



NIRscan Nano Spectrometer

June 1, 2018



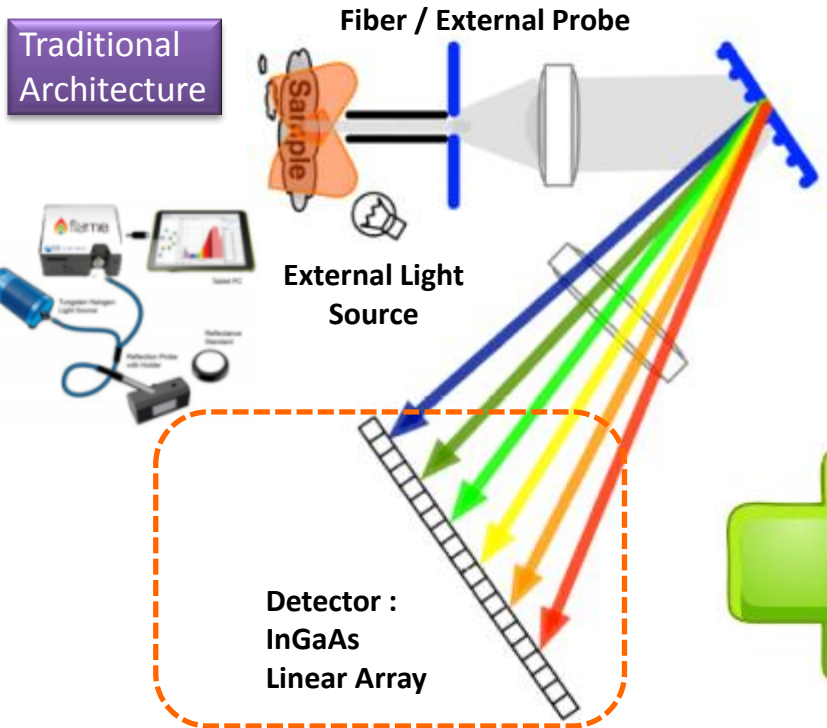
Responsibility Innovation Superiority Entrepreneurship

General Introduction

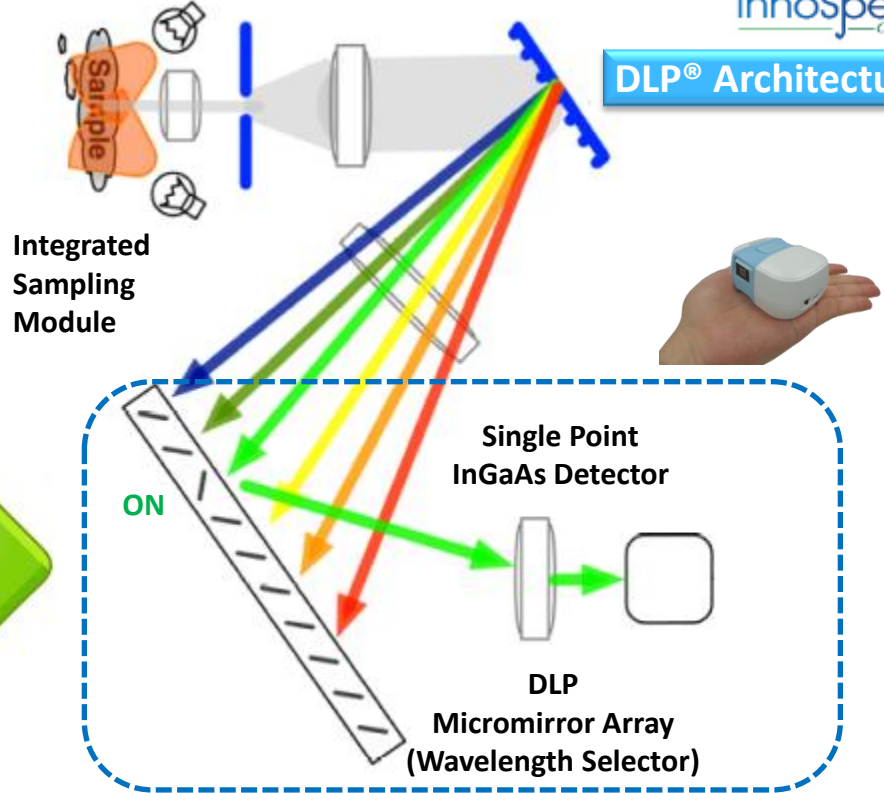
Advantage of DLP® Architecture



Traditional Architecture



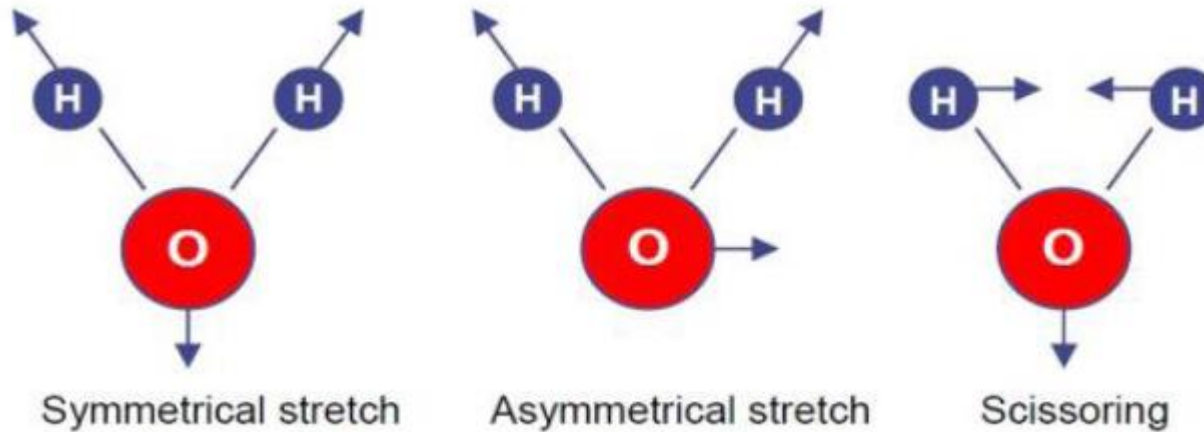
DLP® Architecture



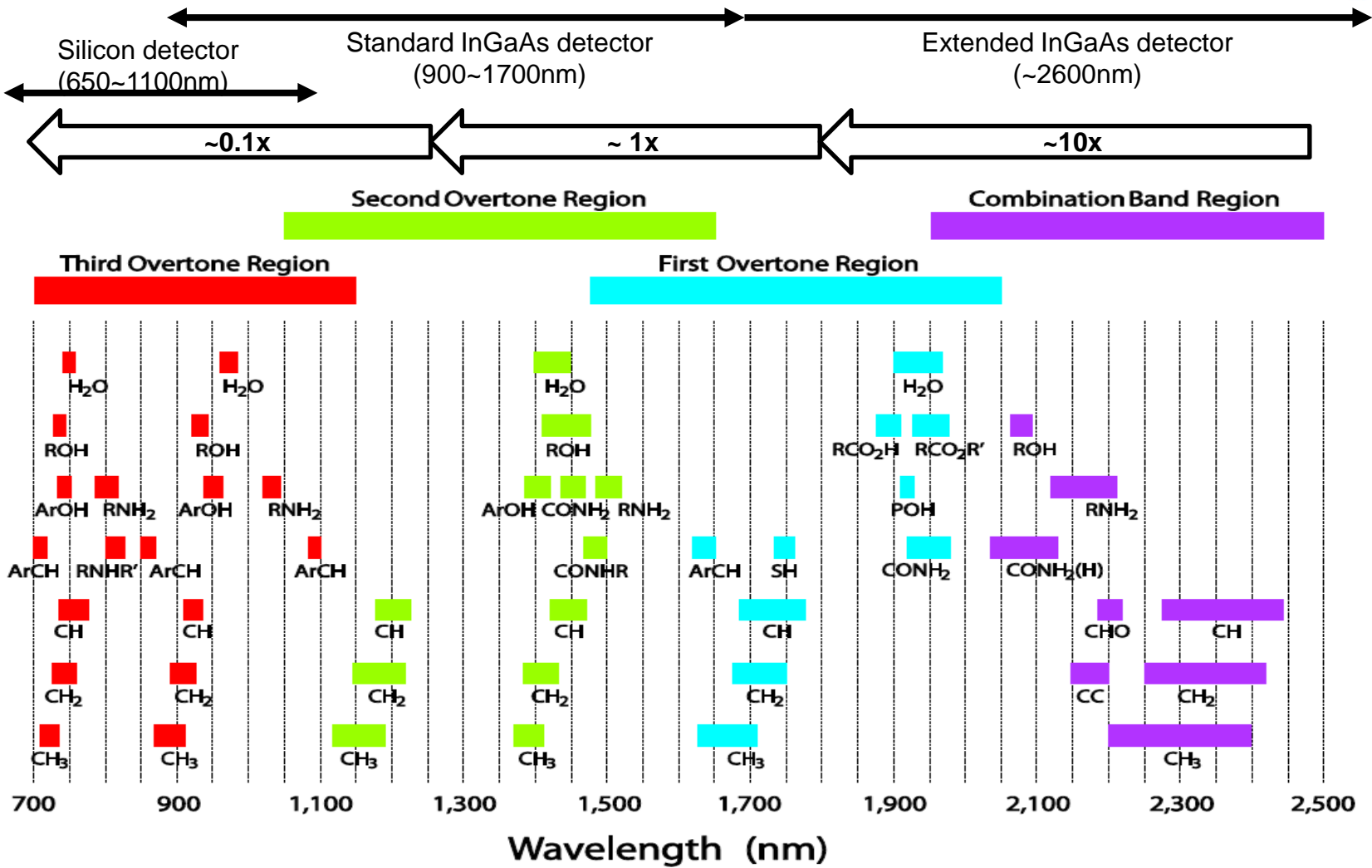
Traditional Architecture	DLP® Architecture	Advantages
Small Pixel (e.g. 50um Pitch)	Large Sensing Area (e.g. Dia. 1mm)	<div style="background-color: #4682B4; color: white; padding: 5px; text-align: center;">Highly Integrated</div> <div style="background-color: #32CD32; color: white; padding: 5px; text-align: center;">Compact Design</div> <div style="background-color: #9ACD32; color: white; padding: 5px; text-align: center;">Programmable</div> <div style="background-color: #FF8C00; color: white; padding: 5px; text-align: center;">High C/P Value</div>
Limited Pixels (e.g. 128 Pixels)	High Resolution (e.g. 854x480)	
Non Programmable	Programmable (2D)	
Bulky	Compact & Integrated	
High Cost > \$6,000	Low Cost < \$1,000	

Vibration Spectroscopy

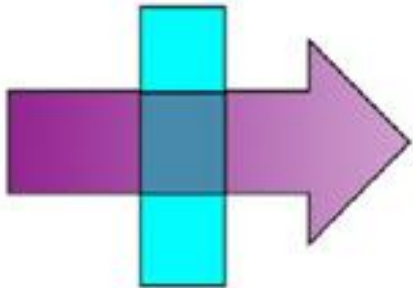
- Organic material with functional groups like O-H, C-H, N-H, etc.



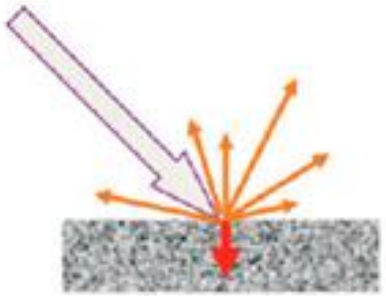
NIR (Combination / Overtone)



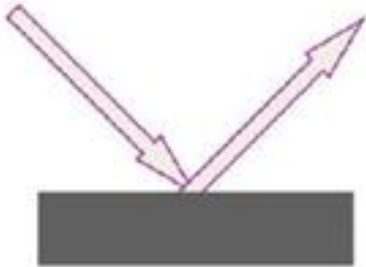
Measurement Mode



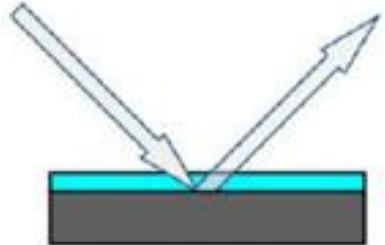
Transmission (liquid)
Transparent Samples



Diffuse Reflectance



Specular Reflectance "Mirror"
Smooth Surface Reflections



Transflectance or
Reflection-absorption



Diffuse Reflectance
Depth Dependency

DLP® NIR Spectrometer Product Line



Complete Product Line for Diverse Applications

Modules



Reflective Type (M-R2)

- Two integrated tungsten halogen lamps
- USB and UART
- Bluetooth Low Energy (Optional)
- 77 g



Fiber-input (M-F1)

- SMA905 Connector
- USB and UART
- Bluetooth Low Energy (Optional)
- < 65 g



Transmissive Type (M-T1)

- One integrated tungsten halogen lamp
- USB and UART
- Bluetooth Low Energy (Optional)
- < 100 g (w/o Cuvette)

Finish Goods



Reflective Model (S-G1)

- Built-in M-R1/R2 and Li-ion battery / BLE
- CE / FCC Certificates
- < 145 g (with battery)



Fiber-input Model (S-F2)

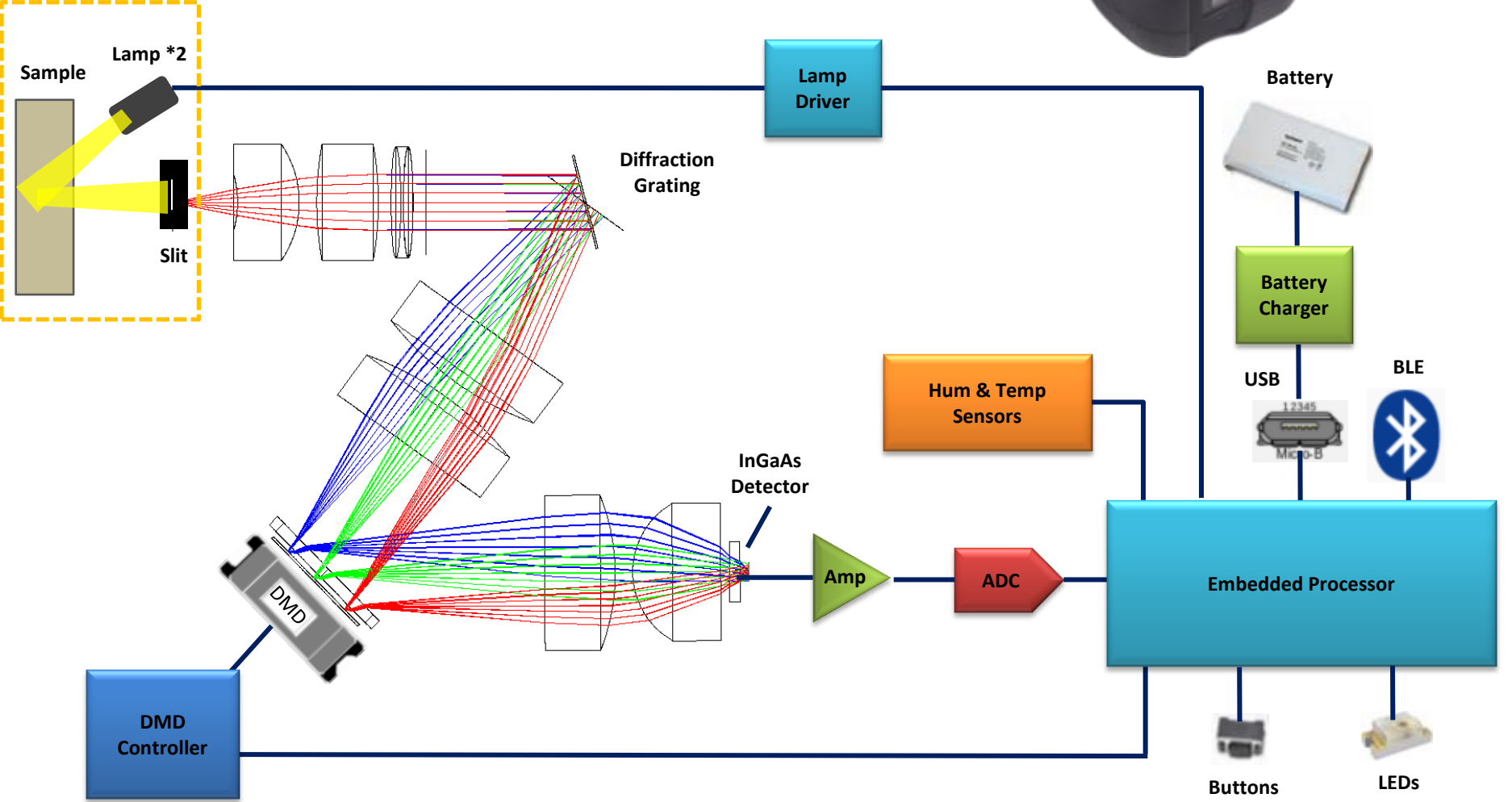
- Built-in M-F1
- < 125 g

NIR-S-G1



Model Name	NIR-S-G1	U2U absorbance consistency (Spectralon	Stdev < 0.02
Sampling method	Reflective	ADC	24-bit
ID	Design for Hnadheld and Mobile Application	Slit	1.8 x 0.025mm
Weight	<145g (Inlcuding 1000mAh Li-Po battery & BLE module)	Sample working distance	0.75mm+/-0.25mm from window
Size	82mm * 63mm * 42.5mm (Enclosure)	Scan capability	Linear/Hadamard/Slew Scan
Dispersing element	Plano grating plus DMD wavelength selector	Scan pattern	Programmable, up to 624 patterns.
Detector	Single 1mm InGaAs detector (uncooled) Equivalent to 128 pixels (scan pattern=6px, no overlapping) Equivalent to 256 pixels (scan pattern=6px, with overlapping)	Integration time	0.635ms~60.960ms (exposure time)
Wavelength selector	TI DMD DLP2010NIR, 854x480	Measurement time	Depends on scan configuration
Pixel to pixel interval	DMD: 1.17nm/pixel	Illumination source	Two integrated halogen tungsten lamps, 0,7W *2
Wavelength range	900-1700nm	Connectivity	USB, BLE
Resolution (FWHM)	10nm typical 12nm max	Wireless scan	via BLE
SNR	> 5000:1 in 1s scan	APP	iOS, Android
Thermal stability	average 0.0375nm/C, 25~50C	Data format	CSV and DAT output
Wavelength accuracy (SRM2036)	+/- 1nm typical	Power	USB (500mA@5V) and Li-ion battery 1000mAh@3.7V, 1000 times of scan per
Photometric linearity (Spectralon 2%/50%/75%/99%)	<ul style="list-style-type: none"> • slope = 1.0 ± 0.05 • intercept = 0.0 ± 0.05 • $R^2 > 0.985$ • RSME < 0.05 	Certification	FCC/IC, CE EMC, RF

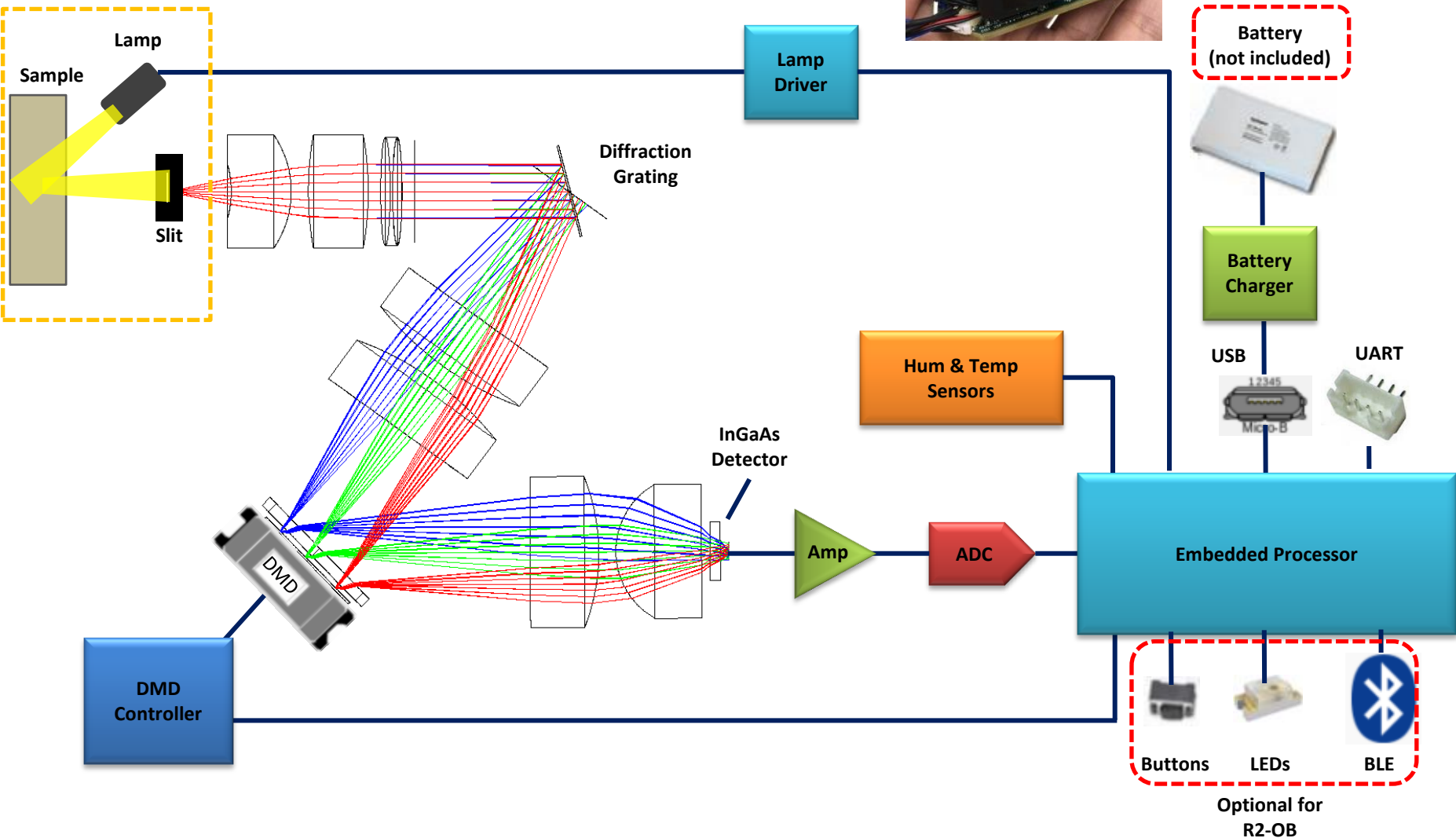
Block Diagram of NIR-S-G1



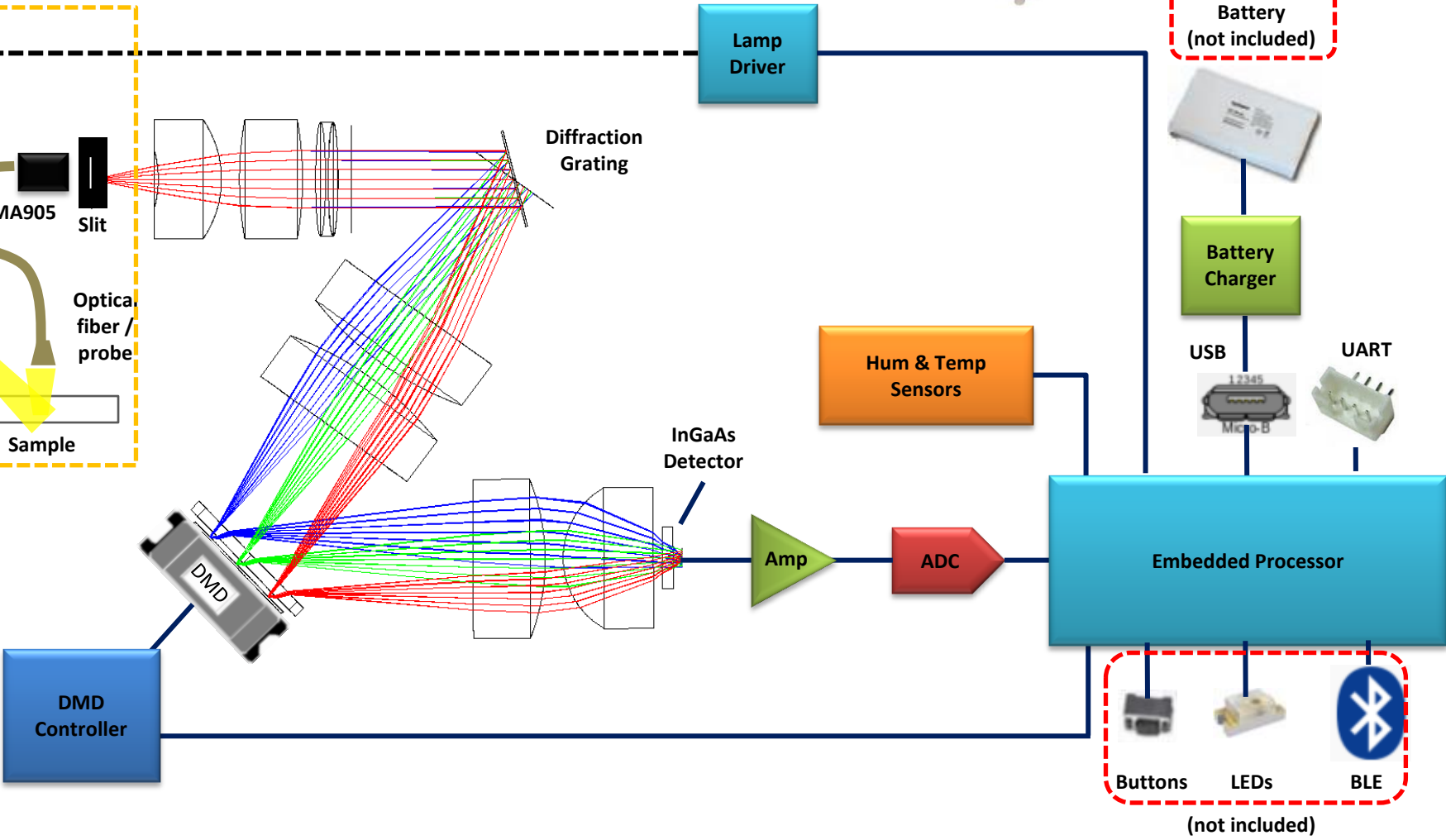
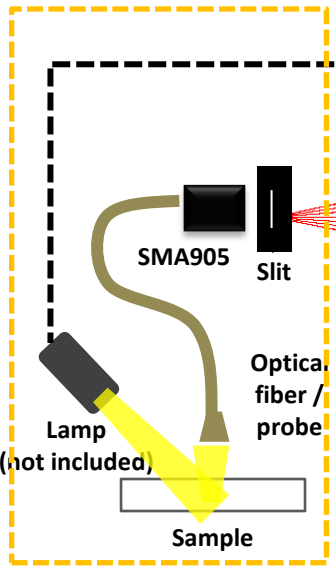
責任 · 創新 · 卓越 · 開創

Responsibility Innovation Superiority Entrepreneurship

Block Diagram of NIR-M-R2



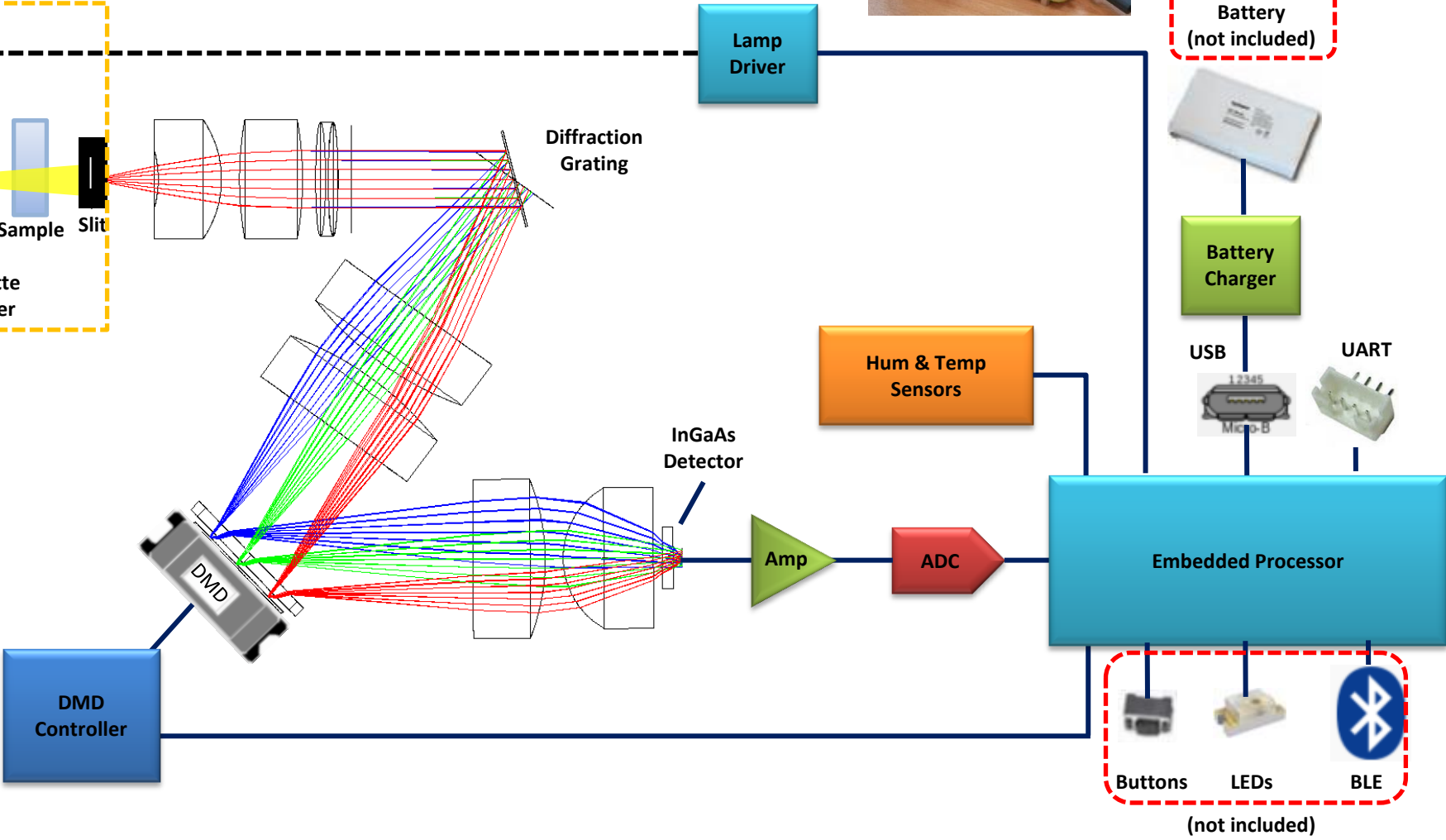
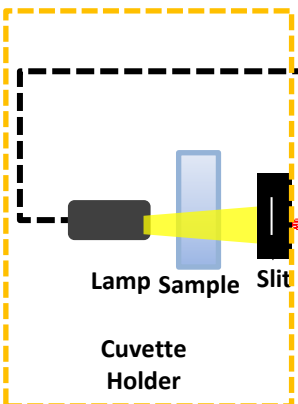
Block Diagram of NIR-M-F1



責任 · 創新 · 卓越 · 開創

Responsibility Innovation Superiority Entrepreneurship

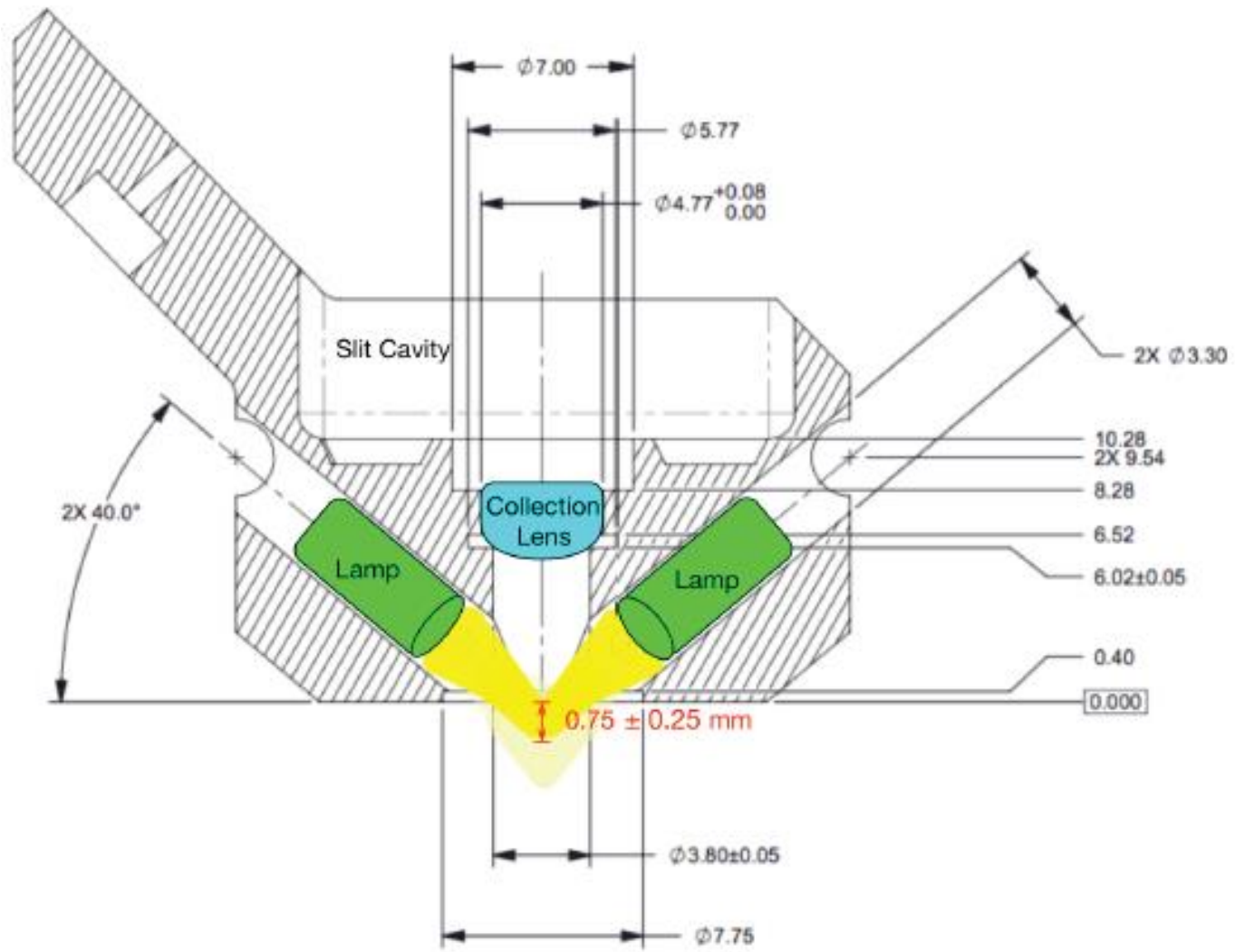
Block Diagram of NIR-M-T1



責任 · 創新 · 卓越 · 開創

Responsibility Innovation Superiority Entrepreneurship

Reflective Probe



The collection lens gathers light from a 2.5 mm diameter region at the sample window. The size of the collection region was matched to the nominal illumination spot size created by the lens-end lamps. This requires that the sample be placed directly against the sapphire window, where the two angled light source paths intersect the collection vision cone of the lens. **If the sample is shifted farther away from the window, the sample may not receive enough illumination for the system to perform an accurate scan.**

Reflective Measurement

Incident light is trapped in the solid samples, so the efficiency is good.



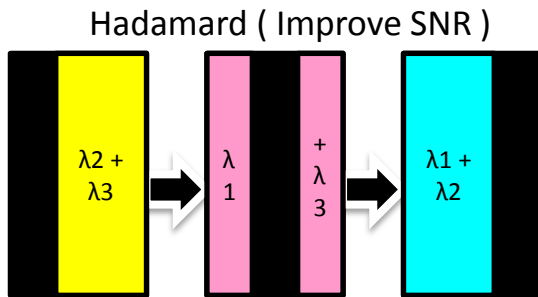
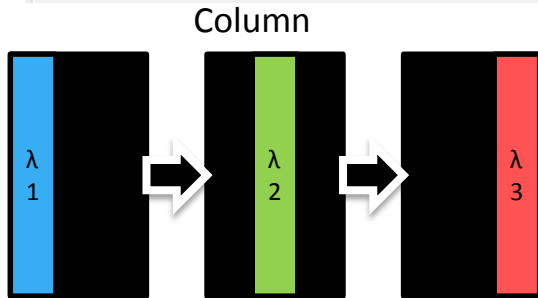
- Incident light is not trapped in the transparent samples, so the efficiency is bad.
- Need to consider transmission or transreflectance measurement.

Programmable

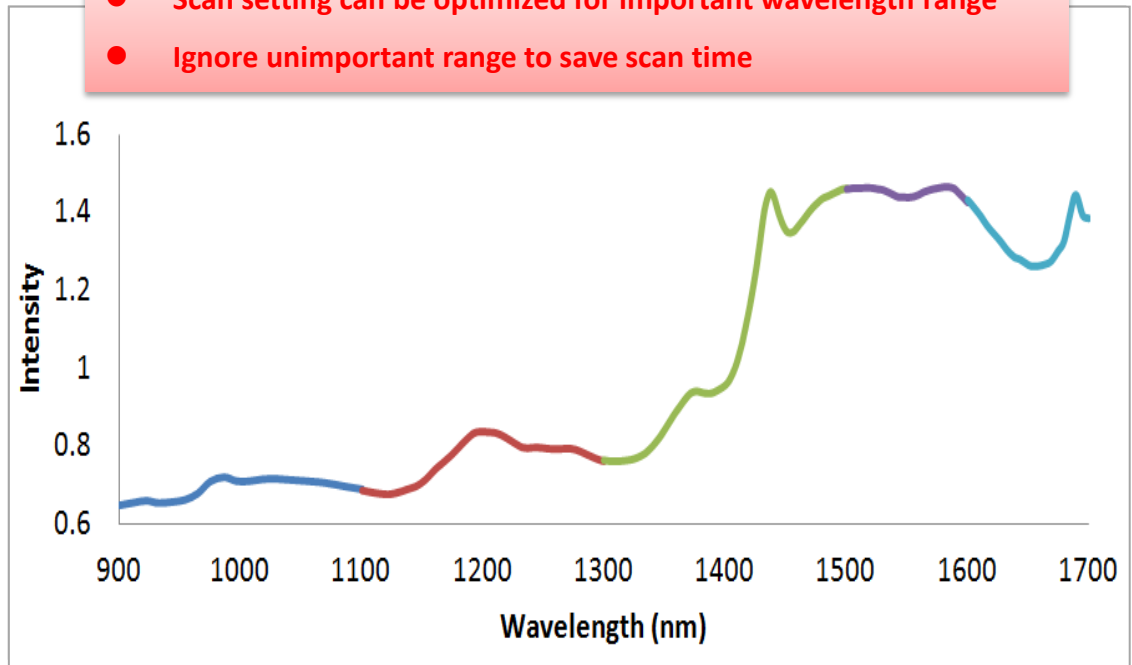
Create/View/Edit slew scan configuration

Name: Slew 1 No. of scans to average: 6 No. of Sections: 5

Method	Start nm	End nm	Width nm	Dig Resolution	Exposure ms
Column	900	1100	19.91	20	0.635
Hadamard	1100	1300	8.20	50	2.540
Hadamard	1300	1500	8.20	50	2.540
Hadamard	1500	1600	8.20	25	2.540
Column	1600	1700	8.20	20	5.080



- Scan setting can be optimized for important wavelength range
- Ignore unimportant range to save scan time



Thank You



責任 · 創新 · 卓越 · 開創

Responsibility Innovation Superiority Entrepreneurship