

WG1: Higgs XS&BR Group Structure

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**Workshop of LHC Higgs Cross Section Working
Group, 13/06/14**

Scope

Range of topics for this group is quite large, but these can be summarized as follows

- Compilation of state-of-the-art corrections**
 - Cross-sections and branching ratios for different initial and final states**
 - Facilitate convergence among groups, if necessary**
- MC-related issues + PDF**
 - Comparisons between generators**
 - Understanding reweighting**
- H+jets**

Summary of Wishlists

R.Tanaka

- 1) ggF - reduction of QCD scale (N3LO) and PDF+ α_s uncertainties below 5% possible?
 - probability distribution functions of QCD scale and PDF+ α_s uncertainties.
 - improvement in jet-bin uncertainty after S&T to JVE-resummed, SCET approach (0,1-jet incl. calc. 2-jets?).
 - NLO MC in H+n-jets (HJ, HJJ, HJJJ, ...) with finite-quark-mass effect.
- 2) VBF, WH/ZH
 - (N)NLO QCD + NLO EW MC (currently MC is reweighed for NLO EW with Higgs p_T)
- 3) ttH/bbH
 - NLO MC developments for ttbar+HF/V+jets.
- 4) HH
 - NLO MC and relevant backgrounds. Sensitivity in bbbb, bbyy, etc. BSM scenarios like in 2HDM.
- 5) BR
 - reduction of THU, PU.
 - correlation handling in different BRs.
- 6) NLO MC
 - toward NNLO QCD + NLO EW MC?
 - precise predictions for differential distributions like Higgs p_T , new physics effect.
 - improvements in irreducible SM bkg. NLO MC,
 - ex. NLO QCD+EW in $qq \rightarrow WW/ZZ$, NLO QCD in $gg \rightarrow WW/ZZ$ (box diagram), NLO ttbar+HF/V+jets.
 - update Les Houches wishlist?
- 7) MSSM
 - new benchmark and scan in MSSM/2HDM, NMSSM, etc.
 - cover missing cross sections and public tool, ex. charged Higgs XS in MSSM.
- 8) PDF
 - new PDF4LHC prescription at NNLO PDF, meta-PDF approach.
 - correlation handling in different process (between signal and backgrounds).
- 9) Tools
 - tool repository? SVN in LHC Higgs XS WG exists.
- 10) preparing for 13-14TeV run
 - same grid as 7&8TeV for 13-14TeV necessary?
 - "Survey All SM Higgs Production and Decay Processes Campaign"
 - XS&BR calculations with coherent theory uncertainty assignments.

Former structure

Group	Higgs decay	ATLAS	CMS	THEORY			
1. ggF	$\gamma\gamma, WW^*, ZZ^*$	Biagio di Micco (Roma Tre)	Giovanni Petrucciani (CERN)	Daniel de Florian (Buenos Aires)	Kirill Melnikov (Johns Hopkins)	Frank Petriello (Northwestern)	
2. VBF	$\pi, \gamma\gamma, WW^*, ZZ^*$	Daniela Rebuffi (Pavia)	Pietro Govoni (CERN)	Ansgar Denner (Würzburg)	Carlo Oleari (Milano-Bicocca)		
3. WH/ZH	bb	Jason Nielsen (UCSC)	Andrea Rizzi (Pisa)	Stefan Dittmaier (Freiburg)	Giancarlo Ferrera (Milano)		
4. ttH	bb	Aurelio Juste (Barcelona) Peter Onyisi (Texas)	Chirs Neu (Virginia) Andrea Rizzi (Pisa)	Laura Reina (Florida)	Michael Spira (PSI)		
5. HH	all						
6. Light Mass Higgs	all	Michael Dührssen (CERN) Kirill Prokofiev (New York)	André Tinoco Mendes (LIP) Marco Zanetti (MIT)	Ansgar Denner (Würzburg)	Massimiliano Grazzini (Zurich)	Christophe Grojean (Barcelona)	Georg Weiglein (DESY)
7. MSSM	Neutral Charged	Trevor Vickey (Witwatersrand) Martin Flechl (Freiburg)	Monica Vazquez Acosta (IC) Sami Lehti (Helsinki)	Robert Harlander (Wuppertal)	Michael Krämer (Aachen)	Pietro Slavich (LPTHE Paris)	Michael Spira (PSI)
8. Heavy Higgs and BSM		Sara Diglio (Melbourne) Krisztian Peters (CERN)	Mario Pelliccioni (Torino/CERN) Mario Kadastik (NICPB Estonia)	Margarete Muehlleitner (Karlsruhe)	Heather Logan (Carleton)		
9. Branching ratios		Daniela Rebuffi (Pavia)	Ivica Puljak (Split)	Sven Heinemeyer (IFCA)	Alexander Mück (Aachen)		
10. Jets		Bruce Mellado (Witwatersrand)	Daniele Del Re (Roma 1)	Gavin Salam (CERN)	Frank Tackmann (DESY)		
11. NLO MC				Stefano Frixione (CERN)	Frank Krauss (Durham)	Fabio Maltoni (Louvain)	Paolo Nason (Milano-Bicocca)
12. PDF		Joey Huston (Michigan State)		Stefano Forte (Milano)	Robert Thome (UCL)		

It is felt that we need a substructure in order to continue to be productive.

Few considerations

- ❑ **We probably do not want serious re-structure of the subgroups. These have already evolved after discovery, anyway**
- ❑ **We do not want to have a very large number of subgroups**
 - ❑ **Need to cope with increase of # of topics, though**
- ❑ **How feasible is to combine topics. For instance, can we include HH into the ggF, VBF sub-groups?**
- ❑ **Should we be thinking about accelerators?**
 - ❑ **High energy pp**
 - ❑ **LHeC and high energy ep**
 - ❑ **How about e^+e^- ?**

How about this?

- ggf (with HH)**
- VBF (with HH)**
- VH**
- ttH**
- Jets**
- MC**
 - Need to discuss format and role with experts**
- PDF**
 - Liaison with the PDF4LHC**