PRODUCT NOTE

High-sensitivity 2D optical meets High-resolution x-ray.

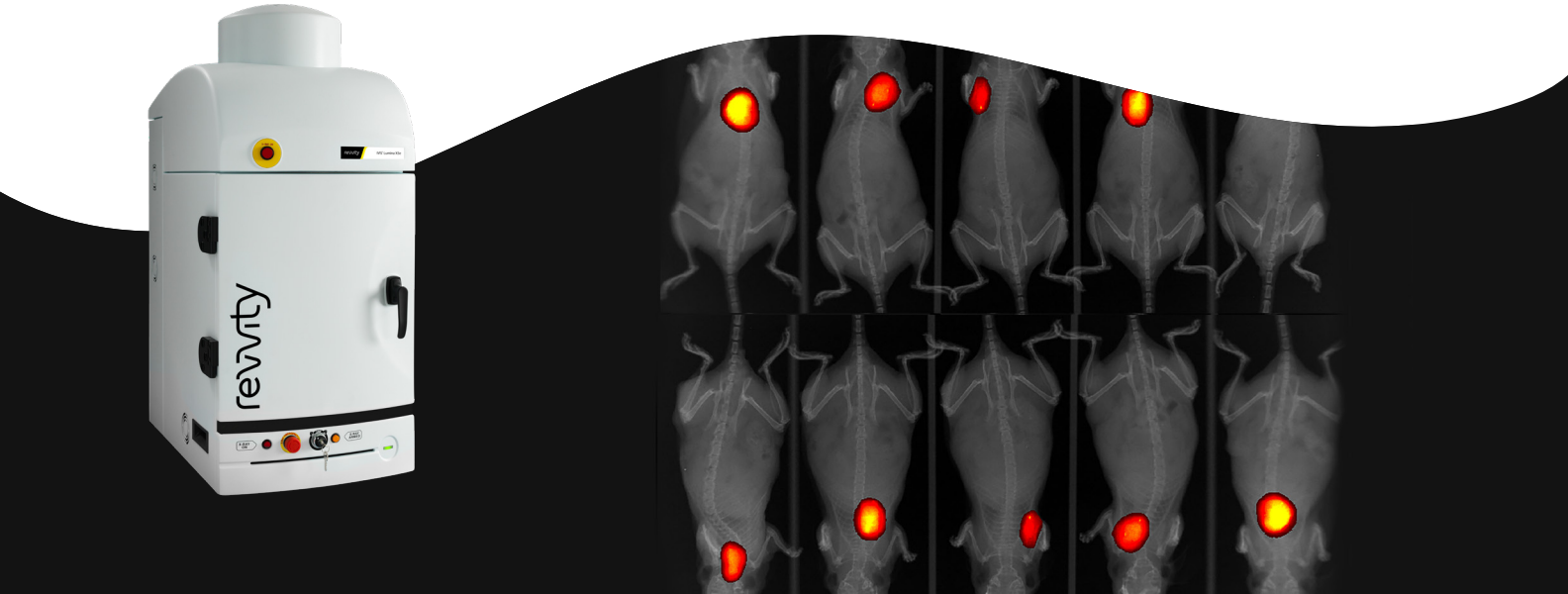
The IVIS® Lumina X5 combines best in class high-throughput *in vivo* bioluminescence and fluorescence imaging with high-resolution 2D X-ray into a compact benchtop system. With an expanded field of view for 2D optical and X-ray imaging, CCD camera for high sensitivity imaging, plus our unique line of accessories to accelerate setup and labeling, it has never been easier or faster to get robust data – and answers – on anatomical and molecular aspects of disease. For greater detail, high-resolution X-ray image capture with optical overlay provides industry leading resolution in a multimodality imager. The IVIS Lumina X5 also includes state of the art spectral unmixing features for sensitive multispectral imaging to monitor multiple biological events in the same animal.

Key features

- Large field of view enabling high-throughput imaging of up to 10 mice*
- High-resolution, low dose X-ray with optical overlay
- High sensitivity 2D bioluminescence imaging
- Spectral unmixing for sensitive multispectral imaging for monitoring multiple biological events
- Full fluorescence tunability through the NIR spectrum
- Optional Smart animal handling accessories increasing throughput and streamlining imaging workflow
- Software wizard for simplified experimental workflow

*Using optional manifold

IVIS Lumina X5



High-throughput optical and X-ray imaging – no compromise

The IVIS Lumina X5 integrates a one inch CCD camera into our benchtop instrument providing a high throughput 20 x 20 cm FOV sufficient for imaging up to 10 mice at a time with bioluminescence and fluorescence. Moreover, scintillator allows anatomical X-ray overlays for optical images at any field of view.

Furthermore the automatic and independently deployed scintillator provides the flexibility to image larger rodents up to 500-600 g in weight with seamless, accurate optical overlay.

As with other IVIS Lumina systems, the IVIS Lumina X5 is equipped with 26 filters tunable to image fluorescent sources that emit from green to near-infrared. Novel illumination technology effectively increases fluorescent transmission through 900 nm. Moreover, the IVIS Lumina X5 incorporates our patented Compute Pure Spectrum (CPS) algorithms and spectral library generation software tools to ensure accurate autofluorescence removal, unmixing and fluorophore quantitation.

Standard on all IVIS instruments, absolute calibration affords consistent and reproducible results independent of magnification, filter selection, or acquisition settings from one instrument to any IVIS instrument within an organization or around the world.

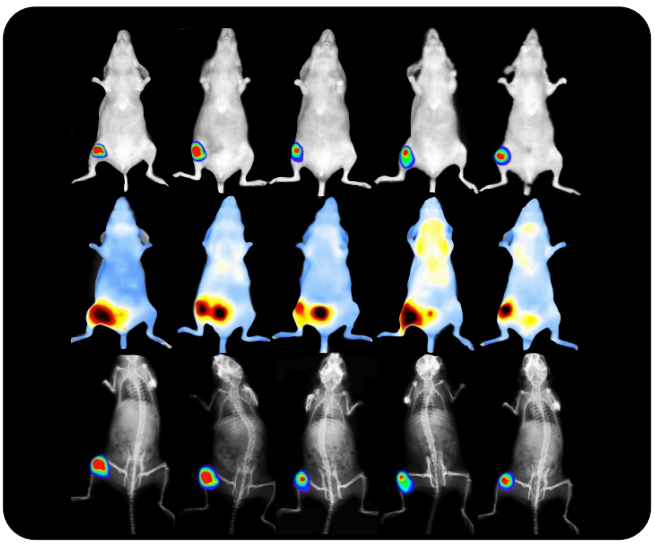


Figure 1. IVISbrite™ 4T1 Red F-luc tumor cell line injected subcutaneously in flank and imaged on IVIS Lumina X5: (top) bioluminescent signal acquisition, (middle) fluorescence detection of IVISense™ Integrin Receptor 750 probe accumulation at tumor site, and (bottom) five mouse X-ray overlaid with bioluminescent signal from knee.

Industry leading X-ray resolution

The IVIS Lumina X5 is equipped with a microfocus X-ray source and high-resolution imaging modes that set a new standard in multimodal 2D imaging resolution. With optical image overlays at every X-ray resolution, you won't miss underlying anatomical and structural changes.

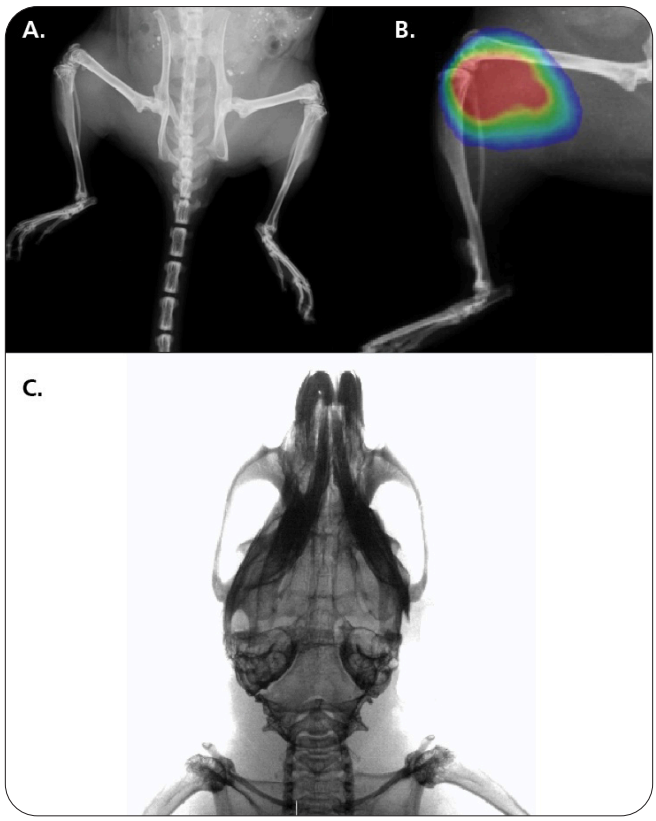


Figure 2. IVISense 4T1 tumor cells injected into knee showing X-ray imaging of injected knee and contralateral control, (b) high-resolution X-ray image of knee with bioluminescent overlay showing signal localization and intensity, and (c) cranium of control animal imaged in the IVIS Lumina X5.

Simplified Workflow

Not only does the IVIS Lumina X5 offer higher throughput via the one inch CCD, but it is also compatible with a set of Smart animal handling accessories (purchased separately) designed with throughput and safety in mind.

Smart loading trays (Figure 3) enables users to pose animals on the benchtop before placing the tray into the IVIS. Using fiducials built into the tray, the software can automatically recognize and draw ROIs providing automated animal identification.

Animal trays are designed with ease of use and user safety in mind. No nose cones are required thus minimizing cleanup. All tray parts have been tested and are resistant to repeated use with common laboratory disinfectants. Furthermore when used with the next generation anesthesia unit (RAS-4), strong vacuum capabilities minimize excess gas from escaping thus preventing exposure of users to anesthetic gas.

Finally, Living Image® software brings IVIS technology to life by facilitating an intuitive workflow for *in vivo* optical, X-ray image acquisition, analysis and data organization. The software will support input of unique animal IDs when using chip technologies and readers from third party vendors thus streamlining labeling, setup and subsequent export of data for analysis.

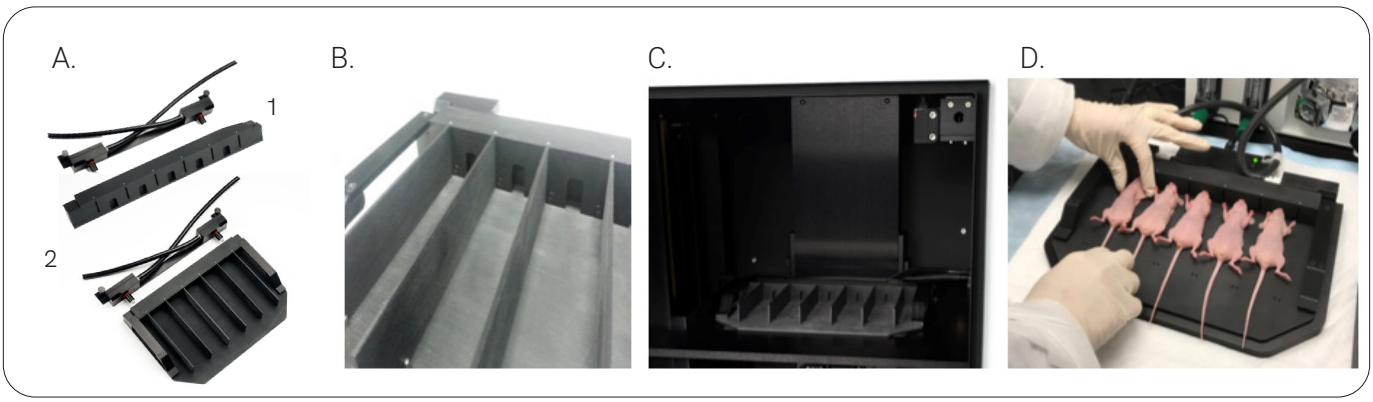


Figure 3. Smart animal management accessories designed with safety, ease of use and speed of acquisition in mind. A quick connect anesthesia port and 5 mouse/2 rat manifold come standard with the IVIS Lumina X5 (A1). The high throughput five mouse tray (purchased separately) connects seamlessly to the supplied quick connect port (A2). The ergonomic tray design does not require nose cones; new baffles securely isolate signal for data integrity; and fiducials present in the tray allow automatic subject recognition during image acquisition (B). The tray can connect either inside the IVIS (C) or it can be used for prepositioning animals (D) on the benchtop when used in conjunction with the benchtop posing station (sold separately).

IVIS Lumina X5 - Standard excitation and emission filter sets

Excitation filter ranges (nm)	Emission filter ranges (nm)	Common dyes / agents / reporters
410-430	500-540	IVISense™ targeted, vascular, & activatable probes
430-450	550-590	IVISense dyes
450-470	600-640	IVISense self-quenching dyes
470-490	650-690	IVISense cell labeling dyes
490-510	690-730	Alexa Fluor® 600-750
510-530	770-810	Cy5-Cy7.5
530-550	825-865	DsRed, Doxorubicin**
550-570		mCherry**
570-590		tdTomato**
590-610		GFP*
610-630		FITC*
630-650		ICG
650-670		
670-690		
690-710		
710-730		
730-750		
750-770		
770-790		

* Best used with *in vitro, ex vivo* and surface imaging techniques

** Enhanced quantification with Spectral Unmixing

Inside the IVIS Lumina X5

- Back-illuminated CCD camera
- Light-tight imaging chamber
- 19 excitation filters and eight emission filters support CPS spectral unmixing
- LED lamps for photographic images
- Heated stage to maintain optimum body temperature
- Motor controlled stage, filter wheels, lens position, and f-stop

X-Ray module

- Supports small and large rodent models
- The high sensitivity camera allows fast X-Ray image acquisition times of 1-10 seconds reducing radiation exposure
- Radiation shielded cabinet
- Exceeds standards set by the U.S. FDA Center for Devices and Radiological Health (21 CFR 1020.40)
- Automated image integration to overlay with bioluminescence, fluorescence and photograph

Optional accessories

- Smart animal management accessories to accelerate setup and streamline imaging workflow
- Heavy duty workbench with integrated keyboard tray and monitor stand.
- MVI-2™ for 360 degree surface mapping

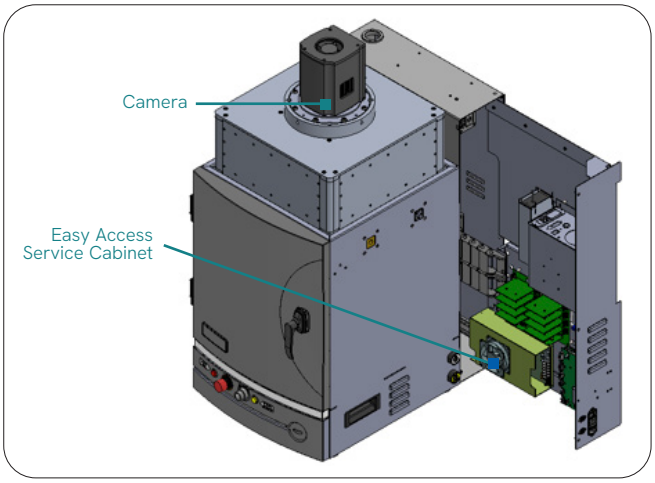


Figure 4. Diagram of external features of IVIS Lumina X5.

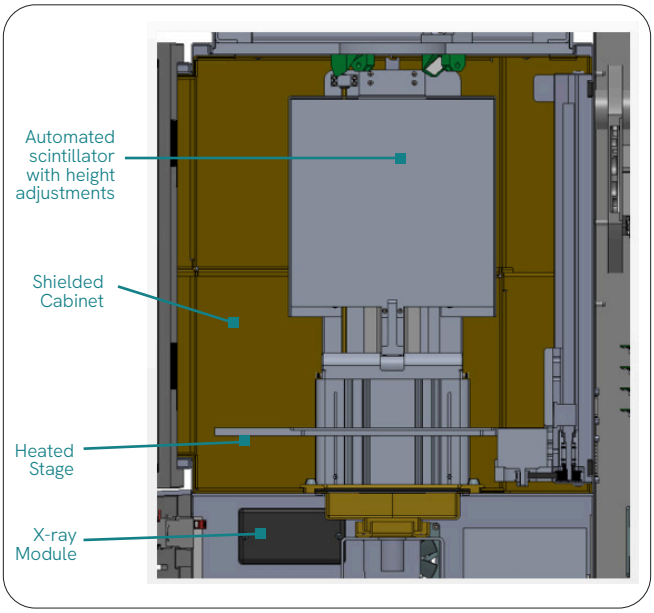
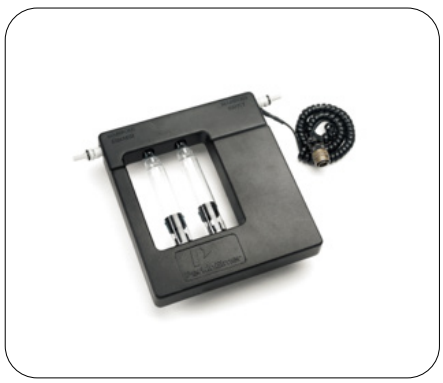


Figure 5. Cross-section of IVIS Lumina X5 imaging chamber.

IVIS Lumina Platform System Accessories – Expand your IVIS Lumina Instrument with features when you need them!

Smart high throughput imaging kit CLS148874



MVI-2 Module for 360 Degree surface mapping CLS143807

RAS-4 Rodent anesthesia system CLS146737

Table 1. IVIS Lumina Platform Comparison.

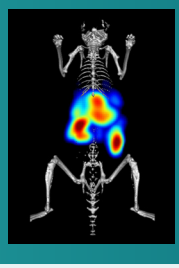
Features	IVIS Lumina LT	IVIS Lumina III	IVIS Lumina XRMS	IVIS Lumina S5	IVIS Lumina X5
Capacity	Up to 5 mice*	Up to 5 mice*	Up to 3 mice	Up to 10 mice**	Up to 10 mice**
1.3 x 1.3 cm CCD -90 °C	√	√	√		
2.7 x 2.7 cm CCD -90 °C				√	√
2D Bioluminescence	√	√	√	√	√
2D Fluorescence	√	√	√	√	√
Enhanced fluorescence		√	√	√	√
Extended range 150 W Tungsten EKE	√	√	√	√	√
Narrow bandpass excitation filters Supporting CPS Spectral Unmixing		√	√	√	√
Standard X-ray Package			√		
High-Resolution X-ray					√
Mouse tray with automatic subject recognition (optional)				√	√

* Using optional manifold
**Using optical manifold kit

Table 2. IVIS Lumina X5 specifications.

Imaging system components:	Specifications
Camera Sensor	Back-illuminated AR coated, cooled Grade 1 CCD
CCD Size	2.7 x 2.7 cm
CCD Operating Temperature	-90 °C
Imaging Pixels	2048 x 2048
Quantum Efficiency	>85% at 500 nm, >80% at 650 nm
Pixel Size	13.5 microns
Optical Field of View (FOV)	10 x 10, 15 x 15, 22.5 x 22.5 cm
X-ray Field of View (FOV)	10 x 10, 15 x 15, 20 x 20 cm
Lens	f/1 – f/8
Minimum Image Pixel Resolution	50 microns
Minimum Read Noise (e-)	2e- RMS for Bin 1
Dark Current	< 0.0008e-/pix/sec
Illumination Source	Extended NIR Range 150W Tungsten EKE
Excitation Fluorescence Filters, Number/Range	19 hard-coated narrow band pass
Emission Fluorescence Filters, Number/Range	7
X-ray Resolution	>21 lp/mm (25 lp/mm typical)
Radiation Shielded Cabinet	Exceeds standards set by the U.S. FDA Center for Devices and Radiological Health (21 CFR 1020.40)
Radiation Leakage	<0.1 mR/hr
Plate Voltage Range	0-50 kV
Tube Current Range	0-1mA
Anode Material	Tungsten
Typical X-Ray Image Acquisition Time	10 sec
X-Ray Tube Window	0.254 um beryllium
Animal Height (cm)	0-5.3 (average mouse is 2 cm, average rat is 4.5 cm)
Multimodality	Automated optical/X-ray overlays in all FOVs
Imaging System Space Requirement	48 x 69 x 122 cm (W x D x H)
Imaging Chamber Interior Dimension	37 x 37 x 43 cm (W x D x H)
Power Requirements	6A at 120V
Stage Temperature	20-40 °C
Computer (Minimum specifications)	Windows® 10, 4 GB RAM, nVidia Quadro 600, 250 GB and 1 TB HD, 24" widescreen LED Monitor
Living Image® Software	Included with IVIS purchase

In Vivo imaging solutions

Optical			Micro-CT	Ultrasound	Reagents
					

IVIS® Lumina Series III
▪ 2D optical imaging
▪ Imaging up to 5 mice
▪ Optional integrated x-ray
	IVIS® Lumina S5 & X5
	▪ 2D optical imaging
	▪ Imaging of up to 10 mice using optional manifold
	▪ Optional integrated high-resolution x-ray
	▪ Optional Smart accessories to streamline imaging workflow
	▪ MVI-2 for automated 360 degree imaging
		IVIS® Spectrum 2 Series
		▪ 2D & 3D optical imaging
		▪ Imaging of up to 10 mice using optional manifold
		▪ Fully automated, one-click co-registration with IVIS SpectrumCT
		▪ Seamlessly co-register 3D optical and hi-res microCT data
		▪ Two powerful modes of fluorescence excitation—epi- and trans- illumination
			Quantum GX3
			▪ High-resolution, low-dose microCT
			▪ Cardiac & respiratory gating
				Vega®
				▪ Automated, hands-free
				▪ High-throughput 3 mice imaging
				▪ Scan times in < 1 minute
				▪ Whole body field of view
				▪ Multiple 3D imaging modes
				  ▪ Elastography (tissue stiffness)
				  ▪ B-mode (soft tissue imaging)
				  ▪ 4D B-mode/M-mode (cardiac imaging)
				  ▪ Acoustic angiography (microvessel networks)
					IVISbrite™
					▪ Bioluminescent substrates, cells, and lentiviral particles
					IVISense™
					▪ Fluorescent probes, labels, and dyes
					VesselVue®
					▪ Microbubble contrast agents for vascular ultrasound imaging

For more information, please visit our website at www.revvity.com

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