LASER INTERFEROMETER GRAVITATIONAL WAVE OBSERVATORY

LIGO Laboratory / LIGO Scientific Collaboration

T1900395-v1 *LIGO* June 2019

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) 395-2129
FAX: (626) 304-9834
E-mail: info@ligo.caltech.edu

Massachusetts Institute of Technology
LIGO Project, NW22-295
185 Albany St.
Cambridge, MA 02139
Phone: (617) 253-4824
FAX: (617) 253-7014
E-mail: info@ligo.mit.edu

LIGO Hanford Observatory
P.O. Box 159
Richland, WA 99352
Phone: (509) 372-8106
FAX: (509) 372-8137

LIGO Livingston Observatory
P.O. Box 940
Livingston, LA 70754
Phone: (225) 686-3100
FAX: (225) 686-7189

http://www.ligo.caltech.edu

1. 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.

2. 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.

2.1 Serial Numbers

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

2.2 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

3. 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

4. Output Power

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

5. 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.

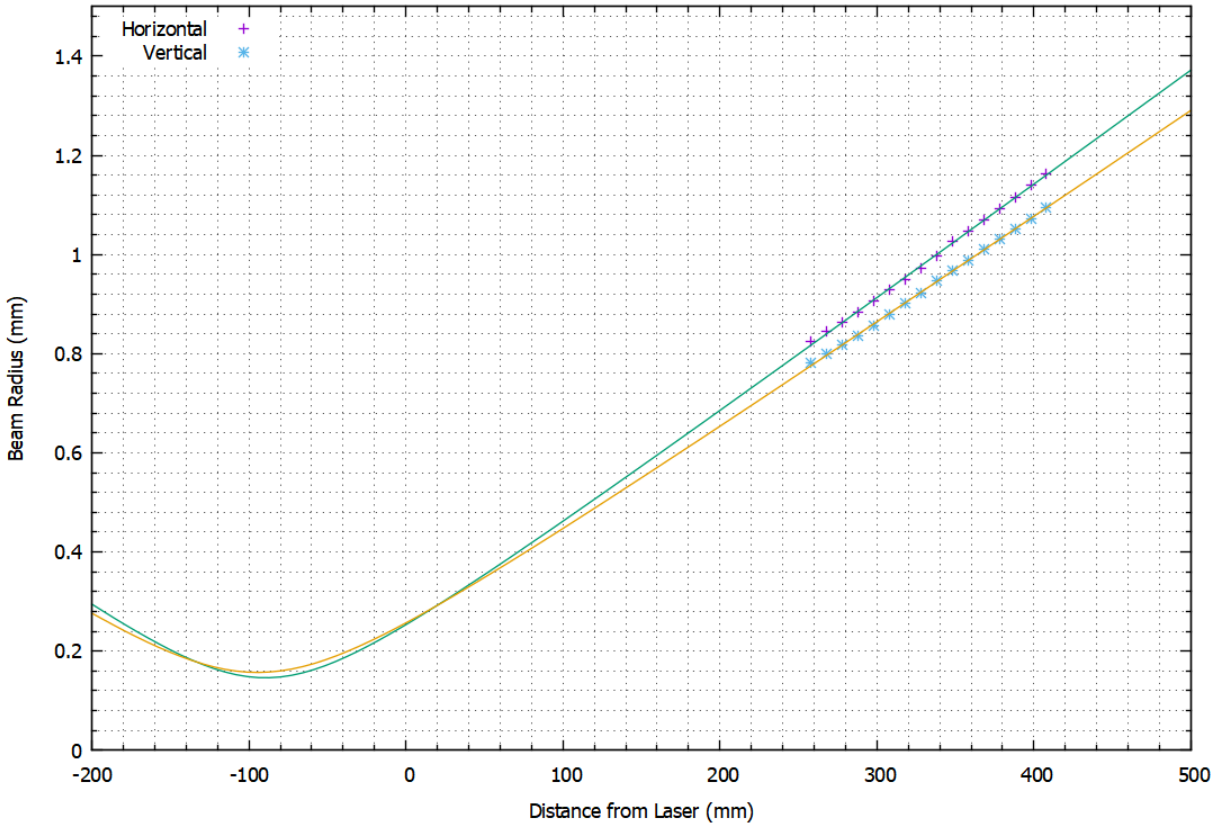

Figure 1: The measured free-space beam propagation.

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

6. 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.

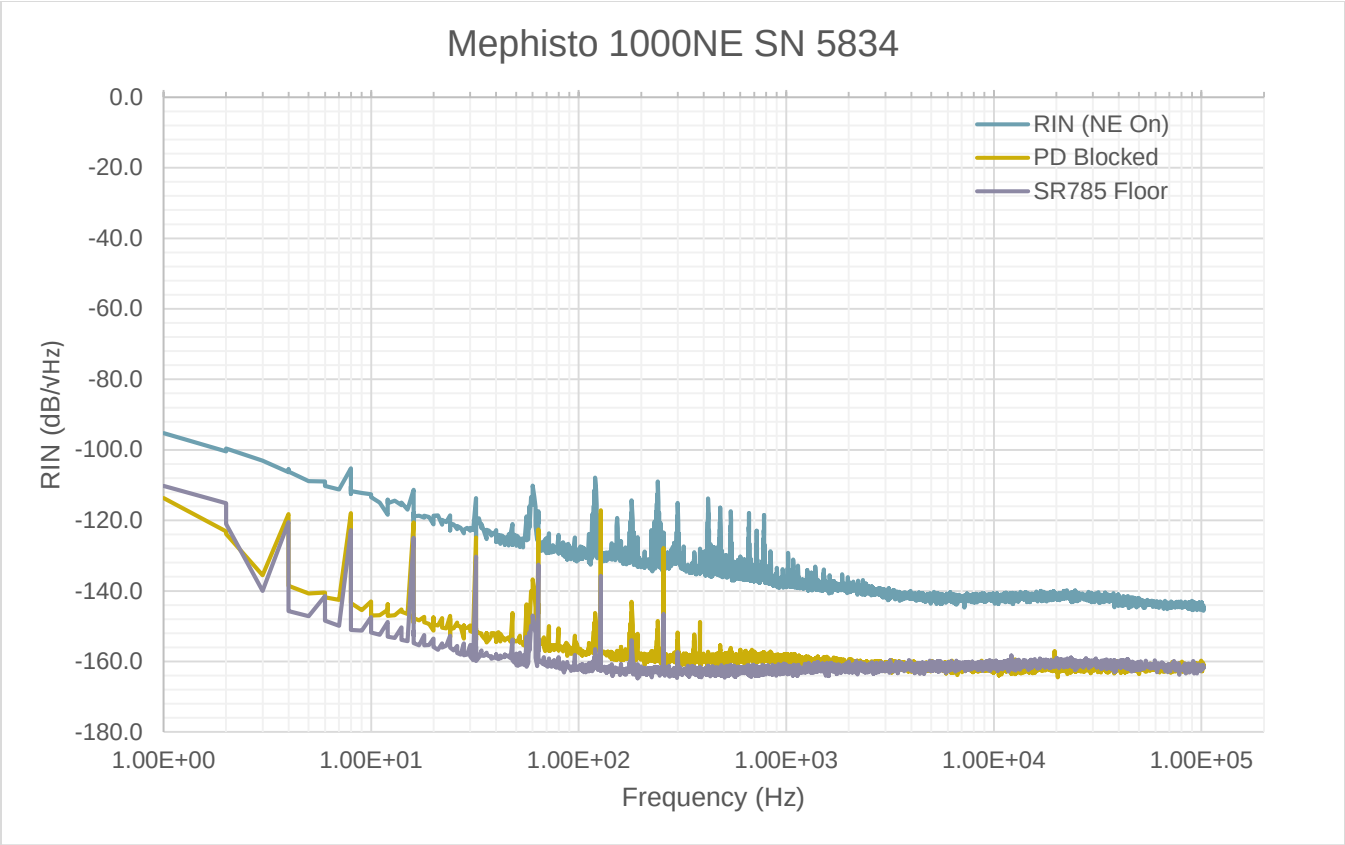

Figure 2: Measured RIN of Mephisto 1000NE SN5834