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Monte Carlo generation involving searches for scalar resonances with diphoton in association with tau+ tau-/2 b-jets in ATLAS detector at the LHC

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A Monte Carlo generation campaign has been submitted under the HBSM subgroup to study a simplified model featuring the resonant production of scalar particles at the electroweak scale. The process under consideration is $gg \rightarrow H \rightarrow SS'$, where the scalar S (with a mass of approximately 150 GeV) decays to a diphoton final state ($\gamma\gamma$), and the accompanying scalar S' (with a mass of approximately 95 GeV) decays to either $b\bar{b}$ or $\tau^+\tau^-$. The motivation for these studies is rooted in the persistent multi-lepton anomalies observed in various channels at the LHC, as highlighted in combined searches for scalar resonances by ATLAS and CMS and further explored in the context of electroweak-scale scalar states decaying to photons, leptons, or b -jets [arXiv:2109.02650, arXiv:2306.17209, arXiv:2503.16245]. The MC production is designed for Run 3 conditions at a center-of-mass energy of $\sqrt{s} = 13.6$ TeV and will facilitate detailed kinematic studies and optimization of selection strategies in these channels.

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