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Electrons inside jets in ATLAS: not an isolated problem

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The standard electron and jet reconstruction processes in ATLAS happen independently, as a result energy deposits from electrons in Electromagnetic calorimeter often end up reconstructed as a jet close to the electron. Also, real jets can end up being reconstructed as a "fake" electron. Therefore, an overlap removal procedure is applied during analysis in ATLAS, where a jet close to an electron is removed as a physics object, and further if the electron has any more jets closer to it, the electron is discarded. This procedure results in using electrons which is isolated from nearby hadronic activity. In fact, even during the reconstruction of the electron, some isolation from hadronic activity is demanded.

Where for most of the scenarios, this works as intended, there are situations when this causes a problem. For example, in top antitop pair production and semi-leptonic decay, if the system is boosted and decay products overlap, then the electron can land up close to jet. Certain models of new physics can also result in a similar situation, for example in ATLAS heavy neutrino analysis, for certain configurations, the heavy neutrino can be reconstructed as large-radius jet containing the electron inside where the electron is close to a real jet and we want to keep them both. Then the standard electron reconstruction and overlap removal procedure results in a large fraction of real signal events being discarded, thereby severely hampering the search.
Additionally, the events which are kept, the performance of electron reconstruction is likely to adversely affected. Currently, a larger systematic uncertainty is applied to account for this effect.

This presentation proposes how we can deal with the reconstruction of such electrons that are close to the real jets. This work further aims at identifying such electrons in the midst of dense hadronic activity without removing either the electron or the jet which will highly benefit many analyses in ATLAS

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