



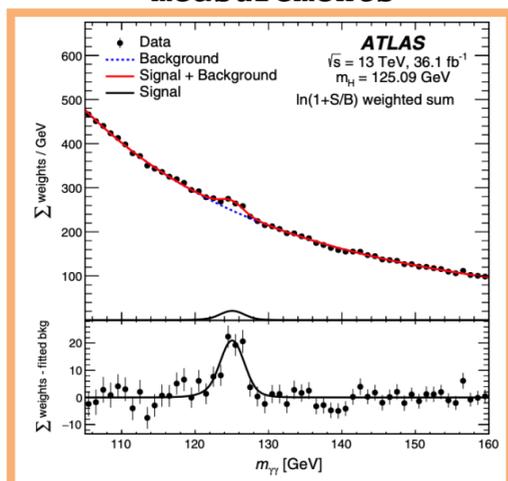
Electron and photon energy measurement calibration with the ATLAS detector

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LP2021, Manchester(UK), 10-14 January, 2022

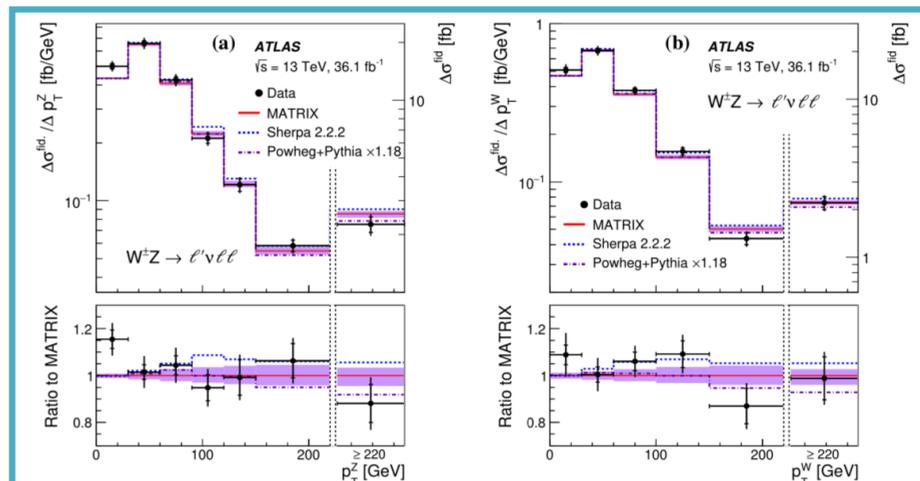
Why the precise electron/photon energy calibration is needed?

- Important ingredient for many physics analysis, specially for precise physics measurements

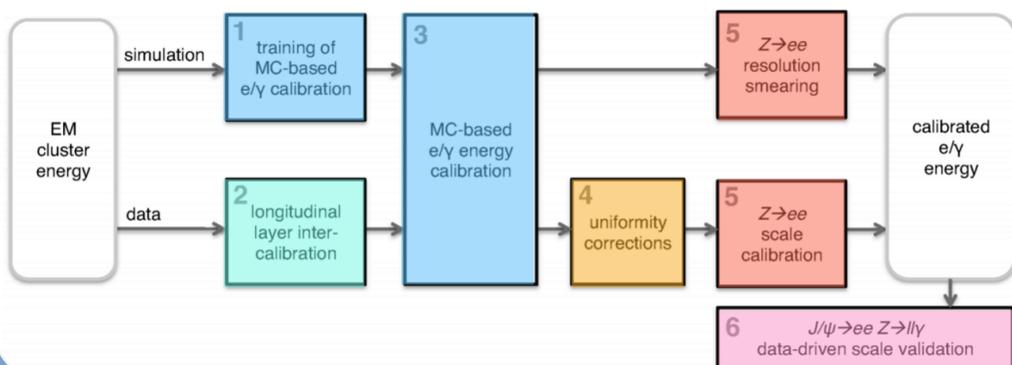


Higgs Mass Measurement

Measurement of the W(+/-)Z production cross sections

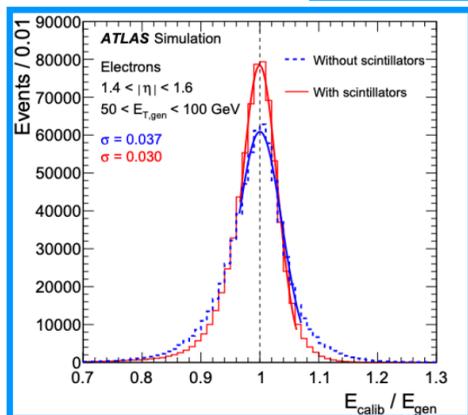


Electron and photon energy calibration scheme

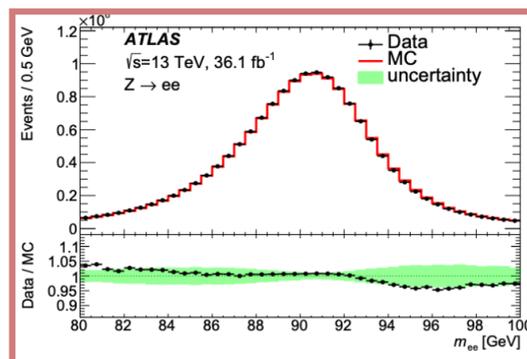


- 1,3 MC-based calibration:** optimised separately for electrons, converted and unconverted photons
- 2 Layer-intercalibration (E1/E2):** equalization of the energy scale in data with respect to MC due to the segmented EM longitudinally
- 4 Uniformity and Stability corrections:** corrections for residual non-uniformities modeled by the simulation
- 5 Correction for residual Data/MC differences:** applying energy scale and resolution factors to Data and MC
- 6 J/psi(ee) and Z(ee):** sample processes used as cross-checks

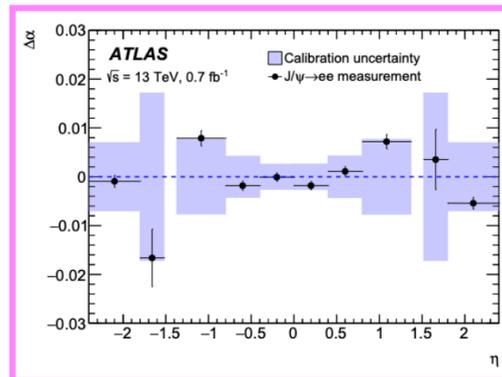
MC-based Calibration



- e^\pm and γ energies measured from reco EM clusters:
 - energy loss due to: passive material in EM, neighboring cells, etc..
 - Single correction derived from Multivariate Analysis (BDT)

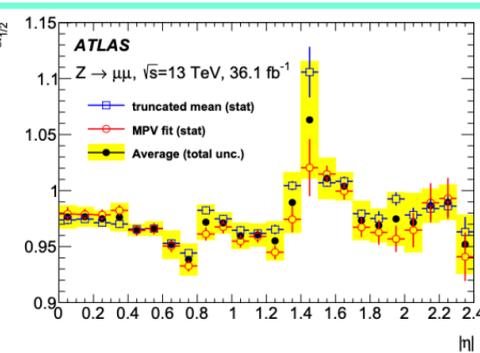


- Corrections derived (χ^2 minimization) for energy scale (data) and resolution (MC)
- Fair agreement in $M(ee)$ between data and MC

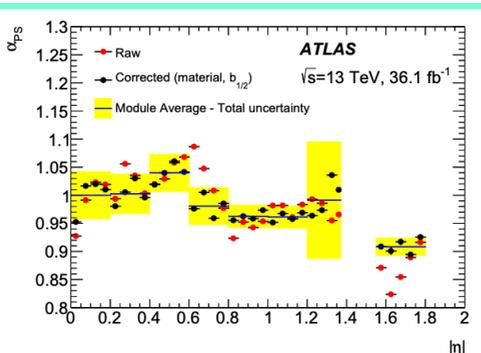


- Cross-checks: $J/\psi(ee)$ (energy scale) and Radiative Z decay (energy resolution)
- $J/\psi(ee)$: Δx (residual energy scale difference) extracted in data and MC is consistent with zero

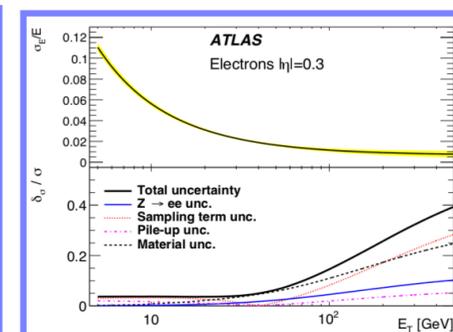
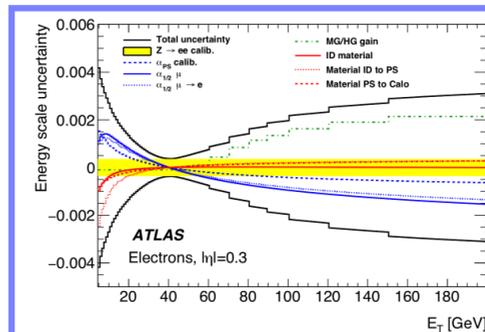
E1/E2 layers inter-calibration



Pre-sampler (PS) energy scale



- Corrections applied on data:
 - E1/E2 layer inter-calibration measurement:** using muons (MIP particles) and cross-checked with electrons
 - Two methods: TM and MPV fit
 - largest barrel/end-cap uncertainty: 1.5% and 2.5%
 - PS measurement:** ratio of the energy in PS in data and MC
 - Z(ee) decays sensitive to amount of material in front of PS
 - uncertainty varying from 3% to 1.5% (η -dependent)



- Uncertainties on energy scale and uncertainties on the energy resolution: Electrons/Photons (30-60GeV), energy resolution precision from 5% to 10%
 - Relative uncertainty in the energy resolution reaches 20% to 50% (high-energy electrons or photons)

For more information:

[1]: Electron and photon energy calibration with the ATLAS detector using 2015-2016 LHC proton-proton collision data

JINST 14 (2019) P03017

