Equalization of beam transmission through investigated object in proton radiography images using scheme with additional scintillator

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Proton radiography with the use of high-energy proton beams is powerful diagnostic method for investigation of internal structure of dense objects. This technique has unique composition of properties such as high spatial and temporal resolution, high density contrast and capability to observe evolution of dynamic objects.

The result of a proton radiography experiments is two-dimensional image of investigated object in units of beam intensity. Transmission of proton beam through investigated object is function of its areal density. To obtain transmission an image of investigated object can be divided by an image of beam registered in abscence of object. Due to instability of proton beam cross-section from shot to shot this operation leads to errors in resulting transmission values.

To solve this problem an additional thin scintillator can be installed right before investigated object allowing to register beam image in the same shot. Technique to find mathematical transformation that links images obtained on both detectors is developed and its algorithms implemendet in Matlab.

Capabilities and performance of technique demonstrated with results of processing and analysis of data obtained in virtual Monte-Carlo experiments in Geant4 using full-scale model of proton microscope.