

# Paradigms for Experimentalists and Theorists to Collaborate in the LHC Era

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LJMET Workshop, U.C. Davis, April, 2009

## Basic Motivation and Ideas

1. We should work on this issue. CERN is certainly going to work on it as indicated by statements from Heuer.

The main issue for theorists is how to get access to the data in such a way that they can test their **many** models.

The main issue for experimentalists is how to test their data against the huge number of theoretical possibilities that have been dreamed up or will be dreamed up by the theorists.

In this workshop, we have also seen that even if a clear signal is seen, theorists and experimentalists could productively collaborate on the many different ways to analyze this signal for mass/spin/.... determinations, in particular combining and optimizing techniques.

Existing practices are not very efficient unless the new physics is quite simple so that a new signal is quickly found and quickly published by the

experimentalists allowing theorists to understand quickly the impact on their models.

## 2. Possible ideas for more direct communication:

### (a) Theorists directly join collaborations.

This might work for some theorists, but most theorists would like to be able to play their games independently of experiment to the extent possible.

### (b) If no really obvious new signals emerge early, experiments could publish early-on limits and/or small excesses in terms of limits/excesses in various bins of various variables; in an extreme this would be an "bin-tuple" approach, but at least two or three dimensional bin limits provided as soon as possible would be very helpful.

Could this be done earlier than has typically been the case if experiments focused a bit more on this?

### (c) If obvious new excesses emerge quickly, could experiments provide access to details in terms of multi-variable binning that would allow theorists to really compare to their models.

Typically, this kind of more detailed information emerges only in "final" publications that come quite a bit after the initial discovery.

Of course, if experiments see a new physics signal, they will be very tempted to find the right model themselves. So this would amount to giving up a certain amount of the proprietary information so that theorists could have their input and perhaps determine how many different models would yield the same signals in detail.

(d) The Quaero approach: history suggests that setting this up requires considerable time on the part of the collaborations and so probably not something that can be provided early.

(e) Agreed upon framework:

Should MadGraph be declared the winner and all theorists and experimentalists agree to set up model in this framework, generate events, analyze down to pythia level (maybe PGS level) where experimental results and theoretical ideas could most usefully overlap.

Experiments would provide a certain amount of information on their limits/excesses in this zone of overlap.

Experiments could provide background files (Monte Carlo and/or extracted

using data-driven techniques) so that theorists would only need to generate signal events.

Possible issue: higher order corrections would need to be built in using MadGraph framework.

- (f) Dedicated working groups in which experimentalists really share their data with theorists who agree to certain rules and and really work directly with the experimentalists.

All share in credit for discoveries/understandings with appropriate footnotes indicating the different kinds of roles played.

- (g) Rapid response workshops organized on an extremely short time scale when the experimentalists are ready to or have just released data and are ready to share with the broader community.

- (h) Experimentalists provide “PGS-level” event information and then let the theorists have open access to it.

Theorists will crawl over such data like ants and may find something that is not real, but that is their problem. The upside is that they might find something the experimentalists would never think of looking for.

### 3. Facilitation mechanisms for the working group concept (2f) and rapid

## response workshops:

- (a) If working groups exist they could have rapid response workshops.
- (b) Whether or not working groups exist, there should be rapid response workshops open to a broader community of theorists and experimentalists.
- (c) The rapid response workshops success keys we have identified are:
  - i. Roughly equal numbers of experimentalists and theorists, especially experimentalists intimately involved in the relevant analyses.
  - ii. that participants get extra travel money for going to these precisely targeted events so that the only things preventing participation would be motivation and time.
  - iii. that the money to host such a workshop be on-hand or else utterly trivial to get (e.g. one page description with approval from a central steering committee selected to review these one page descriptions).
- (d) Location(s):
  - i. Could be held at different places around the country who apply for money from a central DOE/NSF fund earmarked for this.
  - ii. Agreed upon location(s) with money on-hand that have expertise in organizing and running such workshops very quickly.

# Is this the plan for the Fermilab LPC?