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Searches for scalar resonances with di-photon in association with taus using the easyjet analysis framework in ATLAS detector at the LHC

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Recent studies (arXiv:2109.02650, 2306.17209, 2503.16245) have identified growing excesses in scalar resonances with di-photon at the Large Hadron Collider (LHC), suggesting the presence of scalar particles beyond the Standard Model. These scalar resonances are motivated by the multi-lepton anomalies at the LHC which indicate a potential new scalar particle S with a mass of approximately 151.5 GeV, originating from a heavier scalar H with a mass near 270 GeV, with a global significance of $\sim 5\sigma$. Motivated by these findings, the HBSM group within the HMBs physics group at ATLAS has launched a new analysis using the easyjet analysis framework. This analysis focuses on searching for scalar resonances through di-photon production in the process $gg \rightarrow H \rightarrow SS'$, where $S \rightarrow \gamma\gamma$ and S' decays to $S' \rightarrow \tau_h \tau_\ell$. We are preparing to use the analysis tools to analyse the 2022-2024 Run-3 data with an integrated luminosity of 183 fb^{-1} at $\sqrt{s} = 13.6 \text{ TeV}$

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