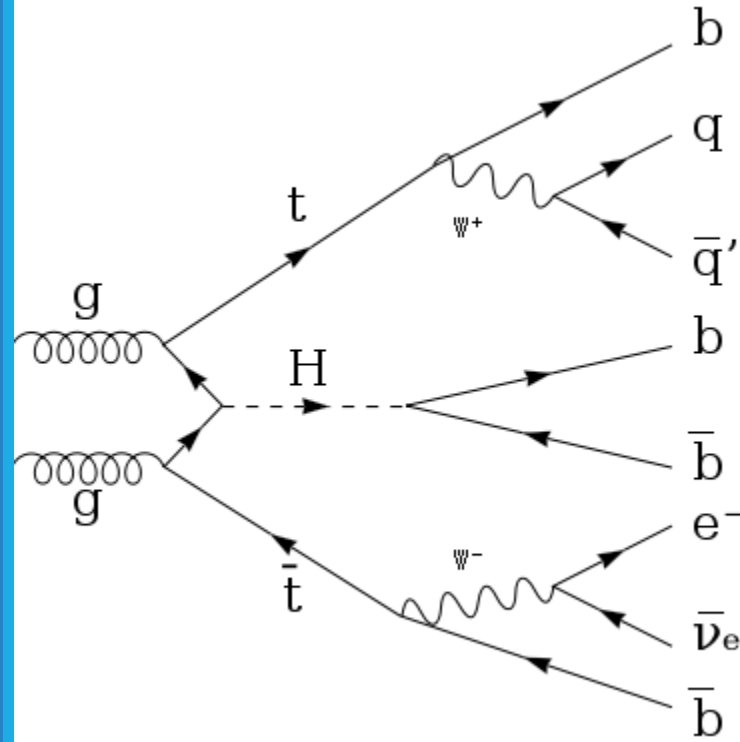


Kinematic distributions study for the $t\bar{t}H$ and $t\bar{t}$

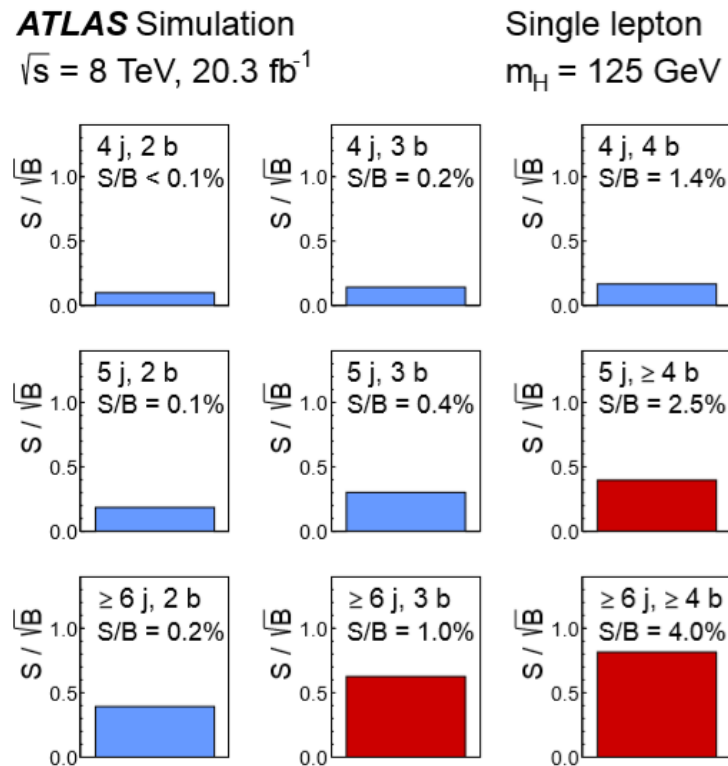
AnalysisTop 2.3.20 and the new TTHNtupleAnalysis package.



Signal ($t\bar{t}H$) with semileptonic inclusive Higgs decay and Background ($t\bar{t}$) samples

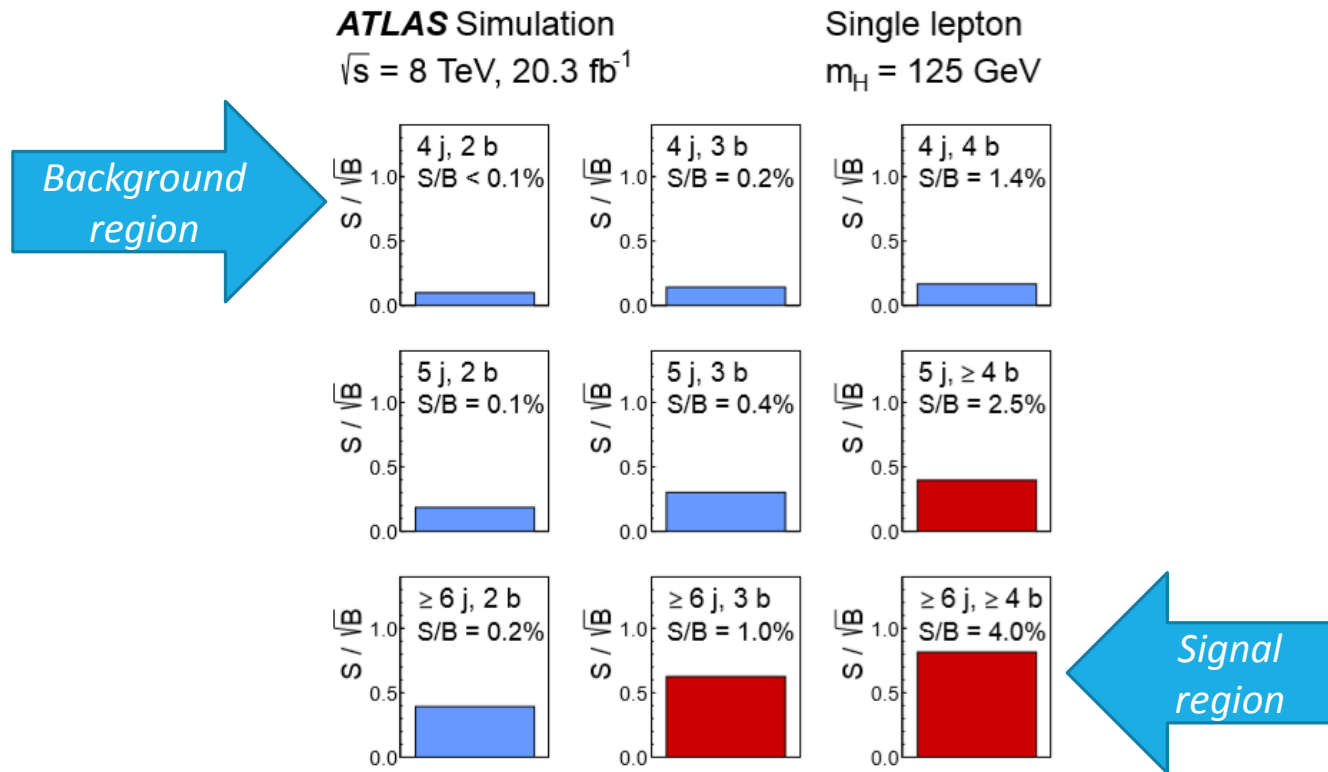
$t\bar{t}H$ production	$t\bar{t}$ production
MC15	MC15
13 TeV	13 TeV
Generator :MG5_aMC@NLO (CT10) Showering: Herwig++	Generator : Powheg (CT10) Showering: Pythia6

- *Single-lepton channel: (a) S/\sqrt{B} ratio for different regions*



Reff: Search for the Standard Model Higgs boson produced in association with top quarks and decaying into $b\bar{b}$ in pp collisions at $\sqrt{s} = 8 \text{ TeV}$ with the ATLAS detector/ The ATLAS Collaboration/(*Eur.Phys.J. C75 (2015) 349*)

- *Single-lepton channel: (a) S/\sqrt{B} ratio for different regions*



Reff: Search for the Standard Model Higgs boson produced in association with top quarks and decaying into $b\bar{b}$ in pp collisions at $\sqrt{s} = 8 \text{ TeV}$ with the ATLAS detector/ The ATLAS Collaboration/(*Eur.Phys.J. C75 (2015) 349*)

signal and $t\bar{t}$ background samples (just used 5 files for each) $t\bar{t}H$

$t\bar{t}H$:

- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.341270.aMcAtNloHerwigppEvtGen_UEEE5_CTEQ6L1_CT10ME_ttH125_inc_semil.merge.DAOD_TOPQ1.e3921_s2608_s2183_r6630_r6264_p2372_tid05809550_00/DAOD_TOPQ1.05809550._000004.pool.root.1
- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.341270.aMcAtNloHerwigppEvtGen_UEEE5_CTEQ6L1_CT10ME_ttH125_inc_semil.merge.DAOD_TOPQ1.e3921_s2608_s2183_r6630_r6264_p2372_tid05809550_00/DAOD_TOPQ1.05809550._000025.pool.root.1
- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.341270.aMcAtNloHerwigppEvtGen_UEEE5_CTEQ6L1_CT10ME_ttH125_inc_semil.merge.DAOD_TOPQ1.e3921_s2608_s2183_r6630_r6264_p2372_tid05809550_00/DAOD_TOPQ1.05809550._000016.pool.root.1
- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.341270.aMcAtNloHerwigppEvtGen_UEEE5_CTEQ6L1_CT10ME_ttH125_inc_semil.merge.DAOD_TOPQ1.e3921_s2608_s2183_r6630_r6264_p2372_tid05809550_00/DAOD_TOPQ1.05809550._000017.pool.root.1
- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.341270.aMcAtNloHerwigppEvtGen_UEEE5_CTEQ6L1_CT10ME_ttH125_inc_semil.merge.DAOD_TOPQ1.e3921_s2608_s2183_r6630_r6264_p2372_tid05809550_00/DAOD_TOPQ1.05809550._000030.pool.root.1

$t\bar{t}$:

- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.410000.PowhegPythiaEvtGen_P2012_ttbar_hdamp172p5_nonallhad.merge.DAOD_TOPQ1.e3698_s2608_s2183_r6630_r6264_p2353_tid05562695_00/DAOD_TOPQ1.05562692._000028.pool.root.1
- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.410000.PowhegPythiaEvtGen_P2012_ttbar_hdamp172p5_nonallhad.merge.DAOD_TOPQ1.e3698_s2608_s2183_r6630_r6264_p2353_tid05562695_00/DAOD_TOPQ1.05562695._000022.pool.root.1
- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.410000.PowhegPythiaEvtGen_P2012_ttbar_hdamp172p5_nonallhad.merge.DAOD_TOPQ1.e3698_s2608_s2183_r6630_r6264_p2353_tid05562695_00/DAOD_TOPQ1.05562697._000031.pool.root.1
- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.410000.PowhegPythiaEvtGen_P2012_ttbar_hdamp172p5_nonallhad.merge.DAOD_TOPQ1.e3698_s2608_s2183_r6630_r6264_p2353_tid05562695_00/DAOD_TOPQ1.05562701._000001.pool.root.1
- /afs/cern.ch/work/r/rsoualah/samples/mc15_13TeV.410000.PowhegPythiaEvtGen_P2012_ttbar_hdamp172p5_nonallhad.merge.DAOD_TOPQ1.e3698_s2608_s2183_r6630_r6264_p2353_tid05562695_00/DAOD_TOPQ1.05562702._000037.pool.root.1

Event Selection:

The Signal ($t\bar{t}H: \geq 6 \text{ Jets}, \geq 4 b$).

The Signal ($t\bar{t}: \geq 4 \text{ Jets}, \geq 2 b$).

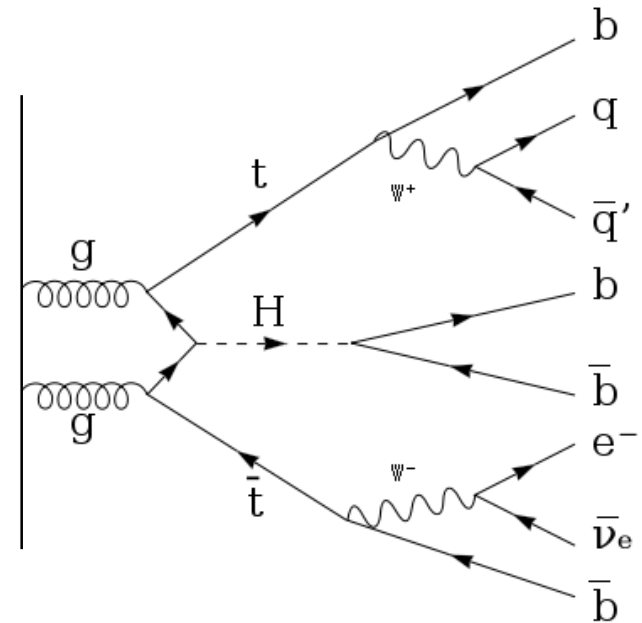
❖ Cut flow Signal region $t\bar{t}H$

El + Jets

cut	events
INITIAL	200000
GRL	200000
GOODCALO	200000
<u>EL_N 25000 == 1</u>	<u>40052</u>
<u>MU_N 25000 == 0</u>	<u>37990</u>
JET_N 25000 >= 1	37953
JET_N 25000 >= 2	37912
JET_N 25000 >= 3	37530
JET_N 25000 >= 4	35851
JET_N 25000 >= 5	30996
<u>JET_N 25000 >= 6</u>	<u>22425</u>
MET > 30000	19311
MWT > 30000	15647
MV2C20_N 0.5 >= 2	8240
MV2C20_N 0.5 >= 3	2969
<u>MV2C20_N 0.5 >= 4</u>	<u>585</u>
EXAMPLEPLOTS	585
SAVE	585

Mu + Jets

cut	events
INITIAL	200000
GRL	200000
GOODCALO	200000
MU_N 25000 >= 1	37575
<u>MU_N 25000 == 1</u>	<u>36285</u>
<u>EL_N 25000 == 0</u>	<u>34440</u>
JET_N 25000 >= 1	34107
JET_N 25000 >= 2	34061
JET_N 25000 >= 3	33744
JET_N 25000 >= 4	32237
JET_N 25000 >= 5	27850
<u>JET_N 25000 >= 6</u>	<u>20234</u>
MET+MWT > 60000	18422
MV2C20_N 0.5 >= 2	9769
MV2C20_N 0.5 >= 3	3616
<u>MV2C20_N 0.5 >= 4</u>	<u>736</u>
EXAMPLEPLOTS	736
SAVE	736



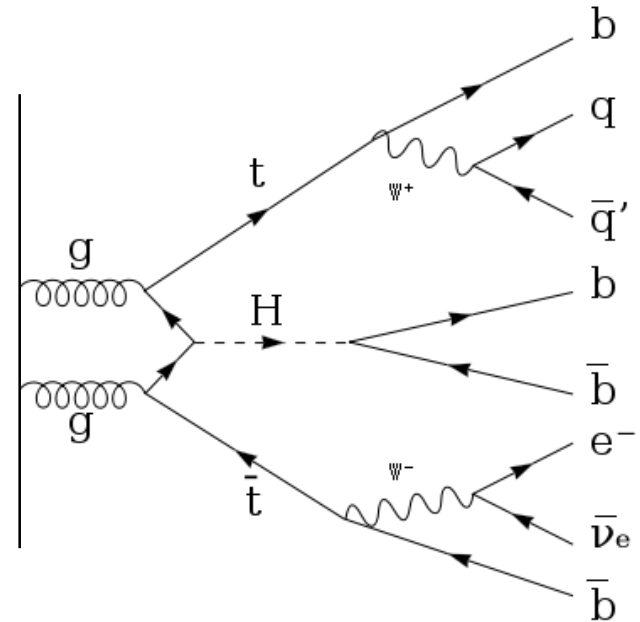
❖ Cut flow Signal region $t\bar{t}$

El + Jets

cut	events
INITIAL	205000
GRL	205000
<u>EL_N 25000 == 1</u>	<u>41935</u>
<u>MU_N 25000 == 0</u>	<u>38602</u>
JET_N 25000 >= 1	38402
JET_N 25000 >= 2	36981
JET_N 25000 >= 3	31614
JET_N 25000 >= 4	21304
JET_N 25000 >= 5	10580
<u>JET_N 25000 >= 6</u>	<u>4336</u>
MET > 30000	3633
MWT > 30000	2939
MV2C20_N 0.5 >= 2	919
MV2C20_N 0.5 >= 3	52
<u>MV2C20_N 0.5 >= 3</u>	<u>3</u>
EXAMPLEPLOTS	3
SAVE	3

Mu + Jets

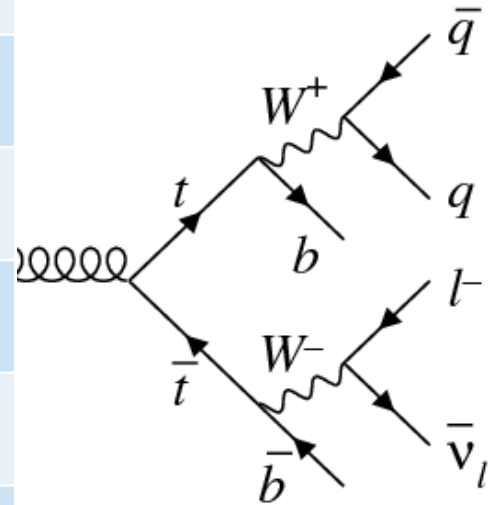
cut	events
INITIAL	205000
GRL	205000
GOODCALO	205000
<u>MU_N 25000 == 1</u>	<u>40909</u>
<u>EL_N 25000 == 0</u>	<u>37972</u>
JET_N 25000 >= 1	37584
JET_N 25000 >= 2	36114
JET_N 25000 >= 3	30756
JET_N 25000 >= 4	20731
JET_N 25000 >= 5	10154
<u>JET_N 25000 >= 6</u>	<u>4168</u>
MET+MWT > 60000	3765
MV2C20_N 0.5 >= 2	1198
MV2C20_N 0.5 >= 3	64
<u>MV2C20_N 0.5 >= 4</u>	<u>2</u>
EXAMPLEPLOTS	2
SAVE	2



❖ Cut flow Background region region $t\bar{t}H$

El + Jets	
cuts	events
Initial	200000
GRL	200000
EL_N 25000 >= 1	41257
EL_N 25000 == 1	40052
MU_N 25000 == 0	37990
JET_N 25000 >= 4	35851
MET > 30000	30778
MWT > 30000	25006
MV2C20_N 0.5 >= 2	671

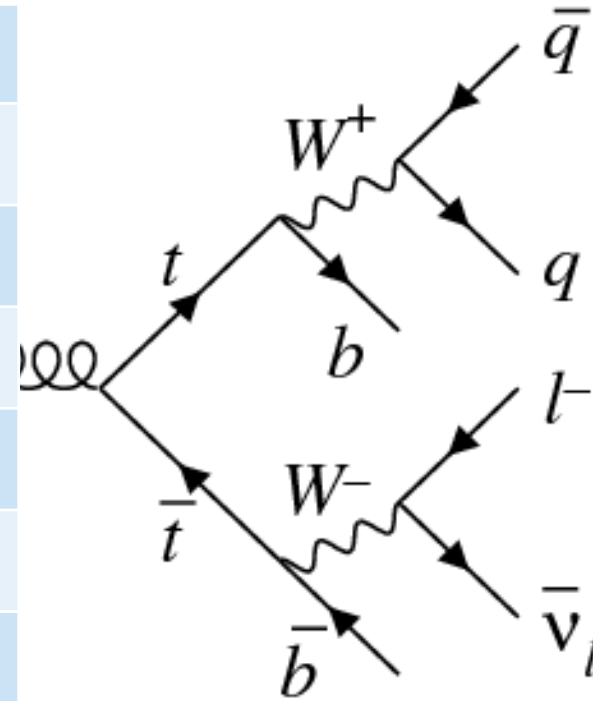
Mu + Jets	
cut	events
Initial	200000
GRL	200000
MU_N 25000 >= 1	37575
MU_N 25000 == 1	36285
El_N 25000 == 0	34440
JET_N 25000 >= 4	32237
MET+ MWT > 60000	29369
MV2C20_N 0.5 >= 2	14257



❖ Cut flow Background region region $t\bar{t}$

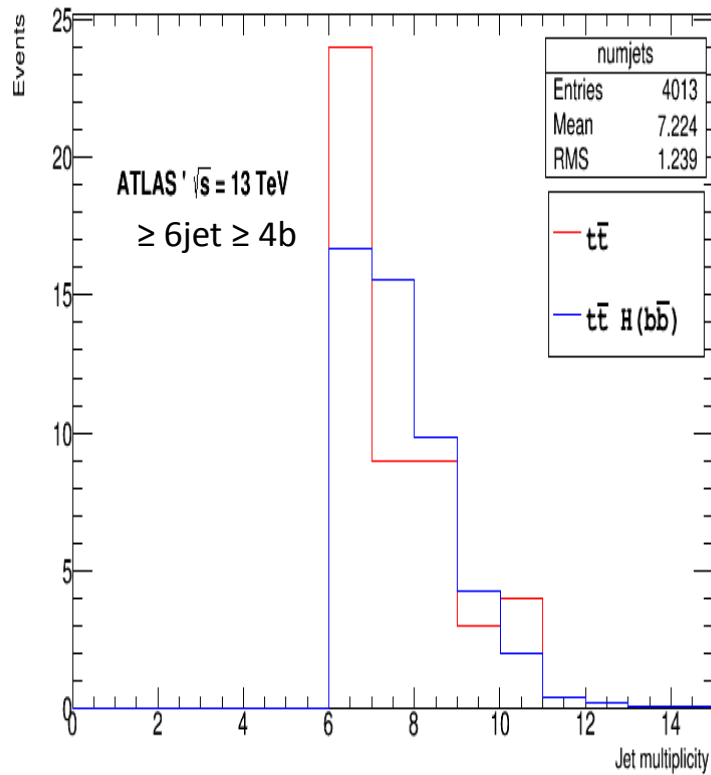
El + Jets	
cut	events
Initial	205000
GRL	205000
EL_N 25000 >= 1	43475
EL_N 25000 == 1	41935
MU_N 25000 == 0	38602
JET_N 25000 >= 4	21304
MET > 30000	17575
MWT > 30000	14809
MV2C20_N 0.5 >= 2	4098

Mu + Jets	
Cut	events
Initial	205000
GRL	205000
MU_N 25000 >= 1	42762
Mu_N 25000 == 1	40909
El_N 25000 == 0	37972
JET_N 25000 >= 4	20731
MET+ MWT > 60000	18629
MV2C20_N 0.5 >= 2	5221

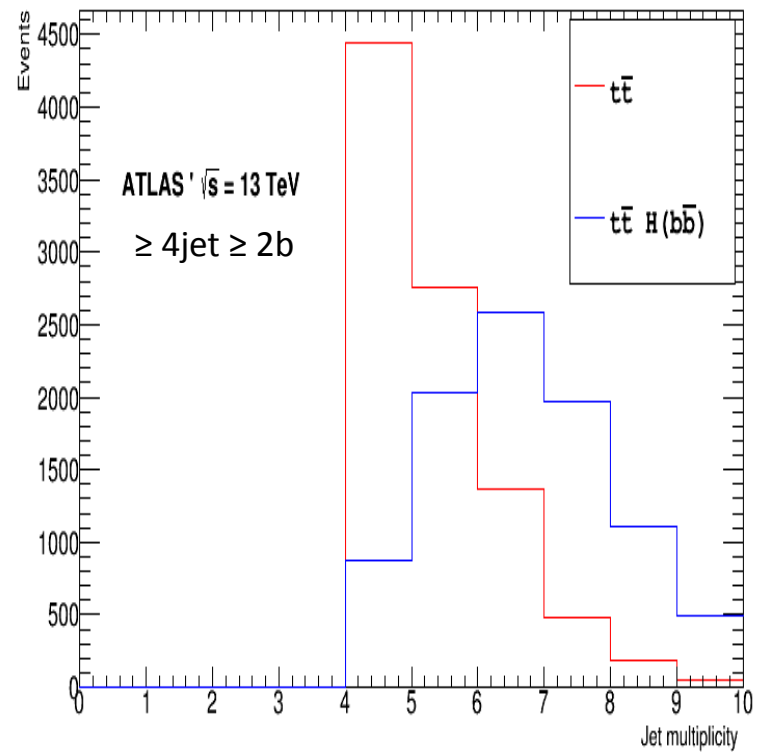


Jet Multiplicity

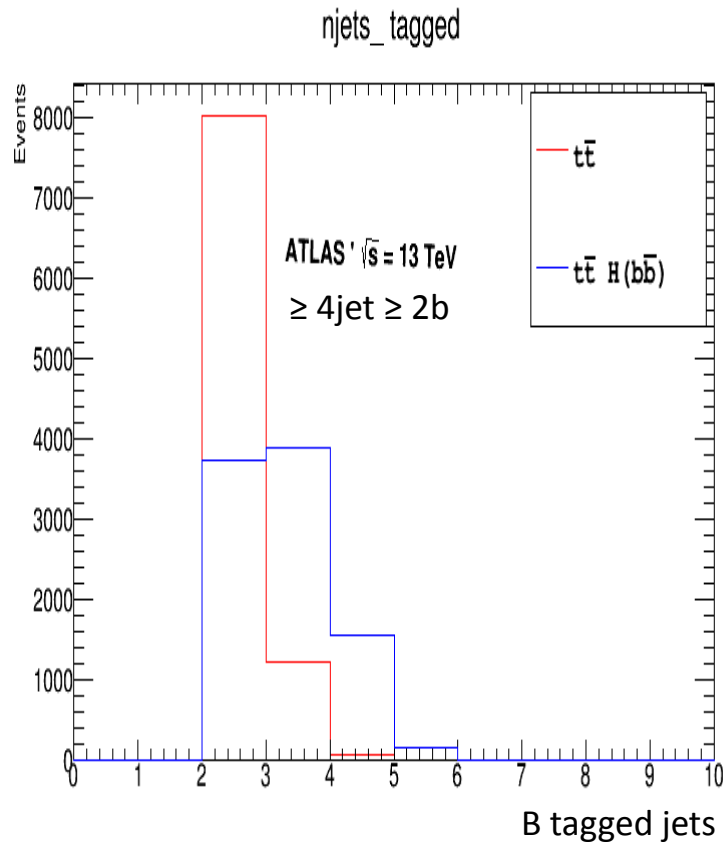
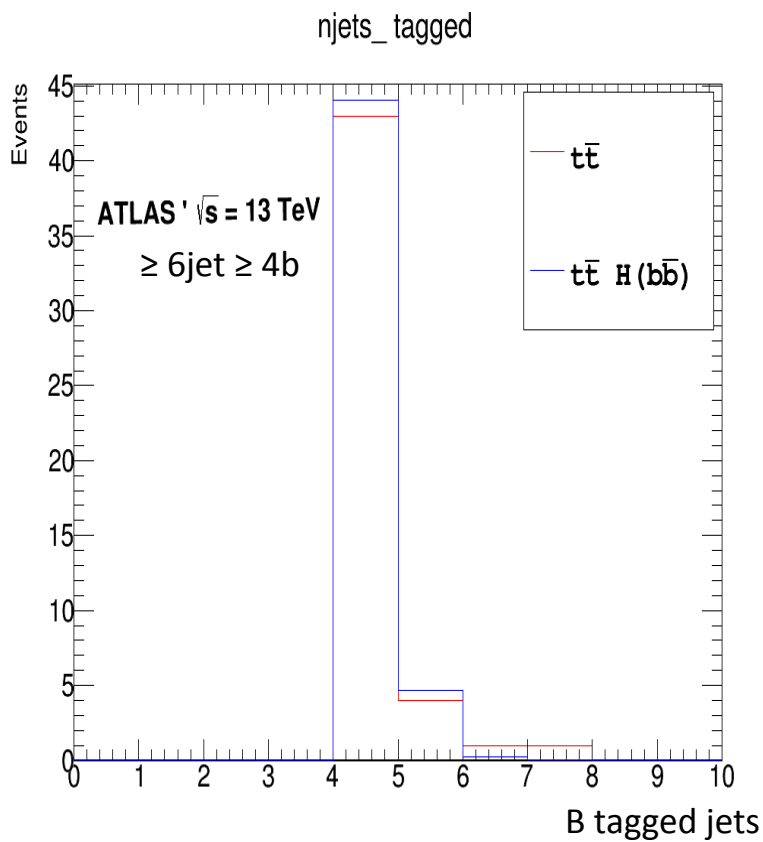
Jet multiplicity



Jet multiplicity

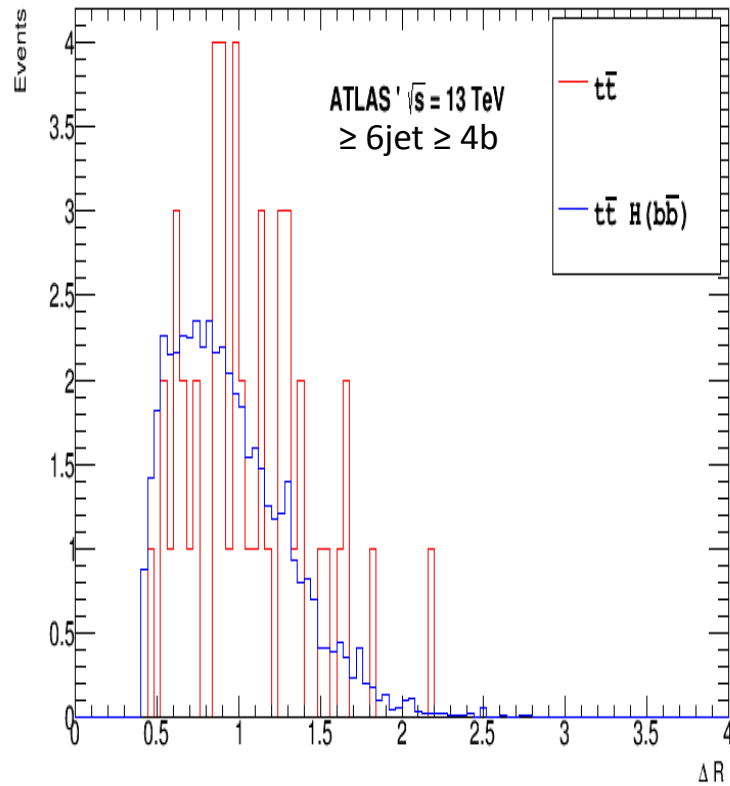


B Tagged Jets

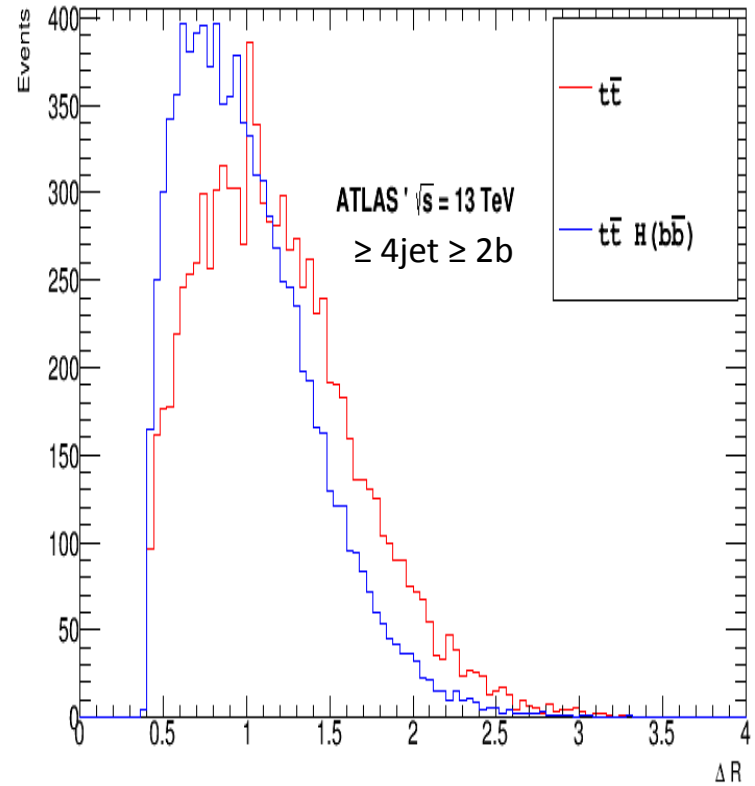


Delta R

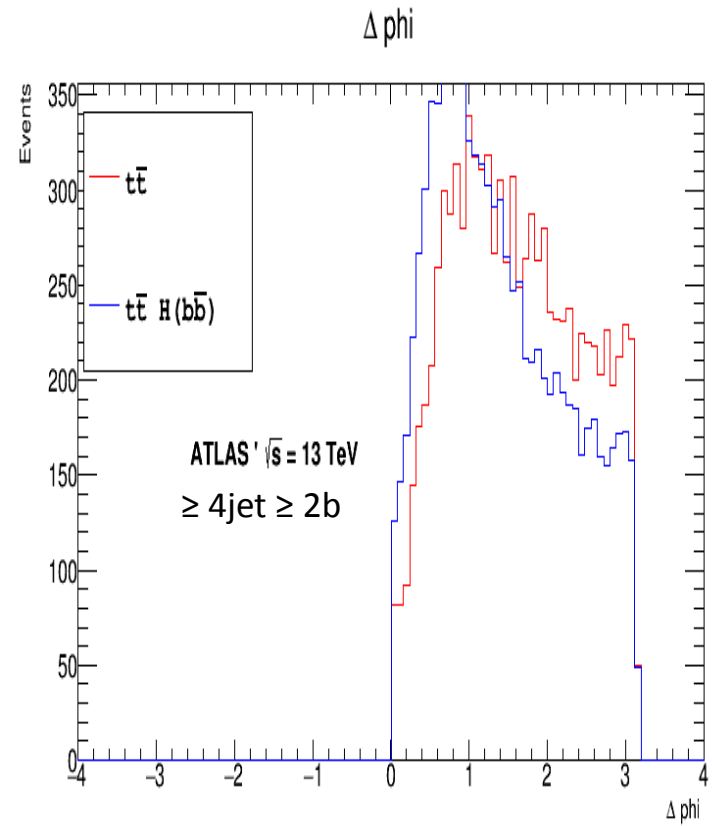
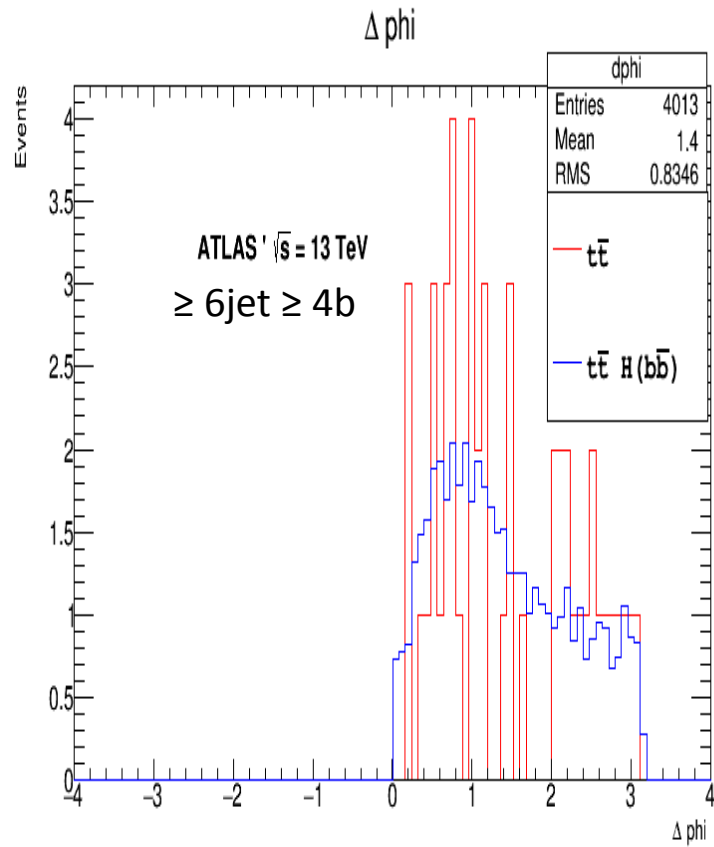
ΔR



ΔR

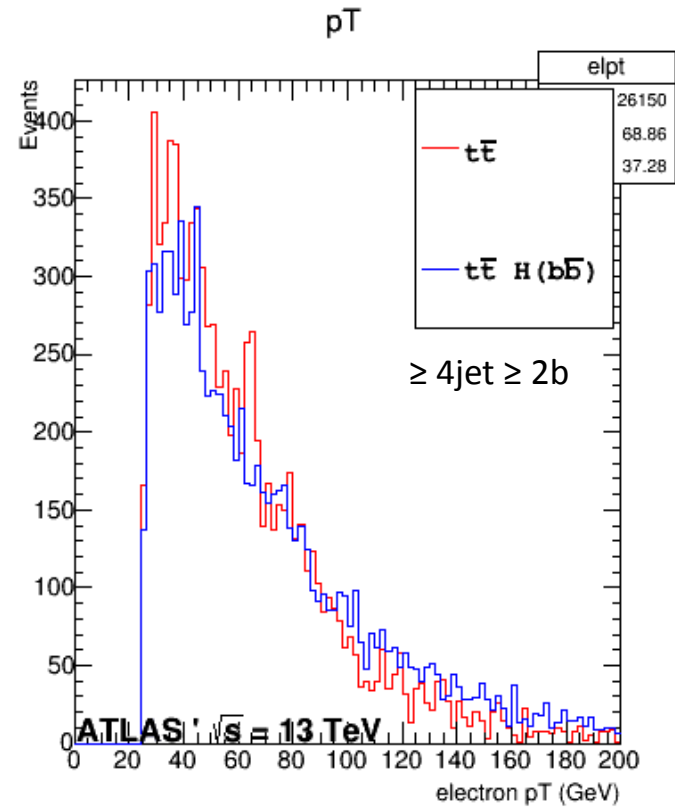
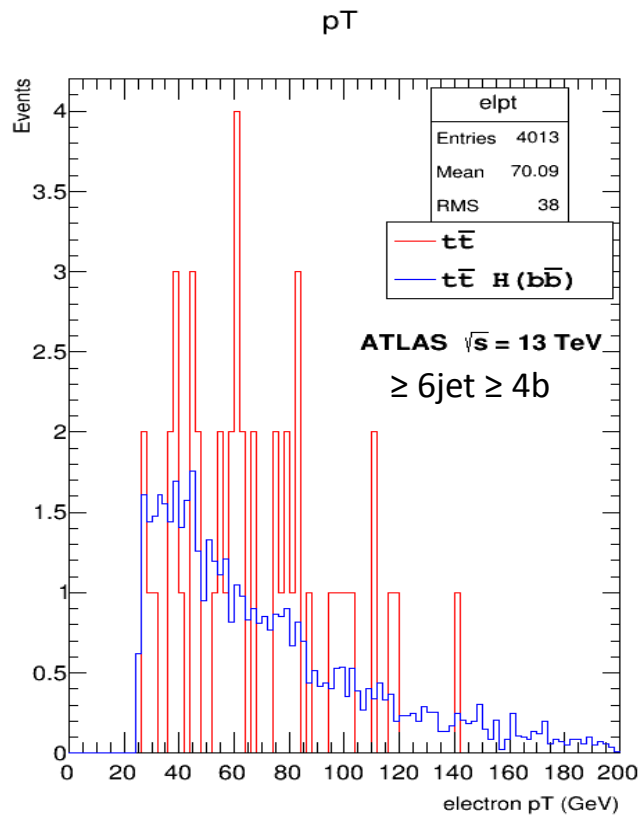


Delta Phi



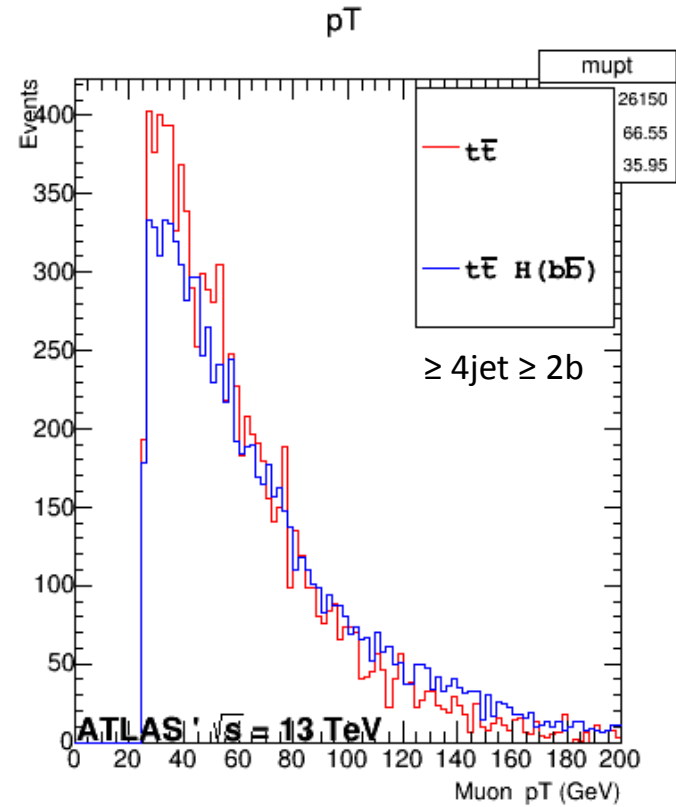
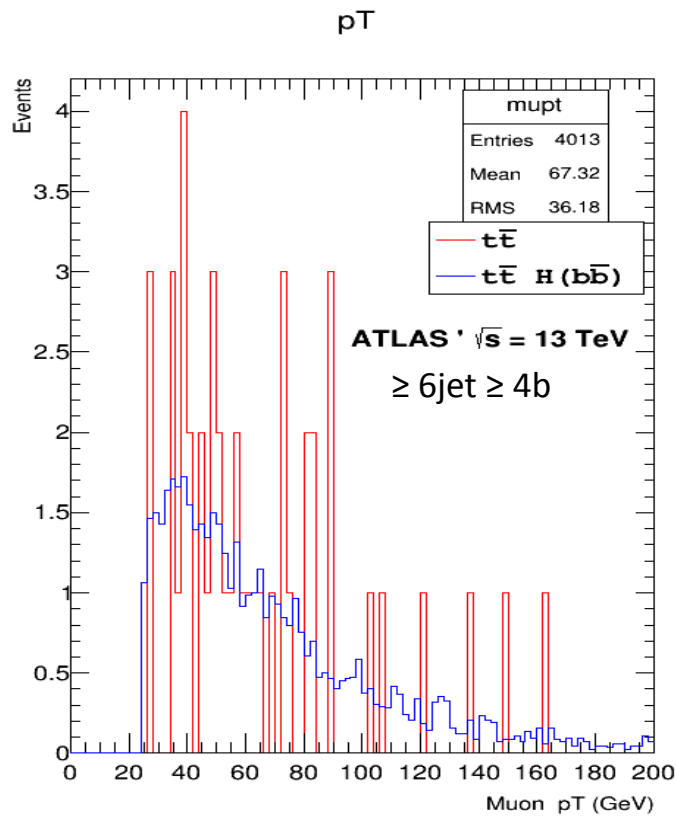
Some Kinematic Distributions($\geq 4j \geq 2b$):

-Lepton p_T / electron

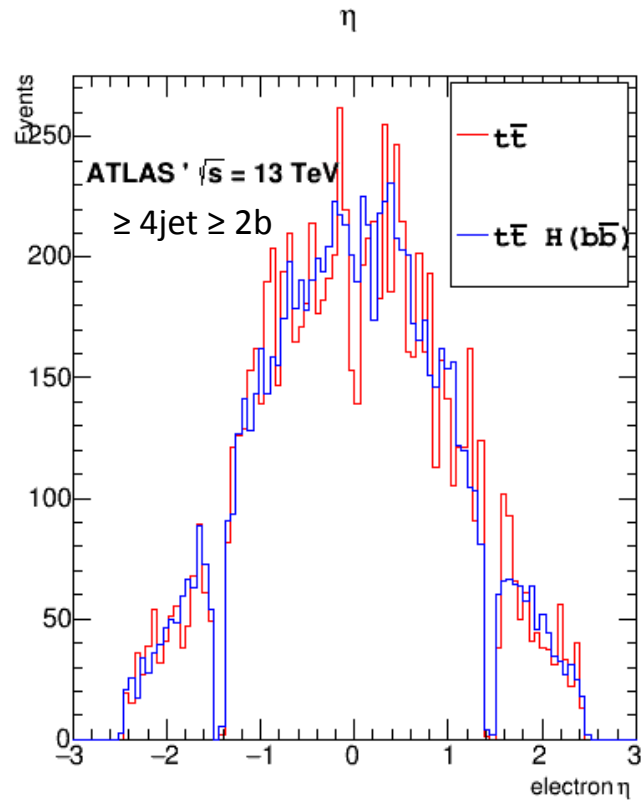
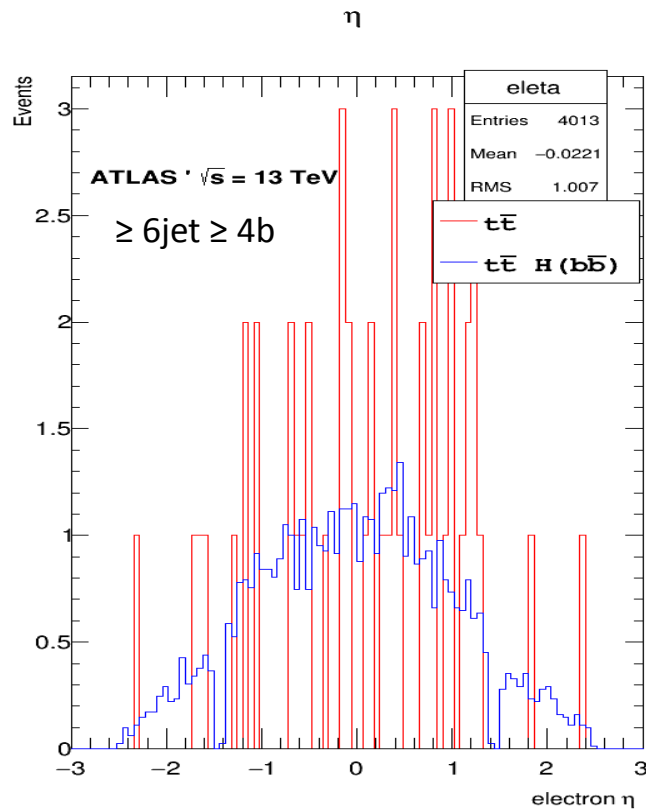


Some Kinematic Distributions ($\geq 4j \geq 2b$):

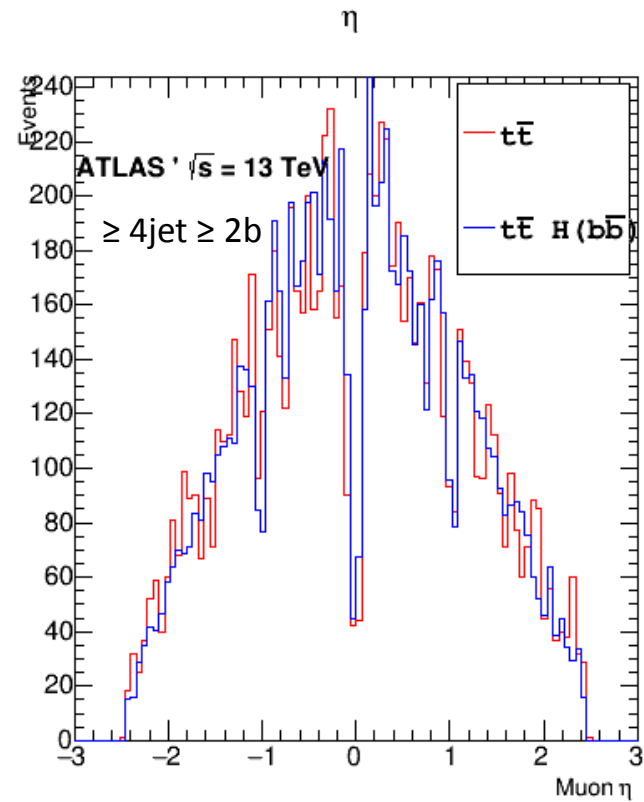
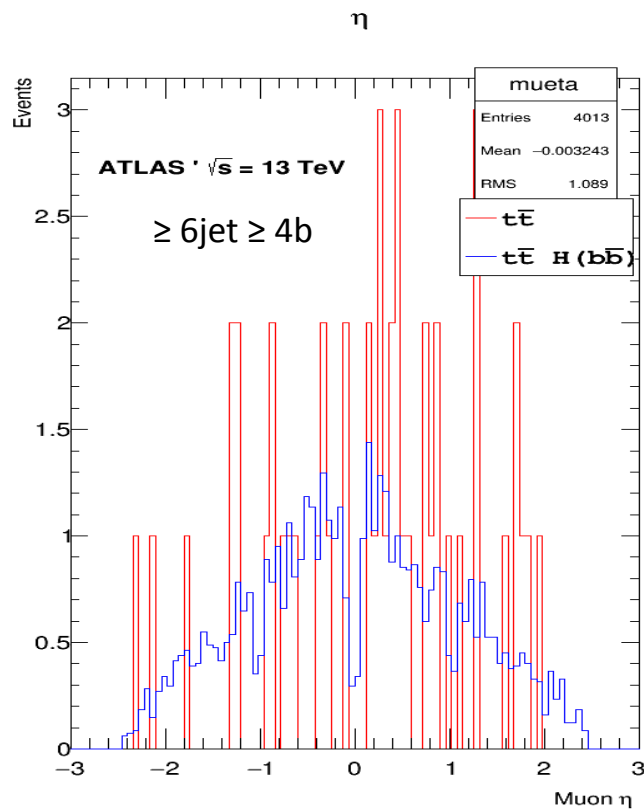
-Lepton p_T /Muon



Lepton eta/ electron

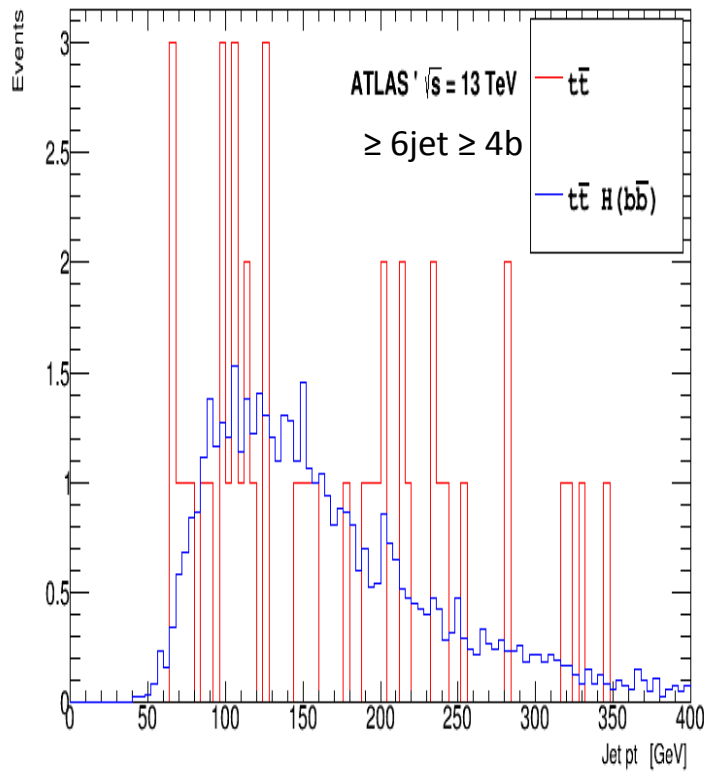


Lepton eta/Muon

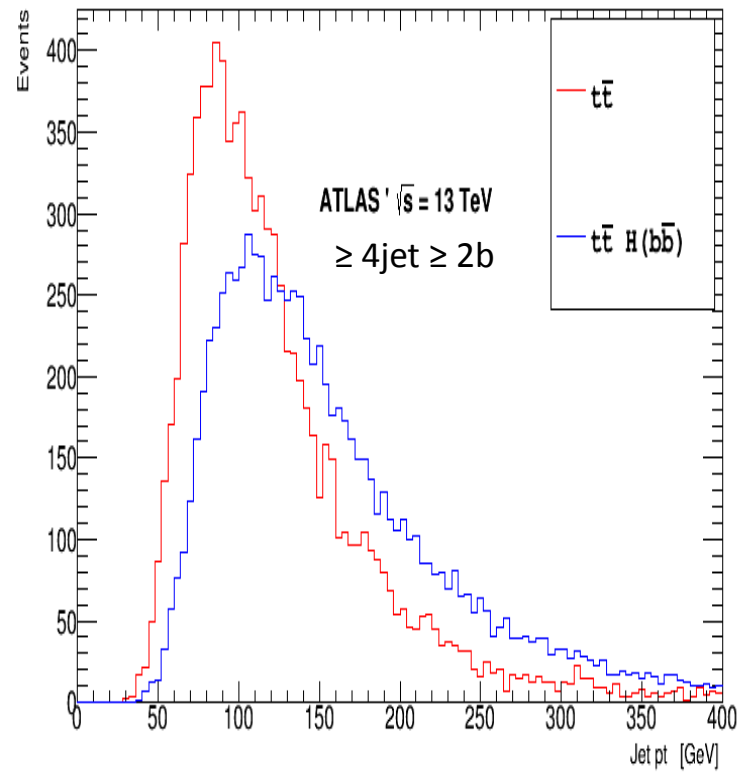


Leading Jet pt

Leading jet pt

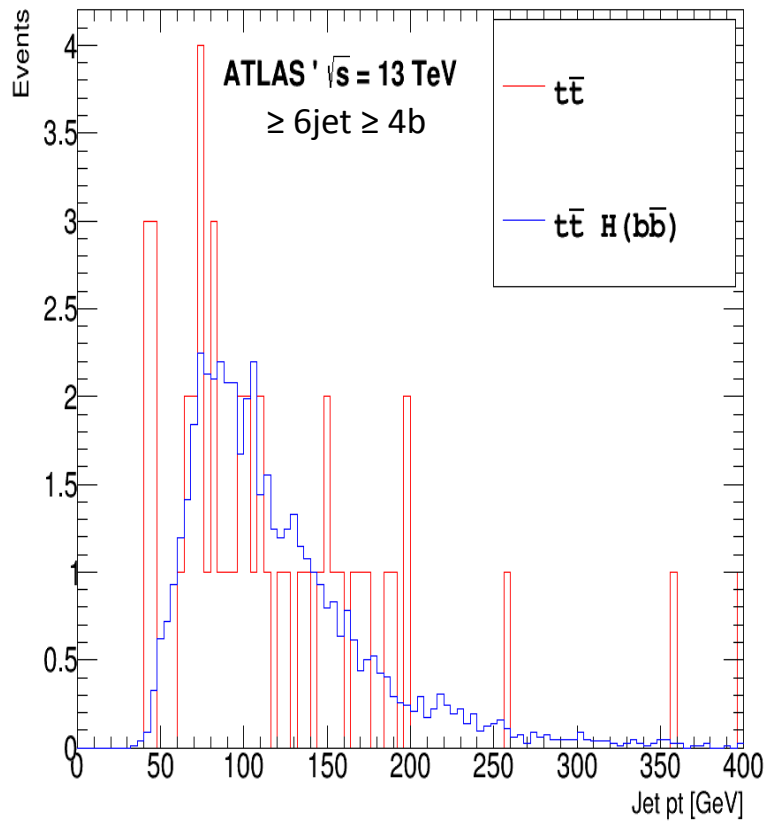


Leading jet pt

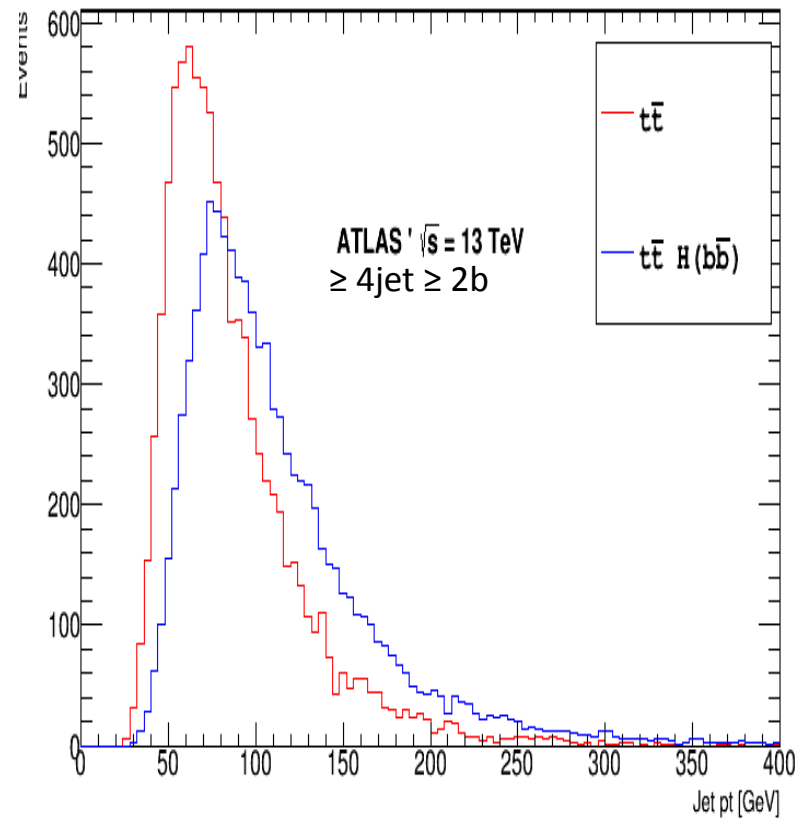


Second leading Jet pt

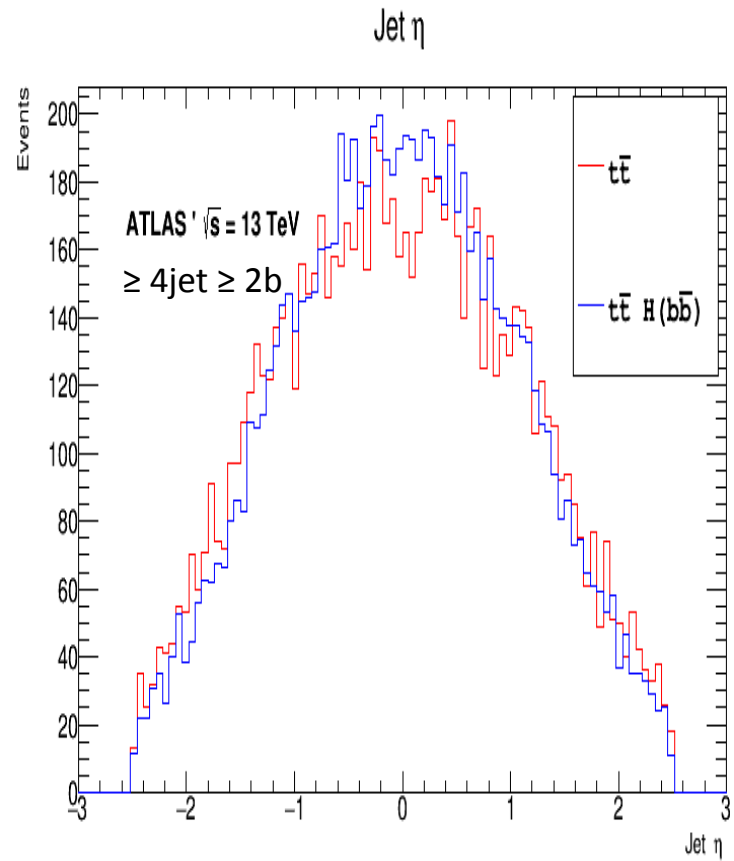
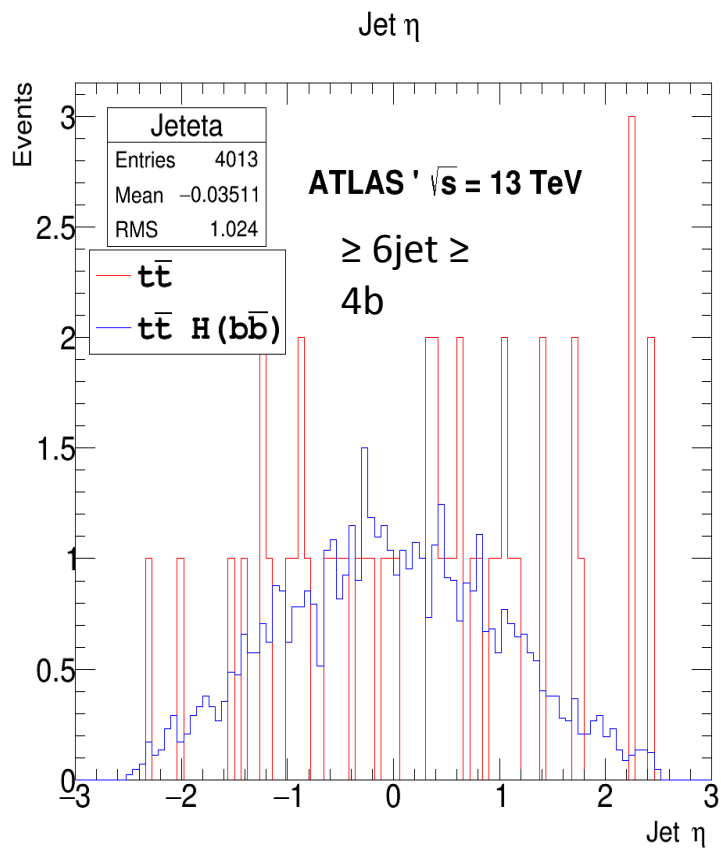
Second Leading Jet pt



Second Leading Jet pt

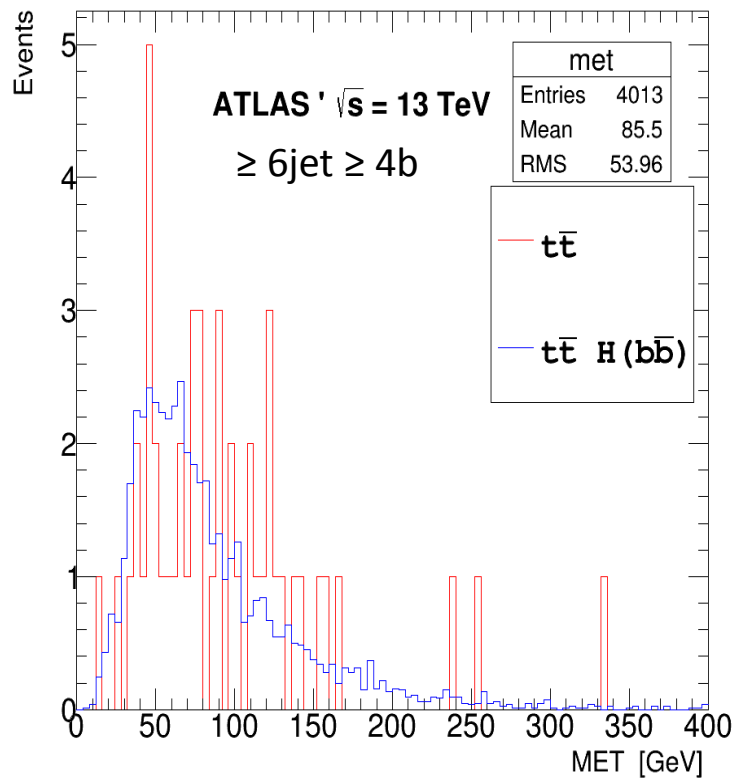


Jet Eta

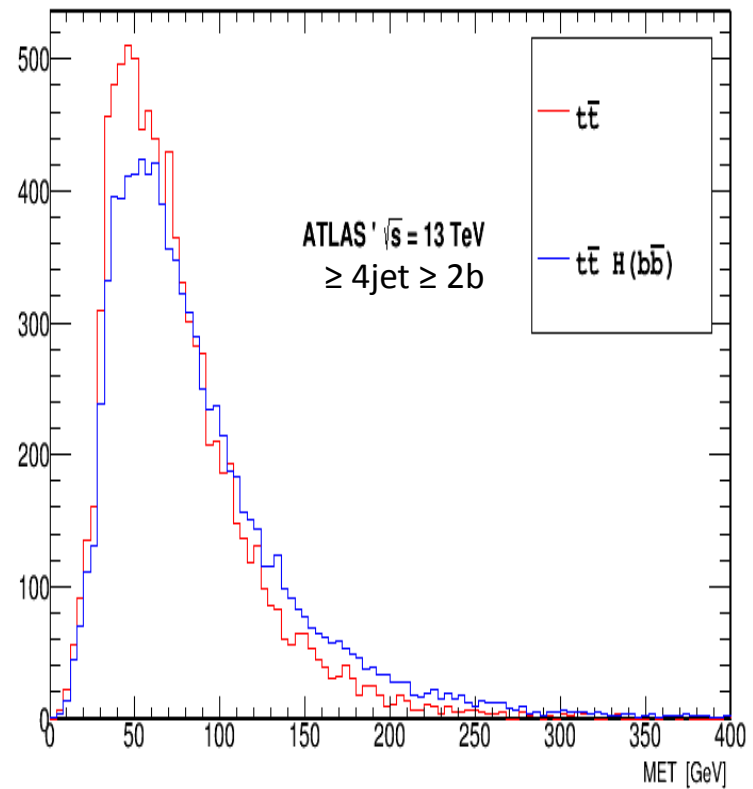


Missing Energy

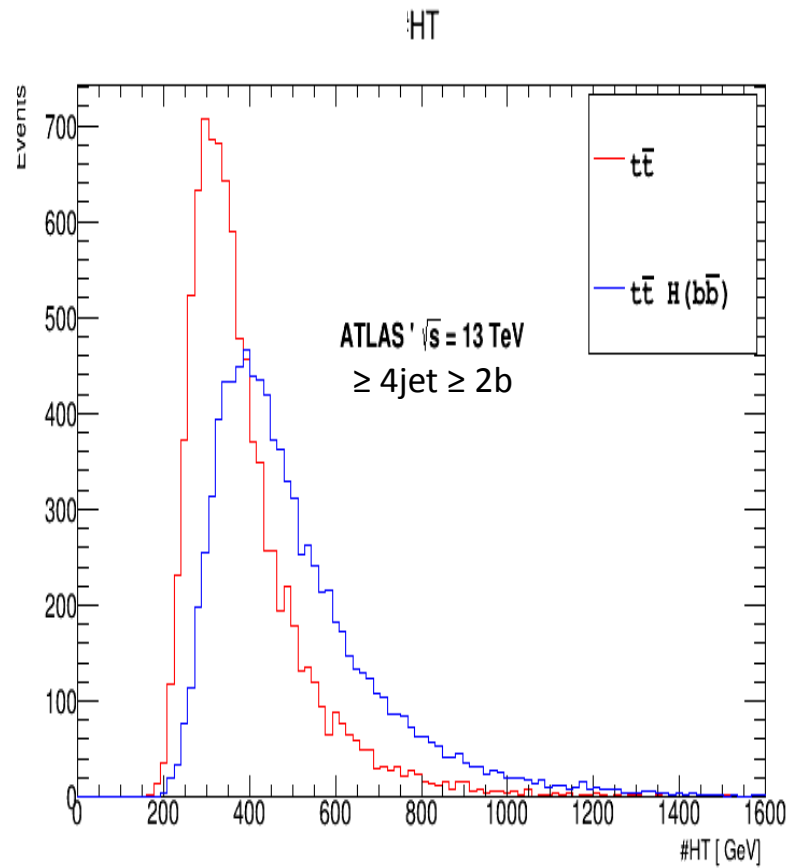
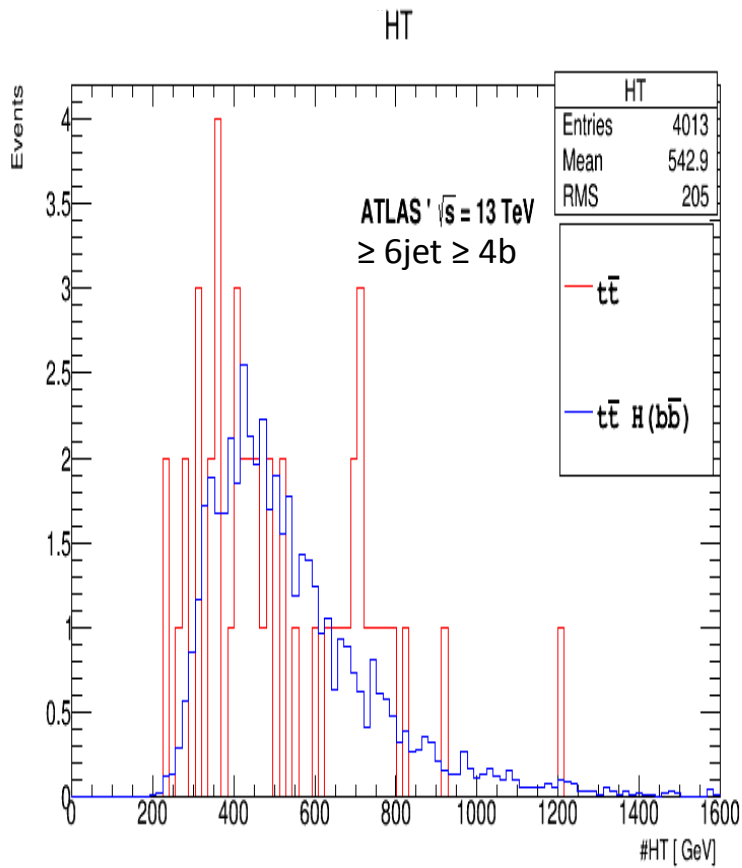
Missing energy



Missing energy

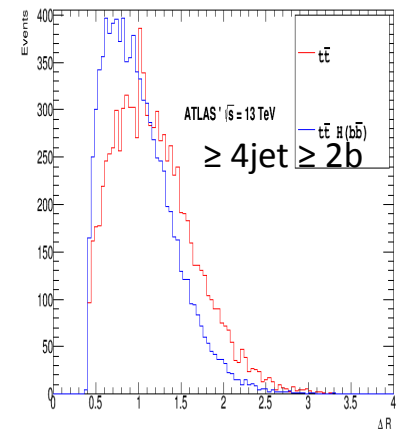
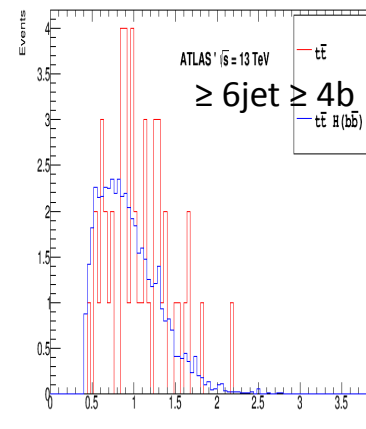
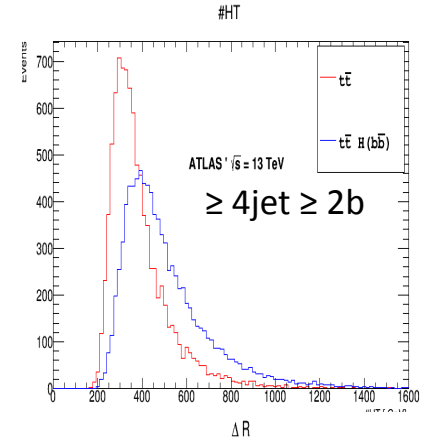
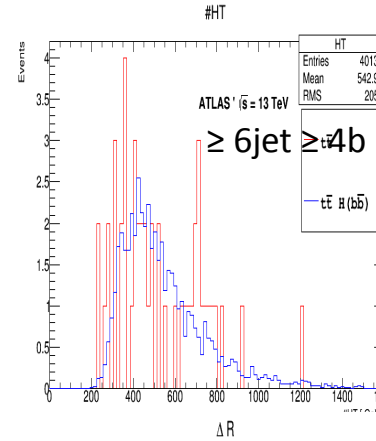
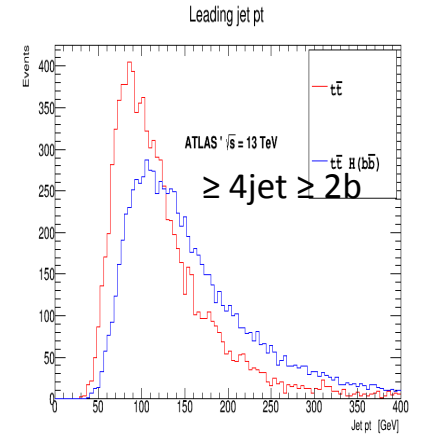
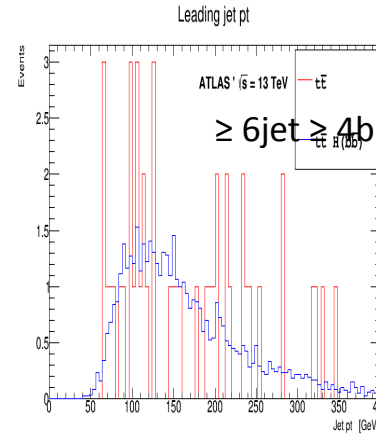


$$HT = \sum p_t^{jets}$$



❖ The significant plots

1. Jet p_t
2. $HT = \sum p_t^{jets}$
3. ΔR



Report outline

Introduction:

- LHC.
- ATLAS (Definition, components , trigger).
- Higgs (Introduce the Higgs, top and TTH) .
- Introduce the project .

Event selection :

- What code & trigger we used .
- Cut flow
- Signal event selection.
- Background event selection

Main analysis:

- **Plots** an interpretation .

Conclusion: