

Action Items: June 4 “Characterization of New Physics” Meeting

July 13, 2010

The “Characterization of New Physics” meeting on June 4 at CERN explored the role of topology-based approaches and simplified model spectra in new-physics searches and characterization. This and other issues related to understanding and communicating possible new physics results from the LHC will be explored further in a second workshop in November. From the perspective of the experiments, topology-based approaches and simplified model spectra are valuable to guide the organization of searches and as a means of presenting experimental findings. Further details of the perspective of ATLAS and CMS can be found in the introductory talks of the meeting. The approach also received strong support from a broad group of theorists present at the June 4 meeting.

Evidently, some guidance is needed on the most valuable topologies to consider in evaluating searches, and on how to characterize the results of these searches. The theory community is therefore asked to formulate and build consensus around a comprehensive set of topologies. It would be very helpful to include recommendations for variables that are potentially capable of discriminating among different signal topologies, typical cross-sections, and any preferred mass and branching ratio ranges that should be emphasized.

A second “Characterization of New Physics” workshop will be held on November 4–5, 2010 and will include further discussion of topology-based approaches, among other topics. Specific goals for this workshop with respect to topology-based approaches are listed below.

From theory: A proposal from the theory community covering the following:

1. A comprehensive set of most important topologies for ATLAS and CMS to target in their searches.
 - Ideally an initial high priority list corresponding to possible early discoveries should be developed and made available in August 2010 for use by the experiments in preparation for the November workshop.
 - Topologies with high missing transverse energy (MET) signatures are of obvious interest, but we would like also to have recommendations for topologies without MET.
 - For both cases (MET or no MET) topologies with leptons should also be included (e.g. one or both cascades involving leptonic or multileptonic final state particles).
2. Proposals for presentation of limits in the parameter spaces of these topologies.
3. Variables that can be used to discriminate among these topologies.

From Experiment: ATLAS and CMS will define and carry out exercises related to using the topologies provided by the theory community. The goal of these exercises will mainly be to assure that basic tools and procedures necessary for using the topological sets are established or under development. The exercises will therefore include some or all of the following for one or more of the recommended topological sets of simplified model spectra:

1. Generation of datasets along a grid of masses.
2. Optimization of search selection criteria, taking into account SM backgrounds and making use of recommended variables.
3. Pseudo experiment(s) involving comparison of a spectral model (a full mass grid of datasets) to a combination of a simulated signal and SM backgrounds to extract the optimal parameters (contributing processes; masses, cross sections, branching ratios).
4. To the greatest extent possible, the exercise(s) should include uncertainties on extracted parameters, and/or a measure of goodness of fit. Closure tests can be carried out by using a point on the mass grid as signal to be compared to the full mass grid.

We expect that significant progress on these tasks will be achieved by November, and will enable concrete discussion of how the initial efforts can be improved.

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