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Numerical simulation of proton-radiographic facilities at Geant4

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The high-energy proton radiography in the investigations of dense dynamic target provides greater penetration depth, spatial resolution, density resolution and dynamic range than conventional X-Ray methods.
The high-energy proton microscopy facilities PRIOR-II (2-5 GeV beam energy) will be one of the key diagnostic tool for HEDP experiments at FAIR project, also the scheme of 247 MeV proton microscope (PM) proposed for experiments at INR proton linac (Russia, Troitsk). The ion optics of facilities is designed according to the schemes of proton microscopes with magnifying an image of objects. In this work, using Geant4 code, the full-scale Monte-Carlo numerical simulation of future proton radiography experiments were performed. The virtual model of PRIOR-II facility was developed based on ion optical data described at PRIOR —Proton Microscope for FAIR TDR with energy of the beam –4GeV. The scheme of 247 MeV proton microscope was developed by COSY Infinity code. The full-scale numerical simulation for PRIOR-II was performed for static objects (Cu, plexiglas step wedges) and static models of dynamic process, such as Ta-wire in water in the UEWE investigation and investigation of compressibility of Ce. The full-scale numerical simulation for PR proton microscope also was performed for Cu and plexiglas step wedges and for static model of target in the investigation of shock compressed Xe gas (non ideal plasma) and anomalous compressibility of docosane.

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