

MONTE-CARLO SIMULATION OF FUSION AND MULTINUCLEON TRANSFER REACTIONS IN THE MEDIPIX DETECTOR USING THE GEANT4

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The position-sensitive quantum counting hybrid pixel detector MEDIPIX provide high spatial resolution and single-quantum detection. This device has an array of 256x256 square pixels of pitch size 55 μ m for full sensitive area 14x14 mm². Operating these detectors with the integrated readout interface FITPIX developed by the Prague group one can have a compact and portable radiation camera which operates as an active nuclear emulsion for heavy charged particles and fission fragments, alpha particles, electrons (positrons), X-rays and γ -rays in wide and linear dynamic range for which MEDIPIX ensures 100% detection efficiency and noiseless digital integration (single-quantum counting) with on-line tracking visualization (see example in Fig. 1). With the use of the DAQ and pattern recognition software Pixelman, also developed by Prague group, it is possible to distinguish the various types of particles. The new Timepix device adds the capability of directly measuring the particle energy and arrival time in each individual pixel. Using the MEDIPIX detector will increase considerably the detection and identification possibilities of mass-spectrometer MASHA. The mass-spectrometer MASHA was designed for determination of the masses of superheavy elements. The unique property of this mass-spectrometer is his ability to measure masses of the synthesized super heavy isotopes ($m/\Delta m \sim 1300$) simultaneously with registration of their α -decay or spontaneous fission. The mass-spectrometer is connected to the U-400M cyclotron of the Flerov Laboratory for Nuclear Reactions (FLNR) JINR, Dubna. We plan to use MASHA and MEDIPIX in two types of experiments with heavy ions: Synthesis of heavy and superheavy elements in fusion reactions and production of new neutron-rich isotopes in multinucleon transfer reactions.

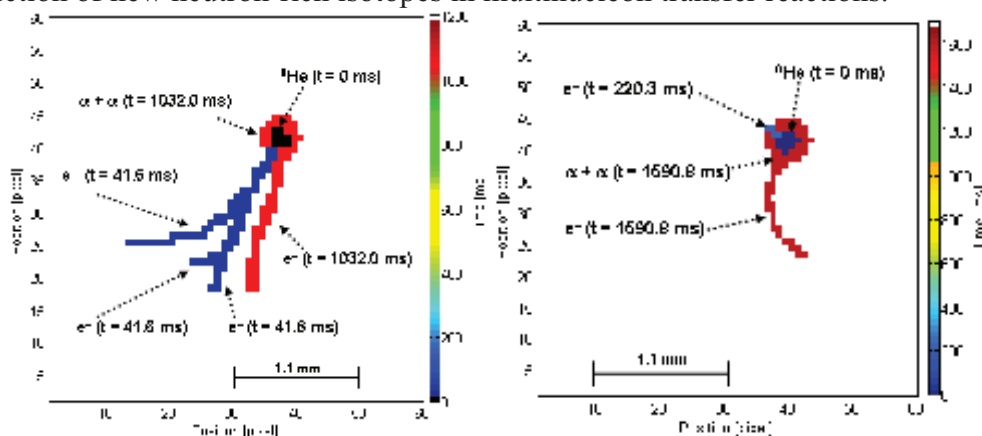


Fig. 1. Registration of arrival of ^8He ions (central signal – few pixels in black). Electrons emitted in consecutive β decays (of ^8He and ^8Li) are registered by the thin tracks. The final decay of two α particles is registered by the round halo surrounding the initial ^8He blob. Secondary electrons are registered too (see image on left). Pixels run in time mode (in ms in the vertical scale).

Summer practice: Familiarization with experimental setup. Study the GEANT4 software package. Active participation in controlling and testing “MASHA” and MEDIPIX.

Goals: Acquirement of practical experience in preparation the experiments on synthesis of superheavy elements concerning the simulation of prepared experiment.

Results: Preparation the presentation on MASHA and MEDIPIX from point of view of MONTE-Carlo simulation.

Number of students: 2