Monarc Cathodoluminescence System

Model 450

Monarc™—redefining what's possible with SEM-based (scanning electron microscope) cathodoluminescence (CL).

Built upon a groundbreaking optical design, Monarc dramatically boosts sensitivity and spectral resolution, empowering the most complete CL analysis to date with unique wavelength- and angle-resolved capabilities. This true next generation CL detector now provides brand new insights in the most demanding applications in nanophotonics, optoelectronics, and geosciences.

Benefits

Fastest time to the best data

- Acquire CL data with unmatched spatial (<10 nm), angular (1°), and wavelength (0.1 nm) resolutions
- Simultaneously capture angle- and wavelength-resolved CL data
- Collect hyperspectral data up to 30 times faster than other CL detectors

Easy operation for all users

- Guarantee optimal results with fully automated alignment and recipe-driven operation
- Permanently aligned optics deliver reproducible results across the short- and long-term
- Utilize the largest field of view to increase the data throughput and simplify user workflows

Most accurate correlation with other signals

- Detect multiple signals simultaneously for correlated imaging of physical properties and composition with CL data
- No compromises – Make full use of the in-lens SEM detectors during CL measurements

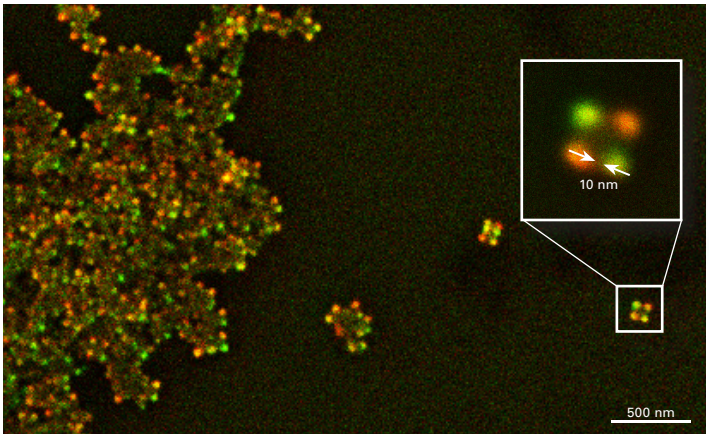
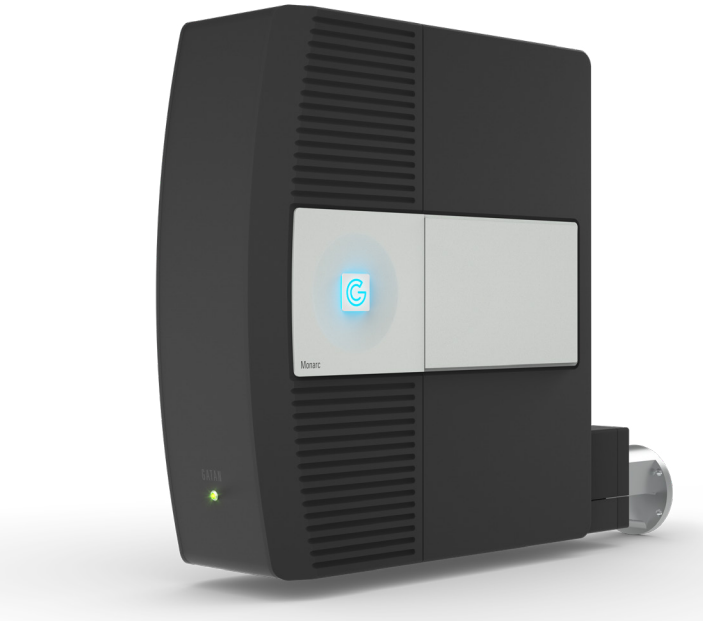


Figure 1. This polarization-filtered CL map demonstrates Monarc's ability to provide CL data with a spatial resolution better than 10 nm. The image shown is a colored overlay of two orthogonal linear polarizations emitted from a collection of gold nano-stars that are 100 nm in size.



Unique Capabilities

- **Angle-resolved (ARCL):** Understand how light and matter interact far below the optical diffraction limit – Provides a 400x larger field of view than other CL detectors with virtually no loss in resolution (patent pending)
- **Wavelength- and angle-resolved (WARCL):** Visualize how light and matter interact across multiple viewing angles and wavelengths at full resolution – What was impossible or highly impractical, is now routine with Monarc's unique optical design
- **Polarization filtering:** Determine the emission polarization properties of deep sub-wavelength structures like optical nanoantenna, nanocavities, and photonic crystals

Applications

- Optoelectronic material development
- LED and laser failure analysis
- Display and lighting
- Fundamental light-matter interactions
- Nanophotonics
- Photonic crystals
- Trace element mapping in geosciences
- Photovoltaic material characterization
- Phosphor technology

Specifications

	Model	
Mode	**Monarc Pro**	**Monarc**
Unfiltered CL mapping	•	•
Wavelength-filtered CL mapping	•	•
Wavelength-scanned CL spectroscopy	•	•
Wavelength-resolved CL spectroscopy	•	•[1]
Wavelength-filtered CL spectrum imaging (SI)	•	•
Wavelength-resolved CL SI	•	•[1]
Angle-resolved CL pattern	•[1]	–
Angle-resolved CL SI	•[1]	–
Wavelength- and angle-resolved CL spectroscopy	•[1]	–
Polarization-filtered CL	•[1]	–
Feature		
Wavelength range	185 – 2300 nm[1]	300 – 800 nm
Virtually aberration-free spectrograph	•	–
Wavelength resolution	0.1 nm	0.5 nm
SI pixel rate, max.	6000 pixels/s	6000 pixels/s
Field of view	Up to 10,000 µm^2	10,000 µm^2
Expert results for all users	•	•
Reproducible results in the short- and long-term	•	•
Recipe-driven operation and analysis	•	–
Use with in-lens SEM detectors	•[1]	–

The specifications provided herein are approximate and are intended as guidelines only. All specifications are subject to change.

[1] Specification requires appropriate options.

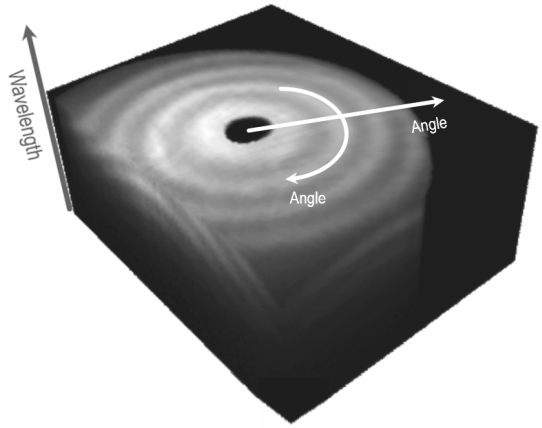


Figure 3. Near-complete characterization of the emission from a thin-film InGaN-based LED captured using Monarc's exclusive wavelength- and angle-resolved spectroscopy mode. Interference between emitted and reflected light rays produce an emission pattern that varies with the emitted wavelength.

Two Monarc models are available to meet your application needs:

Monarc

Ideal for geoscience and mapping applications, the Monarc model surpasses prior generation SEM CL detectors with the largest field of view independent of spectral resolution and provides hyperspectral data collection with greater spatial sampling using novel wavelength-filtered spectrum imaging capabilities.

Monarc Pro

The Monarc Pro is preferred for nanophotonic and optoelectronic material applications since it provides the highest sensitivity and spectral resolution of any CL system; plus unique wavelength- and angle-resolved analysis as well as polarization-filtering options.

Ordering

Model	Description
450	Monarc System
450.P	Monarc Pro CL System

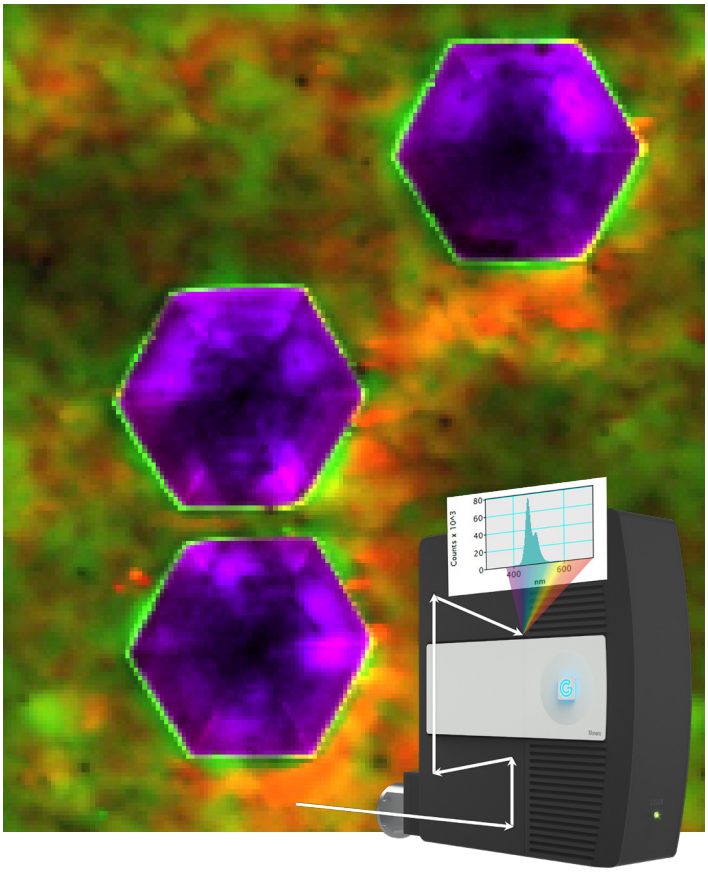


Figure 2. Composite wavelength-filtered image extracted from a hyperspectral data cube acquired with the Monarc of a GaN/InGaN multi-quantum well sample with V-pit defects (R = 504 ± 2 nm, G = 435 ± 2 nm, V = 365 ± 2 nm).

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