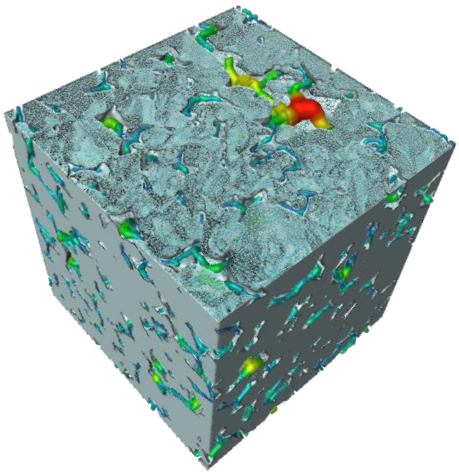
Master thesis subject jointly proposed by UPPA and Total EP

Accurate modelling of an X-ray detector



Context

This thesis subject is proposed by UMS 3360 DMEX (Développement de Méthodologies Expérimentales) within the framework of the X-ray imaging chair. DMEX is the X-ray Imaging Center at UPPA (https://imagingcenter.univ-pau.fr/).

The X-ray imaging chair is a collaboration between UPPA, the CNRS and the energy major Total. The Chair aims to improve the understanding of multiphase flows in porous media.

Thesis subject

X-ray tomographs are used to observe the 3D microstructure of objects in a non-destructive way. The working principle is pretty straightforward: X-ray photons are emitted from an X-ray source and travel through the sample before impinging on the detector. If the sample is very dense, most photons don't make it through, and the image is black. Conversely, photons easily travel through less dense material, yielding white images. The local grey value of the images thus informs about the density of the sample material. The amount of attenuation, i.e. the reduction of the beam intensity, is characteristic for each material and has been measured by NIST. However, in ordre to be able to relate grey levels to materials, we need to know the so-called detector response function. This one characterises how much brighter an image gets with each collected photon. Ideally each photon would have an equal contribution, yielding a linear function. Reality is however quite different.

The goal if this thesis subject is to characterize the detector response function for a given X-ray detector. We dispose of a series of measurements of grey values, corresponding to different known materials and material thicknesses, and this for various photon energy spectra. We also have a database of material properties and a forward simulation tool. Validation of the obtained response function is an integral part of the internship.

Practical info

Pre-requisites:	notions on programming with Python, Matlab or similar. Interest in optimisation problems.
Location:	UPPA, UMS 3360 DMEX, 64000 Pau, France
Duration :	4 months FTE (full time equivalent)
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