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Title:Hard-field THz tomography
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Abstract:We report on hard-field tomography measurements in the THz spectral range and subsequent image reconstruction of a phantom subject. At THz wavelengths, the traditional hard-field tomography approach to measure attenuation is hindered by a substantial diffusely scattered component. Consequently, we work in optical density image contrast, as opposed to material density typical in high-energy hard-field modalities, such as X-ray CT. The hard-field component of the signal is extracted with a spatial filter, efficiently suppressing the soft-field contributions from the imaged subject. Using time-domain THz spectroscopy, line integrals of the real part of the refractive index are taken, by measuring the delay of the THz pulse across the subject at 12 angles and 0.5 mm steps in the transversal direction for each angle. The delay values are calculated from the location of the first peak in the integrated time-domain waveforms. This is justified by the physics of THz generation with ultrashort pulses in a biased-gap antenna and is shown to be superior to existing alternatives. The resulting tomography projections provide evidence for the hard-field character of the line integrals. The quality of the reconstructed image is interpreted and discussed, together with some limitations and future avenues.
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