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Conceptual design of the optical system of the UV/VUV beam line for the PolFEL free electron laser

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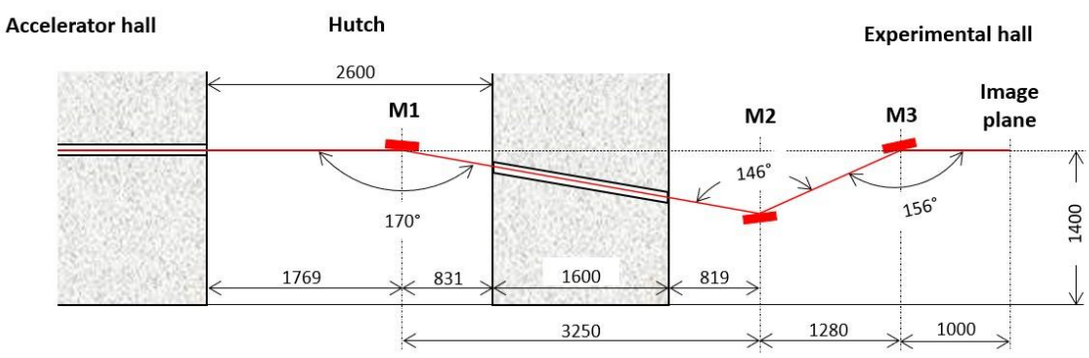
The PolFEL free electron laser will generate a beam of coherent electromagnetic radiation in the ultraviolet (UV) spectral range with a wavelength of about 150 nm to 300 nm, in the form of pulses with a duration of several hundred fs, energy up to 50 μJ and repetition rate 50 kHz. By selecting the third harmonic, it will be possible to obtain vacuum ultraviolet (VUV) radiation with a wavelength in the range from 50 nm to 100 nm.

The diagram of the optical system of the UV/VUV beam line for the PolFEL laser is shown in the figure (all dimensions are given in mm).



The system consists of the following three main optical components:

- a directing plane mirror (M1) with dimensions of 240 × 30 × 40 mm,
- a directing plane mirror (M2) with dimensions of 100 × 30 × 30 mm,
- a focusing ellipsoidal mirror (M3) with dimensions 130 × 30 × 40 mm.

The radiation beam produced in the undulator hits the M1 mirror at a grazing incidence angle of 5°. After reflection from the M1 mirror, the beam falls on the M2 mirror at a grazing incidence angle of 17°, which directs the beam to the ellipsoidal M3 mirror, focusing the beam in the image plane at the second focal point of the ellipsoid. The directing M1 mirror is placed behind the 3 m-thick concrete wall in a hutch separated from the experimental hall by a 1.6 m-thick concrete wall.

The optical properties of the beam, as well as the parameters and dimensions of the mirrors were tested by ray-tracing computer simulations performed using the RAY-UI software developed at Helmzoltz-Zentrum Berlin (HZB) , the results of which are presented in the paper.

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References

1. P. Baumgärtel, M. Witt, J. Baensch, M. Fabarius, A. Erko, F. Schäfers and H. Schirmacher, RAY-UI: A Powerful and Extensible User Interface for RAY, AIP Conf. Proc. 1741, 040016 (2016)
2. P. Baumgärtel, P. Grundmann, T. Zeschke, A. Erko, J. Viefhaus, F. Schäfers, and H. Schirmacher, RAY-UI: New Features and Extensions, AIP Con. Proc. 2054, 060034 (2019)