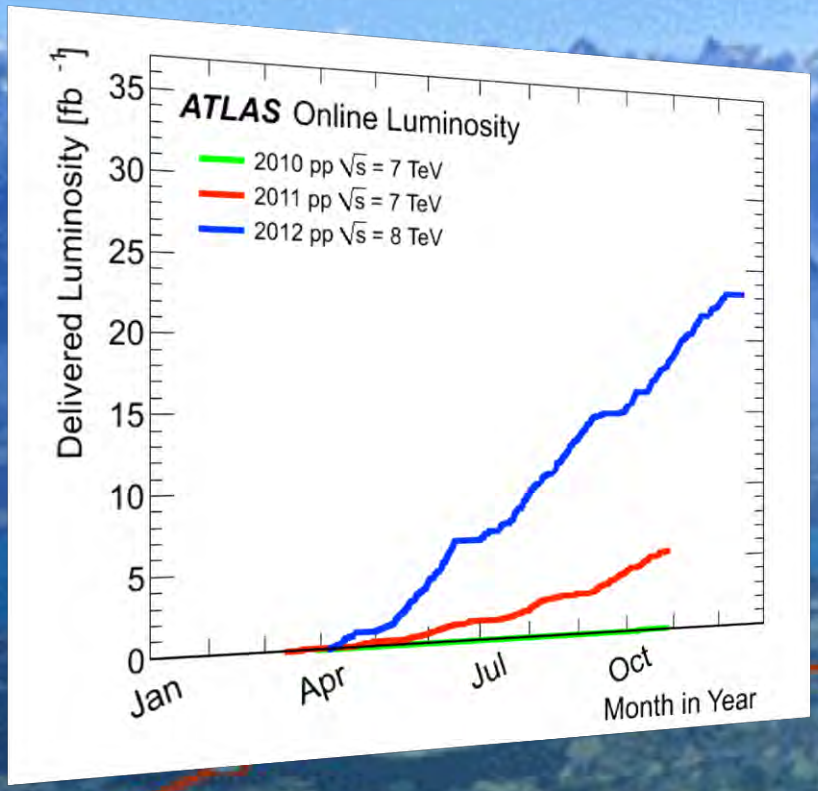
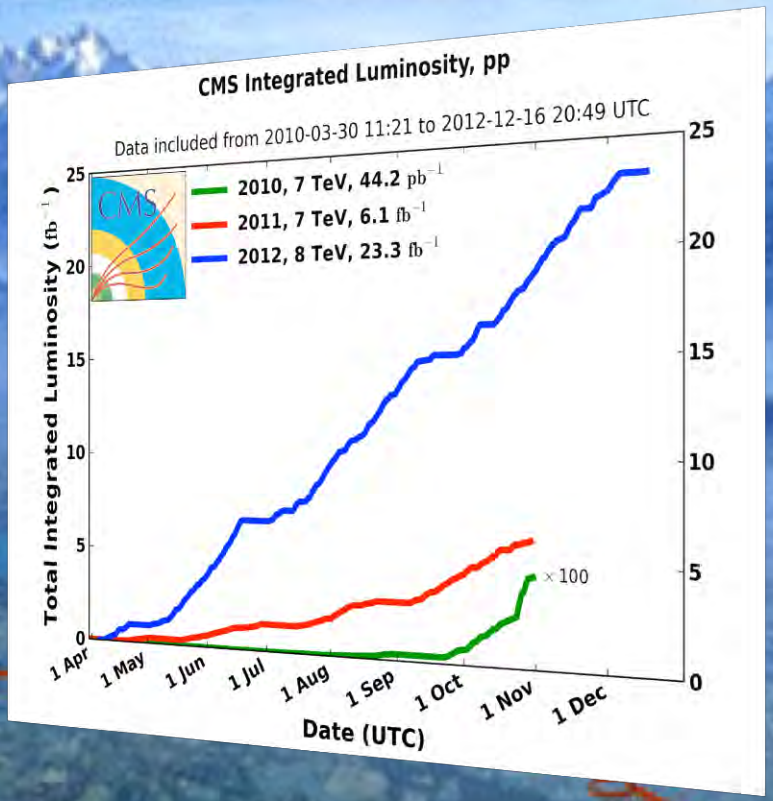




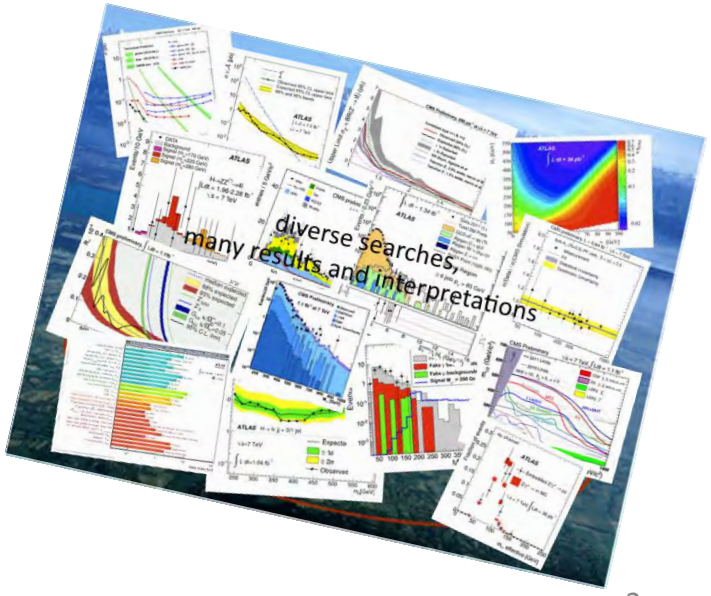
Perspectives on public data

Sabine Kraml (LPSC Grenoble)
Sezen Sekmen (CERN)

Joint DASPOS/DPHEP Meeting, 21-22 March 2013, CERN

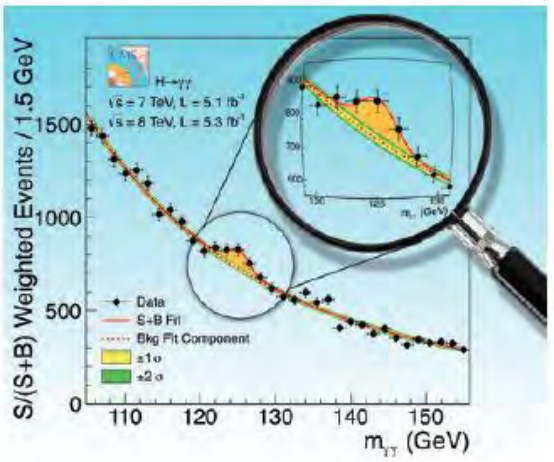
Motivation

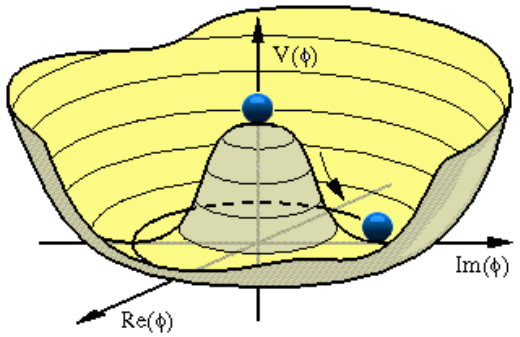
- LHC is the high energy frontier machine to explore the TeV scale and provide answers to many key questions in particle physics.
  - Search for the Higgs boson
  - Search for New Physics beyond the Standard Model
- Need to interpret LHC results in the contexts of all kinds of models of new physics; crucial if we are to unravel the correct theory and determine its parameters.
- The complexity of a) the experimental analyses and b) the possible new physics models requires active collaboration of experimentalists and theorists - the whole HEP community - to fully exploit the LHC potential.
- Makes persistence and long-term use(ability) of LHC results extremely important



Example: Higgs search

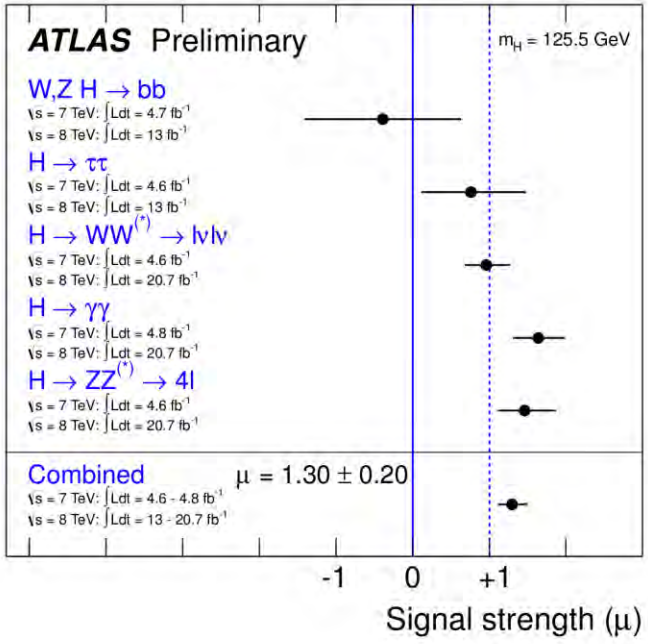
- The discovery of the Higgs boson is a tremendous first success for the LHC experimental program
- Next: need to determine whether it is a SM Higgs (and only the SM Higgs)
  - is it the SM Higgs?
  - is it fully responsible for electroweak symmetry breaking?
  - is there more than one Higgs? (contributing to the 125 GeV signal / to EWSB?)
- Precise measurements in a variety of production and decay modes.
- Fits and tests of various models; need to be able to put all information together.

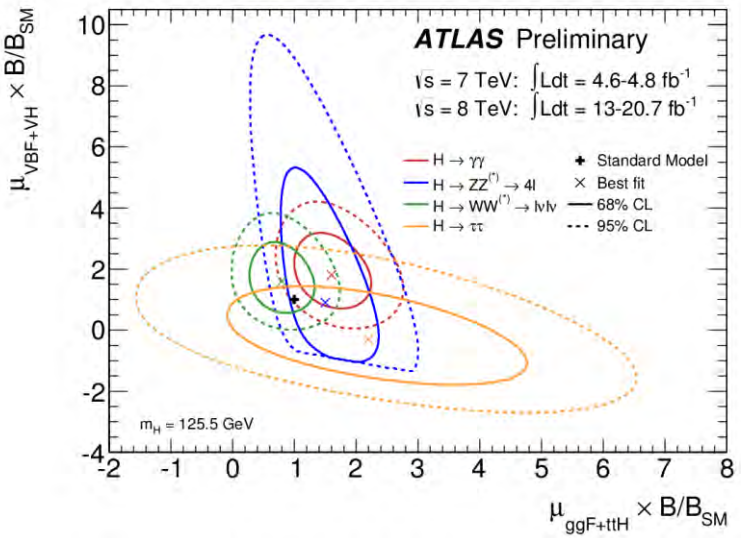


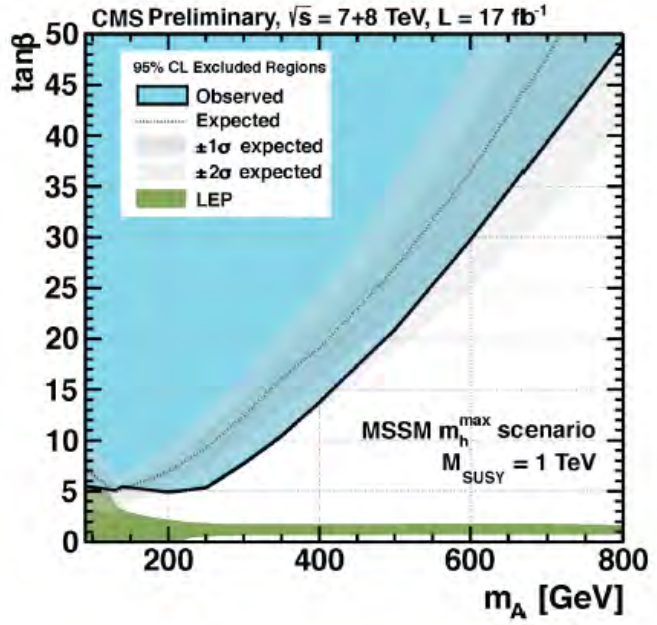


Is the Higgs mechanism as simple as envisaged in the SM?

Example: Higgs search







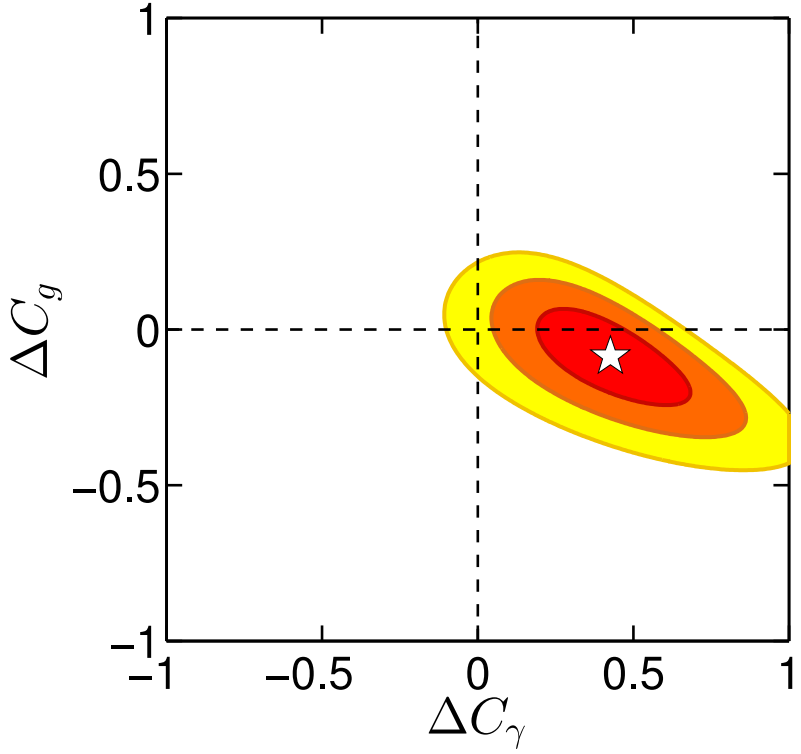
Detailed channel-by-channel information (separated into production and decays) is necessary in order to test non-standard Higgs scenarios.

Experiments assume SM composition of production modes; this may easily differ in BSM models → need also event rate information etc to recast analyses.

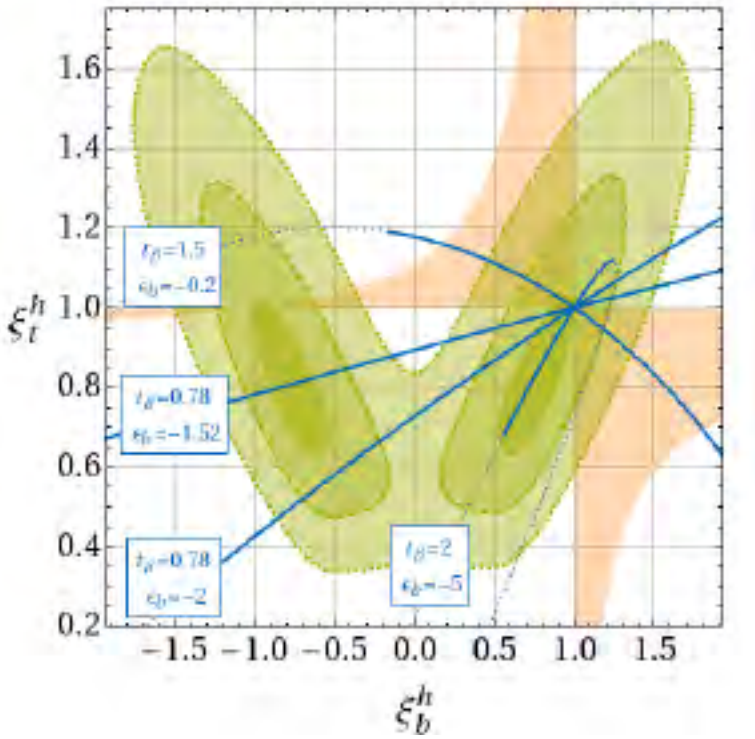
Higgs fits

Theorists perform fits with different parameterizations of deviations from SM couplings and/or non-SM contributions.

Effective lagrangian, arxiv:1212.5244

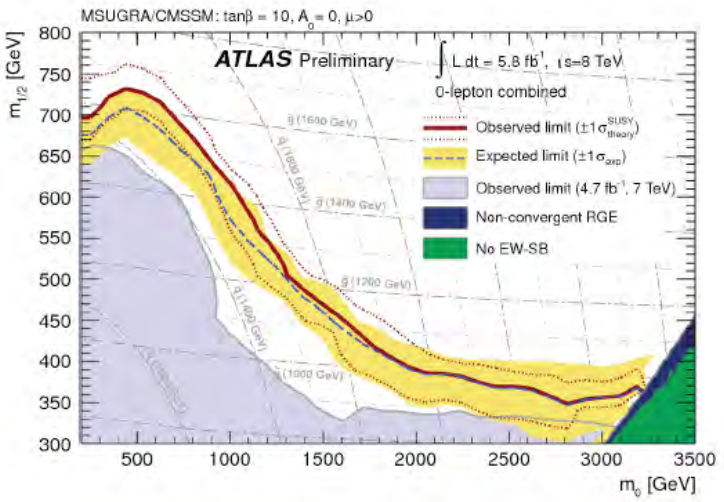


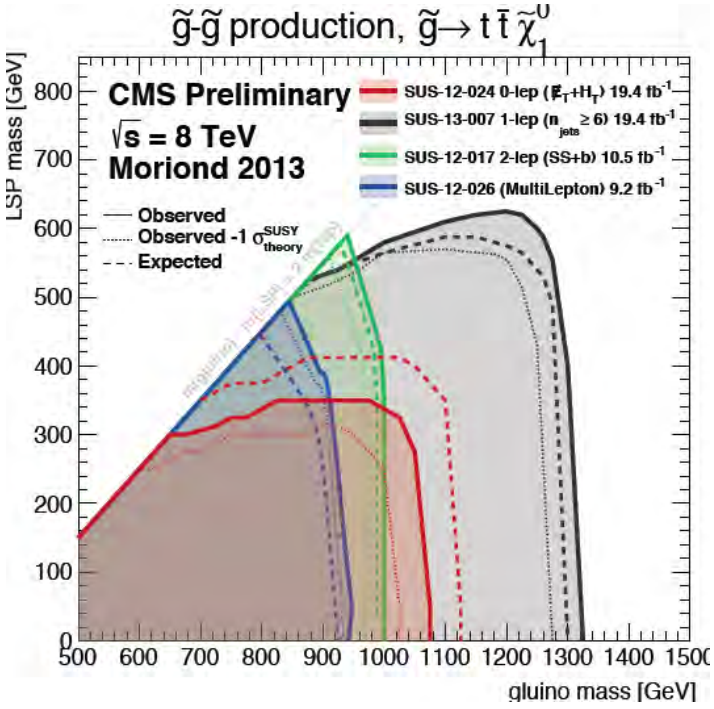
2HDM, arxiv:1210.2465



New physics (BSM) searches

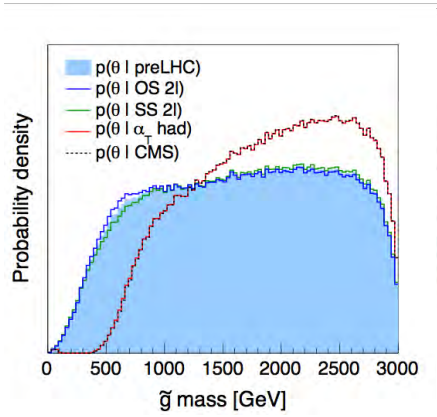
- ATLAS and CMS perform searches for new physics in many different channels.
- The collaborations typically interpret their results within constrained models, e.g. the CMSSM, or within topology-based "Simplified Models" (SMSs).
- However, constrained models and SMSs always have specific assumptions built in (mass ratios, branching fractions, etc).
- SUSY (and BSM in general) has much larger variety of signatures.
- Need to interpret LHC results in the contexts of all kinds of models of new physics; crucial if we are to unravel the correct theory and determine its parameters ⇨ community-wide effort !

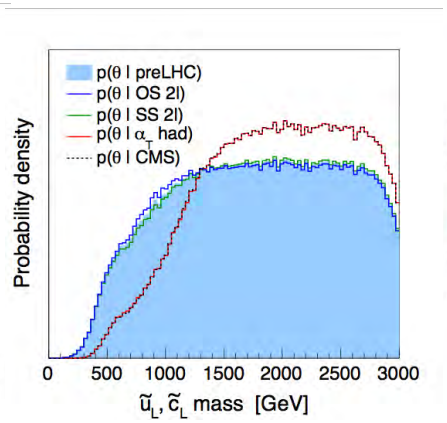


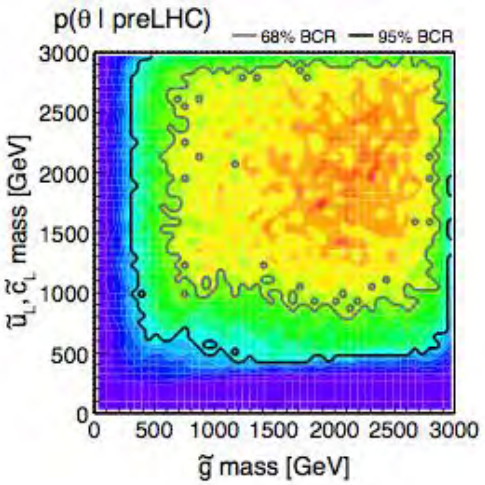


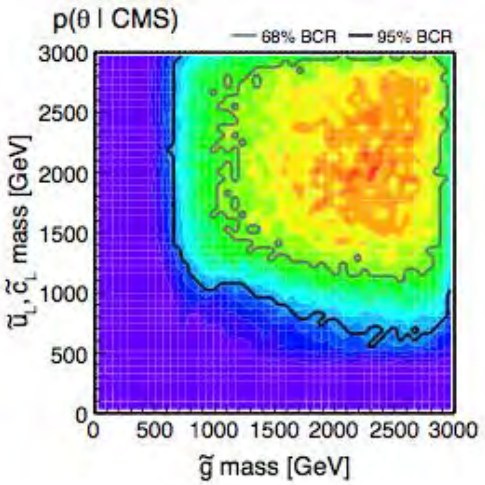
Example: Phenomenological MSSM

- In arXiv:1109.5119, we interpreted the results of SUSY searches published by the CMS collaboration based on the first 1 fb-1 of data taken during the 2011 LHC run at 7 TeV within the phenomenological MSSM (pMSSM).
- The pMSSM is a 19-dimensional parametrization of the MSSM that captures most of its phenomenological features. It encompasses and goes beyond, a broad range of more constrained SUSY models.
- This allowed us to obtain more generic conclusions on how the current data constrain the MSSM.



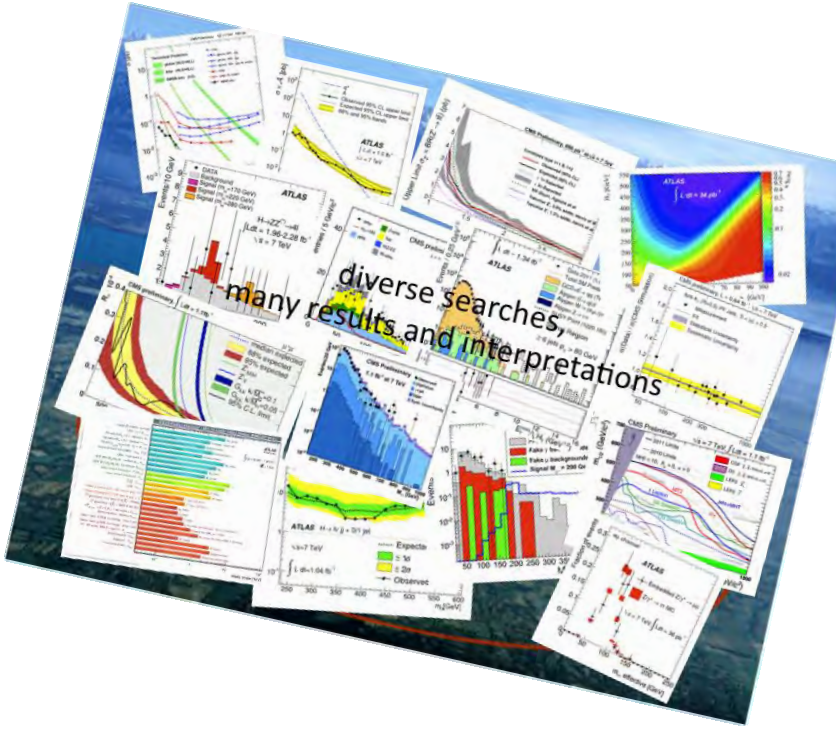






Example: Phenomenological MSSM

- The complexity of a) the experimental analyses and b) the possible new physics models requires active collaboration of experimentalists and theorists -- the whole HEP community -- to fully exploit the LHC potential.
- A common standard for the information to provide would immensely help this task. (it would actually help not only the interpretation of results but also comparisons within/across experiments, data preservation efforts, etc.)
- Besides our own (physics) interest in making the most out of the LHC data, we may soon be seriously mandated by the funding agencies to work much more openly towards this aim ...



Searches for New Physics: Les Houches Recommendations for the Presentation of LHC Results

S. Kraml, B.C. Allanach, M. Mangano, H.B. Prosper, S. Sekmen (editors),
C. Balazs, A. Barr, P. Bechtle, G. Belanger, A. Belyaev, K. Benslama,
M. Campanelli, K. Cranmer, A. De Roeck, M.J. Dolan, T. Eifert, J.R. Ellis,
M. Felcini, B. Fuks, D. Guadagnoli, J.F. Gunion, S. Heinemeyer,
J. Hewett, A. Ismail, M. Kadastik, M. Kreamer, J. Lykken, F. Mahmoudi,
S.P. Martin, T. Rizzo, T. Robens, M. Tytgat, A. Weiler

"We present a set of recommendations for the presentation of LHC results on searches for new physics, which are aimed at providing a more efficient flow of scientific information between the experimental collaborations and the rest of the high energy physics community, and at facilitating the interpretation of the results in a wide class of models. Implementing these recommendations would aid the full exploitation of the physics potential of the LHC."

Eur. Phys. J. C 72 (2012) 1976; arXiv:1203.2489

Photo courtesy J. Hewett

Analysis description

Recommendation 1a: *Provide a clear, explicit description of the analysis in publications. In particular, the most crucial information such as basic object definitions and event selection should be clearly displayed in the publications, preferably in tabular form, and kinematic variables utilized should be unambiguously defined. Further information necessary to reproduce the analysis should be provided, as soon as it becomes available for release, on a suitable common platform.*

Recommendation 1b: *The community should identify, develop and adopt a common platform to store analysis databases, collecting object definitions, cuts, and all other information, including well-encapsulated functions, necessary to reproduce or use the results of the analyses, and as required by other recommendations*

Analysis code database

- Many phenomenological studies would like to make use of the LHC BSM analyses for interpreting the results in terms of new physics models.
- It is an unnecessary loss of time for each group to code the analysis implementations individually.
- We have started efforts on building an analysis code database where analysis codes written by phenomenologists can be collected.
  - This database will not be official, or "blessed" – it is an informal effort.
- We are also working on a common format for such analysis codes.

Detector modeling

Recommendation 2a: *Provide histograms or functional forms of efficiency maps wherever possible in the auxiliary information, along with precise definitions of the efficiencies, and preferably provide them in standard electronic forms that can easily be interfaced with simulation or analysis software.*

Recommendation 2b: *The community should take responsibility for providing, validating and maintaining a simplified simulation code for public use, reproducing the basic response of the LHC detectors. The validation and tuning of this tool should be based on comparisons with actual performance plots, and/or other inputs, made available by the experiments along the lines of Recommendation 2a. Limits of validity should be investigated and clearly documented.*

Fast Simulators for the LHC

11-12 June 2012
CERN
Europe/Zurich timezone

Search

- Overview
- Timetable
- Registration
  - Registration Form
- List of registrants
- LH Recommendations

Starts Jun 11, 2012 09:00
Ends Jun 12, 2012 18:20
Europe/Zurich

CERN
TH Conference Room

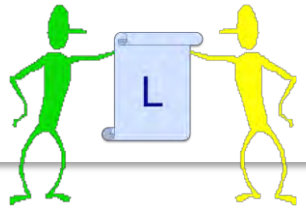
Mangano, Michelangelo
Kraml, Sabine
Sekmen, Sezen

Minutes

This workshop has been motivated by the recently published "Les Houches Recommendations for the presentation of LHC results", arXiv:1203.2489, which emphasize the important role of public fast detector simulators in maximizing the use of LHC results, and suggest the HEP community to take responsibility for providing, validating and maintaining tools for fast simulation.
The workshop aims to bring together the developers of the existing and upcoming tools, the experts from experiments, and the current and potential users in order to thoroughly discuss fast simulators, and address topics such as:
- current status and shortcomings
- object implementation, difficult topologies
- validation
- input/output formats, common analysis tools

These discussions are intended to result in concrete solutions to the technical questions and suggestions for overall improvement of fast simulators, and hence take a step towards realizing recommendation 2b which says: "The community should take responsibility for providing, validating and maintaing a simplied simulation code for public use, reproducing the basic response of the LHC detectors. The validation and tuning of this tool should be based on comparisons with actual performance plots, and/or other inputs, made available by the experiments along the lines of Recommendation 2a. Limits of validity should be investigated and clearly documented."

http://indico.cern.ch/conferenceDisplay.py?confId=187127

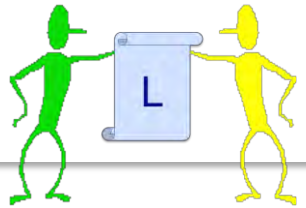


Analysis dissemination: basic requirements

Recommendation 3a: *Provide all crucial numbers regarding the results of the analysis, preferably in tabulated form in the publication itself. Further relevant information, like fit functions or distributions, should be provided as auxiliary material.*

Addendum to 3a: *For multi-bin results, provide an ensemble of sets of the numbers B, δB, L, δL, Q, k, etc in the auxiliary information. These would be created by sampling from the various experiment-specific systematic effects, such as the jet energy scale, jet energy resolution, etc. Results should be quoted without inclusion of systematic/theoretical uncertainties external to the experiment.*

B: BG estimate, L: Luminosity estimate, Q: Observed number of events in the control region, k: expected BG in control region / expected BG in signal region



Analysis dissemination: the full likelihood

Recommendation 3b: *When feasible, provide a mathematical description of the final likelihood function in which experimental data and parameters are clearly distinguished, either in the publication or the auxiliary information. Limits of validity should always be clearly specified.*

Recommendation 3c: *Additionally provide a digitized implementation of the likelihood that is consistent with the mathematical description.*

Likelihoods for the LHC Searches

21-23 January 2013
CERN
Europe/Zurich timezone

Search

- Overview
- Timetable
- Registration
  - Registration Form
- List of registrants
- Video Services

The primary goal of this 3-day workshop is to educate the LHC community about the scientific utility of likelihoods. We shall do so by describing and discussing several real-world examples of the use of likelihoods, including a one-day in-depth examination of likelihoods in the Higgs boson studies by ATLAS and CMS.

The workshop will start with two pedagogical lectures that introduce likelihood concepts and terminology. These lectures are followed, in the afternoon of Day 1, by a moderated discussion that focuses on the concepts and issues raised in the lectures. Day 1 ends with several presentations that illustrate the use of likelihoods in Higgs and Beyond the Standard Model (BSM) research. The goal here is to get feedback from researchers who have used Higgs and BSM results in their work.

Given the importance of the work on the Higgs boson, we shall devote the second day of the workshop to the thorough deconstruction of likelihood usage in the Higgs boson work by ATLAS and CMS. The goal is to shed a bright light on the many details, and assumptions, that underlie the likelihoods used in the recently published results.

The final day of the workshop covers the use of likelihoods in BSM work and ends with an examination and discussion of the concrete steps needed to make the publication of likelihoods by the LHC community systematic and routine.

http://indico.cern.ch/conferenceDisplay.py?confId=218693