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## **Challenges and opportunities of $t\bar{t}b\bar{a}$ resonance search at the LHC (12' + 3')**

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The heavy scalar resonance search channel of  $gg \rightarrow S \rightarrow t\bar{t}$  is known to be very challenging, caused by a large destructive interference with the SM background. We analyze the line shapes of heavy scalars in several well-motivated beyond the standard model physics models. Commonly existing additional contributions to the glu-glu-scalar coupling change the relative phases of the signal and background amplitudes, inducing new opportunities in this channel. In many cases, we also make connections with the corresponding indirect constraints from the observed light Higgs boson properties. We further outline various methods to improve the LHC search in this channel.

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