



Spherical mirror enables novel particle acceleration experiments

Optical Surfaces Ltd

has delivered a 305mm diameter **spherical mirror** to the **GSI Helmholtz Zentrum für Schwerionenforschung** in Germany for use in novel particle acceleration experiments.

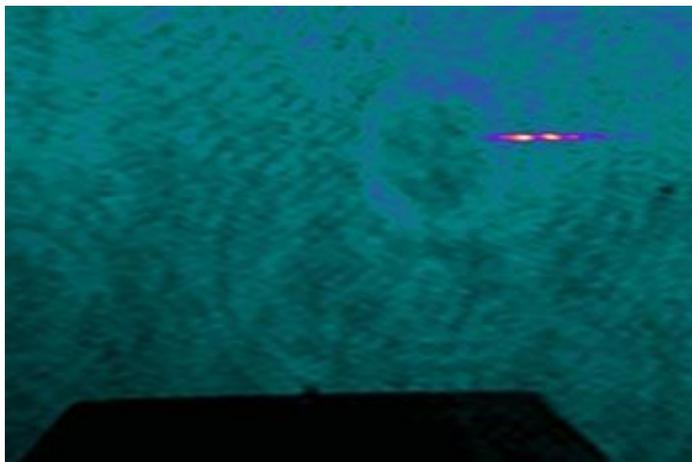


Image captions: A snapshot of laser-plasma interaction with the gas nozzle (black region). The “bright line” is coming from the self-emission of the plasma where the PHELIX laser intensity is the highest (Courtesy: GSI/FAIR)

The ultra smooth mirror

was required to enable the researchers to perform experiments on electron acceleration in medium density gas jets, with the subsequent goal to create x-ray and gamma ray sources for use as diagnostic tools in high-energy density experiments. The **Petawatt High-Energy Laser for heavy Ion eXperiments (PHELIX)** is a versatile laser facility delivering intense laser beams with energies up to 1 kilojoule or powers up to 500 Terawatt.

Dr Johannes Hornung,

a scientific assistant working in the GSI Plasma Physics department said, “Our experiments on electron acceleration in gas jets required a high F-number final focusing mirror to achieve a good focal spot quality with a long Rayleigh length to enable a large interaction length with the gas jet. This would not have been possible with the lower F-number focusing optics we previously used



with PHELIX. Optical Surfaces Ltd supplied the necessary new component according to our demanding specifications.”

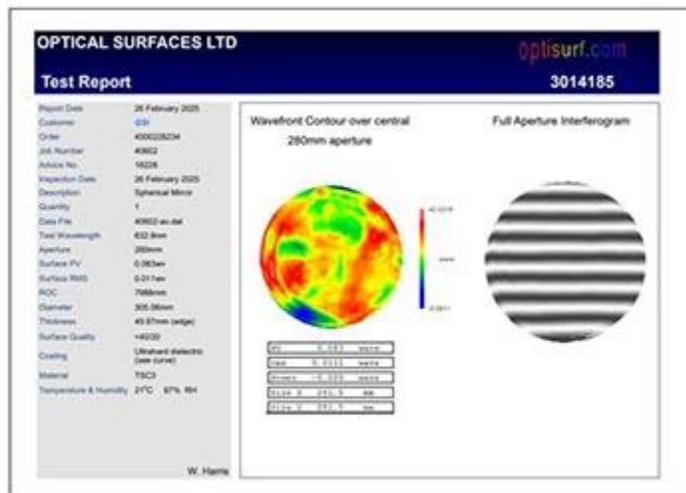


Image captions: B:Test report on GSI spherical mirror demonstrating high surface quality (Courtesy: Optical Surfaces Ltd)

Dr Aris Kouris

from Optical Surfaces Ltd commented, “We were extremely pleased to be selected for this prestigious project. There were several critical performance parameters we had to achieve to produce the required spherical mirror with a very long radius of curvature. It was required to have a high damage threshold (>2 J/cm²) to avoid damage of the coating for high laser energies (200 J) that will be used in experiments, combined with a very high reflectivity (>99.5 %) to avoid losses and a reduction of the laser intensity. The most crucial parameter however was the high-quality surface finish, to achieve a very good energy distribution in the beam focus. Operating in our uniquely stable production facility, using proprietary polishing techniques, our skilled craftsmen were able to produce a uniform mirror surface accuracy of 1/90 RMS and surface quality of better than 40:20 scratch/dig”.

The GSI Helmholtz Zentrum für Schwerionenforschung



in Darmstadt, Germany, operates a world-leading particle accelerator research facility for research purposes. It is the only facility that can accelerate ions of all chemical elements found on earth. The facility also operates PHELIX, a petawatt-class laser system delivering up to 200 Joules of energy within 500 fs pulse duration, tightly focused to spot sizes of a few micrometres to reach intensities exceeding 10^{21} W/cm². Such high intensities are required for laser-driven particle acceleration from protons to electrons. For further information on the Plasma Physics department and the PHELIX Petawatt Laser System please visit www.gsi.de/en/pelix.

Optical Surfaces Ltd

has been producing optical components and systems for 60 years and is today accepted as one of the world's leading manufacturers of high precision mirrors and optics for plasma physics research. For further information please visit <https://optisurf.com/> or contact Optical Surfaces Ltd. on +44-208-668-6126 / sales@optisurf.com.

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