Latest developments of the Monte Carlo Fluka code for medicine

Giuseppe Battistoni [1], Francesca Bellinzona [7], Julia Bauer [2], Till T. Boehlen [3], Francesco Cerutti [4], Mary P. W. Chin [4], Caterina Cuccagna [9], Ricardo Dos Santos Augusto [4, 5], Alessia Embriaco [7], Alfredo Ferrari [4], Andrea Fontana [7], Pablo G. Ortega [4], Wioletta Kozlowska [4,6], Giuseppe Magro [7], Andrea Mairani [7, 8], Katia Parodi [5, 8], Paola R. Sala [1, 4], Philippe Schoofs [4], Thomas Tessonnier [2], Vasilis Vlachoudis [4,*]

[1] INFN Sezione di Milano, Milan, Italy,
[2] Uniklinikum Heidelberg, Heidelberg, Germany,
[3] EBG MedAustron GmbH, Wiener Neustadt, Austria,
[4] CERN, Geneva, Switzerland,
[5] Ludwig Maximilian University of Munich, Munich, Germany,
[6] Medical University of Vienna, Vienna, Austria,
[7] Centro Nazionale di Adroterapia Oncologica, Pavia, Italy,
[8] Heidelberger Ionenstrahl- Therapiezentrum (HIT), Heidelberg, Germany
[9] TERA Foundation, Novara, Italy
* Corresponding author

Monte Carlo (MC) particle transport and interaction calculations are recognized for their superior accuracy in predicting dose and fluence distributions in patients compared to analytical algorithms, which are generally used for treatment planning due to their shorter execution times. The suitability of a MC code for application to hadrontherapy demands accurate and reliable physical models capable of handling all components of the expected radiation field. This becomes important for correctly performing not only physical but also biologically based dose calculations, especially in cases where ions heavier than protons are involved. Moreover therapeutic based MC studies, require the implementation of algorithms and tools able to import and use in an easy way complicated sequence of data, all referred to a defined case. Recently Flair, the FLUKA graphical interface, was enhanced with the capability of constructing in a fast and well-structured way, voxel-based computational phantoms as FLUKA input, based on CT DICOM images. The interface is capable of importing also the radiotherapy treatment data described in a dedicated DICOM RT (RTSTRUCT, RTDOSE, RTPLAN) standard for direct simulation of treatment plannings with FLUKA. In addition the interface is equipped with an intuitive PET scanner geometry generator and a dedicated scoring routine for coincidence events and the final reconstruction. FLUKA and its interface has been already used at CNAO and HIT for the generation of the physical databases for the TPS in use in those centers. It is also used for verification and sometimes further optimization of the treatment plans computed with the analytical TPS. The present paper will highlight the recent developments in FLUKA and its interface in the field of medicine.