

Tools Summary

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Accords

- A long history of agreeing accords for communication between computer programs and people at Les Houches.
- This year we discussed:
 - Changes to the SLHA;
 - A new accord for dark matter programs;
 - new event file formats.

SLHA

- Add new blocks with production cross section of particles. Proposal is to add one new block for each process under consideration.

- Block starts with

XSECTION SQRTS PDG_CODE1 PDG_CODE2 NF PDG_CODE3

- This general information line is then followed by the cross sections

SCALE_SCHEME QCD_ORDER EW_ORDER KAPPA_F KAPPA_R PDF_ID
VALUE CODE VERSION

- Will need agreement of the original authors.

DLHA

Dark matter Les Houches Accord

<http://phystev.in2p3.fr/wiki/2013:groups:tools:dlha>

People involved at Les Houches: Alexandre, Andreas, Ben, Benj, Björn, Csaba, Fawzi, Geneviève, Nazila, Sasha, Sezen, Pietro; Outside of Les Houches: Ben Allanach, David Cerdeno, Peter Skands, & 50+ other people representing various dark matter calculators.

What Standardized interface for exchanging DM info

Why Enhanced flexibility of DM calculators

How Allow user to access I/O for DM modules

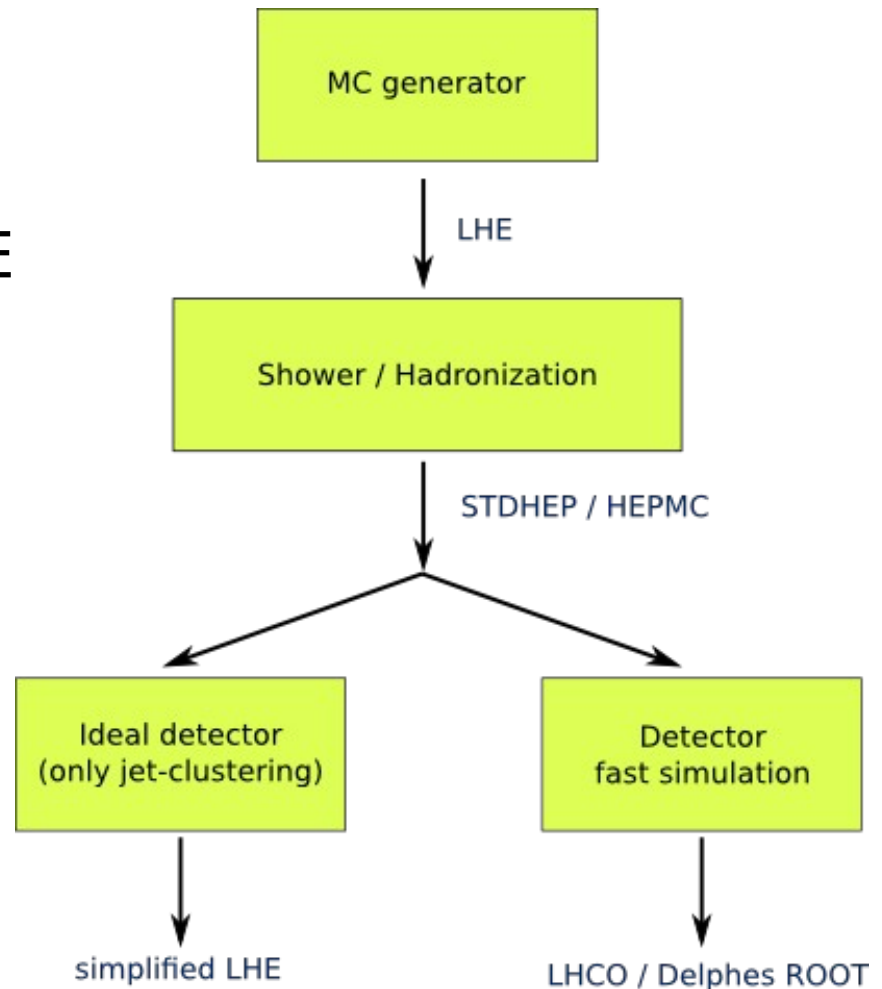
LH11 DLH agreement in arXiv:1203.1488 (35 pages)

LH13 Progress on several fronts: FUNCTION aim and format, TABLE object, DLHA reader/writer

Goal DLH Accord, starting implementation in codes

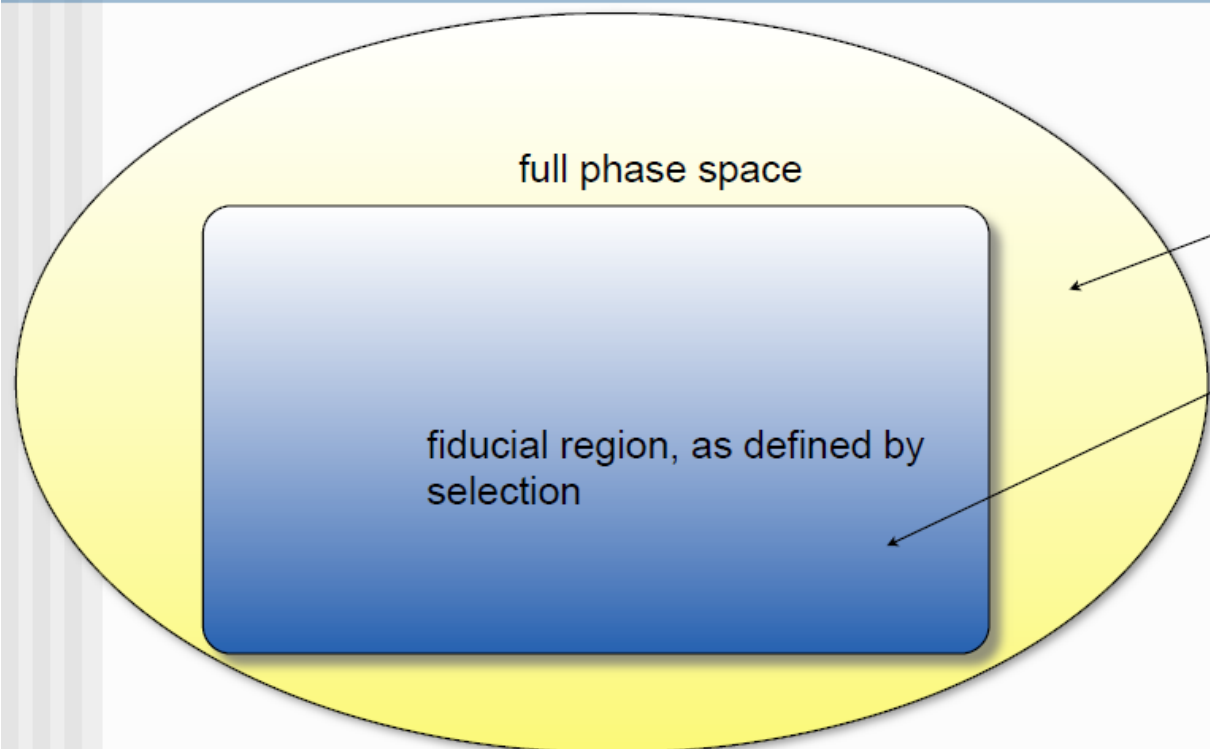
Event Formats

- People involved: Eric & Benj
- Propose a new event format based on the LHE for reconstructed events, after either particle level analysis or detector simulation.
- Needs discussion with session I people.



Experimental Results

- There's a long history of discussions on how experimental results should be presented.
- For most SM physics there is a consensus that the results should be corrected for detector effects and pileup and presented as fiducial (differential) cross sections.
- The experimental paper may go on and interpret the results but normally the basic measurement is presented first.
- In the best case a Rivet analysis is also provided to allow comparison with theory.



$$\sigma_{\text{incl}} = \frac{\sigma_{\text{meas}}}{A}$$

Acceptance

Number of objects/events within fid. reg.

 Number of "all produced" objects/events

very simple example:

$N(\text{muons})$ with $p_T > 10 \text{ GeV}$ and $\eta < 2$

 $N(\text{all generated muons})$

- the issue is: the Acceptance can only come from "theory", eg. MC; this implies, that the final result for the full phase is **model dependent**, and an additional syst. uncertainty has to be added.
- to avoid this, it is necessary to have a theoretical calculation which is able to give a prediction for the fiducial region only.

Experimental Results

- More issues for both the Higgs and BSM physics, particularly for more complicated analyses using BDT etc.
- A number of discussions on both:
 - Higgs results;
 - BSM physics;
 - and simplified models.

Recommendations for the presentation of Higgs results

F. Boudjema, G. Cacciapaglia, G. Dissertori, A. Deandrea, G. Drieu la Rochelle, B. Dumont, U. Ellwanger, A. Falkowski, J. Galloway, R.M. Godbole, J.F. Gunion, S. Kraml, H.B. Prosper, V. Sanz, S. Sekmen,

The discovery in July 2012 of a new particle with mass around 125 GeV and with properties consistent with those of a SM Higgs boson is a first triumph for the LHC physics program. However, it should not be regarded as the closing of a chapter, but opening of a new one.

Indeed, with the LHC operations at 7-8 TeV, we have just begun the exciting exploration of the TeV scale. Natural stabilization of the electroweak scale requires new phenomena at TeV energies-the measurements of the Higgs properties may provide a guide as to where and how to look for this new physics. Moreover, if new physics is discovered, combining it with the results from the Higgs sector will be essential for establishing the underlying fundamental theory beyond the SM.

It is thus important and timely to discuss how Higgs results can be presented in a way that maximizes their impact and use to the community at large.

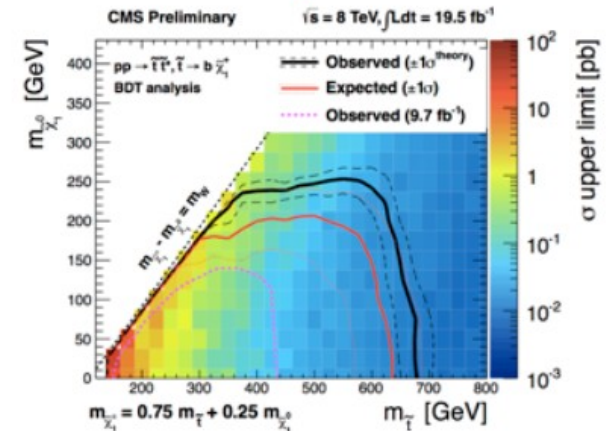
BSM Physics

- On the BSM side there are two main approaches
 1. Recode the analysis at either particle level or using fast detector simulations. Calculate the number of events in a model and use the experimental result to obtain a limit, e.g. Atom, Rivet, MadAnalysis
 2. Use the simplified models presented in the papers to present limits.
- For first point the authors of the relevant tools need to agree a common way forward.

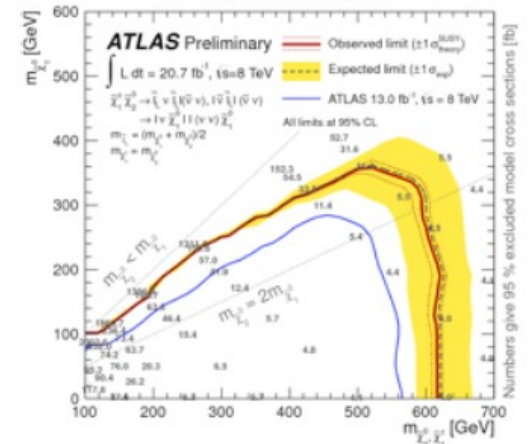
Wishlist for the presentation of SMS results

1. Digitize, digitize, digitize,
2. For topologies involving cascade decays, provide results for more than one (at least 3) intermediate mass values.
3. Provide good coverage of the parameter space considered.
4. Avoid too restrictive assumptions (and obviously don't make unphysical ones).
5. For topologies involving different decays on each leg, parametrize results in terms of branching fractions.
6. Give expected upper limits on $\sigma \times \text{BR}$ in addition to the observed ones.
7. (in progress)

the good



the bad



and we don't show the ugly

Everything is on the wiki. Interested people here in LH:
Wolfgang, Suchita, Sabine, Aoife, Sofio, Tobias

Goal

Incorporate likelihoods from LHC new physics searches in SModels using RooFit/RooStats framework to facilitate a more precise interpretation of full models using simplified model spectra (SMSs). (Wolfgang, Sezen, Harrison Prosper)

Workflow

- **non-Les Houches - CMS**: for a CMS analysis that the authors are involved in, publish a likelihood (i.e. : statistical model + data) as a RooFit workspace and SMS efficiency maps in a way that would be most feasible for interpretation.
- Implement the usage of this likelihood in SModels. Link with RooStats for statistical analysis.
- The cross section for a given SMS point is a free parameter. Exercise calculating the likelihood versus cross section for a given SMS point, and use this information for:
 - Combining analyses
 - Combining different SMSs that make up a full model point in order to find the probability of that full model point.

Conclusions

- So this is now my fifth Les Houches as a tools convenor.
- Things have moved on a lot in the last ten years.
- The simulation of both Standard Model backgrounds and BSM models has improved dramatically, and there are many more people working on them.
- Hopefully we'll see more progress in the proceedings.