

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Ratio Method of Measuring the Mass of W Boson

By

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This thesis describes an alternative method (ratio method) of measuring the mass of the W boson using the data of 1 inverse femtobarn integrated luminosity collected by Run IIa of the D0 experiment at Fermilab. Instead of fitting the W transverse mass between data and fast Monte Carlo simulation (standard method), we fit it with the transverse mass (multiplied by a floating scale factor) Z data, which has one of its two electrons discarded, to be treated as a neutrino in the W event. The best fitted scale factor corresponds to the ratio of the W boson mass over the Z boson mass. As the Z boson mass value has been precisely measured from the LEP experiments, the W boson mass is hence obtained from the ratio.

Fast Monte Carlo simulations are extensively used to study the systematic corrections that take into account the difference between W and Z events. The ratio method is tested on the larger dataset of GEANT based full Monte Carlo simulations before being applied to data. The final measured W mass with the 1 inverse femtobarn integrated luminosity Run IIa data of D0 is $M_W = 80432 \pm 48(\text{stat}) \pm 16(\text{sys})$ MeV. This value is consistent with the current world average value within uncertainties.

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