

Overview of the Central Laser Facility

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The Central Laser Facility (CLF) is a world leading centre for research using lasers. This section provides a brief overview of the capabilities available to our international user community.

As with last year, we have again been very successful in attracting some exceptional new scientists and engineers. We have instigated new joint appointments with some of our key user groups, and have developed closer ties with our international counterparts and users to create new scientific and facility opportunities.

Vulcan

Vulcan is a highly versatile Nd:glass laser with three independent target areas that couple long and short pulse beams in a variety of flexible geometries. A maximum of 2.5 kJ can be delivered in its eight beams. Long-pulse temporal shaping is possible, with pulse durations from 100 ps to 20 ns, and a selection of focusing, beam smoothing and harmonic conversion options. Short pulse (<500 fs), high irradiance (up to 10^{21} Wcm⁻²) chirped pulse amplification (CPA) capability is available on the Petawatt and 100 TW beams. Within the past year we have introduced a long-pulse beam into the Petawatt area and developed the available short pulse probing and diagnostic capabilities. These are designed to provide a more flexible area for interaction experiments. We have also paid attention to the high intensity contrast levels, and dedicated funding to tackling known points of weakness in the facility operations. These changes are designed to provide a higher quality, more reproducible system.

A major upgrade to Vulcan is now underway, designed to offer 10 Petawatt capability (300J in 30fs). Users' opinions on the optimum configuration for this facility are being canvassed to ensure we maximise the scientific output from this world-leading capability when it comes online at the turn of the decade.

Astra

The Astra Ti:Sapphire laser facility currently delivers to two target areas.

Target Area 1 is an ultrafast area for atomic and molecular physics studies, combining pulses at 1kHz or 10Hz in 30-50fs duration and energy up to 10 mJ along with a 10fs, 0.5mJ beam. CEP stabilisation is now being commissioned, in readiness for a major new upgrade project. Called Artemis, this will mark a major development to TA1, combining <10fs high energy IR and XUV beams with a tunable probe source and end-stations offering optimised time resolution or energy resolution. This upgrade is due to come online in 2009 and involves many of the major UK university groups along with staff from the CLF and the Diamond synchrotron light source.

Target Area 2 delivers 500 mJ in <40fs with flexible target irradiance options up to 10^{19} Wcm⁻², at contrast levels up to $10^{10}:1$. Significant development to the probe beam capabilities is underway, to offer 10fs ultra-short pulses along with a broadly tunable source.

In July 2004 the Astra facility started a 3-year upgrade project called "Gemini" to raise its output power by a factor of 40. Two beams will each deliver 0.5 PW up to three times per minute, enabling interaction studies at 10^{22} Wcm⁻² in a dedicated interaction area, due to come online to users later this year.



Lasers for Science Facility (LSF)

The LSF operates a suite of state-of-the-art table top laser systems, giving users access to highly tunable (VUV to IR) and variable pulse width (ns to fs) laser radiation. The extremely versatile lasers are applied to a wide range of scientific and industrial applications across chemistry, physics, biology, medical and material sciences.

The time resolved resonance Raman (TR³) facility enables highly fluorescent samples to be studied using a 4ps optical Kerr shutter in combination with a fully tunable kHz femtosecond synchronised pump-probe capability. The same laser source also drives the high brightness PIRATE facility (Picosecond InfraRed Absorption and Transient Excitation) giving two independently tunable beams across the mid infrared region of the spectrum for pump / probe experiments.

Good progress is being made with the Ultra upgrade project, which will significantly enhance our Raman and IR spectroscopy. Operating at 10kHz with spectral coverage from 200-16000 nm and temporal resolution down to 50fs, this will provide unsurpassed sensitivity, with 60 fold faster data acquisition than the current state of the art.

The Laser Microscope Laboratory is actively developing the use of lasers for imaging and spectroscopic characterisation of biological materials at the cellular level. Alongside this, a “laser tweezers” laboratory is used to study Raman spectra and pico-Newton forces between particles in solution (such as living cells and aerosol droplets) for bioscience and environmental research.

Laser Loan Pool

Commercial laser systems are available from the EPSRC Laser Loan Pool for periods of up to 6 months at the user’s home laboratory. A wide range of ancillary and diagnostic equipment is also available to support user experiments.

Engineering Services

Mechanical, electrical and computing support is provided for the operation of the laser facilities at the CLF, for the experimental programmes on these facilities and for the CLF’s research and development activities. Access to mechanical and electrical CAD tools and workshop facilities enable a rapid response to be provided to users.

Target Preparation

A high quality target fabrication facility is operated within the CLF. It is equipped with a wide range of target production and characterisation equipment, including evaporation and sputter coating plants, interference microscopes, SEM, AFM, surface profiling and a plasma etch facility. Many targets are produced in collaboration with STFC micromachining and lithographic services. A rapid turnaround service responds quickly to the developing demands for targets, essential for maintaining the scientific productivity of the programme.

Access to Facilities

Calls for access are made twice annually, with applications peer reviewed by external Facility Access Panels. For information please visit: www.cclrc.ac.uk/activity/facilityaccess or contact me at the above email address.

Access to CLF facilities is awarded to European researchers under the auspices of the LaserLab-Europe initiative (www.laserlab-europe.net). Hiring of the facilities and access to CLF expertise is also available on a commercial basis for industrial research and development.

See our website for more details on all aspects of the CLF.

