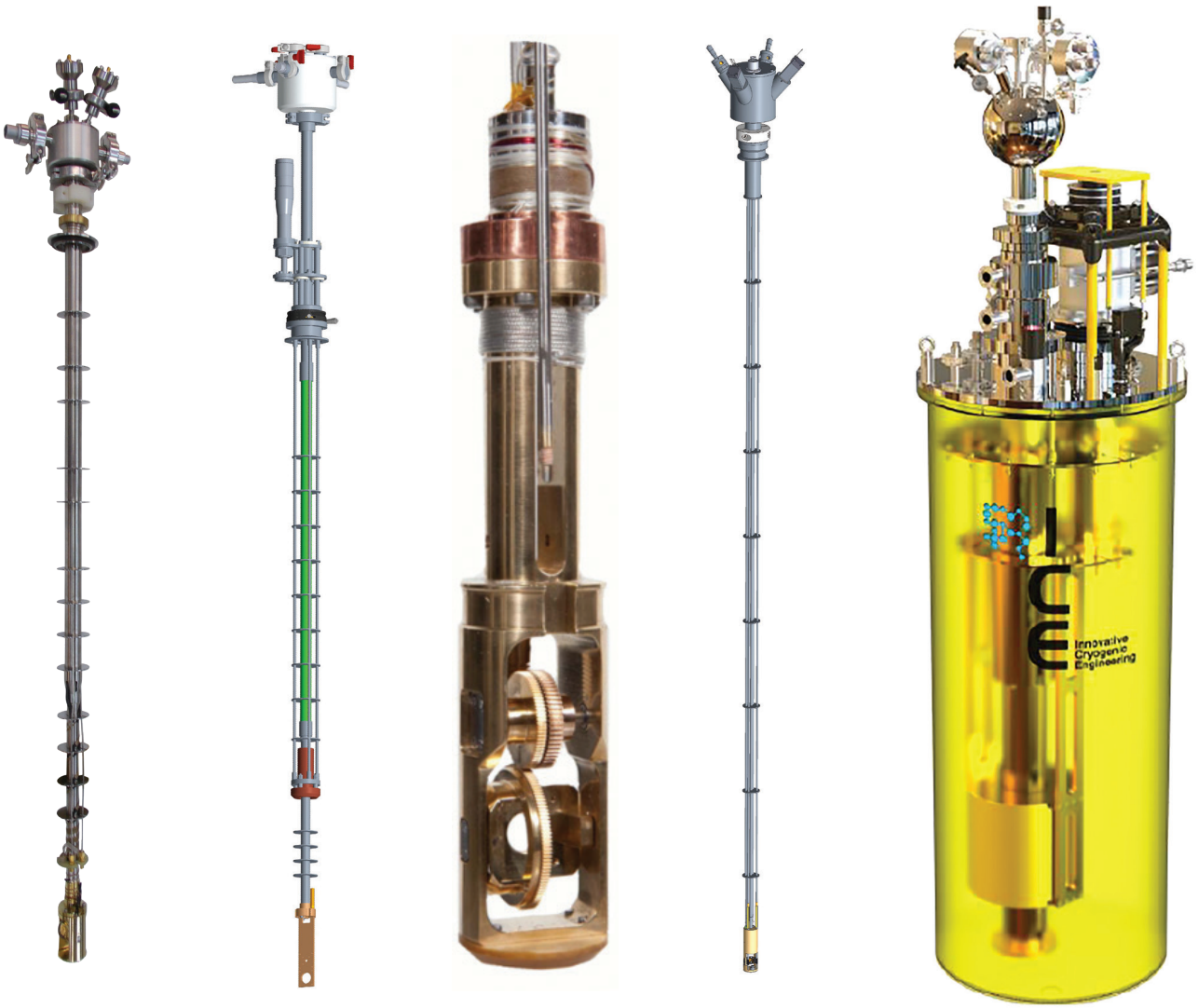
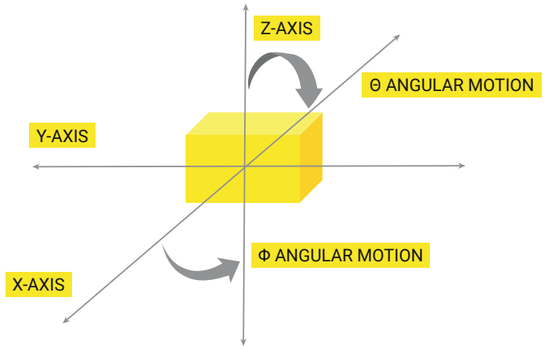
ICE Innovative Cryogenic Engineering

ROTATOR PROBES

Single / Dual / Multiple Sample Movement Manipulation probes



SAMPLE HOLDER POSSIBLE MOTION DIRECTIONS:



The diagram above is an indicator/reference through the brochure for the sample holder movement

Top loading Probes specifications

The top loading probe inserts into the system via a flange with a a sliding seal. This locates the sample at the field centre. The probe is fitted with radiation baffles to minimise the radiative heat loads to the sample region. A thin wall stainless steel tube is used to minimise conduction.

The sample rod is typically terminated in a copper sample holder with a fire rod heater and sensor. At the top of the sample rod is a housing that is used to supply access to the sample region from room temperature.

This type of sample rod typically allows cooling of the sample in exchange gas but can also be customised to keep the sample in vacuum. High temperature probes are available upon request with temperatures up to 800K ICEoxford wiring allows a customised range of DC, COAX, Fibre, HV lines, High current and high voltage lines, typically with Fischer or SMA connectors but many wiring and connector options are available. .

Top loading probes Key features:

- Operating temperature <0.3K to 420K
- Our Probes are compatible with Helium 3 and dilution insert systems
- Typical cool down time <180 Minutes (<45 minute with Dual-Cool upgrade)
- Sample space diameter Ø and length range can be customised to meet the customer expectation
- Option for sample in vacuum operation

A: Z-AXIS PROBE WITH COARSE ROTATION

Sample space motion:

- Height range ±32mm motion with position accuracy of 0.5mm
- 360° about z-axis (Φ) with position accuracy of 1°
- Manually adjusting sample space motion by physically relocating the sample rod up/down

B: MAGNETIC FIELD DIRECTION

Φ ANGULAR MOTION

Z-AXIS MOTION

B: Z-AXIS PROBE WITH ACCURATE ROTATION

Sample space motion:

- Accurate motion obtained using micrometre

Φ ANGULAR MOTION

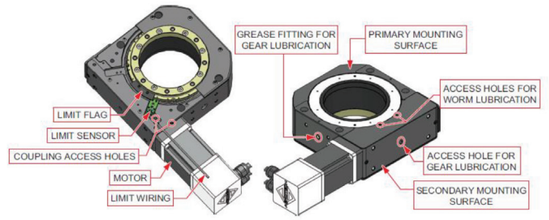
Z-AXIS MOTION

AUTOMATED ROTATION STAGE FOR CRYOSTAT TOP FLANGE

ICEoxford uses the latest generation of motorized worm-gear-drive rotary stages to provide significant improvements in speed, load capacity, and long-term positioning performance. Available in both continuous and limited travel versions. The rotation stage base is fabricated from an aluminium alloy that offers significant weight savings in multi-axis arrangements and other weight critical applications, while providing high structural stiffness and long-term stability. Each stage is designed with two high-precision angular contact bearings with optimal spacing to provide excellent error motions coupled with high load capacities in a small, compact package.

Designed for use with ICEoxford and existing inserts up to 70mm in diameter. Allows automated rotation of an insert continuously through 360° with an accuracy of 180 arcsecond. The rotation stage is controlled via an optional encoder and LabVIEW based software. The rotation stage is supplied with a mounting kit for integration with an existing cryostat and insert. Rotation stage fitted to top of cryostat at probe mounting point. An example of a rotation stage supplied with a previous system can be seen below (images are for illustration only, actual system supplied will differ).

Automated rotation stage placed at the cryostat



Automated rotation stage for cryostat top flange

C: X-AXIS PROBE WITH AUTOMATED ROTATION STAGE

Sample space motion:

- In addition to the manual adjustment available on probe A.
- The drive rod rotates the worm gear that is used to rotate the sample holder.
- Accurate motion is obtained using micrometre placed on the top of the probe.
- 0-360° rotation perpendicular to the magnetic field, 0.1° rotation accuracy.
- Stepper motor automatic rotation can be fitted for higher accuracy and automatic motion control using LabVIEW software.
- Compatible with helium 3 and dilution insert systems

Θ ANGULAR MOTION

D: Z-AXIS AND X-AXIS PROBE

Sample space motion:

- In addition to the manual adjustments available on probe A
- Twin drive rod rotates the worm gear that is used to rotate the sample holder.
- Accurate motion is obtained using two micrometers placed on the top of the probe.
- Stepper motor automatic rotation can be fitted for higher accuracy and automatic motion control using LABVIEW software.
- Motions from previous probes are achieved using Z&X axis probes with an extra rotation option Z-axis(Θ)
- To maintain the sample position at the field centre the second drive rod is automatically counter rotated against the motion of the first drive rod.

Θ ANGULAR MOTION

Φ ANGULAR MOTION

B: MAGNETIC FIELD DIRECTION

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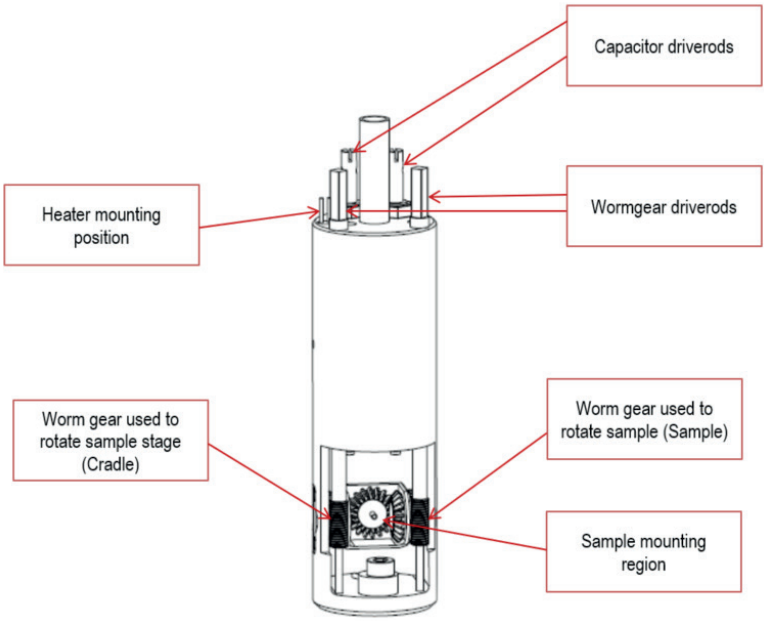
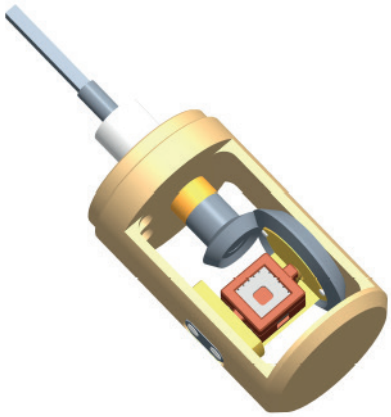


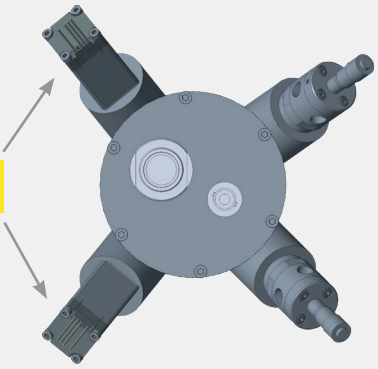
Custom chip holder:

Designed to fit most of quantum chips research and quantum experiments.



SAMPLE AUTOMATED ROTATION USING STEPPER MOTOR (C & D PROBES)

Stepper motor can be used in order to achieve high accuracy and automatic motion.



The 2-axis rotator probe is able for 360 ˚ sample platform rotation and 180˚ sample cradle rotation.

Motor movement specification:

- 1.8 or 0.9 degrees stepper motor angle
- Number of steps for full rotation is 200 or 400 depending on Stepper motor angle
- Worm gear ratio 40:1
- Number of steps for full sample/cradle rotation is 8000 (Number of steps x gear ratio)
- Sample platform rotational range is unlimited
- Max cradle platform rotational range is half a turn or 4000 steps
- 360 degrees rotation on both stages
- Standard mi angle resolution is 0.045 degrees. However,0.022 degrees is reached using micro-stepping
- Encoder option for increased positional accuracy

Motor Specifications:

- 1.4 A Phase current
- 2.3 Ω phase resistance
- 1.8 mH Phase inductance
- 0.117 Nm holding torque
- 1.8˚ or 0.9˚ step angle
- ±5% step accuracy

Motion controller:

- ICErotate controller is a 3-axis stepper motor controller that is used to provide accurate stepper motor control for a range of motion applications.
- Trinamic TMCL-IDE3.0 software/LabVIEW software

ICE