Dual Canting Mirror

In order to increase the beam separation as well as to provide power filtering and higher-harmonics rejection for the downstream optics, a dual mirror system with focusing capability is used as the first optic at approximately 28 m from the center of the straight section.

The mirrors are mounted in a vacuum chamber, facing each other, in a staggered configuration, see Fig. 2. The mirror motions are completely independent of each other. The system is provided with a one-time-change of the relative distance between the mirrors from 11.1 mm, for the current beamline configuration, to 28.0 mm for 1 mrad canting capability in the future. This way the lateral translation is maintained to a small range of ±6 mm for stability.

The beam separation at the monochromators is between 38 mm and 56 mm. The beam-defining apertures of 1 mm width reduce the absorbed power into the mirrors to 208 W. The inboard mirror (IM) focuses horizontally onto a beam-defining aperture 6.25 m downstream, and the outboard mirror (OM) focuses horizontally onto a beam-defining aperture 6.43 m downstream. OM minimum bending radius is 2.6 km. IM minimum bending radius is 3.9 km.

The cooling is achieved via a typical "cooling slot and fin" design and Indium/Gallium eutectic as interface layer. The meridional RMS slope error is expected to be ±0.3 μrad and the RMS micro-roughness after coating ±2.5 Å. The mirror supports are designed to minimize exposure to scattered radiation, and are protected by shields. In addition, a shield is installed between the two mirrors to prevent Compton scattering produced by the IM from reaching the OM.

References


Table 1. Table 2. Mask 2 and Mask 3 thermal and stress analysis results

<table>
<thead>
<tr>
<th>Mask</th>
<th>Material</th>
<th>Incident angle</th>
<th>Beams overlap</th>
<th>Beam size (mm)</th>
<th>Power (W)</th>
<th>Peak power density (W/mm²)</th>
<th>Tsurf (°C)</th>
<th>Tmelt (°C)</th>
<th>σmax (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mask 2</td>
<td>Copper</td>
<td>4°</td>
<td>Yes</td>
<td>Outb WB</td>
<td>1.21</td>
<td>12.1</td>
<td>215.6</td>
<td>156.2</td>
<td>126.9</td>
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<tr>
<td>Mask 3</td>
<td>Copper</td>
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<td>No</td>
<td>Outb WB</td>
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<td>1.33</td>
<td>109.2</td>
<td>496.9</td>
<td>104.8</td>
</tr>
</tbody>
</table>

The peak power density of the Beam Shutters is calculated as 250 W/mm² for the worst case scenario.

Figure 2. Schematic of the staggered mirror system.