ENTERVISION

Research **Training** in 3D Digital **I**maging for Cancer Radiation Therapy

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http://cern.ch/ENTERVISION

ENTERVISION, is a Marie Curie Initial Training Network project providing training for 12 Early - Stage Researchers and 4 Experienced Researchers in the field of online medical imaging for hadron therapy. It was established in response to the critical need for reinforcing research in online imaging and for training of highly skilled professionals, with the aim of early detection and more precise treatment of tumours.

Towards optimal cancer treatment

Every year over 3 million people in Europe are diagnosed with some form of cancer, making it a major societal challenge. Radiotherapy is a potent and cost-effective method and is central to cancer management, together with surgery, for more than 50% of all cancer patients. Radiotherapy with protons and ions, called hadron or particle therapy, is able to target the tumour effectively while sparing surrounding normal tissues. It is being used increasingly with the first two dual ion beam European centres in operation and others in the process of being built or developed.

Currently, the many unique potentialities of hadron therapy are not optimally exploited because of the lack of tailored medical imaging tools for dose delivery systems, monitoring and quality assurance.

New experts needed

The ENTERVISION platform provides comprehensive training to researchers, starting with the core principles of image guided radiotherapy and extending them to the specific hardware and software technologies needed for hadron therapy.

In addition to the on - the - job training at their home institutes, the researchers will be offered a multidisciplinary curriculum and a large choice of training courses of academic and industrial relevance. They have the opportunity to gain in - depth knowledge of disciplines such as physics based technologies, informatics solutions for imaging, medical treatment planning, basic radiation biology, cell handling and cell culture, image processing and GPU computing.

Entervision course "Leadership and Development" Guildford, UK November 2012

ENTERVISION research projects focus on the following four distinct research clusters:

Hardware and software solutions for signal handling, data acquisition and processing for image based in-vivo dosimetry

This cluster will define standards and develop common unified components for a system for real time signal handling, data acquisition and processing for image based in-vitro dosimetry, including a clinical interface. The data acquisition system will provide input ports where the signal is digitized and time stamped, to enable the software to identify the coincidences, and eventually do pre-processing prior to the transfer of data to the controlling server. It should generate and distribute trigger, timing and control signals to the different modules providing adequate synchronization.

Modelling of in-beam PET and SPECT imaging devices

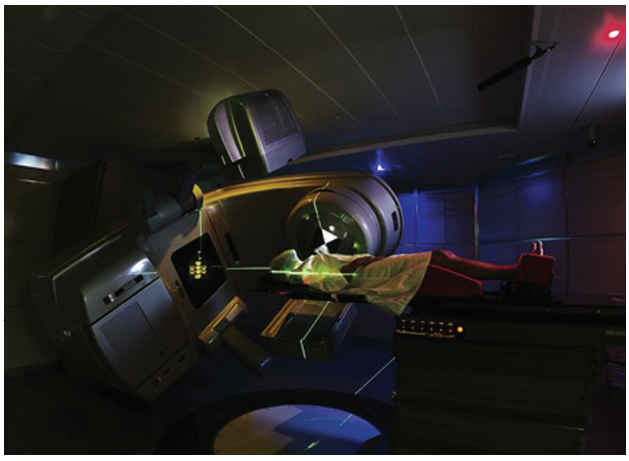
This cluster will provide common language and tools to model Emission Tomography, coupled to an assessment of the detection techniques for in-beam control, imaging and dosimetry during ion therapy. Modelling based on simulations is of crucial importance at all stages of an image processing system, and ought to be mastered by experienced researchers involved in particle detection and medical imaging.

Nuclear fragmentation studies

The characteristic features of secondary particles, produced along its path by the ion beam traversing thick tissue-equivalent absorbers, will be established by experiments designed for this purpose. The lightest nuclear fragments have the longest ranges and therefore can be detected with good efficiency outside the patient body. Even though experimental data on production cross-sections, angular and energy distributions of secondary particles are still scarce, preliminary studies have shown that the yield of protons emerging from the patient in the forward direction is high enough to allow interaction with tracking detectors.

Integration of treatment related imaging and dosimetry data

The focus will be on pre-clinical development and simulation of imaging strategies for image guided hadron therapy. With the development of this technology, it will be important to address other issues relating to its safe, fast and effective implementation as well as those relating to biological optimization, facilitating the early clinical adoption of the newly developed imaging hardware.



Treatment room, photo courtesy CERN

Enlight meeting 2012, CNAO, Italy photo courtesy Lorenzo Iorino

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