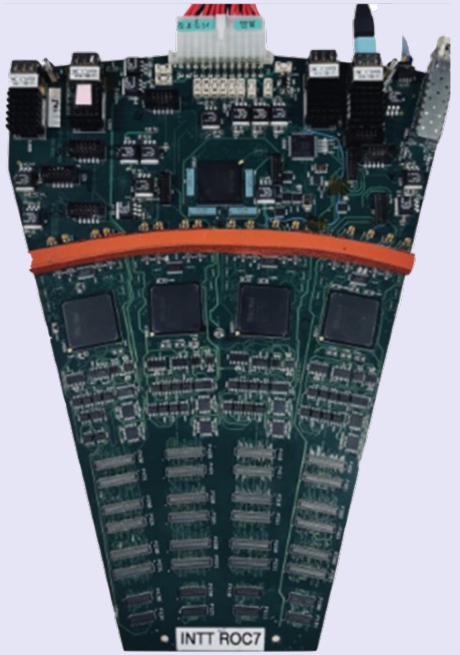
# Fakehit Research

Ryota Shishikura

# Motivation

1. Acquired data is contaminated by unwanted fake hits from open input ports of ROC board.

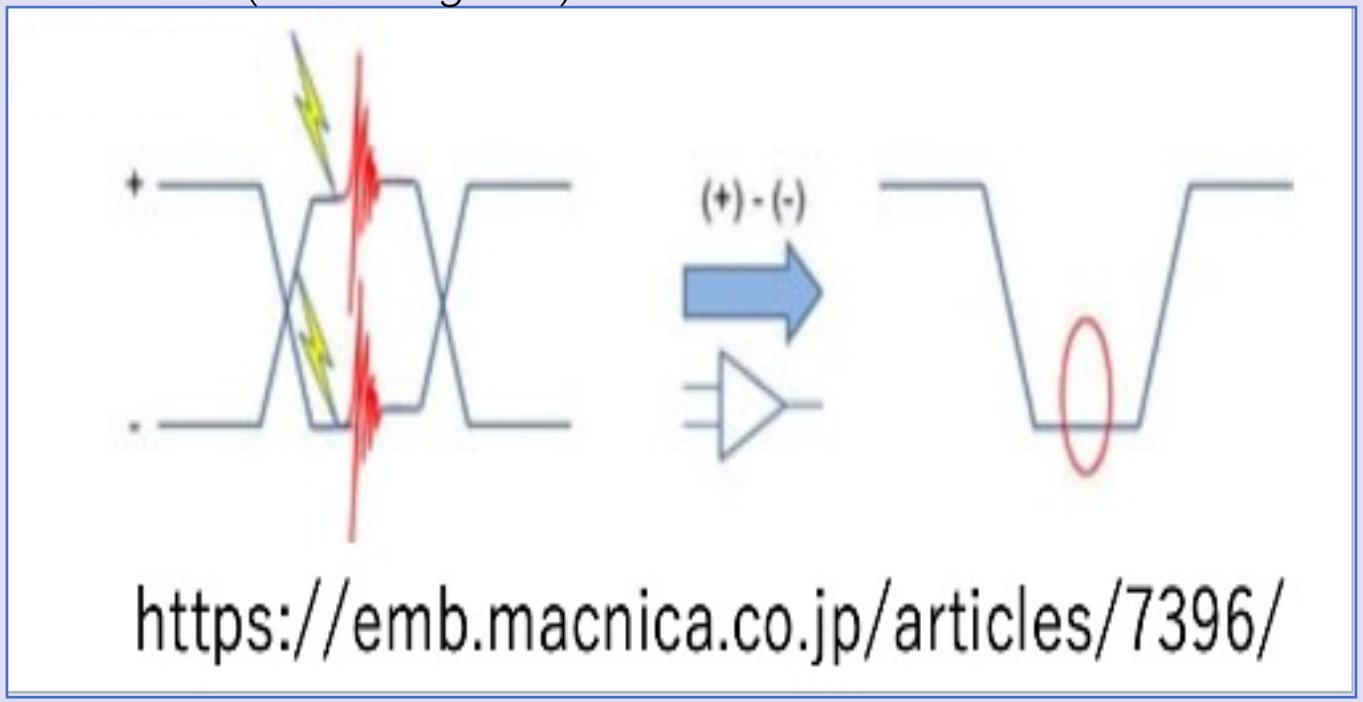
2. The goal of this study is to quench fake hits



# LVDS(Low Voltage Differential Signaling)

LVDS・・・A differential transmission method in which signals are sent Positive (+) , Negative (-) and the difference is output at the receiver.

Two lines (LVDS Signals)



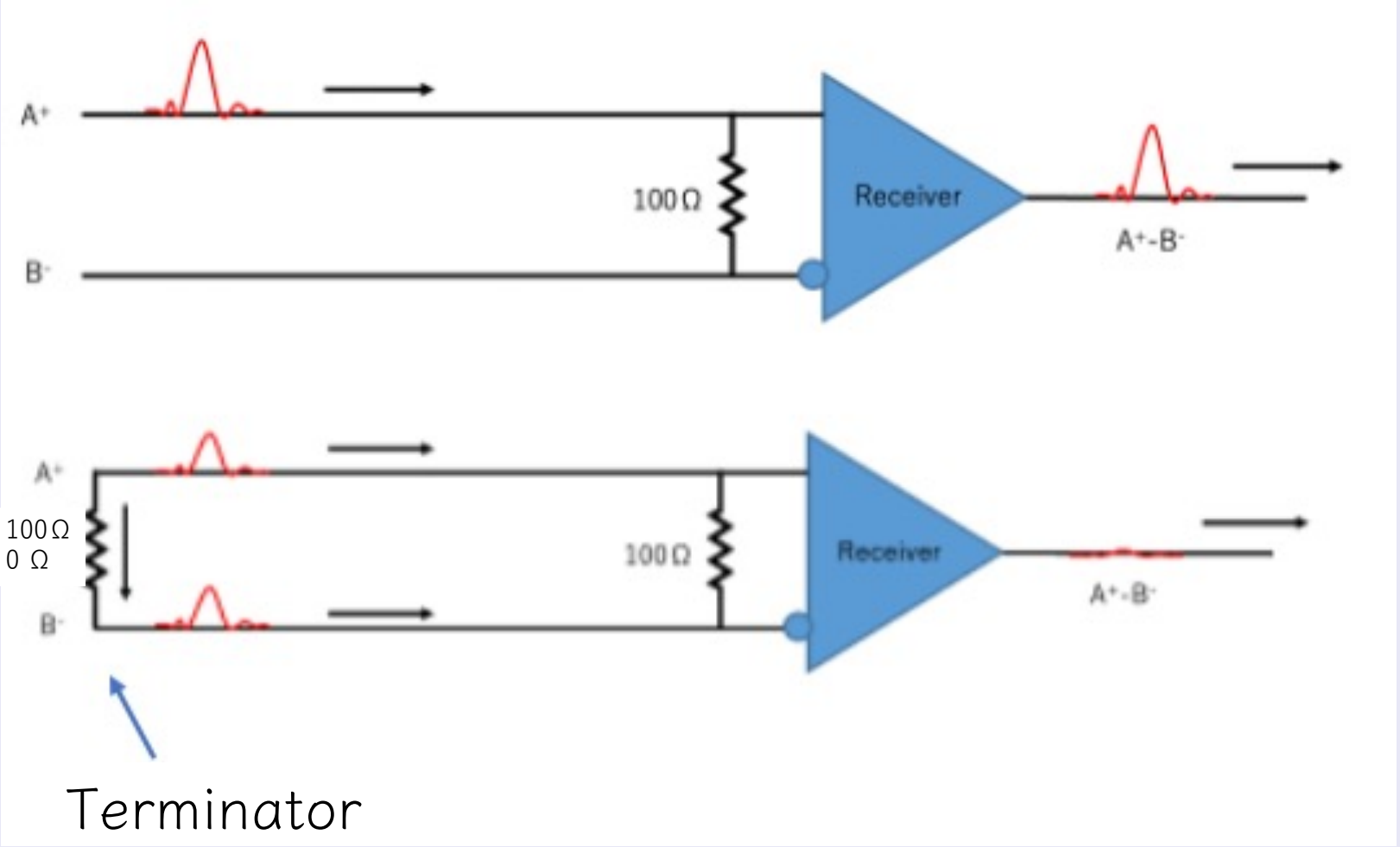

Cable is connected

If differential transmission picks up the same noise (common mode noise) on positive and negative signal lines, the noise can be canceled out when the difference is taken at the receiving end.

# hypothesis

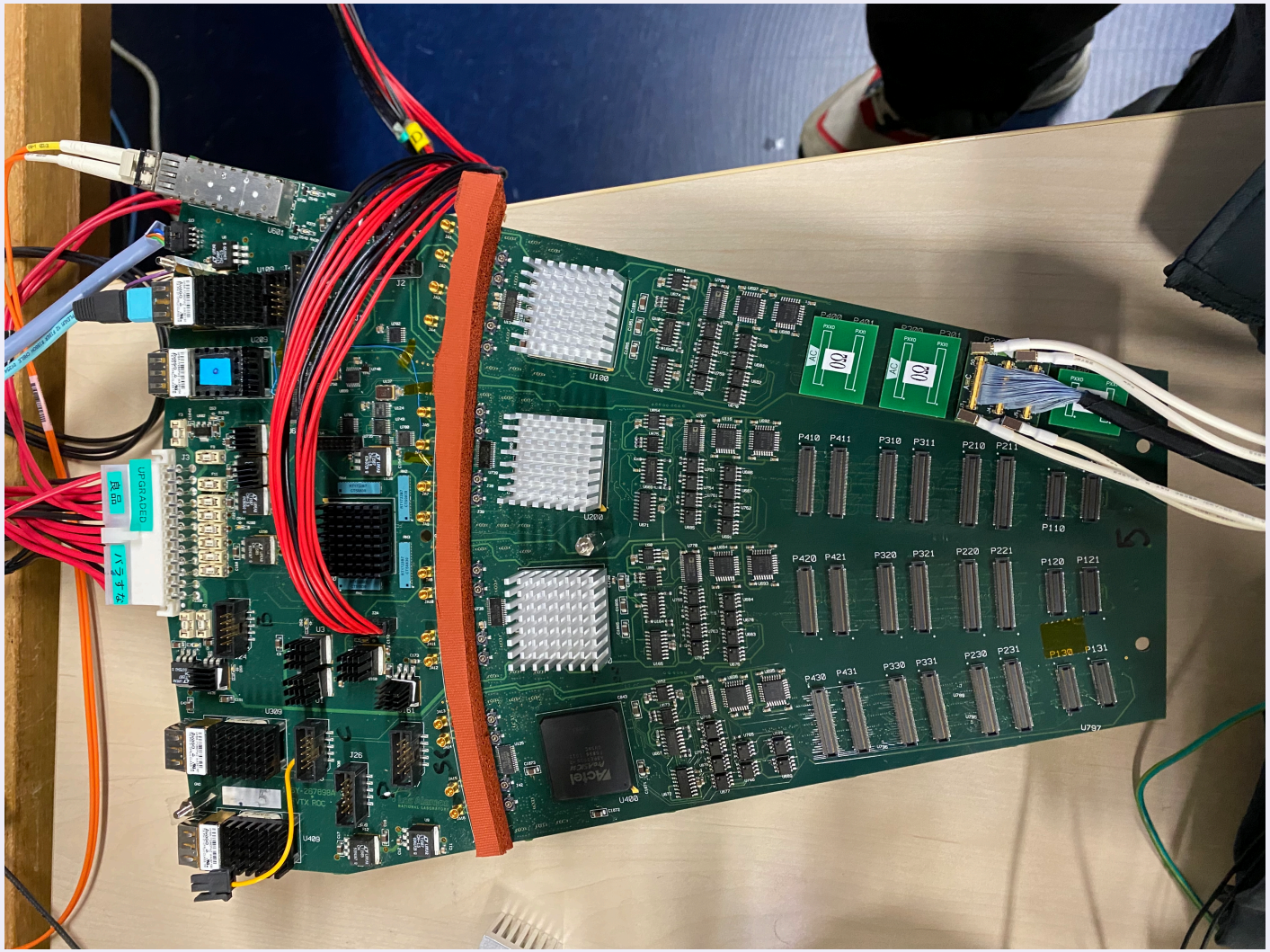
Connector

Cable is not connected

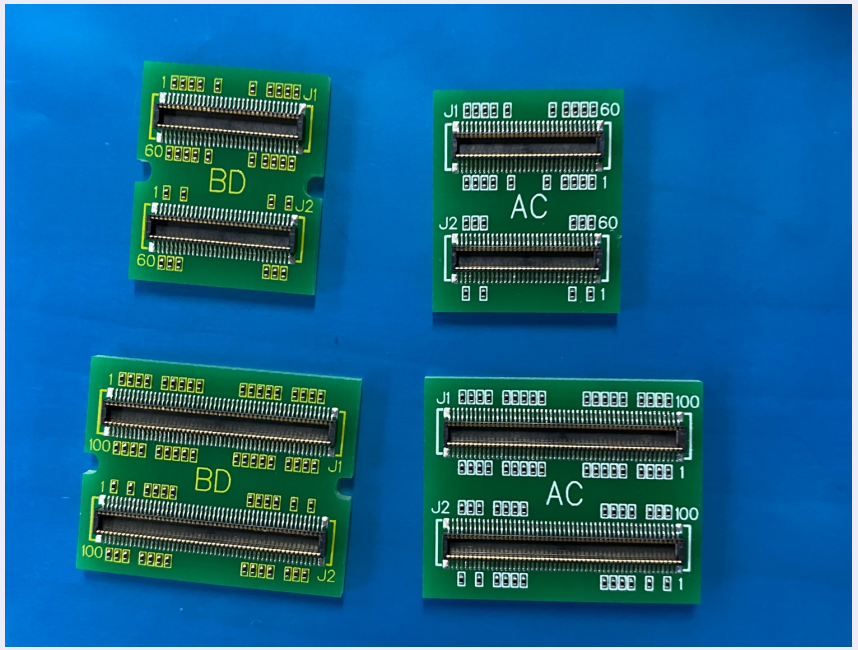



By attaching a terminator at the open end,
we force the noise to be in common-mode and let it cancel out at the receiver.

# Experiment



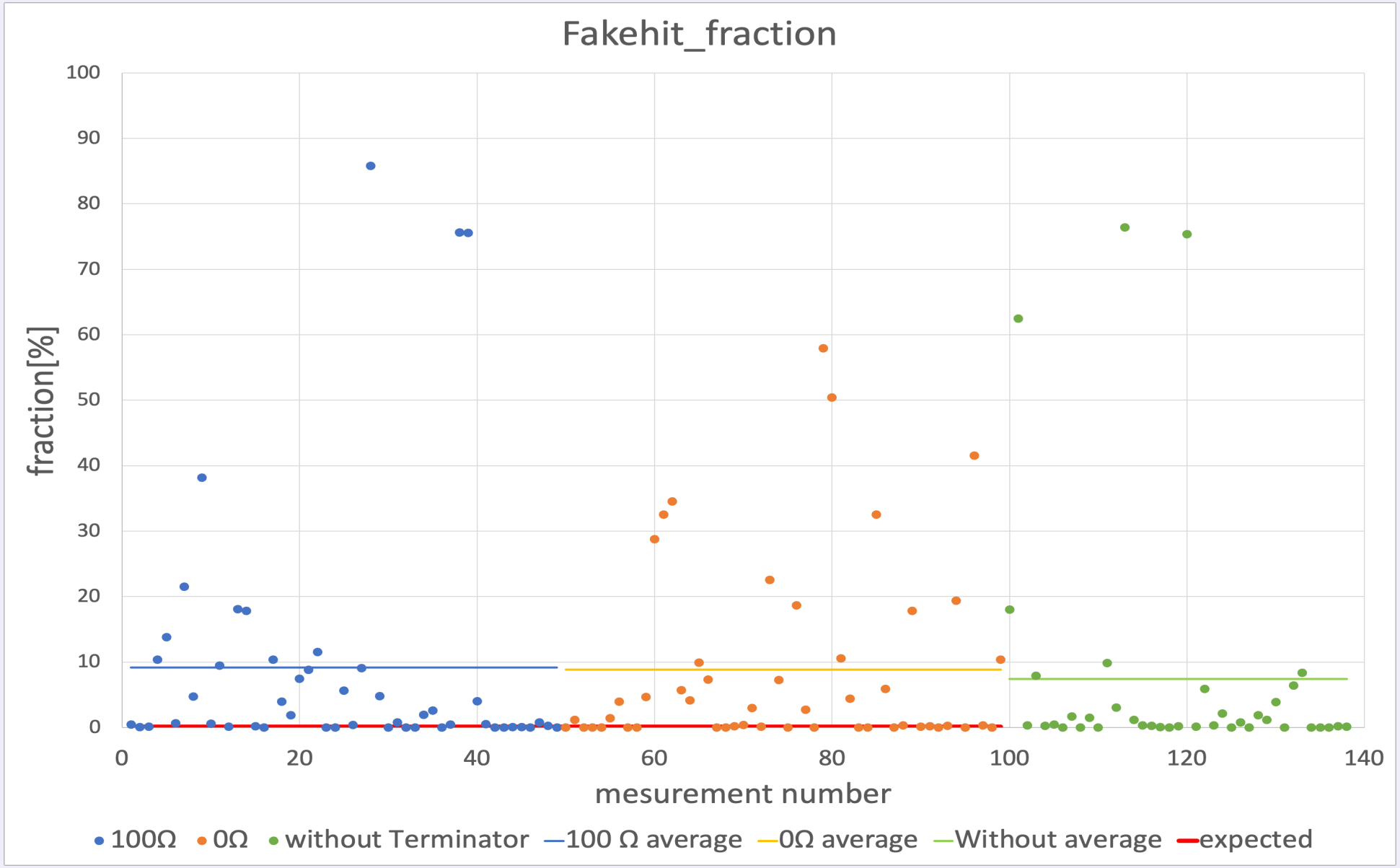
Back side




Calibration tests were conducted about 50 times each, and data analysis was conducted.

Two types of termination resistors, 100 Ω and 0 Ω were made as prototypes.

# Analysis

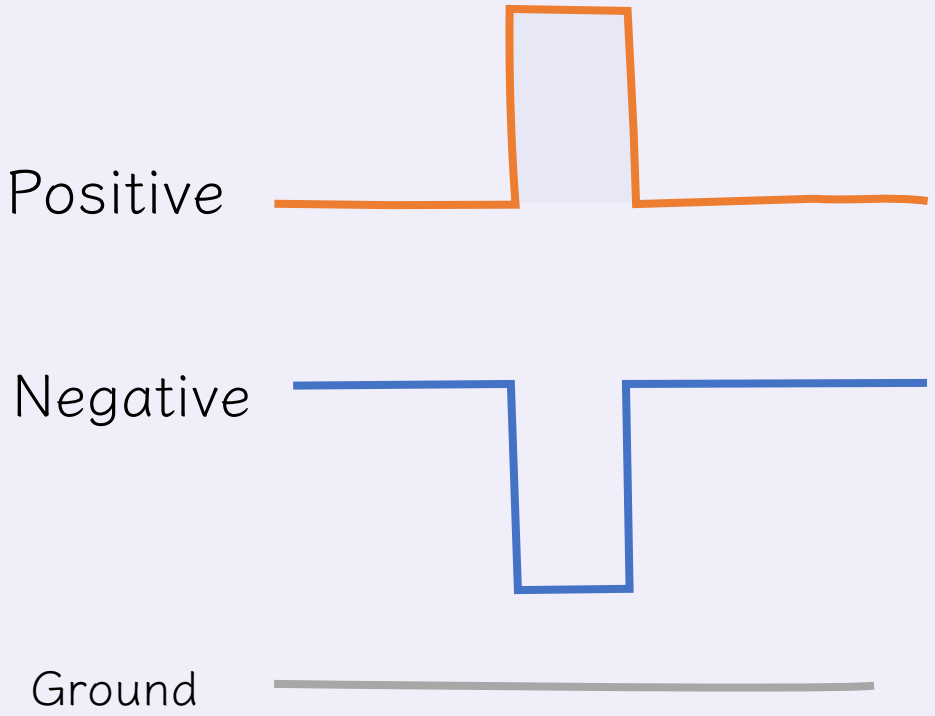



$$Fakehit\_fraction = \frac{Hits\ other\ than\ the\ port\ to\ which\ it\ is\ connected}{Total\ hits}$$

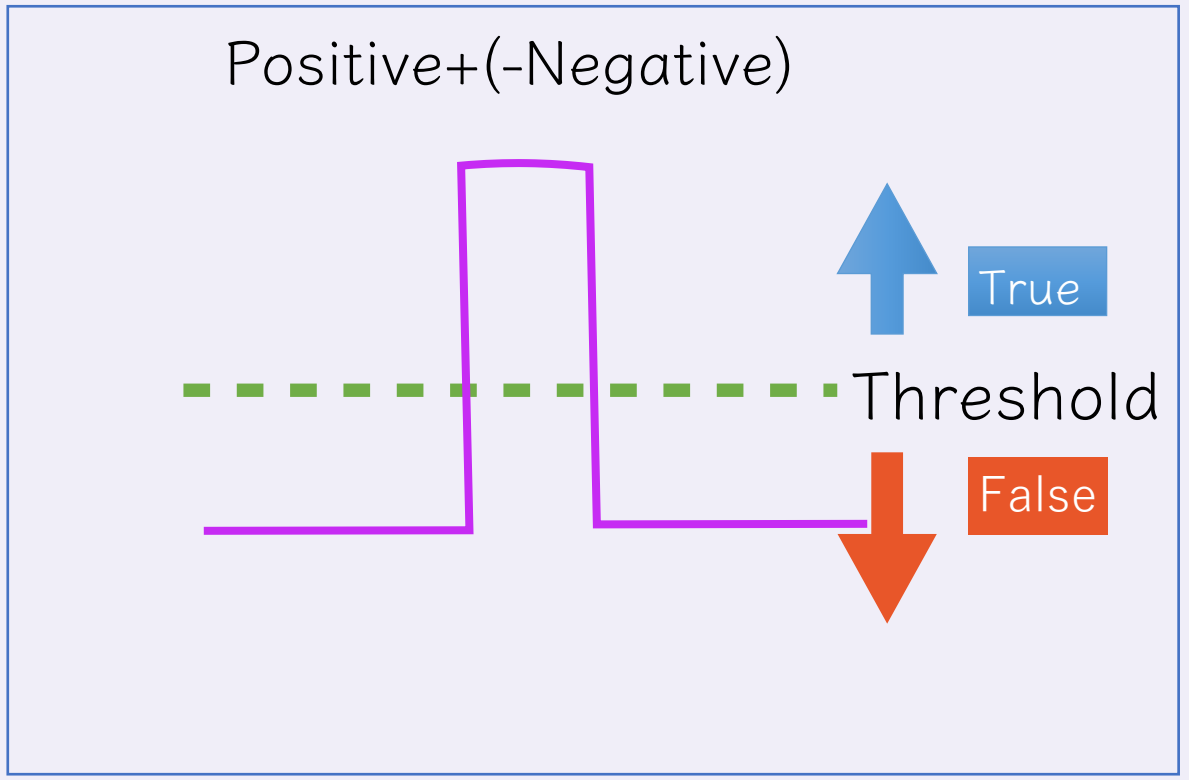
# Proposed new terminator

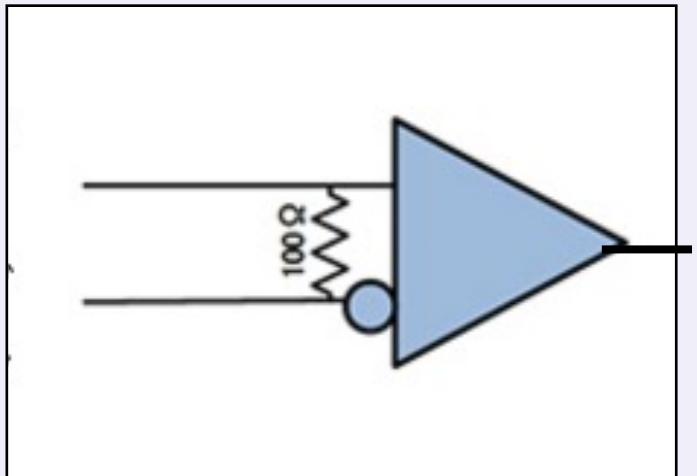
# New Hypothesis

Normal(Cable is connected)




Receiver



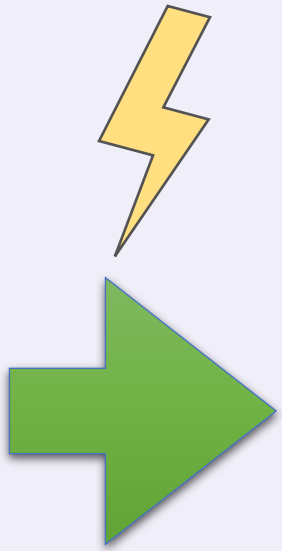
# New Hypothesis

Cable is not connected

Negative ?V

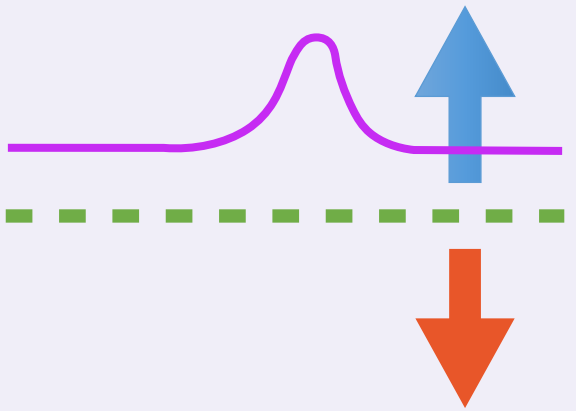
Positive ?V

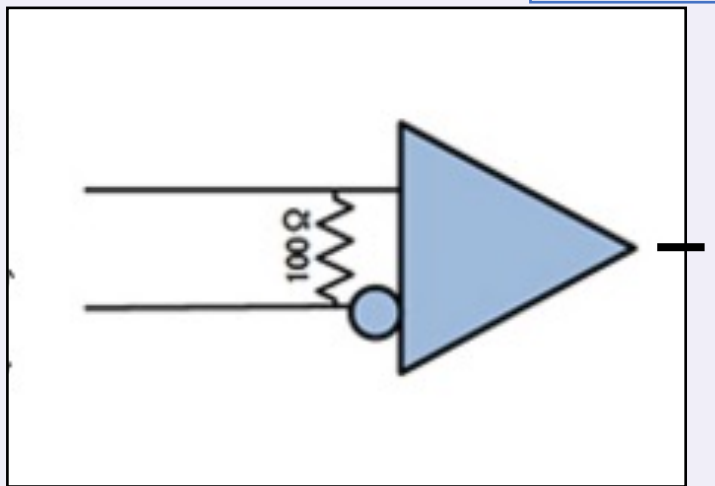
The voltage levels can be affected by the surrounding electromagnetic field because they are floating



Receiver

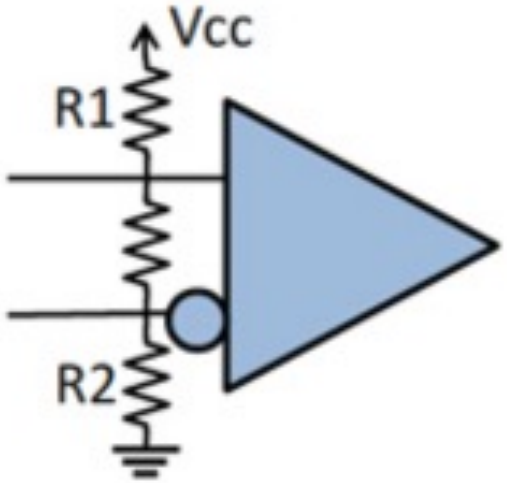
Positive+(-Negative)




Voltage is unstable

# Proposal



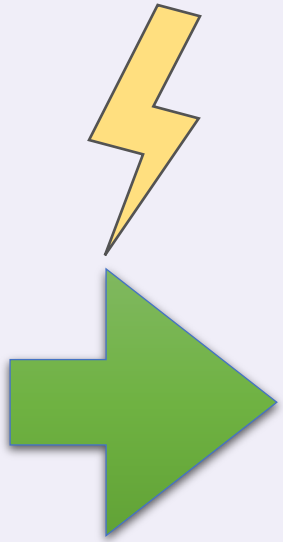

Connect the positive and negative lines to Vcc and GND via resistors

New terminator provides adequate voltage levels

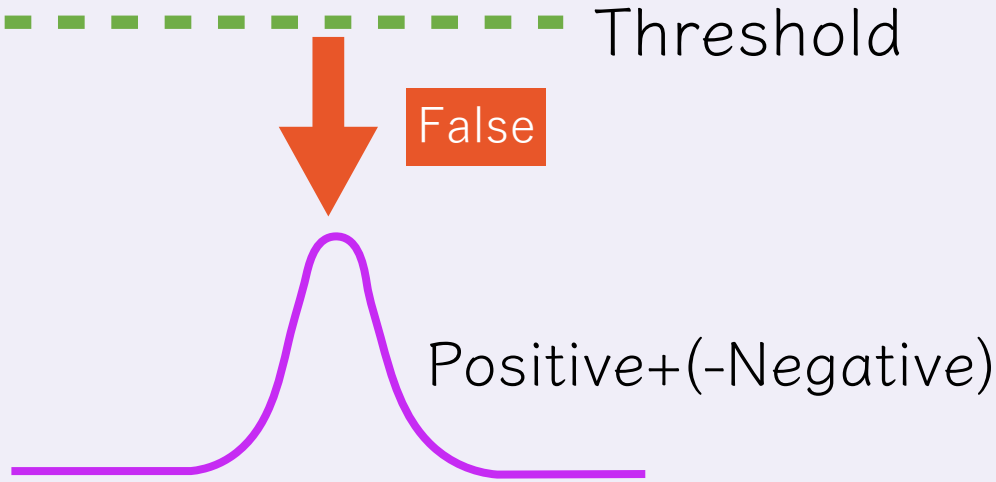
# Structure

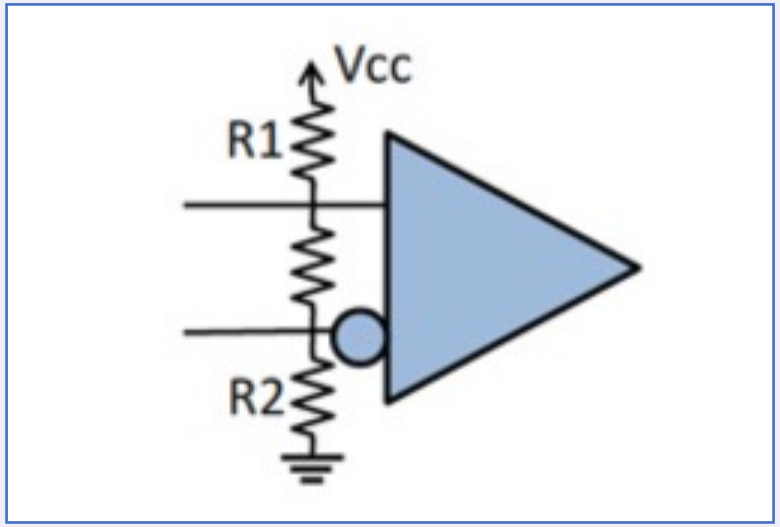
Negative

Positive



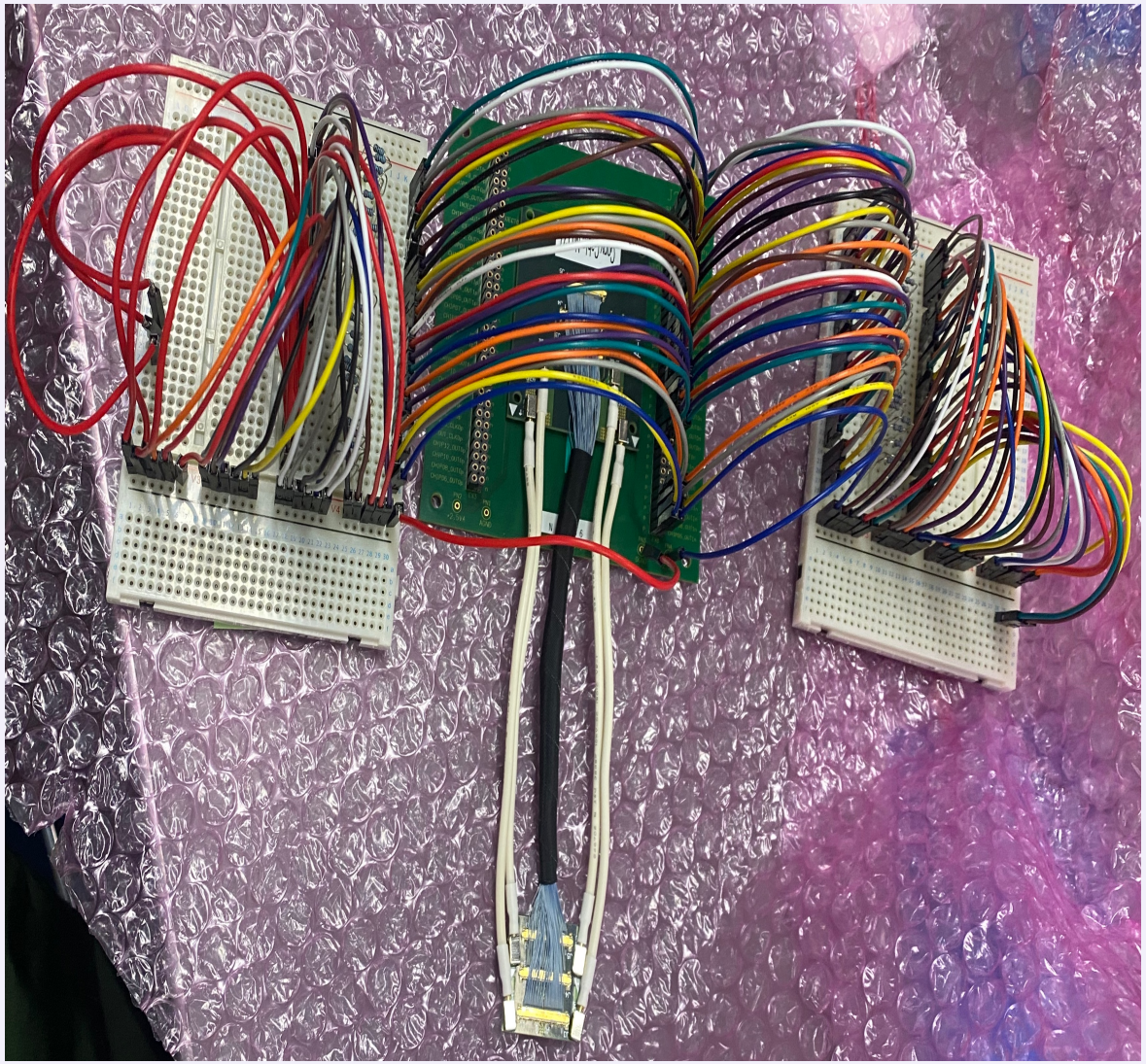
## Receiver



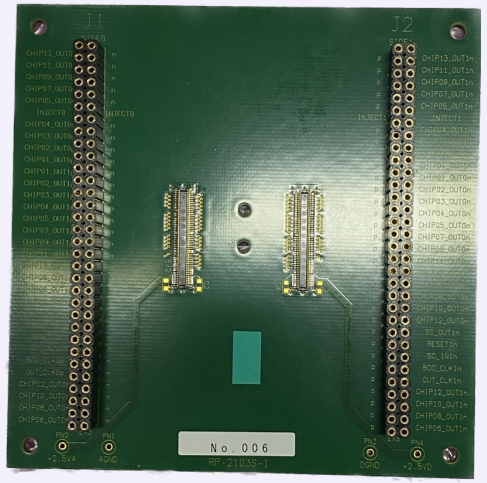




Drop the potential to the false position.

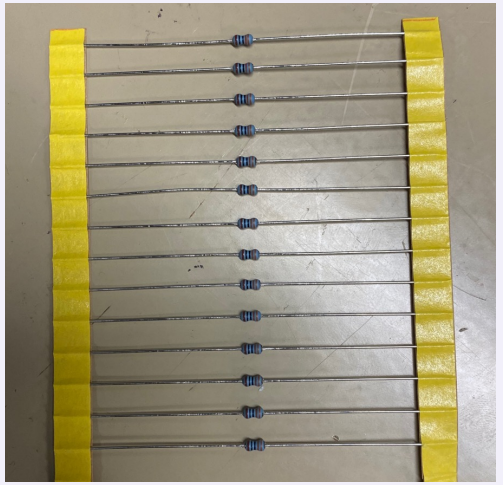
# prototype



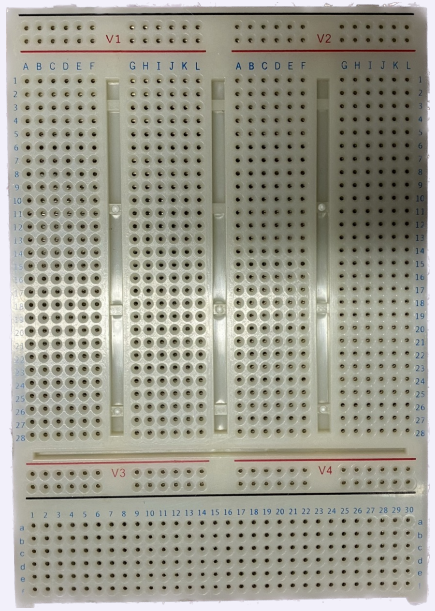
# material



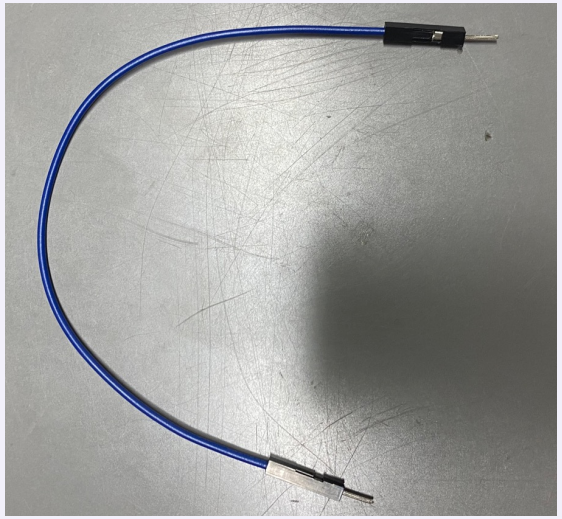
Interception board



resistance

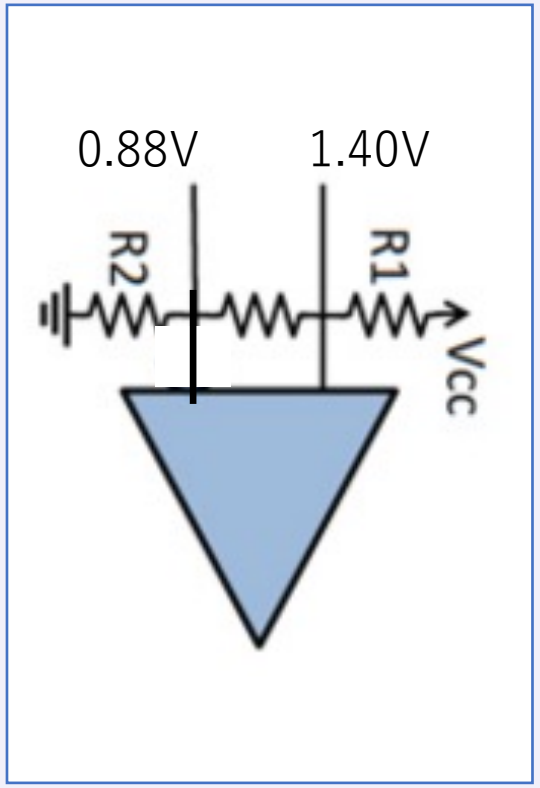


breadboard



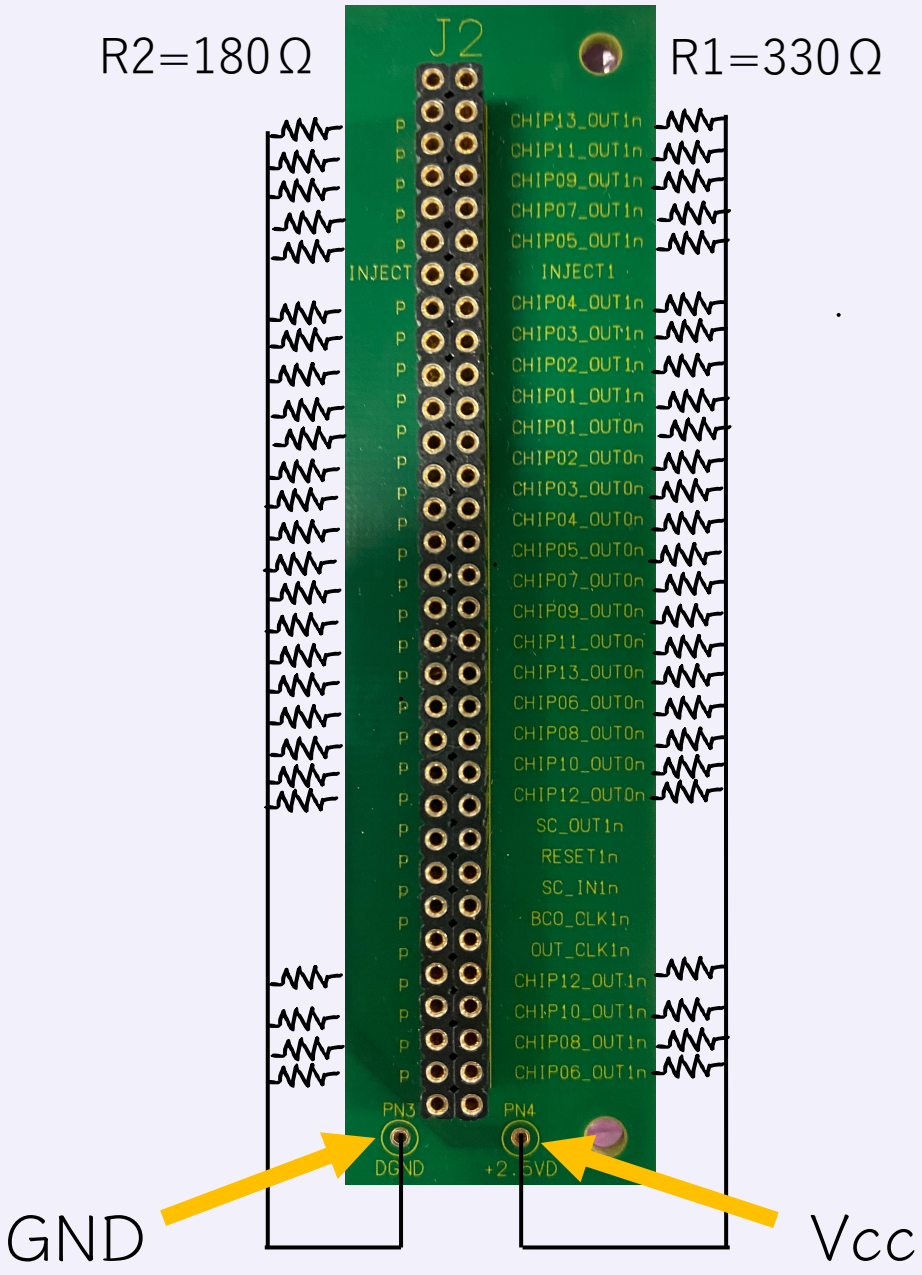
Jumper cable

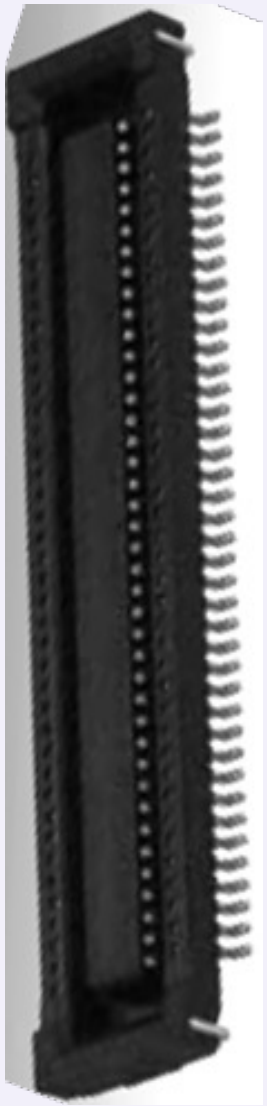
# structure



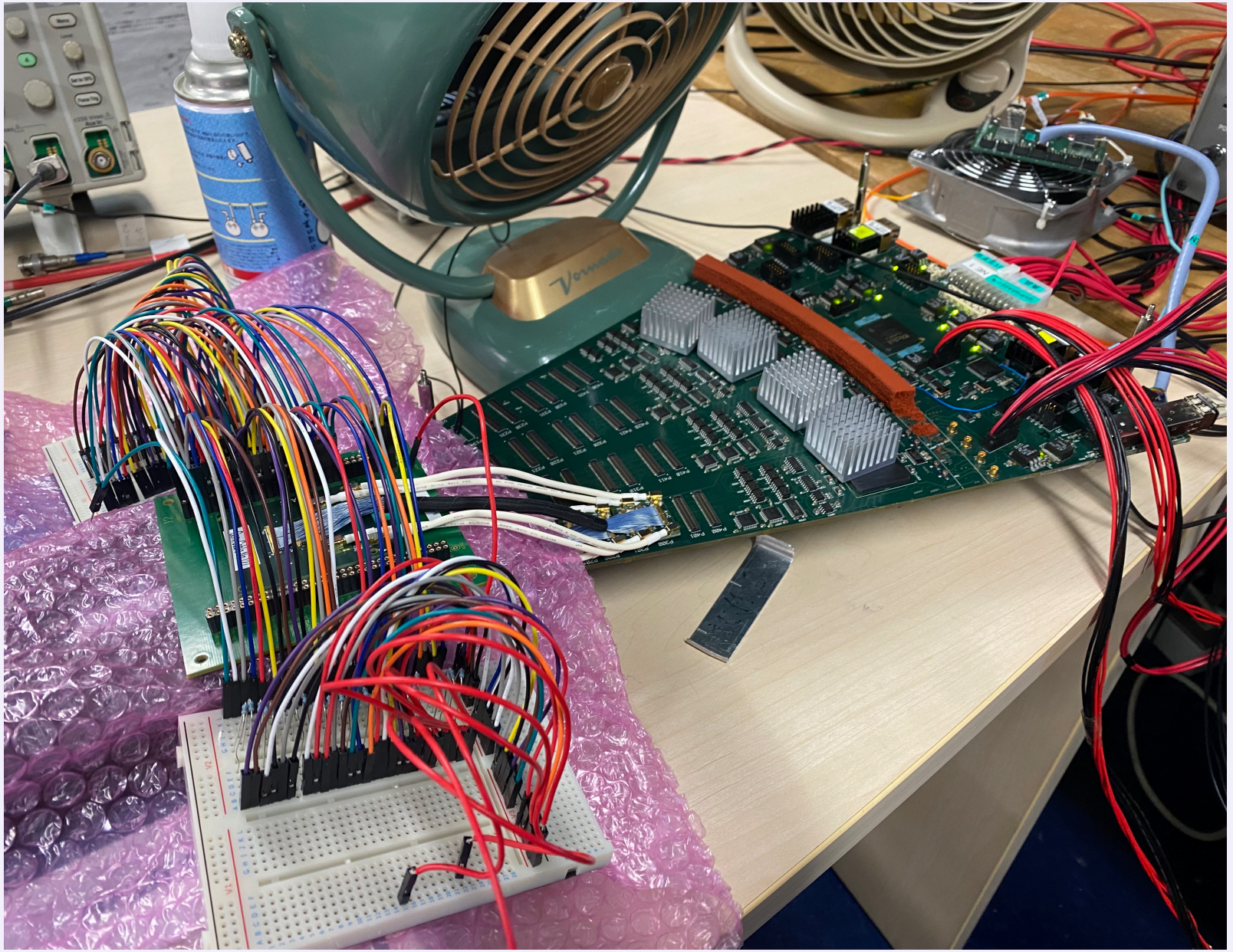

R2=180Ω

R1=330Ω



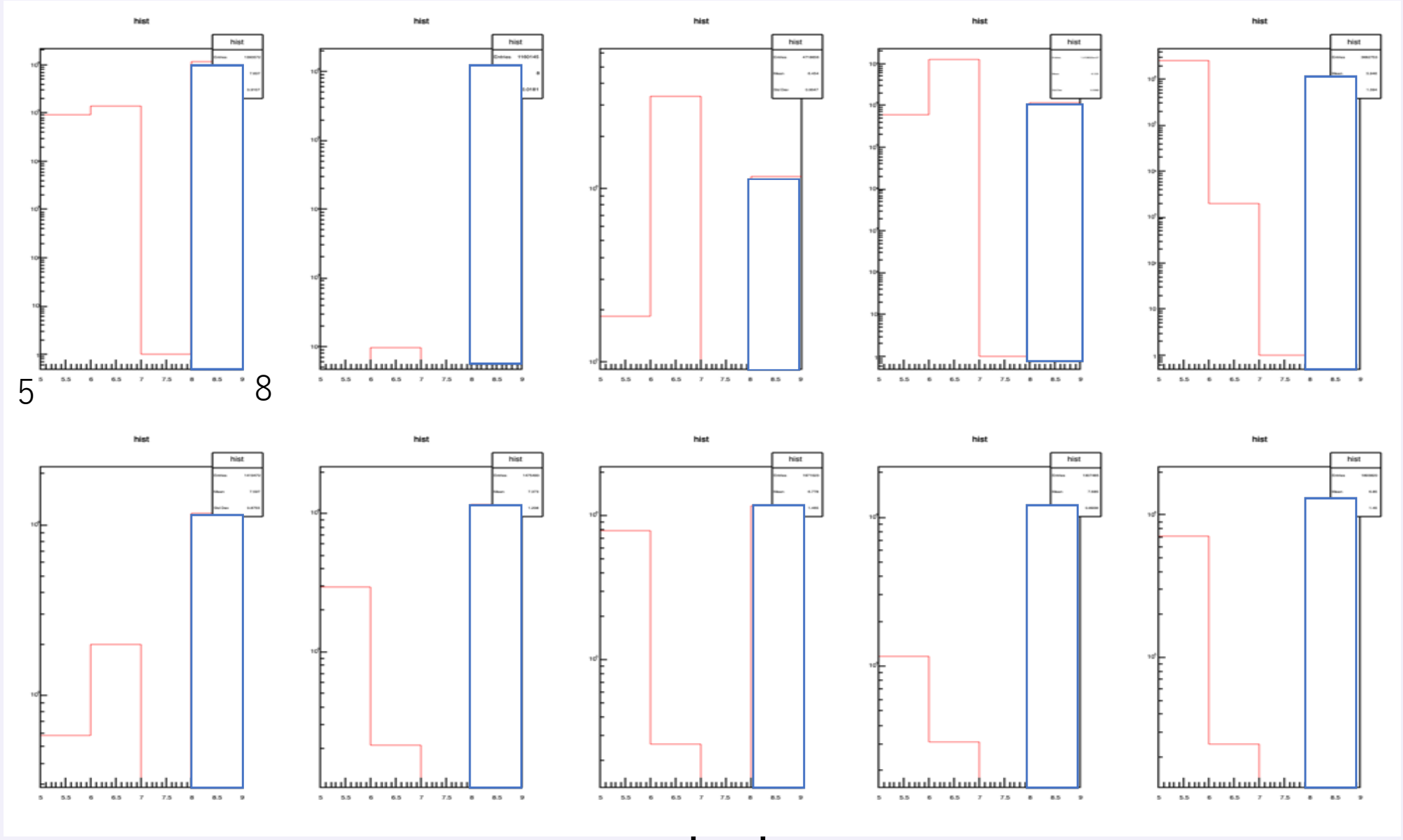



# Experiment



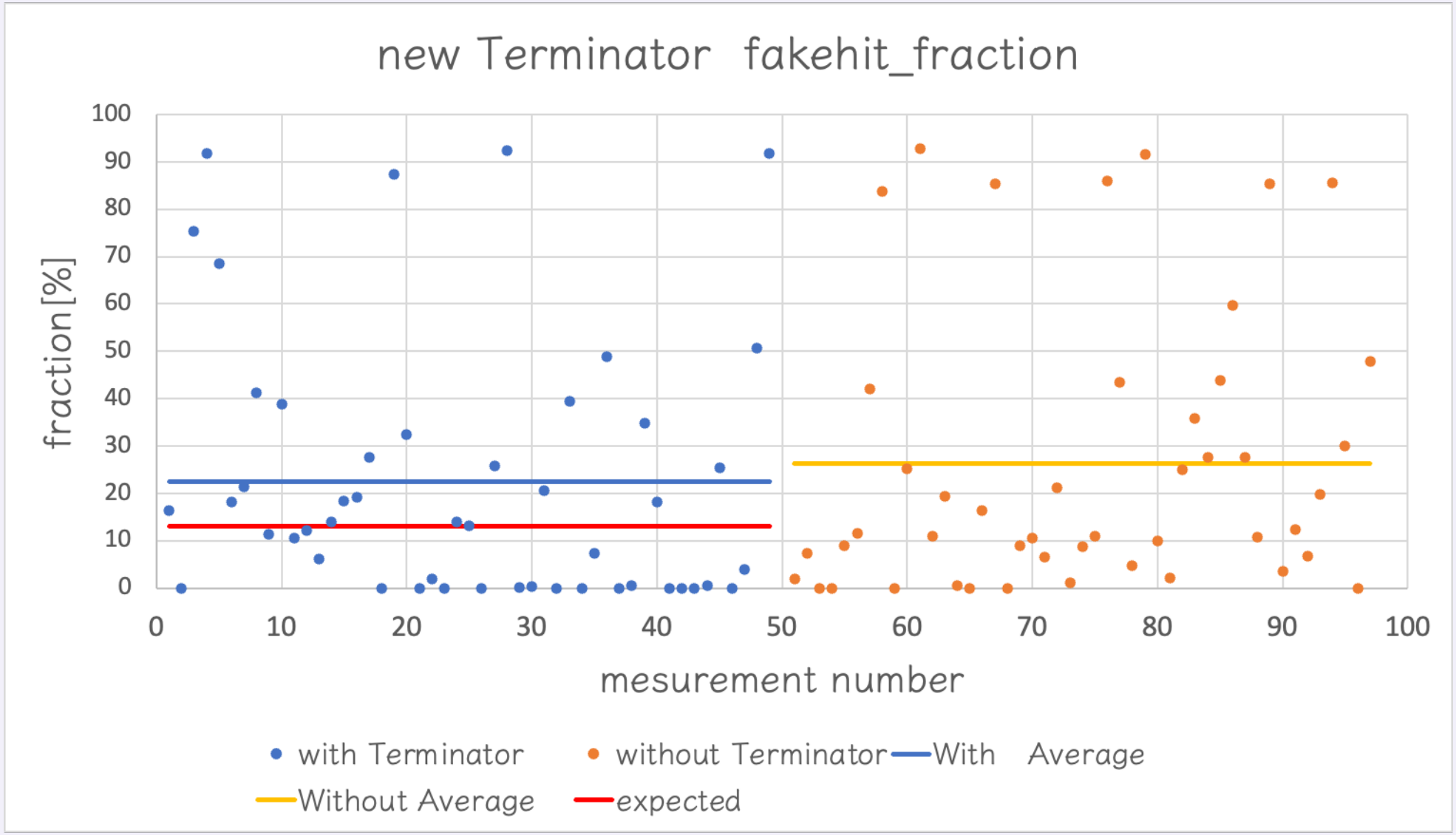
Calibration tests were conducted about 50 times, and data analysis was conducted.

# analysis




※connected to module 8

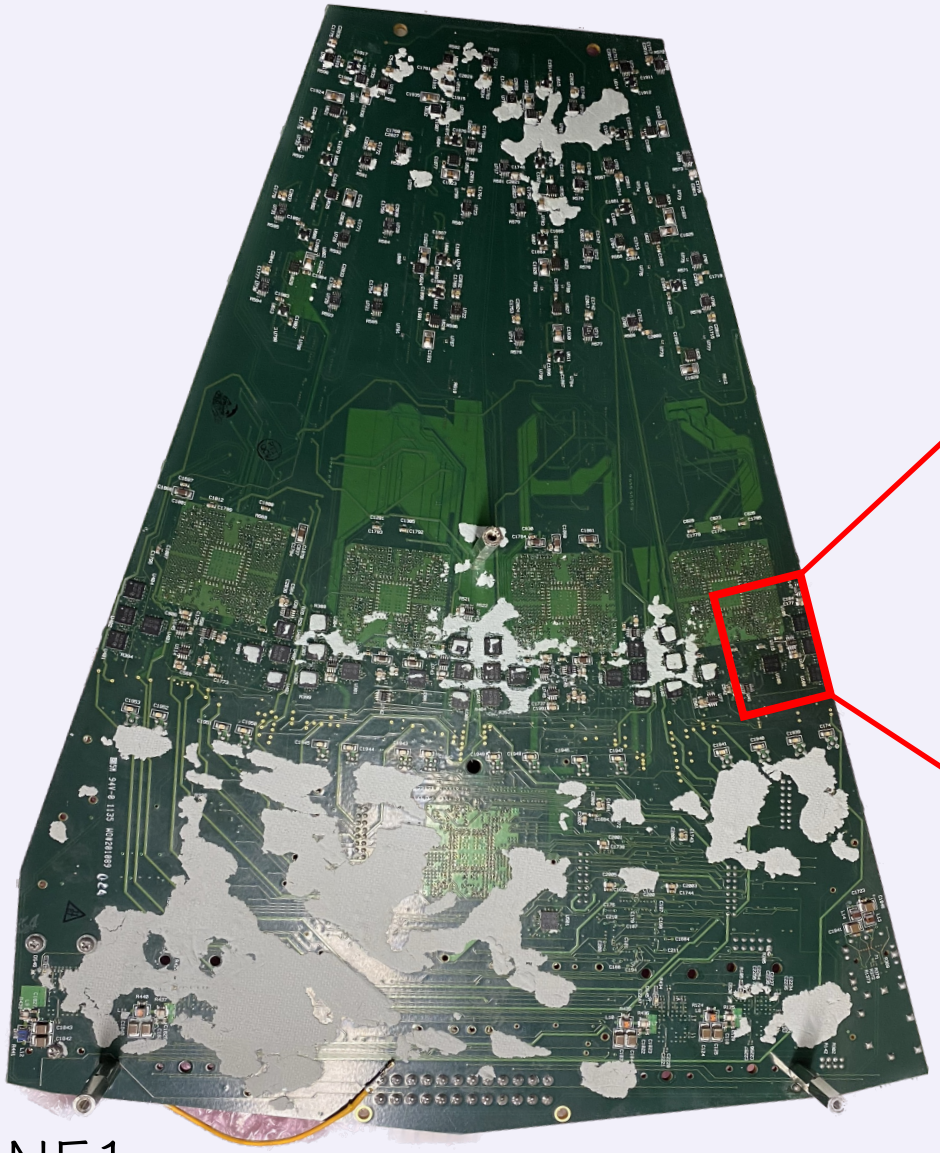
# analysis




$$Fakehit\_fraction = \frac{Hits\ other\ than\ the\ port\ to\ which\ it\ is\ connected}{Total\ hits}$$

# Replacement of TLK

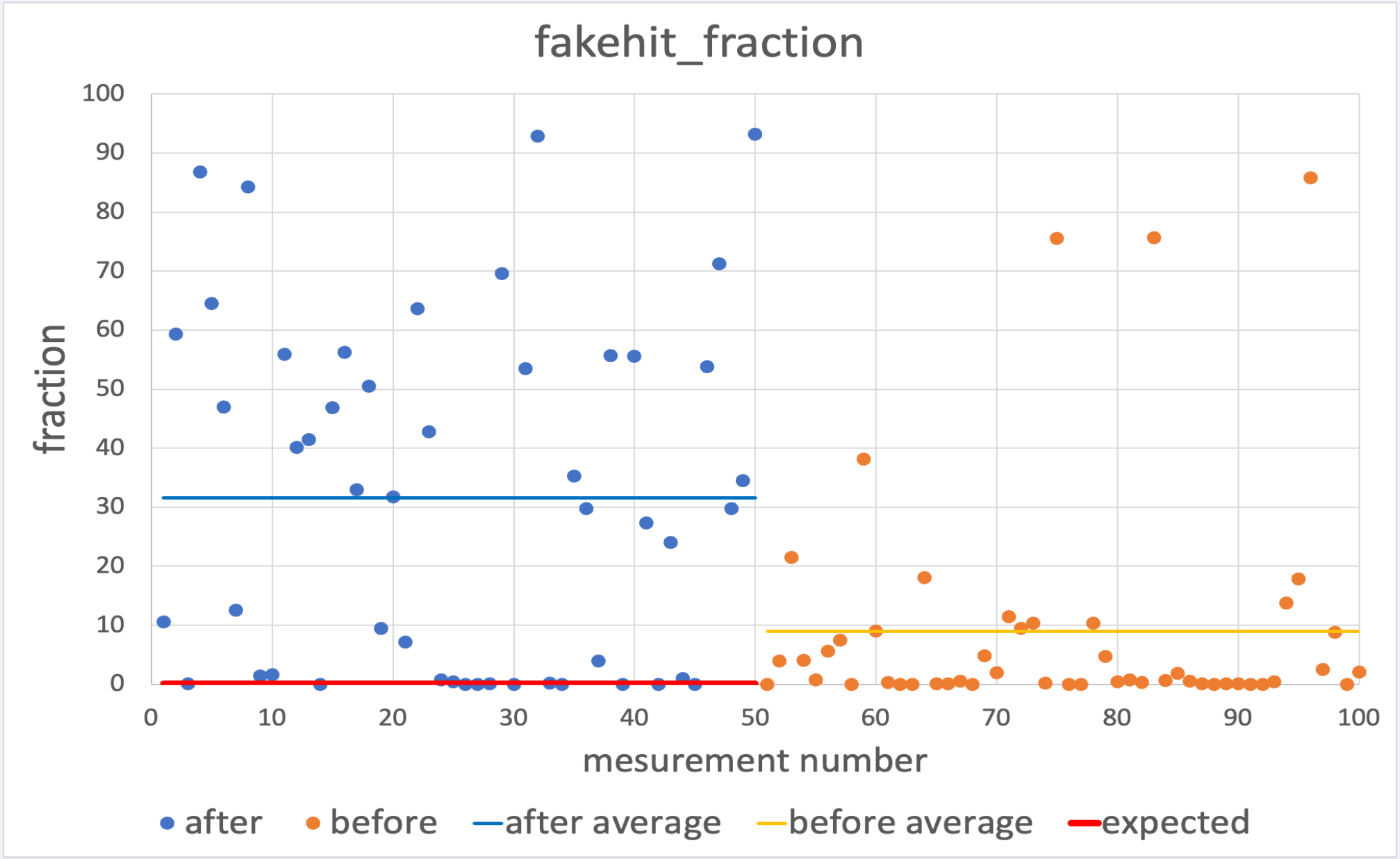
# Replacement of TLK



ROC NE1


Calibration tests were conducted about 50 times, and data analysis was conducted.

# analysis




$$Fakehit\_fraction = \frac{Hits\ other\ than\ the\ port\ to\ which\ it\ is\ connected}{Total\ hits}$$

# Conclusion

None of the methods worked.

## Next Step

To consider the next measures, find conclusive evidence to determine if the Fakehit comes from an open port or if it was generated inside the ROC.