



Water Ice in Lunar Simulants: NIRVSS Drilling Observations

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19 July 2017, Exploration Science Forum



Continuing evidence for H₂O on Moon

Missions

Clementine, Lunar Prospector, Chandrayan, Deep Impact,
Galileo, LCROSS, LRO, Apollo samples

H₂O is a Potential Resource enabling living off the land

oxygen

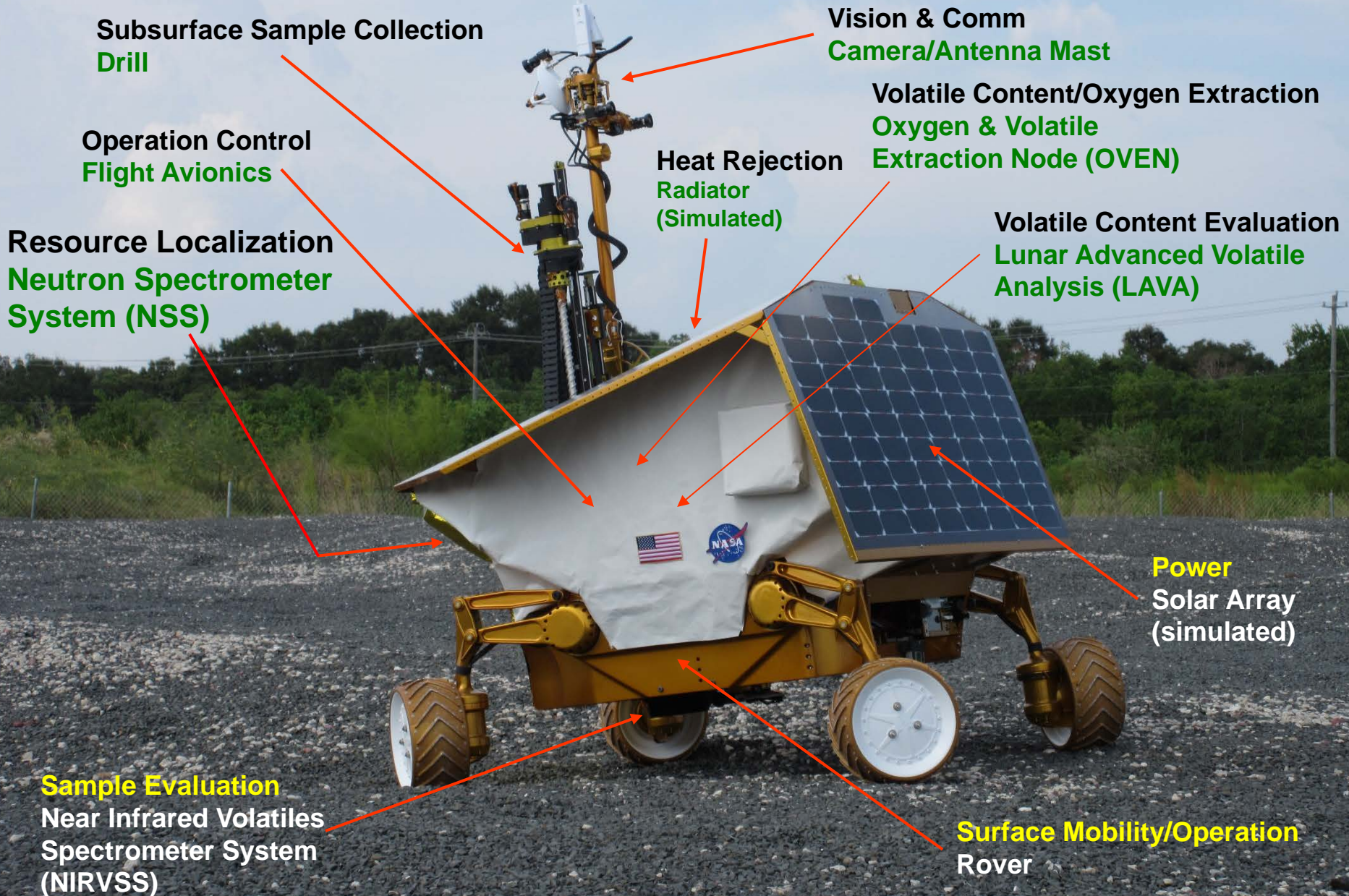
fuel

human support

Resource Prospector (RP) going to Lunar Pole to
characterize distribution and abundance of H₂O and other
volatiles.

Test RP payload components early and often

RP – The Tools



Subsurface Sample Collection Drill

Vision & Comm Camera/Antenna Mast

Volatile Content/Oxygen Extraction Oxygen & Volatile Extraction Node (OVEN)

Operation Control Flight Avionics

Heat Rejection Radiator (Simulated)

Volatile Content Evaluation Lunar Advanced Volatile Analysis (LAVA)

Resource Localization Neutron Spectrometer System (NSS)

Power Solar Array (simulated)

Sample Evaluation Near Infrared Volatiles Spectrometer System (NIRVSS)

Surface Mobility/Operation Rover

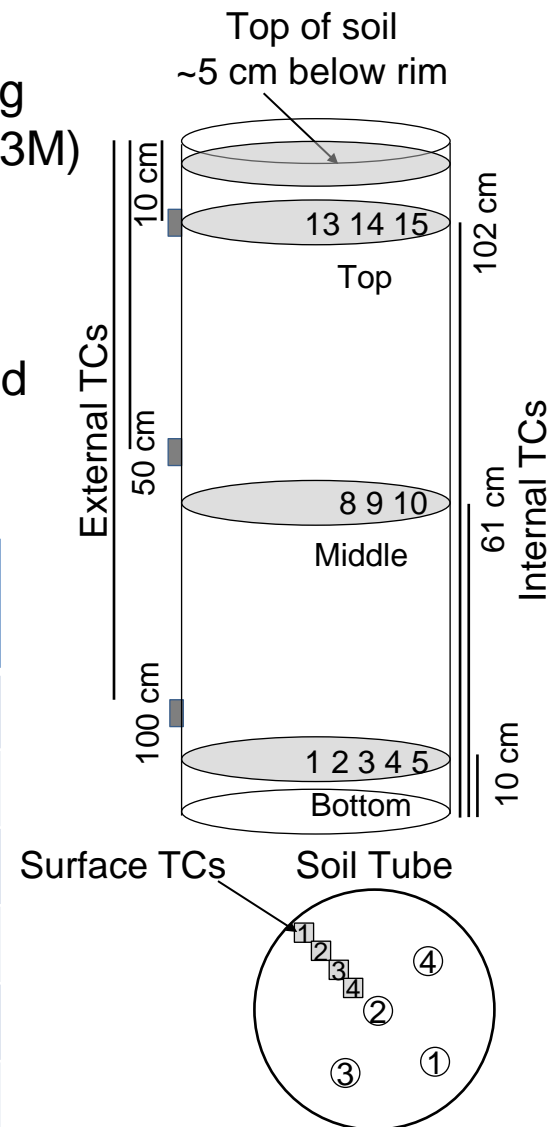
On-Going testing of RP science components and drill at Glenn Research Center using VF-13



VF-13 accommodates:

- 1.2 m x 30 cm diam. tubes containing H₂O-doped lunar simulant (NU-LHT-3M)
 - HR drill
 - ARC NIRVSS
 - JSC OVEN
- VF-13 actively cools the shroud and soil tubes
- RGA as proxy for MS

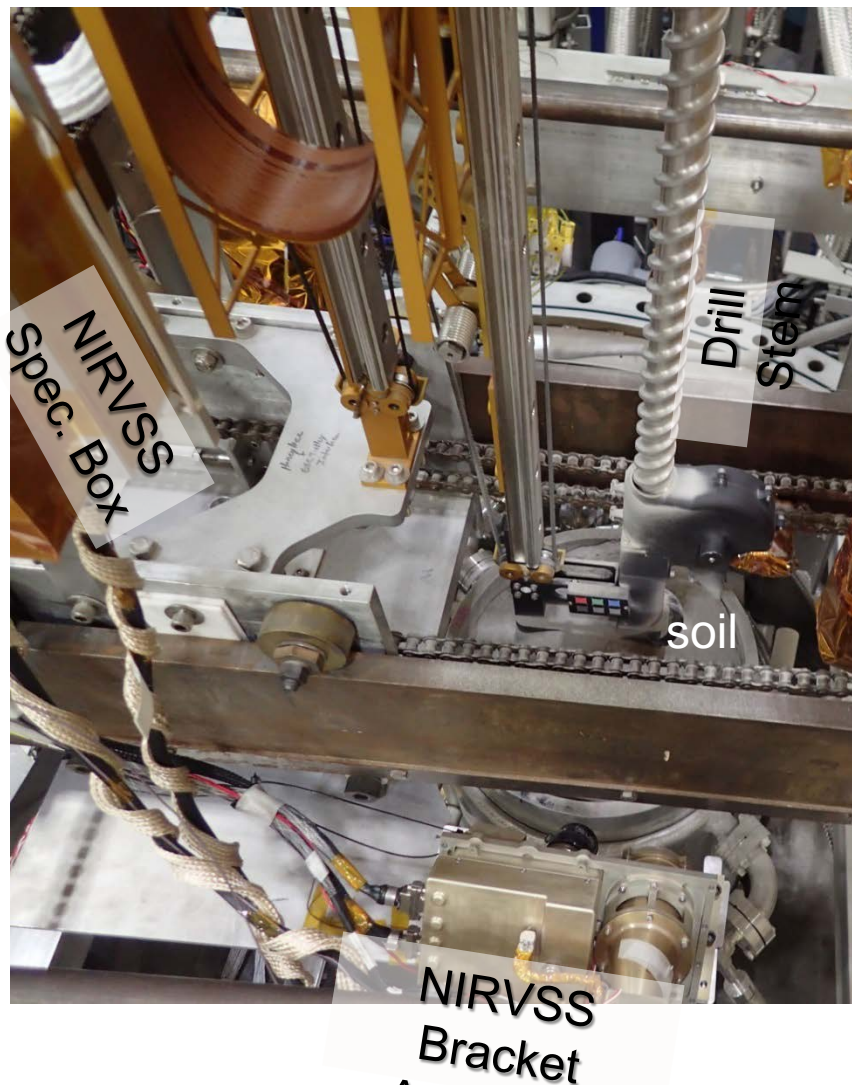
Soil Tube	Date	Wt. % H ₂ O	Soil T, K
1	4/10/2017	2.5	~154
2	4/18/2017	0.8	~170
3a	4/24/2017	2.5	~110
3b	4/26/2017	2.5	~110
3c	4/28/2017	2.5	~110
4	5/4/2017	0.8	~143



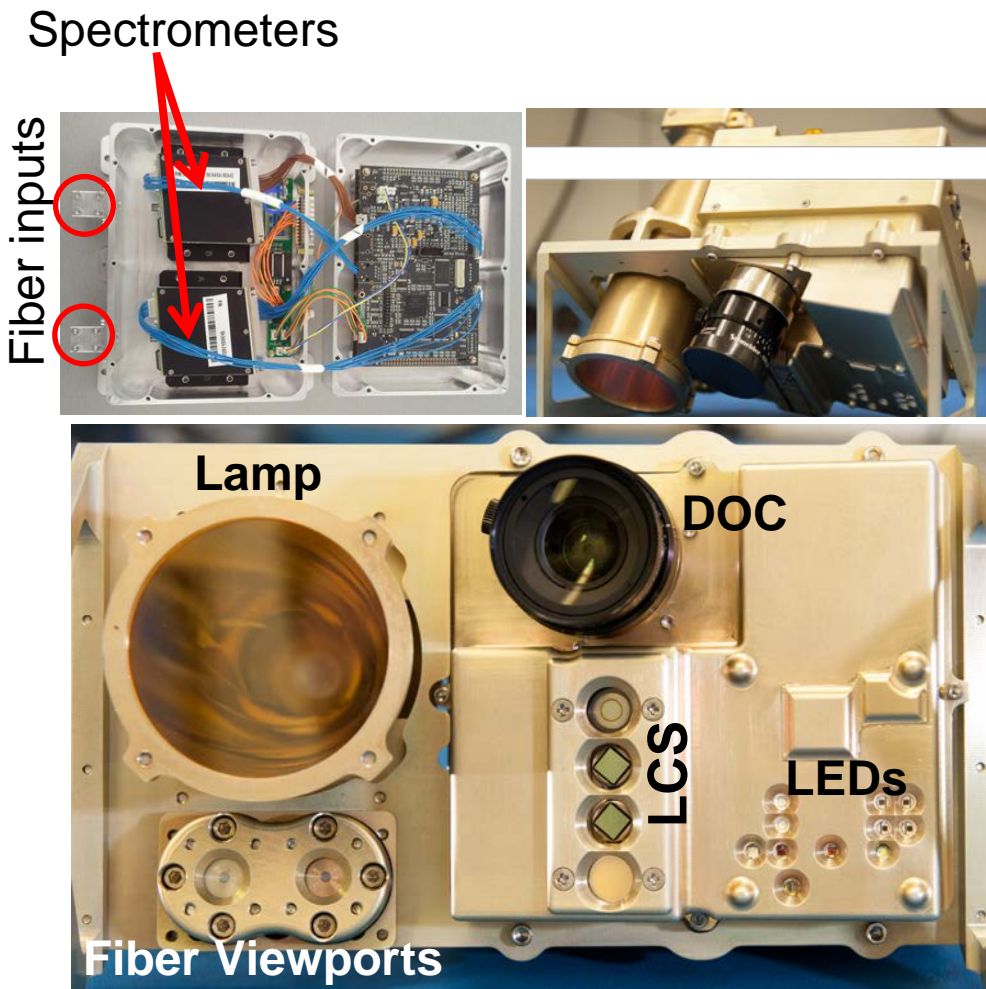
NIRVSS accommodation in VF-13 2017, and components



NIRVSS @GRC in 2017



NIRVSS components



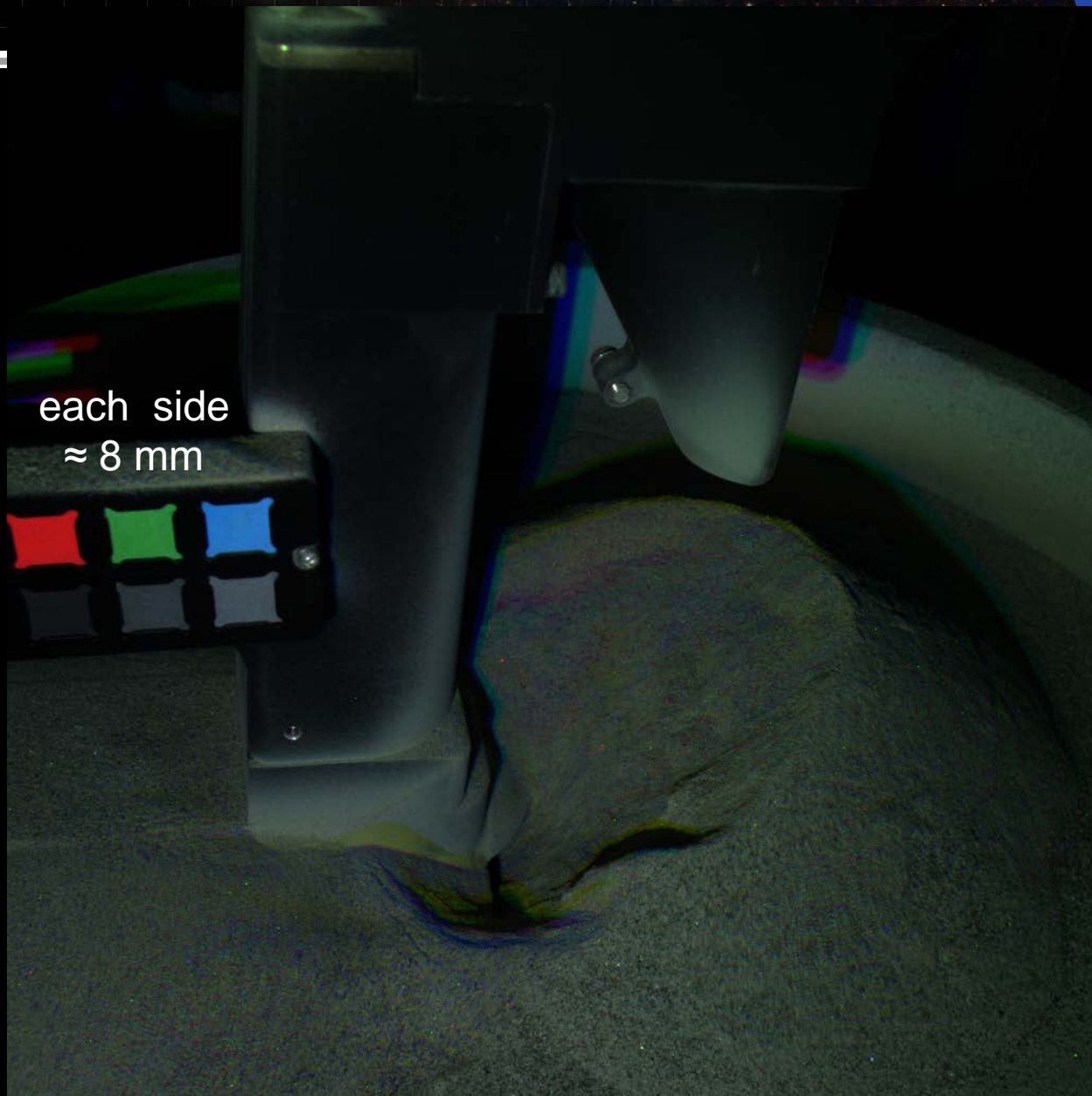
Remote Instrumental Control and Monitoring



NIRVSS data collection in VF-13 commanded from Ames while monitoring DOC imaging and spectral data



Near RGB Color Composite, Unstaturated Images



each side
≈ 8 mm

scale = 1

1024 x 1024

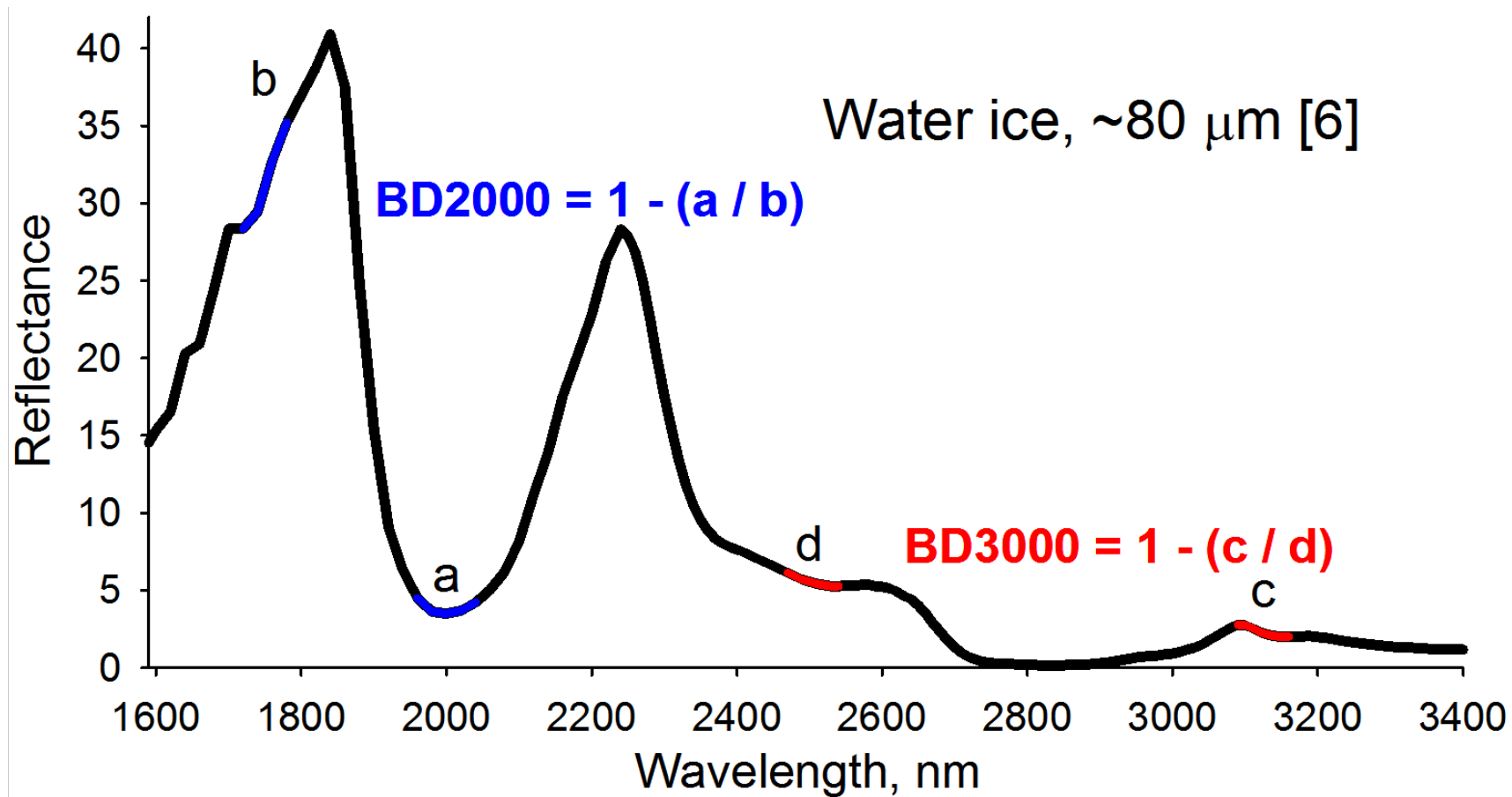
B = 410 nm LED

G = 540 nm LED

R = 650 nm LED



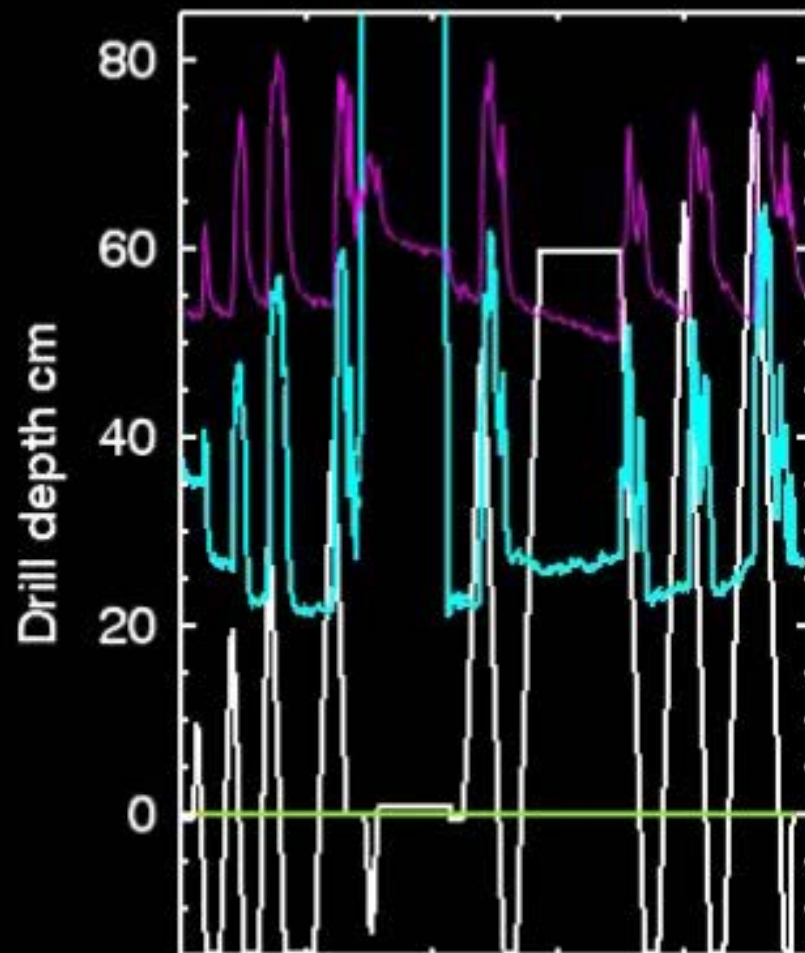
Spectral parameters to monitor water ice during drilling





BD2000*800 BD3000*100

Surface



NIRVSS GRC 2017 Summary



New cut-on filter for Lamp permits DOC and spectrometers operation simultaneously to characterize compositional and physical nature of drill cuttings pile.

New DOC calibration targets permit easier rendering of near RGB colors and can be used to assist in multi-wavelength compositional mapping from images.

Both BD2000 and BD3000 vary with drilling activities as seen in previous tests at GRC, permitting real-time monitoring of water ice in cuttings pile.

Correlation of BDs with RGA measurements remains to be performed.

Effect of differing spectrometer FOVs on compositional characterization remains to be evaluated.

BD2000 and BD3000 ↑ as drilling proceeds

