



CAVITAR

- CAVILUX Laser Illumination
- Schlieren Imaging Solutions
- CAVILUX OEM

WELCOME TO THE

# INVISIBLE WORLD



CAVITAR

# Value in Sight

We at Cavitar are here to bring you Value in Sight with our diode-laser based illumination systems and welding cameras that reveal your application and processes with the level of clarity and detail you have never seen before.

We offer versatile products, systems and solutions for industrial visual process monitoring and R&D, as well as for scientific research, for integrators, OEM manufacturers, and end-users alike. In addition to our high-performance CAVILUX systems and Cavitar Welding Cameras, we also offer customized solutions.



SEE THROUGH HEAT - FREEZE THE MOTION

# CAVILUX Laser Illumination Systems

Versatile high-performance laser illumination systems for machine vision and demanding high-speed and ultra-high-speed imaging up to 10 million fps.

For various industrial processes and R&D as a stand-alone product or as an integrated monitoring solution.

For imaging and monitoring of welding, additive manufacturing, shockwaves, flows, droplets, sprays and jets, Schlieren imaging, etc.

Plug-and-play systems and fully compatible with high-speed and machine vision cameras.

## For high-speed imaging and monitoring

- See through blinding brightness of high-temperature processes
- Accurate imaging of processes involving extremely small and/or fast objects
- High-power, ultra-short pulses down to 10 ns eliminate motion blur and enable optimal image quality
- Versatility by varying pulse duration and repetition rate
- Versatility through changeable fiber optic illumination (fiber coupling, front/back illumination, light sheet illumination)
- Monochromatic and low-coherence light ensures the best possible image quality - without chromatic aberrations or speckle
- Fiber coupling enables efficient lighting of processes even in limited space and hard-to-reach places
- Light is immune to surrounding lighting conditions such as ambient or sunlight, as well as to process vibrations



CAVILUX HF



CAVILUX Smart



CAVILUX HF UHS



CAVILUX Smart UHS

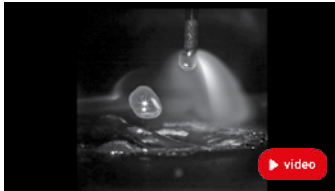
Designed, Engineered and  
Manufactured in Finland



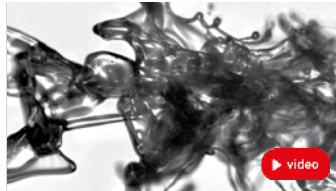
	CAVILUX HF	CAVILUX Smart	CAVILUX HF UHS	CAVILUX Smart UHS
	<b>Components and camera synchronization</b>	<b>Components and camera synchronization</b>	<b>Components and camera synchronization</b>	<b>Components and camera synchronization</b>
System content	Laser unit, control unit, illumination optics	Laser unit, control unit, illumination optics	Laser unit, control unit, illumination optics	Laser unit, control unit, illumination optics
Software interface	CAVILUX Control Software	CAVILUX Control Software	No software	No software
Laser units	1 to 4	1 to 4	1	1
Sync signal	5 V TTL	5 V TTL	5 V TTL	5 V TTL
	<b>Laser unit</b>	<b>Laser unit</b>	<b>Laser unit</b>	<b>Laser unit</b>
Wavelength options	640 nm (visible), 810 nm (invisible)	640 nm (visible), 810 nm (invisible)	640 nm (visible), 810 nm (invisible)	640 nm (visible), 810 nm (invisible)
Power options	280 W @ 640 nm, 500 W @ 810 nm	200/400 W @ 640 nm, 300/500 W @ 810 nm	280 W @ 640 nm, 500 W @ 810 nm	200/400 W @ 640 nm, 300/500 W @ 810 nm
Laser class	Laser class 4	Laser class 3B or 4 (based on power and wavelength)	Laser class 4	Laser class 3B or 4 (based on power and wavelength)
Min pulse duration (limited power)	50 ns	10 ns	50 ns	10 ns
Min pulse duration (full power)	100 ns	30 ns	100 ns	30 ns
Pulses per frame	up to 5	up to 5	1	1
Continuous duty cycle	0.03%	0.03%	0.03%	0.03%
High-speed duty cycle	2%	0.1%	100%	100%
Max high-speed duration	10 seconds (optional 30 seconds for 810 nm)	10 seconds	30 µs total laser time	30 µs total laser time
	<b>Versatility (changeable fiber optics)</b>	<b>Versatility (changeable fiber optics)</b>	<b>Versatility (changeable fiber optics)</b>	<b>Versatility (changeable fiber optics)</b>
Fiber-coupled	Yes	Yes	Yes	Yes
Adjustable illumination	Yes	Yes	Yes	Yes
Light sheet illumination	Yes	Yes	Yes	Yes
	<b>Pulse duration / frequency examples</b>	<b>Pulse duration / frequency examples</b>	<b>Pulse duration / frequency examples</b>	<b>Pulse duration / frequency examples</b>
10 ns	Not applicable	100,000 Hz (@ 0.1% DC)	Not applicable	50,000,000 Hz (1500 pulses)
50 ns	400,000 Hz (@ 2% DC)	20,000 Hz (@ 0.1% DC)	12,000,000 Hz (500 pulses)	16,000,000 Hz (500 pulses)
100 ns	200,000 Hz (@ 2% DC)	10,000 Hz (@ 0.1% DC)	7,500,000 Hz (230 pulses)	90,000,000 Hz (270 pulses)
1 µs	20,000 Hz (@ 2% DC)	1,000 Hz (@ 0.1% DC)	100,000 Hz (30 pulses)	990,000 Hz (30 pulses)
10 µs	2,000 Hz (@ 2% DC)	100 Hz (@ 0.1% DC)	10,000 Hz (3 pulses)	10,000,000 Hz (3 pulses)
	<b>Example applications</b>	<b>Example applications</b>	<b>Example applications</b>	<b>Example applications</b>
	Welding	Welding	Shockwaves	Shockwaves
	Flows/droplets/sprays/jets	Shockwaves	Schlieren imaging	Schlieren / Shadowgraphy
	Additive manufacturing	Schlieren / Shadowgraphy	Flows/droplets/sprays/jets	Flows/droplets/sprays/jets
	Materials testing	Flows/droplets/sprays/jets	Materials testing	Materials testing
	Ballistics/explosions	Industrial webs	Ballistics/explosions	Ballistics/explosions



# Application images



MIG WELDING PROCESS WITH A GLOBULAR TRANSFER MODE (LABSOLDA, CAVILUX HF)



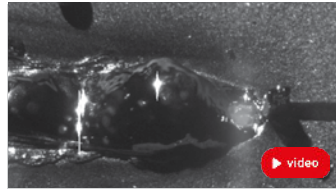
MEASUREMENT OF FLUID JETS IN DIESEL ENGINE - DOUBLE-PULSE AND BACK-ILLUMINATION (CAVILUX SMART)



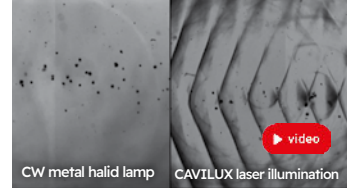
CMT WITH SCHLIEREN IMAGING (CAVILUX HF AND SMART)



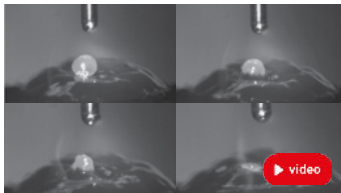
SCHLIEREN IMAGING OF ARC WELDING - WITH FRONT-ILLUMINATION (CAVILUX HF)



LASER WELDING - HUMPING EFFECT (CAVILUX SMART)



COMPARISON OF ILLUMINATION - SHOCKWAVE FORMATION IN GEL (TOHOKU UNIVERSITY AND NOBBY TECH, CAVILUX SMART)



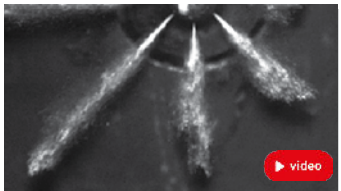
MAG WELDING (CAVILUX HF)



NORMAL VISION VS. CAVITAR VISION



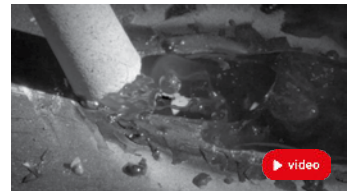
ADDITIVE MANUFACTURING - LASER WELDING (CAVILUX HF)



FUEL INJECTION (CAVILUX HF)



TIG WELDING - (LABSOLDA, CAVILUX HF)



SMAW (NOBBY TECH, CAVILUX HF)



Visit our YouTube channel for the videos: CavitarLtd

# Cavitar Schlieren Imaging Solutions

## Flow visualization solutions

- Reveal the invisible flow patterns (gases, fluids) in your process by optical methods
- High-quality imaging
- High sensitivity for detection of fine details

## High-performance plug-and-play solution

- Suitable for use in Schlieren and shadowgraph imaging
- Optimized to be used with CAVILUX laser illumination systems and/or Cavitar Welding Cameras
- Various solution options based on application
- Front and back illumination available (front illumination enables simultaneous visualization of e.g., melt pool and wire motion and melting)
- Protected compact design with an open test area for studying process phenomena

## For visualization of changes in refractive index:

- Temperature gradients (heating processes)
- Phase differences (mixing of liquids, gas flows and evaporation)
- Small particles (efficient light scattering)
- Pressure gradients (shock waves in air or liquid)



	<b>COMPLETE IMAGING SOLUTION*</b>	<b>Z-TYPE SCHLIEREN</b>	<b>LENS SCHLIEREN</b>
Description	Self-contained Schlieren set-up including everything	Plug-and-play pre-aligned Z-type Schlieren imaging system	Plug-and-play pre-aligned Lens Schlieren imaging system
Method of visualization	Mirror or lens based	Mirror based	Lens based
Includes	Everything included - table frame - optical elements - adjustable mask holder - Schlieren masks - laser illumination and/or welding camera	- table frame - optical elements - adjustable mask holder - Schlieren masks	- frame, can be split into two - optical elements - adjustable mask holder - Schlieren masks
Options	- High-speed camera as an option	- CAVILUX lasers - Cavitar Welding Cameras - High-speed camera	- CAVILUX lasers - Cavitar Welding Cameras
Dimensions (LxWxH)**	2.4 x 0.5 x 1.2 m	2.4 x 0.5 x 1.2 m	1.2 x 0.2 x 0.3 m
Test area**	0.5 x 0.5 m	0.5 x 0.5 m	0.2 x 0.4 m
Image field of view	ca. 60...100 mm (depending on lens and camera)	ca. 60...100 mm (depending on lens and camera)	ca. 10...40 mm (depending on lens and camera)

\* Working title

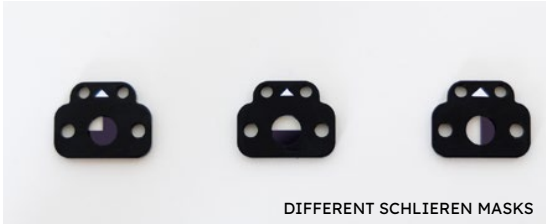
\*\* Might vary depending on realization

## For research and development of various applications and processes

- For welding process imaging (shadowgraph also possible)
- For welding research
- Additive manufacturing
- Energy technologies
- Chemical industry (mixing of liquids and gasses)
- Shockwaves
- Ballistics
- Aerospace
- Materials testing

## Easy to use

- Comes pre-aligned to customer's specifications
- Can be customized for specific cameras
- Plug-and-play: 1. Install the table legs, 2. Install camera and light source, 3. Start imaging (Z-type)
- Schlieren mask adjustment is possible during imaging
- Different Schlieren masks (also custom masks) are available for emphasizing different flow elements



## CAVILUX OEM Laser lighting for machine vision

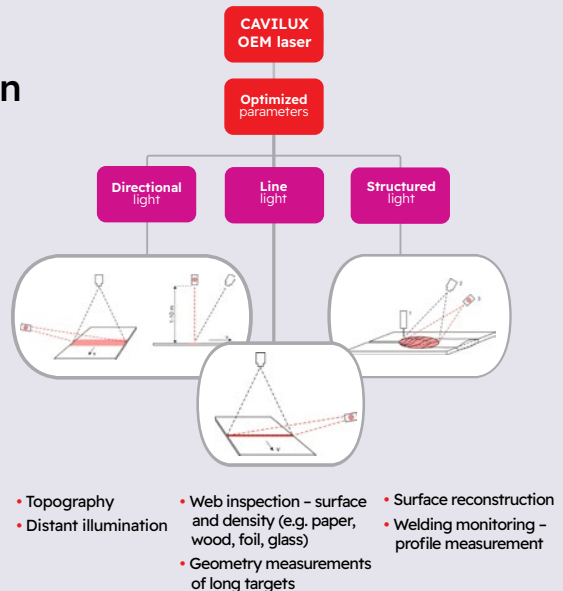
### Customized CAVILUX OEM for machine vision integrators

CAVILUX OEM lasers are ideal light sources for industrial machine vision solutions. You will get all the CAVILUX benefits to your own integrated monitoring solution.

The products are compact and robust as well as suitable for harsh industrial environments for 24/7 use. Fiber coupling brings further flexibility also in difficult to reach or in cramped spaces.

Application specific illumination profiles through customization bring further benefits and additional information to images.

Contact us to discuss your high-volume machine vision solution requirements.





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