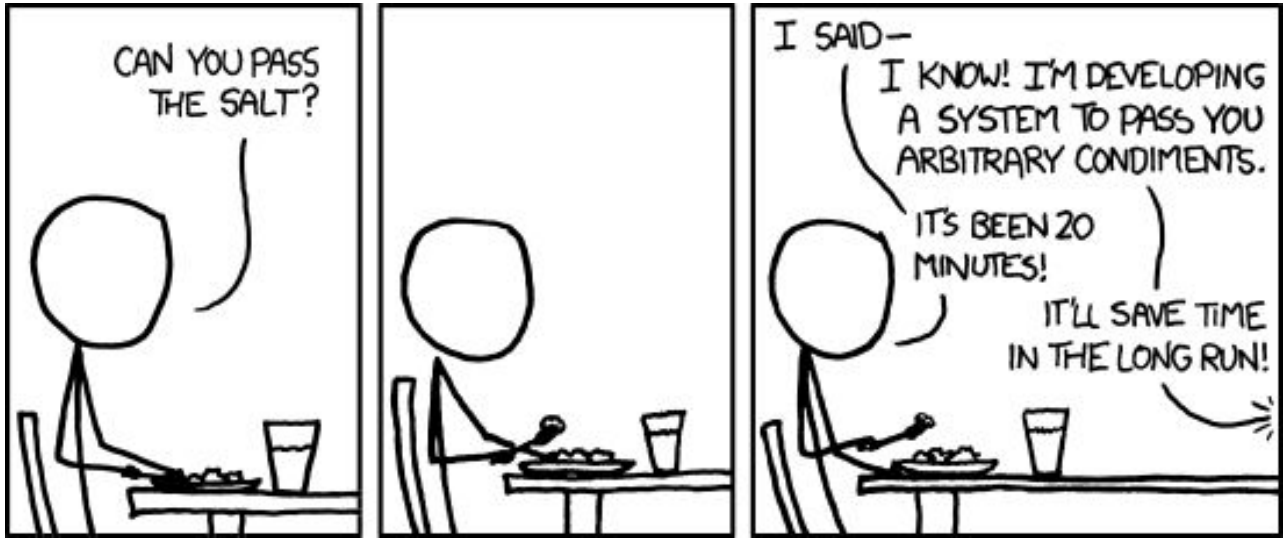


MC Tools report
Les Houches 2017 - BSM Session

Fabio Maltoni, Peter Richardson, Luca Perrozzi

Outline of the activities

Topics:

- SUSY Les Houches Accord update
- Recasting/Reinterpretation
- Simplified Models

Topics in collaboration with Higgs and BSM

- Simplified Models for Long Lived Particles
- Using Higgs fiducial cross sections

SUSY Les Houches Accord update

- Work started in LH 2013. Already quite complete. Needs to be polished and written up. Need to get agreement for the SUSY code developers.
  - The plan is to add new blocks to a supersymmetric spectrum with information on section of particles included in the spectrum of interest. We propose to add one r process under consideration.

- Header

```
XSECTION SQRTS PDG_CODE1 PDG_CODE2 NF PDG_CODE3 ....
```

- Cross section entry format

```
SCALE_SCHEME QCD EW K_F K_R PDF_ID1 PDF_ID2 VAL VALUP VALDOWN DUMMY
```

Reminder:

Why a Les Houches Accord on Analysis Description?

- Picking up an experimental publication
  - Reading
  - Understanding

  ✅ Relatively easy

- Writing the analysis code in the tool internal language

  ✅ Relatively easy

- Getting the information missing from the publication for a proper validation
  - Efficiencies (trigger, electrons, muons, b-tagging, JES, *etc.*)
    - ★ Including p_T and/or η dependence
    - ★ Accurate information
  - Detailed cutflows for some well-defined benchmark scenarios
    - ★ Exact definition of the benchmarks (SLHA spectra)
    - ★ Event generation information (cards, tunes, LHE files if possible)
  - Expected number of events in each region and cross sections
  - Digitized histograms (*e.g.*, on HEPDATA)

  ⚠ Essential
  ✗ Often difficult!

- Comparing tools and real life

Reminder:

LHAAD: Les Houches Accord on Analysis Description

[The session 2 tools working group]

- Development of a way to provide the information on the analysis in a readily form
  - The analysis is described following a text format
    - ★ Two similar options so far (to be merged in one for the proceedings)
    - ★ Blocks for object definitions, functions and methods, selections, region definitions
    - ★ Regions are defined from a combination of cut blocks
  - Validation: detailed cutflows for specific benchmarks must be provided in the description
  - Must be endorsed by the experimental collaborations
    - ★ Small amount of work to make the analysis useable by the TH community
  - Finalization of the recommendations to be achieved for the proceedings

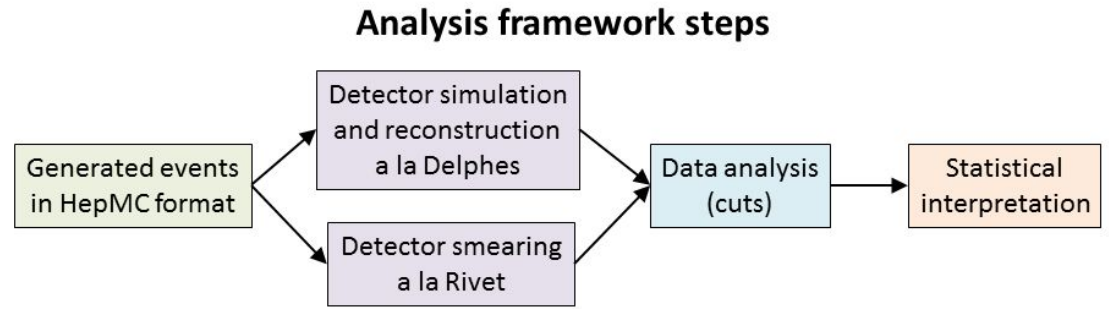
- Presentation of results for specific new physics scenario
  - Structure for the cutflows, the errors, *etc.*
  - Information on how to (or not to) combine signal regions / analyses

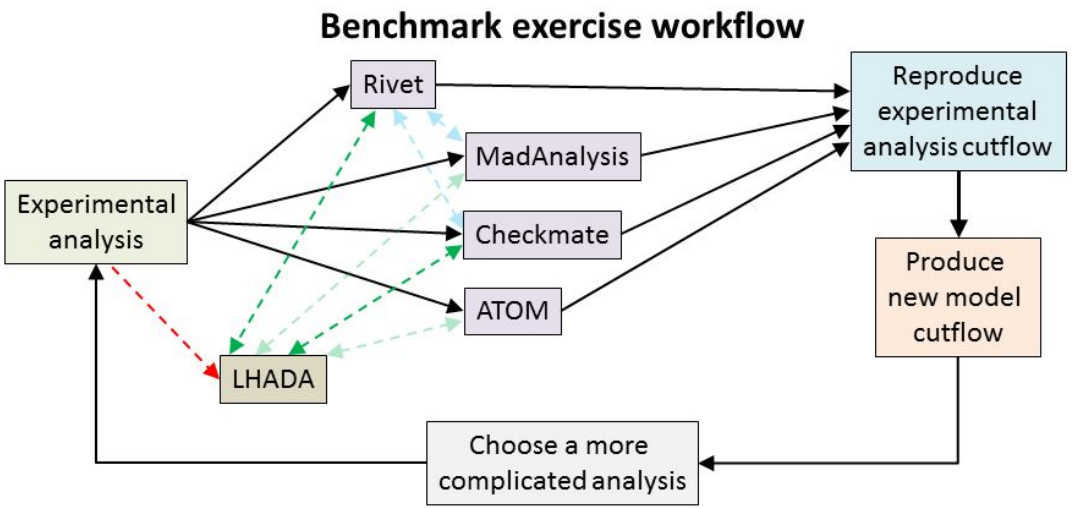
Recasting/Reinterpretation

Long standing exercise at Les Houches focused on LHAD proposal

At LH17 biggest focus on benchmarking different frameworks:

- Implement experimental analyses with increasing difficulty
  - Jets+MET - ATLAS - 13 TeV (arxiv:1605.03814)
  - Monophoton - ATLAS - 13 TeV (arxiv:1704.03848)
  - 3 leptons + MET - CMS - 13 TeV (CMS-SUS-16-039)
  - 1 lepton + MET + Jets (>=1b) - CMS - 13 TeV (arxiv:1706.04402)
- Cross-check cut-flow tables and most representative plots
  - Using 2 different BSM signal models





Jets+MET - ATLAS - 13 TeV (arxiv:1605.03814)

-

Description	#evt	tot.eff	rel.eff	#evt	tot.eff	rel.eff	tot.eff
2jm cut-flow:		Rivet			MadAnalysis5		CheckMATE
	31250	100%	-	32150	100%	-	100%
Pre-sel+MET+pT1	28472	91%	91%	28478	91%	91%	91%
Njet	28472	91%	100%	28477	91%	100%	91%
Dphi_min(j,MET)	22950	73%	81%	22889	73%	80%	73%
pT2	22950	73%	100%	22889	73%	100%	73%
MET/sqrtHT	10730	34%	47%	10710	34%	47%	33%
m_eff(incl)	10630	34%	99%	10609	34%	99%	32%
4jt cut-flow:		Rivet			MadAnalysis5.		CheckMATE
	31250	100%	-	31250	100%	-	100%
Pre-sel+MET+pT1	28592	91%	91%	28626	92%	92%	91%
Njet	27322	87%	96%	27128	87%	95%	87%
Dphi_min(j,MET)	18929	61%	69%	18829	60%	69%	60%
pT2	18715	60%	99%	18825	60%	100%	--
pT4	16610	53%	89%	16430	53%	87%	52%
Aplanarity	11849	38%	71%	11395	36%	69%	36%
MET/m_eff(Nj)	8334	27%	70%	7971	26%	70%	25%
m_eff(incl)	7201	23%	86%	6972	22%	87%	21%

Andy, David, Benjamin, Nishita

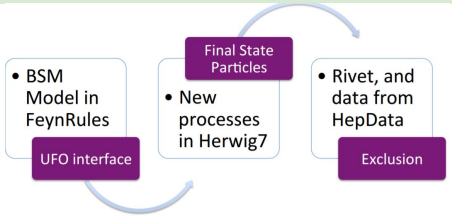
June 15th
©danieltolson

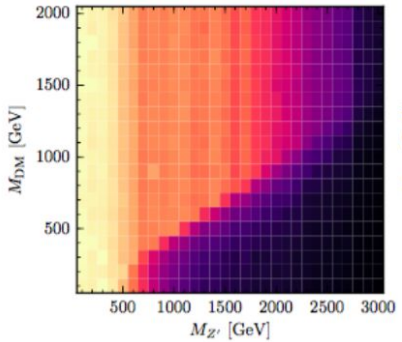
June 23rd
Positively Panicked

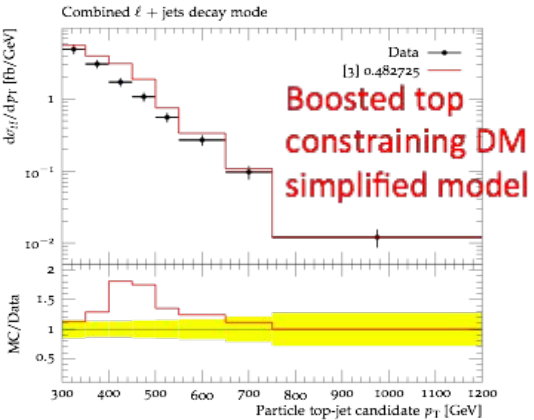
June 23rd

Contur: Constraints On New Theories Using Rivet

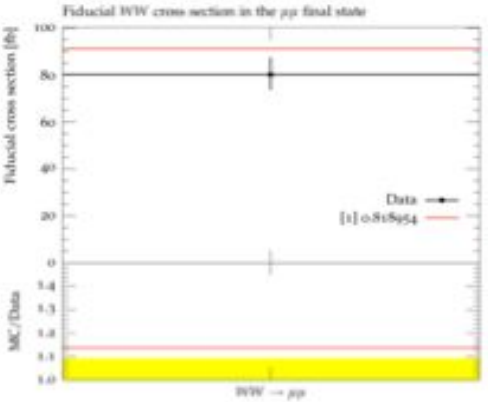
- John Butterworth, David Grellscheid: Quite a bit of development work this week, including adding several new data/analyses
- Studies of several new models underway within a few projects, aim for proceedings
  - Kristin Lohwasser, Ken Lane, Jose Zurita, Ursula Laa (Higgs fiducial cross sections group), Gregory Moreau, Sylvain Fichet, Tim Cohen, …
- Clear that including ability to compare directly to SM calculations is a priority



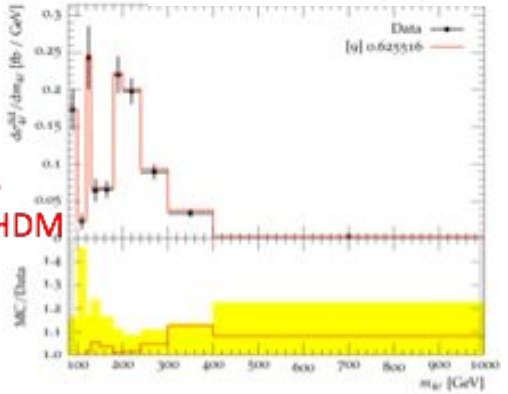




Boosted top constraining DM simplified model



WW & 4l measurements constraining 2HDM



Other activities

Simplified Models

(Some discussion but not much concrete activities under the MC umbrella)

Activities encompassing the definition and extension of simplified models:

- Simplified Models for Long Lived Particles
- SMODELS
- Paper by Tim Cohen et al.

- Lecture on simplified likelihoods (Andy)
- Lots of discussions...

Conclusions

- Go home and do QCD :-D