



ATLAS Higgs Combinations & EFT Interpretations

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on behalf of the ATLAS Collaboration**

QCD@LHC

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Introduction



A detailed map of Higgs boson interactions by the ATLAS experiment ten years after the discovery

The ATLAS Collaboration

Original Run 2 Higgs Combination ([Nature 607, 52-59 \(2022\)](#))

Improvements in statistical power in measurements, new analyses



Final Run 2 Higgs Combination ([arXiv:2608.07332](#))

Combination of Higgs boson measurements at $\sqrt{s} = 13$ TeV and their interpretations by the ATLAS experiment

The ATLAS Collaboration

This paper presents combined measurements of Higgs boson production and decay using up to 140 fb^{-1} of proton–proton collision data collected by the ATLAS experiment at the LHC at $\sqrt{s} = 13 \text{ TeV}$. The inclusive Higgs boson event rate relative to its Standard Model prediction is determined to be $0.990^{+0.051}_{-0.051} = 0.990 \pm 0.027 \text{ (stat.)} \pm 0.024 \text{ (exp.)}^{+0.037}_{-0.035} \text{ (sig. theo.)}^{+0.016}_{-0.015} \text{ (bkg. theo.)}$, separating statistical, experimental, signal-theory and background-theory uncertainty components. The signal theory uncertainty is the largest contribution, dominated by missing higher-order terms in QCD and the modelling of parton shower effects. Inclusive production cross-sections and decay branching ratios are measured, with sensitivities improved by up to 35% relative to the previous ATLAS publication. Production cross-sections for individual decay channels are also reported. The results are interpreted in terms of modifiers to Higgs boson couplings. The combination of single Higgs boson and Higgs boson pair production measurements yields $\kappa_t = 1.3^{+3.1}_{-1.6}$ for the modifier to the Higgs boson self-coupling, with an interval of $[-1.5, 6.5]$ at 95% confidence level. The partial width in the $H \rightarrow b\bar{b}$ decay channel is used to obtain the first ATLAS determination of the running mass of the b -quark at the Higgs boson mass scale in the modified minimal subtraction scheme, found to be $m_b(m_H) = 2.73^{+0.27}_{-0.25} \text{ GeV}$. The total width of the Higgs boson is measured to be $\Gamma_H = 3.6^{+2.1}_{-1.6} \text{ MeV}$ based on its on- and off-shell production rates. The kinematics of Higgs boson production are probed within the framework of Simplified Template Cross-sections in 44 kinematic regions, and the results are interpreted in the context of Standard Model Effective Field Theory models.

This updated analysis presents:

- Global production/decay rates
- Coupling strengths to fundamental particles, BSM physics, and invisible decays in the κ framework
- Higgs width combination 
- The mass of the b -quark on the Higgs mass scale and Higgs Self-Coupling 
- Simplified Template Cross Section (STXS) measurements of Higgs productions and decays
- SM Effective Field Theory (EFT) interpretations of Higgs productions and decays

ATLAS Higgs boson combination strategy

The combination effort used the most up-to-date analyses from ATLAS Run 2 at the LHC:

- 14 **on-shell** Analyses used (8 updated or new)
- 4 Higgs $\rightarrow$ **Invisible** decays analyses (2 new)
- 3 **off-shell** analyses ($H^* \rightarrow ZZ \rightarrow 4\ell$, $H^* \rightarrow ZZ \rightarrow 2\ell 2\nu$, $H^* \rightarrow WW \rightarrow \ell\nu\ell\nu$, all new)
- 6 **di-Higgs** analyses

~600-800 Analysis regions, ~6000-8000 NPs across all combined studies!

Analysis

	$H \rightarrow ZZ^* \rightarrow 4\ell$
UPDATED	$H \rightarrow WW^* \rightarrow \ell\nu\ell\nu$
UPDATED	$H \rightarrow WW^* \rightarrow \ell\nu\ell\nu, \ell\nu jj$
	$H \rightarrow \gamma\gamma$
	$H \rightarrow Z\gamma$
UPDATED	$H \rightarrow \tau\tau$
NEW	$(V \rightarrow \text{leptons})H \rightarrow \tau\tau$
	$H \rightarrow \mu\mu$
	VBF $H \rightarrow bb$
UPDATED	$(V \rightarrow \text{leptons})H \rightarrow bb$
	$H \rightarrow bb$ (high p_T^H)
UPDATED	$H \rightarrow \text{multileptons}$
UPDATED	$t\bar{t}H \rightarrow bb$
UPDATED	$tH \rightarrow bb$
	VBF $H \rightarrow \text{invisible}$
NEW	VBF + $\gamma H \rightarrow \text{invisible}$
	$(V \rightarrow \text{leptons})H \rightarrow \text{invisible}$
NEW	$t\bar{t}H \rightarrow \text{invisible}$
NEW	off-shell $H^{(*)} \rightarrow ZZ \rightarrow 4\ell$
NEW	off-shell $H^{(*)} \rightarrow ZZ \rightarrow 2\ell 2\nu$
NEW	off-shell $H^{(*)} \rightarrow WW \rightarrow \ell\nu\ell\nu$
	$HH \rightarrow bbbb$
	$HH \rightarrow bbbb$ (high p_T^H)
	$HH \rightarrow bb\tau\tau$
	$HH \rightarrow bb\gamma\gamma$
	$HH \rightarrow bbl\ell + E_T^{\text{miss}}$
	$HH \rightarrow \text{multileptons}$

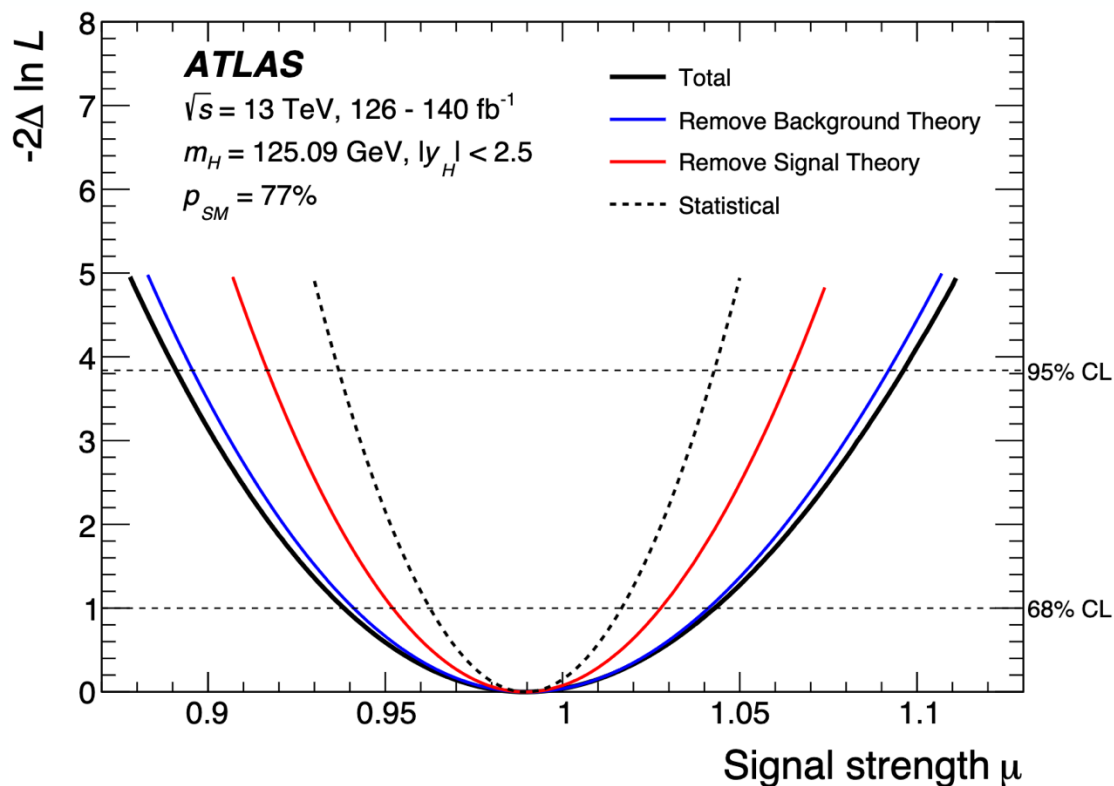
Global signal strength



- Signal Strength μ defined as $\mu \equiv \frac{\sigma_i \times B_i}{\sigma_i^{SM} \times B_i^{SM}}$

- Single Higgs measurements yield an inclusive signal strength of:

$$\mu = 0.990^{+0.053}_{-0.051} = 0.990 \pm 0.027 \text{ (stat.)} \pm 0.024 \text{ (exp.)}^{+0.037}_{-0.035} \text{ (sig. theo.)}^{+0.016}_{-0.015} \text{ (bkg. theo.)}$$

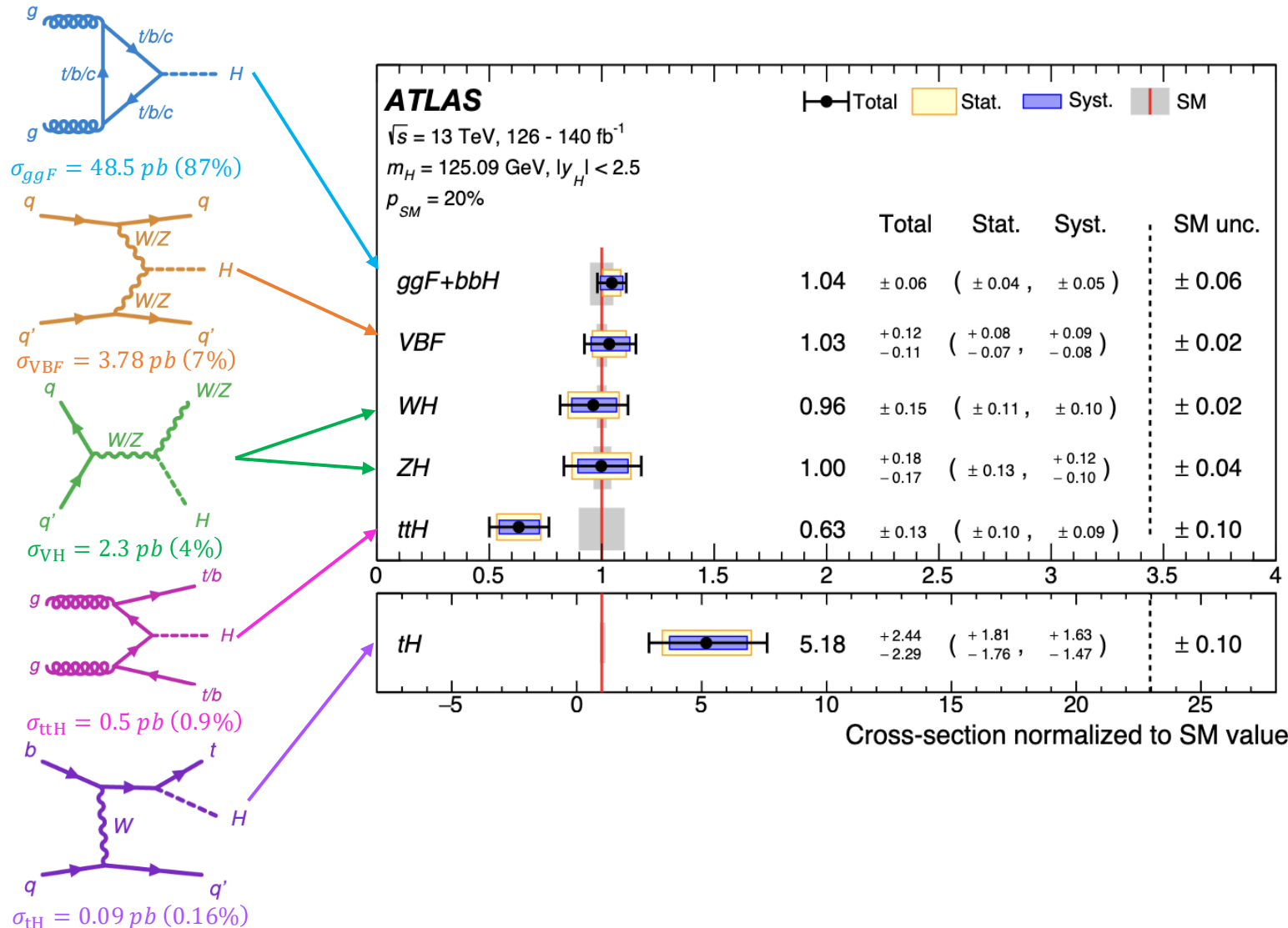


Signal Theory Uncertainties now biggest contributor to overall uncertainties:

- Missing higher-order QCD corrections: $+0.026$
 -0.024
- PS/UE: $+0.019$
 -0.018
- PDF: $+0.017$
 -0.015

~15% improvement over [Nature 607, 52-59 \(2022\)](#)

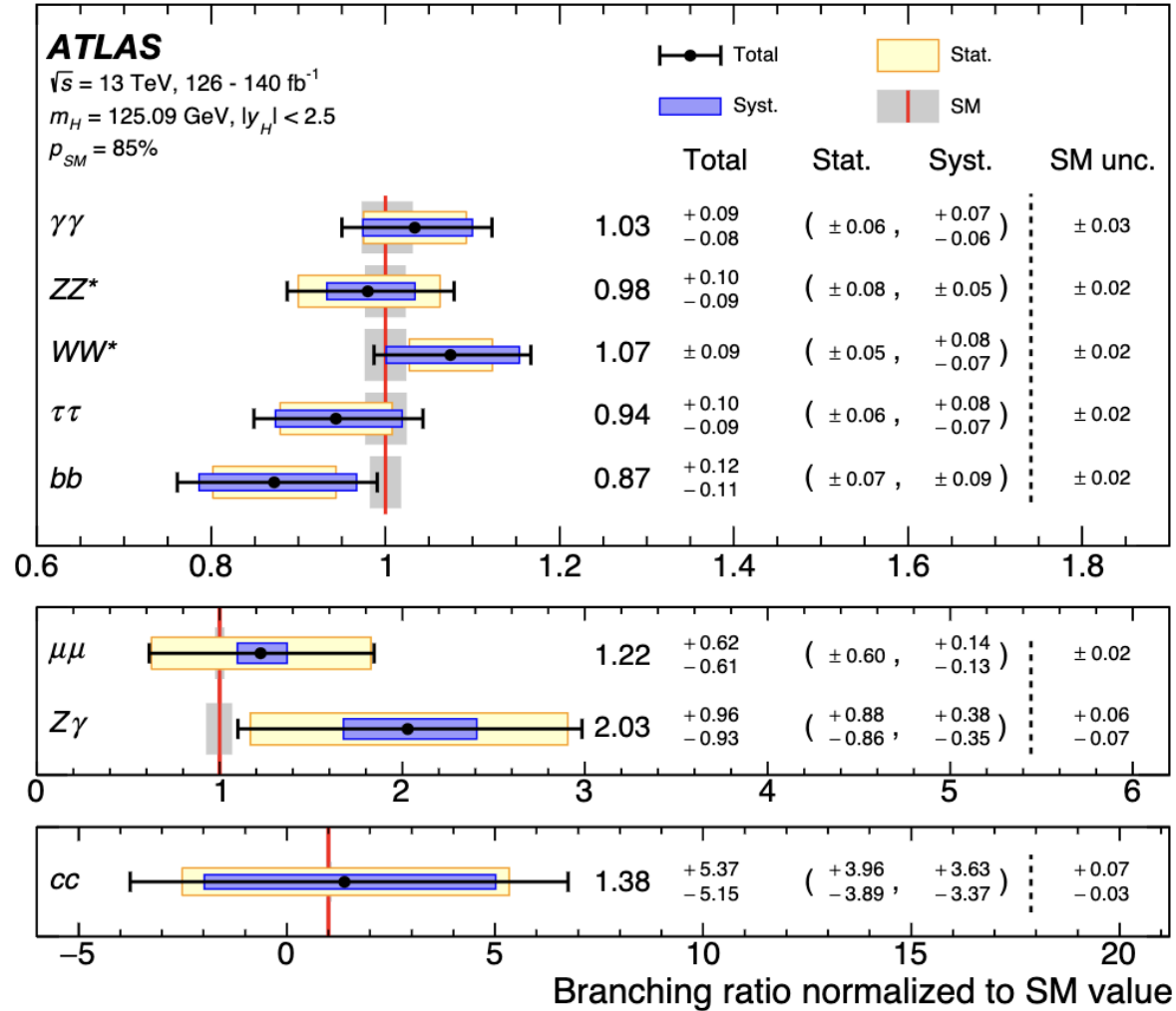
Higgs Boson production modes



Improvements over [Nature 607, 52-59 \(2022\)](#) (and their main contributors):

- ggF/VBF : 15% (updated $H \rightarrow WW^*, \tau\tau$)
- VH : 20-30% (new + updated $VH, H \rightarrow WW^*/\tau\tau/bb/cc$)
- ttH/tH : 40-45% (updated $ttH \rightarrow bb/\text{multilepton}$)

Higgs Boson decay modes



Improvements over [Nature 607, 52-59 \(2022\)](#) (and their main contributors):

- WW^* : 20% (updated $ggF+VBF/VH/ttH \rightarrow WW^*$)
- bb : 20% (updated $VH \rightarrow bb/cc, ttH \rightarrow bb$)
- $\tau\tau$: 40-45% (updated $ttH \rightarrow bb/\text{multilepton}$)

κ -framework coupling modifiers

Measure Higgs coupling to fundamental particles – modify couplings by multiplicative ratios relative to SM-predicted values

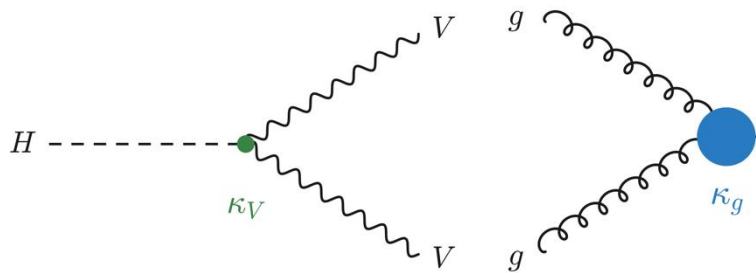
Separate modifiers to couple to gluons and photons over entire triangle loops to account for possible BSM effects.

As always assumed in the κ -framework approach, these couplings have the same energy evolution as in the SM

All Run 2 measurements allow for simultaneous measurements of:

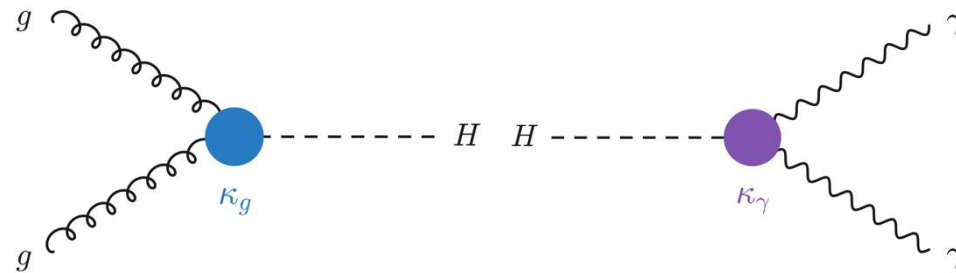
Gauge Bosons

$$\kappa_V = \kappa_W = \kappa_Z$$



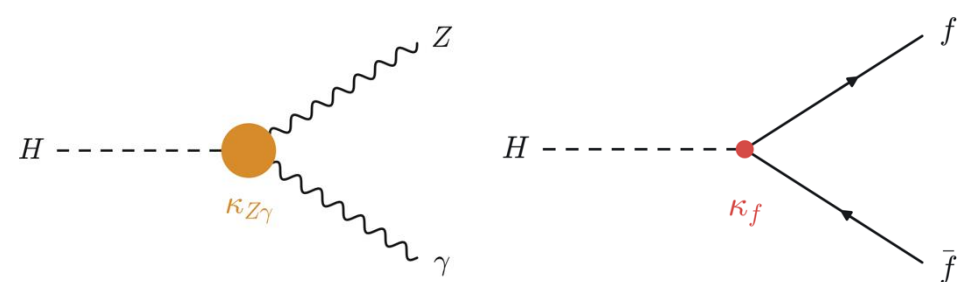
Loops

$$\kappa_g, \kappa_\gamma, \kappa_{Z\gamma}$$



Fermions

$$\kappa_t, \kappa_b, \kappa_c, \kappa_\tau, \kappa_\mu$$



κ -framework and the Higgs boson width

On-shell Higgs boson modifiers are proportional to $\frac{\kappa_i^2 \kappa_f^2}{\kappa_H^2}$ where $\kappa_H^2 = \frac{\Gamma_H}{\Gamma_H^{\text{SM}}}$

- There is a degeneracy between $\kappa_i \kappa_f$ and κ_H . We perform three different measurements:
 - On-shell only measurements and assume $\kappa_H = 1$
 - On-shell with some external condition to limit the value of κ_H : traditionally $|\kappa_V| \leq 1$
 - On-shell + off-shell since off-shell modifiers are proportional only to $\kappa_i^2 \kappa_f^2$ breaking the degeneracy
- Do not assume $\kappa_H = 1$

A modification on width can be interpreted as the Higgs boson decaying to a light BSM state

- Higgs Total Width Modifier $\kappa_H^2 = \frac{\sum_f (\kappa_f^2 B^{SM}(H \rightarrow f))}{1 - B_i - B_u}$, $B_{BSM} = B_i + B_u$



- Searches for $H \rightarrow E_T^{\text{miss}}$ need to be included to break the degeneracy between BSM undetected (B_u) and invisible decays (B_i)

κ -framework coupling modifiers

Improvement over [Nature 607, 52-59 \(2022\)](#) by $\sim 15\%$ in κ_t

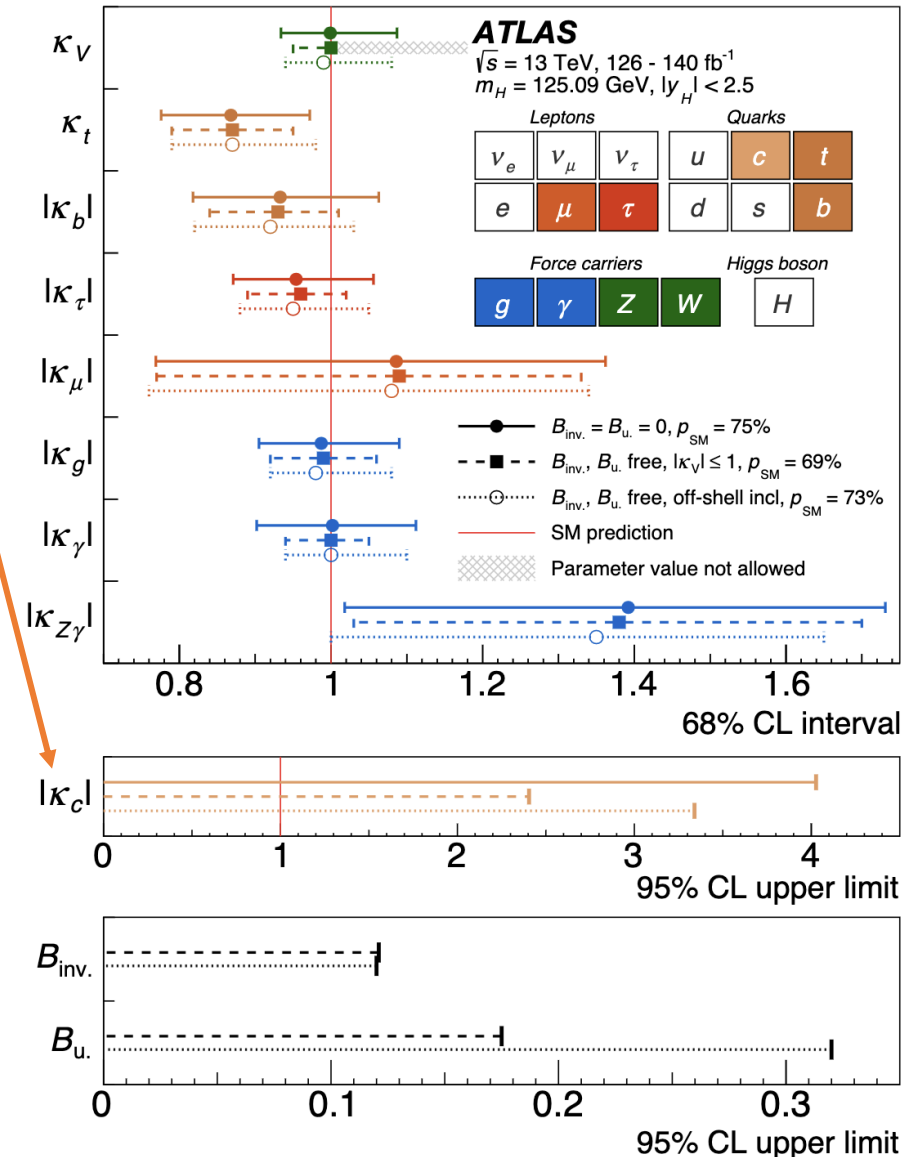
Significant improvement in constraint on κ_c in the global combination due to dedicated $VH \rightarrow cc$ analysis.

Limits on B_i :

- On-shell + Invisible + $|\kappa_V| \leq 1$: $< 12\%$ Observed, $< 7.6\%$ Expected
- On-shell + Invisible + off-shell: $< 12\%$ Observed, $< 7.5\%$ Expected
 - **New** to the analysis

Limits on B_u :

- On-shell + Invisible + $|\kappa_V| \leq 1$: $< 18\%$ Observed, $< 20\%$ Expected
- On-shell + Invisible + off-shell: $< 32\%$ Observed, $< 45\%$ Expected



Bosonic and fermionic Higgs boson decays

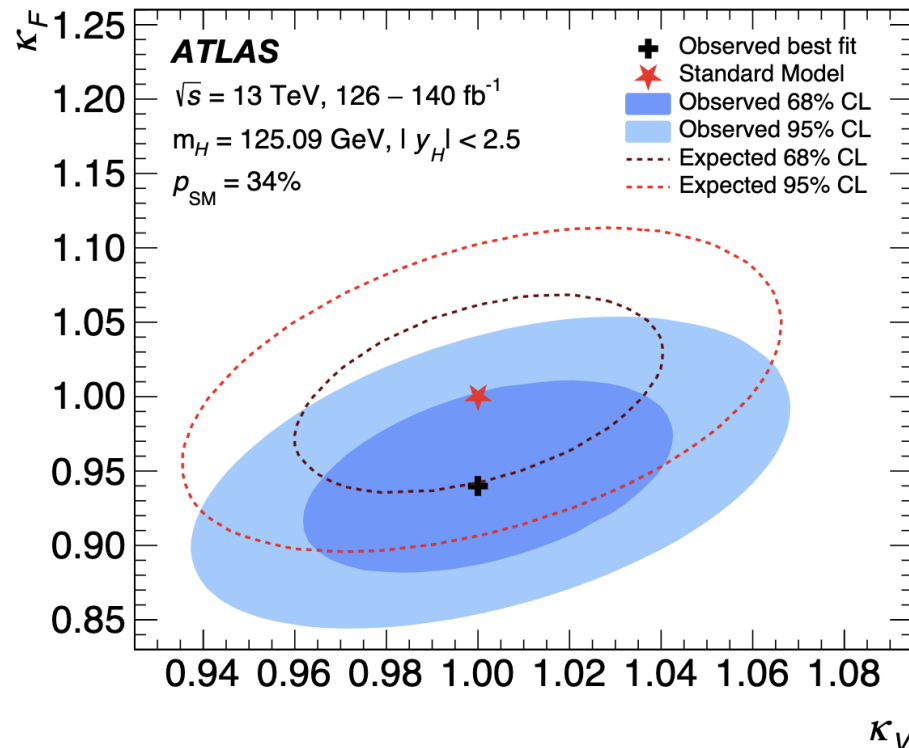


A coarser model defines measured coupling strength modifiers for general vector bosons and fermions:

Constraints on κ_F comes mostly from ggF production resolving

$\kappa_g(\kappa_F, \kappa_V)$

Assumes $\kappa_H = 1$

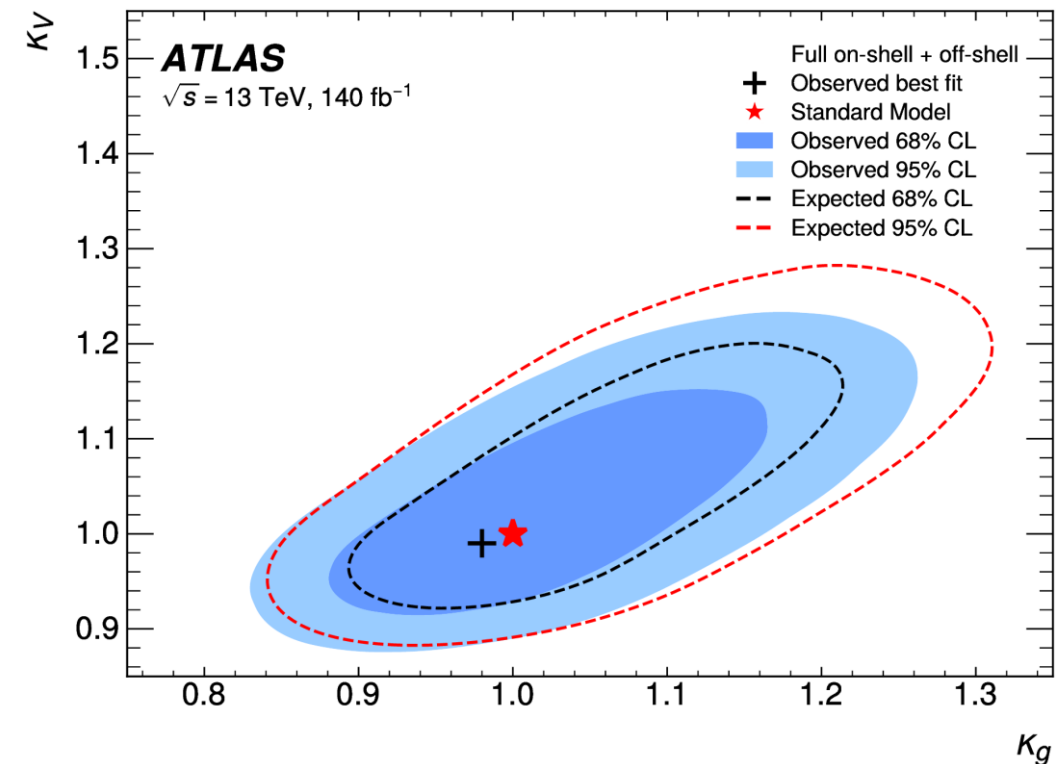


10-15% improvement over [Nature 607, 52-59 \(2022\)](#)

Similar plots with on-shell + off-shell Higgs production

No assumption on the Higgs width with off-shell information

Uncertainty on κ_V worsens from approximately [0.94, 1.07] to [0.9, 1.2] at 95%CL



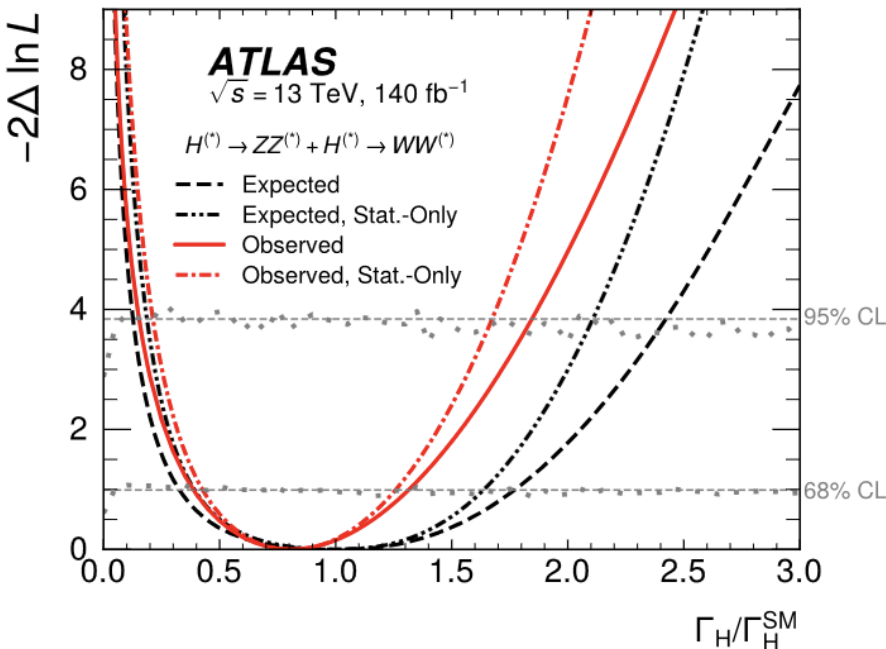
Measurement of the Higgs boson width

Measurements of the Higgs boson width were performed combining only the channels that are measured simultaneously on-shell and off-shell ($H \rightarrow ZZ + H \rightarrow WW$, floating only κ_V and κ_g) and with all on-shell + off-shell analyses (floating all κ)

- Using $H \rightarrow ZZ + H \rightarrow WW$: $\Gamma_H = 3.3^{+2.1}_{-1.7}$ (obs.) $\left(4.1^{+3.2}_{-2.7}$ (exp.) MeV
- Similar uncertainty as the most recent [CMS combination](#)

Uncertainty source	Absolute impact on Γ_H/Γ_H^{SM}	Absolute impact on Γ_H/Γ_H^{SM}
	Nuisance Parameter Method	Global Observable Method
Electron uncertainties	(-0.02, +0.03)	(-0.02, +0.02)
Muon uncertainties	(-0.01, +0.01)	(-0.01, +0.01)
Jet uncertainties	(-0.04, +0.05)	(-0.04, +0.03)
Fakes uncertainties	(-0.01, +0.01)	(-0.01, +0.01)
Luminosity	(-0.01, +0.01)	(-0.01, +0.01)
Total experimental	(-0.05, +0.06)	(-0.05, +0.04)
Signal modeling	(-0.15, +0.10)	(-0.12, +0.10)
Background modeling	(-0.02, +0.02)	(-0.03, +0.02)
Total modeling	(-0.15, +0.10)	(-0.12, +0.10)
Systematic uncertainty	(-0.16, +0.12)	(-0.13, +0.11)
Statistical uncertainty	(-0.39, +0.40)	(-0.40, +0.41)
Total uncertainty	(-0.42, +0.50)	

Theory
uncertainties
dominate total
uncertainty



Close to asymptotic behavior for points away from $\kappa_H \simeq 0$

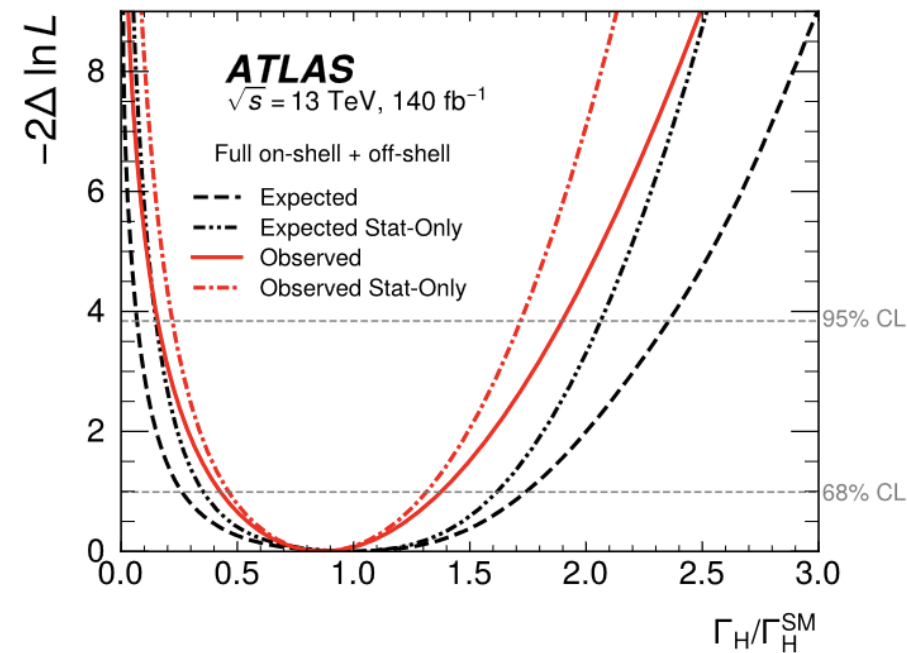
Measurement of the Higgs boson width

Measurements of the Higgs boson width were performed combining only the channels that are measured simultaneously on-shell and off-shell ($H \rightarrow ZZ + H \rightarrow WW$, floating only κ_V and κ_g) and with all on-shell + off-shell analyses (floating all κ)

- Using $H \rightarrow ZZ + H \rightarrow WW$: $\Gamma_H = 3.3^{+2.1}_{-1.7}$ (obs.) $\left(4.1^{+3.2}_{-2.7}$ (exp.) $\right)$ MeV
- Similar uncertainty as the most recent [CMS combination](#)
- Using **all** on-shell + off-shell analyses: $\Gamma_H = 3.6^{+2.1}_{-1.6}$ (obs.) $\left(4.1^{+3.0}_{-3.0}$ (exp.) $\right)$ MeV

Uncertainty source	Absolute impact on Γ_H/Γ_H^{SM}	Absolute impact on Γ_H/Γ_H^{SM}
	Nuisance Parameter Method	Global Observable Method
Electron uncertainties	(−0.02, +0.03)	(−0.02, +0.02)
Muon uncertainties	(−0.01, +0.01)	(−0.01, +0.01)
Jet uncertainties	(−0.04, +0.05)	(−0.04, +0.03)
Fakes uncertainties	(−0.01, +0.01)	(−0.01, +0.01)
Luminosity	(−0.01, +0.01)	(−0.01, +0.01)
Total experimental	(−0.05, +0.06)	(−0.05, +0.04)
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Background modeling	(−0.02, +0.02)	(−0.03, +0.02)
Total modeling	(−0.15, +0.10)	(−0.12, +0.10)
Systematic uncertainty	(−0.16, +0.12)	(−0.13, +0.11)
Statistical uncertainty	(−0.39, +0.40)	(−0.40, +0.41)
Total uncertainty	(−0.42, +0.50)	

Theory
uncertainties
dominate total
uncertainty



Higgs boson self-coupling

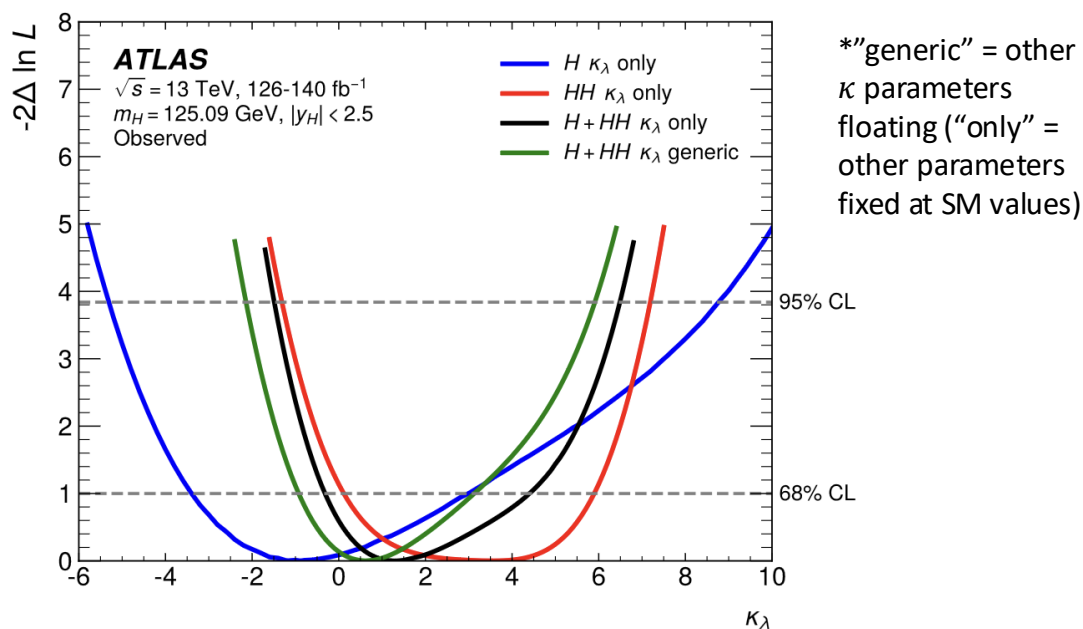


Single Higgs analyses combined with di-Higgs analyses to measure the Higgs self-coupling strength λ

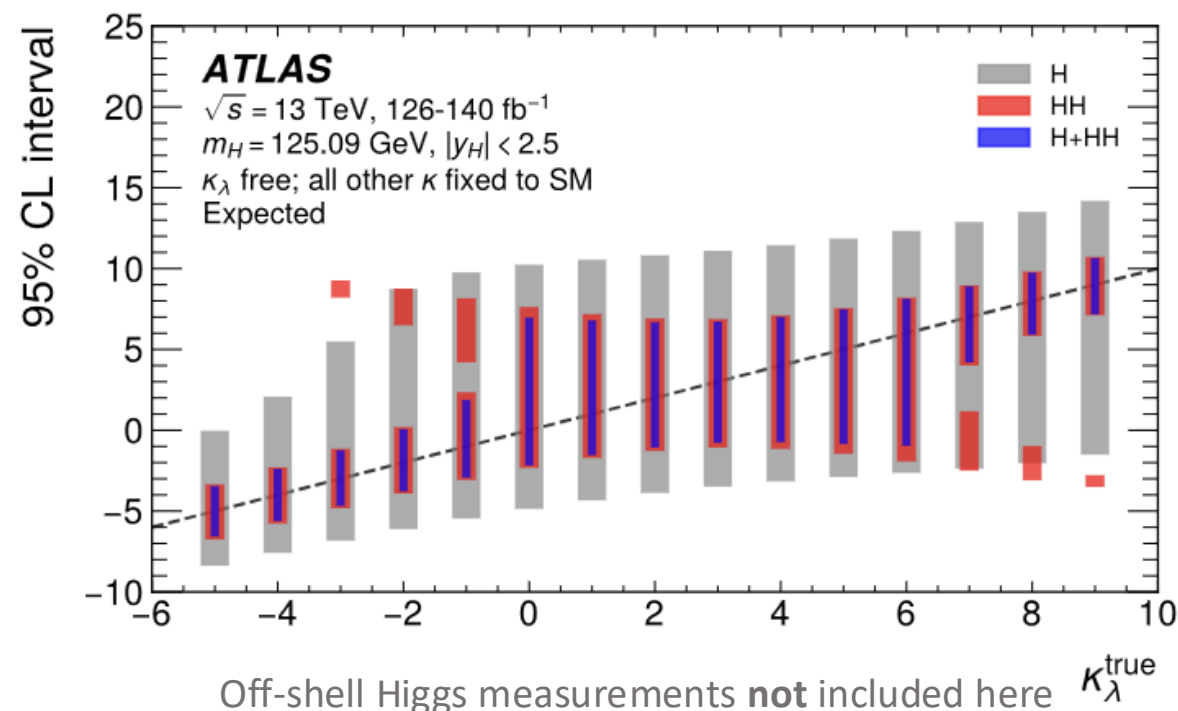
Most power through di-Higgs in ggF, some power through NLO EW processes of single-Higgs

Define $\kappa_\lambda = \lambda/\lambda_{SM}$ to measure self-coupling strength of Higgs

Expected value follows “true” value thanks to single-H inclusion!



Observed $\kappa_\lambda = 1.0^{+5.5}_{-2.5}$ at 95% CL



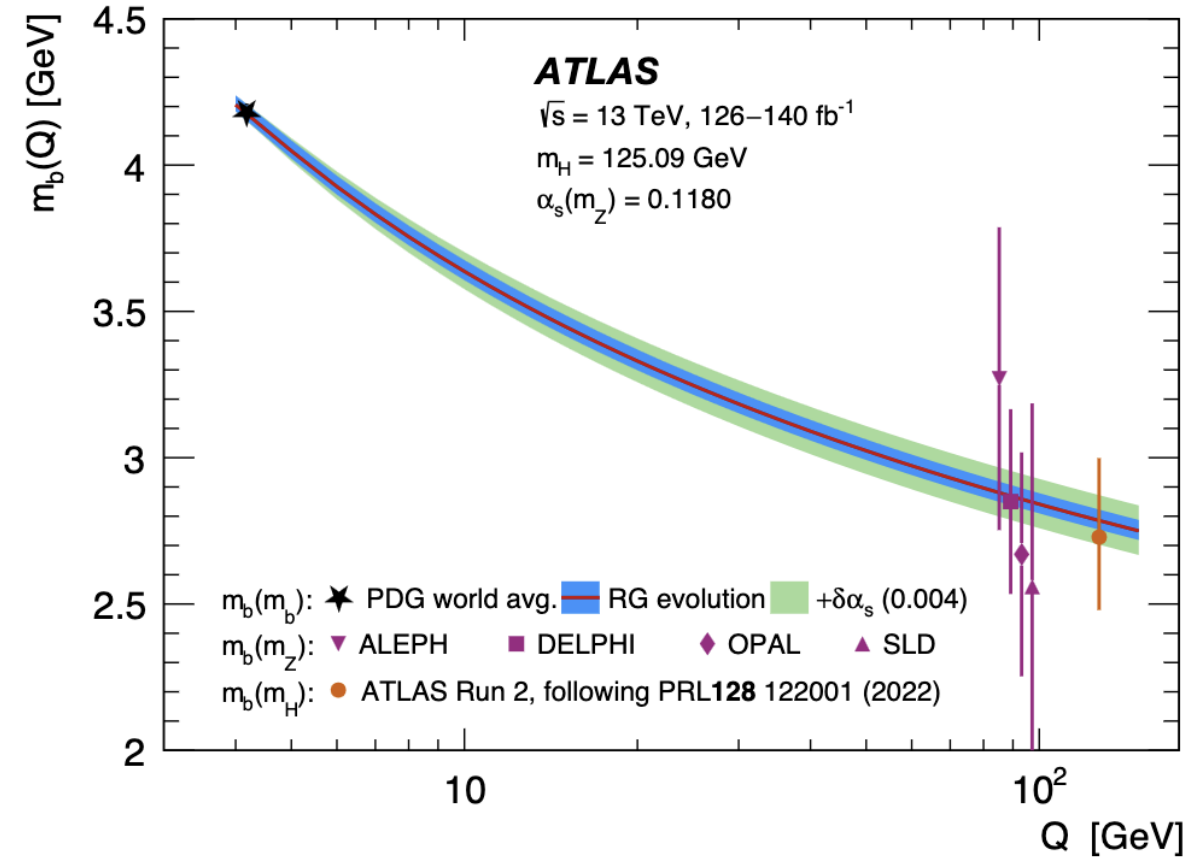
Running mass of the b -quark

We use the coupling strength of Higgs to b -quark to determine the b -quark mass at Higgs mass scale

- Reinterpretation of the partial Higgs width to bb decay: $\frac{(\Gamma_{bb}/\Gamma_{ZZ})_{obs}}{(\Gamma_{bb}/\Gamma_{ZZ})_{SM}} = 0.96^{+0.20}_{-0.17}$, from which b mass is determined

Compared to other m_b measurements

- b -quark mass measurement from B-hadron spectroscopy and decay kinematics (including lattice-QCD simulations) at low-scales
- Measurements of the b -quark mass at the Z-pole from three-jet production rate and event-shape variables at LEP and SLC

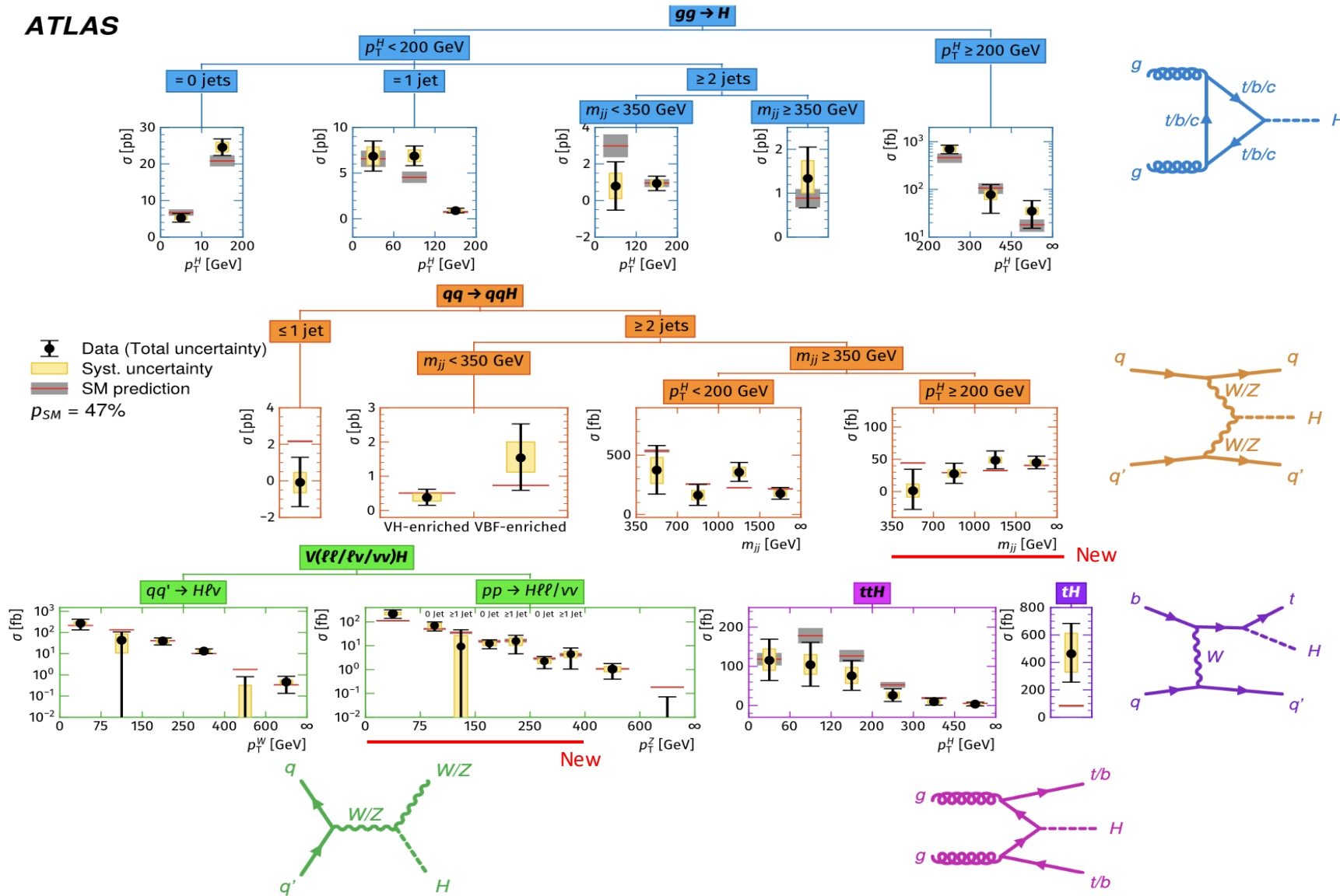


$$m_b(m_H) = 2.73^{+0.22}_{-0.20}(\text{stat.})^{+0.15}_{-0.14}(\text{syst.})^{+0.07}_{-0.06}(\text{theo.}) \text{ GeV}$$

First determination of $m_b(m_H)$ from an ATLAS Higgs Combination
 Excellent agreement with the RG evolution predicted by the SM.

Simplified Template Cross Sections (STXS) measurement

ATLAS



Changes compared to Nature 607 (2022) 52-59:

- Finer binning in m_{jj} for $p_T^H > 200$ GeV of EW qqH process
- New bins for $p_T^V < 75$ GeV and for 0j and 1j between $75 < p_T^V < 400$ GeV in the VH production



PCA performed on groups of Wilson coefficients in Warsaw basis

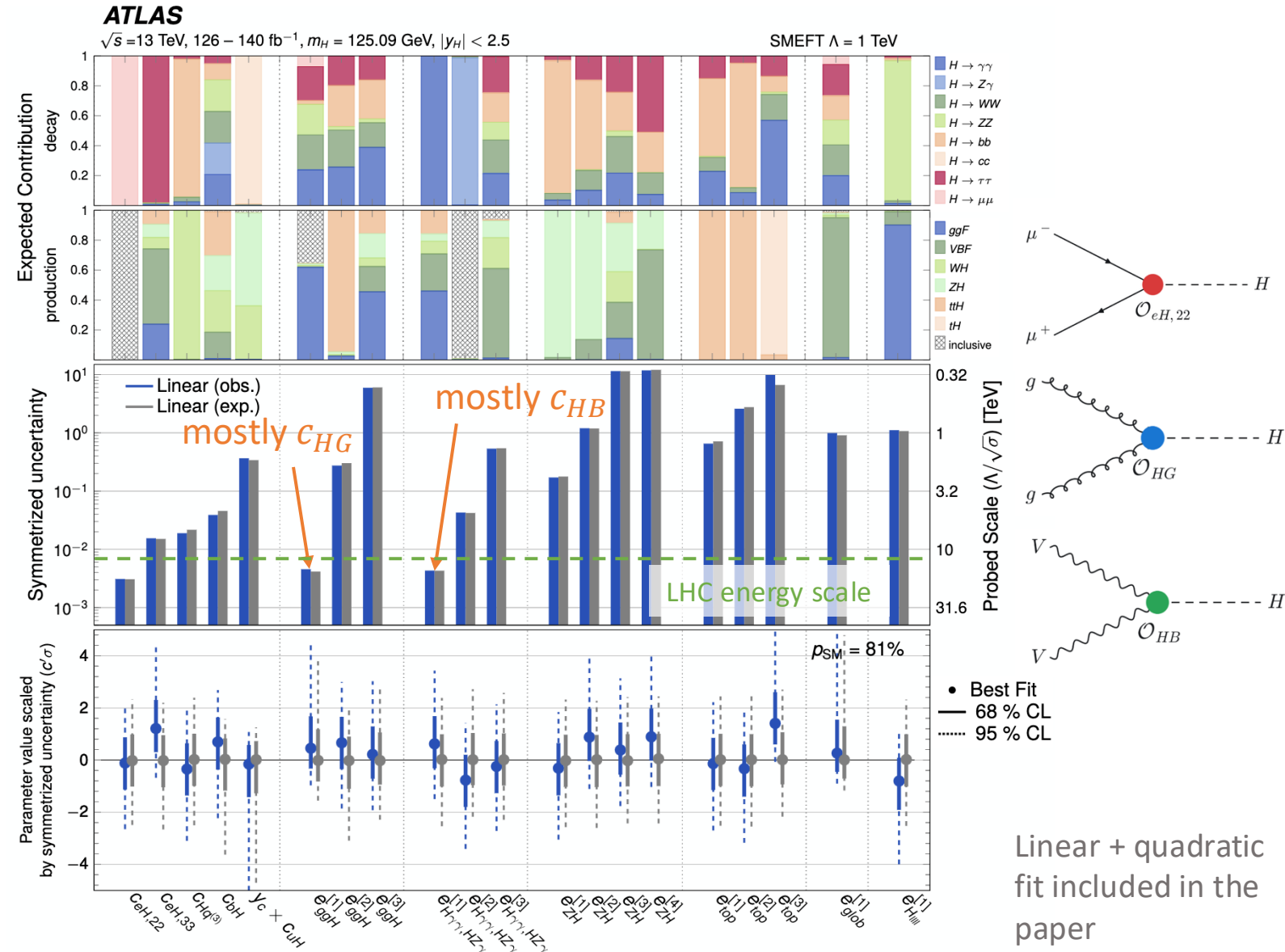
Standard Model Effective Field Theory (SMEFT) interpretations

Up to 55% improvement over [JHEP 11 \(2024\) 097](#)

First ATLAS constraint of c_{uH}

- Constrained by $VH \rightarrow cc$ measurement
- Additional degree of freedom weakens constraint in other directions
 - Particularly relevant for $c_{H\Box}$ which was mostly constrained by total Higgs production

Strongest couplings in $c_{eH,22}, c_{HG}, c_{HB}, c_{HW}$ - sensitivity to EFT scales from 10 – 30 TeV



Linear + quadratic fit included in the paper

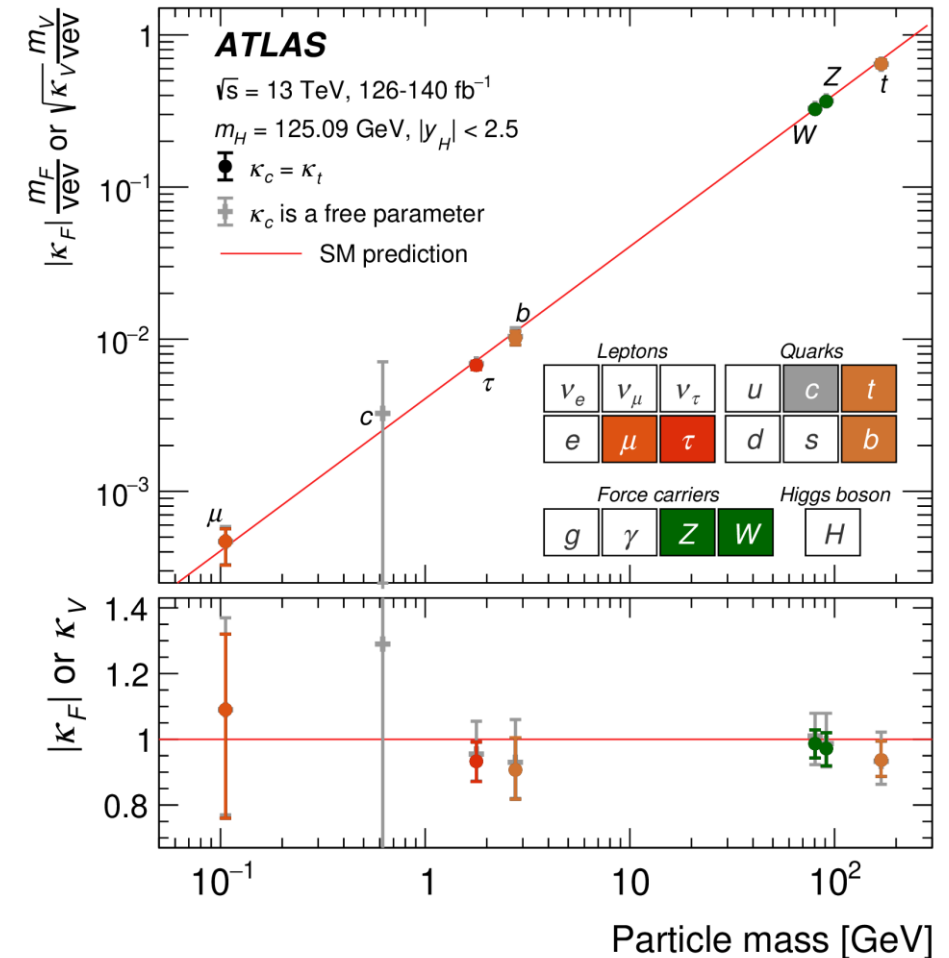
Conclusion

Many improved and some new studies have been performed as part of the ATLAS Legacy Run 2 Higgs Coupling Combination effort ($\sqrt{s} = 13$ TeV, 126 – 140 fb⁻¹)

New results were presented for the κ -framework, the mass of the b -quark at Higgs mass renormalization scale, the Higgs total width, the Higgs self-coupling, and in STXS and SMEFT interpretations. Improvements up to 45% or entirely new results.

More can be found in [arXiv:2608.07332](https://arxiv.org/abs/2608.07332)

This paper contains data up to 140 fb⁻¹ at 13 TeV, but there is another 312 fb⁻¹ of data at 13.6 TeV being analyzed. **Stay tuned for much stronger results in the future.**

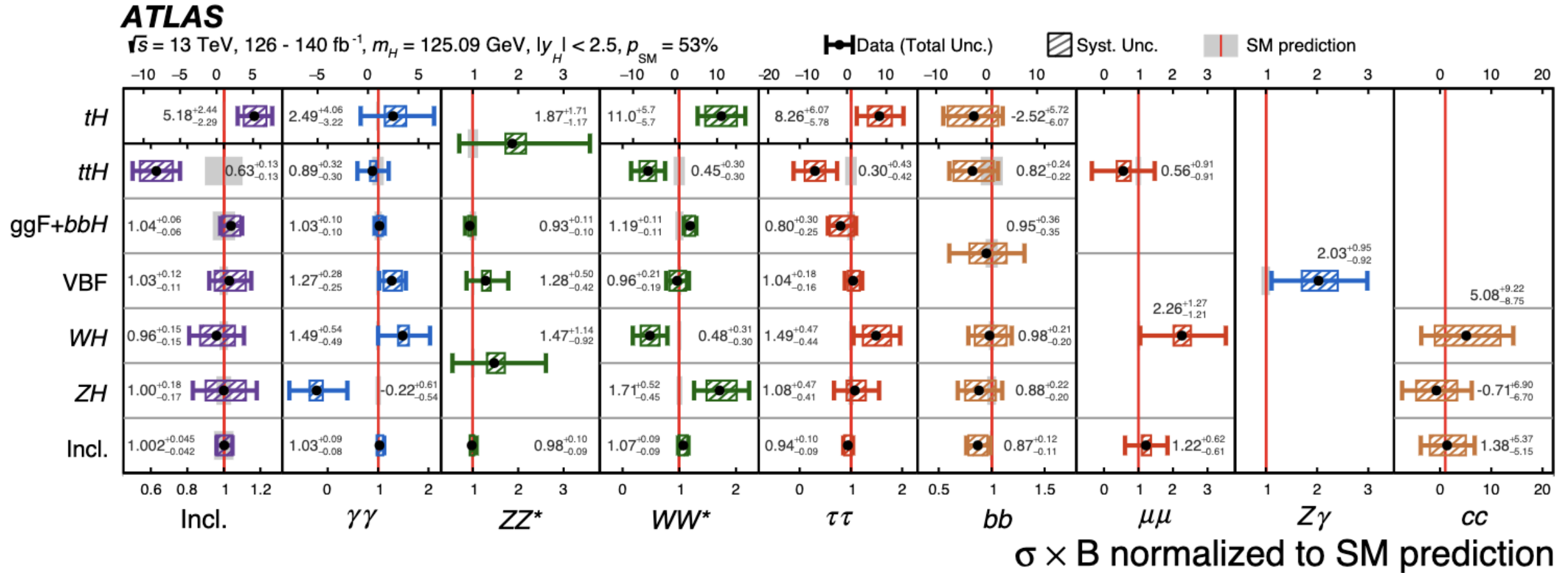


Questions?

Backup

Production x Branching Ratio Measurements

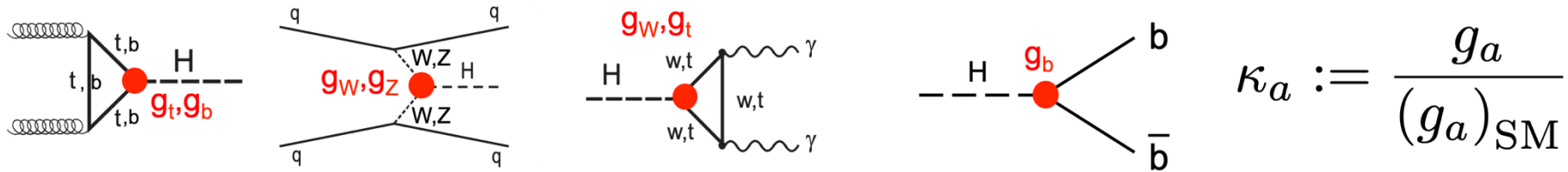
Up to 70% improvement in total uncertainties ($VH, H \rightarrow WW^*$) over [Nature 607 \(2022\) 52-59](#)



The κ Framework

Once Higgs mass is known, all other Higgs parameters are fixed in SM

- Coupling modifiers allow for measurement deviations from SM rates:



$$(\sigma \cdot \mathcal{B})(i \rightarrow H \rightarrow f) = \frac{\sigma_i \cdot \Gamma_f}{\Gamma_H} = \sigma^{\text{SM}}(i \rightarrow H) \cdot \mathcal{B}^{\text{SM}}(H \rightarrow f) \cdot \frac{\kappa_i^2 \cdot \kappa_f^2}{\kappa_H^2}$$

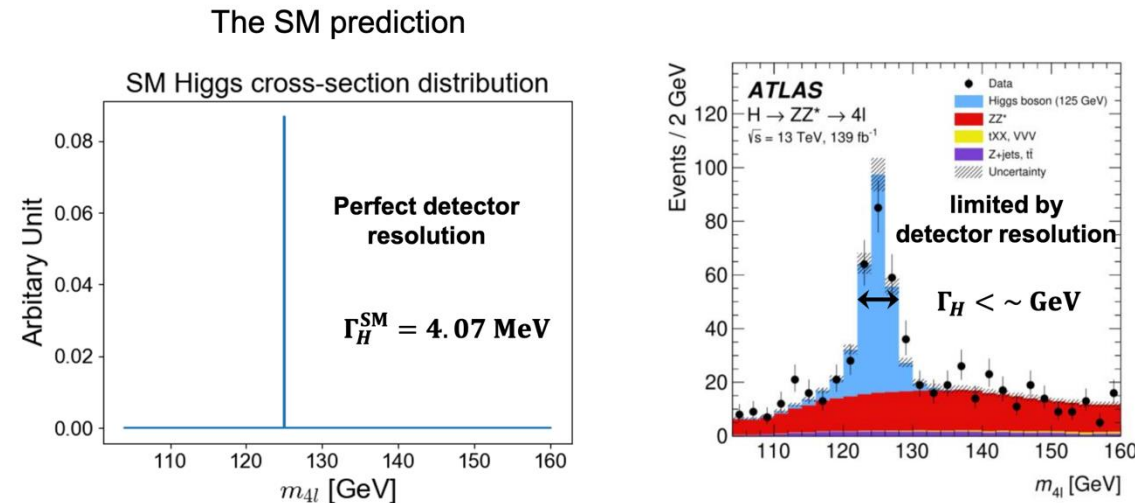
$$\kappa_H^2 = \frac{\sum_f (\kappa_f^2 \cdot \mathcal{B}^{\text{SM}}(H \rightarrow f))}{1 - B_i - B_u} \quad B_{\text{BSM}} = B_i + B_u$$

- Narrow-width assumption: Only one SM Higgs-like state at 125 GeV with negligible width

Measurement of the Higgs Boson Width



SM-Predicted Higgs width of 4.1 MeV much narrower than current energy resolution of ATLAS measurements



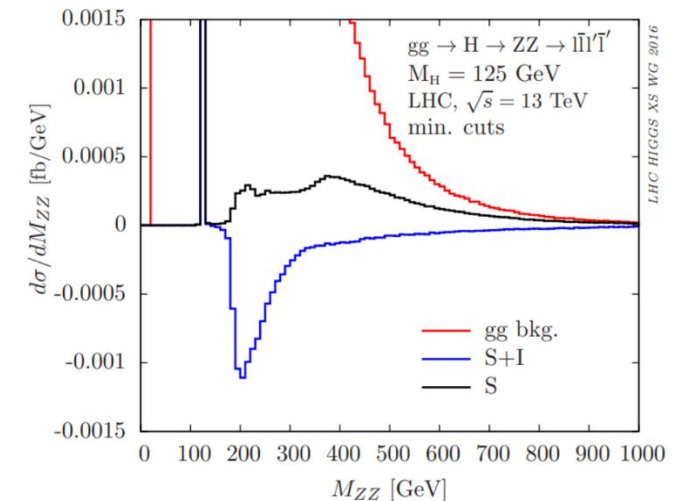
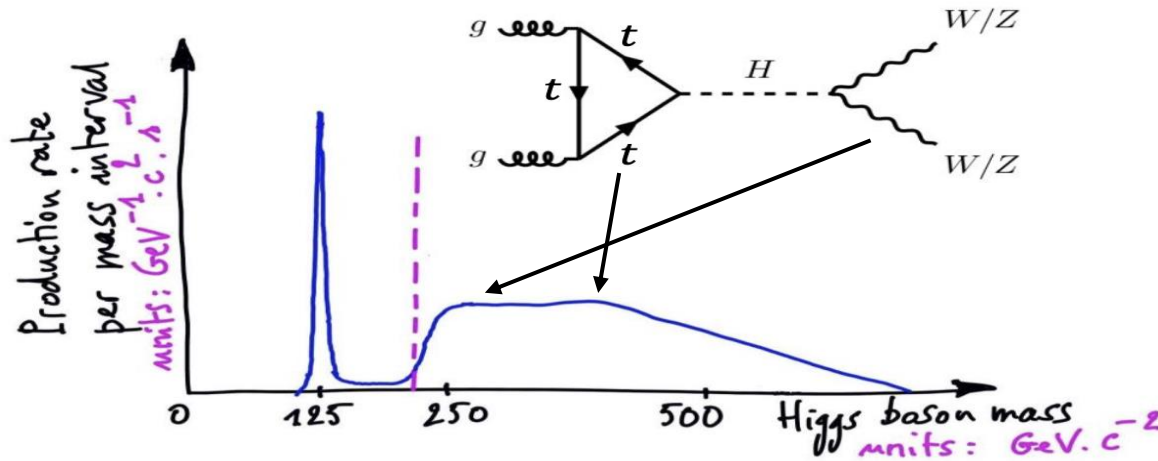
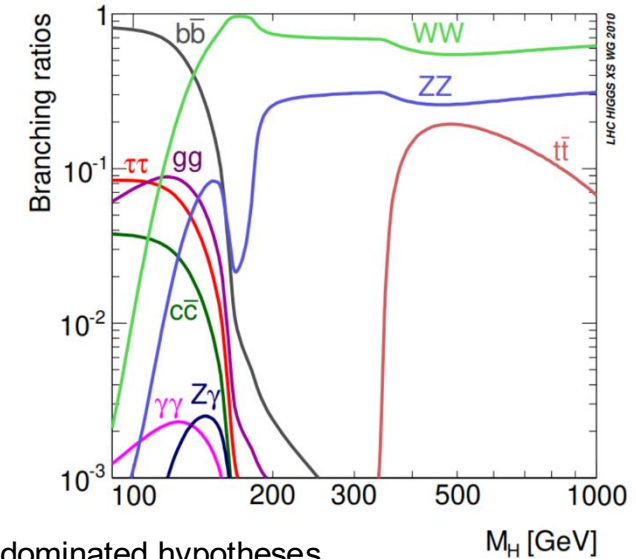
Combining on-shell with off-shell measurements of Higgs production allows for an indirect method of measuring the Higgs boson width (J. Campbell et al. [JHEP 04 \(2014\) 060](#))

Measurement of the Higgs Boson Width

- Combining measurements in the high-mass off-shell regime allow for Width extraction via indirect method:

- For on-shell measurements: $\sigma_{on-shell} \propto \frac{g_{Hgg}^2 g_{HVV}^2}{m_H \Gamma_H}$
- For off-shell measurements: $\sigma_{off-shell} \propto g_{Hgg}^2 g_{HVV}^2$
- Then $\frac{\sigma_{off-shell}}{\sigma_{on-shell}} \propto \Gamma_H$ (assuming no BSM physics changes off-shell couplings from on-shell couplings)

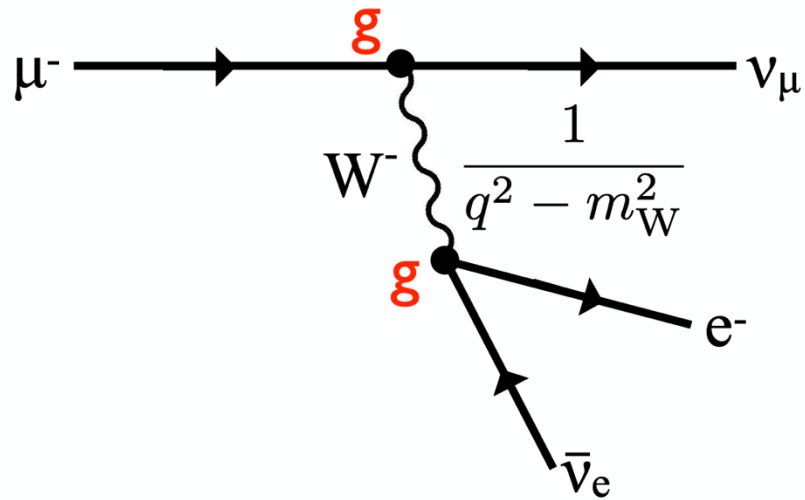
- $H \rightarrow WW$ has largest off-shell branching ratio, but with large backgrounds
- $H \rightarrow ZZ$ has 2nd largest off-shell branching ratio, but with much cleaner backgrounds
 - Both are subject to significant quantum interference effects in the ggF production channel, especially for background-dominated hypotheses



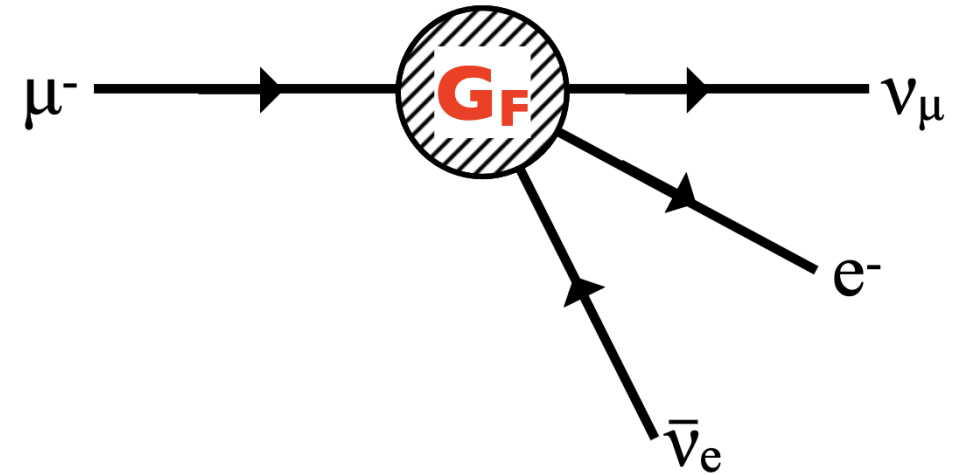
Effective Field Theory Example: Muon Decay



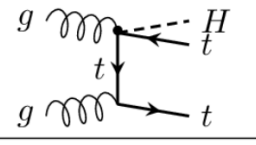
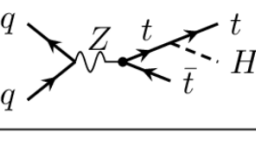
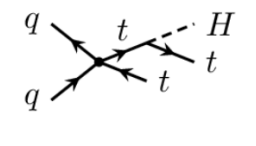
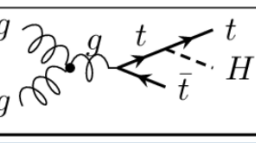
Weak Interaction (“full” field theory)

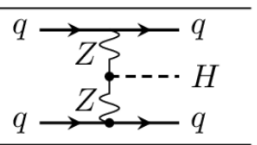
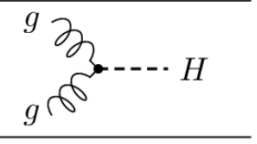
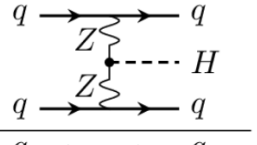
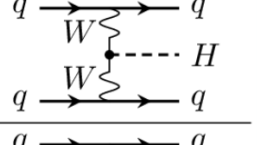
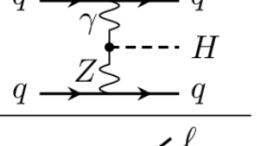
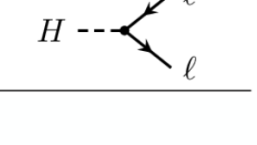


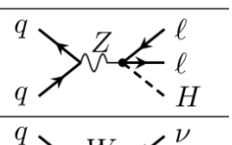
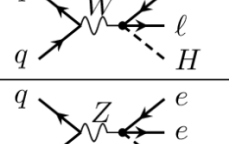
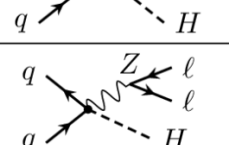
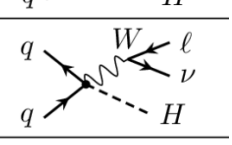
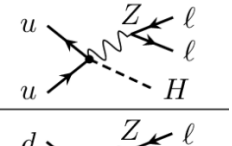
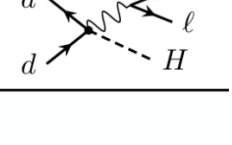
Fermi-Theory (EFT)



$$\text{For } q^2 \ll m_W^2, \frac{1}{q^2 - m_W^2} \rightarrow \frac{1}{-m_W^2} \text{ and } \frac{g^2}{8m_W^2} \rightarrow \frac{G_F}{\sqrt{2}}$$

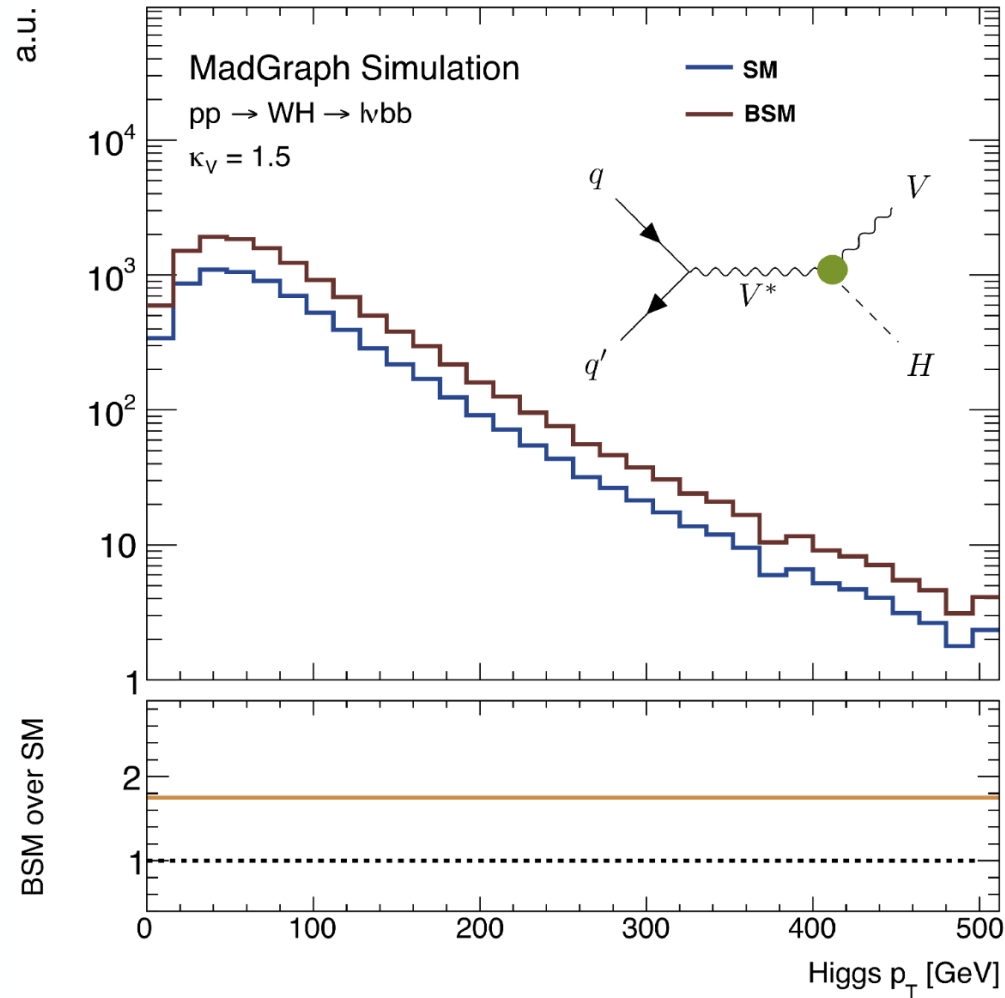
Coefficient	Operator	Example process
c_{uG}	$(\bar{q}_p \sigma^{\mu\nu} T^A u_r) \tilde{H} G_{\mu\nu}^A$	
c_{uW}	$(\bar{q}_p \sigma^{\mu\nu} u_r) \tau^I \tilde{H} W_{\mu\nu}^I$	
c_{uB}	$(\bar{q}_p \sigma^{\mu\nu} u_r) \tilde{H} B_{\mu\nu}$	
$c_{qq}^{(1)}$	$(\bar{q}_p \gamma_\mu q_t)(\bar{q}_r \gamma^\mu q_s)$	
$c_{qq}^{(3)}$	$(\bar{q}_p \gamma_\mu \tau^I q_r)(\bar{q}_s \gamma^\mu \tau^I q_t)$	
c_{qq}	$(\bar{q}_p \gamma_\mu q_t)(\bar{q}_r \gamma^\mu q_s)$	
$c_{qq}^{(31)}$	$(\bar{q}_p \gamma_\mu \tau^I q_t)(\bar{q}_r \gamma^\mu \tau^I q_s)$	
c_{uu}	$(\bar{u}_p \gamma_\mu u_r)(\bar{u}_s \gamma^\mu u_t)$	
$c_{uu}^{(1)}$	$(\bar{u}_p \gamma_\mu u_t)(\bar{u}_r \gamma^\mu u_s)$	
$c_{qu}^{(1)}$	$(\bar{q}_p \gamma_\mu q_t)(\bar{u}_r \gamma^\mu u_s)$	
$c_{ud}^{(8)}$	$(\bar{u}_p \gamma_\mu T^A u_r)(\bar{d}_s \gamma^\mu T^A d_t)$	
$c_{qu}^{(8)}$	$(\bar{q}_p \gamma_\mu T^A q_r)(\bar{u}_s \gamma^\mu T^A u_t)$	
$c_{qd}^{(8)}$	$(\bar{q}_p \gamma_\mu T^A q_r)(\bar{d}_s \gamma^\mu T^A d_t)$	
c_G	$f^{ABC} G_\mu^{A\nu} G_\nu^{B\rho} G_\rho^{C\mu}$	

Coefficient	Operator	Example process
c_{HDD}	$(H^\dagger D^\mu H)^* (H^\dagger D_\mu H)$	
c_{HG}	$H^\dagger H G_{\mu\nu}^A G^{A\mu\nu}$	
c_{HB}	$H^\dagger H B_{\mu\nu} B^{\mu\nu}$	
c_{HW}	$H^\dagger H W_{\mu\nu}^I W^{I\mu\nu}$	
c_{HWB}	$H^\dagger \tau^I H W_{\mu\nu}^I B^{\mu\nu}$	
c_{eH}	$(H^\dagger H)(\bar{l}_p e_r H)$	

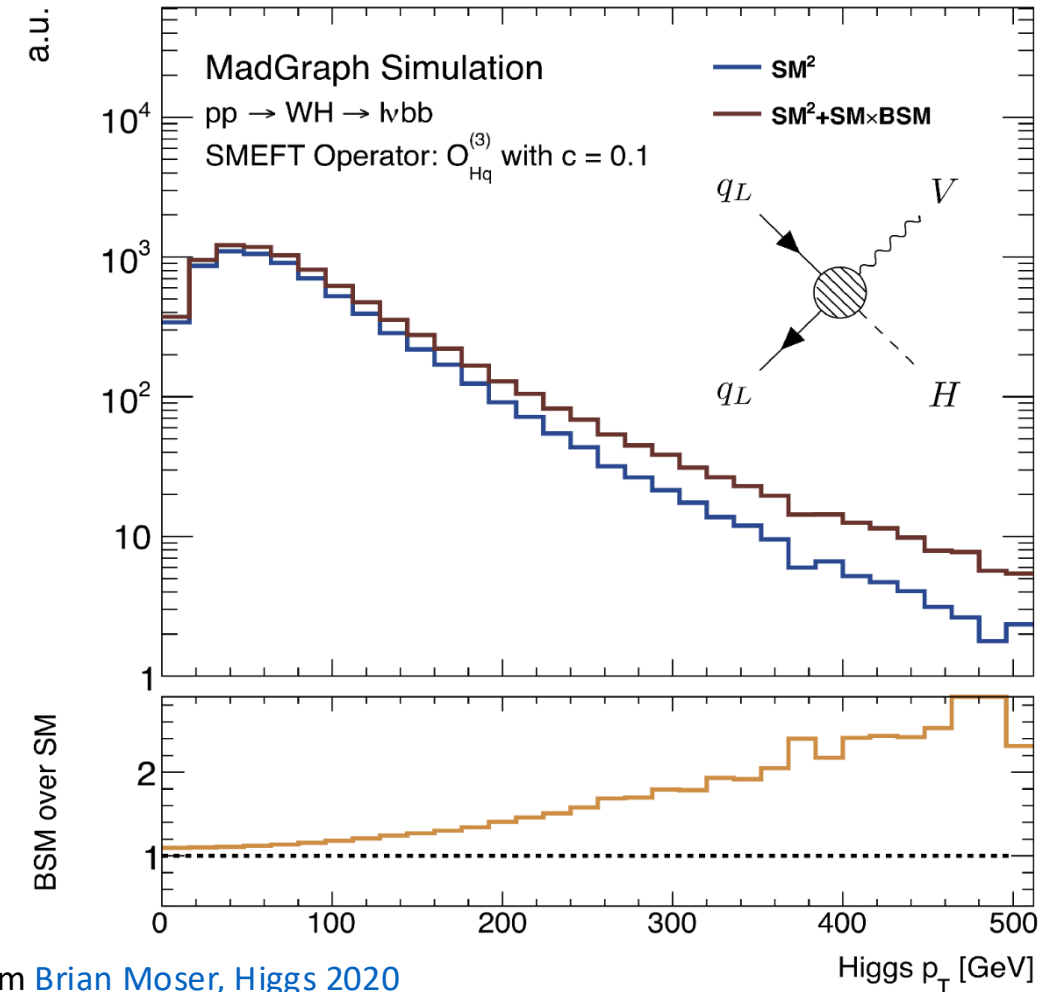
Coefficient	Operator	Example process
$c_{Hl}^{(1)}$	$(H^\dagger i \overleftrightarrow{D}_\mu H)(\bar{l}_p \gamma^\mu l_r)$	
$c_{Hl}^{(3)}$	$(H^\dagger i \overleftrightarrow{D}_\mu^I H)(\bar{l}_p \tau^I \gamma^\mu l_r)$	
c_{He}	$(H^\dagger i \overleftrightarrow{D}_\mu H)(\bar{e}_p \gamma^\mu e_r)$	
$c_{Hq}^{(1)}$	$(H^\dagger i \overleftrightarrow{D}_\mu H)(\bar{q}_p \gamma^\mu q_r)$	
$c_{Hq}^{(3)}$	$(H^\dagger i \overleftrightarrow{D}_\mu^I H)(\bar{q}_p \tau^I \gamma^\mu q_r)$	
c_{Hu}	$(H^\dagger i \overleftrightarrow{D}_\mu H)(\bar{u}_p \gamma^\mu u_r)$	
c_{Hd}	$(H^\dagger i \overleftrightarrow{D}_\mu H)(\bar{d}_p \gamma^\mu d_r)$	

κ Framework vs. SMEFT

κ Framework



SMEFT



*Graphics from [Brian Moser, Higgs 2020](#)

EFT Eigenvector Rotation



ATLAS

$\sqrt{s} = 13 \text{ TeV}, 126 - 140 \text{ fb}^{-1}, m_H = 125.09 \text{ GeV}$

