Modeling of Optical Scattering in Advanced LIGO

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In a quantum limited sensitivity interferometer such as LIGO, light which scatters from an optic can introduce noise in the phase measurement at the antisymmetric port, as well as become a significant source of power loss. By measuring power seen by a camera or photodiode in a well defined position, outside of the beam path, one can use the incident light in order to model the total amount of light scattered from the optic. We have used the bidirectional reflectance distribution function on data obtained from photodiodes along the beam tubes baffles to model scattering from LIGOs test masses during each alignment since the first transmission of Advanced LIGO. This data acquisition and analysis has been automated for ease of future analysis. We have also experimentally determined 8 and 12 bit monochromatic count to Watt conversion factors for the Basler Ace 100gm cameras, currently used to monitor light within the interferometer, so that archived images may be used as a data source for the model.