

1 Naam van Project

W+Heavy Flavor background suppression for stop searches.

2 Experiment

ATLAS

3 Begeleider

Pierfrancesco Butti

4 Beschrijving project

As a consequence of mass hierarchy inversion, the stop quark (\tilde{t}), the supersymmetric partner of the top quark (t), could be the lightest particle predicted by Super Symmetry. This property makes the \tilde{t} an extremely interesting particle since, if it exists, its production cross section in LHC would be the highest among all supersymmetric particles and it could be detected by ATLAS experiment. In stop searches the two main backgrounds are the top pair ($t\bar{t}$) and the production of a real W boson in association with Heavy Flavor jets ($W+HF$). The former is the dominant background for this search, since it looks exactly like the signal and needs a dedicated strategy in order to suppress it without killing the signal. The latter, on the other hand, has a high cross section, so a considerable amount of events of this process can pass the analysis selections. In addition, since the normalization of the $W+HF$ process has a high uncertainty, it leads to a considerable increase on the systematics of the analysis. This project is focused on the study of a set of variables for \tilde{t} signal, $t\bar{t}$ production and $W+HF$ in order to select the most suitable to discriminate among these processes without loss in the signal selection efficiency. A series of cuts can be then optimized in order to try to highly suppress the $W+HF$ contribution to the selected sample with a minimum impact on the signal acceptance. On the other hand, if this is not possible, a dedicated control region could be defined in order to better estimate the normalization and to reduce the systematics on the limit setting for the \tilde{t} production cross section.

5 Doel

The aim of this project is to study a set of variables that can discriminate among the \tilde{t} signal, $t\bar{t}$ pair production and $W+HF$ process in order to highly reduce the latter, with a minimum impact on the signal acceptance. If this result can not be achieved, it is possible to define a $W+HF$ dedicated control region where the normalization of this background can be estimated with higher precision, leading to a lowering of the systematics on the analysis. The student will acquire knowledge reading previously selected articles and notes in order to have a background on stop searches and will gain computational skills in writing a code for studying the best discriminating variables for the analysis.

Week	Activiteit
19	Introduction to Root. Reading n-tuples. Reading articles and notes
20	Study of distributions and comparison between different processes. First choice of set of variables
21	Investigation of a set of discriminating distribution
22	Optimization of the cuts. Preliminary results
23	Presentation.
24	Definition of a dedicated control region for $W+HF$ background
25	Improving on the normalization estimate.
25	Preparing a presentation on the work done
