**Run-2 ATLAS Trigger/Daq system**

- Two-level system to reduce average event rate recording to ~1 kHz from the LHC beam crossing rate of 40 MHz. ~20% allocated for e/γ.
- Hardware-based Level 1 (L1) trigger
  - Uses low granularity data from calorimeters and muon system.
  - Identifies regions of interest (Rols).
  - Maximum output rate of 100 kHz.
- Software-based high-level trigger (HLT)
  - Full granularity data from all the detector + Rols from accepted events by the L1.
  - Performs the online particle reconstruction.

**Triggering e/γ**

- HLT e/γ trigger reconstructs objects within electromagnetic (EM) Roi provided by the L1 Calorimeter (L1Calo) trigger.
- e/γ HLT sequence
  - Fast algorithms reject events early.
  - Precise algorithms to efficiently identify e/γ + cut-based ID for Photons.
  - Likelihood-based ID for Electrons.
- Clusters are reconstructed with a sliding window algorithm; selection is based on the transverse energy of the cluster ($E_T$).
- Common shower shape variables for e/γ calculated for identification.
- Photons are reconstructed with only the cluster.
- Electron candidates have tracks loosely matched to the cluster ($\Delta R$, $\Delta \eta$).
- Tracks are then extrapolated to 2nd EM layer.
- Electrons have additional information
  - hits in the tracking detectors.
  - transition radiation hit information.
- e/γ Reconstruction, calibration and identification
  - reduced offline software and techniques.

**Improvements in Run-2**

- Topological cluster based isolation for photons. Online since 2017.
- New Neural Network based algorithm (Ringer) to improve fast calorimeter selection for the electron trigger chains. Re-optimized in 2018.
- Identification for electrons at HLT.
  - Likelihood selection and ID pileup correction updated for 2018 data taking.

**Sources of inefficiency for single electron triggers**

- Study data on 2017, at each selection step in the HLT w.r.t offline reconstruction.
- Try to keep online selection as close as possible to offline.
- Still some differences, mainly in the Precision Electron step.
  - In particular in the tracking.
- The trigger developments are made to minimize those differences.

**Electron Trigger Performance**

- Efficiencies measured with a tag-and-probe method.
  - Using $Z \rightarrow \mu\mu$ decays in early 2018 data and late 2017 data.
  - Offline reconstructed electrons are required to pass a likelihood-based ID.
- The error bars show statistical uncertainties.
- Achieving same performance in 2018 conditions as in 2017. Robust against pileup.

**Photon Trigger Performance**

- Efficiencies measured based on a data-driven bootstrap method.
  - Events selected from a fully efficient reference trigger to measure the performance of the offline trigger.
  - No background subtraction is applied. Bayesian statistical uncertainty.
  - Good trigger performance. Robust against pileup.

**References:**