

The Matrix Element Method and $t\bar{t}H$ identification

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- ATLAS.
- Working with the Matrix Element Method.
- Determines likelihoods of events based on measured momenta and theoretical model.
- Have been separating $t\bar{t}H$ from $t\bar{t}b\bar{b}$ events.
- Now searching for vector-like quarks.

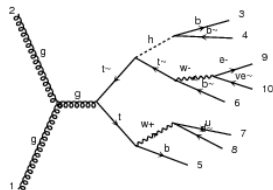


Figure: Example of $t\bar{t}H$.

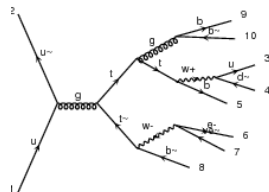


Figure: Example of $t\bar{t}b\bar{b}$.

The Matrix Element Method

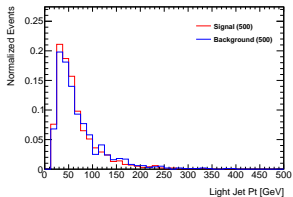


Figure: Light jet momentum.

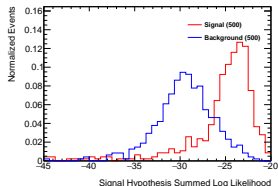


Figure: Signal hypothesis likelihood for $m_H = 125$ GeV.

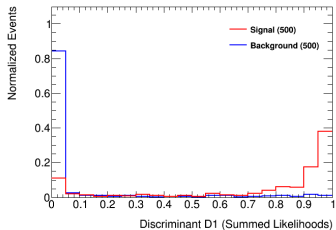


Figure: Discriminant values for $m_H = 125$ GeV.

- Even with Gaussian smearing to simulate detector resolution, signal and background can be separated.

Estimating Unknown Parameters

- However, I am currently unable to use the smeared data to estimate parameter values.

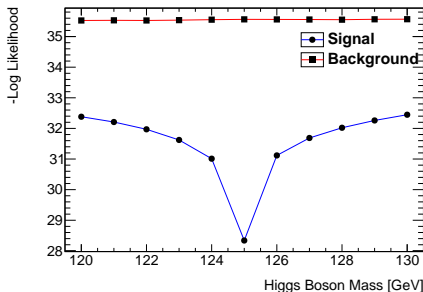


Figure: Unsmearred data.

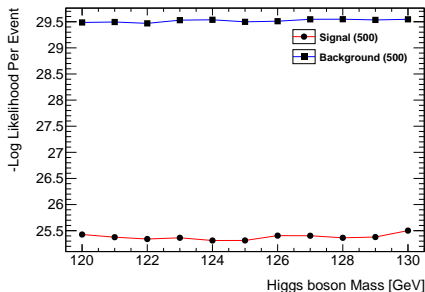


Figure: Smeared data.

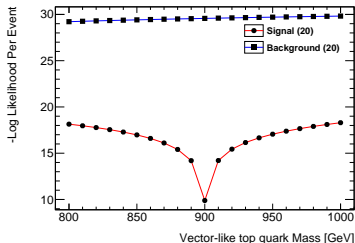


Figure: Preliminary vector-like quark tests.

- Automated plotter in ROOT for the output of MEMTool (done).
- Creation of script that optimizes automatically generated matrix element calculation code (done).
- Non-standard-model modifications to the MEMTool code to support vector quarks (in progress).
- Application of modified tools to Monte Carlo data to test effectiveness of MEM.