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Investigation and mitigation of anomalous power absorptions in the Advanced Virgo Plus core optics

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Advanced gravitational waves detectors revealed until now a significant number of signals from the mergers of compact objects with amplitudes of the order of 10^(-21)-10^(-22). The necessity to increase the detection volume and the number of candidate sources requires an improvement of the sensitivity of the interferometers (ITF). For this purpose, an increase of laser power in the ITF and high stability are required.
During O3 observing run, small, highly absorbing areas on the surfaces of the main interferometer optics of Advanced Virgo have been observed. These anomalous micron-scale absorbers produce distortions as additional thermo-elastic deformation of the high reflectivity mirrors surfaces and thermal lensing in the optics substrate. With the aim to understand and mitigate their effects in the interferometer, a detailed and quantitative study of their characteristics has been carried out. The information about their position and fraction of absorbed power allows to put the basis for the development of an adaptive actuator, able to correct these aberrations in the Advanced Virgo Plus (AdV+) test masses. Here the analysis of AdV+ input mirrors surfaces, point absorbers identification and characterization, the corresponding thermo-elastic deformation and its compensation are presented.

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