The Design of a High Heat Load Shutter for a Superconducting Wiggler Front-End

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Abstract

A new superconducting wiggler will be installed in the Elettra storage ring; the maximum total power and power density of this new insertion device are 18.34 kW and 5.88 kW/mrad^2, respectively, with a 2-GeV beam energy and eventual 400 mA of beam current. This intense X-ray synchrotron radiation requires the installation of a new shutter in the beamline front-end. The high load absorber must be fitted in a preexisting vacuum chamber and moving frame. In this paper the design of the absorber is described and in particular the cooling system optimization used to minimize temperatures on the front face and the cooling channel surface of the shutter. A definition of the absorber design parameters and the choice of material are presented along with several designs that were evaluated using finite-element thermal analysis. Some improvements in the piping layout are also discussed in order to reduce the pressure losses.

Keywords: heat load, finite element analysis, wiggler

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