FLUKA simulation of selected topics regarding proton pencil beam scanning

Christian Baeumer
Westdeutsches Protonentherapiezentrum Essen

Abstract

Monte-Carlo simulations have been performed with the FLUKA code in order to guide and interpret measurements with proton beams in pencil beam scanning (PBS) mode. The field of particle therapy is currently experiencing a technology push to PBS delivery systems. In a basic dosimetric experiment a narrow, static, pristine proton beam with an energy of about 100 MeV to 200 MeV traverses a water tank until it is stopped. The corresponding FLUKA simulations of depth-dose curves and depth-dependent lateral spread have been compared with MCNPX simulations and analytical computations. An advanced dosimetry device is the multi-layer ionization chamber (MLIC). It is essentially a stack of ionization chambers which allows a fast measurement of light-ion depth-dose distributions. A FLUKA model of a commercial MLIC has been established. The traversal of static pencil beams in an MLIC with large electrode has been analyzed and compared with the reference simulations in water. Some of the MC predictions have been compared with measured data. A further topic of interest in proton therapy is the production of secondary neutrons. The corresponding simulations will be shortly discussed. An outlook is given on the plans for