



# PROFESSIONAL LASER DAMAGE TESTING

Innovate to dominate



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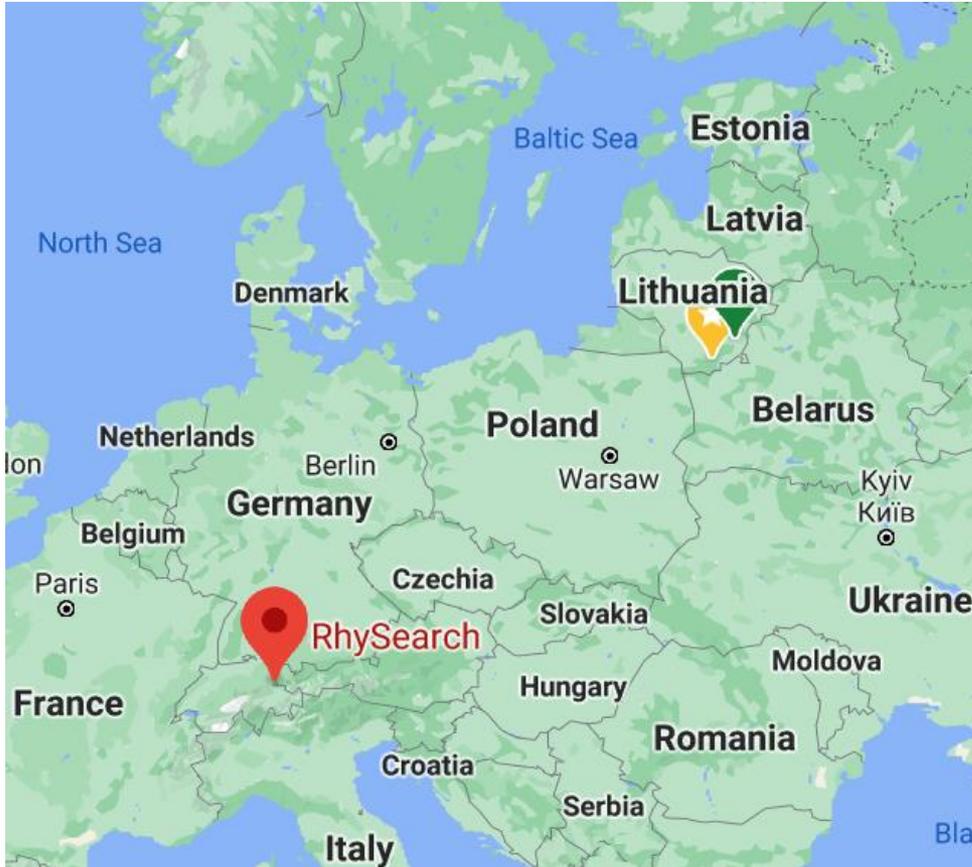


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Lidt\_service

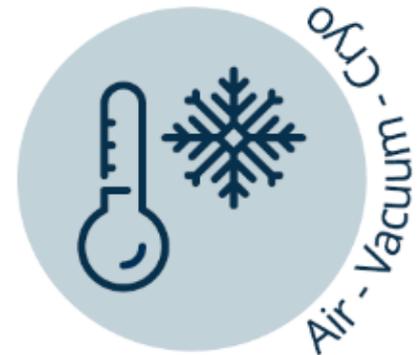
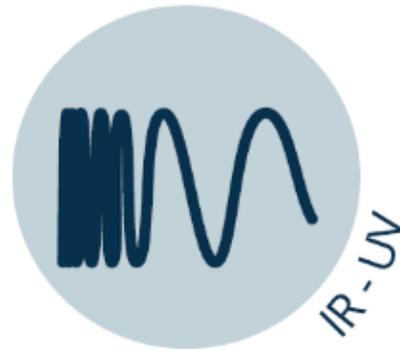
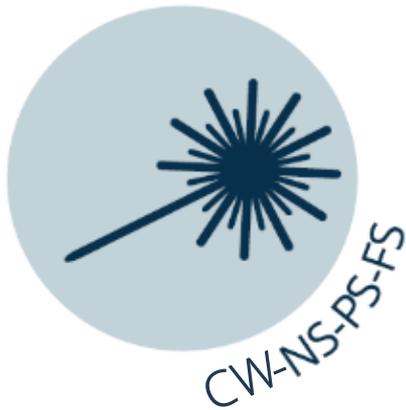
# LASER DAMAGE TESTING SERVICE



## LIDARIS organized Laser Damage Competition 2020 (@532nm, ns)



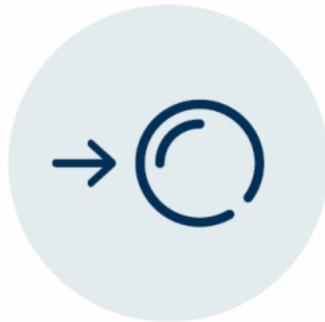
# ALL TESTING AT ONE PLACE!



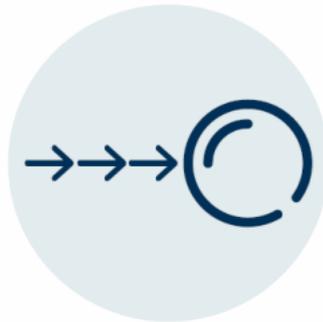
WIDE ASSORTMENT OF LIDT TEST CONDITIONS

# ALL TESTING AT ONE PLACE!

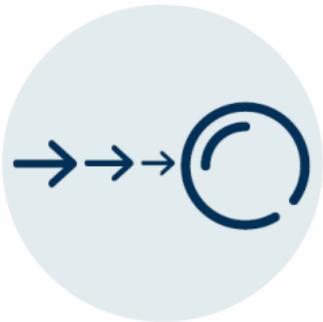
1-ON-1



S-ON-1



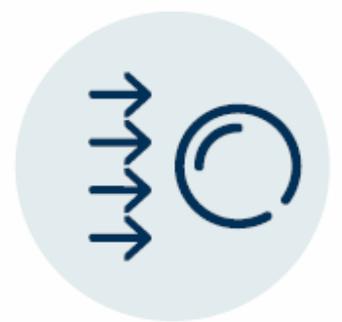
R-ON-1



Certification



Raster Scan



WIDE ASSORTMENT OF LIDT TEST PROCEDURES



Optics **got damaged** below  
specified LIDT: whom to blame  
when everybody is right?

Dr. Gintarė Batavičiūtė



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# Irrational problem: why it got damaged?

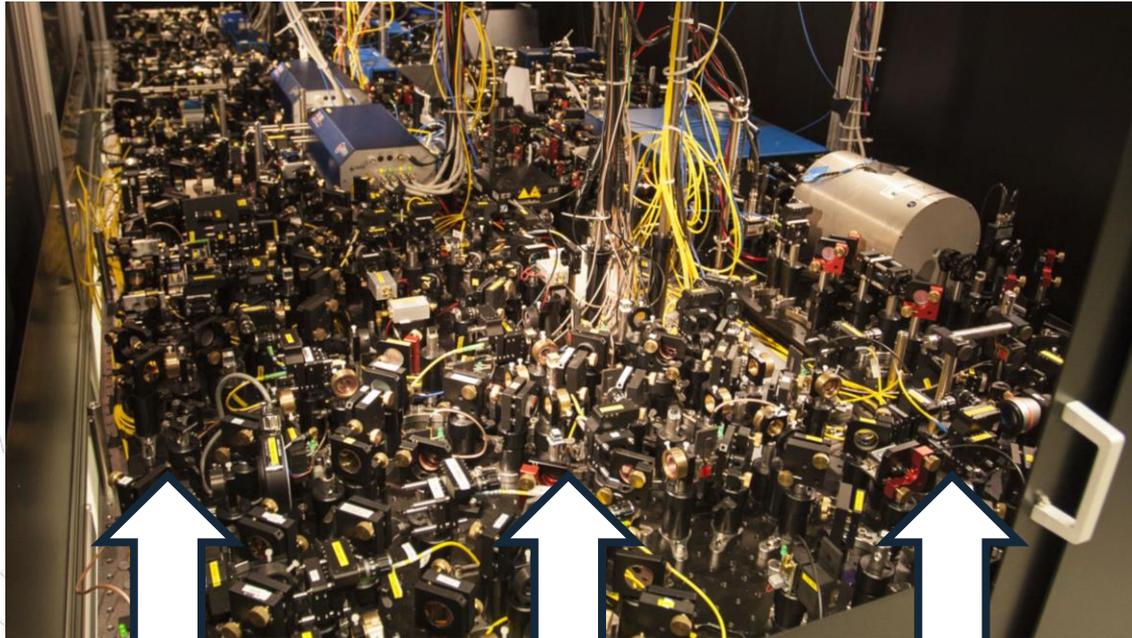


Image credit: <http://www.quantum-optics-munich.de>



LIDT

$10 \text{ J/cm}^2 @$   
 $1064\text{nm}, 10\text{ns},$   
 $10\text{Hz}$



# Irrational problem: why it got damaged?

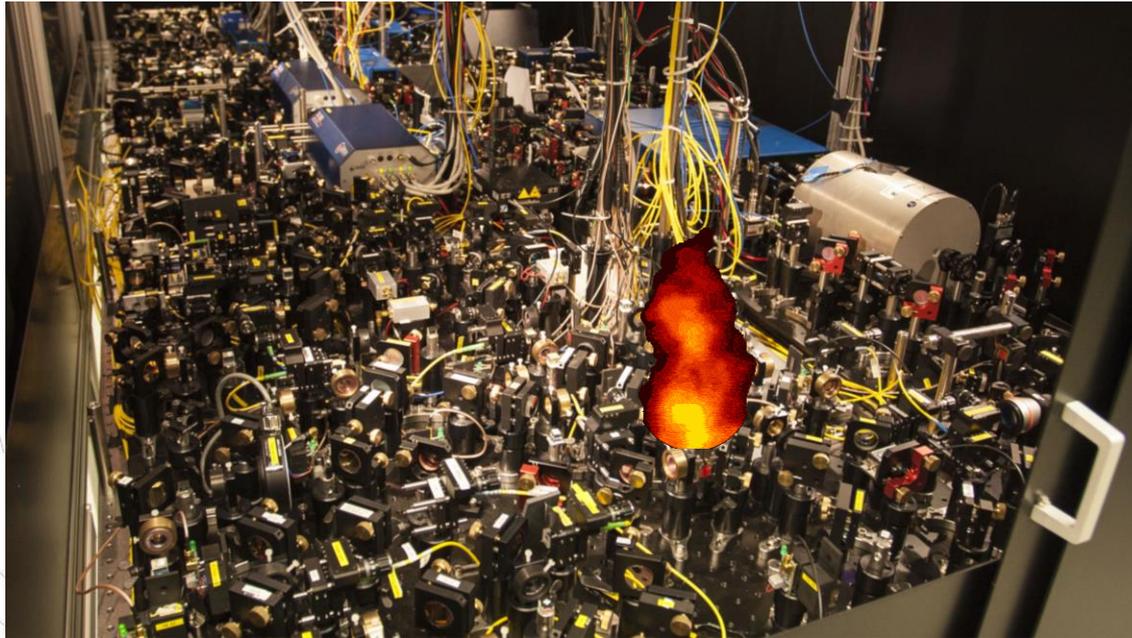
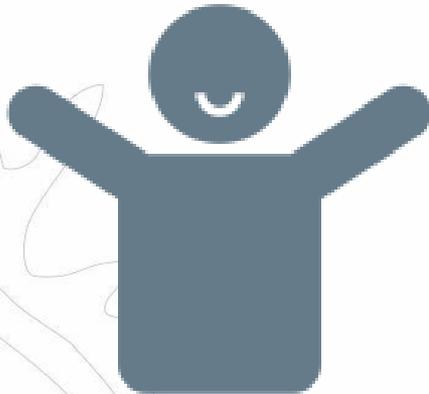


Image credit: <http://www.quantum-munich.de>



# Whom to blame when everybody is right?

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Engineer



Vendor's  
Company



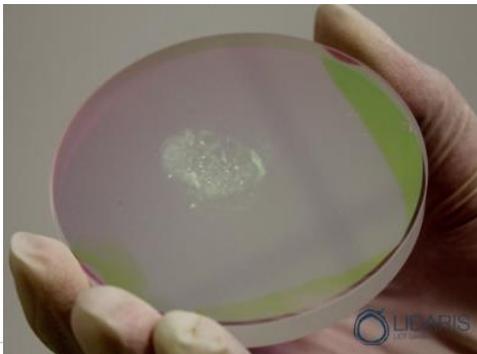
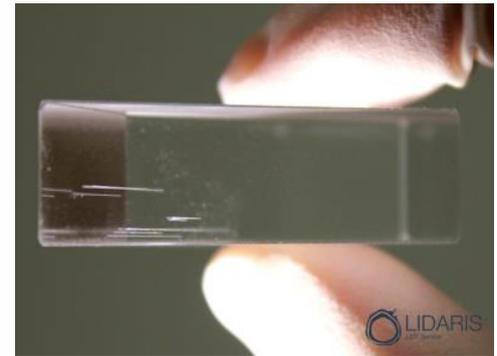
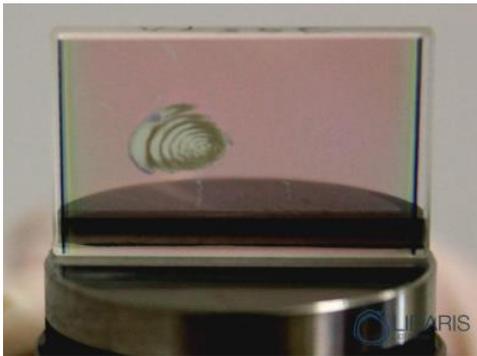
Testing  
Company

Then, why  
optics still  
get damaged?



1  
myth

LIDT is always a constant  
(or LIDT is a single number)



Defect driven damage mode

0 pulses



1 pulse

Initiation of catastrophic damage (easy to miss)



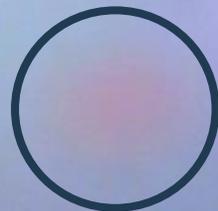
4 pulses

Catastrophic damage (easy to recognize)



Colour change

Color change



100.000 pulses original image

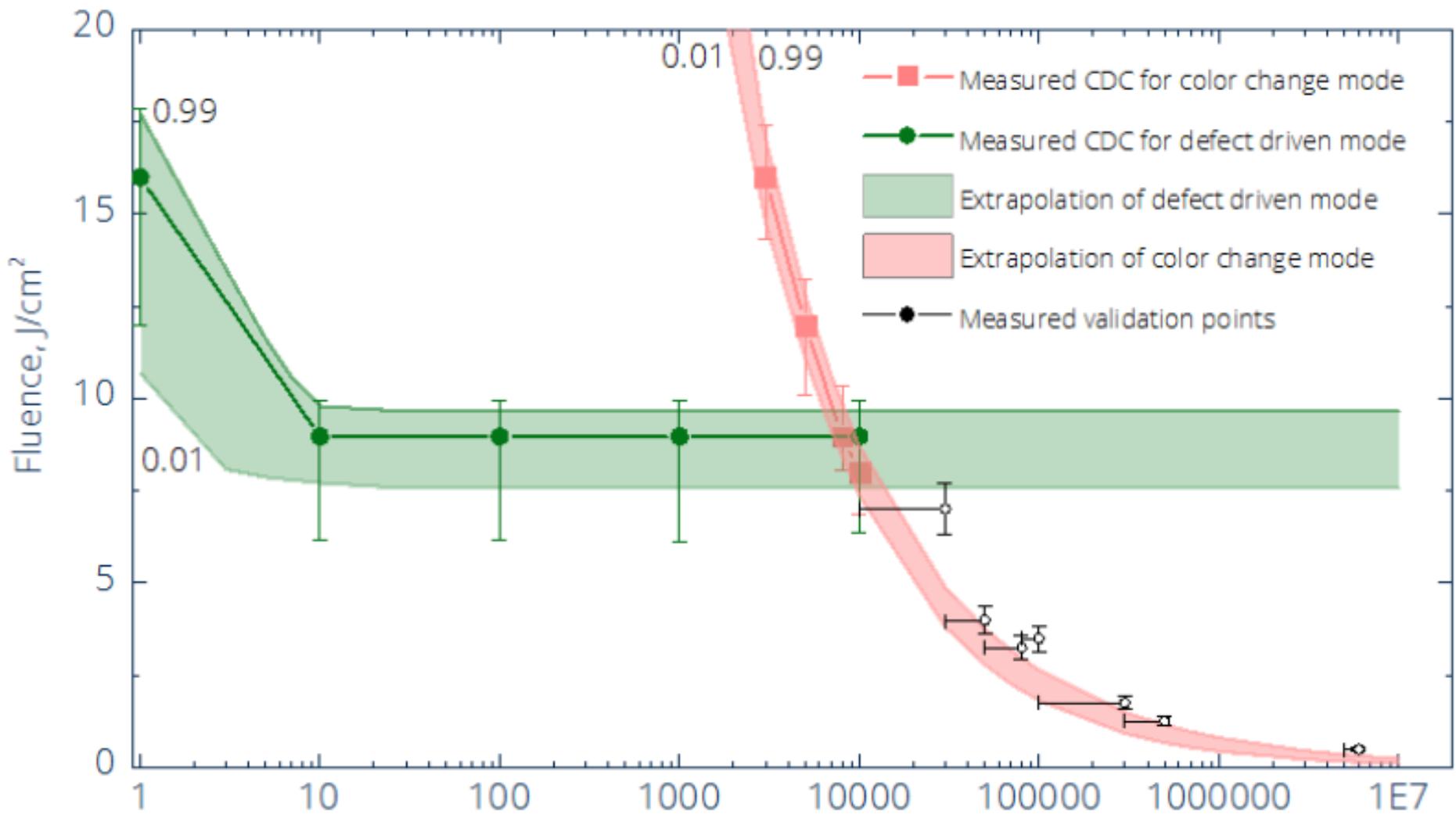
Hardly visible color change



100.000 pulses enhanced image

Easily recognizable color change





A. Melninkaitis et al Towards qualification longevity of high power Space optics International Conference on Space Optics - ICSO 2018 SPIE

How does  
this impacts  
testing?



# THERE ARE DIFFERENT WAYS HOW TO BREAK OPTICAL ELEMENT



1-on-1



S-on-1



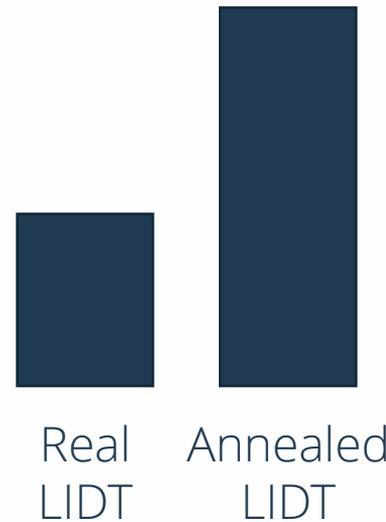
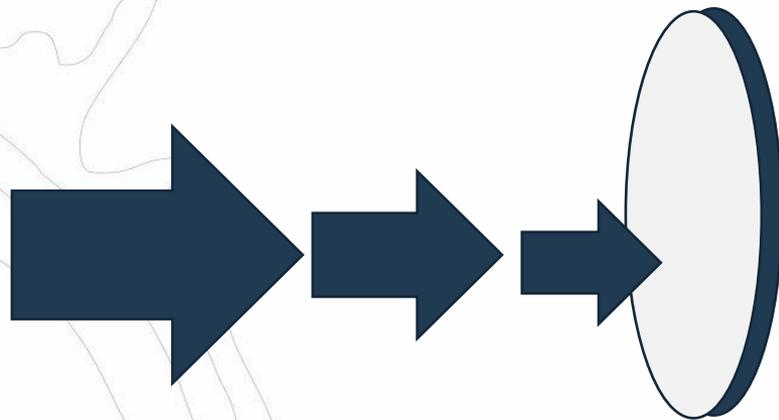
R-on-1



Raster  
scan

2  
myth

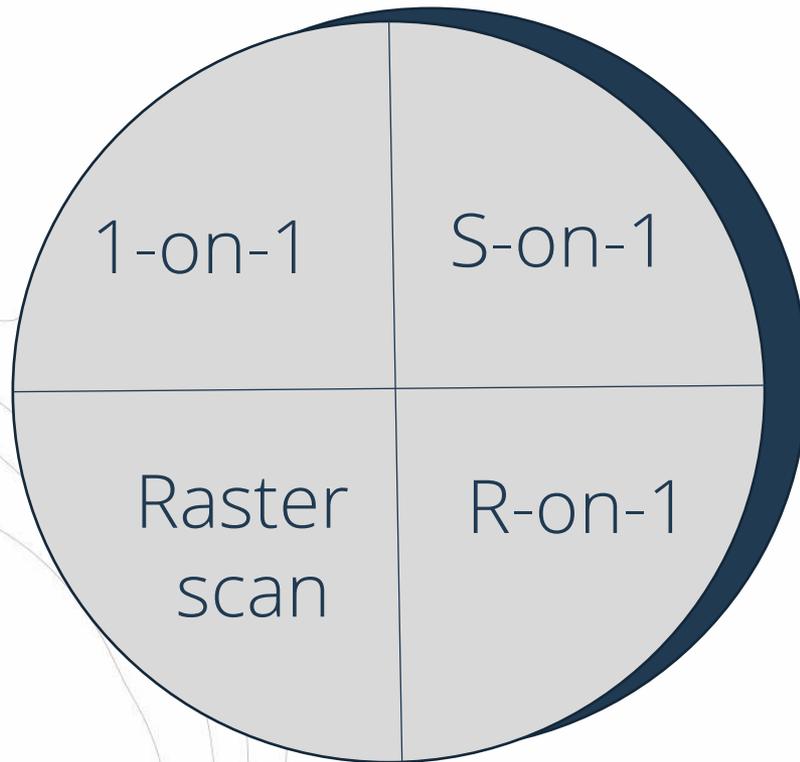
Most of the other LIDT tests will not work, because of annealing effect



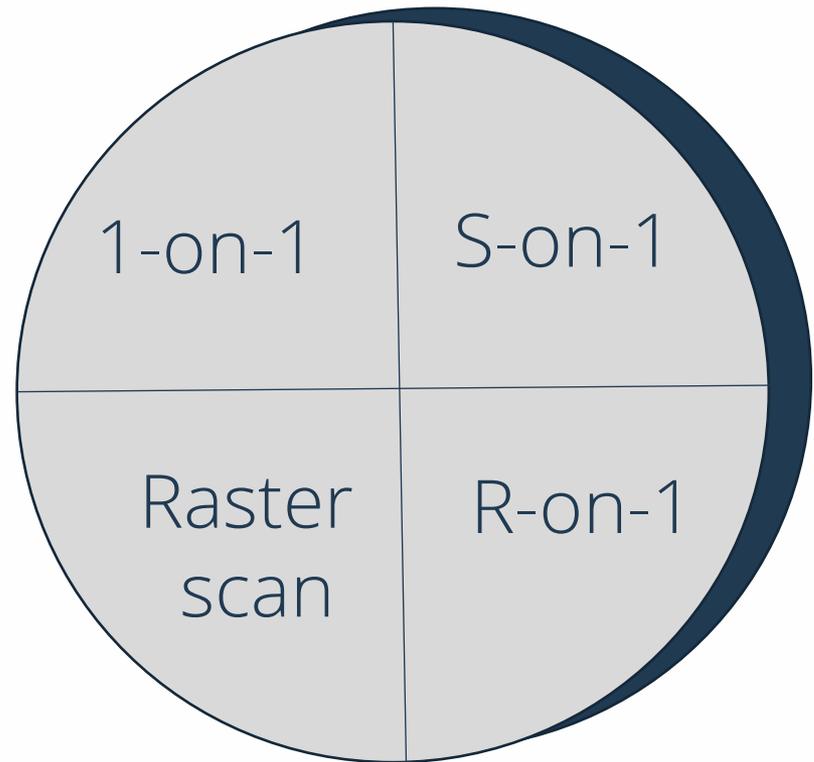
Overestimated  
LIDT!

# Comparison of the LIDT test procedures

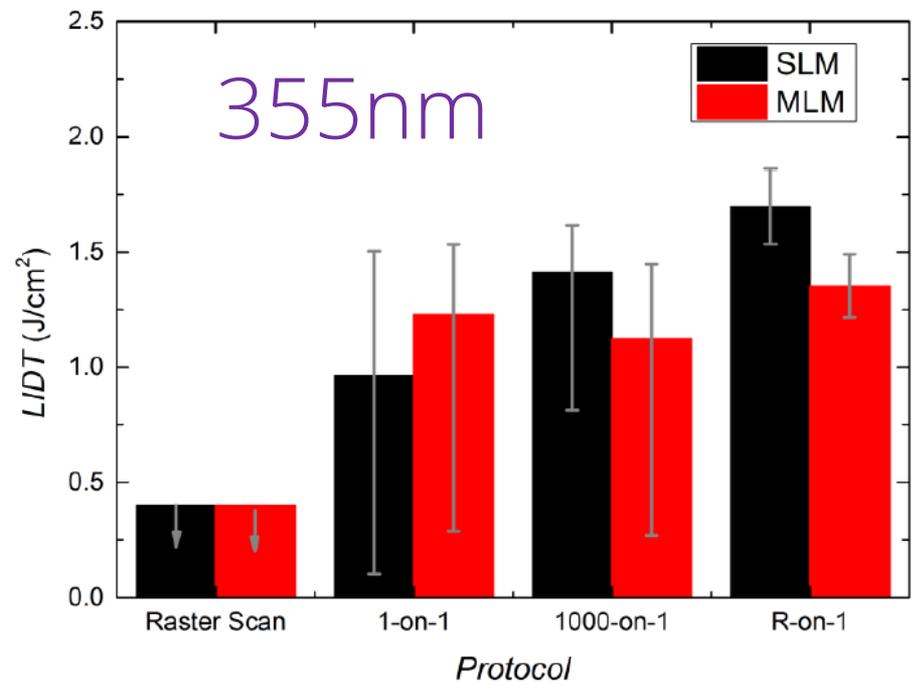
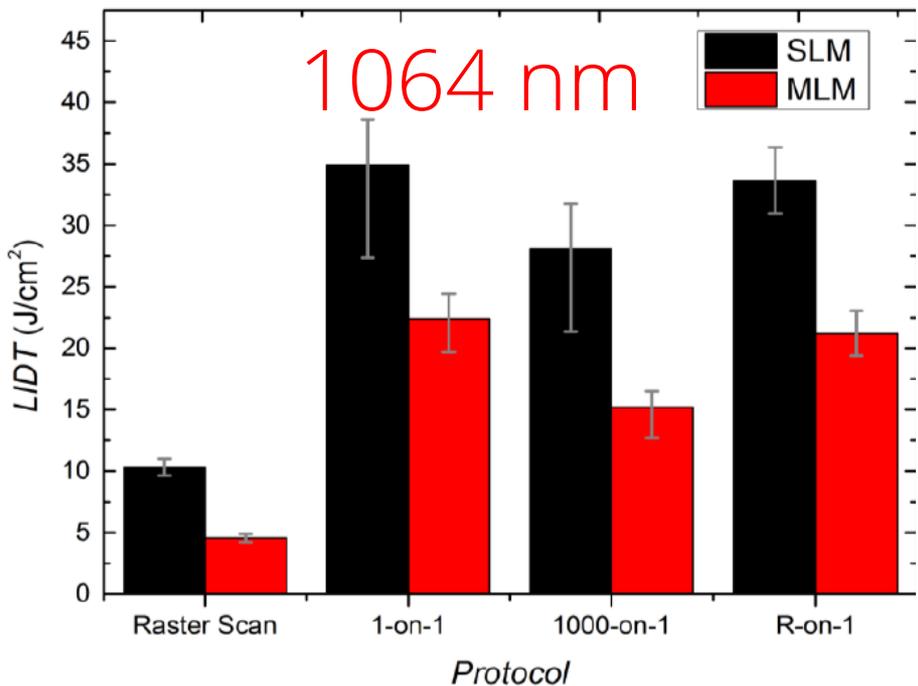
HR, (10-5)ns, AOI: 0 deg.



1064 nm  
MLM+SLM



355nm  
MLM+SML



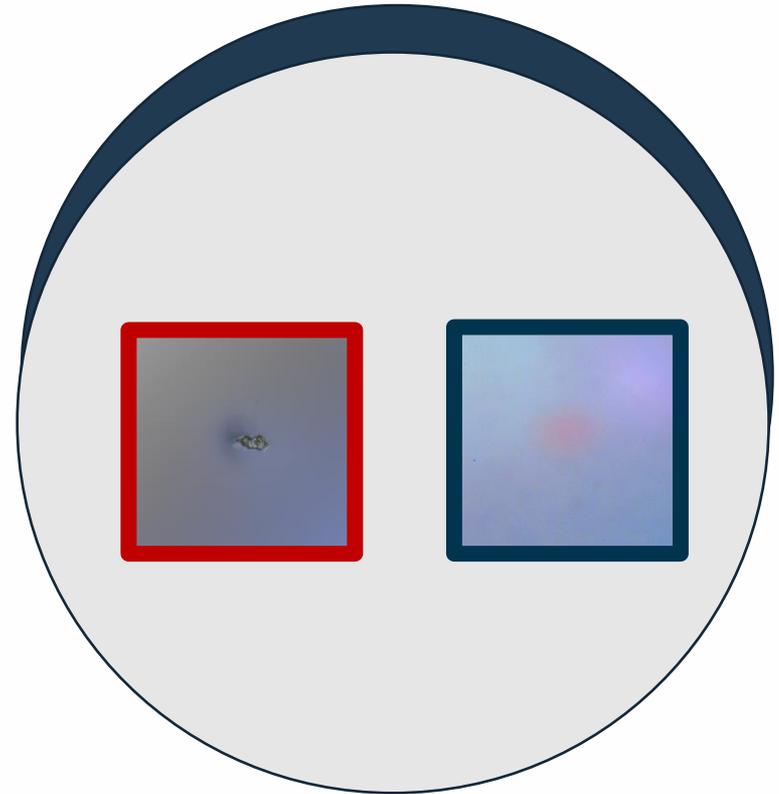
1] R. Pakalnyte et al "Direct comparison of laser-induced damage threshold testing protocols on dielectric mirrors: effect of nanosecond laser pulse shape at NIR and UV wavelengths", Proc. of SPIE, Laser-induced Damage in Optical Materials 2019, 1117318 (17 December 2019)



# Messages to take home

1

Laser damage failure modes exist (coexist)



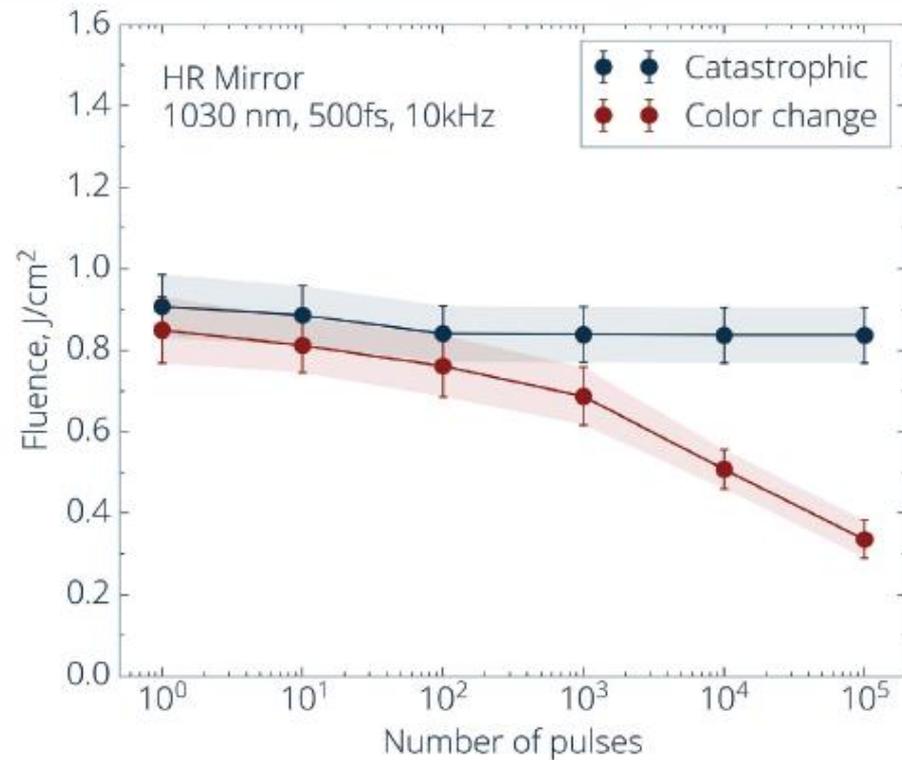
# Messages to take home

1

Laser damage failure modes exist (coexist)

2

Laser damage in space and time should be separated



# Messages to take home

1

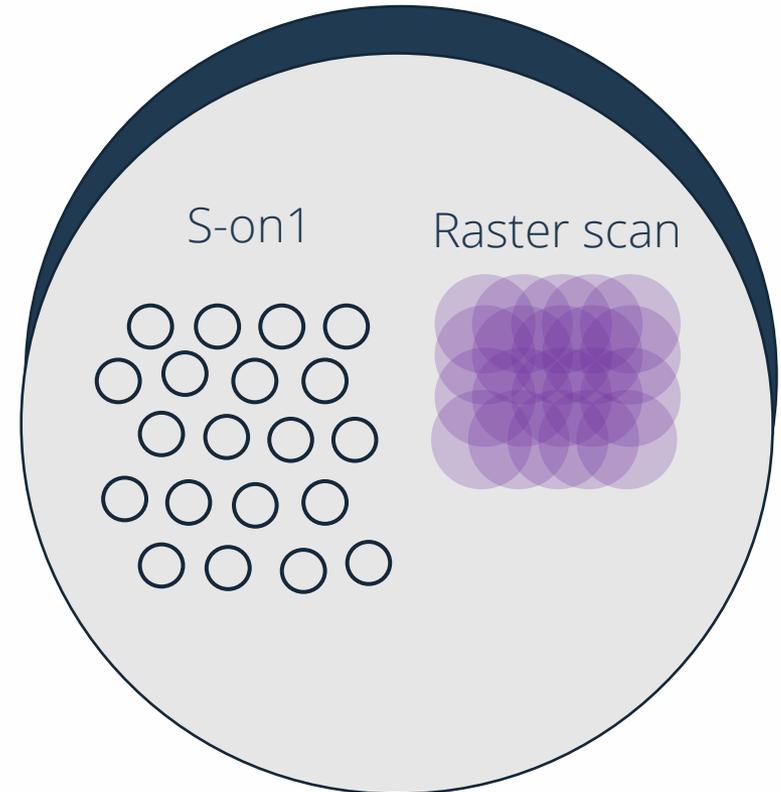
Laser damage failure modes

2

Laser damage in space and time

3

Combined laser damage testing



# Messages to take home

1

Laser damage failure modes

2

Laser damage in space and time

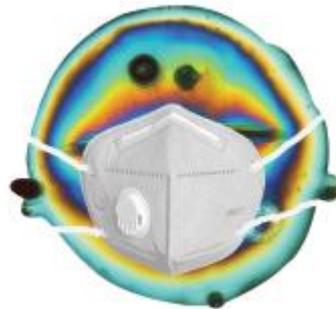
3

Combined laser damage testing



Find a trusted partner so solve laser damage issue

THANK YOU FOR YOUR ATTENTION!



CONTACT US  
LET'S MAKE A DIFFERENCE!



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