

P.P., APD and PIN test report

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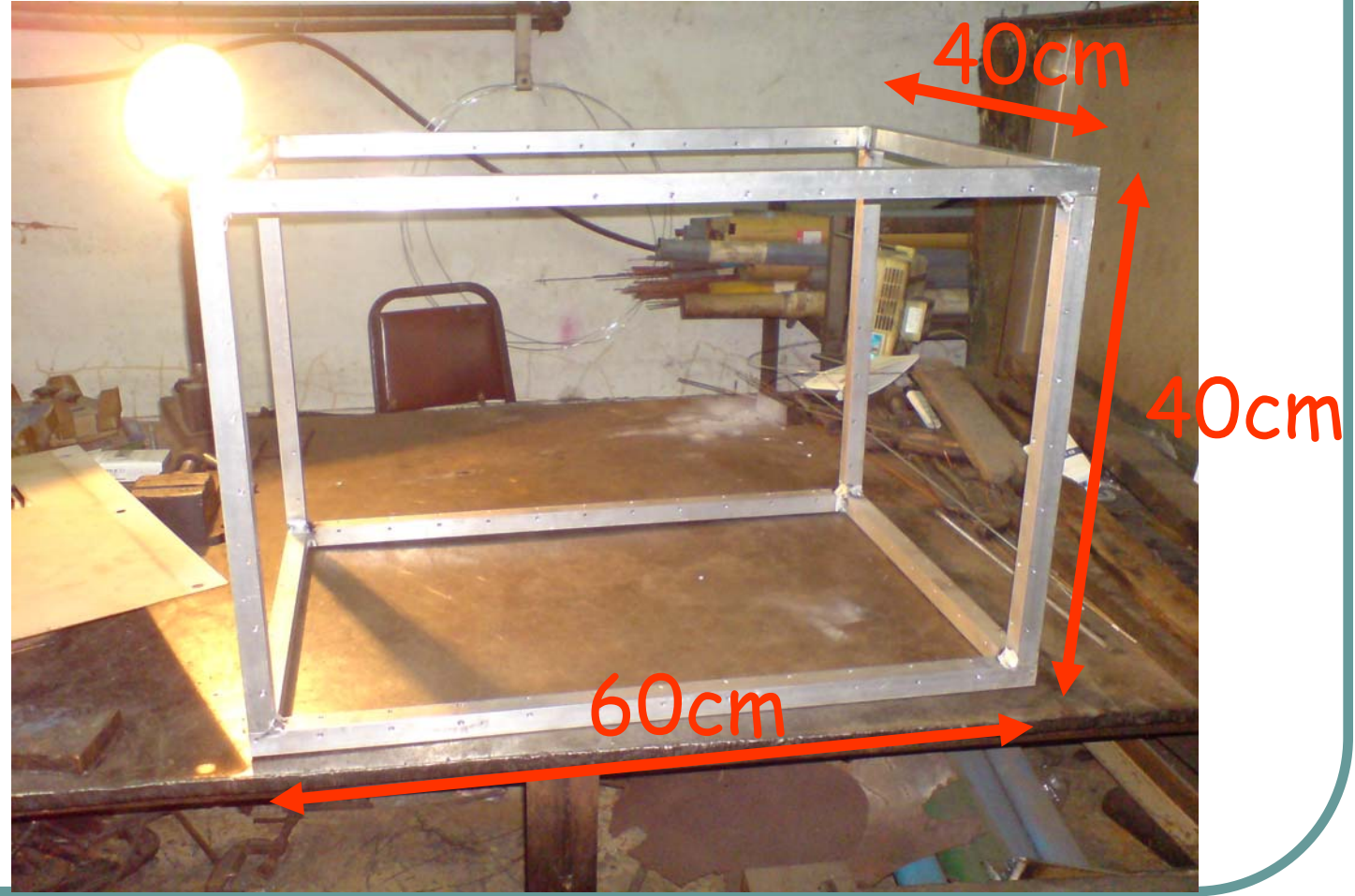
2008/July/04

Motivation

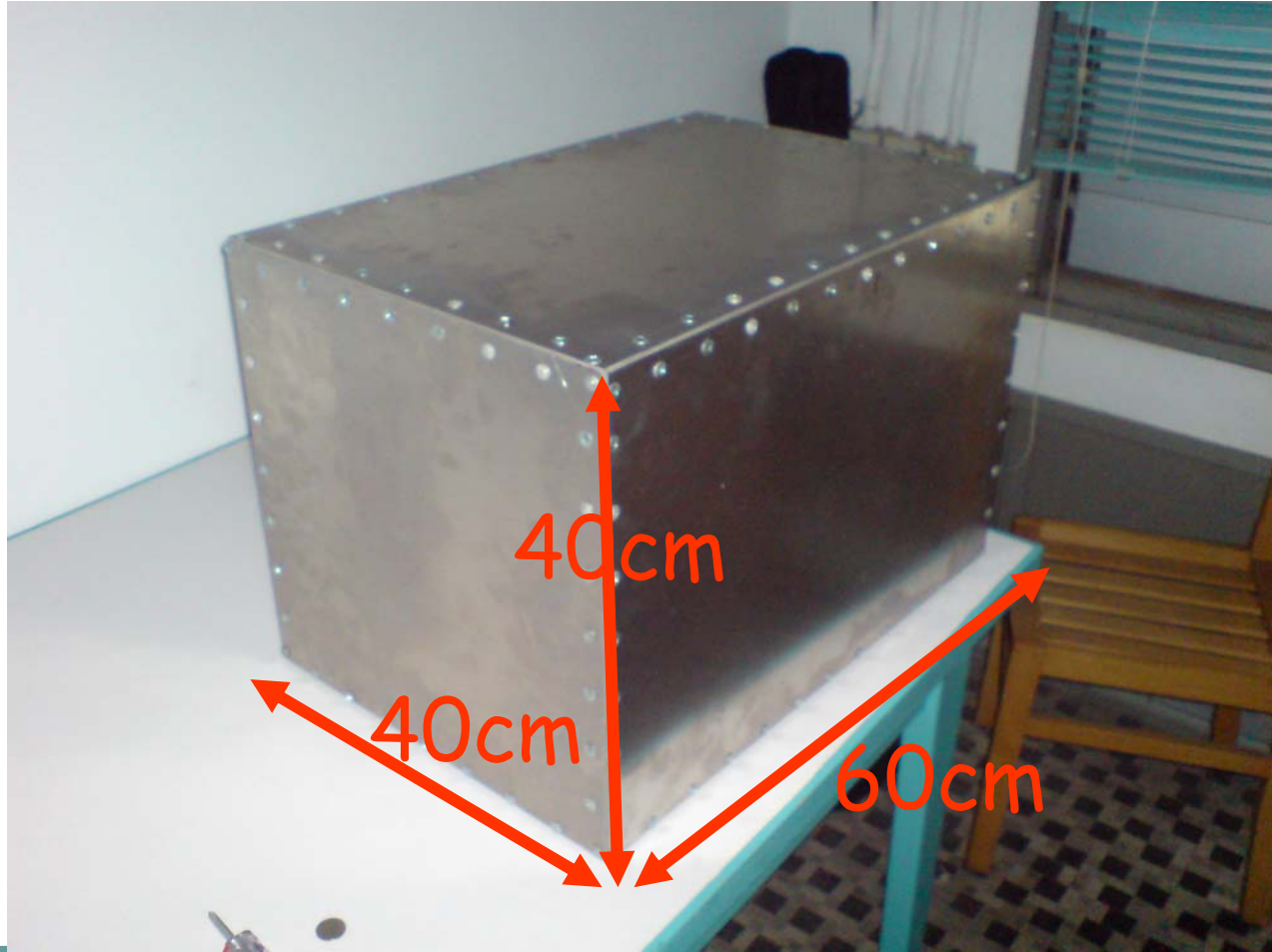
- We have two kind of samples aiming for the upgraded ECL (in super Belle).
 - **Photopentode (PP) x3**
 - **Avalanche photodiode (APD) x4**
- We hope to know the stability of their gain factors.

Make a black box for testing: picture1

Aluminum Framework: 40cm x 40cm x 60cm



Make a black box for testing: picture2

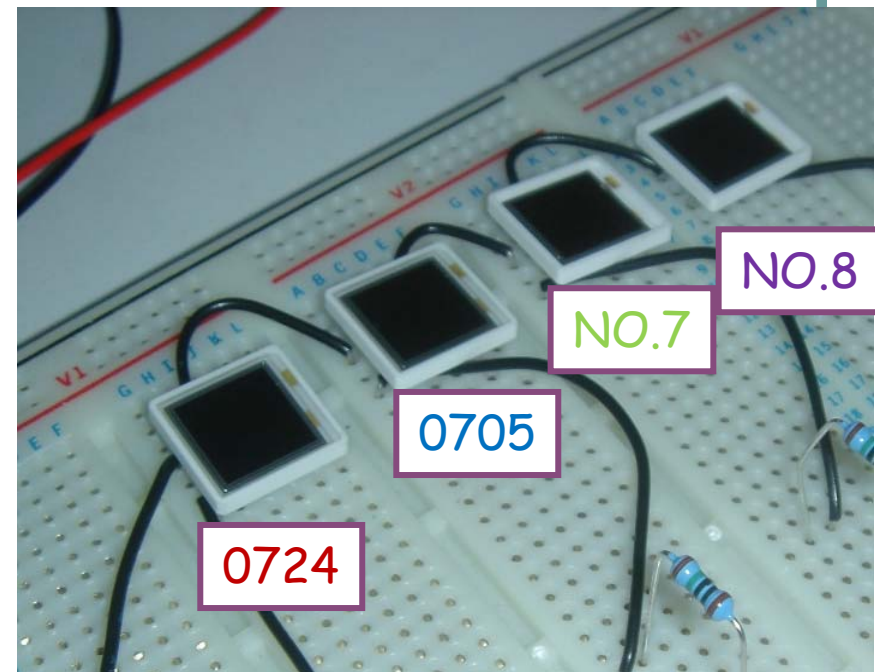


Samples

PP x3

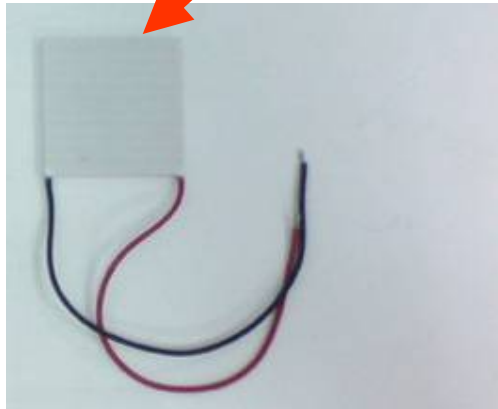


APD x4



Cool the air inside the black box

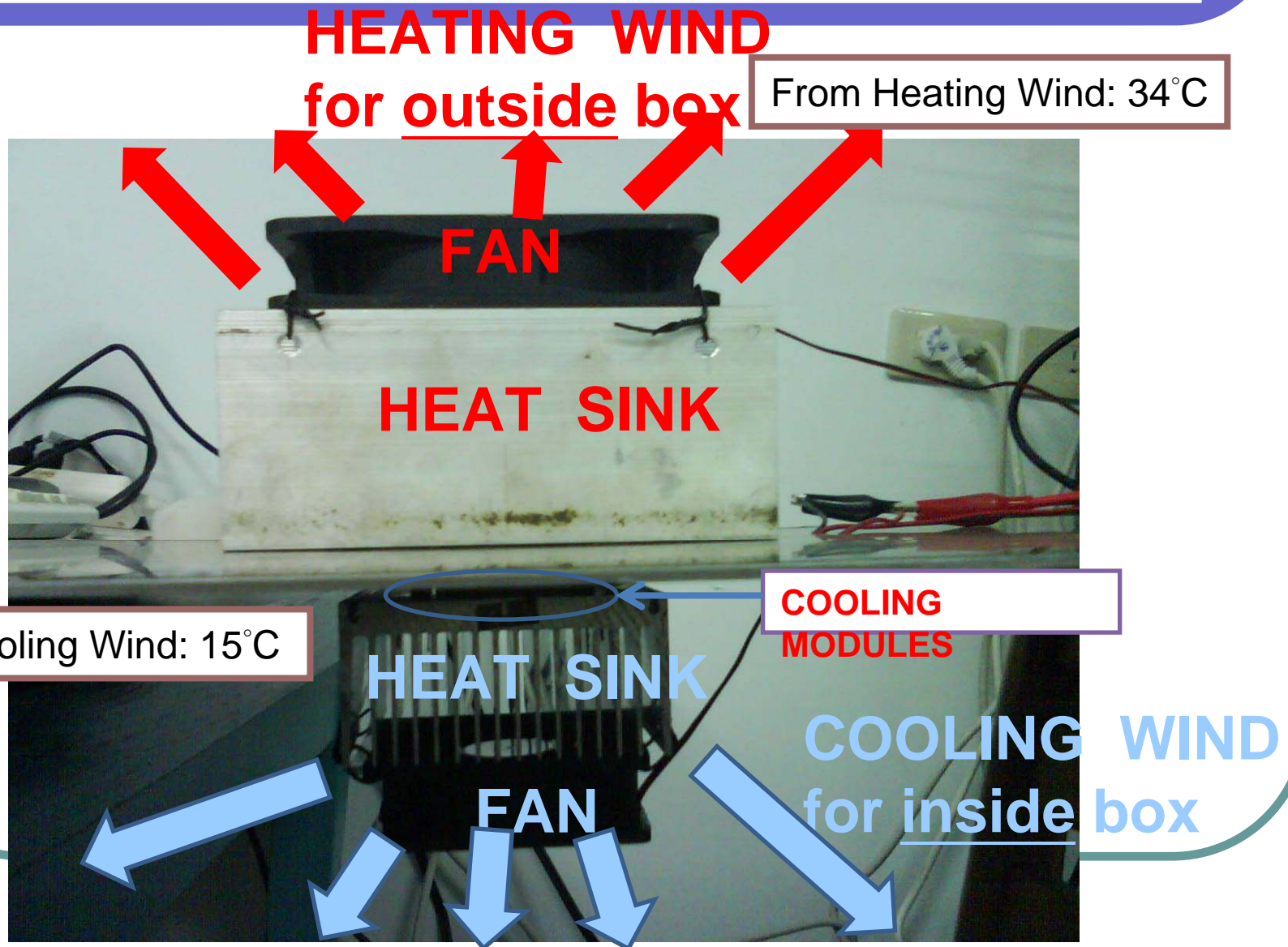
- In Taipei, the weather in summer is very hot. We hope to reduce the testing temperature. (similar as in KEK.)



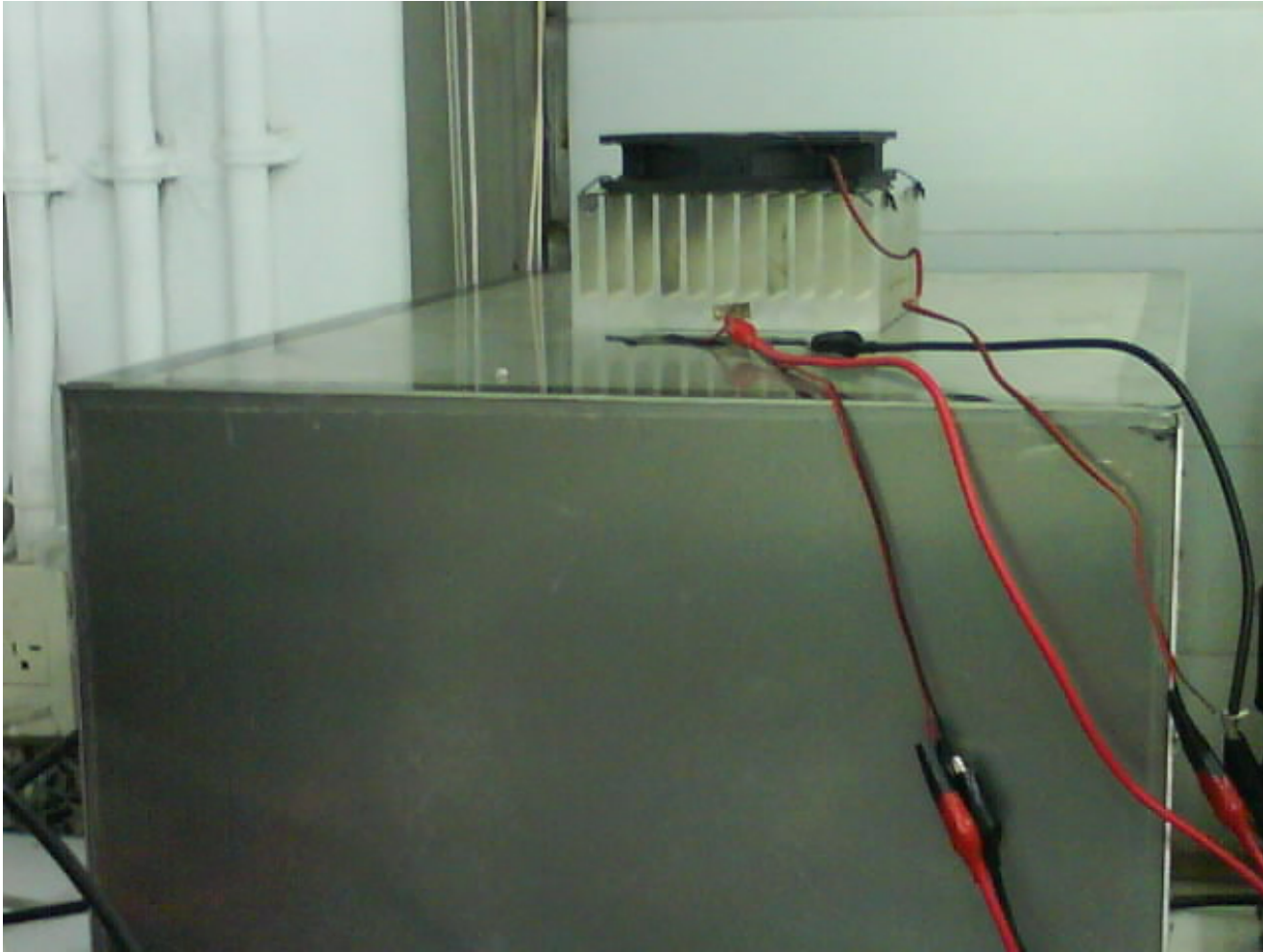
Cooling module: 15*15*3.3mm



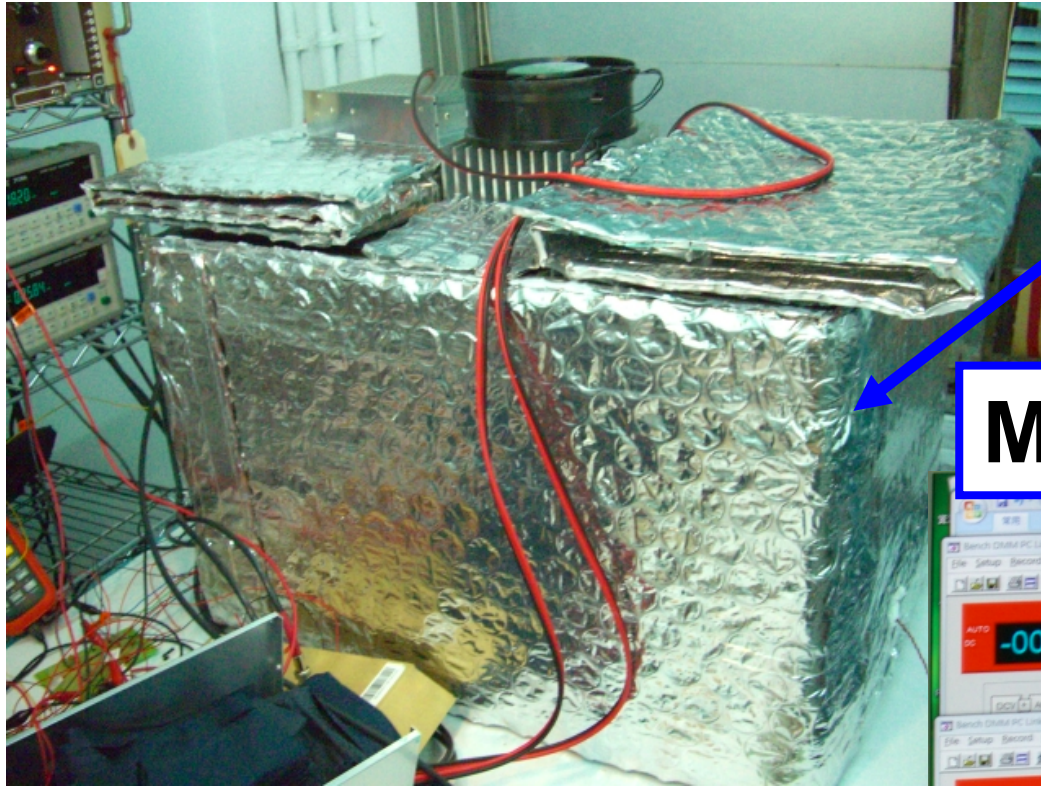
Cooling Setup



Black box with cooling module: picture3



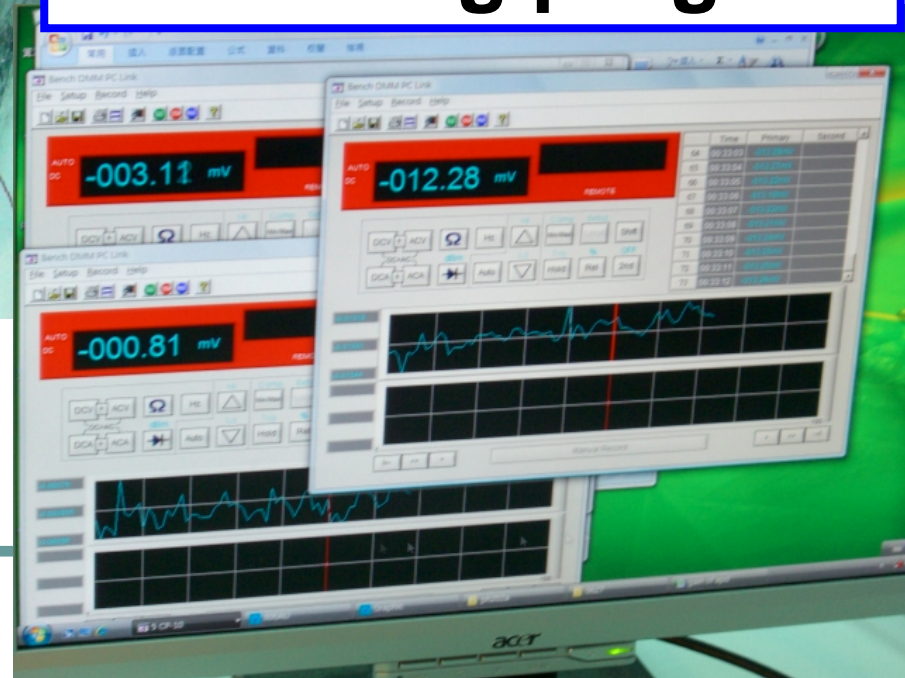
Black box with cooling module: picture4



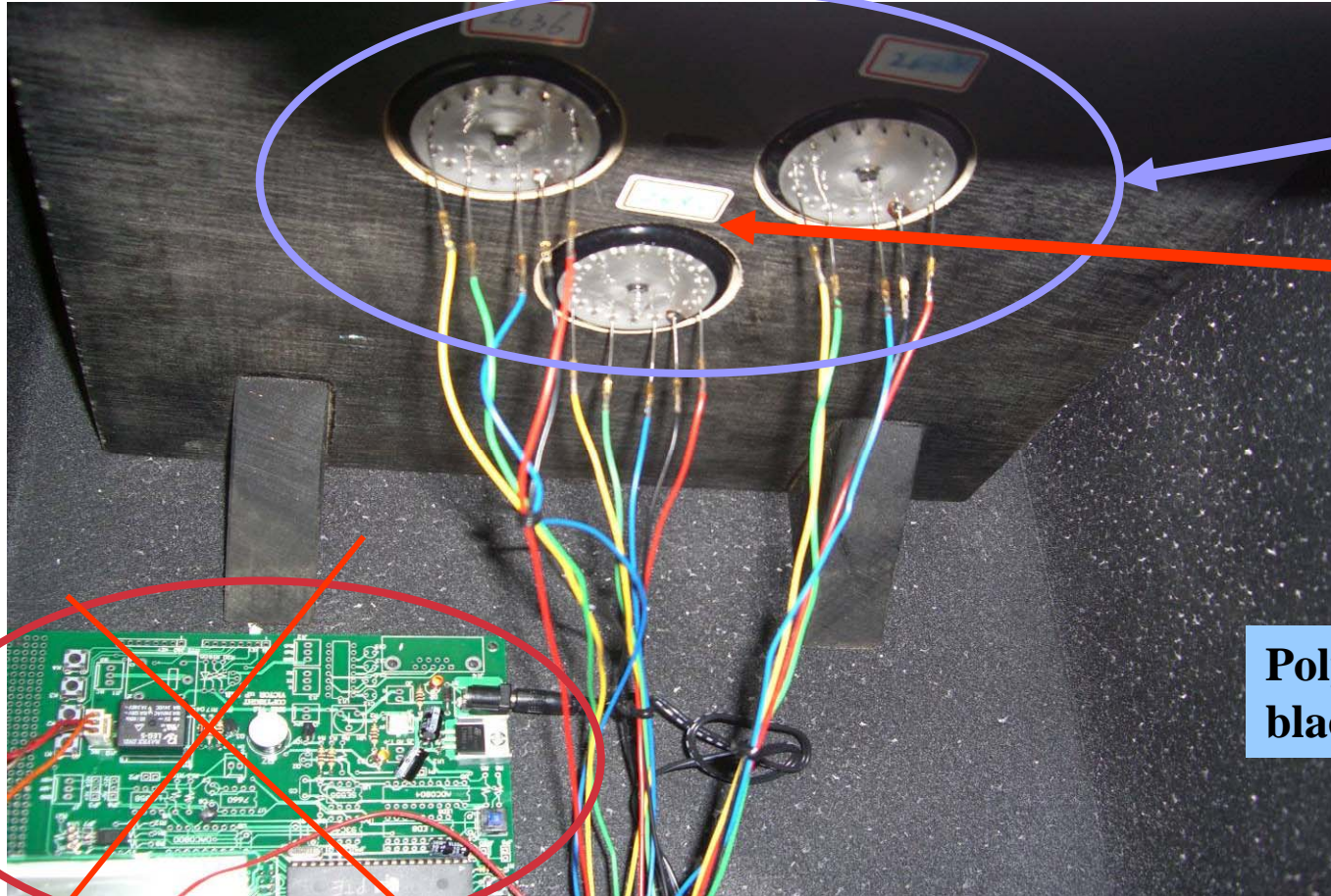
heat insulation blanket

Monitoring program

Black Box



Black Box1: PP inside

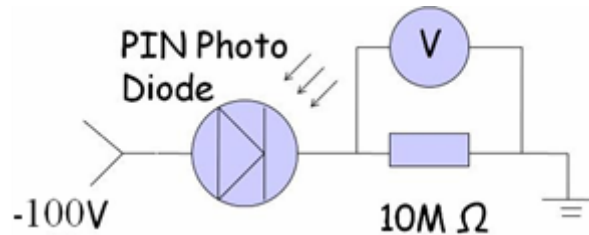


P.P.
PIN

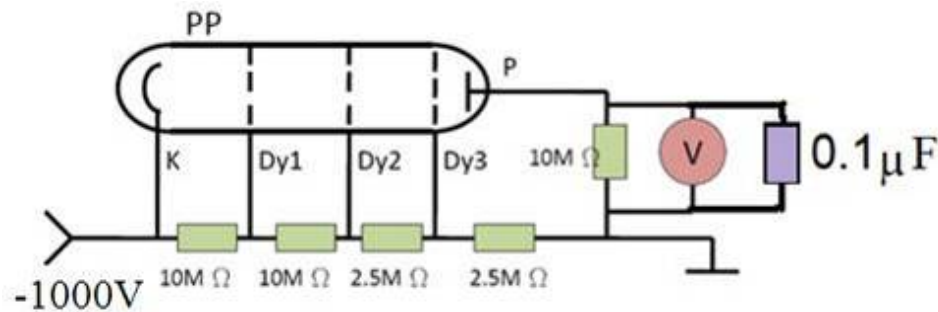
Polystyrene, coat with
black lacquer

Temperature control

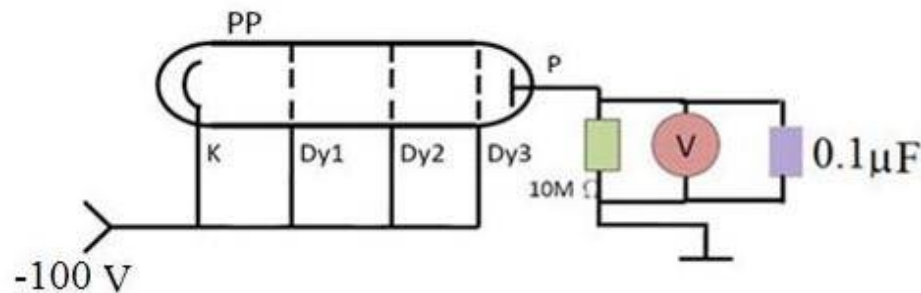
Circuits for PP



PIN CIRCUITS



PP PENTRODE
MODE (FIG1)



PP DIODE MODE
(FIG2)

Definition of Gain for P.P.

$$Gain_{PP} = \frac{V(\text{light} + 1000V)_{\text{pentrode}} - V(\text{dark} + 1000V)_{\text{pentrode}}}{V(\text{light} + 100V)_{\text{diode}} - V(\text{dark} + 100V)_{\text{diode}}}$$

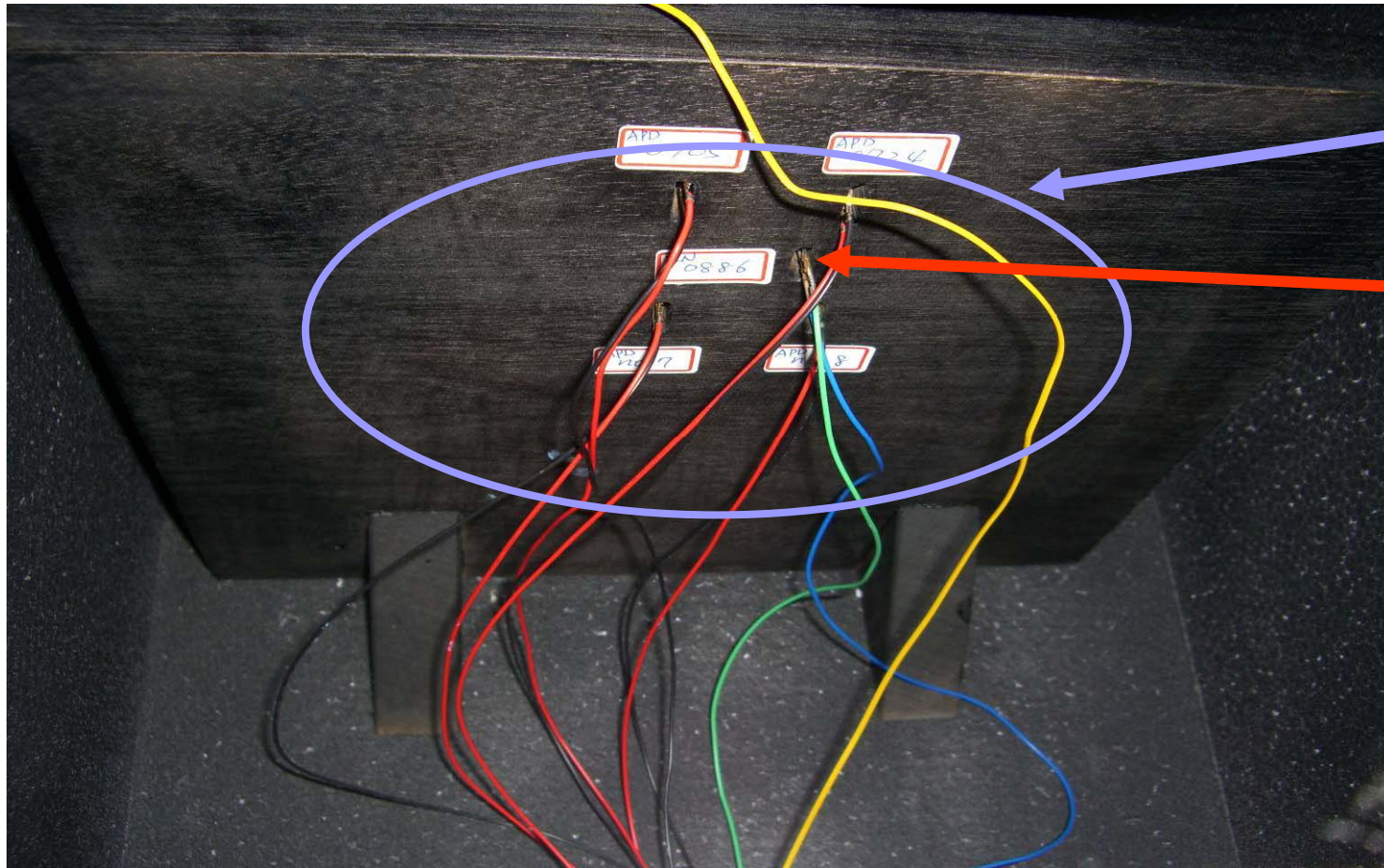
Results of P.P. (3 piece)

- We can't repeat our previous measurement results. Problem is

$$V(\textit{light} + 100V)_{diode} - V(\textit{dark} + 100V)_{diode} < 0$$

- After checking our circuits with Kuzmin-san, we found our diode-mode circuit was wrong. Now, we know how to fix it.

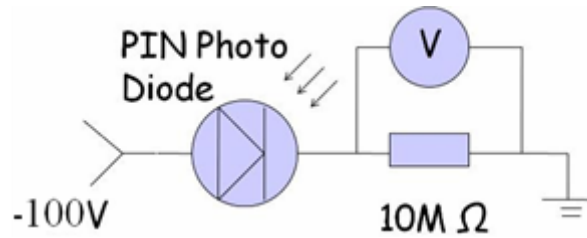
Black Box2: APD inside



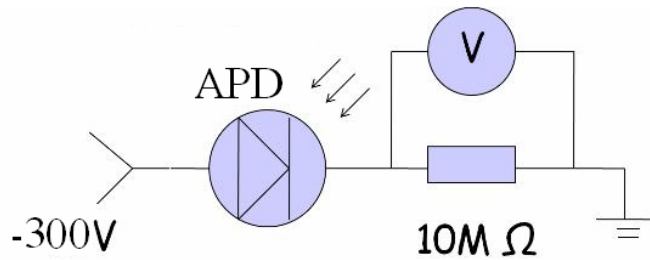
APD

PIN

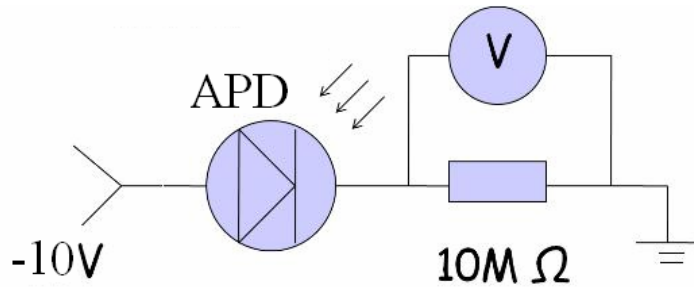
Circuits for APD



PIN CIRCUITS



APD High Bias Voltage



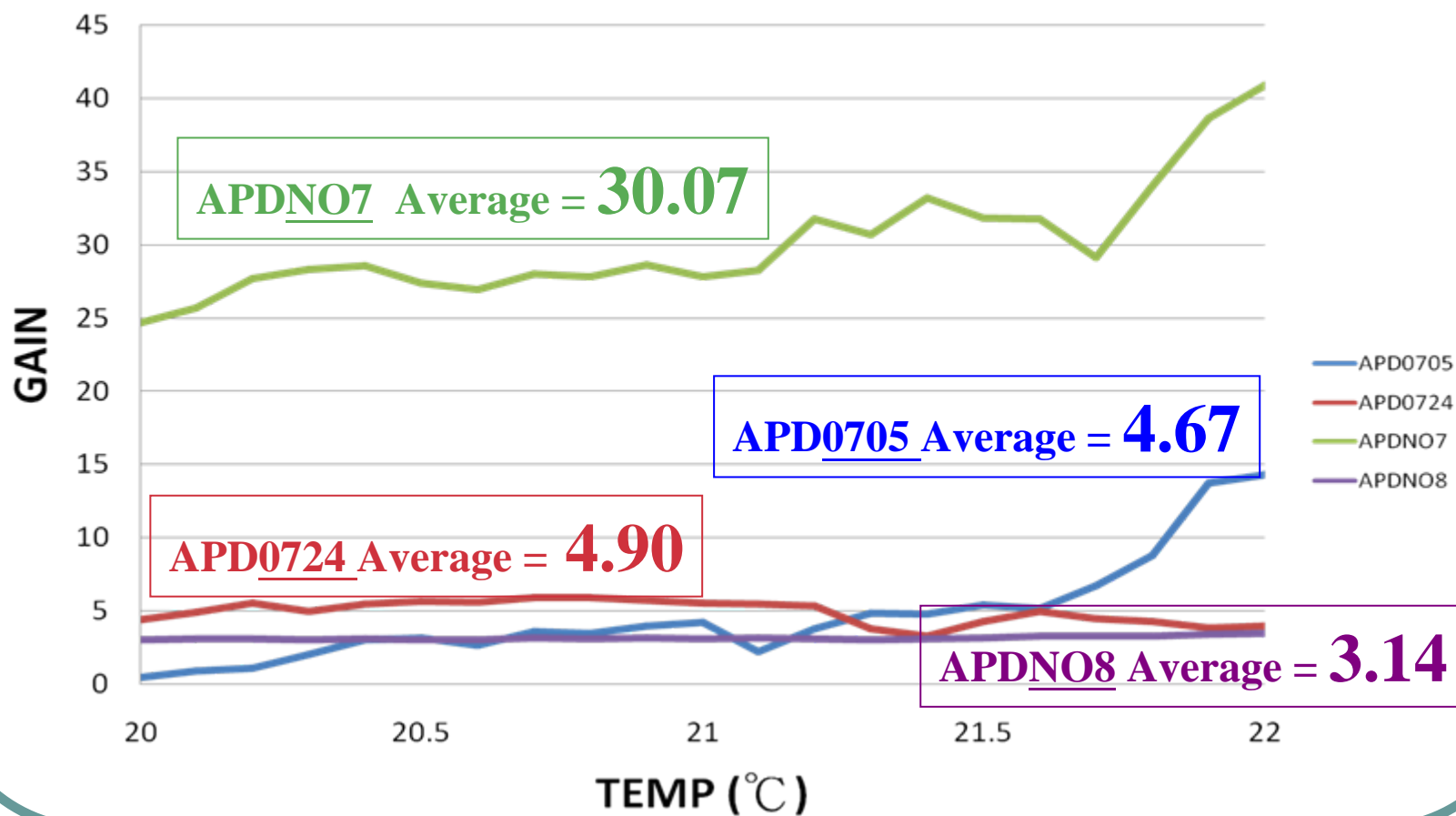
APD Low Bias Voltage

Definition of Gain for APD

$$\text{Gain}_{APD} = \frac{V(\text{light} + 300V) - V(\text{dark} + 300V)}{V(\text{light} + 10V) - V(\text{dark} + 10V)}$$

Results of APD (4 piece)

GAIN of APD

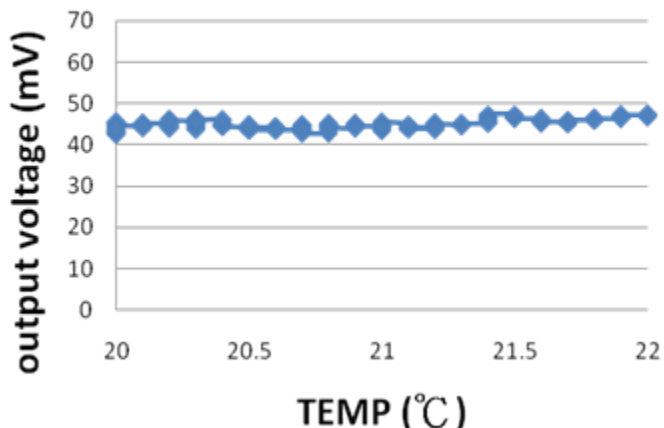


Results of APD (4 piece)

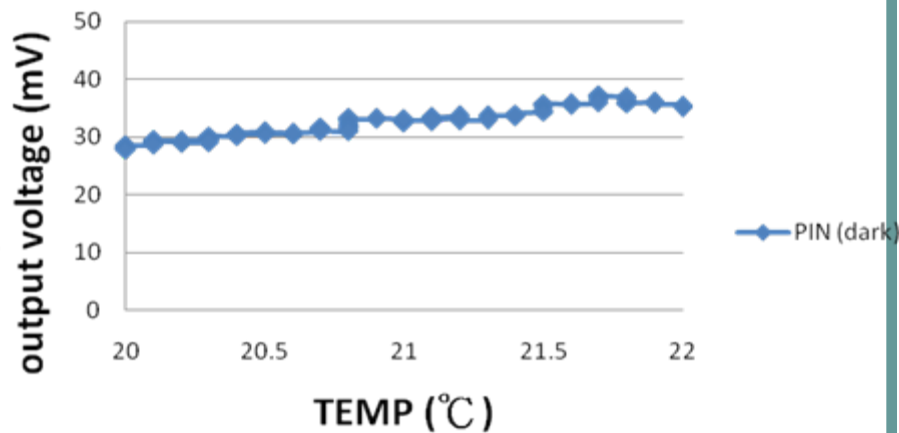
- It takes 20 minutes to finish the data taking.
- The data record period is 1s.
- The temperature precision is 0.1°C.

PIN & APD output voltage

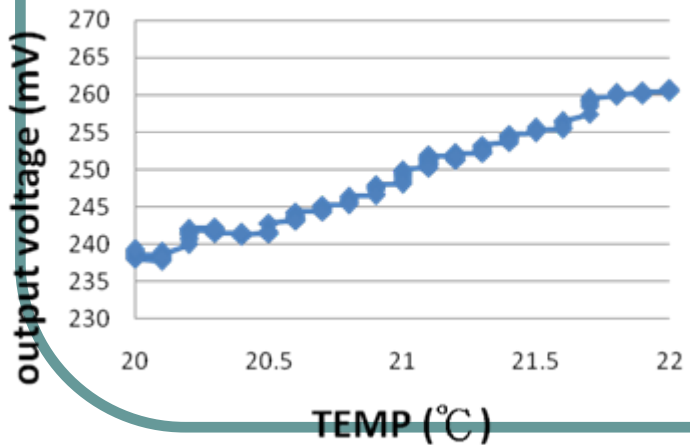
PIN (LED)



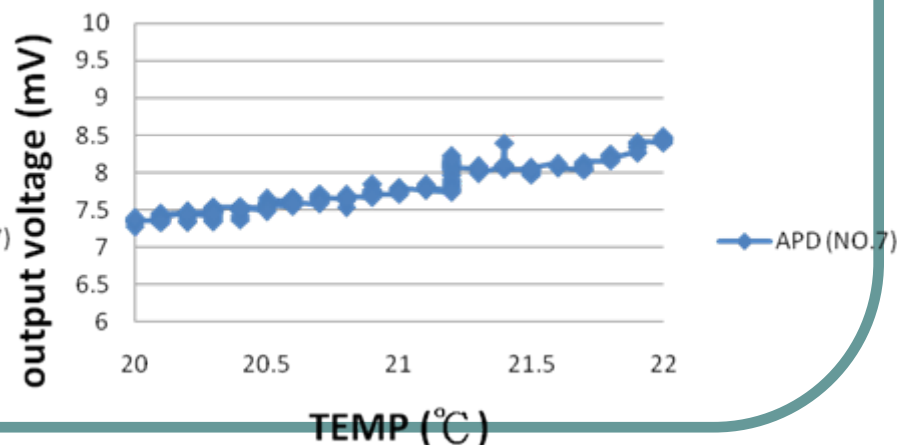
PIN (dark)



APD (NO.7) 300V dark



APD (NO.7) 10V dark



Summary

- APD measurement is more or less normal.
- We met problems for PP measurement. But we know how to fix it now.