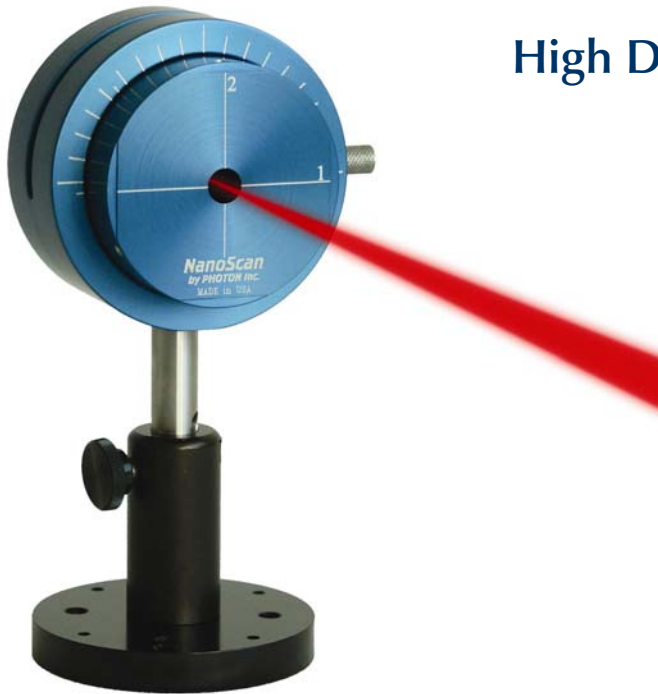


NanoScan

High Dynamic Range Beam Profiler



NanoScan—the most versatile and flexible beam profiling system available

Photon's NanoScan scanning slit profilers provide major performance enhancements while maintaining the ease-of-use and flexibility that customers have come to expect with its predecessor, the world-renowned BeamScan. NanoScan scan heads are available to measure CW and pulsed beams across the entire spectral range from UV to far infrared.

Capabilities

The NanoScan digital controller based on PCI architecture. This provides deep, 12-bit digitization of the signal for enhanced

dynamic range up to 35dB_{power} optical. The digital controller improves the accuracy and stability of the beam profile measurement by orders of magnitude. It is now possible to measure beam size and beam pointing with a 3-sigma precision of several hundred nanometers. The software controllable scan speed and a "peak-connect" algorithm allows the measurement of pulsed and pulse width modulated lasers with frequencies of a few kHz and higher with any detector.¹ The ability to alter the drum speed also helps to increase the dynamic range allowing a much larger operating space for any given scan head (see operating space charts for a graphic explanation).

Multiple Beam Analysis Software

In addition to the hardware, the NanoScan has an integrated software package for the Microsoft Windows Platform, which can measure from one to 16 beams in the NanoScan aperture, all with sub-micron precision. The software includes ActiveX automation for users who want to integrate the NanoScan into OEM systems or write their own user interface screens.

¹ The minimum frequency is a function of the beam size and the scan speed. This is a simple arithmetic relationship; there must be a sufficient number of pulses during the time that the slits sweep through the beam to generate a meaningful profile. Please refer to Photon's Application Note, *Measuring Pulsed Beams with a Slit-Based Profiler*.

Power Meter Standard

The silicon and germanium NanoScan systems include the 200mW power meter as a standard feature, and there is a no-charge option (/P75) to replace this with the more accurate 75mW power meter. The power meter can be calibrated against the user's ISO- or NIST- traceable power meter. The 200mW power meter has a quartz attenuator - window that provides a uniform response across a broad wavelength range with a 1.5% accuracy when used in the same geometry as calibrated. The /P75 uses a more uniform Kodak Wratten filter that provides better than 1% accuracy, but it has an upper power limit of 75mW and must be supplied for a specific wavelength of use.

The power meter screen in the software shows both the total power and the individual power in each of the beams being measured. The power meter option is not available with pyroelectric detectors due to the broad range of power levels and wavelengths encountered with these scan heads.

Available Detectors

The NanoScan is available with silicon, germanium and pyroelectric detectors to cover the light spectrum from UV to far infrared beyond 100 μ m. The scan heads are available in several sizes, apertures and slit dimensions. See the table for available configurations.

Features

- ◆ Sub-micron precision for position and beam size
- ◆ Easy-to-use integrated software package
- ◆ Single and multiple beam analysis standard in one software package
- ◆ Software controllable scan speed (update rate)
- ◆ Peak-connect algorithm for pulsed beam measurement
- ◆ PCI interface and digital head control
- ◆ 12-bit digitization of signal
- ◆ ActiveX automation for communication with other software packages
- ◆ Standard power meter with silicon and germanium scan heads
- ◆ Silicon, germanium, and pyroelectric detectors available

Benefits:

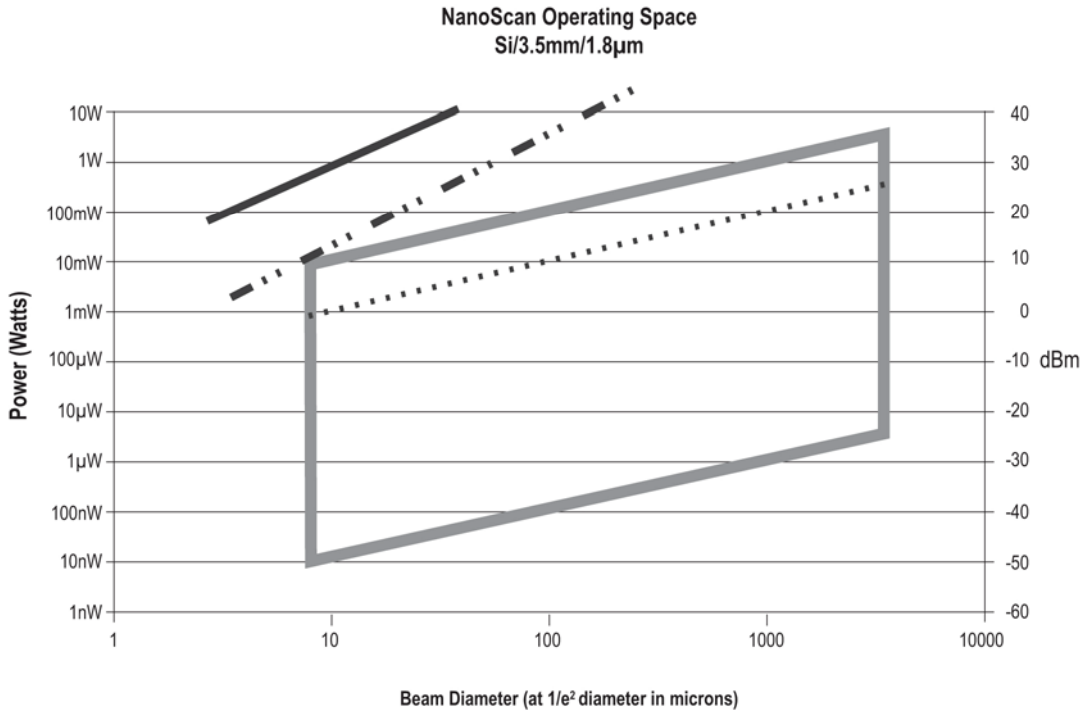
- ◆ Laser beam XY position measurement uncertainty better than 300nm
- ◆ Beam size measurement precision to better than 0.5%
- ◆ High dynamic range ($\sim 35\text{dB}_{\text{power}}$)
- ◆ Low instrument noise/jitter
- ◆ Precise knowledge of components' beam configuration possible to allow precise component assembly
- ◆ OEM automation integration capability
- ◆ Simple, intuitive software GUI for minimal learning curve
- ◆ Flexibility to control more head parameters increases range of operation
- ◆ Low-power pulsed beams can be measured
- ◆ Many high-power beams can be measured at focus without attenuation

NanoScan Configurations

Detector Type	Power Range	Wavelength	Aperture	Slits	Scan Head Size
Silicon	~100nW-100mW*	190nm-1000nm	3.5mm	1.8 μ m	63mm
				1.0 μ m	
			9mm	5 μ m	63mm
				25 μ m	
25mm	25 μ m	100mm			
Germanium	~1 μ W to 100mW*	700nm-1800nm	3.5mm	1.8 μ m	63mm
				1.0 μ m	
			9mm	5 μ m	63mm
				25 μ m	
			12.5mm	25 μ m	100mm
25mm	25 μ m				
Pyroelectric	100mW-100W* *Dependent on beam size	190nm->100 μ m	9mm	5 μ m	63mm
		190nm->100 μ m >700nm recommended	9mm	5 μ m Copper	63mm
		190nm->100 μ m	20mm	25 μ m	100mm
		190nm->100 μ m >700nm recommended		10 μ m Copper	100mm

Typical NanoScan Operating Space Charts

Operating Range is at Peak Sensitivity of Detector.
 Operating Space is NOT absolute.
 THESE CHARTS TO BE USED AS A GUIDE ONLY.



Silicon Detector

Silicon Detector: Responsivity varies with wavelength. Detects between 190-950nm. Peak responsivity is 0.4 amps/watt at 850nm. Detector to detector responsivity variation can be as great as ±20%.

Power: Power in the measured laser beam. Assumes a round beam diameter. An elliptic beam can be approximated by using the maximum width dimension and assuming all the energy is in a beam of this diameter. For extremely elliptic beams (ratio >4:1) contact the factory.

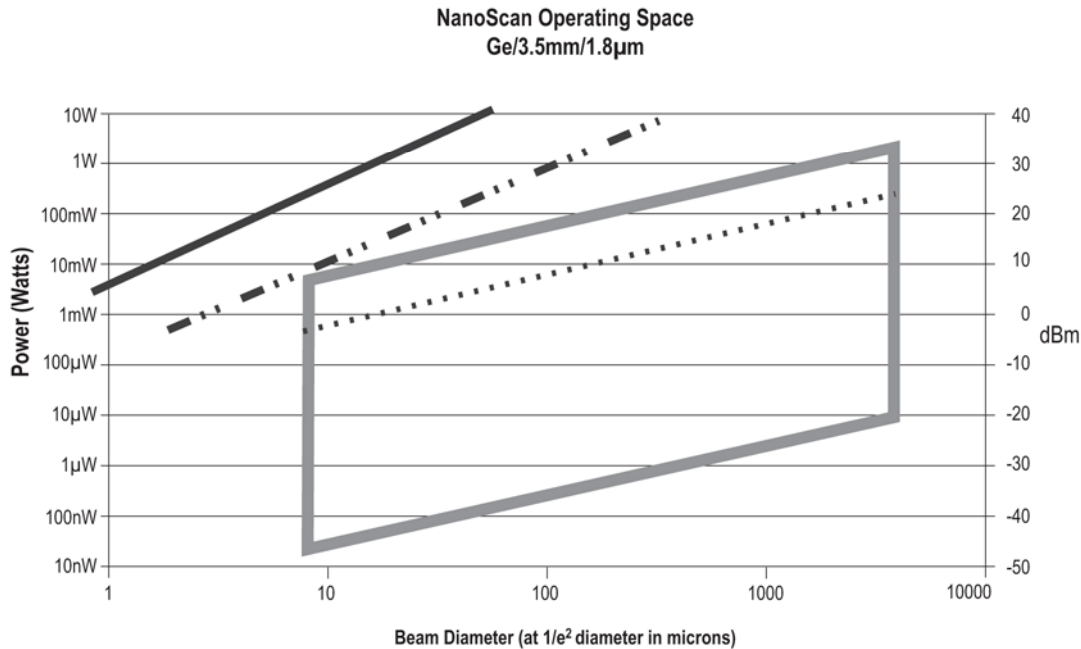
Pulsed Operation: (·········) Upper limit of the operating space for pulsed laser measurements.

Black Coating Removed (— · · · —): Slits are blackened to reduce back reflections; blackening begins to vaporize near this line. Slits in pyro detectors are not blackened.

Slit Damage (—————): Power density (watts/cm²) where one can begin to cut the slits. Refer to Photon's *Damage Threshold with High Power Laser Measurements* document.

Left Boundary: Smallest beam size limited to 4-5 times the slit width. Some models have another limit due to electrical bandwidth.

Right Boundary: Instrument entrance aperture. The largest beam width (1/e²) will be the aperture divided by 1.2-1.4.



Germanium Detector

Responsivity: Detector conversion constant, incident photons to a current.

Detector: Responsivity varies with wavelength. Detects between 700-1800nm. Peak responsivity is 0.7 amps/watt at 1550nm. Detector to detector responsivity variation can be as great as $\pm 20\%$.

Power: Power in the measured laser beam. Assumes a round beam diameter. An elliptic beam can be approximated by using the maximum width dimension and assuming all the energy is in a beam of this diameter. For extremely elliptic beams (ratio >4:1) contact the factory.

Beam Diameter: Circular laser spot being measured by a narrow slit. Clip level method.

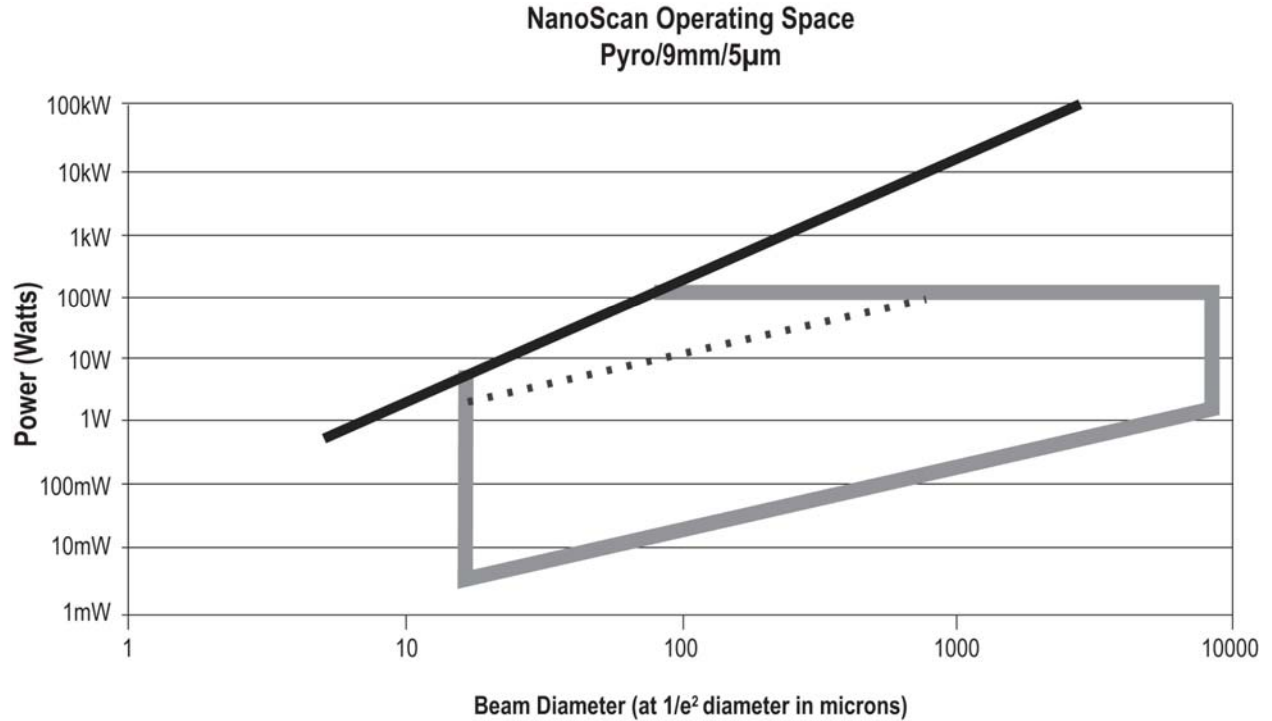
Pulsed Operation (.....): Upper limit of the operating space for pulsed laser measurements.

Black Coating Removed (— ■ —): Slits are blackened to reduce back reflections; blackening begins to vaporize near this line. Slits in pyro detectors are not blackened.

Slit Damage (————): Power density (watts/cm²) where one can begin to cut the slits. Refer to Photon's Aperture Damage due to High Incident Power document.

Left Boundary: Smallest beam size limited to 4-5 times the slit width. Some models have another limit due to electrical bandwidth.

Right Boundary: Instrument entrance aperture. The largest beam width (1/e²) will be the aperture divided by 1.2-1.4.



Pyroelectric Detector

Pyroelectric Detector: Uniform in response between 0.2 and 100 microns wavelength.

Pulsed Operation: (.....) Upper limit of the operating space for pulsed laser measurements.

Slit Damage (—————): Power density (watts/cm²) where one can begin to cut the slits. Refer to Photon’s Aperture Damage due to High Incident Power document.

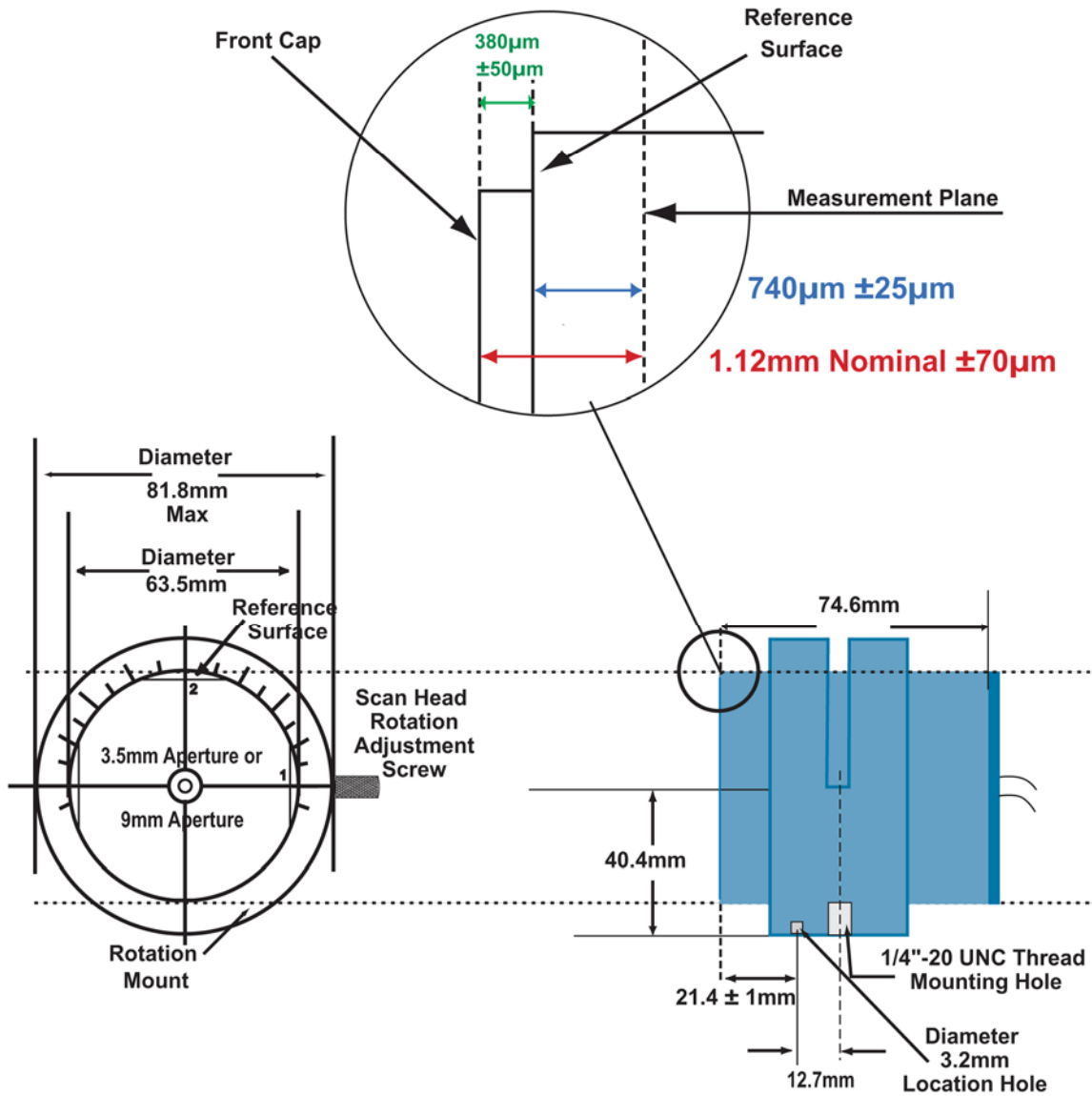
Left Boundary: Smallest beam size limited to 4-5 times the slit width. Some models have another limit due to electrical bandwidth.

Right Boundary: Instrument entrance aperture. The largest beam width (1/e²) will be the aperture divided by 1.2-1.4.

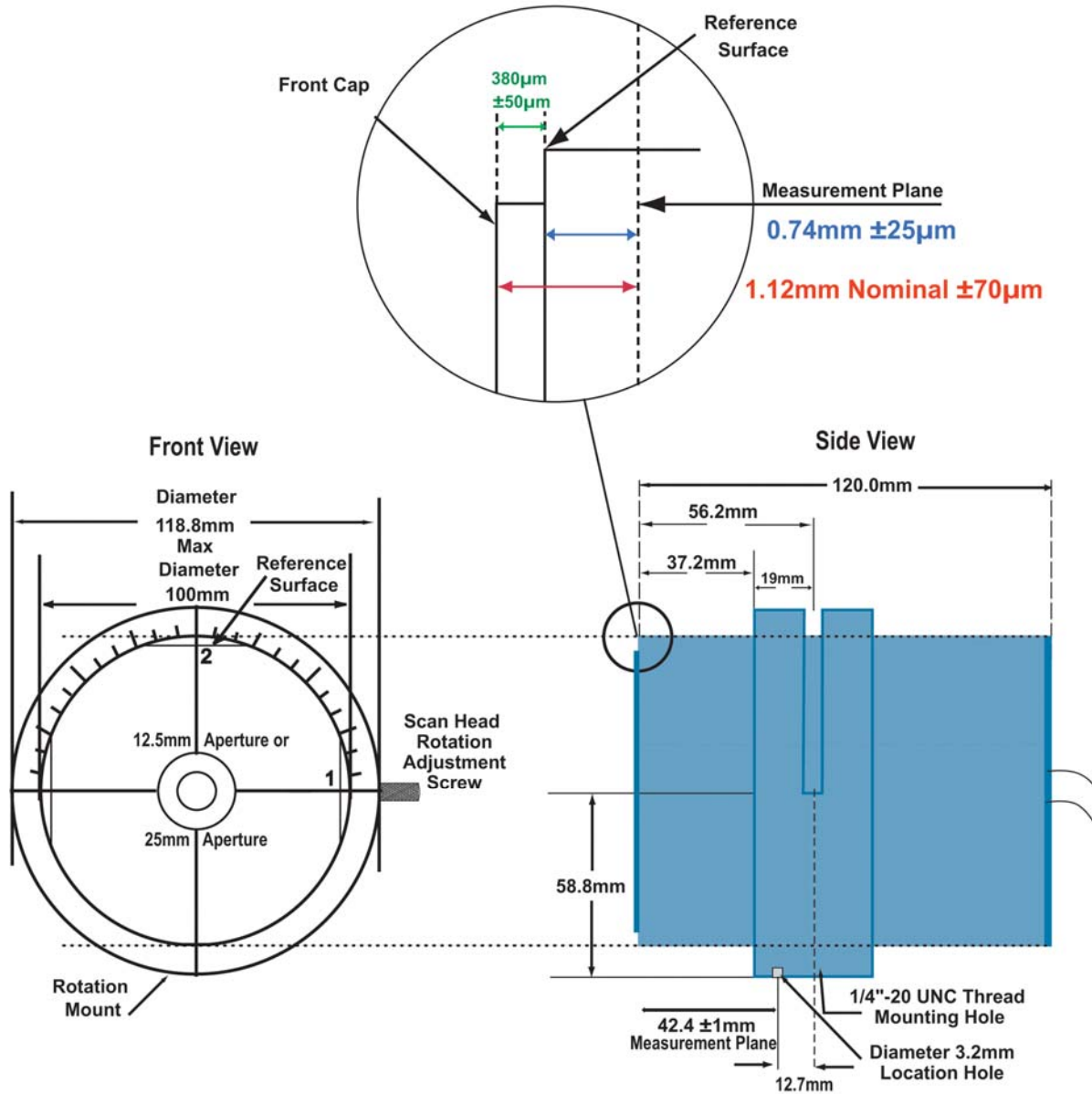
NanoScan

Mechanical Dimensions

NanoScan Silicon and Germanium Standard Scan Head



NanoScan Silicon and Germanium Large Aperture Scan Head



NanoScan Pyroelectric Scan Head

