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VLQ Top Partner Single Production

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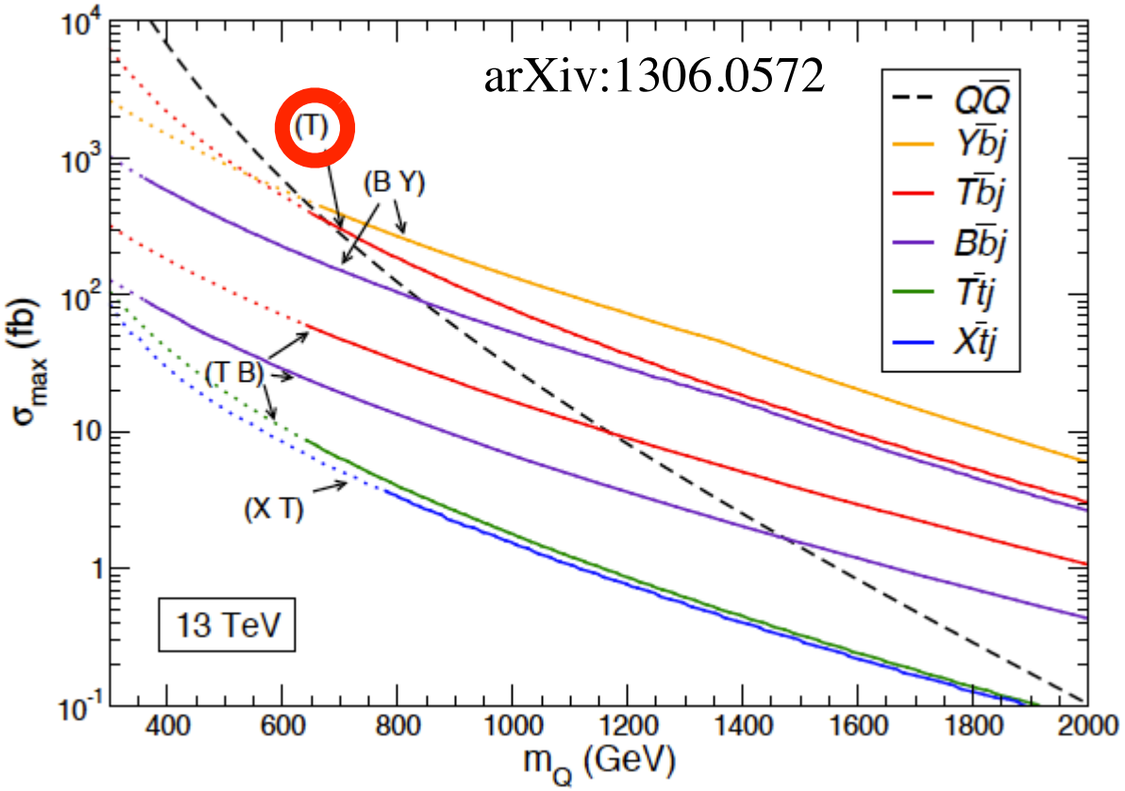

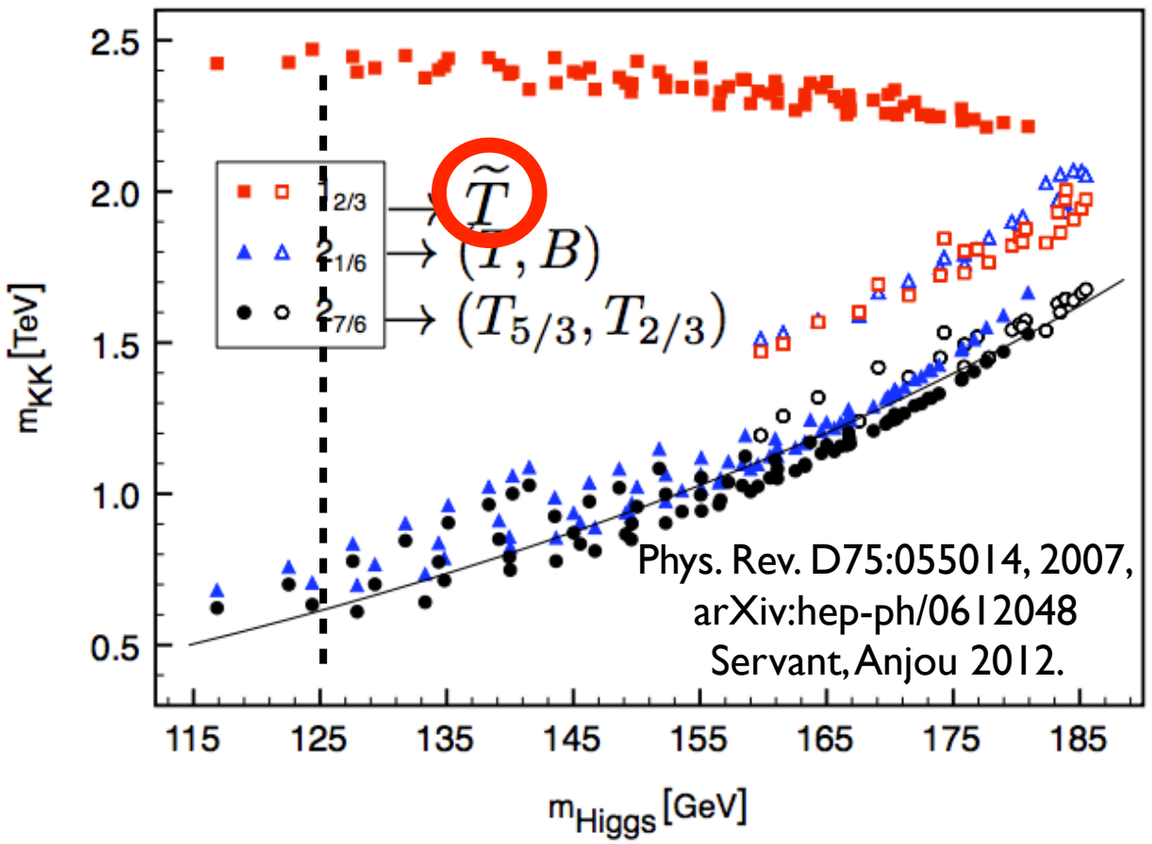

Why VLQ (single production)?

- Simplest new colored fermions allowed by experimental data.
- Predominant mixing with third generation SM quarks.
- Theoretically motivated in composite Higgs and warped ED models.
- Lightest resonances should be ~TeV.

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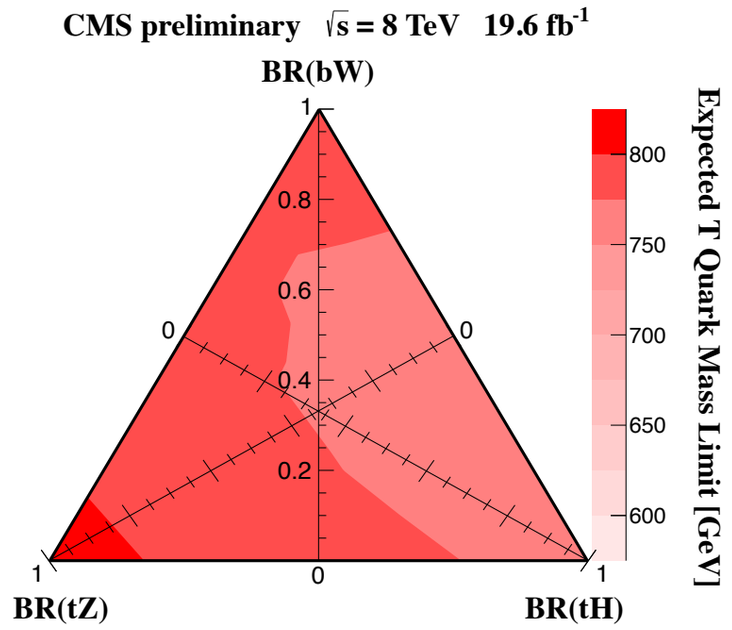
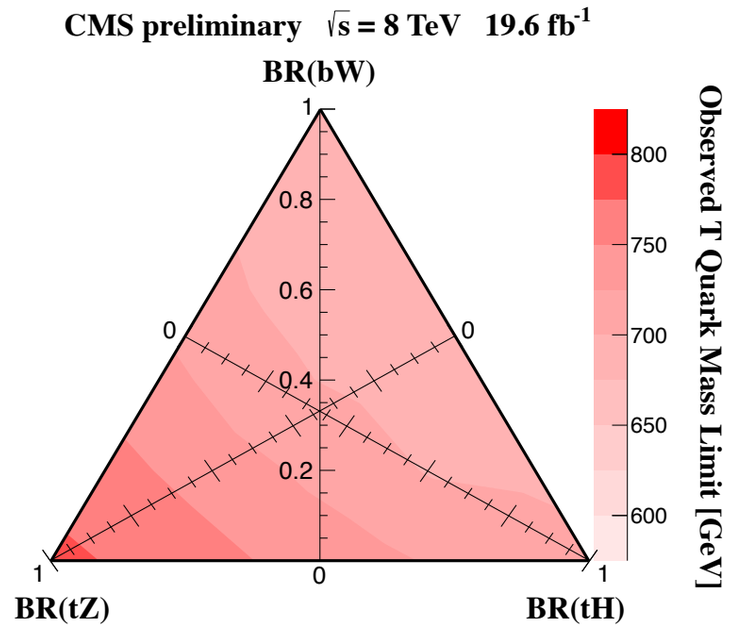
Existing Limits

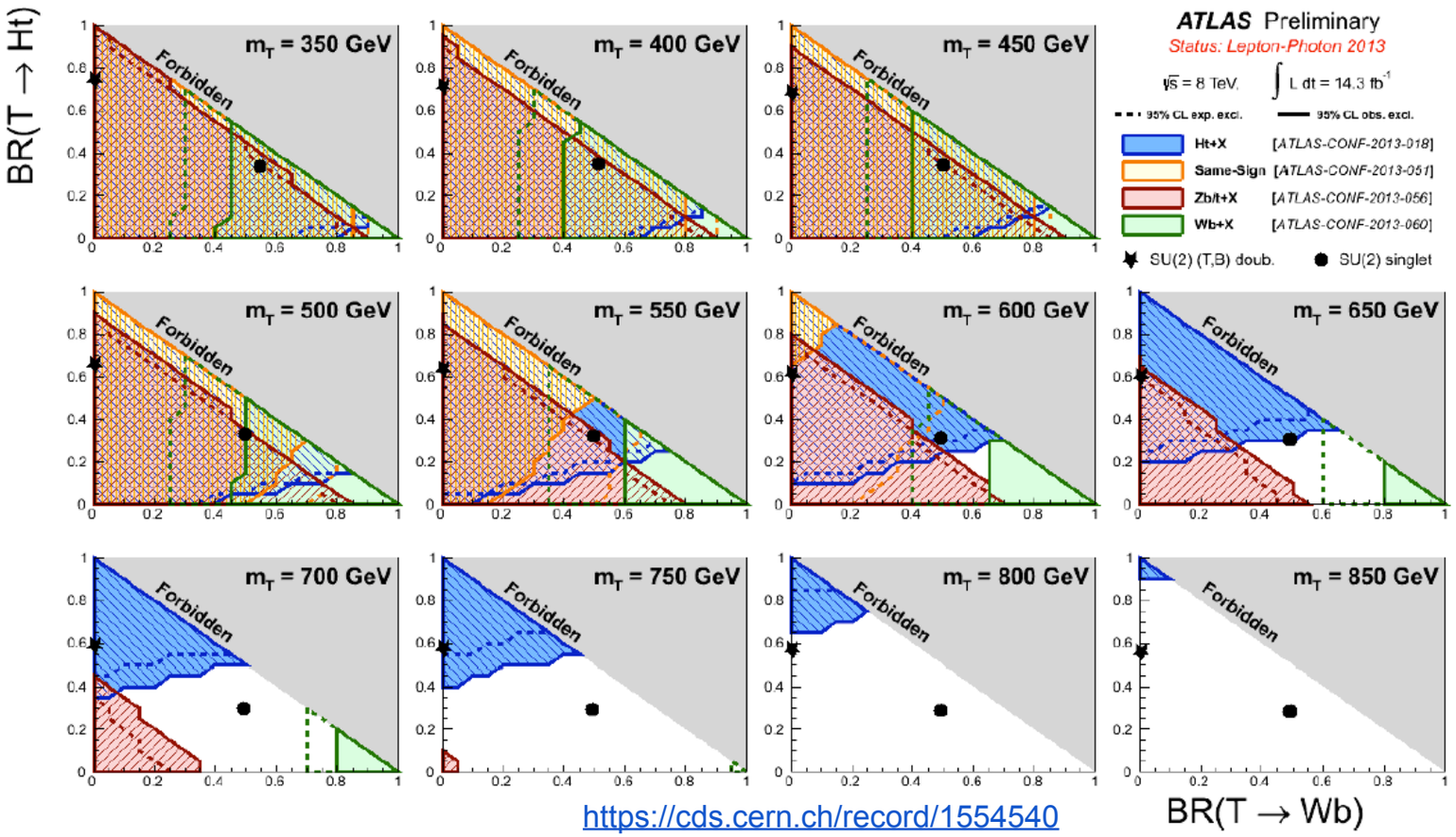
ATLAS and CMS have both recently updated their 8 TeV searches.

Single production has a favorable cross section and is sensitive to masses/BRs with the least stringent experimental limits.





http://cds.cern.ch/record/1557571



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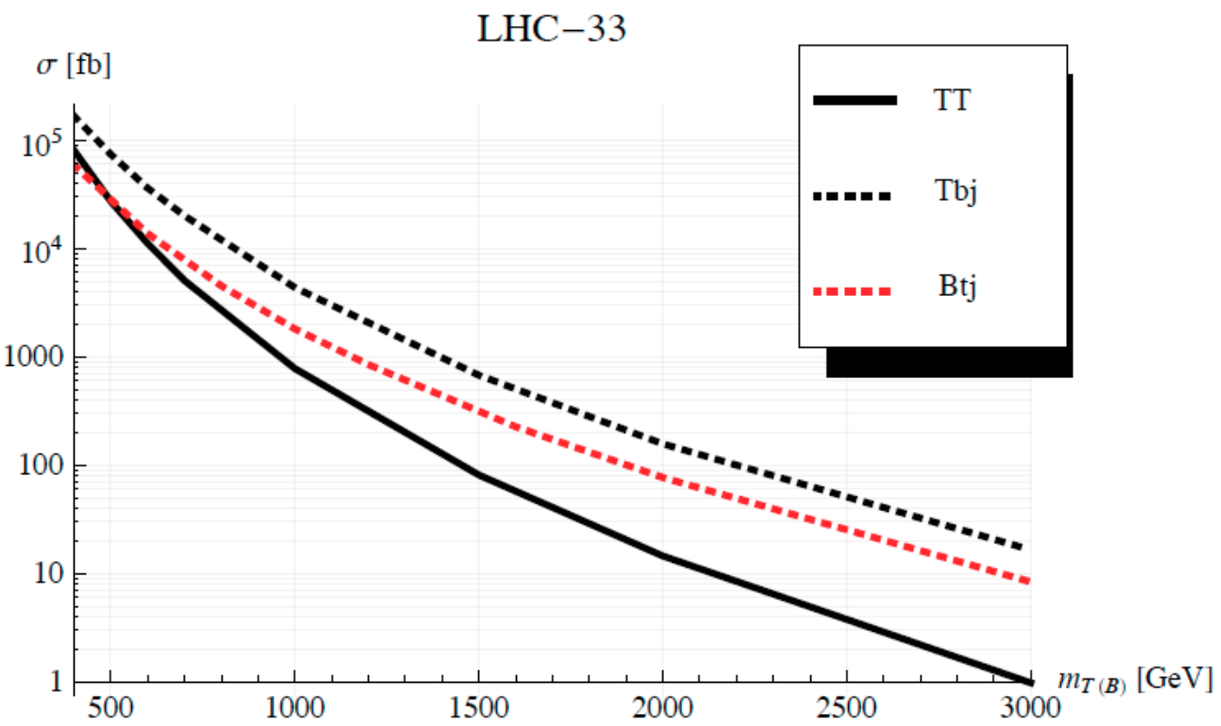
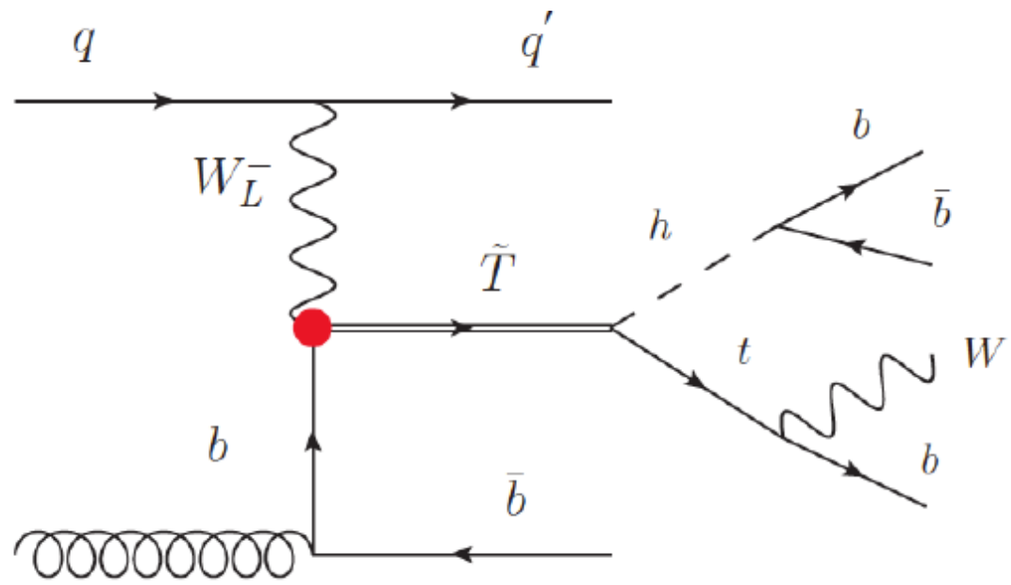
VLQ Top Partner Single-EW Production



$$(\tilde{T} \to (h \to bb)t)b + X$$

$$pp \to l^{\pm} + n\,jets + \not{E}_T$$



Currently:

Model based on PRD 86, 075017 (2012), arXiv: 1207.0830 (NV) and implemented in MG5 processed through Snowmass detector simulation.

T_s masses 0.5 - 3.0 TeV. Using no pileup samples.

Background sample is generated at 14 TeV and rescaled to 33 TeV.

Samples are produced inclusively, decayed with Pythia 6.

Select for single lepton (e/μ) top final state, with h→bb.

Use jet mass to select higgs decay, study jet mass to veto additional tops.

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Selections and Backgrounds

Object level selection:

Jets reconstructed with anti-k_T algorithm with r=0.5 requiring pT>30 GeV, $|\eta| < 5$, and isolated (overlapping jets removed with highest pT jet kept).

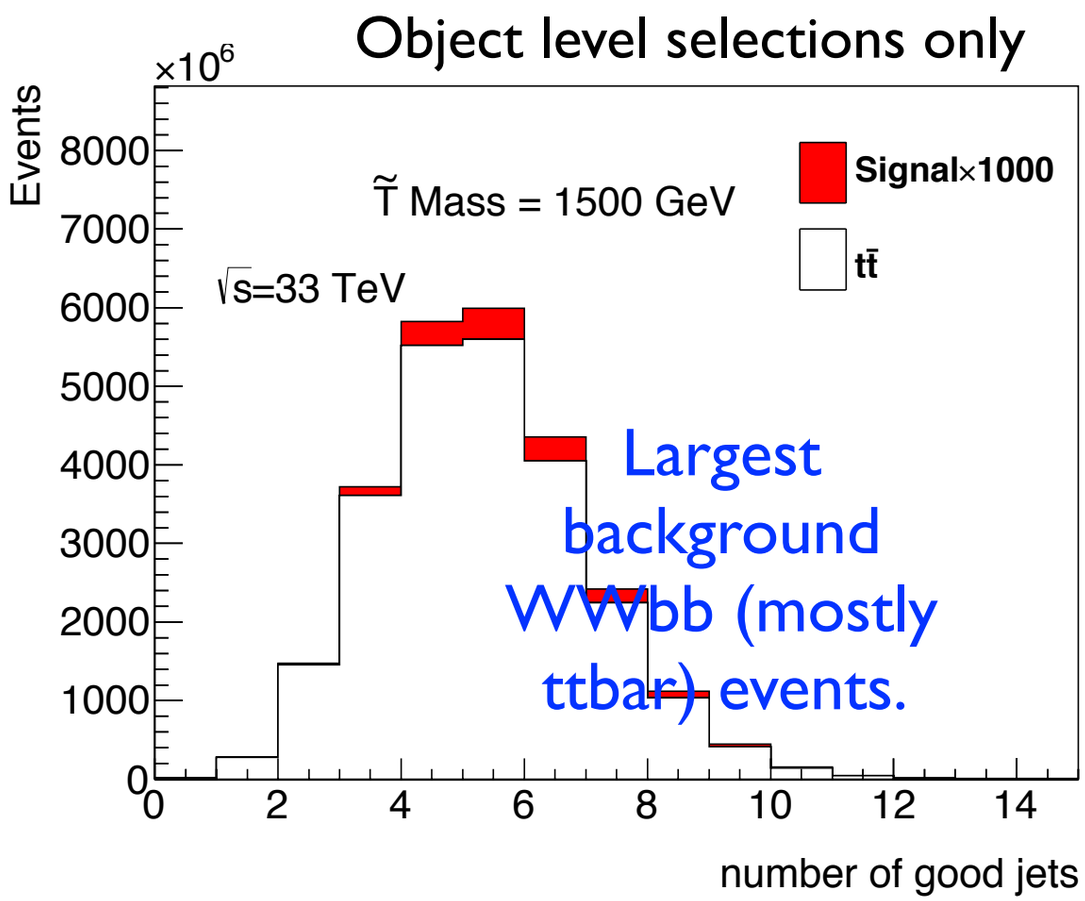
Electron or muon candidates required to have pT> 30 GeV, $|\eta| < 2.5$, isolated from jets with radius of 0.5.

Missing E_T > 30 GeV.

Event selection:

N jets > 3, with > 1 tight b-tags.

One and only one lepton in the event.



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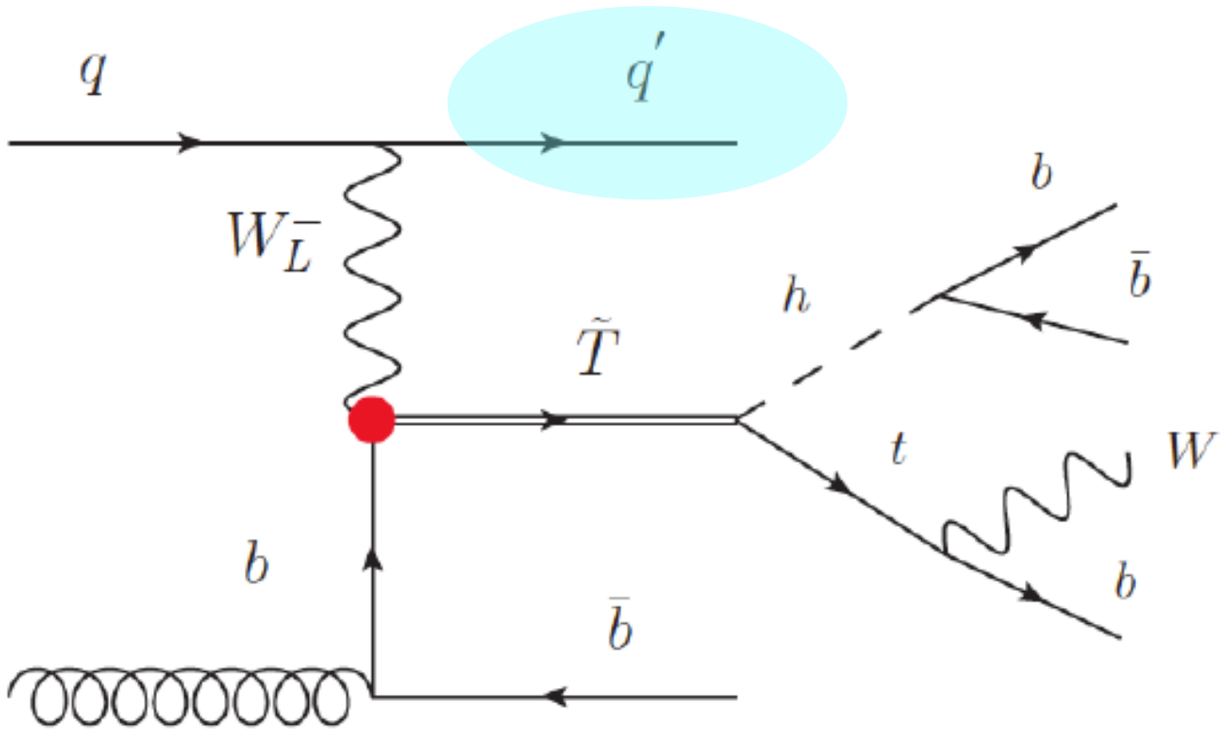
Selection

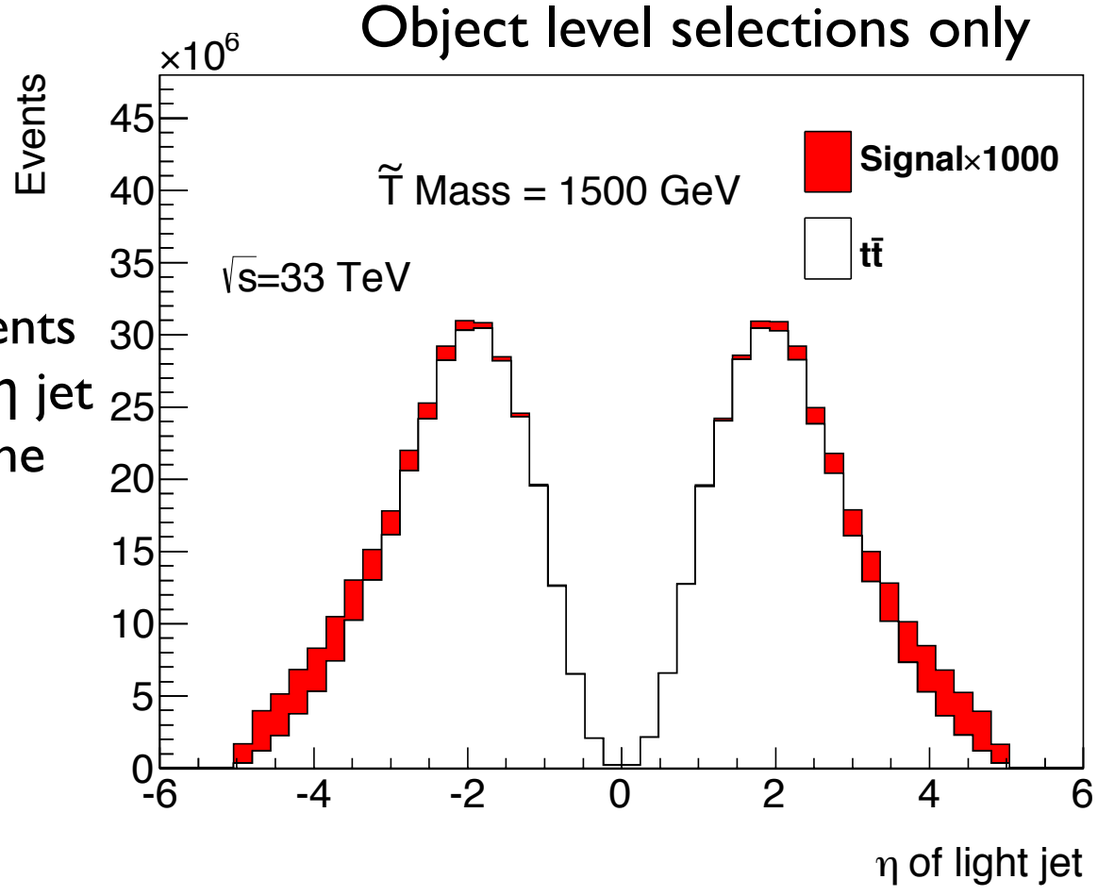
Event selection strategy:

1) Tag highest η jet as light jet.
(and cut at |η| > 2.5)



Object level selections only

In signal events the highest η jet ~70% of the time.



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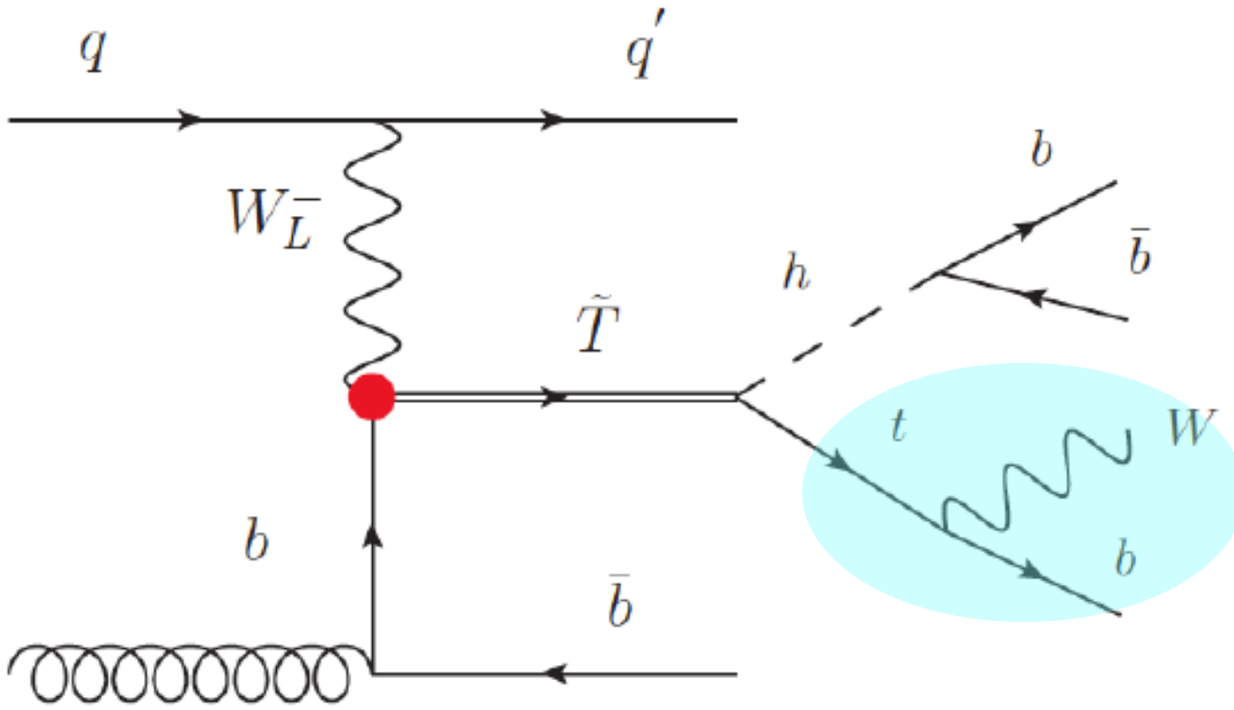
Selection

Event selection strategy:

1) Tag highest η jet as light jet.

2) Reconstruct neutrino using W mass constraint. Then select Wj jet combination with an invariant mass closest to M(top) to identify the top candidate. Require 160 GeV < M(Wj) < 190 GeV.



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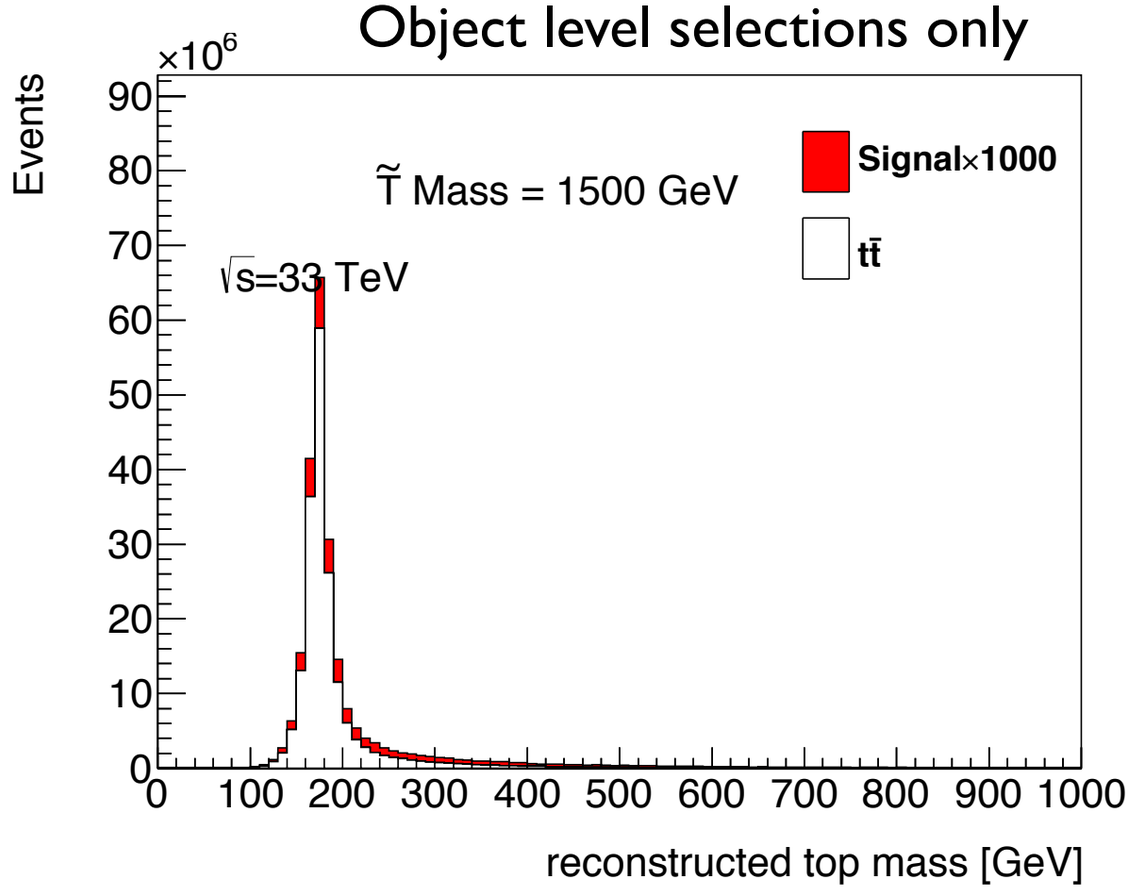

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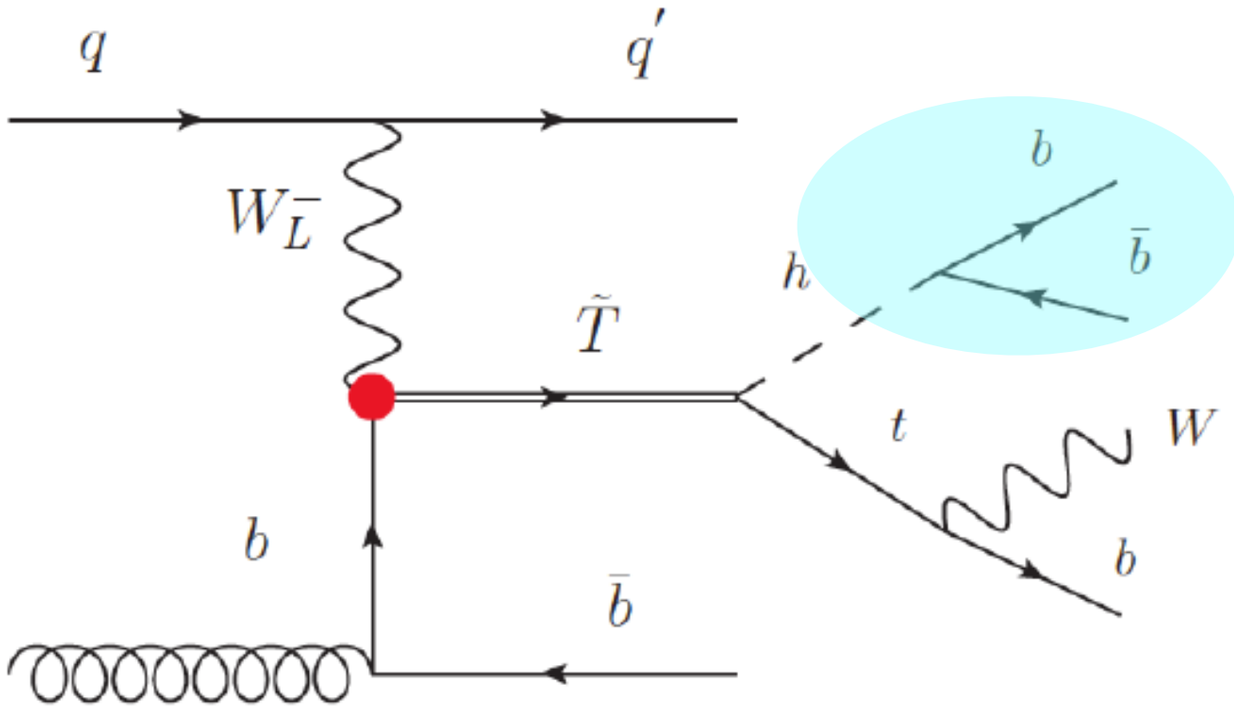
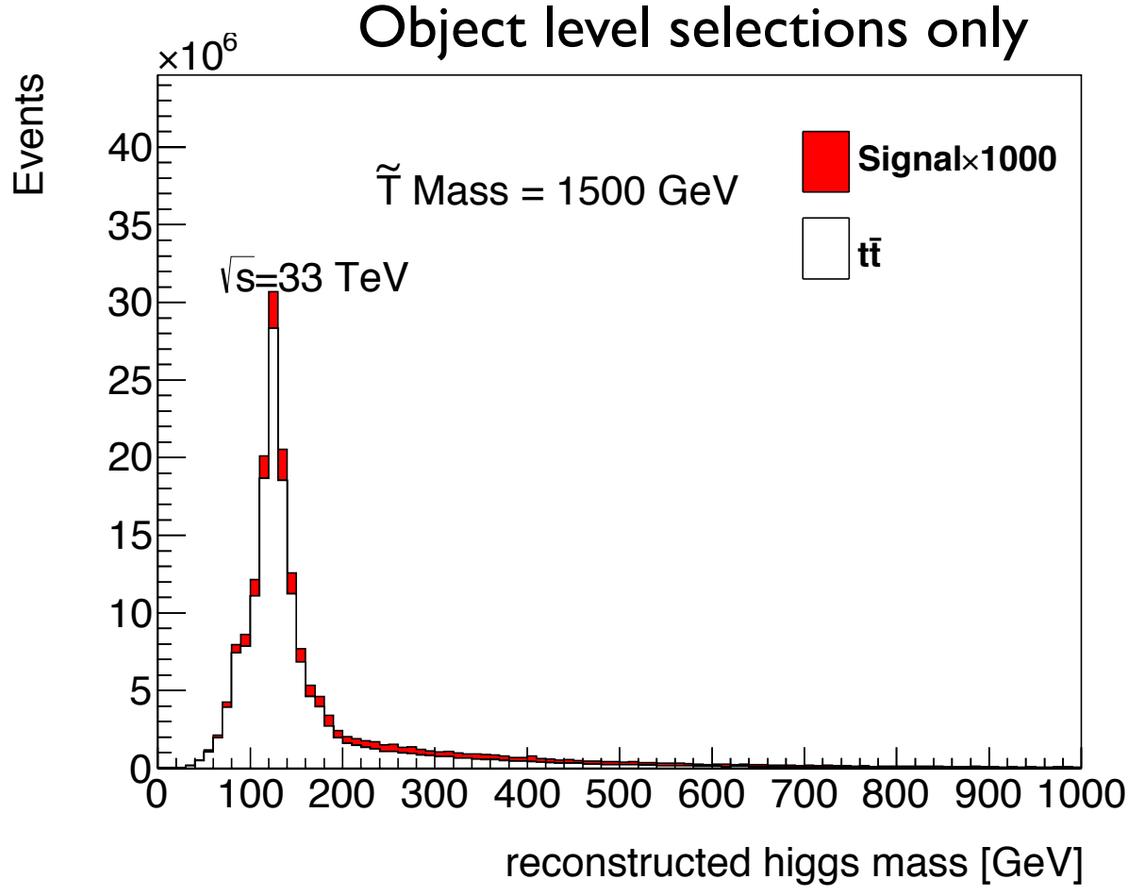
3) Select jet with jet mass closest to higgs mass (boosted) to identify the higgs candidate.





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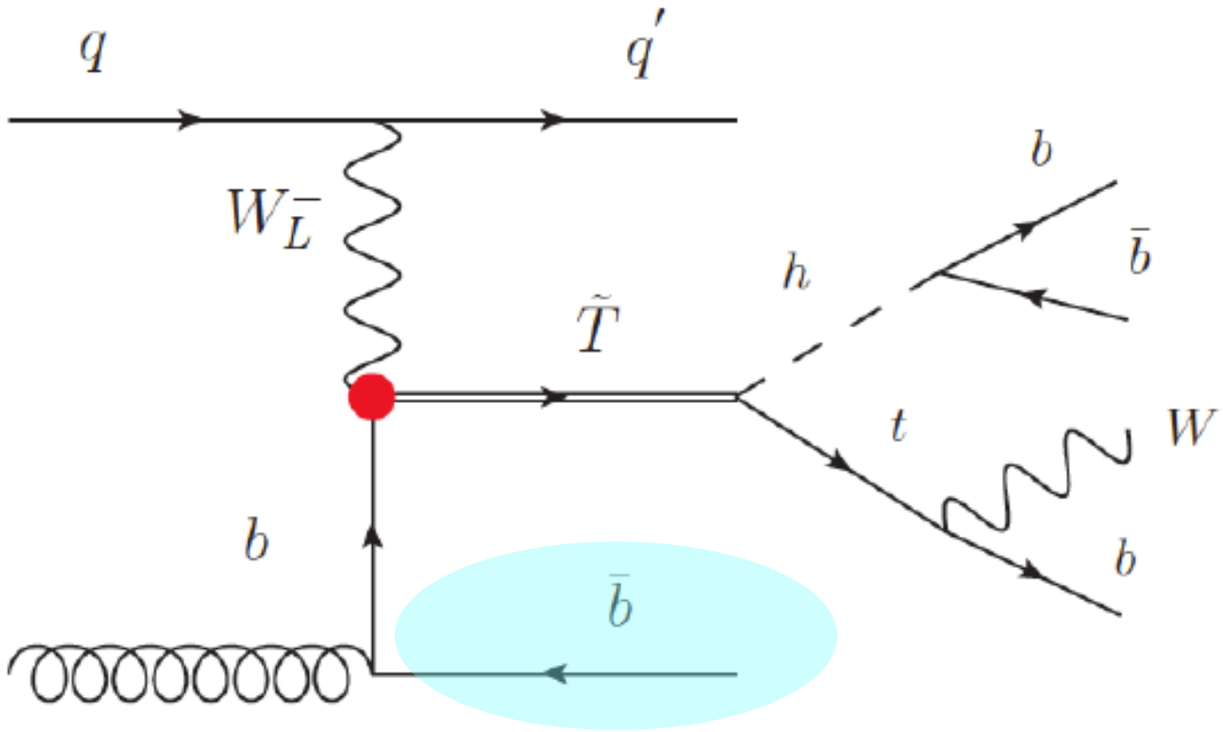

4) Remaining, highest η jet selected as b jet from Tbj.

5) The top partner is reconstructed as the sum of the top and higgs four-vectors.

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Final selections

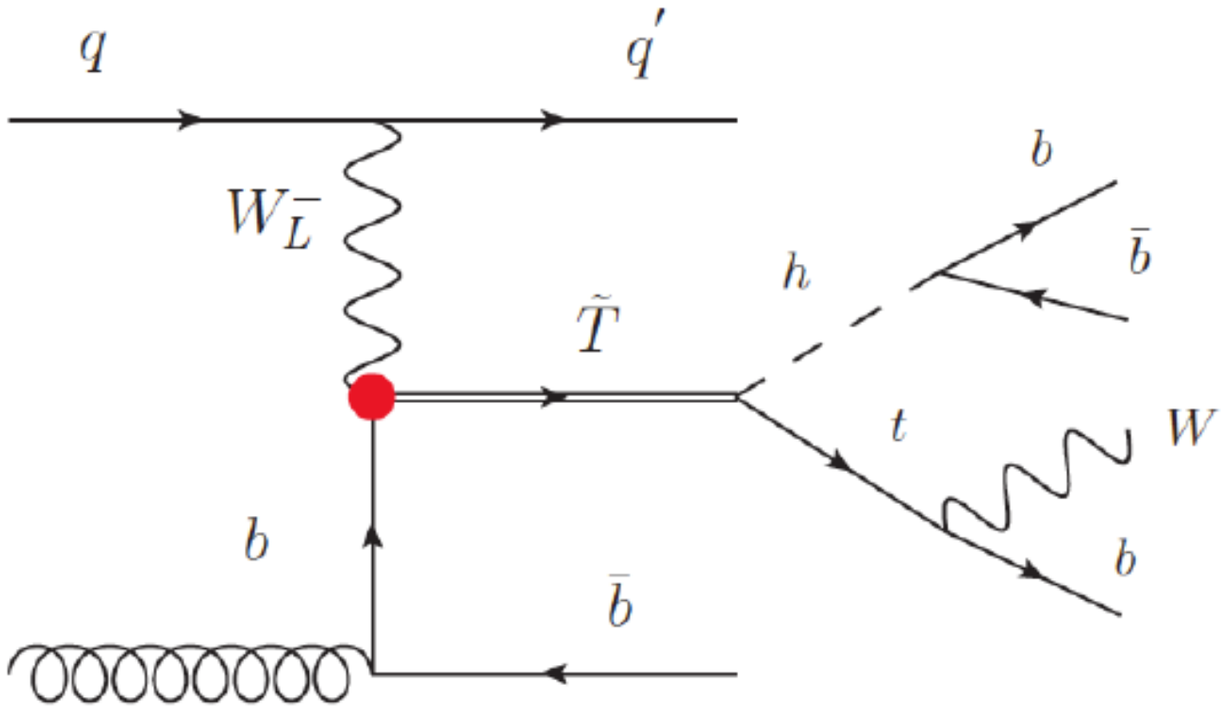
Reconstructed object selections (in progress):

Select events with pT of higgs candidates (>300 GeV) and top candidates (>500 GeV).

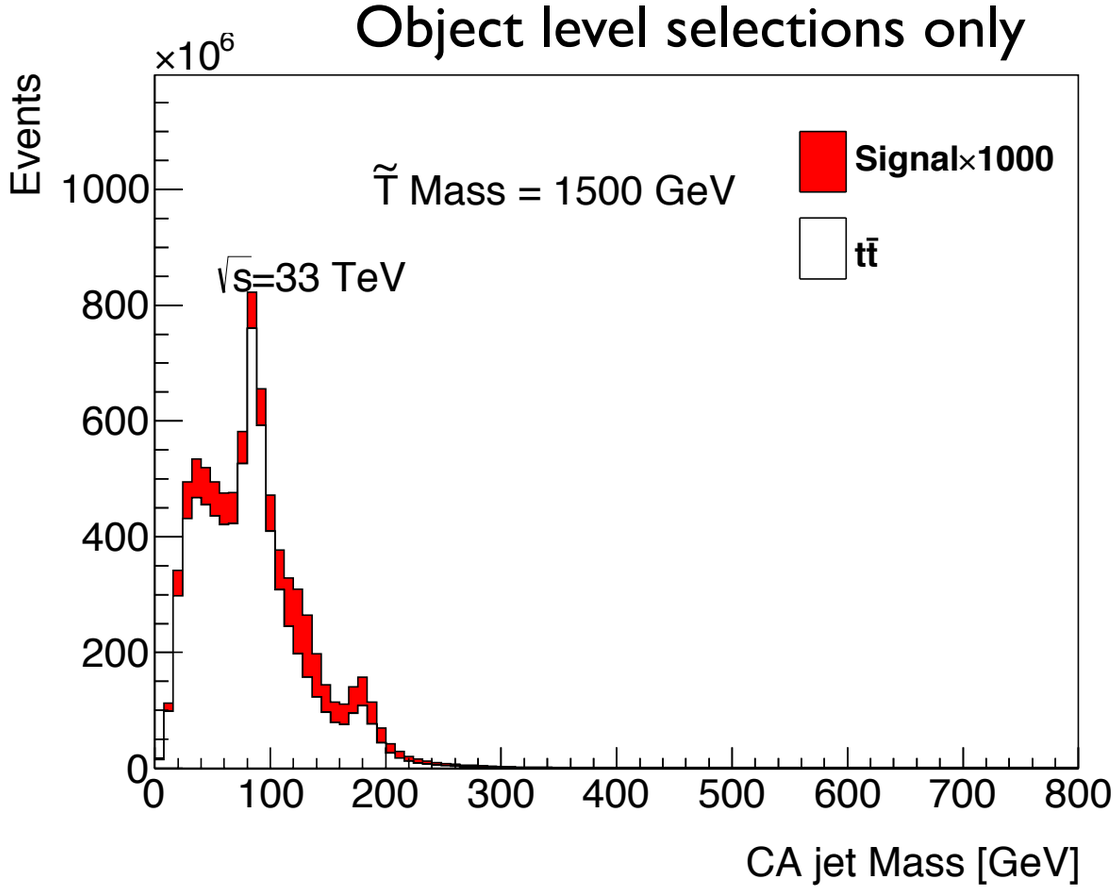
Veto on events with large-R jets with jet mass near top mass (removes hadronic tops from ttbar background).

Require Δ(R) between light jet and b jet and Δ(R) between higgs candidate and b jet to be large (>3.0 and >5.0).

Minimum HT selection tuned for specific top partner masses.



Object level selections only



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Overview

Currently:

Single top partner production searches investigate a well motivated and experimentally interesting region.

Procedure appears viable. Fine tuning for the selection and statistical machinery for significance/limit setting are in progress.

To come:

Anticipating HT-binned 33 TeV sample for additional tuning and limit setting (this week).

Generate signal samples at 14 TeV, for HL-LHC analysis.