ANGULAR DIVERGENCE OF ELECTRONS RIBBON BEAM REB IN MAGNETICALLY ISOLATED DIODE (COMPUTER MODELING, MEASUREMENTS) [[1]](#footnote-1)\*)

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The generation of submillimeter radiation in the scheme of a two-stage free electron maser (FEM) requires the use of a relativistic electron beam (REB) with a ribbon cross section, having current density of ~ 1-3 kA / cm2 and a small (no more than 5 degrees) angular spread of electron velocities. For transporting such a high-current beam, a strong guiding magnetic field is used, which significantly complicates the measurement of the angular characteristics of the electrons due to their magnetization. The sensor composed from several collectors with cylindrical holes of different depths and diameters previously was used for measuring the angular spread in such conditions. From the ratio of the electron currents absorbed in these collectors and the function describing the passage of electrons through such holes in the guiding magnetic field, we can find the value of the root-mean-square angular velocity spread. In [2], this value was obtained under the assumption of a Gaussian distribution function over the angle with respect to the direction of the magnetic field, and the absence of electron reflection from the collector material. But as experiments have shown, the reflection of electrons strongly affects on the results of measurements, especially in the case of a sliding fall of electrons on side walls of holes in the collectors. To obtain correct results in measuring the angular divergence of electron velocities, a computer simulation of the absorption of relativistic electrons in collectors, taking into account the reflection, was carried out by the GEANT-4 code. Basing on the results of this simulation, the geometry of the multicollector angular spread sensor was modernized and then the angular spread measurements were carried out on the U-2 accelerator [3,4].

This paper presents the results of the measurement of the angular electron spread of ribbon REB at the ELMI device. The measurement results were compared with the simulation results (for a given 3D diode geometry) made with software package CST Particle Studio. Besides that, to test this sensor, experiments to measure the angular spread of the beam passed through a thin foil were conducted. This data as compared with theoretical estimates and the results obtained by modeling the scattering of an electron beam in a thin foil, using by GEANT-4 code.

References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Pt/ru/GX-Stepanov.docx) [↑](#footnote-ref-1)