

Implications of LHC Results for TeV-Scale Physics

WG1 (Signals of Electroweak Symmetry Breaking): Goals of the Intermediate Workshop and Beyond

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

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1. LHC2TSP and WG1
2. The tasks
3. How to go ahead

1. LHC2TSP and WG1

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:
 - to summarize 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 $115 \text{ GeV} \lesssim M_H \lesssim 140$ GeV

C: non-SM-like Higgs with $\dots \text{ GeV} \lesssim M_H \lesssim \dots \text{ GeV}$

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: $\mathcal{L} \sim 4 - 5 \text{ fb}^{-1} @ 7 \text{ TeV}$

analyzed: up to $\sim 2 \text{ fb}^{-1}$

End of 2012: $\mathcal{L} \sim 15 \text{ fb}^{-1} @ 7/8(?) \text{ TeV}$

For our analysis/write-up: $\mathcal{L} \lesssim 10 \text{ fb}^{-1} @ 7/8(?) \text{ TeV} ?$

(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 , “cyan band”, channel by channel, ...
- interpretation of results (TH ↔ EXP)

2. The tasks

(according to our Twiki page)

1. **Theorist** should try to interpret the existing (and/or anticipated) LHC results (on Higgs/EWSB/other) searches in their favorite model. Which models are still allowed, which are excluded? How do they differ in their LC phenomenology? How does this compare to the HL-LHC expectations?
2. For particular models of specific interest it can be possible to put data (XS, BR, ...) on a web page so that it can be used by experimental groups/analyses (this will be WG1 convenor moderated) → **TH**
3. **Experimental** expectations for Higgs searches (for 2011/2012 data), what are the expectations on the determination of Higgs properties of a possible signal?
4. How can/should experimental results are presented? $\sigma \times \text{BR}$, channel by channel, ... → **TH** \oplus **EXP**

5. Insert the assumption of a SM-like Higgs and the LHC measurements assuming 10/fb at 7 TeV into your Higgs analysis (in the 'favored' mass rang of 115 - 135 GeV). What can be measured? → TH ⊕ EXP
6. The same as task 5, but for the assumption of reduced couplings (or other deviations from a SM-like Higgs). → TH ⊕ EXP
7. Insert the assumption of a Higgs signal and some evidence of SUSY (or another favored model) into your analysis/fits. What can we learn? → TH ⊕ EXP
8. Assume large M_H , prepare an analysis in the M_H - Γ_H plane. → TH ⊕ EXP
9. VV scattering at 7 TeV: what is the status? What can be done? → TH ⊕ EXP

Task assignments

WG1 Twiki page:

<https://twiki.cern.ch/twiki/bin/view/LHCPhysics/WG1>

- Tasks posted on Twiki page
 - email about tasks sent to [LHC2TSP list](#)
 - email about tasks sent to [WG1 list](#)
Not signed up yet? DO IT NOW! :-)
 - [individual invitations](#) sent out to many people
You did not receive your invitation? SORRY!
- ⇒ you can always volunteer to contribute

3. How to go ahead

Goals for this meeting:

- First assessment of the tasks
- First results on the tasks with $1-2 \text{ fb}^{-1}$
- Discussion: how to prepare ourselves for the future data set?
→ what do we really want for the LHC2TSP workshop?
- Who is committed to work on a task?
- How can we solícite more “volunteers”?
- Other ideas?
- ...

next “general meeting”:

after Moriond, last week of March 2012 at CERN

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!)