

Vulcan Operational Statistics

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Vulcan has completed an active experimental year, with 10 full experiments taking place in target areas TAE, TAW and TAP between March 2005 and March 2006. This was the third complete operational year for the Petawatt target area (TAP).

Table 1 below shows the operational schedule for the year, and illustrates the shot rate statistics for each experiment. Numbers in parentheses indicate the total number of full energy laser shots delivered to target, followed by the number of these that failed. The total number of full disc amplifier shots that have been fired to target this year is 672 with 93 of these failing to meet user requirements. The overall shot success rate to target for the year is 86%, compared to 94% for the previous year, and 90% and 80% two and three years ago. Figure 1 shows the reliability of the Vulcan laser over the past four years.

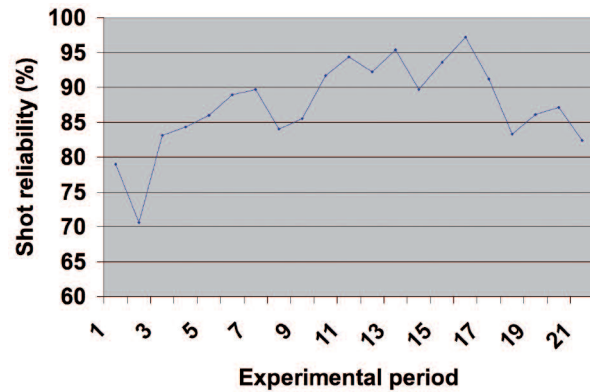


Figure 1. All areas shot reliability for each experimental period for 2002-3 (periods 1-5), 2003-4 (6-11), 2004-5 (12-16) and 2005-6 (17-21).

Period	TAE	TAW	TAP
Shutdown for system access February - May 2005			
9 May - 3 July*		<i>M. Koenig</i> Photon-probed shocks (83, 8) (90.3%)	<i>P. McKenna</i> Heavy ion acceleration (53, 4) (92.5%)
18 July - 28 Aug		<i>K. Krushelnick</i> Laser-driven Z-pinch (65, 10) (84.6%)	<i>P. Norreys</i> Electron energy transport (43, 8) (81.4%)
12 Sept - 23 Oct	<i>D. Riley</i> KeV X-ray sources (125, 18) (85.6%)		<i>K. Krushelnick</i> Energetic particles (33, 4) (87.9%)
31 Oct - 18 Dec*		<i>D. Jarosynski</i> Raman (57, 8) (86.0%)	<i>K. Krushelnick</i> Energetic particles (82, 10) (87.8%)
9 Jan - 23 Feb*		<i>M. Borghesi</i> Plasma dynamics (98, 17) (82.6%)	FIGEX (33, 6) (81.8%)

Table 1. Experimental schedule for the period March 2005 - February 2006

(* experiments had staggered start)

(Shots fired, failed shots)
(Reliability)

This was the third full year of operations for the Petawatt target area, with 5 full experiments. The total number of full disc amplifier shots that have been fired to TAP is 244 with 32 of these failing to meet user requirements. The overall shot success rate to TAP for the period is 86.9%. Figure 2 shows the reliability of the individual experimental campaigns as the year progressed.

Analysis of the reasons for failure of the individual shots enables a breakdown of these causes into specific categories. Figure 3 shows the individual failure rates for the identified failure modes, and compares these with the figures for TAP and TAE+TAW. For the past 12 months, the most serious causes of failed shots to TAP are the oscillators and alignment of the OPCPA beam through the rod chain (28 failed shots, or 88%). For TAE+TAW, oscillators and alignment have accounted for 37 failed shots, or 61%, of all failures). Other significant contributions this year have been pulsed power and triggering (18%) and initial problems with automated configuration of slides and beam stops for new experiments (10%). The dramatic improvement in the failure rate of the 9mm amplifiers due to installation of new power supplies last year continues with just one failed shot to either area over the past 2 years since the commissioning. This compares with the 9mm amplifiers accounting for between 30 and 40% of all failures prior to the installation.

There is a requirement which was originally instigated for the EPSRC FAA that the laser system be available, during the four week periods of experimental data collection, from 09:00 to 17:00 hours, Monday to Thursday, and from 09:00 to 16:00 hours on Fridays (a total of 156 hours).

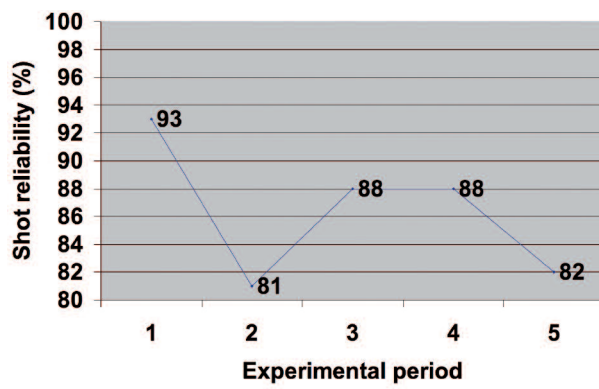


Figure 2. TAP shot reliability for each experimental period.

The laser has not always met the startup target of 9:00 am but it has been common practice to operate the laser well beyond the standard contracted finish time on several days during the week. In addition, the introduction of early start times on some experiments has led to improvements in availability.

On average, Vulcan has been available for each experiment to TAP for 81.5% of the time during contracted hours and 113.8% overall. For TAE+TAW the availabilities are 85.1% and 122.0%. These figures compare with 77.3% and 104.3% in 2004-2005 to all target areas. However, over the past twelve months, each experiment has also experienced an average of 5.8 hours during the standard working week when the laser has been unavailable, or just over one hour per day (primarily this is the time taken for beam alignment at the start of the day).

