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Achieving the highest intensity from the Orion Laser Facility

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Abstract content
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The Orion Laser Facility at AWE in the UK is a recently commissioned, multi-kilojoule laser facility for the study of high energy density plasma physics. It consists of ten "long pulse" beamlines, which each deliver 500 J at 351 nm and two "short pulse beams", each capable of 500 J pulses in 0.5 ps at 1054 nm.

The long pulse beams usually operate with continuous phase plates to deliver a user-defined focal profile, albeit at many times the diffraction limit. The need for wavefront correction is therefore limited to system operability issues.

The short pulse beams utilise the chirped pulse amplification scheme to deliver power in excess of 1 petawatt to target. Experiments also usually require the highest possible focal intensity – greater than 10^21 Wcm^-2 has been inferred from measurements. Adaptive optics systems are of crucial importance in achieving this goal. Each short pulse beamline is fitted with a 63 element monomorph mirror and a wavefront sensor at the end of the amplifier chain. However, further downstream optics, such as the pulse compression gratings and final focussing mirror, produce aberrations and these must also be controlled.

An overview of the facility will be given for context. The main theme of the talk will be a detailed discussion of the sources of aberration and the challenges faced and overcome in delivering the highest intensity on target.

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