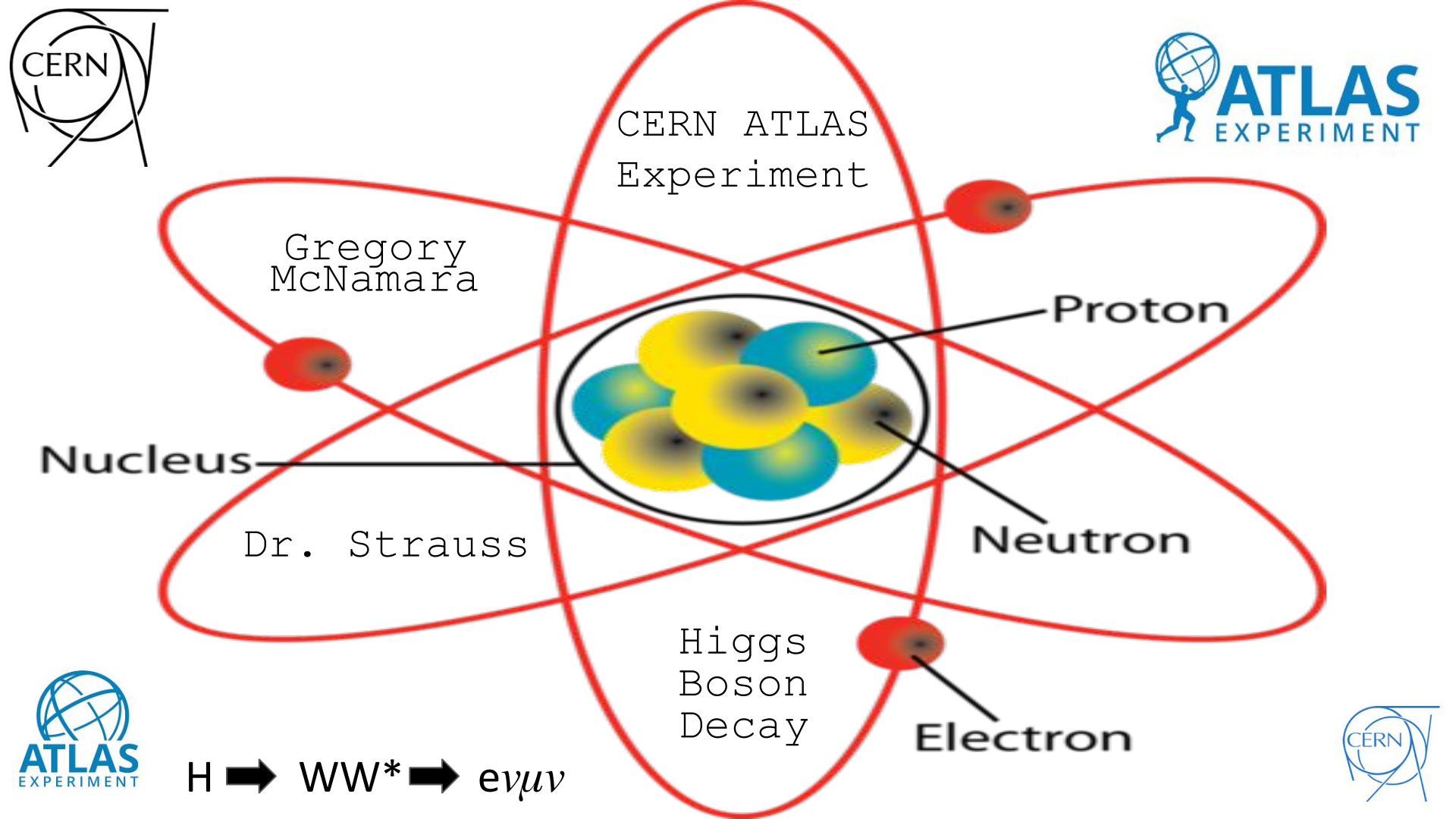
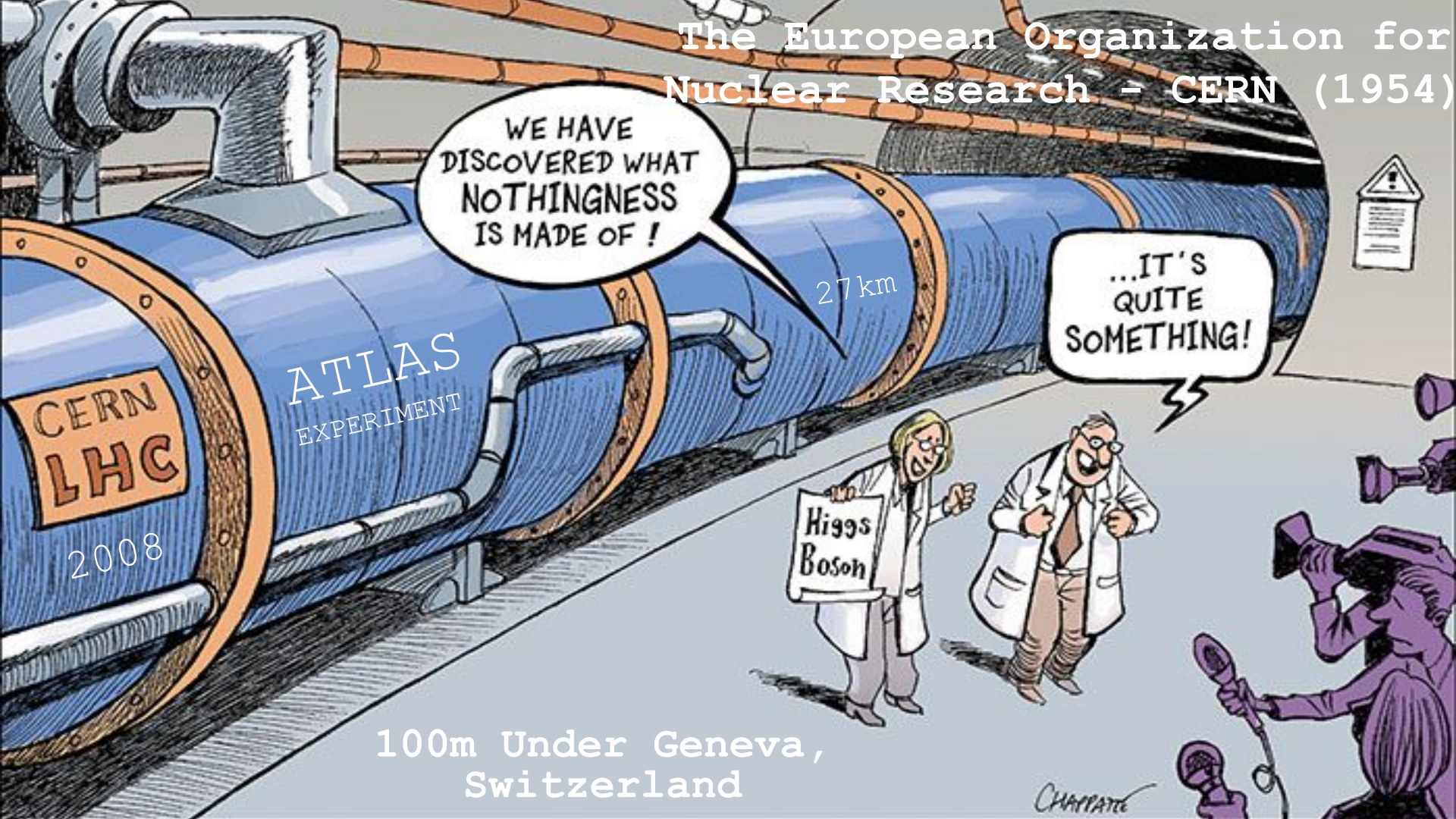
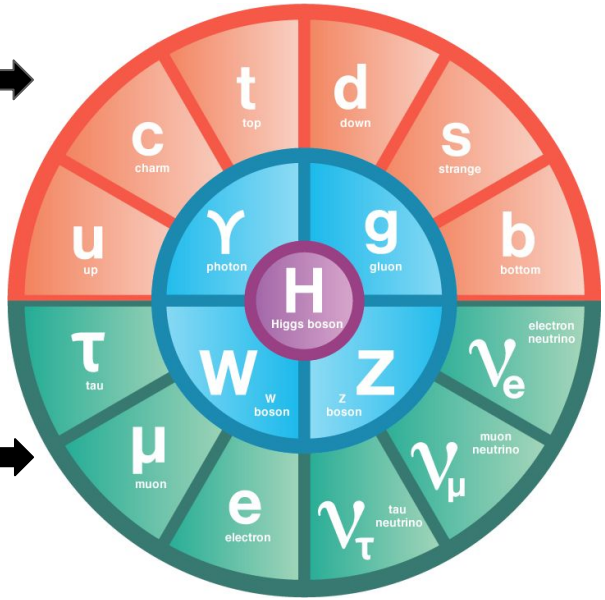

CERN ATLAS
Experiment
Gregory
McNamara
Proton
Nucleus
Dr. Strauss
Neutron
Higgs
Boson
Decay
Electron
H ➡ WW* ➡ eνμν


The European Organization for Nuclear Research - CERN (1954)
WE HAVE DISCOVERED WHAT NOTHINGNESS IS MADE OF !
...IT'S QUITE SOMETHING!
27km
ATLAS
EXPERIMENT
CERN
LHC
2008
Higgs Boson
100m Under Geneva, Switzerland
CHAPPATTE

The Standard Model

Particle Physics



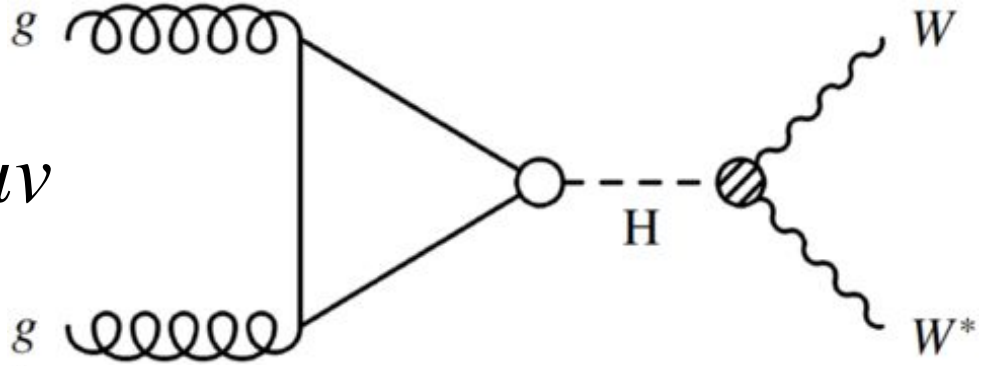
Higgs predicted in 1964

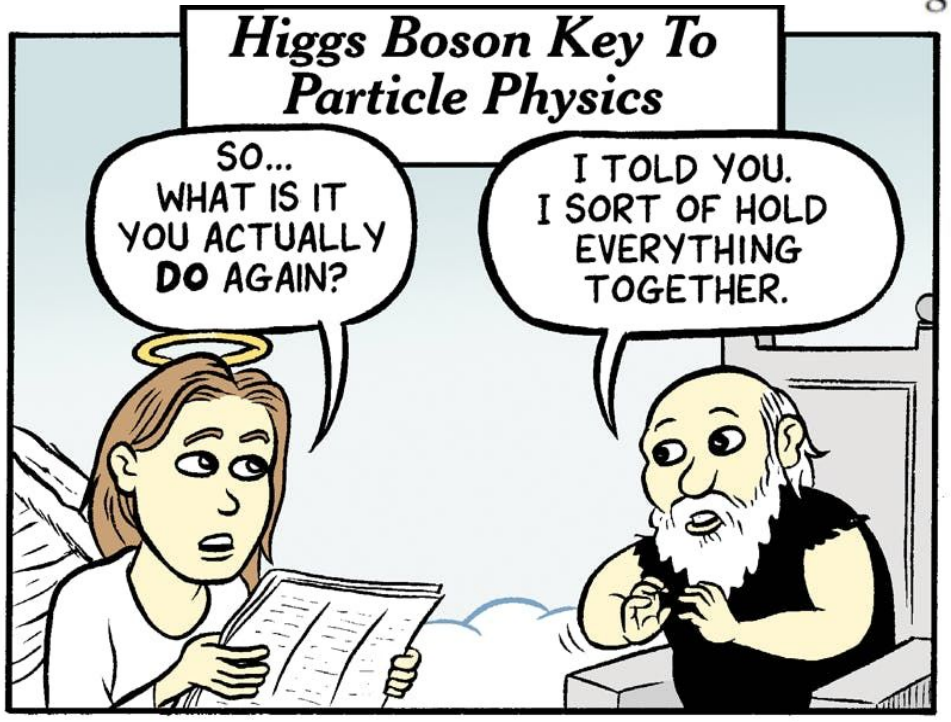
- Six quarks
- Six leptons
- Force carriers

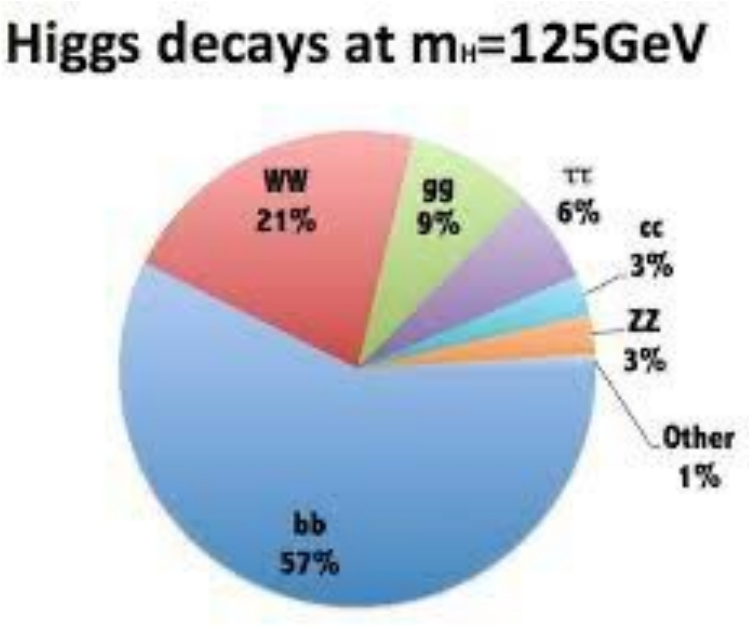
- Deals with the properties, relationship, and interactions of subatomic particles.

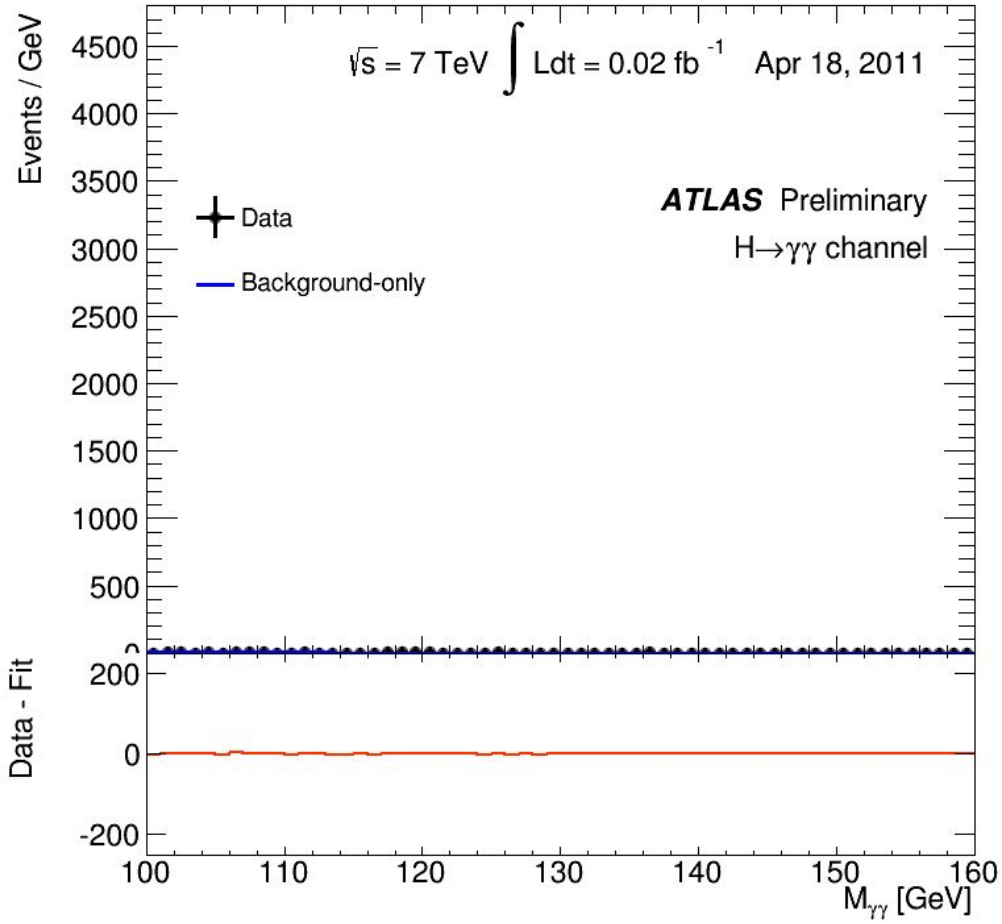
Higgs Bosons Decay

H➡ WW*➡ e$\nu\mu\nu$



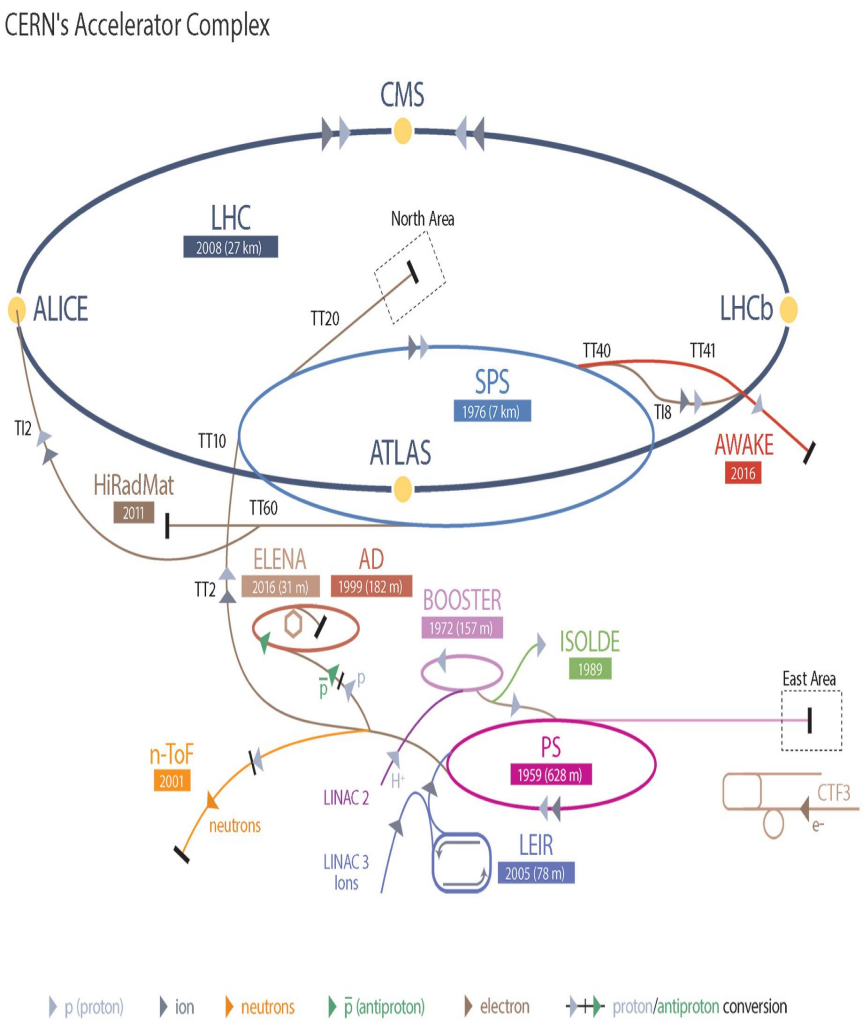


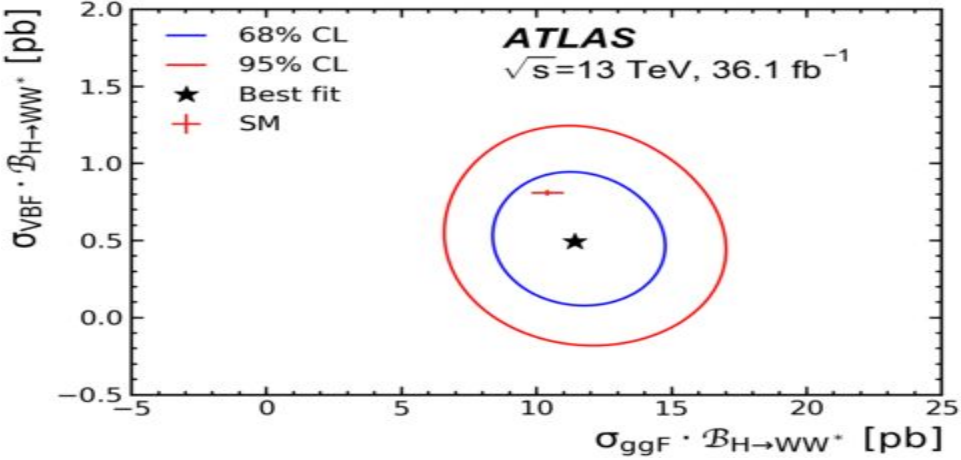




Signal & Background

"Hmm, More evidence of Higgs Boson"



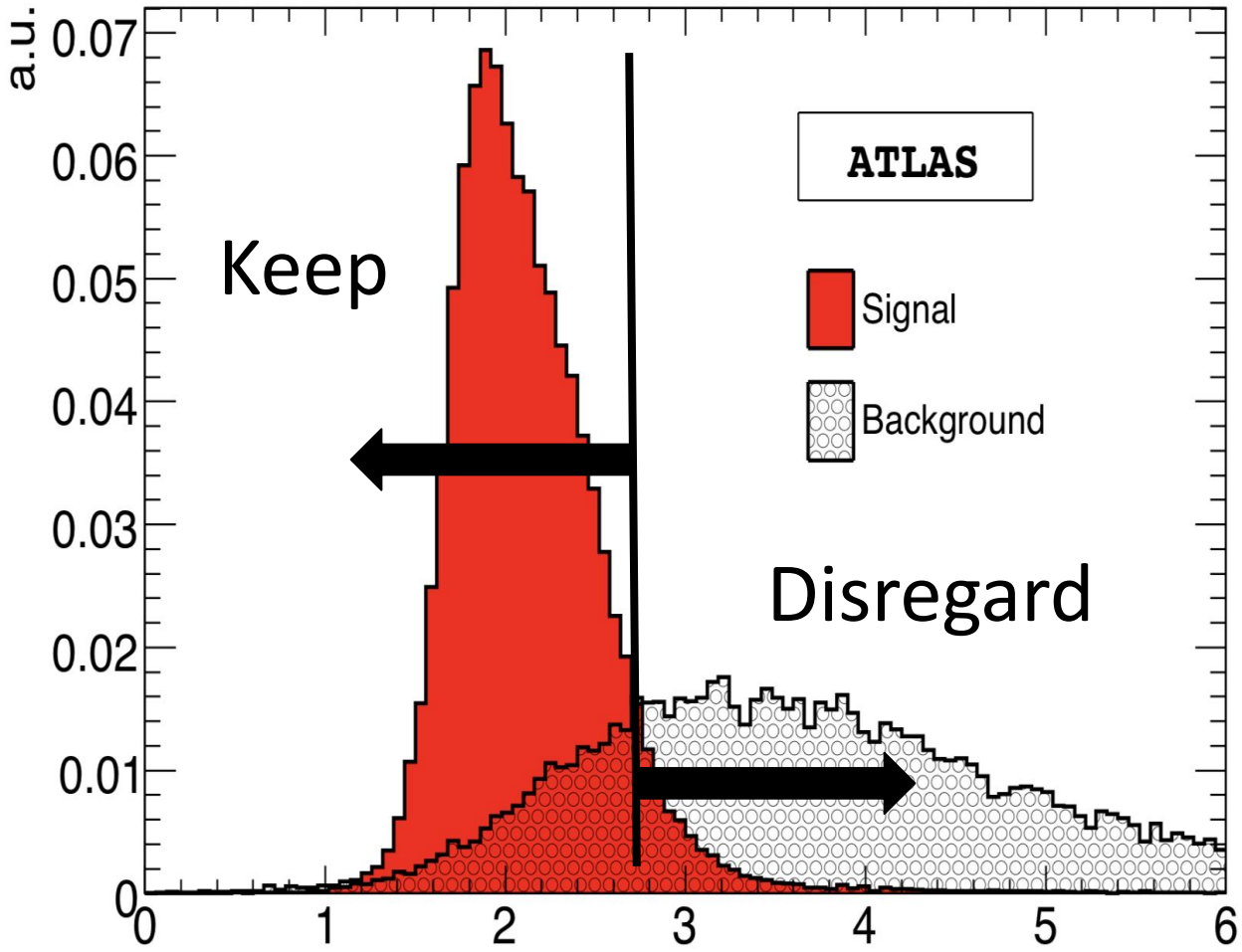


Monte Carlo

An essential experimental component for running simulations in particle physics

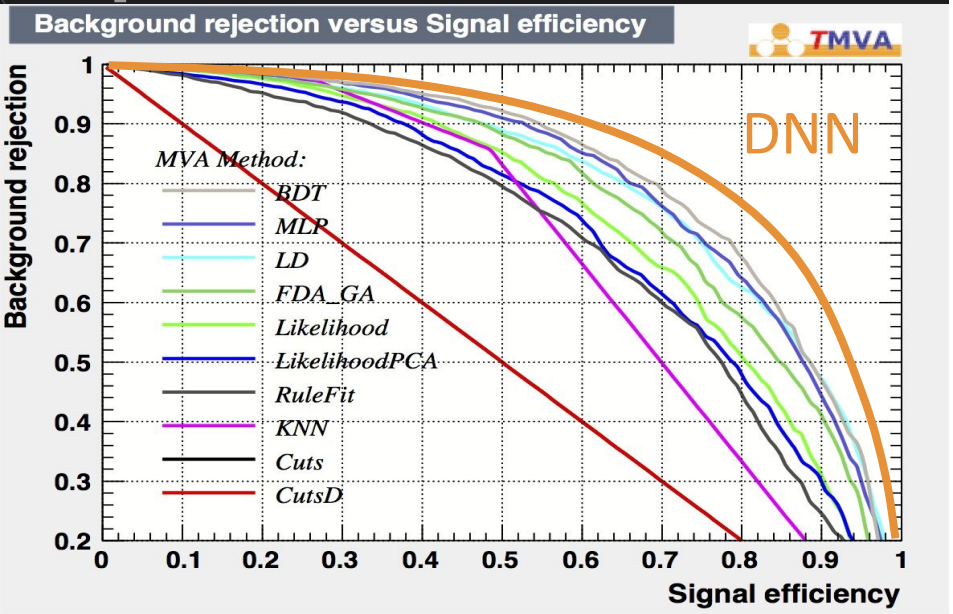
Cuts

Choosing a specific amount of variables to remove background and retain optimum signal within a region



```
Requested:  root ...
 Setting up root 6.18.00-x86_64-centos7-gcc8-opt ...
  ROOT is from lcgenv -p LCG_96 x86_64-centos7-gcc8-opt ROOT
>>>>>>>>>>>>>>>>>>>>>>>> Information for user <<<<<<<<<<<<<<<<<<<<<<<<
 root:
   Tip for _this_ standalone ROOT and grid (ie prun) submission:
    avoid --athenaTag if you do not need athena
    use --rootVer=6.18/00 --cmtConfig=x86_64-centos7-gcc8-opt
 root:
   Note this ROOT from lcgenv sets up a long list of library paths.
   This may slow down executables; they look at each library path item.
   A faster alternative - setup the entire LCG stack with views:
    lsetup "views LCG_96 x86_64-centos7-gcc8-opt"
********************************************************************************
[gregory@ouhep03 ~]$ root
   ------------------------------------------------------------
  | Welcome to ROOT 6.18/00                        https://root.cern |
  |                                (c) 1995-2019, The ROOT Team |
  | Built for linuxx8664gcc on Jun 25 2019, 09:22:23            |
  | From tags/v6-18-00@v6-18-00                                 |
  | Try '.help', '.demo', '.license', '.credits', '.quit'/'.q' |
   ------------------------------------------------------------

root [0]
```



Tools

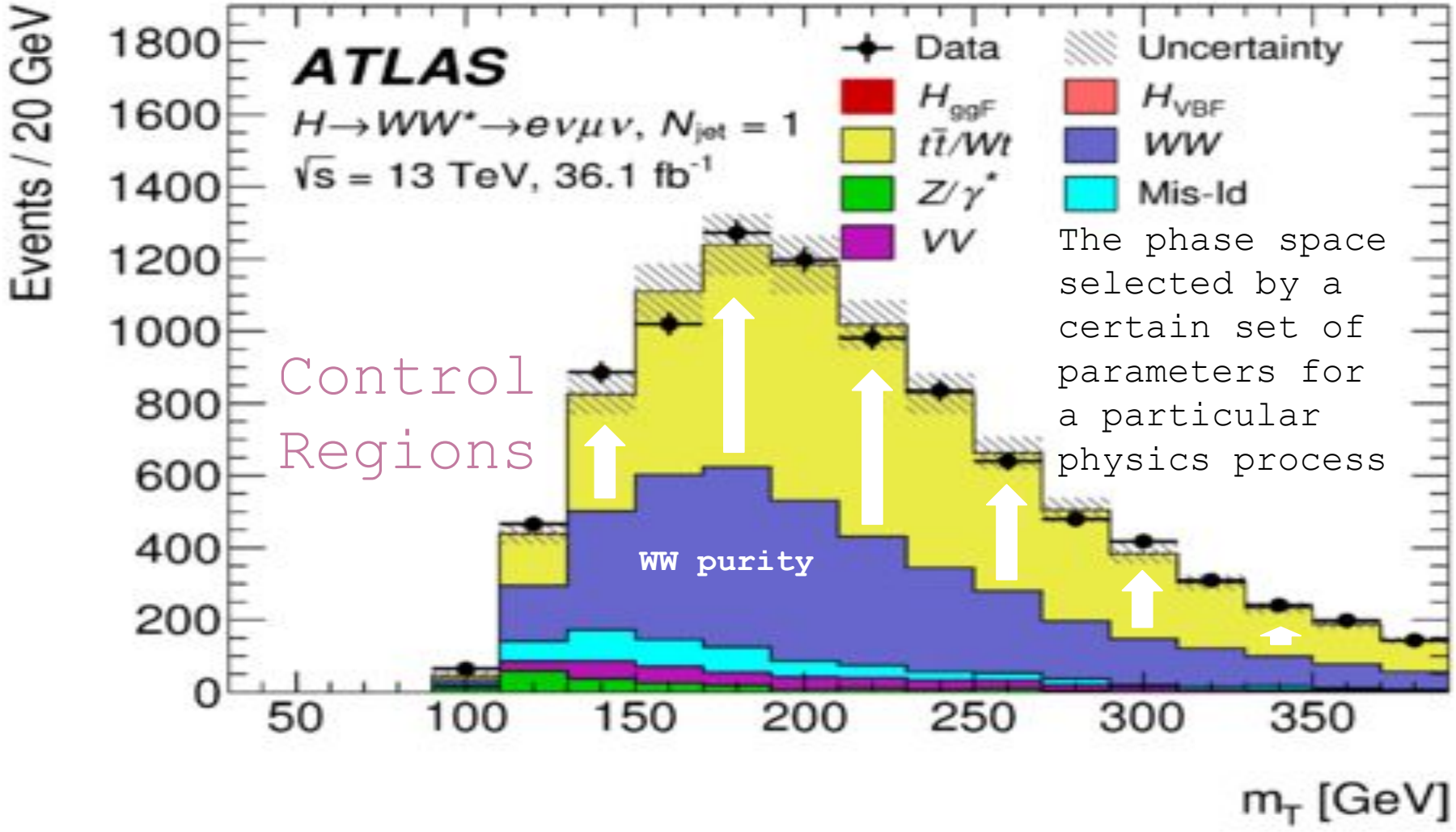
(Root)

(MVA - BDT & DNN)

MVA - MULTIVARIATE STATISTICAL ANALYSIS

BDT - BOOSTED DECISION TREE

DNN - DEEP NEURAL NETWORK


ATLAS
$H \to WW^* \to e\nu\mu\nu$, $N_{jet} = 1$
$\sqrt{s}$ = 13 TeV, 36.1 fb^{-1}
Data
H_{ggF}
$t\bar{t}/Wt$
Z/γ^*
VV
Uncertainty
H_{VBF}
WW
Mis-Id
Events / 20 GeV
m_T [GeV]
Control Regions
WW purity
The phase space selected by a certain set of parameters for a particular physics process


!The End!
¿Questions?