• 6% relative uncertainty in the normalisations of the signal and non-$$t\bar{t}$$ backgrounds;
• 2% relative uncertainty in the $$b$$-tagging efficiency;
• 10% relative uncertainty in the light jet fake rate.

Similarly to Section 5.4 the expected limits on the FCNC-induced top-quark decays $$t \to Hu(c)$$ are calculated using the profile likelihood method [24] as described in Section 6.2. The statistical package RooStat [21] is used to combine all discriminant variables $$2'$$ into a single statistics following the statistical analysis method used in Ref. [10] where further details can be found. Table 14 shows the 95% C.L. limits on the FCNC-induced top-quark decays $$t\to Hq$$ estimated using the Asimov dataset fits in the different ATLAS detector upgrade scenarios.

![Table 14](image)

The profile likelihood fit with the systematic uncertainties shows a factor ~2, ~2.2 and ~2.6 degradation in the reference, middle and low upgrade scenario, respectively, as compared to the corresponding limits obtained using statistical uncertainties only. The degradation caused by the inclusion of systematic effects is thus significantly smaller than in the $$t\to Zq$$ case. In contrast to the $$t\to Zq$$ analysis, where the performance degradation in the limit setting with the systematic effects between reference and low scenarios is ~10%, in the $$t\to Hq$$ case this degradation reaches ~50%, while for the middle scenario it is ~20%. The different responses of the $$t\to Zq$$ and $$t\to Hq$$ FCNC limits to systematic uncertainties can be understood by the very different data statistics in these two analyses. The $$t\to Zq$$ analysis at 3000 fb$$^{-1}$$ uses ~3 · 10$$^4$$ data events, while for the $$t\to Hq$$ case the number of events is ~3 – 30 · 10$$^6$$ in the six analysis regions. The large number of expected data events and the use of multiple fit regions allow to constrain the background normalisations in the profile likelihood fit and, therefore, to reduce the influence of the background related systematic uncertainties on the $$t\to Hq$$ analysis sensitivity.

All assumed systematic uncertainties in the $$t\to Hq$$ analysis are expected to be strongly constrained (e.g. a reduction factor ~50 for the $$t\bar{t}$$ normalisation) in the profile likelihood fit when using a dataset corresponding to 3000 fb$$^{-1}$$. In future a significant reduction of systematic uncertainties is to be expected due to high statistics measurements using the HL-LHC data.