International Conference on Space Optics—ICSO 2004

Toulouse, France

30 March–2 April 2004

Edited by Josiane Costeraste and Errico Armandillo

Conduction cooled compact laser for the MALIS instrument

E. Durand, D. Decaux, F. Falcoz, M. Saccoccio, et al.

International Conference on Space Optics — ICSO 2004, edited by Errico Armandillo,
Josiane Costeraste, Proc. of SPIE Vol. 10568, 105680O · © 2004 ESA and CNES
CCC code: 0277-786X/17/$18 · doi: 10.1117/12.2308015

CONDUCTION COOLED COMPACT LASER FOR THE MALIS INSTRUMENT

E. Durand[(1)], D. Decaux[(1)], F. Falcoz[(1)], M. Saccoccio[(2)] and M. Sylvestre[(3)]

[(1)] THALES LASER, RD 128, BP 46, 91401 Orsay cedex, France, eric.durand@fr.thalesgroup.com, dominique.decaux@fr.thalesgroup, franck.falcoz@fr.thalesgroup.com
[(2)] CNES, 18, avenue Edouard Belin, 31401 Toulouse cedex 4, France, muriel.saccoccio@cnes.fr
[(3)] Observatoire Midi-Pyrénées, Laboratoire d'Astrophysique, 14, avenue Edouard Belin, 31400 Toulouse, France, maurice@ast.obs-mip.fr

ABSTRACT

A new conduction cooled compact laser for laser induced spectroscopy is presented. An oscillator combined to an amplifier is designed to generate 30mJ at 1µm with a good spatial quality.

1. INTRODUCTION

This communication describes a diode pumped laser based on innovative pumping laser head, cooled by conduction. This compact laser, designed to work in burst mode in very stringent temperature conditions, necessitates no active cooling, neither for the laser diode nor for the laser medium. One application foreseen is laser induced spectroscopy on MALIS instrument. Other potential applications for this laser like telemetry are under study.

2. LASER ARCHITECTURE AND PERFORMANCES DATA

The laser runs in the nanosecond regime, at a repetition rate of 15Hz maximum. Its architecture is based on an oscillator followed by a double-passed amplifier. The oscillator provides a beam with a high beam quality. The output energy is enhanced in the amplifier while keeping good spatial beam characteristics.

2.1 The oscillator

The pumping head is composed by a Nd : KGW rod longitudinally pumped by an autostack. The main advantage of the autostack is its very high brightness. It provides a peak power of 1 kW for a 100 µs pulse duration. The very high spectral acceptance of the Nd : KGW rod provides very small absorption variations over wide temperature ranges. This allows both the diode and the rod to be conductively cooled and run on the large temperature variations of the mission.

Fig. 1 shows the oscillator energy versus the autostack temperature measured on a table top prototype. For a diode temperature range as large as 25°C, the energy decrease is less than 20%.

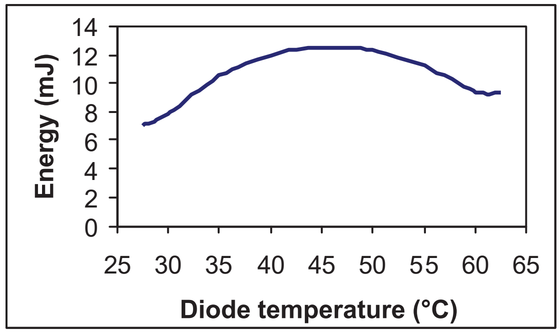

Fig. 1 Oscillator energy versus autostack temperature

The oscillator is linear and composed of the pumping structure and two mirrors. A polarizer, wave-plate and pockels cell Q-switch the cavity. **Fig. 2** shows a mechanical drawing of the oscillator. It should provide an output energy of 13mJ with a pulse duration < 10ns, and a quality factor < 3.

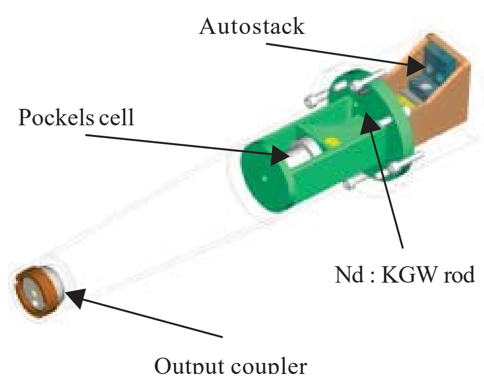

Fig. 2 : Mechanical drawing of the oscillator

Due to the mission constraints, compactness and weight were two driving factors of the mechanical design, keeping the necessary ruggedness at the same time. Oscillator dimensions are about ϕ50 x 200 mm, and weight is about 300 g

2.2 The amplifier

The pumping head for the amplifier is identical to the oscillator one. The laser beam emitted by the oscillator enlarged by a telescope travels twice the amplifier, in order to increase the extraction efficiency.

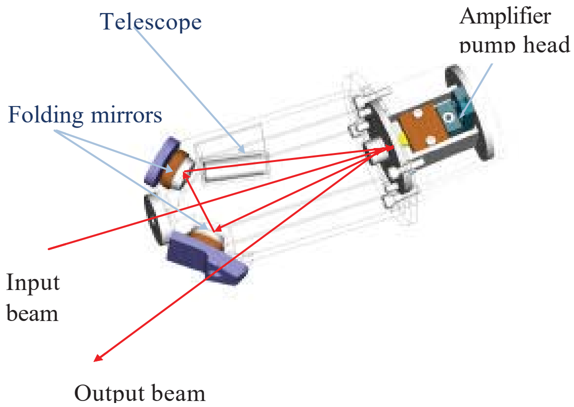

Fig. 3 : Mechanical drawing of the amplifier

An output energy in excess of 30 mJ should be obtained at the system output, with a M^2 factor < 3.

Acknowledgement
This work is performed in the frame of a laser feasibility study for the MALIS instrument. It is funded by CNES, under contract No. DTS/AE/INS/TO-02-053.