

MicroCT imaging: Which system should I choose?

Introduction

Revvity offers numerous preclinical imaging instruments to support your life sciences research. The available modalities include: 2D & 3D optical, ultrasound, and computed tomography (CT). Specifically, the two instruments that produce CT images are the IVIS SpectrumCT 2 and Quantum GX3. This brief describes how to determine the best option for your research goals.

The **IVIS SpectrumCT 2** produces 2D & 3D optical and CT images. Optical imaging of bioluminescent or fluorescent sources provides valuable functional information about disease burden, gene activation, drug biodistribution, and cell tracking. The CT in this instrument is used primarily as an anatomical reference for the optical signal. In addition to the CT, the user can utilize the digital organ atlas to determine approximate location of the optical signal. The CT field of view and x-ray energy for this instrument are appropriate for 3D imaging of mice only, however, 2D optical imaging can be performed on many different animal species.

The **Quantum GX3** is a stand-alone CT imager that supports *in vivo* anatomical, physiological, and functional imaging via fast, low-dose gated and static scans in a wide variety of animal models (e.g., mice, rats, guinea pigs, rabbits, etc.). Subvolume reconstructions allow for images to be re-reconstructed at a higher resolution without the need to rescan the subject. There is a mouse shuttle that transfers between the IVIS Spectrum 2 (optical instrument without CT) and the Quantum GX3 if the user needs optical co-registration and advanced CT capabilities.

IVIS® SpectrumCT 2



Quantum™ GX3

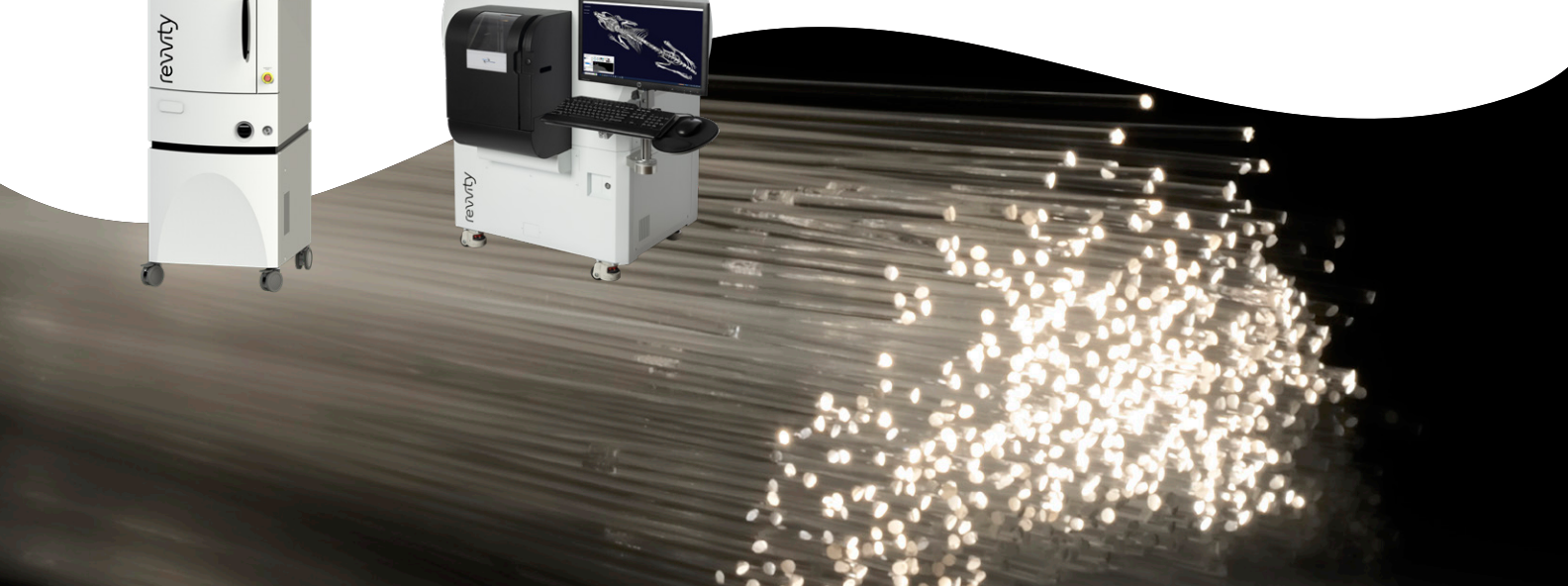


Table 1: Overview of instrument features & applications

Feature	IVIS SpectrumCT 2	Quantum GX3	Notes
Low dose microCT	✓	✓	For anatomical reference
Fluoroscopy "live" mode		✓	Used to center animal in field of view and monitor dynamic processes (e.g., angiography using contrast)
Optical co-registration	✓	✓*	*IVIS Spectrum 2 + Quantum GX3 co-registration possible with mouse shuttle that transfers between the two instruments
Bone mineral density (BMD) analysis		✓	Requires scanning of a separate phantom to convert Hounsfield units to mm ³ hydroxyapatite (density)
Body fat analysis		✓	Can segment subcutaneous fat, visceral fat, and brown adipose tissue
Respiratory & cardiac gating		✓	Retrospective intrinsic image-derived two-phase gating. Produces two reconstructed images for lung (inspiration & expiration) and/or two images for heart (systole & diastole).
Respiratory & cardiac functional measurements		✓	Respiratory measurements: functional residual capacity, lung volumes Cardiac measurements (contrast required): end diastolic volume, end systolic volume, stroke volume, ejection fraction

Table 2: Comparison of CT specifications

	IVIS SpectrumCT 2	Quantum GX3
X-Ray Energy & Current	Fixed: 50 kV, 1 mA	Variable: 20-90 kV, 40-200 μA (8W max)
X-ray Filter options	No selection is possible	Cu 0.06 mm +Al 0.5 mm, Al 0.5 mm & 1 mm, Cu 0.1 mm & 0.2 mm
Fastest scan time	90 s	3.9 s
Focal spot	50 μm	5 μm
Spatial resolution	225 μm (<i>in vivo</i>), 150 μm (<i>ex vivo</i>)	100 μm (<i>in vivo</i>), 10 μm (<i>ex vivo</i>)
Field of view	120 x 120 x 30 mm (L x W x H) to 20 x 20 x 20 mm (L x W x H)	18, 36, 72, or 86 mm (diameter)
Smallest voxel size	40 μm	2.3 μm
No. of animals	2 (bioluminescence tomography) 1 (fluorescence tomography)	1
Species compatible with CT	mouse	mouse, rat, guinea pig, rabbit, etc. (5 kg weight limit)

Examples of microCT applications

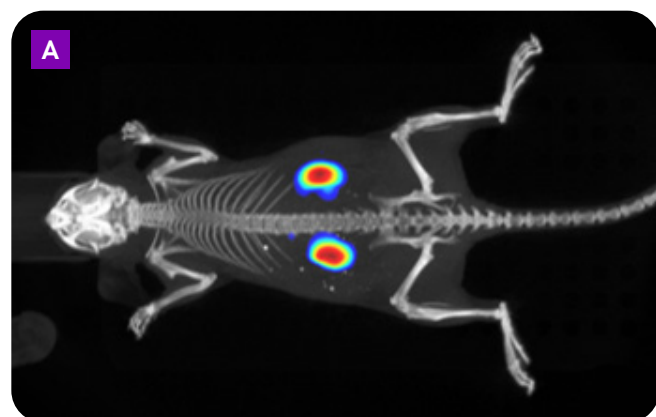


Figure 1A: IVIS SpectrumCT. MicroCT is used to provide anatomical context for a fluorescent probe targeting folate receptor in the kidneys.

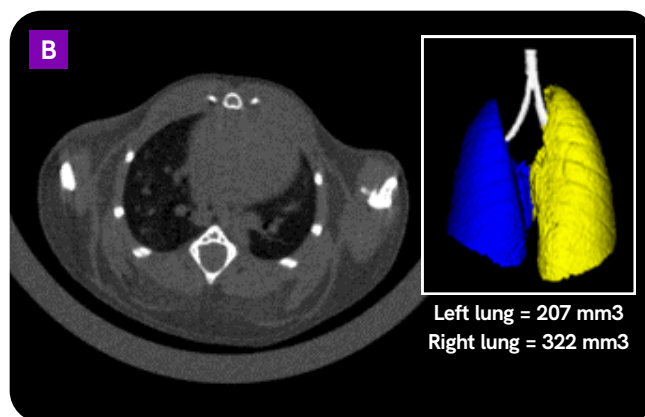


Figure 1B: Lung-gated Quantum microCT scan provides information about lung function & volume.

Get the best of both worlds: Co-registering advanced CT with optical imaging

The Quantum GX3 is the optimal instrument to use if you need advanced CT capabilities, including tumor/organ volumes, bone/fat analyses, angiography, or lung/cardiac functional metrics. Also, the Quantum GX3 is the only option that can provide multi-species CT scans and allow for co-registration of those images with optical tomography if paired with our IVIS Spectrum 2 standalone instrument.

Co-registration is accomplished using a mouse imaging shuttle (MIS, Figure 2A) that keeps the mouse anesthetized and in the same position for both microCT and optical scans. In the Living Image® imaging and analysis software, you open the optical scan, perform a 1-click reconstruction, and then open the CT scan. The CT scan will automatically co-register due to the use of fiducial markers which tell the software how to align the two scans (Figure 2B).



Figure 2A: The mouse imaging shuttle (MIS) allows an anesthetized mouse to be transferred from the IVIS Spectrum 2 to the Quantum GX3, enabling co-registration of optical and advanced microCT images.

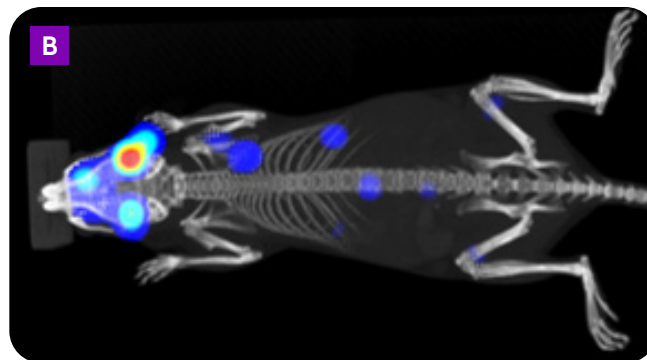
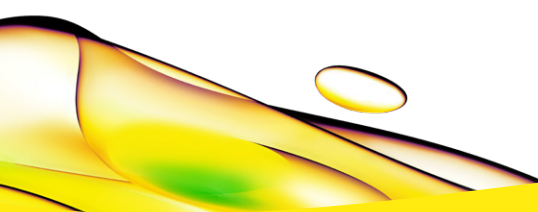


Figure 2B: Co-registration of a bioluminescence imaging from the IVIS Spectrum showing breast cancer metastases and a microCT image from the Quantum GX2.

Whatever approach you choose, having a supplier that has the resources and expertise to partner with on your *in vivo* imaging studies can help you avoid potential pitfalls, and get the quality results you need, faster. We offer a range of imaging technologies to address the breadth of applications that require a non-invasive, sensitive, and/or high-resolution imaging.



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