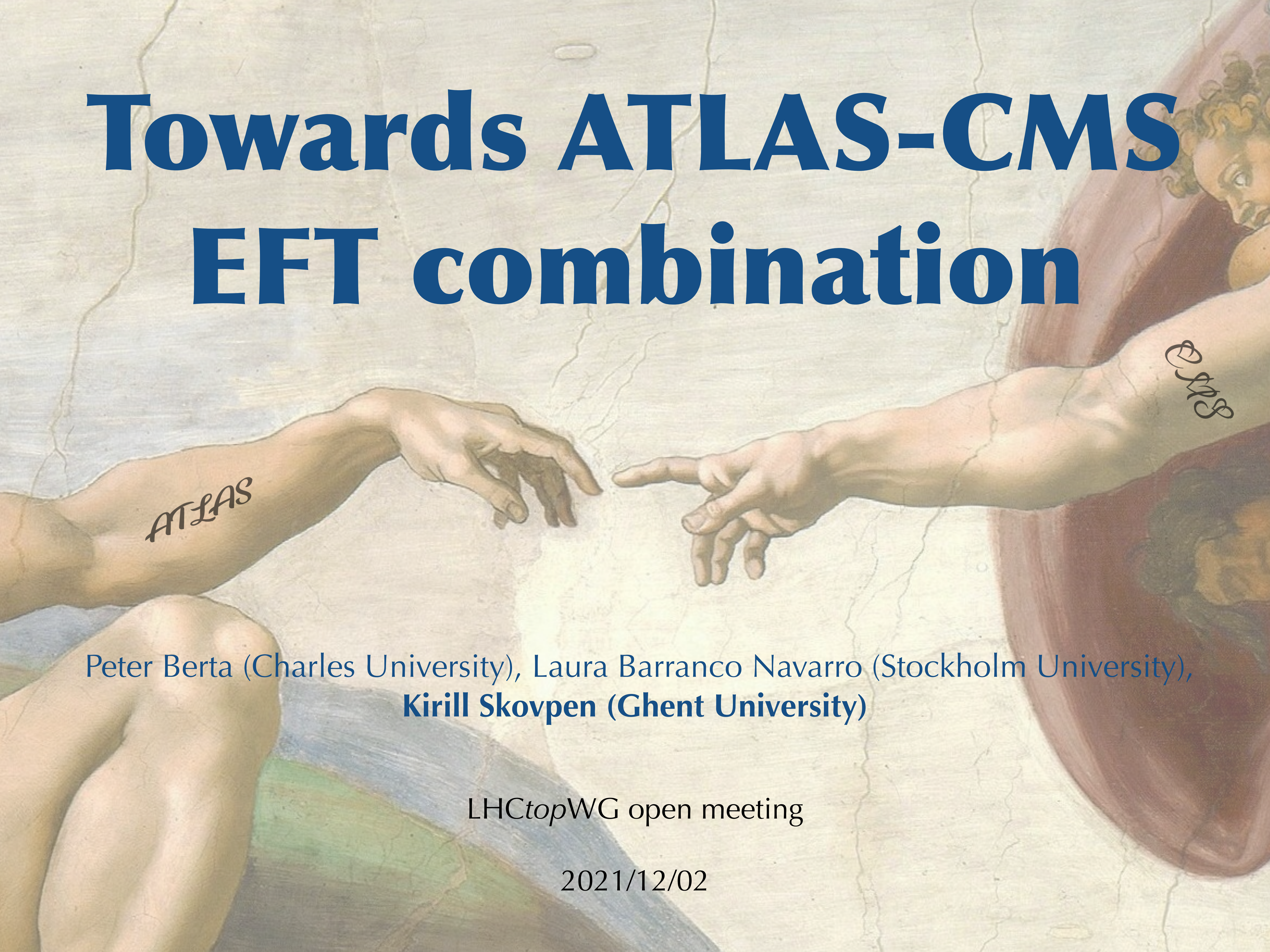
Towards ATLAS-CMS EFT combination



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Kirill Skovpen (Ghent University)

LHC*top*WG open meeting

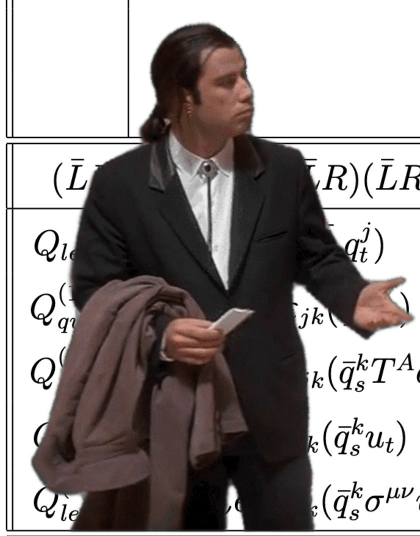
2021/12/02

X^3		φ^6 and $\varphi^4 D^2$		$\psi^2\varphi^3$	
Q_G	$f^{ABC} G_\mu^{A\nu} G_\nu^{B\rho} G_\rho^{C\mu}$	Q_φ	$(\varphi^\dagger\varphi)^3$	$Q_{e\varphi}$	$(\varphi^\dagger\varphi)(\bar l_p e_r \varphi)$
$Q_{\widetilde G}$	$f^{ABC} \widetilde G_\mu^{A\nu} G_\nu^{B\rho} G_\rho^{C\mu}$	$Q_{\varphi\Box}$	$(\varphi^\dagger\varphi)\Box(\varphi^\dagger\varphi)$	$Q_{u\varphi}$	$(\varphi^\dagger\varphi)(\bar q_p u_r \widetilde\varphi)$
Q_W	$\varepsilon^{IJK} W_\mu^{I\nu} W_\nu^{J\rho} W_\rho^{K\mu}$	$Q_{\varphi D}$	$\left(\varphi^\dagger D^\mu\varphi\right)^\star \left(\varphi^\dagger D_\mu\varphi\right)$	$Q_{d\varphi}$	$(\varphi^\dagger\varphi)(\bar q_p d_r \varphi)$
$Q_{\widetilde W}$	$\varepsilon^{IJK} \widetilde W_\mu^{I\nu} W_\nu^{J\rho} W_\rho^{K\mu}$				

$X^2\varphi^2$		$\psi^2 X\varphi$		$\psi^2\varphi^2 D$	
$Q_{\varphi G}$	$\varphi^\dagger\varphi\, G^A_{\mu\nu} G^{A\mu\nu}$	Q_{eW}	$(\bar l_p \sigma^{\mu\nu} e_r)\tau^I \varphi W^I_{\mu\nu}$	$Q_{\varphi l}^{(1)}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar l_p \gamma^\mu l_r)$
$Q_{\varphi\widetilde G}$	$\varphi^\dagger\varphi\, \widetilde G^A_{\mu\nu} G^{A\mu\nu}$	Q_{eB}	$(\bar l_p \sigma^{\mu\nu} e_r)\varphi B_{\mu\nu}$	$Q_{\varphi l}^{(3)}$	$(\varphi^\dagger i\overleftrightarrow{D}^I_\mu \varphi)(\bar l_p \tau^I \gamma^\mu l_r)$
$Q_{\varphi W}$	$\varphi^\dagger\varphi\, W^I_{\mu\nu} W^{I\mu\nu}$	Q_{uG}	$(\bar q_p \sigma^{\mu\nu} T^A u_r)\widetilde\varphi\, G^A_{\mu\nu}$	$Q_{\varphi e}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar e_p \gamma^\mu e_r)$
$Q_{\varphi\widetilde W}$	$\varphi^\dagger\varphi\, \widetilde W^I_{\mu\nu} W^{I\mu\nu}$	Q_{uW}	$(\bar q_p \sigma^{\mu\nu} u_r)\tau^I \widetilde\varphi\, W^I_{\mu\nu}$	$Q_{\varphi q}^{(1)}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar q_p \gamma^\mu q_r)$
$Q_{\varphi B}$	$\varphi^\dagger\varphi\, B_{\mu\nu} B^{\mu\nu}$	Q_{uB}	$(\bar q_p \sigma^{\mu\nu} u_r)\widetilde\varphi\, B_{\mu\nu}$	$Q_{\varphi q}^{(3)}$	$(\varphi^\dagger i\overleftrightarrow{D}^I_\mu \varphi)(\bar q_p \tau^I \gamma^\mu q_r)$
$Q_{\varphi\widetilde B}$	$\varphi^\dagger\varphi\, \widetilde B_{\mu\nu} B^{\mu\nu}$	Q_{dG}	$(\bar q_p \sigma^{\mu\nu} T^A d_r)\varphi\, G^A_{\mu\nu}$	$Q_{\varphi u}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar u_p \gamma^\mu u_r)$
$Q_{\varphi WB}$	$\varphi^\dagger\tau^I\varphi\, W^I_{\mu\nu} B^{\mu\nu}$	Q_{dW}	$(\bar q_p \sigma^{\mu\nu} d_r)\tau^I \varphi\, W^I_{\mu\nu}$	$Q_{\varphi d}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar d_p \gamma^\mu d_r)$
$Q_{\varphi\widetilde WB}$	$\varphi^\dagger\tau^I\varphi\, \widetilde W^I_{\mu\nu} B^{\mu\nu}$	Q_{dB}	$(\bar q_p \sigma^{\mu\nu} d_r)\varphi\, B_{\mu\nu}$	$Q_{\varphi ud}$	$i(\widetilde\varphi^\dagger D_\mu\varphi)(\bar u_p \gamma^\mu d_r)$

$(\bar LL)(\bar LL)$		$(\bar RR)(\bar RR)$		$(\bar LL)(\bar RR)$	
Q_{ll}	$(\bar l_p\gamma_\mu l_r)(\bar l_s\gamma^\mu l_t)$	Q_{ee}	$(\bar e_p\gamma_\mu e_r)(\bar e_s\gamma^\mu e_t)$	Q_{le}	$(\bar l_p\gamma_\mu l_r)(\bar e_s\gamma^\mu e_t)$
$Q_{qq}^{(1)}$	$(\bar q_p\gamma_\mu q_r)(\bar q_s\gamma^\mu q_t)$	Q_{uu}	$(\bar u_p\gamma_\mu u_r)(\bar u_s\gamma^\mu u_t)$	Q_{lu}	$(\bar l_p\gamma_\mu l_r)(\bar u_s\gamma^\mu u_t)$
$Q_{qq}^{(3)}$	$(\bar q_p\gamma_\mu \tau^I q_r)(\bar q_s\gamma^\mu \tau^I q_t)$	Q_{dd}	$(\bar d_p\gamma_\mu d_r)(\bar d_s\gamma^\mu d_t)$	Q_{ld}	$(\bar l_p\gamma_\mu l_r)(\bar d_s\gamma^\mu d_t)$
$Q_{lq}^{(1)}$	$(\bar l_p\gamma_\mu l_r)(\bar q_s\gamma^\mu q_t)$	Q_{eu}	$(\bar e_p\gamma_\mu e_r)(\bar u_s\gamma^\mu u_t)$	Q_{qe}	$(\bar q_p\gamma_\mu q_r)(\bar e_s\gamma^\mu e_t)$
$Q_{lq}^{(3)}$	$(\bar l_p\gamma_\mu \tau^I l_r)(\bar q_s\gamma^\mu \tau^I q_t)$	Q_{ed}	$(\bar e_p\gamma_\mu e_r)(\bar d_s\gamma^\mu d_t)$	$Q_{qu}^{(1)}$	$(\bar q_p\gamma_\mu q_r)(\bar u_s\gamma^\mu u_t)$
		$Q_{ud}^{(1)}$	$(\bar u_p\gamma_\mu u_r)(\bar d_s\gamma^\mu d_t)$	$Q_{qu}^{(8)}$	$(\bar q_p\gamma_\mu T^A q_r)(\bar u_s\gamma^\mu T^A u_t)$
		$Q_{ud}^{(8)}$	$(\bar u_p\gamma_\mu T^A u_r)(\bar d_s\gamma^\mu T^A d_t)$	$Q_{qd}^{(1)}$	$(\bar q_p\gamma_\mu q_r)(\bar d_s\gamma^\mu d_t)$
				$Q_{qd}^{(8)}$	$(\bar q_p\gamma_\mu T^A q_r)(\bar d_s\gamma^\mu T^A d_t)$

$(\bar L$[illegible]$R)(\bar LR)$		B-violating	
Q_{l}[illegible]	[illegible]$q_t^j)$	Q_{duq}	$\varepsilon^{\alpha\beta\gamma}\varepsilon_{jk}\left[(d_p^\alpha)^T C u_r^\beta\right]\left[(q_s^{\gamma j})^T C l_t^k\right]$
$Q^{(}$[illegible]	[illegible]jk ([illegible]	Q_{qqu}	$\varepsilon^{\alpha\beta\gamma}\varepsilon_{jk}\left[(q_p^{\alpha j})^T C q_r^{\beta k}\right]\left[(u_s^\gamma)^T C e_t\right]$
$Q^{(}$[illegible]	[illegible]$k(\bar q_s^k T^A d_t)$	Q_{qqq}	$\varepsilon^{\alpha\beta\gamma}\varepsilon_{jn}\varepsilon_{km}\left[(q_p^{\alpha j})^T C q_r^{\beta k}\right]\left[(q_s^{\gamma m})^T C l_t^n\right]$
[illegible]	[illegible]$k(\bar q_s^k u_t)$	Q_{duu}	$\varepsilon^{\alpha\beta\gamma}\left[(d_p^\alpha)^T C u_r^\beta\right]\left[(u_s^\gamma)^T C e_t\right]$
Q_{le}[illegible]	[illegible]$(\bar q_s^k \sigma^{\mu\nu} u_t)$		



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Q_G	$f^{ABC} G_\mu^{A\nu} G_\nu^{B\rho} G_\rho^{C\mu}$	Q_φ	$(\varphi^\dagger\varphi)^3$	$Q_{e\varphi}$	$(\varphi^\dagger\varphi)(\bar l_p e_r \varphi)$
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$X^2\varphi^2$		$\psi^2 X\varphi$		$\psi^2\varphi^2 D$	
$Q_{\varphi G}$	$\varphi^\dagger\varphi\, G^A_{\mu\nu} G^{A\mu\nu}$	Q_{eW}	$(\bar l_p \sigma^{\mu\nu} e_r)\tau^I \varphi W^I_{\mu\nu}$	$Q_{\varphi l}^{(1)}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar l_p \gamma^\mu l_r)$
$Q_{\varphi\widetilde G}$	$\varphi^\dagger\varphi\, \widetilde G^A_{\mu\nu} G^{A\mu\nu}$	Q_{eB}	$(\bar l_p \sigma^{\mu\nu} e_r)\varphi B_{\mu\nu}$	$Q_{\varphi l}^{(3)}$	$(\varphi^\dagger i\overleftrightarrow{D}^I_\mu \varphi)(\bar l_p \tau^I \gamma^\mu l_r)$
$Q_{\varphi W}$	$\varphi^\dagger\varphi\, W^I_{\mu\nu} W^{I\mu\nu}$	Q_{uG}	$(\bar q_p \sigma^{\mu\nu} T^A u_r)\widetilde\varphi\, G^A_{\mu\nu}$	$Q_{\varphi e}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar e_p \gamma^\mu e_r)$
$Q_{\varphi\widetilde W}$	$\varphi^\dagger\varphi\, \widetilde W^I_{\mu\nu} W^{I\mu\nu}$	Q_{uW}	$(\bar q_p \sigma^{\mu\nu} u_r)\tau^I \widetilde\varphi\, W^I_{\mu\nu}$	$Q_{\varphi q}^{(1)}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar q_p \gamma^\mu q_r)$
$Q_{\varphi B}$	$\varphi^\dagger\varphi\, B_{\mu\nu} B^{\mu\nu}$	Q_{uB}	$(\bar q_p \sigma^{\mu\nu} u_r)\widetilde\varphi\, B_{\mu\nu}$	$Q_{\varphi q}^{(3)}$	$(\varphi^\dagger i\overleftrightarrow{D}^I_\mu \varphi)(\bar q_p \tau^I \gamma^\mu q_r)$
$Q_{\varphi\widetilde B}$	$\varphi^\dagger\varphi\, \widetilde B_{\mu\nu} B^{\mu\nu}$	Q_{dG}	$(\bar q_p \sigma^{\mu\nu} T^A d_r)\varphi\, G^A_{\mu\nu}$	$Q_{\varphi u}$	$(\varphi^\dagger i\overleftrightarrow{D}_\mu \varphi)(\bar u_p \gamma^\mu u_r)$
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$Q_{\varphi\widetilde WB}$	$\varphi^\dagger\tau^I\varphi\, \widetilde W^I_{\mu\nu} B^{\mu\nu}$	Q_{dB}	$(\bar q_p \sigma^{\mu\nu} d_r)\varphi\, B_{\mu\nu}$	$Q_{\varphi ud}$	$i(\widetilde\varphi^\dagger D_\mu\varphi)(\bar u_p \gamma^\mu d_r)$

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$Q_{lq}^{(3)}$	$(\bar l_p \gamma_\mu \tau^I l_r)(\bar q_s \gamma^\mu \tau^I q_t)$	Q_{ed}	$(\bar e_p \gamma_\mu e_r)(\bar d_s \gamma^\mu d_t)$	$Q_{qu}^{(1)}$	$(\bar q_p \gamma_\mu q_r)(\bar u_s \gamma^\mu u_t)$
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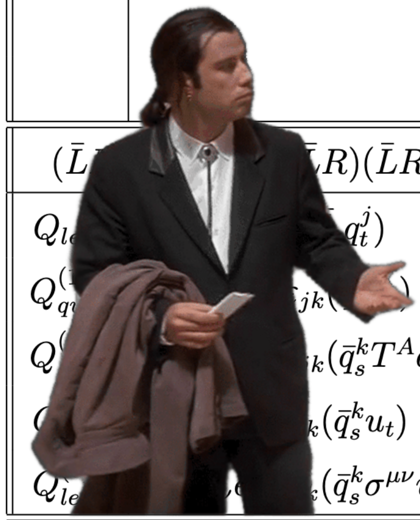
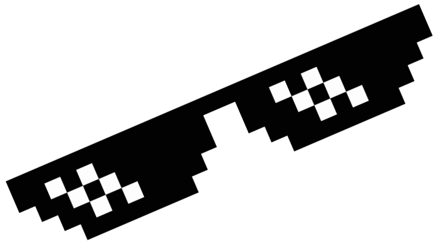
$(\bar L$ [illegible] $R)(\bar LR)$		B-violating	
Q_{l} [illegible]	[illegible] $q_t^j)$	Q_{duq}	$\varepsilon^{\alpha\beta\gamma}\varepsilon_{jk}\left[(d_p^\alpha)^T C u_r^\beta\right]\left[(q_s^{\gamma j})^T C l_t^k\right]$
Q_{q} [illegible]	[illegible] jk [illegible]	Q_{qqu}	$\varepsilon^{\alpha\beta\gamma}\varepsilon_{jk}\left[(q_p^{\alpha j})^T C q_r^{\beta k}\right]\left[(u_s^\gamma)^T C e_t\right]$
Q [illegible]	[illegible] $k(\bar q_s^k T^A d_t)$	Q_{qqq}	$\varepsilon^{\alpha\beta\gamma}\varepsilon_{jn}\varepsilon_{km}\left[(q_p^{\alpha j})^T C q_r^{\beta k}\right]\left[(q_s^{\gamma m})^T C l_t^n\right]$
Q [illegible]	[illegible] $k(\bar q_s^k u_t)$	Q_{duu}	$\varepsilon^{\alpha\beta\gamma}\left[(d_p^\alpha)^T C u_r^\beta\right]\left[(u_s^\gamma)^T C e_t\right]$
Q_{le} [illegible]	[illegible] $k(\bar q_s^k \sigma^{\mu\nu} u_t)$		





CERN-LPCC-2018-01

Interpreting top-quark LHC measurements in the standard-model effective field theory

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Abstract

This note proposes common standards and prescriptions for the effective-field-theory interpretation of top-quark measurements at the LHC.

Experimental EFT analysis

- A number of new exciting **EFT** results in the **top quark sector** from ATLAS and CMS
- Probing a diverse set of **dim-6** operators in **individual** and **marginalized** fits
- Focus on a **specific** top quark production, as well as perform simultaneous EFT studies across **different** processes
- A **global** EFT analysis requires a **comprehensive** (and **challenging**) experimental approach:

  → model EFT effects with state-of-art simulation programs
  → include EFT in signal and background processes
  → simultaneous multidimensional fits
  → consistent systematics treatment
  → publication of EFT results

Approaching EFT combination

- An EFT analysis: **complex**!
- An EFT ATLAS+CMS combination: **complex²**!
  → Need to **start early** in order not to cut corners later
  → Internal **discussions** and common **tools** development is a key
- How to combine?
  Faster: Combined reinterpretation of ATLAS and CMS results
  Better: Use ATLAS and CMS results in a common EFT fit
- Use **Run 2 data** → future baseline for Run 3
- Ultimately aim for **likelihood-based combination**
  → in the meantime, various simplified approaches can be considered for existing results
- Benefit from **exploring both approaches** to agree on:
  - common conventions
  - systematics correlations
  - fitting method
  - publication format

Inputs to combination

◆ Short-listed candidates for an ATLAS-CMS EFT combination:

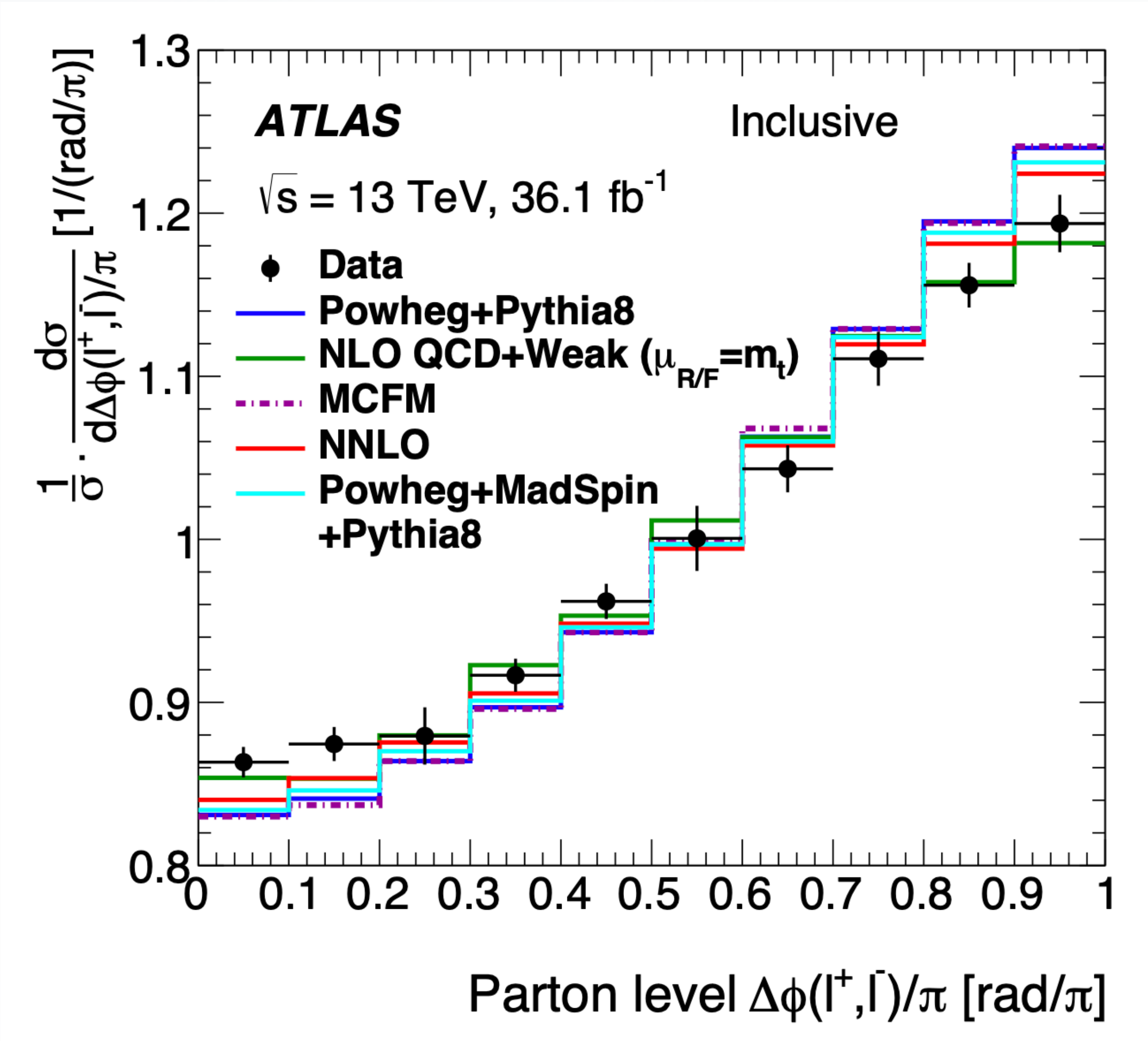
Process	ATLAS	CMS	Possible strategy
Spin correlations	EPJC 80 (2020) 754	PRD 100 (2019) 072002	Differential, EFTfitter
ttZ/W	PRD 99 (2019) 072009	JHEP 03 (2020) 056, JHEP 08 (2018) 011	EFT/SM generator-level reweighting, full likelihood
ttγ	JHEP 09 (2020) 049	CMS-PAS-TOP-21-004, arXiv:2107.01508	EFT/SM generator-level reweighting, full likelihood
tZq	JHEP 07 (2020) 124	arXiv:2107.13896, arXiv:2111.02860	Differential + inclusive, EFTfitter
FCNC t-gluon	EPJC 76 (2016) 55	JHEP 02 (2017) 028	Inclusive, EFTfitter
FCNC t-Higgs	JHEP 05 (2019) 123	arXiv:2111.02219, CMS-PAS-TOP-19-002	Inclusive, EFTfitter
t(t)X	ttZ/W	JHEP 03 (2021) 095	Detector level, full likelihood

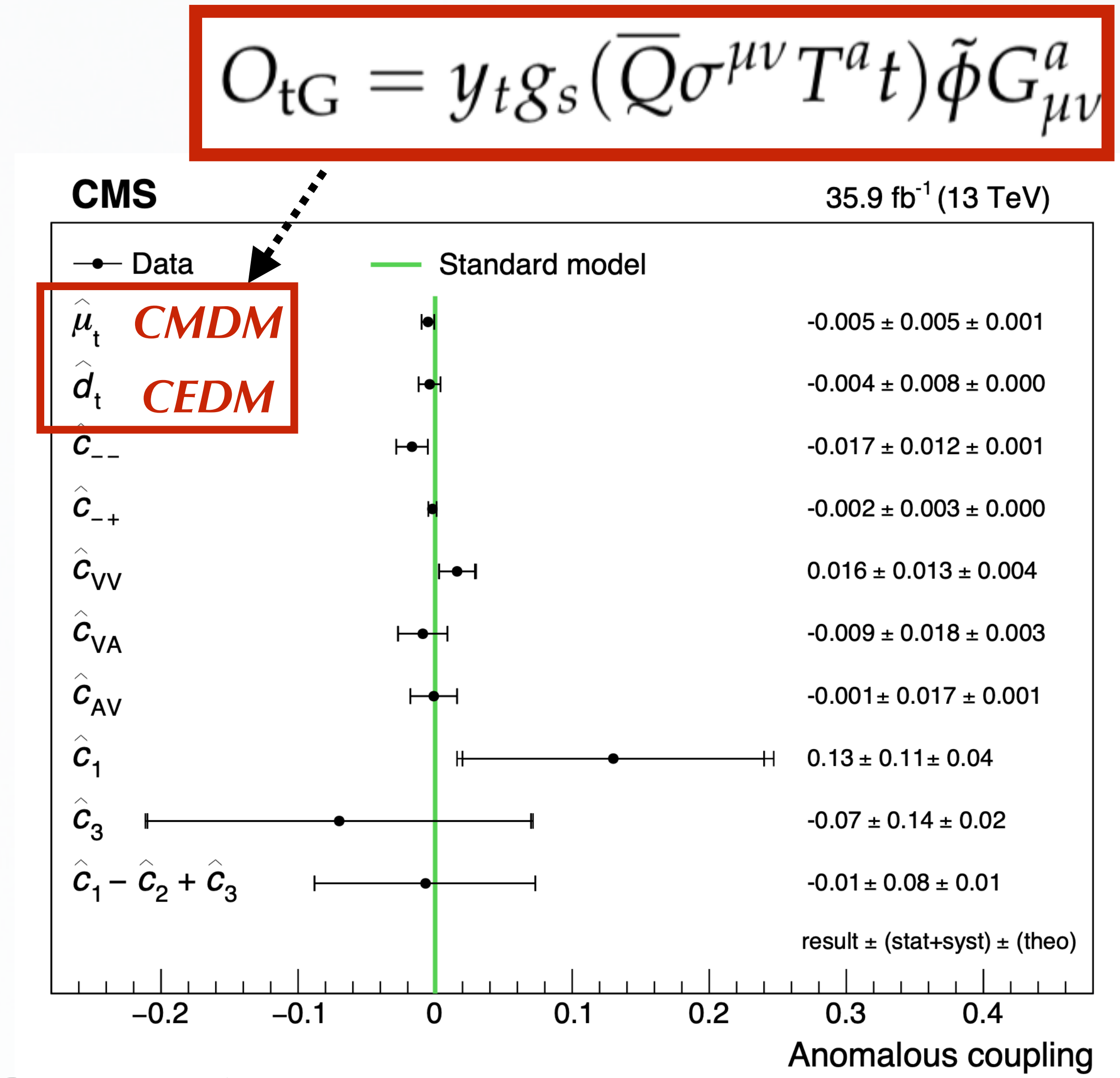
◆ Imminent action items:
- confirm person-power
- set up internal communication
- check EFT conventions, etc.

More details in next slides

Spin correlations

EPJC 80 (2020) 754



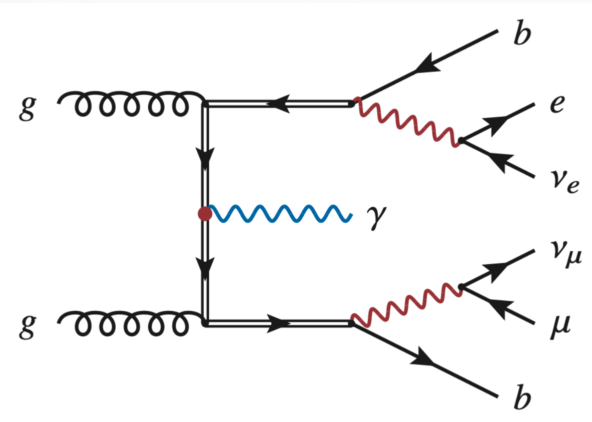


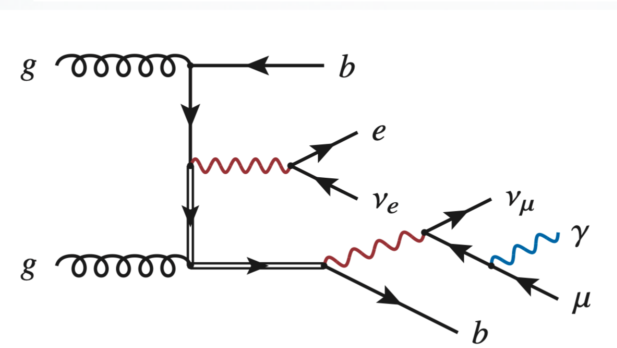
PRD 100 (2019) 072002

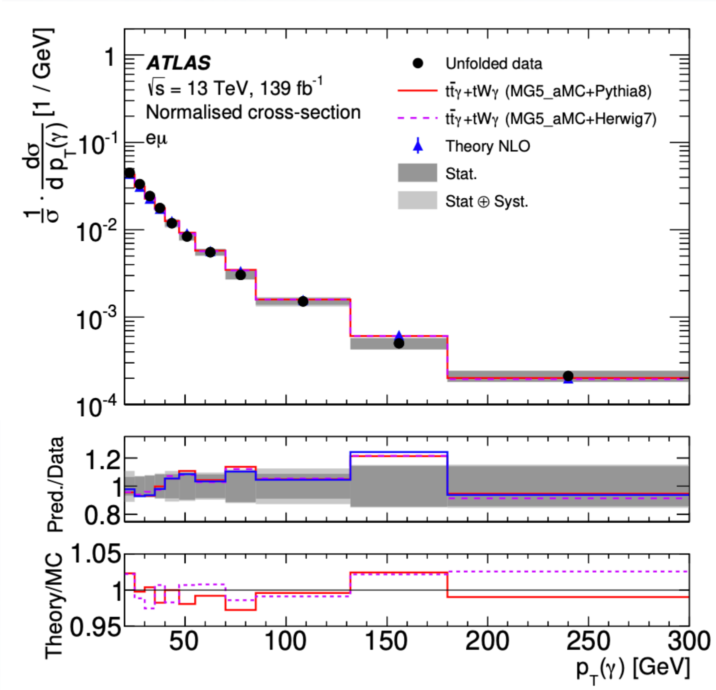
- **Data**: 2016
- **Topology**: eμ ttbar
- **Measurement**: Differential cross sections at parton and particle levels
- **Model**: -
- **Target**: -

- **Data**: 2016
- **Topology**: dilepton ttbar
- **Method**: Differential cross sections at parton level
- **Model**: Phys. Rev. D 91 (2015) 114010, compatible with dim6top
- **Target**: C_{tG}, $C^{[I]}_{tG}$

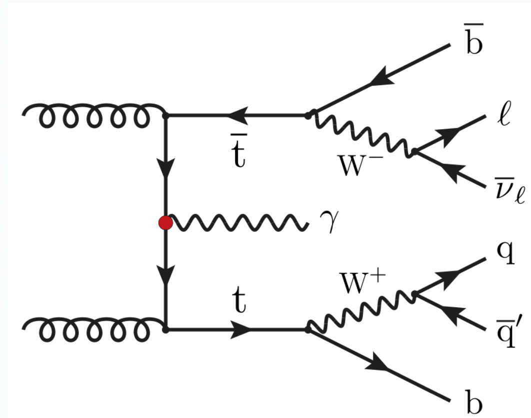
ttγ

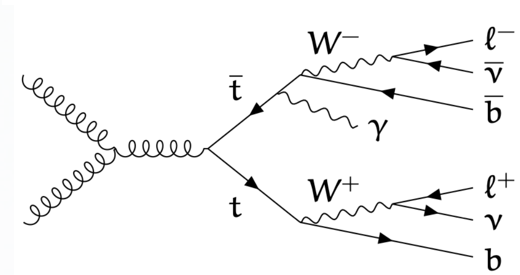


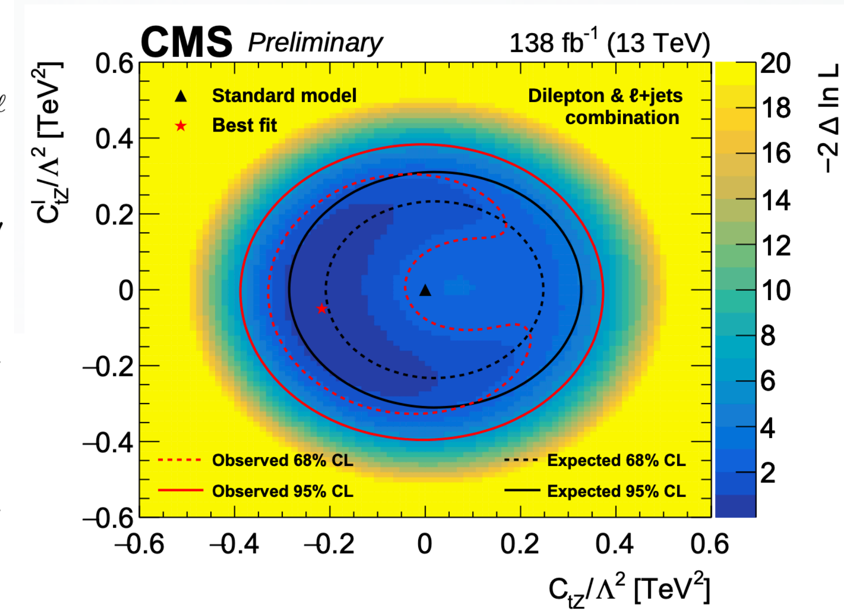




[JHEP 09 (2020) 049](#)







[arXiv:2107.01508](#)

[CMS PAS TOP-21-004](#)

$$C_{tA} \equiv c_w C_{tB} + s_w C_{tW} = \frac{1}{s_w}\left(C_{tW} - c_w C_{tZ}\right)$$

- **Data**: Full Run 2
- **Topology**: tt**γ** + tW**γ** in dilepton (eμ) channel
- **Method**: Unfolded differential cross section, parton-level unfolding
- **Model**: -
- **Target**: -

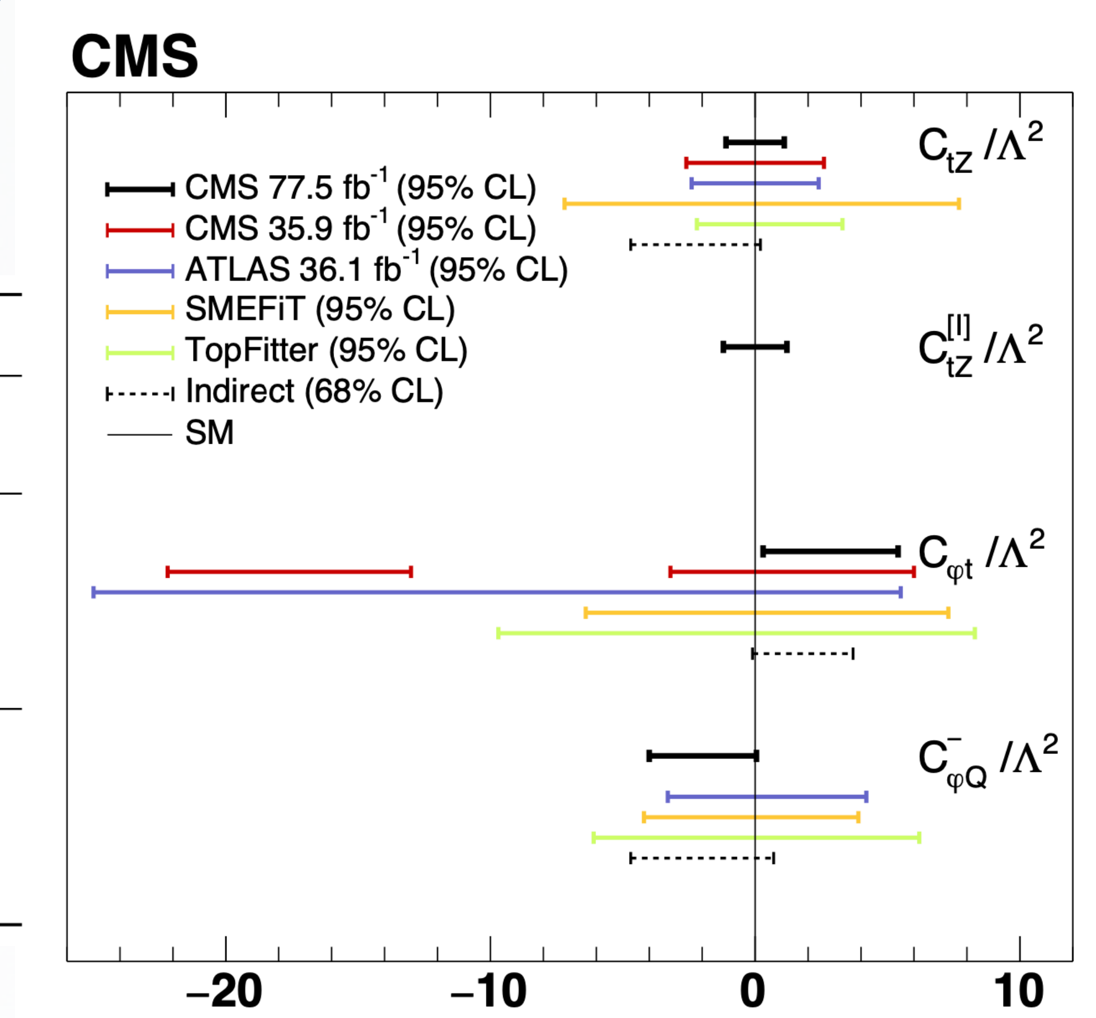
- **Data**: Full Run 2
- **Topology**: tt**γ** in single-lepton and dilepton channels
- **Method**: Direct measurement with EFT/SM gen-level reweighting, particle-level unfolding
- **Model**: dim6top
- **Target**: C_{tZ}, $C^{[I]}_{tZ}$

Detailed comparison between these analyses [in this talk](#)

ttZ/W

PRD 99 (2019) 072009 EPJC 81 (2021) 737

Coefficients	$C_{\phi Q}^{(3)}/\Lambda^2$	$C_{\phi t}/\Lambda^2$	C_{tB}/Λ^2	C_{tW}/Λ^2
Previous indirect constraints at 68% CL	[–4.7, 0.7]	[–0.1, 3.7]	[–0.5, 10]	[–1.6, 0.8]
Previous direct constraints at 95% CL	[–1.3, 1.3]	[–9.7, 8.3]	[–6.9, 4.6]	[–0.2, 0.7]
Expected limit at 68% CL	[–2.1, 1.9]	[–3.8, 2.7]	[–2.9, 3.0]	[–1.8, 1.9]
Expected limit at 95% CL	[–4.5, 3.6]	[–23, 4.9]	[–4.2, 4.3]	[–2.6, 2.6]
Observed limit at 68% CL	[–1.0, 2.7]	[–2.0, 3.5]	[–3.7, 3.5]	[–2.2, 2.1]
Observed limit at 95% CL	[–3.3, 4.2]	[–25, 5.5]	[–5.0, 5.0]	[–2.9, 2.9]
Expected limit at 68% CL (linear)	[–1.9, 2.0]	[–3.0, 3.2]	–	–
Expected limit at 95% CL (linear)	[–3.7, 4.0]	[–5.8, 6.3]	–	–
Observed limit at 68% CL (linear)	[–1.0, 2.9]	[–1.8, 4.4]	–	–
Observed limit at 95% CL (linear)	[–2.9, 4.9]	[–4.8, 7.5]	–	–



JHEP 08 (2018) 011 JHEP 03 (2020) 056

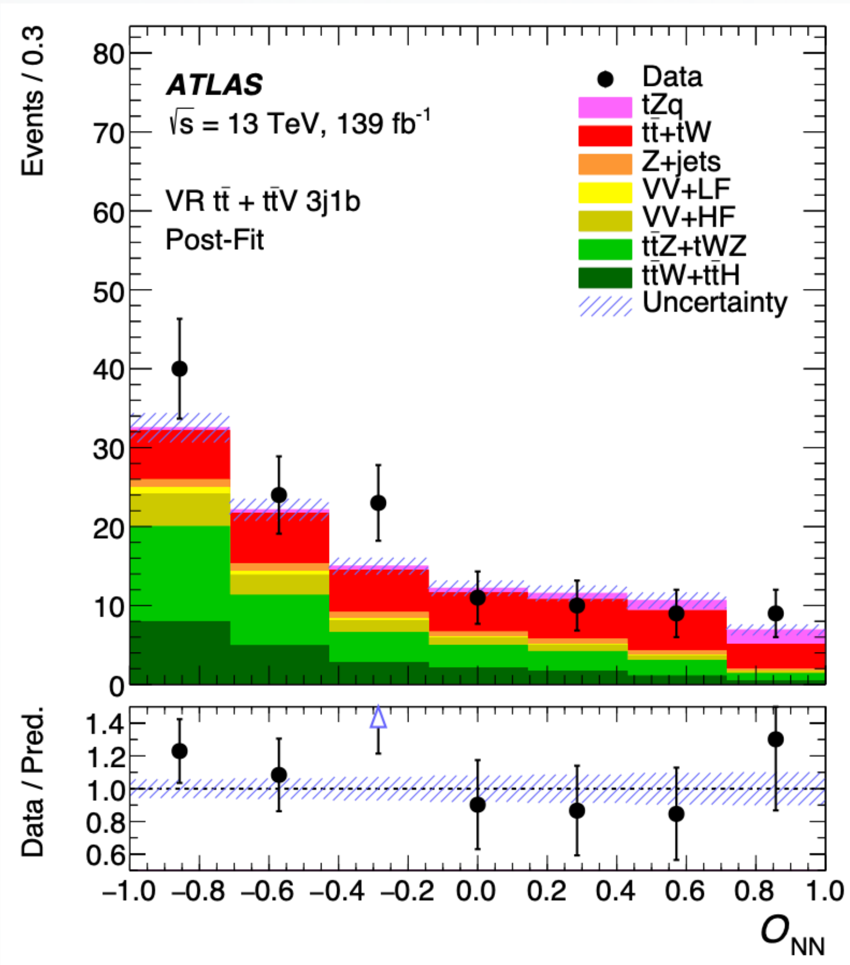
- **Data**: 2016 (with EFT), Full Run 2
- **Topology**: ttZ in multilepton channels
- **Method**: Direct measurement with EFT/SM gen-level reweighting, parton- and particle-level unfolding
- **Model**: JHEP 05 (2016) 052
- **Target**: $C_{\phi Q}^{(3)}$, $C_{\phi Q}^{(1)}$, $C_{\phi t}$, C_{tW}, C_{tB}

- **Data**: 2016+2017
- **Topology**: ttZ in multilepton channels
- **Method**: Direct measurement with EFT/SM gen-level reweighting, parton-level unfolding
- **Model**: dim6top
- **Target**: $C_{\phi Q}^{-}$, $C_{\phi t}$, C_{tZ}, $C_{tZ}^{[I]}$

$$c_{tZ} = \mathrm{Re}\left(-\sin\theta_W C_{uB}^{(33)} + \cos\theta_W C_{uW}^{(33)}\right)$$
$$c_{tZ}^{[I]} = \mathrm{Im}\left(-\sin\theta_W C_{uB}^{(33)} + \cos\theta_W C_{uW}^{(33)}\right)$$
$$c_{\phi t} = C_{\phi t} = C_{\phi u}^{(33)}$$
$$c_{\phi Q}^{-} = C_{\phi Q} = C_{\phi q}^{1(33)} - C_{\phi q}^{3(33)},$$

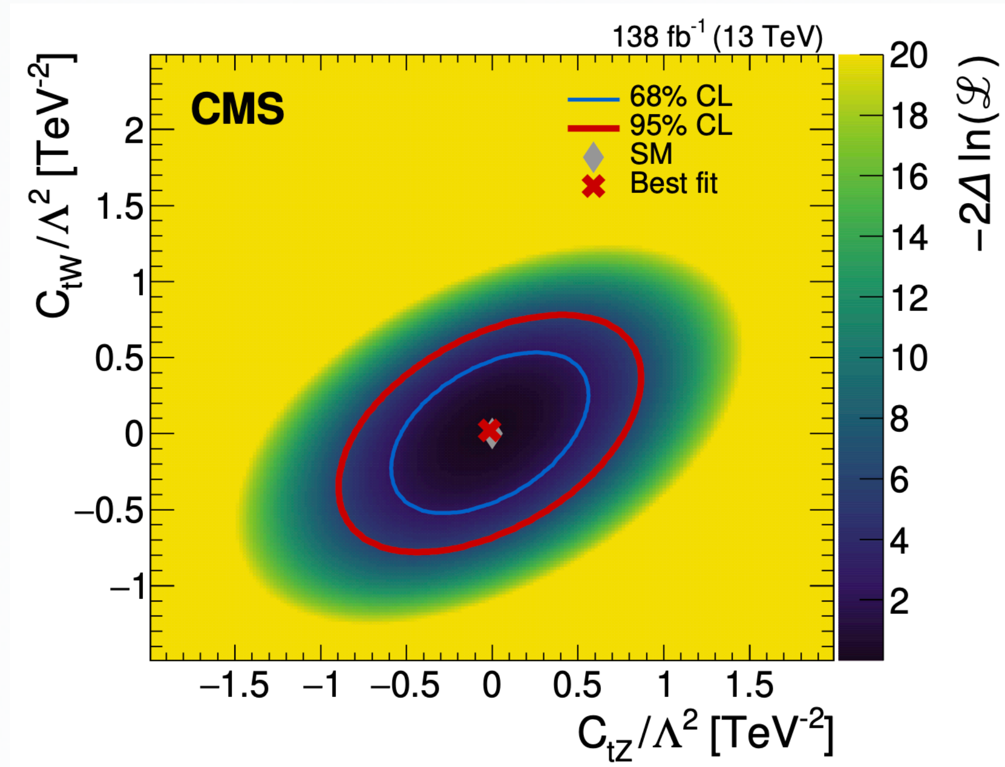
tZq

JHEP 07 (2020) 124



- **Data**: Full Run 2
- **Topology**: tZq/ttZ trilepton
- **Measurement**: Inclusive cross section
- **Model**: -
- **Target**: -

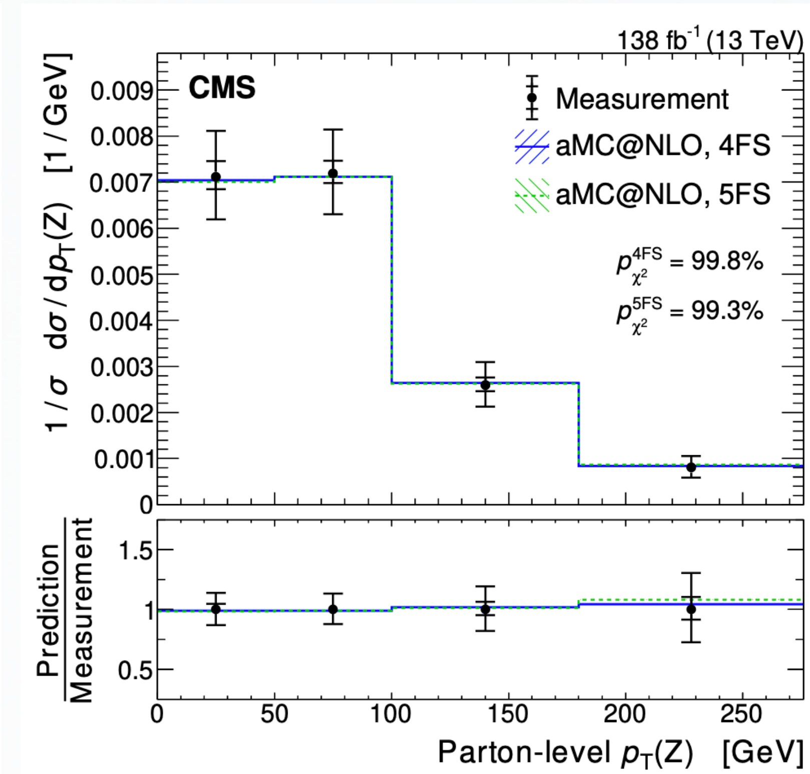
arXiv:2107.13896



- **Data**: Full Run 2
- **Topology**: tZq/ttZ trilepton
- **Method**: Direct measurement using Machine Learning
- **Model**: dim6top
- **Target**: C_{tW}, $C^{3}_{\varphi Q}$, C_{tZ}, $C^{-}_{\varphi Q}$, $C_{\varphi t}$

See talk by Nadjieh Jafari!

arXiv:2111.02860

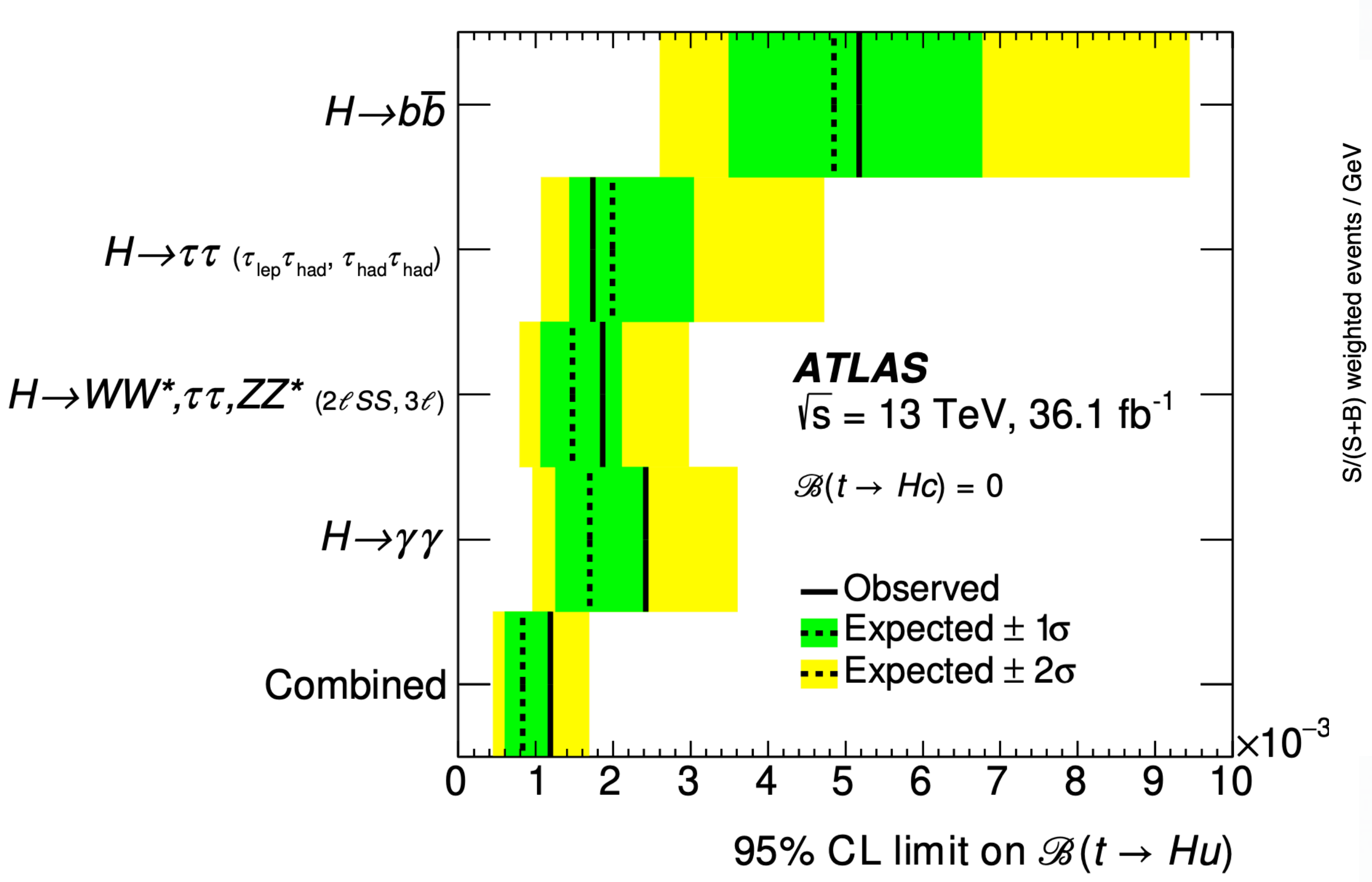


- **Data**: Full Run 2
- **Topology**: tZq/ttZ trilepton
- Inclusive and differential cross sections at parton and particle levels available

See talk by Luka Lambrecht!

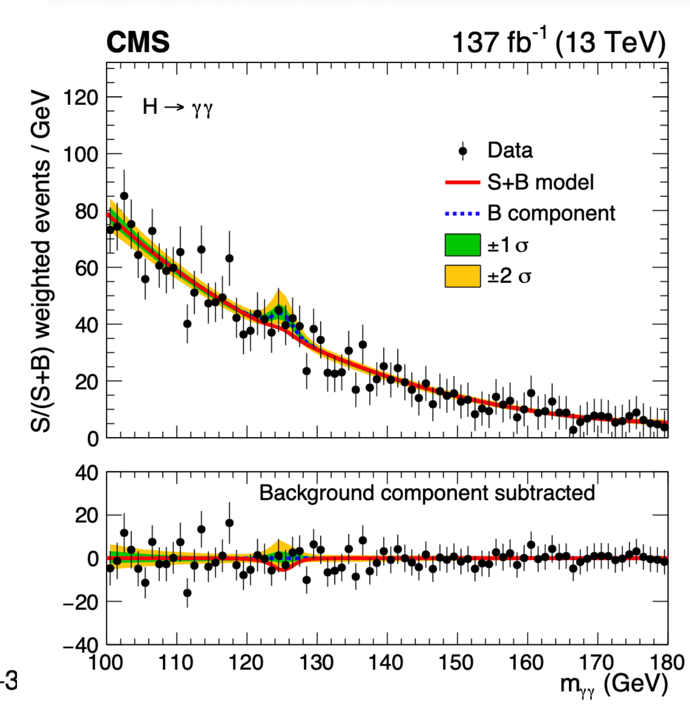
FCNC: t-Higgs

JHEP 05 (2019) 123

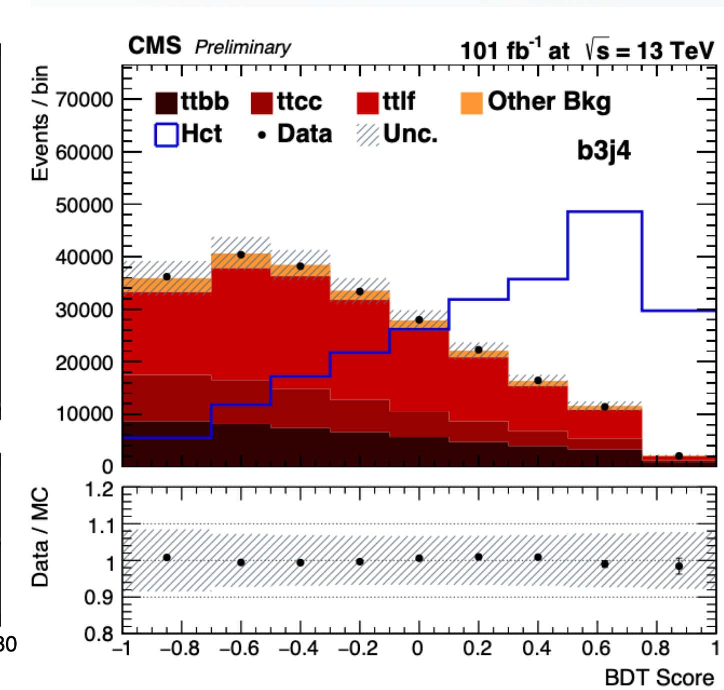


- **Data**: 2016
- **Topology**: H→**γγ**, H→WW/ZZ/**ττ**, H→bb
- **Model**: kappa-framework
- **Target**: κ_{Hqt}

arXiv:2111.02219



CMS-PAS-TOP-19-002

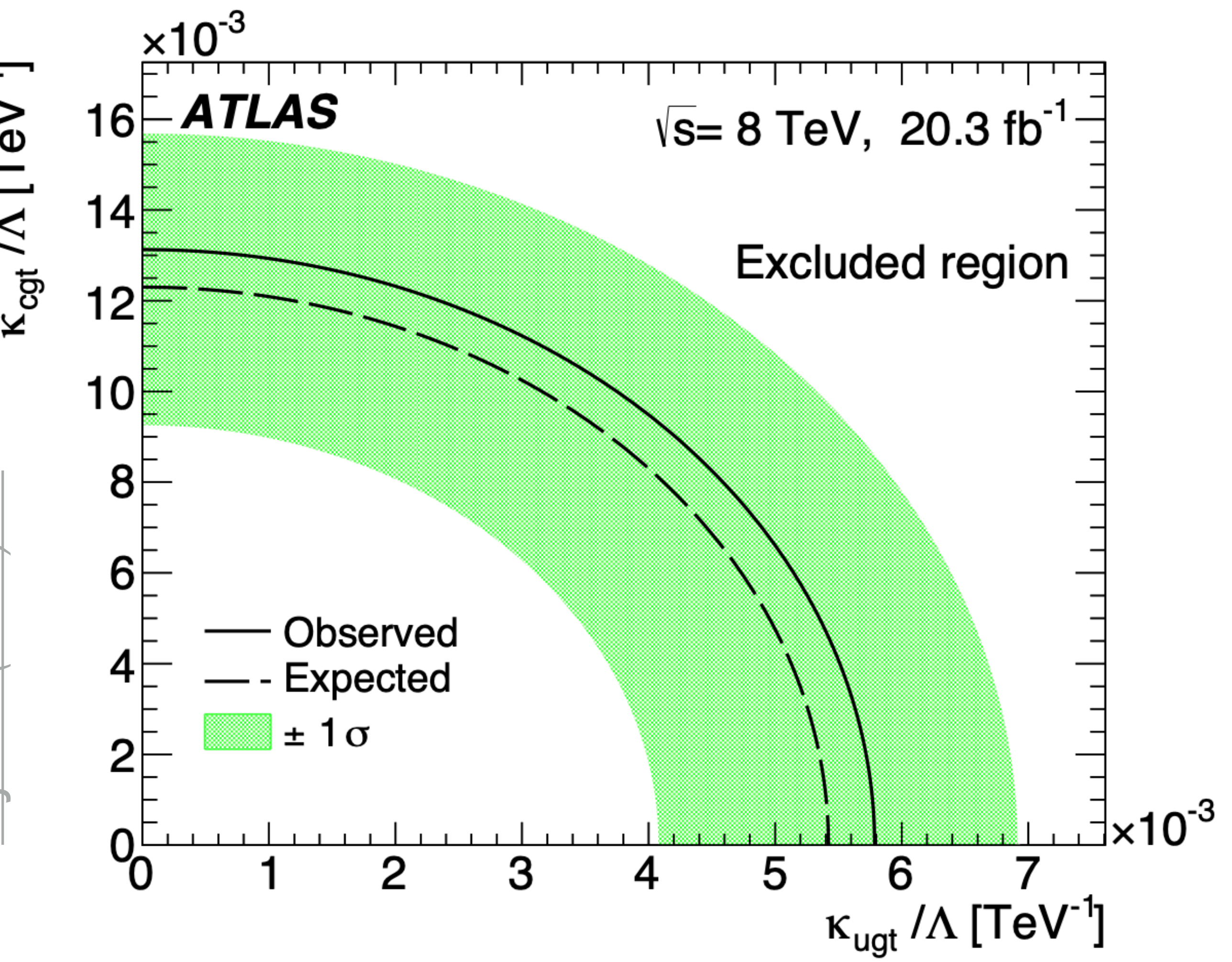


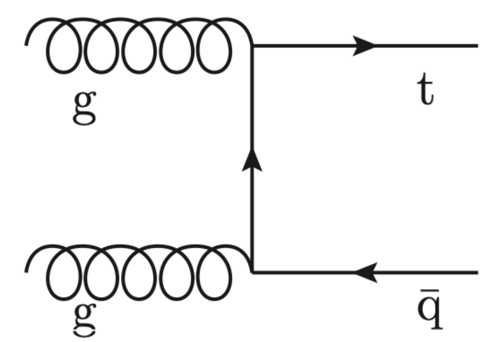
- **Data**: Full Run 2
- **Topology**: H→**γγ**, H→bb
- **Model**: kappa-framework
- **Target**: κ_{Hqt}

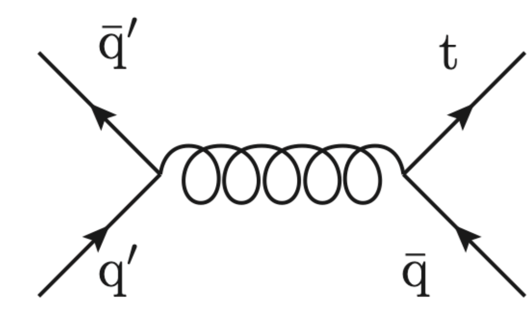
FCNC: t-gluon

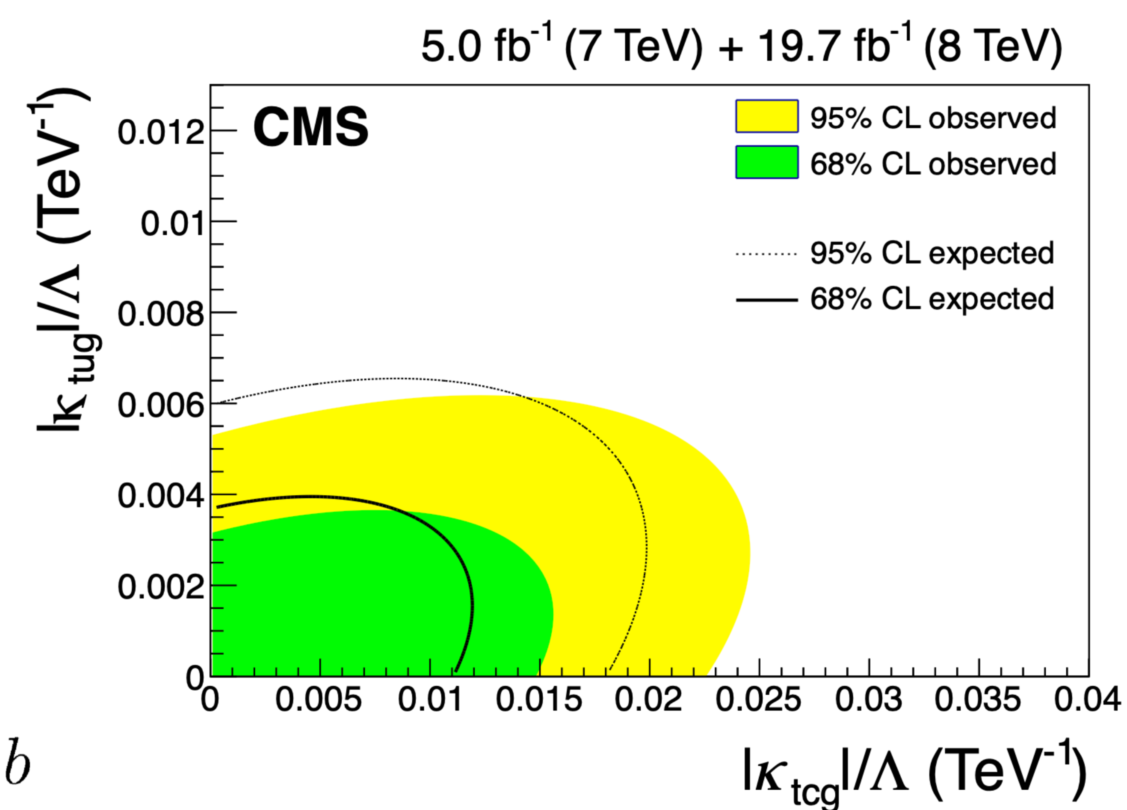
JHEP 02 (2017) 028

EPJC 76 (2016) 55

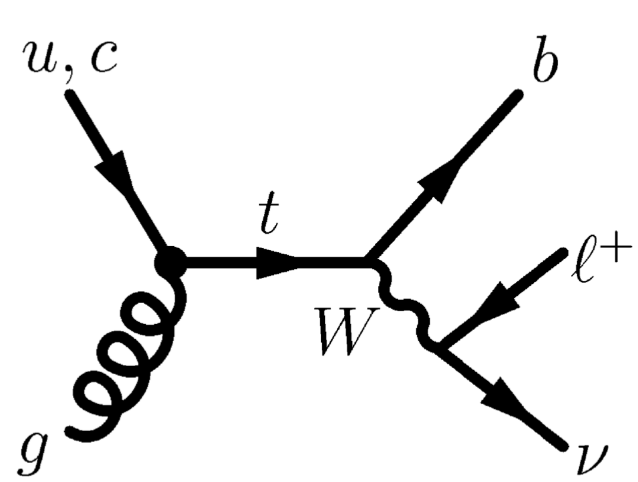








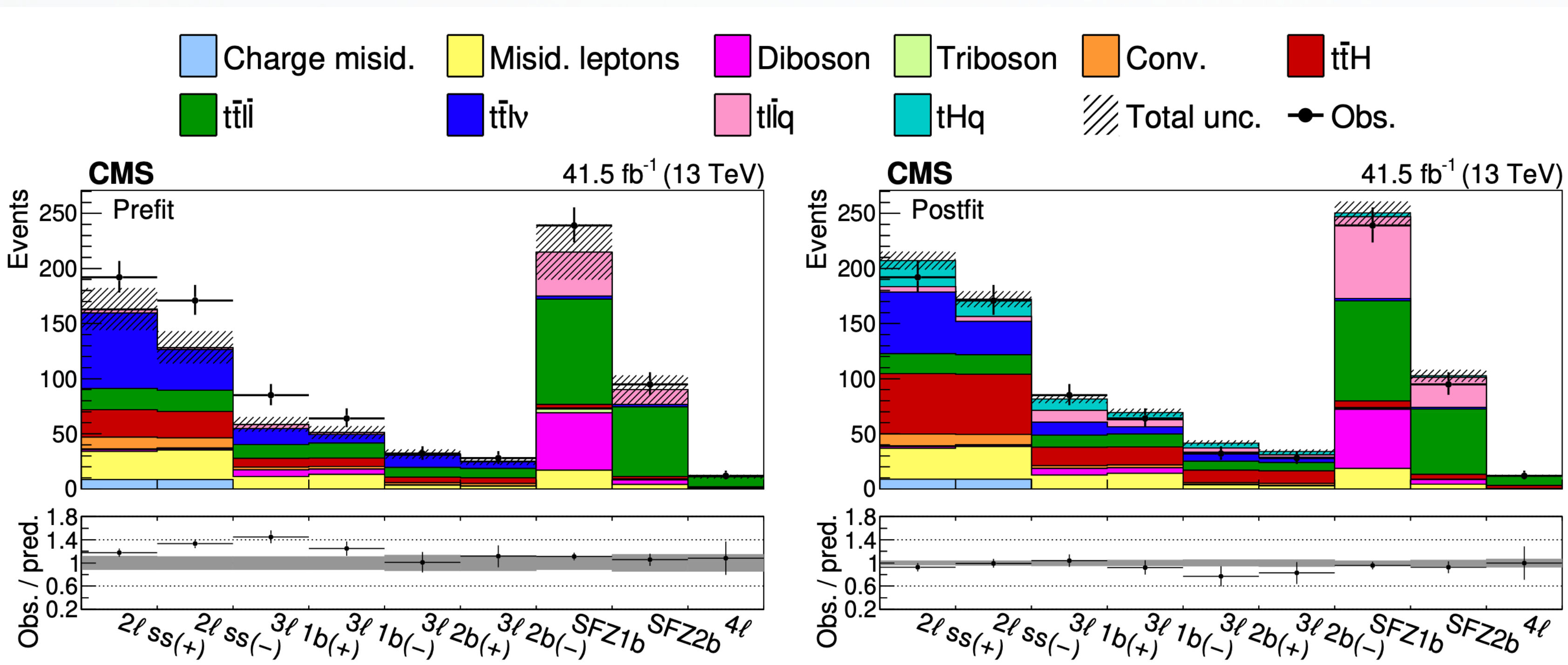
- **Data**: 8 TeV
- **Topology**: single top
- **Model**: kappa-framework
- **Target**: κ_{gqt}

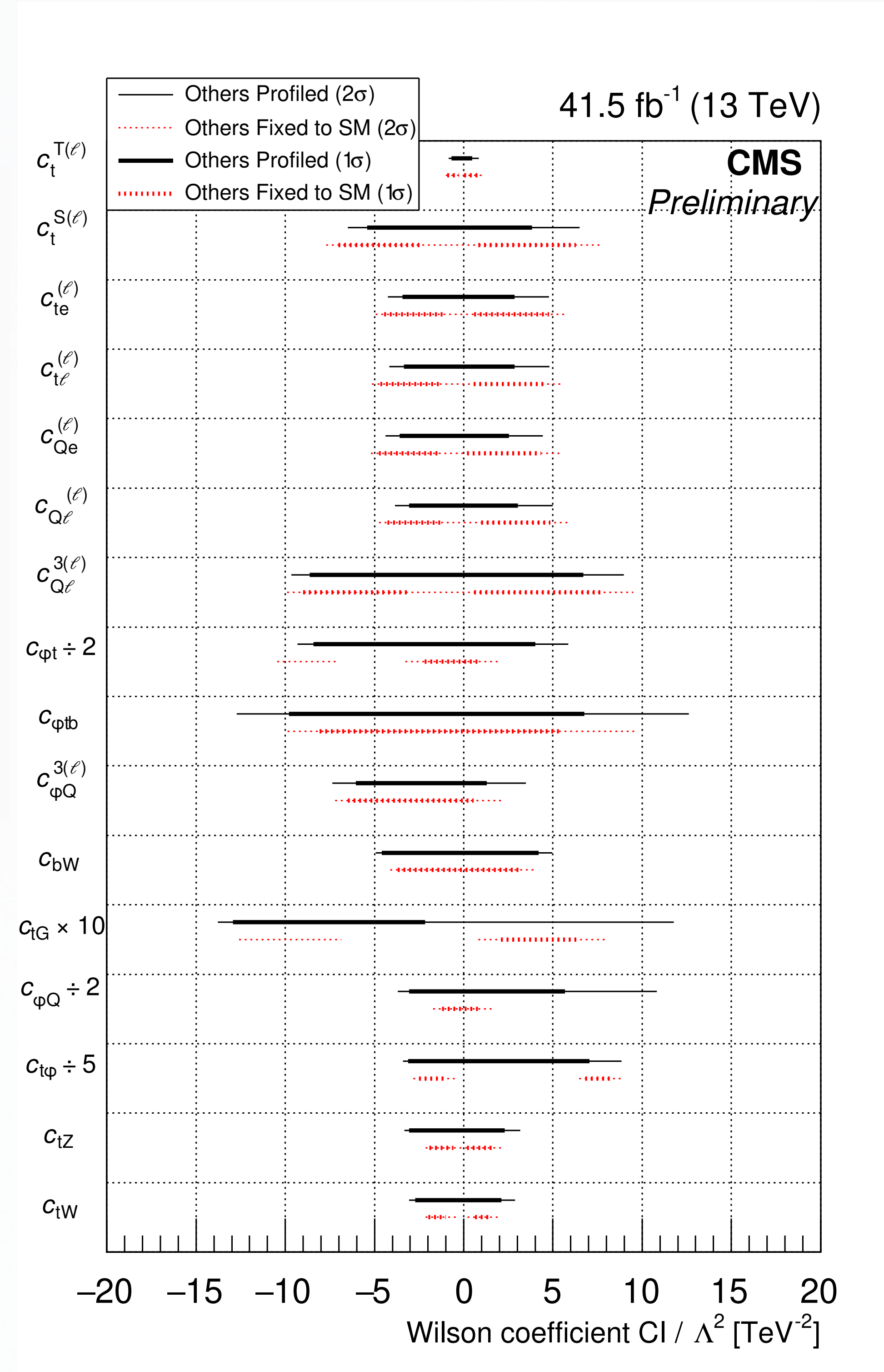


- **Data**: 7+8 TeV
- **Topology**: single top
- **Model**: kappa-framework
- **Target**: κ_{gqt}

ttX

JHEP 03 (2021) 095



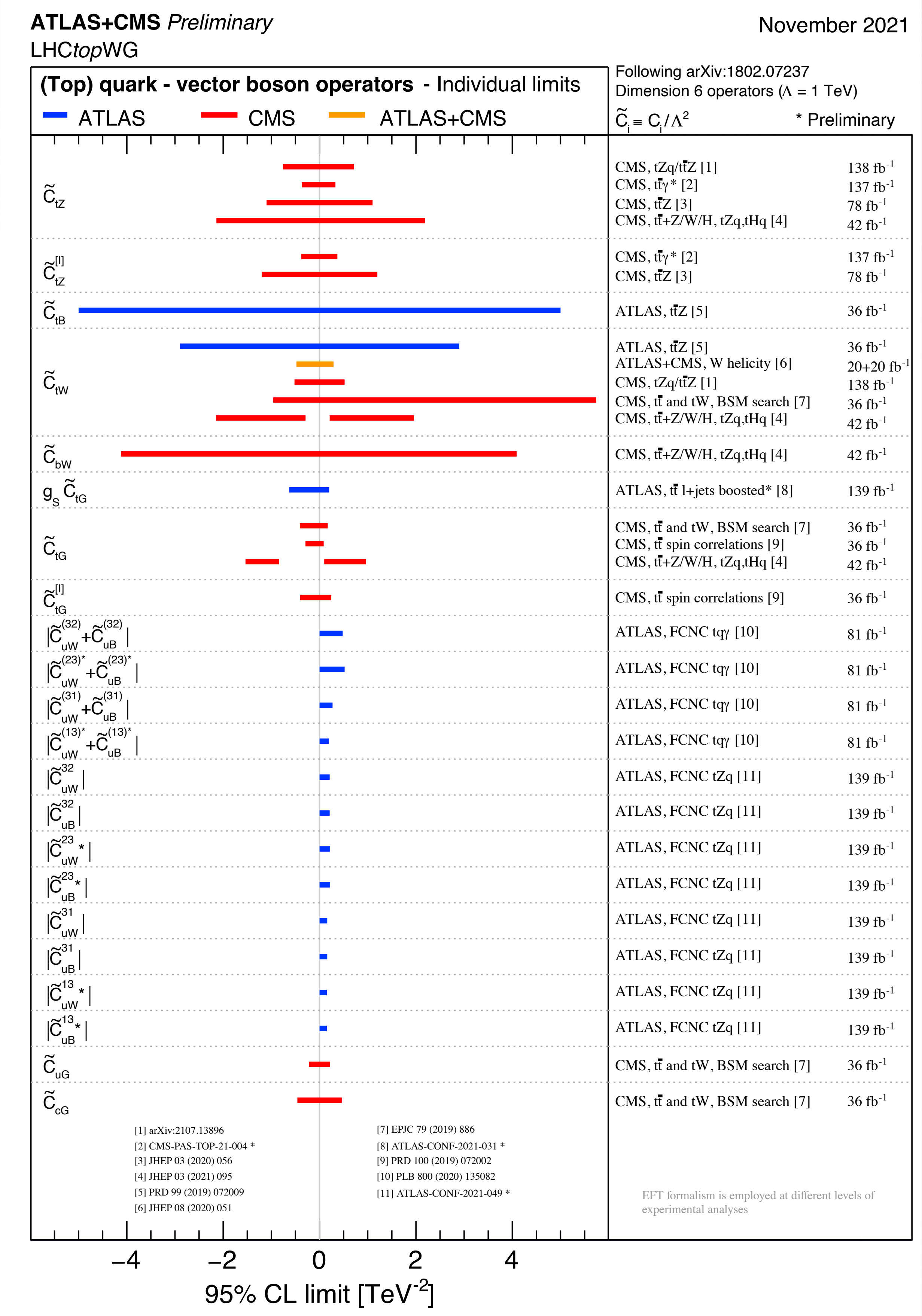


- **Data**: 2017
- **Topology**: Multilepton
- **Method**: Direct measurement
- **Model**: dim6top
- **Target**:

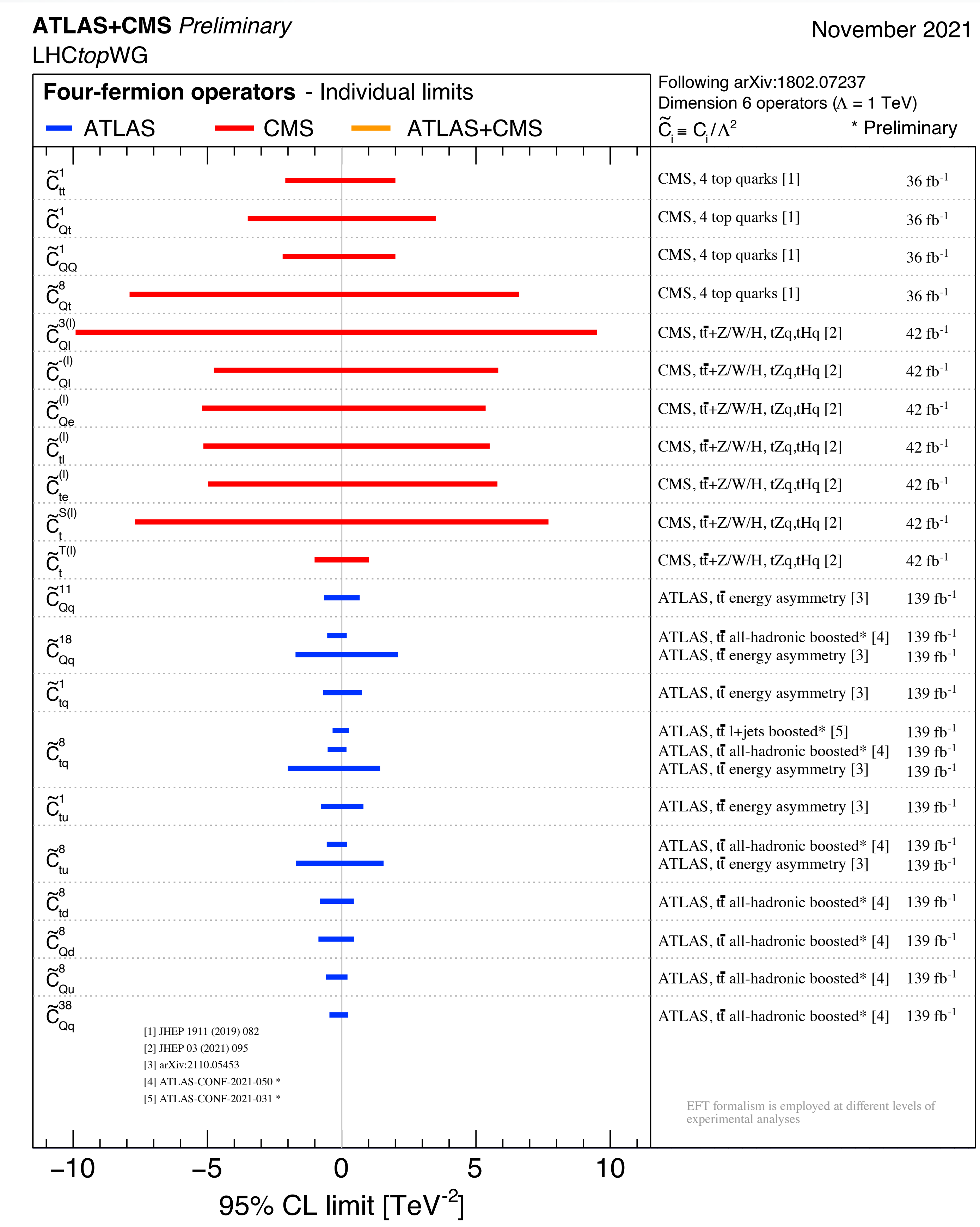
C_{tW}, C_{tZ}, $C_{t\varphi}$, $C_{\varphi Q}$, C_{tG}, C_{bW}, $C^{3(\ell)}_{\varphi Q}$, $C_{\varphi tb}$, $C_{\varphi t}$, $C^{3(\ell)}_{Q\ell}$, $C^{(\ell)}_{Q\ell}$, $C^{(\ell)}_{Qe}$, $C^{(\ell)}_{t\ell}$, $C^{(\ell)}_{te}$, $C^{S(\ell)}_{t}$, $C^{T(\ell)}_{t}$

First LHCtopWG EFT Summaries

Caption: Summary of the 95% confidence level observed limits on the effective field theory Wilson coefficients of the dimension-6 operators related to (top) quark interaction with vector bosons, as obtained by the ATLAS and CMS Collaborations. The results are reported as individual constraints assuming new physics contributions from one specific operator at a time. Interpretations use the SMEFT framework and the Warsaw basis. The formalism is employed at different levels of the experimental analyses, from the interpretation of measured observables to a comparison of the data to simulations at the detector level. Most interpretations follow the LHC*top*WG recommendations from arXiv:1802.07237. In the measurement ATLAS-CONF-2021-031, the limit is derived for the coefficient C_{tG} normalised with the strong coupling, g_S, as implemented in SMEFT@NLO.

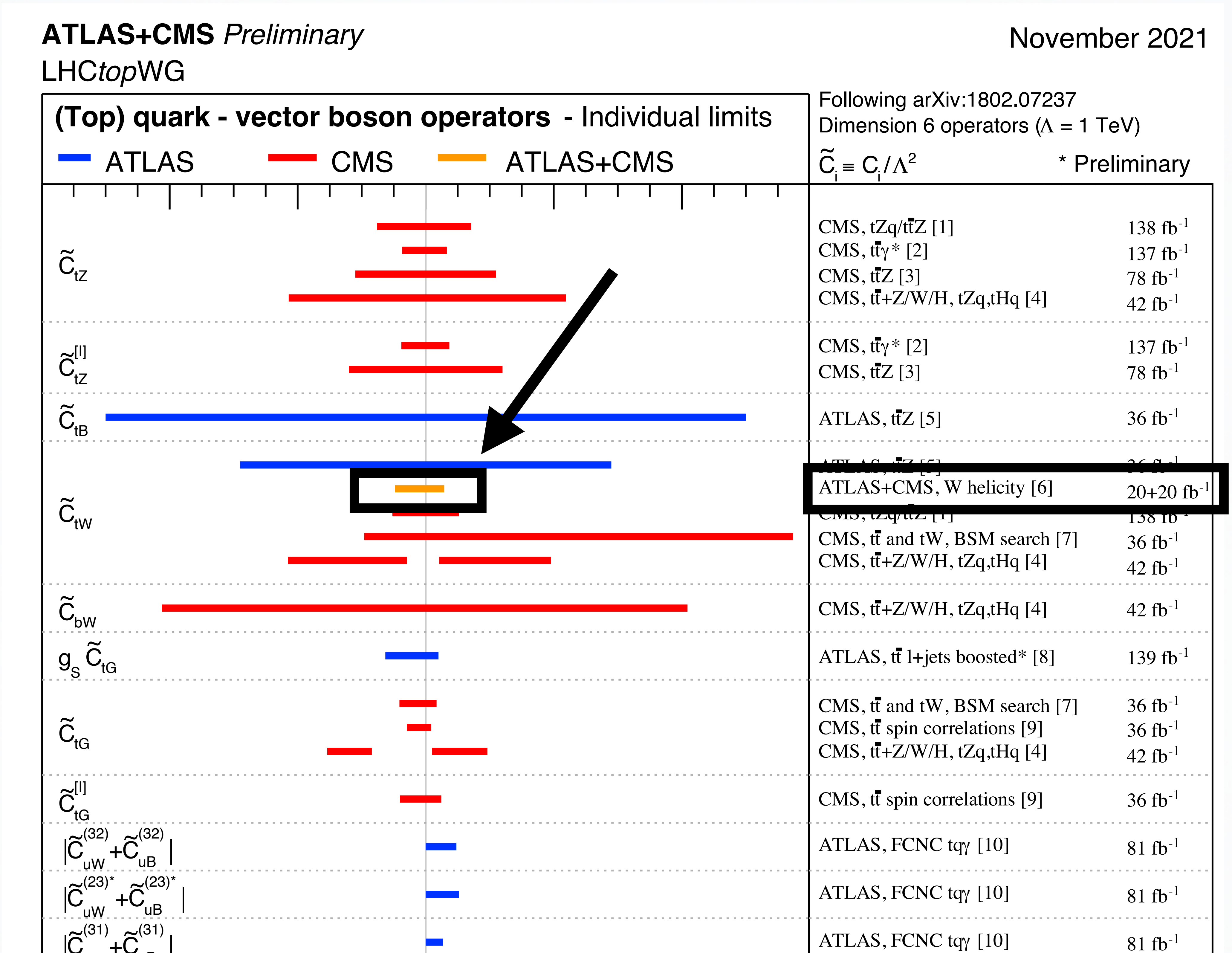


First LHC*top*WG EFT Summaries



Caption: Summary of the 95% confidence level observed limits on the effective field theory Wilson coefficients of the dimension-6 operators related to four-fermion interactions, as obtained by the ATLAS and CMS Collaborations. The results are reported as individual constraints assuming new physics contributions from one specific operator at a time. Interpretations use the SMEFT framework and the Warsaw basis. The formalism is employed at different levels of the experimental analyses, from the interpretation of measured observables to a comparison of the data to simulations at the detector level. Most interpretations follow the LHC*top*WG recommendations from arXiv:1802.07237.

First LHC*top*WG EFT Combination



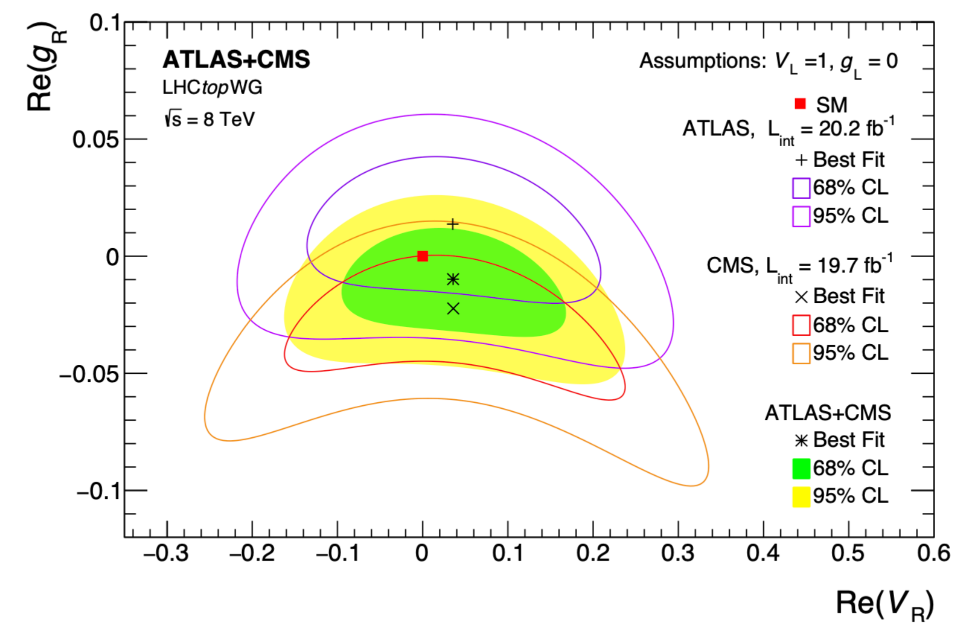
W boson helicity

- Combination of **W-helicity** measurements in ttbar and single top events at 8 TeV (20+20 fb^{-1})
- **EFTfitter** to perform the combination
- Interpretations using combined measurement
  → **Wtb** anomalous couplings
  → **EFT** operators (individual fits)

$$\mathcal{L} = -\frac{g}{\sqrt{2}}\bar{b}\gamma^{\mu}\left(V_L P_L + V_R P_R\right) t W_{\mu}^{-} - \frac{g}{\sqrt{2}}\bar{b}\frac{i\sigma^{\mu\nu}q_{\nu}}{M_W}\left(g_L P_L + g_R P_R\right) t W_{\mu}^{-} + h.c.\,,$$

$$-L^{\mathrm{eff}} = \mathcal{L}^{\mathrm{SM}} + \Sigma_x \frac{C_x}{\Lambda^2} O_x + \mathcal{O}\left(\frac{1}{\Lambda^3}\right) + \cdots$$

$$O_{\phi\phi} = \mathrm{i}(\tilde{\phi}^{\dagger} D_{\mu}\phi)(\bar{\mathrm{t}}_{\mathrm{R}}\gamma^{\mu}\mathrm{b}_{\mathrm{R}}),$$
$$O_{\mathrm{tW}} = (\bar{\mathrm{q}}_{\mathrm{L}}\sigma^{\mu\nu}\tau^{I}\mathrm{t}_{\mathrm{R}})\tilde{\phi}\mathrm{W}^{I}_{\mu\nu},$$
$$O_{\mathrm{bW}} = (\bar{\mathrm{q}}_{\mathrm{L}}\sigma^{\mu\nu}\tau^{I}\mathrm{b}_{\mathrm{R}})\phi\mathrm{W}^{I}_{\mu\nu},$$

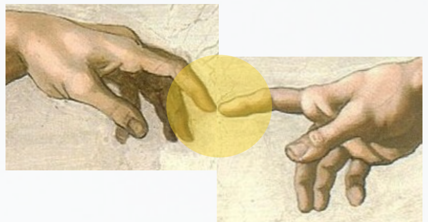


	95% CL interval		
Coefficient	ATLAS	CMS	ATLAS+CMS combination
$C^{*}_{\phi\phi}$	$[-5.64, 7.68]$	$[-3.84, 4.92]$	$[-3.48, 5.16]$
C^{*}_{bW}	$[-1.30, 0.96]$	$[-1.06, 0.72]$	$[-0.96, 0.67]$
C_{tW}	$[-0.34, 0.67]$	$[-0.62, 0.19]$	$[-0.48, 0.29]$

EPJC 76 (2016) 432

JHEP 08 (2020) 051

Summary



- **First** ATLAS-CMS EFT summaries are available!
- A lot of **potential**: complementarity and synergy
- For the **first** time using W-helicity fractions: an EFT interpretation based on an LHC*top*WG combination of polarization measurements
- No real showstoppers from combining EFT results
- Today discussed analysis candidates and possible strategies
- Need to proceed with **practical** discussions
- Hoping for exciting EFT combinations to come up in 2022!