

Instrument Maintenance Record

Vertex QX-500 Confocal Raman Microscope | Asset ID Nimbus-QX500-07

Serial Number

VX-QX500-114487

Location

Core Facility, Rm. 214B

Custodian

Dr. Renata Solis

Commissioned

14 Mar 2022

Service Contract

Synapse Instrument Services, Tier 2

Record Period

Jan 2025 – Jun 2026



Overview



PM Schedule



Service History



Downtime



Calibration



Spare Parts



Incidents & Sign-off

Rev.	Description	Date
A	Initial record opened at instrument commissioning	14 Mar 2022
B	Annual PM schedule revised to quarterly cadence	02 Jan 2024
C	Current revision – reflects service history through Jun 2026	30 Jun 2026

This record is a controlled quality document of the Apex Materials Characterisation Core.
Uncontrolled if printed. Retain for the operating life of the instrument plus five years.

1 Instrument Overview

1. Asset Identification

Master record for the confocal Raman platform serving the polymer, semiconductor, and geosciences user groups.

The Vertex QX-500 confocal Raman microscope was commissioned in the Apex Materials Characterisation Core in March 2022 to support high-spatial-resolution vibrational spectroscopy across three research divisions. This record consolidates preventive maintenance, corrective service, calibration verification, and downtime for the instrument's operating life. It is maintained by the Core facility manager and countersigned by the contracted service provider, Synapse Instrument Services, at every visit.

Field	Value
Instrument	Vertex QX-500 Confocal Raman Microscope
Asset ID	Nimbus-QX500-07
Manufacturer serial number	VX-QX500-114487
Location	Core Facility, Building 4, Room 214B
Custodian	Dr. Renata Solis, Facility Manager
Primary operator group	Materials & Polymer Characterisation Lab
Commissioning date	14 March 2022
Warranty expiry	13 March 2025
Service contract	Synapse Instrument Services – Tier 2 (quarterly PM + on-call)
Replacement value	Capital asset, insured under Nexa Institute policy NX-INS-2244
Utilities required	208 V/20 A dedicated circuit, class 4 laser interlock, vibration-isolated bench
Software platform	Vertex SpectraSuite v6.3, controller firmware 2.14.1

1.1 Configuration

- Excitation sources: 532 nm (50 mW) and 785 nm (300 mW) solid-state lasers
- Objectives: 10×, 50× LWD, 100× oil-immersion
- Detector: back-illuminated CCD, thermoelectrically cooled to -70°C
- Stage: motorised XYZ, 0.1 μm encoder resolution, 100 mm $\times$ 100 mm travel
- Auxiliary modules: polarisation kit, heating/cooling stage (-190°C to 600°C)

1.2 Responsible Parties

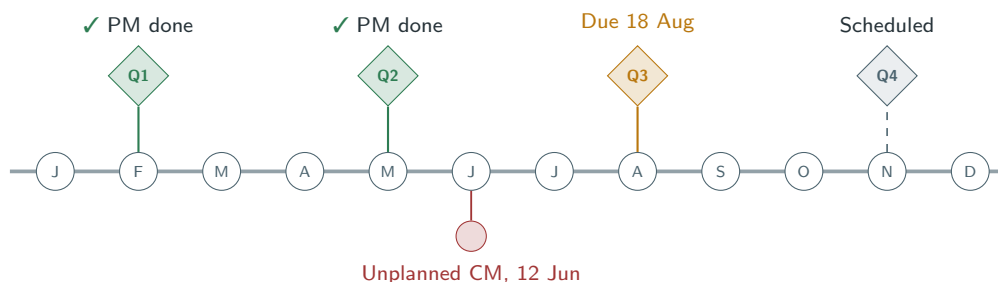
Role	Name	Contact / Notes
Facility manager (custodian)	Dr. Renata Solis	r.solis@apexcore.org, ext. 4471
Service engineer of record	Priya Kanth (Synapse)	priya.kanth@synapse-instruments.com
Laser safety officer	Dr. Aiden Ferro	Class 4 interlock and alignment sign-off
Metrology / QA reviewer	Ines Coutinho	Quarterly calibration audit

2 Preventive Maintenance Schedule

2. Preventive Maintenance Schedule

Task cadence, ownership, and the 2026 service-visit strip.

2.1 2026 Service-Visit Strip



2.2 Task Register

Task	Frequency	Owner	Status
Laser power output check (532/785 nm)	Weekly	Facility staff	Current
CCD dark-current baseline log	Monthly	Facility staff	Current
Interlock and shutter function test	Monthly	Laser safety officer	Current
Full optical alignment & wavelength calibration	Quarterly	Synapse engineer	Due Q3
TEC cooler performance verification	Semi-annual	Synapse engineer	Current
Full preventive maintenance overhaul	Annual	Synapse engineer	Next: Mar 2027

2.3 Escalation Rule

If a quarterly or higher-tier task is not closed within 10 working days of its due date, the facility manager escalates to Synapse Instrument Services dispatch and flags the instrument **Overdue** on the Core booking calendar until resolved. Users may not book Raman sessions on an instrument flagged overdue for a safety- or calibration-relevant task.

3 Service History

3. Service History

Complete chronological log of preventive and corrective work since commissioning.

Entries are recorded by the attending engineer at the close of each visit and countersigned by the facility custodian. PM = preventive maintenance; CM = corrective maintenance; CAL = calibration visit; UPG = upgrade/retrofit.

Date	Type	Work performed	Engineer	Down (h)	Result
14 Mar 2022	PM	Commissioning: factory alignment, base-line wavelength cal, interlock certification.	Priya Kanth	6.0	✓ Pass
02 Sep 2022	CM	785 nm drop-out; replaced diode driver fuse, re-tested to spec.	Priya Kanth	4.0	✓ Pass
11 Jul 2023	CM	Stage Y-axis stall; replaced worn drive belt, re-homed axes.	Devon Achebe	5.5	✓ Pass
08 Apr 2024	UPG	Installed heating/cooling stage module and controller software; retrained operators.	Priya Kanth & Devon Achebe	9.0	✓ Pass

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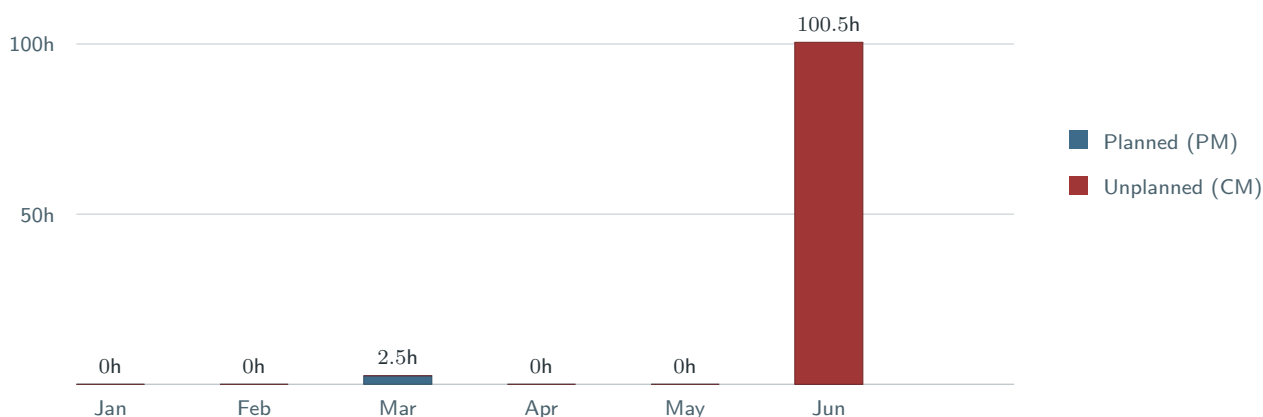
Date	Type	Work performed	Engineer	Down (h)	Result
02-16 Nov 2024	CM	CCD readout noise above baseline; failing preamp board diagnosed and replaced under contract.	Priya Kanth	8.5	✓ Pass
18 Dec 2024	PM	Annual overhaul, firmware to 2.14.1, full safety re-certification.	Priya Kanth	8.0	✓ Pass
19 Jun 2025	PM	Q2 service: stage encoder check, laser power log review, cleaning.	Priya Kanth	2.0	✓ Pass
12 Jun 2026	CM	532 nm laser failed to reach threshold power; head returned to Vertex for repair.	Priya Kanth	96.0	✗ Escalated
30 Jun 2026	CM	Repaired 532 nm laser head reinstalled; re-alignment, power curve verified.	Priya Kanth	4.5	✓ Pass

4 Downtime Tracker

4. Downtime Tracker

Planned versus unplanned downtime, availability, and reliability metrics.

4.1 Monthly Downtime, Jan–Jun 2026



4.2 Reliability Metrics – Trailing 12 Months

Metric	Value
Scheduled operating hours	2,184 h (6 days/week, 07:00–19:00)
Total downtime (planned + unplanned)	107.5 h
Availability	95.1%
Mean time between failures (MTBF)	5,840 h
Mean time to repair (MTTR)	21.2 h
Unplanned incidents (12 mo.)	1 (532 nm laser head failure, Jun 2026)
Longest single outage	96.0 h (parts transit, laser head return-to-vendor repair)

The June 2026 outage is the only unplanned incident in the trailing 12 months and is detailed in Section 7; all bookings during the outage window were relocated to the backup Raman unit in Room 210.

5 Calibration Verification

5. Calibration Verification

Most recent verification cycle, performed 19 Jun 2025 and re-confirmed after the June 2026 laser repair.

5.1 Verification Results

Check	Tolerance	Measured	Result	Next due
Wavelength accuracy (Si reference, 520.7 cm ⁻¹)	±0.5 cm ⁻¹	520.6 cm ⁻¹	✓ Pass	Sep 2026
532 nm / 785 nm laser power at sample	±5% of nominal	48.7 / 296.4 mW	✓ Pass	Sep 2026
Stage XY positioning accuracy	±0.5 µm over 50 mm	0.31 µm	✓ Pass	Sep 2026
CCD dark-current baseline	<5 e ⁻ /px/s at -70 °C	3.2 e ⁻ /px/s	✓ Pass	Dec 2026
Interlock trip time (shutter close on door open)	<150 ms	92 ms	✓ Pass	Sep 2026

5.2 Post-Repair Verification, 30 Jun 2026

Following the 532 nm laser head replacement recorded in Section 3, the following checks were repeated in full ahead of the routine schedule and passed on first attempt:

- Wavelength accuracy and power curve at 532 nm excitation – ✓ Pass, linear to $R^2 = 0.999$
- Beam pointing stability over 30 min warm-up – ✓ Pass, drift <1 µrad
- Interlock re-certification with new laser head serial (VX-LH532-9012) – ✓ Pass

Reference standards used for verification are traceable to national measurement institute certificates held by the Core metrology office (silicon wavelength standard SI-2024-0817; NIST-traceable power meter PM-2025-0112).

6 Spare Parts and Consumables

6. Spare Parts and Consumables

On-site inventory maintained to bound corrective-maintenance turnaround.

Item	Stock	Reorder point	Status
Laser diode fuses (532/785 nm, 2 A)	7	4	OK
Stage drive belt (Y-axis)	1	1	Reorder
CCD preamp board (spare, factory refurbished)	0	1	Out of stock
Objective cleaning kit (lint-free wipes, solvent)	6	2	OK
Interlock door switch assembly	1	1	Reorder
Vibration isolation table air-spring cartridge	2	1	OK
Immersion oil, index-matched (100× objective)	5 bottles	2 bottles	OK

6.1 Notes

- The CCD preamp board consumed during the November 2024 repair has not been restocked; lead time from Vertex is 6–8 weeks. A replacement is on order (PO #NX-2026-1188, placed 05 Jul 2026).
- The Y-axis drive belt and interlock door switch are below reorder point and are on the Synapse auto-ship list for the Q3 visit. Consumables are reconciled against this table at every quarterly PM visit.

7 Incident Notes and Sign-Off

7. Incident Notes and Sign-Off

Narrative record of the most significant event this period, and authorisation to return the instrument to service.

7.1 Incident Narrative – 12 June 2026 Laser Failure

At 09:14 on 12 June 2026, the on-duty operator reported that the 532 nm excitation line failed to reach usable power during warm-up, with the power meter reading below 5% of nominal. The facility manager placed the instrument out of service and opened ticket #SYN-88431 with Synapse Instrument Services. Priya Kanth attended the same afternoon and diagnosed a failed laser diode within the 532 nm head, beyond field-repairable scope; the head was returned to Vertex Photonics Repair Centre under contract, and affected users were redirected to the backup Raman unit in Room 210 for the outage duration.

The repaired head (new laser diode, serial VX-LH532-9012) was reinstalled on 30 June 2026. Full realignment and the post-repair verification set in Section 5 were completed and passed before the instrument returned to the booking calendar on 01 July 2026.

7.2 Follow-Up Actions

Action	Owner	Status
Investigate spare 532 nm head or loaner agreement with Vertex	Dr. Renata Solis	In progress
Review contract SLA for repair turnaround (currently 12–18 days)	Dr. Renata Solis	In progress
Add laser diode hour-meter logging to weekly PM checklist	Facility staff	Complete

7.3 Record Sign-Off

This maintenance record and the actions logged within it for the period Jan 2025–Jun 2026 have been reviewed and are certified accurate.

	Priya Kanth
Renata Solis	
Facility Manager, Custodian	Service Engineer of Record, Synapse Instrument Services
Date: _____	Date: _____
Ines Coutinho	
Quality Assurance Reviewer	
Date: _____	

7.4 Reference Standards

Maintenance and calibration practices in this record follow the general quality-management and traceability requirements of International Organization for Standardization (2017) and the manufacturer's field-service specifications (Vertex Instruments, 2024). Preventive maintenance intervals were benchmarked against the reliability-centred maintenance guidance in Moubrey (1997) and adapted to this Core's usage profile.

References

International Organization for Standardization. ISO/IEC 17025:2017 – general requirements for the competence of testing and calibration laboratories. Technical report, International Organization for Standardization, Geneva, Switzerland, 2017.

John Moubray. *Reliability-Centered Maintenance*. Industrial Press, New York, NY, 2nd edition, 1997.

Vertex Instruments. *QX-500 Confocal Raman Microscope: Field Service and Preventive Maintenance Manual*, revision 4 edition, 2024. Document VX-QX500-FSM-04.