WG3 Introduction

Anna Goussiou (ATLAS), David Sperka (CMS),
Zhen Liu & Pietro Slavich (TH)

The 17th Workshop of the LHC Higgs Working Group,
Online only, 9-11 November 2020

Organization of the BSM-Higgs Working Group (WG3)

Anna Goussiou (ATLAS), David Sperka (CMS), Zhen Liu & Pietro Slavich (TH)

- Extended Higgs Sector (neutral + charged)

  Xiangyang Ju (ATLAS, 0), Jana Schaarschmidt (ATLAS, ±)
  Raffaele Gerosa (CMS, 0), Jan Steggemann (CMS, ±)
  Heather Logan, Rui Santos & Shufang Su (TH)

- MSSM

  Tim Barklow (ATLAS), Andrew Gilbert (CMS)
  Stefan Liebler, Pietro Slavich & Michael Spira (TH)

- NMSSM

  Nikos Rompotis (ATLAS), Nadjieh Jafari (CMS)
  Ulrich Ellwanger & Margarete Mühlleitner (TH)

- Exotic Higgs Decays

  Lily Morvaj (ATLAS), Cécile Caillol (CMS), Lorenzo Sestini (LHCb)
  Zhen Liu & Jessie Shelton (TH)

- bbH/bH associated production process

  Lei Zhang (ATLAS), Abdollah Mohammadi (CMS)
  Michael Spira & Marius Wiesemann (TH)

[red = departed/departing]

Organization of the BSM-Higgs Working Group (WG3)

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  Raffaele Gerosa (CMS, 0), Jan Steggemann (CMS, ±)
  Heather Logan, Rui Santos & Shufang Su (TH)

- MSSM

  Tim Barklow (ATLAS), Artur Gottmann (CMS)
  Emanuele Bagnaschi, Pietro Slavich & Michael Spira (TH)

- NMSSM

  Nikos Rompotis (ATLAS), Janek Bechtel (CMS)
  Ulrich Ellwanger & Margarete Mühlleitner (TH)

- Exotic Higgs Decays

  Lily Morvaj (ATLAS), Georgia Karapostoli (CMS), Lorenzo Sestini (LHCb)
  Matthias Konig & Brian Shuve (TH)

- bbH/bH associated production process

  Lei Zhang (ATLAS), Abdollah Mohammadi (CMS)
  Michael Spira & Marius Wiesemann (TH)

[green = arrived/arriving]

General tasks of the WG3

- Develop benchmark scenarios for interpreting Higgs searches in BSM models
- Identify missing signatures and assess the feasibility of new Higgs searches
- Develop/maintain/combine tools for the calculation of physical observables
- Ensure a correct description of TH/PH issues in EXP publications

Plenary Session Schedule

13:00	**Introduction**	*Anna Goussiou et al.*	
	Online only	13:00 - 13:05	
	MSSM Subgroup Updates	*Emanuele Angelo Bagnaschi*	
	Online only	13:05 - 13:20	
	MSSM Subgroup Updates	*Artur Il Darovic Gottmann*	
	Online only	13:20 - 13:35	
	NMSSM Subgroup Updates	*Milada Muehlleitner*	
	Online only	13:40 - 13:55	
14:00	**NMSSM Subgroup Updates**	*Janek Bechtel*	
	Online only	13:55 - 14:10	
	Extended Higgs Sector Subgroup Updates	*Rui Santos*	
	Online only	14:15 - 14:30	
	Extended Higgs Sector Subgroup Updates	*Lidija Zivkovic*	
	Online only	14:30 - 14:45	
15:00	**Exotic Higgs Decays Subgroup Updates**	*Georgia Karapostoli*	
	Online only	14:50 - 15:15	
	bbH Subgroup Updates	*Abdollah Mohammadi*	
	Online only	15:20 - 15:40	
16:00	**Tea/Coffee Break**		
	Online only	15:50 - 16:10	
	On the yb sensitivity of bbH	*Davide Pagani*	
	Online only	16:10 - 16:25	

Slides from last year's introductory talk:

HXSWG recommendations for the Run-2 legacy papers

- It started as a vague proposal: a chance for the WG3 theorists to tell the EXP collaborations what information they would like to find in the final Run-2 papers, and for the WG3 experimentalists to say if that is feasible or pie-in-the-sky
- SC input: focus on the presentation of auxiliary information meant to facilitate future re-interpretations of the Run-2 Higgs searches in different BSM scenarios
- Call for contributions from authors of re-interpretation codes: `HiggsBounds/HiggsSignals`, `Lilith`, …
- Should our recommendations be limited to new-Higgs searches or also address the properties of the 125-GeV Higgs? (overlap WG2 – joint recommendations?)

Early discussions on new-Higgs searches in a nutshell:

TH request:

- Model-independent 95% exclusion limits (both expected and observed) as function of all relevant parameters (mass, width…)
- The same for the exclusion likelihoods

EXP reaction:

Feasible !

However… The likelihoods have already been provided in $pp \to \phi \to \tau^+\tau^-$ searches, and they proved very useful in global fits of BSM models

Don't miss Sven's talk and the parallel discussion this afternoon!!!

Schedule of the afternoon discussion session for WG3

- 14:30 – 15:45 Joint session with the HH group
- 16:00 – 17:00 Discussion with VBF group on the use of "HXS4BSM" numbers
- 17:00 – 18:00 Discussion on the "Recommendations" business

HXS4BSM and its discontents

"SM-like" cross-section predictions for a scalar with mass different from 125 GeV

What for?

- "unit of measure" to compare with model-dependent BSM-Higgs XS
- also used directly to compute BSM-Higgs XS by rescaling couplings

The HXS4BSM manifesto (November 2015):

https://twiki.cern.ch/twiki/bin/view/LHCPhysics/LHCHXSWGCrossSectionsCalc#2_BSM_Higgs_boson_production_cro

The numbers: https://twiki.cern.ch/twiki/pub/LHCPhysics/LHCHXSWG/Higgs_XSBR_YR4_update.xlsx

How to account for model-dependent effects when using these "rescaled" BSM-Higgs XS? (e.g. width effects; interference with backgrounds or with SM Higgs)

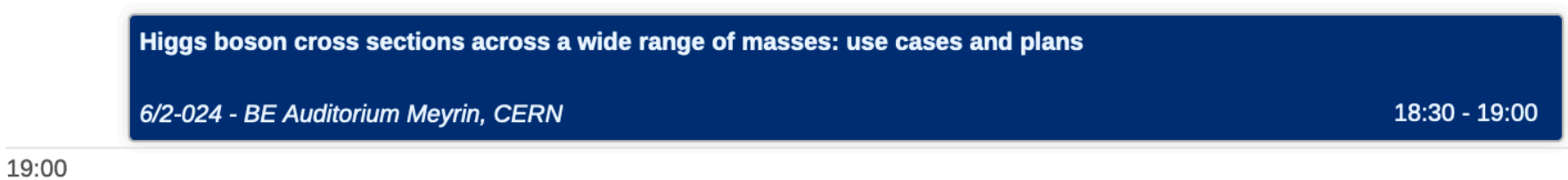
The question was raised again in a recent CMS search for $VV \to \phi \to VV$ (HIG-17-033)

If you are a provider or a user of HXS4BSM numbers, join the discussion this afternoon!

What ever happened to last year's hot topics?

- The "Recommendations" business coalesced into a promise by ATLAS & CMS to eventually release exclusion likelihood maps as supplemental material for all BSM-Higgs searches (see e.g. https://www.hepdata.net/record/ins1782650)

- For the "HXS4BSM" business, questions on the use of SM-like cross sections for the production of a heavy Higgs keep arising (e.g., in recent searches for a VBF-produced scalar decaying to photon + invisible). A cross-group discussion of the outstanding issues has been organized for today at 18:30 CERN time:



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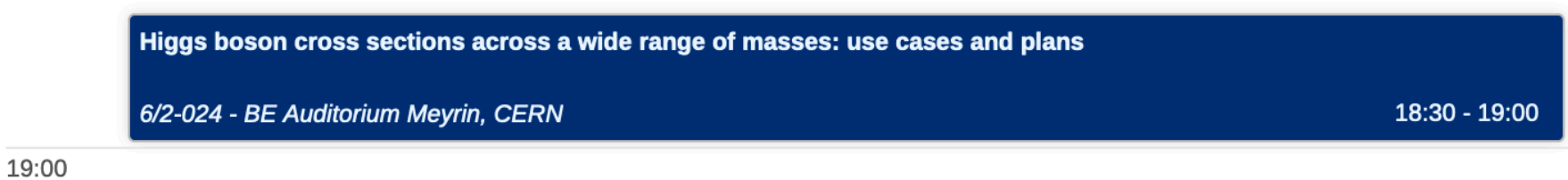

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