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On side cooling of high-heat-load x-ray mirrors

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Under appropriate conditions, side cooling provides an attractive cooling strategy for thermal management of high-heat-load optical substrates. Such an approach avoids a number of known problems as well as some of the uncertainties inherent in the design of internally cooled high-heat-load optics.

In this paper, we describe the general side-cooling concept, point out its advantages, disadvantages, and limitations, discuss various design aspects and options, and provide simple guidelines for the design of such mirrors. As an example of its application, we describe the design of a high-heat-load first mirror for the Advanced Photon Source (APS). This mirror, which is 1.2 m long and is exposed to a total power of 2 kW with a uniform heat flux of 0.37 W/mm^2 , is expected to have negligible tangential slope error without any bending mechanism. This mirror is currently being fabricated.

The side-cooling concept also has potential in the design of focusing optics. This aspect of the problem, now only conceptual, is also presented.

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