Control

Stepping motor
and
Displacement sensor
and
Actuators

Dan Chen
2014/1/7 Cryo-payload meeting

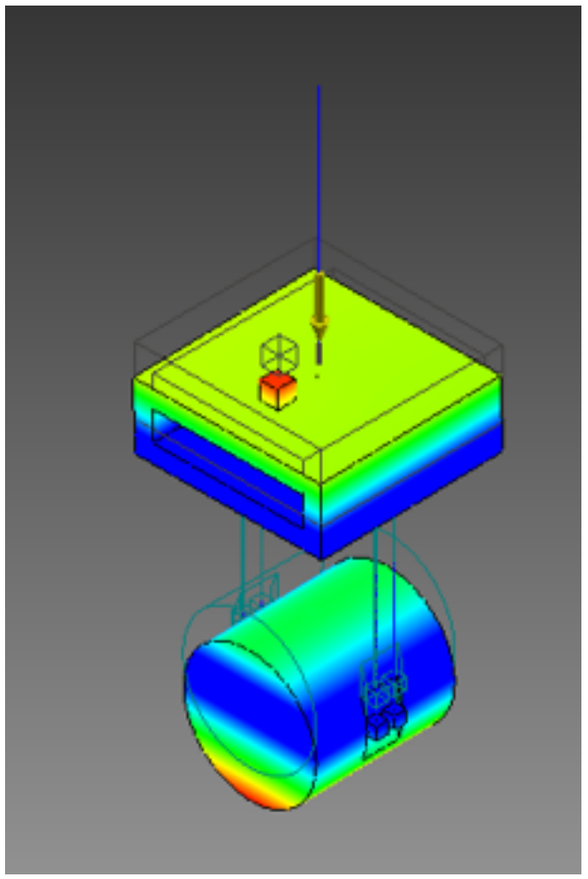
Test of actuator for initial alignment in cryogenic temperature

82	**1.5.1**	**Stepping motor (ICRR)**	**134日**	**13/11/18 (月) 14/03/31 (月)**		**8%**	**8%**	**Chen Dan**
83	1.5.1.1	Candidate list	27日	13/12/05 (木) 13/12/31 (火)		50%	50%	Sekiguchi Takanori,Takahashi R.,Chen Dan
84	1.5.1.2	Procurement of candidates	78日	13/11/29 (金) 14/02/14 (金)		0%	0%	Takahashi R.,Yamamoto Kazuhiro
85	1.5.1.3	Preparation for candidates test	26日	13/11/18 (月) 13/12/13 (金)		0%	0%	Chen Dan,Student from AEI Hannover
86	1.5.1.4	Test at cryo temp	1.43月	14/02/17 (月) 14/03/31 (月)	84,85	0%	0%	To be determined (ICRR),Small cryostat

Candidate and Status

Name	Number we have in ICRR	comment
Stepping motor	0	The delivery time is 2.5 month. The company said this works at 4K. We have ordered.
Pico motor	1	We had a cooling test using a PT cooler. But it did not work below 200K.
Autex	0	Salesmen from Autex show us a motor (PZT). But they said they don’t have experience at 10K. They gave us a sample for cooling test. We need more cable which they will give us. And they will search a stage for cryo.

Calculation of the requirement for the mass shifter



Dynamic range we need:

±1mrad ← Beginning adjustment limit by hand

Accuracy we need:

3urad ← 1 step of the mass shifter = 1 cm shift of main beam on the other TM

For IM

Mass: 0.5kg

Drive range: ±10cm → ±1mrad Drive accuracy: 271um → 3urad

Mass: 1.0kg

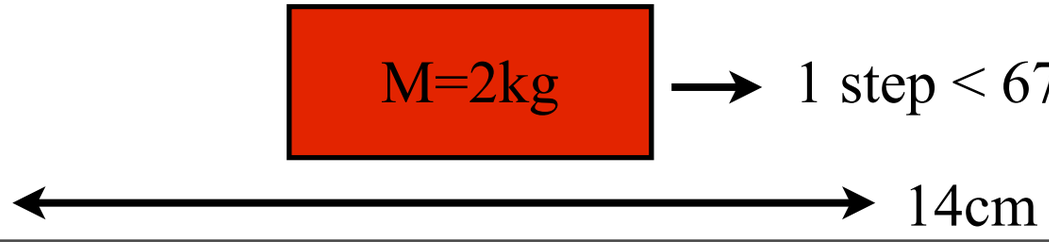
Drive range: ±5cm → ±1mrad Drive accuracy: 135um → 3urad

Mass: 2.0kg

Drive range: ±2.2cm → ±1mrad Drive accuracy: 67um → 3urad

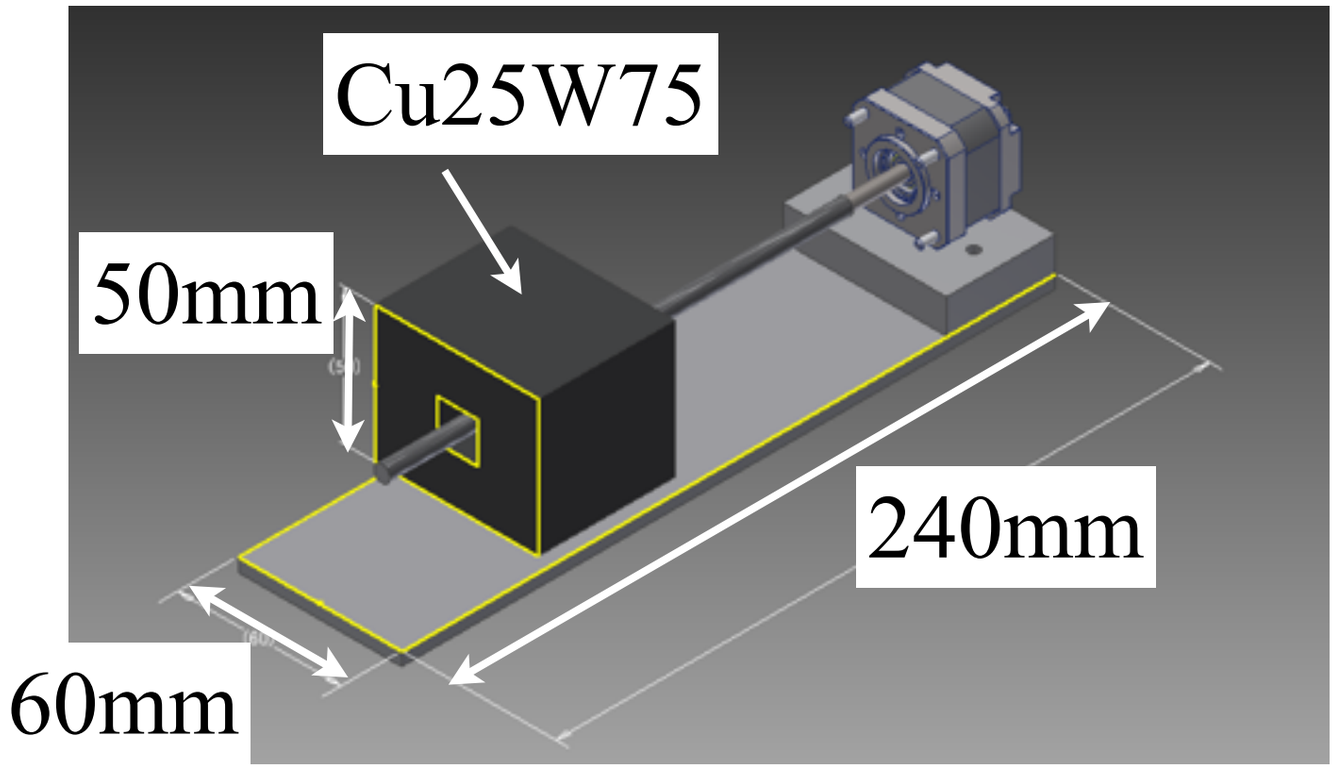
For larger range: ±3mrad

Mass: 2.0kg Drive range: ±6.8cm → ±3mrad Drive accuracy: 67um → 3urad



Test of actuator for initial alignment in cryogenic temperature A/I

- We will make a test stage for Stepping motor.
  - We have to consider the connection point between the motor we ordered and this stage.
- We have to consider the rotate component.



We drew a figure of the mass shifter.
The size of this mass shifter will be like this.

Test of Displacement sensor and actuators (OSEM) in cryogenic temperature

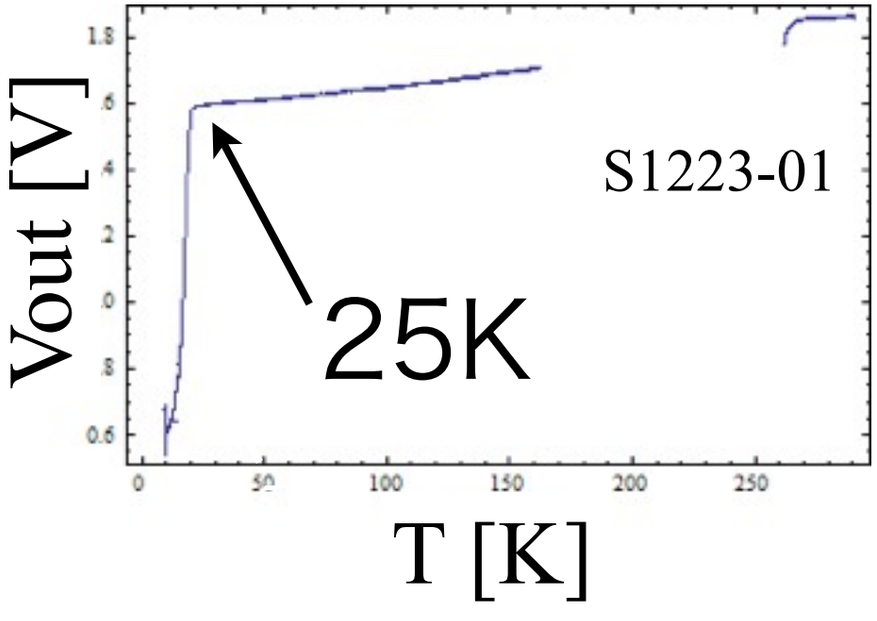
87	**1.5.2**	**Displacement sensor and actuators (between Intermediate Mass and Intermediate Recoil Mass) (ICRR)**	**117日**	**13/11/04 (月) 14/02/28 (金)**		**0%**	**0%**	**Chen Dan**
88	1.5.2.1	Candidate list of light sources and photo diodes	12日	13/11/04 (月) 13/11/15 (金)		0%	0%	Suzuki T,Takahashi R,Yamamoto Kazuhiro,Chen Dan
89	1.5.2.2	Procurement of candidates of light sources and photo diode	26日	13/11/16 (土) 13/12/11 (水)	88	0%	0%	Chen Dan
90	1.5.2.3	Preparation of test for the candidates of light sources and photo diode	12日	13/11/29 (金) 13/12/10 (火)		0%	0%	Chen Dan,Student from AEI Hannover
91	1.5.2.4	Test for the candidates of light sources and photo diode	20日	13/12/12 (木) 13/12/31 (火)	90,89	0%	0%	Chen Dan,Small cryostat
92	1.5.2.5	Preparation for test of sensor	27日	13/11/17 (日) 13/12/13 (金)		0%	0%	Student from AEI Hannover
93	1.5.2.6	Test of sensor at cryogenic temperature	54日	14/01/06 (月) 14/02/28 (金)	92	0%	0%	To be determined (ICRR),Small cryostat

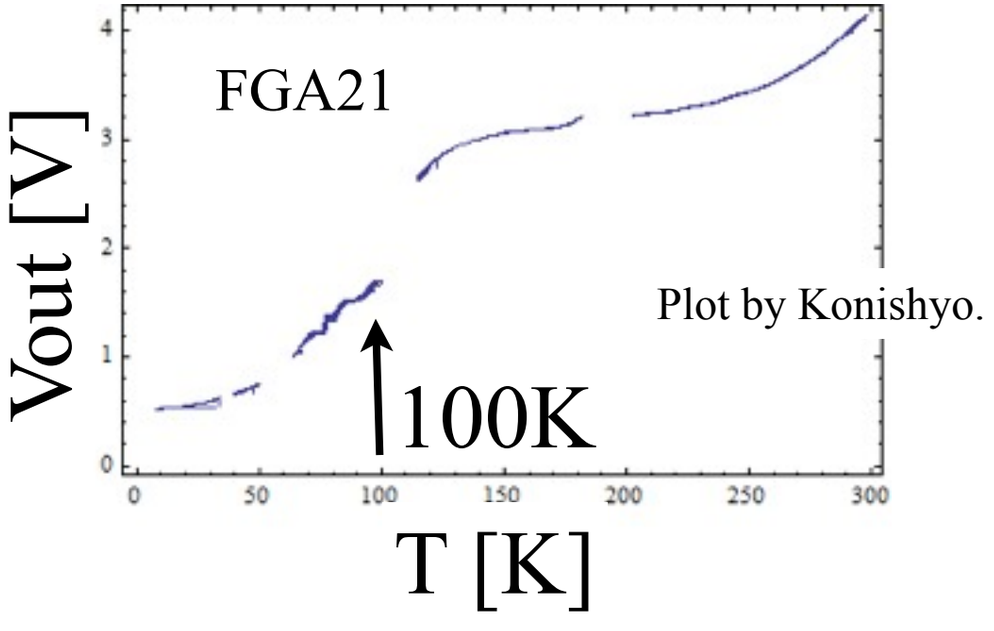
Status

PD: We tasted 2 PDs at low temperature.
LED: Two of LD works at 77K.

PD

Name	Type	Peak	We have	comment	Status
S1223-01	Si PIN PD	960 nm	5	We had a cooling test. Efficiency decreases at low T (37%)	Test: done Analysis: done
G8370-01	InGaAs PIN PD	1550 nm	0	Tomaru-san said this works at low T. I asked a quotation but is was out of stock.	-
FGA21	InGaAs Pin PD	1600 nm	2	The quantum efficiency decreases at low T(15%).	Test: done Analysis: done
FDG03	Ge PD	1550 nm	2	We ordered. ThourLab said it works at low T.	Test: not yet Analysis: not yet
S3590	Si PIN PD	980 nm	0	We can order. But LED doesn't work. So we don't need? -> I think we need.	Order: not yet

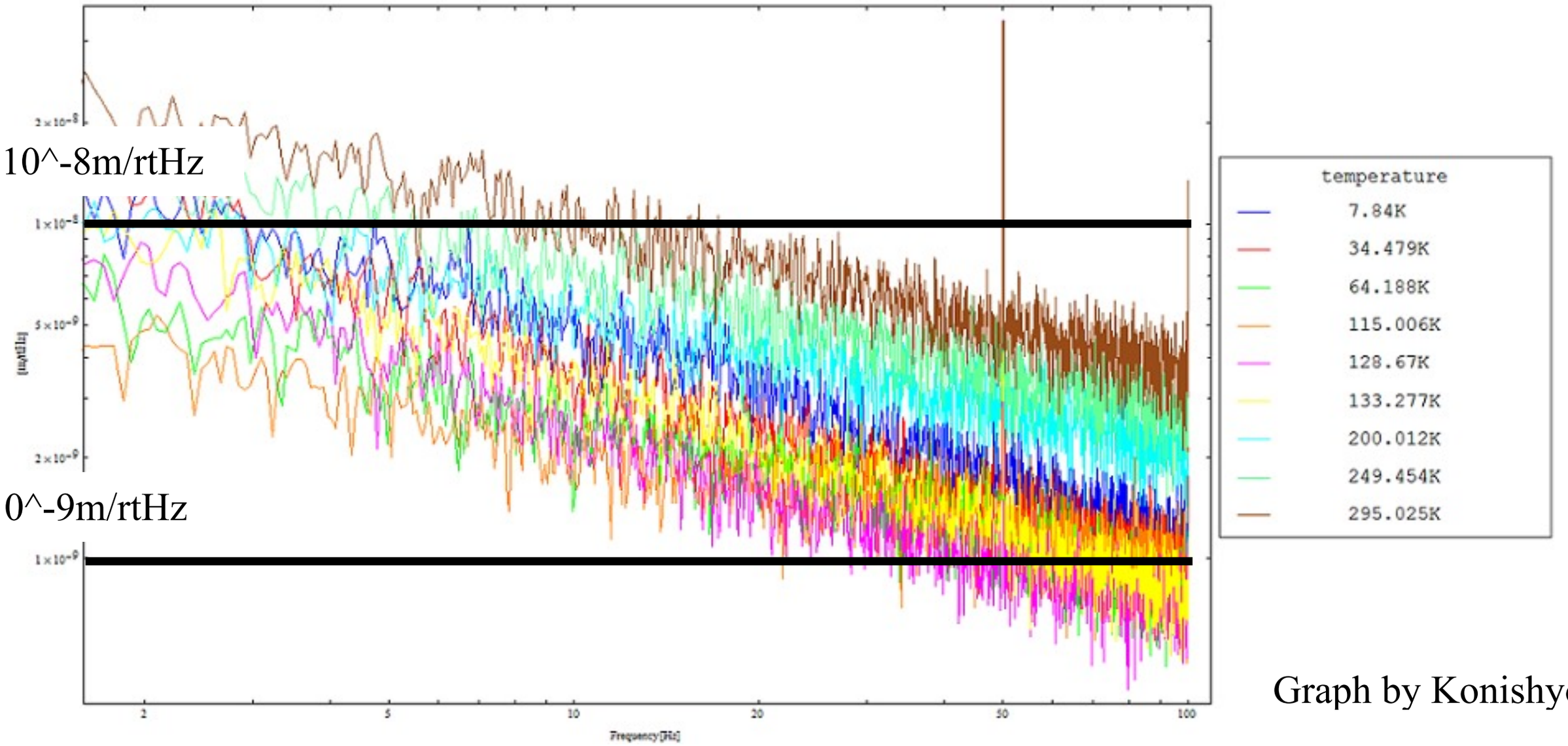




PD at low temperature
Measurement result

Corrected version

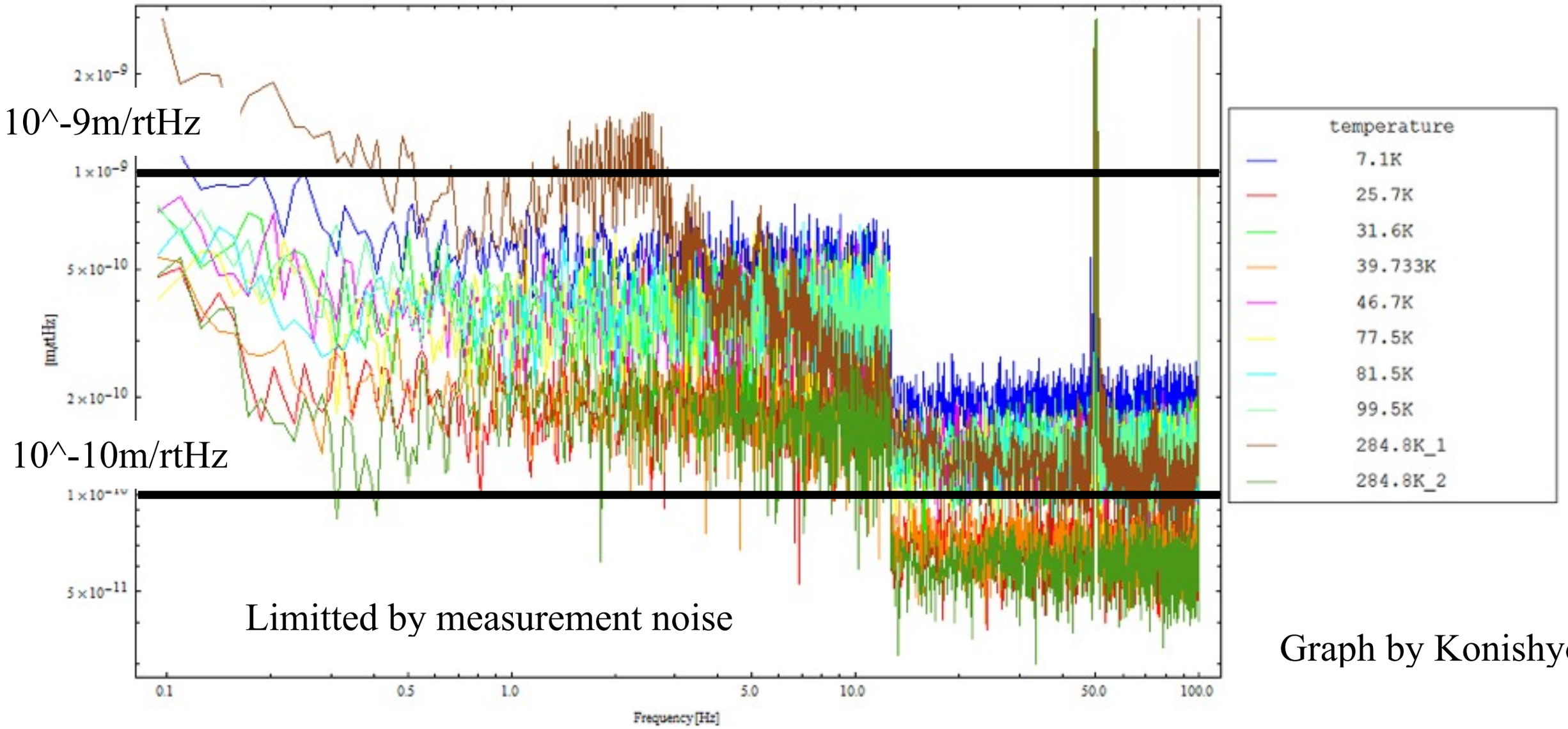
FGA21



Graph by Konishyo

PD at low temperature
Measurement result

S1223



Graph by Konishyo

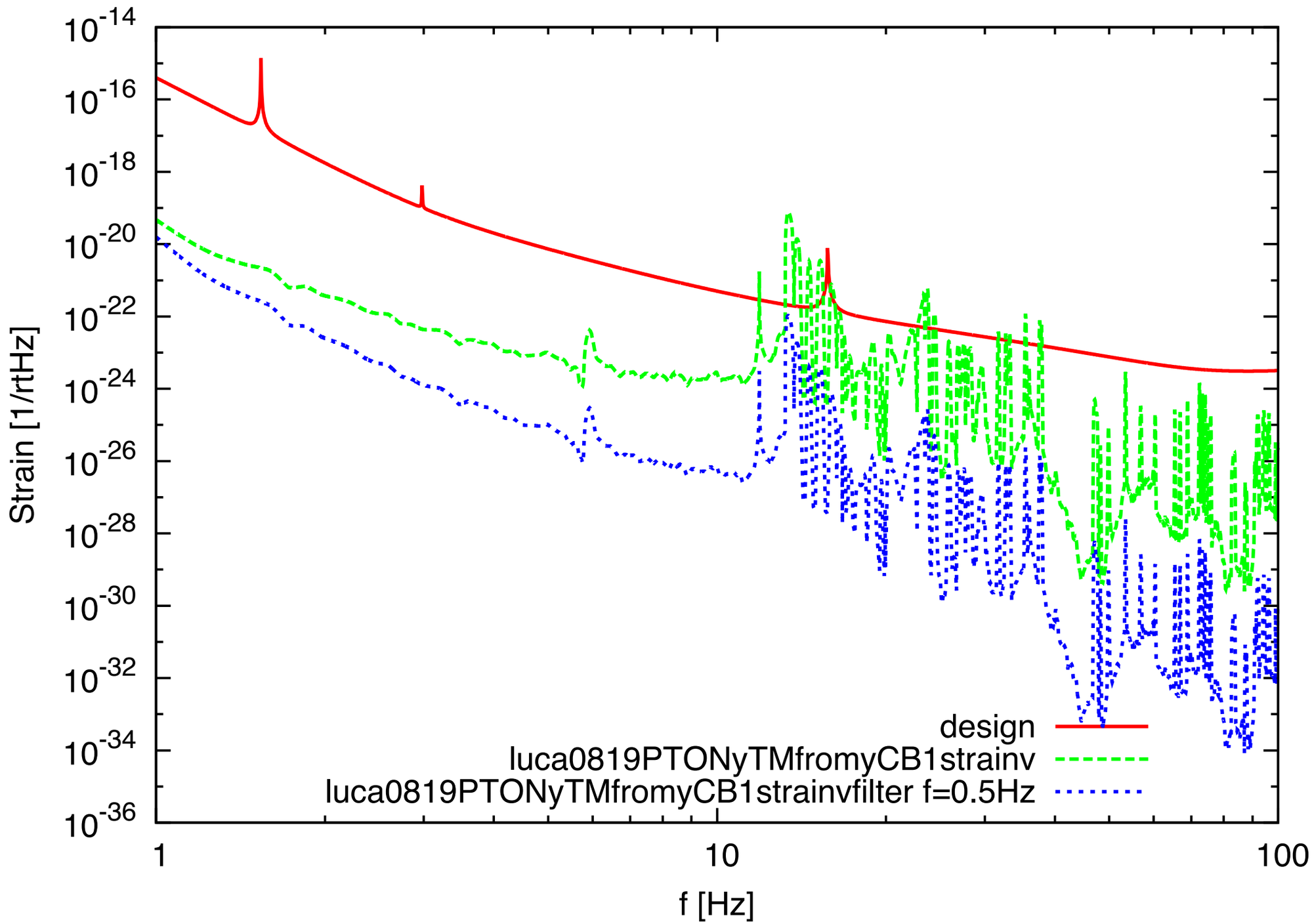
LED

Name	Type	Peak	Number we have in ICRR	comment
OP232	GaAIAs	890 nm	5	This is used in OSEM at room temperature.
L2656-03	GaAlAs	890 nm	20	Tomaru-san said this works at low T. I received.
ML925B45F	InGaAsP	1550 nm	2	

Liquid nitrogen test: 77K

OP232	Does not work
L2656-03	Works!
ML925B45F	Works!

Detect by sensor card


Strain [1/rtHz]
f [Hz]
10^-14
10^-16
10^-18
10^-20
10^-22
10^-24
10^-26
10^-28
10^-30
10^-32
10^-34
10^-36
1
10
100
design
luca0819PTONyTMfromyCB1strainv
luca0819PTONyTMfromyCB1strainvfilter f=0.5Hz

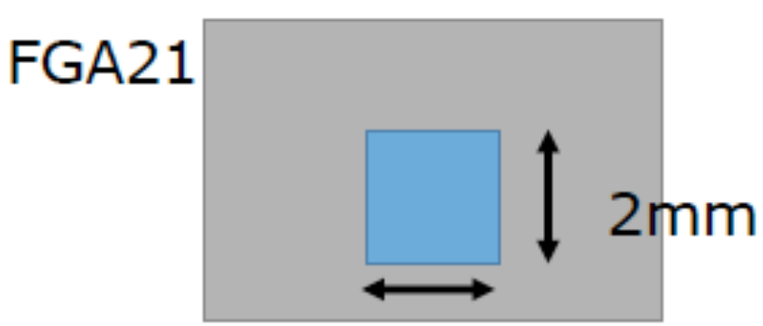
Slide by Konishyo

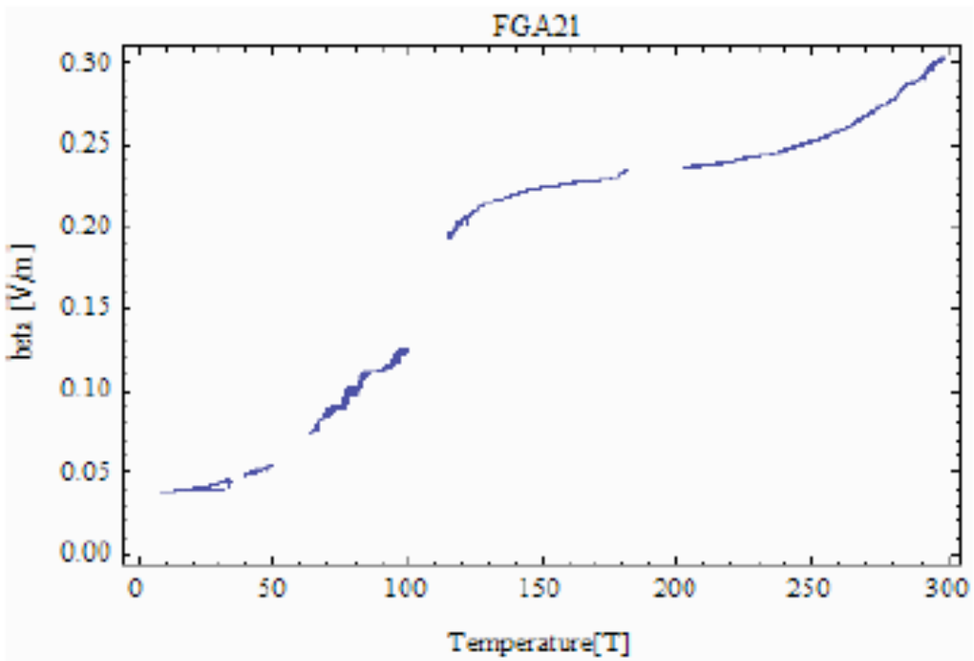
To know the sensitivity of the PD (FGA21)

Use the results of experiments [Hz-V/rtHz] at different temperature and [T-A].

1. Calculate the efficiency of shadow-sensor, β : V[V] =β[V/m] * x[m] from [T-V].

In the case of FGA21,R is $1k\Omega$ and size is 2mm×2mm.





回転軸
=回転で動かない点

V
T
R
A
T
⇒ α(T) [A/W]

√/√Hz
f
R
β = V/m
A/√Hz
f
m/√Hz
f

A
α₀ [A/W]
P [W]
2mm
⇒ γ(T) [A/m]
2mm
x