Residual field measurement in the magnetic shield for STF-SC cavity

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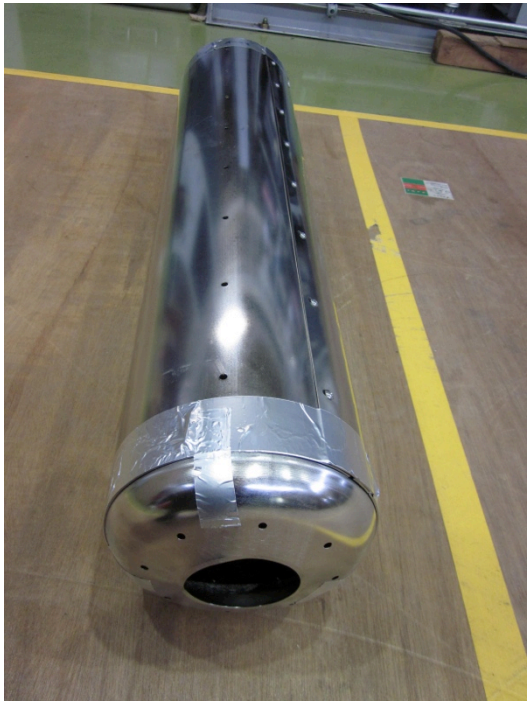
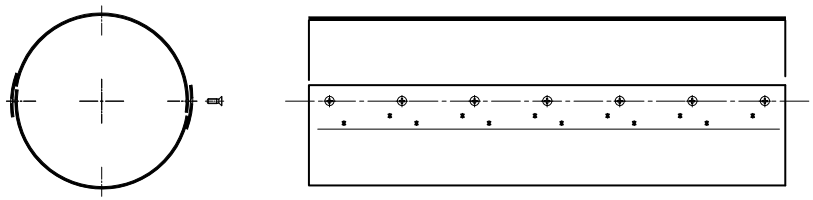
(1) Magnetic shield for STF cavity

Cavity shield-1

materials: VDM for RT use

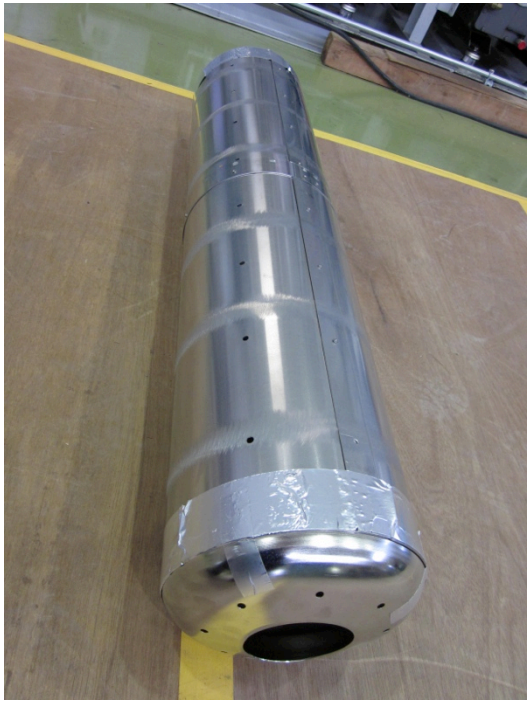


1.5 t

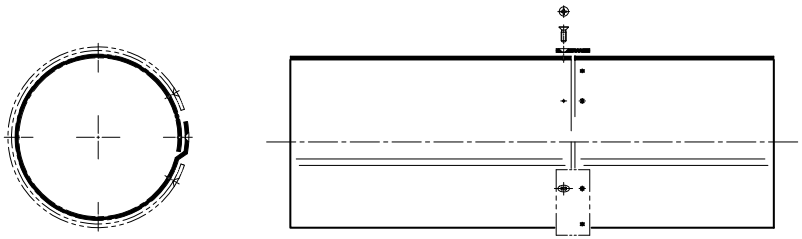


Cavity shield-2

materials: Tokin-R for Low T use

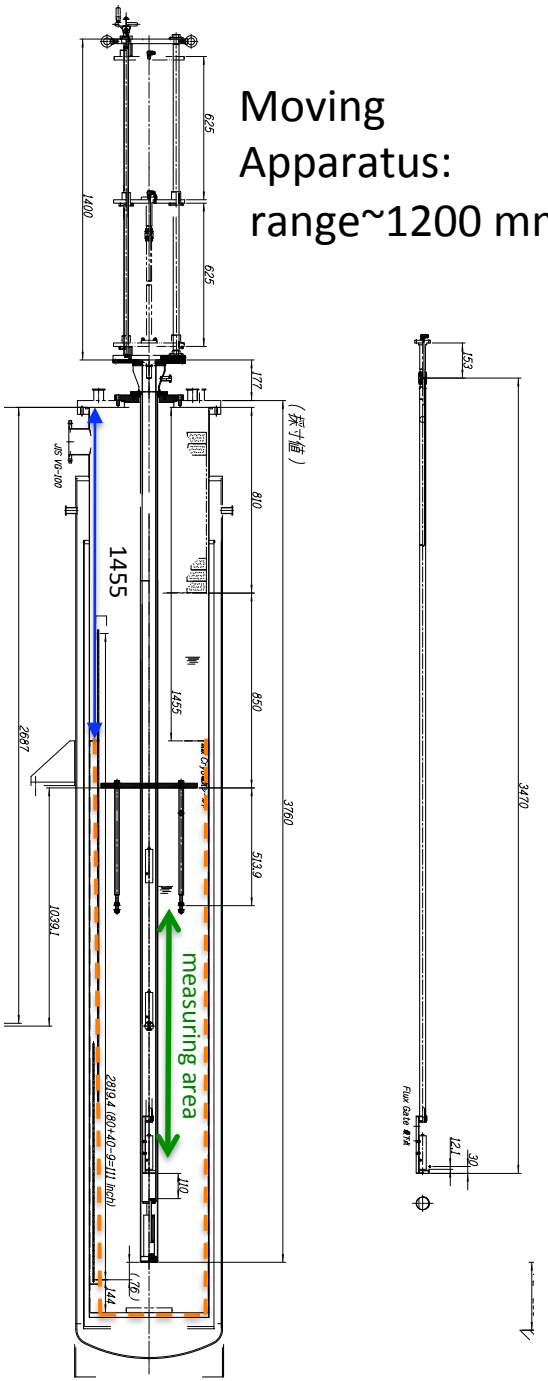


1.0 t



joint

(2) Experimental setup

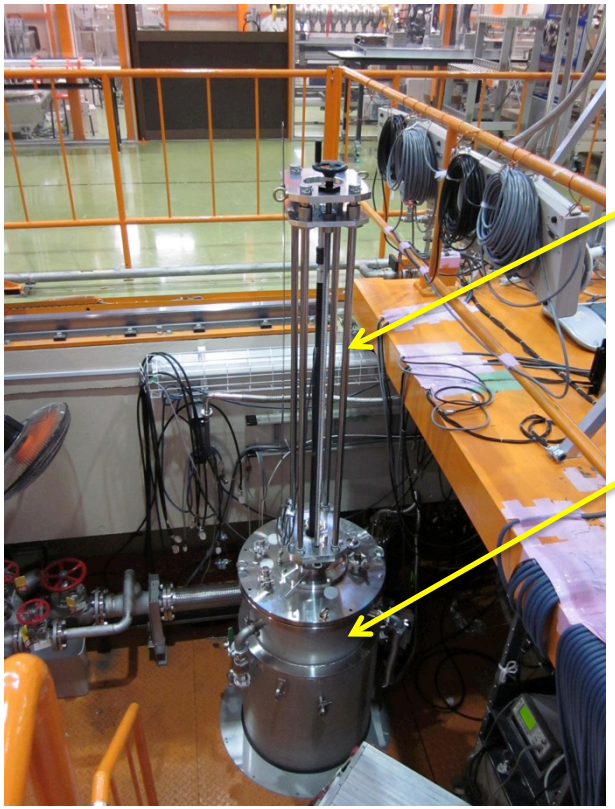


- Field measurement was performed in a cryostat.
- The cryostat was the one prepared for vertical test of SC cavity.
- On the top of the cryostat, a moving apparatus to change the position of the magnetic sensor was placed.
- To keep the magnetic sensor warm, a warm tube made of stainless-steel was prepared.
- The cavity shield was assembled in the measuring area and the warm tube was inserted through the shield.

- Magnetic sensor: Bartignton Flux gate

Magnetic sensor was moved along the shield axis and the field was measured.

(2) Experimental setup

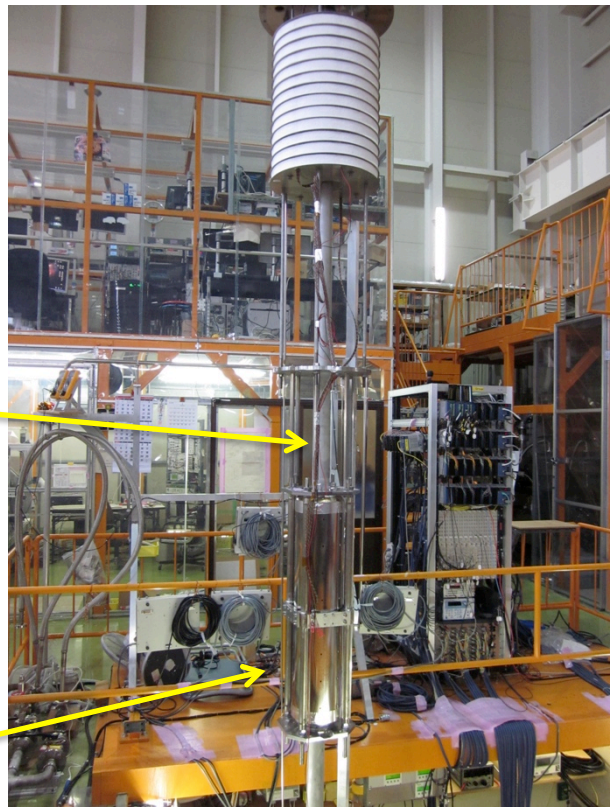


Moving apparatus

Vertical cryostat

Experiment place
(Upper part of the 3.5 m long cryostat and the moving apparatus)

Warm tube and cavity-shield suspended from the cryostat top plate

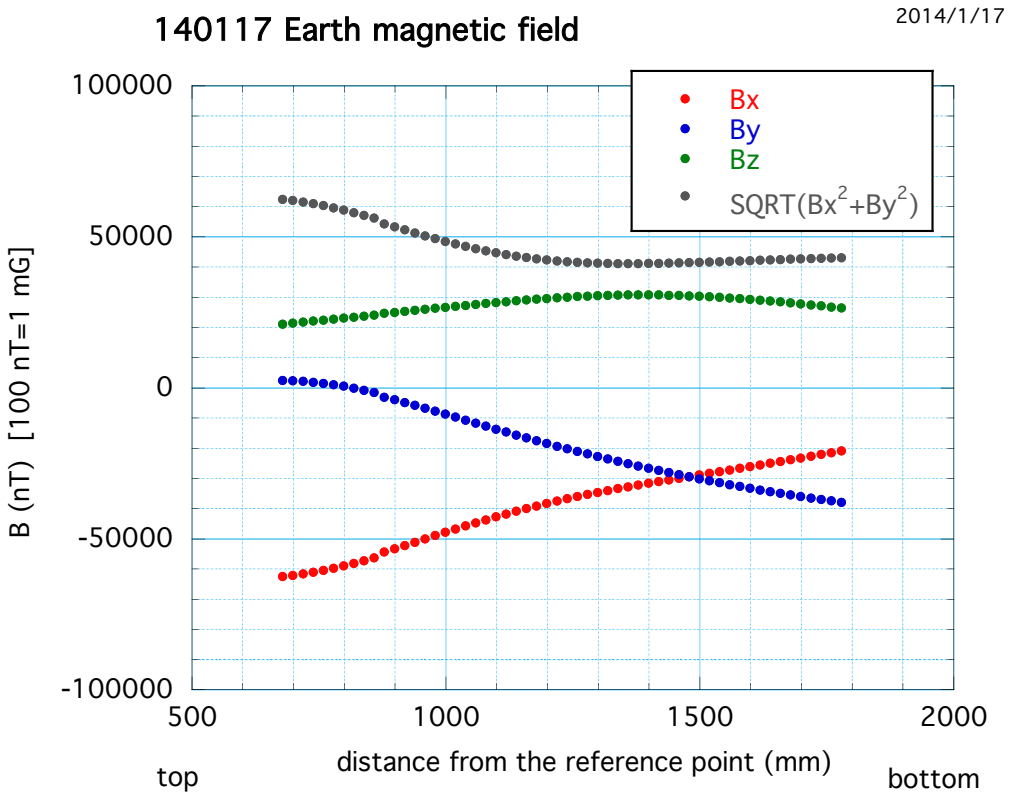


Warm tube

Cavity shield

(3) Measurement results

Earth's magnetic field in the cryostat w/o cavity shield

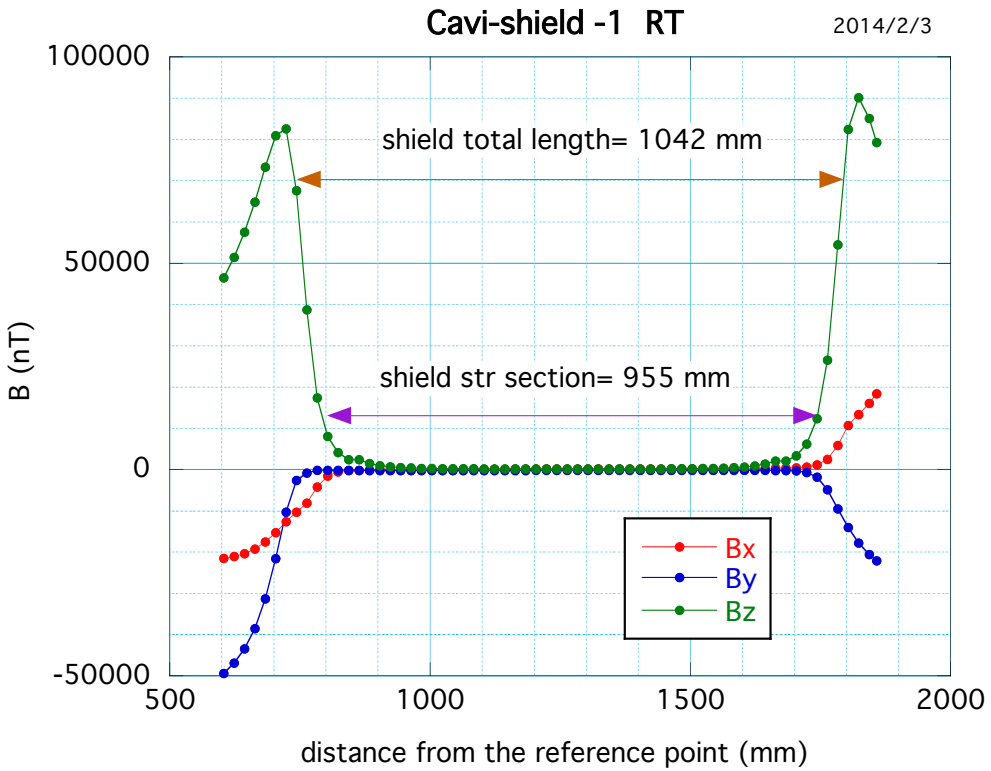


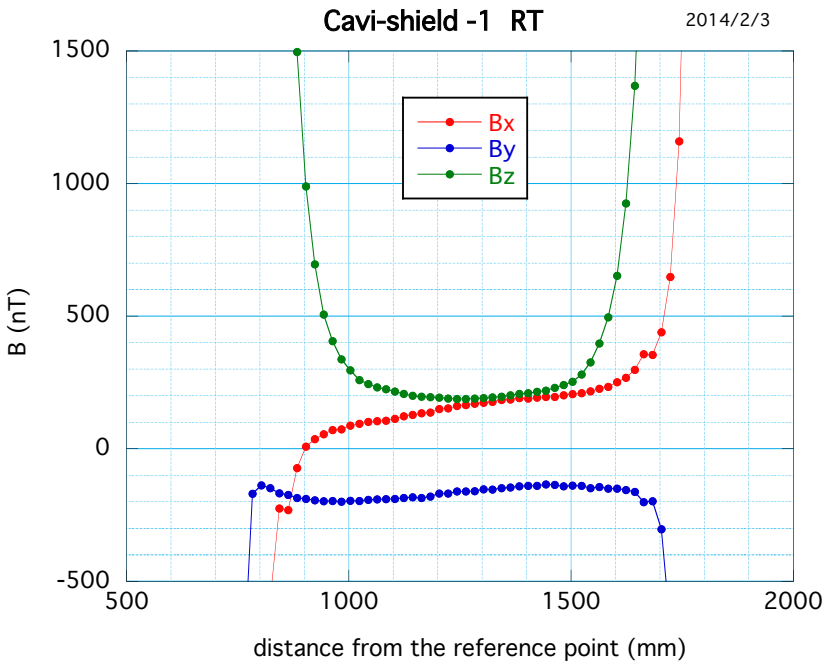
Bx: -600 mG ~ -200 mG
By: 0 mG ~ -400 mG
Bz: 200 mG ~ 300 mG

Bz axis is a vertical direction.
Bx and By axes are in a horizontal plane.

(3) Measurement results of shield-1 @ RT

Field distribution along the shield axis

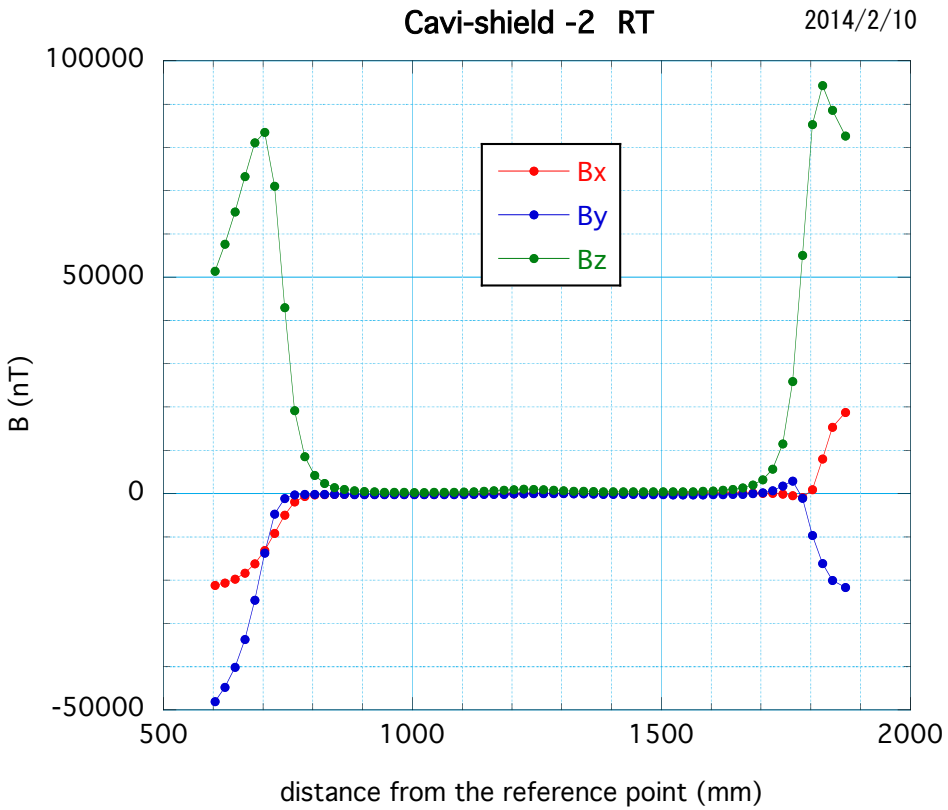


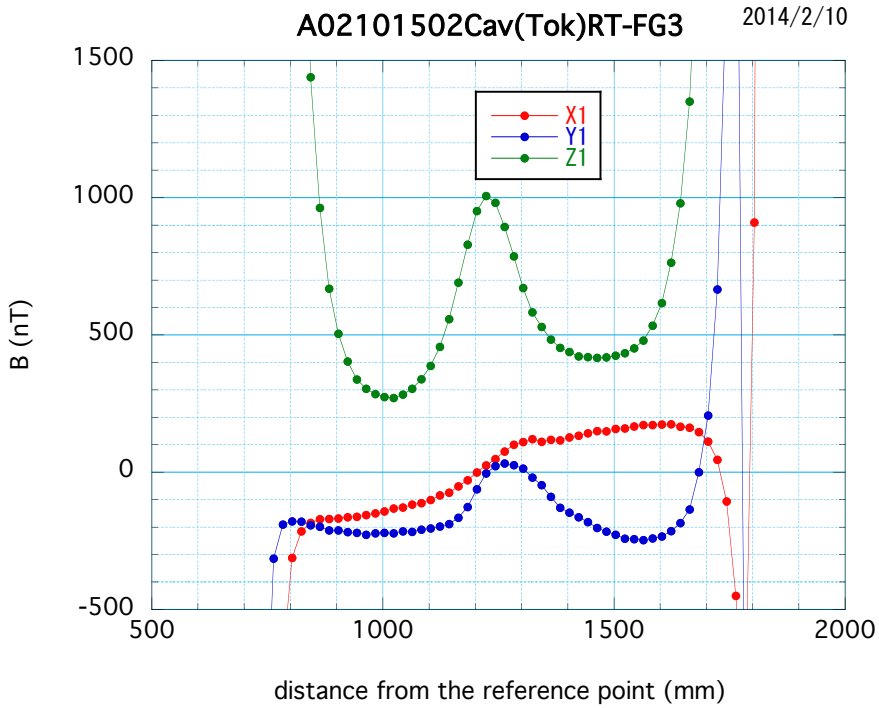


There is an enhancement of Bz near the ends of the shield ; Bz 800-900 mG

(3) Measurement results of shield-2 @ RT

Field distribution along the shield axis





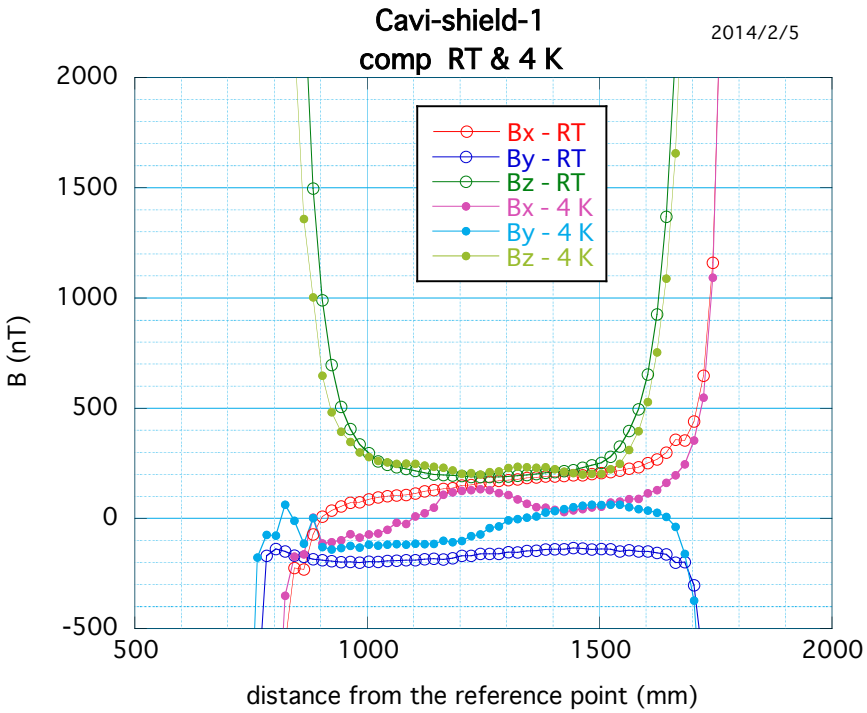
This field distribution is very similar to that of shield-1.

There is a bump in Bz distr at the centeral part of the shield.
This seems to come from the existence of the joint.

(3) Measurement results @ 4 K

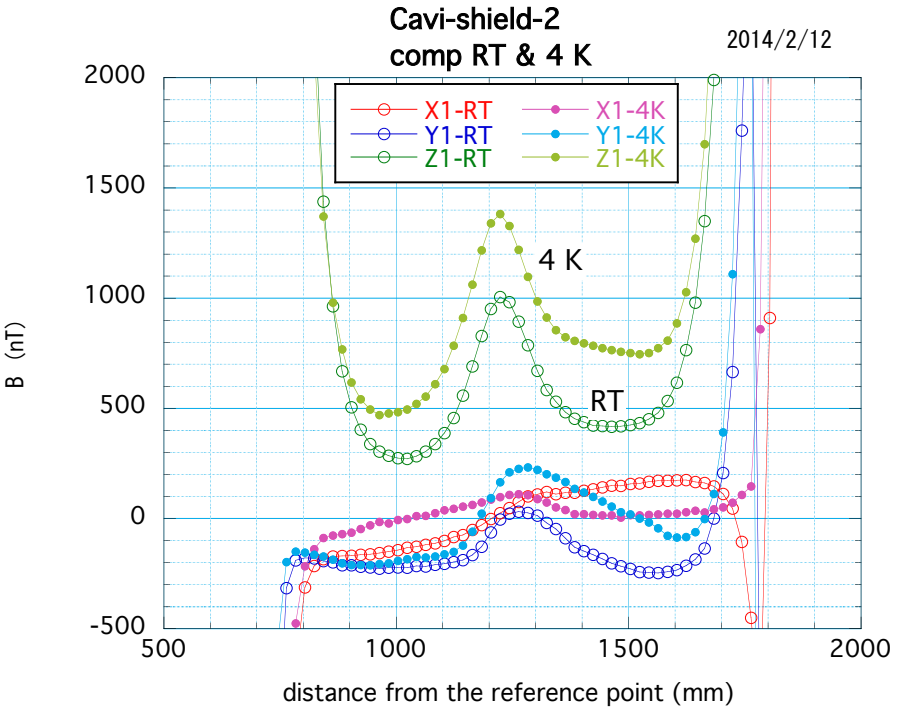
data of RT are also shown in these figs. for comparison

Cavity shield-1



Bz field at 4 K and RT are very similar.

Cavity shield-2



The clear difference can be seen in Bz comp.

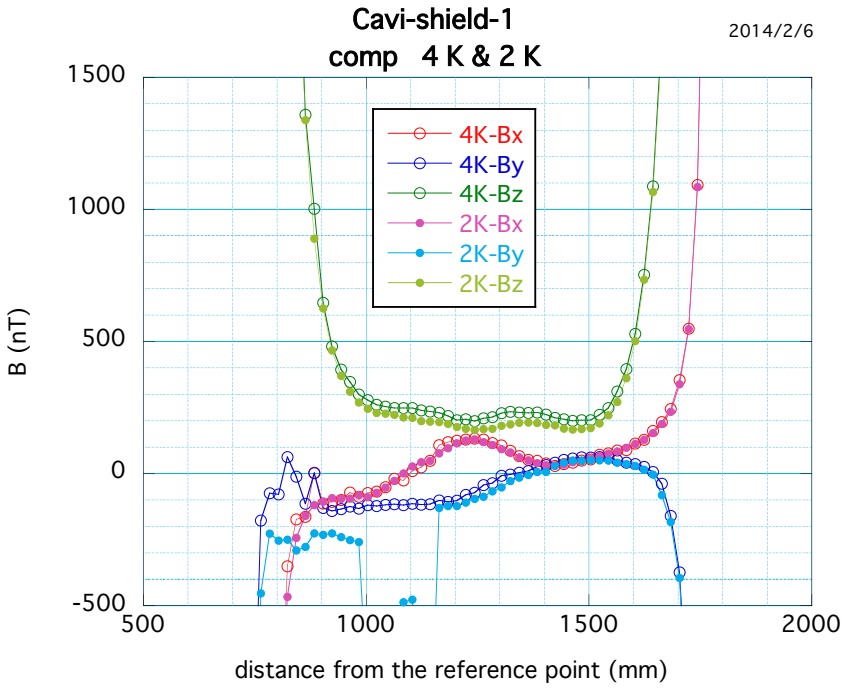
ΔBz ~ few mG

This shift might be occured because of the degradation of permeability at low temp.

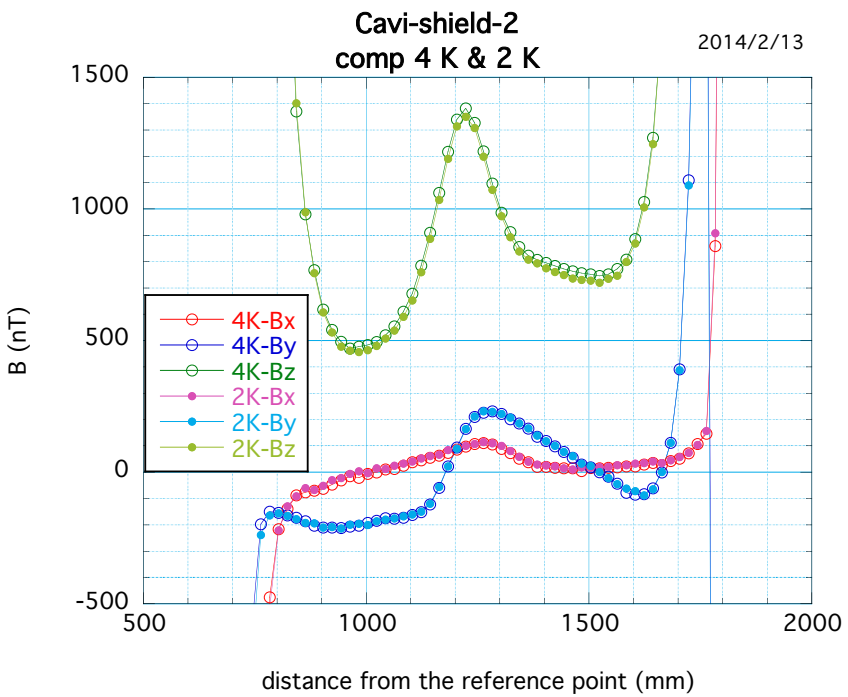
(3) Measurement results @ 2 K

data of 4 K are also shown in these plots for comparison

Cavity shield-1



Cavity shield-2



Difference is not seen in the data of 4 K and 2 K.

(4) Summary

- We have performed the residual field measurement of two kinds of cavity-shields at RT, 4 K and 2 K.
- Though more detailed analysis will be necessary, following things became clear at present.
  - joint of cavity axis direction will surely increase the residual field.
  - in case of shield-2, performance degradation due to 4 K cooling was of the order of few mG.
  - no degradation was observed in the shield performance even if the shield temperature is lowered from 4 K to 2 K.
  - performance of shield-1, which made of standard VDM materials, was fairly good.
  - in both shields, transverse residual field at 4 K was about few mG.