

EBG MedAustron GmbH is currently building and, in the future, will operate a state-of-the-art centre for ion beam therapy and research in Wiener Neustadt, Austria. After the centre's completion, patients will be treated using proton and carbon ion radiation. Currently, only three centres worldwide offer these two radiation treatment options at the same location.

In collaboration with the CREATIS laboratory (France), we offer exciting and challenging activities in a unique and very innovative health care project. You can participate in making MedAustron the most successful centre for ion beam therapy and research in the world, being part of our "Medical Physics" team as a:

PhD Student (m/f)

We are looking for exactly YOU, if you have the following (or equivalent) **qualifications and experience**:

- Master's degree in medical physics/engineering
- Preferred experience in Monte Carlo simulation using Gate/Geant4 software
- Preferred experience in ion beam therapy
- Particular interest in ion beam dosimetry and patient dose calculation algorithms
- Solid skills in computer sciences and software development (C++)
- Excellent English skills, good German and French skills are an asset
- Reliable personality with hands-on-mentality and the ability to work accurately, attentively and independently
- Good communication skills and the ability to collaborate with other teams in an international and multidisciplinary environment
- Flexibility to adapt to new challenges

Your **tasks** in this challenging position include:

- **To participate in the Medical Commissioning activities related to beam delivery:**
 - To acquire knowledge in commissioning measurements of an ion therapy facility
 - To participate in Treatment Planning System (TPS) commissioning and get a deep understanding of dose calculation algorithms
 - To tackle dosimetry challenges in proton and carbon ion beam therapy
- **To participate in the development of the Gate/Geant4 Monte Carlo platform to support medical commissioning and future research activities at MedAustron:**
 - To model the beam delivery nozzle in Gate using innovative methods
 - To develop an automatized workflow for TPS dose verification using Gate
 - To benchmark Gate/Geant4 physics models against measurements

Interested? Impress us with your personal strengths and skills!

- Application deadline: 01/07/2014
- Position available from: 01/09/2014
- Minimum remuneration: € 38.500,-- (gross p.a.), per year
- Working place: MedAustron, Wiener Neustadt, Austria

Please apply by e-mail (CV, application letter, references) to jobs@medaustron.at

Additional information is provided in 20140306_PhD_Medical_Physicist_Additional_V0.3.docx.
Reference-NR: AP_FOS/PUR_20131111

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Subject of the PhD thesis:

Gate as a Geant4-based Monte-Carlo platform to support Medical Commissioning and Treatment Planning System (TPS) verification for scanned proton and carbon ion beam therapy.

Overview of the different medical physics areas that would benefit of Monte Carlo simulations:

The commissioning of ion beam therapy facilities requires an extensive set of measured data. Parts of these measurements are used as input in the treatment planning systems to generate the beam model for patient dose calculation. Monte Carlo can be used to generate a beam data library representative of the system in order to reduce the number of required measurements.

For scanned proton and ion beam delivery, the currently available dosimetric devices, such as integral Bragg peak chambers, do not allow to fully encompass the lateral dose delivered by secondary fragments, which escape detection by the measuring device. However, the TPS usually requires depth-dose profiles integrated over a large area and the measured depth-dose profiles using available ionization chambers have to be corrected to account for the non-measured dose.

For proton beam delivery, the air gap between the nozzle exit and the patient can cause large lateral penumbra, especially for the low energy protons. One possible solution to reduce this air gap is to move the patient towards the nozzle exit. However, treatments under non-isocentric conditions have to be carefully checked using independent tools.

The response of some detectors such as radiochromic films and alanine depends on the particle spectra at the measured point, which can be predicted with Monte Carlo simulations. Such detectors can be used for end-to-end tests and auditing procedures allowing validating the entire beam delivery chain.

In order to calculate the Relative Biological Effectiveness (RBE) for ion beam delivery, secondary particles and LET spectra are used as input in the TPS. However, such data are not measurable in a clinical environment and MC simulations must be used to generate such data set. Due to uncertainties in the nuclear interaction cross-sections, LET and particle spectra may depend on the MC code used and influence the 3D dose distribution in the patient.

In-vivo range verification in patient usually relies on prompt radiation (gammas, protons) or subsequent PET image analysis. Alternatively, in-vivo dosimetry can also be performed, by inserting micro-dosimeters in patient cavities.

Context:

The selected candidate will be based at MedAustron, Wiener Neustadt, Austria and will perform regular trips to the Creatis laboratory, Lyon, France, in order to fulfil his/her university obligations.

	Institution	Responsible advisors	Co-advisors
MedAustron	<i>Host</i>	<i>Dr. L. Grevillot</i>	<i>Dr. H. Palmans, Dr. S. Vatnitsky</i>
University of Lyon	<i>Academic partner</i>	<i>Dr. D. Sarrut</i>	<i>Dr. N. Freud</i>

Contact persons:

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