

The Institute of Nuclear physics of Lyon (IPNL) opens a postdoc position on proton computed tomography (CT) reconstruction. The position is funded by the *fondation pour la recherche médicale (FRM)* in the framework of a collaborative project with the biomedical imaging lab CREATIS. The postdoctoral fellow will be based at the radiotherapy department of the *Léon Bérard center* which is a hospital focused on cancer care.

Medical and scientific context

Proton therapy is a radiation treatment aiming at improving the ratio between the dose to the target and the dose to healthy tissues [1]. Range uncertainties currently represent the biggest caveat for the exploitation of the full potential of proton therapy [2]. To better predict proton range in tissues and produce more conformal treatment plans, we propose to directly derive the proton range from proton computed tomography (pCT).

pCT suffers from artefacts stemming, e.g., from multiple Coulomb scattering and nuclear collisions. The goal of the postdoctoral fellow will be to improve the spatial resolution and the accuracy of pCT. The investigations will be focused on improving the tomographic reconstruction algorithm by improving the scanner model in the reconstruction algorithm, both in list [3] and integral [4] modes. He/She will join a research group investigating proton imaging using existing hardware, in collaboration with other groups for advanced prototypes

Objectives and research program

Several challenges still need to be addressed to fully exploit the potential of proton imaging. The postdoctoral fellow will reformulate the image reconstruction problem with a better modeling of proton physics. He/She will develop and implement an algorithm to solve the resulting inverse problems. The postdoctoral fellow will also participate in the acquisition and the processing of proton imaging.

Qualifications

- **Education:** PhD in computer sciences or physics.
- **Scientific interests:** computer sciences (medical image processing), particle physics, medical physics, mathematics (inverse problems and tomographic reconstruction).
- **Programming skills:** Matlab, Python or C++.
- **Languages:** Command of English required, French optional.
- **Location:** Centre Léon Bérard, Lyon, France.
- **Salary (net):** depending on experience, starting at 2000 euros/month.
- **Period:** 1 year renewable once, starting as soon as possible.

Contacts

Send CV, PhD thesis and a brief statement of interest by email to Simon Rit (simon.rit@creatis.insa-lyon.fr).

References

- [1] A.R. Smith. Vision 20/20: proton therapy. *Med Phys*, 36(2):556–568, Feb 2009.
- [2] H. Paganetti. Range uncertainties in proton therapy and the role of Monte Carlo simulations. *Phys Med Biol*, 57(11):R99–117, Jun 2012.
- [3] S. Rit, G. Dedes, N. Freud, D. Sarrut, and J.M. Létang. Filtered backprojection proton CT reconstruction along most likely paths. *Med Phys*, 40(3):031103, 2013.
- [4] N. Krah, M. Testa, S. Brons, O. Jäkel, K. Parodi, B. Voss, and I. Rinaldi. An advanced image processing method to improve the spatial resolution of ion radiographies. *Phys Med Biol*, 60(21):8525–8547, Oct 2015.