

QUANTITATIVE ANALYSIS OF IMAGING QUALITY IN PROPAGATION-BASED PHASE-CONTRAST TOMOGRAPHY

T.E. Gureyev¹, Ya.I. Nesterets¹ and G. Tromba²)

¹) Commonwealth Scientific and Industrial Research Organisation, Melbourne, Australia

²) Elettra-Sincrotrone, Trieste, Italy

Abstract

A systematic approach to analysis and optimization of imaging quality of propagation-based phase-contrast X-ray computed tomography (PCT) will be discussed. Quantitative effects of phase contrast and phase retrieval on key imaging parameters, such as spatial resolution, contrast-to-noise ratio, X-ray dose and two recently proposed characteristics, "gain factor" and "intrinsic imaging quality", will be evaluated. It will be shown that PCT can deliver a substantial improvement in these objective quality characteristics of the reconstructed tomographic images compared to conventional (absorption-based) techniques. A theoretical basis for such an improvement will be proposed and examples of recent experimental studies will be presented where the corresponding results have been verified in practice. These results confirm, explain and quantify the significant potential benefits achievable with the use of 3D X-ray phase-contrast imaging and phase-retrieval techniques.