$H{-}{>}WW^*{-}{>}e\nu\mu\nu$

Dustin Gier
Advisor: Dr. Michael Strauss

- Searching for two forms of Higgs Production
  - Gluon-Gluon fusion (ggF)
  - Vector Boson fusion (VBF)
  - Both decay to 2 W bosons, which decay to $e\nu_\mu\nu$
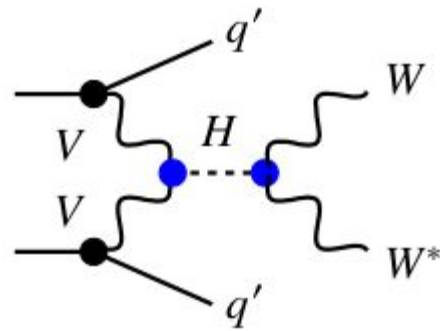- Measure the cross-section (probability measurement) and branching fraction, and check against Standard Model (SM) predictions
  - Provide evidence that this particle is actually the Higgs
- Need to deal with the high background of the data
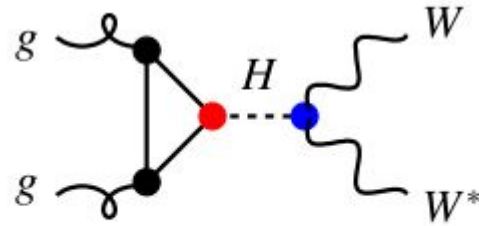

ggF production

VBF production

Investigation of Analysis Programs

Root:

- Simply enough to be used by non-experts
- Can handle data that is output in a specific way from CAF

Central Analysis Framework (CAF):

- High learning curve
- More flexible, better designed to handle Higgs research

- Investigate viability of CAF
  - Updates to CAF which require less specialization
  - Is running Root analysis on CAF data reasonably doable?
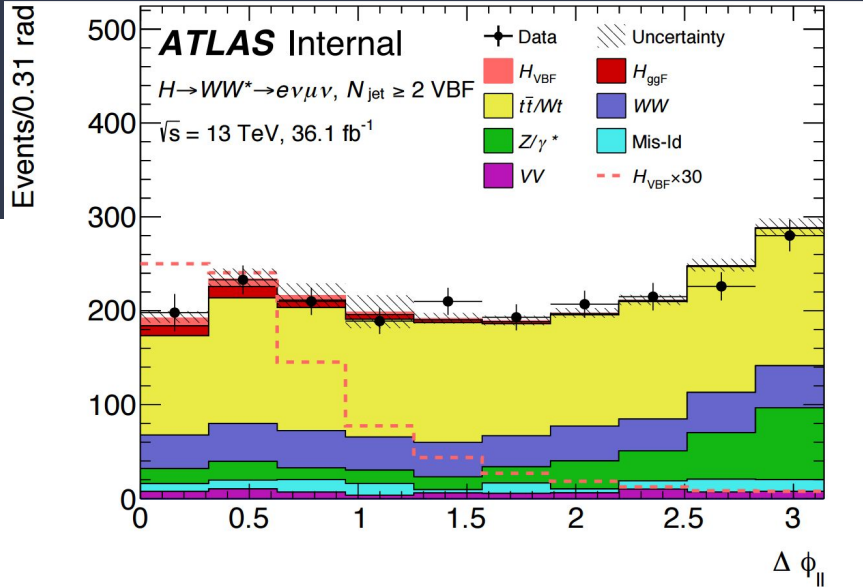
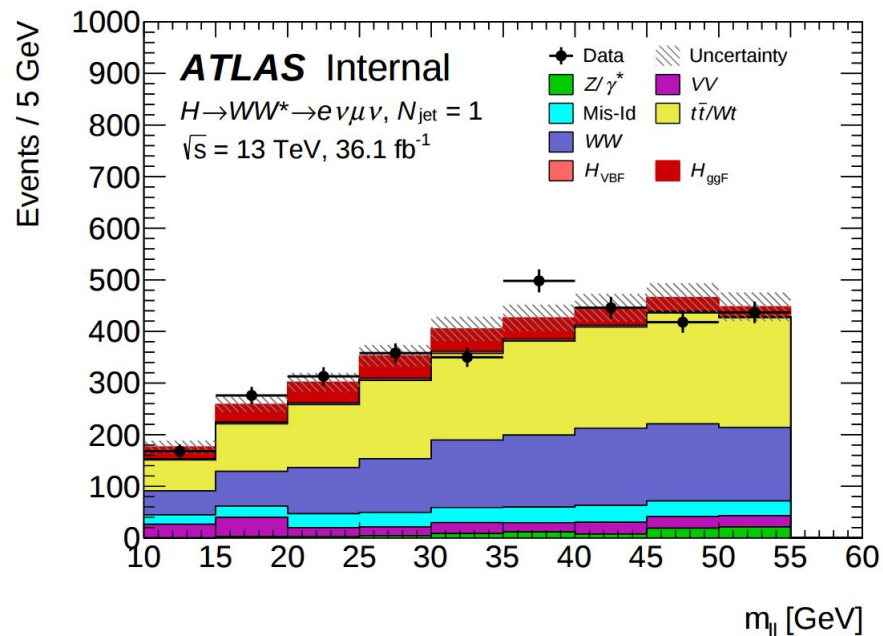# Cut Bases

- Cut away data where background is high and signal is low
- Mostly done with ggF, which occurs 90% of the time
  - Enough signal that we can afford to cut some
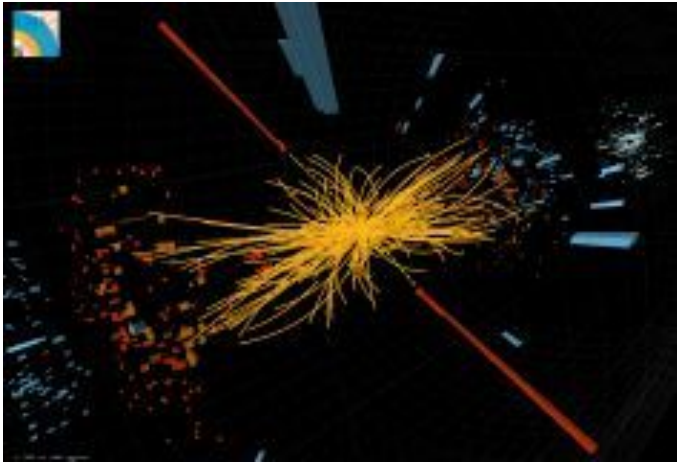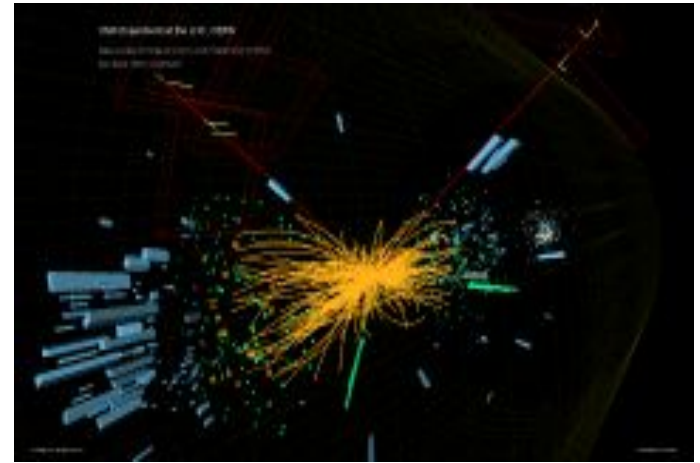 - Control regions (CR) to ensure data can still be fit

*Not for public distribution

Multivariate Analysis

- Use neural networks and boosted decision trees to identify if the event we're looking for occurred in a specific sample
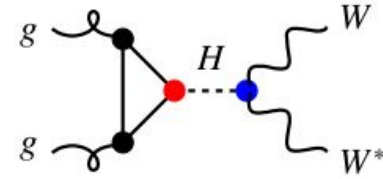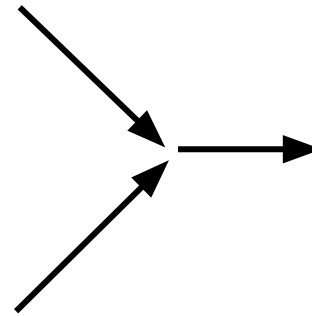- Mostly done with VBF, which occurs only 10% of the time

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Taylor, Lucas. "CMS search for the Standard Model Higgs Boson in LHC data from 2010 and 2011." December 13th, 2011. Available at cms.cern.web.ch.
Taylor, Lucas. "New CMS Higgs Search Results for the Lepton Photon 2011 Conference." August 22nd, 2011. Available at cms.cern.web.ch.

- Cutting bases removes some signal
- Apply multivariate analysis techniques to ggF so as to preserve all the signal

ggF production

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Peter Higgs, Discoverer of the Higgs Boson

"Peter Higgs - Facts". *Nobelprize.org*. Nobel Media AB 2014. Web. 7 Jun 2018. <http://www.nobelprize.org/nobel_prizes/physics/laureates/2013/higgs-facts.html>

Questions?