# Run II Preparation Work in ATLAS HGamma Group

Kaicheng Li, Magda Chelstowska

# Terminology

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- HGamma Group
  - ***Higgs***$\rightarrow\gamma\gamma$
  - ***Higgs***$\rightarrow$***Z***$\gamma$

# ATLAS HGam Run II Preparation

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  - Photon Reconstruction
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- Optimization Studies
  - Early Discoveries
  - Long Term Searches

# My Contributions

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- Derivation & Analysis Framework Development
  - General Classification Tool
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- Optimization Studies
  - ttH(H→γγ) and tH(H→γγ) (with Jared Vasquez and everyone in the team)

# General Classification Tool

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    - Distinctive Properties of different production modes

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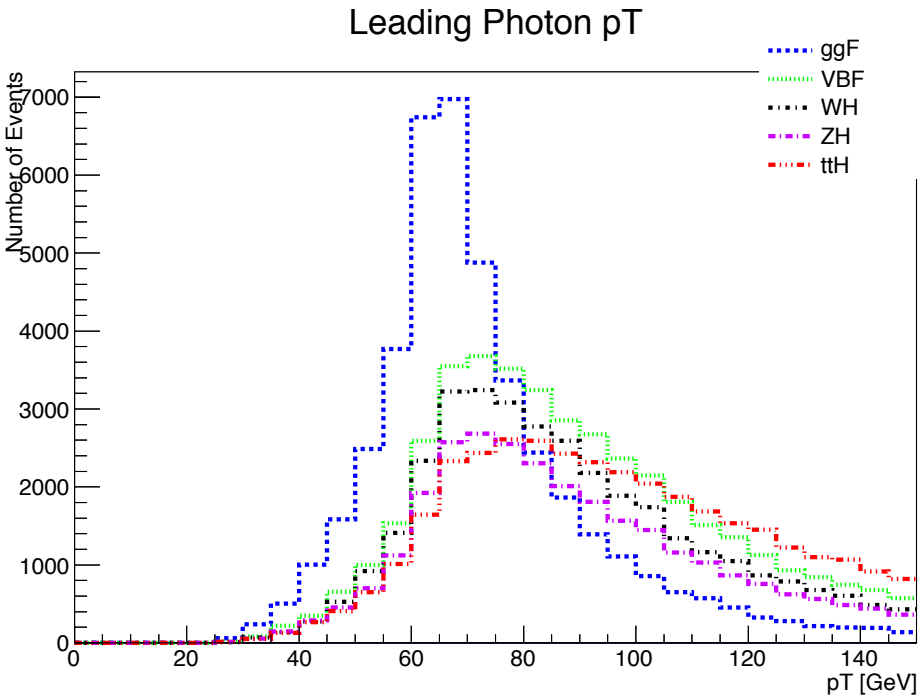
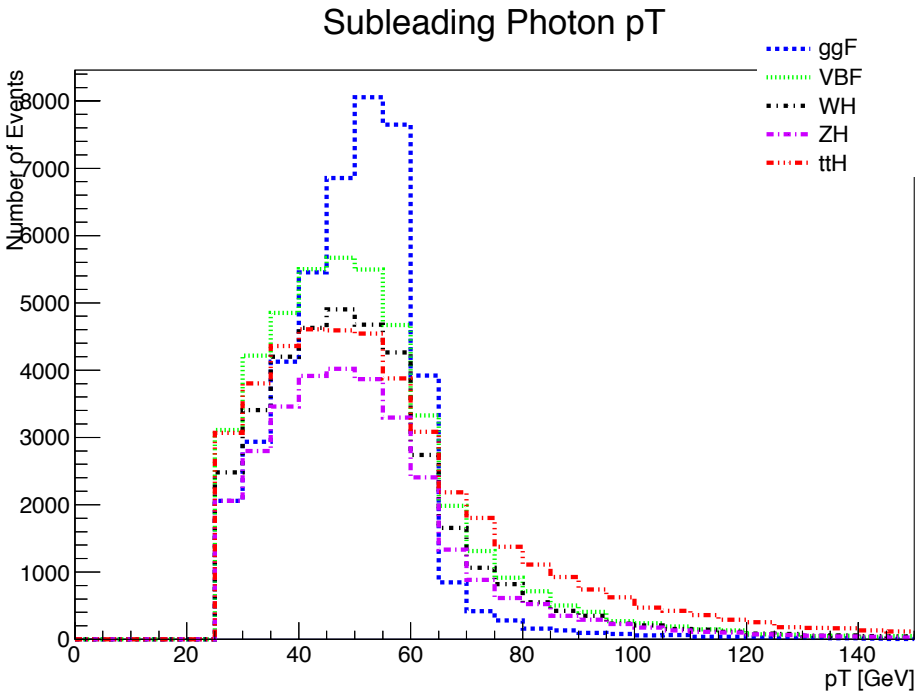
  - Generate various histograms
    - General Properties of tagged events
    - Distinctive Properties of different production modes
  - **Compare between Monte Carlo sample and data**

# Event General Properties



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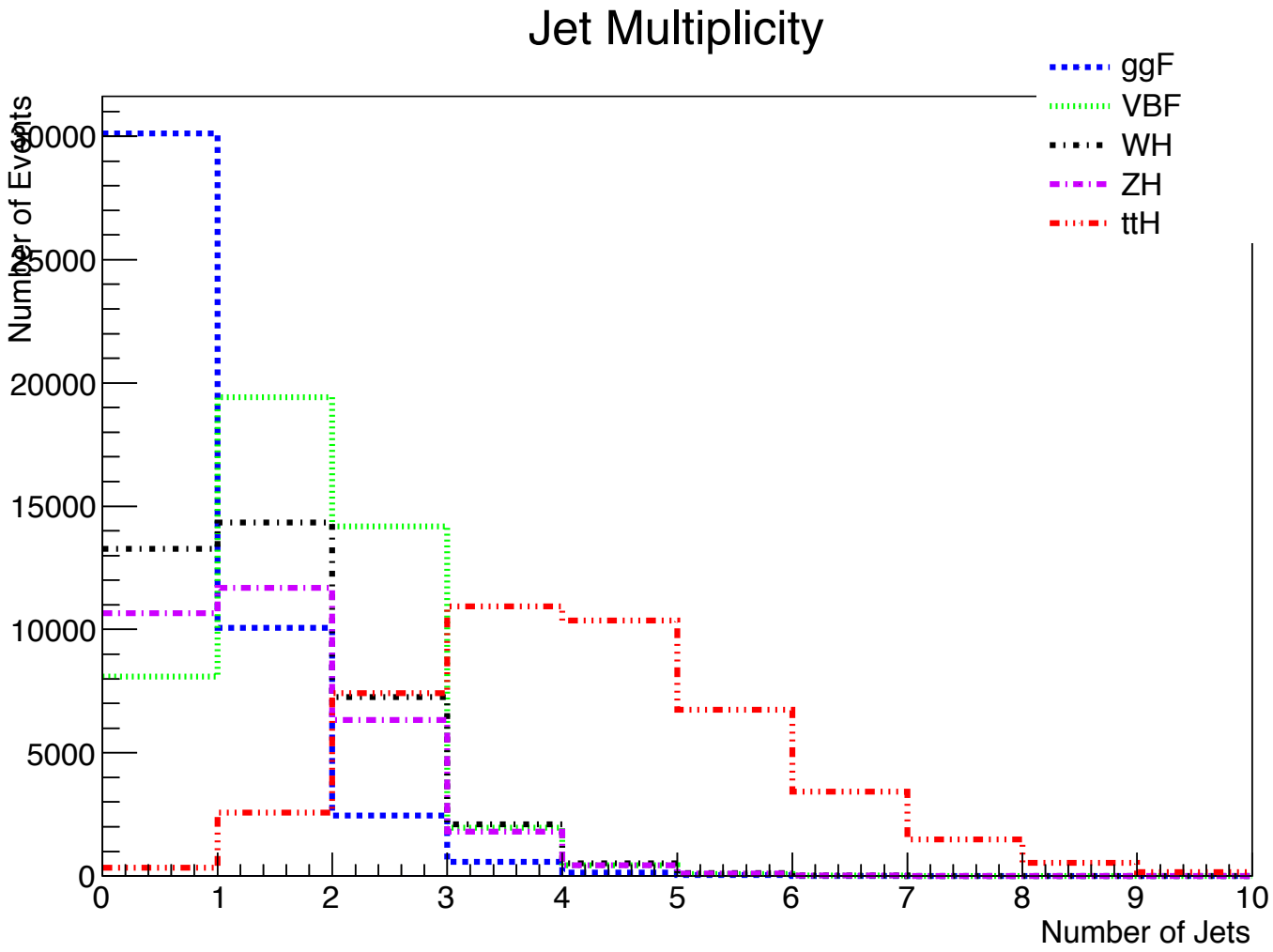
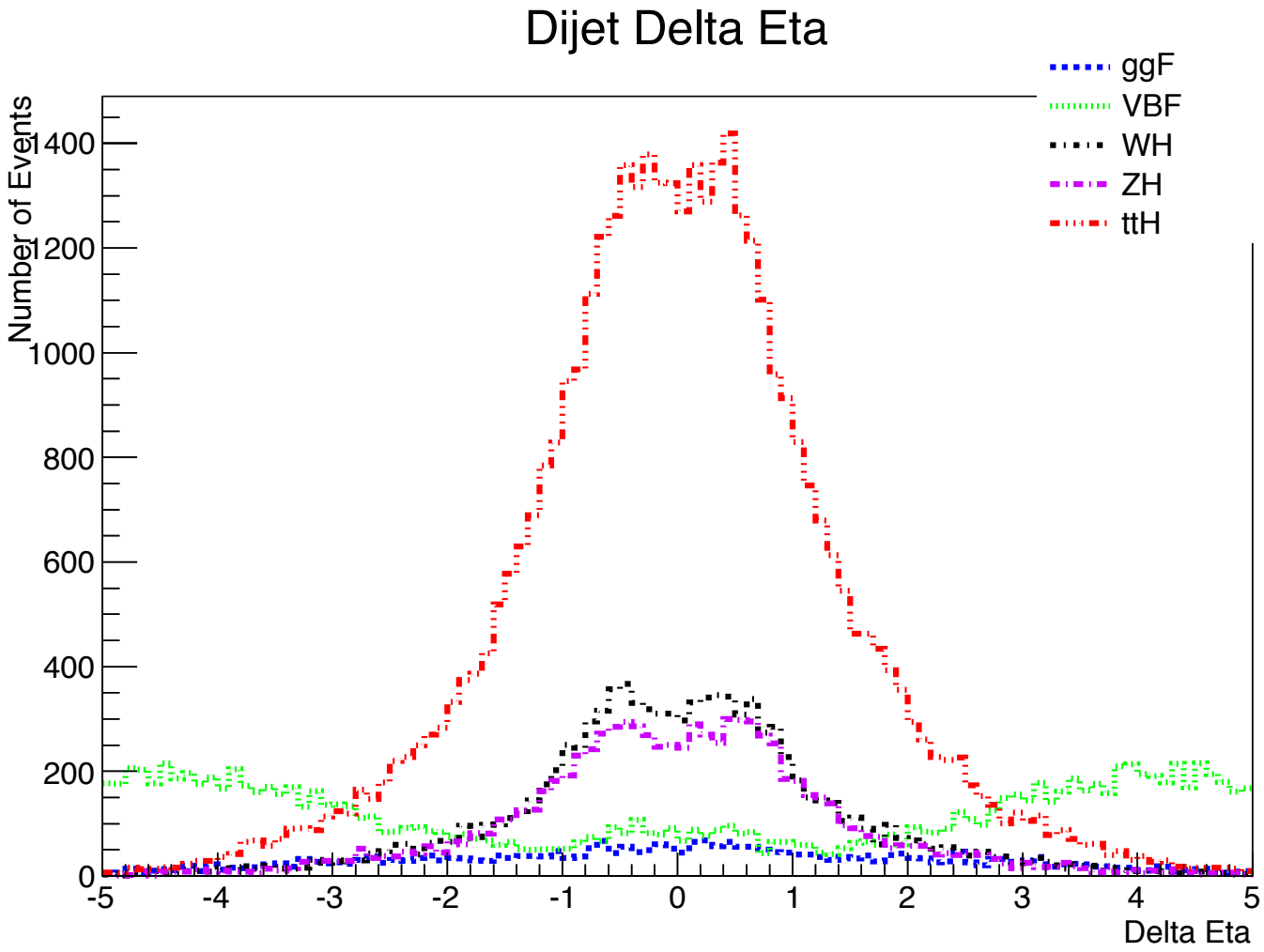


# Production Mode Properties



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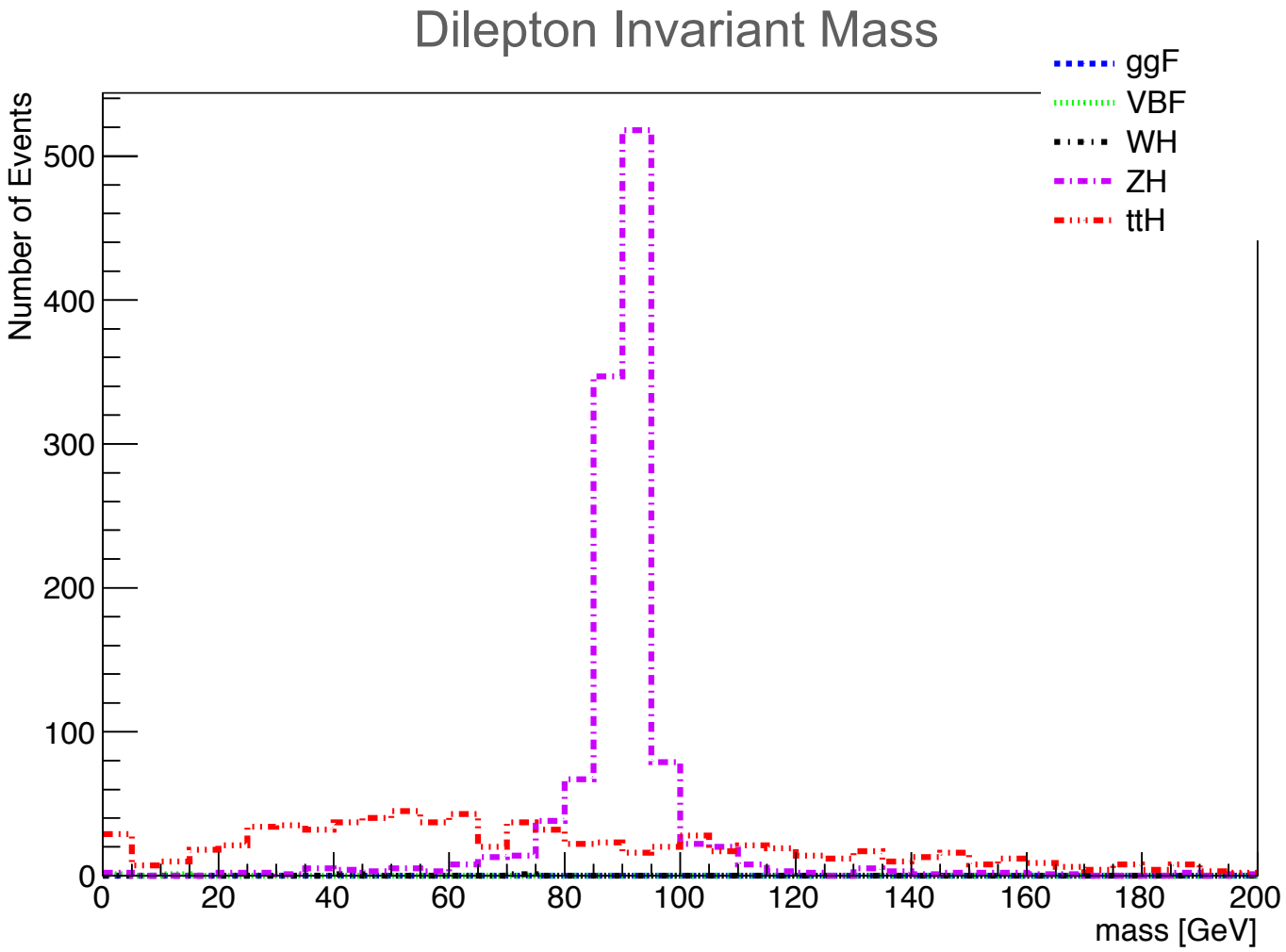

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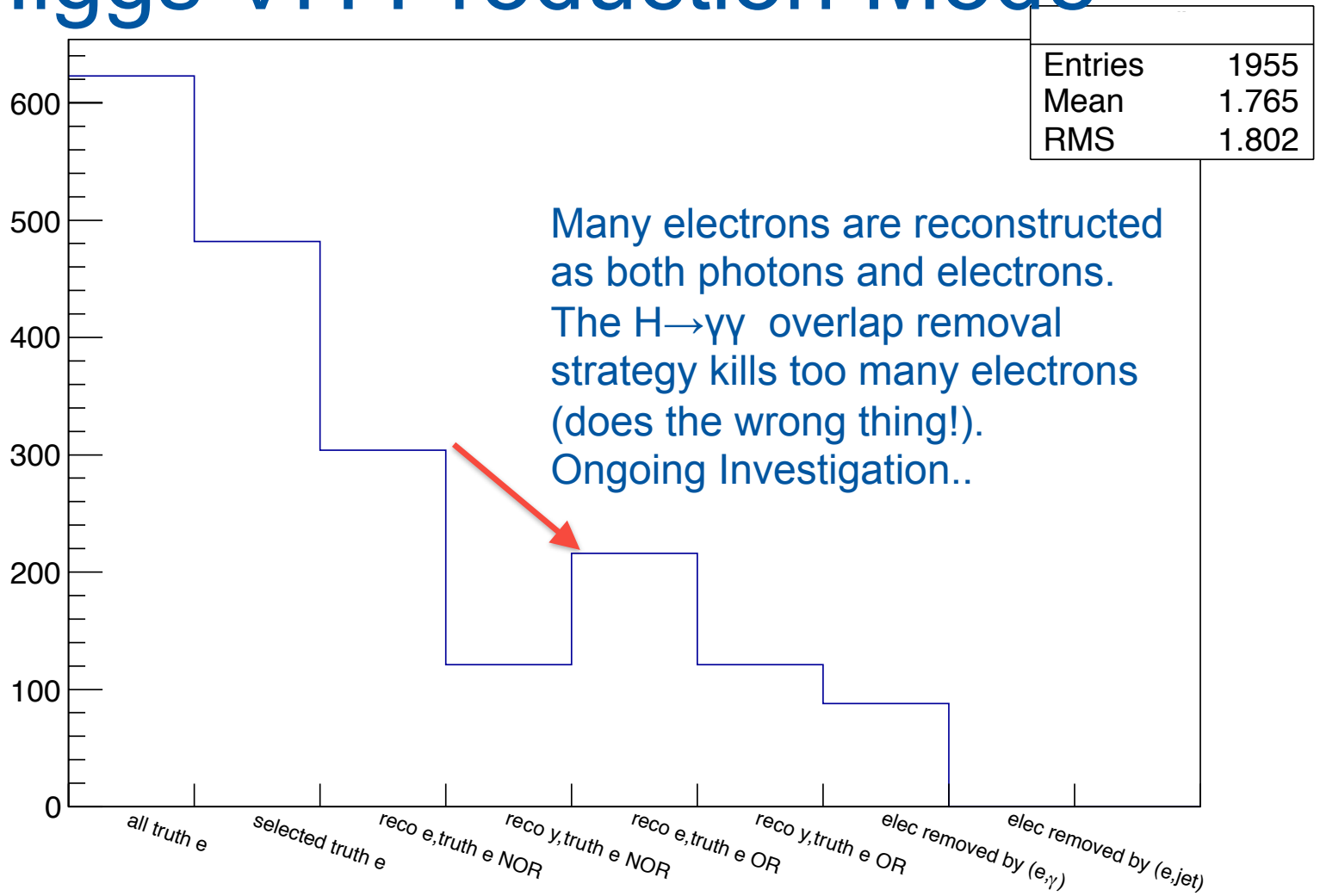
  - Investigated the official overlap removal package
  - Developed standalone codes based on Hγγ overlap removal strategy (SVN Link)
  - Current testing overlap removal for VH production mode and Zγ decay mode of the Higgs

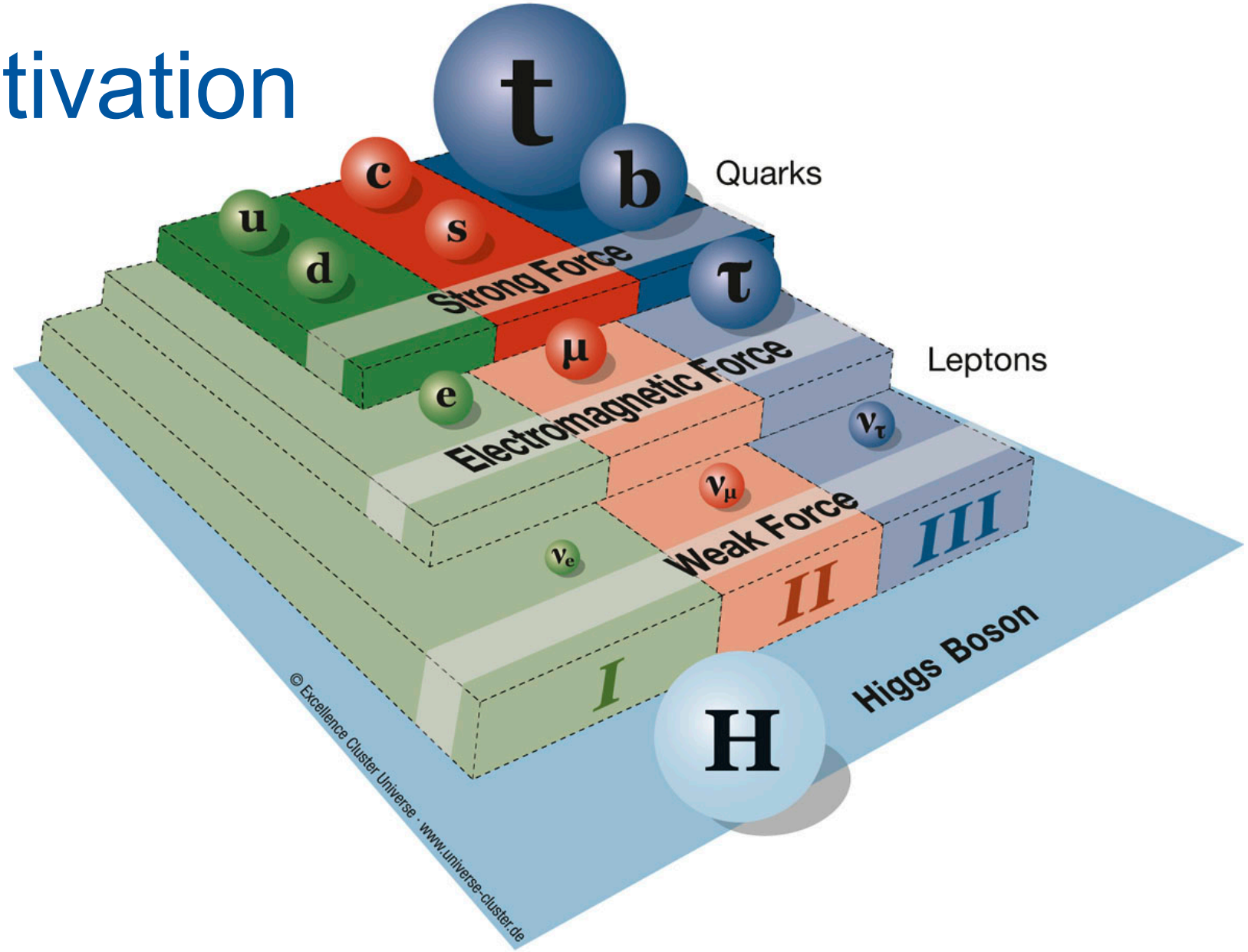
# Overlap Removal Study for Higgs VH Production Mode




Many electrons are reconstructed as both photons and electrons. The H→γγ overlap removal strategy kills too many electrons (does the wrong thing!). Ongoing Investigation..

# Optimization Studies for ttH(H→γγ) and tH(H→γγ)

# Motivation


t
b
c
s
u
d
Quarks
Strong Force
τ
μ
e
Electromagnetic Force
Leptons
$\nu_\tau$
$\nu_\mu$
Weak Force
III
$\nu_e$
II
I
H
Higgs Boson
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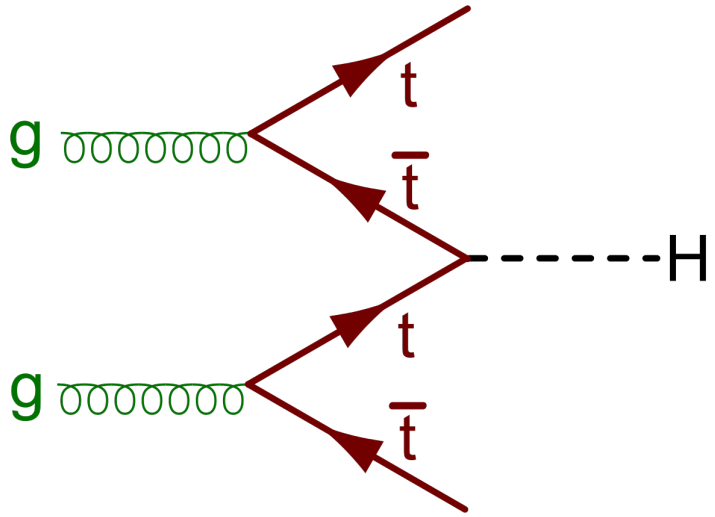
# Motivation

- ttH



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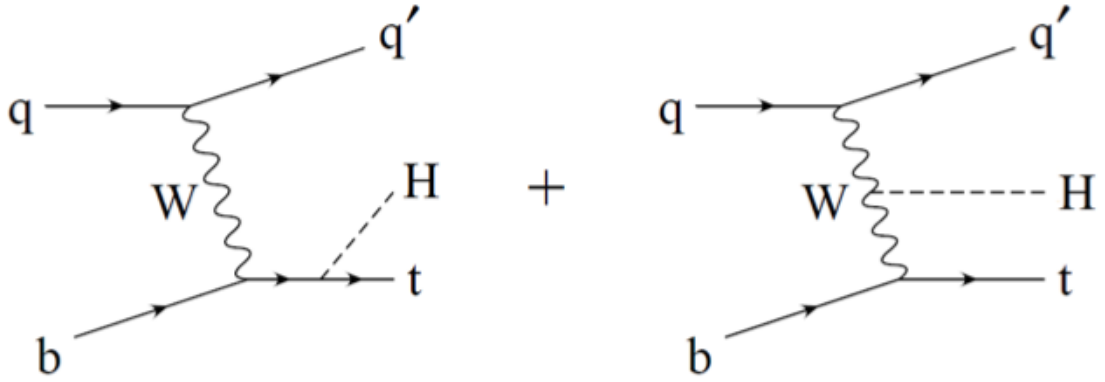

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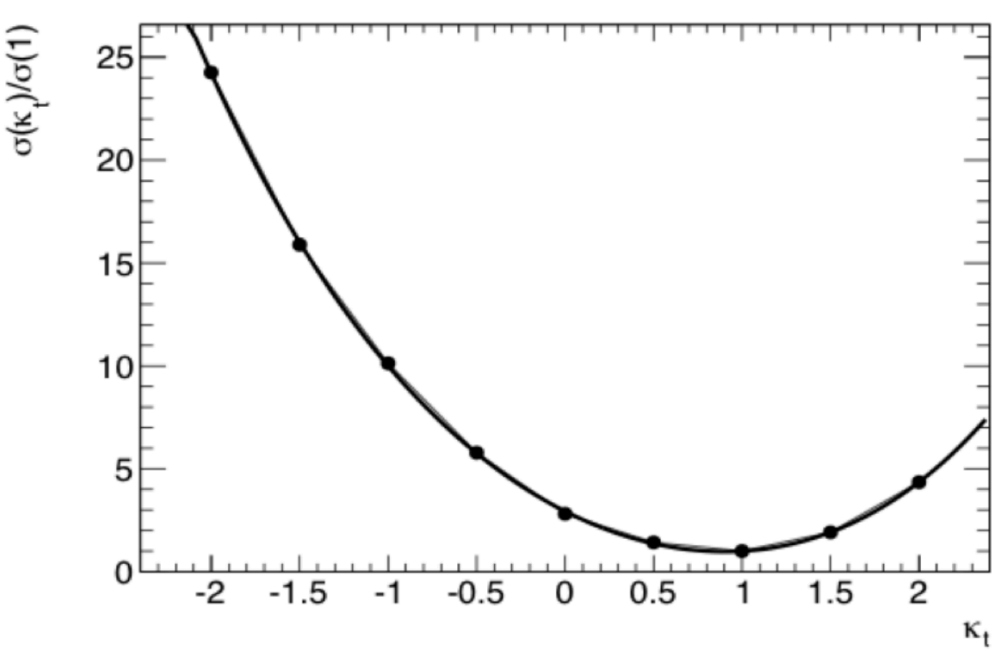


| X Section (pb) | **Run I** | **Run II** |
|---|---|---|
| ttH | 0.13 | 0.5027 |
| tHq $k_t$=1 | 0.018 | 0.0882 |
| tHq $k_t$=-1 | 0.197 | 0.98 |

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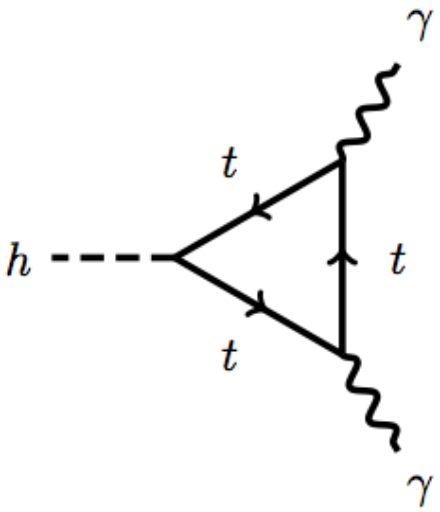
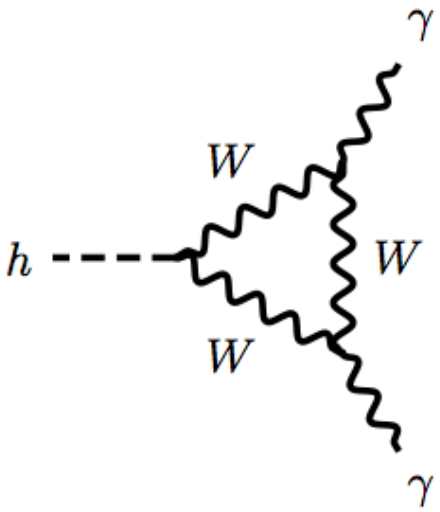
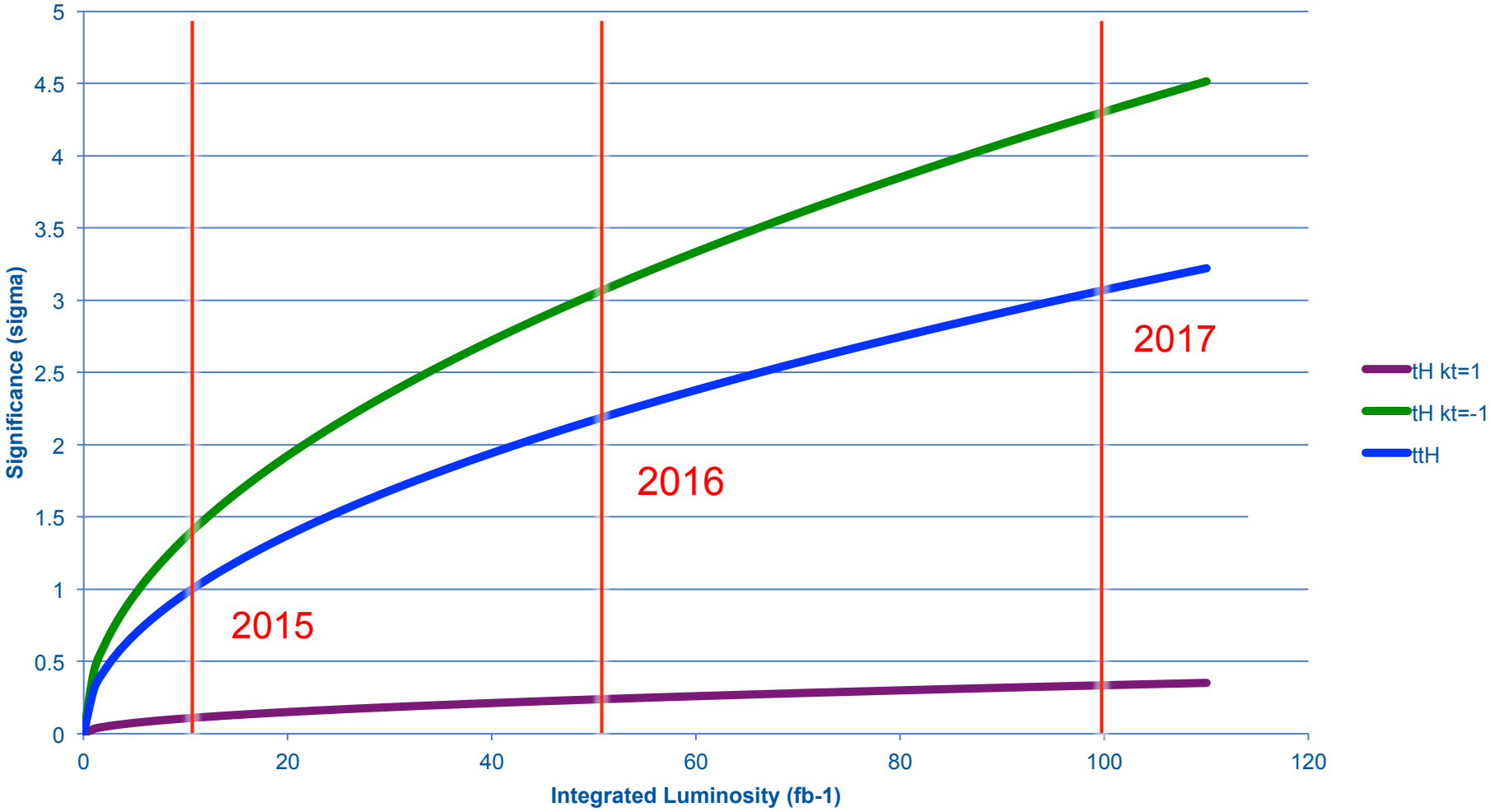
- tH
- ***H→γγ***



# Run II Sensitivity Projection



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  - Sensitivity Studies on ttH(***H→γγ***) and ttH(***H→γγ***)
- Ongoing
  - ttH Leptonic Channel Selection Re-Optimization
  - signal separation between ttH and tH (in May)

# Acknowledgements