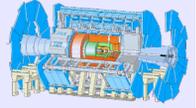


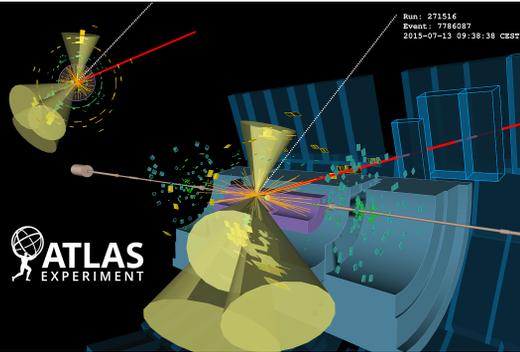
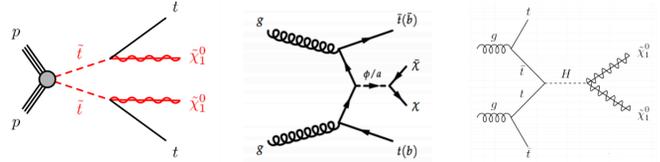


Search for Supersymmetry and Dark Matter



Search for new physics with pairs of top quarks at the LHC

Several extensions of the Standard Models predict new particles to be produced together with pairs of top quarks. These are for instance SUSY or DM particles, which are undetected and leave an energy imbalance (MET). The search for tt +MET is a unique opportunity for discovery of a broad range of new physics.



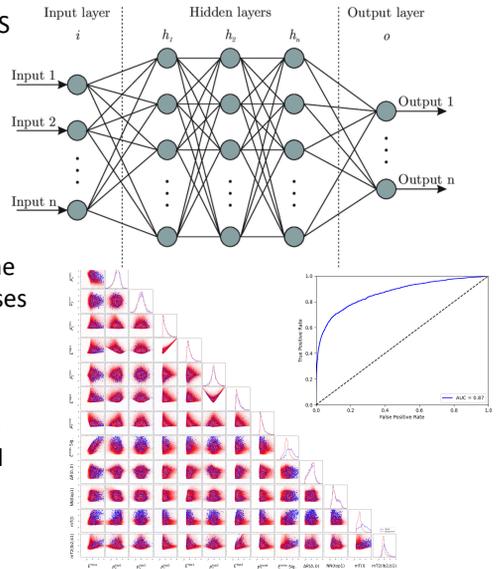
Reconstruction of the tt +MET kinematic

The decay of the top quarks leads to events with a high multiplicity of particles. These particles need to be properly assigned in order to reconstruct the top quark momenta and to distinguish potential signal events from background SM processes. This is a challenging task due to the presence of undetected neutrinos and the large combinatorics of jets. Reconstruction techniques are developed using advanced machine learning techniques, including deep neural networks, to optimally exploit the kinematic correlations among final state particles.

Topics for bachelor and master theses

A variety of topics in the search for new physics in tt +MET events at ATLAS is available in the group. Here are a few examples:

- **Reconstruction of hadronic top decays via machine learning:** machine learning methods will be used to efficiently assign the final state particles to the original top quarks. Regression techniques will also be investigated to precisely measure the top quark momentum.
- **Classification of signal and background events via machine learning:** the search is sensitive to a wide range of new particles with different masses and different properties (eg. stop quarks, new scalar or pseudoscalar DM-mediators, Higgs decays into invisible particles). All these signals have distinctive properties and need dedicated analysis to distinguish them from background events. New machine learning approaches will be developed to optimally target these signals, including parametrized or adversarial neural networks.



Don't hesitate to contact us, we will be happy to tell you about these and other topics in more detail!



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