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Your Subtitle

Your Presentation Title

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Introduction

Standard Model of Particle Physics

Standard Model

Four fundamental forces:

Standard Model

Four fundamental forces:

- Strong Nuclear Force

Standard Model

Four fundamental forces:

- Strong Nuclear Force
- Electromagnetic Force

Standard Model

Four fundamental forces:

- Strong Nuclear Force
- Electromagnetic Force
- Weak Nuclear Force

Standard Model

Four fundamental forces:

- Strong Nuclear Force
- Electromagnetic Force
- Weak Nuclear Force
- Gravitation (not part of the SM)

Standard Model

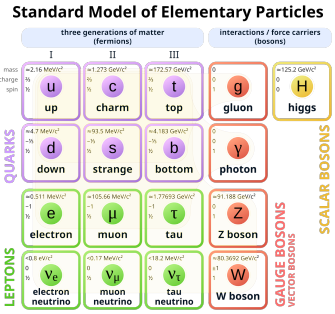

Figure 1: Standard Model of Particle Physics.

Source: wikipedia.org

Vector and Scalar Bosons

- Different than gluons and photon , $W^{\pm}$ and Z^0 bosons are massive.

Vector and Scalar Bosons

- Different than gluons and photon , $W^{\pm}$ and Z^0 bosons are massive.
- If we naively added mass terms for the $W^{\pm}$ and Z^0 bosons directly, these mass terms would break the gauge invariance.

Higgs Mechanism

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- This problem brings us to here; how do $W^{\pm}$ and Z^0 bosons have mass?

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- This problem brings us to here; how do $W^{\pm}$ and Z^0 bosons have mass?

  Answer is Higgs mechanism.

- Why do we need to measure W boson and determine Higgs boson mass?

  Accurate measurements of these masses test the validity of the SM and help verify theoretical predictions.

CERN, LHC and Atlas Detector

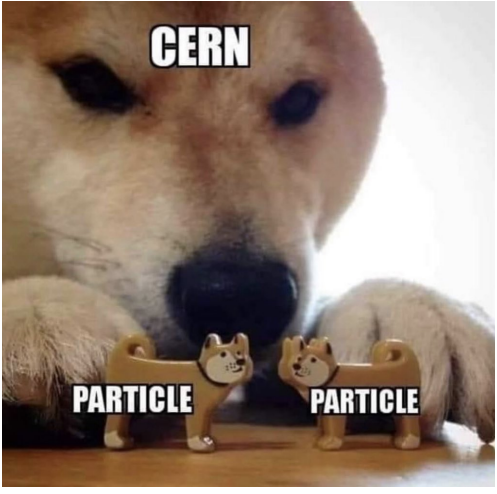
CERN, LHC and Atlas Detector

- European Council for Nuclear Research (in French, **C**onseil **E**uropéen pour la **R**echerche **N**ucléaire) was founded in 1954.
- Located on the France–Switzerland border.
- **L**arge **H**adron **C**ollider (LHC) is the largest human-made hadron collider.

Figure 2: The Globe of Science and Innovation, CERN.

Source: CERN

CERN



Methodology and Analysis

Event Display

Event Display

GOAL

- To get familiar with ATLANTIS, comprehend and differentiate particle reaction mechanisms.

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PROCEDURE

- Recognizing particles through 6 different event displays.

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- Recognizing particles through 6 different event displays.
- Predicting possible reaction mechanisms.

Event Display

GOAL

- To get familiar with ATLANTIS, comprehend and differentiate particle reaction mechanisms.

PROCEDURE

- Recognizing particles through 6 different event displays.
- Predicting possible reaction mechanisms.
- Drawing their Feynman diagrams.

Calibration of Electromagnetic Calorimeter

Calibration of Electromagnetic Calorimeter

GOAL

- Calibration of Electromagnetic calorimeter (ECAL) of ATLAS detector using Z^0 Boson mass.

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PROCEDURE

- Analysing data by looking histogram of parameters.
- Make selections to obtain accurate results.

Calibration of Electromagnetic Calorimeter

GOAL

- Calibration of Electromagnetic calorimeter (ECAL) of ATLAS detector using Z^0 Boson mass.

PROCEDURE

- Analysing data by looking histogram of parameters.
- Make selections to obtain accurate results.
- Finding the correction factor α and applying it to the Z^0 Boson mass distribution.

Results

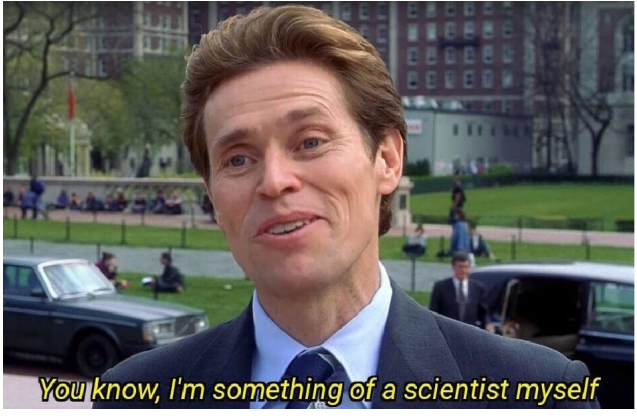
Summary

Measured Mean Mass Value of Z boson: $m_Z = 90.759$ GeV
Literature value of Z boson: $m_Z = 91.187 \pm 0.002$ GeV [1]

Mass of W boson measured: $m_W = 81.692^{+0.037}_{-0.017}$ GeV
Literature value of W boson: $m_W = 80.377 \pm 0.012$ GeV [1]

Mass of Higgs boson measured: $m_H = 124.595 \pm 2$ GeV
Literature value of Higgs boson: $m_H = 125.25 \pm 0.17$ GeV [2]

Thank you for listening.



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[2] P. D. Group et al., "Review of Particle Physics," *Progress of Theoretical and Experimental Physics*, vol. 2022, no. 8, p. 083C01, Aug. 2022, ISSN: 2050-3911. DOI: 10.1093/ptep/ptac097. eprint: https://academic.oup.com/ptep/article-pdf/2022/8/083C01/49175539/ptac097.pdf. [Online]. Available: https://doi.org/10.1093/ptep/ptac097.