SDD status at KEK

30 July 2009

Current situation

Summary of previous meeting report;

1. Installation preamp inside the vacuum chamber works well (resolution: ~150 eV in FWHM)

2. Checked preamp temperature dependence ~ resolution constant 150eV around Chip temperature 255~275K

3. stability against day-long measurement ~resolution and chip ,finger temperature are stable.

Contents of Today's report:

1. Study of the Signal fall down time

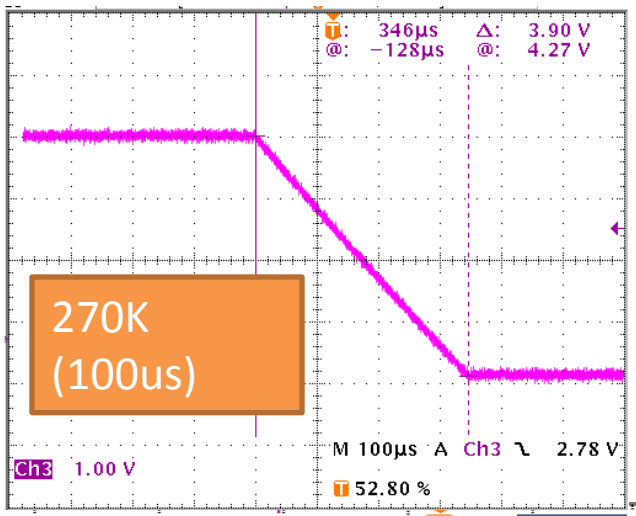
2. Checked substrate voltage dependence

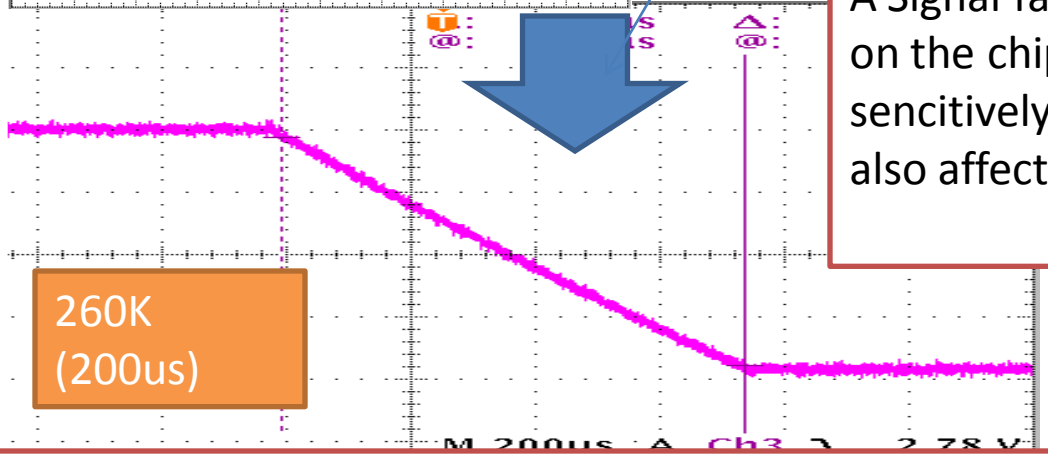
3. Test the new SDD rod for the E17 cryostat

Signal fall down time

1: Trigger rate in ramp up time ~40Hz is not change through measurement.

2: The finger temperature is stable. =>SDD temperature is stable.





Tchip[K]	Tdrop[us]
270	~300
260	~800

A Signal fall down time depends on the chip temperature sencitively. The substrate volatage also affect this time length.

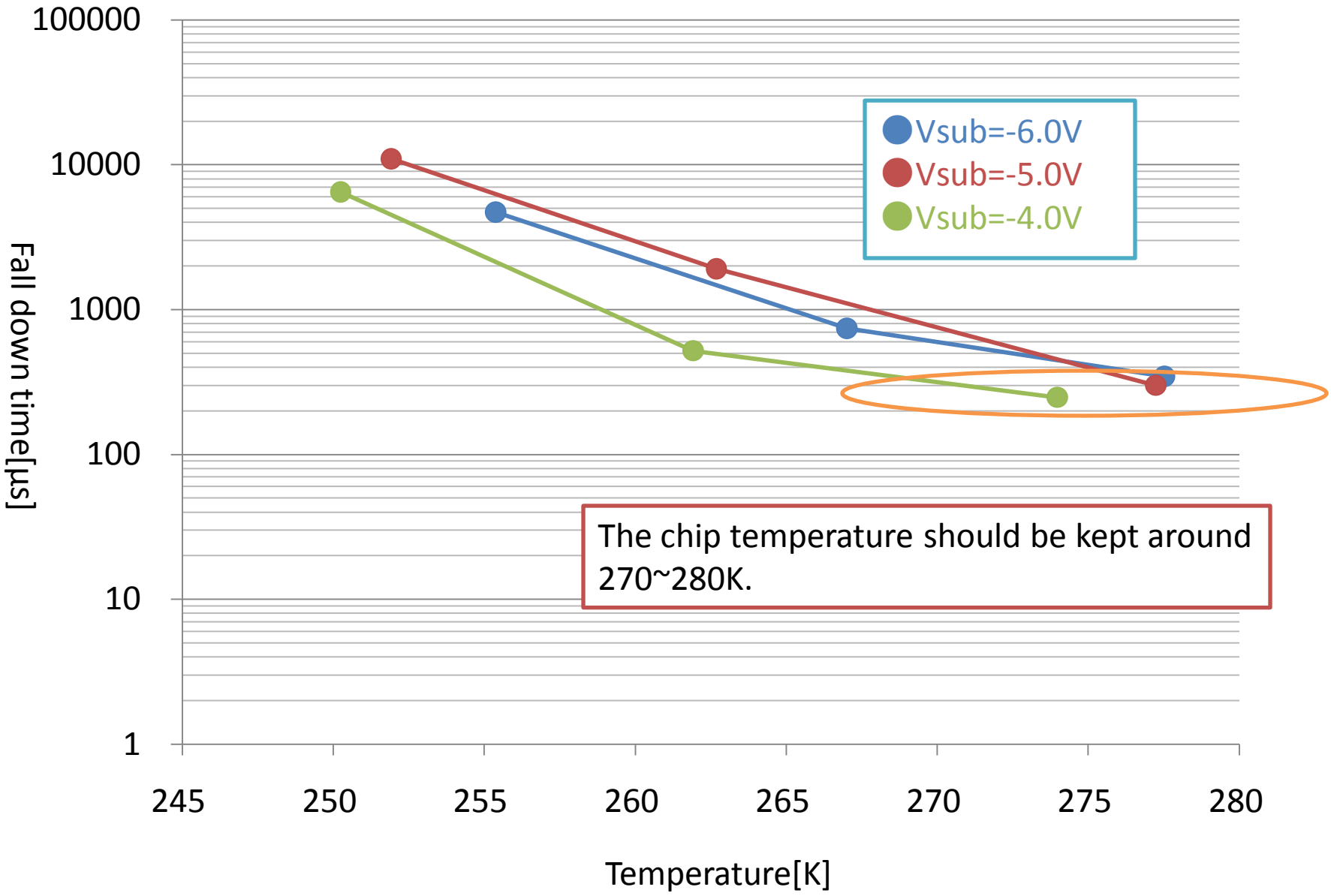
Fall down time (Vsub , Tchip) should be reduced ->
With the information of Resolution (Vsub, Tchip), we decide Vsub voltage and Tchip optimized value.

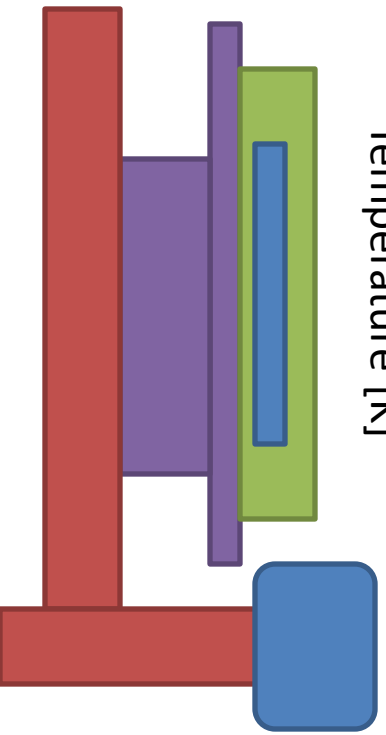
Result

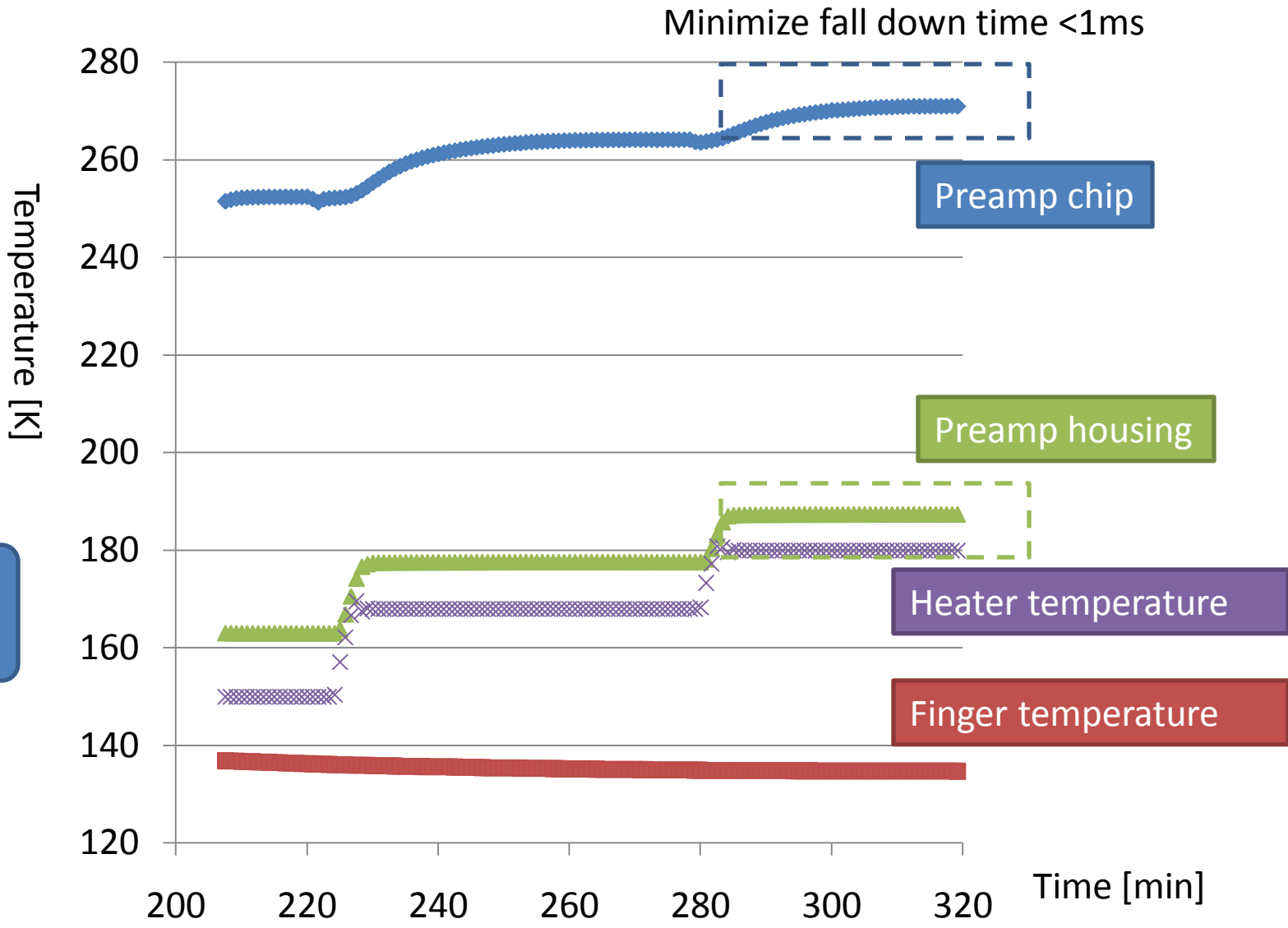
Vsub [V]	Tchip [K]	Tdrop [μs]	Resolution [eV](MnKa)
-6.0	277.523	346	145.35
-6.0	267.0059	744	148.18
-6.0	255.379	4700	154.56
-5.0	251.9194	11000	150.237
-5.0	262.6887	1910	150.863
-5.0	277.2408	300	151.116
-4.0	250.2457	6480	154.454
-4.0	261.9153	520	152.826
-4.0	273.9788	248	158.441

•Preamp “sub” supply was used to as SDD bulk voltage supply. If we use external power supply to apply bulk voltage, unavoidable oscillation caused on preamp out.
•** Tchip means temperature of the preamp chip. Shown values are avaraged value of during time of measurement.
• ***Tdrop measured with oscilloscope.
•Resolution is FWHM of MnKa spectrum

Fall down time v.s. Temperature

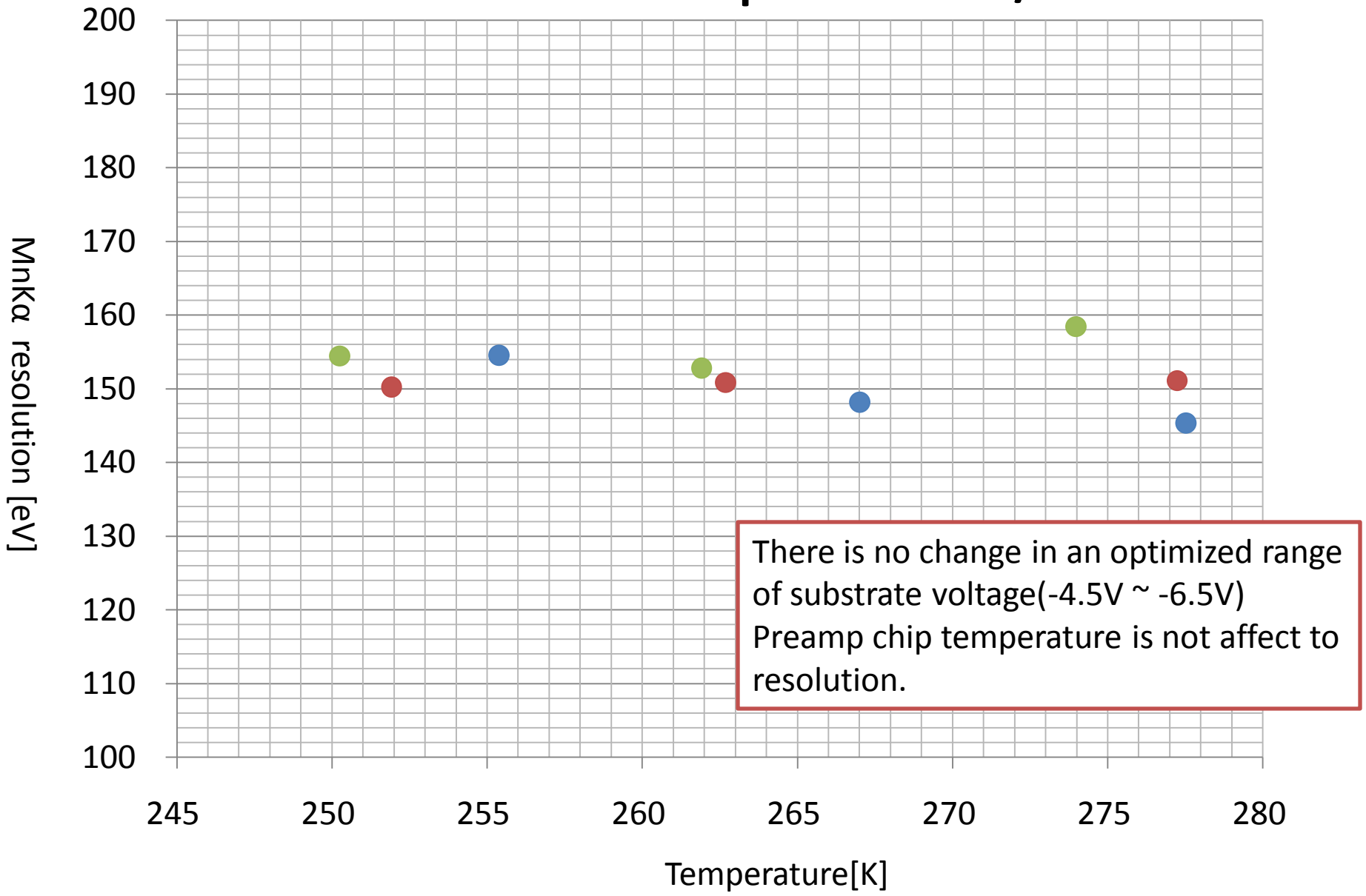




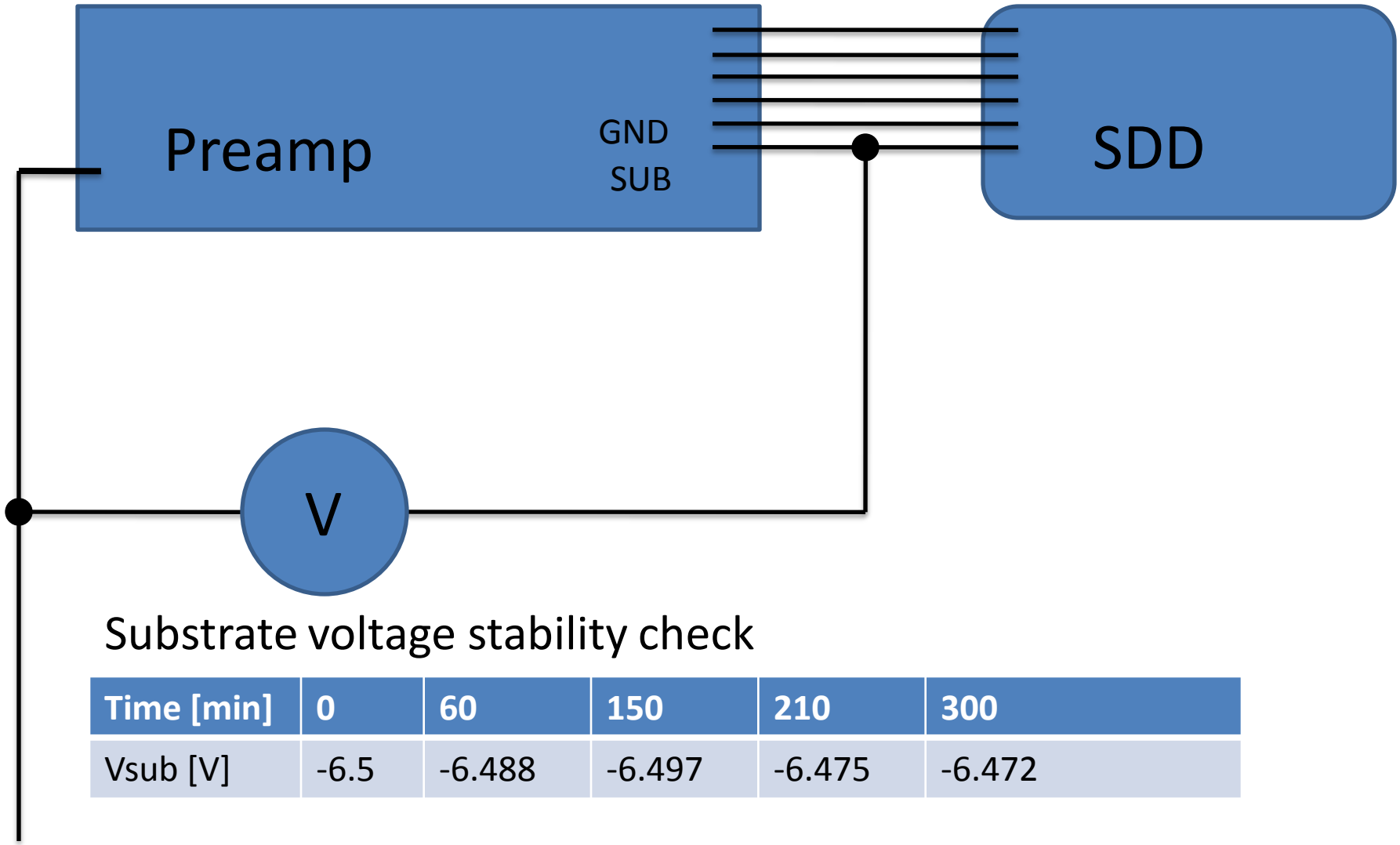


When the temperature of Preamp housing is around **190 K**, we can keep the chip temperature at 270 K. And E17 cryostat with sato box, we will be able to controll the temperature of preamp housing from **80 K to 230K.**

Resolution v.s. Temperature/ substrate



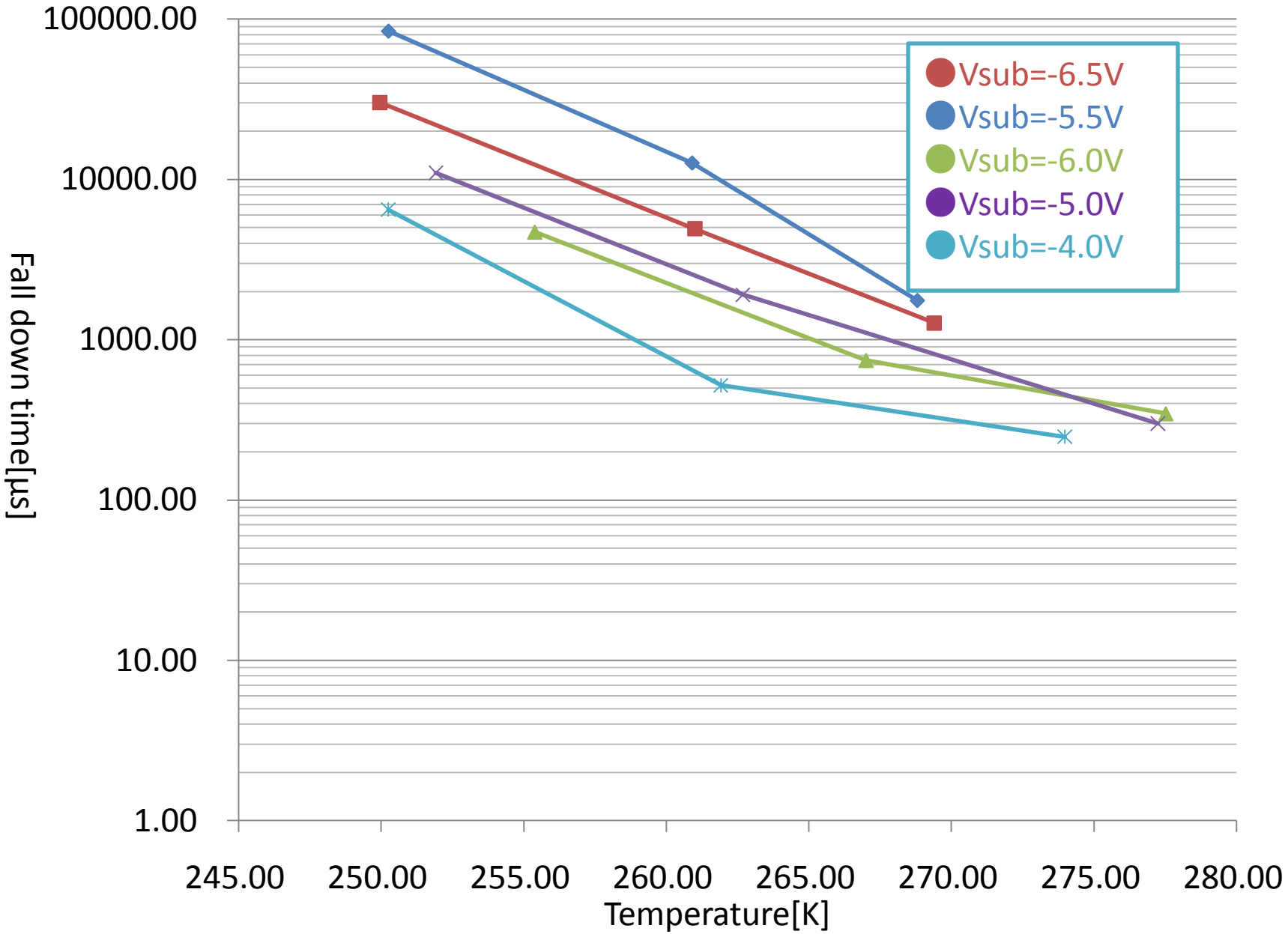
Substrate voltage monitor



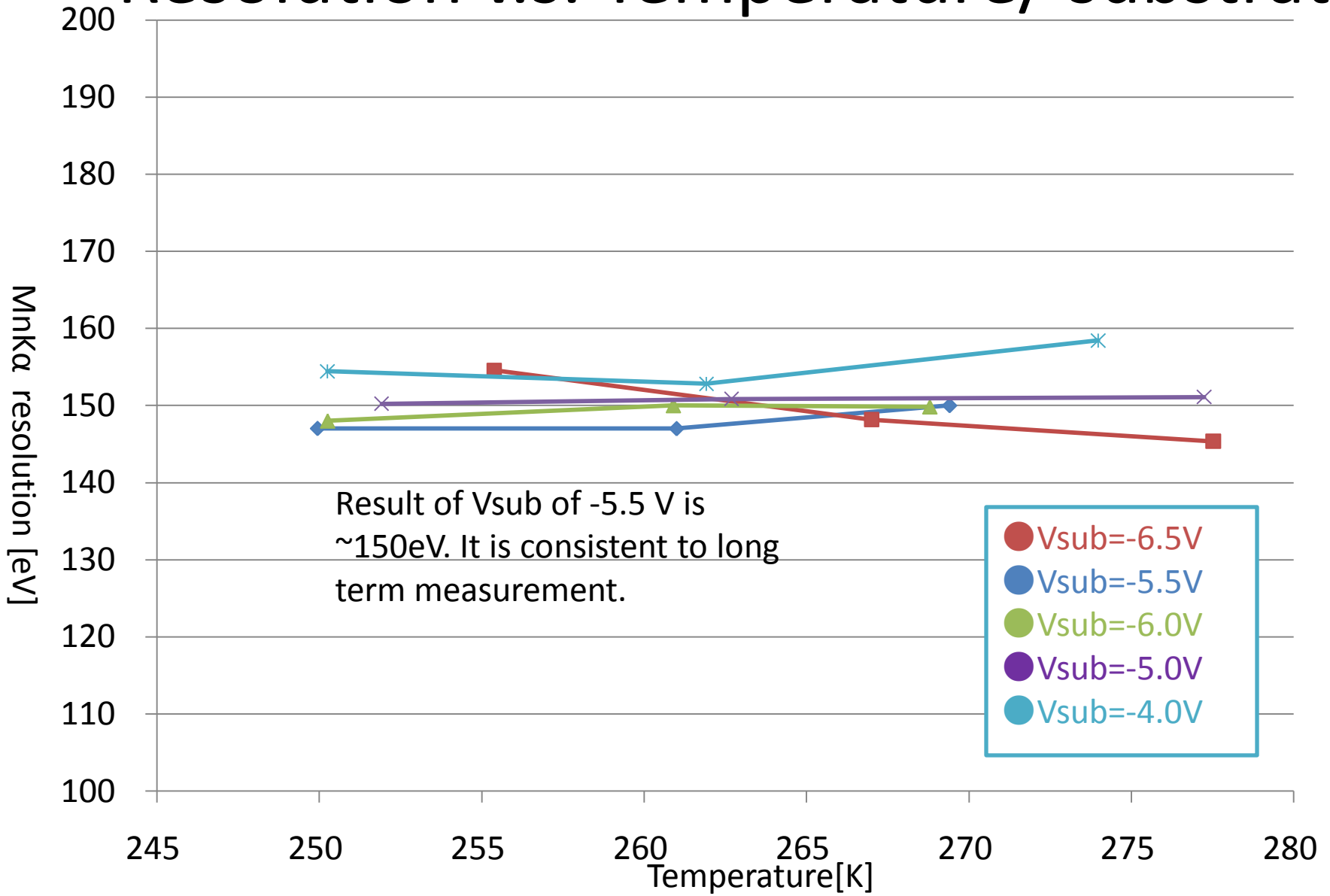
Substrate voltage stability check

Time [min]	0	60	150	210	300
Vsub [V]	-6.5	-6.488	-6.497	-6.475	-6.472

Fall down time v.s. Temperature

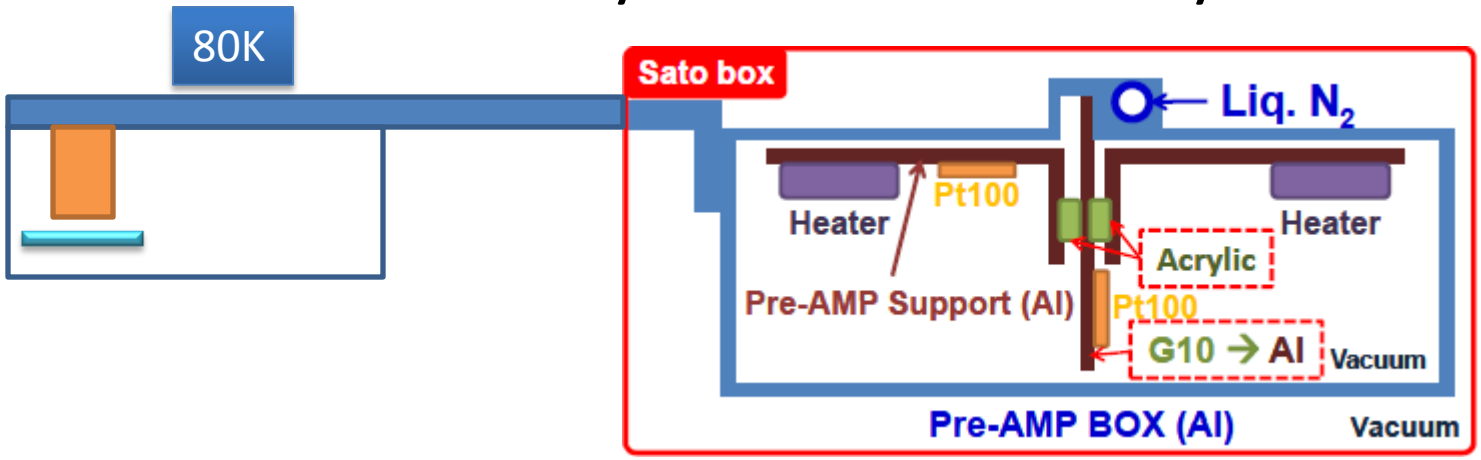


Resolution v.s. Temperature/ substrate



Vsub = -6.5V , Tchip = 275 K
(Preamp housing temperature ~ 190K)

Instllation of the SDD system in the E17 cryostat



☑check sdd temperature dependence ~ optimim is around **130K**

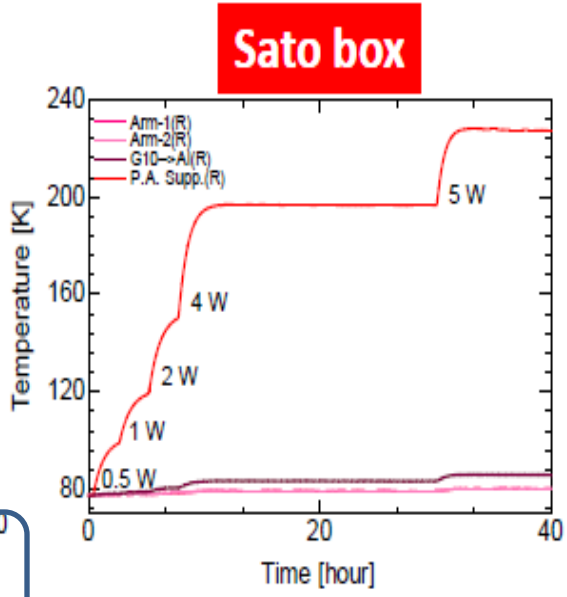
☐Finding setup to keep sdd temperature at around 130K

☑ New sdd arm

☑ New sdd rod and housing

☑thermal condition of the preamp box~ **80 to 230K variable, very small effect on 1K part and sdd support**

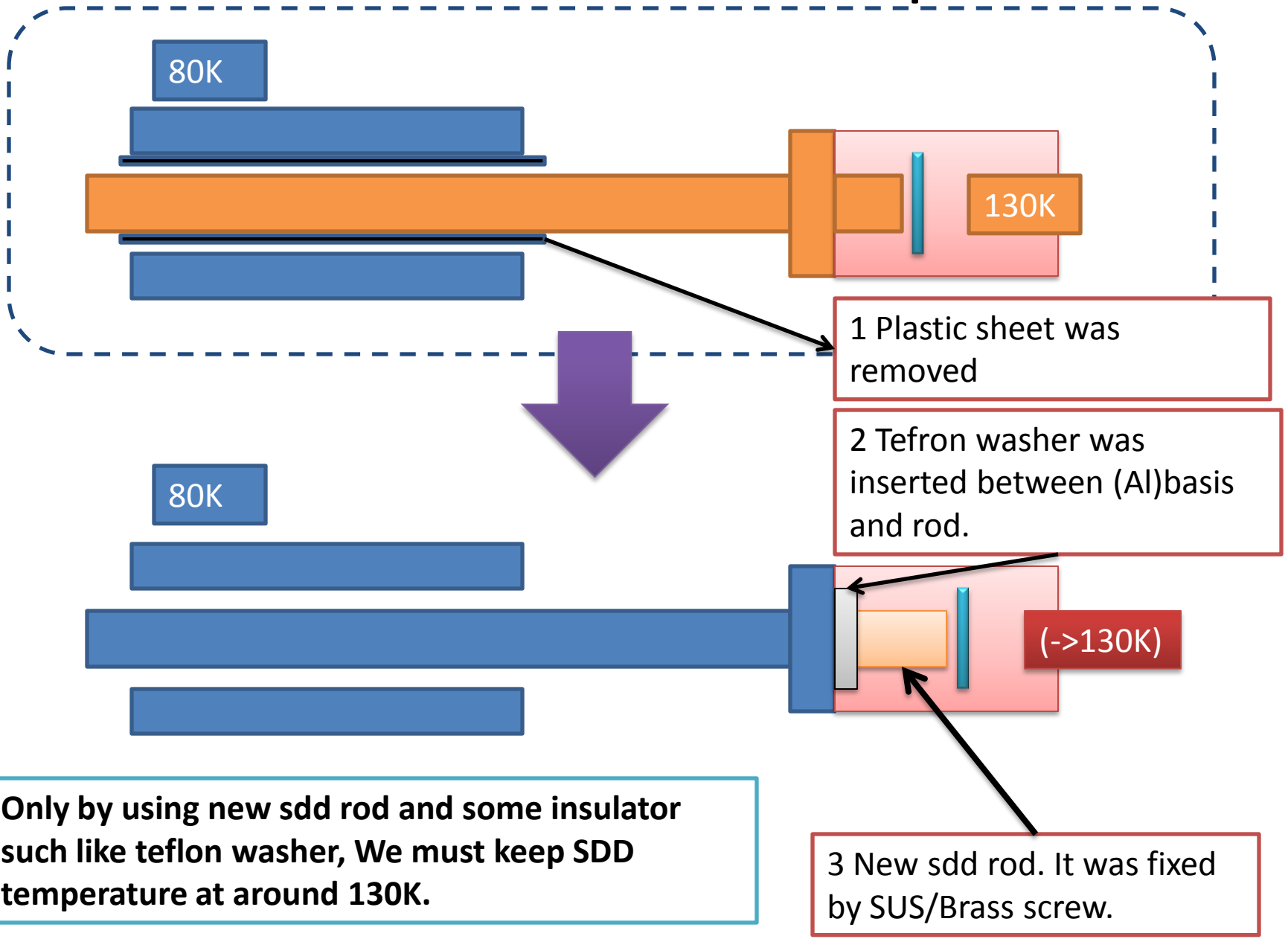
☑check chip temperature dependence~ **constant and stable**



☑ check substrate dependence

☑ temperature and sub dependence of signal fall down time

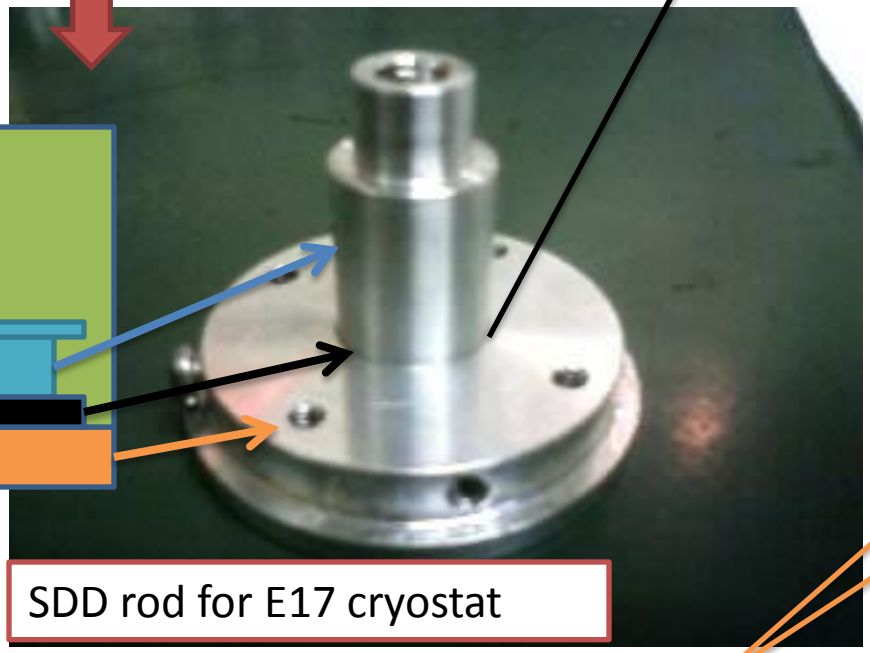
New sdd rod setup



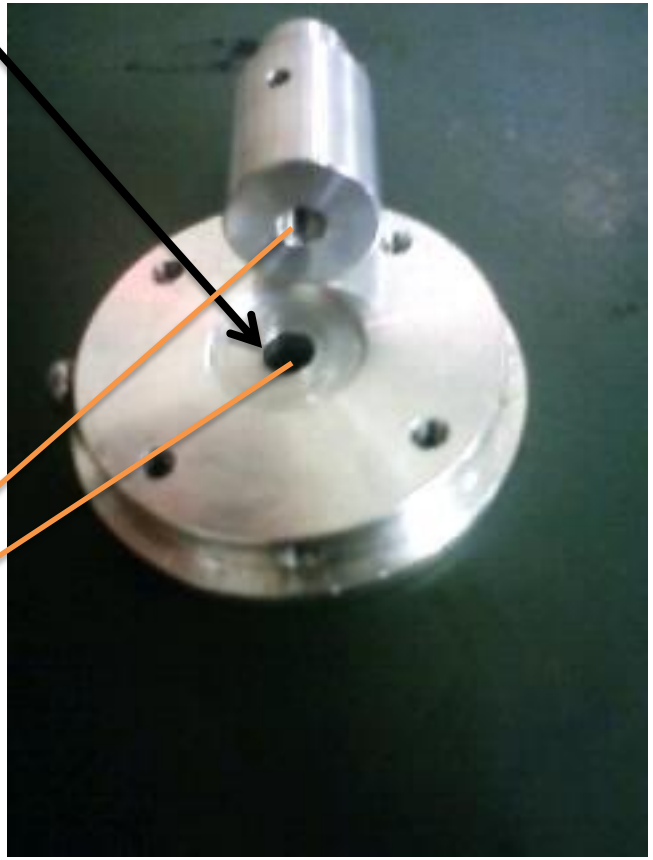
Only by using new sdd rod and some insulator such like teflon washer, We must keep SDD temperature at around 130K.

New sdd rod

Teflon washer

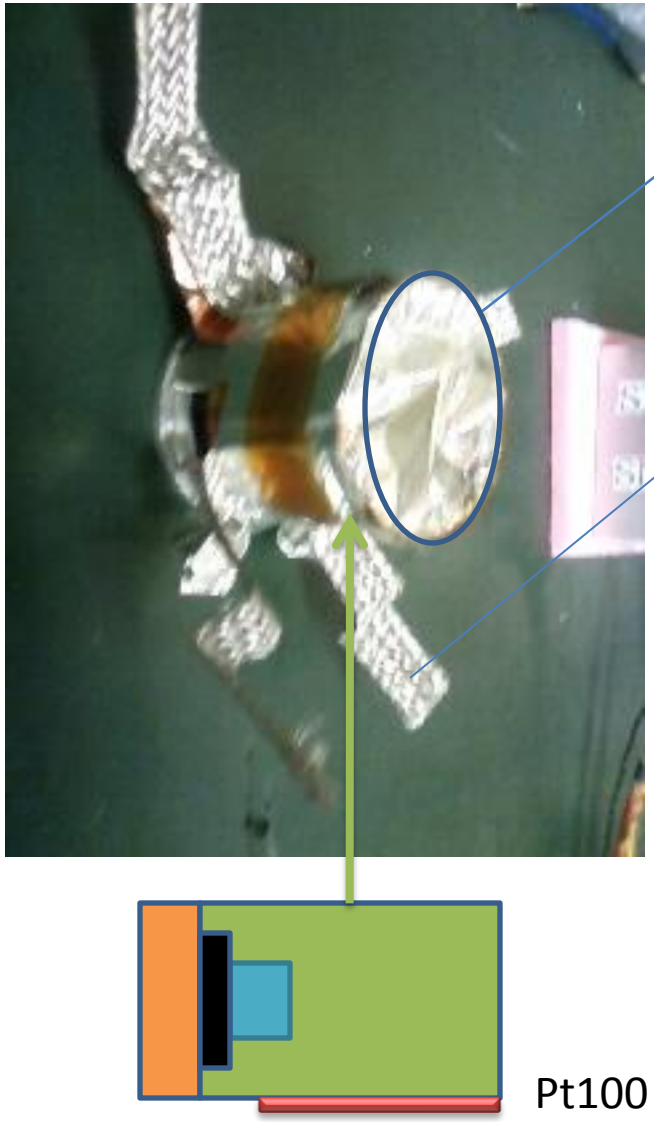


SDD rod for E17 cryostat

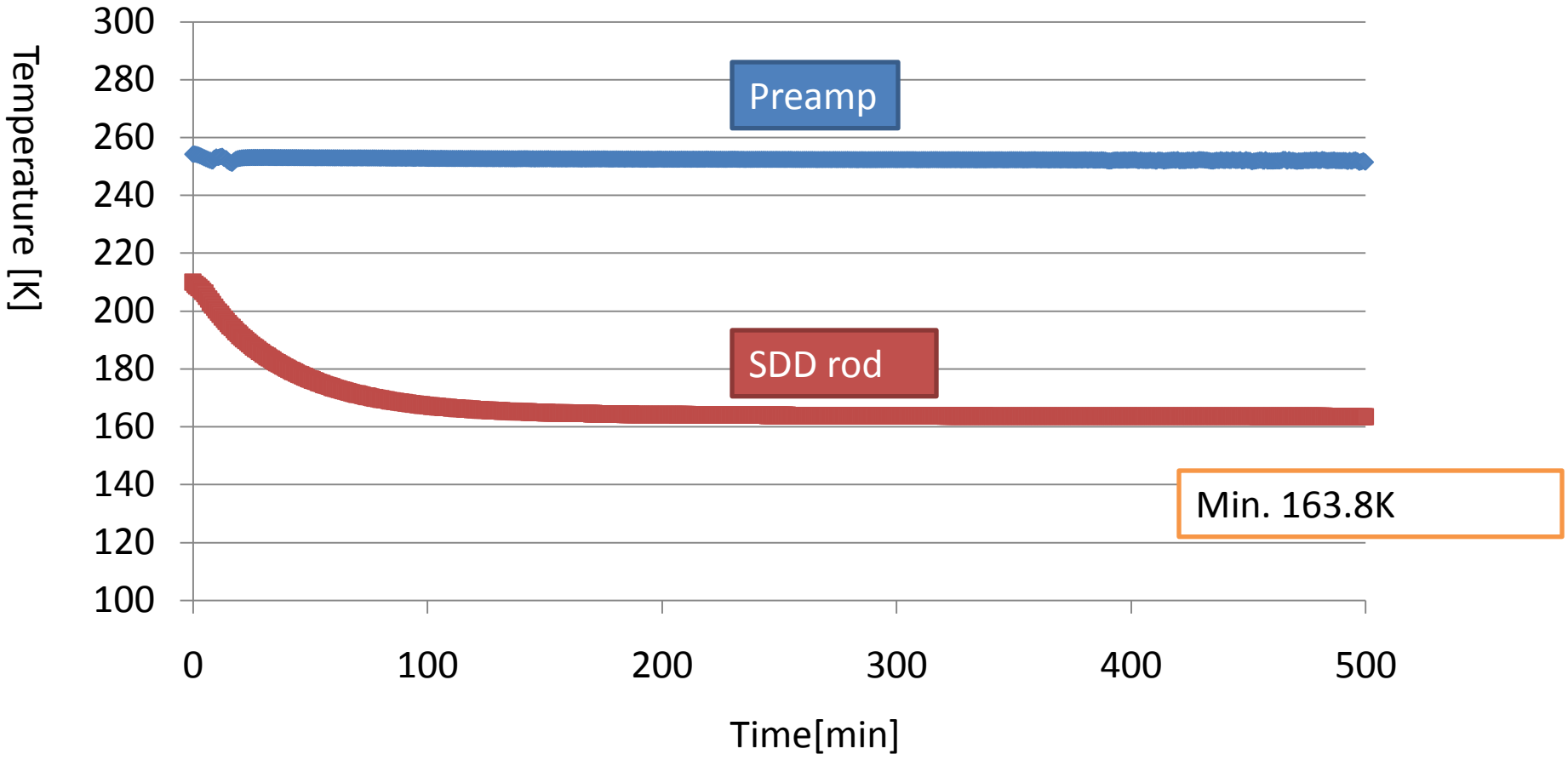


Brass / SUS screw

New sdd rod

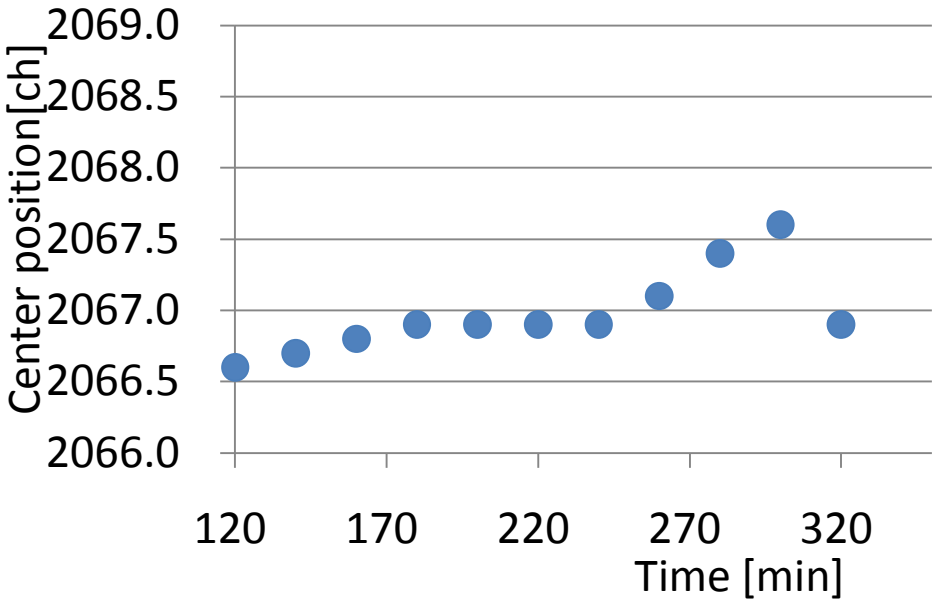


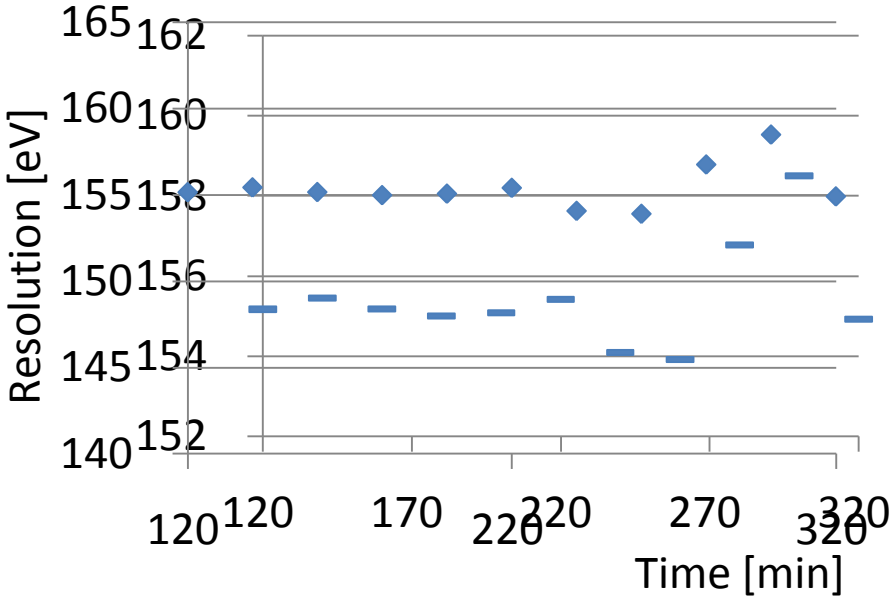
A new sdd housing Cooling(Brass screw)



Finger temperature~ 80 K. A minimum value of sdd housing(rod)temperature is 163 K.(w/ tefron washer)
Mylar window ~130 K.

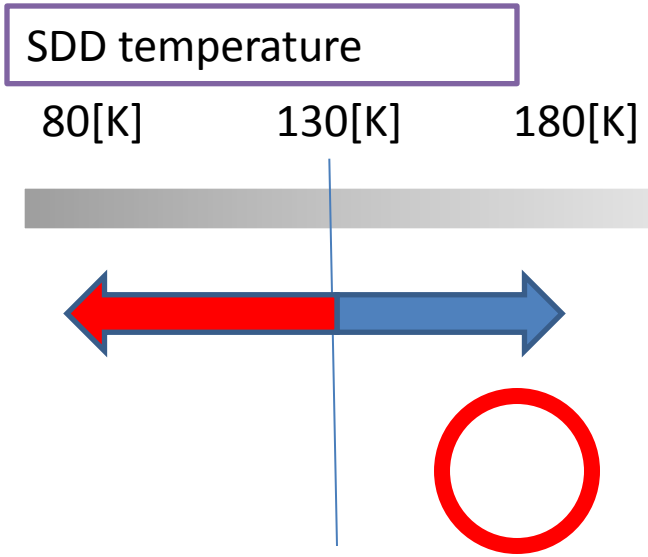
Result





A SDD temperature did not decrease less than 160K. However,resolution still was kept around 150 eV.

(In the left figure, resolution is around 155eV and it is not so good, it was caused noise from thermometer line. We detach these lines, resolution back to 150eV(147eV))



Summary

- Fall down time increase exponentially with decreaseing preamp chip temperature. It is minimized (~<1000 μs)at the chip temperature of 270 K with temperature of preamp housing of 190K. The temperature of the preamp support in the E17 cryostat can be controlled from 80K to 230K. So we can now install preamp in E17 cryostat
- The optimized range of the substrate voltage is not changed by a preamp position.(set inside of the cryostat or outside.)
- The new SDD rod and other appratus have good thermal insulativity. The rod temperature cannot be cool down less than 160K, but a SDD resolution is still good ~150eV. A sdd operational temperature range is now sured that 130~170K.

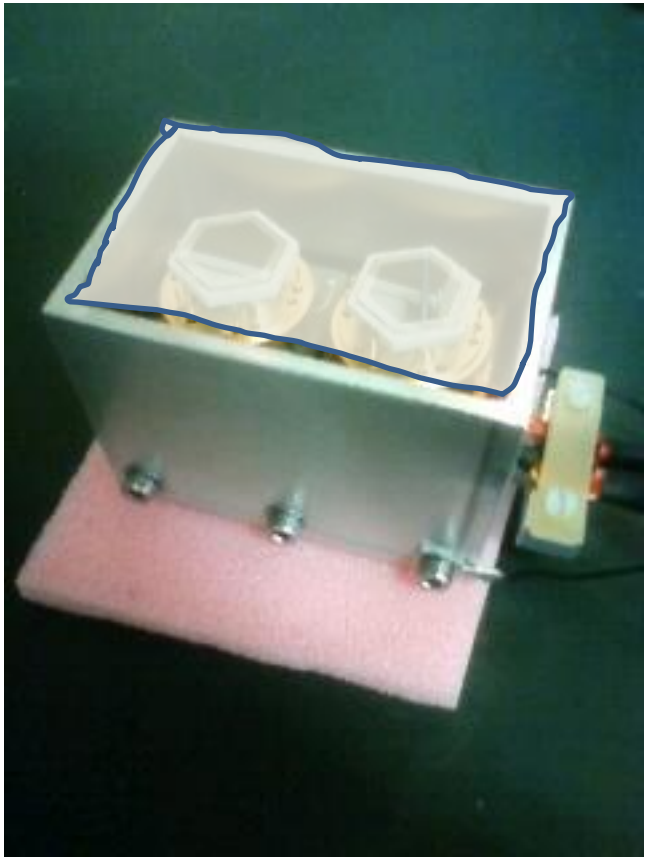
Schedule

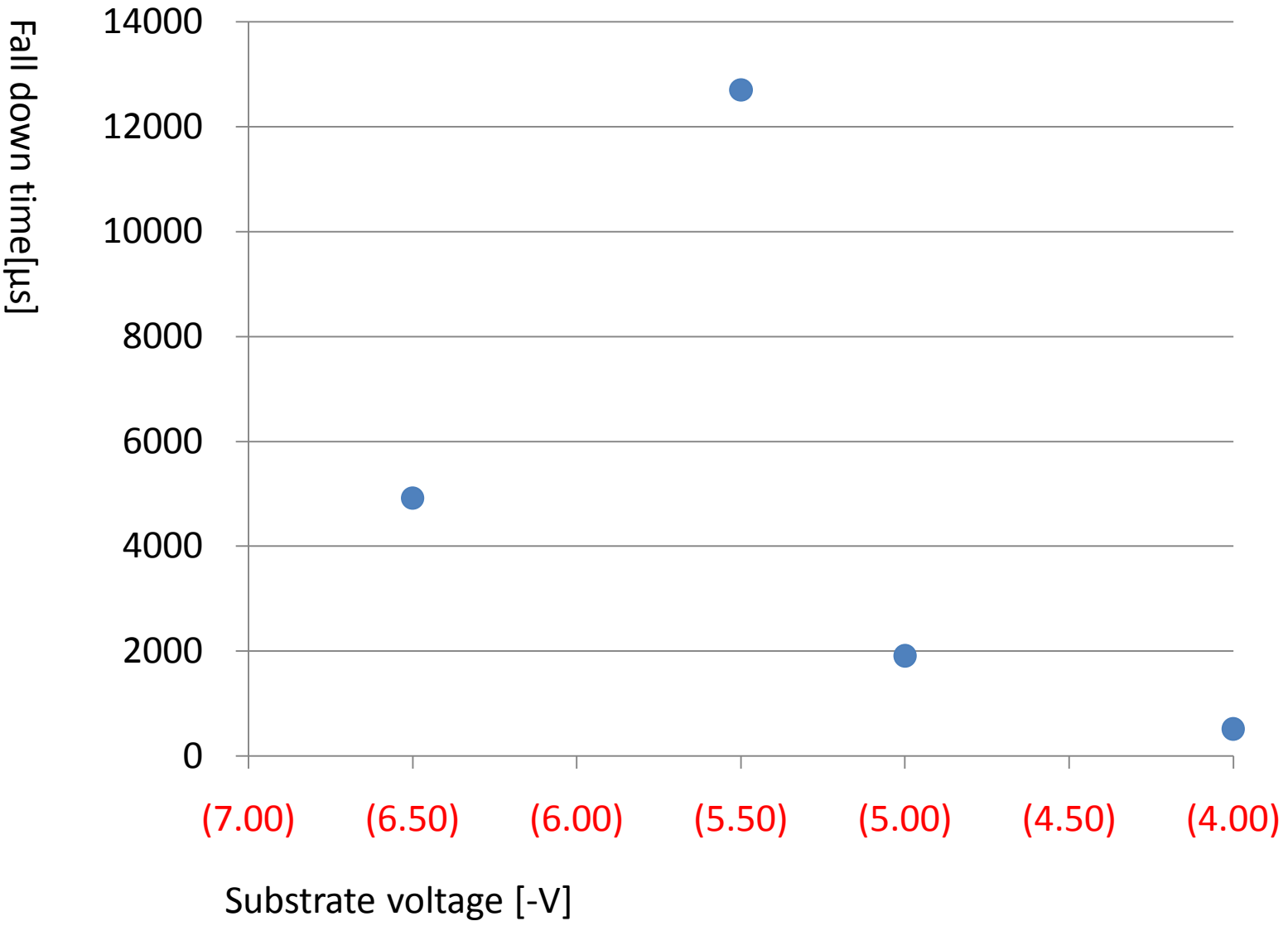
- Test with E17 cryostat

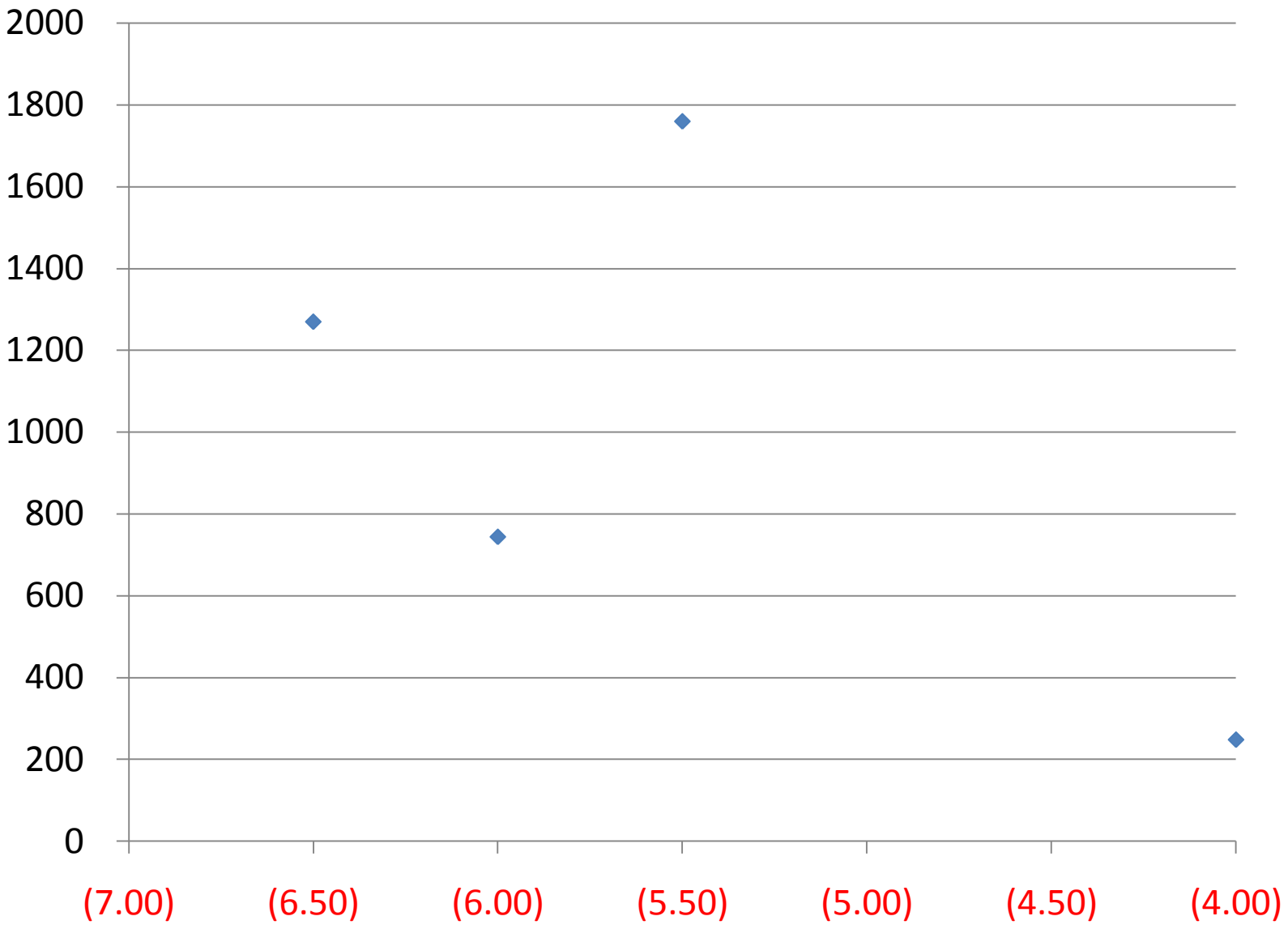
Substrate -6.5V, R1=-20V RX=-130V Back=-60V

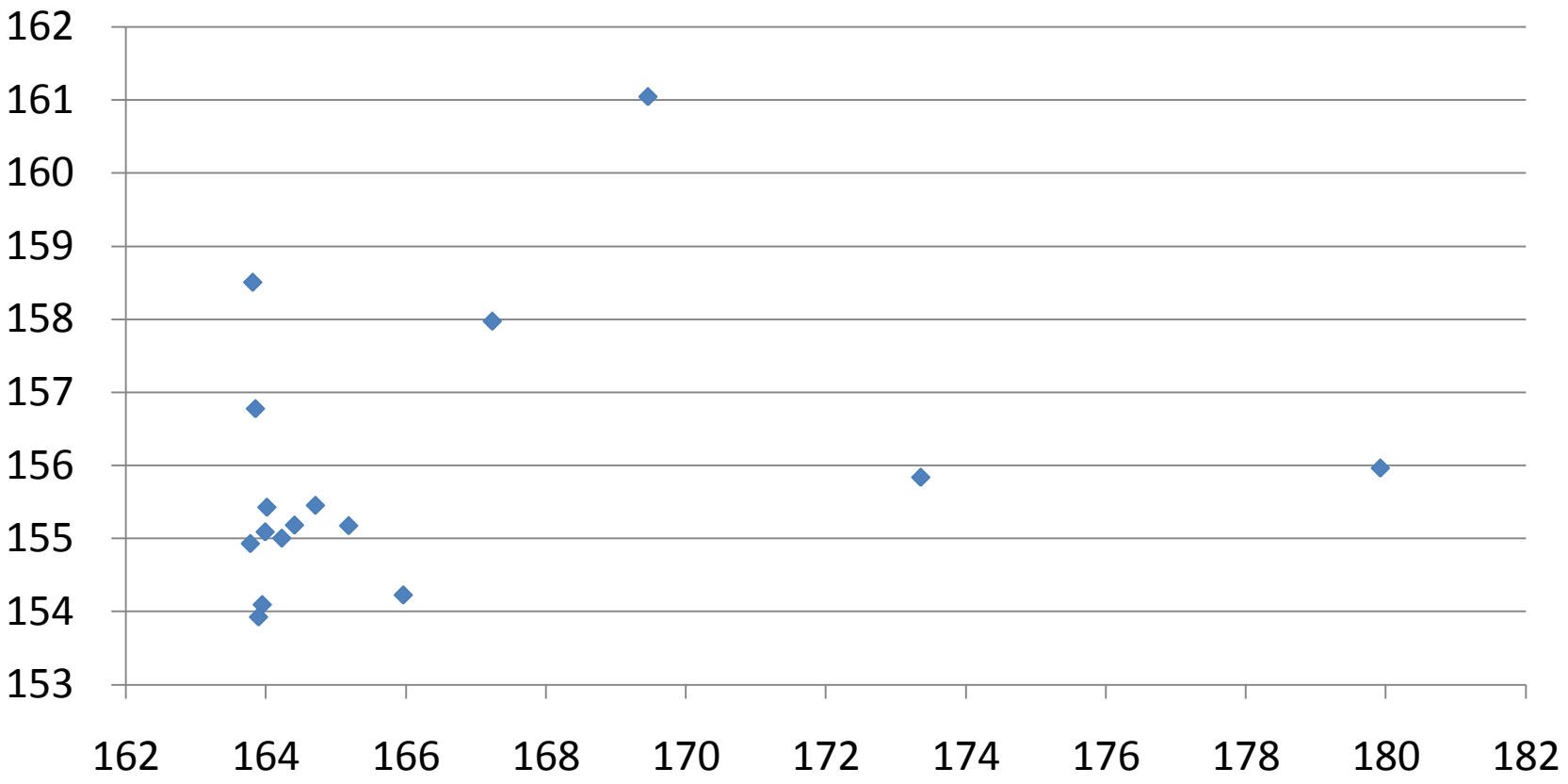
Preamp:+-24V type

- Check new sdds from vienna (4)




Fall down time[μs]
14000
12000
10000
8000
6000
4000
2000
0
(7.00)
(6.50)
(6.00)
(5.50)
(5.00)
(4.50)
(4.00)
Substrate voltage [-V]


2000
1800
1600
1400
1200
1000
800
600
400
200
0
(7.00)
(6.50)
(6.00)
(5.50)
(5.00)
(4.50)
(4.00)


162
161
160
159
158
157
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153
162
164
166
168
170
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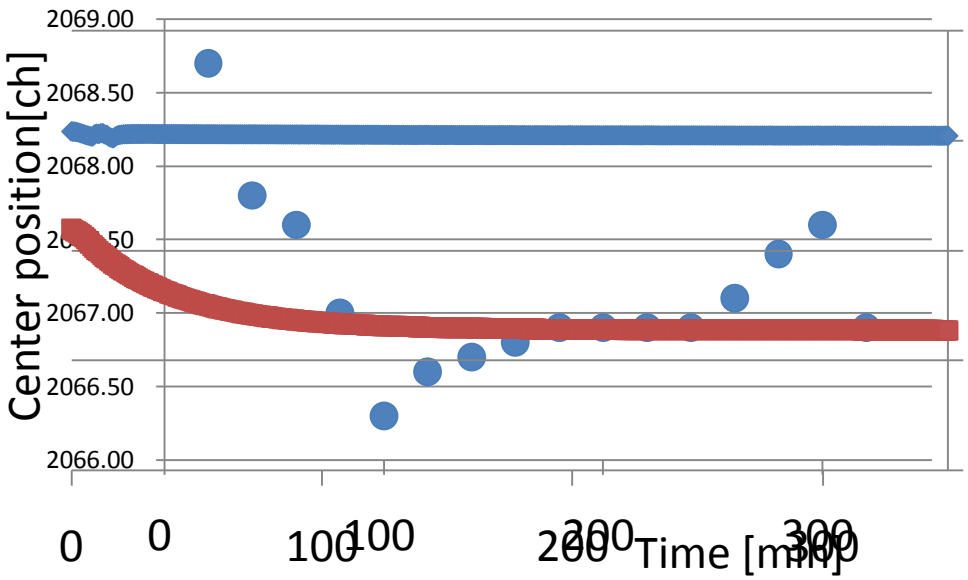
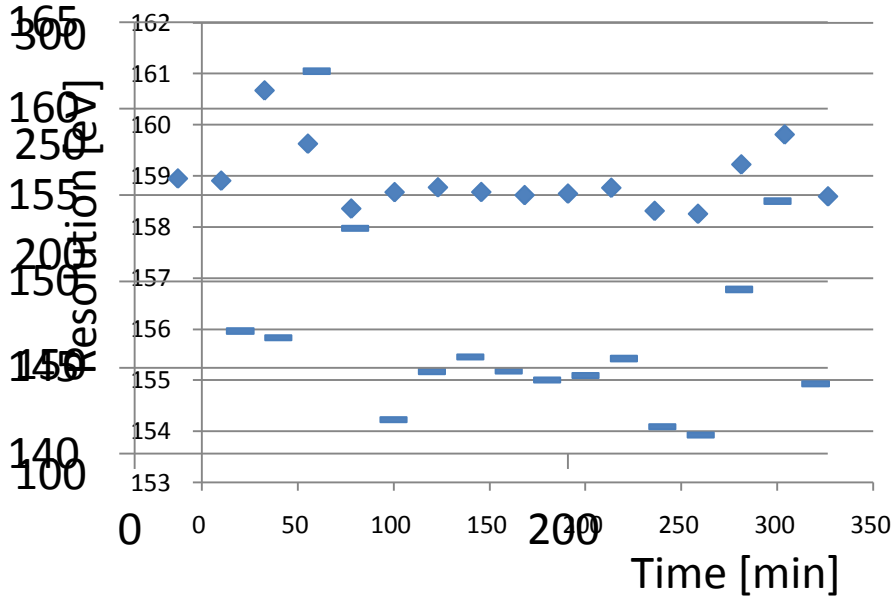
176
178
180
182

Result





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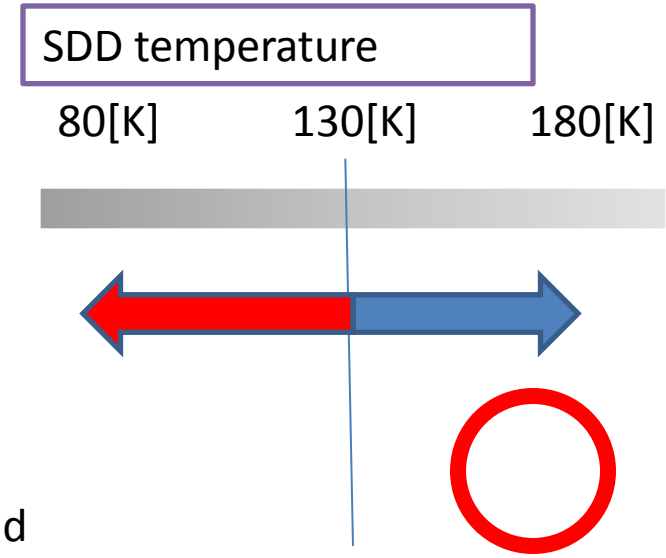

Next : Mylar wind

Vsub [V]	Tchip [K]	Tdrop [µs]	Resolution [eV]
-5.5	250.25pm0.1	84.4	148
-5.5	260.9pm0.1	12.7	150
-5.5	268.8	1.76	149.84
-6.5	249.95	30.2	147.021
-6.5	261	4.92	147
-6.5	269.4	1.27	150