Contents

1 genvistau: hadronic decay part of a gen-tau (pdgID = 15 and status = 2)

1. definition from nanoaod
2. from cmssw, this collection is produced by "GenVisTauProducer" 2.1 from the first link above, a tauGenJet object is needed first, which is produced in this producer 2.2 a tauGenJet is made from the 4-vector sum of non-neutrino descendents from a status=2 tau (pdg=2)
3. when making genvistau in genvistauproducer, there is a genTauDecay-Mode function to determine the decay product of the tauGenJet (has e? has mu? has 1/2 pion+/- with n photon?)
4. A genvisatau is only saved if its decay product is n pion + n photon (saved in $\text{GenVisTau}_{\text{status}}$ flag)

question: do all signal events have 2 status-2 particle with pdgID = 15? and can they be traced back to Higgs eventually?

- an example code from nick to check parents/mothers using nanoEvents

In [88]:
```
import numpy as np
import awkward as ak

# https://coffeateam.github.io/coffea/notebooks/nanoevents.html
from coffea.nanoevents import NanoEventsFactory

fname = "/home/users/namin/2019/scouting/repo/generation/junk/production/highmass/output_nanoaod.root"
events = NanoEventsFactory.from_root(fname, entry_stop=1000).events()
```

executed in 1.77s, finished 14:55:54 2021-05-28

In [89]:
```
goodgen = ak.fill_none((np.abs(events.GenPart.pdgId) == 15) & (events.GenPart.parent.pdgId == 25), False)
taupair = events.GenPart[goodgen]
tau1 = taupair[:,0]
tau2 = taupair[:,1]

tau1.children.pdgId
```

executed in 67ms, finished 14:55:54 2021-05-28

Out[89]:
```
<Array [[16, 11, -12], ... [16, 11, -12]] type='500 * var * ?int32[parameters={"...'>
```

In [90]:
```
tau1_to_had = ak.any(tau1.children.hasFlags(["isDecayedLeptonHadron"]), axis=1)
print(tau1[tau1_to_had].children.pdgId)

tau2_to_had = ak.any(tau2.children.hasFlags(["isDecayedLeptonHadron"]), axis=1)
print(tau2[tau2_to_had].children.pdgId)
```

executed in 25ms, finished 14:55:54 2021-05-28

```
[[15, 22], [22, 22, 15, 22], [15], [15, ... 22], [15, 22], [15, 22], [22, 15, 22]]
[[-16, 111, 111, 211], [-15], [-15], [-15, ... [-15], [-15], [-16, 111, 111, 211]]
```

In [91]:
```
print(np.mean(tau1_to_had))
print(np.mean(tau2_to_had))
print(1 - 0.175*2) # hadronic BR from pdg
```

executed in 4ms, finished 14:55:54 2021-05-28

```
0.66
0.648
0.65
```