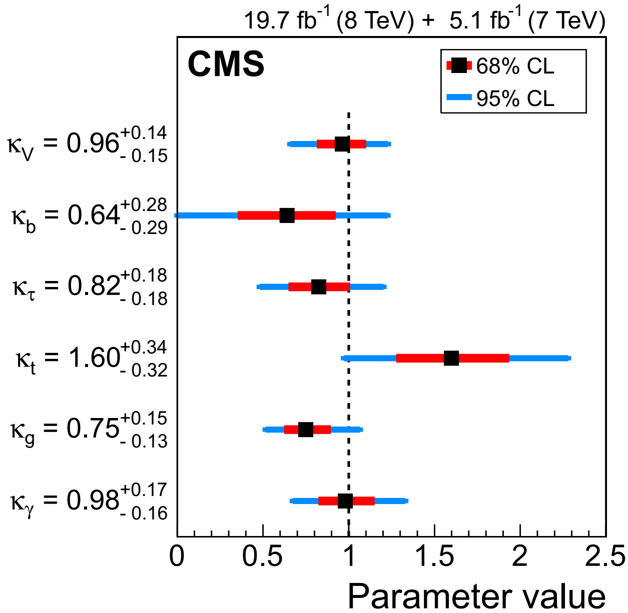

Fig. 16 Likelihood scans for parameters in a model with coupling scaling factors for the SM particles, one coupling at a time while profiling the remaining five together with all other nuisance parameters; from *top* to *bottom*: κ_V (W and Z bosons), κ_b (bottom quarks), κ_τ (tau leptons), κ_t (top quarks), κ_g (gluons; effective coupling), and κ_γ (photons; effective coupling). The *inner bars* represent the 68 % CL confidence intervals while the *outer bars* represent the 95 % CL confidence intervals

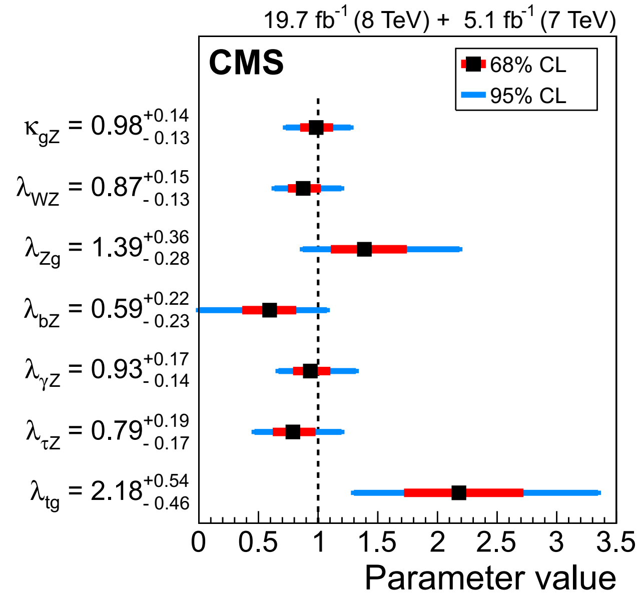

Fig. 17 Likelihood scans for parameters in a model without assumptions on the total width and with six coupling modifier ratios, one parameter at a time while profiling the remaining six together with all other nuisance parameters; from *top* to *bottom*: κ_{gZ} $(= \kappa_g\kappa_Z/\kappa_H)$, λ_{WZ} $(= \kappa_W/\kappa_Z)$, λ_{Zg} $(= \kappa_Z/\kappa_g)$, λ_{bZ} $(= \kappa_b/\kappa_Z)$, $\lambda_{\gamma Z}$ $(= \kappa_\gamma/\kappa_Z)$, $\lambda_{\tau Z}$ $(= \kappa_\tau/\kappa_Z)$, and λ_{tg} $(= \kappa_t/\kappa_g)$. The *inner bars* represent the 68 % CL confidence intervals while the *outer bars* represent the 95 % CL confidence intervals

7.6 Test of a model with scaling factors for SM particles

After having examined the possibility for BSM physics to manifest itself in loop-induced couplings while fixing all the other scaling factors, we now release the latter assumption. For that, we explore a model with six independent coupling modifiers and make the following assumptions:

- The couplings to W and Z bosons scale with a common parameter $\kappa_V = \kappa_W = \kappa_Z$.
- The couplings to third generation fermions, i.e. the bottom quark, tau lepton, and top quark, scale independently with κ_b, κ_τ, and κ_t, respectively.
- The effective couplings to gluons and photons, induced by loop diagrams, scale with free parameters κ_g and κ_γ, respectively.
- The partial width Γ_{BSM} is zero.

A likelihood scan for each of the six coupling modifiers is performed while profiling the other five, together with all other nuisance parameters; the results are shown in Fig. 16. With this set of parameters, the ggH-production measurements will constrain κ_g, leaving the measurements of ttH production to constrain κ_t, which explains the best-fit value, $\kappa_t = 1.60^{+0.34}_{-0.32}$. The current data do not show any statistically significant deviation with respect to the SM Higgs boson hypothesis. For every κ_i probed, the measured 95 % CL confidence interval contains the SM expectation, $\kappa_i = 1$. A goodness-of-fit test between the parameters measured in this model and the SM prediction yields a $\chi^2/\text{dof} = 7.5/6$, which corresponds to an asymptotic p-value of 0.28.

7.7 Test of a general model without assumptions on the total width

Given the comprehensiveness of the set of analyses being combined, we can explore the most general model proposed in Ref. [171], which makes no assumptions on the scaling of the total width. In this model, the total width is not rescaled according to the different κ_i values as a dependent parameter, but is rather left as a free parameter, embedded in $\kappa_{gZ} = \kappa_g\kappa_Z/\kappa_H$. All other parameters of interest are expressed as ratios between coupling scaling factors, $\lambda_{ij} = \kappa_i/\kappa_j$.

A likelihood scan for each of the parameters κ_{gZ}, λ_{WZ}, λ_{Zg}, λ_{bZ}, $\lambda_{\gamma Z}$, $\lambda_{\tau Z}$, and λ_{tg} is performed while profiling the other six, together with all other nuisance parameters. The results are shown in Fig. 17 and are in line with those found in Sect. 7.6.

7.8 Constraints on BR_{BSM} in a scenario with free couplings

An alternative and similarly general scenario can be built by allowing for $\Gamma_{BSM} > 0$. In order to avoid the degener-