Convection absorber status & plans

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Absorber Review Meeting at FNAL, Aug 12-13, 2002

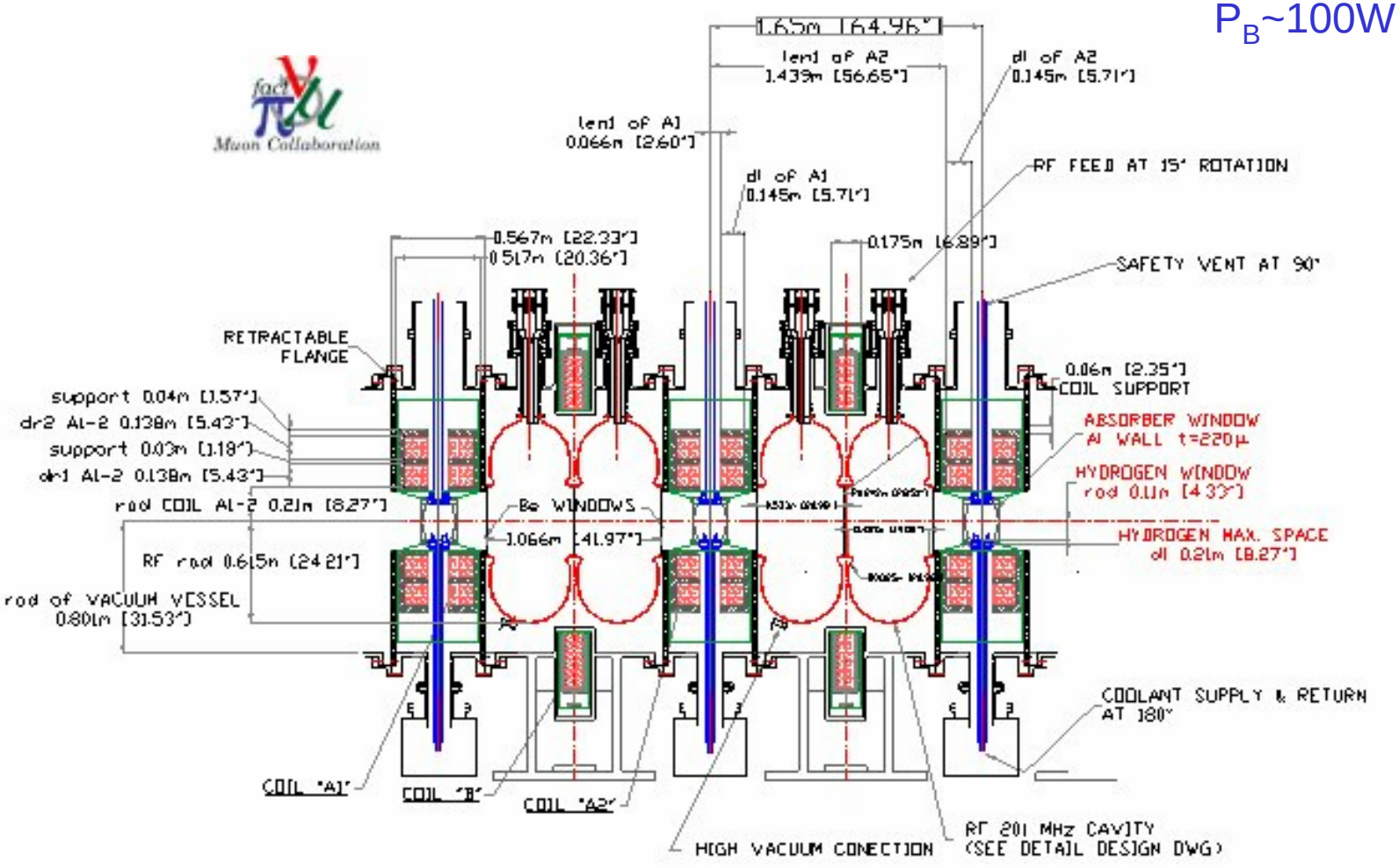
http://ishimotopc2.kek.jp/absorber/

Contents

LH_2 Absorber

D=22cm, L=21cm

P_B~100W

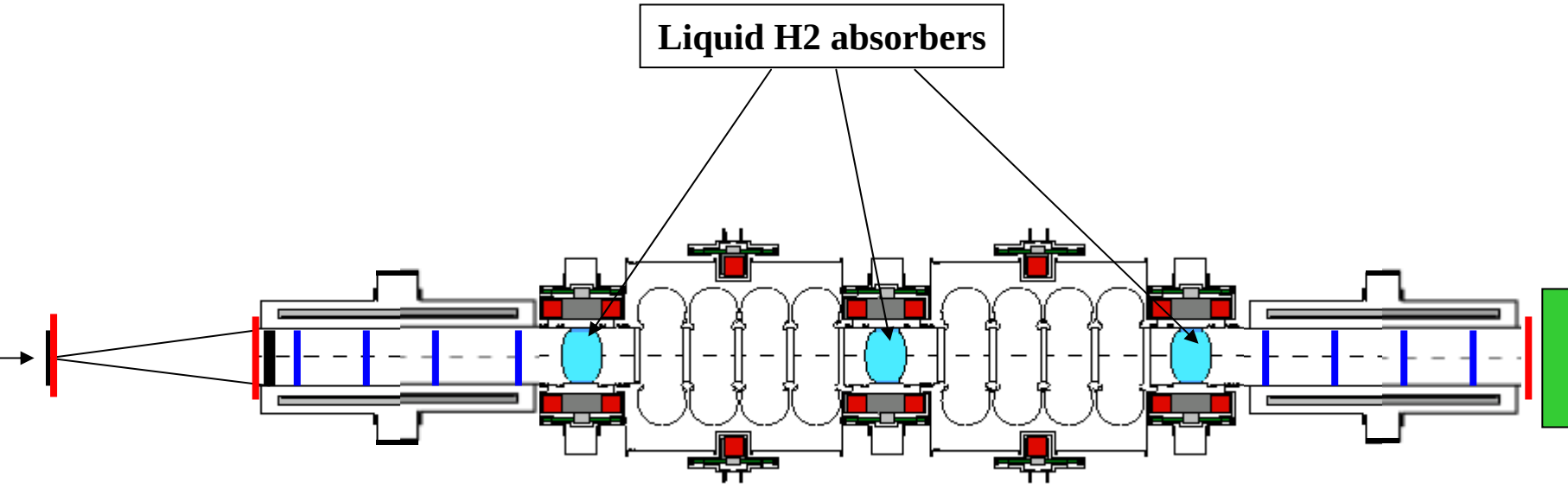


SFOFO 1.65 m LATTICE 2
SCTIONS: 2,1 TO 2,3
STUDY 2

SFOFOLATTICE2rev7a

E.L.Bock 01/21/2001
Rev.7 GENERAL
Rev.7a N.Green design 03/06/2001

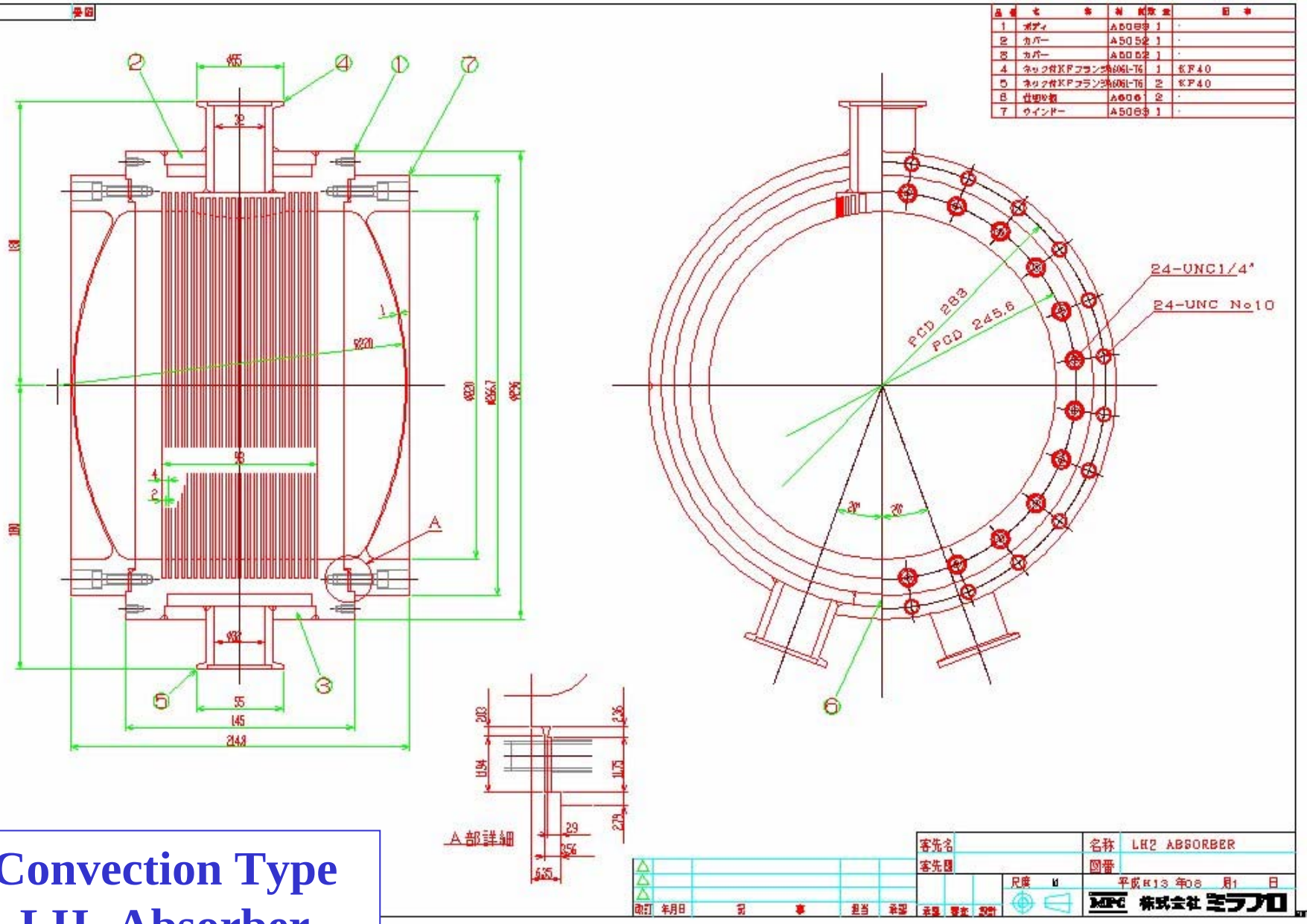
International Muon Ionization Cooling Experiment (MICE)



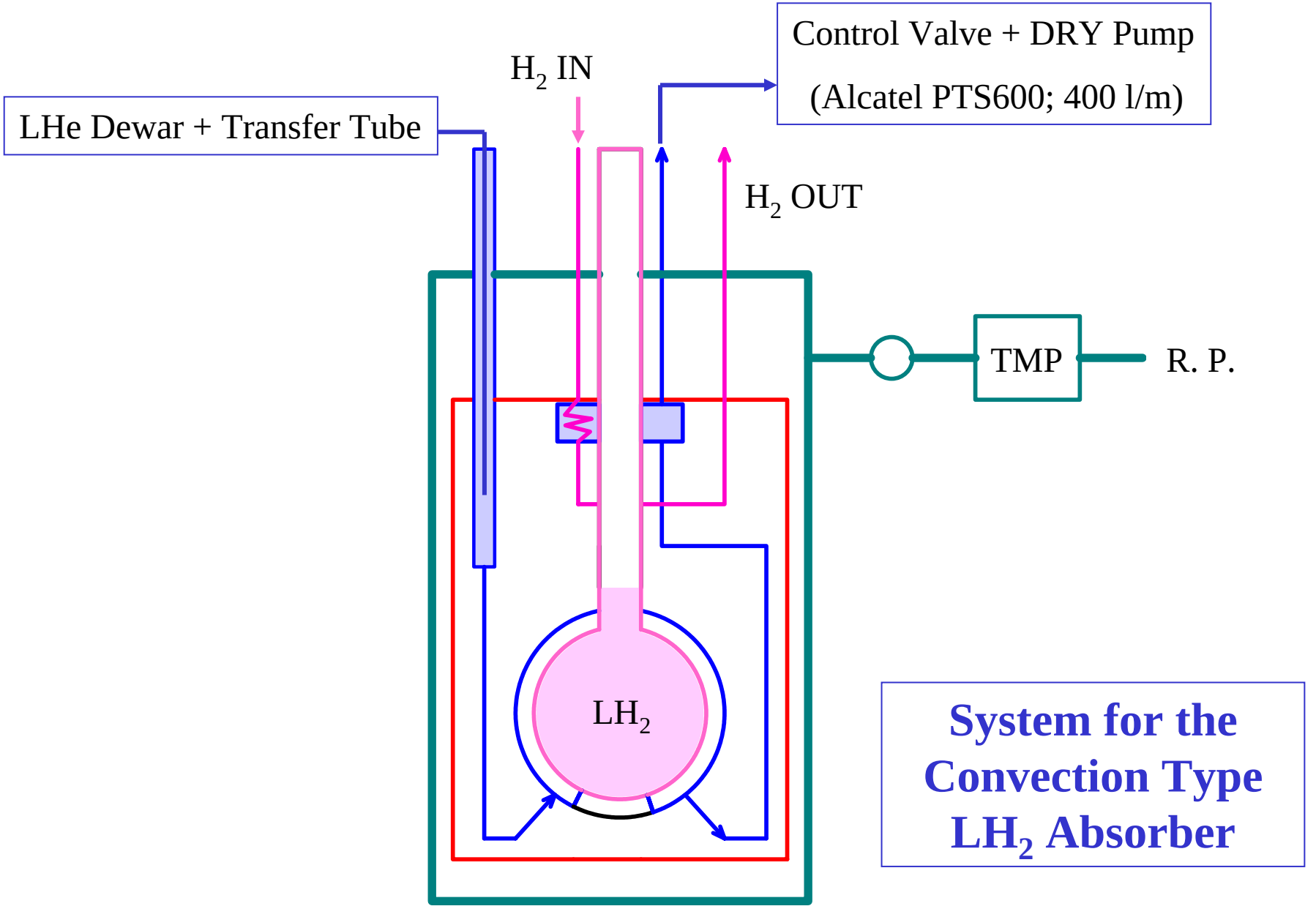
LH_2 Absorber

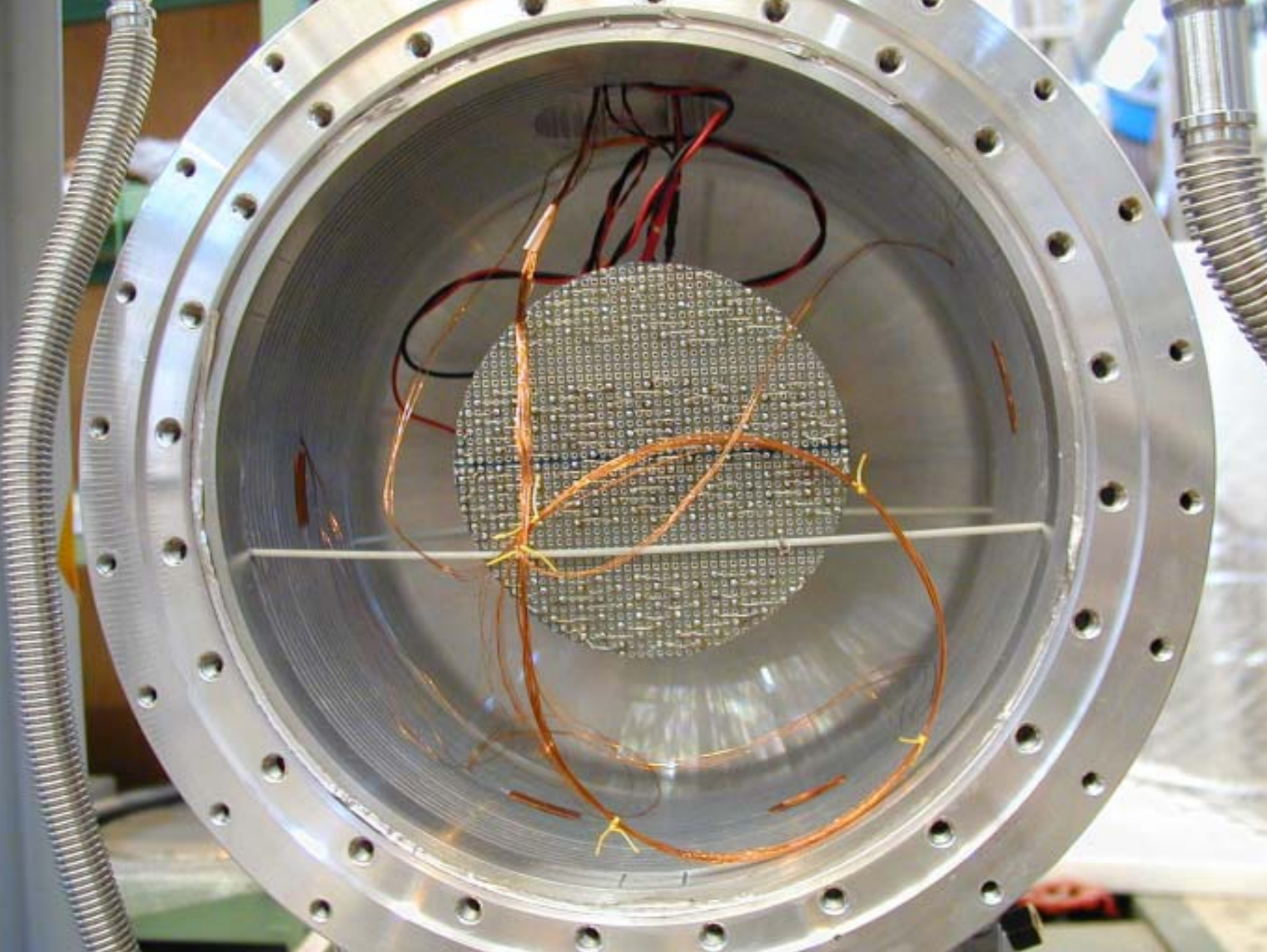
D=38cm, L=35cm

P ~ 0 W → 23 W



Convection Type LH_2 Absorber


Control Valve + DRY Pump
(Alcatel PTS600; 400 l/m)
H2 IN
LHe Dewar + Transfer Tube
H2 OUT
TMP
R. P.
LH2
System for the Convection Type LH2 Absorber



Dummy Heater

Stainless Steel Wire

d = 0.34 mm

Resistance;

r = 7.5 Ohm/m at R.T.

~ 6 Ohm/m at 27 K

Total;

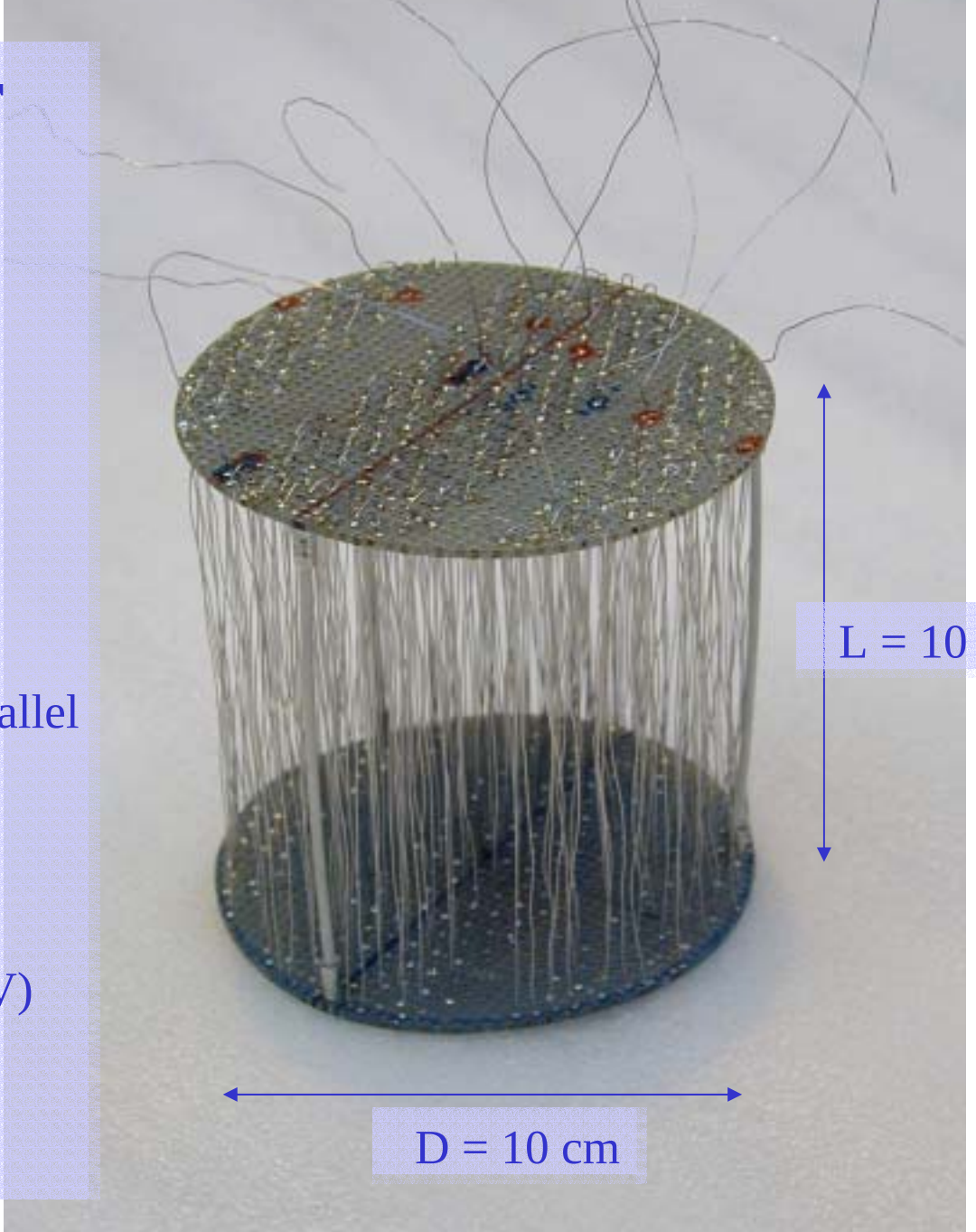
2 wires of 15 m length parallel

R = 56 Ohm at R.T.

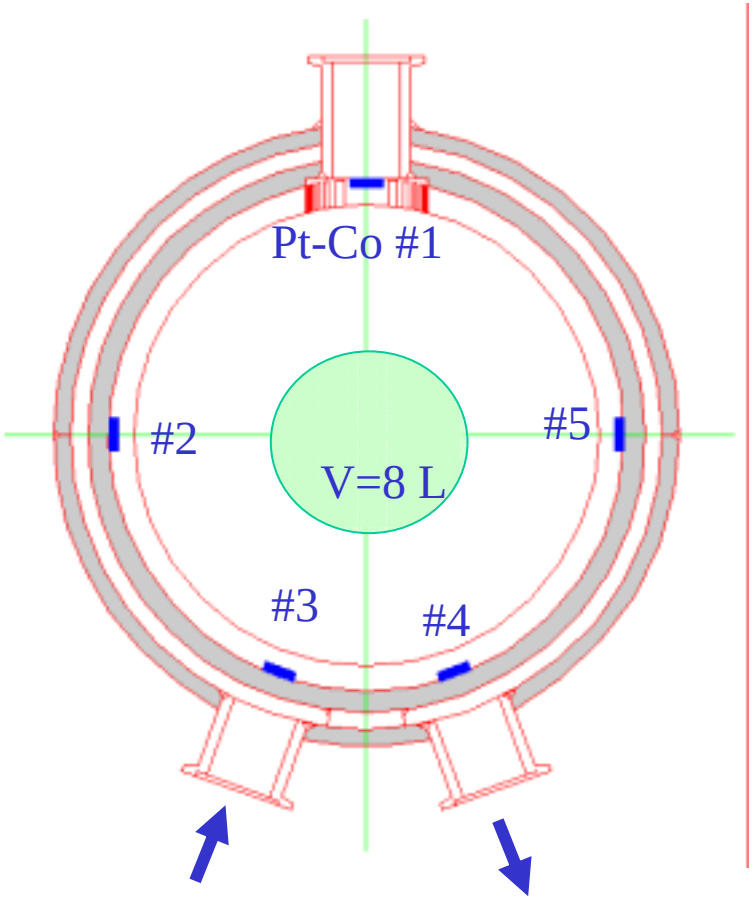
~ 45 Ohm at 27 K

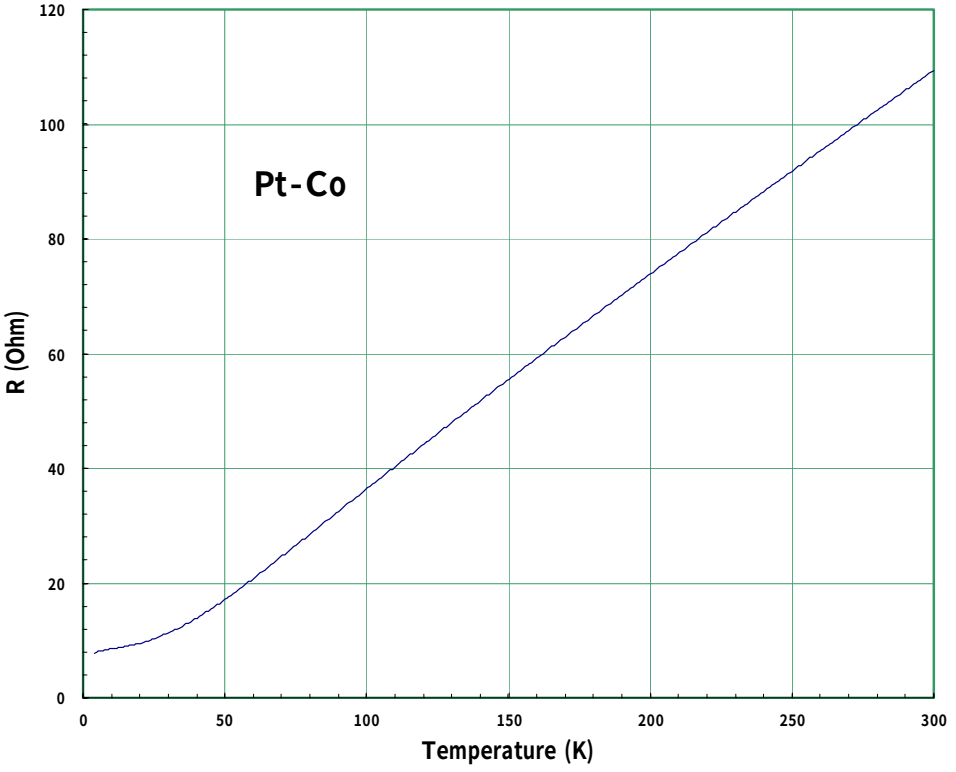
DC-PS (I_{max};2A,V_{max};100V)

P < 180 W



Temperature Measurement

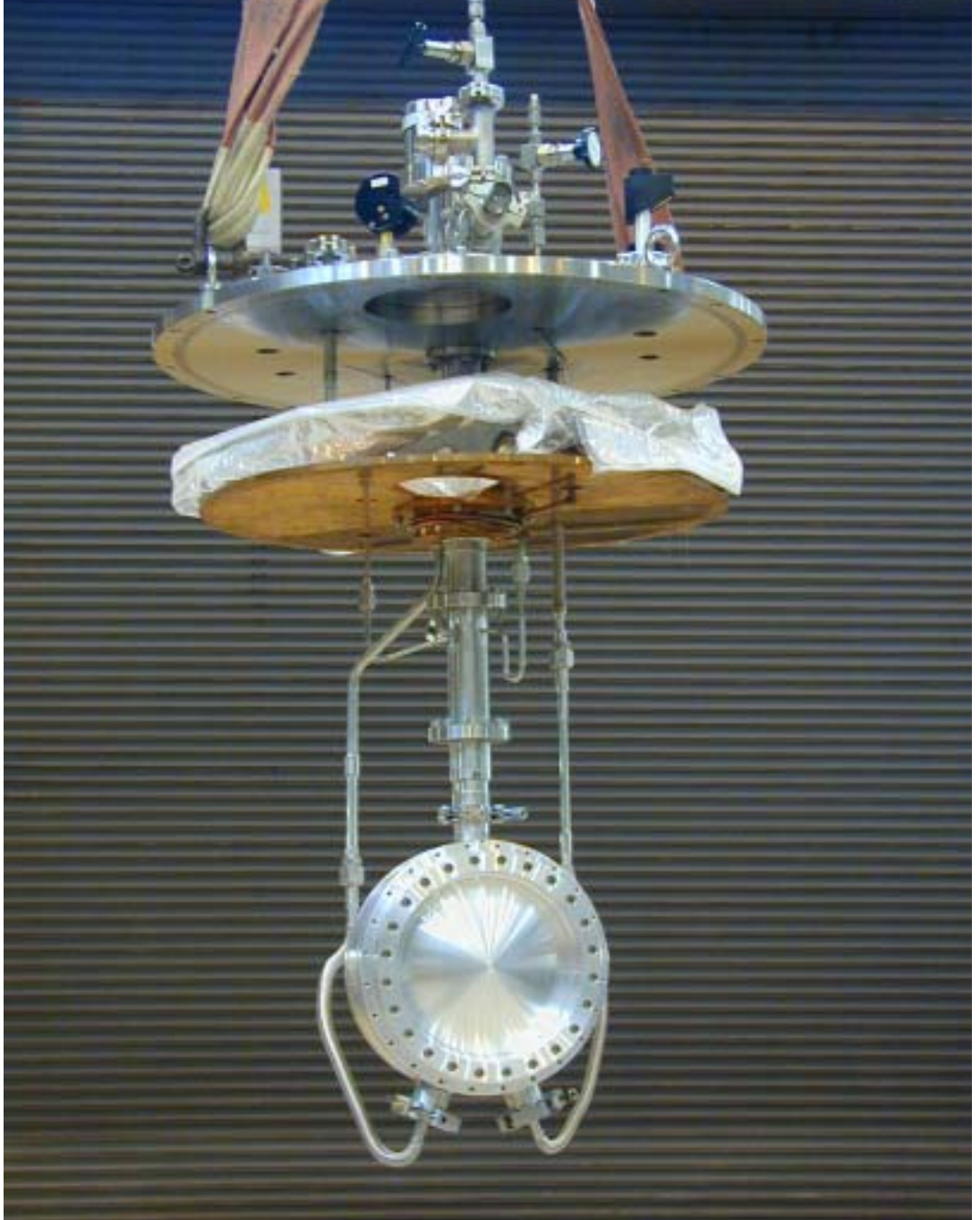




Pt-Co Thermometer

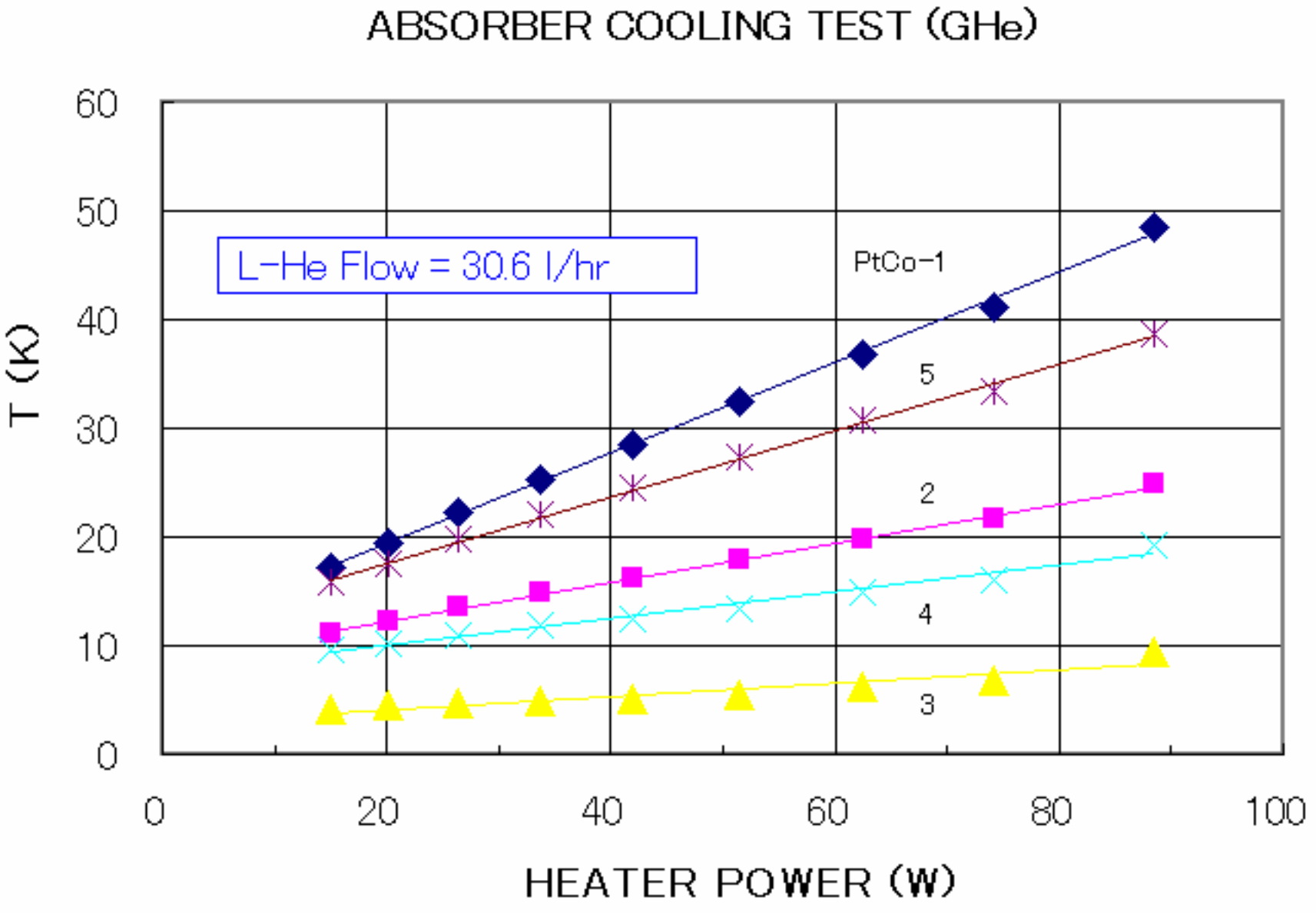
Chino R800-6

100 Ohm at 273K

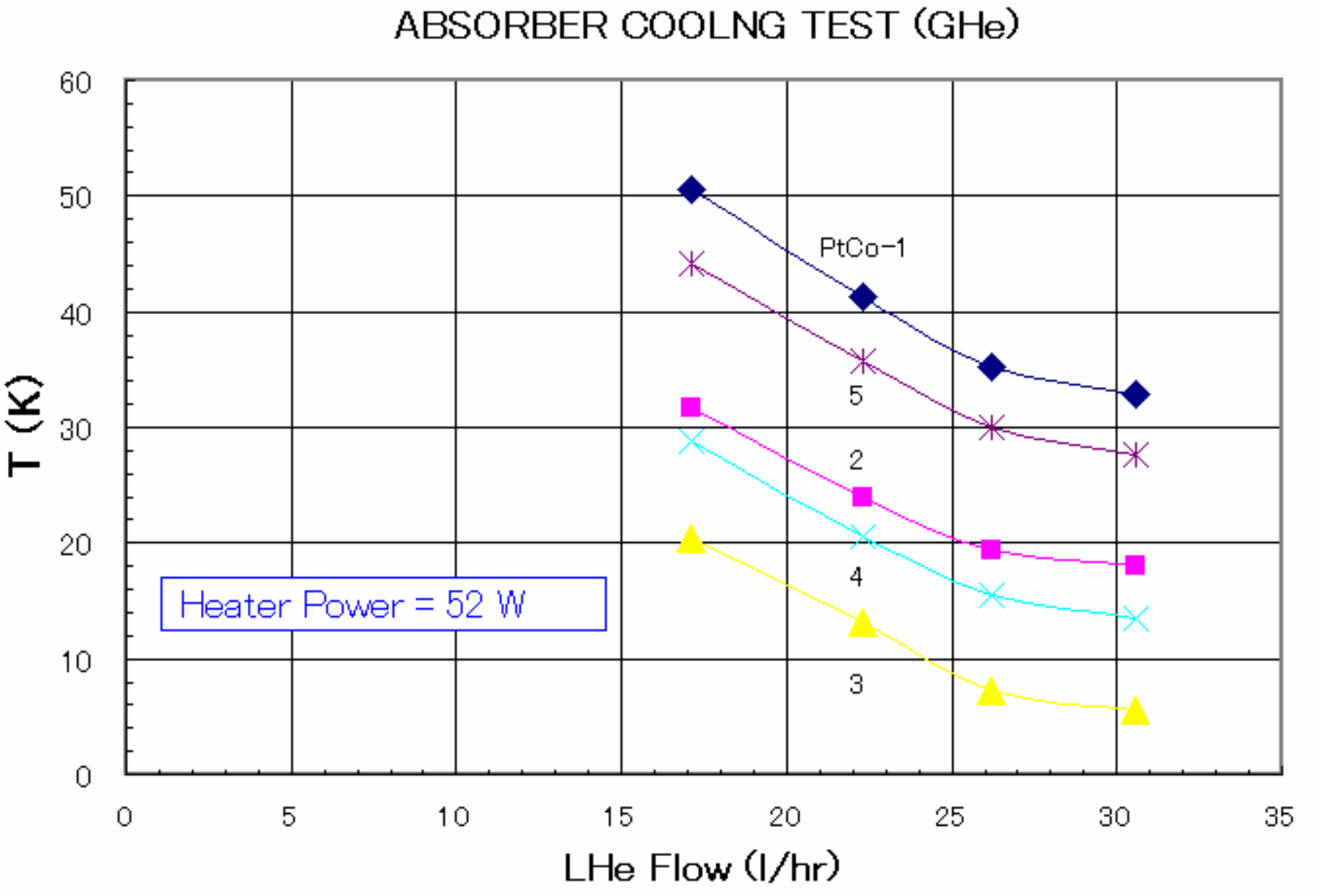


Test Cryostat for LH_2 Absorber

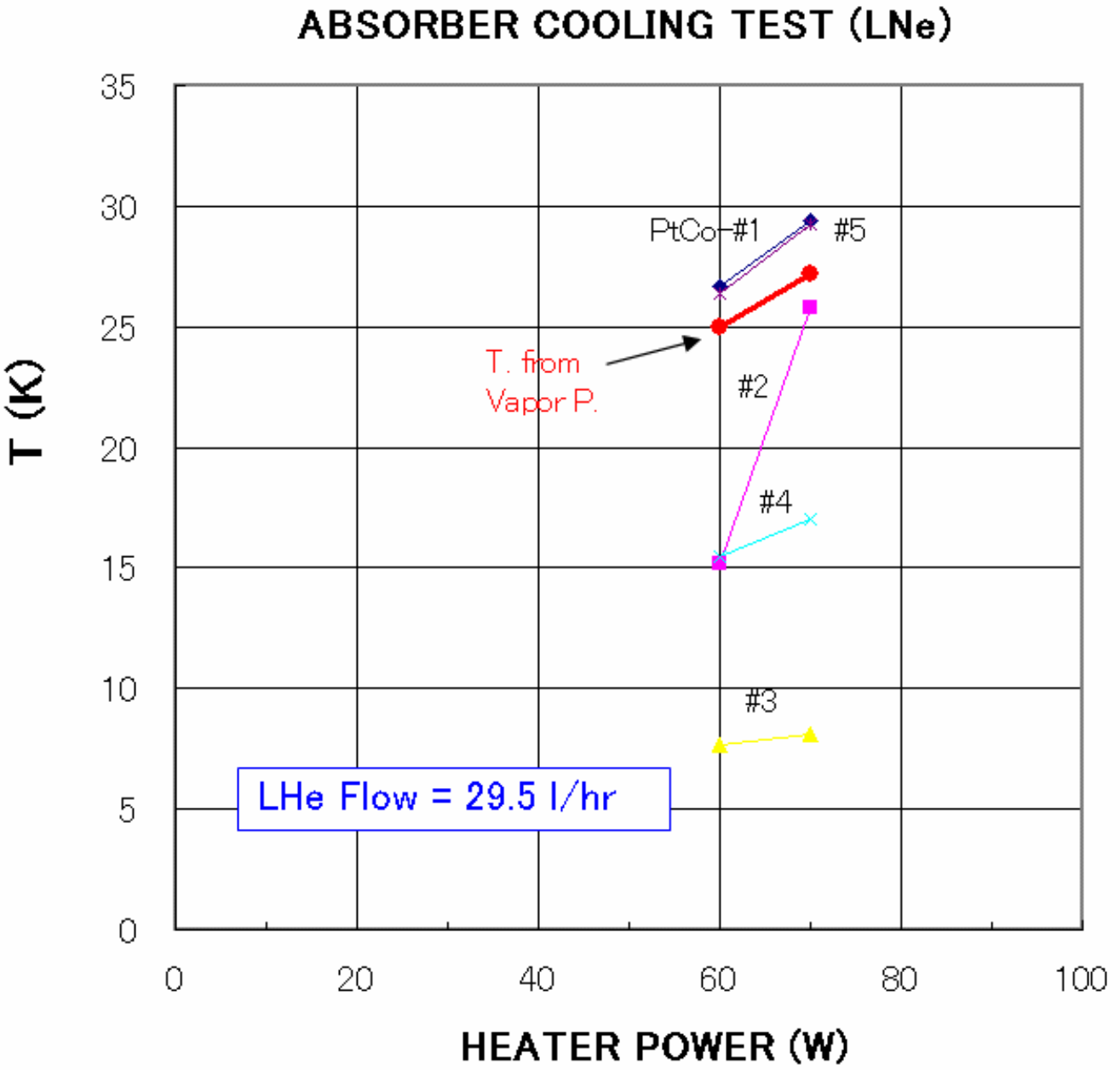
est Result #1; GHe



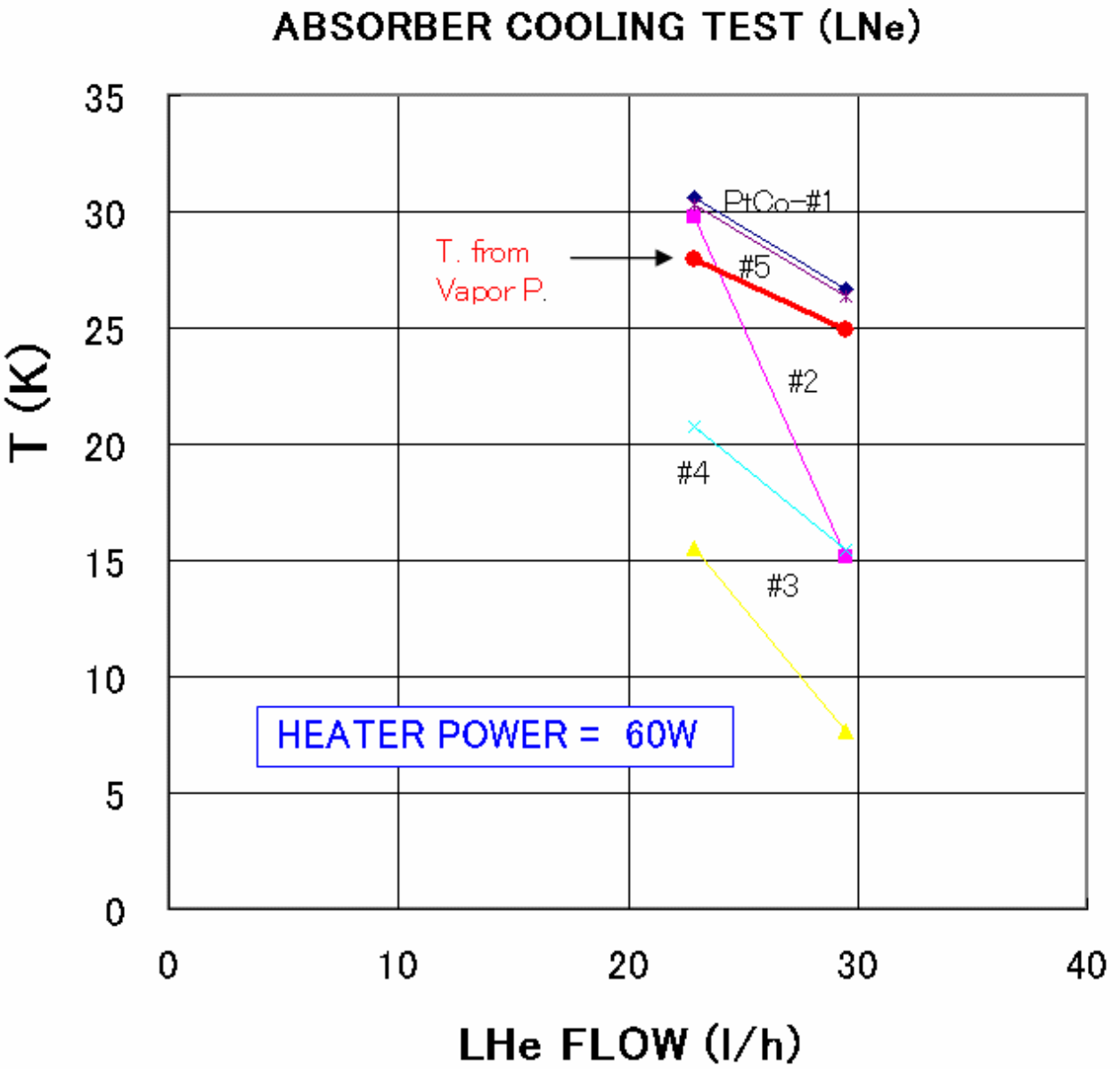
est Result #1; GHe



est Result #2; LNe



est Result #2; LNe



Question and Modification

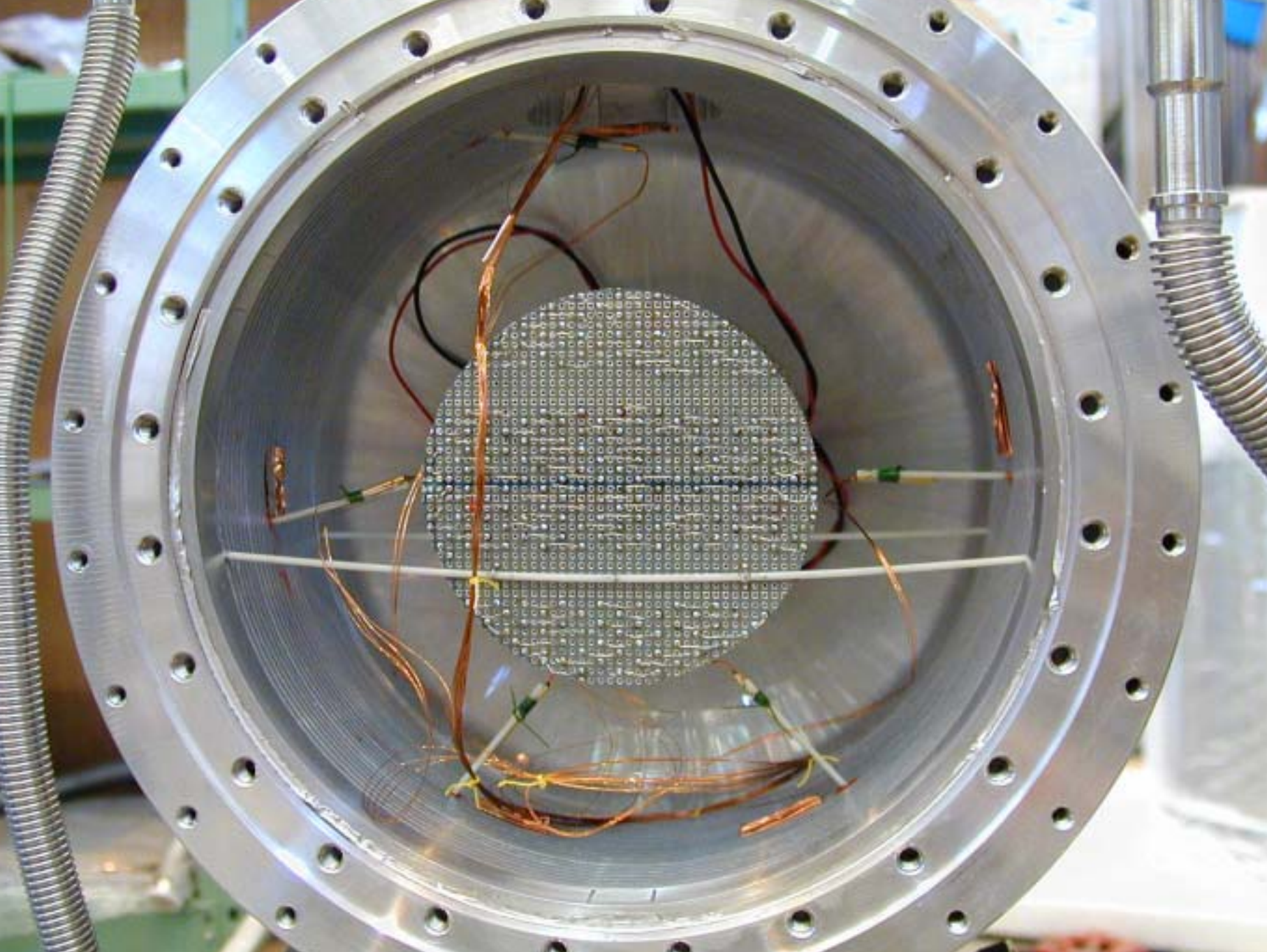
Why large temperature difference? Solid Ne?

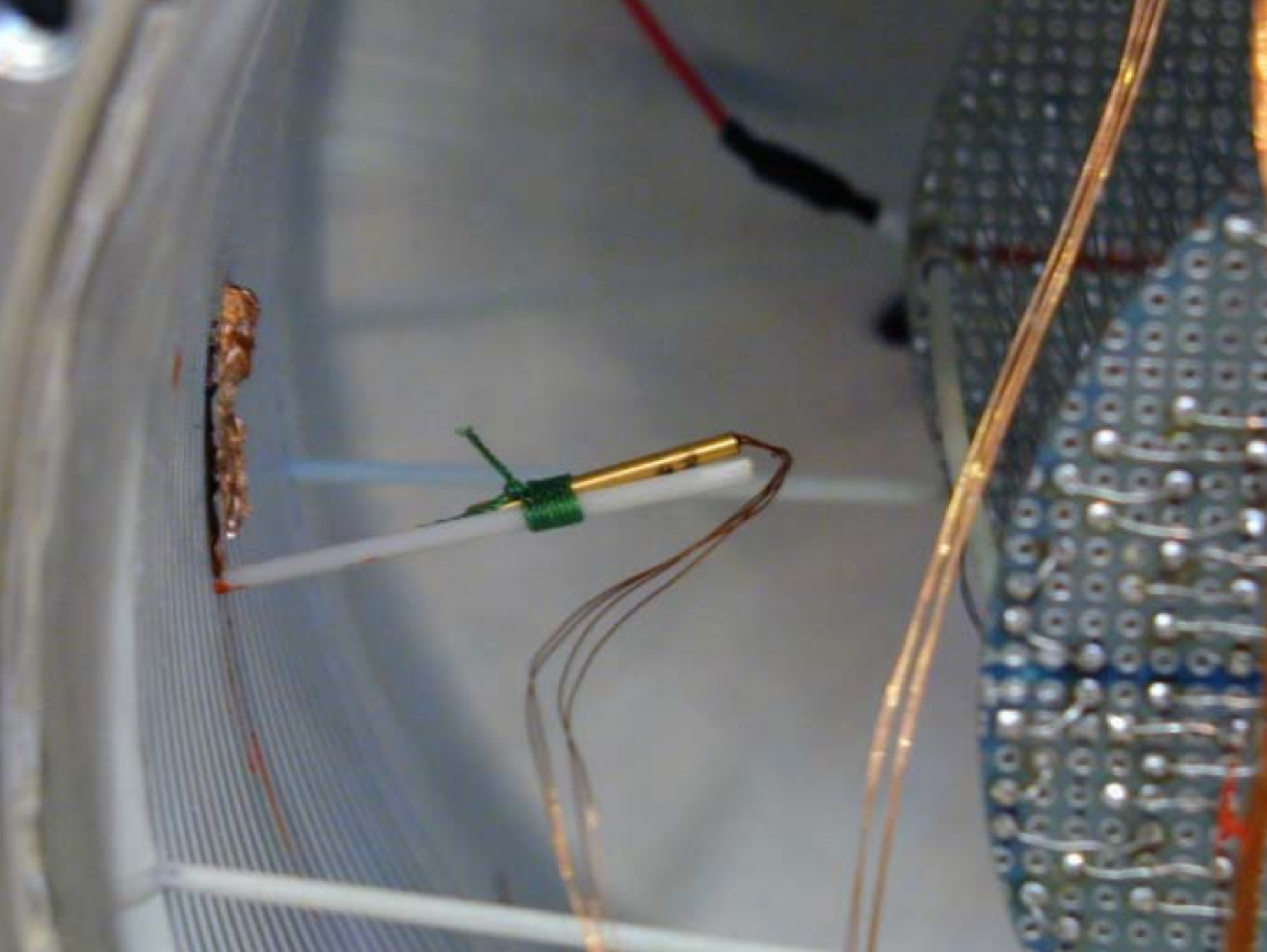
(1) needs improvement of temperature measurements;

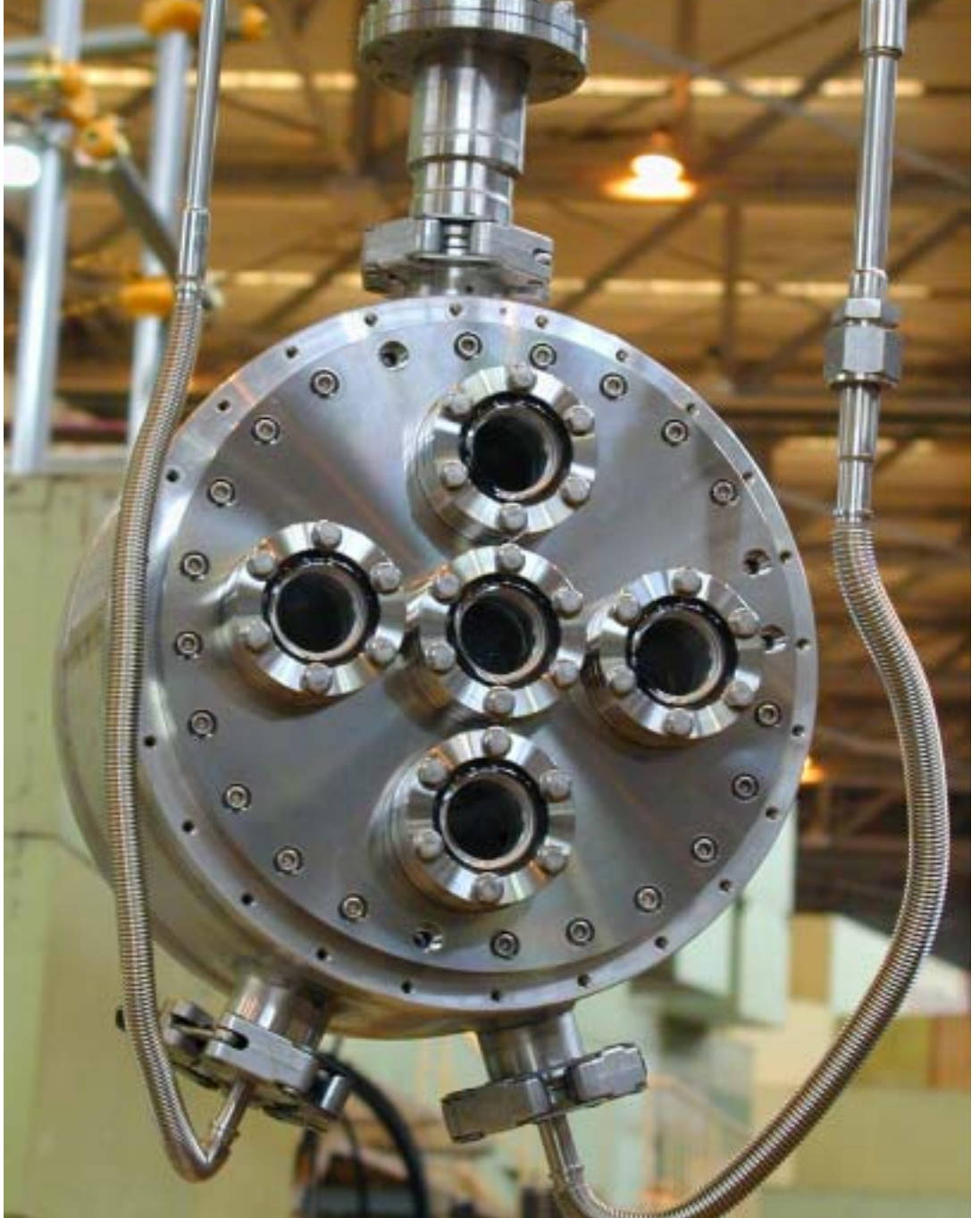
→ set thermometers in liquid

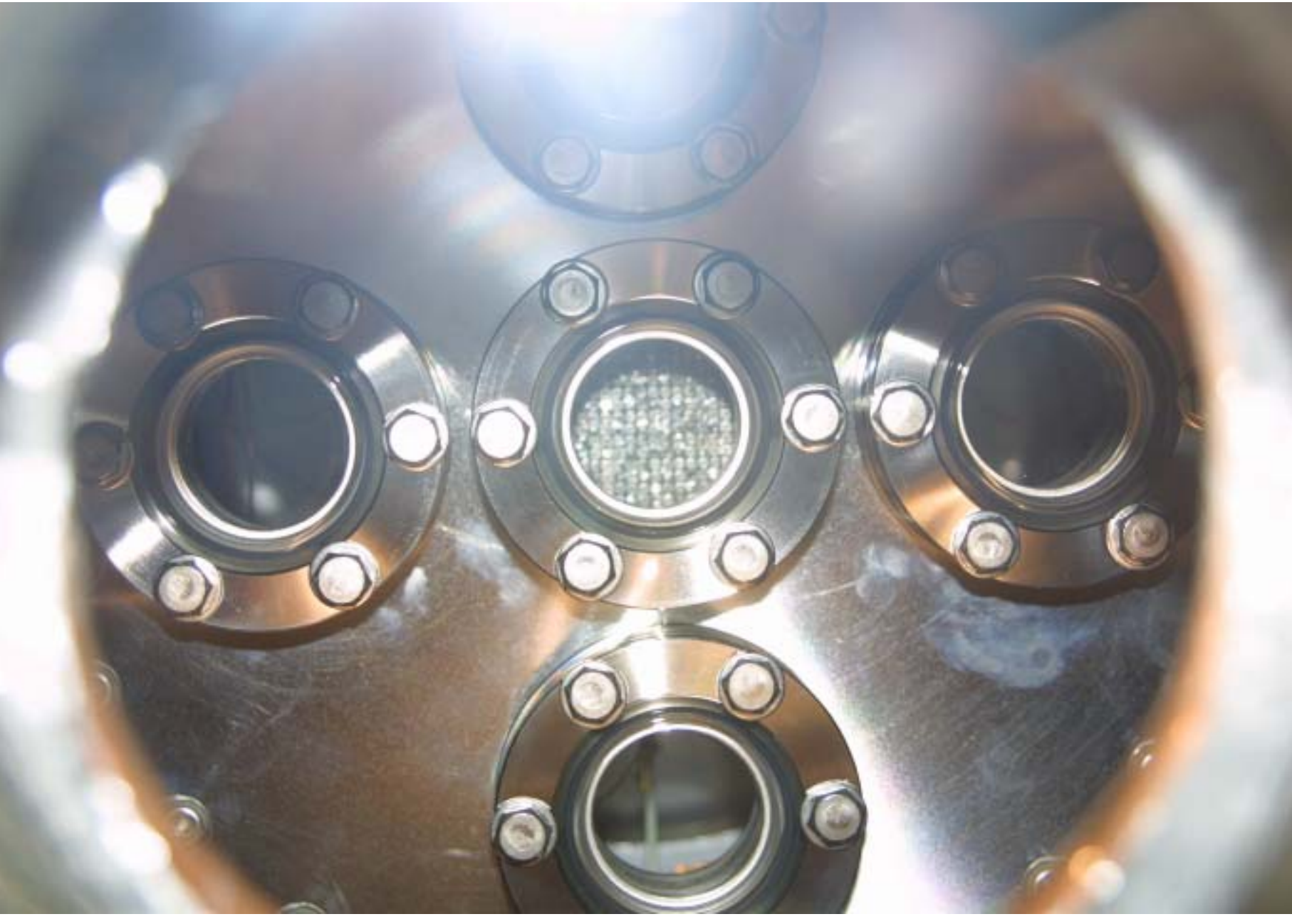
(2) needs observation of inside absorber;

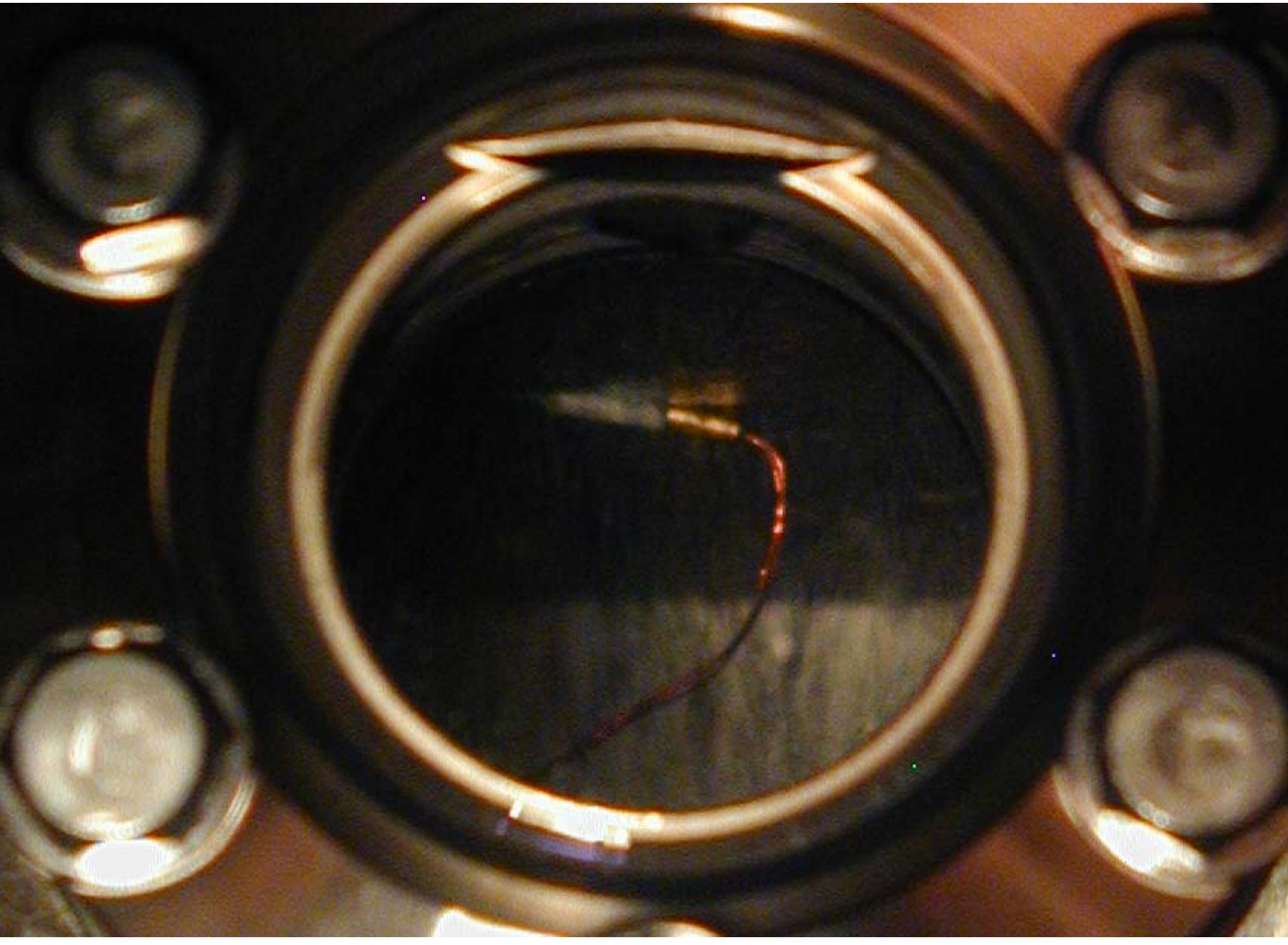
→ use view ports





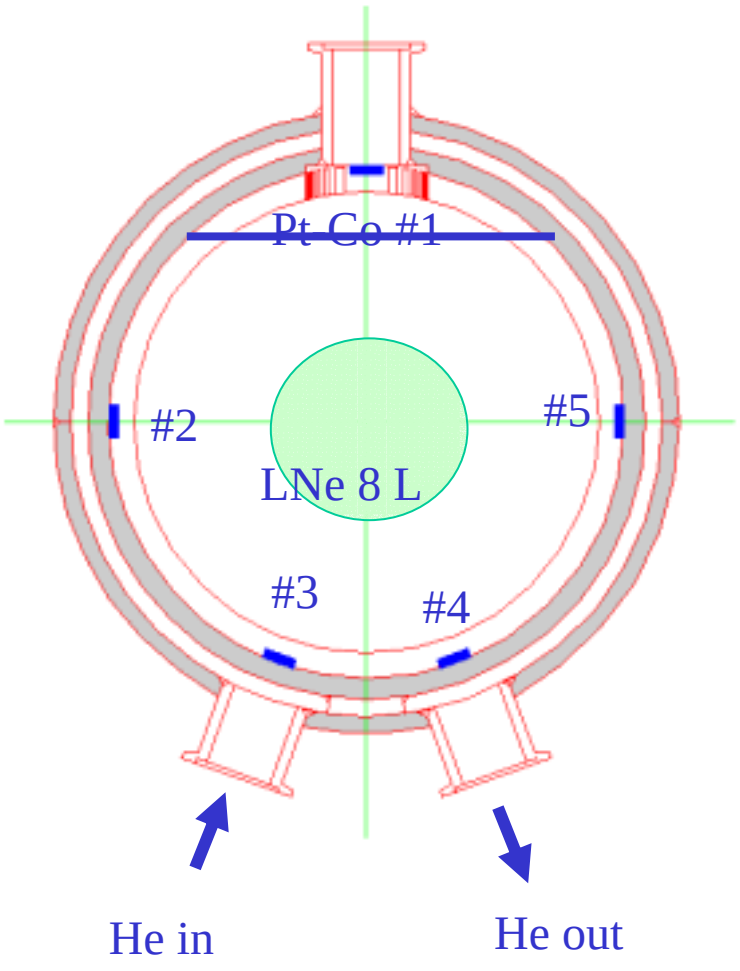






Results of Thermometer Offset

P_H = 60 W, LHe ; 30 L/hr



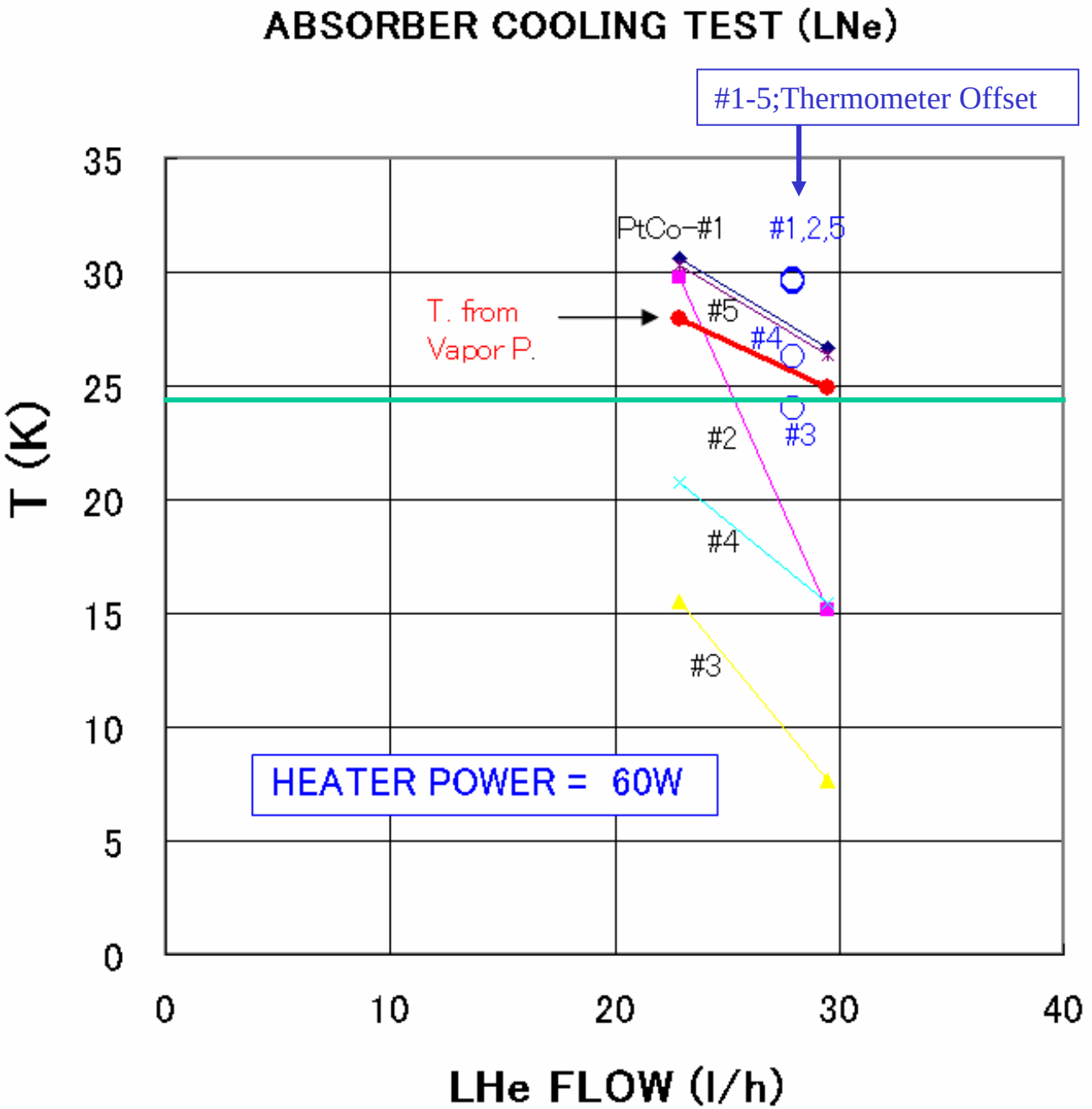
Pt-Co	R (Ohm)	T (K)
#1	10.675	29.7
#2	10.668	29.6
#3	9.878	24.0
#4	10.185	26.3
#5	10.660	29.6

(1) dT = 5.7 K

dt = 18 K when thermometers were on the heat exchanger

(2) Solid-Ne at bottom

est Result #2 and #3



T_t(Ne)
24.56 K

MICE Mode (P_{BEAM} ~ 0 W)

(1) P_{HEATER} = 0 W

LHe; ~1.2 L/hr

dT = 1.1 K

No Bubble & No Solid

Pt-Co	R (Ohm)	T (K)
#1	10.783	30.4
#2	10.708	29.9
#3	10.625	29.3
#4	10.628	29.4
#5	10.693	29.8

(2) P_{HEATER} = 1.7 W

LHe; ~1.6 L/hr

dT = 1.4 K

No Bubble & No Solid

Pt-Co	R (Ohm)	T (K)
#1	10.408	27.9
#2	10.357	27.5
#3	10.213	26.5
#4	10.215	26.5
#5	10.341	27.4

LHe; ~1.6 L/hr = 38 L/d = 1,140 L/30d

(Main heat sources are radiation shield and view-port.)

MICE conditions for the LH_2 Absorber

(1) Room temperature RF

→ Radiation heat

(2) Safety → Double windows

(3) Two vacuum system; S.C.-Mag.(10^{-7}) & RF(10^{-9})

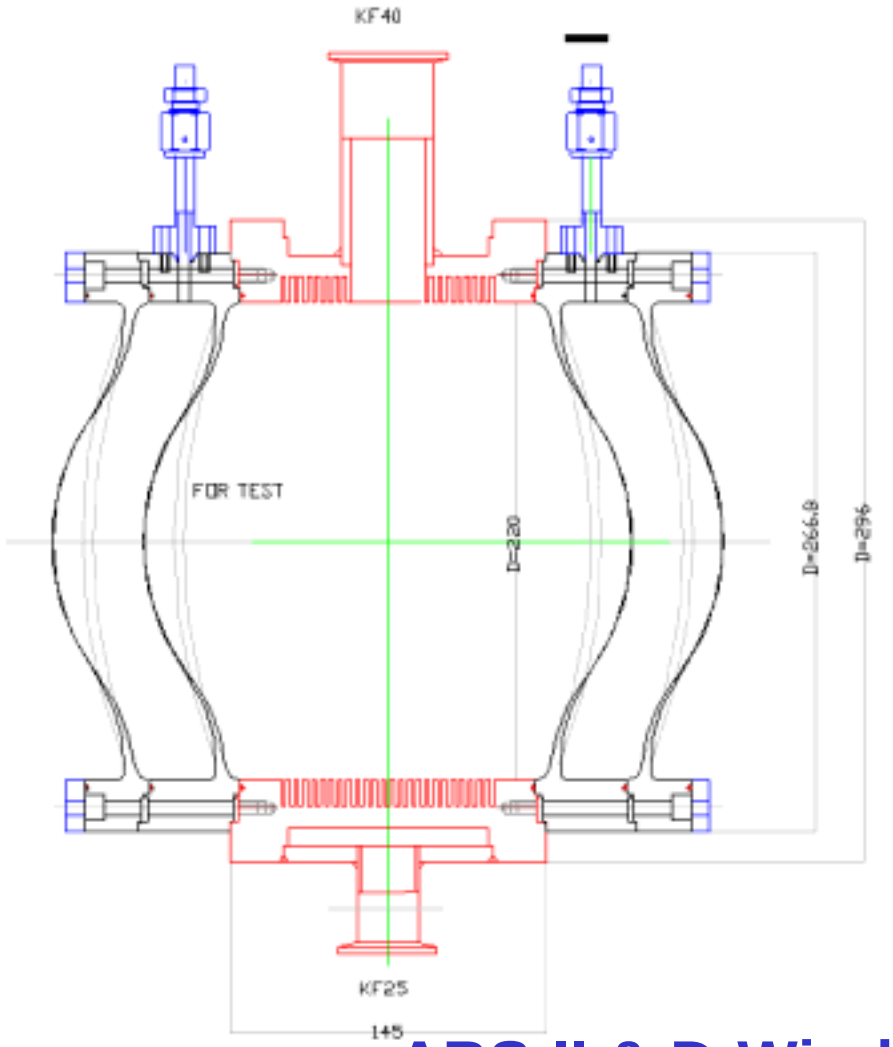
Need partition on the absorber

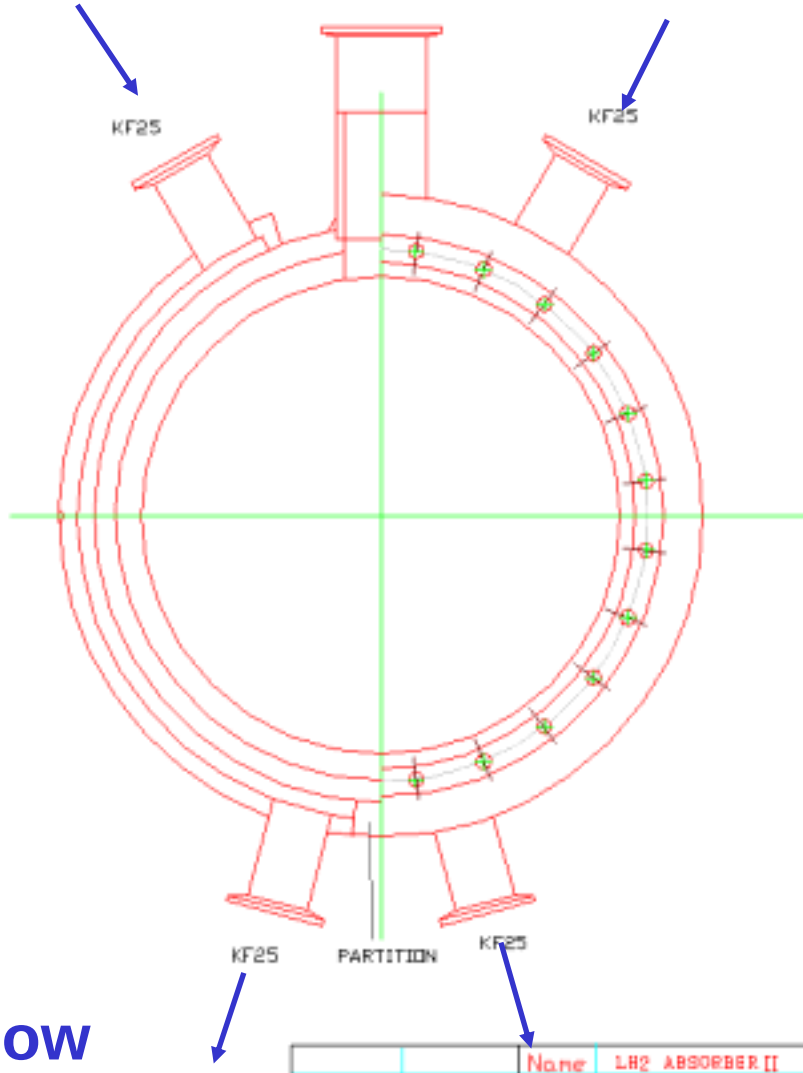
→ Solid heat conductance

(4) D=380, L=350 (V=40 L, W=2.8 kg)

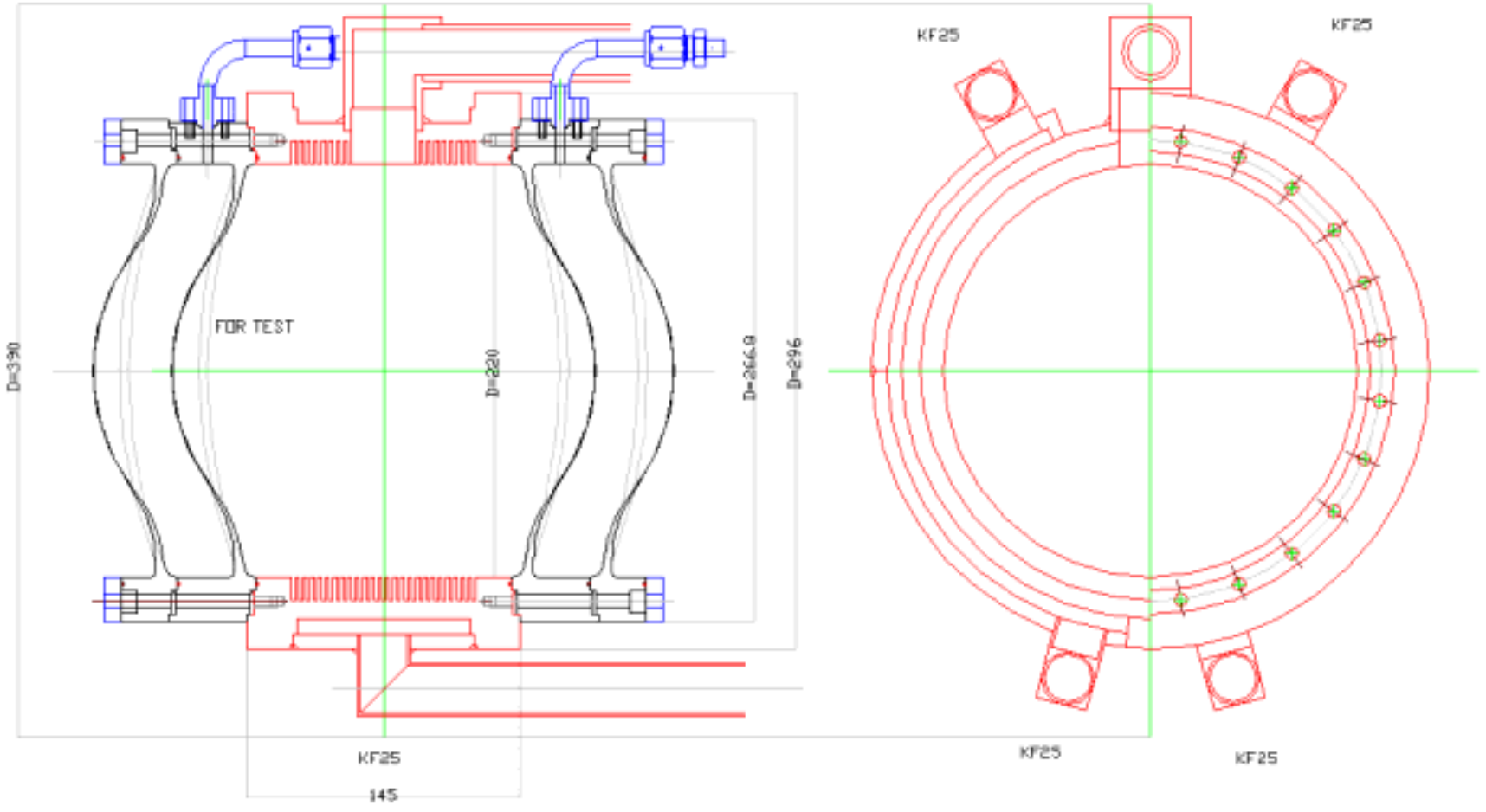
(5) Easy assemble & access

→ Horizontal setup & access port



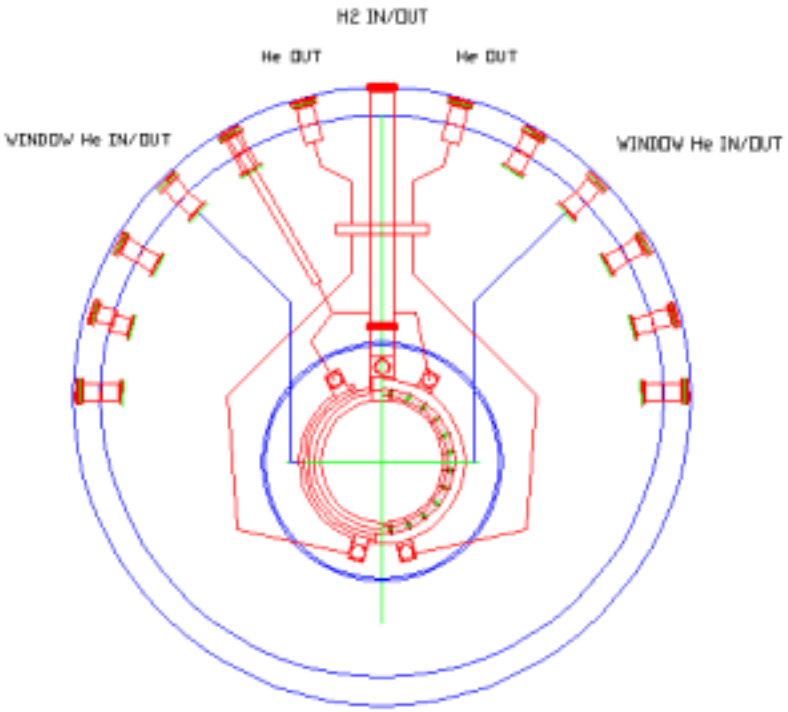


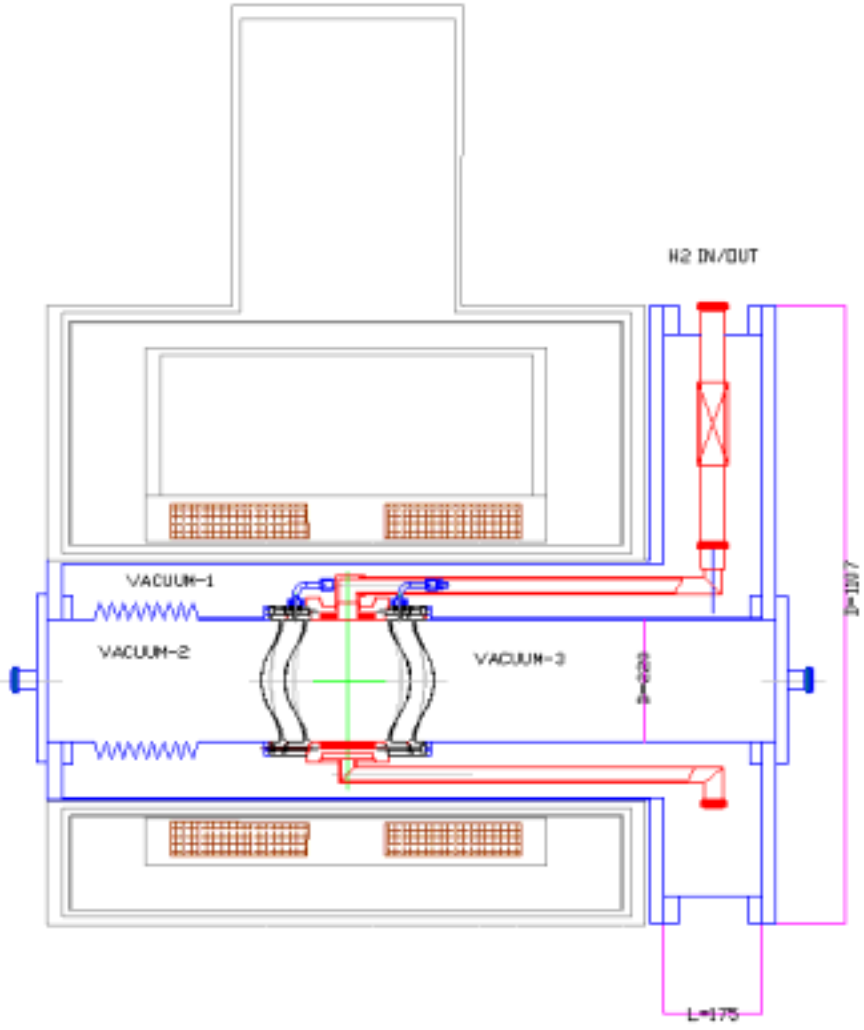
ABS-II & D-Window (D=22cm)



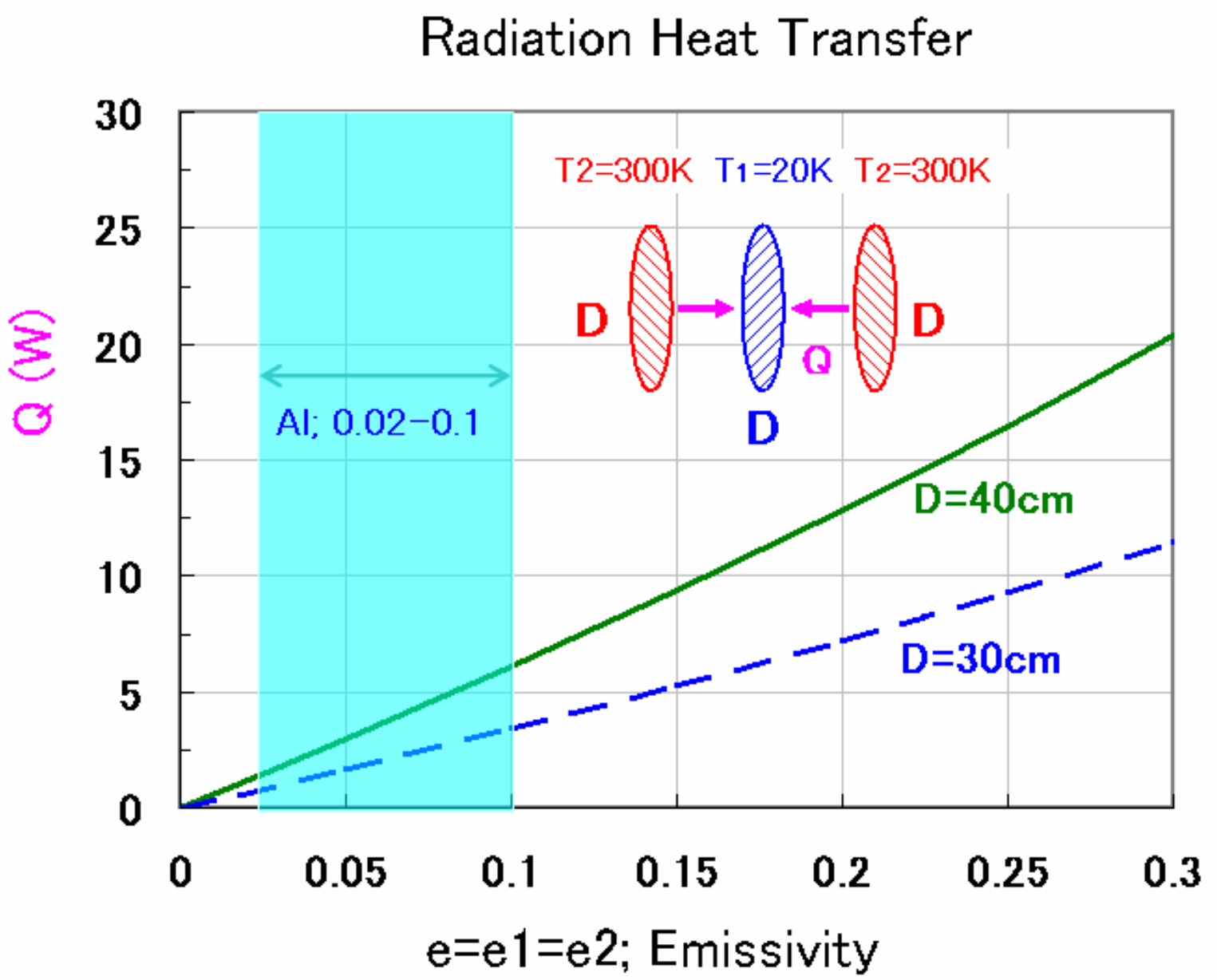
ABS-III
(D=22cm)

		Name	LN2 ABSORBER III
D#		D#	
	Scale M		ABS-III
DK chk Drw			





ABS-III & CRY-III
(D=22cm)


Radiation Heat Transfer
Q (W)
30
25
20
15
10
5
0
0
0.05
0.1
0.15
0.2
0.25
0.3
e=e1=e2; Emissivity
T2=300K T1=20K T2=300K
D
D
Q
D
Al; 0.02-0.1
D=40cm
D=30cm

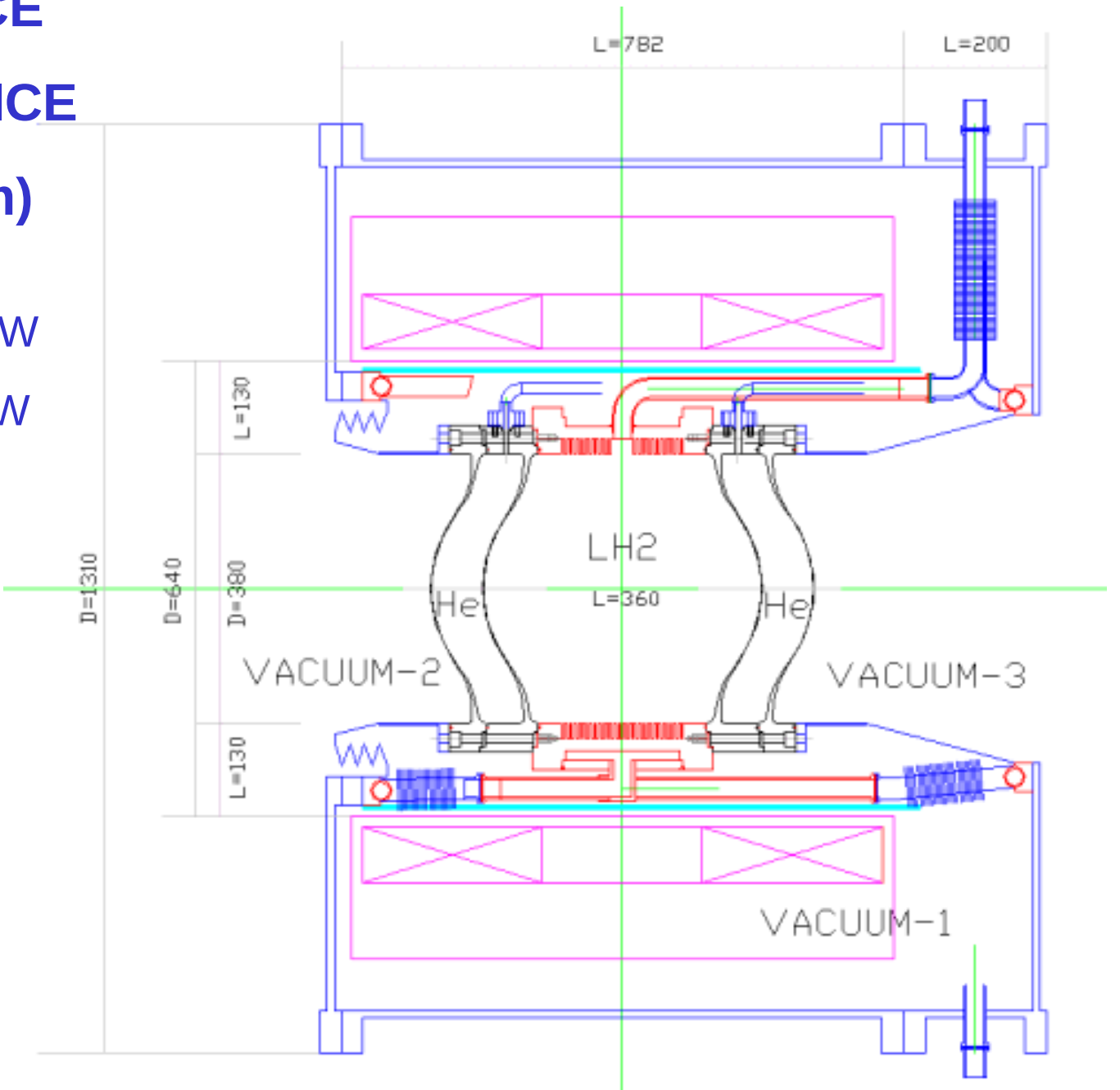
ABS-MICE

& CRY-MICE

(D=38cm)

$P_{Rad.}$ ~ 20 W

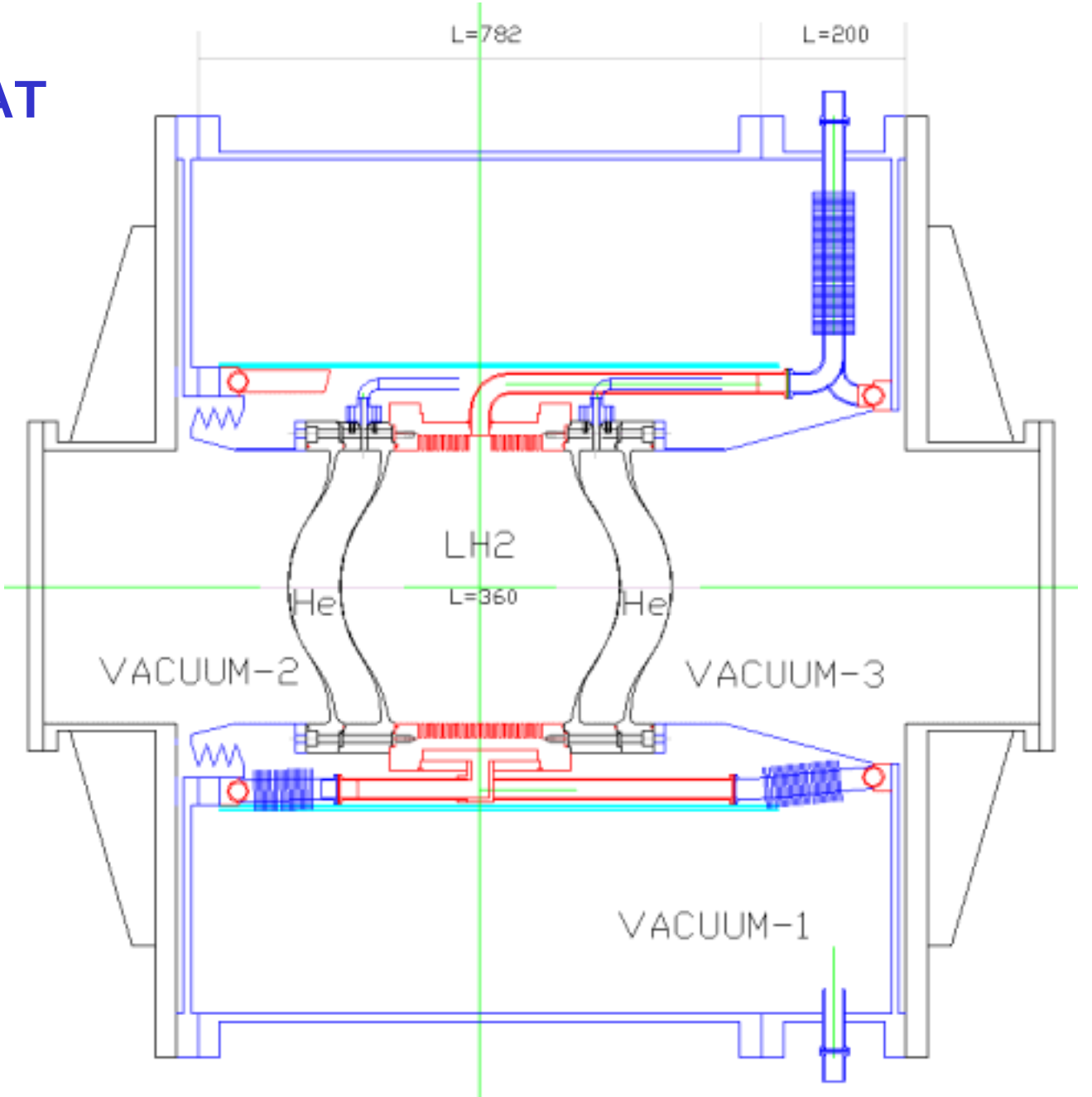
P_{Solid} ~ 3 W

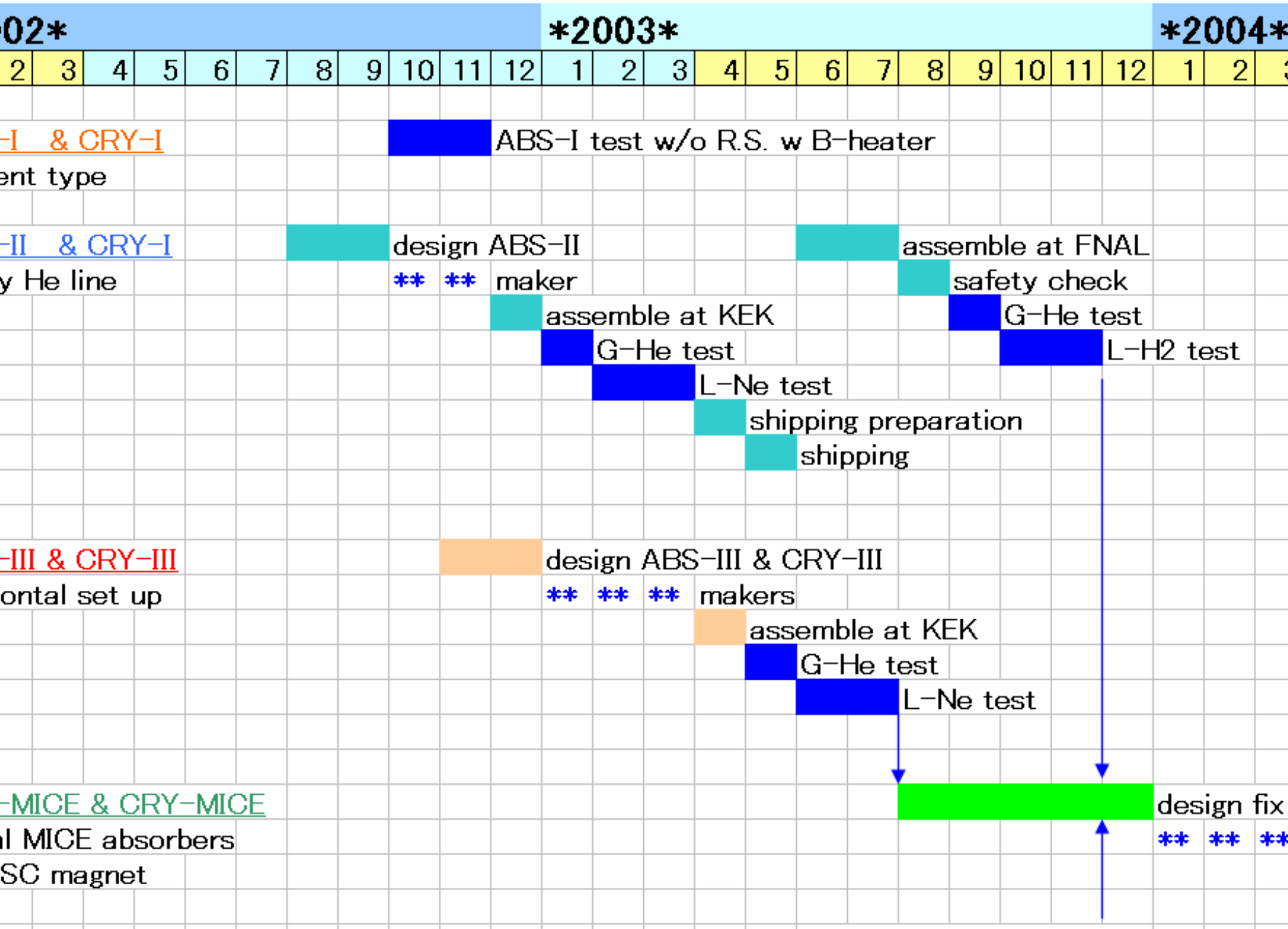


ABS-MICE

TEST CRYOSTAT

(D=38cm)




2003
2004
2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2
-I & CRY-I
ent type
ABS-I test w/o R.S. w B-heater
-II & CRY-I
y He line
design ABS-II
** ** maker
assemble at FNAL
safety check
assemble at KEK
G-He test
G-He test
L-H2 test
L-Ne test
shipping preparation
shipping
-III & CRY-III
ontal set up
design ABS-III & CRY-III
** ** ** makers
assemble at KEK
G-He test
L-Ne test
-MICE & CRY-MICE
l MICE absorbers
SC magnet
design fix
** ** **

Conclusion (1/2) ; Status

(1) For MICE ; P ~ 0 W

- We have succeed to operate the absorber with LNe and Q_H= 1.7 W and 27 K. The LHe consumption was 1.6 l/hr.

(2) For MICE with radiation and solid heat conductance; P ~ 23 W

- Test by present absorber without radiation shield ; P = 10 ~ 20 W

(3) MUCOOL ; P_B ~ 100 W

- We have succeed to operate the absorber with LNe and Q_H= 70 W.

The LHe consumption was 29.5 l/hr.

- High heat load and high LHe flow rate make solid-Ne on the heat exchanger near the LHe inlet.

→ Need to modify the LHe flow direction

→ Additional heater at bottom

Conclusion (2/2) ; Design & Plan

(1) ABS-II (2-way flow) ; will be ordered soon

(2) Absorber & cryostat design for MICE were presented under following conditions.

a) absorber size ; D=380, L=35 , O.D.=510, V=40 L

b) access port length ; 200

c) room temp. RF → rad. heat ; P_{Rad} ~ 20 W

d) double windows

e) with vacuum partition → solid heat input ; P_{Solid} ~ 3 W

(3) Schedule was reported ---- to be continued

(4) Cost estimation was reported ---- to be continued