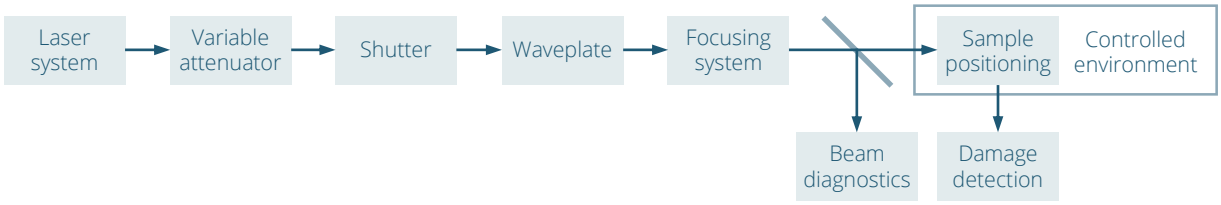
LIDARIS
LIDT Service

TEST EQUIPMENT

Test setup

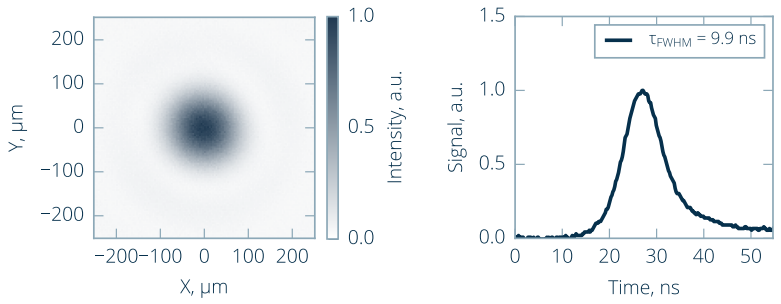


Laser and its parameters

Type	Q-switched, seeded Nd:YAG
Manufacturer	InnoLas Laser II
Model	SpitLight Hybrid
Central wavelength	1064.0 nm
Angle of incidence	0.0 deg
Polarization state	Linear
Pulse repetition frequency	100 Hz
Spatial beam profile in target plane	TEM00
Beam diameter in target plane ($1/e^2$)	(225.3 ± 3.4) µm
Longitudinal pulse profile	Single longitudinal mode
Pulse duration (FWHM)	(9.9 ± 0.3) ns
Pulse to pulse energy stability (SD)	0.8 %

Energy/power meter

Manufacturer	Ophir
Model	PE50-DIF-C
Calibration due date	2022-05-01



(a) Beam profile (b) Pulse profile

Figure 1. Laser parameters used for measurements.

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TEST SPECIFICATION

Definitions and test description

Laser-induced damage (LID) is defined as any permanent laser radiation induced change in the characteristics of the surface/bulk of the specimen which can be observed by an inspection technique and at a sensitivity related to the intended operation of the product concerned. Laser-induced damage threshold (LIDT) is defined as the highest quantity of laser radiation incident upon the optical component for which the extrapolated probability of damage is zero. [1]

LID of the sample is investigated by performing a standardized S-on-1 test procedure.[2]
LIDT value is determined by fitting experimental damage probability data with a model derived for a Poisson damage process assuming degenerate defect ensemble. [3]

Test sites

Number of sites	420
Arrangement of sites	Hexagonal
Minimum distance between sites	900 µm
Maximum pulses per site	1000

Analysis information

Online detection	Scattered light diode
Offline detection	Nomarski microscope
Software version	5b02bef

Test environment

Environment	Air
Cleanroom class (ISO 14644-1)	ISO7
Pressure	1 bar
Temperature	21.4 - 21.6 C
Humidity	39.8 - 39.9 %

Sample preparation

Storage before test	Normal laboratory conditions
Dust blow-off	Canned air
Cleaning	Isopropanol

[1] ISO 21254-1:2011: Lasers and laser-related equipment - Test methods for laser-induced damage threshold - Part 1: Definitions and general principles, International Organization for Standardization, Geneva, Switzerland (2011)

[2] ISO 21254-2:2011: Lasers and laser-related equipment - Test methods for laser-induced damage threshold - Part 2: Threshold determination, International Organization for Standardization, Geneva, Switzerland (2011)

[3] J. Porteus and S. Seitel, Absolute onset of optical surface damage using distributed defect ensembles, Applied Optics, 23(21), 3796–3805 (1984)

LIDT TEST RESULTS

LIDT VALUE

10^3-on-1	$115.8\ ^{+4.3}_{-8.2}$ J/cm^2

CHARACTERISTIC DAMAGE CURVE

Table 1: Estimated LIDTs from fiting model for sample M001948 LOT0082540.

Test mode	Threshold (Offline detection - microscopy)	Threshold (Online detection - scattering)
1-on-1	$115.8\ ^{+5.6}_{-8.2}$ J/cm^2	$115.8\ ^{+6.6}_{-7.9}$ J/cm^2
10-on-1	-	$115.8\ ^{+6.6}_{-7.9}$ J/cm^2
10^2-on-1	-	$115.8\ ^{+5.1}_{-7.9}$ J/cm^2
10^3-on-1	$115.8\ ^{+4.3}_{-8.2}$ J/cm^2	$115.8\ ^{+4.1}_{-7.9}$ J/cm^2

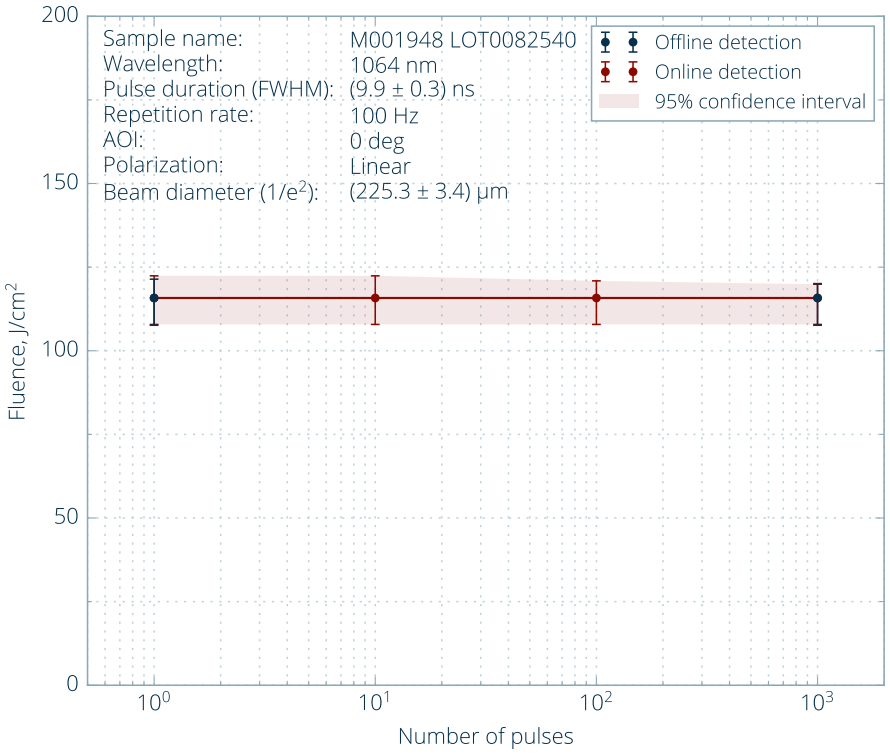
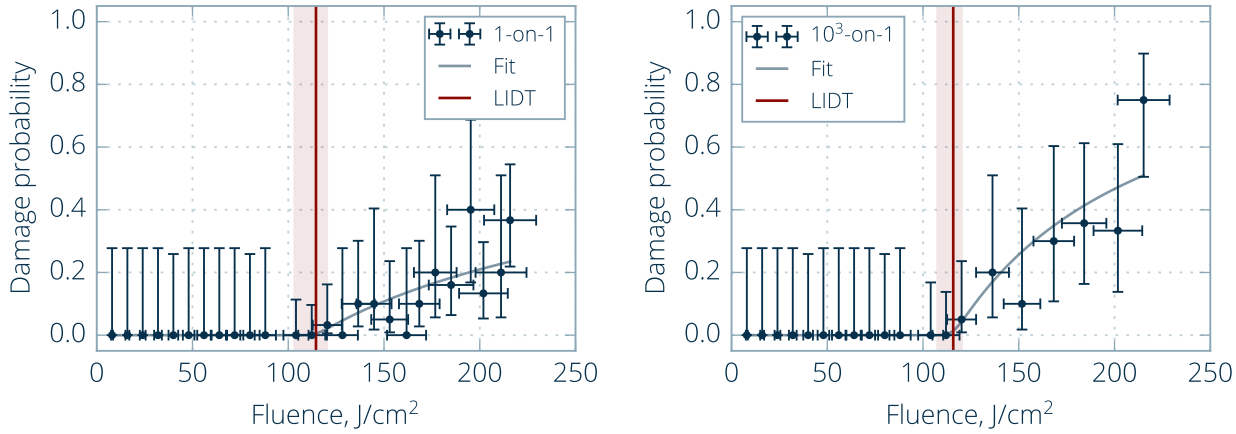


Figure 2. Characteristic damage curve.

DAMAGE PROBABILITY (OFFLINE DETECTION)



(a) 1-on-1

(b) 10^3-on-1

Figure 3. Damage probability plots.

TYPICAL DAMAGE MORPHOLOGY (OFFLINE DETECTION)

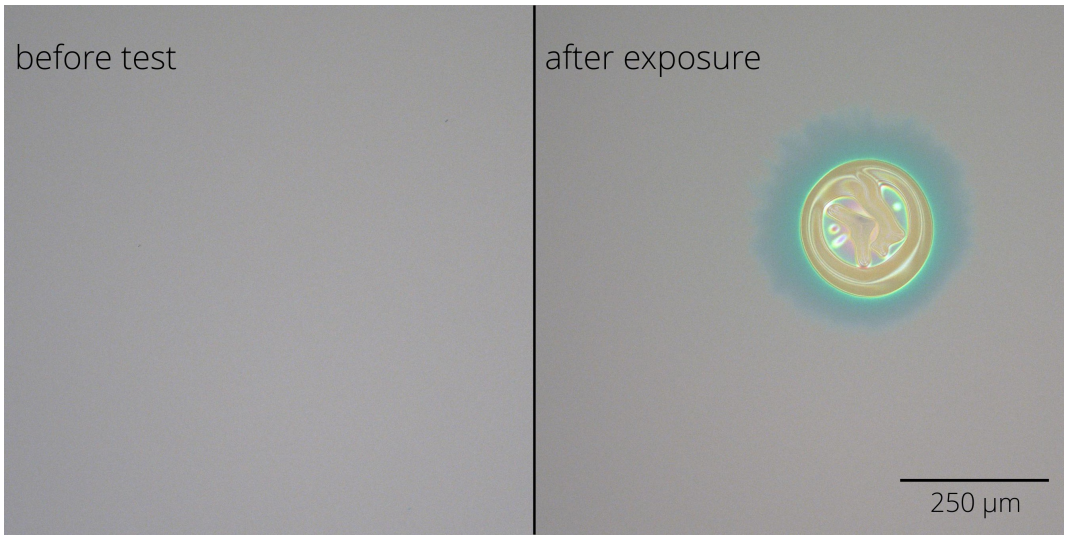


Figure 4. Typical damage morphology: fluence 122 J/cm^2, damage after 1 pulse(s).

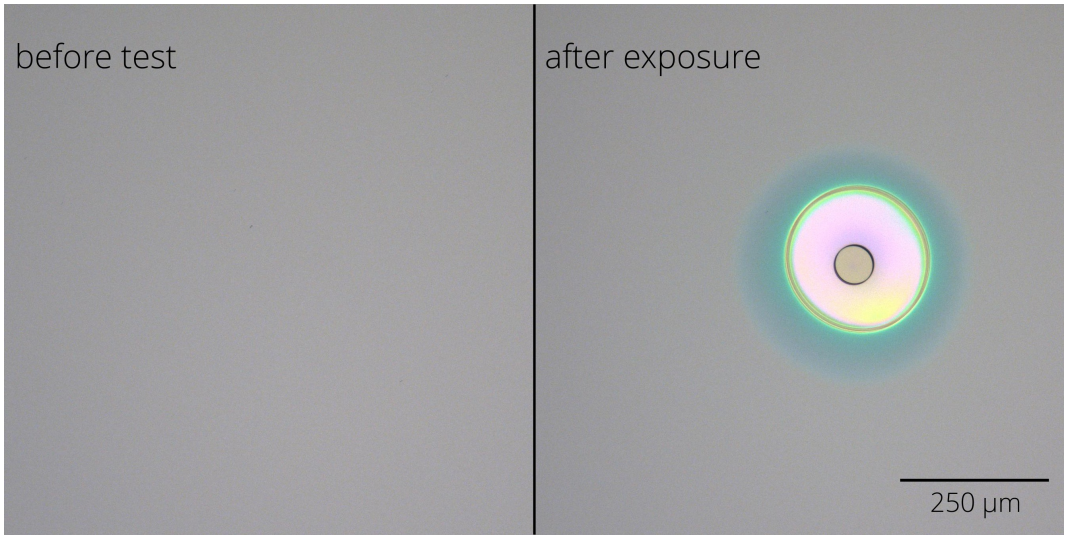
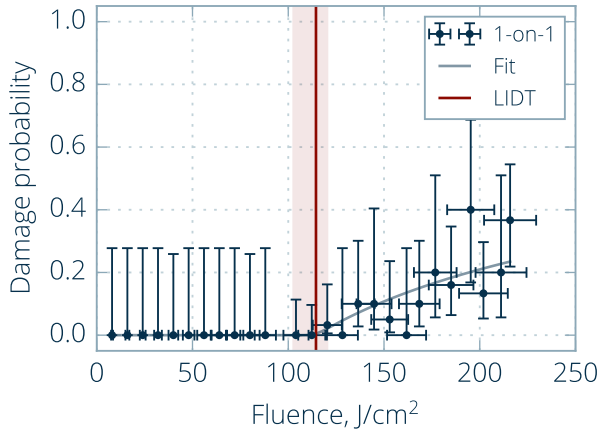
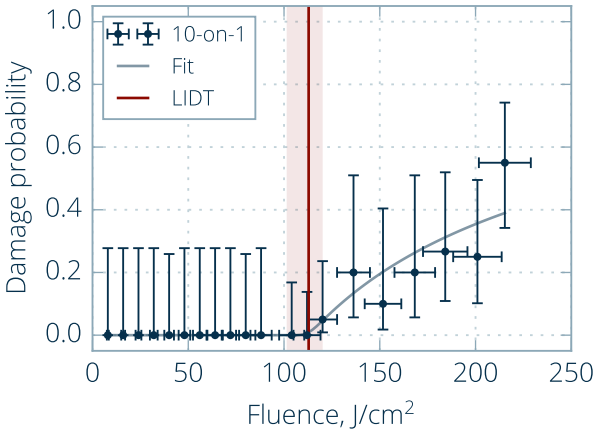


Figure 5. Typical damage morphology: fluence 149 J/cm^2, damage after 1 pulse(s).

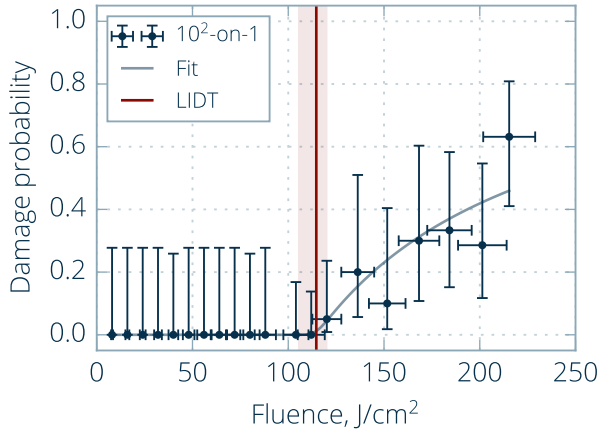
DAMAGE PROBABILITY (ONLINE DETECTION)



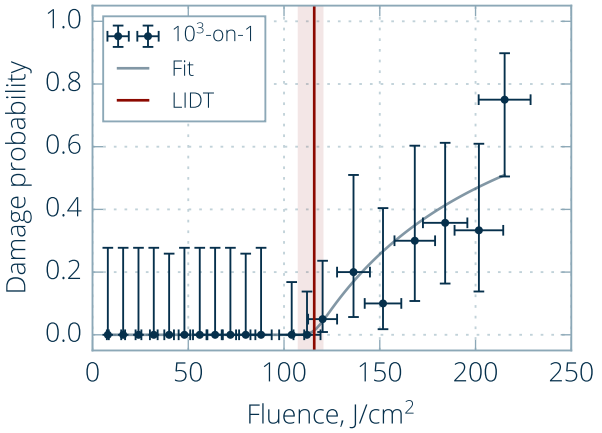
(a) 1-on-1



(b) 10-on-1



(c) 10^2-on-1



(d) 10^3-on-1

Figure 6. Damage probability plots.