PhD position

Toward Improved X-ray imaging :
Use of a new generation detector based on phantom counting

Project: X-ray microtomography has been extensively used to characterize the 3D microstructure of materials, with or without a stimuli. The obtained data is important in a variety of materials such as metals, fiber reinforced composites, or geo-materials. This technique, based on the acquisition of 2D images (radiographs), provides a 3D map of the local absorption of the considered sample. First initiated in synchrotron, the development of laboratory X-ray tomographs has enlarged opportunities and utility of this technique.

Recent advances in so-called 'color-detectors' offers several advantages over conventional detectors. These advantages range from fast read out time, high efficiency for all the energy of the polychromatic beam provided by laboratory X-ray source, and a capacity to select the energy of the beam in each pixel of the detector. Such a detector has the potential to reveal otherwise inaccessible phase data by selective irradiation at different beam energy.

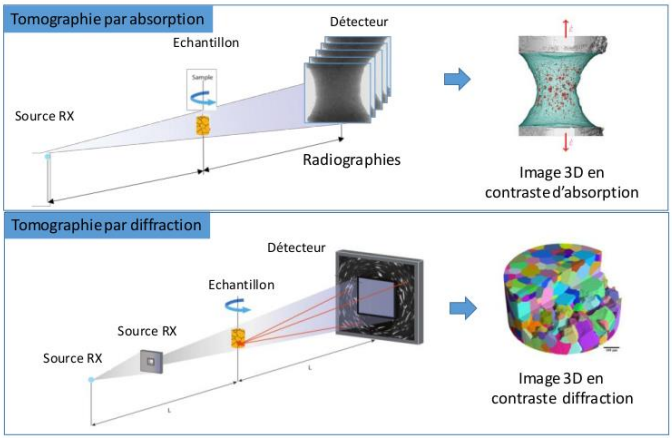

Fig 1 : expected results (a) absorption tomography (b) diffraction contrast tomography (McDonald2015)

During this PhD project, two possibilities of the detector will be investigated to increase the contrast in the image provided by a laboratory X-ray microtomography :

- Selection of the energy (fig1 top): The PhD fellow will develop strategies to acquire data and reconstruct X-ray tomography data sets using this mode of the detector with the following constraints: i) the acquisition time must be reasonable, and ii) the obtained 3D data set must have a high signal to noise ratio. The development will first be based on model materials such as green materials (panels constituted of wood fibers glued together with cellulose based glue) and then on synthetic functional materials such fiber reinforced composite or materials obtained by additive manufacturing (Al-Mg-Si for example)

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- Toward X-ray diffraction contrast tomography (fig. 1 bottom) : The PhD fellow will develop strategies to acquire data and reconstruct X-ray tomography data sets to reveal information on the crystallographic orientation of grains that constitute the sample. The method will be developed on model materials such ice or pure Al and then on functional materials such Al-Mg-Si.

Background of PhD candidate: Applicant must hold a master of science or an engineering degree in material science, physics or applied mathematics. The candidate must be able to propose procedures for both acquisitions and reconstruction and must be able to work within a team.

Location : The PhD will take place in Grenoble France (fig 2a) in two laboratories SIMAP and 3SR which are both recognized for their expertise in X-ray microtomography and are equipped with a nanotomograph (fig2b).

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*Fig 2a : Grenoble's campus

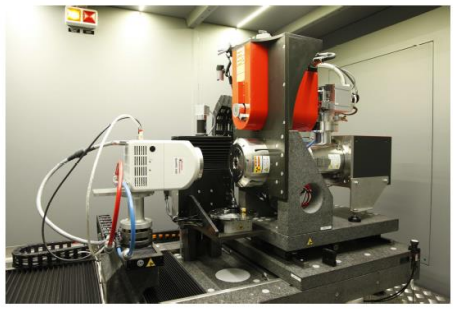

Fig 2b : Photogrpah of the lab tomograph