Latest CMS m_W measurement

https://indico.cern.ch/event/1441575/

https://indico.cern.ch/event/1457452

https://indico.cern.ch/event/1464211/

https://cms-results.web.cern.ch/cms-results/public-results/preliminary-results/SMP-23-002/

Ludovica A.B

Subtile:
What i would like you keep in mind

https://indico.cern.ch/event/1441575/

https://indico.cern.ch/event/1457452

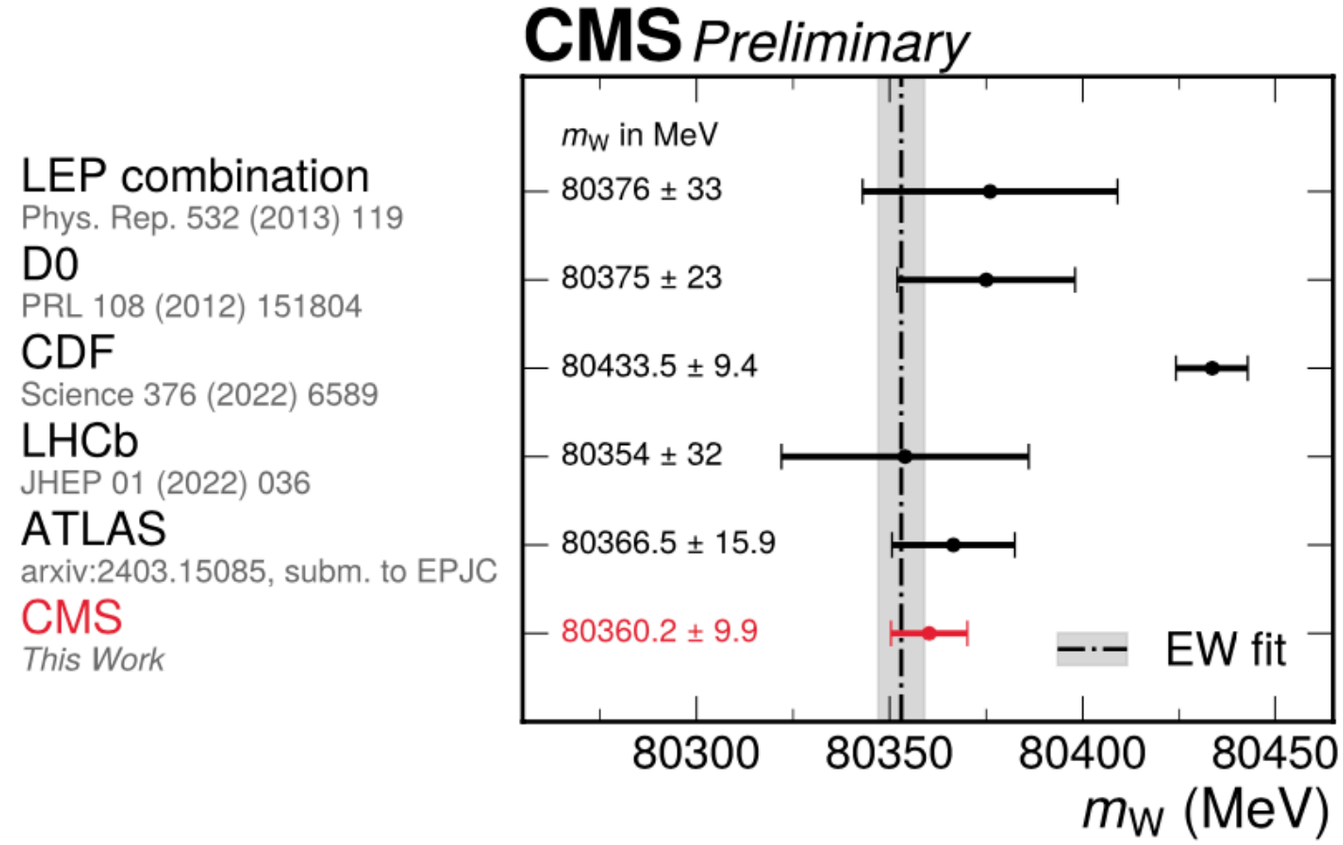
https://indico.cern.ch/event/1464211/

https://cms-results.web.cern.ch/cms-results/public-results/preliminary-results/SMP-23-002/

Ludovica A.B

from this talk spectacular :)

$m_W = 80360.2 \pm 9.9\,\text{MeV}$



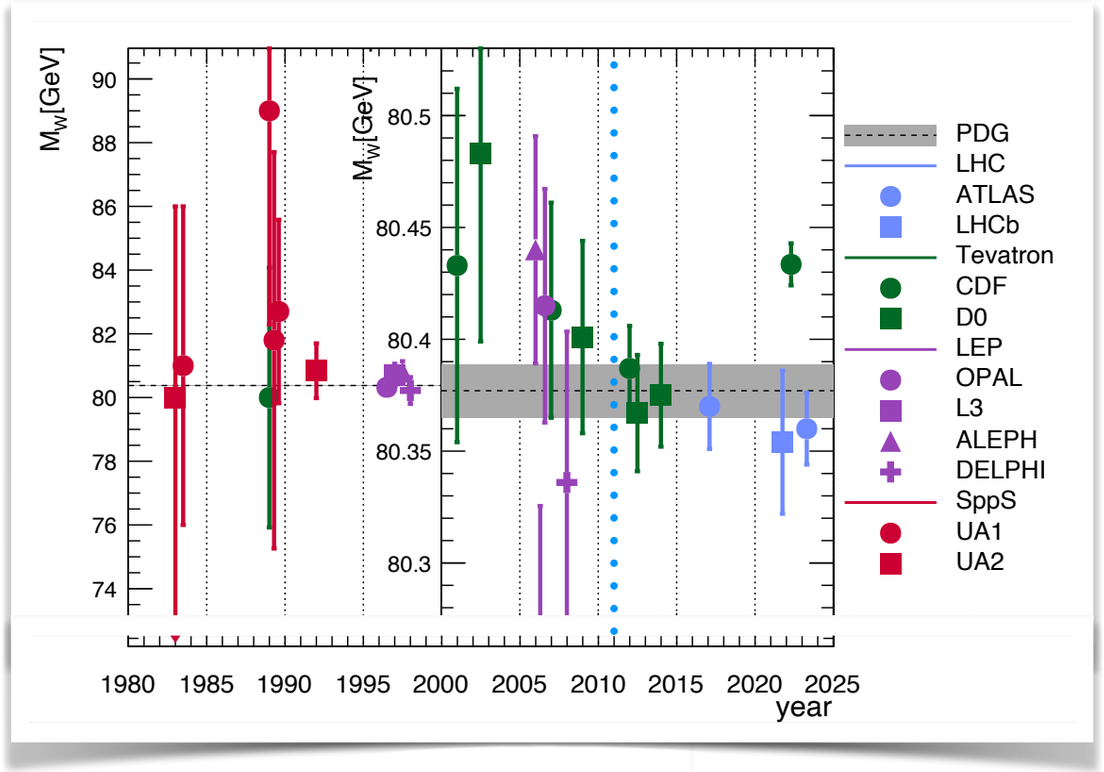
- This is the first m_W measurement from CMS
- Measurement is performed with $\sim$ 10% of Run 2 data
- Major advances in experimental and theoretical techniques form the basis for further improved precision and additional measurements in the future

In my view 3 crucial takes away from this kind of measurements :

from this talk :

- Road map to arrive to those results
  - AKA : building up the knowledge to reach that level of understanding of detector + theory
- Experimental challenges
  - AKA : I need to know what and how I am measuring things
- TOOLs
  - AKA not need to be frustrated and wait the results we need to be able to analyse the data with suitable framework

The road map of the first **ATLAS/LHC** m_W measurement



2008 Eur.Phys.J.C 57
ATLAS Potential on m_W

2014 JHEP 09 (2014) 145
Z Boson Transverse Momentum at 7 TeV

2012 Start of the m_W analysis Efforts

2016 Eur. Phys. J. C 77 (2017) 367
W and Z Boson Production at 7 TeV

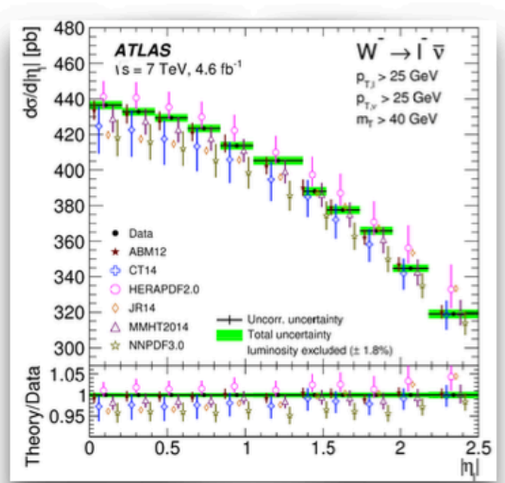
2016 JHEP 08 (2016) 159
Z Boson Angular Coefficients

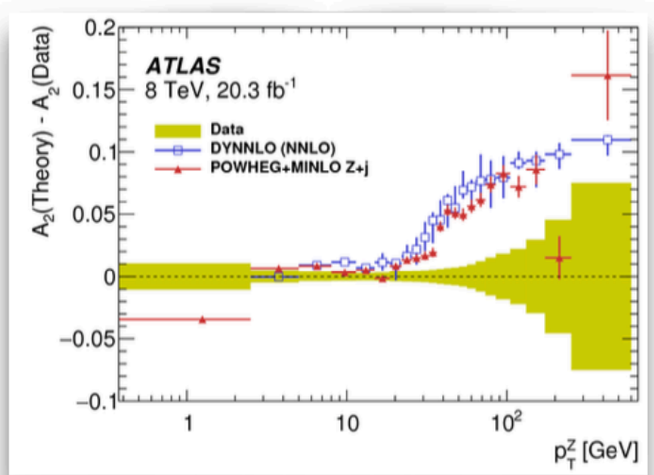
2017 Eur.Phys.J.C 78 (2018)
First Measurement of m_W

2018 Start of the m_W Re-analysis Efforts

2019 A. Düdder
PhD Theses
2020 L. Adam
PhD Thesis
2022: P. König
PhD Thesis

2023 This Work
Reanalysis of m_W



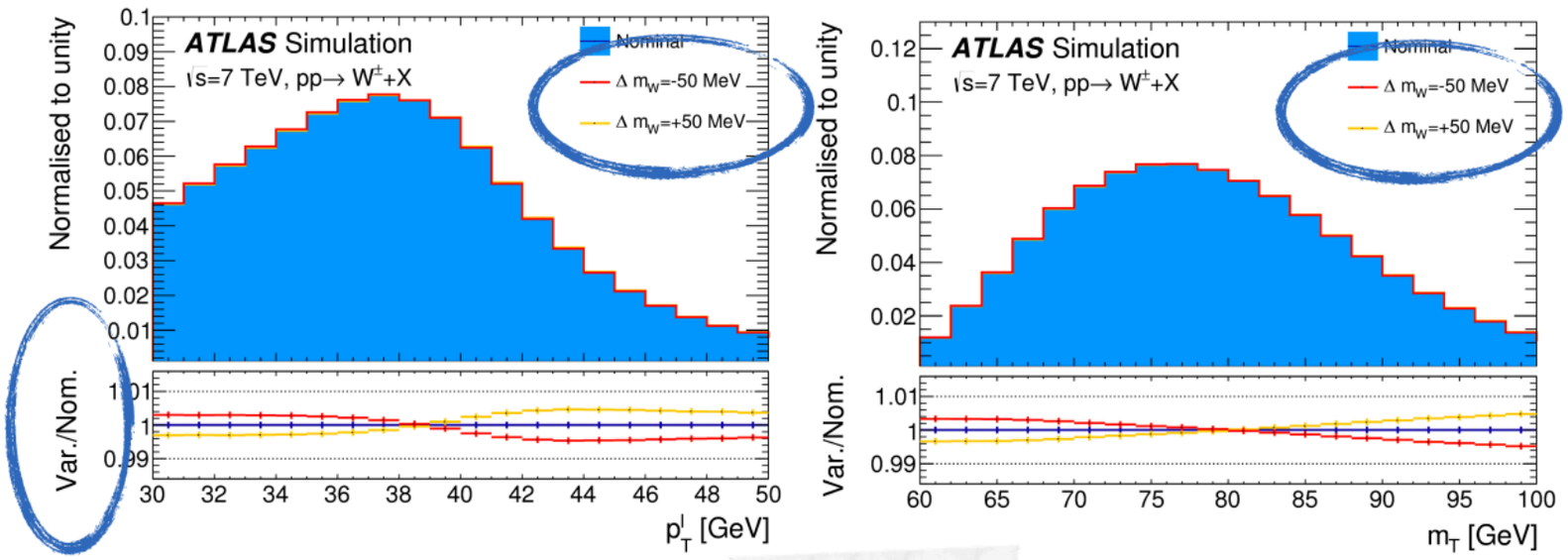


The experimental challenges of any m_W measurement

performance girl ?

Besides all the difficulties coming from the modelling we should not forget (because we are experimentalist) about the **experimental challenging related to this measurement** !

To measure m_W we produce models ("templates") with different m_W-hypotheses and compare to **data** in 28 categories (e/μ, η regions, W^+W^- , p_T^l m_T)

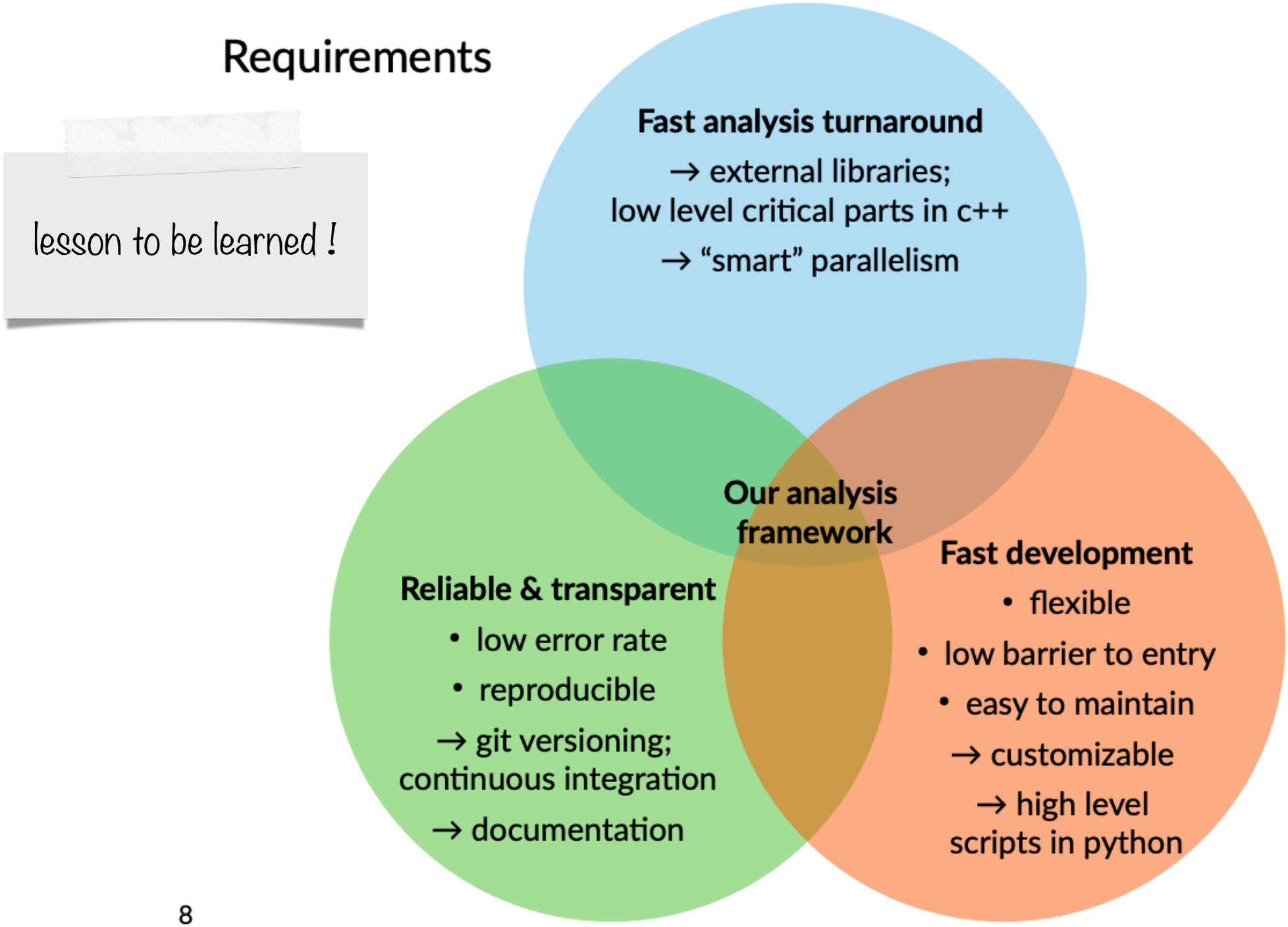


50 MeV variation in m_W value results in ~0.2-0.5% variation on the kinematics of the W production

we aim for O(10 MeV) precision
⇨ ~ O (10^{-4}) on lepton calibration and sub-% level on the recoil

I strongly recommend that you have a look at this talk to get an idea of how long it has taken ATLAS to reach the required precision.

Analysis framework



Any Questions ?