How to handle model uncertainty and motion in Compton Scattering Tomography

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Abstract: Modelling the Compton scattering effect leads to many challenges such as non-linearity of the forward model, multiple scattering and high level of noise for moving targets. While the non-linearity is addressed by a necessary linear approximation of the first-order scattering with respect to the sought-for electron density, the multiple-order scattering stands for a substantial and unavoidable part of the spectral data which is difficult to handle due to highly complex forward models. However, The smoothness properties of the operators modelling the different scattering orders suggests that differential operators can be used to reduce the level of multiple scattering. Last but not least, the stochastic nature of the Compton effect may involve a large measurement noise, in particular when the object under study is subject to motion, and therefore time must be taken into account. To tackle these different issues, we explore and discuss in this talk the possibilities to use the well-established regularized sequential subspace optimization methods (RESESOP) as well as a stochastic approach based on the generalized Golub-Kahan bidiagonalization.