Electronic Work Record – Laura Cairns
Project Notes Pre-Term

Previous to written workbook

Revision of 3rd Year Standard Model module, PX395

Reading of Electroweak theory and W & Z boson theory, no written notes made

26/09/2020

Made notes in book for:

1. CERN mW Measurement press release, 12/02/2018
   (https://home.cern/news/news/experiments/first-high-precision-lhc-measurement-w-boson-mass)
2. Project Description
3. CERN mW Measurement paper, Eur. Phys. J. C (2018), 78:110.
   Main Mika reference in brief and email. Saved to Mendeley
   Electroweak theory, previous measurements. Read up to start of page 2, discussion of specific decay paths, and paper structure. *Come back to paper after read more Mika context.*
   (https://arxiv.org/abs/1701.07240)
4. Brief description of Drell Yan
5. Mika LHCb proposal paper, Eur. Phys. J. C (2015), 75:601
   Other Mika reference in brief and email. Saved to Mendeley. Lead to PDF tangent
   (https://arxiv.org/abs/1508.06954)
6. PDFs – parton distribution function
   Description from
   (http://www.scholarpedia.org/article/Introduction_to_Parton_Distribution_Functions) and
   (https://en.wikipedia.org/wiki/Parton_(particle_physics)), (https://arxiv.org/abs/1111.5452)
   Seems v important. Read more of Mika paper for more context, then continue to research as necessary – could easily be a rabbit hole.

Extension reading:

- 2004 paper for Precise mW SM prediction.
  Reference 14 in Eur. Phys. J. C (2018), 78:110, includes mW equation, and discussion of latest calculation.
  https://arxiv.org/abs/hep-ph/0311148
- 2014 paper for Limits of SM calculation with up to date values. "Global electroweak fit at NNLO".
  Reference 16 in Eur. Phys. J. C (2018), 78:110, suggests mW precision as limit for studying new physics beyond SM.
  Also used as reference for recent mW SM prediction. Worth reading.
  https://link.springer.com/article/10.1140/epjc/s10052-014-3046-5
- 2011 paper discussing PDFs
  https://arxiv.org/abs/1111.5452

Areas to study further:

- Electroweak gauge theory, SU(2)L x U(1)Y
- Should probably study the LHCb itself at some point
- Drell yan?
- PARTON DISTRIBUTION FUNCTIONS

General to read:

- Mika, 3 linked papers r/measuring mW with LHCb
- Rowan links
- Ref 16.
- Return to Eur. Phys. J. C (2018), 78:110 with more context of Mika plans

End of Session: Continue to read Eur. Phys. J. C (2015), 75:601, Mika proposal paper, to get project context.

03/10/20

Eur. Phys. J. C (2015), 75:601, Mika proposal paper

1. Pseudorapidity definition
   https://en.wikipedia.org/wiki/Pseudorapidity
   http://edu.itp.phys.ethz.ch/hs10/ppp1/2010_11_02.pdf
2. Benefit of LHCb use
3. fb^{-1} definition https://en.wikipedia.org/wiki/Barn_(unit)
4. Section 2, PDF uncertainties
5. Section 3, LHCb experimental sensitivity to W mass
    a. Calculate measurement uncertainty
    b. Background processes
    c. FIGURES of simulated data -> statistical uncertainties
    d. Quarkonium definition https://en.wikipedia.org/wiki/Quarkonium
    e. Momentum scale??
6. Section 4, LHC average improved by 20 to 40 %
7. Section 5, pWT modelling still gives uncertainties not discussed in this paper.

Questions

1. PDF4LHC recommendation? https://arxiv.org/abs/1101.0538
2. NNPDF3.0, MMHT2014, and CT10 sets?
3. I think I need PDF explained in detail, sorry.
    a. What is a PDF?
    b. How can we calculate an uncertainty from it?
4. What is momentum scale, how does it relate to uncertainties?
5. What is the scope of our project? Are we calculating the mass exclusively from LHCb, or calculating mass using other data also? I am not, this is probably a stupid question

Further work

- *(Checked) Potentially useful to read and study 2nd year Physics of Particle Detectors https://moodle.warwick.ac.uk/course/view.php?id=28885*
- *(Completed) Revise error calculation, especially r/correlation*
- *(Completed) Read https://arxiv.org/abs/1902.04323, Eur. Phys. J. C, 79, 6, 2 2019 (in Mendeley)*

Workbook Notes

PAGE	DATE	TOPIC
2	26/09/2020	CERN mW Measurement press release, 12/02/2018 Project description
3, 4		CERN mW Measurement paper, Eur. Phys. J. C (2018), 78:110
4		Brief description of Drell Yan
5		Mika LHCb proposal paper, Eur. Phys. J. C (2015), 75:601 Description of PDFs
6 – 9	03/10/2020	Mika LHCb proposal paper, Eur. Phys. J. C (2015), 75:601
6		Pseudorapidity definition Energy-momentum relationship
7		Benefit of LHCb use fb^{-1} definition Section 2, PDF uncertainties
8		Section 3, LHCb experimental sensitivity to W mass Section 4, LHC average improved by 20 to 40 %
9		Section 5, pWT modelling still gives uncertainties not discussed in this paper.