

Search for New Physics in fully hadronic final states with the ATLAS detector at the LHC

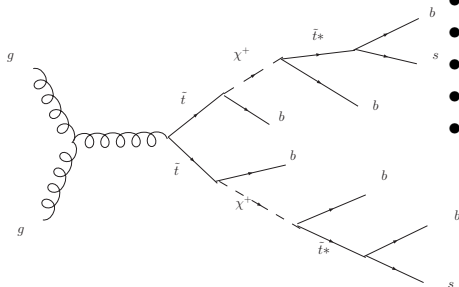
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May 4, 2016



RpV Signal diagram

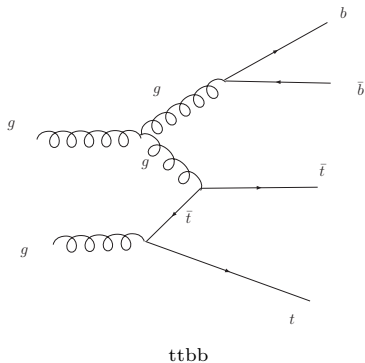


RpV Signal

- Cross section: 0.072 pb.
- stop mass: 603.44 GeV.
- chargino mass: 504.45 GeV.
- neutralino1 mass: 501.89 GeV.
- neutralino2 mass: 508.61 GeV.
- Higg mass: 125.03 GeV.

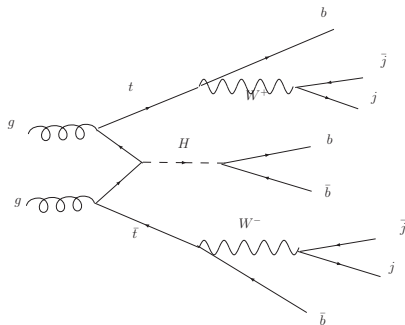
ttbb background

- Cross section: 5.1 pb.



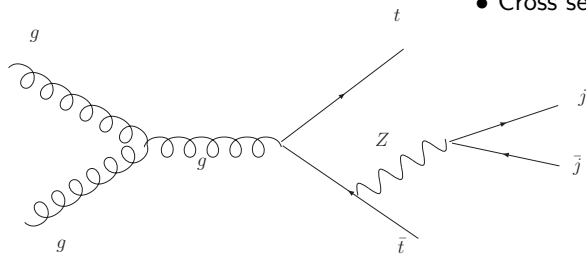
ttHTobb background

- Cross section: 0.12398 pb.



ttHTobb

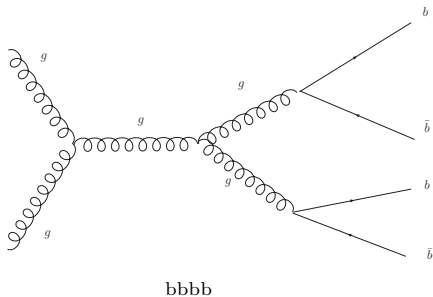
$t\bar{t}Z$ tojj background



- Cross section: 0.09168 pb.

$t\bar{t}Z$ tojj

bbbb background



- Cross section: 4185 pb.

Selection condition

Kinematic selection

- at least 5 jets whose $PT > 55$ GeV.
- $|\eta| < 2.5$.

b-tagging efficiency

- $\epsilon_b = 77\%$
- $\epsilon_c = 5\%$
- $\epsilon_{light} = 0.5\%$

Probabilities to have n b-tag jet (take example n=5,3 b-jet, 1 c-jet, 1 light jet)

$$P_0 = (1 - \epsilon_b)^3 (1 - \epsilon_c) (1 - \epsilon_{light})$$

$$P_{\geq 1} = 1 - P_0;$$

$$P_1 = \sum_{j=1}^5 \epsilon_j \prod_{i \neq j} (1 - \epsilon_i)$$

$$P_5 = \epsilon_b^3 \epsilon_c \epsilon_{light}$$

Number of event

1 Number of event at MC level

Signal

- nevent= 10000
- njrec5= 9252

ttbbar

- nevent= 109990
- njrec5= 17335

ttHtobb

- nevent= 101229
- njrec5= 26441

ttZtojj

- nevent= 36378
- njrec5= 9713

bbbb

- nevent= 92048
- njrec5= 415

1 Number of event with 6-jets at final state $n' = \frac{\sigma \times L}{N_{event}} \times n_{MC}$

b-tag	signal	ttbbar	ttHtobb	ttZtojj	bbbb
3	41	3137	262	91	177444
4	35	374	93	30	58521
5	12	11	6	1	4221
≥ 6	1	0.07	0.1	0.01	20

Number of event

- ① Number of event with 7-jets at final state

b-tag	signal	ttbbar	ttHtobb	ttZtojj	bbbb
3	113	5482	416	137	164760
4	139	1081	168	51	55391
5	77	64	14	3	3229
≥ 6	13	1	0.6	0.07	28

- ① Number of event with at least 8-jets at final state

b-tag	signal	ttbbar	ttHtobb	ttZtojj	bbbb
3	542	11419	1007	304	132975
4	902	3651	480	135	49959
5	803	383	64	16	7092
≥ 6	374	28	6	0.7	119

Transverse hadronic energy distribution

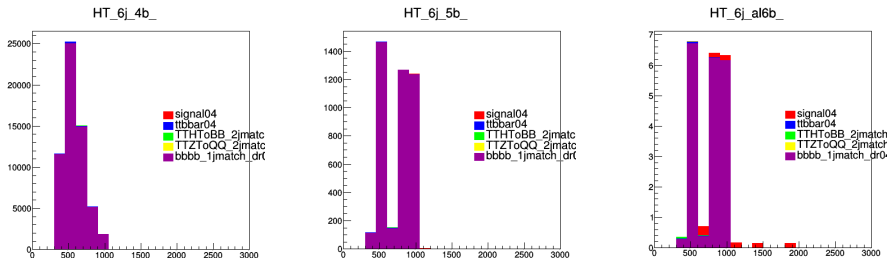


Figure : Left: HT with 6 jets and 4 b-tag Middle: HT with 6 jets and 5 b-tag Right: HT with 6 jets and 6 b-tag

Transverse hadronic energy distribution

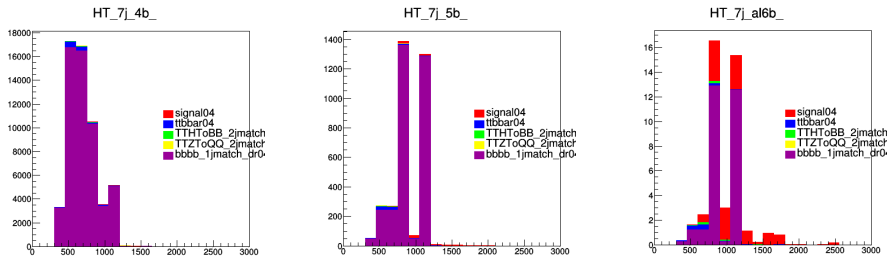


Figure : Left: HT with 7 jets and 4 b-tag Middle: HT with 7 jets and 5 b-tag Right: HT with 7 jets and at least 6 b-tag

Transverse hadronic energy distribution

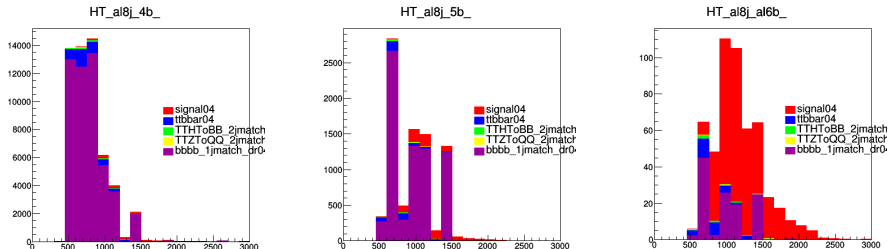
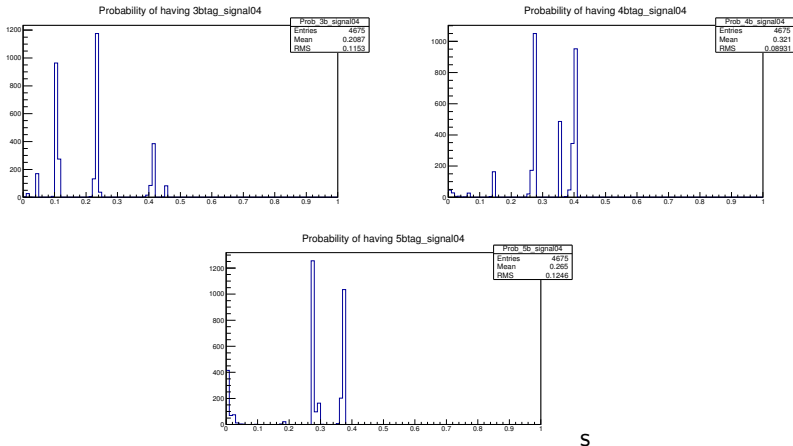


Figure : Left: HT with at least 8 jets and 4 b-tag Middle: HT with at least 8 jets and 5 b-tag Right: HT with at least 8 jets and at least 6 b-tag

Probabilities of b-tagging of signal

- Signal.



S

Figure : Upper left: Probability of having 3 b-tagging Upper right: 4 b-tagging Middle: 5 b-tagging

Probabilities of b-tagging of background

- bbbb background.

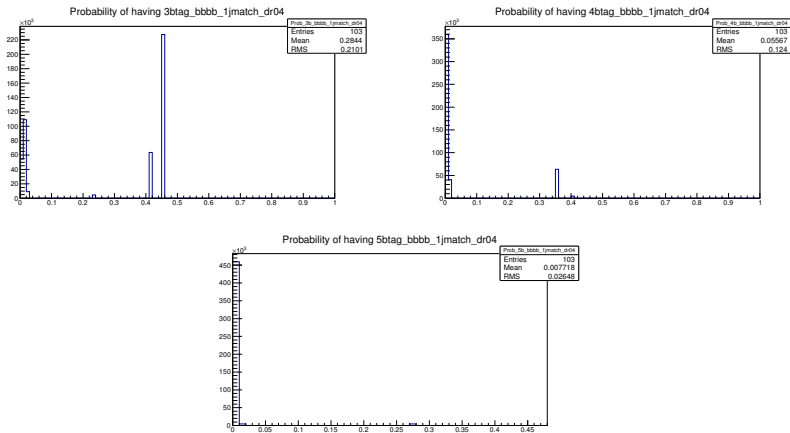


Figure : Upper left: Probability of having 3 b-tagging Upper right: 4 b-tagging Middle: 5 b-tagging

Number of b,c and light jets in 7 jets

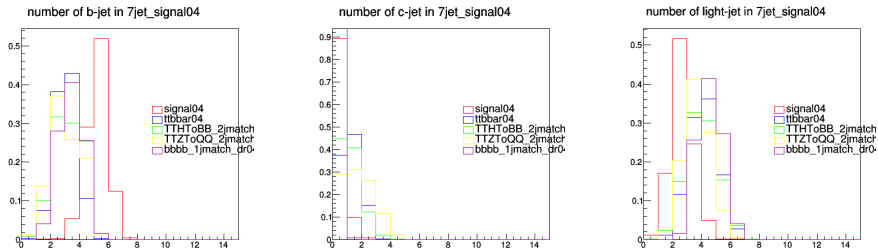


Figure : Left: Number of b-jet in 7 jets Middle: Number of c-jet in 7 jets Right: Number of light-jet in 7 jets

Number of b,c and light jets in 8 jets

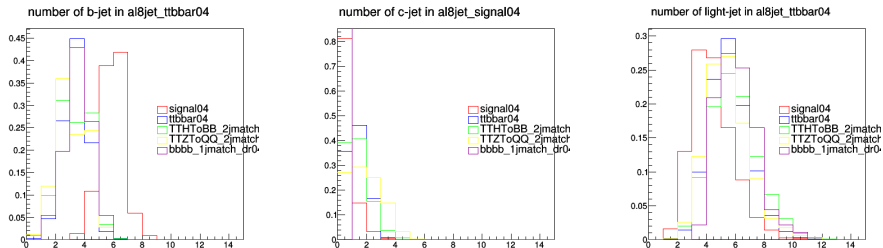


Figure : Left: Number of b-jet in 7 jets Middle: Number of c-jet in 7 jets Right: Number of light-jet in 7 jets

Invariant mass of chargino

- Chargino MC mass: 504.4 GeV.

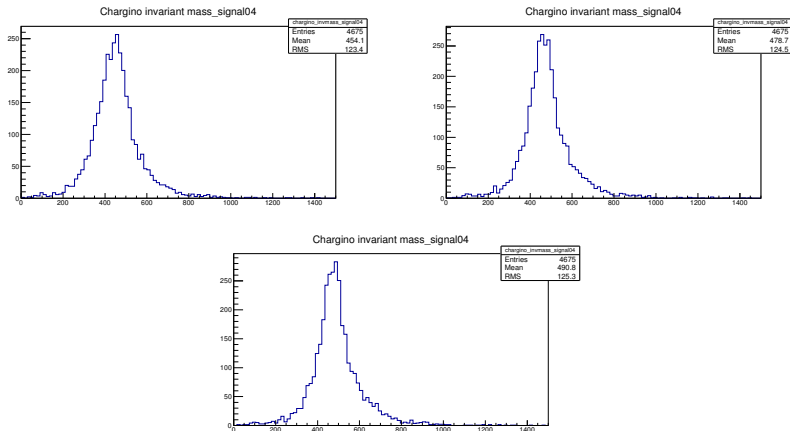


Figure : Upper left: $m_{\tilde{\chi}^+} = 455.2 \text{ GeV}$ without ν_e, ν_μ, μ Upper right: $m_{\tilde{\chi}^+} = 479.7 \text{ GeV}$ with ν_μ, μ Middle: $m_{\tilde{\chi}^+} = 491.8 \text{ GeV}$ with ν_μ, μ, ν_e

Invariant mass of stop

- Stop MC mass: 603.4 GeV.

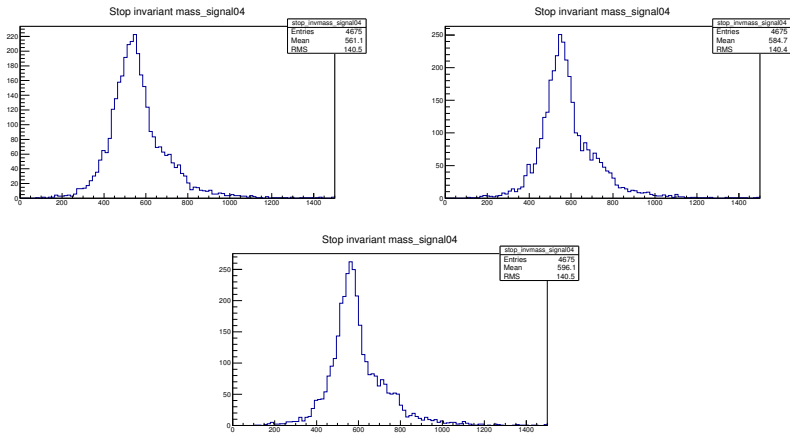


Figure : Upper left: $m_{\tilde{t}} = 562 \text{ GeV}$ without ν_e, ν_μ, μ Upper right: $m_{\tilde{t}} = 585.8 \text{ GeV}$ with ν_μ, μ Middle: $m_{\tilde{t}} = 597.4 \text{ GeV}$ with ν_μ, μ, ν_e

Conclusions

- Analyze bbbb background.
- Create tables of number of event with different jet numbers at final state with 5 and at least 6 of b-tagging.
- Plot histograms of transverse hadronic energy distribution.
- Check the invariant mass of chargino and stop.

Next steps

- Apply b-tagging algorithm using CalibrationDataInterface.
- Probability versus hadronic transverse energy.

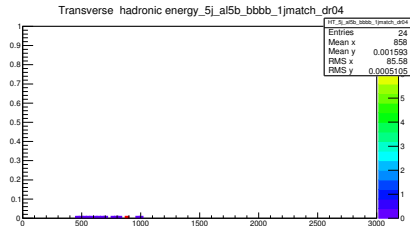
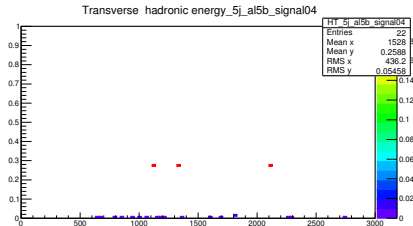


Figure : Probability of having 5 b tagging in 5 jets event - hadronic transverse energy,
LEFT: signal , RIGHT: bbbb background

BACK UP

Transverse hadronic energy distribution

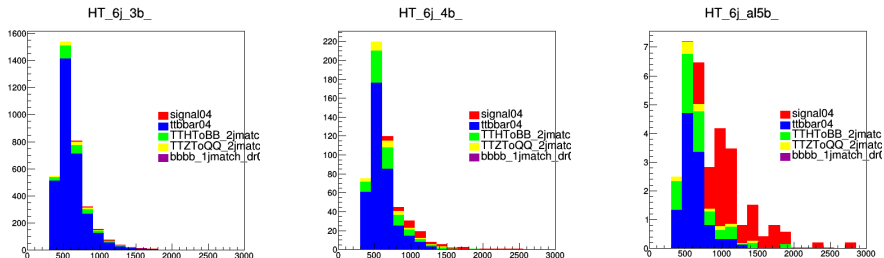


Figure : Left: HT with 6 jets and 3 b-tag Middle: HT with 6 jets and 4 b-tag Right: HT with 6 jets and at least 5 b-tag

Transverse hadronic energy distribution

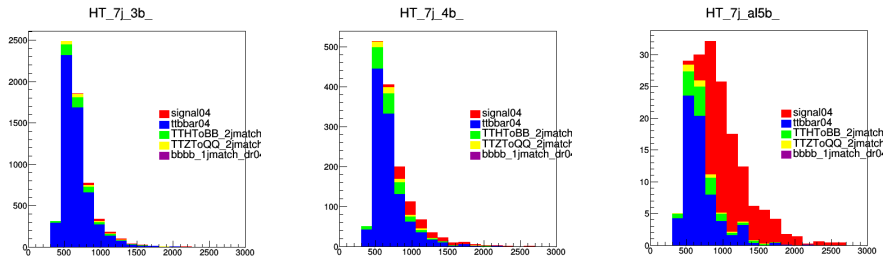


Figure : Left: HT with 7 jets and 3 b-tag Middle: HT with 7 jets and 4 b-tag Right: HT with 7 jets and at least 5 b-tag

Transverse hadronic energy distribution

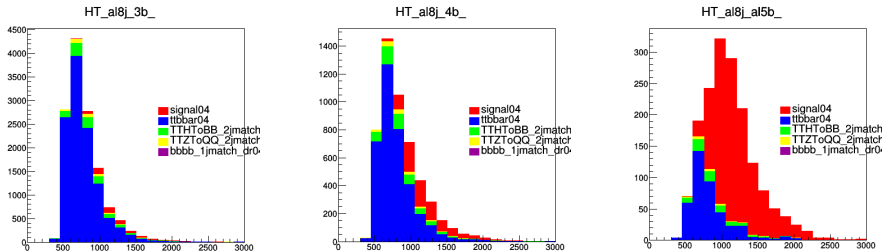


Figure : Left: HT with at least 8 jets and 3 b-tag Middle: HT with at least 8 jets and 4 b-tag Right: HT with at least 8 jets and at least 5 b-tag