Stop Fat Jets

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Overview

- In decay of stop to LSP and W, where W->qq, as mass difference between stop and LSP increases, deltaR separation between qq decreases
  - This manifests itself as two jets that are close
  - When clustering jets, closeness in deltaR can result in a lost jet (or formation of “fat” jet)
- Study percentage of “fat” jets as a function of mass difference
- Plots at http://web.physics.ucsb.edu/~namin/dump/stop081214//_index.php (click images to get pdfs)

Samples

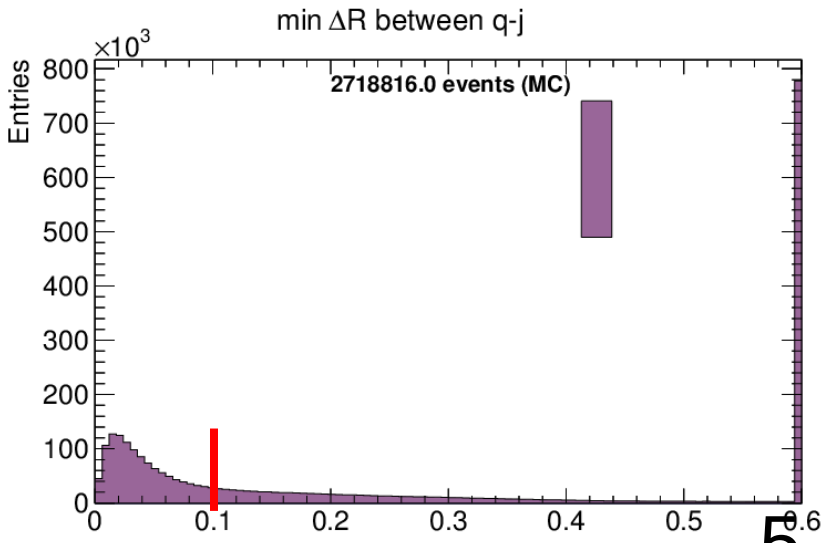
- https://twiki.cern.ch/twiki/bin/viewauth/CMS/SMST2ttMadgraph8TeV
  - LSP mass of 1
  - Stop mass in [200,900] (increments of 100)
- Filtered samples for LSP mass of 1
  - /hadoop/cms/store/user/namin/mStop150to475_mLSP1
  - /hadoop/cms/store/user/namin/mStop500to800_mLSP1
  - /hadoop/cms/store/user/namin/mStop825to900_mLSP1

Selections

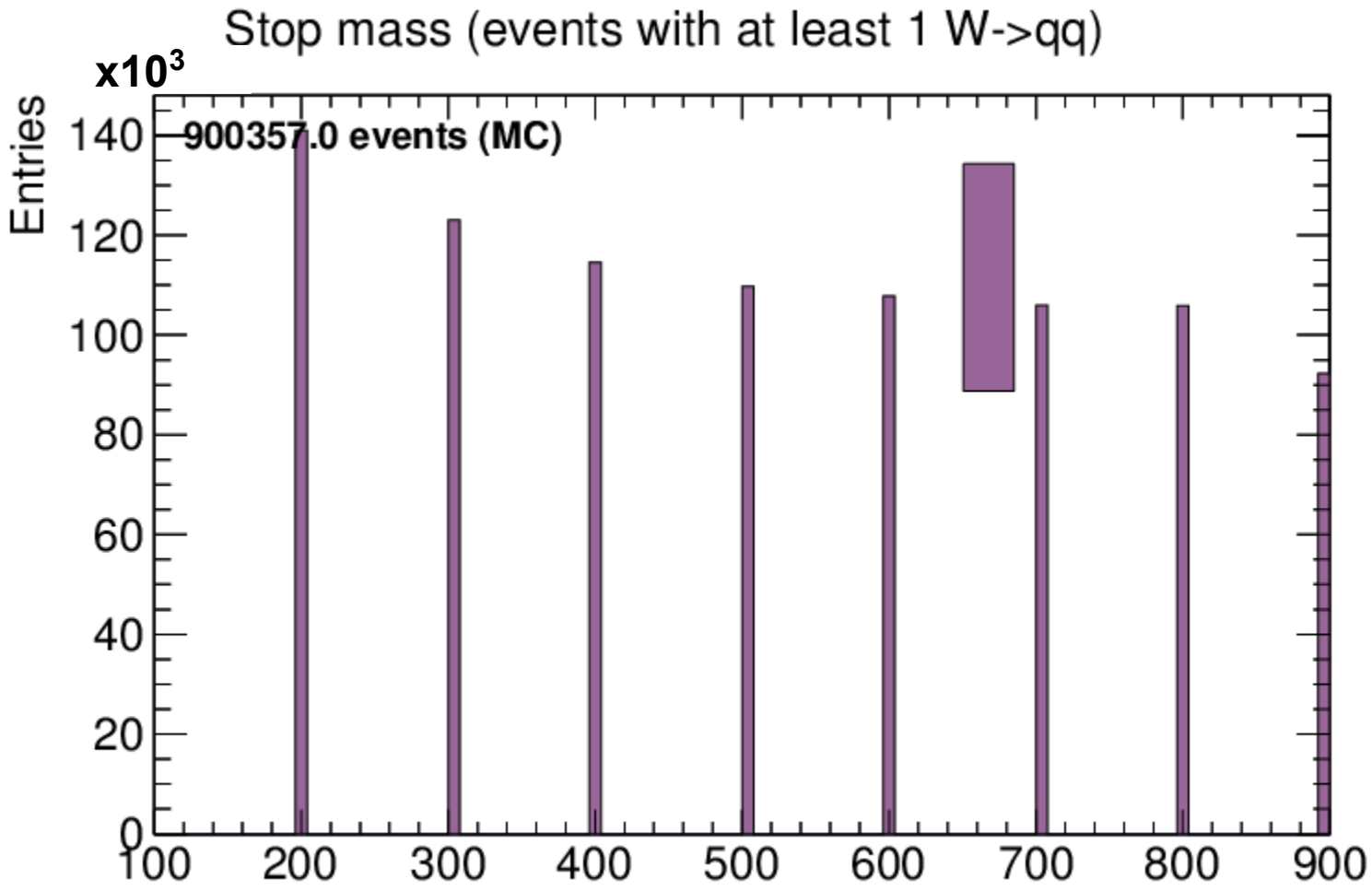
- Loop through events where there is at least 1 W that decays hadronically
  - Can have at least 1 (~90%) or exactly 2 (~50%) W->qq decays per event
  - We will end up treating each W->qq independently
- Filter to get quality jets
  - pt > 40
  - |eta| < 2.4
  - passesLoosePFJetID()

Quark-Jet Matching

- Find 2 jets with minimum deltaR to the 2 quarks
  - if the 2 jets happen to be the same, call it a “lonely” jet
- Now make the requirement that jet-quark deltaR < 0.1
  - if we end up with 2 distinct jets, continue on to plot/calculate

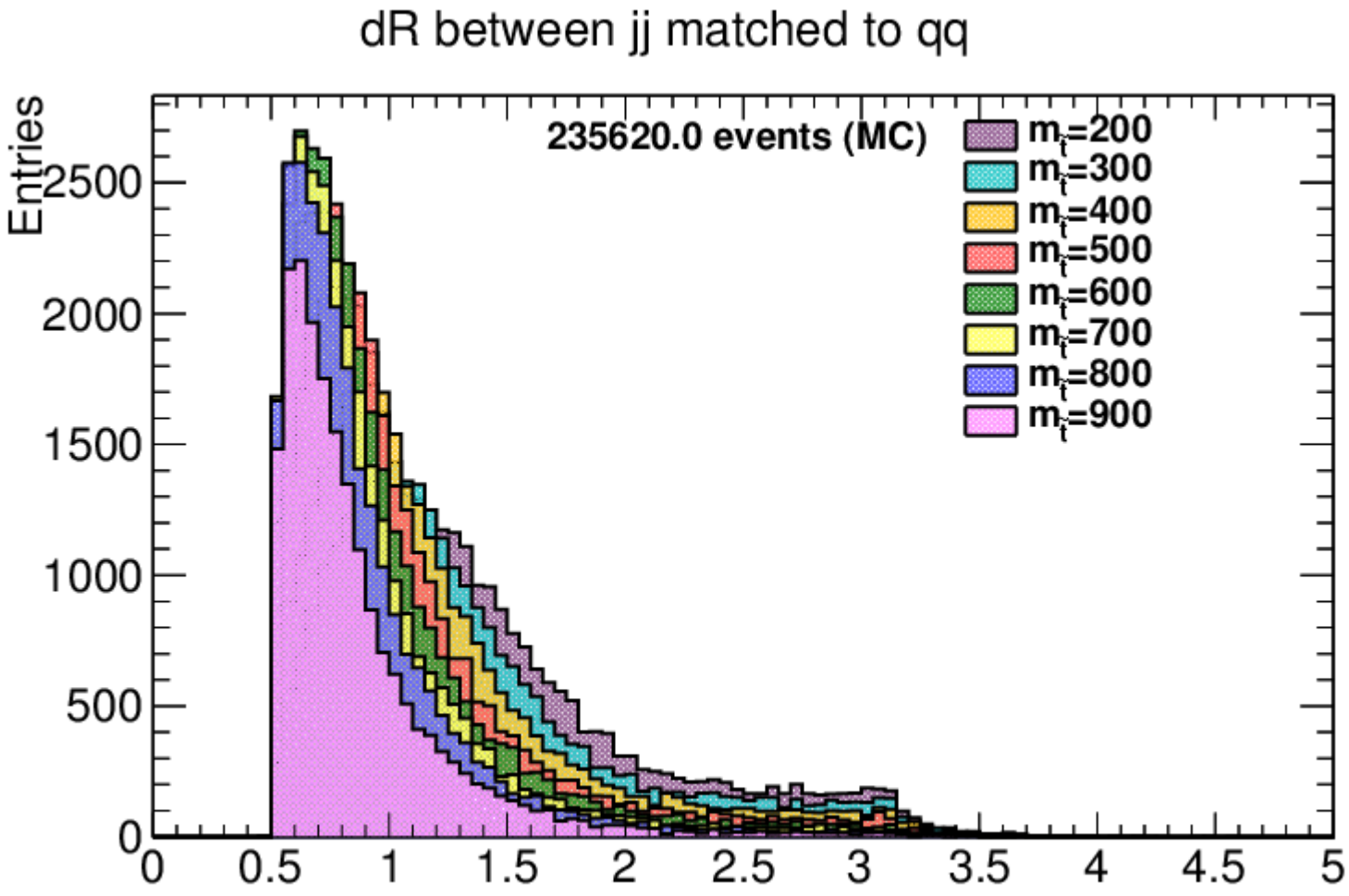


Statistics

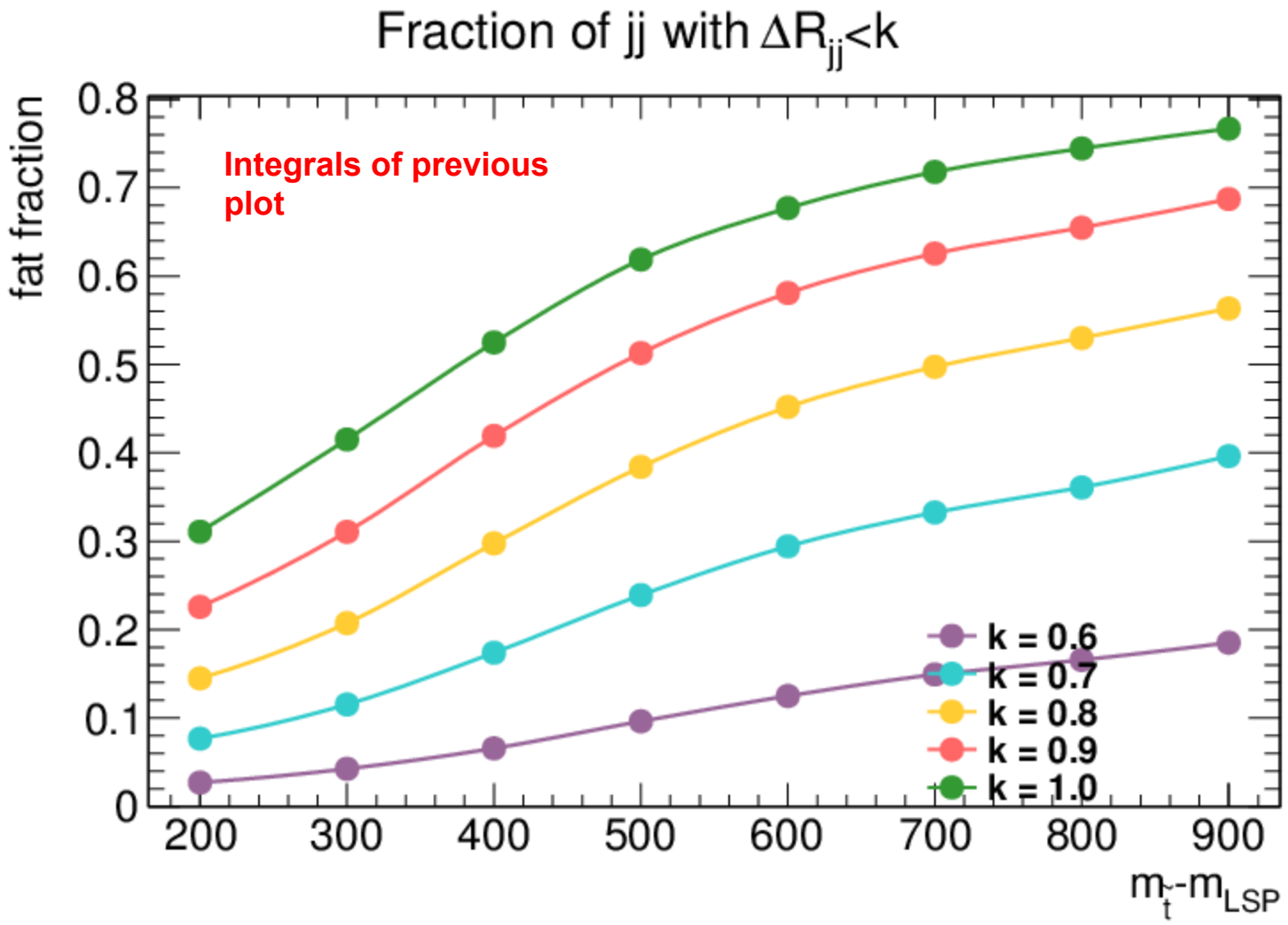

Stop mass (events with at least 1 W->qq)
x10^3
Entries
900357.0 events (MC)
140
120
100
80
60
40
20
0
100
200
300
400
500
600
700
800
900

Plots

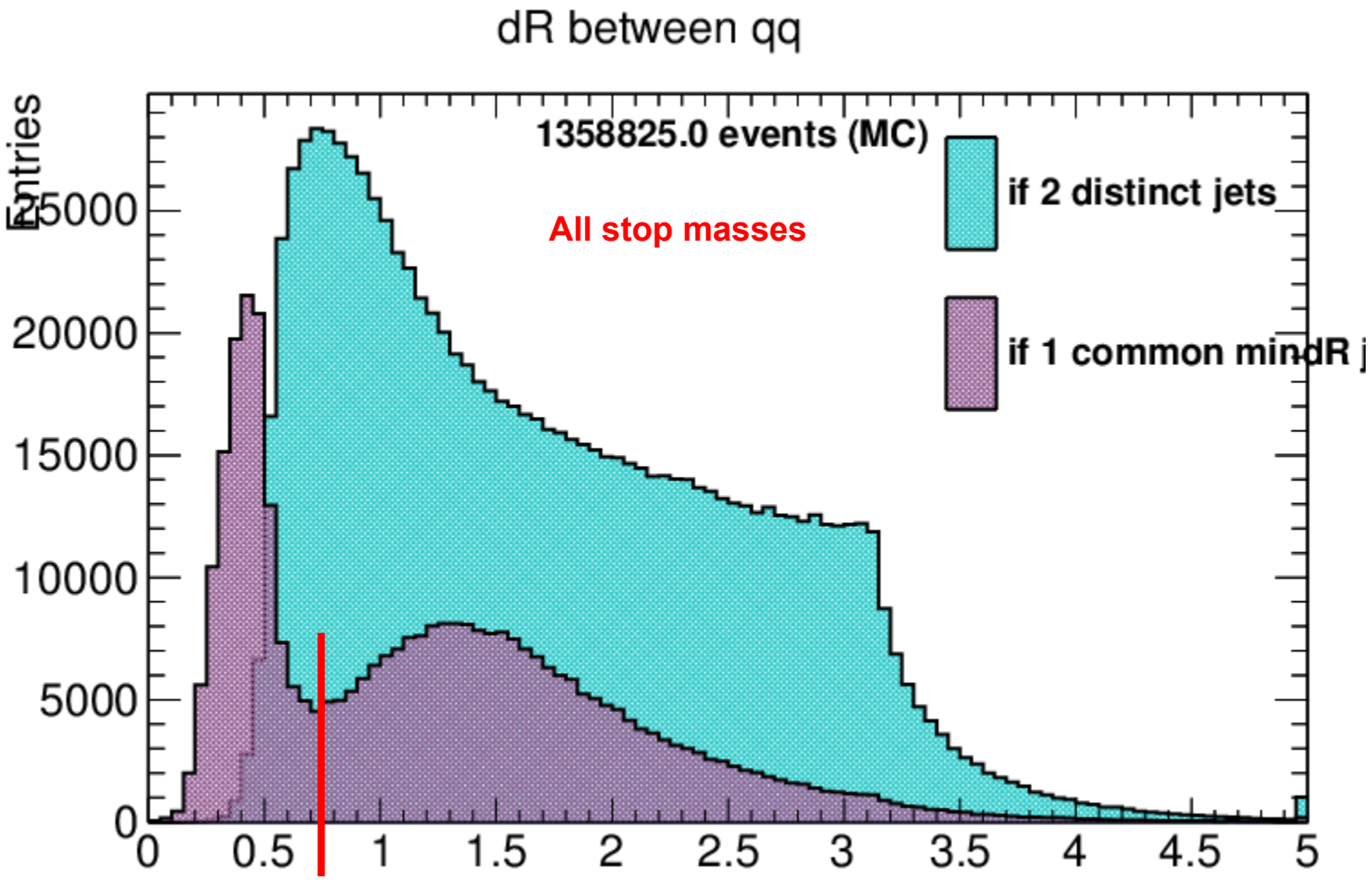
Note: All of the following plots are not stacked (easier to tell in .pdf versions!)



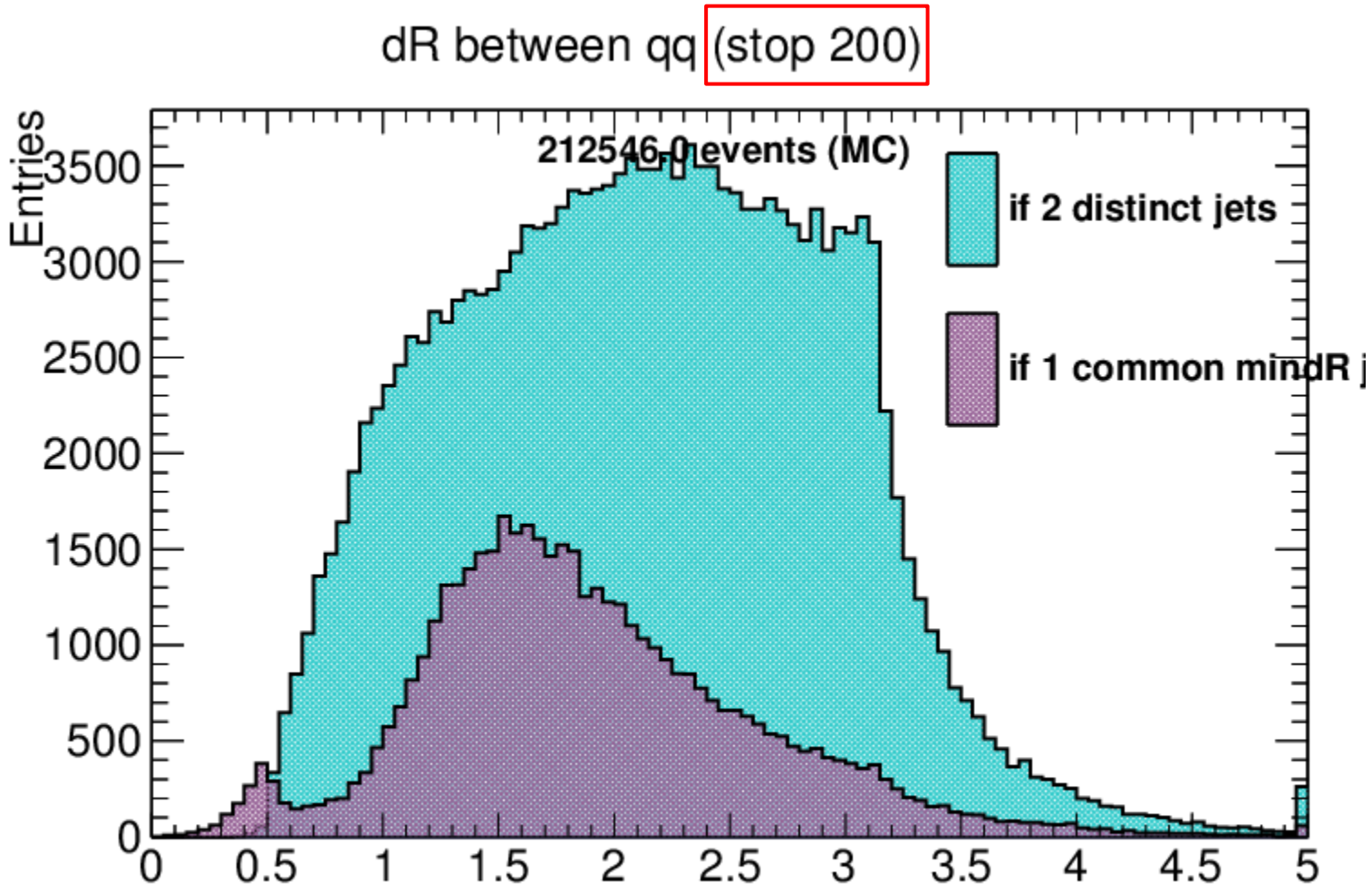
Plots


Fraction of jj with ΔR_jj<k
fat fraction
Integrals of previous plot
k = 0.6
k = 0.7
k = 0.8
k = 0.9
k = 1.0
m_t̃-m_LSP
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
200
300
400
500
600
700
800
900

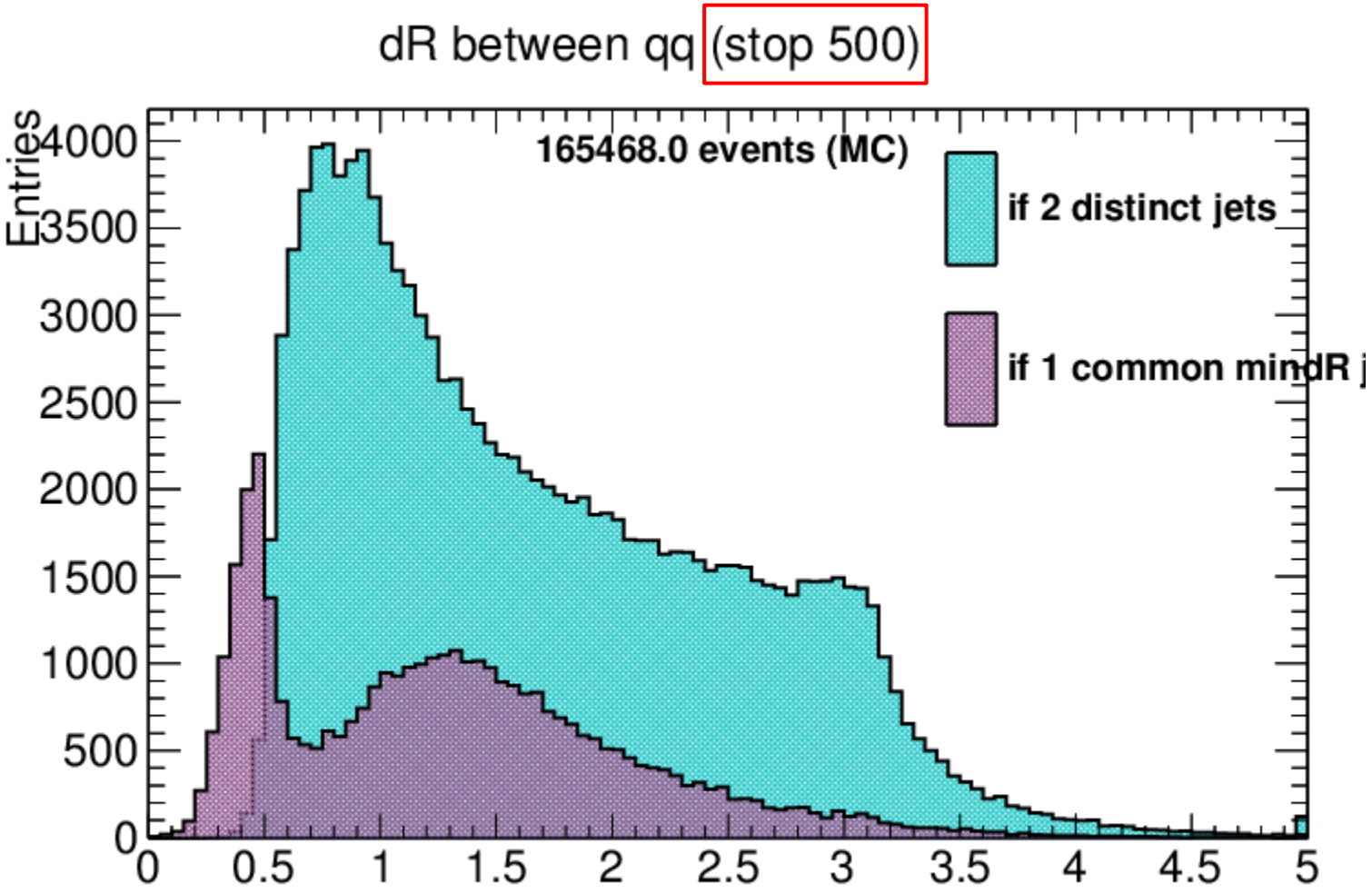
Plots


dR between qq
Entries
1358825.0 events (MC)
All stop masses
if 2 distinct jets
if 1 common mindR j
25000
20000
15000
10000
5000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

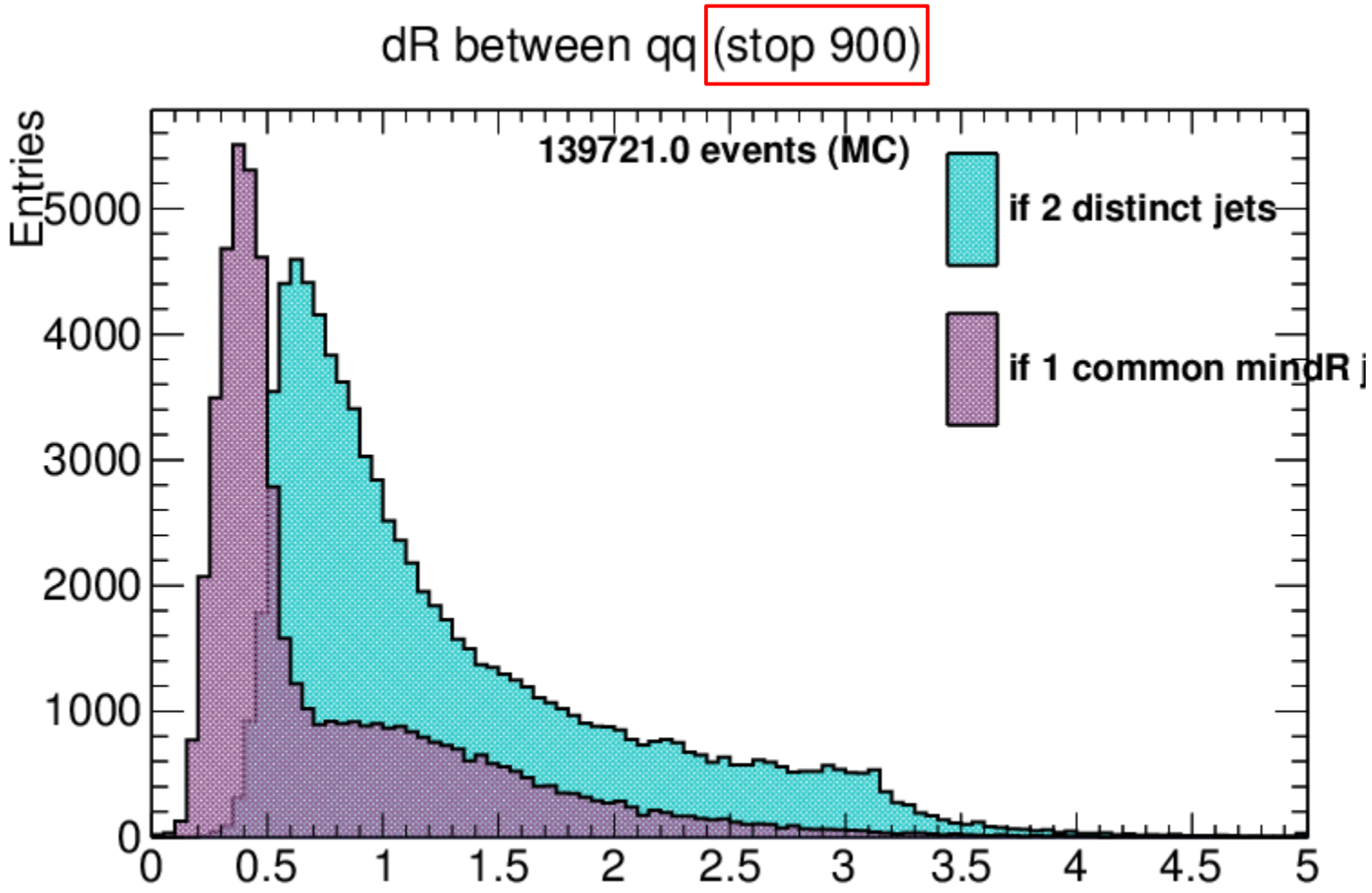
Plots


dR between qq (stop 200)
212546.0 events (MC)
if 2 distinct jets
if 1 common mindR j
Entries
3500
3000
2500
2000
1500
1000
500
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

Plots


dR between qq (stop 500)
165468.0 events (MC)
if 2 distinct jets
if 1 common minidR j
Entries
4000
3500
3000
2500
2000
1500
1000
500
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

Plots


dR between qq (stop 900)
139721.0 events (MC)
Entries
5000
4000
3000
2000
1000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
if 2 distinct jets
if 1 common mindR j

Conclusions

- As stop mass increases, fraction of 1-jet (over 2-jet) instances increases
- DeltaR (=0.5) clustering of jets makes small separation studies less exact
  - Curves on slide 8 are underestimates