

Early Measurement of the W and Z Cross Sections in the Electron Decay Channels

XLIVth Rencontres de Moriond : Electroweak Interactions and Unified Theories

David Wardrope

Introduction

CMS was designed to make discoveries at the TeV scale

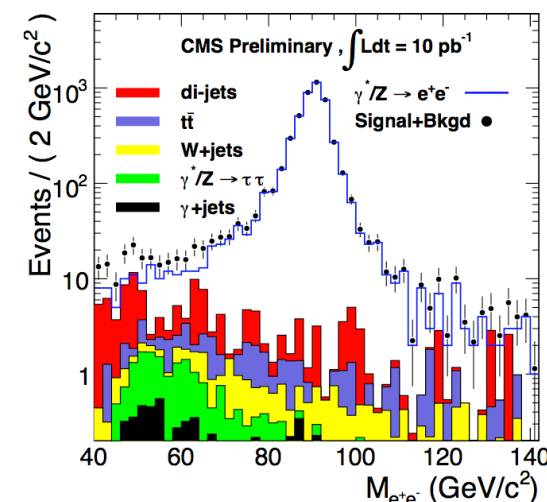
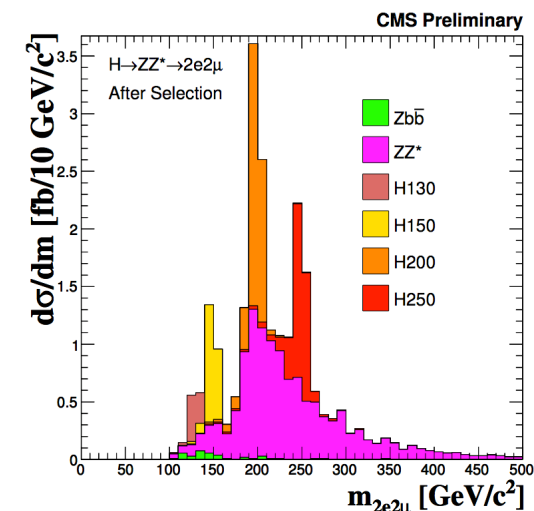
- Higgs, SUSY, extra-dimensions etc.

For credible discoveries, we must demonstrate that

- We understand the detector and the reconstruction of events
- We understand the LHC environment
- We understand the backgrounds

Focus on realistic early analyses to make these demonstrations

- Measurement of W and Z cross-section



W and Z Cross-Section Measurement

W and Z have large production cross-sections at LHC :

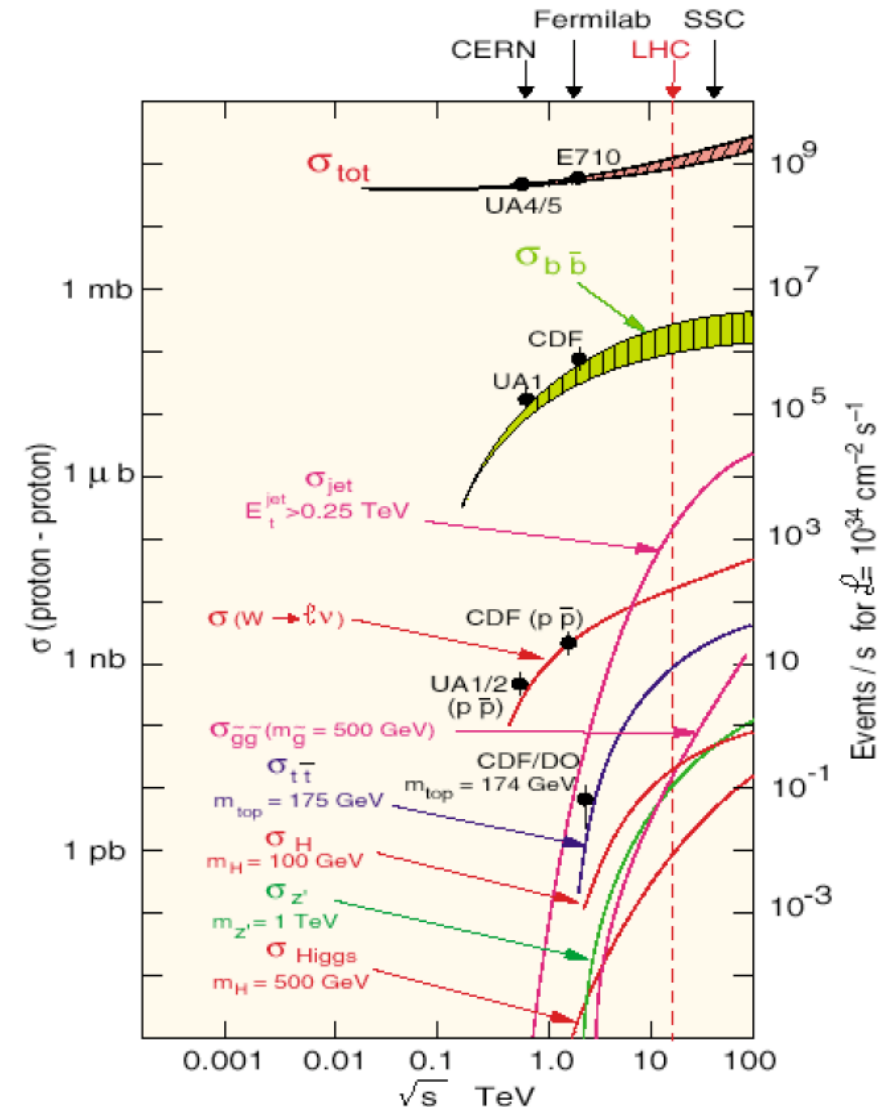
- $O(10\text{pb}^{-1})$ sufficient for significant analysis ($\sqrt{s} \sim 10 \text{ TeV}$)

Well isolated electrons with high transverse momenta

- Distinctive in hadron collisions

W/Z important in many discovery analyses

Develop use of data-driven techniques

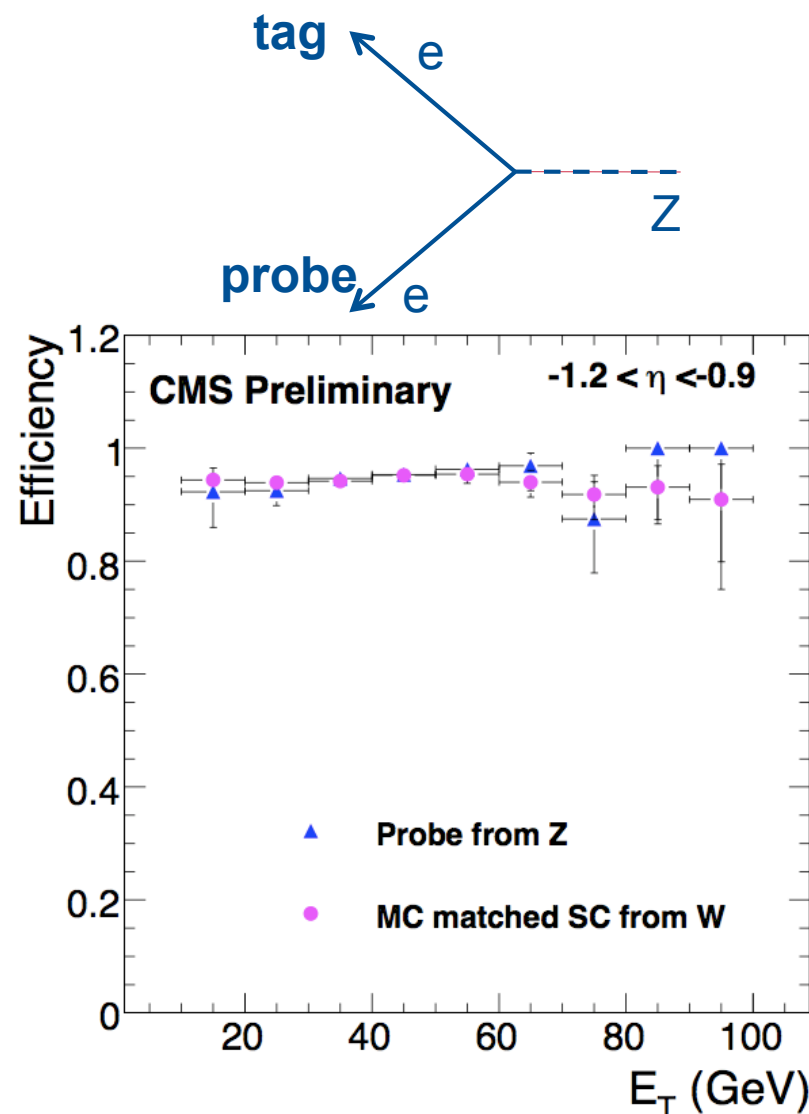


Tag and Probe : Trigger, Reconstruction and Selection Efficiencies

An unbiased and pure sample of electrons is selected from $Z \rightarrow ee$ events

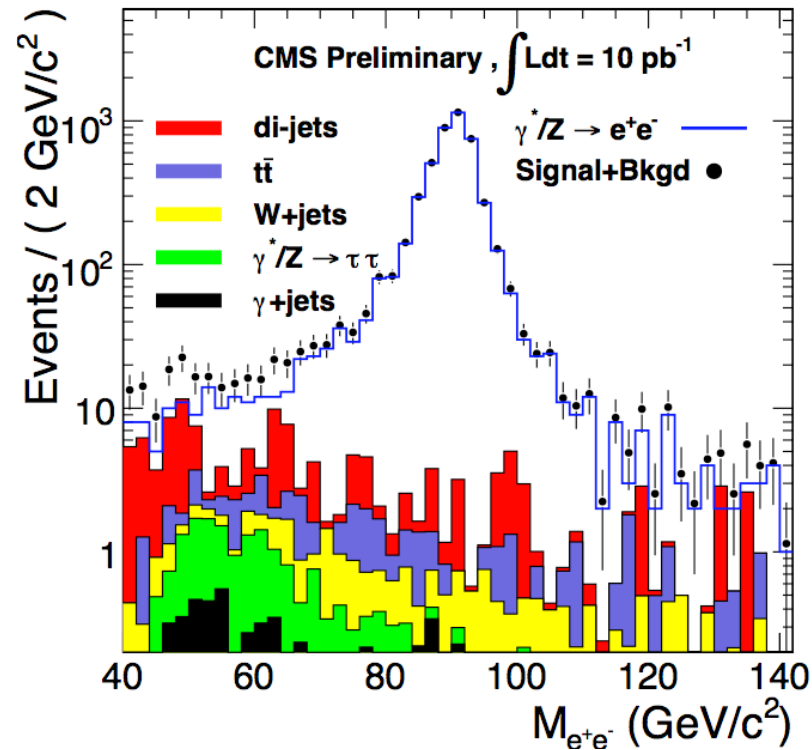
- One electron must meet tight criteria, “**tagging**” the event
- The **probe** need satisfy only very loose criteria, ensuring an unbiased sample
- An invariant mass cut on the **tag-probe** pair ensures the purity of the **probe** sample

The **probe** sample then used to determine efficiencies



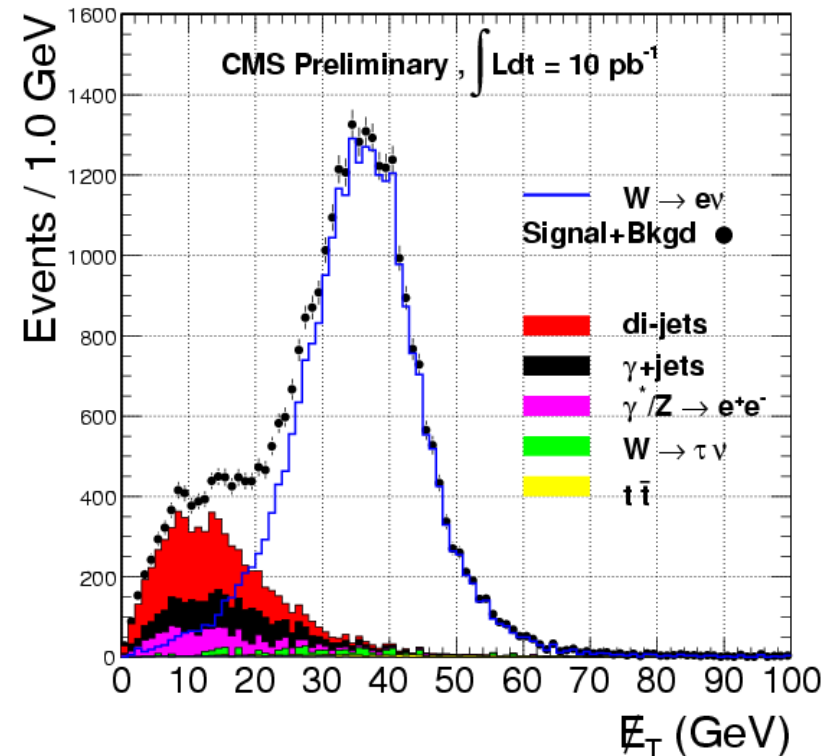
Signal and Background

$Z \rightarrow ee$



Effectively background free

$W \rightarrow ev$



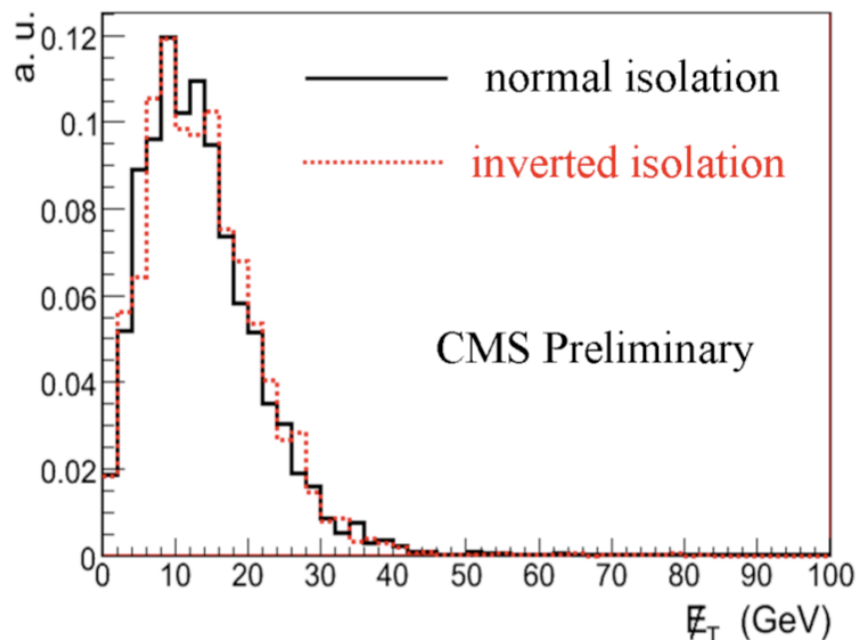
QCD background hard to model
ME_T vulnerable to detector effects

Estimating Properties of Signal and Background from Data

QCD background ME_T :

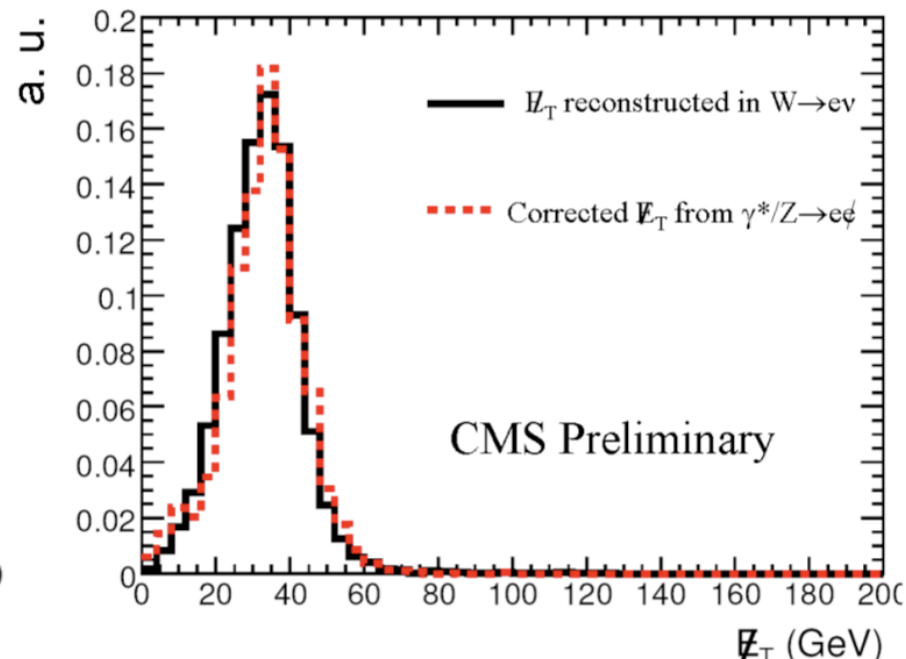
Invert electron selection criteria

- E.g. isolation, cluster shape...



$W \rightarrow e\nu$ ME_T : from $Z \rightarrow ee$

- Apply W selection to one electron
- Remove other electron from ME_T sum
- Correct for boson mass and neutrino acceptance



Conclusions

A strategy for measuring W and Z cross-sections has been developed

Vital activity for early LHC running

Ideal test bench

- Monitoring detector performance
- Tuning electron reconstruction and identification
- Analysing ME_T

Success for W and Z cross-section measurements paves way towards discoveries