

Tech. Note – Precision, Spatial Resolution & Repeatability

Some definitions and discussion of technical parameters

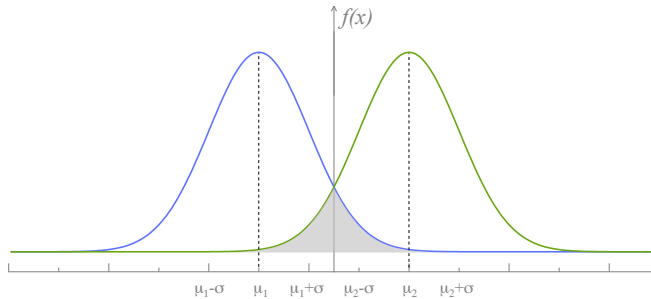
➔ Precision, also known Standard Deviation (ISO standard)

Precision is the closeness of agreement between independent test results obtained under stipulated conditions. **The measure of precision is usually expressed in terms of imprecision and computed as a standard deviation of the test results.** Less precision is reflected by a larger standard deviation. [SOURCE: ISO 3534-2:2006,3.3.4]

➔ Spatial Resolution, discussion about the criterion

Resolution is generally defined as the smallest detectable interval between measured values. For a physical parameter whose measurement values follow a Gaussian distribution $N(\mu, \sigma^2)$, a significant portion of people equate the standard deviation σ directly with resolution, while others adopt a stricter criterion, such as 3σ .

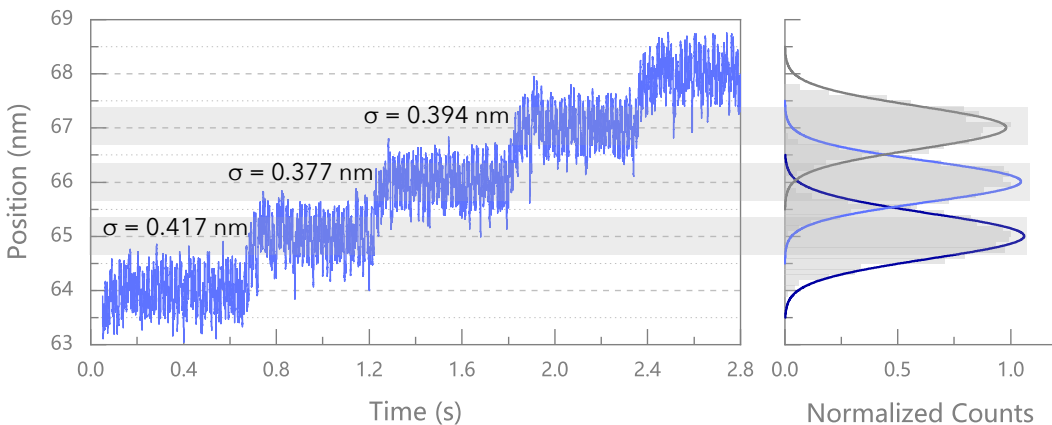
When the measured values are adjacent, the percentage of overlapping area between their Gaussian distributions determines the distinguishability of these two values, which is a critical factor in defining the resolution.



➔ Example, Spatial resolution of Scanner.Ultra motion

Scanner35-z.Ultra was operated at 4.2 K in a ultra low-vibration cryogenic platform (ColdTABLE) .

The data acquisition from the capacitive sensor showed the RMS noise (σ) during closed-loop control was typically ~ 0.4 nm. We make scanner to move step by step with 1 nm distance. It is easy to distinguish steps.



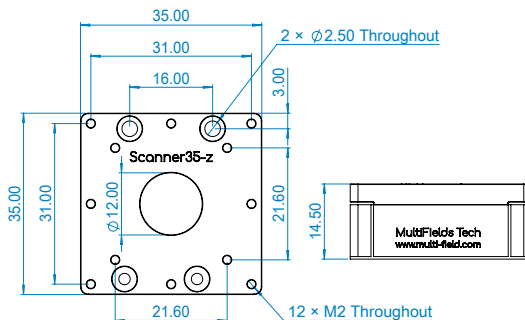


"Closed-loop scanner series" – Scanner35-z.Ultra

Scanners with sub-nanoscale resolution capacitive displacement sensors for closed-loop control

- ➔ Features
- Compact design
 - Long travel range
 - Closed-loop control
 - High load & high force
 - Non-magnetic material

➔ Picture & dimensions



➔ Specifications

Optional Versions ➔	.HV (default)	.ULT	.UHV	.ULT.UHV
	.HV version, compatible with 1E-7 mbar .ULT version, used at He3 or dilution cryogenics systems .UHV version, compatible with 2E-11 mbar			
1 Footprint × hight	35 × 35 mm × 14.5 mm			
2 Weight	110 g			
3 Work environment	Temperature range: 1.4 ~ 400 K, Max. Magnetic field: 35 Tesla			
4 Option1 - 30 mK		✓		✓
5 Option2 - 2e-11 mbar			✓	✓
6 Mainbody	Pure Ti	BeCu	Pure Ti	BeCu
7 Wires	twisted paired wire & triax cable			
8 Connectors	2 head pins + 1 triax connector (for each dimension)			
9 Scanning Axis	Z			
10 Travel range	@300 K: 100 µm; @4 K: 60 µm			
11 Drive Voltage	Max. 75 V @300 K; Max. 150 V @4 K			
12 Max. Load	500 g			
13 Capacitance @300 K	7 uF			
14 Sensor	Capacitive displacement sensor			
15 Resolution	0.5 nm			
16 Linearity error	Typical ~ 0.1 %			
17 Repeatability	< 5 nm			

For detail drawing and 3D model please contact us.