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Tracing and damping ghost beams for Virgo in O5: a lesson for ET

An ideal design of the Einstein Telescope would assume perfect coatings and alignment, and would foresee no polarization leakage. However, non-idealities, such as residual reflectivity of antireflection coatings or residual transmissivity of mirrors, a number of "ghost beams"are generated. These are beams that should nominally not exist, serve no purpose and are not directly handled and routed in the ideal optical layout of the interferometer. If unstopped, they can easily spoil the sensitivity of the detector by generating additional interfering signals and generically causing stray light noise. To obtain a realistic design, it is mandatory to take into account the presence of those unwanted beams in a ray tracing simulation, useful for planning adequate measures to block all ghost beams before they become harmful.
We report on our recent experience with Virgo in the context of the new Stable Recycling Cavities: in particular, we show a ghost beam ray tracing study for the Power and Signal Recycling cavities, developed with the commercial software Zemax. We discuss how our case studies offer insights for planning ray tracing simulations for ET.

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