smartWLI

Cylinderinspector3D

Q4/2023

	specification
optical 3D sensor	manual exchangeable objectives
measuring principle	coherence scanning (white-light) interferometer
scanning device	piezo positioning system
	200 µm scanning range
high speed camera	2000 x 2000 pixel / 77 fps and acceleration up to 2 kfps with decimation
point evaluation	massive parallel in real time on the GPGPUs
	(general purpose graphic processing unit / programmable high performance graphic boards)
system software	smartVIS3D – user interface for measurements
evaluation algorithms	VSI (vertical scanning interferometry), EPSI (extended phase shift interferometry)
optional evaluation algorithms	HD-EPSI (high density – extended phase shift interferometry) with small scanning increments
optional profile averaging	automated averaging over up to 40 single scans for noise reduction
scanning increments	variable optimization between speed and resolution
evaluation of 3D data	MountainsMap®
	optional system components
standard model – CI 2001	manual handling and stitching, max. insertion depth 190 mm
extended insertion depth – CI 2002	manual handling and stitching, max. insertion depth 270 mm
MotoStitch – CI 2003	motorized insertion, max. depth 200 mm, stitching along cylinder axis
cylinder diameters	70 – 125 mm
centering bushing	diameter specific adapters for centered positioning on the tube

smartWLI system performance and configuration

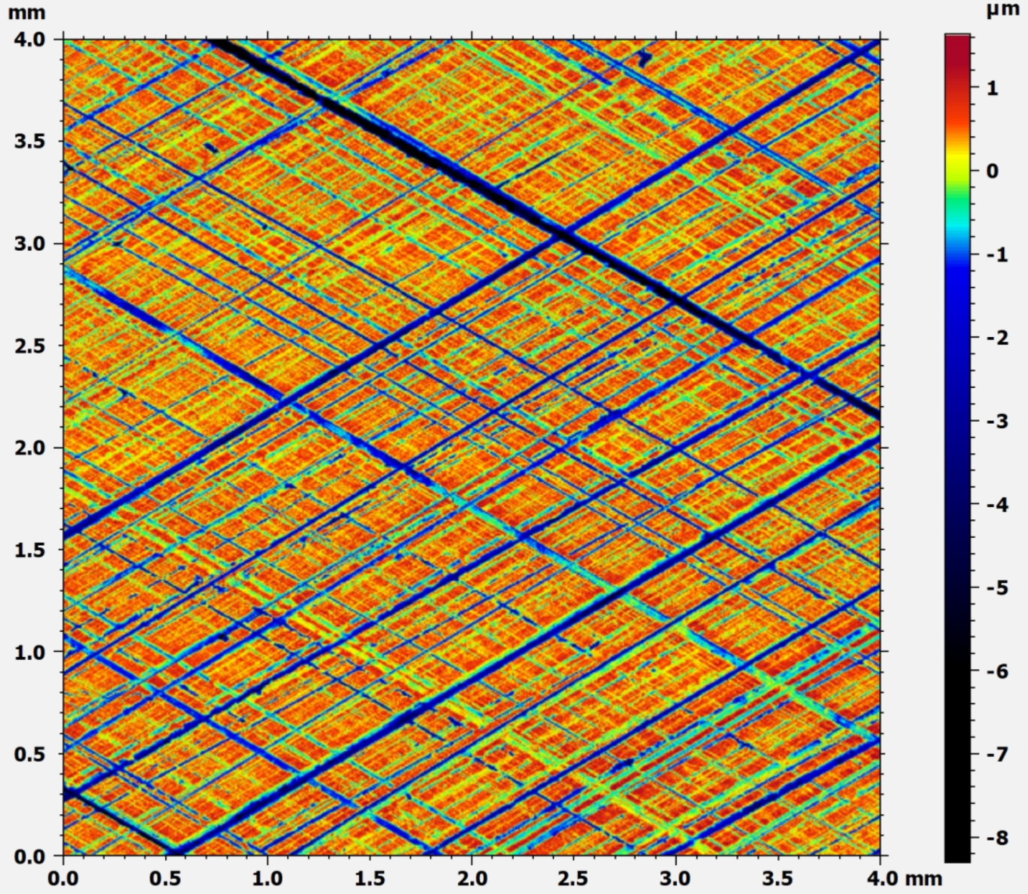
increment	67 nm
scanning speed full resolution	5.2 µm/s
repeatability RMS*	0.025 nm
topography reproducibility**	0.25 nm
1-σ repeatability 12 µm step height	12 nm

* 1-σ repeatability Sq / single scan, without phase or profile averaging, laboratory conditions, 1 million points after 3x3 denoising filter

** Sq/√2 – profile difference of 2 scans, single scan, without profile averaging, laboratory conditions, 1 million points after 3x3 denoising filter

	objective				
available objectives	5x	10x	20x	50x	100x
aperture	0.13	0.3	0.4	0.55	0.7
working distance / mm	9.3	7.4	4.7	3.4	2
measuring area / mm²	2.8 x 2.8	1.4 x 1.4	0.7 x 0.7	0.28 x 0.28	0.14 x 0.14
sampling interval / µm	1.4	0.7	0.35	0.14	0.07
optical resolution / Rayleigh criterion	2.44	1.06	0.79	0.58	0.45
optical resolution / Sparrow criterion	1.9	0.81	0.61	0.44	0.35

smartWLI sample analysis – roughness parameters



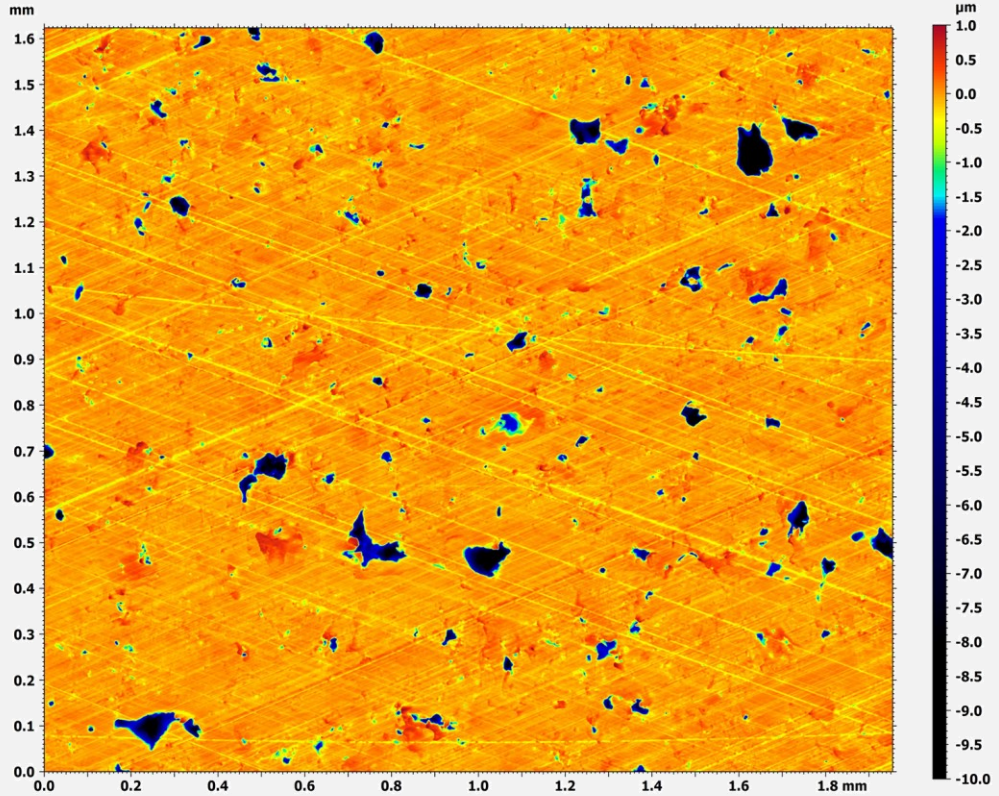
honed cylinder surface, after form filtering

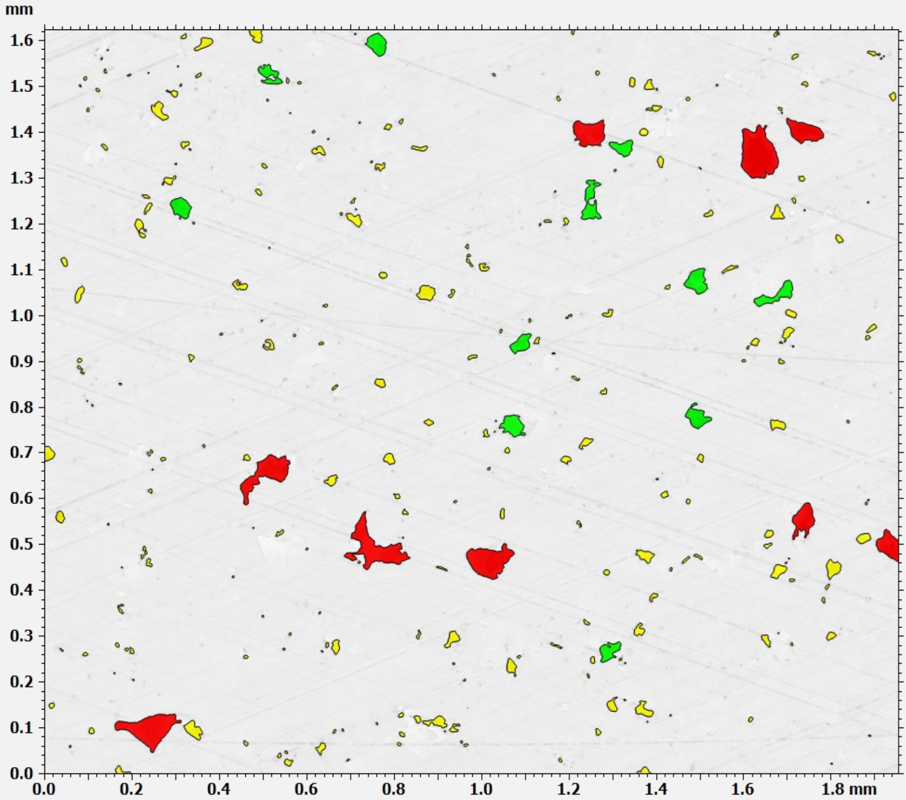
roughness parameters		
Parameters	Value	Unit
Sq - Height parameters - ISO 25178	1.071	µm
Sp - Height parameters - ISO 25178	1.637	µm
Sv - Height parameters - ISO 25178	8.304	µm
Sz - Height parameters - ISO 25178	9.941	µm
Sa - Height parameters - ISO 25178	0.7314	µm

volume parameters		
Parameters	Value	Unit
Vmp	1.496e-05	mm^3/mm^2
Vmc	0.0007298	mm^3/mm^2
Vvc	0.0006474	mm^3/mm^2
Vvv	0.000231	mm^3/mm^2

functional surface parameters		
Parameters	Value	Unit
Sk	1.290	µm
Spk	0.2629	µm
Svk	2.255	µm
Smrk1	5.076	%
Smrk2	75.58	%

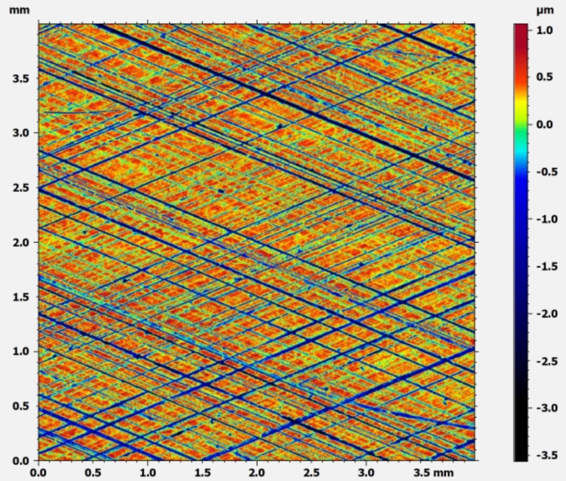
smartWLI pore classification, thermal sprayed surface

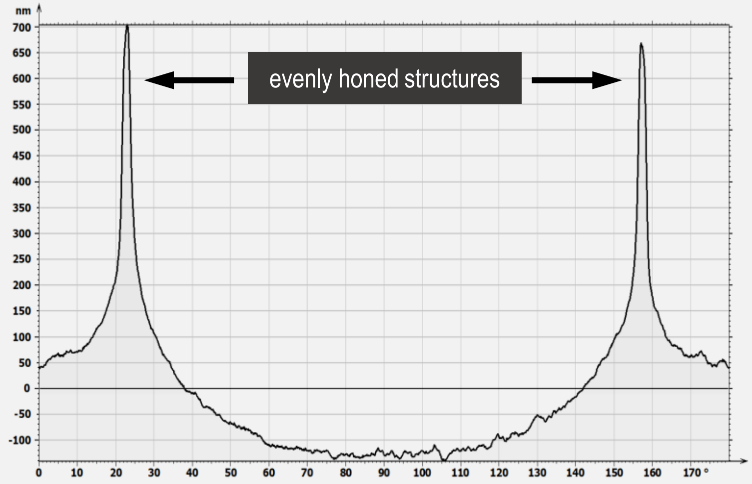




parameter	number of particles	projected area – mean / mm²	projected area – sum / mm²	volume – mean / µm³	volume - sum / µm³
A	308	0.0001	0.0323	193	59734
B	11	0.0015	0.0164	4090	44995
C	9	0.0421	0.0378	22103	198931

smartWLI integral FFT evaluation of honing structures

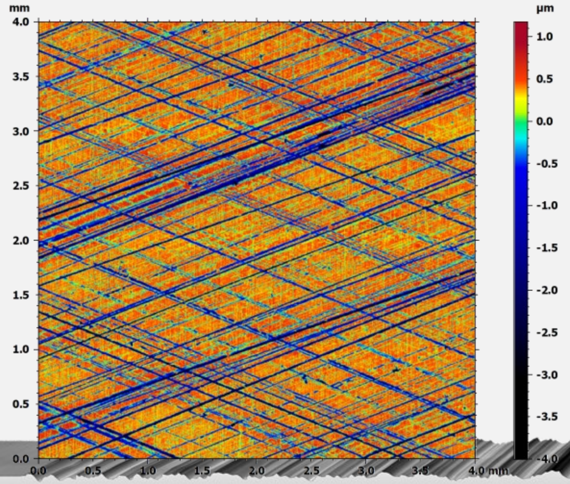


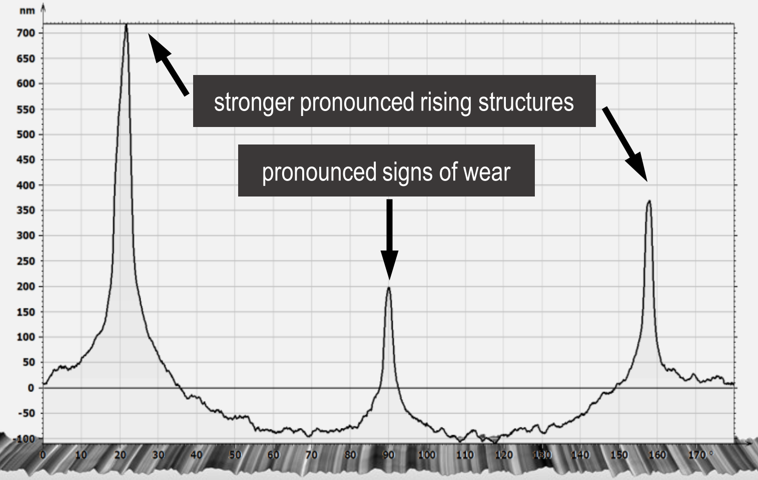


Parameters	Value	Unit
Honing Angle	23.05	°
Cross Structures	1.994	%
Closed Structures	52.45	%

Parameters	Value	Unit
Rising Grooves	23.10	°
Rising Structures	23.45	%
Enclosed area	0.0005079	mm²

Parameters	Value	Unit
Falling Grooves	23.00	°
Falling Structures	22.10	%
Enclosed area	0.0007856	mm²



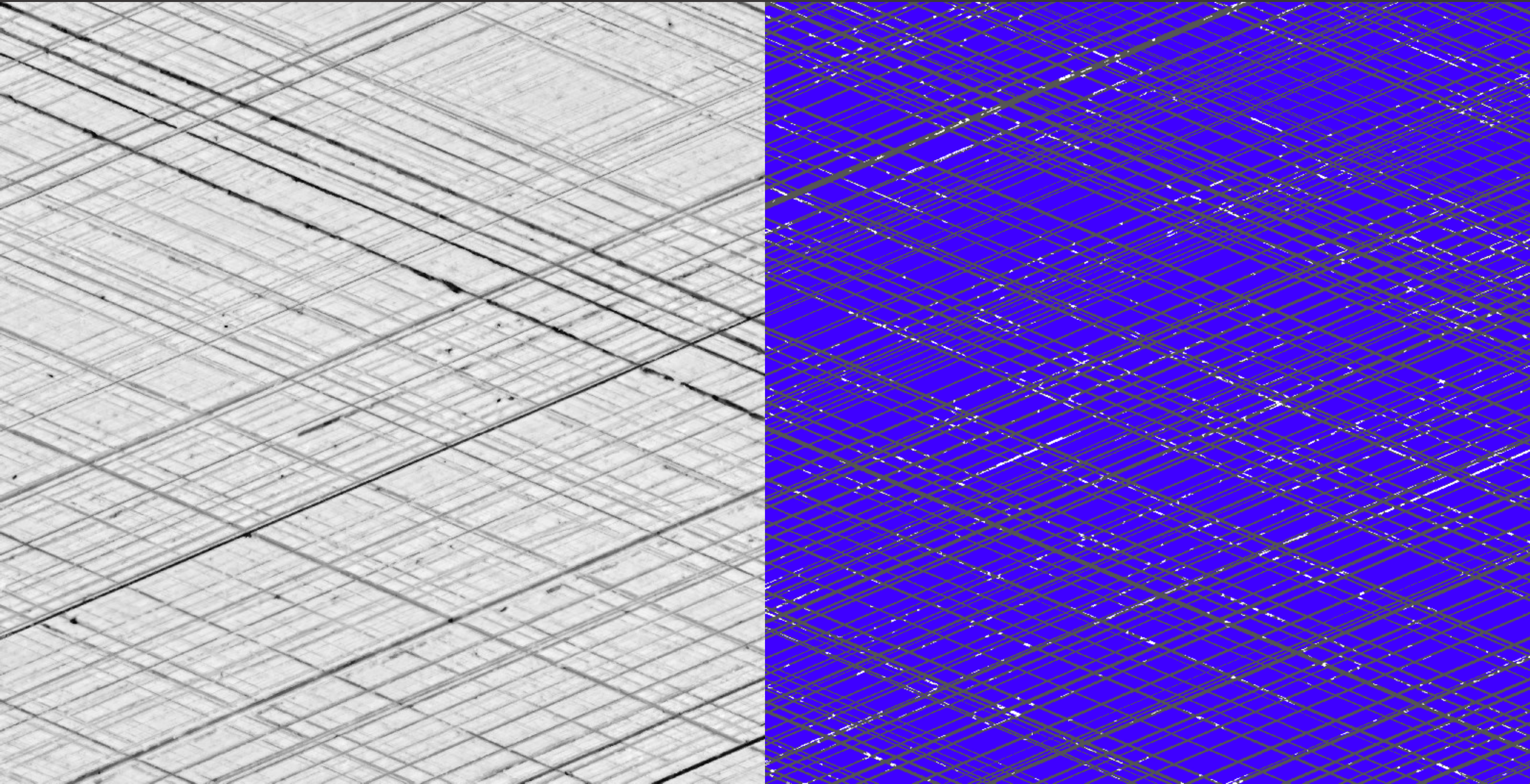


Parameters	Value	Unit
Honing Angle	21.85	°
Cross Structures	5.282	%
Closed Structures	60.93	%

Parameters	Value	Unit
Rising Grooves	21.60	°
Rising Structures	20.83	%
Enclosed area	0.001126	mm²

Parameters	Value	Unit
Falling Grooves	22.10	°
Falling Structures	12.96	%
Enclosed area	0.0009345	mm²

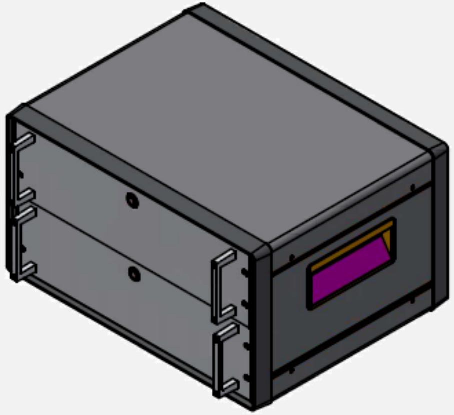
smartWLI evaluation of particles inside honing grooves

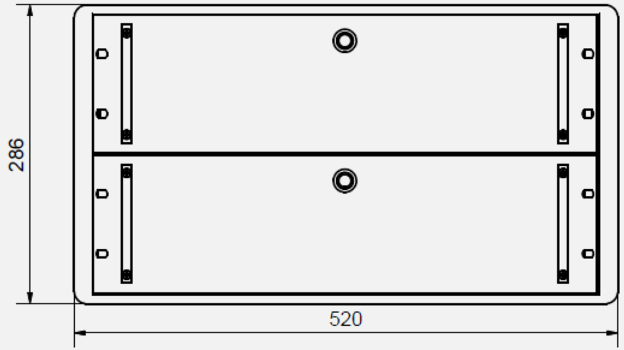


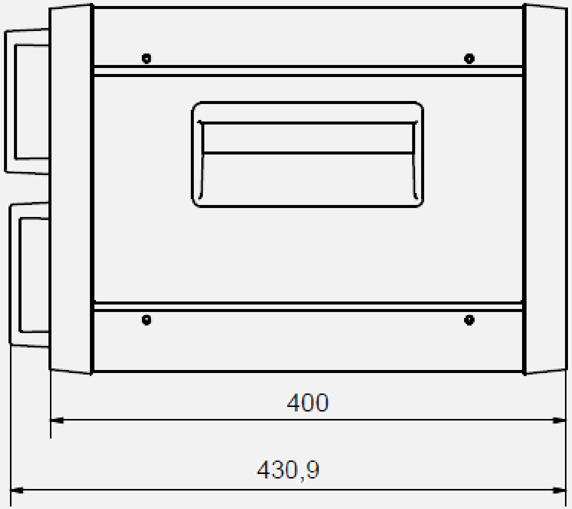
smartWLI control unit

controller	key features	
housing	industrial 19” rack / 6 height units	
power supply	100 – 240 V AC / 50-60 Hz	
LED	LED controller	
piezo	piezo control unit	
stages	optional controller for motorized xyz stages	
	standard PC	optional high performance PC
operating system	Windows 10/11	Windows 10/11
CPU	Core I5	Core I9
RAM	16 GB	64 GB
SSD	1 TB	1 TB
	GPGPU	GPGPU
FP 32 (float)	16 TFLOPS	82 TFLOPS
memory	12 GB / GDDR6	24 GB / GDDR6
	optional components	
	27” monitor, keyboard, mouse	
	environmental conditions	
humidity	up to 80% / non-condensing	
operation temperature	10 - 35 °C	

controller dimensions	
height	286 mm
width	520 mm
depth	430.9 mm
weight	app. 25 kg







modification date	December 11, 2023
disclaimer	changes are subject to technical progress