

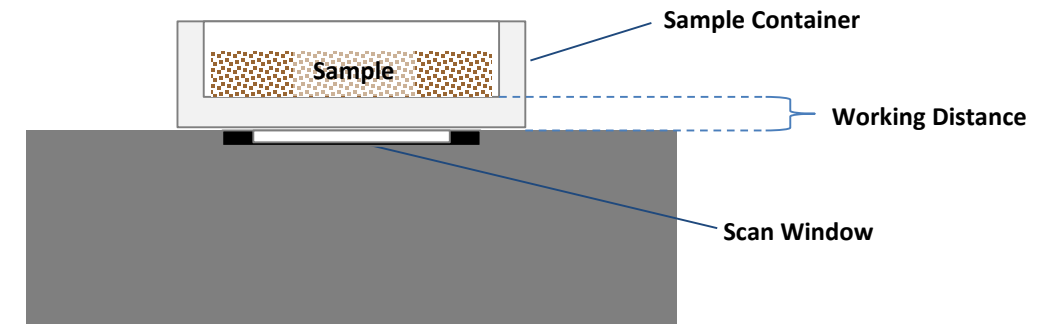
NIR-M-R15 / NIR-S-R16

Product Introduction

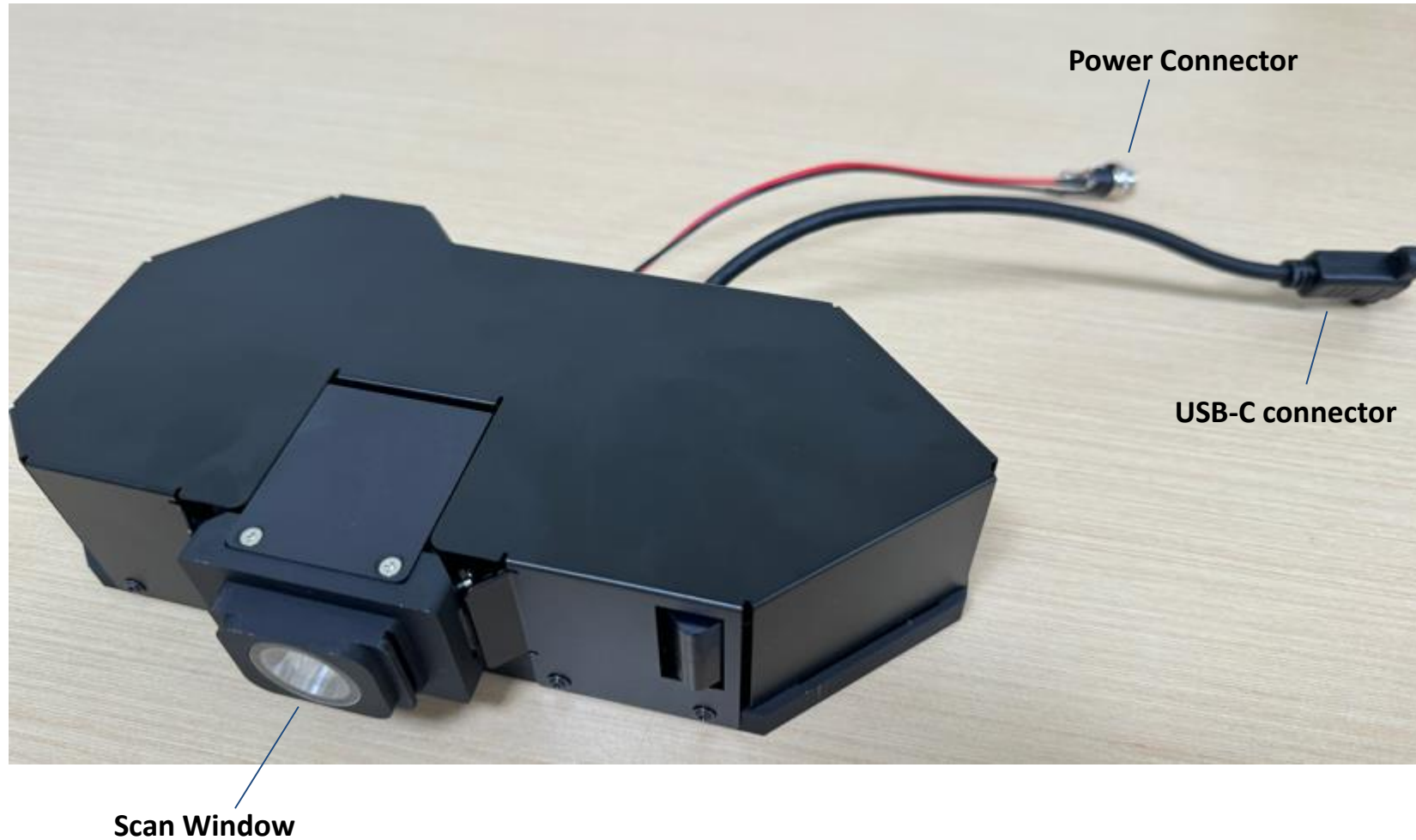
2024/7/5

Specification

- Wavelength Range: 900 to 2400nm
- Signal-to-Noise Ratio (SNR): 3,000:1 @2200nm
- Optical Resolution: 10nm~12nm
- Wavelength Accuracy: Typ. ± 1 nm
- Detector: InGaAs (Uncooled)
- Slit Size: 1.8mm * 0.025mm
- Scan Capability: Linear(Column) / Hadamard / Slew Scan
- Illumination Module: one 5W tungsten filament lamp with reflector
- Lamp Life: 10,000 hours
- Scan Window: sapphire glass
- Collection Region: Typ. 16mm in diameter
- Working Distance: The working distance is defined from the bottom of the sample to the surface of the scanning window, including the container thickness. The sensitivity is better when the working distance is within 5mm, and 2mm is the best.
- Communication Interface: USB-C
- Power Supply for Spectrometer : 5V/3A (AC Adapter included)
- Dimensions (R15 / R16) : 195.5*114.5*45 mm³ / 208*126*70 mm³
- Weight (R15 / R16) : < 0.8 kg / < 1.5 kg
- Operating Temperature: 0 ~ 40 °C, RH Max. 85%



Appearance & Interface (R15)



Appearance & Interface (R16)



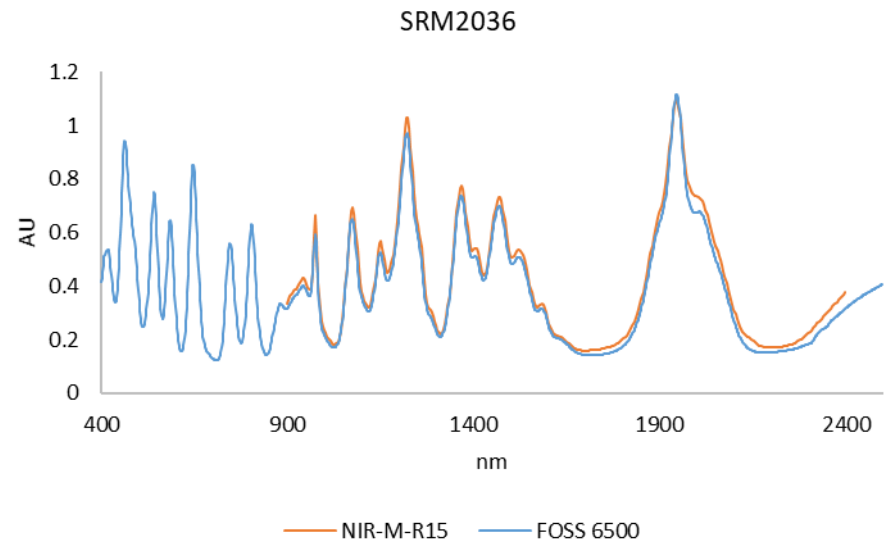
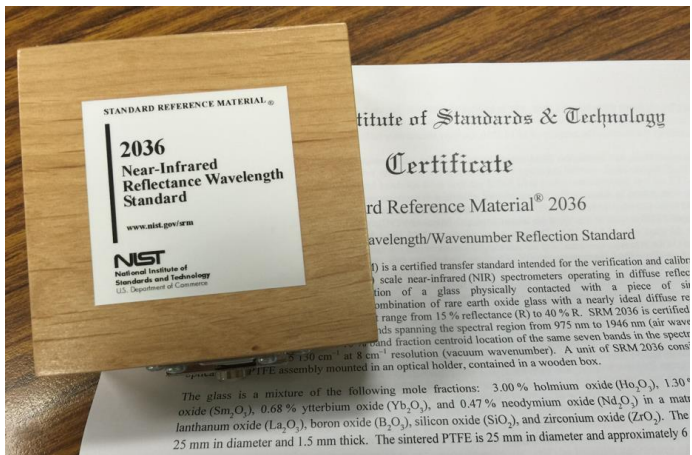
Power & USB Connection



5V/3A Power Adapter

Performance

- Spectral response and wavelength accuracy are verified with NIST SRM2036.
- The spectral response of NIR-M-R15 is very close to that of FOSS 6500 in the range of 900 nm to 2400 nm. Wavelength accuracy is within +/-1nm.

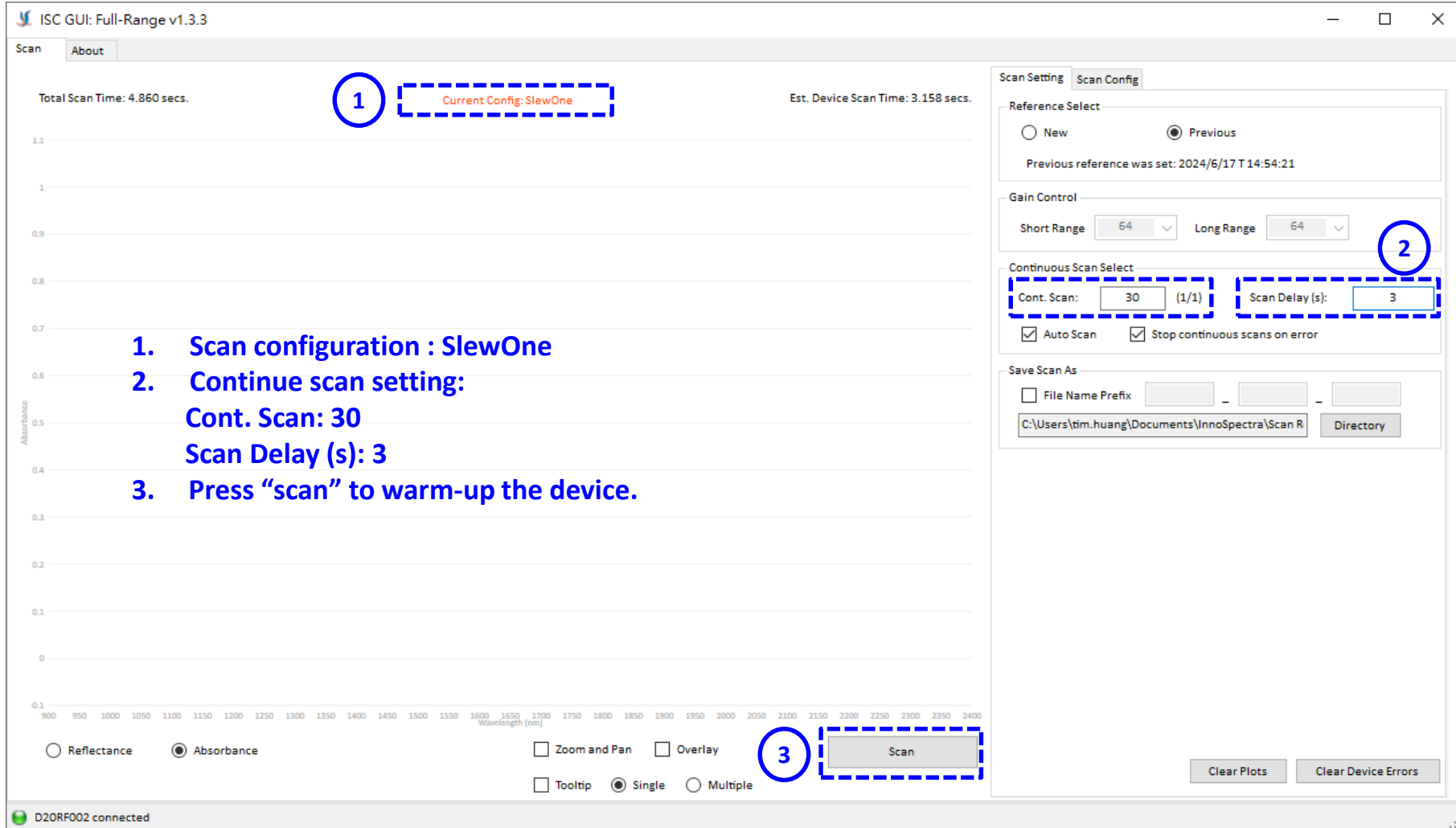


Expected Wavelength (nm)	Actual Wavelength (nm)	Offset (nm)
975.9	975.821959	-0.078041
1075.8	1075.655248	-0.144752
1151	1150.845079	-0.154921
1222.1	1222.321757	0.221757
1367.3	1367.64089	0.34089
1469.5	1469.611613	0.111613
1945.6	1945.403669	-0.196331

Software Operation

Warm Up

- It is recommended to warm up the lamp before a formal scan. You can set up a continuous scan to warm up the lamp. The intermittent lighting mode can be set for continuous scanning, for example, 30 consecutive scans with an interval of 3 seconds each time.



ISC GUI: Full-Range v1.3.3

Scan | About

Total Scan Time: 4.860 secs. **1** Current Config: SlewOne Est. Device Scan Time: 3.158 secs.

1. Scan configuration : SlewOne

2. Continue scan setting:
Cont. Scan: 30
Scan Delay (s): 3

3. Press "scan" to warm-up the device.

Reference Select
☐ New ☒ Previous
Previous reference was set: 2024/6/17 T 14:54:21

Gain Control
Short Range 64 Long Range 64 **2**

Continuous Scan Select
Cont. Scan: 30 (1/1) Scan Delay (s): 3
☒ Auto Scan ☒ Stop continuous scans on error

Save Scan As
☐ File Name Prefix - -
C:\Users\tim.huang\Documents\InnoSpectra\Scan R Directory

900 950 1000 1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 2100 2150 2200 2250 2300 2350 2400

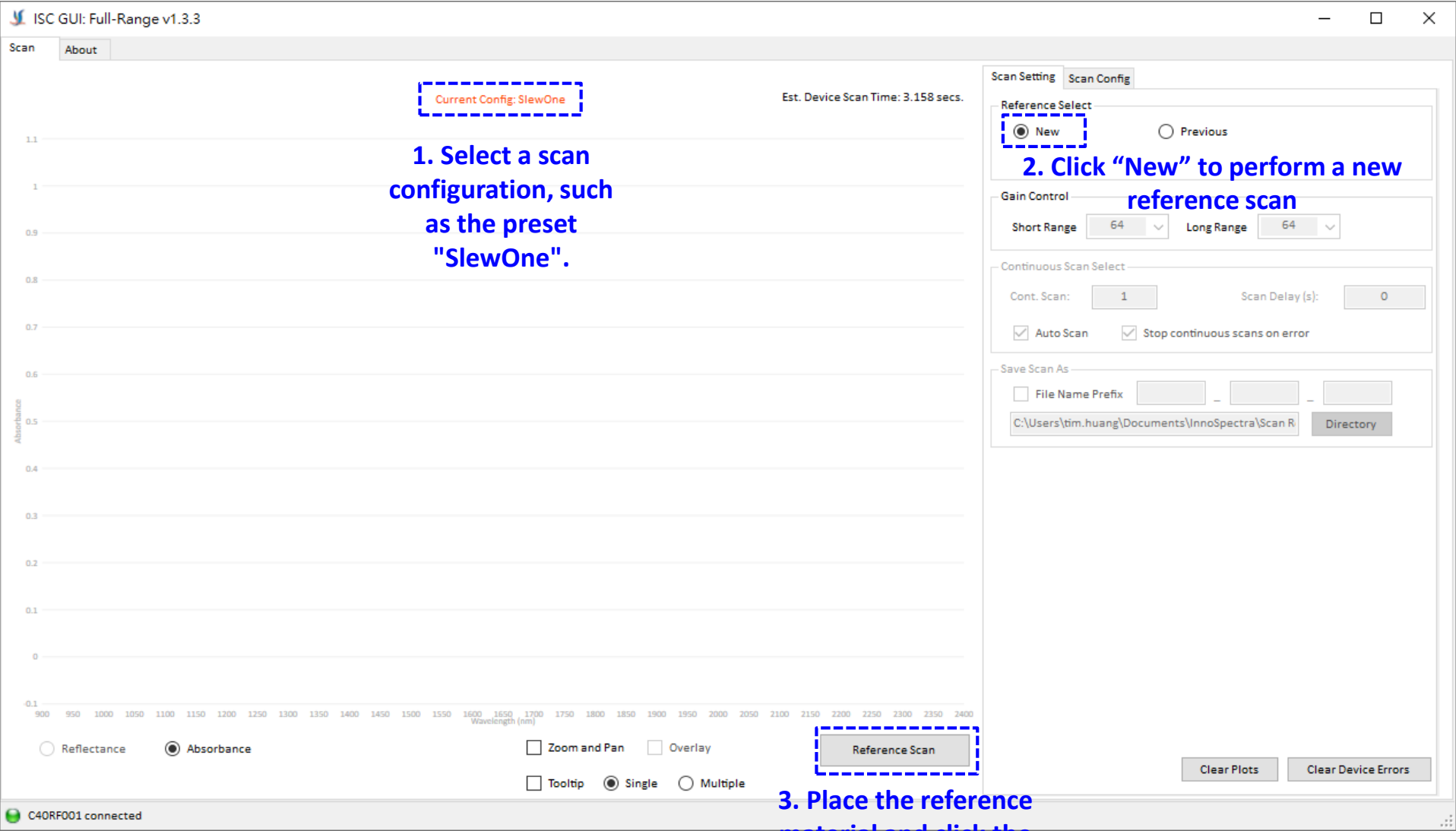
Wavelength (nm)

☐ Reflectance ☒ Absorbance ☐ Zoom and Pan ☐ Overlay **3** Scan
☐ Tooltip ☒ Single ☐ Multiple

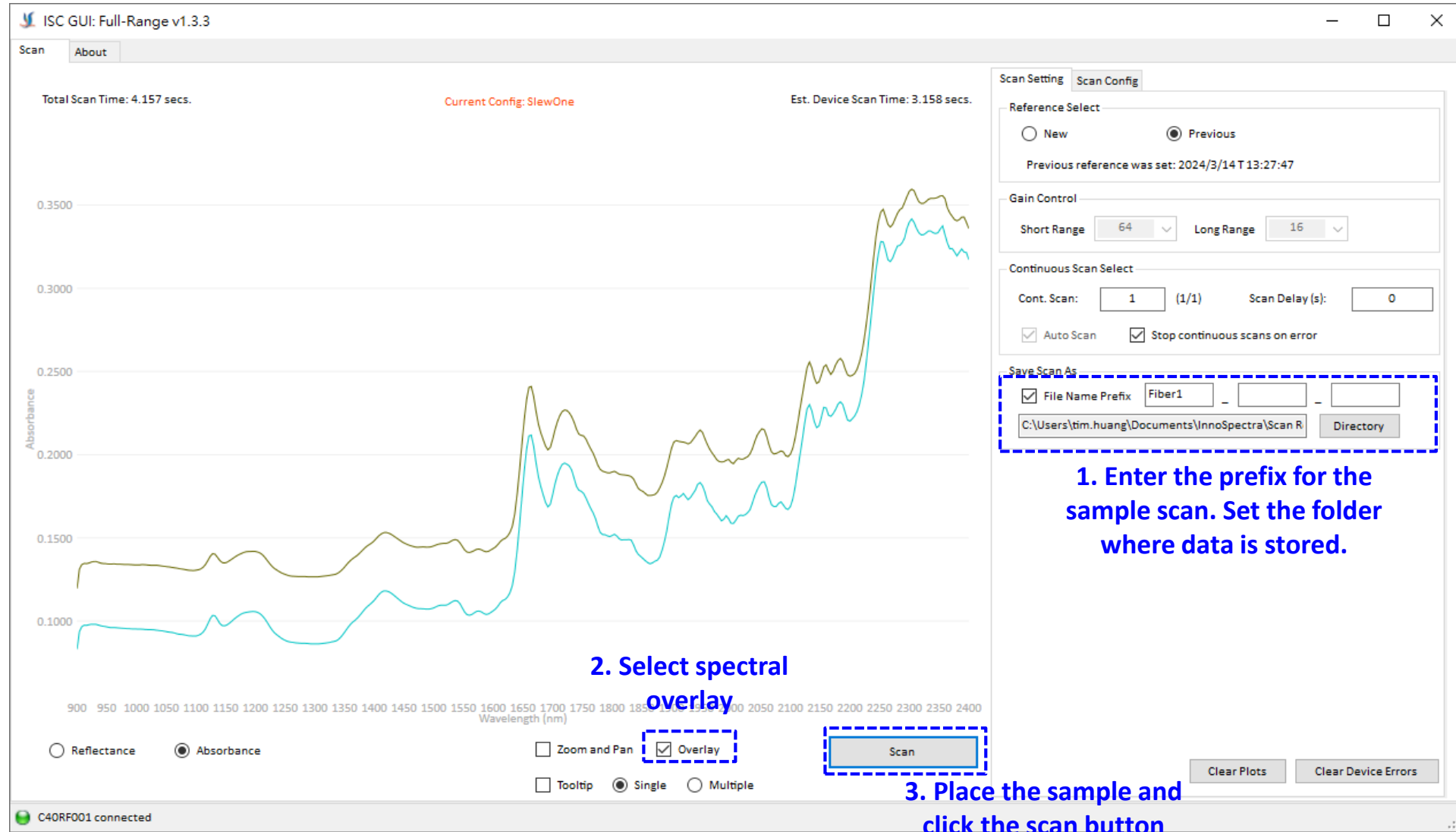
D20RF002 connected

Clear Plots Clear Device Errors

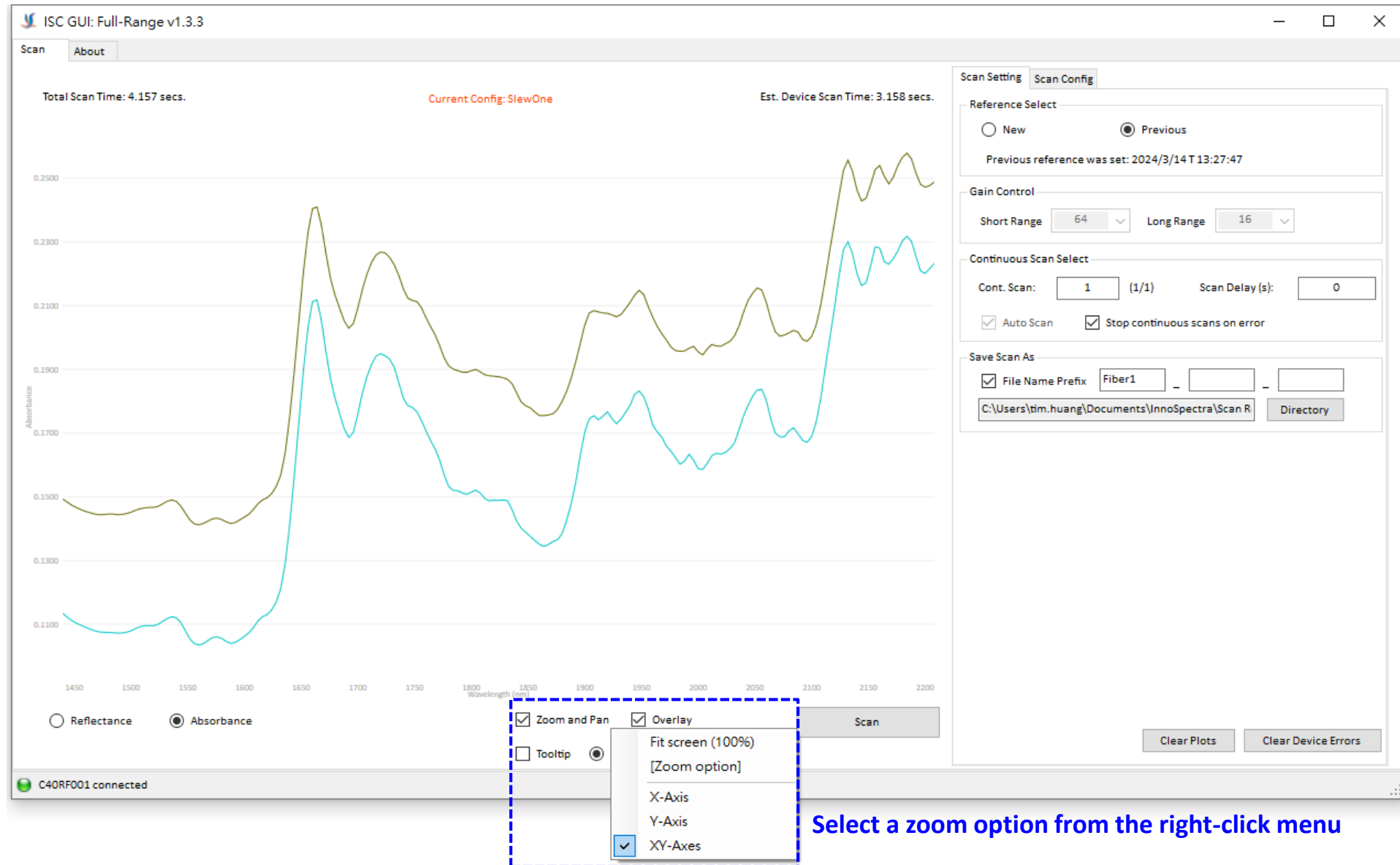
Reference Scan



Sample Scan

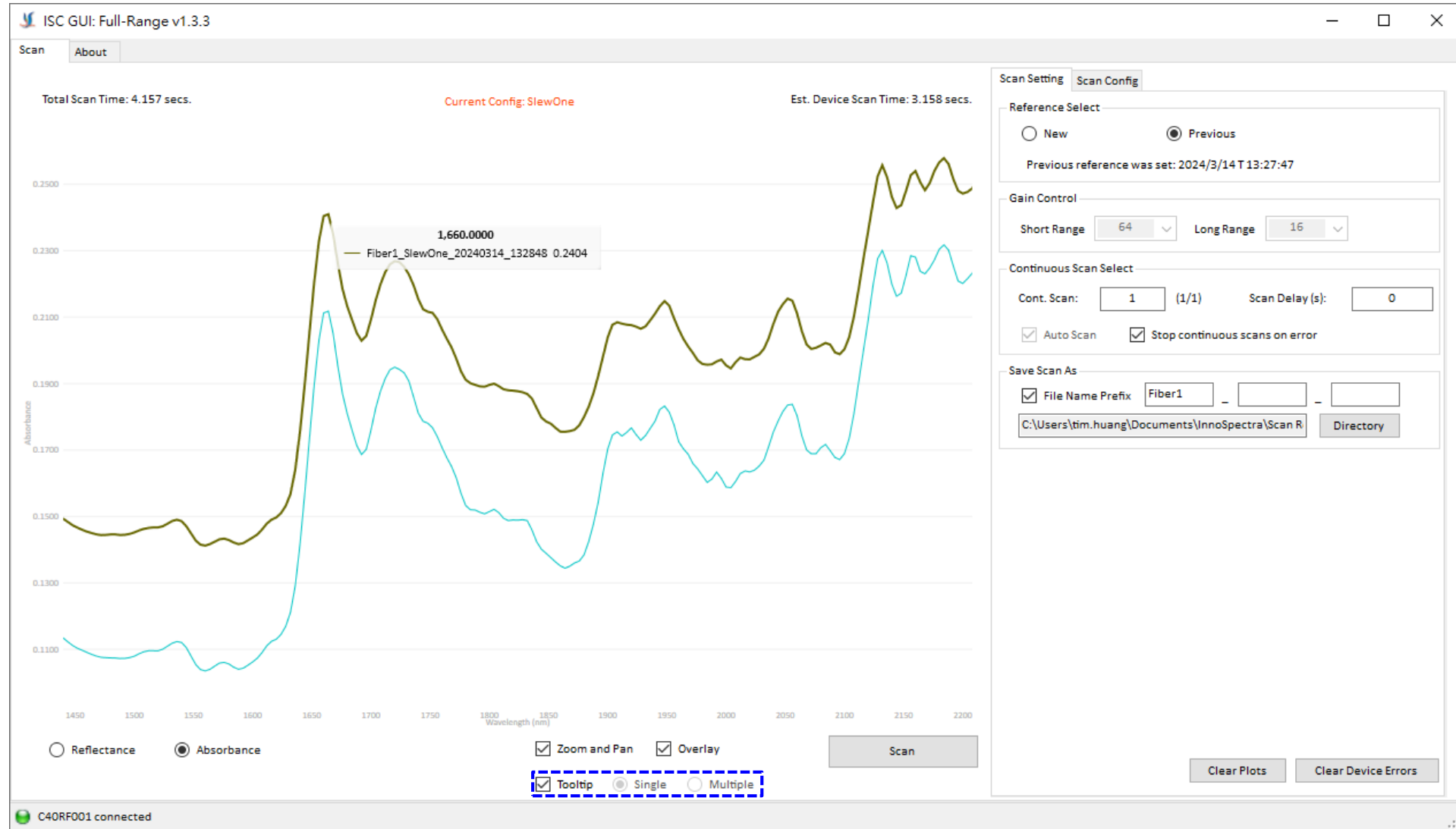


Zoom and Pan

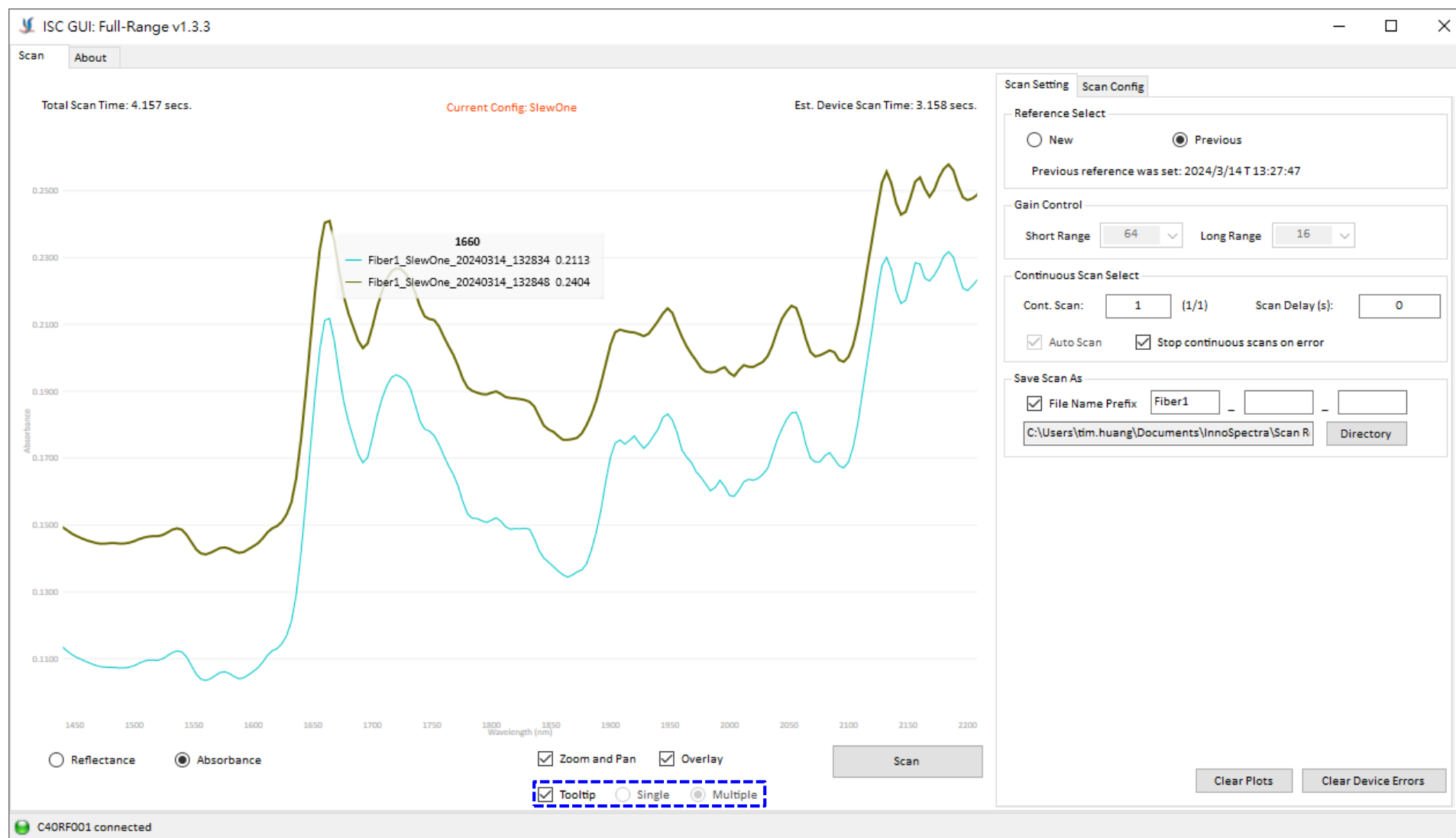


Select a zoom option from the right-click menu

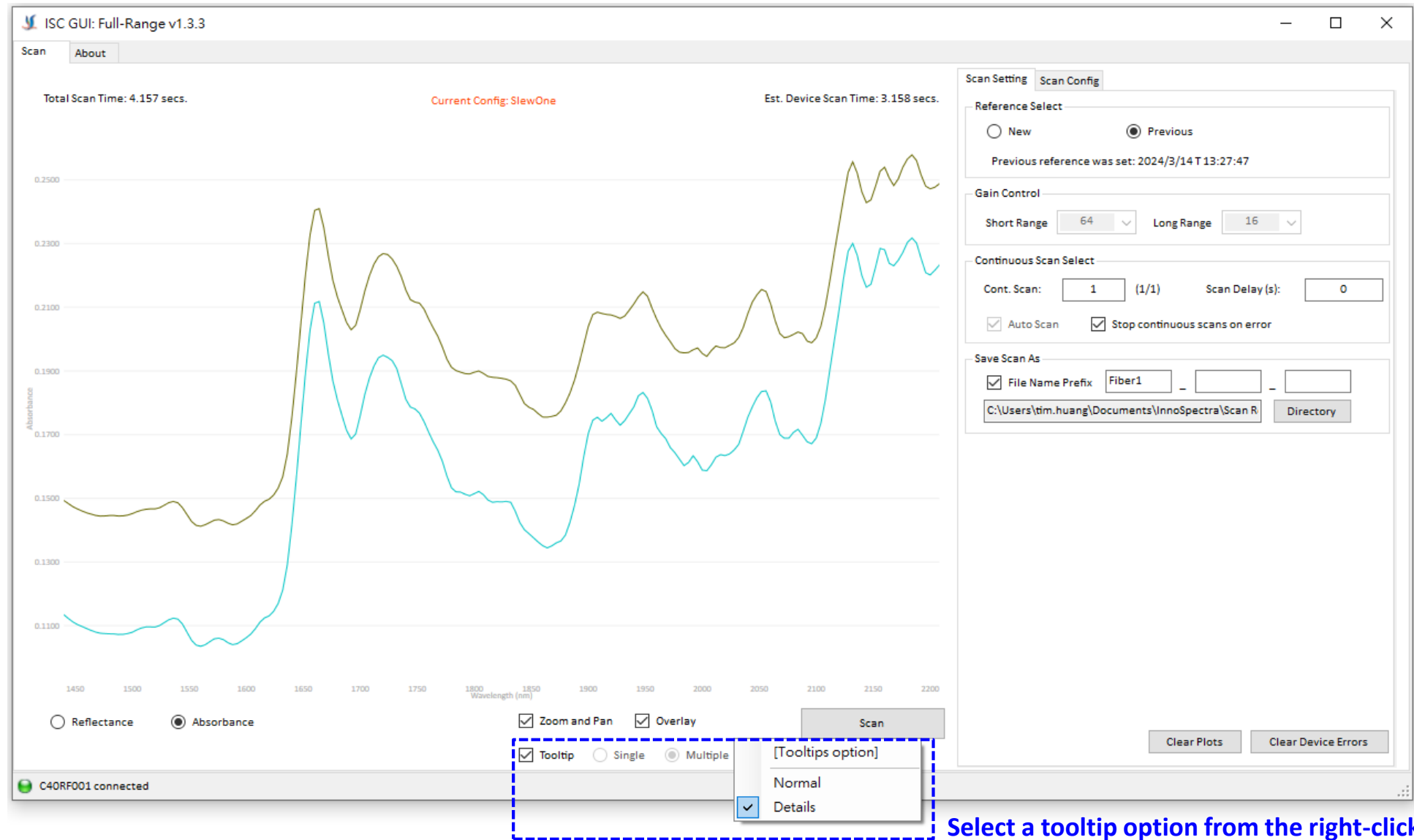
Tooltip (Single)



Tooltip (Multiple)

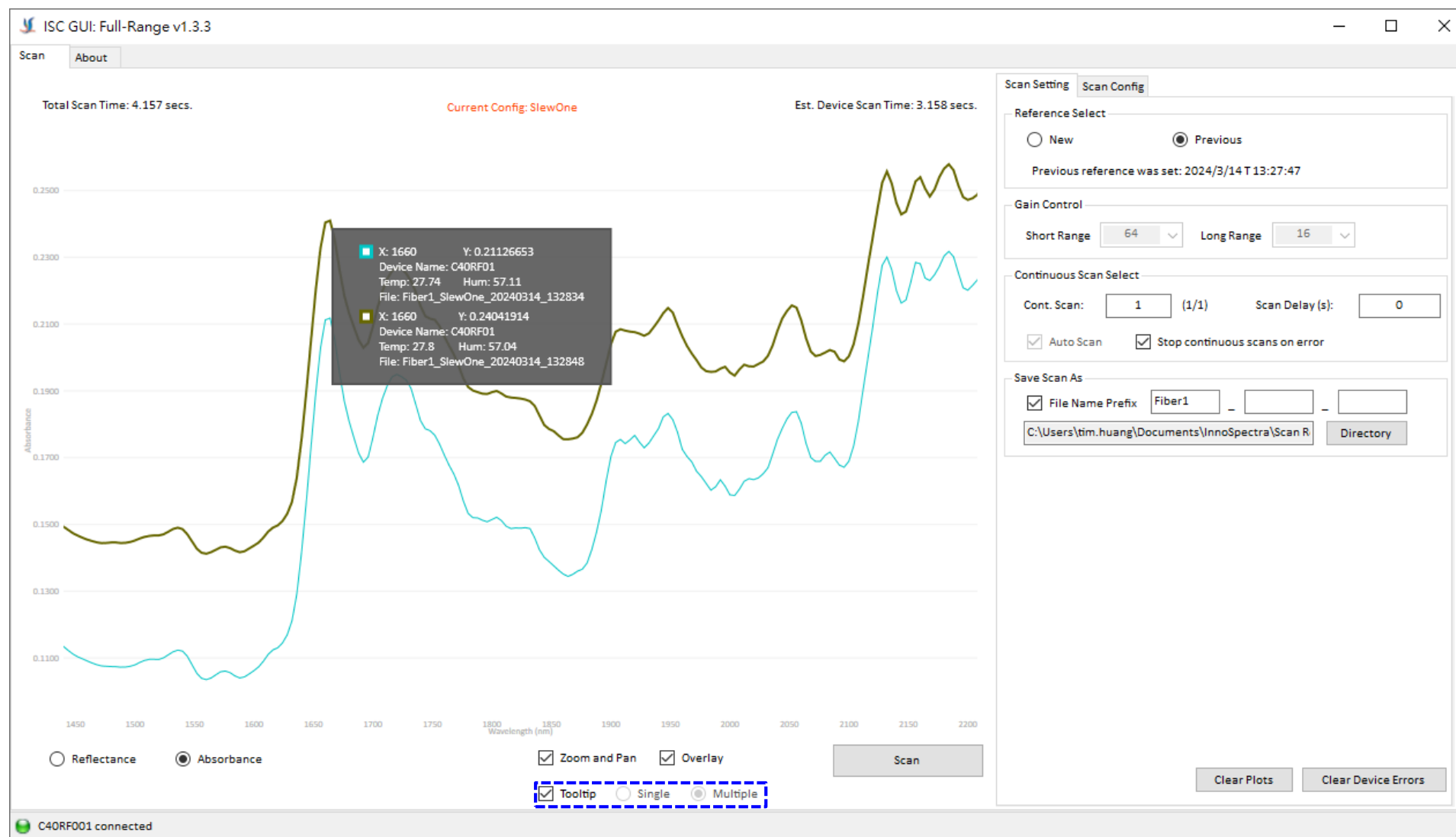


Tooltip (Option)



Select a tooltip option from the right-click menu

Tooltip (Details)



Scan Configuration & Output Files



Scan Setting Scan Config

Device configurations

SlewOne

Set Configuration

Details

Name SlewOne Num Scans to Avg. 6

Short Range Long Range

Scan Type Col Had

Spectral Range Start 900 1650

Spectral Range End 1650 2400

Width (nm) 7.03 10

Exposure Time (ms) 0.635 1.27

Digital Resolution 228 160

Oversampling 2.0 2.0

New Edit Delete Save Cancel

Fiber1_SlewOne_20240308_095244.xlsx - Excel			Fiber1_SlewOne_20240308_095244_SR.csv - Excel			Fiber1_SlewOne_20240308_095244_LR.csv - Excel			Fiber1_SlewOne_20240308_095244_FR.csv - Excel									
A B C			A B C			A B C			A B C D E F G H I J K L M									
1 Wavelength Absorbance (AU)			1 ***Scan Config Information***			1 ***Scan Config Information***			1 Wavelength Absorbance (AU)									
2	900	0.126161450239765	2	Scan Config SlewOne		2	Scan Config SlewOne		2	900	0.126161							
3	904	0.137702679398073	3	Scan Config Slew		3	Scan Config Slew		3	904	0.137703							
4	908	0.140068326878128	4	Section Co/Column		4	Section Co/Hadamard		4	908	0.140068							
5	912	0.14096186155591	5	Start Wave		5	Start Wave		5	912	0.140962							
6	916	0.141498166127025	6	End Wave		6	End Wave		6	916	0.141498							
7	920	0.14197236656901	7	Pattern Width		7	Pattern Width		7	920	0.141972							
8	924	0.142436812057768	8	Exposure (ms)		8	Exposure (ms)		8	924	0.142437							
9	928	0.142679986604697	9	Digital Resolution		9	Digital Resolution		9	928	0.14268							
10	932	0.142579356736138	10	Num Repetitions		10	Num Repetitions		10	932	0.142579							
11	936	0.142114498184245	11	PGA Gain		11	PGA Gain		11	936	0.142114							
12	940	0.14153277093364	12	System Temperature		12	System Temperature		12	940	0.141533							
13	944	0.140785781687098	13	Humidity (%)		13	Humidity (%)		13	944	0.140786							
14	948	0.140072401605488	14	Data Date-Time		14	Data Date-Time		14	948	0.140072							
15	952	0.139611711078448	15			15			15	952	0.139612							
16	956	0.139206868597475	16	***General Information***		16	***General Information***		16	956	0.139207							
17	960	0.138818650669218	17	Model Name		17	Model Name		17	960	0.138819							
18	964	0.138546613035285	18	Serial Number		18	Serial Number		18	964	0.138547							
19	968	0.138411438345879	19	GUI Version		19	GUI Version		19	968	0.138411							
20	972	0.138235948324227	20	TIVA Version		20	TIVA Version		20	972	0.138236							
21	976	0.137990771146795	21	DLPC Version		21	DLPC Version		21	976	0.137991							
22	980	0.137738144662575	22	Main Board		22	Main Board		22	980	0.137738							
23	984	0.137557834441716	23	Detector		23	Detector		23	984	0.137558							
24	988	0.137459244219242	24			24			24	988	0.137459							
25	992	0.137233276469929	25			25			25	992	0.137233							
26	996	0.137055881727987	26	***Scan Data***		26	***Scan Data***		26	996	0.137056							
27	1000	0.136898497323177	27	Wavelength Absorbance Reference		27	Wavelength Absorbance Reference		27	1000	0.136898							
28	1004	0.136702328876214	28	901.02 0.129372 368816		28	1601.68 0.143766 438687		28	1004	0.136702							
29	1008	0.136556606692399	29	904.97 0.139403 397975		29	1607.68 0.145922 438969		29	1008	0.136557							
30	1012	0.136373684587492	30	908.92 0.140473 427533		30	1613.68 0.148546 435836		30	1012	0.136374							
31	1016	0.13631303085119	31	912.86 0.141089 462034		31	1619.66 0.14965 432433		31	1016	0.136313							
32	1020	0.136264308306007	32	918.11 0.141748 517904		32			32	1020	0.136264							
33	1024	0.136161322734561	33	922.04 0.142195 567007		33			33	1024	0.136161							
34	1028	0.136016136422531	34	925.97 0.142726 624741		34			34	1028	0.136016							
35	1032	0.135852442375234	35	929.89 0.142683 691061		35			35	1032	0.135852							
36	1036	0.135687123839494								1036	0.135687							
37	1040	0.135541378620397								1040	0.135541							
38	1044	0.135304643141465								1044	0.135305							
39	1048	0.135075253245778								1048	0.135075							
40	1052	0.134852381746542								1052	0.134852							
41	1056	0.134533669789994								1056	0.134534							
42	1060	0.134223730448405								1060	0.134224							
43	1064	0.13406687378027								1064	0.134067							

X:\Users\XXX\Documents\InnoSpectra\Scan Results

Fiber1_SlewOne_20240308_095244.xlsx

Fiber1_SlewOne_20240308_095244_FR.csv

Fiber1_SlewOne_20240308_095244_LR.csv

Fiber1_SlewOne_20240308_095244_SR.csv

X:\Users\XXX\Documents\InnoSpectra\Scan Results

- Fiber1_SlewOne_20240308_095244.xlsx
- Fiber1_SlewOne_20240308_095244_FR.csv
- Fiber1_SlewOne_20240308_095244_LR.csv
- Fiber1_SlewOne_20240308_095244_SR.csv

Sample Measurement #1

Spectrometers and Samples

- Scanning tests were performed using 4 spectrometers, all from InnoSpectra. Scan the white reference material first, then scan the samples.
- Samples are filled into a Petri dish (optical grade, glass bottom) for measurement.

NIR-M-R2
900-1700nm



NIR-M-R11
1350-2150nm



NIR-M-R13
1600-2400nm



NIR-M-R15
900-2400nm



White Reference

Sample #1
Milk Powder

Sample #2
Flour



Scan Configurations

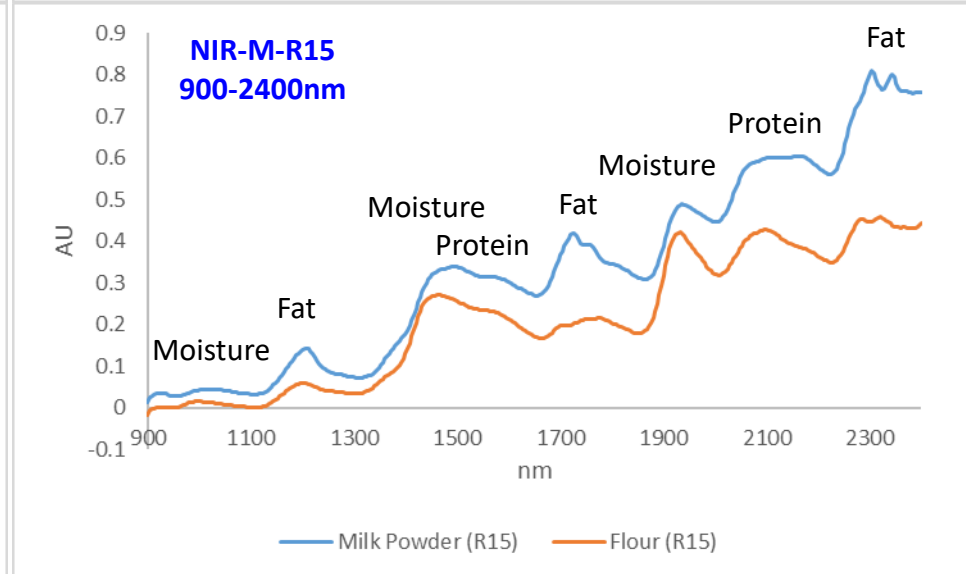
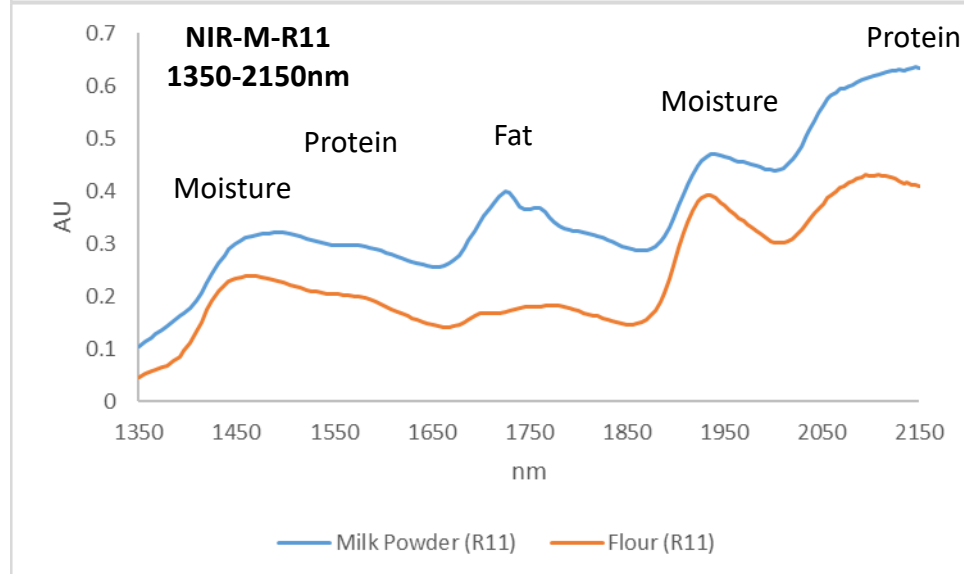
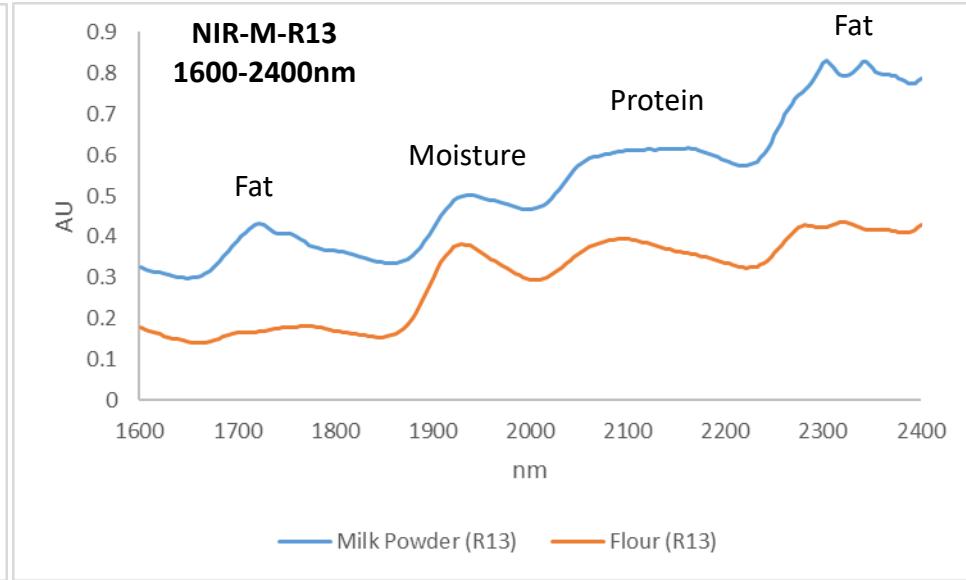
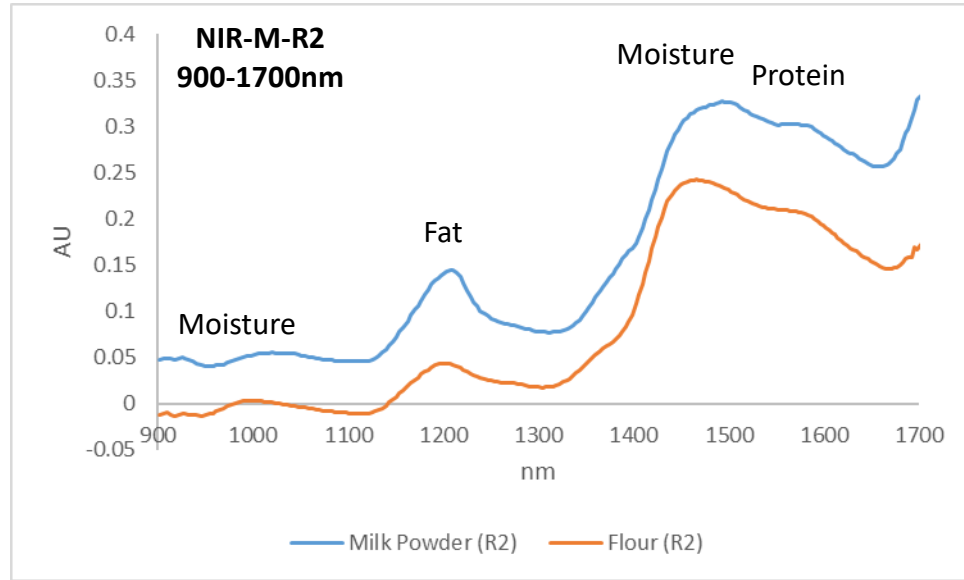


- The NIR-M-R15 supports simultaneous scanning via a **slew scan** configuration. The 900-1700nm band and the 1600-2400nm band are scanned simultaneously. **This patented design cuts scanning time of 900-2400nm in half.**

Spectrometer:	NIR-M-R2	NIR-M-R11	NIR-M-R13	NIR-M-R15	
Section Config Type:	Hadamard	Hadamard	Hadamard	Column	Hadamard
Start Wavelength (nm):	900	1350	1600	900	1600
End Wavelength (nm):	1700	2150	2400	1700	2400
Pattern Width (nm):	7.03	10.54	12	7.02	10
Exposure (ms):	0.635	0.635	1.27	0.635	1.27
Digital Resolution:	228	160	200	228	160
Num Repeats:	6	12	15	6	6
PGA Gain:	16	4	8	64	16

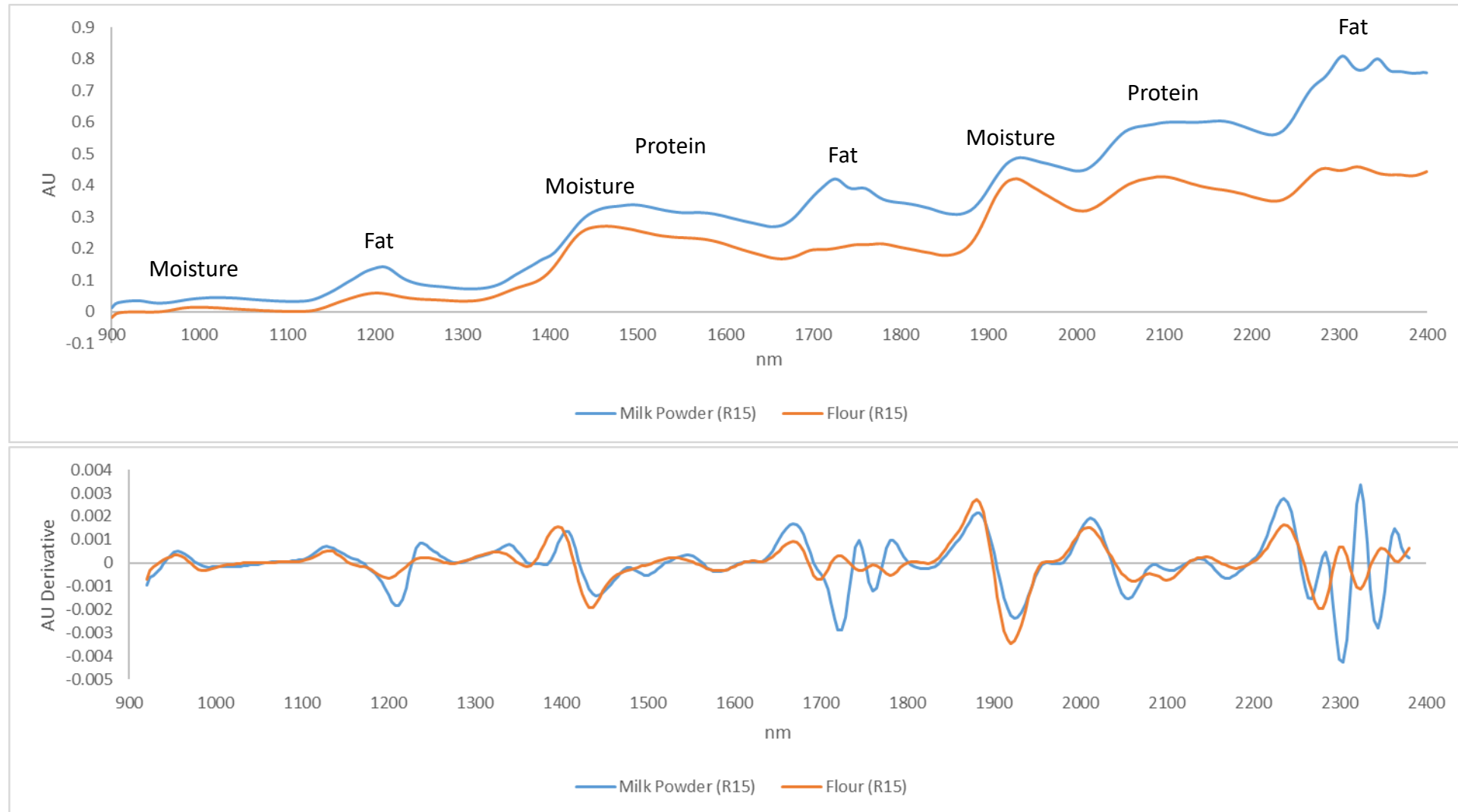
Measurement Results

- The longer the wavelength, the higher the absorbance and the more dispersed the absorption bands of different components.



- The longer the wavelength, the higher the absorbance (more sensitive) and the more dispersed the absorption bands of different components.

If the sample has high NIR absorptivity, the absorbance may be saturated (distorted) in the longer wavelength range. For example, if the sample is water rich, the NIR absorption may be normal (no saturation/distortion) in the 1450 nm band, but will be saturated in the 1930 nm band. In this experiment, the sample is not rich in moisture, so both 1450nm and 1930nm can be used to monitor moisture levels.



Sample Measurement #2

Spectrometers and Samples

- Scanning tests are performed using NIR-M-R15. Scan the white reference material first, then scan the samples.
- Place soil samples into Petri dish (optical grade, glass bottom) for measurement.
- Scan Configuration: SlewOne (Default)

NIR-M-R15
900-2400nm



Scan
Configuration

Scan Config Name:	SlewOne	
Section Config Type:	Column	Hadamard
Start Wavelength (nm):	900	1600
End Wavelength (nm):	1700	2400
Pattern Width (nm):	7.02	10
Exposure (ms):	0.635	1.27
Digital Resolution:	228	160
Num Repeats:	6	6
PGA Gain:	64	8

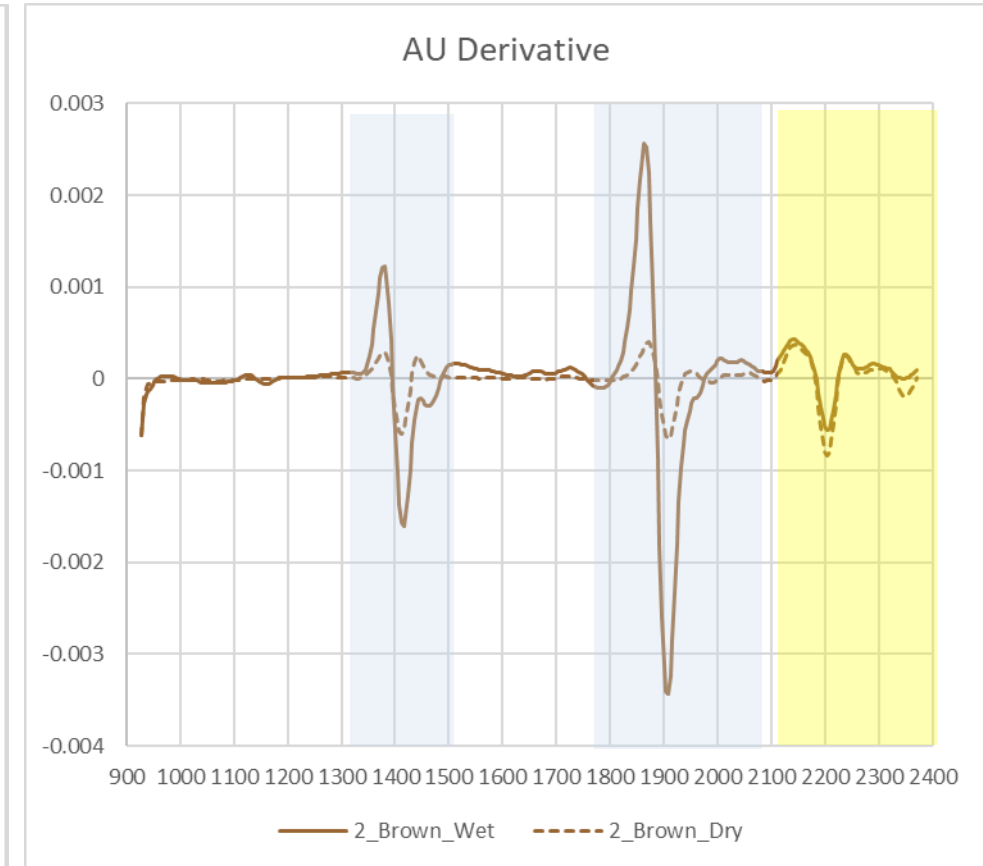
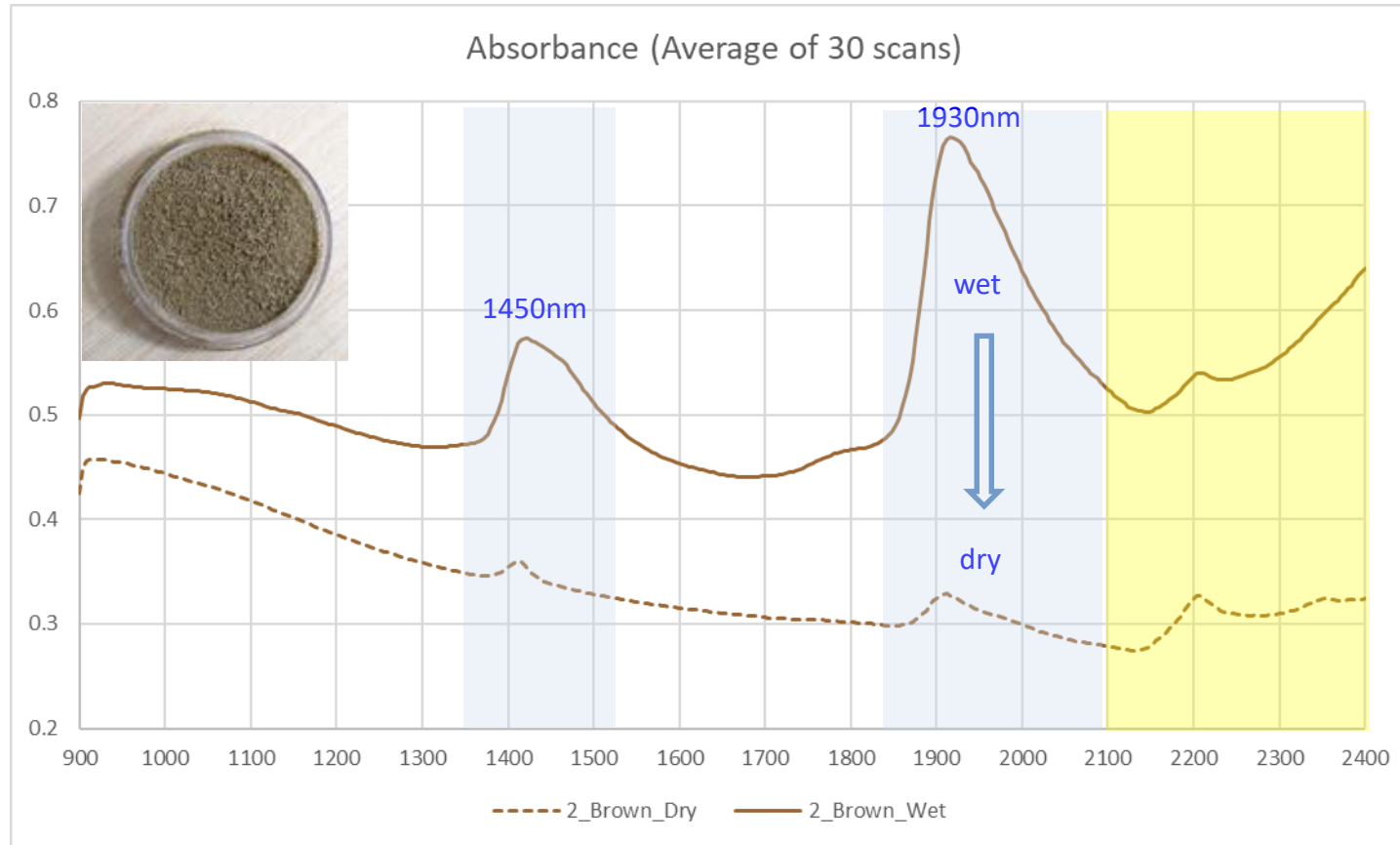
Sample #1
dark soil

Sample #2
brown soil



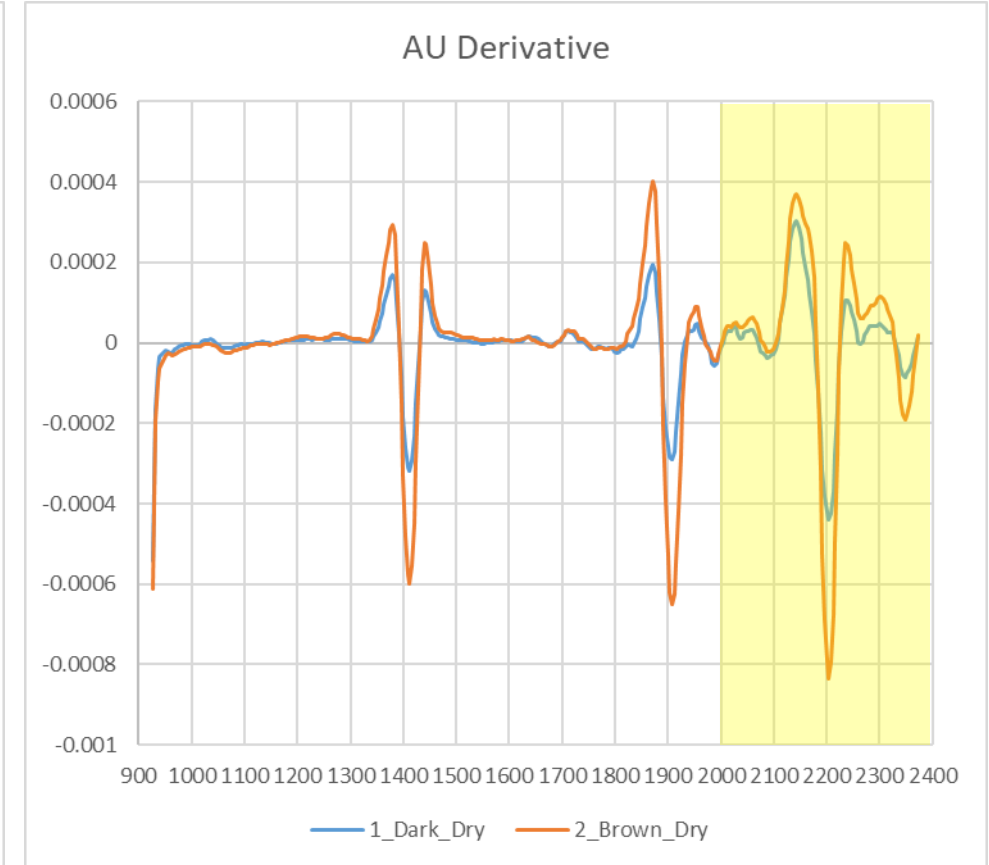
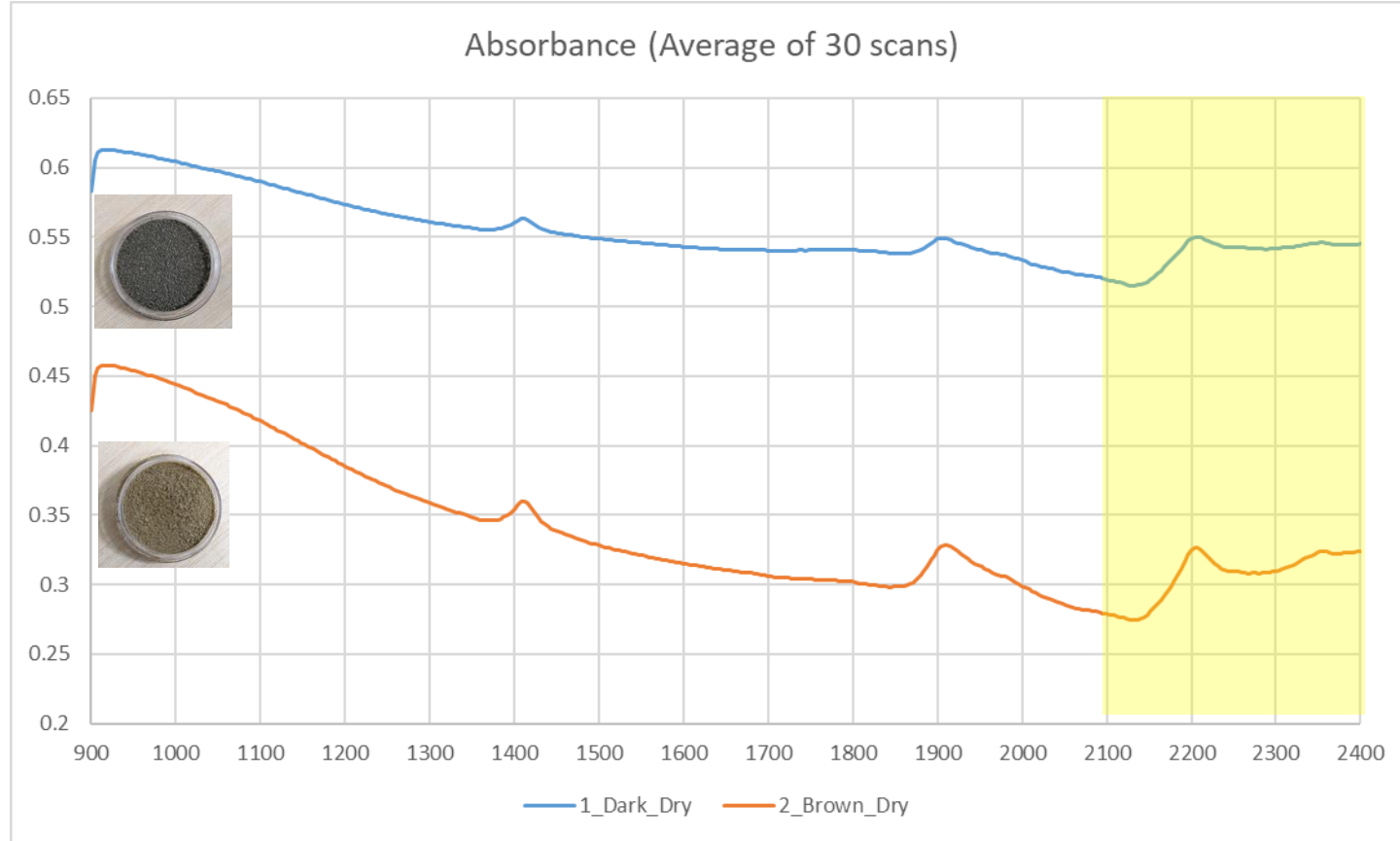
Measurement Results

- Typical water absorption bands in the NIR spectrum are at 1450nm and 1930nm. When sample is wet, the absorbance will be dominated by water absorption bands.



Measurement Results

- Absorbance average of 30 scans
- Cubic spline resampling: range=900~2400nm, step=4nm.
- Savitzky-Golay smoothing: derivative=2, polynomial order=2, window size=15.



Sample Measurement #3

Spectrometers and Samples

- Scanning tests are performed using NIR-M-R15. Scan the white reference material first, then scan the samples.
- Scan Configuration: SlewOne (Default)

NIR-M-R15
900-2400nm



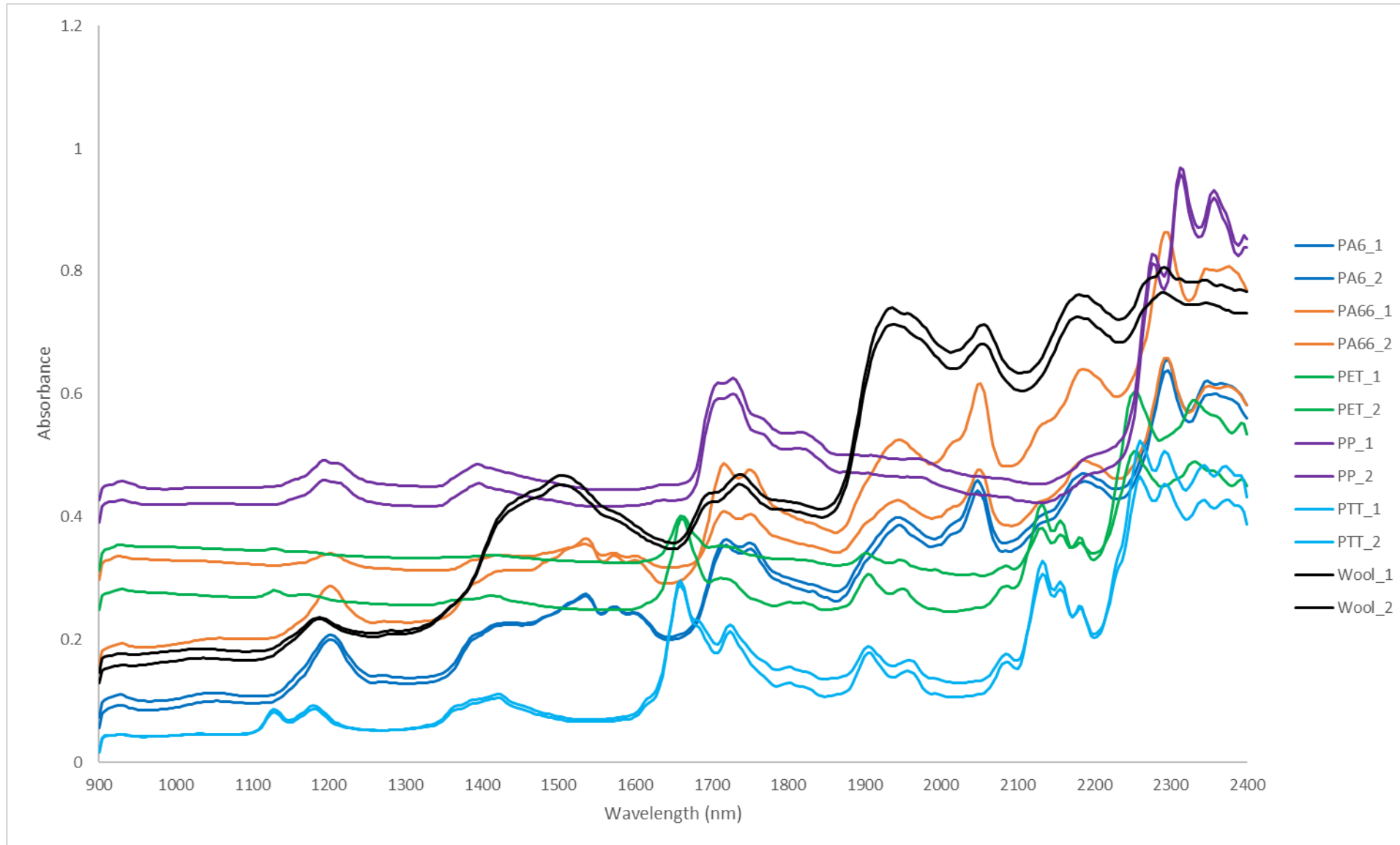
Scan
Configuration

Scan Config Name:	SlewOne	
Section Config Type:	Column	Hadamard
Start Wavelength (nm):	900	1600
End Wavelength (nm):	1700	2400
Pattern Width (nm):	7.02	10
Exposure (ms):	0.635	1.27
Digital Resolution:	228	160
Num Repeats:	6	6
PGA Gain:	64	8

Samples: Carpets of different materials



Measurement Results



Thank You