



Measuring the Efficiency of Boosted Higgs to Tau-Tau Level 1 Trigger

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Abstract

Abstract: Identifying tau leptons produced in the Large Hadron Collider's (LHC) proton- proton collisions is key to the Compact Muon Solenoid (CMS) experiment's goals of discovering new physics and precisely measuring Standard Model (SM) processes, such as the recently discovered SM Higgs Boson decay to a tau-antitau pair. However, distinguishing taus from large sources of background is challenging due to the tau's complex and numerous decay signatures. This task is performed at CMS by algorithms in the two-tiered Trigger system, which consists of a hardware-based Level 1 trigger followed by a software- based High-Level Trigger. Using a particle flow algorithm, tau leptons can be reconstructed and examined.



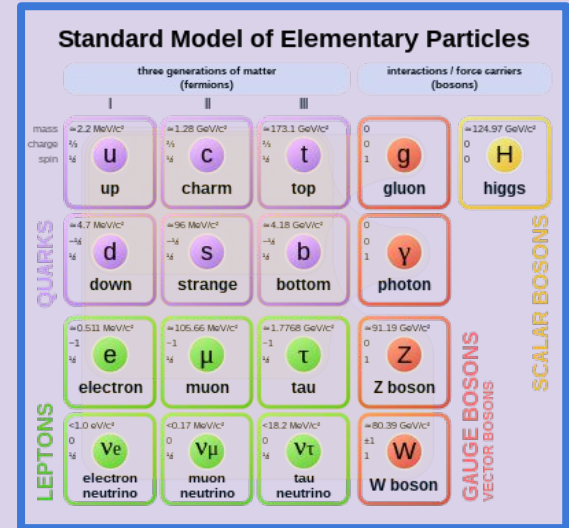
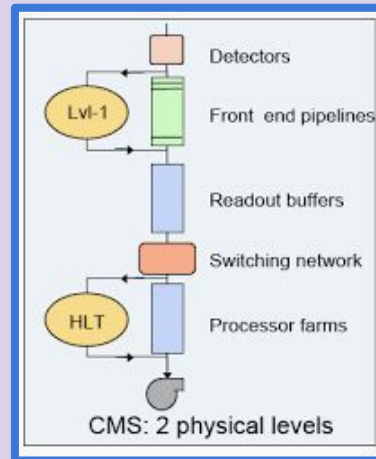
Overview

- Introduction
- Higgs
- Tau Leptons and Reconstruction
- Create control plots
- Measure efficiency and rate of a boosted Tau-Tau trigger



Introduction

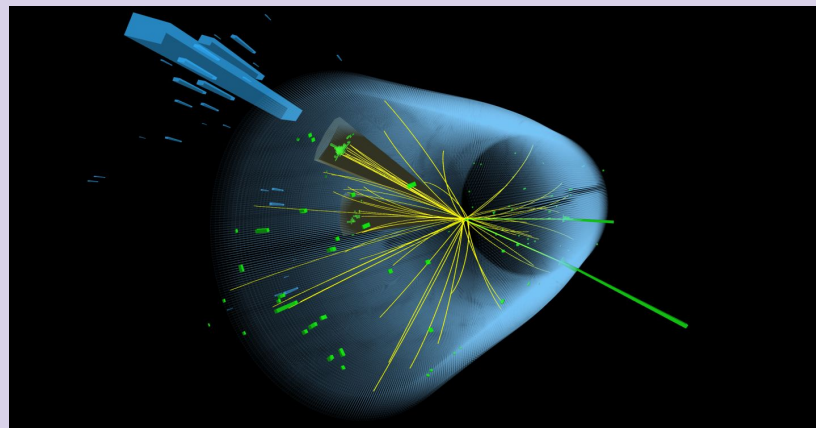
- Higgs Boson
- Tau Leptons
- Reconstruction
- Level 1 Trigger





Higgs Info

- Higgs Field
 - Particle interaction and mass
- Clue to new particles?





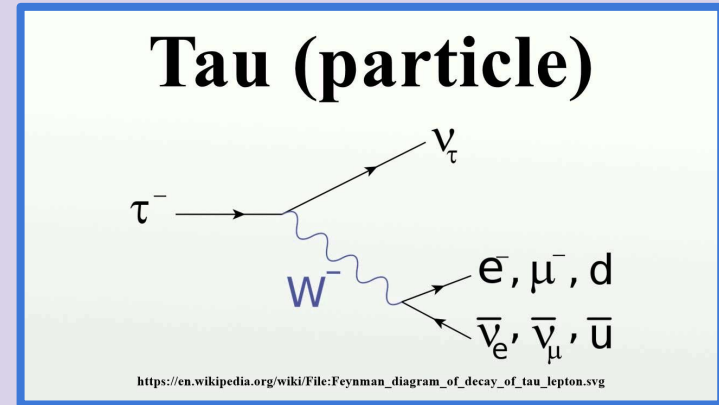
Tau Leptons and Reconstruction

Tau Leptons:

- Half-integer spin
 - Antiparticle counterpart
- Decay before passing the detector

Reconstruction:

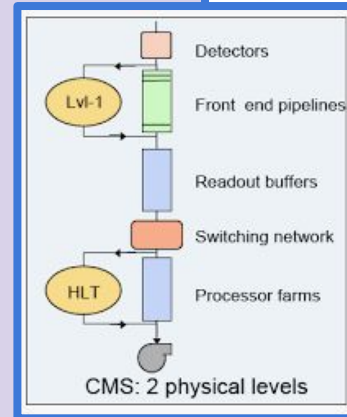
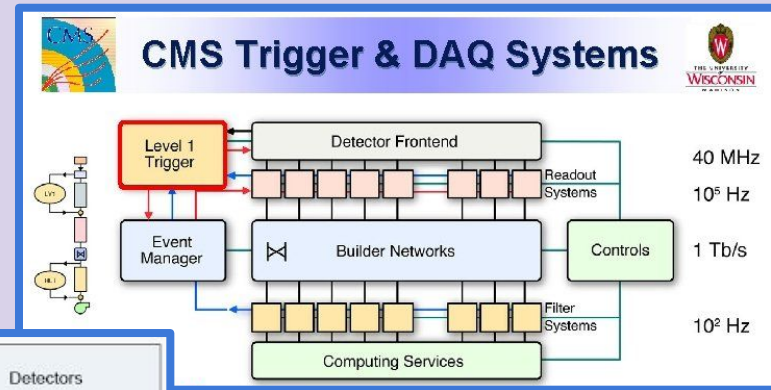
- Particle-flow algorithm
- Reconstruct individual particles to reconstruct into leptons





Level 1 Trigger

- Performs the first level of online event selection using custom electronic system
- An algorithm processes data in a pipeline manner
- Emphasis on calorimeter triggers
- **Purpose:** Select proton-proton interactions that include high transverse energy electrons, photons, jets, or high missing transverse energy





Work to do

1. Create control plots of the level 1 trigger Tau object
2. Create control plots of reconstructed Tau
3. Create control plots of the generator level Tau
4. Measure the efficiency of a boosted Tau-Tau trigger
5. Measure the rate of a boosted Tau-Tau trigger



Method

- Making efficiency plots
- Checking control plots and performing measurements
- Optimizing performance to improve efficiency
- Conclusion