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Computer Simulations of Particle Beams Motion into Capillaries

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Advanced computer technology and wide use of personal computers today open up great perspectives of computer simulations for studying various processes and phenomena of the surrounding world. Computer models are often used to obtain new data about simulated object or for approximate estimation of the system behaviour while this system is too complex for analytical exploration. Consistency of computer models allows both the main factors that determine the properties of simulated objects to be identified and the response of the simulated system to change of its parameters or initial conditions to be explored.

In this paper we implemented the program (CapStruct) in its first version that simulates the passage of neutral particle beams in capillary structures in dependence on both geometry of these structures and beams parameters. This program calculates and graphically depicts distributions of particles on the detector depending on following parameters: the shape of the capillary (cylindrical, toroidal or conical), the position of the capillary, the internal radius, the capillary length, the curvature and the angle of rotation (for toroidal capillary), the opening angle (for conical capillary) and parameters of the roughness of the capillary's inner surface. Cap-Struct allows simulating the propagation of parallel as well as divergent beams in variation of the following parameters: the amount of particles, the absolute value and the direction of the particle velocity, the angle of solution (for a divergent beam). The parameters of the distribution of particles in the beam at the initial time also can be varied. For this version the code both particle size and interaction between them was not considered. This computer model was constructed in the approximation of elastic interaction of particles with a capillary surface, the loss of energy at the reflection of particles was neglected. All models are characterized by a significant simplification of the processes of interaction of the beams with surface. This simplification, which characterizes our code in the first version, becomes very important in order to study in details all structural features of such interaction. The latter enables preserving future developed codes from any errors due to geometrical factors of the system under evaluation that is typically very crucial point for multi systems. Thus, this work is the basis for solving more complex problem in the future - simulation of charged particle beams motion into capillary structures.

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