

Master internship 2025 in Lyon, France.

### Monte Carlo simulation model of innovative SPECT systems.

*This work is a collaboration between researchers from the CREATIS lab and the nuclear medicine department of the Léon Bérard cancer center (Lyon, France).*

**Context.** Radiopharmaceutical Therapy (RPT), such as  $^{177}\text{Lu}$ -PSMA for castration-resistant prostate cancer, has been growing rapidly in recent years [1,2]. Personalized dosimetry is critical for maximizing tumor control while minimizing risks to healthy organs. This process relies on SPECT/CT imaging to estimate the pharmacokinetics of radiopharmaceuticals in the patient, but image quality is affected by various factors like attenuation and scatter [3-6]. Monte Carlo simulation provides an accurate method to optimize image acquisition and reconstruction, addressing these challenges.

**Objective.** The internship will focus on developing and validating a Monte Carlo model for the VERITON-CT system, a new CZT-based digital SPECT/CT camera recently acquired by the Léon Bérard cancer center. This system stands out due to its innovative scanning geometry, where the detectors can move radially and swivel independently, providing enhanced imaging flexibility and sensitivity [8]. Simulations will be performed with GATE10 [7], the very new version of GATE using python, multithreading and advanced AI-based variance reduction techniques. Detailed steps are:

1. Develop a Monte Carlo model of the Veriton with GATE10 (already started in the team)
2. Compare Monte Carlo model predictions with experimental data
3. Design new measurements, if needed, to further validate the model.
4. Reconstruct the activity distribution from projection data with RTK [9]

**Environment.** The student will work in a multidisciplinary team of nuclear physicians, medical physicists, researchers, and computer scientists of CREATIS laboratory and Leon-Bérard Cancer Center.

#### Expected skills and other information

- Expected skills: medical physics, computer sciences, image processing
- Technical skills: Python is required, experience with GATE would be an asset.
- English and French
- Location: Léon Bérard cancer center, Lyon, France

#### Supervisors:

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## References

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