background estimation sec:background-estimation-efake Electrons are reconstructed from the electromagnetic (EM) calorimeter energy deposits and the associated track reconstructed in the inner detector. Where photons are reconstructed from the EM calorimeter energy deposits. The reconstruction of electrons and photons is similar, and the main difference is that the electron has a track associated with it. Also there are photons which produces pair of electron and positron after interacting with the detector material, referred as converted photon. The converted photon can be identified and reconstructed from the two tracks and energy deposit in the calorimeter. Therefore, it is possible that an electron is misidentified as a photon, which is called $e \rightarrow \gamma$ fake. The reconstruction efficiency of the electromagnetic cluster is very close to 100%, the electron misreconstruction as photon is mainly due to tracking inefficiency or the bad matching between the track and the cluster.

It is an important background in the single-lepton channel. The main processes contributing to this background are the dileptonic decays (and channels) and $Z \rightarrow ee$ decay, where one electron fakes a photon. Although the same algorithm is used to reconstruct electrons and photons in MC and data, the MC simulation doesn't model the $e \rightarrow \gamma$ fake events correctly. This discrepancy in the $e \rightarrow \gamma$ fake rate between data and MC is corrected by using a fake rate scale factor, which is the ratio between fake rate in data and the fake rate in MC.

Fake rate can be defined as the probability that an true electron is misreconstructed as a photon (define in sec:egammafakes$_f$r).$To estimate fake rate, a fake enriched control region is defined using process. The process has very high c sectionmeaningitisproducedinthedetectorveryfrequentlyandtherebysaturatesthedetectorphasespacewiththeelectrons.Thi calledtag-and-probemethodisusedtodefinetwocontrolregions, and.SincethereisnoprocessinSM, inthiscontrolregionth γ fakes by matching them to the truth level particles. Section sec:egammafakes$_f$r$defines the fake rate, estimation of fake r$

figure[!htbp] [width=0.69]figures/efake$_C$Rs.png[]$Graphical representation of the ee and e\gamma$ control regions.■
fig:egammafake$_c r_t oy$