Laser Engines

Highly Efficient, Multi-line Laser Sources

Key Features

- ✓ Single & multimode laser engines
- ✓ Up to 8 (ILE) or 10 (HLE) laser lines
- ✓ Up to 3 switched output ports
- ✓ Wavelength range 405-785 nm
- ✓ Classic wavelengths
- ✓ Active thermal stabilization
- ✓ Extended dynamic range

Key Applications

- ✓ Live cell bioimaging
- ✓ Photostimulation
- ✓ Super-resolution (dSTORM)
- ✓ DNA-PAINT applications
- ✓ Single molecule studies
- ✓ High-speed scanning
- ✓ Transcriptomics and multiplex
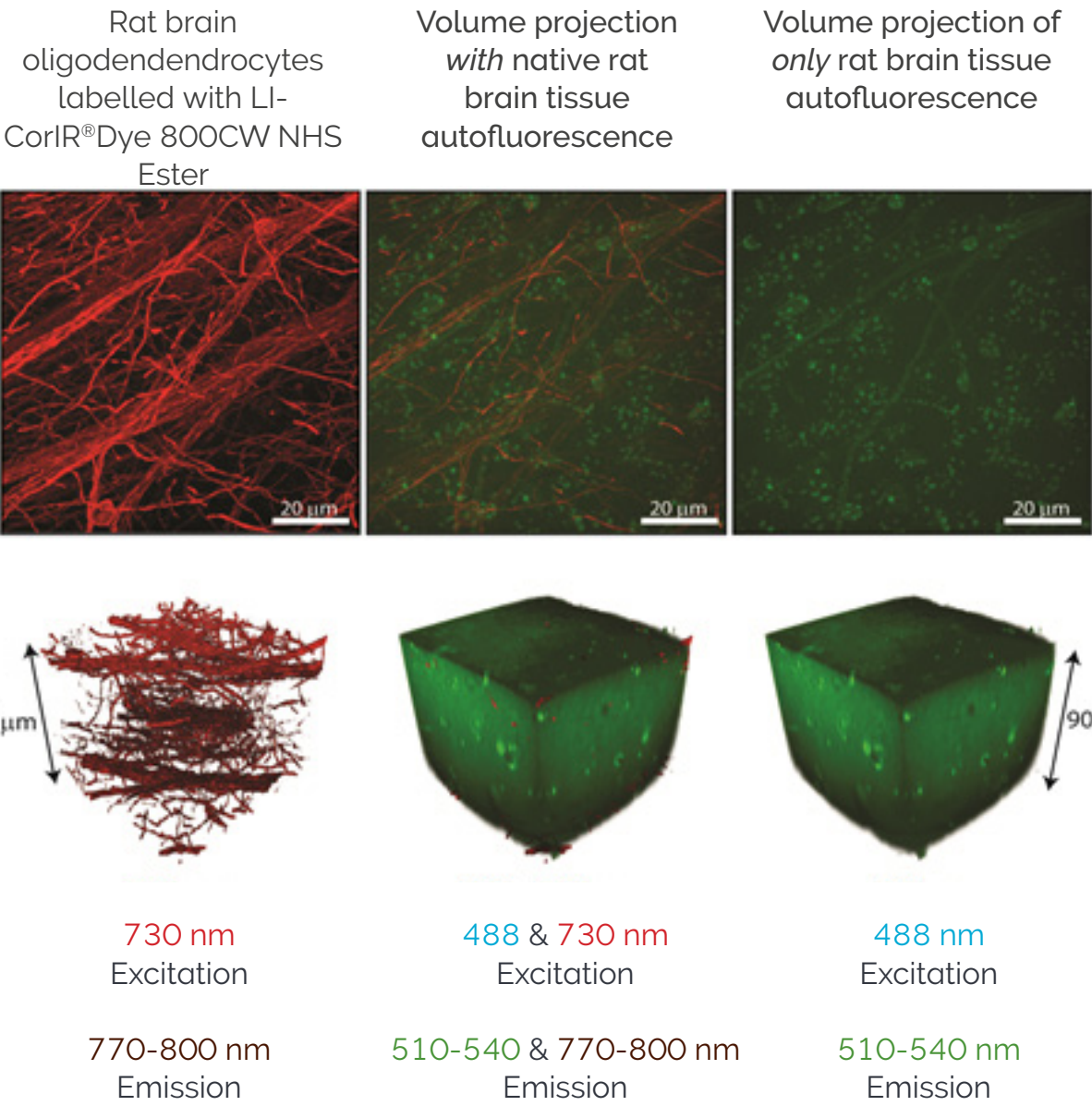
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Introducing Laser Engines

The **Andor HLE is a High Power Laser Engine** utilizing the latest multimode laser diode technologies. HLE is a fourth-generation source which builds on the finest features of our ILE, integrated laser engine. **ILE** is the preeminent single mode laser engine for TIRF, widefield and confocal microscopy, providing exceptional stability, performance and flexibility. With more than a thousand ILEs in the field and more than 15 years' experience we build on this platform with confidence. **ILE** delivers between **two and four laser lines** per chassis and up to eight lines in a dual chassis configuration, **HLE** offers **two to seven multimode laser lines** in a single chassis and up to ten lines in dual configuration. Both engines can be outfitted with two or three fast galvo-switched fibre outputs. Active power and thermal management deliver long-term, ultra-stable, agile illumination. **HLE and ILE wavelengths are closely matched**, with selections from **405, 445, 488, 515, 560, 594, 640, 685, 730, 785 nm** (nominal) allowing their use in a wide range of bioimaging applications.

The new HLE benefits from lower coherence multimode lasers and with power levels ranging from **400 to 2500 mW** is suitable for studies like **dSTORM and PAINT** (point accumulation in nanoscale topography) single molecule applications and photostimulation. HLE is equipped with direct modulation (2-100%) as well as serial neutral density filters enabling a further 1,2 or 3 optical density units for ultra-low light live-cell imaging.

ILE with single mode laser powers 50-150 mW supports all applications including confocal, widefield, single mode TIRF and HiLo.

Feature	Benefit
Multi-line laser source	Up to 8 single mode (ILE) or 10 multimode (HLE) laser lines
Direct modulation	Supports dual laser simultaneous imaging with active blanking
405-785 nm	Excite DAPI to NIR fluorescent reporters
Three-port switch	Multi-function flexibility: stable, millisecond galvo switching
Field upgradeable[•1]	Protect your investment and expand capabilities as required
Huge dynamic range	Adapt easily from single molecule power blinking to gentle live cell imaging
Thermally managed	Long term, ultra-stable power delivery
Borealis compatible	Enhanced throughput and uniformity widefield and spinning disk confocal imaging. Now supporting Borealis-TIRF (patent pending).

Rat brain oligodendendrocytes labelled with LI-CorIR®Dye 800CW NHS Ester | Volume projection *with* native rat brain tissue autofluorescence | Volume projection of *only* rat brain tissue autofluorescence

730 nm Excitation | **488** & **730 nm** Excitation | **488 nm** Excitation

770-800 nm Emission | 510-540 & 770-800 nm Emission | 510-540 nm Emission

Maximum intensity z-projection and 3D volume rendering of an aged rat brain slice containing oligodendrocytes and blood vessels fluorescently labelled with Invitrogen Alexa Fluor 488 dye and LI-COR® IRDye 800. Tissues like these accumulate autofluorescent lipofuscin pigments that create a high image background when excited and imaged with visible wavelengths. The same z-projection and volume rendering. of the brain slice when excited and imaged with infrared wavelengths show a greatly reduced autofluorescence background signal and a deeper imaging depth. Specimen kindly prepared by Dr. Claude Messier, University of Ottawa.

Application Focus

Super-resolution (dSTORM)

The Borealis® optical configuration allows illumination zoom (iZoom) to be supported in Dragonfly 600 series. iZoom enables power density multiplication in reduced fields of illumination. HLE raises the bar on power density for single molecule localization techniques such as dSTORM especially when combined with B-TIRF - see single molecule studies.
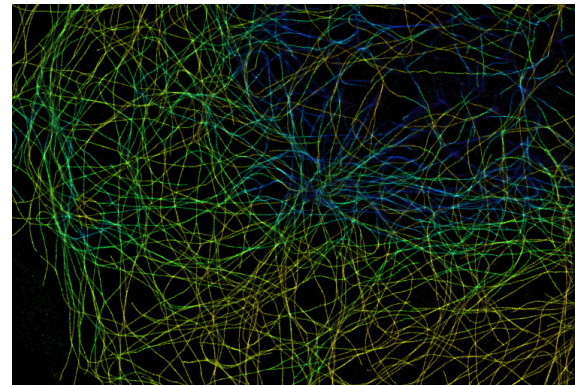
Super-resolution image of microtubules with B-TIRF. *Image credits: F. Rivera-Molina, Yale University.* Also on cover.
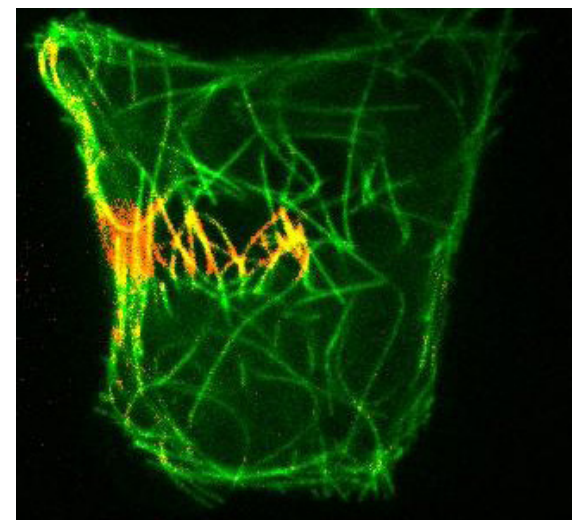
Photostimulation

The HLE extends Mosaic® photostimulation (PS) capabilities using fast port switching to deliver high power at peak absorption bands for many fluorescent probes. The microscope filter turret holds a beam combining dichroic or splitter enabling imaging and PS with minimal moving parts. Mosaic® is a digital mirror device (DMD) that can be readily utilized for FRAP, activation and optogenetics. Mosaic® can be equipped with laser and/or LED illumination depending on the applications requirements.

Live-cell expressing photo switchable fusion protein – emission changes with exposure to targeted 405 nm laser irradiation – Mosaic®. *Image credits: A. Gunjan, FSU.*

DNA-PAINT Applications

DNA-PAINT (point accumulation for imaging in nanoscale topology) is a super-resolution method that exploits transient hybridization between short oligonucleotides strands to visualize nanostructures Resolution of 5-10 nm can be routinely achieved. A "docking strand" is targeted to a motif of interest via antibody or aptamer or similar and the imager strand in solution binds stochastically, HLE or ILE with iZoom provides intense laser illumination to highlight binding events for high precision localization.
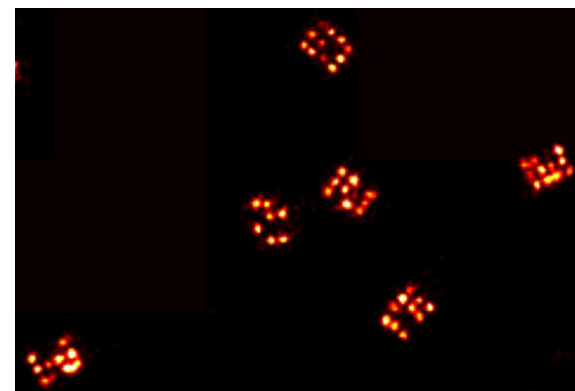

PAINT images of 20 nm DNA origami structures using B-TIRF. *Image credits: F. Schuder, Yale University.*
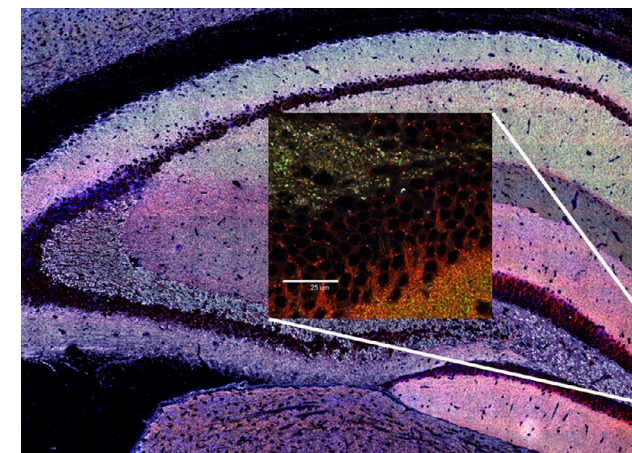
Single Molecule Studies

A single molecule focus led us to invent a new mode of total internal reflection imaging: Borealis-TIRF or B-TIRF. B-TIRF exploits super-critical angle incidence to create a uniform evanescent field with full control of power density. B-TIRF provides near perfect molecular blinking, when used with suitable chemistry.

B-TIRF utilizes a modified BCU light path and can be optimized for both 60x and 100x TIRF lenses, as well as highly inclined oblique illumination (HiLo) for deeper specimen penetration.
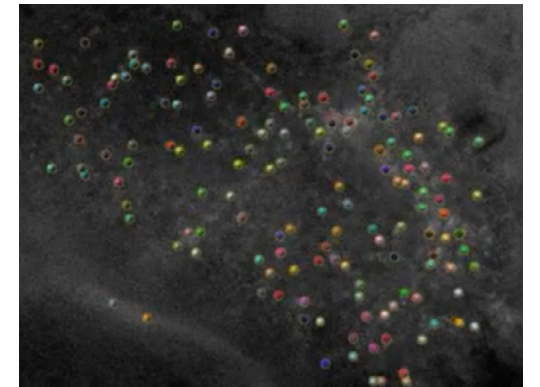
Tracking single molecules for vesicle trafficking studies. *Image credits: T. Chaya, University of Delaware.*

Spatial Transcriptomics

Imaging tissue is the target of spatial "omics" research, which aims to understand tissue architecture, its spatial organization and how this impacts the genetic and functional profile of individual cells in-situ. In these situations, where large tissue volumes require fast imaging across many wavelengths, HLE and ILE are called upon to deliver the necessary power and spectral output for high performance imaging.

Large tissue section scanned for synaptic protein density mapping Dragonfly high speed confocal. *Image credits: S. Grant, University of Edinburgh.*

Live Cell Bioimaging

Phototoxicity can be a big problem for live specimens and a source should be adaptable. ILE and HLE are therefore designed to deliver extremely low light levels with fast switched neutral density (ND) filters in the excitation light path under user control. When we combine analogue control with ND filters laser power ranges from 100% down to 0.002% in HLE and 100% to 0.2% in ILE. Thus a 2 Watt laser can deliver a few microwatts in the full field of view of the microscope. This is well below the phototoxic level observed during mitosis of mammalian cells.●[2]
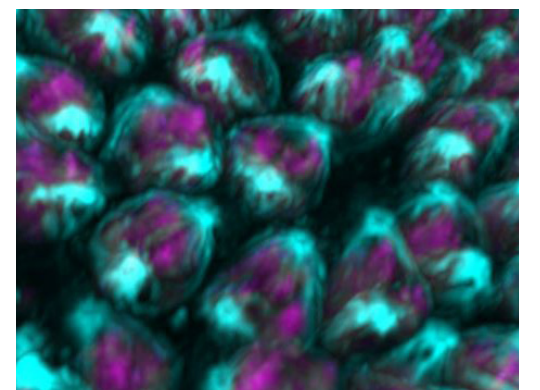
Observing synchronized mitosis in drosophila embryo. *Image credits: I. Balao-Santos & A. Tavares, University of Algarve.*

ILE & HLE Specifications

Model specifications	ILE-400	ILE-700	ILE-800	HLE-700
Max number of lasers	4	7	8	7
Output mode	Single and/or multi		At least 1 multimode port (8 lines)	Multimode only
Wavelength range (nm)	405-640 single mode, 405-785 multimode			405-785
Multiport switch outputs	2, 3		+1 or +2	Up to 3
Multiport switch time (ms)	3			<7
Blank/TTL modulation (diode) MHz	50			1
Blank/TTL modulation (fibre laser only) kHz	NA			0.1
Blank/TTL modulation (OPSL) kHz	50			
Computer control interface	RS-232 or USB 2.0			
TTL/analogue control interface	HD15 D-sub	HD15 D-sub x2		Ext TTL only (no analogue)
Non-linearity (% full scale)	<5%			
Software requirements and compatibility	Fusion, Andor iQ, MetaMorph, Micro-Manager			Fusion, Andor iQ, Micro-Manager

ILE & HLE with Borealis for Superior Uniform Illumination

The laser engines are optimized for **Borealis**® illumination, with a multi-mode fibre output for direct coupling to the Beam Conditioning Unit (BCU). Homogenization of the multi-mode output provides outstanding illumination uniformity with our **Dragonfly**® high speed confocal platform,

BCU - Beam conditioning Unit.   Dragonfly confocal system

Borealis illumination is further exploited in oblique and TIR (total internal reflection) imaging using our newly introduced and patented **Borealis-TIRF (B-TIRF) modality, available on Dragonfly 600 series only. B-TIRF** delivers superior uniformity, avoids fringing artefacts and enables high power densities for localization imaging techniques.

Both HLE and ILE can be used for all multimode illumination strategies, but ILE products can also be used for single mode applications including TIRF, which may be preferred in situation where extremely tight control of the evanescent field penetration depth is required. Find out more about Dragonfly and B-TIRF

Coming Soon Configuration with Mosaic and MicroPoint

HLE and ILE fast multiport switches are ideal for sharing imaging lasers for targeted photo-stimulation applications to get more value from your investment. HLE can be combined with **Mosaic**® to deliver power for efficient photo-switching, bleaching (FRAP/FLIP) and optogenetics applications. While ILE with Mosaic® will find applications in Optogenetics, where the required power densities for activation are lower. These capabilities are currently under development.
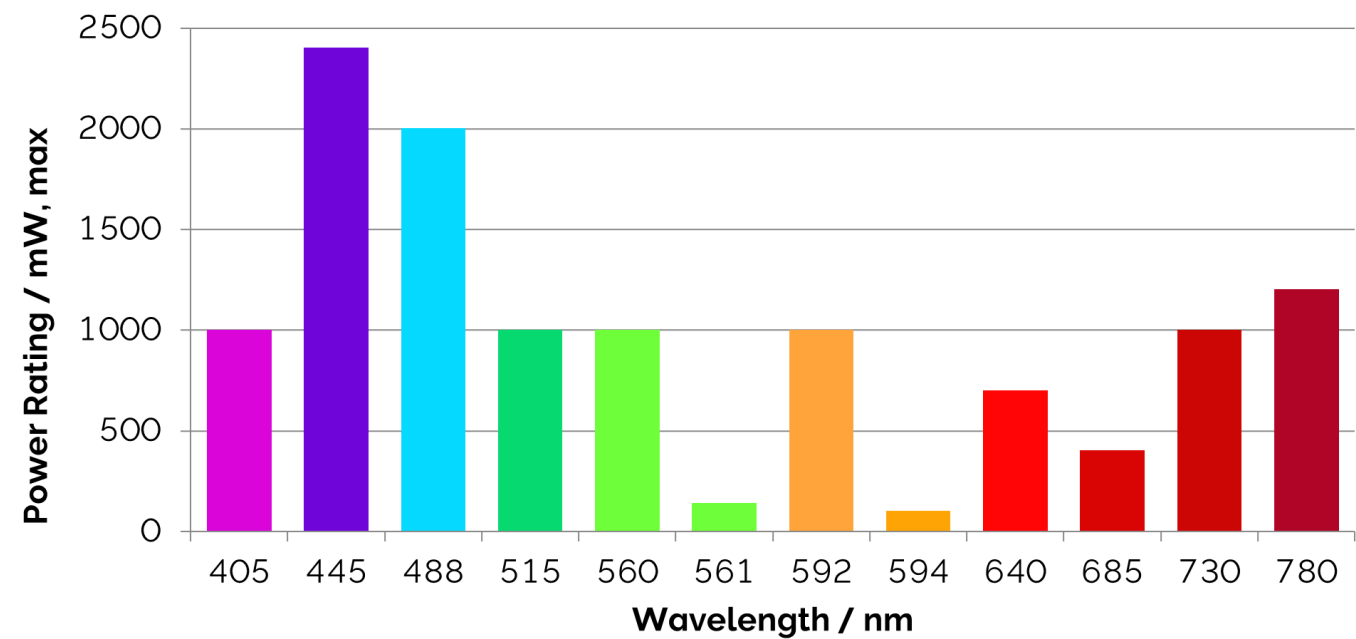
Mosaic

Find out more about Photostimulation products.

ILE Laser Options and Maximum Power
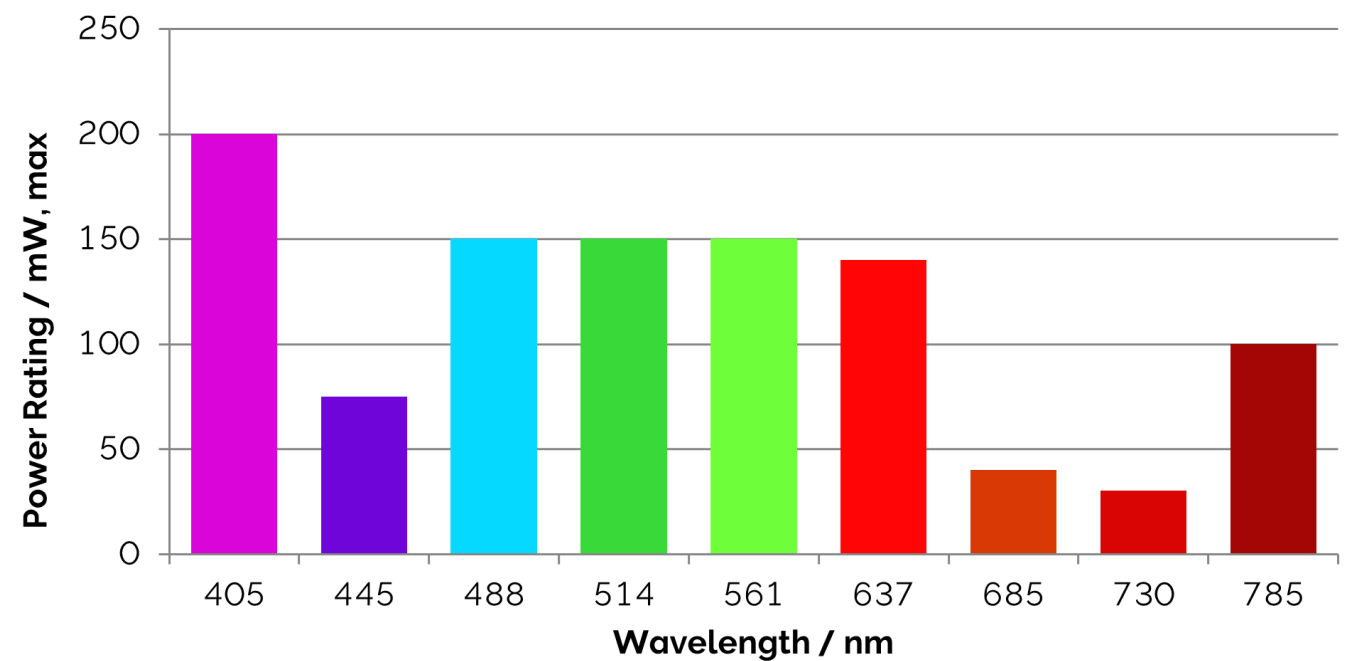
HLE Laser Options and Maximum Power

Wavelengths options for ILE and HLE are closely matched and so both are compatible with all Andor Dragonfly optical configurations. You can substitute or upgrade from ILE to HLE in situations where more power is required, with only one exception: single mode TIRF requires ILE. If upgrading from an older Dragonfly system, please check details of dichroic specifications. HLE and ILE can work together in a system requiring a combination of laser configurations, for example if single mode TIRF is required along with high powered Borealis illumination.

	HLE		ILE	
Laser wavelength (nm)	Diode power (mW)	Max at 50 μm fibre output (mW)	Module Power (mW)	Max at 50 μm fibre output (mW)
405	1000	510	100/200	65/130
445	2400	1880	75	50
488	2000	1350	50/150	40/115
514	N/A	N/A	100/150	75/115
515	1000	440	N/A	N/A
560	1000	840	N/A	N/A
561	150	130	50/100/150	37/75/115
592	1000	840	N/A	N/A
594	100	90	N/A	N/A
637	N/A	N/A	140	110
640	700	480	N/A	N/A
685	400	190	40	35
730	1000	380	30	25
780	1200	250	N/A	N/A
785	N/A	N/A	100	65

HLE wavelength tolerances: 560, 592 & 642 ±0.5 nm; 561, 594 ±2 nm; 685±3 nm; 405, 515, 640 & 730 ±5 nm; 448 +5/-2 nm; 780 ±3 nm
ILE wavelength tolerances: 488, 514, 561 & 594±2 nm; 405, 445, 637, 685, 730 & 785 ±5 nm
Please contact Andor for more details on expected efficiencies.

ILE

Step 1.   Build Your Product

Select from the following options to build your specific product order code for our 400 and 700 ILE models.

ILE-400: 4 lines

* See note 1

Choose number of ports

Single Mode only:
- 1 LC-ILE-400-MOS1
- 2 LC-ILE-400-MOS2
- 3 LC-ILE-400-MOS3

LC-ILE-400-M (MM only)
or
Mixed Mode:
- 1 LC-ILE-400-M1S1
- 2 LC-ILE-400-M1S2

smTIRF, MicroPoint 4, Confocal

Borealis

LC-ILE-400-M2 and ILE-ILE-400-M3 options also available for all multi-mode excitation e.g. MicroPoint FRAP.

Up to 4 lines (ILE-400)

Description	Mode	Ports	Part number
4-line ILE	Single mode only	1	LC-ILE-400-MOS1
	Single mode only	2	LC-ILE-400-MOS2
	Single mode only	3	LC-ILE-400-MOS3
	Multimode only	1	LC-ILE-400-M
	Mixed mode	2	LC-ILE-400-M1S1
	Mixed mode	3	LC-ILE-400-M1S2

MM indicates Multimode

ILE-700: 7 lines
ILE 4 line: e.g.405/488/561/640 &
ILE 3 line: e.g.445/515/685

*see note 1

Choose number of ports

Single Mode only:
- 1 LC-ILE-700-MOS1
- 2 LC-ILE-700-MOS2
- 3 LC-ILE-700-MOS3

Mixed Mode:
- LC-ILE-700-M2S1
or
- LC-ILE-700-M2S2

smTIRF, MicroPoint 4

Dual input Borealis

Up to 7 lines (ILE-700)

Description	Mode	Ports	Part number
7-line ILE	Single mode only	1	LC-ILE-700-MS01
	Single mode only	2	LC-ILE-700-MS02
	Single mode only	3	LC-ILE-700-MS03
	Mixed mode	3	LC-ILE-700-M2S1
	Mixed mode	4	LC-ILE-700-M2S2

Step 1.   Build Your Product Continued...

ILE-800: 8 lines
ILE-4 line: e.g.405/488/560/640 &
ILE-4 line: e.g.445/514/594/685

* See note 1

LC-ILE-800-M (MM only)

Borealis

LC-ILE-800-M1S

Choose number of additional ports (max 2)

- LC-ILE-PORT-1S
or
- LC-ILE-PORT-2S

- LC-ILE-PORT-1S-2
or
- LC-ILE-PORT-2S-2

B-TIRF® or MicroPoint

Select from the following options to build your specific product order code for our 800 model.

Up to 8 lines (ILE-800)

Description	Mode	Ports	Part number
8-line ILE	Multimode only	1	LC-ILE-800-M

8 Lines Mixed Mode (by CSR only) [3]

Description	Mode	Part number
8-line ILE single port multimode only	Multimode only	LC-ILE-800-M1S
Select Ports - Up to maximum of 2 single mode (SM) ports		
First SM port on primary ILE-800 unit		LC-ILE-PORT-1S
First SM port on secondary ILE-800 unit		LC-ILE-PORT-1S-2
Second SM port on primary ILE-800 unit		LC-ILE-PORT-2S
Second SM port on secondary ILE-800 unit		LC-ILE-PORT-2S-2

Coming soon: HLE as the light source for MicroPoint and Mosaic in Dragonfly.

Step 2.   Select Additional Fibres

Additional Fibre Selection

Fibre selection is typically only required for third party products

	Part number
Single mode, polarization maintaining (PM) fibre for applications that require angled fibre input. Typical applications are standard CSU heads and TIRF systems with angled input.	LD-FIBR-PMTA
Micropoint - 25 micron/0.12, 4 meter FC to SMA	SV-HLE-FIB-MIC

Step 3.   Select the Laser Powers and Wavelengths

Some laser combinations may not be supported if the wavelengths are too close. Please contact your Andor representative for current options.

Laser Power & Wavelength

Description	Compatibility considerations	Part number
Solid state 405 nm smart laser where XXX is 100 or 200 mW	> 4 lines place in primary ILE unit	LM-405-XXX
Solid state 445 nm smart laser at 75 mW	> 4 lines place in secondary ILE unit	LM-445-075
Solid state 488 nm smart laser at xxx mW where XXX is 050 or 150 mW	> 4 lines place in primary ILE unit	LM-488-XXX
Solid state 514 nm smart laser at 45 mW	> 4 lines place in secondary ILE unit	LM-514-45
Solid state 561 nm smart laser at xxx mW where XXX is 050, 100 or 150 mW	> 4 lines place in primary ILE unit	LM-561-XXX
Solid state 594 nm smart laser at xxx mW where XXX is 060 or 100 mW	> 4 lines place in secondary ILE unit	LM-594-XXXSL
Solid state 637 nm smart laser at 140 mW	> 4 lines place in primary ILE unit	LM-637-140
Solid state 685 nm smart laser at 40 mW	> 4 lines place in secondary ILE unit	LM-685-40
Solid state 730 nm smart laser at 30 mW	> 4 lines place in secondary ILE unit	LM-730-30
Solid state 785 nm smart laser at 100 mW	> 4 lines requires CSR (BCU-200 dichroic)	LM-785-100

HLE

Industry-Leading Power, Flexibility, Classic Wavelengths for Bio-imaging+

Step 1. Build Your HLE Product

HLE-700: 7 lines

No of ports   **Fibre diameters**

1 HLE-700-M1 — 50 µm → Borealis
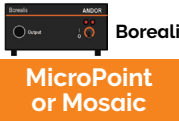
or

2 HLE-700-M2 — 50 µm / 25 or 400 µm → Borealis / MicroPoint or Mosaic

or

3 HLE-700-M3 — 50 µm / 25 µm / 400 µm → Borealis / MicroPoint / Mosaic

Up to 7 lines (HLE-700)

Description	Ports	Part number
7-line HLE	1	LC-HLE-700-M1
	2	LC-HLE-700-M2
	3	LC-HLE-700-M3

The M1 requires return to base for future addition of ports. M2 can be field upgraded to M3.

HLE-1000: 10 lines

1 Wavelengths 405/488 445/525 560 or 561 640/730

2 Wavelengths 592 or 594 685/785

HLE-700-MP   HLE-300-MP

Dual input Borealis

MicroPoint

Mosaic

Up to 10 lines, select HLE-700 and HLE-300

Description	Ports	Part number
7-line HLE	1	LC-HLE-700-M1
	2	LC-HLE-700-M2
	3	LC-HLE-700-M3
3-line HLE	1	LC-HLE-300-M1
	2	LC-HLE 300-M2

Step 2. Select Additional Fibres

Additional Fibre Selection

Fibre selection is typically only required for third party products.
If purchasing for use with Borealis you do not need to specify a fibre for the M1 port. But if purchasing for stand alone operation please select fibres for all ports.

| Description	Part number
Borealis – 50 micron/0.12, 3 meter, FC to FC	LD-FIBR-MM50
MicroPoint® – 25 micron/0.12, 4 meter FC to SMA	SV-HLE-FIB-MIC
Mosaic® - 400 micron/0.22, 4 meter FC to SMA	SV-HLE-FIB-MOS

Step 3. Select the Laser Wavelengths

Laser Power & Wavelength

Four slots available per HLE: up to seven wavelengths with dual laser modules (DLM). For dual HLE configurations see figures on page 12. If 56X nm and 59X nm selected 6 lines can be configured in a single HLE.

| Description	Configuration notes	Part number
405 nm/1000 mW and 488/2000 dual laser module (DLM)	Requires one slot of four	LM-405-488-DUAL-MM
445/2400 and 515/1000 DLM	Requires one slot of four	LM-445-515-DUAL-MM
560 nm, 1000 mW single mode fibre laser (SMFL)	If used with 592-1000 requires second HLE	LM-HLE-560-1000
561 nm, 150 mW single mode OPSL smart laser module.	Requires one slot of four	LM-561-150
592 nm, 1000 mW SMFL	If used with 560/1000 requires second HLE	LM-HLE-592-1000
594 nm, 100 mW single mode OPSL smart laser module	Requires one slot of four	LM-594-100
640/700 multimode laser diode	Requires one slot of four	LM-640-700-MM
640/700 and 730/1000 DLM	Requires one slot of four	LM-640-730-DUAL-MM
685/400 and 785/1200 DLM	Requires one slot of four	LM-685-785-DUAL-MM

Note: Only one HLE can excite MicroPoint fibre input. Mosaic can accept inputs from both HLE-700 units if required.

HLE
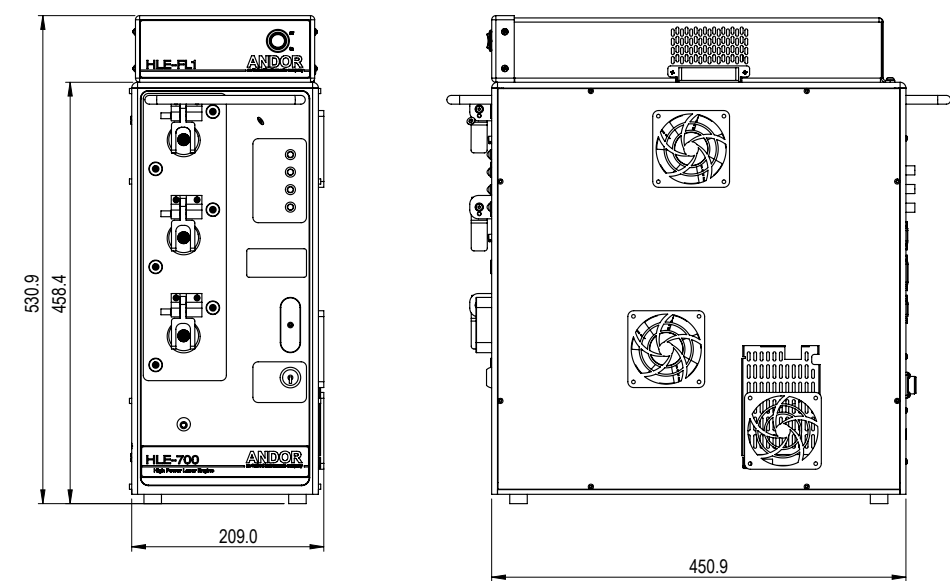
Front Panel
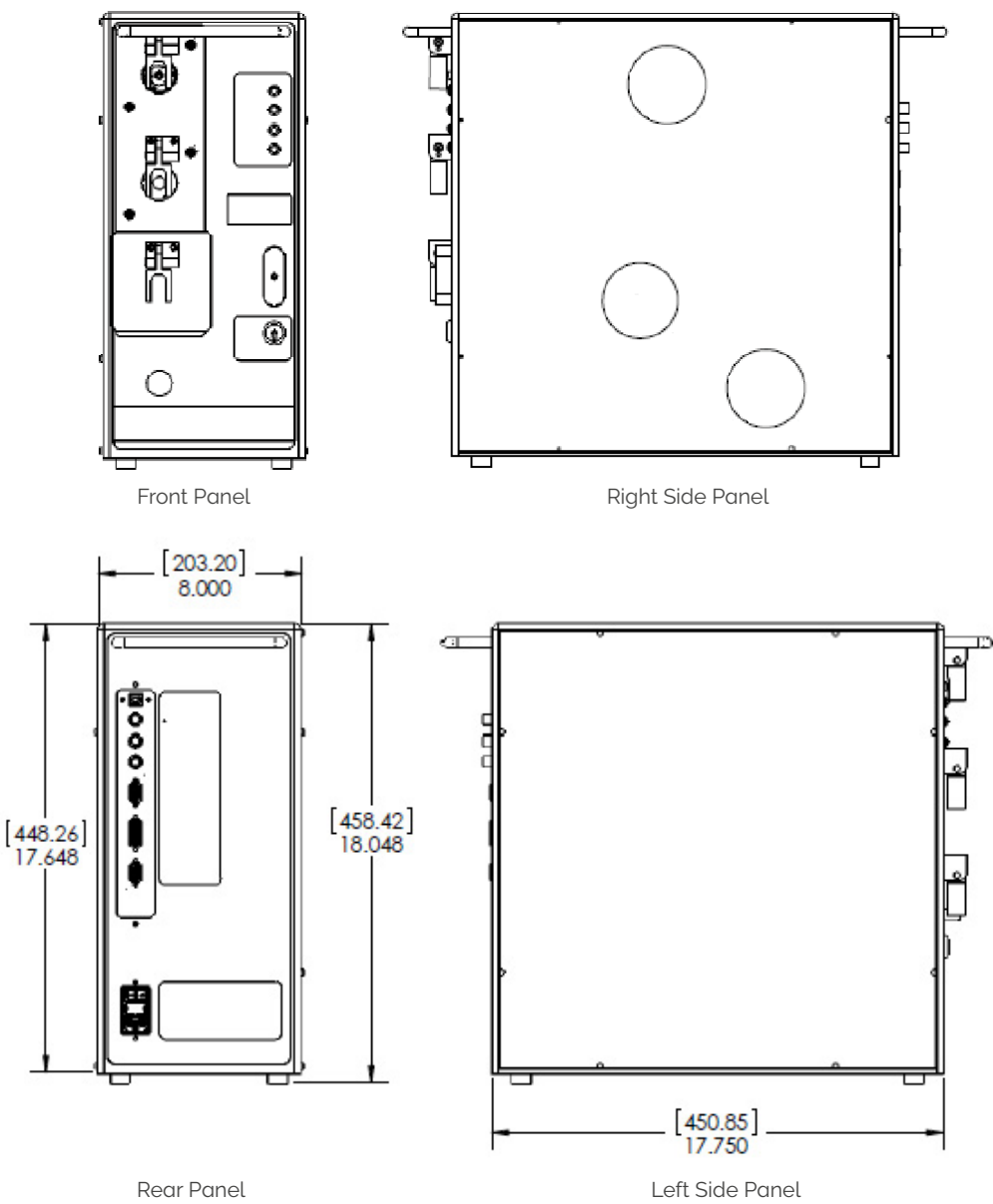

Right Side Panel
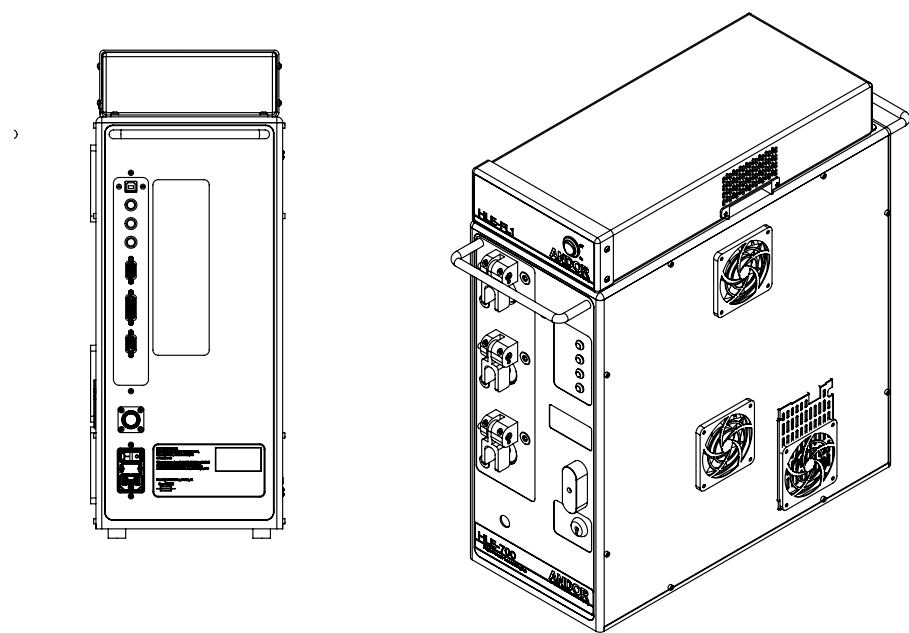
Rear Panel

Left Side Panel

Dimensions in mm

Model	HLE-700
Dimensions, cm	53 x 46 x 21
Weight, fully loaded, kg	35

Notes:
Allow 100 mm space around the HLE for ventilation
Weight will vary with system configuration

ILE

Front Panel

Right Side Panel

Rear Panel

Left Side Panel

Dimensions in inches [mm]

Top Panel

Model	ILE-400	ILE-700/800
Dimensions, cm	46 x 46 x 20	46 x 46 x 41
Weight, fully loaded, kg	20	40

Notes:
Allow 100 mm space around the ILE for ventilation
Weight will vary with system configuration
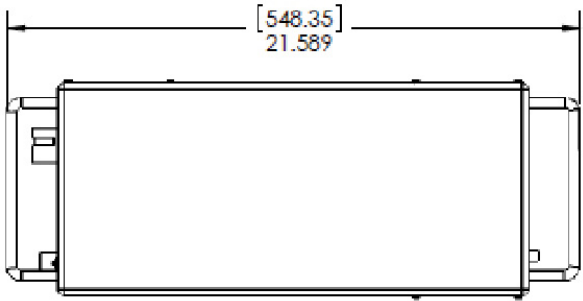
Order Today

Need more information? At Andor we are committed to finding the correct solution for you. With a dedicated team of technical advisors, we are able to offer you one-to-one guidance and technical support on all Andor products. For a full listing of our local sales offices, please see: andor.oxinst.com/contact

Our regional headquarters are:

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Fax +1 (860) 290 9566

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Items shipped with your system:
Fully configured platform
Single or multimode fibres as ordered
System performance sheet
User manual in electronic format
USB 2.0 cable
Communication cable (RS-232)
Triggering and interlock cables (BNC)
Blanking cable: HD 15D-sub to 3x BNC male
Country specific power cable

Minimum Computer Requirements:
- Compatible with Andor Fusion, iQ, Micro-Manager, MetaMorph (ILE only) and supported in Andor ALC SDK

Regulatory Compliance
- EU EMC/ LV/ Machinery/ RoHS Directives
- Registered with CDRH
- Laser safety compliant for IEC 60825-1 and CDRH 21 CFR 1040.10

Operating & Storage Conditions
- Operating Temperature: 18°C to 28°C ambient
- Operating Relative Humidity: < 70% (non-condensing)
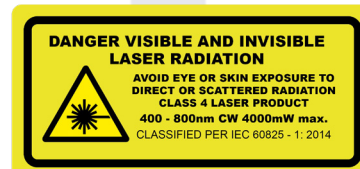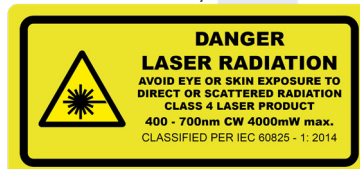- Storage Temperature: -20°C to 50°C ambient

Power Requirements
- Mains Power supply: 100-240 VAC, 50/60 Hz
- Power consumption: HLE-700: 70 W typical (140 W max)
- Power consumption: ILE-400: 60 W typical (300 W max), ILE-700/800: 120 W typical (600 W max)

Footnotes: Specifications are subject to change without notice

1. HLE-700-M1 has a single output on the top port. Field upgrade to multi-port is not supported. HLE-700-M2 can be field upgraded to HLE-700-M3.
2. Magidson V, Khodjakov A. Circumventing photodamage in live-cell microscopy. Methods Cell Biol. 2013;114:545-60. doi: 10.1016/B978-0-12-407761-4.00023-3.
3. For mixed mode systems, the multimode port is always the last port. i.e. port 2 of a 2 port, or port 3 of a 3 port ILE configuration.
4. The HLE-700 and some ILE configurations are Class 4 Laser Products and so must comply with IEC 60825-1 and the CDRH regulations for Manual Reset. An external manual reset box is provided for this purpose.
5. Standard warranty - 12 months parts and labour.
6. Extended warranty - up to 5 years, is available on request.
7. Installation, service and upgrade should be performed by qualified personnel.
8. All local safety standards should be followed by users.

HLE Class 4 laser safety classification labels

DANGER LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT
400 - 700nm CW 4000mW max.
CLASSIFIED PER IEC 60825 - 1: 2014

DANGER VISIBLE AND INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT
400 - 800nm CW 4000mW max.
CLASSIFIED PER IEC 60825 - 1: 2014

ILE Class 3B/4 laser safety classification labels

WARNING - VISIBLE AND INVISIBLE LASER RADIATION
AVOID EXPOSURE TO BEAM
CLASS 3B LASER PRODUCT
400 - 800 nm CW 500 mW max.
CLASSIFIED PER IEC 60825 -1: 2014

DANGER - VISIBLE AND INVISIBLE LASER RADIATION
AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION
CLASS 4 LASER PRODUCT
400 - 800 nm CW 2000mW max.
CLASSIFIED PER IEC 60825 -1: 2014

bsi. ISO 9001 Quality Management FM40523

bsi. ISO 14001 Environmental Management EMS91062

bsi. OHSAS 18001 Occupational Health and Safety Management OHS502497

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