

Validation of whizard LHE output

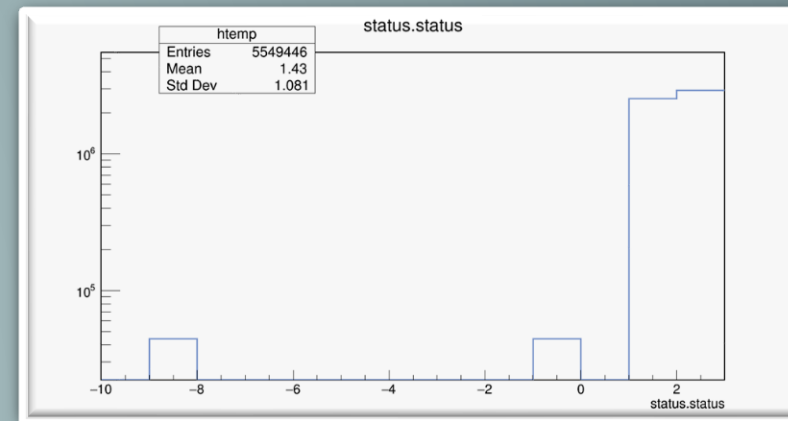
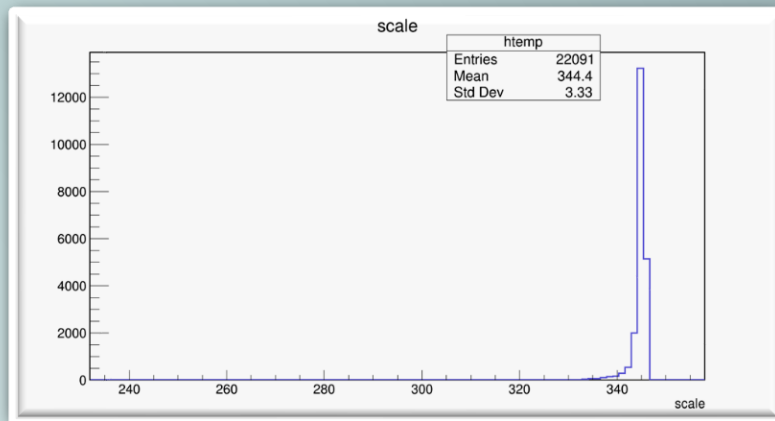
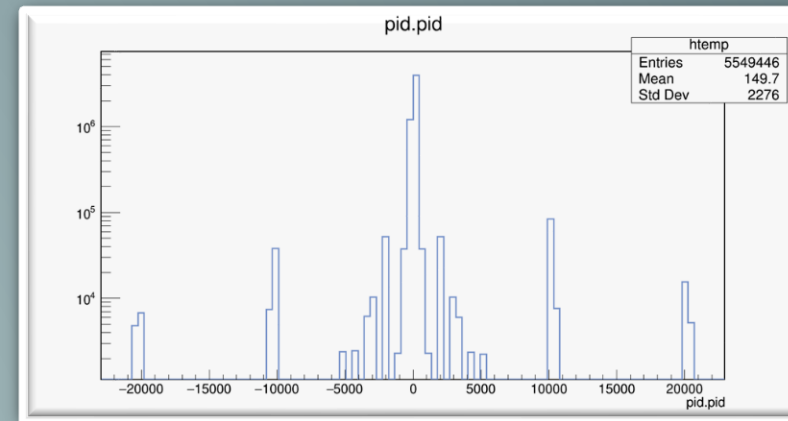
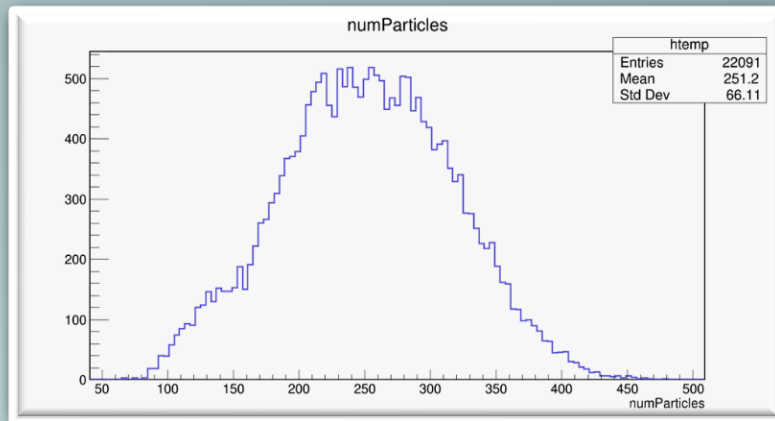
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Abideh Jafari

May 2024

* LHE events for $e^+e^- \rightarrow WbWb$ at $E_{\text{com}} = 345$ GeV are studied (thanks to Marcel for providing the input)

* The LHE file converted to a ROOT file using the [LHEReader](#).



Plots are taken directly from the ROOT file

* Still challenging for me to extract the information properly:

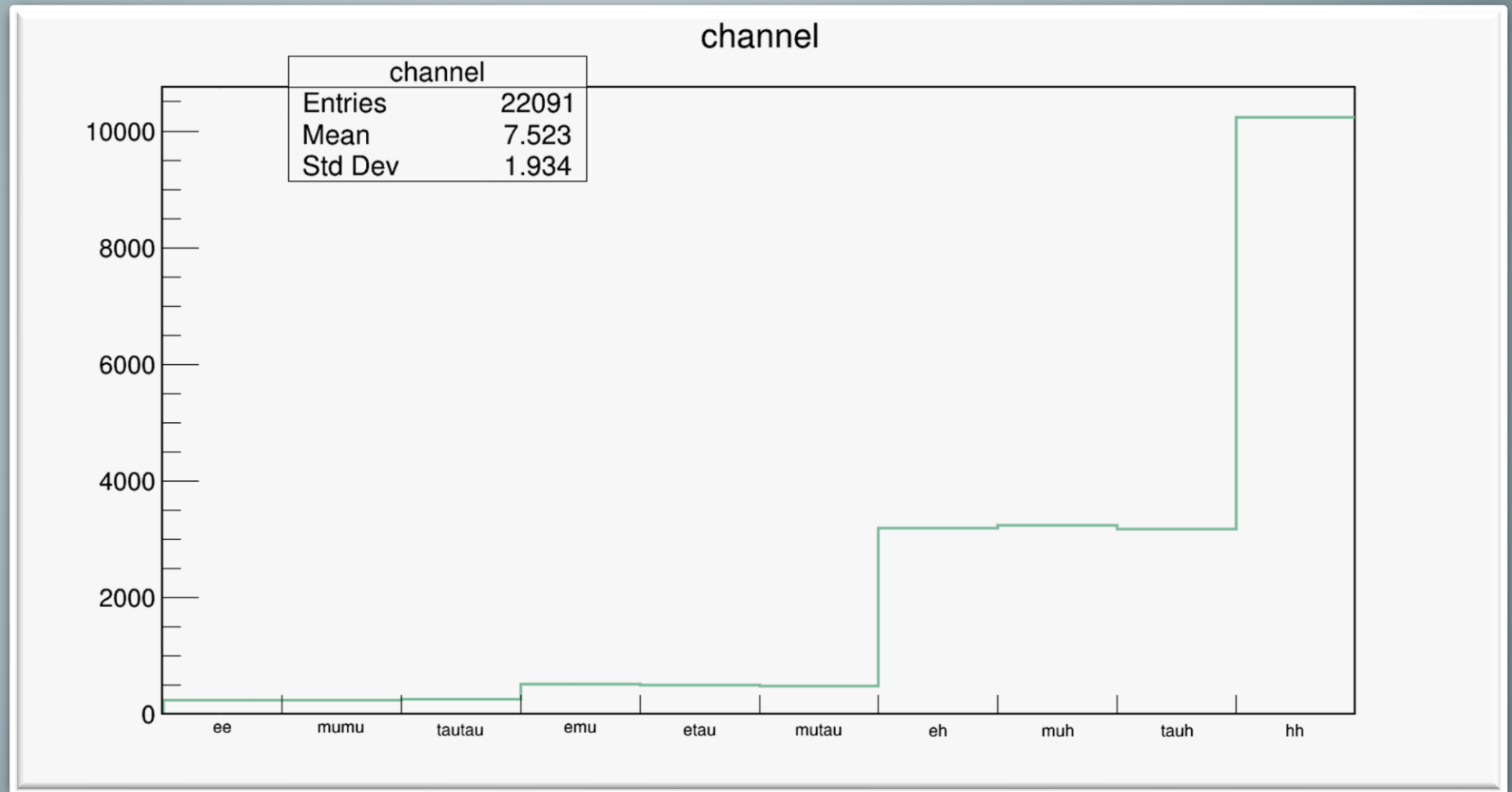
- Particle status was not as expected, e.g., the final state electron had status 2 (a resonance!)
- Mother id was confusing

* Decided to take the first 16 particles which seemed to correspond to ttbar decays before hadronization.

```
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6.7637270814E-02 8.9778483102E-05 1.000000000E+00 1
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<xsecinfo neve="10000" totxsec="6.7637270814E-02" />
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-11 -9 0 0 0 0.000000000E+00 0.000000000E+00 -1.725000000E+02 1.725000000E+02 0.000000000E+00 0.000000000E+00 9.000000000E+00
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-11 2 1 2 0 0.000000000E+00 0.000000000E+00 -1.7287649081E+02 1.7287649081E+02 0.000000000E+00 0.000000000E+00 9.000000000E+00
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22 1 3 0 0 0 0.000000000E+00 0.000000000E+00 8.6282178164E-38 8.6282178164E-38 0.000000000E+00 0.000000000E+00 9.000000000E+00
22 1 4 0 0 0 -5.7661487946E-05 1.4521167195E-04 -1.0155813401E-03 1.0275294328E-03 -1.4551915228E-11 0.000000000E+00 9.000000000E+00
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-24 2 5 6 0 0 1.5863995042E+00 5.3007428944E+01 -5.2710383401E+01 1.0978359135E+02 8.038500000E+01 0.000000000E+00 9.000000000E+00
5 2 5 6 501 0 3.8958807589E+01 1.8761531621E+01 -4.5421769954E+01 6.2713004579E+01 1.1680077280E-06 0.000000000E+00 9.000000000E+00
-5 2 5 6 501 0 6.7932139589E+00 -3.7148258742E+01 5.1018843220E+01 6.3474902496E+01 9.5367431641E-07 0.000000000E+00 9.000000000E+00
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2 2 9 0 1000 1001 -2.4757072133E+01 -2.0566488110E+01 6.8942571939E+01 7.6086005148E+01 3.300000000E-01 0.000000000E+00 9.000000000E+00
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-2 2 10 0 1002 1003 2.2041812358E+00 1.0361087594E+00 2.0206171082E+01 2.0355102213E+01 3.300000000E-01 0.000000000E+00 9.000000000E+00
94 2 9 12 0 0 5.7662100008E-05 -1.4521200000E-04 5.5381153500E-01 3.4630475004E+02 3.4630430721E+02 0.000000000E+00 9.000000000E+00
5 2 17 0 1003 1004 3.8758556469E+01 1.8665095651E+01 -4.5187256415E+01 6.3042350368E+01 9.0464524796E+00 0.000000000E+00 9.000000000E+00
-5 2 17 0 1004 1005 6.7582964107E+00 -3.6957314092E+01 5.0757440577E+01 6.3672700699E+01 8.1472329735E+00 0.000000000E+00 9.000000000E+00
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5 2 20 0 1009 1010 1.6028038801E+01 9.6074394596E+00 -2.0330302276E+01 2.7613802915E+01 1.1680077280E-06 0.000000000E+00 9.000000000E+00
21 2 20 0 1010 1011 2.2731843241E+01 9.2426917258E+00 -2.3227980137E+01 3.3789097483E+01 -4.7683715820E-07 0.000000000E+00 9.000000000E+00
-5 2 22 0 1011 1012 5.2901471105E+00 -2.8236003079E+01 4.1557150742E+01 5.0519840698E+01 9.5367431641E-07 0.000000000E+00 9.000000000E+00
21 2 22 0 1012 1013 2.1587944333E+00 -8.3004250115E+00 8.5997150852E+00 1.2145474397E+01 0.000000000E+00 0.000000000E+00 9.000000000E+00
-1 2 13 0 1013 1014 -2.2337968425E+01 -1.3876405269E+01 -2.1519980567E+01 3.3981729211E+01 3.300000000E-01 0.000000000E+00 9.000000000E+00
2 2 14 0 1014 1015 -2.4757072133E+01 -2.0566488110E+01 6.8942571939E+01 7.6086005148E+01 3.300000000E-01 0.000000000E+00 9.000000000E+00
94 2 28 29 0 0 -4.7095040558E+01 -3.4442893379E+01 4.7422591372E+01 1.1006773436E+02 8.038500000E+01 0.000000000E+00 9.000000000E+00
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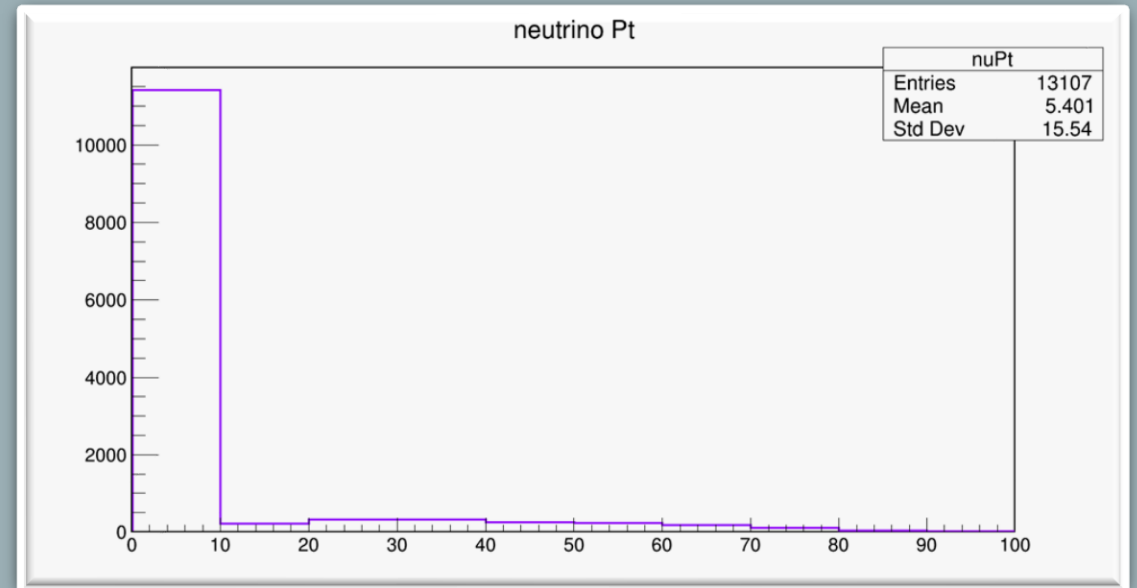
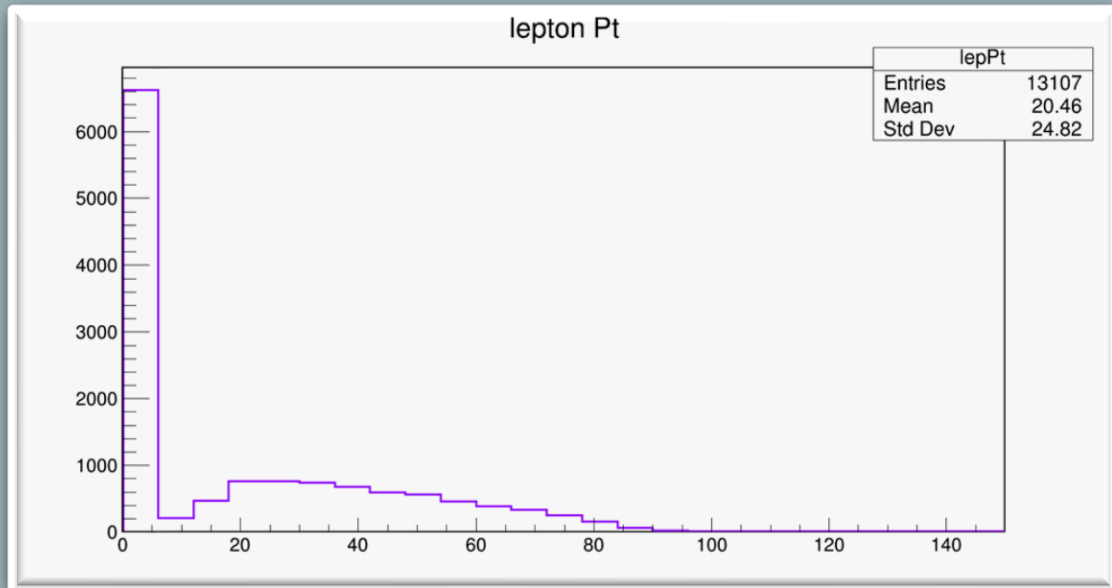
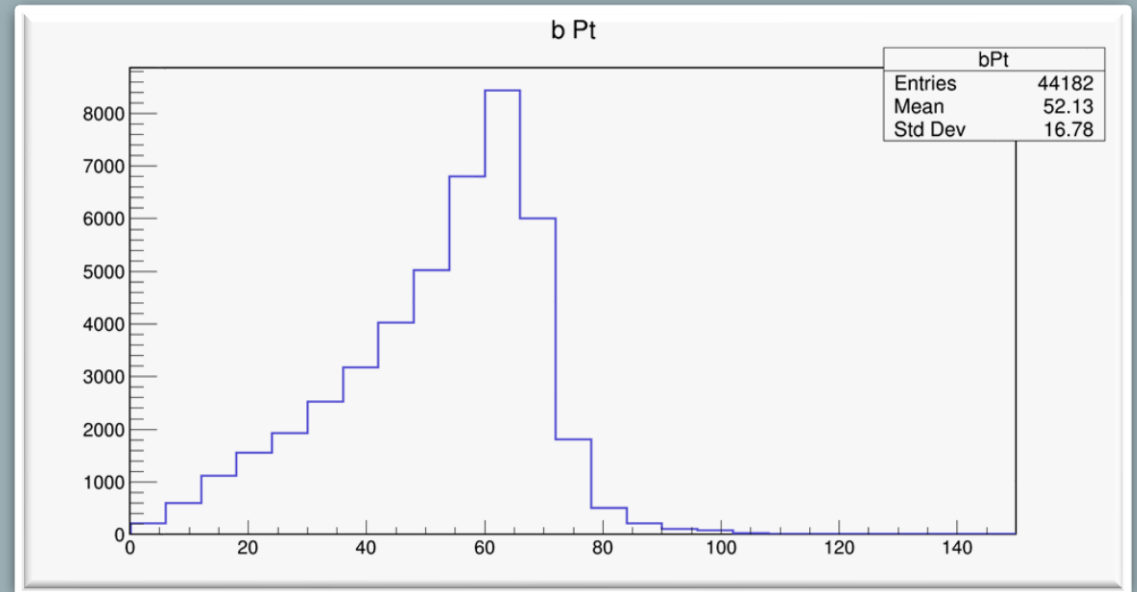
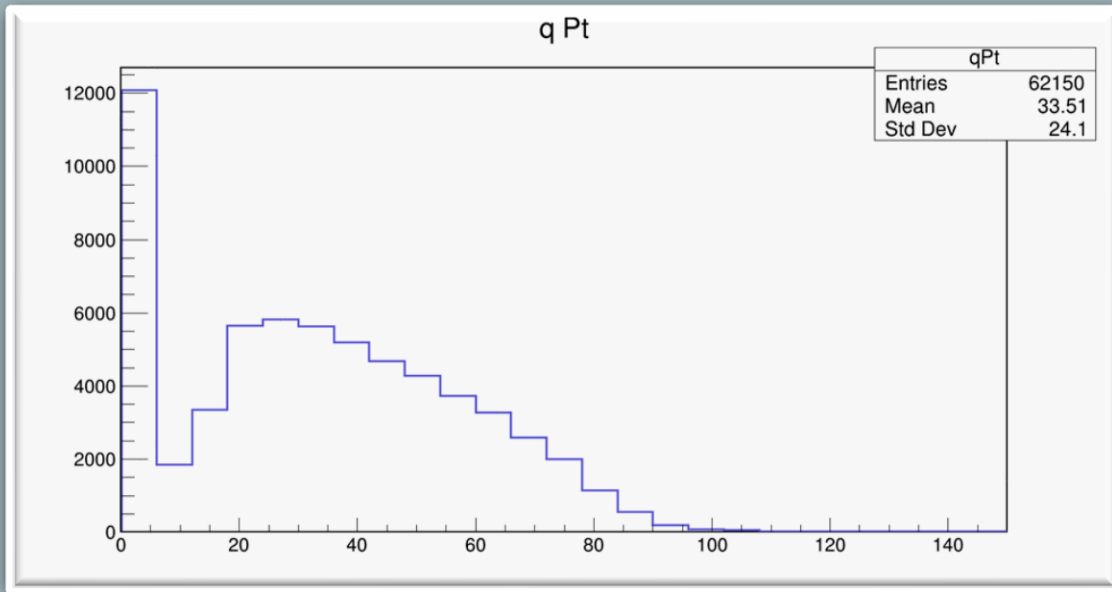
We looked at the different decay channels of the 'w' and attempted to identify them:

The distribution looks as expected.

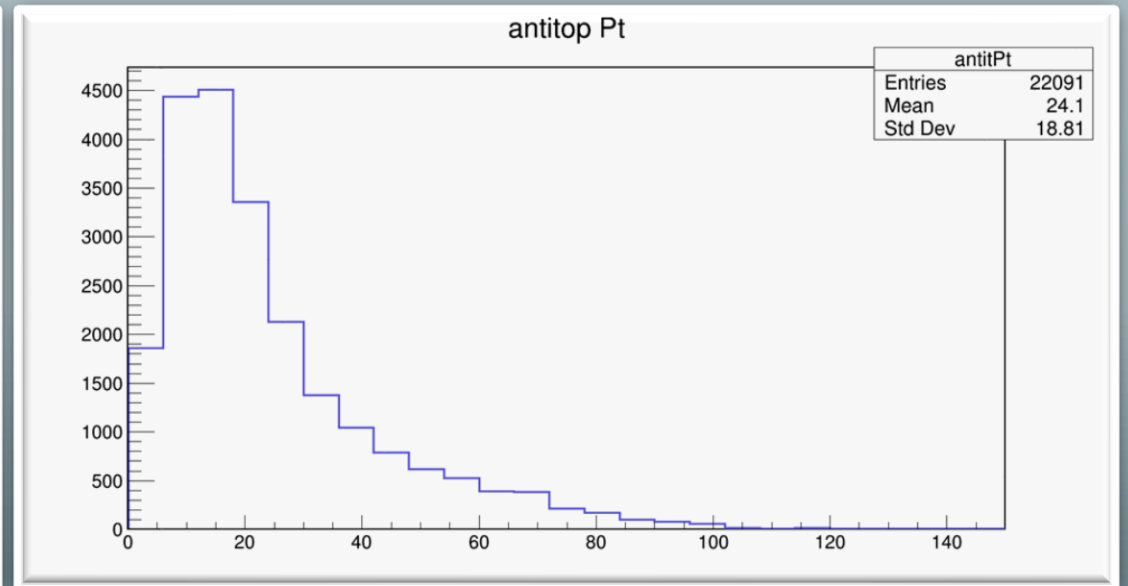
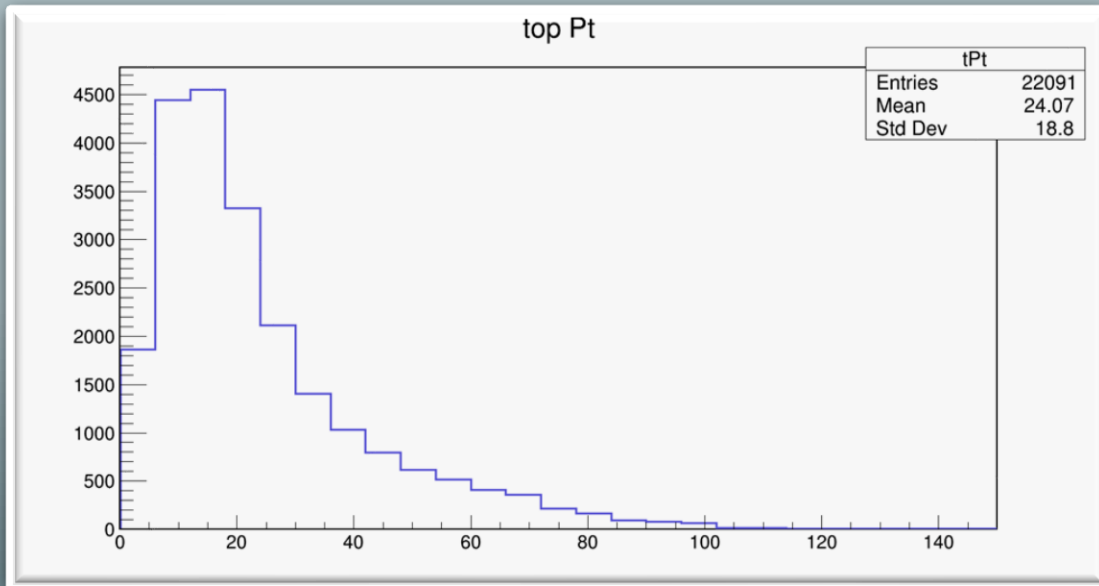
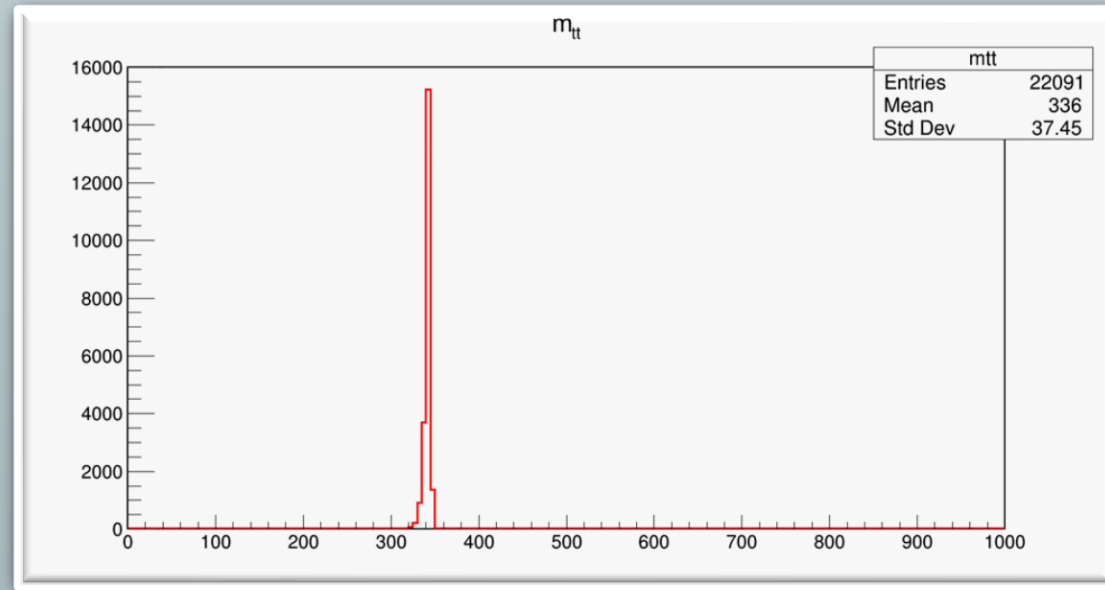


Distributions of final state particles from all channels together:

- Seems reasonable



Distributions related to reconstructed top (anti)quark :



Summary

* $e^+e^- \rightarrow WbWb$ LHE events produced by whizard at $E_{\text{com}} = 345$ GeV are analyzed

- Behave as expected
- The code is available on my personal github here:

https://github.com/ZBahariyoon/FCCAnalyses/tree/master/case-studies/analysis_example/scripts