

## DX-3100 系列振动样品磁强计

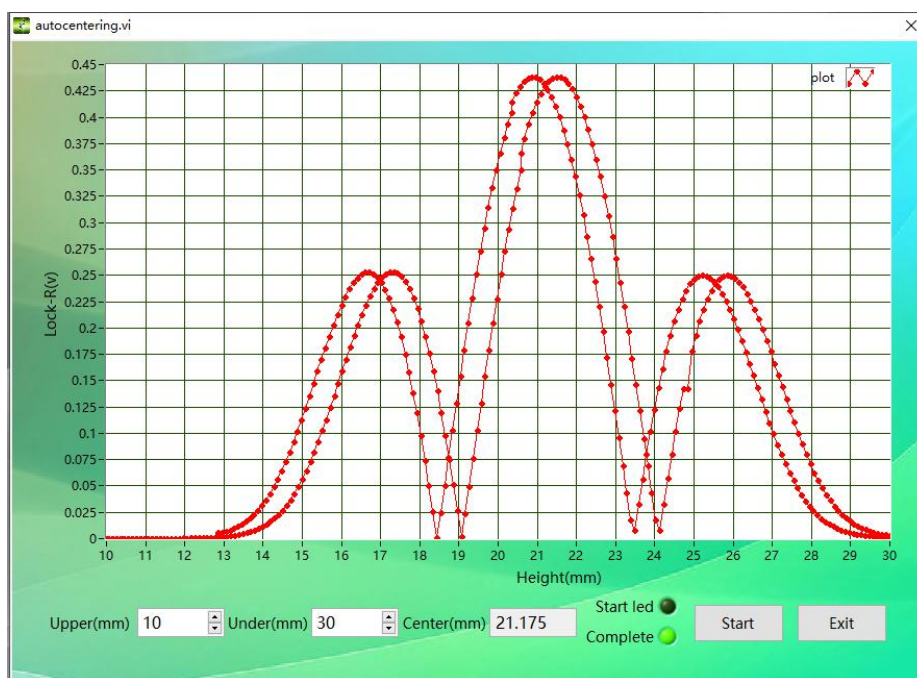


## 简介

DX-3100 系列振动样品磁强计，是国内首套磁矩测量噪音进入  $10^{-8}$  emu 量级 ( $4 \times 10^{-8}$  emu noise floor at 10 s/point) 的商业 VSM。我司在国际范围内对磁性测量设备的引进推广、代理销售和技术服务等方面，有超过 20 年的经验。我们借鉴了国际上最先进的几种振动样品磁强计的的优点，并参考了超导磁体上振动样品磁强计的设计理念，在电磁铁的平台设计出性能一流、功能均衡和选件丰富的全新一代产品。

## 功能和特点

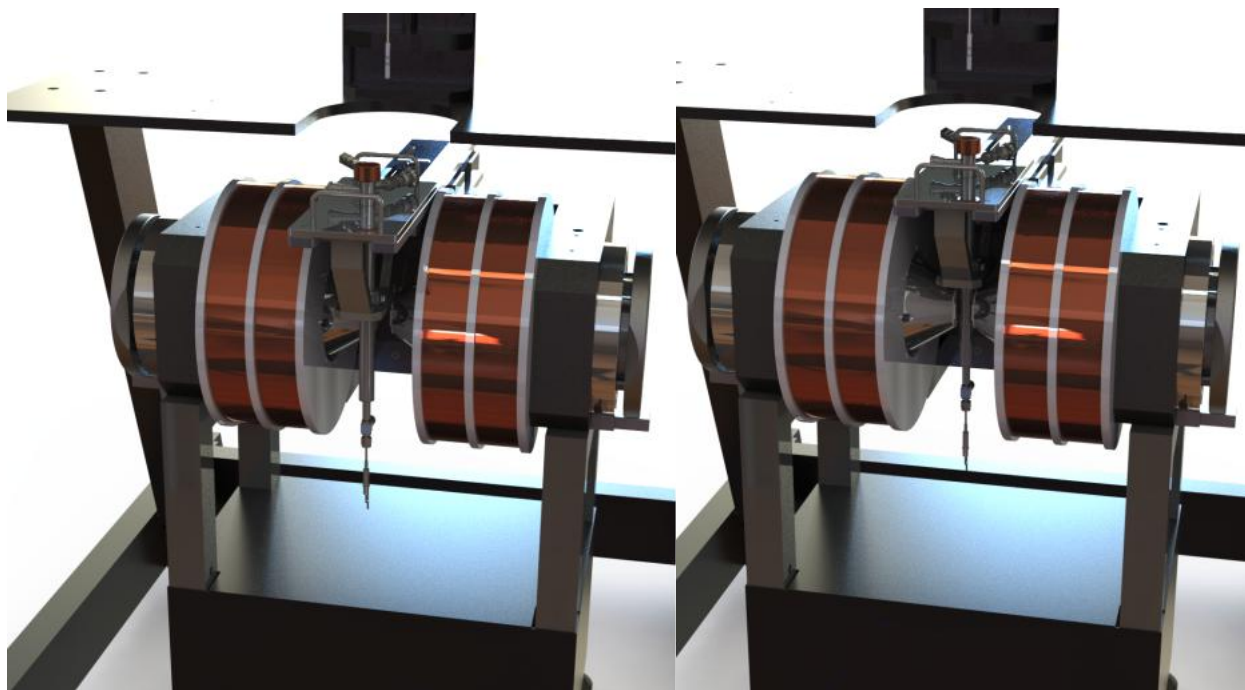
- 可测试磁滞回线(M-H)，可得到矫顽力、剩余磁化强度和饱和磁矩等参数；
- 可测试磁矩温度曲线(M-T)，配合低温选件可得到超导转变温度，配合高温选件可得到居里温度点；
- 全系标配 360°连续电动旋转的振动头，且样品在连续旋转过程中都处于采集线圈和磁场的中心位置；相比于超导磁体形式的 VSM，更加方便于进行各向异性的研究；
- 特殊设计的电磁铁磁场间隙调整方式，保证样品杆在左右方向不再需要调整中心；极为精密的机械装置，保证样品杆每次都处于采集线圈的前后方向中心；全新理念的电动升降系统，能自动完成上下方向的样品中心位置调整；以上三个方面的设计可大幅提高测试的准确度和重复性；



- 测试速度革命性地加快了，可连续按 10ms 间隔采集磁矩、磁场和温度值，确保用户捕获测试过程中快

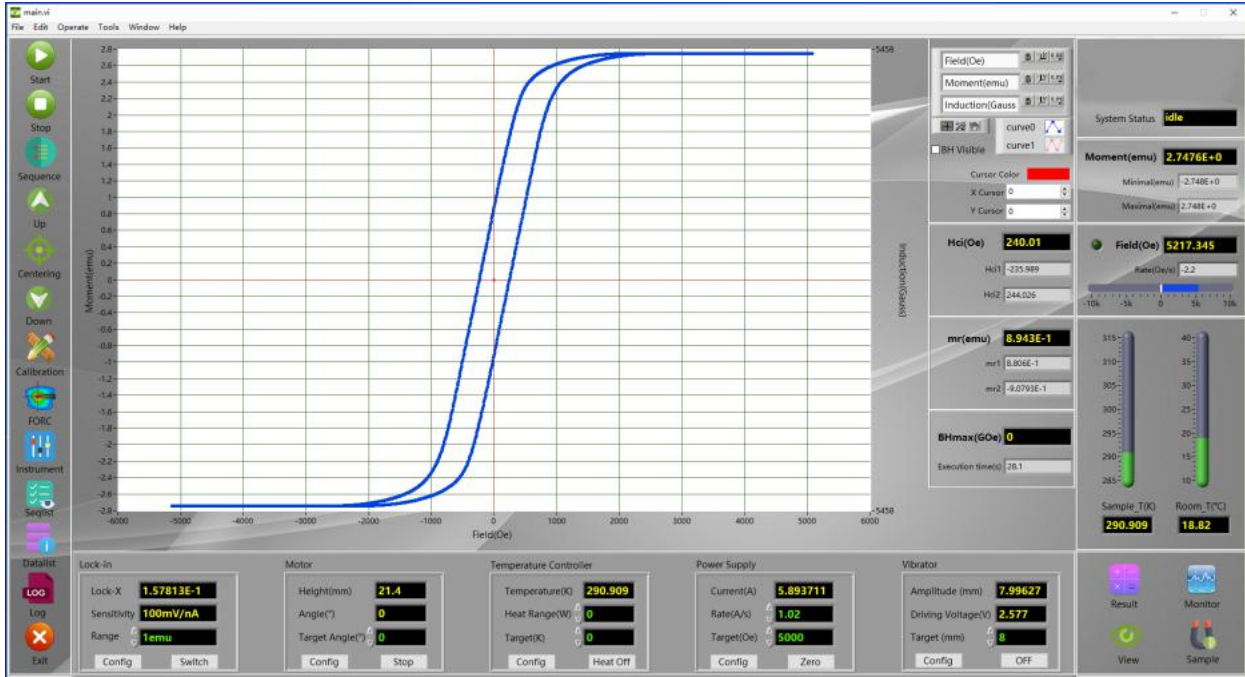
速变化的任何细节；电磁铁磁场变化速率高达 5000 Oe/s，这是超导磁体不可能拥有的速率；在此高速  
磁场变化速率和高速数据采集速率下，14s 就能得到一个磁滞回线；

- 引入高精度的激光位移传感器，可分辨 1 微米的振幅变化，与特殊定制的样品振动驱动系统形成闭环控制，可实现 10mm 振幅长时间（24 小时）万分之五的稳定度；
- 综合设计的选件更换和对齐装置，保证使用所有选件时样品都垂直于地面上下振动不“碰壁”；高低温选件时也支持矢量磁矩测试；



- 磁矩信号采集线圈和高斯计探头集成一体化，占用空间更小，安装更加方便，电缆更加牢靠；
- 拥有专利的外观设计，单手更换样品的操作简便性，以及软件一键测试的人机交互界面。

## 软件界面



## 规格和参数

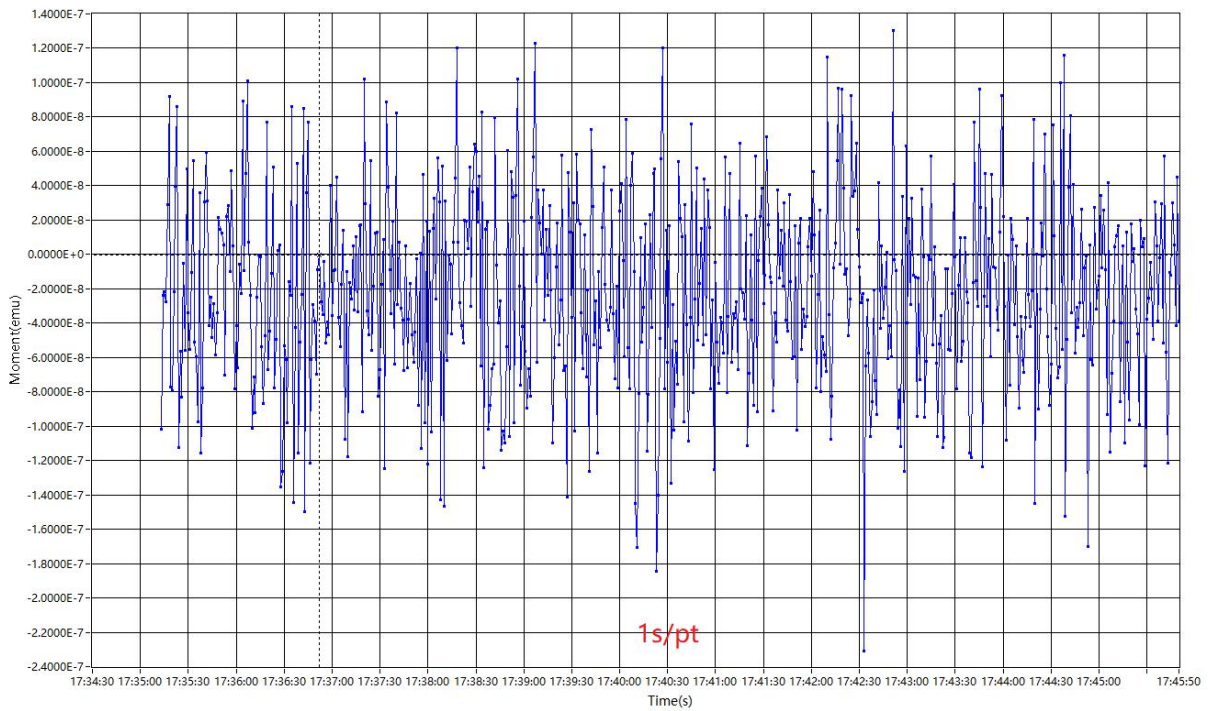
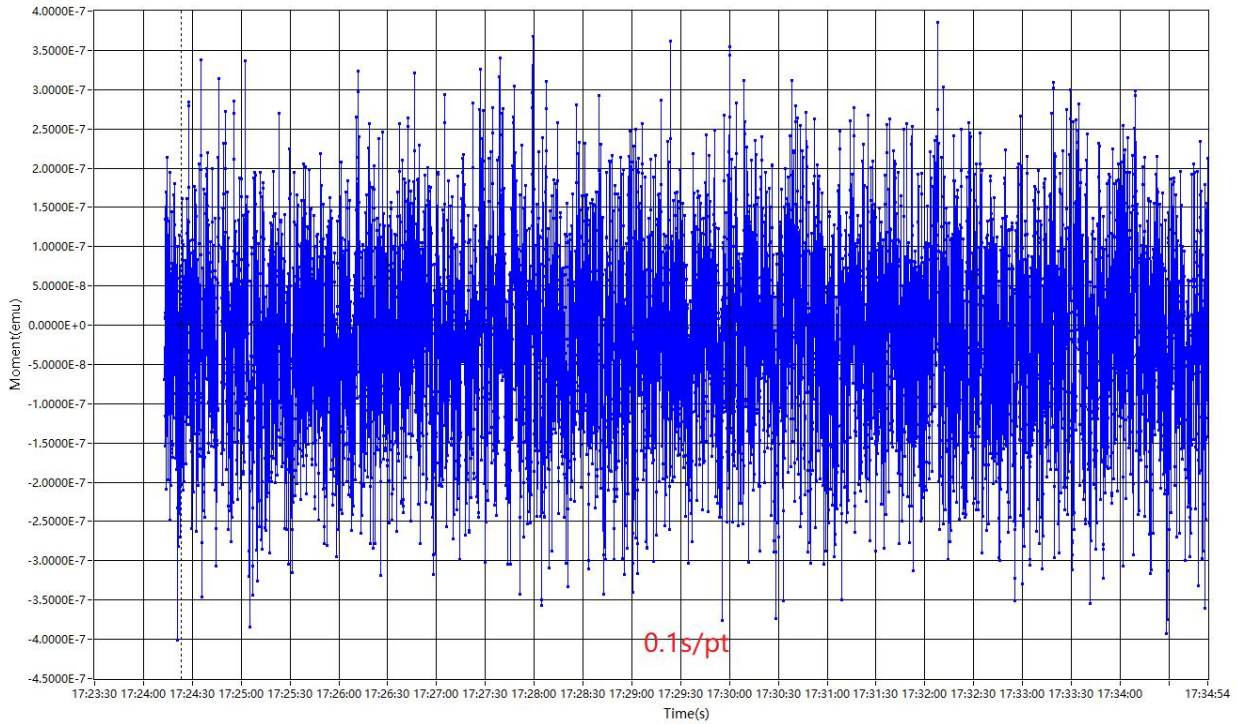
磁矩测量						
噪音	0.1s/pt(RMS)	0.1s/pt(P-P)	1s/pt(RMS)	1s/pt(P-P)	10s/pt(RMS)	10s/pt(P-P)
室温 (@3.5mm)	150 nemu	800nemu	80 nemu	380nemu	40 nemu	80nemu
高低温一体 (@8mm)	TBD	TBD	TBD	TBD	TBD	TBD
高温或低温 (@8mm)	0.5 $\mu$ emu	2.5 $\mu$ emu	TBD	TBD	0.1 $\mu$ emu	0.2 $\mu$ emu
动态范围	40*10 <sup>-9</sup> emu to 10 <sup>3</sup> emu					
稳定性	±0.05% of full scale/day (固定线圈间距, 恒定温度和磁场下相对于最大量程并需要 2 小时热平衡之后 24 小时测得的数据)					
重复性	±0.5% (相同线圈间距, 相同量程下重复装载和移除样品十次测得的数据)					
准确性	±1% (对比 NIST 772a 标样)					
样品质量	0 to 10g (更大质量样品会导致振幅下降, 从而导致信噪比降低)					

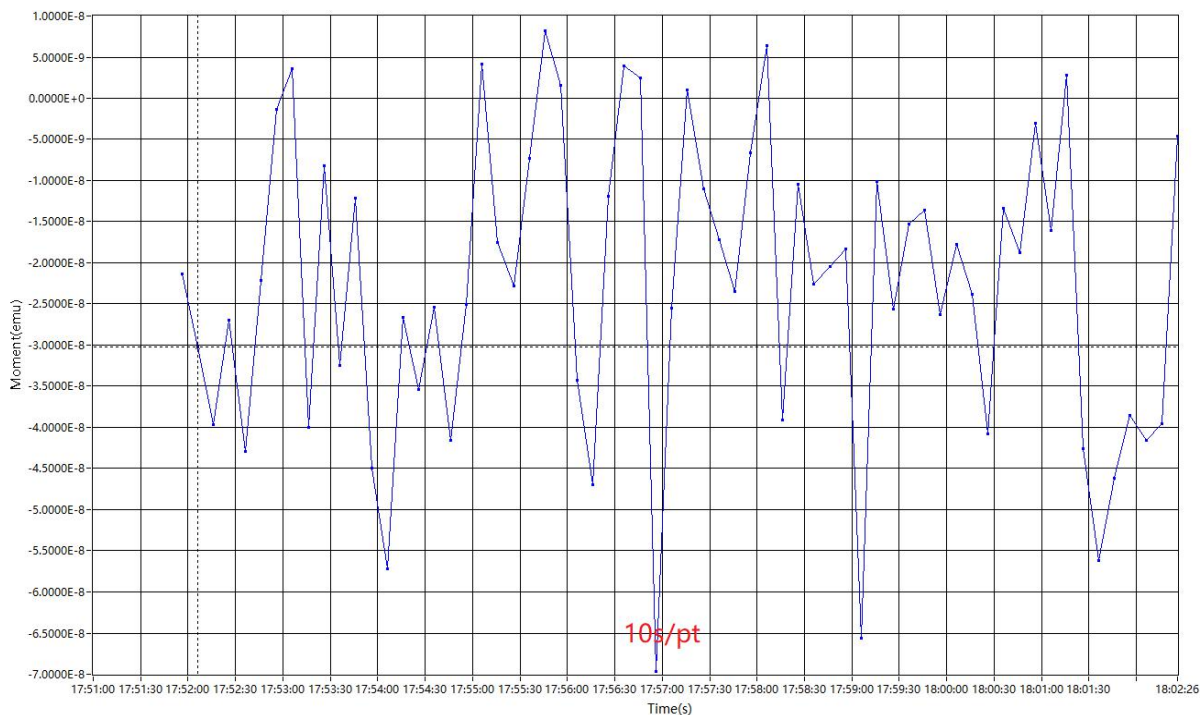
**其他参数**

系统采样频率 0.01~10s (连续模式 10ms) ;

锁相放大器时间常数固定为 100ms, 低通陡降 18dB/oct;

振动幅度 5~10mm (默认 8mm) , 振动频率 55~85Hz (默认 57Hz) 。





### 磁场强度

样品温度	极帽间隙	样品空间	3105(caps dia. 50mm)	3107(caps dia. 50mm)
室温	7.5mm	3.5mm	TBD	3.017T
	12mm	8mm	TBD	2.784T
高低温一体	20mm	8mm	TBD	2.361T
高温或低温	28mm	8mm	TBD	2.023T

### 磁场性能

### 样品升降旋转

准确度	1%	升降精度	0.1mm
分辨率	1 mOe	升降范围	0 to 300mm
稳定性	100 mOe	旋转精度	0.1°
变化速率	5000 Oe/s	旋转范围	0 to 730° continuous

温度选件	低温	高低温一体	高温
温度范围	80K to 370K	TBD	350K to 1050K
温度分辨率	0.001K	TBD	0.1K
稳定性	±0.1K	TBD	±1K
变温时间和速率	15min min, 6K/min max	TBD	35min min, 20K/min max
样品环境	流动氮气	TBD	静态氩气
绝热层	真空	TBD	真空, 另有多层保温材料
外径和样品空间	φ19mm, φ8mm	TBD	φ19mm, φ8mm

## DX-3100 Series Vibration Sample Magnetometer



### I. Introduction.

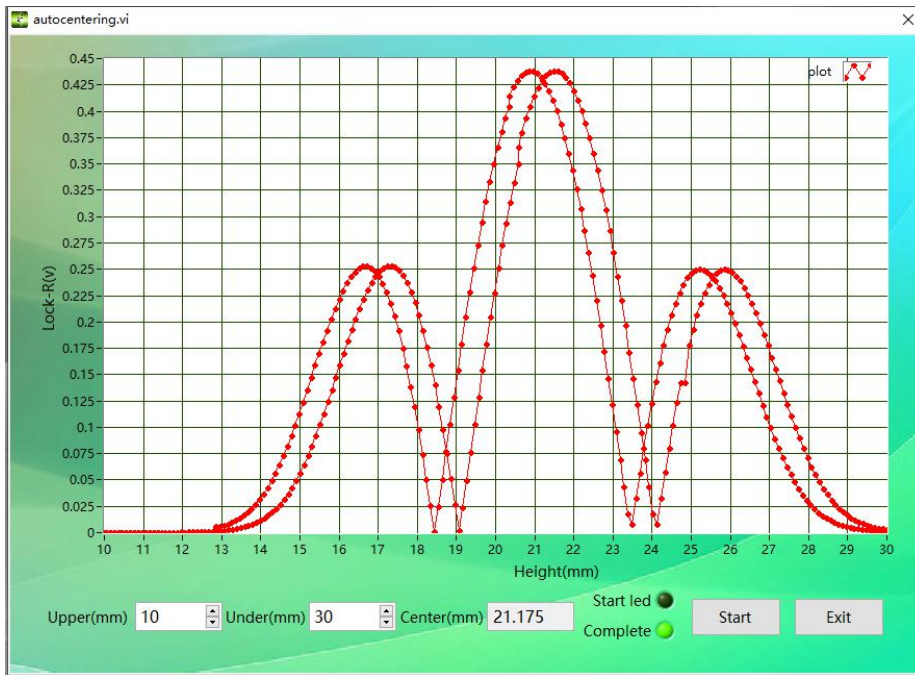
DX-3100 series vibration sample magnetometer, is the first set of magnetic moment measurement noise into  $10^{-8}$  emu ( $4 \times 10^{-8}$  emu noise floor at 10 s/point) commercial VSM. We draw lessons from the advantages of several most advanced vibration sample magnetometers in the world, and refer to the design concept of vibration sample magnetometers on superconducting magnets, and design a new generation of products with first-class performance, balanced function and rich selection on the platform of electromagnets.

### II. Functions and characteristics.

1. Hysteresis loop (M-H) can be tested and parameters such as coercivity, residual magnetization and saturation magnetic moment can be obtained.
2. A magnetic moment temperature curve (M-T) can be tested, a superconducting transition temperature can be obtained with a low temperature selection, and a Curie temperature point can be obtained with a high temperature selection.
3. The system is equipped with  $360^\circ$  vibration heads for continuous electric rotation, and the samples are in the center position of the collecting coil and magnetic field during the continuous rotation. Compared with the VSM in the form of superconducting, it is more convenient to study anisotropy.

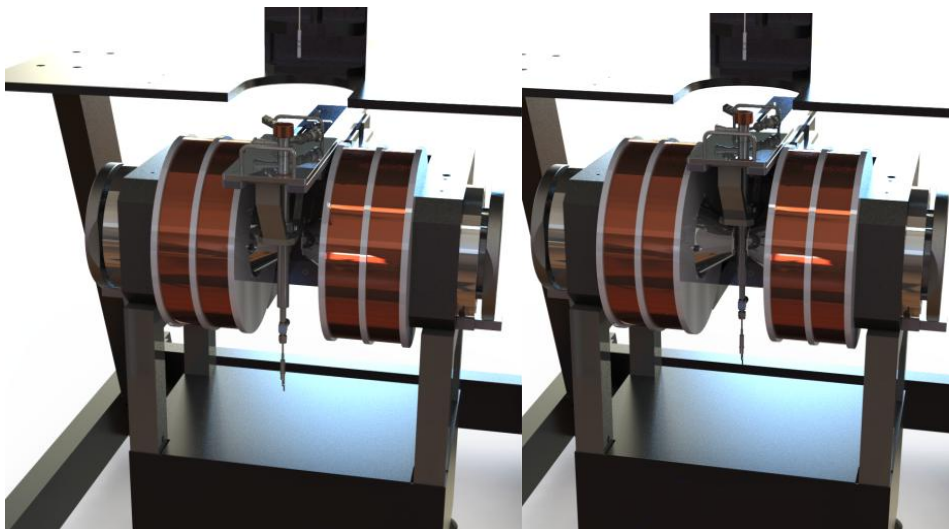


4. The special design of electromagnet magnetic field gap adjustment mode to ensure that the sample rod in the left and right direction no longer need to adjust the center; extremely precise mechanical device to ensure that the sample rod is in the front and back center of the collection coil each time; the new concept of electric lifting system, can automatically complete the upper and lower direction of the sample center position adjustment; the above three aspects of the design can greatly improve the accuracy and repeatability of the test.



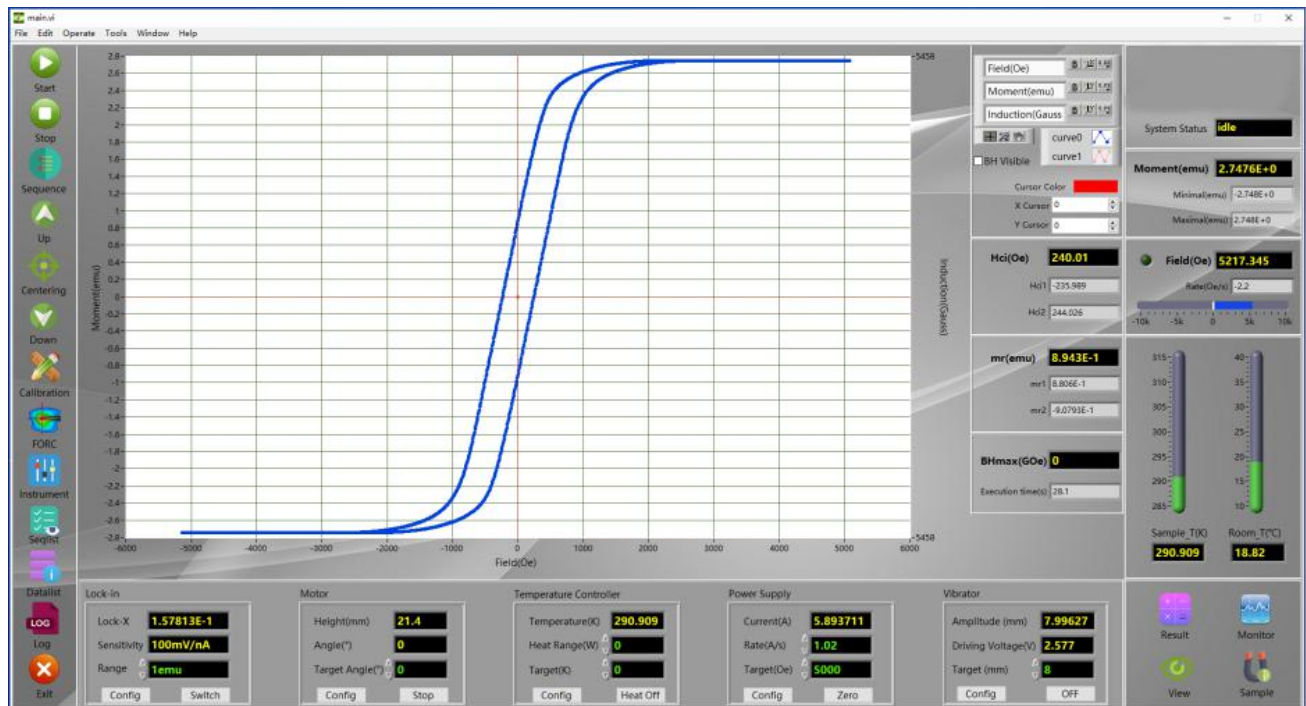
5. The speed of the test has been revolutionized by collecting magnetic moments, magnetic fields and temperature values at 10ms intervals in a row to ensure that users capture any details of the rapid changes in the test process; the rate of change in the electromagnet's magnetic field is as high as 5000 Oe/s, a rate that superconducting magnets can not have; and a hysteresis loop can be obtained at 14 s at this high rate of change in the magnetic field and rate of data acquisition.

6. High precision laser displacement sensor is introduced, which can distinguish the amplitude change of 1 micron, and form closed loop control with the special customized sample vibration drive system, which can achieve 10mm amplitude long time (24 hours) 5/10000 stability.



7. The option replacement and alignment device is designed to ensure that the sample is perpendicular to the ground and does not "hit the wall" when all the options are used, and the vector magnetic moment test is also supported when the high and low temperature option is used.
8. Integrated magnetic moment signal acquisition coil and probe of Gauss meter, less space, more convenient installation, more reliable cable.
9. With a patented design, one-handed sample replacement ease of operation, and software one-click test of the human-computer interface.

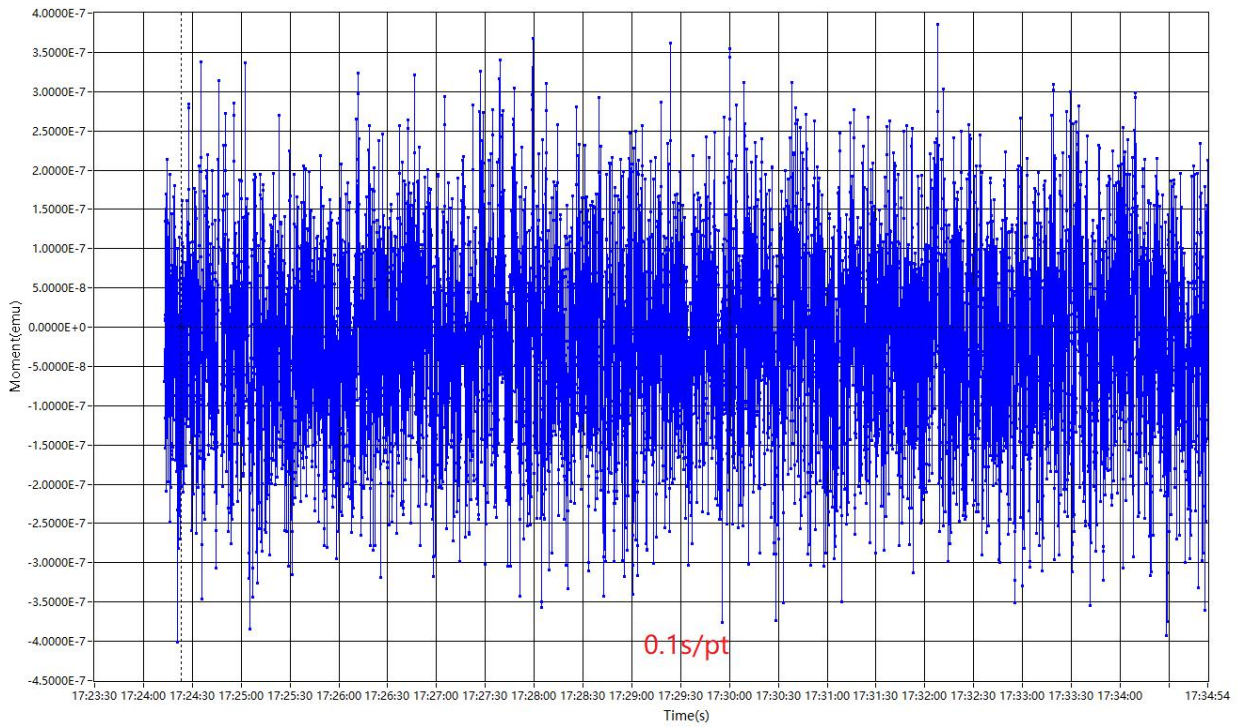
### III. Software Interface.

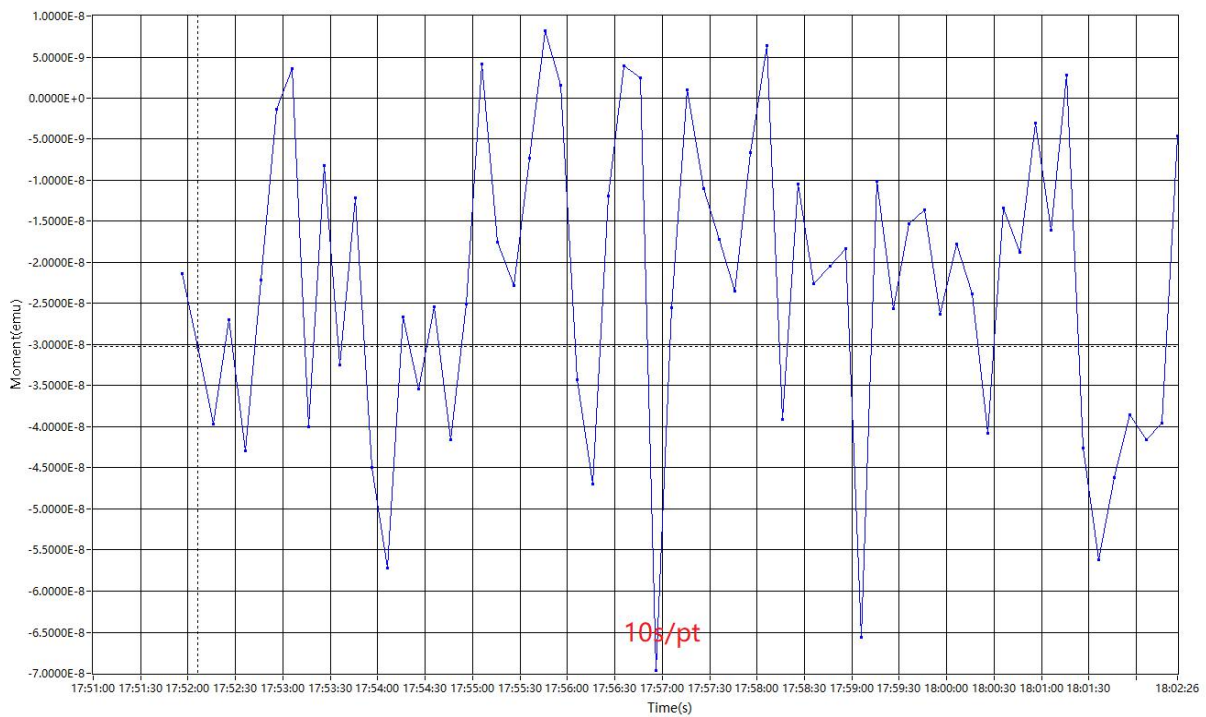
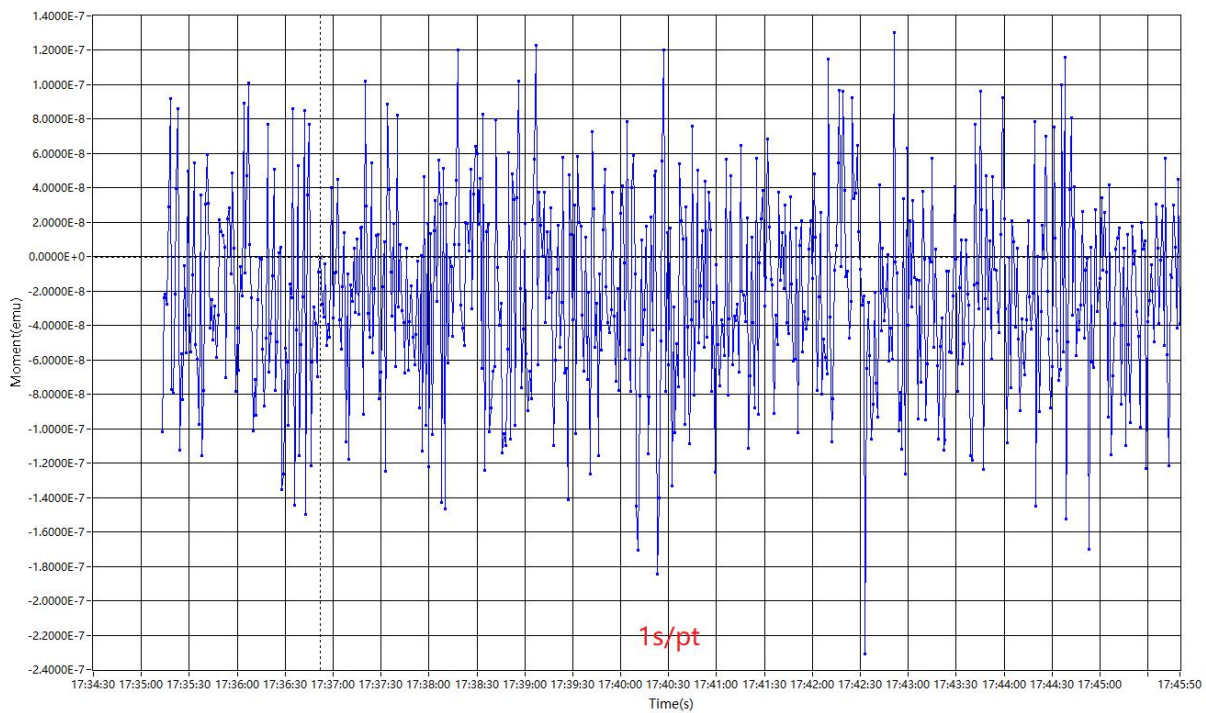


### IV. Specifications and Parameters.

Magnetic Moment Measurement						
Noise	0.1s/pt(RMS)	0.1s/pt(P-P)	1s/pt(RMS)	1s/pt(P-P)	10s/pt(RMS)	10s/pt(P-P)
Room temperature (@3.5mm)	150 nemu	800nemu	80 nemu	380nemu	40 nemu	80nemu
High and low temperature (@8mm)	TBD	TBD	TBD	TBD	TBD	TBD
High or low temperature (@8mm)	0.5 $\mu$ emu	2.5 $\mu$ emu	TBD	TBD	0.1 $\mu$ emu	0.2 $\mu$ emu
Dynamic range	40*10 <sup>-9</sup> emu to 10 <sup>3</sup> emu					
Stability	±0.05% of full scale/day (Fixed coil spacing, data measured 24 hours after constant temperature and magnetic field relative to the maximum range and requiring 2 hours of thermal equilibrium.)					

<b>Repetitiveness</b>	<p style="text-align: center;"><math>\pm 0.5\%</math></p> <p>(The same coil spacing, the same range of repeated loading and removal of samples 10 times measured data.)</p>
<b>Accuracy</b>	<p style="text-align: center;"><math>\pm 1\%</math> (Contrast NIST 772a standard sample)</p>
<b>Sample mass</b>	<p style="text-align: center;">0 to 10g</p> <p>(A larger mass of the sample leads to a decrease in amplitude, which leads to a decrease in SNR.)</p>
<b>Other parameters</b>	<p>System sampling frequency 0.01~10s (continuous mode 10ms);  Time constant of Lock-in amplifier fixed at 100ms, low pass steep drop 18dB/oct;  Vibration amplitude 5~10mm (default 8mm), vibration frequency 55~85 Hz (default 57Hz).</p>





### Magnetic Field Strength

	<b>Magnetic Field Strength</b>			
<b>Sample temperature</b>	<b>Pole cap gap</b>	<b>Sample space</b>	<b>3105(caps dia. 50mm)</b>	<b>3107(caps dia. 50mm)</b>
<b>Room temperature</b>	7.5mm	3.5mm	TBD	3.017T
	12mm	8mm	TBD	2.784T
<b>High and low</b>	20mm	8mm	TBD	2.361T

<b>temperature</b>				
<b>High or low temperature</b>	28mm	8mm	TBD	2.023T

<b>Magnetic Field Performance</b>		<b>Sample Lifting Rotation</b>	
<b>Accuracy</b>	1%	<b>Lifting accuracy</b>	0.1mm
<b>Resolution</b>	1 mOe	<b>Lifting range</b>	0 to 300mm
<b>Stability</b>	100 mOe	<b>Rotation accuracy</b>	0.1°
<b>Rate of change</b>	5000 Oe/s	<b>Rotation range</b>	0 to 730°continuous

<b>Temperature options</b>	<b>Low temperature</b>	<b>High and low temperature</b>	<b>High temperature</b>
<b>Temperature range</b>	80K to 370K	TBD	350K to 1050K
<b>Temperature resolution</b>	0.001K	TBD	0.1K
<b>Stability</b>	±0.1K	TBD	±1K
<b>Time and rate of temperature change</b>	15min min, 6K/min max	TBD	35min min, 20K/min max
<b>Sample environment</b>	Flow nitrogen	TBD	Static argon
<b>Heat-insulating layer</b>	Vacuum	TBD	Vacuum, with multi-layer insulation
<b>Outer diameter and sample space</b>	φ19mm, φ8mm	TBD	φ19mm, φ8mm