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Stray light from dust in Virgo

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Surface roughness of optics and dust contamination are two main sources of stray light in advanced GW detectors: stray light can not only contribute extra noise if it recouples to the main beam when reflected by vibrating surfaces, but can also spoil the control signals of the interferometer.
Given the extremely low roughness of the optics employed, dust contamination is critical as it can easily become the leading contributor to scattered light even in the clean environment of Virgo. Predicting dust contamination on the optics' surface based on environmental measurements with commercial particle counters is however very difficult and prone to big uncertainties. Instead, we monitor dust contamination in Advanced Virgo directly: we use silicon wafers as dust witness samples by placing them on the different optical benches and exposing them to the same local environment and activities as the optics we want to monitor. We use a photographic setup to take pictures of the exposed samples and thereby determine the amount of deposited dust as well as its distribution as function of particle diameter: these values serve as input for inferring the BSDF of the polluted optics and hence the amount of produced stray light. We report about the results obtained for the Quantum Noise Reduction subsystem of Advanced Virgo.

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