UNTERSTÜTZT VON / SUPPORTED BY

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HUMBOLDT
STIFTUNG

Introduction to the project: electron and photon energy calibration in ATLAS

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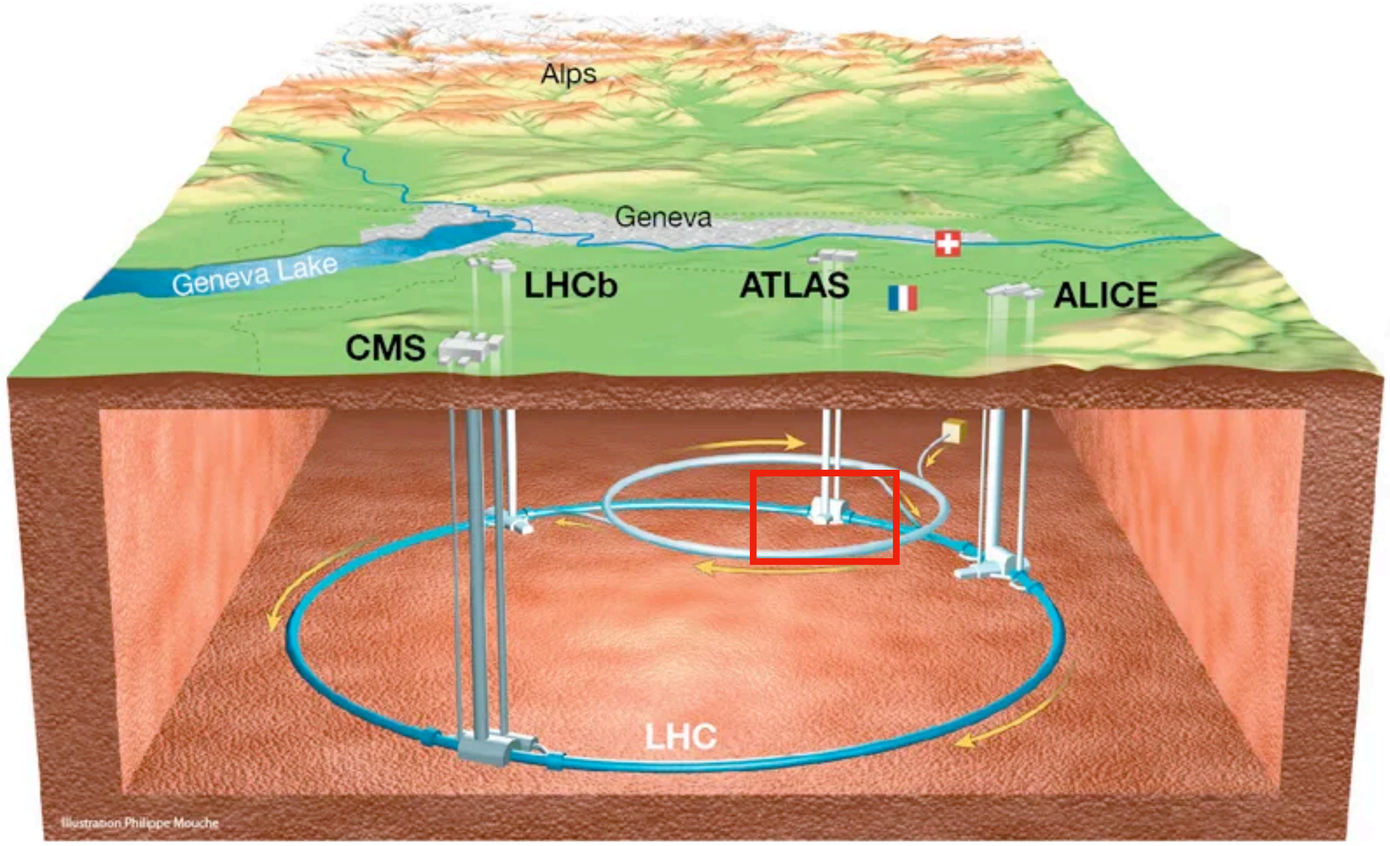
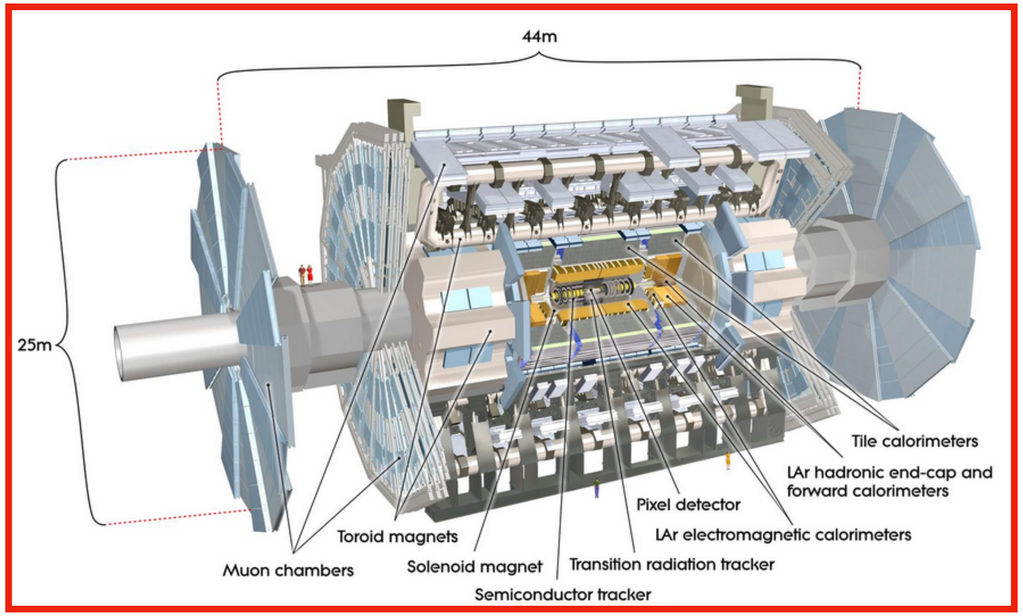
EGamma @ DESY bi-weekly meeting - 21/10/2025

The Large Hadron Collider (LHC)



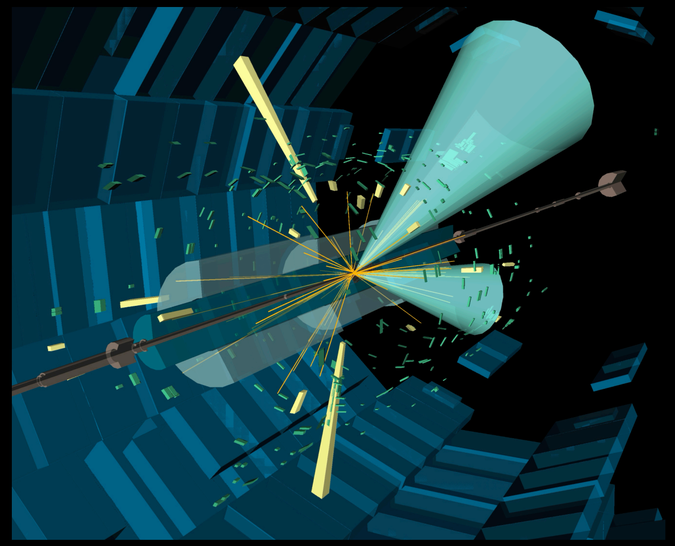
- 27 km ring for accelerating hadrons
- Proton-proton (pp) collisions (among others)
- $\sqrt{s}$ = 13 TeV in Run 2 and 13.6 TeV in Run 3
- 4 detectors: CMS, LHCb, **ATLAS**, ALICE

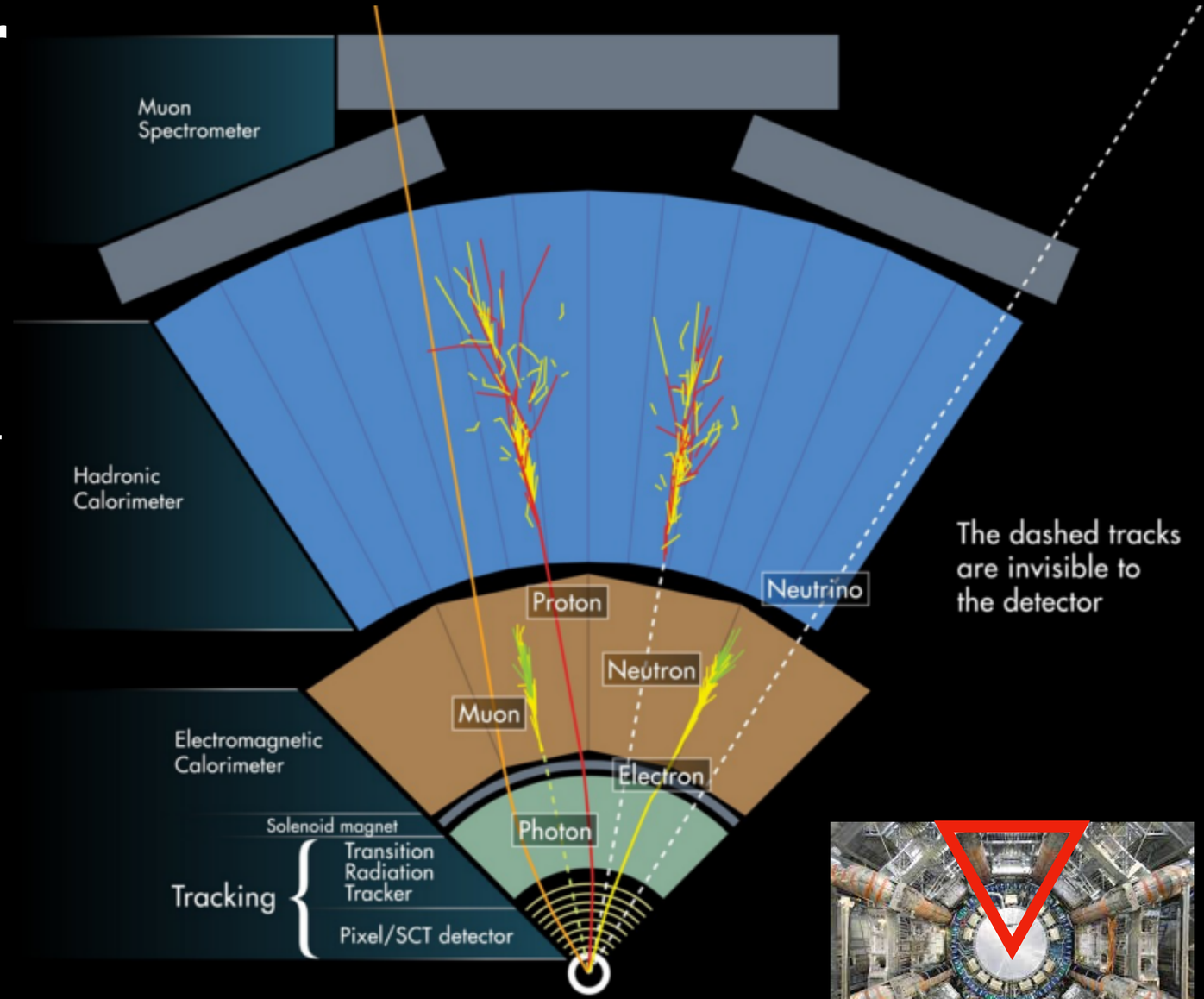


The ATLAS detector

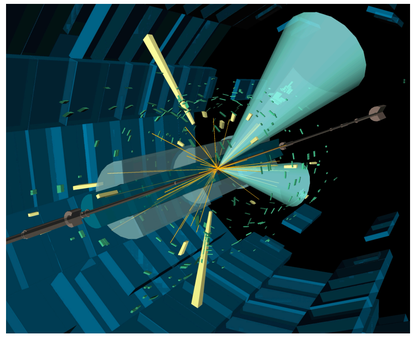
- Made of several subsystems
- Particle identification
- Reconstruction of “flight direction” (track)
- Measurement of energy, electric charge, etc…

Example of a collision event

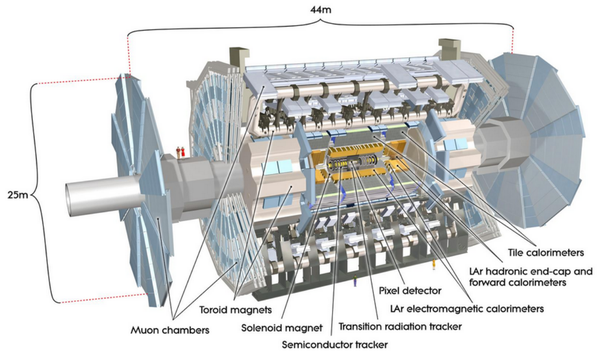




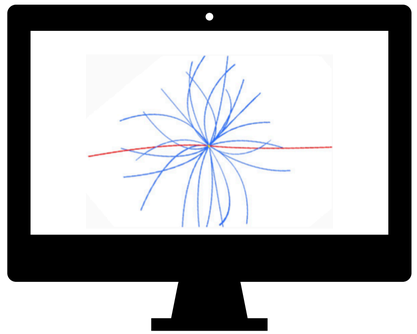
Data and simulation



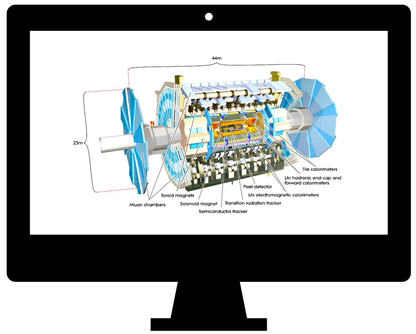
Actual collisions



Actual detector response



Monte Carlo (MC) simulation of collisions



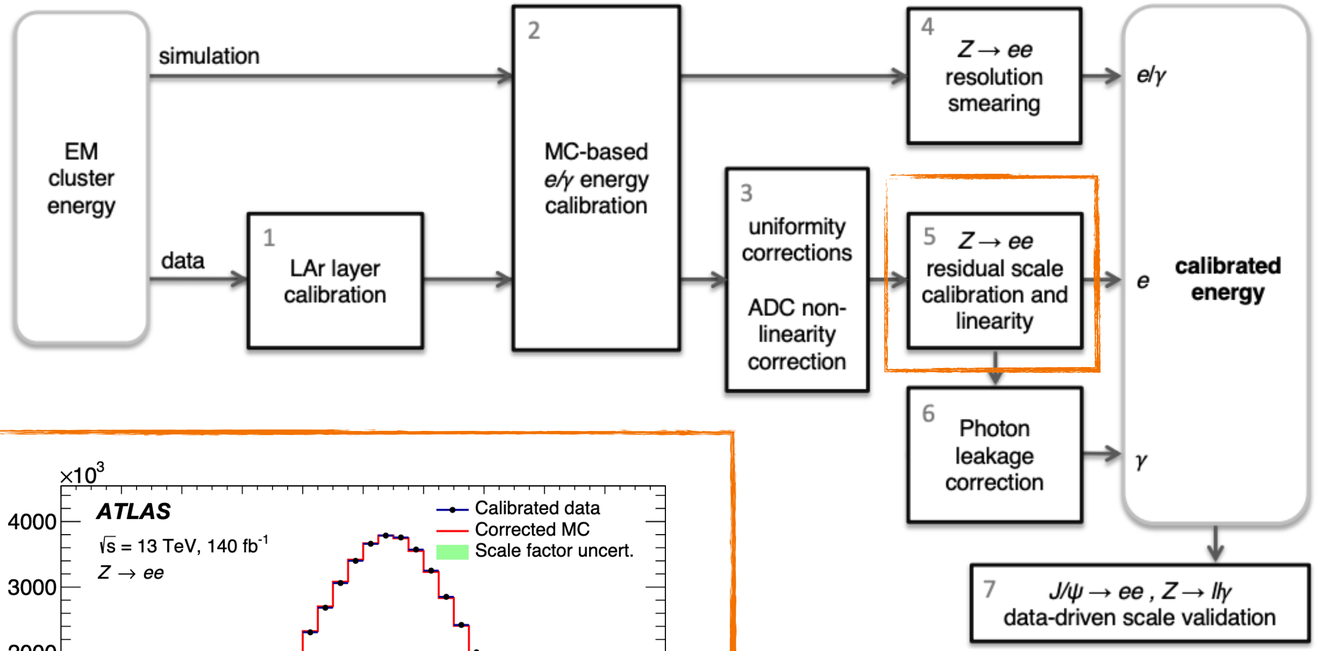
MC simulation of detector response

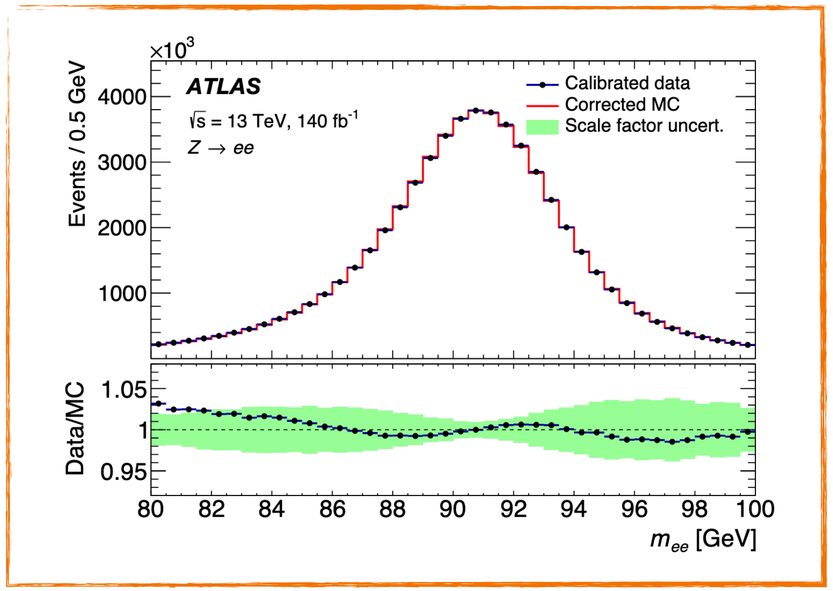
ATLAS EXPERIMENT

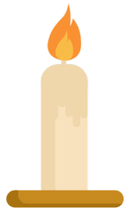
Reconstruction software

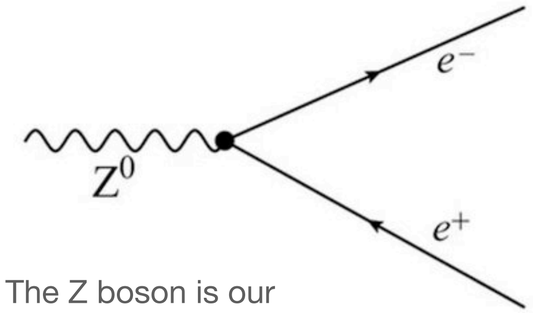
Does the <u>simulation</u> describe the <u>data</u> well?

Energy scale calibration

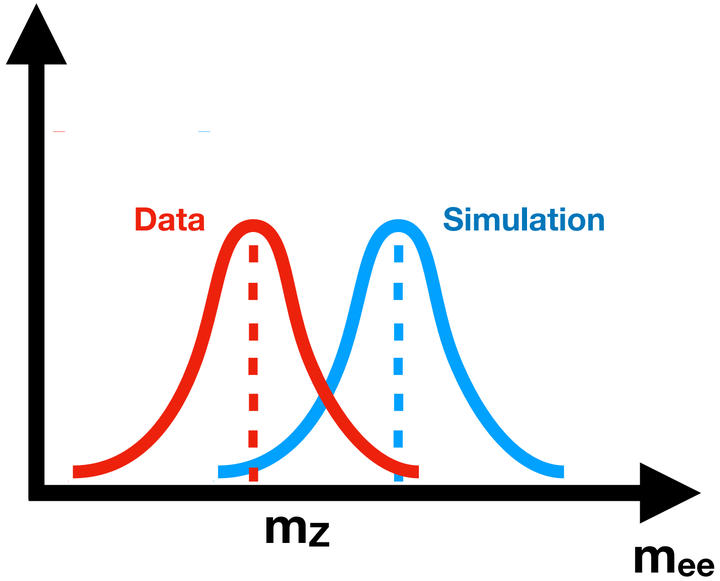




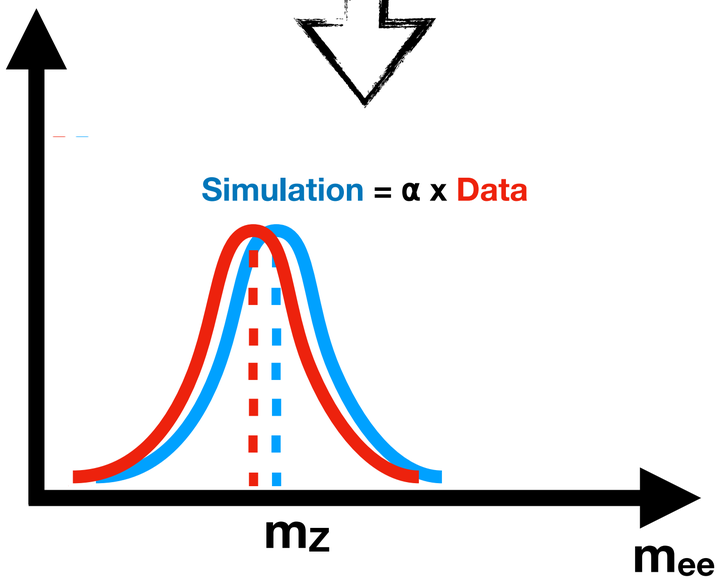




The Z boson is our "standard candle"

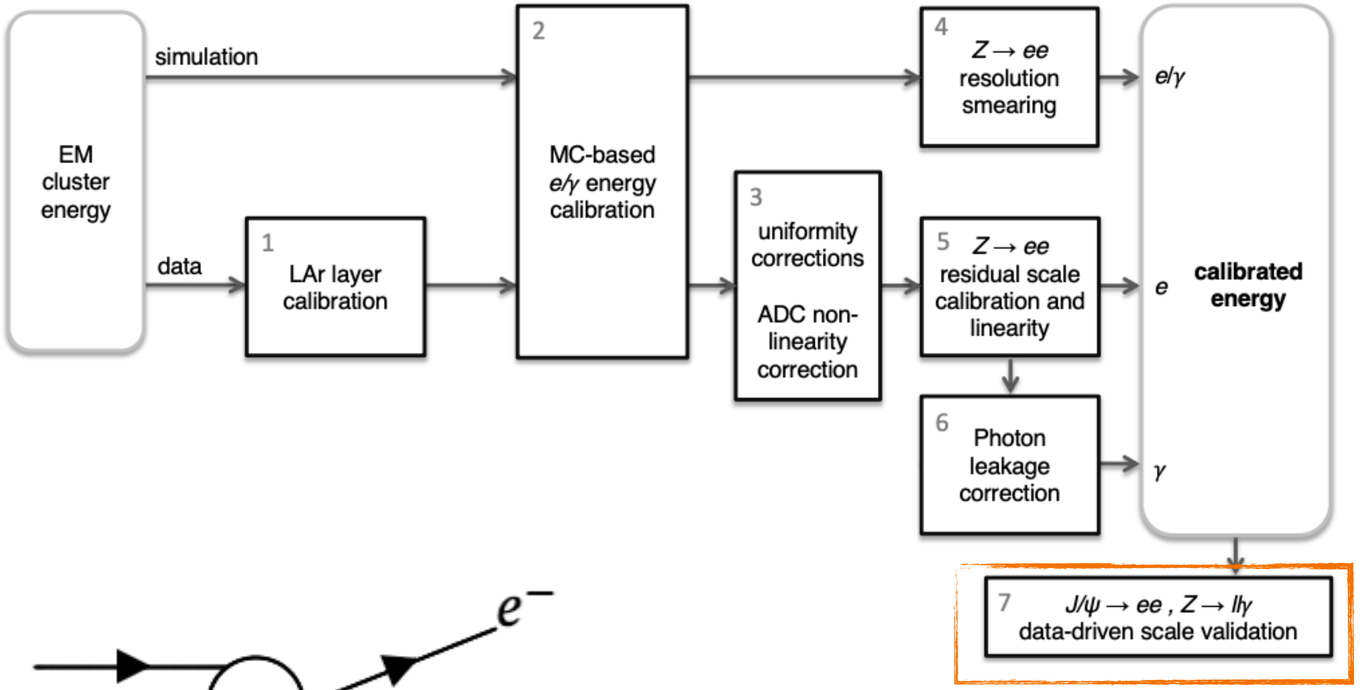


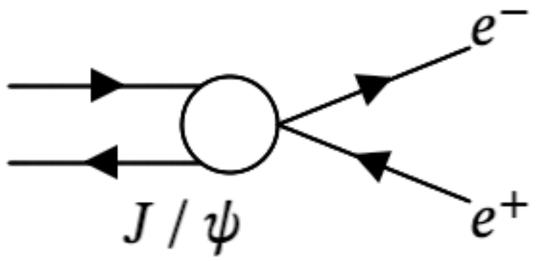
Calibration based on the Z→ee process



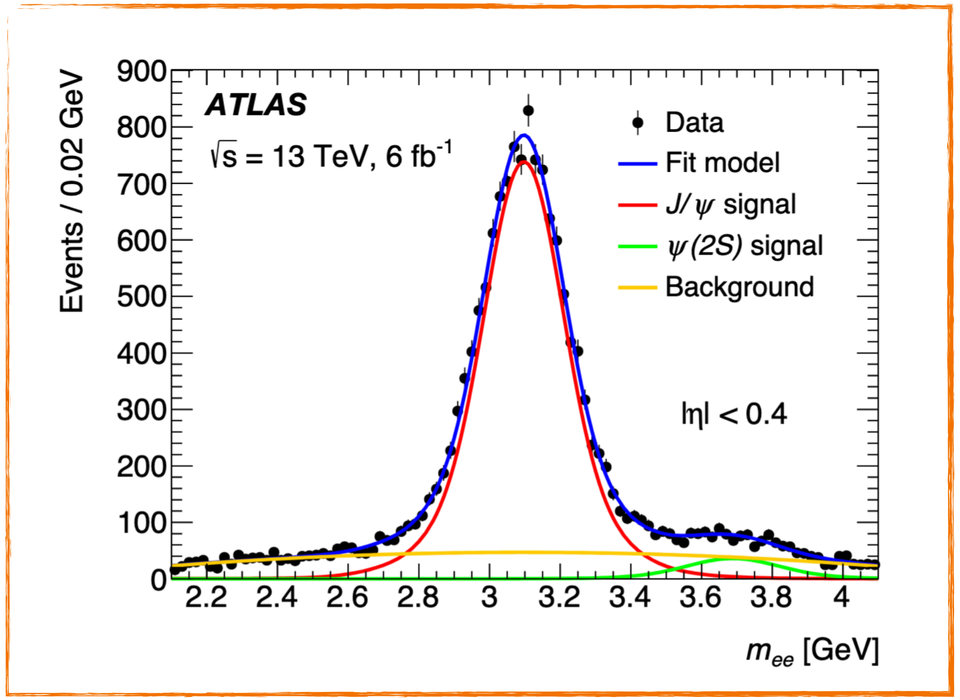
Energy scale validation

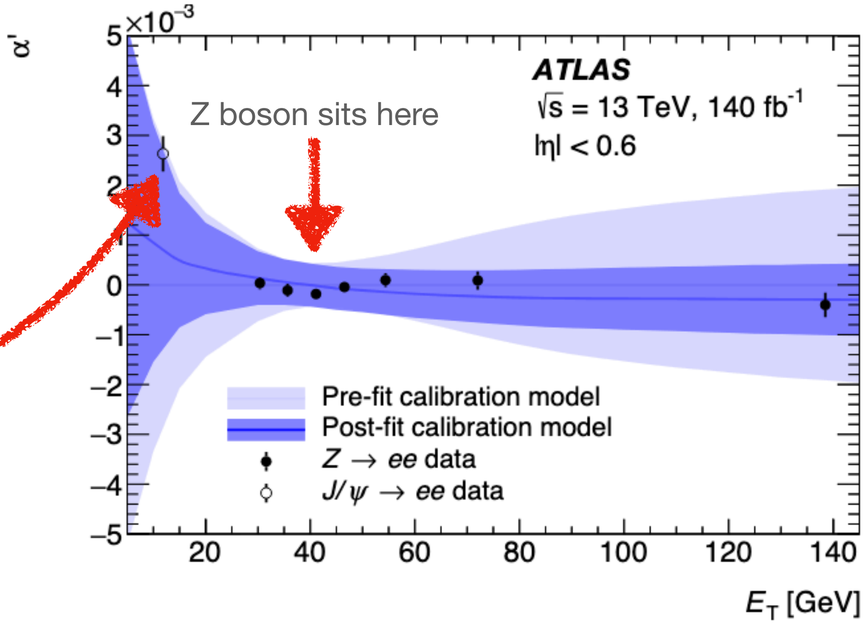
- Is the calibration universal? I.e. valid for electrons of any process?





J/ψ→ee is another well-known process





Back-up