

# Searching for Ultra Rare Processes Using the Large Hadron Collider

$$t \rightarrow q\gamma$$

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# Overview

## The Large Hadron Collider

- The Standard Model of Particle Physics

- LHC And ATLAS

- Picking Through The Data

## Search For Ultra Rare Decays

- Problems with the Standard Model

- Machine Learning

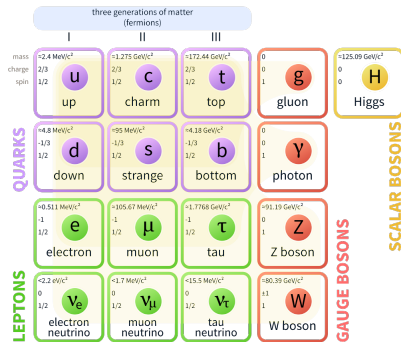
## Outlook and Conclusions

# The Standard Model of Particle Physics

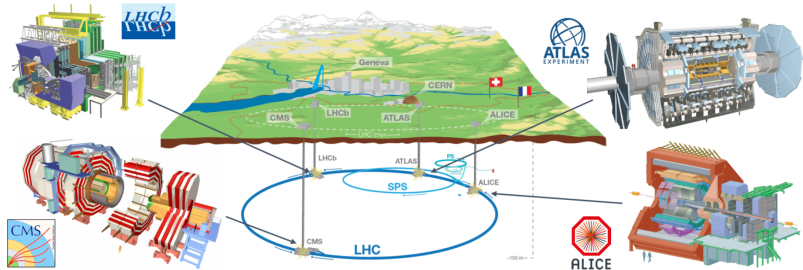
- Newest Addition: Higgs Boson  
- 2012



## Standard Model of Elementary Particles

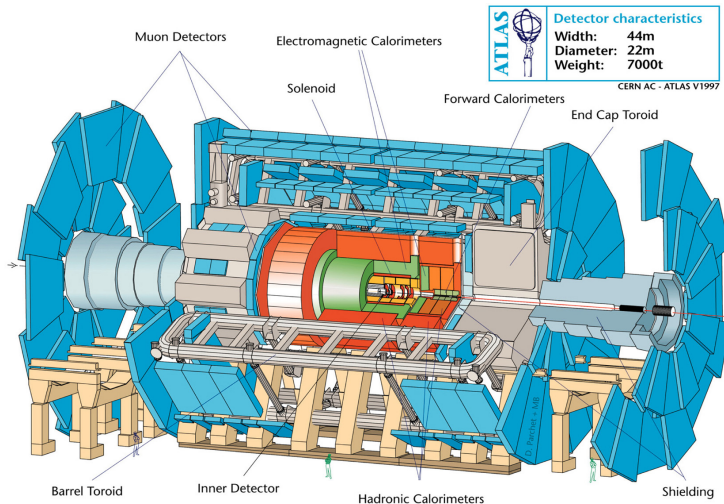


# The Large Hadron Collider

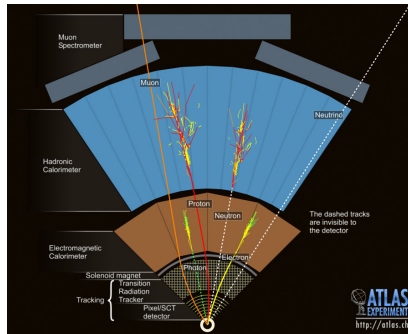


- ▶ 27km ring beneath Franco-Swiss Border
- ▶ 4 Major Experiments
- ▶ Collides protons at  $\sqrt{s} = 13\text{TeV}$
- ▶ Over 11 Quadrillion events produced within the ATLAS detector so far

# The ATLAS Detector

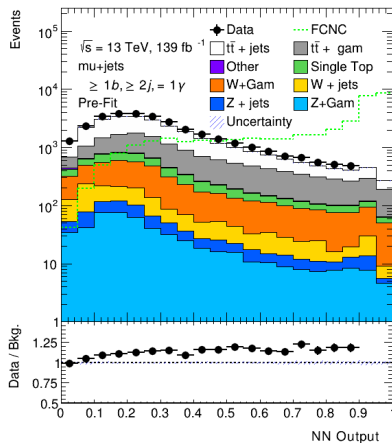
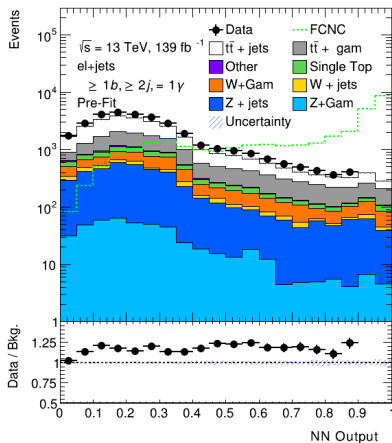


# Particles in ATLAS



# Standard Model Problems

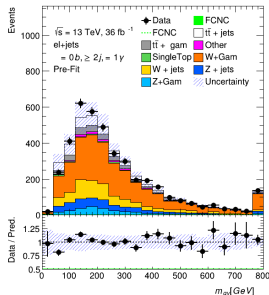
# Analysis Neural Network Outputs



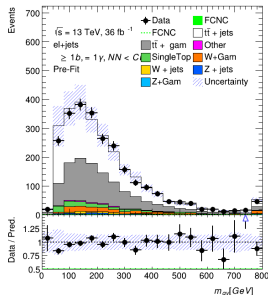


# Initial Output Plots

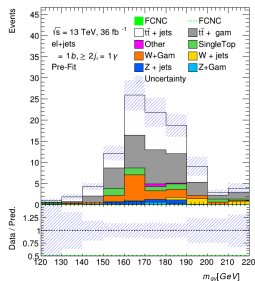
## ► Validation Region 1



## ► Validation Region 2



## ► Signal Region



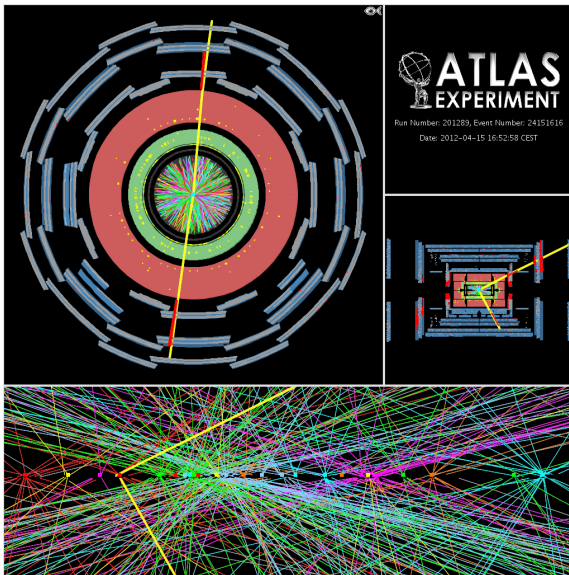
# Outlook



▶ Questions?

# Backup

# Particles in ATLAS



# FCNC Diagrams

