PhD fellowship on Proton CT reconstruction

http://www.creatis.insa-lyon.fr/site/fr/node/43969

The CREATIS laboratory (http://www.creatis.insa-lyon.fr/, Lyon, France) opens a PhD fellowship on the topic of proton computed tomography (CT) reconstruction. The position is funded by the French state. The PhD student will join the research group that is located in the radiotherapy department of the Léon Bérard center which is a hospital focused on cancer care (http://www.centreleonberard.fr/). The investigations will be carried out in the frame of the Labex PRIMES (http://primes.universite-lyon.fr/, WP4: image reconstruction) in collaboration with the French pCT working group coordinated by the GDR MI2B (http://www.mi2b.fr/).

Medical and scientific context

Proton CT was among the first tomography techniques in the 1960s. However, its lower spatial resolution and its higher cost compared to photon CT slowed down its development until the advent of proton therapy in the 1990s. Today, proton CT is actively investigated by a few international teams because it could help improve the accuracy of proton treatment planning via a better characterization of tissues while lowering the imaging dose. CREATIS has recently started to investigate this field of research and a first breakthrough has been obtained with a practical filtered backprojection algorithm that improves spatial resolution (http://www.creatis.insa-lyon.fr/site/fr/publications/RIT-13).

Objective

The goal of this project is to investigate and evaluate new proton CT reconstruction algorithms to accurately reconstruct the 3D map of several properties of the patient tissues: the electron density, the ionization potential, the atomic number Z, and ultimately, the proton stopping power.

Research program

The PhD fellow will join a small research group composed of one postdoctoral fellow and a few permanent people from CREATIS and the IPNL (http://www.ipnl.in2p3.fr/) laboratories. It is expected that the following tasks will be carried out:

- Develop simulated test cases with Monte Carlo techniques in GATE (http://www.opengatecollaboration.org/) to evaluate the algorithms in clinically relevant situations based on our experience (http://www.creatis.insa-lyon.fr/site/fr/publications/GREV-12),
- Evaluate the existing proton CT algorithm and compare with photon CT,
- Propose, implement and test new proton CT reconstruction algorithms. The new reconstruction algorithms could make use of nuclear interactions (currently discarded) and/or other imaging modalities. The implementation will use the Reconstruction Toolkit (RTK) (http://www.openrtk.org/).

Profile

- **Education**: The candidate must hold a master in image processing, medical physics or particle physics.
- **Scientific interests**: computer sciences (medical image processing), mathematics (inverse problems and tomographic reconstruction), particle/medical physics.
- **Programming skills**: C++.
- **Languages**: English required, French optional.
- **Location**: Centre Léon Bérard, Lyon, France.
- **Salary (gross)**: 1685 euros/month.
- **Period**: 3 years starting fall 2013.

Contacts

Send CV by email to:

- Simon Rit: simon.rit@creatis.insa-lyon.fr
- Jean Michel Létang: jean-michel.letang@creatis.insa-lyon.fr