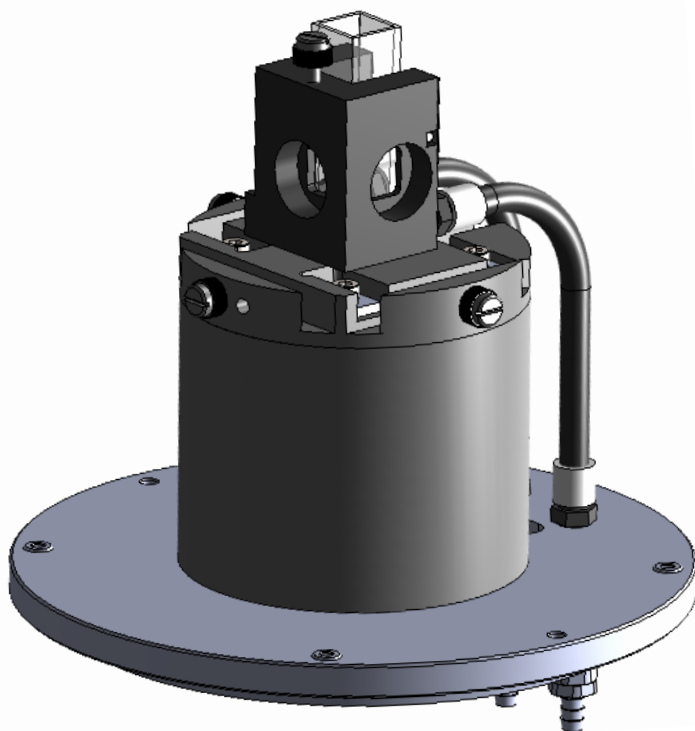
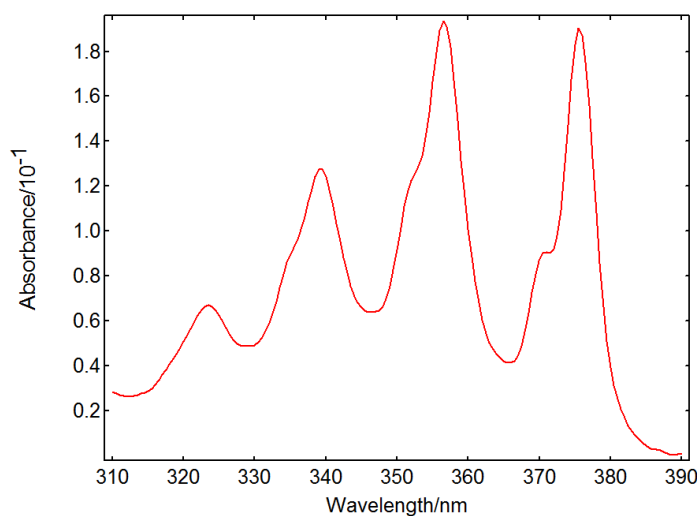
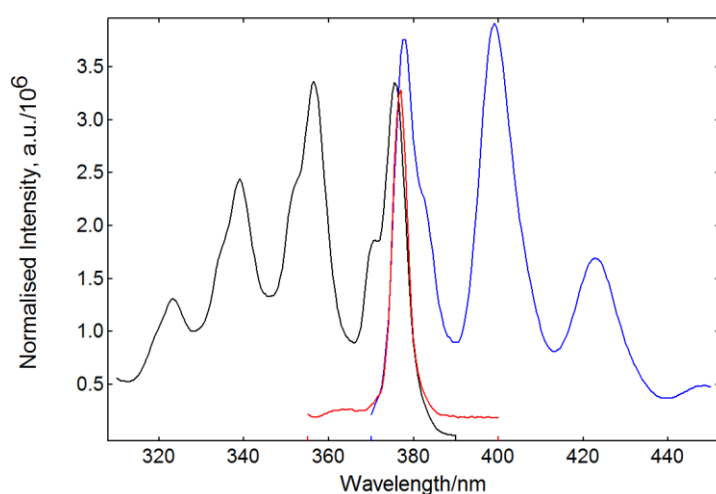


## N-J01 Standard Cuvette Holder



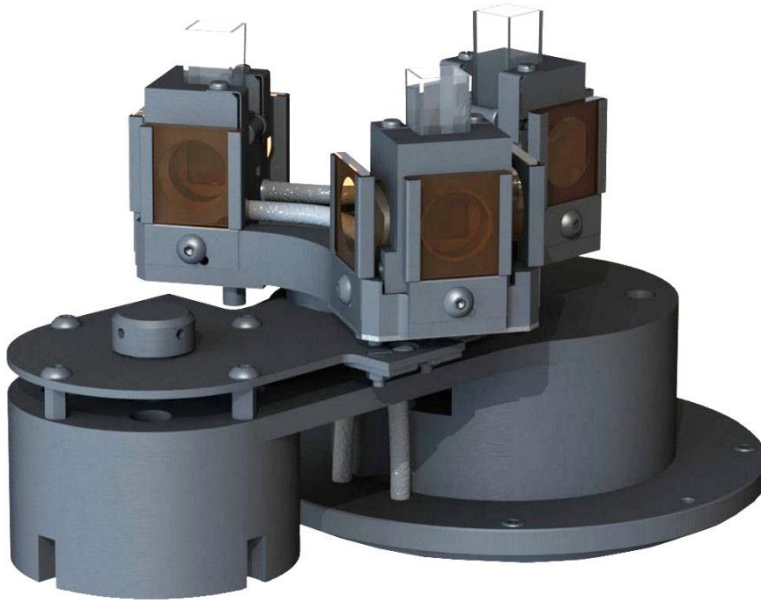
- Standard sample holder for liquid samples in 10 mm path length cuvettes. Z height (distance from base to beam) is 15 mm.
- Enables photoluminescence and transmission (if detector present) measurements of liquid samples
- Includes slots for 50 mm x 50 mm filters
- Temperature adjusted by water/coolant circulation (external bath required). Operating temperature from +5°C to +80°C
- Temperature sensor monitored by the software with a resolution of 0.1°C

## Measurement Examples



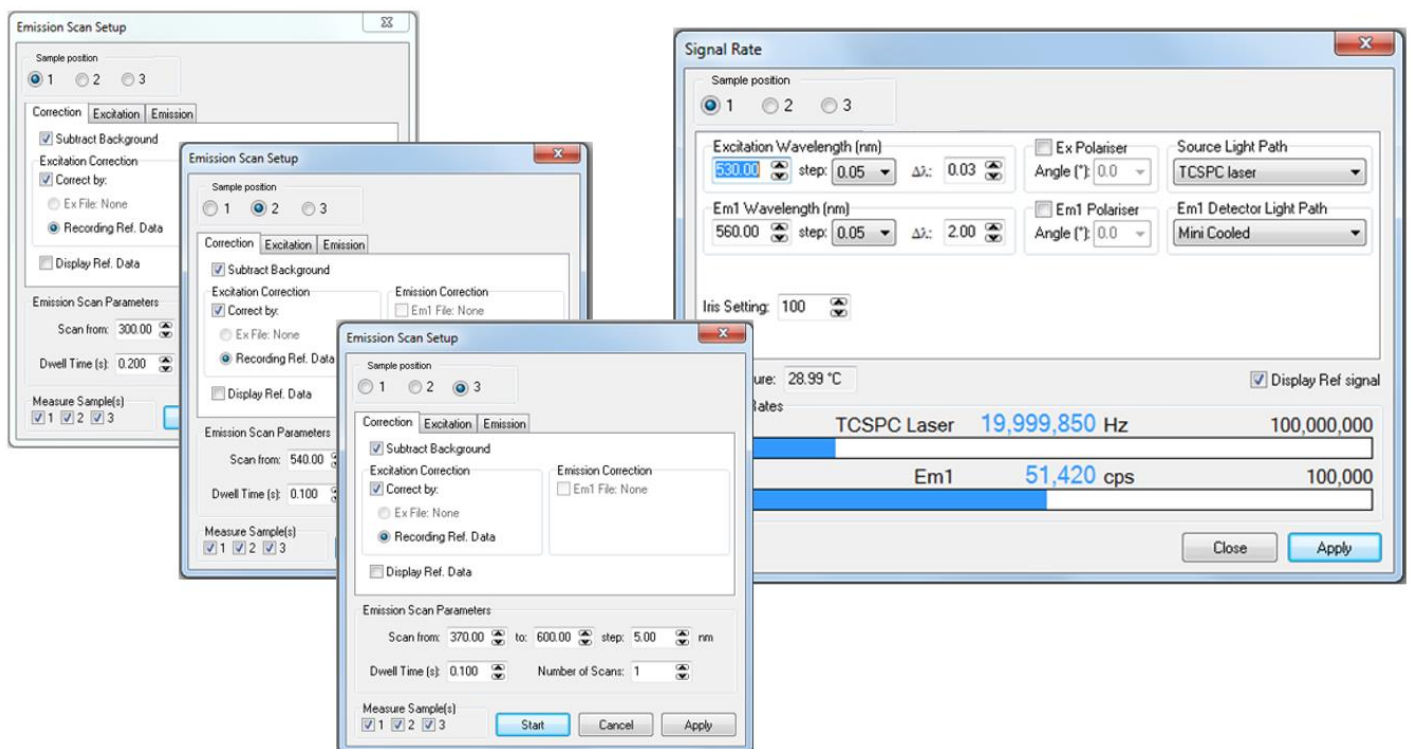
**Left:** Excitation (black), synchronous (red) and emission (blue) photoluminescence spectra of anthracene in cyclohexane. **Right:** Absorption spectrum of anthracene in cyclohexane acquired with the transmission detector accessory.

## N-J02 Three-Position Sample Turret

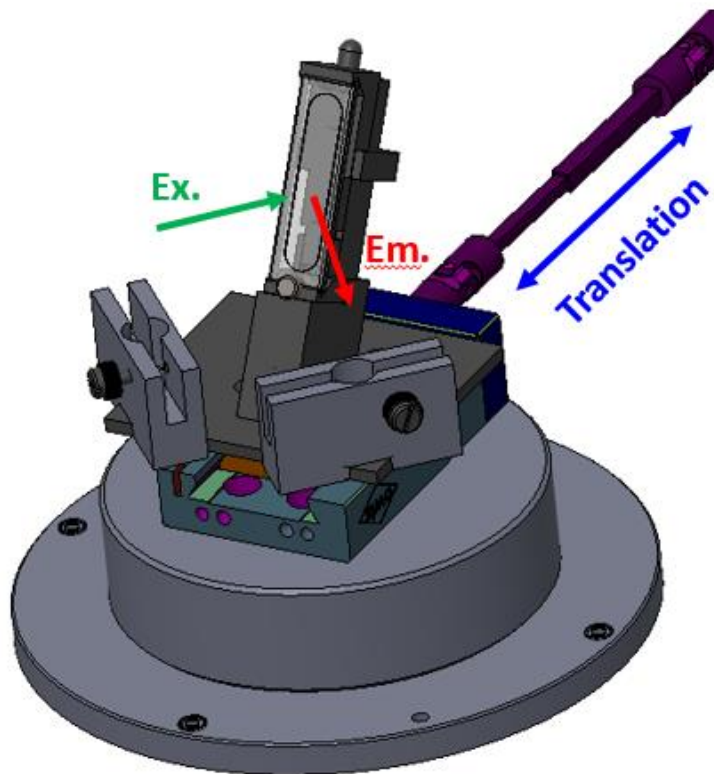


- Three cuvette positions fully controlled by the software. Cuvette path length = 10 mm, Z height = 17 mm
- One common circuit for heating/cooling fluid (external bath required), +5°C to +80°C
- Three 25 mm x 25 mm filter positions and magnetic stirrer available for each cuvette
- One cuvette position equipped with software-read temperature sensor
- Suitable for L- and T-geometry systems (X-geometry requires collimated laser excitation)

Independent Setup of spectral scans / lifetime measurement parameters for each sample in the turret



## N-J03 Front-Face Sample Holder



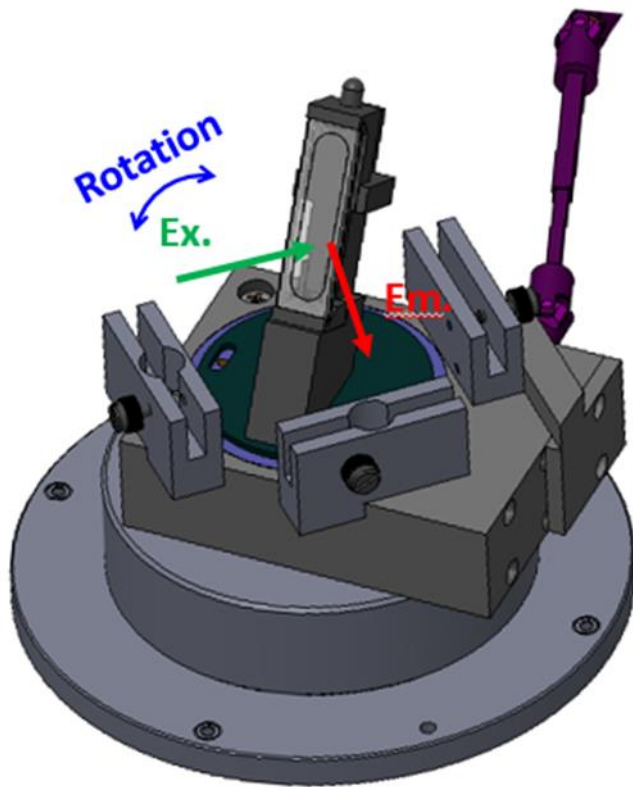
- Holder for front-face measurements of solids or cuvettes with highly absorbing liquids
- Mounted on linear slide enabling position control from outside the sample chamber while monitoring the signal
- Can be used in 90° or in 30° (mirror optics) geometry. Tilted sample configuration avoids direct reflection of excitation into emission channel
- Two 50 mm x 50 mm filter slots provided. An additional filter set (N-RSet) is recommended.
- Suitable for L- and T-geometry if manually rotated

Supplied with three inserts:

- N-J03lng: Spring clamp with quartz demountable cuvette for powders (35 mm x 7 mm x 1 mm)
- N-J03shrt: Spring clamp for slides with at least one dimension of 25 mm
- Adjustable screw clamp for holding small samples (max. 10 mm x 10 mm, min. 2 mm x 2 mm)

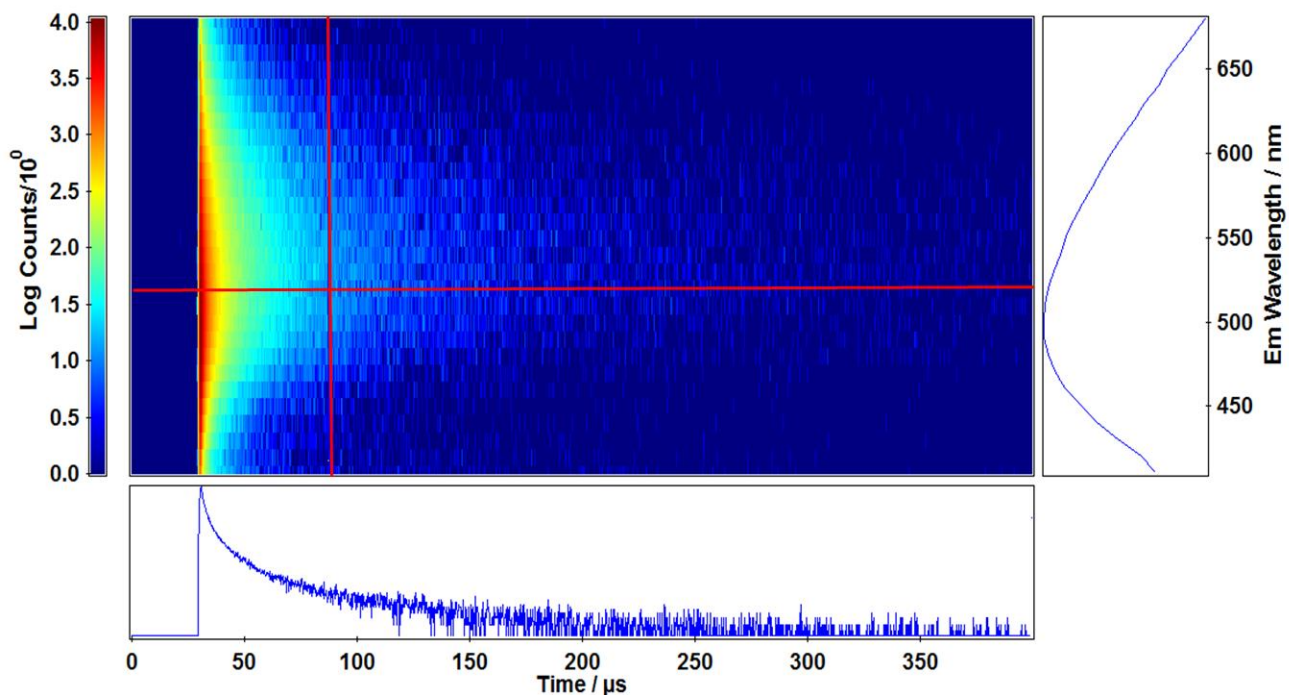


## N-J04 Front-Face Sample Holder on Rotational Stage



- Similar to N-J03 but on a rotational stage instead of a linear slide
- Rotational angle can be adjusted from outside the sample chamber with a precision of  $\pm 1^\circ$
- Angle marked on rotational stage
- Two slots for 50 mm x 50 mm filters provided. An additional filter set (N-RSet) is recommended.
- Supplied with same inserts as N-J03

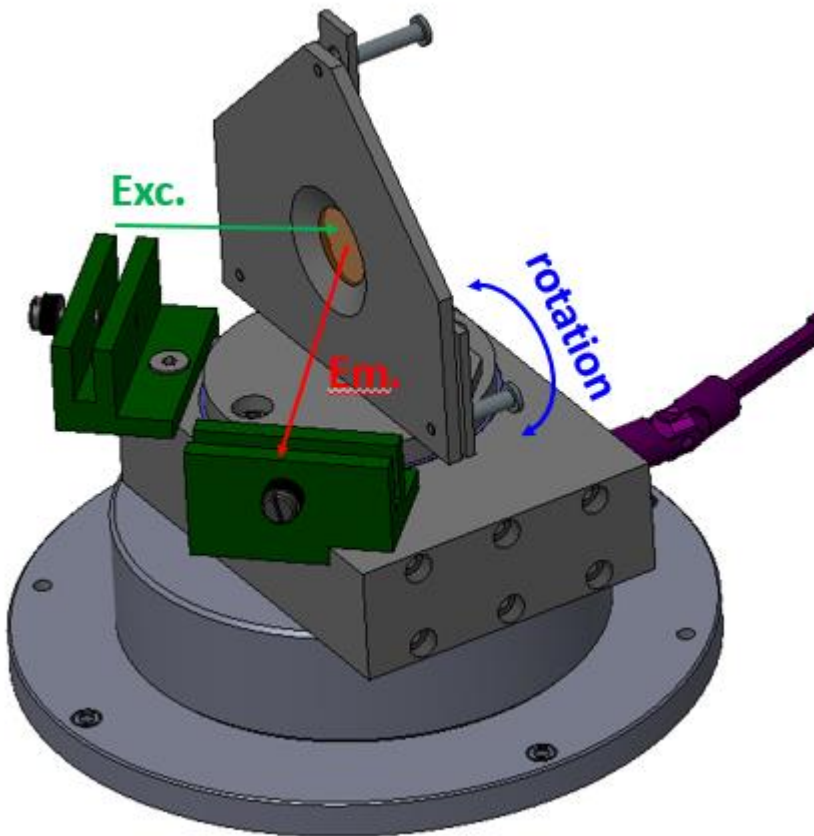
### Measurement Example



**Above:** Photoluminescence Time-Resolved Emission Spectrum of  $\text{TiO}_2$  measured in a front face sample holder using an EPL-375 for excitation. Spectral and time-resolved slices are shown in the graph.

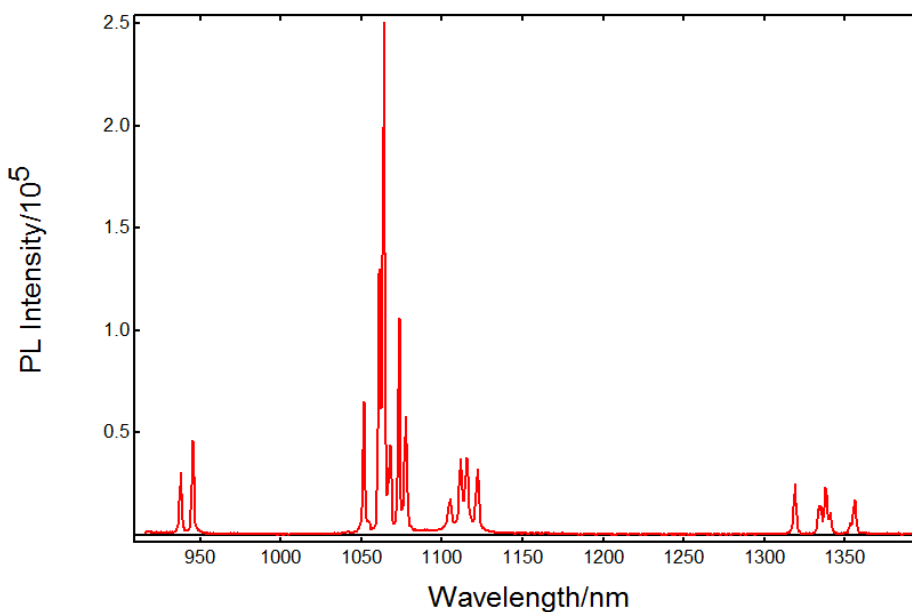


## N-J05 Front-Face Clamp on Rotational Stage



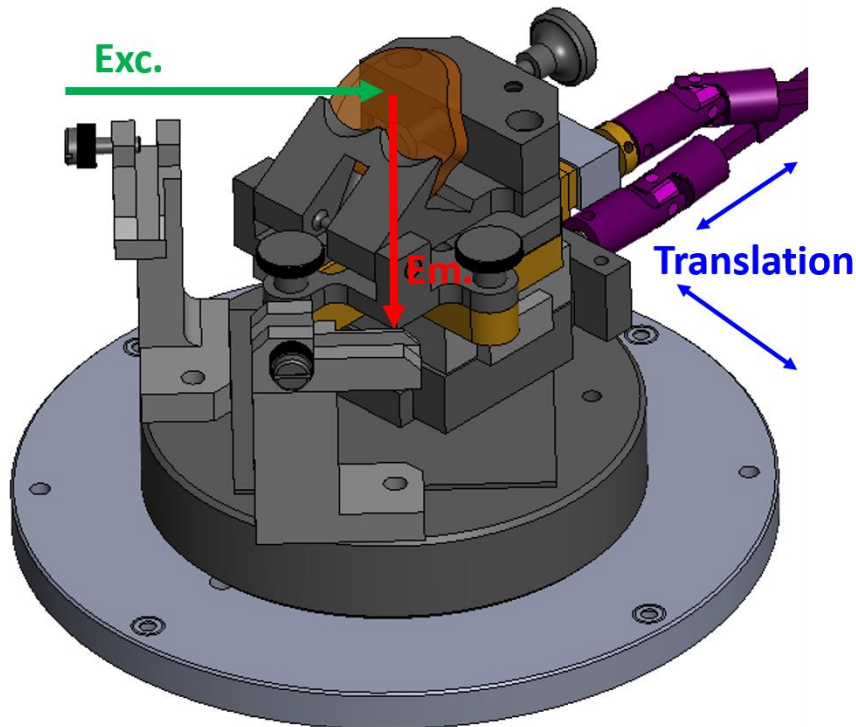
- Suitable for film and slide samples, or cuvettes with thickness  $\leq 5$  mm
- Flexible spring-loaded plate can be pulled back to load the sample between the two vertical plates
- Sample aperture of 20 mm diameter, compatible with transmission detector
- Rotational angle can be adjusted from outside the sample chamber with a precision of  $\pm 0.5^\circ$
- Two slots for 50 mm x 50 mm filters. Additional filter set (N-RSet) is recommended

### Measurement Example



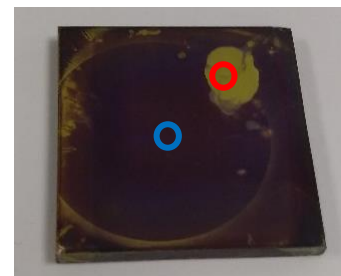
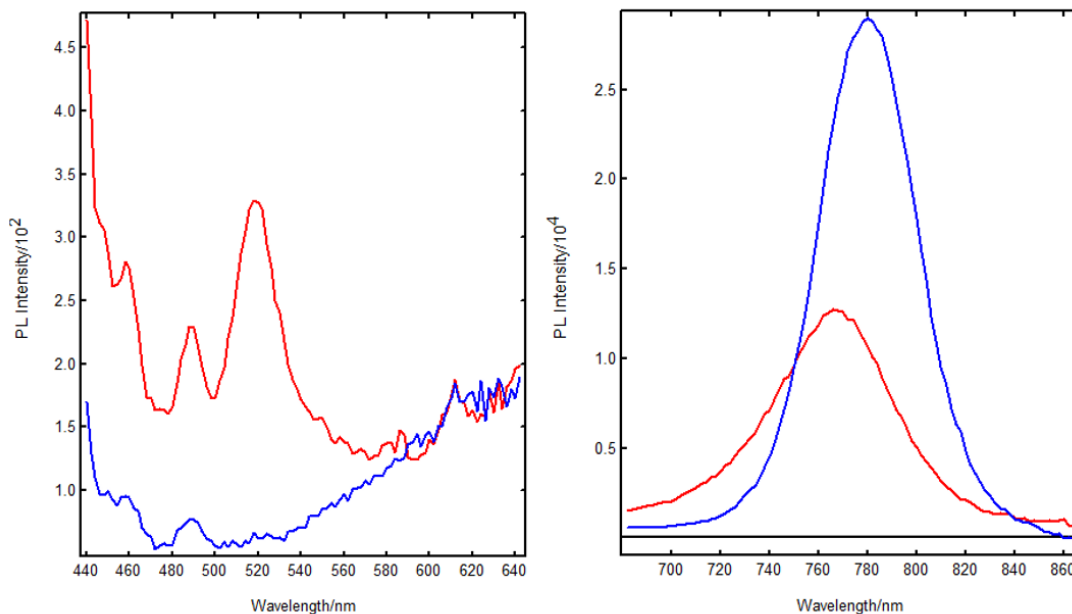
**Left:** Photoluminescence emission spectrum from a slide of Nd:YAG. Excitation at 355 nm from the standard Xe lamp and detection with a PMT-1700 detector.

## N-J06 Front Face Sample Holder on XY Stage



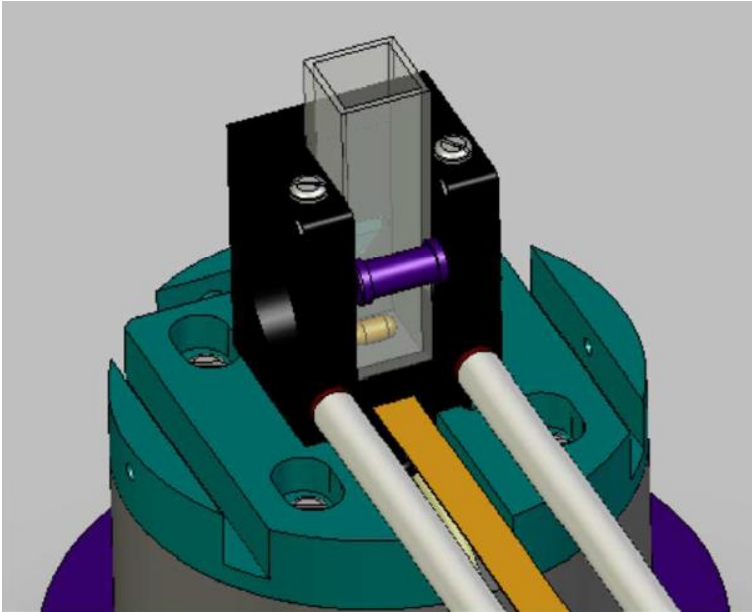
- Designed for inhomogeneous solid samples, width  $\leq 30$  mm and depth  $< 13$  mm
- XY translation control from outside the sample chamber while monitoring signal
- Sample held with a spring-loaded plunger and inclined  $30^\circ$  to avoid direct scattering of excitation into emission path
- Two slots for 50 mm x 50 mm filters. Additional filter set (N-RSet) is recommended

### Measurement Example



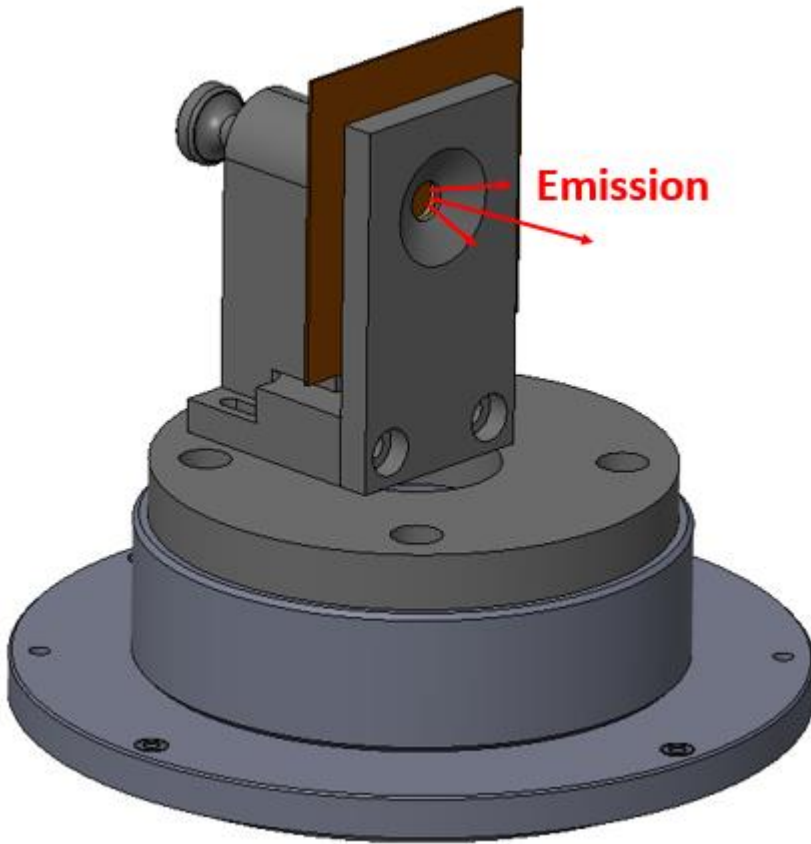
**Above:** Photoluminescence emission spectrum from perovskite acquired in the centre of the slide (blue) and in an area exposed to water (red).

## N-J07 Magnetic Stirrer



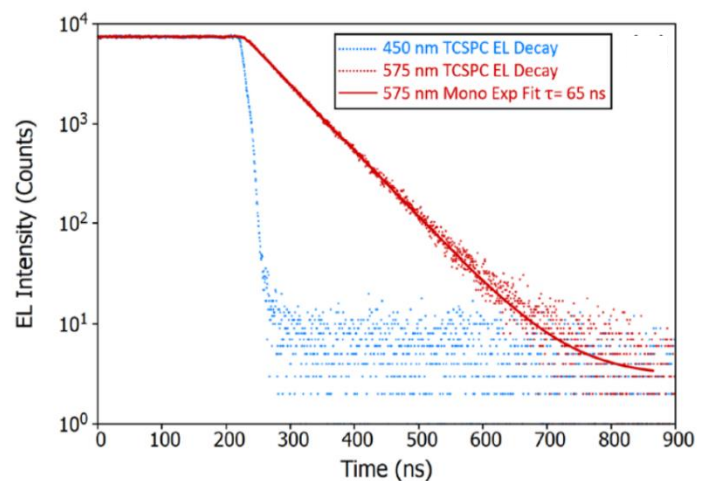
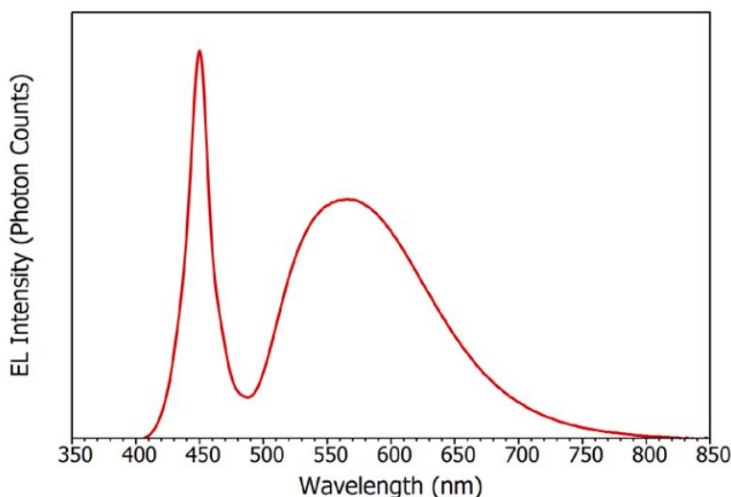
- Fits into the base of standard cuvette holder N-J01
- Stirrer head connected to an external controller through one of the feedthrough tubes in the sample chamber
- Computer-controlled operation allowing to control the stirring speed
- 10 different stirring speeds available

## N-J08 Electroluminescence Sample Clamp



- Suitable for samples with minimum dimensions 20 mm x 20 mm, maximum thickness 4.8 mm
- Sample held in place by spring-loaded plunger
- Electrical connections must be provided by the user and are fed into the sample chamber through feedthrough tubes
- A range of continuous and pulsed voltage generators are available

### Measurement Examples

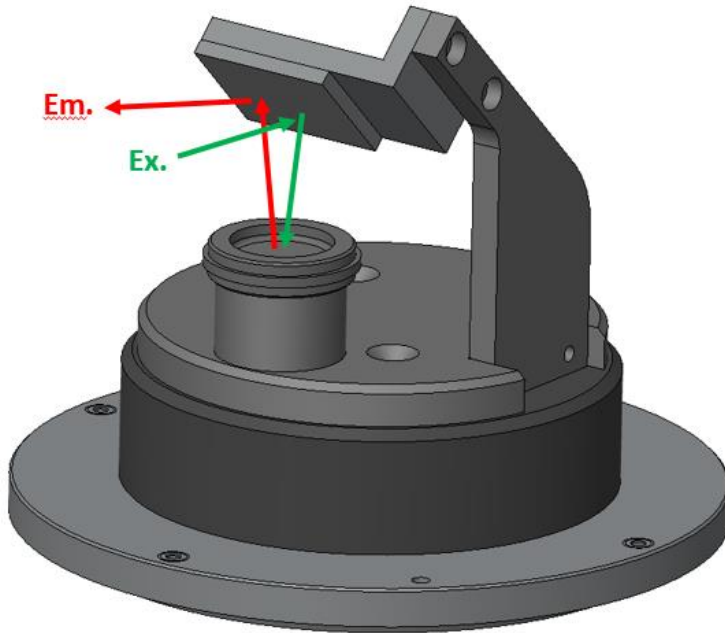


**Left:** Steady State electroluminescence spectrum of a white light InGaN LED at a drive current of 20 mA (3.4 V).

**Right:** Time-resolved electroluminescence of white light InGaN LED, measured at 450 nm (blue) and 575 nm (red) using TCSPC.

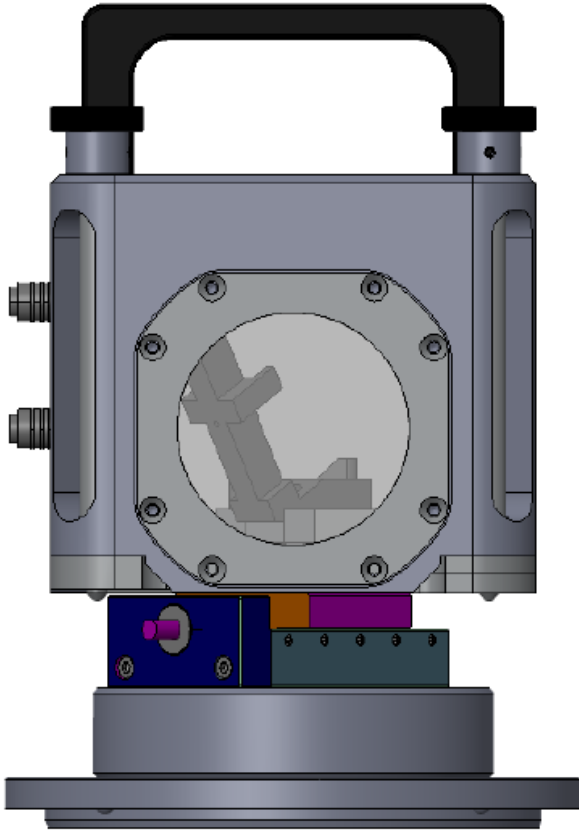


## N-J09 Vertical Excitation Powder Holder



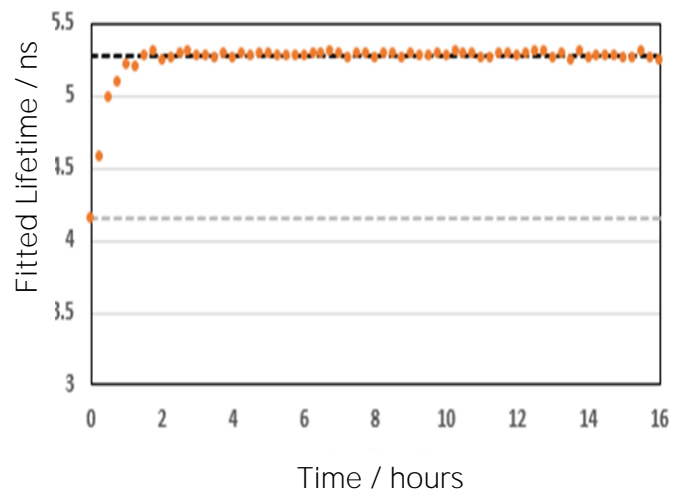
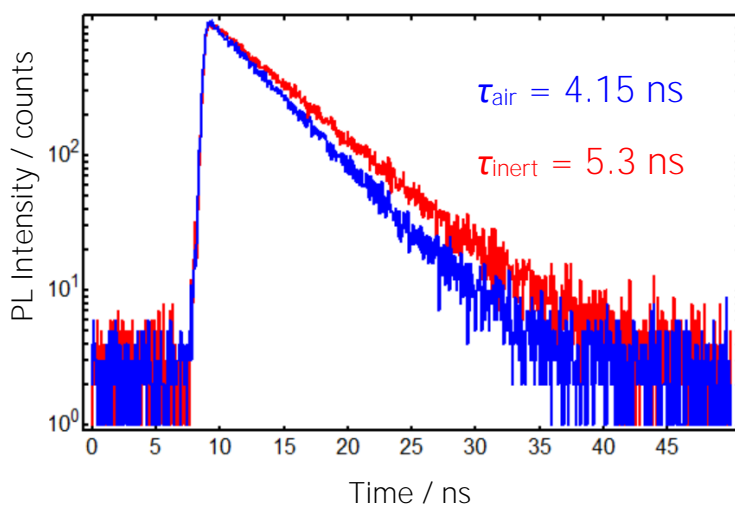
- Removable powder tray enables easy measurement of powders without a quartz cuvette
- Excitation beam is directed quasi-vertically on sample. The emission light is collected with the same mirror
- This holder must be used with the mirror optics option in the sample chamber (N-F03)

## N-J11 Inert Gas Sample Chamber



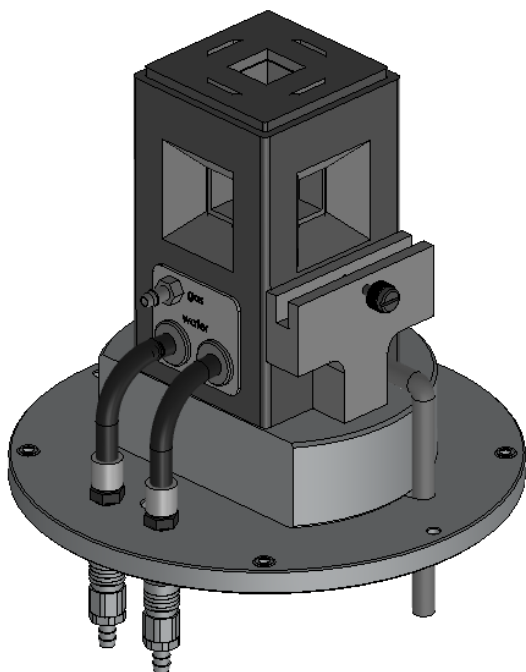
- Holds the sample under inert gas for > 8 hours (inert gas not included)
- Includes a solid sample holder and a cuvette holder
- The upper section is removable and exchanged between the solid sample and cuvette bases
- Glove box compatible
- Purge ports included as standard

### Measurement Example



**Left:** PL Lifetime decay of anthracene in cyclohexane under air (blue) or under nitrogen (red) .  
**Right:** Anthracene lifetime upon flushing the chamber with nitrogen for ~1 hour and sealing it, showing that an inert atmosphere is maintained overnight.

## N-K02 TE Cooled Sample Holder

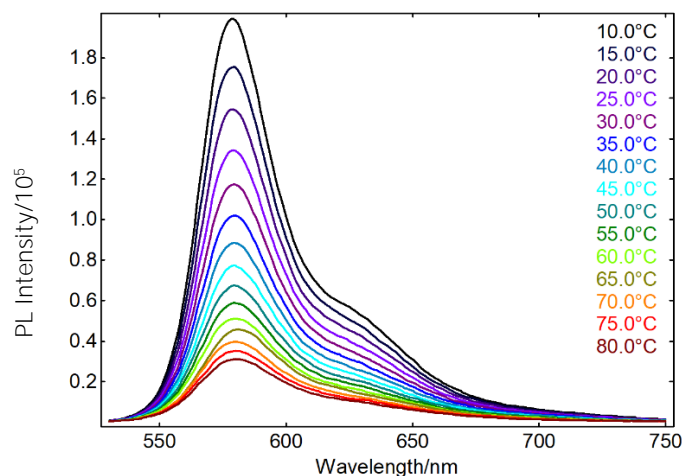


- Thermoelectrically cooled holder for cuvettes with 10 mm path length. Z height = 15 mm
- Sample temperature is controlled from the software with  $\pm 0.02^\circ\text{C}$  precision enabling the creation of automated temperature maps. **"Set temperature" option available** in batch measurement mode
- Includes external controller, cooling water circulator, gas inlet, magnetic stirrer and 50 mm x 50 mm filter slots
- Magnetic stirrer controlled from software
- Three versions offered, standard (N-K02) from  $-40^\circ\text{C}$  (\*) to  $+105^\circ\text{C}$ ; low range (N-K02lw) from  $-50^\circ\text{C}$  to  $+110^\circ\text{C}$  and extended (N-K02exd) from  $-40^\circ\text{C}$  (\*) to  $+150^\circ\text{C}$

### \*Accessories Required for Low Temperature

$\geq +5^\circ\text{C}$	No additional accessories required
$-10^\circ\text{C}$ to $+5^\circ\text{C}$	Dry gas flow to avoid condensation
$-15^\circ\text{C}$ to $-10^\circ\text{C}$	Dry gas flow and cooled circulating fluid within $25^\circ\text{C}$ of the operating temp.
$-40^\circ\text{C}$ to $-15^\circ\text{C}$	Dry gas flow, cooled circulating fluid within $25^\circ\text{C}$ of the operating temperature, and additional windowed jacket N-K02J if using N-K02 or N-K02exd

### Measurement Example



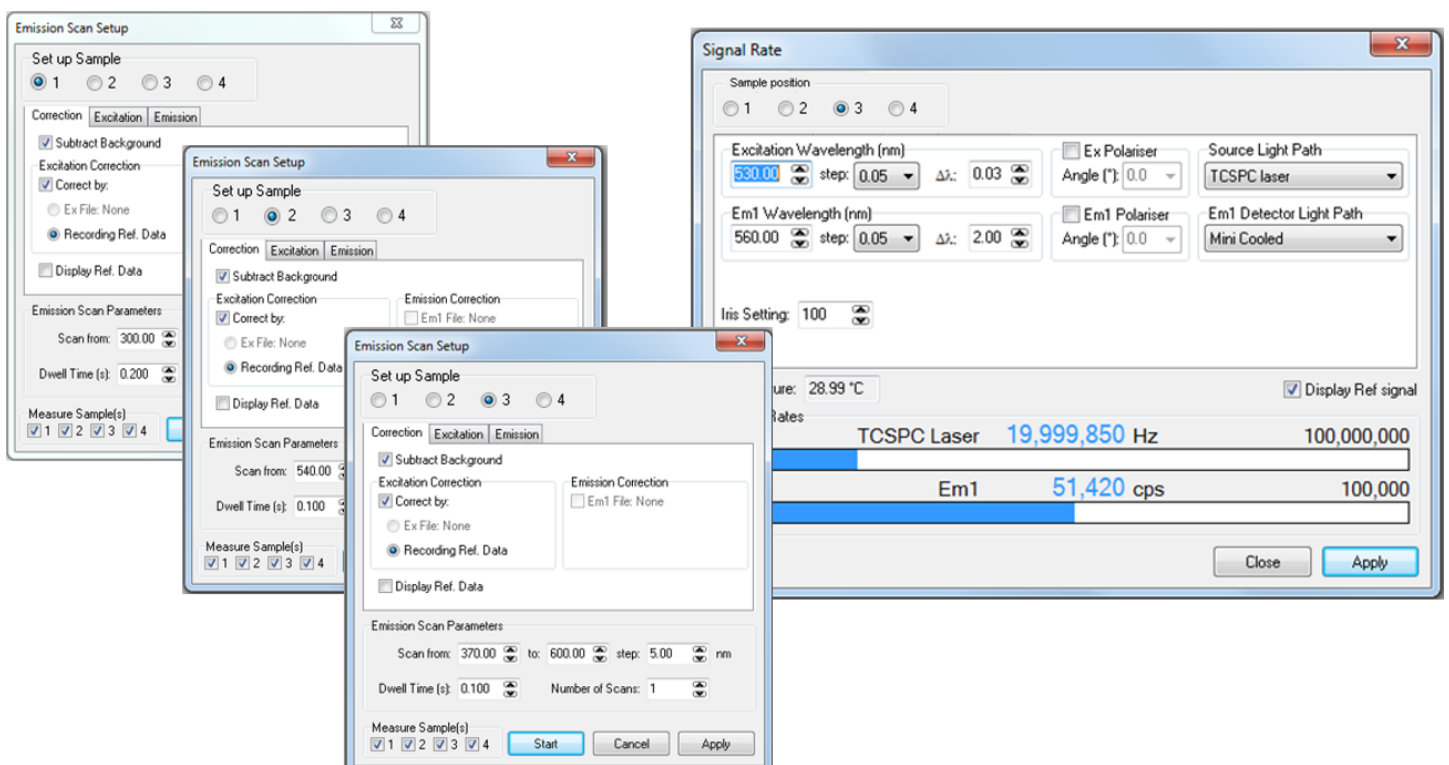
Left: Temperature map of Rhodamine B emission acquired in  $5^\circ\text{C}$  intervals.

## N-K03 Four-Position TE-Cooled Sample Holder

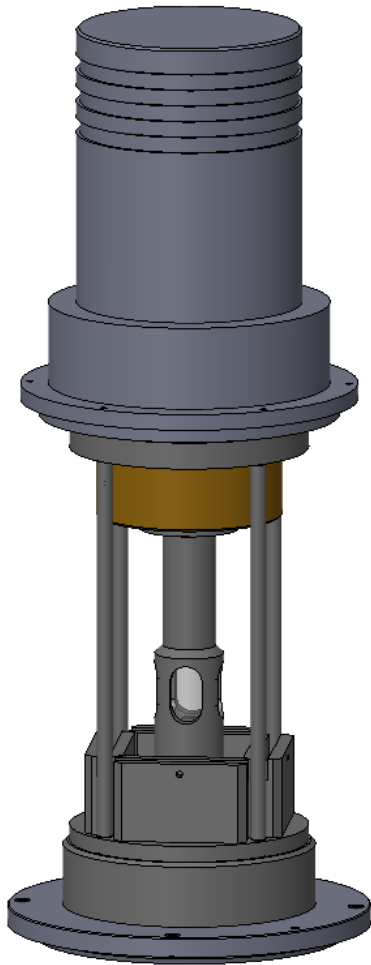


- Similar to N-K02 but allowing up to four 10 mm path length cuvettes. Cuvette path length = 10 mm, Z height = 15 mm
- Cuvette positions fully controlled by the software. Set measurement parameters independently and change cuvette in batch mode
- Temperature control from -10°C to +105°C (dry gas flow required for operation below 5°C)
- Sample temperature is controlled from the software with  $\pm 0.02^\circ\text{C}$  precision enabling the creation of automated **temperature maps**. **"Set temperature"** option available in batch mode.

Independent Setup of spectral scans / lifetime measurement parameters for each sample in the turret

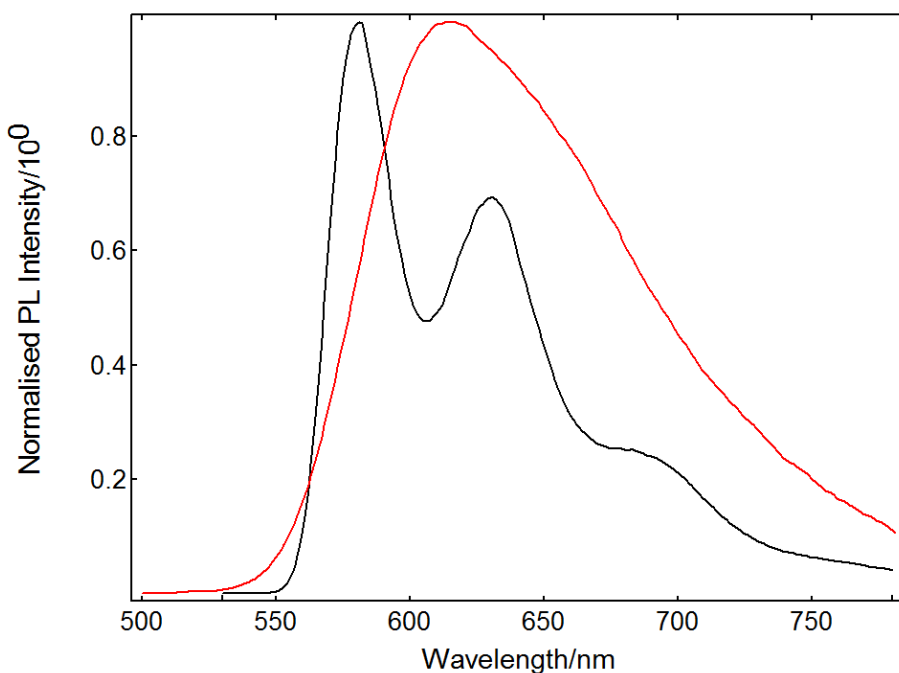


## N-K04 Liquid Nitrogen EPR Dewar



- Low-cost option for measurements at 77 K
- Suitable for liquid and powder samples
- Liquid nitrogen Dewar manufactured with quartz contains the sample in an EPR tube
- One quartz EPR tube supplied with dimensions: 4.97 mm outside diameter, 4.20 mm inside diameter
- Dewar can hold temperature for 1 hour after being filled with liquid nitrogen

### Measurement Example



**Left:** Emission spectrum of tris(bipyridine)ruthenium(II) chloride  $[\text{Ru}(\text{bpy})_3]\text{Cl}_2$  in 4:1 ethanol/methanol acquired at 77 K (black) and room temperature (red) with the N-K04 holder

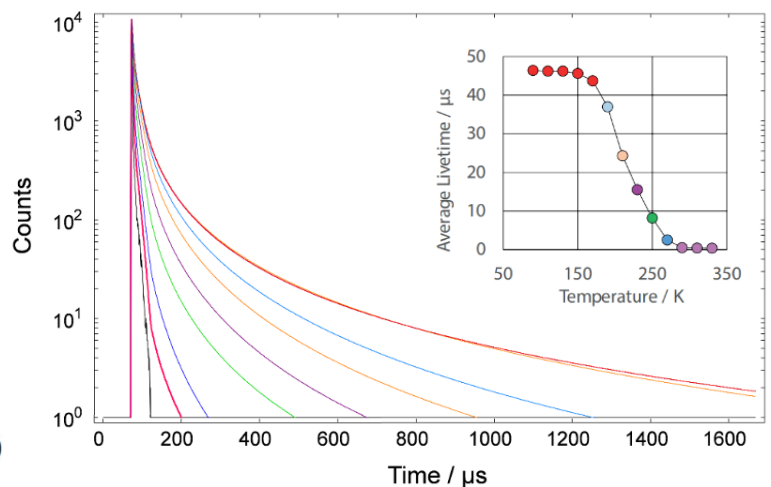
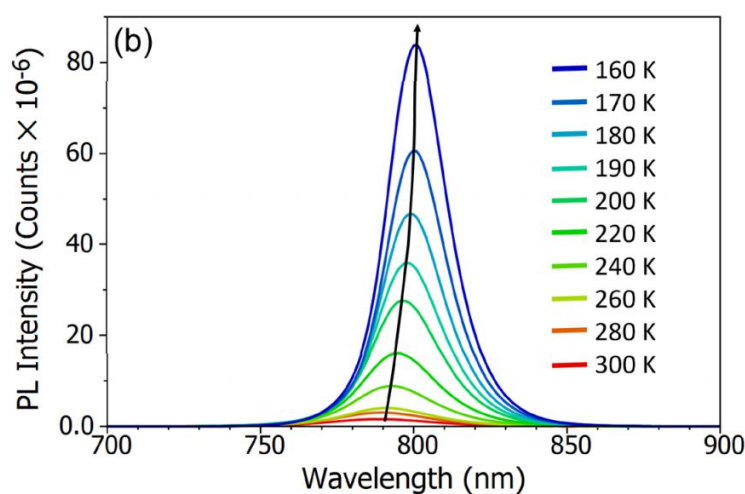


## N-K05 Liquid Nitrogen Cryostat



- Liquid nitrogen cryostat mounted in the FLS1000 sample position and easily exchanged for other sample holders
- Temperature range from 77 K to 300 K (standard version), or from 77 K to 500 K (extended version)
- Temperature-controlled and monitored from the software enabling the creation of temperature maps
- L-, T- and X-configuration cryostats available
- Sample holders for cuvettes, solids and powders available
- Other third-party cryostat models and custom mounts are available
- A turbomolecular pump may be required

## Measurement Examples



**Left:** Spectral temperature map of photoluminescence from MAPI perovskite acquired with liquid nitrogen cryostat.

**Right:** MCS temperature map of GaN thin film acquired with liquid nitrogen cryostat. The inset shows the fitted lifetimes.

## N-06/07 Liquid Helium and Closed Cycle Cryostats



- A range of third-party liquid helium and closed cycle cryostats can be integrated in the FLS1000
- Lower temperature limit from 2.3 K and upper temperature limit up to 800 K (model dependent)
- Closed cycle cryostats eliminate the need for cryogenic liquid, reducing running costs
- Temperature-controlled and monitored from the software enabling the creation of temperature maps
- L-, T- and X-configuration cryostats available
- Sample holders for cuvettes and solids available
- Other third-party cryostat models and custom mounts are available
- A turbomolecular pump may be required

### Options Summary

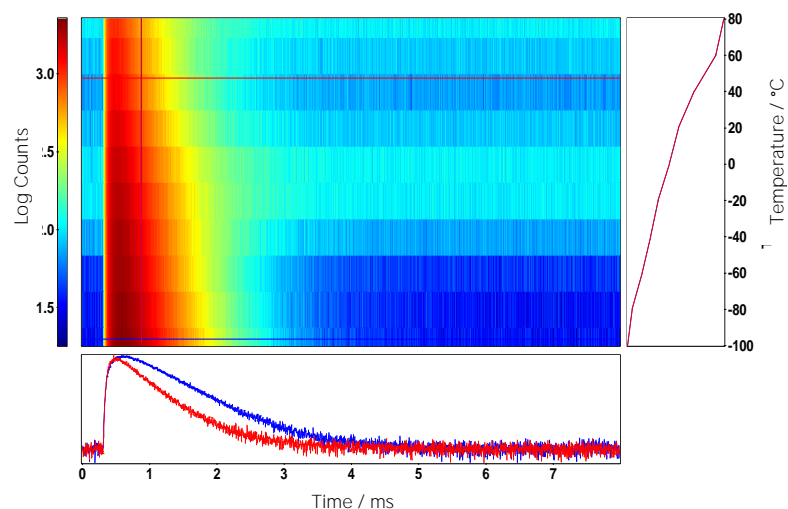
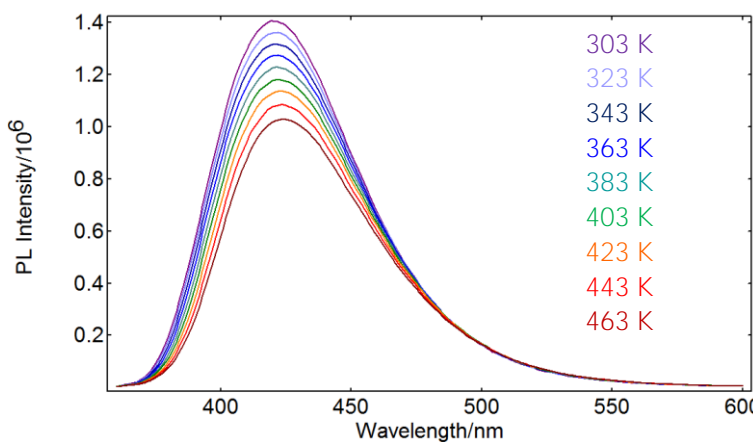
Model	Type	Temperature Range	Notes
N-K05DAX	Closed cycle, air cooled	3 K – 300 K	Suitable for solid samples (no liquids)
N-K05DWX	Closed cycle, water cooled	3 K – 300 K	Suitable for solid samples (no liquids)
N-K06	Liquid helium	3.4 K – 300 K	Requires pressurised He storage vessel
N-K06exd	Liquid helium	3.4 K - 500 K	Requires pressurised He storage vessel
N-K06exdlw	Liquid helium	2.3 K - 500 K	Requires pressurised He storage vessel
N-K07-10350	Closed cycle	10 K – 350 K	Mounted through base of sample chamber
N-K07-10500	Closed cycle	10 K – 500 K	Mounted through base of sample chamber
N-K07-10800	Closed cycle	10 K – 800 K	Mounted through base of sample chamber
N-K07-4350	Closed cycle	4 K – 350 K	Mounted through base of sample chamber
N-K07-4500	Closed cycle	4 K – 500 K	Mounted through base of sample chamber
N-K07-4800	Closed cycle	4 K – 800 K	Mounted through base of sample chamber

## N-Link Temperature Stage Holder



- Temperature-controlled stages compatible with films and powders. Temperature range from -196 °C to 600 °C (model dependent), stability < 0.1 °C
- Controlled from Fluoracle software enabling the acquisition of temperature maps
- Includes controller, liquid nitrogen pump and Dewar, mounting external to the spectrometer, fibre bundles
- Couples to spectrometer via fibre bundles. Fibre bundle UV (200 nm - 1200 nm) or VIS (300 nm - 2400 nm) range to be specified at the time of order. Requires adaptor N-L09

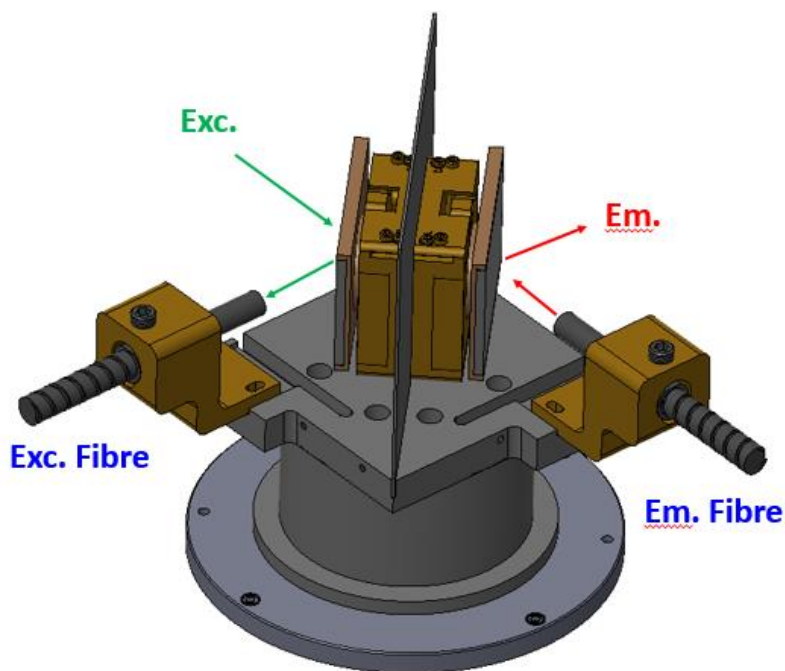
## Measurement Examples



**Left:** Spectral temperature map of photoluminescence from sodium salicylate measured in N-Link accessory.

**Right:** MCS temperature map of  $\text{NaY}_{0.77}\text{Yb}_{0.20}\text{Er}_{0.03}\text{F}_4$  acquired with N-Link.

## N-L0X Fibre Coupling Module

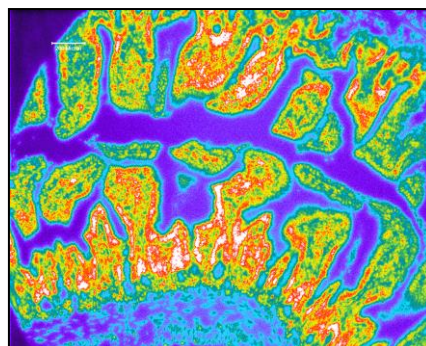
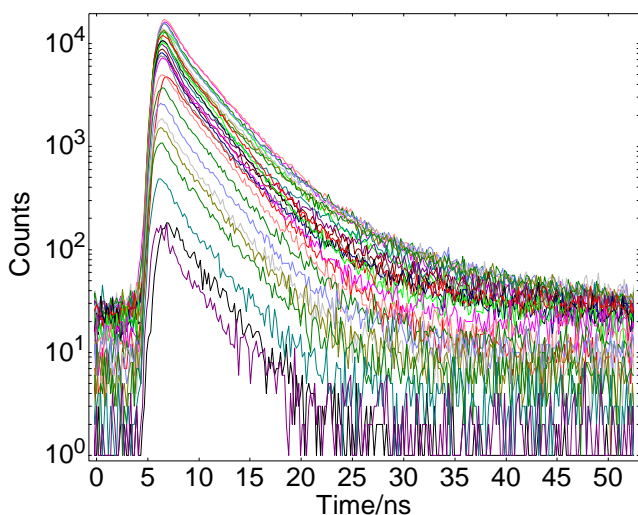


- Enables remote measurement of samples outside the spectrometer and coupling to third-party accessories such as microscopes
- Coupling of individual fibres (SMA/FC), fibre bundles (individual or bifurcated), or liquid light guides
- A range of fibres is available from Edinburgh Instruments in UV, visible or NIR ranges

### Fibre and Light Guide Options

N-L01	2 m bifurcated fibre bundle, 250 nm – 900 nm
N-L01exd	2 m bifurcated fibre bundle, 400 nm – 2000 nm
N-L03	2 m fibre bundle, 250 nm – 900 nm
N-L03exd	2 m fibre bundle, 400 nm – 2000 nm
N-L06UV	2 m liquid light guide, 300 nm – 650 nm
N-L06VIS	2 m liquid light guide, 340 nm – 800 nm
N-L06NIR	2 m liquid light guide, 420 nm – 2000 nm

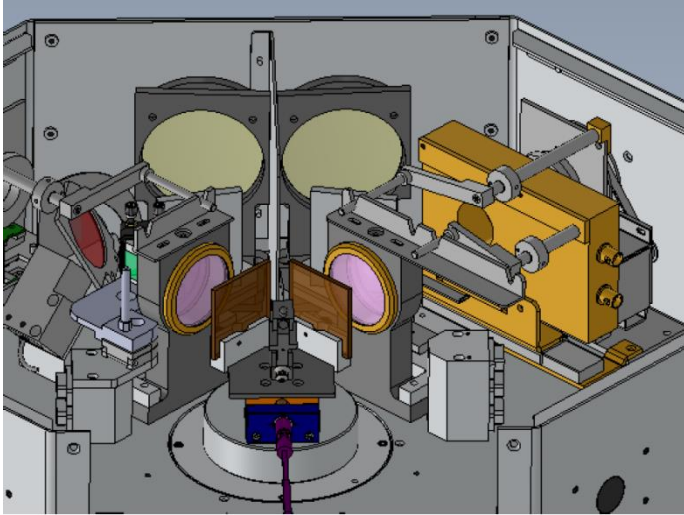
### Measurement Examples



*Above:* Slice of a mouse intestine stained with Sytox green imaged in a microscope with excitation light from the FLS spectrometer. *Left:* Time-Resolved Emission Spectroscopy from a point in the sample. Excitation with an EPL laser into a microscope.

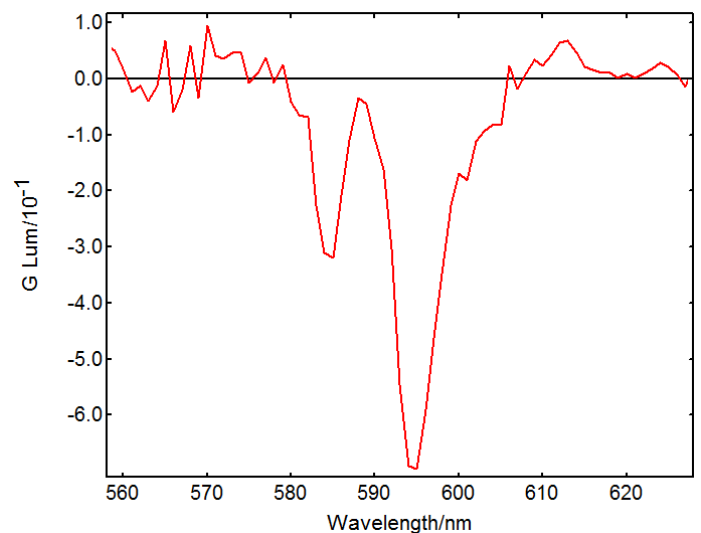
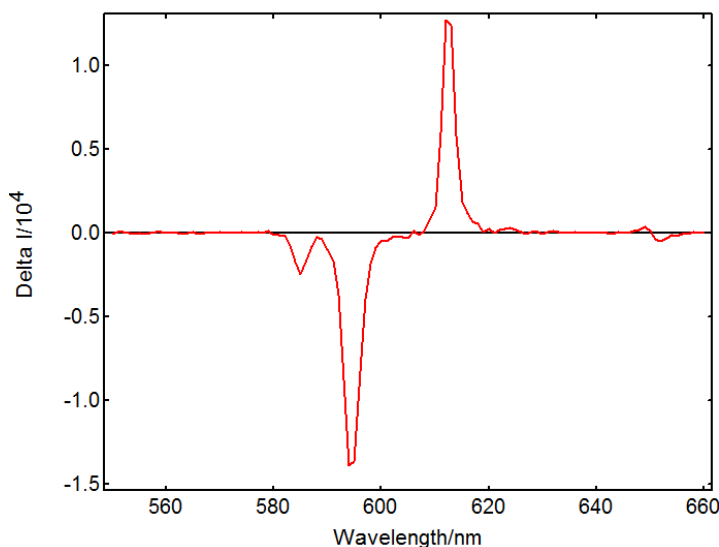


## N-CPL Circularly Polarised Luminescence



- Detect circularly polarised luminescence (CPL) in the FLS1000 spectrometer
- Includes a software-controlled photoelastic modulator and lock-in amplifier enabling automatic acquisition of  $\Delta I (= I_L - I_R)$  and  $G_{lum}$  values
- A measurement with  $G = 0.1$  typically requires 10 minutes of acquisition time for the total spectrum.
- Wavelength range: 200 nm – 900 nm
- Requires emission polariser N-F06EM (not included)

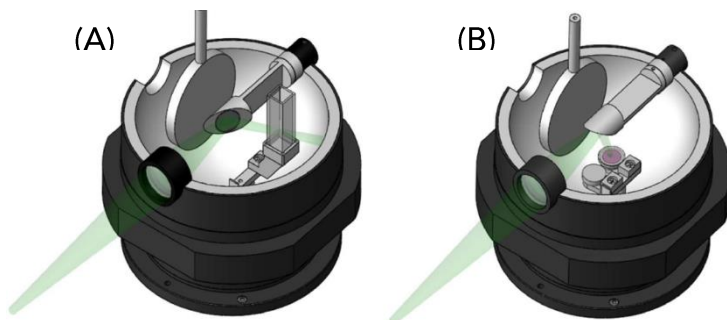
### Measurement Examples



**Left:**  $\Delta I$  from europium(III) tris[3-(trifluoromethylhydroxymethylene)-d-camphorate] acquired with the circularly polarized luminescence accessory. **Right:**  $G_{lum}$  from europium(III) tris[3-(trifluoromethylhydroxymethylene)-d-camphorate] acquired with the circularly polarized luminescence accessory.

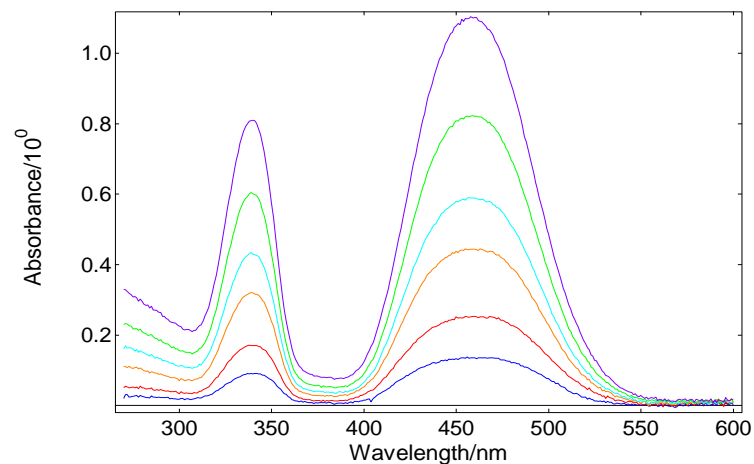
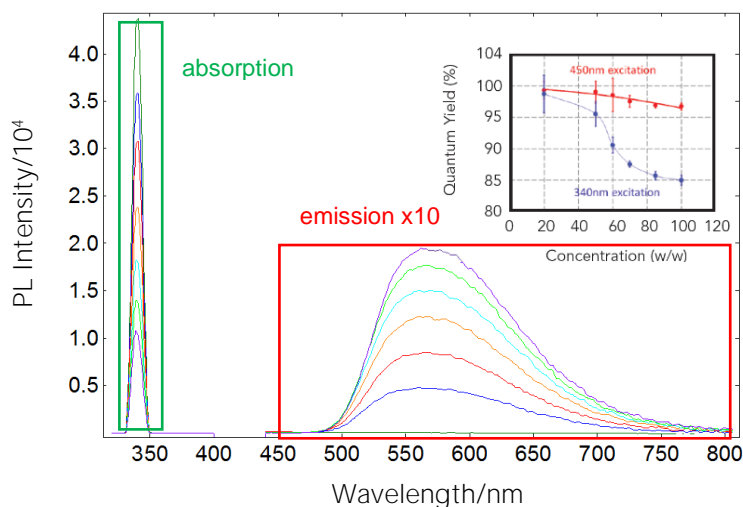


## N-M01 Integrating Sphere



- Demountable 120-mm diameter sphere coated with reflective material, mounted in the sample chamber
- Measurement of photoluminescence quantum yield and reflectance of (A) solutions, (B) films and powders, from 300 nm to 2000 nm
- Direct and indirect excitation possible
- Supplied with holders for cuvette and solid samples, quartz cuvette, powder tray, reference scattering plug, and neutral density filter
- User-friendly wizards for calculating quantum yield and reflectance included in software
- An IR version is available for applications above 2000 nm (not suitable for quantum yield)

## Measurement Examples



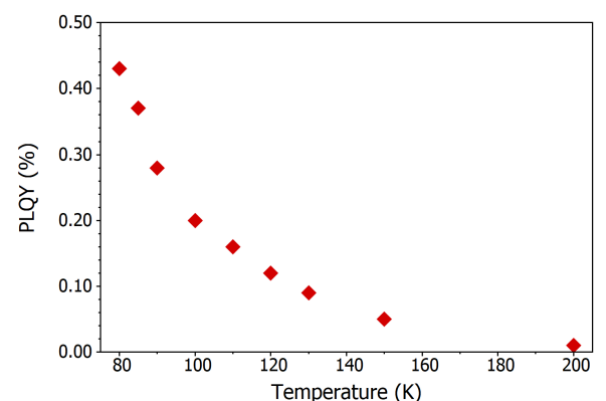
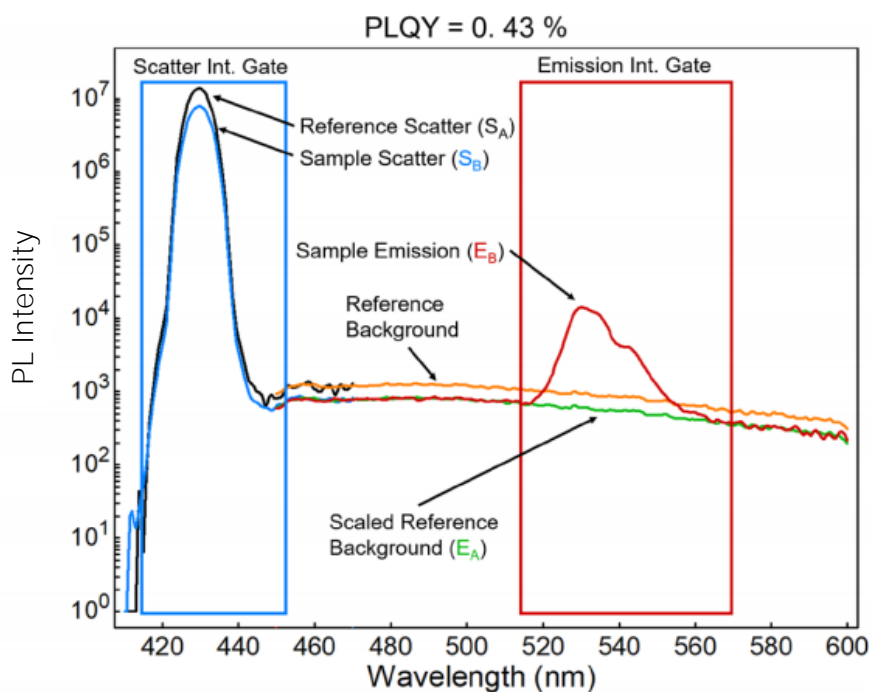
**Left:** Photoluminescence quantum yield measurement of YAG:Ce powder in BaSO<sub>4</sub> at various concentrations (20% to 100%), results at 340 nm and 450 nm excitation. **Right:** Normalised absorbance of YAG:Ce in BaSO<sub>4</sub> at various concentrations (20% to 100%) measured in integrating sphere.

## N-M01T Cryosphere



- Absolute photoluminescence quantum yield of solid and powder samples from 77 K to 500 K
- Coupled to the FLS1000 spectrometer by fibre bundles. Bundles and launcher should be ordered separately (N-L03T)
- Temperature controlled from Fluoracle software enabling the automatic creation of temperature maps
- Direct and indirect excitation positions available
- Features liquid-nitrogen cooled cryostat, controller, 5 L Dewar, gas flow pump. A turbo-molecular pump (recommended) or a two-stage rotary pump is required for routine maintenance and operation

## Measurement Examples



Left: Photoluminescence quantum yield of CsPbBr<sub>3</sub> at 80 K measured in the cryosphere accessory.

Above: Variation of photoluminescence quantum yield of CsPbBr<sub>3</sub> with temperature characterised in cryosphere.

## N-M02 Titration Module



- Dual syringe titrator external to the instrument and controlled from the FLS1000 software
- Perform kinetic measurements with manual or automated titration, and automated multiple spectral scans
- Comprises two 1 mL syringes as standard (other volumes available), connecting tubing, flow cuvette and feedthrough into the FLS1000 sample chamber

## Specification

Syringe volumes	10 $\mu$ L	100 $\mu$ L	1 mL (standard)
Syringe accuracy	<3%	<3%	<1.2%
Syringe precision	<2%	<1.5%	<0.5%
Flow rate ( $\mu$ L/s)	0.003 – 6.5	0.03 – 66.5	0.3 - 665

**Test Titrator** ✕

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**Information**

Titrator type: Hamilton M600 Change  
 Software/firmware version: NV01.085.000.121.0N

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**Configuration**

Single/dual dispense  
  Continuous dispense  
  Dual dilute

**Left syringe**

Use

Speed (s):

Fill volume ( $\mu$ L):

Dispense volume ( $\mu$ L):

**Right syringe**

Use

Speed (s):

Fill volume ( $\mu$ L):

Dispense volume ( $\mu$ L):

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**Operations**

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**Direct command**

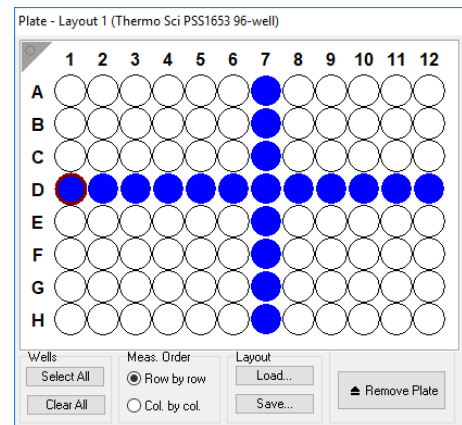
Command:   
 Reply:

Left: Setup of titration parameters in Fluoracle software. The fill volume, dispense volume, and dispensing speed can be controlled independently for each syringe.

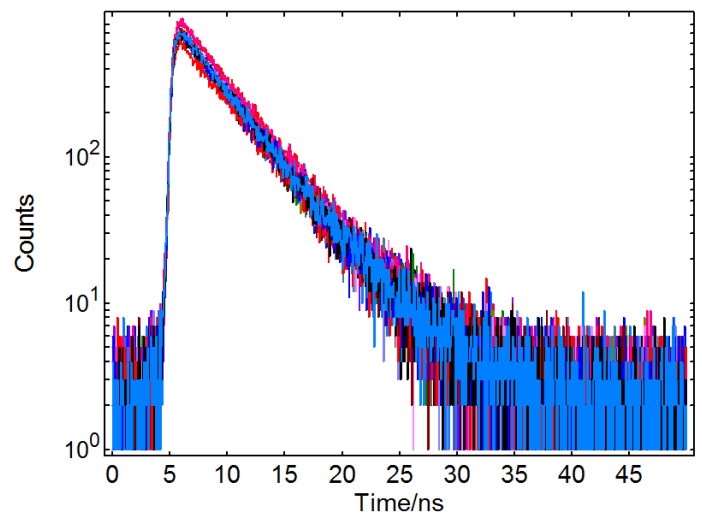
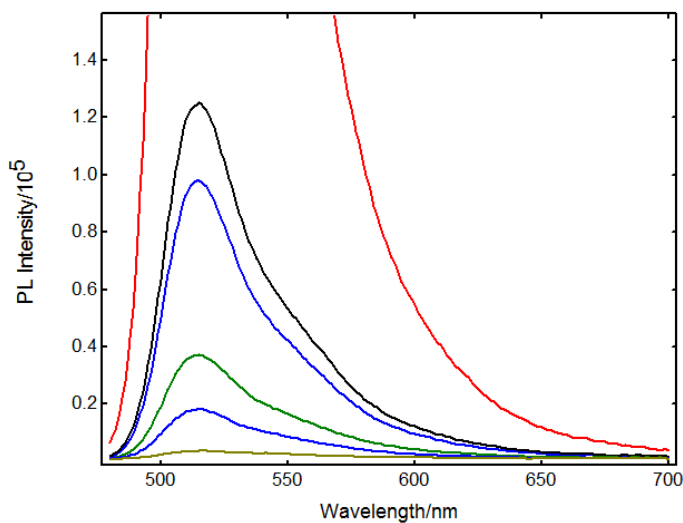
## N-M03 Multi-well Plate Reader



- Software-controlled plate reader module connected to FLS1000 via a bifurcated fibre bundle (N-L02, must be ordered separately)
- Compatible with spectral and lifetime measurements (TCSPC and MCS)
- Supports multi-well plates with a format of up to 96 wells
- Features temperature monitoring and interlocked hatch



### Measurement Examples



**Left:** Emission spectra from fluorescein in PBS at different concentrations measured in adjacent wells. The lowest concentration is 10 pM. **Right:** TCSPC lifetime measurements of sample in adjacent wells, acquisition time = 5 seconds/well

## N-M04 Stopped Flow Accessory



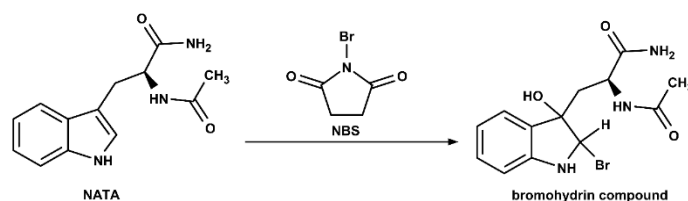
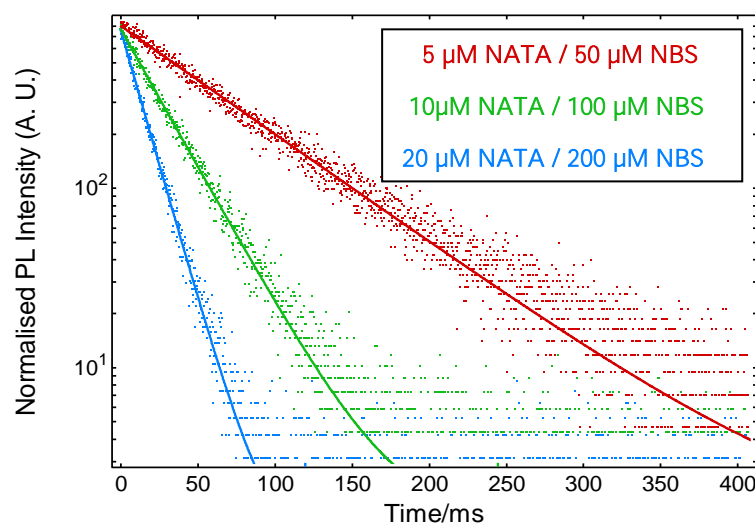
- Stopped-flow accessory for measuring rapid reaction kinetics with ms time resolution
- Silica cuvette with 4 Spectrosil B observation windows with 10 mm path length
- Includes 3 multimixing 2.5 mL injection syringes
- Software controlled or manual injection options
- Computer controlled option: emission kinetics with 100  $\mu$ s resolution and transmission kinetics with 10 ms resolution (if absorption detector present). Manual option: 10 ms resolution
- Compatible with N-J01 and N-K02

### Specification

Dead Time (ms)	<10
Dead Volume ( $\mu$ l)	350 (micro-volume version) or 700 (standard)
Volume per Shot ( $\mu$ l)	100 per reactant
Mixing Ratio	1:1 to 20:1
Chemical Resistance	Very high. Silica and PTFE construction.
Temperature Range ( $^{\circ}$ C)*	5 to 80

\*Temperature control is provided by N-J01 or N-K02.

### Measurement Examples



Left: PL kinetic of NATA quenching by N-bromosuccinimide (scheme above) at different concentrations.  $\lambda_{\text{ex}} = 280$  nm,  $\lambda_{\text{em}} = 360$  nm. The decays were fit with a single monoexponential using Fluoracle.



## N-XS1 X-Ray Sample Chamber



- CW and/or pulsed X-ray excitation of samples in a separate sample chamber
- UV/visible/NIR photoluminescence of the X-ray excited sample is collected by a liquid light guide\* and sent to the FLS1000 emission path
- Sample holders for cuvettes, slides and powders included as standard
- Option to excite the sample directly with a laser

\*Standard 340 – 800 nm. Other options available

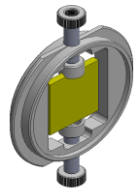
### Options

N-XS1-CW	CW X-ray source (60 kV, 12 W)
N-XS1-P	40 kV X-ray source triggered by HPL-450 laser X-ray pulses of ~100 ps or wider, compatible with TCSPC Mount for second source (simultaneous excitation of the sample)
N-XS1-PCW	CW and pulsed sources from N-XS1-CW and N-XS1-P Easy swap between sources

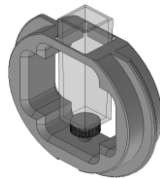
### Sample Holders



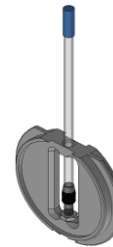
Powders  
(Standard)



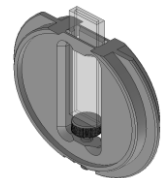
Film  
(Standard)



10 mm cuvette  
(Standard)

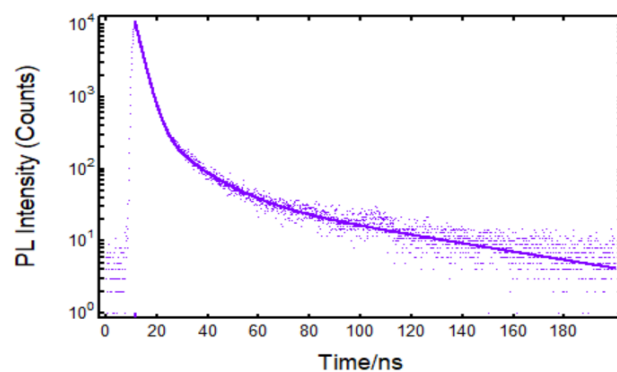
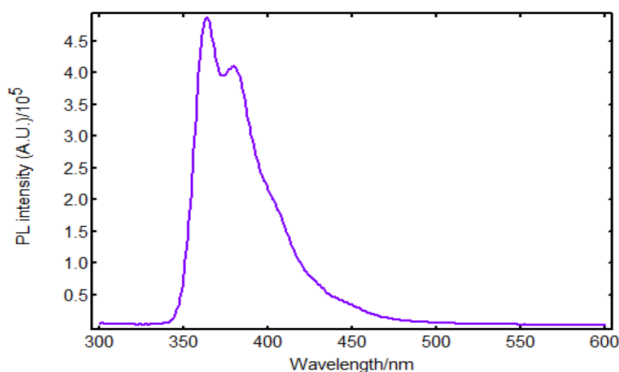


Powder / Crystal  
(Optional)



1 mm cuvette  
(Optional)

### Measurement Examples



**Left:** X-ray excited luminescence spectrum of LAB/PPO liquid scintillator. **Right:** X-ray excited luminescence decay of LAB/PPO measured by TCSPC.



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