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Modelling the effects of optical vibrations on photon beam parameters using ray-tracing software

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A method to simulate beam parameters observed at a beamline sample point in the presence of motion of optical components has been developed at Diamond Light Source. Stationary ray-tracing simulations are used to model the impact on the beam stability caused by dynamic motion of optical elements. Ray-tracing simulations using SHADOW3 in OASYS, completed over multiple iterations and stitched together, permit the modelling of a pseudo-dynamic beamline. As beamline detectors operating at higher frequencies become more common, the beam stability becomes crucial. Synchrotron ring upgrades to low emittance lattices require increased stability of beamlines in order to conserve beam brightness. By simulating the change in beam size and position an estimate of the impact certain motions have on stability is possible. The results presented in this paper focus on modelling the physical vibration of optical elements. However, the basic principle can be applied to any parameter which dynamically changes. Multiple situations can be analysed in succession without manual inputs. In this paper we describe the simulation code and present the results obtained. This method can be applied during beamline design and operation for the identification of optical elements that may introduce large errors in the beam properties at sample point.

Primary author: Ms HOUGHTON, Claire (Diamond Light Source)

Co-authors: ALIANELLI, Lucia (Diamond Light Source);   Mr BLOOMER, Chris (Diamond Light Source Ltd.)

Presenter: Ms HOUGHTON, Claire (Diamond Light Source)

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