



Using b-jets
with a muon
in the decay

Stijn Blyweert

Introduction

Matching of
muons with
b-jets

Adding the
muon to the
b-jet

Using the
neutrino from
the
GenParticles

Trying to
estimate the
neutrino
energy

Conclusion

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Stijn Blyweert

Master student – VUB

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Overview



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Matching of
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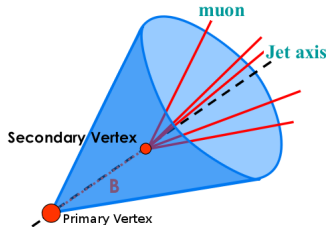
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Conclusion

- Using a sample containing 78174 fully-hadronic $t\bar{t}$ -events
- PatLayer1 with L2L3L7 JetMET corrections
- Using only b-jets from $t\bar{t}$ -decay
 - $t\bar{t} \rightarrow W^+ b W^- \bar{b}$
- Initial cuts on the b-jets:
 - $p_T^{b\text{-jet}} > 20 \text{ GeV}/c$
 - $|\eta_{b\text{-jet}}| < 2.4$
 - $\Delta R(b\text{-jet}, b\text{-quark}) < 0.3$
- Looking for muons in the b-jet originating from b-decay
- When there is a muon from b-decay, there was also an (undetected) neutrino





Matching of muons with b-jets



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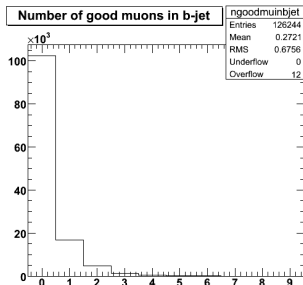
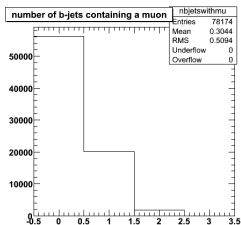
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- Initial cuts on muons
 - Only GlobalMuons or TrackerMuons
 - Muon track $\chi^2/ndf < 5$
 - Number of valid tracker hits > 10
- Muon matched with b-jet if $\Delta R(b - jet, muon) < 0.5$
- About 13 % of the b-jets is matched with one muon



- Only used b-jets with 1 muon, b-jets matched with more muons will be done later



b-jets with and without muons



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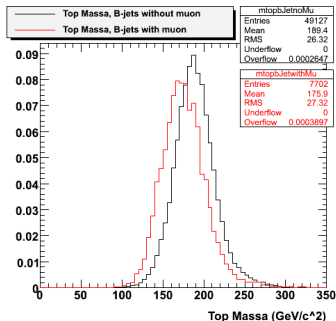
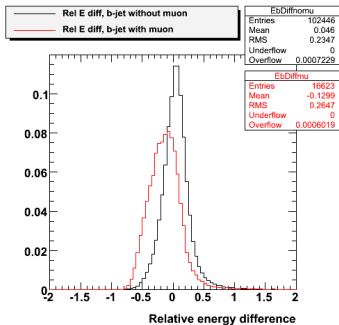
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$$\frac{E_{b\text{-jet}} - E_{b\text{-quark}}}{E_{b\text{-quark}}} \text{ and } M_{top}$$





Adding the muon to the b-jet



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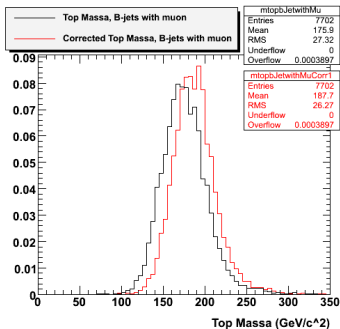
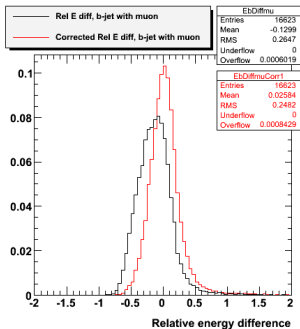
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- Adding the energy and momenta of the matched muon to the b-jet





Adding the muon to the b-jet



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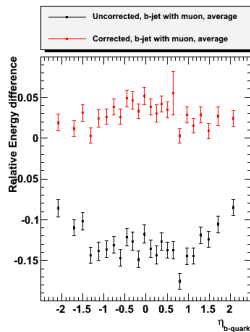
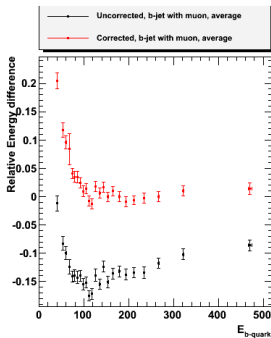
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- Binning: same number of b-jets in each bin
- In each bin: average and error on average

Using the neutrino from the GenParticles



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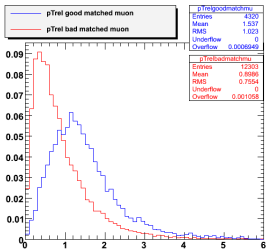
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Using the neutrino from the GenParticles

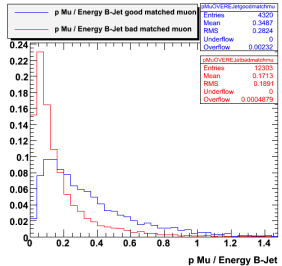
Trying to estimate the neutrino energy

Conclusion

- For the matched muons, use the GenParticles to check it's from $B \rightarrow \mu\nu_\mu X$. Result: only 1/3 is from $B \rightarrow \mu\nu_\mu X$!
- Other sources of muons matched with a b-jet
 - 43.7 % has no genParticle, no decay info
 - 51.9 % from c-hadron decay
 - 4.4 % from τ -decay
- Distinguish between muons from b-decay and other muons



$$p_{Trel} = \frac{\|\vec{p}_{mu} \times (\vec{p}_{mu} + \vec{p}_{jet})\|}{\|\vec{p}_{mu} + \vec{p}_{jet}\|}$$





Using the neutrino from the GenParticles



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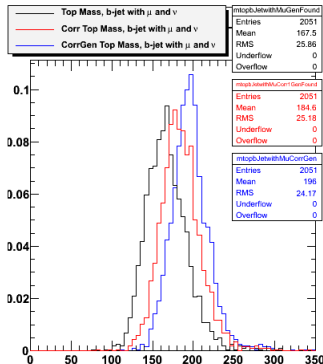
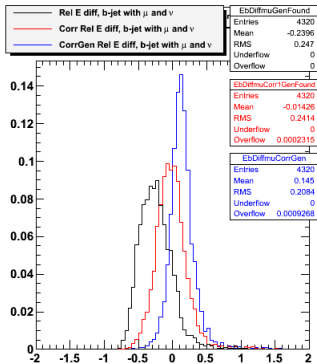
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Conclusion

- $\text{CorrGen} = \text{B-Jet} + \text{muon} + \text{generated neutrino}$



- In principle, the correction can give good results



Trying to estimate the neutrino energy



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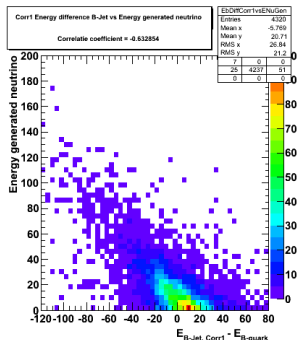
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- Find variables correlated with $E_{\nu_{\mu},generated}$ and with $E_{b-jet,corrected} - E_{b-quark}$
- Only for b-jets with $B \rightarrow \mu\nu_{\mu}X$ in the GenParticles
- Make graph with $E_{\nu_{\mu},generated}$ in function of that variable, fit this graph and use the result of the fit to estimate $E_{\nu_{\mu}}$
- Tried this for several variables





Trying to estimate the neutrino energy



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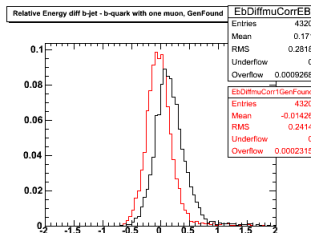
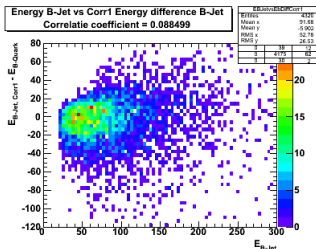
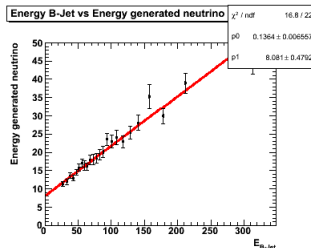
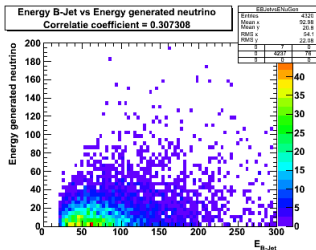
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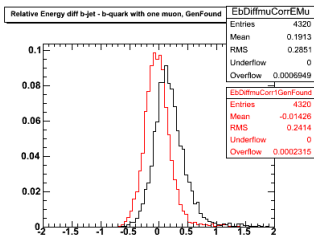
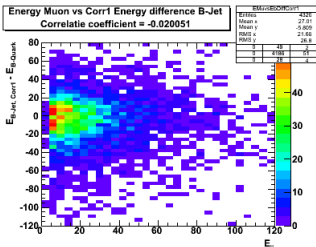
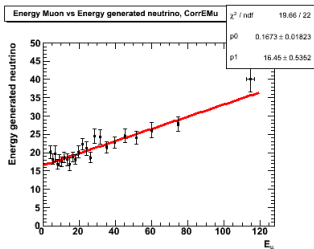
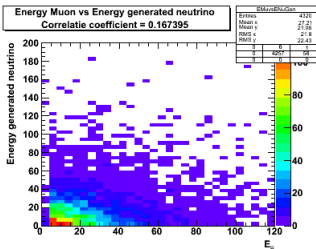
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Compact Muon Solenoid

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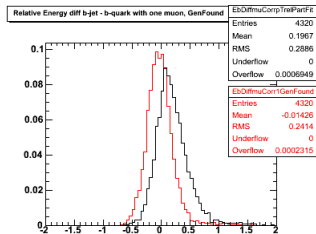
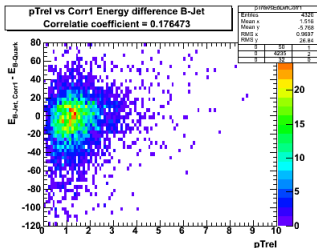
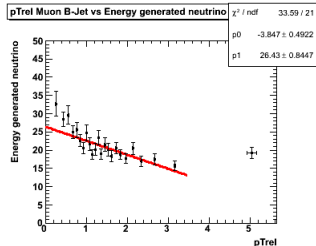
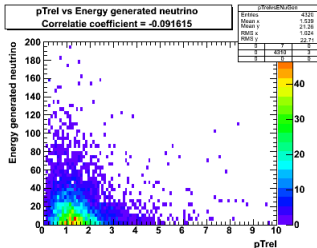
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- Tried a number of variables, but couldn't find a correction which gives a better result than (b-jet + muon)
- To do:
 - Small analysis on ttbar selection: ask for 1 or 2 jets containing a muon to (hopefully) reduce the background
 - Writing my thesis...