Contribution ID: **28** Type: **Student short presentation**

Multivariate analysis to discriminate top quark pair production channels at LHC

Wednesday 29 March 2023 09:50 (10 minutes)

The top quark is one of the fundamental fermions of the Standard Model, and is observed in the highest energy collisions. Our focus is the $t\bar{t}$ pair, which is produced through strong interaction in two cases: from gluon fusion (gg) or quark-antiquark annihilation ($q\bar{q}$). Different production channels lead to pairs with different characteristics: one example is the $t\bar{t}$ spin state, which near the production threshold presents higher correlations in the case of a gg event. A study that proposes to study the entity of such correlations can thus benefit from a way to discriminate pairs on the basis of their production channels.

This work has therefore the purpose of obtaining, through the use of multivariate analysis methods, a tool to select events in such way. Multivariate algorithms are often used to separate a signal from a background that pollutes the sample; in this case for the signal we choose gg events, while for the background we select to $q\bar{q}$ events. Such a problem is called a *classification problem*.

We thus studied the performance of some classifiers, using the distributions of some variables associated to the $t\bar{t}$ production process. Then we selected the best performing algorithm evaluating its efficiency in selecting signal events and rejecting background ones. The chosen classifier turns out to be the *Boosted Decision Trees*, which allows to obtain a sample of purity 0.92, starting from an initial purity of 0.81, at the cost of a reduced efficiency of 0.74.

Title

Multivariate analysis to discriminate top quark pair production channels at LHC

Author: DEL GRATTA, Morgan

Presenter: DEL GRATTA, Morgan

Session Classification: Presentations