



RESEARCH PROJECTS

Quality assurance under the spotlight, ENLIGHT meeting 2019

[First part of our report on the 2019 annual meeting of the European Network for Light Ion Hadron Therapy \(ENLIGHT\)](#)

In the second part of our report on the 2019 annual meeting of the European Network for Light Ion Hadron Therapy (ENLIGHT), we consider the topics related to quality assurance, advanced instrumentation and organ motion control, which were undisputed highlights of the rich scientific programme of the meeting.

<https://indico.cern.ch/event/783037/timetable/#all.detailed>

A discussion about **machine quality assurance (QA)** was opened with a presentation by Dr Sairos Safai of the Paul Scherrer Institute (PSI) in Switzerland. His presentation, based on a European Particle Therapy Network (EPTN) survey, showed that daily QA, lasting an average of 44 minutes, was the most time-consuming part of the QA. Different approaches were used by different centres; QA performed by pencil beam scanning was considered to be suboptimal as yet, and detailed requirements for global improvement were extracted from this survey. More comprehensive, simple and fast QA was necessary so that radiotherapy technologists could perform it. As examples, the QA of PSI gantries 2 and 3 were detailed and the presentation showed also the interest of log files (data registered by the machine itself) for QA purposes.



The presentations took place at the cancer treatment centre, the Centre François Baclesse, in Caen, France.

Patient quality assurance by online imaging is a longstanding research topic. Denis Dauvergne of the Laboratory of Subatomic Physics and Cosmology, Grenoble, part of the Centre National de la Recherche Scientifique (CNRS) in Paris, France, provided a very nice review of 20

years of research in this domain for PET and prompt gamma detectors. New and future detection principles were mentioned. Relations between time structure of the beam and the modalities of detection were emphasised, as well as ongoing on-site experiments. This domain is still in fast evolution with successive generations of detectors.



Sessions covered topics that spanned quality assurance, advanced instrumentation and organ-motion control.

Organ-motion control in clinical practice was discussed by Alessandro Vai of the Italian National Centre for Oncological Hadrontherapy (CNAO, Italy). He gave detailed insight into the current practice at CNAO for the application of internal target volume-respiratory gated (+/- 30% exp / insp) irradiation, with detailed discussion of the principles of treatment planning and day-to-day QA and plan recalculation. The time requirements of this technique were presented with realistic details of several patients' cases, and issues of robust planning regarding organ-motion control were discussed.



Dr Alessandro Vai (CNAO, Italy)

Along the same lines, Ye Zhang of PSI, Switzerland, gave a very didactic presentation on the global issue of motion mitigation. She presented various solutions with their evaluated uncertainties and cumulative dosimetric aspects. The different levels of complexity and capabilities were

nicey shown with an ultimate demonstration of the value of *off-line* patient-specific motion models for use in *on-line* tracking.



Dr Ye Zhang (PSI, Switzerland)

Modelling of organ motion was presented and nicely discussed in detail by Hamid Ladjal of the Laboratory of Image Information and Information Systems (Laboratoire d'Informatique en Image et Systèmes d'Information, LIRIS, Lyon, France). The project he described built models of organ motion and deformation during the respiration cycle based on multiple surrogate pieces of anatomical information that could be used to alleviate the lack of exact reproducibility of the respiratory cycle. This work is ready for clinical application for any type of external-beam radiotherapy and could be very interesting to track targets.



Dr Hamid Ladjal (LIRIS, France)

The discussion of '*Jet ventilation apnoea*' surprised the participants for the simplicity of the idea. Jean Bourhis of Lausanne University Hospital (Centre Hospitalier Universitaire Vaudois (CHUV), Lausanne, Switzerland) explained this technique to mitigate motion and reduce planning target volume (PTV) by the immobilisation of the target through use of long-lasting apnoea. Several apnoea-gating systems are used routinely in radiotherapy. However, long-lasting apnoea may be useful for irradiations that cannot be interrupted, such as helicoidal irradiation (tomotherapy) or in cases in which duration of irradiation must be kept to a minimum. As presented by Dr Bourhis, application of the jet ventilation apnoea-like condition is convincing as it is not invasive for the patient and can be used to provide apnoea-like situations for 15 to 20 minutes. Applications are ongoing at the CHUV in Lausanne.



Dr Jean Bourhis (CHUV, Switzerland)



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