***LIGO Laboratory / LIGO Scientific Collaboration***

|  |  |  |  |
| --- | --- | --- | --- |
|

|  |  |  |
| --- | --- | --- |
| T1900395-v1 | *LIGO* | June 2019 5 |

 |
| Incoming Test of SQZ Spare Mephisto 1000NE Laser |
| Jason Oberling |

Distribution of this document:

LIGO Scientific Collaboration

This is an internal working note
of the LIGO Laboratory.

|  |  |
| --- | --- |
| **California Institute of Technology****LIGO Project, MS 100-36****1200 E. California Blvd.****Pasadena, CA 91125**Phone: (626) 395-2129FAX: (626) 304-9834E-mail: info@ligo.caltech.edu | **Massachusetts Institute of Technology****LIGO Project, NW22-295****185 Albany St.****Cambridge, MA 02139**Phone: (617) 253-4824FAX: (617) 253-7014E-mail: info@ligo.mit.edu |
|  |  |
| **LIGO Hanford Observatory****P.O. Box 159****Richland, WA 99352**Phone: (509) 372-8106FAX: (509) 372-8137 | **LIGO Livingston Observatory****P.O. Box 940****Livingston, LA 70754**Phone: (225) 686-3100FAX: (225) 686-7189 |

<http://www.ligo.caltech.edu>

# Scope and Purpose

This document shows the results of the incoming tests performed on the Coherent Mephisto 1000NE S/N 5834 laser system, hereafter referred to as the NPRO. This is the spare NPRO laser for the SQZ subsystem.

# Introduction

Upon unpacking, the NPRO powered up without issue. Below are the serial numbers of the NPRO and its power supply, as well as a list of equipment used for the testing.

## Serial Numbers

* Mephisto 1000NE, P/N 1309412, S/N GDP.1309412.5834
* Mephisto Controller, P/N 1309412, S/N GDP.1309412.5834

## Equipment

* Power meter: Ophir Vega, P/N 7Z01560, S/N 730491
* Calorimeter: Ophir 10A-V2-SH, P/N 1Z02146, S/N 75126
* Beam profiler: Thorlabs BP209-VIS
* Photodiode: Thorlabs PDA36A
* Signal Analyzer: SRS SR785

# Laser Settings

The data sheet for the NPRO is located on the DCC file card for this test report. For completeness, the NPRO settings are shown in Table 1.

Table 1: NPRO Settings

|  |  |
| --- | --- |
| NPRO crystal temperature | 26.20 °C |
| Diode current | 2.14 A |
| Diode A temperature | 26.01 °C |

# Output Power

The output power was measured to be 1.12 W after a warm-up period of ~5 minutes.

# Free-space Beam Propagation

The free-space beam propagation was measured with the beam profiler listed above and is shown in Figure 1 along with a Gaussian fit. The transmitted beam through a 98/2 (%R/%T) beamsplitter was used to do this measurement. For the purpose of this measurement, zero is the flat front face of the NPRO laser housing.



Figure 1: The measured free-space beam propagation.

Table 2 summarizes the NPRO beam waist radius and location. As stated above, zero is the flat front face of the NPRO laser head housing.

Table 2: NPRO Waist Radius and Location

|  |  |  |
| --- | --- | --- |
|  | **Waist Radius (µm)** | **Waist Location (mm)** |
| **Horizontal** | 146 | -89.4 |
| **Vertical** | 157 | -94.4 |

# Relative Power Noise

The measured low-frequency relative intensity noise (RIN) is shown in Figure 2; the measurement was performed with a SR785 Digital Signal Analyzer from Stanford Research Systems. It should be noted that Coherent does not give a performance specification for the RIN below 10 kHz. It simply lists the RIN as better than -140 dB/Hz at frequencies greater than 10 kHz, which the NPRO satisfies.

Figure 2: Measured RIN of Mephisto 1000NE SN5834