Electrons in ATLAS: from Run1 to Run2
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Introduction
The performance of electron reconstruction, identification and calibration plays a critical role in several physics analysis with electrons in the final state, as for instance in Standard Model measurements, Higgs boson discovery and measurements, and the searches for new physics beyond the Standard Model. This poster will present Run 1 results and latest results from Run 2.

Reconstruction
In the central region of the ATLAS detector (|η| < 2.47) [1], the electron reconstruction is seeded from energy deposits (clusters) in the EM calorimeter, which are then associated to reconstructed tracks of charged particles in the inner detector. In 2012, the electron reconstruction consisted of the following steps:

- Electron seed-cluster reconstruction:
  a) building clusters by sliding-windows algorithm;
  b) duplicate removal algorithm.
- Electron-track candidate reconstruction:
  a) pattern recognition: standard pattern recognition using the pion hypothesis and modified pattern recognition algorithm, allowing larger energy loss to account for possible bremsstrahlung;
  b) track fit: track candidates are fitted with the same hypothesis as for pattern recognition using the global γ fitter [3].
- Loose matching to cluster:
  a) tracks are extrapolated to the middle layer of EM calorimeter
  b) selection on the difference in η (Δη) between track and cluster if tracks have silicon Δη, in Δη, and also after rescaling the track momentum to the measured cluster energy passing a tightened cut for variable.
- Electron-track candidates previously defined are reﬁtted using an optimized electron track fitter, the Gaussian Sum Filter (GSF).
- Electron-track candidate reconstruction:
  a) track-cluster matching: GSF refitted tracks with tighter requirements on Δη and Δφ (more than one track can be associated with a cluster);
  b) choose the best match as primary track for the future analysis.

Identification
Objects built by electron reconstruction algorithms: signal electron and background objects including hadronic jets as well as background electrons from photon conversions, Dalitz decays and semi-leptonic heavy flavor hadron decays. To reject these backgrounds, electron identification is based on discriminating variables:

- longitudinal and transverse shapes of the electromagnetic showers in the calorimeter,
- properties of the tracks in the inner detector,
- matching between track and energy cluster

The cut-based selections contain few operation points: loose, multilepton, medium and tight (as shown in Fig.2) [2].

Identification

Another technique used is likelihood (LH) identification:
- uses probability density functions (PDFs) of discriminating variables;
- overall probability is calculated for the object to be signal or background;
- for a given electron the probabilities are combined into a discriminant δℓ, on which a cut is applied: dL = δℓ, L(ξ) = [P(ξ) | π(ξ)]

For Run 2 the identification is adapted to changes in ATLAS detector: use Xe or Ar in different parts of the TRT, the new Pixel layer (IBL) and to have good pileup robustness with 25ns bunch spacing. Electron efficiency measurements using 2015 data (85 pb⁻¹) are presented in Fig.3 [4].

Calibration

Dielectron mass distribution for the data corrected with the energy scale factors and for the MC simulation with and without the resolution corrections [5].

References