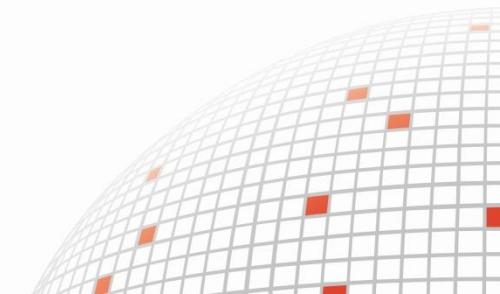


Projects in Optech, Inc. MS

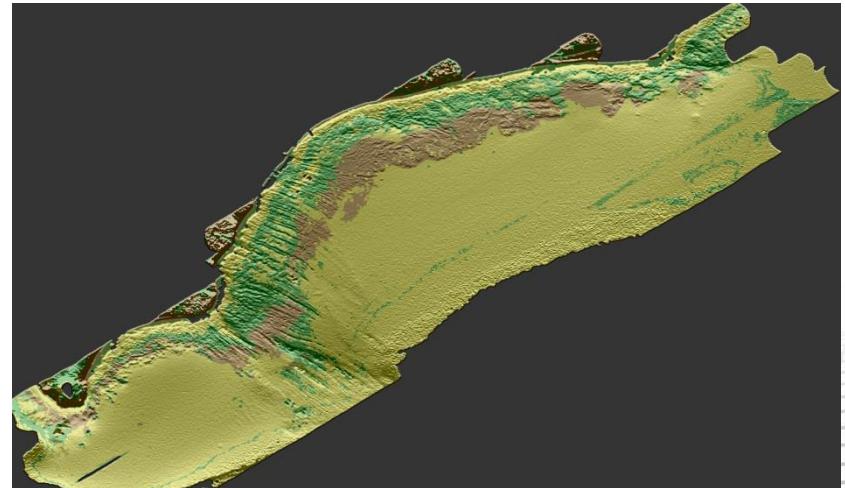
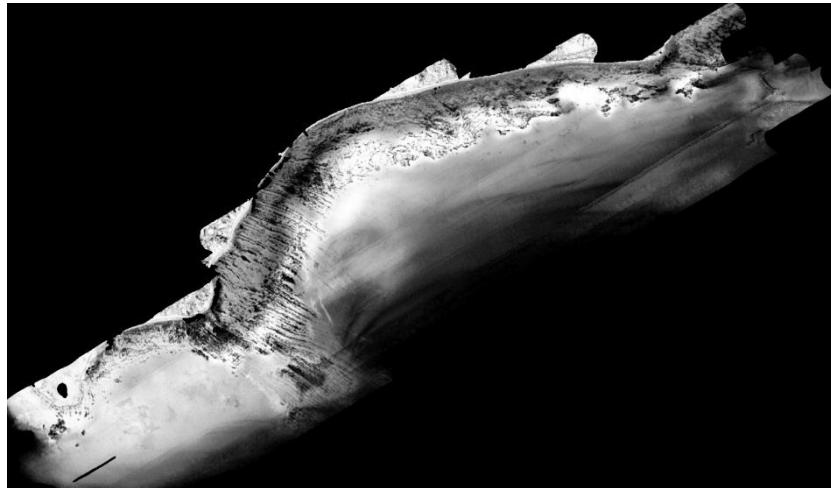
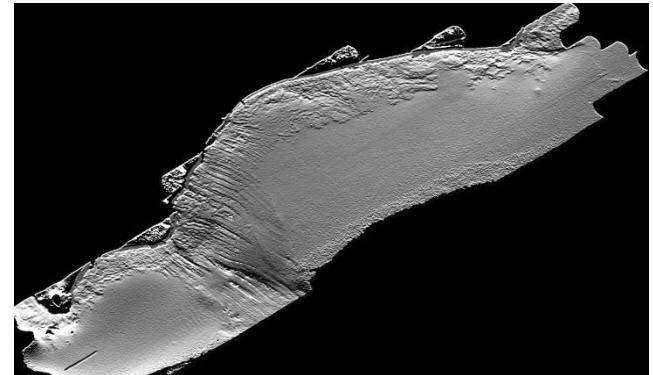
Joong Yong Park



- Countermeasures Lidar UAV-based System (CLUBS)
 - Funded by Office of Naval Research (ONR)
- Coastal Zone Mapping and Imaging Lidar (CZMIL)
 - Funded by US Army Corps and US Navy
- Depth Extraction Software for Aquarius - AquaDX
 - Funded by Optech, Inc., Toronto
- Data Fusion Software for Integrated Vision System (IVS)
 - Canadian Space Agency (CSA)



- Superior land/water discrimination and depth resolution
 - Water quality (IOPs) characterization
 - Shallow-water seafloor classification
- Water column characterization
- Water bottom characterization



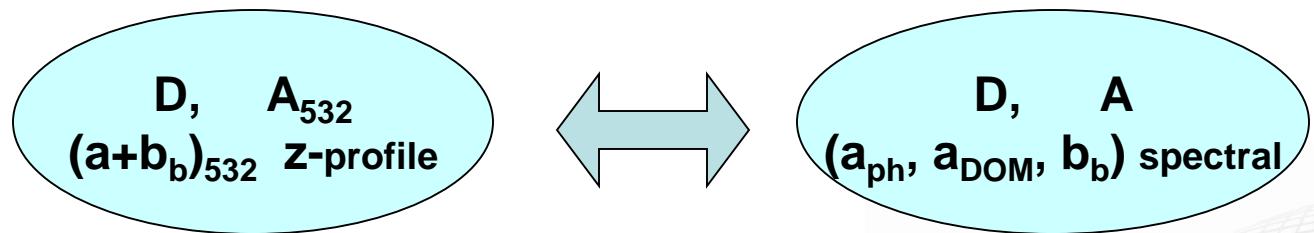
Data Fusion

Lidar

- Wavelength
- Bottom penetration
- Shallow water IOP
- Deep water IOP
- Profiling
- Low illumination
- Calm surface

Spectral

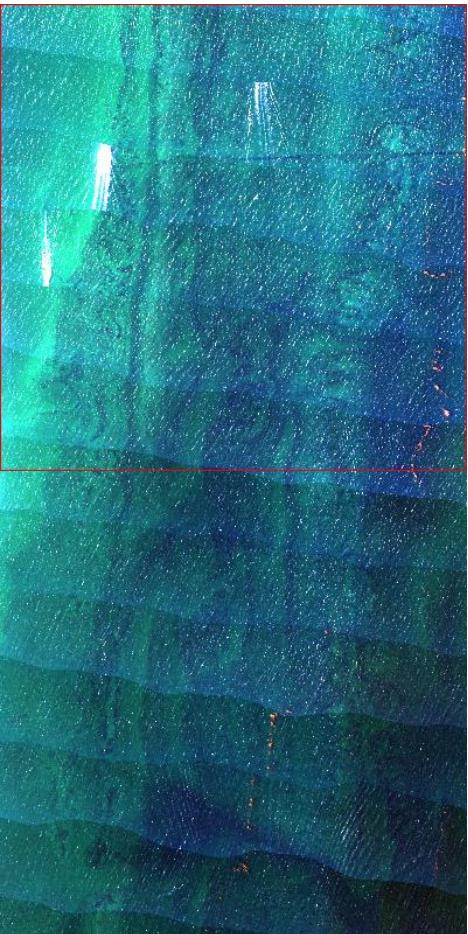
monochromatic	<	full spectral
$3 / K_d$	>	$1.5 / K_d$
problematic*	<	good
excellent	=	excellent
yes	>	no
excellent	>	poor
poor**	<	excellent



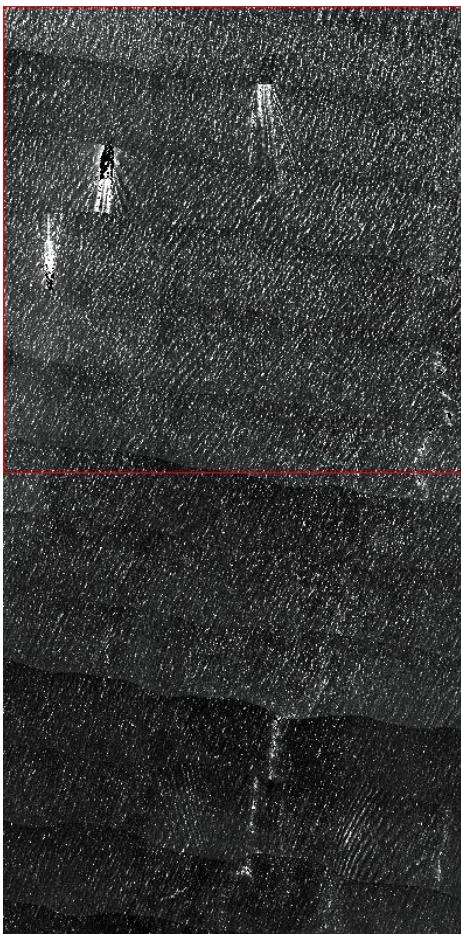
* : system response function, digitizer, beam divergence, FOV

** : software issue, data recording trigger by IR

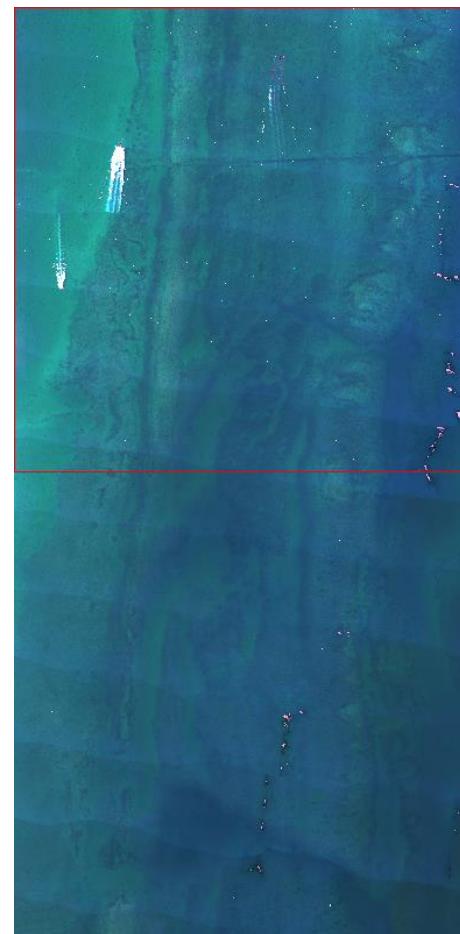
Raw Hyperspectral



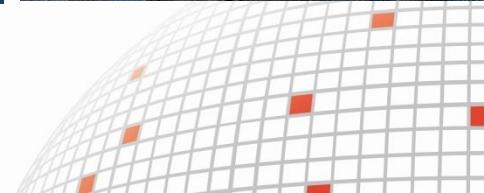
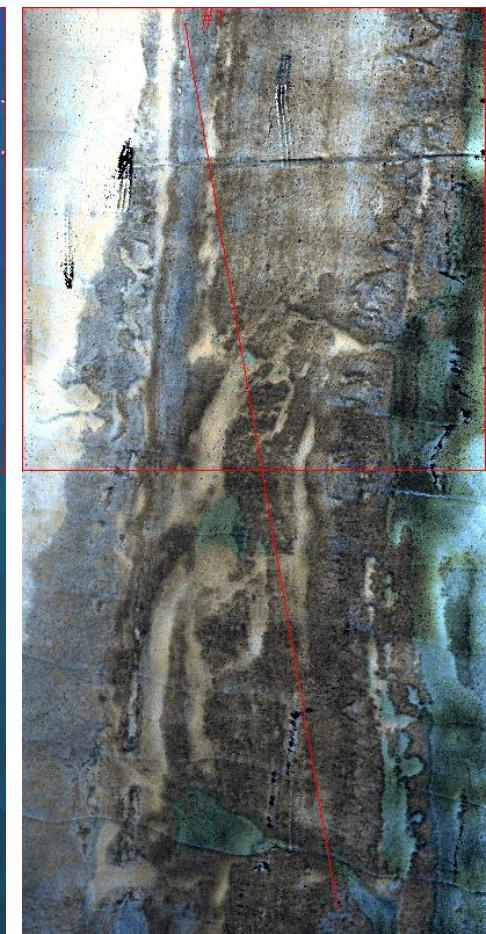
Removed Atm + Surf



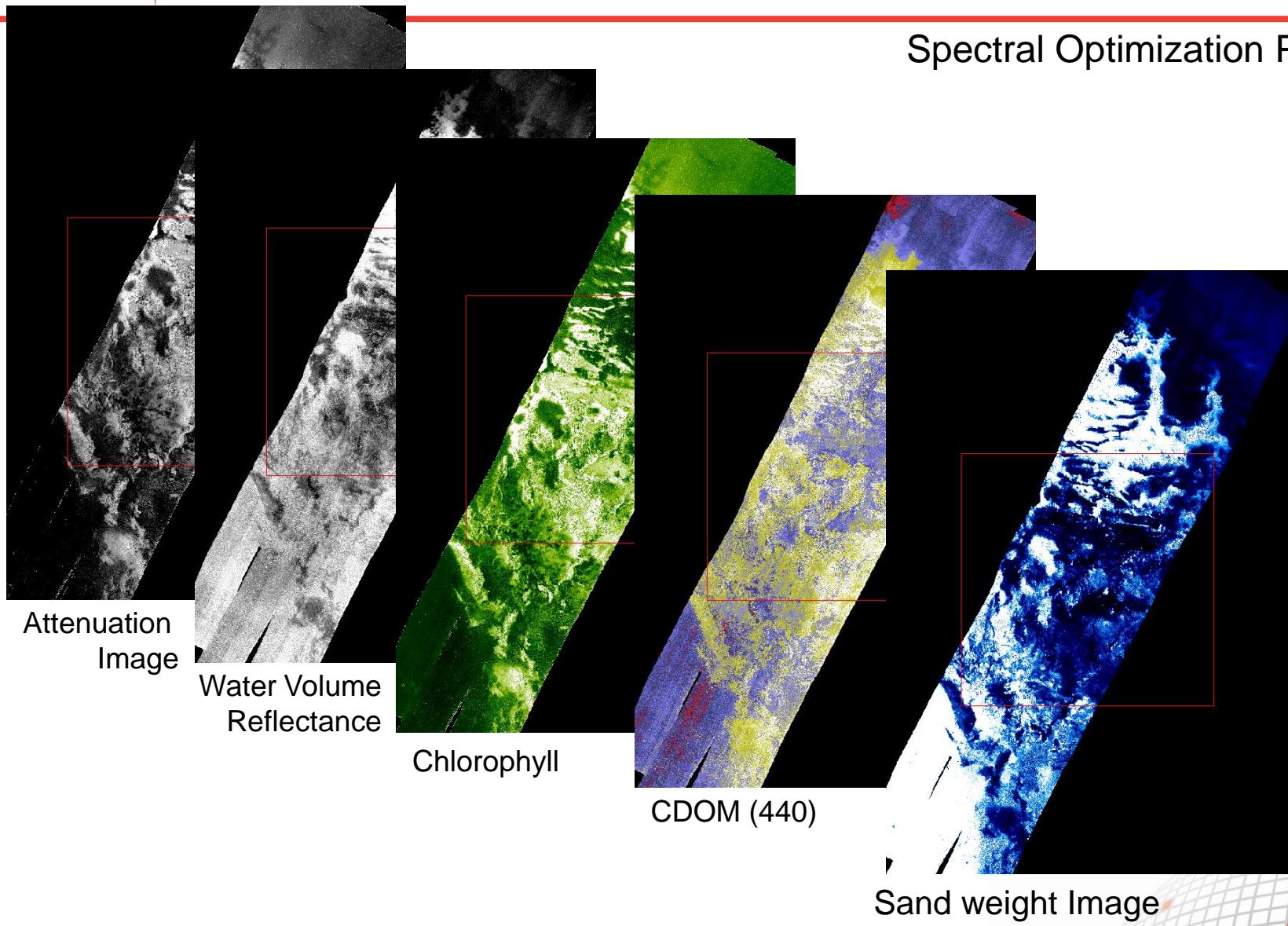
Pure Lw retrieved

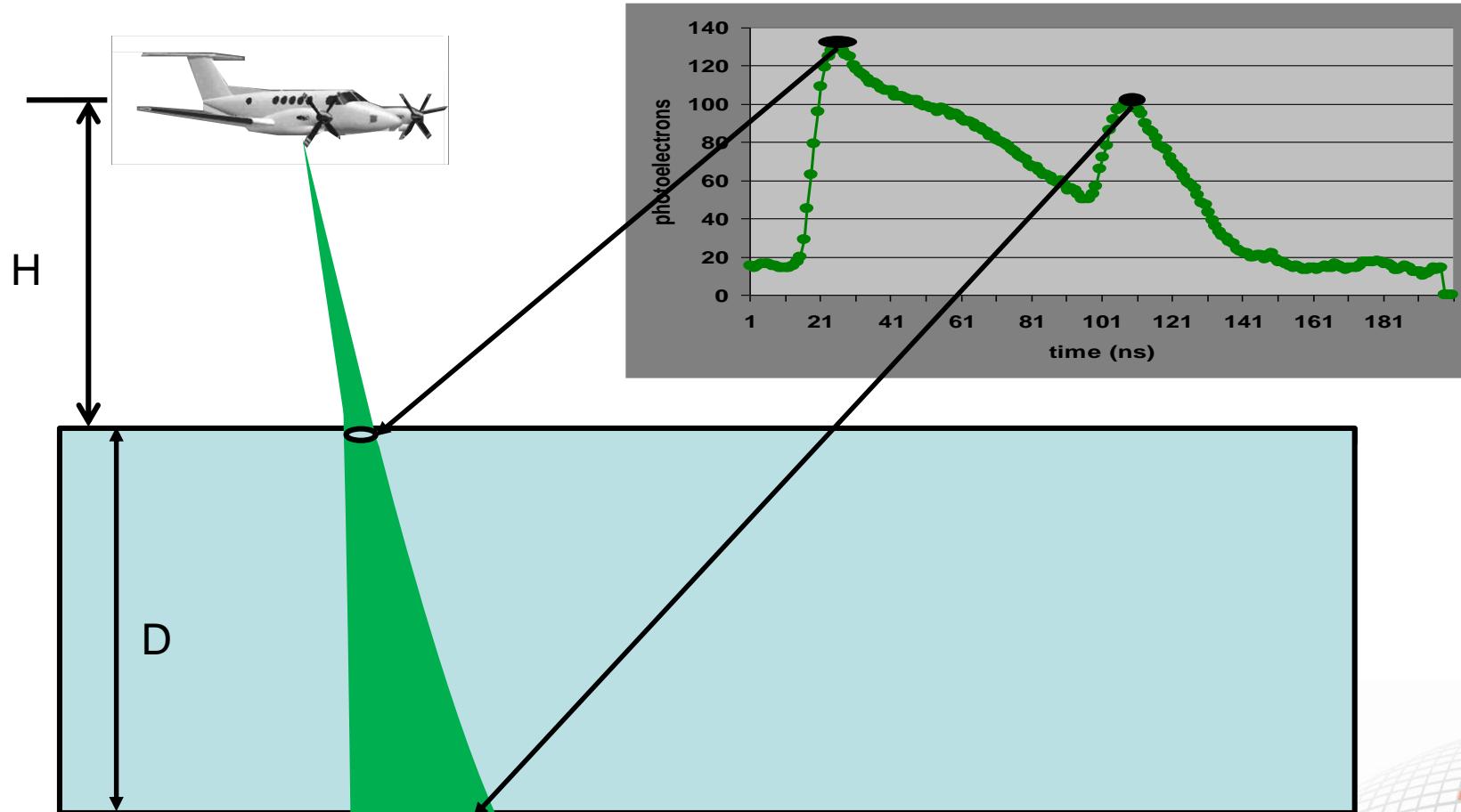


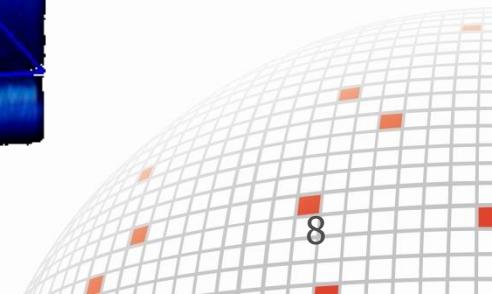
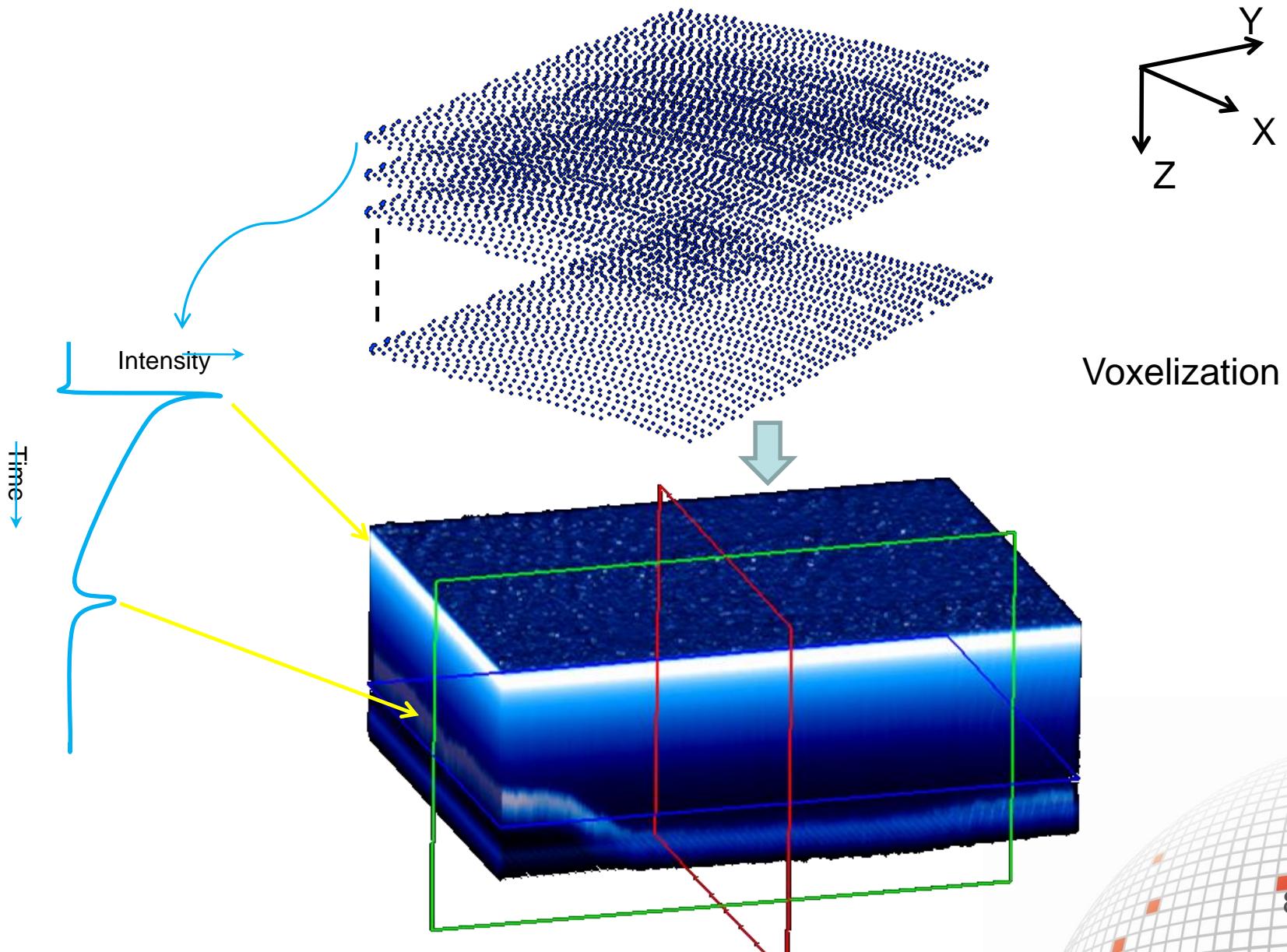
Seafloor reflectance



Spectral Optimization Products



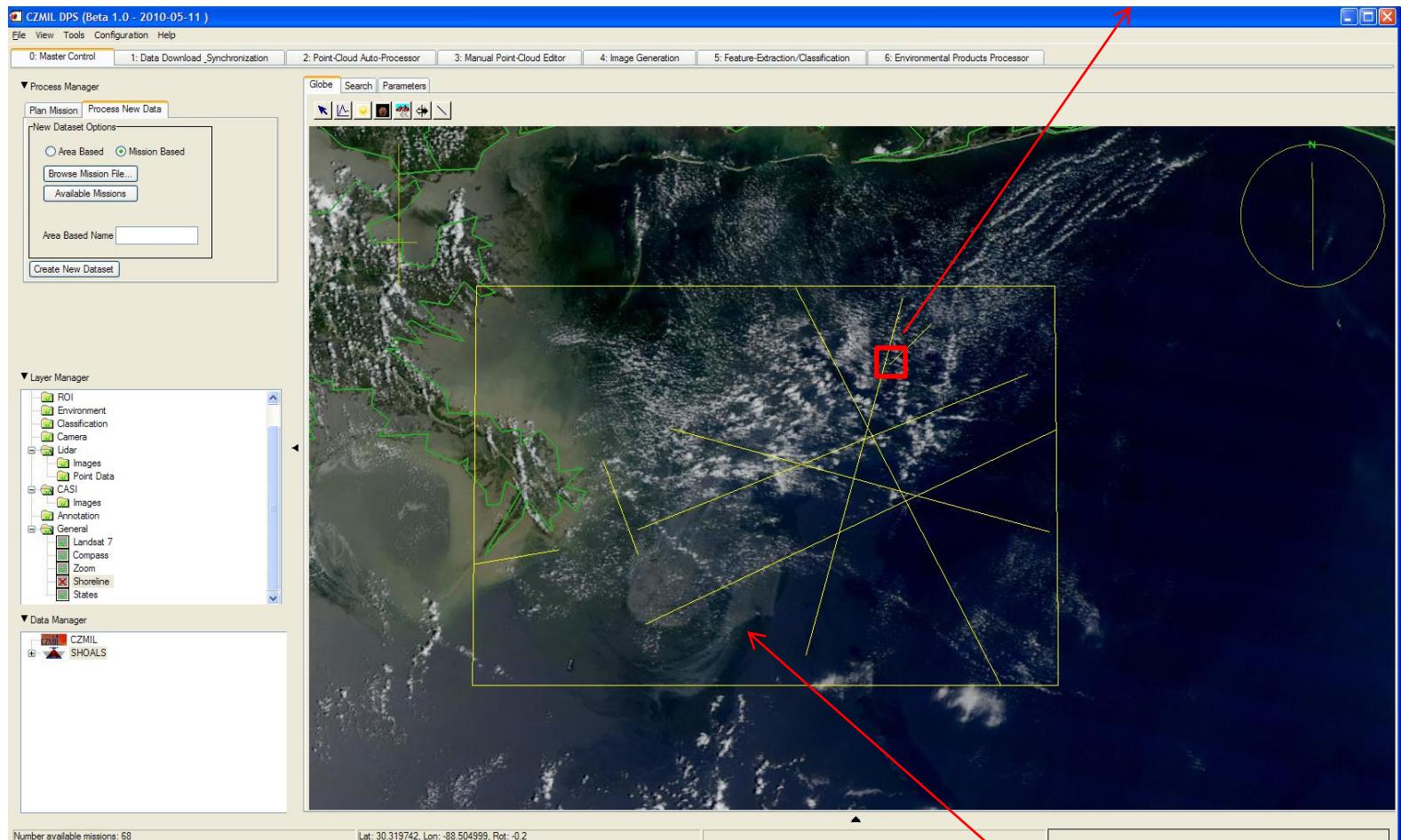




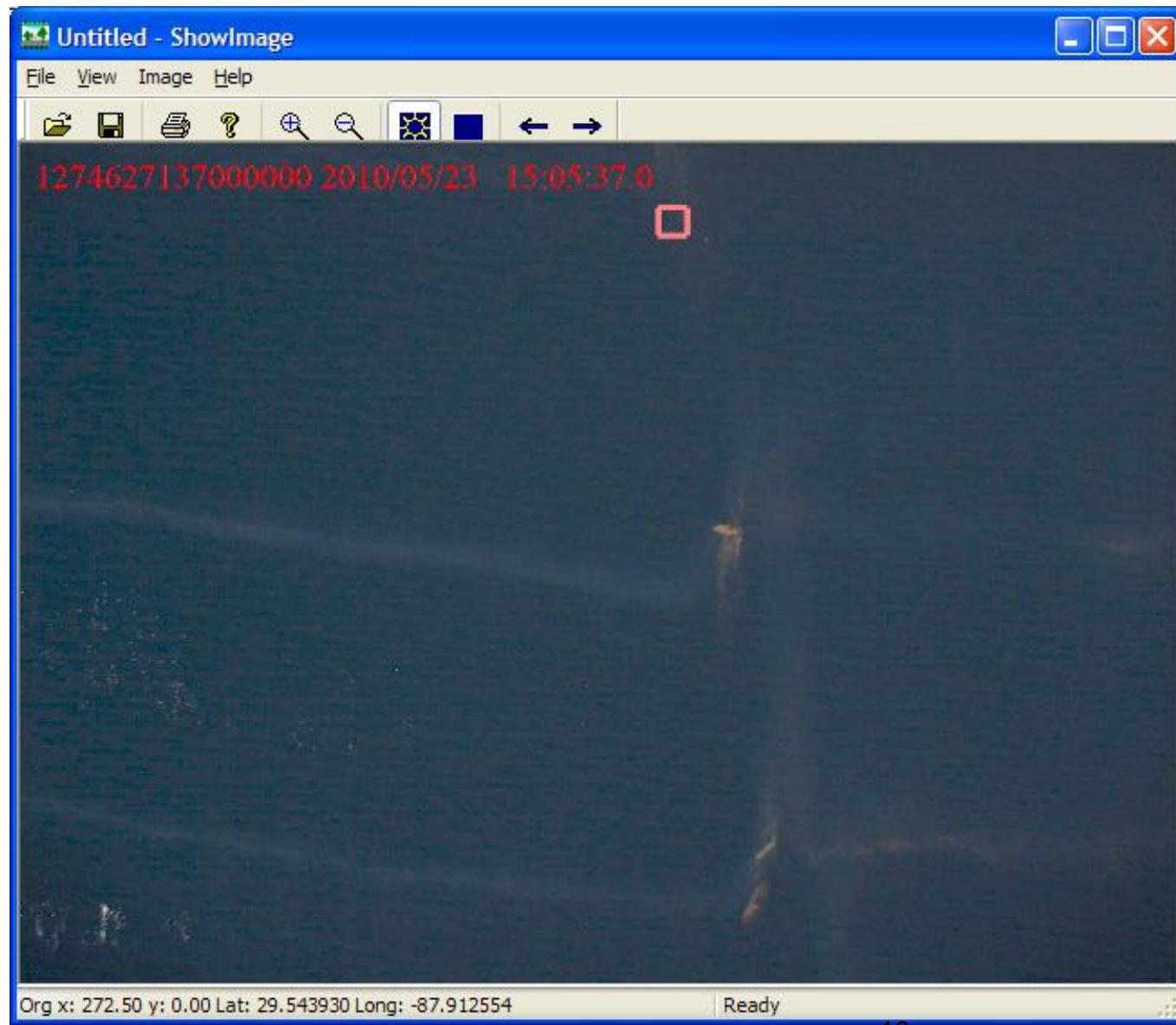
BP Accident in Gulf Coast

SHOALS data collected on May 23, 2010

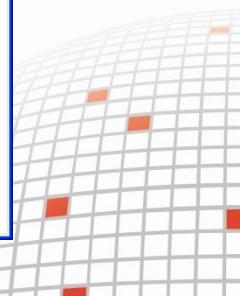
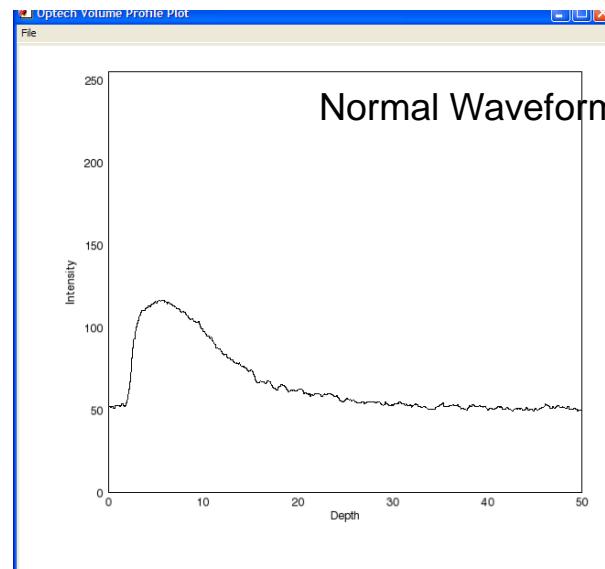
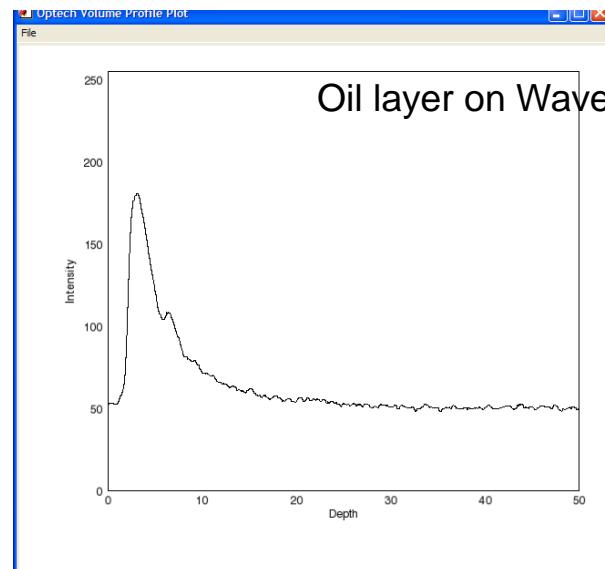
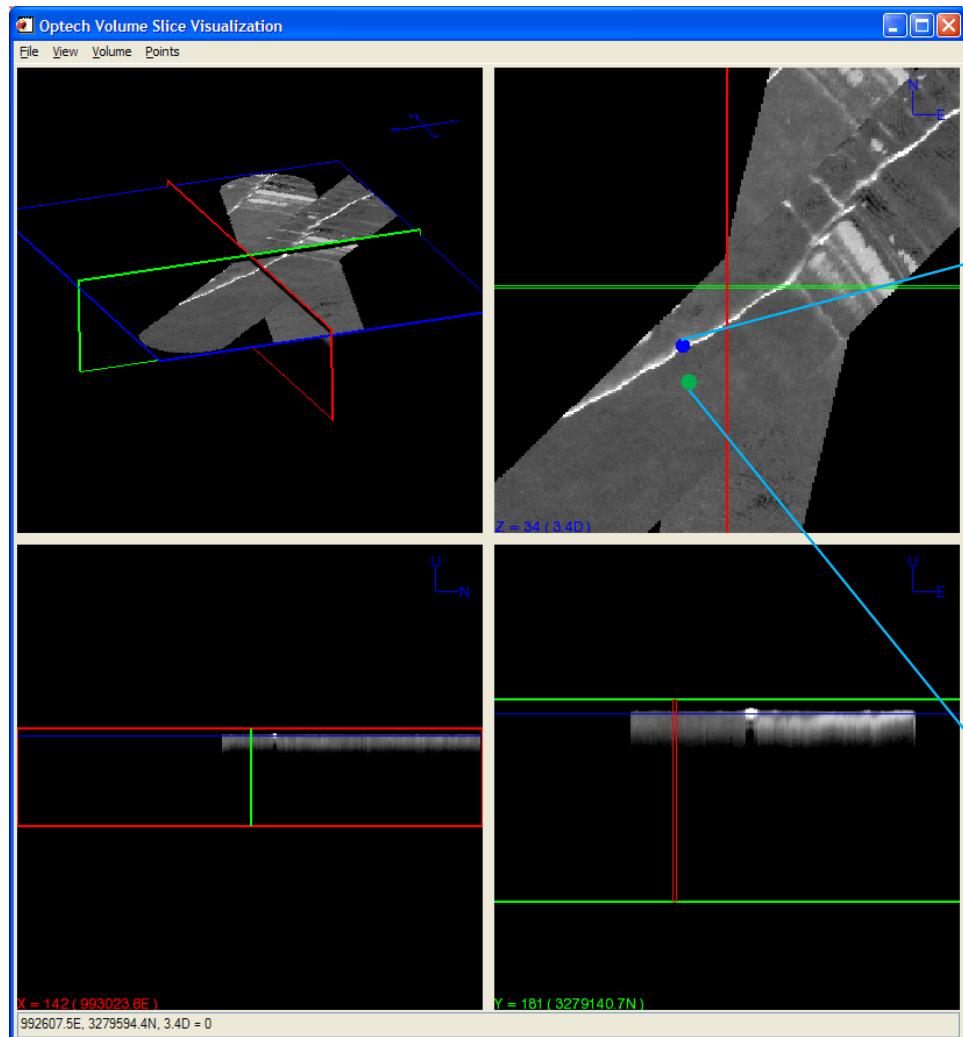
ROI in Volume Visualizer



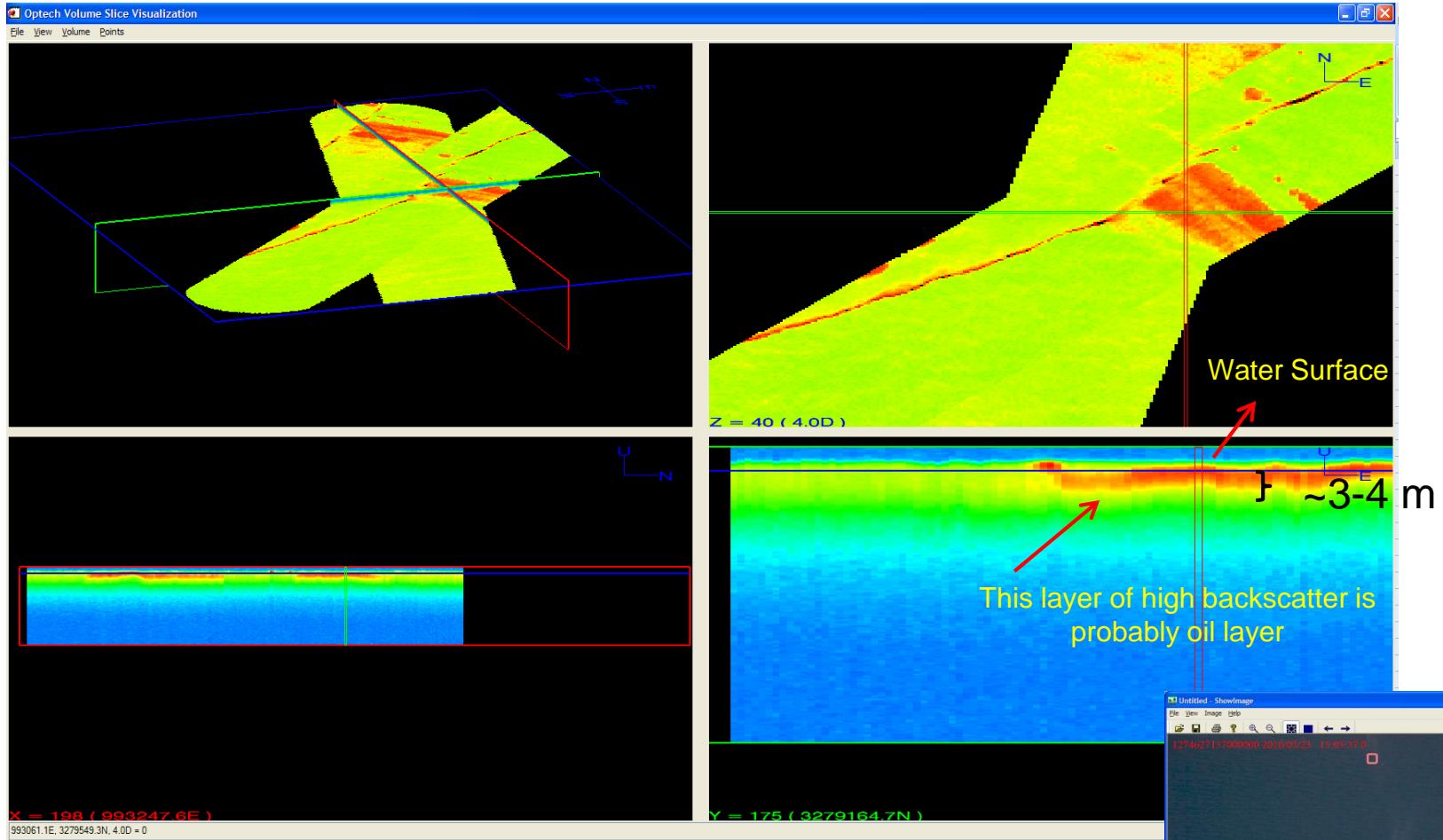
Oil spill visible in MODIS imagery

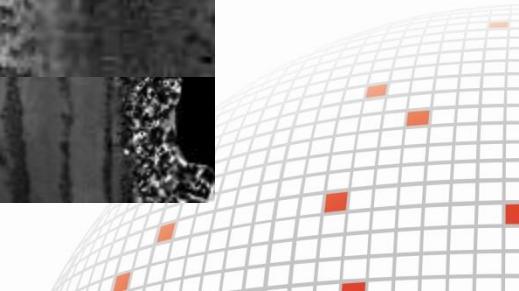
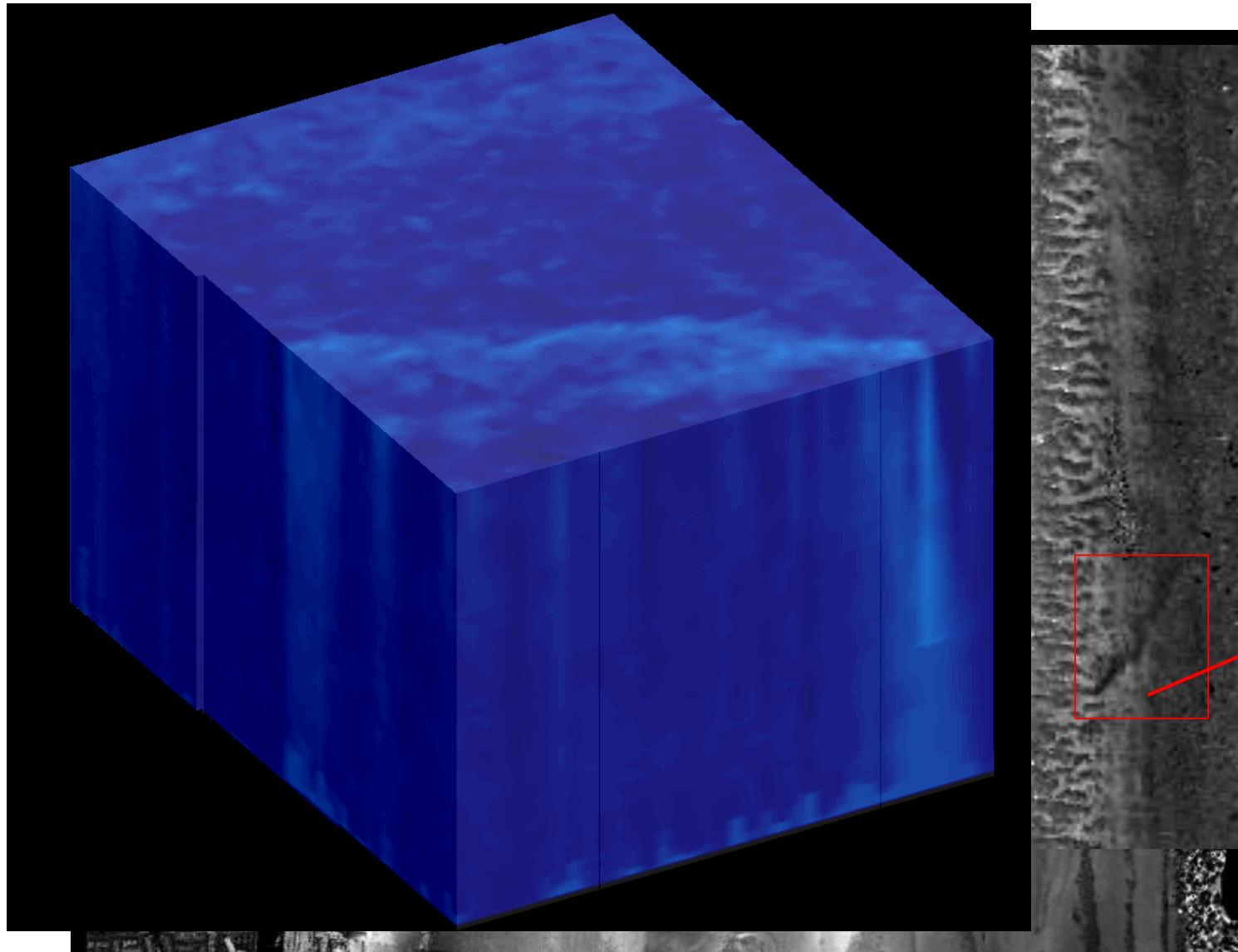


Oil Layer Detection on Lidar Waveform

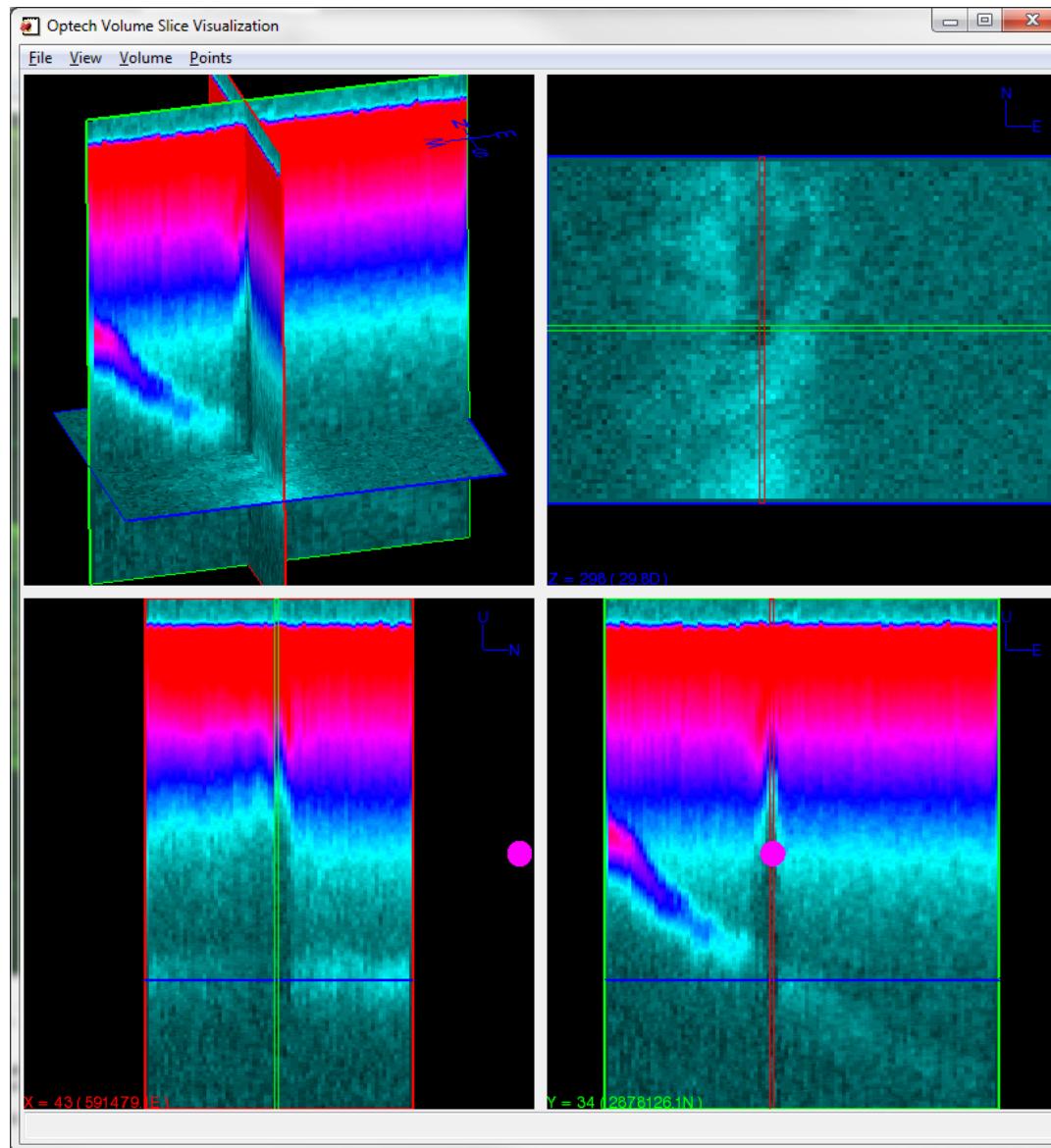


Volume Visualizer: Color scale





Detecting the Leak from Volume Visualizer

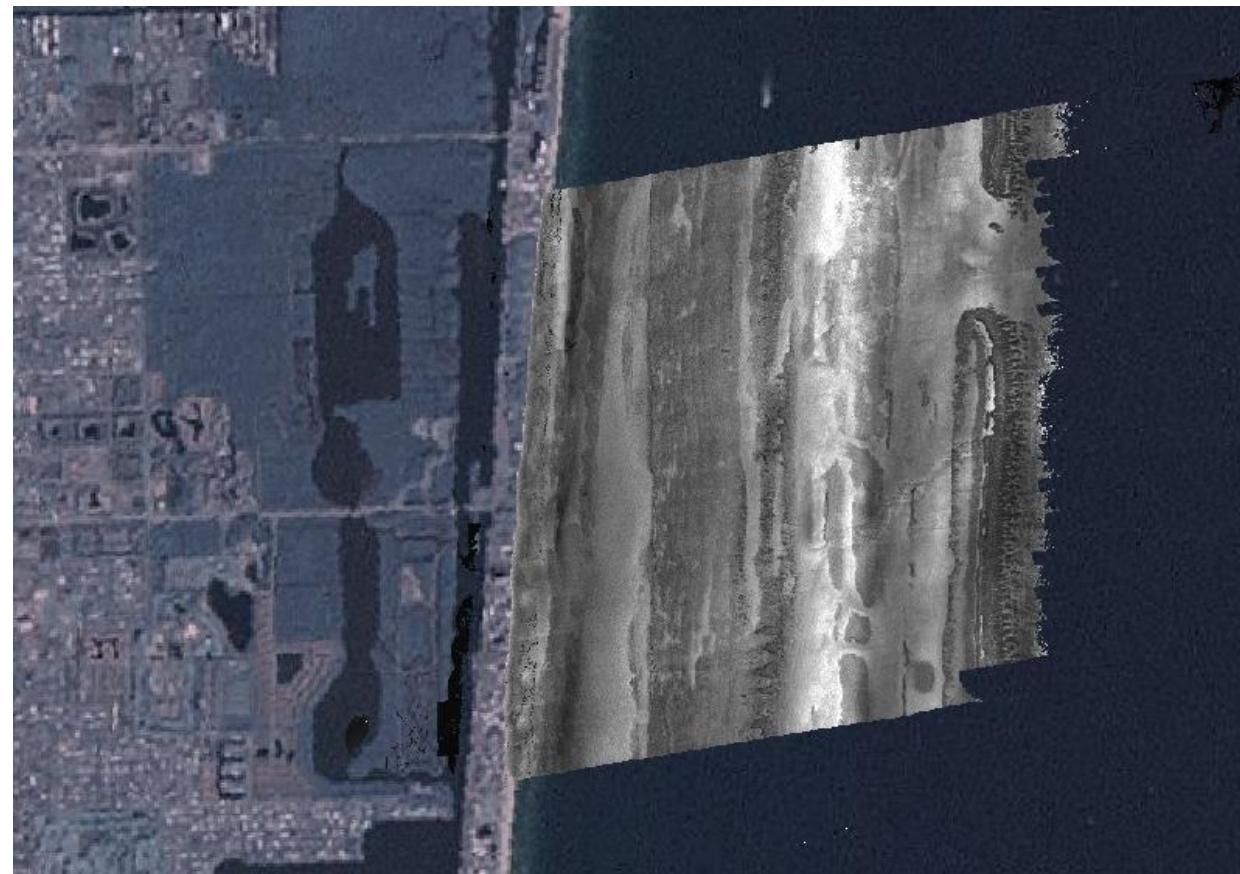


Water Column Visualzier: Small Target Detection



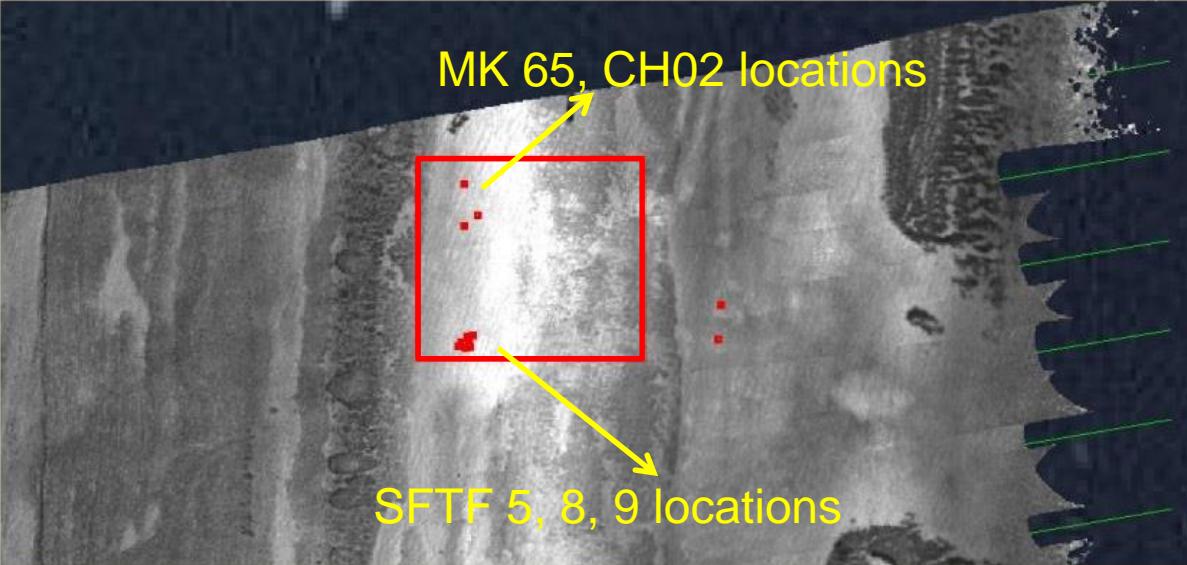
Ft. Lauderdale, FL

Date collected: July 2005



SHOALS Reflectance $\sim 3 \times 3 \text{ km}^2$

Mine locations



North block (July 2005)
“SHOALS reflectance
image”

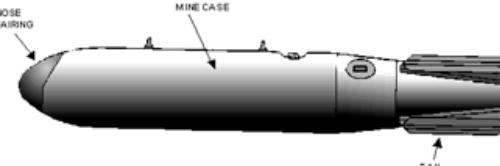
Mine locations:
Mine locations during
deployment (show in red)
and later the locations
verified by dive (shown in
blue).



Please note the change in
locations...essentially
there is an uncertainty in
their positions

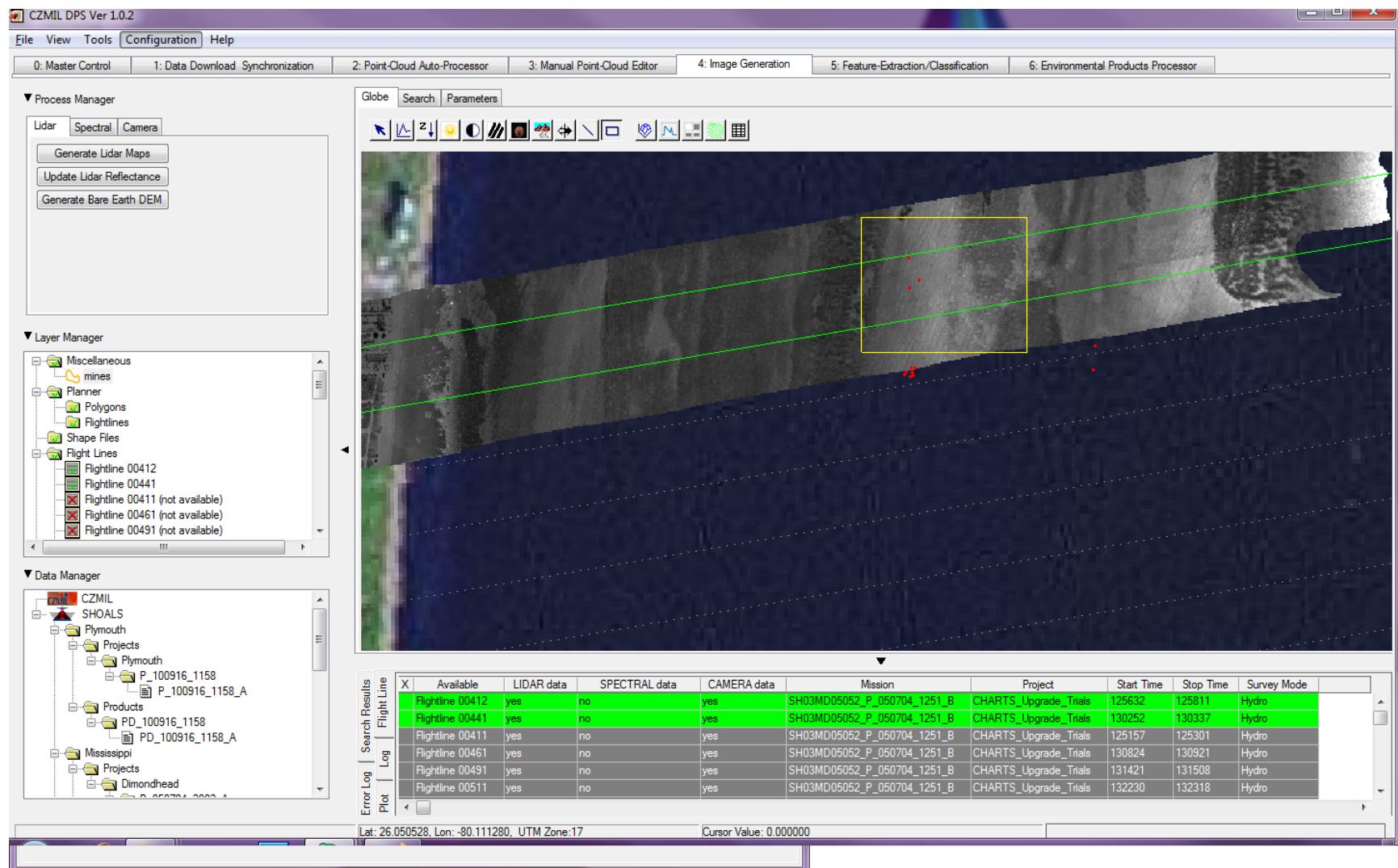


Mine Descriptions

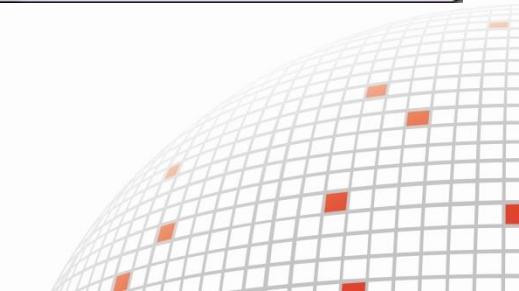
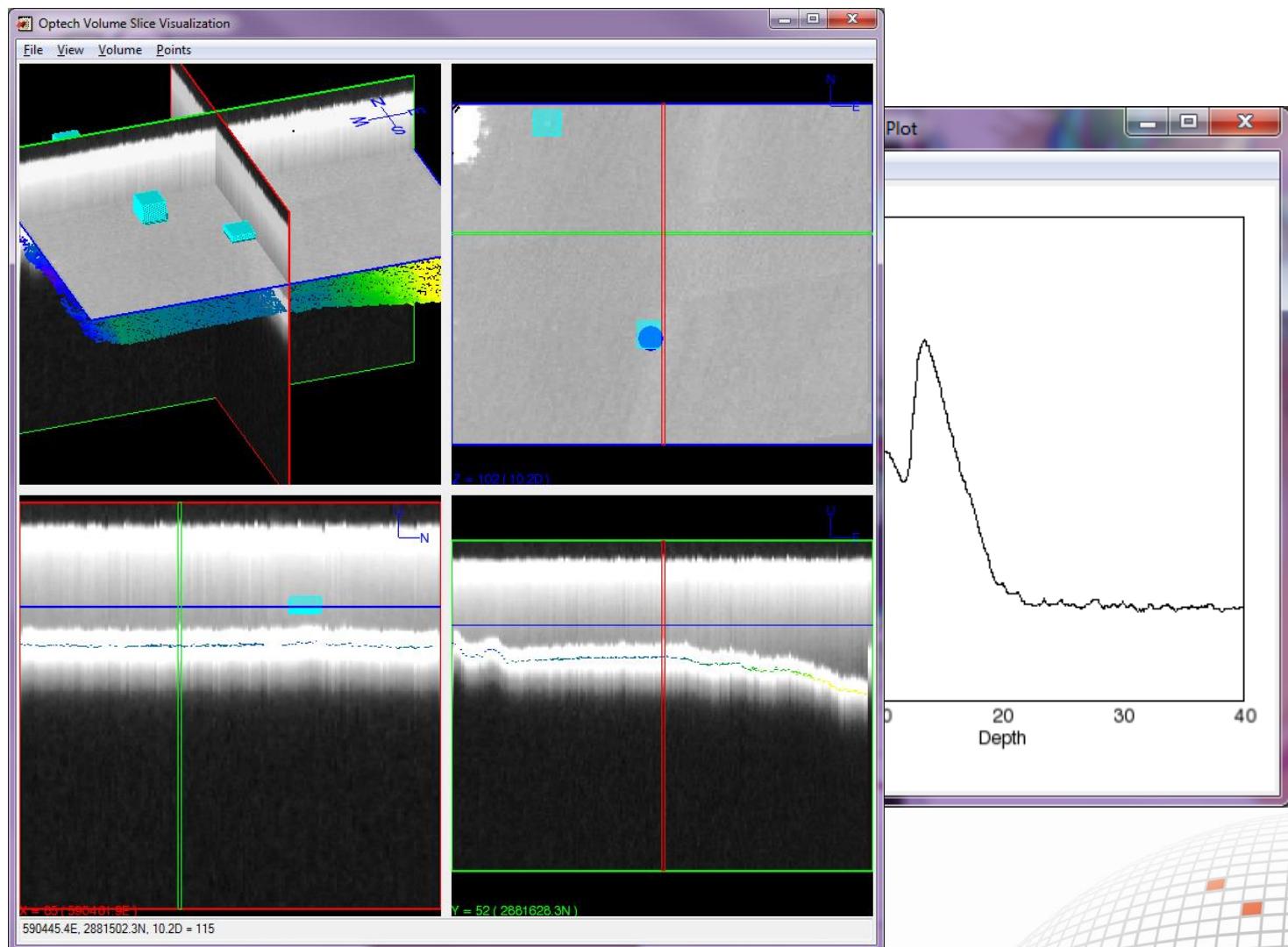
Mine ID	MK65	CH02	SFTF 5, 8, 9
Dimensions	~3m x 0.75m	Diameter ~ 1m	~1m x 0.5m
Location	20 meters of water with moored depths of 10 m from the sea floor	Moored at about 4-5 m above the sea floor	Laid on the seafloor
			

The PVC quadrate is
0.5 x 0.5 m²

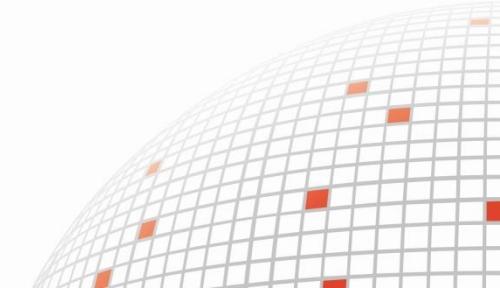
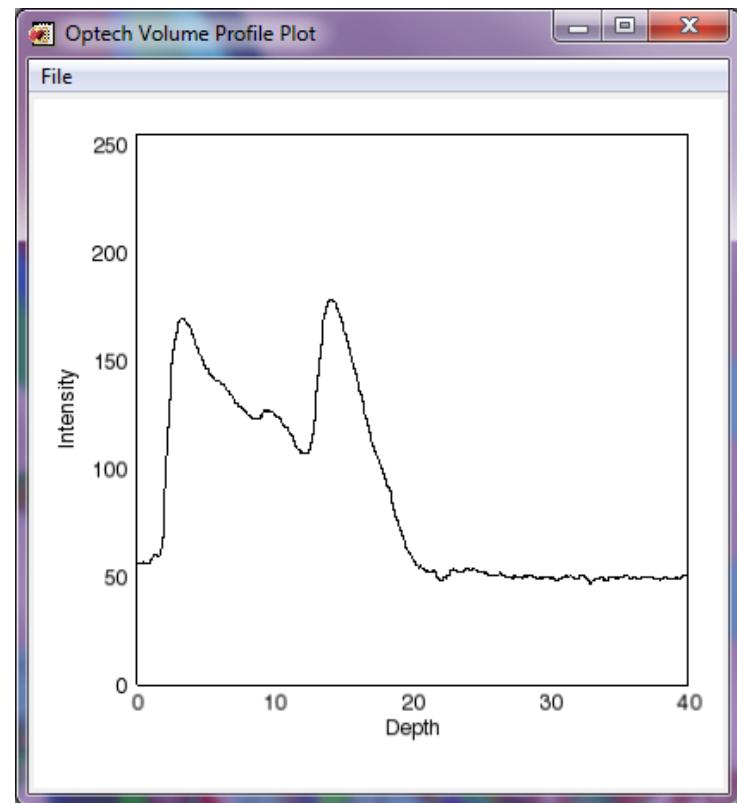
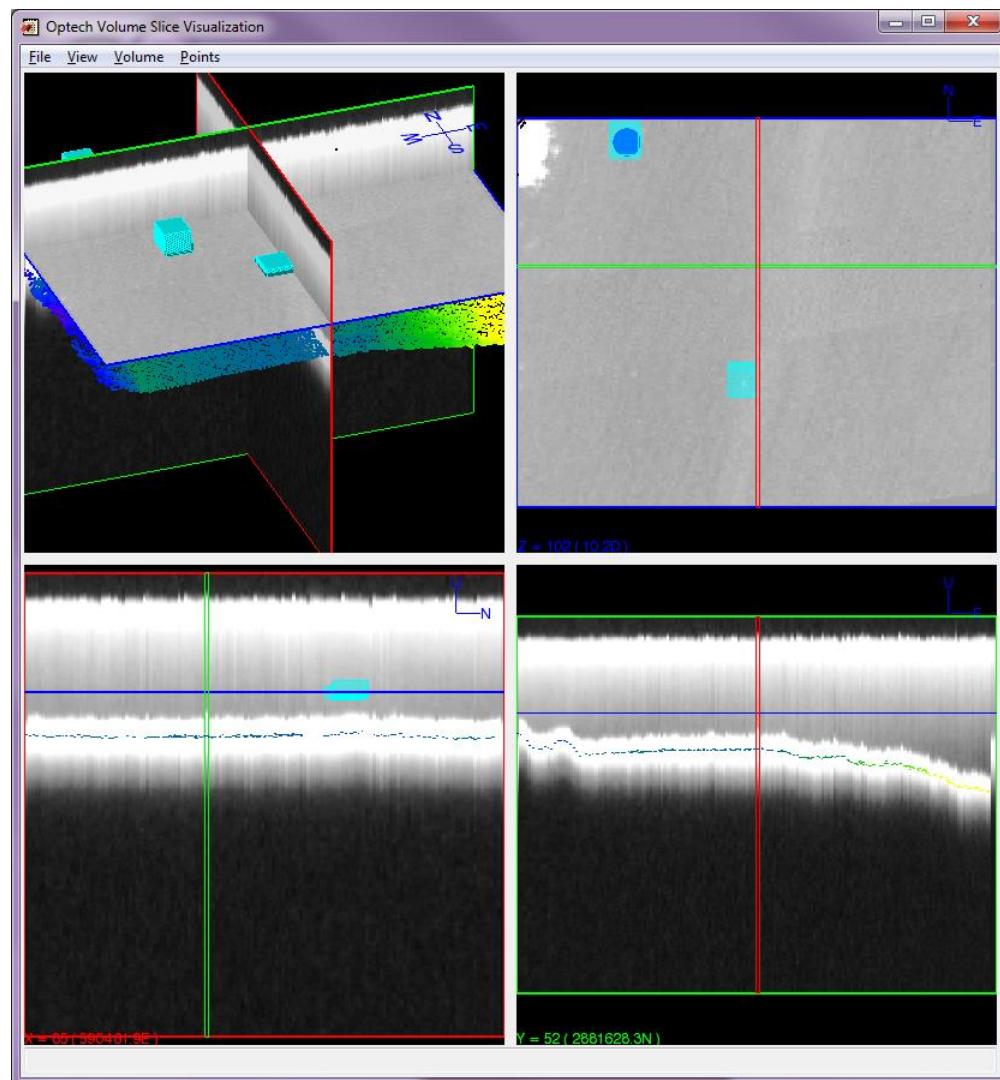
Water Column Visualzier: Small Target Detection



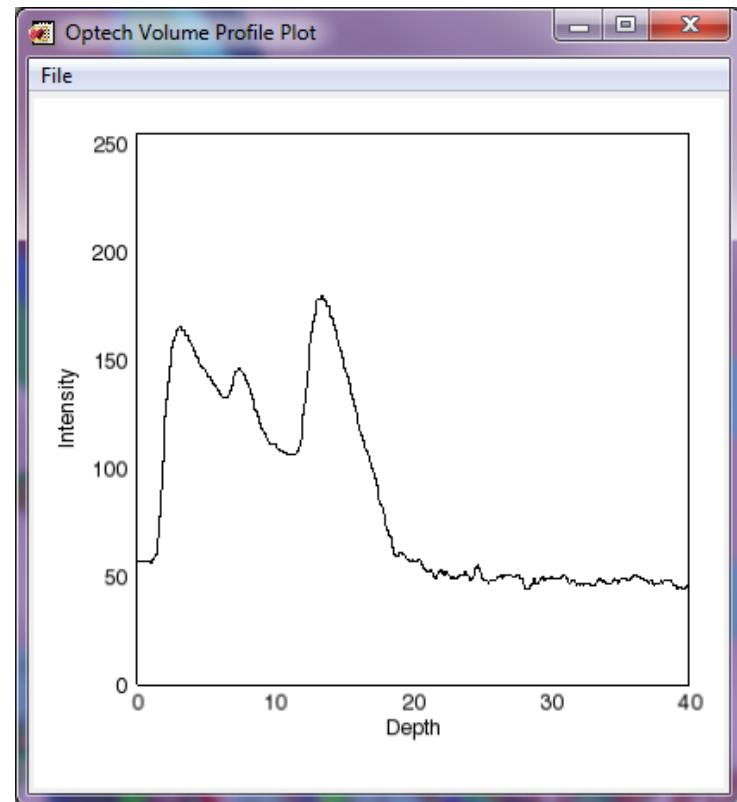
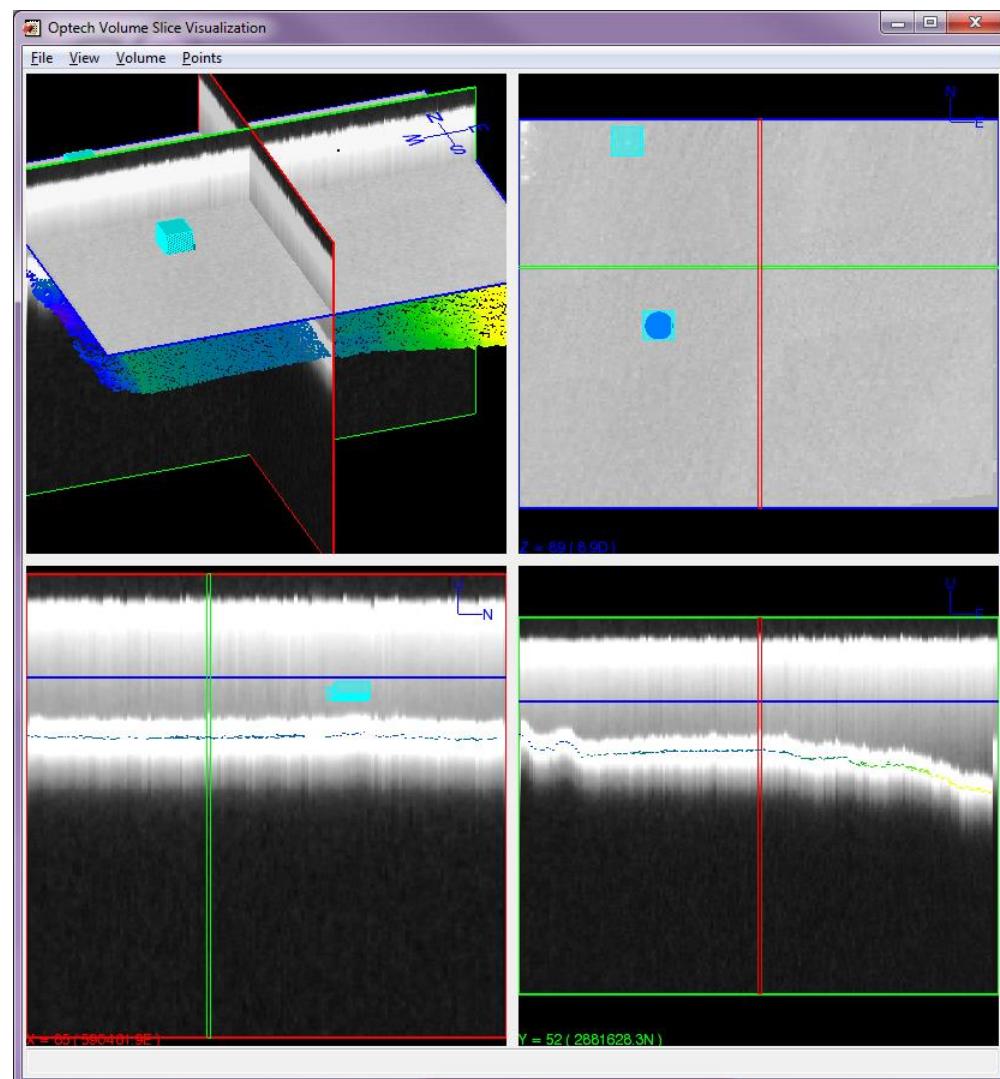
Water Column Visualizer: Small Target Detection



Small Target Detection



Small Target Detection



UAS based Bathymetric System



Integrator UAS

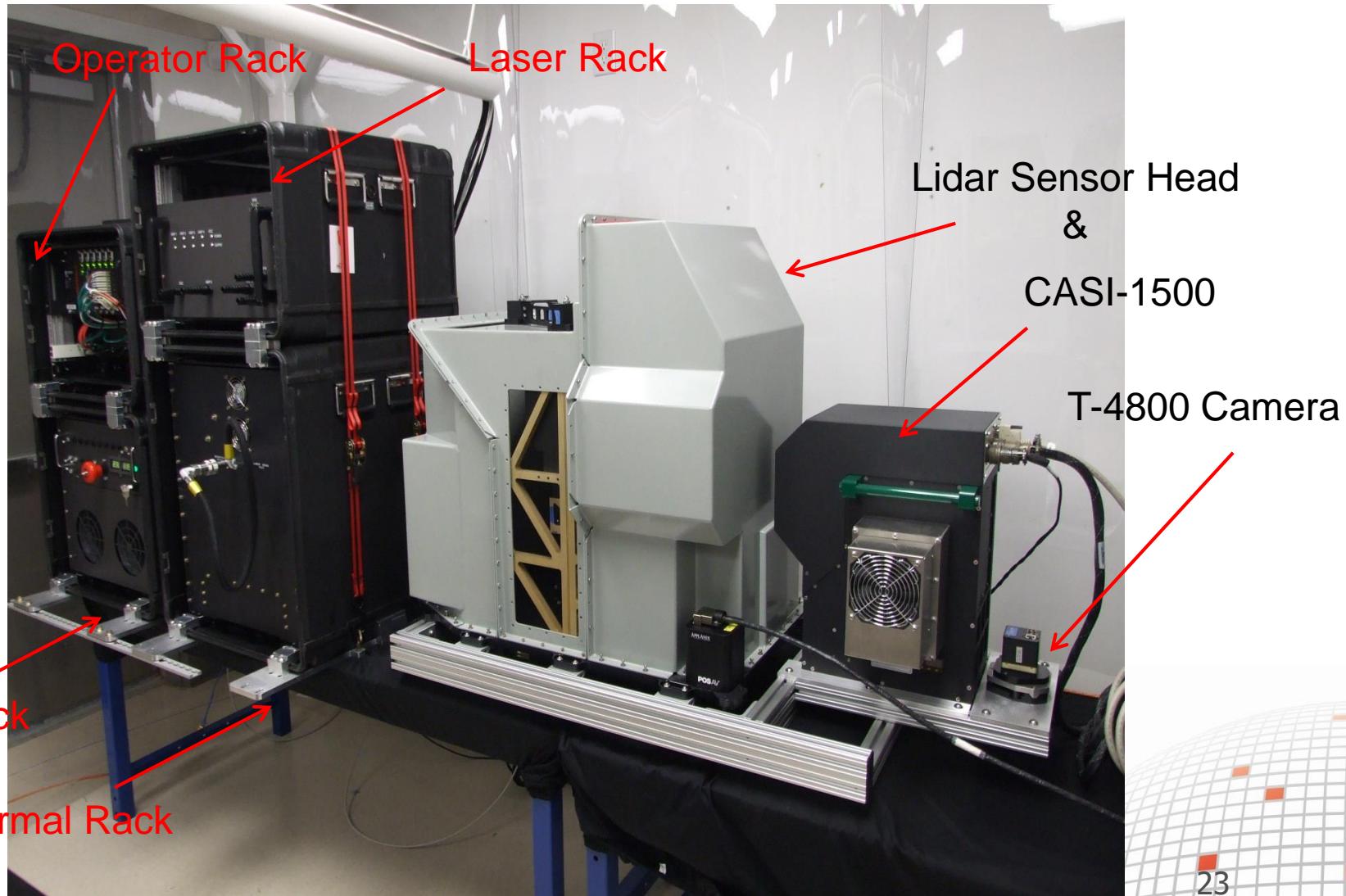
AltiCam gyrostabilized 10" diameter Multi-8000 turret

Weight: 12.5 lbs (leaves 25 lbs available)

Simultaneous daylight and NIR(400-900 nm), LWIR and MWIR (3-5, 8-12 micron).



- Multi-Sensor Data Fusion System



CZMIL DPS Ver 1.0.2

File View Tools Configuration Help

0: Master Control 1: Data Download Synchronization 2: Point-Cloud Auto-Processor 3: Manual Point-Cloud Editor 4: Image Generation 5: Feature-Extraction/Classification 6: Environmental Products Processor

▼ Process Manager

Plan Mission Process New Data

Distance between FLs (m)

Lidar swath overlap (%)

Flightline distance by % overlap?

Lidar off-nadir angle (deg)

Spectral off-nadir angle (deg)

Air speed (knots)

Altitude (m)

DC rep rate (sec)

DC x (mm)

DC y (mm)

▼ Layer Manager

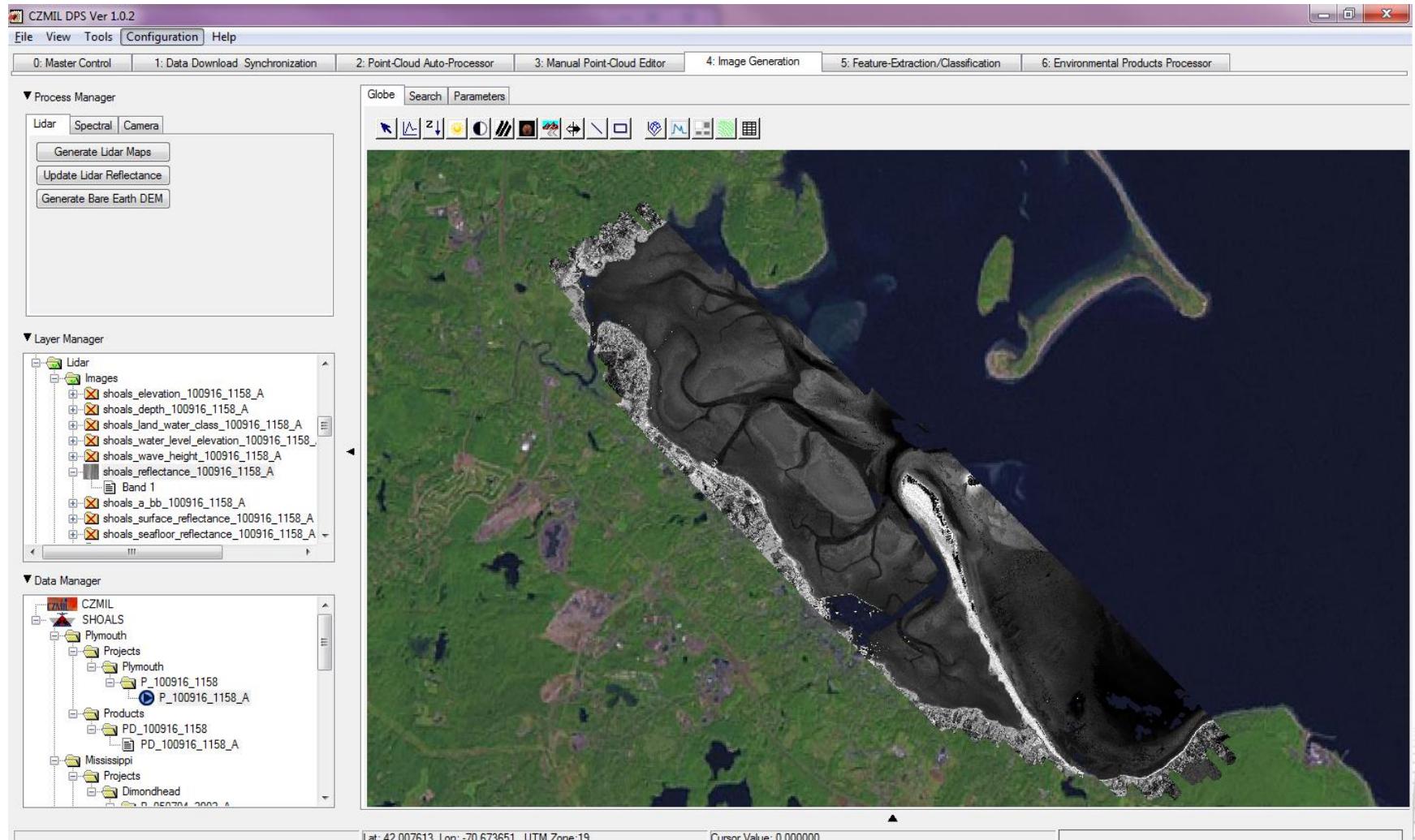
- Miscellaneous
- + FL_elev_exag
- Planner
 - Polygons
 - R_L_D
 - Flightlines
 - R_L_D_fl_14
 - R_L_D_fl_13
 - R_L_D_fl_12
 - R_L_D_fl_11
 - R_L_D_fl_10
 - R_L_D_fl_9
 - R_L_D_fl_8
 - R_L_D_fl_7
 - R_L_D_fl_6
 - R_L_D_fl_5
 - R_L_D_fl_4
 - R_L_D_fl_3
 - R_L_D_fl_2
 - R_L_D_fl_1
 - R_L_D_fl_0
- Shape Files
- Flight Lines
- ROI

► Data Manager

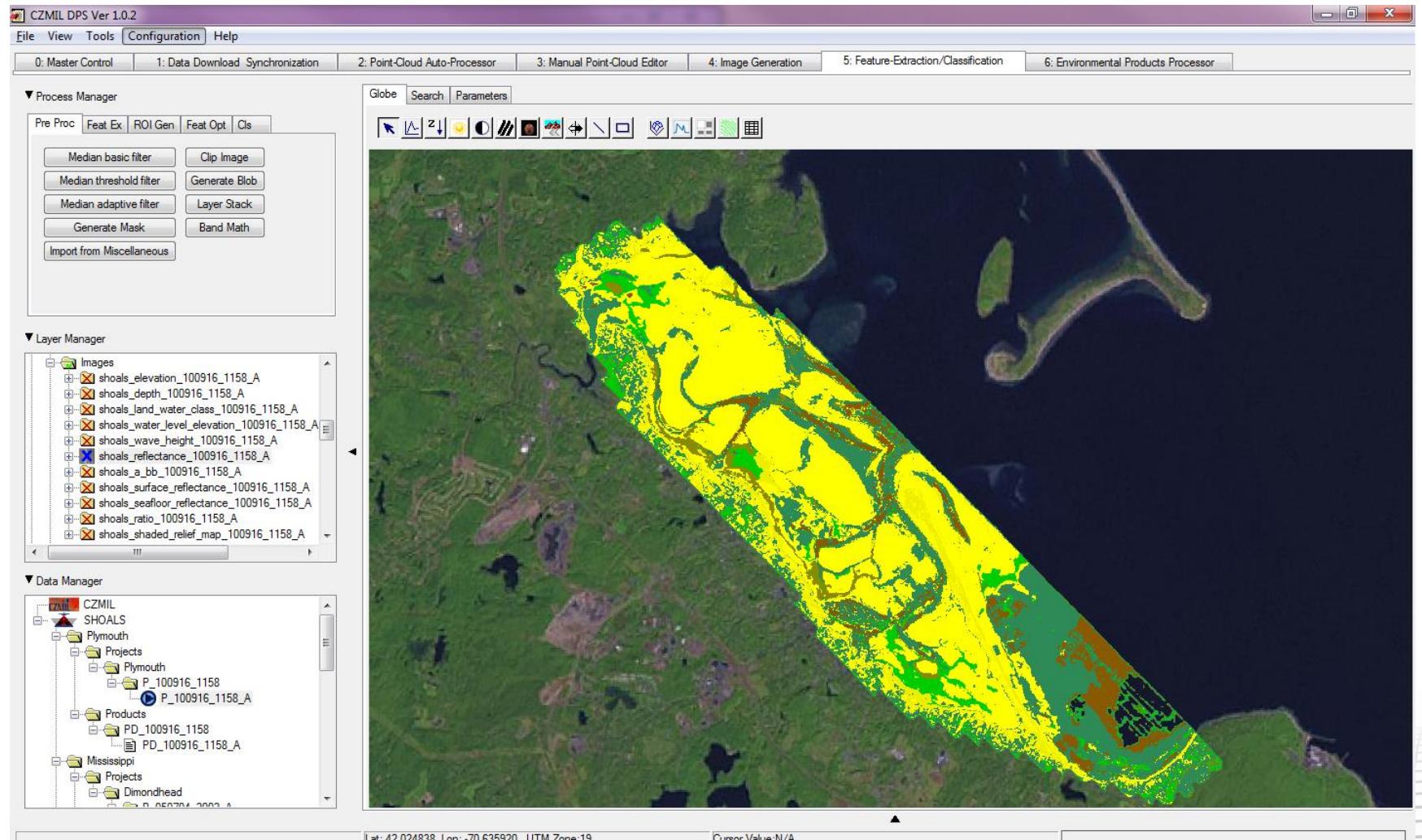
Globe Search Parameters

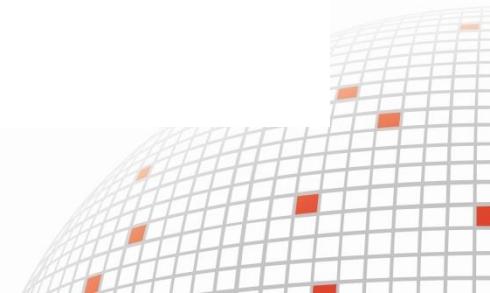
Lat: 90.000000, Lon: 126.286874, Rot: -0.0, UTM Zone: 52 N

Multi Sensor Processing

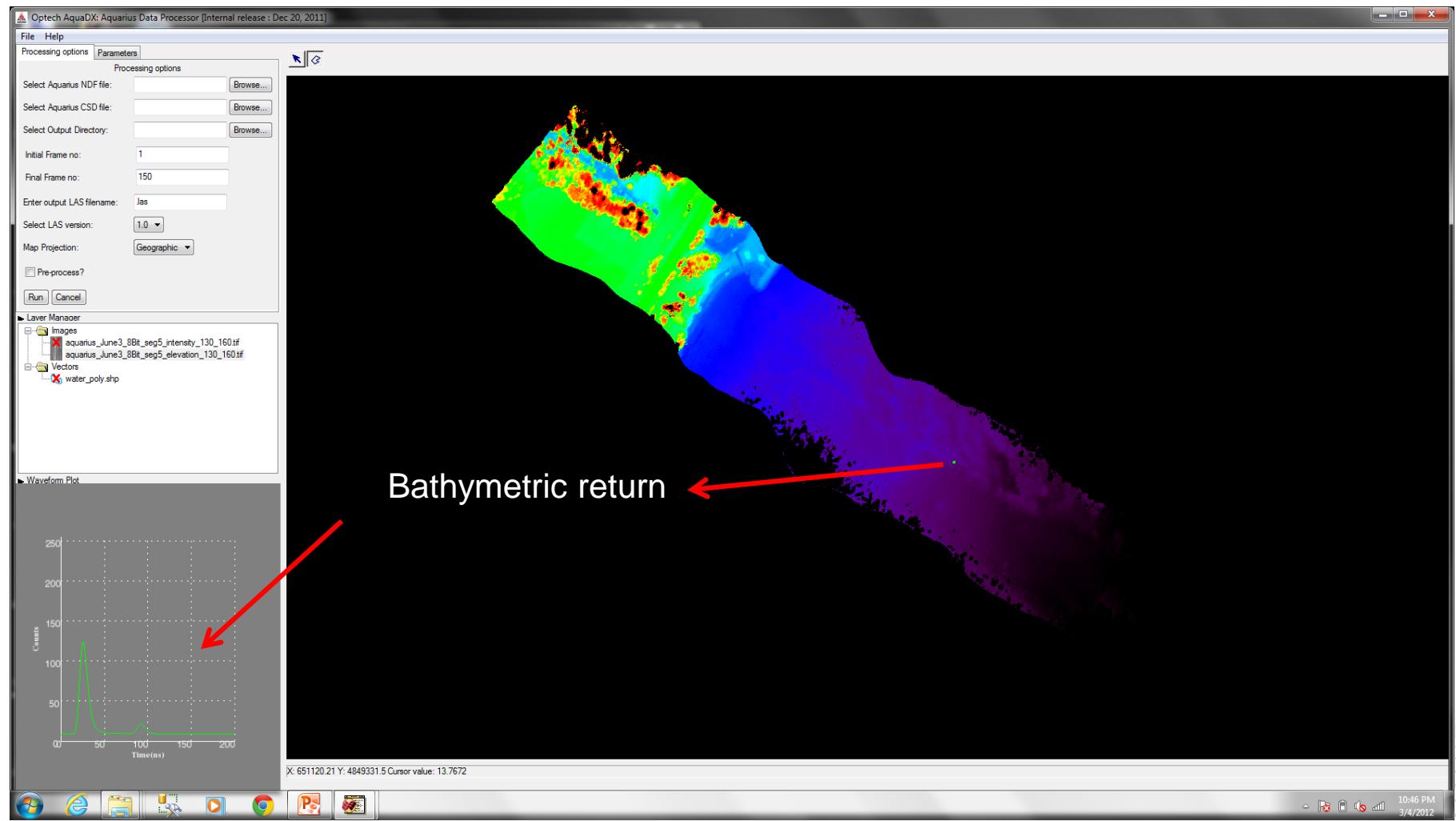


Feature Extraction/Classification





Elevation image



- The CSA Exploration Surface Mobility (ESM) program calls for the development of lunar and Martian prototype rover systems and instruments

- IVS will integrate the following three sensors:
 - A high performance lidar for DEM generation
 - An HD RGB camera for color imagery and
 - A compact NIR passive spectrometer for mineralogical and/or elemental compositional data collection.



IVS ver 0.1

File Tools Preferences Help

Main System configuration
Spectrometer Camera Download
Pan/Tilt Fusion Lidar

Available Lidar files:
ivs_data.sav
ivs_data_10M.sav
ivs_data_13M.sav
ivs_data_14M.sav
ivs_data_5M.sav
ivs_data_sim_z.sav
ivs_real_data_xyzi.sav
xyzirgb.sav

Available Camera files:
123.jpg
124.jpg
125.jpg
126.jpg
127.jpg
128.jpg
129.jpg
130.jpg
131.jpg
132.jpg
133.jpg
134.jpg
Copy of 123.jpg
Copy of 124.jpg
Copy of 125.jpg
Copy of 126.jpg

Refresh Download Fuse
Cancel Camera clear Lidar cl

Overview 2D 3D **Images** Plots Log



Camera downloaded!

XY: 1168, 1099; RGB: 244, 245, 247

IVS ver 0.1

File Tools Preferences Help

Main System configuration
Pan/Tilt Fusion Lidar
Spectrometer Camera Download

Available spectral locations:

Name	X	Y	Z	Dat
Spec_6	35.97	43.63	2.63	No
Spec_7	10.98	8.99	-1.58	No
Spec_8	7.83	27.27	2.50	No

Integration time:

Trigger mode:

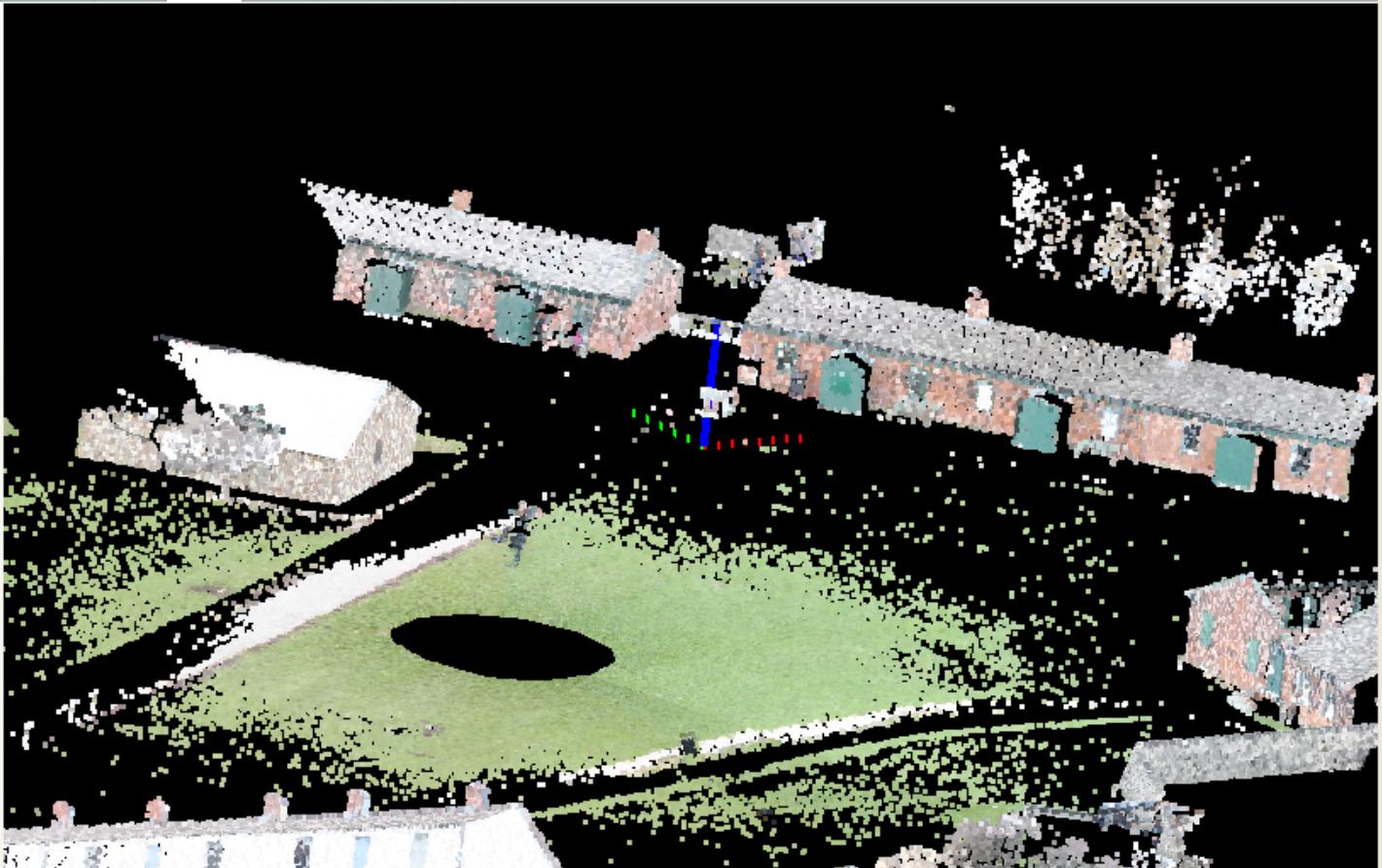
File Name:

Show flags

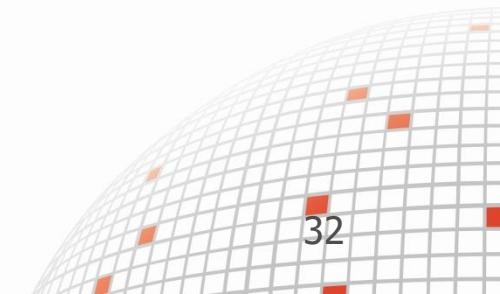
Fusion complete!

X: 8.89 Y: 26.37 Z: 2.69

Overview 2D 3D Images Plots Log



- Resources: 8 out of 9 have post graduate degrees. 5 of team has doctoral degrees.
- Professional group of developing geospatial data processing tools since 2003.
- Dedicated to develop a total solution to replace 7-8 softwares for USACE and US Navy since 2008.



- UAS based Lidar system (or sensor fusion based)
 - Tactical – small target detection
 - Nautical – bathymetric charting
 - Natural Disaster Management – Oil detection

- UUV based Optical properties and mapping system

