

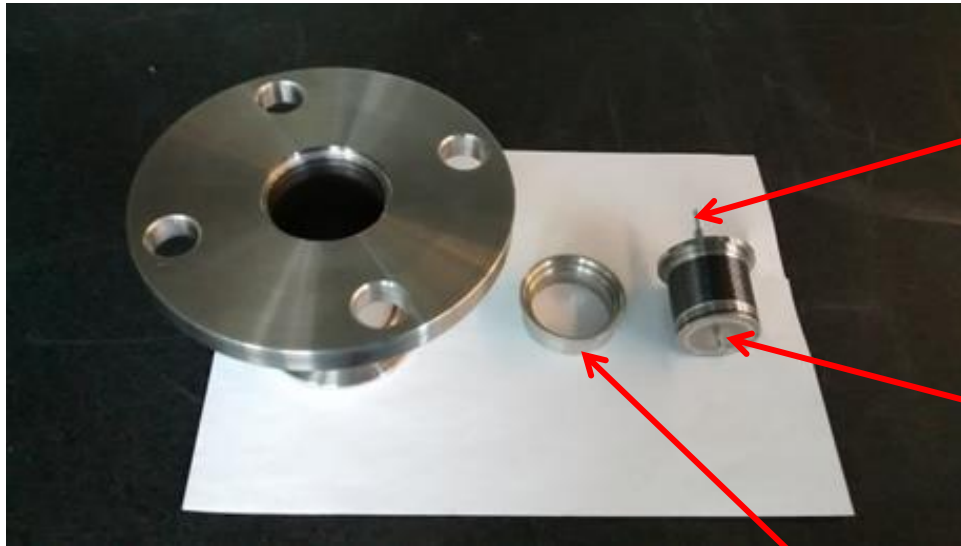
Mossbauer Vertical Drive for JANIS Superconducting Magnet

TechNotes

Peiqing Wang

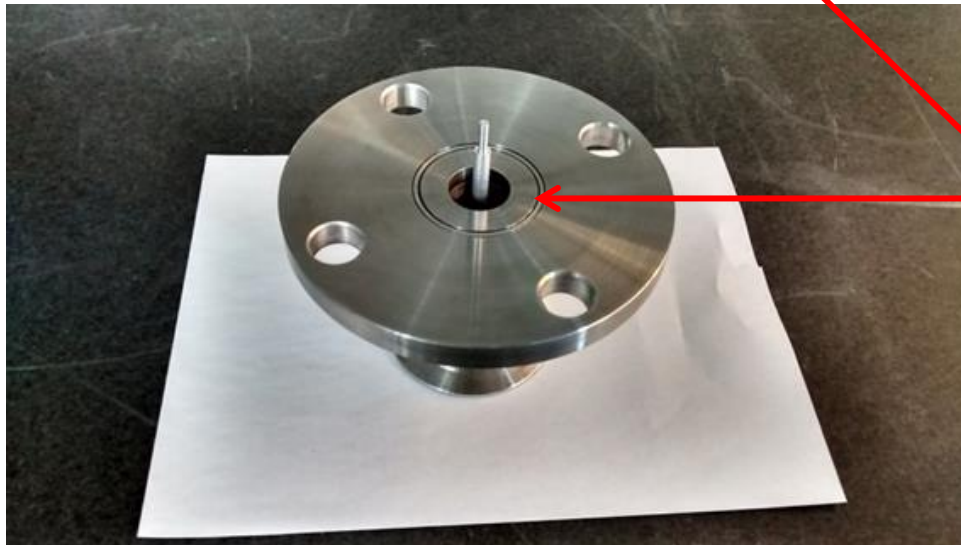
03/19/2018

Transducer-to-Cryostat Adaptor



Center rod connecting to
transducer

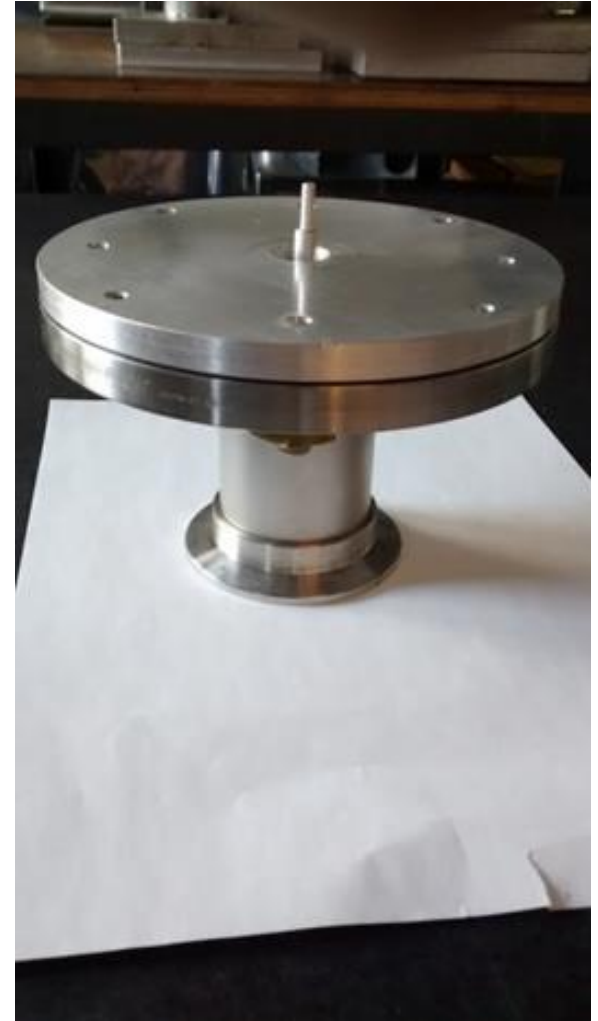
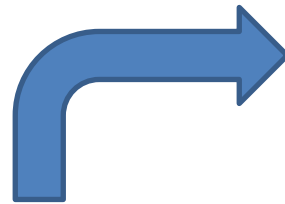
6-32NC screw
connecting to Co-57
source rod



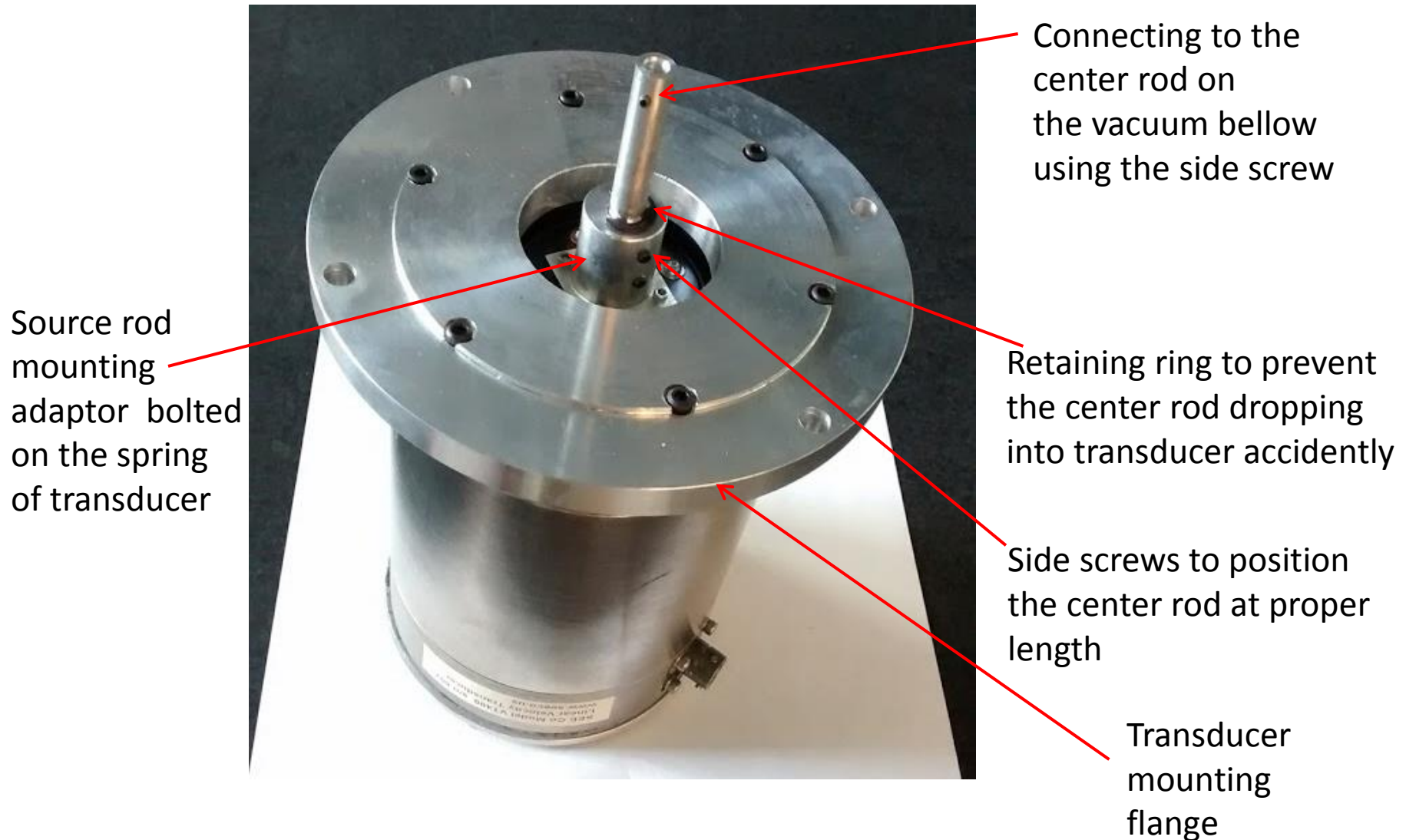
Bellow to flange adaptor

Transducer-to-Cryostat Adaptor

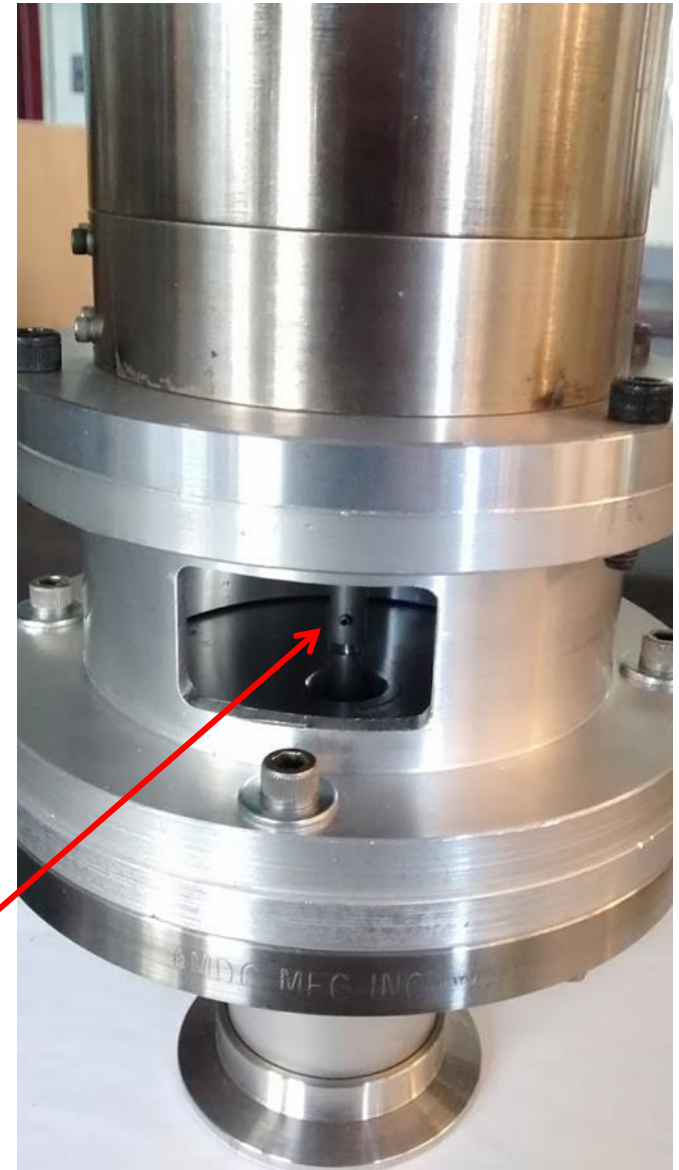
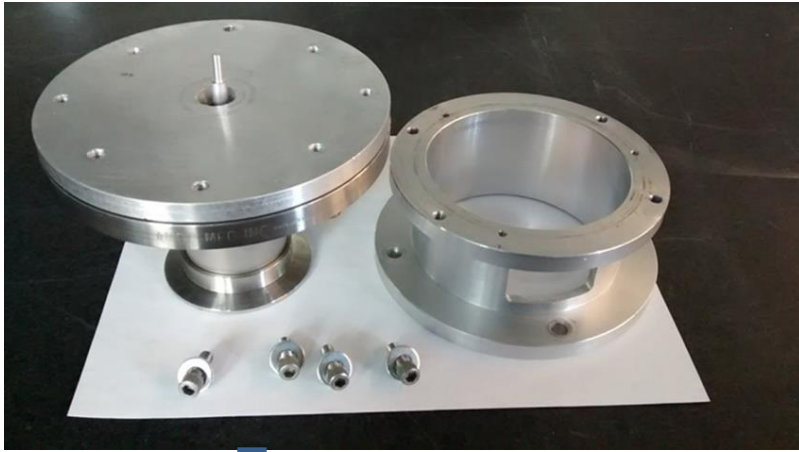
- O-rings and bellow isolate the source/sample space from atmosphere
- Slightly grease O-rings before putting into grooves



Transducer Assembly - I

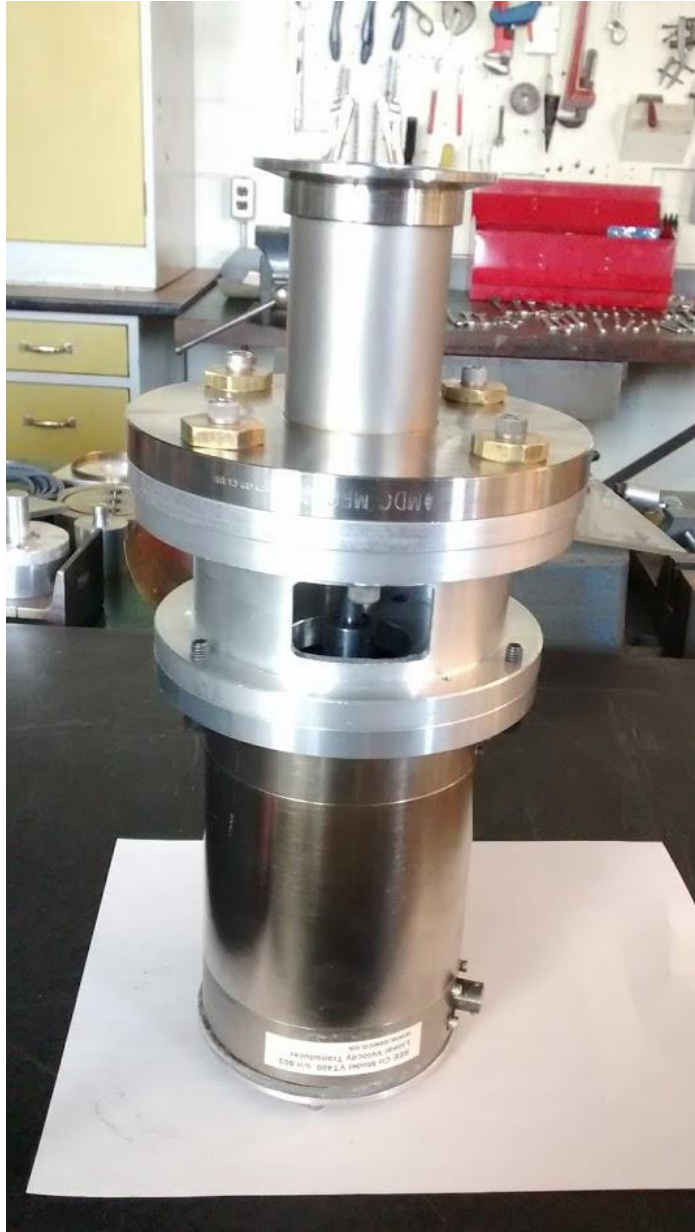


Transducer Assembly - II



- Flip transducer
- Connect the center rod with side screw

Transducer Assembly - III



Completed transducer-bellow assembly

Note:

This is a vertical drive system. Due to the mass of the end plate on bellow, the transducer test should be performed in the vertical configuration.

Sample Rod Holder

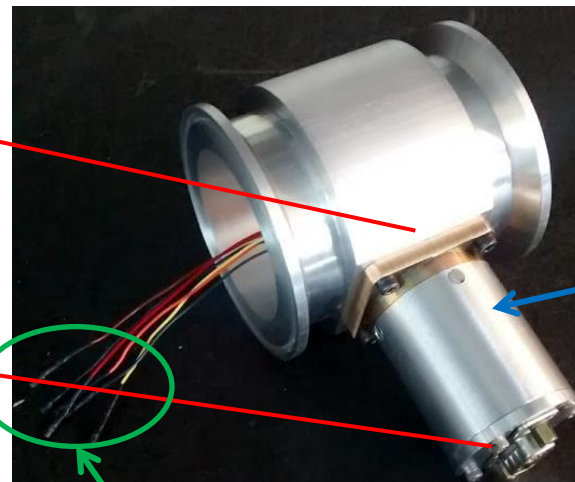
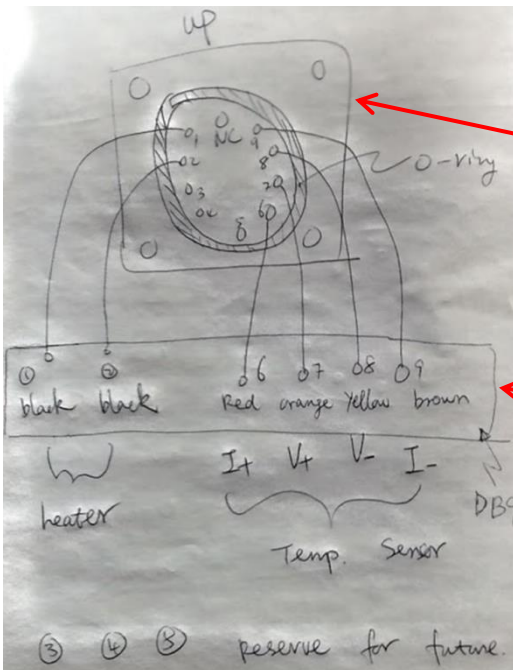


Insert



For fixing
sample rod

Inner side
screw to
lock the
sample rod
holder



Home-made
vacuum feed-
through
connector

Connecting to sample holder

Source Rod - I



- Thin wall SS tube
- Venting holes to balance pressure, gas flow and temperature
- Spiral Be-Cu helper springs to keep source rod in the center of sample rod

- Two sections of rod
- 6-32 NC screw jointing two sections
- An thread adaptor (10-32 NC to 6-32 NC) was made to mount the Co-57 source onto the end of source rod



Source Rod - II

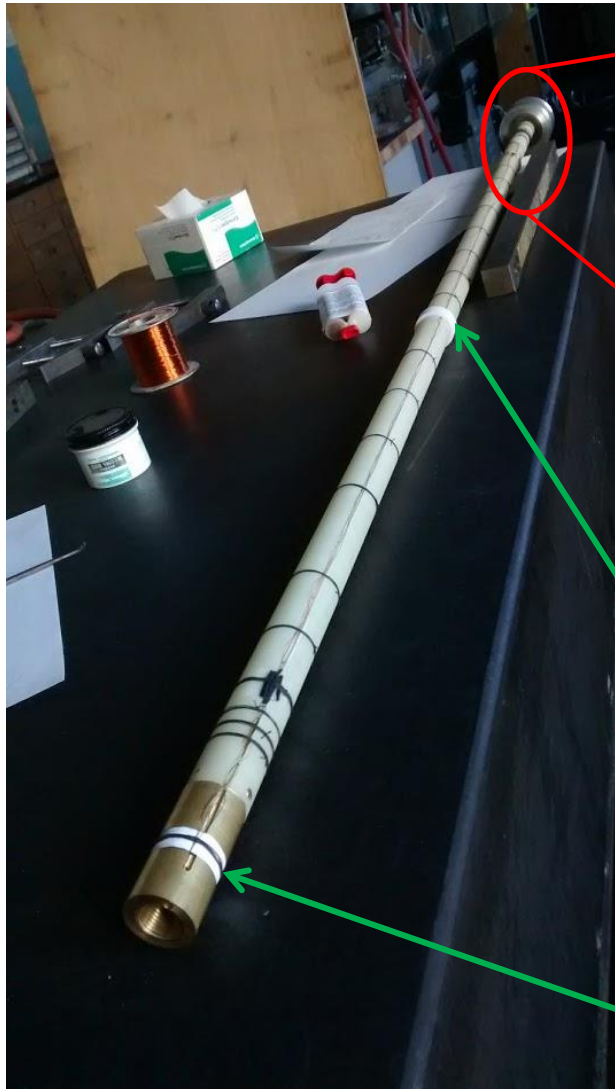


Insert the source rod into sample rod, carefully go through the glue joint of the G10 tube (the long sample tube was made by gluing two sections of G10 tubes together)



Twist the source rod onto the center screw of the rubber stopper to temporarily fix the source rod and prevent it accidentally dropping into the sample rod when change samples

Sample Rod - I



Copper ring
to help
dissipating
heat from
leads

Teflon ring to keep rod in the
center of sample space

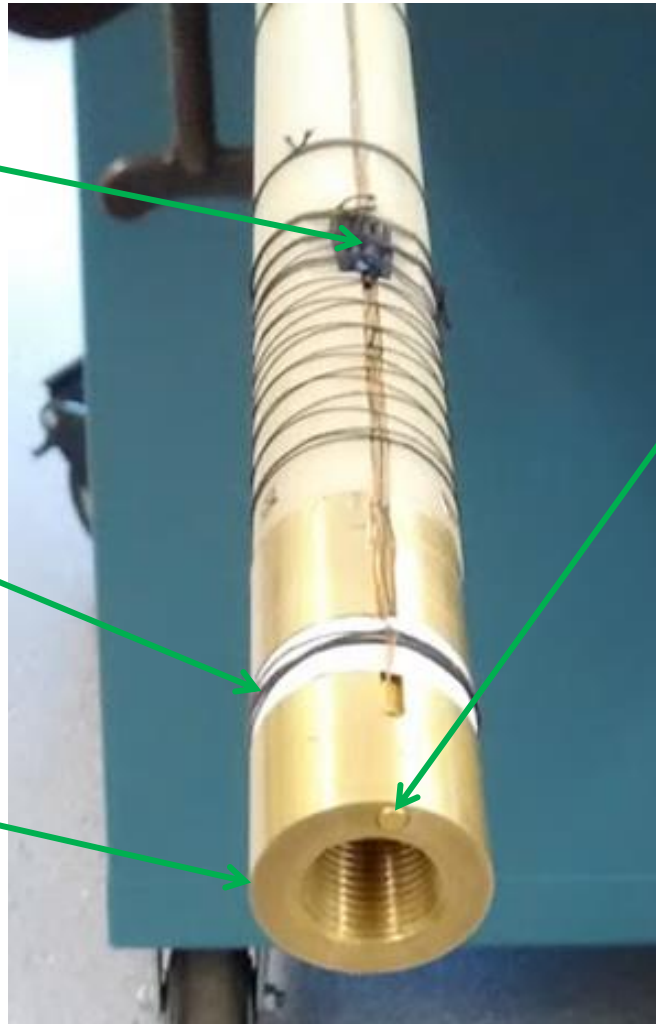
Sample holder with heater and
temperature sensor

Sample Rod - II

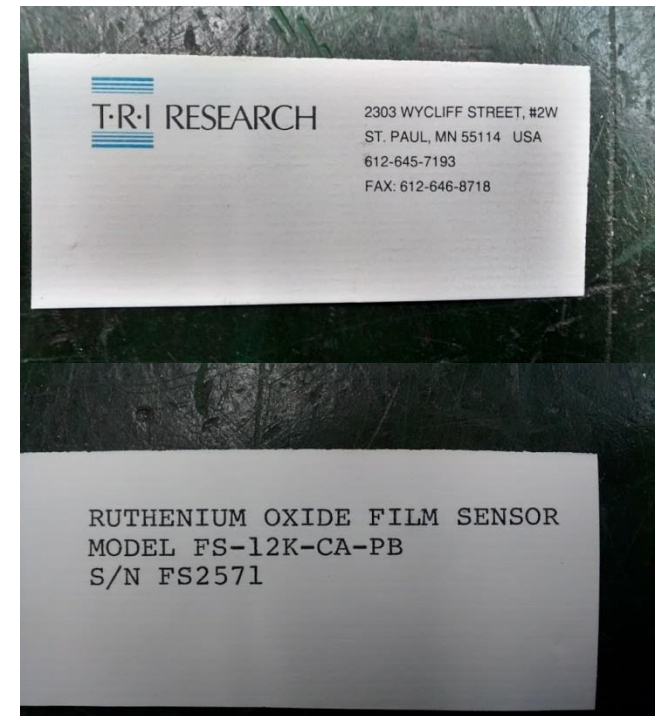
Connection
of leads to
heater and
temperature
sensor

Heater
50 Ohm

Bottom plane is
3 mm lower
than magnetic
field center



Temperature Sensor



Temperature Sensor Calibration

Using a 6th order polynomial fit of the form:

$$y = a_0 + a_1 * x + a_2 * x^2 + a_3 * x^3 + a_4 * x^4 + a_5 * x^5 + a_6 * x^6,$$

where,

$$x = \log_{10}(\text{Temp}) - 1.1$$

$$y = \log_{10}(\text{Resistance}),$$

the following values were obtained using the typical data which was given:

$$a_0 = 4.0747546$$

$$a_1 = -0.15340574$$

$$a_2 = 0.14336514$$

$$a_3 = -0.073078410$$

$$a_4 = 0.00087845179$$

$$a_5 = 0.0098087524$$

$$a_6 = 0.003691589$$

$$a_2 = 3.2673463$$

$$a_1 = -0.3428601$$

$$a_2 = 0.60372912$$

$$a_3 = 0.115619076$$

$$a_4 = -0.13033725$$

$$a_5 = 0.00447007$$

$$a_6 = -0.00685$$

For each of the actual sensors only two data points were given. These values were used to recalculate the coefficients for each. This was done by writing the equation as,

$$y = a_0 + a_1 * f(x)$$

where,

$$f(x) = x + (a_2 * x^2 + a_3 * x^3 + a_4 * x^4 + a_5 * x^5 + a_6 * x^6) / a_1$$

Two governing equations were written using the given data points,

$$y_1 = a_0 + a_1 * f(x_1)$$

$$y_2 = a_0 + a_1 * f(x_2),$$

a_0 and a_1 were then calculated.

The calibrated curve may be constructed using the following formula:

$$y' = a_0' + (a_1' / a_1) * (a_1 * x + a_2 * x^2 + a_3 * x^3 + a_4 * x^4 + a_5 * x^5 + a_6 * x^6).$$

For Serial #FS2571:

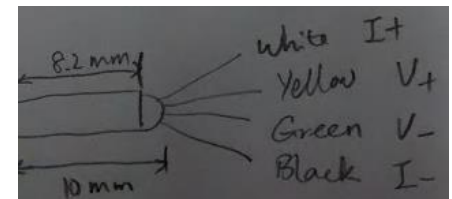
$$a_0' = 4.07244$$

$$a_1' = -0.151480$$

$$R@4.188K = 15308$$

$$R@77.2K = 10229$$

Wiring:



Installation of Sample Tube

Sample tube
holder/adaptor

Clean the bore of the
superconducting
magnet with a long
rod and Kimwipes
(wetted with alcohol)
before inserting the
sample tube



Result of the
initial cleaning

Installation of Source



- Tighten two sections of source rod
- Carefully insert it into sample tube
- Using rubber stopper to hold it in place

Installation of Transducer



- Two person needed to install transducer!
- One person hold the transducer on top of sample tube holder, keeping a ~5" gap between the bottom of transducer and the top of sample tube holder
- Another person remove the rubber stopper, then twist the source rod onto the center screw on the bellow of the transducer assembly
- Seat the transducer on the sample r tube holder and fasten it with clamp
- Reverse the above steps when removing transducer to change sample or to change source