

# LHC Higgs Working Group 2 introduction

Mingshui Chen, Marco Delmastro, Chris Hays, David Marzocca,  
Predrag Milenovic, Francesco Riva

WG2 session  
10 December 2018

# Overview of WG2

- WG2 links SM (WG1) to BSM (WG3) Higgs physics
  - General frameworks for measurements and interpretations

## **Differential and simplified-template cross sections**

Kinematic and topological measurements of Higgs processes

## **Pseudo-observables**

Process parameterization at the scattering amplitude level

## **Effective field theories**

Parameterize high-scale physics at the Lagrangian level

### **WG2 conveners**

ATLAS: Chris Hays → Marco Delmastro

CMS: Mingshui Chen → Predrag Milenovic

Theory: Francesco Riva & David Marzocca

### **Fid/STXS conveners**

ATLAS: Nicolas Berger

CMS: Predrag Milenovic

Theory: Frank Tackmann

# Recent meetings and activities

## Differential and simplified-template cross sections

Correlating uncertainties in VBF & VH

*Talks today from VBF (Yacine Haddad) & VH (Thomas Calvet)*

Refining binning

Adding differential final-state information

*STXS report today from Frank Tackmann*

*Discussion tomorrow 10:30-11:30*

## Pseudo-observables

*Report today from David Marzocca*

## Effective field theories

BSM-inspired benchmarks with specific operators

*Report today from Francesco Riva*

Tools and procedures for global fits

*Discussion tomorrow 9-10:30*

### Fiducial/STXS subgroup meeting

Thursday 17 May 2018, 11:00 → 13:00 Europe/Zurich  
53-R-044 (CERN)

Videoconference Rooms [Fiducial\\_STXS\\_subgroup\\_discussions](#)

11:00	→ 11:10	<b>Introduction</b> ⌚ 10m
<b>Speakers:</b> Frank Tackmann (Deutsches Elektronen-Synchrotron (DE)), Nicolas Berger (CERN)		
11:25	→ 11:45	<b>Including final-state information in the STXS framework</b> ⌚ 20m
<b>Speaker:</b> Michael Duehrssen-Debling (CERN)		
<a href="#">STXS_and_decay_i...</a>		
12:00	→ 12:20	<b>Uncertainties for the Stage-1 VH</b> ⌚ 20m
<b>Speaker:</b> Thomas Calvet (Stony Brook University)		
<a href="#">calvet_VHbb_STXS...</a> <a href="#">fixes_calvet_VHbb...</a>		

### WG2 fid/dif/STXS meeting: Presentation of results and STXS updates

Friday 23 Nov 2018, 13:00 → 15:40 Europe/Zurich  
60-2-023 (CERN)

Videoconference Rooms [Fiducial\\_STXS\\_subgroup\\_discussions](#)

13:00	→ 13:05	<b>News and plans</b> ⌚ 5m
<b>Speakers:</b> Frank Tackmann, Nicolas Berger (Centre National de la Recherche Scientifique (FR)), Predrag Milenovic (University of Belgrade (RS))		
13:05	→ 13:30	<b>Presentation of results -- beyond the covariance matrix (15'+10')</b> ⌚ 25m
<b>Speaker:</b> Andrew Gilbert (CERN)		
<a href="#">TaylorExpansion-W...</a>		
13:30	→ 13:50	<b>Presentation of results -- including theory systematics (15'+5')</b> ⌚ 20m
<b>Speaker:</b> Nicolas Berger (Centre National de la Recherche Scientifique (FR))		
<a href="#">STXS-20181123.pdf</a>		
13:50	→ 14:20	<b>VH STXS update (15'+15', tbc)</b> ⌚ 30m
<b>Speaker:</b> Thomas Calvet (Stony Brook University)		
<a href="#">calvet_VHbbSTXSu...</a>		
14:20	→ 14:40	<b>VBF STXS binning update studies (15'+5')</b> ⌚ 20m
<b>Speaker:</b> Oleh Kivernyyk (Centre National de la Recherche Scientifique (FR))		
14:40	→ 15:00	<b>VBF STXS binning update studies (15'+5')</b> ⌚ 20m
<b>Speakers:</b> Claudia Bertella (Chinese Academy of Sciences (CN)), Yacine Haddad (Northeastern University (US))		
<a href="#">VBF-STXS-UNCERT...</a>		
15:00	→ 15:25	<b>Additional discussion</b> ⌚ 25m

# Issues for EFT global fits

## Validation of tools providing global EFT predictions

Initial WG2 discussion on Higgs processes in June

*Report today from Ilaria Brivio and Eleni Vryonidou*

Validation effort broadened and moved to LPCC

*Report Wednesday from Michelangelo Mangano*

### Validation of EFT tools

Thursday 14 Jun 2018, 14:00 → 15:00 Europe/Zurich  
4-3-004 - TH Discussion Room (CERN)

Videoconference Rooms Benchmarking\_and\_validation

14:00 → 14:30 **General proposal** ⌚ 30m

WG214Jun2018.pdf

## Model-independent CP-odd observables

A combined fit to CP-odd operators affecting ggH and VVH used  $d\phi(j_1, j_2)$  measurements

Most experimental results assume one operator is zero, precluding global fit

## Dimension-8 terms

Tools available for studying dimension-8 effects

### WG2 meeting on EFT & CP

Tuesday 13 Nov 2018, 14:00 → 17:00 Europe/Zurich  
14-4-002 (CERN)

Videoconference Rooms WG2\_meeting

14:00 → 14:30 **Effects of CP-odd EFT operators** ⌚ 30m

**Speaker:** Felipe Ferreira de Freitas

eft\_higgs.pdf

14:30 → 15:00 **CP-odd EFT constraints from ggH + VBF + H4I** ⌚ 30m

**Speaker:** Hannes Mildner (University of Sheffield (GB))

hmildner\_lhchxswg...

15:00 → 15:30 **Dimension-8 operators and WH production** ⌚ 30m

**Speaker:** Adam Orion Martin (University of Notre Dame (US))

dim8\_amartin.pdf

15:30 → 16:00 **Basis construction and translation with DEFT** ⌚ 30m

**Speaker:** Dave Sutherland

DEFTWG2Talk.pdf

## Recommendations from LHC top WG in 1802.07237

Will be focus of tomorrow's discussion 9-10:30

### • Main recommendations:

1. Provide individual (also by process) and global (marginalised) constraints
2. Provide constraints using i) linear and ii) linear+squared terms
3. Provide information on the energy scales probed by the process

# Agendas

## Today

<b>WG2 introduction and overview</b>	<i>Chris Hays</i>
4-3-006 - TH Conference Room, CERN	14:30 - 14:45
<b>Report on STXS</b>	<i>Frank Tackmann</i>
4-3-006 - TH Conference Room, CERN	14:45 - 15:15
<b>Uncertainty scheme for VBF STXS Bins</b>	<i>Yacine Haddad</i>
4-3-006 - TH Conference Room, CERN	15:15 - 15:35
<b>Uncertainty scheme for VH STXS Bins</b>	<i>Thomas Calvet</i>
4-3-006 - TH Conference Room, CERN	15:35 - 15:55
<b>Discussion</b>	
4-3-006 - TH Conference Room, CERN	15:55 - 16:15
<b>Coffee break</b>	
4-3-006 - TH Conference Room, CERN	16:15 - 16:35
<b>Status update on PO</b>	<i>David Marzocca</i>
4-3-006 - TH Conference Room, CERN	16:35 - 17:05
<b>EFT benchmarks</b>	<i>Francesco Riva</i>
4-3-006 - TH Conference Room, CERN	17:05 - 17:35
<b>Report on EFT tools validation</b>	<i>Eleni Vryonidou et al.</i>
4-3-006 - TH Conference Room, CERN	17:35 - 18:05

## Tomorrow

<b>EFT issues for global fits</b>	
40-S2-A01 - Salle Anderson, CERN	09:00 - 10:30
<b>STXS binning &amp; differential decay information (with WG1)</b>	
40-S2-A01 - Salle Anderson, CERN	10:30 - 11:30