LHC Higgs WG2:
EFT and benchmarks

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Overview

LHC Higgs WG2

WG2 document plans

Fitting EFT parameters using STXS

LHC Higgs WG2: Higgs properties

Working group tasked with general characterization of the Higgs boson
Serves as an intermediary between SM predictions and BSM models

Yellow report 4 defined several directions for further study

Measurement-based:
- *Simplified template cross sections (STXS)*
- *differential cross sections (diffXS)*

Joined into a subgroup headed by Frank Tackmann, Nicolas Berger, and Predrag Milenovic

Interpretation-based:
- *pseudo-observables (PO)*
- *effective field theory (EFT)*

https://twiki.cern.ch/twiki/bin/view/LHCPhysics/LHCHXSWG2
Conveners: Mingshui Chen, Chris Hays, David Marzocca, Francesco Riva

WG2 documents

Three documents proposed in July LHC Higgs general meeting:

(1) Relating STXS to BSM parameters (EFT / PO)
Collection of documents on STXS updates and STXS→EFT equations
Status:
STXS/diffXS subconveners have clear plans for updating documentation
Note on STXS→EFT equations to be posted soon (details in this talk)

(2) Benchmark models and interpretations
Discuss a handful of simplified models and mappings to EFT parameters
Status:
not started, kick-start with a WG2 meeting

(3) Combining Higgs & EW measurements
Collection of documents joint with LHC EW WG to standardize diboson bins and define equations for EFT parameters
Status:
Initiated discussion with LHC EW WG in July, will follow up

STXS overview

YR4 defined standard binning for cross section measurements using unfolding (diffXS) or SM template distributions (STXS)

The standards allow for public ‘tools’ mapping the measurements to EFT parameters

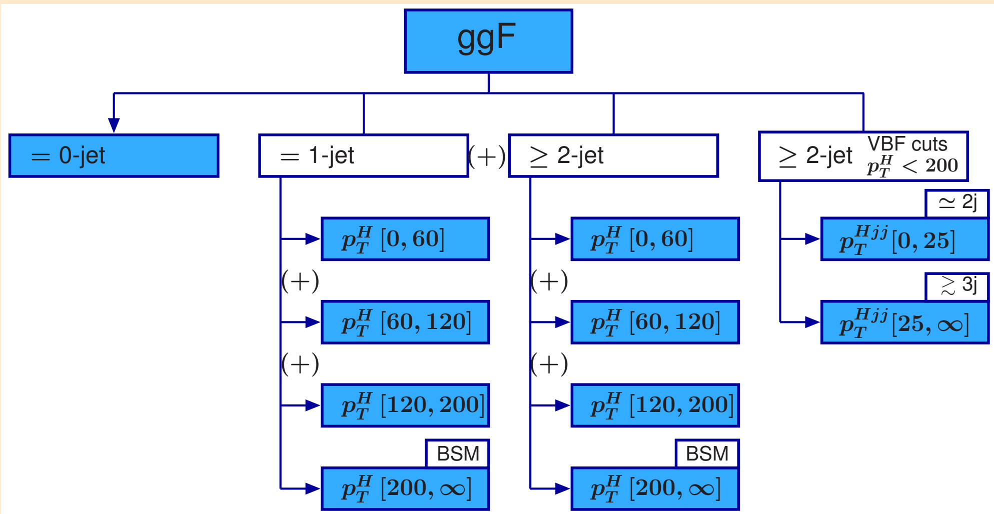
Aim for experiments to use the tools to perform combined EFT fits

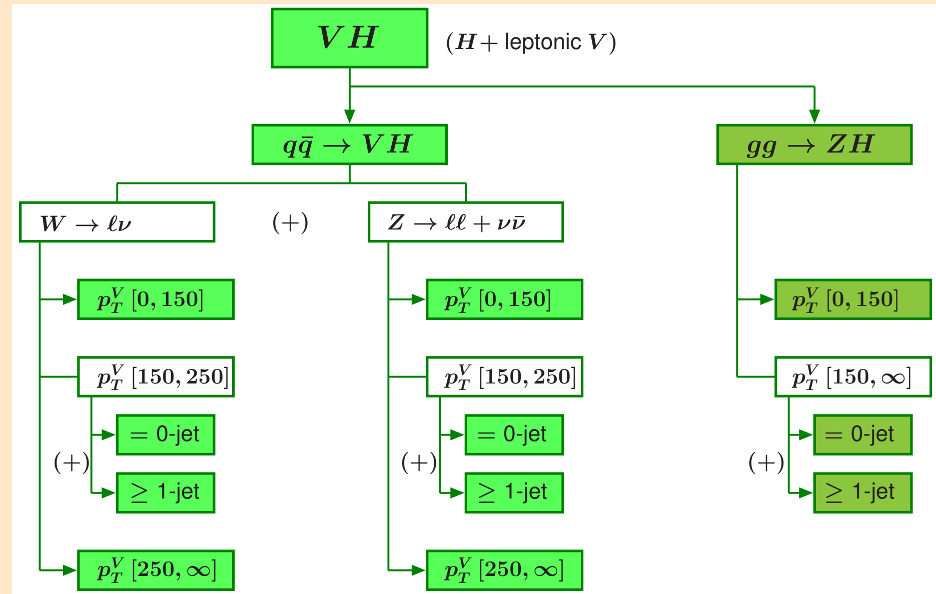
STXS vs diff-XS for fitting EFT parameters:

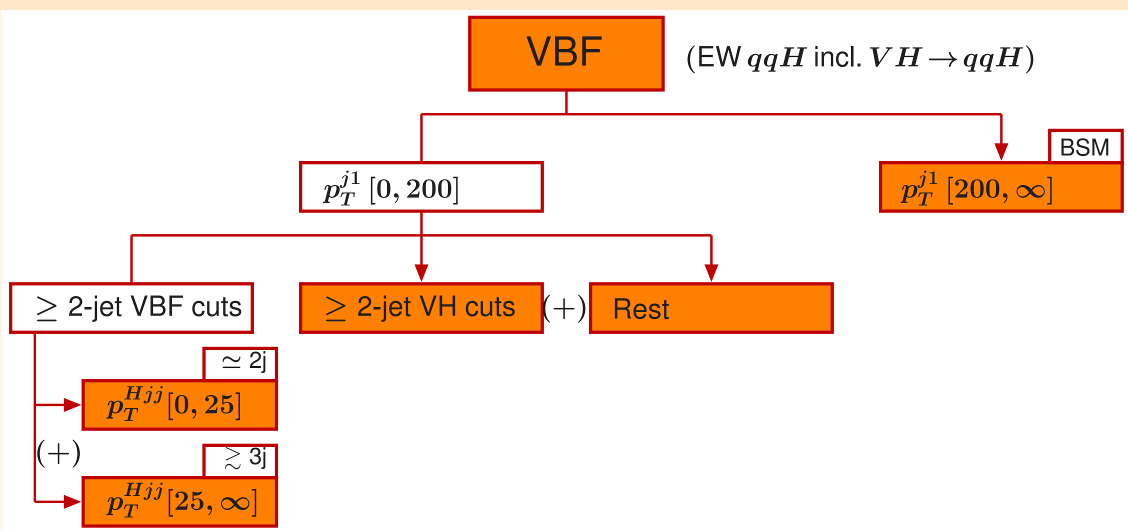
- STXS implemented in workspace as an intermediate translation of the data: effectively a direct fit to data
- STXS can better fit low-statistics regions (no unfolding)
- STXS relies on SM distributions for extrapolations within bins and migrations across bins
  - Leads to theory uncertainties and potential model-dependence

Mapping STXS to EFT

Use “Stage 1” STXS: $\sigma_i \times \mathcal{B}_{4\ell}$







Can update to Stage 1.5 or Stage 2 when available / appropriate

Mapping STXS to EFT

Take cross sections and decay widths to be quadratic functions of EFT

Have validated approximation to substantially higher accuracy than data

$$\sigma_{EFT} = \sigma_{SM} + \sigma_{int} + \sigma_{BSM}$$

$$\frac{\sigma_{int}}{\sigma_{SM}} = \sum_i A_i c_i,$$
$$\frac{\sigma_{BSM}}{\sigma_{SM}} = \sum_{ij} B_{ij} c_i c_j.$$

$$\mathcal{B}_{4\ell} = \frac{\Gamma_{4\ell}}{\sum_f \Gamma_f} \approx \frac{\Gamma_{4\ell}^{SM}}{\sum_f \Gamma_f^{SM}} \left[1 + \sum_i A_i^{4\ell} c_i + \sum_{ij} B_{ij}^{4\ell} c_i c_j - \sum_f \left(\sum_i A_i^f c_i + \sum_{ij} B_{ij}^f c_i c_j\right)\right],$$
$$\frac{\Gamma_f}{\Gamma_{4\ell}} \approx \frac{\Gamma_f^{SM}}{\Gamma_{4\ell}^{SM}} \left[1 + \sum_i A_i^f c_i + \sum_{ij} B_{ij}^f c_i c_j - \left(\sum_i A_i^{4\ell} c_i + \sum_{ij} B_{ij}^{4\ell} c_i c_j\right)\right]. \quad (3)$$

Madgraph options available to directly evaluate A_i and B_{ij} for $i = j$

Need to subtract two calculations to get B_{ij} for $i \neq j$

EFT tools

Until recently only one Madgraph EFT implementation available to fit both Higgs & EW data

Higgs effective Lagrangian (HEL) model includes 39 flavor-symmetric operators in the SILH basis (all except 4-fermion, with some redundancy)

HEL limitations:
- *Leading order, no running EFT couplings*
- *ggF loop not resolved*
- *only a subset of operators*

Impending updates to address these issues:
- *HEL to add top-Higgs couplings in ggF loop*
- *Warsaw basis implementation (Trott et al) includes operators without flavour-symmetry assumptions (2499 parameters)*
  http://feynrules.irmp.ucl.ac.be/wiki/SMEFT
- *Another Warsaw basis implementation (Maltoni et al) to include NLO QCD corrections and running couplings*

EFT tools

Case	CP even	CP odd	WHZ Pole parameters
General SMEFT $(n_f = 1)$	53 [10]	23 [10]	~ 23
General SMEFT $(n_f = 3)$	1350 [10]	1149 [10]	~ 46
$\mathrm{U}(3)^5$ SMEFT	~ 52	~ 17	~ 24
MFV SMEFT	~ 108	-	~ 30

Class	Parameters	
1	$C_W \in \mathbb{R}$	1
3	$\{C_{HD}, C_{H\Box}\} \in \mathbb{R}$	2
4	$\{C_{HG}, C_{HW}, C_{HB}, C_{HWB}\} \in \mathbb{R}$	4
5	$\{C_{uH}, C_{dH}\} \in \mathbb{R}$	~ 2
6	$\{C_{uW}, C_{uB}, C_{uG}, C_{dW}, C_{dB}, C_{dG}\} \in \mathbb{R}$	~ 6
7	$\{C^{(1)}_{H\ell}, C^{(3)}_{H\ell}, C^{(1)}_{Hq}, C^{(3)}_{Hq}, C_{He}, C_{Hu}, C_{Hd}\} \in \mathbb{R},$	~ 7
8 $(\bar{L}L)(\bar{L}L)$	$\{C_{\ell\ell}, \mathcal{C}_{\ell\ell}\} \in \mathbb{R}$	2
	Total Count	~ 24

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Standard Model Effective Field Theory -- The SMEFTsim package

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The model description

The Standard Model Effective Field Theory (SMEFT) is constructed out of a series of $SU(3)_C \times SU(2)_L \times U(1)_Y$ invariant higher dimensional opera… L_7, … built out of the SM fields.
The SMEFTsim package provides a complete implementation of the lepton and baryon number conserving dimension-6 Lagrangian adopting the … basis arXiv:1008.4884

The SM Lagrangian is included and extended with the SM loop-induced Higgs couplings to gg, γγ and Zγ.

The SMEFTsim package provides implementations for 3 different flavor assumptions and 2 input scheme choices, for a total of 6 different models…

The flavor assumptions adopted are (see arXiv:1709.xxxxx for a detailed description)

- The flavour general case
- The $U(3)^5$ flavor symmetric case, with possible non-SM CP-violating phases
- A linear Minimal flavor violation (MFV) ansatz arXiv:0207036, in which non-SM CP-violating effects are neglected, but linear flavor-violatin… insertions are allowed in quark currents

SMEFT.fr

For each model it is possible to choose between two input parameters sets for the electroweak sector, namely:

- α scheme: $\{\alpha_{em}, m_Z, G_f\}$
- m_W scheme: $\{m_W, m_Z, G_f\}$

Importantly, field rotations required to have canonically normalized kinetic terms and parameter redefinitions following from the choice of an inp… parameters set are automatically applied in the Lagrangian.

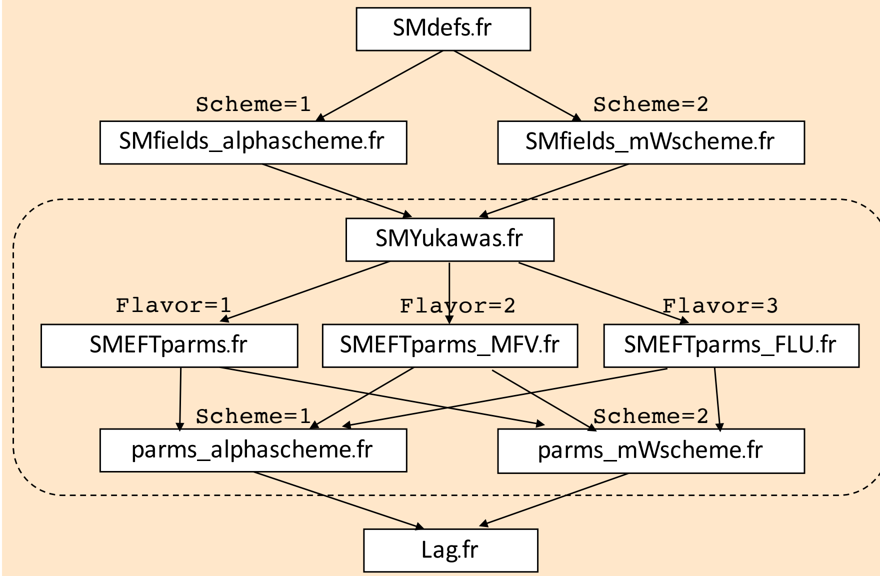
Two independent models sets (A and B) are supplied. Each set contains a main file, a number of subroutines and restriction files. The two sets d… e structure and in the technical implementation of L_6, but they produce consistent results. The use of both sets is recommended for debugging an… on of the numerical results.
Pre-exported UFO files to be interfaced with MadGraph5_aMC@NLO can also be downloaded from this page (see Table below).

We would appreciate if you could report to us any inconsistency or bugs.

Usage recommendations

The SMEFTsim package is designed to enable numerical studies of the LO interference of the SMEFT with the SM, while neglecting NLO corrections. In this spirit, it has not been optimized for loop calculations in the SM or in the SMEFT. In particular:

- the Lagrangian assumes unitary gauge. Using it in R_{xi} or Feynman gauge may lead to inconsistent results, as the ghost Lagrangian have not been modified to account for L_6 corrections.
- the UFO files are not suitable for NLO evaluation in MadGraph5_aMC@NLO



STXS fit strategy

- Start with HEL implementation of SILH basis in Madgraph

- Reduce parameter set using external constraints
    - Take tightly constrained parameters to be zero
    - Can relax to Gaussian constraints to check impact

- Use equations relating STXS to EFT parameters to fit the data

Aims for first fit:
- Compare fits from workspace to those from STXS measurements
- Compare fits with and without quadratic terms
- Study variety of operator fit combinations and constraints

V. Sanz contributing constraints and G. Zemaityte determining equations
Documenting in WG2 note, will expand to include EFT updates

External constraints

HEL EW scheme: m_W, α_{EM} and G_F inputs

$$m_Z = \frac{gv}{2\cos\theta_W}\left[1 - \mathtt{cT} + \frac{g'^2}{2m_W^2\sin^2\theta_W}\left(\mathtt{cWW}\cos\theta_W^2 + \mathtt{cB}\sin\theta_W^2 + 4\mathtt{cA}\sin^4\theta_W\right)\right]^{1/2}$$

Constrain m_Z to 91.19 ± 0.02

HEL operator	Coefficient	Constraint (TeV^{-2})
$\mathcal{O}_g = \frac{g_s^2\mathtt{cG}}{m_W^2}\lvert H\rvert^2 G^A_{\mu\nu}G^{A\mu\nu}$	$\frac{c_g}{\Lambda^2} = \frac{g_s^2}{m_W^2}\mathtt{cG}$	$(-0.074, 0.025)$
$\tilde{\mathcal{O}}_g = \frac{g_s^2\mathtt{tcG}}{m_W^2}\lvert H\rvert^2 G^A_{\mu\nu}\tilde{G}^{A\mu\nu}$	$\frac{\tilde{c}_g}{\Lambda^2} = \frac{g_s^2}{m_W^2}\mathtt{tcG}$	$(-0.028, 0.028)$
$\mathcal{O}_\gamma = \frac{g'^2\mathtt{cA}}{m_W^2}\lvert H\rvert^2 B_{\mu\nu}B^{\mu\nu}$	$\frac{c_\gamma}{\Lambda^2} = \frac{g'^2}{m_W^2}\mathtt{cA}$	$(-0.0022, 0.00043)$
$\tilde{\mathcal{O}}_\gamma = \frac{g'^2\mathtt{tcA}}{m_W^2}\lvert H\rvert^2 B_{\mu\nu}\tilde{B}^{\mu\nu}$	$\frac{\tilde{c}_\gamma}{\Lambda^2} = \frac{g'^2}{m_W^2}\mathtt{tcA}$	$(-0.0024, 0.0024)$
$\mathcal{O}_u = \frac{y_u\mathtt{cu}}{v^2}\lvert H\rvert^2 u_L H u_R + \text{h.c.}$	$\frac{c_u}{\Lambda^2} = \frac{\mathtt{cu}}{v^2}$	$(-1.4, 2.6)$
$\mathcal{O}_d = \frac{y_d\mathtt{cd}}{v^2}\lvert H\rvert^2 d_L H d_R + \text{h.c.}$	$\frac{c_d}{\Lambda^2} = \frac{\mathtt{cd}}{v^2}$	$(-3.3, 1.5)$
$\mathcal{O}_\ell = \frac{y_\ell\mathtt{cl}}{v^2}\lvert H\rvert^2 \ell_L H \ell_R + \text{h.c.}$	$\frac{c_\ell}{\Lambda^2} = \frac{\mathtt{cl}}{v^2}$	$(-170, 170)$
$\mathcal{O}_H = \frac{\mathtt{cH}}{2v^2}\left(\partial^\mu\lvert H\rvert^2\right)^2$	$\frac{c_H}{\Lambda^2} = \frac{\mathtt{cH}}{v^2}$	$(-2.3, 3.2)$
$\mathcal{O}_6 = \frac{\lambda\mathtt{c6}}{v^2}\left(H^\dagger H\right)^3$	$\frac{c_6}{\Lambda^2} = \frac{\lambda}{v^2}\mathtt{c6}$	$(-170, 170)$
$\mathcal{O}_{HW} = \frac{ig\mathtt{cHW}}{m_W^2}\left(D^\mu H\right)^\dagger\sigma^a(D^\nu H)W^a_{\mu\nu}$	$\frac{c_{HW}}{\Lambda^2} = \frac{g}{m_W^2}\mathtt{cHW}$	$(-3.5, 1.5)$
$\tilde{\mathcal{O}}_{HW} = \frac{ig\mathtt{tcHW}}{m_W^2}\left(D^\mu H\right)^\dagger\sigma^a(D^\nu H)\tilde{W}^a_{\mu\nu}$	$\frac{\tilde{c}_{HW}}{\Lambda^2} = \frac{g}{m_W^2}\mathtt{tcHW}$	$(-6.0, 6.0)$
$\mathcal{O}_{HB} = \frac{ig'\mathtt{cHB}}{m_W^2}\left(D^\mu H\right)^\dagger(D^\nu H)B_{\mu\nu}$	$\frac{c_{HB}}{\Lambda^2} = \frac{g'}{m_W^2}\mathtt{cHB}$	$(-2.5, 4.1)$
$\tilde{\mathcal{O}}_{HB} = \frac{ig'\mathtt{tcHB}}{m_W^2}\left(D^\mu H\right)^\dagger(D^\nu H)\tilde{B}_{\mu\nu}$	$\frac{\tilde{c}_{HB}}{\Lambda^2} = \frac{g'}{m_W^2}\mathtt{tcHB}$	$(-13, 13)$
$\mathcal{O}_W = \frac{ig\mathtt{cWW}}{2m_W^2}\left(H^\dagger\sigma^a D^\mu H\right)D^\nu W^a_{\mu\nu}$	$\frac{c_W}{\Lambda^2} = \frac{g}{m_W^2}\mathtt{cWW}$	$\frac{c_W/g - c_B/g'}{\Lambda^2} = (-5.4, 0.77)$
$\mathcal{O}_B = \frac{ig'\mathtt{cB}}{2m_W^2}\left(H^\dagger D^\mu H\right)\partial^\nu B_{\mu\nu}$	$\frac{c_B}{\Lambda^2} = \frac{g'}{m_W^2}\mathtt{cB}$	$\frac{c_W/g + c_B/g'}{\Lambda^2} = (-0.51, 0.28)$

Operators constrained by Higgs & EW data

Most CP-even constraints taken from global Run 1 fit by Ellis, Sanz, and You

CP-odd operators constrained from individual fits

External constraints

HEL operator	Coefficient	Constraint (TeV^{-2})
$\mathcal{O}_{3W} = \frac{g^3 \mathtt{c3W}}{m_W^2}\epsilon_{ijk}W^i_{\mu\nu}W^{\nu j}_\rho W^{\rho\mu k}$	$\frac{c_{3W}}{\Lambda^2} = \frac{g^3}{m_W^2}\mathtt{c3W}$	$(-3.6, 1.9)$
$\tilde{\mathcal{O}}_{3W} = \frac{g^3 \mathtt{tc3W}}{m_W^2}\epsilon_{ijk}W^i_{\mu\nu}W^{\nu j}_\rho \tilde{W}^{\rho\mu k}$	$\frac{\tilde{c}_{3W}}{\Lambda^2} = \frac{g^3}{m_W^2}\mathtt{tc3W}$	$(-7.8, 7.8)$
$\mathcal{O}_T = \frac{\mathtt{cT}}{2v^2}\left(H^\dagger D^\mu H\right)^2$	$\frac{c_T}{\Lambda^2} = \frac{\mathtt{cT}}{v^2}$	$(-0.071, 0.055)$
$\mathcal{O}_{2W} = \frac{g^2 \mathtt{c2W}}{m_W^2}D^\mu W^k_{\mu\nu}D_\rho W^{\rho\nu}_k$	$\frac{c_{2W}}{\Lambda^2} = \frac{g^2}{m_W^2}\mathtt{c2W}$	$(-170, 170)$
$\mathcal{O}_{2B} = \frac{g'^2 \mathtt{c2B}}{m_W^2}\partial^\mu B_{\mu\nu}\partial_\rho B^{\rho\nu}$	$\frac{c_{2B}}{\Lambda^2} = \frac{g^2}{m_W^2}\mathtt{c2B}$	$(-170, 170)$
$\mathcal{O}^u_R = \frac{\mathtt{cHu}}{v^2}\left(iH^\dagger D_\mu H\right)\left(\bar{u}_R\gamma^\mu u_R\right)$	$\frac{c^u_R}{\Lambda^2} = \frac{\mathtt{cHu}}{v^2}$	$(-0.18, 0.18)$
$\mathcal{O}^d_R = \frac{\mathtt{cHd}}{v^2}\left(iH^\dagger D_\mu H\right)\left(\bar{d}_R\gamma^\mu d_R\right)$	$\frac{c^d_R}{\Lambda^2} = \frac{\mathtt{cHd}}{v^2}$	$(-0.69, 0.073)$
$\mathcal{O}^e_R = \frac{\mathtt{cHe}}{v^2}\left(iH^\dagger D_\mu H\right)\left(\bar{e}_R\gamma^\mu e_R\right)$	$\frac{c^e_R}{\Lambda^2} = \frac{\mathtt{cHe}}{v^2}$	$(-0.030, 0.0041)$
$\mathcal{O}^q_L = \frac{\mathtt{cHQ}}{v^2}\left(iH^\dagger D_\mu H\right)\left(\bar{Q}_L\gamma^\mu Q_L\right)$	$\frac{c^q_L}{\Lambda^2} = \frac{\mathtt{cHQ}}{v^2}$	$(-0.031, 0.11)$
$\mathcal{O}^{(3)q}_L = \frac{\mathtt{cpHQ}}{v^2}\left(iH^\dagger \sigma^a D_\mu H\right)\left(\bar{Q}_L\sigma^a\gamma^\mu Q_L\right)$	$\frac{c^{(3)q}_L}{\Lambda^2} = \frac{\mathtt{cpHQ}}{v^2}$	$(-0.073, 0.073)$
$\mathcal{O}^{(3)L}_{LL} = \frac{1}{v^2}\left(\bar{L}_L\sigma^a\gamma^\mu L_L\right)\left(\bar{L}_L\sigma^a\gamma^\mu L_L\right)$	$\frac{c^{(3)l}_{LL}}{\Lambda^2} = \frac{1}{v^2}$	$(-0.021, 0.012)$
$\mathcal{O}_{3G} = \frac{g_s^3 \mathtt{c3G}}{m_W^2}f_{abc}G^a_{\mu\nu}G^{\nu b}_\rho G^{\rho\mu c}$	$\frac{c_{3G}}{\Lambda^2} = \frac{g_s^3}{m_W^2}\mathtt{c3G}$	$(-0.045, 0.045)$
$\tilde{\mathcal{O}}_{3G} = \frac{g_s^3 \mathtt{tc3G}}{m_W^2}f_{abc}G^a_{\mu\nu}G^{\nu b}_\rho \tilde{G}^{\rho\mu c}$	$\frac{\tilde{c}_{3G}}{\Lambda^2} = \frac{g_s^3}{m_W^2}\mathtt{tc3G}$	$(-0.045, 0.045)$
$\mathcal{O}_{2G} = \frac{g_s^2 \mathtt{c2G}}{m_W^2}D^\mu G^a_{\mu\nu}D_\rho G^{\rho\nu}_a$	$\frac{c_{2G}}{\Lambda^2} = \frac{g_s^2}{m_W^2}\mathtt{c2G}$	$(-0.045, 0.045)$

Operators constrained by EW & QCD data

EW constraints taken from global fit by Ellis, Sanz, and You

QCD constraint taken from individual fit by Krauss, Kuttimalai, and Plehn (assume similar constraints for all operators)

12 additional HEL operators not constrained (e.g. chromomagnetic)

Equations relating STXS to EFT

Show leading terms in note (coefficients must span <3 orders)
Put complete equations on LHCHXSWG twiki

Cross-section region	$\sum_i A_i c_i$
$gg \to H$ (0-jet)	
$gg \to H$ (1-jet, $p_T^H < 60$ GeV)	$56c'_g$
$gg \to H$ (1-jet, $60 \leq p_T^H < 120$ GeV)	
$gg \to H$ (1-jet, $120 \leq p_T^H < 200$ GeV)	$56c'_g + 18\mathtt{c3G} + 11\mathtt{c2G}$
$gg \to H$ (1-jet, $p_T^H \geq 200$ GeV)	$56c'_g + 52\mathtt{c3G} + 34\mathtt{c2G}$
$gg \to H$ ($\geq$ 2-jet, $p_T^H < 60$ GeV)	$56c'_g$
$gg \to H$ ($\geq$ 2-jet, $60 \leq p_T^H < 120$ GeV)	$56c'_g + 8\mathtt{c3G} + 7\mathtt{c2G}$
$gg \to H$ ($\geq$ 2-jet, $120 \leq p_T^H < 200$ GeV)	$56c'_g + 23\mathtt{c3G} + 18\mathtt{c2G}$
$gg \to H$ ($\geq$ 2-jet, $p_T^H \geq 200$ GeV)	$56c'_g + 90\mathtt{c3G} + 68\mathtt{c2G}$
$gg \to H$ ($\geq$ 2-jet VBF-like, $p_T^{j_3} < 25$ GeV)	$56c'_g$
$gg \to H$ ($\geq$ 2-jet VBF-like, $p_T^{j_3} \geq 25$ GeV)	$56c'_g + 9\mathtt{c3G} + 8\mathtt{c2G}$
$qq \to Hqq$ (VBF-like, $p_T^{j_3} < 25$ GeV)	$1.4\mathtt{cWW} - 4.3\mathtt{cHW} - 0.29\mathtt{cHB}$
$qq \to Hqq$ (VBF-like, $p_T^{j_3} \geq 25$ GeV)	$1.6\mathtt{cWW} - 5.5\mathtt{cHW} - 0.39\mathtt{cHB}$
$qq \to Hqq$ ($p_T^j \geq 200$ GeV)	$30\mathtt{cWW} + 1.6\mathtt{cB} - 7.0\mathtt{cHW} - 0.62\mathtt{cHB}$
$qq \to Hqq$ ($60 \leq m_{jj} < 120$ GeV)	$31\mathtt{cWW} + 2.5\mathtt{cB} + 13\mathtt{cHW} + 1.0\mathtt{cHB}$
$qq \to Hqq$ (rest)	$8.7\mathtt{cWW} + 0.52\mathtt{cB} - 0.40\mathtt{cHW}$
$gg/q\bar{q} \to ttH$	$-0.98\mathtt{cH} + 2.9\mathtt{cu} + 0.93\mathtt{cG} + 310\mathtt{cuG}$ $+27\mathtt{c3G} - 13\mathtt{c2G}$

($c_g' = 16\pi^2$ cG)

In this implementation gg→H binning just constrains c2G and c3G

Fit to current measurements can focus on c_g', cWW-cB, cHW, cHB, cu

Substantial enhancement in sensitivity in VBF $p_T^j > 200$ GeV bin

Equations relating STXS to EFT

Cross-section region	$\sum_i A_i c_i$
$q\bar{q} \to Hl\nu$ ($p_T^V < 150$ GeV)	$-1.0\texttt{cH} + 34\texttt{cWW} + 11\texttt{cHW} + 24\texttt{cpHQ} + 2.0\texttt{cpHL}$
$q\bar{q} \to Hl\nu$ ($150 \leq p_T^V < 250$ GeV, 0 jets)	$-1.0\texttt{cH} + 76\texttt{cWW} + 51\texttt{cHW} + 67\texttt{cpHQ} + 2.0\texttt{cpHL}$
$q\bar{q} \to Hl\nu$ ($150 \leq p_T^V < 250$ GeV, ≥ 1 jet)	$-1.0\texttt{cH} + 71\texttt{cWW} + 46\texttt{cHW} + 61\texttt{cpHQ} + 2.0\texttt{cpHL}$
$q\bar{q} \to Hl\nu$ ($p_T^V \geq 250$ GeV)	$-1.0\texttt{cH} + 200\texttt{cWW} + 170\texttt{cHW} + 190\texttt{cpHQ} + 2.0\texttt{cpHL}$
$q\bar{q} \to Hll$ ($p_T^V < 150$ GeV)	$-1.0\texttt{cH} - 4.0\texttt{cT} + 30\texttt{cWW} + 8.4\texttt{cB} + 8.5\texttt{cHW}$ $+2.5\texttt{cHB} + 0.032\texttt{cA} - 1.9\texttt{cHQ} + 23\texttt{cpHQ} + 5.2\texttt{cHu}$ $-2.0\texttt{cHd} - 0.96\texttt{cHL} + 2.0\texttt{cpHL} - 0.23\texttt{cHe}$
$q\bar{q} \to Hll$ ($150 \leq p_T^V < 250$ GeV, 0 jets)	$-1.0\texttt{cH} - 4.0\texttt{cT} + 62\texttt{cWW} + 18\texttt{cB} + 38\texttt{cHW}$ $+11\texttt{cHB} - 5.0\texttt{cHQ} + 61\texttt{cpHQ} + 14\texttt{cHu} - 5.2\texttt{cHd}$ $-0.98\texttt{cHL} + 2.1\texttt{cpHL} - 0.23\texttt{cHe}$
$q\bar{q} \to Hll$ ($150 \leq p_T^V < 250$ GeV, ≥ 1 jet)	$-1.0\texttt{cH} - 4.0\texttt{cT} + 58\texttt{cWW} + 17\texttt{cB} + 33\texttt{cHW}$ $+9.9\texttt{cHB} - 4.6\texttt{cHQ} + 56\texttt{cpHQ} + 14\texttt{cHu} - 4.6\texttt{cHd}$ $-0.99\texttt{cHL} + 2.1\texttt{cpHL} - 0.24\texttt{cHe}$
$q\bar{q} \to Hll$ ($p_T^V \geq 250$ GeV)	$-1.0\texttt{cH} - 4.0\texttt{cT} + 150\texttt{cWW} + 46\texttt{cB} + 130\texttt{cHW}$ $+38\texttt{cHB} - 14\texttt{cHQ} + 170\texttt{cpHQ} + 42\texttt{cHu} - 14\texttt{cHd}$ $-0.98\texttt{cHL} + 2.1\texttt{cpHL} - 0.24\texttt{cHe}$

VH includes many parameters constrained by LEP (Vff)

Equations relating STXS to EFT

Partial width	$\sum_i A_i c_i$
$H \to b\bar{b}$	
$H \to WW^*$	
$H \to ZZ^*$	$10\mathtt{cWW} + 2.8\mathtt{cB} + 2.9\mathtt{cHW} + 0.018\mathtt{cA} + 2.0\mathtt{cHL} + 2.0\mathtt{cpHL} + 0.027\mathtt{cHe}$
$H \to \gamma\gamma$	$-5.8c'_\gamma$
$H \to \tau\tau$	
$H \to gg$	
$H \to cc$	
$H \to$all	$0.0029\mathtt{cT} + 0.17\mathtt{cu} + 2.3\mathtt{cd} + 0.11\mathtt{cl} + 1.0\mathtt{cWW} + 0.023\mathtt{cB} + 0.37\mathtt{cHW}$ $+0.0079\mathtt{cHB} + 1.6\mathtt{cG} + 0.0078\mathtt{cHQ} + 0.17\mathtt{cpHQ} + 0.0027\mathtt{cHu} + 0.057\mathtt{cpHL}$

($c\gamma' = 16\pi^2$ cA)

Partial width	$\sum_{ij} B_{ij} c_i c_j$
$H \to b\bar{b}$	
$H \to WW^*$	
$H \to ZZ^*$	$+0.25\mathtt{cH}^2 + 4.0\mathtt{cT}^2 + 28\mathtt{cWW}^2 + 3.5\mathtt{cB}^2 + 2.2\mathtt{cHW}^2 + 0.20\mathtt{cHB}^2 + 1.8\mathtt{cHL}^2$ $+1.8\mathtt{cpHL}^2 + 0.43\mathtt{cHe}^2 + 0.14\mathtt{tcHW}^2 + \mathtt{cH}(2.0\mathtt{cT} - 5.1\mathtt{cWW} - 1.3\mathtt{cB} - 1.4\mathtt{cHW}$ $-0.43\mathtt{cHB} - 1.0\mathtt{cHL} - 1.0\mathtt{cpHL} + 0.43\mathtt{cHe}) + \mathtt{cT}(-20\mathtt{cWW} - 5.3\mathtt{cB} - 5.7\mathtt{cHW}$ $-1.7\mathtt{cHB} - 4.1\mathtt{cHL} - 4.1\mathtt{cpHL} + 1.7\mathtt{cHe}) + \mathtt{cWW}(10\mathtt{cB} + 15\mathtt{cHW} + 4.4\mathtt{cHB}$ $+12\mathtt{cHL} + 12\mathtt{cpHL} - 3.5\mathtt{cHe}) + \mathtt{cB}(3.8\mathtt{cHW} + 1.1\mathtt{cHB} + 0.052c'_\gamma + 1.1\mathtt{cHL}$ $+1.1\mathtt{cpHL} - 2.1\mathtt{cHe}) + \mathtt{cHW}(1.3\mathtt{cHB} + 3.0\mathtt{cHL} + 3.0\mathtt{cpHL} - 1.3\mathtt{cHe})$ $+\mathtt{cHB}(0.91\mathtt{cHL} + 0.91\mathtt{cpHL} - 0.39\mathtt{cHe}) + \mathtt{cHL}(3.5\mathtt{cpHL} - 0.13\mathtt{cHe})$ $+\mathtt{cpHL}(-0.13\mathtt{cHe}) + 0.081\mathtt{tcHW}(\mathtt{tcHB})$
$H \to \gamma\gamma$	$8.4(c'^2_\gamma + c'^2_{\tilde{\gamma}})$
$H \to \tau\tau$	
$H \to gg$	
$H \to cc$	
$H \to$all	$0.24\mathtt{cH}^2 + 0.037\mathtt{cT}^2 + 0.13\mathtt{cu}^2 + 1.7\mathtt{cd}^2 + 0.084\mathtt{cl}^2 + 2.6\mathtt{cWW}^2 + 4.7\mathtt{cHW}^2$ $+4.3\mathtt{cHB}^2 + 23\mathtt{cG}^2 + 0.09\mathtt{cpHQ}^2 + 0.066\mathtt{cHud}^2 + 0.027\mathtt{cpHL}^2 + 4.3\mathtt{tcHW}^2$ $+4.3\mathtt{tcHB}^2 + 23\mathtt{tcG}^2 + \mathtt{cH}(-0.086\mathtt{cu} - 1.2\mathtt{cd} - 0.056\mathtt{cl} - 0.51\mathtt{cWW}$ $-0.18\mathtt{cHW} - 0.083\mathtt{cpHQ} - 0.029\mathtt{cpHL}) + \mathtt{cT}(-0.19\mathtt{cWW} - 0.046\mathtt{cB}$ $-0.051\mathtt{cHW} - 0.027\mathtt{cpHQ}) + \mathtt{cWW}(0.11\mathtt{cB} + 1.9\mathtt{cHW} + 0.04\mathtt{cHB} + 0.86\mathtt{cpHQ}$ $+0.29\mathtt{cpHL}) + \mathtt{cHW}(0.03\mathtt{cB} - 8.6\mathtt{cHB} + 0.1c_\gamma + 0.31\mathtt{cpHQ} + 0.11\mathtt{cpHL})$ $+\mathtt{cHB}(-0.1c_\gamma) + \mathtt{tcHW}(-8.6\mathtt{tcHB} + 0.1\tilde{c}'_\gamma) + \mathtt{tcHB}(-0.10\tilde{c}'_\gamma)$

Widths appear in all measurements

Quadratic terms messy

Many new operators appear
e.g. first appearance of CP-odd operators

Cross-terms have larger stat uncertainty

Equations relating STXS to EFT

$gg \to H$ region	$\sum_{ij} B_{ij} c_i c_j$
0-jet	$780(c_g'^2 + c_{\tilde{g}}'^2) + c_g'(300\mathtt{cH} + 1200\mathtt{cd} + 700\mathtt{cuG} - 200\mathtt{cdG} + 200\mathtt{c3G})$
1-jet, $p_T^H < 60$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + c_g'(-1000\mathtt{cH} - 1000\mathtt{cd} - 2000\mathtt{cdG} - 2000\mathtt{c2G})$ $+\tilde{c}_g'(-2000\mathtt{tc3G})$
1-jet, $60 \le p_T^H < 120$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + 70(\mathtt{tc3G}^2 + \mathtt{c3G}^2) + 80\mathtt{c2G}^2 + c_g'(1000\mathtt{cH} + 1000\mathtt{cd}$ $+1000\mathtt{cuG} + 3000\mathtt{cdG} + 1000\mathtt{c3G} - 1000\mathtt{c2G}) + \tilde{c}_g'(2000\mathtt{tc3G})$
1-jet, $120 \le p_T^H < 200$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + 940(\mathtt{c3G}^2 + \mathtt{tc3G}^2) + 560\mathtt{c2G}^2 + 5.6\mathtt{cuG}^2 + c_g'(2000\mathtt{cH}$ $+4000\mathtt{cd} + 4000\mathtt{cuG} - 1000\mathtt{cdG} + 1000\mathtt{c3G} + 2000\mathtt{c2G}) + \tilde{c}_g'(1000\mathtt{tc3G})$
1-jet, $p_T^H \ge 200$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + 32\mathtt{cuG}^2 + 13100(\mathtt{c3G}^2 + \mathtt{tc3G}^2) + 12200\mathtt{c2G}^2$ $+c_g'(8000\mathtt{cH} - 14000\mathtt{cd} - 4000\mathtt{cuG} - 7000\mathtt{cdG} - 6000\mathtt{c3G} + 11000\mathtt{c2G})$ $+\mathtt{c2G}(800\mathtt{cH} + 1200\mathtt{cu} + 1300\mathtt{cuG} + 1800\mathtt{cdG} + 900\mathtt{cd} + 2900\mathtt{c3G})$ $+\mathtt{c3G}(400\mathtt{cu} + 100\mathtt{cd} + 400\mathtt{cuG}) + 10000\tilde{c}_g'\mathtt{tc3G}$
$\ge$ 2-jet, $p_T^H < 60$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + 170(\mathtt{c3G}^2 + \mathtt{tc3G}^2) + 140\mathtt{c2G}^2 + c_g'(-1000\mathtt{cH} - 1000\mathtt{cd}$ $-1000\mathtt{cuG} - 1000\mathtt{cdG} - 1000\mathtt{c3G} + 2000\mathtt{c2G}) + 2000\tilde{c}_g'\mathtt{tc3G} + \mathtt{c3G}(50\mathtt{c2G})$
$\ge$ 2-jet, $60 \le p_T^H < 120$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + 360(\mathtt{c3G}^2 + \mathtt{tc3G}^2) + 410\mathtt{c2G}^2 + c_g'(-2000\mathtt{cd} - 1000\mathtt{cuG}$ $-1000\mathtt{cdG} - 2000\mathtt{c3G} + 2000\mathtt{c2G}) + \mathtt{c2G}(-20\mathtt{cH} - 20\mathtt{cu} + 70\mathtt{c3G})$
$\ge$ 2-jet, $120 \le p_T^H < 200$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + 1800(\mathtt{c3G}^2 + \mathtt{tc3G}^2) + 1900\mathtt{c2G}^2$ $+c_g'(-1000\mathtt{cH} - 2000\mathtt{cd} - 1000\mathtt{cuG} + 2000\mathtt{cdG} - 2000\mathtt{c3G} - 3000\mathtt{c2G})$ $+\mathtt{c2G}(-20\mathtt{cH} - 20\mathtt{cu} - 100\mathtt{cd} + 40\mathtt{cuG} - 110\mathtt{cdG} + 340\mathtt{c3G})$ $+\mathtt{c3G}(10\mathtt{cH} + 10\mathtt{cu} + 30\mathtt{cd} - 10\mathtt{cuG}) + \tilde{c}_g'(3000\mathtt{tc3G})$
$\ge$ 2-jet, $p_T^H \ge 200$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + 63000\mathtt{c2G}^2 + 35000(\mathtt{c3G}^2 + \mathtt{tc3G})$ $+c_g'(-1000\mathtt{cH} - 3000\mathtt{cd} - 4000\mathtt{cuG} + 5000\mathtt{cdG} - 9000\mathtt{c3G} + 6000\mathtt{c2G})$ $+\mathtt{c2G}(-100\mathtt{cuG} + 100\mathtt{cdG} + 4500\mathtt{c3G}) + \tilde{c}_g'(3000\mathtt{tc3G})$
$\ge$ 2-jet, VBF-like, $p_T^{j_3} < 25$ GeV	$780(c_g'^2 4 + c_{\tilde{g}}'^2) + 240(\mathtt{c3G}^2 + \mathtt{tc3G}^2) + 360\mathtt{c2G}^2 + c_g'(2000\mathtt{cH} - 4000\mathtt{cd}$ $+2000\mathtt{cuG} + 2000\mathtt{cdG} + 5000\mathtt{c3G} + \mathtt{c2G}(-20\mathtt{cH} - 30\mathtt{cu} + 10\mathtt{cuG} + 30\mathtt{c3G})$ $+\mathtt{c3G}(-10\mathtt{cH} + 20\mathtt{cu} + 30\mathtt{cuG}) + \tilde{c}_g'(4000\mathtt{tc3G})$
$\ge$ 2-jet VBF-like, $p_T^{j_3} \ge 25$ GeV	$780(c_g'^2 + c_{\tilde{g}}'^2) + 540(\mathtt{c3G}^2 + \mathtt{tc3G}^2) + 950\mathtt{c2G}^2$ $+c_g'(1000\mathtt{cH} - 1000\mathtt{cd} + 2000\mathtt{cuG} - 1000\mathtt{cdG} + 5000\mathtt{c3G} + 3000\mathtt{c2G})$ $+\mathtt{c2G}(-70\mathtt{cH} - 50\mathtt{cd} - 80\mathtt{cu} - 140\mathtt{cuG} - 50\mathtt{cdG} - 10\mathtt{c3G})$ $+\mathtt{c3G}(30\mathtt{cH} + 20\mathtt{cu} + 20\mathtt{cd} + 30\mathtt{cuG} + 20\mathtt{cdG}) - \tilde{c}_g'(3000\mathtt{tc3G})$

Equations relating STXS to EFT

Cross-section region	$\sum_{ij} B_{ij} c_i c_j$
$qq \to Hqq$ (VBF-like, $p_T^{j_3} < 25$ GeV)	$8.4\texttt{cWW}^2 + 0.20\texttt{cB}^2 + 12\texttt{cHW}^2 + 0.22\texttt{cHB}^2$ $+\texttt{cWW}(-0.48\texttt{cB} + 1.7\texttt{cHW} - 1.3\texttt{cHB}) + \texttt{cHW}(1.1\texttt{cHB})$
$qq \to Hqq$ (VBF-like, $p_T^{j_3} \geq 25$ GeV)	$14\texttt{cWW}^2 + 0.34\texttt{cB}^2 + 23\texttt{cHW}^2 + 0.42\texttt{cHB}^2$ $+\texttt{cWW}(-3.4\texttt{cB} + 14\texttt{cHW} - 4.3\texttt{cHB})$ $+\texttt{cB}(-0.77\texttt{cHW} + 0.35\texttt{cHB}) + \texttt{cHW}(0.95\texttt{cHB})$
$qq \to Hqq$ ($p_T^j \geq 200$ GeV)	$2400\texttt{cWW}^2 + 44\texttt{cB}^2 + 2200\texttt{cHW}^2$ $+\texttt{cWW}(-1200\texttt{cB} + 4300\texttt{cHW} - 1200\texttt{cHB})$ $+\texttt{cB}(-1100\texttt{cHW} + 79\texttt{cHB}) + \texttt{cHW}(-1100\texttt{cHB})$
$qq \to Hqq$ ($60 \leq m_{jj} < 120$ GeV)	$440\texttt{cWW}^2 + 8.7\texttt{cB}^2 + 200\texttt{cHW}^2$ $+\texttt{cWW}(-270\texttt{cB} + 520\texttt{cHW} - 290\texttt{cHB})$ $+\texttt{cB}(-120\texttt{cHW} + 9.9\texttt{cHB}) + \texttt{cHW}(-130\texttt{cHB})$
$qq \to Hqq$ (rest)	$81\texttt{cWW}^2 + 1.5\texttt{cB}^2 + 25\texttt{cHW}^2$ $+\texttt{cWW}(-45\texttt{cB} + 56\texttt{cHW} - 52\texttt{cHB})$ $+\texttt{cB}(-9.0\texttt{cHW} + 1.0\texttt{cHB}) + \texttt{cHW}(-9.5\texttt{cHB})$
$gg/q\bar{q} \to ttH$	$120000\texttt{cuG}^2 + 140000(\texttt{c3G}^2 + \texttt{tc3G}^2) + 33000\texttt{c2G}^2$ $+\texttt{cuG}(110000\texttt{c3G} + 50000\texttt{c2G} + 400\texttt{cu} - 200\texttt{cH})$ $+\texttt{c3G}(-140000\texttt{c2G})$

Cross-section region	$\sum_{ij} B_{ij} c_i c_j$
$q\bar{q} \to Hl\nu$, $p_T^V < 150$ GeV	$310\texttt{cWW}^2 + 61\texttt{cHW}^2 + 36\texttt{tcHW} + 170\texttt{cpHQ}^2 + 170\texttt{cHud}^2 + 1.1\texttt{cpHL}^2$ $+\texttt{cH}(-18\texttt{cWW} - 6.1\texttt{cHW} - 12\texttt{cpHQ} - 1.0\texttt{cpHL})$ $+\texttt{cWW}(230\texttt{cHW} + 460\texttt{cpHQ} - 2.0\texttt{cHud} + 34\texttt{cpHL})$ $+\texttt{cHW}(170\texttt{cpHQ} + 11\texttt{cpHL}) + \texttt{cpHQ}(24\texttt{cpHL})$
$q\bar{q} \to Hl\nu$, $150 \leq p_T^V < 250$ GeV, 0 jets	$1600\texttt{cWW}^2 + 870\texttt{cHW}^2 + 1200\texttt{cpHQ}^2 + 1300\texttt{cHud} + 160\texttt{tcHW}^2$ $+\texttt{cH}(-33\texttt{cWW} - 26\texttt{cHW} - 26\texttt{cpHQ} + 2200\texttt{cHW})$ $+\texttt{cWW}(2800\texttt{cpHQ} + 3.0\texttt{cHud} + 88\texttt{cpHL} + 7.0\texttt{cuW} + 12\texttt{clW})$ $+\texttt{cHW}(1900\texttt{cpHQ} + 3.0\texttt{cHud} + 49\texttt{cpHL}) - \texttt{cHud}(-4.0\texttt{cpHL})$ $+\texttt{cpHQ}(-5.0\texttt{cHud} + 68\texttt{cpHL} + 4.0\texttt{cuW} - 3.0\texttt{cdW} + 6.0\texttt{clW})$
$q\bar{q} \to Hl\nu$, $150 \leq p_T^V < 250$ GeV, ≥ 1 jet	$1500\texttt{cWW}^2 + 800\texttt{cHW}^2 + 1100\texttt{cpHQ}^2 + 1200\texttt{cHud}^2 + 150\texttt{tcHW}^2$ $+\texttt{cH}(-29\texttt{cWW} - 23\texttt{cHW} - 35\texttt{cpHQ}) + \texttt{cHud}(5.0\texttt{cdW})$ $+\texttt{cWW}(2000\texttt{cHW} + 2600\texttt{cpHQ} + 70\texttt{cpHL} - 3.0\texttt{cdW})$ $+\texttt{cHW}(1800\texttt{cpHQ} + 41\texttt{cpHL}) + \texttt{cpHQ}(65\texttt{cpHL} - 4.0\texttt{cuW} - 7.0\texttt{cdW})$
$q\bar{q} \to Hl\nu$, $p_T^V \geq 250$ GeV	$16000\texttt{cWW}^2 + 14000\texttt{cHW}^2 + 15000\texttt{cpHQ}^2 + 16000\texttt{cHud}^2 + 520\texttt{tcHW}^2$ $+\texttt{cH}(-80\texttt{cWW} - 70\texttt{cHW} - 100\texttt{cpHQ}) + \texttt{cHW}(29000\texttt{cpHQ} + 190\texttt{cpHL})$ $+\texttt{cWW}(30000\texttt{cHW} + 32000\texttt{cpHQ} + 70\texttt{cHud} + 210\texttt{cpHL}) + \texttt{cpHQ}(180\texttt{cpHL})$

Equations relating STXS to EFT

Cross-section region	$\sum_{ij} B_{ij} c_i c_j$
$q\bar{q} \to Hll$, $p_T^V < 150$ GeV	$4.0cT^2 + 240cWW^2 + 20cB^2 + 34cHW^2 + 3.0cHB^2 + 170cHQ^2 + 170cpHQ^2$ $+100cHu^2 + 75cHd^2 + 1.3cHL^2 + 1.3cpHL^2 + 26tcHW^2 + 2.3tcHB^2$ $+cH(2.0cT - 15cWW - 4.3cB - 4.4cHW - 1.3cHB + 1.0cHQ - 12cpHQ$ $-2.3cHu + 0.8cHd + 0.48cHL - 1.0cpHL) + cT(-59cWW - 17cB$ $-17cHW - 5.1cHB + 2.5cHQ - 46cpHQ - 11cHu + 3.7cHd + 1.9cHL$ $-4.1cpHL + 0.46cHe) + cWW(140cB + 150cHW + 44cHB + 0.5cA - 17cHQ$ $+390cpHQ + 82cHu - 31cHd - 14cHL + 33cpHL - 3.3cHe + 0.6cdB$ $+0.9cdW + 0.8clB - 1.0clW) + cB(42cHW + 12cHB - 2.8cHQ + 110cpHQ$ $+31cHu - 12cHd - 4.6cHL + 8.3cpHL - 1.2cHe) + cHW(20cHB - 5.3cHQ$ $+120cpHQ + 29cHu - 11cHd - 4.1cHL + 8.8cpHL - 0.8cHe) + cHB(-1.2cHQ$ $+37cpHQ + 8.8cHu - 3.5cHd - 1.2cHL + 2.6cpHL) + cHQ(-50cpHQ - 1.0cHd$ $+0.8cHL - 0.4cuB) + cpHQ(-1.0cHu - 0.6cHd - 12cHL + 24cpHL - 2.0cHe$ $+1.0cuB + 1.0cdW + 1.0clB + 1.0clW) + cHu(-2.3cHL + 4.9cpHL + 0.6cuB$ $+1.5cuW) + cHd(1.2cHL - 2.2cpHL) + cHL(-0.53cpHL) + tcHW(15tcHB)$
$q\bar{q} \to Hll$, $150 \leq p_T^V < 250$ GeV, 0 jets	$4.0cT^2 + 1000cWW^2 + 90cB^2 + 480cHW^2 + 43cHB^2 + 1200cHQ^2 + 12000cpHQ^2$ $+680cHu^2 + 490cHd^2 + 120tcHW^2 + 10tcHB^2 + cH(-24cWW - 9.0cB - 20cHW$ $-5.1cHB + 11cHQ - 25cpHQ - 11cHu + 2.0cHd + cT(-120cWW - 36cB$ $-75cHW - 22cHB + 13cHQ - 120cpHQ - 29cHu + 9.0cHd - 4.2cpHL)$ $+cWW(610cB + 1300cHW + 400cHB - 150cHQ + 2100cpHQ + 470cHu$ $-170cHd - 24cHL + 55cpHL + 7.0cuB + 10cuW + 14cdW + 30clW)$ $+cB(380cHW + 110cHB - 39cHQ + 600cpHQ + 160cHu - 59cHd - 9.4cHL$ $+19cpHL - 2.2cHe) + cHW(290cHB - 78cHQ + 1300cpHQ + 320cHu - 110cHd$ $-18cHL + 41cpHL - 3.0cHe - 2.0cdB) + cHB(-21cHQ + 400cpHQ + 96cHu$ $-34cHd - 5.1cHL + 12cpHL) + cHQ(-380cpHQ + 30cHu + 2.0cHd + 14cHL$ $-6.0cHe + 25cuB + 24cdB + 10cdW - 3.0clB + 4.0clW) + cpHQ(10cHu$ $-40cHL + 80cpHL - 7.0cHe + 3.0cdW + 30clB - 3.0clW) + cHu(14cpHL$ $+3.0cHe - 8.0cuB + 8.0cdB + 8.0cdW + 13clB + 7.0clW)$ $+cHd(9.0cHL + 3.0cpHL - 4.0cuB - 3.0clB - 6.0clW) + 69tcHWtcHB$

Equations relating STXS to EFT

Cross-section region	$\sum_{ij} B_{ij} c_i c_j$
$q\bar{q} \to Hll$, $150 \leq p_T^V < 250$ GeV, ≥ 1 jet	$4.0\mathtt{cT}^2 + 960\mathtt{cWW}^2 + 82\mathtt{cB}^2 + 440\mathtt{cHW}^2 + 39\mathtt{cHB}^2 + 1100\mathtt{cHQ}^2 + 1100\mathtt{cpHQ}^2$ $+640\mathtt{cHu}^2 + 430\mathtt{cHd}^2 + 110\mathtt{tcHW}^2 + 9.7\mathtt{tcHB}^2 + \mathtt{cH}(2.1\mathtt{cT} - 23\mathtt{cWW} - 8.1\mathtt{cB}$ $-18\mathtt{cHW} - 4.9\mathtt{cHB} - 36\mathtt{cpHQ} - 2.0\mathtt{cHu}) + \mathtt{cT}(-110\mathtt{cWW} - 34\mathtt{cB} - 71\mathtt{cHW}$ $-20\mathtt{cHB} + 4.0\mathtt{cHQ} - 120\mathtt{cpHQ} - 24\mathtt{cHu} + 10\mathtt{cHd} + 2.0\mathtt{cHL} - 4.2\mathtt{cpHL})$ $+\mathtt{cWW}(560\mathtt{cB} + 1200\mathtt{cHW} + 340\mathtt{cHB} - 200\mathtt{cHQ} + 1900\mathtt{cpHQ} + 440\mathtt{cHu}$ $-150\mathtt{cHd} - 24\mathtt{cHL} + 68\mathtt{cpHL} + 3.0\mathtt{cHe} + 5.0\mathtt{cuB} + 3.0\mathtt{cuW} - 3.0\mathtt{cdB}$ $-10\mathtt{cdW} - 10\mathtt{clW}) + \mathtt{cB}(330\mathtt{cHW} + 100\mathtt{cHB} - 30\mathtt{cHQ} + 550\mathtt{cpHQ} + 140\mathtt{cHu}$ $-52\mathtt{cHd} - 9.6\mathtt{cHL} + 17\mathtt{cpHL} - 2.3\mathtt{cHe}) + \mathtt{cHW}(260\mathtt{cHB} - 120\mathtt{cHQ}$ $+1200\mathtt{cpHQ} + 290\mathtt{cHu} - 100\mathtt{cHd} - 20\mathtt{cHL} + 29\mathtt{cpHL} - 10\mathtt{cHe} - 5.0\mathtt{cuB}$ $+2.0\mathtt{cuW} + 2.0\mathtt{cdB} - 3.0\mathtt{cdW}) + \mathtt{cHB}(-30\mathtt{cHQ} + 360\mathtt{cpHQ} + 85\mathtt{cHu} - 30\mathtt{cHd}$ $-4.8\mathtt{cHL} + 11\mathtt{cpHL}) + \mathtt{cHQ}(-420\mathtt{cpHQ} - 20\mathtt{cHd} + 17\mathtt{cHL} + 23\mathtt{cHe} + 3.0\mathtt{cuB}$ $+17\mathtt{cuW} + 6.0\mathtt{cdW} + 30\mathtt{clB} + 10\mathtt{clW}) + \mathtt{cpHQ}(-6.0\mathtt{cHd} - 40\mathtt{cHL} + 20\mathtt{cpHL}$ $-20\mathtt{cHe} + 10\mathtt{cuB} - 10\mathtt{cuW} - 3.0\mathtt{cdB} + 10\mathtt{clW}) + \mathtt{cHu}(-6.0\mathtt{cHL} + 13\mathtt{cpHL}$ $-3.0\mathtt{cHe} + 10\mathtt{cuB} + 4.0\mathtt{cdB} + 10\mathtt{cdW} + 4.0\mathtt{clB}) + \mathtt{cHd}(-8.0\mathtt{cHL} - 7.0\mathtt{cHe}$ $-5.0\mathtt{cdB} - 2.0\mathtt{clB} + 3.0\mathtt{clW}) + \mathtt{tcHW}(65\mathtt{tcHB})$
$q\bar{q} \to Hll$, $p_T^V \geq 250$ GeV	$9600\mathtt{cWW}^2 + 850\mathtt{cB}^2 + 8000\mathtt{cHW}^2 + 720\mathtt{cHB}^2 + 14000\mathtt{cHQ}^2 + 14000\mathtt{cpHQ}^2$ $+8600\mathtt{cHu}^2 + 5200\mathtt{cHd}^2 + 380\mathtt{tcHW}^2 + 35\mathtt{tcHB}^2 + \mathtt{cH}(-80\mathtt{cWW} - 22\mathtt{cB}$ $-50\mathtt{cHW} - 90\mathtt{cpHQ} - 30\mathtt{cHu}) + \mathtt{cT}(-310\mathtt{cWW} - 90\mathtt{cB} - 250\mathtt{cHW} - 78\mathtt{cHB}$ $-310\mathtt{cpHQ} - 100\mathtt{cHu} + 30\mathtt{cHd}) + \mathtt{cWW}(5700\mathtt{cB} + 17000\mathtt{cHW} + 5100\mathtt{cHB}$ $-3200\mathtt{cHQ} + 22000\mathtt{cpHQ} + 5400\mathtt{cHu} - 1700\mathtt{cHd} - 70\mathtt{cHL} + 160\mathtt{cpHL}$ $-30\mathtt{cHe} - 30\mathtt{cdW} + 20\mathtt{clB} - 30\mathtt{clW}) + \mathtt{cB}(5100\mathtt{cHW} + 1500\mathtt{cHB} - 880\mathtt{cHQ}$ $+6400\mathtt{cpHQ} + 1700\mathtt{cHu} - 500\mathtt{cHd} + 48\mathtt{cpHL}) + \mathtt{cHW}(4800\mathtt{cHB} - 2900\mathtt{cHQ}$ $+19000\mathtt{cpHQ} + 4900\mathtt{cHu} - 1500\mathtt{cHd} - 50\mathtt{cHL} + 130\mathtt{cpHL}) + \mathtt{cHB}(-870\mathtt{cHQ}$ $+5700\mathtt{cpHQ} + 1500\mathtt{cHu} - 430\mathtt{cHd} + 37\mathtt{cpHL}) + \mathtt{cHQ}(-6700\mathtt{cpHQ} - 70\mathtt{cHu}$ $+50\mathtt{cHd} - 30\mathtt{cHL} - 50\mathtt{cpHL} - 40\mathtt{cuB} - 30\mathtt{cdB} - 30\mathtt{cdW} - 30\mathtt{clW})$ $+\mathtt{cpHQ}(50\mathtt{cHd} + 220\mathtt{cHL} - 30\mathtt{cHe} - 50\mathtt{cuB} - 50\mathtt{cdW} - 110\mathtt{clB} - 70\mathtt{clW})$ $+\mathtt{cHu}(-30\mathtt{cHL} + 70\mathtt{cpHL} - 20\mathtt{cuW} - 30\mathtt{cdW}) + \mathtt{cHd}(30\mathtt{cHL} + 40\mathtt{cHe}$ $+\mathtt{tcHW}(230\mathtt{tcHB})$

Future plans

End of this year
Post draft notes on STXS and STXS→EFT equations with follow-up meetings
Implement first EFT fit in combined channels
Initiate discussion of benchmark results for individual analyses (including PO)

Early next year
Expand EFT equations to Warsaw basis & add HH production
Define binning for Higgs+EW fit
Post draft note on benchmarks

Sometime next year
Follow-up EFT fit with more complete set of Higgs & EW measurements (ideally in two bases to test the translations)
Update EFT equations to include NLO QCD, running couplings & uncertainties
Discuss expanding EFT fits to top (and QCD) measurements

Eventually
Full combination of Run 2 ATLAS+CMS STXS measurements and EFT fits

Next WG2 meeting?