Hi, my name is Andrii Anataichuk
Nice to meet you!

My backgroud

- **V. N. Karazin Kharkiv National University – will be finished in summer 2023.**

4-years Bachelor of Science in Physics

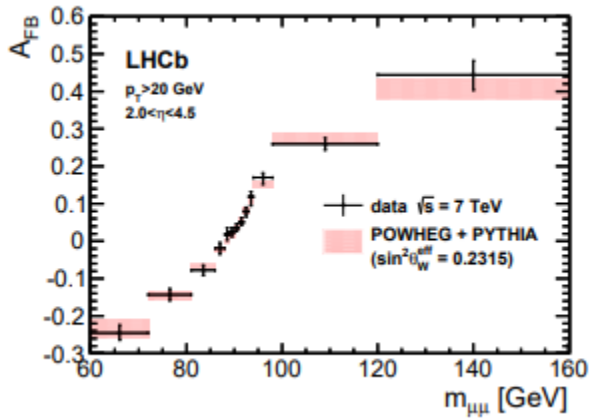
- **École Polytechnique – also will be finished in summer 2023**

3-years Bachelor of Science in Physics

What is my subject here?

- study of the forward-backward asymmetry with xFitter

    1. setup xFitter
    2. adapt xFitter and repeat some calculation from ATLAS-CONF-2018-037
    3. upgrade xFitter to include some non-SM corrections and study non-SM constraints using ATLAS data following arXiv:2103.12074v1
    4. Extend this to LHC pseudo-data



arXiv:1509.07645v2

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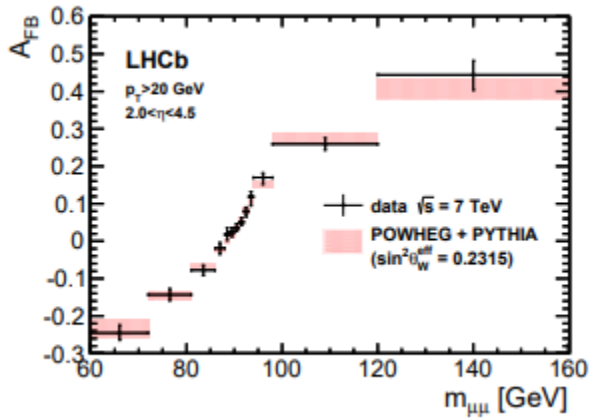

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The hardest part

Some details about the second part

The data to compare with ATLAS-CONF-2018-037

- Added rapidity (y_min, y_max) as changing parameters
- Changed some parameters, constants, and PDF set to MMHT2014nnlo68cl

```
1663 // Main function to compute results at an iteration
1664 void ReactionAFB::compute(TermData *td, valarray<double> &val, map<string, valarray<double> > &err)
1665 {
1666   td->actualizeWrappers();
1667   auto *Minv_min  = const_cast<std::valarray<double>*>(td->getBinColumnOrNull("Minv_min"));
1668   auto *Minv_max  = const_cast<std::valarray<double>*>(td->getBinColumnOrNull("Minv_max"));
1669   auto *y_min  = const_cast<std::valarray<double>*>(td->getBinColumnOrNull("y_min"));
1670   auto *y_max  = const_cast<std::valarray<double>*>(td->getBinColumnOrNull("y_max"));
1671
1672   if (Minv_min == nullptr || Minv_max == nullptr) {
1673     hf_errlog(19050500, "F: AFB code requires Invariant mass bins to be present");
1674   }
1675
1676   int Npnt_min = Minv_min->size();
1677   int Npnt_max = Minv_max->size();
1678
1679   // check on the rapidity cut
1680   if (y_min_param  >= eta_cut_param) {
1681     hf_errlog(19050500, "F: The chosen lower rapidity cut is not compatible with acceptance cuts");
1682   }
1683   if (y_min_param / log(energy_param/(*Minv_max)[Npnt_max-1]) > 1) {
1684     hf_errlog(19050500, "F: The chosen lower rapidity cut is too high in this invariant mass range");
1685   }
1686
1687   if (Npnt_min != Npnt_max) {
1688     hf_errlog(19050500, "F: uneven number of Invariant mass min and max");
1689   }
1690
1691   // Fill the array "val[i]" with the result of the AFB function
1692   for (int i = 0; i < Npnt_min; i++) {
1693     if (y_min) {
1694         y_min_param = (*y_min)[i];
1695     }
1696     if (y_max) {
1697         y_max_param = (*y_max)[i];
1698     }
1699     double AFB_result = AFB ((*Minv_min)[i], (*Minv_max)[i]);
1700     val[i] = AFB_result;
1701   }
1702 }
```

ReactionAFB.cc

https://gitlab.com/fitters/xfitter/-/merge_requests/7

Results

|Y|	A_4 (xFitter LO)	A_4 (ATLAS NNLO)
0.0 – 0.8	0.0147	0.0144 ± 0.0007
0.8 – 1.6	0.0483	0.0471 ± 0.0017
1.6 – 2.5	0.0959	0.0928 ± 0.0021
2.5 – 3.6	0.1496	0.1464 ± 0.0021

SM predictions using 8 TeV data for a dilepton invariant mass in the range [80 GeV,100 GeV]

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Error ~2-3% → Is that OK?

Thank you for your attention!