Z→ee Tutorial

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Introduction

the Z boson

Tutorial

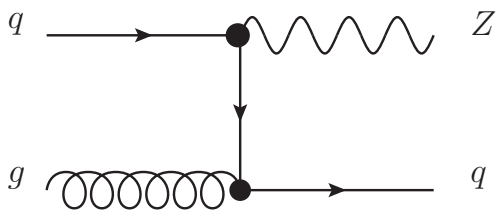
Part 1: The ATLANTIS Event Display

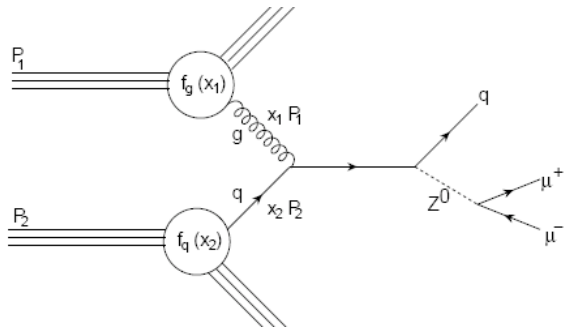
Part 2: Zee Events

Conclusions

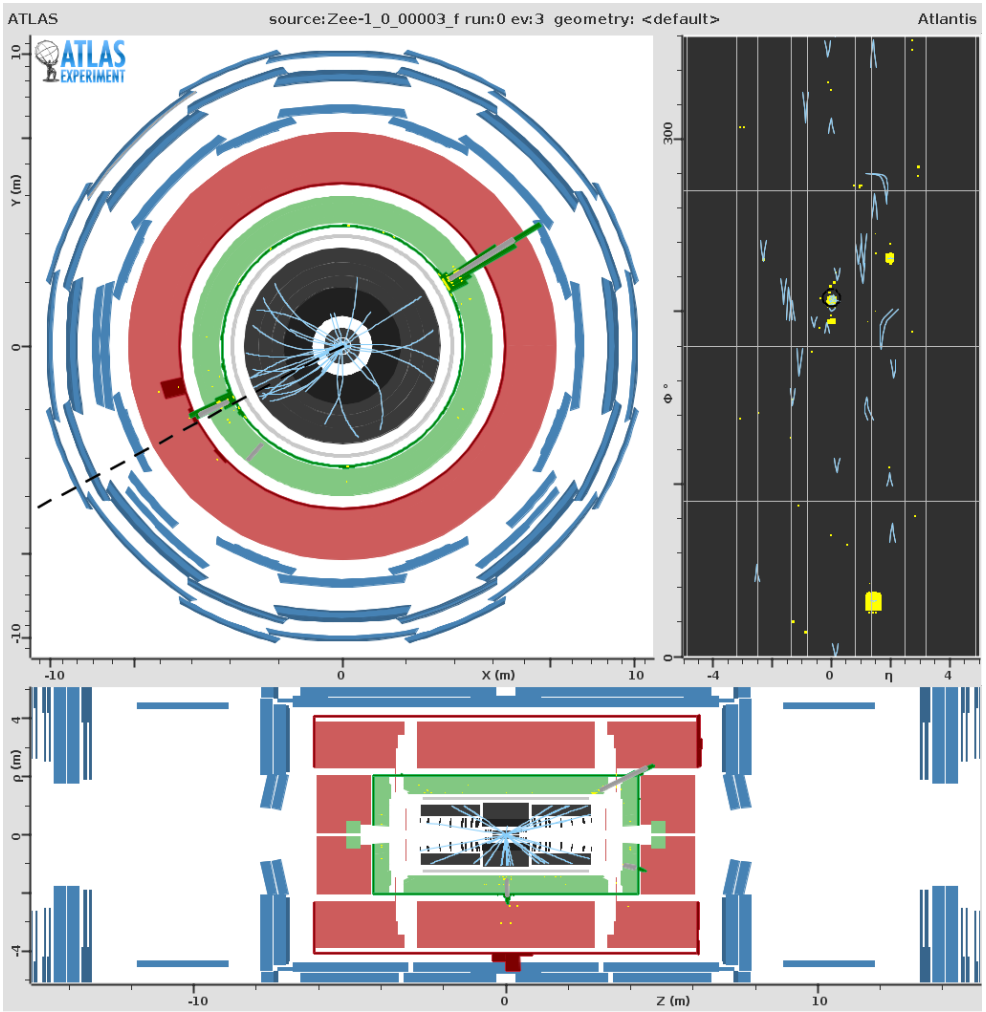
Funfacts about the Z

- why Z?:
  - high cross section
  - well known $\longrightarrow$ used for calibration of various other processes
  - ATLAS and CMS: further improvement of mass measurement
  - current mass: 91.19 GeV
- interesting decay chains:
  - $Z \longrightarrow ee, \mu\mu, \tau\tau$





Tutorial (1): the ATLANTIS Event Display



Tutorial (1): main tasks

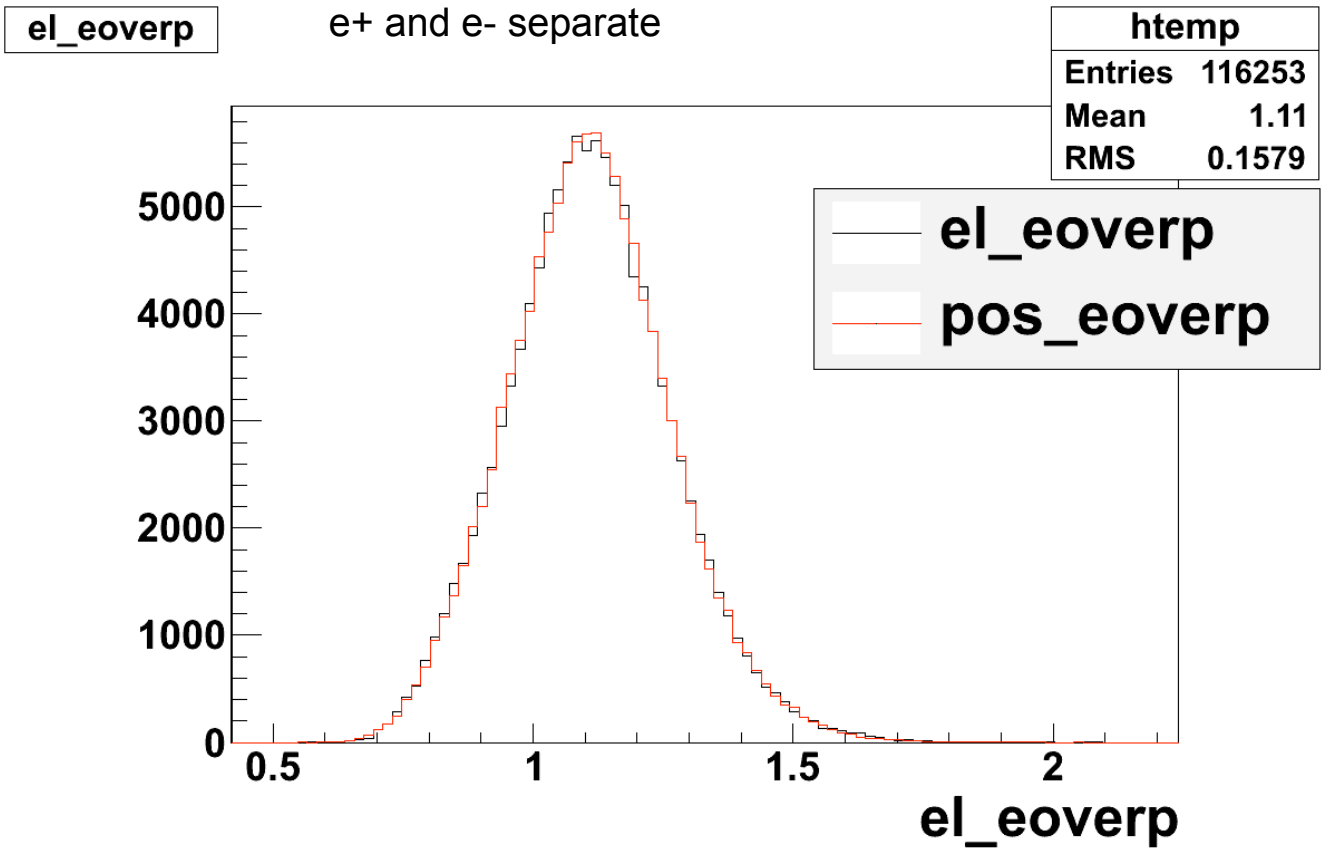
1. getting familiar with the program:
- many buttons, short time

2. energy measurement: track vs. calo
- detected: opposite sign leptons
- E(track) systematically lower then E(calo)
$\rightarrow$ partly huge derivations
- eta and phi: match rather well

3. computaion of Z-mass (ev. 7):
- $M_{inv} = \sqrt{(p_{el} + p_{pos})^2}$
- calo: 72.76 GeV
- track: 69.49 GeV

Tutorial (2): main tasks

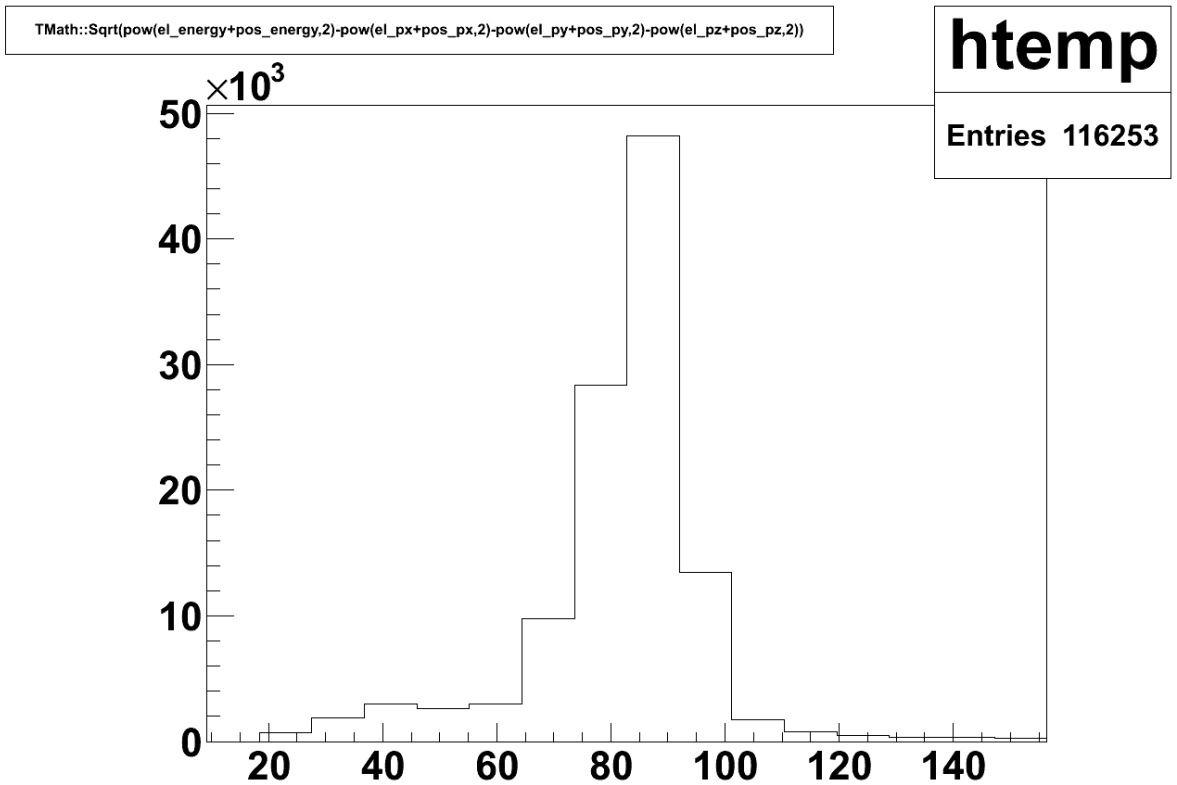
1. getting familiar with Datasample (TBrowser):



Tutorial (2): main tasks

2. plot $M_{inv}^{e^+e^-}$ and determine Z peak :

- $M_{inv}^{e^+e^-} = \sqrt{(E_{el} + E_{pos})^2 - ((p_x^{el} + p_x^{pos})^2 + (p_y^{el} + p_y^{pos})^2 + (p_z^{el} + p_z^{pos})^2)}$



- measured Z mass: 87.5 GeV

Tutorial (2): main tasks

3. look at electron pt at different jet multiplicities

- njet $= 0$: peak at half Z mass
- njet > 0: peak shifted to lower momentum

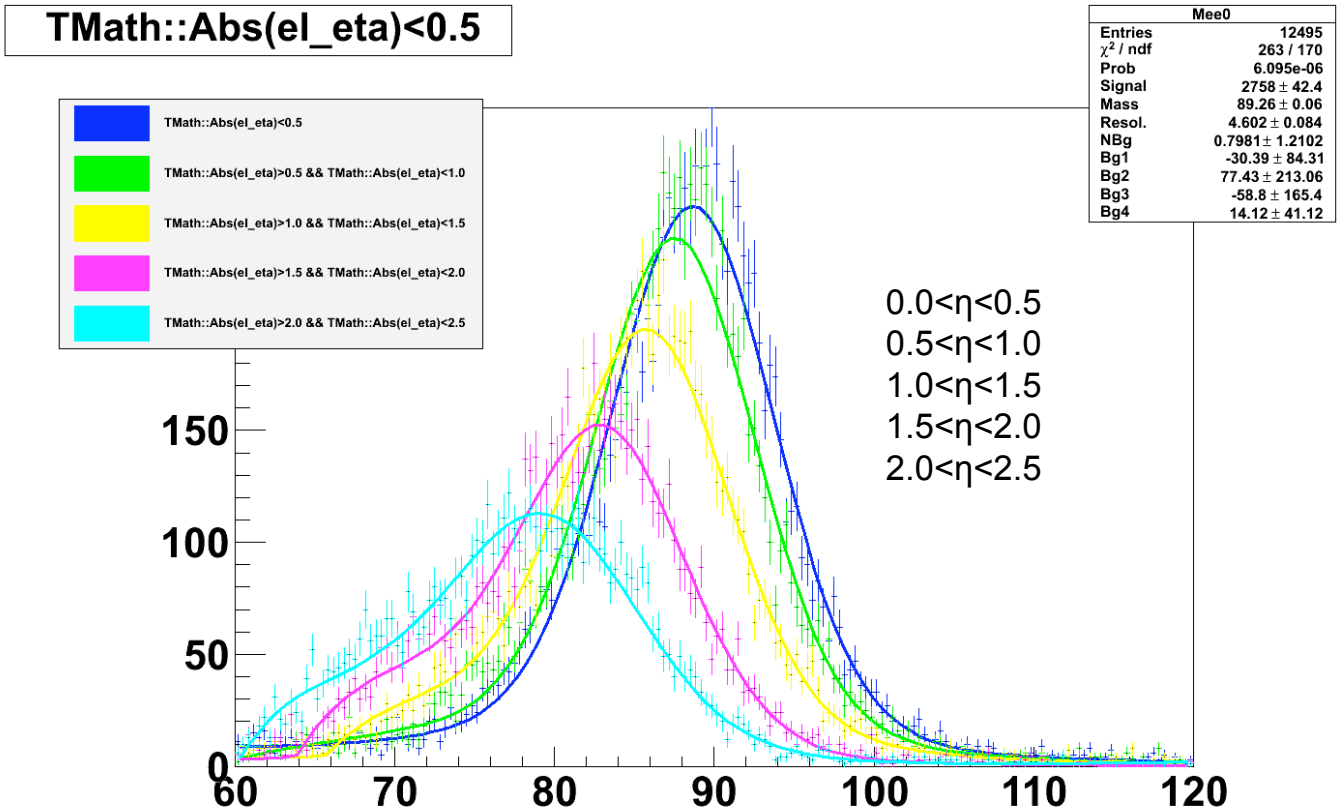
(additional jets balance their pt against Z momentum)

Tutorial (2): main tasks

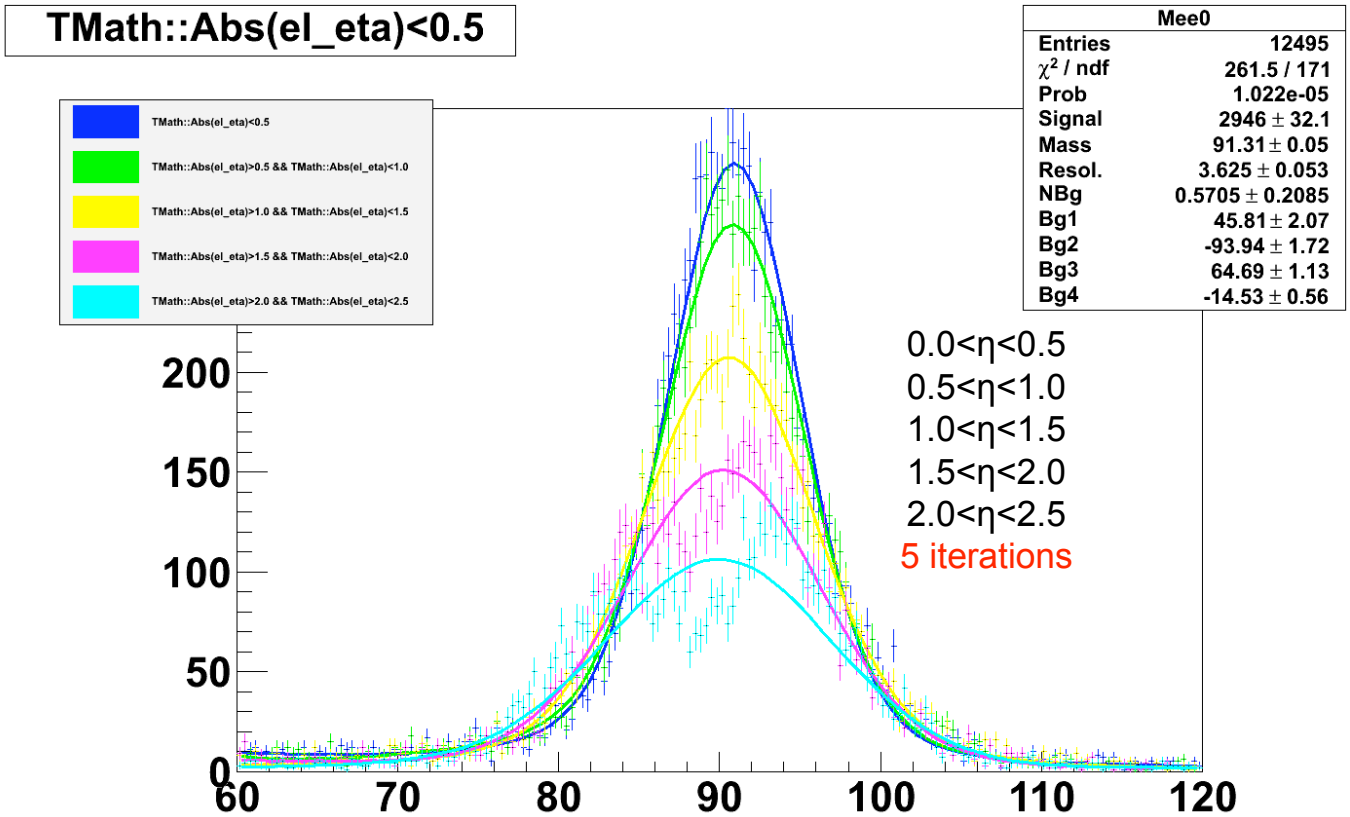
4. calibrate electron energy:

- modifications in ElecCalib.C:
- get fit-value in various eta bins (0-0.5, 0.5-1.0, ..., 2.0-2.5)
- calibrate (multiply data with ratio: true value/observed value)
- repeat iteratively (mayby 5 times)

Tutorial (2): main tasks



Tutorial (2): main tasks



Conclusion

- wiki outdated :(
- part 1: too little time, due to complexity of ATLANTIS
- part 2: use of prewritten code: better for time, far from "research reality"