Contribution ID: **158** Contribution code: **THP40** Type: **Poster Presentation**

Minimization of the heat-induced deformation in the switching mirror for the Elettra 2.0 nanoESCA/nanospectroscopy beamline

Thursday 18 September 2025 16:40 (1 hour)

As part of the Elettra storage ring upgrade to 4th generation standards, the Nanospectroscopy/nanoESCA beamline is replacing its switching mirror. The new mirror is based on a 100 mm x 40 mm x 40 mm monocristalline silicon piece, optimized for the maximum heatload produced by the 25 eV horizontal polarity of the elliptical undulator serving the beamline (100.4 mm period, kx = 7.3). To minimize the deformations, a notched, top-side cooling design was chosen for the mirror, with an almost full-illumination of its top surface, in combination with slits downwards in the beam trajectory to select only the center portion of the reflected radiation. This paper presents the calculations and the optimization process of the mirror geometry. As a novelty, the contact length between the cooling circuit and the mirror was introduced as a parameter. This led to a cooling circuit shorter than the mirror length and to slightly higher temperatures in the mirror extremities, which proved to be beneficial for the reduction of the heatload-induced bump. Additional simulations confirmed that the optimized design performs equally well or better at higher photon energies.

Footnotes

Funding Agency

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Session Classification: Thursday Poster Session

Track Classification: SIMULATION: Thermal