

Operation check of the SDD preamplifier in vacuum and low-temperature condition (I)

For low noise operation of SDDs, the signal cables between SDD chips and the preamplifiers should be kept as short as possible.

In J-PARC E17, we plan to operate SDD preamplifiers in vacuum vessel to shorten the signal cables.

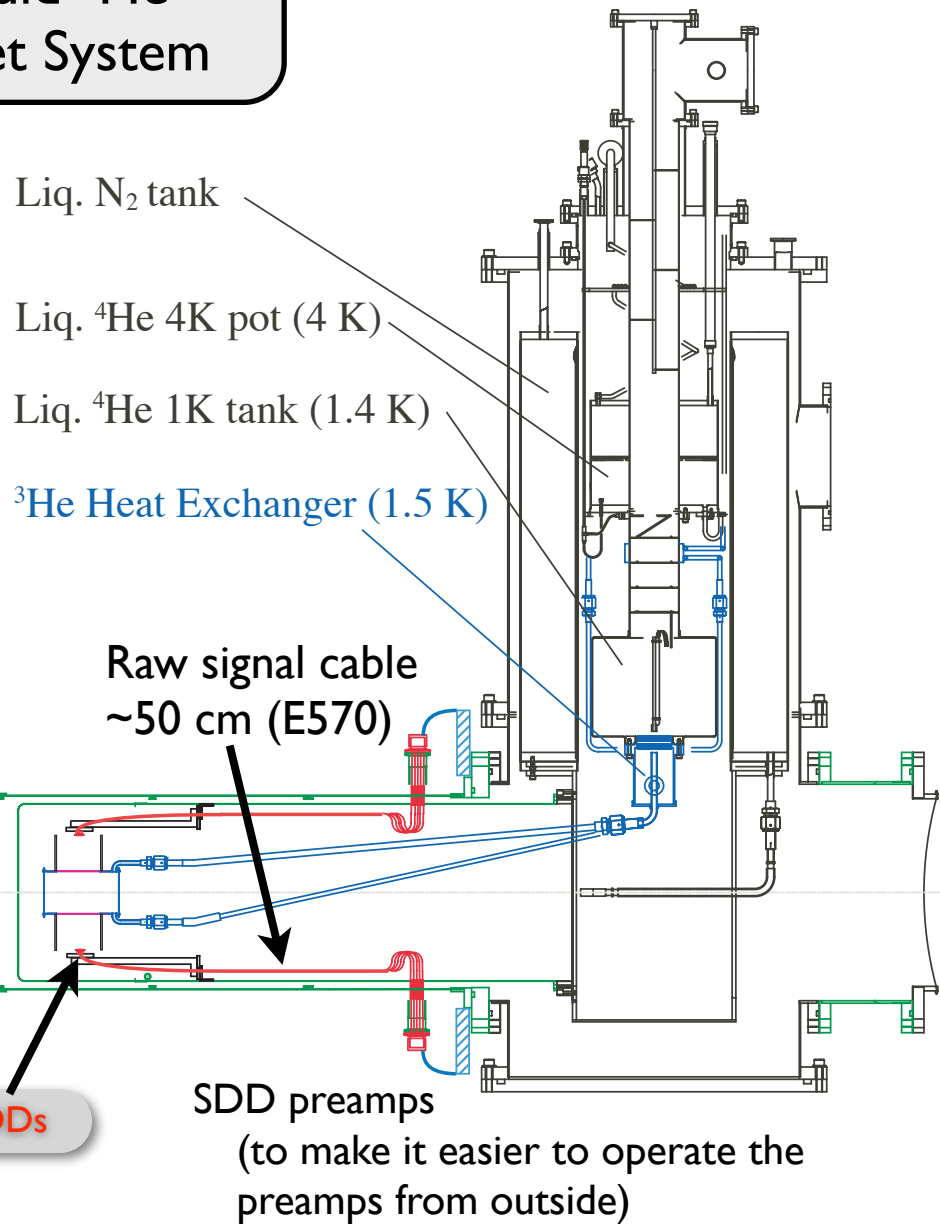
To check the operation of the SDD preamplifier in vacuum and low-temperature condition (\sim nitrogen temperature), we have constructed the test bench system last two weeks (Iio, Ishimoto, Itahashi, Okada, Tatsuno).

The test is not yet finished. Here, the intermediate step will be presented.

July 30, 2007 S.Okada

Operating SDD preamps in vacuum vessel of E17

Liquid ^3He Target System



Preamps in vacuum vessel



Low noise & stable resolution thanks to short raw-signal cables between SDD and the preamp.



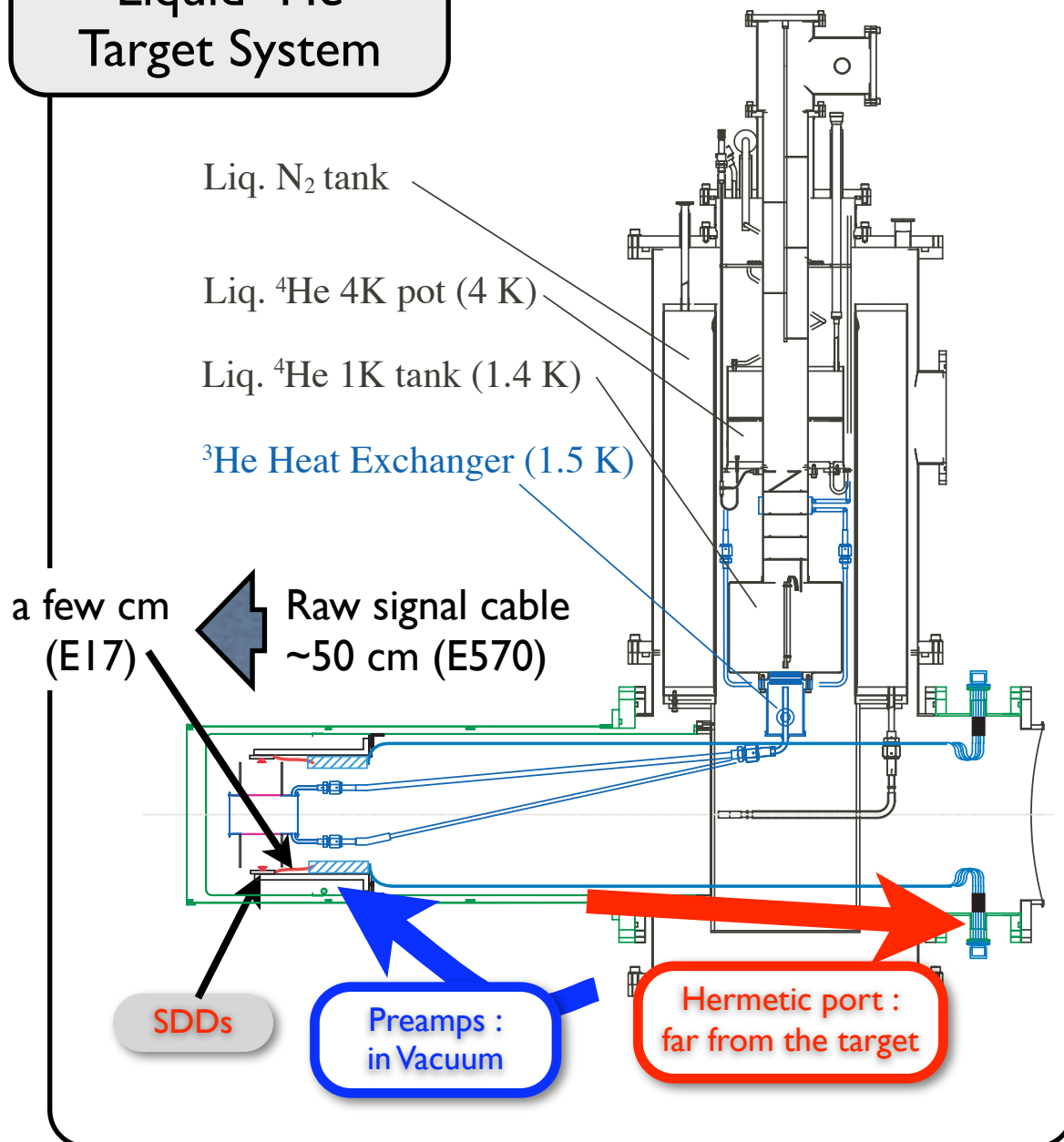
Thanks to the short signal cables, hermetic ports will be able to arrange far from the target. This helps to reduce the heat release value to the target.

R & D

- ▶ Preamp control from outside
- ▶ Heat release value from the preamp

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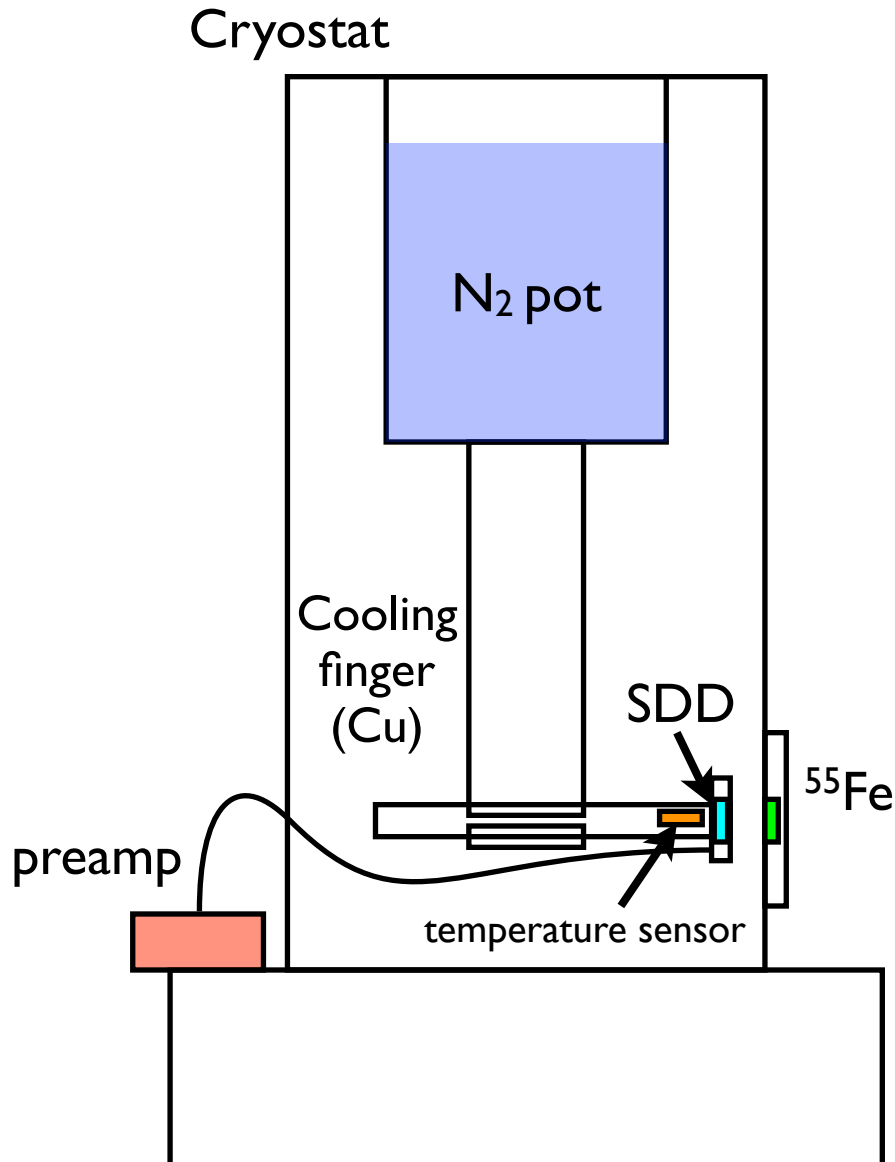
Purpose of this test experiment

- Operation check of the SDD preamplifier in vacuum and low-temperature condition
- Estimation of the heat consumption

furthermore ...

- Remote control of the preamplifier
- This test bench system will be also used for the R&D of the beam veto counter which might be operated in vacuum at E15.

I. preamp **outside** vacuum vessel



Normal condition
(same as E570 test bench)

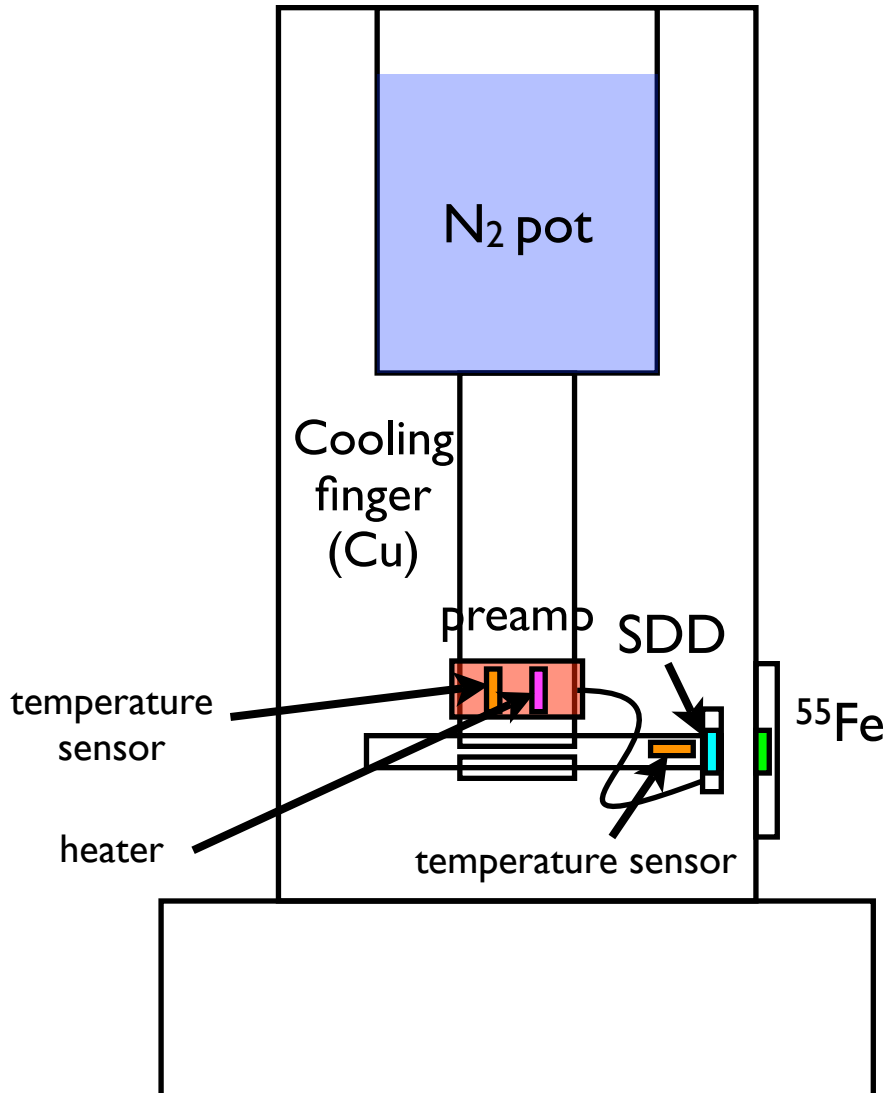
- SDD chip : S/N:V2-6-03.02 (SDD #10) which was installed on #1 port of the SDD folder at 2nd cycle
- Temperature at SDD : **97 K**



Good energy resolution
~ 180 eV (FWHM) at 5.9 keV

2. preamp **inside** vacuum vessel

Cryostat



- same SDD
- same preamp (without modifying the settings ... reset and substrate voltage)
- Temperature at preamp : **150 K** with heater (64.6% 30W)
- Temperature at SDD : **99 K**

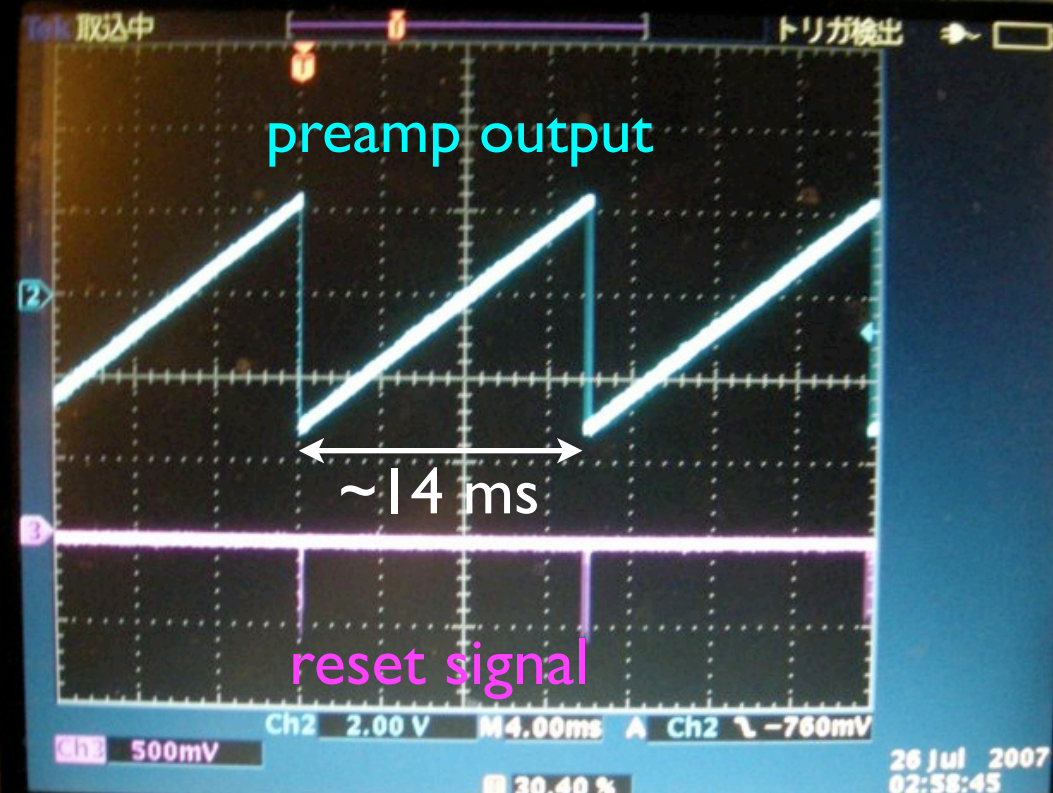


healthy signal output
only for 5 minutes...

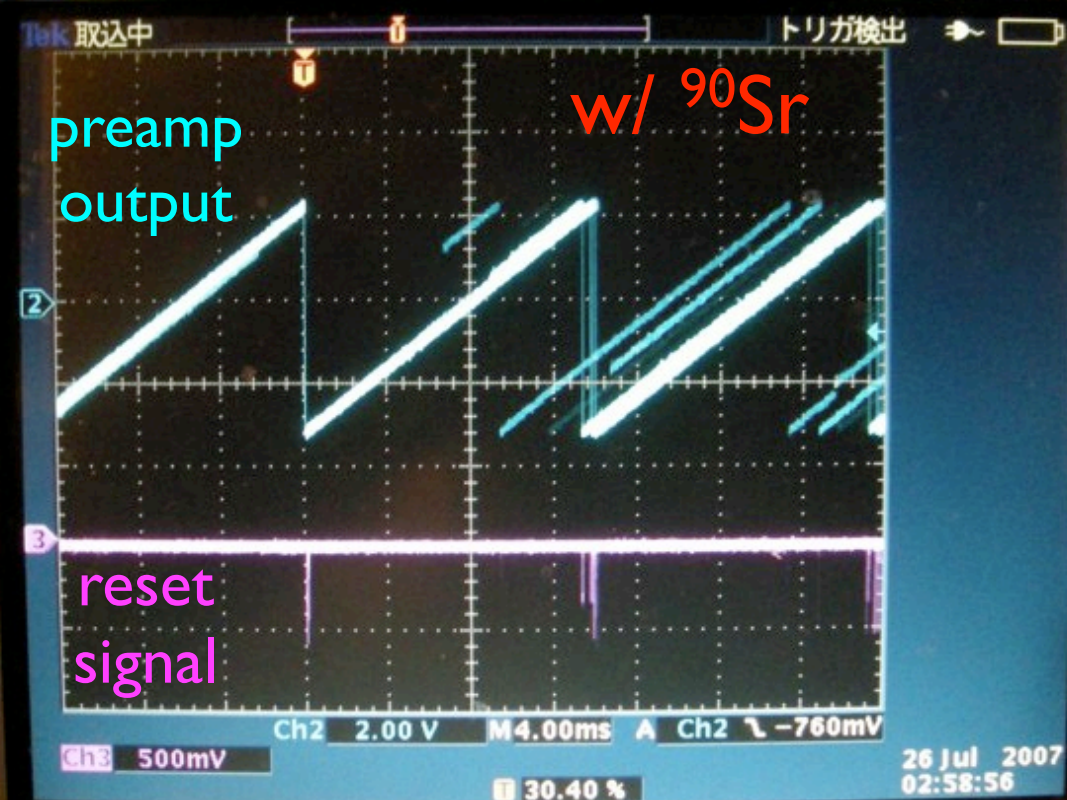
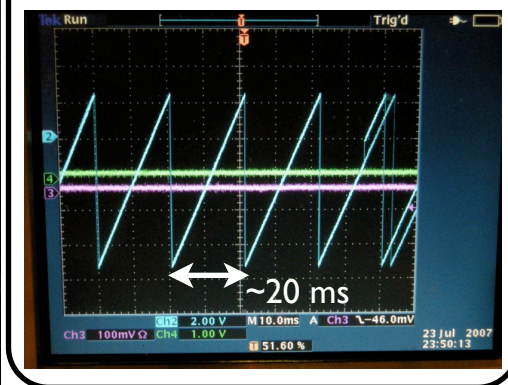
Preamp **inside**
vacuum vessel

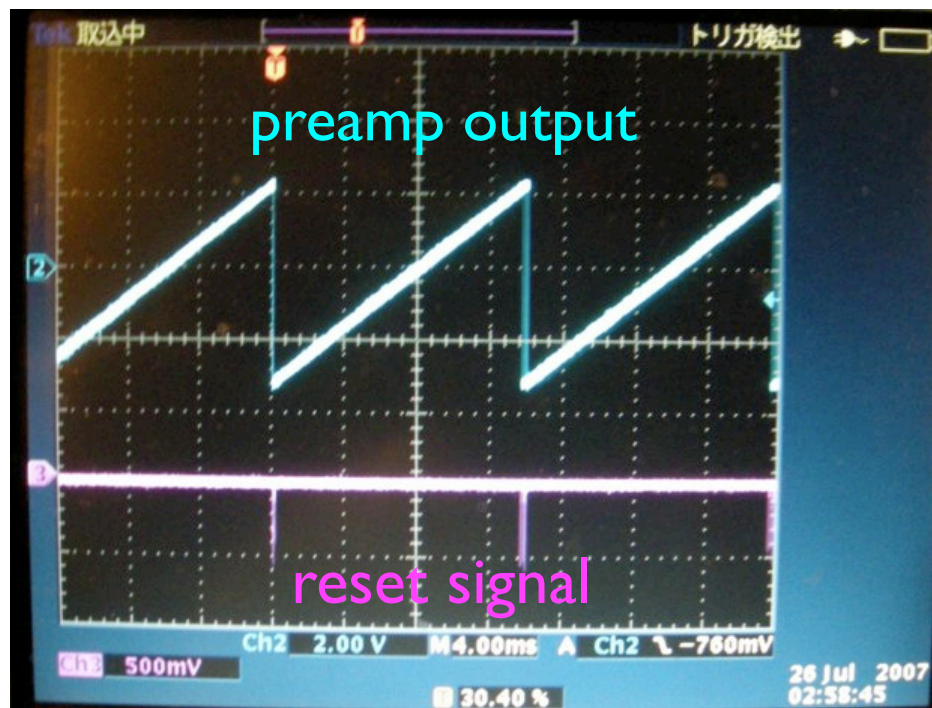


healthy output !

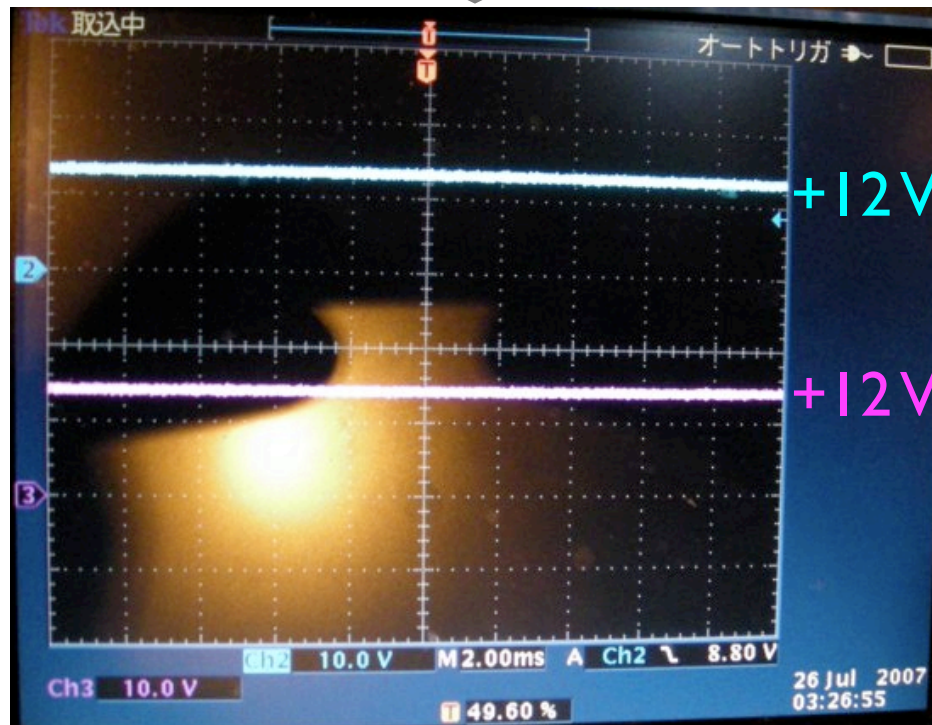


cf. preamp outside
vacuum vessel





~5 minutes after



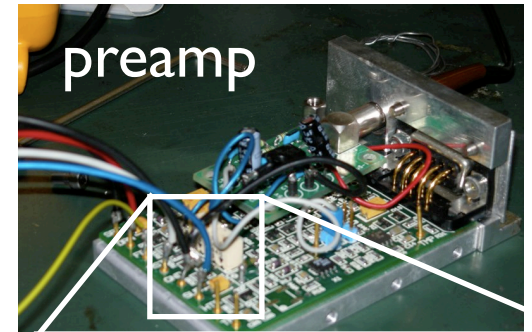
disappeared the ramp up signal !



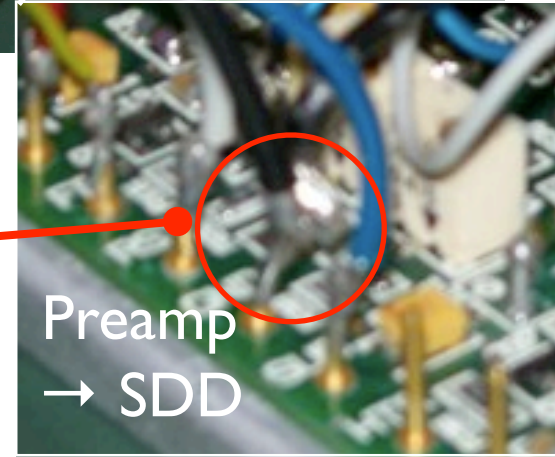
preamp output

reset signal

~ 5 minutes after

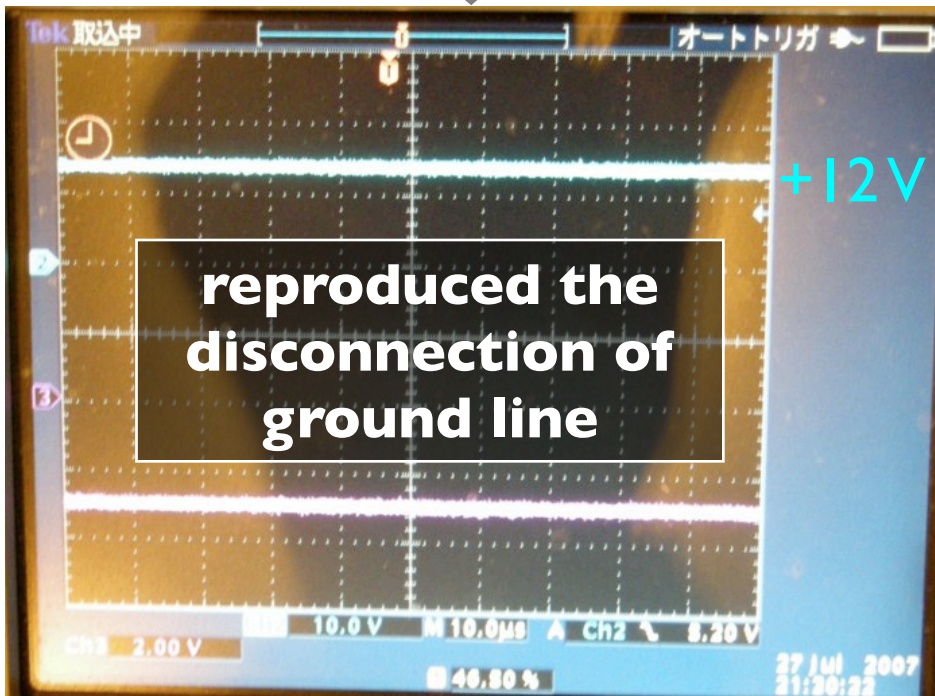


preamp



Found bad connection of ground line !

Preamp
→ SDD



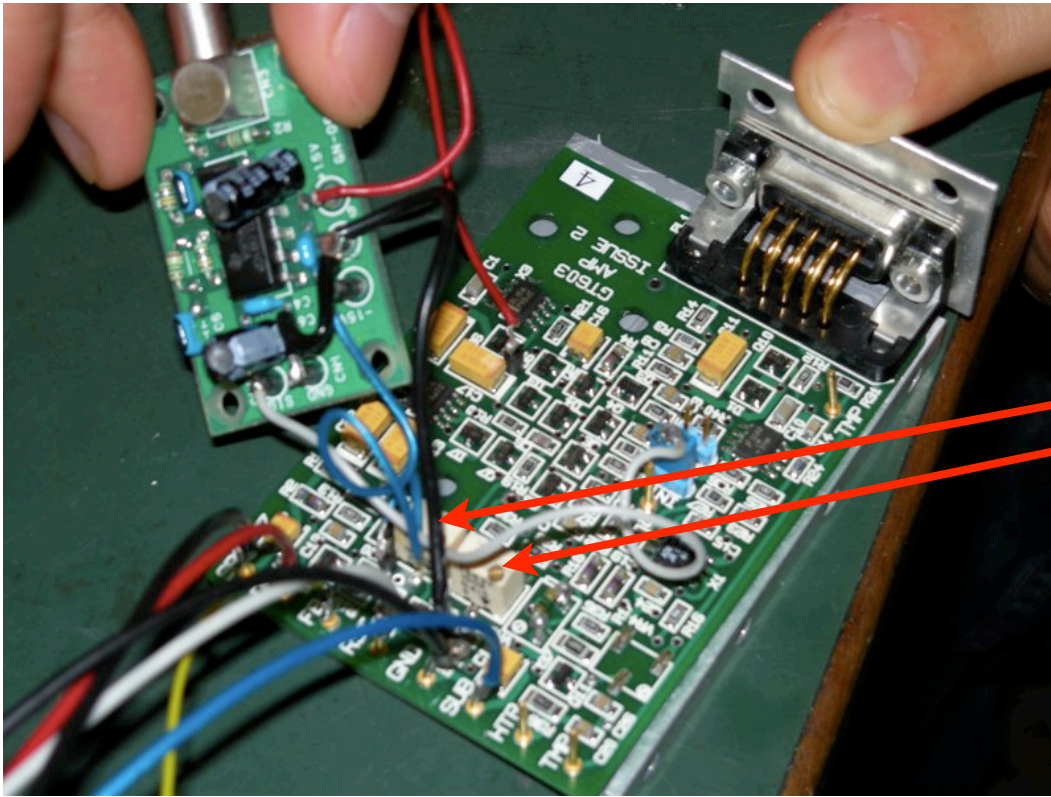
reproduced the disconnection of ground line

same preamp-output signal (+12V)



heat shrinkage of soldering portion ?

3. remote control of the preamps



Pre-amp GT603 Notes

The preamplifier should be placed as near as possible to the detector. The connections of the FET have to be connected to the equivalent pins on the preamplifier board. The preamplifier board needs +/- 24 V for operation as well as a ground connection.

1. The connections to the FET in the cryostat are on the edge opposite the 9 way D and are labelled clearly.

2. The potentiometer functions are as follows;

VR1 Gain (2:1)

VR2 Reset magnitude (0 to +2.5V)

VR3 Substrate voltage (-3.5V to -12.5V)

3. 9 way D connections.

PL1-1 Ground

PL1-2 Temperature

PL1-5 External reset

PL1-6 -24V

PL1-7 +24V

PL1-8 Output (-2V to +2V)

PL1-9 Signal ground

4. There are two test pins on the PCB for Output (OUT) and for Temperature (TMP).

5. The pre-amp will work with internal or external restore. A link is provided for this function.

6. A hole is provided near VR2 to support the board

According to Taniguchi-san

- reset magnitude --> not so difficult.
- substrate voltage --> we might use the op-amp whose gain can be controlled with voltage.

4. heat consumption

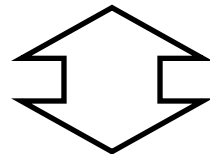
The preamp temperature was controlled by “AC resistance bridge with temperature control (Lakeshore 350)” to keep the temperature **150 K** with a heater (30W). The difference of the heat load between power off and on of the preamp was ~ 1.1 W which is consistent with that calculated by the high voltage and current applied to the preamp.

preamp power OFF : $64.6\% @ 30W = 19.4$ W



Heat consumption : ~ 1.1 W

preamp power ON : $61.6\% @ 30W = 18.5$ W



consistent

Voltage and current applied to the KETEK-Preamp :
 $\sim +24V/33mA$ and $-24V/26mA$.
→ Heat dissipation : $\sim 1.4W$.