INTT Sensor Test Result Check

NCU

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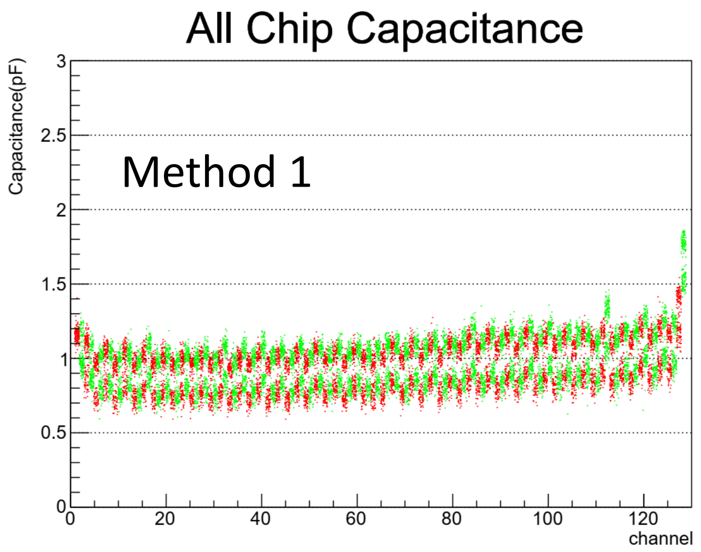
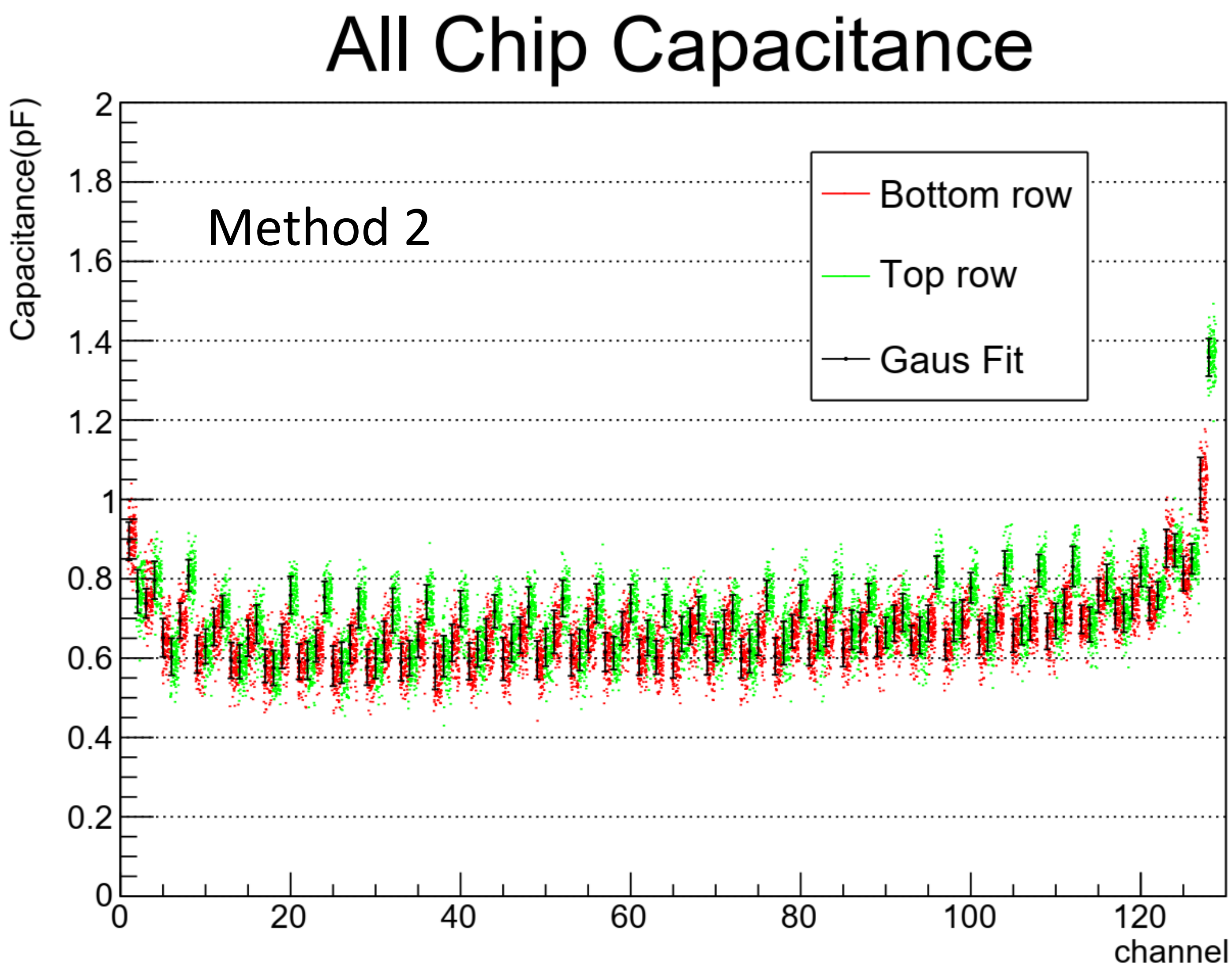
Capacitance Distribution of all Chips

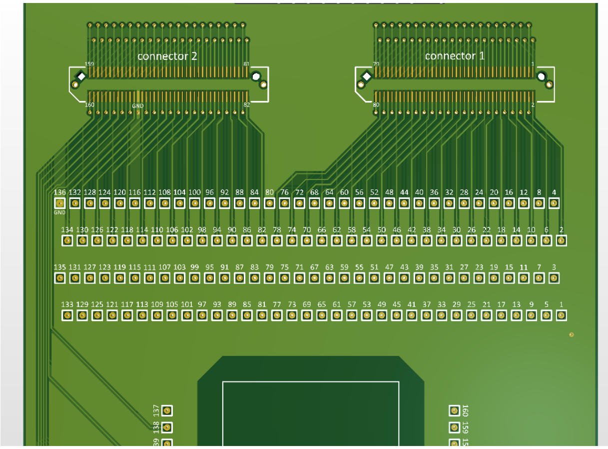
- Include even chips from sensor 1134-1149. There are 128 chips data in the histogram.
- Red and green markers show the bottom and top readout pads. Usually the top rows have higher capacitance.
- Black markers show the mean and RMS value of single gaussian fit.

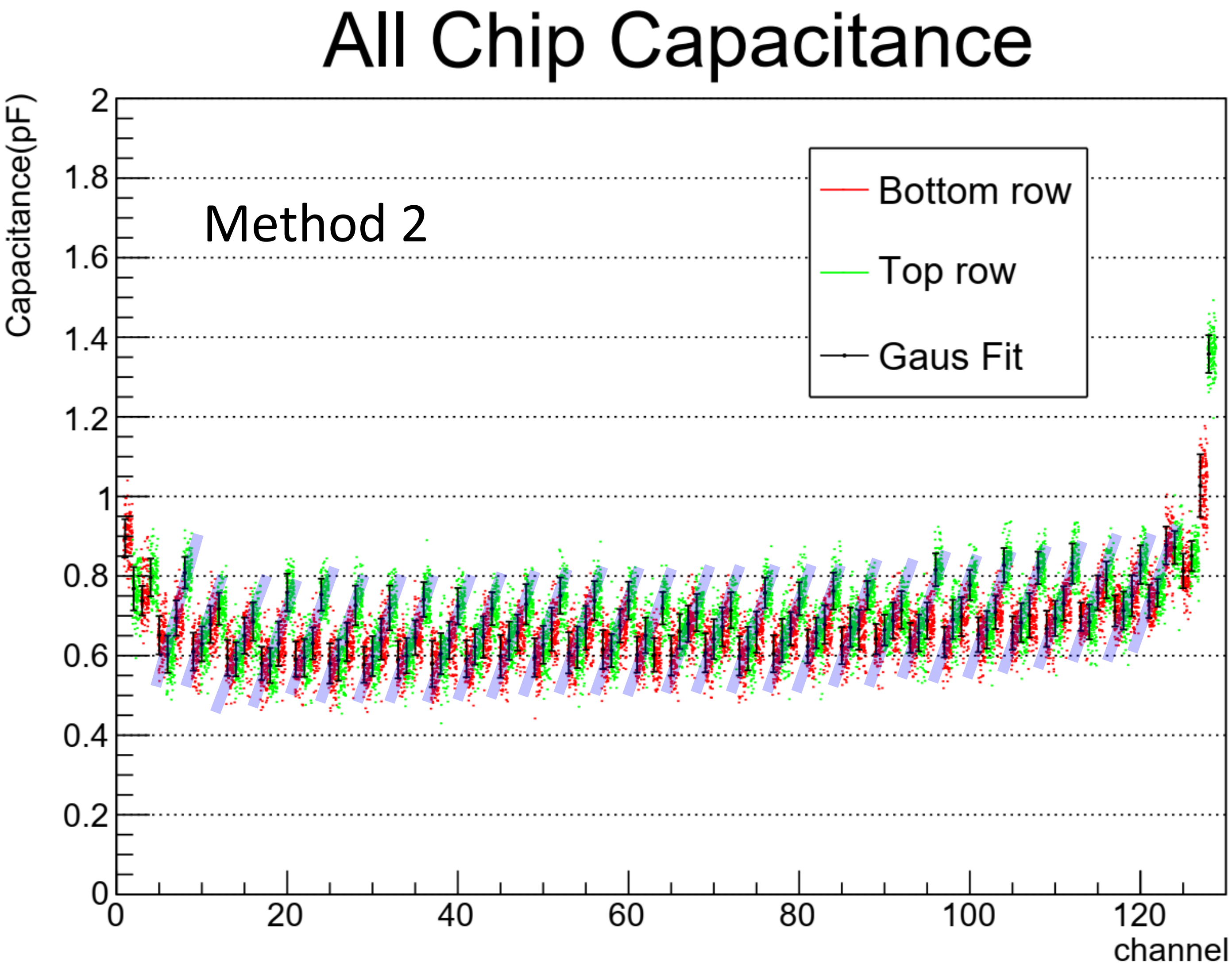




Trend Analyzation

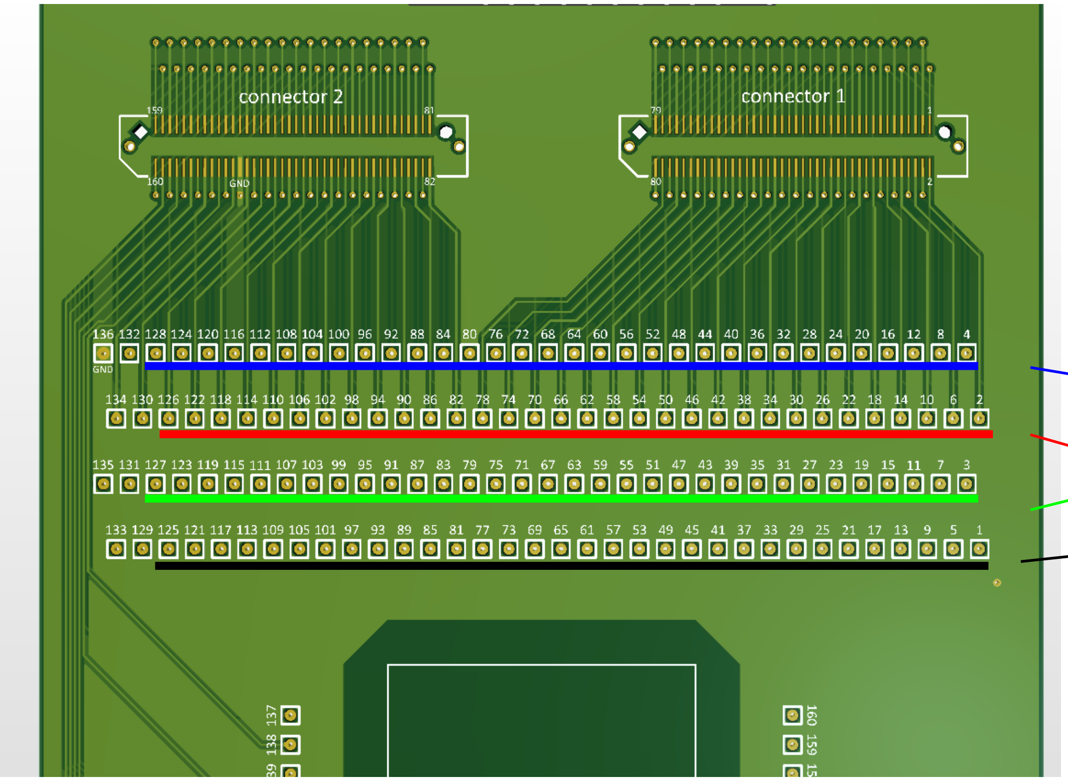
- The variety between channels has a period.
- If we group the four channels to one set, we can find the capacitance usually increase with channel, and this trend will repeat in next set.
- The readout pads just have two row, but the solder pad in probe card is divided into four rows.

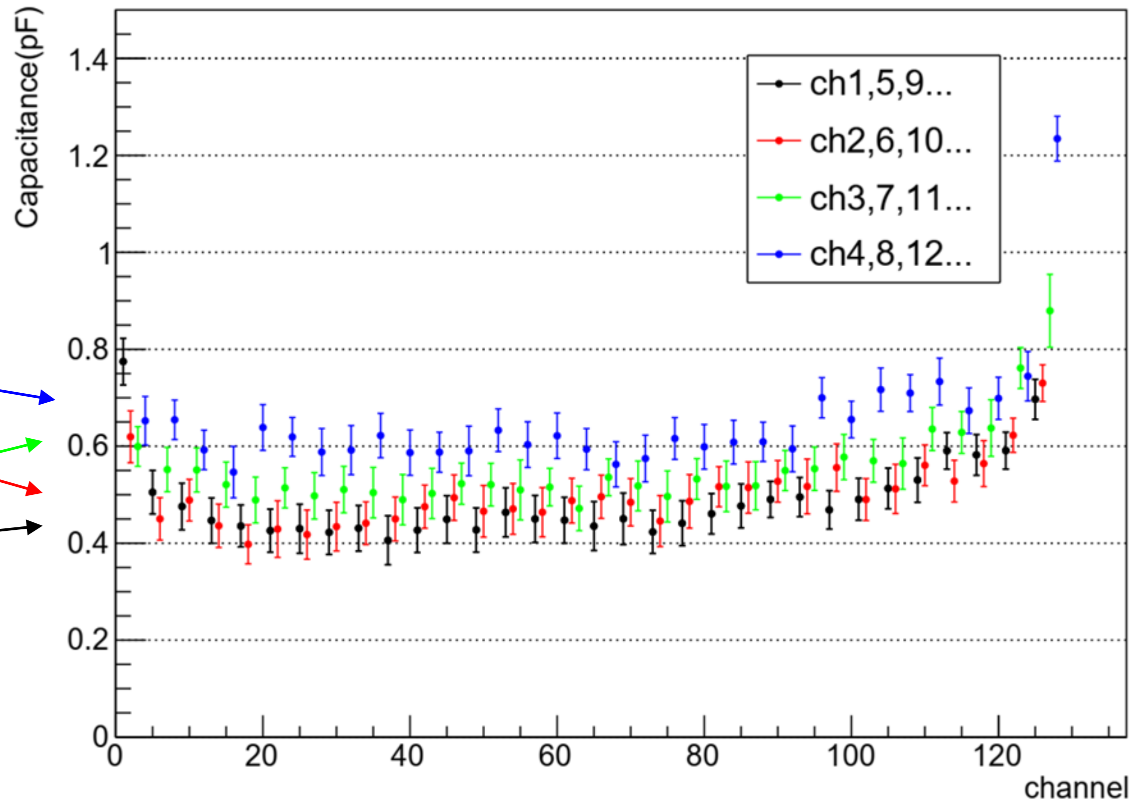




Trend Analyzation

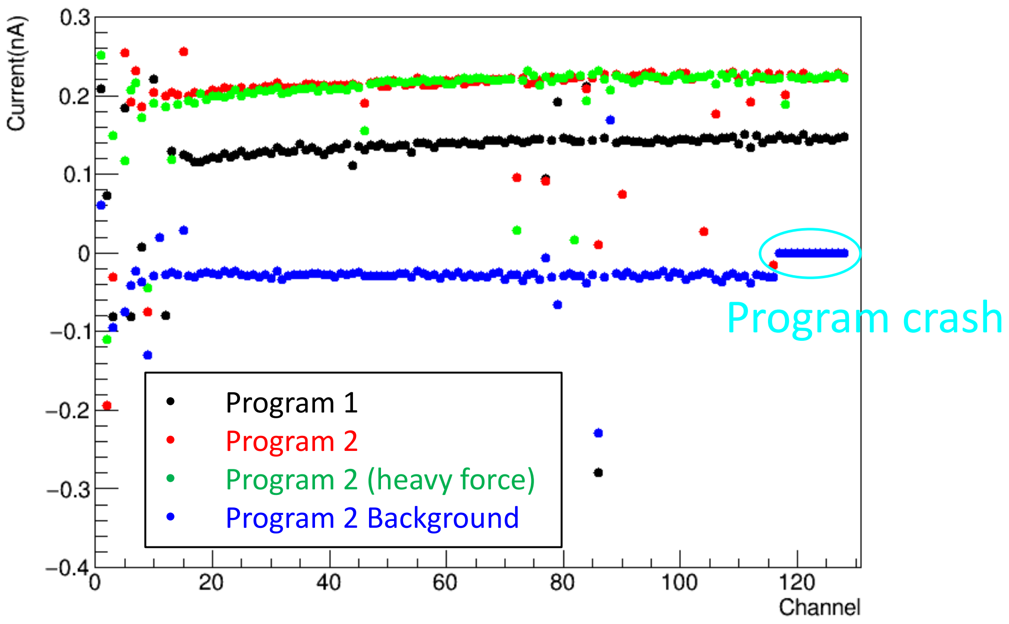
- I plot the capacitance of channels with four colors like the row of probe card. Each color correspond the different rows in the probe card.
- The probe card may contribute a part of difference between capacitance, but this contribution can't remove with background subtraction?
- However, this fluctuation is tinier than difference caused by broken.

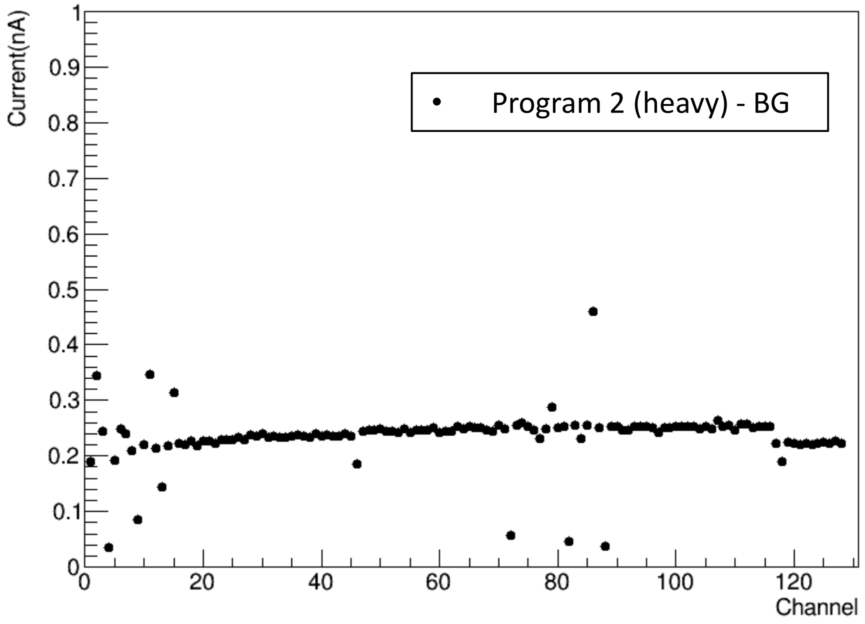




IV test

- Test to supply the inverse voltage from the single DC pad => Missing command problem still happen. No matter how, the current already raise to 30nA at 100V. In the HAMAMATSU report, the total current from the sensor is ~60nA, so this method could not measure the leakage current of single channel.
- In backside voltage (normal condition), I use two different programs to test: program 1 use the VI that get from network; program 2 use the VI that write by myself (simpler command).
- The measurement between channel 1 to 15 have some fluctuation. According to background value, the main problem is not come from sensor.
- Each channels can get the shape of IV curve, but the pedestal will shift.
- I still can't get the stable measurement of leakage current now.

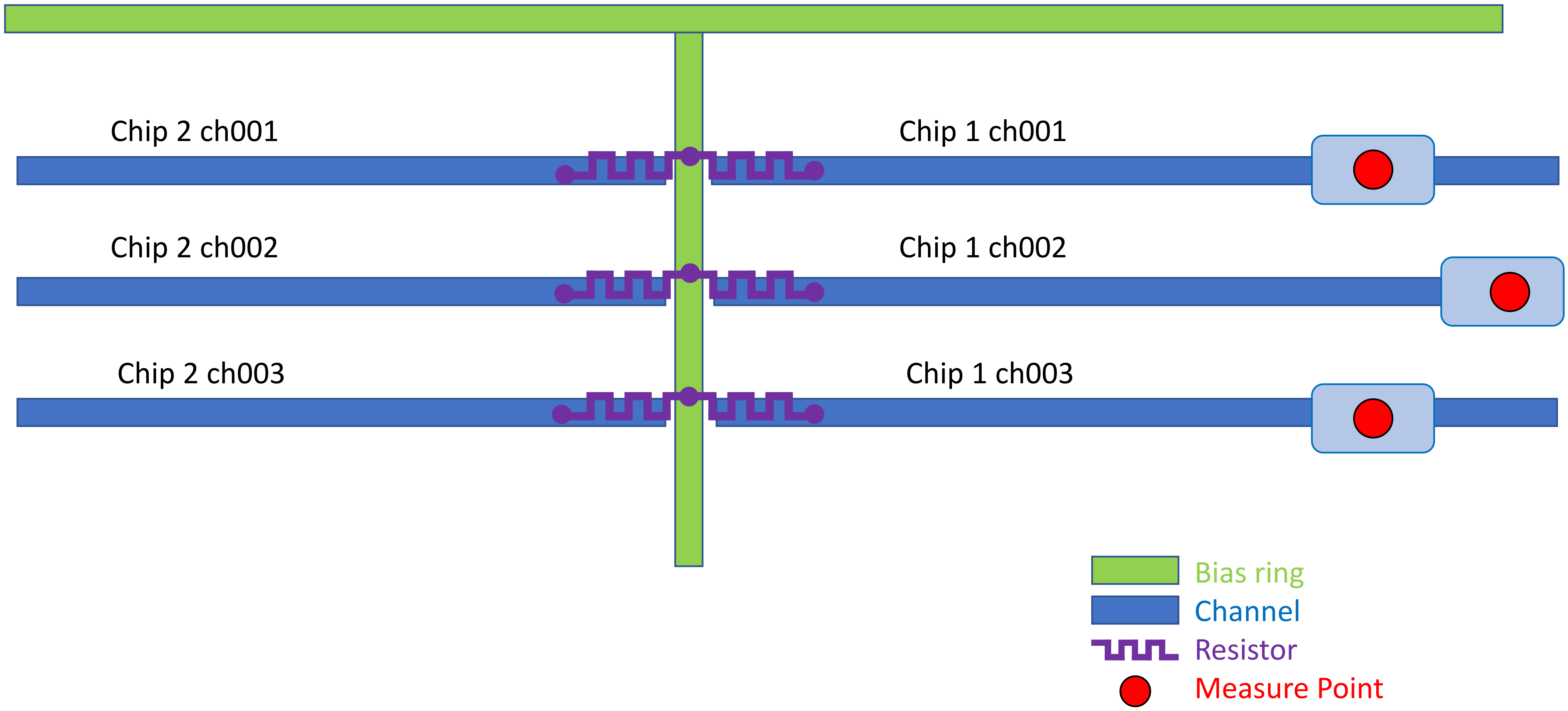




Summary

- The distribution of capacitance from method 2 is single gaussian, so we can define the stand value of measurement in each channels. The fluctuation could come from the difference of wire in the probe card, sensor and switch card, but the difference (~0.2pF) is tinier than the broken channels.
- In IV test, the fluctuation still need be studied. If continue this study, can measure the broken sensor first to see what the behavior when channel has been broken. Secondary step is that solve the fluctuation of back ground.
- Next Step is that re-measure the odd chips of type A of No. 1133-1149 with method 2 to compare with result in slide 2.

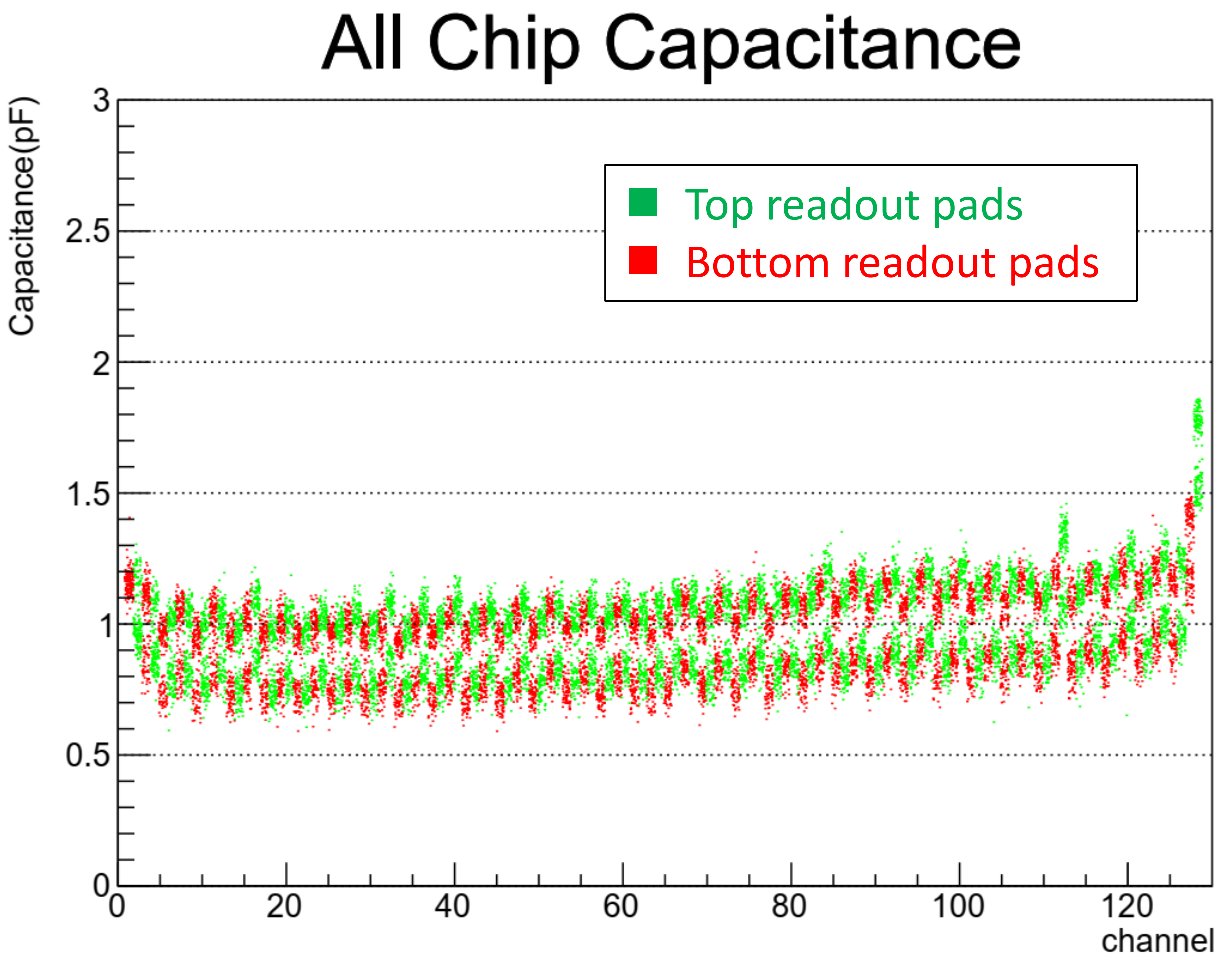
Back up



Chip 2 ch001
Chip 1 ch001
Chip 2 ch002
Chip 1 ch002
Chip 2 ch003
Chip 1 ch003
Bias ring
Channel
Resistor
Measure Point

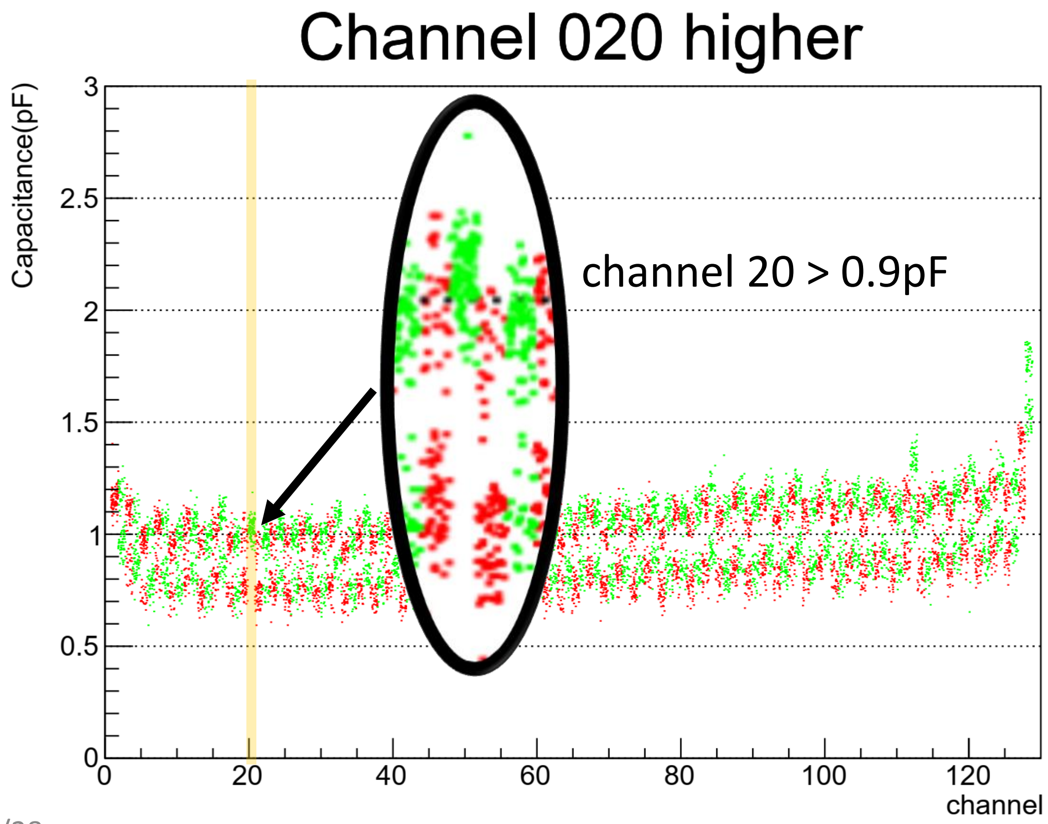
Sensor Structure

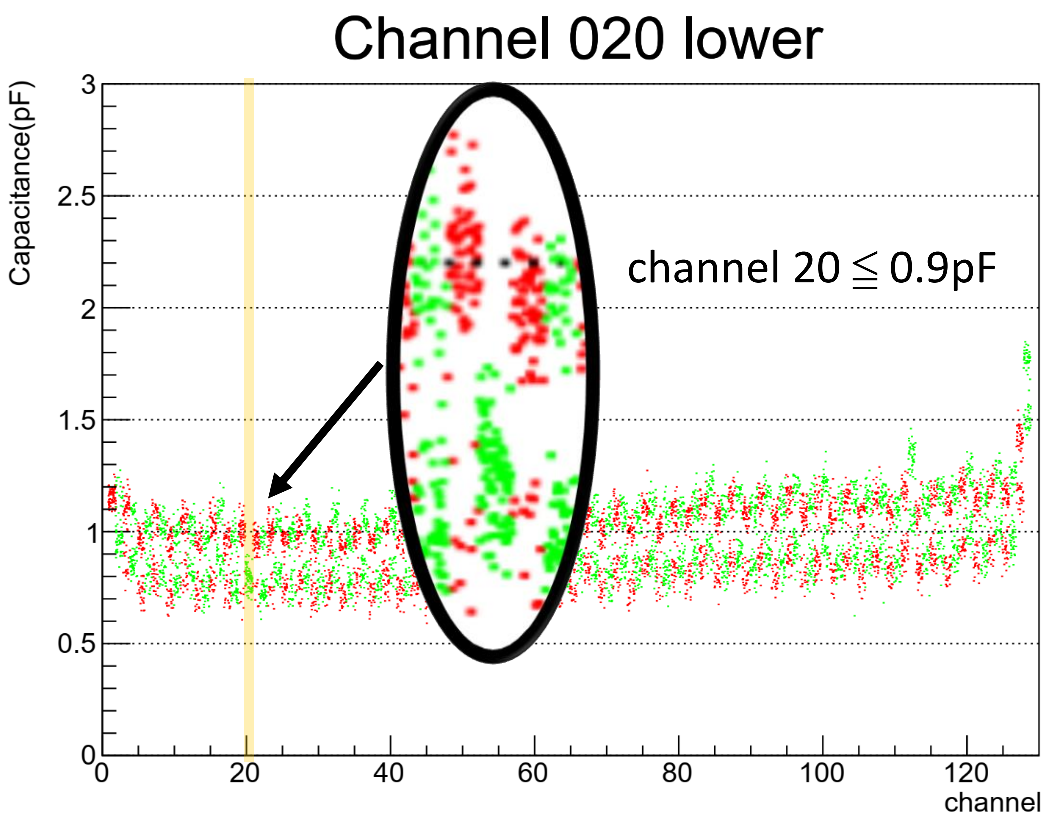
- From looking all chip result in Cap2_Graph.pdf. Seems there are not fix trend in top or bottom pads, so I plot the histogram to count all chip together to observe behavior.
- Right plot include all odd chips of sensor 1131-1148. The plot shows there are obvious two lines in measurement.
- The probability of higher and lower value almost both are 50%, but from the histogram we can find top readout pads is tiny higher than bottom pads. This is caused by the geometry of metal length.
- For further study why there are two trends in measurement, I try to divide the histogram into two plots by specific channel in next page.



Fix the Status in One Channel

- However, if we focus on near channels, we find the near channels has higher probability to show opposite status.
- This behavior not only show in channel 20. When I check channel 60 with same method, I can find the same behavior.
- In next slide, I try to present the relation in all channels.





Relation between Near Channels

- Divide all channels into high or low status (like the digital data).
- If the status both are opposite in near channels, fill the value 2 to target channel in histogram.
- If the status both are same in near channels, fill the value 1 to target channel in histogram.
- Other situation fill value 1.5 to channel in histogram.
- The result shows the relation between near channels usually are opposite