

ATLAS Z path preparation/improvements for 2012

University of Oslo

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Overview

- ▶ Web page
- ▶ Plotting tool
- ▶ Data sample
- ▶ HYPATIA

2011 procedure (recap from April meeting)

Students

1. Analyse 50 Z muon muon events in HYPATIA, and combine objects in HYPATIA for inv mass calc
2. Enter invariant mass in an excel sheet
3. Upload results to google docs or deliver results manually to institute responsible

Institute responsible

4. Pick up students results either from google-docs or from memory-stick
5. Institute combined students results in a semi-automatic combination excel sheet
6. Take snapshot of result, extraction of mass, width 3.
7. Upload of combined results to moderators for videoconference

Video conference

8. J/ψ and Z results had to be combined in one presentation for moderators

Obviously way too many steps

Requirements for new plotting tool - Z path

Required

- ▶ General
 - ▶ Tempting interface for students
 - ▶ Easy saving/upload of histogram
 - ▶ Reduce needed steps from student entry to video conference discussion of results
 - ▶ Reduce/simplify combination tasks for institute responsables
 - ▶ Remove all need for videoconference moderators to treat the results
- ▶ Technical
 - ▶ Reliable system (like for instance server)
 - ▶ Scalable tool (how will server respond to many requests at the same time?)
 - ▶ Mirror sites, to both automatic copy files from one site to a mirror site, but also to distribute load onto several sites/servers
 - ▶ If upload possibilities, need secure upload
 - ▶ No installation needs

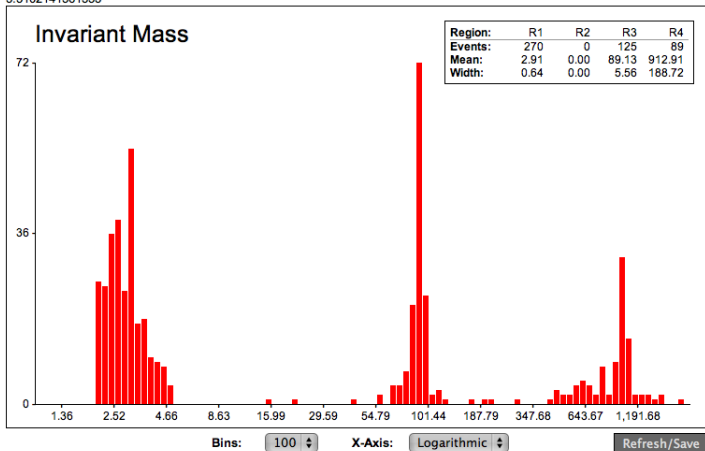
MasterClass – Combination for Oslo

[♦ Index Page](#)**Data:**

One entry per line

2.01
2.01
2.01
2.02
2.02
2.03
2.05
2.06
2.07
2.07
2.08
2.08
2.08
2.09
2.10
2.10
2.11
2.11
2.12
2.12
2.12
2.13
2.13
2.14
2.15
2.16
2.17
2.19
2.20

3.3102141561553



R1 Min: R2 Min: R3 Min: R4 Min:
 R1 Max: R2 Max: R3 Max: R4 Max:

Oslo plotting tool

Features in the Oslo tool that meet the requirements on previous page

- ▶ Steps in process reduced from 7 to 1. Only the students entry of values (invariant masses) is required.
- ▶ Possibility for students to tweak histogram
- ▶ Possibility to combine cross-institute results
- ▶ Possibility to combine ATLAS, CMS results in a seamless and straightforward way
- ▶ php-based, you just enter a web-page

Tools entry points

- ▶ For students (possibility to select, date, institute, group)
- ▶ For institutes (possibility to select date, institute)
- ▶ For video conference (possibility to select date)
- ▶ For administrator

Zpath webpage modifications

Work has gone into tidying up the Zpath webpage.

- ▶ Shuffled pages (for instance opening page)
- ▶ Menus in 2011 version had some logic problems
- ▶ Some pages were too long/ too much text, could be split up
- ▶ Added chapter about New physics and the use of MC simulation

Zpath opening page

Old opening page

Home Page **W-Path** Z-Path

Z-Path

Welcome to the Z-path! Here you will learn about the Z boson and its importance to our understanding of Nature. You will analyze real ATLAS data from the Large Hadron Collider (LHC) at CERN. Before taking on this task, we will first lead you through a journey into the tiniest structures known to man: the elementary particles. You will see how these can be produced in the proton-proton collisions at the LHC, and you will learn how to identify the elementary particles in the ATLAS detector. Finally, you will do a real physics measurement on fresh data from the ATLAS detector: identify the Z boson and measure its mass! You will even realize that you have just mastered a tool for discovering the unknown!


But first, a bit about our friend, the Z boson:

The neutral Z boson, and the electrically charged W^+ and W^- bosons are all mediators of the weak interaction, like for instance the photon is the mediator of the electromagnetic force. The W bosons are responsible for radioactivity by transforming a proton into a neutron, and vice-versa. You can learn how radioactivity works at the elementary particle level by following this link.

The role of the Z boson is somewhat more elusive, but absolutely not less important!

So what is the Z boson good for? Well, we know that neutrinos interact among themselves, and without the Z boson this would be impossible! Since neutrinos do not have electric charge they cannot self-interact via a photon, which would be the only other option. In fact, the Z boson is closely related to the photon. You know that electromagnetic interactions proceed through photons. Because the photon has no mass, it can travel infinite distances and two electric charges can feel each other even at very large distances.

The Z boson, on the other hand, is very heavy and has a very short lifetime and, therefore, travels only a very tiny distance. This is the reason why, contrary to the common light (made of photons), you don't see a "trail" of Z bosons. Although we don't much notice the Z boson in our everyday-life, in extreme conditions of the early Universe and of supermassive explosions, the Z boson is a "daily" particle.



Too much text for an opening page! Now moved into the menu instead

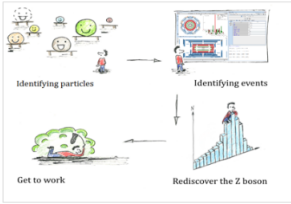
New opening page

Home Page **W-Path** Z-Path

Z path

Welcome to the Z-path! Here you will learn about the Z boson and its importance to our understanding of Nature. In this quest you will use real ATLAS data from the Large Hadron Collider (LHC) at CERN.

Before taking on this task, we will lead you through a journey into the tiniest structures known to man: the elementary particles. You will see how these can be produced in the proton-proton collisions at the LHC, and you will learn how to identify the elementary particles in the ATLAS detector. Finally, you will do a real physics measurement on fresh data from the ATLAS detector: identify the Z boson and measure its mass! You will even realize that you have just mastered a tool for discovering the unknown!



Identifying particles Identifying events

Get to work Rediscover the Z boson

Main Path

- INTRODUCING THE Z BOSON
- IDENTIFYING PARTICLES
- IDENTIFYING EVENTS
- REDISCOVERING THE Z BOSON
- GET TO WORK!
- DISCOVER THE UNKNOWN

Knowledge Center

- RESEARCH AT THE LHC
- MORE ABOUT THE Z BOSON
- THE Z BOSON
- ENERGY UNITS
- MOMENTUM
- VICTIMS
- INVASION MODE
- HISTOGRAMS

Natural opening page was the earlier Aims and Task page.

Zpath menus

Old menu

Content

AIMS/TASKS
IDENTIFYING PARTICLES
IDENTIFYING EVENTS
MEASUREMENT
ANALYSIS

New menu

Main Path

INTRODUCING THE Z BOSON
IDENTIFYING PARTICLES
IDENTIFYING EVENTS
REDISCOVER THE Z BOSON
GET TO WORK!
DISCOVER THE UNKNOWN

Knowledge Center

RESEARCH AT THE LHC
MORE ABOUT THE Z BOSON
THE Z' BOSON
ENERGY UNITS
MOMENTUM
VECTORS
INVARIANT MASS
HISTOGRAMS

Some submenu items were not very logical. Menu-structure tidied up.

Zpath sub-menus

Old menu

Content

AIMS/TASKS
IDENTIFYING PARTICLES
IDENTIFYING EVENTS
Measurement
Concepts, definitions and methods
HELP 1: ENERGY UNITS
HELP 2: MOMENTUM
HELP 3: VECTORS
HELP 4: INVARIANT MASS
HYPATIA AND DATA SAMPLES
ANALYSIS

Measurement sub-menu was basically including lots of item which really belonged elsewhere

New menu

MAIN PATH

INTRODUCING THE Z BOSON
IDENTIFYING PARTICLES
IDENTIFYING EVENTS
REDISCOVER THE Z BOSON
Get to work!
DATA SAMPLES AND TOOLS
Do it!
ANALYZE YOUR RESULT
DISCOVER THE UNKNOWN

Now Measurement sub-menu corresponds to the Get to Work! item in the opening page, and contains only items relevant to exactly the measurement

Data sample

- ▶ Larger datasampel compared to 2011 event
- ▶ More relevant background events
 - ▶ J/ψ Υ , in addition to some W and dijet events
 - ▶ Will make the student selection of Z events maybe more interesting/challenging

HYPATIA - in the future

- ▶ In work to streamline tools could be good if HYPATIA (/MINERVA) has option to save track-list in other formats. For instance JSON which iSpy uses.
- ▶ This could allow a more developed histogramming tool to plot lot's of nice distributions, momentum, missing energy, invariant mass etc etc. just be the output from HYPATIA.