

Study of the inhomogeneity in a sapphire substrate for KAGRA

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KAGRA is a first large-scale cryogenic interferometric gravitational-wave detector. Its four test masses are C-axis sapphire crystals with high thermal conductivity and presumably no birefringence for the transmitting 1064nm laser beam. It has turned out, however, that one of the sapphire substrates shows a steep ridge toward the 3 o'clock direction. This kind of inhomogeneity causes a local lensing effect in the beam coming out from a high-finesse arm cavity, resulting in a possible mode-mismatching in the output mode-cleaner or in an undesirable offset in the alignment control signal. We created a simulation model with modal-model simulation software FINESSE and investigated effects of the inhomogeneity (see Fig.1). This poster shows a number of simulation results and we discuss if the KAGRA interferometer can tolerate this problem.

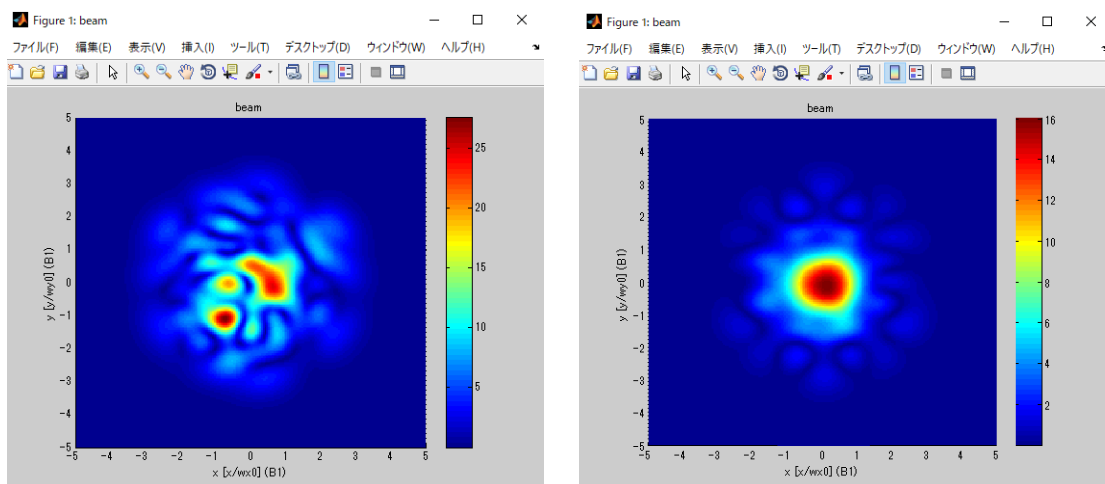


Fig.1 Simulated beam shape at the signal extraction port with (left panel) and without (right panel) the substrate inhomogeneity.