Anatomy of a HEP-ex Analysis

CSU NUPAX CERN IRES
Week 8

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Overview of Data at the LHC

- LHC: Provide proton-proton (or heavy ion) collisions at 8 interaction points

- Experiments (ATLAS/CMS/LHCb/ALICA): collect data from collisions

- Tier0/1/2: Computing centers process the data from the experiments

- World Wide Computing Grid: Distributive storage of data

- Tier 3: Computing clusters for end-user use for analysis

RAW->AOD->xAOD->nTuples/Trees->Plots

Overview of an Analysis

- Select target signal (SM measurement, BSM search, etc)
  - Production mechanism and/or final state (aka channel)
  - Used as a benchmark for optimizing the analysis

- Identify Trigger
  - How would the most signal and least background appear?
  - Loosest selection of analysis

- Design Signal Region
  - What selections would best enhance signal?

- Estimate Background
  - Given signal region strategy, what is your background?
  - Can you trust simulations? If not, need to derive estimate from data

- Statistical Analysis
  - Multi-variate fit of expected signal and backgrounds in all regions

Selecting Signal

- What question are you trying to answer?

- What is the most representative model?

- 'Exact' model vs effective model

- Model-dependent vs model-independent

- Are there any particular processes you want or not?
  — Production or channels?

(a) EFT

(b) Z'-2HDM