QUANTUM YIELD BERLIN

PRODUCT BROCHURE

THE LUQY FAMILY

LuQY Scanner

Absolute luminescence mapping over large areas



Full-area PL imaging
The whole sample in one snapshot

Scan absolute PL
Up to 21 × 21 cm (G12 wafer)

Produce parameter maps
Local spectra, PLQY, QFLS and more

www.quantum-yield-berlin.com

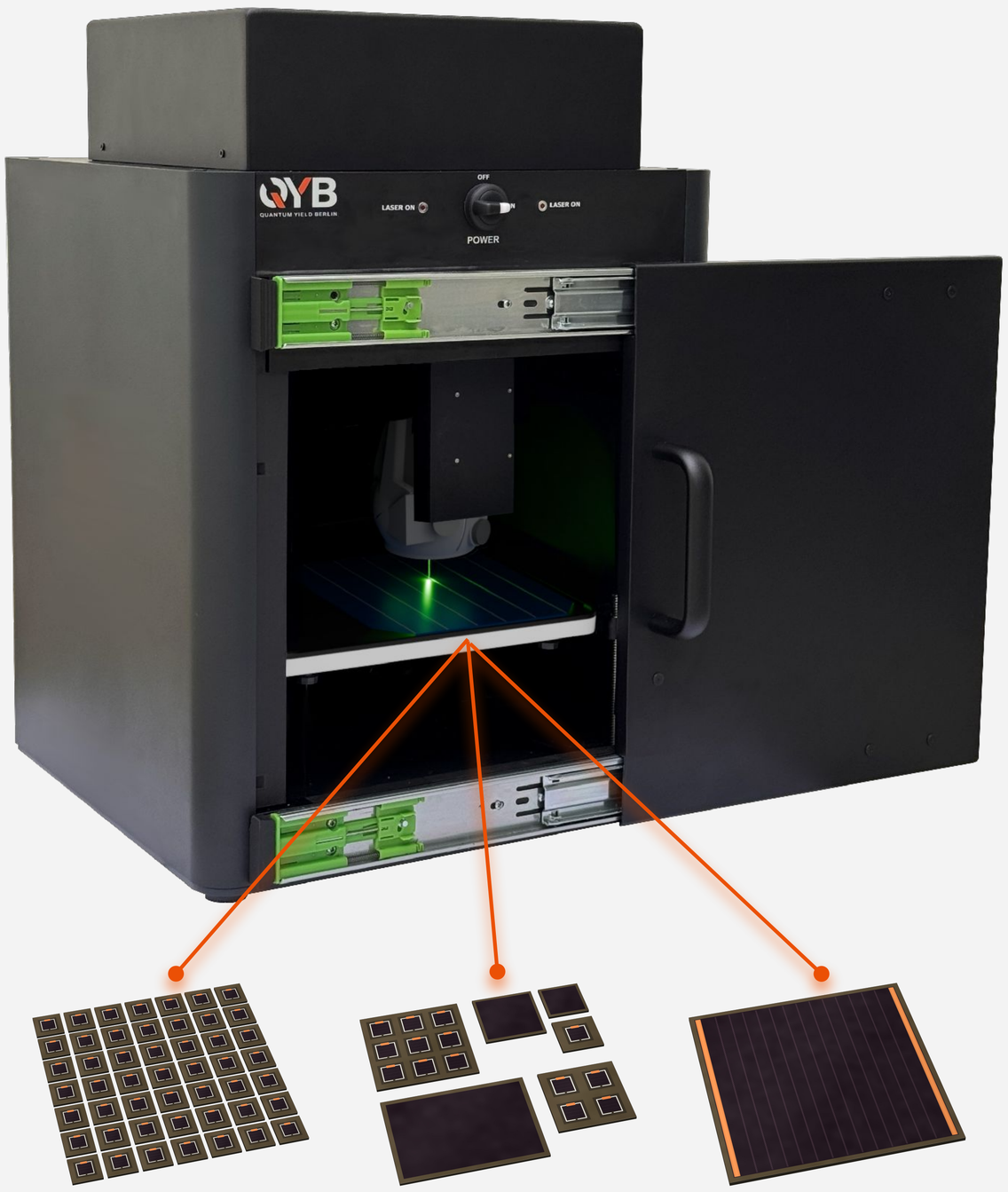
Compact design. Absolute results.

OVERVIEW

Quantitative luminescence on full wafers and large-area devices

The LuQY Scanner combines PL imaging with automated spatial scans of absolute PL and EL up to large-area G12 wafer sizes (21 × 21 cm). The software rapidly evaluates and transforms measurements into quantitative heatmaps of spectrally derived-parameters.

SUITED TO Thin films · Layer stacks · Solar cells & modules · LEDs & optoelectronic devices



What you measure

- Full-area PL images of multiple small or large area samples (scannable area 21 x 21 cm)
- Spatially resolved absolute PL spectra, captured at select points with an automated X/Y/Z measurement head, or across measurements regions that are rasterized from the PL image
- Save and reuse recipes of measurement coordinates/parameters for future measurement cycles

One system, multiple capabilities

- Quantify PLQY and QFLS or implied open-circuit voltage (iVoc) at defined positions or across your entire sample
- Generate heatmaps of the above plus voltage losses, peak emission energy and other derived parameters of choice

21 × 21 cm
Scannable (max sample area), up to G12 wafers

10^{-3} – 20 suns
Motorised & tunable laser excitation intensity

~ ms
Analysis time per measurement point

> 10^{-6}
Minimum resolvable PLQY/ELQY

Your sample should be the complicated part. Not the measurement.

HOW IT WORKS

From a full-area PL image to quantitative PL-derived sample insights

An automated routine that reduces manual steps, and improves reproducibility for both probing absolute PL/EL and rapid calculation of device metrics with spatial resolution

1 Image the full sample

After automatic height calibration, a full-area PL image is recorded at the start.

2 Choose where to measure

Define measurement points, regions or grids directly on the recorded PL image.

3 Take a coffee break

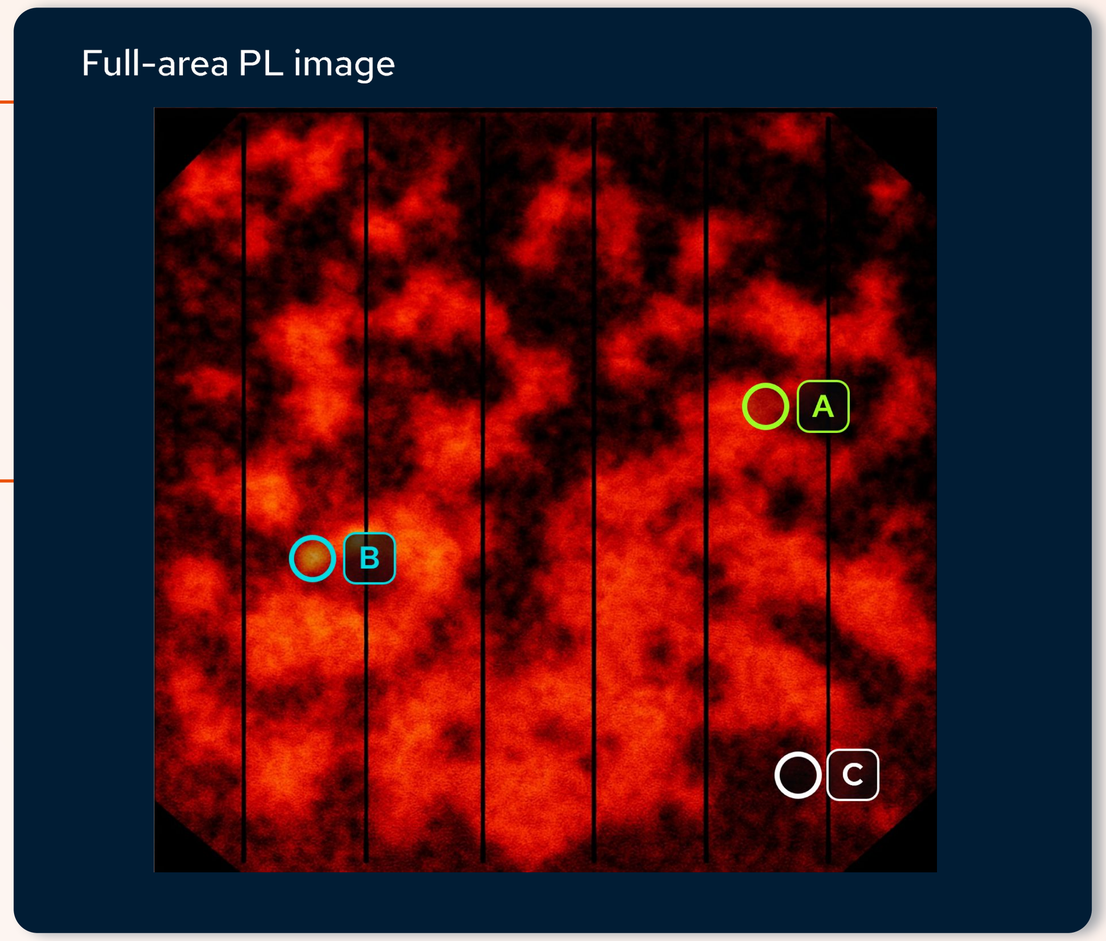
The motorized measurement head moves to the sample plane at each selected position, exciting the sample with a controlled laser and recording the calibrated response (up to 1600 nm) for analysis by the software

* *Single measurements take milliseconds to seconds; total mapping time depends on grid size, integration time and routine.*

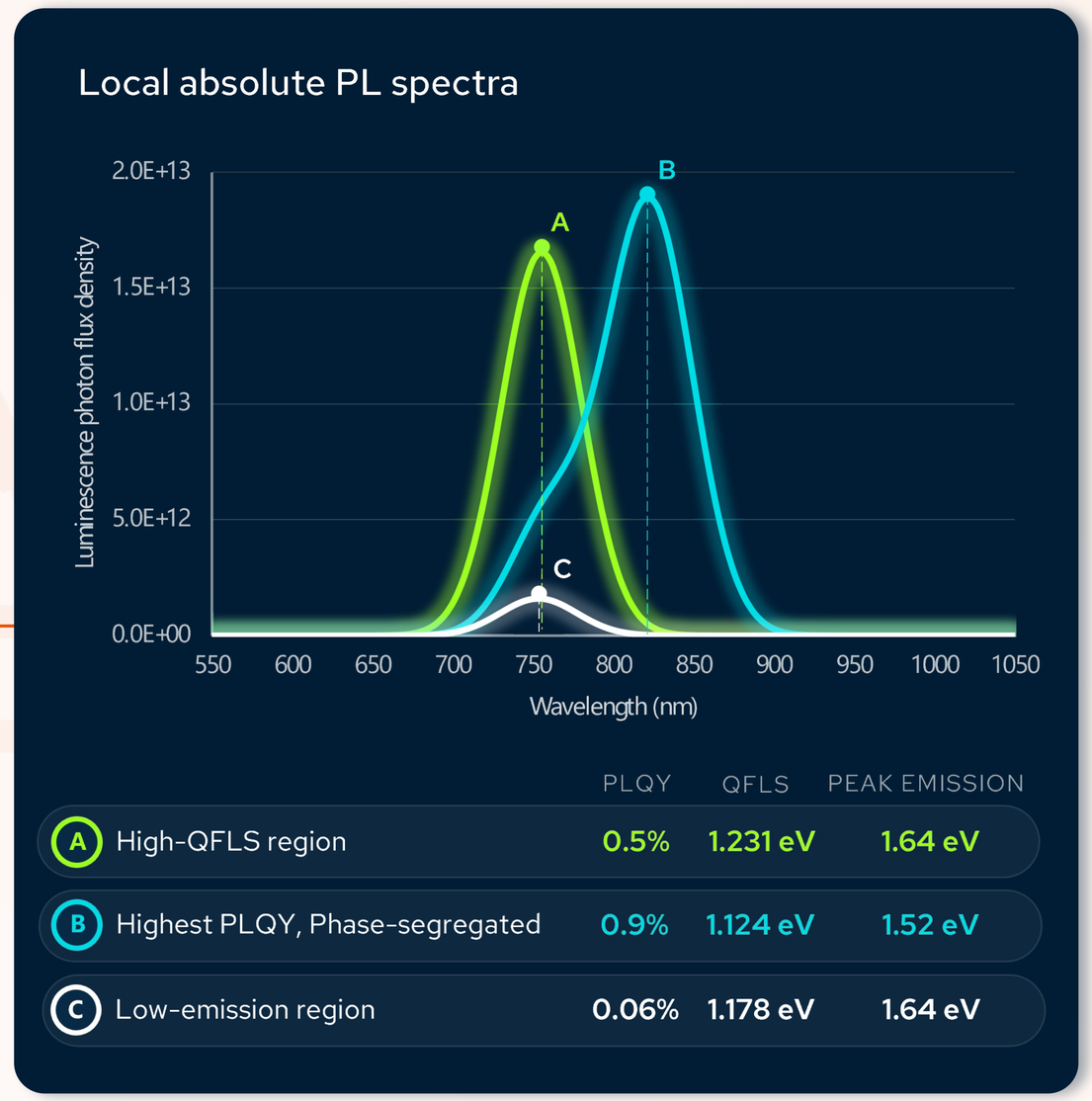
4 View automated spatial absolute PL/EL, with complete analysis & maps

(LuQY Control)

The LuQY Control software handles positioning, acquisition, calculation of PL-derived metrics, and map generation.



Steps 1–2: full-area PL image with select measurement points



Step 4: absolute PL spectra with PL-derived metrics per point

Uniformity analysis
Resolve inhomogeneities across the full area

Process development
Compare recipes and fabrication steps

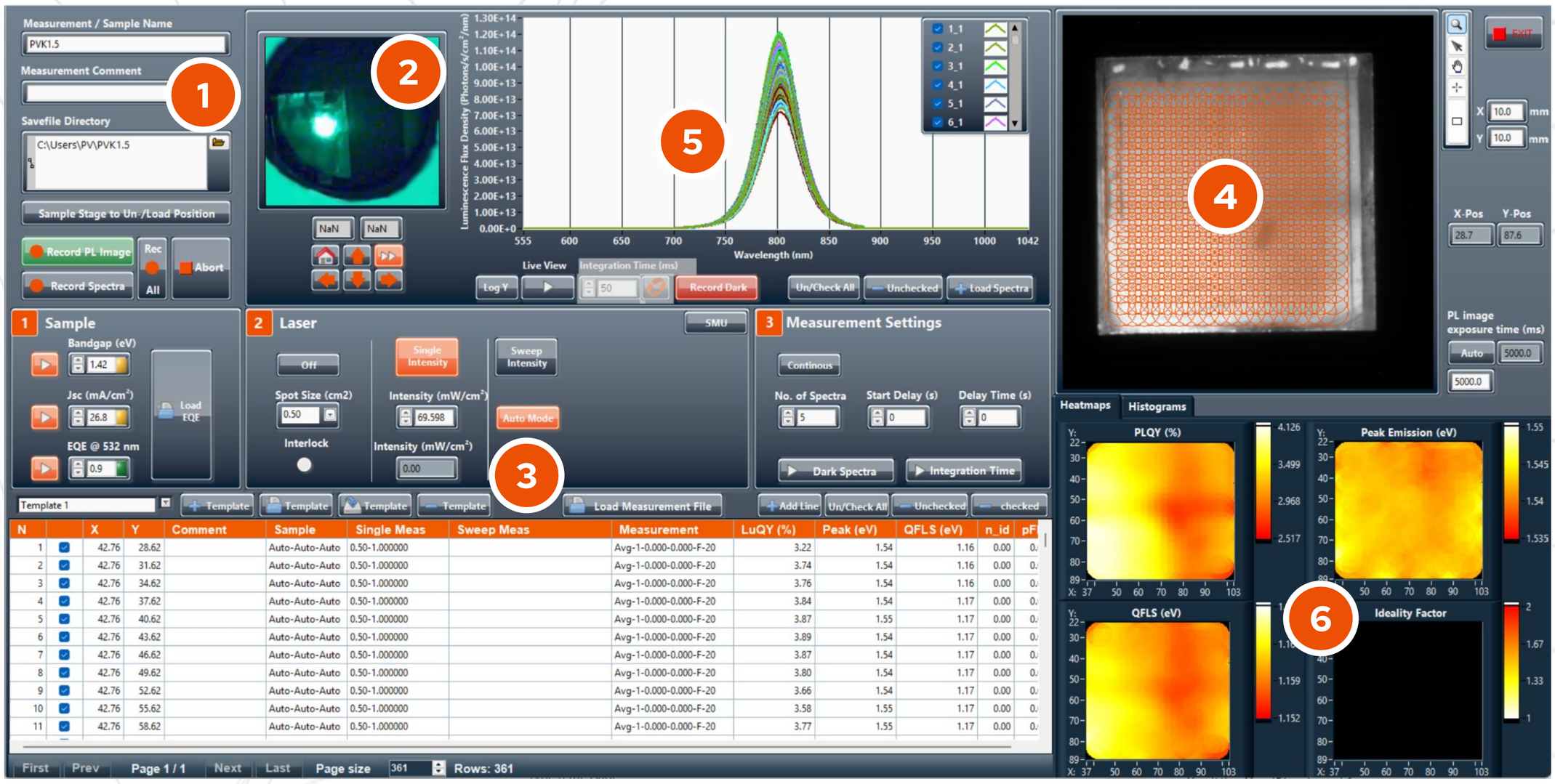
Device comparison
Rank cells and modules on the same scale

SOFTWARE | LUQY CONTROL

Interactive control for reusable routines: See it. Click it. Measure it.

FROM LIVE CAMERA VIEW, TO INTERACTIVE PL IMAGE, TO QUANTITATIVE HEATMAPS

LuQY Control gives you interactive control of your measurement in one window with no scripting and no switching between programs. Save your measurement/scan settings as templates and reuse them across samples, users and projects, so new routines build on existing ones instead of starting from scratch.



1 File name and directory

Name the measurement, add a comment and the set the save folder.

2 Live camera view

Watch the sample in real time during measurement. Or use it to inform your measurement settings

3 Guided settings

Load pre-defined measurement recipes. Or enter sample properties and excitation/measurement preferences that will be assigned to the measurement points or regions selected in step (4).

4 Interactive point/grid selection

Select single measurement points or draw regions on the full area PL image for automatic coordinate retrieval. Configure different measurement settings for each scanning point, if desired. It gets saved to the measurement queue.

5 Live spectra

Watch the absolute PL spectrum as you adjust settings; record darks and compare stored spectra.

6 Dynamic heatmaps & histograms

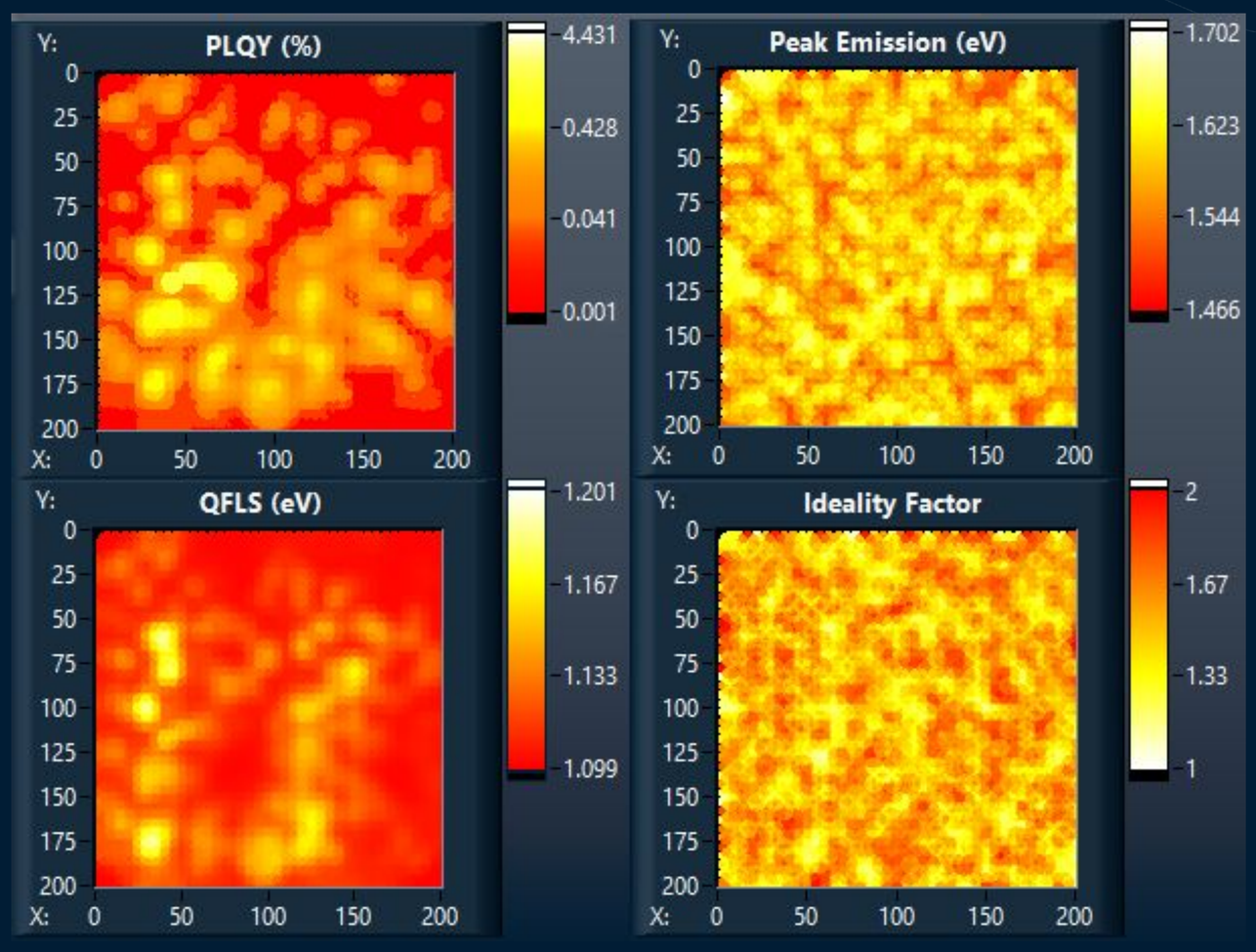
PLQY, QFLS, peak emission and more at each point are instantly calculated from the absolute spectra and mapped to their coordinates.

Save and reuse different scanning patterns & measurement settings per coordinate

SPATIAL DATA ANALYSIS

Quantitative heatmaps, not just fluorescence images

Rasterized measurements of absolute PL become heatmaps and statistical distributions of the quantities relevant for your device. Choose what matters to you.



+ **PLQY and ELQY**
  Spot-to-spot radiative efficiency
+ **QFLS / iV_{oc}**
  Spatial-dependence of potential losses
+ **Peak emission energy**
  Composition and bandgap shifts
+ **Ideality factor & pseudo-FF**
  From intensity-dependent sweeps
+ **Non-radiative voltage losses**

FROM MEASUREMENT TO DATA

Results that slot into your data workflow

Ready-to-use data files

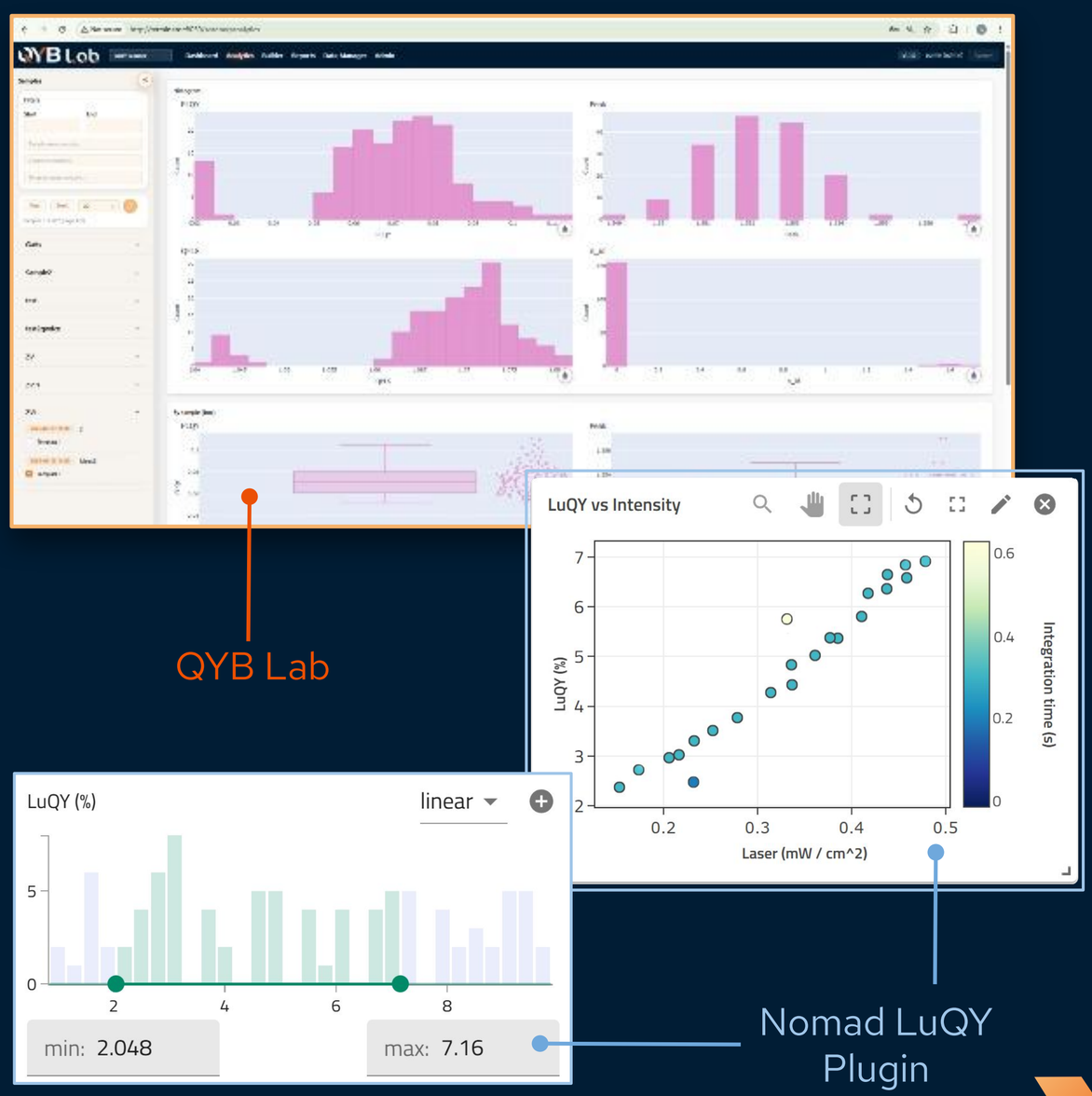
Export results as plaintext files for analysis, archiving or sharing.

Database integration

MySQL · PostgreSQL ·
Microsoft SQL Server · SQLite

Data management & analysis platforms

Connect to QYB Lab, our analysis workspace, or to NOMAD Oasis.



APPLICATIONS

What researchers use it for

From quick checks after each fabrication step to detailed loss analysis, on perovskites, thin-film semiconductors, solar cells and LEDs.

PROCESS CONTROL

Quality assessment

Rapdi checks of process control on large area samples or accelerated screening of many samples.

FAST ACQUISITION

Transient effects

Track shifts in emission spectrum, intensity, PLQY and QFLS from 10 ms to several hours.

RECOMBINATION ANALYSIS

Bulk vs. interface losses

Quantify spatial variation in bulk and interface recombination in films, layer stacks, solar cells and LEDs.

LOSS ANALYSIS

Efficiency potentials

Determine voltage losses, and ideality factors and pseudo-JV curves from intensity-dependent PLQY and iV_{OC}.

OPTIONAL EXTENSION

SMU integration for electroluminescence

Adds controlled electrical excitation, with dedicated sample holders and customizable contacts.

- Controlled current or voltage excitation
- EL imaging and absolute EL spectra
- Spatial scanning of ELQY and QFLS → spatial dependence of non-radiative losses
- Electrical measurement workflows

Analysis and application scope based on scientifically established approaches

1. Al-Ashouri et al., *Energy Environ. Sci.* 12, 3356–3369 (2019)
2. Stolterfoht et al., *Energy Environ. Sci.* 12, 2778–2788 (2019)
3. Caprioglio et al., *Adv. Energy Mater.* 9, 33 (2019)
4. Stolterfoht et al., *Adv. Mater.* (2020), doi:10.1002/adma.202000080
5. Kirchartz et al., *Adv. Energy Mater.* (2020), 1904134
6. Unold et al., in *Advanced Characterization Techniques for Thin Film Solar Cells*, Wiley (2011)

SEE FULL LIST OF RELEVANT REFERENCES *HERE*

TRUST AND VERIFICATION

Reliable results, built on verified performance

Factory calibrated

Integrating sphere and spectrometer are calibrated together as one unit, against a NIST-traceable reference source.

Verified before delivery

Every system is individually tested and commissioned by QYB before it ships.

Research-based methods

Analysis built on established methods from peer-reviewed literature, many co-authored by the QYB team.

Compliant by design

EU conformity · EMC · electrical safety · laser safety. Class 3 laser product in normal closed operation.

TECHNICAL SPECIFICATIONS *

LuQY measurement unit

Spectral detection range	550 – 1050 nm (customisable)
Min. resolvable luminescence quantum yield	10^{-6} (0.0001%)
Spectrometer integration time	1 ms – 35 min
Signal-to-noise ratio	600 : 1
Acquisition modes	Continuous or averaged spectral acquisition
Photoexcitation wavelength	532 nm (customisable)
Photoexcitation intensity, equivalent current (EQE = 1)	3.5 µA – 100 mA (~0.001–20 suns)
Spot sizes (switchable in software)	configurable from 0.1 cm² to 1.3 cm²
Max. sample size (L × W × H)	210 × 210 × 50 mm **

PL imaging

Imaging mode	Raw PL; EL with optional SMU and contacting stage
Camera resolution	3552 × 3552
Spatial resolution	150 µm per pixel
LED array wavelength	520 nm
LED array intensity	22 W (~0.1 suns)

General

Connectors	1× 24 V DC power plug, 1× USB 3.0
Unit dimension (L × W × H)	~400 × 400 × 600 mm

Laser safety

Internal laser source	Class 3B
Safety system	Interlocked sample door, monitored enclosure panels

Calibration

Excitation calibration	Against certified reference solar cells
Spectral calibration	Against NIST-traceable reference source
Recommended re-calibration period	1 year

*Specifications subject to change.

**Larger sample and custom configurations on request.

LuQY Scanner

THIS BROCHURE

Full-area PL imaging and local absolute spectroscopy over 210 × 210 mm sample sizes.



NEXT STEP

Discuss your application

Send us your samples and questions.

We'll help you find the right configuration and can arrange a demo measurement.

ABOUT QYB

Quantum Yield Berlin was founded in 2021 as a spin-off of Helmholtz-Zentrum Berlin. Our team brings together optical spectroscopy, semiconductor research, electronics and automation to build compact instruments that make rapid, absolute measurements and analysis simple and accessible.

THE LUQY FAMILY

Explore our product portfolio

Solutions from lab to fab

One measurement principle

Every LuQY system is built around calibrated, rapid, easy-to-use, and absolute luminescence measurement.

Integrated by design

Each product is an integrated system that combines, in one tool, calibrated hardware and instant analysis based on established scientific methods.

A system for every stage of R&D

- Compact benchtop systems
- Absolute luminescence imaging & mapping
- Automated, high-throughput platforms
- In-line characterization, and more....

Applications

Photovoltaics, LEDs, materials research, automated laboratories and beyond.

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