Implications of LHC Results for TeV-Scale Physics

WG1 (Signals of Electroweak Symmetry Breaking): How to proceed

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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 $\lesssim M_H \lesssim 135$ GeV

C: non-SM-like Higgs with $135$ GeV $\lesssim M_H \lesssim \ldots$

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 ($p_0$, “blue band”, . . .)
- interpretation of results (TH ↔ EXP)
- . . .
**Tasks right now**

1. *(TH)* prepare list of “relevant/interesting” models to be tested by ATLAS and CMS

2. *(TH)* are all necessary tools available? If not . . .

3. *(EXP)* (beyond searching for a SM-like Higgs in “remaining” regions) repeat/extend Higgs (property) analyses to (at least) scenario B (SM-like Higgs): $M_H = 115$ GeV, $120$ GeV, $130$ GeV, . . .
   - 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?)

4. *(EXP)* similar for reduced/enhanced couplings
5. *(TH/EXP)* SM/SUSY fits assuming (at least) scenario B (SM-like Higgs)

6. *(TH/EXP)* Higgs exclusion in \((M_H, \Gamma_H)\) plane
   - can this be done?
   - what does theory have to provide? (MC with interference effects?)

7. *(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!)