# CUQI – A RESEARCH INITIATIVE IN UNCERTAINTY QUANTIFICATION FOR INVERSE PROBLEMS

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Since 2019 we have worked on developing a practical framework for applying uncertainty quantification to inverse problems. This includes a python software package for UQ modeling and computations, called CUQIpy.

Our work contributes to the basis for UQ studies of a range of linear and nonlinear inverse problems with different priors and noise models. Specifically, building on the Bayesian framework we develop a modeling and computational platform, including an abstraction layer aimed at non-experts, which is implemented in the UCQIpy software. Note that this software is the focus of the training course Monday–Tuesday.

In this talk I highlight some of our results and methods, with examples from X-ray computed tomography (CT) and other applications. For CT problems, I describe how we handle uncertain projection angles, how we include structural priors tailored to the geometry of the scanned object, and how we use a goal-oriented approach to compute inclusion boundaries and their roughness. I also show how we use the same computational framework to perform UQ of PDE problems, illustrated with a transport model for the cochlear aqueduct. Finally, I show how implicitly defined priors, such as nonnegativity, can be interpreted and handled satisfactorily in the Bayesian framework.

This is joint work with all the members of the CUQI project:
https://sites.dtu.dk/cuqi