

Analysis of Beam Intensity Data for Determination of Absorbed Dose to Solid Materials for High-Energy Ion Beams

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A method for analysis of the intensity and profile data of the 3.8 GeV/nucleon $^{124}\text{Xe}^{54+}$ ion beam is presented, which contributes to precise determination of the absorbed dose for irradiated materials. The beam profile and intensity distributions together with overall intensity and duration of radiation exposure are analyzed for the set of samples of different geometry and chemical composition. The raw data were taken in the long-term exposure mode, which is the unique option currently available at the ARIADNA target station of the NICA facility. Software was developed for investigation of intensity and profile of the beam. Because the data is a sequence of intensity values per spill, each spill was analyzed separately. The intensity is measured before collision with the target that requires additional study on how the intensity decreases after passing through each detector and approximation of the intensity, which reaches a particular sample. Distributions of beam intensity and profile versus exact duration of irradiation were obtained for each investigated sample. Each sample was at the beam sequentially in series that results in individual profile for particular sample. The distributions obtained with the developed software are shown to be the input data for further precise calculation of energy losses and absorbed dose in irradiated materials.

The study is performed within the ARIADNA Collaboration.