Contribution ID: **65** Type: **Contributed talk**

Embedding simulated particles into real data in search for charged Higgs bosons

Thursday, January 4, 2018 6:45 PM (15 minutes)

Particle physics experiments typically require that background processes affecting the measurement are taken into account in the data analysis. In collider experiments, this means estimating how large fraction of the observed collision events actually originate from background processes and not from signal events.

The background event yields are usually estimated from simulation or with a separate background measurement, conducted in a control region where possible signal does not affect the measurement. However, simulated results always always rely on certain theoretical models and suffer from both theoretical and statistical uncertainties. On the other hand, measuring background from data is feasible only when there exists a control region that is similar enough to signal region but free of signal contamination.

In this talk, a third approach to background estimation is presented. The embedding method aims to combine the best features of background simulation and measurement. This method uses collision events that are very similar to actual signal, except that some of the particles present in the collision events are of "wrong" type. For example, if signal contains tau leptons, similar events containing muons (instead of taus) can be used for embedding. Then the "wrong" type of particles (muons) are carefully removed from event data, and replaced with simulated particles of the correct type (taus). The outcome is a hybrid data sample, where each collision event contains an underlying event from data and only a few simulated particles that were not present in the original event.

Examples of recent applications of the embedding method are given, and a current project to apply embedding in a search of charged Higgs bosons in the CMS experiment is presented. An ongoing analysis is searching for charged Higgs bosons decaying to a hadronic tau and a neutrino. The embedding method allows estimation of the large background of standard model events containing a hadronic tau, using a data sample with muons instead of taus in the final state. The discovery of a charged Higgs boson would be a clear signature of physics beyond the standard model.

Summary

Primary author: LAURILA, Santeri Henrikki (Helsinki Institute of Physics (FI))

Presenter: LAURILA, Santeri Henrikki (Helsinki Institute of Physics (FI))

Session Classification: Thursday PM

Track Classification: Particle physics - experiment