

LTCS specification sheet

TNO has been developing a new optical tool that is able to characterize color centers and related components within various material platforms: the Low Temperature Characterization Setup (LTCS). This state-of-the-art system will be operational before the end of 2025, and offers a unique tool to characterize both NV, SnV (and other) color centers at <1K.

The LTCS consists of a Bluefors LD-HE250 cryostat that provides optical access to the sample space, and a control system to control and read-out the NV or SnV color centers. The control system features (off) resonant laser, optics and electronics that are orchestrated by a dedicated software control framework with ready-to-go measurements.

Out of the box, the LTCS provides measurement scripts to perform Photoluminescence Excitation (PLE), Electron Spin Resonance (ESR) and Charge-Resonance (CR) Check measurements. As the control system is extensible, additional measurement scripts can be implemented easily to perform even more advanced measurements (think of T1, T2 or more).

	Specification	Value
Cryostat		
	Supplier	Bluefors
	Type	LD-HE250
	Base temperature	860 mK
	Cooling power at 1 K	30 mW
	Magnet	Vector magnet up to 1 T
	RF lines	12 lines up to 18 GHz
	DC lines	24x twisted pair (2x 24 pins microD at cold)
	Fibers	6 fibers 630HP 6 fibers 460HP
	Optical access	Yes, using 4f system
	Other specifications:	Vibration isolation frame, ready for dilution fridge upgrade
Free-space optical		
	Course scanning range (XY)	5 mm x 5 mm
	Course scanning range (Z)	5 mm, however typically limited by device-objective distance
	Course scanning step size (XYZ)	~1 μ m
	Fine scanning range (XY)	5 x 5 μ m

	Fine scanning step size (XY)	< 1 nm
Optical		
	Laser 1 wavelength	532 nm
	Laser 1 power in Fiber	5 mW
	Laser 1 power Free space	1 mW
	Laser 1 pulse range	10 ns - CW
	Laser 2 wavelength range	635 – 640 nm
	Laser 2 power in Fiber	500 uW
	Laser 2 power Free space	100 uW
	Laser 2 pulse range	10 ns - CW
	Laser 3 wavelength range	617 – 641 nm
	Laser 3 power in Fiber	10 mW
	Laser 3 power Free space	2 mW
	Laser 3 pulse range	< 1 ns - CW
	SP detector range	500 – 900 nm
	SP detector efficiency	80% @ 670 nm
	SP detector DCR	10 Hz
	Wavemeter wavelength range	330 – 1180 nm
	Wavemeter accuracy	30 MHz
	Wavemeter resolution	1 MHz
	Wavemeter ports	4
	Wavemeter other	Fizeau interferogram visible, PID controls wavelength of lasers
	Other	Camera view of devices
Electronics		
	MW range	1 – 12 GHz
	MW power	0 – 20 dBm
	Microcontroller type	
	Microcontroller IO	
	Microcontroller SW	
	Timetagger resolution	42 ps
	Timetagger channels	4
	Timetagger speed	80 M tag/s
Software		
	SW suit with the following functions:	
	Laser control	Power, frequency, pulsing (also in GUI)
	Position control	Course position, fine position, 2D and 1D scanning of position (also in GUI)

	Scripts ready	Laser calibration, positioning, saturation measurement, ODMR measurements, PLE measurements, CR-check.
	Easy to implement	T2, T2*, T1, MW pulsing (and calibration)
	Other	Separate SW for cryostat and magnet control.