

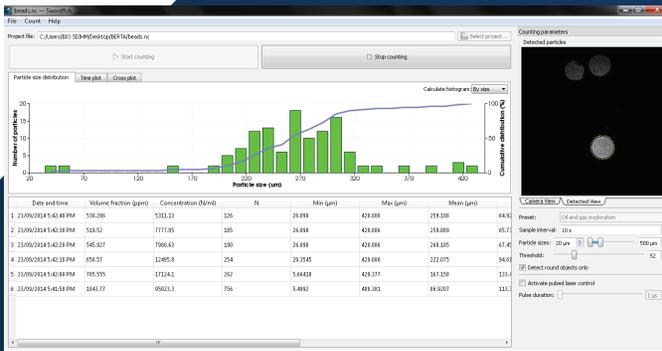
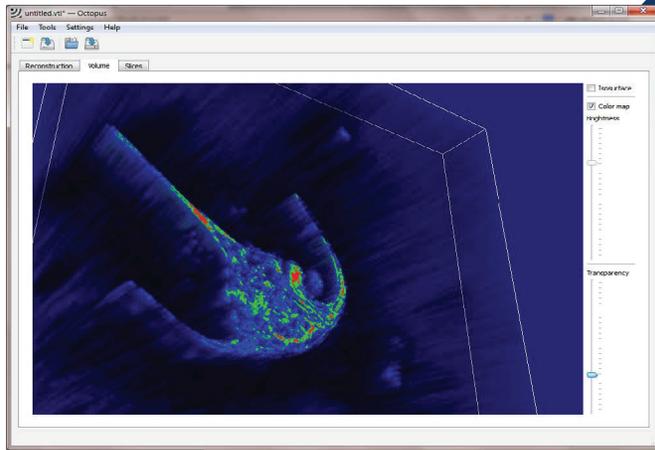


4Deep
inwater imaging



FEATURES / CAPABILITY / BENEFIT

Feature	Capability	Benefit
405nm fiberoptic light source with pulse control as fast as 1 microsecond	Can be towed up to speeds of 4knots with 1 micron resolution	<ul style="list-style-type: none"> - No longer limited by sampling for analysis in the laboratory, which is tedious, time consuming and costly - No sample preparation - Qualitative data combined with images: not just counting, sizing and identifying - Applications in water quality and monitoring, harmful algae bloom monitoring, phytoplankton, bacteria, oil detection.
No moving parts, no pumps or tubes, no focusing or objectives	Can be used in any body of water, portable, deployed from boat, mooring, AUV.	<ul style="list-style-type: none"> - Can be used in "the field" - Easily shipped, deployed, serviced and cleaned - Virtually no installation, moving parts or training.
16 frames per second data acquisition and analysis	Real-time, in-situ imaging of water	<ul style="list-style-type: none"> - The best resolution to price ratio while still having a broad application base.
Models available for shallow or deep water applications	Imaging volume equivalent of 60 ml of water every minute	<ul style="list-style-type: none"> - Ideal instrument for tracking moving samples - Can calculate flow velocities - High definition quality in 3D and 4D representations.



The Swordfish application counts and analyzes particles

RAPID DEPLOYMENT

Simply put the microscope in the water and start recording. There is no calibration, warm up, no pumps, tubes or plumbing. The microscope contains a rapid pulse fiberoptic laser to capture clear images under high flow conditions. The device can effectively travel through the water at speeds of up to 4 knots.

SUBMERSIBLE SPECIFICATIONS

Resolution	1 micron
Power consumption	5 W
Data transfer	Gigabit Ethernet
Communication and Power	13 pin Subconn
Hologram size	from 2048 x 2048 to 512 x 512
Hologram reconstruction time	65 ms
Flow / Imaging chamber gap	15 mm

4DEEP INWATER IMAGING SUBMERSIBLE MICROSCOPE

A holographic microscope system for real-time, in-situ water monitoring

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GO UNDER THE SEA

The microscope uses a 405nm fiberoptic laser as a light source. It will detect and analyze objects in any body of water as small as 1 micron up to a few mm. Versions are available for shallow or deep water deployments. It can be stationary, be used for vertical profiling or even towed through the water column to cover large areas of investigation.

4Deep Submersible Holographic Microscope



REAL TIME ANALYSIS OF THE WATER

The Submersible can collect and reconstruct holograms at a rate of 16 frames per second at full size, and up to 50 frames per second with binning. A 4 Mpix hologram can be reconstructed in under 65 ms; up to 1000 times faster than the closest competitor. The tethered cable of the submersible serves as a power source and Gigabit Ethernet connection. With real time data flow and image analysis users have the advantage of on-line results. The stored holograms also contain all information for off-line processing.

The Stingray application delivers dynamic 3D imaging capabilities

PERFECT PARTNERS

The submersible works seamlessly with Swordfish, Octopus or Stingray software programs (see separate product brochures).

With Swordfish, the microscope acts as a high-speed particle counter that will automatically count, size and image particles and microorganism. Provide full statistics based on size or volume distributions. Results can be updated as fast as every second. Can detect round objects only for oil droplet applications.

With Octopus, users have research grade software with image complete analysis in 2D, 3D and 4D movies.

Stingray will automatically extract images in focus and sort and classify according to morphological criteria.

SEE VOLUMES

The submersible has a 3D holographic imaging sensor that rapidly samples objects within a volume (equivalent to 60 ml / min).

Sampling through a volume allows a larger number of objects to be detected and measured than with traditional optical lens microscopes without a need for focusing. The submersible is also ideal for tracking fast moving objects.

The screenshot shows the Stingray software interface. At the top, there is a menu bar (File, Edit, Taxon, Analyze, Help) and a toolbar with icons for file operations and analysis. Below the menu, there are fields for 'Results selection' with 'From' and 'To' date/time pickers, and buttons for 'Today', 'Week', and 'Month'. A 'Start analysis' button is visible. A 'Manage classifiers' dialog box is open in the center, displaying a table of classifiers and their parameters.

Image	Histogram	PCA of FFT	Taxon	Name	Location
1			Diatomium 1	auto saved	location
2			Diatomium 1	auto saved	location
3			Diatomium 1	auto saved	location
4			Diatomium 1	auto saved	location

Below the table, there are buttons for 'Delete samples' and 'Delete classification'. A second table shows classifier details:

Predictor	Date	Taxons	Samples count	Use geometry	Classifier
1 Potential functi...	4/10/14 11:04 AM	Diatomium 1, C...	86	Yes	Neural network
2 lib-SVM	4/10/14 7:10 PM	Diatomium 1, C...	86	Yes	Neural network
3 Neural network	7/1/14 7:31 PM	Diatomium 1, C...	10	Yes	Neural network
4 Neural network	7/1/14 7:32 PM	Diatomium 1	10	Yes	Neural network
5 Neural network	7/1/14 7:32 PM	Ceratum tripos	10	Yes	Neural network

On the right side of the interface, there are 'Analysis parameters' including 'Detected particles' (with a camera view), 'Particle sizes' (15 µm to 500 µm), 'Threshold' (75), and 'Object properties' for a selected object (Object ID: 142, Ceratum tripos, Length: 198.213 µm, Width: 130.727 µm). The bottom status bar shows 'Current distance: 6489.23' and '12%'.