Progress of cERL injector cavities at KEK

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1. Introduction: About the Injector cryomodule

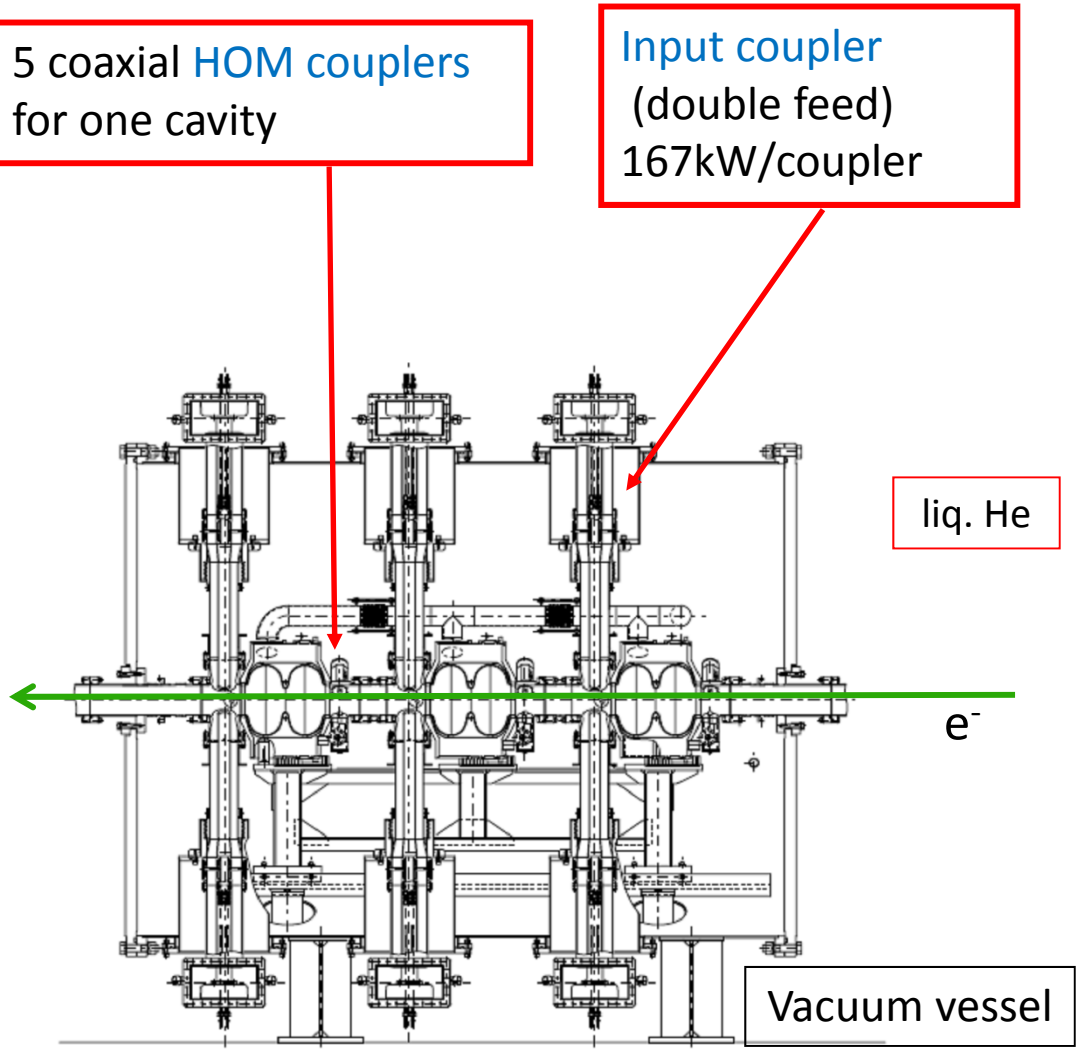
Target

* Accelerate to 10 MeV

Require

* 15 MV/m / cavity at CW

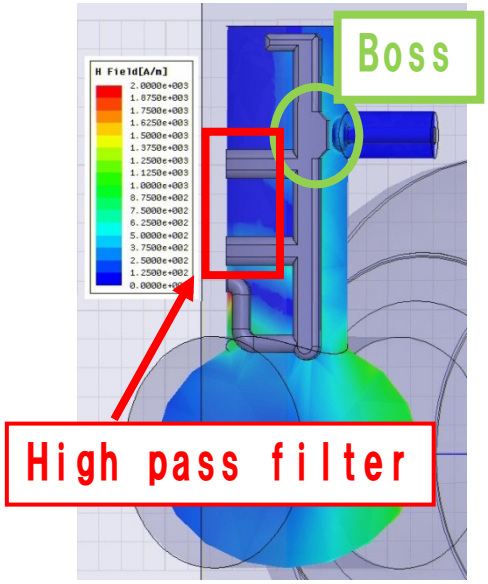
Cavity : 3 x 2-cell cavities
Slide-Jack tuner and piezo tuner



2. Cavity and HOM coupler

- Number of cell : 2 cell
- Number of Input coupler : 2 couplers
- HOM damper : Coaxial type HOM coupler x 5

The HOM coupler was designed by based on TESLA type coaxial HOM coupler.
The TESLA type HOM coupler has a heating problem at low field in CW operation.

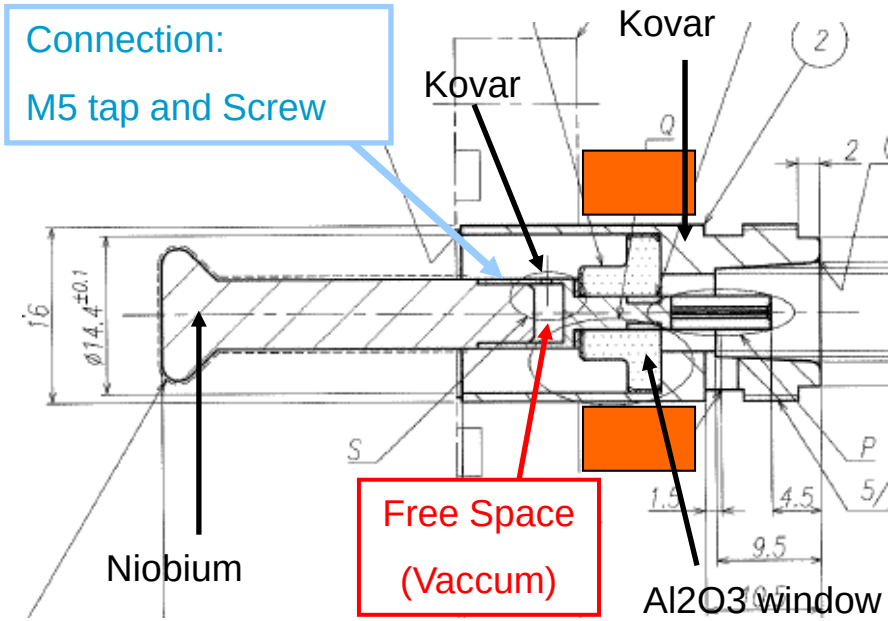


* Deduce a surface current at HOM coupler to 1/2 by high pass filter and boss.
* The loss also reduces to 1/4.

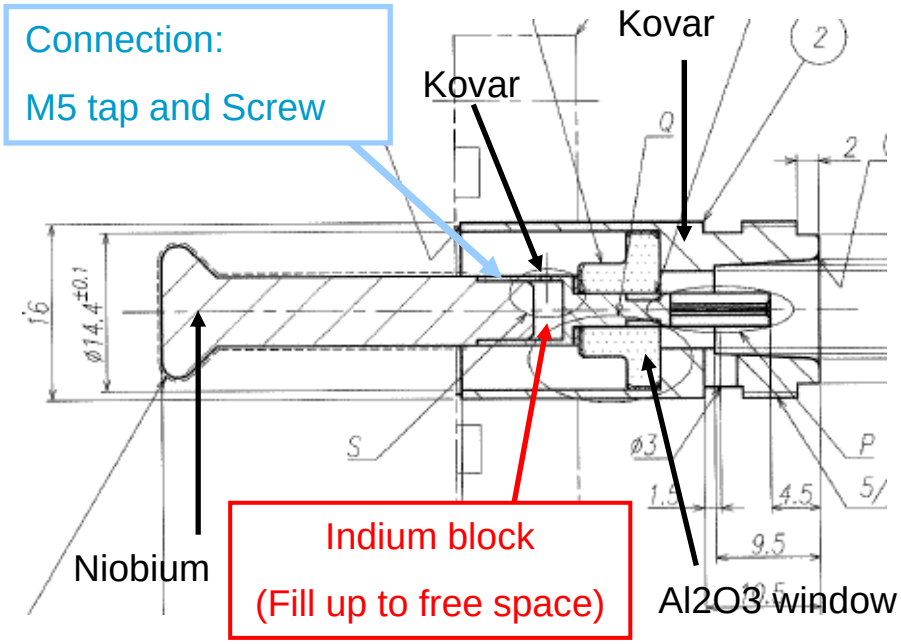
The cavity performance w/o HOM pick-up was achieved exceed 40 MV/m in liq He. The fabrication of cavity is good quality.
A problem of designed HOM coupler is heating of HOM pick-up antenna at operating field. We need to do development a feed-through with good thermal conductivity.

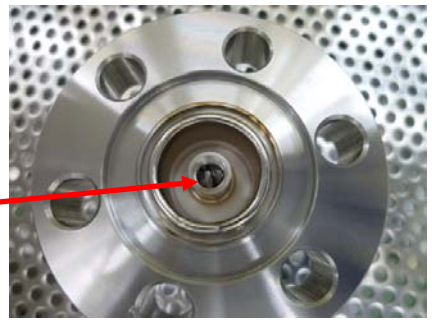
2. Feed-through (1) Kyocera N-R type

Type 0: Normal



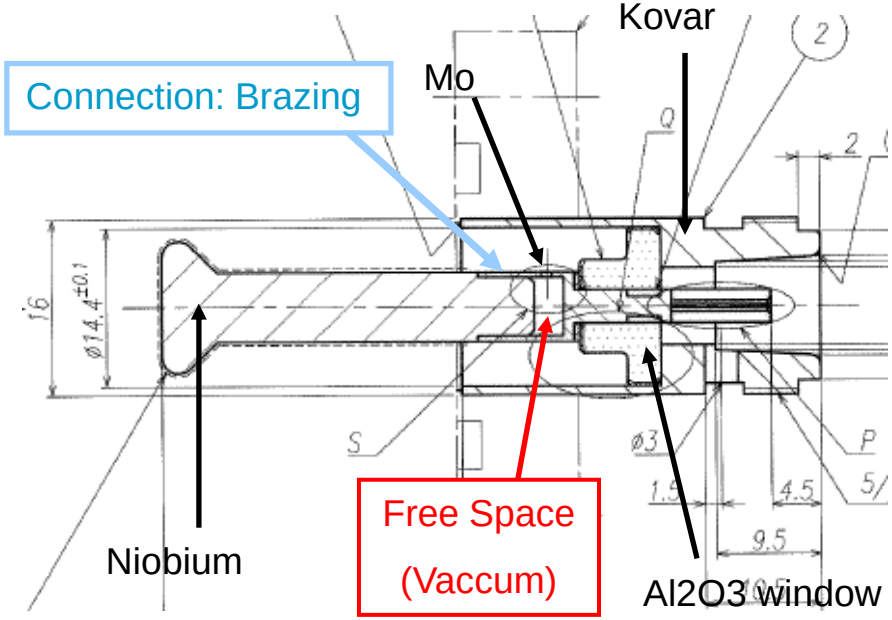
Type 0: Modify



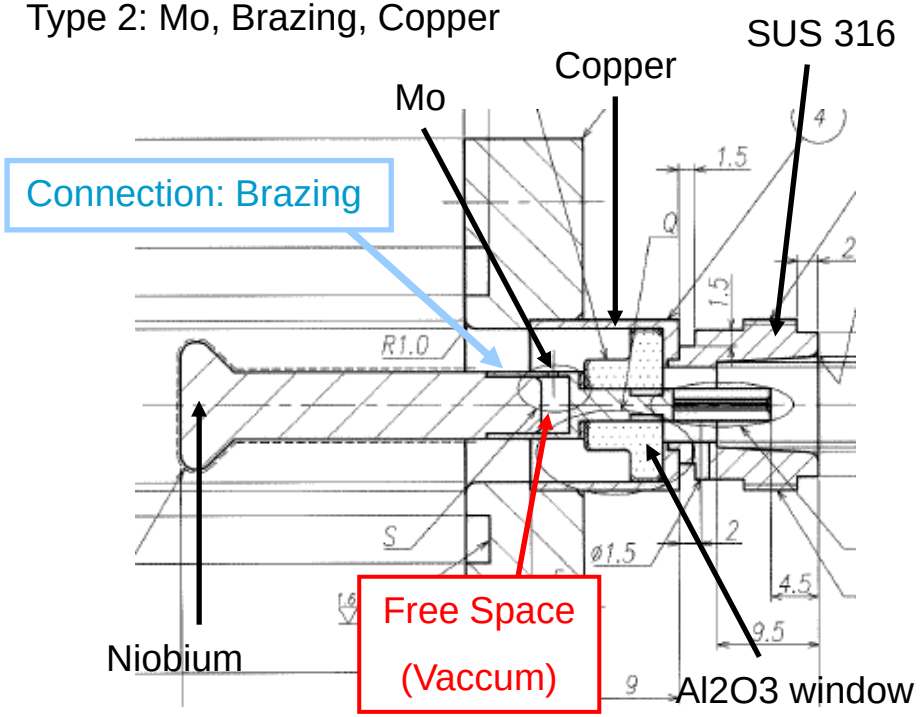


2. Feed-through (2) Modify based on Kyocera N-R type

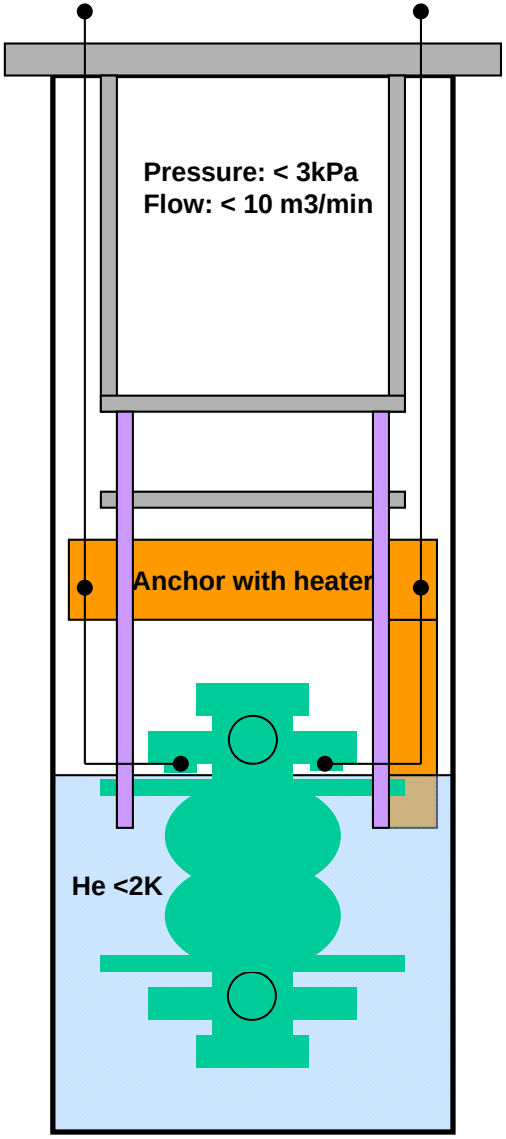
Type 1: Mo, Brazing



Type 2: Mo, Brazing, Copper



3. Setup and RF test in vertical test

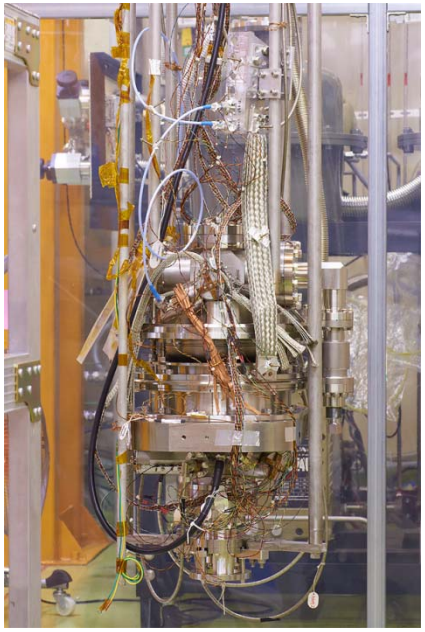


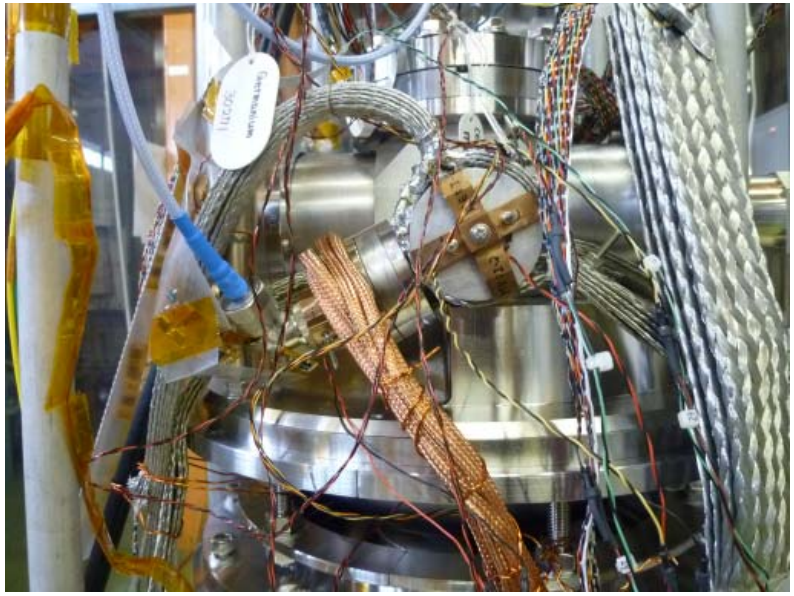
Unfortunately, KEK don't have the CHECIA. We can not test at bad cooling situation before install the real injector cryomodule.

To estimate the cavity performance without the CHECIA, we try to control the liq. He level and flow rate in the dewar at vertical test. **(make a bad cooling situation)**

And the He level vs the Suitable field at CW measured for it.

Six thermo-sensors attached on each HOM couplers to be monitoring a heating. (Feed-through, Outer conductor and etc…)





4. Result of vertical tests of 2-cell cavities

Test	Eacc [MV/m] Suitable field at CW		Feed through type	Eacc Max (Cause of limitation)
	Inside liq. He	Outside liq. He		
#1 cavity (Proto-type) Feb/04/2010	-	-	Without	43.7 (power limit)
#2 cavity (Proto-type) Oct/14/2010	18	13 Slow cooling	Type 0 (normal)	42.6 (Heating HOM pick-up)
#3 cavity (will install CM) June/08/2011	30.3	25 Very Good Fast cooling	Type 0 (modify)	30.3 (Quench by defect)
#4 cavity (will install CM) Sep/20/2011	12	5 Fast cooling	Type 1 (1st test.)	20.3 (Heating HOM pick-up) (Quench by defect ?)
#5 cavity (will install CM) Oct/04/2011	16.5	12 Fast cooling	Type 1 (improvement surface treatment)	28.8 (Heating HOM pick-up)

* Type 2 will be tested from Nov 2011 to Dec 2011 by using #3 ~ #5 cavities.

4. Summary

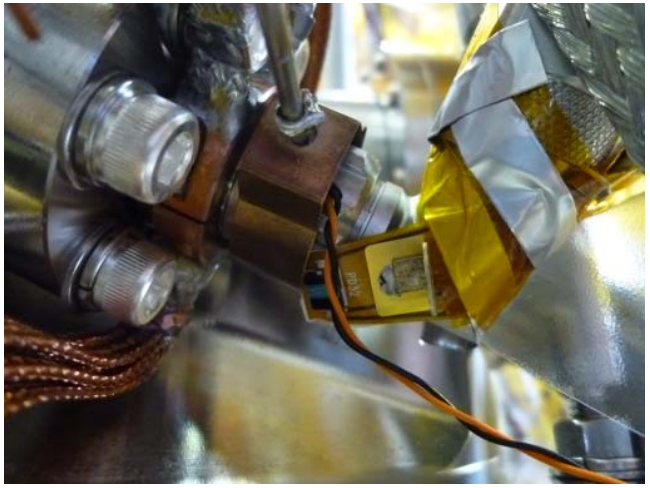
•The 1st vertical tests of the #3 ~ #5 cavities were carried out from Jun 2011 to Oct 2011.

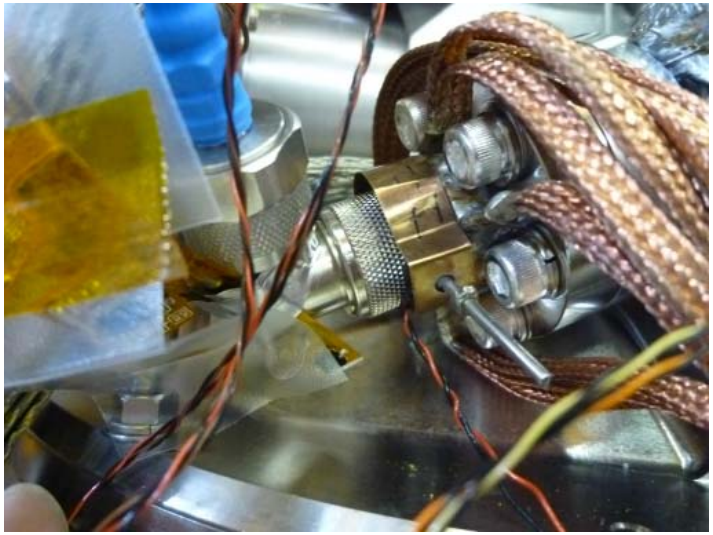
•The maximum gradient of all cavities were reached to the operation gradient.

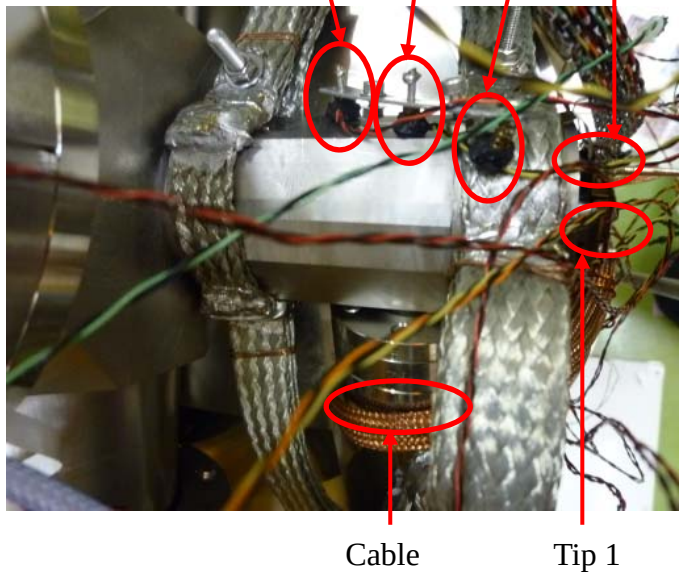
•We got a good result by the feed-through of the type 0 modify.
Type 0 modify has a good performance for back-up and real operation.

•The type 2 feed-through will be tested from Nov 2011 to Dec 2011 at 2nd vertical test after doing the repair on the brazing location and the improved surface treatment.

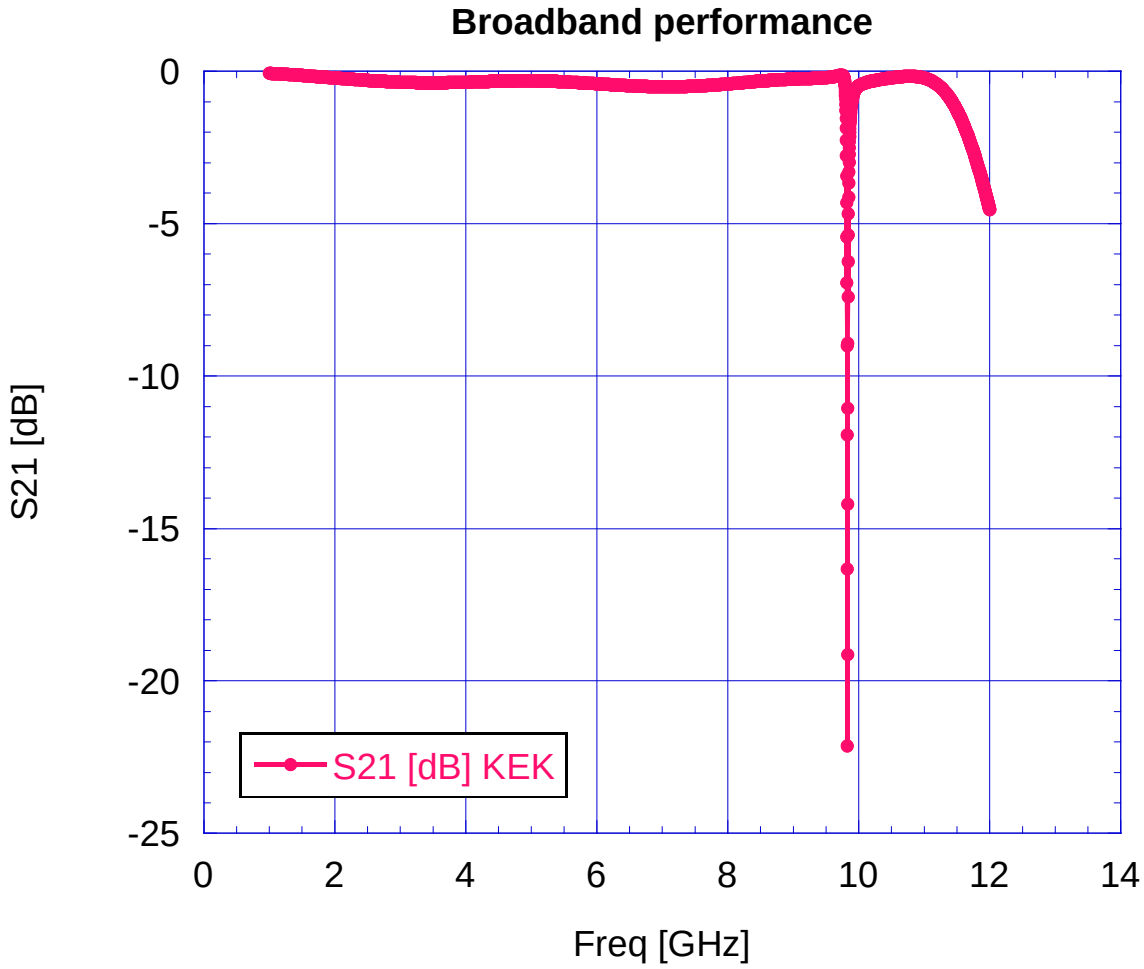
Thermo-sensors

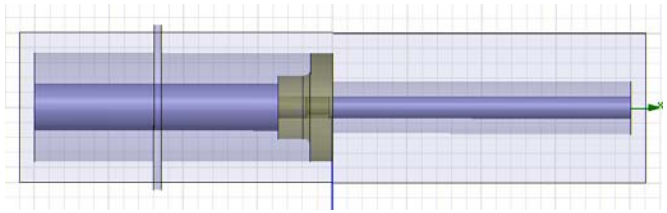






Broadband performance





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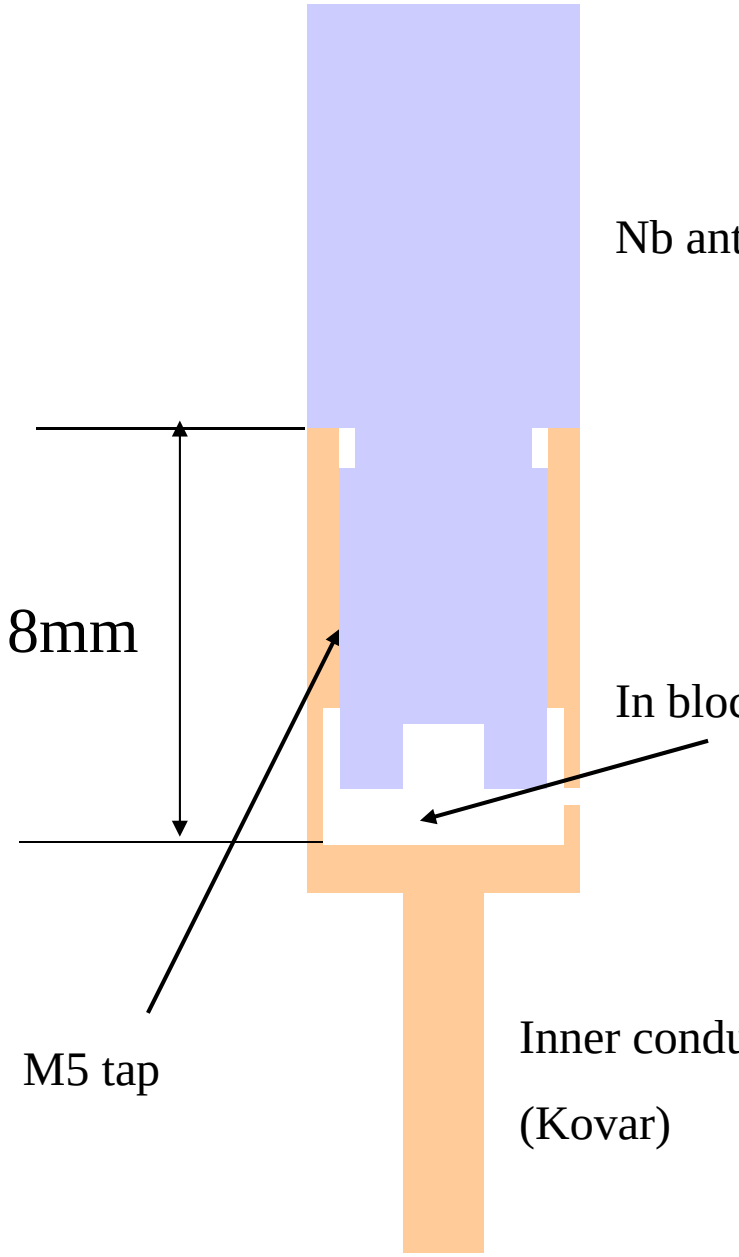
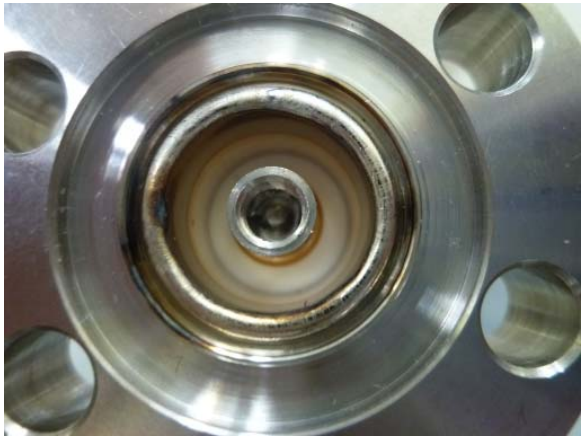

8mm
M5 tap
Nb antenna : Screw
In block, fill up to free space.
Inner conductor
(Kovar)



Anchor for HOM pick-up