ACTS Vertex Finding and b-Jet Tagging Update

sPHENIX Heavy Flavor Topical Group Meeting

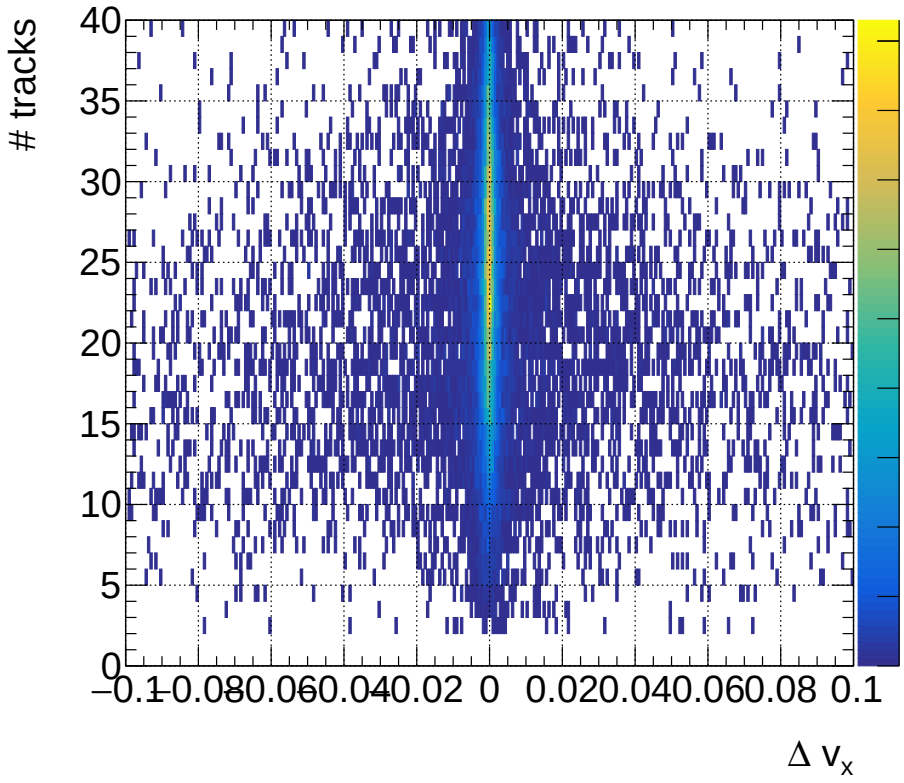
Daniel Lis

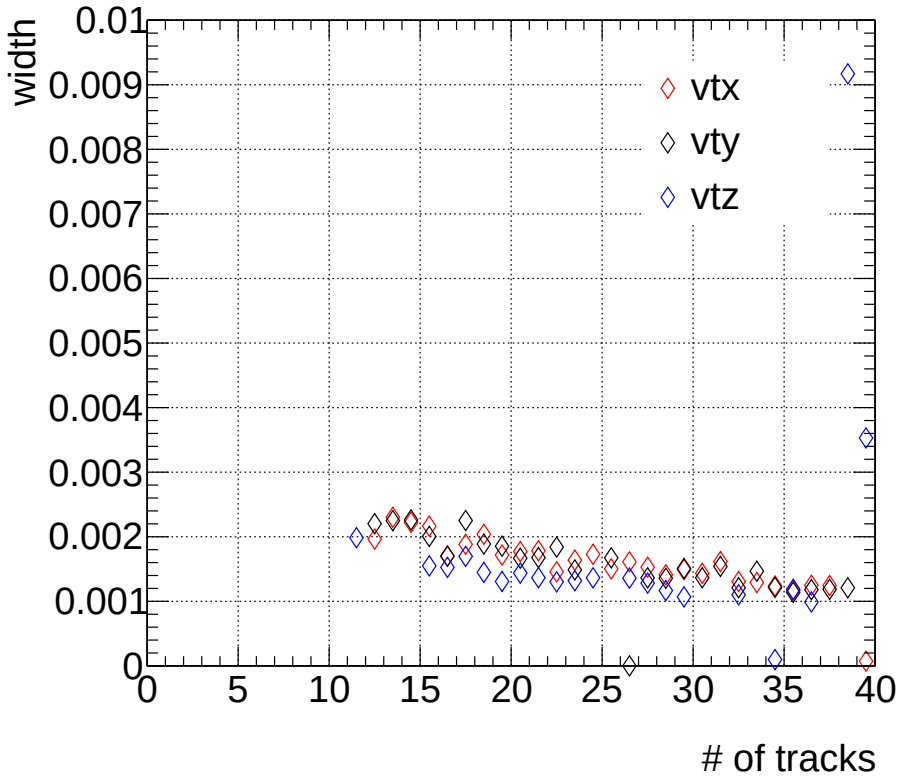
University of Colorado Boulder, Heavy Ions Group

March 8, 2021

ACTS Vertex Finding status

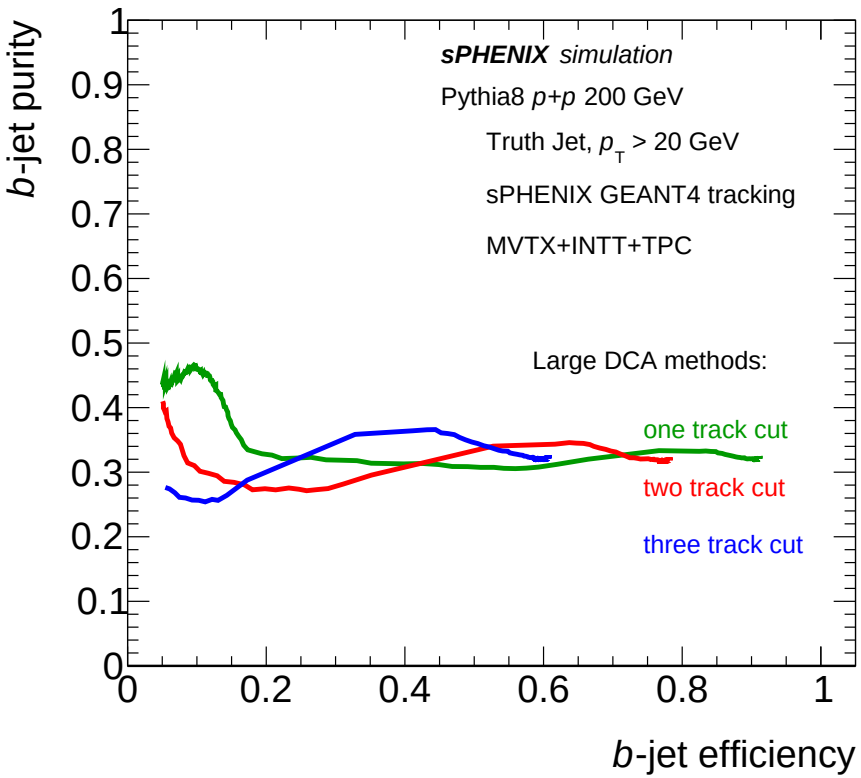
- Number of tracks per vertex seems a bit high, approaching 40 tracks and up.
- Below 10 tracks, there are very little statistics to give a reliable width of the deviation distribution.

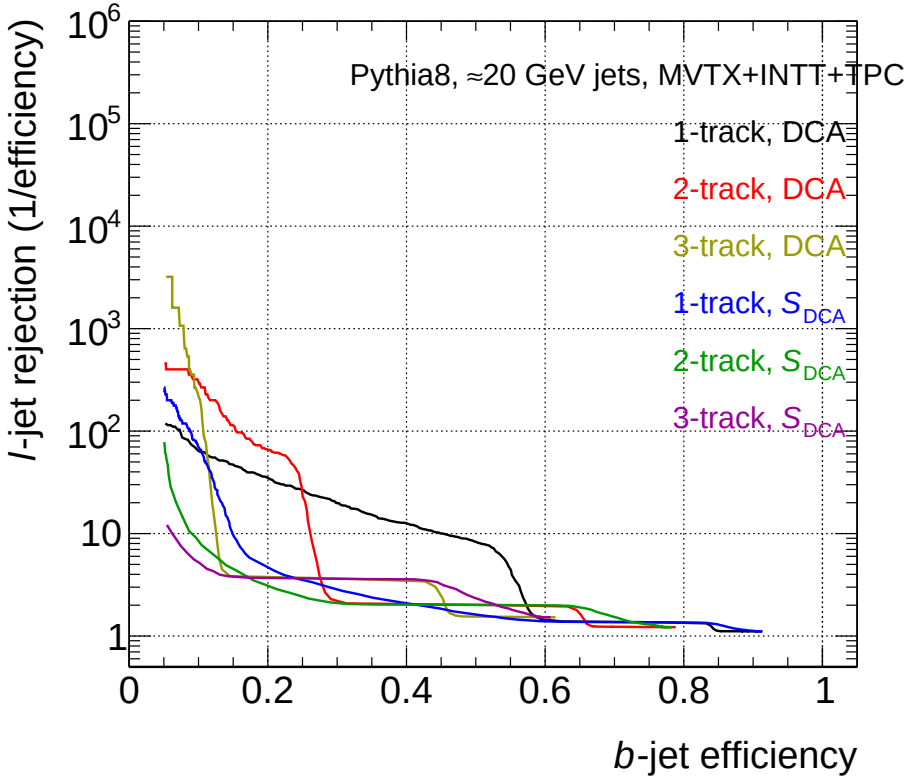




b-Jet Tagging Update

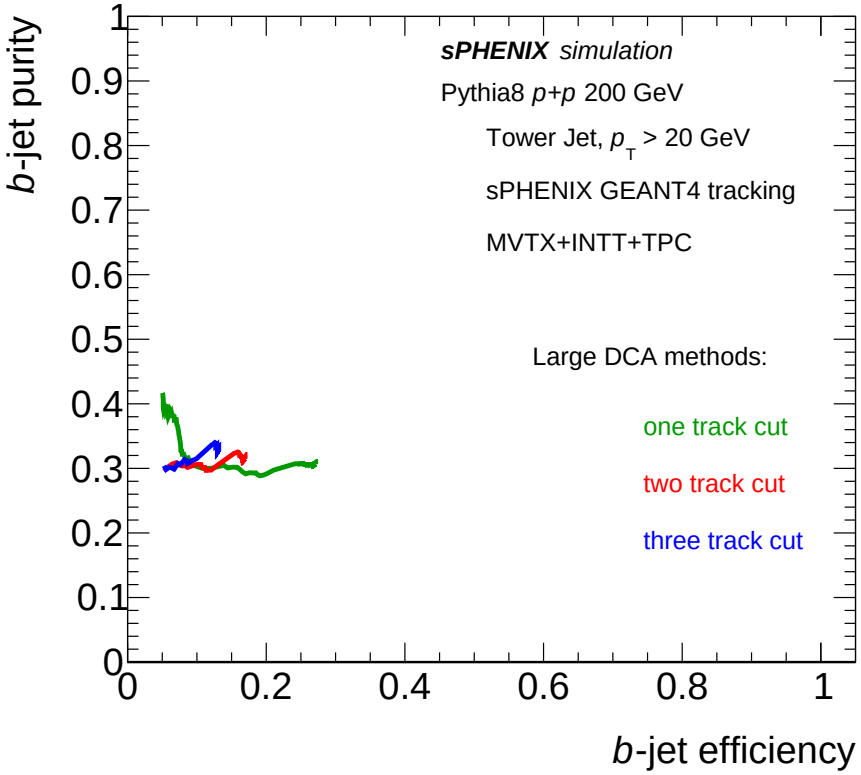
- Make DCA distributions with new 200 GeV pythia8 samples
- Around 8000 events each for light quark, charm quark, and bottom quark tagged jets
- Something is wrong here with the purity plot (using the truth jets)

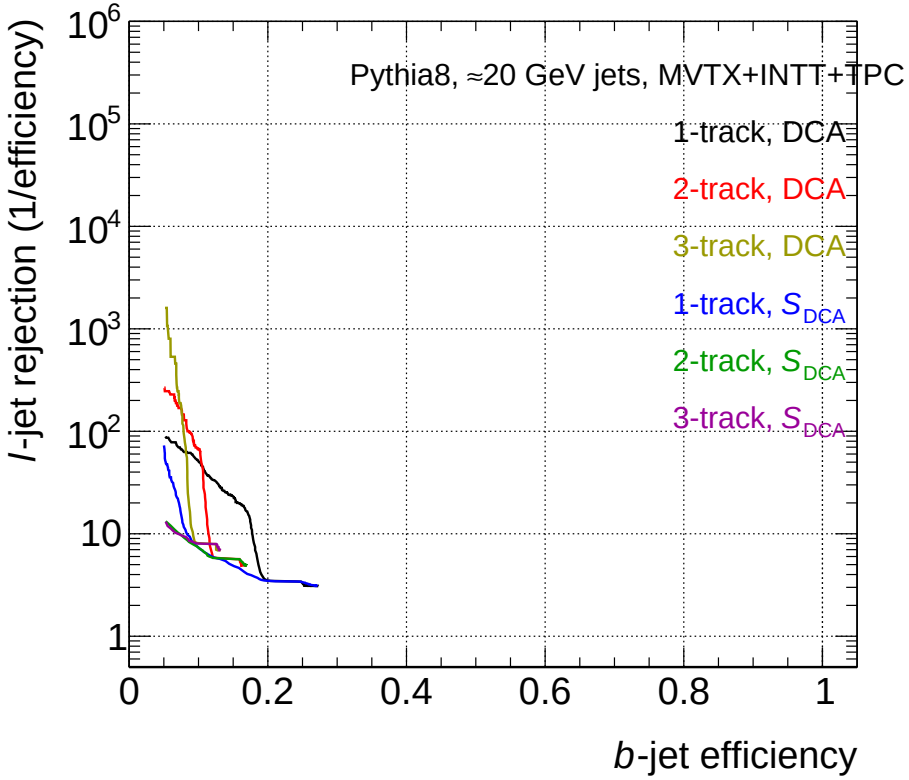




b-Jet Tagging Update

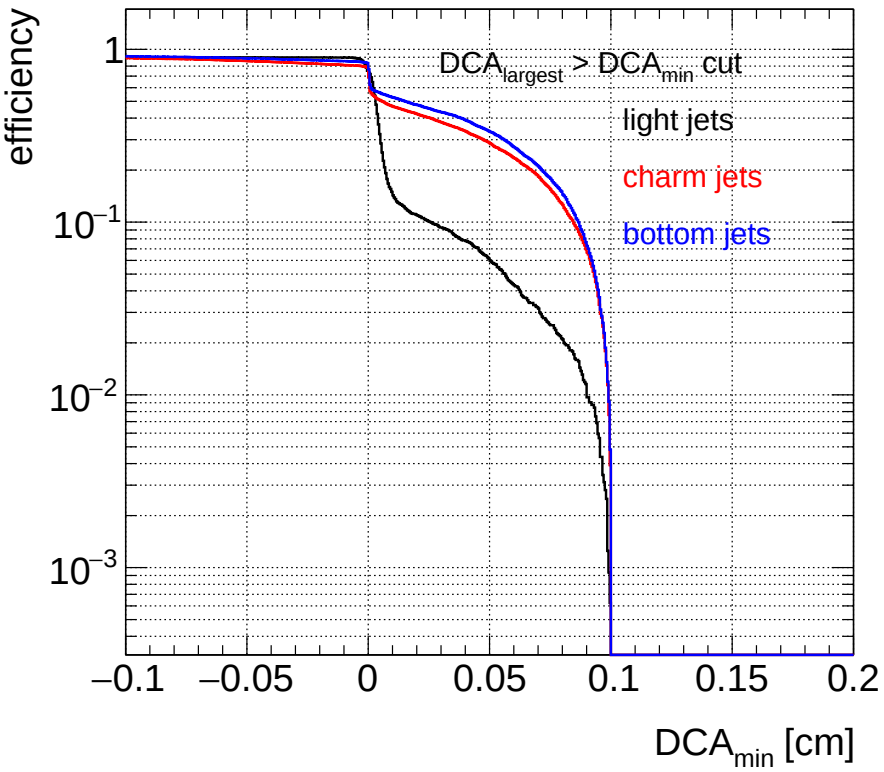
- Here are the same plots, but using the reconstructed jets.

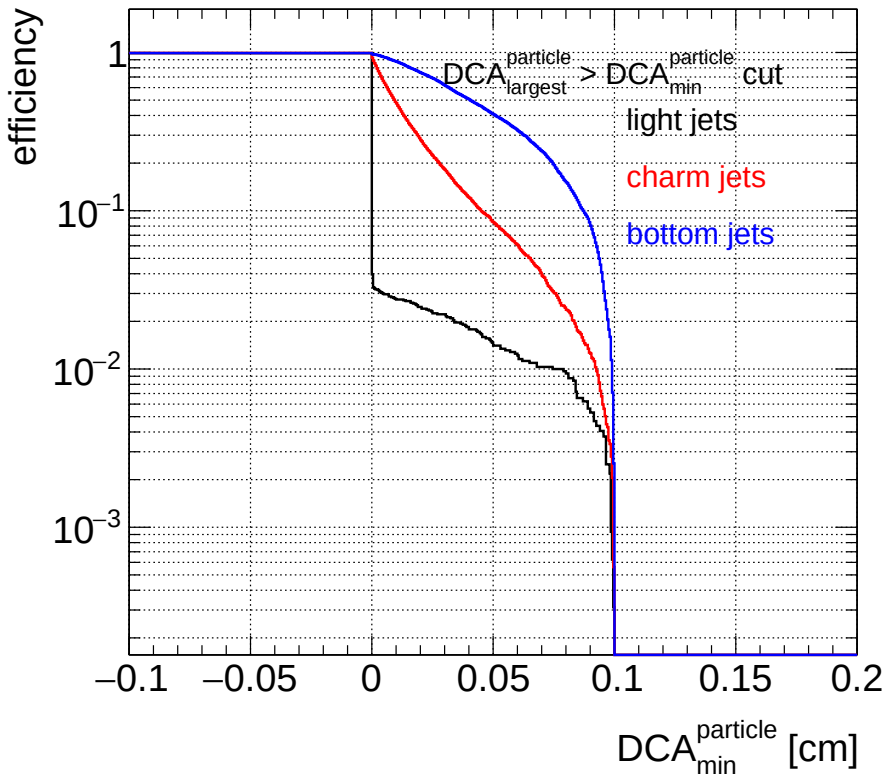




b-Jet Tagging Update

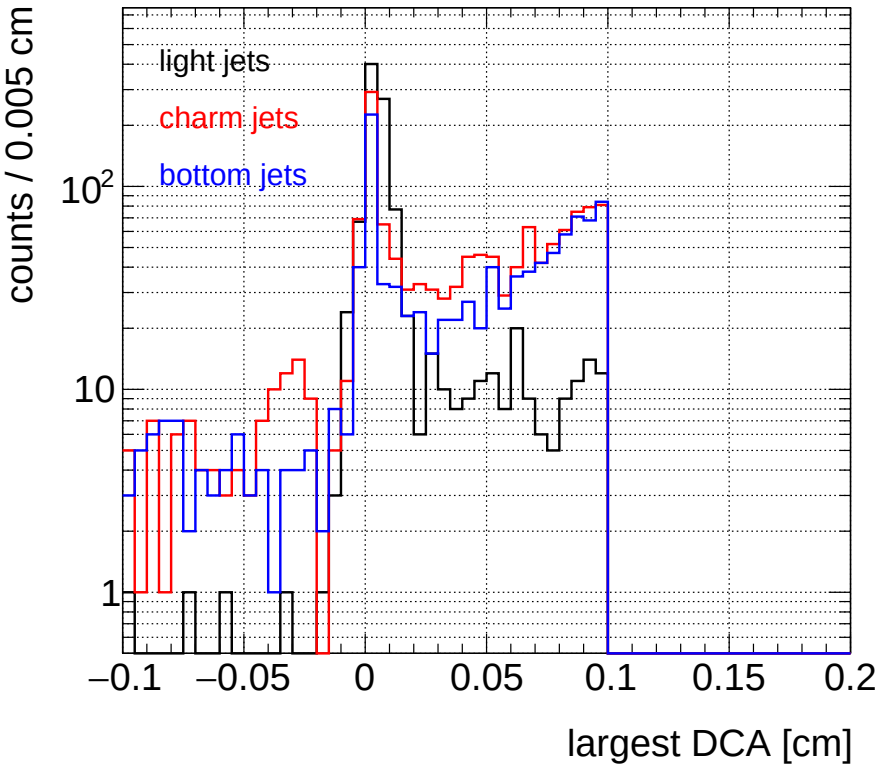
- Where is this coming from? The similarity between the charm and bottom jets possibly.
- Notice the similarity on the efficiencies of the track DCA on the left for bottom and charm jets. To the right is the particle largest DCA.

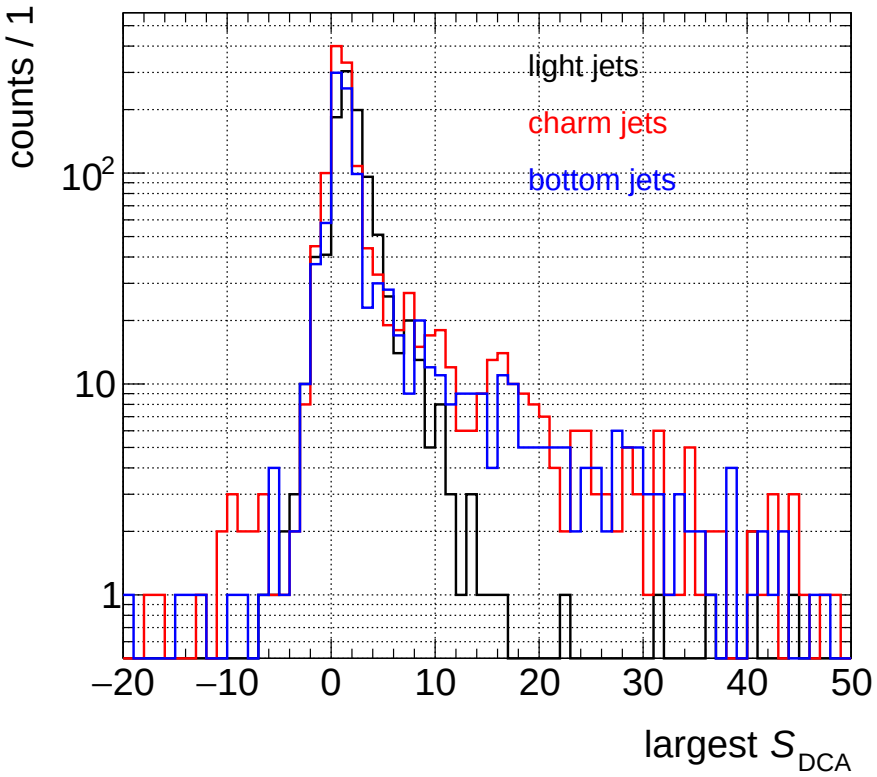




b-Jet Tagging Update

- Couple of notes:
  - substantial population of *DCA* below 0 (tried a fix, didn't change efficiencies)
  - Very large peak around 0 for the bottom and charm distributions
  - Strikingly similar distributions on both track largest *DCA* and S_{DCA}



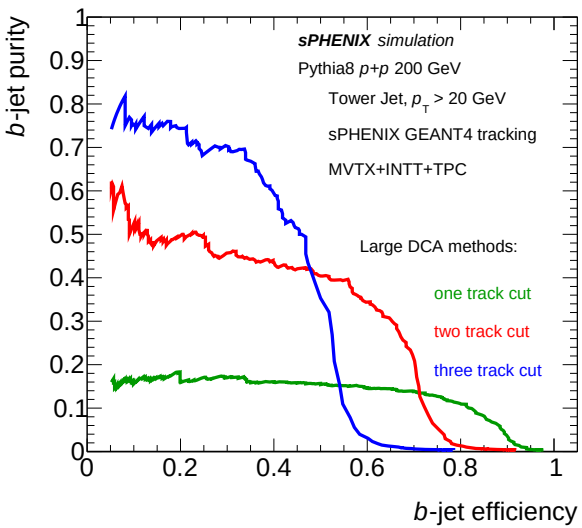


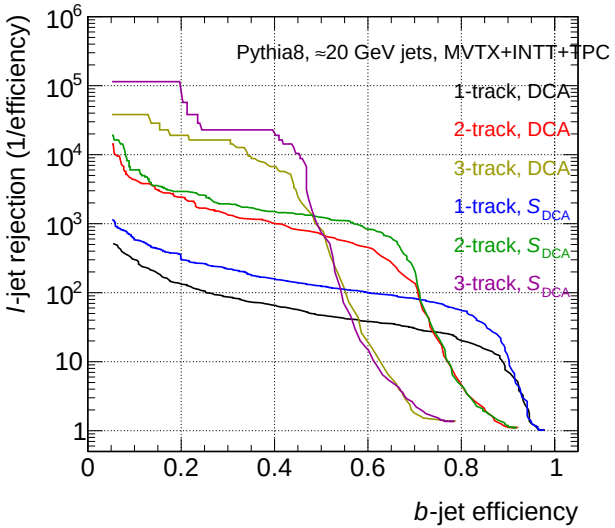
Moving Forward

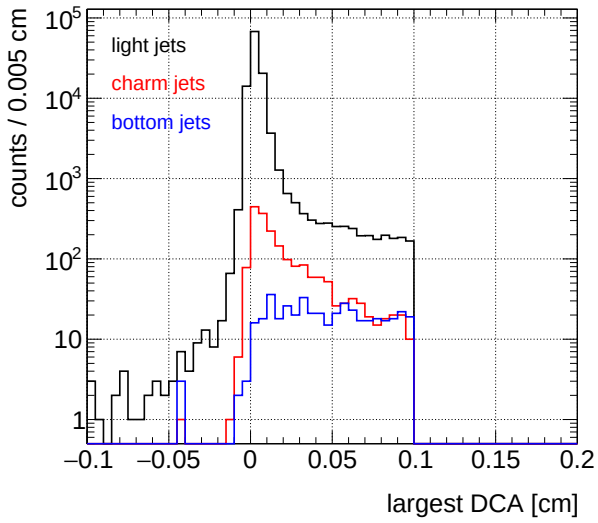
- Acts Vertex Finding
  - How come there are very few tracks per primary vertex?
- b-Jet Tagging
  - What is causing these large peaks at zero? Why are these distributions so similar?

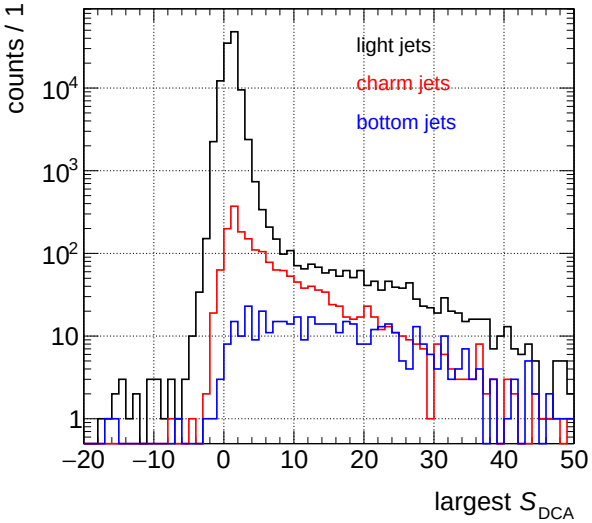
Backup

2017 Plots

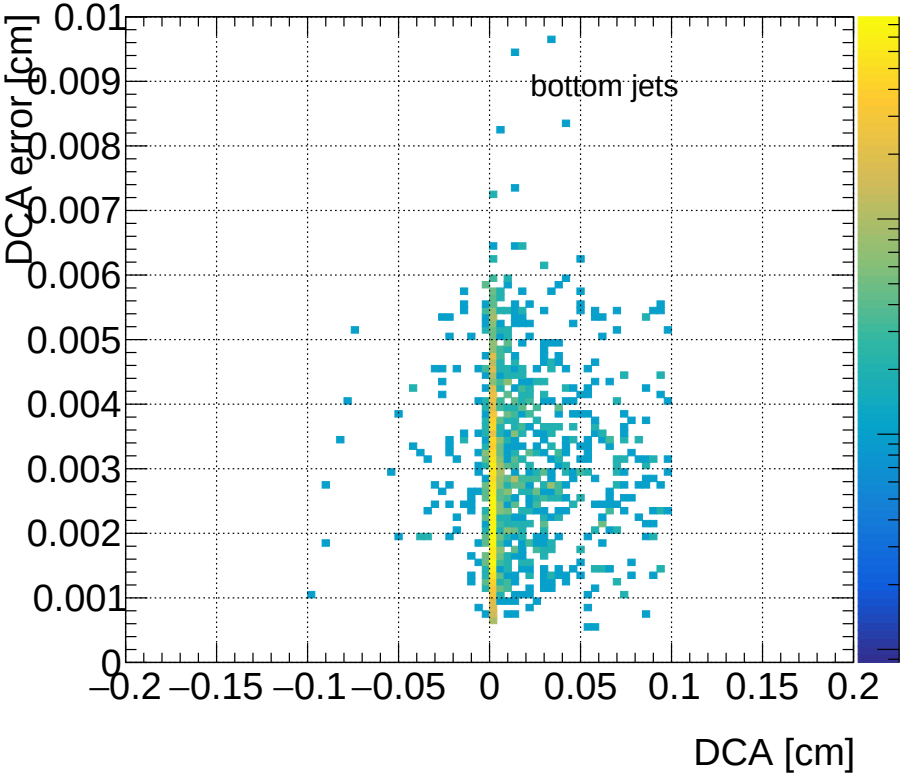

sPHENIX simulation
Pythia8 p+p 200 GeV
Tower Jet, p_T > 20 GeV
sPHENIX GEANT4 tracking
MVTX+INTT+TPC
Large DCA methods:
one track cut
two track cut
three track cut
b-jet purity
b-jet efficiency

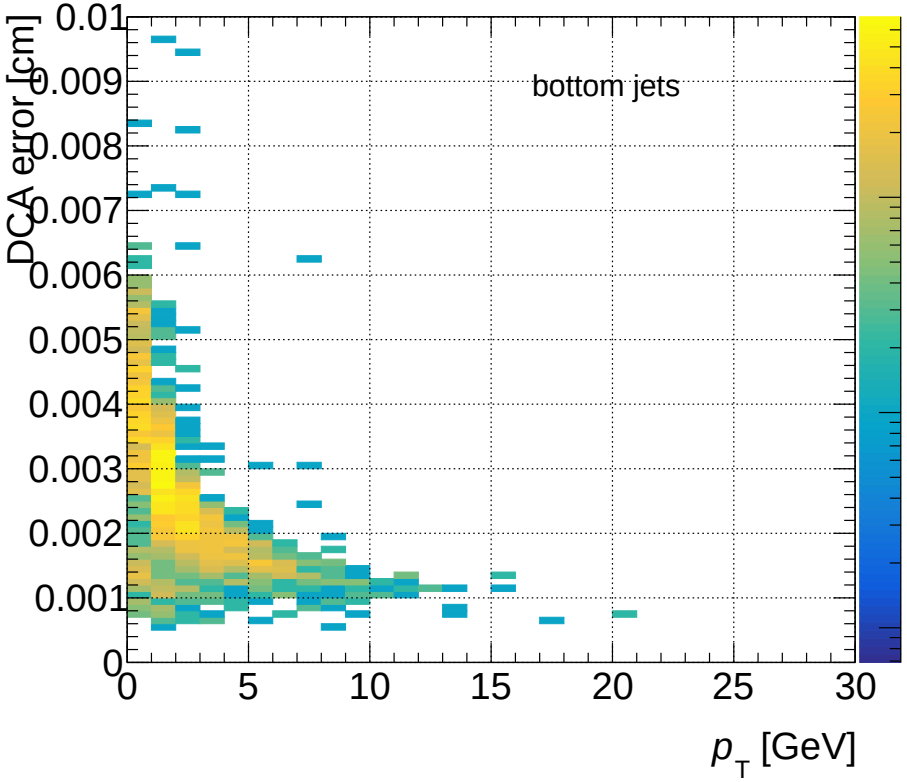

Pythia8, ≈20 GeV jets, MVTX+INTT+TPC
1-track, DCA
2-track, DCA
3-track, DCA
1-track, S_{DCA}
2-track, S_{DCA}
3-track, S_{DCA}
l-jet rejection (1/efficiency)
b-jet efficiency


light jets
charm jets
bottom jets
counts / 0.005 cm
largest DCA [cm]

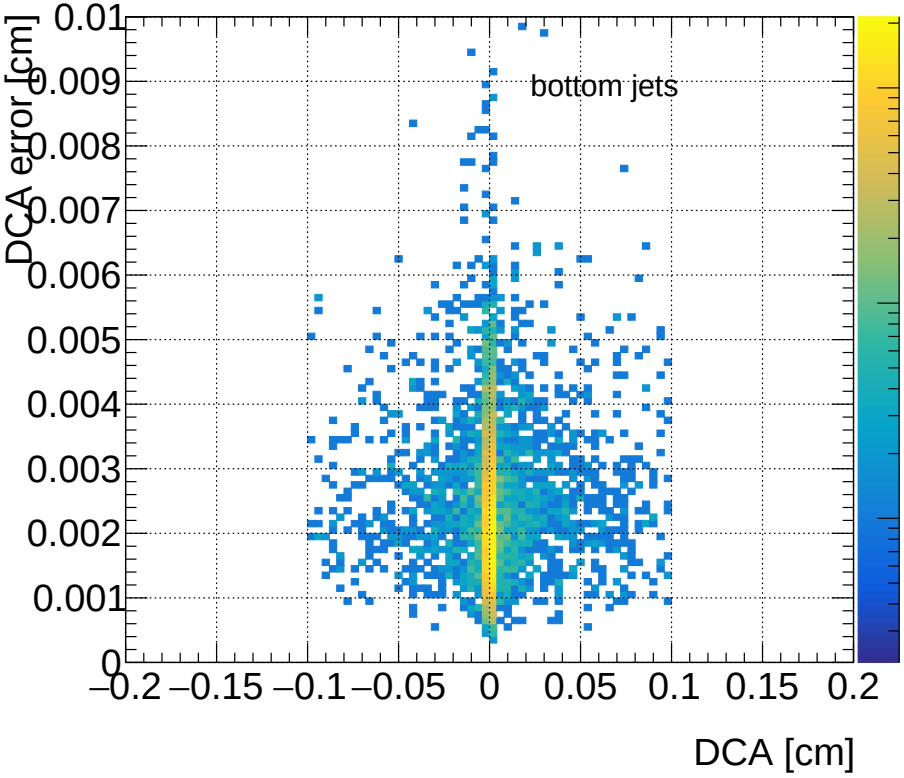

light jets
charm jets
bottom jets
counts / 1
largest S_{DCA}

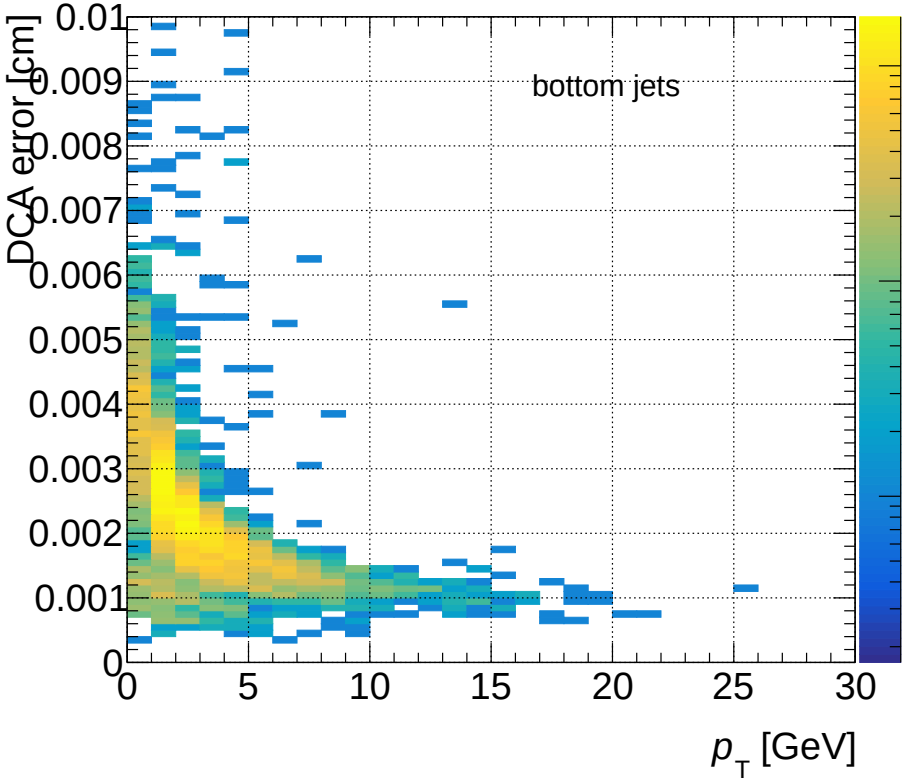
Backup


bottom jets
DCA error [cm]
DCA [cm]
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
–0.2
–0.15
–0.1
–0.05
0
0.05
0.1
0.15
0.2


bottom jets
DCA error [cm]
p_T [GeV]
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
5
10
15
20
25
30

Backup


bottom jets
DCA error [cm]
DCA [cm]
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
–0.2
–0.15
–0.1
–0.05
0
0.05
0.1
0.15
0.2


bottom jets
DCA error [cm]
p_T [GeV]
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
5
10
15
20
25
30