SDD status at KEK

E17 meeting 26/Jun/2009

Current situation

- Summary of previous meeting report
  - ✓ New SDD works well with FWHM ~150 eV with preamplifier outside of the vacuum chamber

$$T_{housing} = 120\sim140\ K$$

- Contents of this meeting
  - ✓ Test external substrate voltage supply
  - ✓ Installation preamplifier into the vacuum chamber

V_{sub} dependence

Set preamplifier outside
(measured @ room temp)

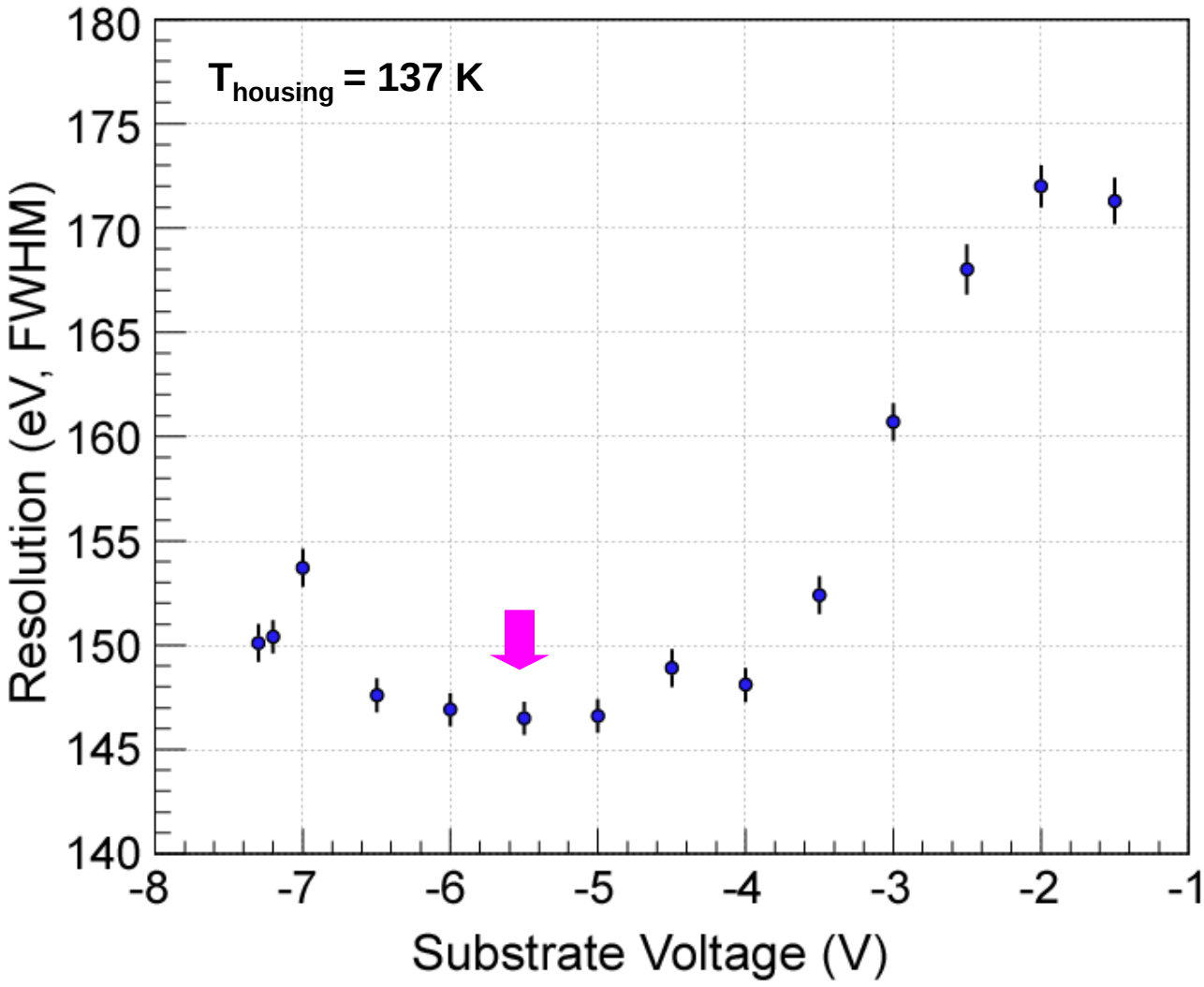
Vsub supplied from amplifier

Region: -7.3 < V < -1.5 V

Optimum value is around -4.5 ~ -6.5 V

Set to -5.5 V

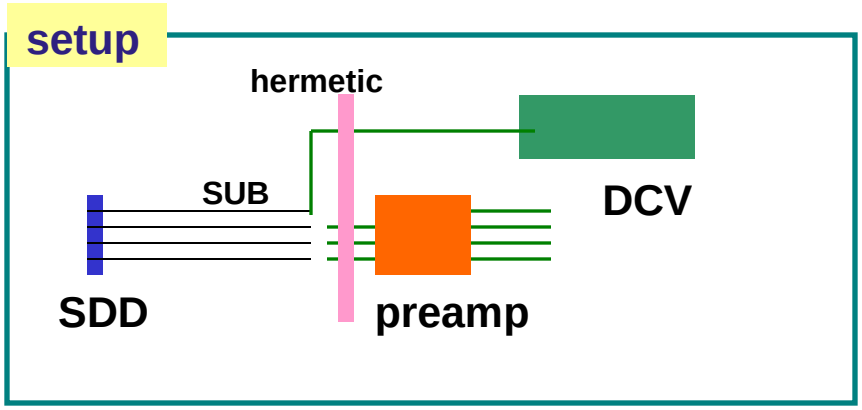
All the figures in this report



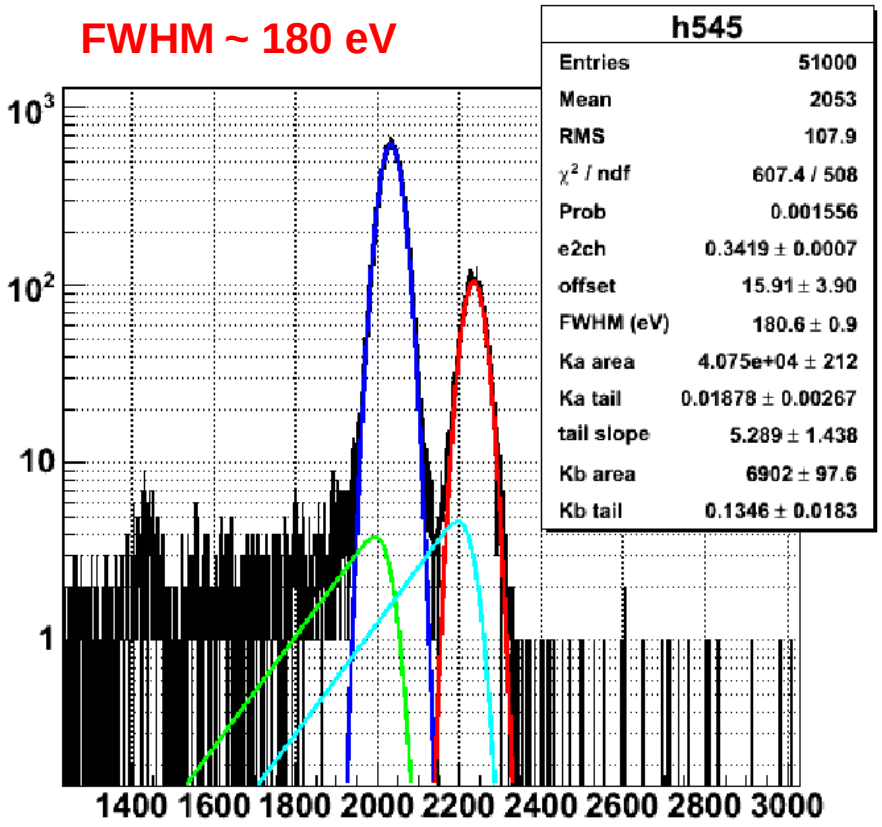
Test for the external V_{sub} supply

Substrate voltage supplied from external DC V source

Easy to adjust Vsub when install preamp in vacuum chamber



FWHM ~ 180 eV



- ✓ Testing several DC sources
- ✓ Shorten the SUB cable
- ✓ Install a bypass capacitor etc.

Cannot achieve good resolution (compared to the case Vsub supplied from preamp ~ 150 eV)

Go back to Vsub supplied from preamp

→ Start preamp installation into vacuum chamber

Preamp inside the vacuum

- ✓ Set preamplifier just above the preamp support

Cable length

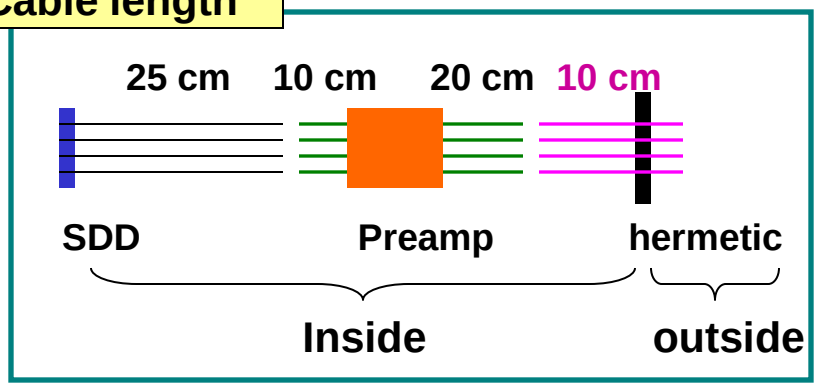
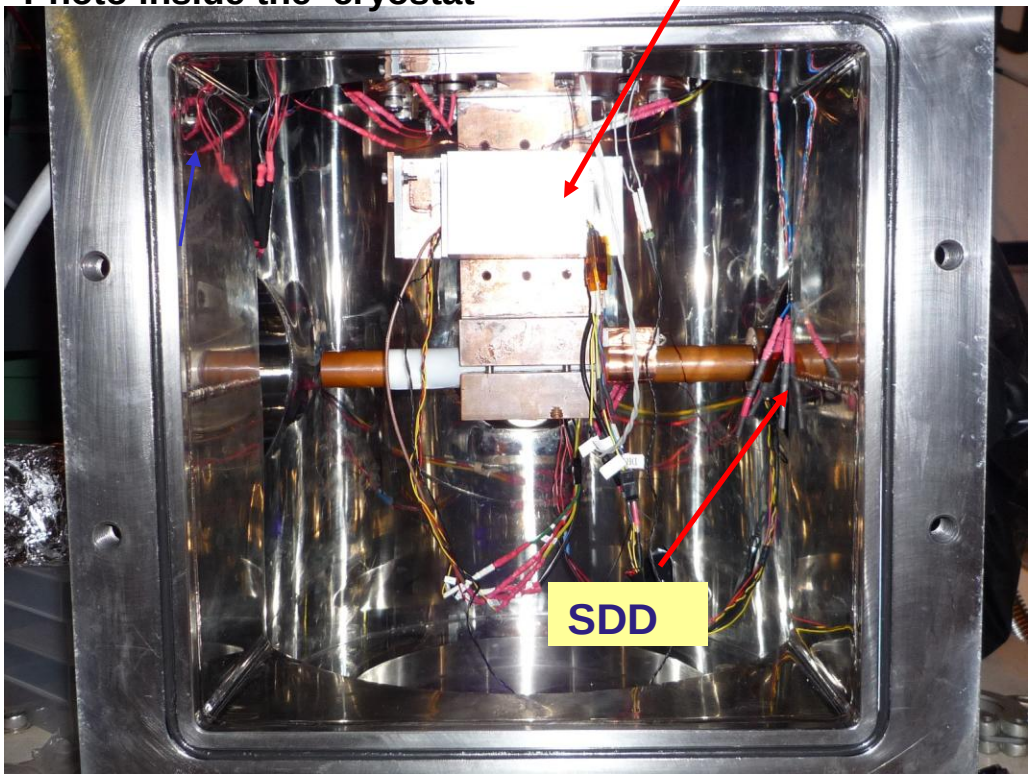
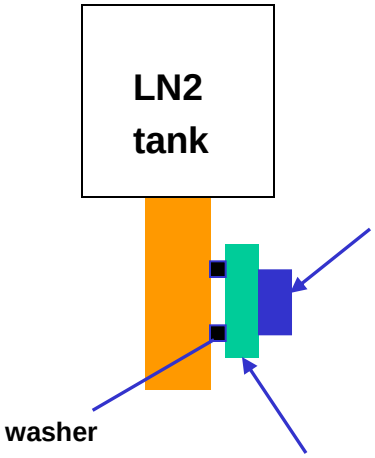


Photo inside the cryostat



schematic



Preamp

2 Pt100s

- **Aluminum cover (Tcover)**
- **Hottest chip on the board (Tchip)**

Preamp support (heater , Pt100: Tsupport)

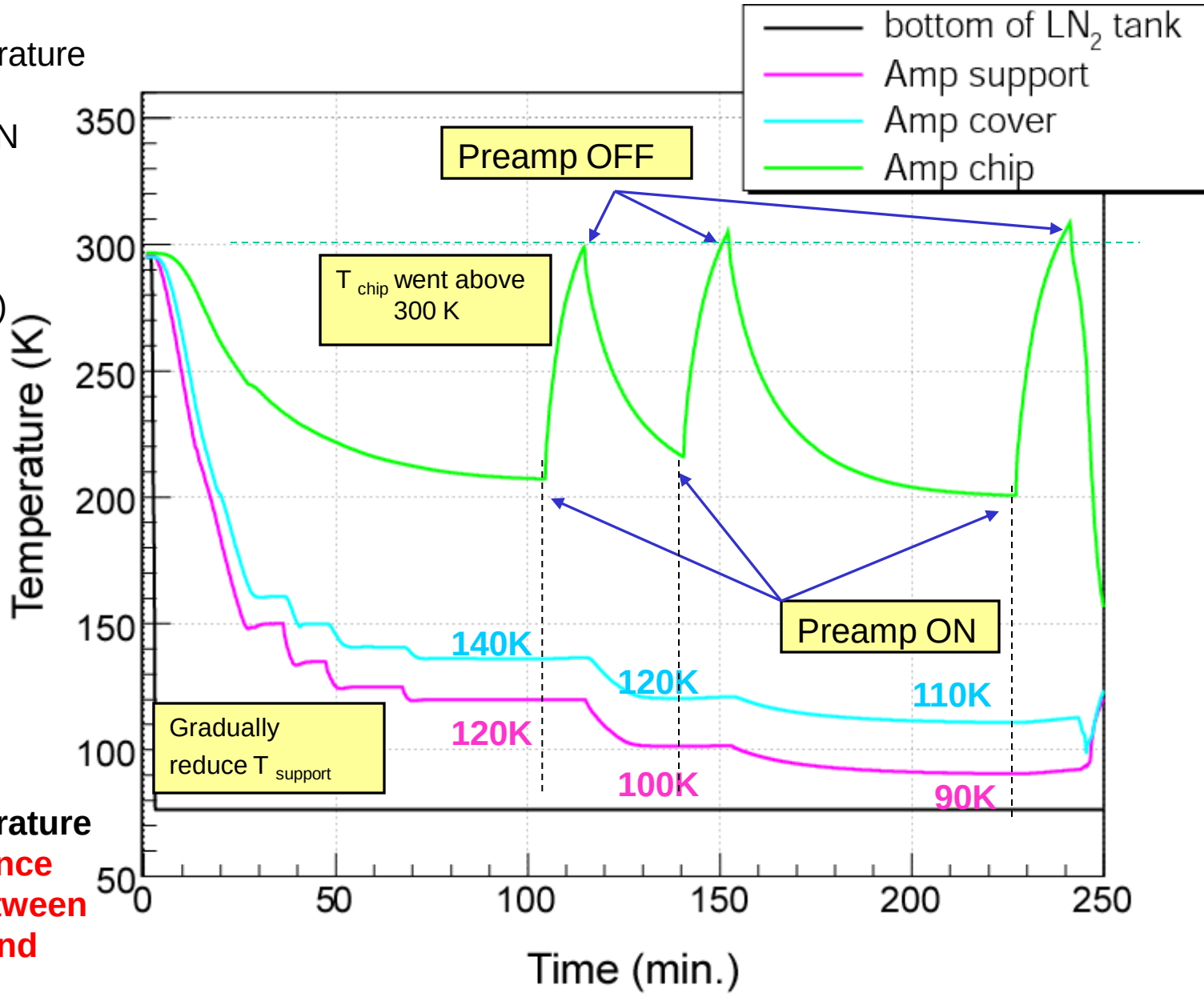
Temperature after LN2 filling (I)

- ✓ Keep chip temperature **< 300 K** with preamp V ON

Vacuum level

2×10^{-5} mbar

→ 3×10^{-6} (W/ LN2 fill)

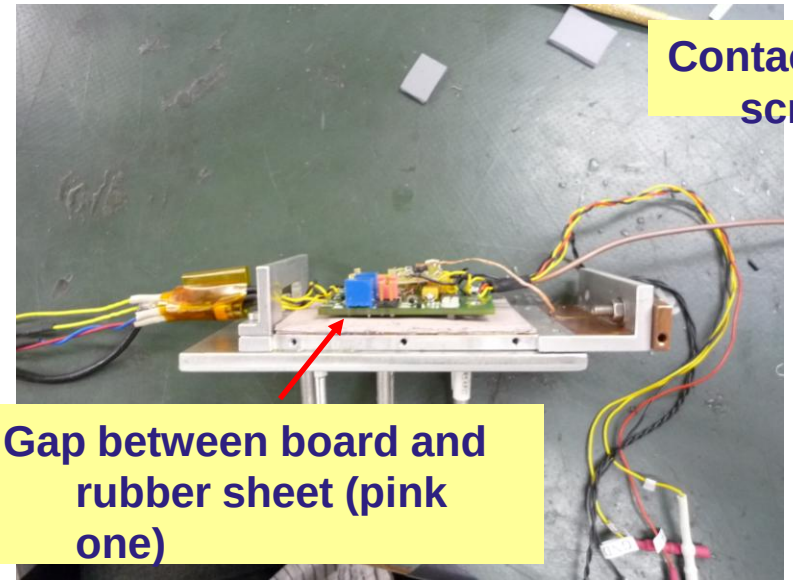


Too hot chip temperature

→ **need to enhance heat contact between preamp board and cover**

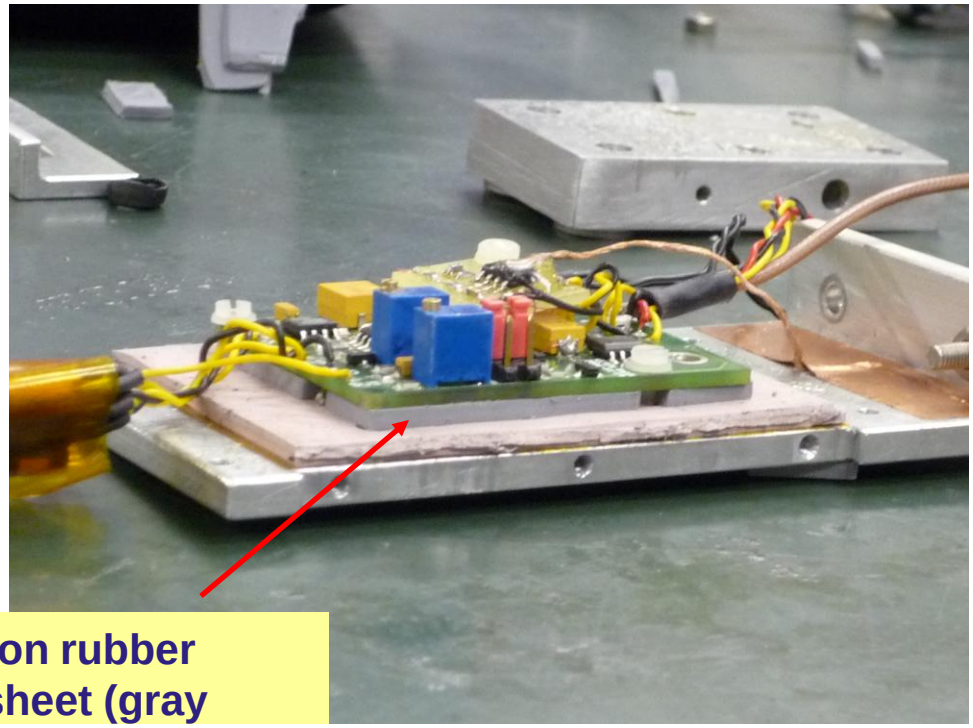
Change heat contact

Check the heat contact between preamp board and cover



Contact only 2 x M2 plastic screws

Gap between board and rubber sheet (pink one)



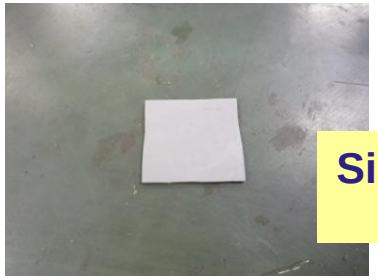
Silicon rubber sheet (gray one)

Shin-Etsu Chemical Co., Ltd.
TC-200TXS

Originally used in E570

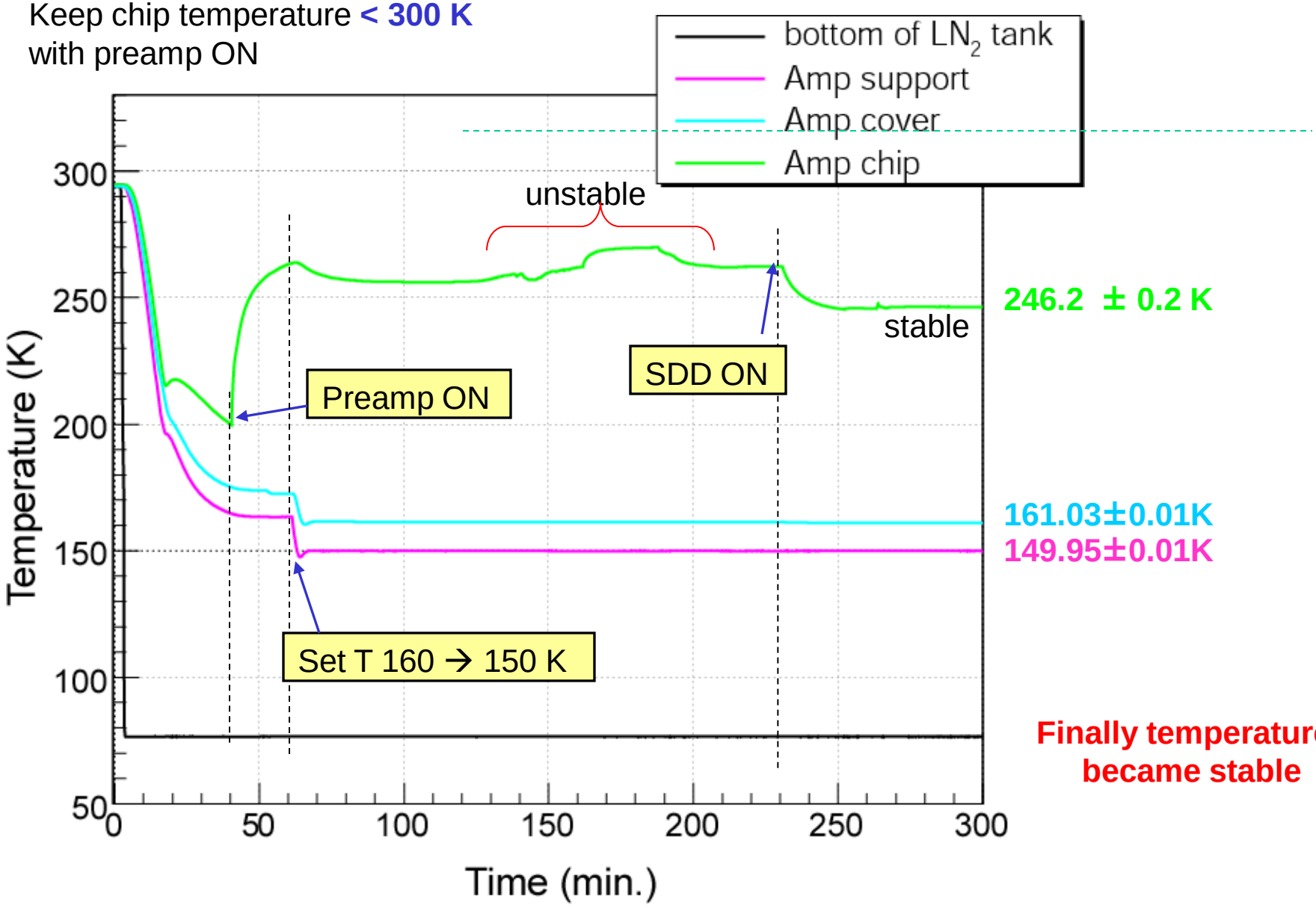
Tg = -40 ~ -50 ^{o}C

2.5 W m/K



Temperature after LN2 filling (II)

- ✓ Keep chip temperature **< 300 K** with preamp ON



Finally temperature became stable

Obtained spectrum

preamp set inside the vacuum chamber

fitted with Gauss+tail for Kα / Kβ
(common σ & tail slope)

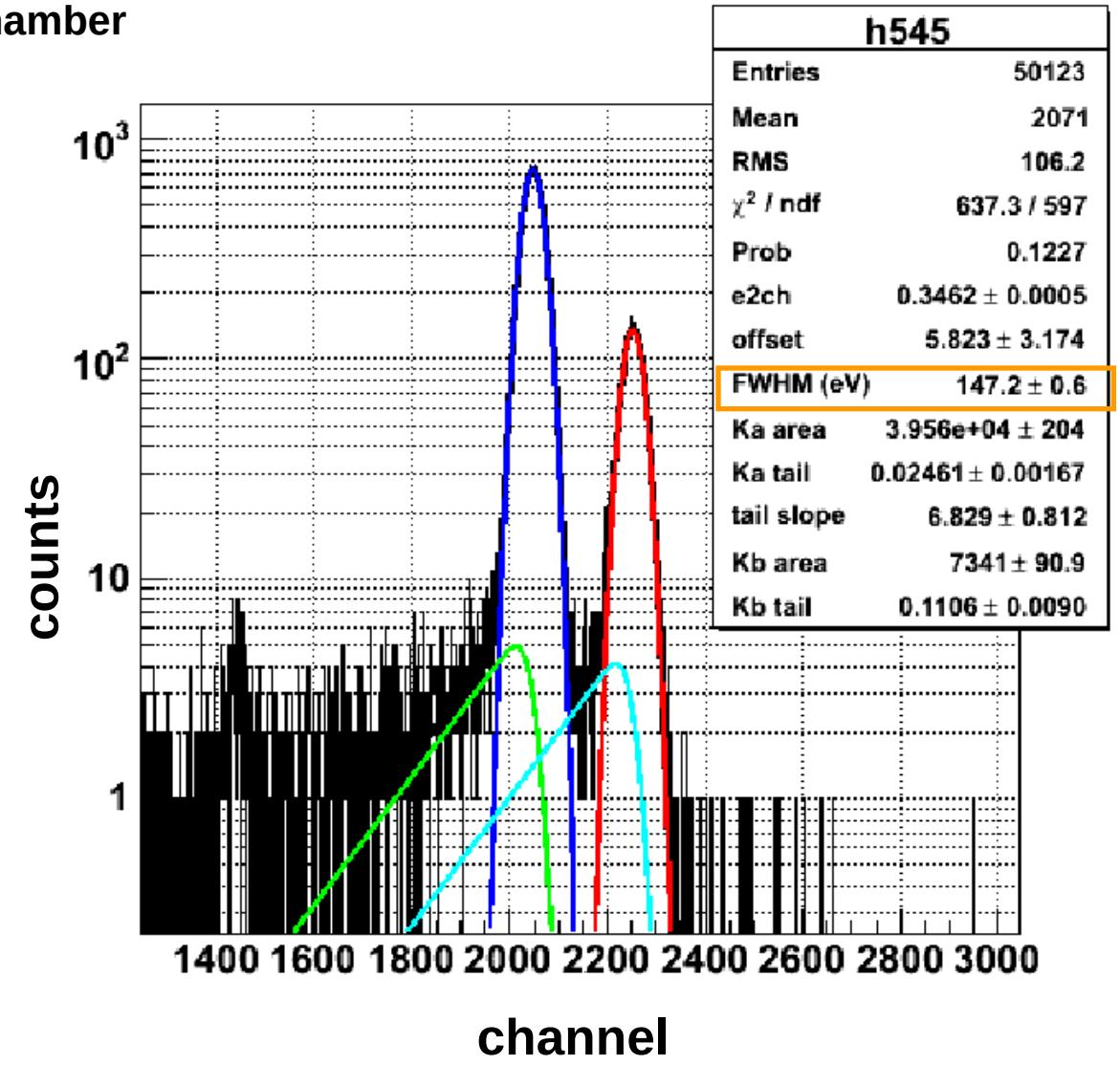
Resolution: ~150 eV (FWHM)

parameters

SDD housing T: ~ 140 K
preamp temperature
chip : ~ 246 K
cover: ~ 160K

HVs
R1 : - 20 V
RX: -130 V
Back: -60 V

Vsub = -5.5 V (from amp)



little trouble

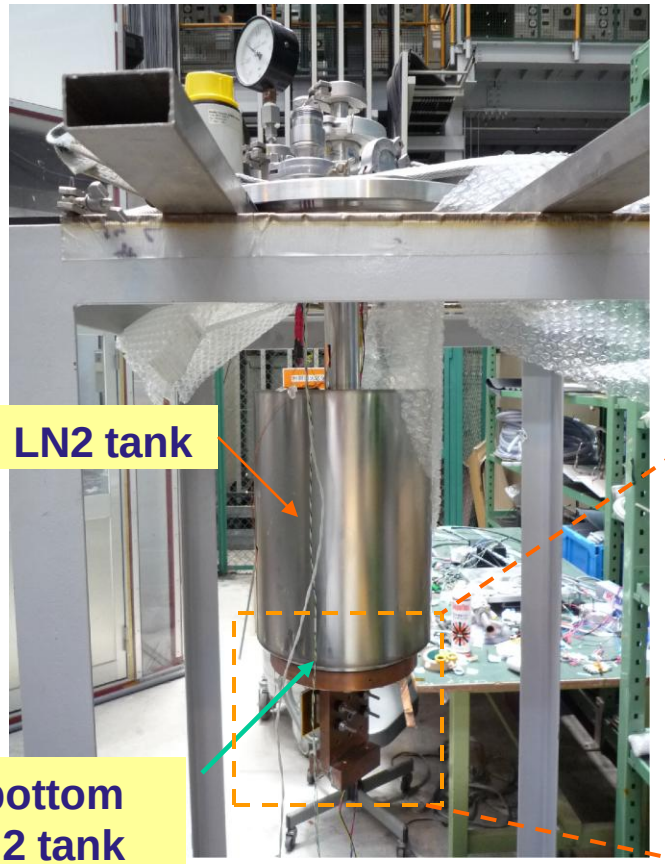
During measurement, vacuum level suddenly became worse up to 10^{-2} mbar

(thermal insulation vacuum was broken)

borrowed Helium leak detector from Ishimoto san

Leakage was found inside the cryostat

Disassemble cryostat



Vacuum level was recovered to 10^{-5} mbar w/ the help of Iio san & Ishimoto san

Preamp temperature dependence

Go back to measurements

Check the resolution Tamp dependence

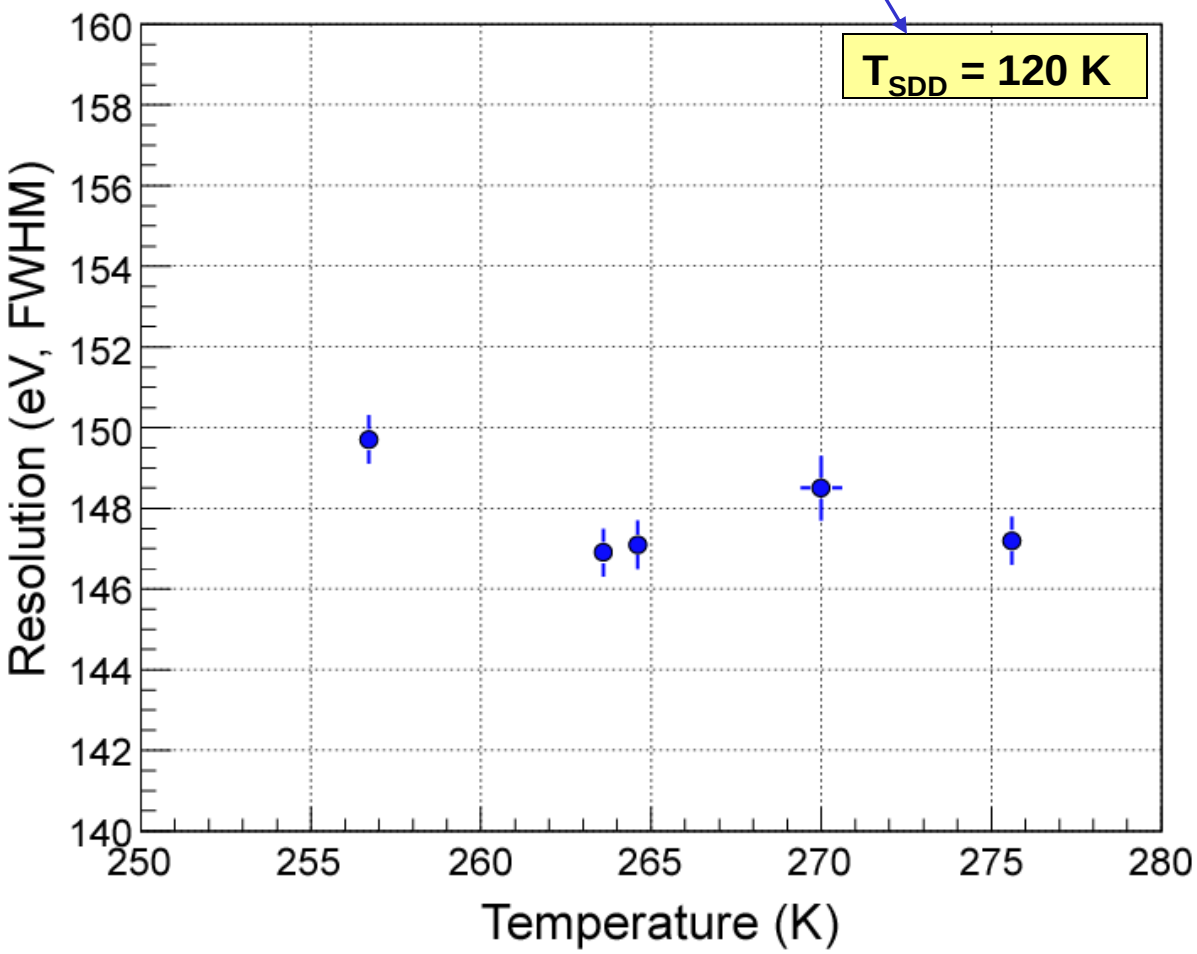
After disassembled cooing finger, T_{SDD} changed

We cannot decrease T_{chip} below 255 K

Around 255 -275K

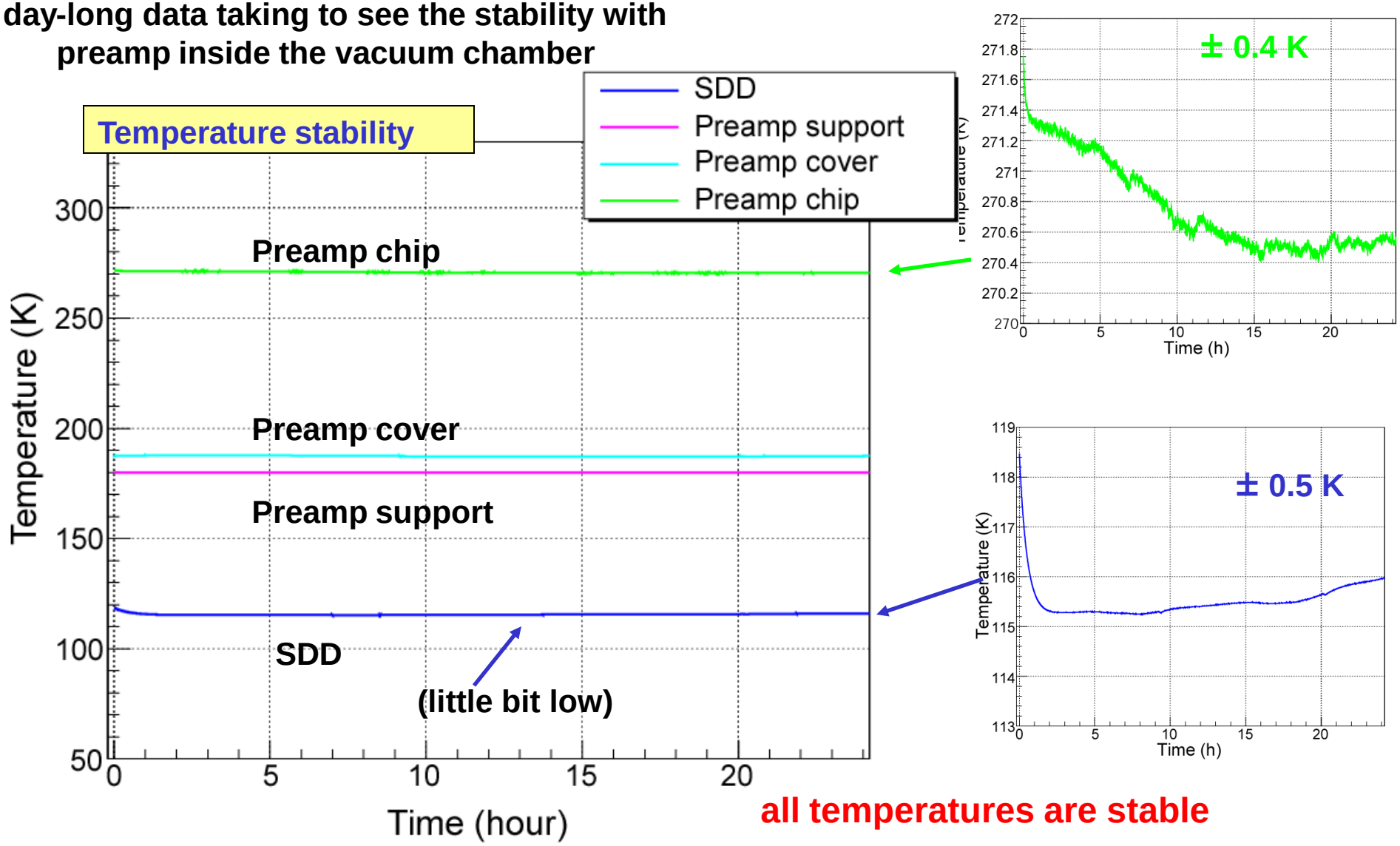
Constantly ~ 150 eV

Looks no dependence (or very small)



Stability : day-long measurement

day-long data taking to see the stability with preamp inside the vacuum chamber

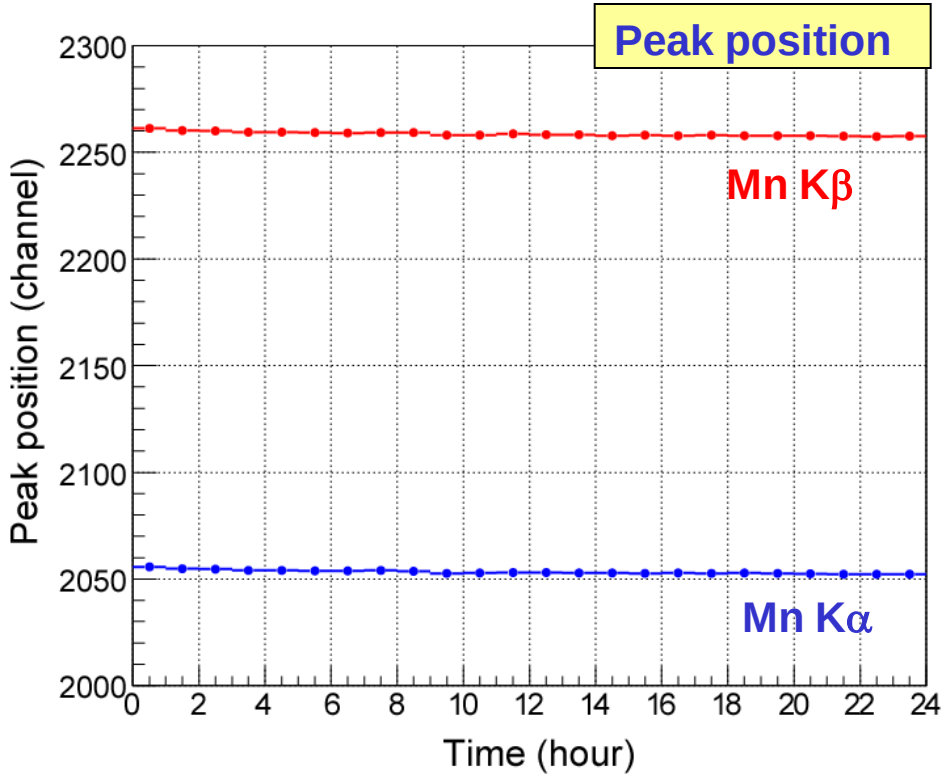


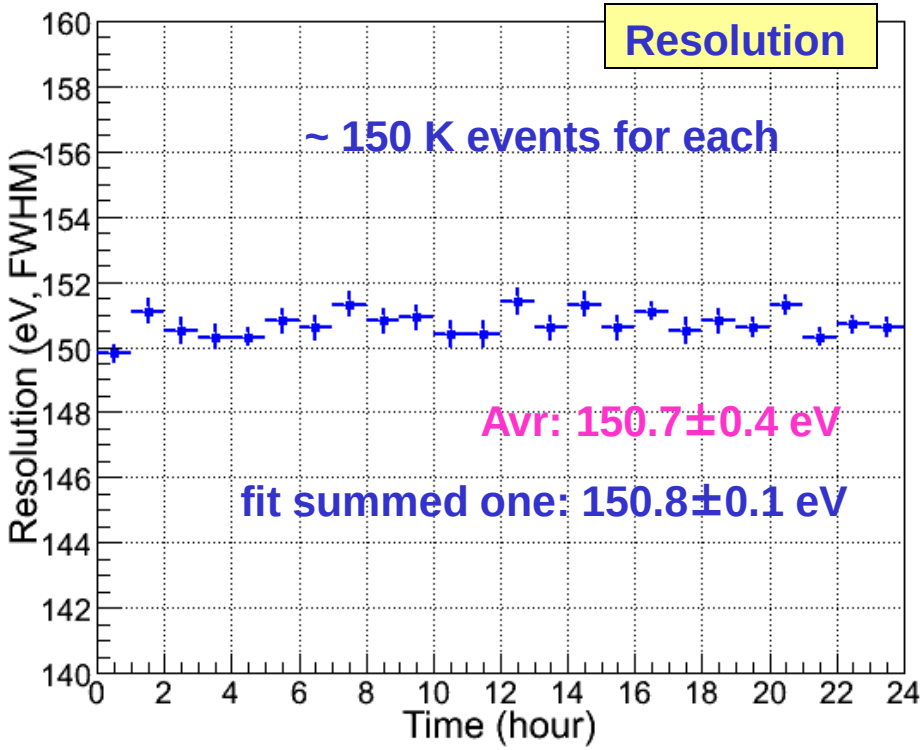
all temperatures are stable

(no surprises inside the vacuum)

Stability : day-long measurement

day-long data taking to see the stability with preamp inside the vacuum chamber





Resolution / peak positions are also stable even with preamp inside vacuum.

Summary

- Installation preamp inside the vacuum chamber

  → works well (resolution: ~150 eV in FWHM)
- Checked preamp temperature dependence, stability against day-long measurement

R&D with test cryostat is close to an end

remains

- ✓ Check SUB voltage dependence
- ✓ Try to decrease preamp temperature for the target operation

Next things to do

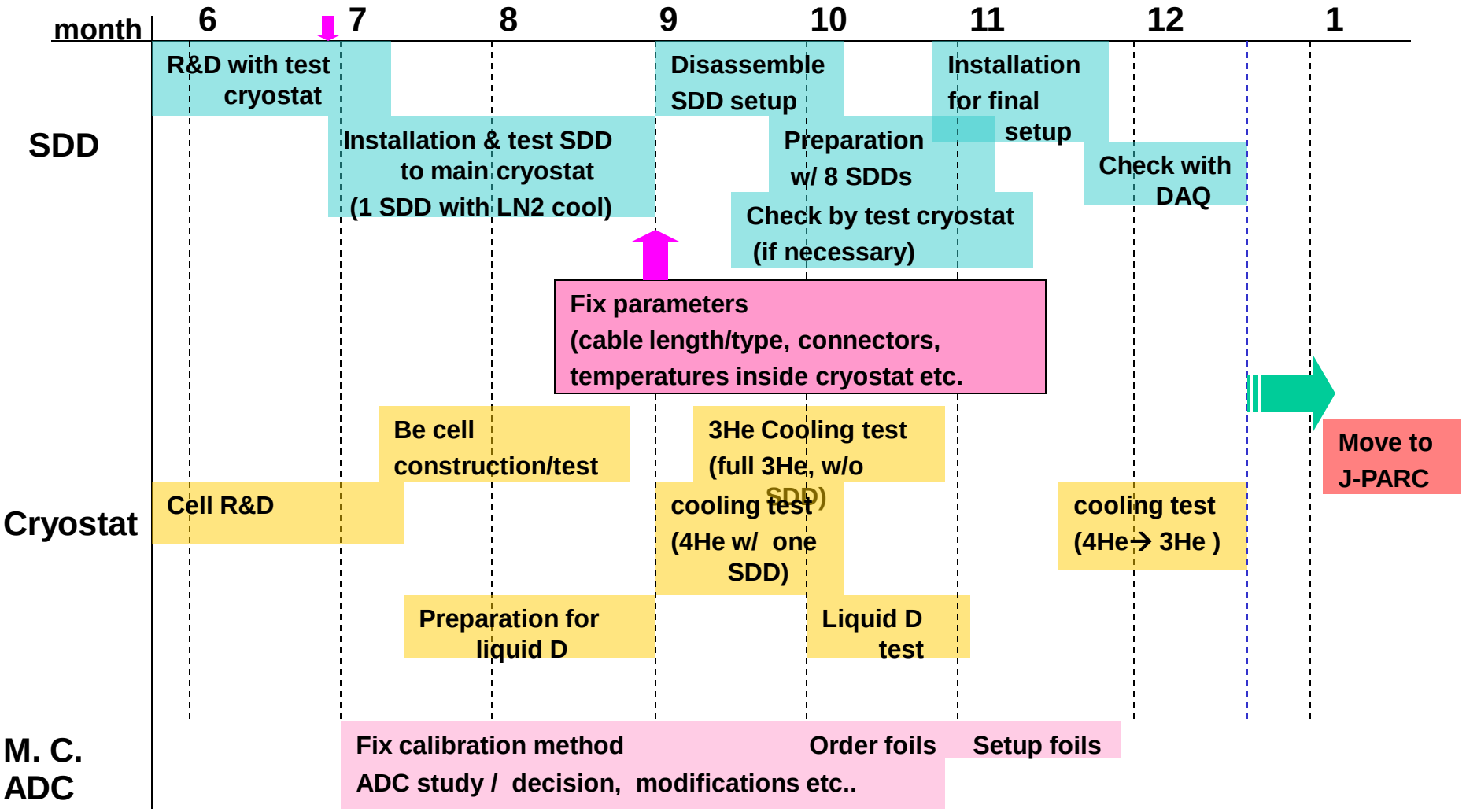
- Installation preamp inside the main cryostat
  - ✓ Decide final setting (cable length/type temperature map inside the cryostat)

near-future scheduling →

Tentative schedule

Assumption: become ready at KEK on middle of Dec.

: all the basic study/ preparation will be done in KEK



Miscellaneous

- request to SMI
  - ✓ Delivery schedule for 8 new SDDs

    after attachment RESET OUT circuit & check
  - ✓ If possible, deliver at least 1 SDD

    for cross talk check, backup, parallel test in test cryostat and main cryostat
  - ✓ Stay schedule in Japan?

    to join the installation SDD into the main cryostat

- module
  - ✓ CAEN shaping amplifier (N568b)

    only one module in KEK (~ 1300 K yen)

    not only for present test, but also for backup in the production run

    (I want to keep apparatus for test cryostat as possible)