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Upgrades to the detection optical benches of Virgo in preparation for the next observing run O5

The Virgo experiment, alongside the American LIGO and Japanese KAGRA detectors, forms an international network of gravitational wave detectors currently in operation. The Virgo detector is a three-kilometer-long double-recycled Fabry Perot Michelson interferometer built near Pisa, Italy. Challenges related to this current optical configuration of Virgo has lead to a redesign of the interferometer's recycling cavities for the next upgrade cycle, in order to improve instrument sensitivity and control. The new, non-degenerate recycling cavities design lead among other changes to a complete redesign of the auxiliary benches hosting the injection and detection optics. In this work we will present adaptions choices to the opto-mechanical design of the detection benches for the stable recycling cavities to be implemented in Virgo, for which low beam jitter, low optical losses, high mode-matching quality between the signal recycling cavity and output mode cleaner cavity, reduction of scattered light and protection of delicate components against power peaks to due interferometer misalignment, are all critical in order to collect the output beam which contains the gravitational wave signal.

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