MONTE-CARLO METHOD SIMULATION OF THE BREMSSTRAHLUNG MIRROR REFLECTION EXPERIMENT

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To detect gamma-ray mirror reflection on macroscopic smooth surface a search experiment at microtrone MT-22S with 330meter flying distance is in progress. Measured slip angles (i.e. angles between incident ray and reflector surface) don't exceed tens of micro-radian. Under such angles an effect of the reflection could be easily veiled due to negative background conditions. That is why the process needed to be simulated by Monte-Carlo method as accurate as possible and corresponding computer program was developed.

A first operating mode of the MT-22S generates 13MeV electrons that are incident on a bremsstrahlung target. So energies of gamma-rays were simulated to be in the range of 0.01÷12.5 MeV and be distributed by known Shiff formula.

When any gamma-quantum was incident on the reflector it resulted in following two cases. If its slip angle was more than the critical one, gamma-quantum was to be absorbed by the reflector and the program started to simulate next event. In the other case the program replaced incident gamma-quantum trajectory parameters by the reflected ones. The gamma-quantum trajectory behind the reflector was traced till its detector. Any gamma-quantum that got the detector was to be registered. As any simulated gamma-quantum was of random energy the critical slip angle of every simulated event was evaluated by the following formula:

$$\alpha_{crit} = \frac{eh}{E}\sqrt{\frac{ZN_A\rho}{\pi Am}},$$

Table values of the absorption coefficients were used for random simulation of gamma-quanta absorption in the air. And it was assumed that any gamma-quantum interaction with air resulted in its disappearance.

Dependence of different flying distances (120 and 330 m), gap heights (10, 20 and 50 μ) of the gap collimator and inclinations (20 and 40 μrad) of the reflector's plane on detected gamma-quanta energy distribution and vertical angle one was studied with a help of the developed program.