



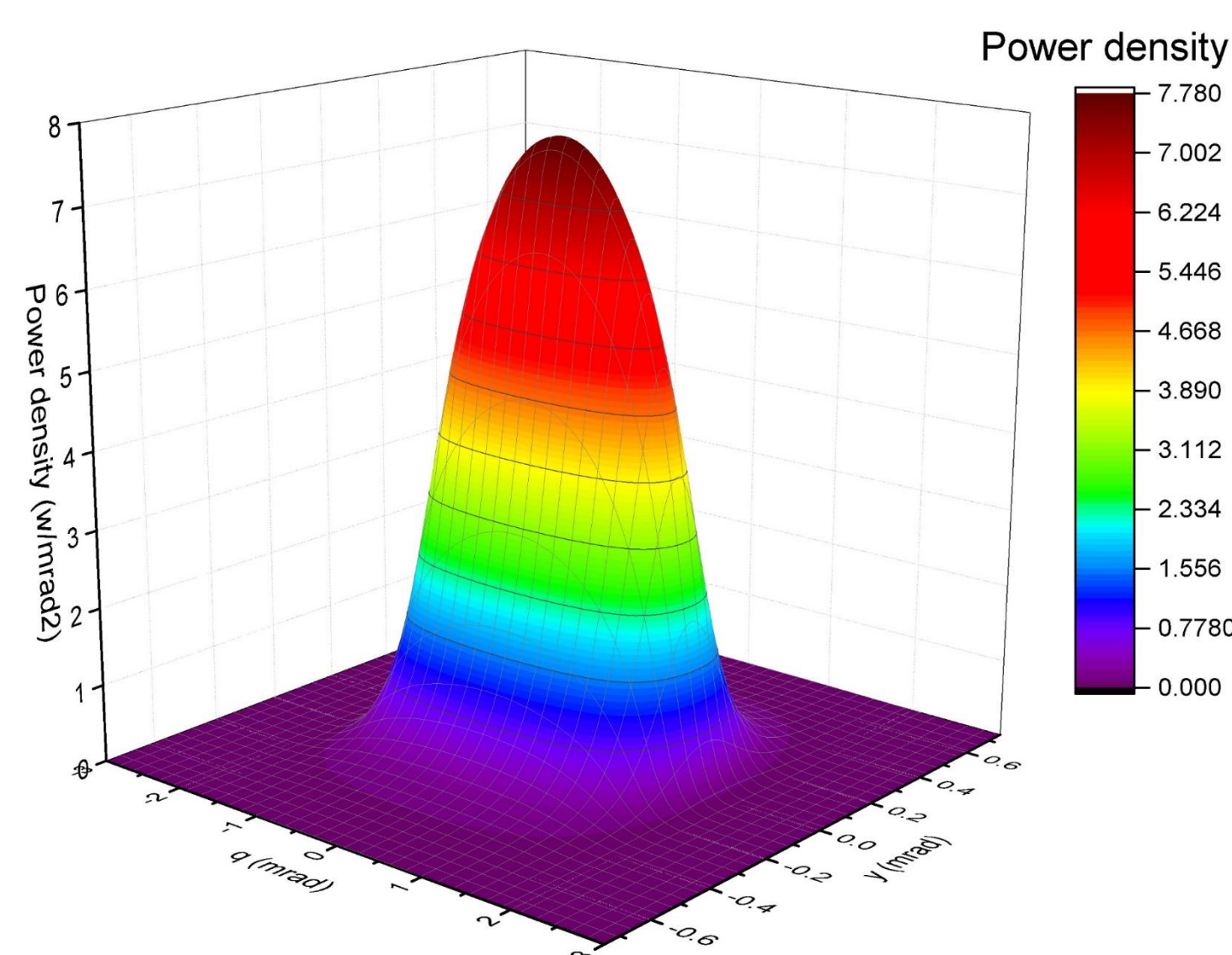
SESAME

Thermomechanical Analysis of SESAME High-Heat-Load Front Ends Components

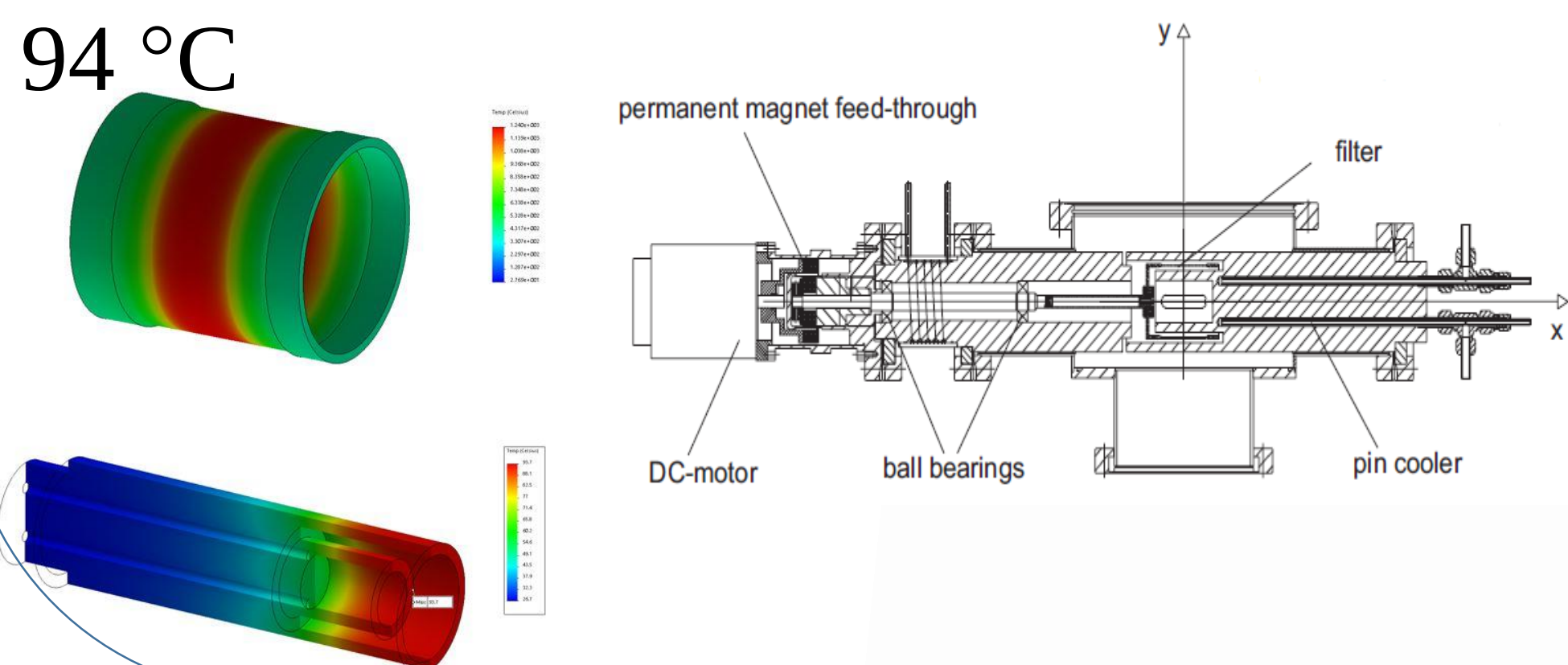
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A mini gap wiggler as a source for the material science beamline will be installed and can deliver a power of over 5.0 kW with a peak power density of 7.79 kW/mrad² at 12 mm magnetic gap. The power calculations had been done using SynRad+, a software using Monte Carlo simulation to simulate the synchrotron radiation from either an insertion device or any magnet source. The surface power density distribution generated by this software can be mapped directly to an FEA software to conduct a coupled thermo-mechanical analyses.

Overall length	2m
Minimum magnetic gap	8 mm
Period length	60.5 mm
Number of poles (Np)	63
Maximum field (Bmax)	1.84T
Effective field (Beff)	1.63T
Deviation parameter (K)	8.6
Critical energy (Ec)	7.0keV



The rotating filter is a commercially available cylindrical crucible made from the glassy-carbon material Sigradur G. The filter is rotated using a drive shaft equipped with two bearings with silicon nitride ceramic balls. The cooling of the carbon filter is achieved by radiation to a water cooled fixed black-oxidized copper jacket. The total power absorbed by the filter is equal to 1.6 kW, the maximum temperature of the carbon filter equal to 1240 °C and the copper jacket 94 °C

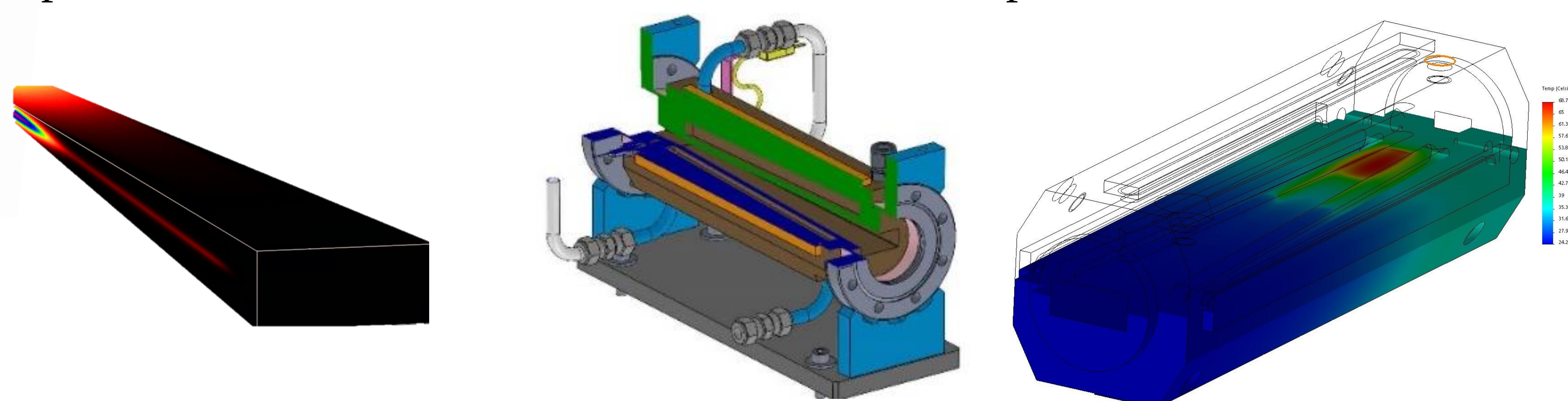


Upstream and downstream dipole magnets introduced in the simulation to have more accurate results for the total synchrotron radiation passed to the front ends. The storage ring parameters are:

Energy	2.5 GeV
Current	400 mA
Circumference	133.2 m
No. of dipoles	16
Natural emittance	26 nmrad
Bending magnet field	1.4554T
Total power	241 kW
Linear power density	38.4 W/mrad

Fixed mask is the first high heat load components in front end to shape the beam coming from the mini gap wiggler. The fixed mask will be manufactured from a Glidcop ® Al15 block with a rectangular tapered tunnel fabricated using wire EDM technology to allow the beam to pass through.

The tapered shape of the fixed mask had been introduced in the simulation and the power distribution has been calculated at each taper face.



The fixed mask will absorb a total power of 2.6 kW, the maximum temperature on the shutter body will reach 69 °C, thermal stress of 183 MPa and an equivalent total strain of 0.14%.

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MECHANICAL ENGINEERING DESIGN
OF SYNCHROTRON RADIATION
EQUIPMENT AND INSTRUMENTATION

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