Project for Master Thesis
Title: “Development of a Monte Carlo dose calculation reference tool for ion beam therapy”
@ Division of Medical Radiation Physics, Department of Radiation Oncology, Medical Univ. Vienna / AKH Wien
@PEG MedAustron GmbH, Wiener Neustadt

Supervisors: DI Hermann Fuchs PhD, Mag. Barbara Knäusl PhD, Univ.-Prof. DI Dr. Dietmar GEORG

Motivation for the project:
Ion beam therapy exploits the physical properties of charged ions to create highly conformal dose distributions for treatment, thereby reducing side effects. The high precision leads to an increased sensitivity towards changes within the patients’ anatomy, making robust and accurate treatment planning challenging. This is an important research field for the development of new therapeutic concepts. In clinical practice a wide variety of dose calculation approaches exists, ranging from fast analytic algorithms to precise full Monte Carlo dose calculation.

At the new Austrian particle therapy facility MedAustron the treatment planning system (TPS) RayStation (Raysearch Laboratories, Sweden) allows treatment planning with protons and carbon ions. At the PEG MedAustron researchers have the possibility to use a research version of this TPS including novel tools that are not used released for clinical use.

In order to evaluate these novel tools and to use the TPS output for further Monte Carlo simulation projects an independent evaluation and verification is required. Therefore, the independent full Monte Carlo simulation toolkit GATE will be used as reference tool.

Aim of this thesis is to adapt the existing Monte Carlo GATE toolkit in order to achieve a good agreement with the output of the TPS RayStation, e.g. including the MedAustron beam model as implemented in RayStation and a correct electron density Hounsfield unit calibration.

Master – Thesis Outline:
- Modeling of the MedAustron beamline in GATE
- Test and ensure CT electron density Hounsfield unit conversion
- Calculate and compare treatment plans with GATE and Raystation

Duration: 6-8 months, the position is open immediately from 04/2016
This Master thesis requires a good working knowledge of the Linux shell and an interest in Monte Carlo simulations. Good knowledge of C++, development environments, cmake and the g++ compiler is an asset.

Who should apply? Motivated students with a completed B.Sc. in Technical Physics, Informatics or Biomedical Engineering from Austria or abroad

What can we offer? Collaboration in a great, international, enthusiastic and high level research oriented team
If you are interested in the topic please send an e-mail to hermann.fuchs@meduniwien.ac.at or dietmar.georg@meduniwien.ac.at