Weekly progress

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Contents

1 Term 1

1.1 Summer reading

1.2 Week 1

- set up SCRTP account and Github repositories for project
- Risk assessment

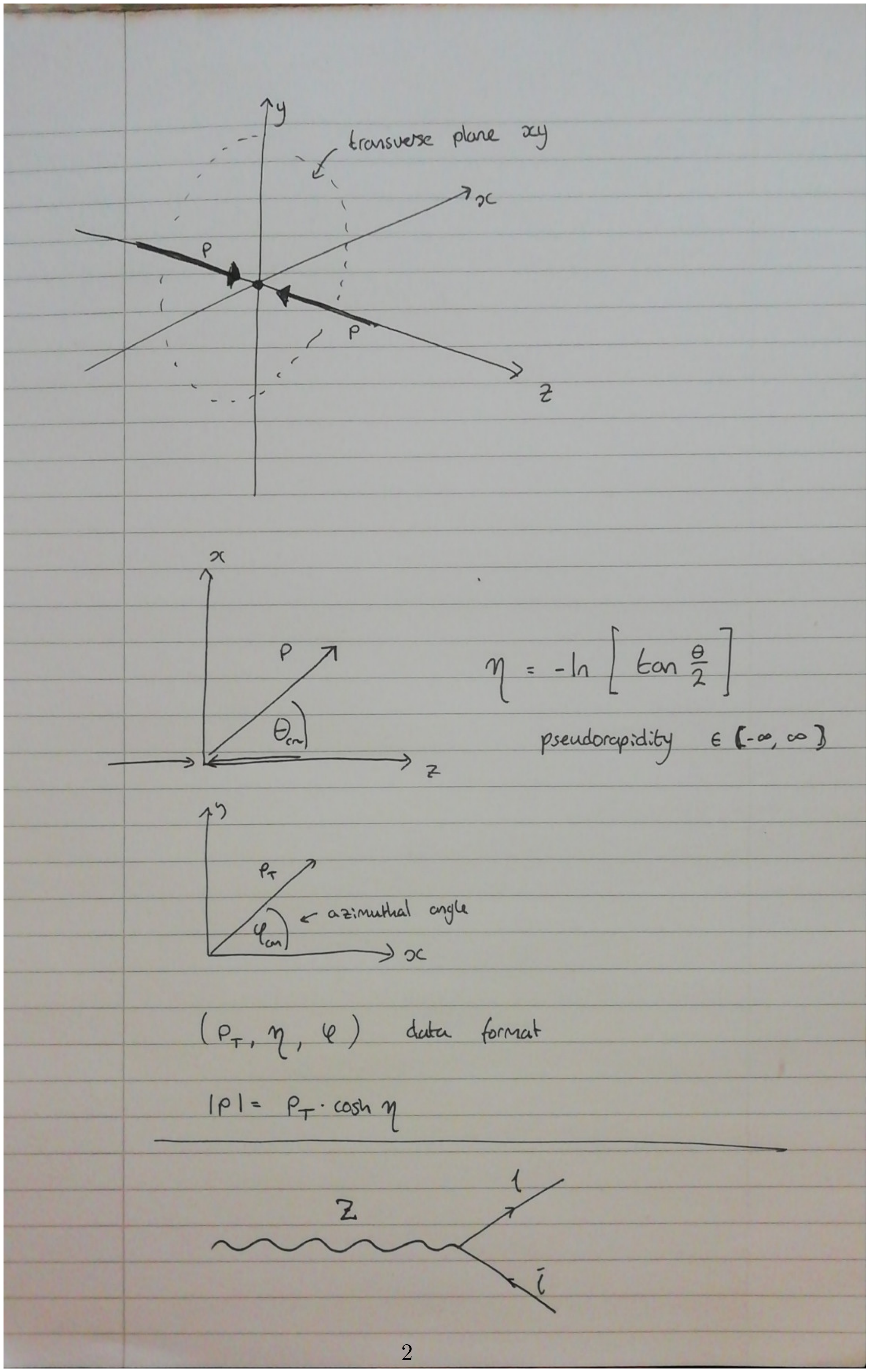

Figure 1: Understanding form of the LHCb momenta data

1.3 Week 2

- Becoming familar with ROOT[1] and the LHCb dataset
- Worked on using ROOT to find Z boson mass peak as practice for W boson (C++) (Figures 2 & 3)

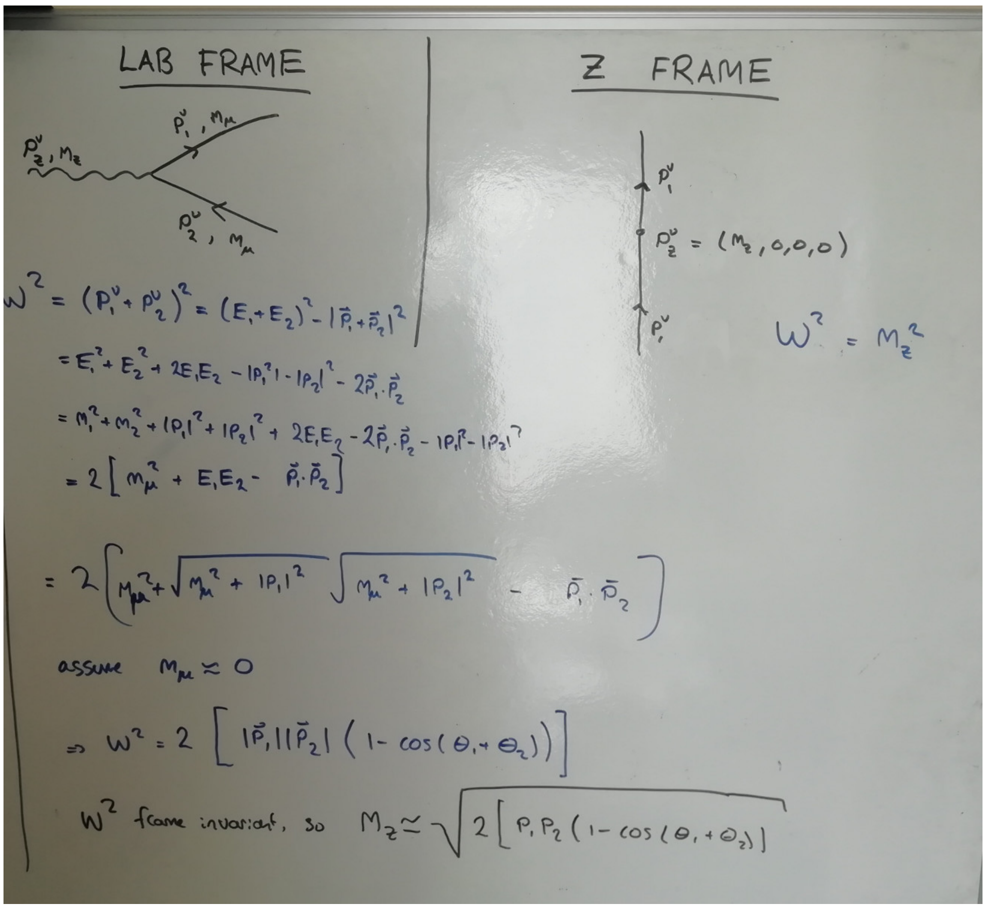

Figure 2: Workings for Z boson mass formula

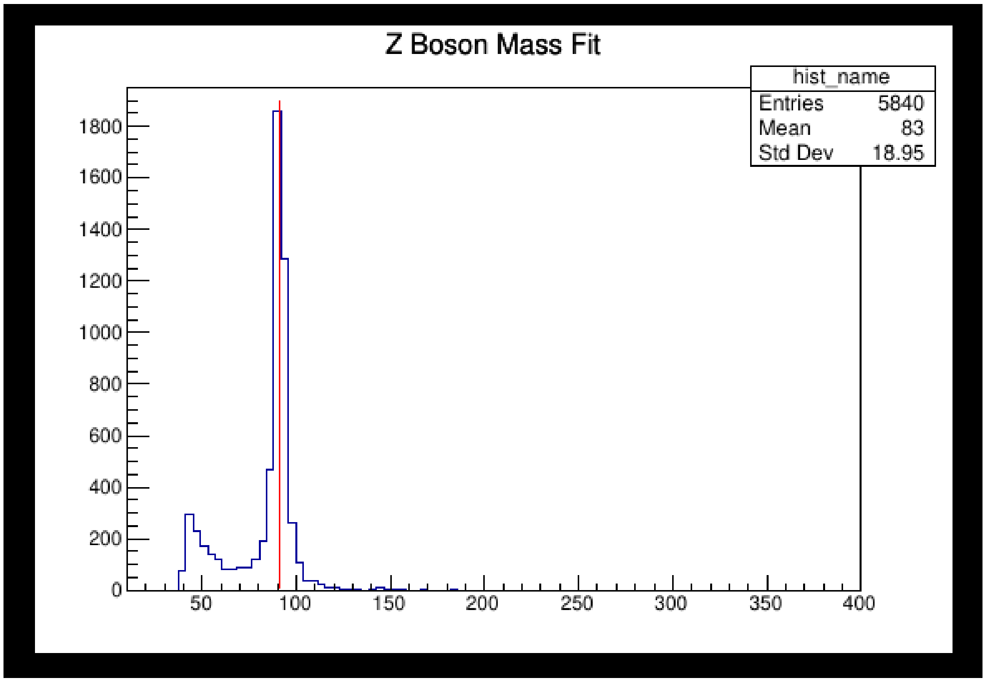

Figure 3: Results using derived Z mass formula with LHCb data

- Found Z mass peak again using Python and TTree/TChain instead (Figure 4)

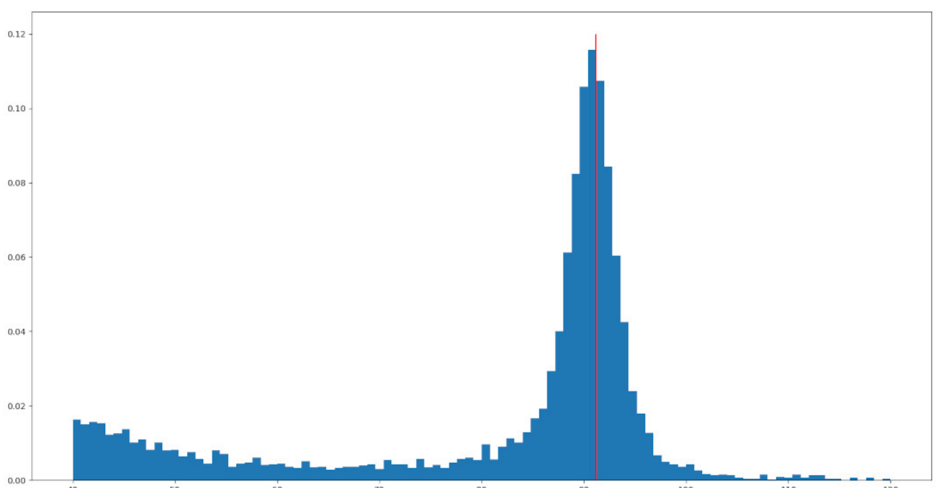

Figure 4: Z mass distribution using LHCb TTree dataset and Python

1.4 Week 3

- Installed Pythia
- Reading through Pythia and ROOT documentation[2]

1.5 Week 4

- Created histograms from LHCb 5TeV dataset
- Consider the highest energy pair of muons from each event

1.6 Week 5

- Refined Pythia code for generating and recording muon events

1.7 Week 6

- Generating theoretical cross sections to compare to 5TeV LHCb data
- Used built-in Pythia functions to obtain a total cross section, which I then used to calculate a weighting for each event recorded

1.8 Week 7

- Hiatus due to severe fatigue episode

1.9 Week 8

- Fixed cross section generating code so recorded muons have the correct weighting [3]
- Restructured code into one C++ file (`generate_z_events.cpp`) to generate muon events and `crosssections.py` to analyse them.

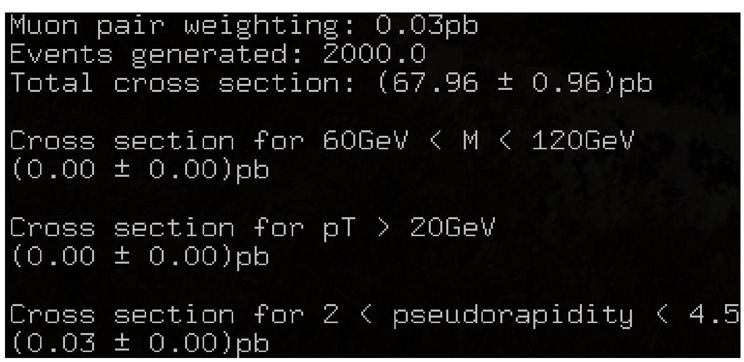

Figure 5: Output of `crosssections.py`: cross section for Z production for various cuts, based off the pair of highest energy muons per event generated.

1.10 Week 9

- Attempting to bugfix cross sections - weighting is correct but total cross section is higher than expected and higher than LHCb data analysis gives

1.11 Week 10

- Some attempted bugfixing of cross section generation code
- Mainly busy with other deadlines

References

[1] ROOT Reference Guide. https://root.cern/doc/v610/. Accessed: 2020-10-15.

[2] Introduction to Pythia 8. https://arxiv.org/pdf/0710.3820.pdf. Accessed: 2020-10-15.

[3] TASI Lectures on Collider Physics. https://arxiv.org/pdf/1709.04533.pdf. Accessed: 2020-11-15.