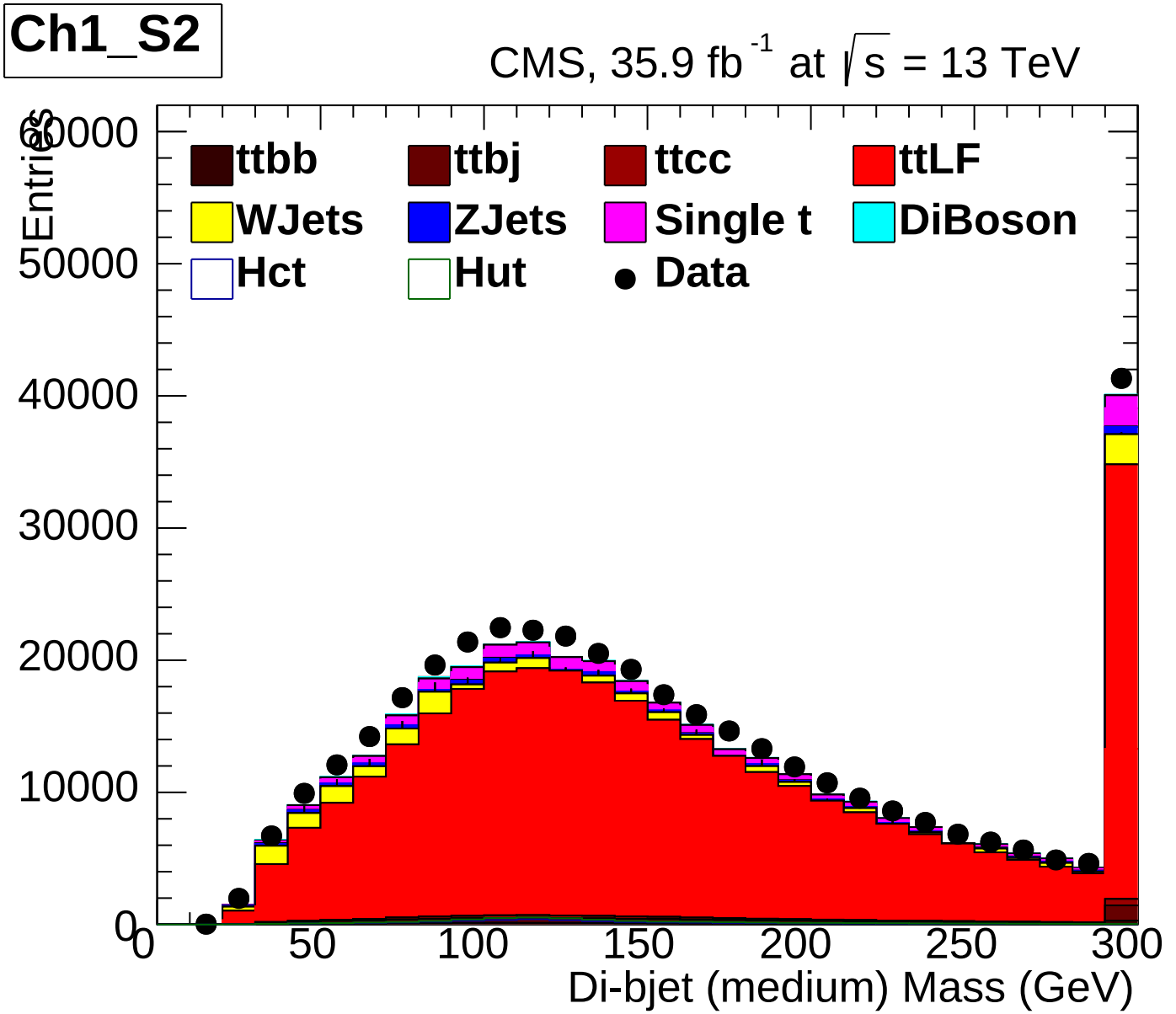
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
70000
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
MET (GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
60000
50000
40000
30000
20000
10000
0
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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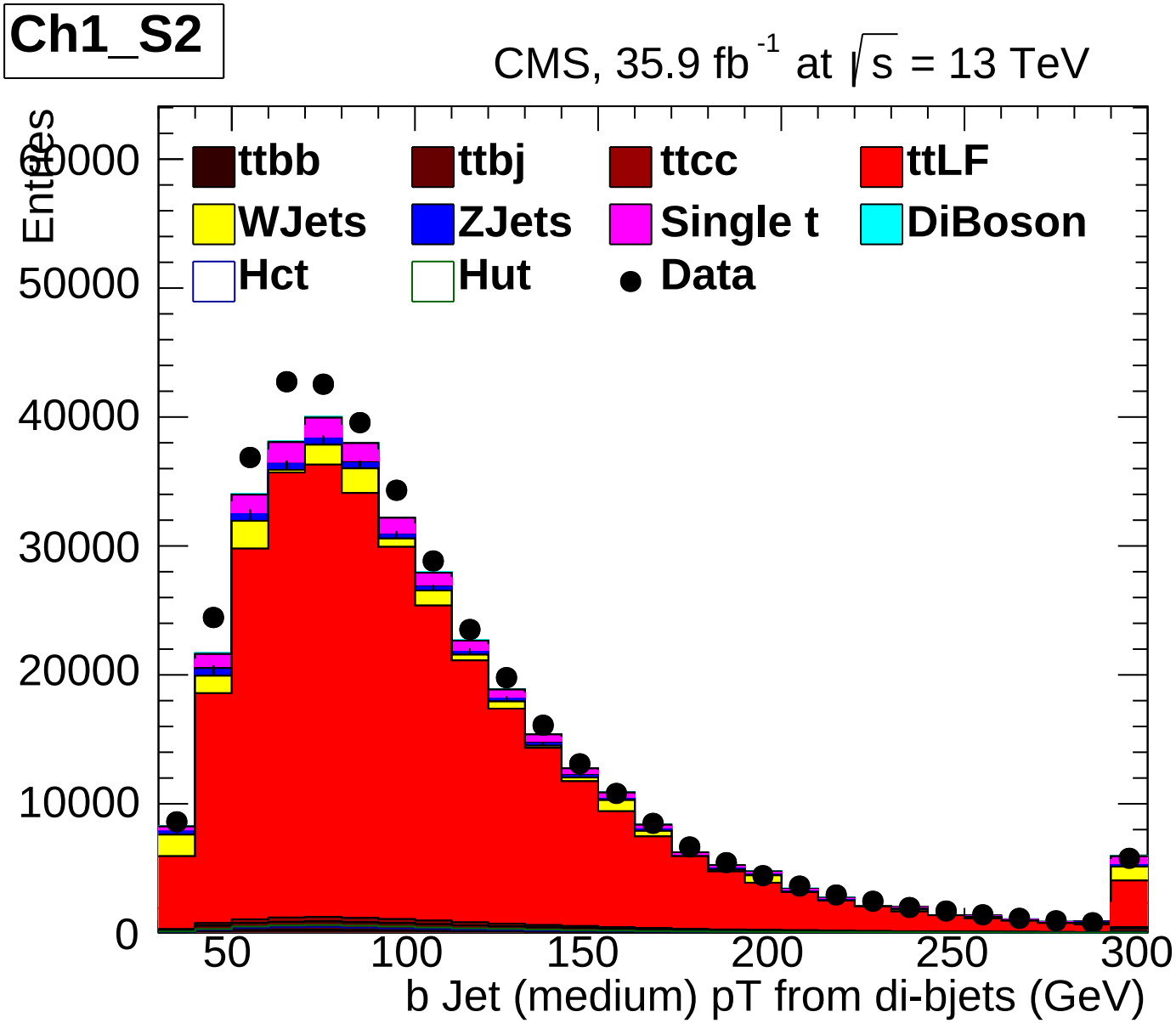
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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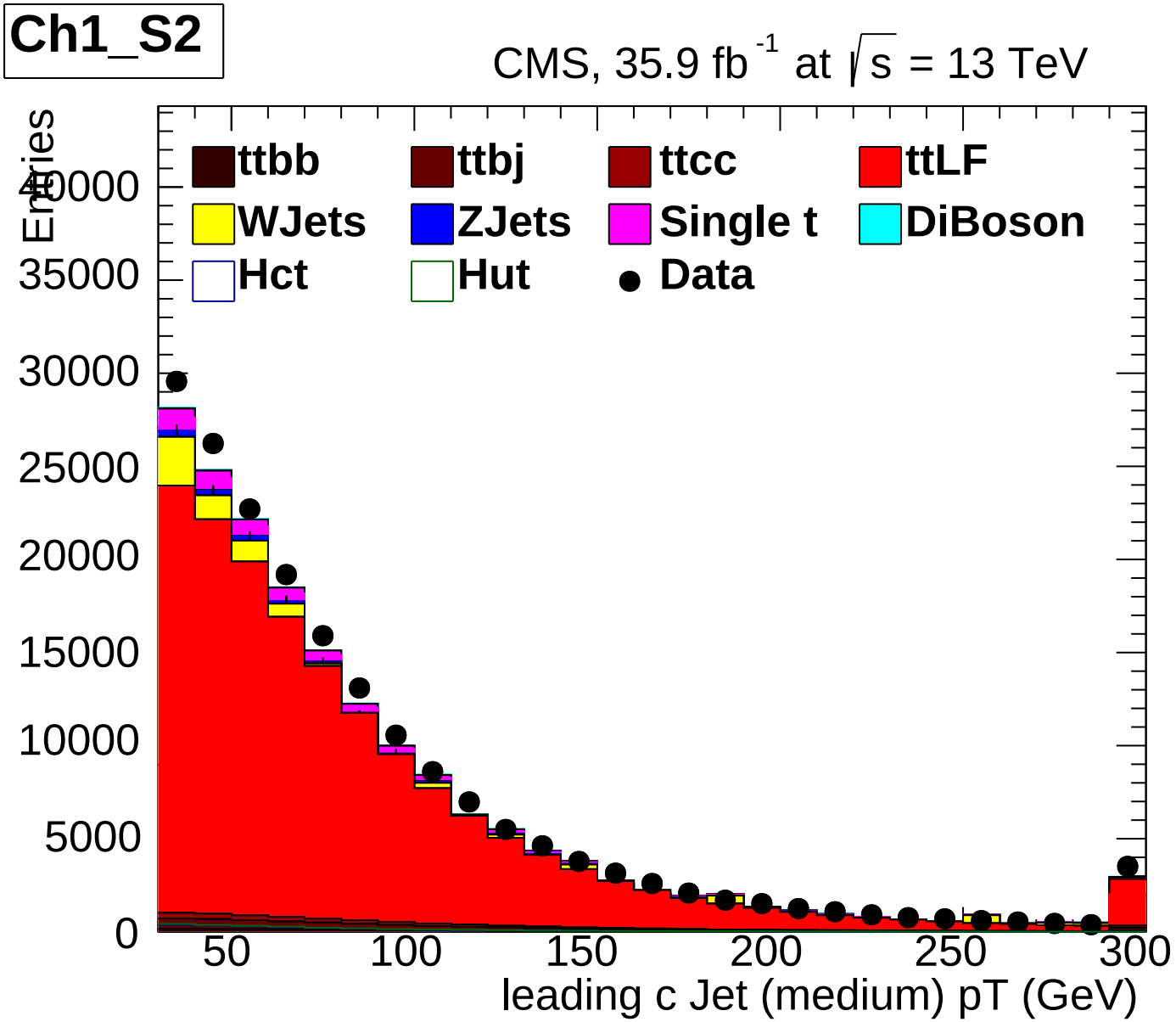
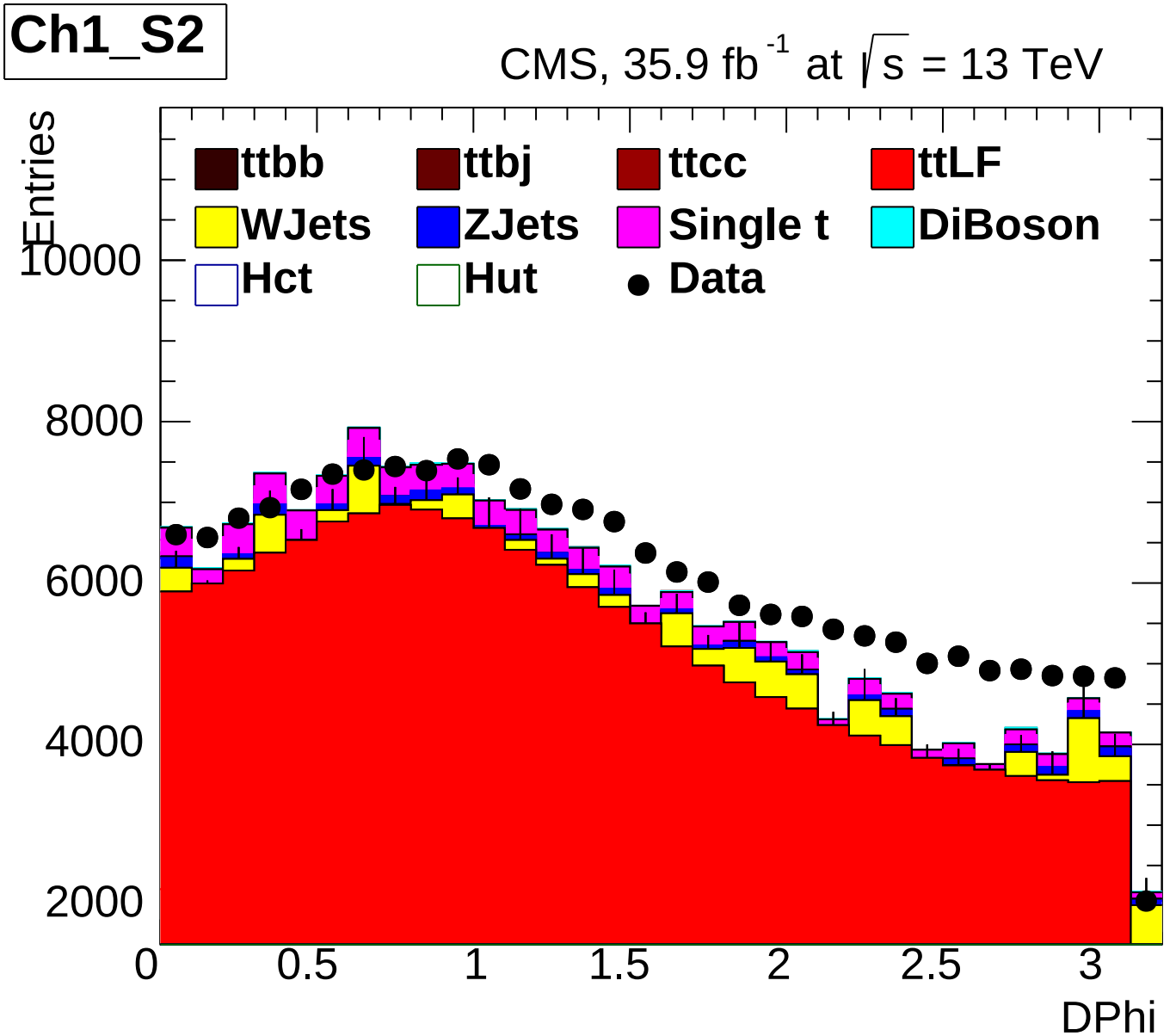
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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8000
6000
4000
2000
0
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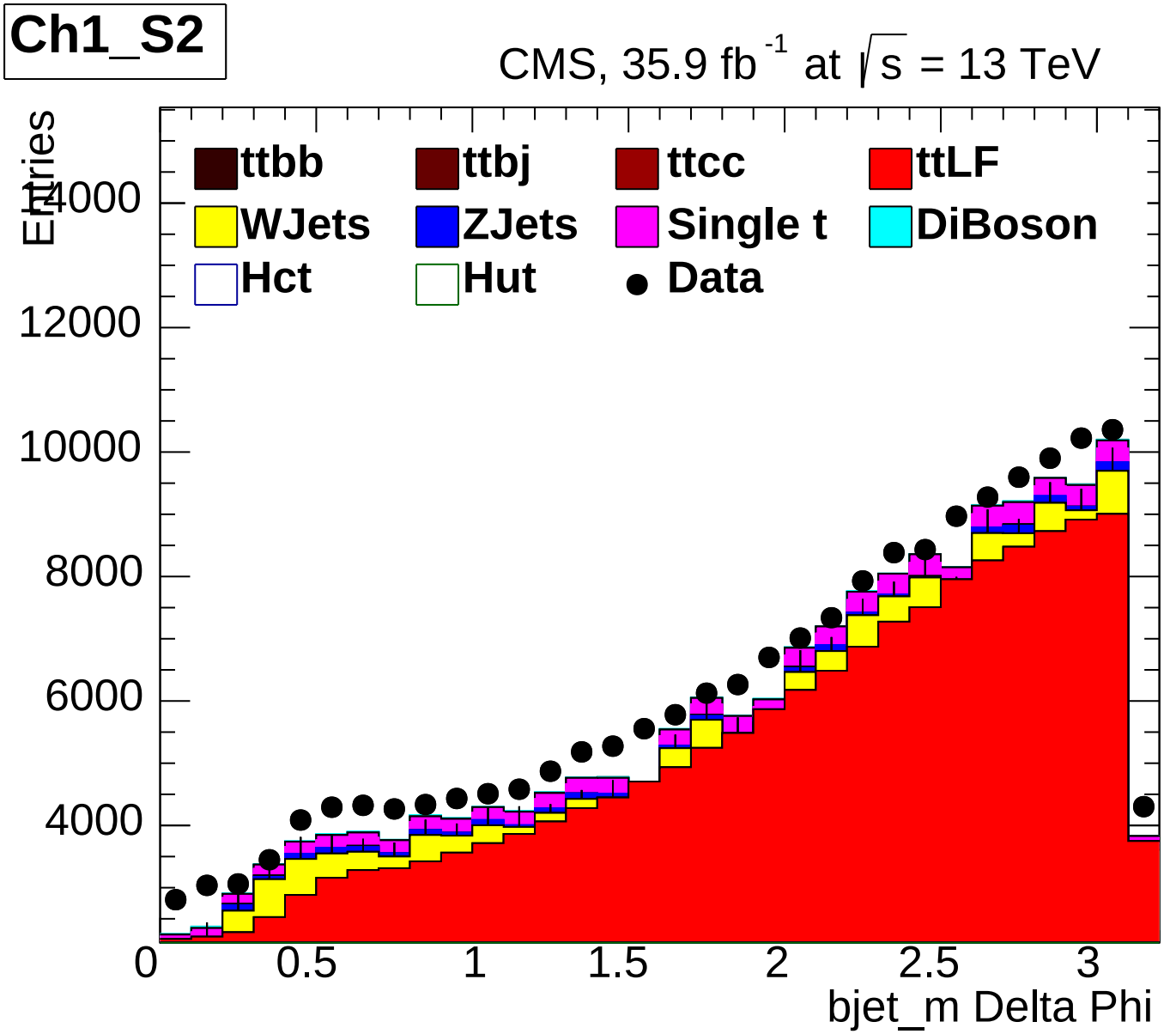
1
1.5
2
2.5
3
DPhi


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
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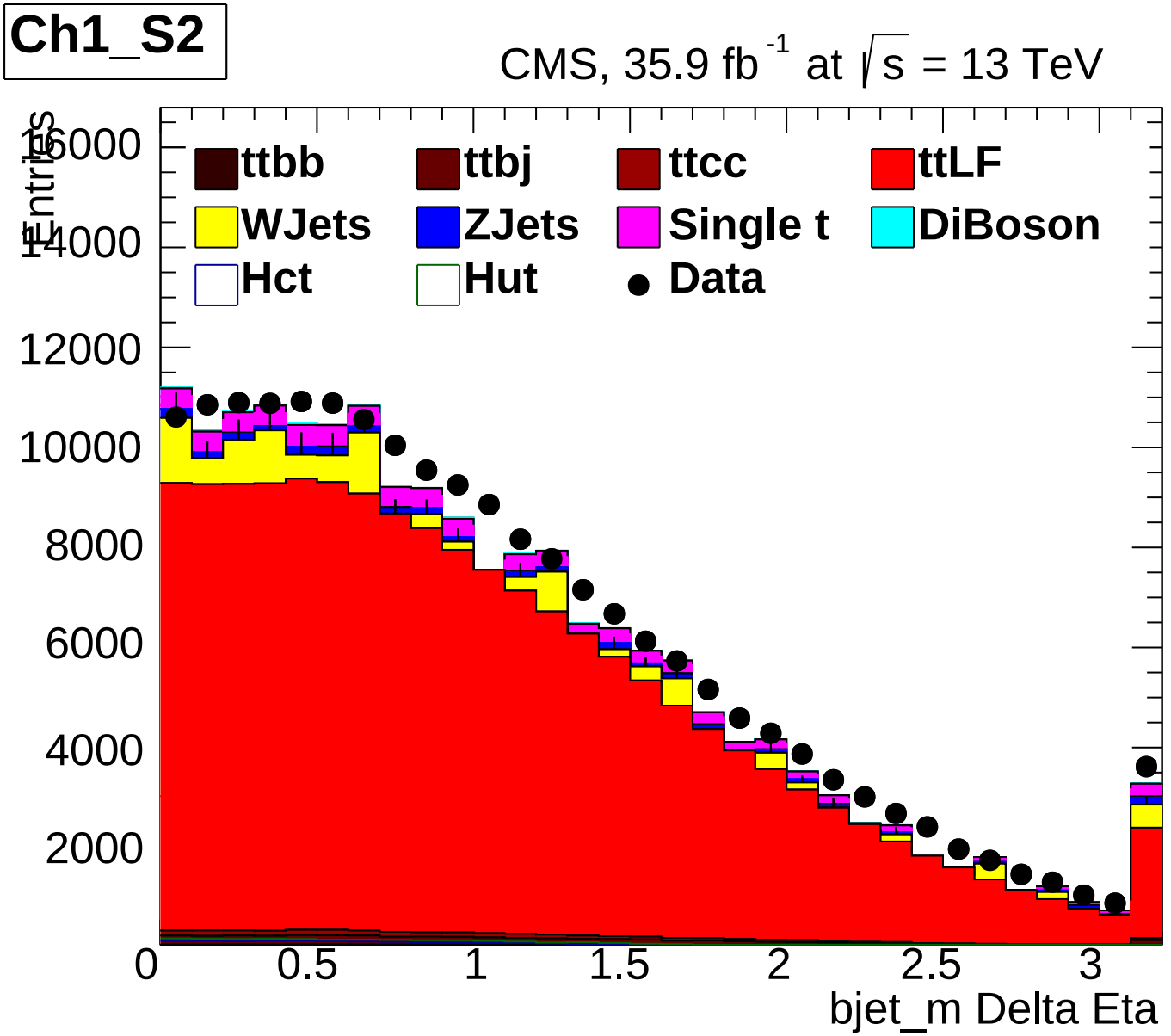
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
14000
12000
10000
8000
6000
4000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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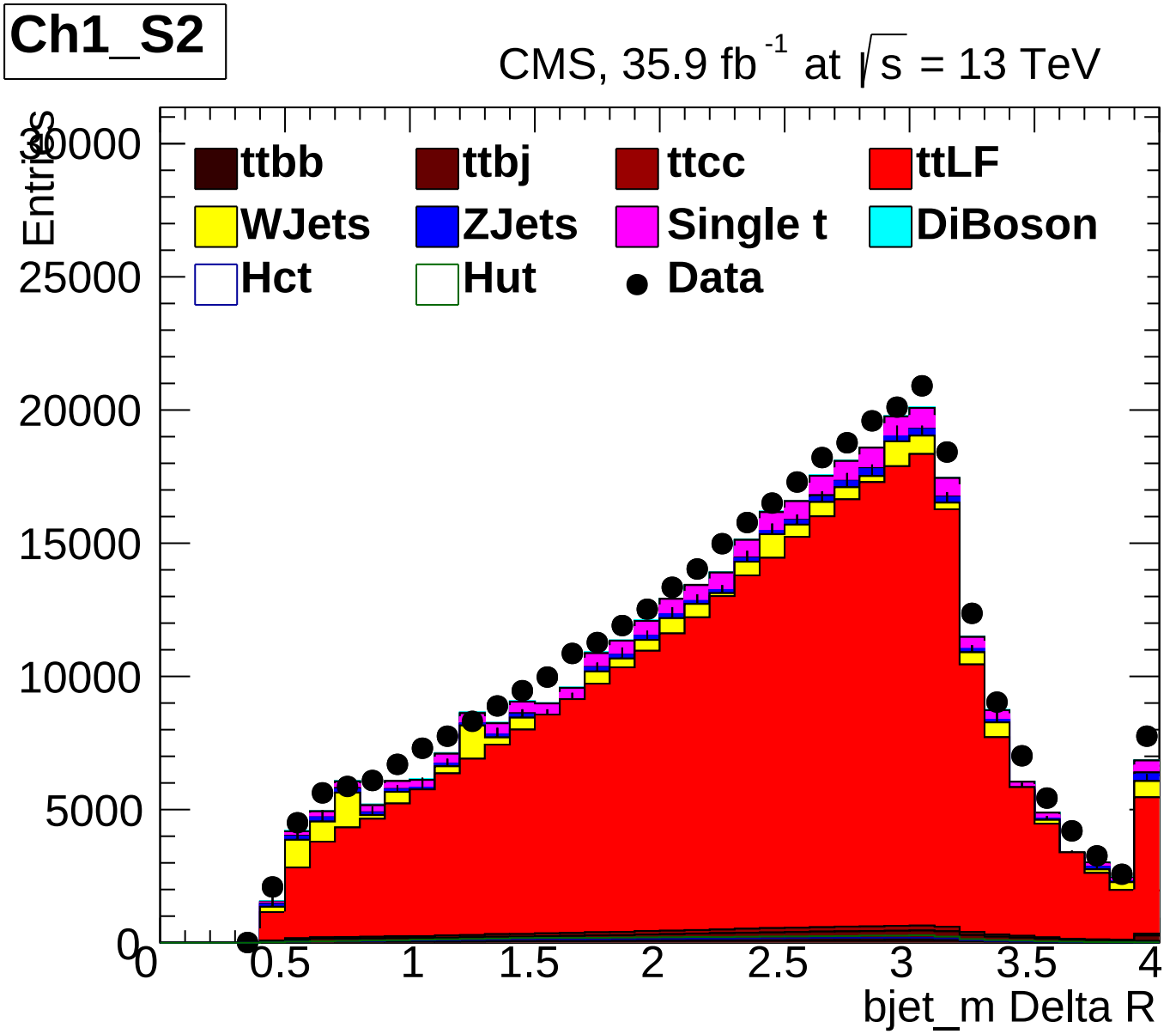
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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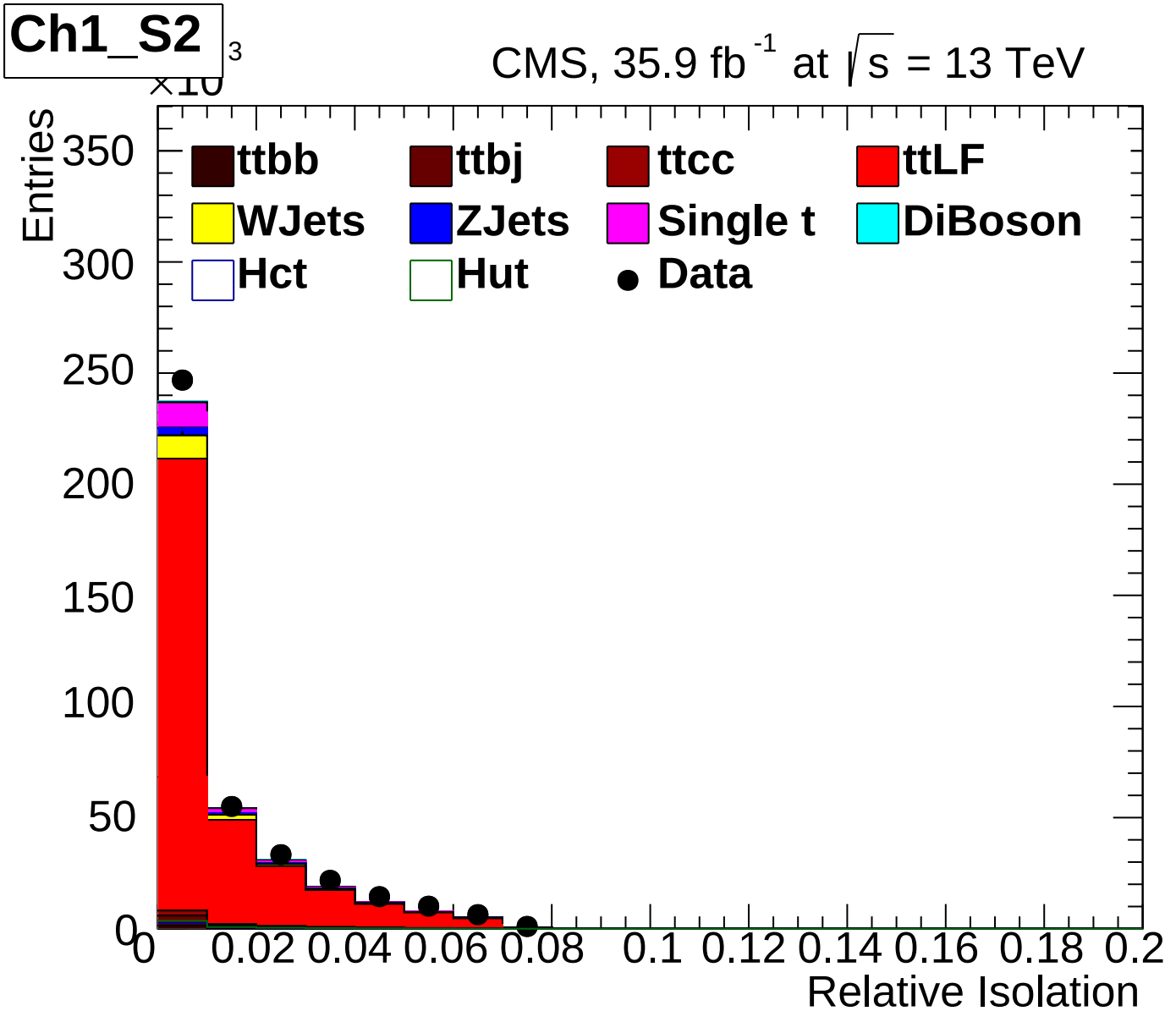
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
350
300
250
200
150
100
50
0
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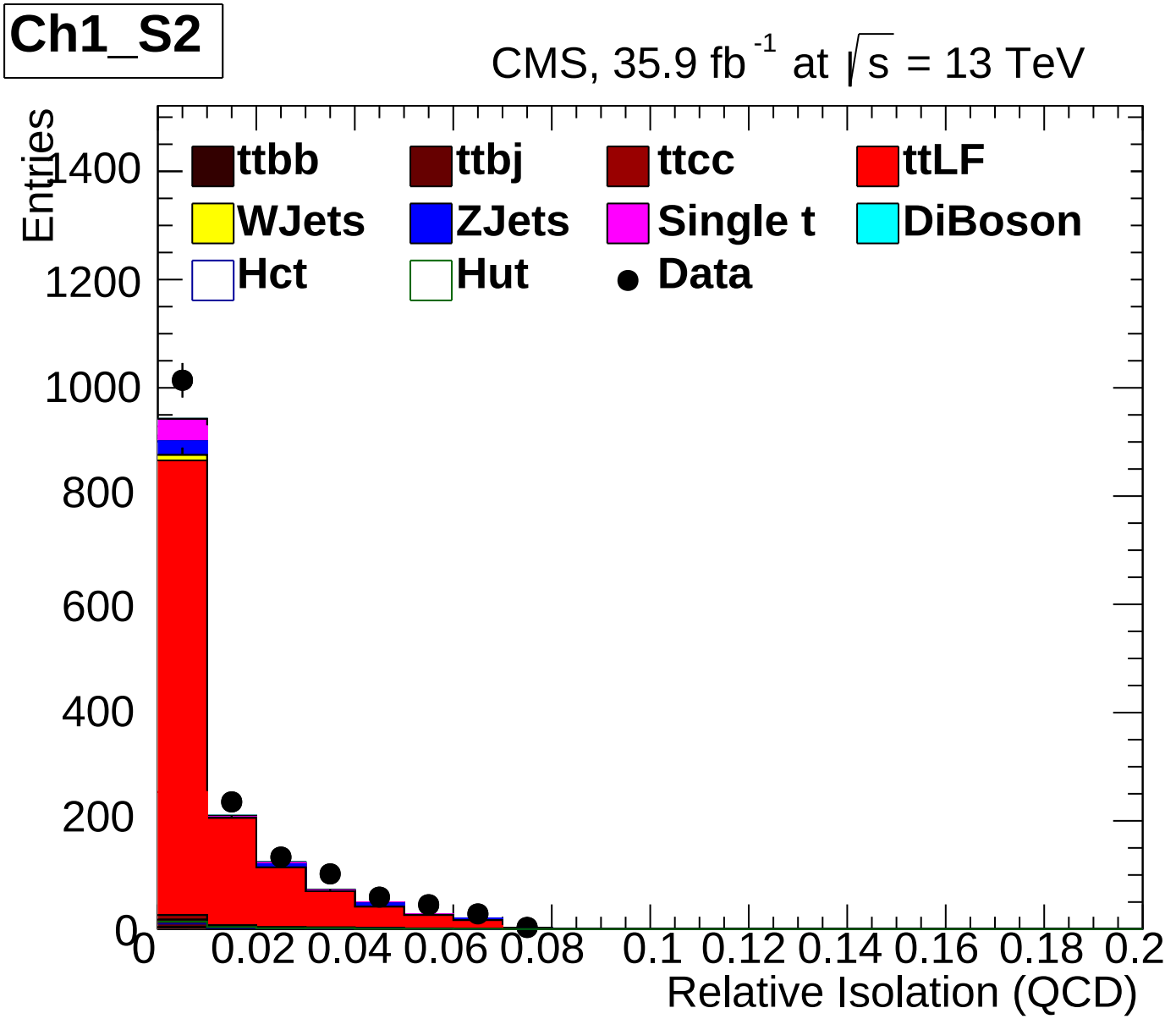
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttLF
WJets
ZJets
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DiBoson
Hct
Hut
Data
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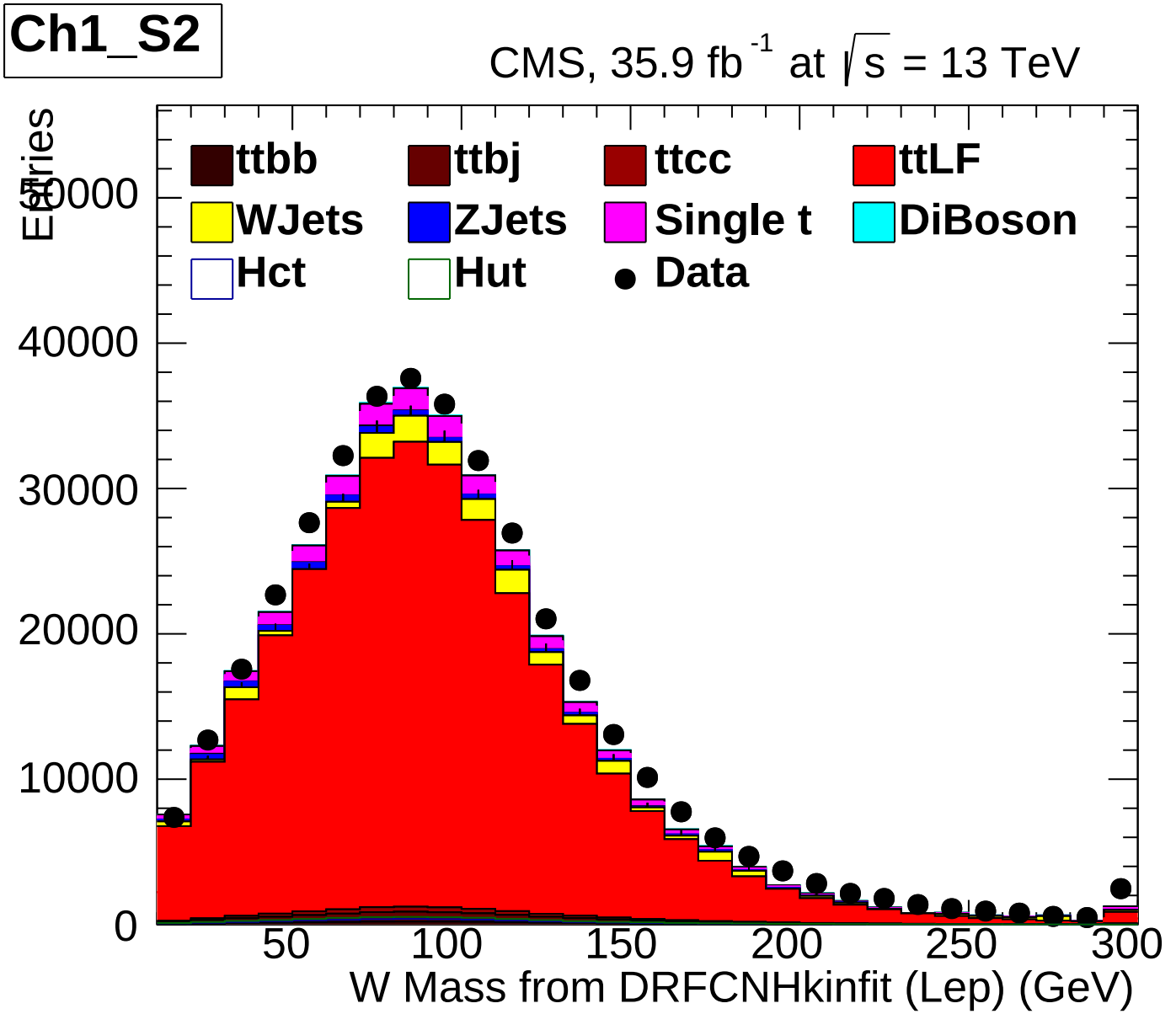
200
400
600
800
1000
1200
1400
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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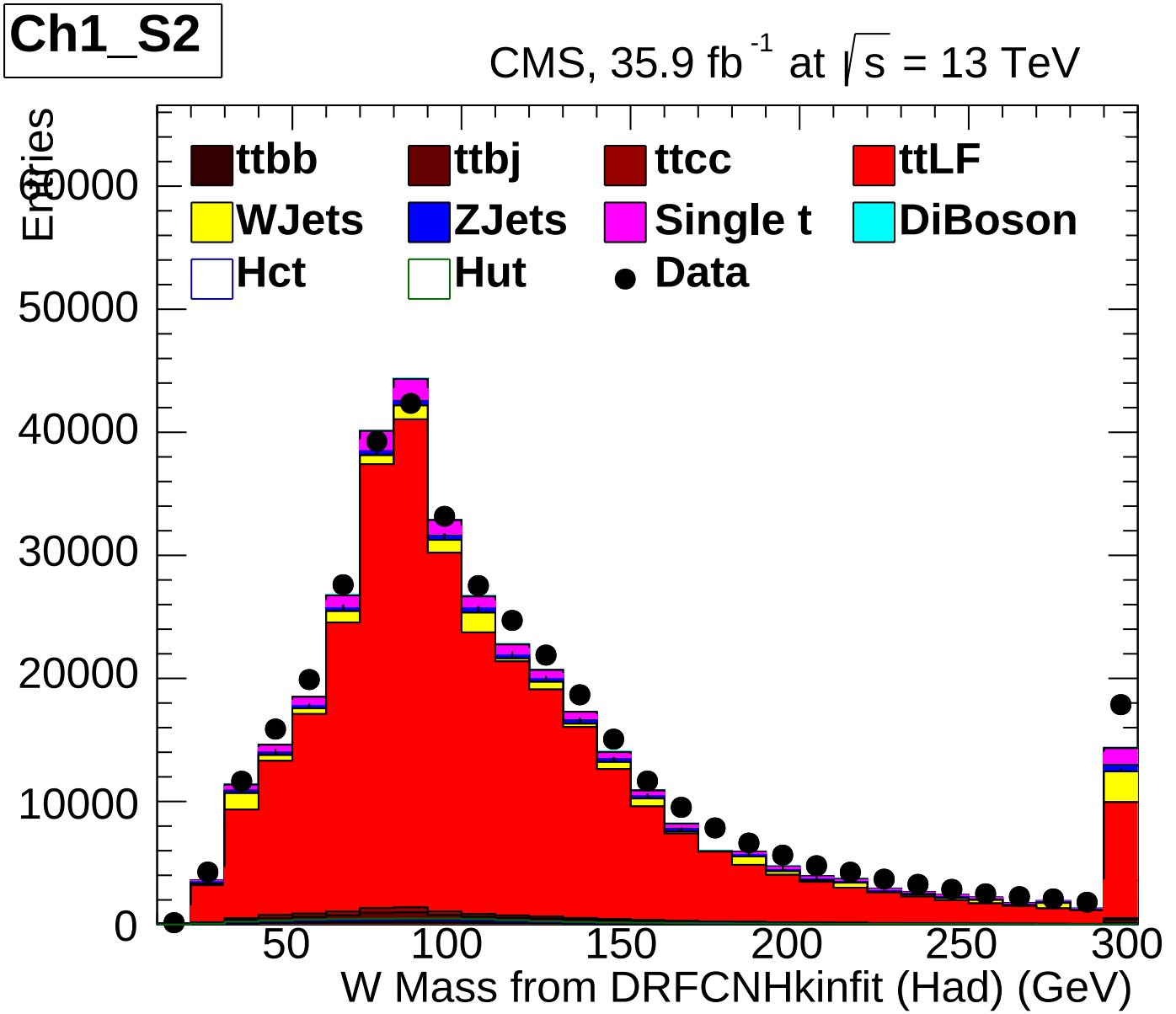
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
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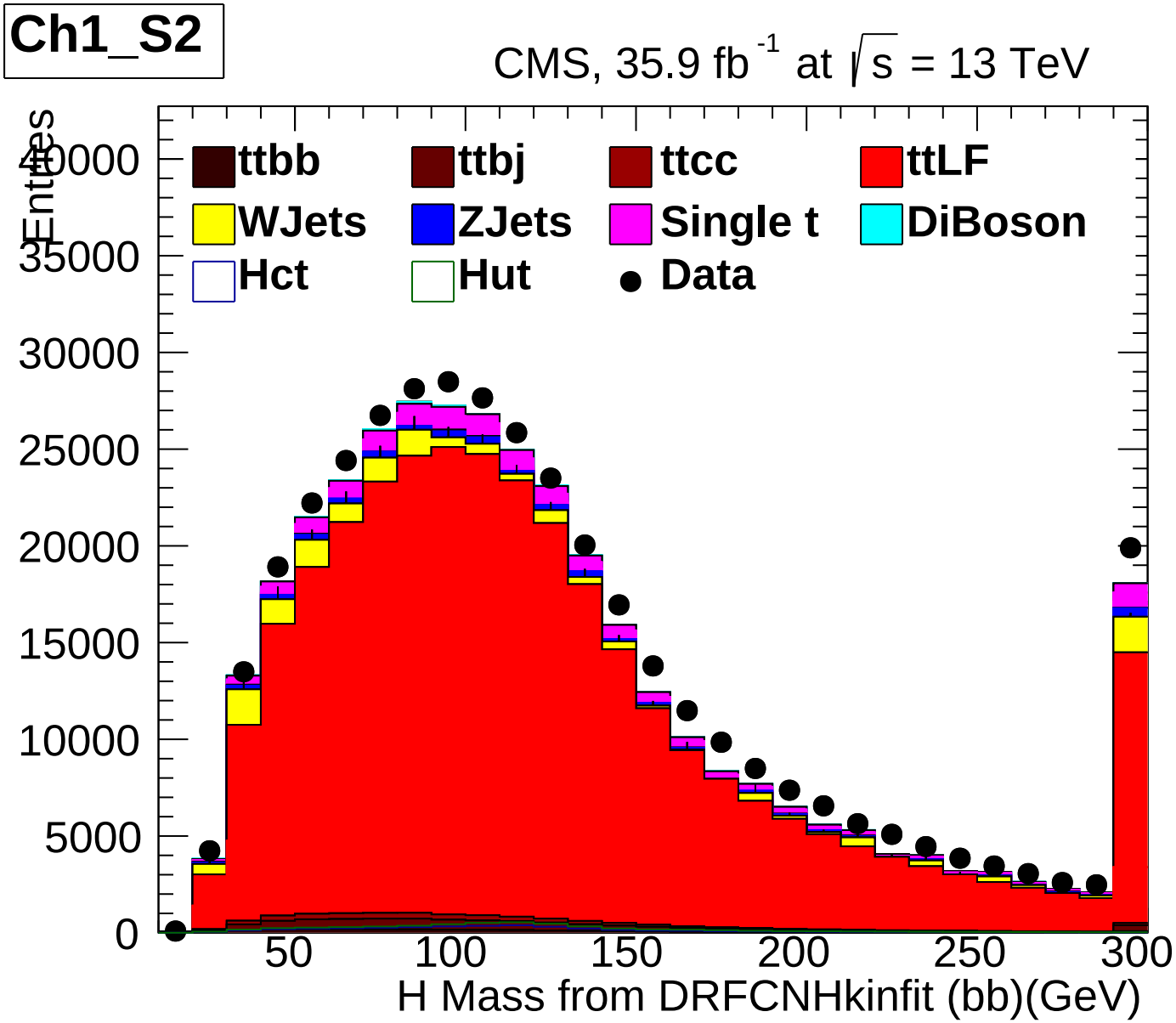
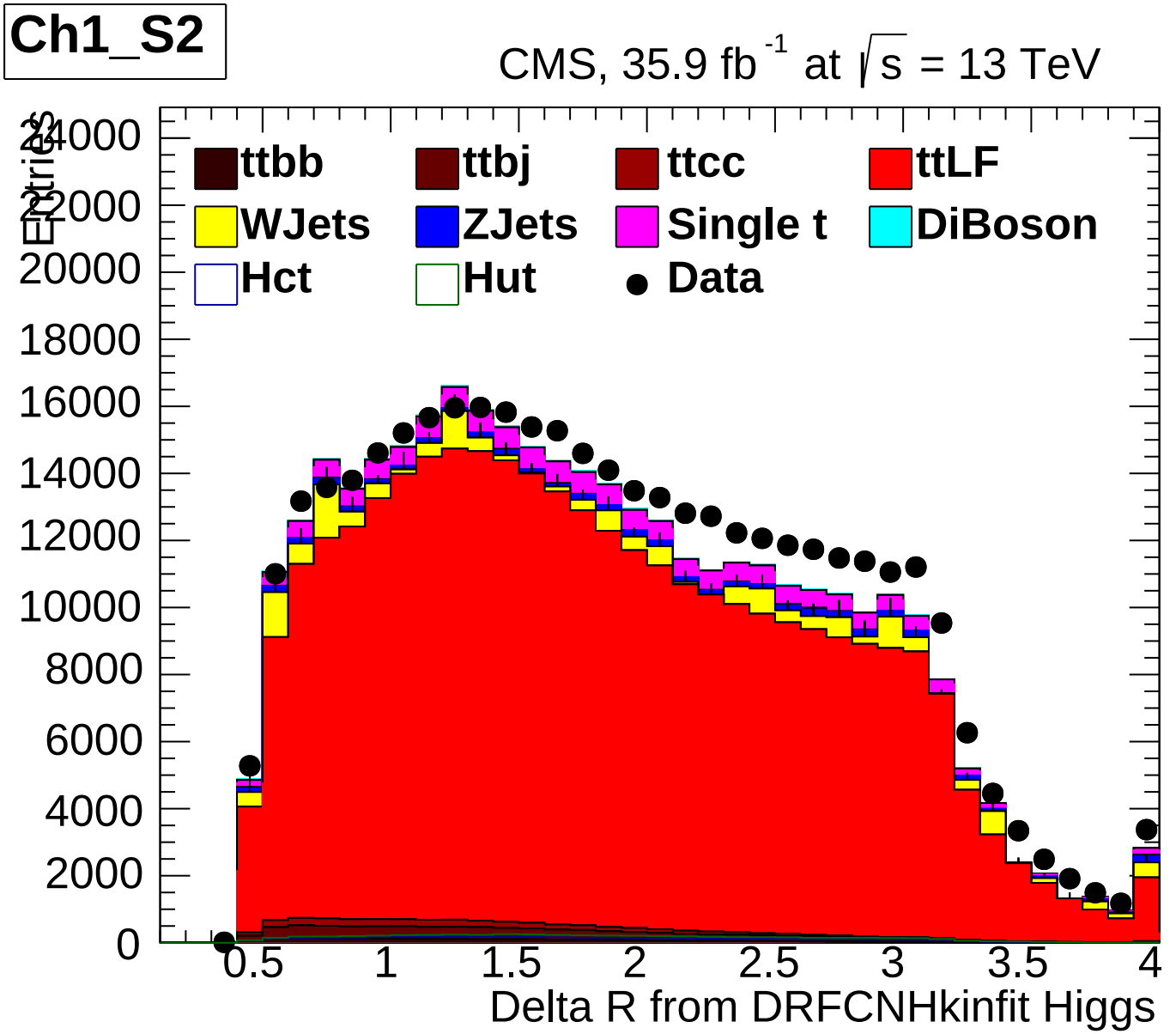
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
24000
22000
20000
18000
16000
14000
12000
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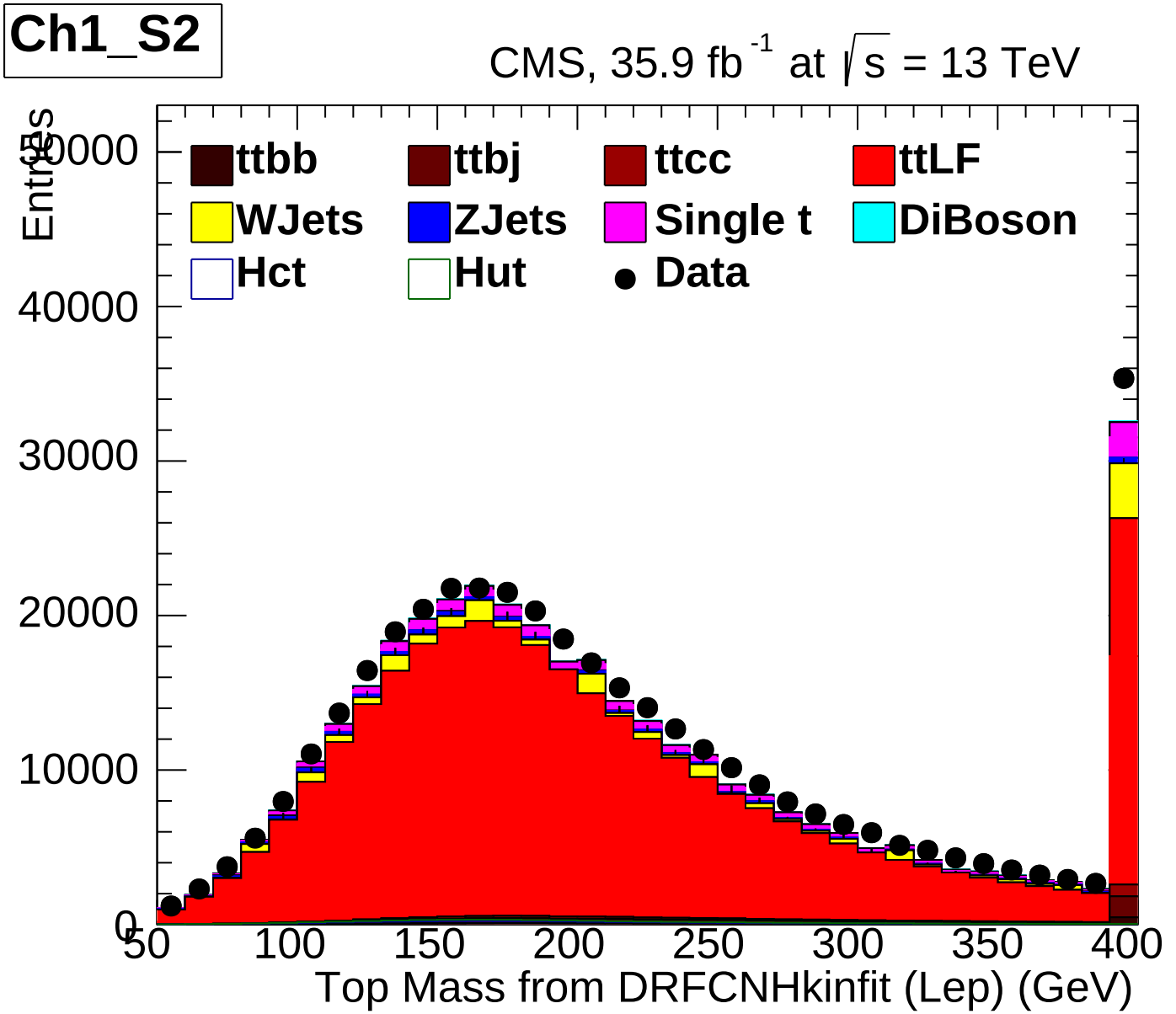
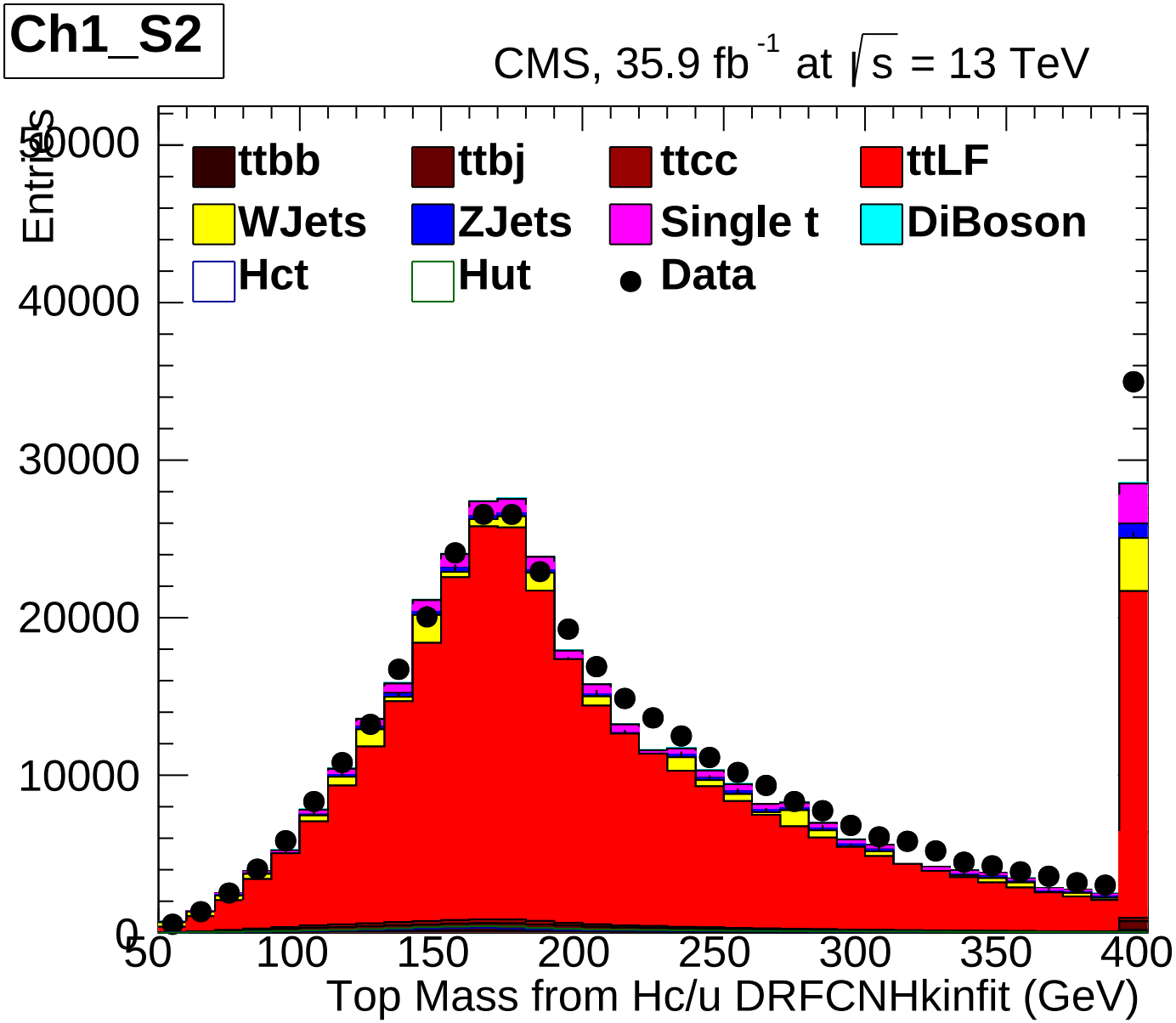
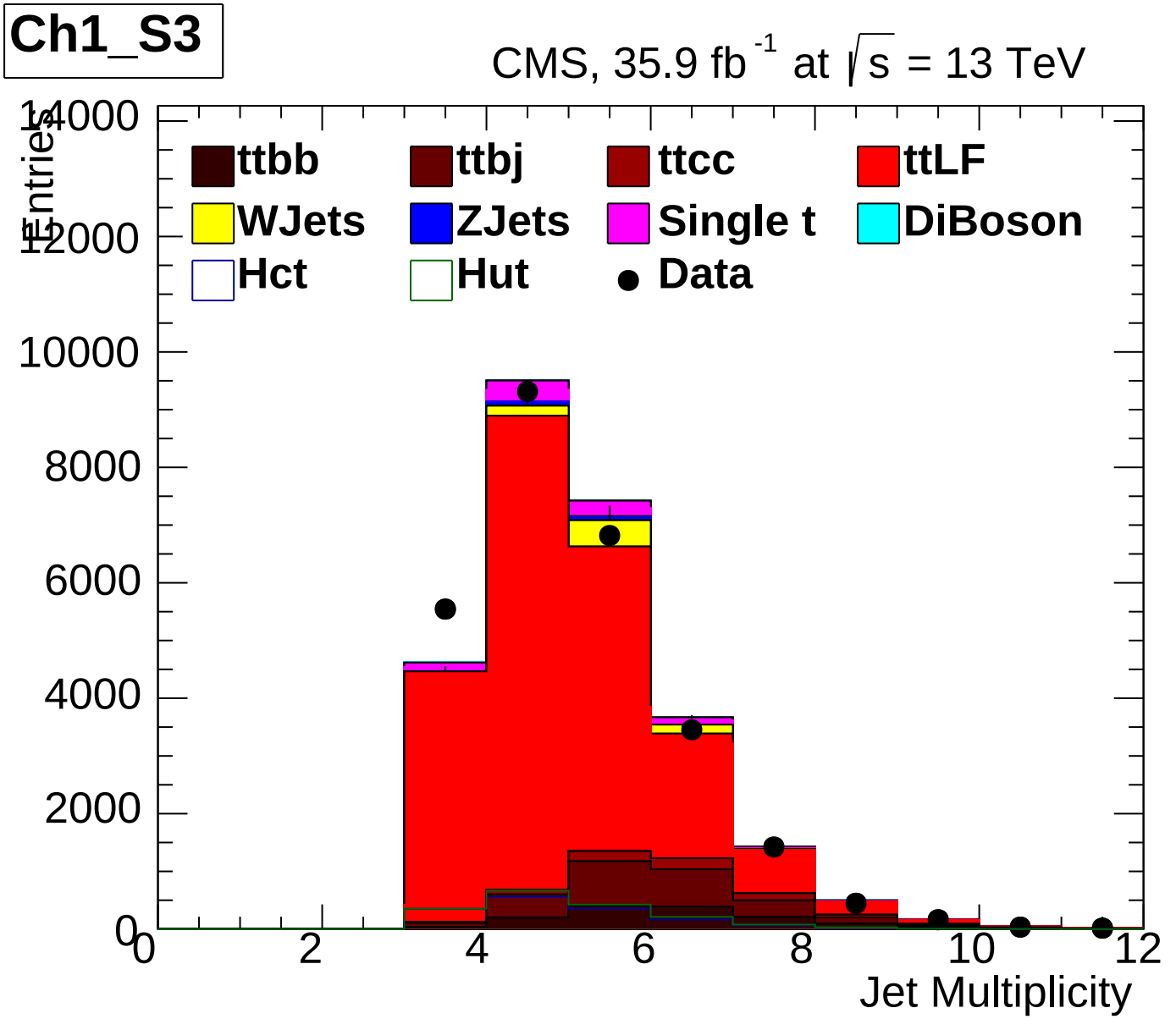
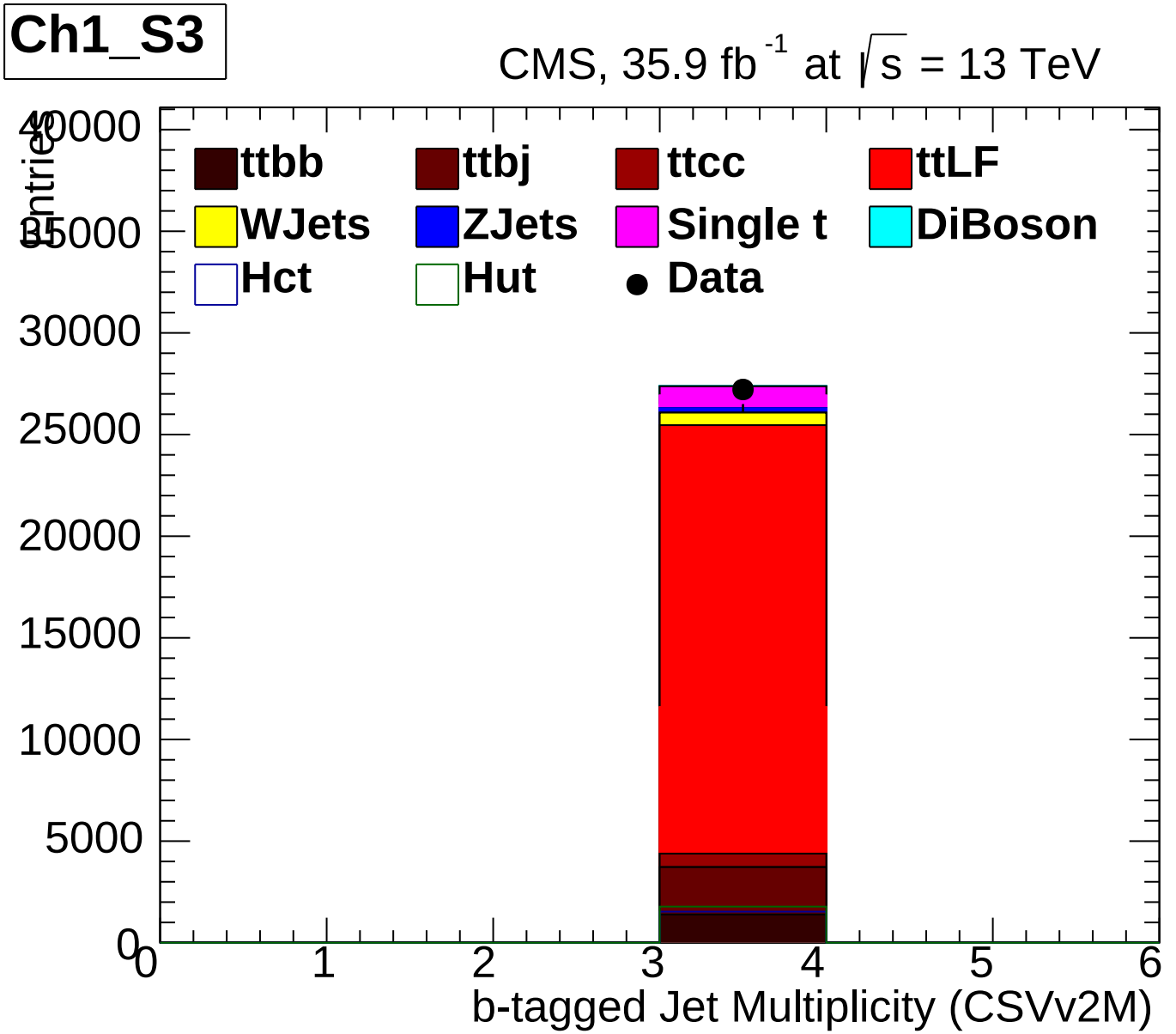
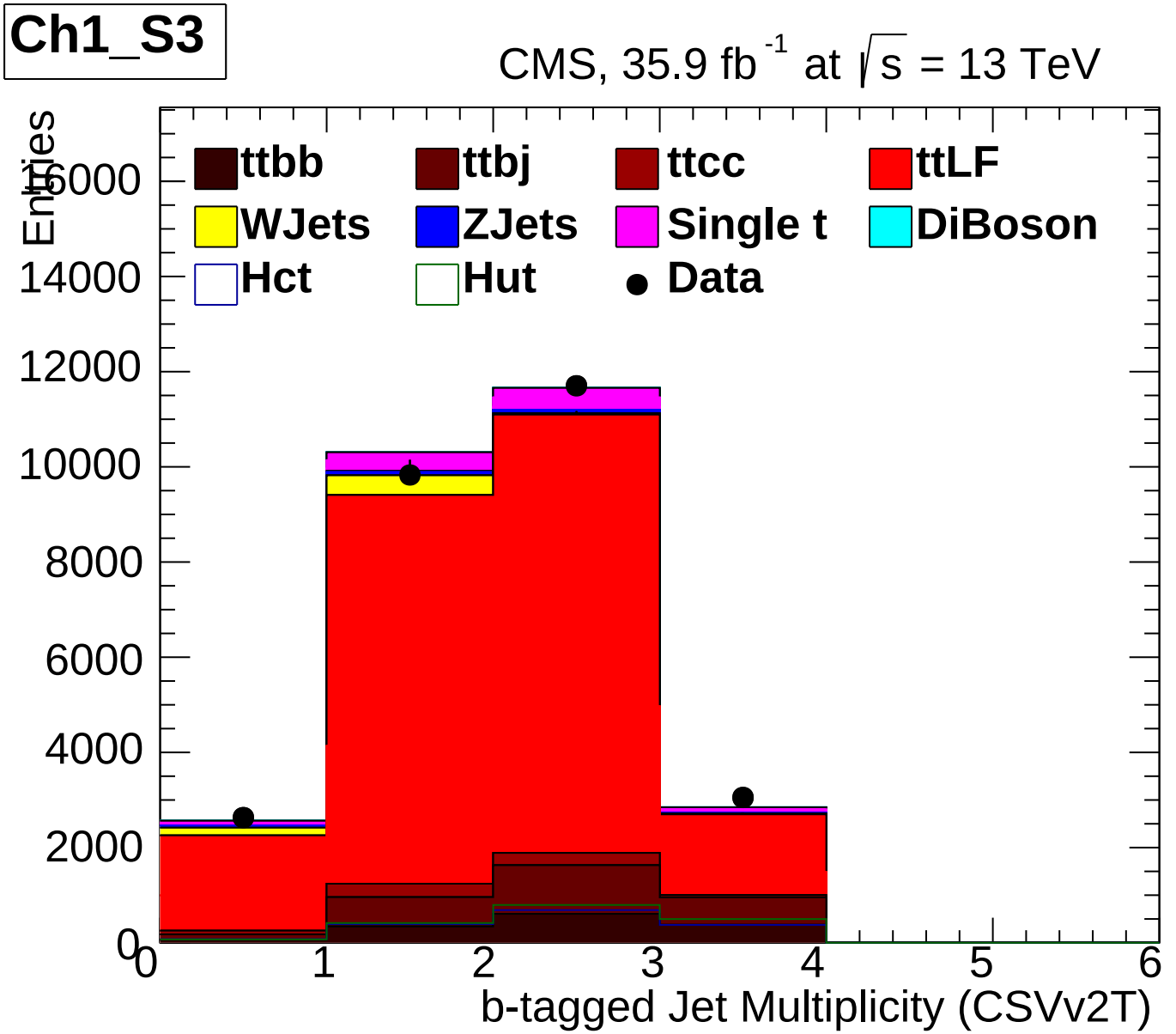
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

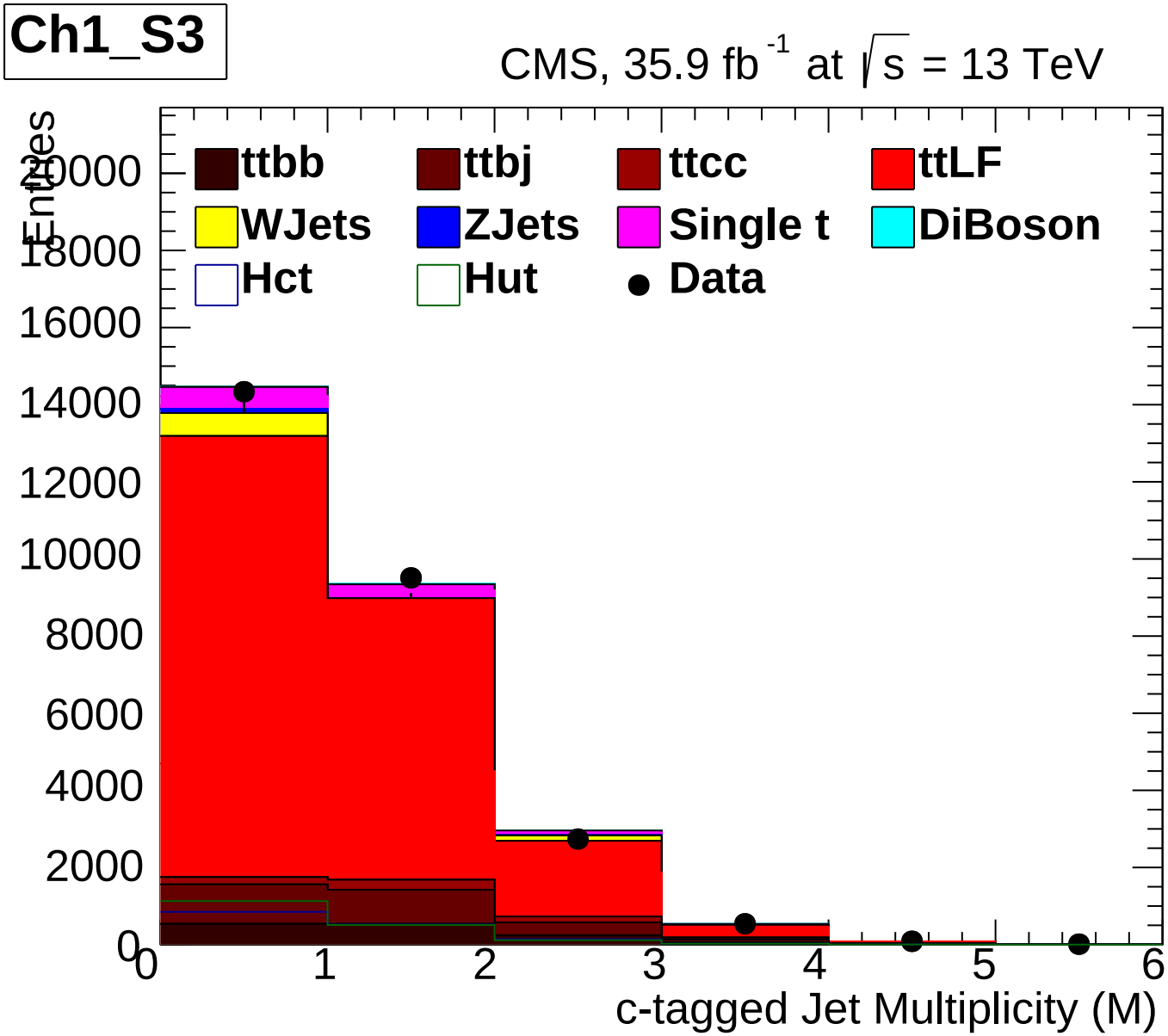

Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

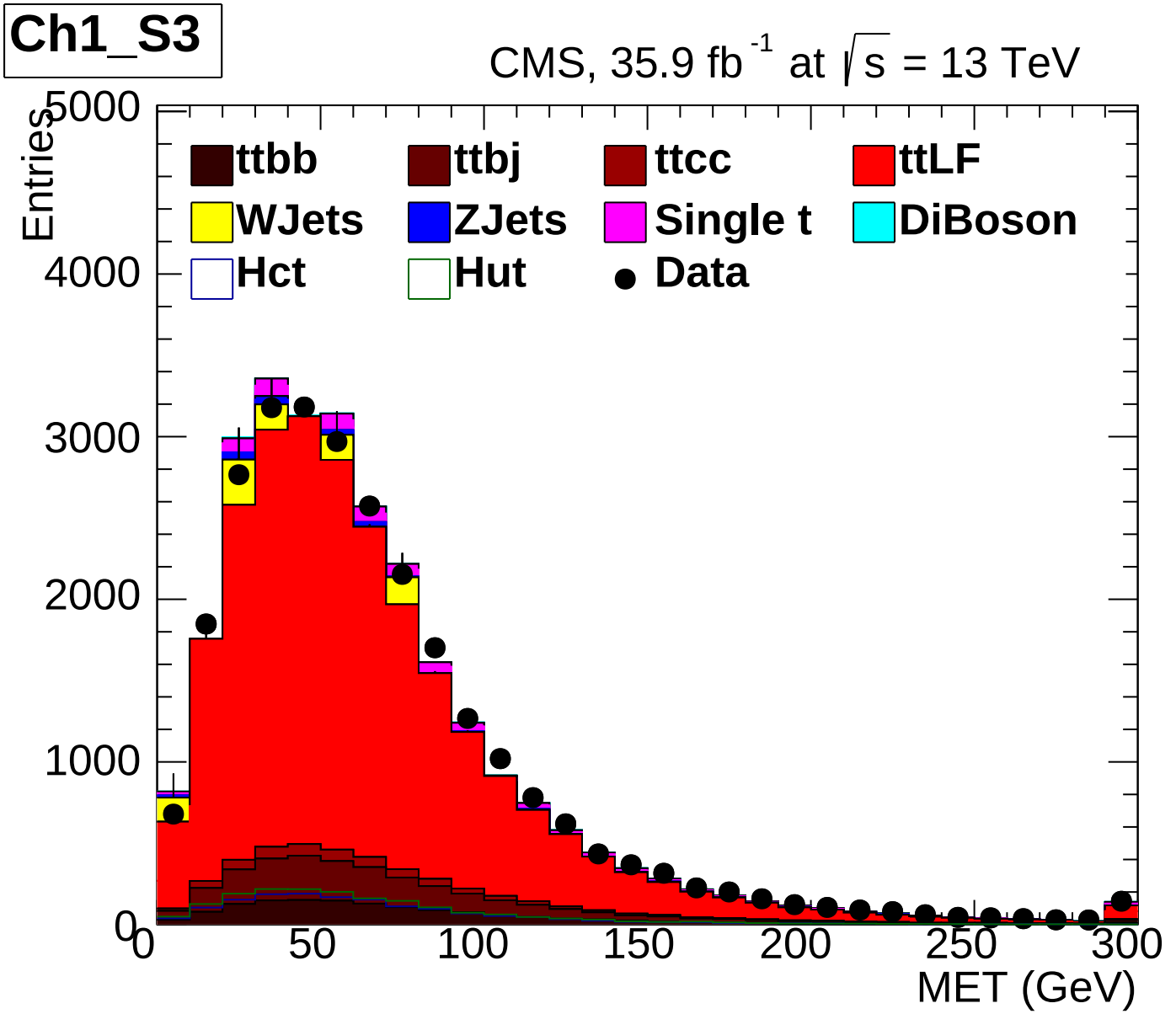

Ch1_S2
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

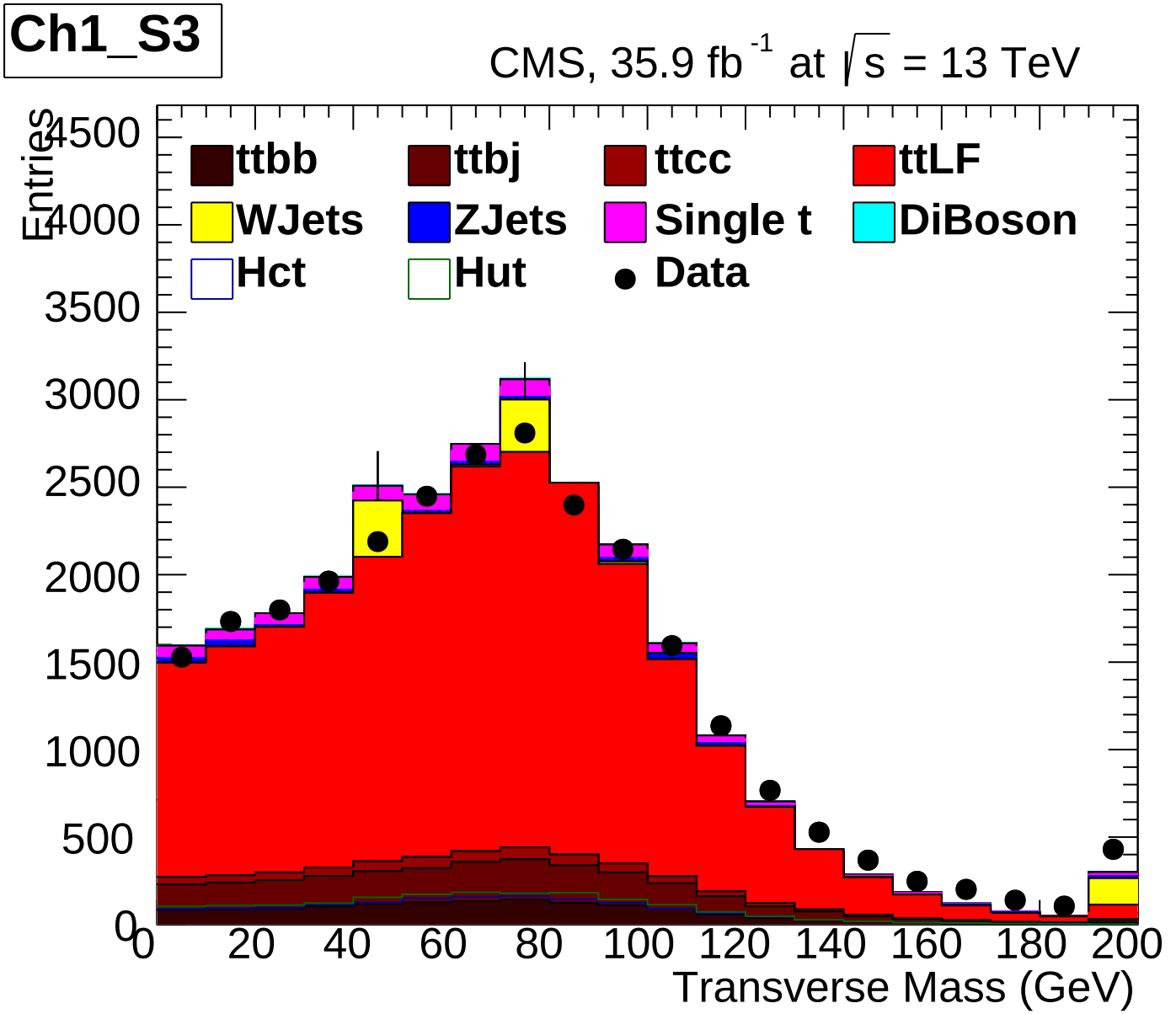

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
14000
12000
10000
8000
6000
4000
2000
0
0
2
4
6
8
10
12
Jet Multiplicity

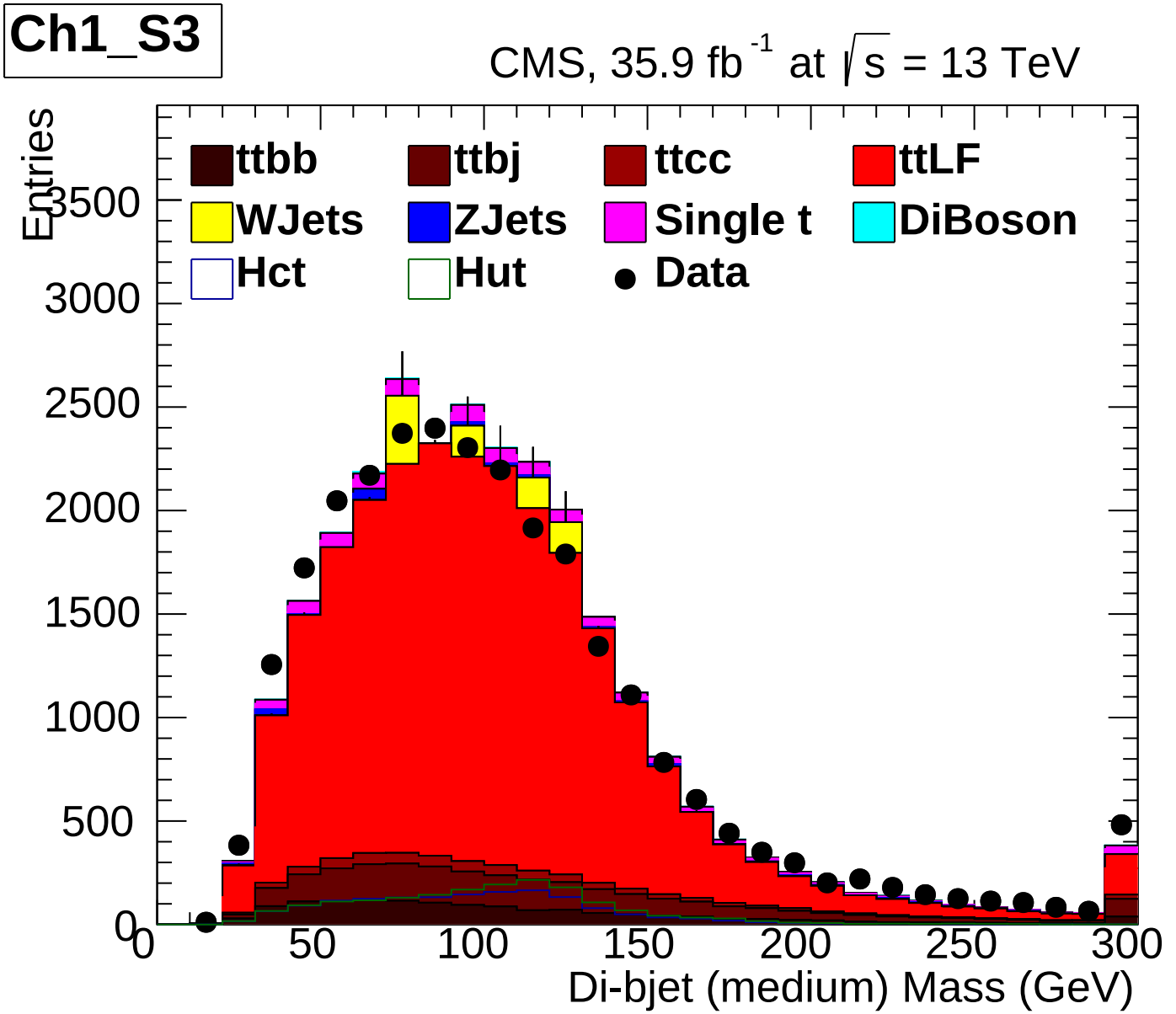

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
entries
40000
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

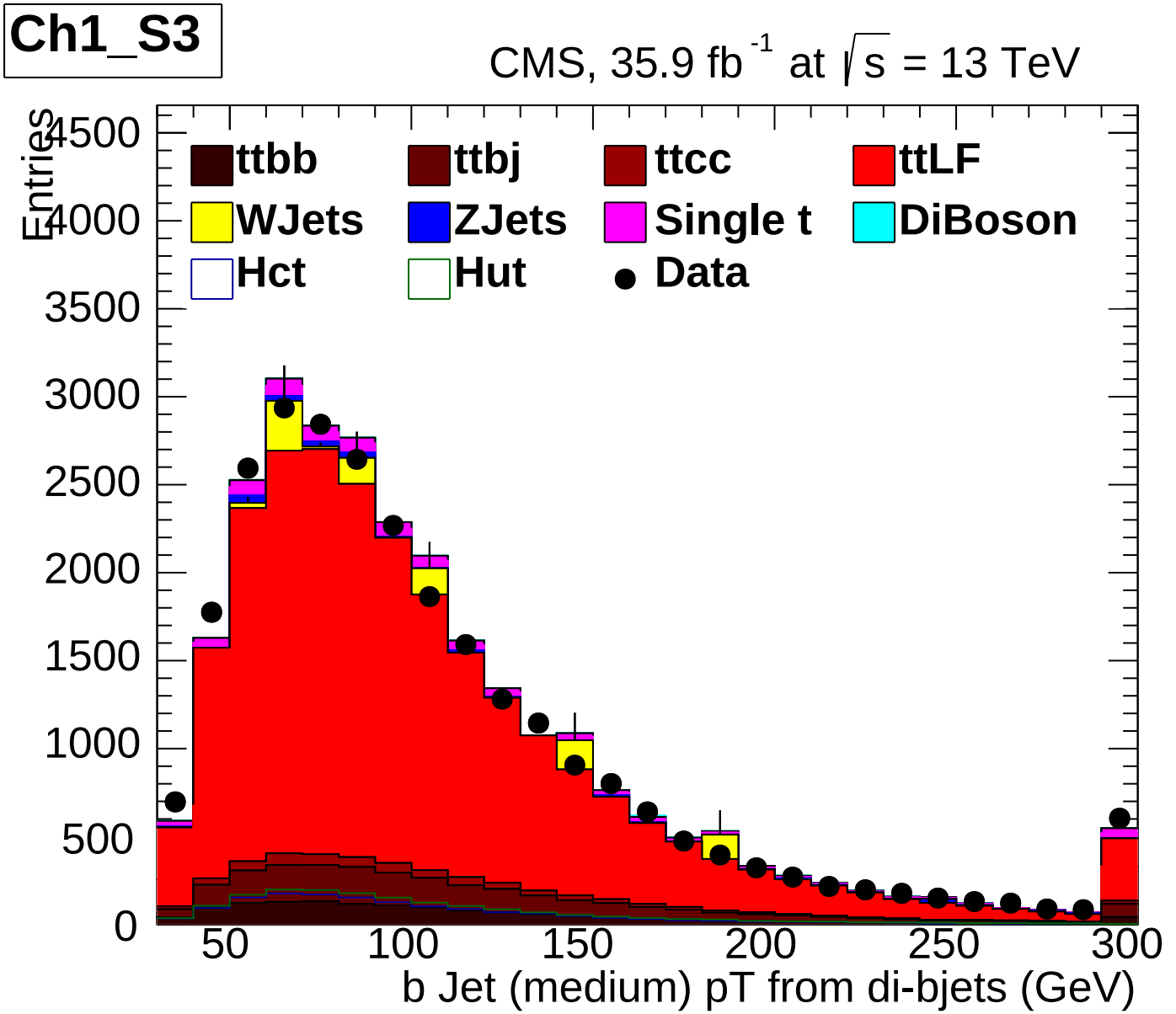

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
2000
4000
6000
8000
10000
12000
14000
16000
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

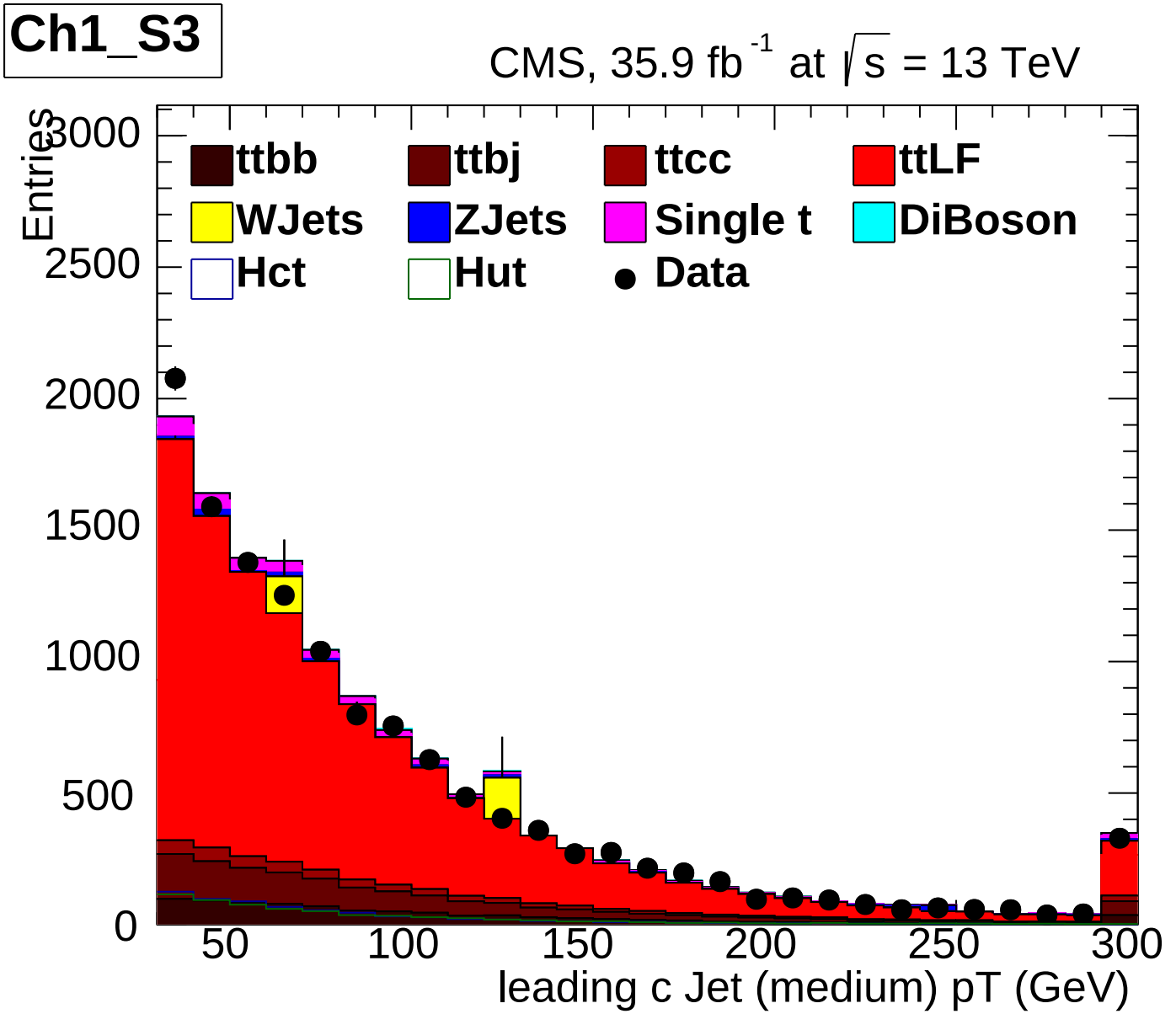

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

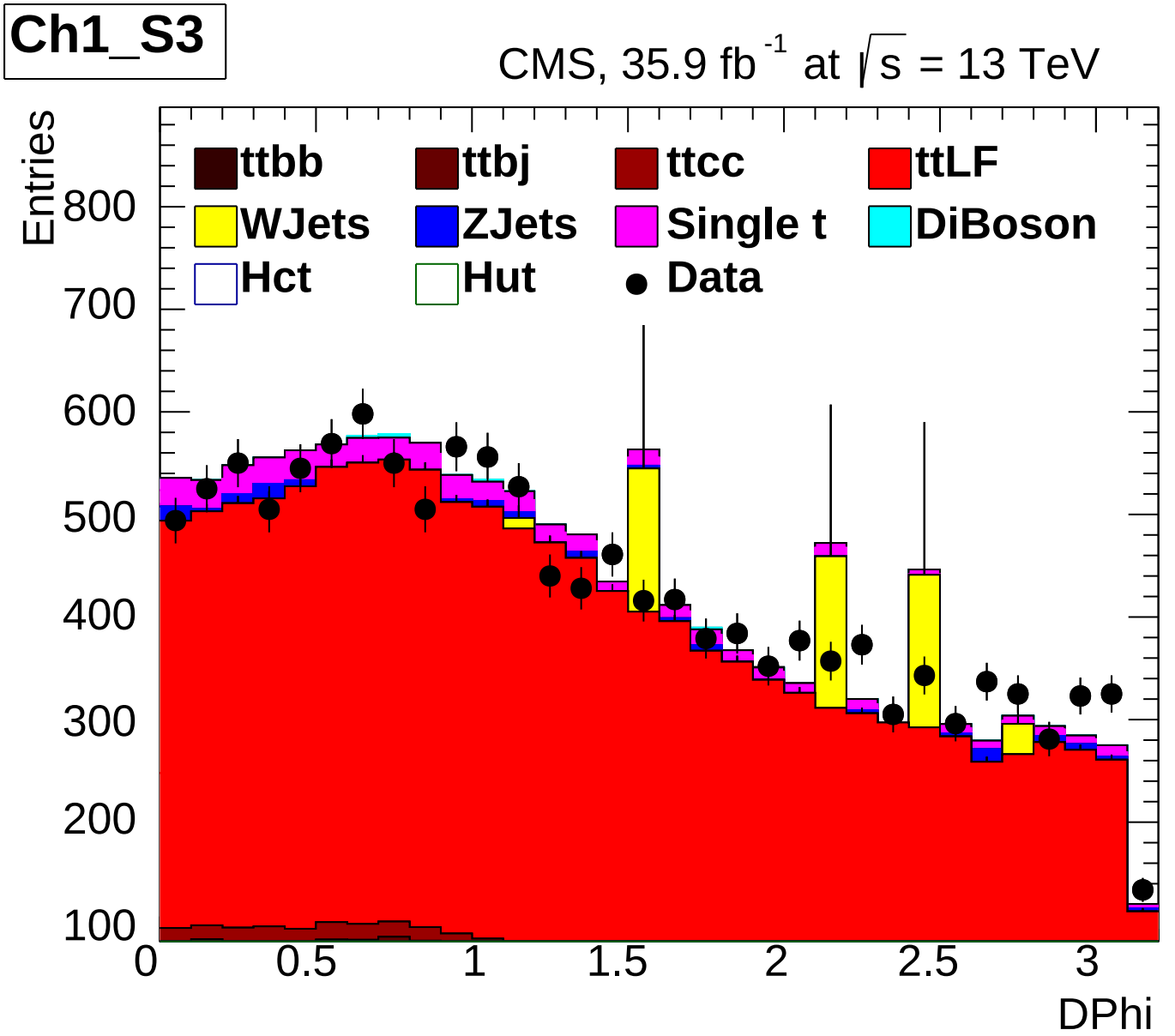

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
50
100
150
200
250
300
MET (GeV)

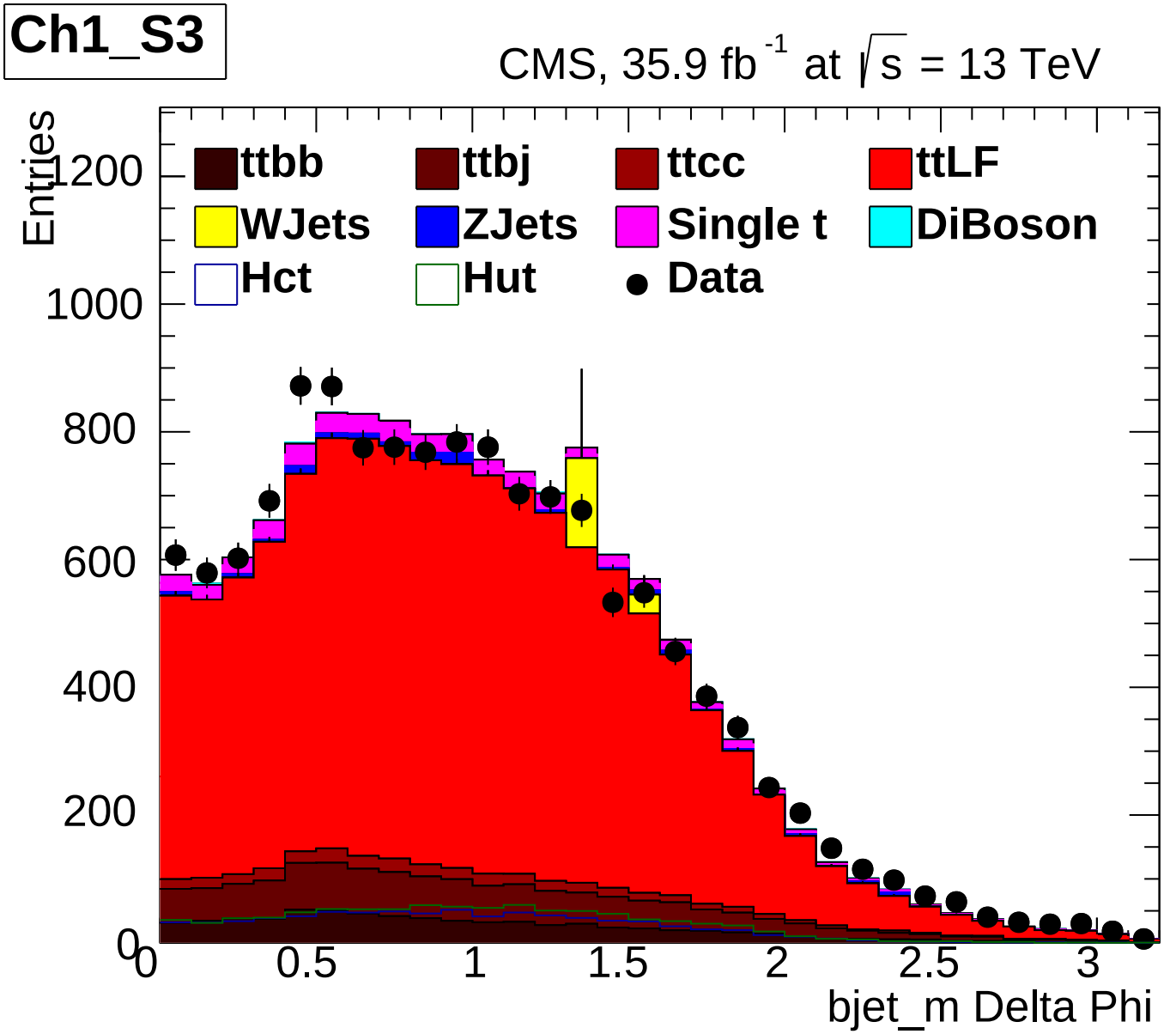

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

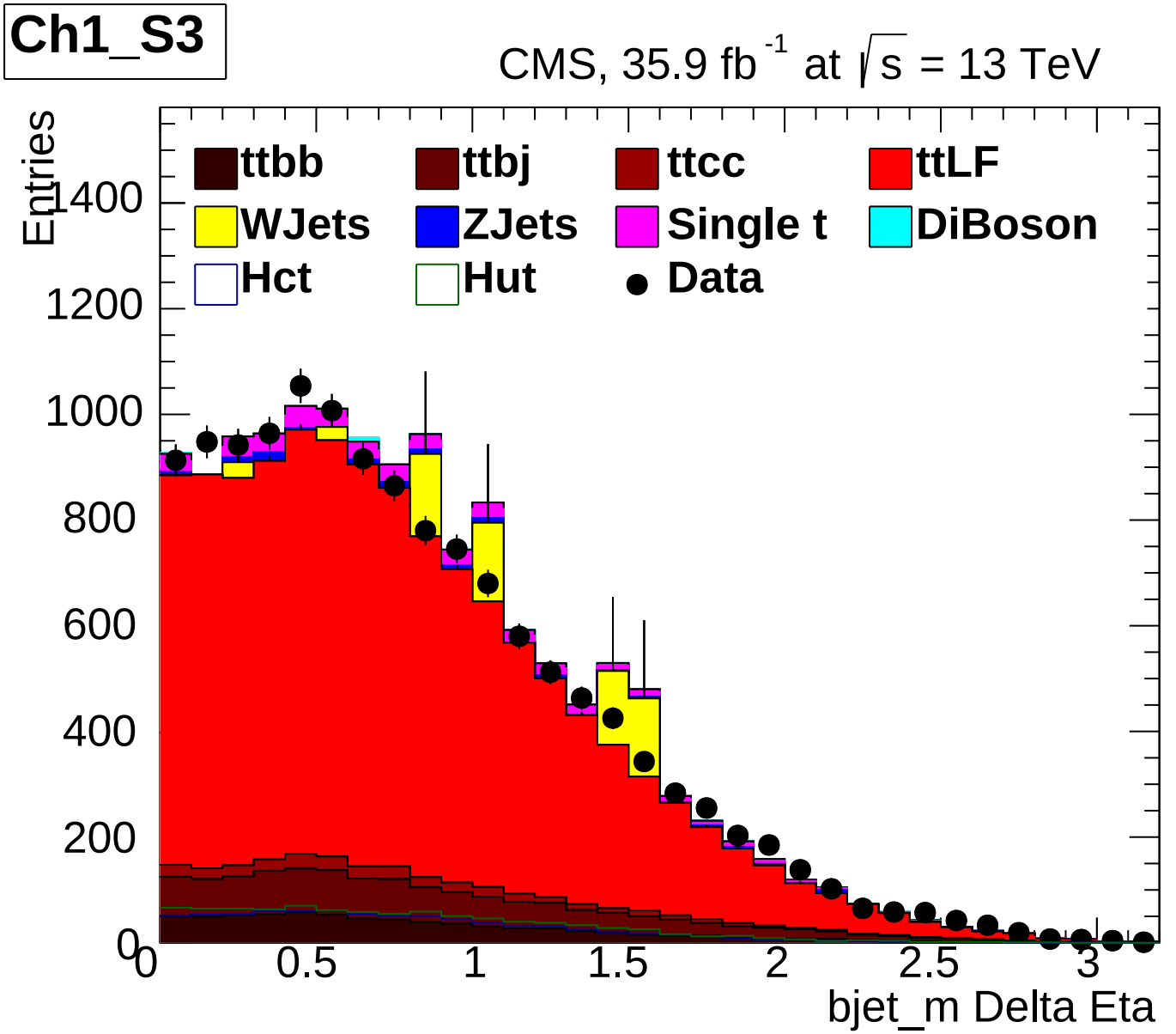

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
500
1000
1500
2000
2500
3000
3500
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

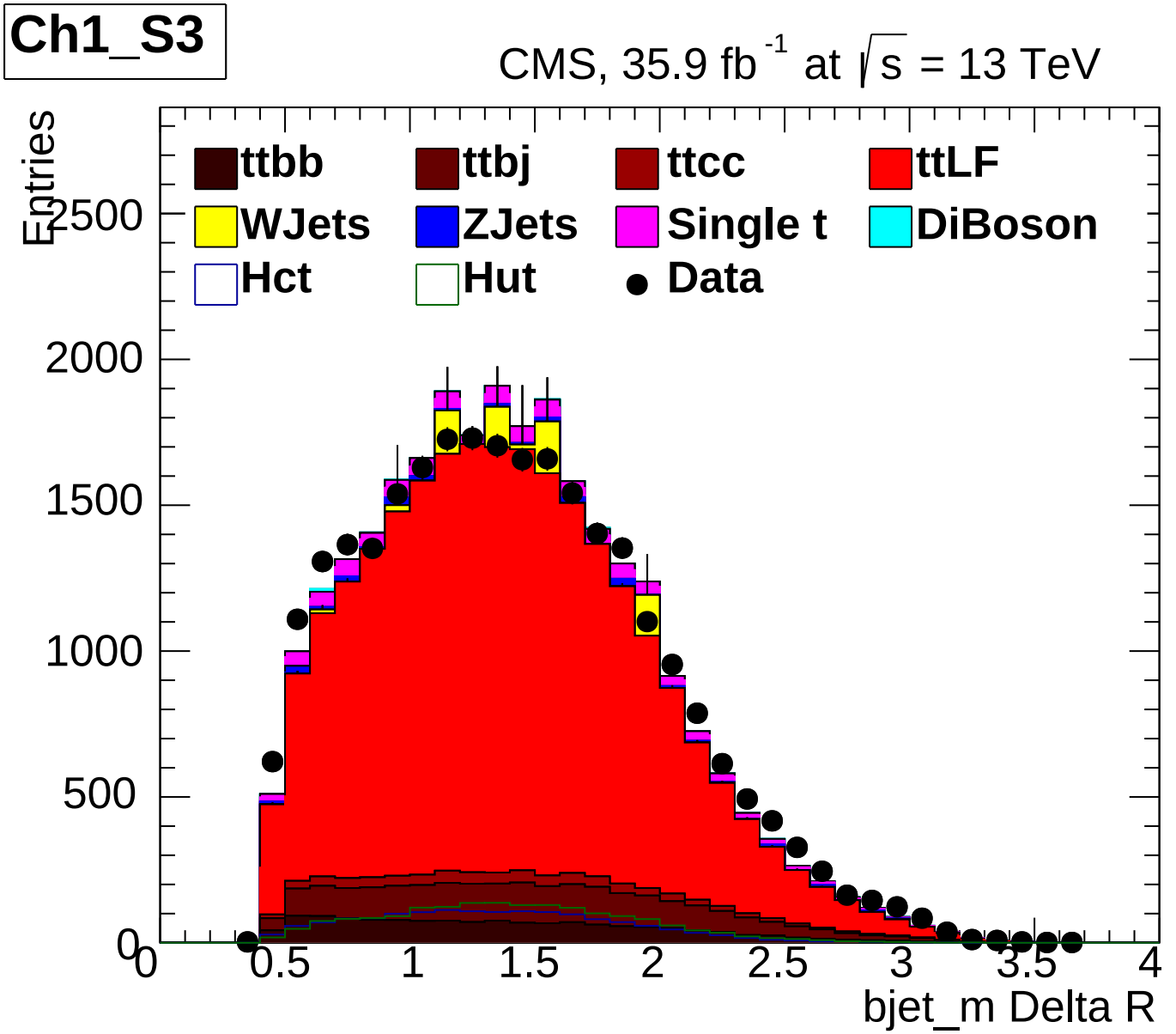

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

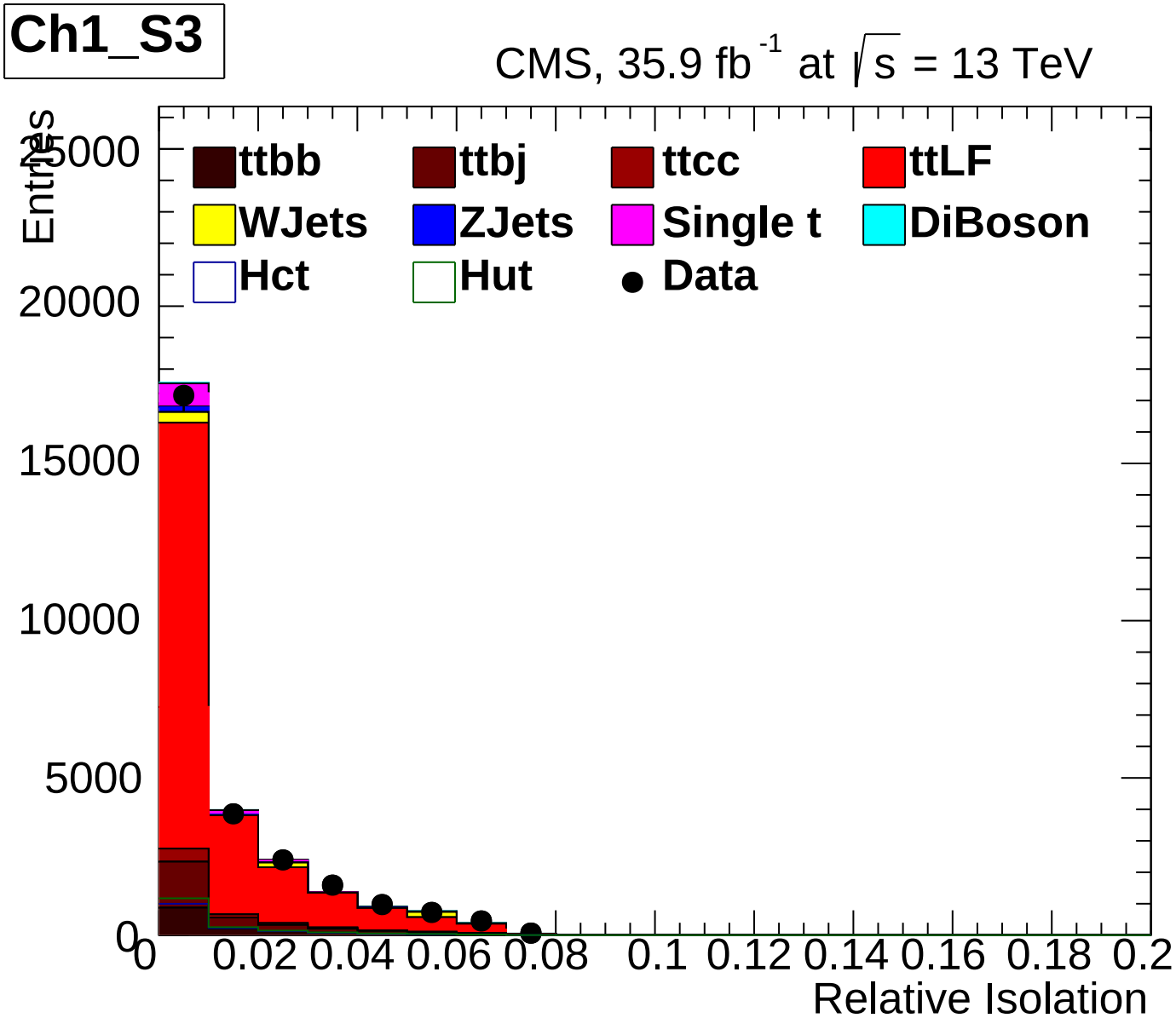

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

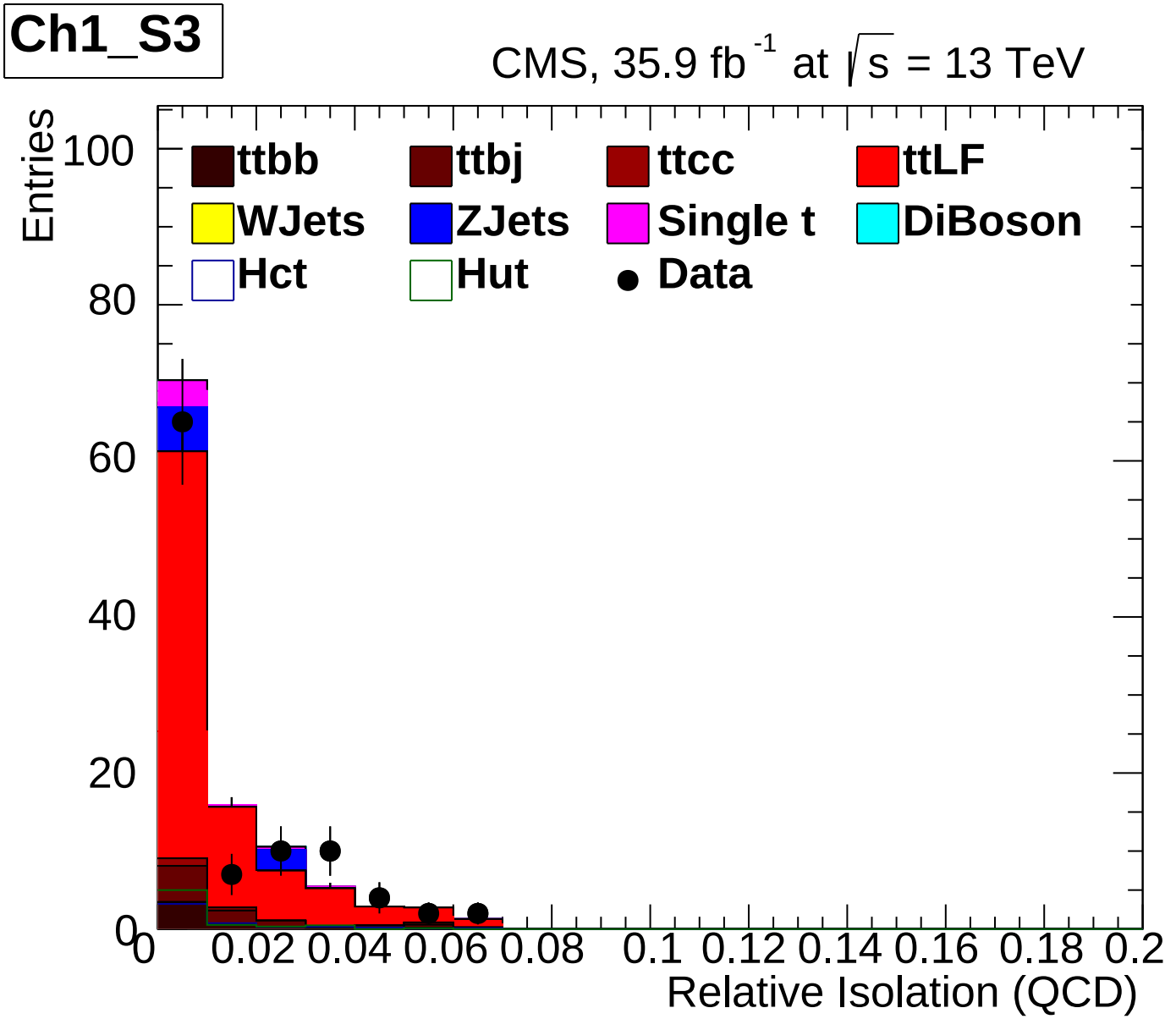

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
800
700
600
500
400
300
200
100
0
0.5
1
1.5
2
2.5
3
DPhi

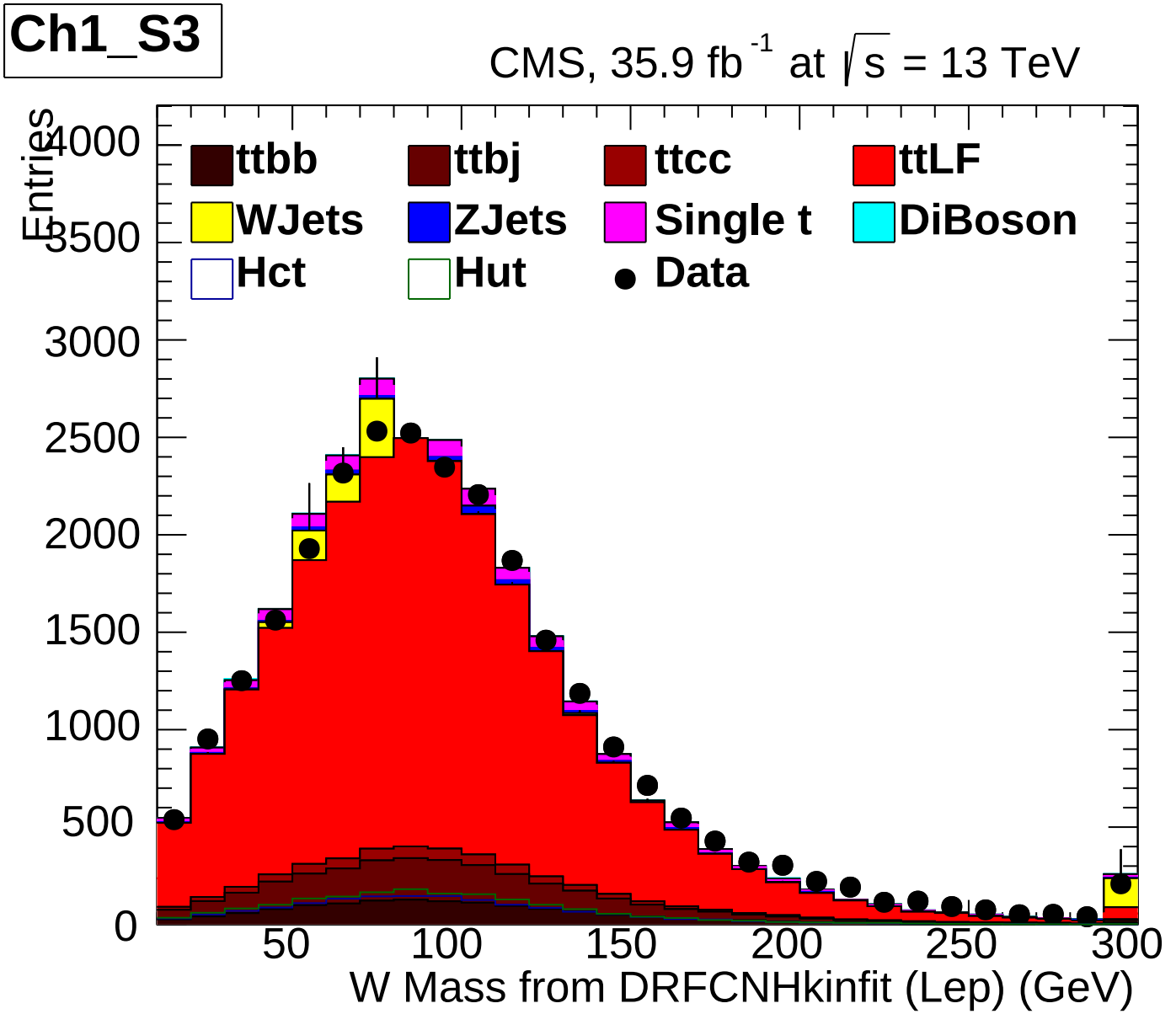

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

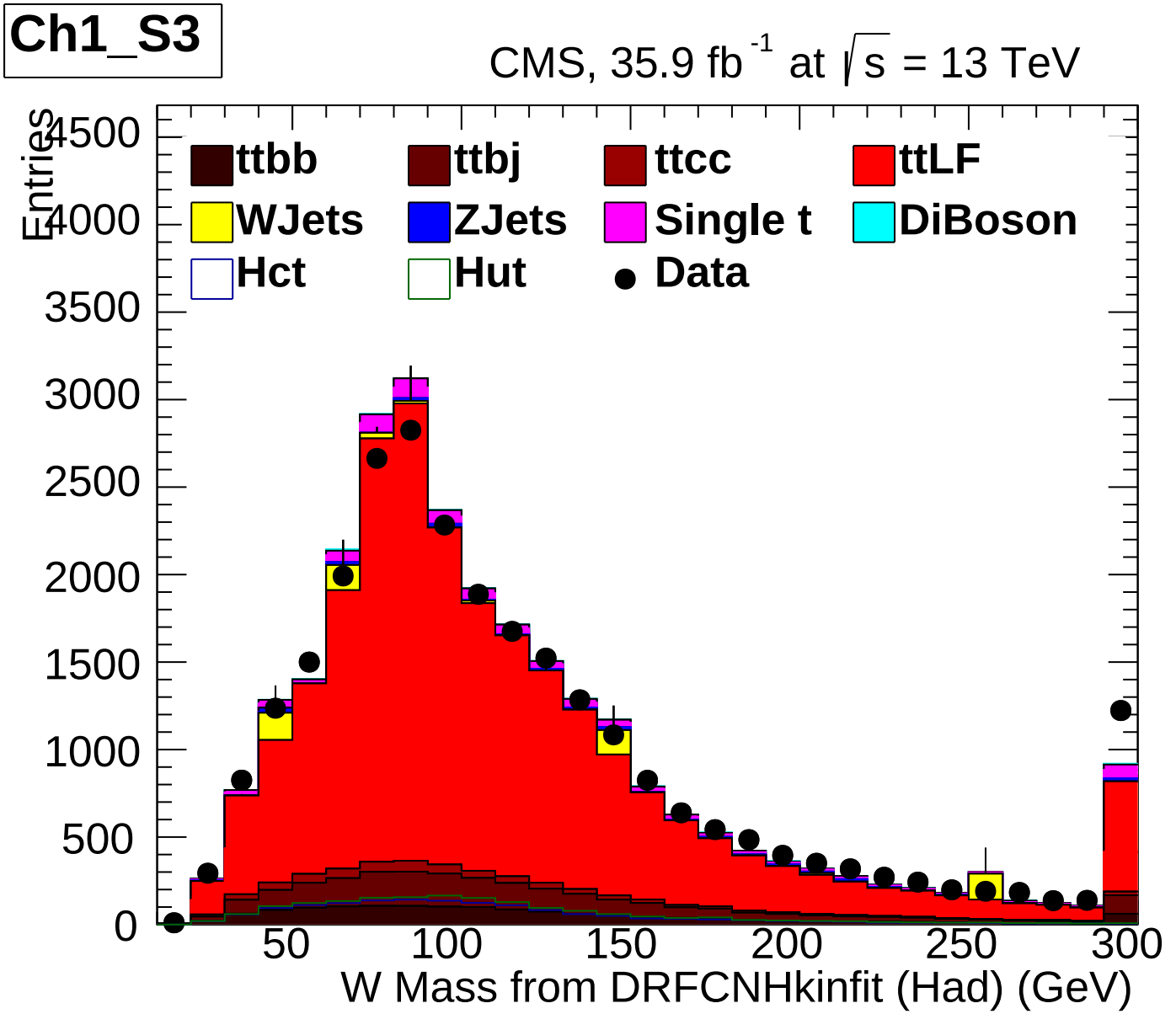

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

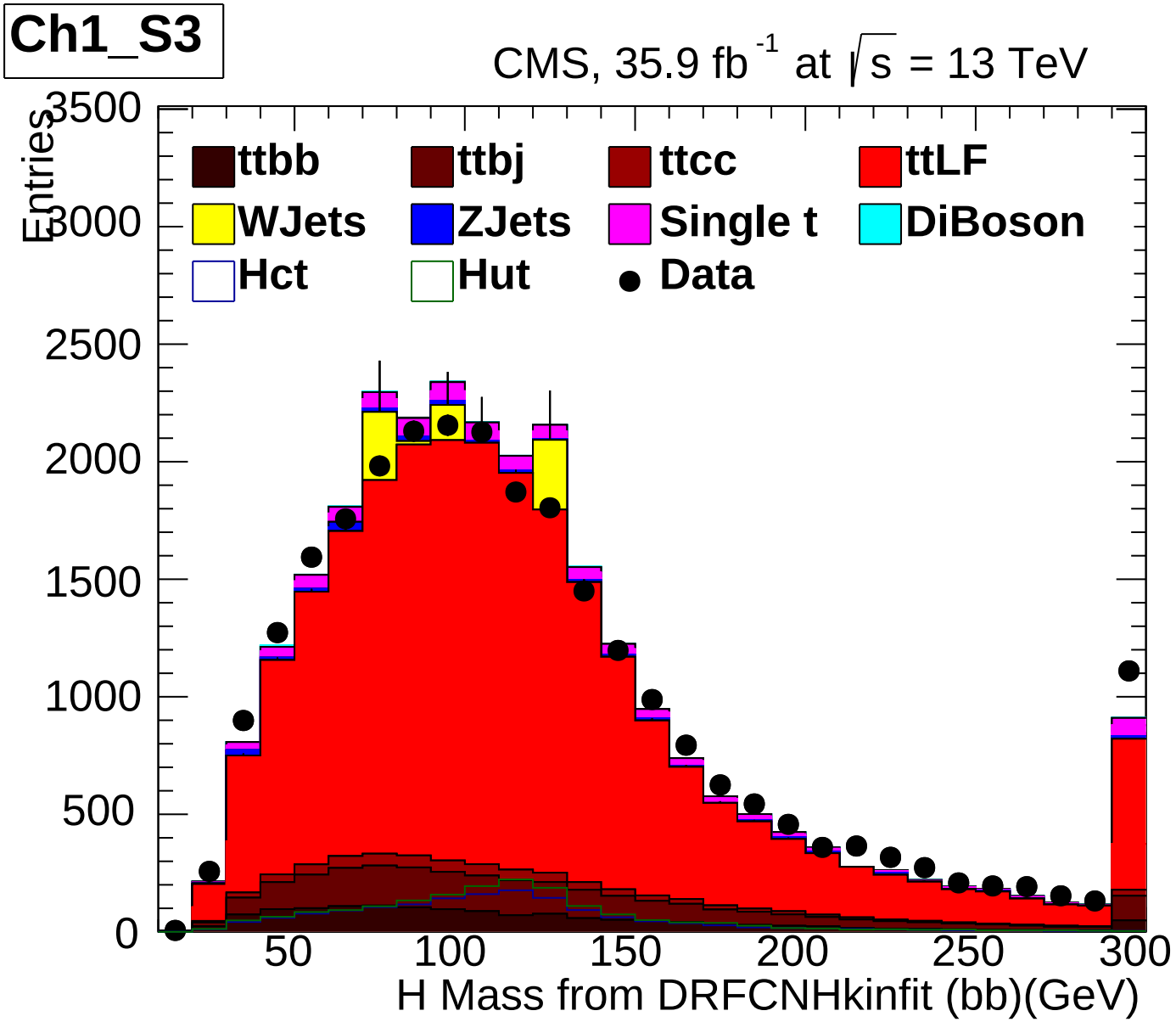

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
500
1000
1500
2000
2500
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

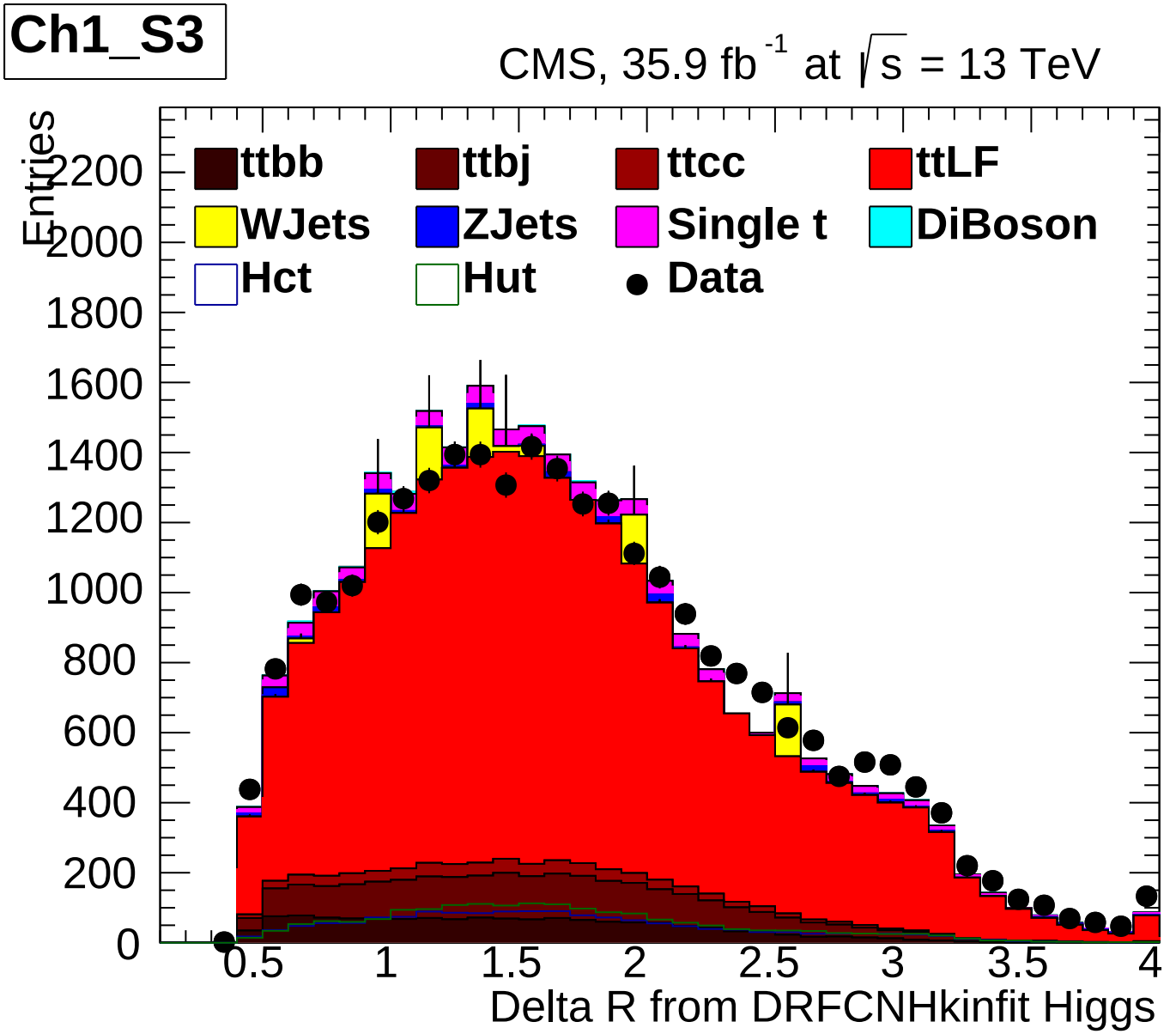

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

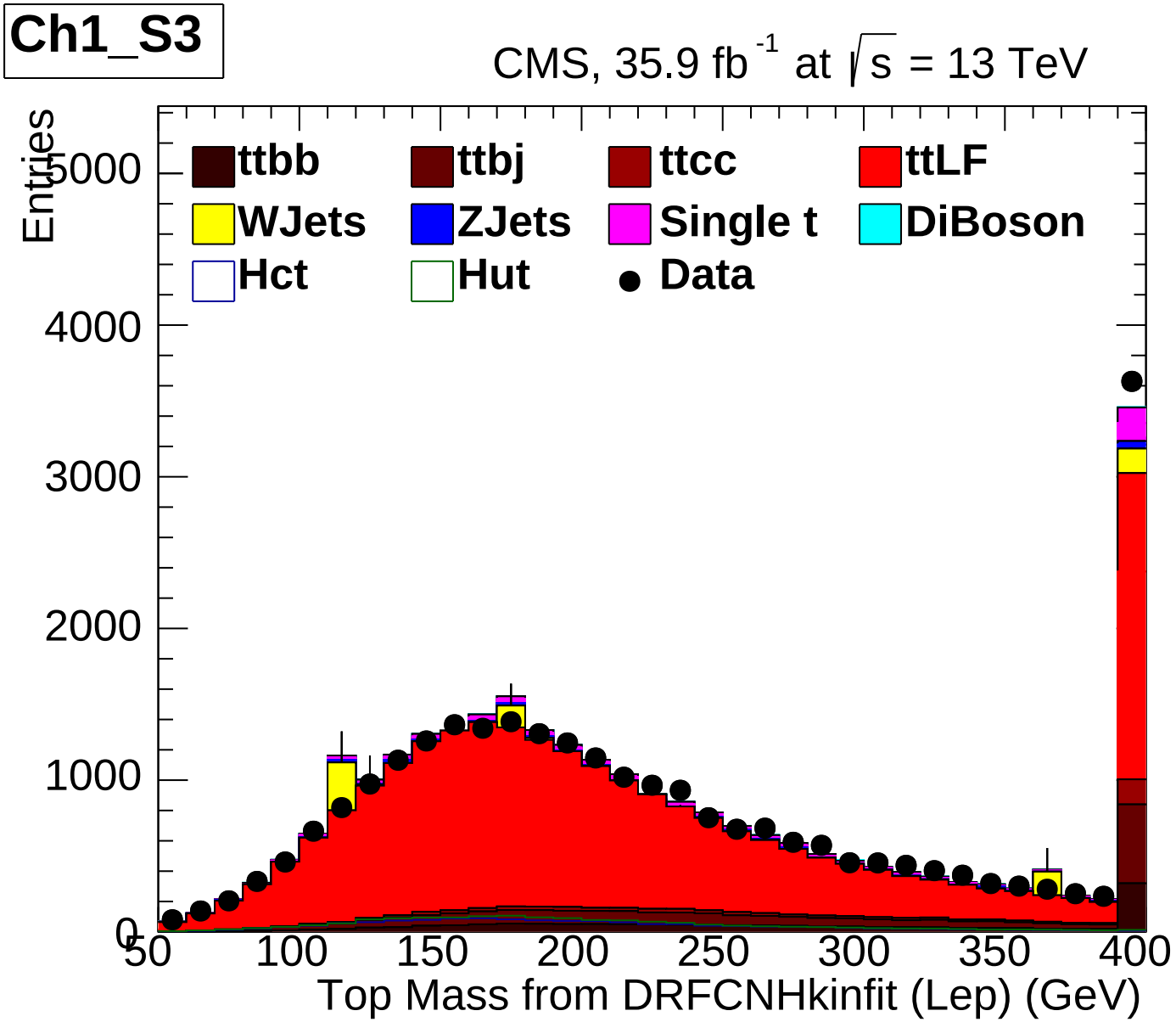

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

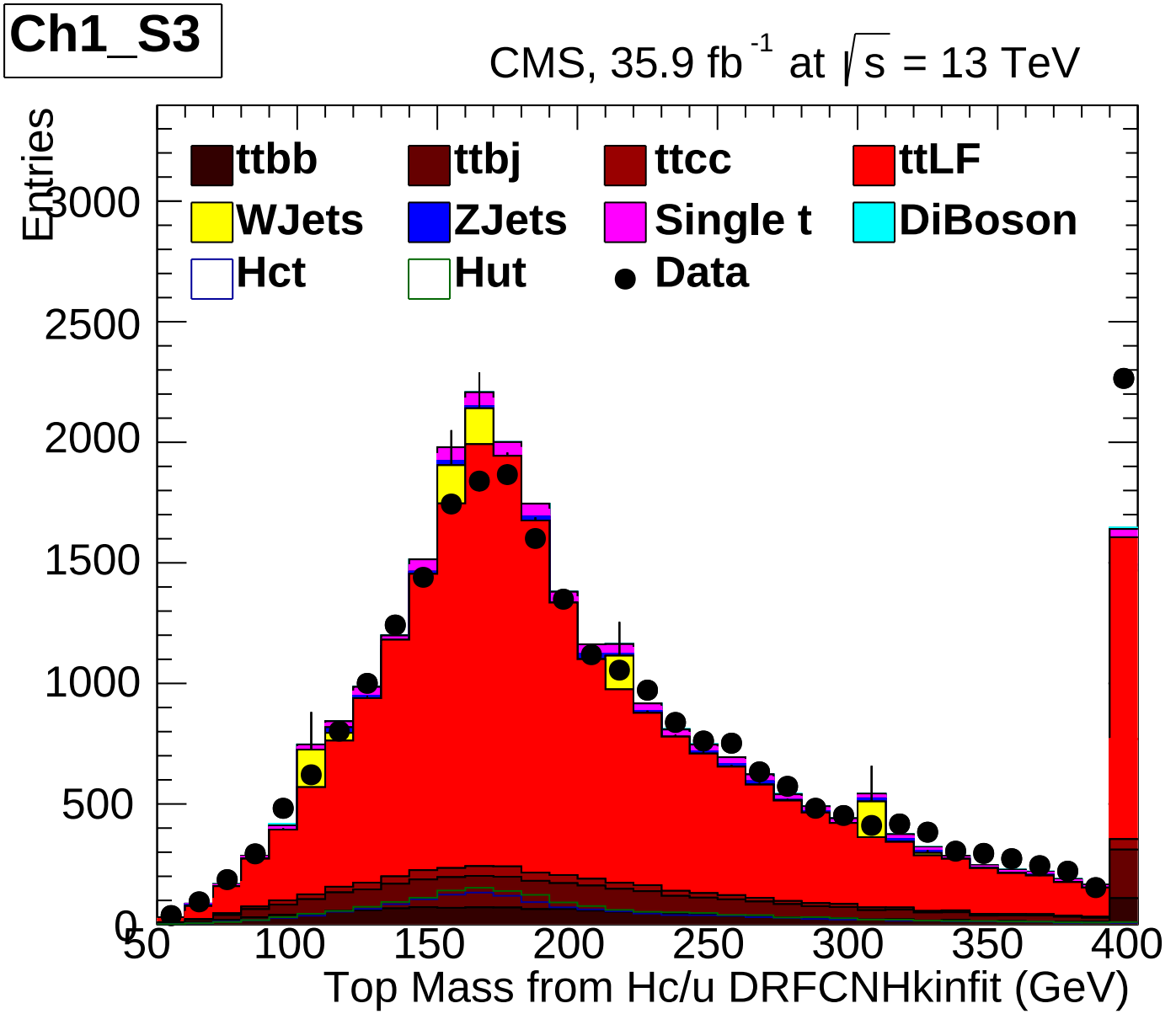

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

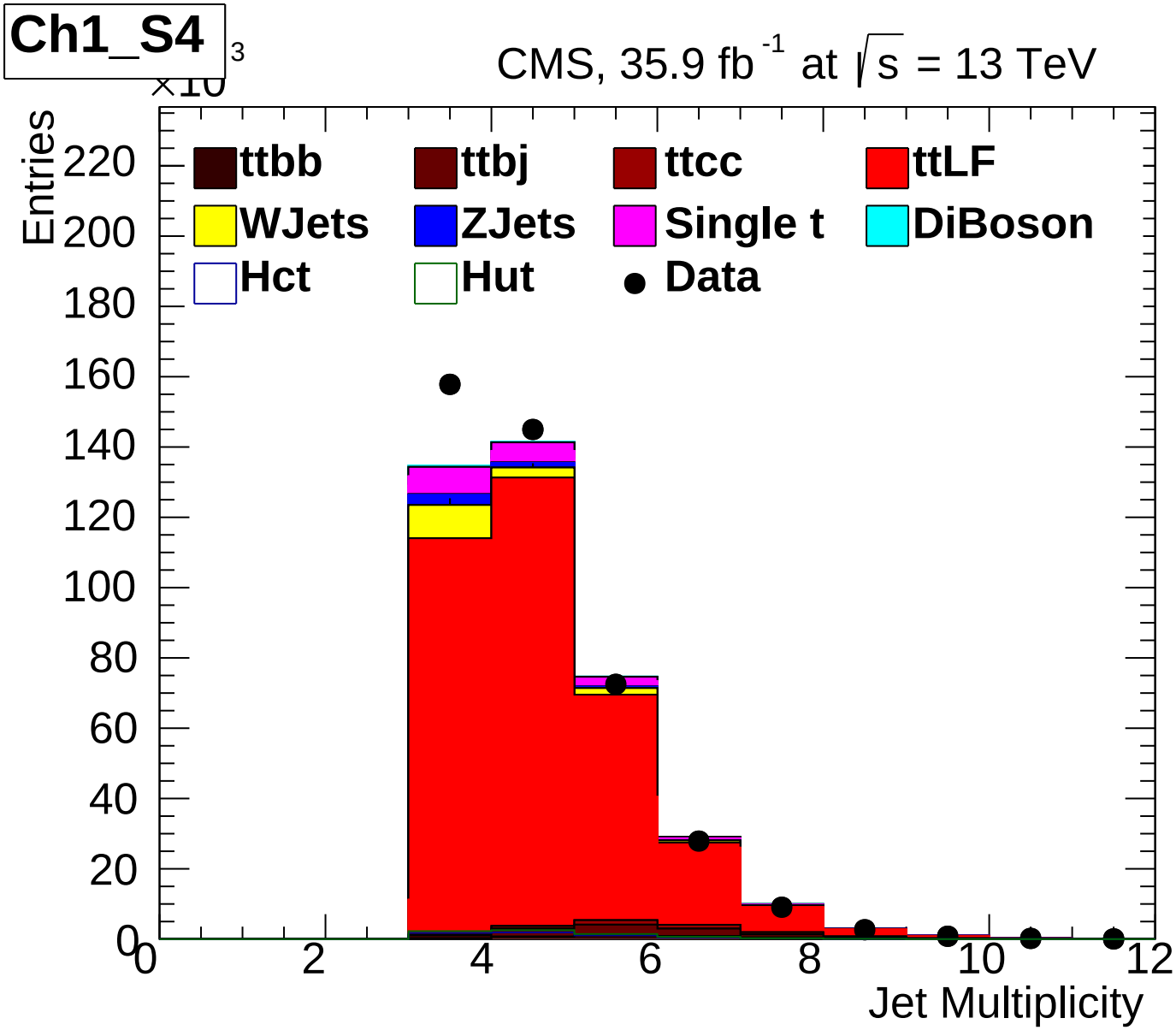

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

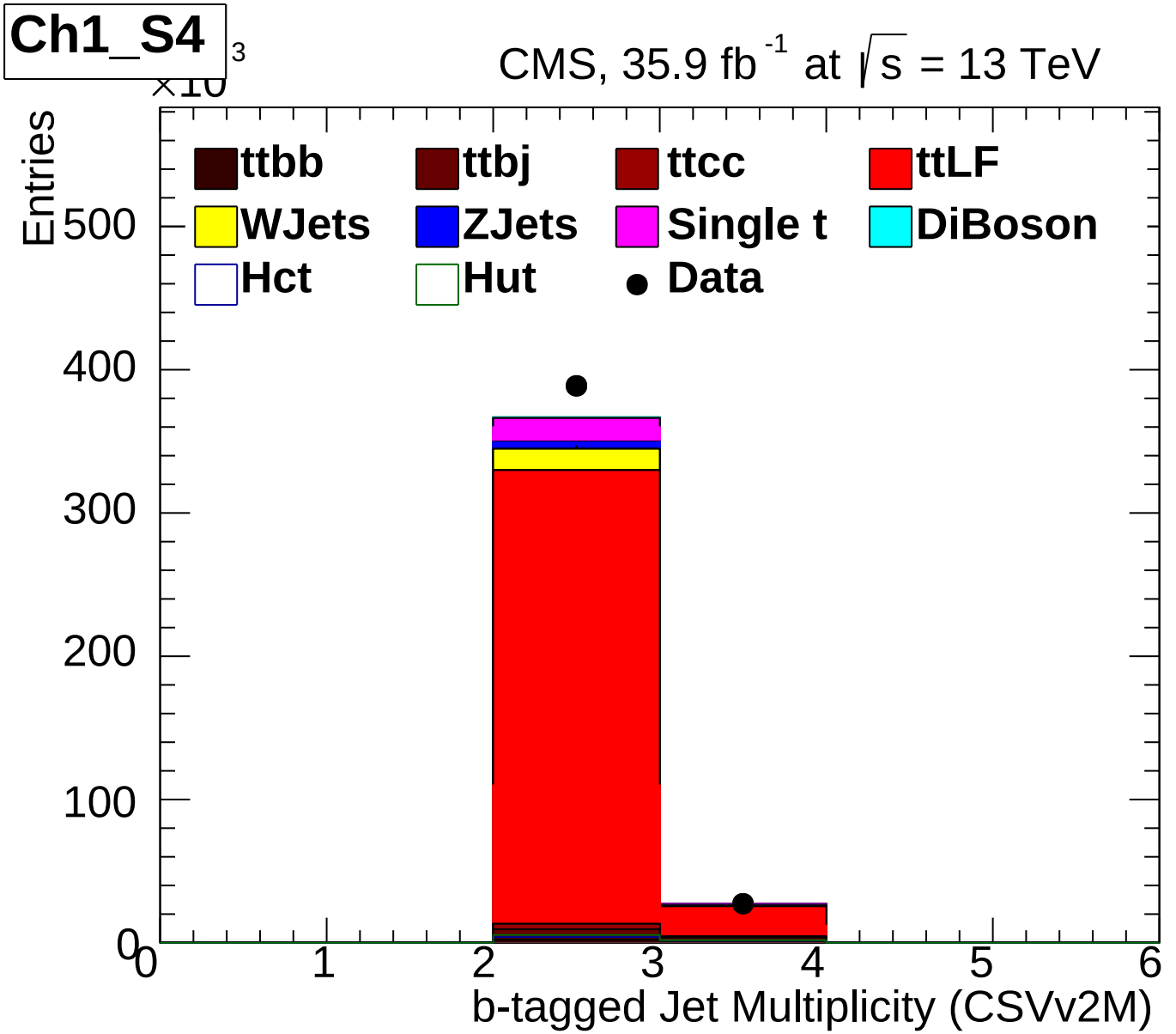

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

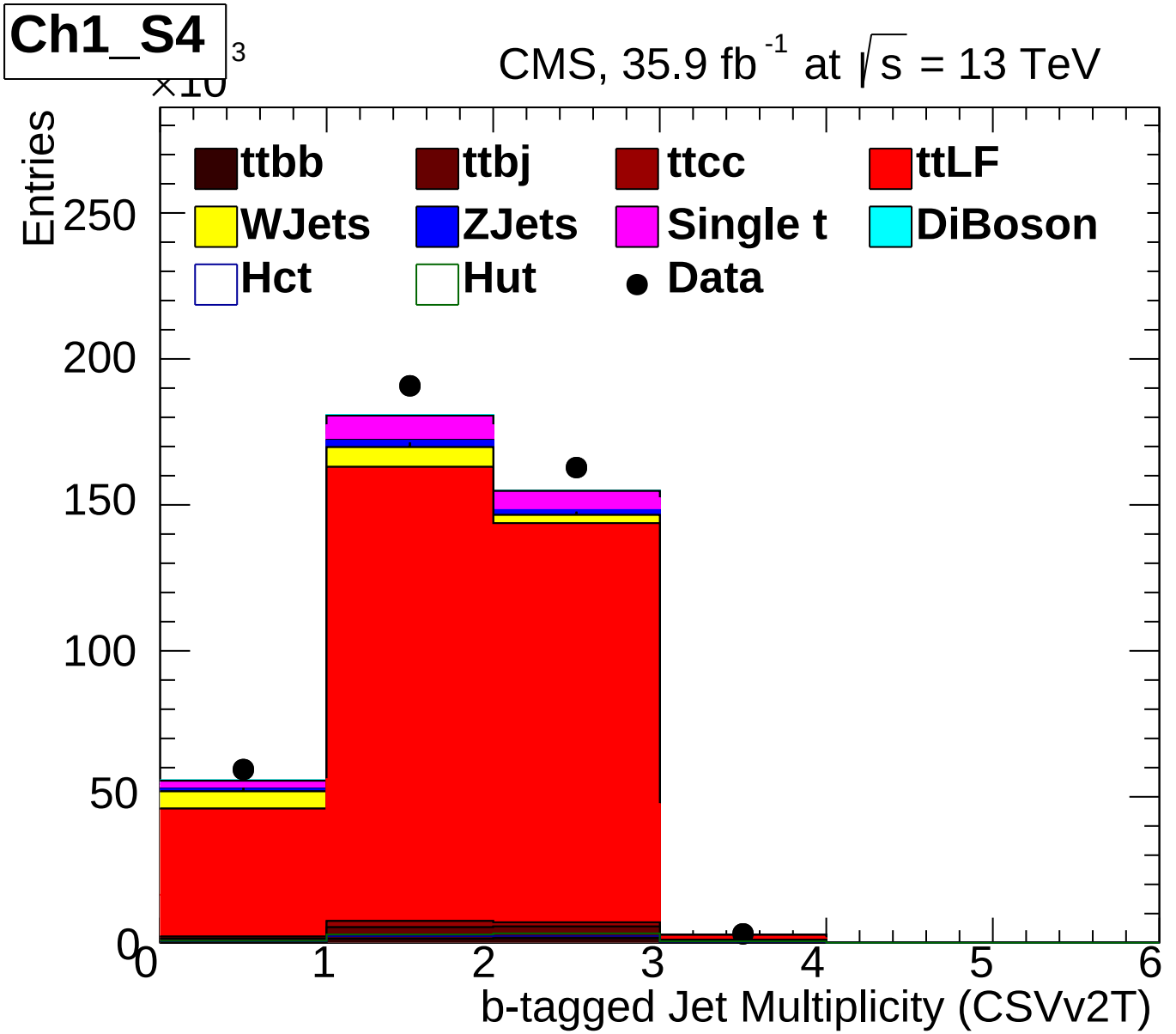

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

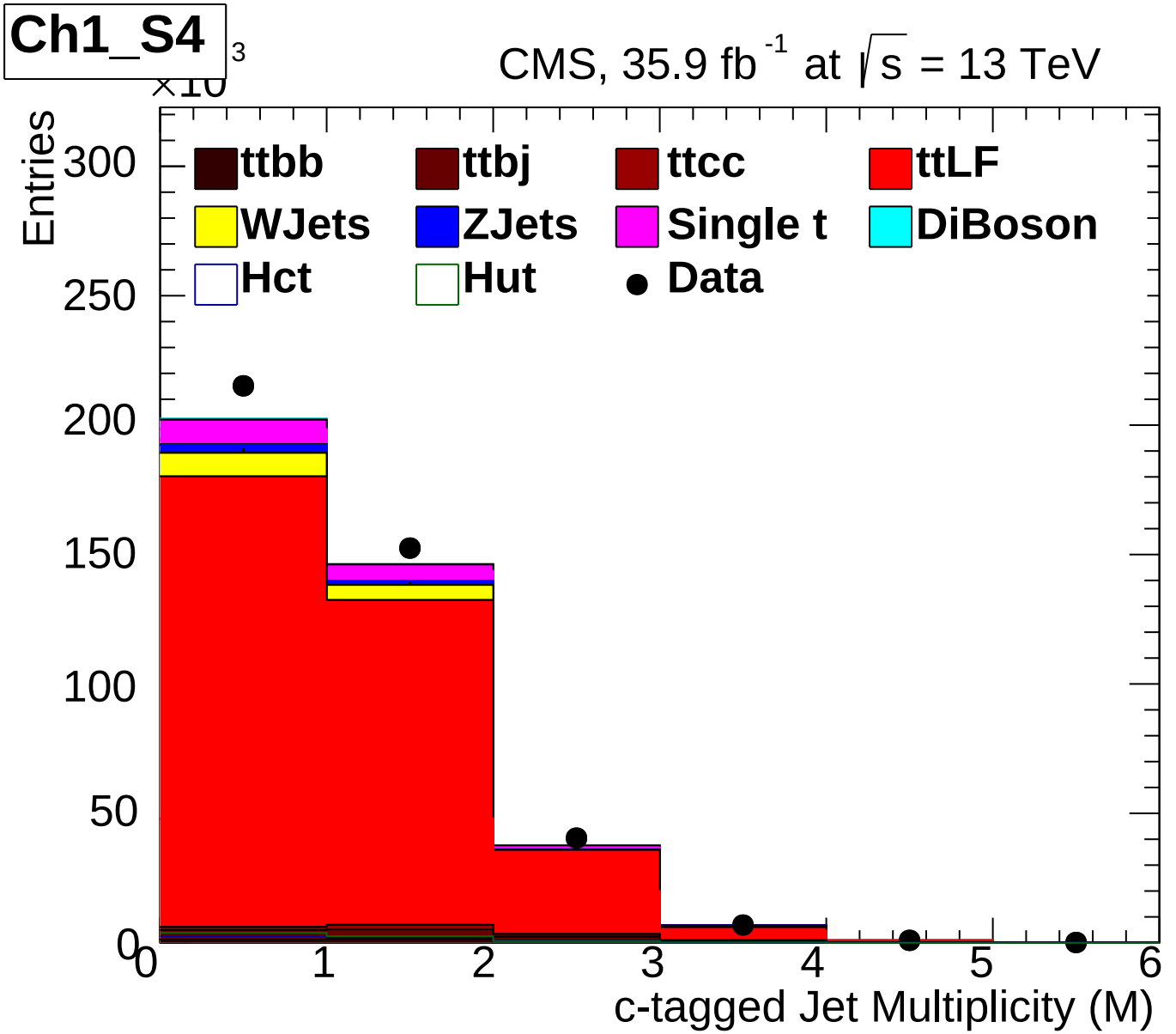

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

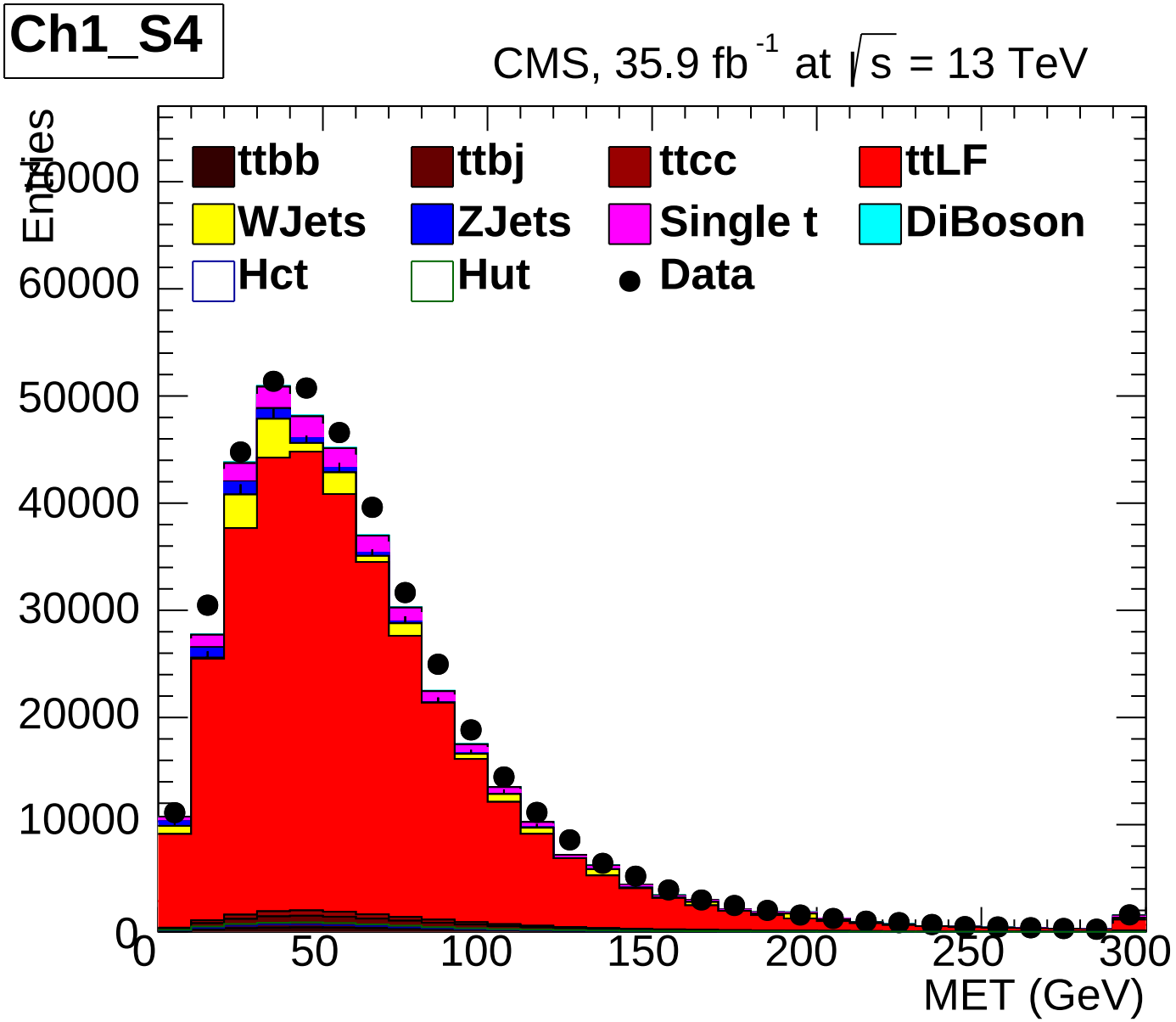

Ch1_S3
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
500
1000
1500
2000
2500
3000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

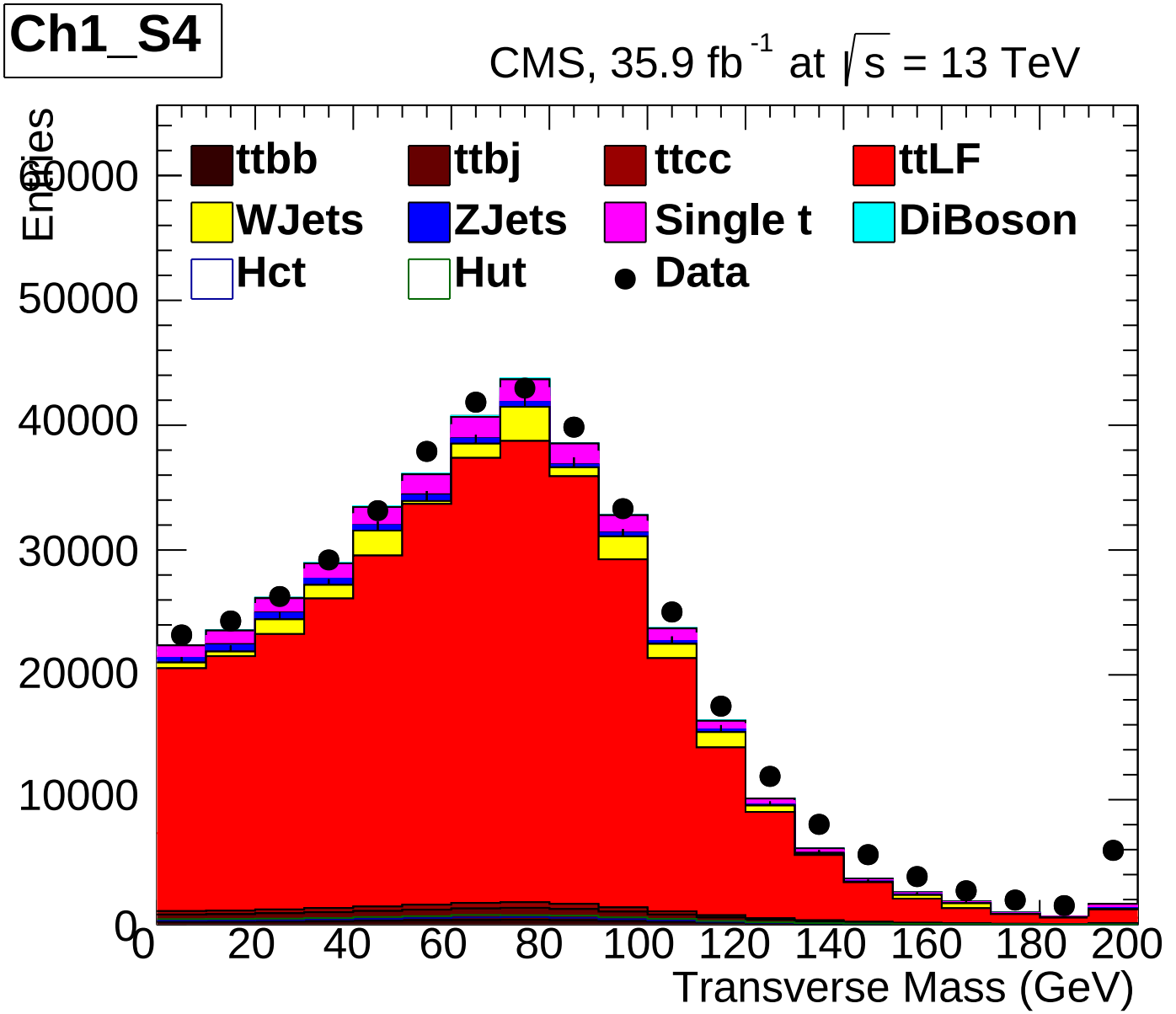

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
0
2
4
6
8
10
12
Jet Multiplicity

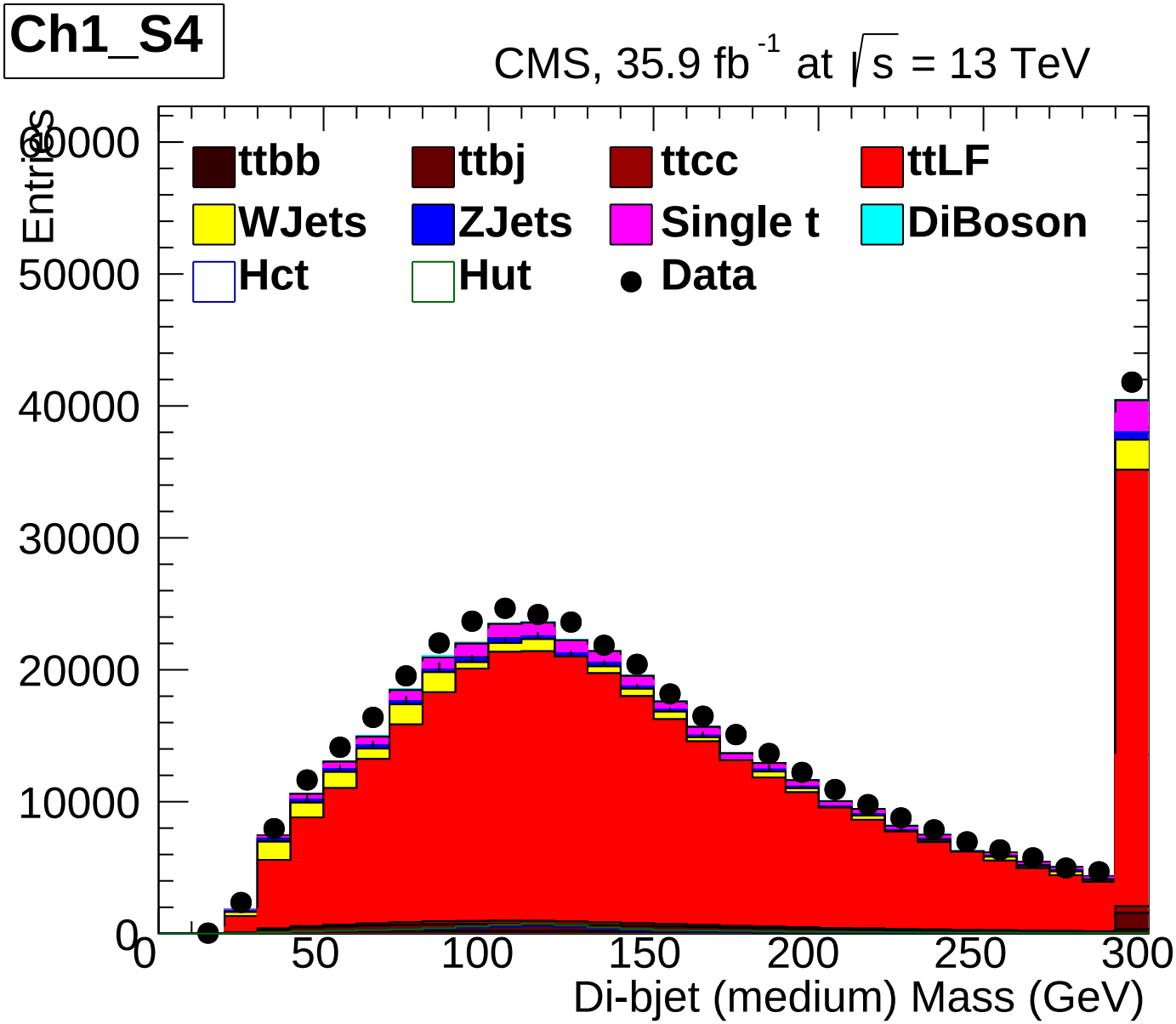

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

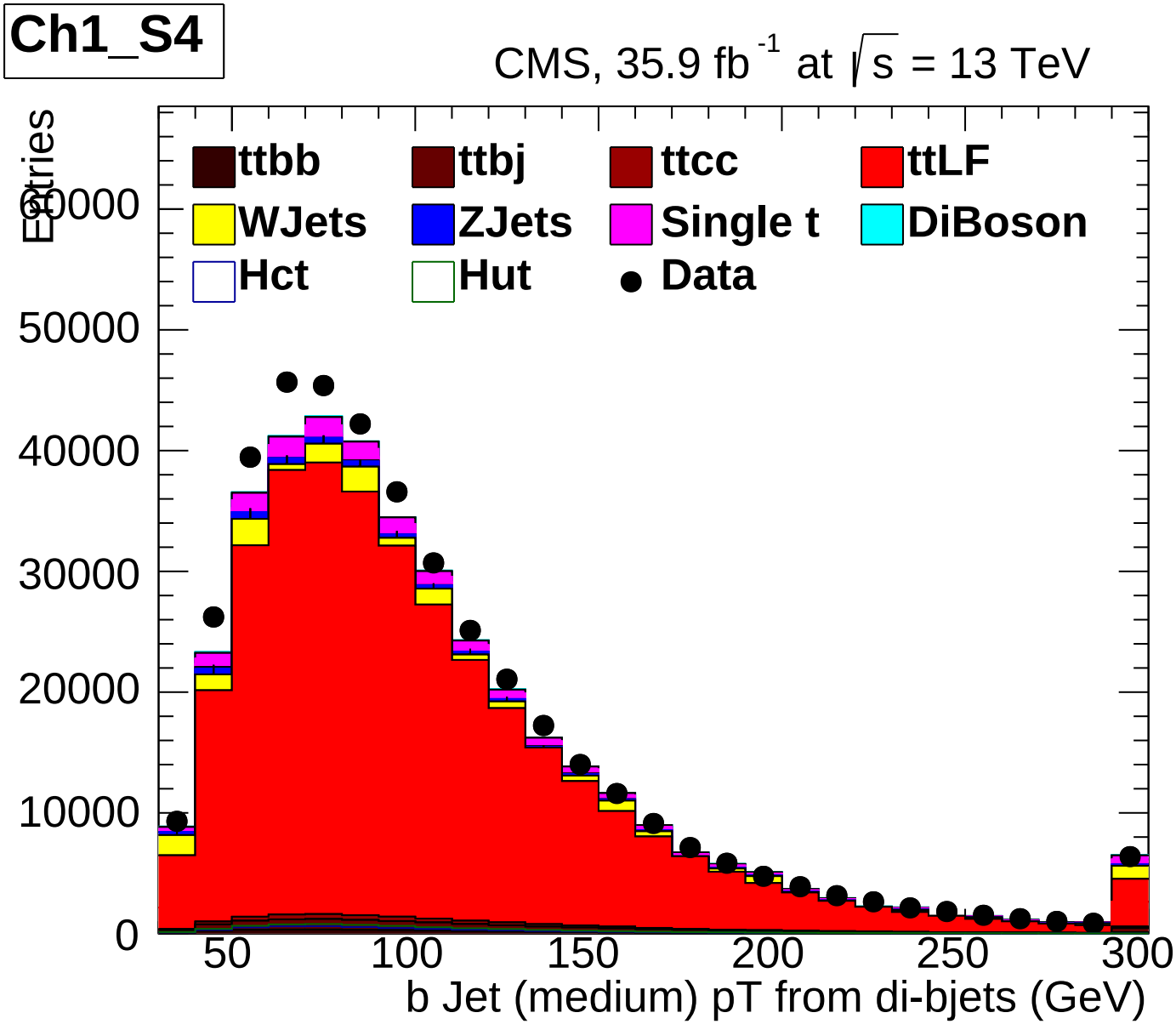

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

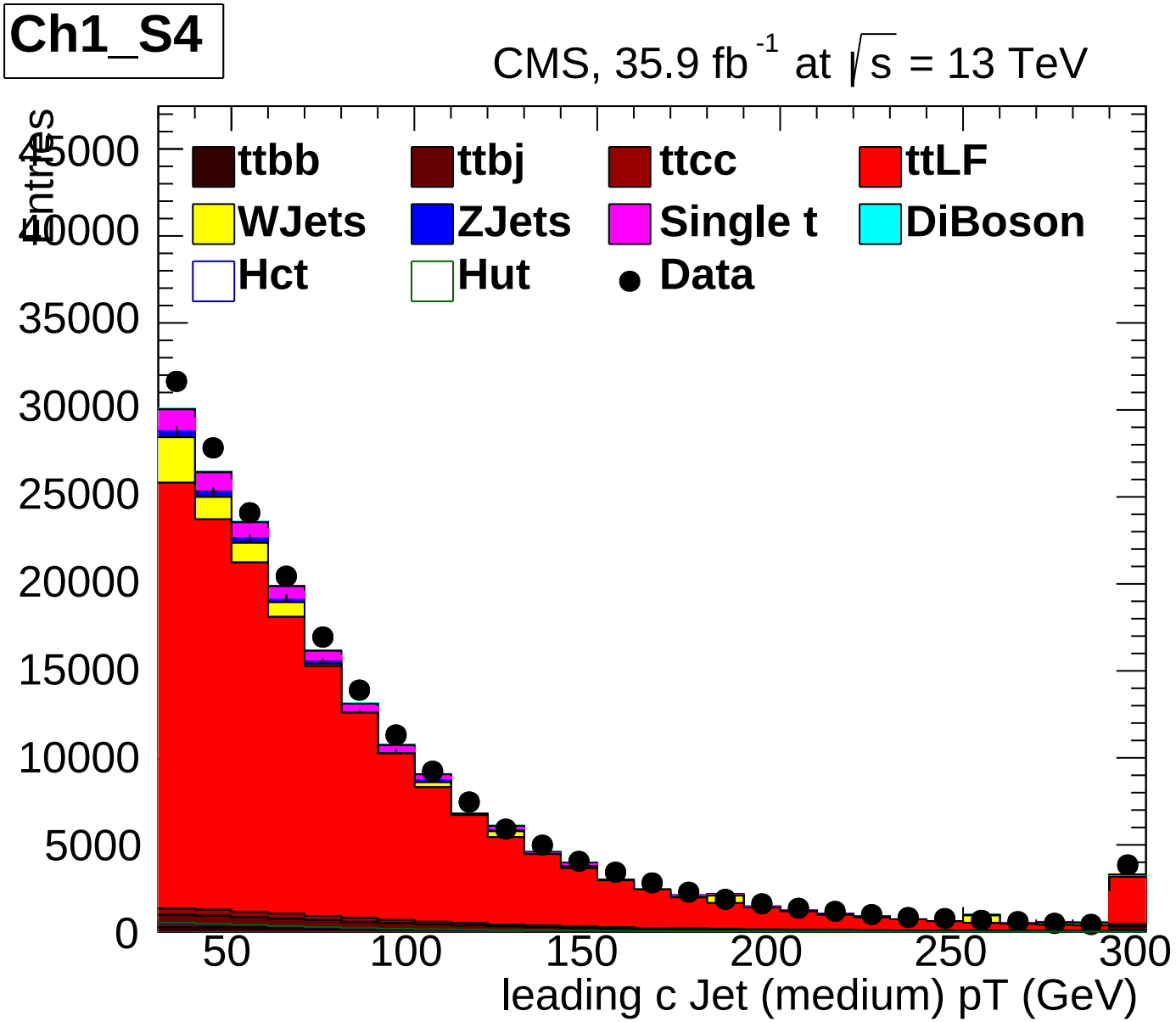

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

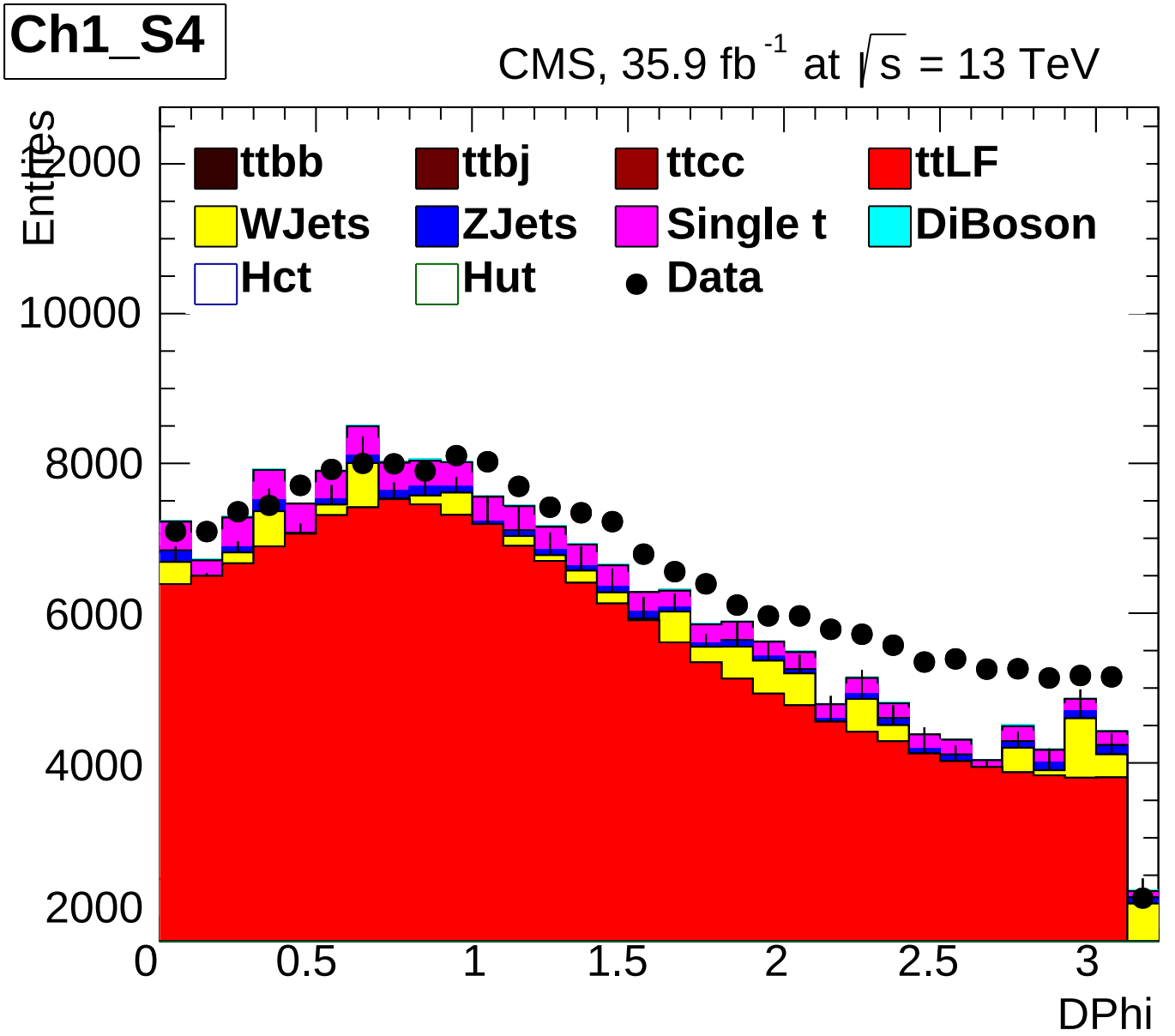

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
70000
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
MET (GeV)

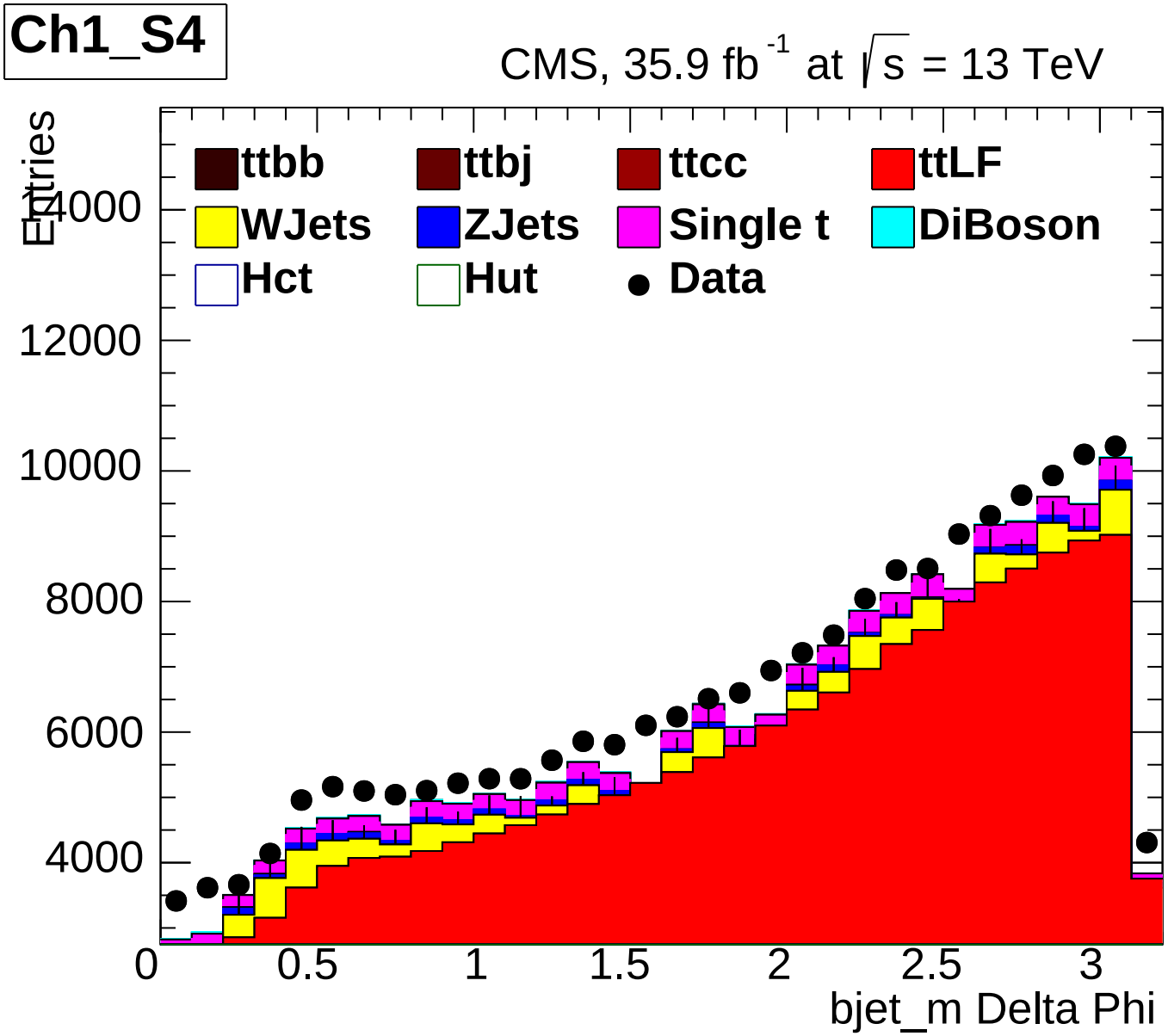

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10000
20000
30000
40000
50000
60000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

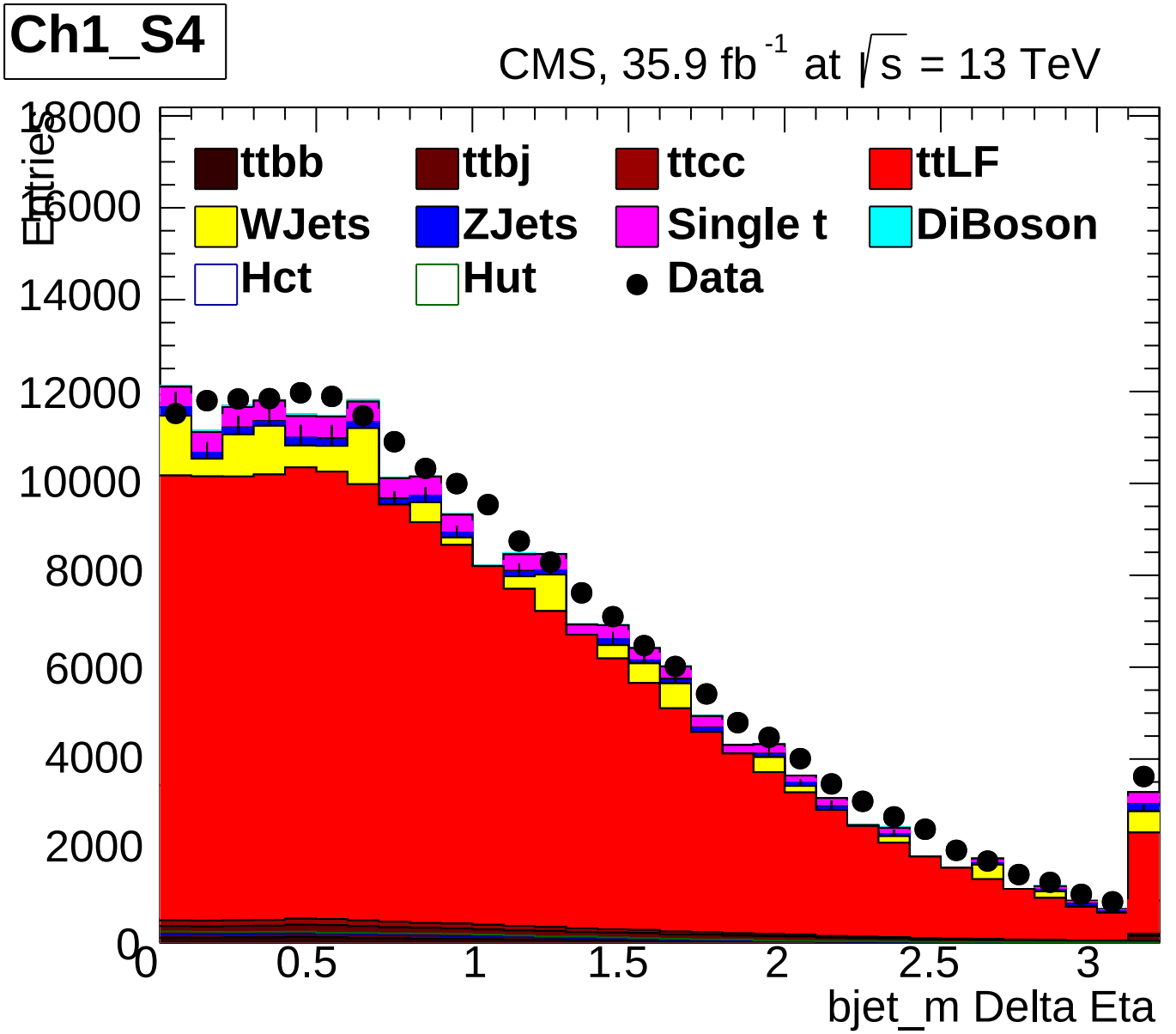

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

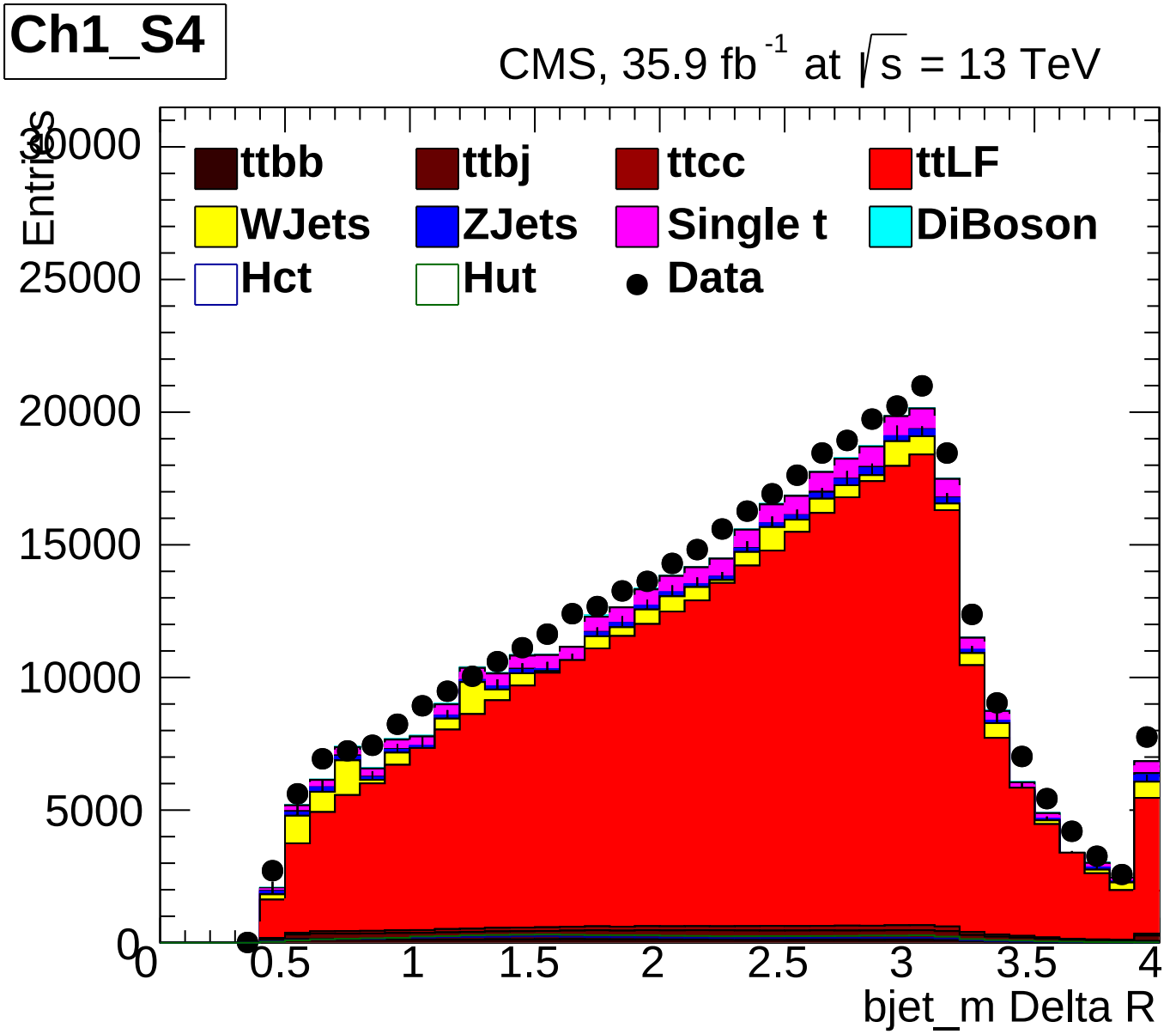

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

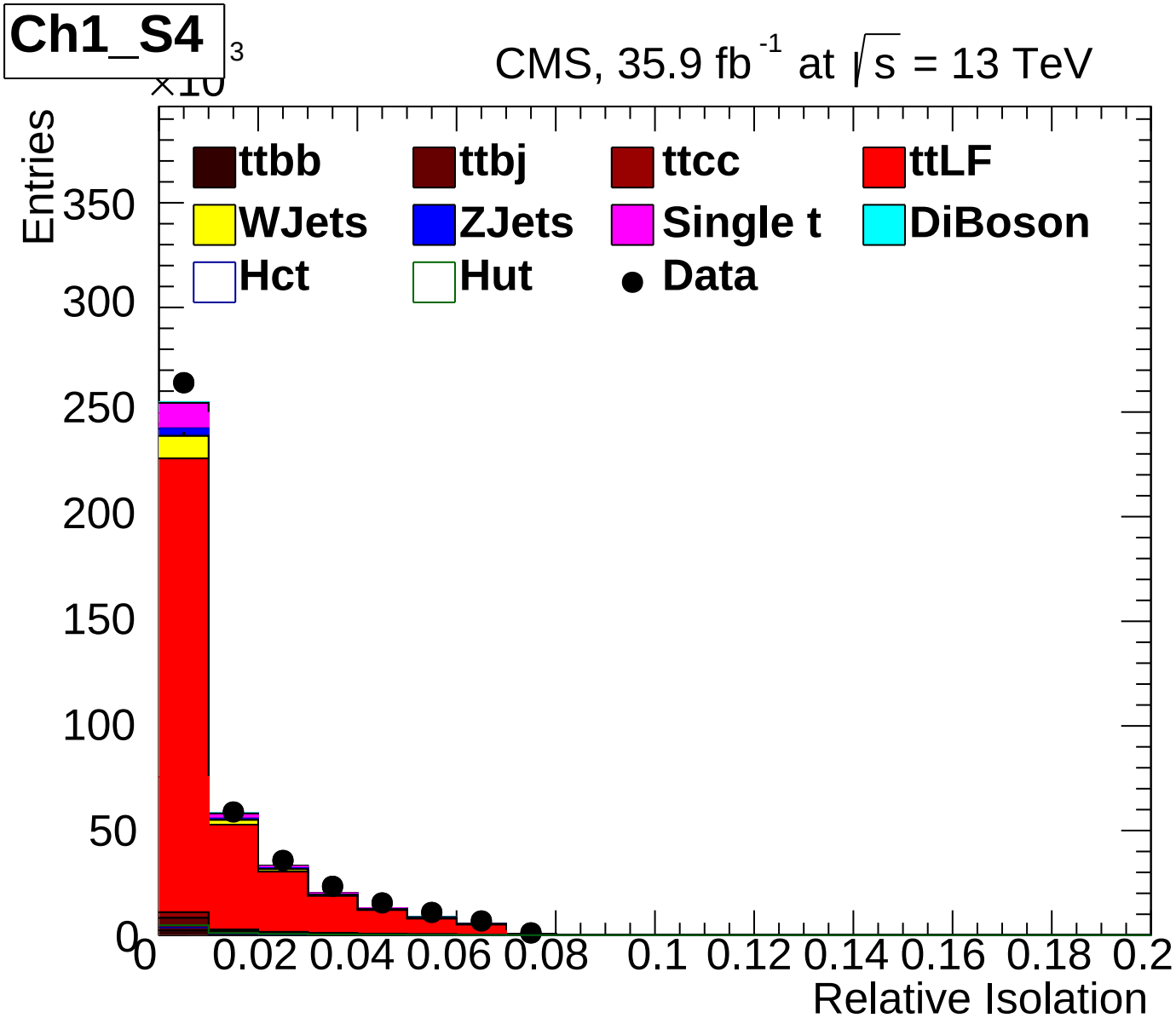

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

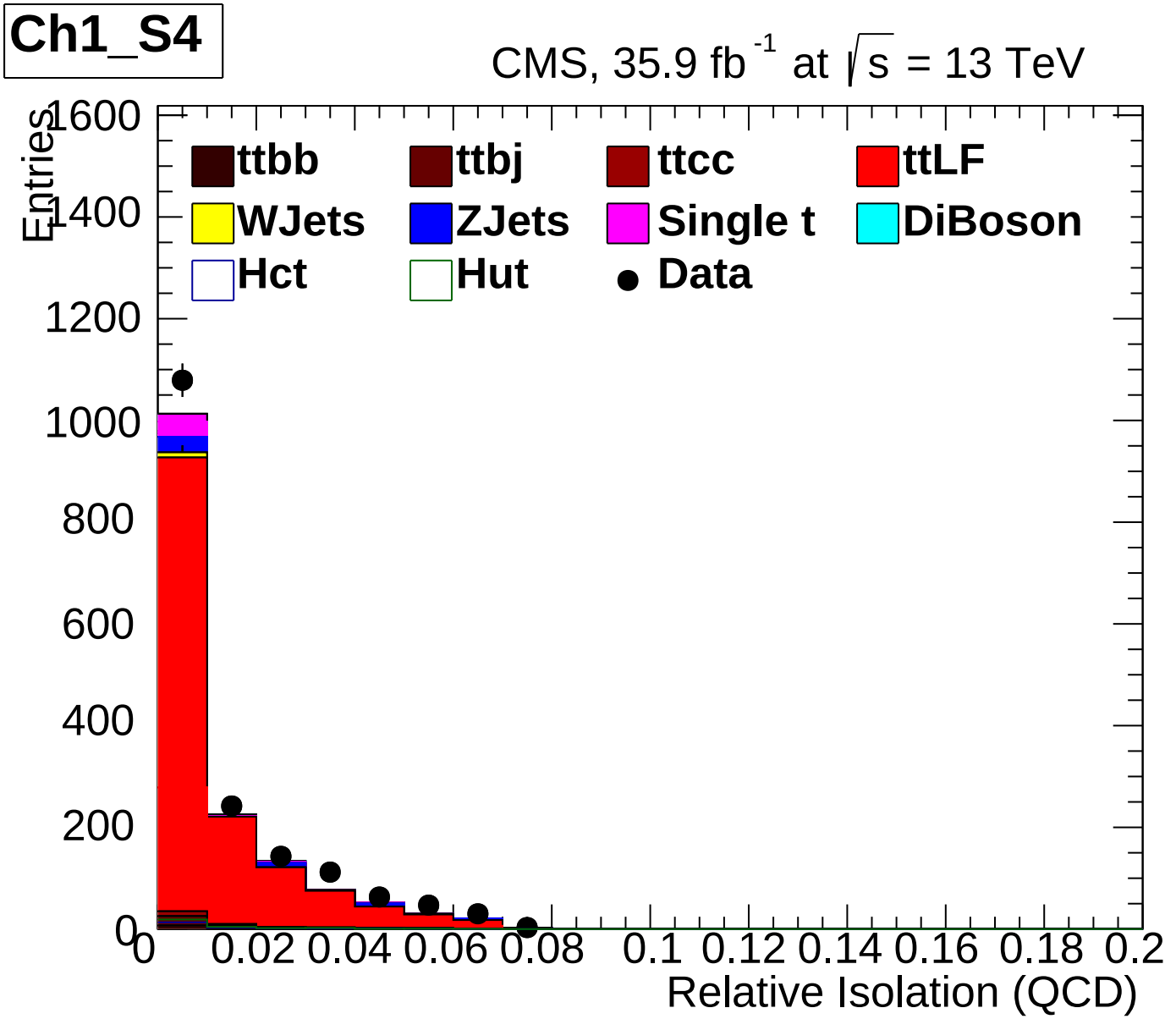

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
DPhi

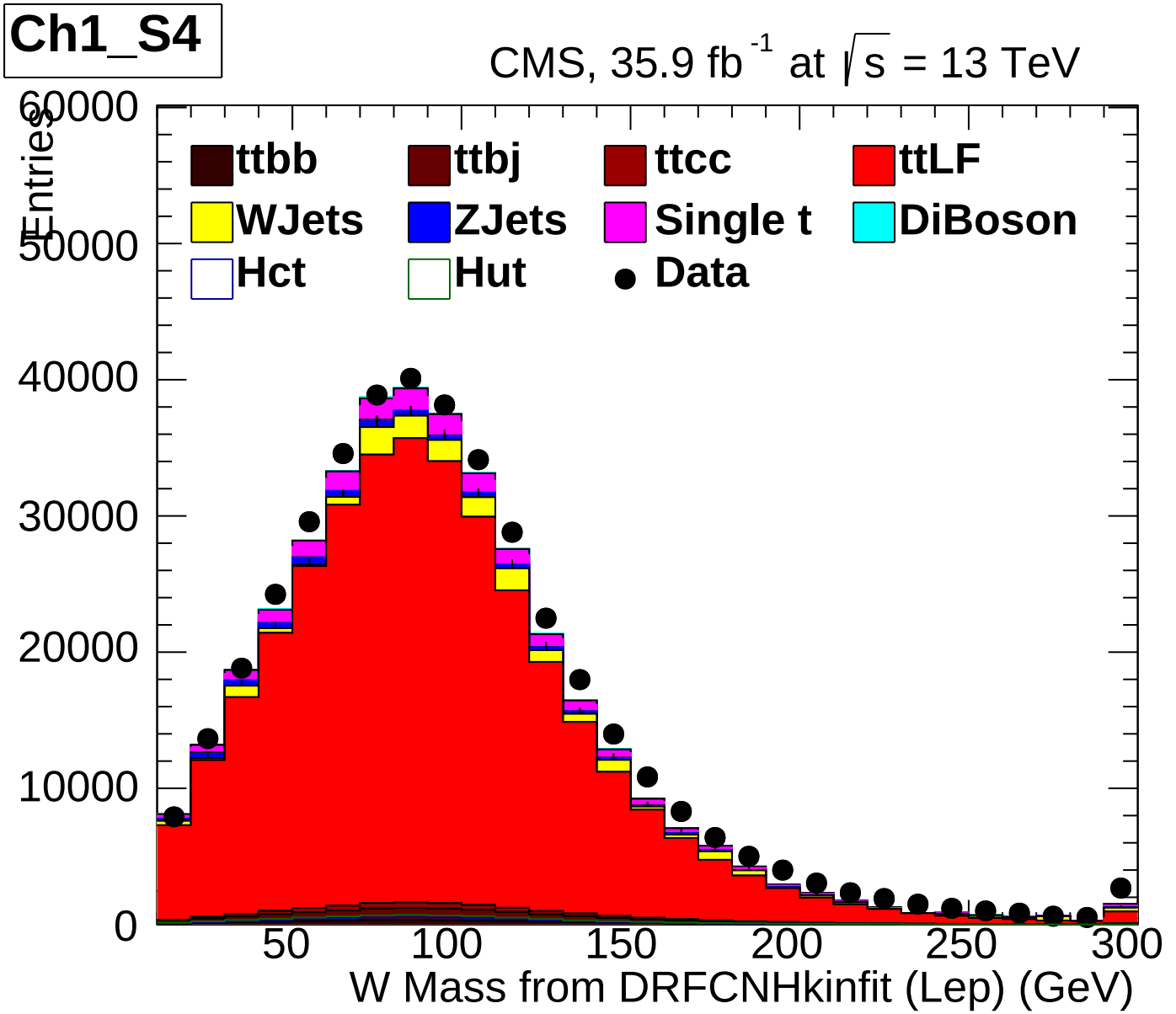

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
14000
12000
10000
8000
6000
4000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1600
1400
1200
1000
800
600
400
200
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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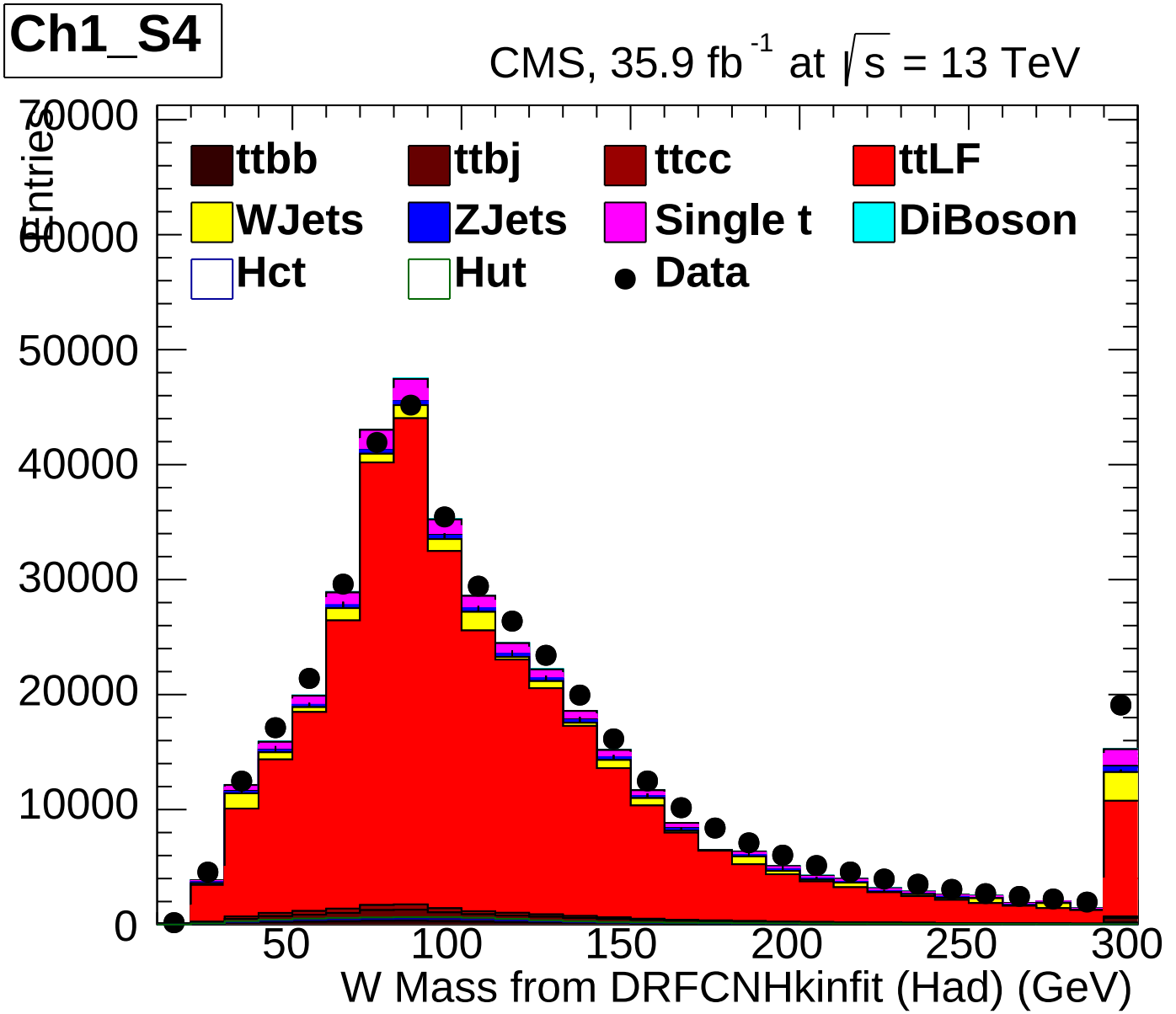
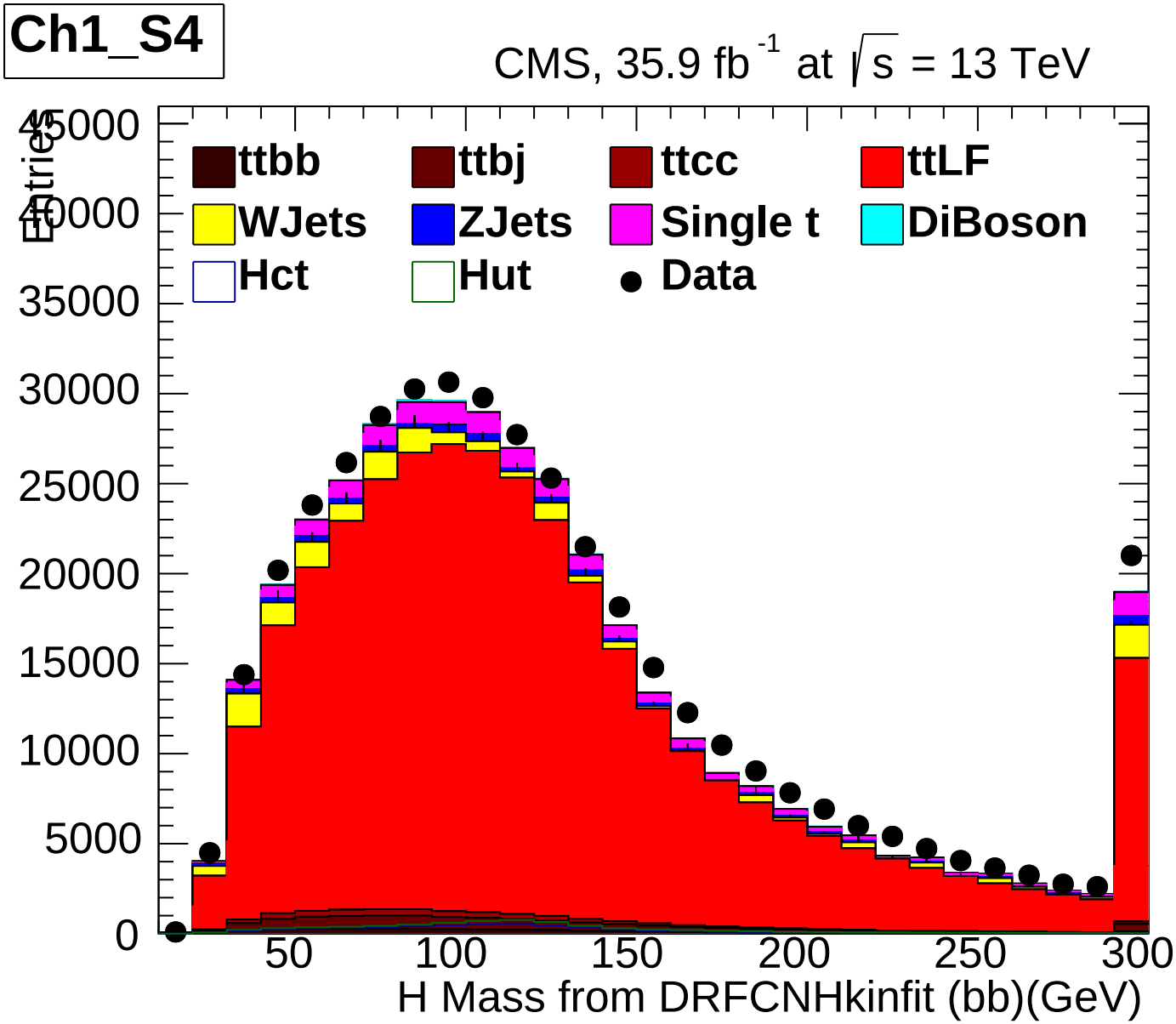
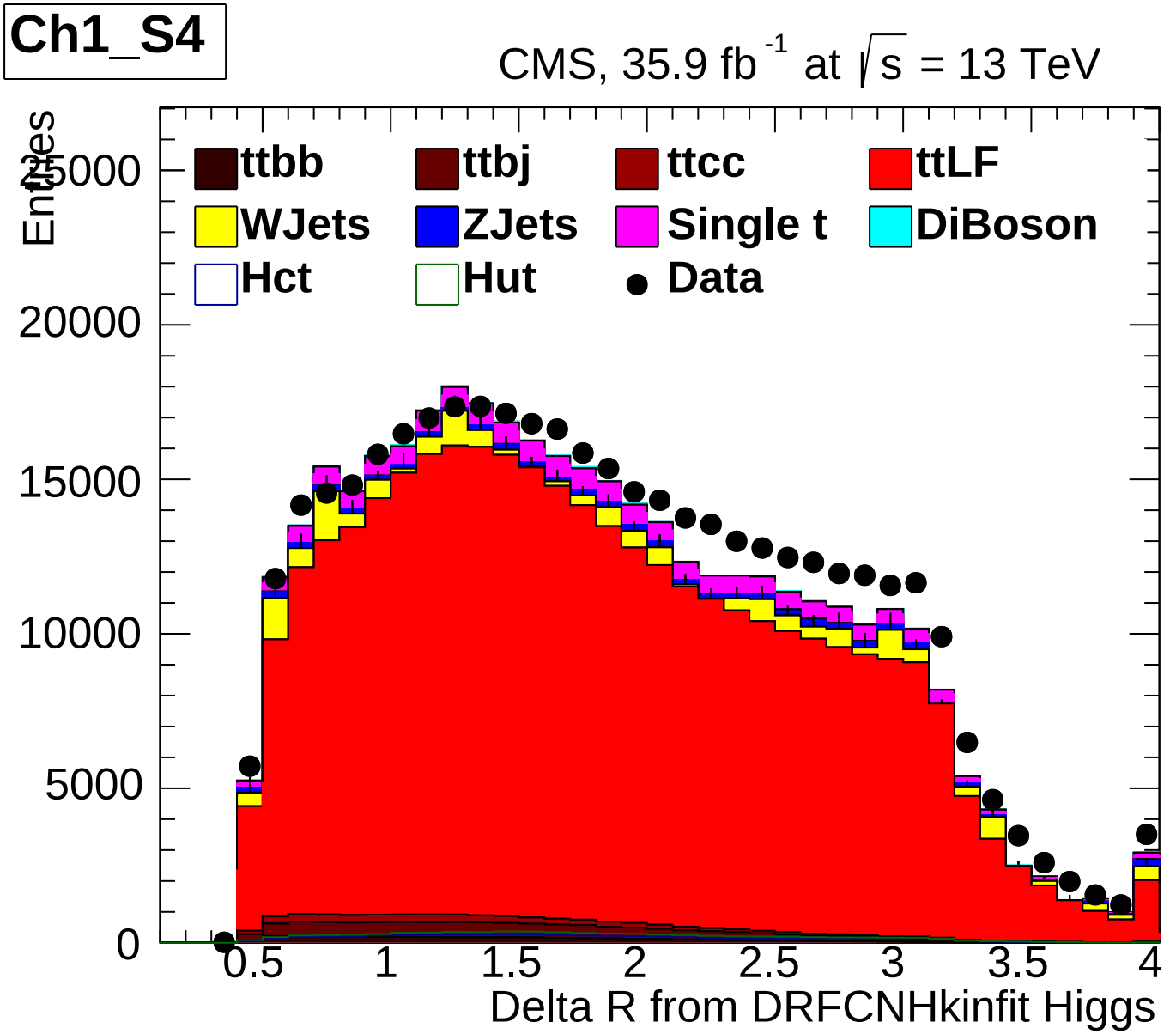
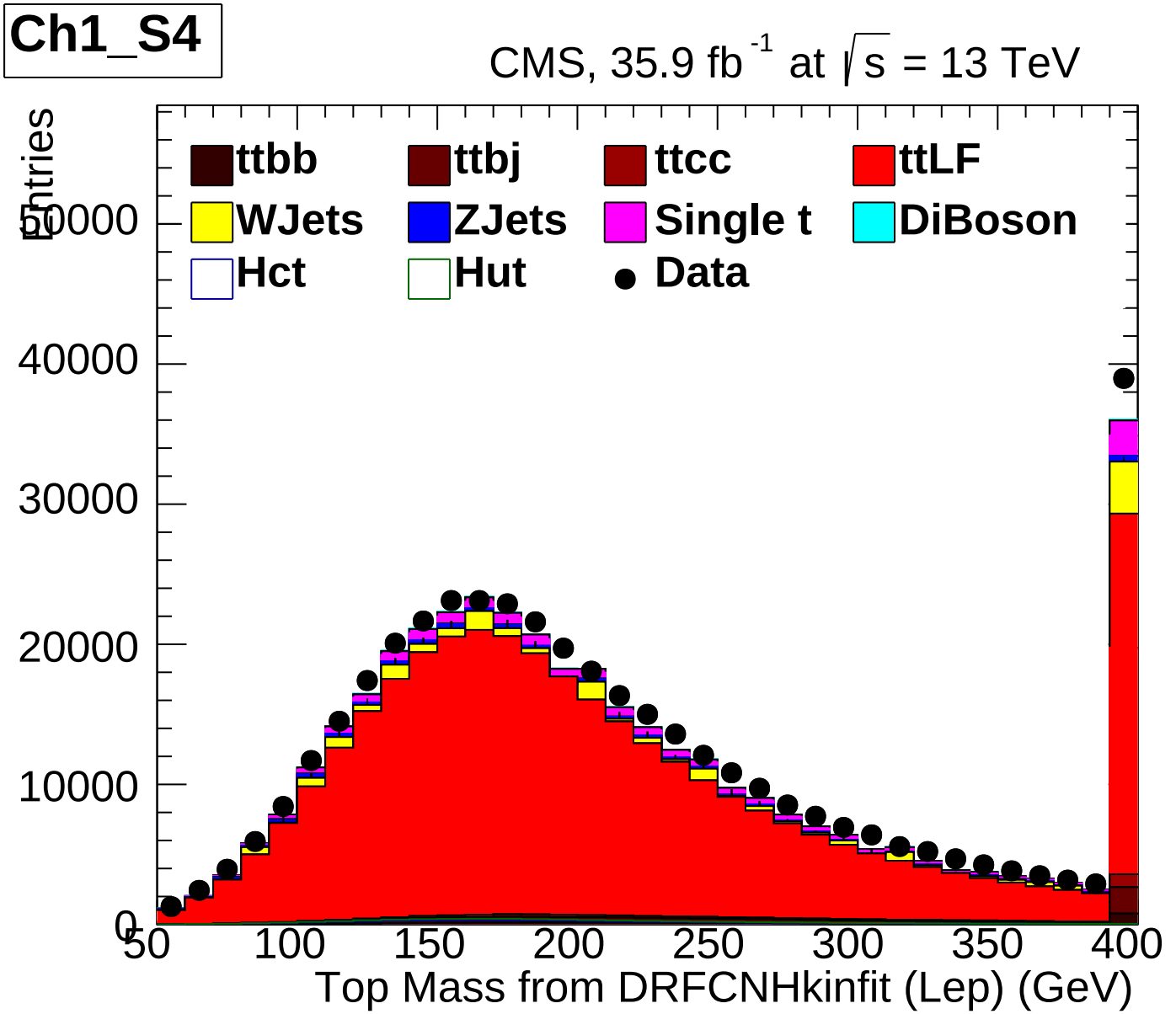
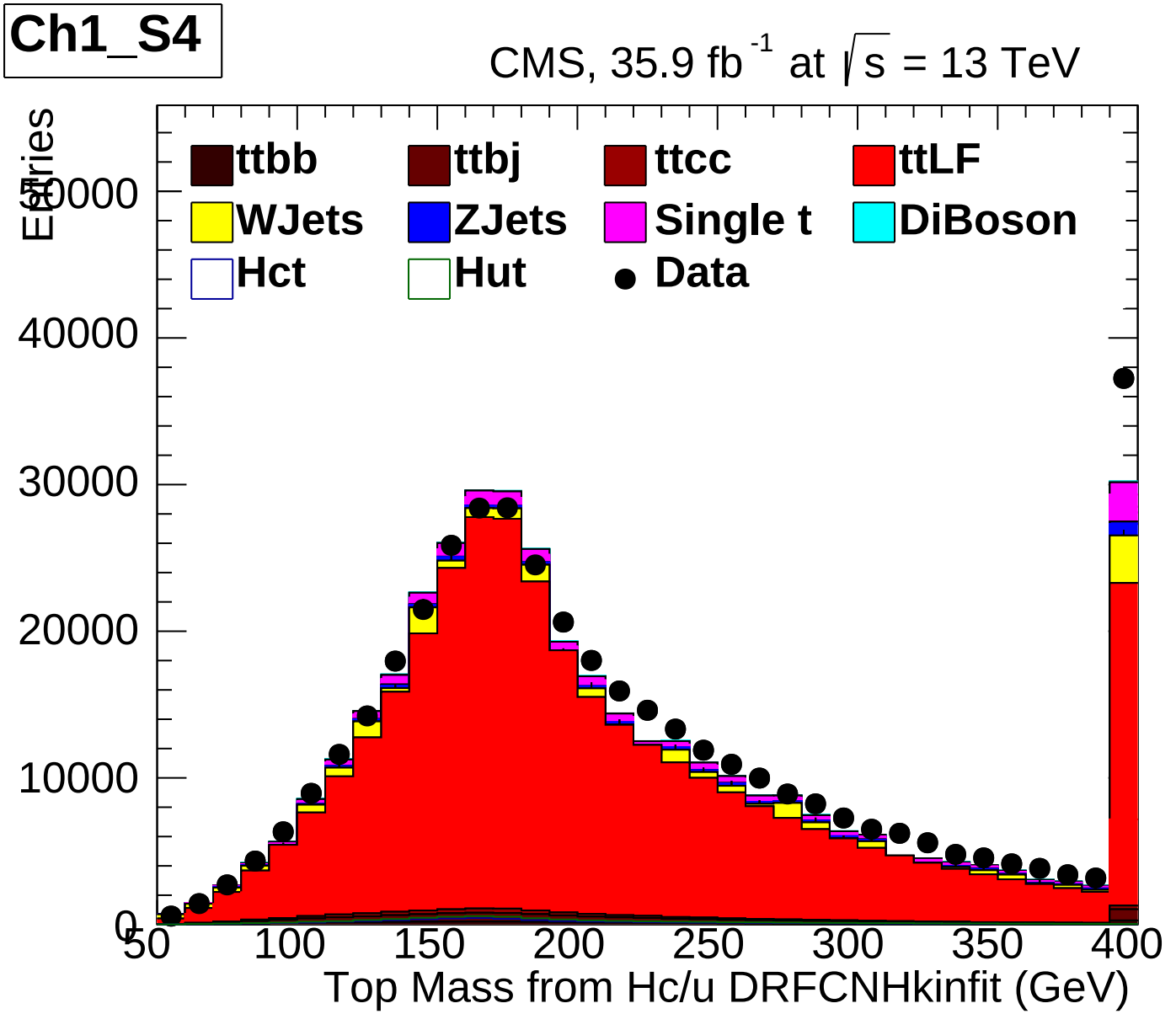
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

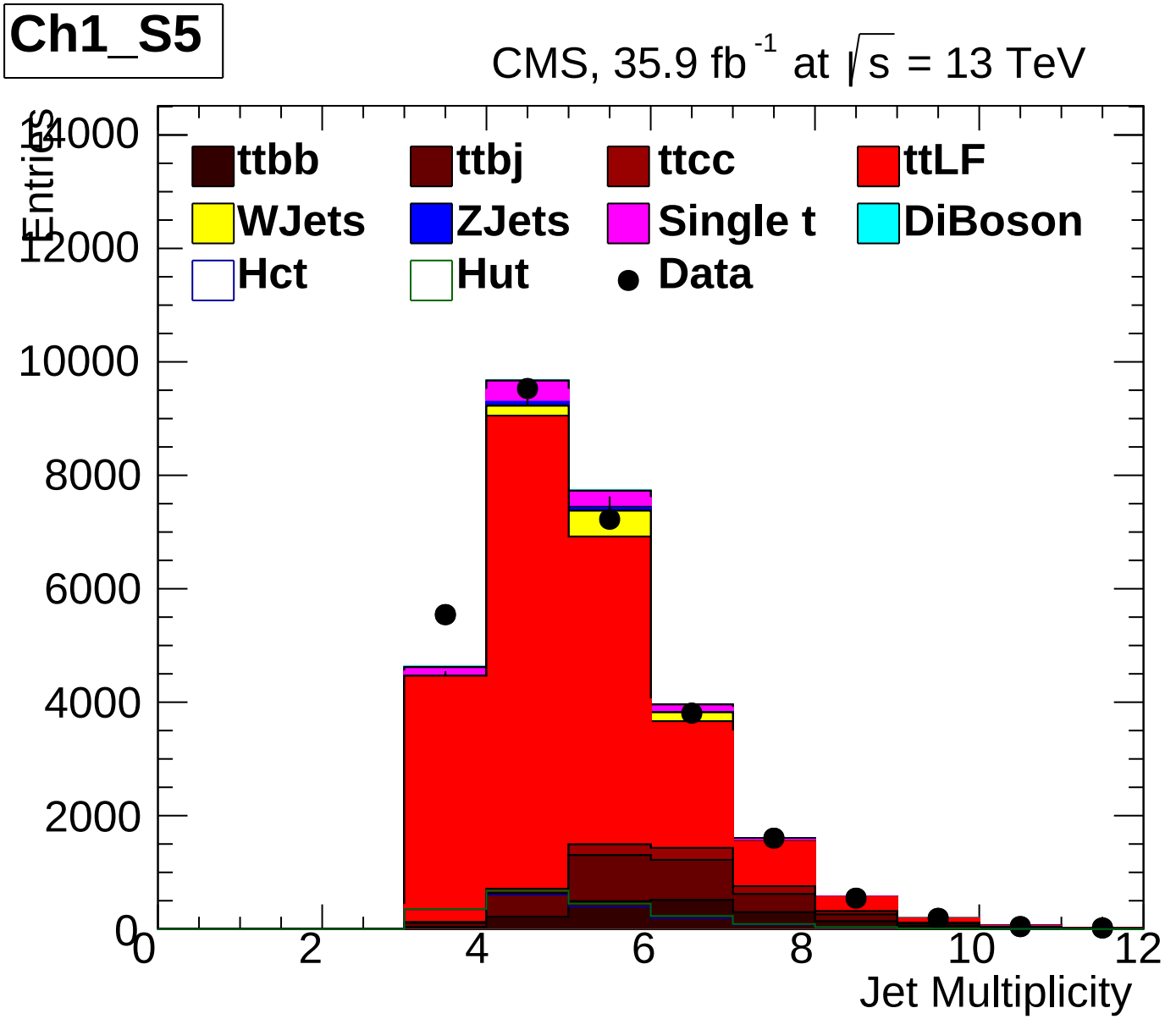

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
70000
60000
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

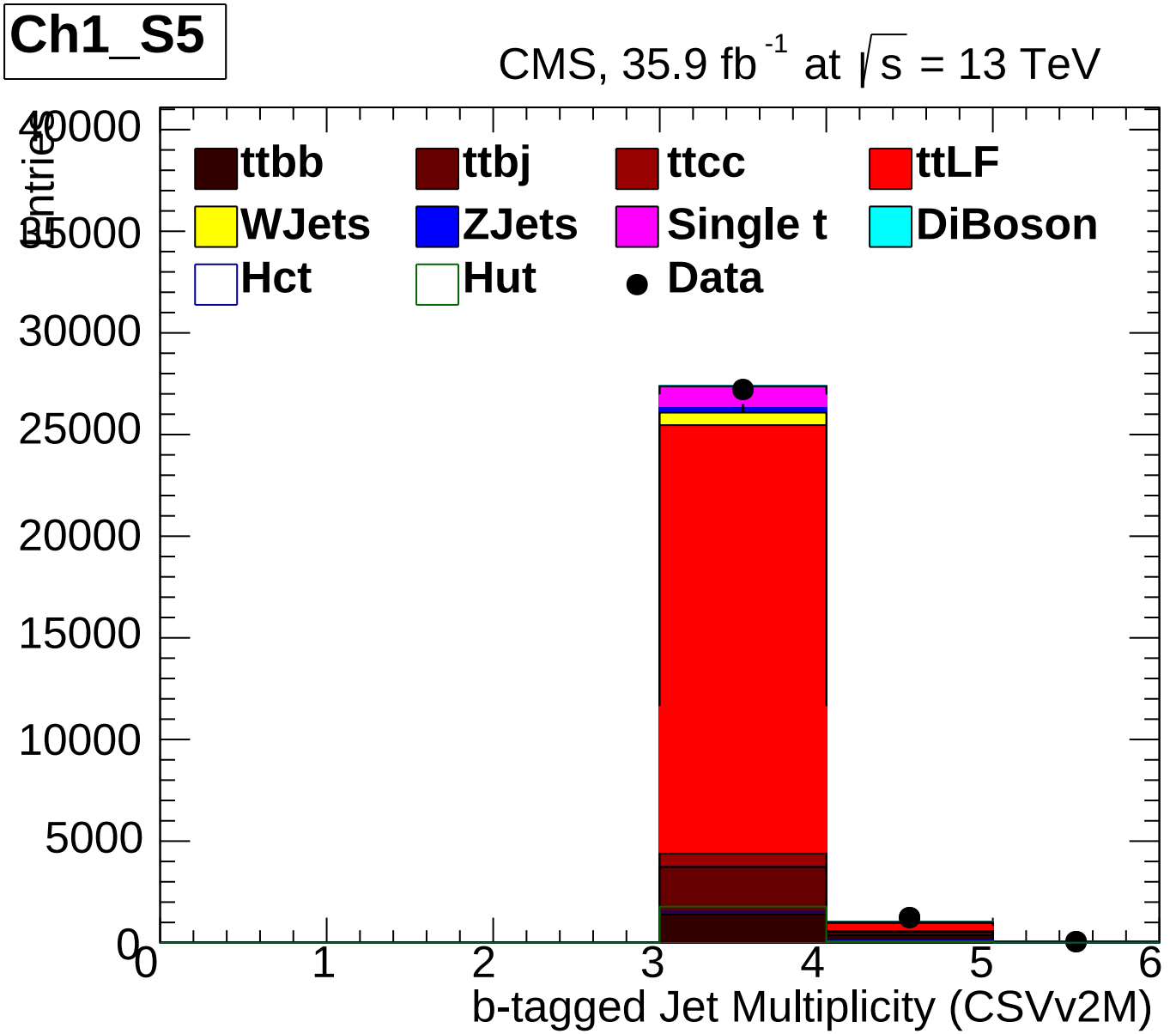

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

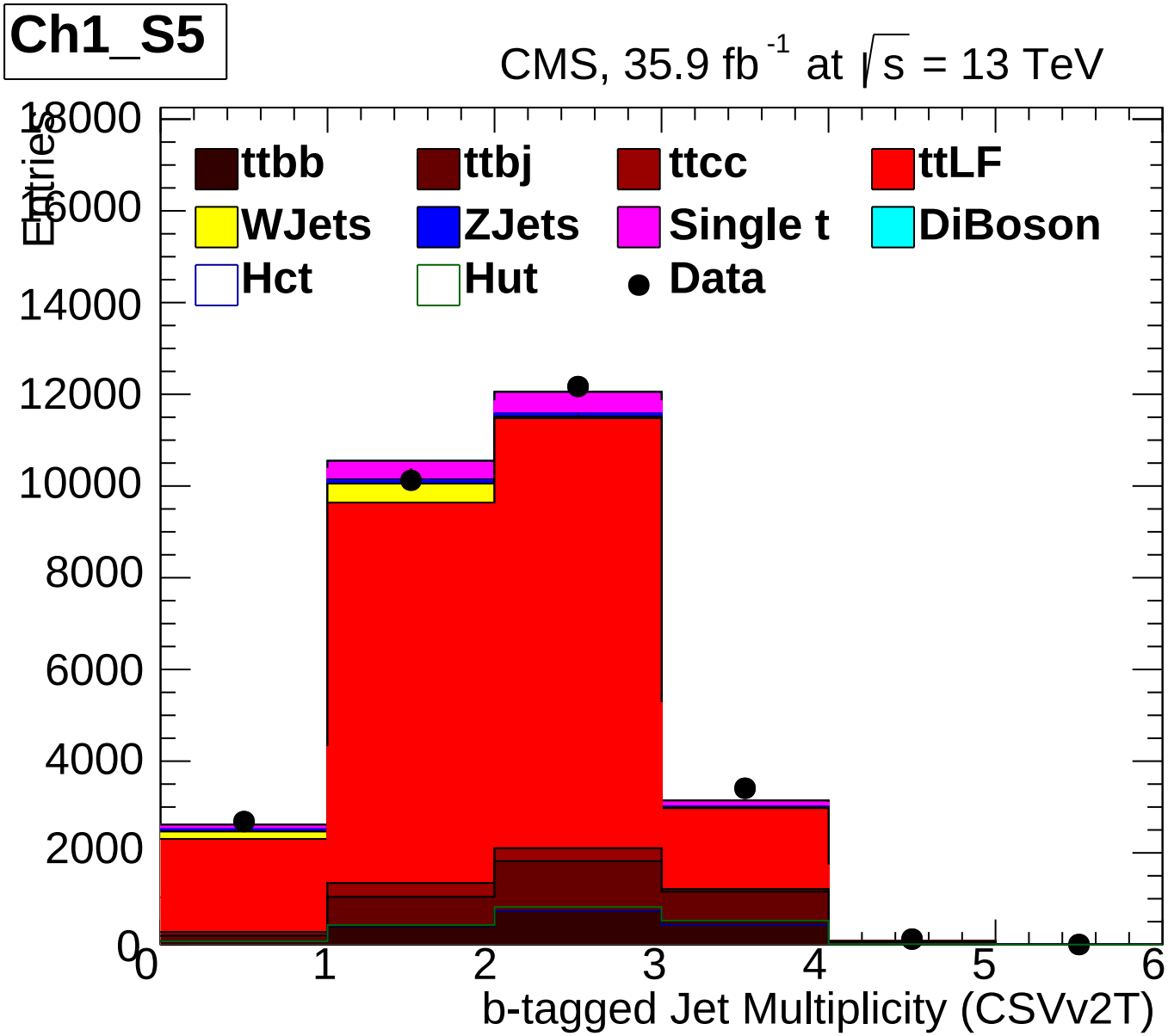

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

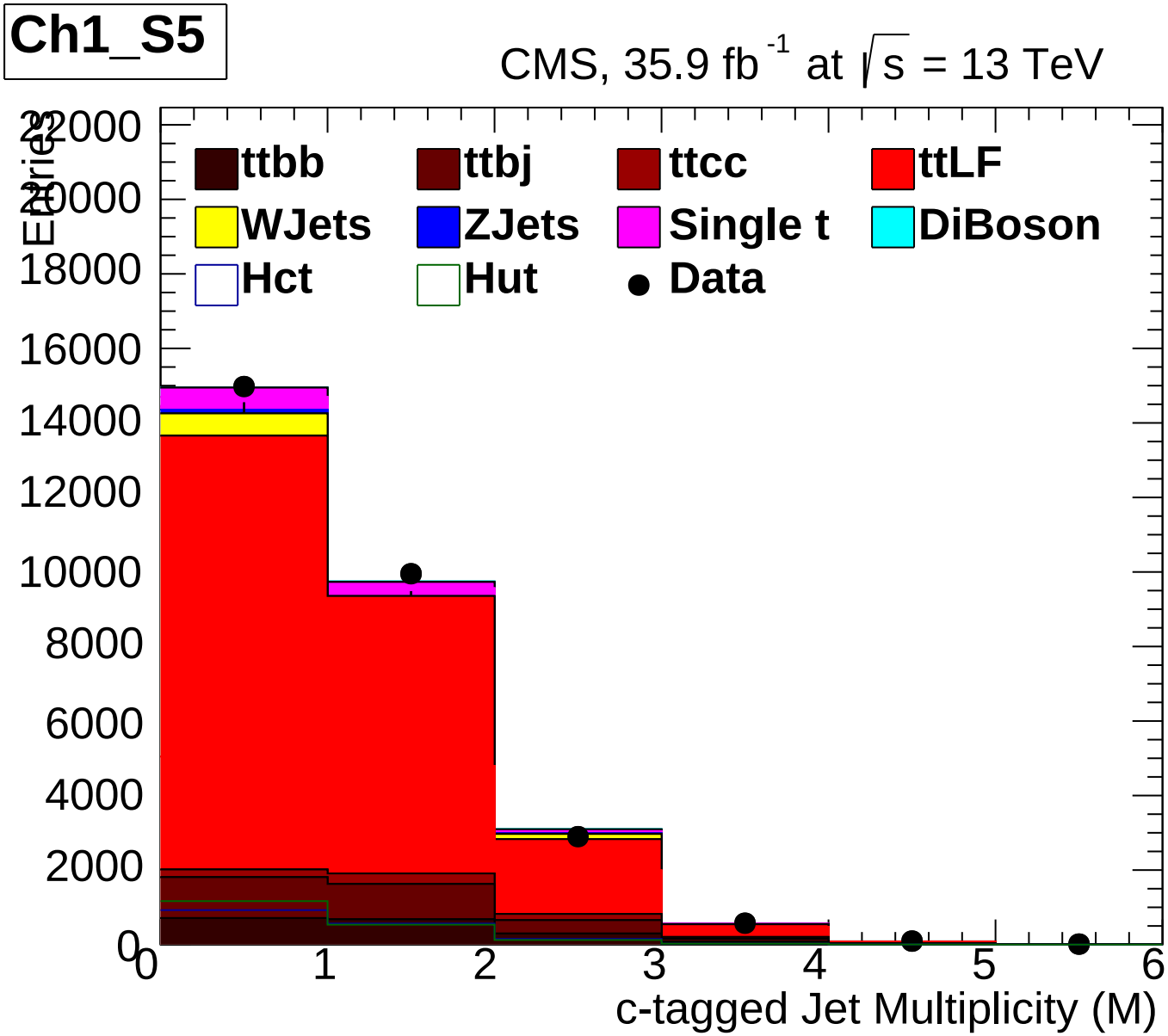

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

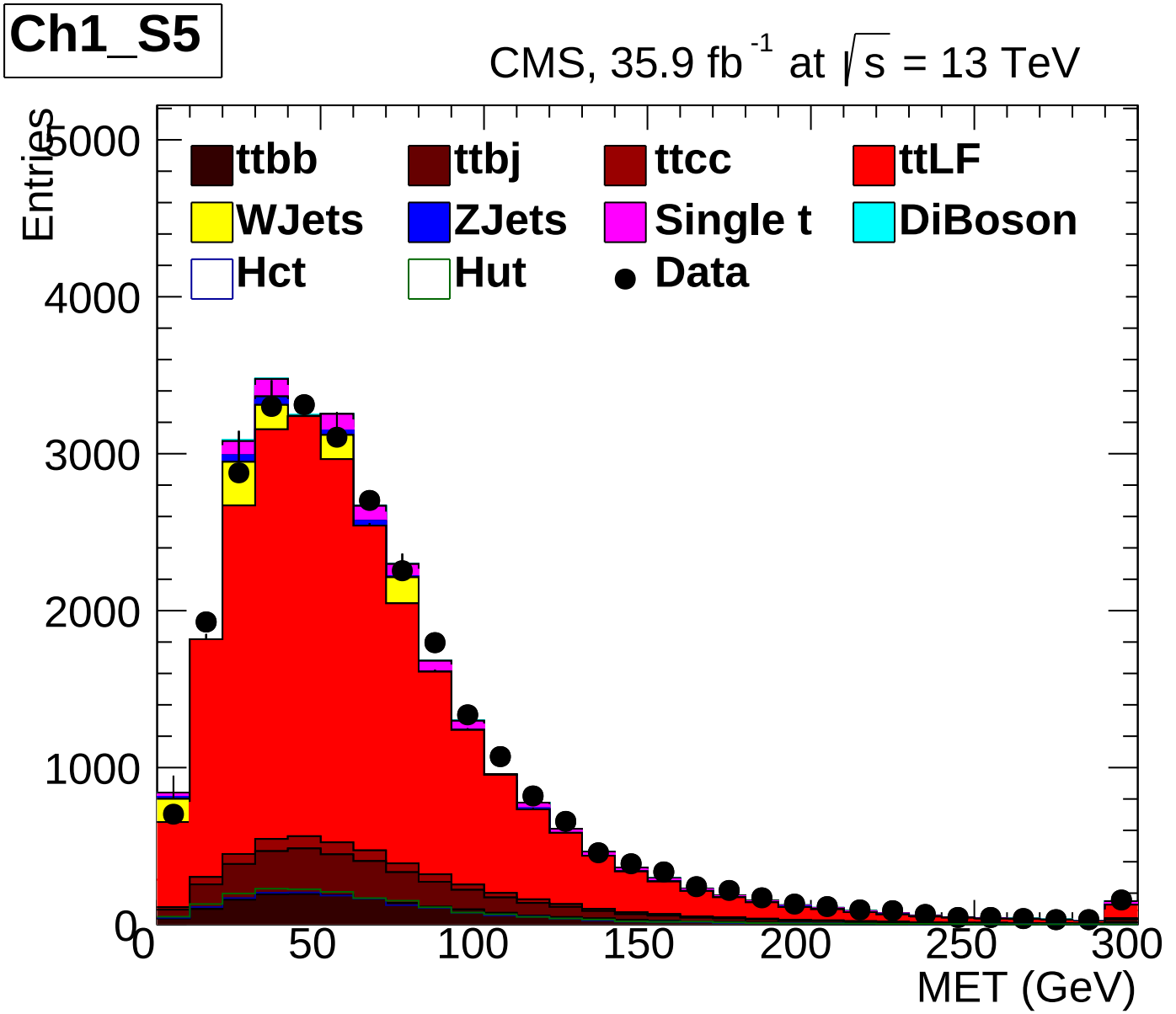

Ch1_S4
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

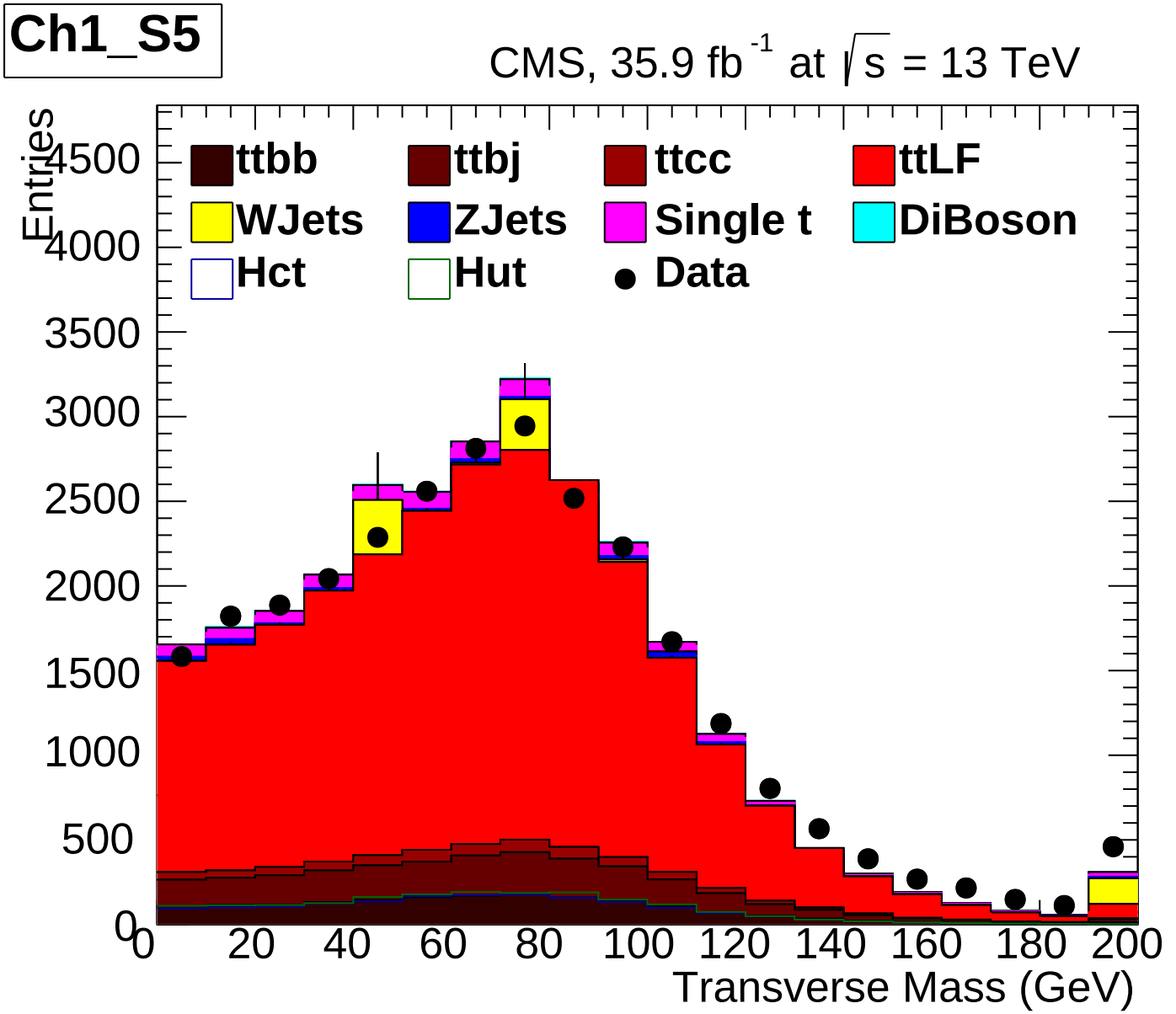

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
14000
12000
10000
8000
6000
4000
2000
0
0
2
4
6
8
10
12
Jet Multiplicity

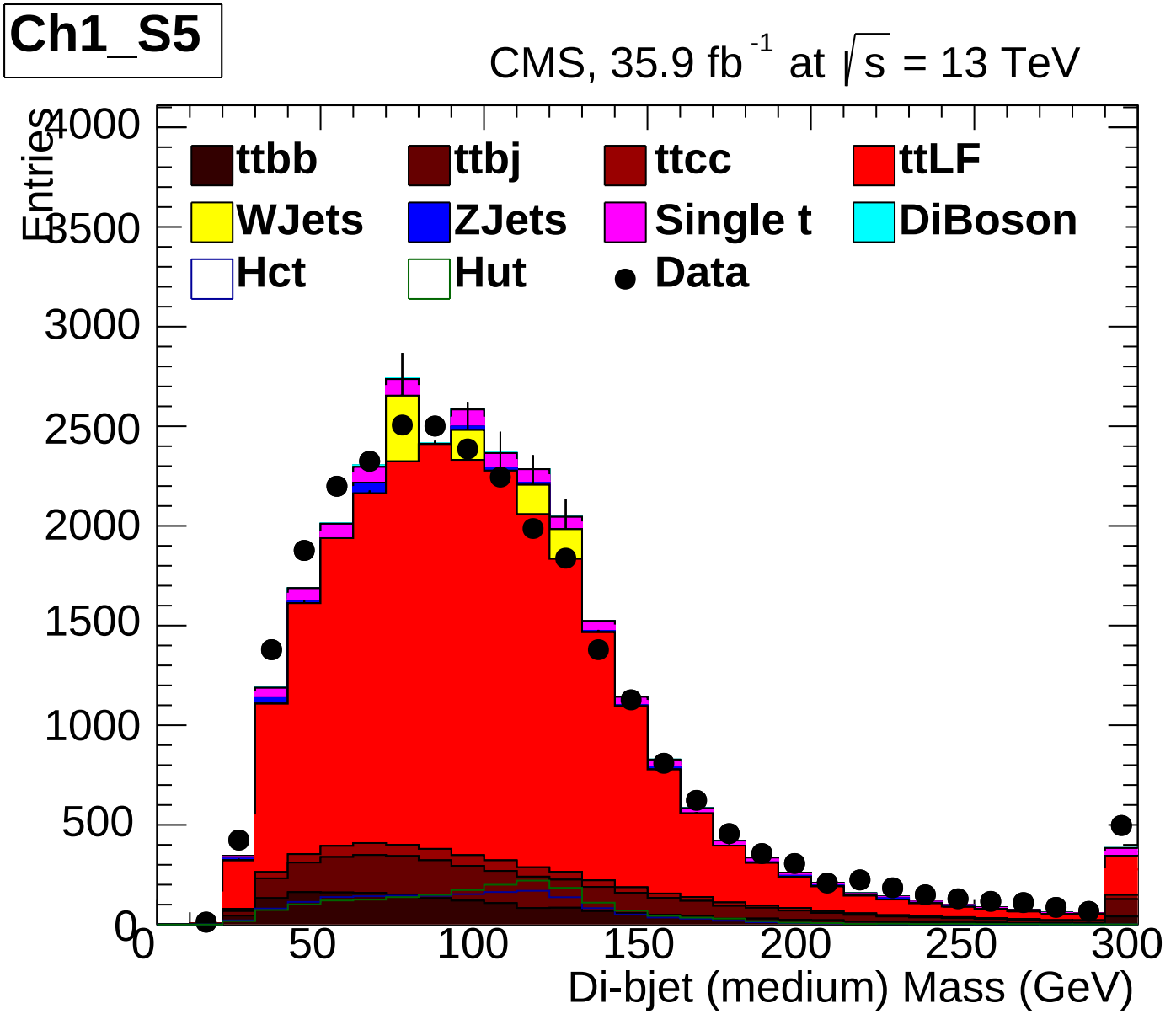

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
entries
40000
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

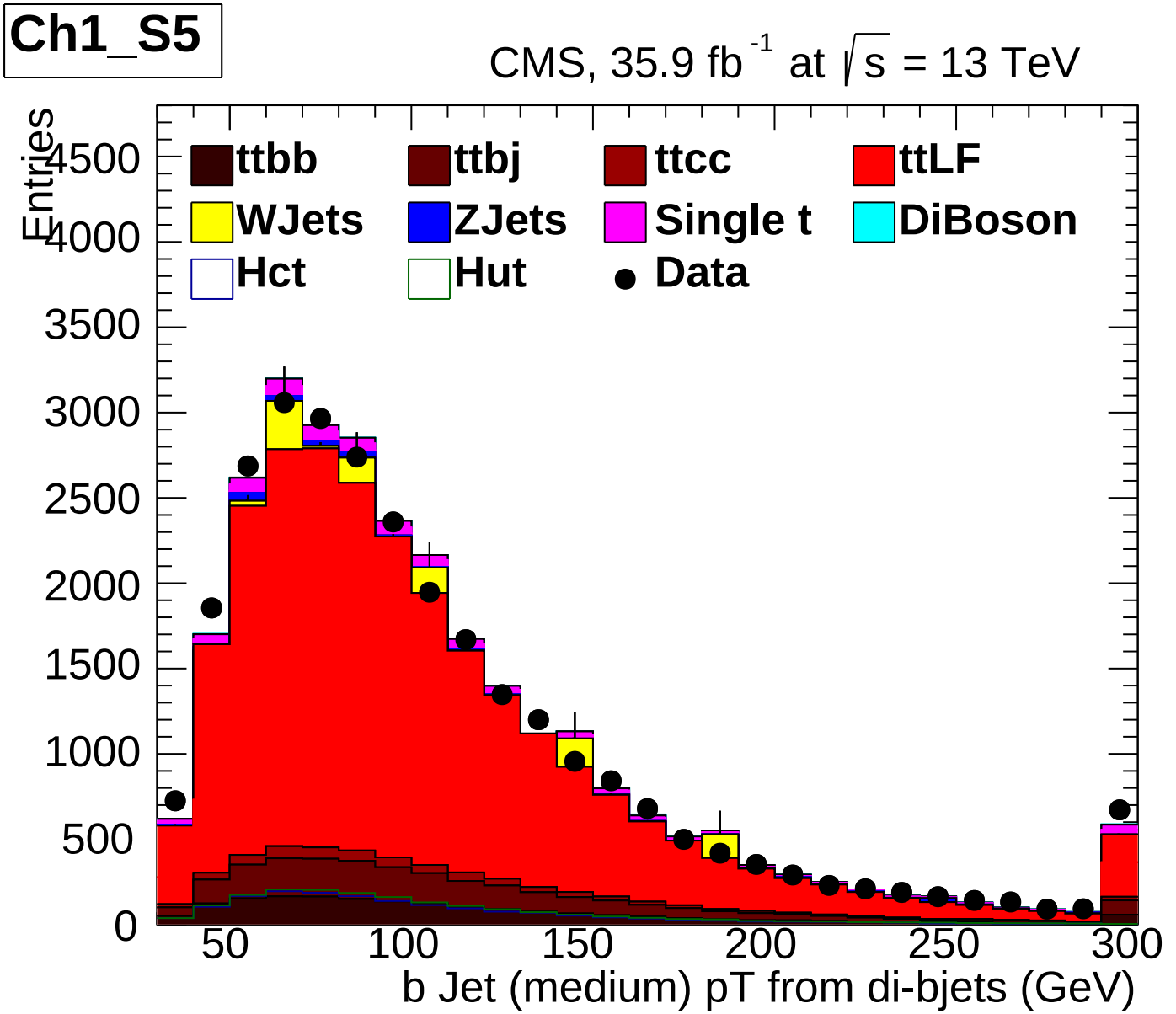

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

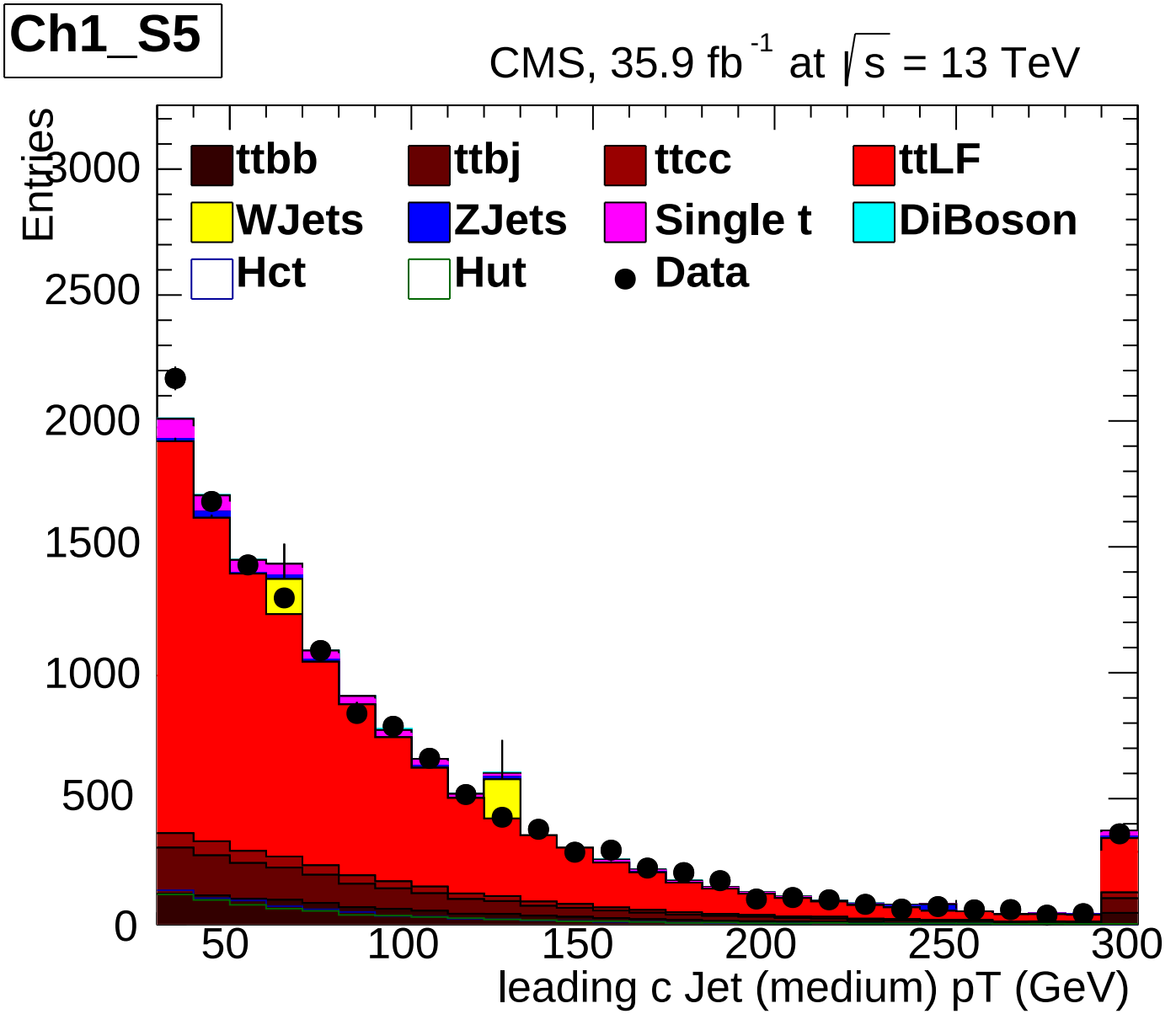

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
22000
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
50
100
150
200
250
300
MET (GeV)


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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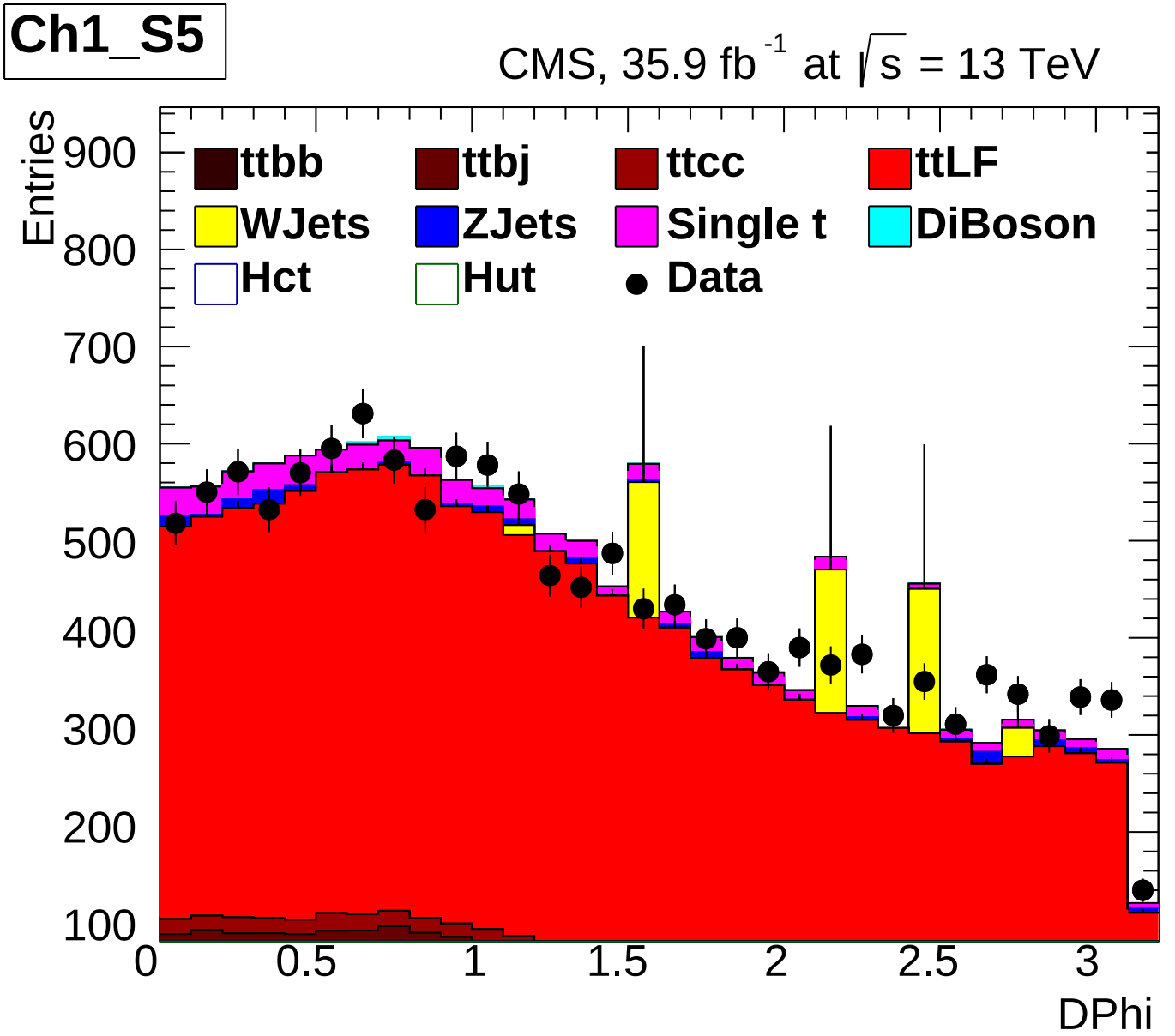
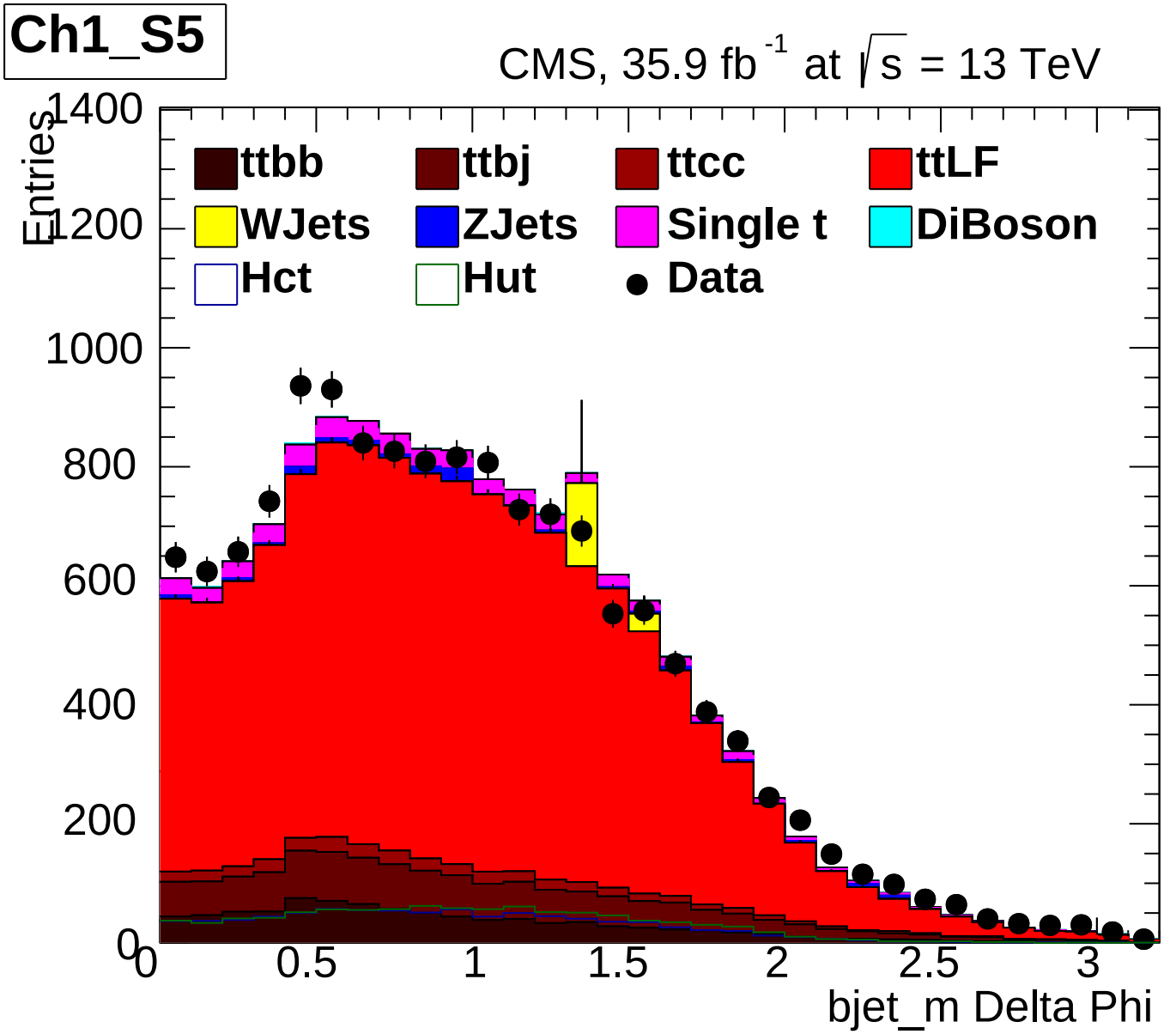
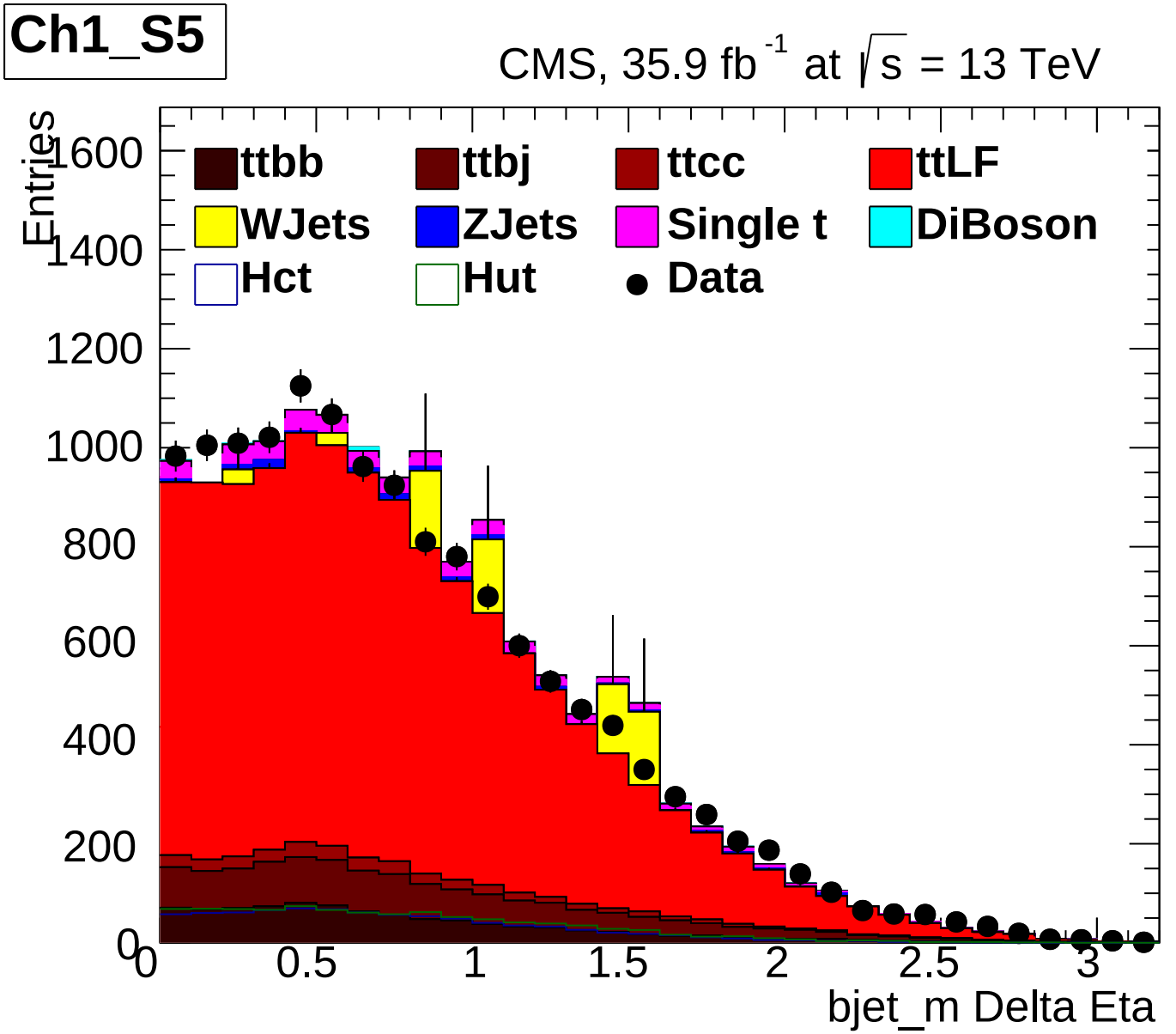
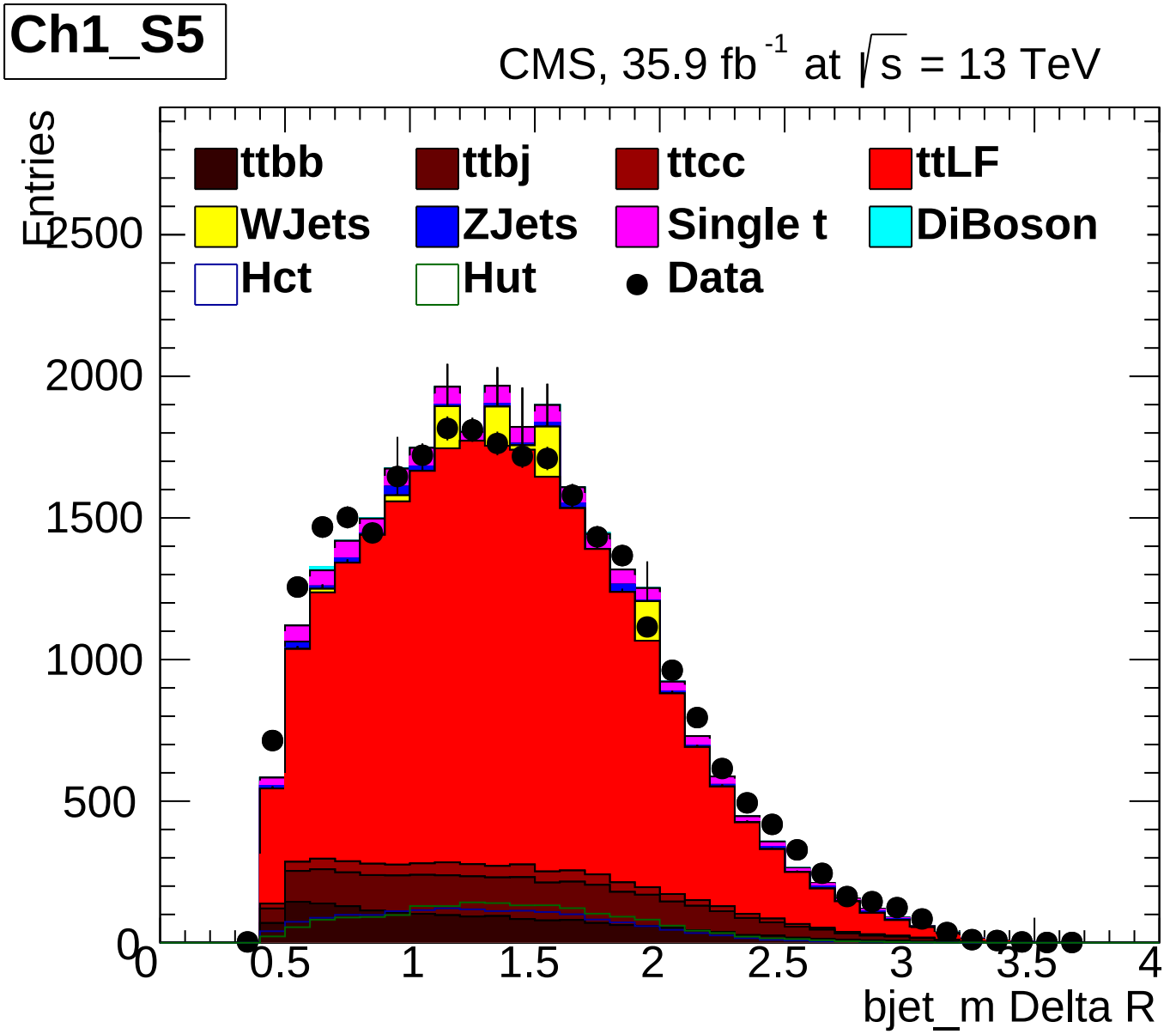
500
1000
1500
2000
2500
3000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
900
800
700
600
500
400
300
200
100
0
0.5
1
1.5
2
2.5
3
DPhi
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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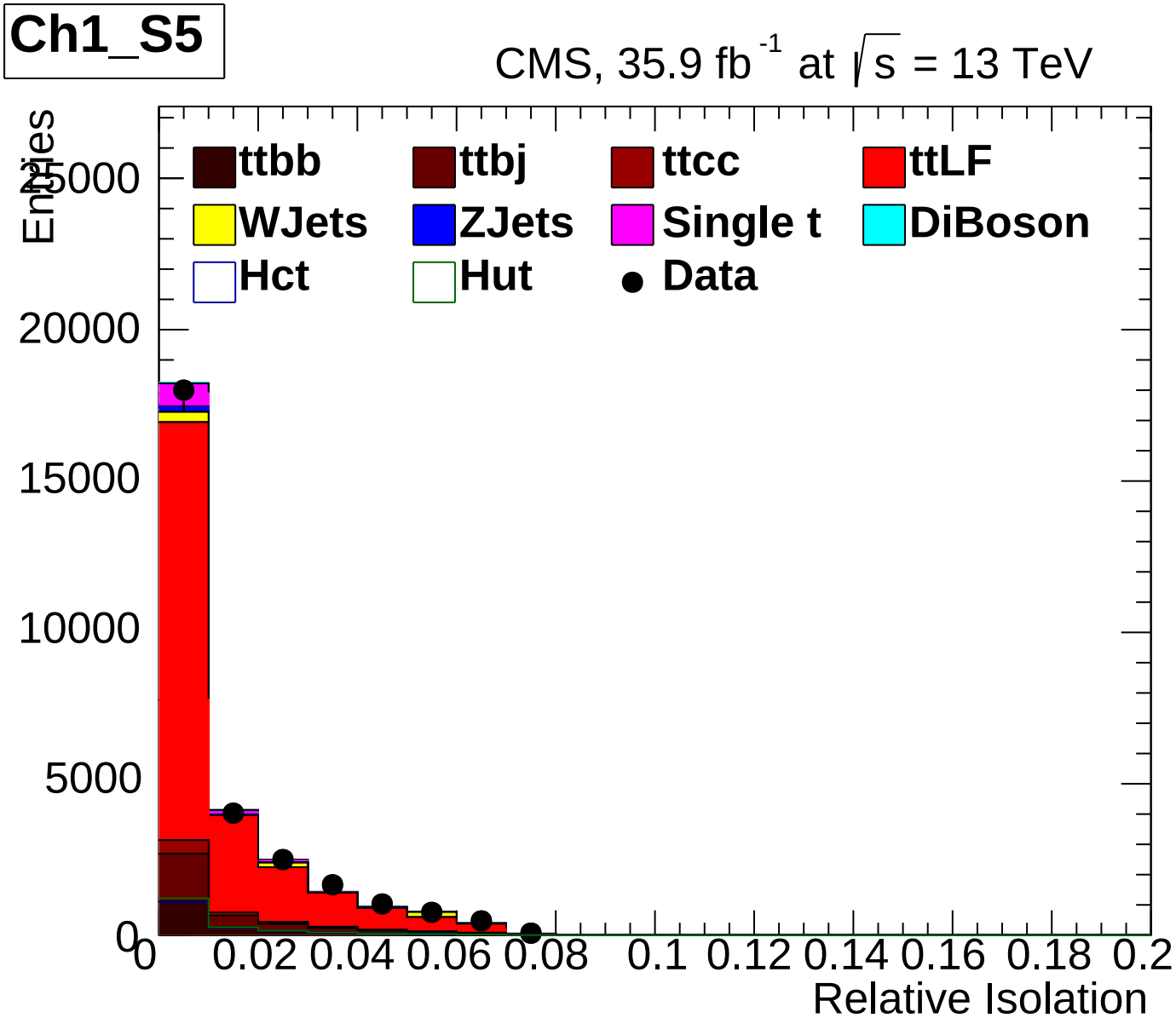
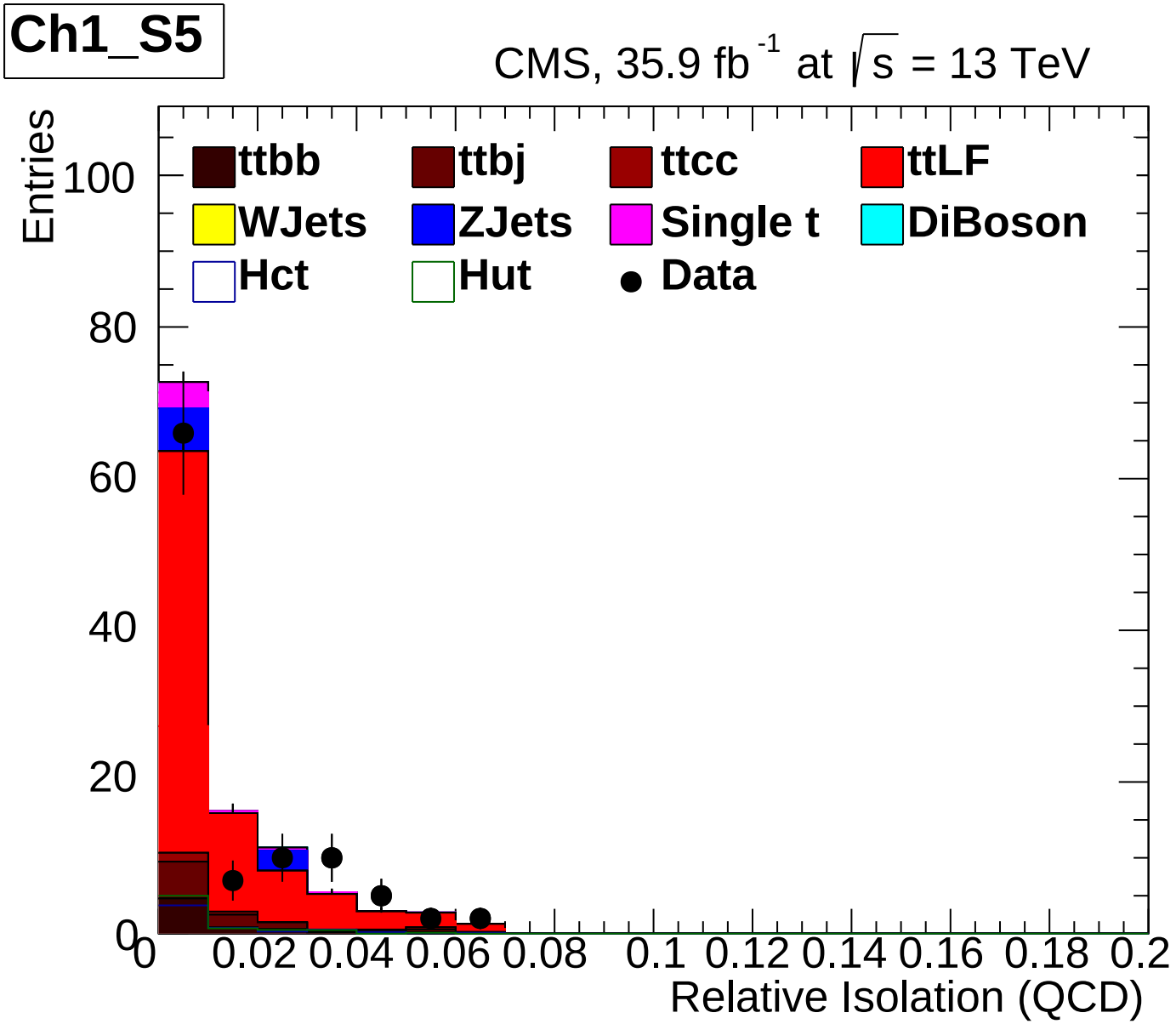
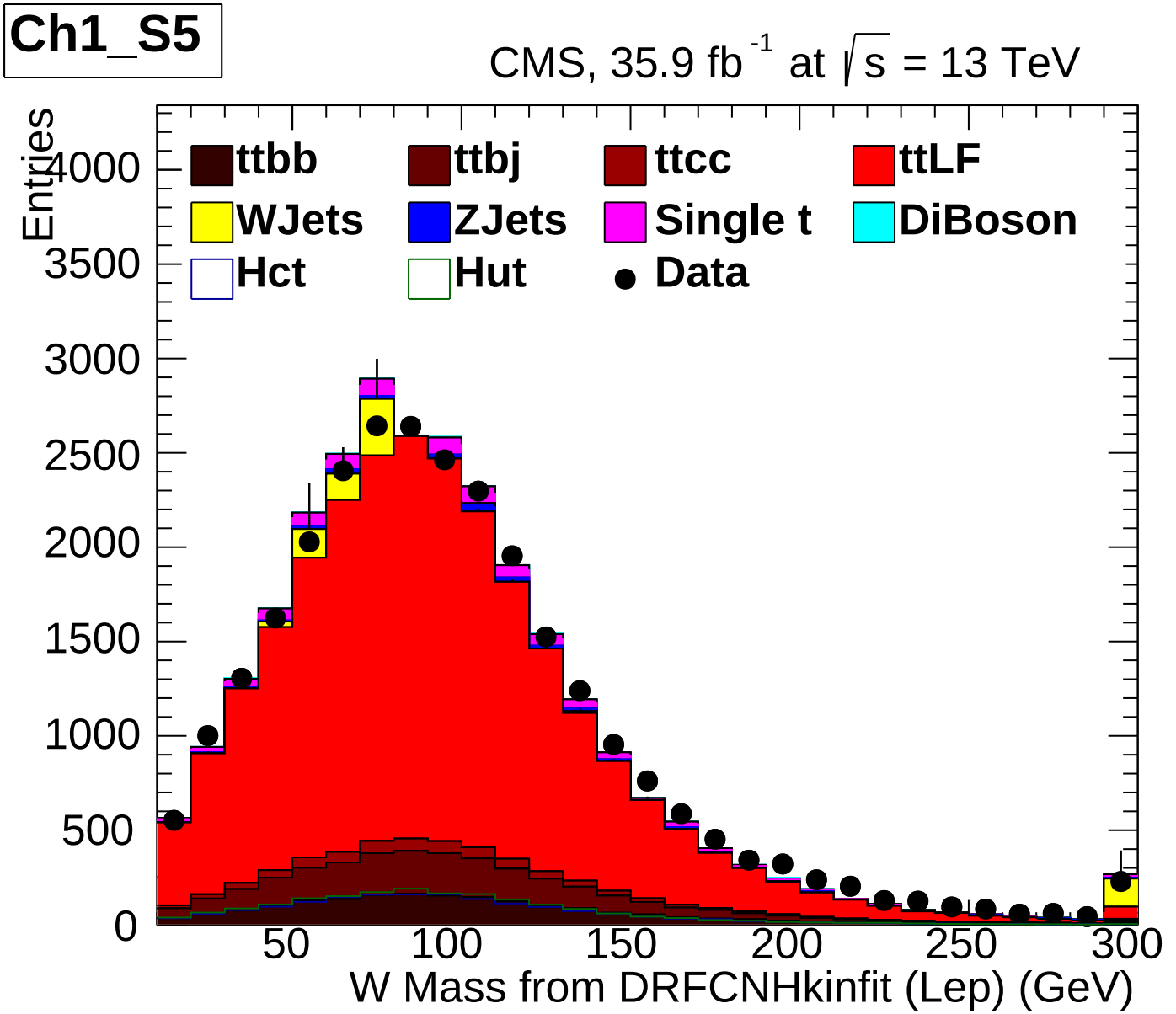
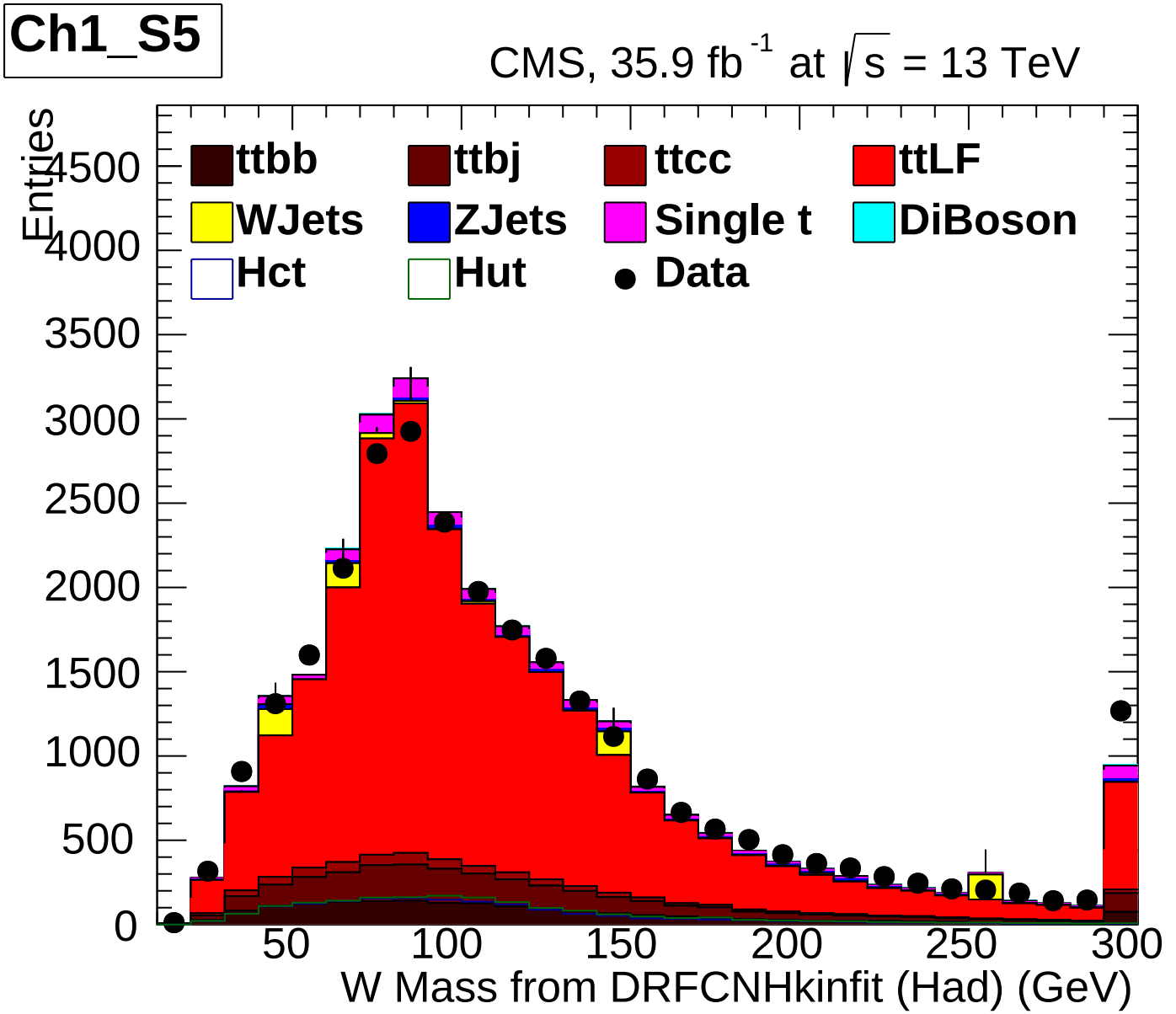
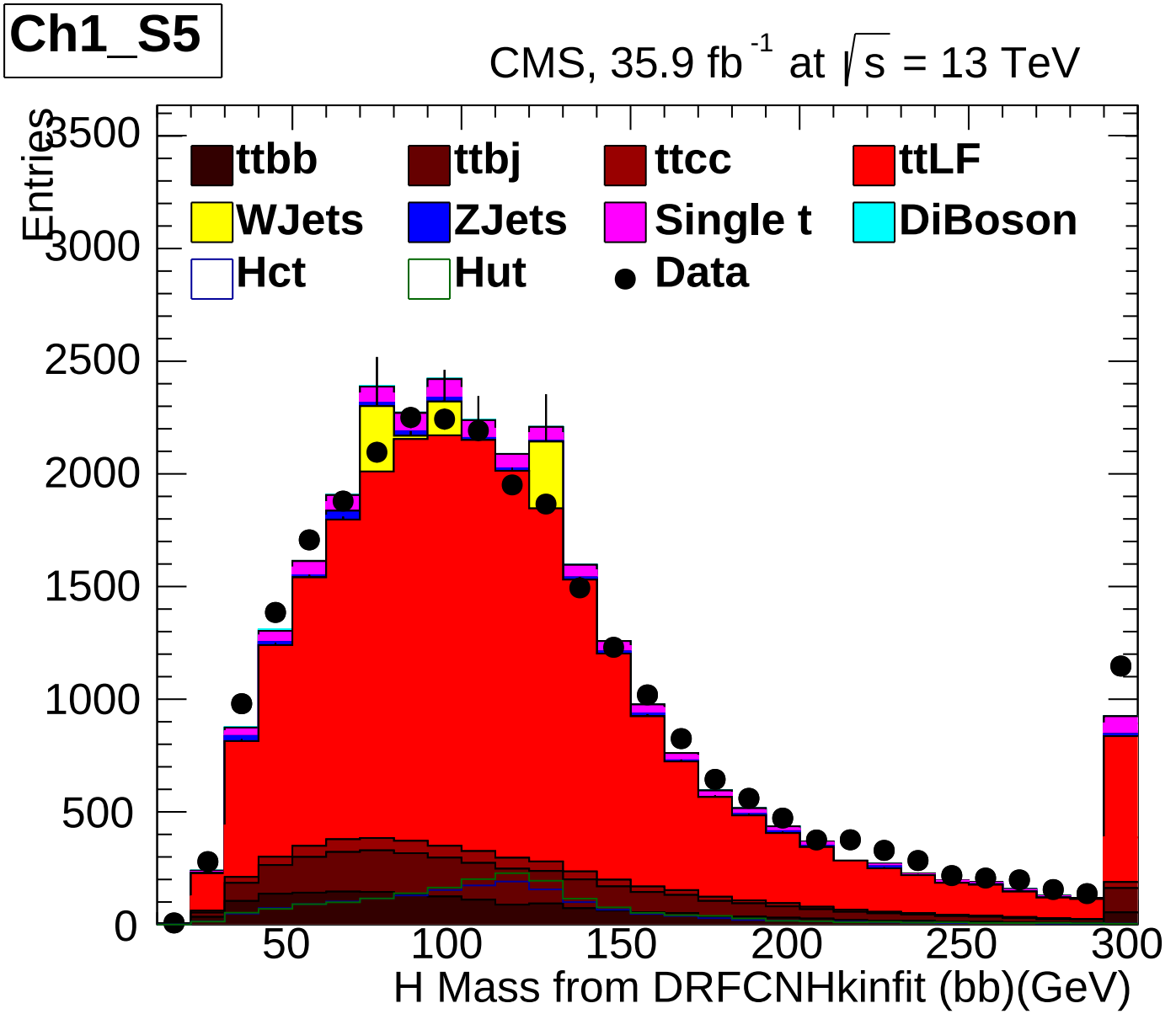
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

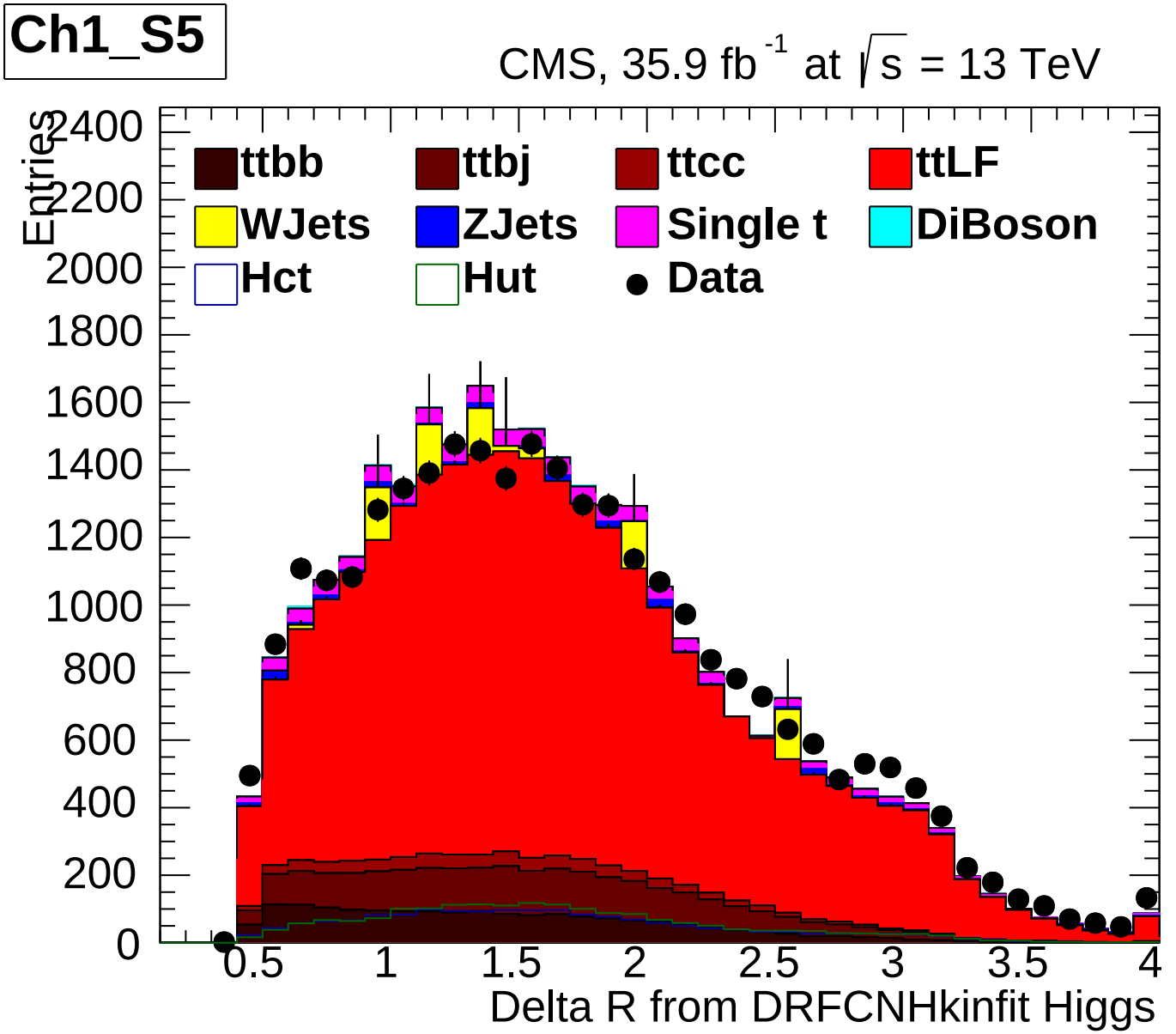

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
25000
20000
15000
10000
5000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

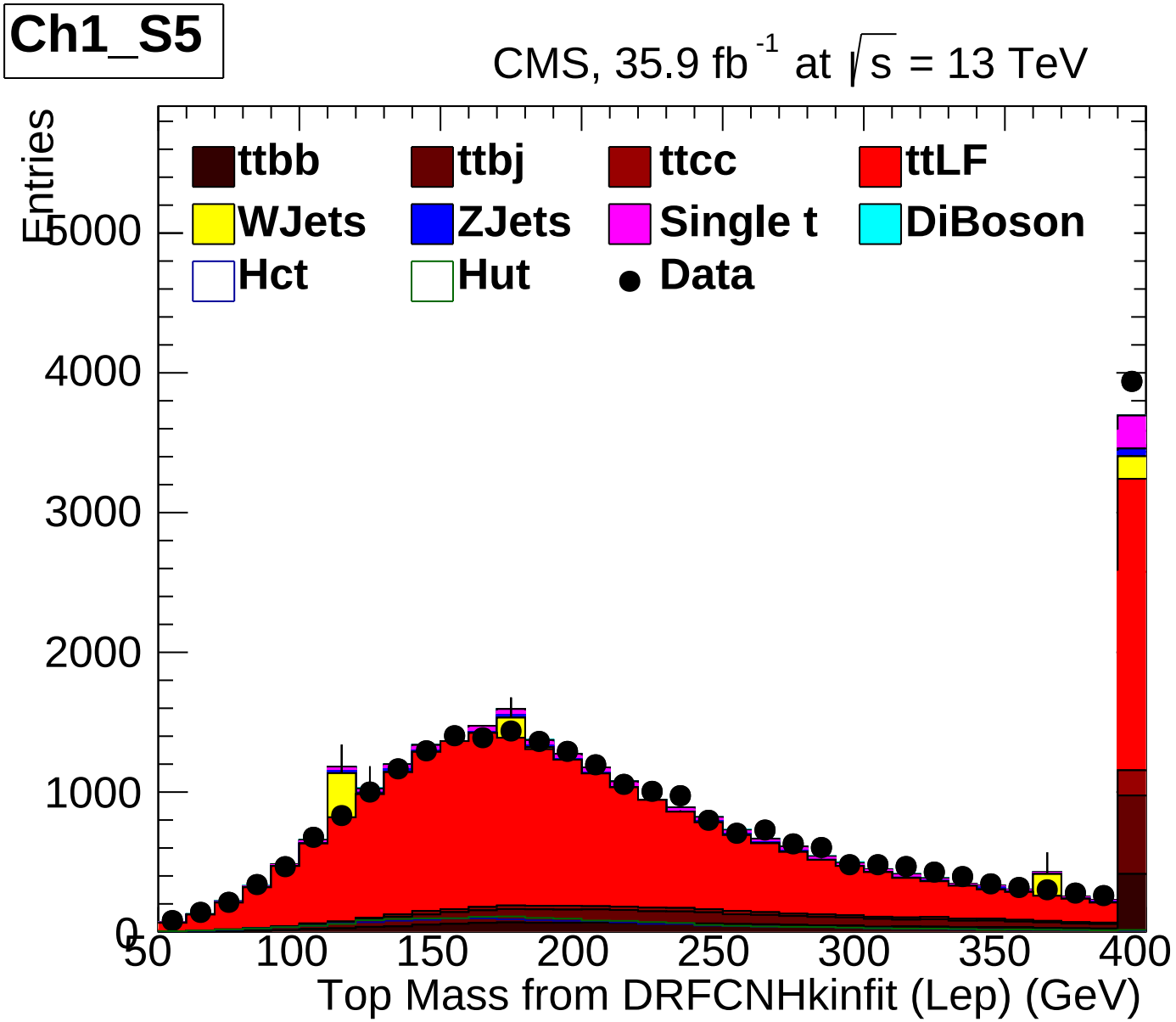

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

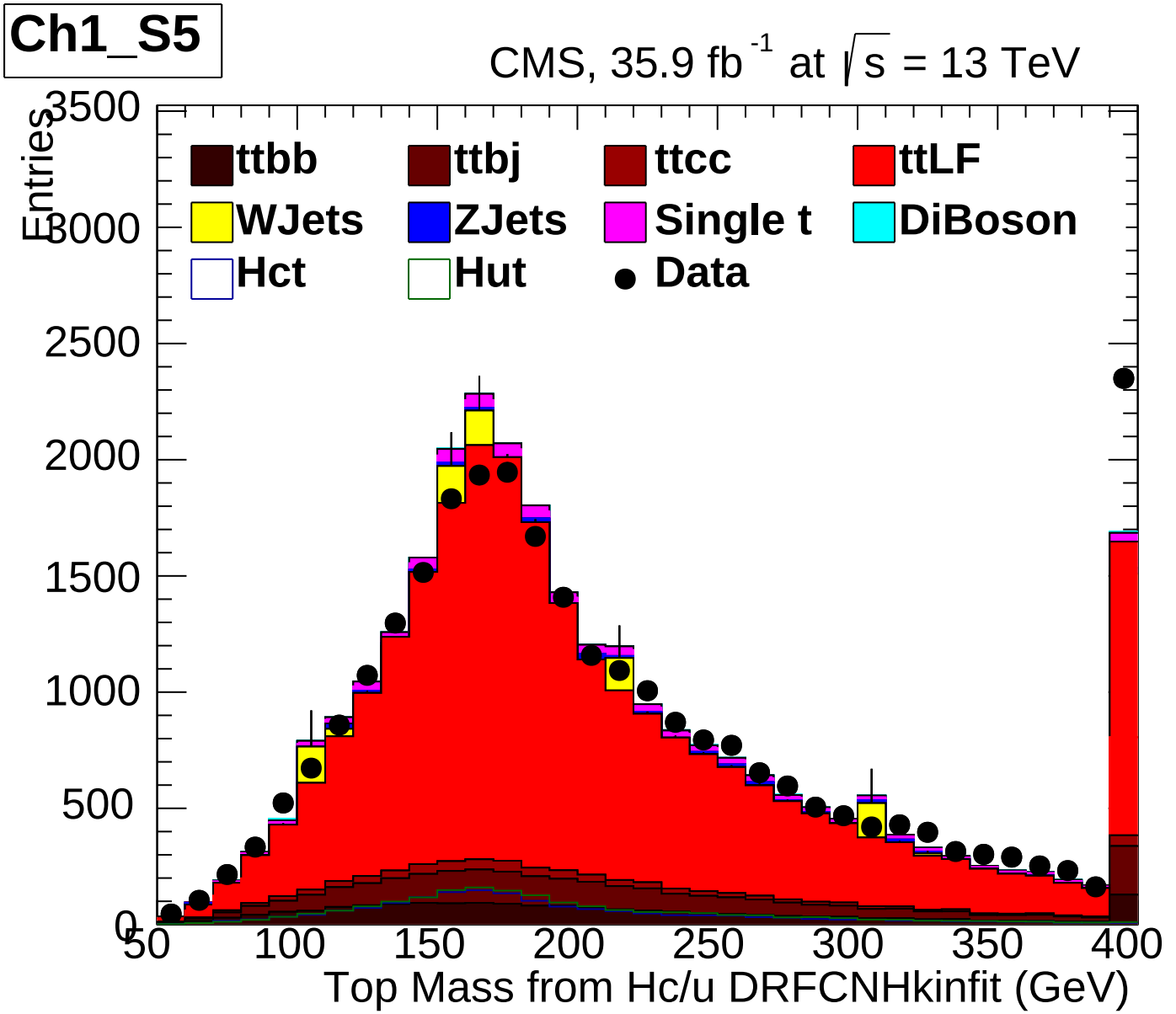

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

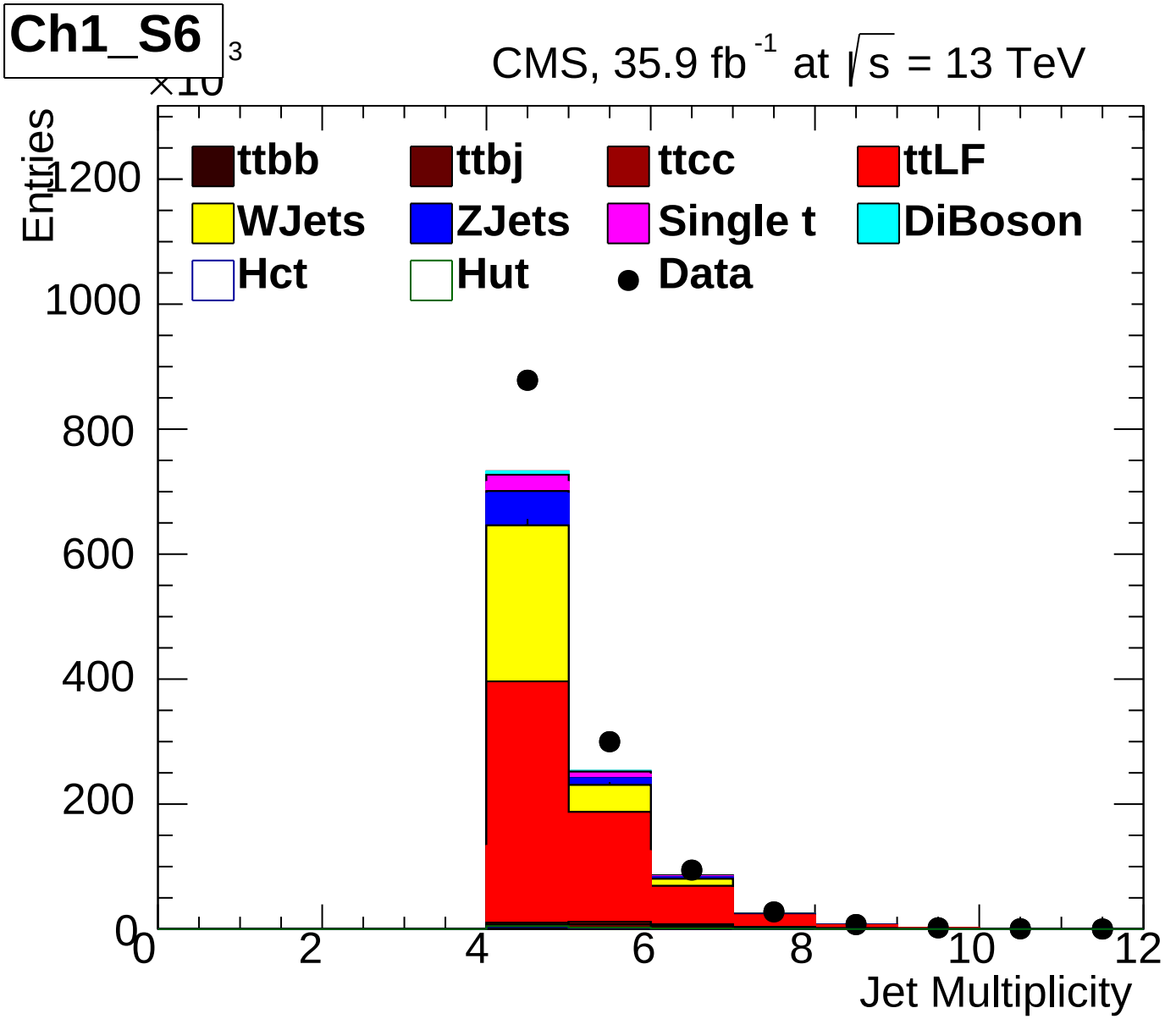

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

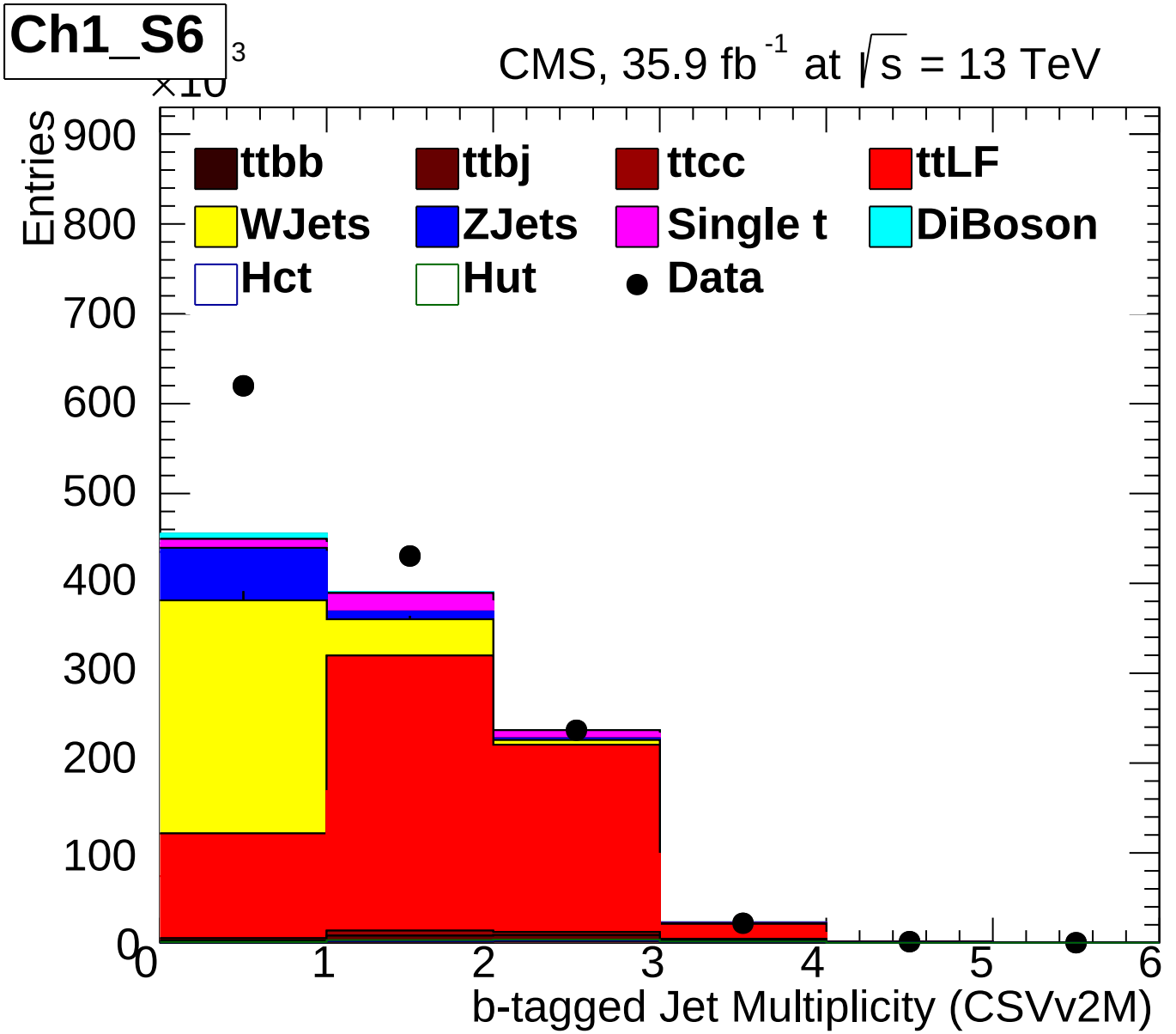

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

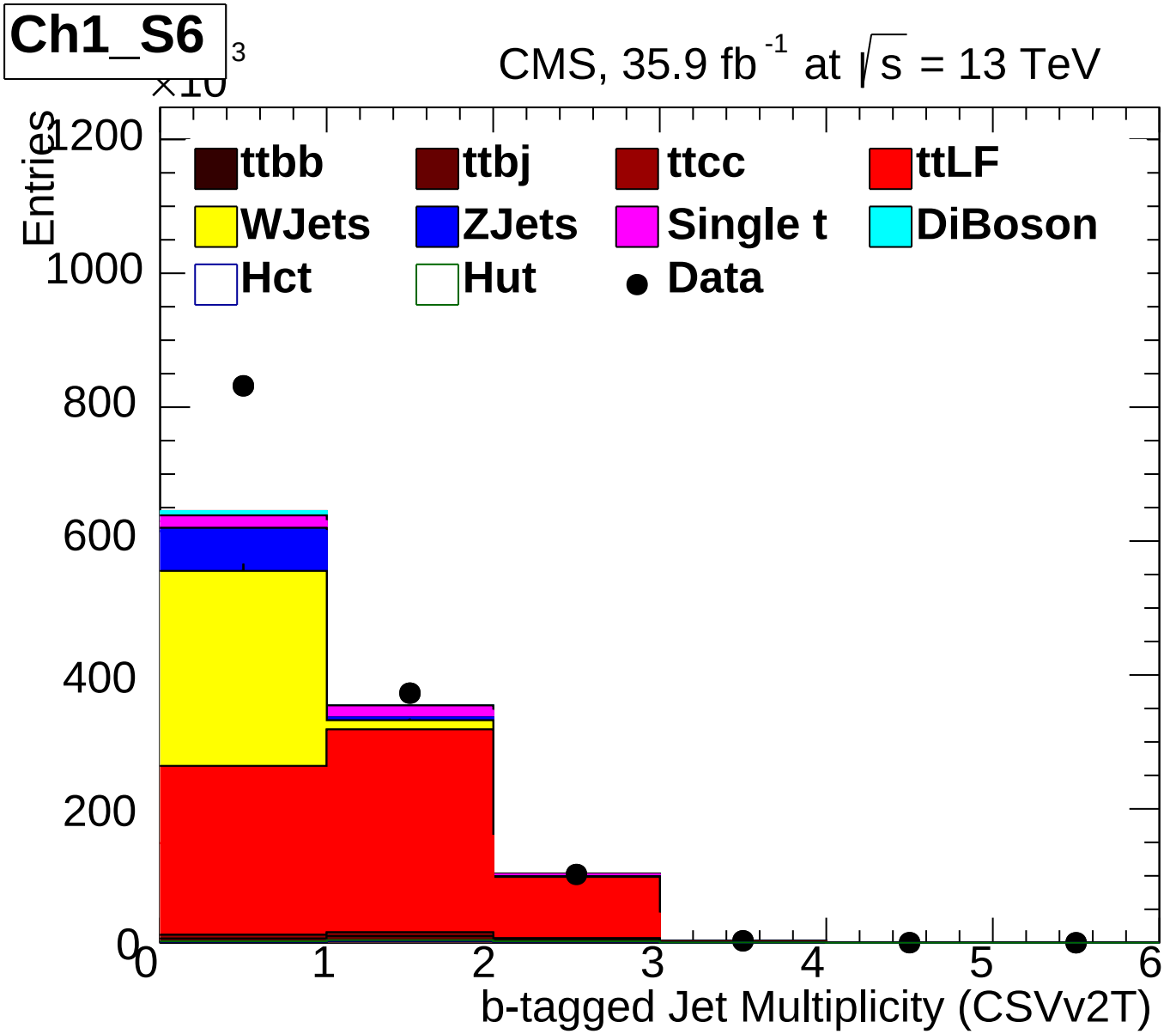

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

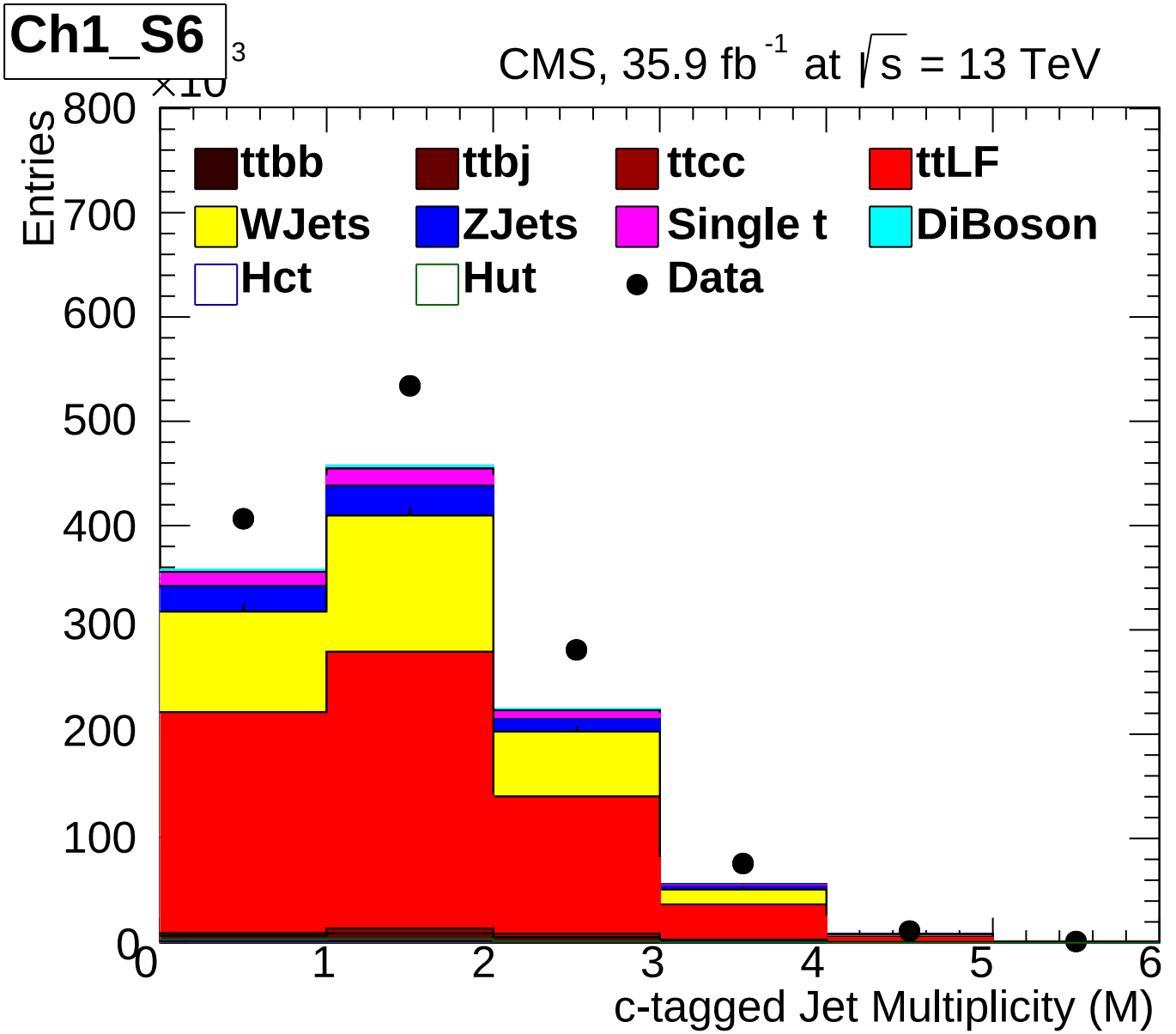

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

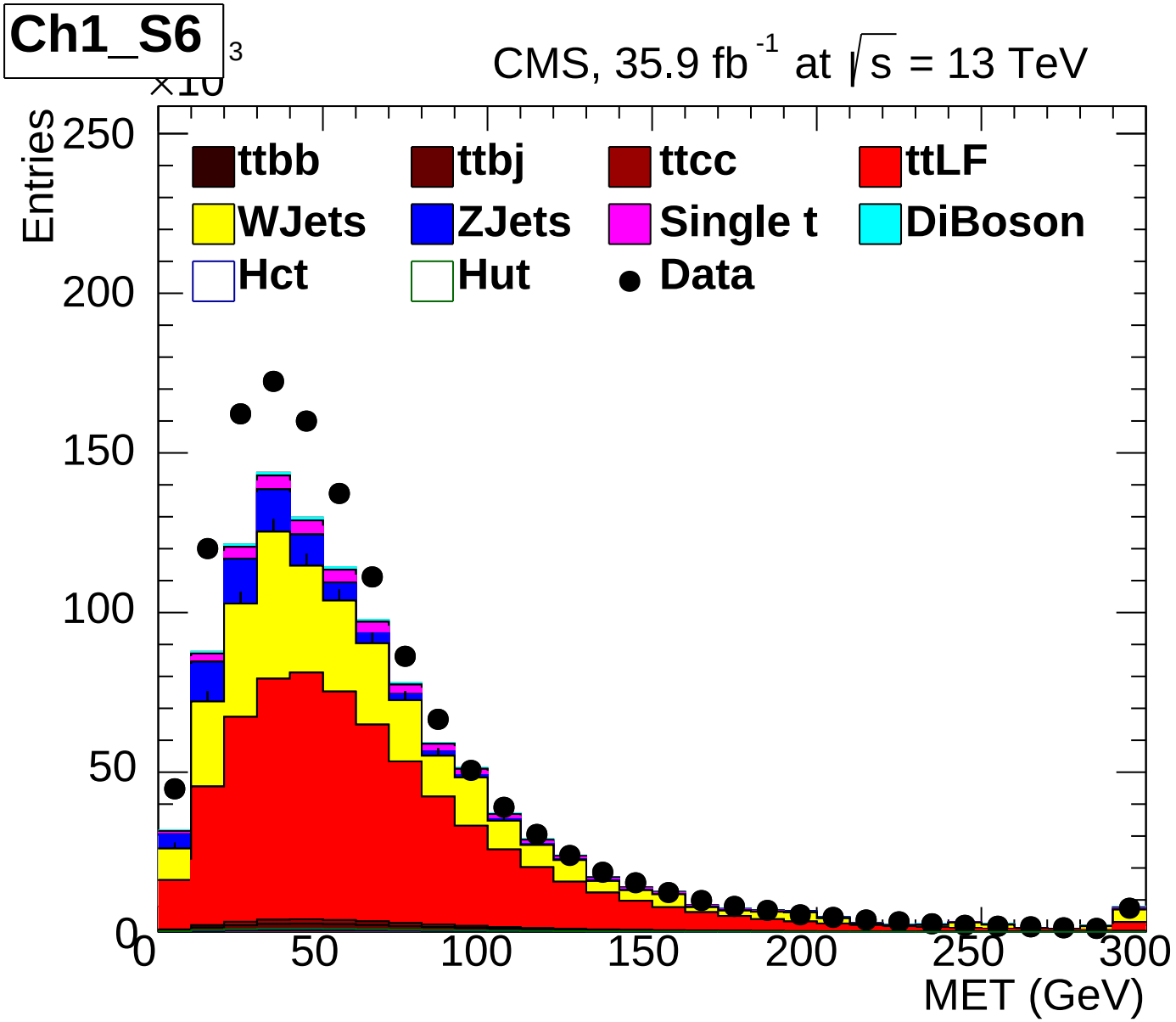

Ch1_S5
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

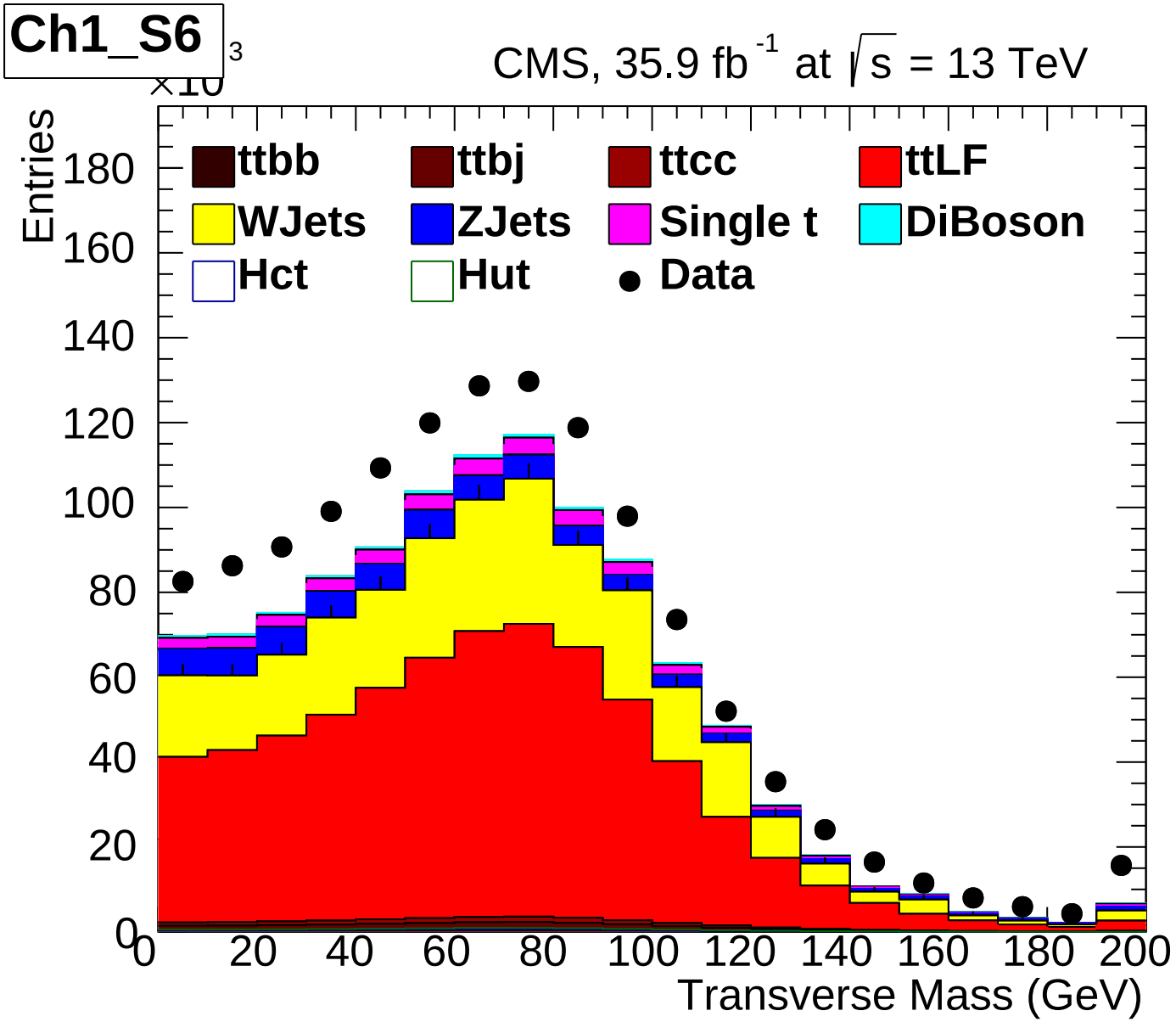

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
0
2
4
6
8
10
12
Jet Multiplicity

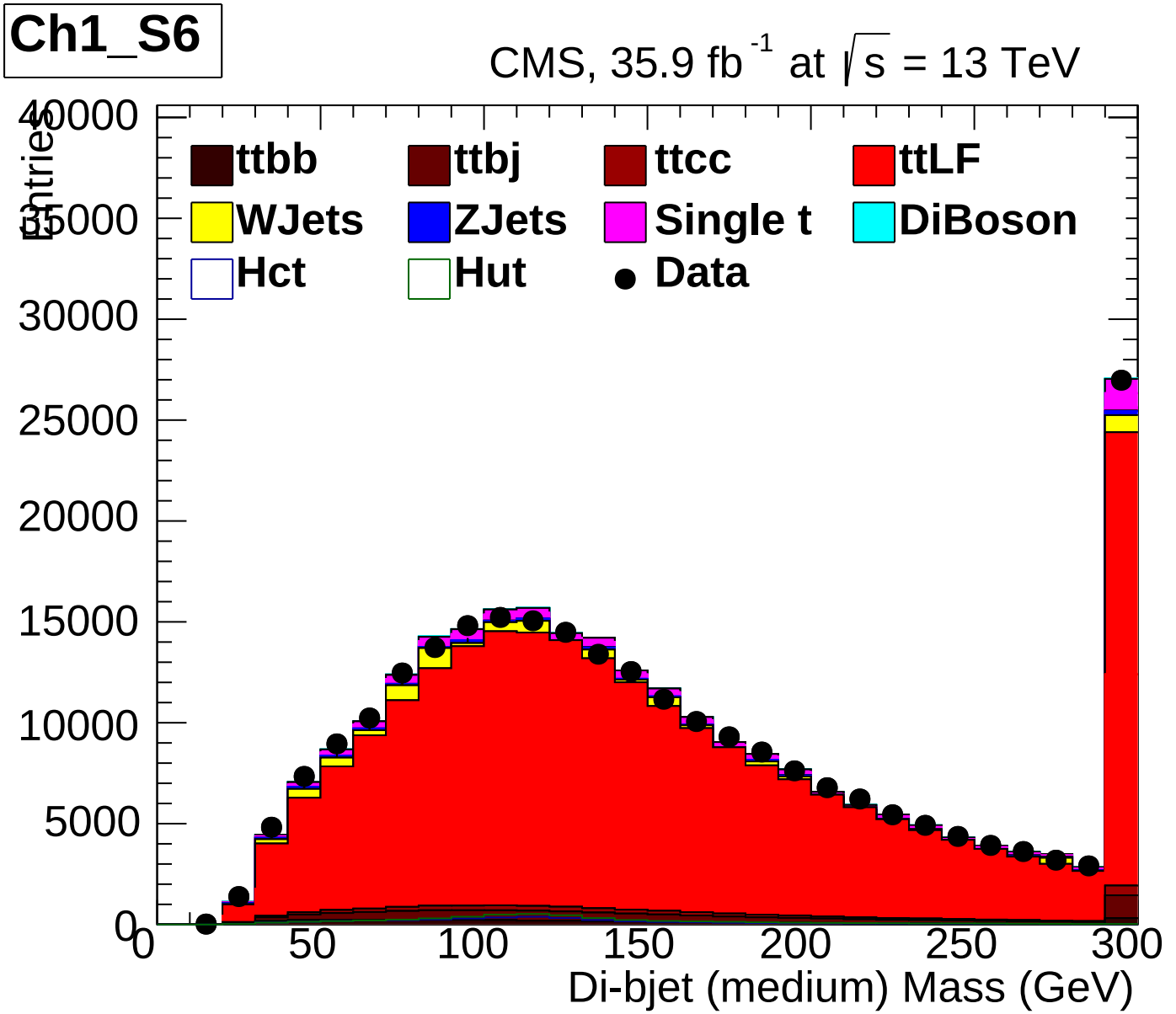

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
900
800
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

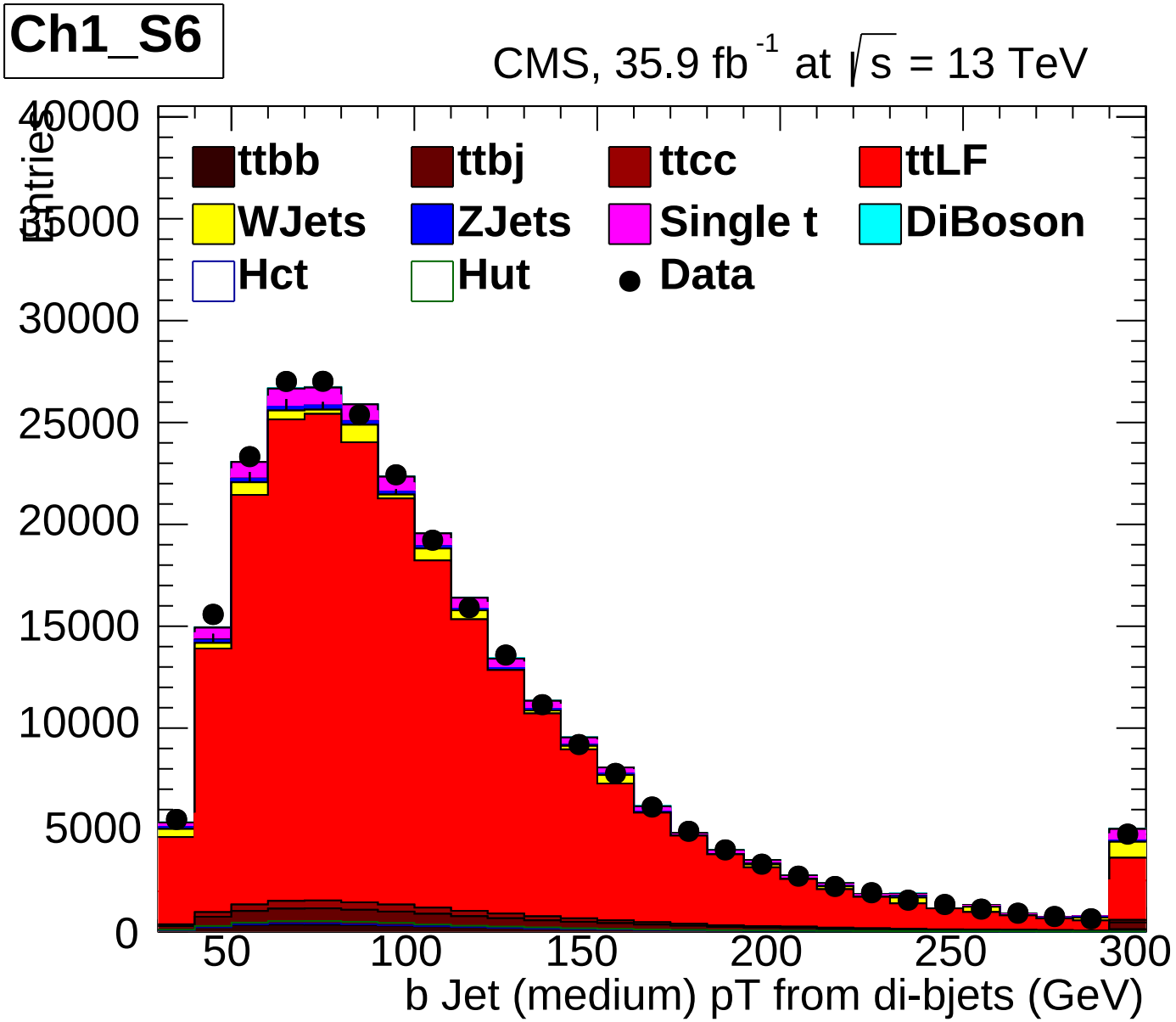

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
1200
1000
800
600
400
200
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

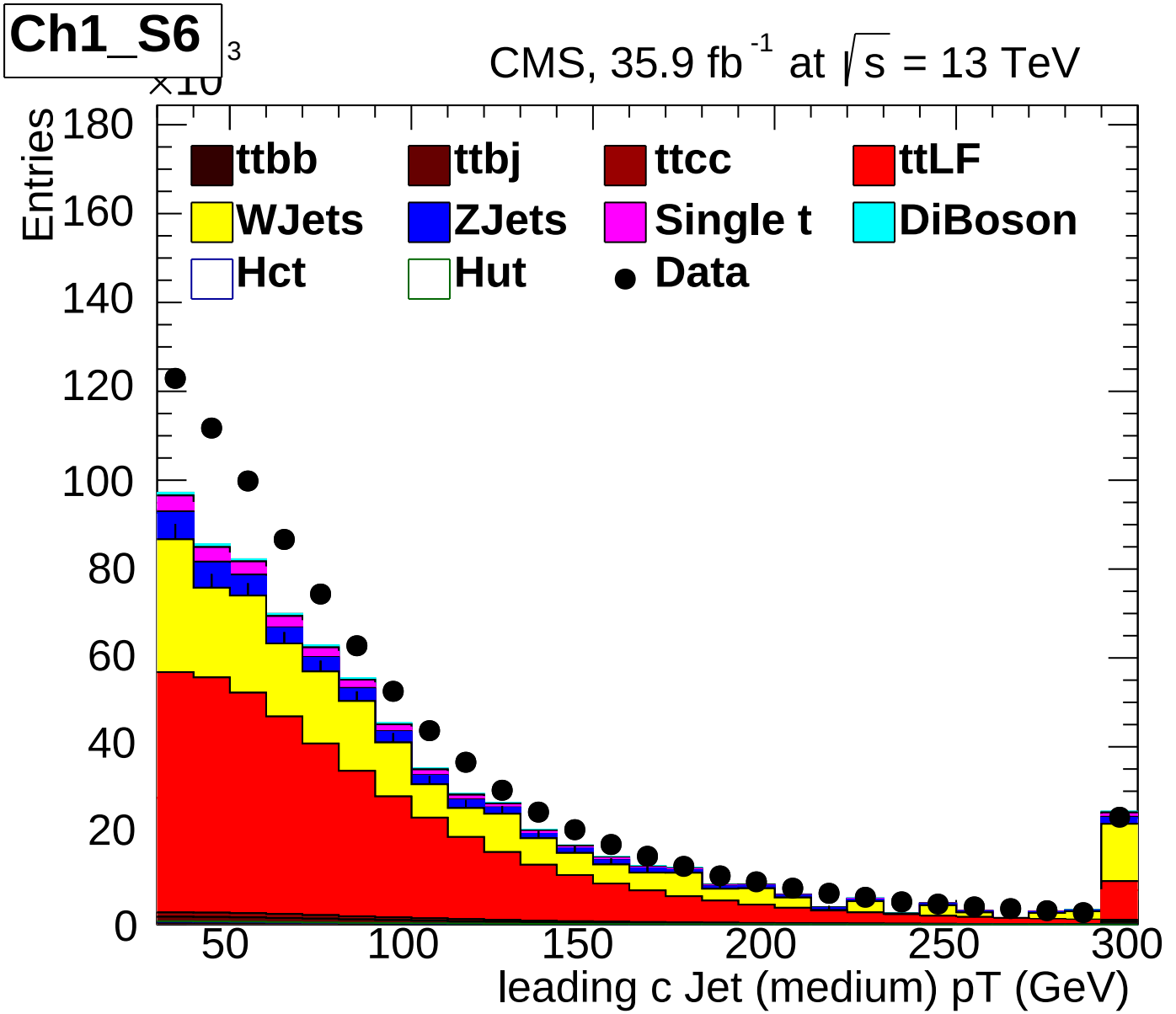

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
800
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

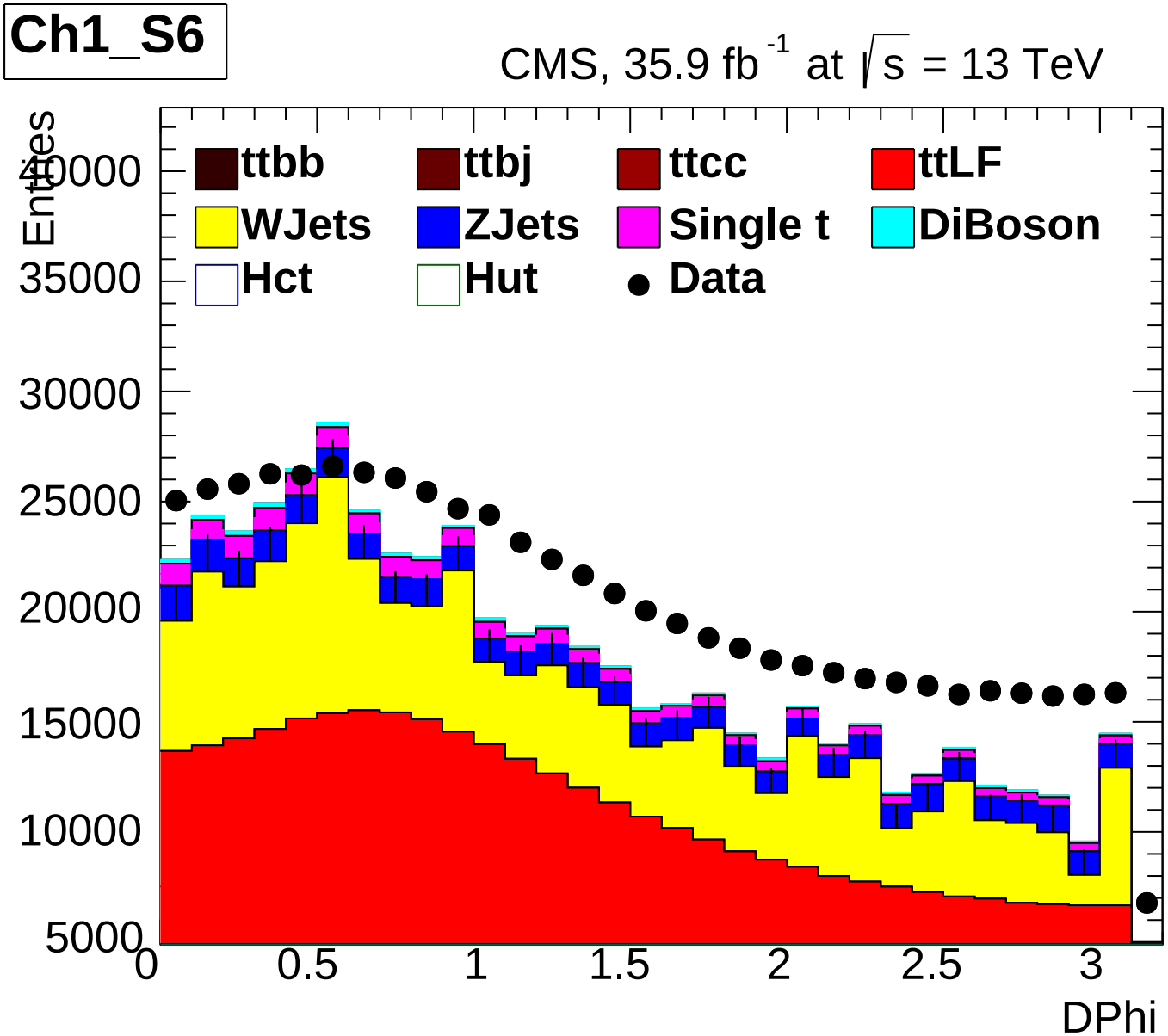

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
250
200
150
100
50
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
MET (GeV)

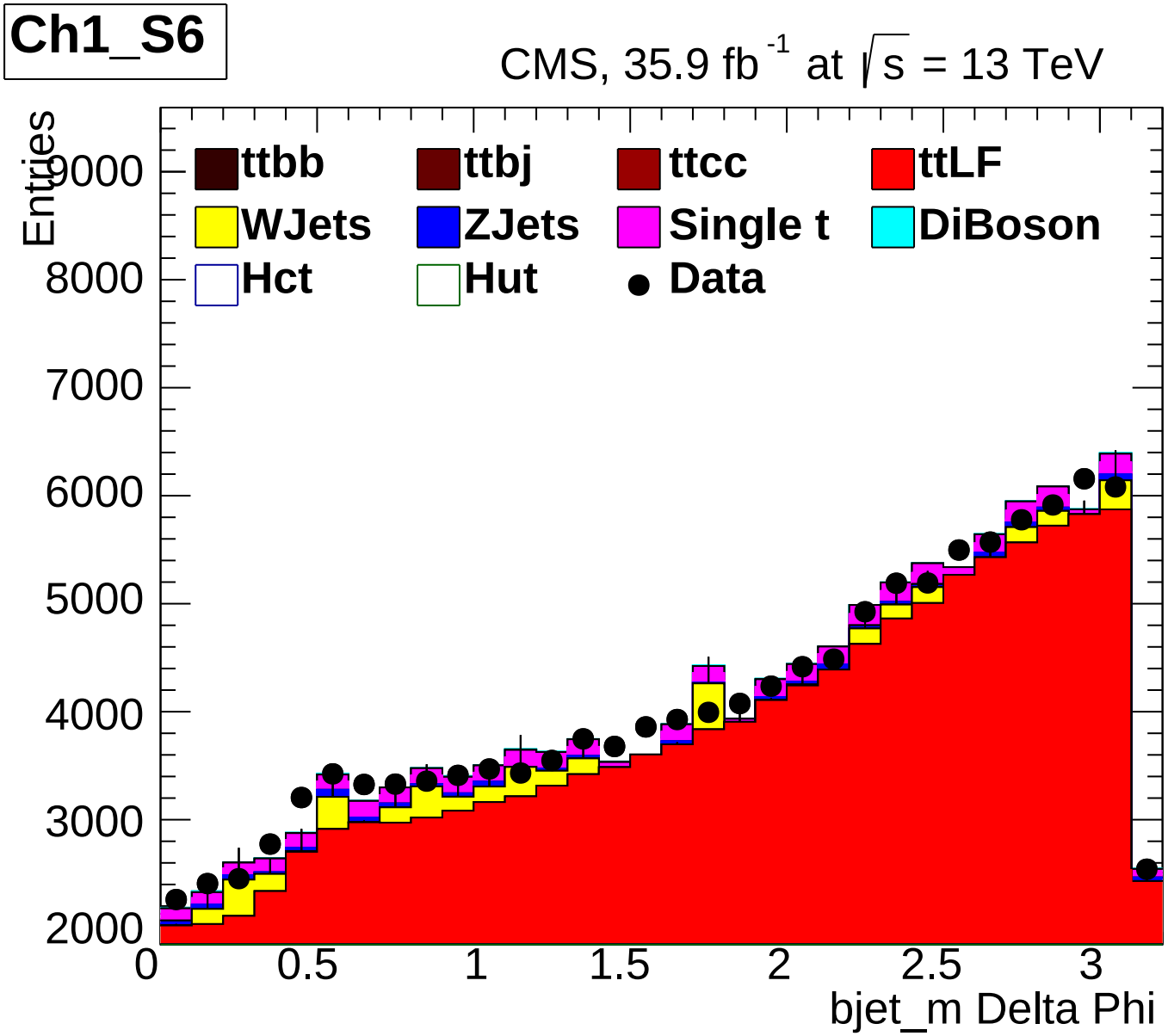

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

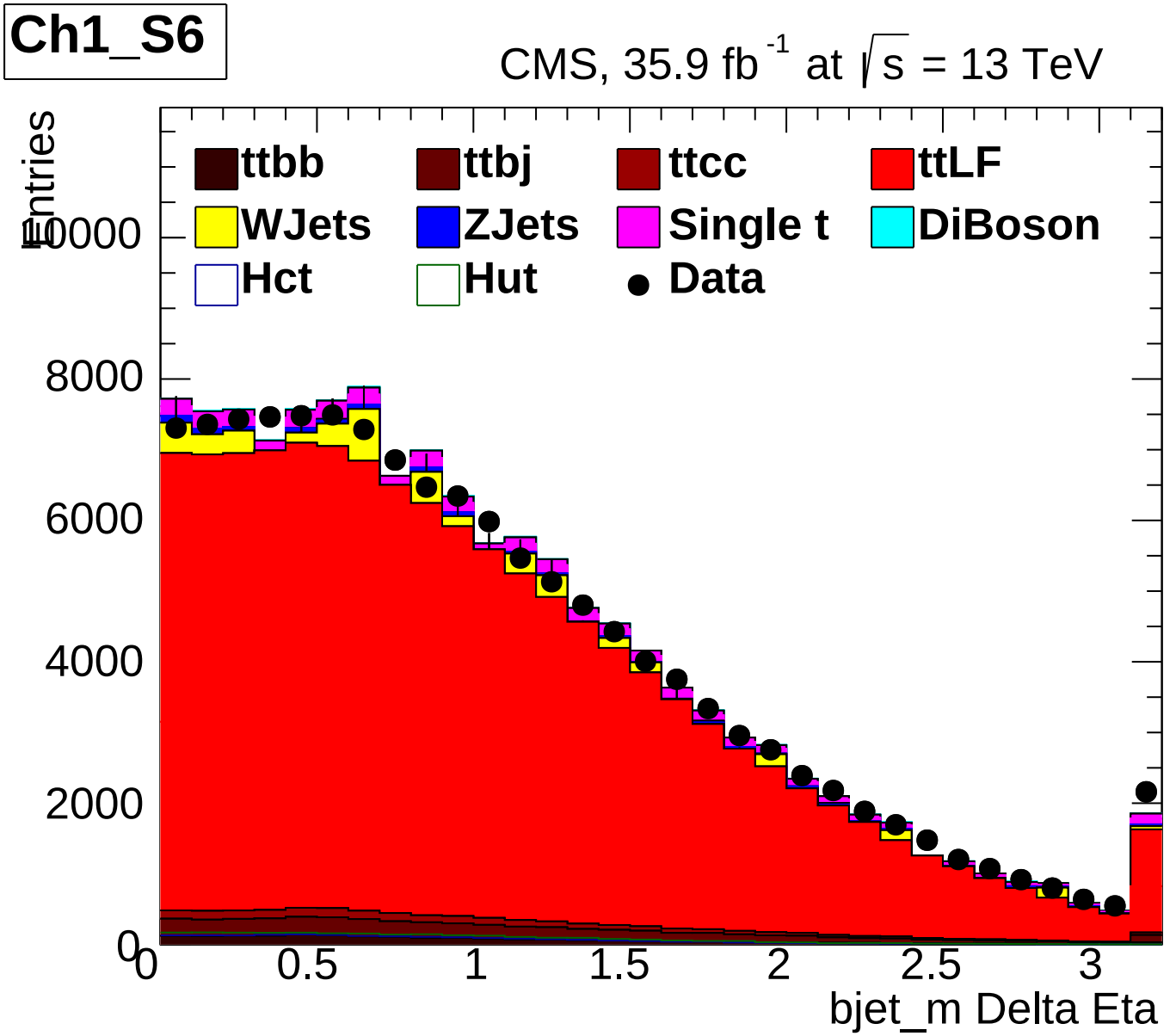

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

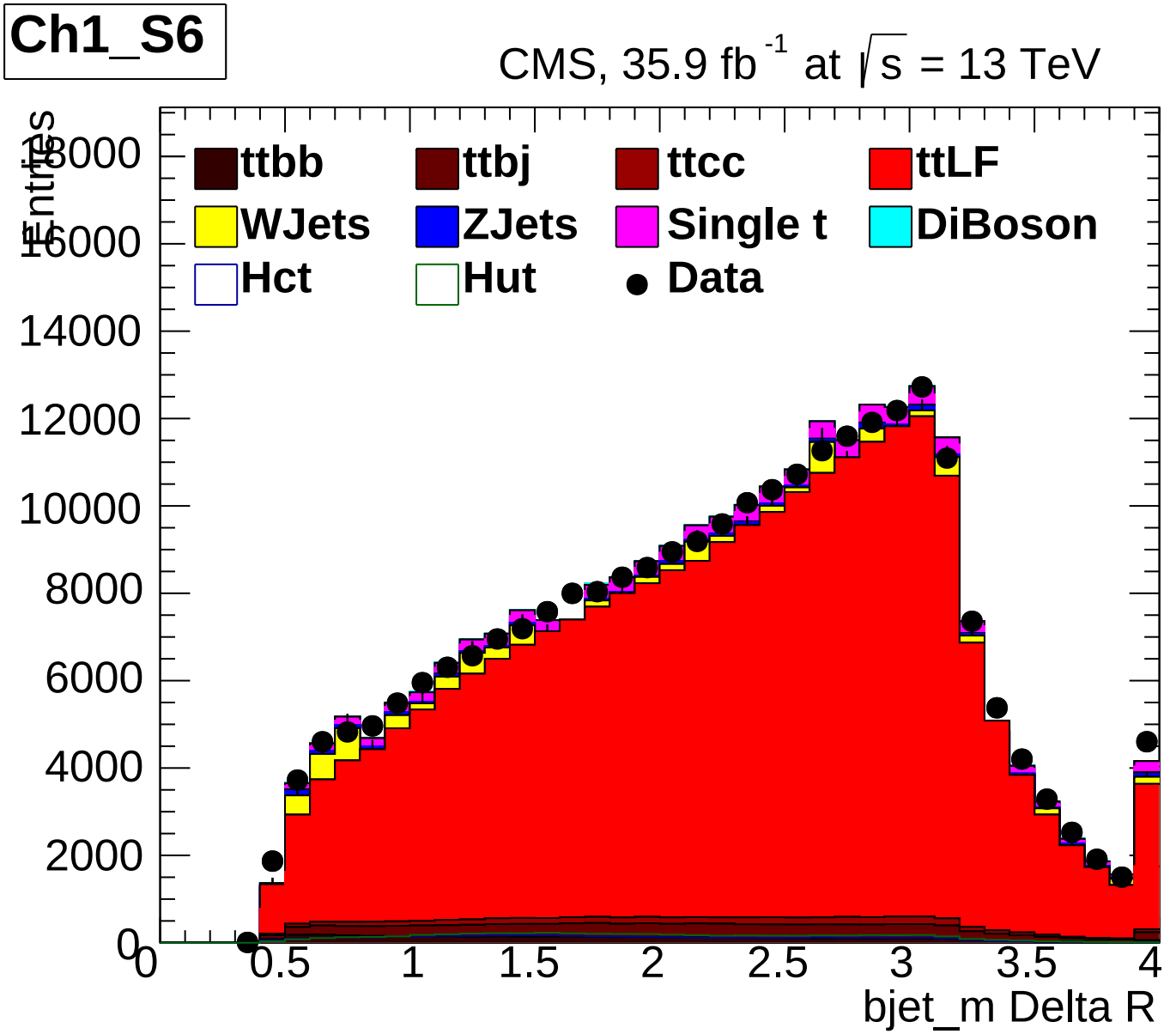

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

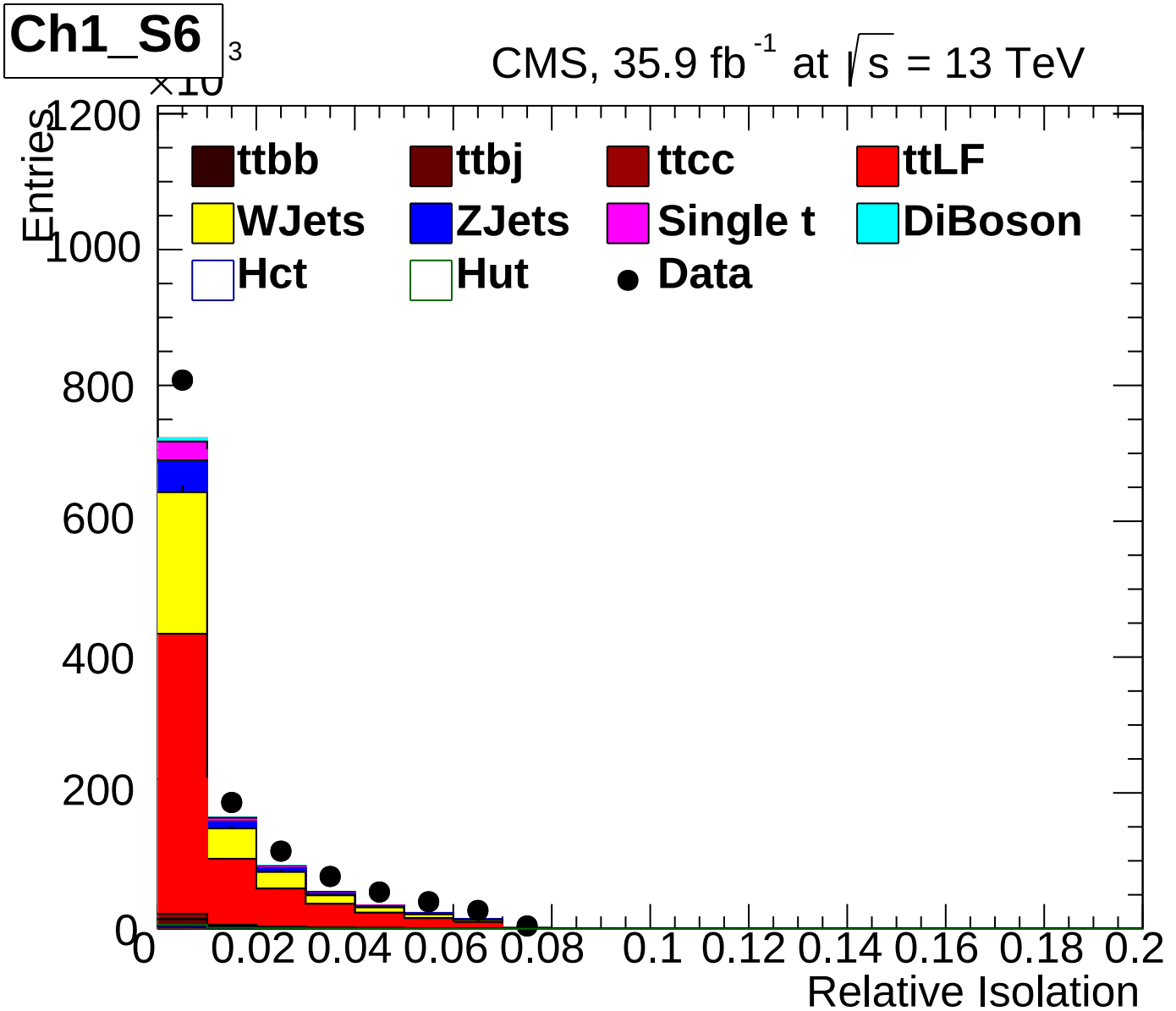

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

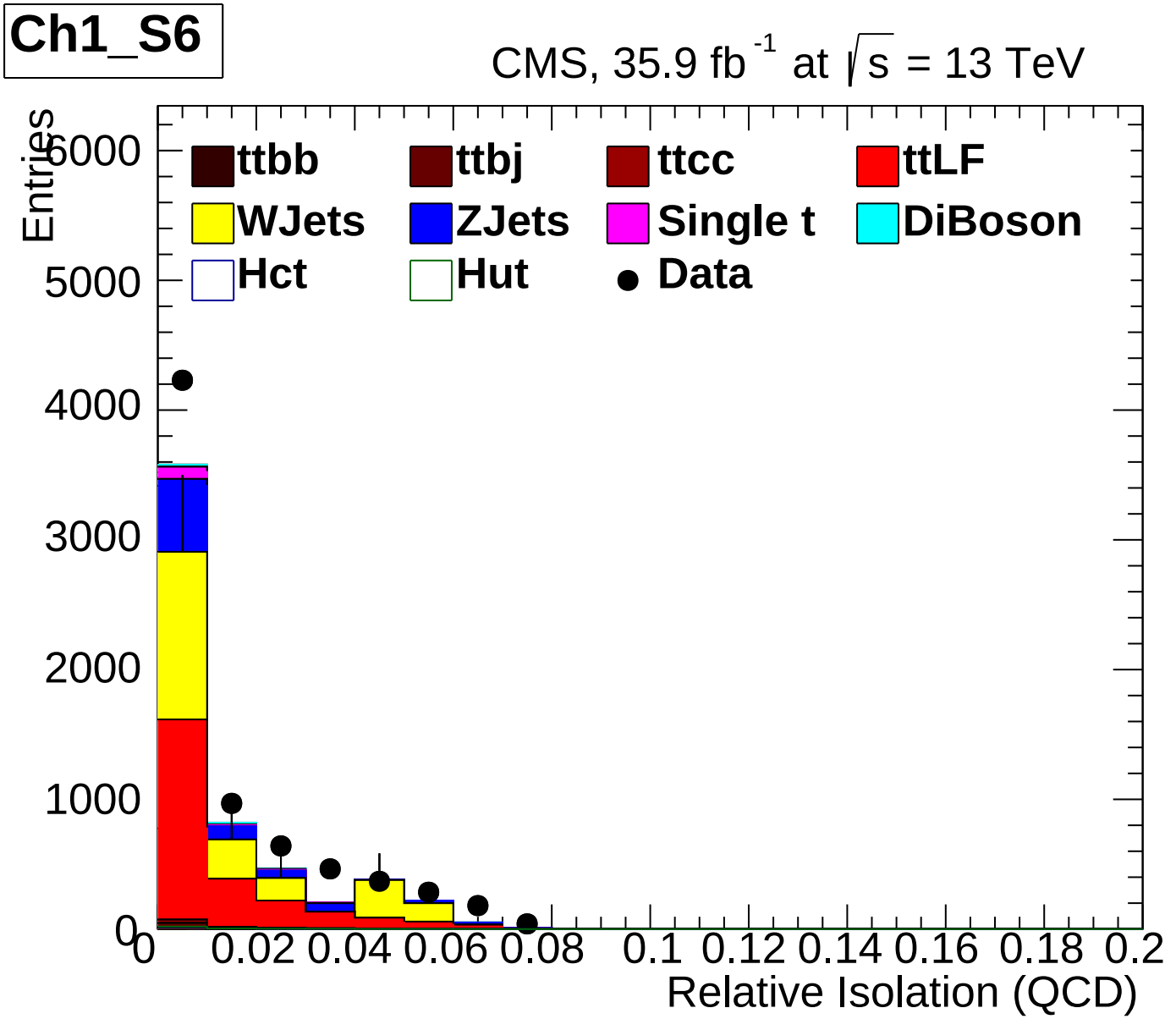

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
0.5
1
1.5
2
2.5
3
DPhi

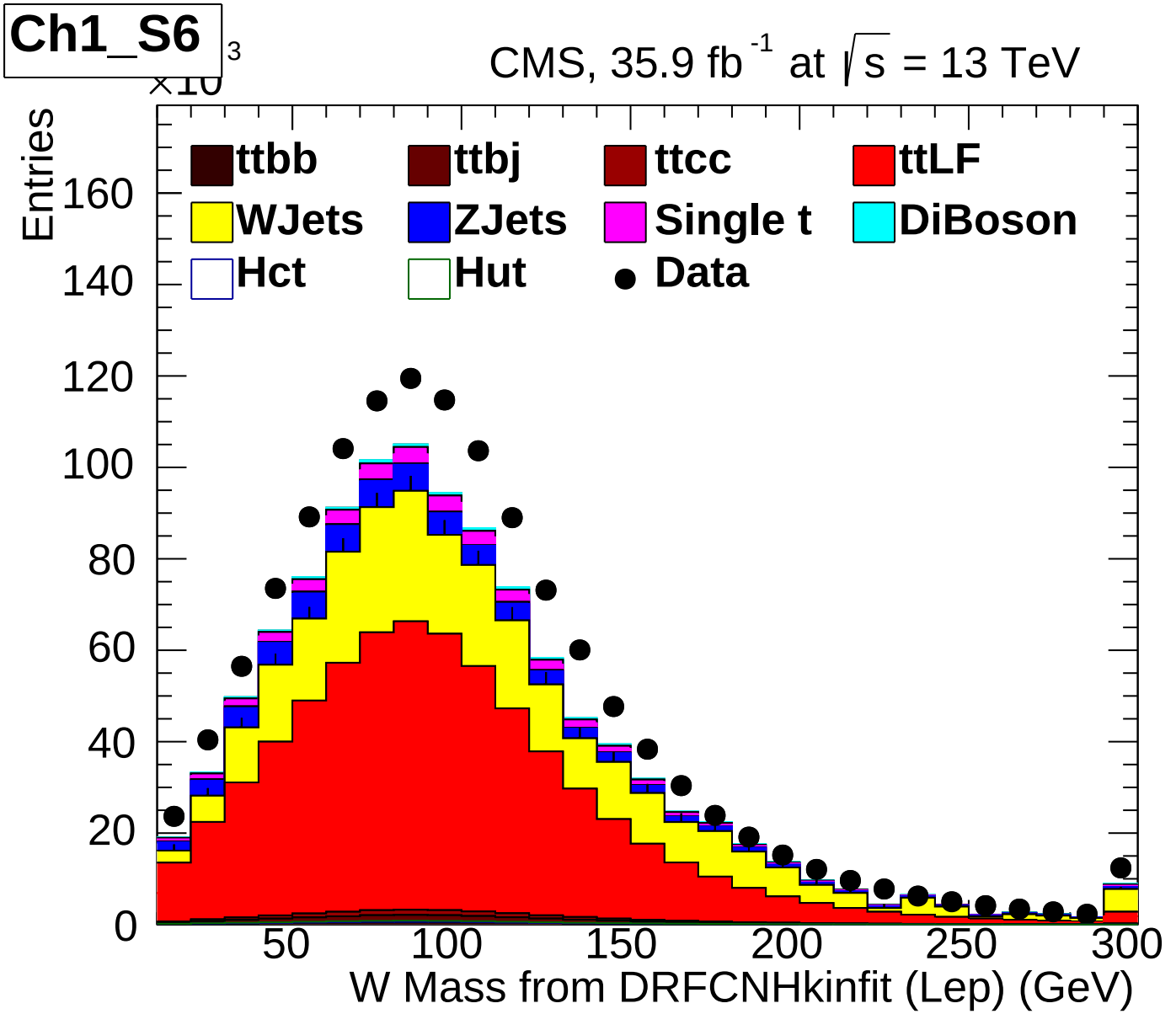

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
9000
8000
7000
6000
5000
4000
3000
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

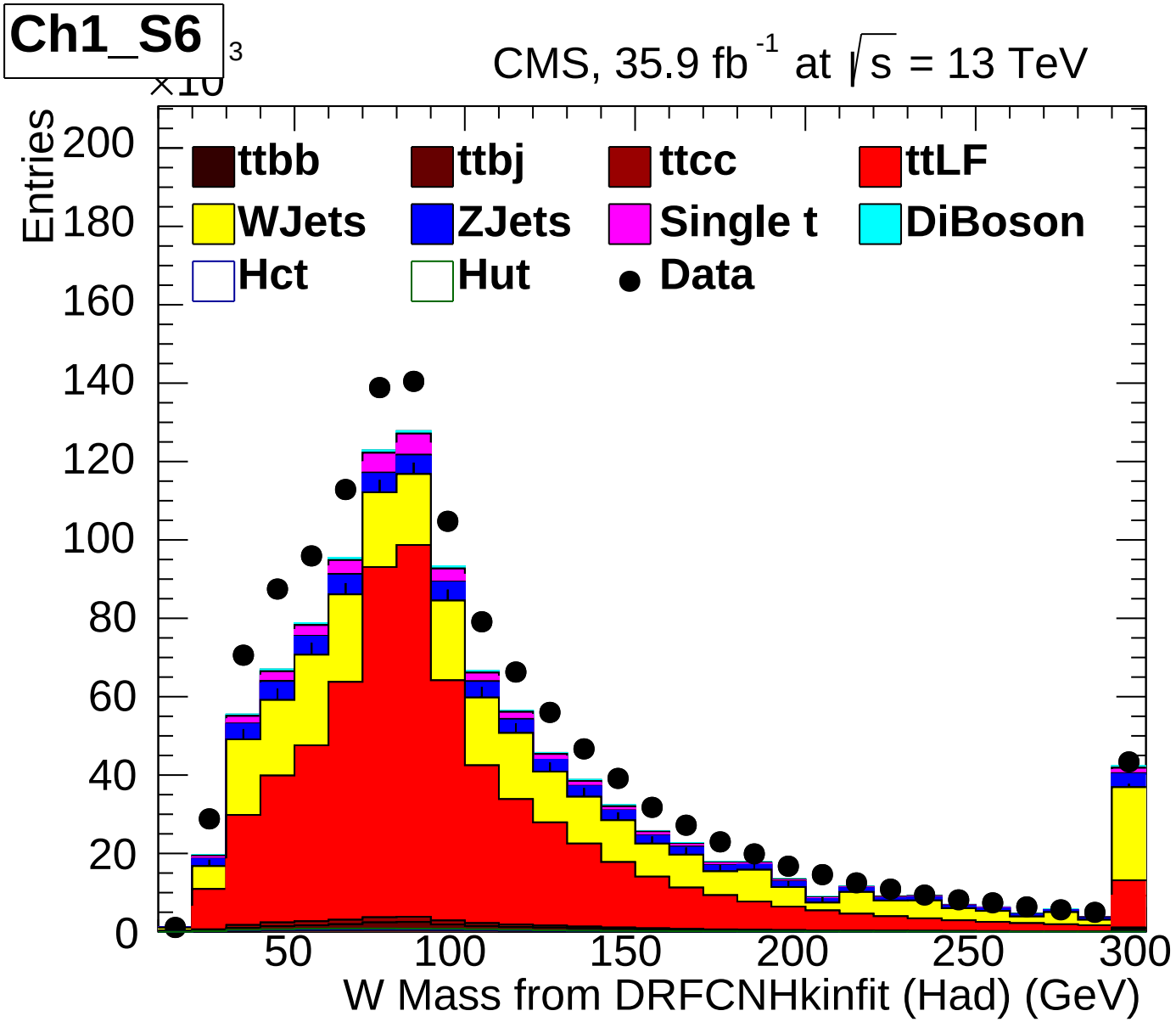

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
10000
8000
6000
4000
2000
0
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

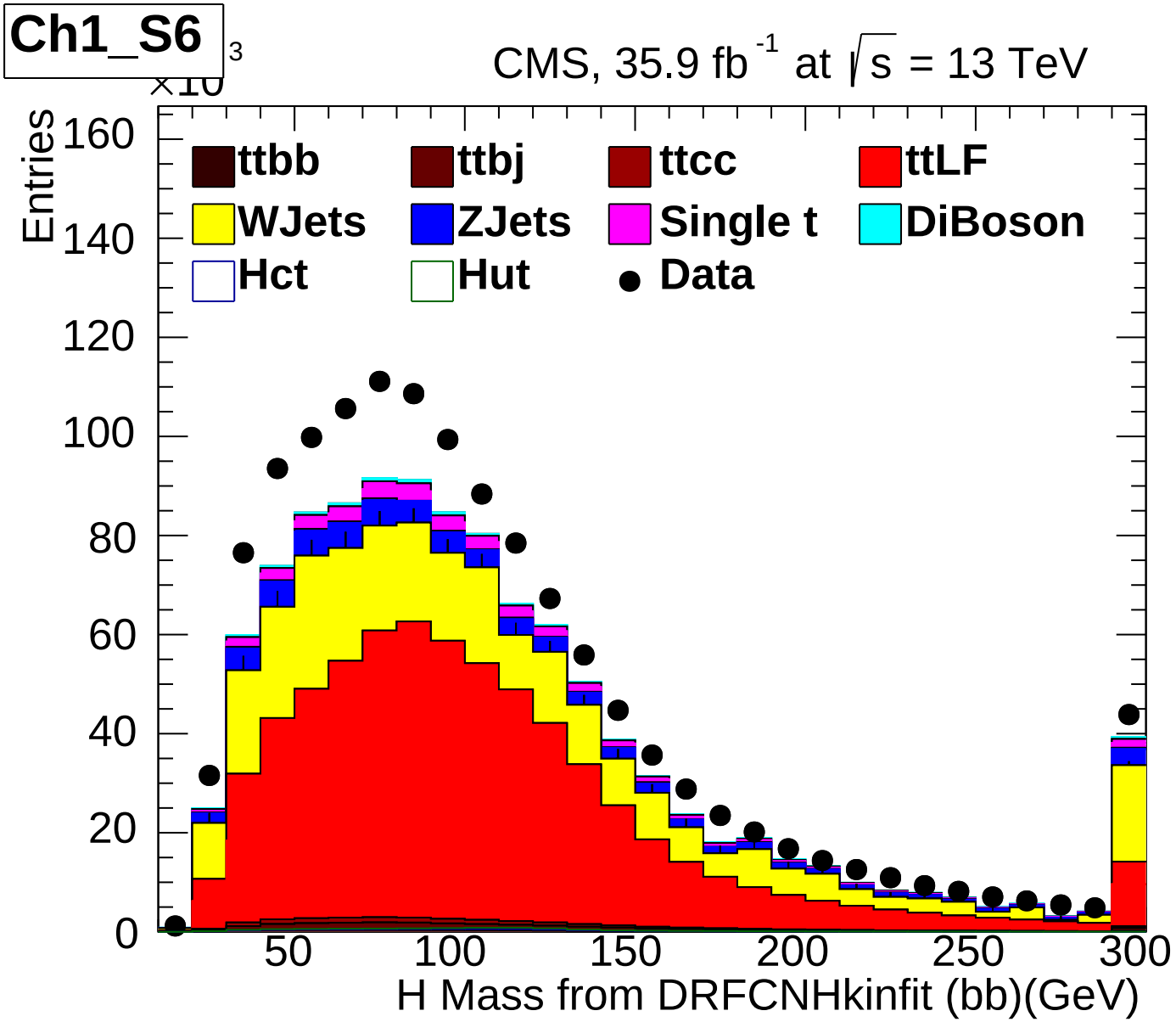

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

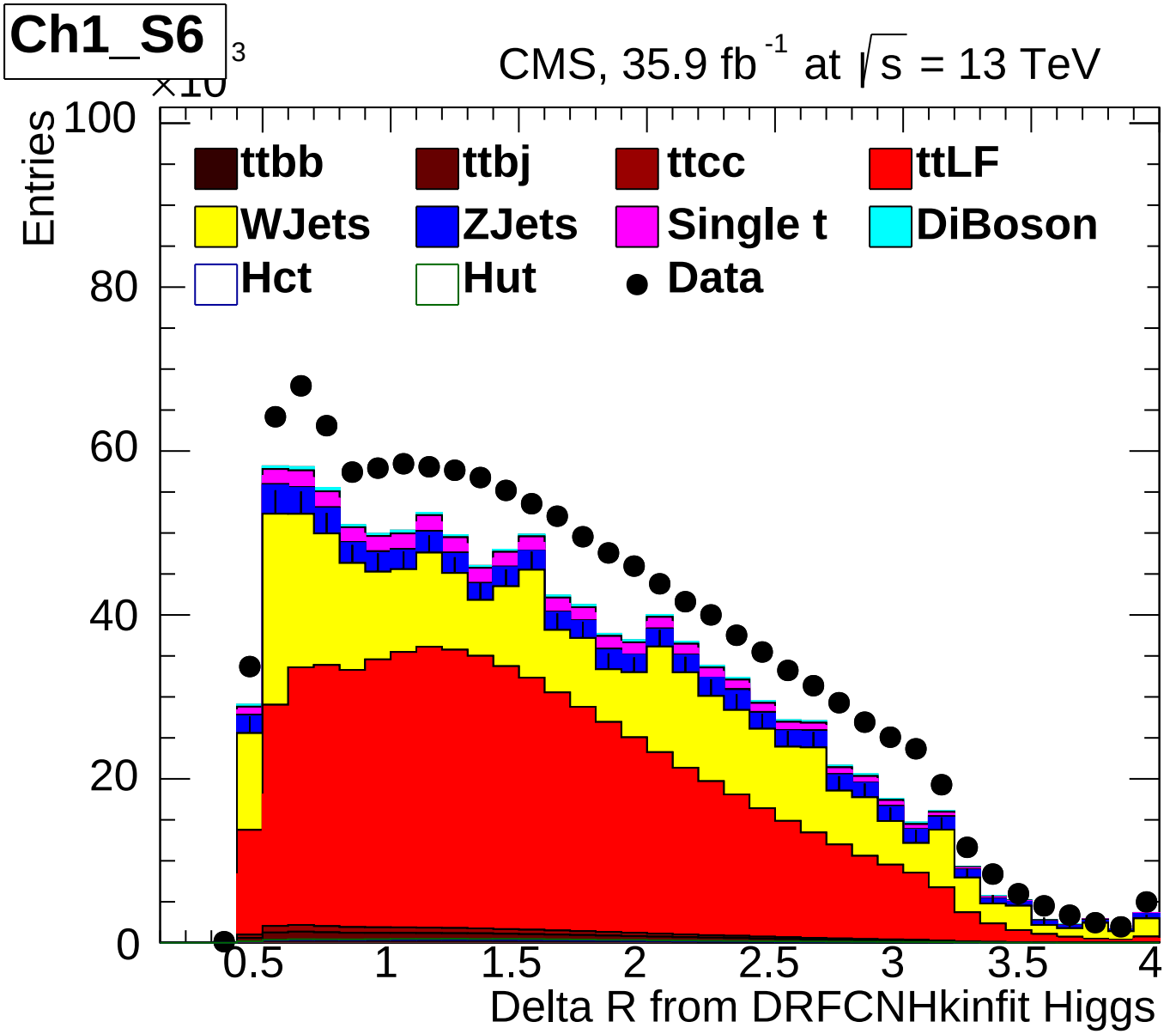

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
1200
1000
800
600
400
200
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

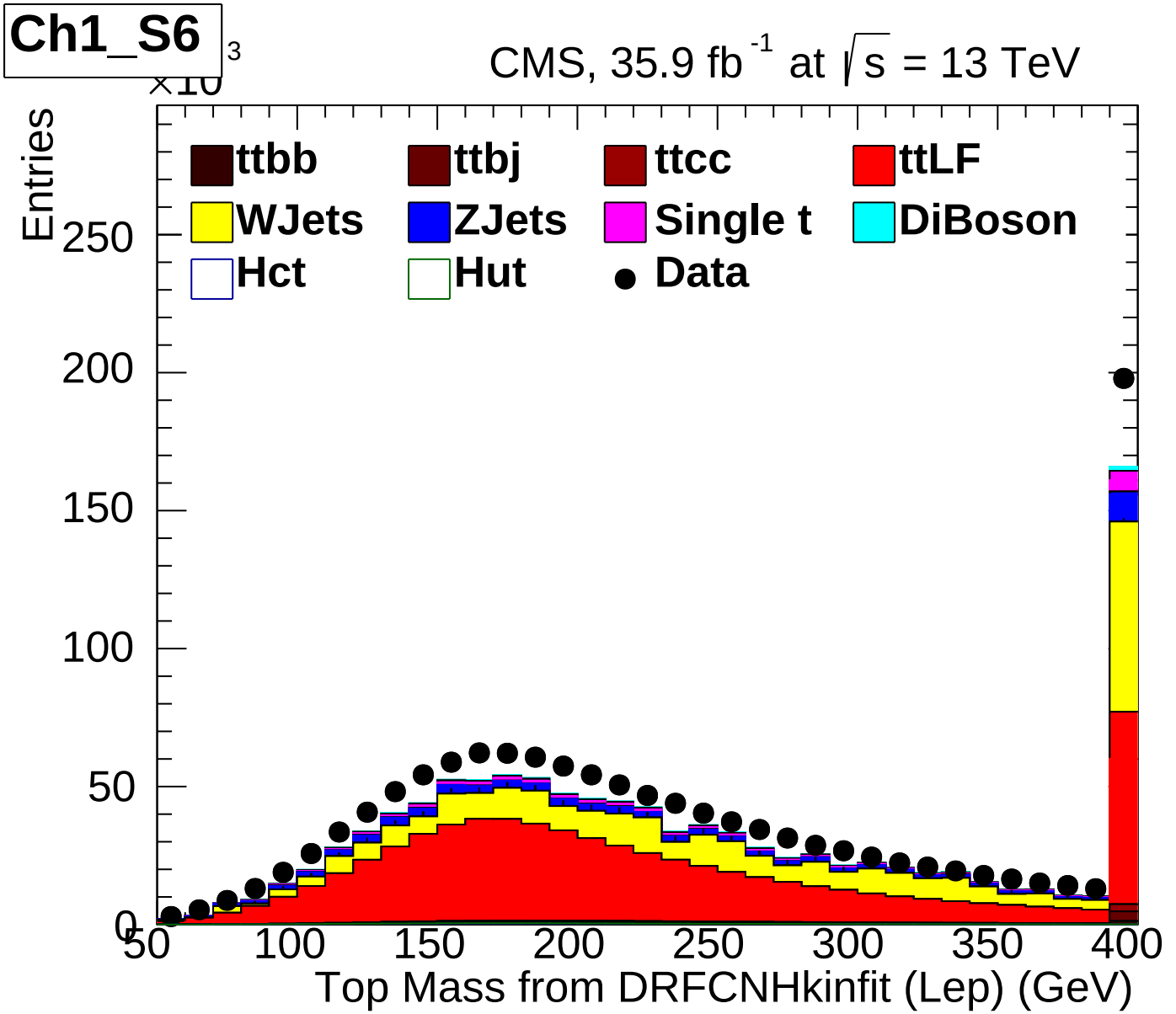

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
6000
5000
4000
3000
2000
1000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

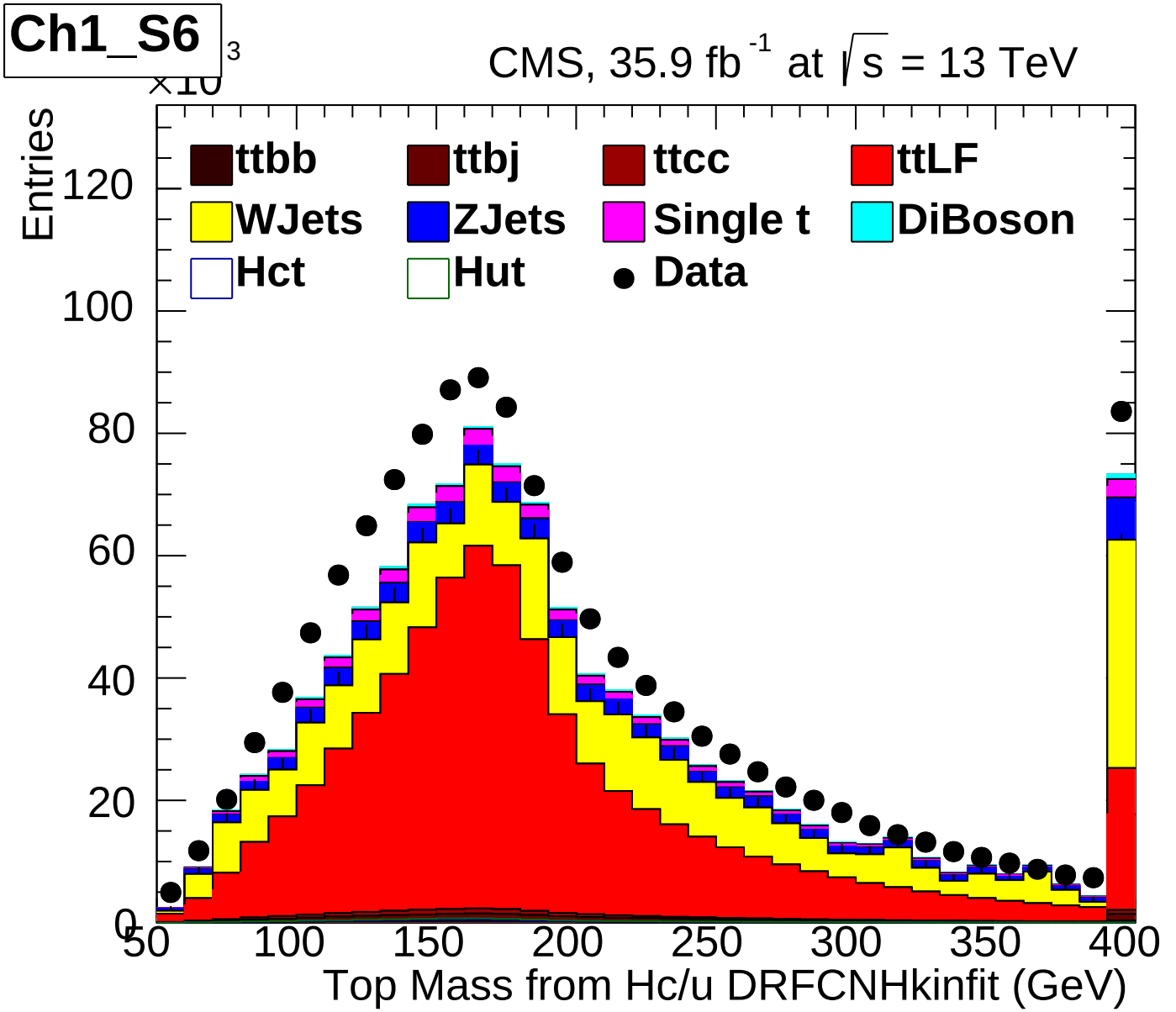

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

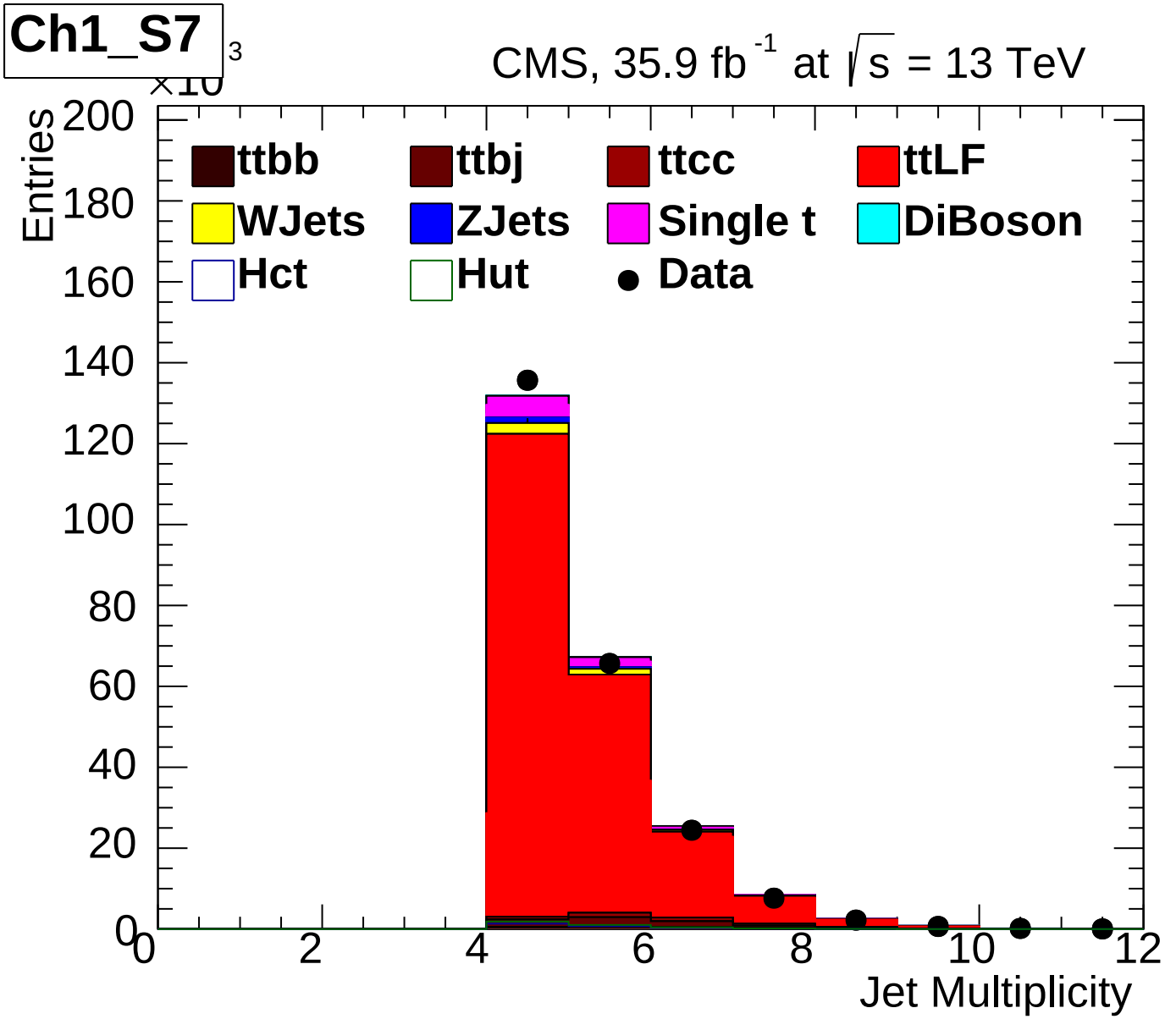

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

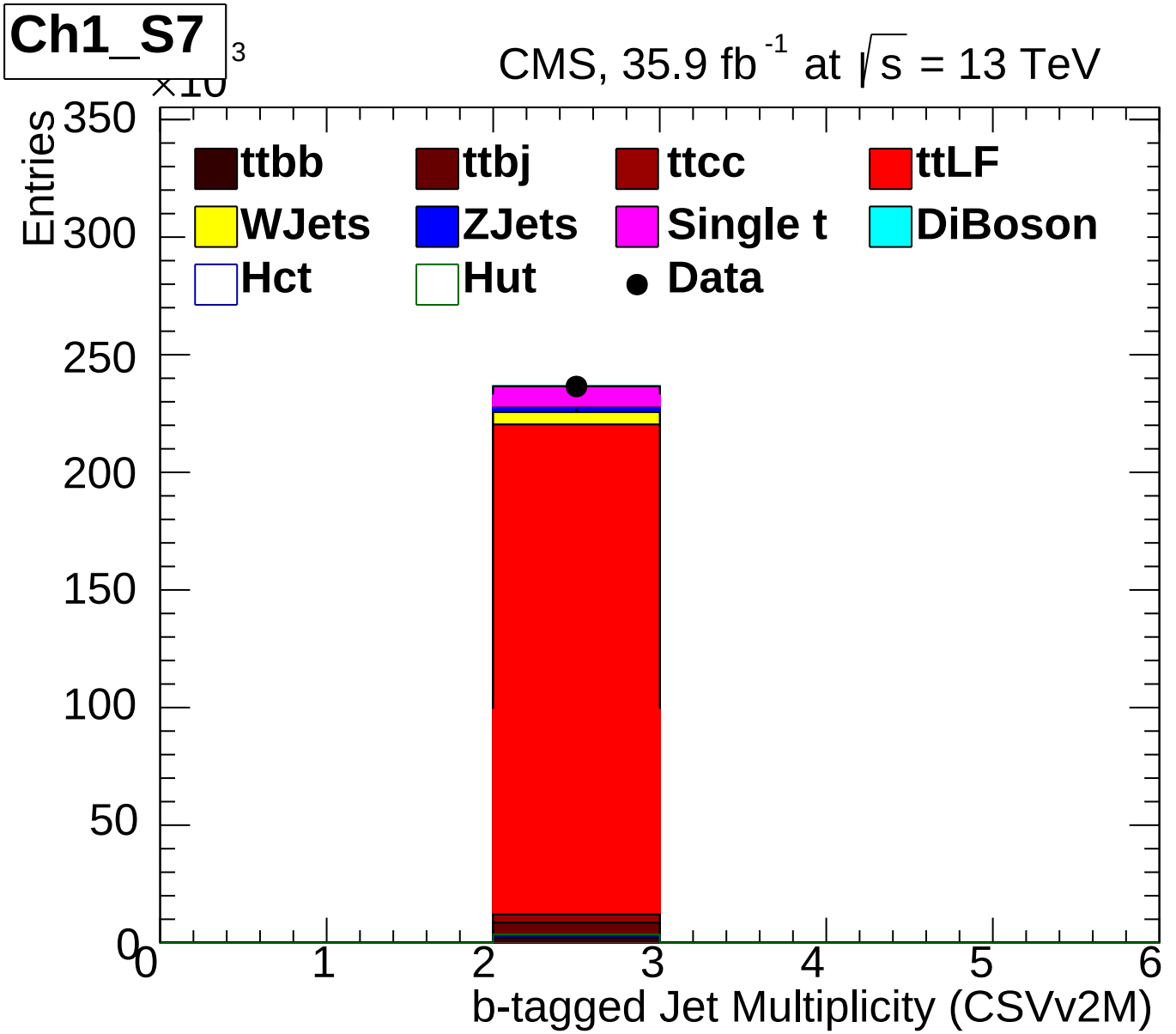

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

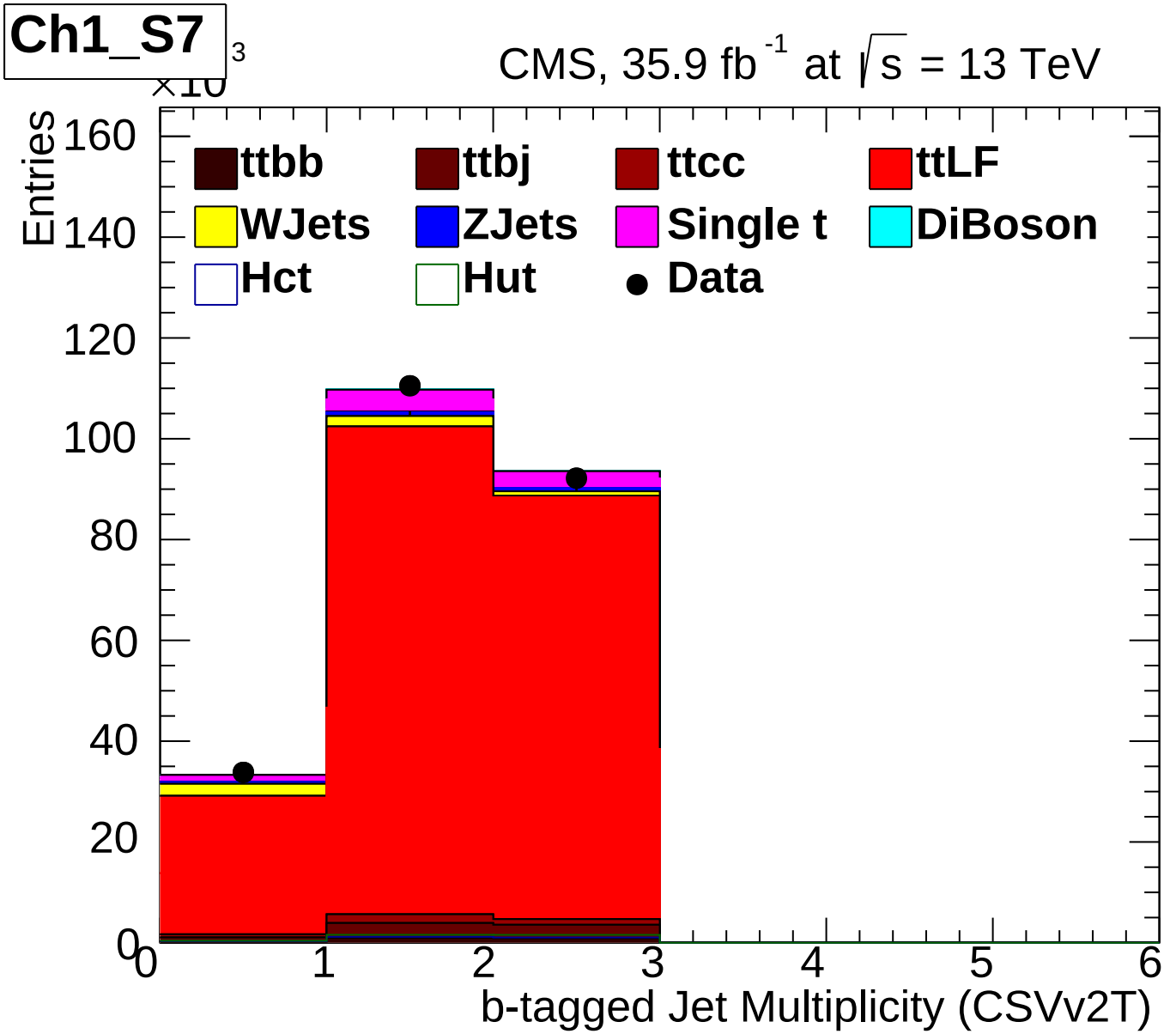

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
100
80
60
40
20
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

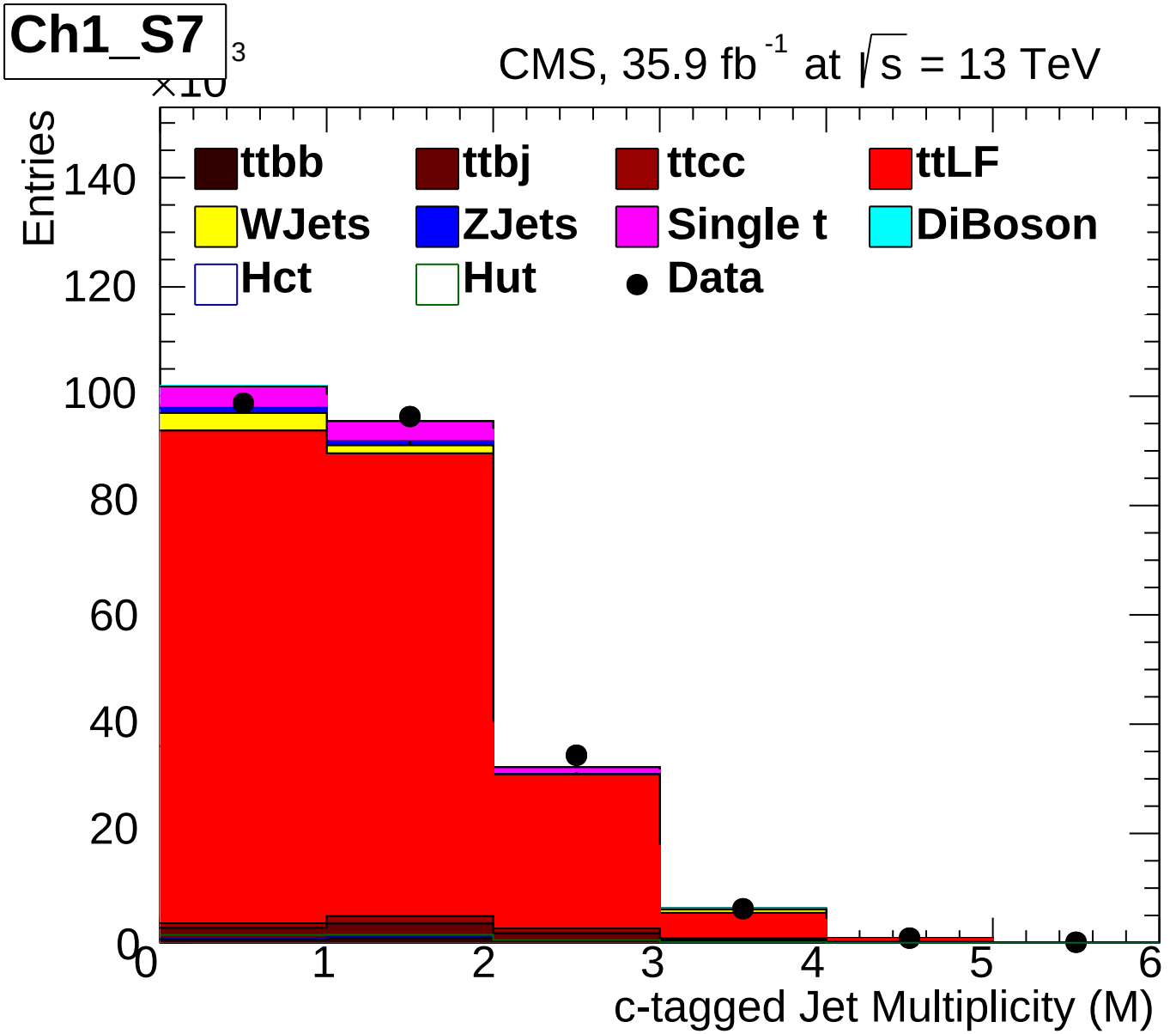

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

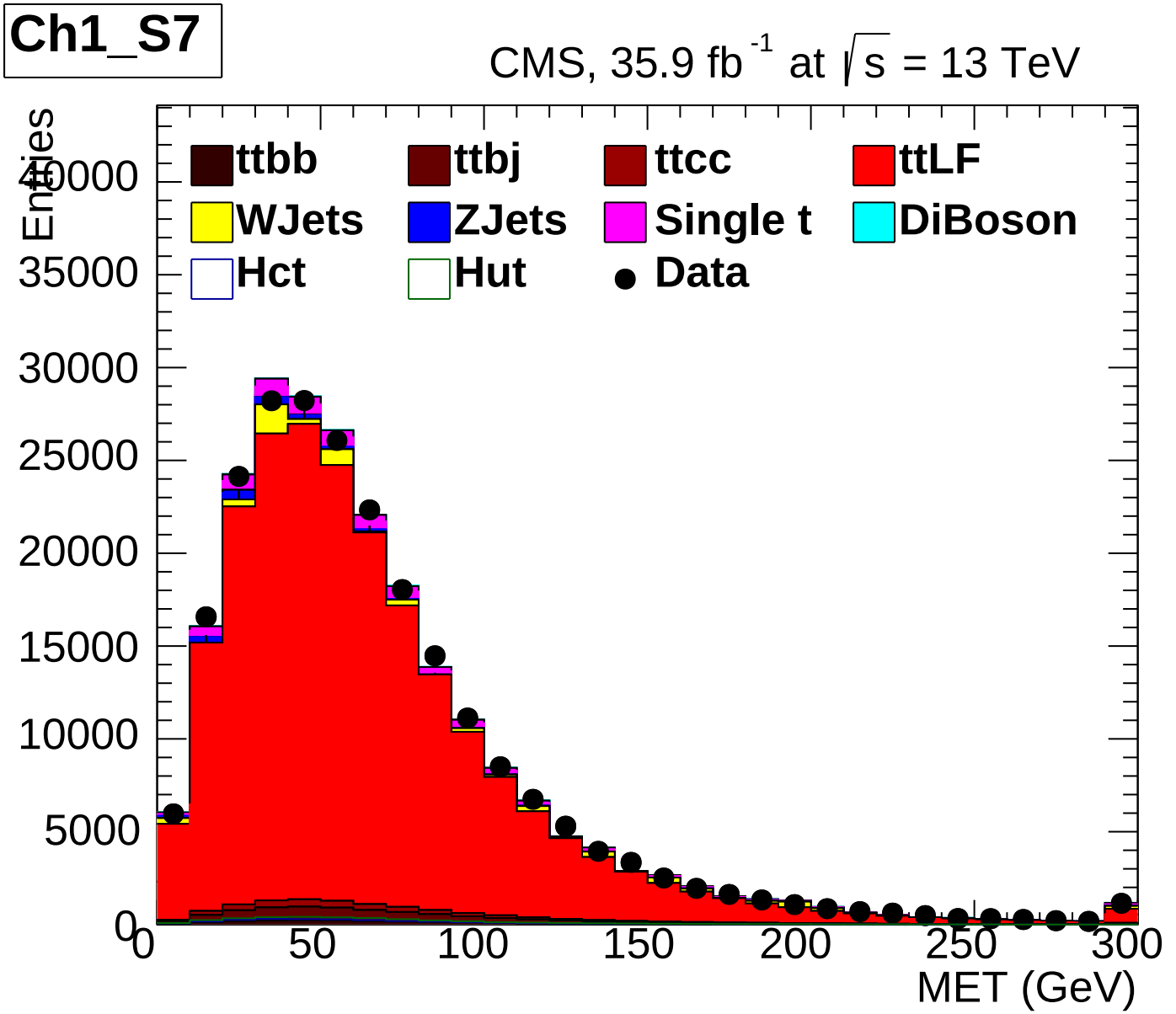

Ch1_S6
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10^3
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

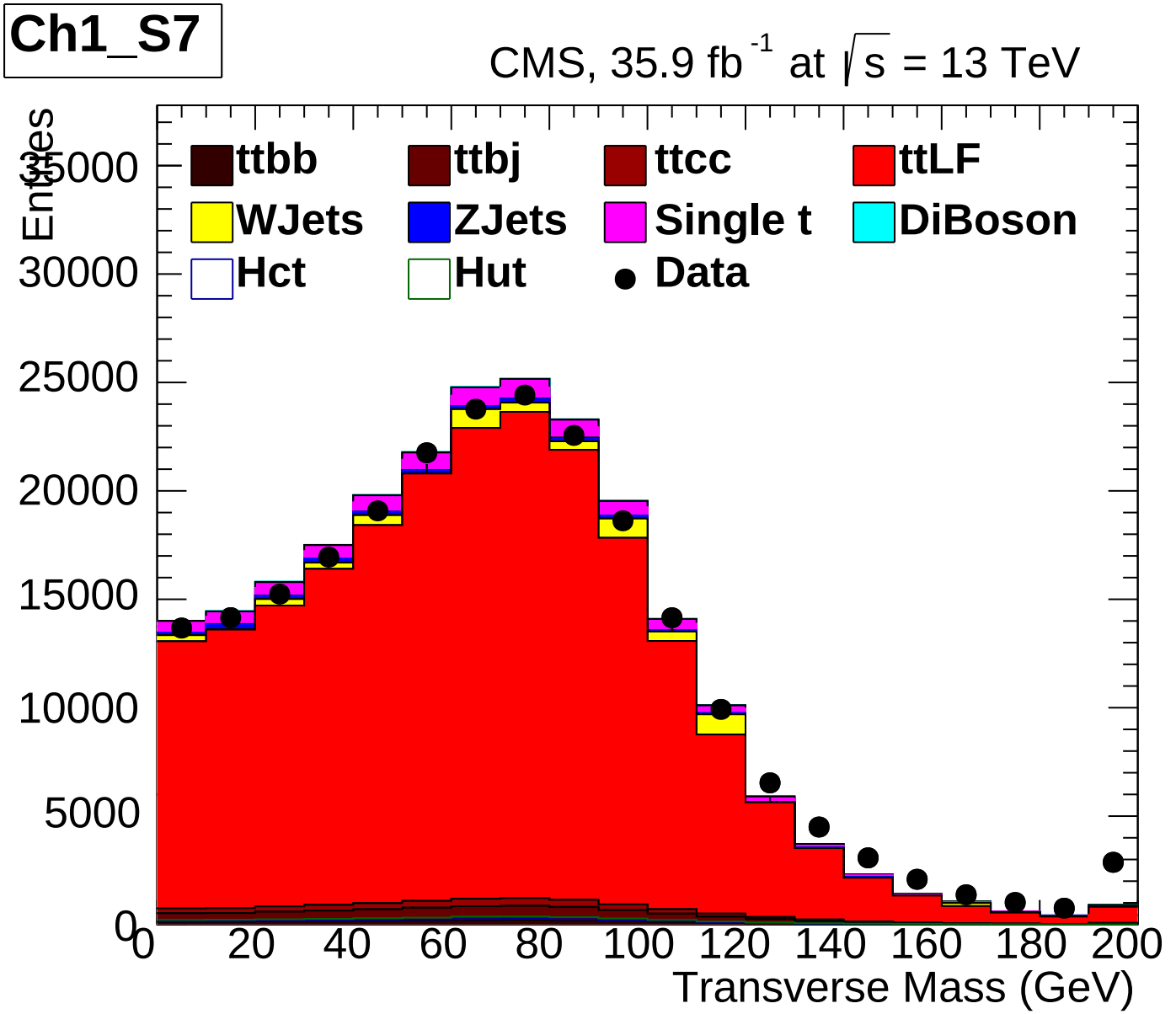

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Jet Multiplicity
0
20
40
60
80
100
120
140
160
180
200
0
2
4
6
8
10
12

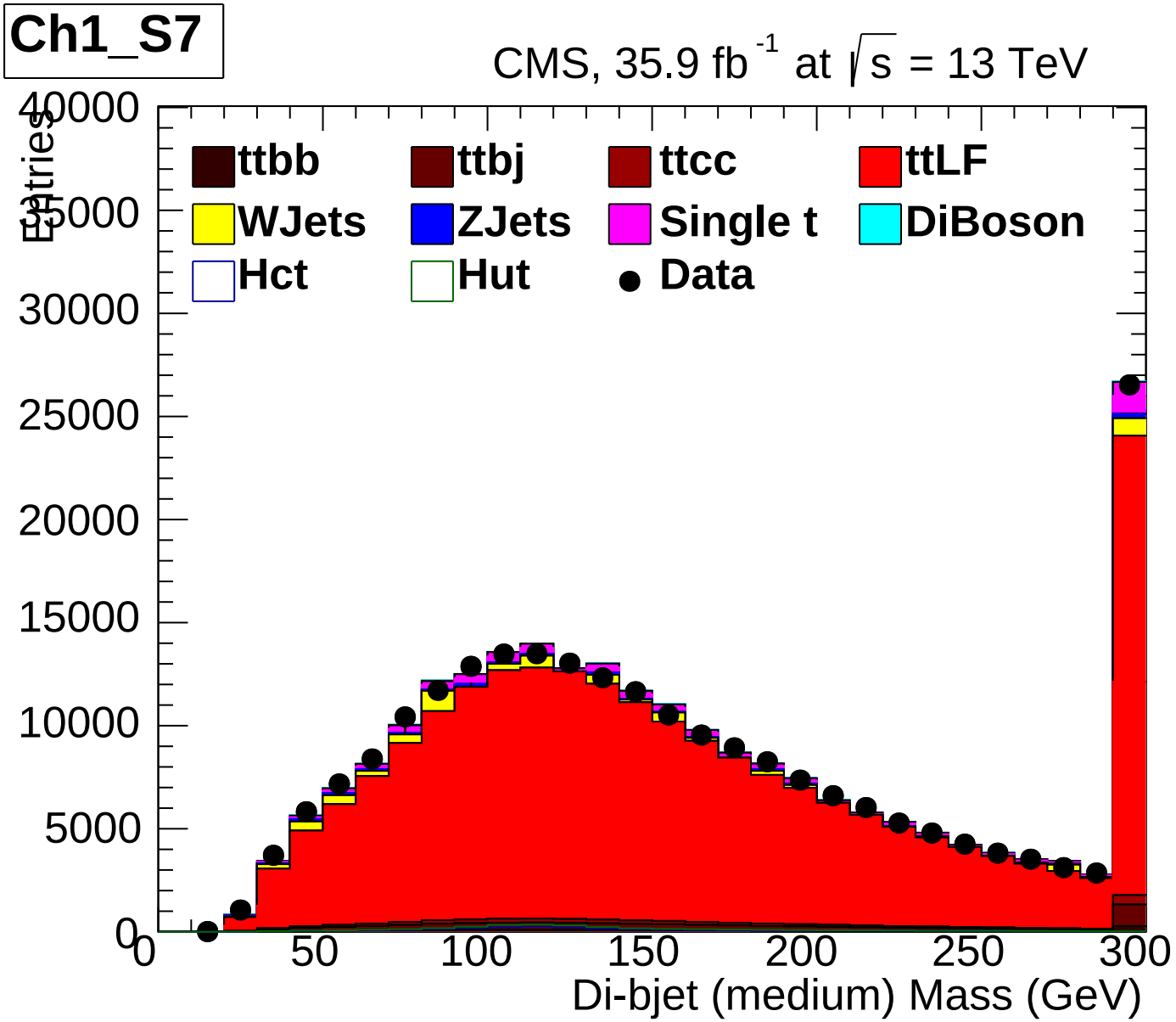

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
0
50
100
150
200
250
300
MET (GeV)


Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
35000
30000
25000
20000
15000
10000
5000
0
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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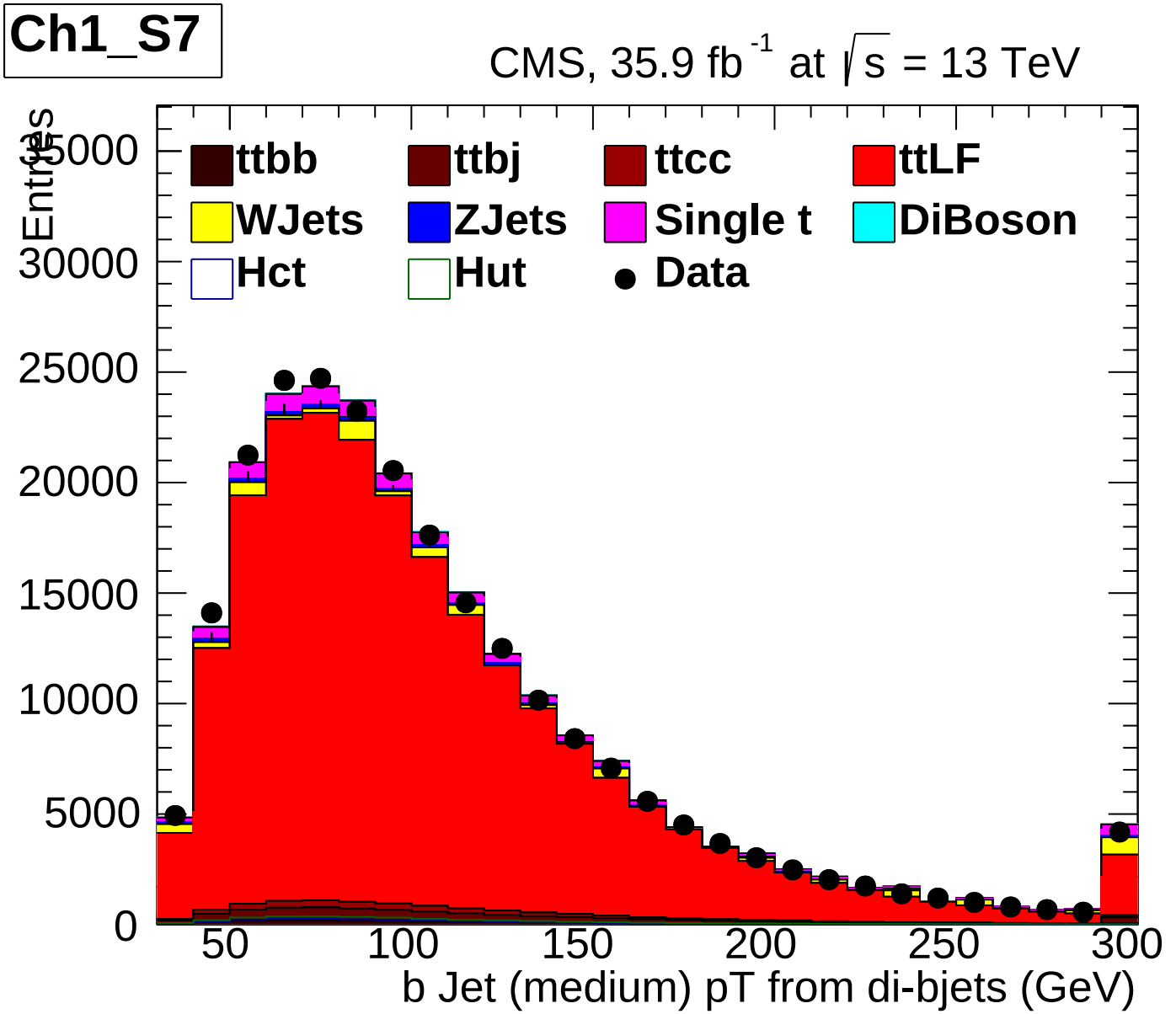
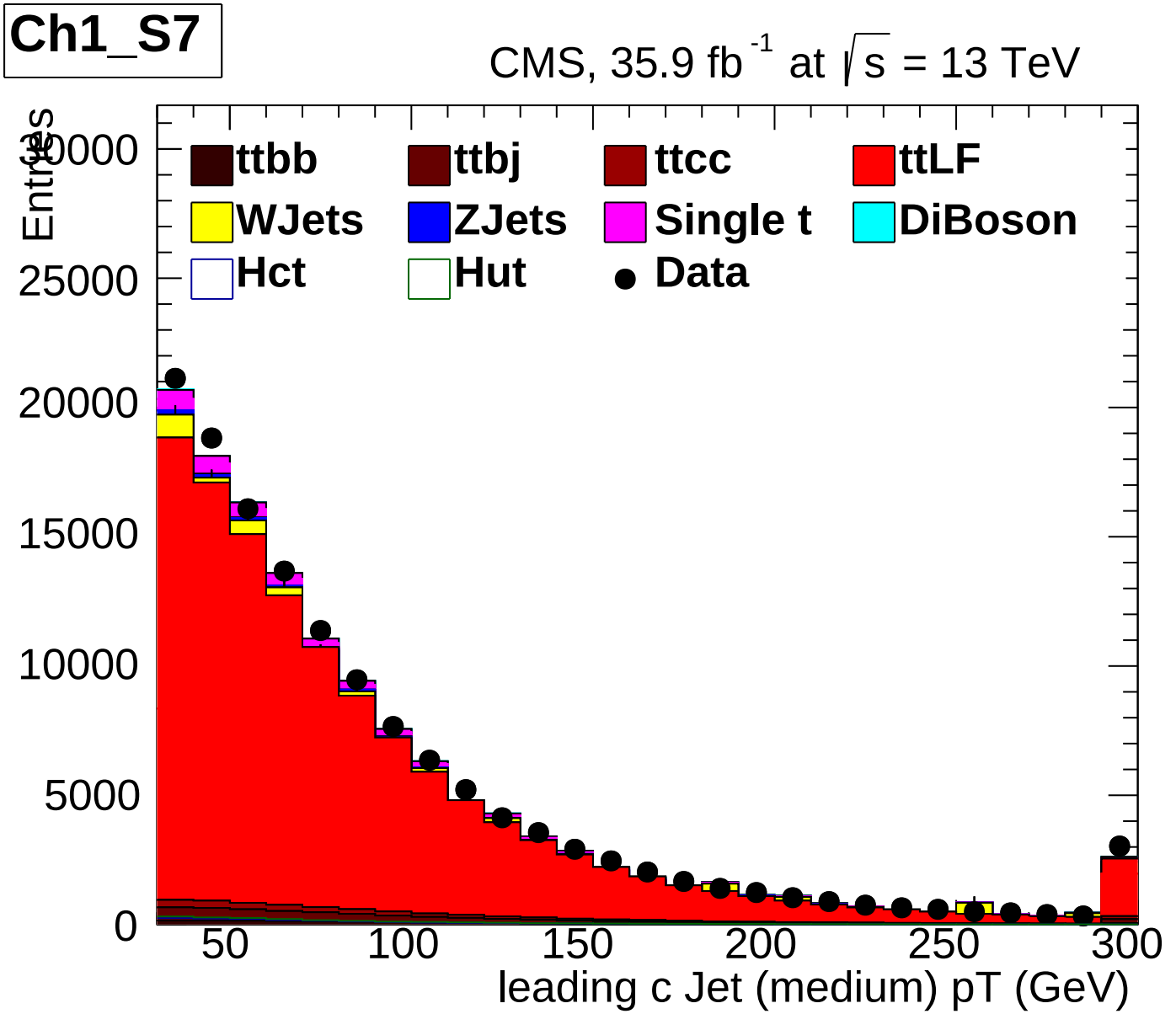
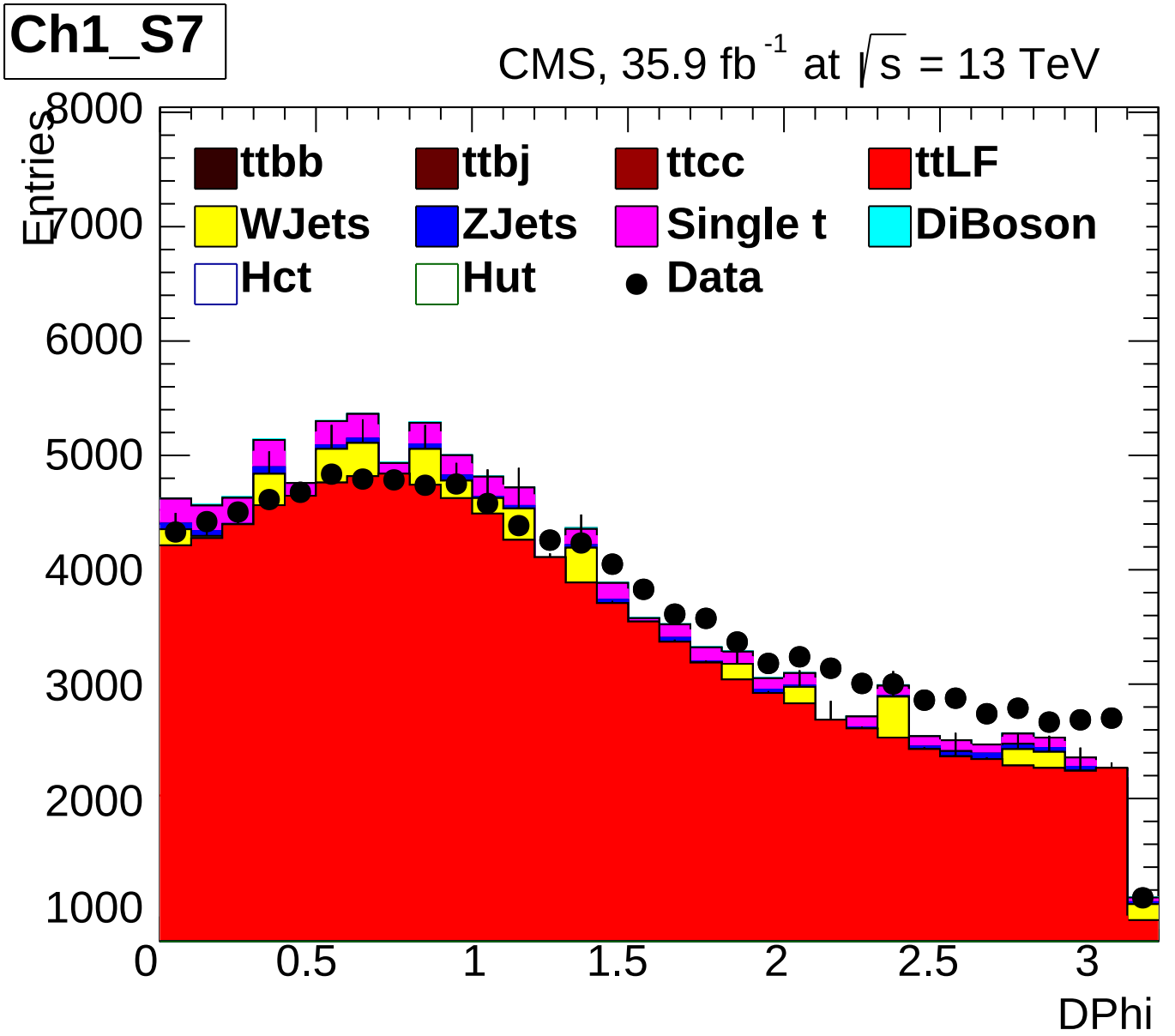
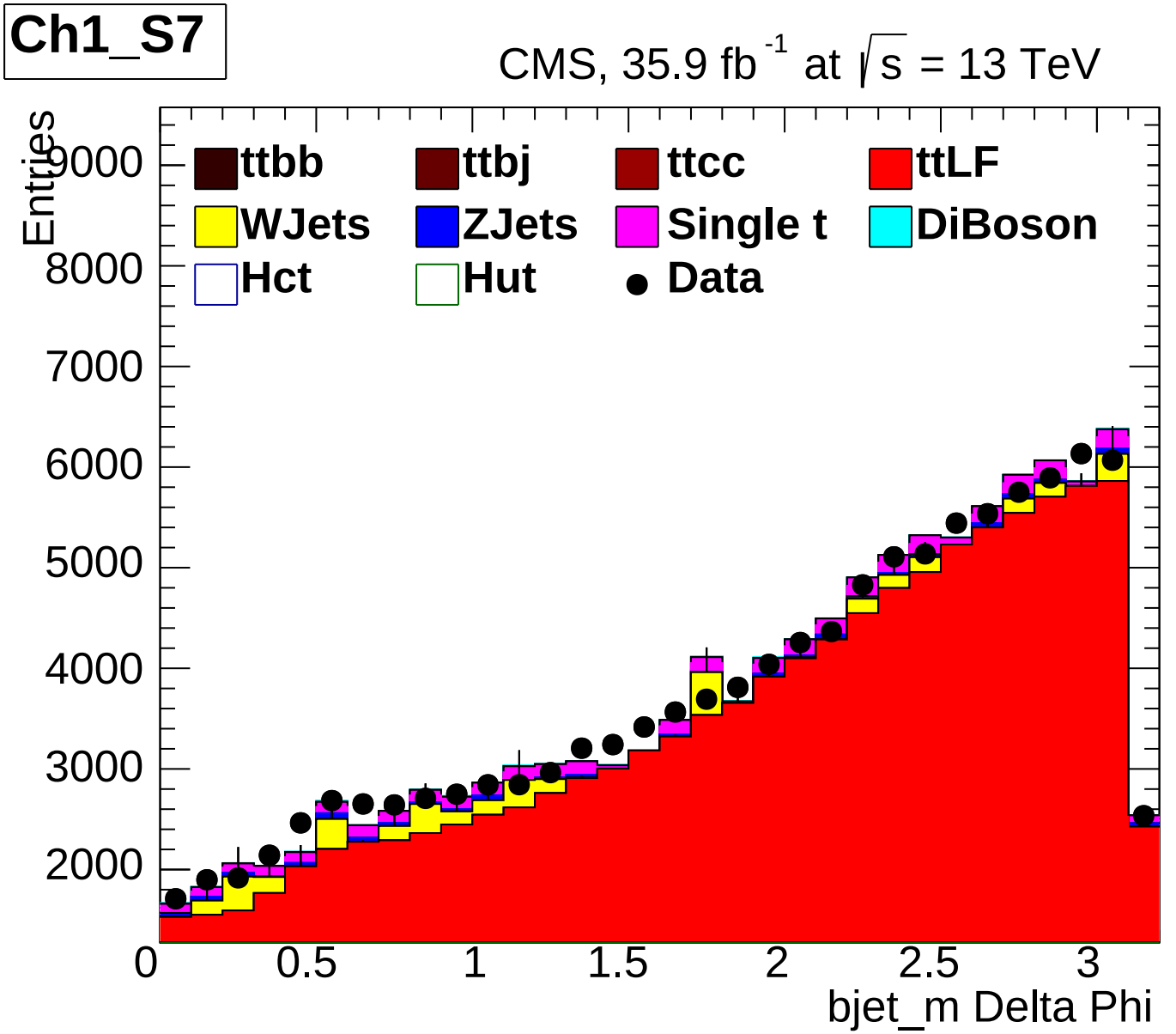
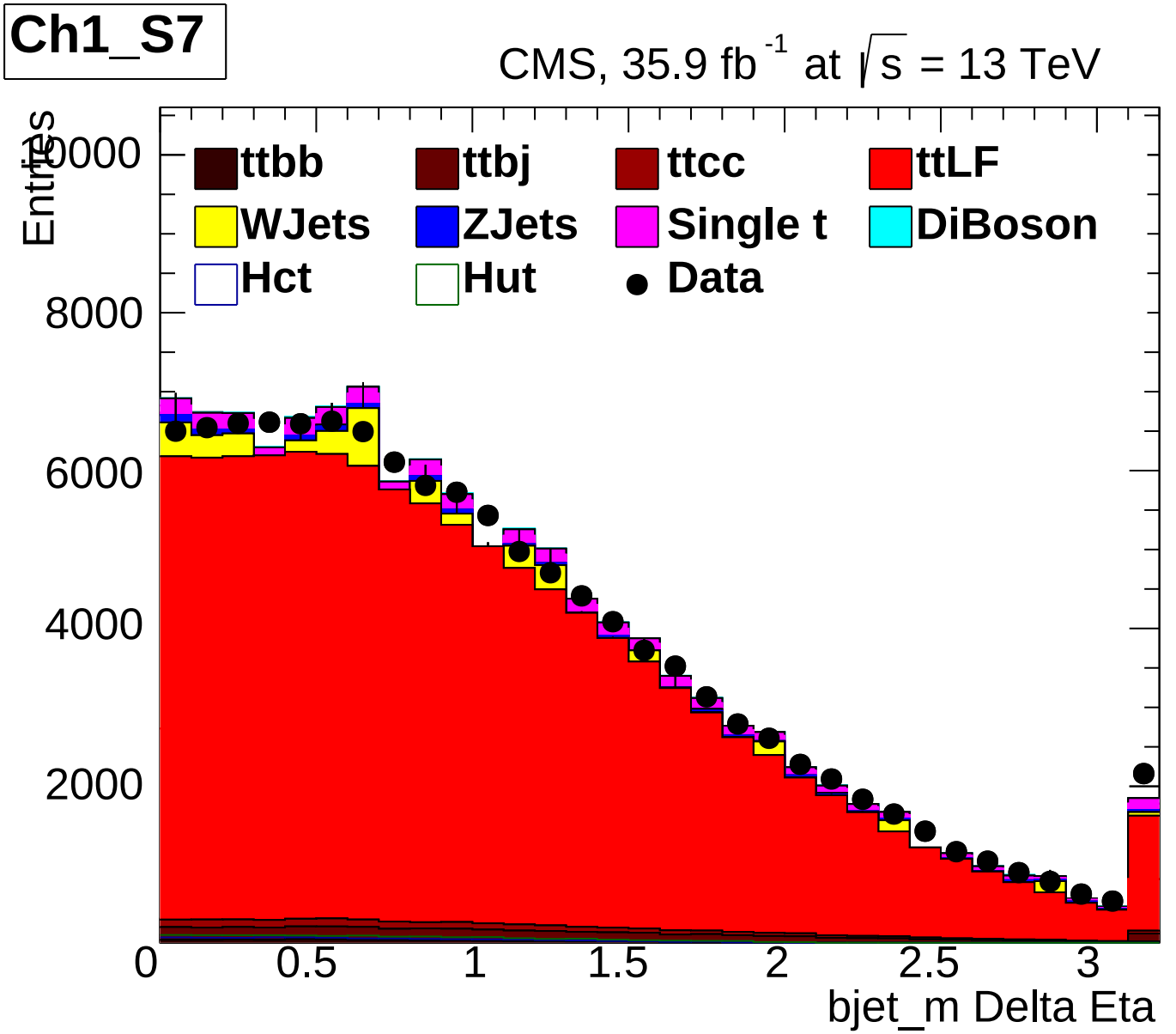
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
40000
35000
30000
25000
20000
15000
10000
5000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

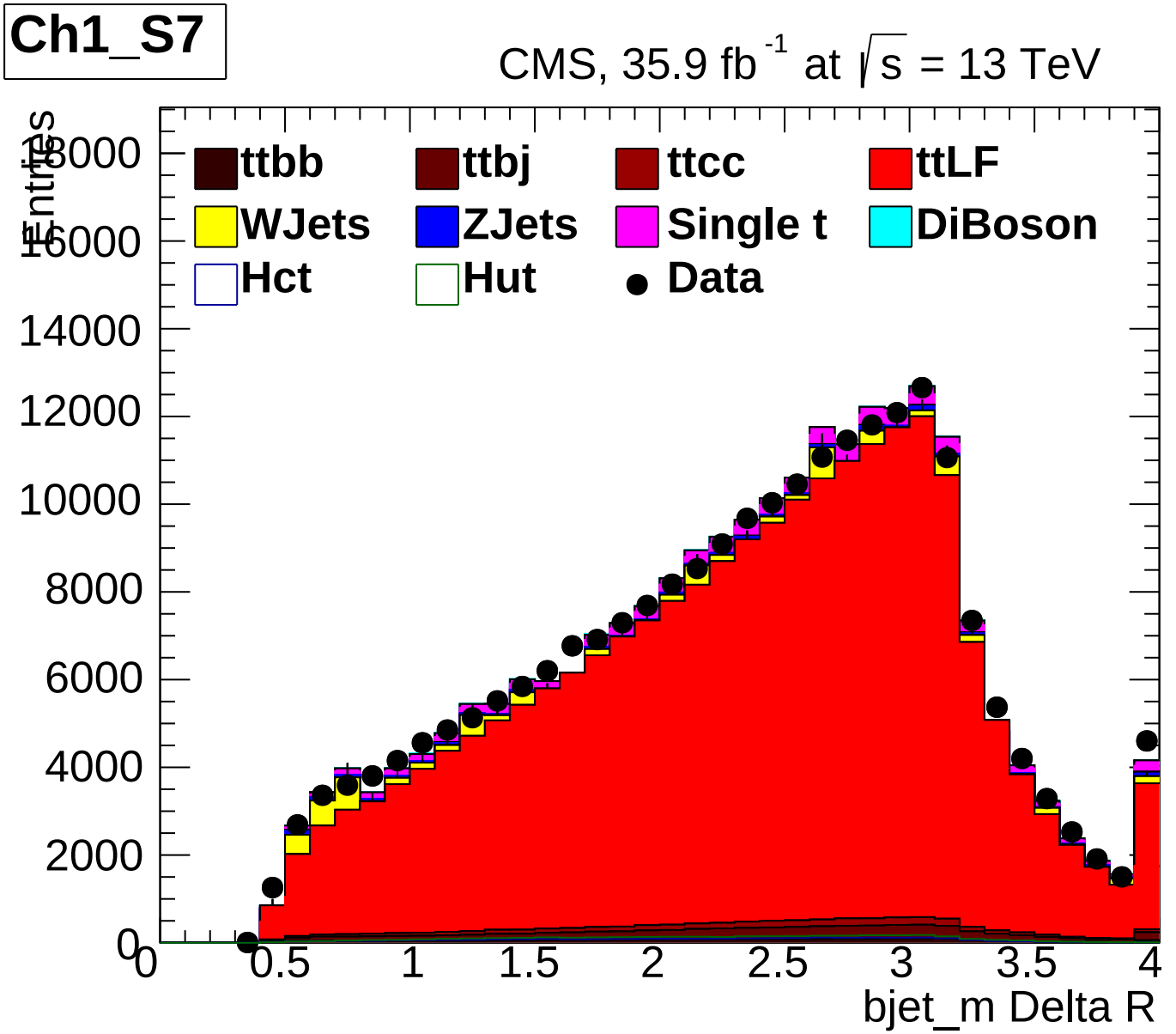

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

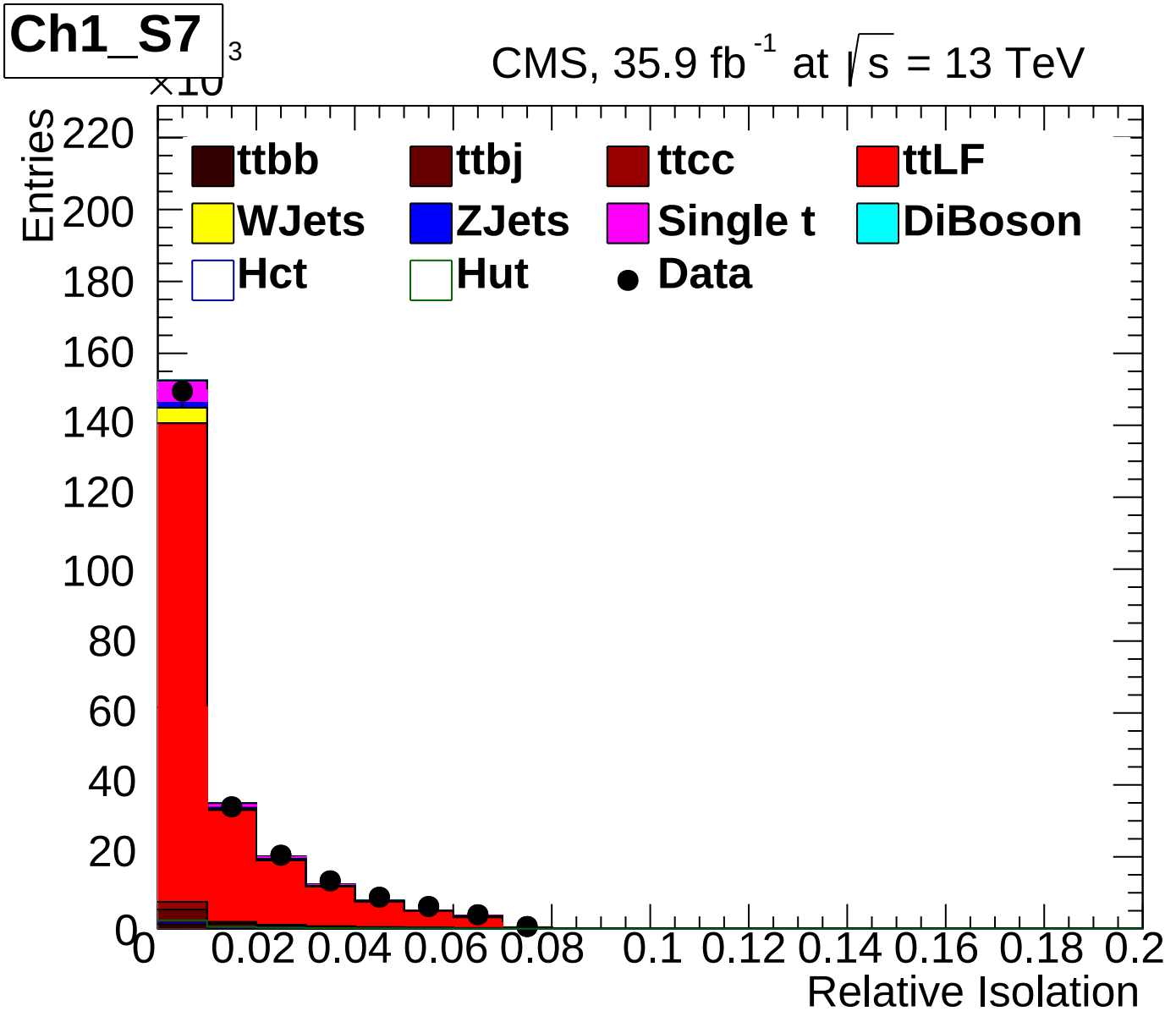

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

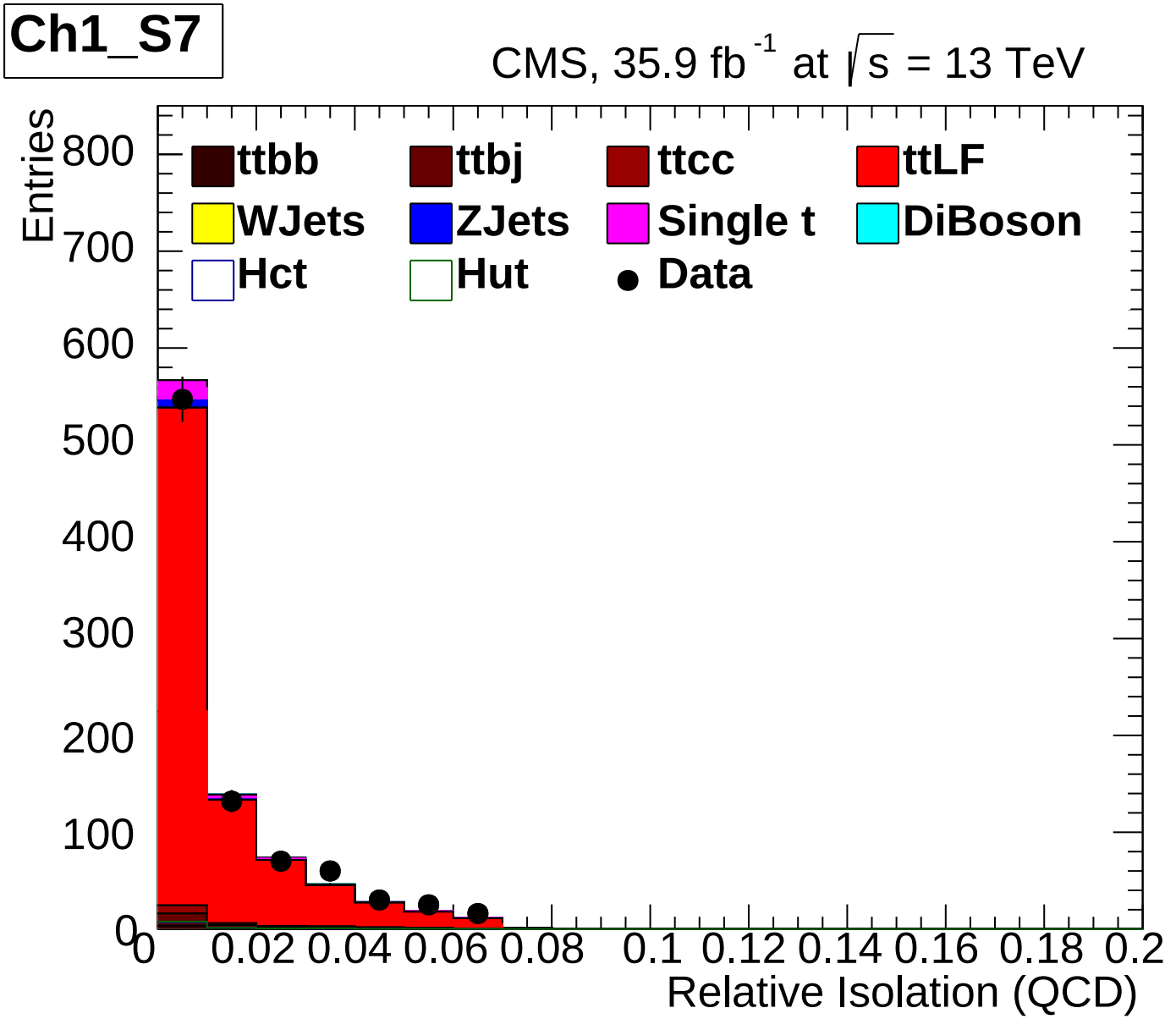

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
8000
7000
6000
5000
4000
3000
2000
1000
0
0.5
1
1.5
2
2.5
3
DPhi

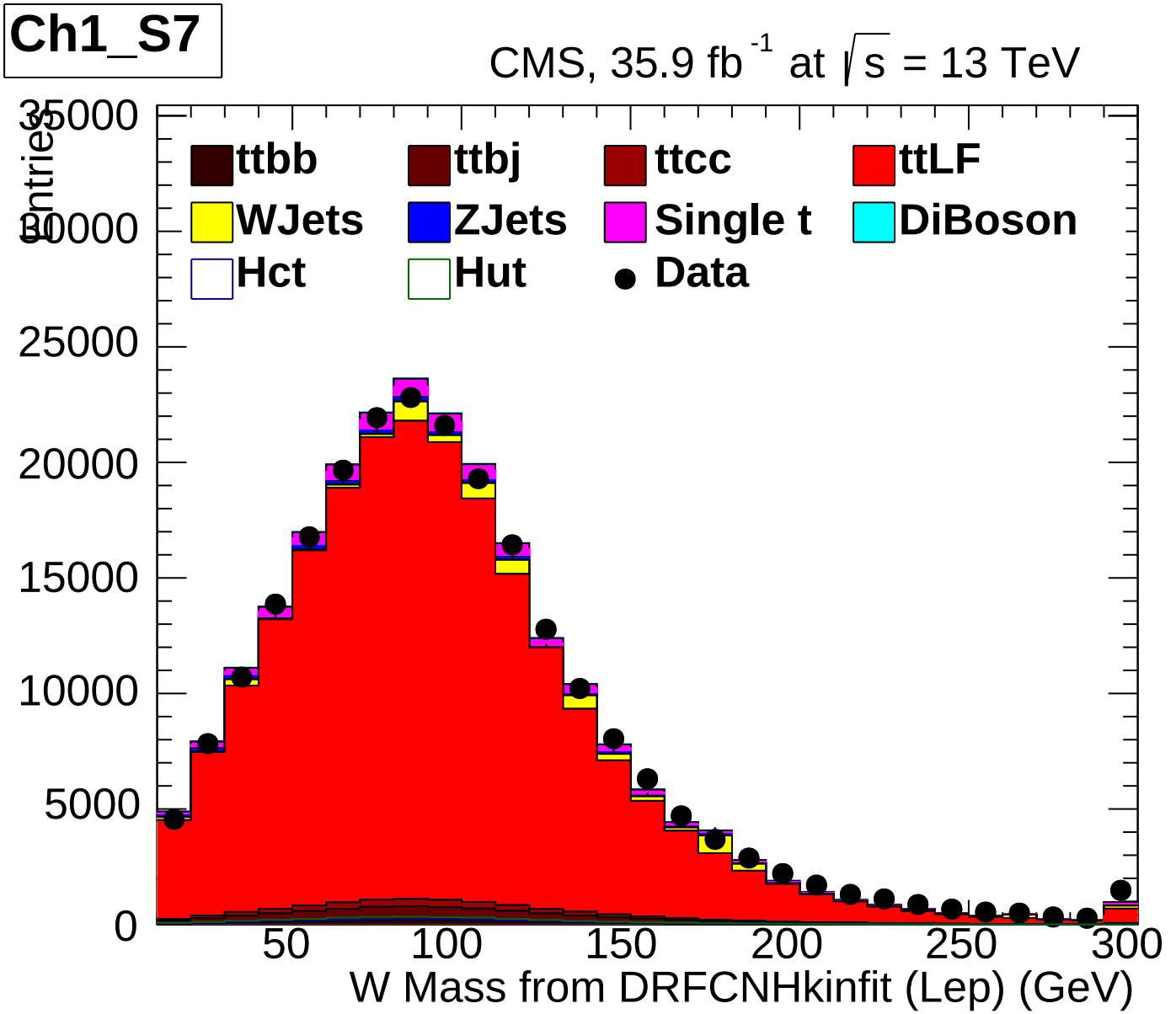

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
9000
8000
7000
6000
5000
4000
3000
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

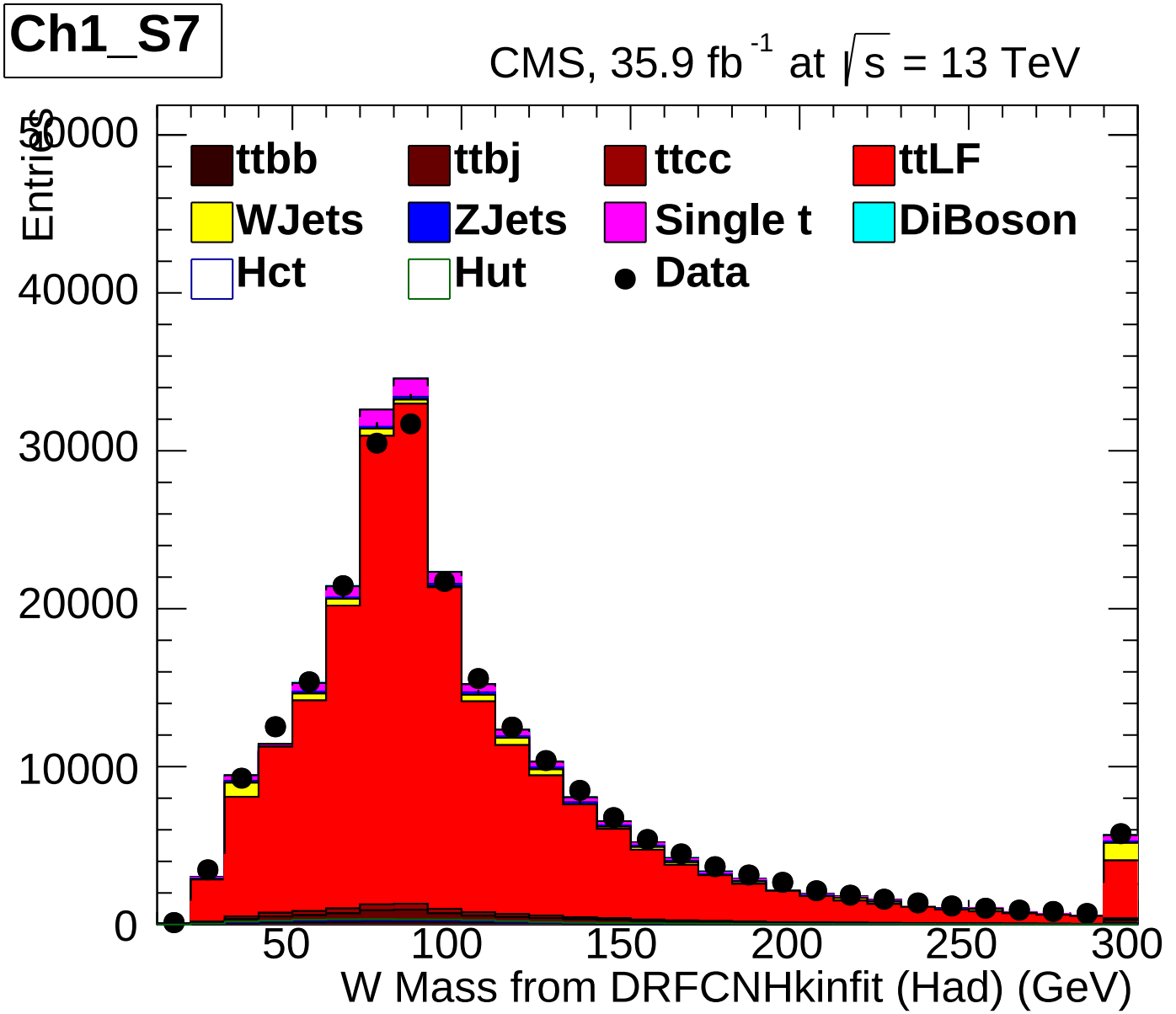

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

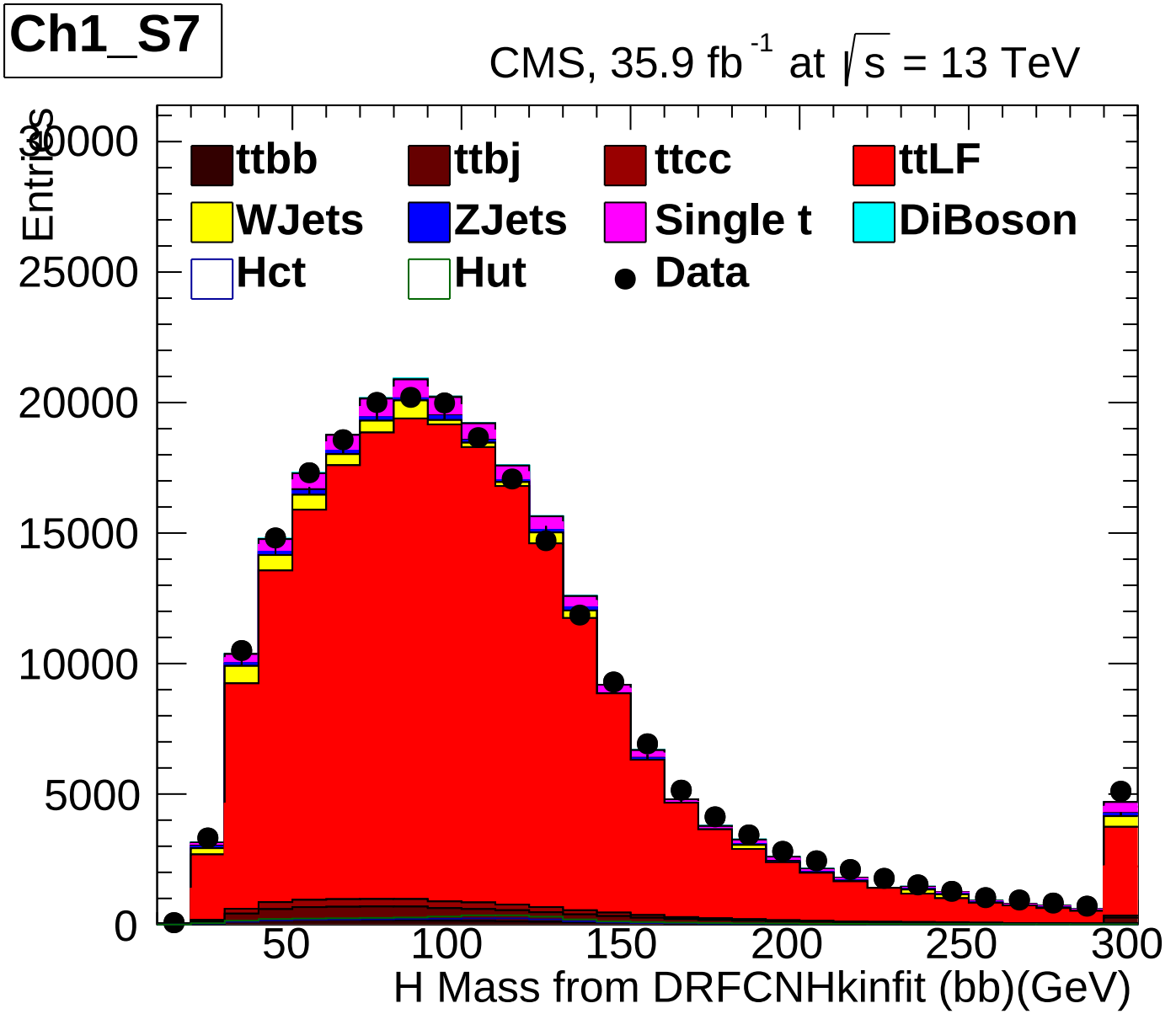

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

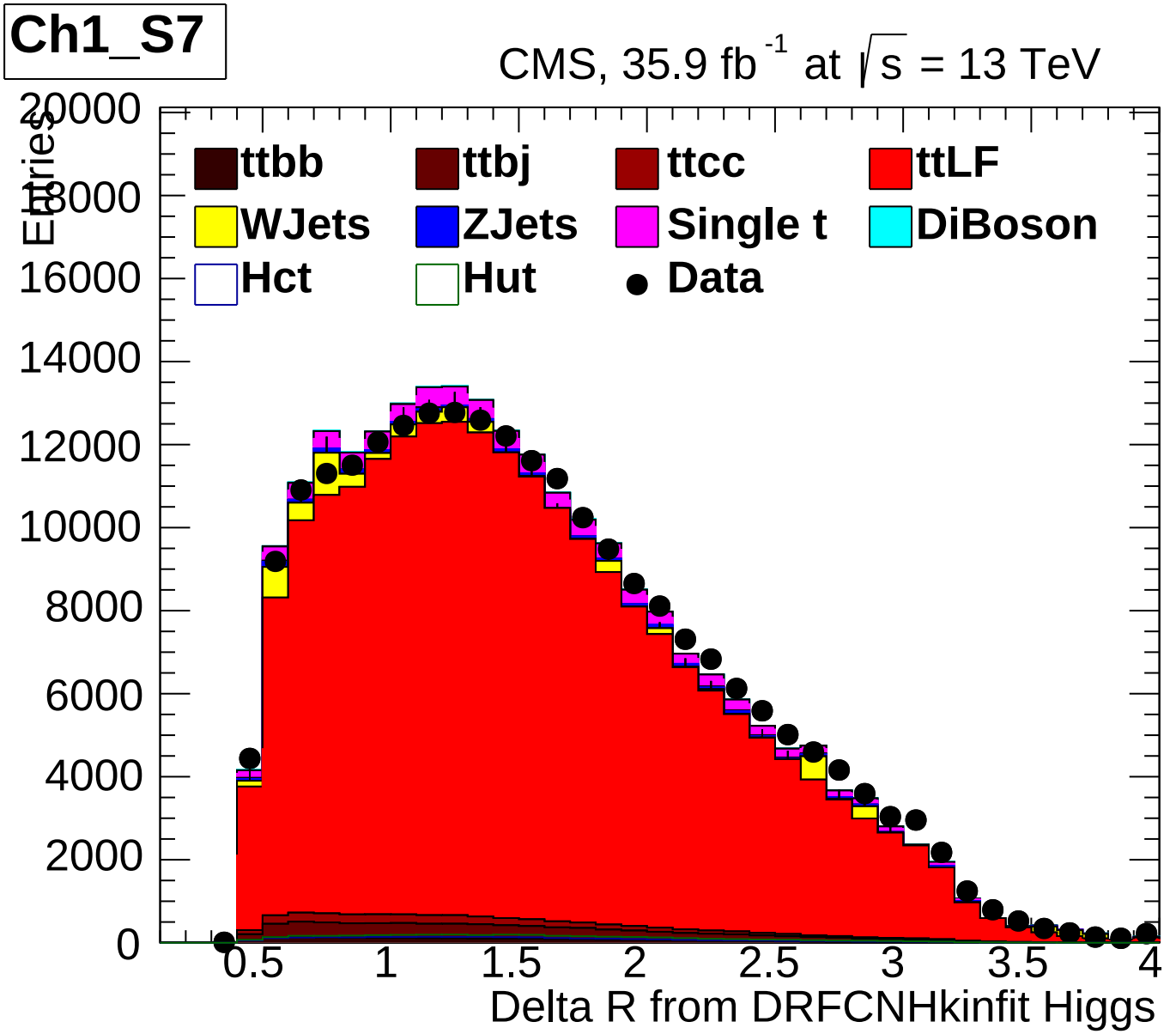

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
180
200
220
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

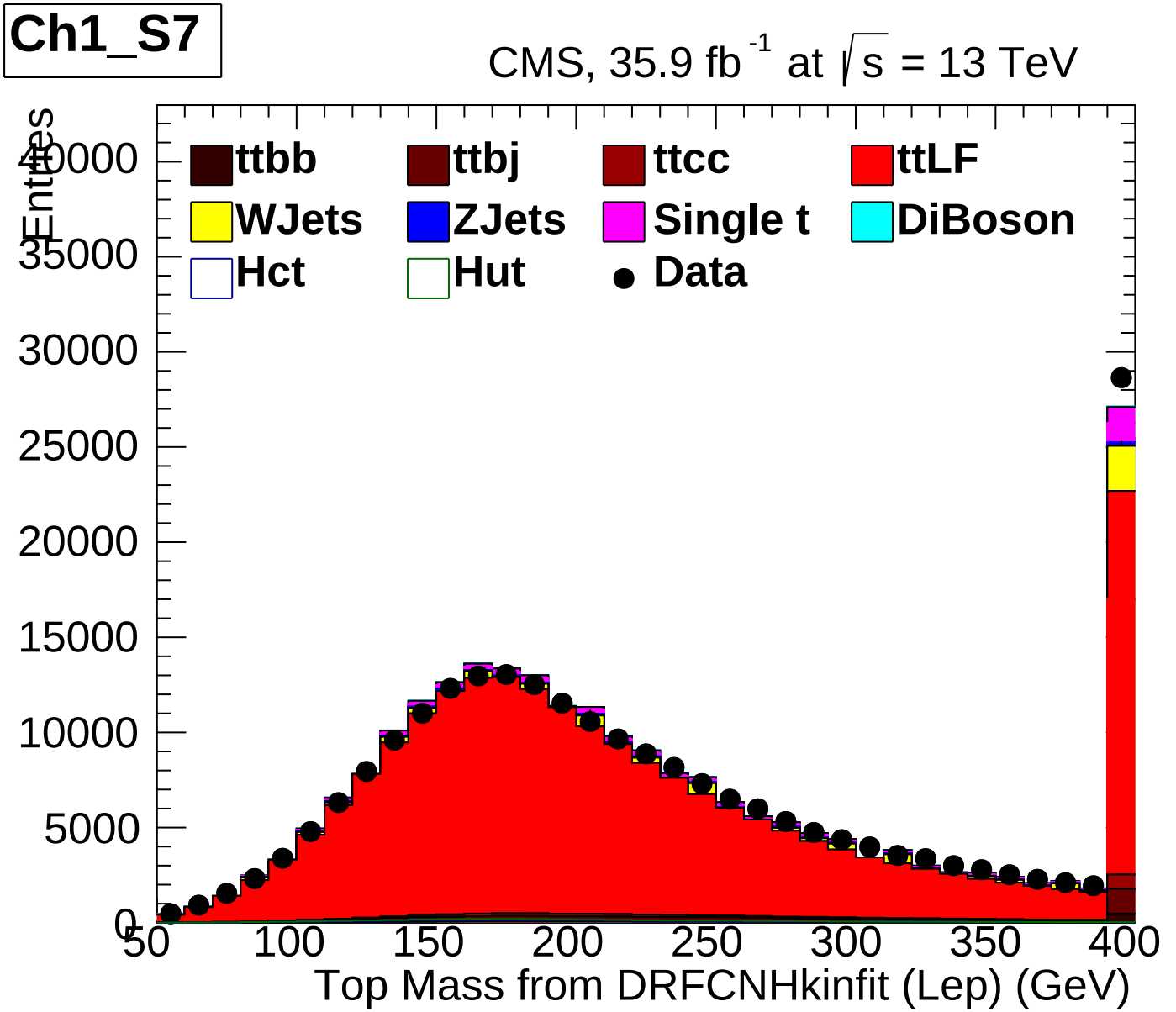

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

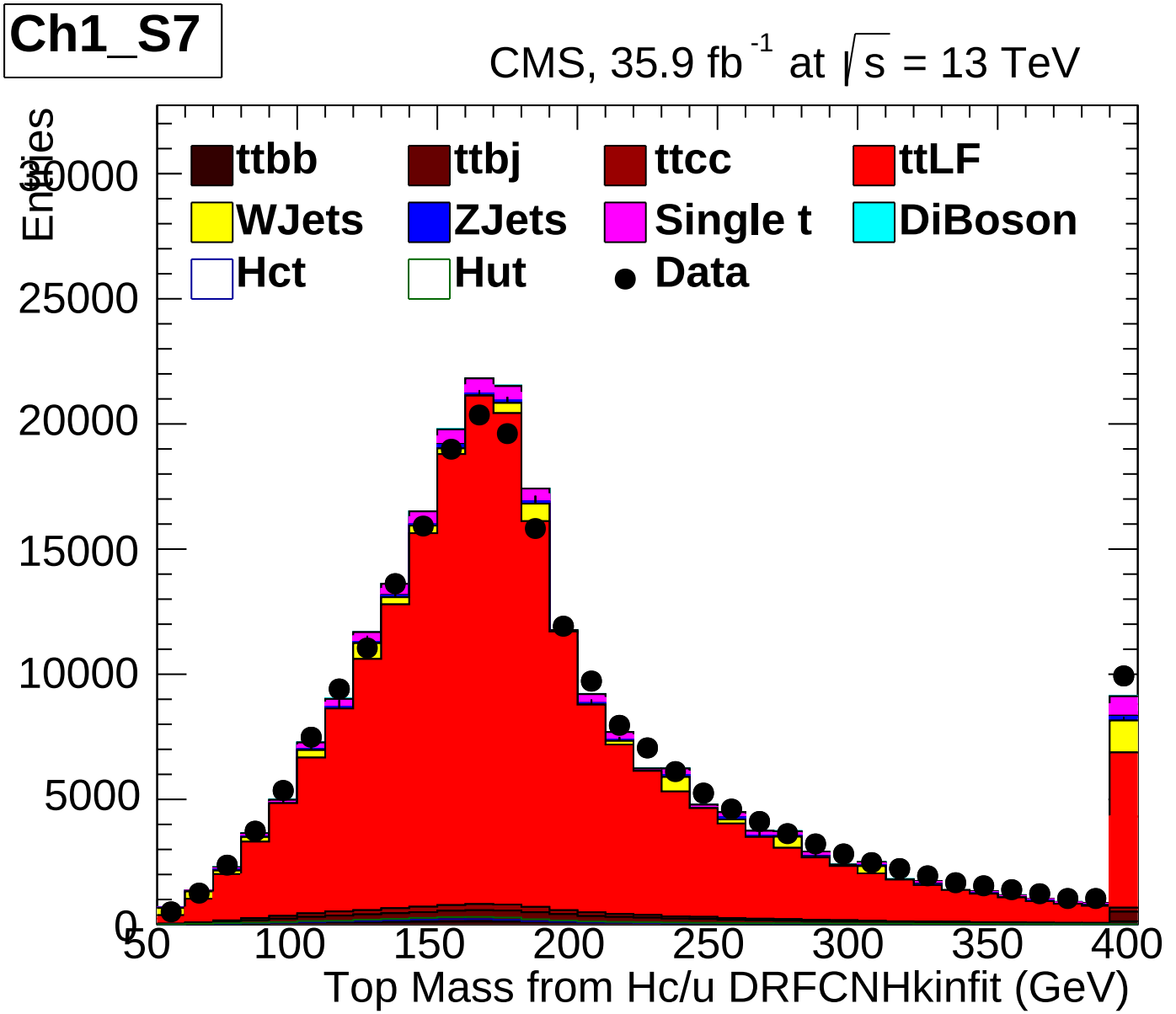

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
entries
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

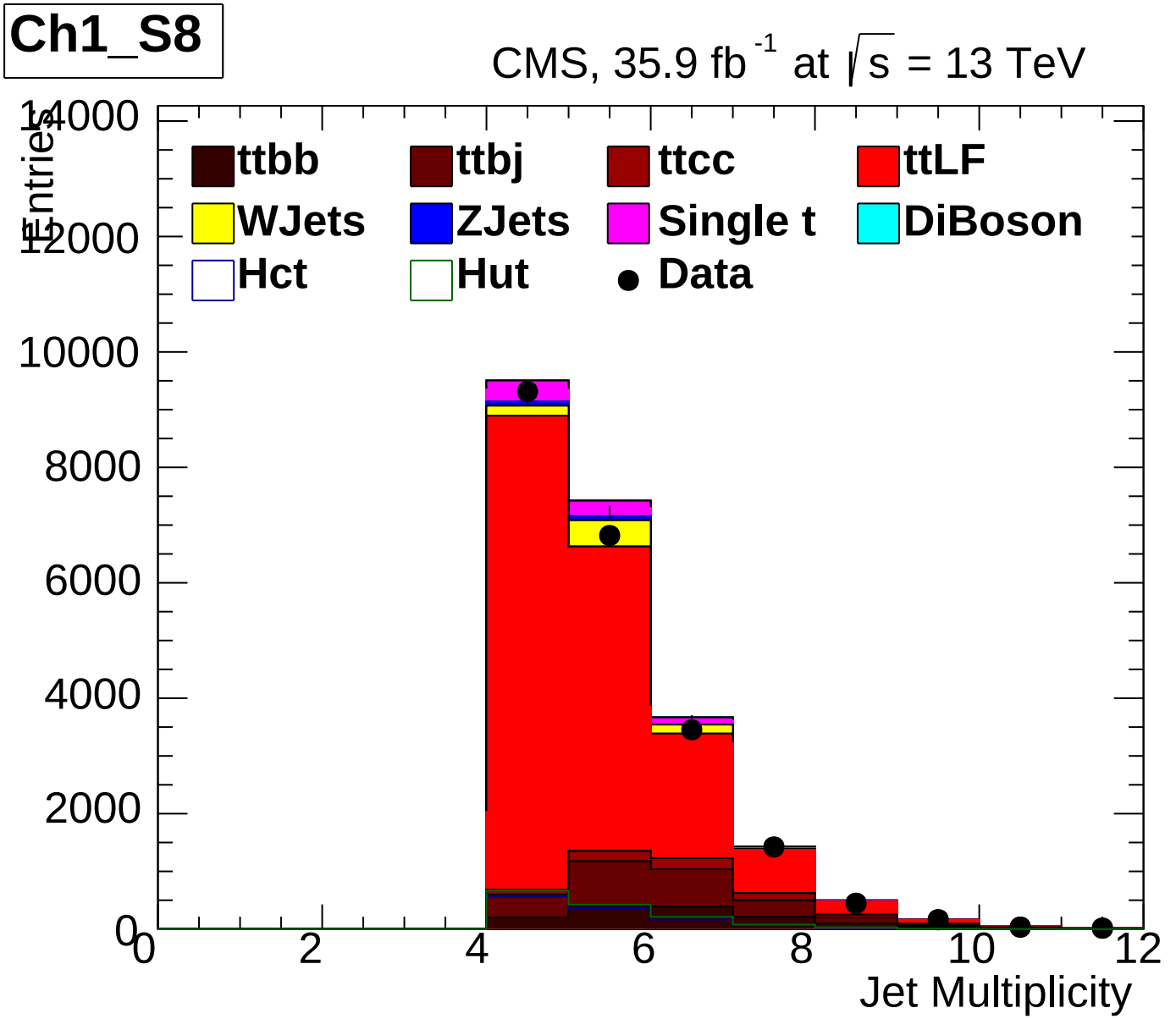

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

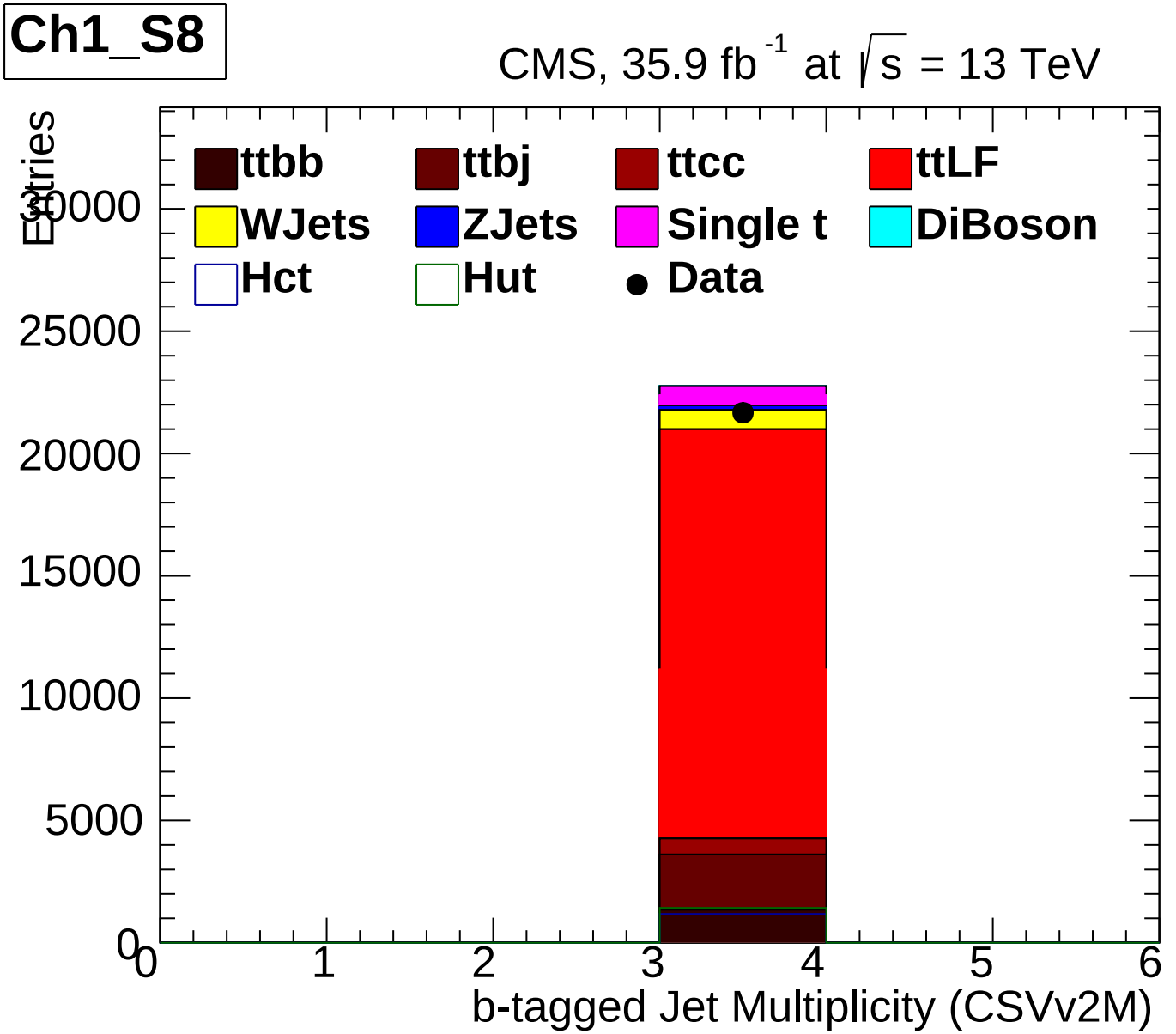

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

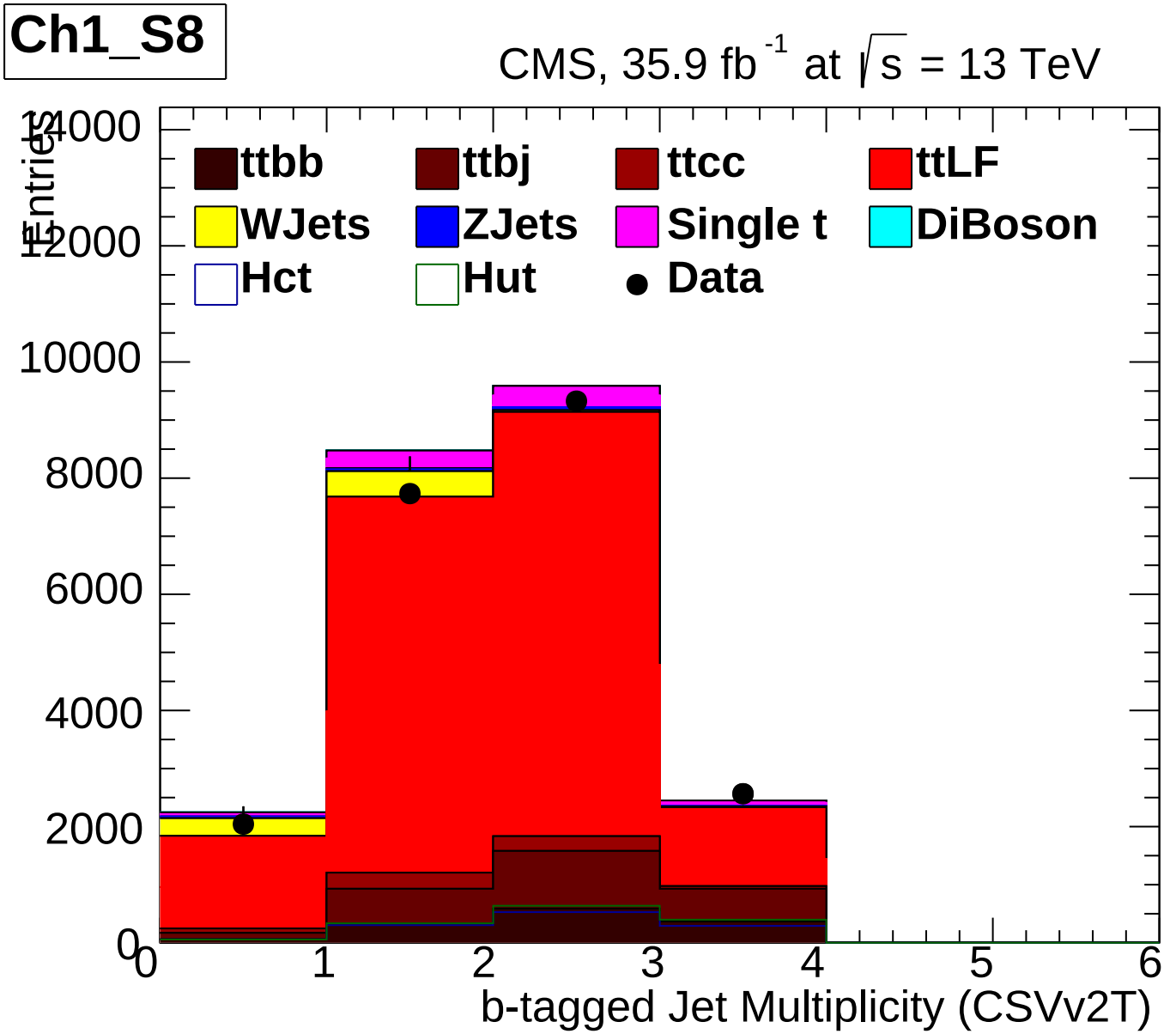

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

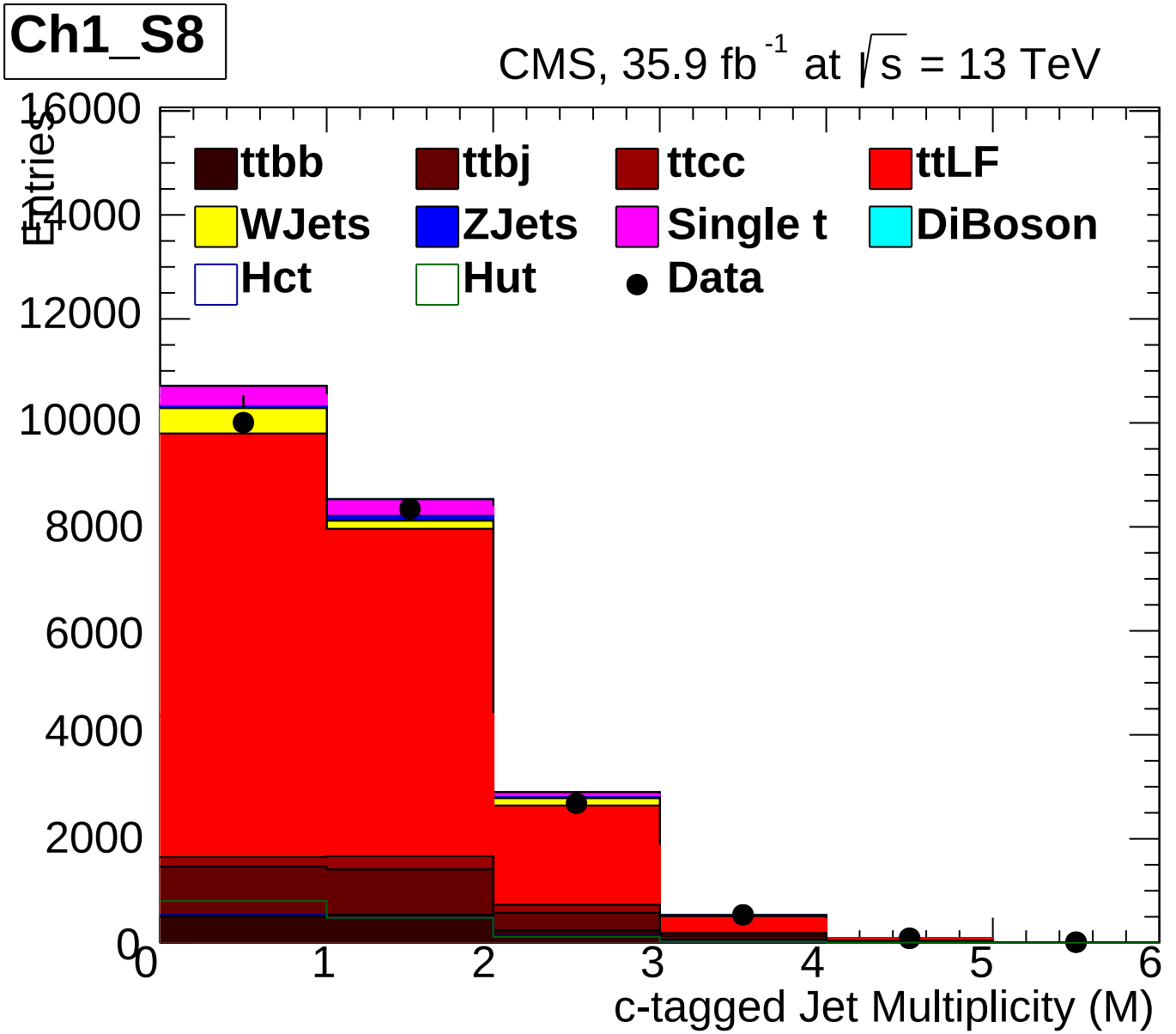

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

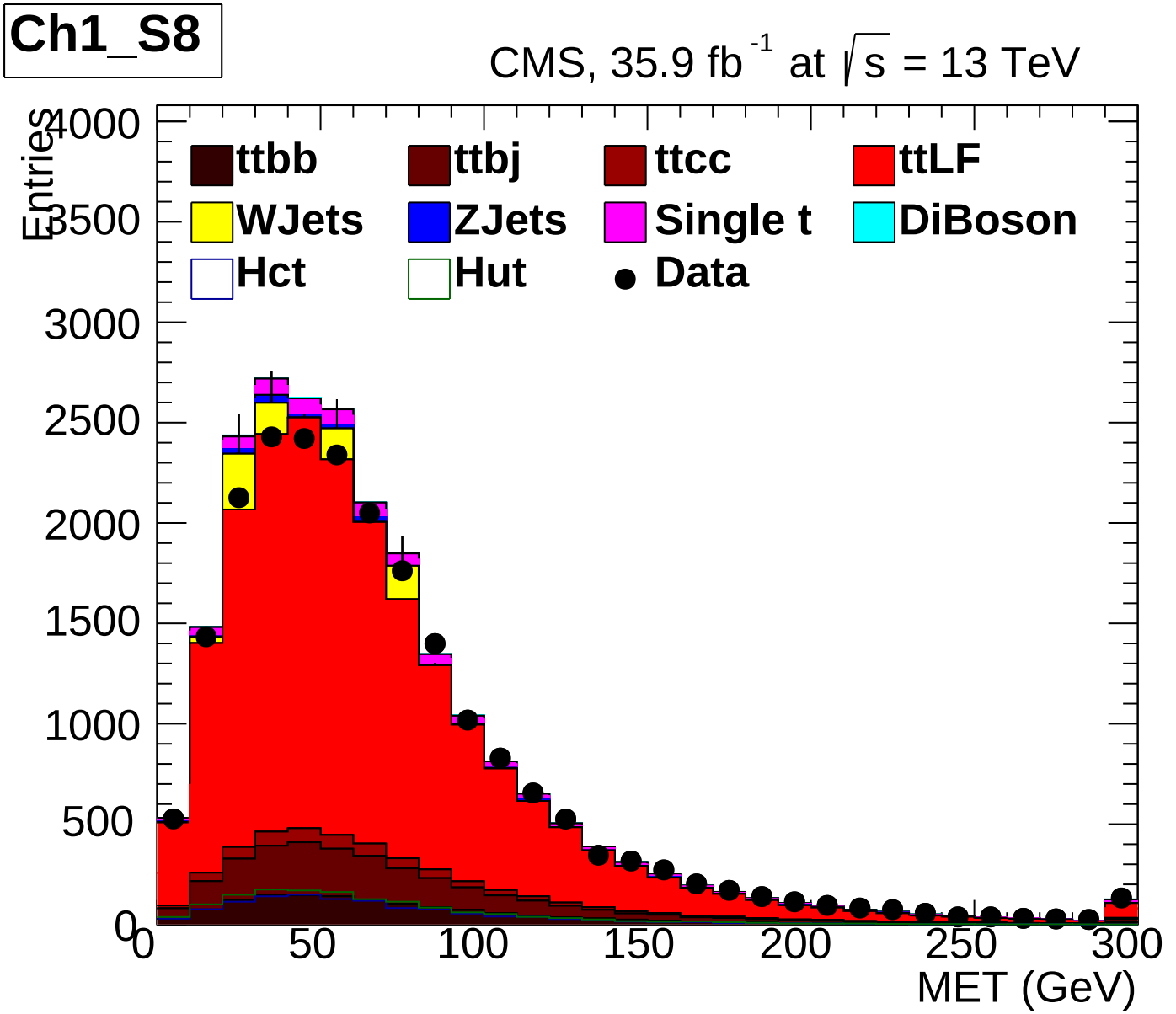

Ch1_S7
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
5000
10000
15000
20000
25000
30000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

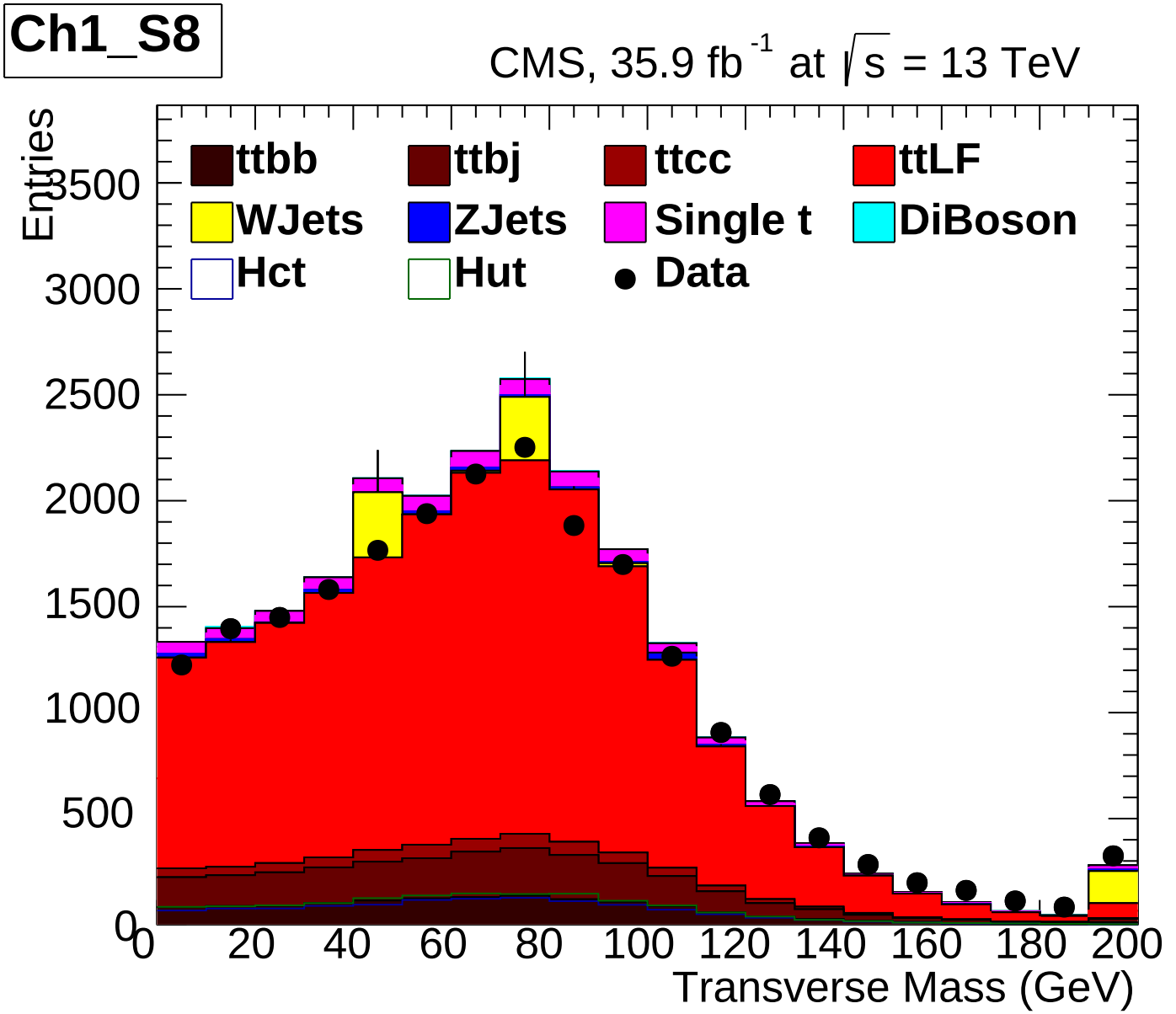

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
14000
12000
10000
8000
6000
4000
2000
0
0
2
4
6
8
10
12
Jet Multiplicity

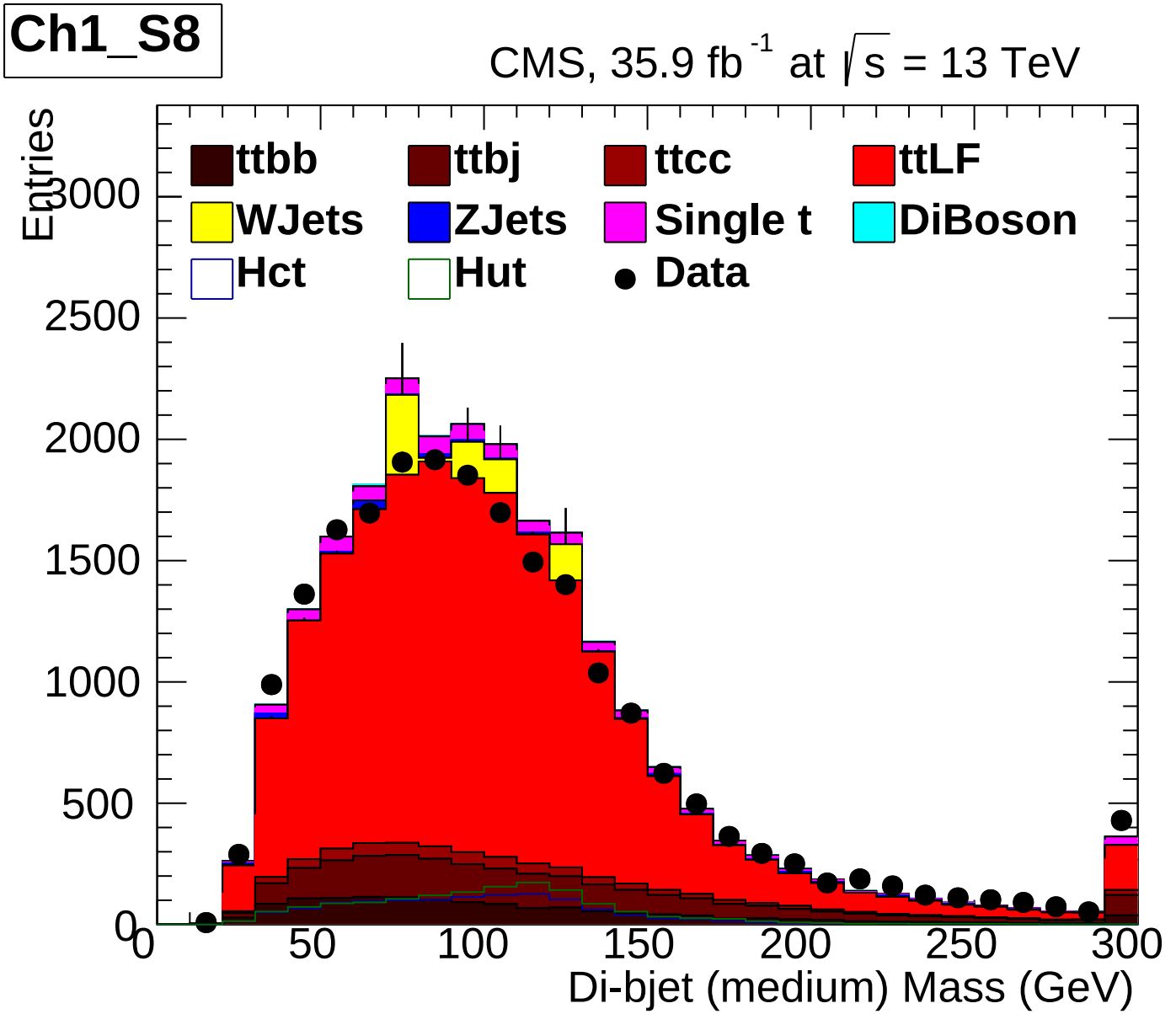

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

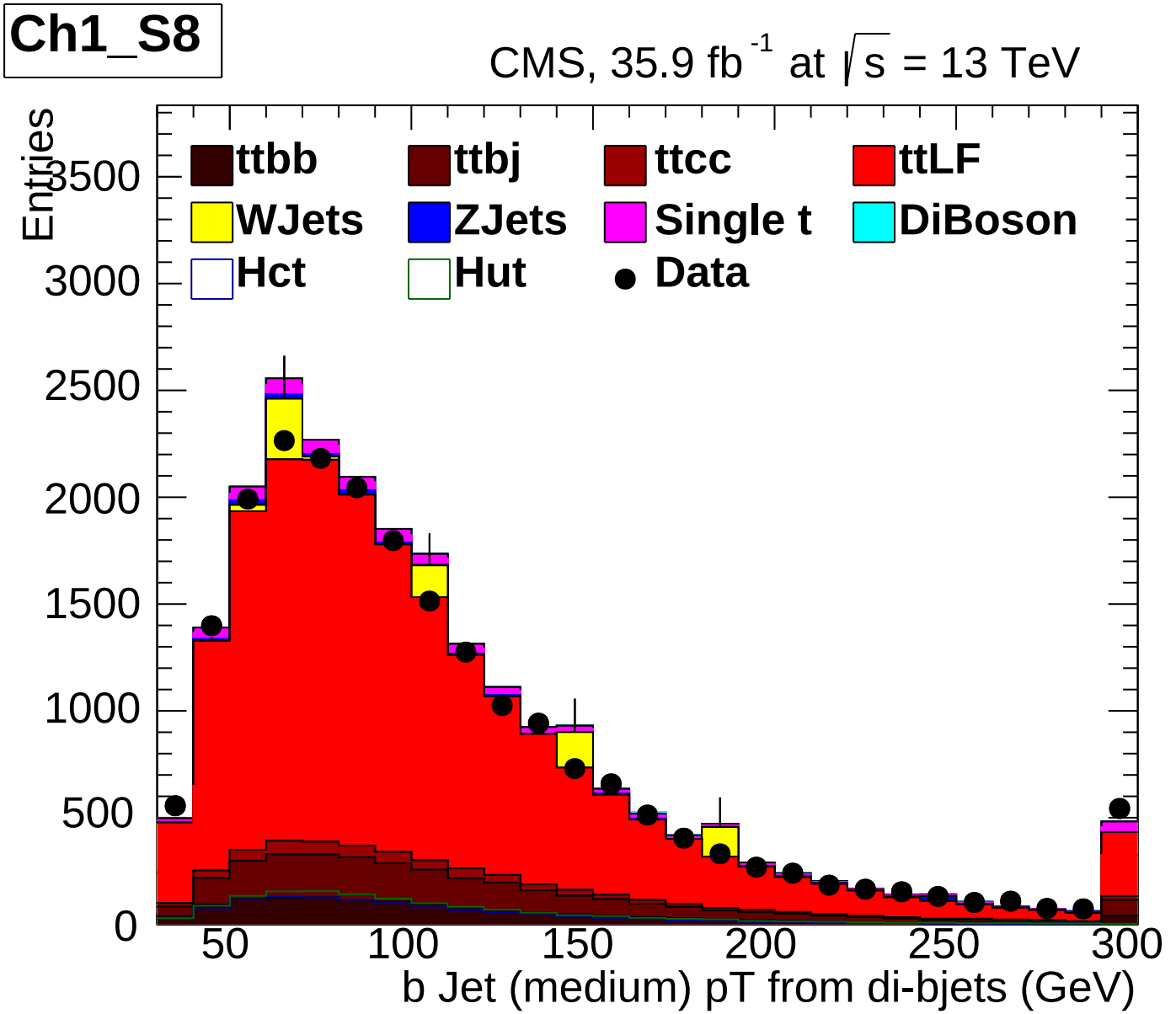

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

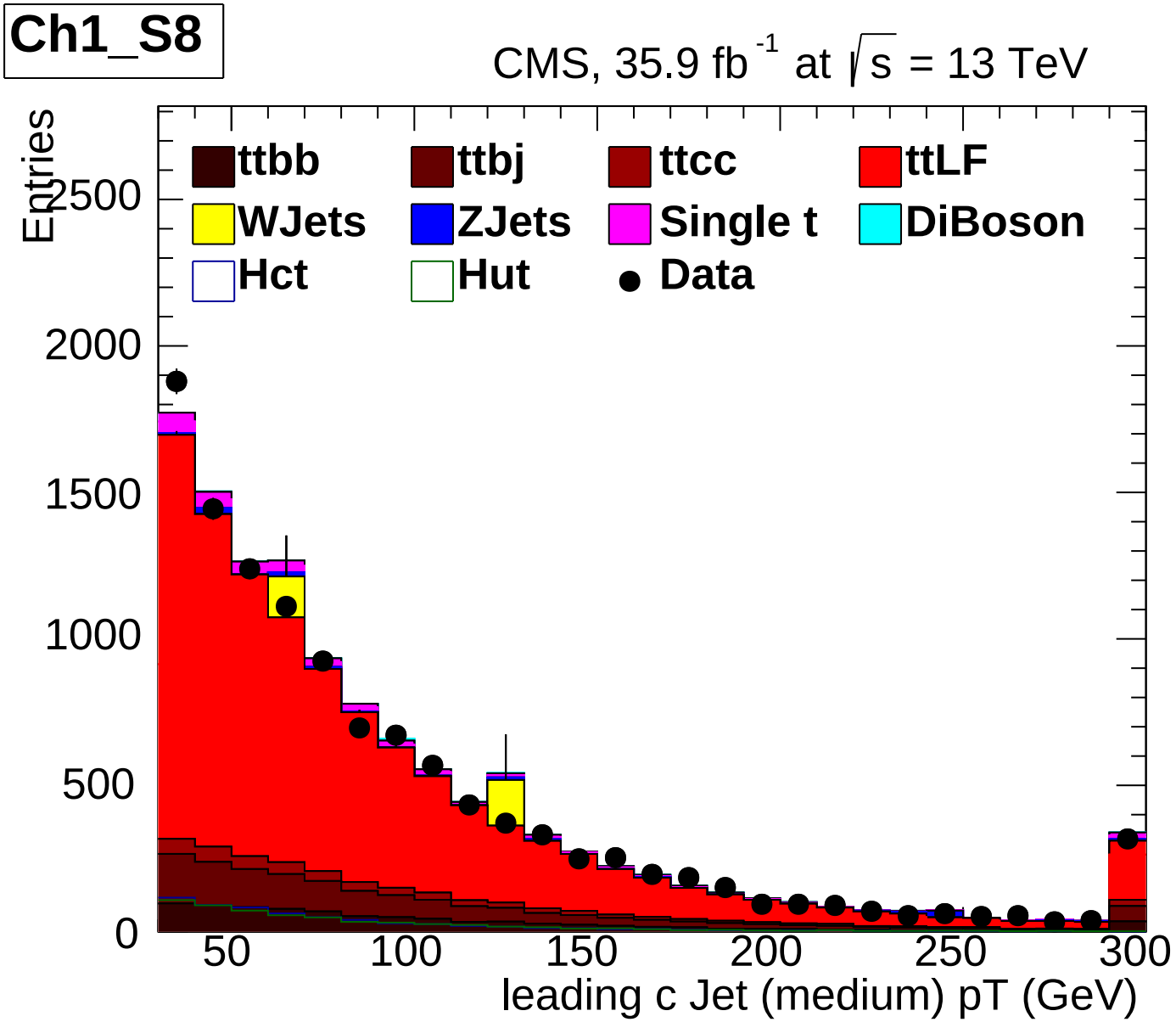

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

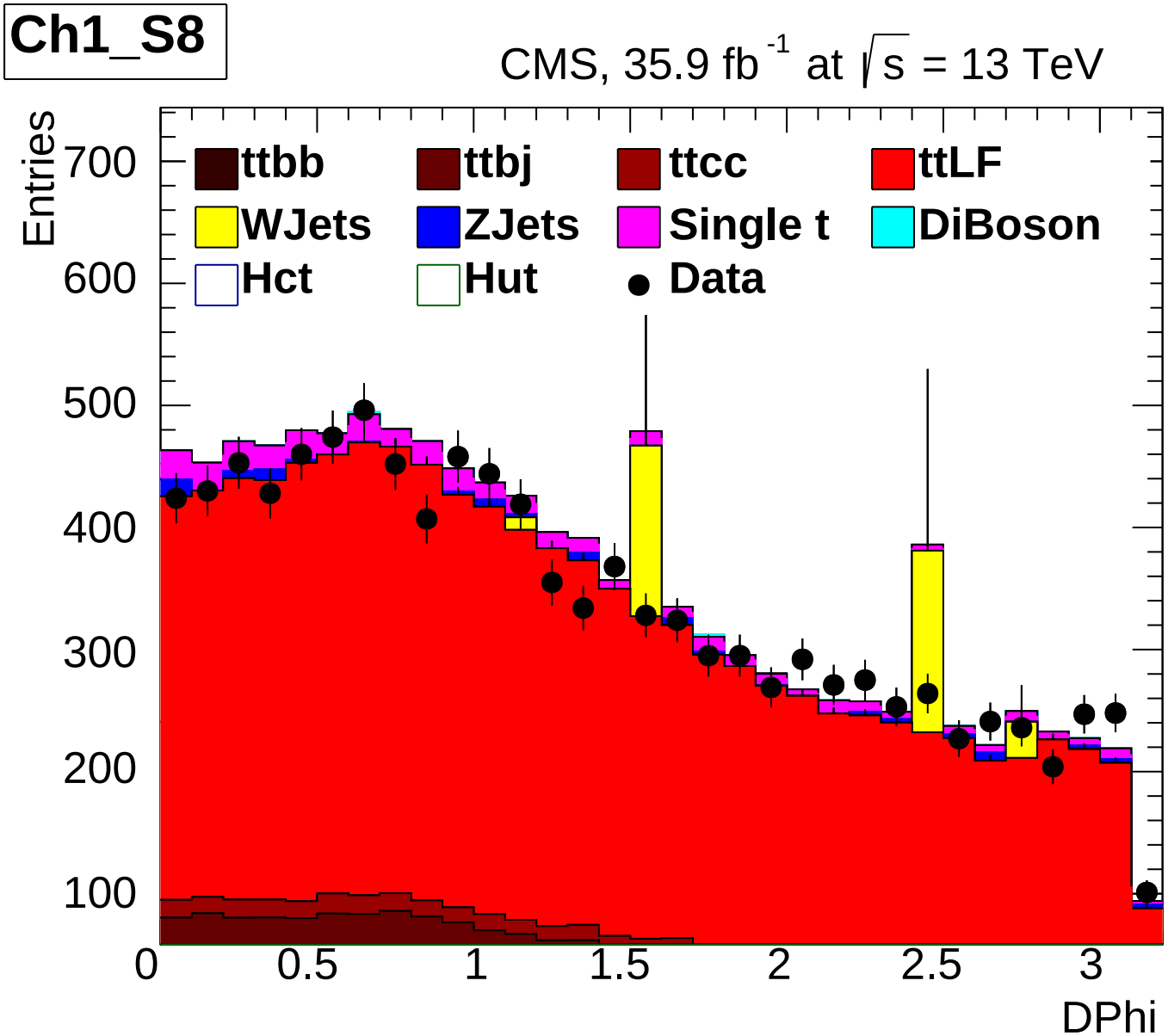

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
0
50
100
150
200
250
300
MET (GeV)

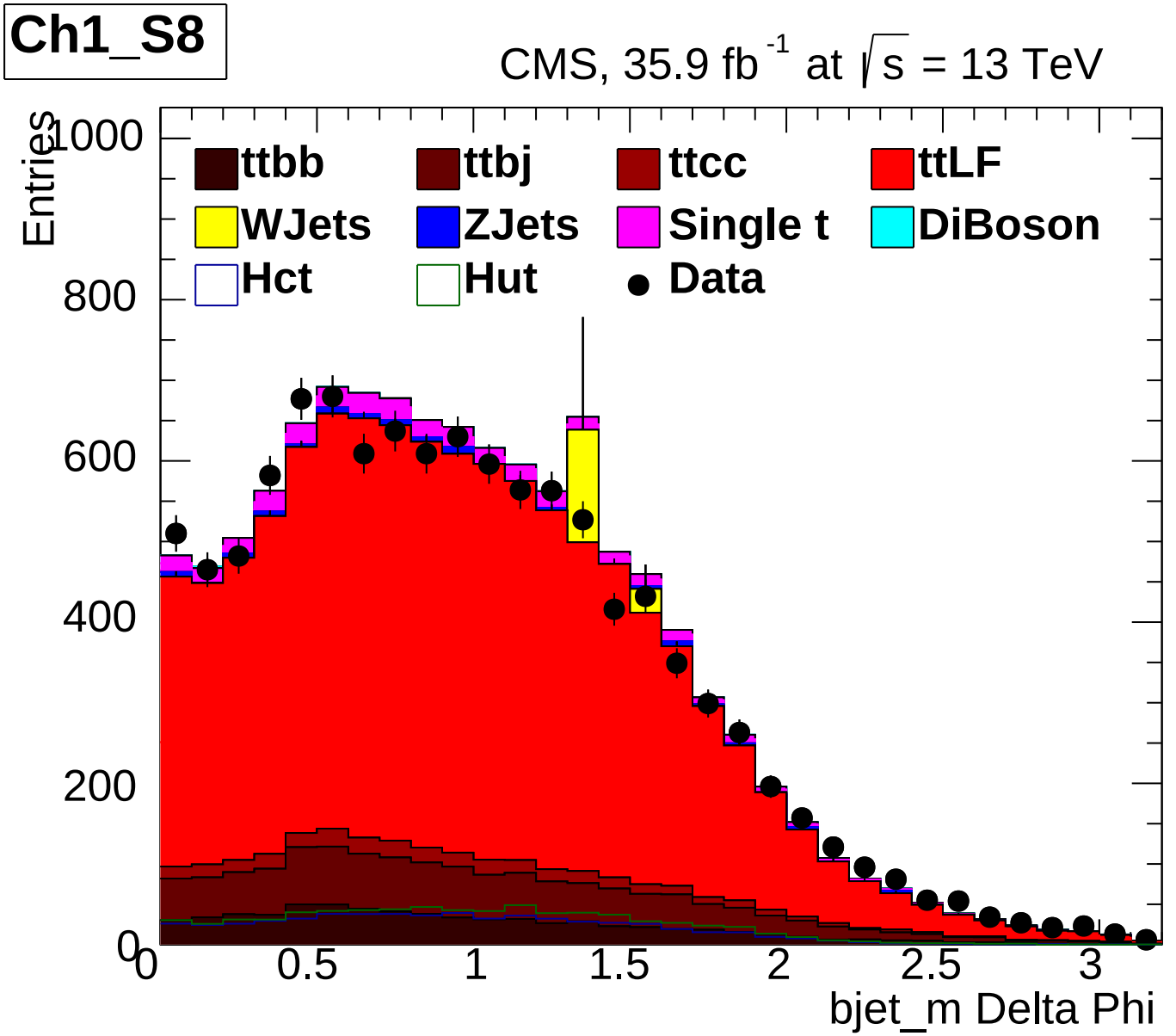

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

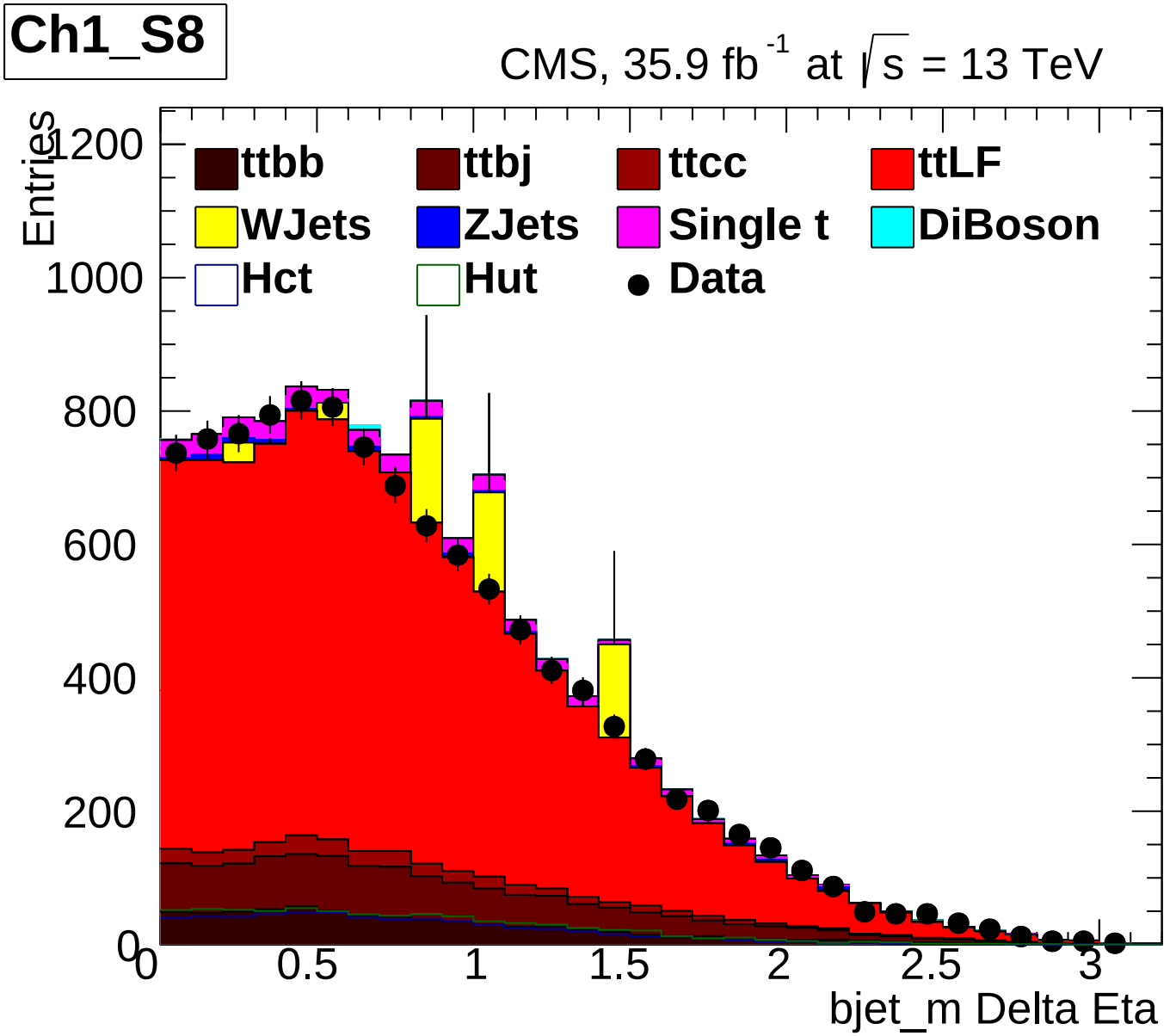

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

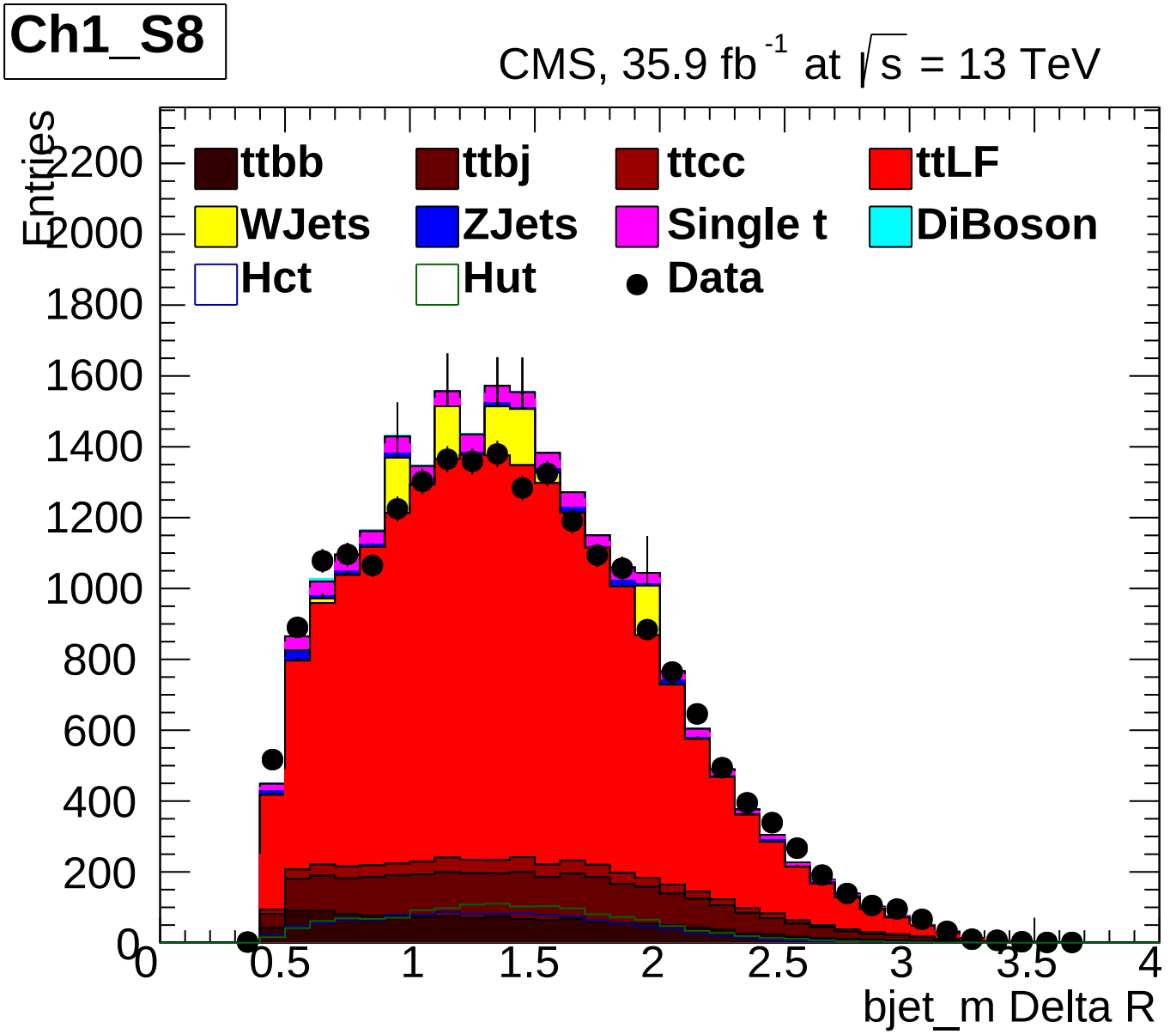

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

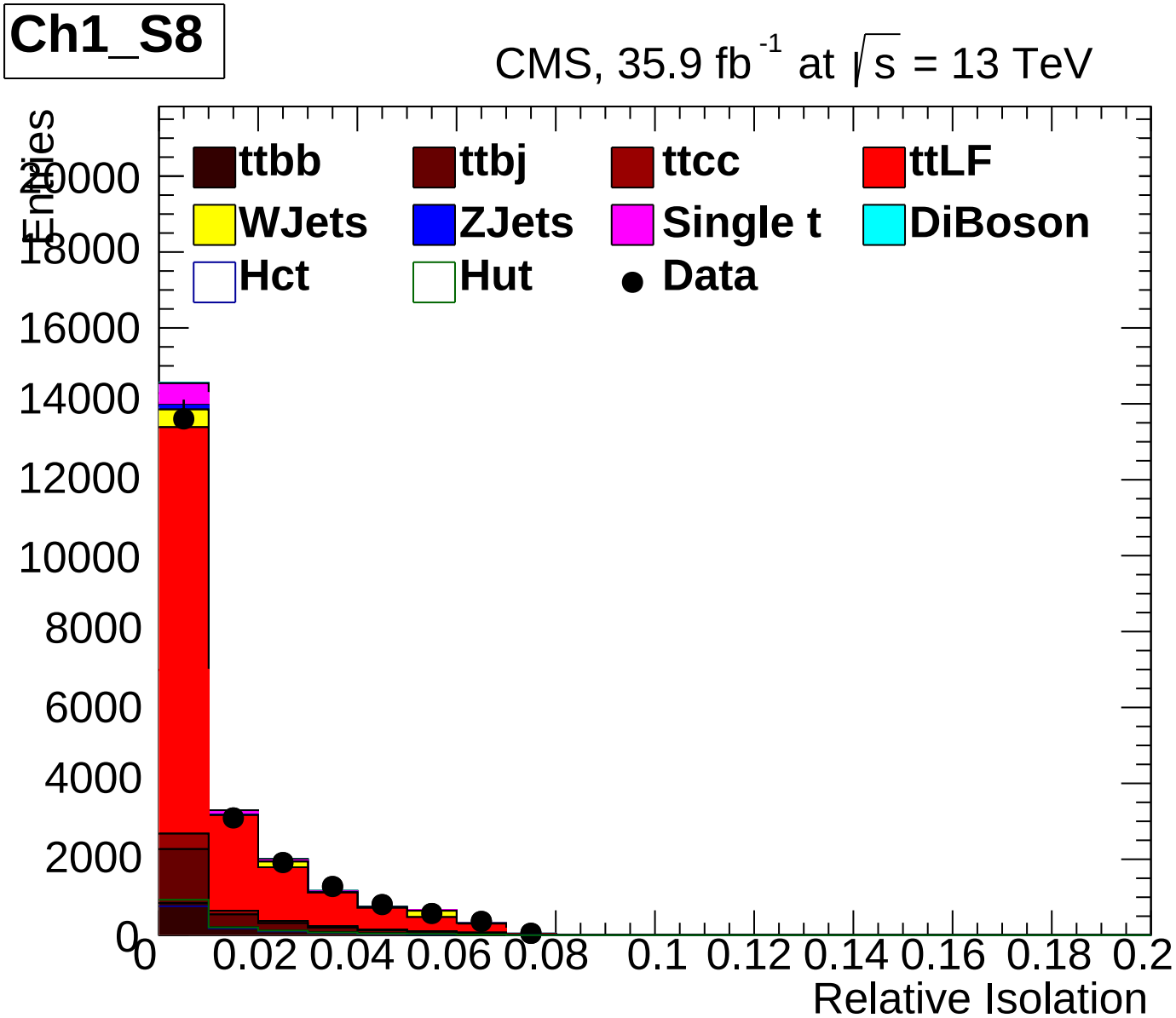

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

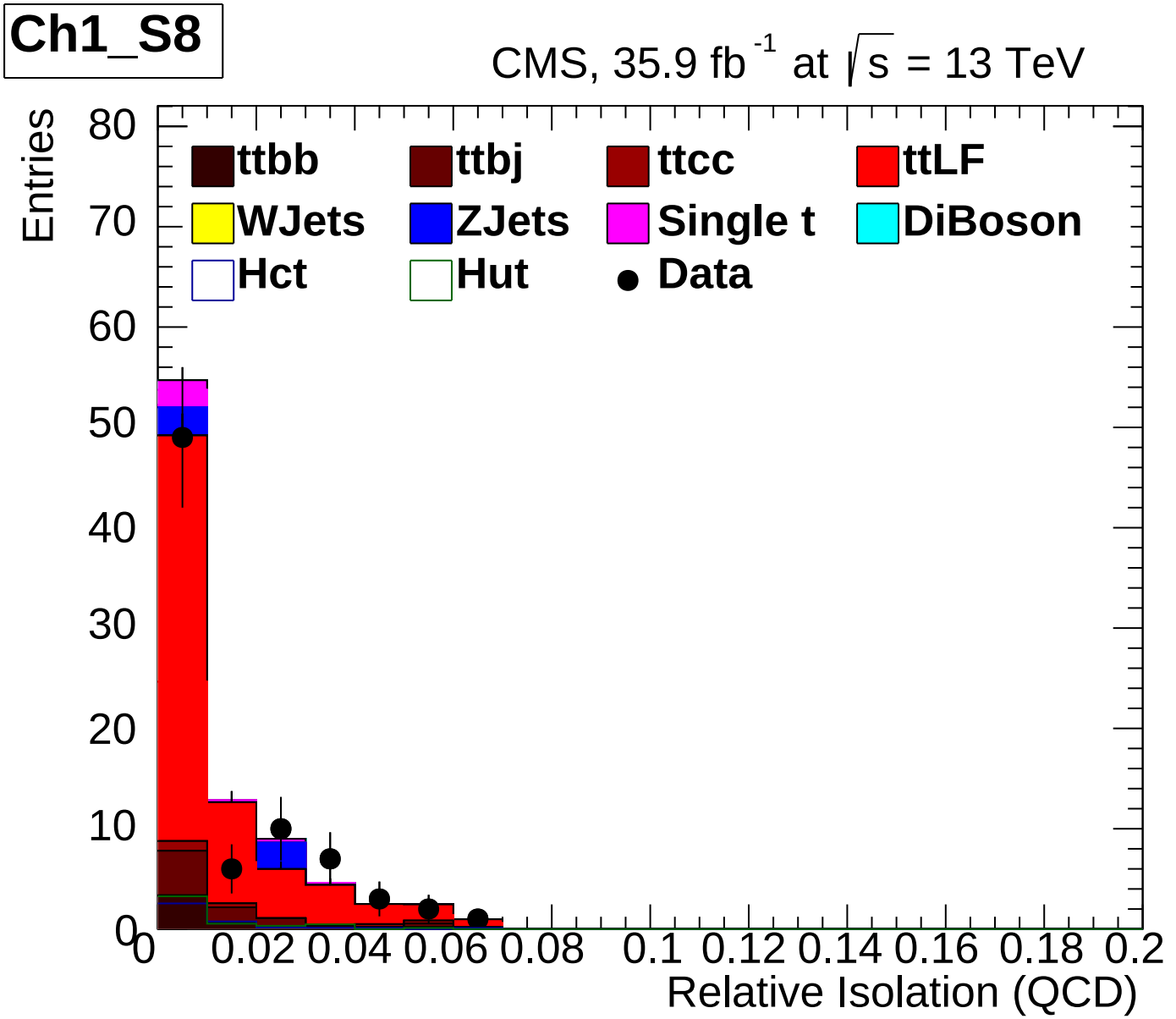

Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
700
600
500
400
300
200
100
0
0.5
1
1.5
2
2.5
3
DPhi
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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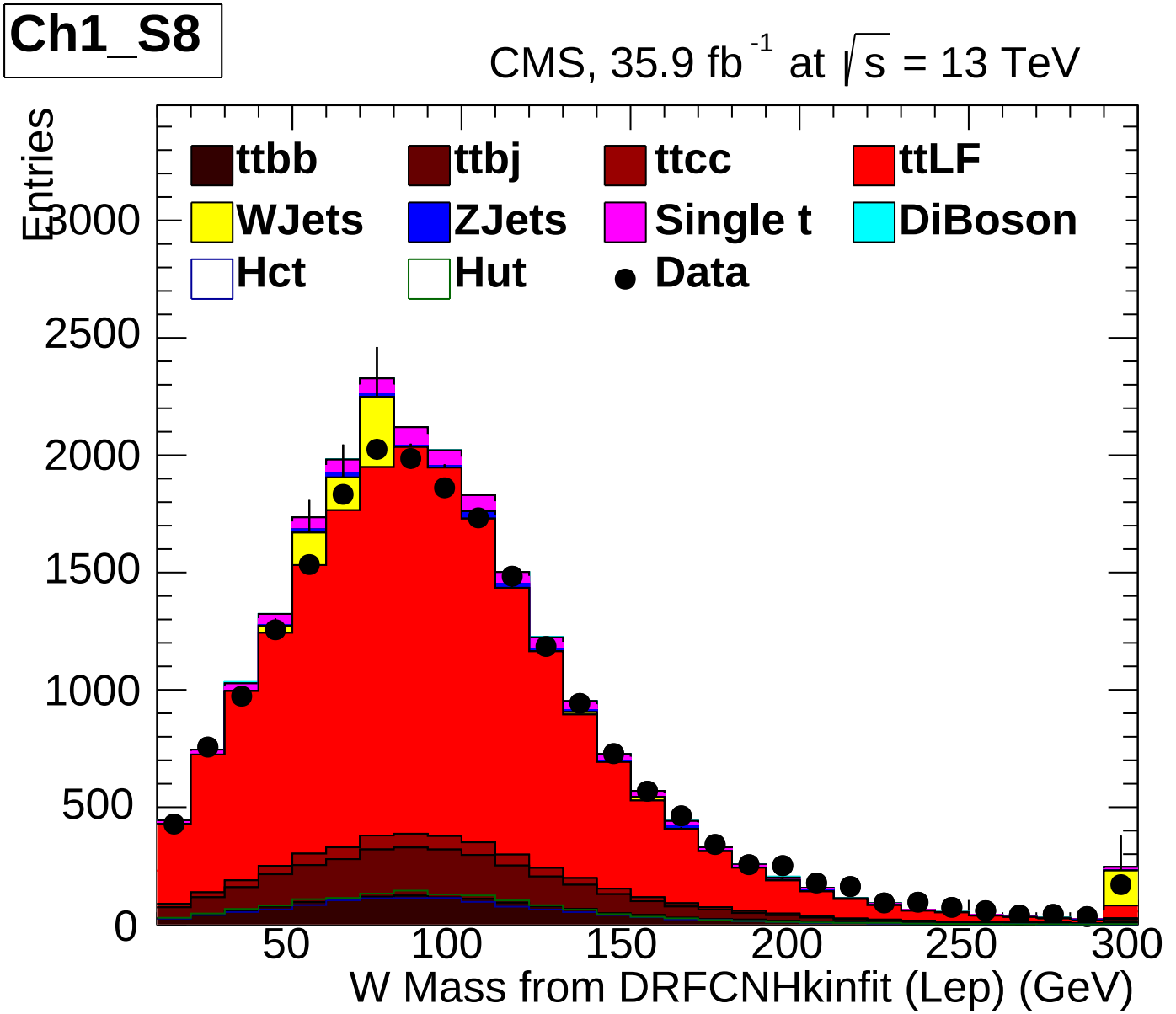
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10
20
30
40
50
60
70
80
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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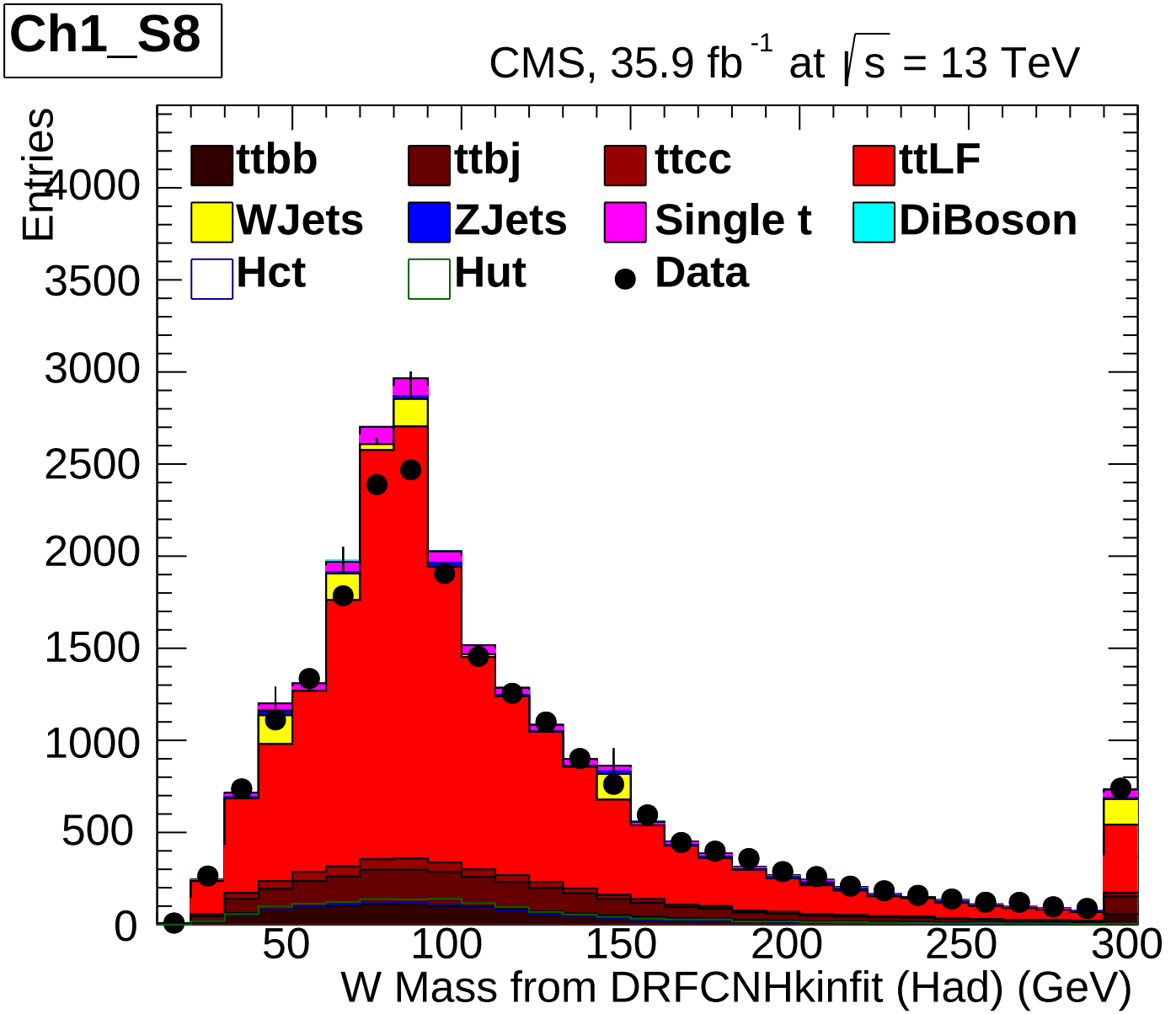
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
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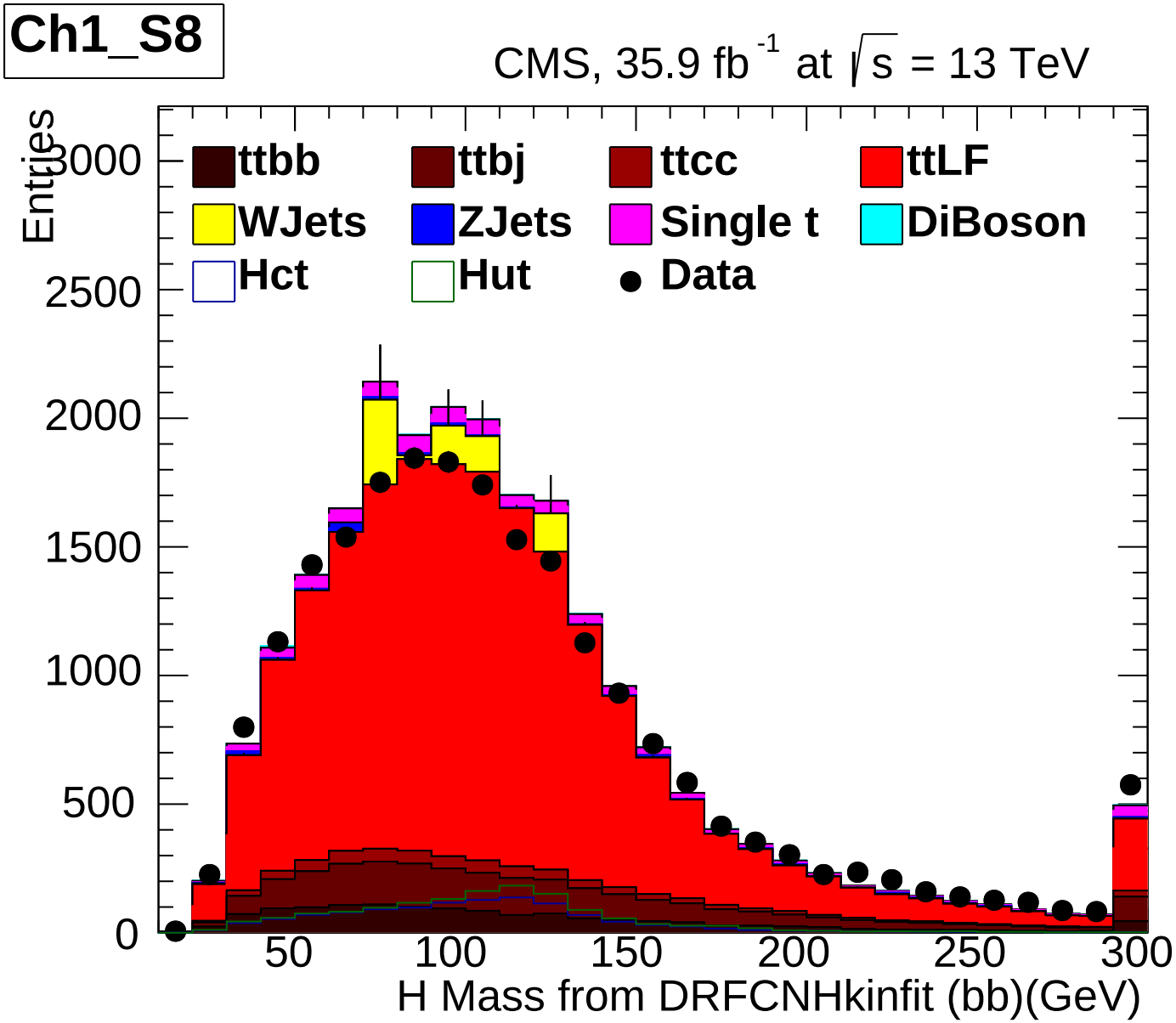
2500
3000
3500
4000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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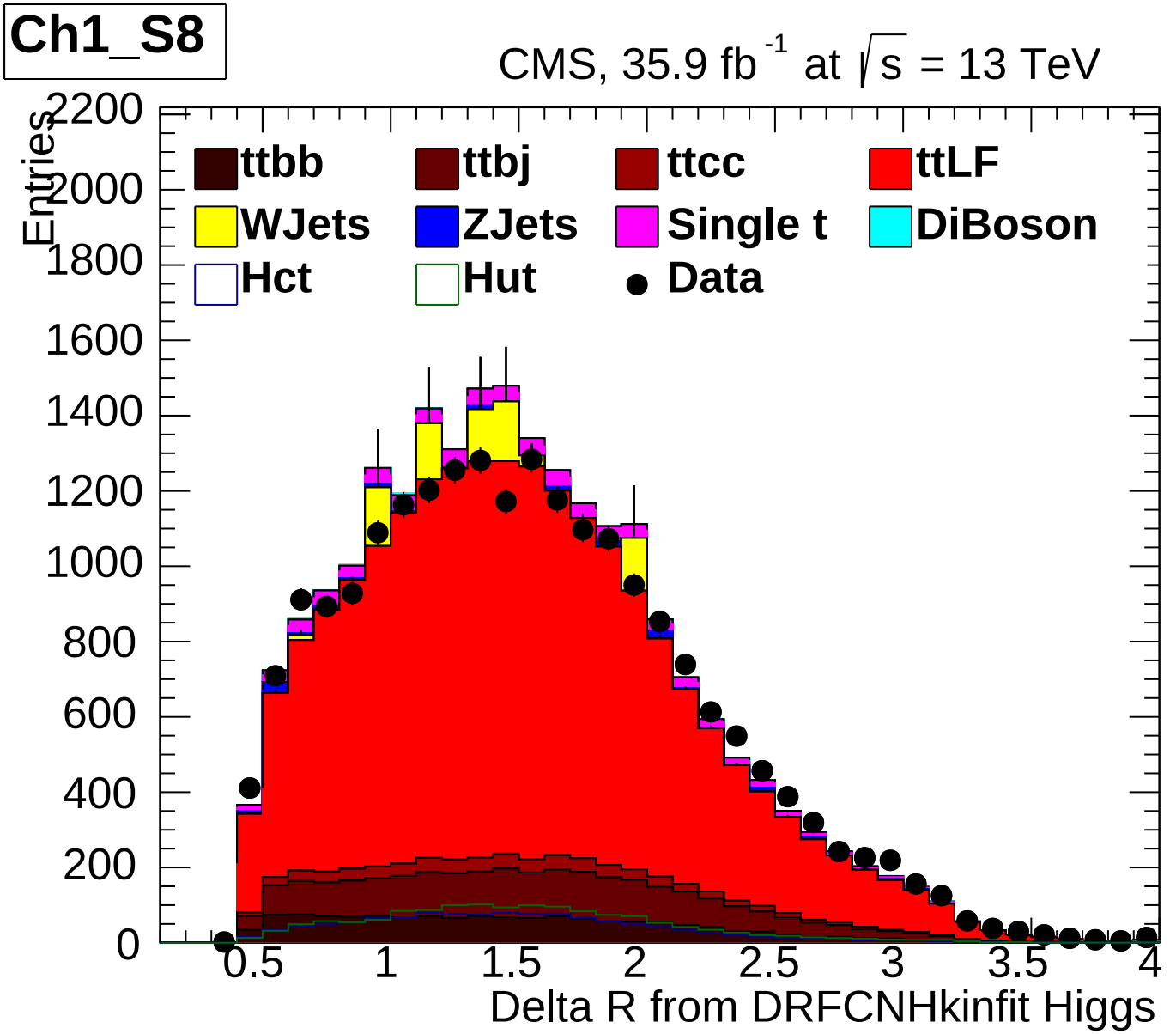
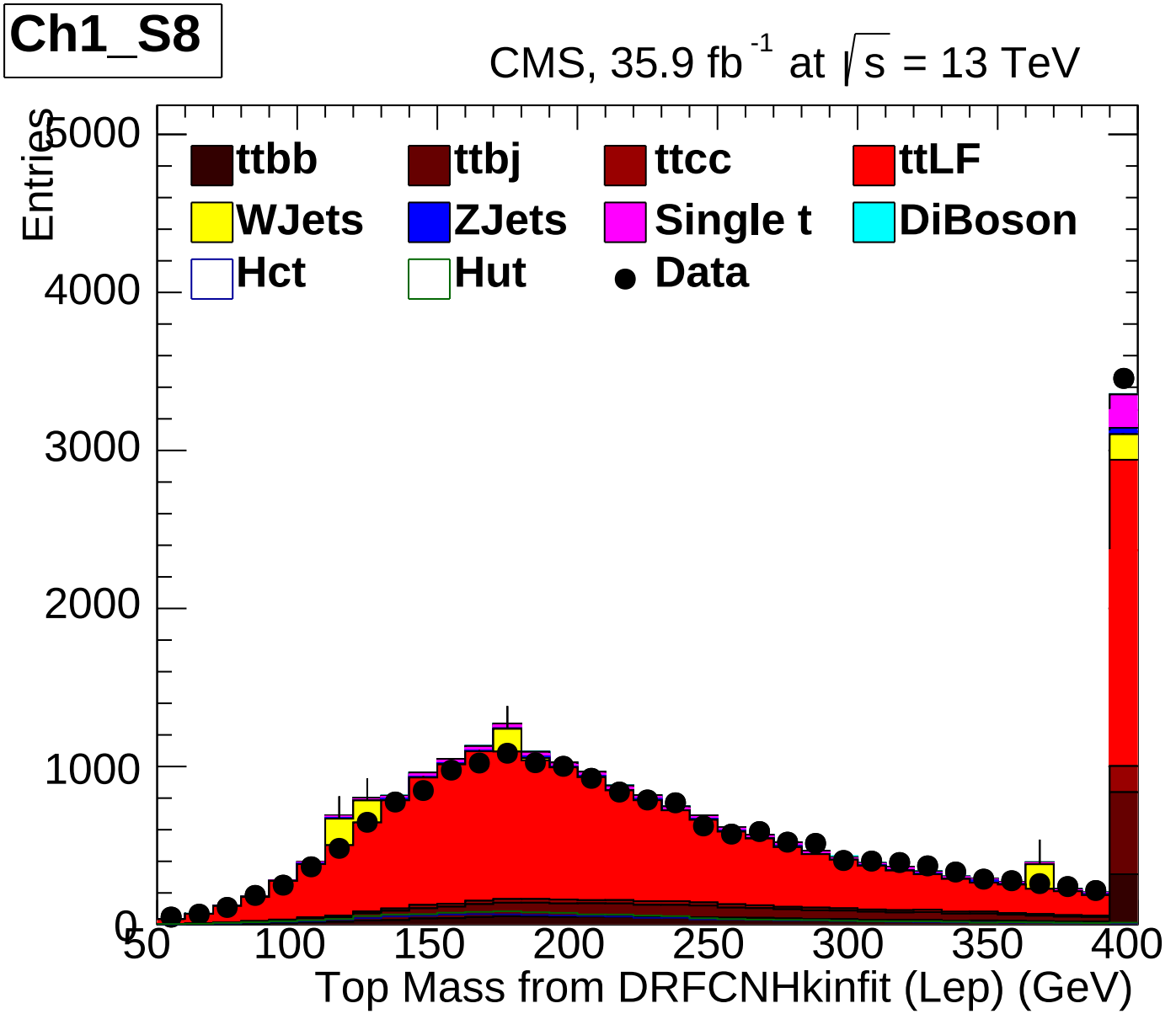
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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1000
2000
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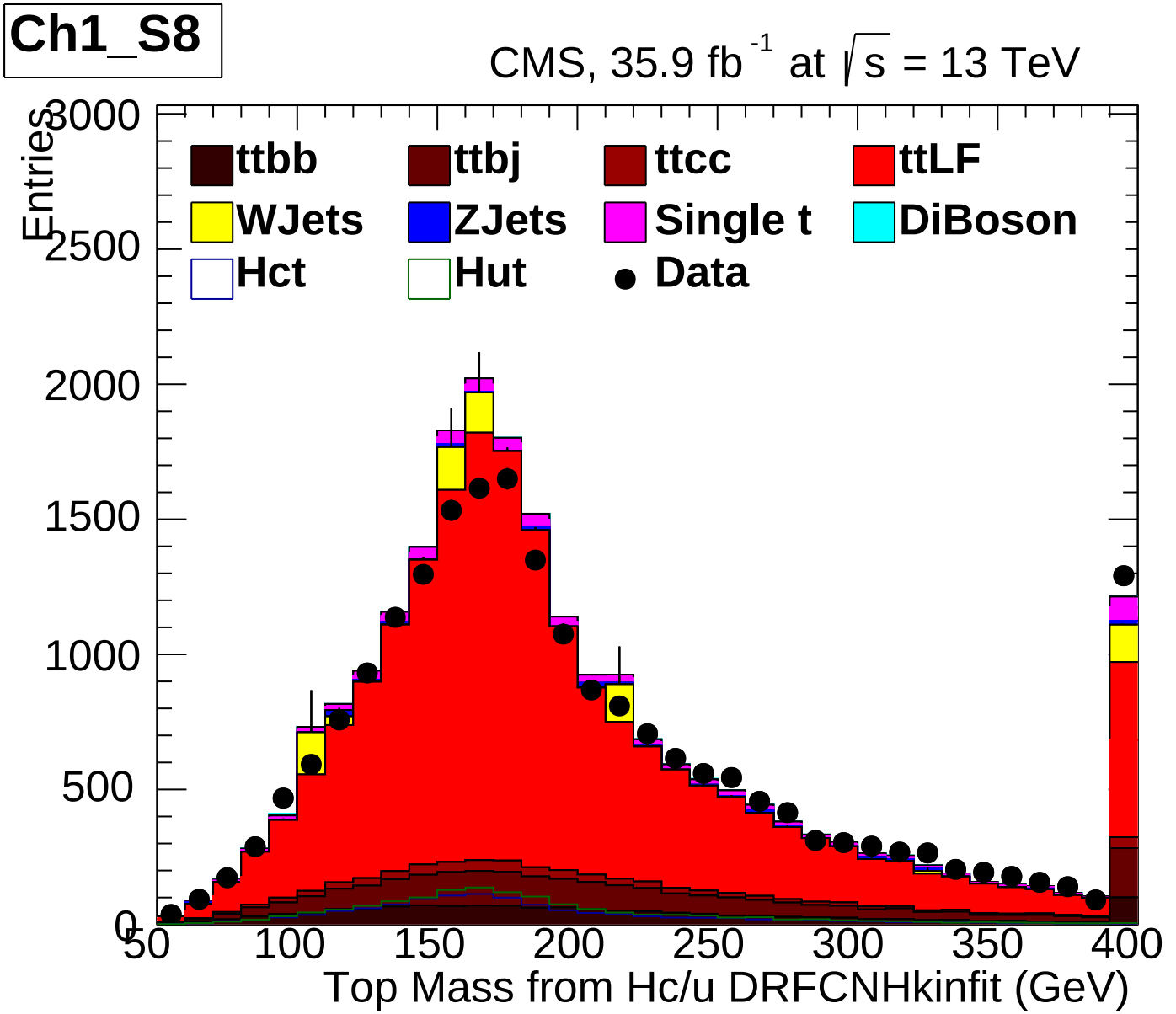
4000
5000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S8
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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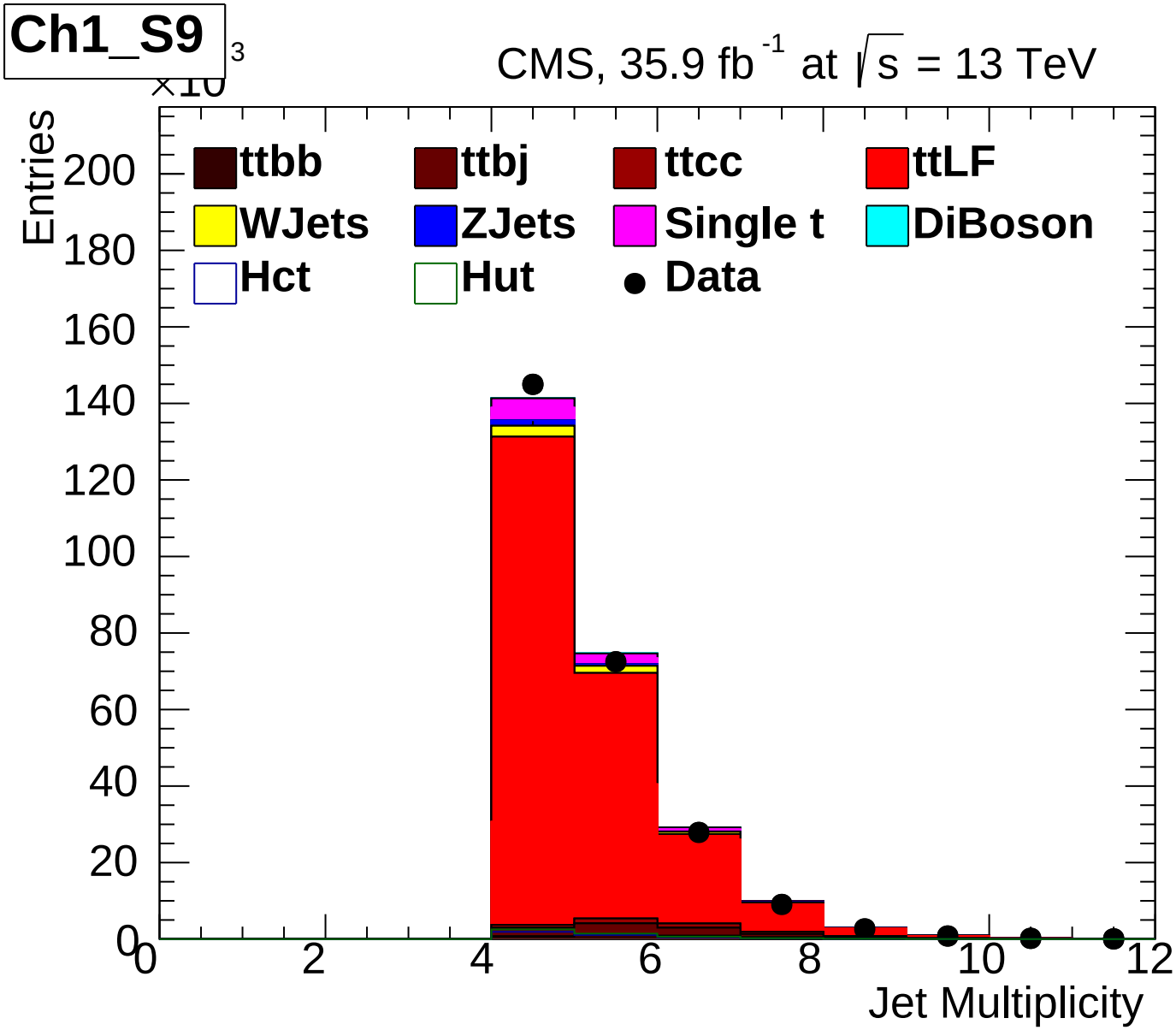
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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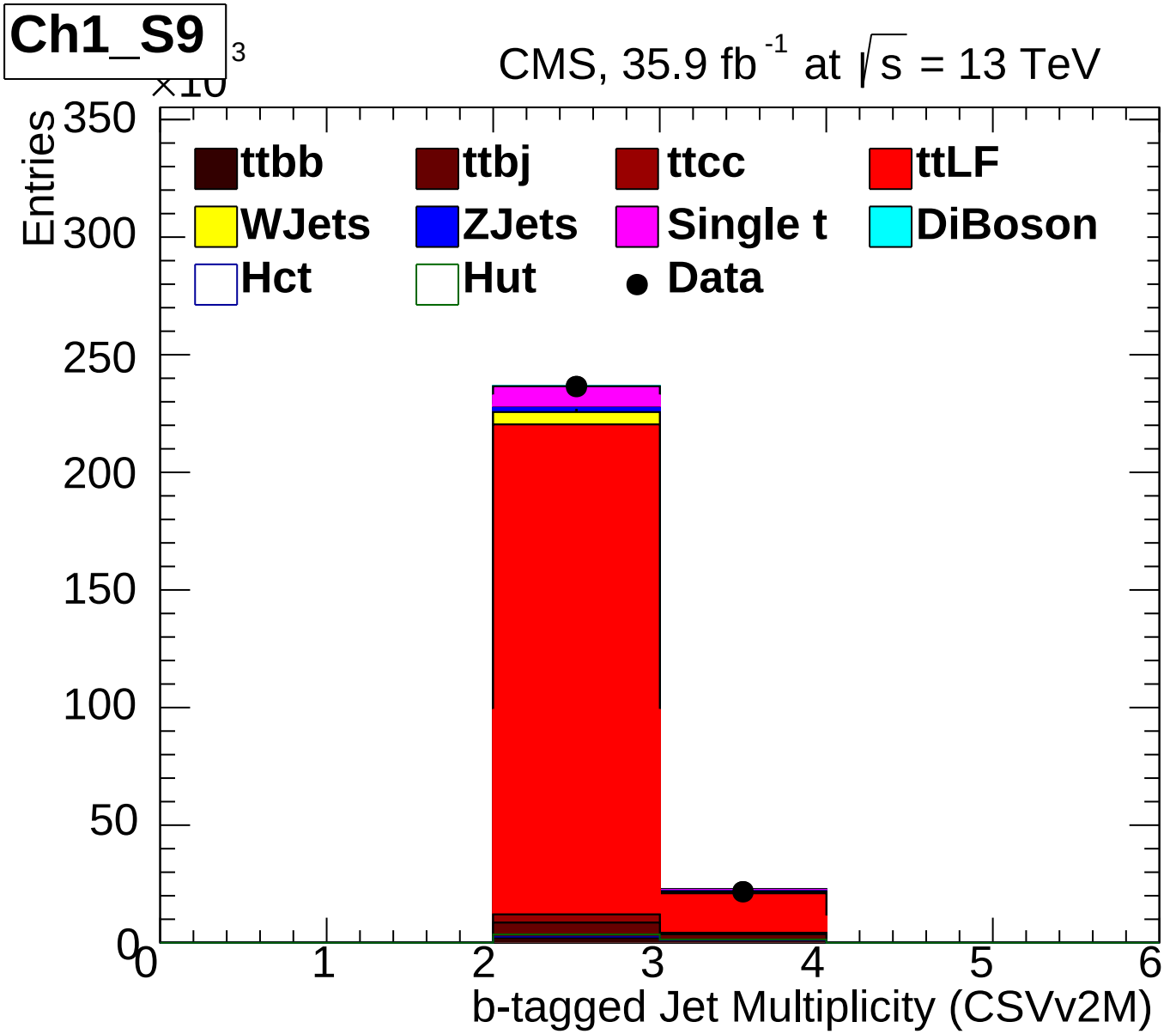
20
40
60
80
100
120
140
160
180
200
0
2
4
6
8
10
12
Jet Multiplicity


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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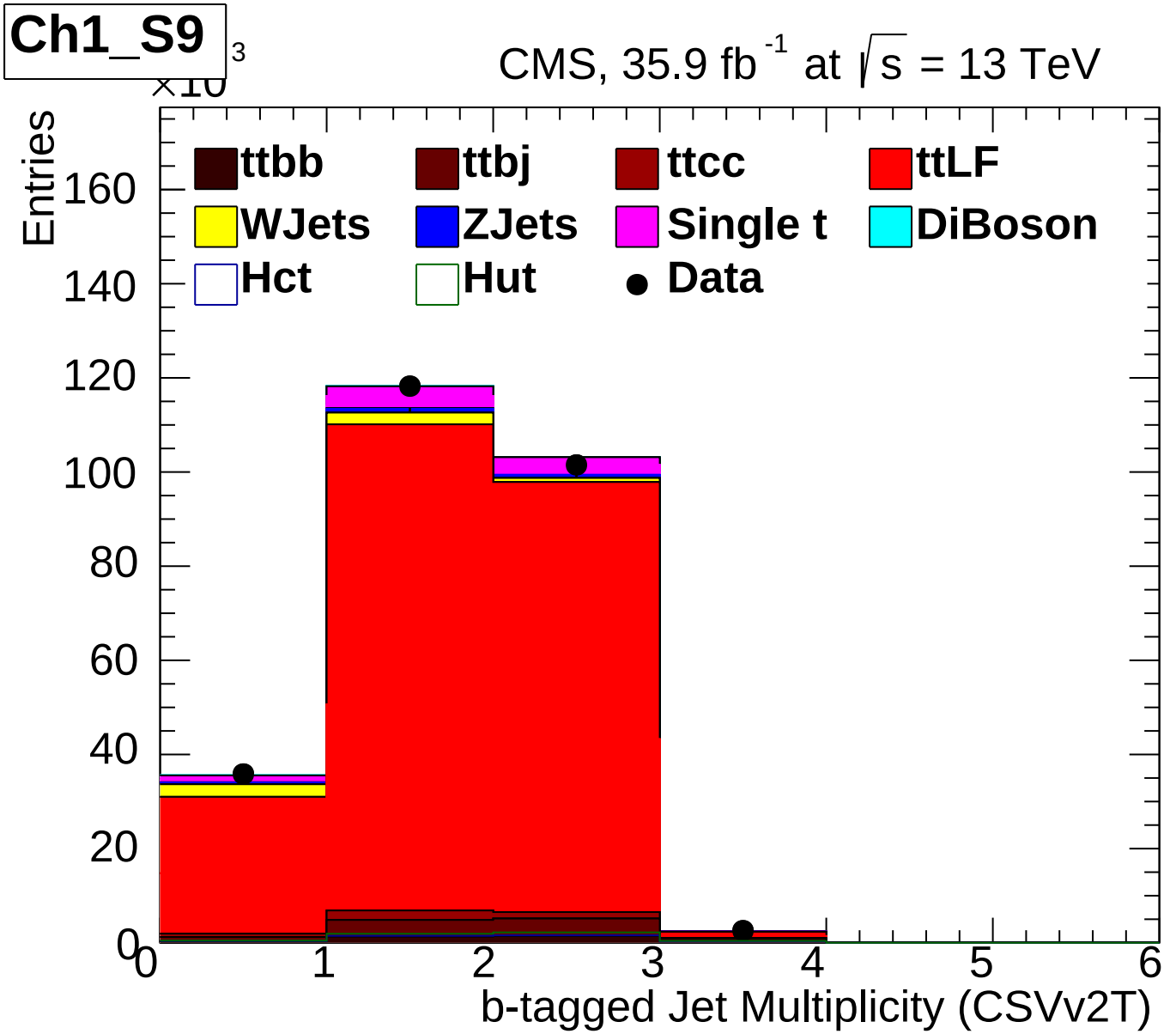
200
250
300
350
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
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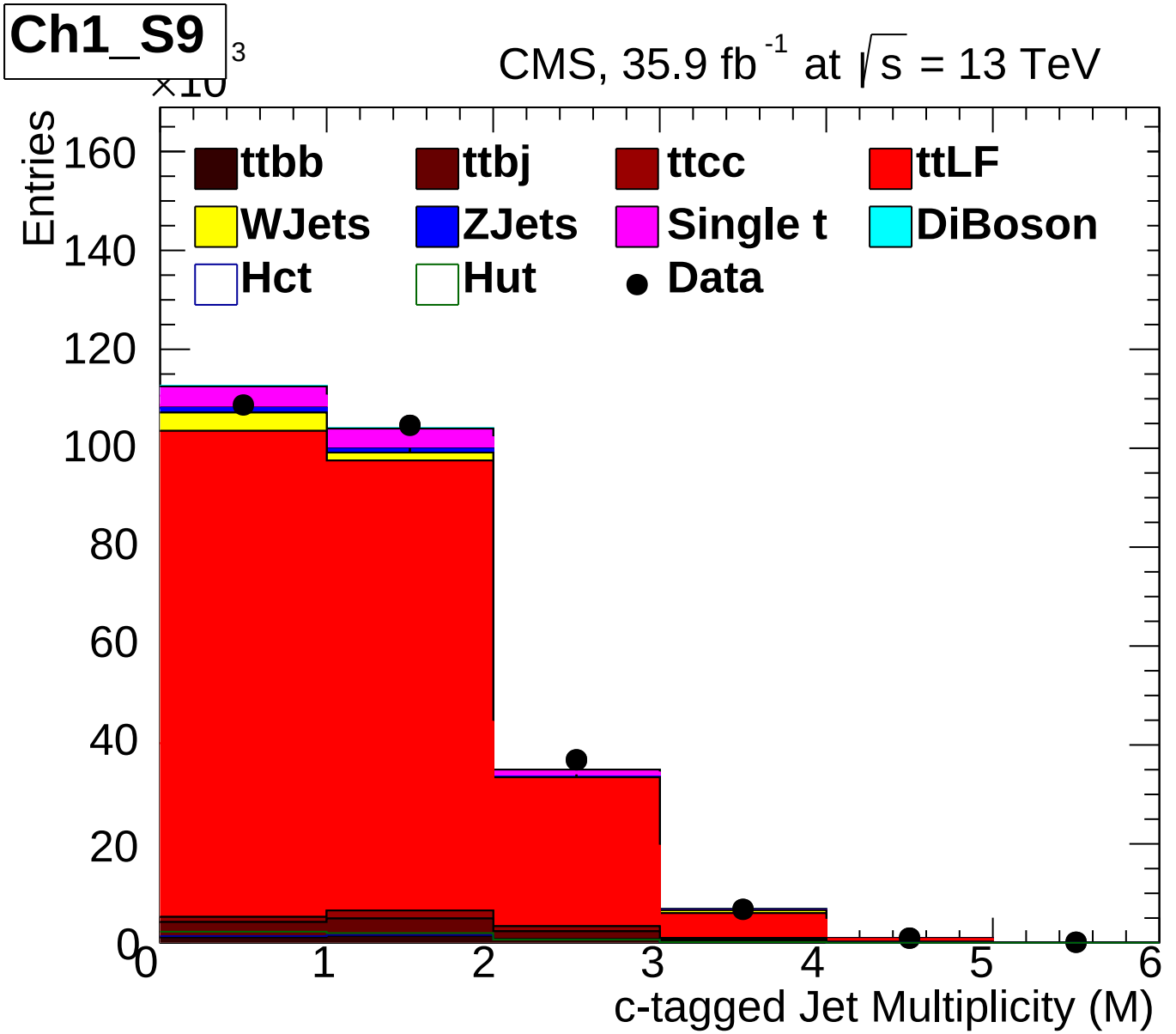
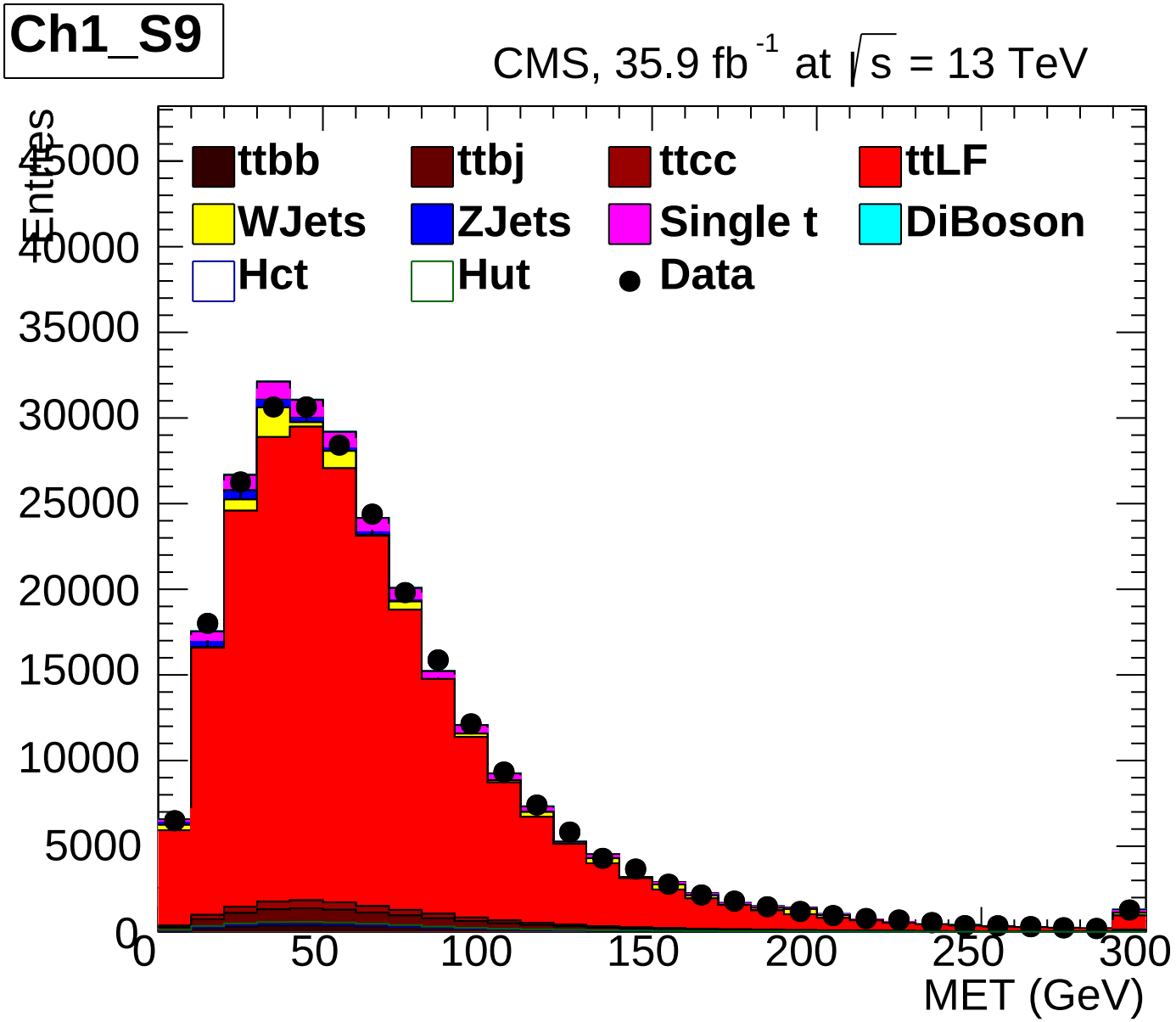
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
140
160
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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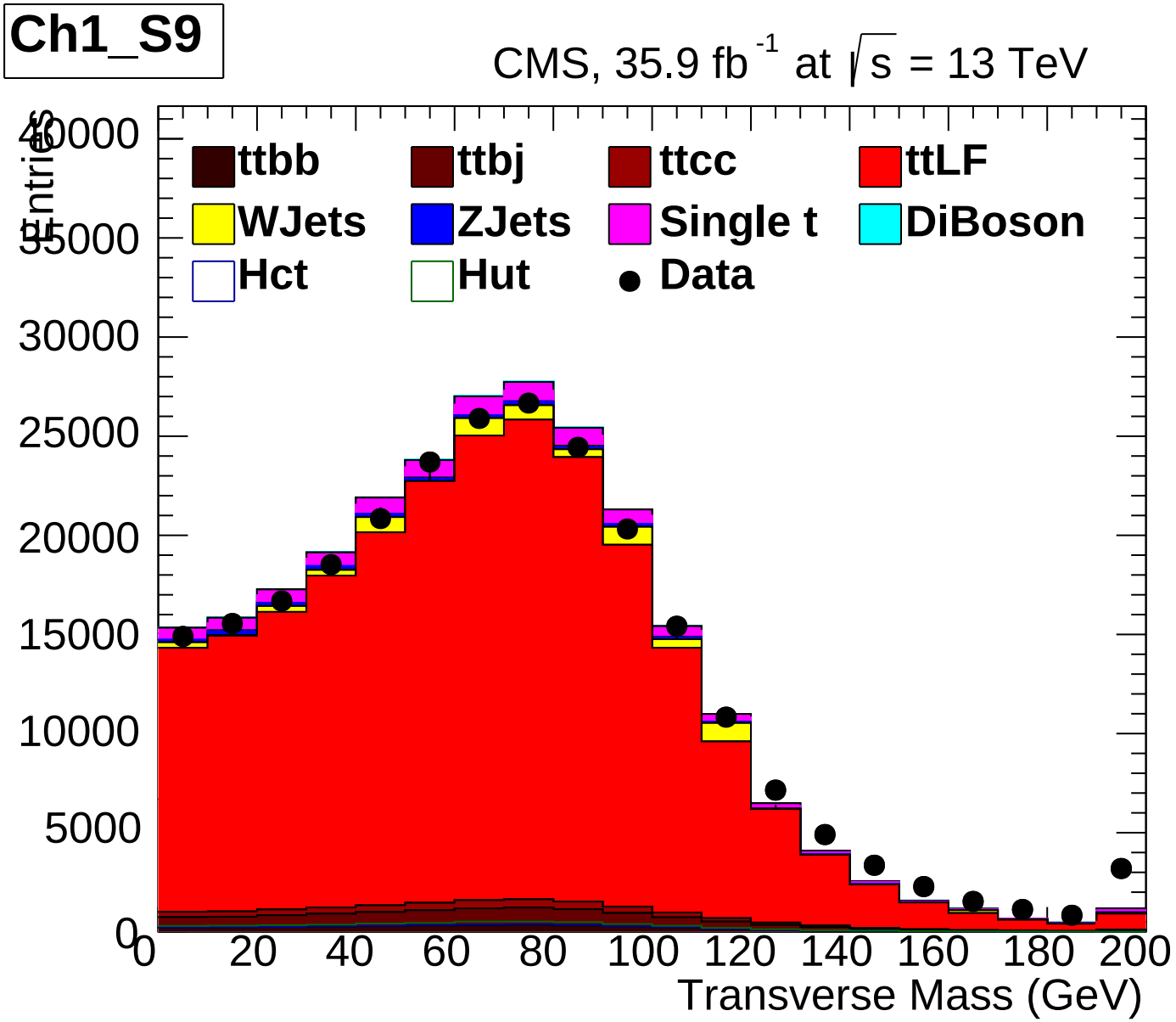
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
50
100
150
200
250
300
MET (GeV)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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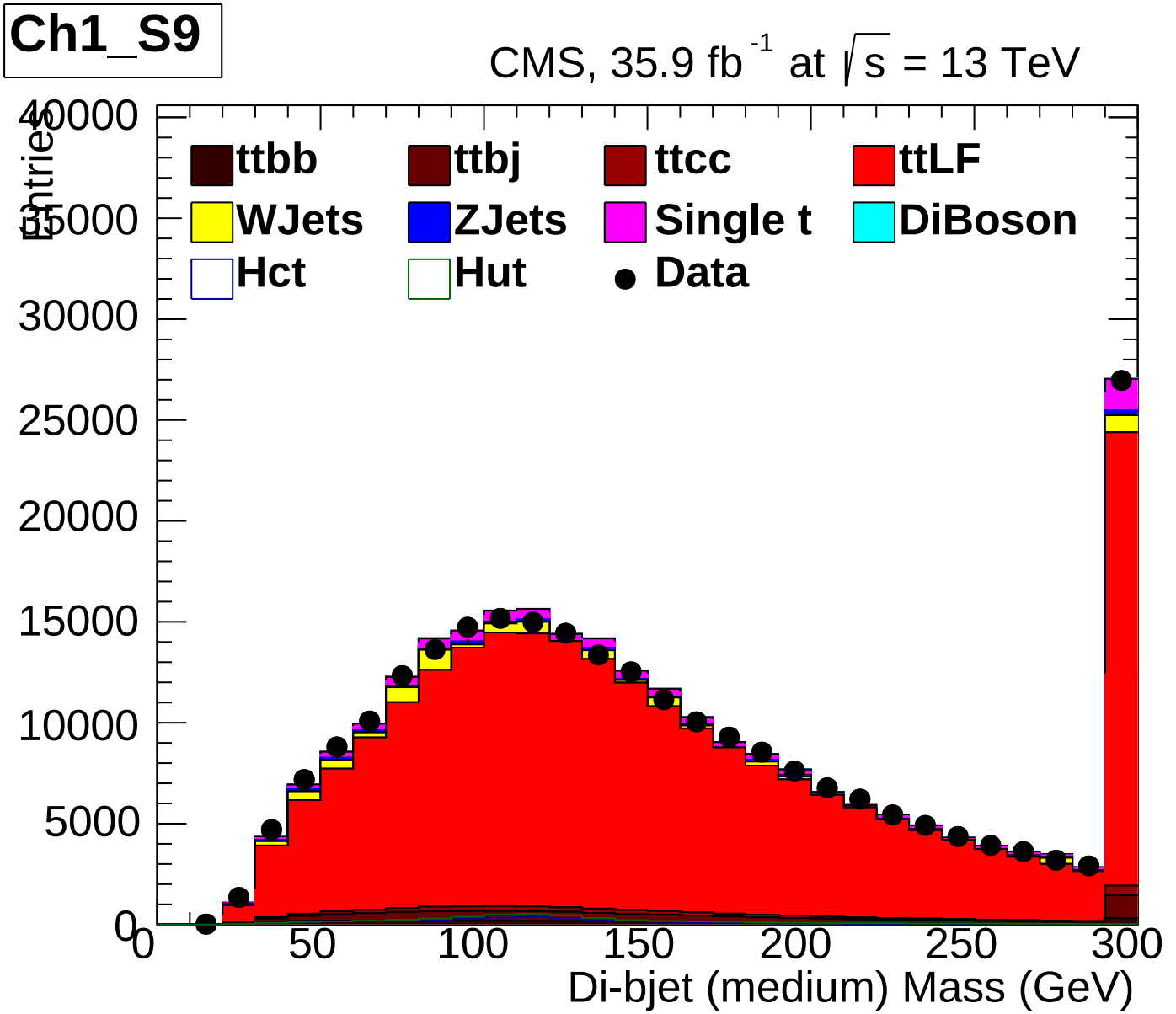
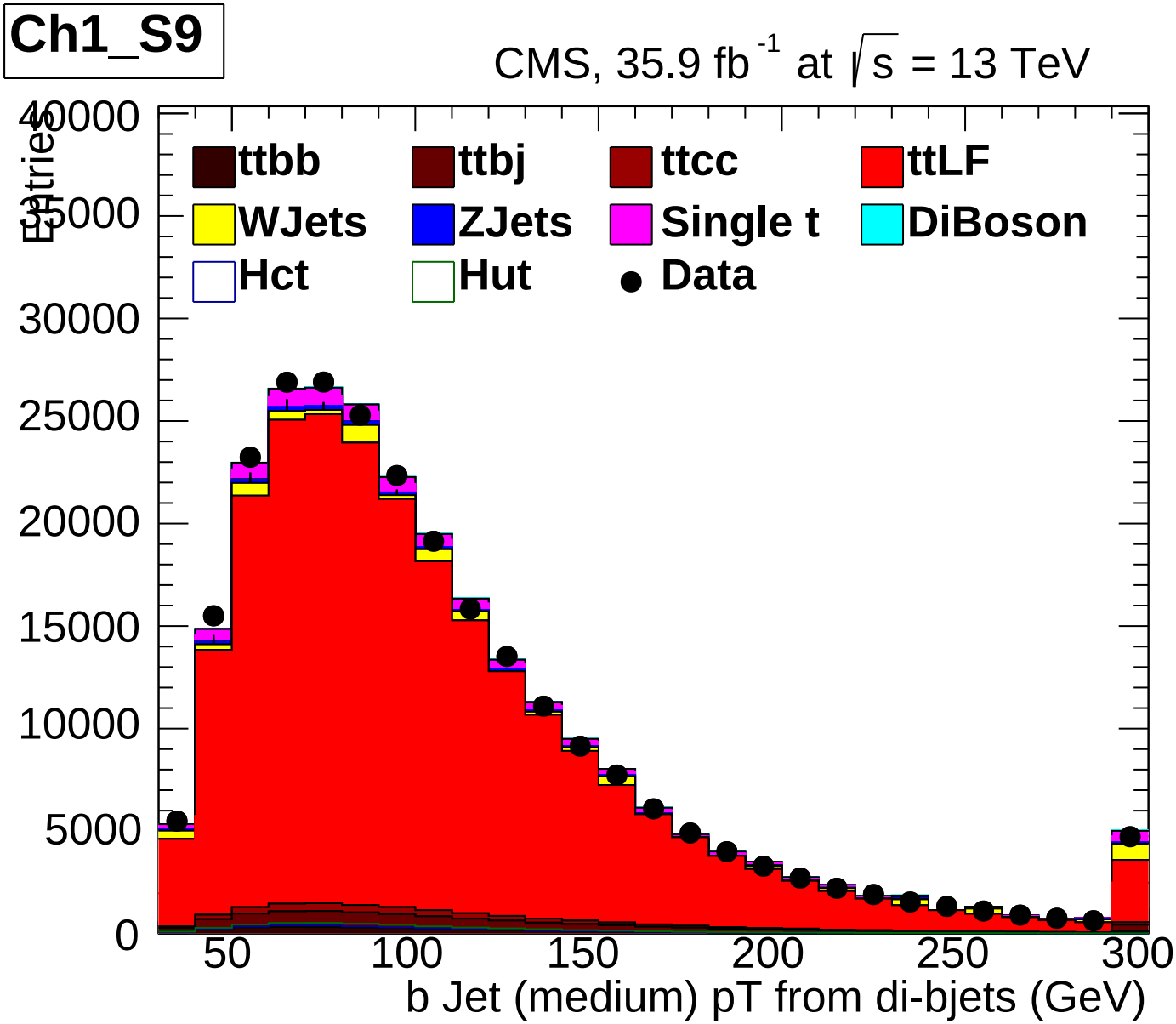
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
40000
35000
30000
25000
20000
15000
10000
5000
0
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
40000
35000
30000
25000
20000
15000
10000
5000
0
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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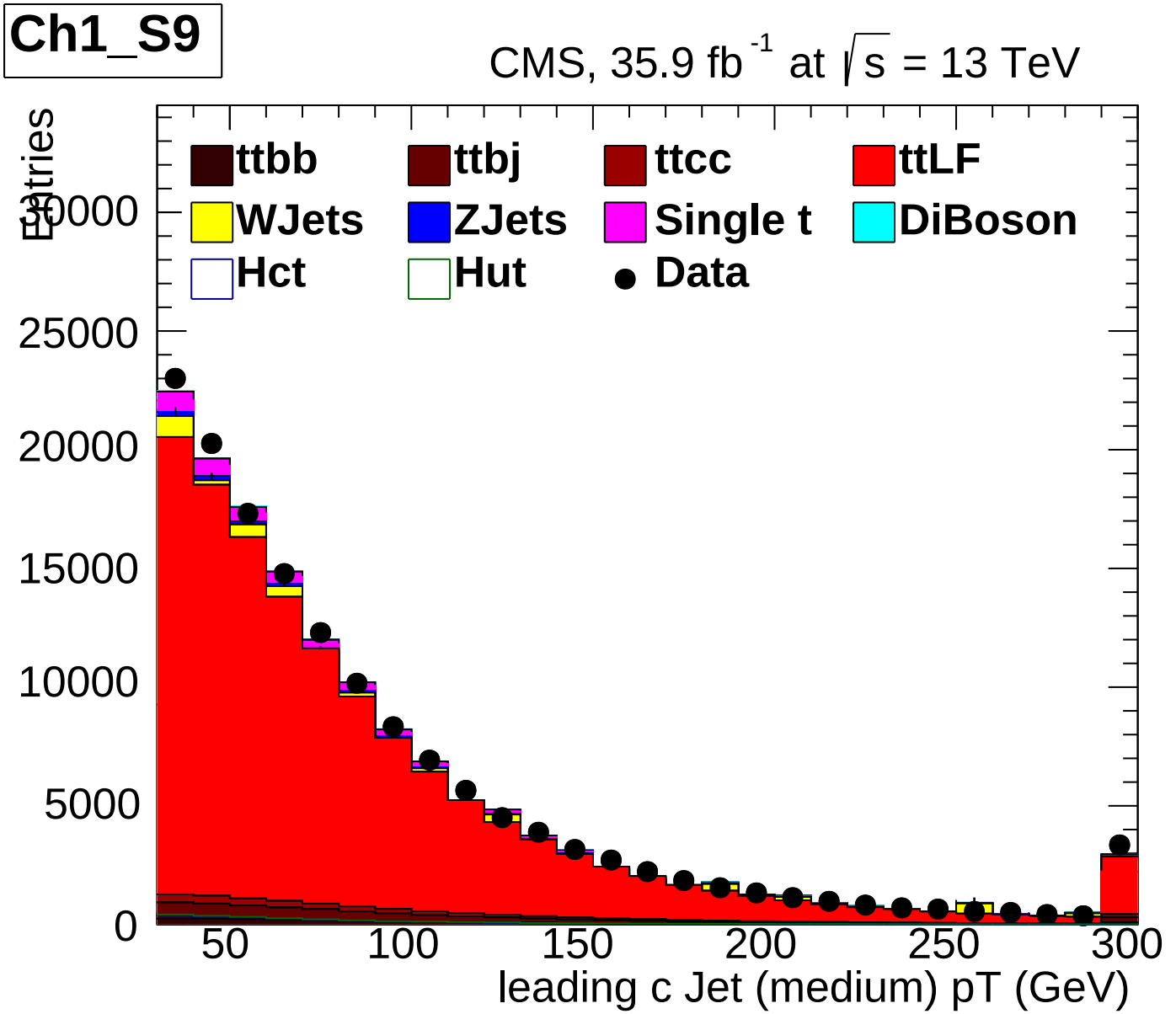
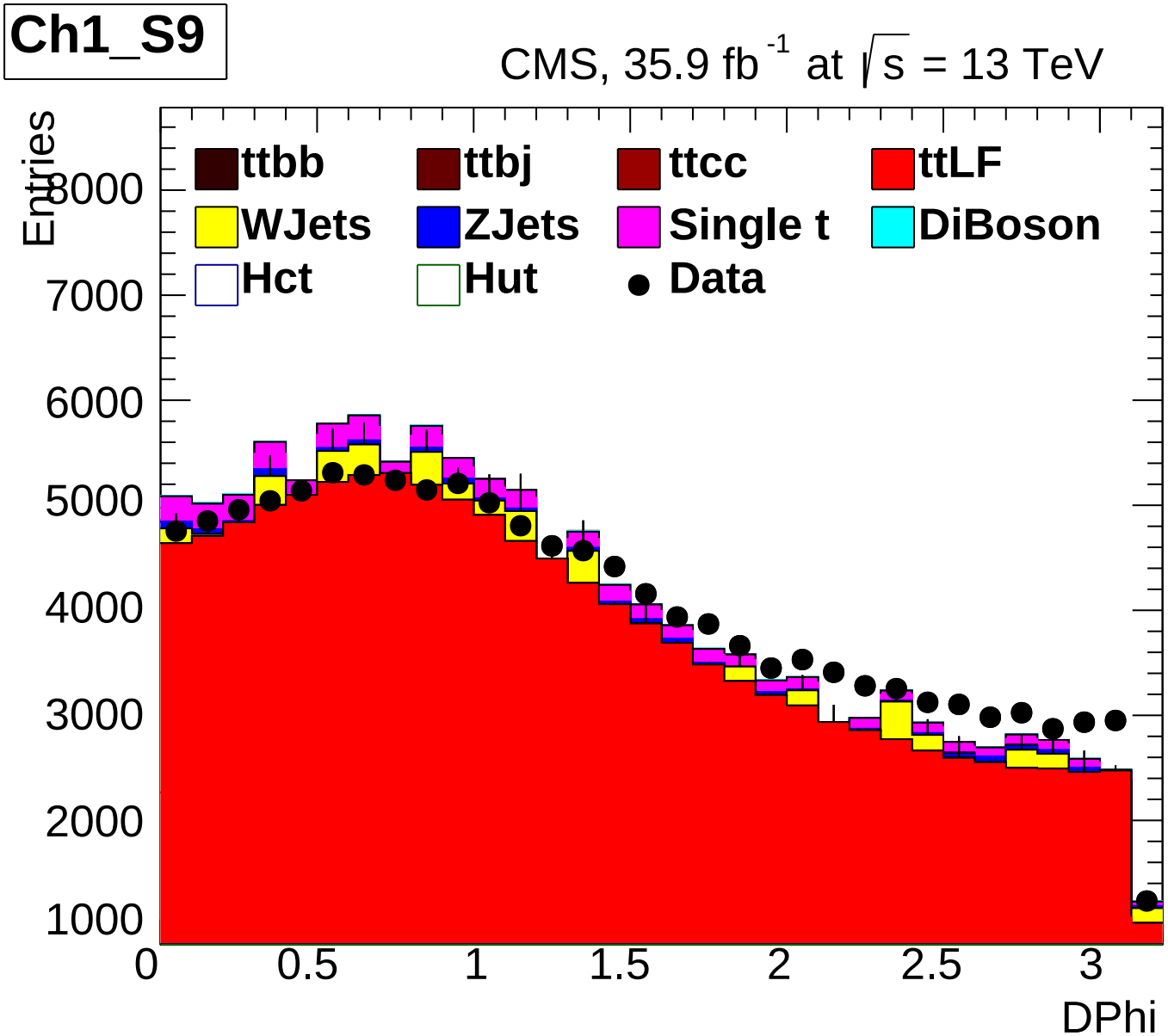
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
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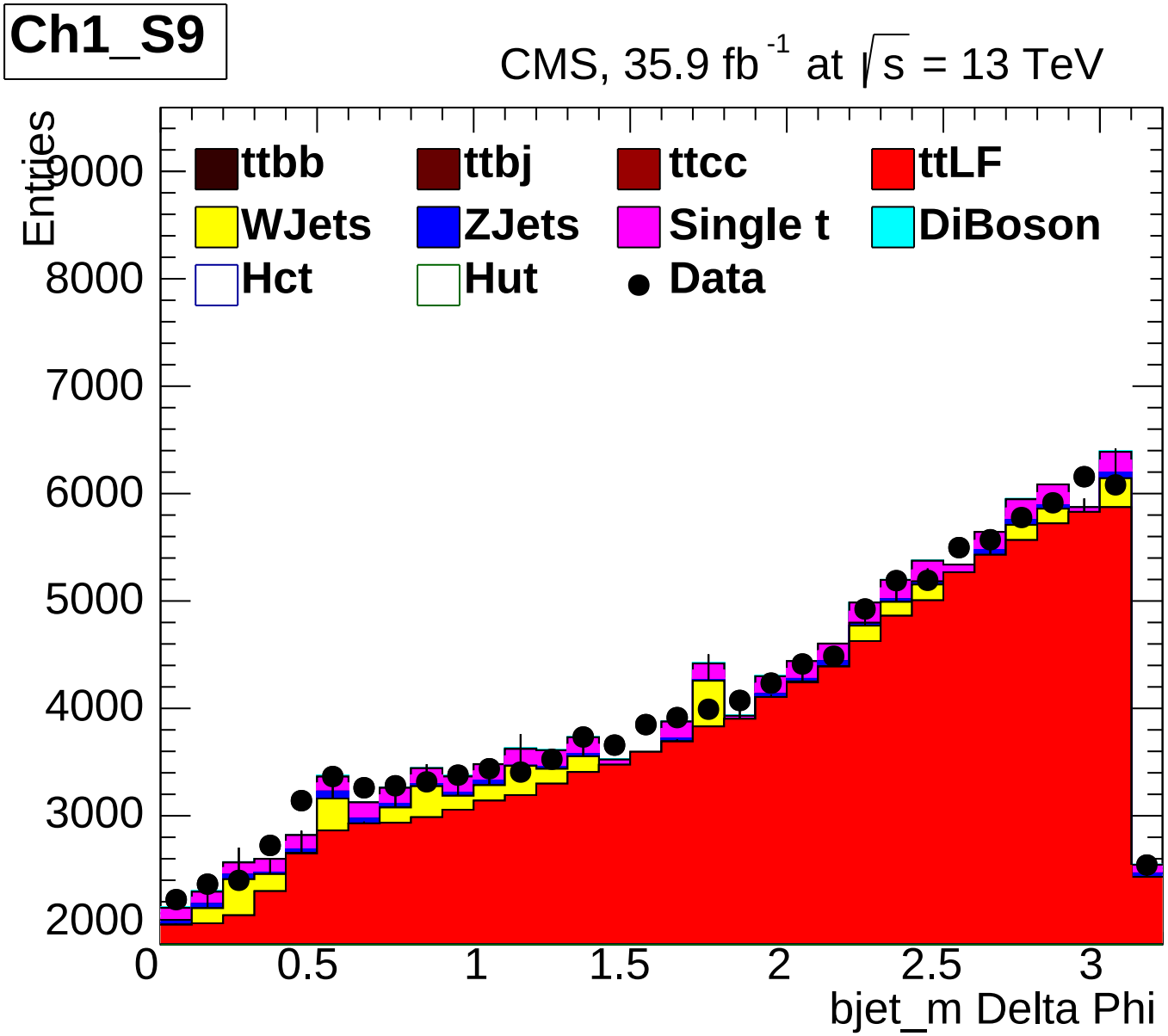
1
1.5
2
2.5
3
DPhi


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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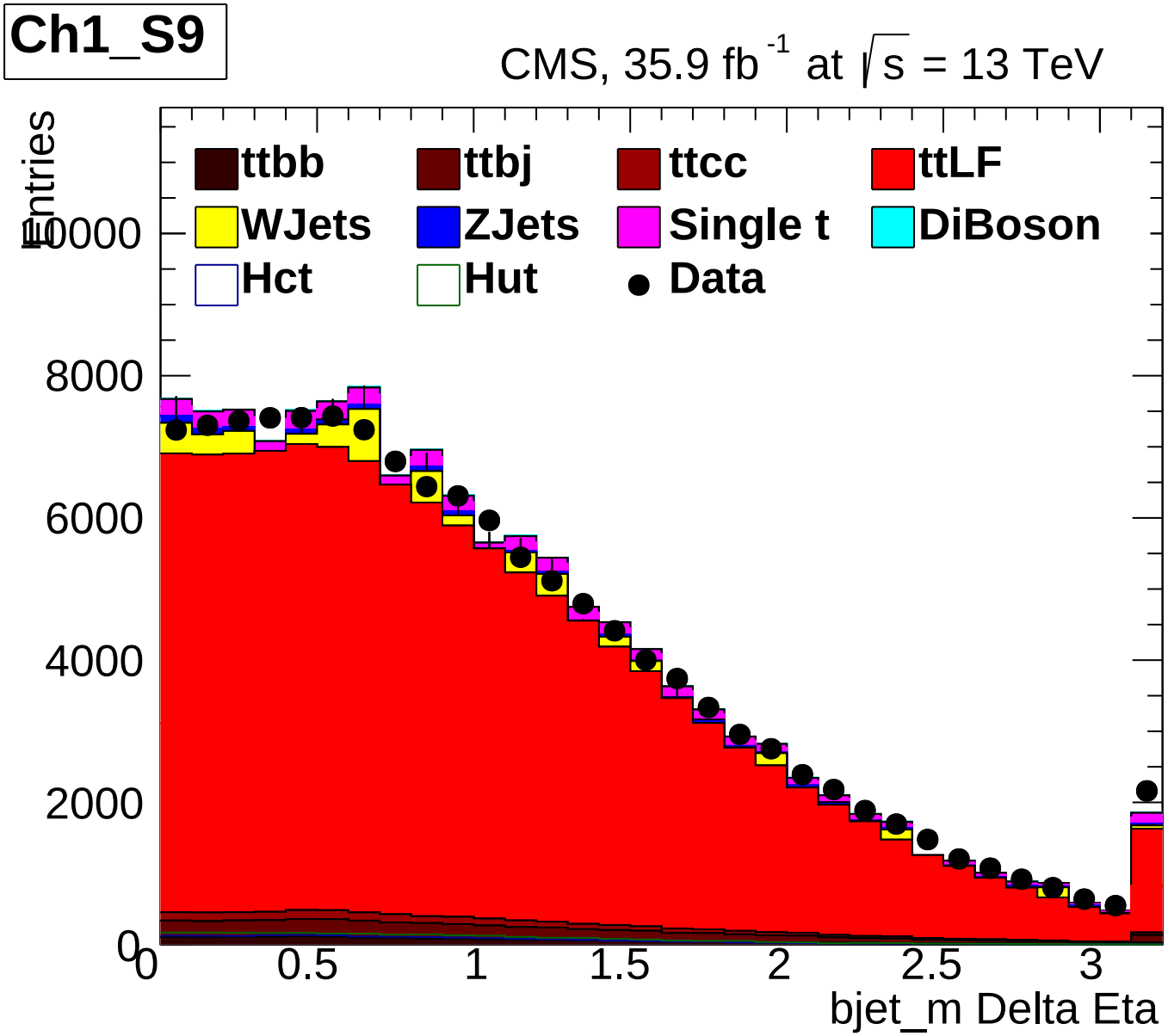
4000
3000
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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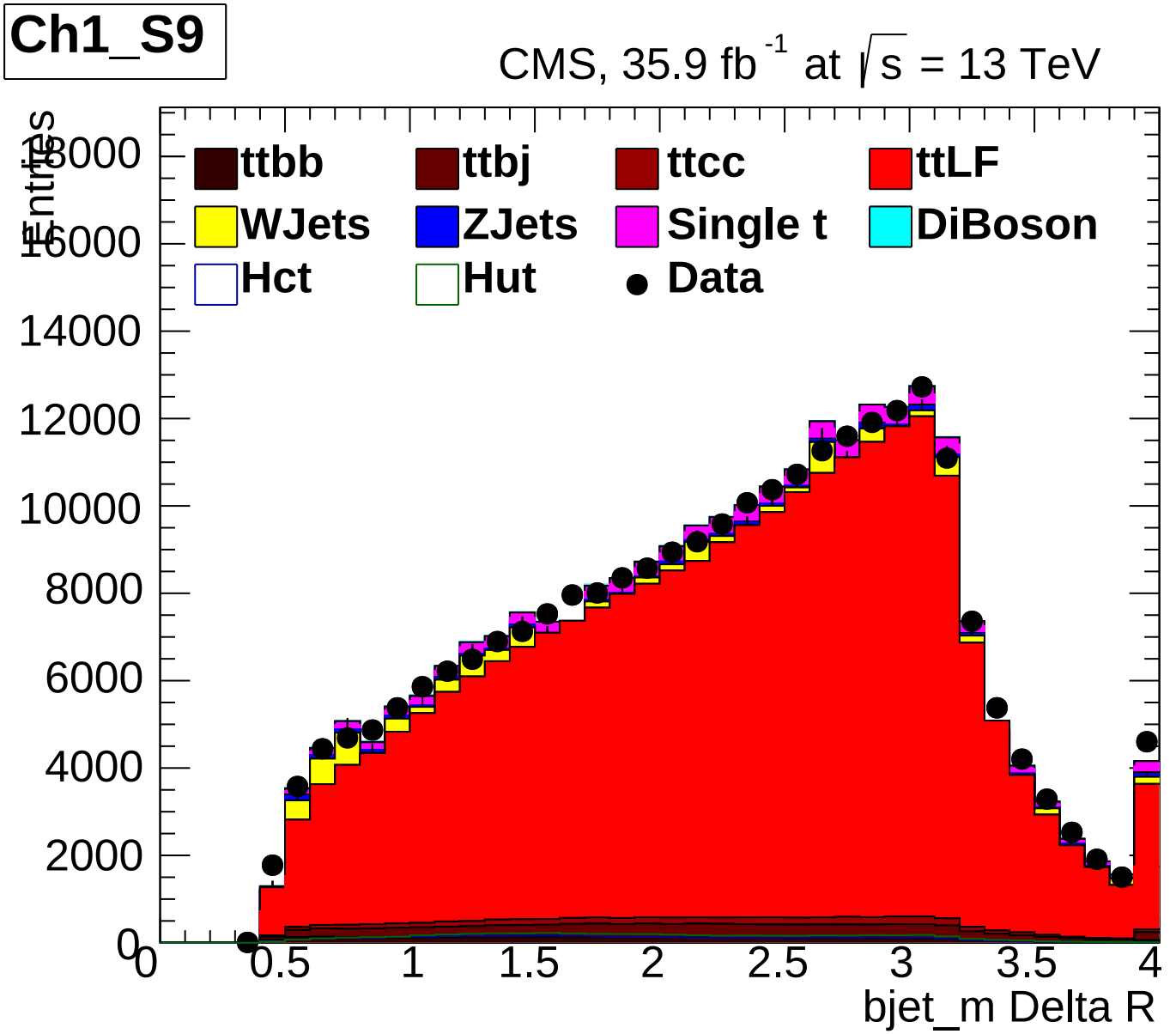
6000
4000
2000
0
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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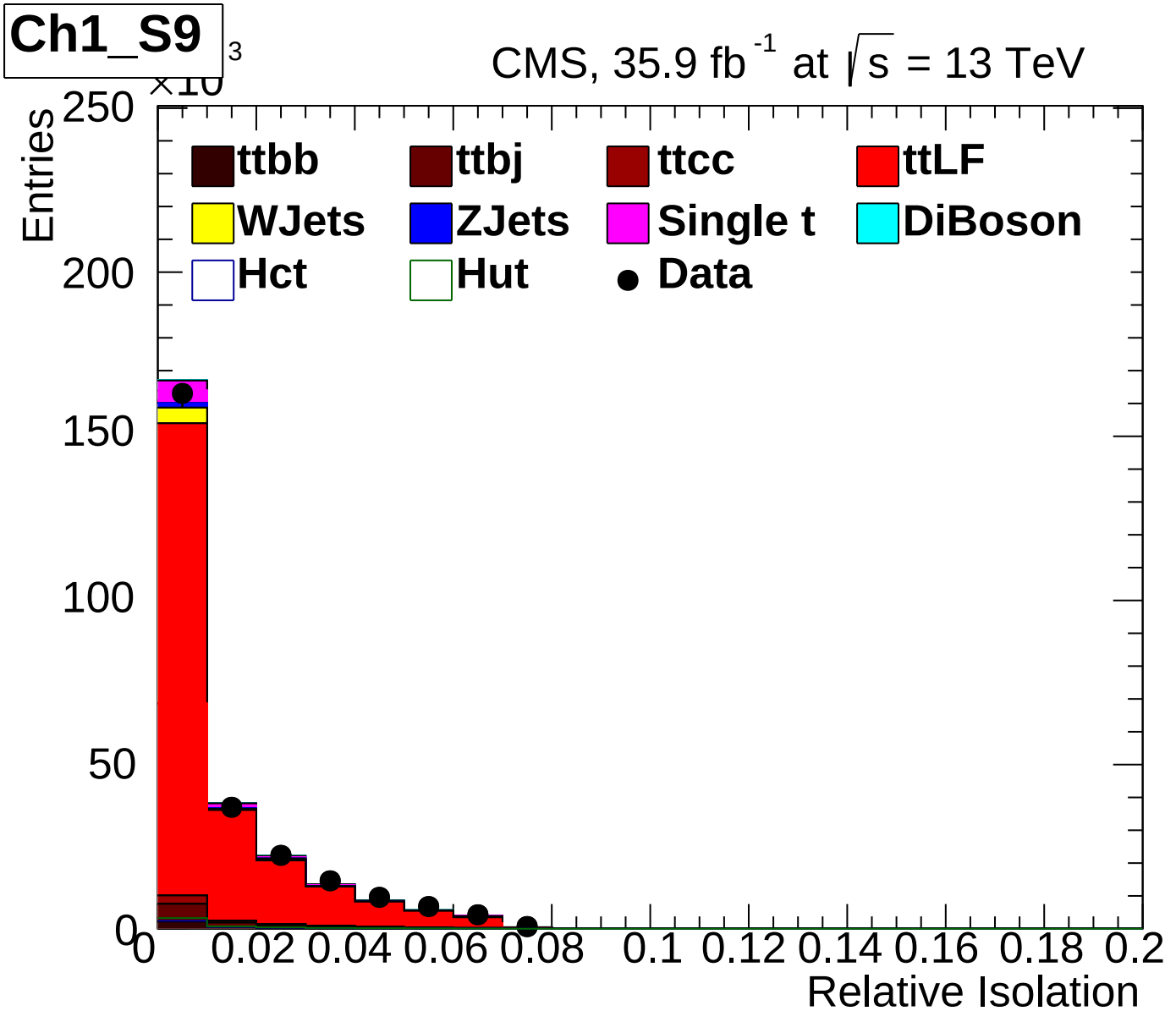
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
$\times 10^3$
Entries
250
200
150
100
50
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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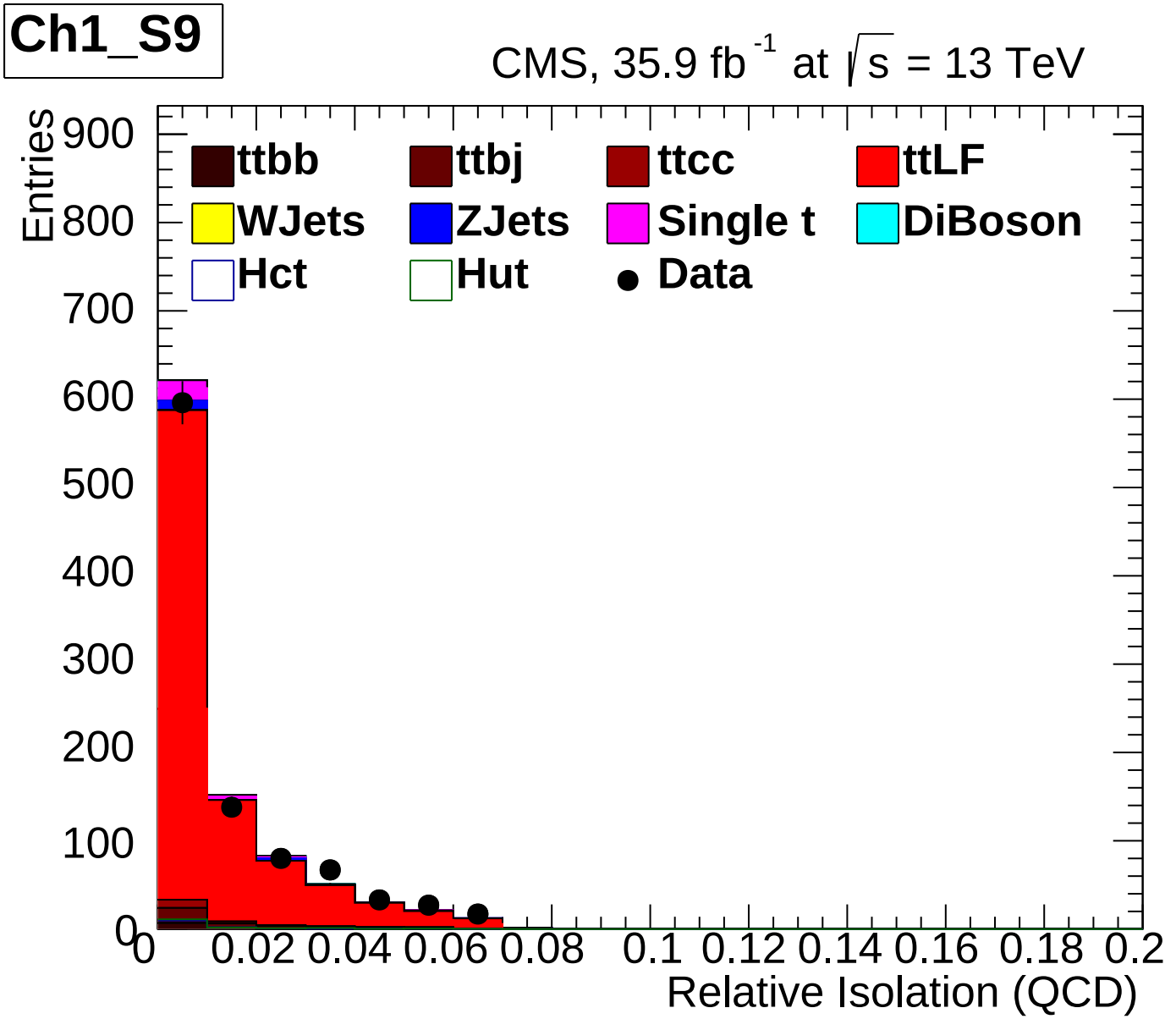
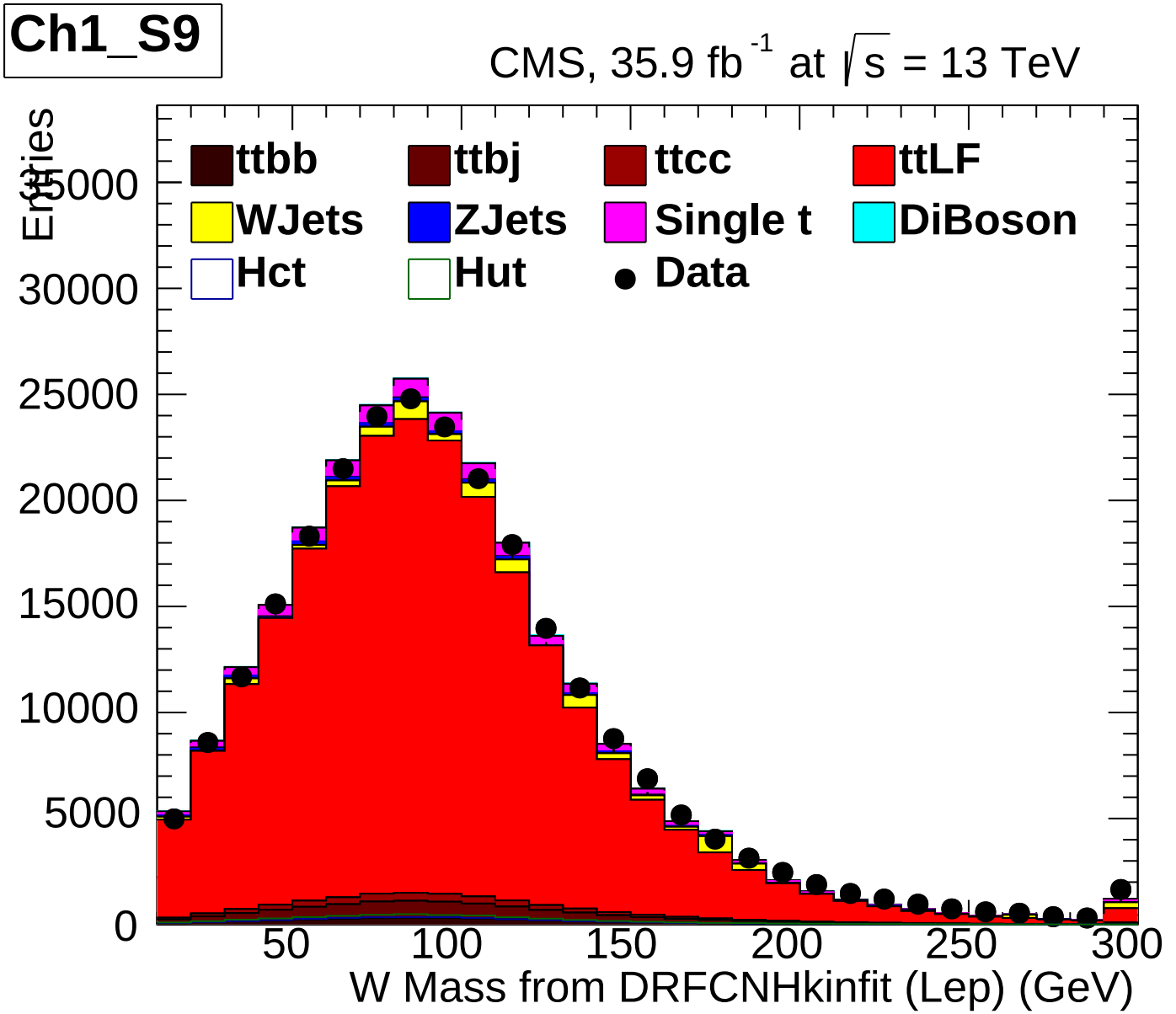
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
900
800
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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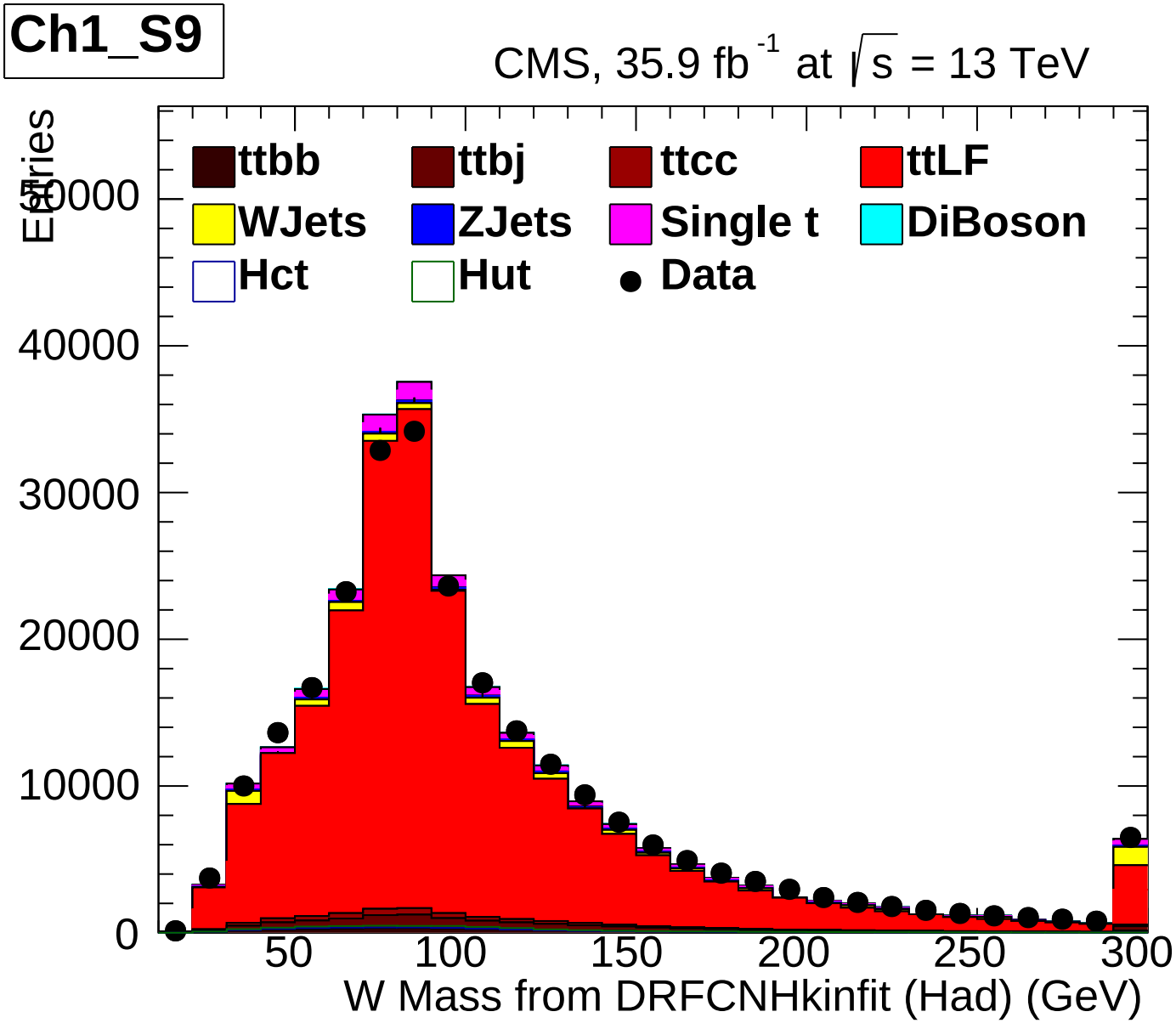
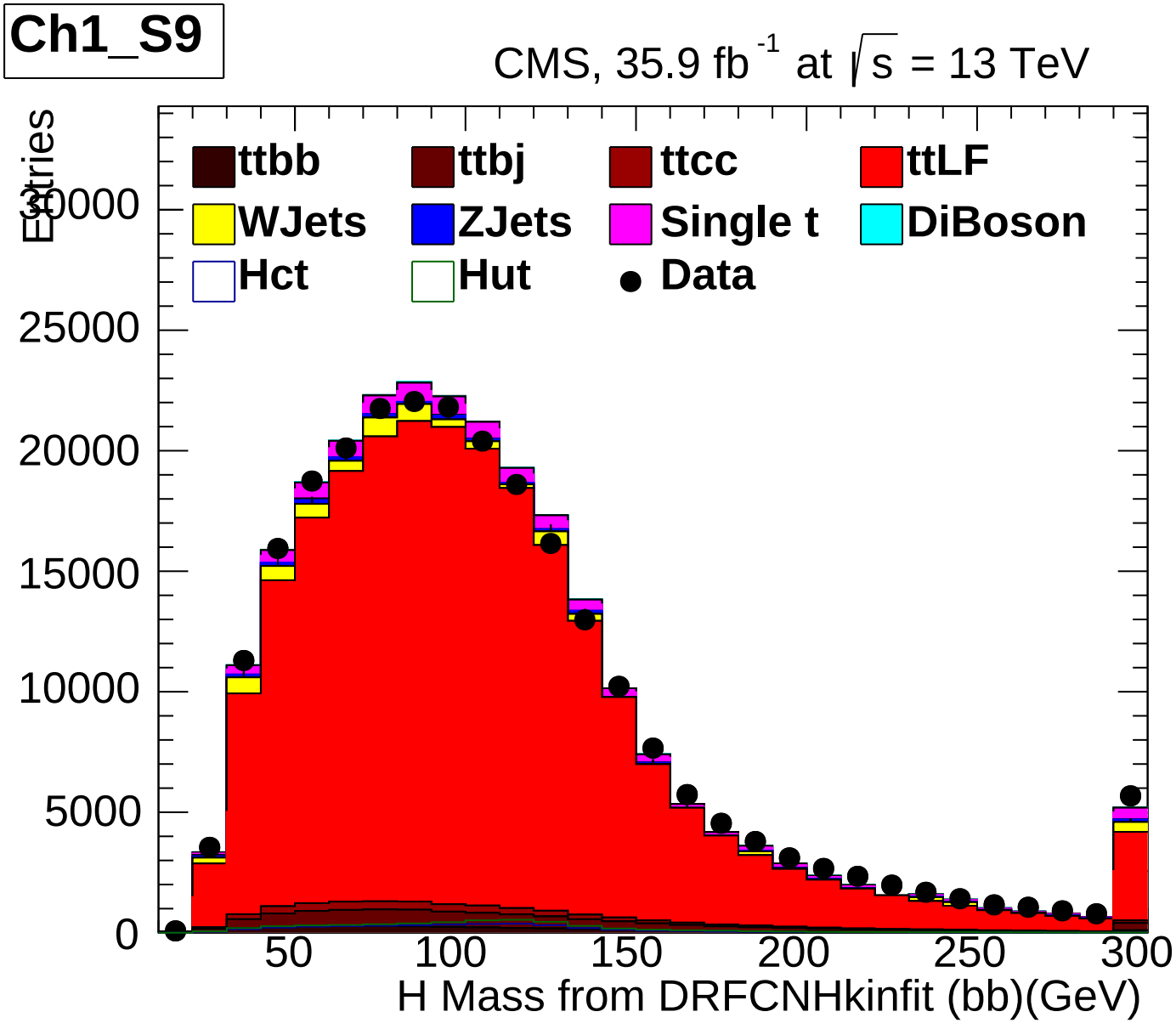
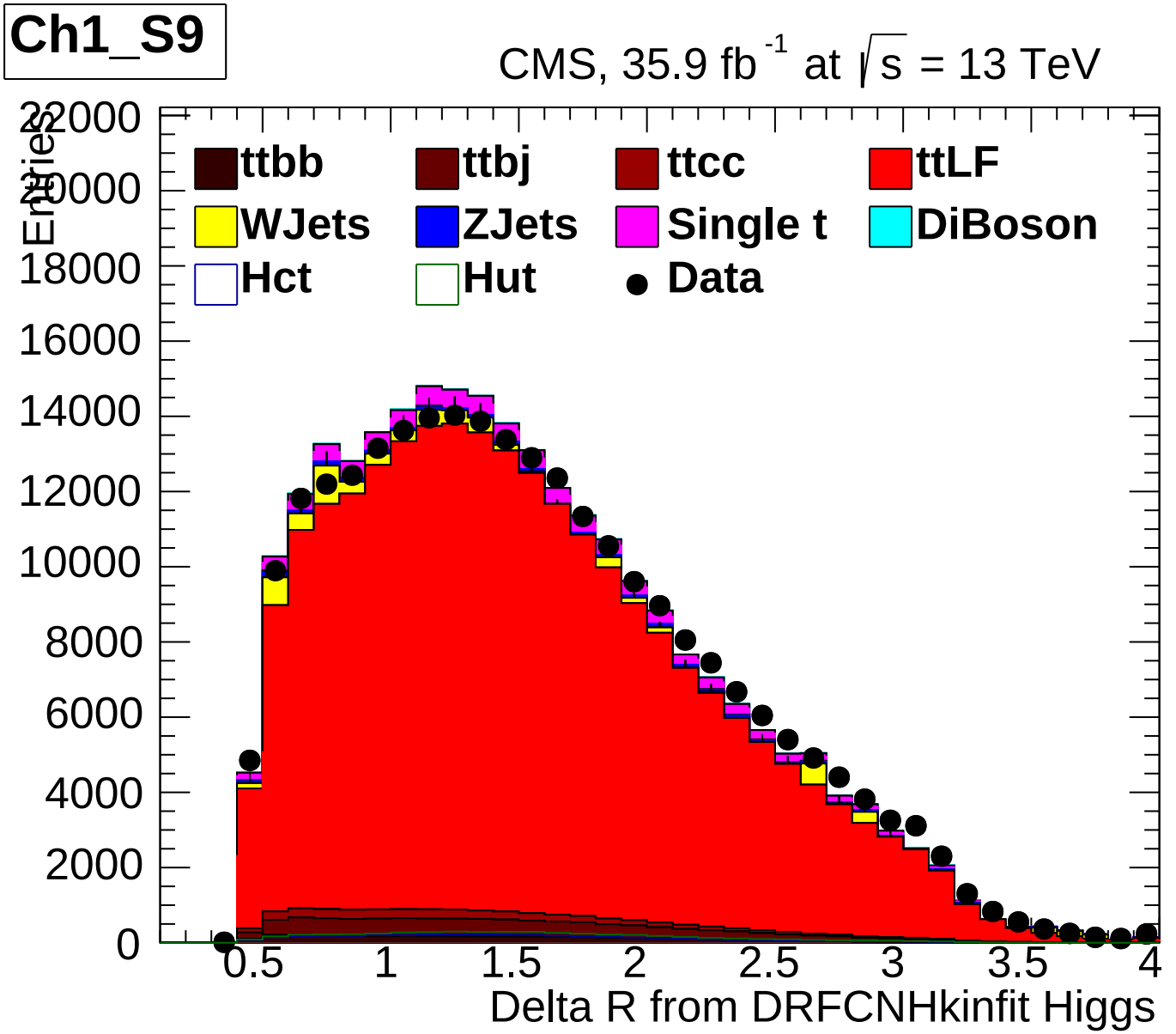
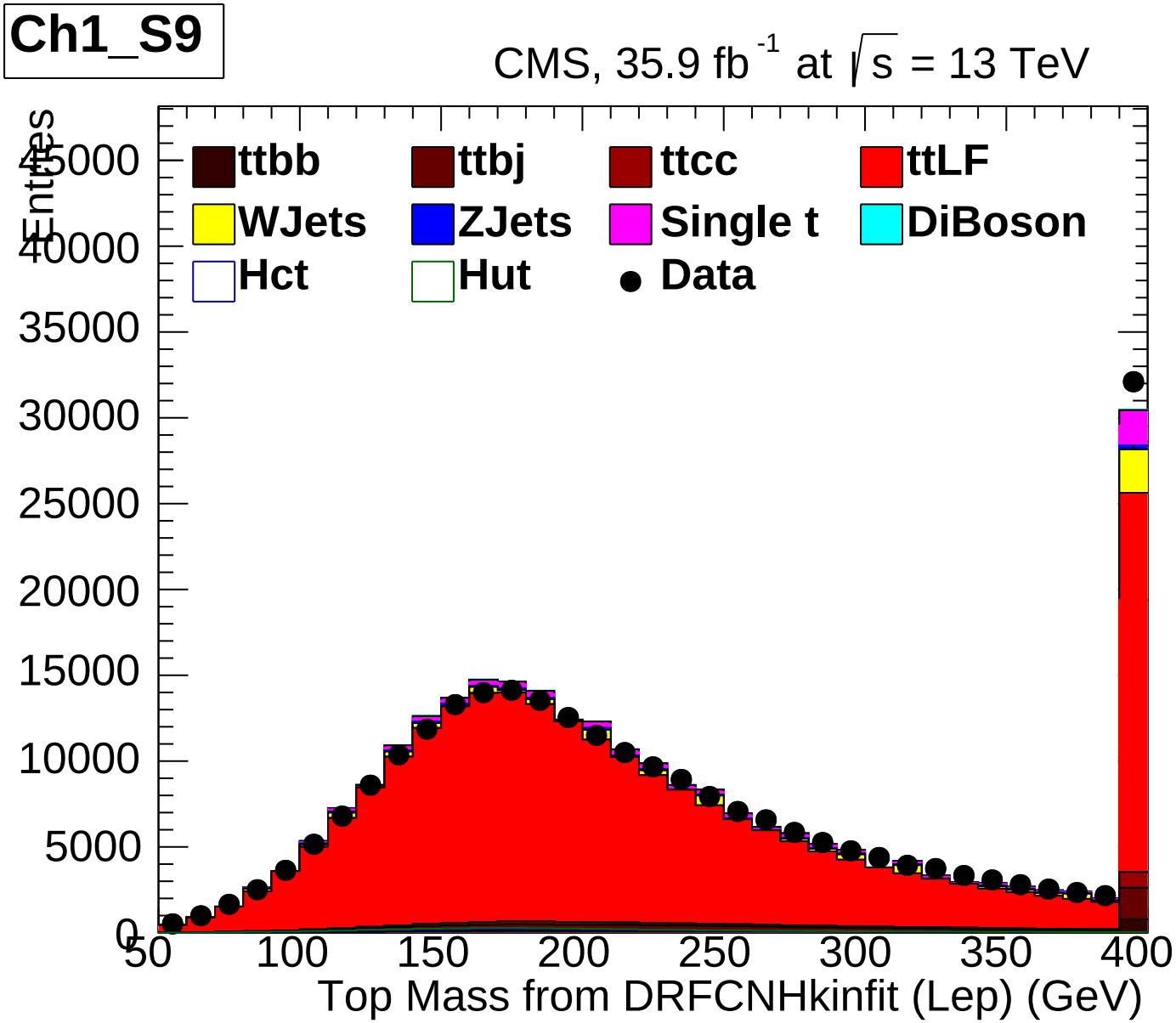
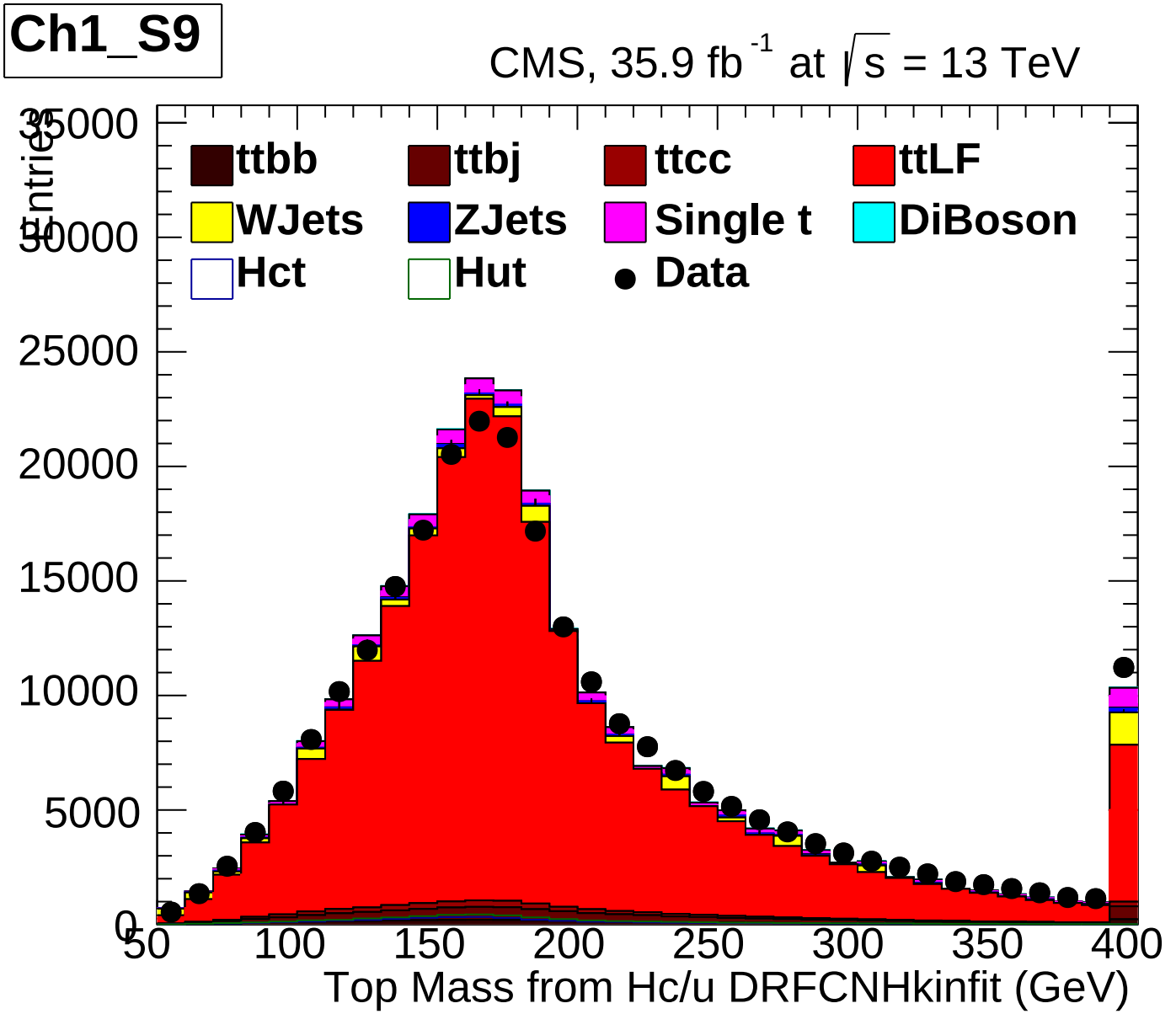
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

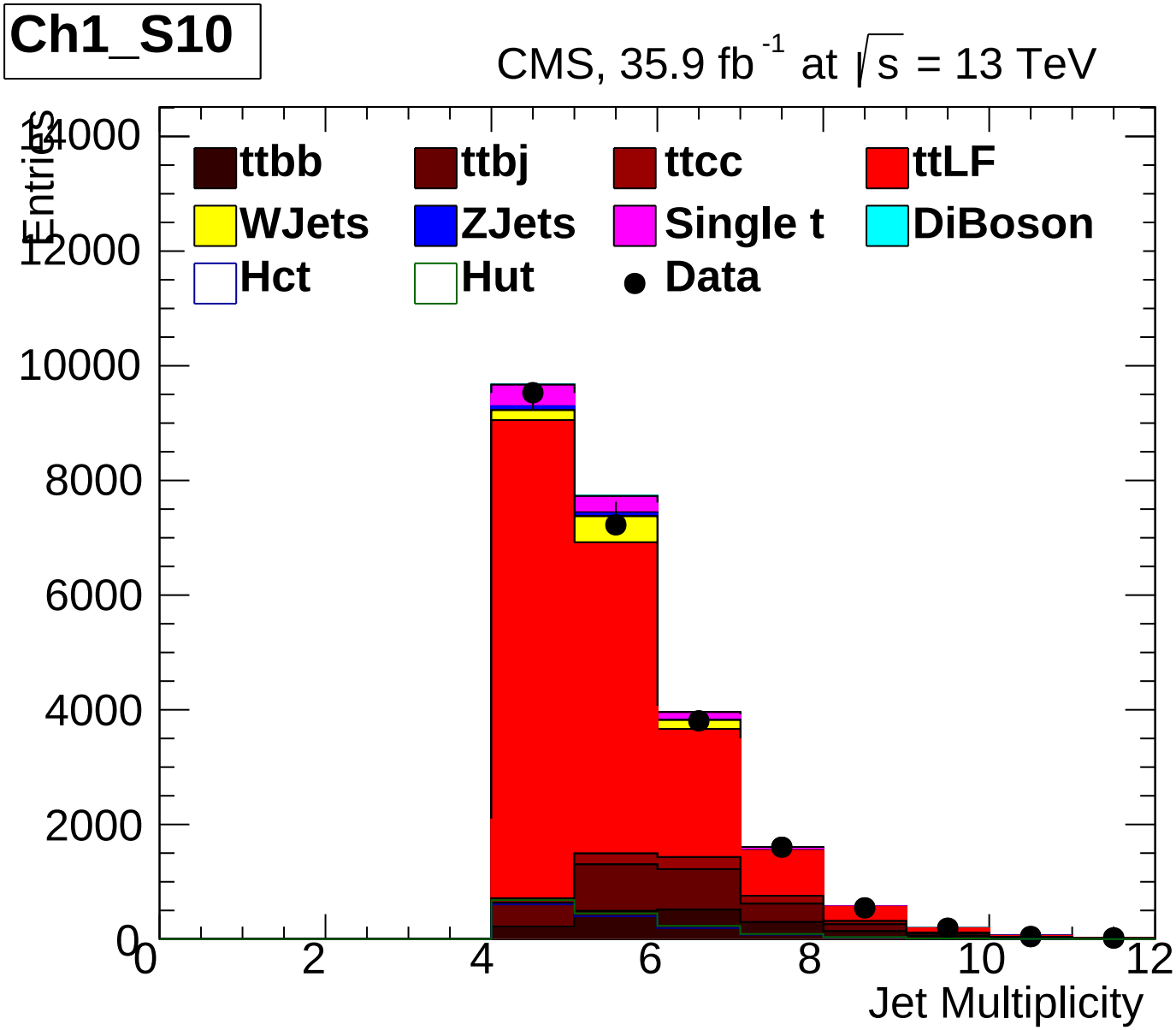

Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

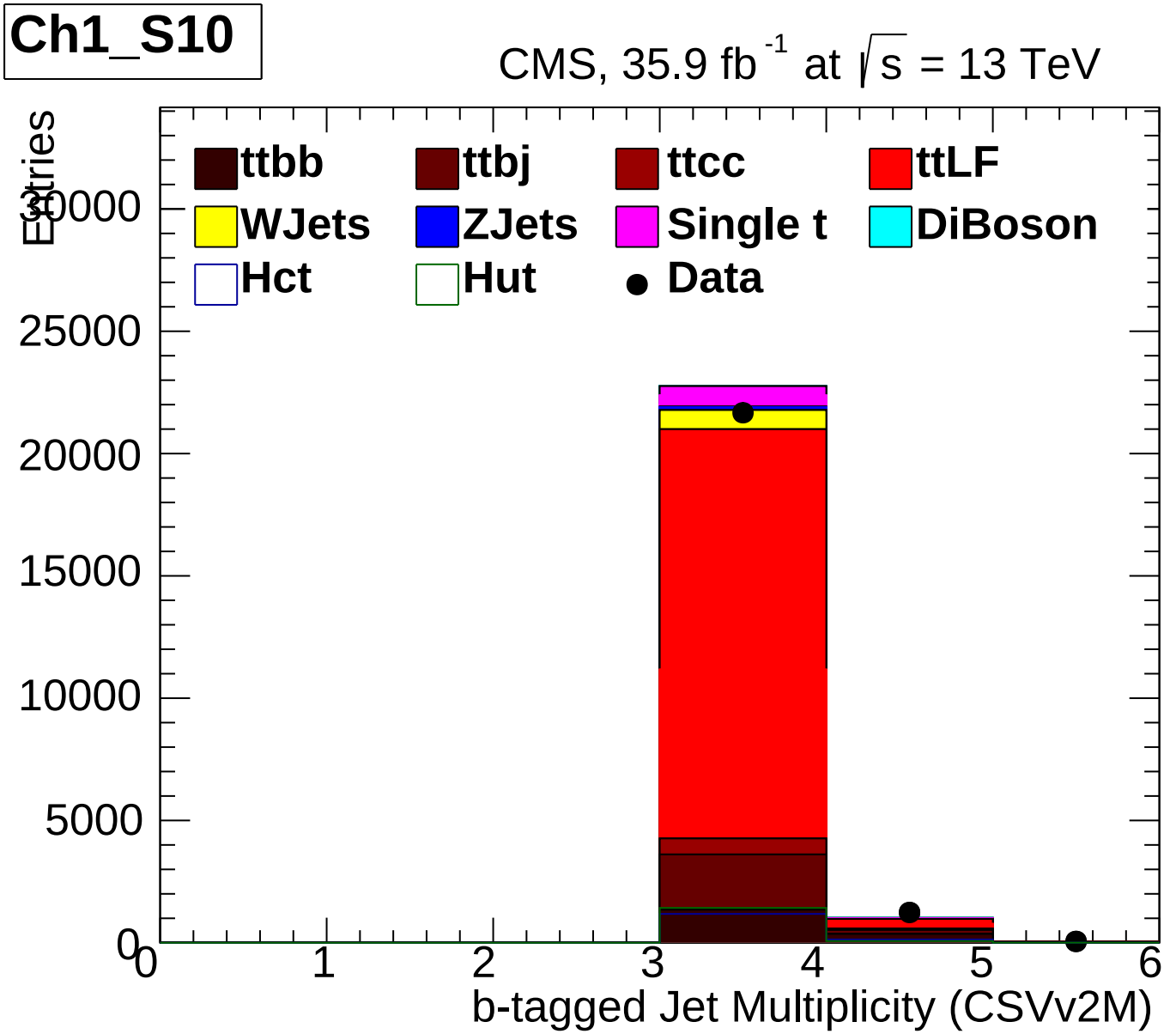

Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

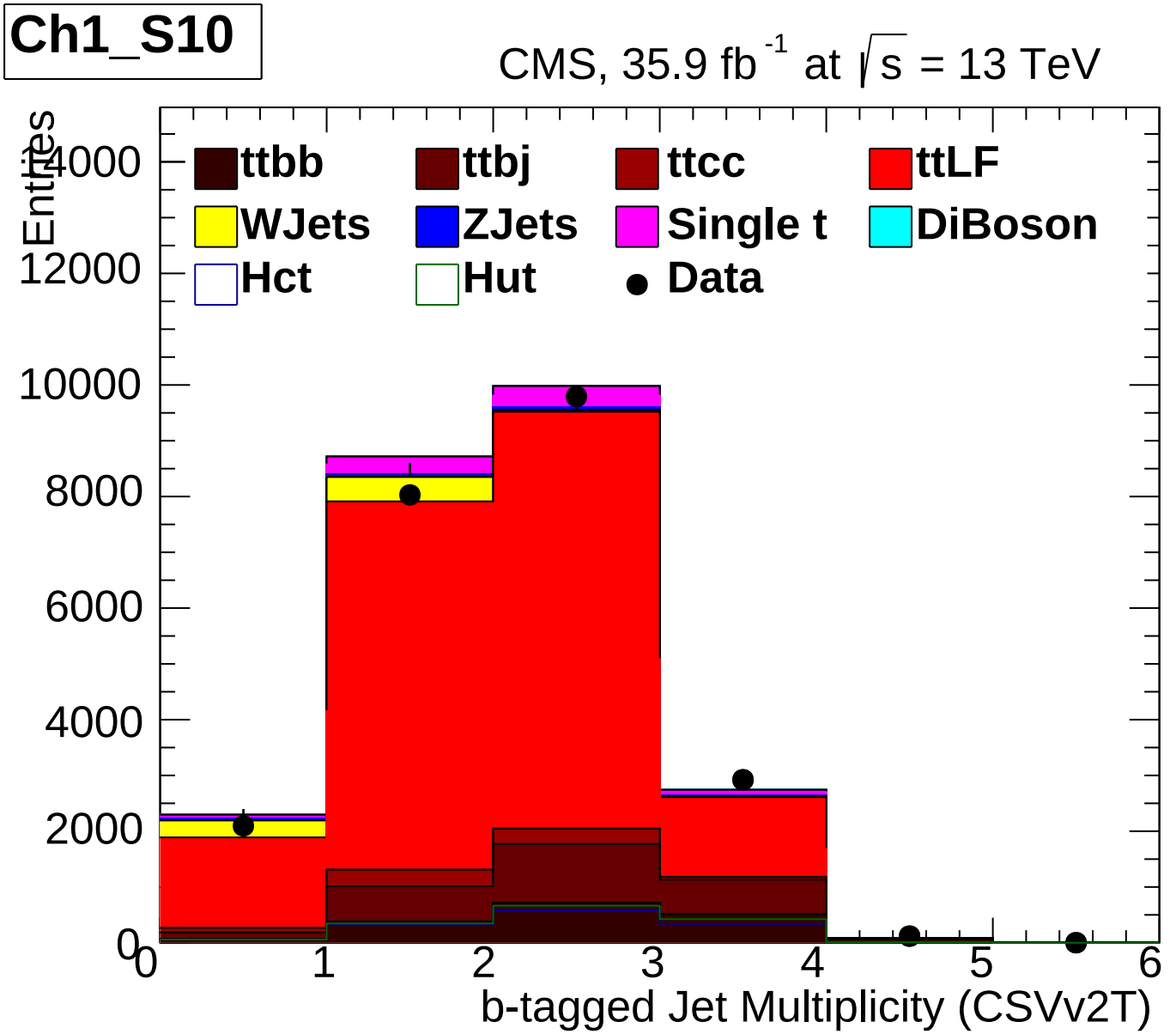

Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

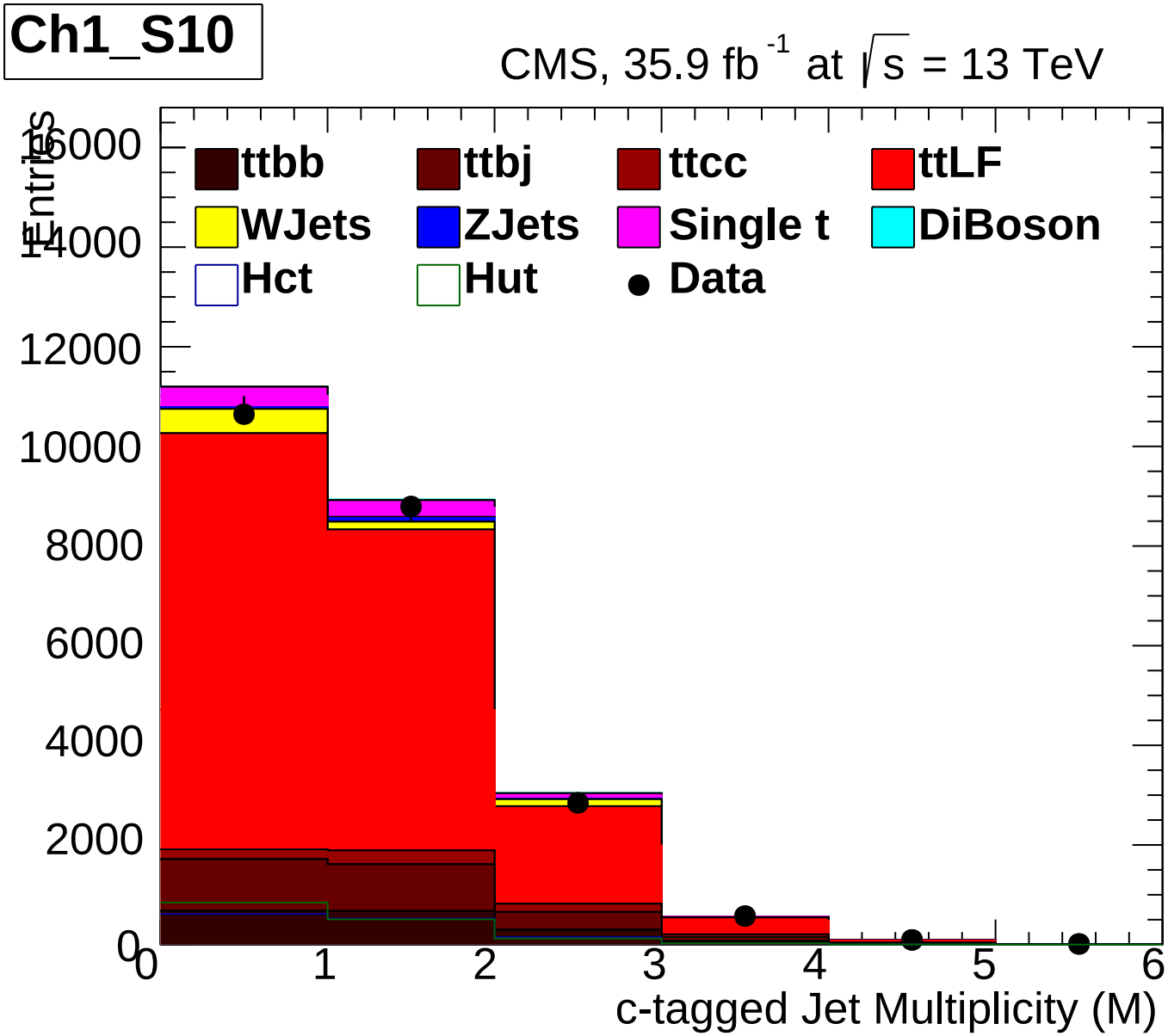

Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

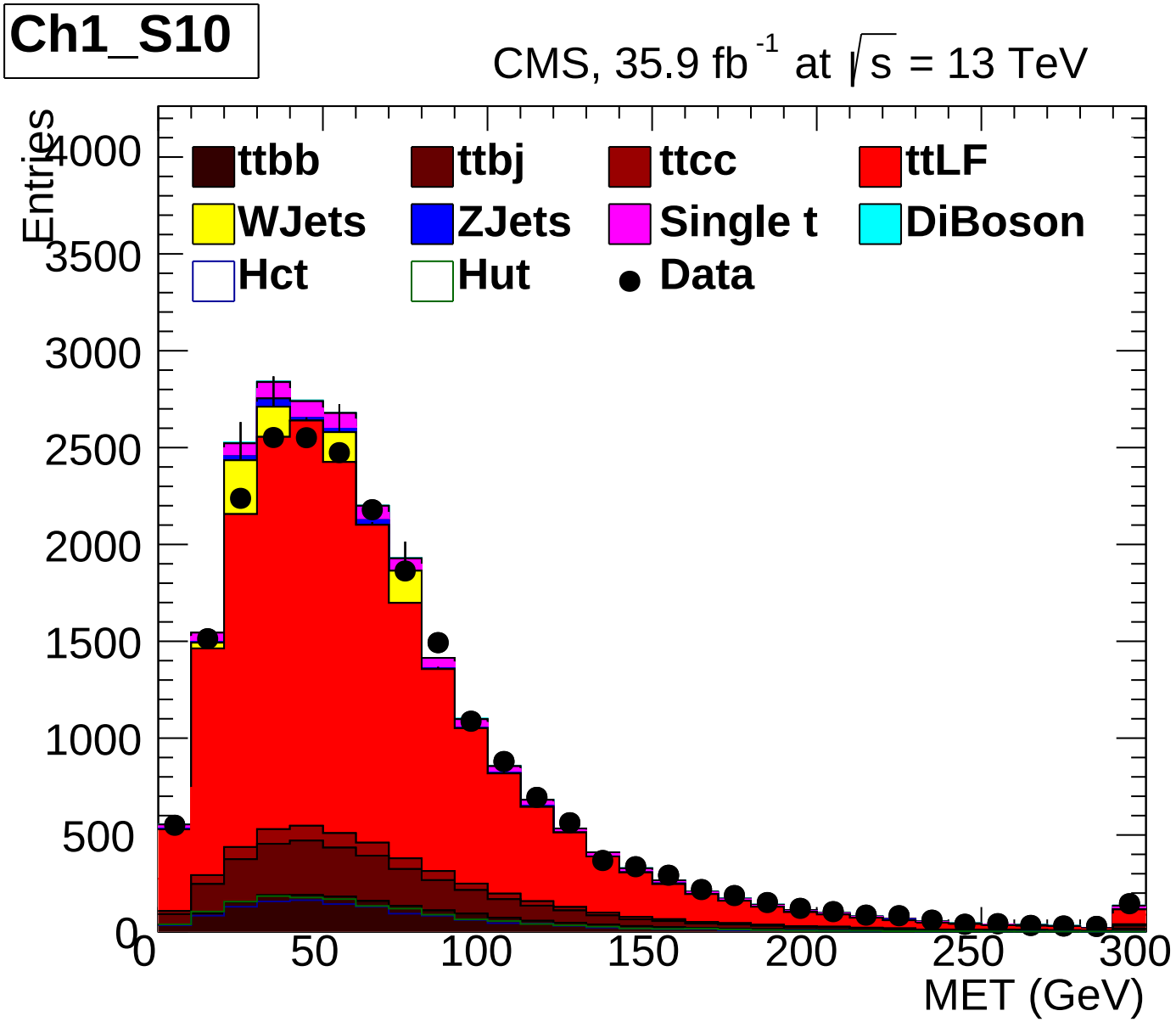

Ch1_S9
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
35000
30000
25000
20000
15000
10000
5000
0
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

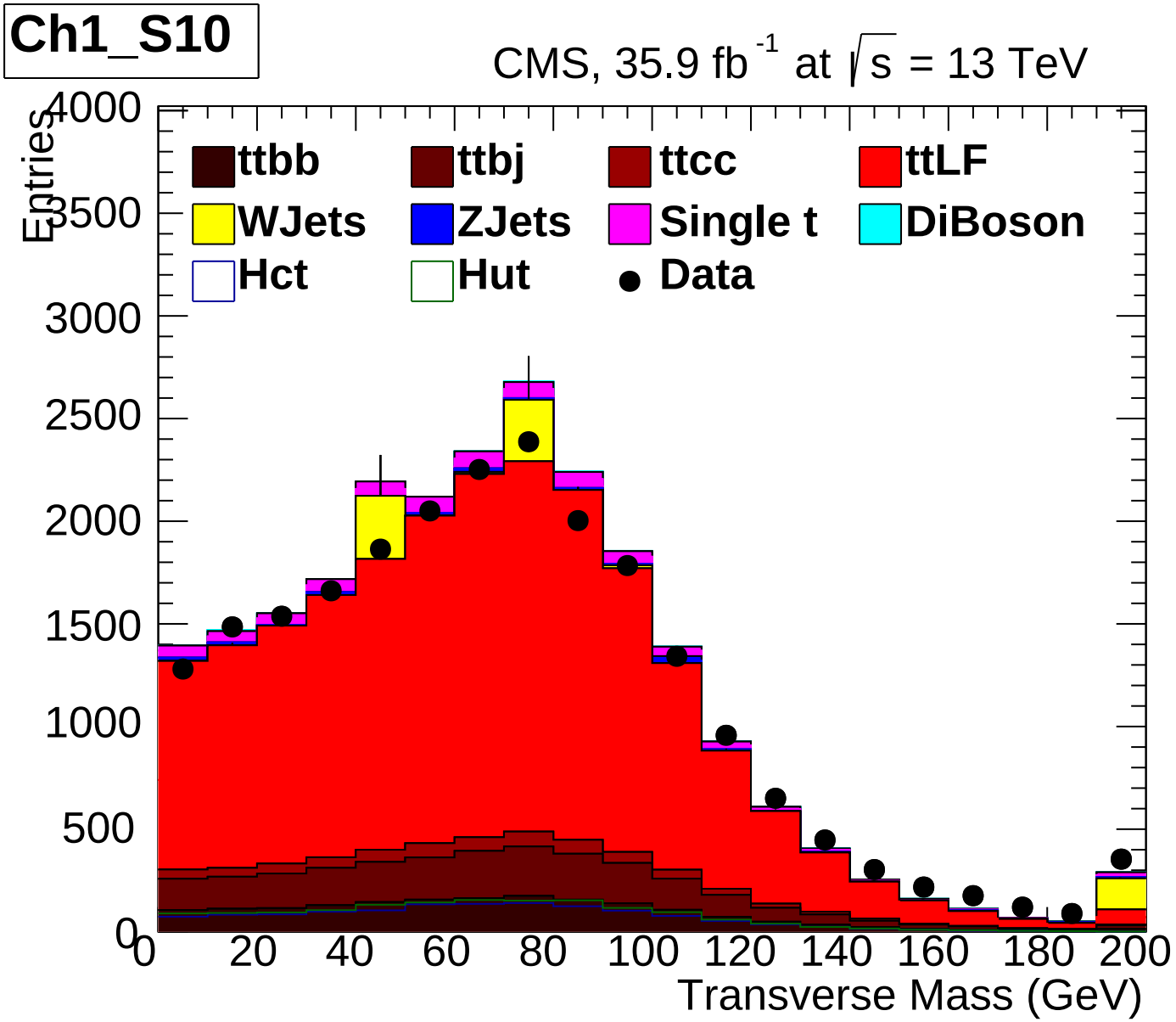

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
14000
12000
10000
8000
6000
4000
2000
0
0
2
4
6
8
10
12
Jet Multiplicity

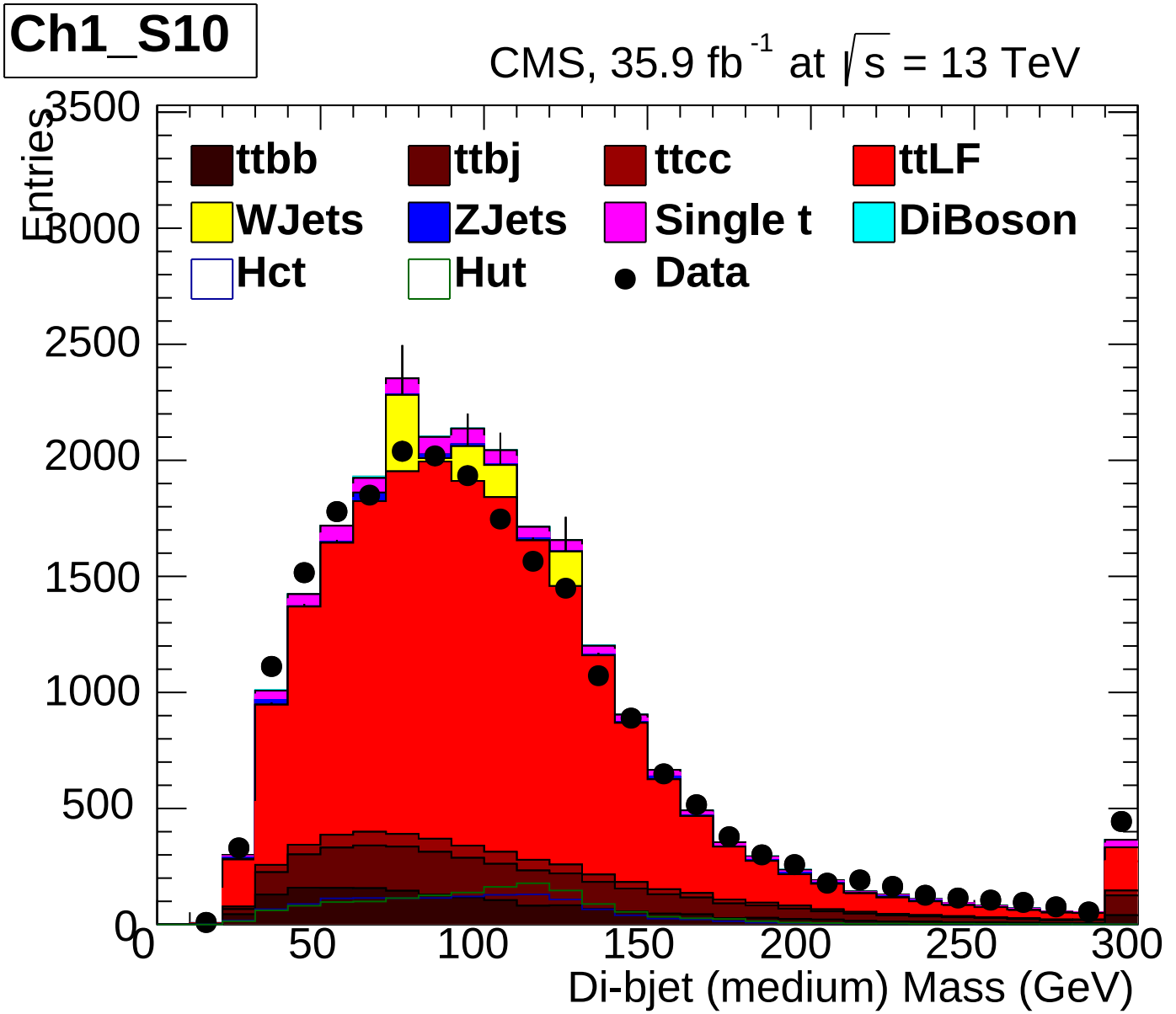

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

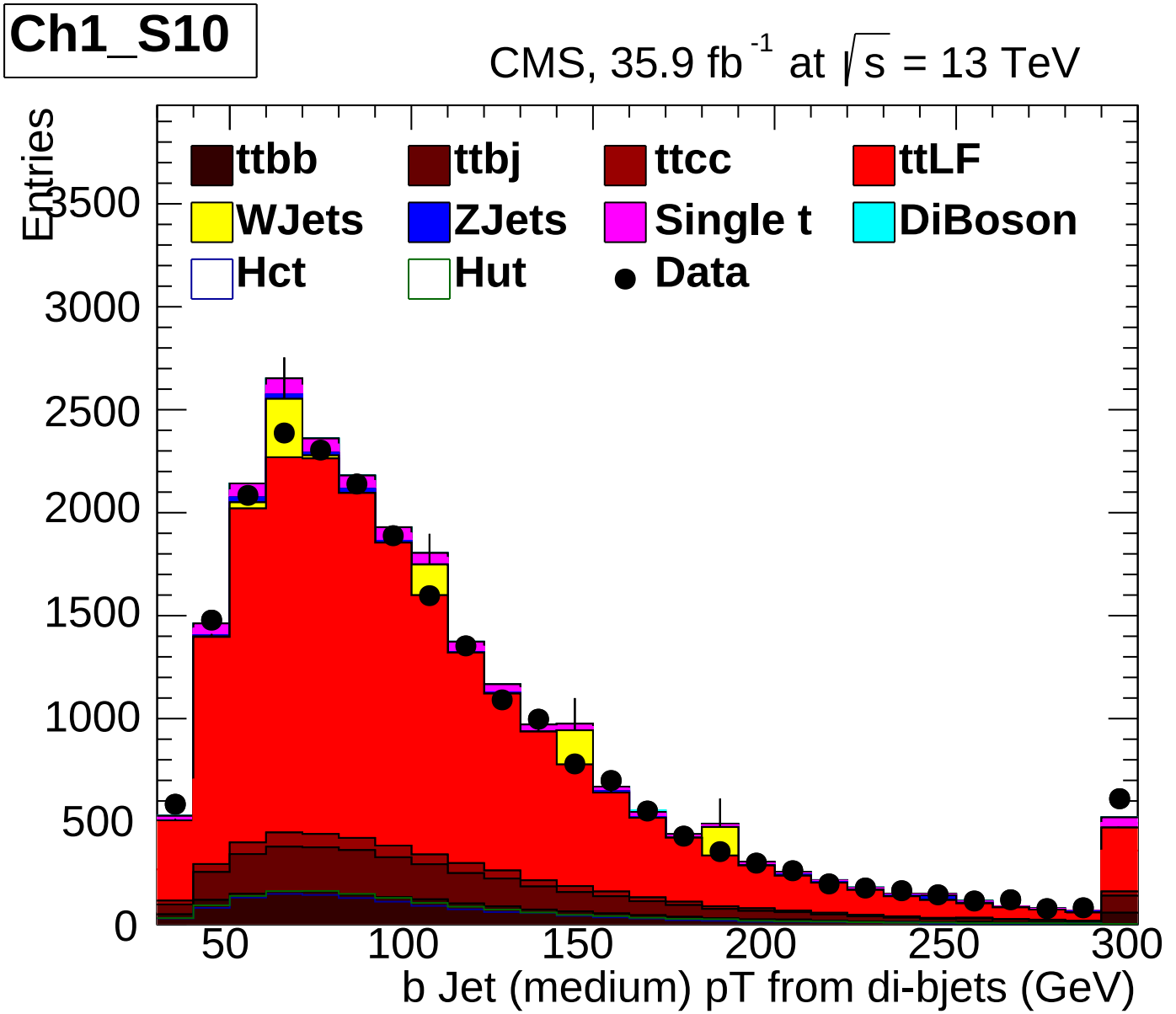

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

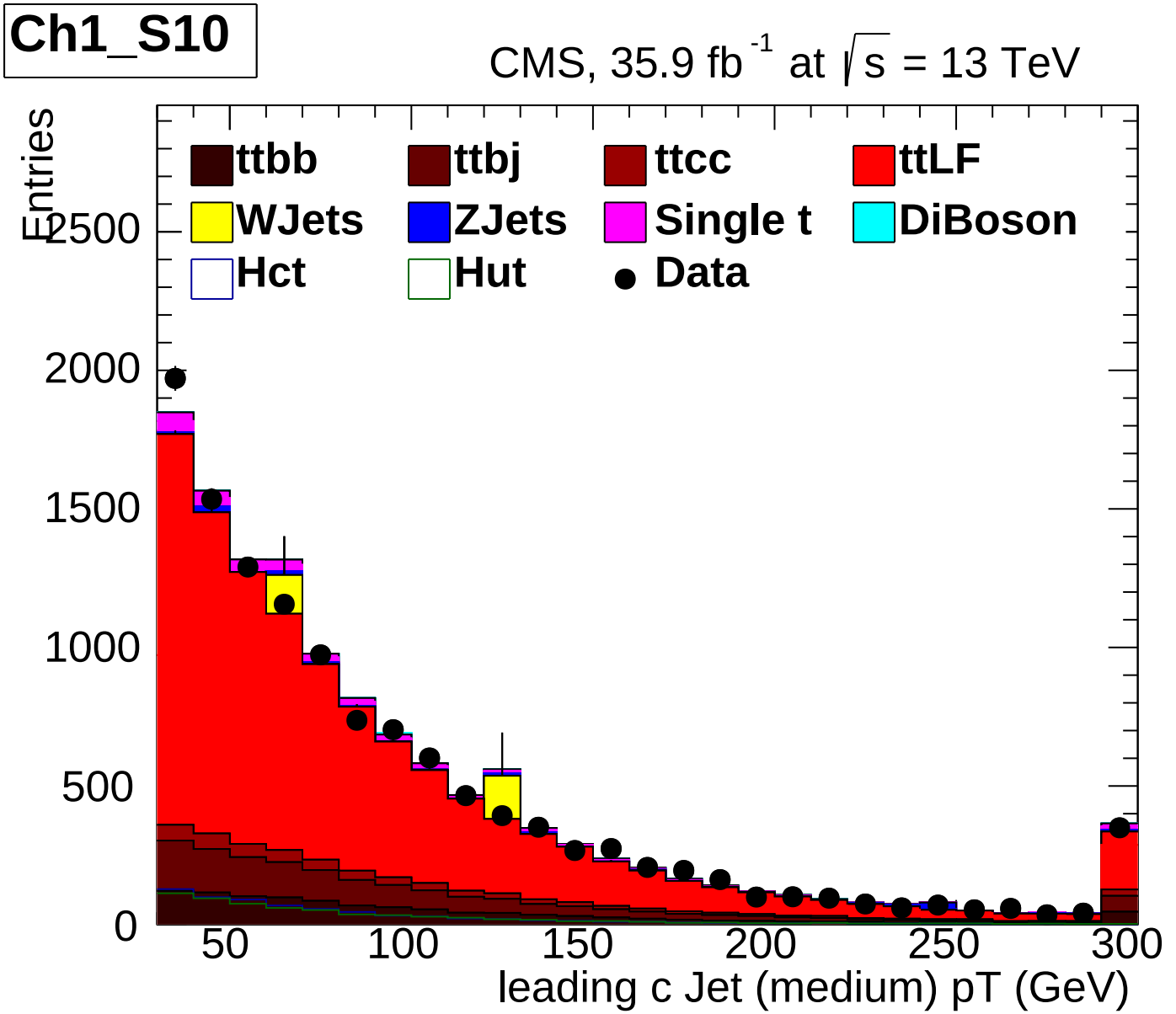

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

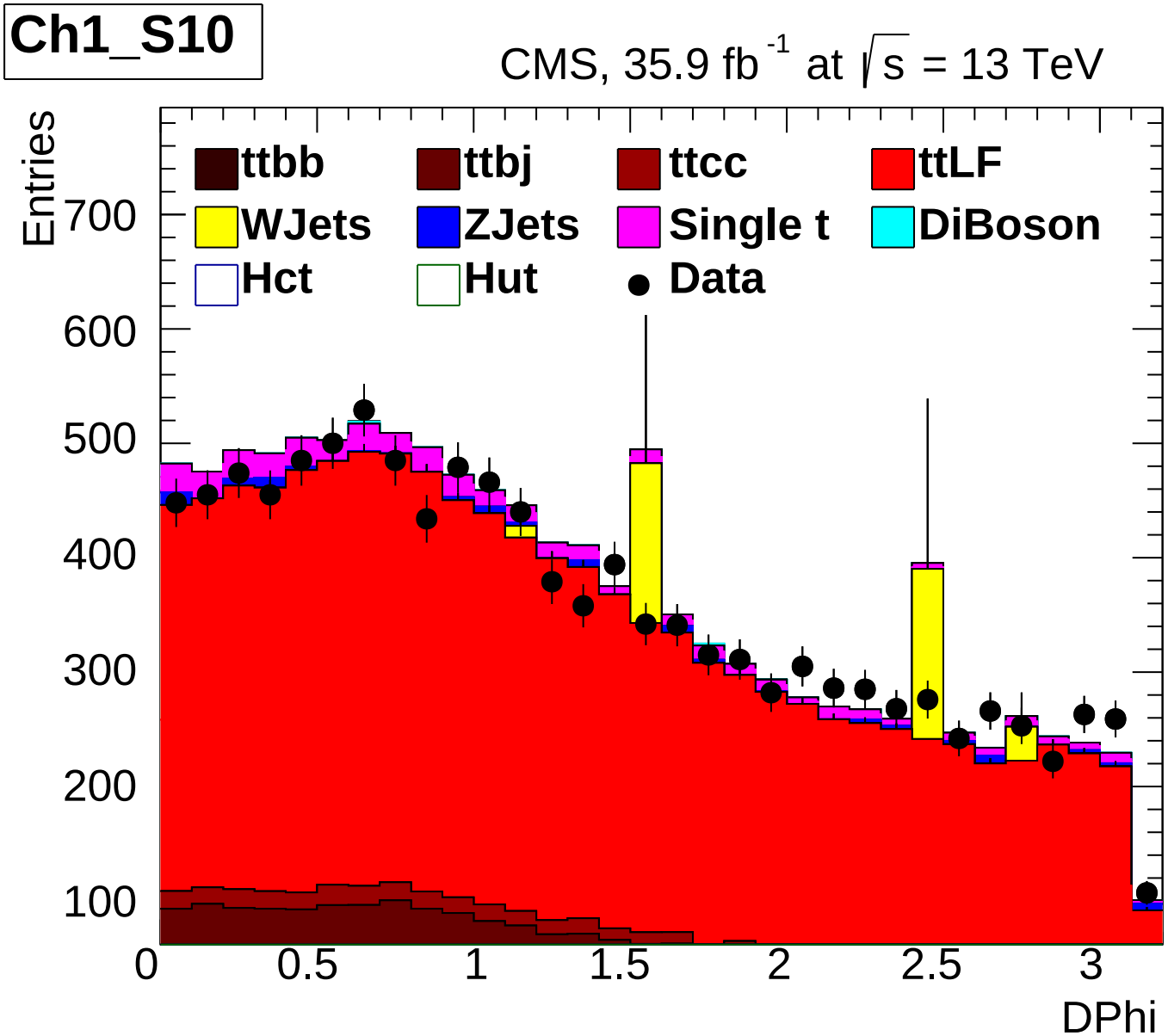

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
0
50
100
150
200
250
300
MET (GeV)

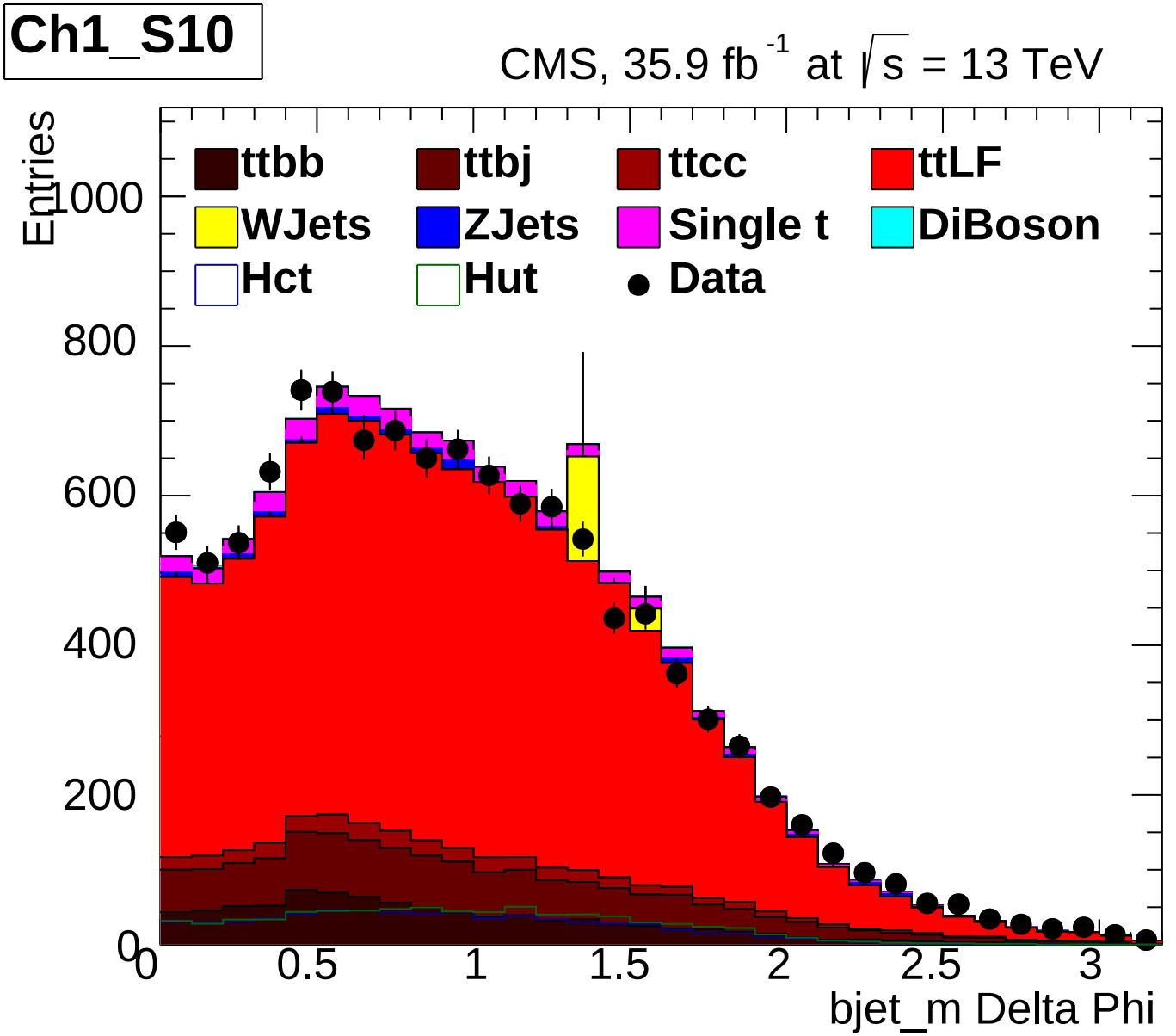

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

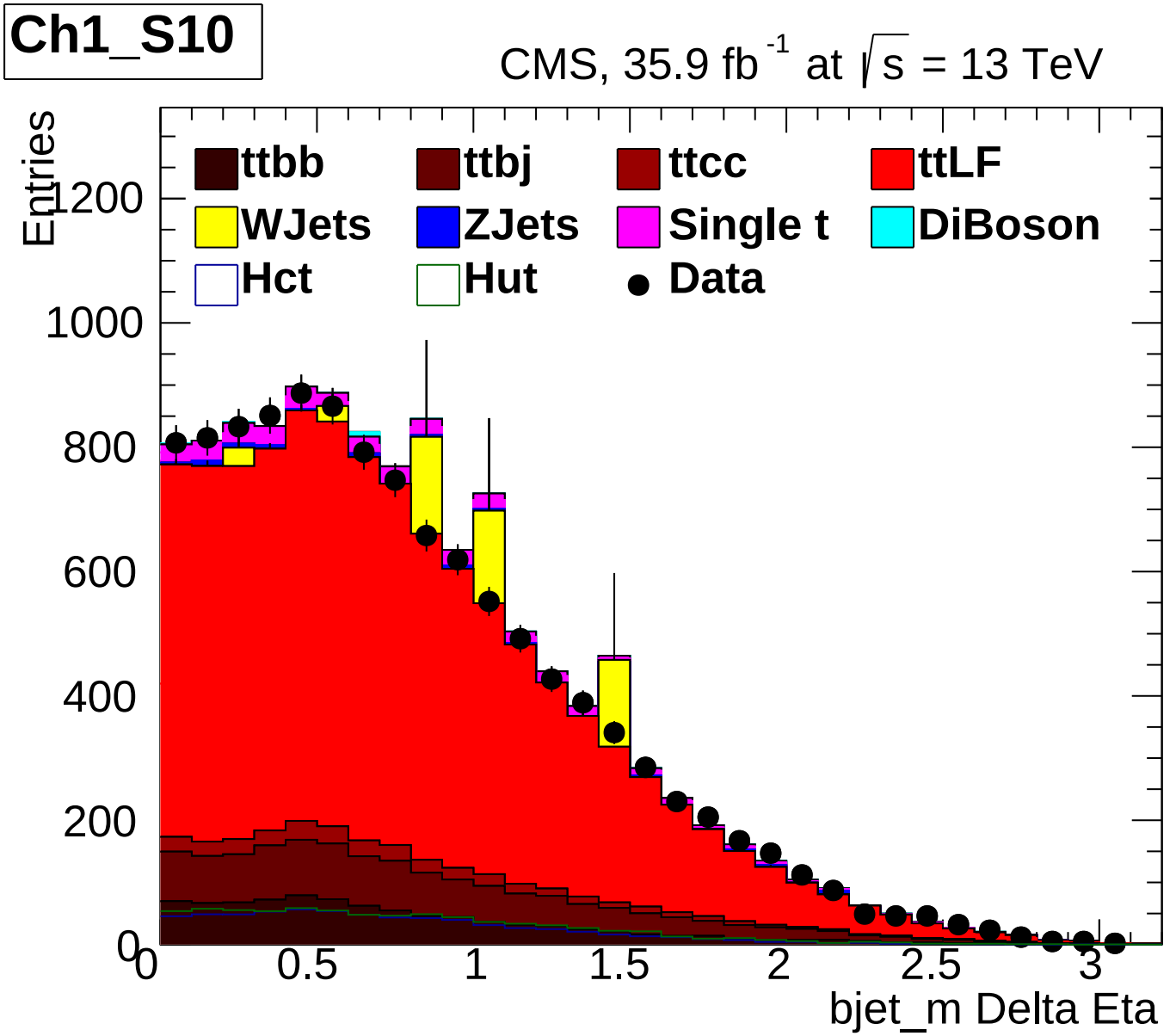

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

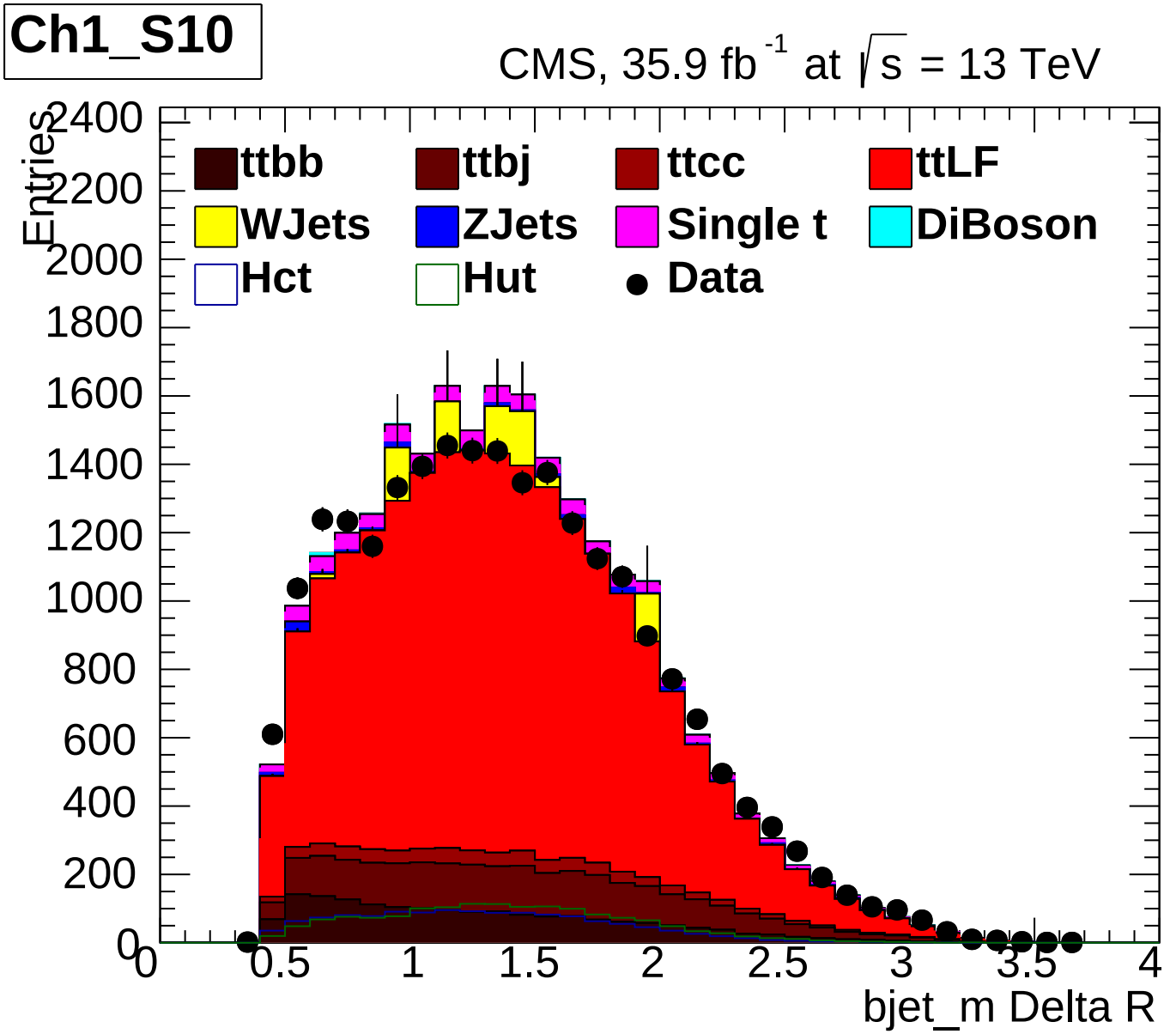

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
500
1000
1500
2000
2500
3000
3500
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

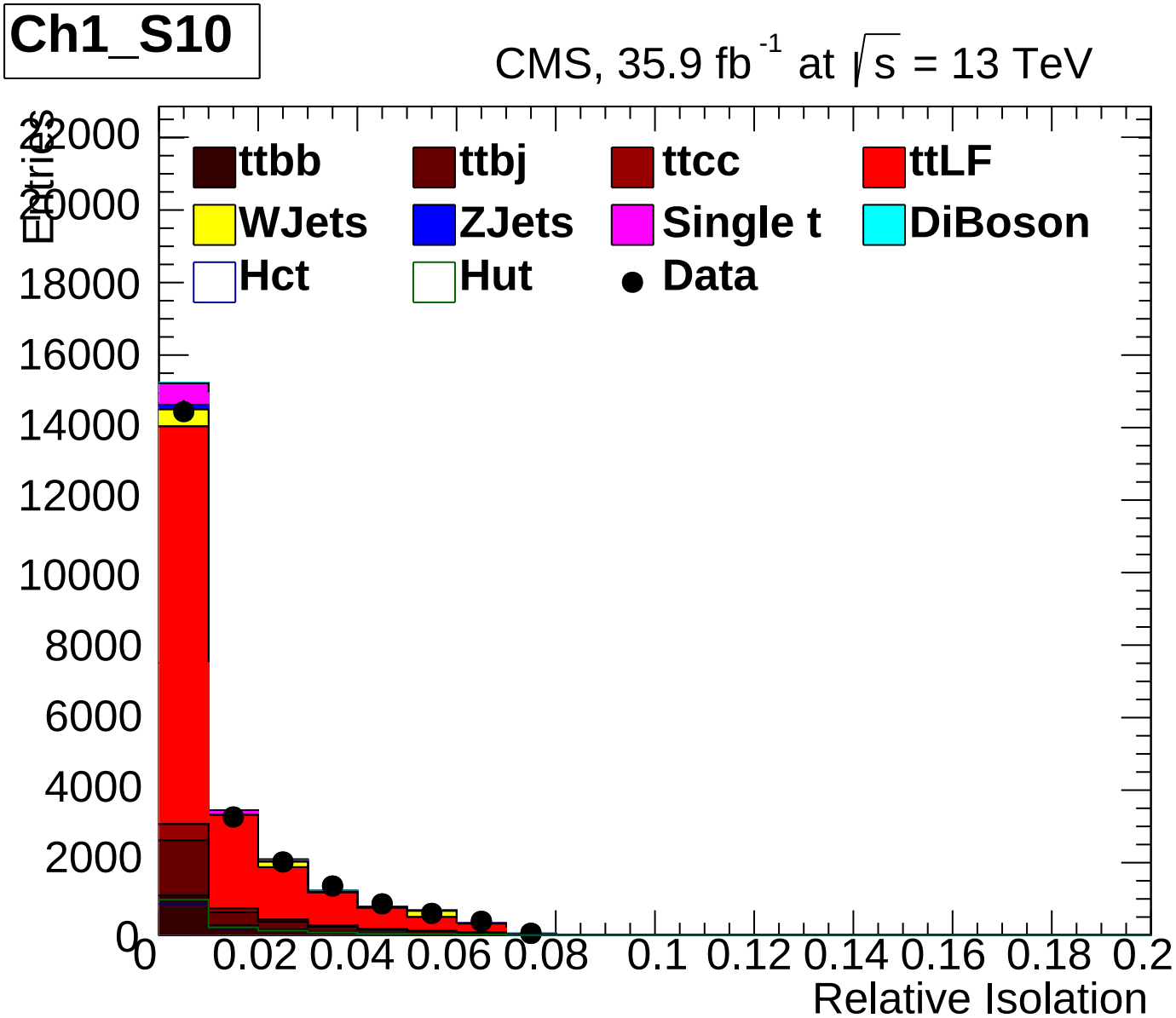

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

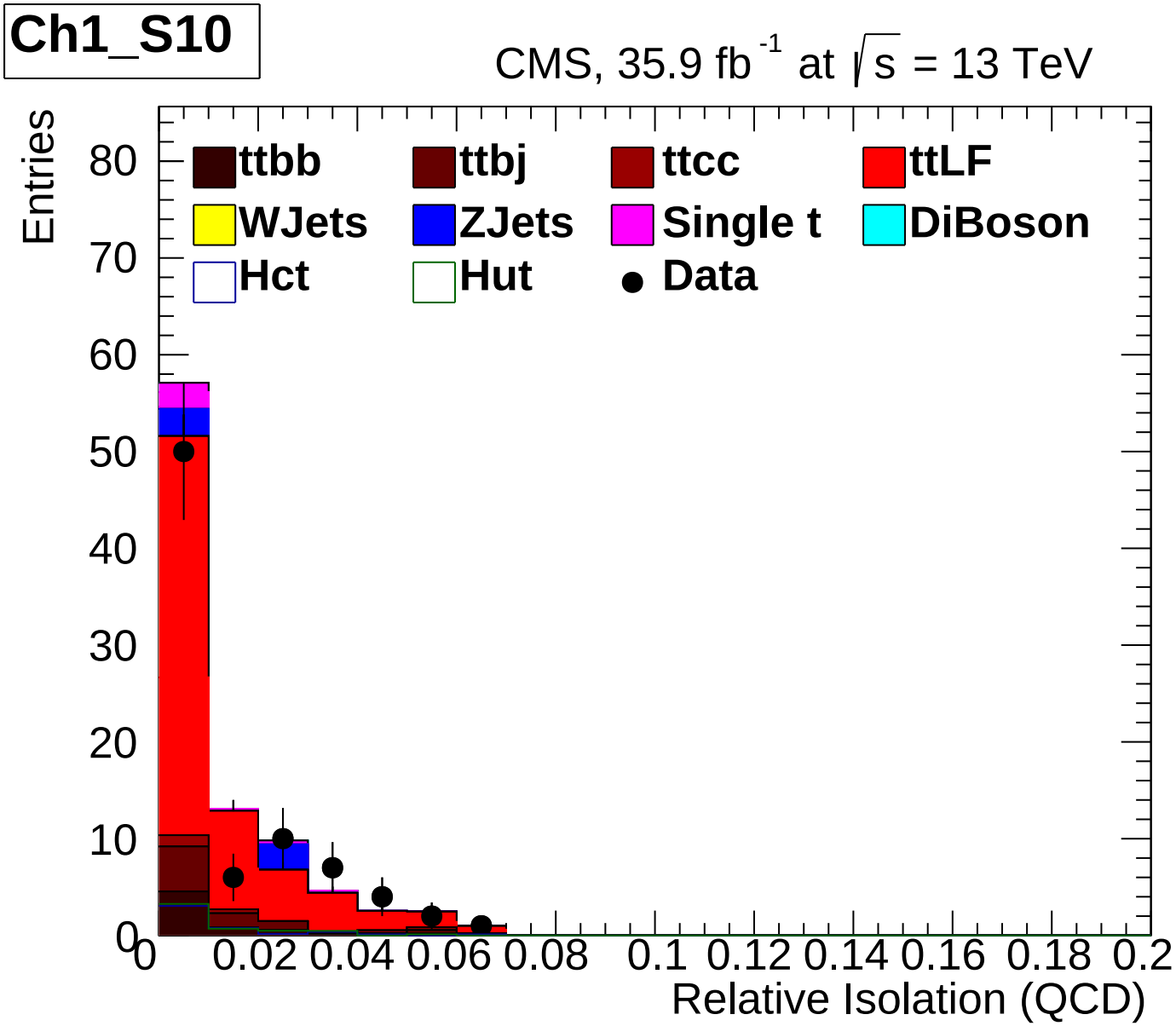

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
700
600
500
400
300
200
100
0
0.5
1
1.5
2
2.5
3
DPhi

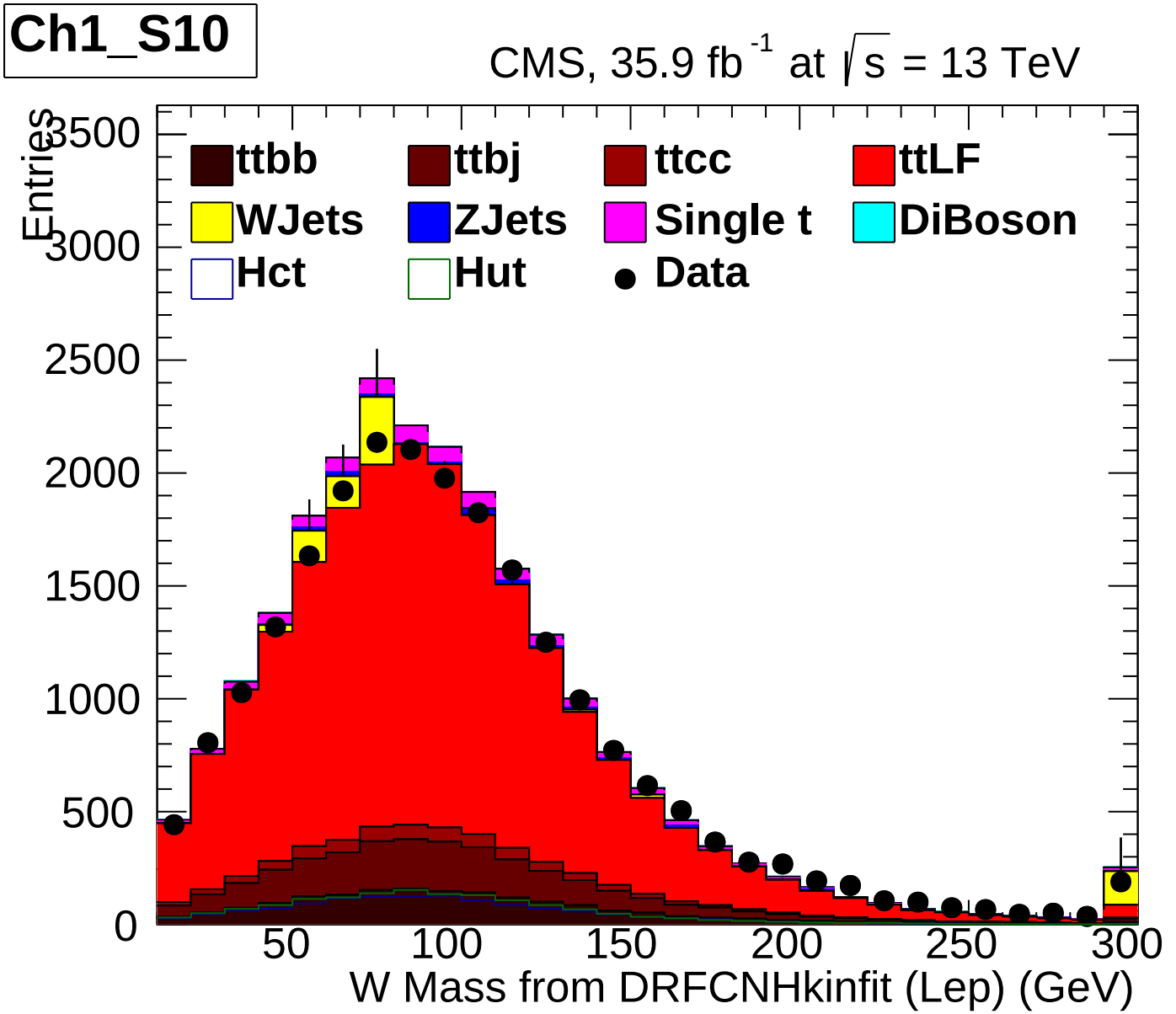

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

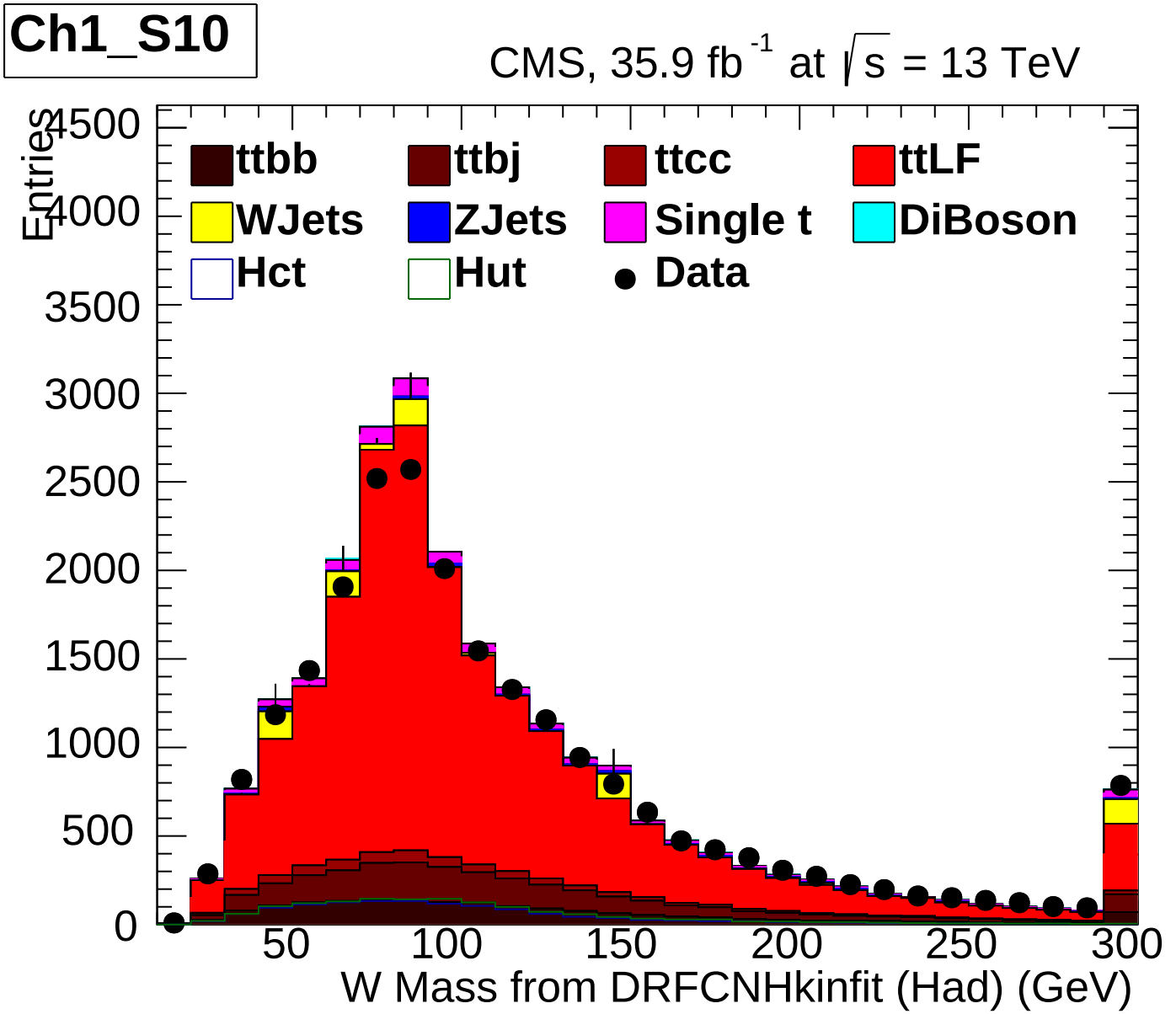

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

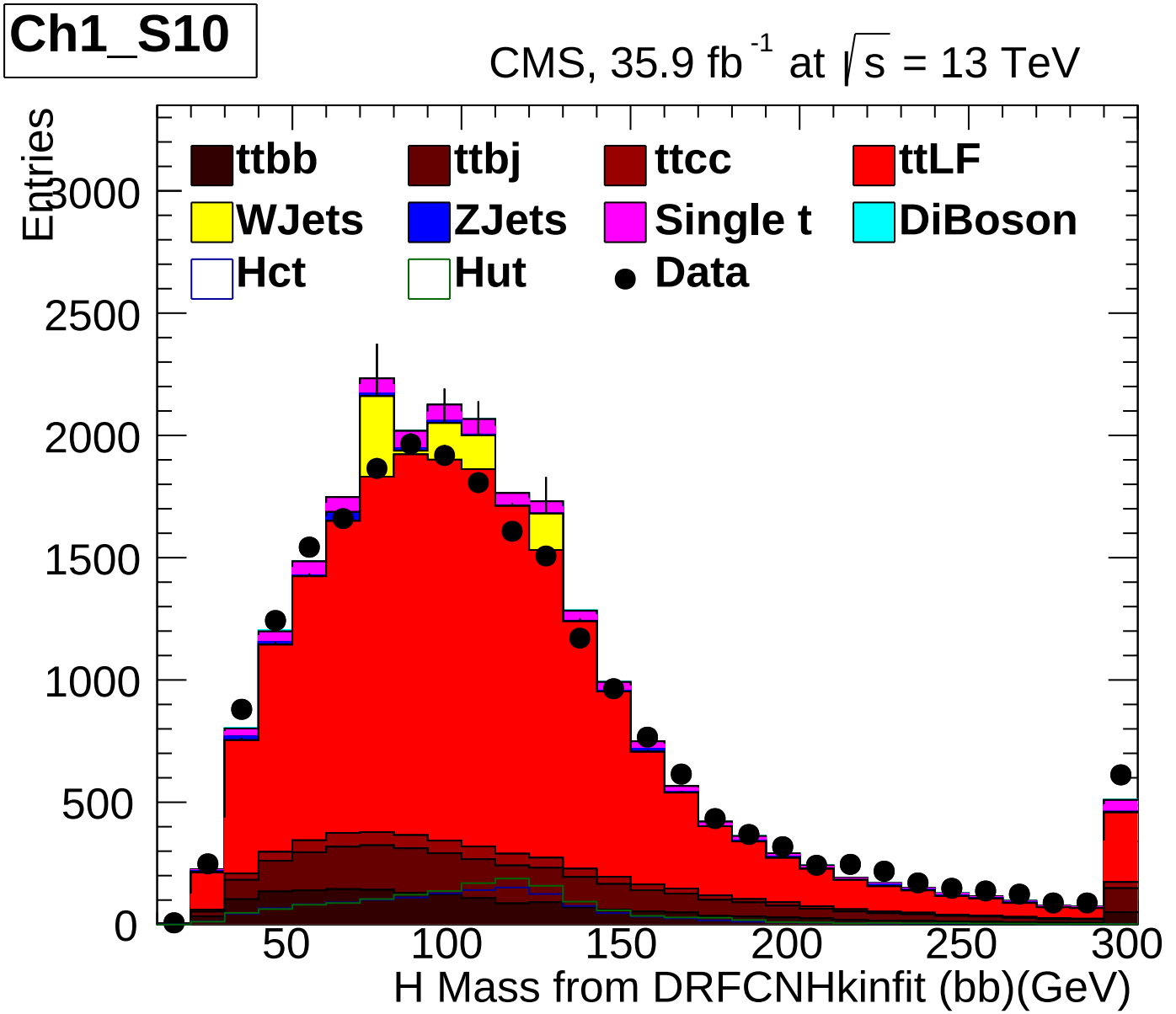

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10
20
30
40
50
60
70
80
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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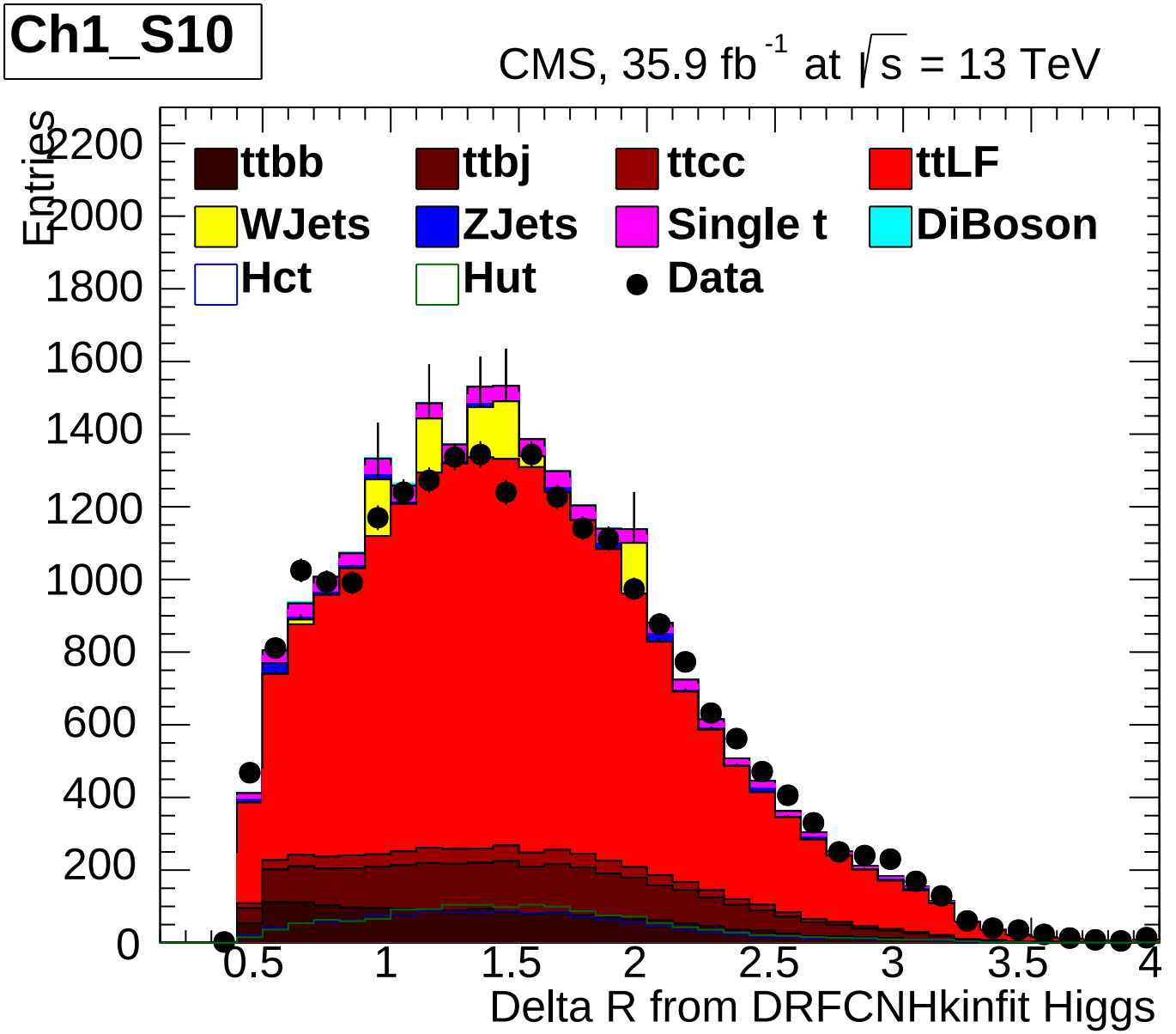
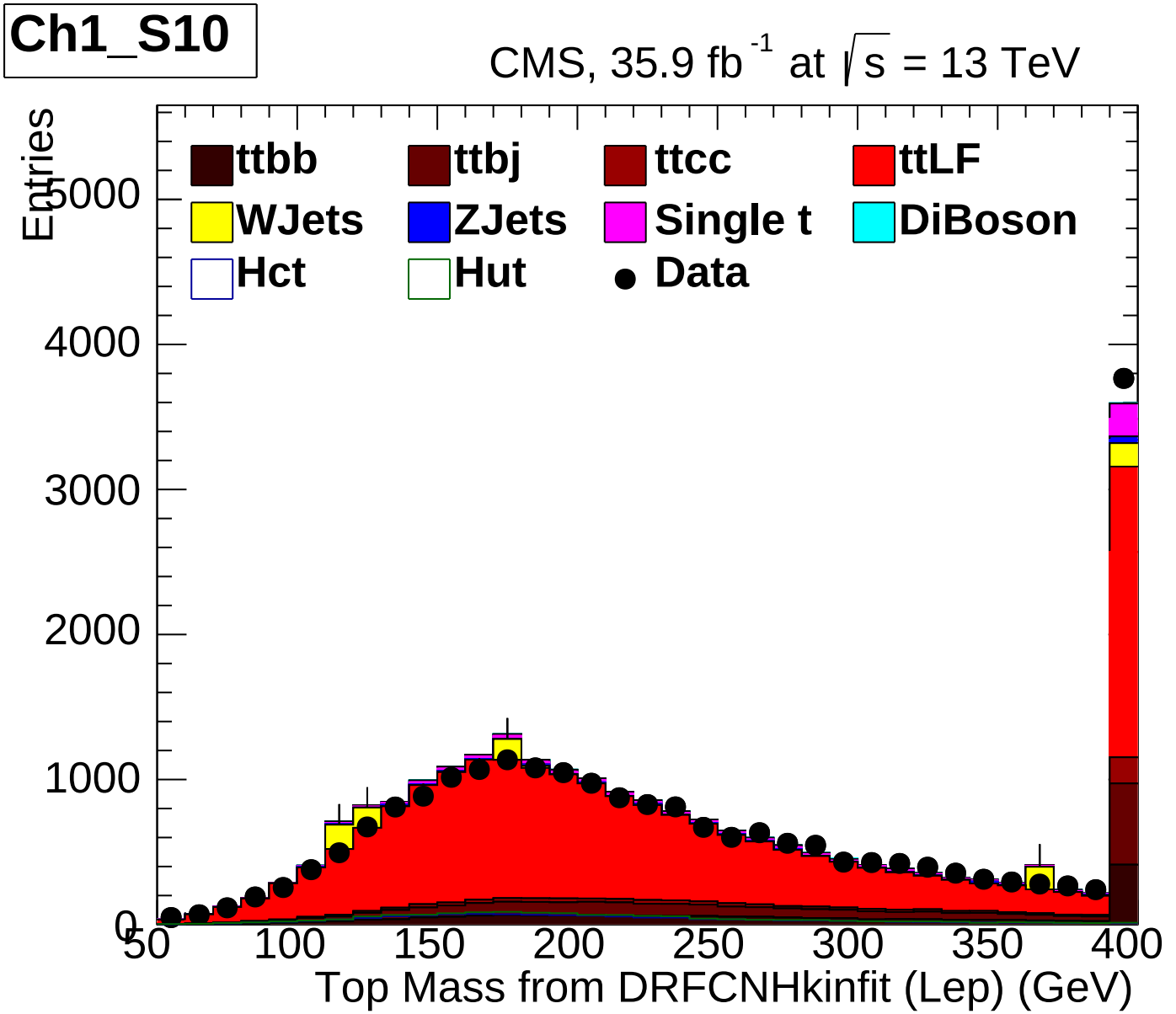
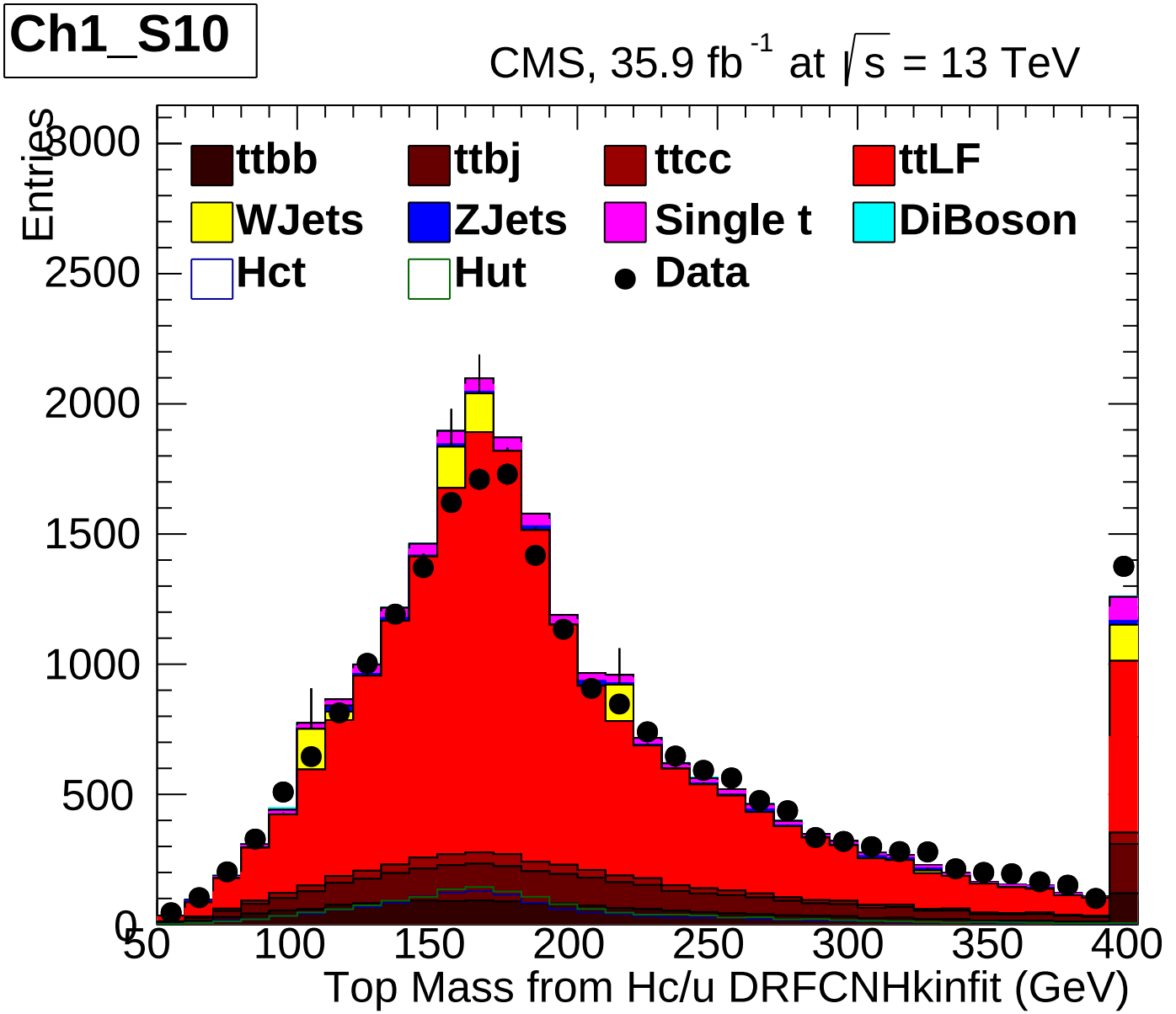
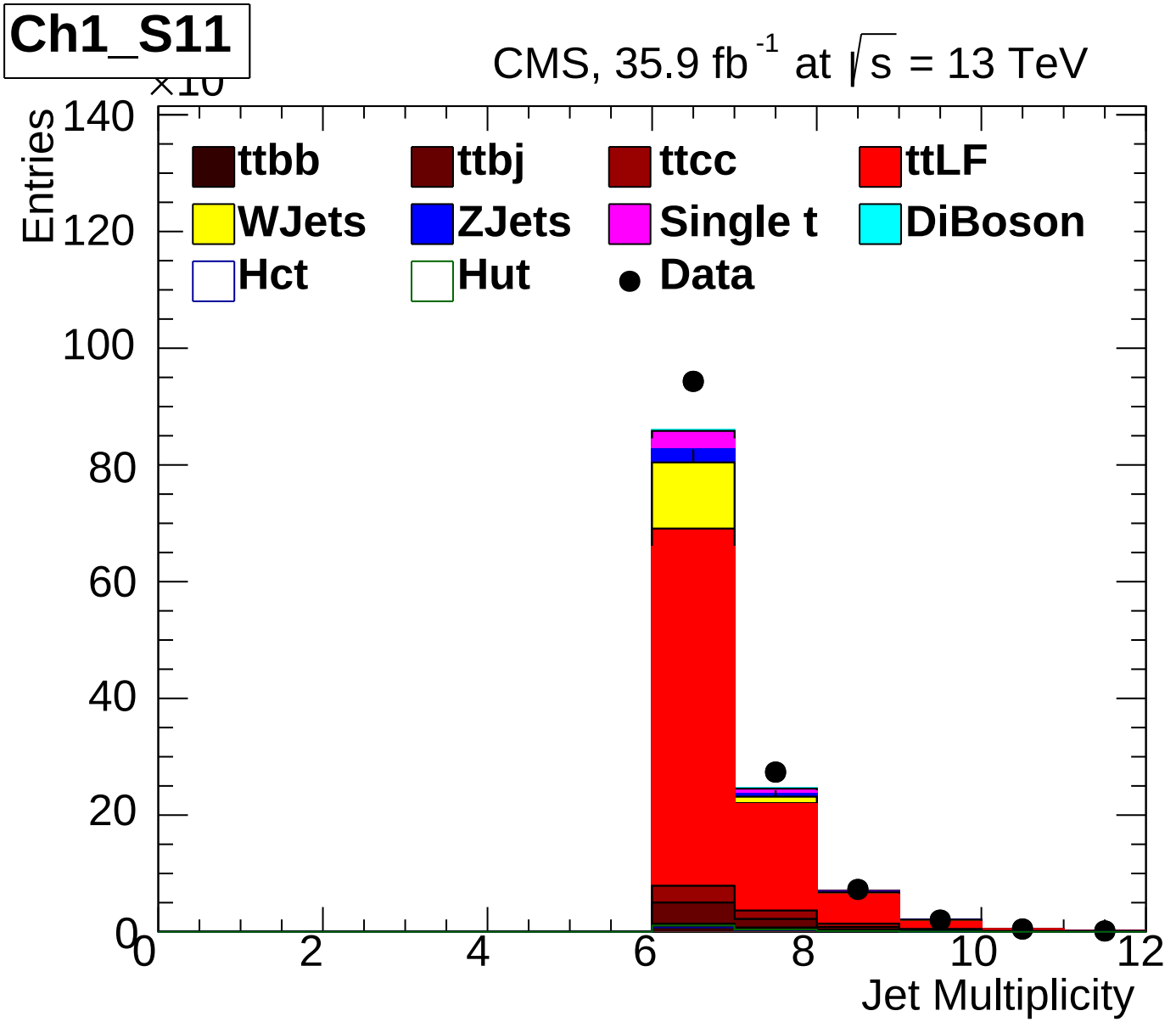
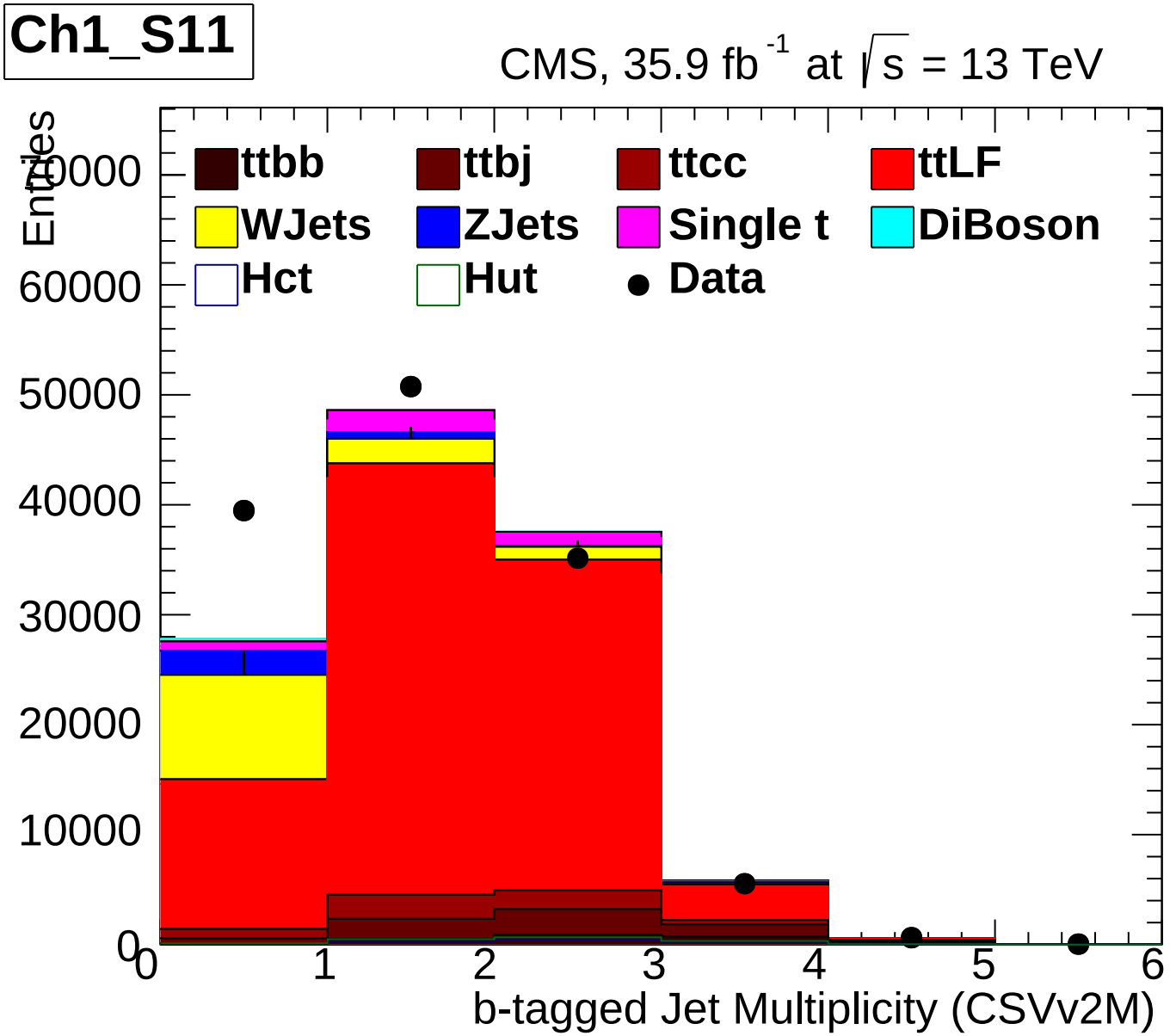
1000
1500
2000
2500
3000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

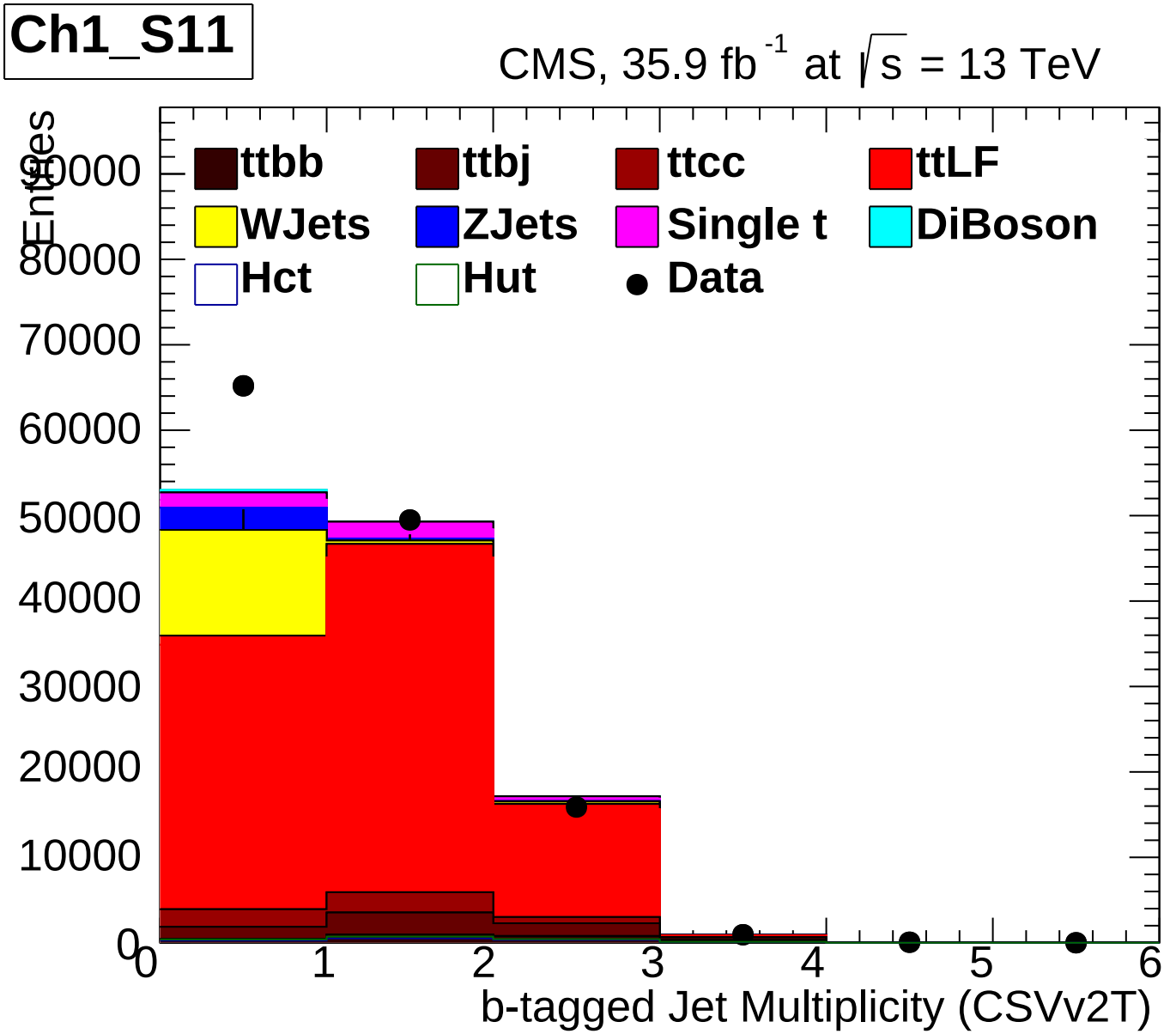

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

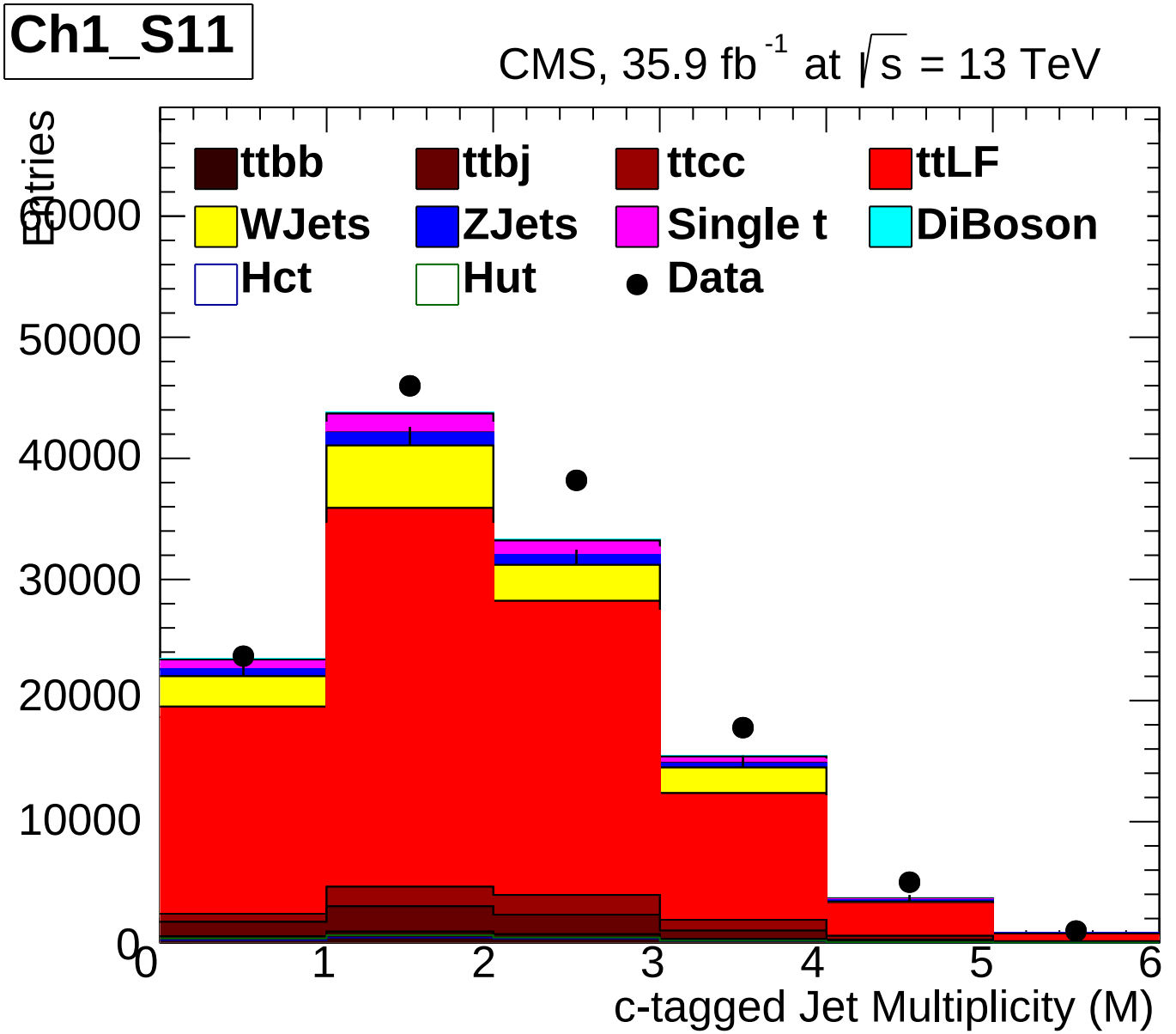

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

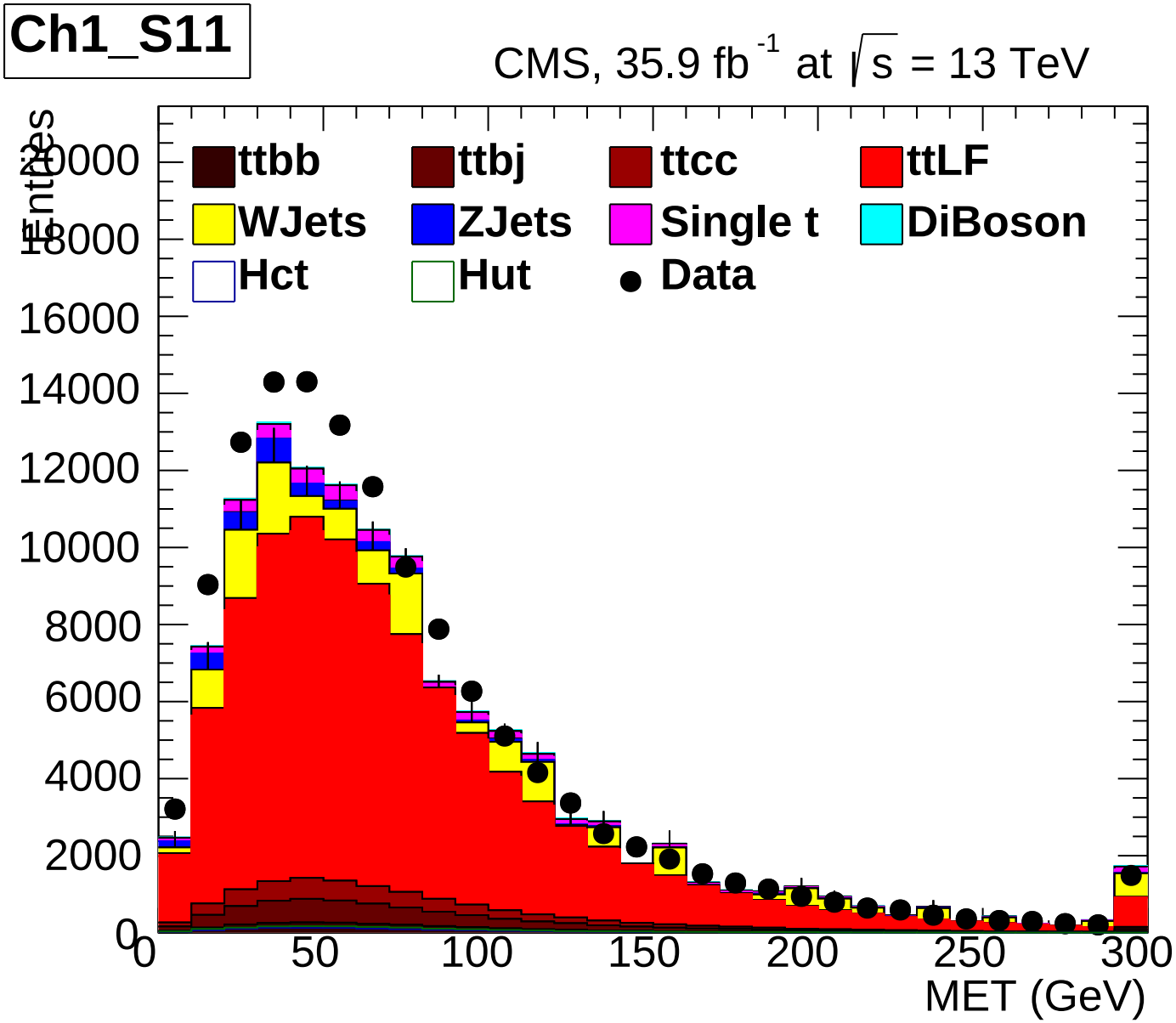

Ch1_S10
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

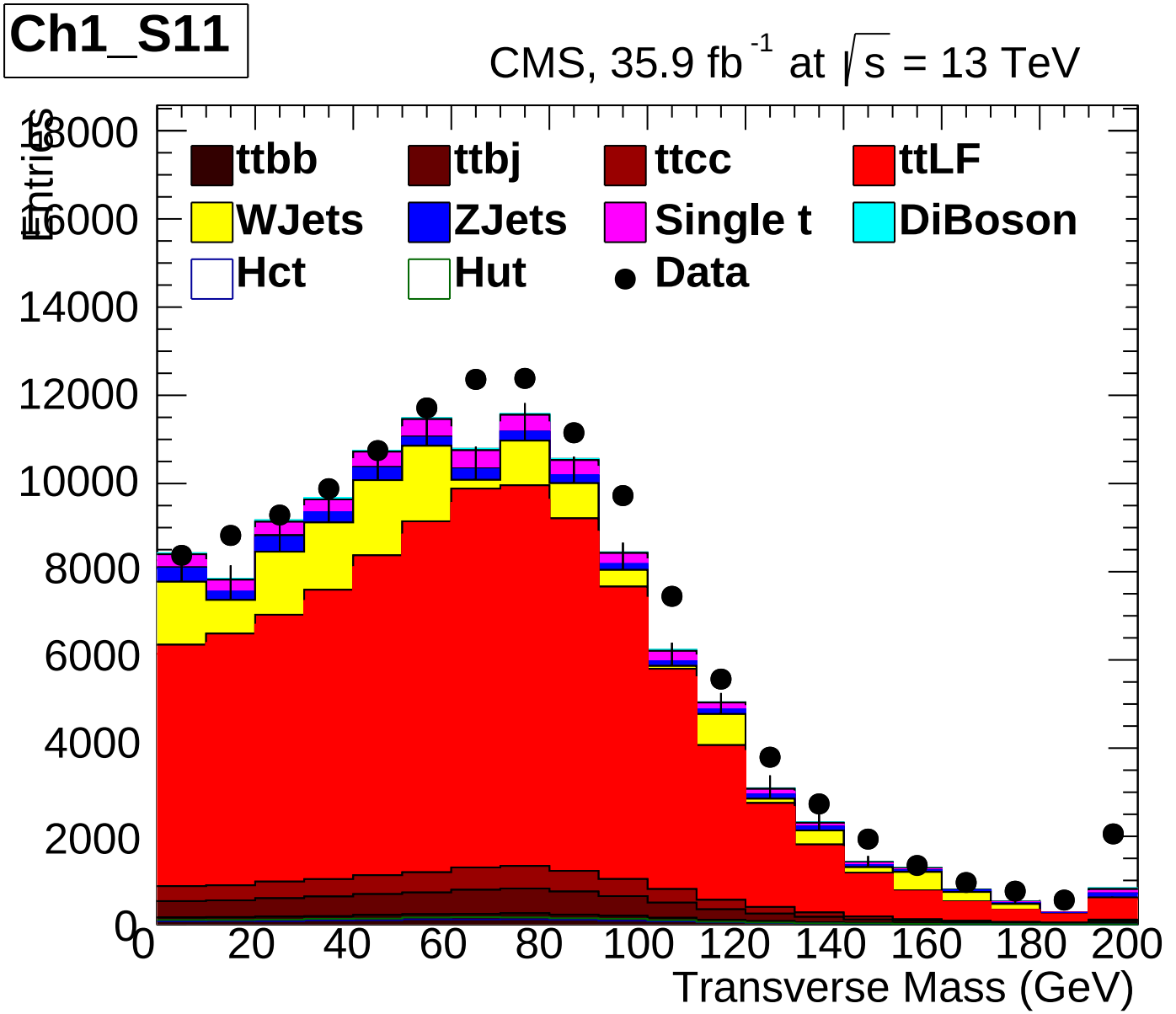

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
×10
Entries
140
120
100
80
60
40
20
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2
4
6
8
10
12
Jet Multiplicity

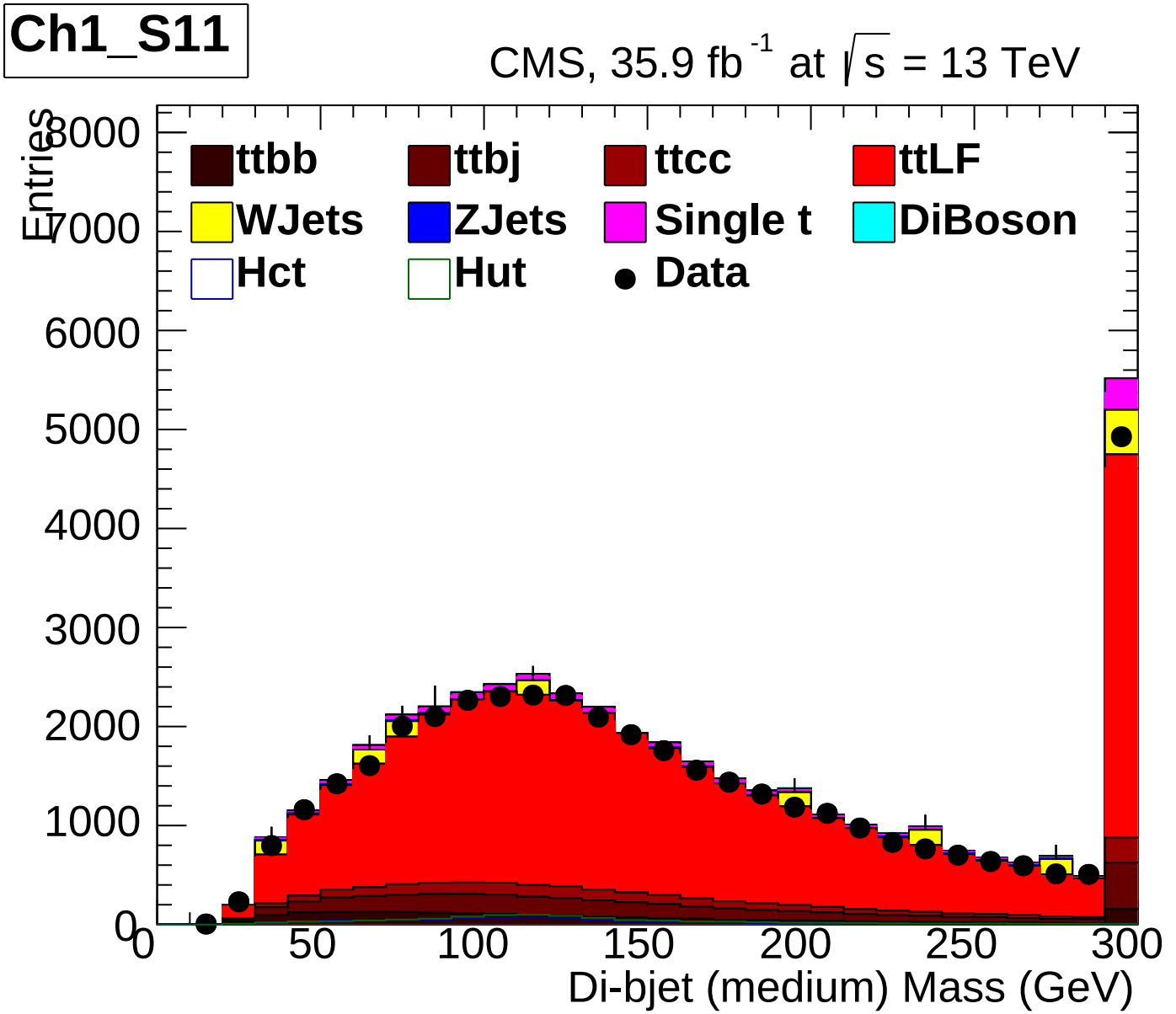

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
70000
60000
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

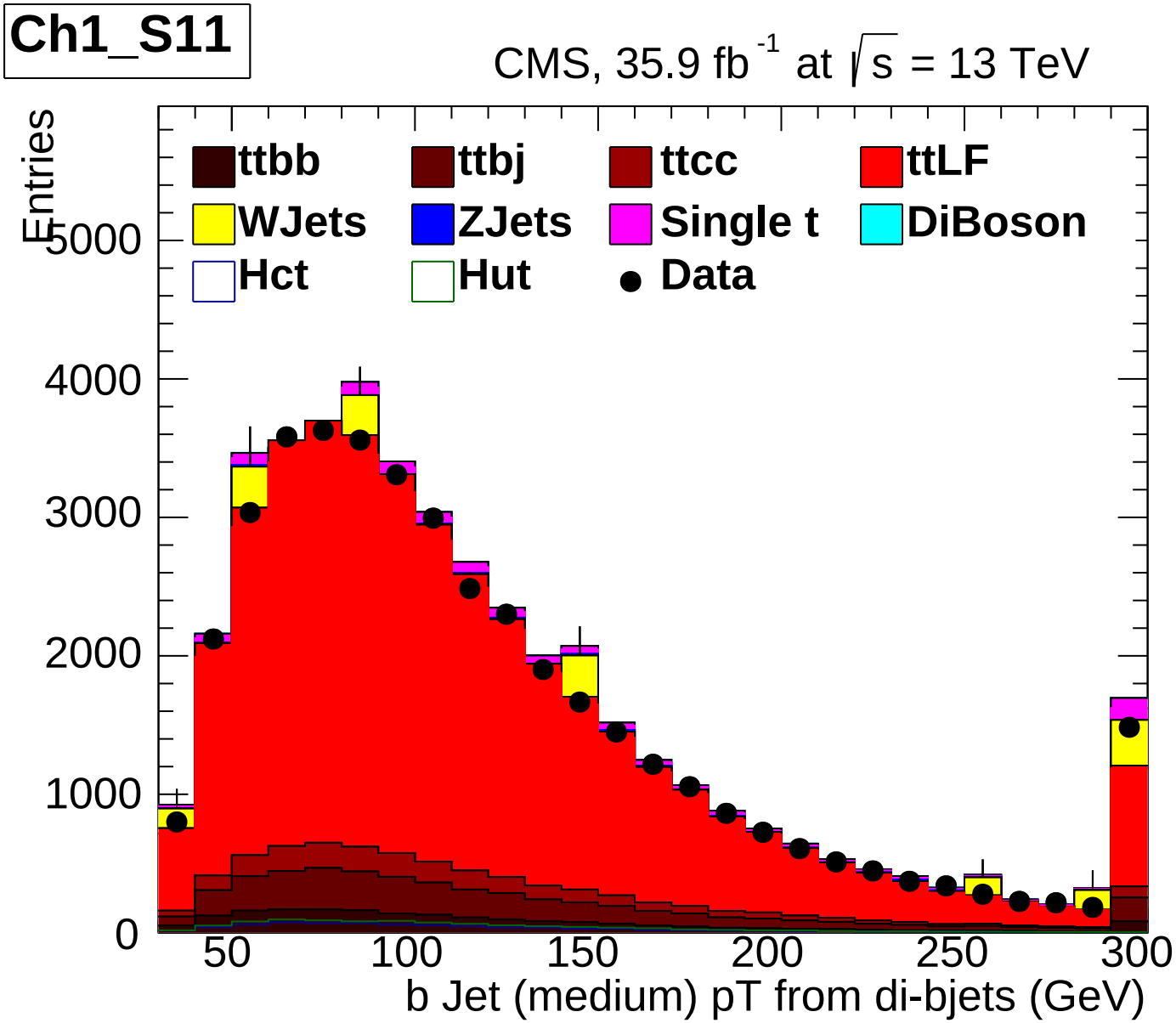

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

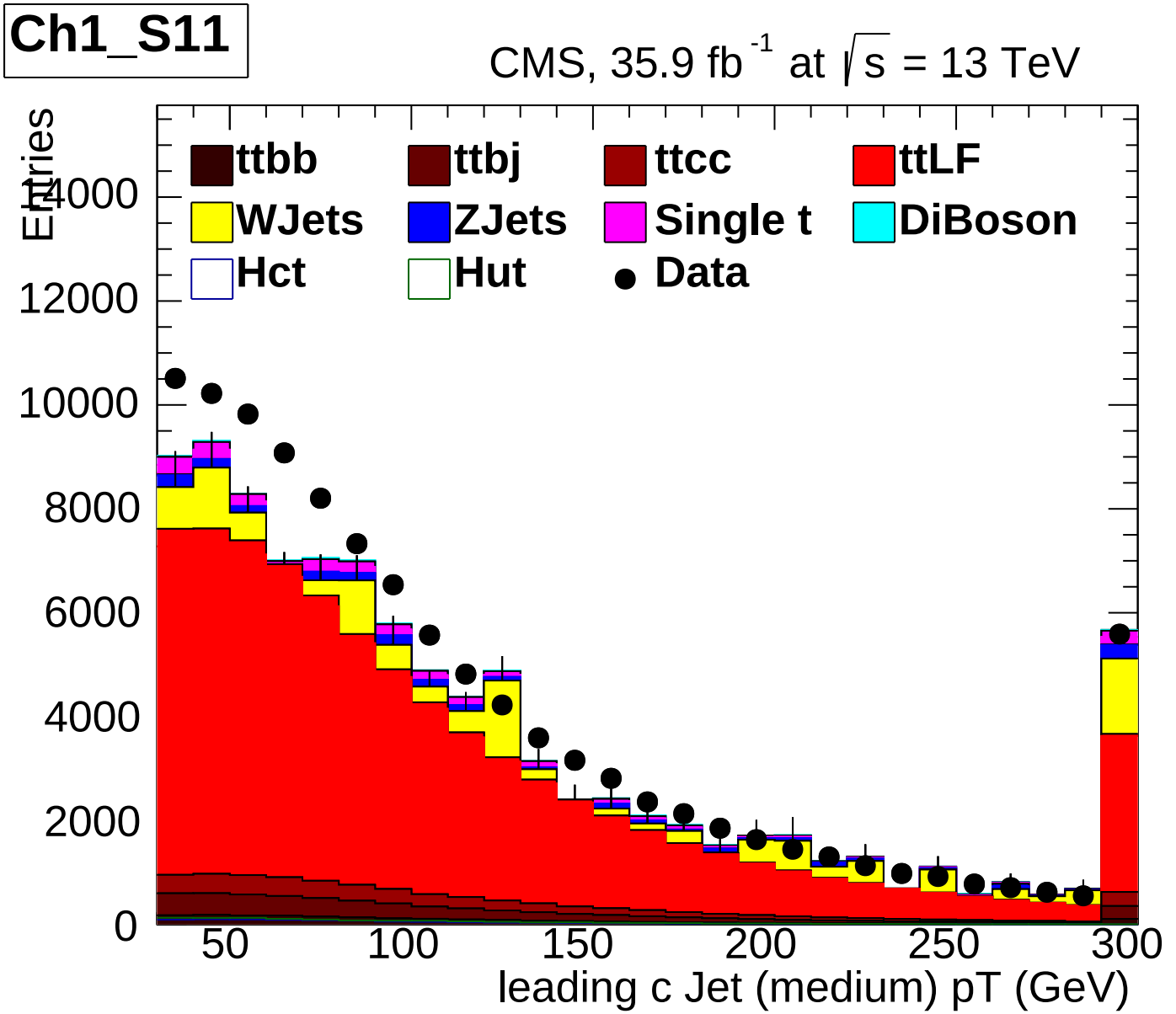

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
10000
20000
30000
40000
50000
60000
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
0
50
100
150
200
250
300
MET (GeV)


Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch1_S11
CMS, 35.9 fb -1 at √s = 13 TeV
Entries
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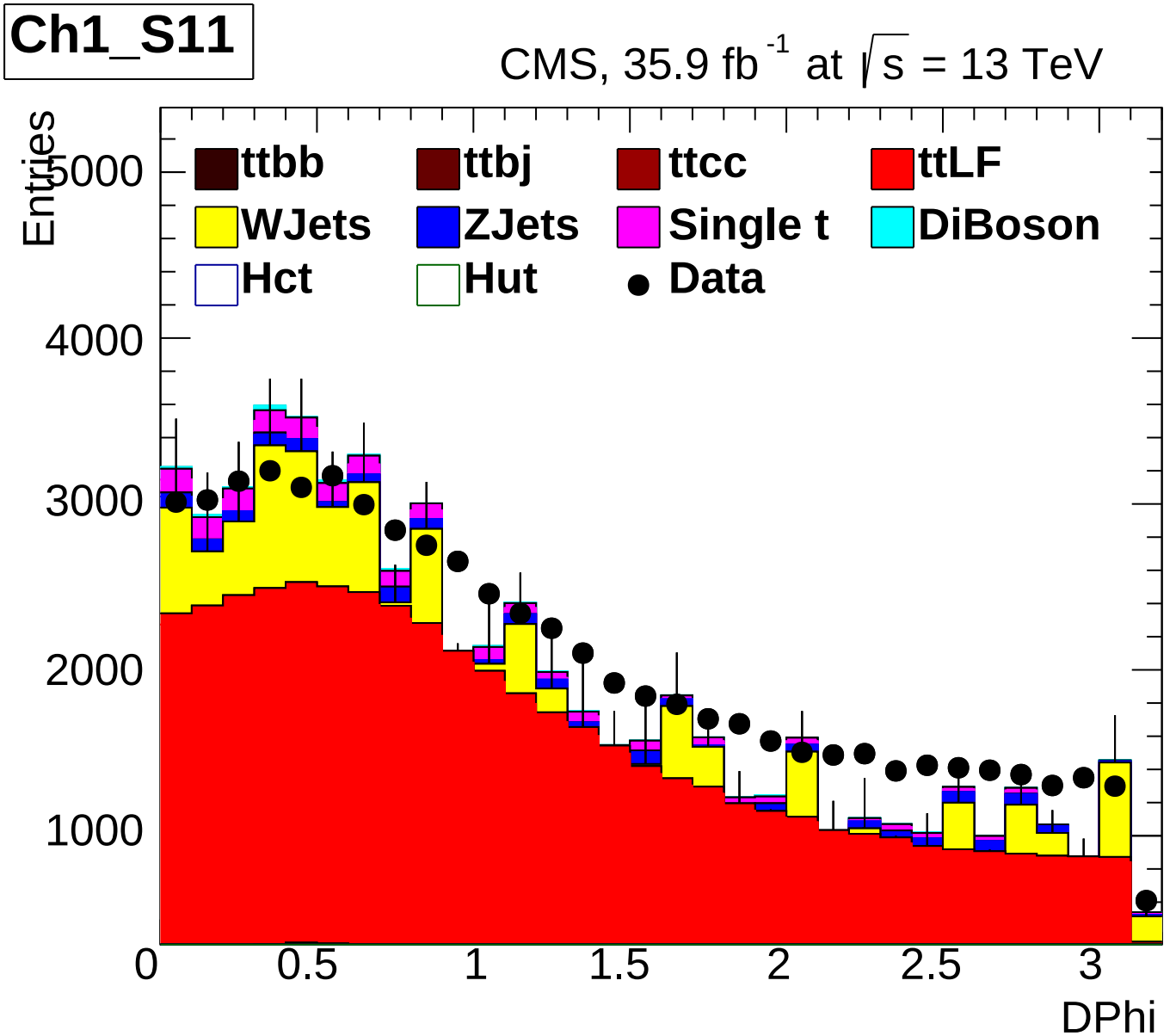
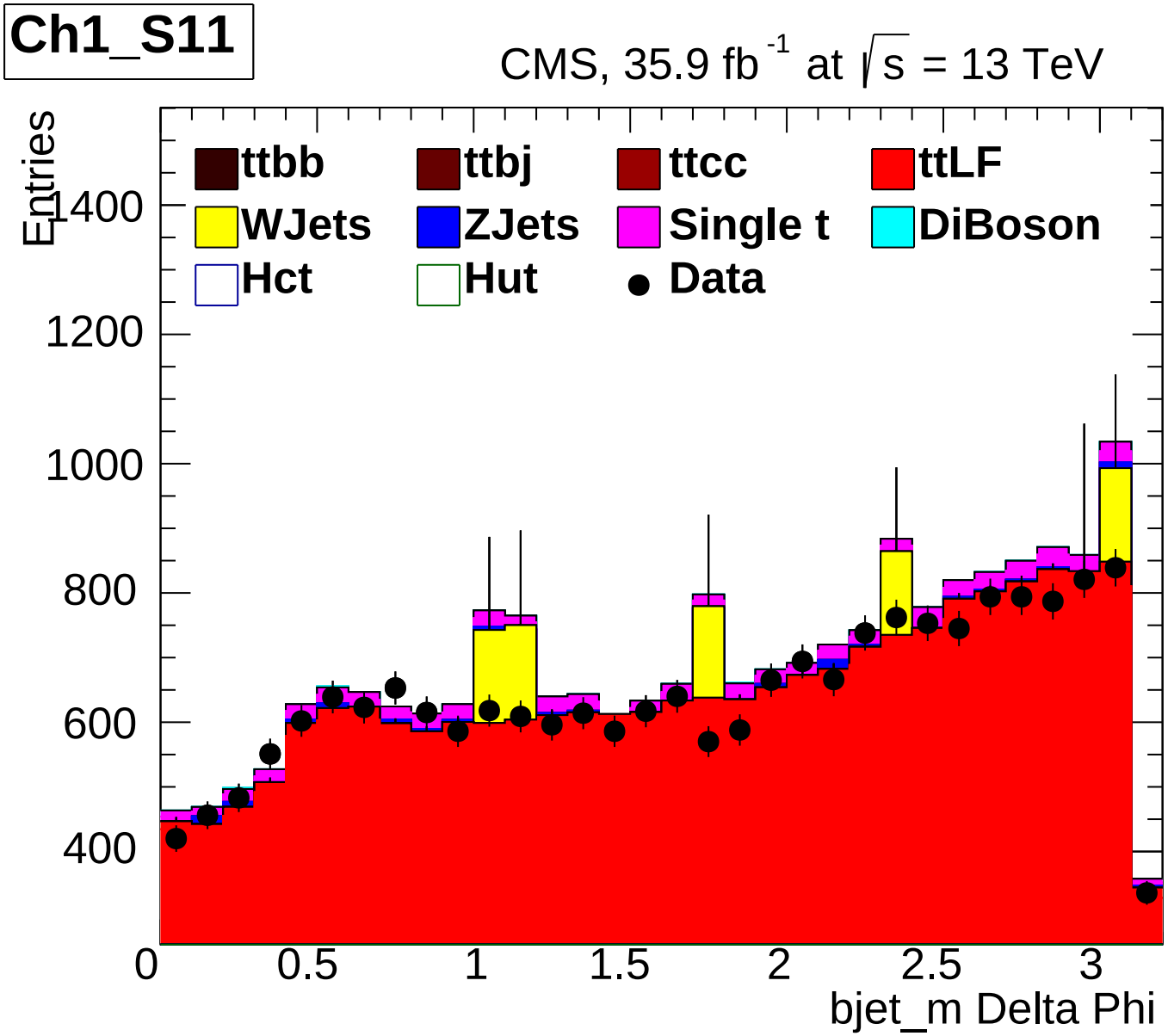
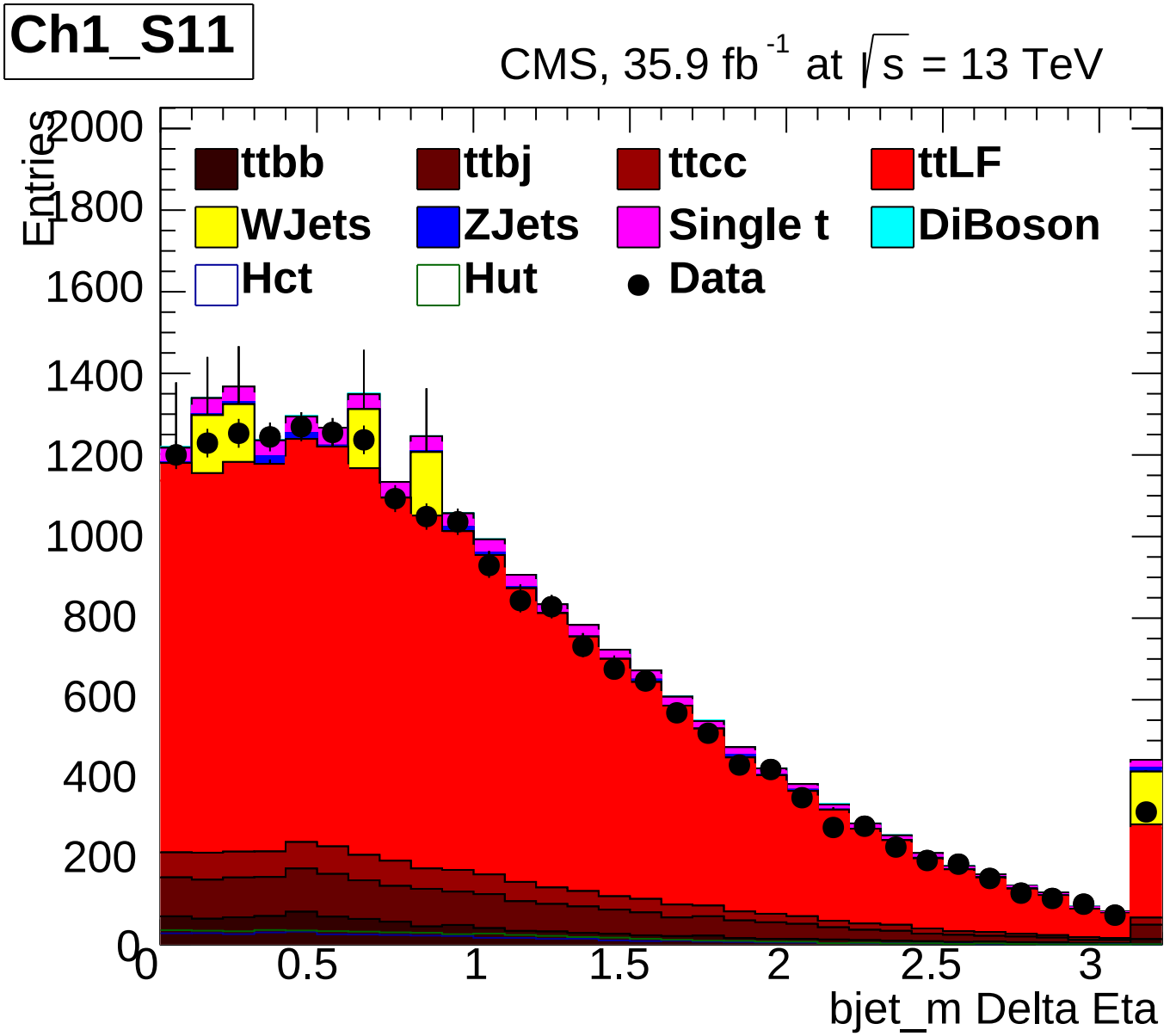
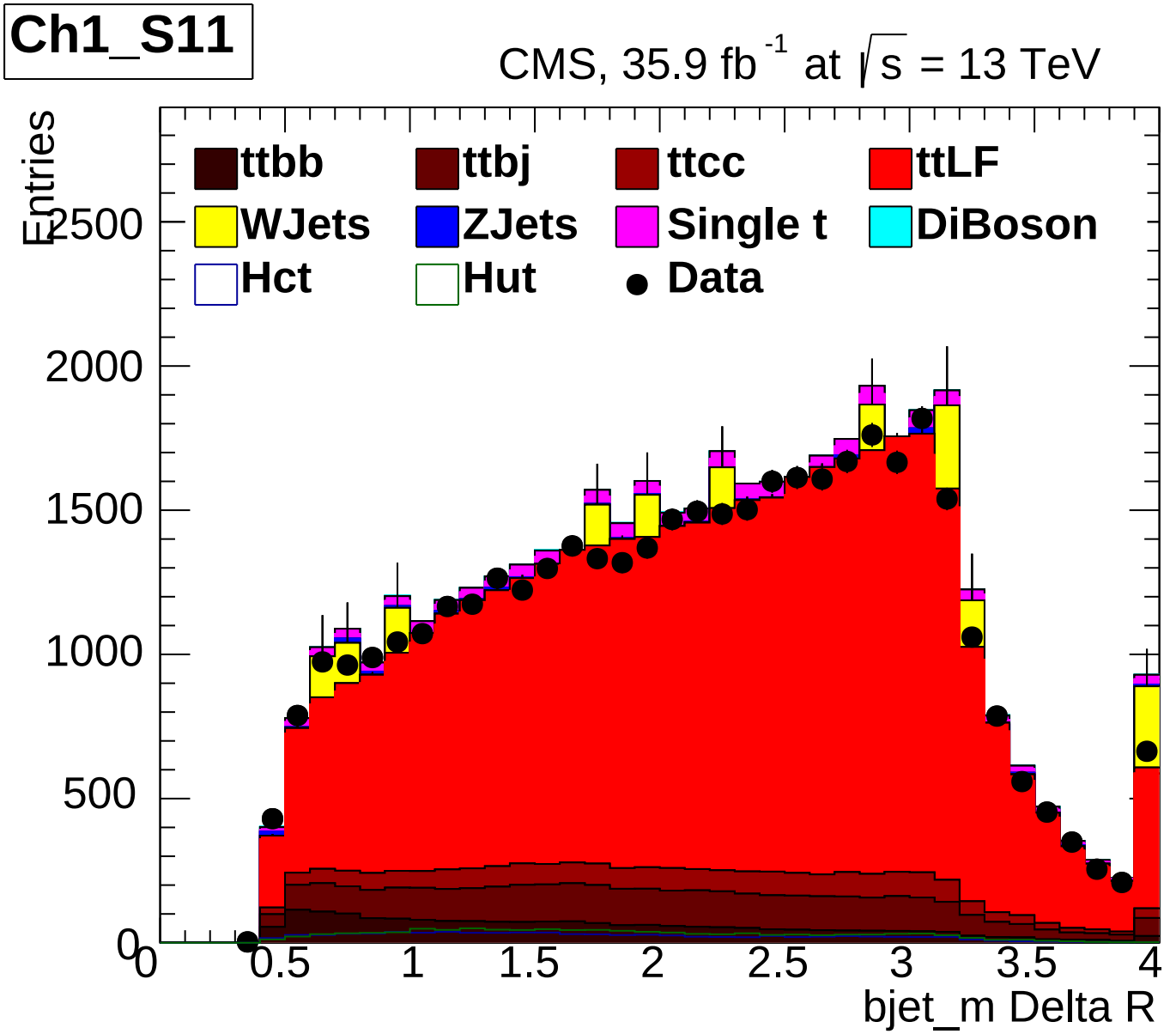
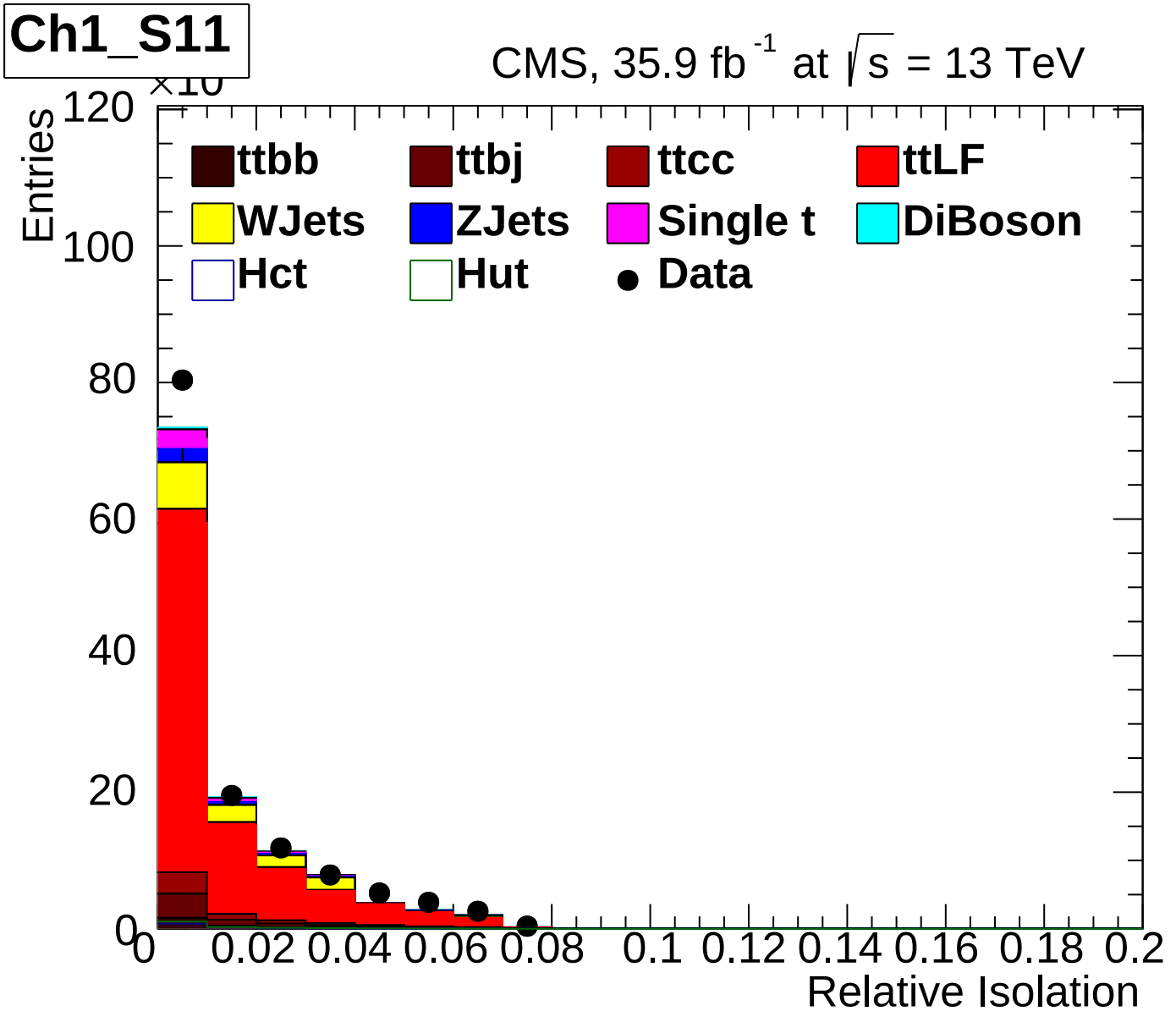
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
2000
4000
6000
8000
10000
12000
14000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

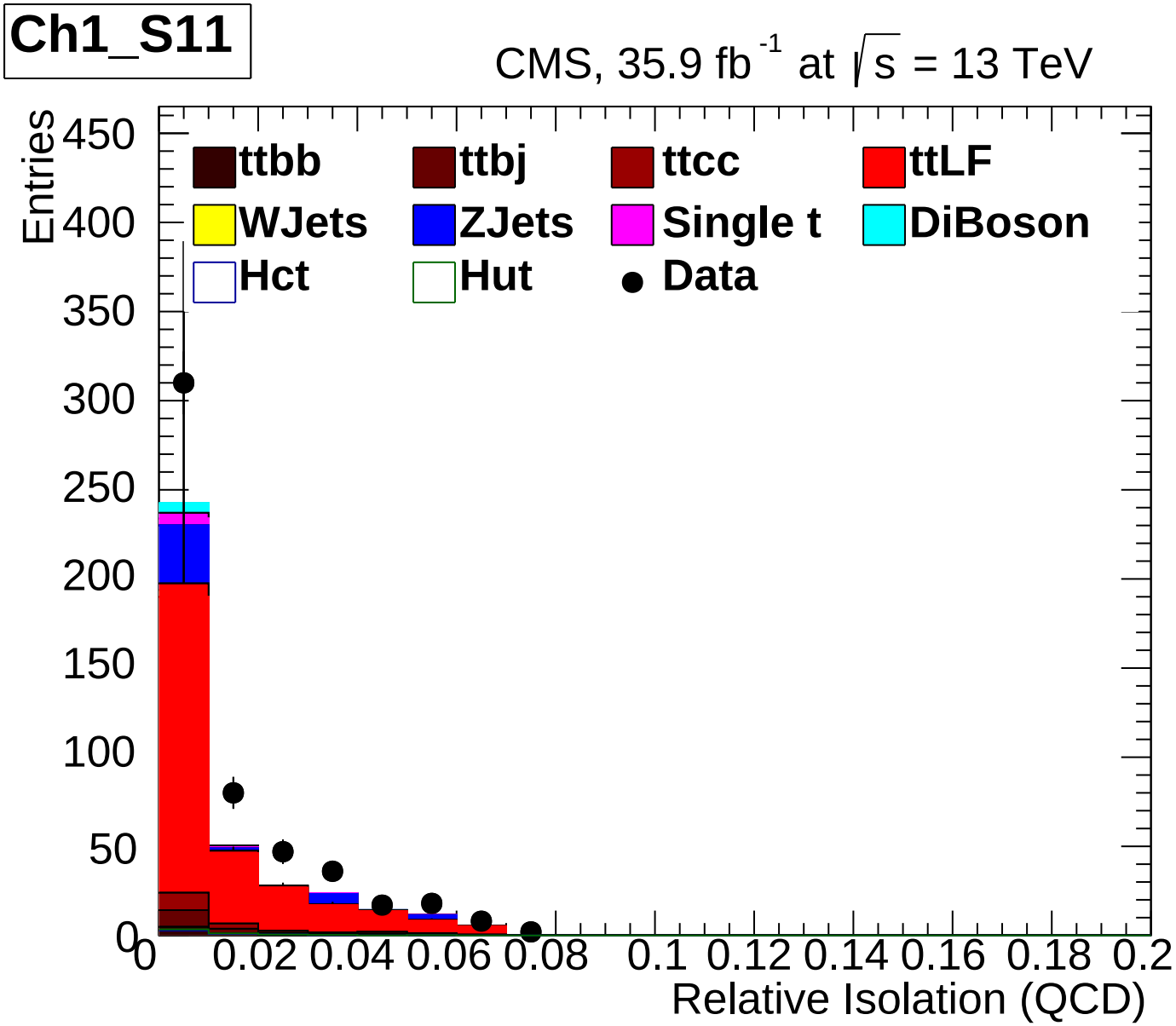

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
5000
4000
3000
2000
1000
0
0.5
1
1.5
2
2.5
3
DPhi

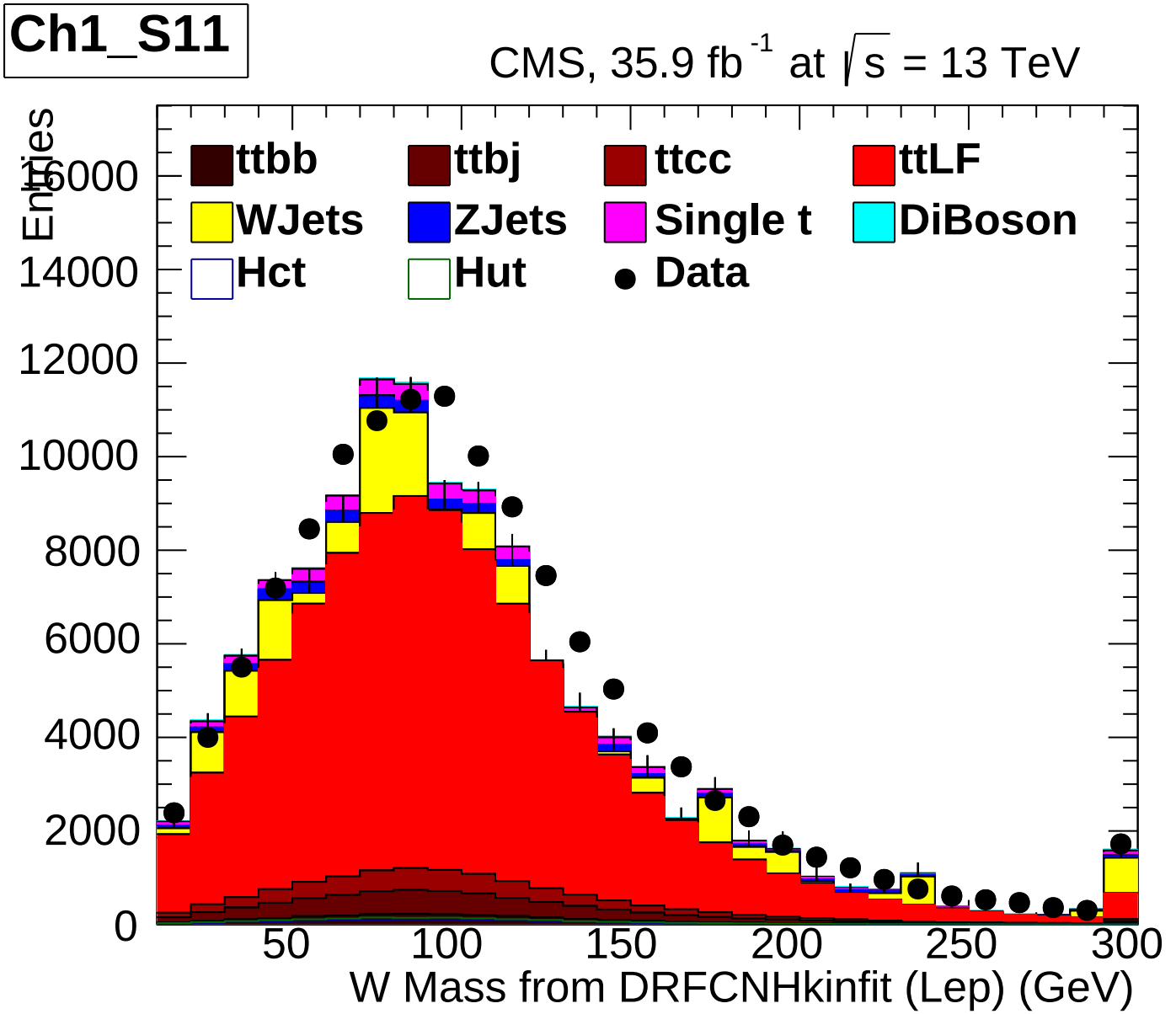

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1400
1200
1000
800
600
400
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

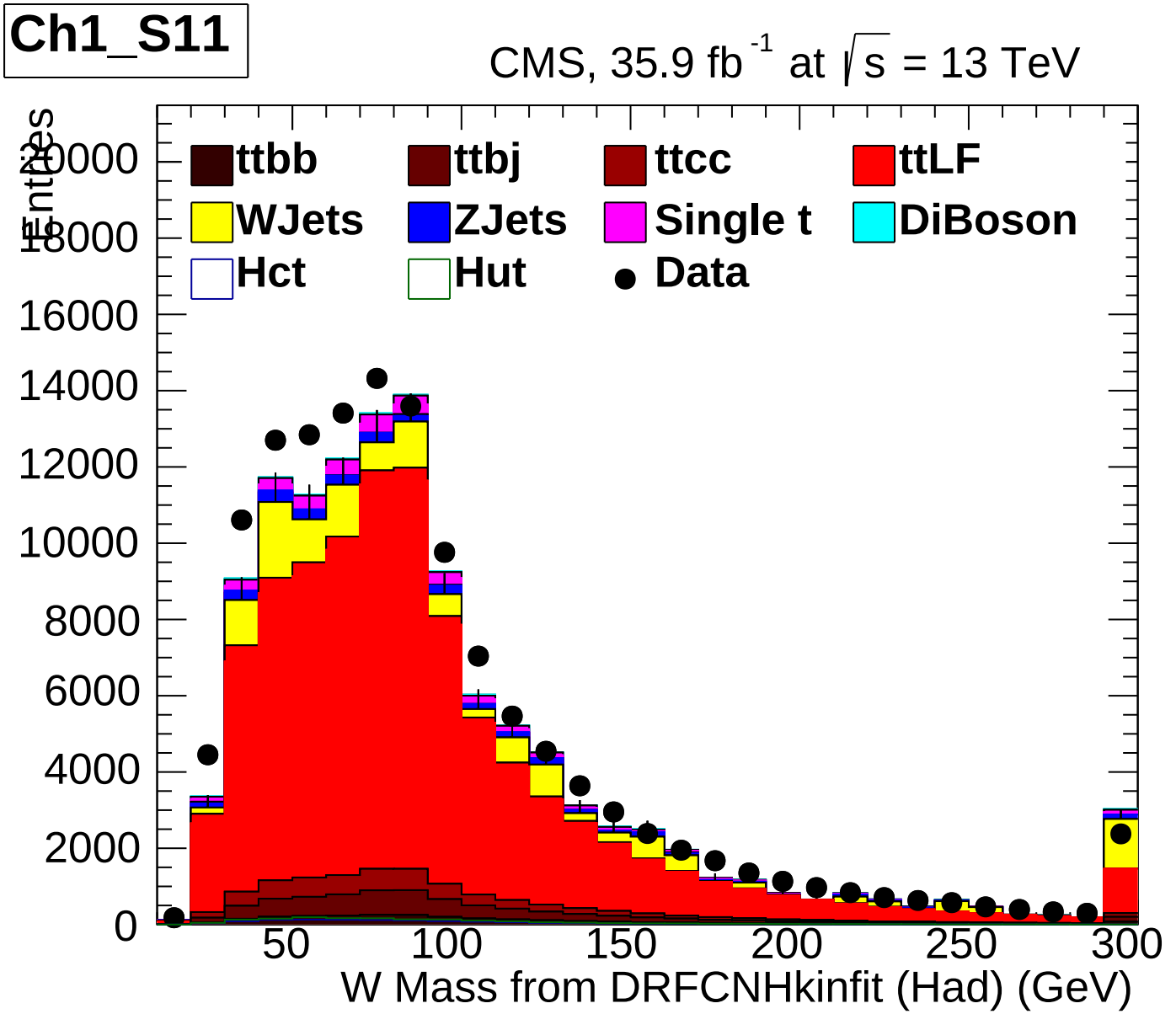

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

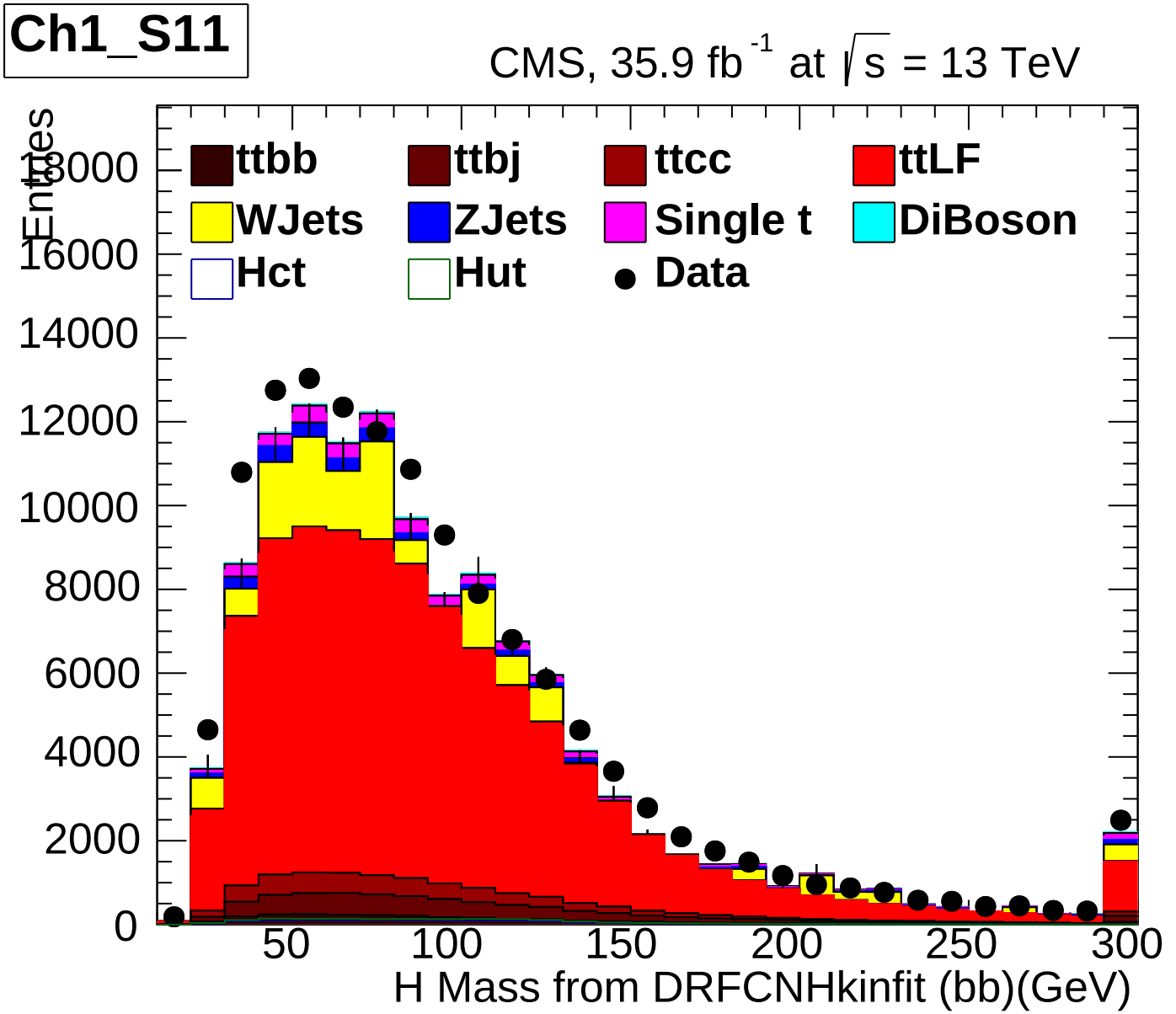

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

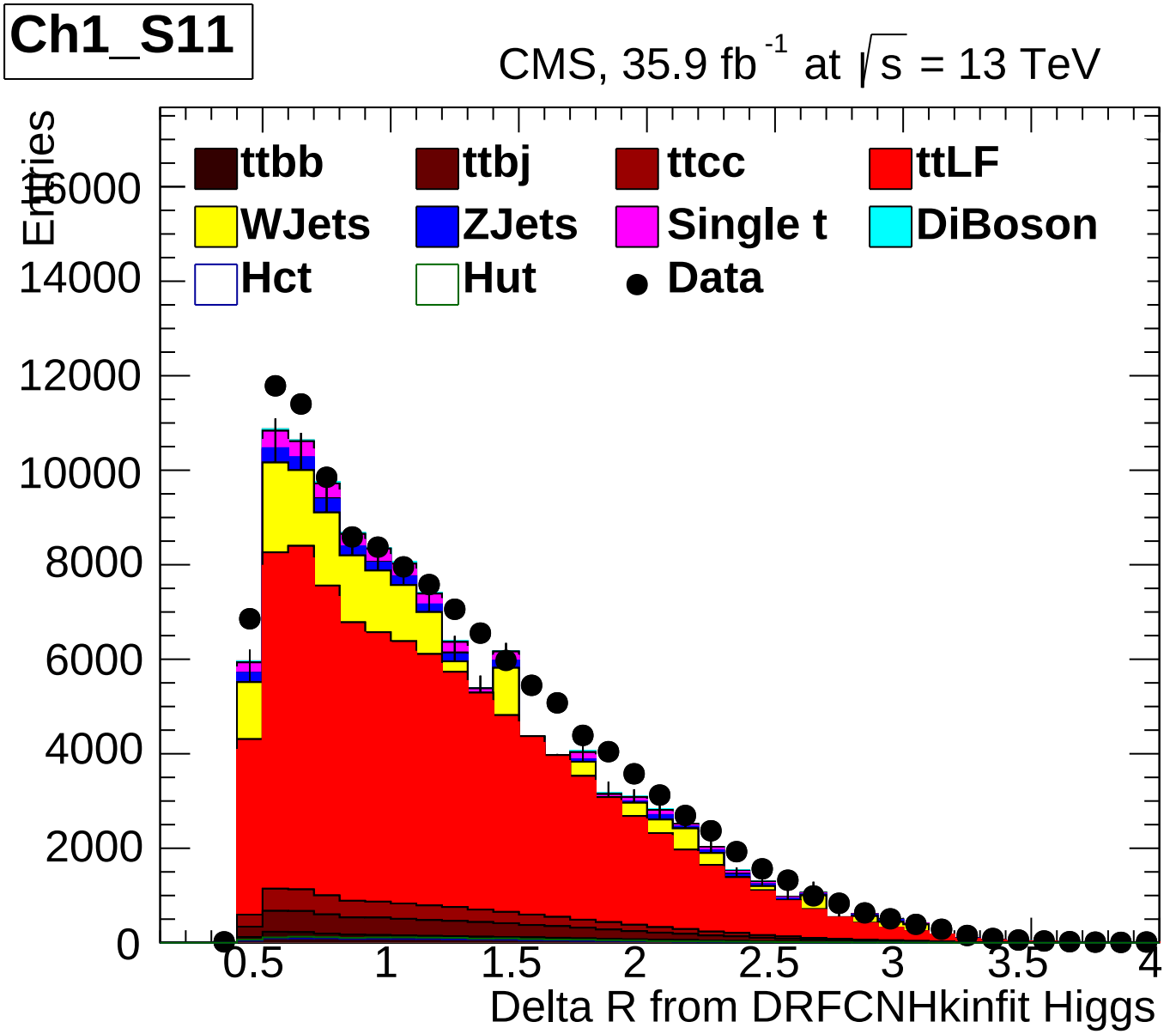

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
×10
120
100
80
60
40
20
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

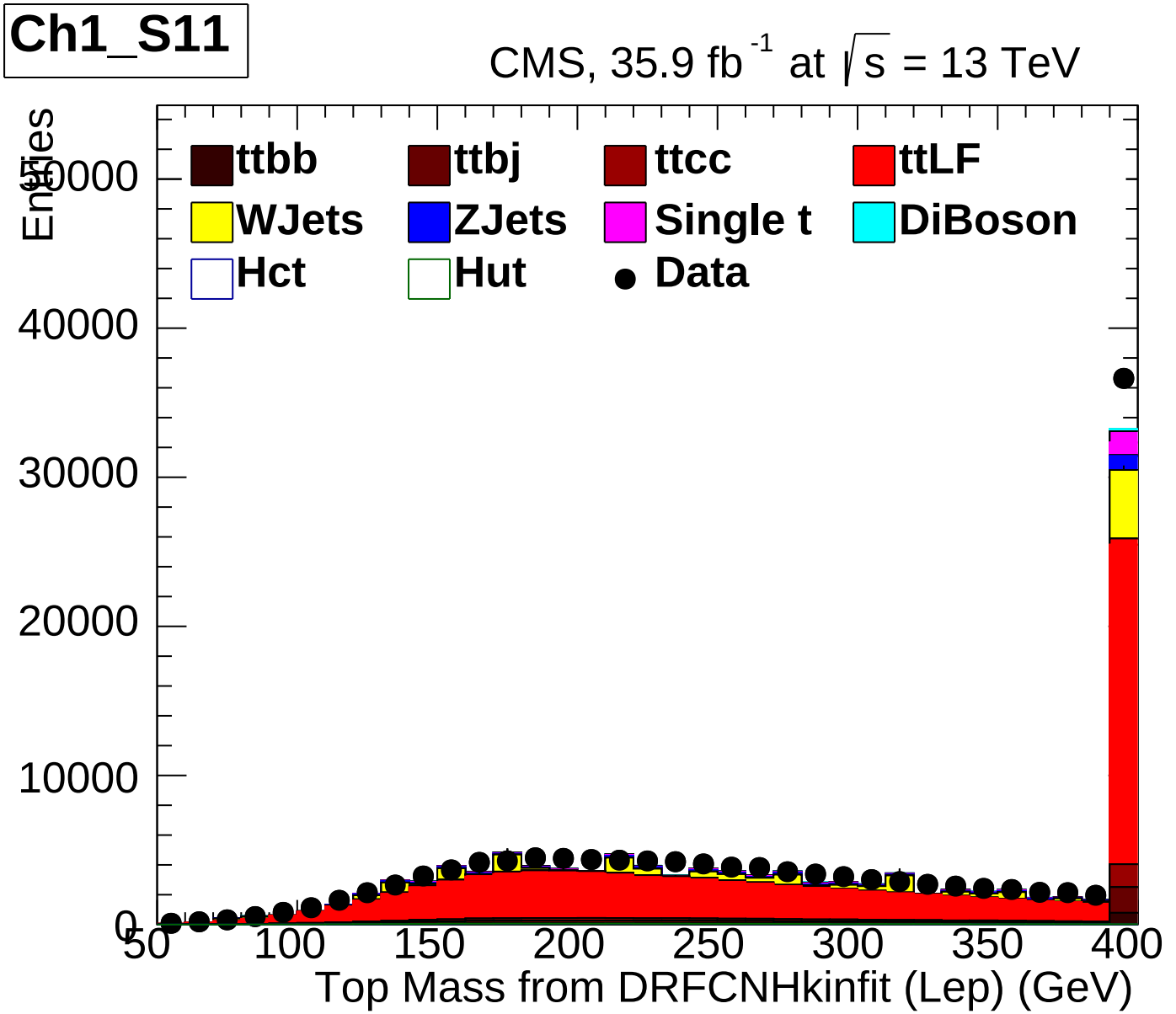

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
250
300
350
400
450
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

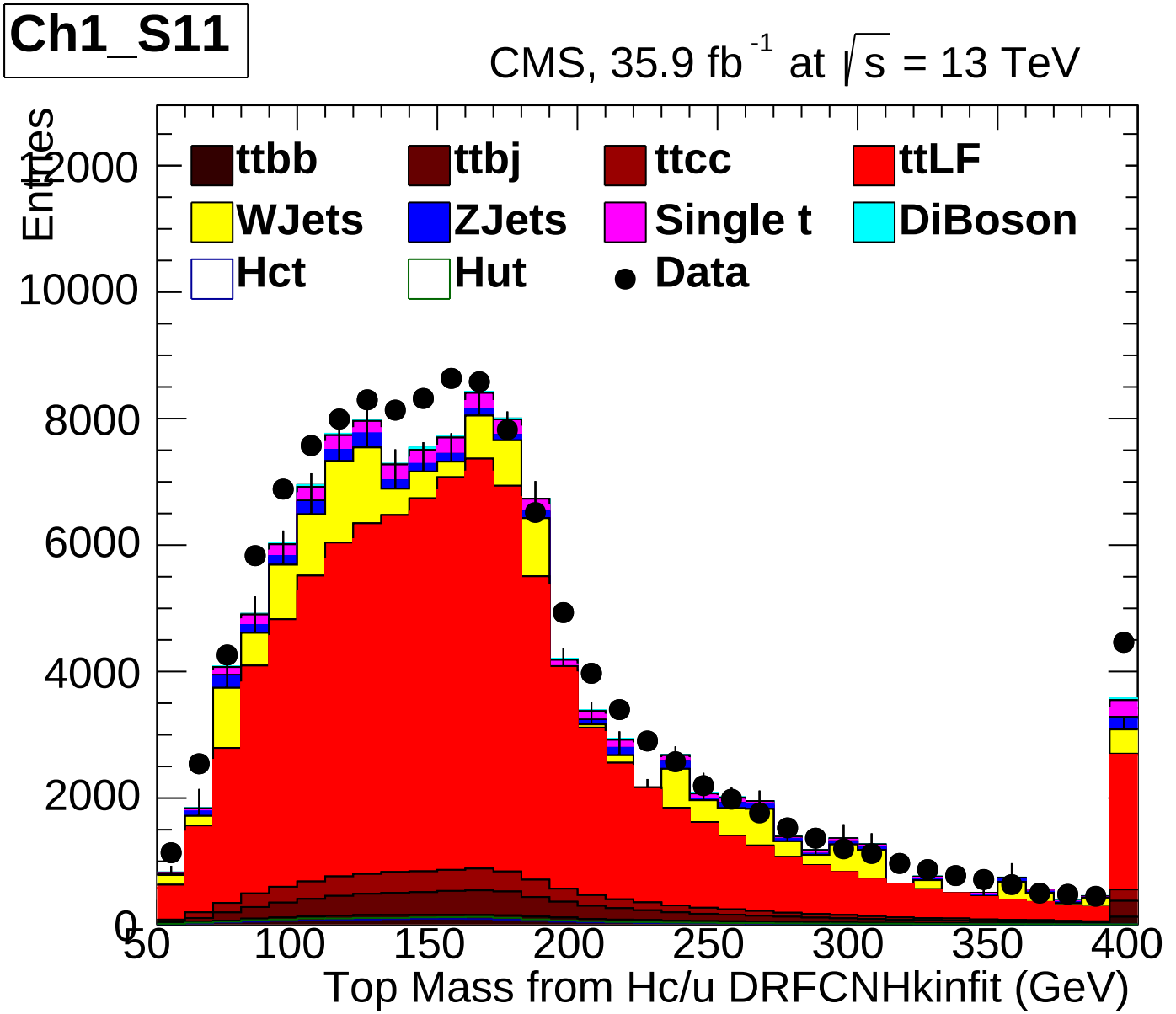

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
2000
4000
6000
8000
10000
12000
14000
16000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

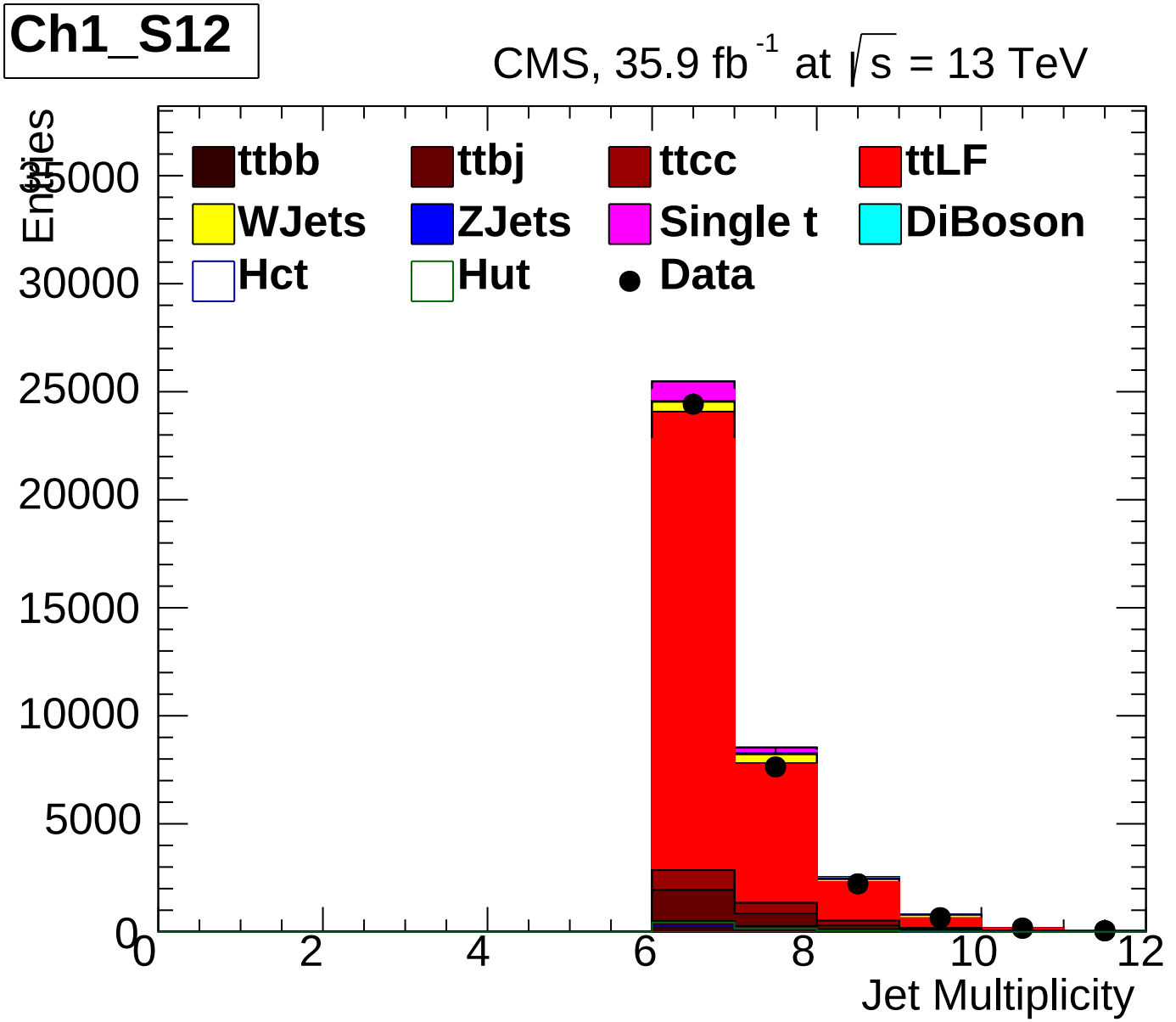

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

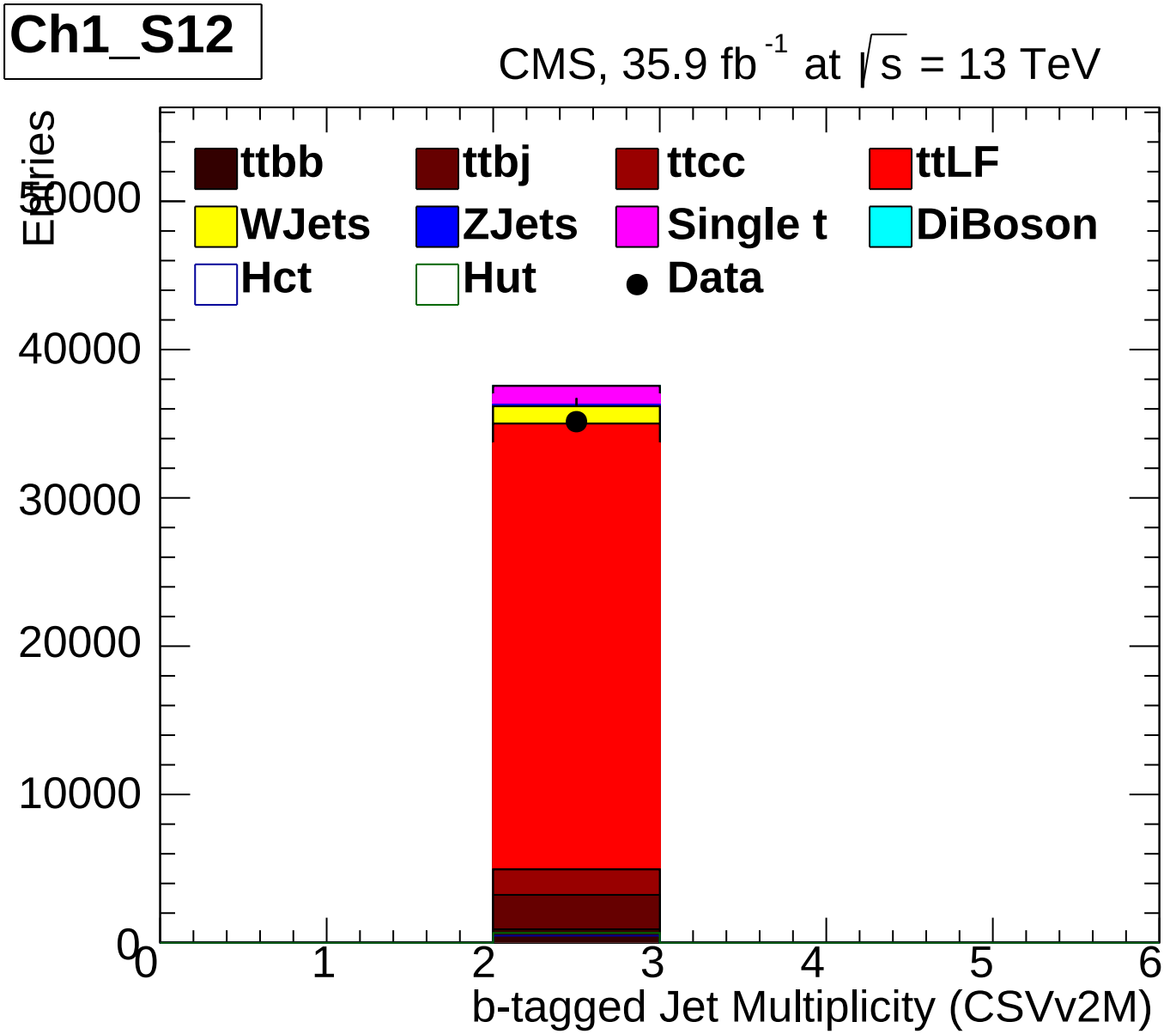

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

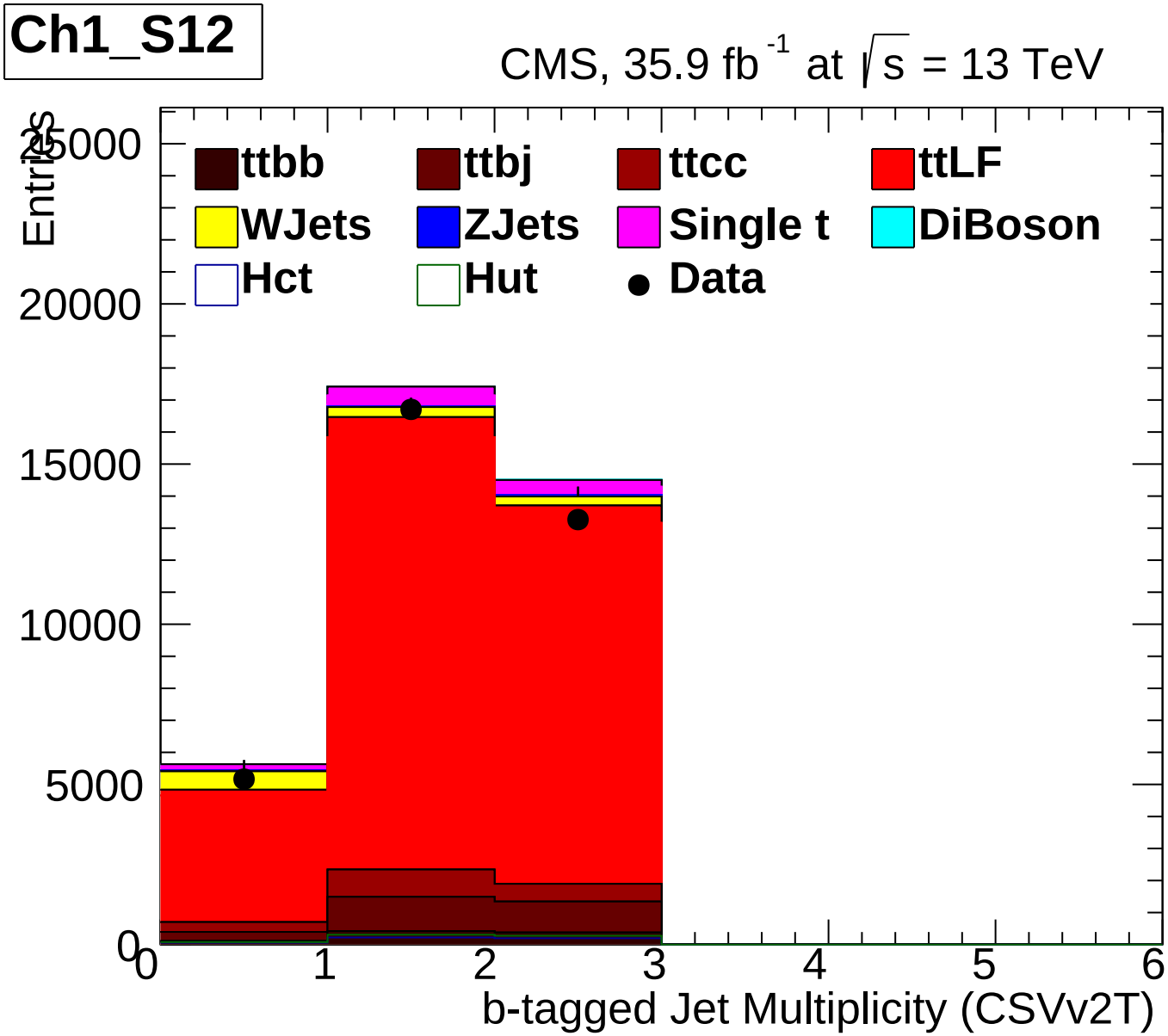

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
16000
14000
12000
10000
8000
6000
4000
2000
0
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

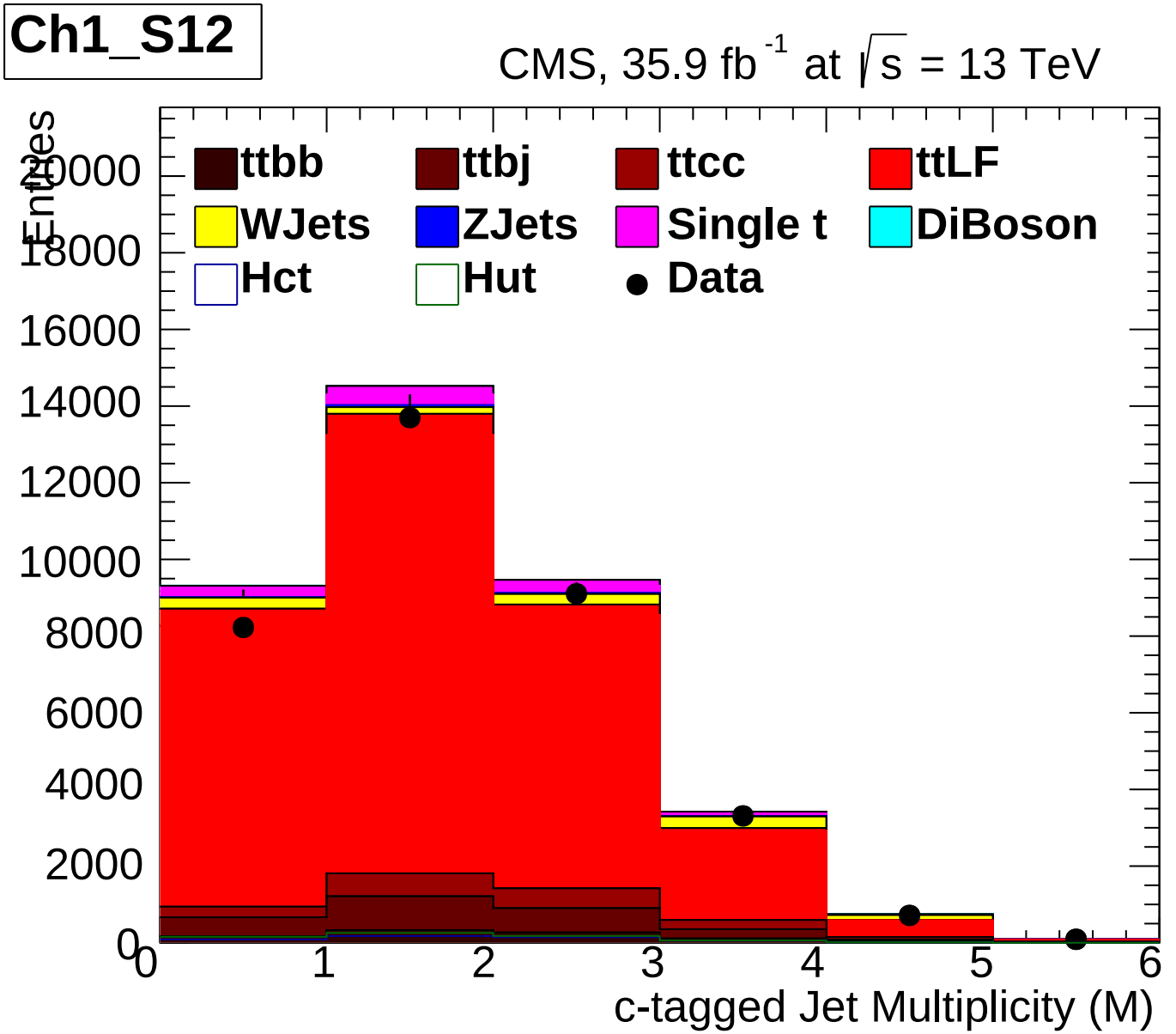

Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S11
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
2000
4000
6000
8000
10000
12000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
35000
30000
25000
20000
15000
10000
5000
0
0
2
4
6
8
10
12
Jet Multiplicity


Ch1_S12
CMS, 35.9 fb -1 at √s = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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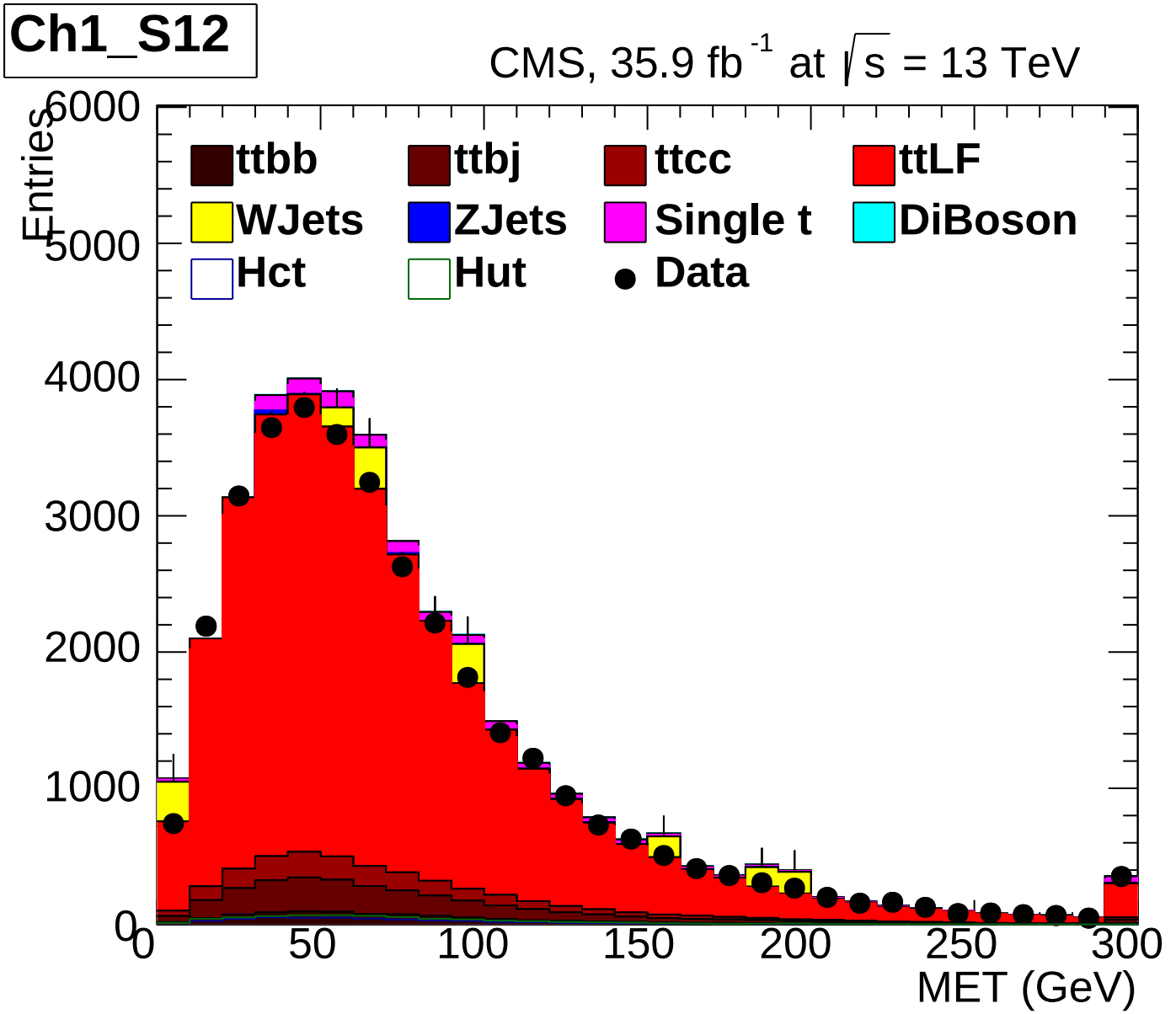
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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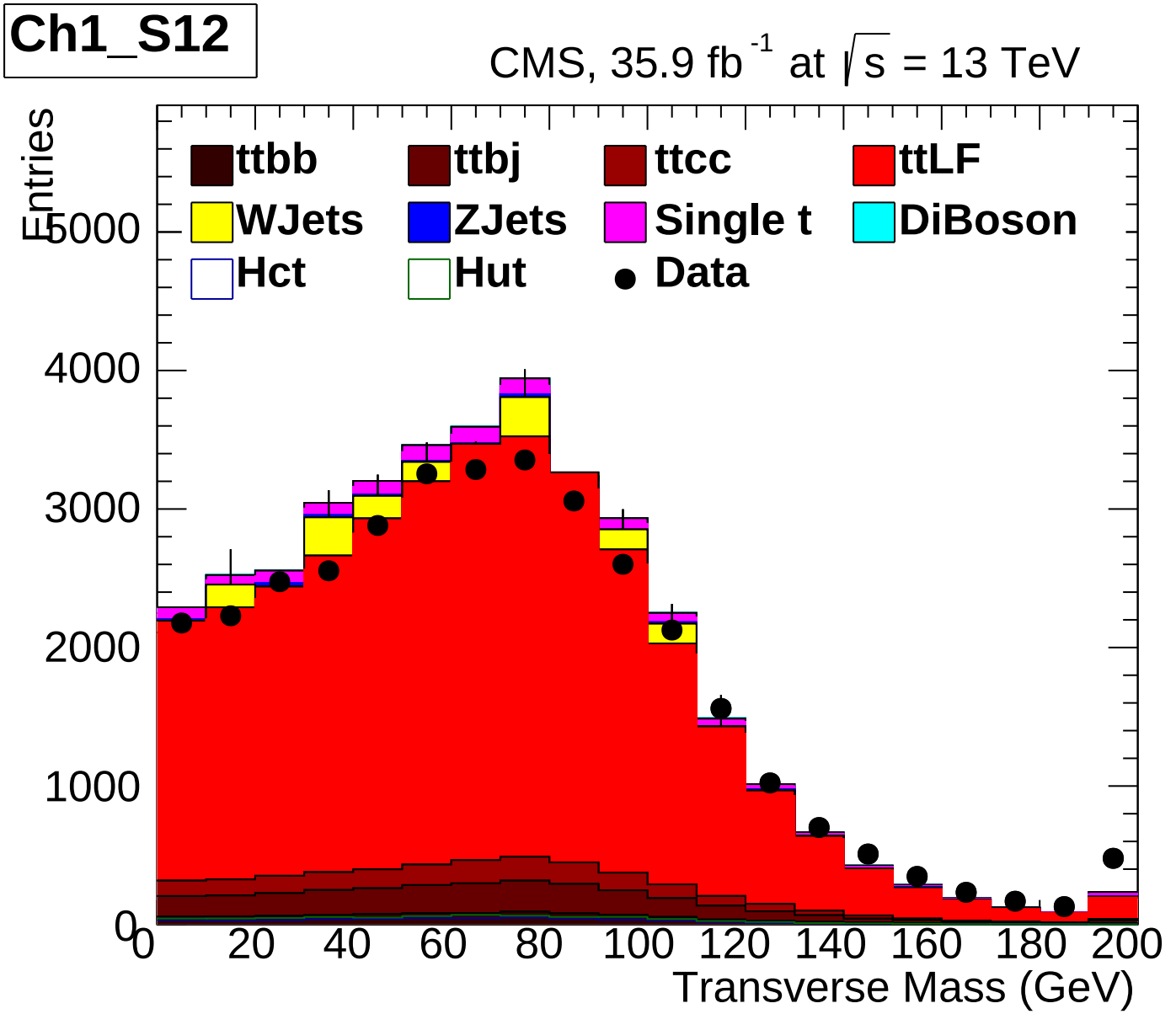
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
0
50
100
150
200
250
300
MET (GeV)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
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1000
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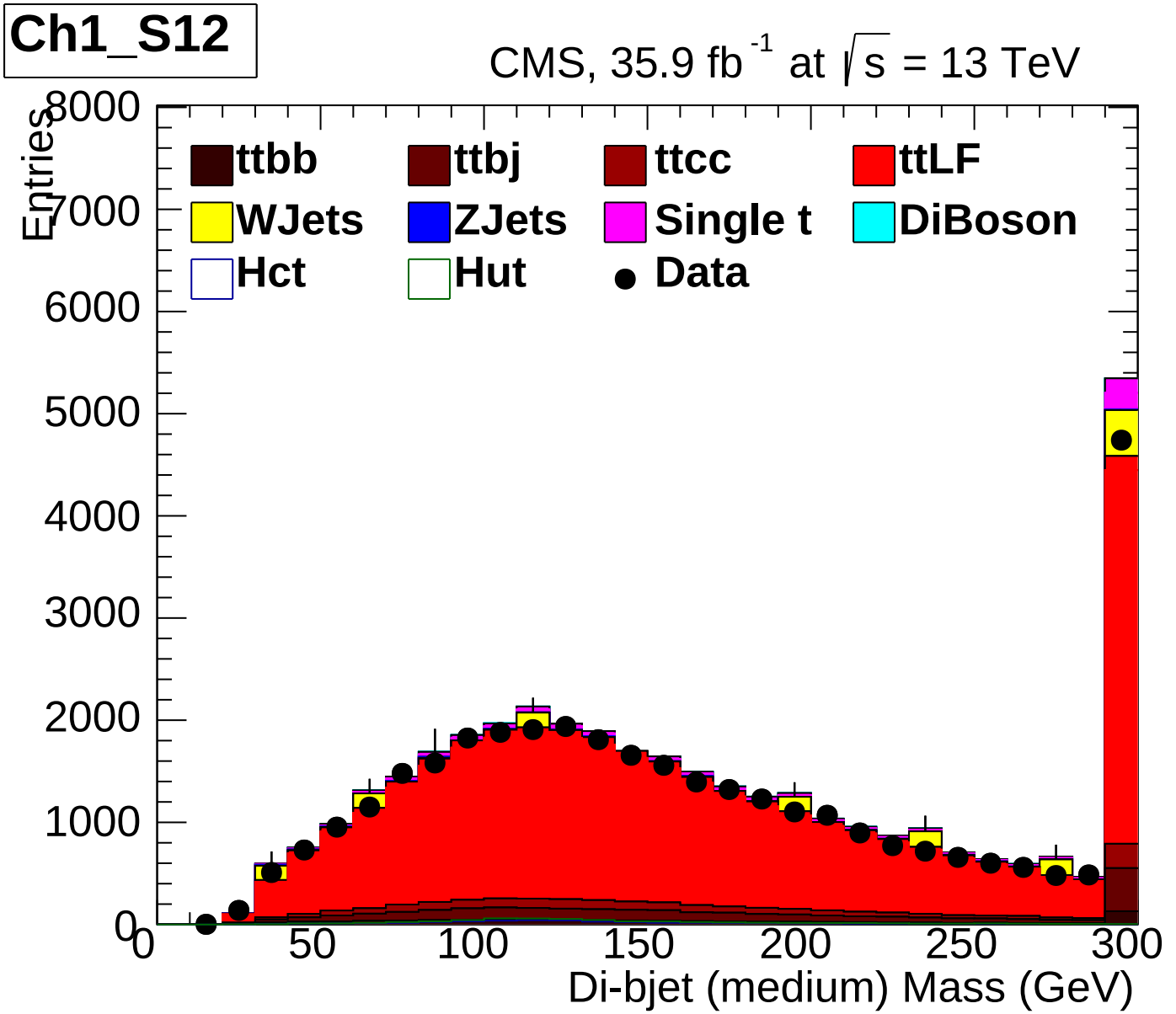
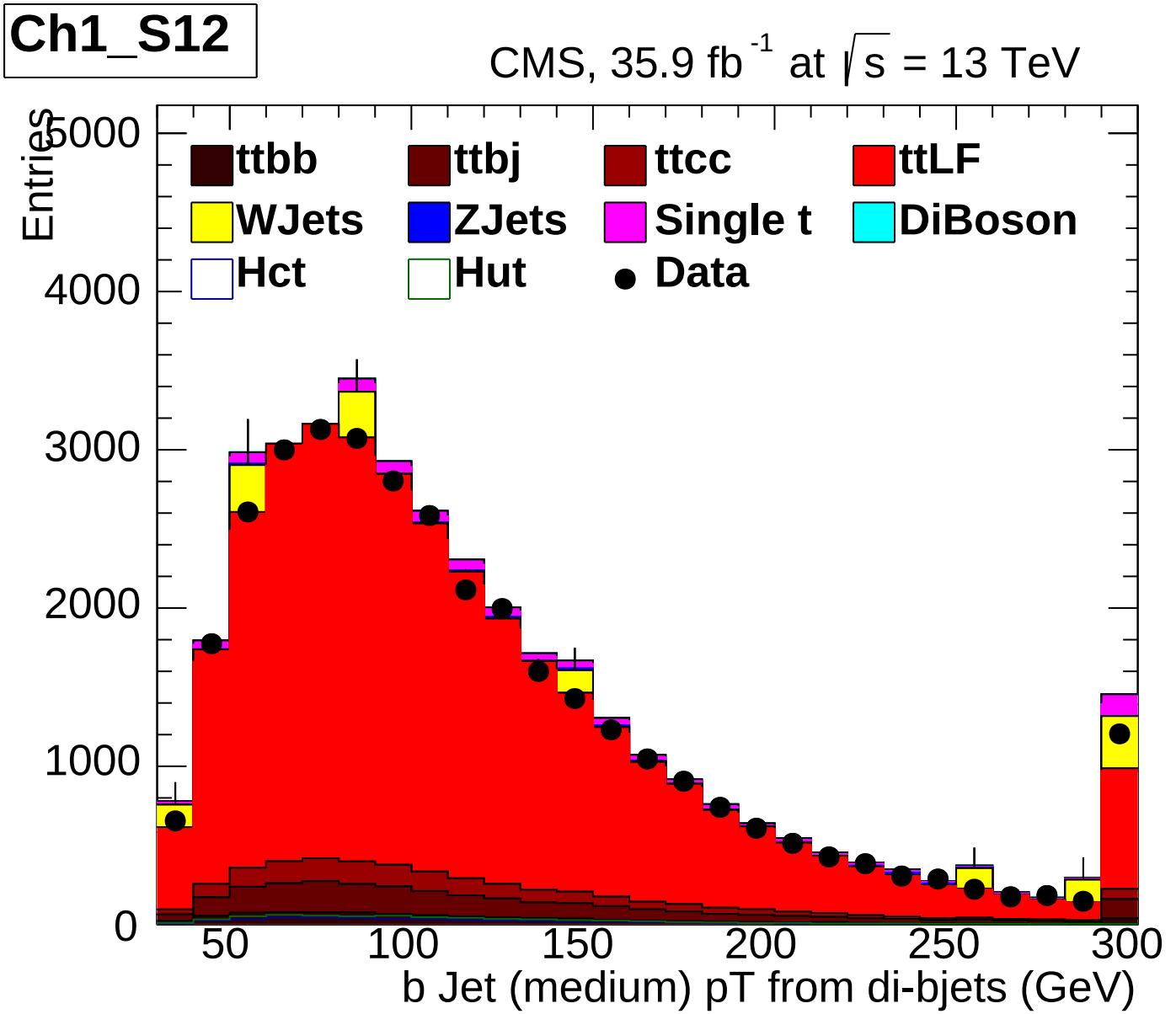
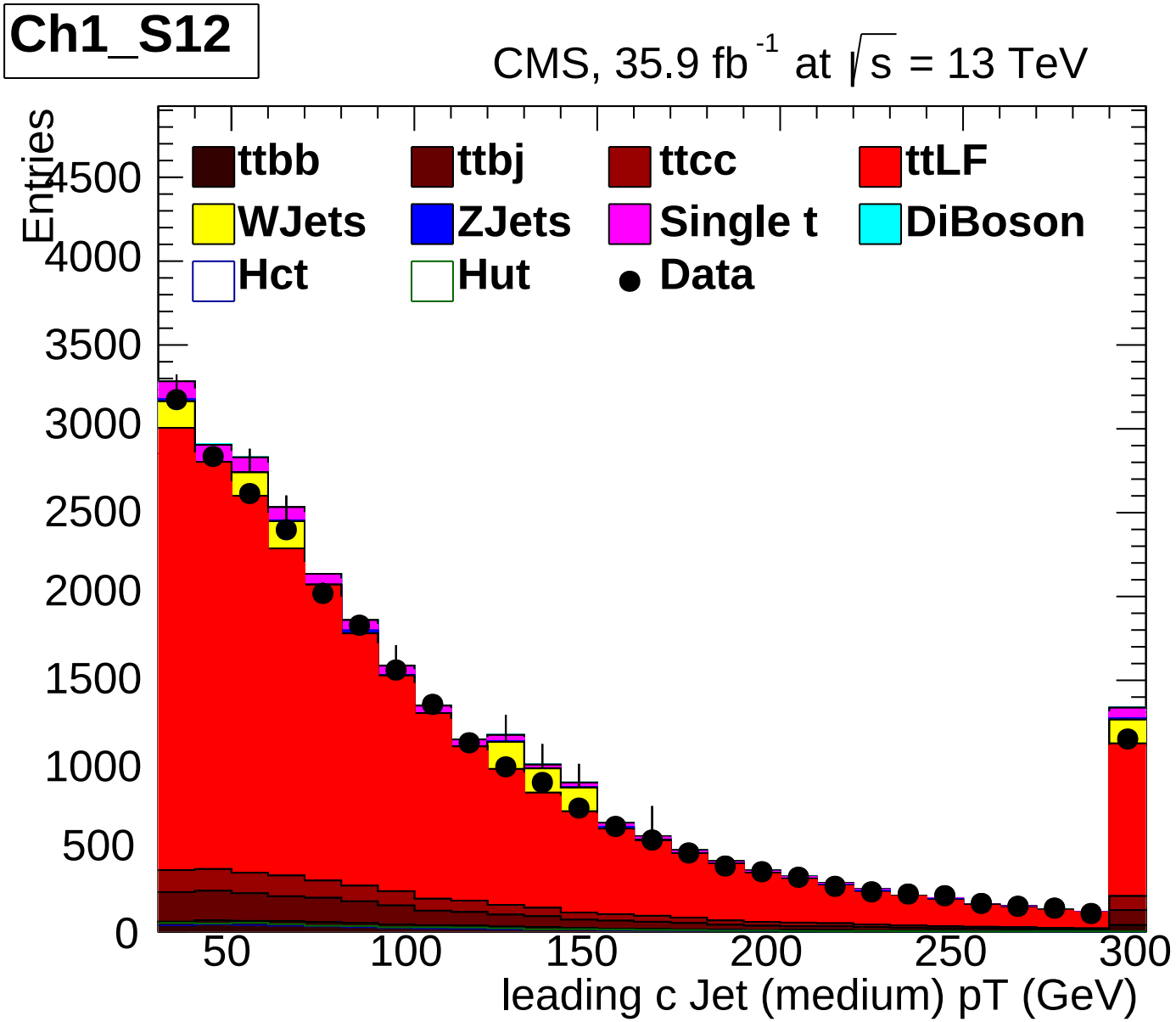
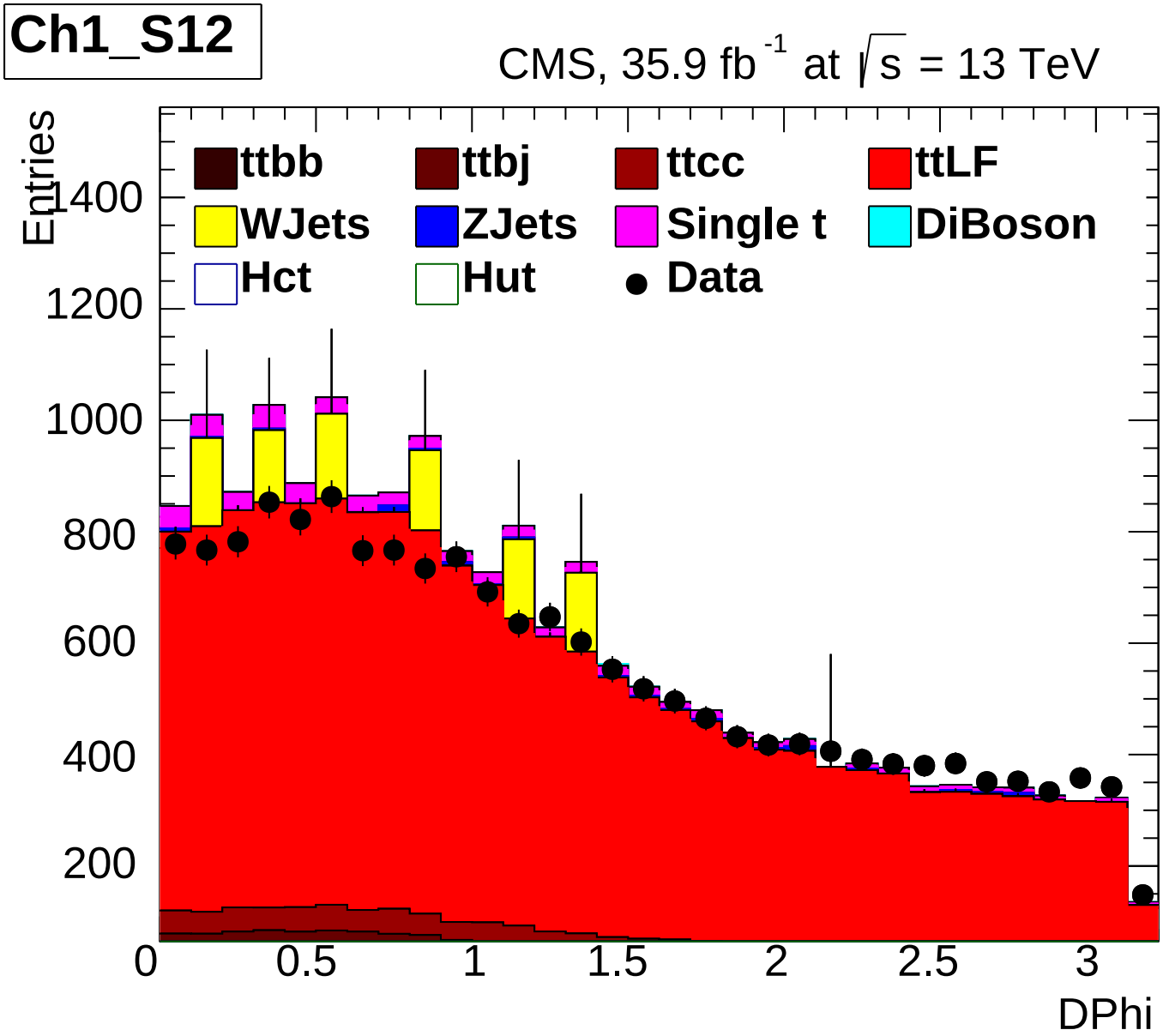
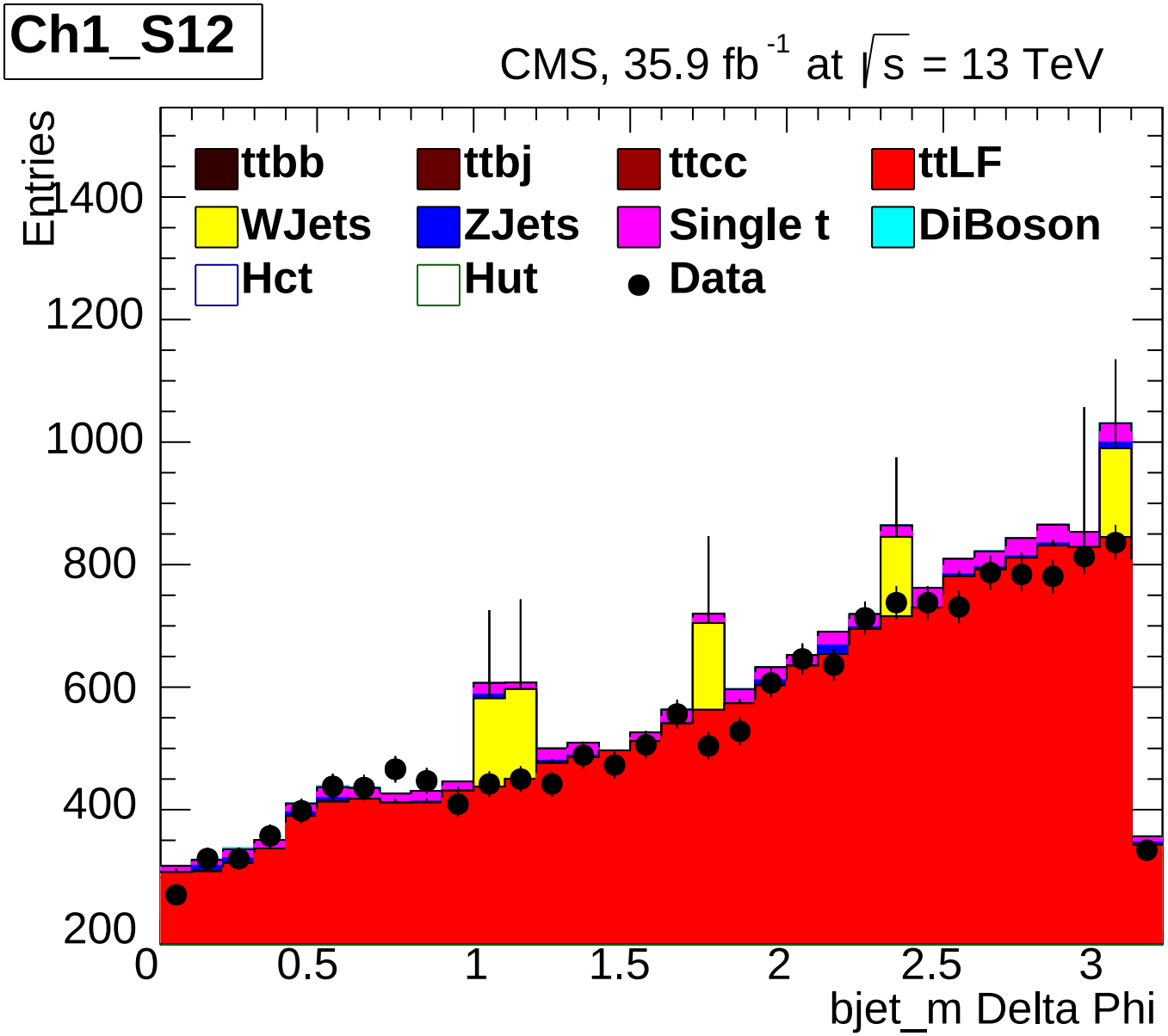
3000
4000
5000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

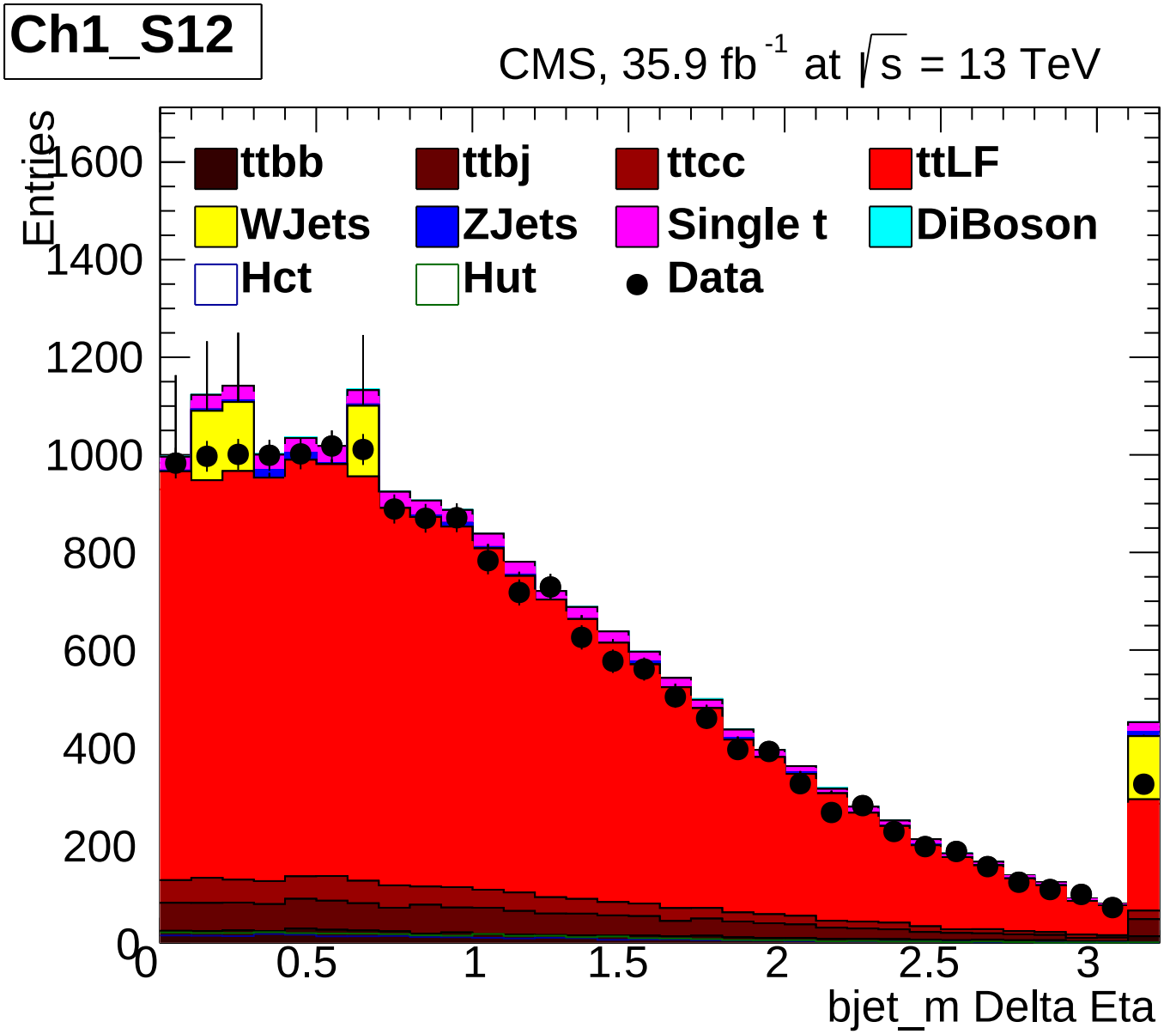

Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

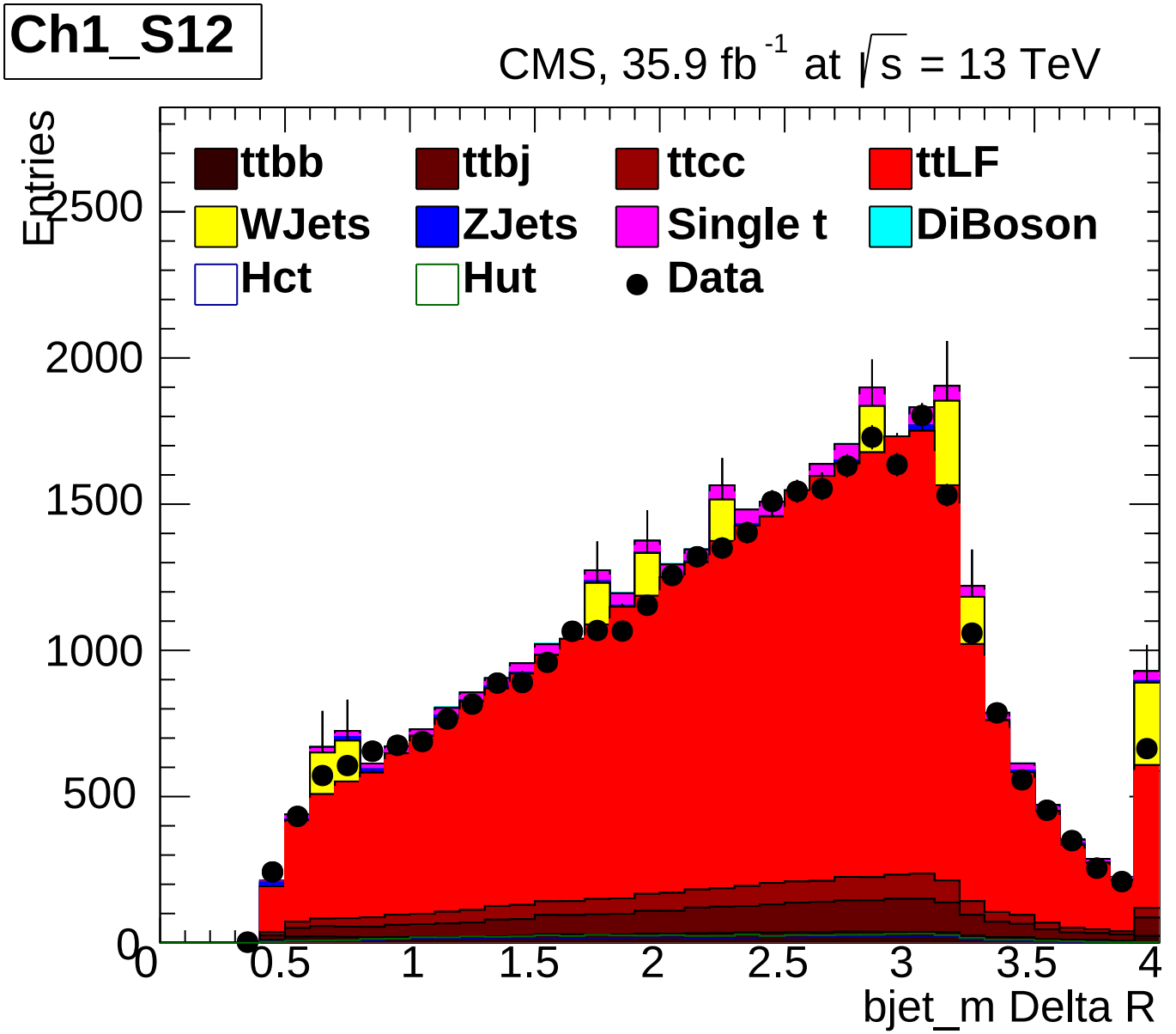

Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

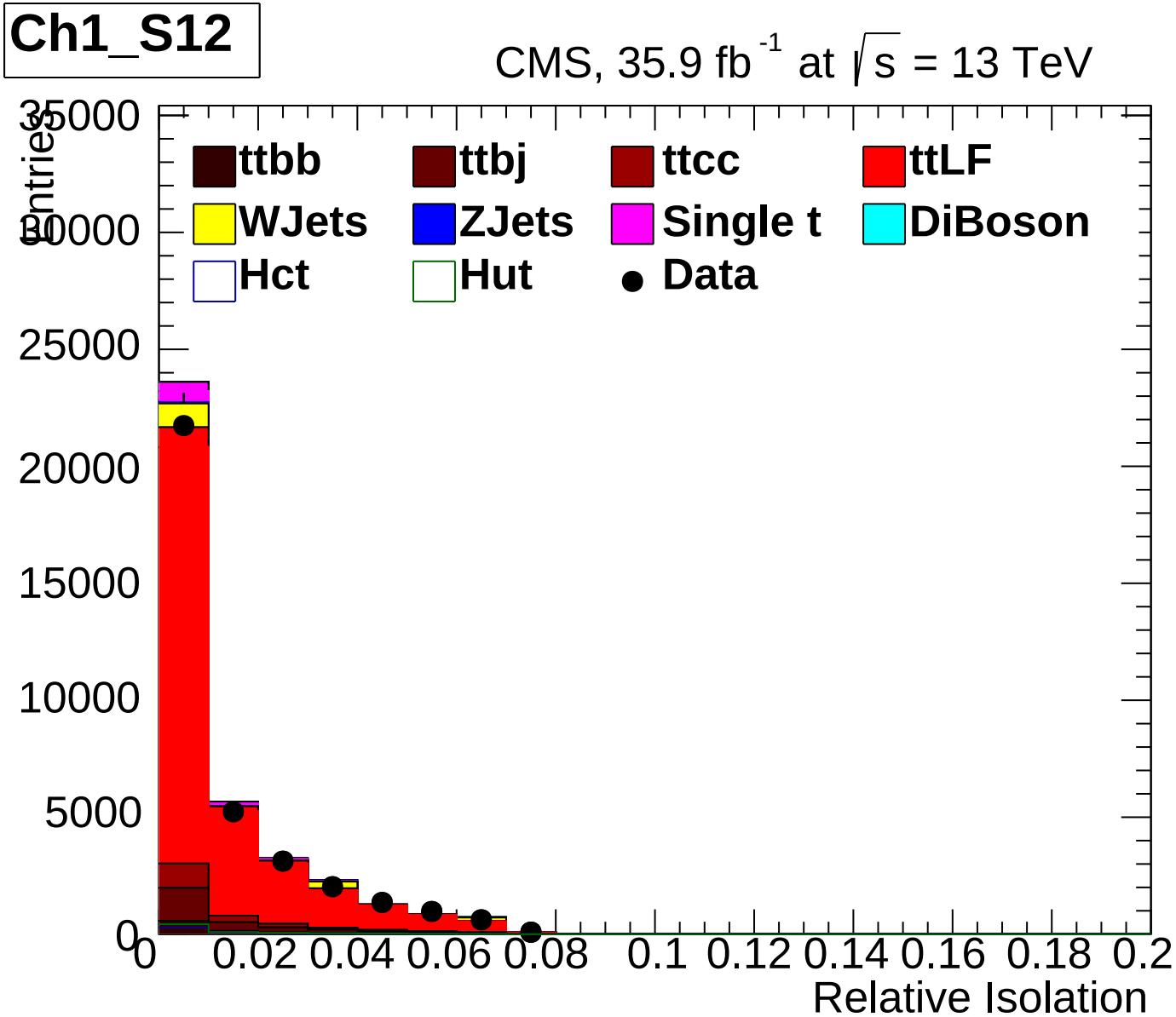

Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

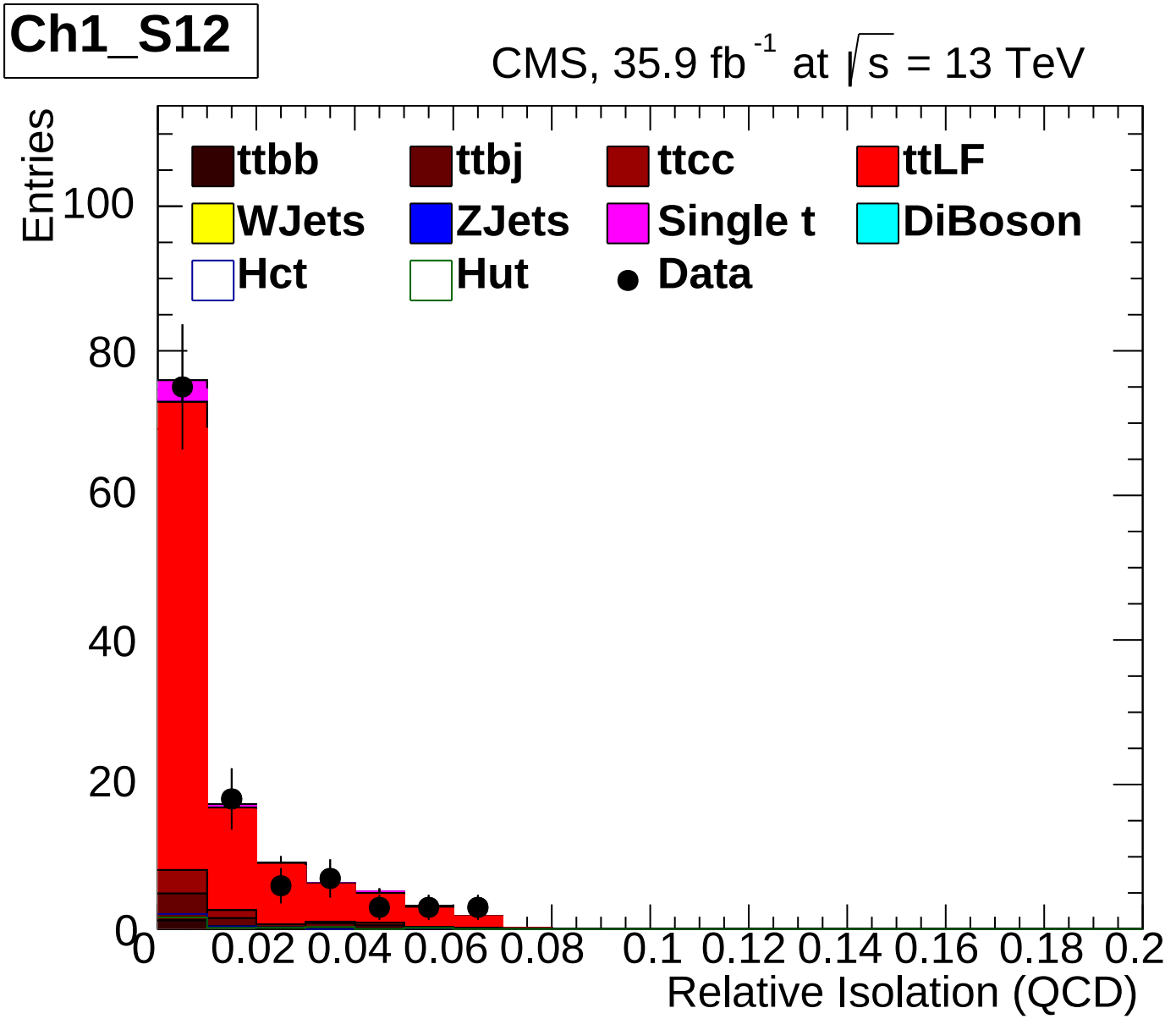

Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1400
1200
1000
800
600
400
200
0
0.5
1
1.5
2
2.5
3
DPhi

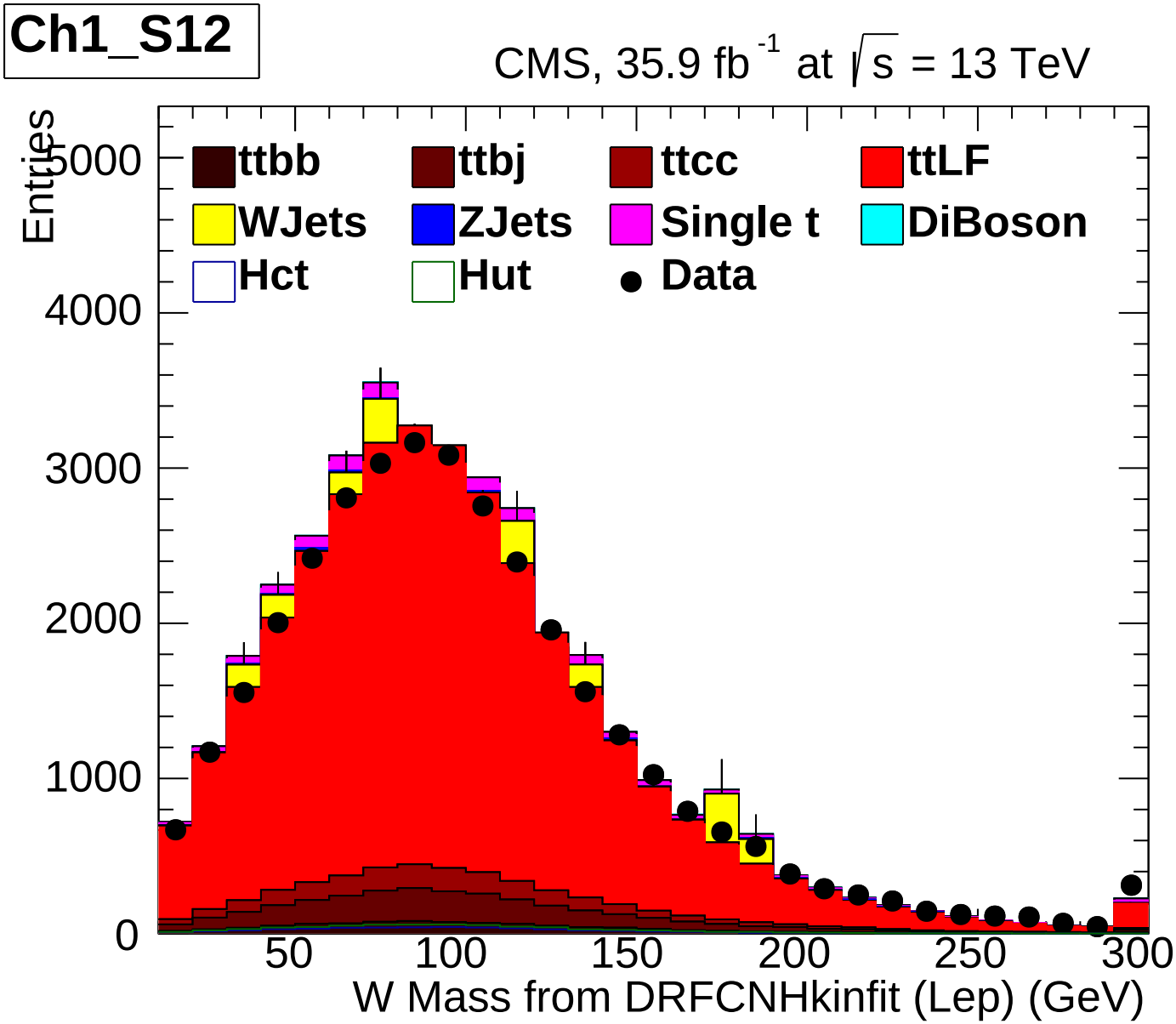

Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1400
1200
1000
800
600
400
200
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

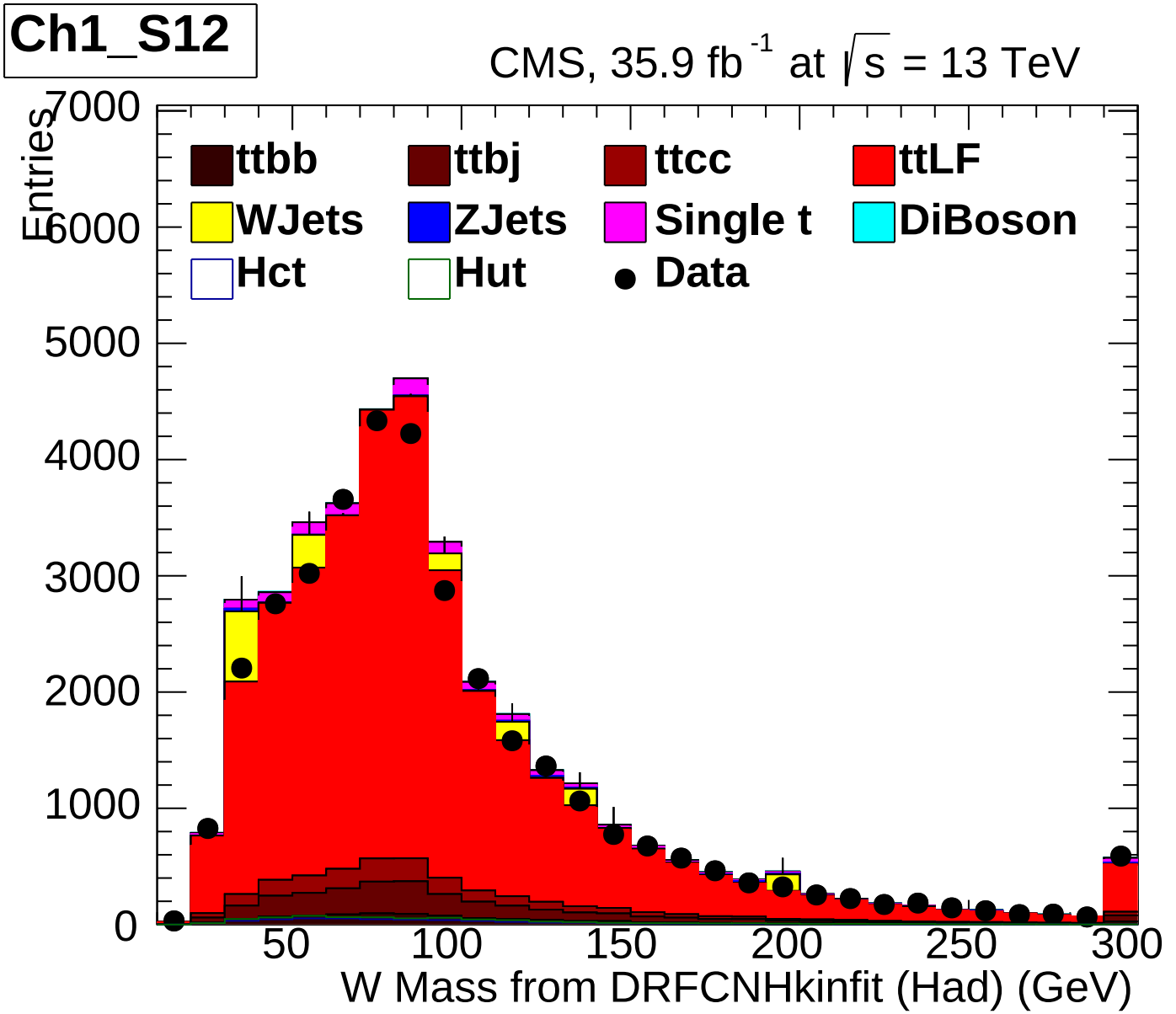

Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
entries
35000
30000
25000
20000
15000
10000
5000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
20
40
60
80
100
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
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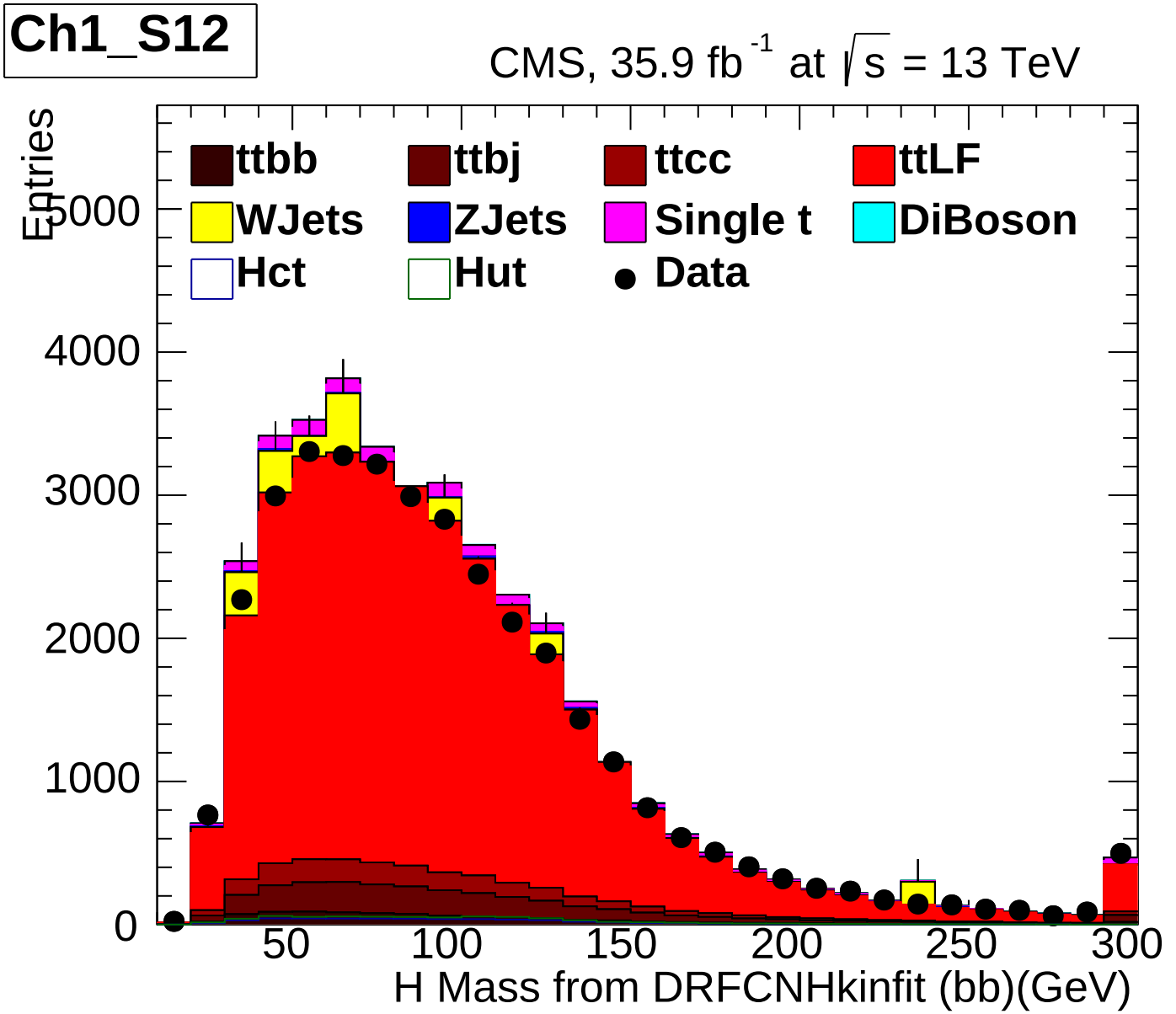
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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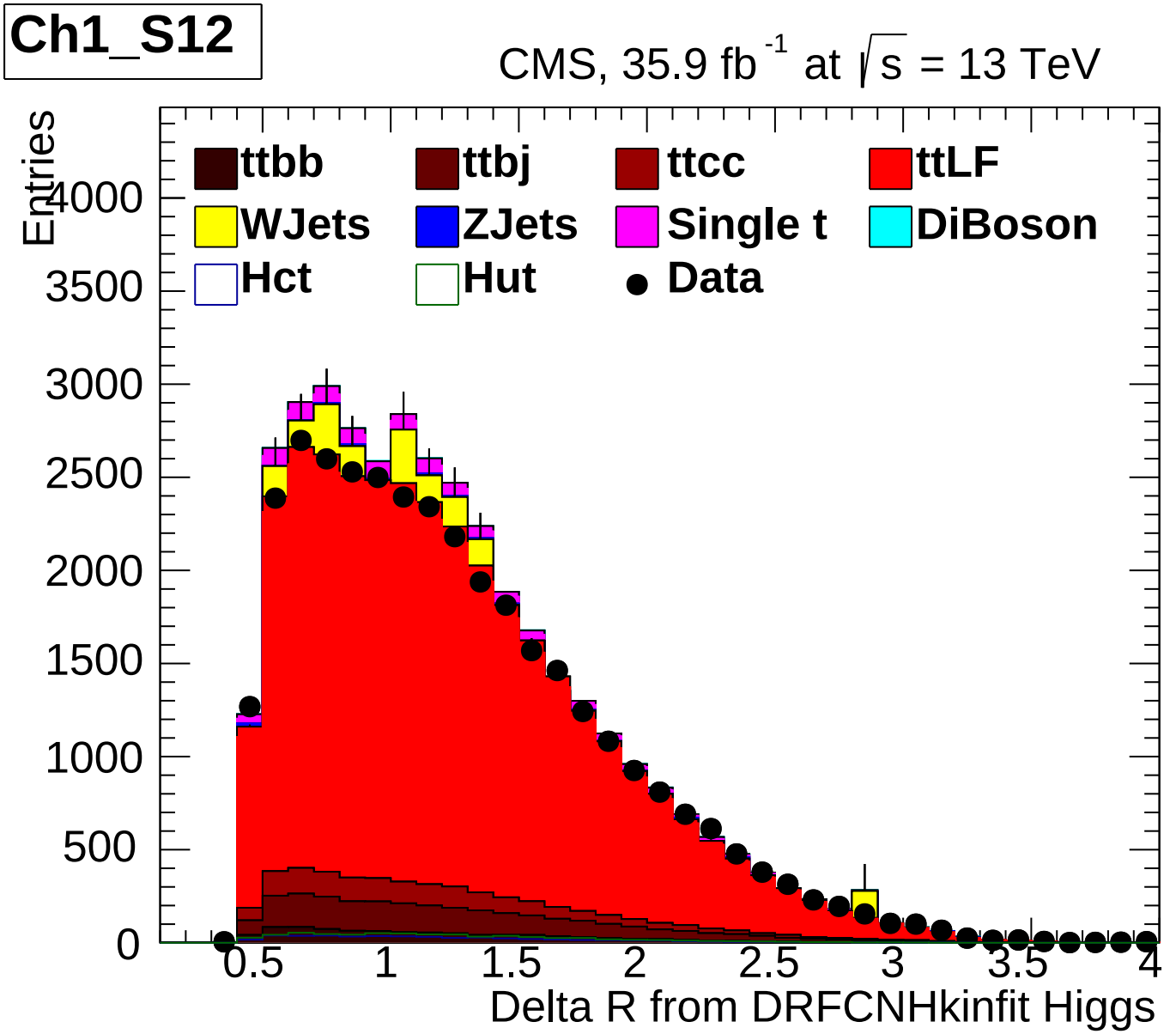
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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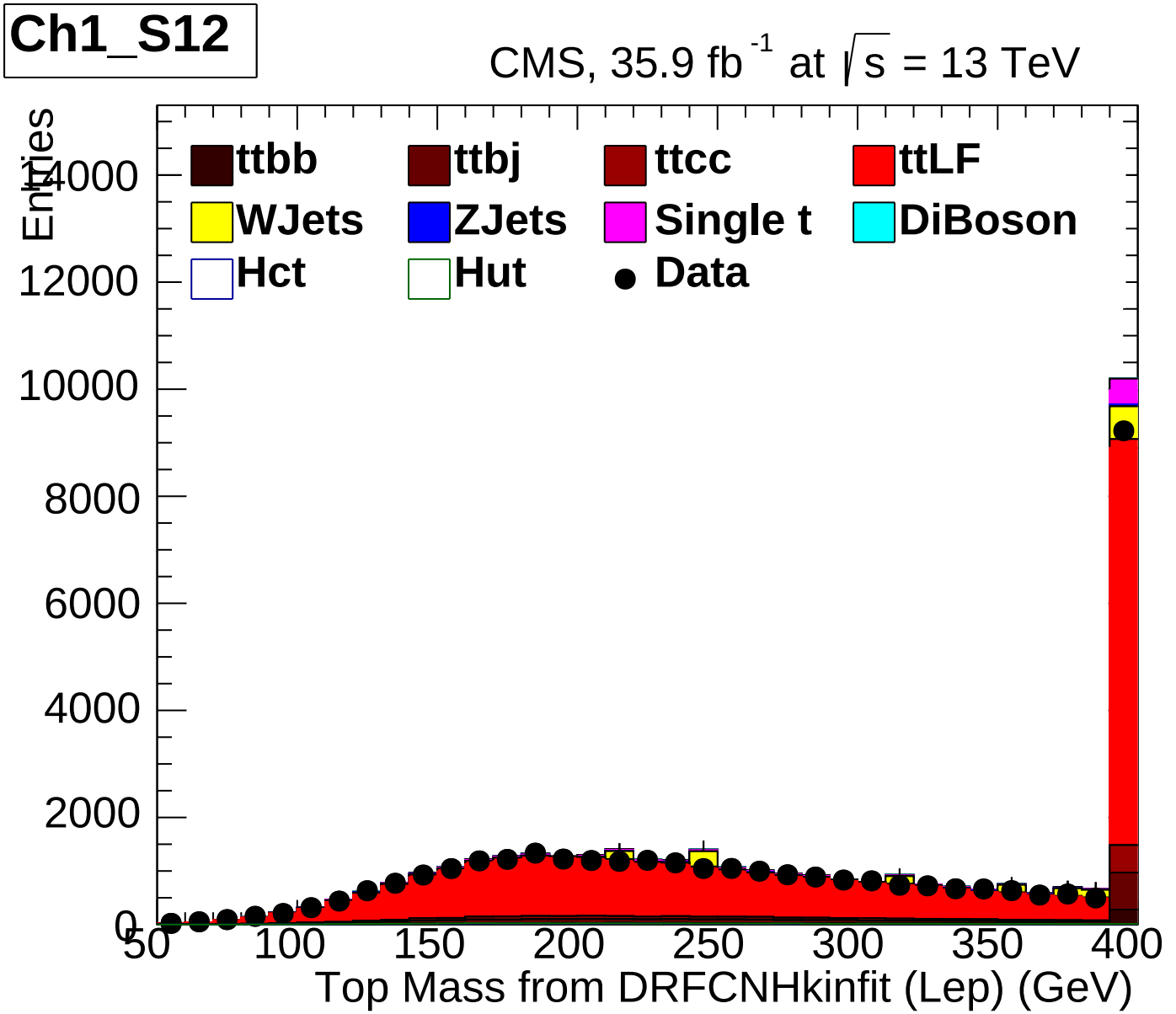
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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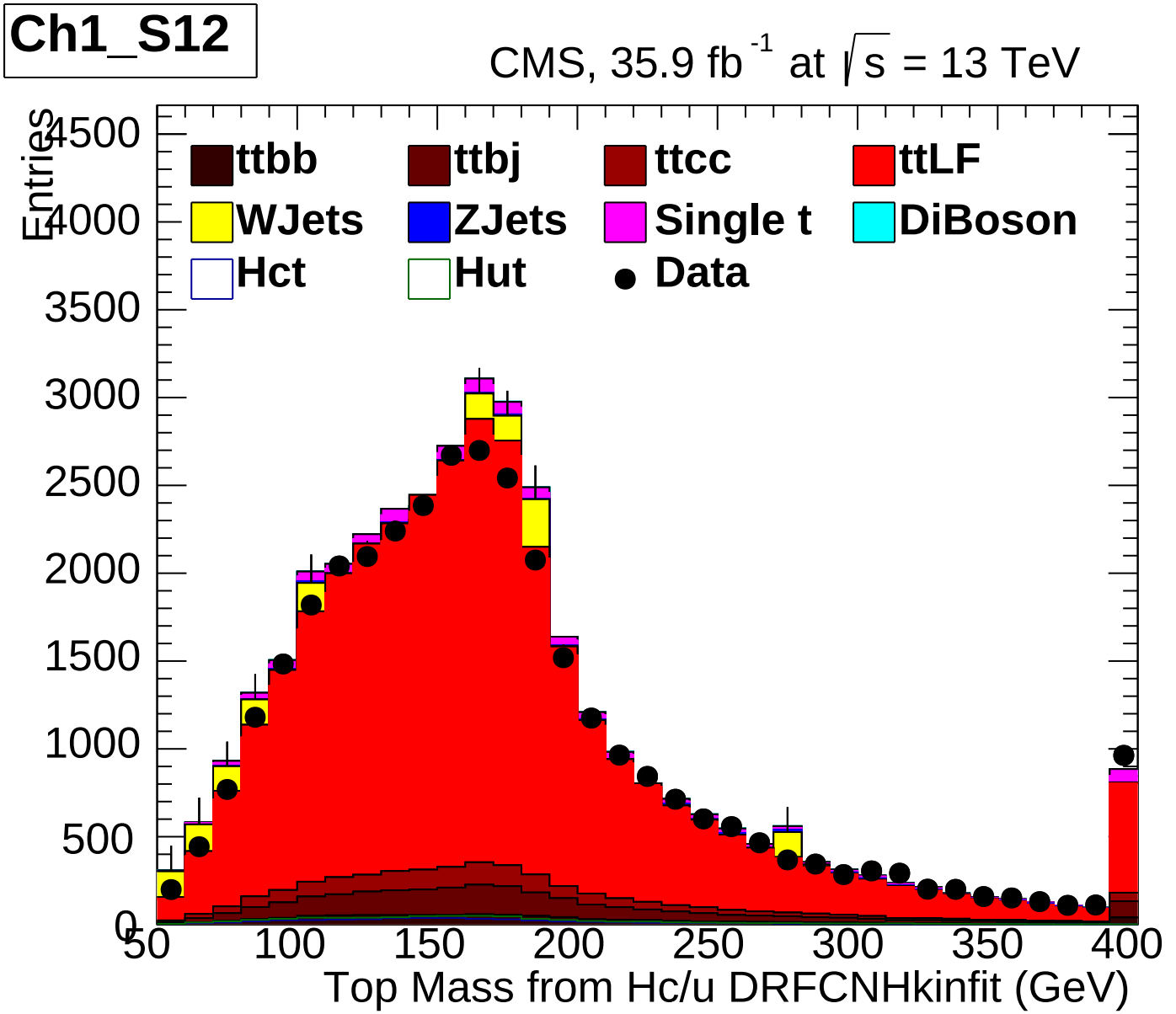
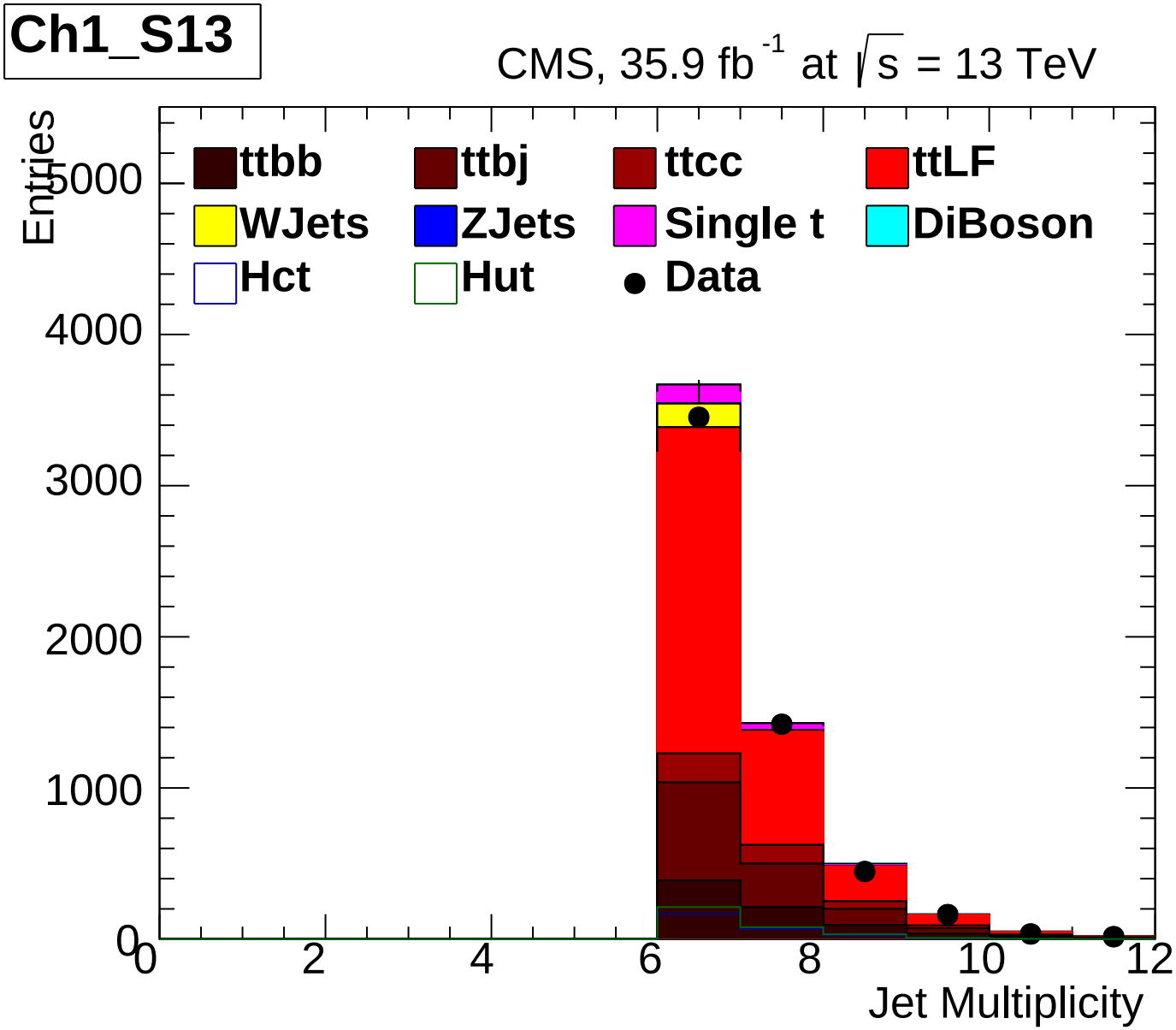
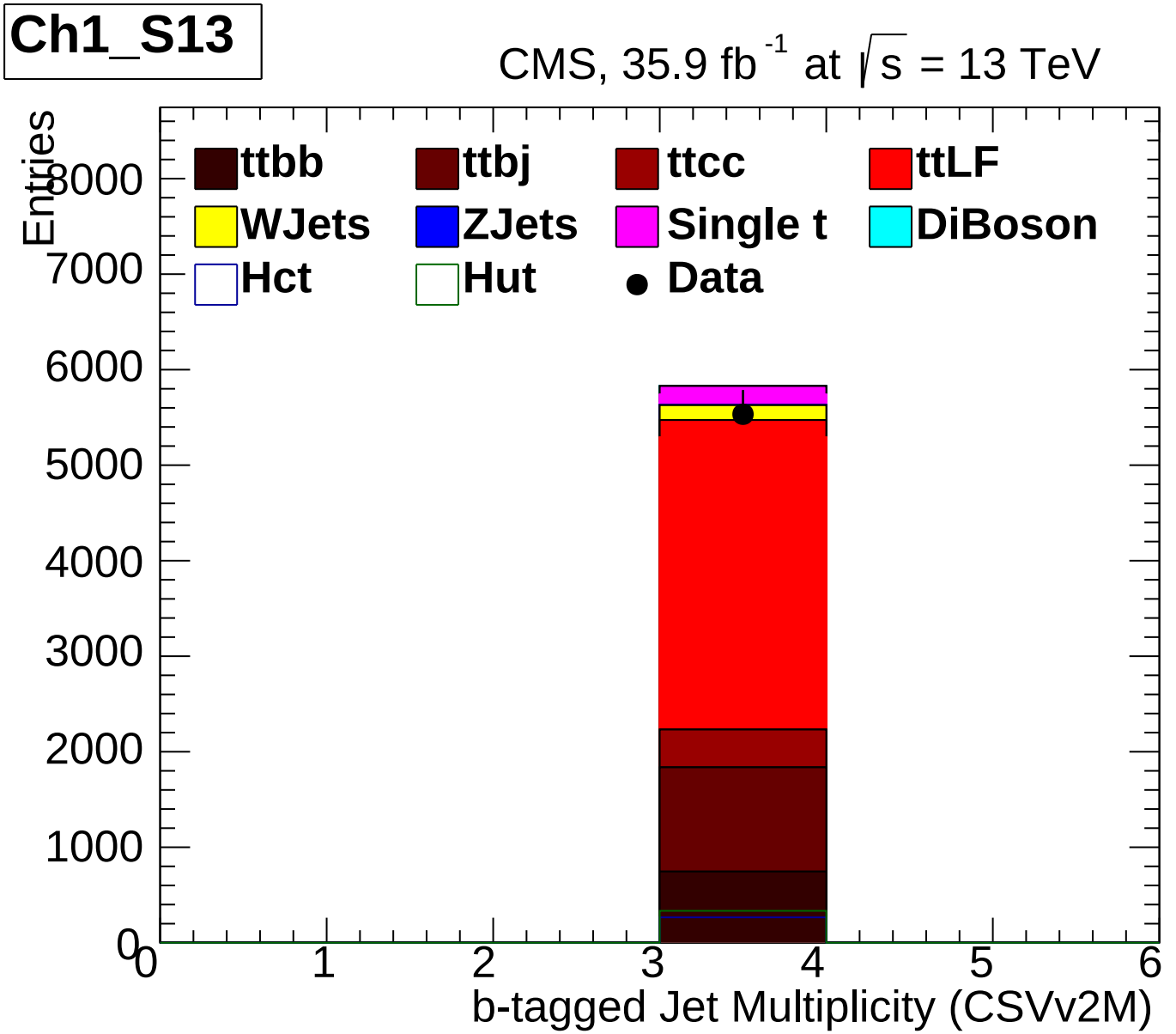
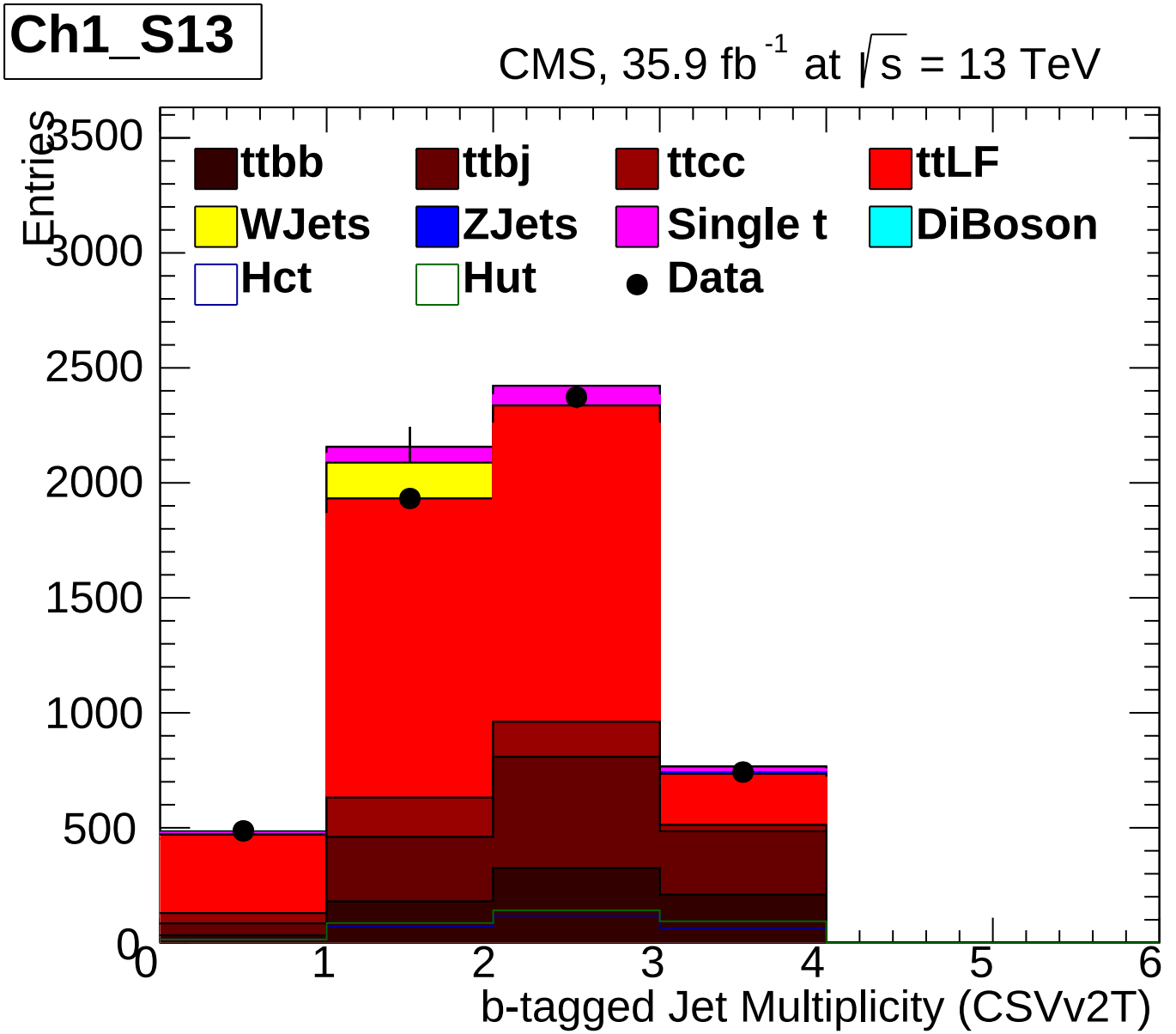
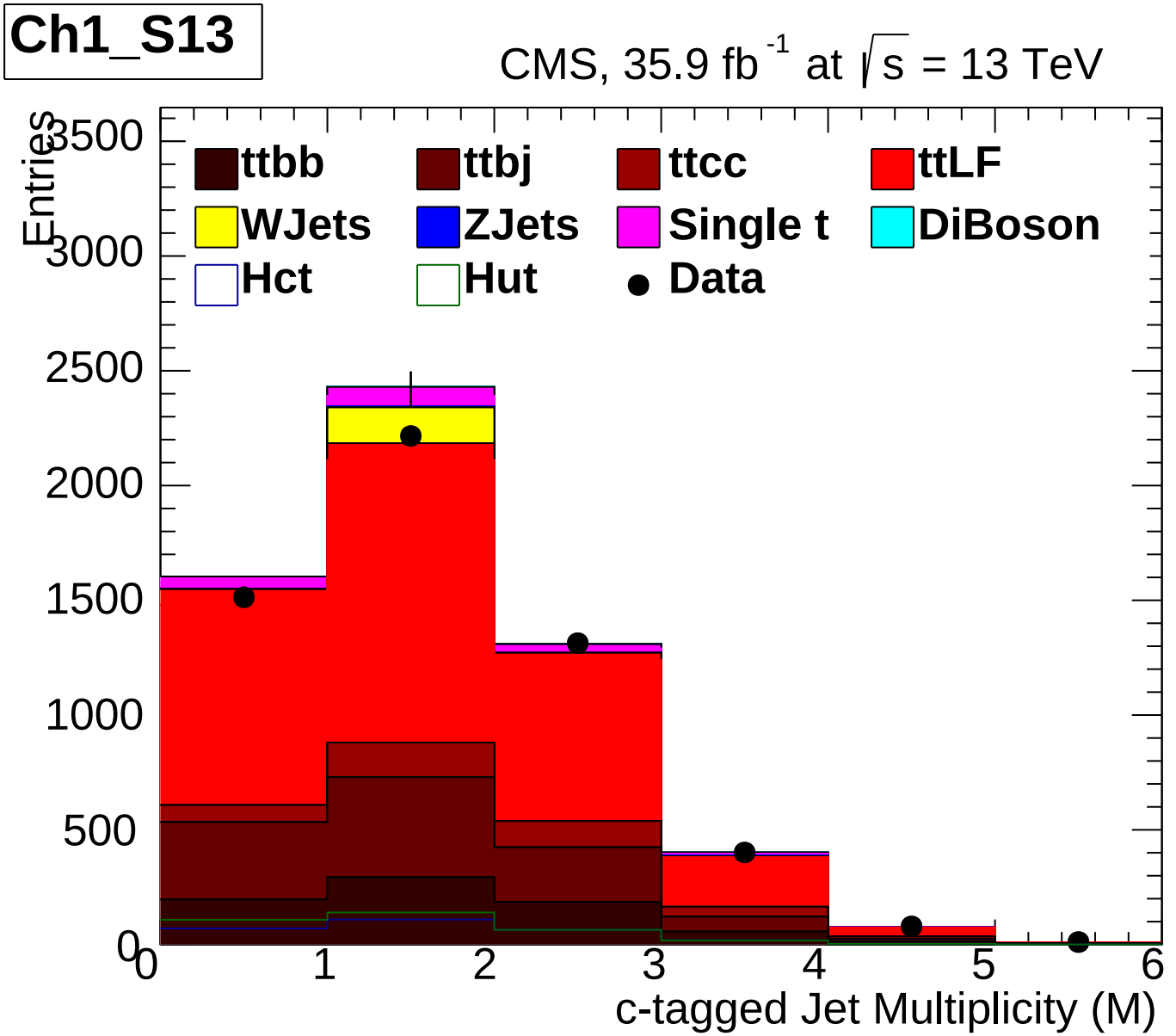
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
2000
4000
6000
8000
10000
12000
14000
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S12
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
4000
4500
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
0
2
4
6
8
10
12
Jet Multiplicity


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
1000
2000
3000
4000
5000
6000
7000
8000
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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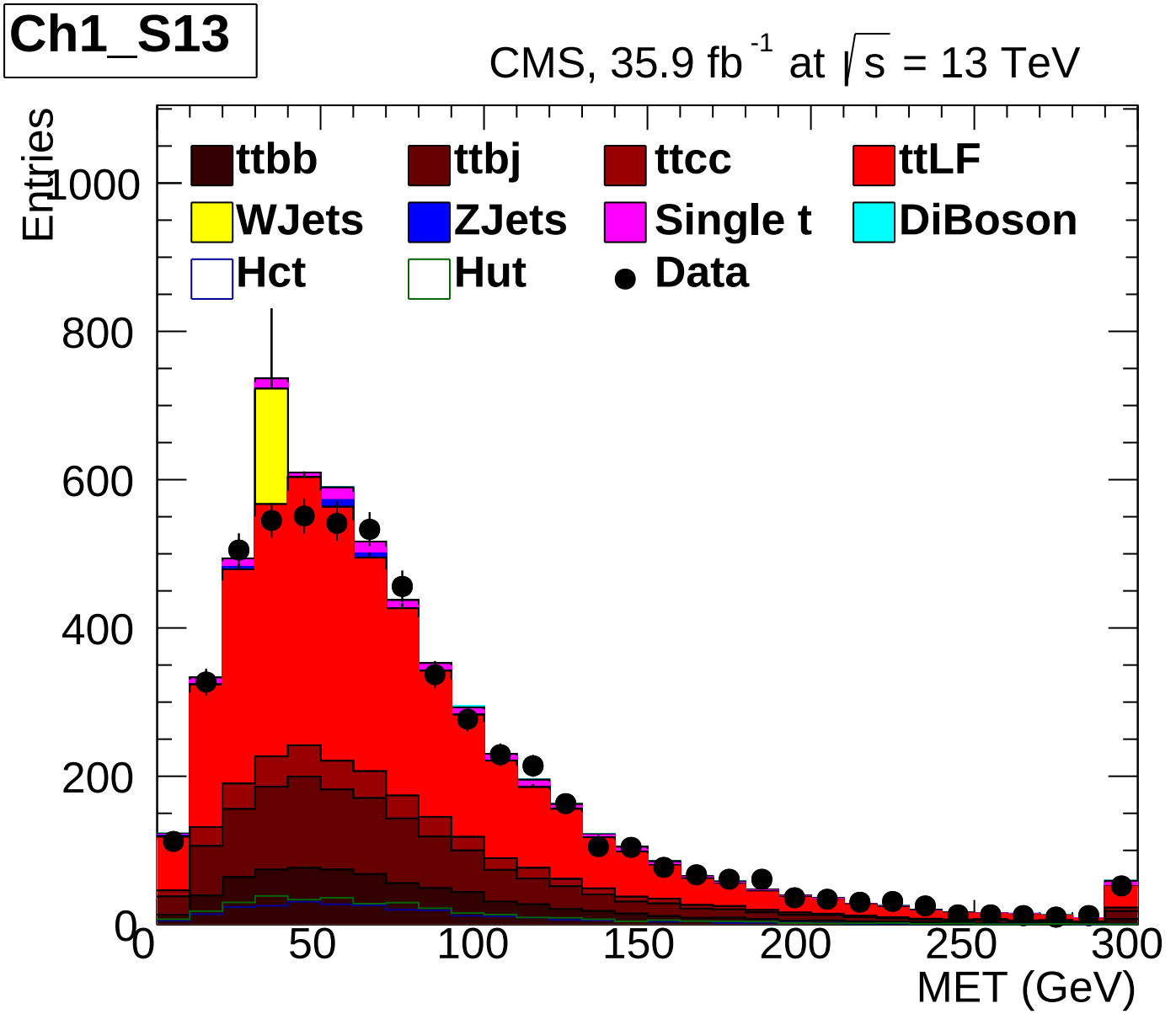
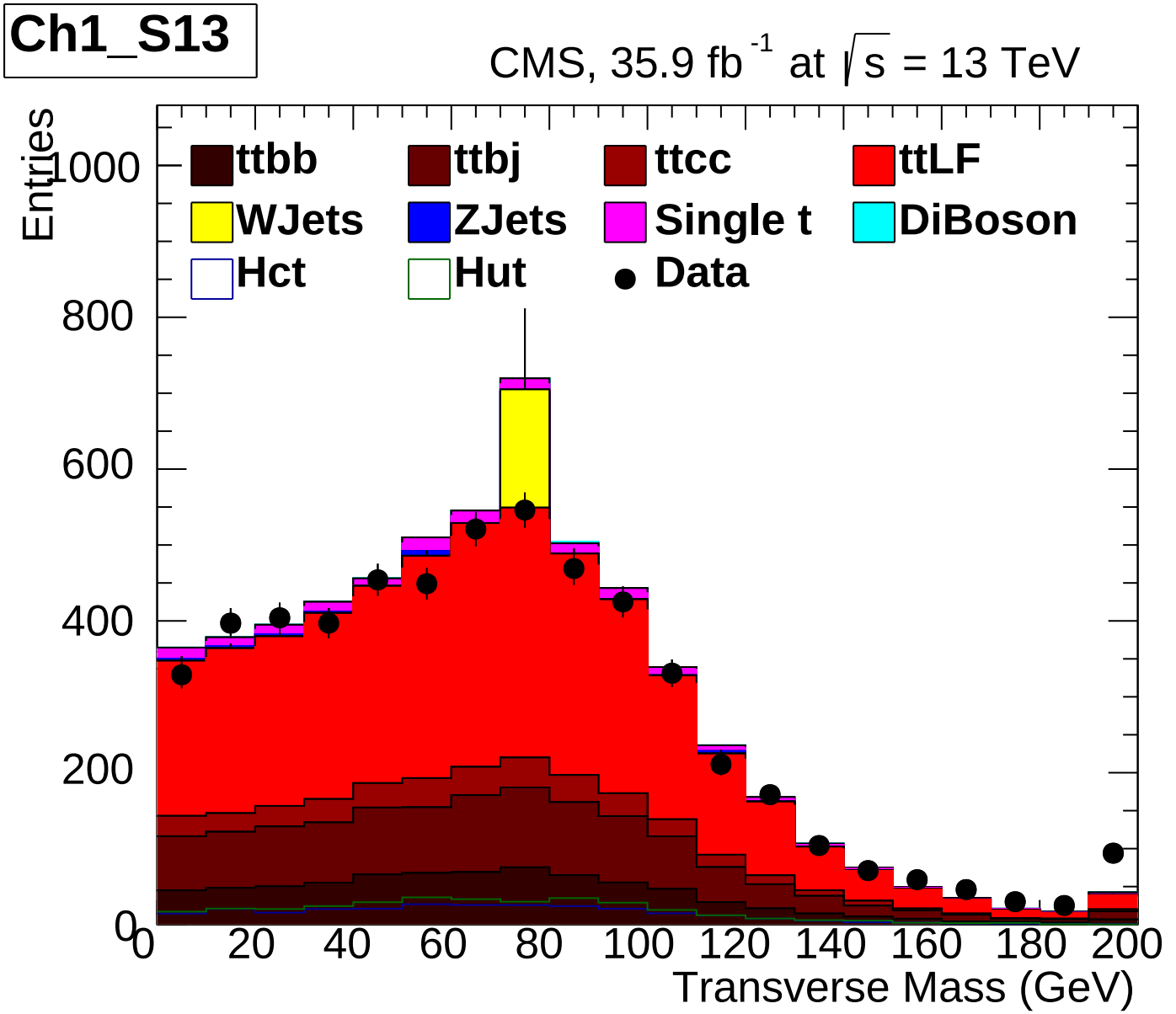
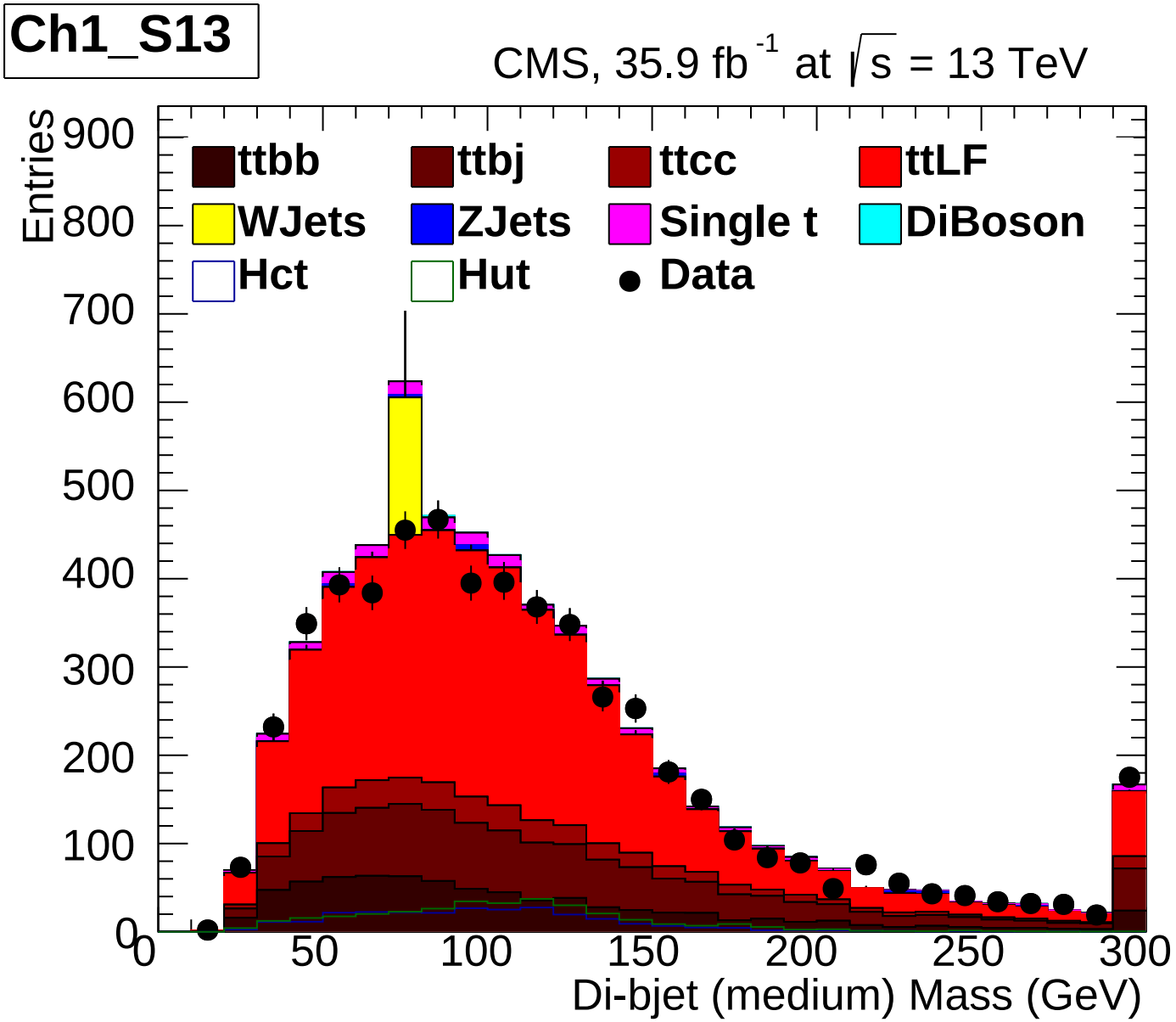
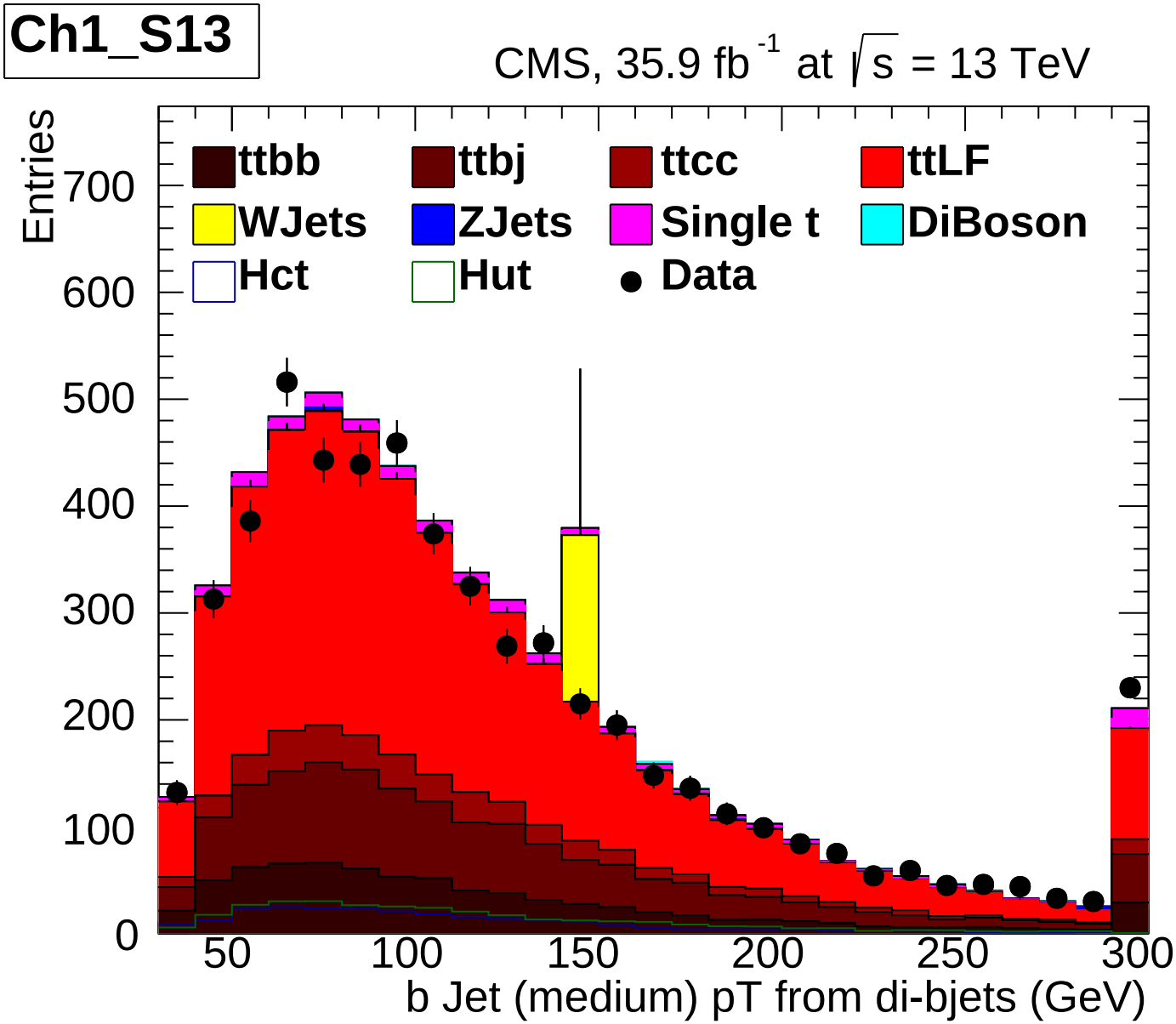
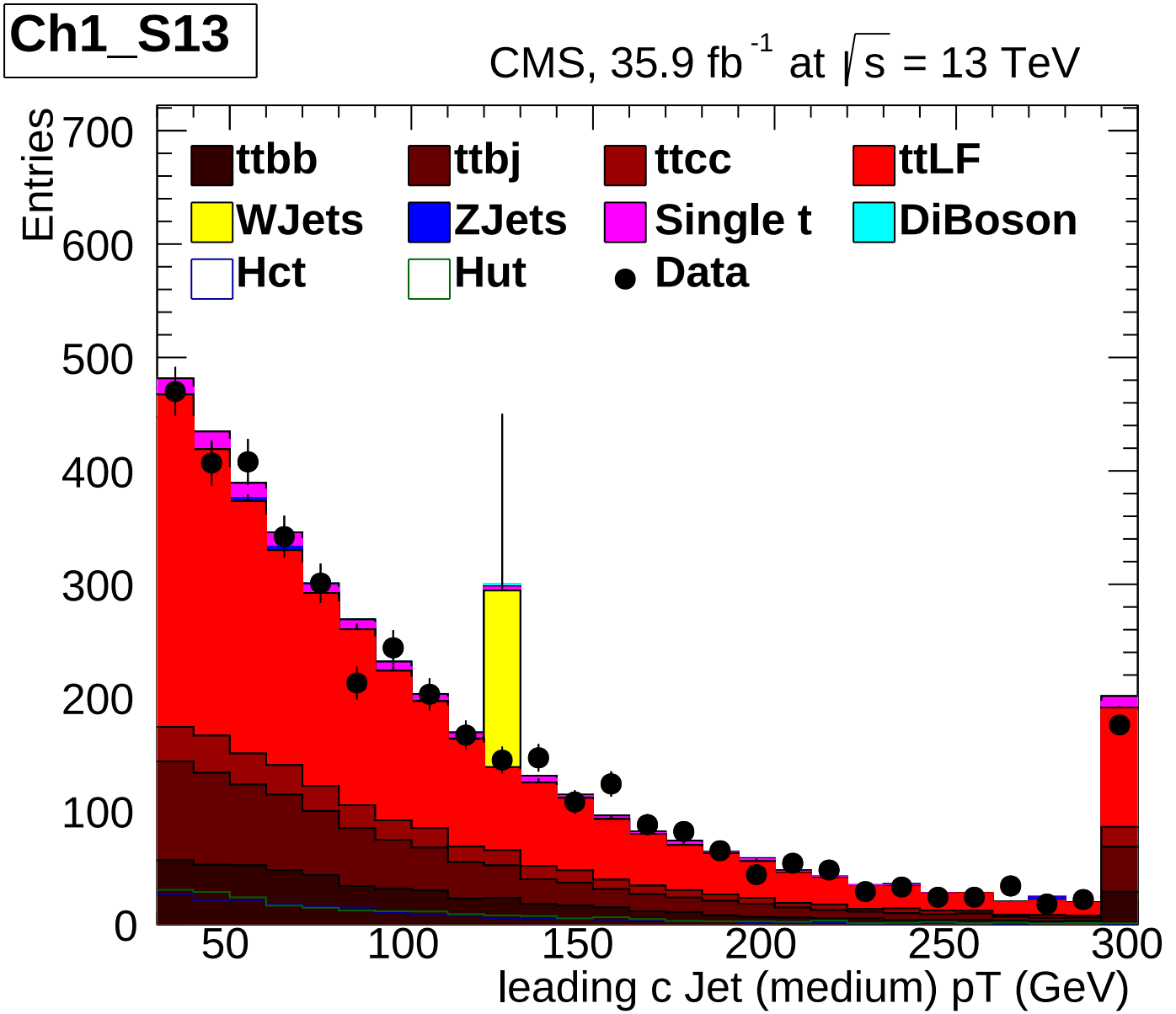
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

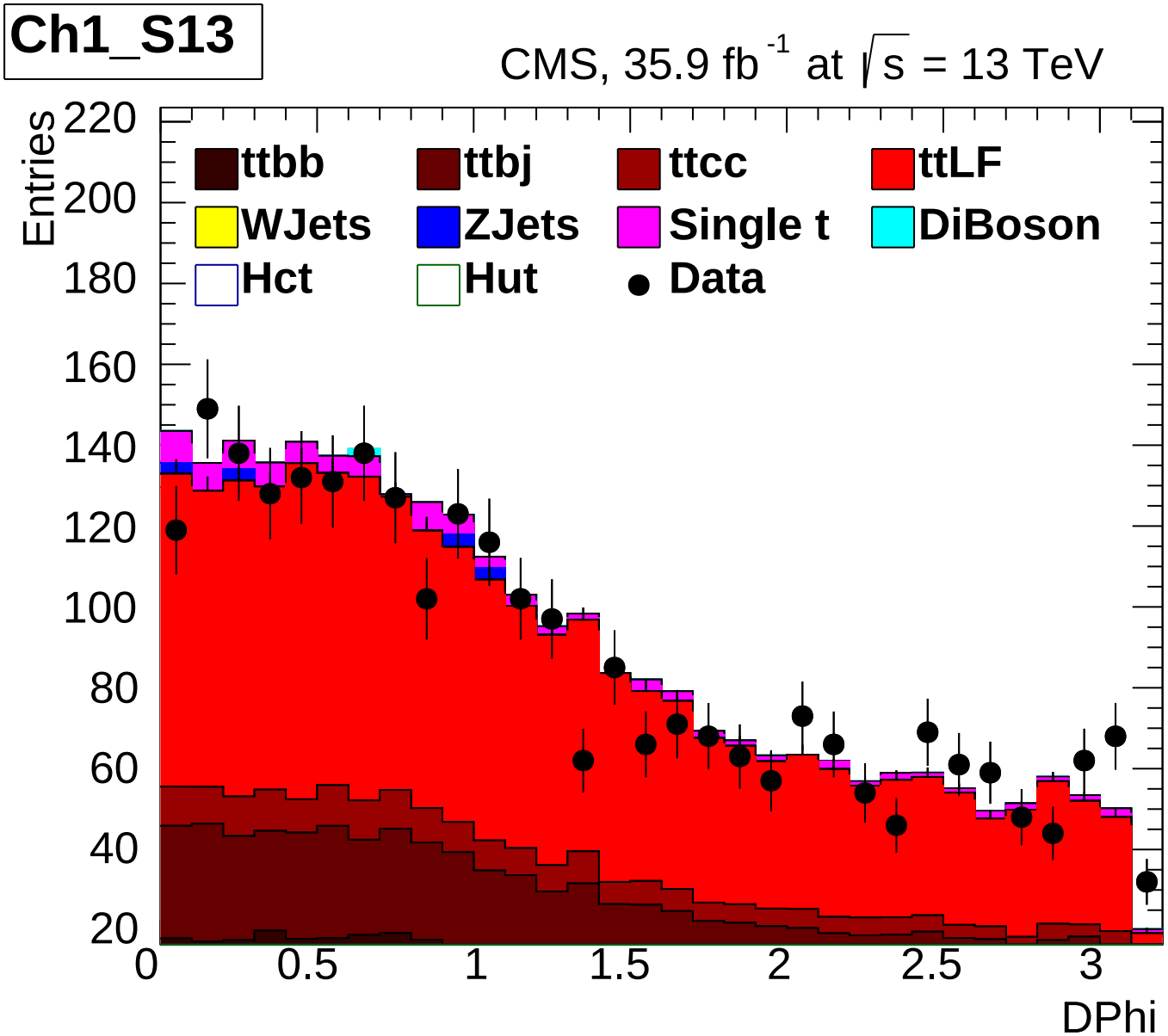

Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
0
50
100
150
200
250
300
MET (GeV)

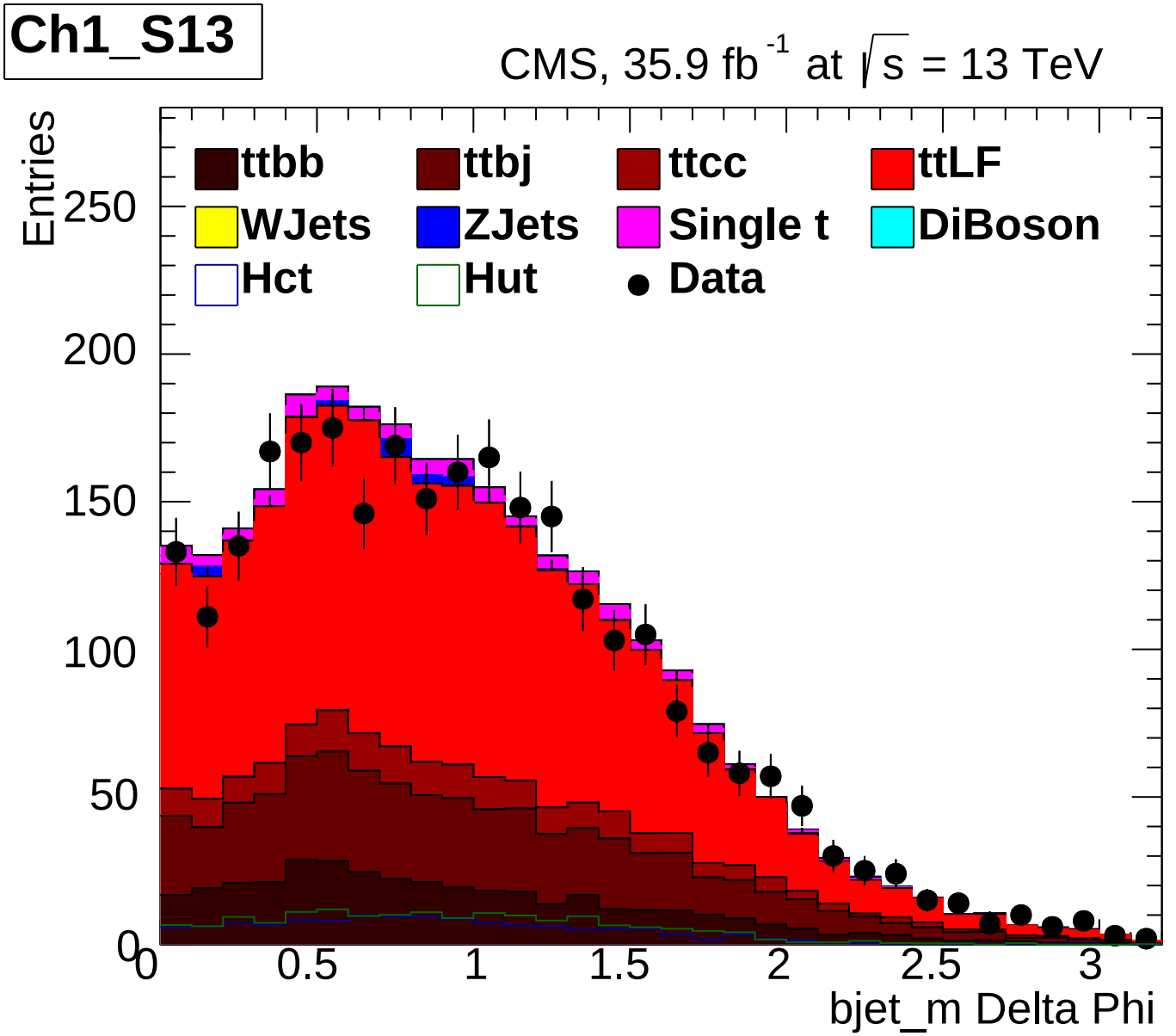

Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
900
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
220
200
180
160
140
120
100
80
60
40
20
0
0.5
1
1.5
2
2.5
3
DPhi


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
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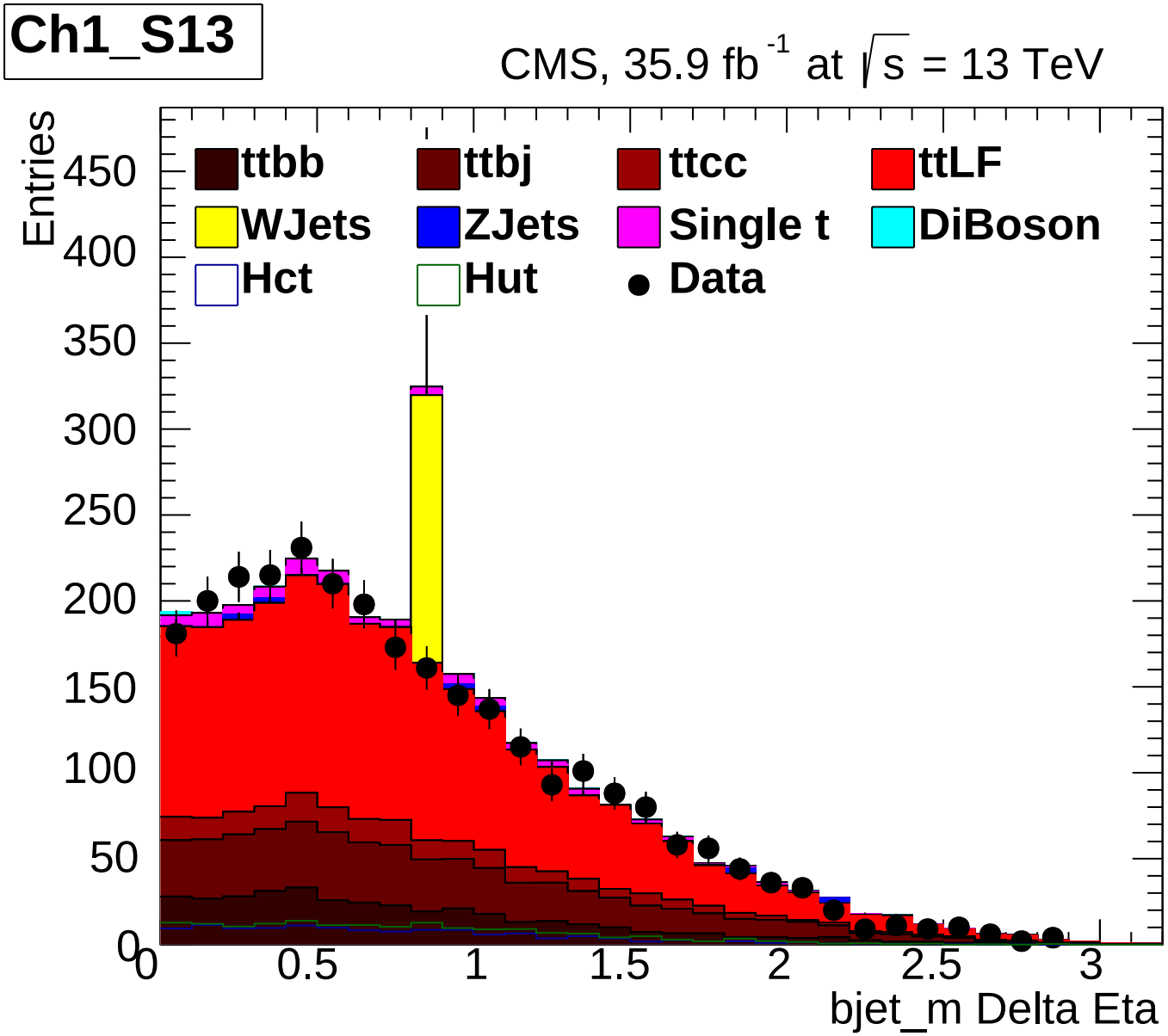
100
150
200
250
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
50
100
150
200
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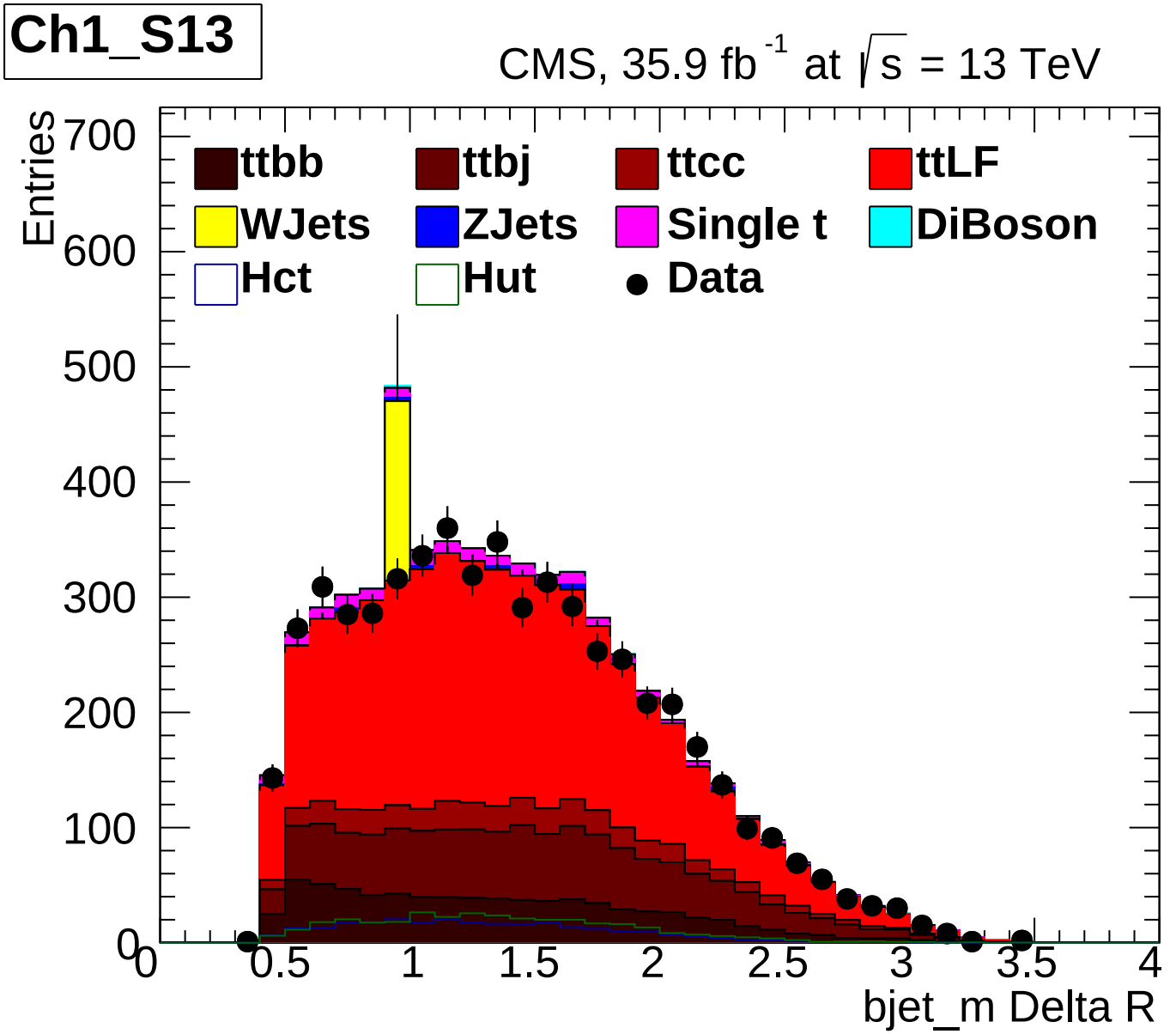
300
350
400
450
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
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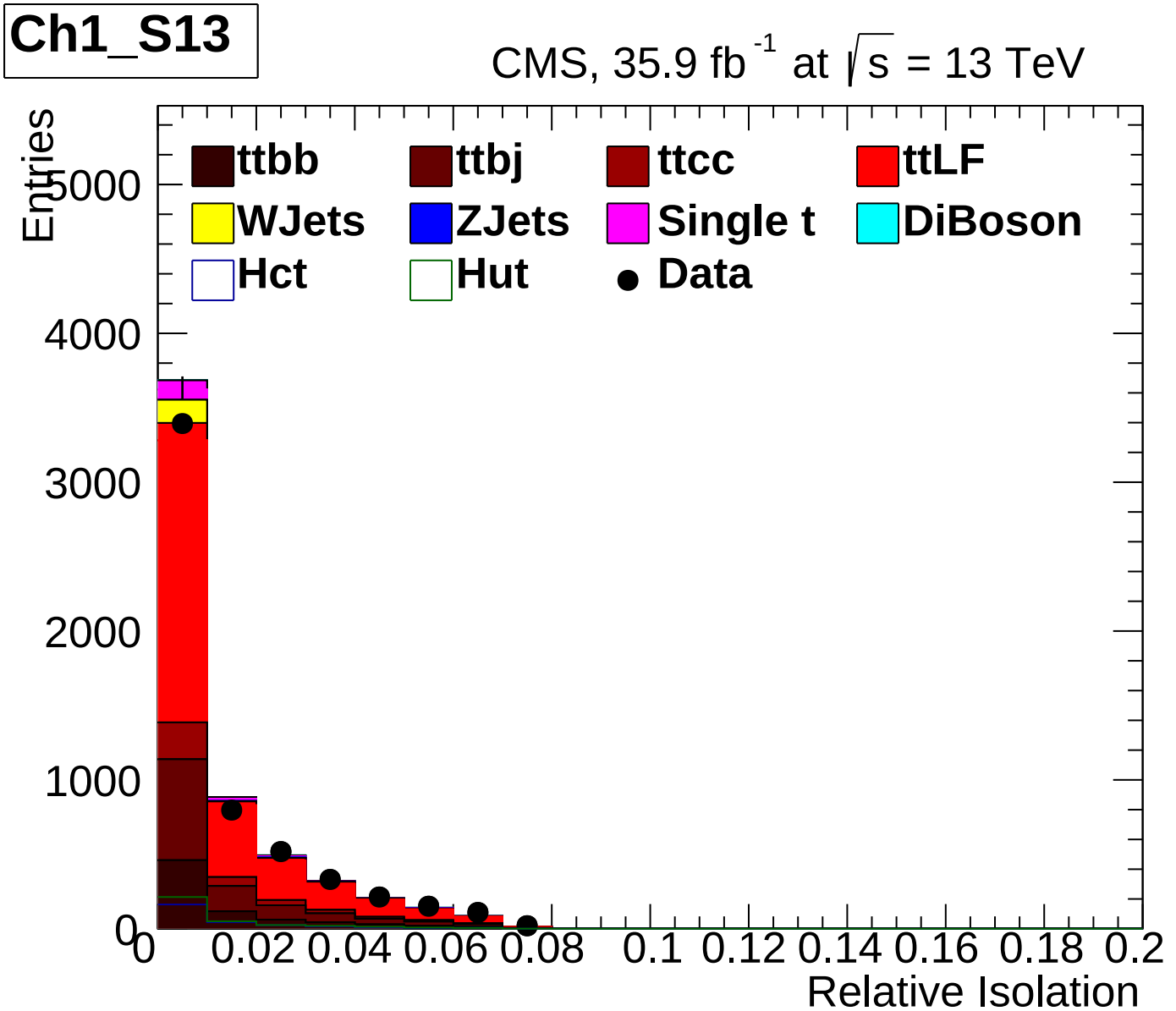
400
500
600
700
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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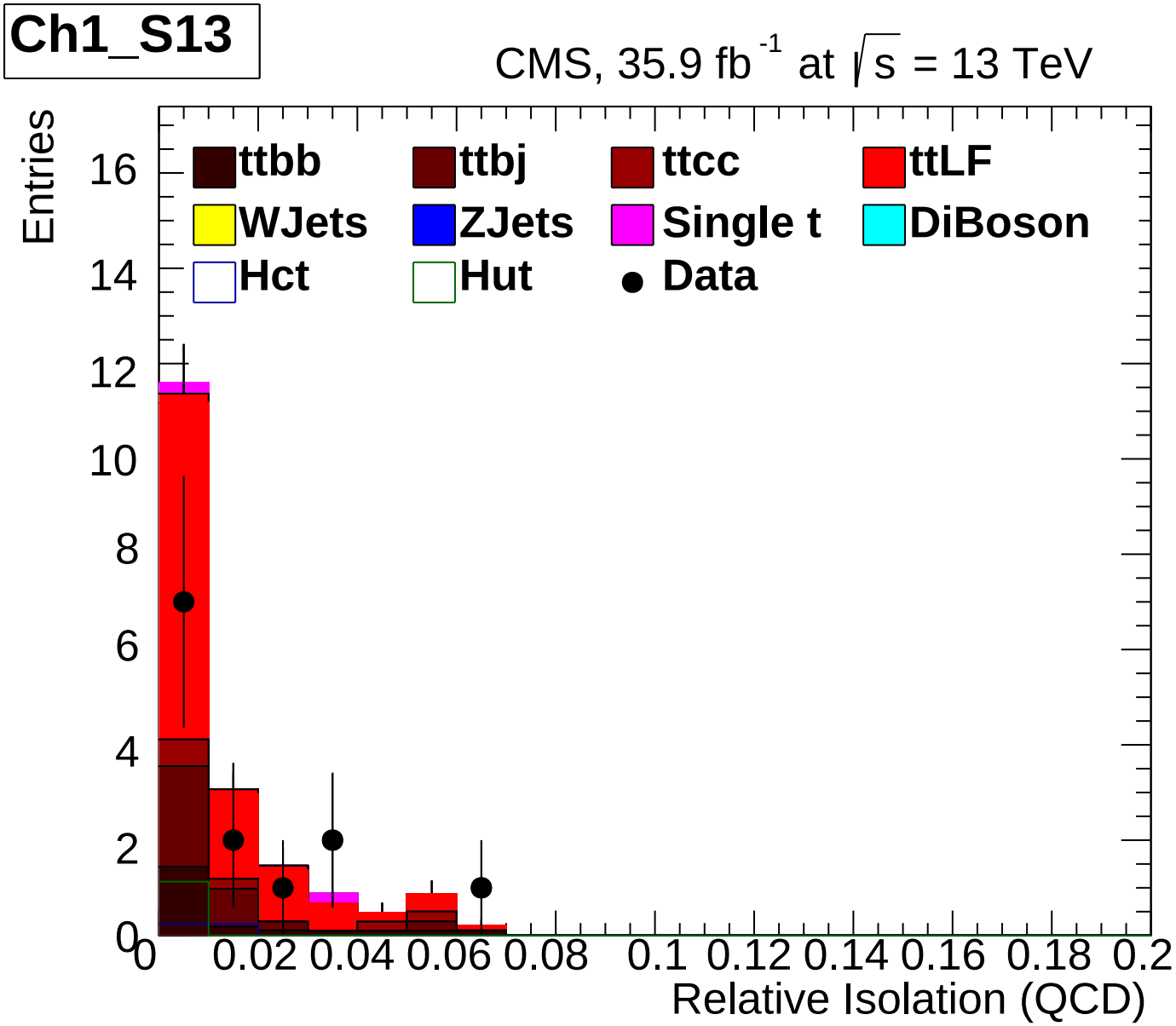
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
5000
4000
3000
2000
1000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
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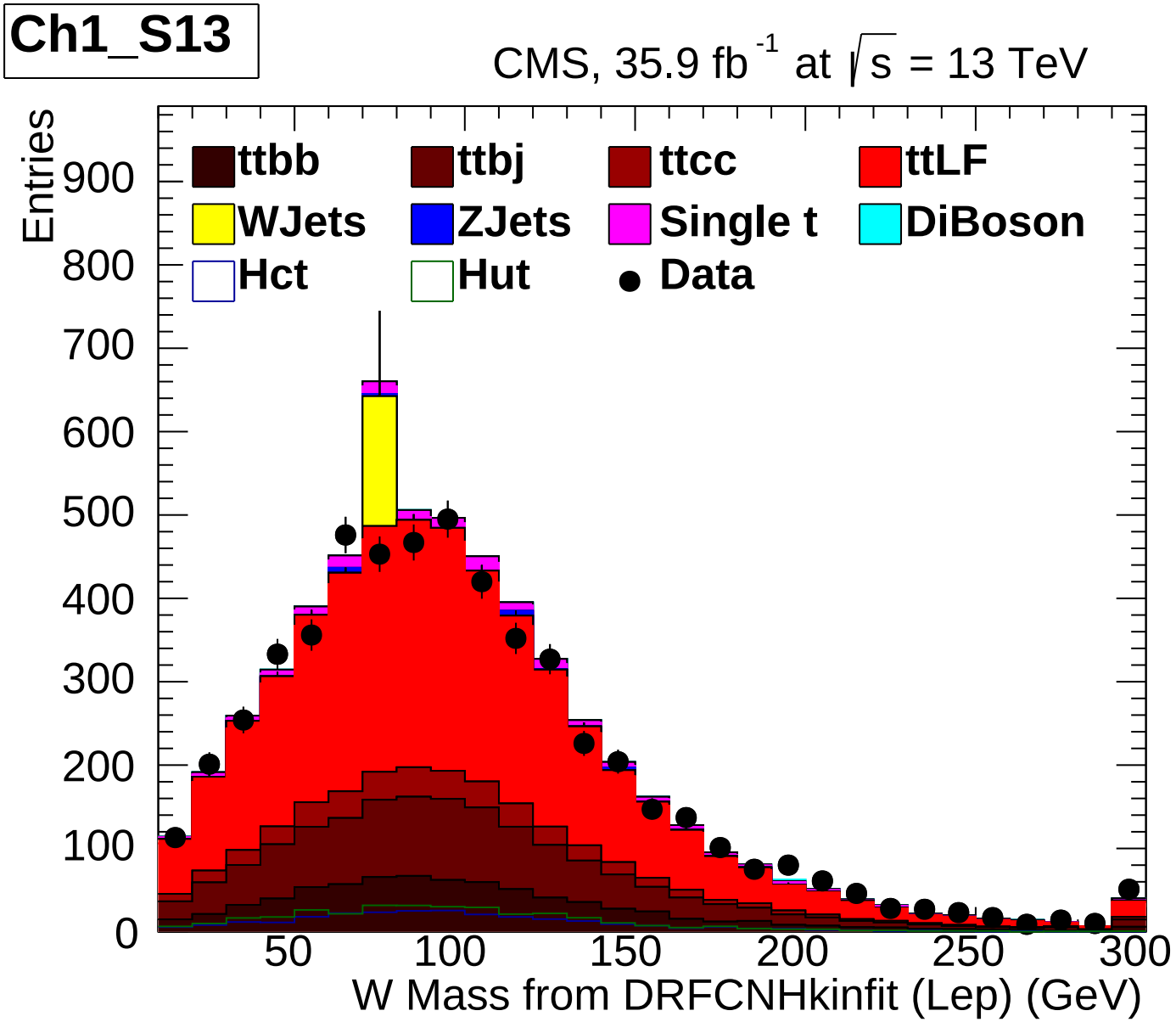
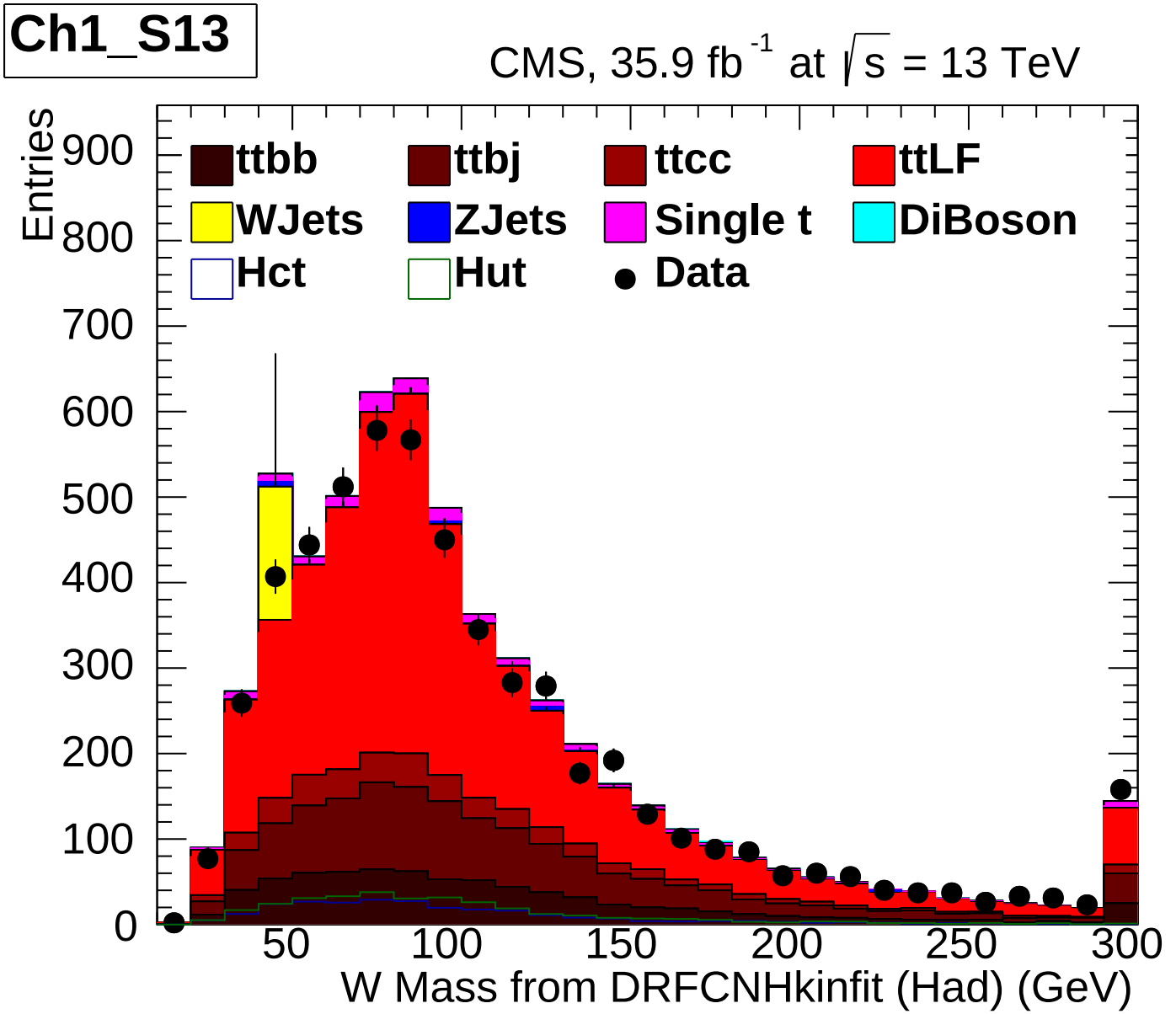
Hct
Hut
Data
0
2
4
6
8
10
12
14
16
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
100
200
300
400
500
600
700
800
900
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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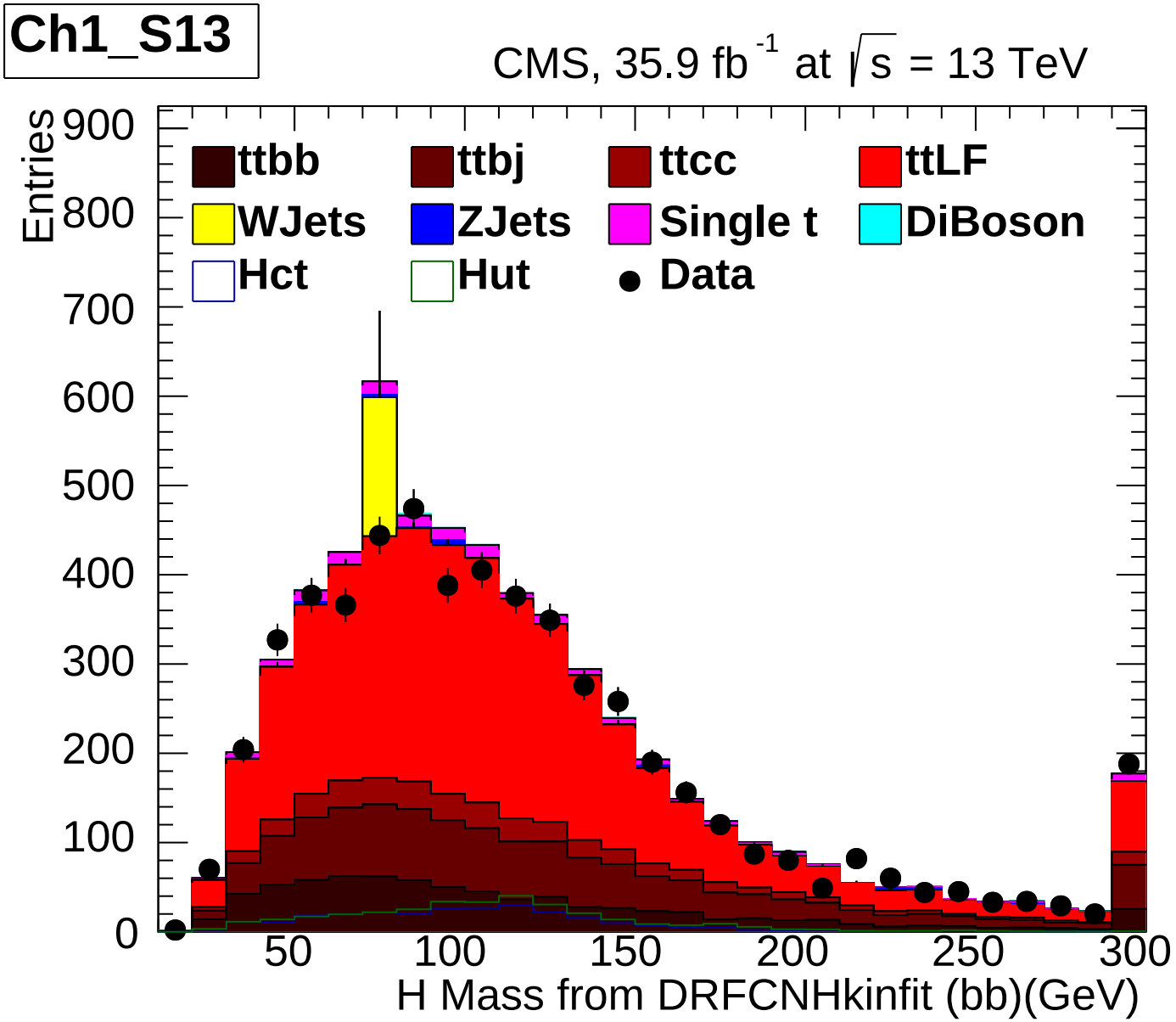
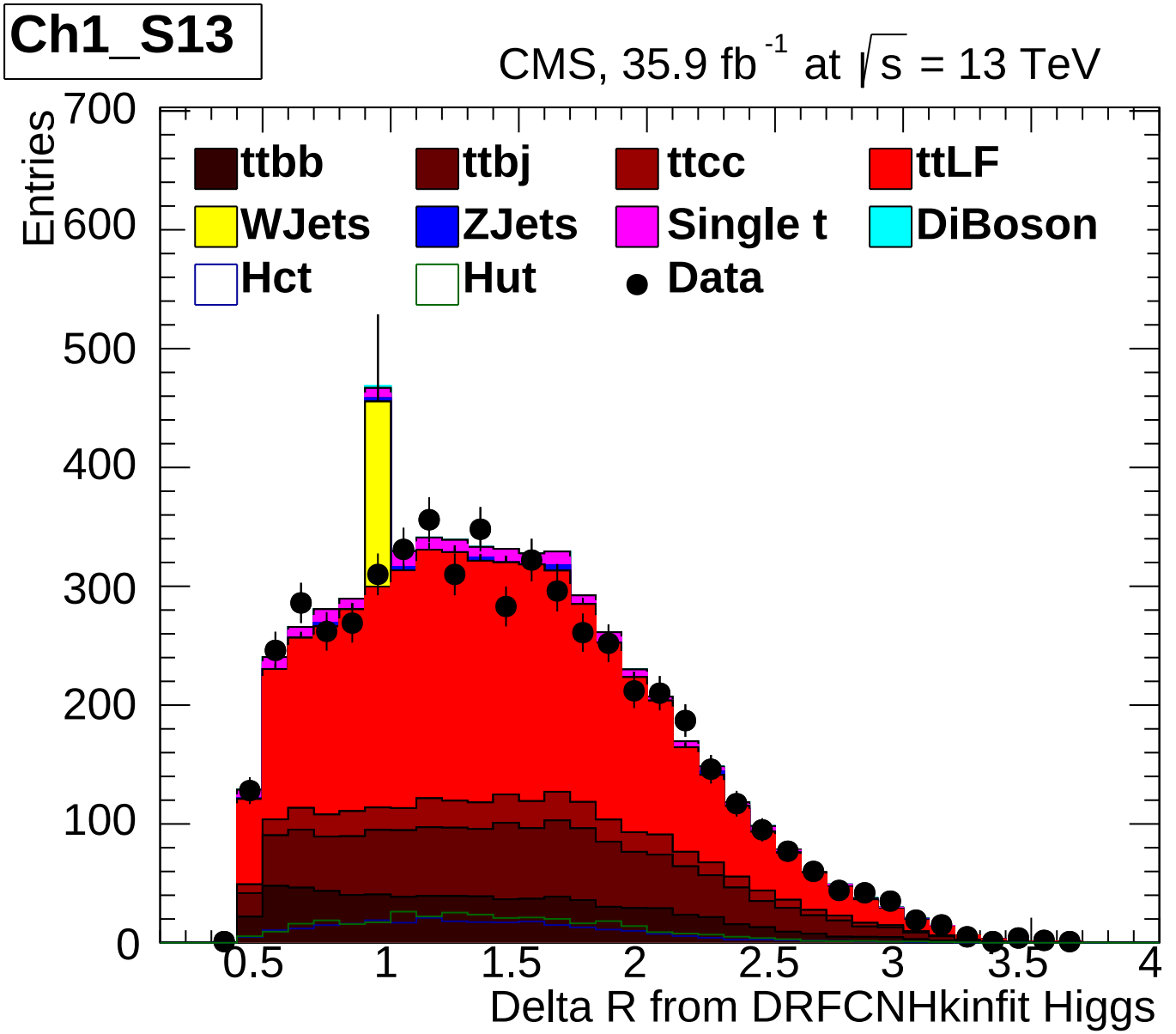
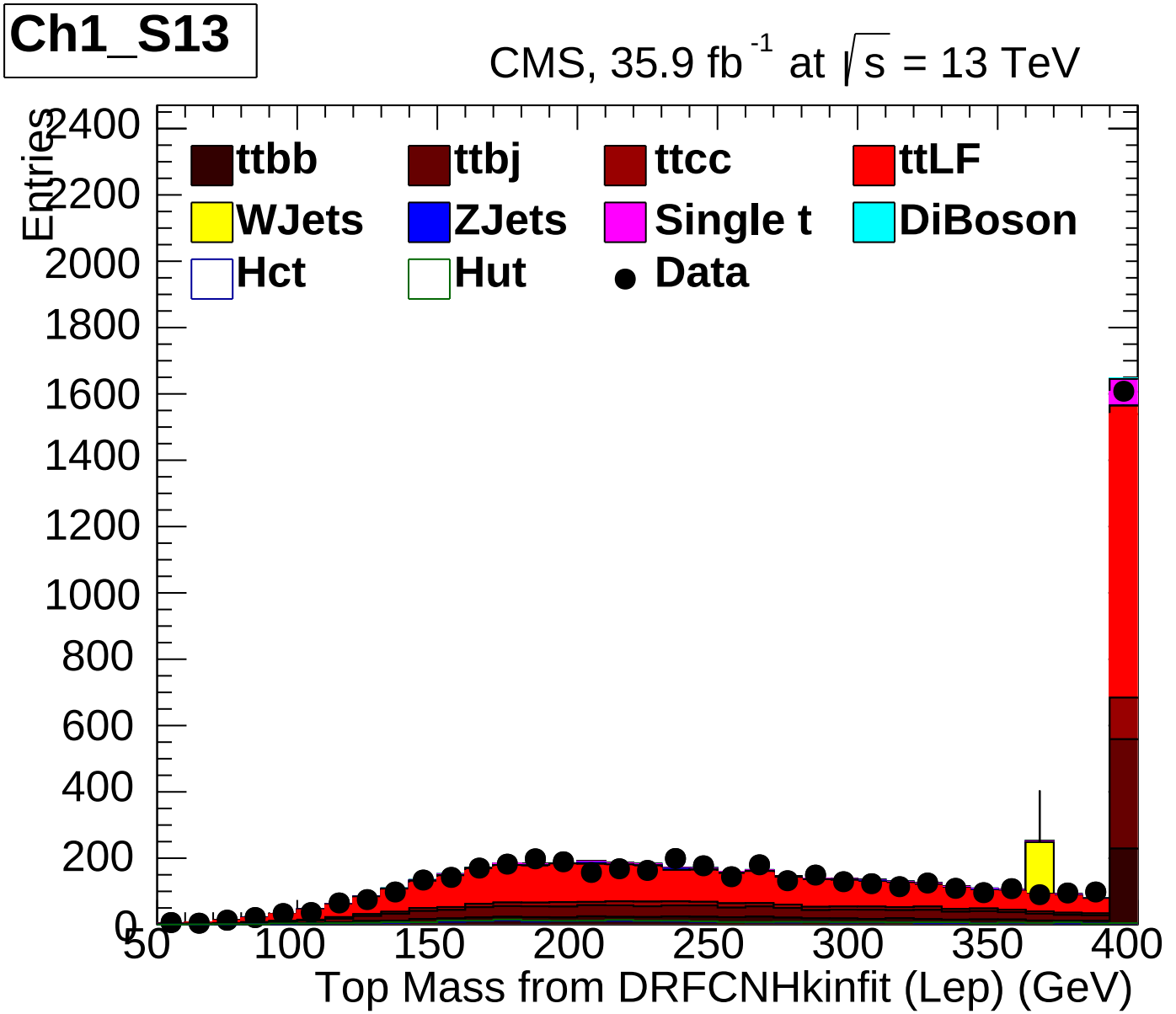
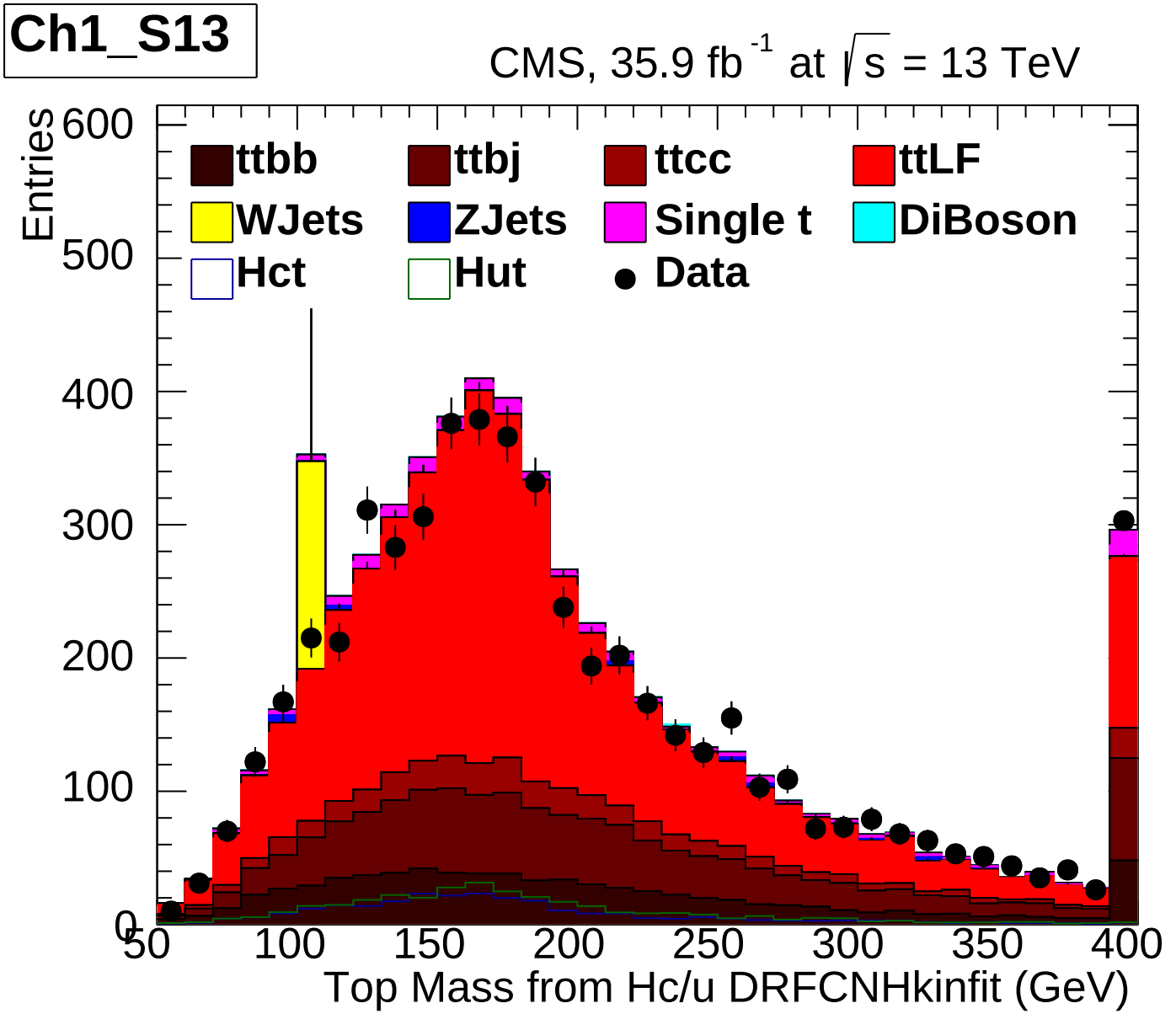
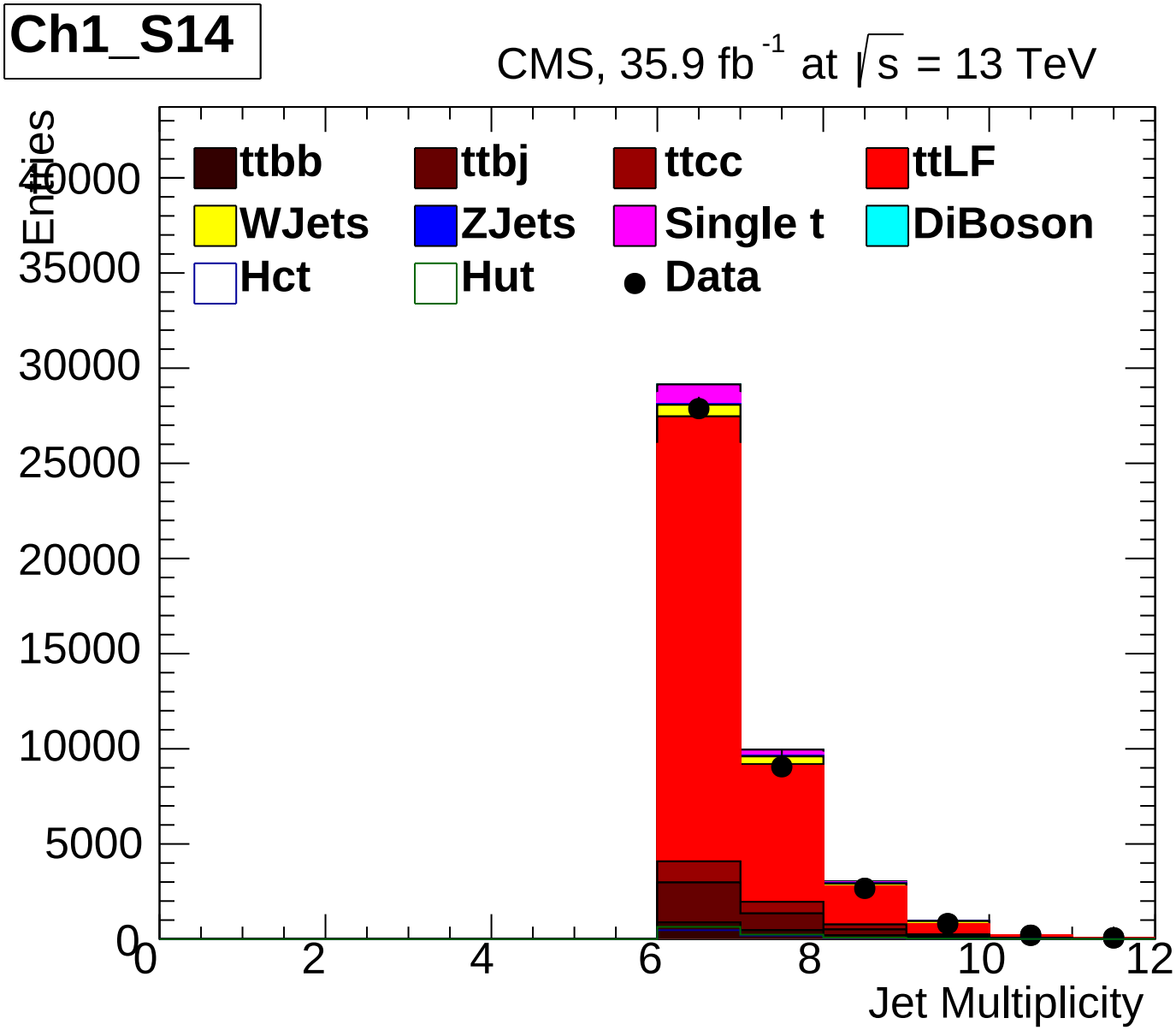
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
900
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

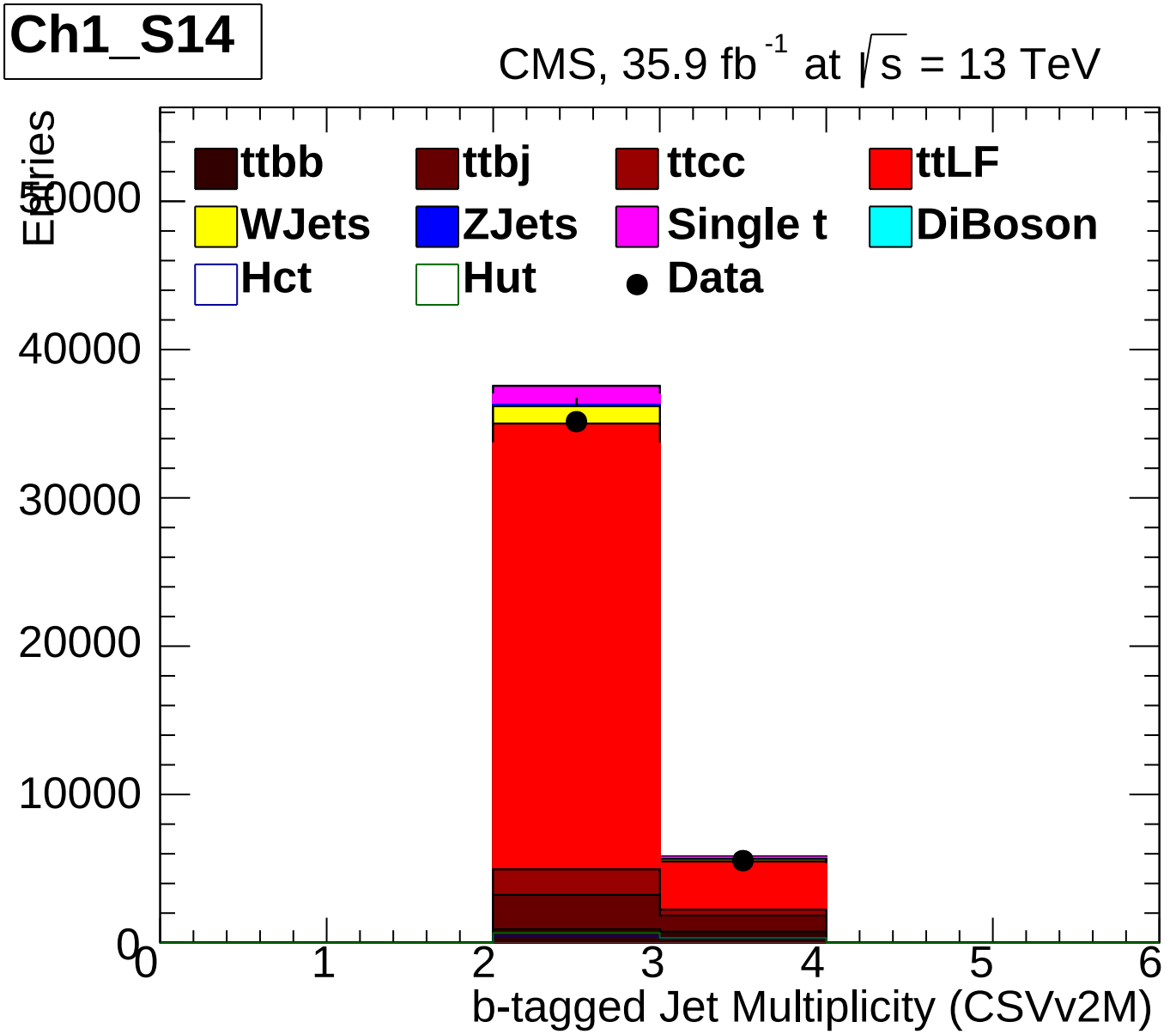

Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
900
800
700
600
500
400
300
200
100
0
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

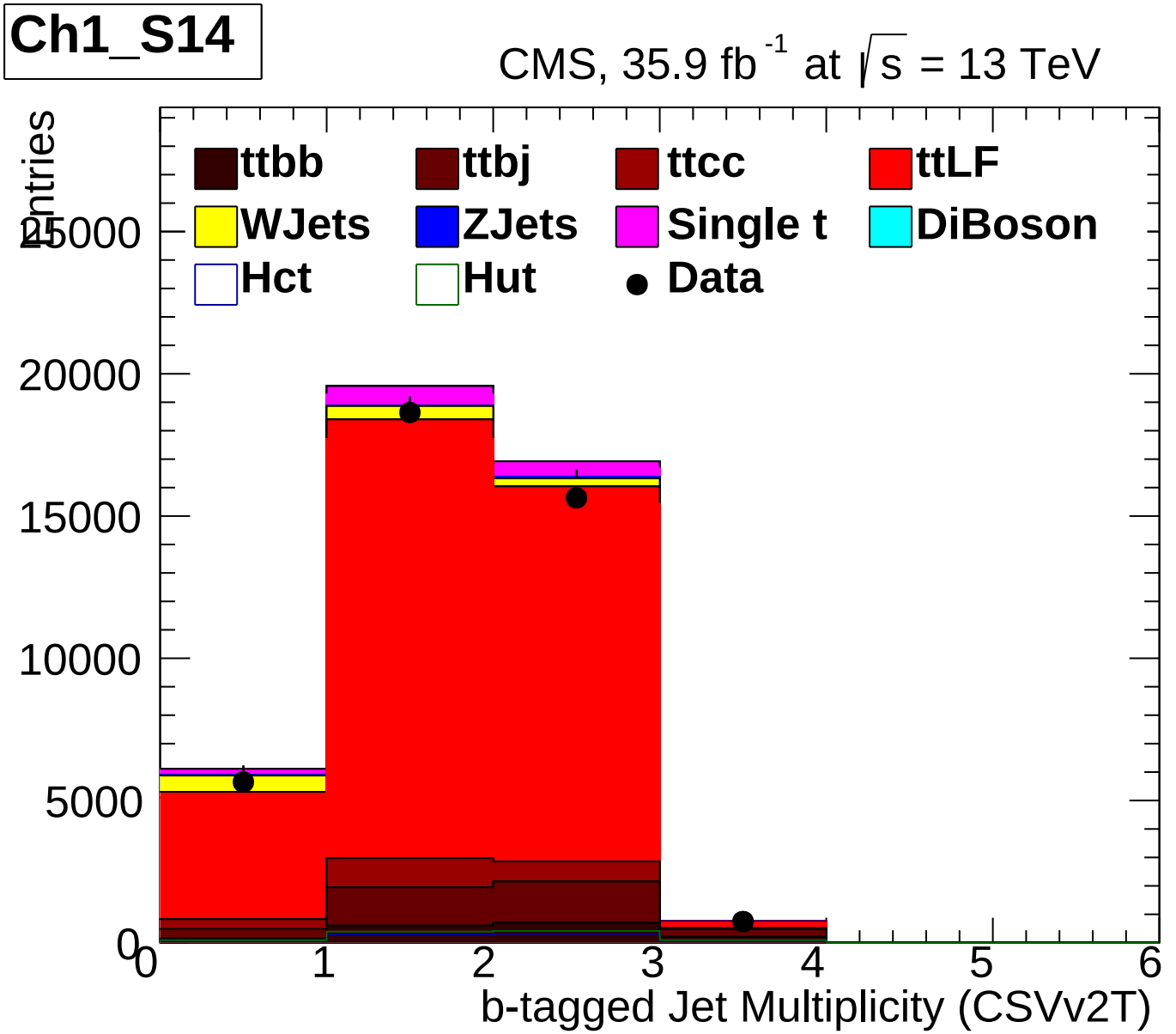

Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

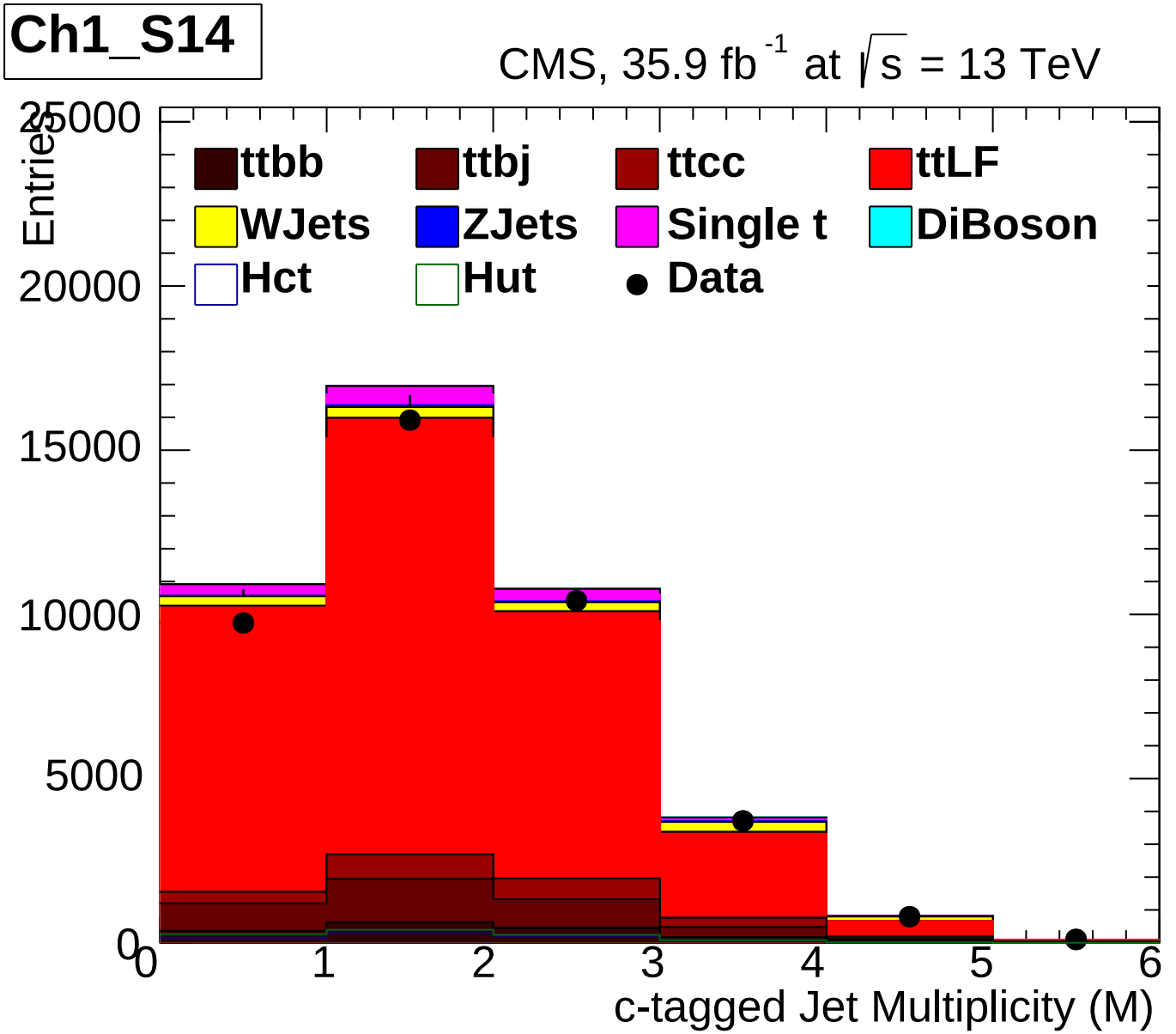

Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

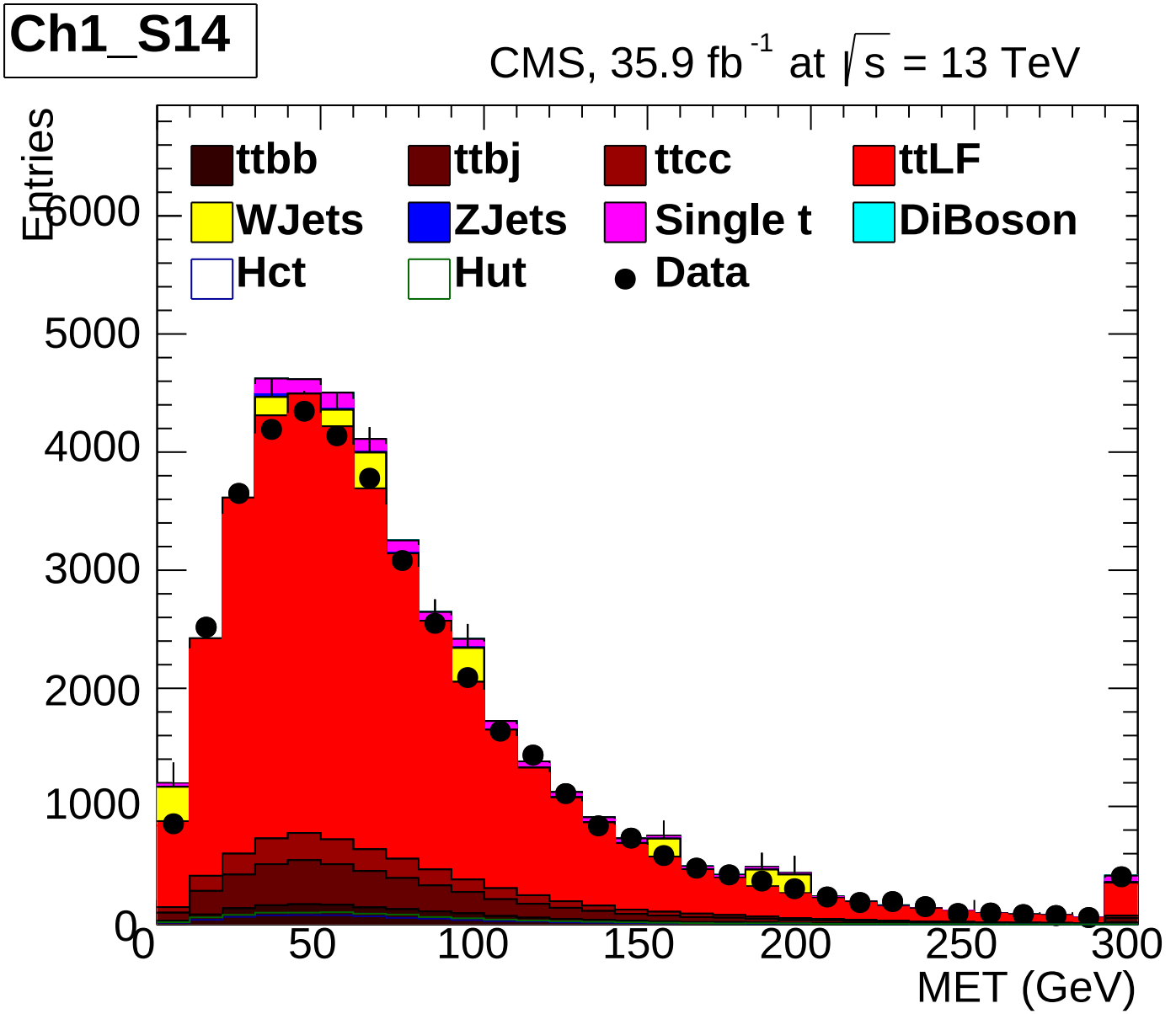

Ch1_S13
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

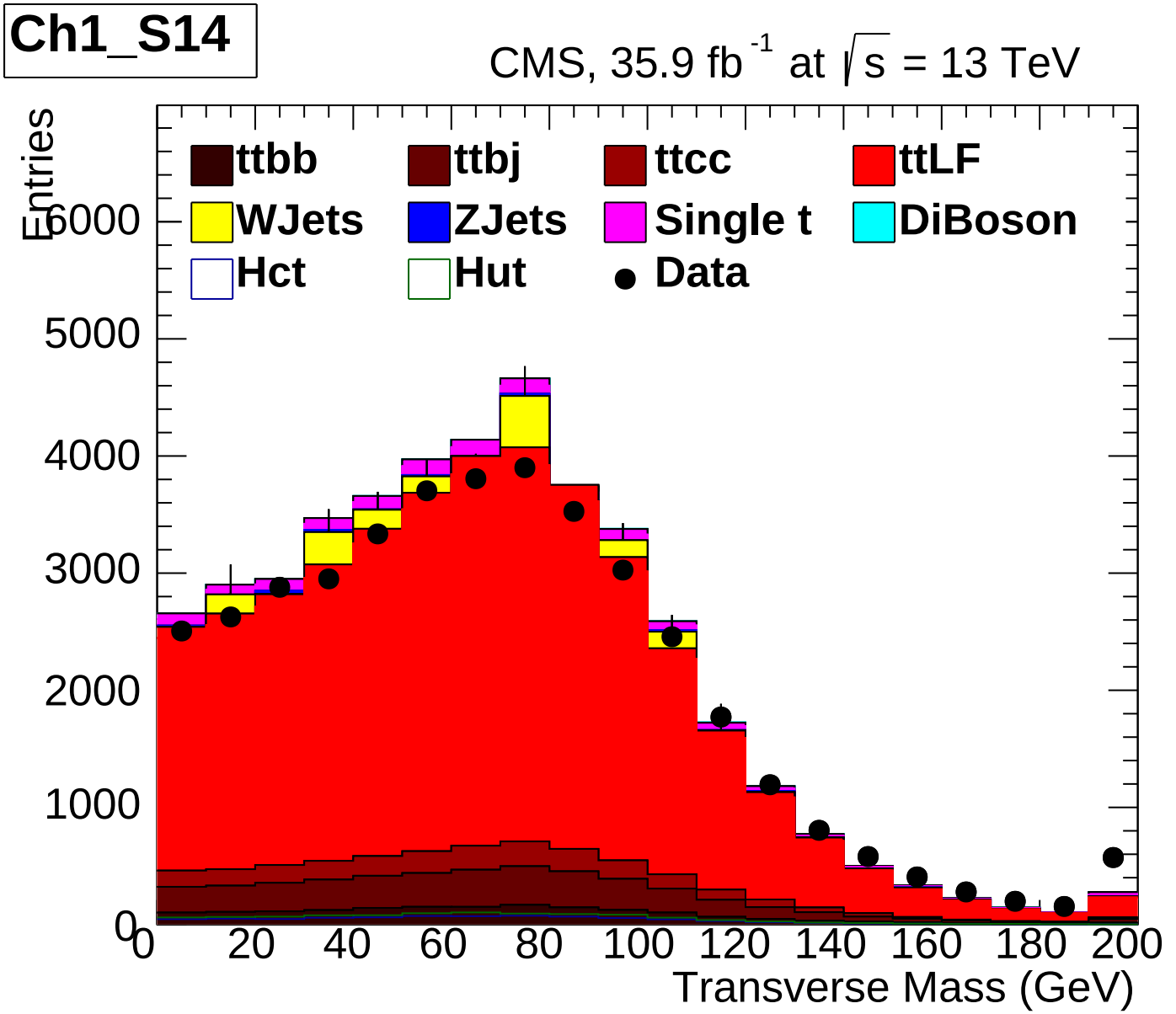

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
0
2
4
6
8
10
12
Jet Multiplicity

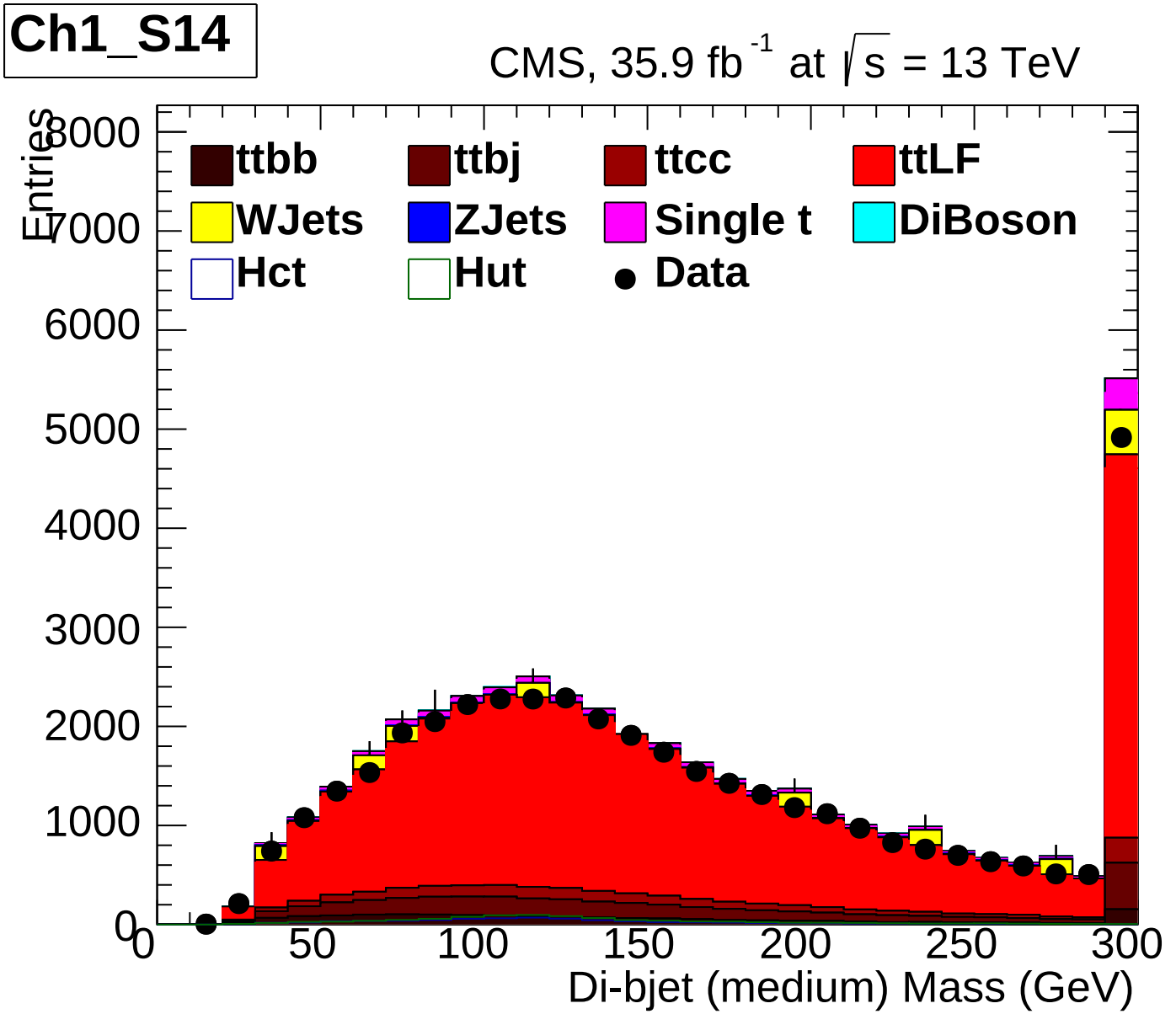

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
50000
40000
30000
20000
10000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

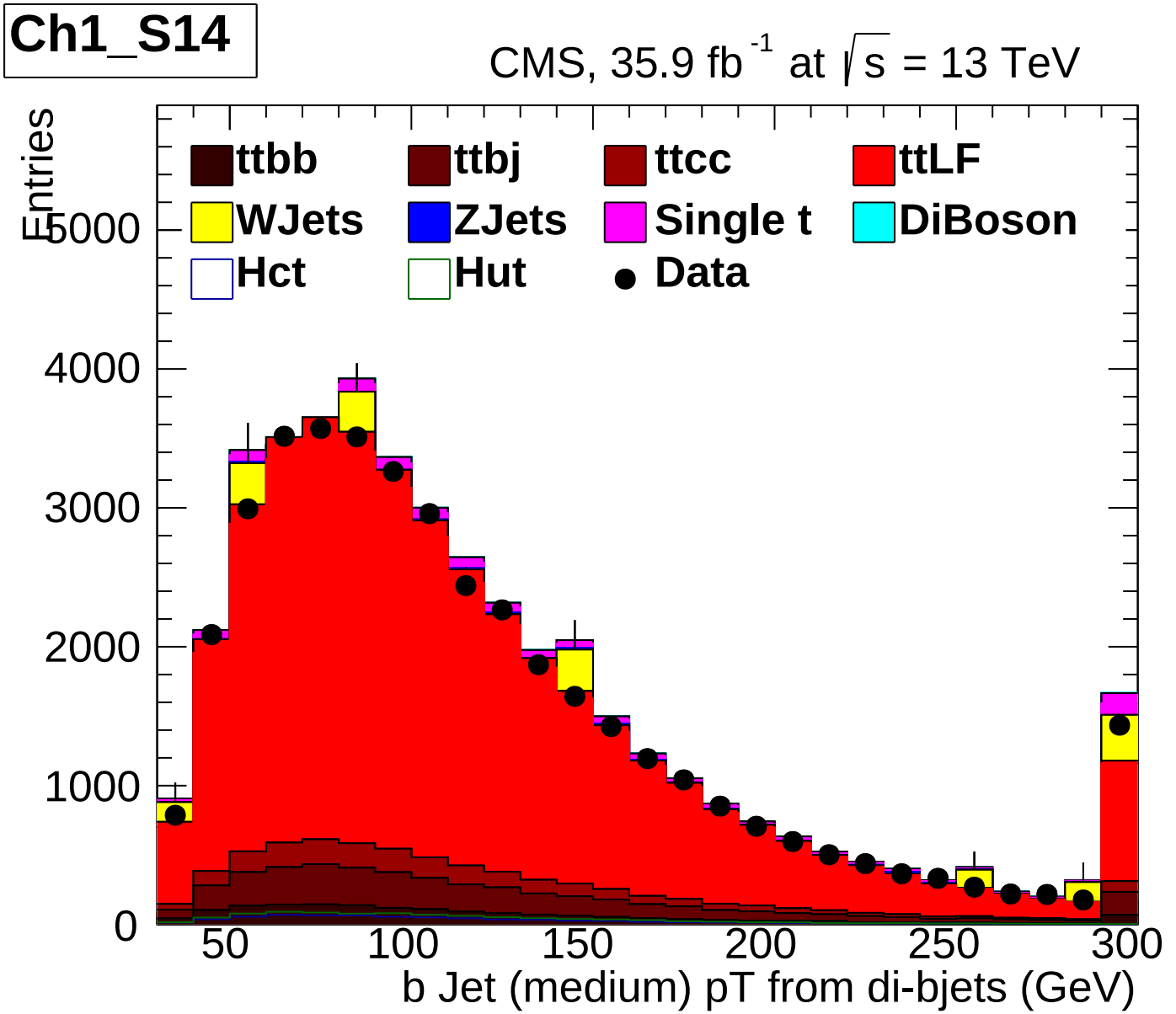

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

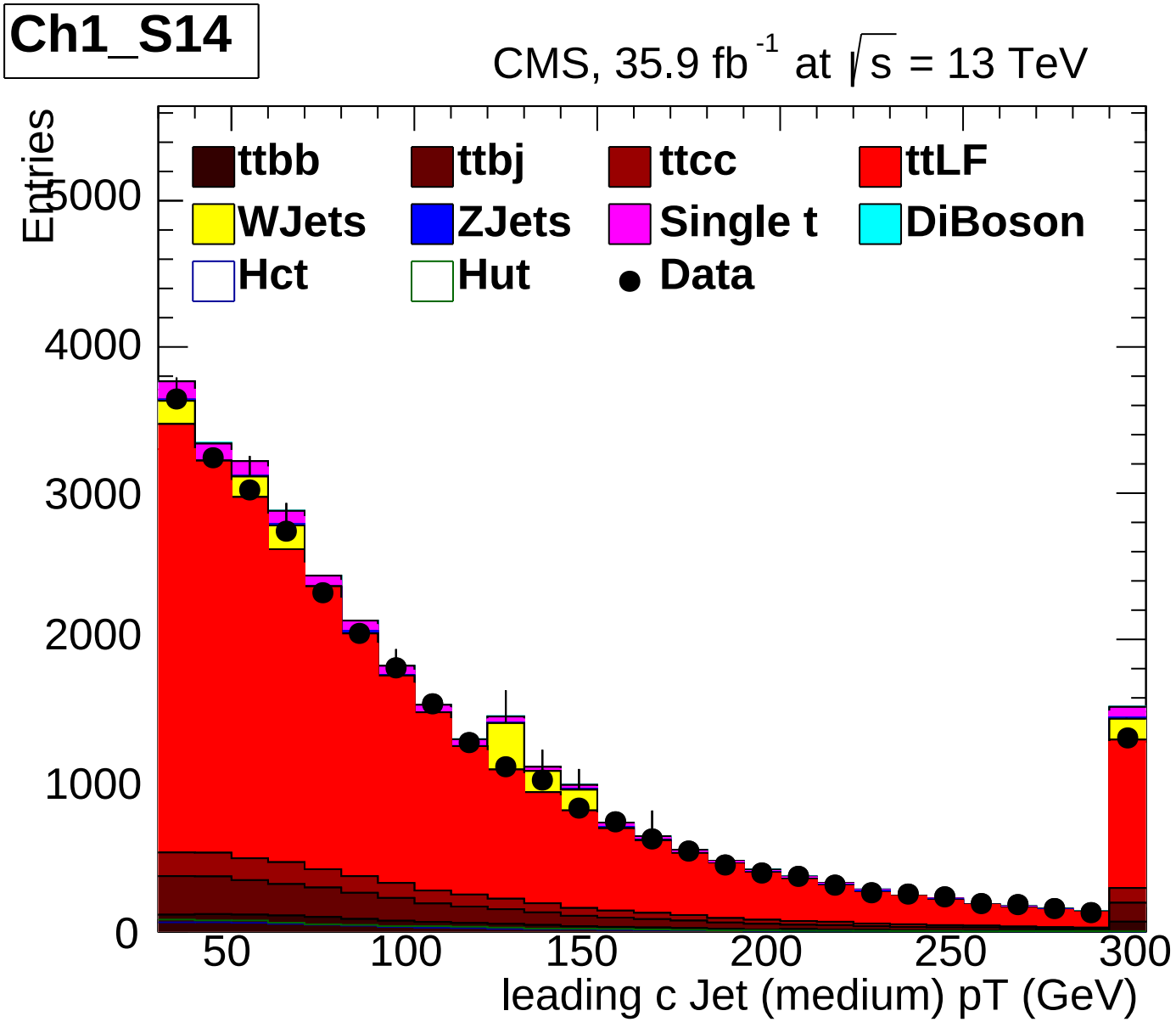

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

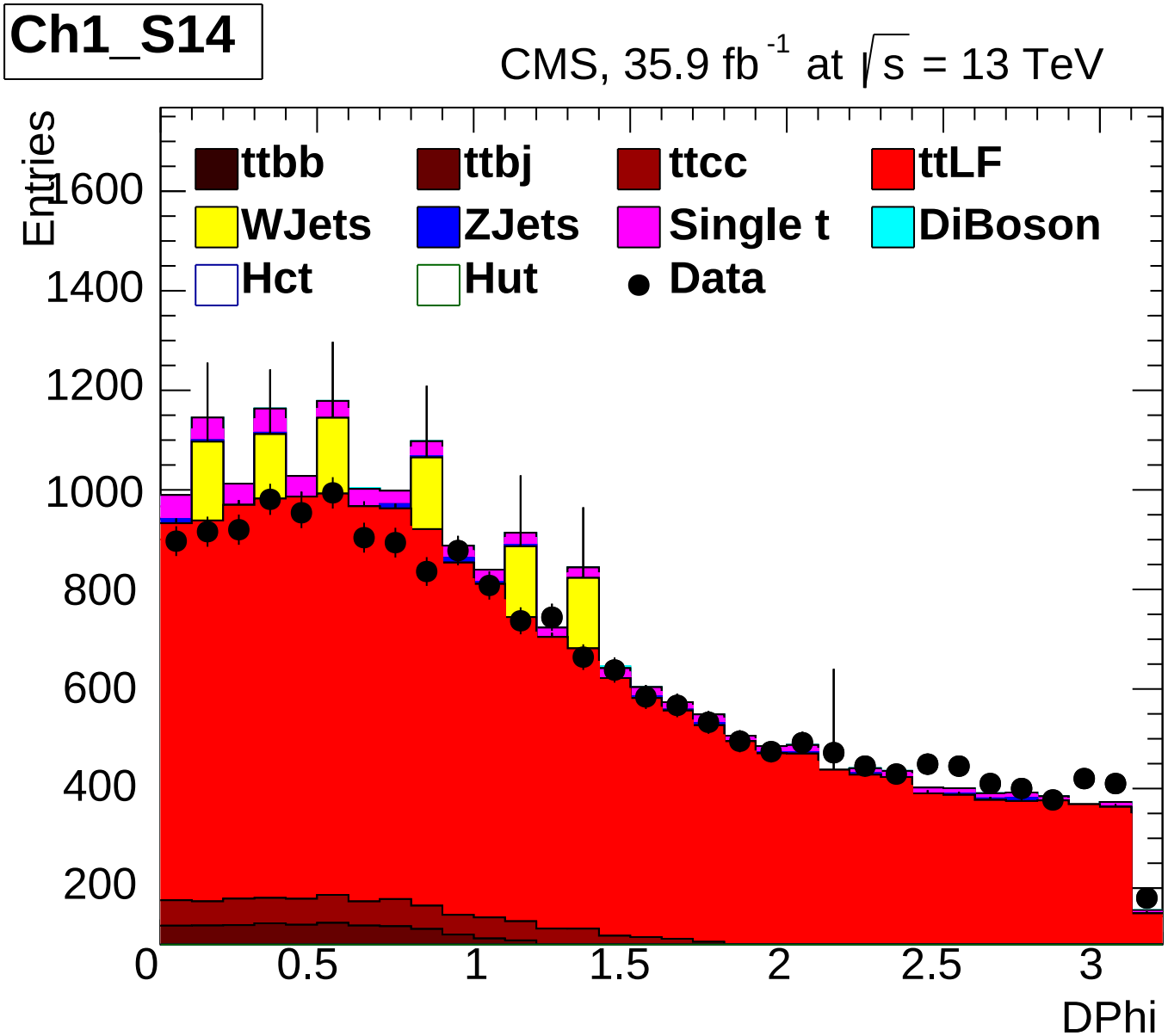

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
1000
2000
3000
4000
5000
6000
0
50
100
150
200
250
300
MET (GeV)

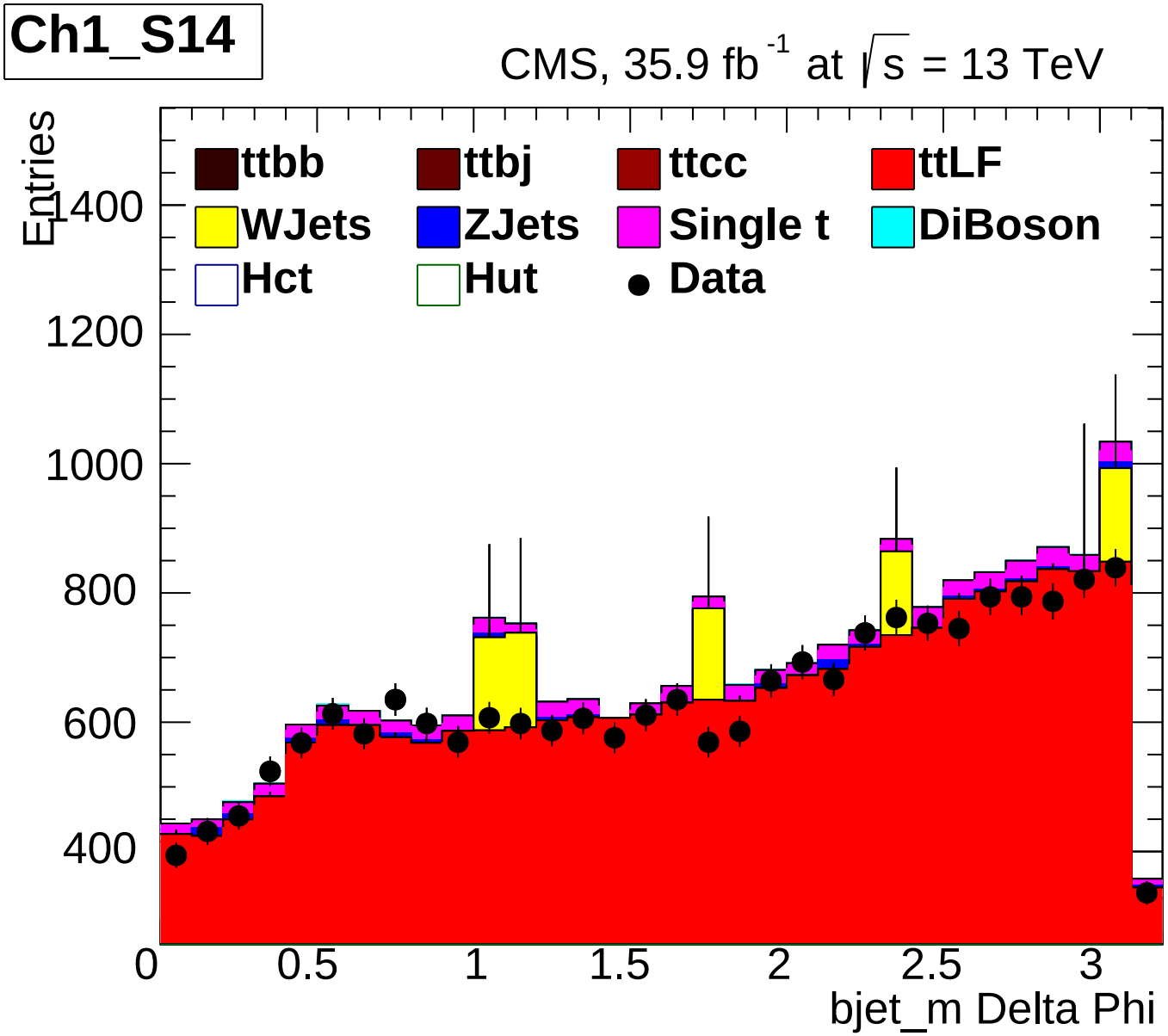

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)

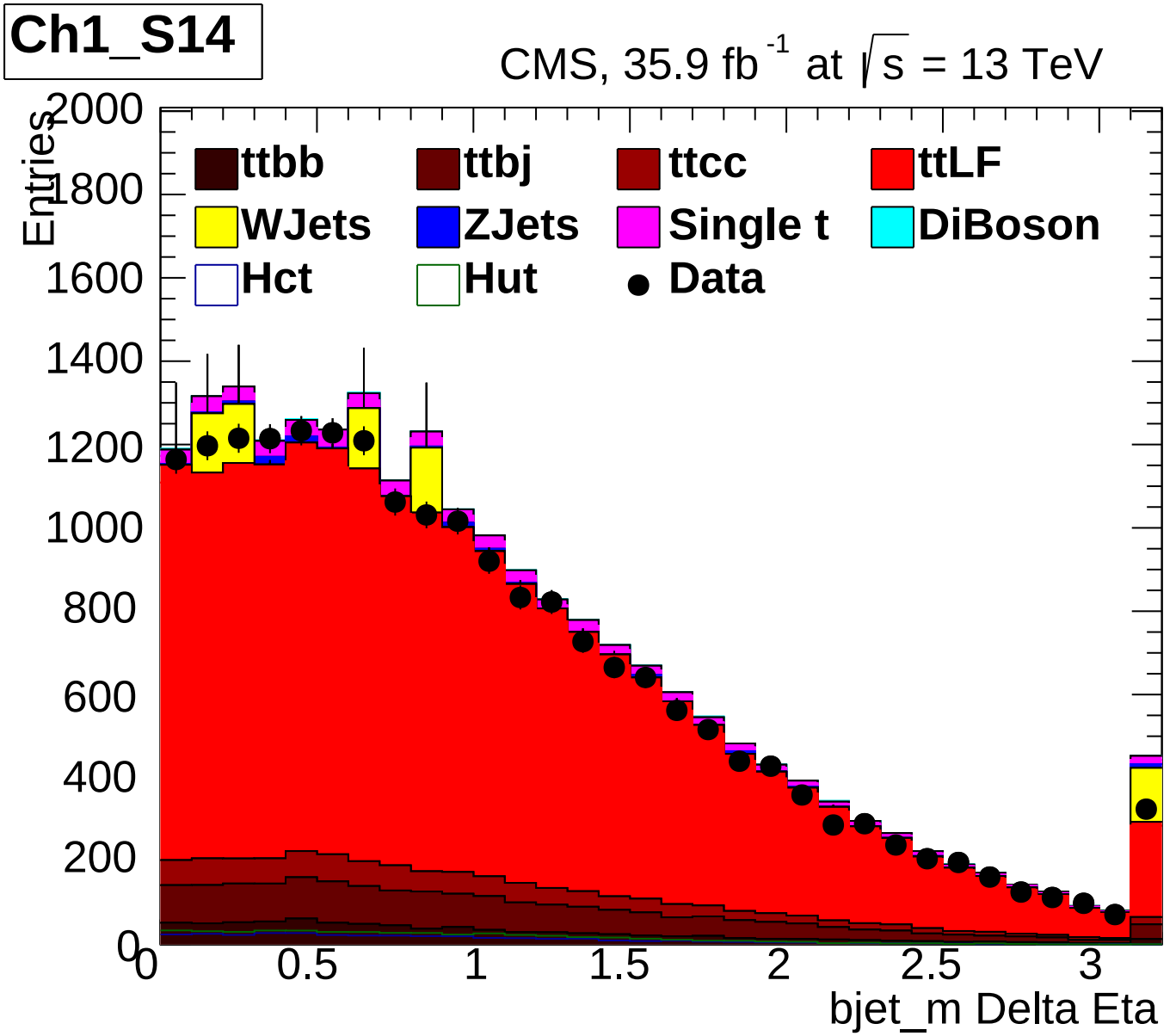

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)

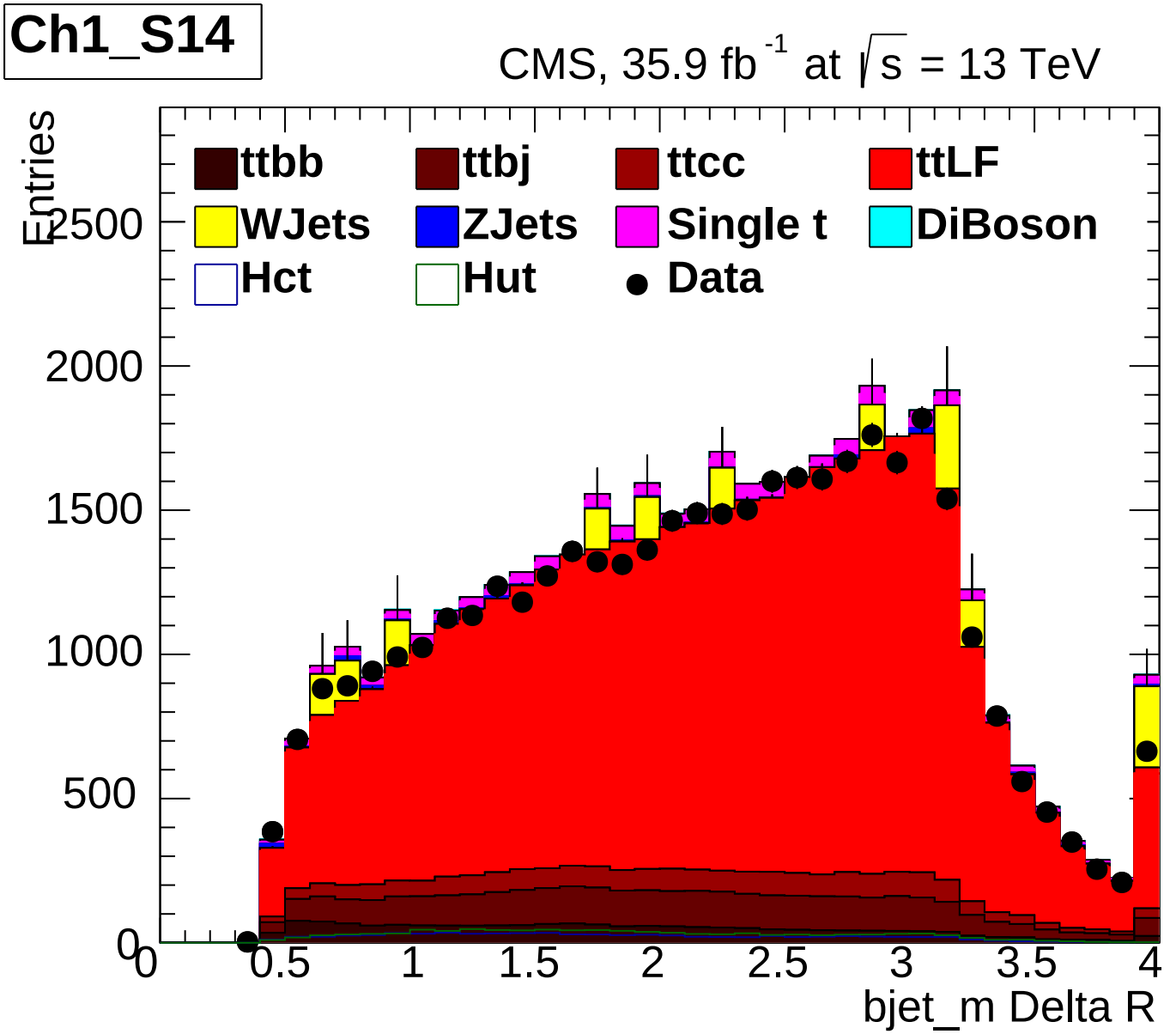

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)

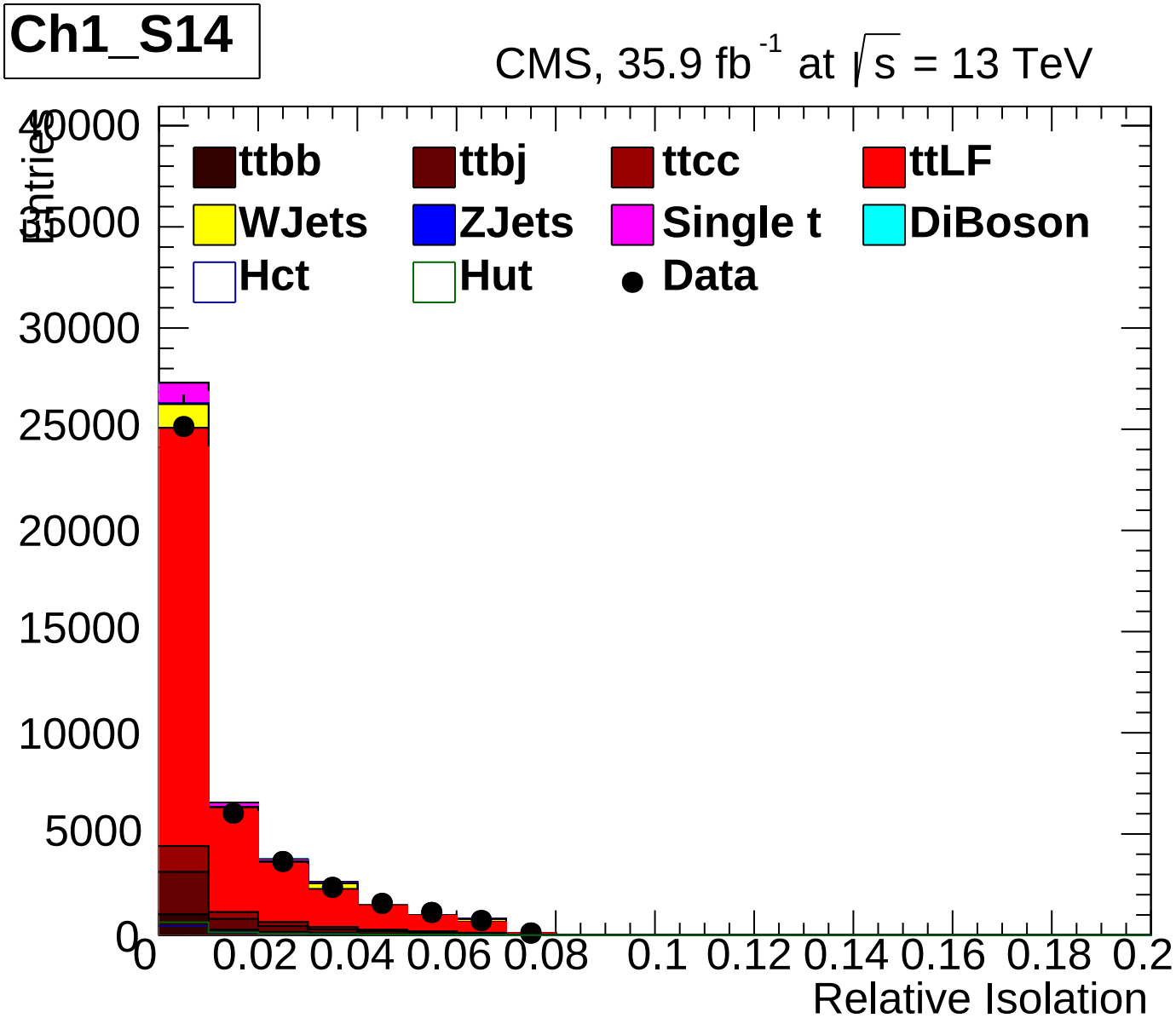

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)

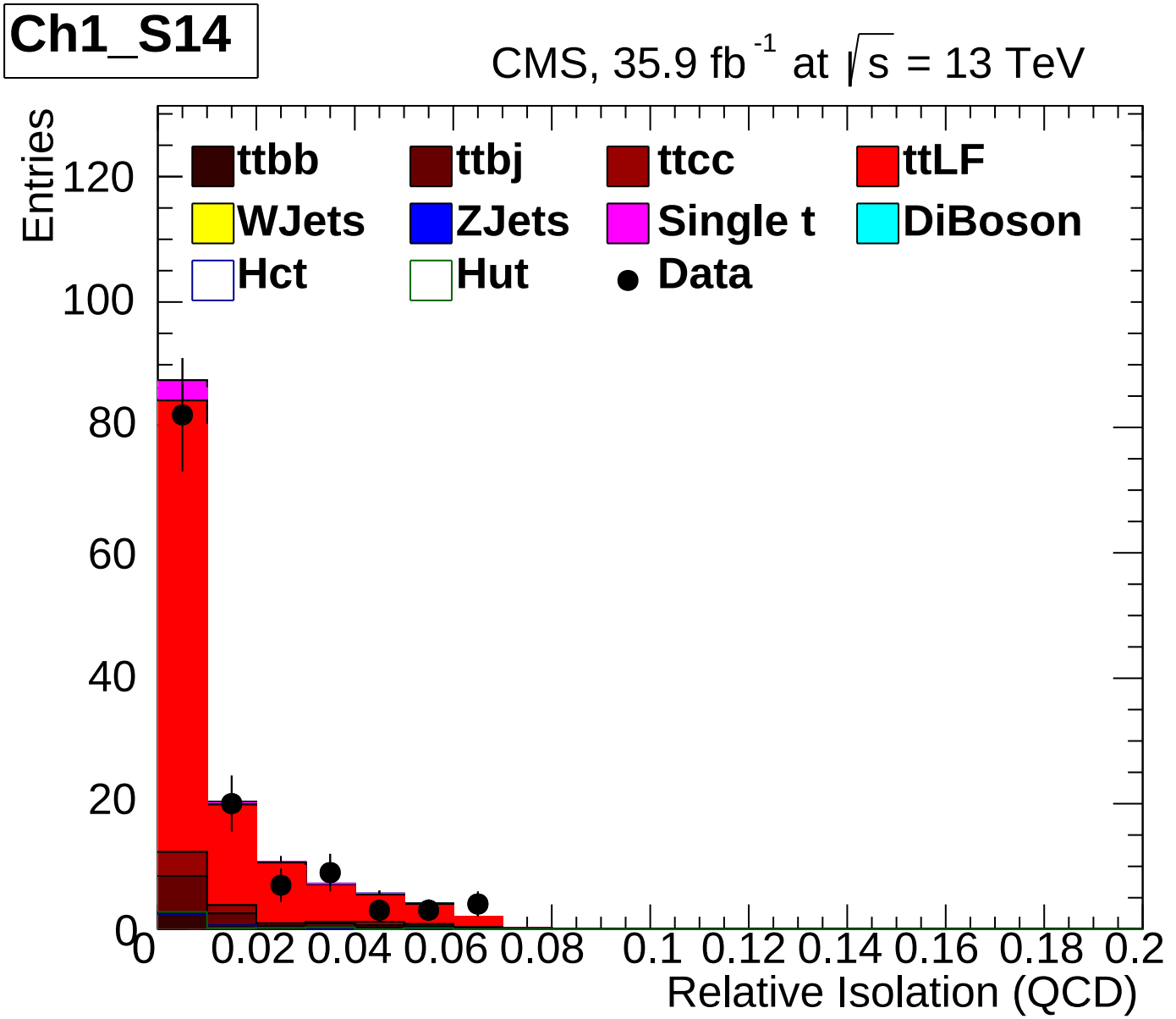

Ch1_S14
CMS, 35.9 fb -1 at √s = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1600
1400
1200
1000
800
600
400
200
0
0.5
1
1.5
2
2.5
3
DPhi

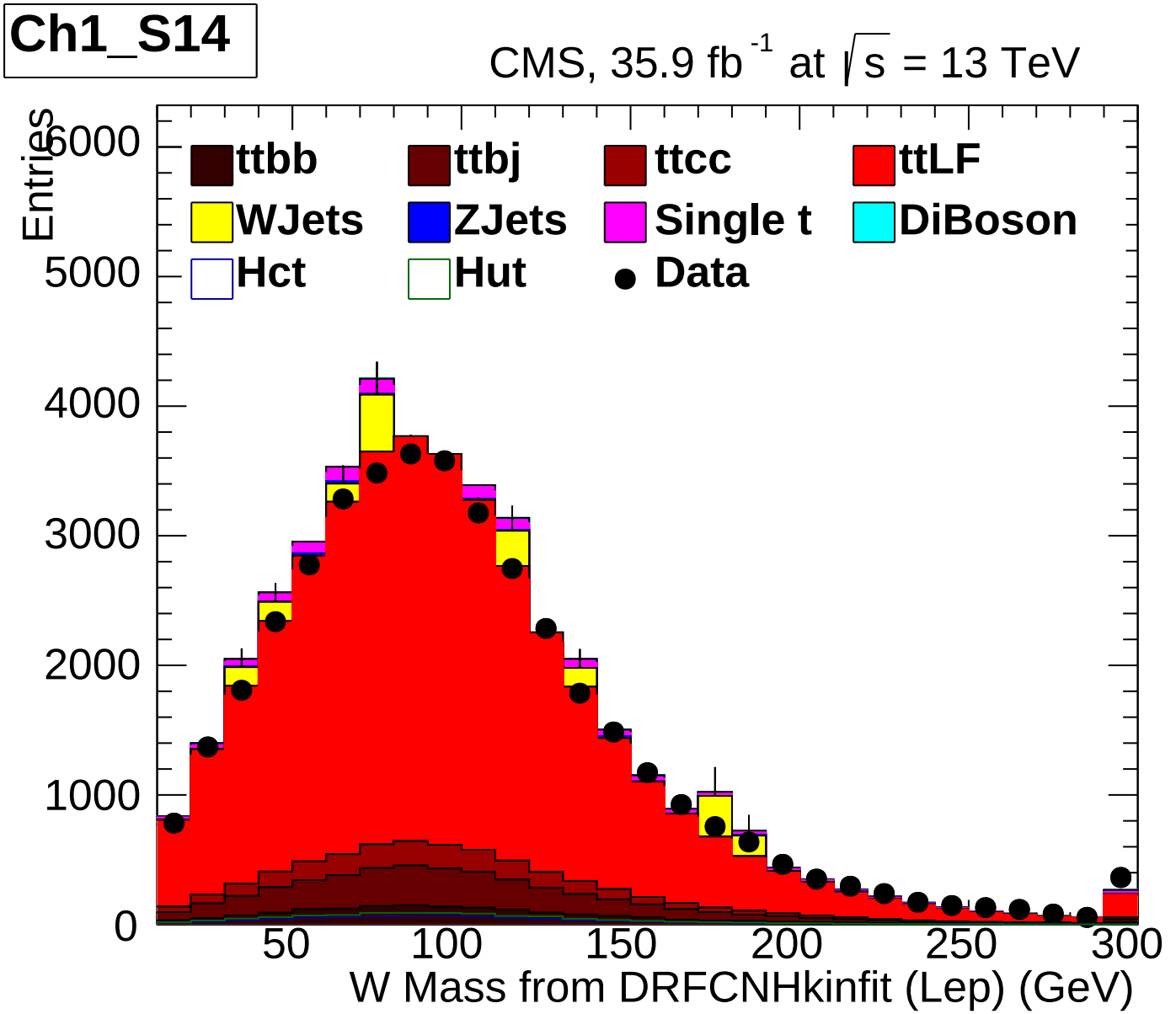

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
1400
1200
1000
800
600
400
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi

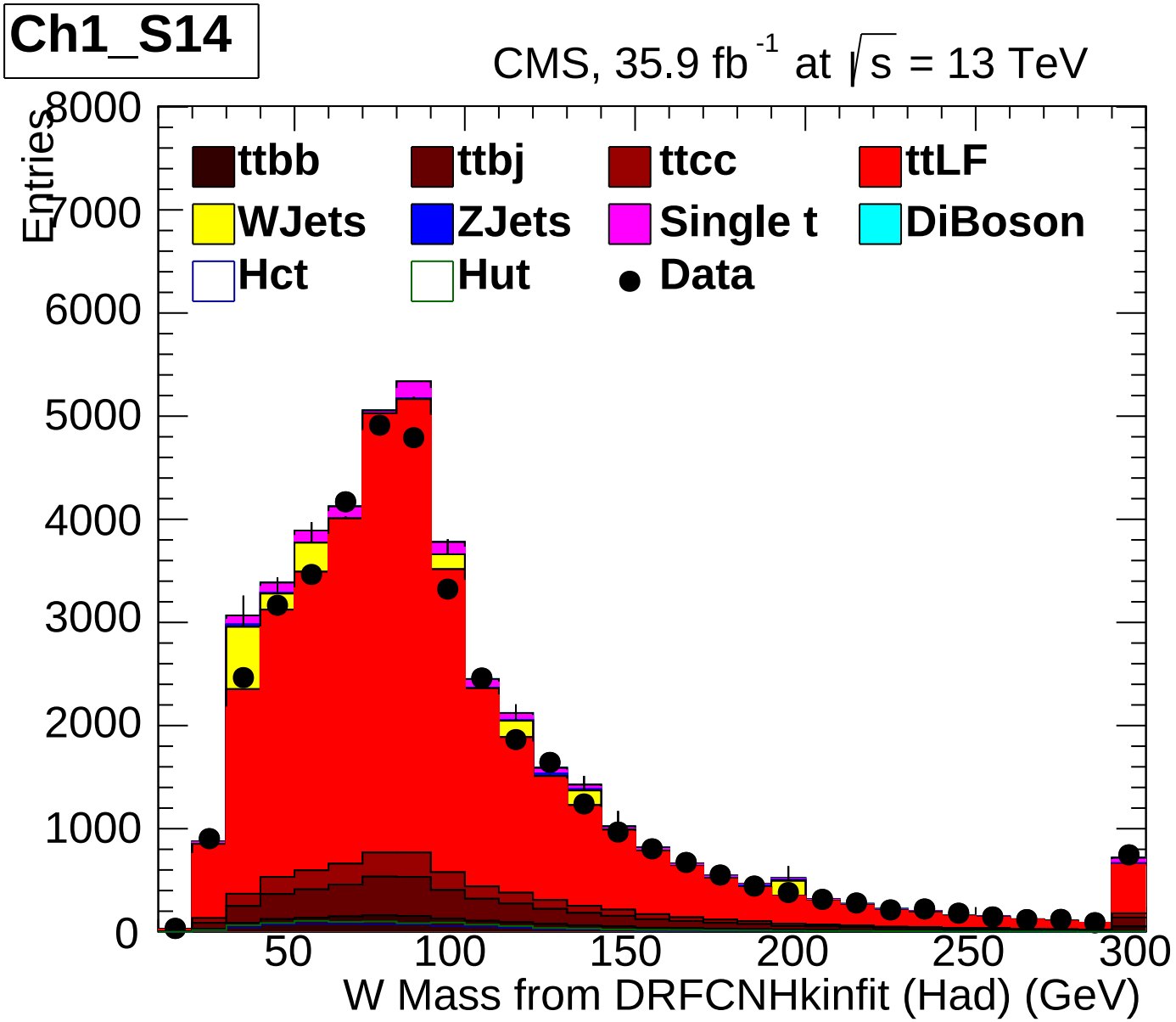

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
1400
1600
1800
2000
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Eta

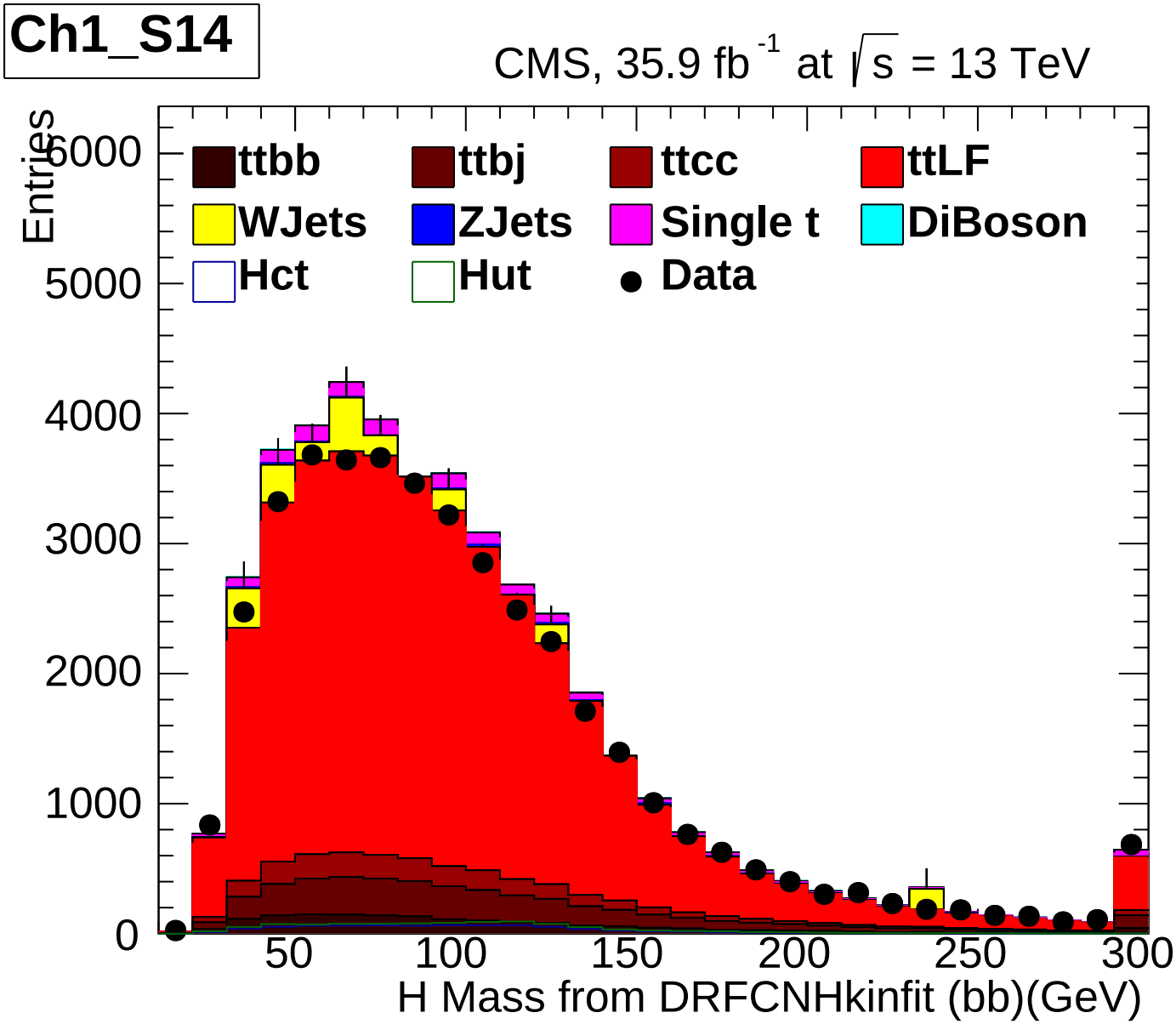

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
0
0.5
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R

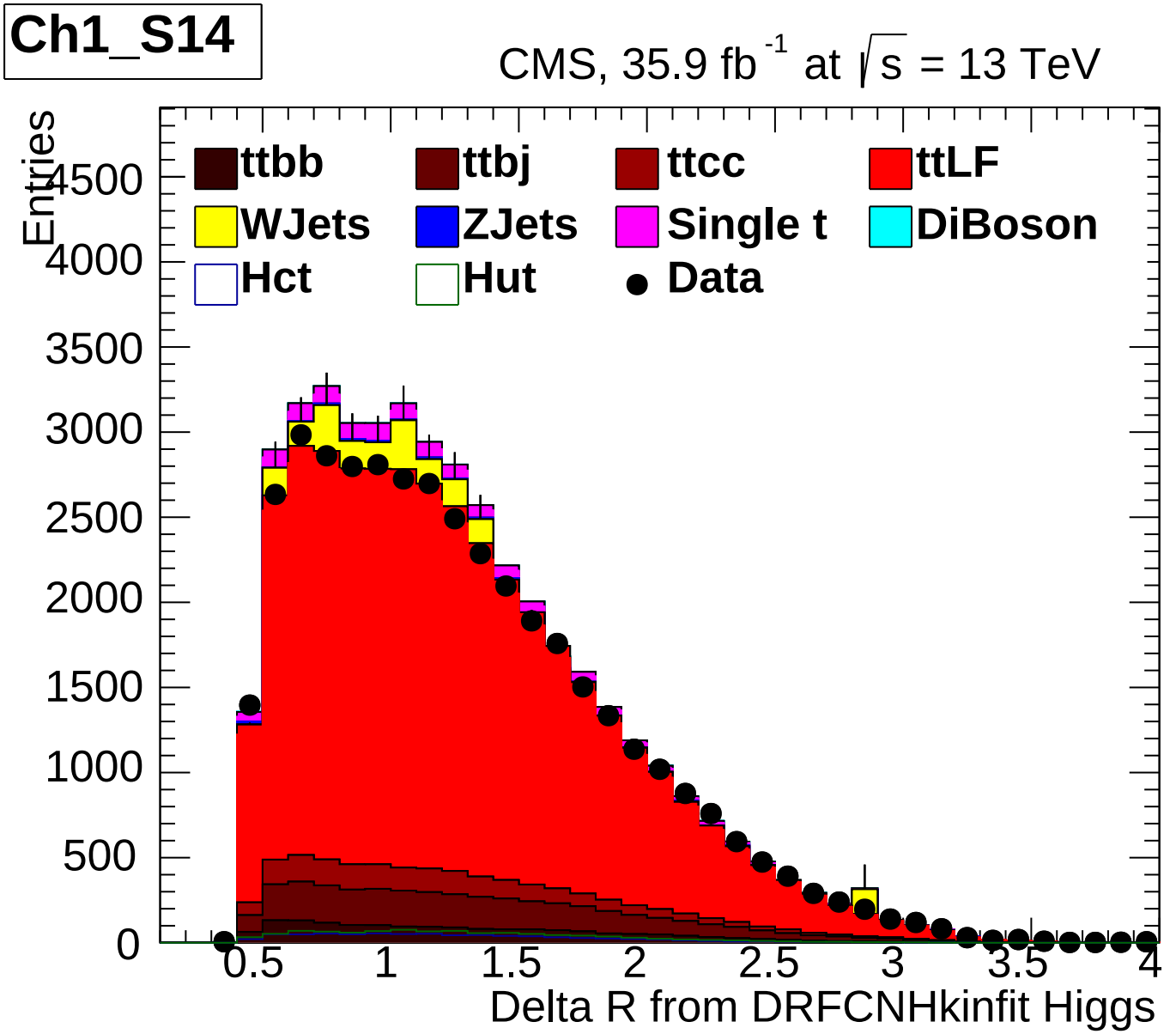

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
40000
35000
30000
25000
20000
15000
10000
5000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation

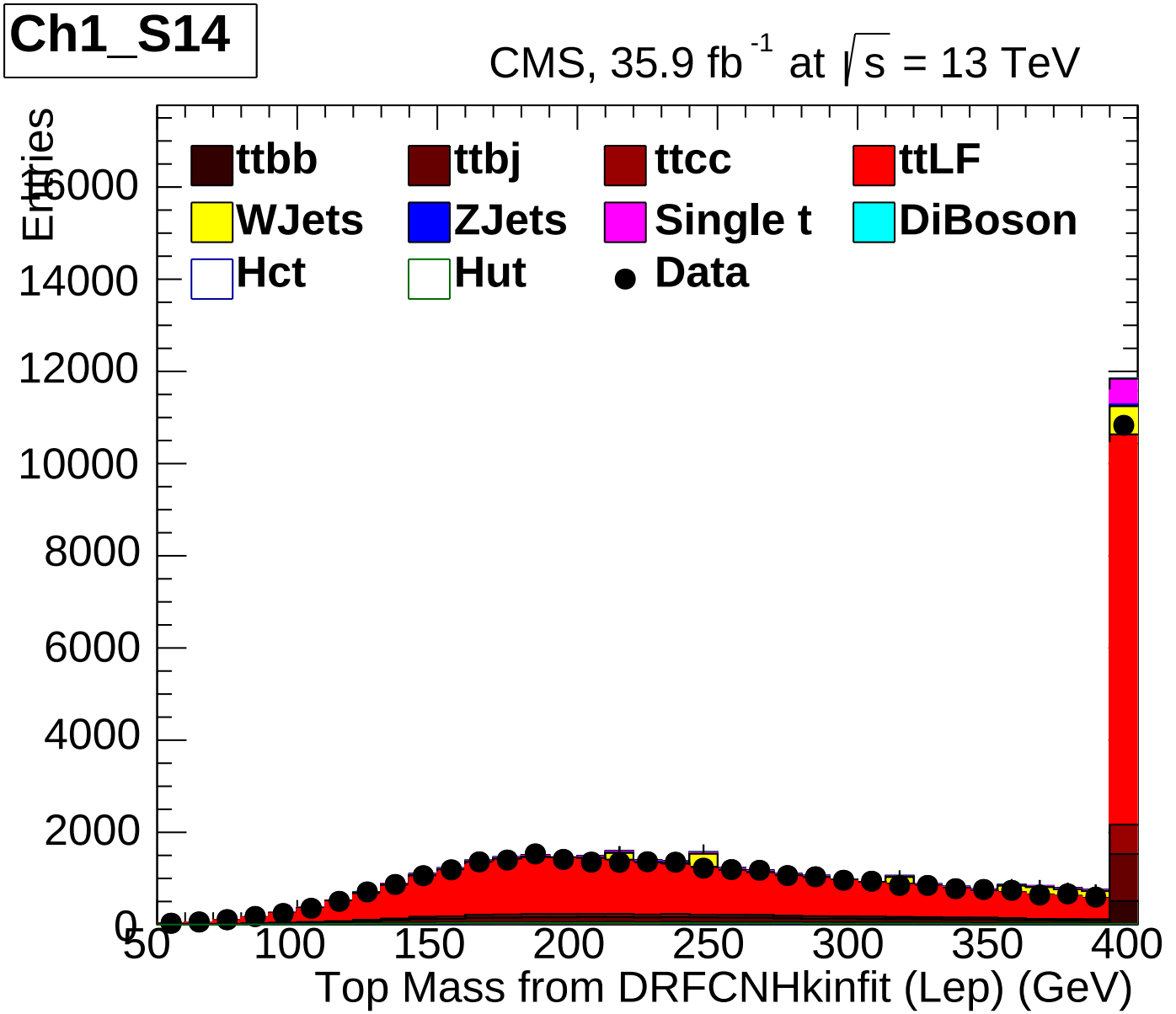

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
20
40
60
80
100
120
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation (QCD)

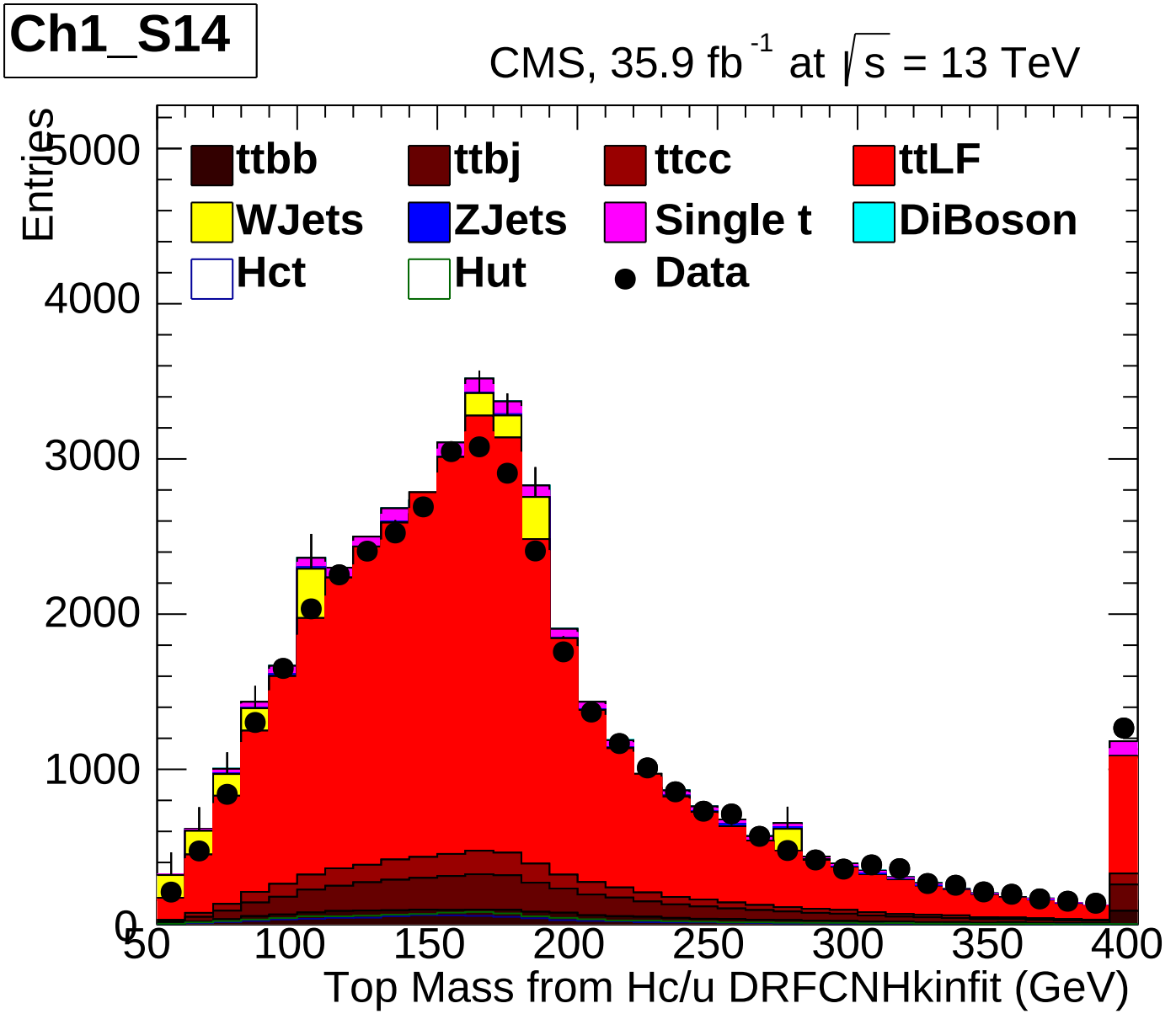

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)

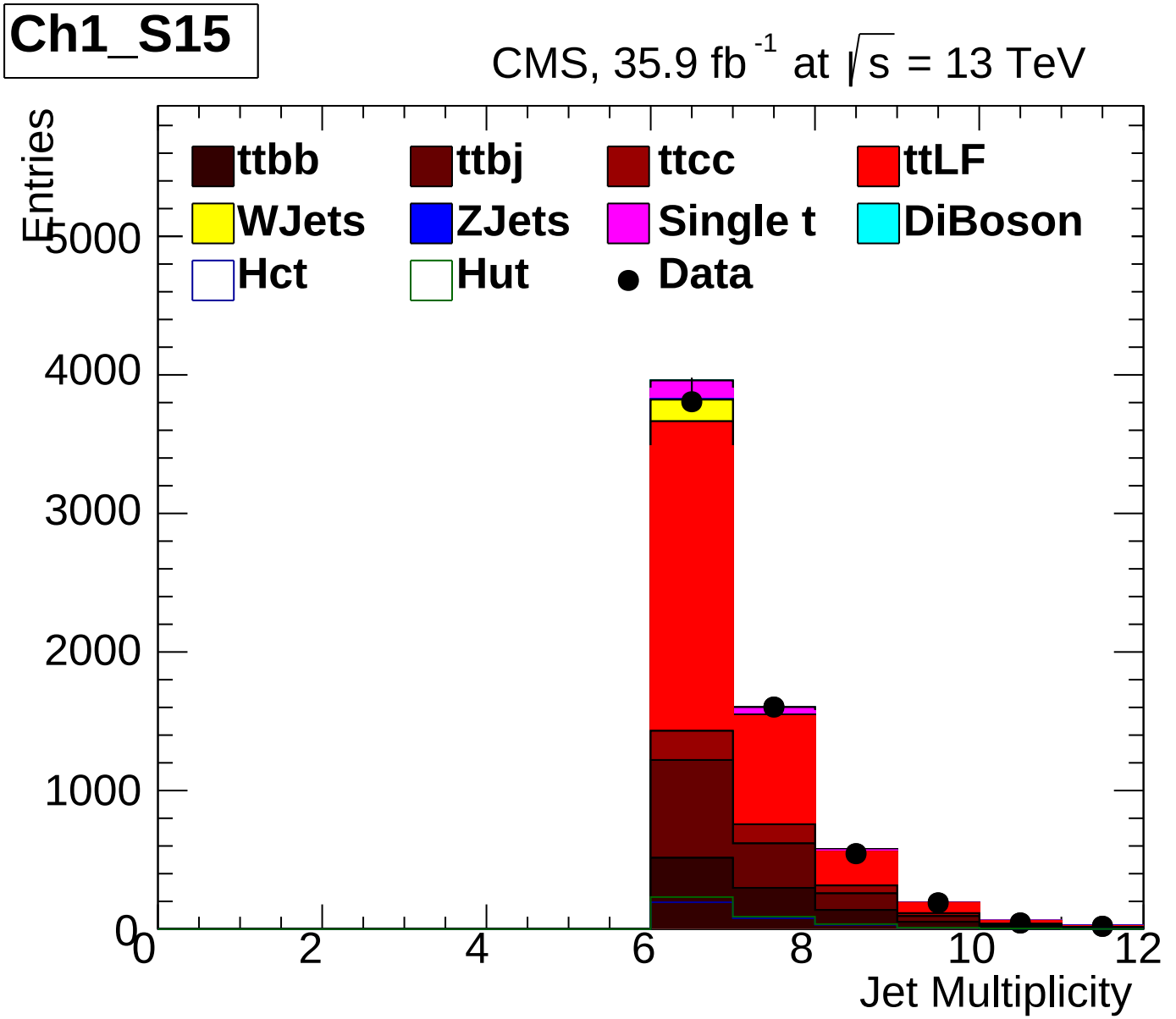

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
7000
8000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)

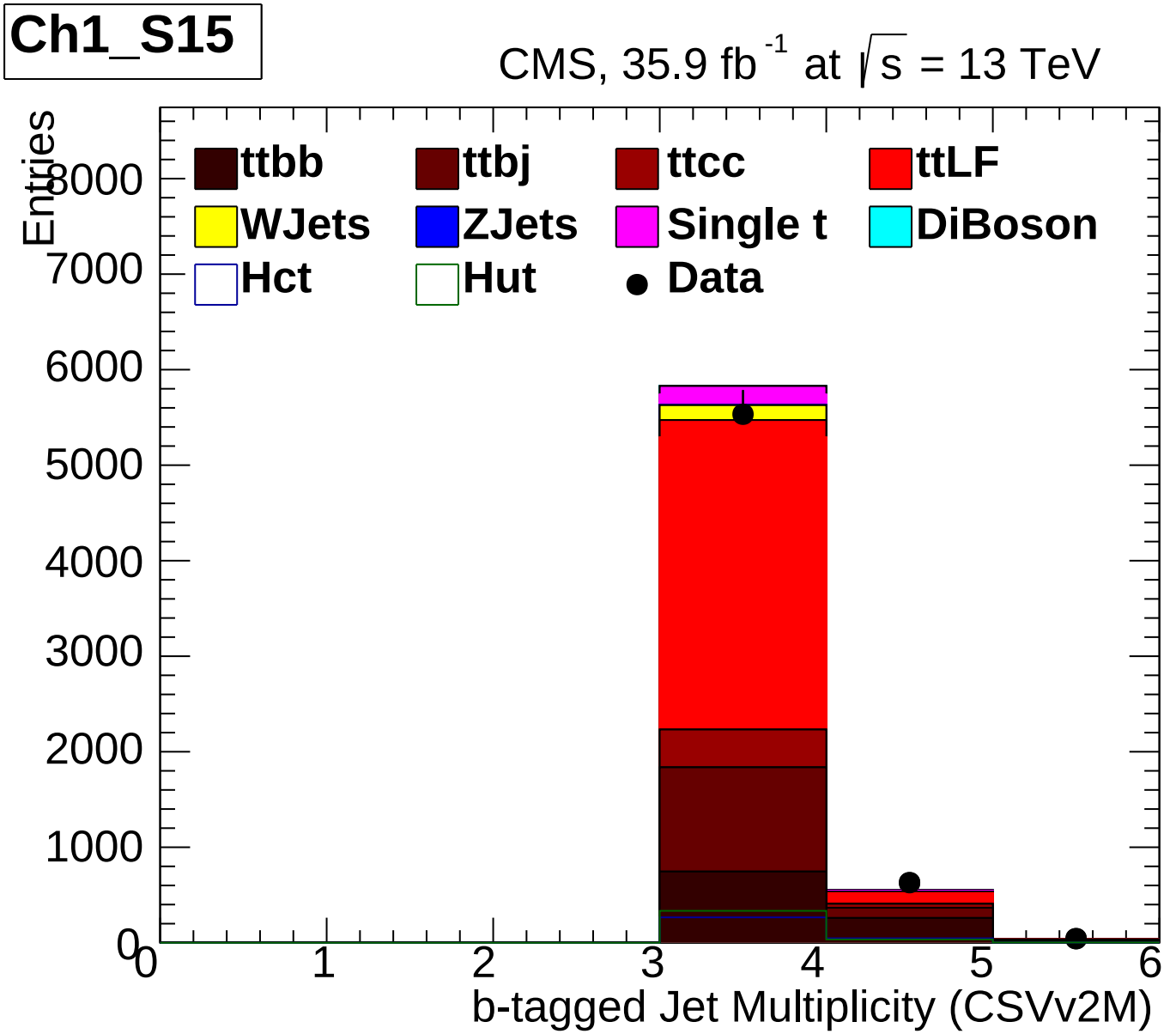

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
6000
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)

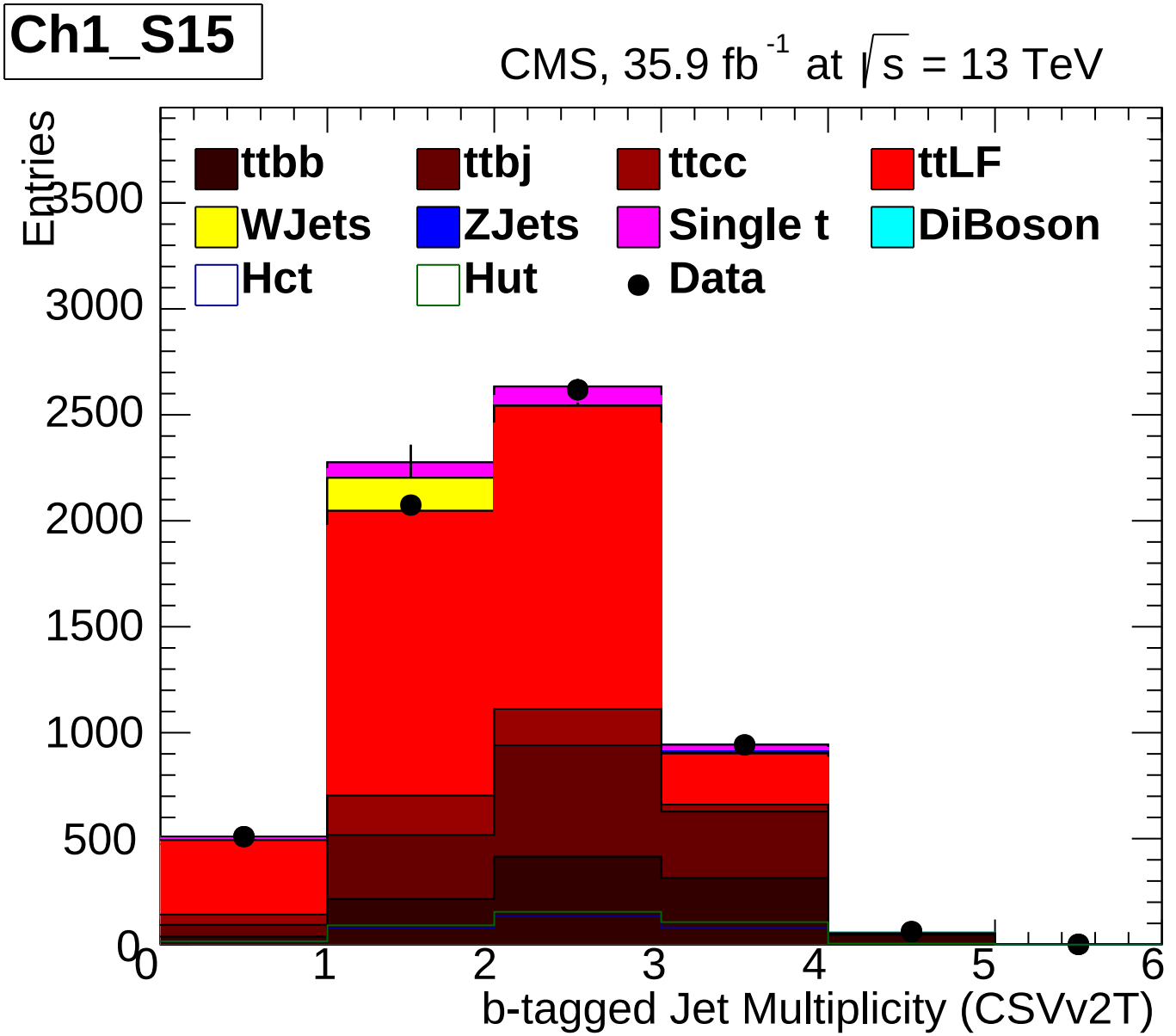

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs

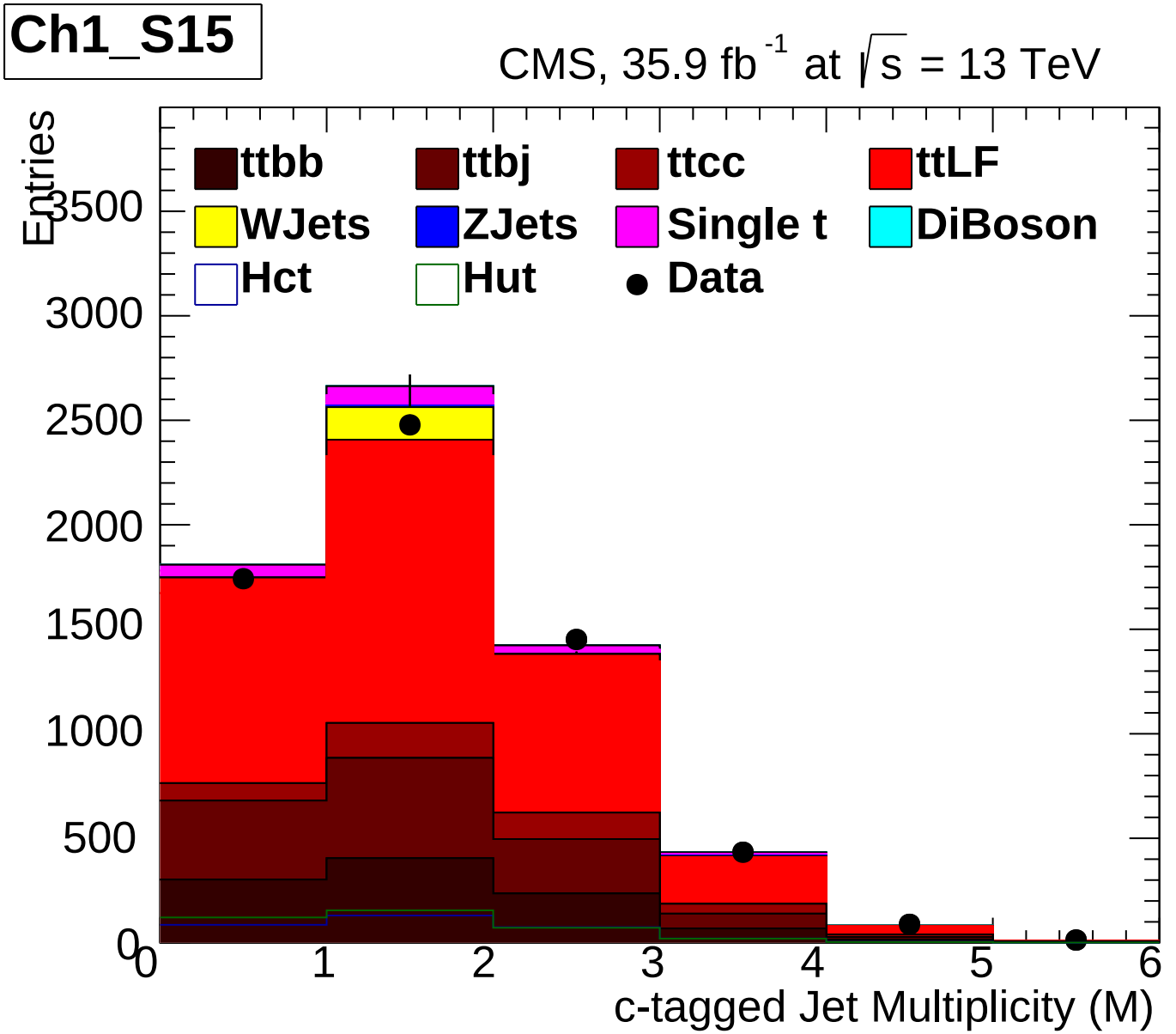

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
16000
14000
12000
10000
8000
6000
4000
2000
0
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)

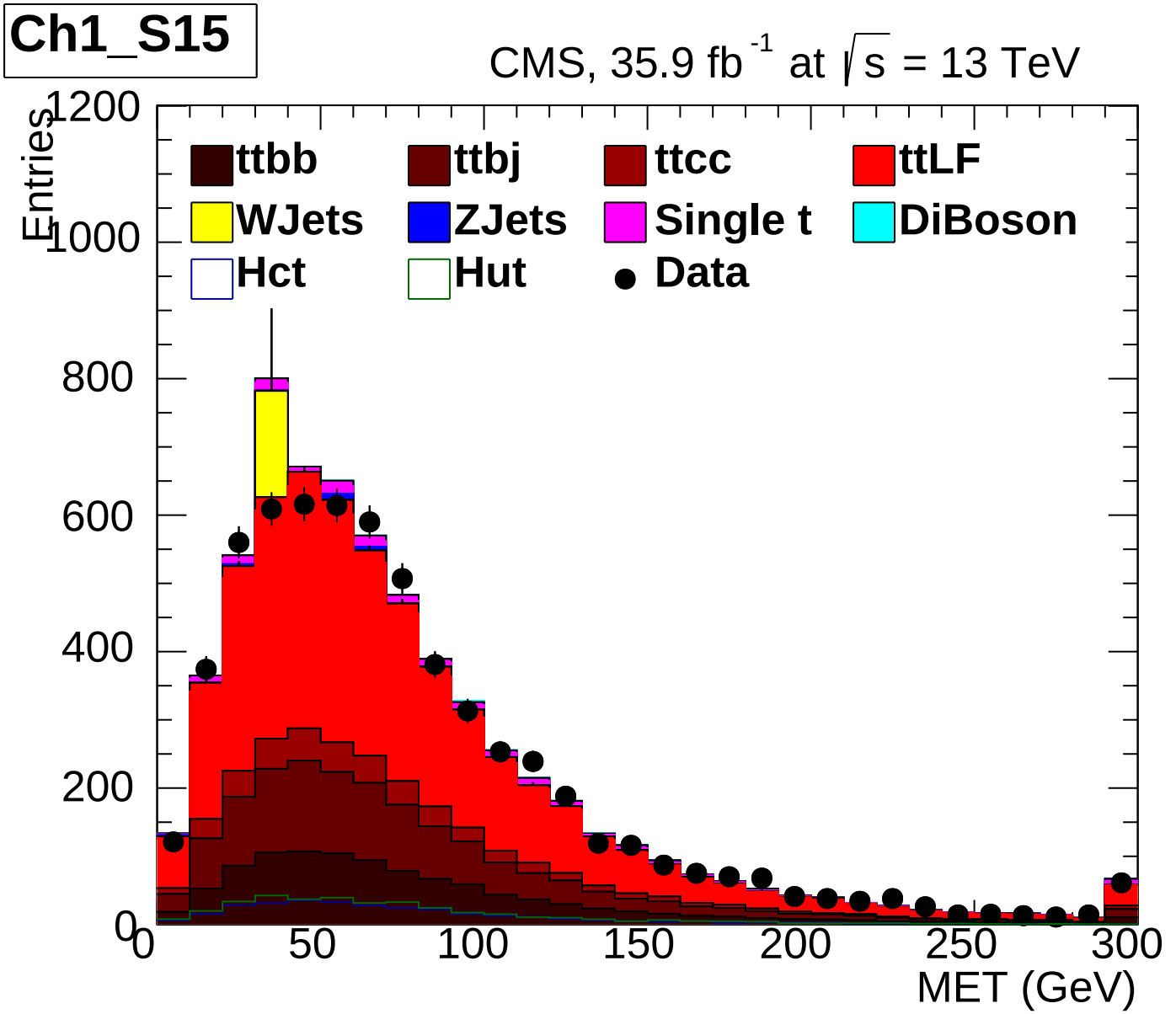

Ch1_S14
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
1000
2000
3000
4000
5000
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)

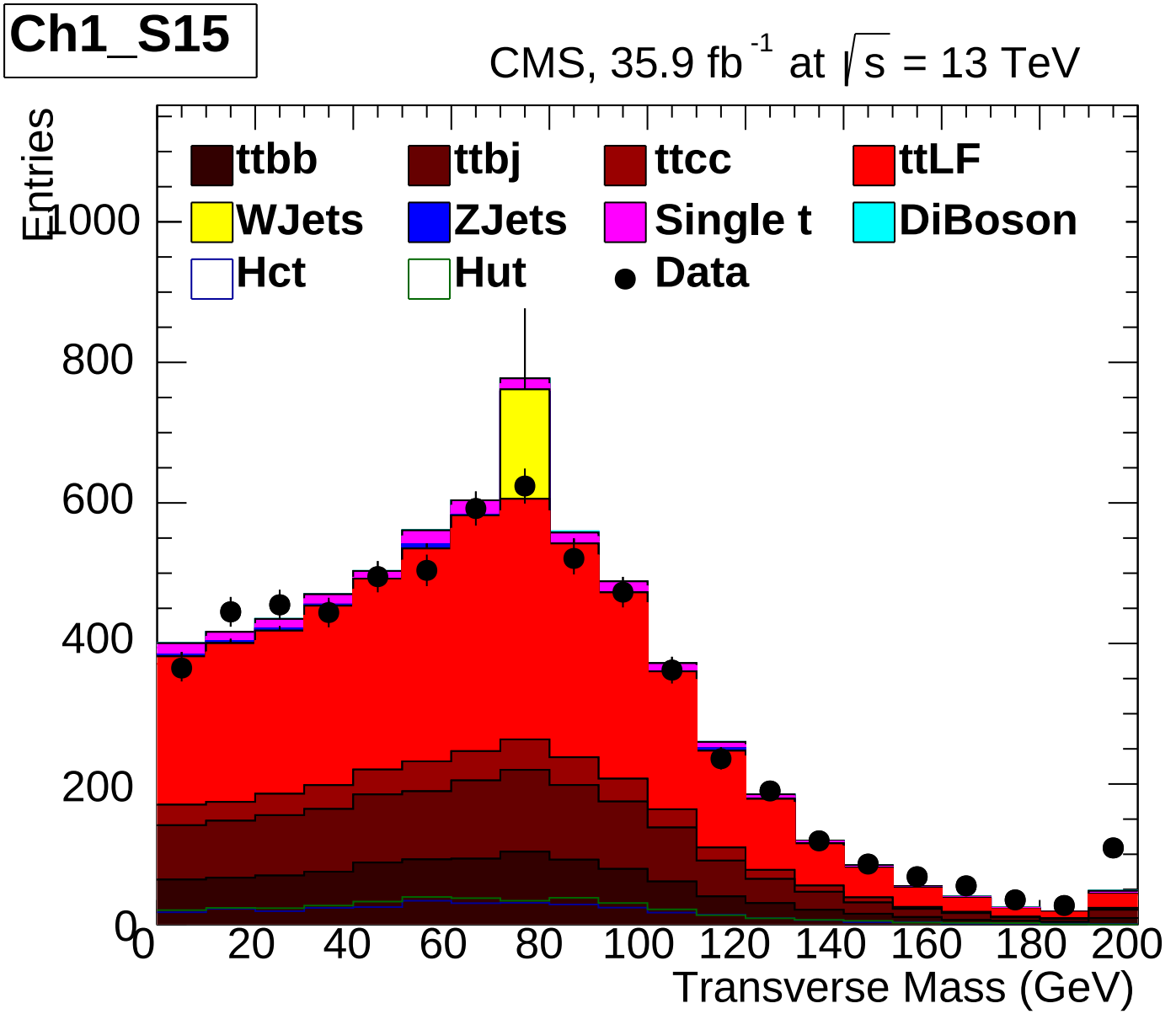

Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
1000
2000
3000
4000
5000
0
2
4
6
8
10
12
Jet Multiplicity

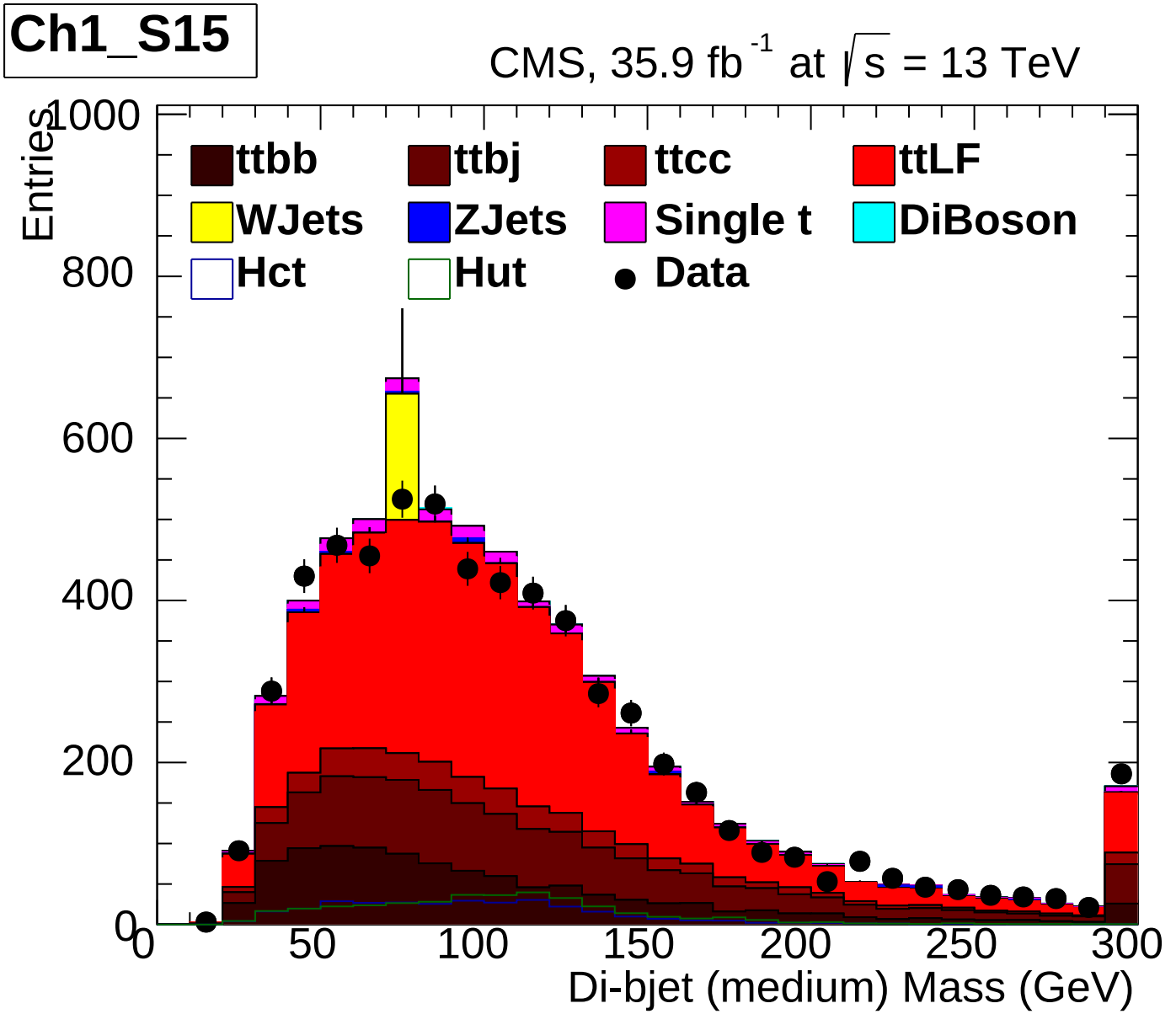

Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
8000
7000
6000
5000
4000
3000
2000
1000
0
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2M)

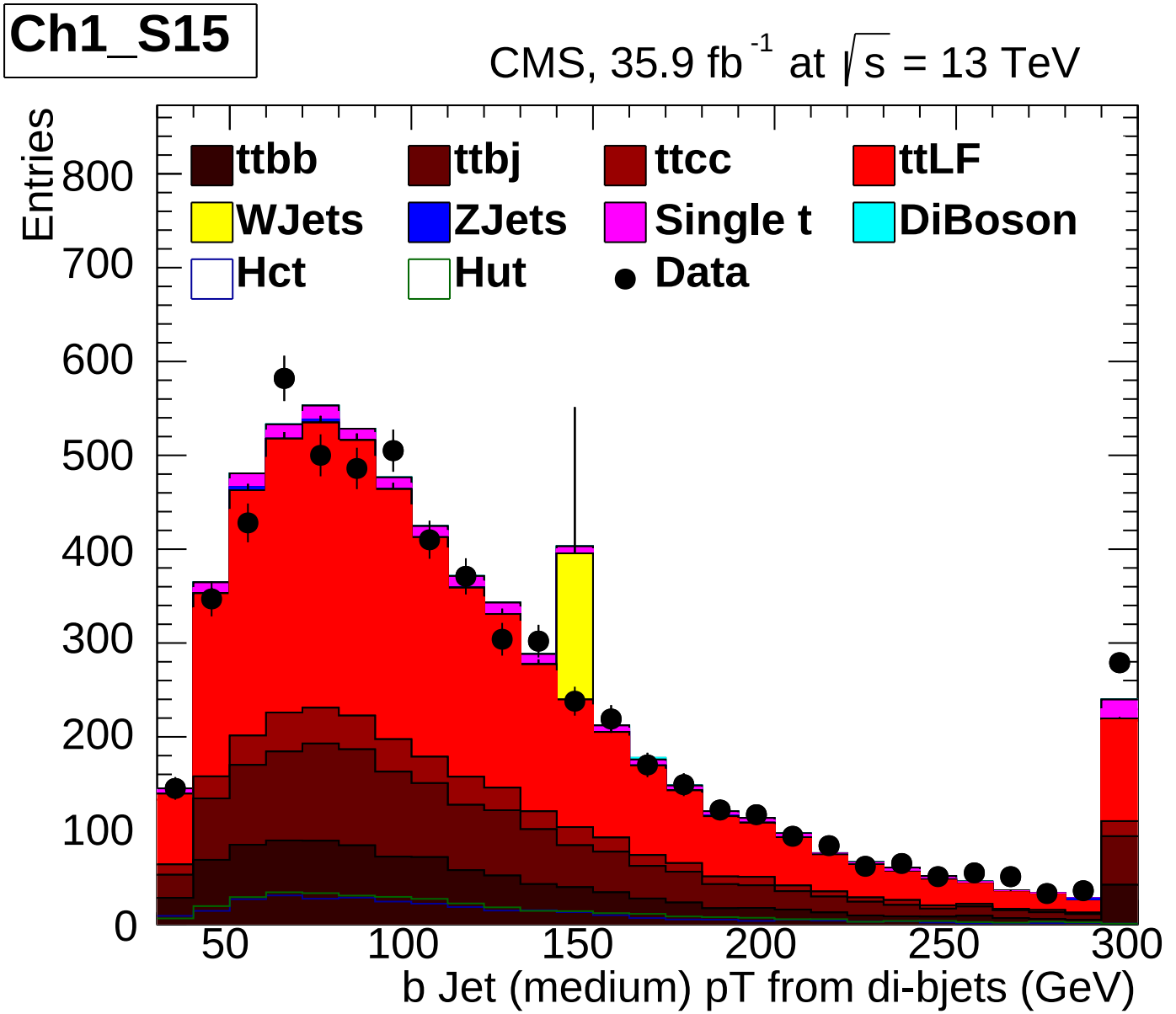

Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
500
1000
1500
2000
2500
3000
3500
0
1
2
3
4
5
6
b-tagged Jet Multiplicity (CSVv2T)

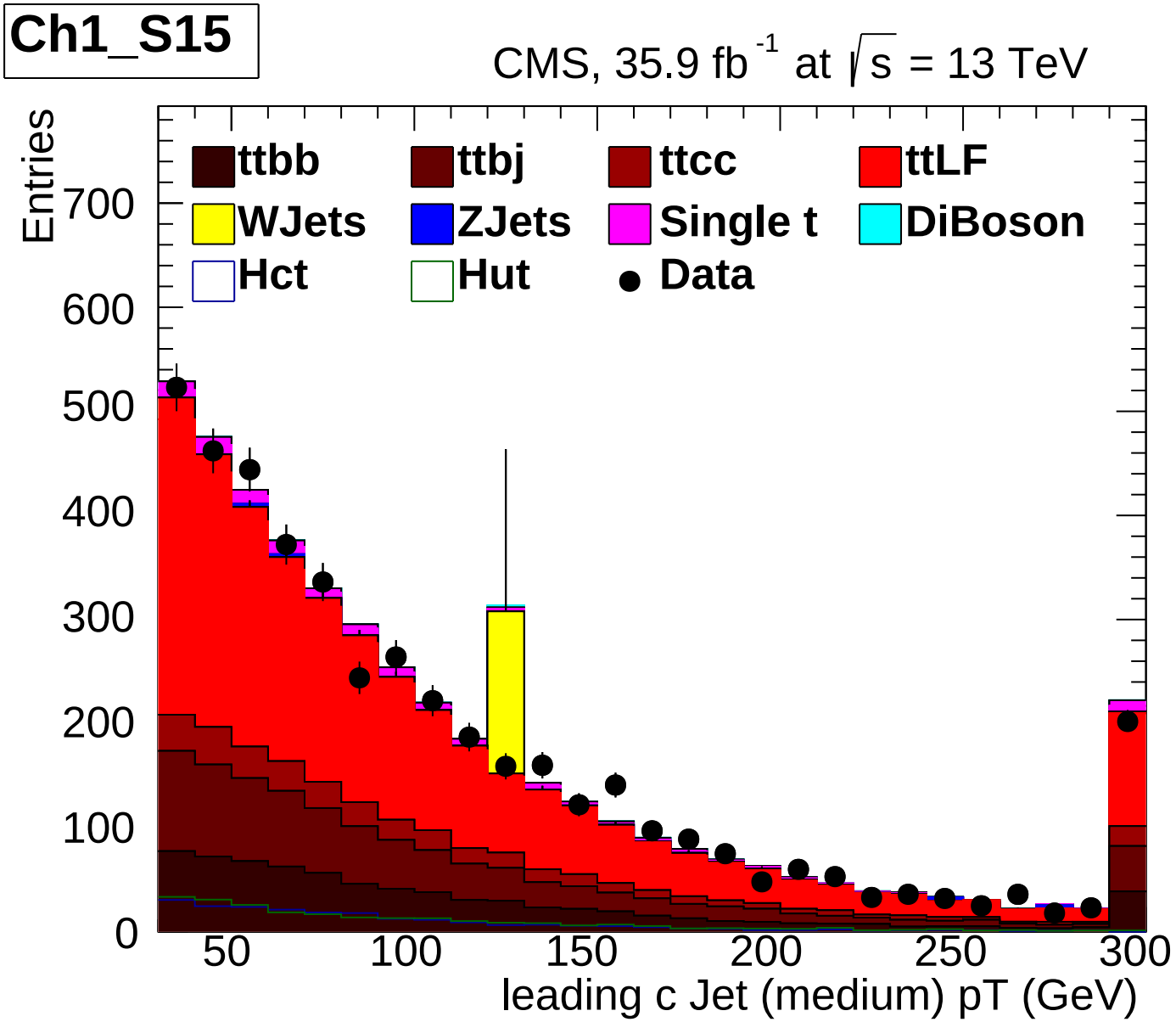

Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
500
1000
1500
2000
2500
3000
3500
0
1
2
3
4
5
6
c-tagged Jet Multiplicity (M)

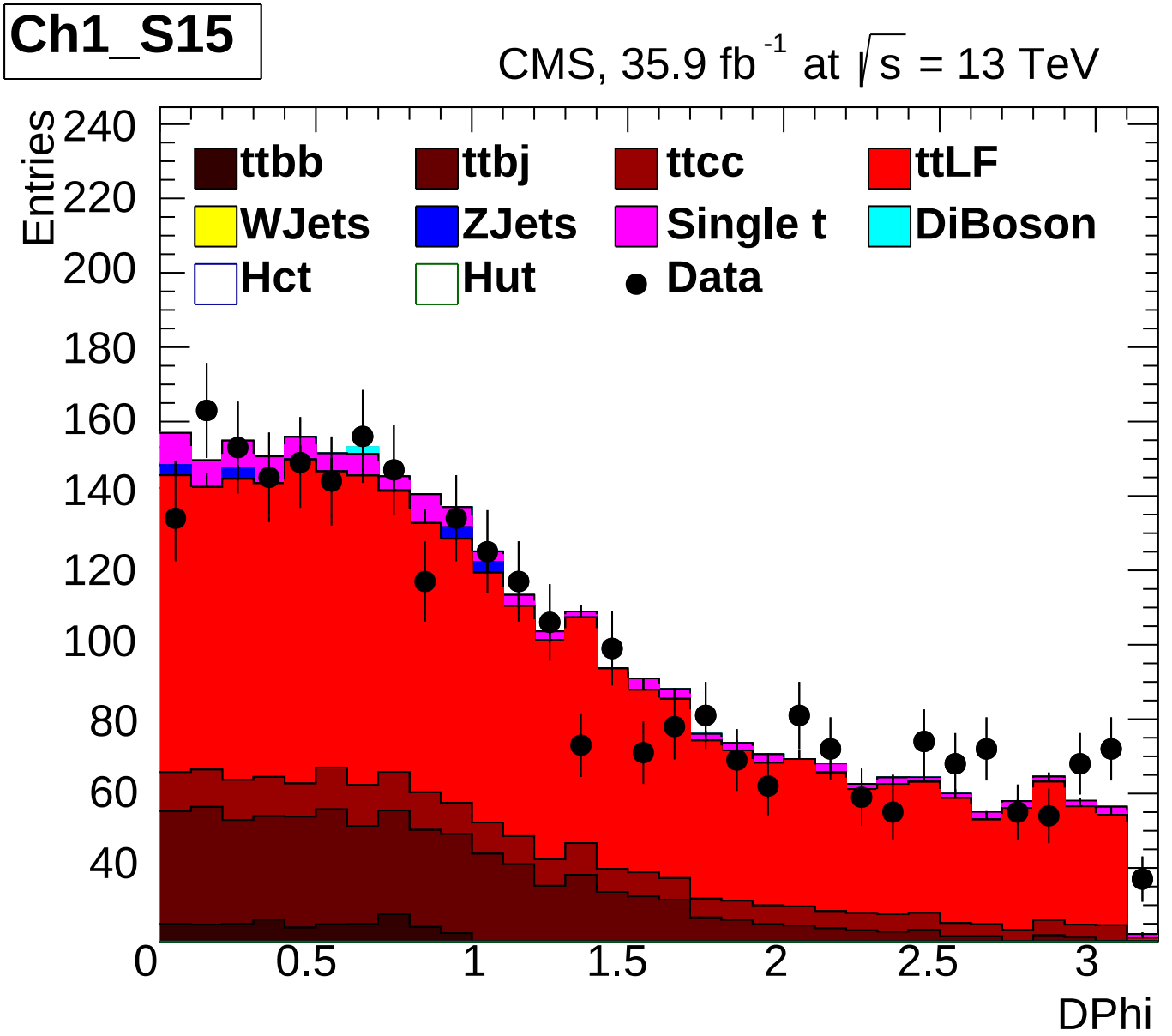

Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
1200
0
50
100
150
200
250
300
MET (GeV)

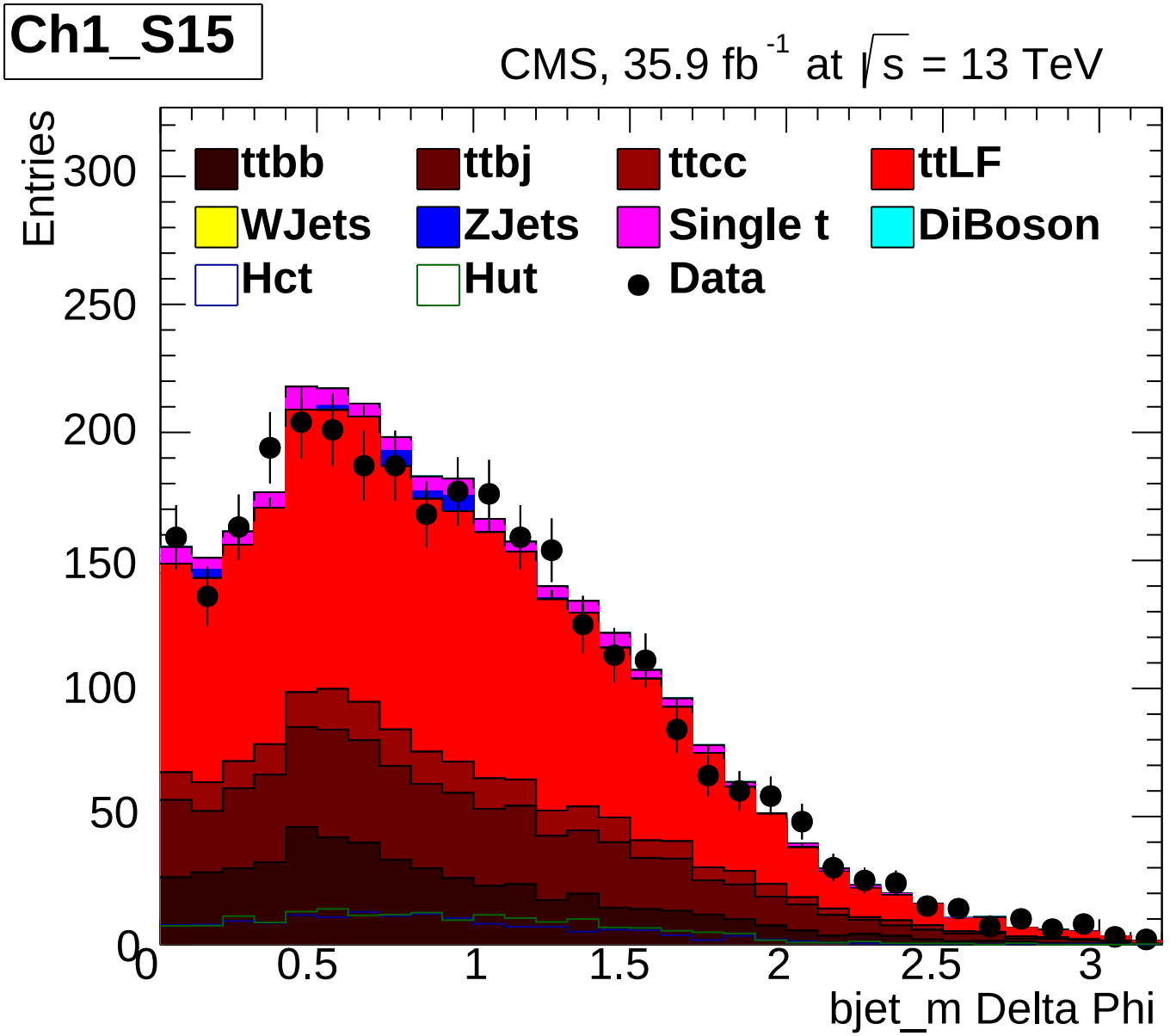

Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
200
400
600
800
1000
0
20
40
60
80
100
120
140
160
180
200
Transverse Mass (GeV)


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
0
50
100
150
200
250
300
Di-bjet (medium) Mass (GeV)


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
100
200
300
400
500
600
700
800
50
100
150
200
250
300
b Jet (medium) pT from di-bjets (GeV)


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
50
100
150
200
250
300
leading c Jet (medium) pT (GeV)


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
240
220
200
180
160
140
120
100
80
60
40
0
0.5
1
1.5
2
2.5
3
DPhi


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
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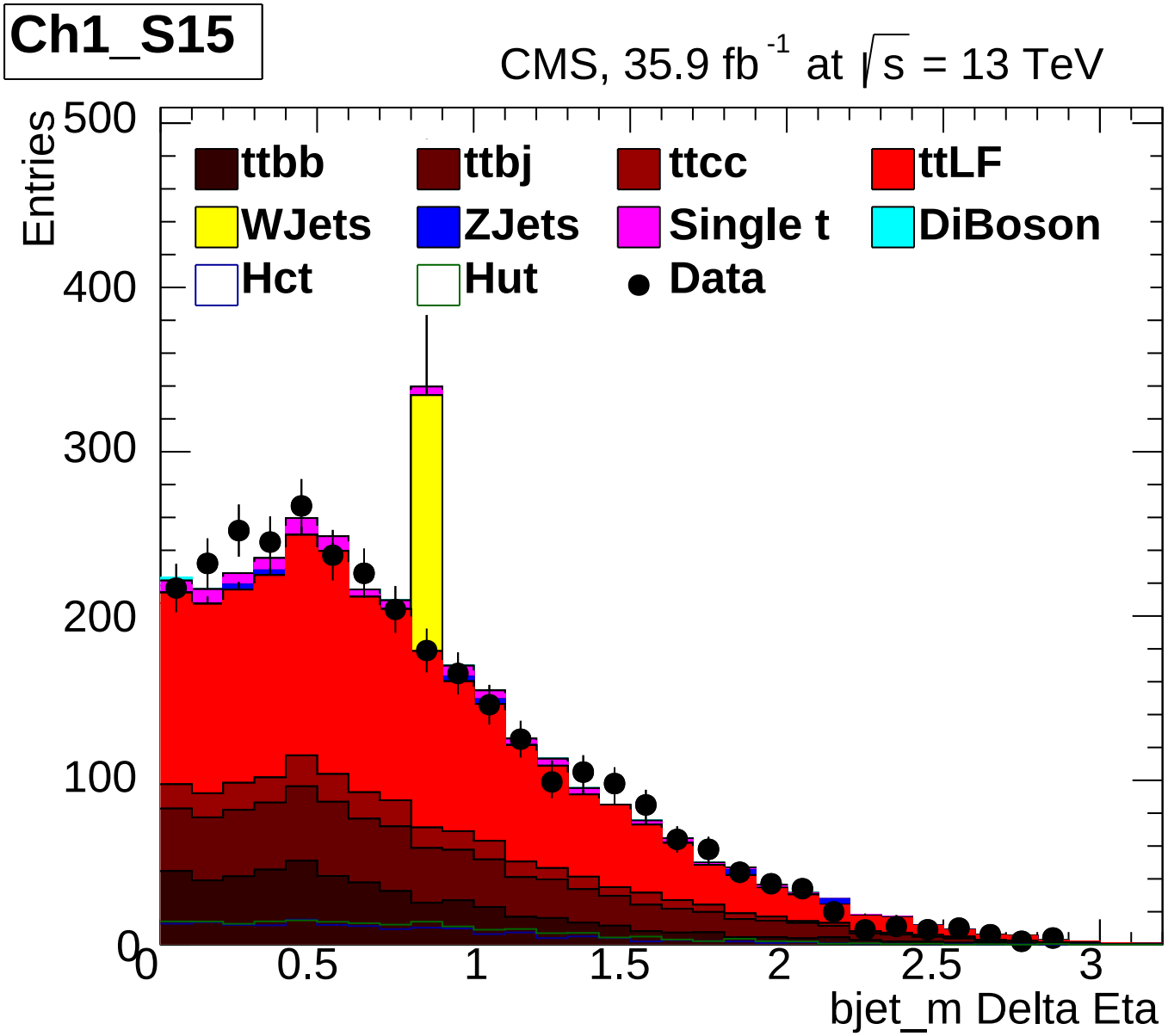
100
150
200
250
300
0
0.5
1
1.5
2
2.5
3
bjet_m Delta Phi


Ch1_S15
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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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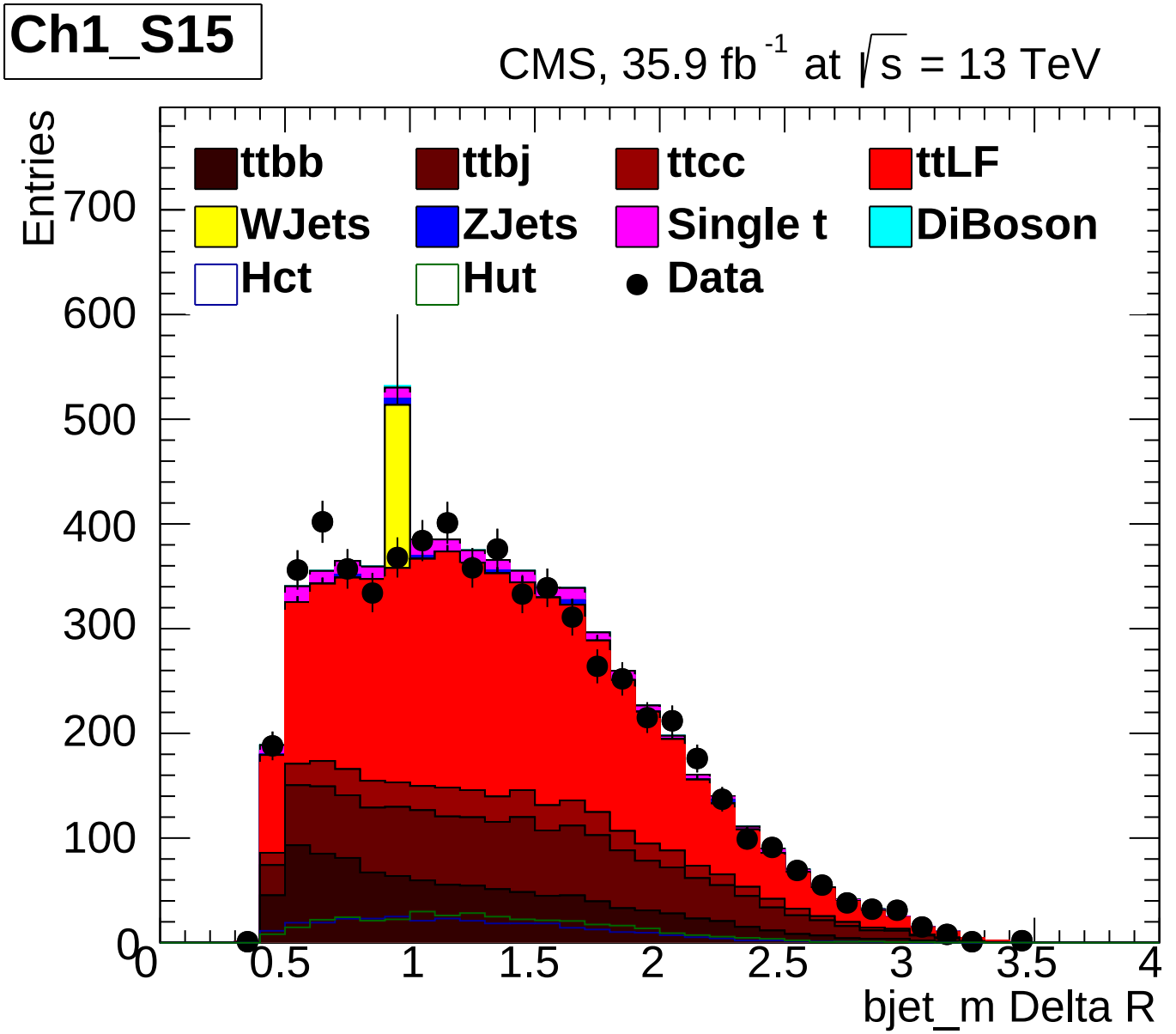
1.5
2
2.5
3
bjet_m Delta Eta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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
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600
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0
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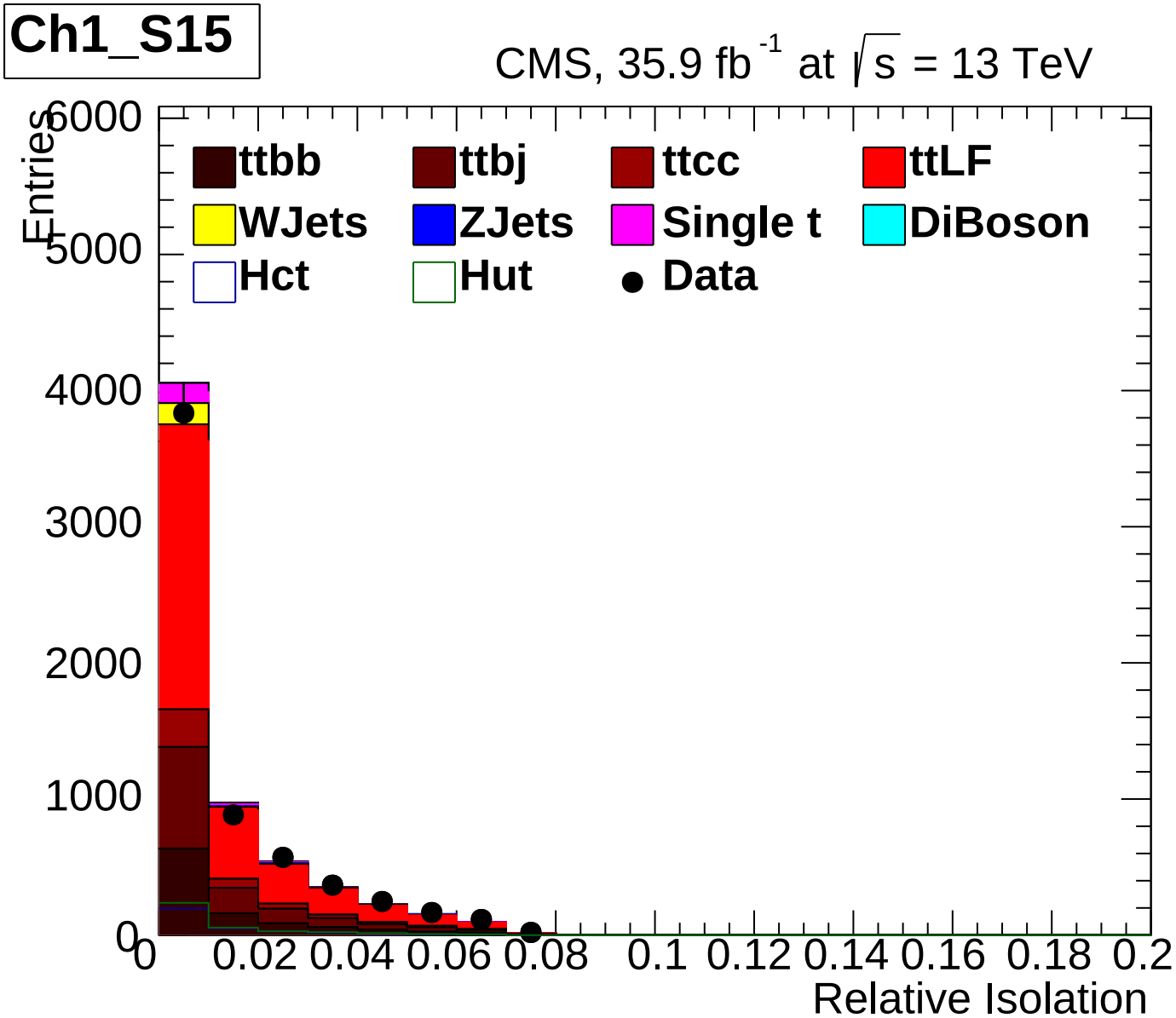
1
1.5
2
2.5
3
3.5
4
bjet_m Delta R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ZJets
Single t
DiBoson
Hct
Hut
Data
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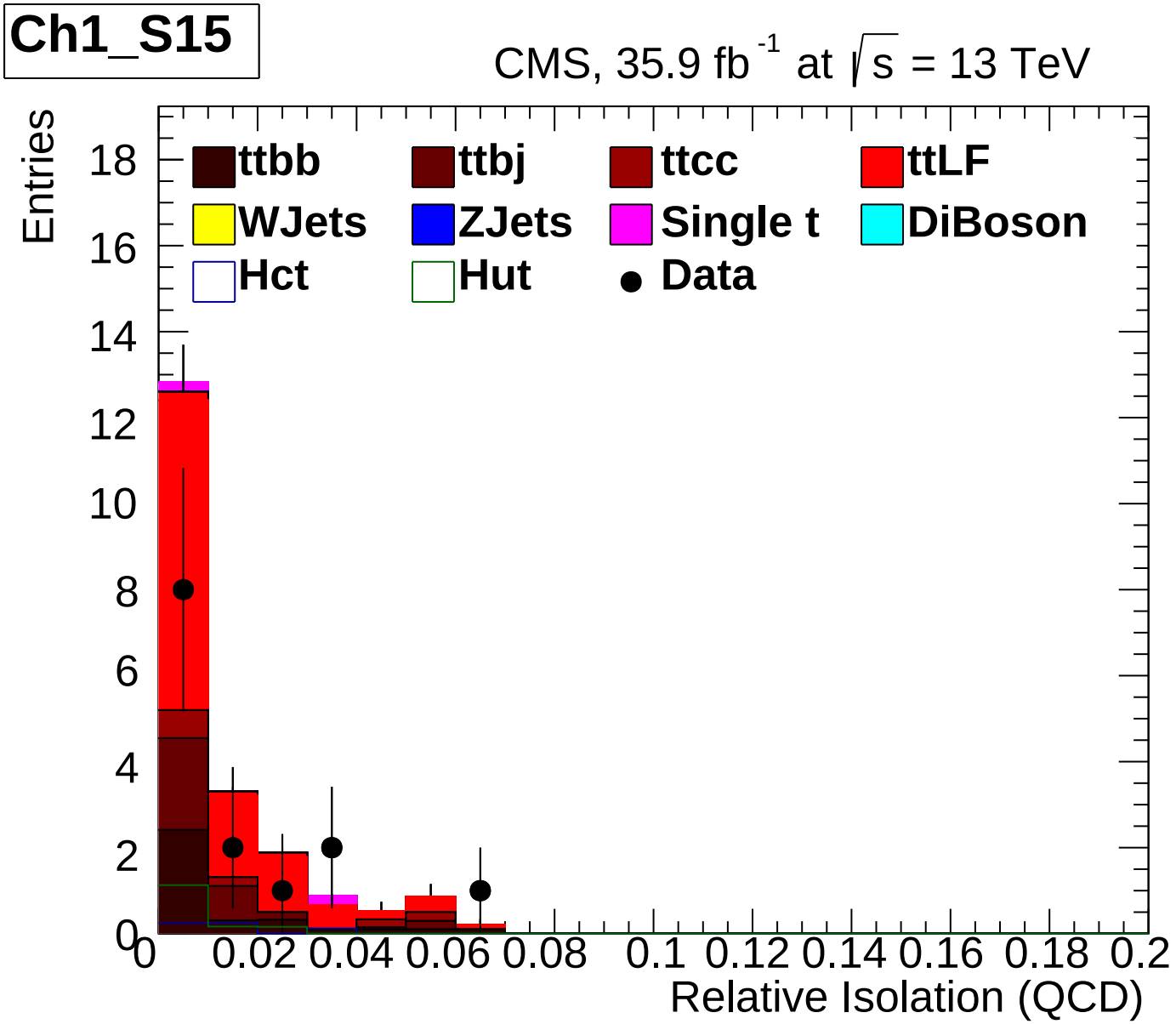
5000
4000
3000
2000
1000
0
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
Relative Isolation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ZJets
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Hct
Hut
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8
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12
14
16
18
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0.08
0.1
0.12
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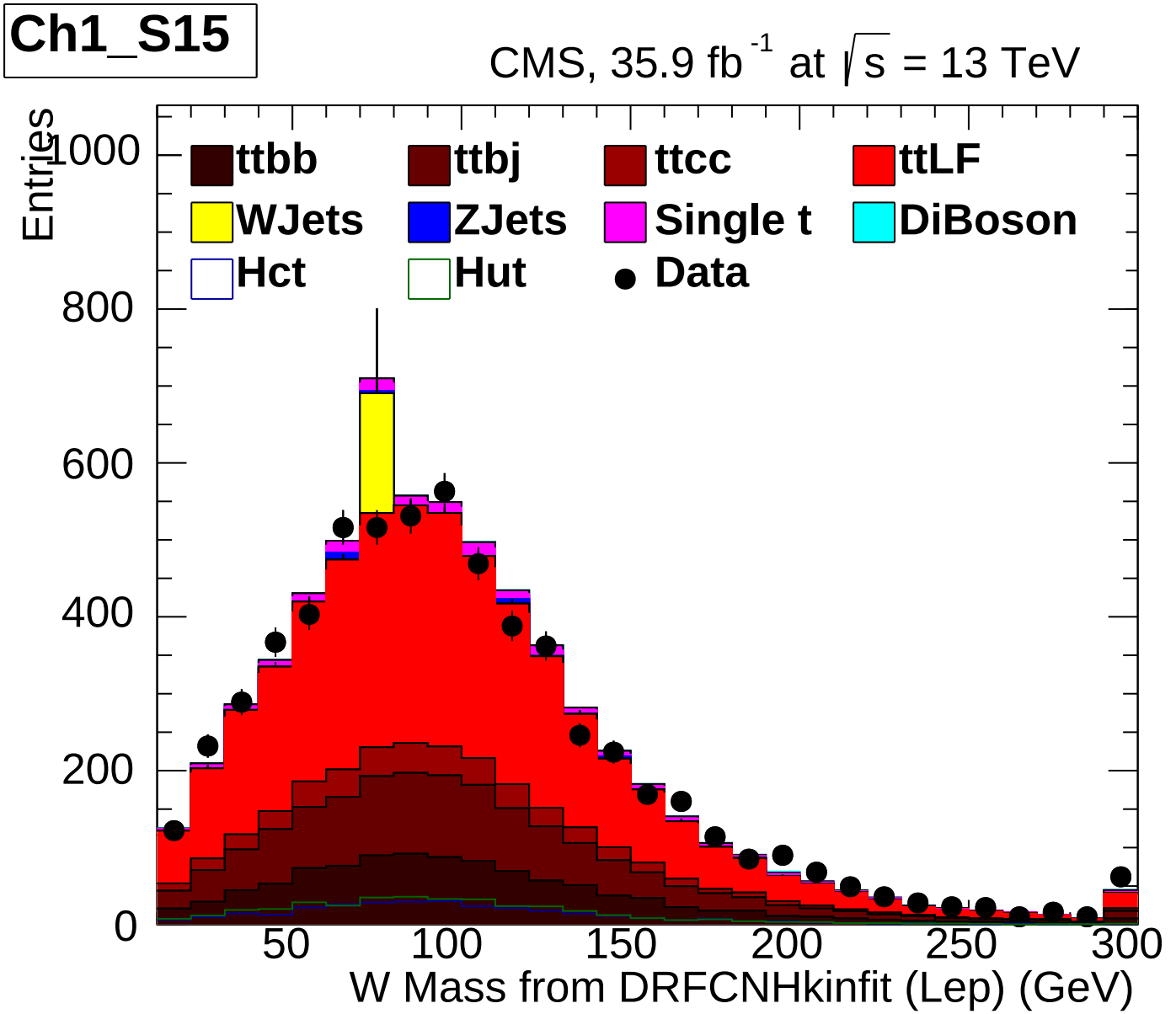
0.16
0.18
0.2
Relative Isolation (QCD)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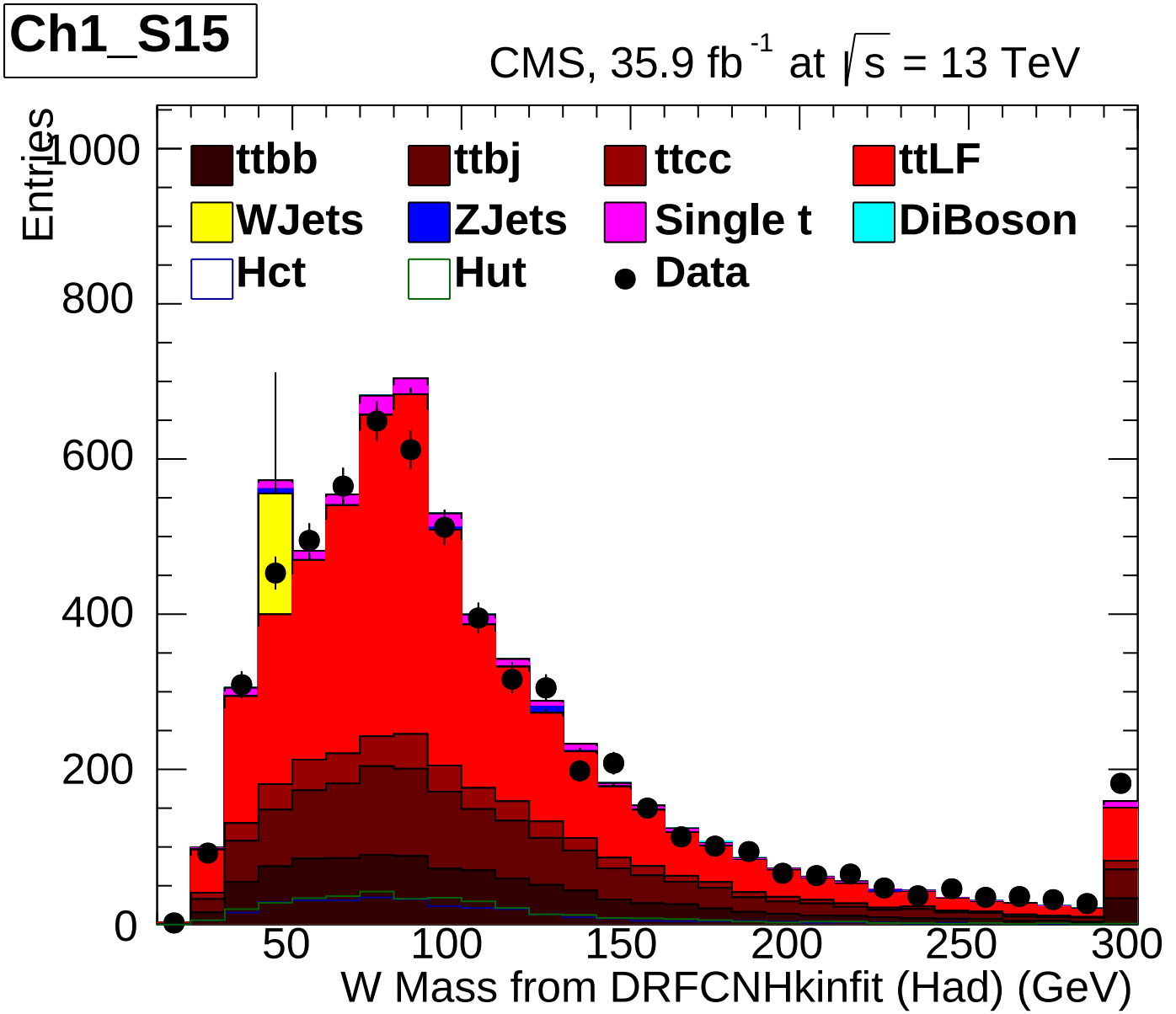
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
200
400
600
800
1000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Lep) (GeV)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WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
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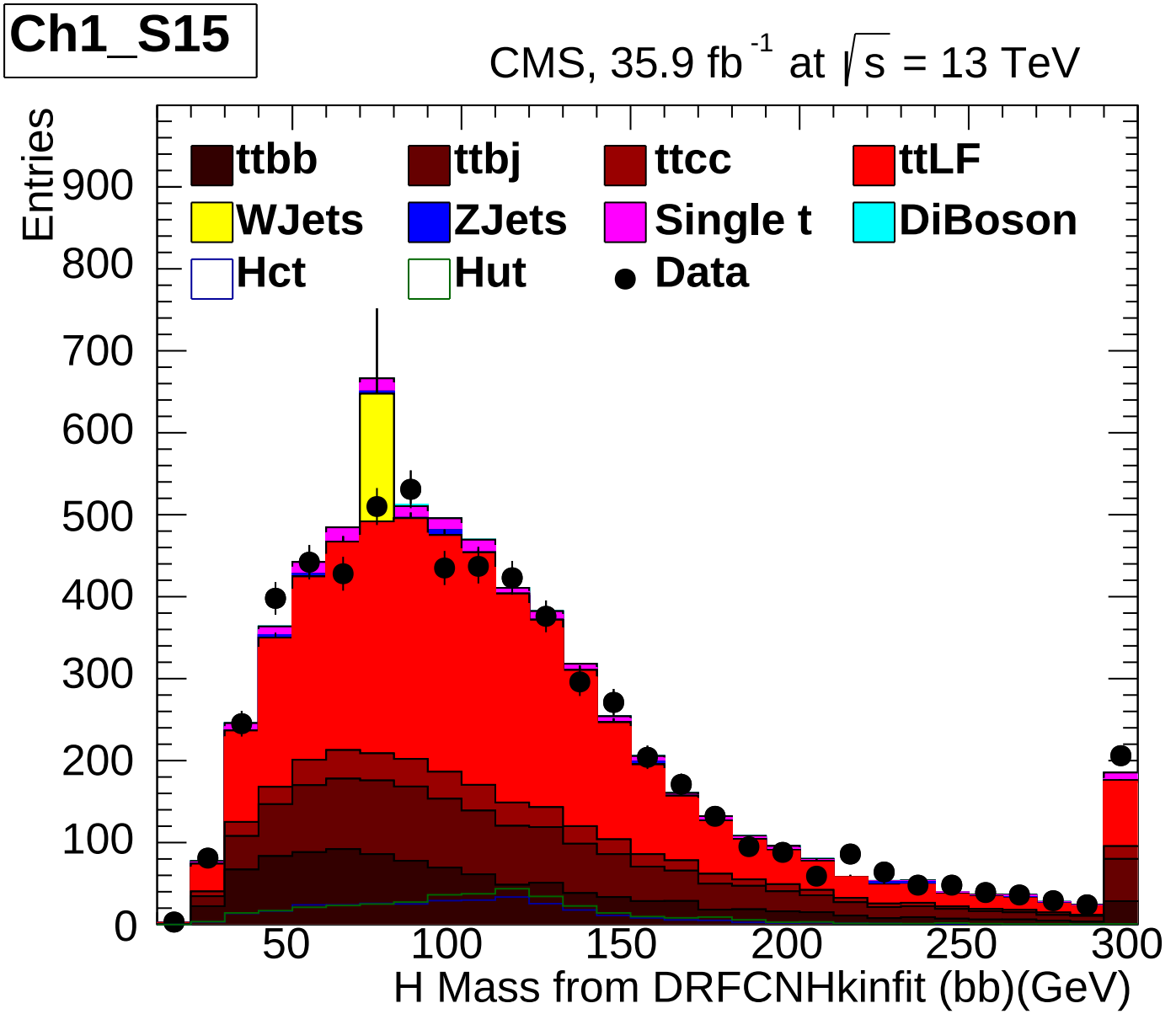
400
600
800
1000
50
100
150
200
250
300
W Mass from DRFCNHkinfit (Had) (GeV)


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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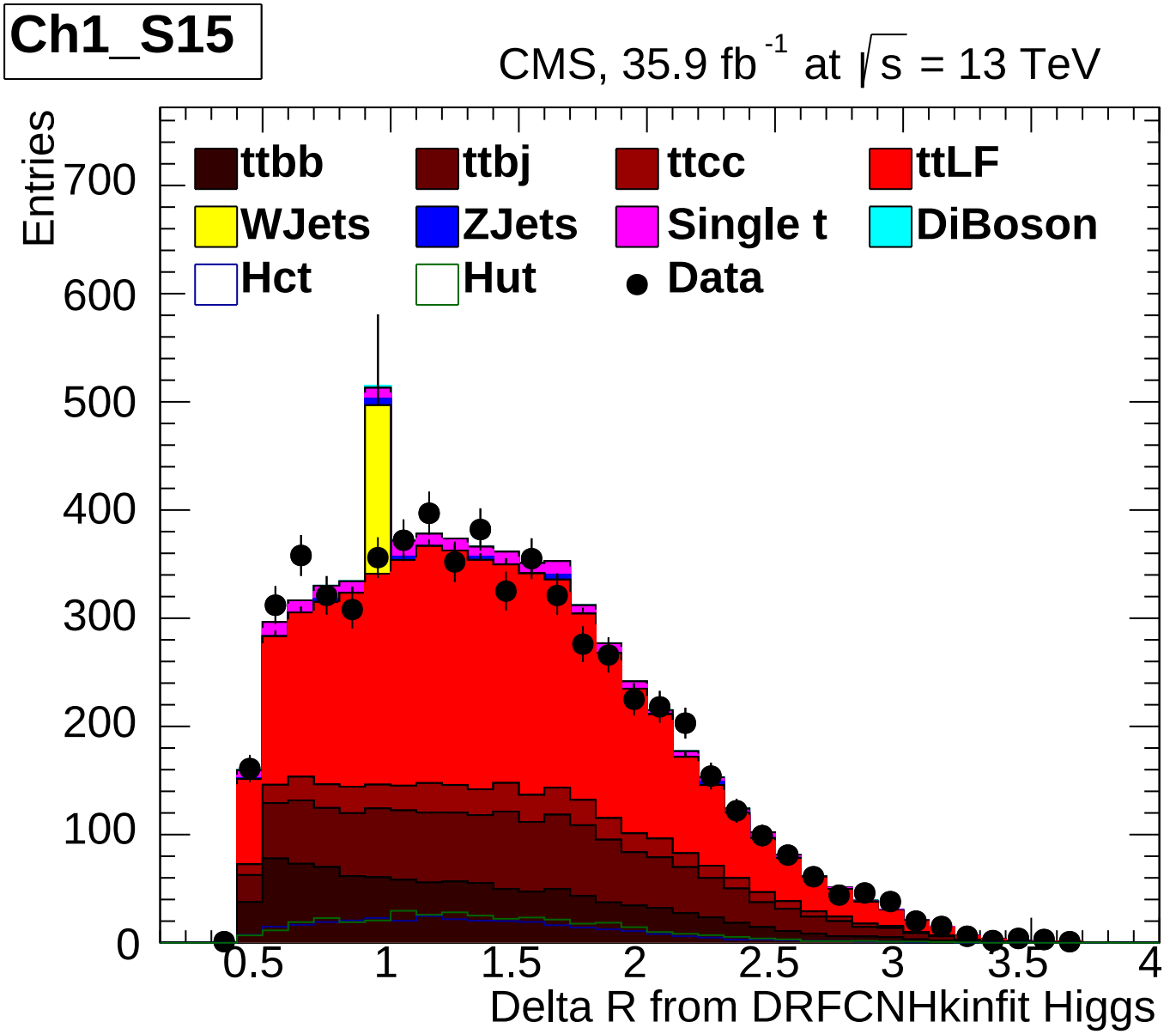
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
300
400
500
600
700
800
900
50
100
150
200
250
300
H Mass from DRFCNHkinfit (bb)(GeV)


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
Entries
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ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
0
100
200
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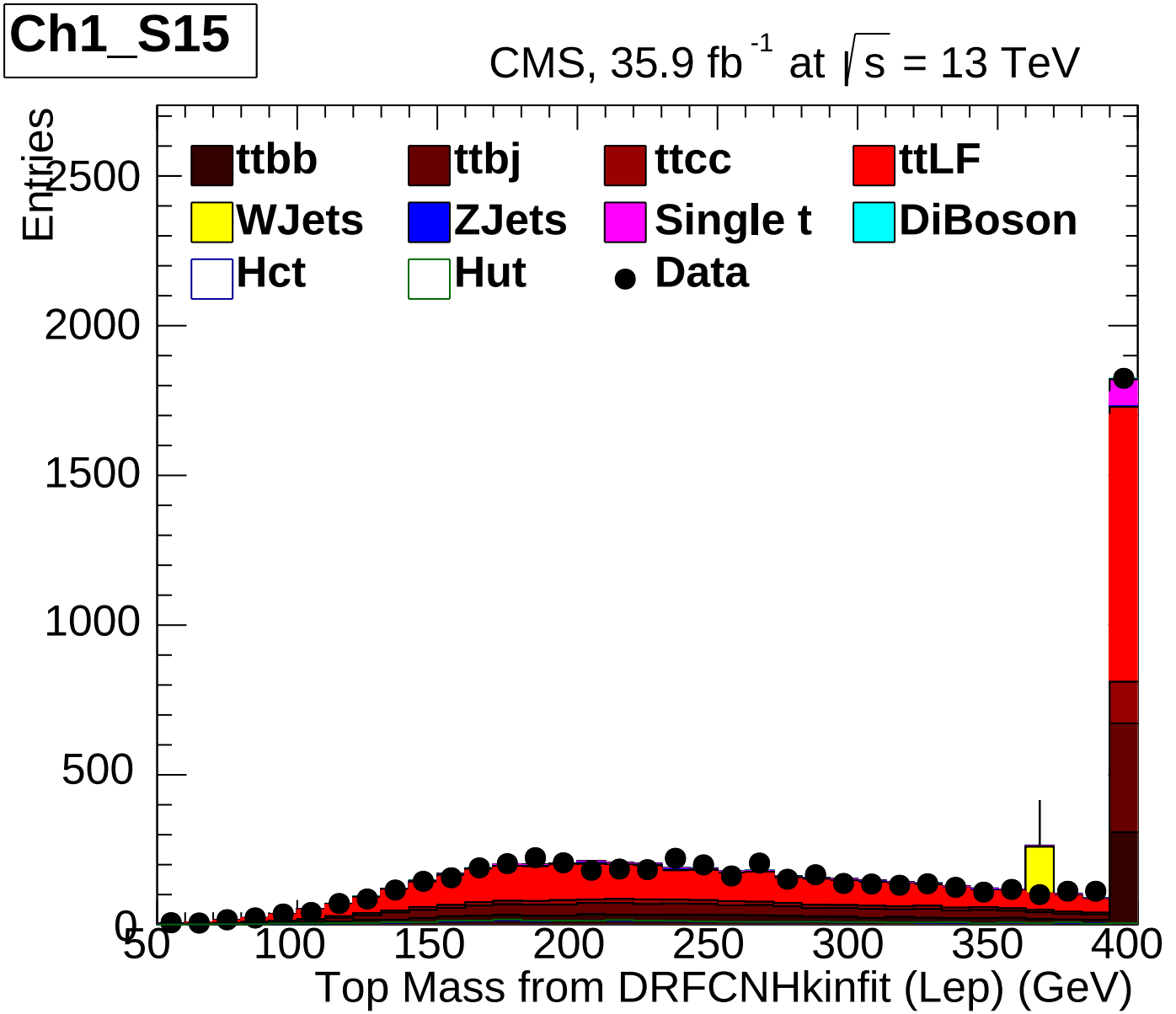
400
500
600
700
0.5
1
1.5
2
2.5
3
3.5
4
Delta R from DRFCNHkinfit Higgs


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
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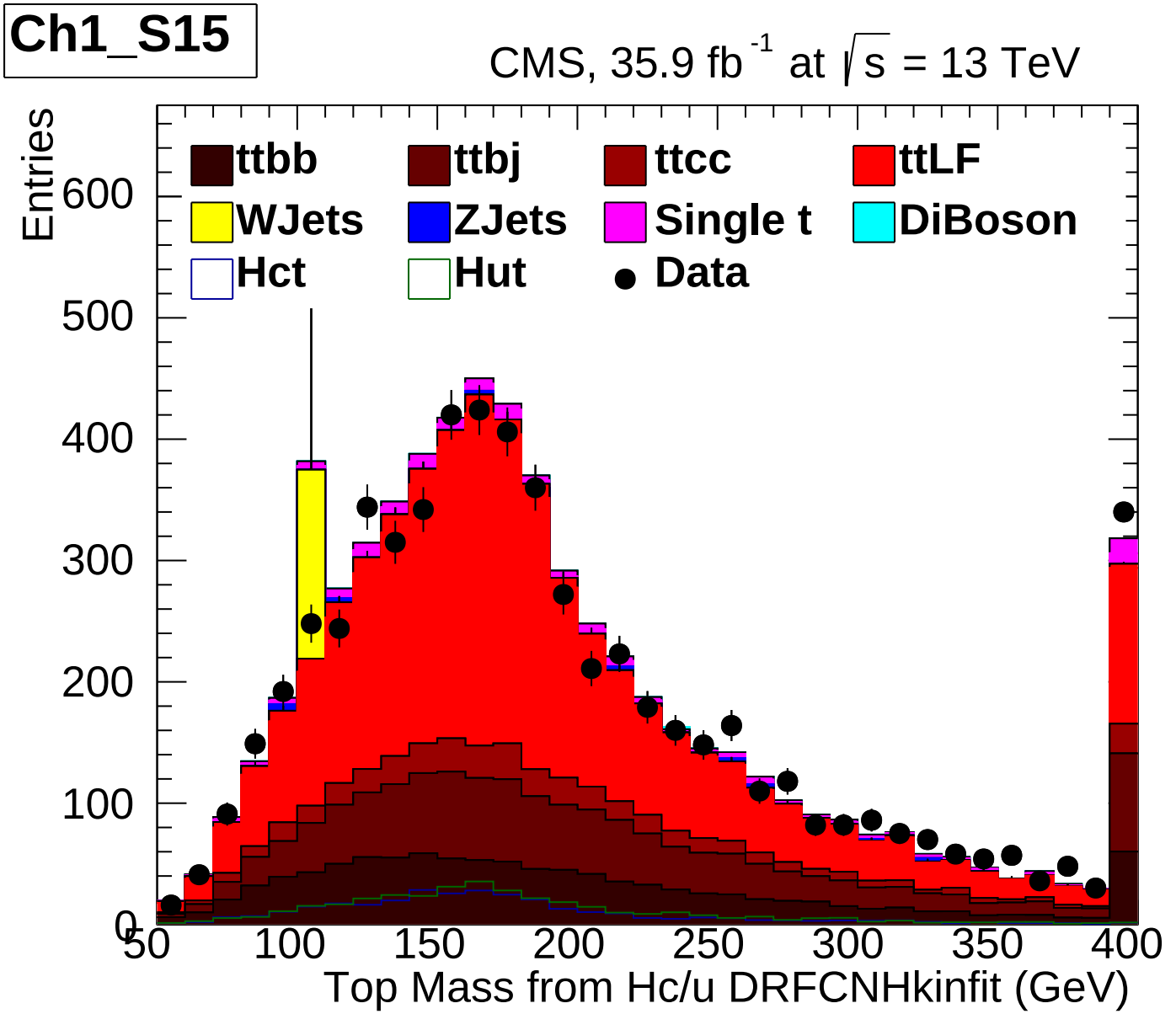
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
500
1000
1500
2000
2500
50
100
150
200
250
300
350
400
Top Mass from DRFCNHkinfit (Lep) (GeV)


Ch1_S15
CMS, 35.9 fb^{-1} at $\sqrt{s}$ = 13 TeV
ttbb
ttbj
ttcc
ttLF
WJets
ZJets
Single t
DiBoson
Hct
Hut
Data
Entries
0
100
200
300
400
500
600
50
100
150
200
250
300
350
400
Top Mass from Hc/u DRFCNHkinfit (GeV)