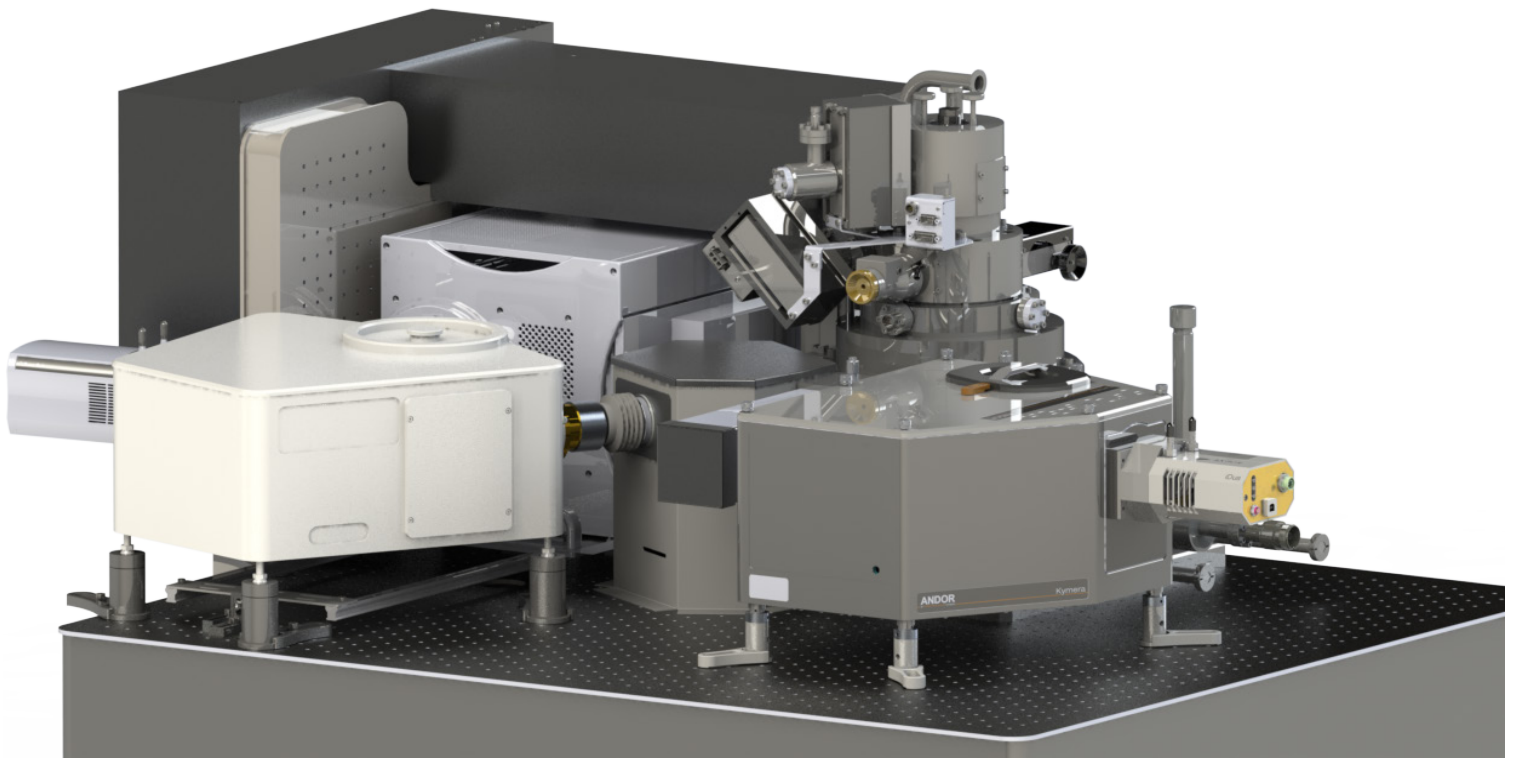


# ALLALIN

## *Hybridized SEM-Spectroscopic platform*

SEM - Cathodoluminescence - Photoluminescence - Pump&Probe - Electrical measurements

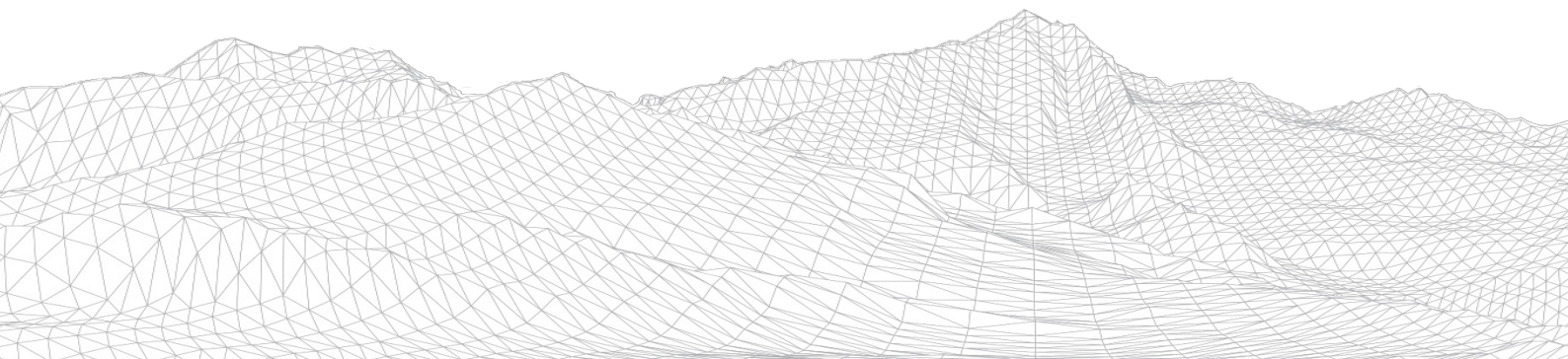


Access to composition, structural, defect information of your samples.

Adaptable spectroscopic, optical, electronic analysis platform.

Nanometric spatial and picosecond temporal resolutions.

Static and dynamic analysis modes.



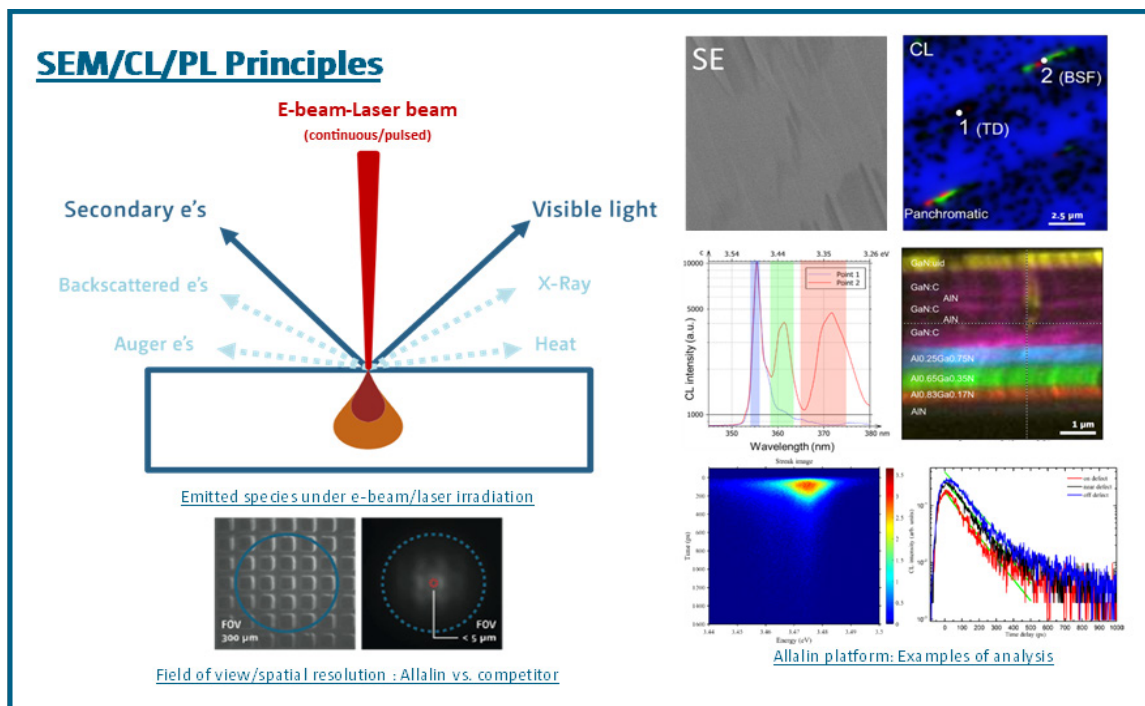
The Allain platform is a versatile and flexible spectroscopic equipment gathering on the same platform:

- A **unique spectro-optical base** including an electronic source and an innovative high-collection optical objective;
- The ability to perform **SEM, Cathodoluminescence, Photoluminescence, Pump and Probe, EBIC/EBAC/RCL...** analyses in static and in dynamic modes.
- The possibility to choose amongst **multiple sources, detectors, stage options...** to match your analytical needs;

The base system was constructed from the ground up to obtain the best luminescence collection efficiency without sacrificing the SEM performance.

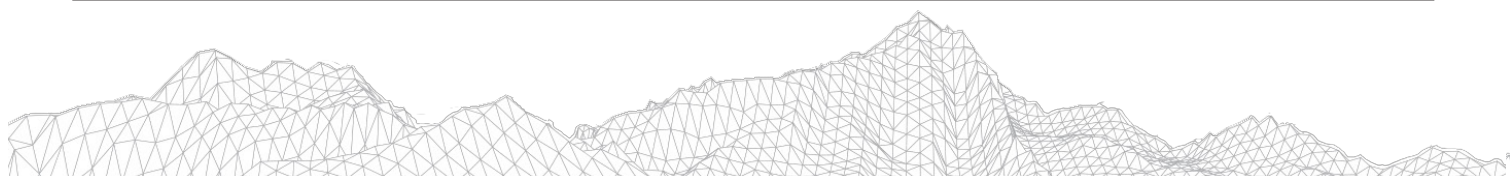
- The light microscope and the SEM objective lens are carefully integrated so that their focal planes match each other;
- An achromatic, high numerical aperture detection (NA=0.71) enables superior photon collection efficiency over a large field of view (up to 300  $\mu\text{m}$ ).

The Allain platform allows for 'No compromise'  
Large field/fast scanning simultaneous SEM imaging with hyperspectral or panchromatic map.



## Topics:

- Electronics & Optoelectronics (GaN, InP, SiC...)
- Photovoltaic cells (GaAs, CdTe, Perovskites...)
- Light emitting diodes (LEDs)
- 2D materials (Graphene, BN, WS<sub>2</sub>...)
- Noble metals (plasmonic)
- Nano-micro particles
- Nano-micro wires/rods
- Photonic crystals
- Quantum wells & quantum dots
- Minerals, glasses, ceramics and gemstones
- Inorganic coatings
- Polymers layers
- Organic materials
- Biological samples, cells, vesicles...



## Main applications:

### Electronics and Optoelectronics

- Strain/dislocation/defect detection and mapping
- Local electronic band gap measurement
- Quantum wells and dots analysis
- Doping distribution/mapping
- Core-shell structure analysis

### Geosciences

- Trace element and geochemical effect detection
- Composition, growth, minerals origin determination
- Internal structure analysis

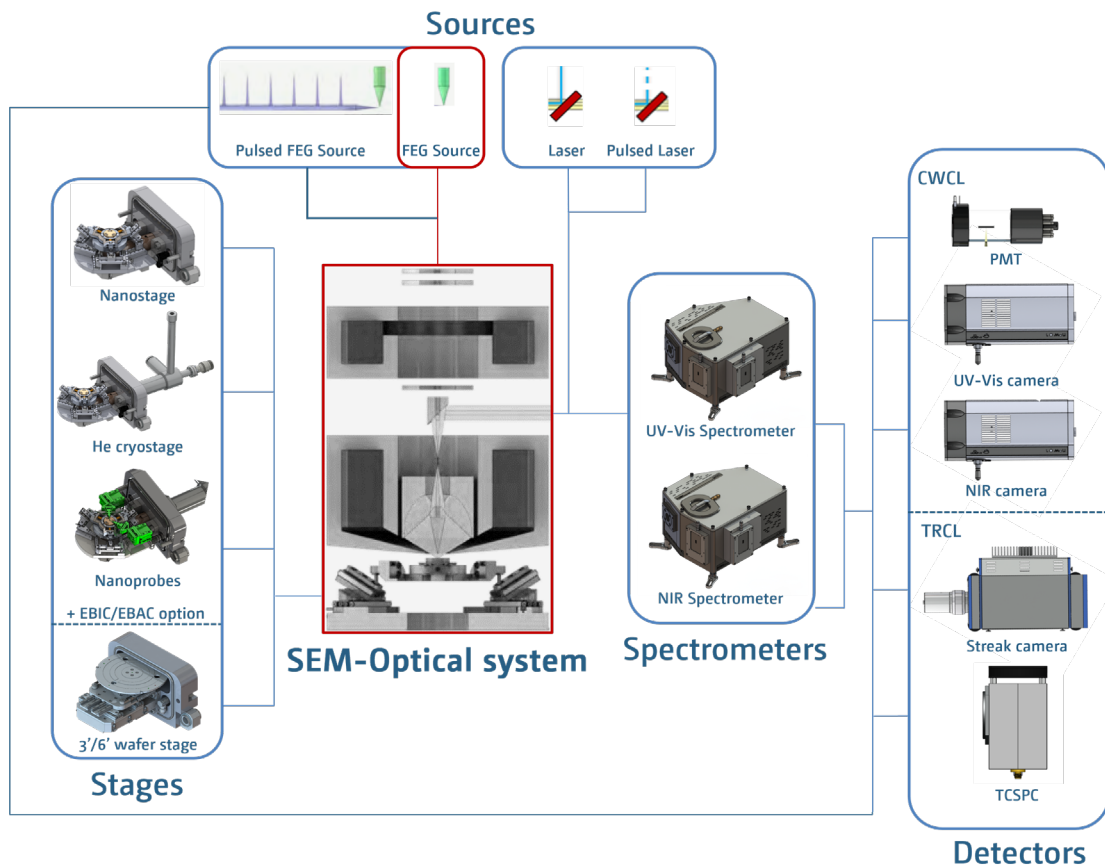
### Material Science

- Micro/nano-wires, fiber, particles spectral mapping
- Micro/nanostructure spectral analysis
- Surface plasmon resonance mode analysis
- Molecule distribution mapping and composition
- Crystal growth localisation, crystallinity analysis

### Biology: Pharmaceuticals & Nanomedicine

- Cell, bacteria, ECM, DNA... imaging and spectral analysis
- Biological structures mapping and composition
- Functionalized vesicles/nanocarrier analysis

## System overview



## Allalin: a performant and flexible platform

- Zero optical alignment
- Highest collection efficiency
- Uniformity and reproducibility
- Large field of view
- Simultaneous SEM CL image/mapping
- High lateral resolution
- Sample nanopositioning
- Low beam dosage
- Applicable to sensitive samples
- Large choice of source, detectors, stages
- Fast hyperspectral map measurement time
- Nanoprobes option
- Scripting functionality to automate measurements



## Specifications

### Base:

#### Spectro-optical chamber with electron gun

- High-vacuum stainless steel chamber (10<sup>-7</sup>mbar)
- Schottky thermal field emission gun
  - Beam energy: 2 keV–10 keV
  - Electron probe current: 30 pA to 100 nA
  - Electron spotsize: down to 3 nm (@10 kV)
- Achromatic reflective objective
  - Optical range: 180 nm to 1.7 μm
  - Numerical aperture: NA 0.71 (f/0.5)
  - Field of view: up to 300 μm-diameter
- Nano-positioning stage
  - 6 degrees of freedom: x; y; z; θx, θy, θz,
  - 25 mm (x,y), 3 mm (z), 3° tilt (x,y), 10° rotation (z)
  - Smallest increment: 1 nm
  - Sample size: 50mm diameter, 1.5 mm thickness
- Touch screen workstation

#### Source for Time-Resolved CL analyses

- Pulsed e-beam (Laser 80MHz; pulse length: <10ps)
- Time range between pulses: 12.5ns - 1μs
- Automated switch from continuous to pulsed emission mode

#### Sources for (TR)Photoluminescence/Raman... analyses

- Large range of continuous/pulsed lasers (on request)

#### Spectrometers

- Dispersive spectrometer
  - Up to 2 spectrometers/4 imaging exits per platform
  - Turret with up to 4 gratings
  - 2 imaging exits per spectrometer
  - Large choice of gratings over 200-1700nm

#### Detectors

##### Continuous mode (CW)

- High speed UV-Visible CCD camera (200 nm–1100 nm)
- InGaAs near infrared detector (900 nm–1700/2200 nm)
- Panchromatic detection (PMT; 200 nm–900 nm)

##### Time-Resolved mode (TR)

- Streak camera : multichannel time-resolved detector (200-850nm; 2ps)
- Time-Correlated Single Photon Counting (220-850nm; 900-1700nm; 20ps)

Other detectors on request

#### Stages

- Nanostage/Cryostage
  - Stage for sample up to 1'inch diam
  - Precision: 1nm; Repeatability : <100nm over 1'inch
  - Temp. range from 10 K to room temp. (0.1 K precision)
  - Less than 300nm drift per hour at 10 K
- Wafer stage
  - Stage for wafer up to 150mm-diameter

#### Nanoprobes

- Up to 4 nanoprobes for nanomanipulation, electrical contacting...
- Voltage/current: Up to +/-210V/100mA
- Max lift force: > 1.5N
- Compatibility with EBIC/EBAC and cryostage

#### Other options

- Electron beam induced/absorbed current (EBIC/EBAC)
  - Measurement limit of 100 fA
  - Gain 10<sup>4</sup> to 10<sup>15</sup> V/A, bandwidth up to 100 kHz

#### Post-Treatment data analysis

- Dedicated software for images, spectral, hyperspectral analyses

## Build up your own system or choose amongst dedicated versions:

Allalin Version	Allalin-CL	Allalin-TRCL	Allalin-TR CL/PL
Source	E-beam (Continuous)	E-beam (Continuous-Pulsed)	E-beam (Continuous-Pulsed)/ Laser (Continuous-Pulsed)
Range of detectors (up to 4 per system)	PMT, UV-Visible (EM)CCD camera, InGaAs detector	PMT, UV-Visible (EM)CCD camera, In- GaAs detector, TCSPC, Streak camera	PMT, UV-Visible (EM)CCD camera, InGaAs de- tector, TCSPC, Streak camera
Cryostage (10K) option	✓	✓	✓
Nanoprobes option	✓	✓	✓
EBIC/EBAC/RCI option	✓	✓	✓
Applications	Strain/dislocation/defect detection and mapping, local electronic gap measurement, doping distribution...	train/dislocation/defect detection and mapping, local electronic gap measurement, doping distribution, charge carrier dynamics, Energy transfer, Ultrafast spectroscopy, local carrier lifetime...	

### About Attolight AG:

Attolight AG started off to revolutionise cathodoluminescence (CL) by designing top of the line CL instruments that deliver superior performance, maximum ease-of-use and make quantitative cathodoluminescence. The Company firmly believes in the potential of cathodoluminescence and aims at establishing the technology as a standard in-line inspection method in the semiconductor industry.

Attolight AG is a company with global presence with systems in Europe, Asia, and North America. The Company is headquartered at the EPFL Innovation Park where the Attolab is located as well.

