HHZ production at 3 TeV CLIC

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HHZ at 3 TeV

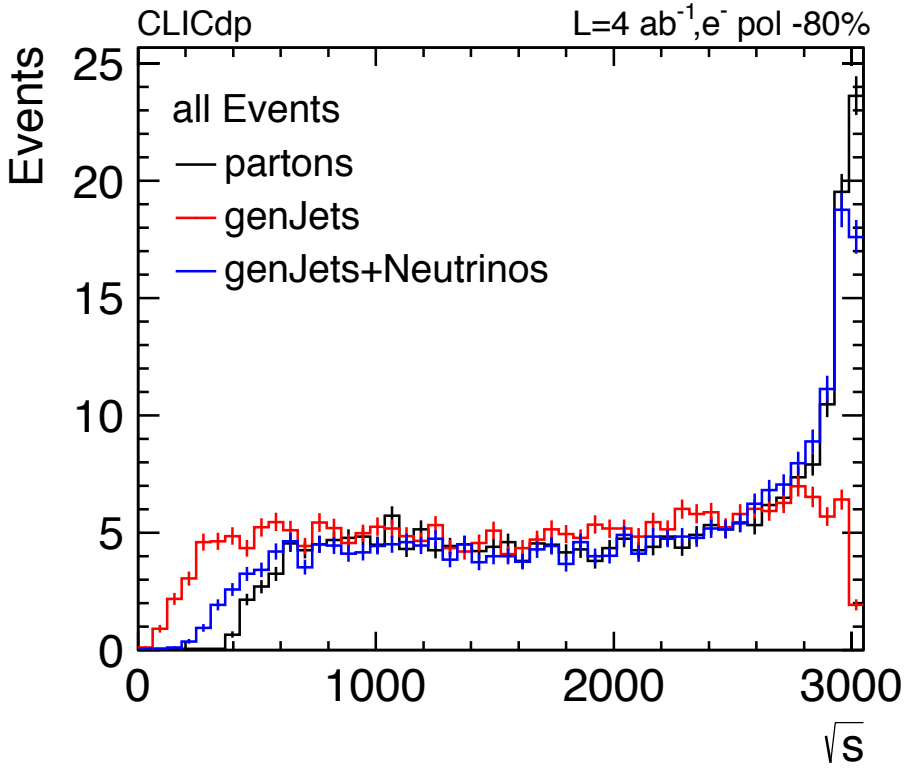
Concentrate on HH Z →bb bb qq:

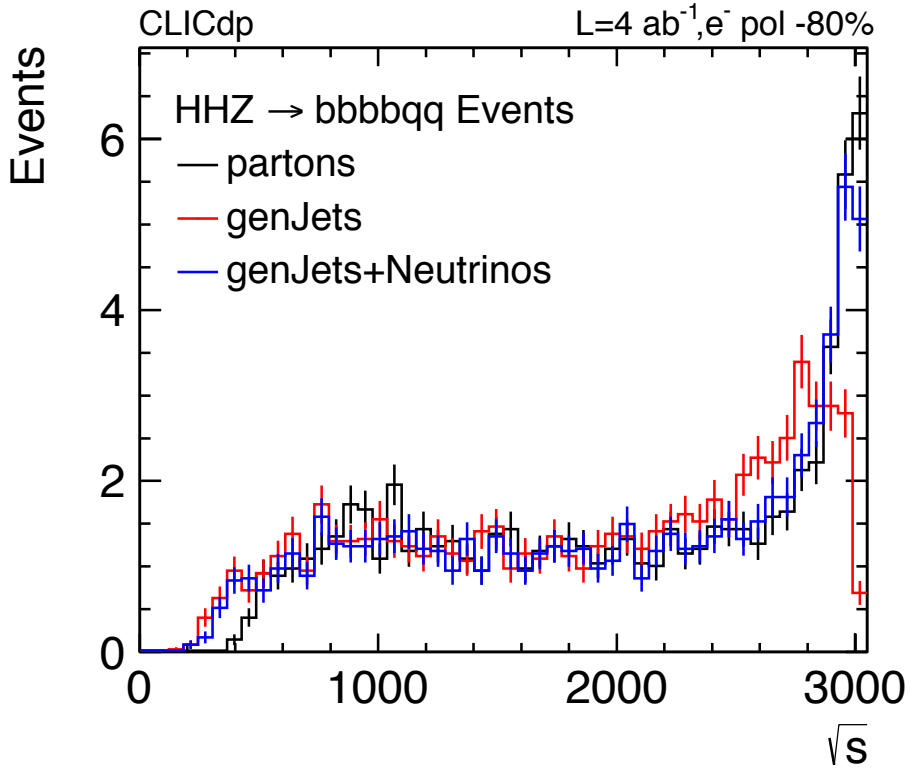
Full hadronic signature, very low statistic:
Total cross section: 6.6e-2 fb^{-1} for -80 % electron beam polarisation
→242 events in total
→ 68 in bb bb qq final state

For +80 % electron beam polarisation:
Cross section: 4.23e-2 fb^{-1}
→ 42 events in total
→ 12 events in desired phase space

Scale of events: sqrt(s)

Partonic √s vs sqrt(s) based on generated jets (use all visible particles): VLC10 in exclusive mode: Njet=3



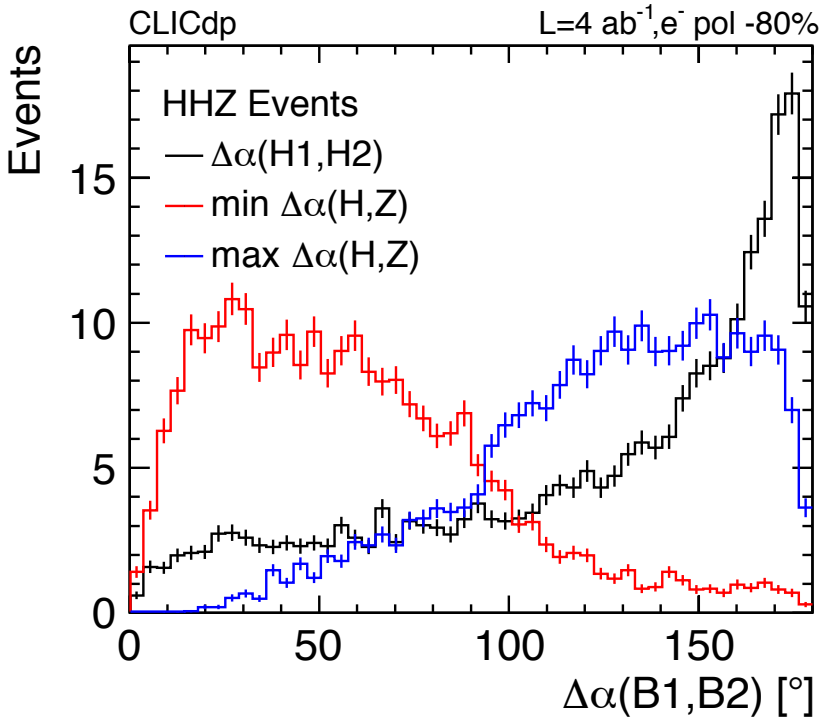


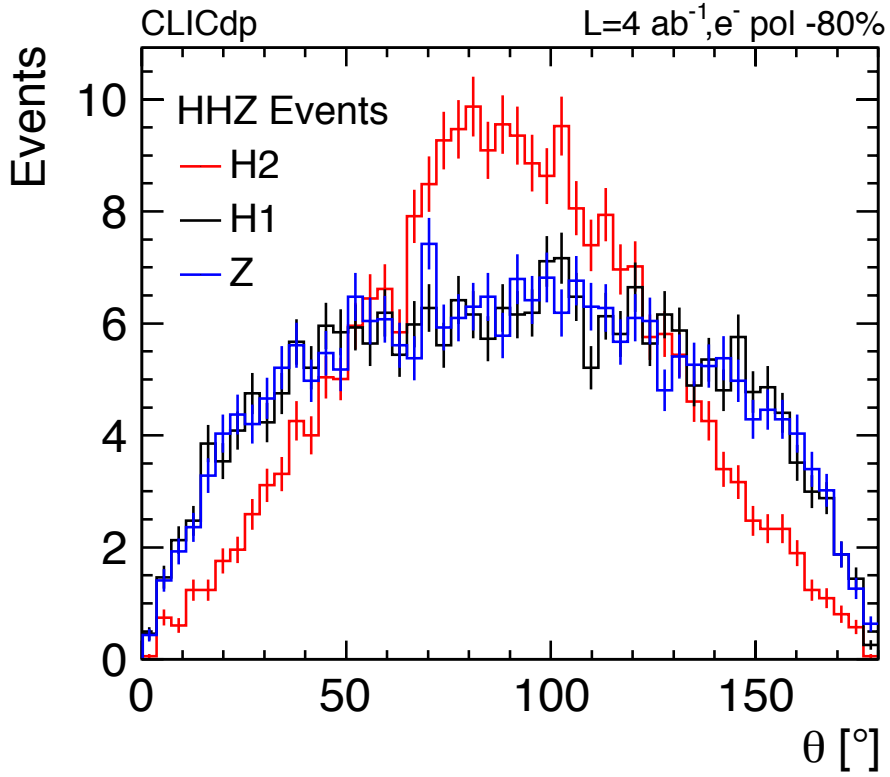
Adding Neutrino vector on genjets recovers parton sqrt(s) → all Events include decays of H→WW and H→ZZ

Neutrinos still play a role for total energy reconstruction in bbbbqq events, but to less extend

Parton level: angular distributions

Boson quantities: angles between both Higgs bosons, angle between Z and H
Polar angles



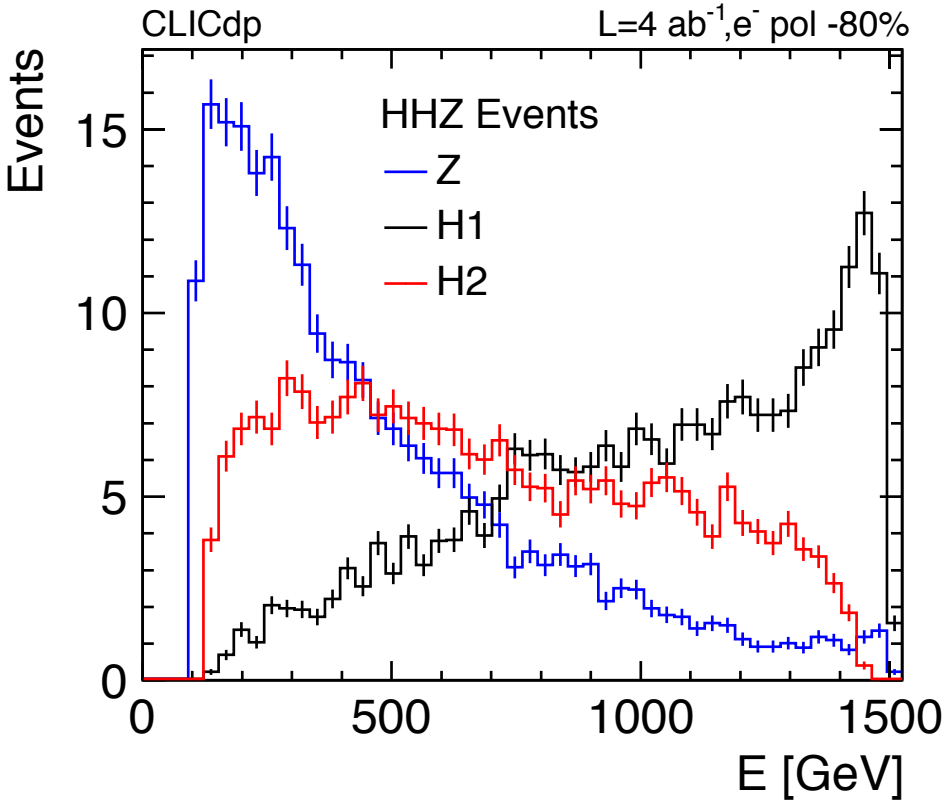


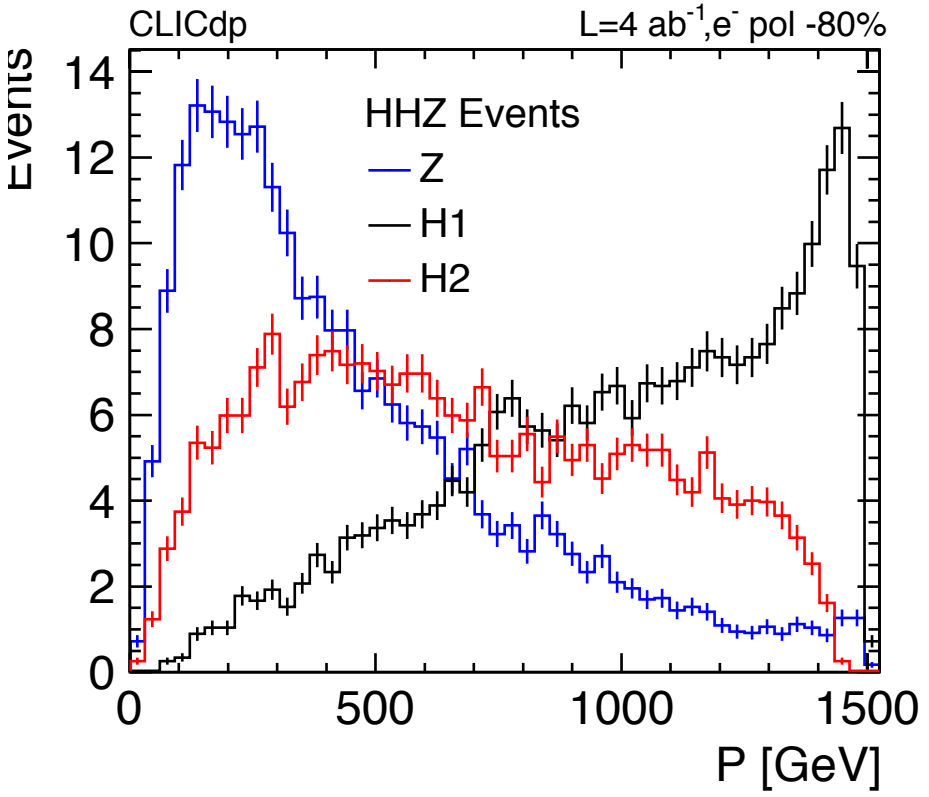
Typically bosons quite separated, more often one H close to Z rather than two collimated H bosons

Lower energetic H boson rather central, more energetic H and Z more forward

Parton level Energies

Boson quantities: energies of both Higgs bosons and Z boson

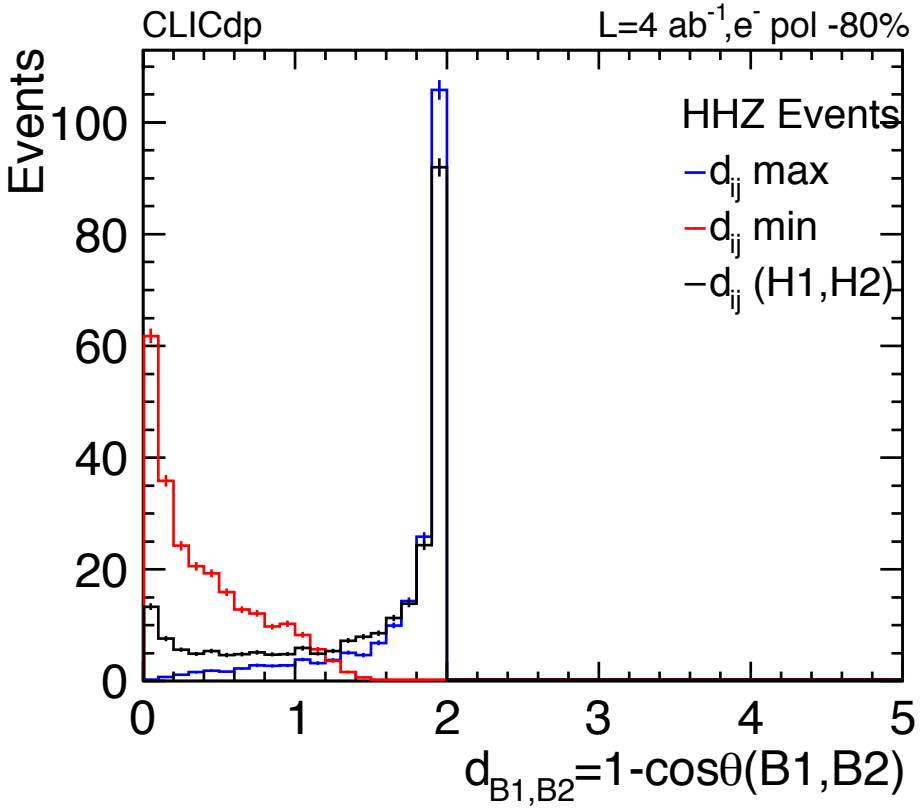




Z boson is typically less boosted, sizable boost of leading H
→maybe 3 jet signature more sufficienc

Parton level distances

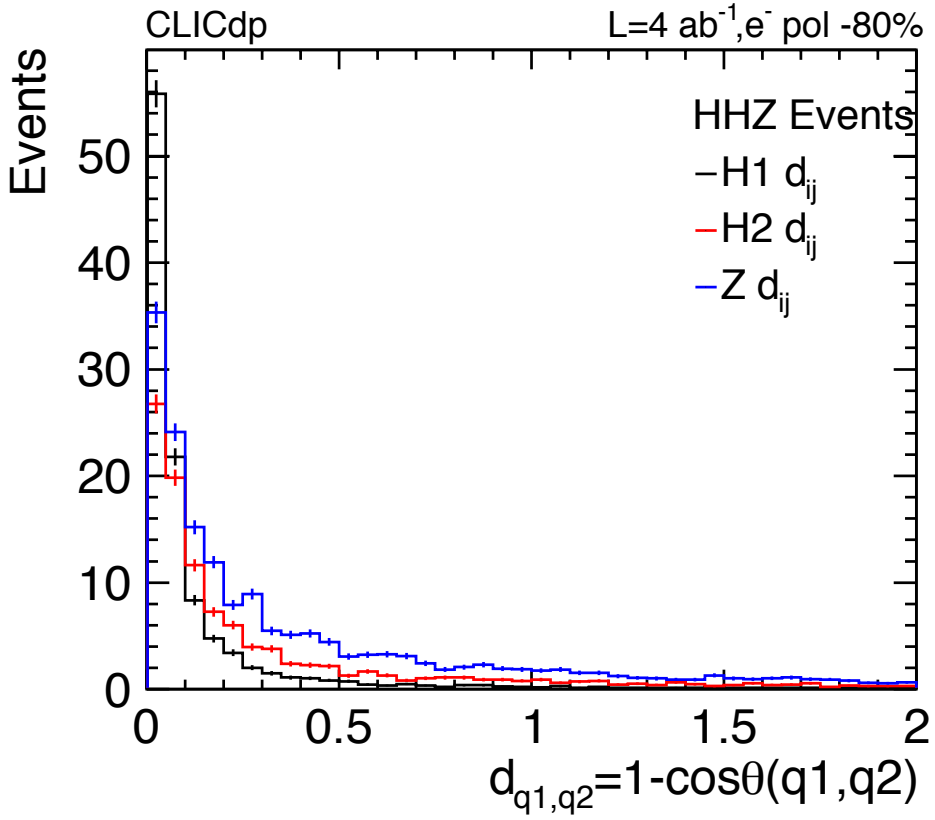
Compare distance measure, as it appears in VLC algorithm d_ij= 1-cos θ(i,j)



Typically largest separation between both H bosons, two bosons are often close
→ Might lead to issues when running exclusive 3 jet algorithm due to overlap

Distances between quarks from Bosons

Compare distance measure between quarks in boson decay, as it appears in VLC algorithm d_ij= 1-cos θ(i,j)

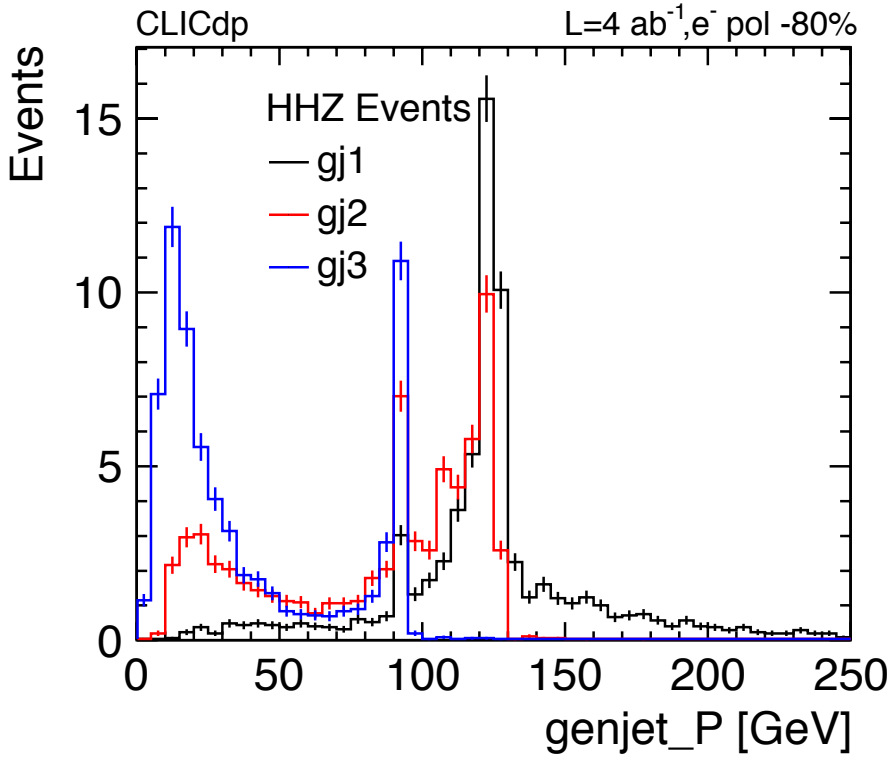


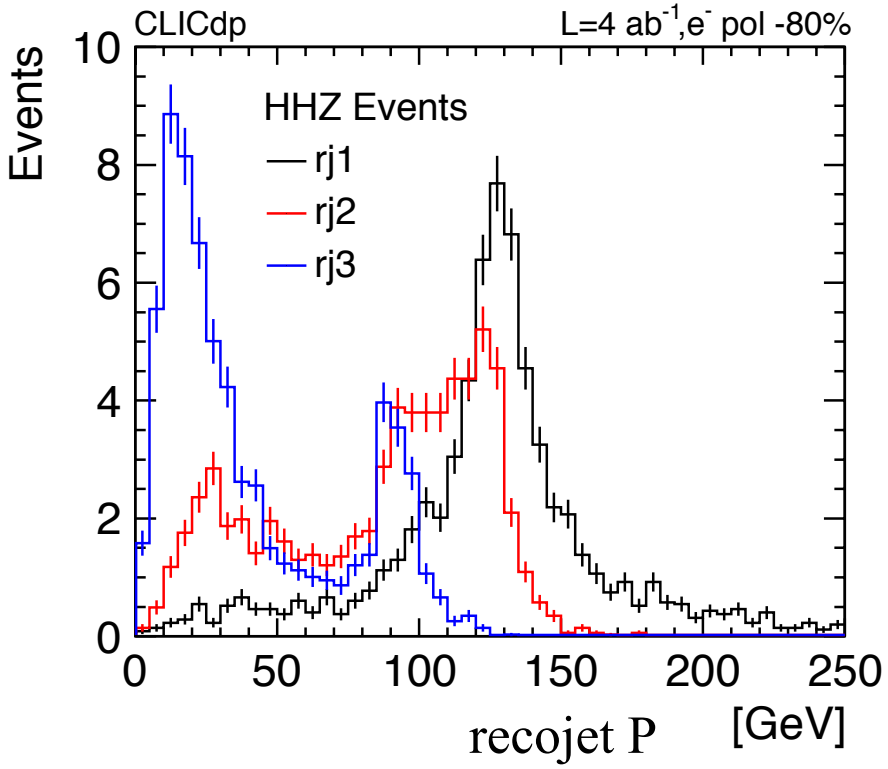
Jet from leading H most collimated, quarks typically within R =0.5 → more sizable spread for Z jet → cone for exclusive 3 jet clustering with R=1.0

Jets

Jet Masses

Study VLC Jets, γ=β=1.0, radius R=1.0, run in exclusive mode with N=3





Clearly the jets are more smeared on reconstructed level, often on reconstructed level (already on particle level jets), third jet does not contain Z properly

→ Second jet affected by the issue as well

Summary

First look at HHZ

- Bosons relatively central, particularly subleading energetic H

Bosons typically not that collimated → 2 jet clustering not sufficient, need at least 3 exclusive jets

Quarks from leading energetic H quite collimated, larger angle between quarks from Z →use larger radius about R=1.0

First look at jets

- Typically leading jet mass reconstructed around H mass
- Subleading jet catches often second H, but sometimes assigned to Z boson (already on generator level)
- Third jet either fails to catch the jet energy of the Z, or shifted even to low jet mass values