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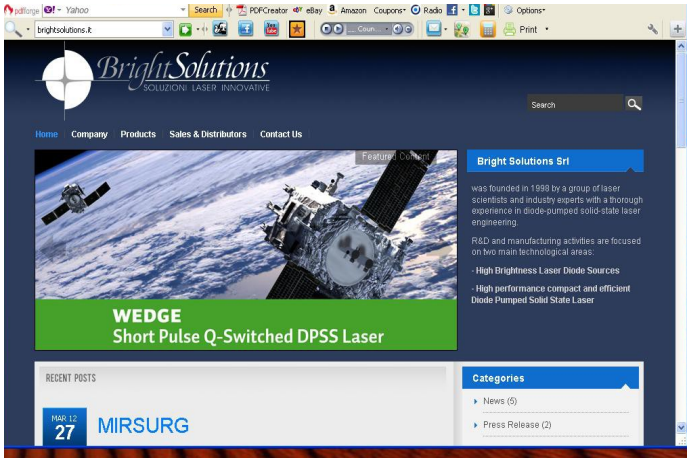
Bright Solutions S.R.L.

AtmoHEAD 2014: Atmospheric Monitoring for High Energy AstroParticle Detectors

Palazzo del Bo, Padova, 19-21 May 2014

Outline

- ✔ Company overview
- ✔ R&D activities
- ✔ SOL family DPSS
- ✔ WEDGE family DPSS
- ✔ CZMIL laser
- ✔ CNISM-BRIT laser



www.brightsolutions.it

50 km far from Milan

Company Overview

Bright Solutions S.r.l was founded in 1998 by group of laser scientists and industry experts with significant experience in diode-pumped solid state laser engineering.
From the origin the Company's activity was oriented towards the development of the state-of-the-art DPSS laser sources with a goals of superior efficiency, compactness and reliability.

Bright Solutions has many experience veterans of the laser industry, with strengths in setting up industrial production and testing, and in guiding professionally skilled personnel in the manufacture of diode-pumped solid-state lasers.
Laser sources for aerospace and scientific applications are also a considerable part of Bright Solutions capabilities.
Bright Solutions has strong relationships with many experienced commercial Partners, thus securing a worldwide presence for the Company and diffusion of its products.

Bright Solutions is an ISO certified Company (ISO 9001:2008)

R&D Activities

Industrial

- Development of high efficiency high peak power air cooled Q-switched DPSS Lasers
- Development of high power fiber coupled diode laser modules and systems
- Fiber laser pumping
- High power optical fiber manufacturing

Aerospace

- Development of DPSS laser sources for LIDAR
- Development of eye safe range finders transmitter
- High power diode pumped laser oscillators for UV Lidar
- Laser module development activities and subcontractor in aerospace and military programs.

Scientific

- Development of a laser source for minimally invasive neurosurgery (MIRSURG EU Project - 7th Framework Programme)
- Development of ps mode locked laser, ns Q-switched lasers and tunable OPOs for non linear optics applications.

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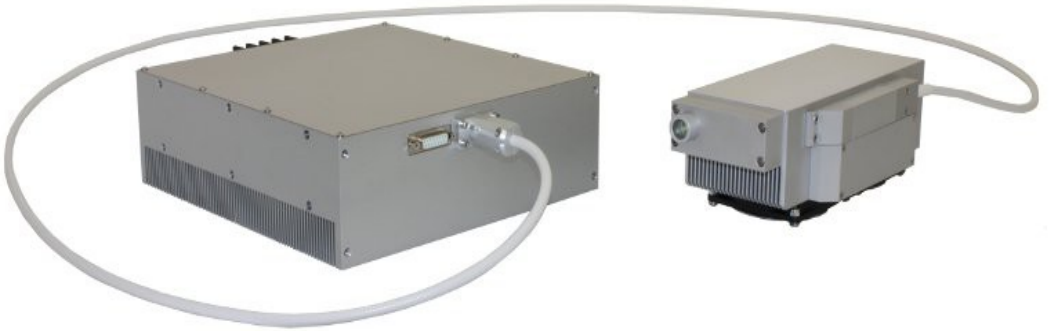
Laser design evolution



Higher and higher integration over time up
to fit all optics and electronics in a single box

Now only the 24 V dc (or 28 V dc) voltage and
the driving signal are required at the input

Main products: SOL family DPSS

- ✗ Up to **40 W** @ 1064 nm
- ✗ Up to **10W** @ 532 nm
- ✗ Very Compact
- ✗ 200 kW Peak Power
- ✗ Up to **100 kHz** repetition rate
- ✗ Electronic Pulse Energy Modulation
- ✗ Sealed and rugged
- ✗ Monolithic Design
- ✗ Air Cooling
- ✗ 24 Vdc

23 x 10 x 9 cm^3 – 4.5 kg

SOL 532	3W	5W	10W
wavelength	532 nm		
Rep rate	10 kHz to 100 kHz (option: single shot)		
pulsewidth	6 to 60 ns		
Beam diameter	< 8 mm (integrated beam expander)		
Beam quality	< 1.3	< 1.5	< 2.0
Electrical req.	24 V DC (6 to 14 A depending on the models)		
cooling	Air cooling (option: water or contact cooling)		

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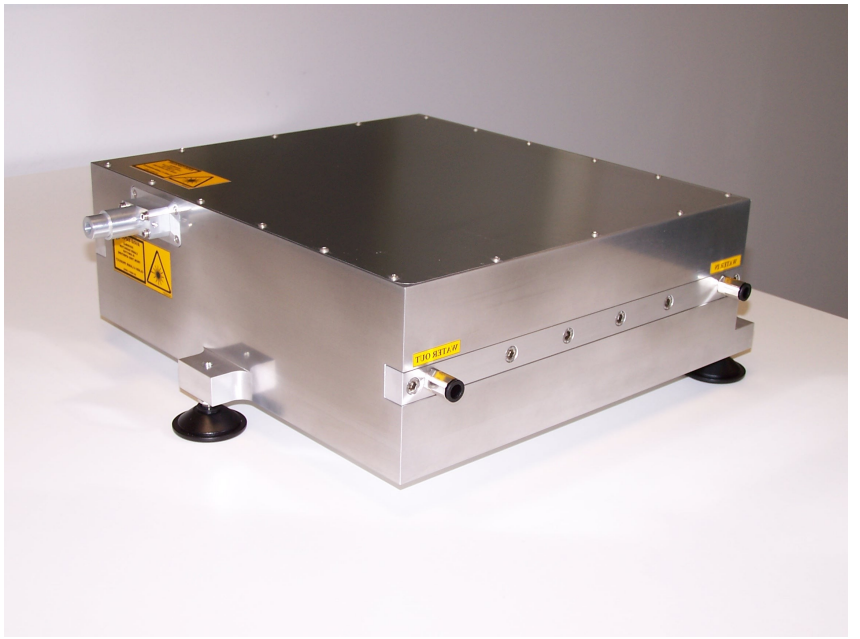
Main products: WEDGE family DPSS

- ✗ Up to 4 mJ Pulse Energy
- ✗ Down to 500 ps Pulse Width
- ✗ Up to 100 kHz repetition rate
- ✗ Air cooling and Water Cooling versions
- ✗ @1064 @532 @355 @266 nm
- ✗ Parametric generation at 1.5 um and 3 um

WEDGE	HB 1064	XB 1064	HF 1064	XF 1064
wavelength	1064 nm			
pulsewidth	< 1.5 ns	< 1.3 ns	0.7 – 3 ns	0.5 – 1 ns
energy	2 mJ	4 mJ	180 µJ	70 µJ
Peak power	2 MW	4 MW	250 kW	140 kW
Rep. rate	SS -2kHz	SS –1 kHz	SS – 100 kHz	
polarization	Linear (100:1) (option: circular)			
Beam dia.	< 2 mm		< 4 mm	
M^2	< 2		< 1.5	< 1.3
cooling	Air cooling (option: water cooling)			
weight	8.5 kg	10 kg	2 kg	



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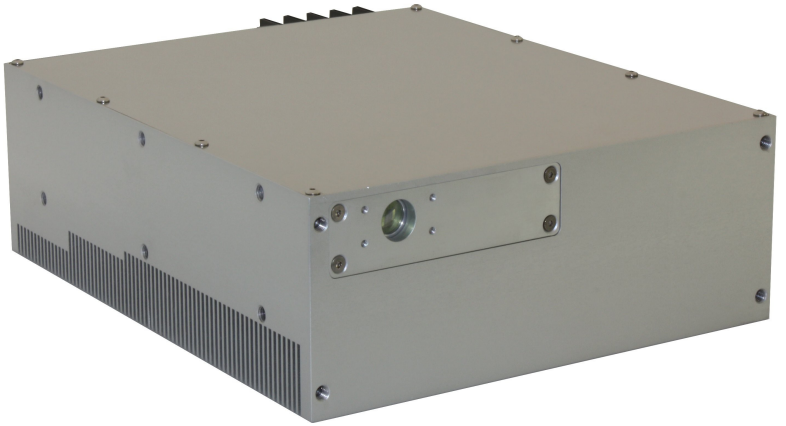
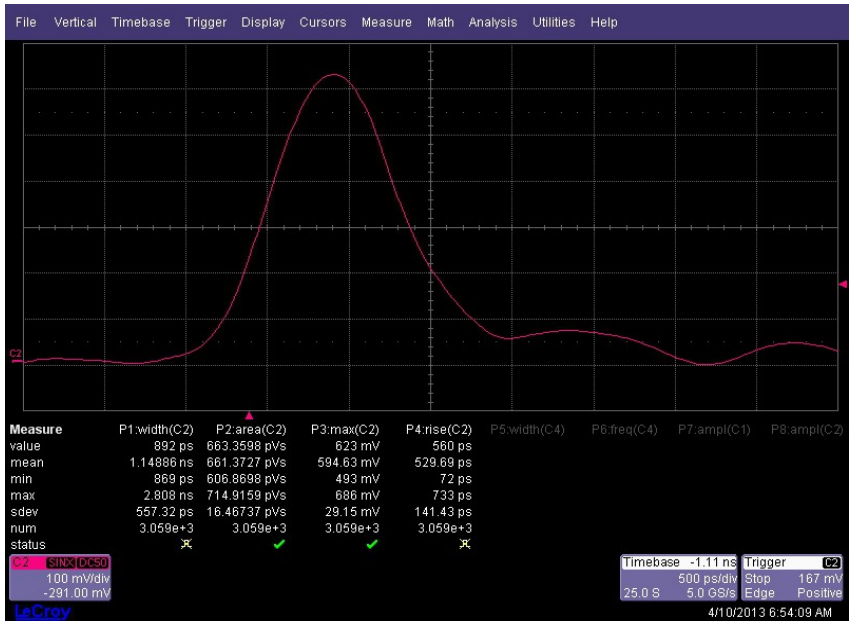
Wedge XB DPSS

Up to **4 mJ** Pulse Energy
4 MW Peak Power
< 1.5 ns Pulse Width
Single Shot to 1 kHz
Monolithic Design
Air Cooling
Low heat waste
@1064 @532 @355 @266 nm



WEDGE XB: 26 x 25 x 10 cm^3 – 10 kg



Options available

Single Longitudinal Mode
Beam Expanding and collimation optics
Red aiming beam
Low jitter option
Circular Polarization
AC-DC Power Supply
Parametric generation at 1.5 um and 3 um

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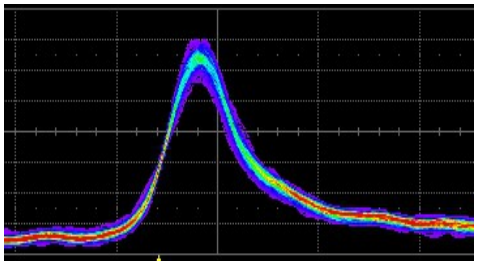
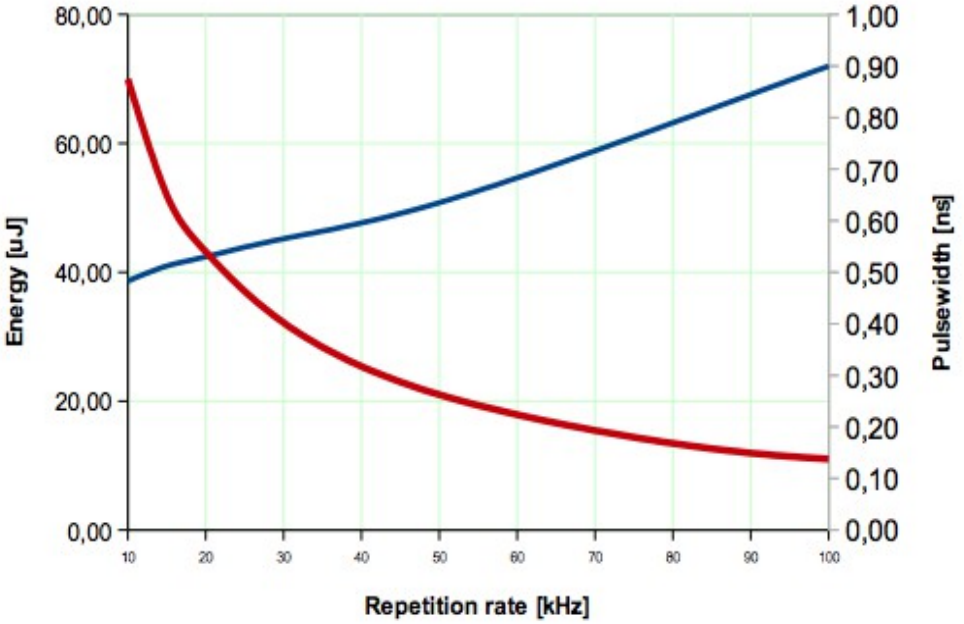
Wedge XF DPSS

Up to 70 µJ Pulse Energy
$M^2 < 1.2$
450 ps to 1 ns Pulse Width
10 kHz to 100 kHz repetition rate
Aerospace qualified Design
Air Cooling
Low heat waste
@1064 @532 @355 @266 nm



<500 ps @ 10 kHz

8 x 9 x 19 cm^3 – 2 kg



Options:
- Third and fourth harmonic generation
- Parametric generation at 1..5 um and 3 um
- Single Shot to 10 kHz
- Beam Expanding and collimation optics
- Red aiming beam
- Circular Polarization
- AC-DC Power Supply

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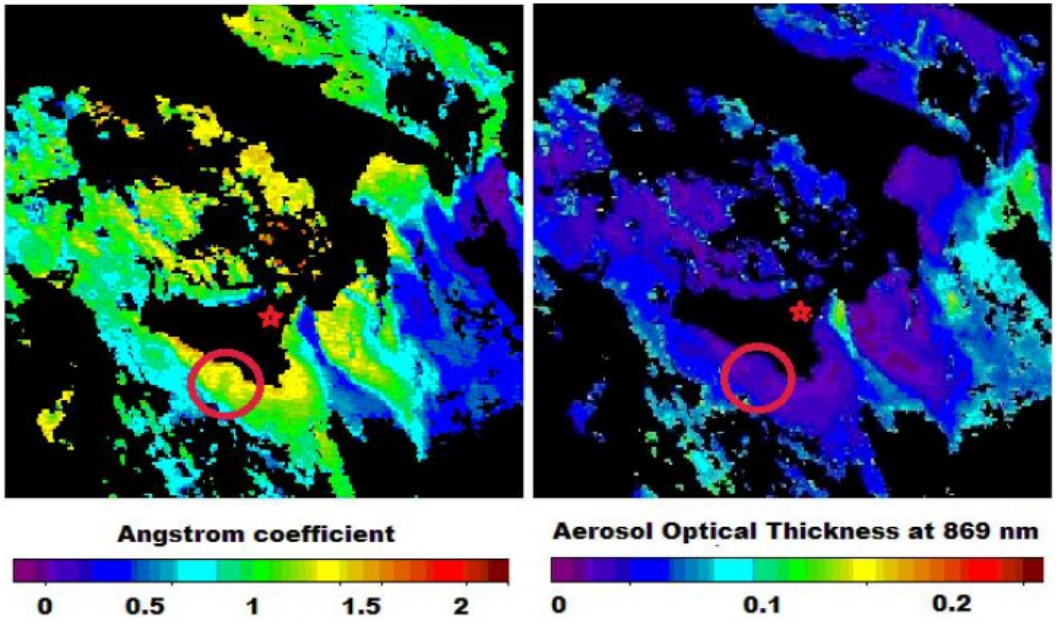
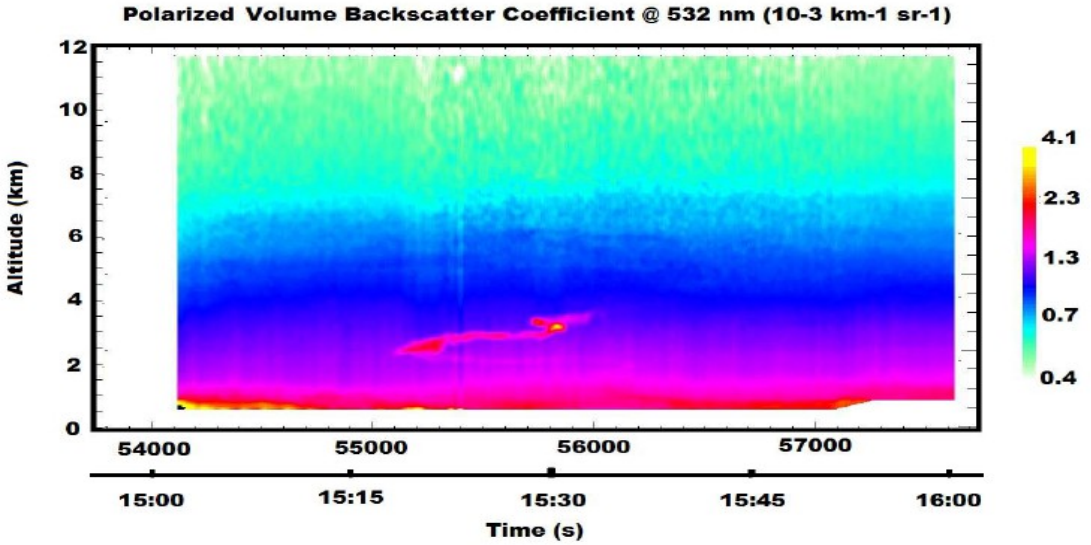
RAMNI airborne lidar

RAMNI – Radar ottico Aviotrasportato per il Monitoraggio delle No-flight zones sopra Italia (Airborne optical radar for monitoring no-flight zones over Italy)





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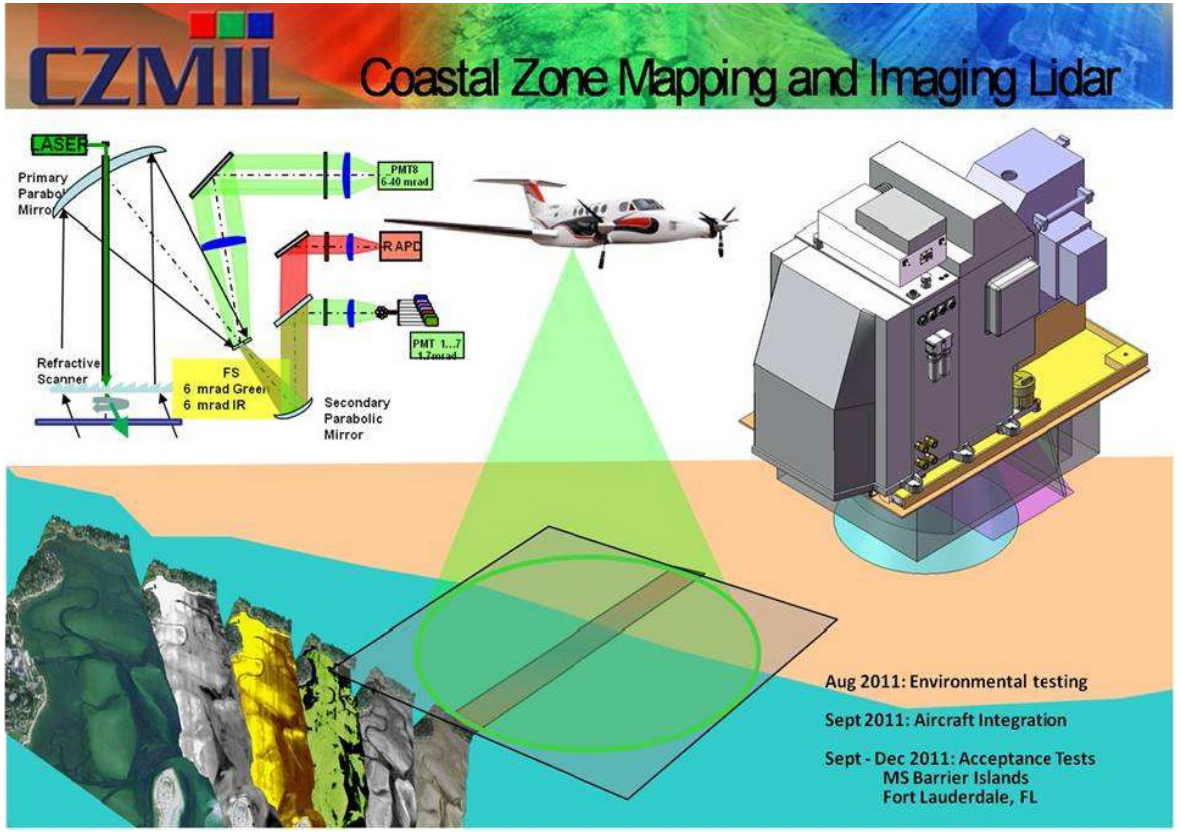
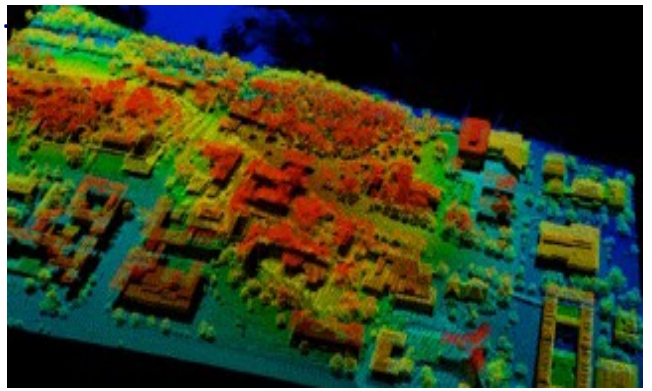
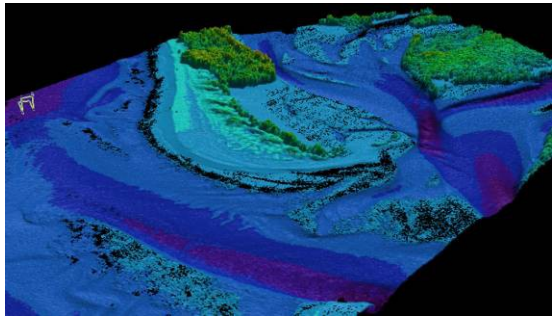
ISAC

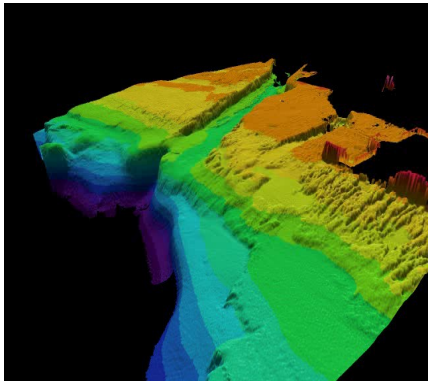
CZMIL (Coastal Zone Mapping and Imaging Lidar)



Combining topographical and bathymetric LIDAR enables survey to be taken of coastline, giving the maximum overlap between







Surveying the shallow areas around the cost would be difficult and time consuming with standard multibeam echosounder survey. With airborne LIDAR large areas can be flown in a short period of time, obtaining snapshots of coast at specific time intervals.

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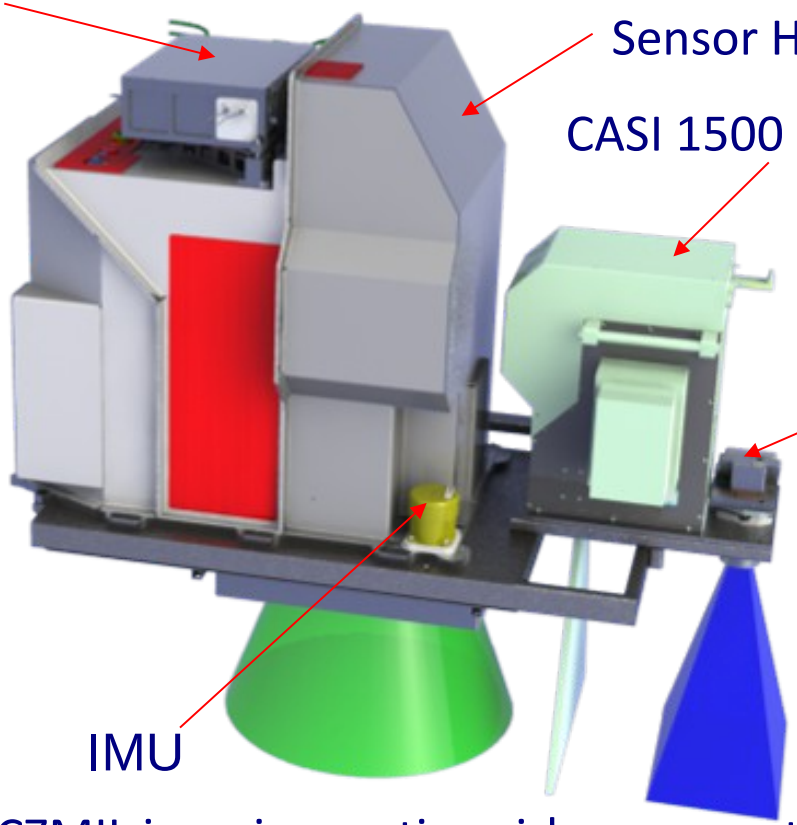
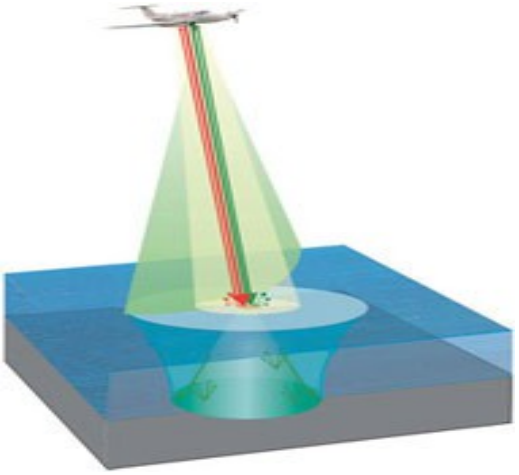
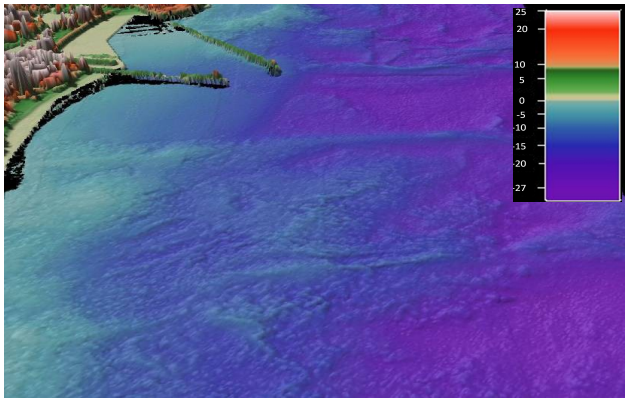
Optech

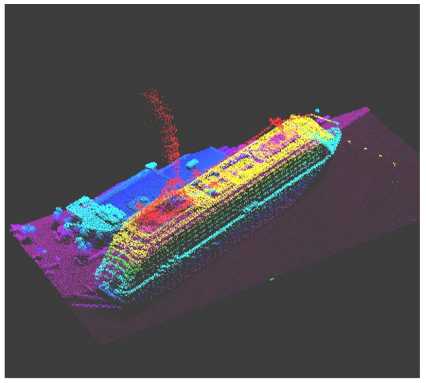
CZMIL hardware







Optech CZMIL is an innovative airborne coastal zone mapping system that produces simultaneous high resolution 3D data and imagery of the beach and shallow water seaflor. Radiation at 532 nm is well suited for transmission through the water while 1064 nm radiation is strongly absorbed.



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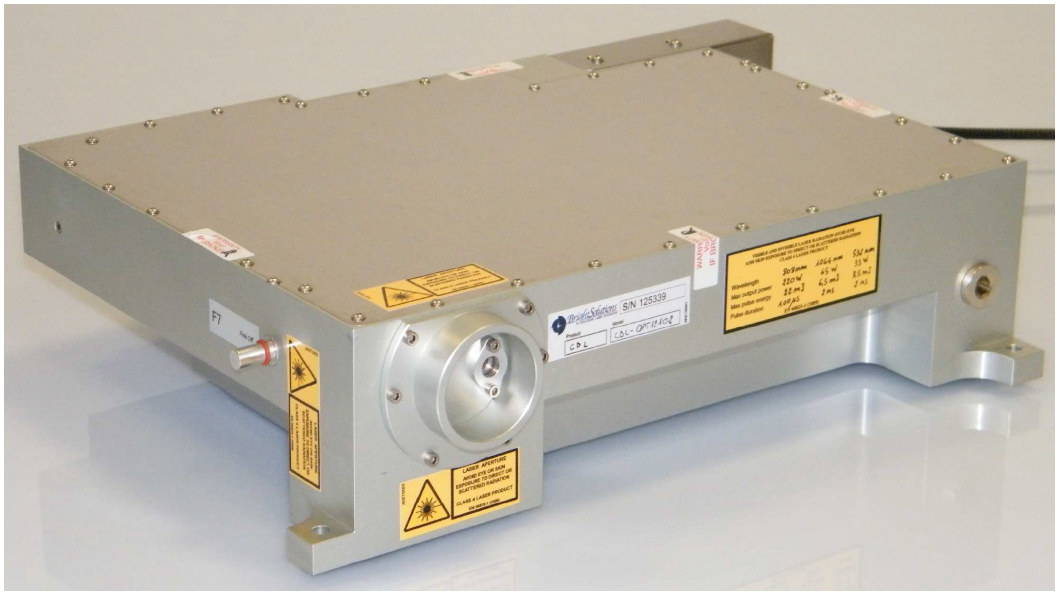
Optech

CZMIL laser



Pulse energy:

3 mJ @ 532 nm

2.5 mJ @ 1064 nm

Pulse duration: **2 ns**
Peak Power: **> 1 MW**
Repetition rate: **10 kHz**

Two collinear laser beams, 30 W @ 532 nm and 25 W @ 1064 nm are provided at laser output.

The beam at 532 nm detects the seafloor while the beam at 1064 detects the sea surface.

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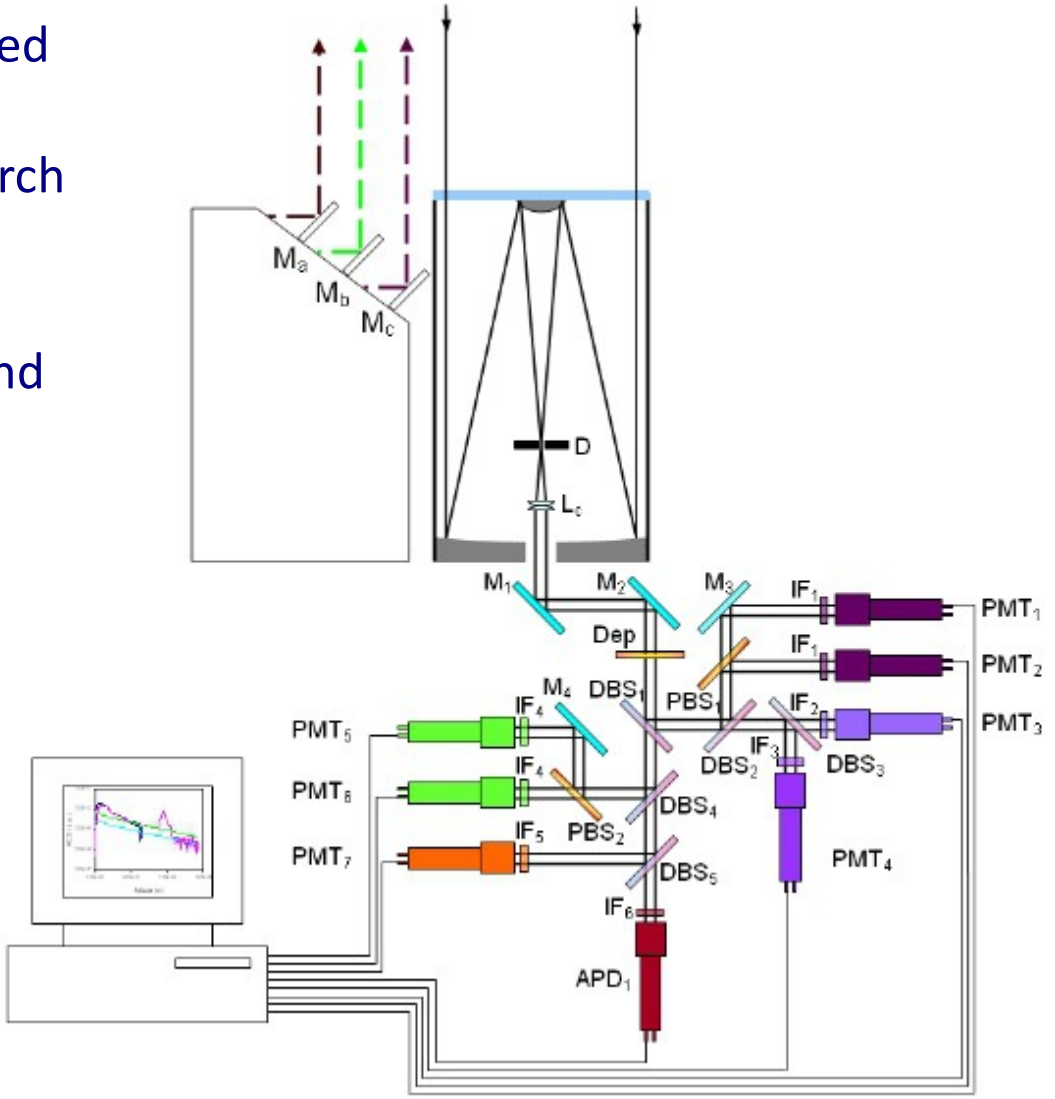
Optech

AMPLE

(Aerosol Multi-wavelength Polarization Lidar Experiment)

A new lidar system for the characterization of highly polluted urban areas (co-operation between CNISM – Beijing Research Institute of Telemetry) and volcanic emission monitoring (a co-operation between CNISM and INGV/INAF)



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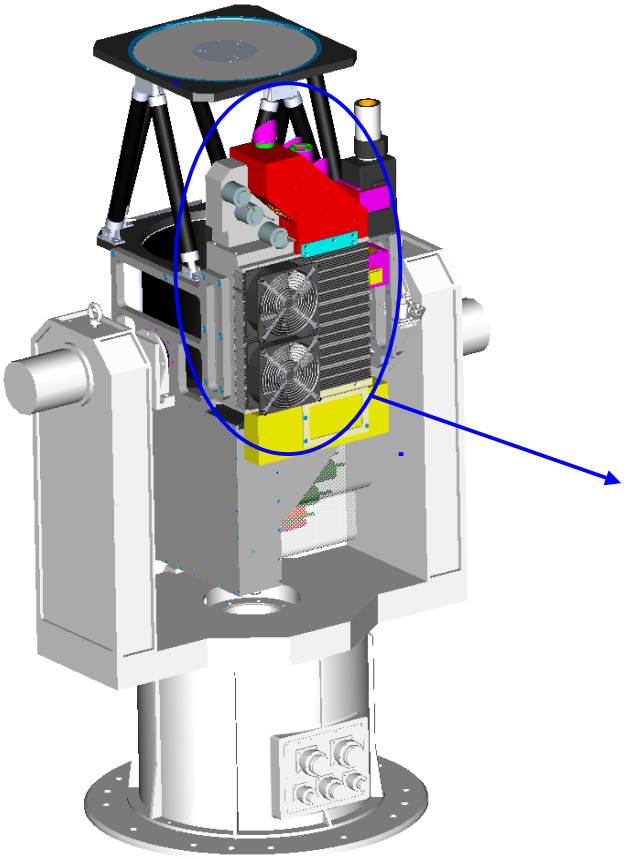
ALA
Advanced LIDAR Applications

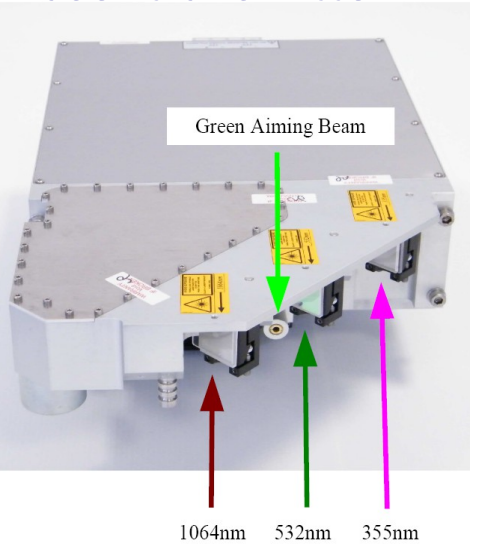
AMPLE

(Aerosol Multi-wavelength Polarization Lidar Experiment)

Designed to perform **3D measurements** by **scanning** the atmosphere along the azimuth and the zenith angles with a scanning of 10° s^{-1} and a precision better than 1'.



Laser transmitter



Two units of the AMPLE have been realized for the Beijing Research Institute for Telemetry and the National Geophysics and Volcanology (Catania, Italy).

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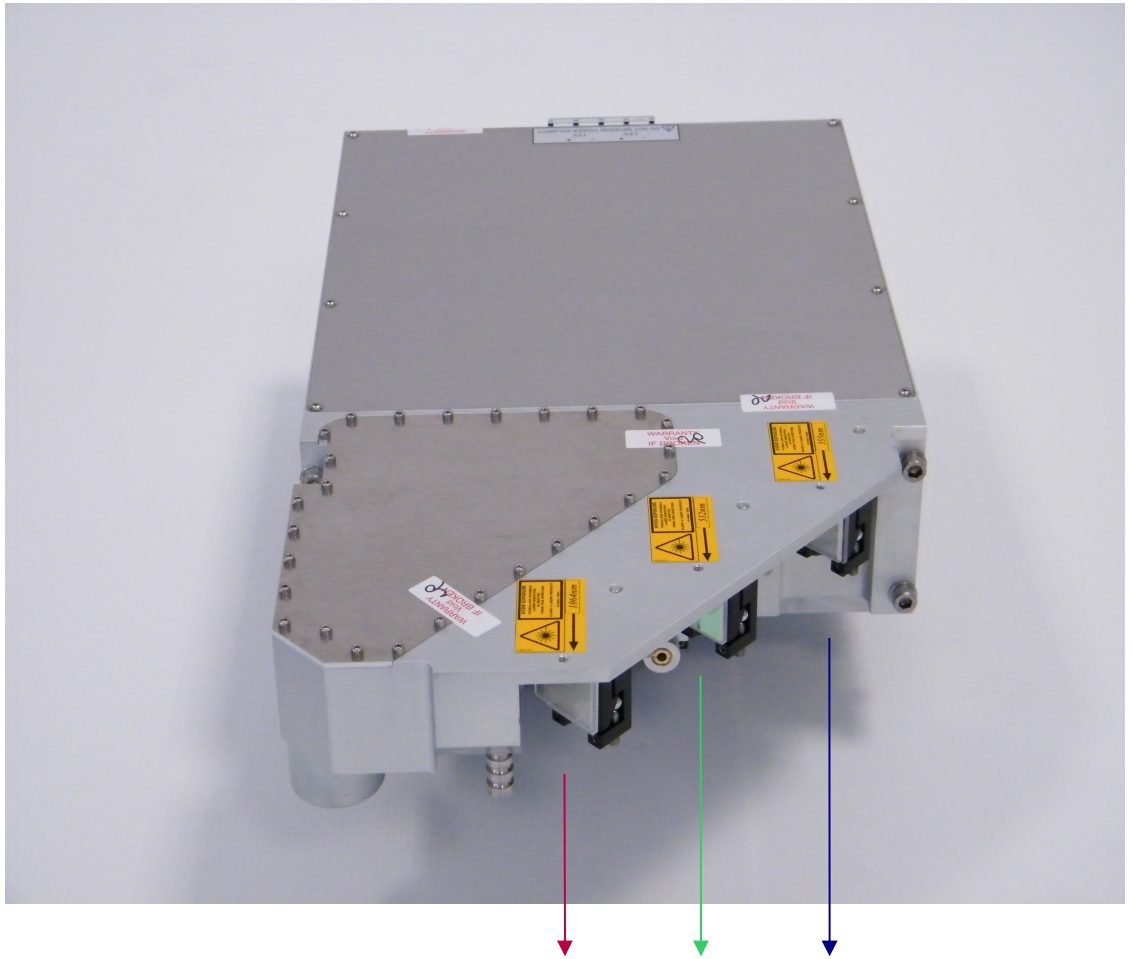
ALA
Advanced LIDAR Applications

CNISM-BRIT laser



Pulse duration: **1 ns**

Repetition rate: **1 kHz**

Pulse energy:

@ 532 nm: **1.5 mJ**

@ 1064 nm: **1 mJ**

@ 355 nm: **> 0.6 mJ**

Three output beams at 1064 nm, 532 nm and 355 nm are individually selectable.

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Advanced LIDAR Applications

Conclusions

- ✔ Wedge family DPSS lasers and pWedge platform particularly suited for LIDAR applications for short pulse durations (< 500 ps in Wedge XF), pulse energies (up to 4 mJ in Wedge XB lasers), compactness and ease of integration
- ✔ Even shorter pulse durations for higher spatial resolutions are under investigation (Wedge and Pico series)
- ✔ Laser sources initially born for micromaching applications, rugged and thought for uninterrupted 24-hours a day operation have been adapted to meet requirements for aerospace applications, in terms of compactness, weight and higher level of integration
- ✔ Compactness and integration produced positive feedback also in the industrial market applications
- ✔ Nowadays the trend is to offer air-cooled single-box solutions, thus integrating all optics and driving electronics together

THANK YOU FOR YOUR ATTENTION!

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