

THE GENESIS OF TITANIA AND ITS CONVERSION TO A GRANT FUNDED PROJECT

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This note summarises how the Titania Project was established and makes recommendations for its completion to be funded through an EPSRC Grant and separate therefore from the SLA based operational programme of the CLF's high power lasers.

The transfer of funds from the SLA to a Grant within EPSRC is cost neutral and consists simply of a transfer of the Titania construction funds from within remaining two years of the previously agreed 3 year SLA to a 2 new year grant. The advantage of the transfer is that it puts the completion of construction of Titania on the same formal basis as other grant funded facility upgrades at the CLF and in other facilities.

Titania did not originate as a grant. It originated through a process of re-appraisal of the CLF's objectives in high power laser development when the Science Board in March 1991 (SB 13-91) formally recognised that the earlier plan to join with European Partners to construct a European Laser Facility would not come to fruition and that a new SERC strategy was therefore required. At the request of the Board, the CLF produced a revised plan for consideration at its next year end policy review.

The CLF undertook an in-depth consultation with high power laser users (papers for the user meeting on 13 Sept. 1991) and a detailed review of the technical opportunities. As a result of this study, the CLF recommended the development of ultra high intensity laser capability through exploitation of the new chirped pulse amplification (CPA) technique using the Vulcan Nd:glass laser and through pioneering development of both CPA and Raman pulse compression using the Sprite KrF laser. The new plan was approved by the Laser Facility Committee and by the Science Board at its Oct. 1991 meeting (SB 69-91)

The first phase of the plan was a two year project involving collaboration with University groups to implement the high brightness modifications to the Sprite and Vulcan lasers and to bring these new capabilities on line to users. The "Joint Project for Ultra-Bright Lasers at the CLF" was awarded supplementary funding of £760k. The final report on this project was published by RAL as RAL - 94059 .

The Board also considered the longer term development of high power lasers at the CLF and approved a four year project for construction of an enhanced KrF laser facility Titania. Titania was to be built within the base line funding of the CLF as part of the high power laser programme. Initial off-line work to build and test a new large KrF amplifier would be followed by closure of Sprite and the commissioning of Titania.

A project team was established within the CLF to develop the detailed engineering design of Titania and in December 1993 a further consultation with users on the technical details of the Titania project was undertaken. A formal document specifying the Titania laser was published in 1994 (RAL-94-014).

The overall Titania plan and the current state of progress was reviewed in depth in the course of the Longair Review of the CLF which reported in January 1995. The review was strongly supportive of the Titania project.

In summary, the Titania project has been subjected to detailed peer review at all stages, which can now be taken as a proper for transferring the remaining funds for Titania construction to an EPSRC grant.

Progress to date on the Titania project has been extremely good. A major accomplishment was the successful construction and testing of the 40 cm amplifier module which was built off-line and its testing completed in 1994. In April 1995 the Sprite laser facility was closed and construction work started to incorporate the components of Sprite and the new amplifier module into the full Titania system. On 2 April, exactly one year after the decommissioning of Sprite, Titania was inaugurated by Dr Paul Williams, Chief Executive of CCLRC.

Titania is now being prepared for its first user experiments where it will provide a single CPA beam for gas and solid target interaction studies performed by groups from Imperial College and Oxford University.

The remaining work for the completion of Titania is now defined as a grant funded project. The funding of the grant is the same as that in existing SLA which in turn conforms to the Forward look of the Laser Facility Committee (LFC- 93-22)

Grant programme for Titania laser construction

Phase 1 (FY '96 - '97)

Titania will be developed to provide a single high energy Raman laser beam in addition to the existing single CPA laser beam. The performance will be up to a maximum of 100 Joules at pulse lengths ranging from 20 picoseconds to 500 picoseconds. The cost of this phase will be £695,000 comprised of £460,000 of equipment and £235,000 staff effort. The Raman beam will be made available to users early in the financial year of 1997/98. Both the Raman and the CPA beams will be delivered to the existing target area, equipped with the existing TA West target chamber. This will become available early in 1997 when a new Vulcan CPA chamber is installed in TA West as part of the Vulcan Peta-Watt enhancement. A detailed costing for the project is given in Appendix 1.

Phase 2 (FY '97 - '98)

Synchronous two beam operation of both CPA and Raman modes will be made available. This advanced capability will enable a new and unique class of experiments to be performed including re-heat X-ray laser studies, and proof of principle experiments for fast ignition fusion. This capability will ensure that Titania is fully exploited, underpinning the high power laser programme at the CLF and stimulating new directions of the scientific programme of its users. This is seen as increasingly important in a ticket-based facility access economy.

Phase 2 involves addition of a second pulse generation system to the laser front end. The existing (TA West) chamber will be replaced by a purpose designed chamber, the target area and laser beam diagnostic instrumentation will be improved and compression gratings capable of handling higher energy will be installed. The two beam synchronous mode of operation will

be made available to users at the beginning of the financial year 1998/99. The total cost will be £536k comprised of £370k for equipment and £ 166 k for staff effort. Costing details are given in Appendix 2

Phase 3 (FY '98 on)

The final phase of the Titania project involves Raman multiplexing to provide four high power Raman beams. This work is planned for the financial year 1998/99. It is recommended that four beam Raman operation be reviewed in the light of experience of users with the single beam (phase 1) and the likely demand for tickets under the new funding scheme for facility access. Funding for this phase would then be the subject of a separate grant application for facility development and would be peer reviewed and "tensioned" in the usual way.

A further consideration for CLF managers will be the status of the Petawatt project on Vulcan for which Phase 2 funding will also be required.