

Radiation dose estimation for region-of-interest CT scans

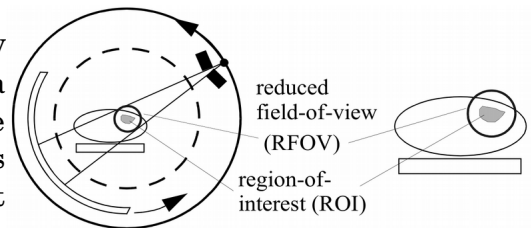
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Context. Region-of-interest computed tomography (CT) refers to the hypothetical situation of using a reduced field-of-view when performing a CT scan. The theoretical basis for image reconstruction in this geometry is now well-known [1]. One potential benefit of region-of-interest scanning is the relatively low radiation dose to tissues outside the reduced field-of-view [2]. However, the reconstructed region-of-interest might not have the same image quality as the situation for conventional full-field scanning. The goal of the ANR-funded project “ROIDoré” is to understand this dose versus image quality trade-off. The ROIdoré project is based at the TIMC laboratory in Grenoble, with scientific partners in Lyon, Brussels, Salzburg, and Ottawa.



Objectives. This project concerns the dose estimation component of the broader ROIdoré project. The objective is to obtain a collection of “dose ratio” maps which indicate, at each point in the patient cross-section, the ratio of absorbed dose when comparing the reduced field-of-view scan with a conventional full-field scan. Analytic dose calculations could be based on the exponential Radon transform. Monte Carlo methods [3] will also be used to model the situation where confounding physical effects such as Compton scatter are present. The dose maps will be validated with scans performed using simple phantom objects. Dose measurements and scanning will be performed at The Ottawa Hospital in Canada.

Practical Information. The duration of this PFE or Masters project is 6 months. A subsequent Ph.D. might be possible. The primary location is the TIMC laboratory (Grenoble). The supervisors are Rolf Clackdoyle (rolf.clackdoyle@univ-grenoble-alpes.fr) and Laurent Desbat (laurent.desbat@univ-grenoble-alpes.fr). A second project on the complementary topic of radiation dose estimation for the ROIdoré project is also available.

References.

- [1] Clackdoyle R, Defrise M. 2010. “Tomographic reconstruction in the 21st century. Region-of-interest reconstruction from incomplete data.” *IEEE Signal Processing Magazine* **27**: 60-80.
- [2] Parsons D, Robar JL. 2015. “An investigation of kV CBCT image quality and dose reduction for volume-of-interest imaging using dynamic collimation.” *Medical Physics* **42**: 5258-5269.
- [3] Smekens F, Létang JM, Noblet C, Chiavassa S, Delpon G, Freud N, Rit S, Sarrut D. 2014. “Split exponential track length estimator for Monte-Carlo simulations of small-animal radiation therapy.” *Physics in Medicine and Biology* **59**: 7730-7715.