

Implications of LHC Results for TeV-Scale Physics

WG1 (Signals of Electroweak Symmetry Breaking):

How to proceed

Sven Heinemeyer, IFCA (CSIC, Santander)

on behalf of *Andreas, Chiara, Georg, Marumi*

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From the charge:

- “. . . to evaluating the implications of recent results from the LHC, and elsewhere, for TeV-scale physics, and to discuss the impact of these results on the future strategy for particle physics.”
- **WG1: Signals of electroweak symmetry breaking**
- The task of the working groups is to assess the possible interpretations of the experimental results in view of their implications for the future strategy of particle physics.
- The charge for the first meeting is
 - to summarise the experimental situation at this time
 - to start the discussion of possible interpretations
 - to define the lines of work that should be carried out
- final document will be ready in time for the Orsay-type meeting of the European Strategy update

Possible scenarios

- observation of a state compatible with
- non-exclusion of

A: non-SM-like Higgs with $M_H \lesssim 115$ GeV

B: SM-like Higgs with 115 GeV $\lesssim M_H \lesssim 140$ GeV

C: non-SM-like Higgs with 115 GeV $\lesssim M_H \lesssim \dots$

D: a “very heavy” Higgs

E: “nothing” (weak signal?)

We know already a lot:

ATLAS/CMS exclude some M_H at 99% CL (as LEP)

Data assumptions

Right now: $\mathcal{L} \sim 1 - 2 \text{ fb}^{-1}$

End of 2011: $\mathcal{L} \sim 4 - 5 \text{ fb}^{-1}$

End of 2012: $\mathcal{L} \sim 15 \text{ fb}^{-1}$

For our analysis/write-up: $\mathcal{L} \lesssim 10 \text{ fb}^{-1}$?

(at best: right after ICHEP 2012)

⊕ combination of ATLAS and CMS !?

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Right now:

- prepare ourselves for “our” data set
- discussion of how results are presented:
 p_0 , “magenta band”, channel by channel, ...
- interpretation of results (TH ↔ EXP)

Tasks right now

1. (TH) prepare list of “relevant/interesting” models to be tested by ATLAS and CMS (\rightarrow WG1 filtered!)
 - $h \rightarrow aa \rightarrow b\bar{b}b\bar{b}/\tau^+\tau^-\mu^+\mu^-$
 - extended $\gamma\gamma$ searches
2. (TH) are all necessary tools available? If not ...
3. (EXP) experimental counter part: list of analysis and ETA
4. (EXP) (beyond searching for a SM-like Higgs in “remaining” regions) repeat/extend Higgs (property) analyses to (at least) scenario B (SM-like Higgs): $M_H = 115 \text{ GeV}, 120 \text{ GeV}, 130 \text{ GeV}, \dots$
 - what do we see? (with 10 fb^{-1} ?)
 - how much do we know? (with 10 fb^{-1} ?)(example: down to which Higgs mass can a coupling structure analysis be successfully be performed?)
5. (EXP) similar for reduced/enhanced couplings

6. (TH/EXP) SM/SUSY fits assuming (at least) scenario B (SM-like Higgs) → (partially) together with MET WG?!

7. (TH/EXP) for large M_H : Higgs exclusion in (M_H, Γ_H) plane
 - can this be done?
 - what does theory have to provide? (MC with interference effects?)

8. (EXP) VV scattering @ 7 TeV?
 - status summary
 - possibility of updates (more data)
 - even if there is a Higgs-like state

- X. (TH/EXP) ??

Task assignments

within one week:

- dedicated mailing list (you will receive an invitation)
- Twiki page
(→ exchange of models?)

within two weeks:

- invitations for concrete task assignments

⇒ you can always volunteer to contribute

Future meetings

next “general meeting”:

most probably after Moriond 2012 at CERN

intermediate WG1 meeting:

right after LHC Higgs XS WG meeting in Paris (21.-23. Nov.)

Towards the final document

Keep in mind:

- a) How well do the observed signatures in the early LHC data **constrain the possible physics scenario?**
- b) What could be the impact of early LHC results on the **choice of the next facility** and its (ultimate) energy reach and luminosity?
- c) What would be the possible implications for the **machine and the detector design?**

⇒ **skeleton draft very soon**

→ hopefully with some names assigned

(take a look at LHC2FC report!)