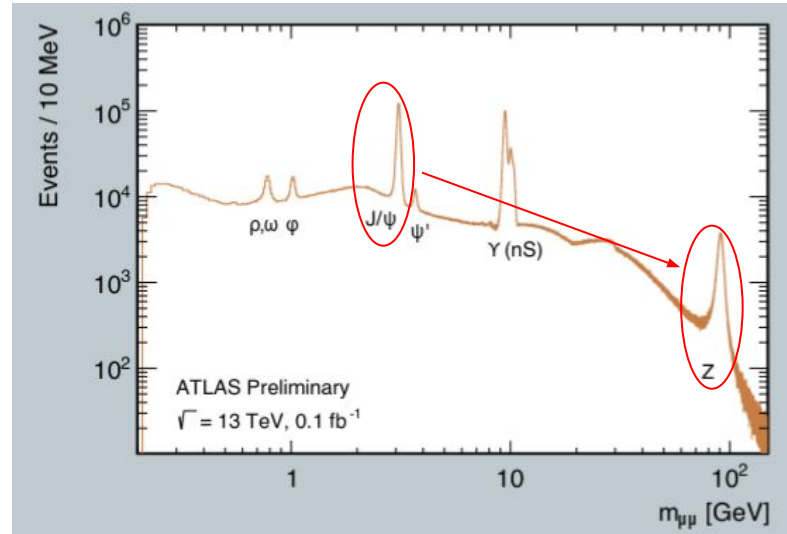


Two PhD theses on precision measurements of electroweak parameters in ATLAS

Maarten BOONEKAMP, Fabrice BALLI, Émilien CHAPON
IRFU / CEA Saclay (France)

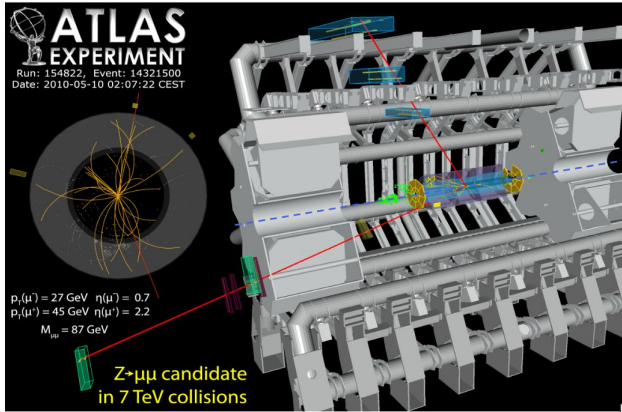
Electroweak physics: Z boson mass

- Measured in the dimuon channel
- Using full Run 2 data (139 fb^{-1})
- Main challenge: muon momentum calibration (using the J/ψ)



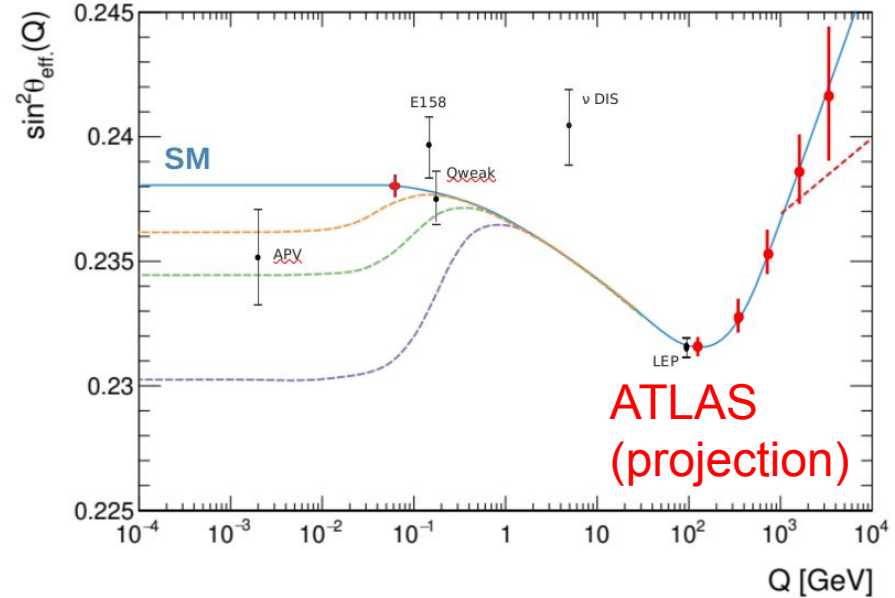
Electroweak physics: weak mixing angle

- Using leptonic Z decays: forward-backward asymmetry A_{FB}
- Measurements at the resonance, and later above



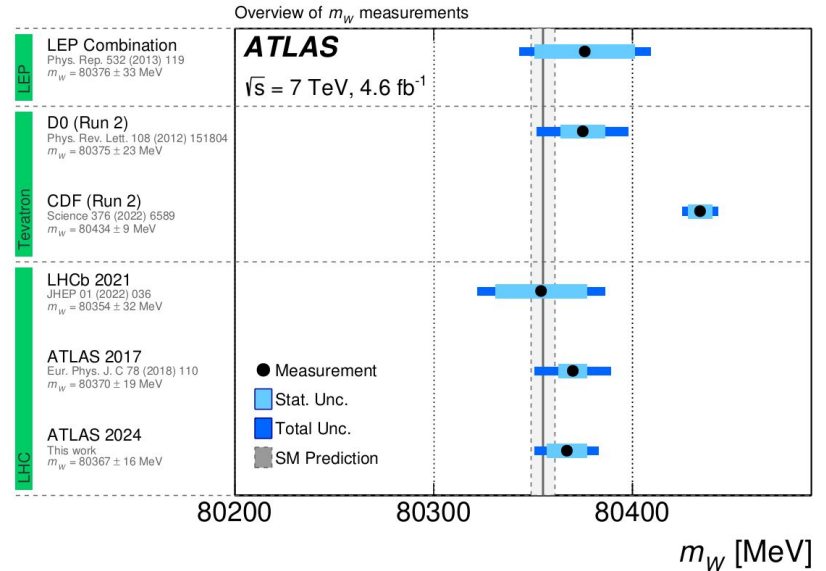
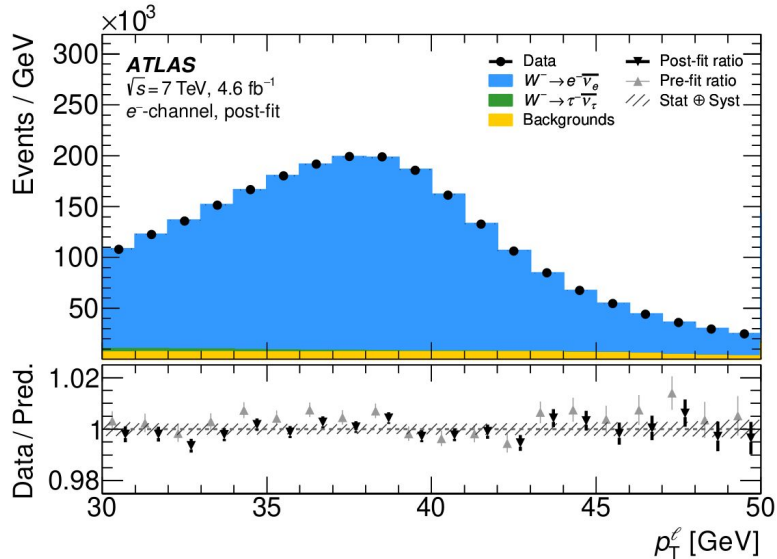
$$A_{FB} = \frac{N_{Fwd} - N_{Bwd}}{N_{Fwd} + N_{Bwd}} \quad (\text{measurement})$$

$$\propto (1 - 4 \sin^2 \theta_W) \quad (\text{prediction})$$



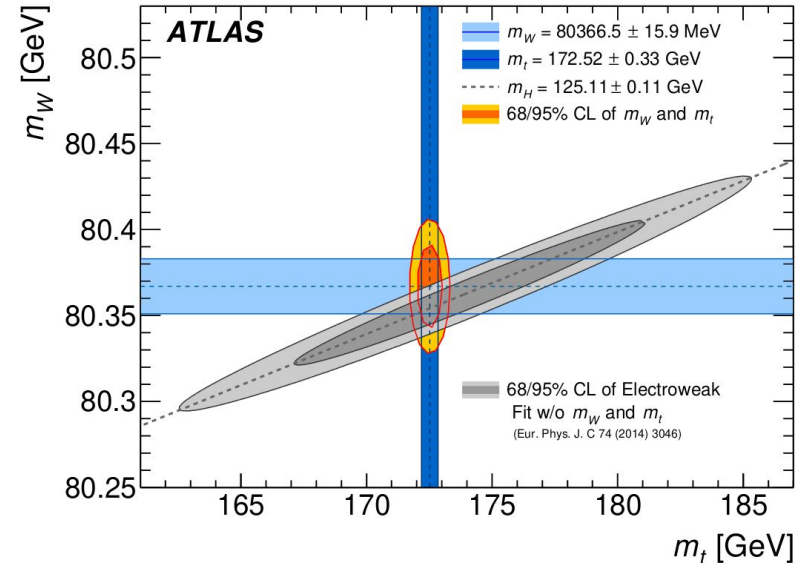
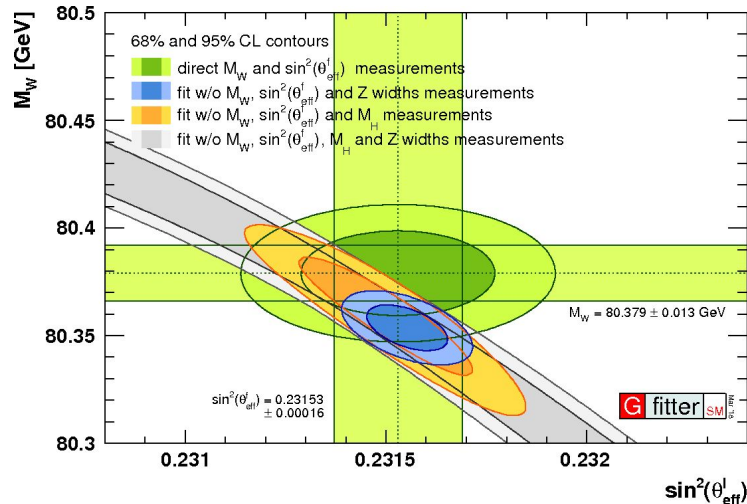
Electroweak physics: W boson mass

- Electron and muon channels
- Several observables: p_T , m_T , E_T^{miss}
- Challenges : electron, muon and recoil calibration; modelling of W-boson production and decay (QCD, PDFs)



Electroweak physics: combinations and interpretation

- These precision measurements are used in global fits to check the consistency of the Standard Model



<https://inspirehep.net/literature/2689656>

Project for the next ~5 years

- PhD thesis details
 - 3 years, based at CEA Saclay (near Paris)
 - fully funded
 - see <https://inspirehep.net/jobs/2777147>
- Expected scientific production
 - W-boson mass with low pile-up data, $\delta m_W \sim 15$ MeV
 - Z-boson mass with full Run2 data, $\delta m_Z < 5$ MeV
 - $\sin^2\theta_W$ with Run2 data, then Run3
 - combinations and interpretation
- Electroweak team @ ATLAS CEA Saclay
 - 3-4 permanent physicists
 - two PhD theses for fall 2024 (**this call**): m_W at low pile-up, m_Z and $\sin^2\theta_W$; interpretation fits / combinations
 - two PhD thesis fall 2025: m_W with full Run2 data; $\sin^2\theta_W$ with Run2+Run3

Backup slides

ATLAS group at IRFU / DPhP

- 15 permanents, 1 post-doc, 9 students at this moment
- Physics analysis
 - Higgs physics : ttH (couplings, CP violation), $H \rightarrow \mu\mu$
 - Electroweak precision measurements and interpretation : m_W , m_Z , $\sin^2\theta_W$
 - ...
- Detectors, reconstruction, performance
 - alignment of the muon spectrometer, calibration of the muon momentum scale
 - Liquid argon calorimeter data quality and monitoring
 - jets and missing E_T
 - Upgrades : mainly inner tracker (ITk) and LAr calorimeter electronics