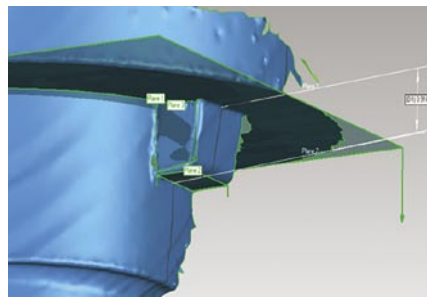


Extended Range Nuclear Underwater Laser Scanner Model NM300UW

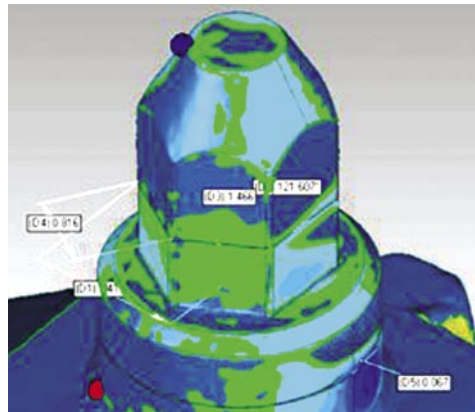
The NM300UW Extended Range Nuclear Underwater Laser Scanner enables time-efficient surveys that capture precise, non-contact measurements with sub-millimeter accuracy of larger, in-vessel or fuel storage pool elements and at a greater stand-off distance.

- The NM300UW system combines rugged, industrial-grade hardware and electronics with sophisticated, Newton-developed software that compensates for the disruption of refraction, turbulence, heat and radioactivity typical of the in-vessel environment.
- The NM300UW outputs a point cloud so detailed, that when utilized with industry standard 3-D software, a fully-measurable CAD model can be generated. This provides plant engineers with precise dimensioning of as-built features, cracks, welds, rust, pitting and other deformities on structures, submerged pipes and valves.

The M310UW is specifically designed to deliver precise measurement scans underwater with a laser-to-target distance ranging from 1.5 feet to 10 feet.



Newton underwater scanning technology measured the position of this BWR jet pump main wedge to establish a base line for any movement in future cycles. **



CAD model of a bracket bolt rendered in 3-D software from point clouds of consecutive scans at different positions. Greenish areas indicate corrosion. **



NM300UW Measurement Head



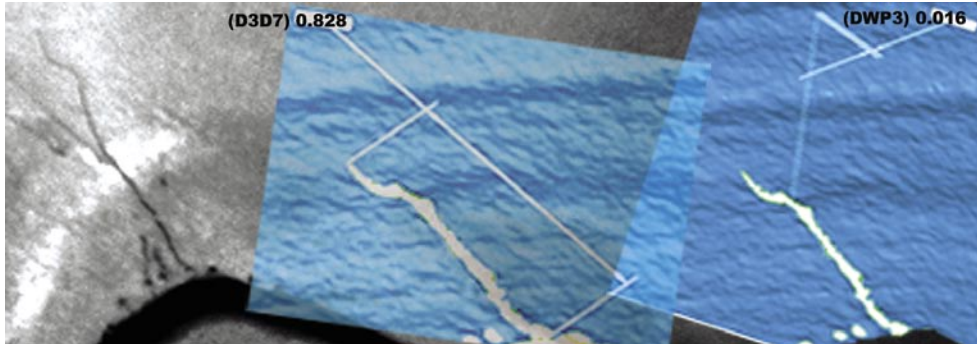
NM300UW Control Console, screen and keyboard with trackball.

NM300UW Scanner Operation

- **The M310UW operates by triangulation** - The laser sweeps the target and the high resolution camera records any deformation of the beam as a point cloud.
- **The M310UW scans a target** as distant as 10 feet (3.0 m) and as close as 1.5 feet (0.46 m), for a scan coverage area of 9 ft. X 7 ft. (2.7 m X 2.13 m). The system measures underwater targets up to an accuracy of +/- .001 in. (0.025 mm).
- **M310UW software can capture much larger target areas** by combining several point clouds together to form larger composites.

- **Operators may select from several levels of scan quality.** The shortest, coarse scan takes 15 seconds; the longest and most detailed takes about three minutes
- **In the visual observation mode,** the LED ring arrays illuminate the area and the camera transmits a monochrome image to the control console screen.
- **Deployment of the scanner head** can be by a pole mounting, articulated arm, ROV, or other robots.

** Images are the property of Westinghouse Electric Company LLC. Used with permission



The monochrome image at left from a standard IVVI video shows a crack in a BWR steam dryer door. The nuclear laser scanner results (in blue) of the same crack and processed with 3-D software, precisely captures the width at all points along the length (shown in inches). (Images are the property of Westinghouse Electric Company LLC. Used with

Background of Newton Labs

Newton Labs is a Seattle area-based privately held developer and manufacturer of machine vision and robotic systems. Newton's powerful, easy to use, and industrially rugged systems provide solutions for wide ranging applications in many sectors, including aerospace, automotive, bottling, electronics, medical, packaging, and nuclear, among others. In 20 years Newton has deployed more than 20,000 machine vision and automation systems worldwide, many that are first-of-a-kind.



(Left) The PT200UW Pan-Tilt Arm enables precise and rapid positioning of a NM300UW scanner with a pole, ROV or robot in order to capture dimensional measurements from multiple angles of a target within a BWR or PWR vessel.

NM300UW Technical Specifications & System Performance

Item	Control Unit	Laser/Camera Head
Height	9.5 in. (241.3 mm)	14.5 in. (368.3 mm)
Width	15 in. (381 mm)	5.25 in. (133.35 mm)
Length	22.5 in. (571.5 mm)	5.0 in. (127 mm)
Weight	98.2 lbs. (44.5 k)	[Air - 17 lbs. (7.7 k)] [Water - 11 lbs. (5 k)]
Construction	Metal electronics cabinet within a molded, high-impact, airline-transportable case	Machined from solid billet of 6061-T6 aluminum stock
Laser power	---	35 mW
Video camera	---	High Resolution Monochrome
LED arrays	---	3,336 lumens
Data storage	Internal solid state & USB stick data	---
Output format	.ply point cloud file	---
Data file size	Approximately 100 MB per scan	---
Maximum scanner-to-target distance	---	10 ft. (3.0 m)
Minimum scanner-to-target distance	---	18.0 in. (0.46 m)
Maximum Resolution accuracy (after processing with 3-D software)	---	+/- .001 in. (0.025 mm)*
Scan area	---	9 ft. X 7 ft. (2.7 m X 2.13 m)
Watertight depth rating	---	150 ft. (46 m)

Depth of Field Distance (Distance to object)	Field of View		Raw Accuracy (Single Point Cloud point, rms)	Approximate CAD Model Accuracy**
	Height	Width		
1.5 ft. (0.5 m)	0.33 m	0.43 m	+/- .005 in. (0.13 mm)	+/- .001 in. (0.025 mm)*
3.0 ft. (0.9 m)	0.66 m	0.86 m	+/- .010 in. (0.25 mm)	+/- .002 in. (0.050 mm)
6.0 ft. (1.8 m)	1.32 m	1.72 m	+/- .027 in. (0.68 mm)	+/- .005 in. (0.137 mm)
8.0 ft. (2.4 m)	1.68 m	2.24 m	+/- .050 in. (1.27 mm)	+/- .010 in. (0.254 mm)
10.0 ft. (3.0 m)	2.08 m	2.80 m	+/- .072 in. (1.83 mm)	+/- .010 in. (0.254 mm)

*NM300UW accuracy is related to the field of view, distance from the object to be measured and can vary by the parameters of the object. Consult Newton for the specific accuracy that can be obtained for your proposed object.

***After 3rd-party 3-D software processing

NEWTON