

Study of a method for determining the particle accelerators multipole elements magnetic axis using optical magnetic fields visualization

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The accelerator technology development requires more and more accuracy improvement of both the manufacture of magnetic elements and their positioning during the accelerator installation. To control the quality of the created magnetic elements, there are various methods of magnetic measurements. Most of the actively used methods involve the use of special precision stands, and therefore magnetic elements are usually measured immediately after production, and then the data obtained are used at the positioning. At the same time, changes in the parameters of magnets associated with mechanical, thermal and other influences during their transportation and installation are not taken into account.

This work is devoted to the study of a magnetic measurement's alternative method. It is based on the magneto-optical effect of the light polarization plane rotation in optically active media, which makes it possible to visualize the intensity distribution of the magnetic field. The possibility of using a laser tracker (which are now widely used at the positioning of accelerator elements) as a radiation source may allow using this method directly during the positioning of accelerator elements, solving the above problem. The paper describes a method for creating an active optical medium and experiments to observe the visualization of the magnetic field distribution intensities in a constant quadrupole and a constant equally-pole dipole specially made for this research. An algorithm for finding the position of the magnetic axis for these magnetic elements was also developed and a program implementing it was written. For further research, a precision alignment stand was designed and assembled, on which achievable accuracy was tested. Also, for comparison, a permanent dipole magnet was measured by the classical method using Hall sensors.

The results of this study present the prospects of this method and the directions for its further development

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