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Using Boosted Decision Trees to look for displaced Jets in the ATLAS Calorimeter

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A boosted decision tree is used to identify unique jets in a recently released conference note describing a search for long lived particles decaying to hadrons in the ATLAS Calorimeter. Neutral Long lived particles decaying to hadrons are "typical"signatures in a lot of models including Hidden Valley models, Higgs Portal Models, Baryogenesis, Stealth SUSY, etc. Long lived neutral particles that decay in the calorimeter leave behind an object that looks like a regular Standard Model jet, with subtle differences. For example, the later in the calorimeter it decays, the less energy will be deposited in the early layers of the calorimeter. Because the jet does not originate at the interaction point, it will likely be more narrow as reconstructed by the standard Anti-kT jet reconstruction algorithm used by ATLAS. To separate the jets due to neutral long lived decays from the standard model jets we used a boosted decision tree with thirteen variables as inputs. We used the information from the boosted decision tree as input into a more traditional straight-cuts analysis to separate background and signal event topologies. We will describe the process by which we choose the variables for the boosted decision tree, "cleaned the data", the tuning of the boosted decision tree, and the results in this talk. As far as we are aware this is the first time a multivariate technique has been used for object ID in a search for long lived particles.

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