Studies of ttH events in the dileptonic final states

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Exploring Meeting, 01 out 2015, 11h00

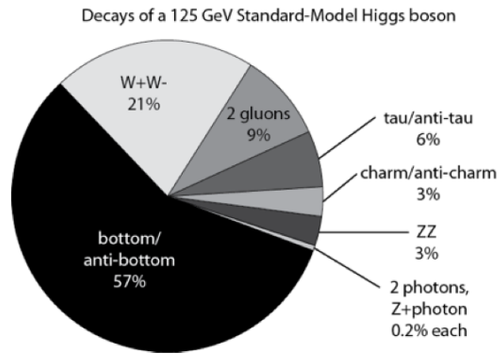
FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

Events Topology

ttH Topology & Event Selection

For low M_H, H → bb is the dominant decay

Consider Top and W decays:

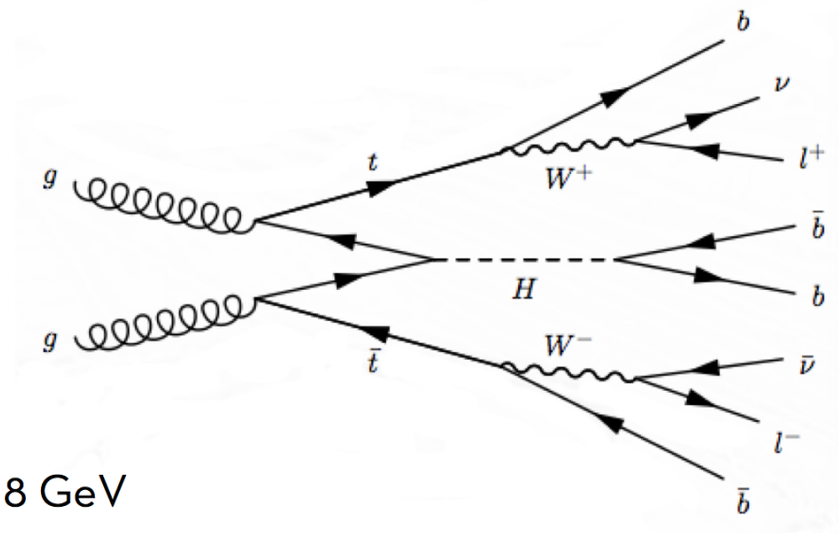


l+jets

- Exactly 1 lepton with pT > 25 GeV & |η| < 2.5;
- At least 4 jets pT>25GeV & |η|<2.5, with at least 2 b-tagged ones;
- Veto of dilepton events;

Dilepton

- Exactly 2 leptons of opposite charge:
  - leading e±: pT>25GeV & |η|<2.5
  - subleading e±: pT>15GeV
  - μ±: pT>25GeV & |η|<2.5
- At least 2 jets, with at least 2 b-tagged ones;
- For eμ : H_T > 130 GeV
- For ee & μμ: M_{ll} > 15 GeV & $|M_{ll} - 91\ GeV| <= 8$ GeV

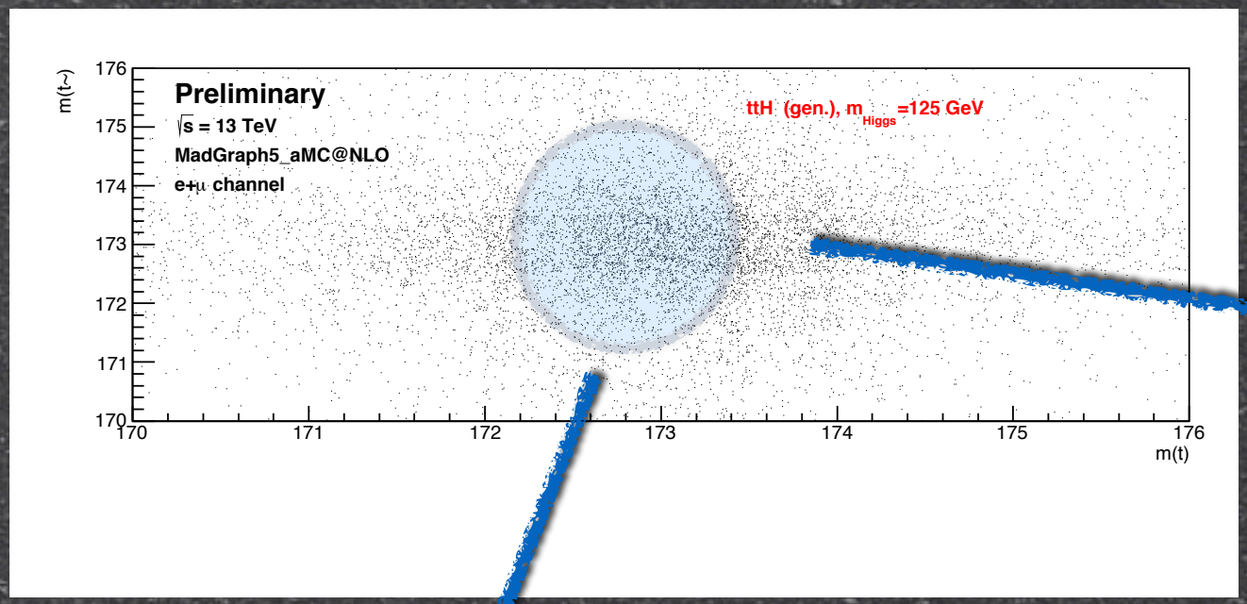


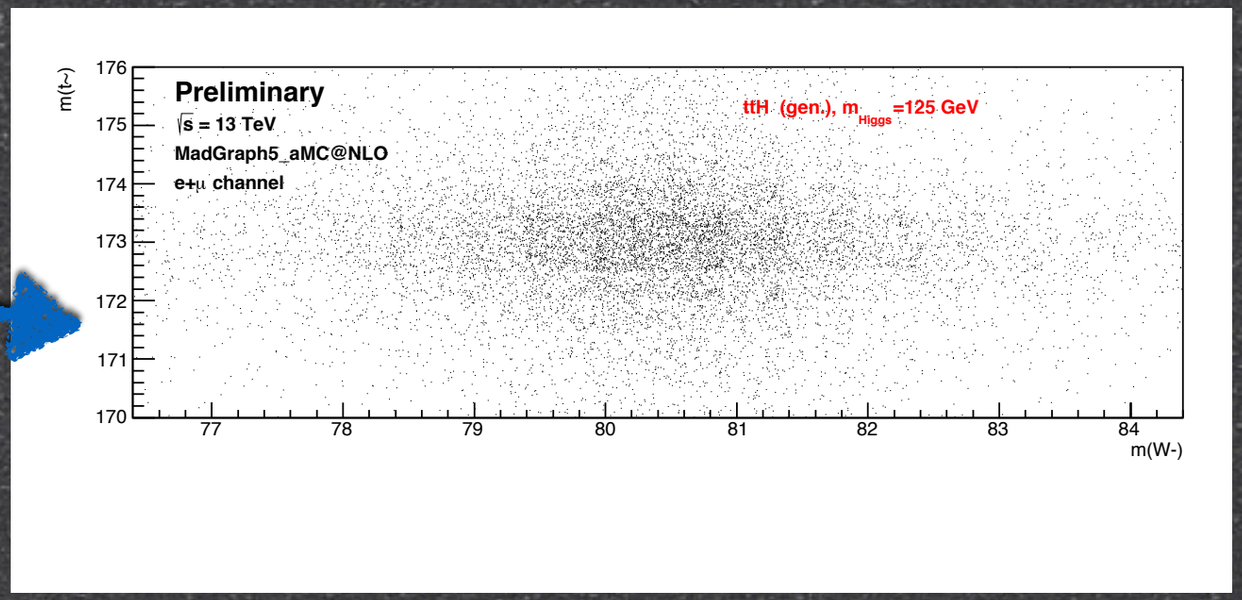
B-tagged Jets with 70% efficiency 1% of light-jets mistag rate

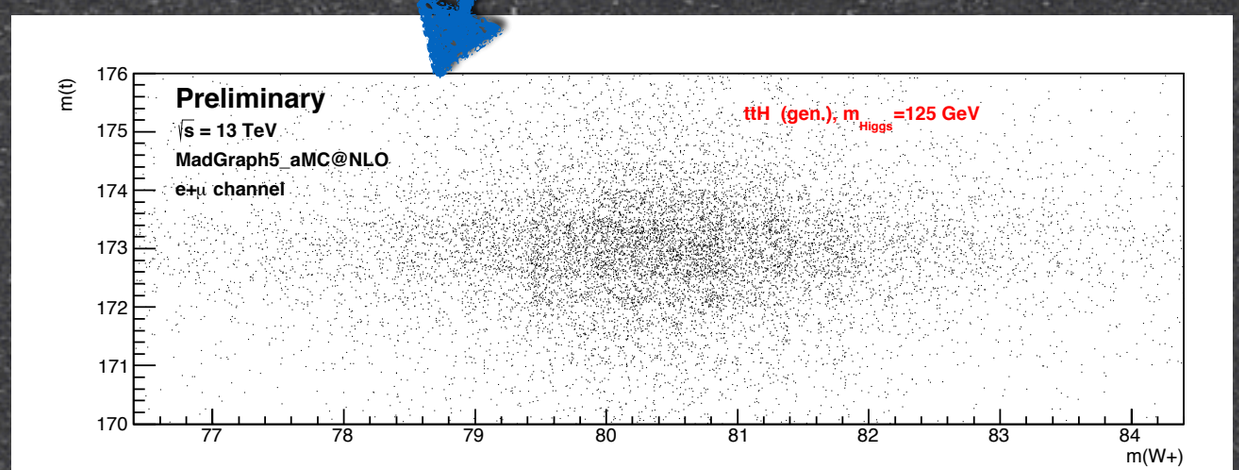
Constraints:

$$p_x^{\nu_1} + p_x^{\nu_2} = E_x^{\text{miss}}; \qquad p_y^{\nu_1} + p_y^{\nu_2} = E_y^{\text{miss}}; \qquad (p_{\ell_1} + p_{\nu_1})^2 = m_W^2;$$
$$(p_{\ell_2} + p_{\nu_2})^2 = m_W^2; \qquad (p_{W_1} + p_{j_1})^2 = m_t^2; \qquad (p_{W_2} + p_{j_2})^2 = m_t^2. \qquad (4.1)$$

Mass Distributions Sampling:

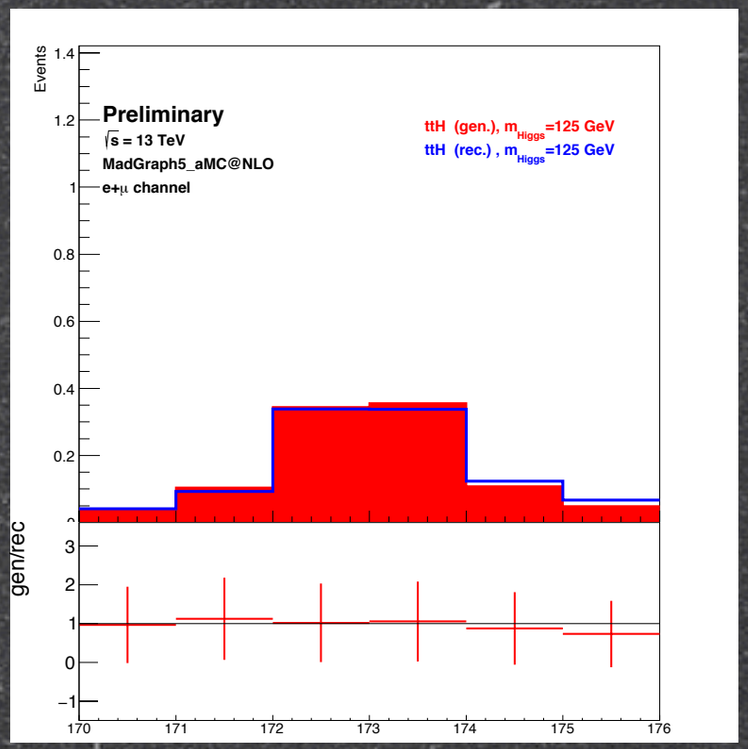


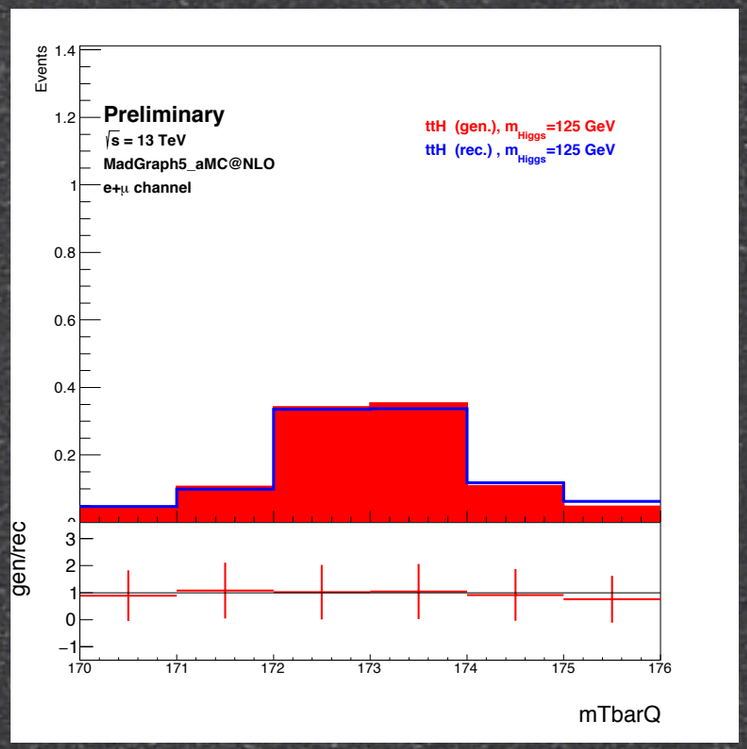


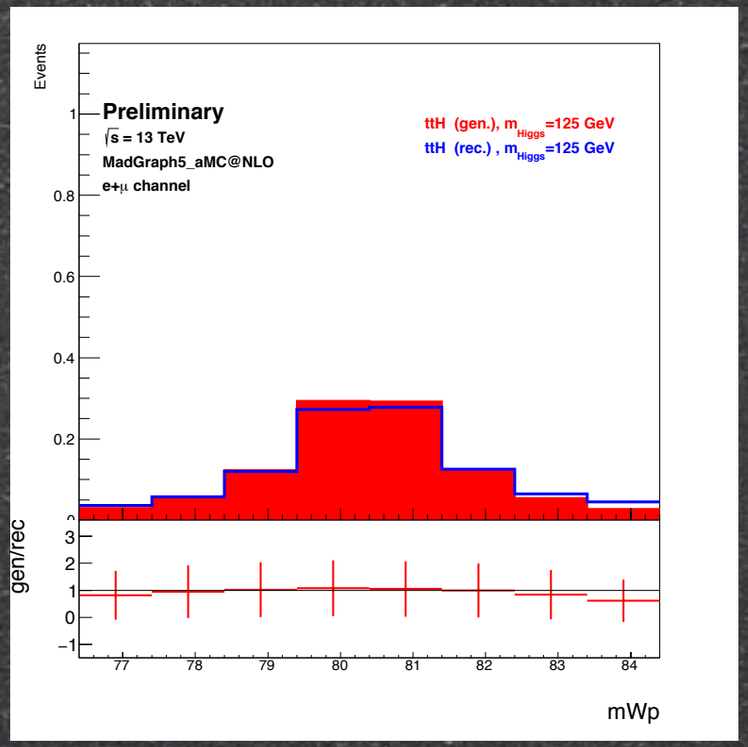


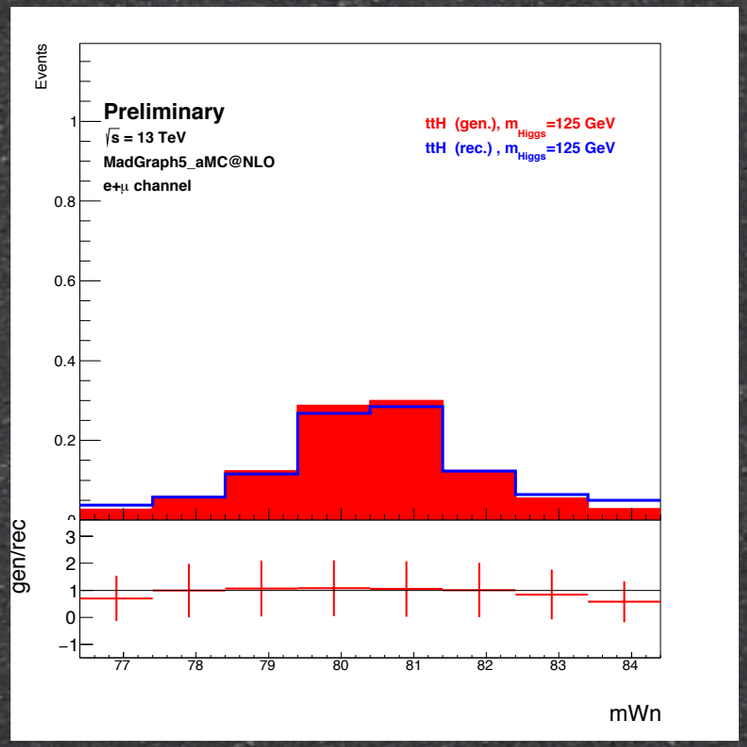
1. Sampling is done starting from m(t,t~)
2. For each value of m(t) and m(t~), values fr m(W+) and m(w-) are obtained (looking into the other distributions

Reconstructed Distributions:
Mass Distributions









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Angular distributions in $t\bar{t}H(H \to b\bar{b})$ reconstructed events at the LHC

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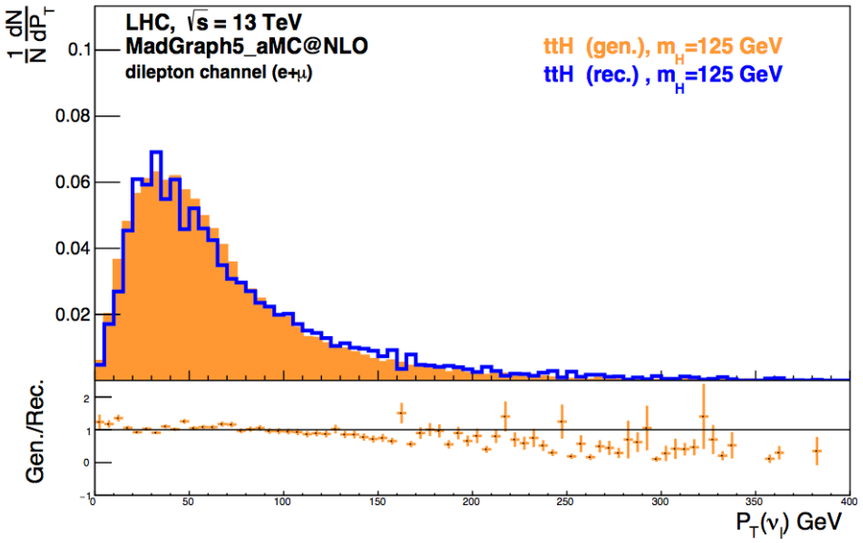
The $t\bar{t}H$ production in proton-proton collisions is addressed in this paper for a center of mass energy of 13 TeV at the LHC. Dileptonic final states of $t\bar{t}H$ events with two opposite charged leptons and four jets from the decays $t \to bW^+ \to b\ell^+\nu_\ell$, $\bar{t} \to \bar{b}W^- \to \bar{b}\ell^-\bar{\nu}_\ell$ and $h \to b\bar{b}$, are used. Signal events, generated with MadGraph5_aMC@NLO, are fully reconstructed by applying a kinematic fit. New angular distributions of the decay products as well as angular asymmetries are explored in order to improve discrimination of $t\bar{t}H$ signal events over the dominant background contribution $t\bar{t}b\bar{b}$. Even after the full kinematical fit reconstruction of the events, the proposed angular distributions and asymmetries are quite different for the $t\bar{t}H$ signal and dominant background ($t\bar{t}b\bar{b}$).

I. INTRODUCTION

$pp \to t\bar{t} +$ jets. For this particular production process several decay channels have been studied [6, 7]. The very

Reconstructed vs Parton Level Info: (Madgraph5_aMC@NLO+Pythia)



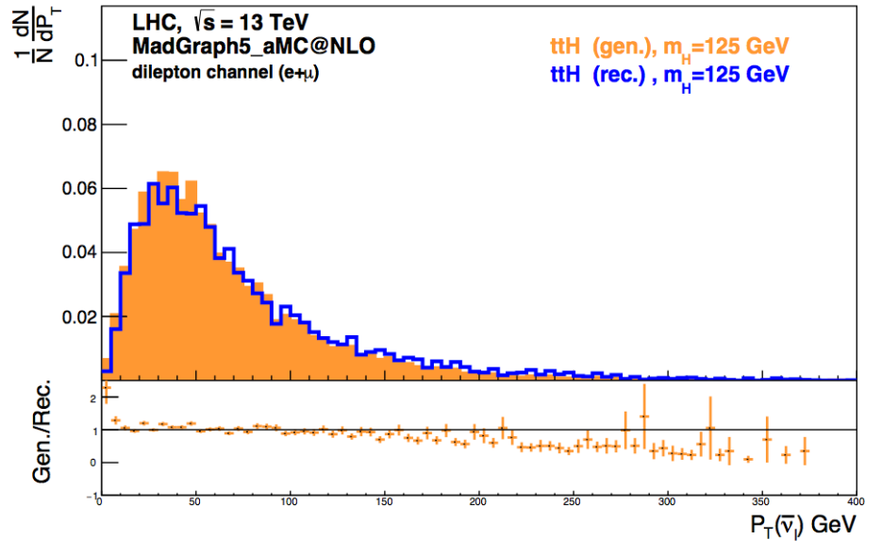
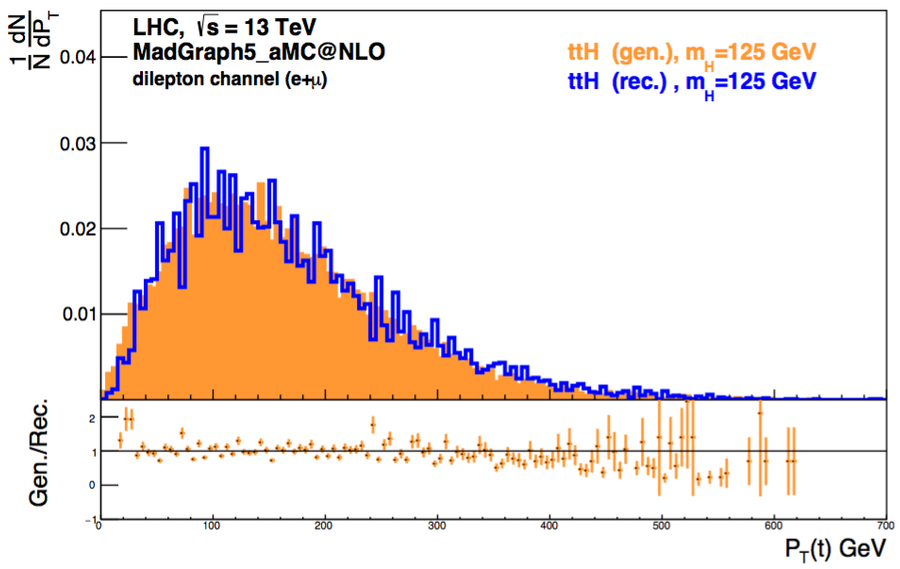


FIG. 1. Neutrino (left) and antineutrino (right) p_T distributions. The generated distribution (shadowed region) is compared with the kinematical fit reconstruction with truth match (full line) distribution.



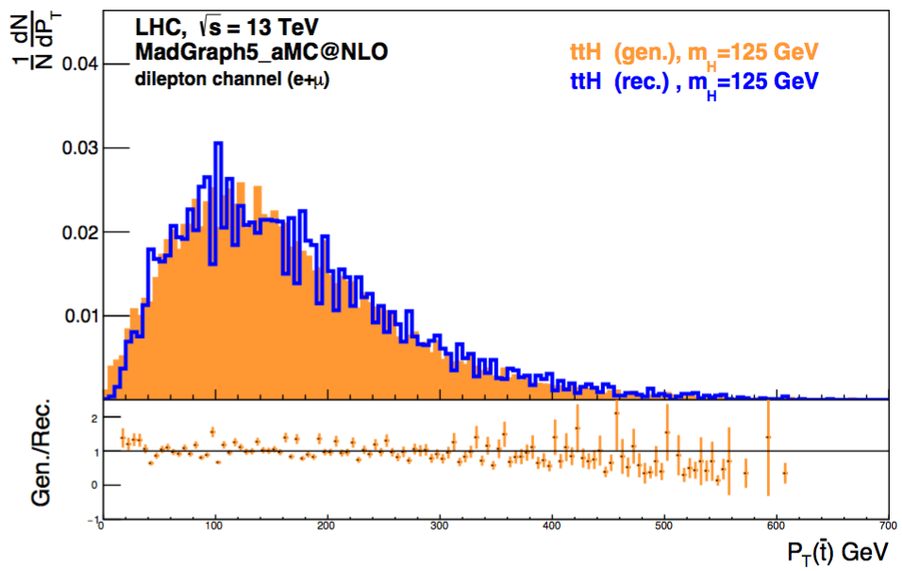
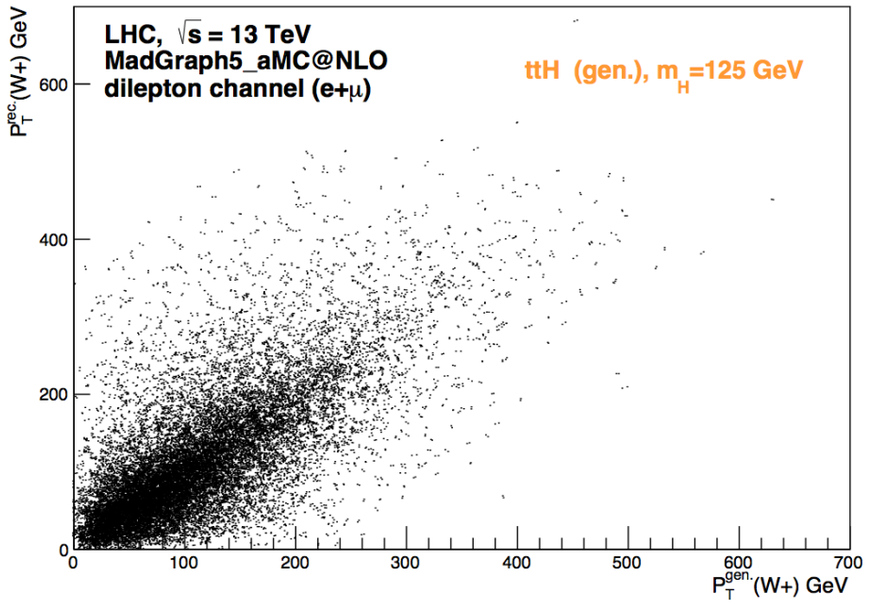


FIG. 2. Same as in figure 1, but for the top (left) and anti-top quarks (right) p_T distributions.

Reconstructed vs Parton Level Info:
(Madgraph5_aMC@NLO+Pythia)



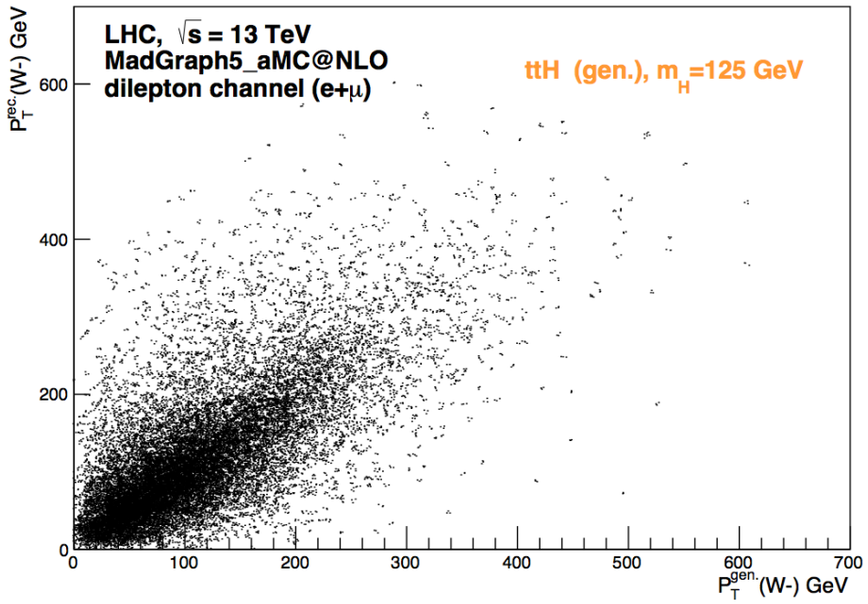
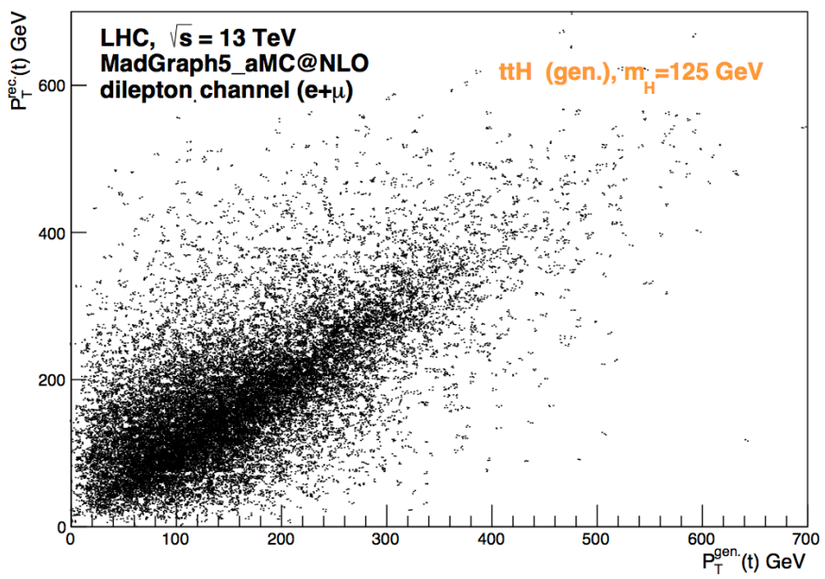


FIG. 5. Same as in figure. 4, but for the W^+ (left) and W^- (right) p_T distributions.



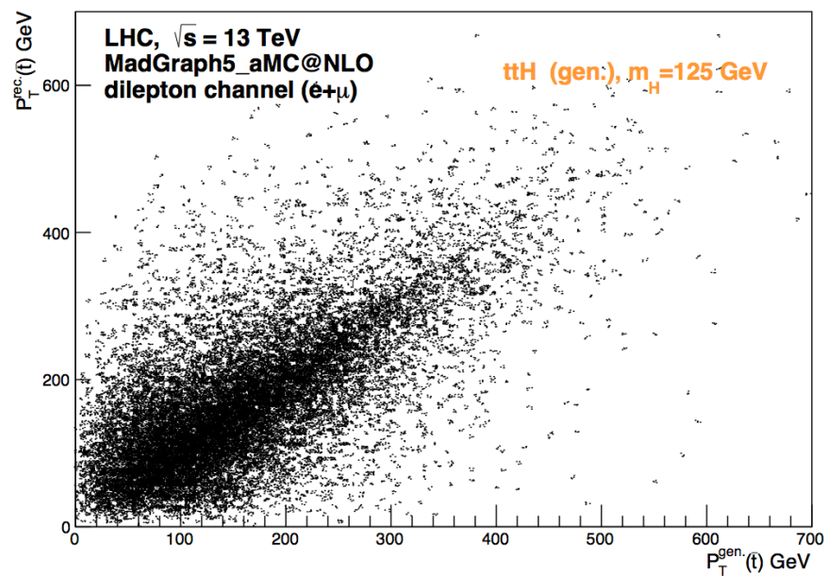
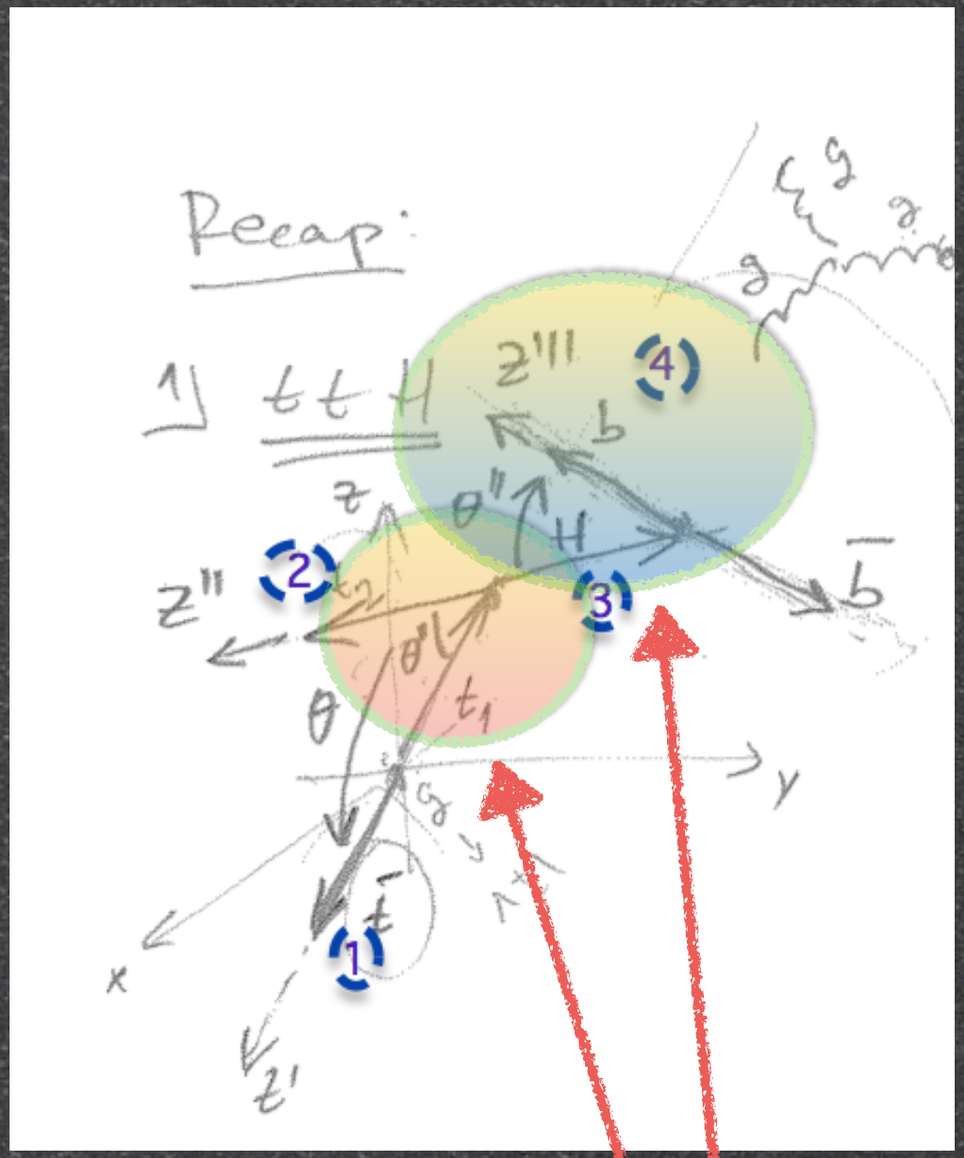


FIG. 4. Reconstructed top (left) and anti-top (right) quark p_T using the kinematical fit (without truth match) as a function of the p_T at parton level.

Angular Distributions

Signal

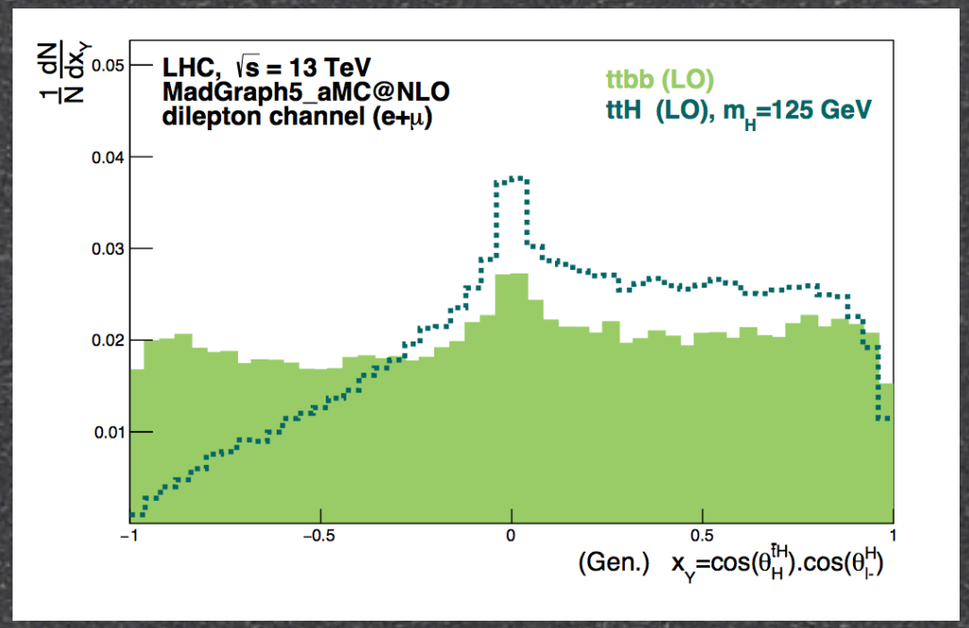


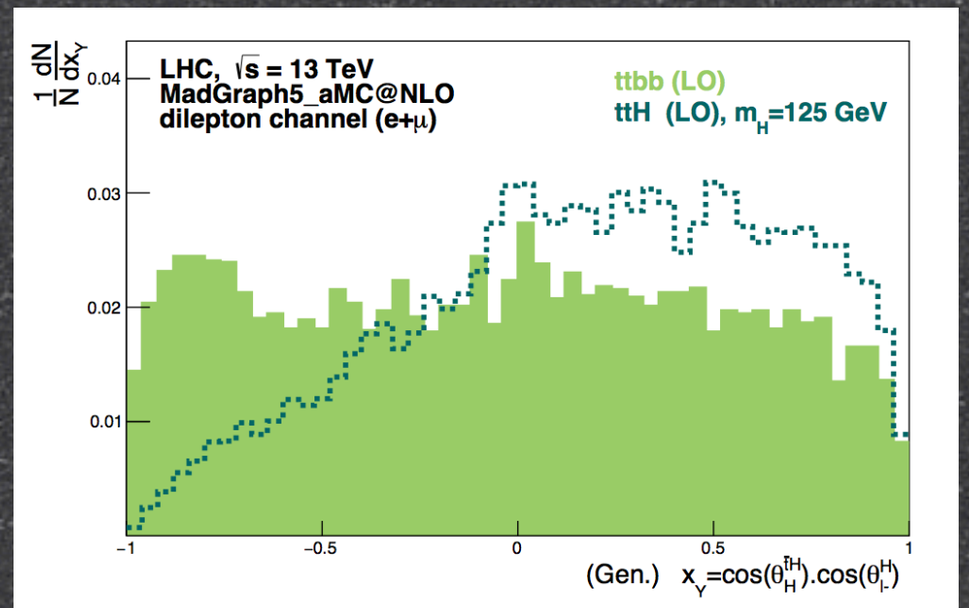
Angles Used

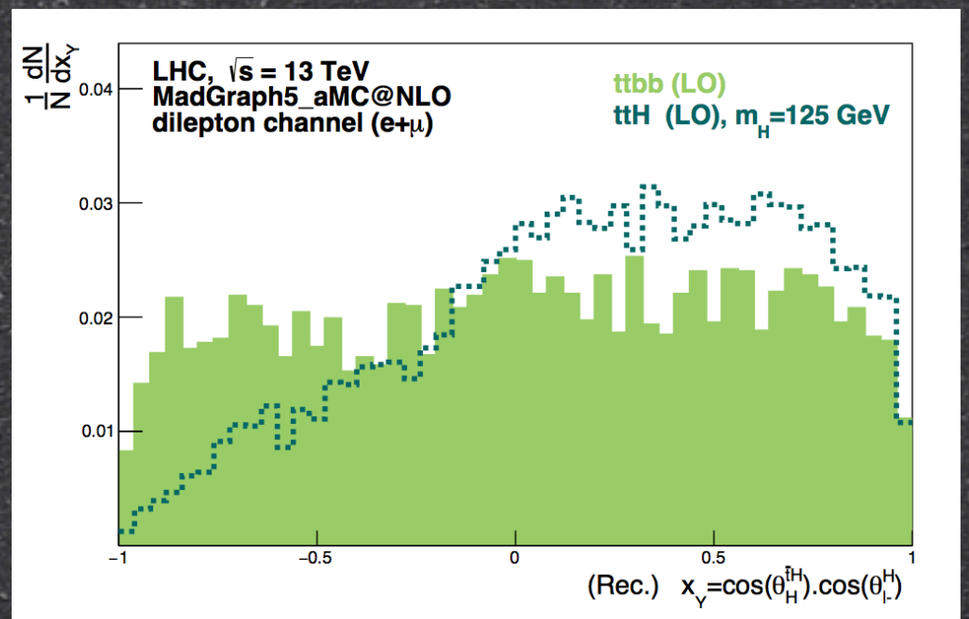
Parton Level

Rec. Level

Exp. Level







Conclusions:

1. Angular distributions seem feasible
2. Reconstruction seems to help
3. Efficiency loss doesn't seem to affect too much (still 90%)
4. need to compare CP even with CP odd (natural next step)