INTT Sensor Test Result Check

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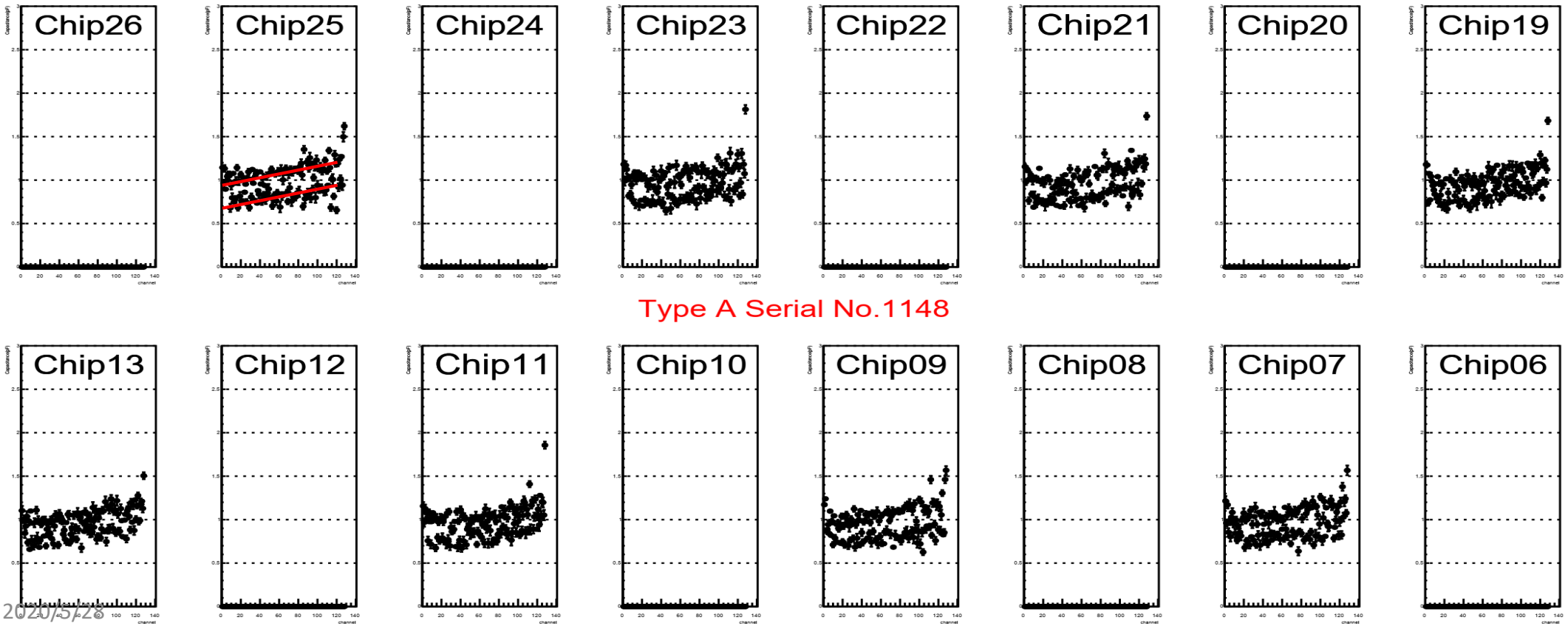
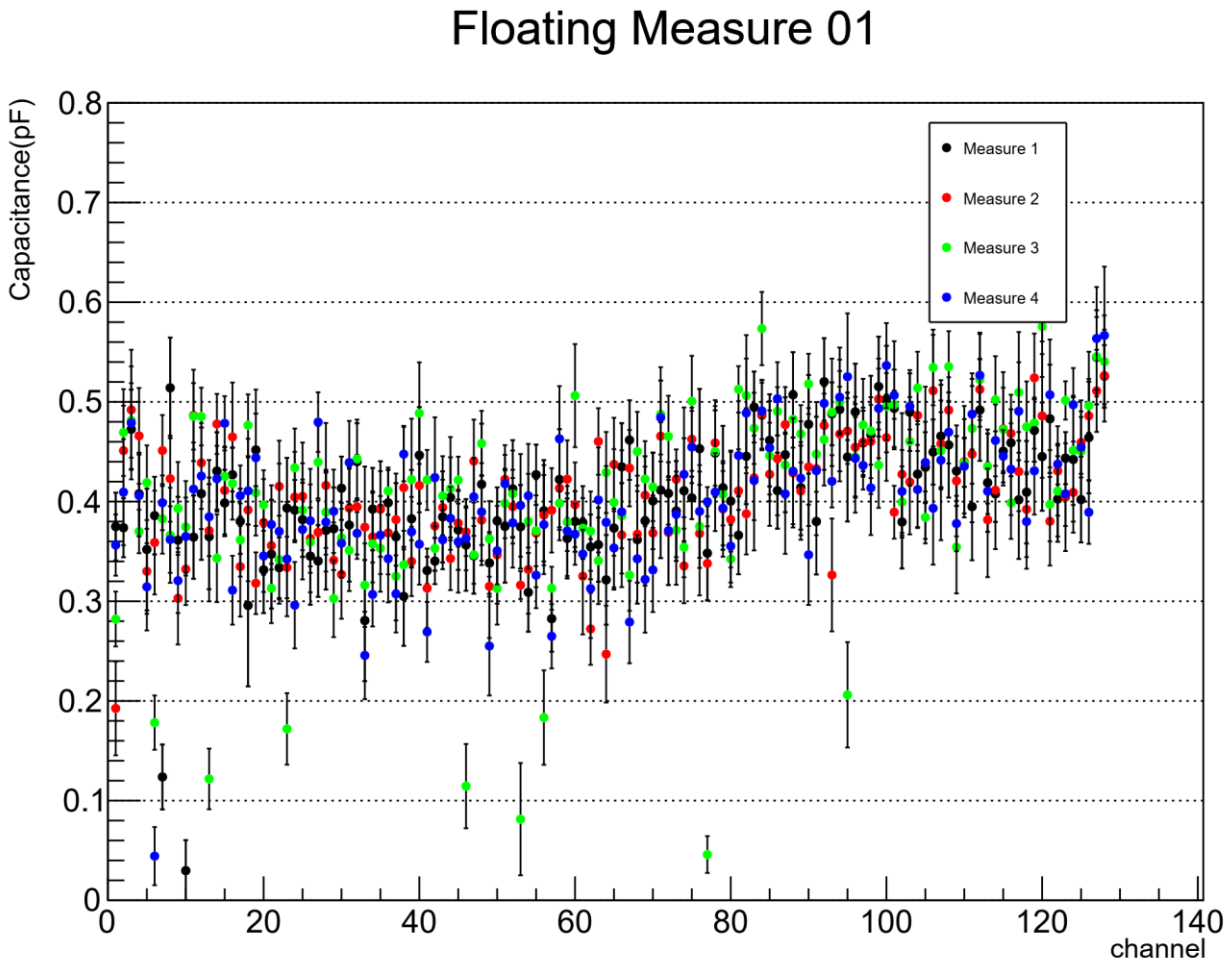
Result Check

- The capacitance result shown in previous meet has two trends. A half channels have higher capacitance and another channels have lower value. The difference is about 0.2 to 0.3 pF.
- We guess the possible reasons are:
  - Silicon geometry
  - Measure fluctuation



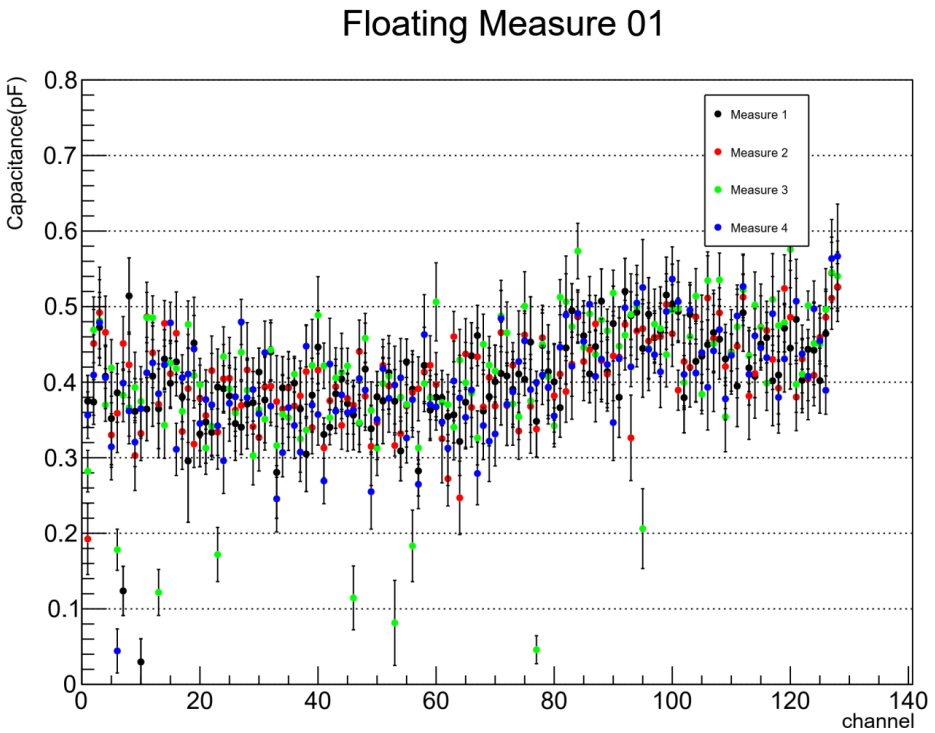
System Check

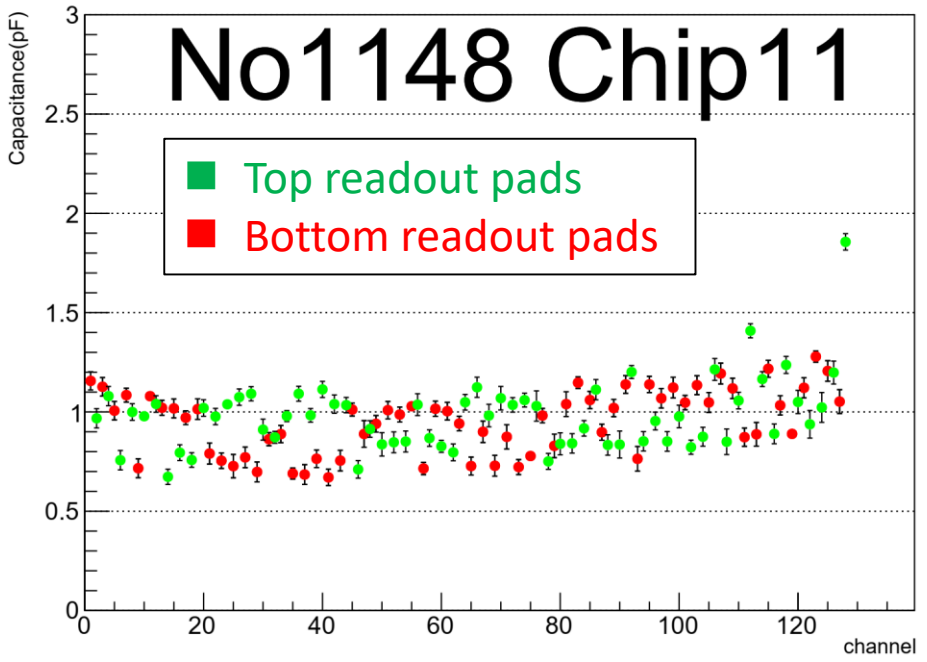
- Measure the background when probes are floating (no sensor)
- Measuring parameters are the same with sensor testing
- Measure 4 times to check background. The fluctuation is about 1.5pF.
- Sometime some channels has lower value, but occur in which channel seems random and probability is lower.
- Now, I can't identify which reason cause the measurement is lower. I think this is caused by environment.
- The value after channel 80 is little higher, because channel 80-128 are connected to another coaxial cable.
- According to this measurement, I think the measuring ground doesn't have obvious problem.



Background Comparing

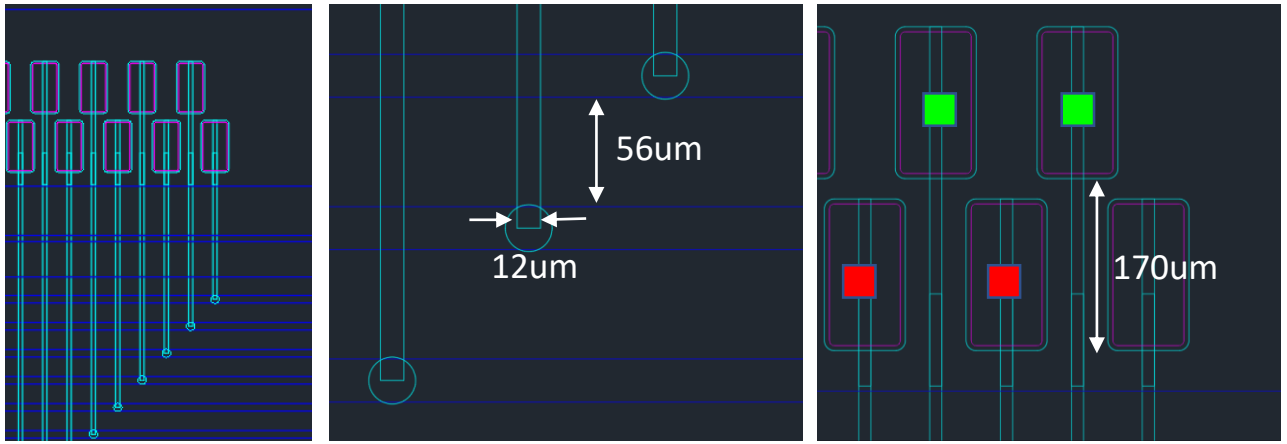
- The background fluctuation is about 1.5pF.
- The difference in real measurement is about 0.3pF, so it is larger than background fluctuation two times.
- Sometime the background have lower value. This difference is similar with sensor testing, but in sensor result almost a half of pads have lower value.
- In background result, only few random channels could have lower value, so the background isn't the major problem.
- Next part, we will check the geometry of sensor.

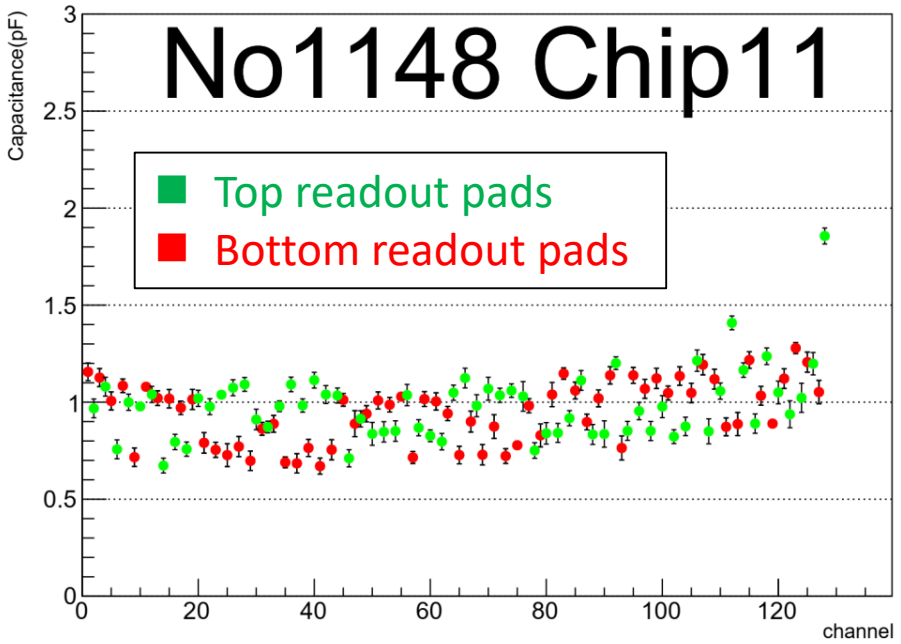


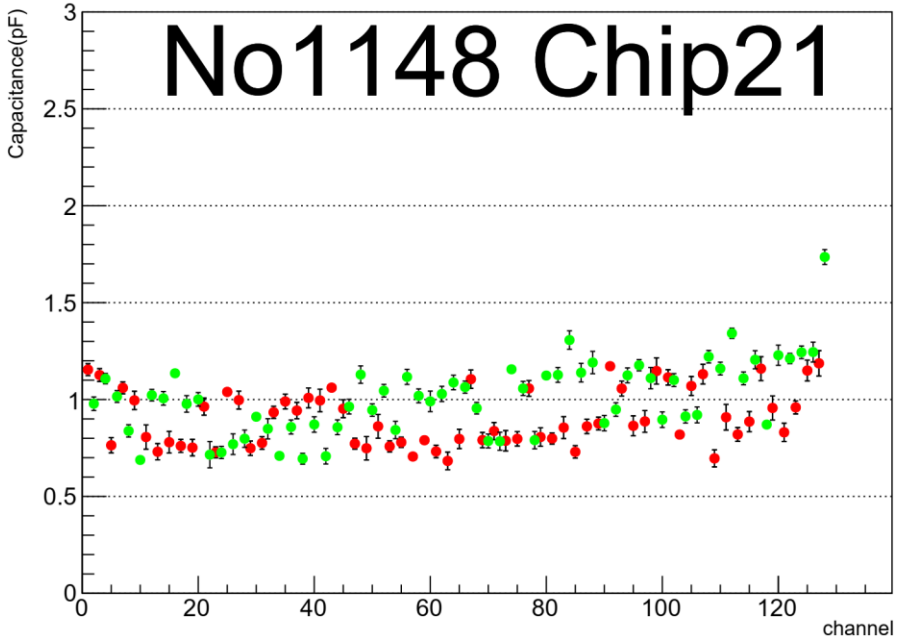


Sensor Structure

- The readout pads are arranged in two rows, so odd channels and even channels have different metal wires. There are 56um length difference between each channels and 170um difference between top and bottom pads.
- We guess maybe two line behavior is caused by different metal length, so I divide the channel into top and bottom rows that are labeled with different color.
- All plots are save in Cap2_Graph.pdf. You can check all chip performance in this file.
- From this result, we can know the higher value and lower value aren't caused by metal length. If the reason is metal length, we show find higher and lower points should only have one color.

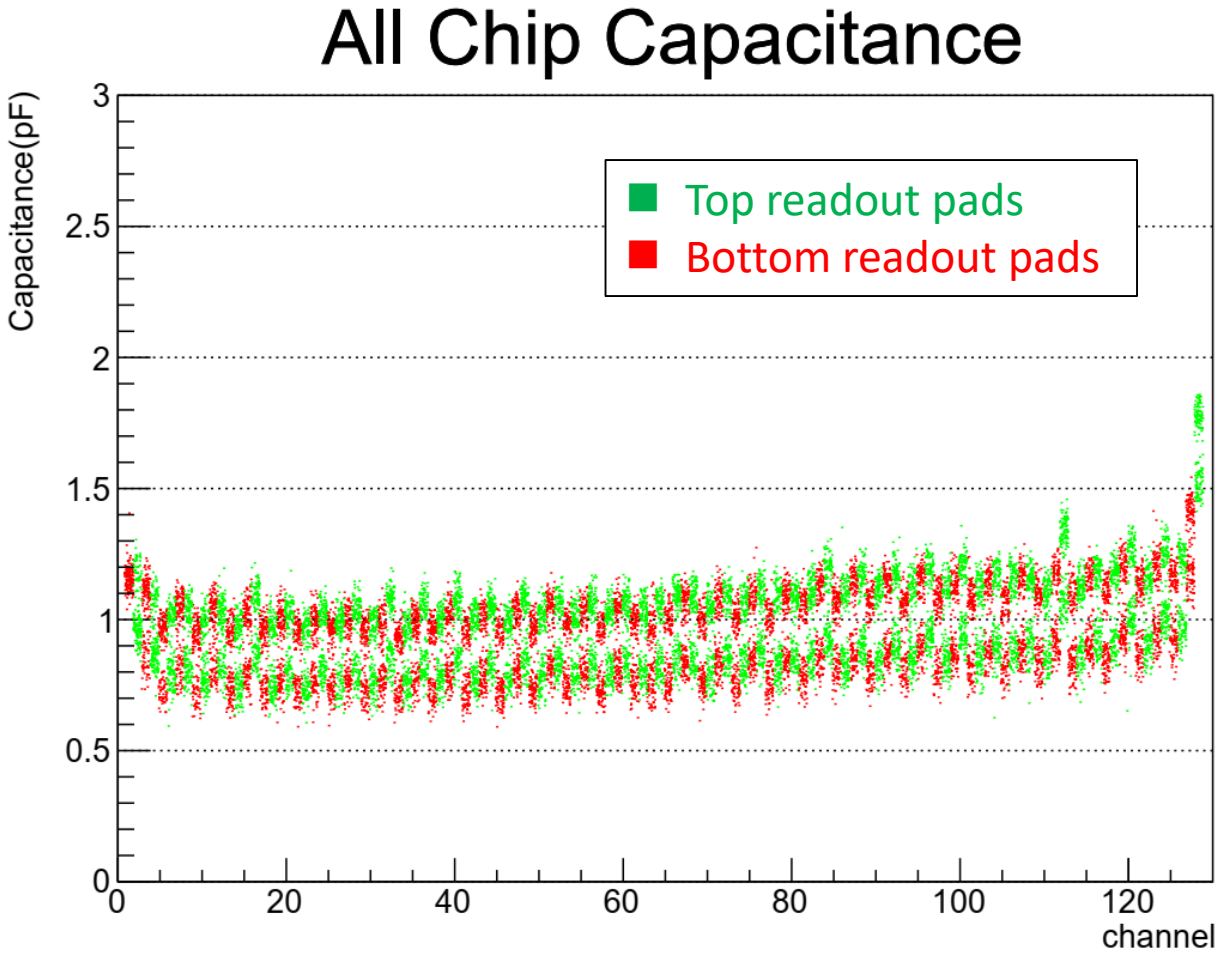






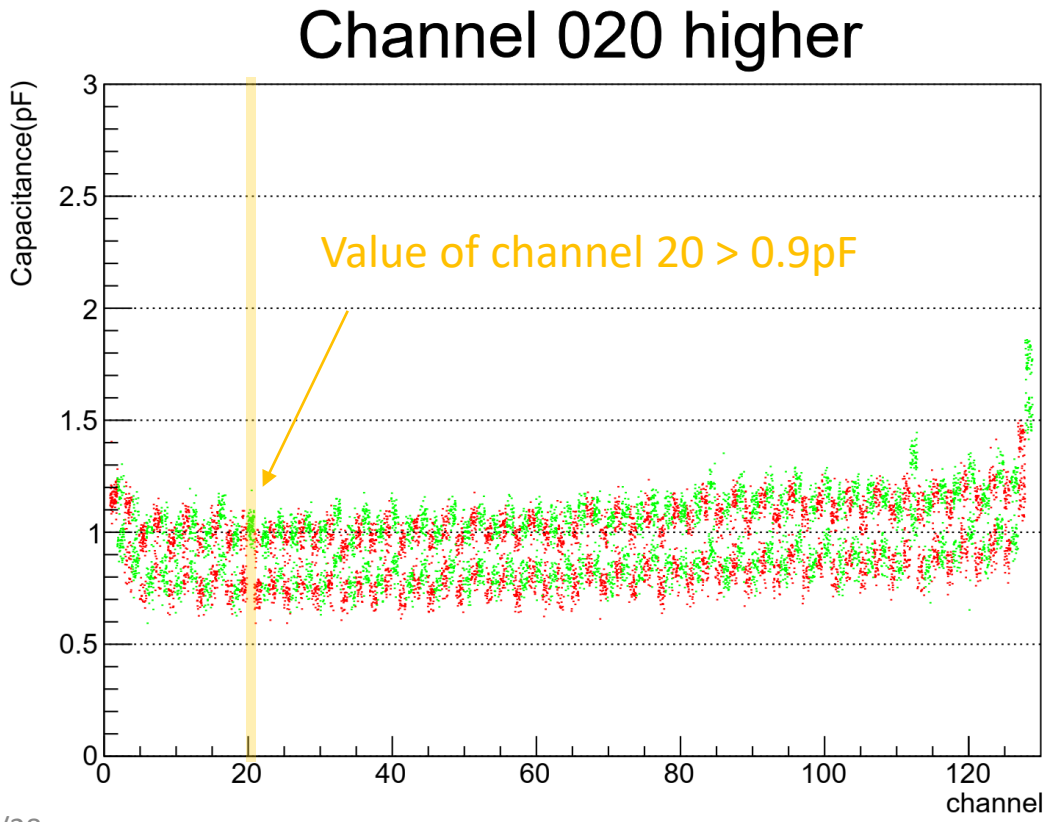
Sensor Structure

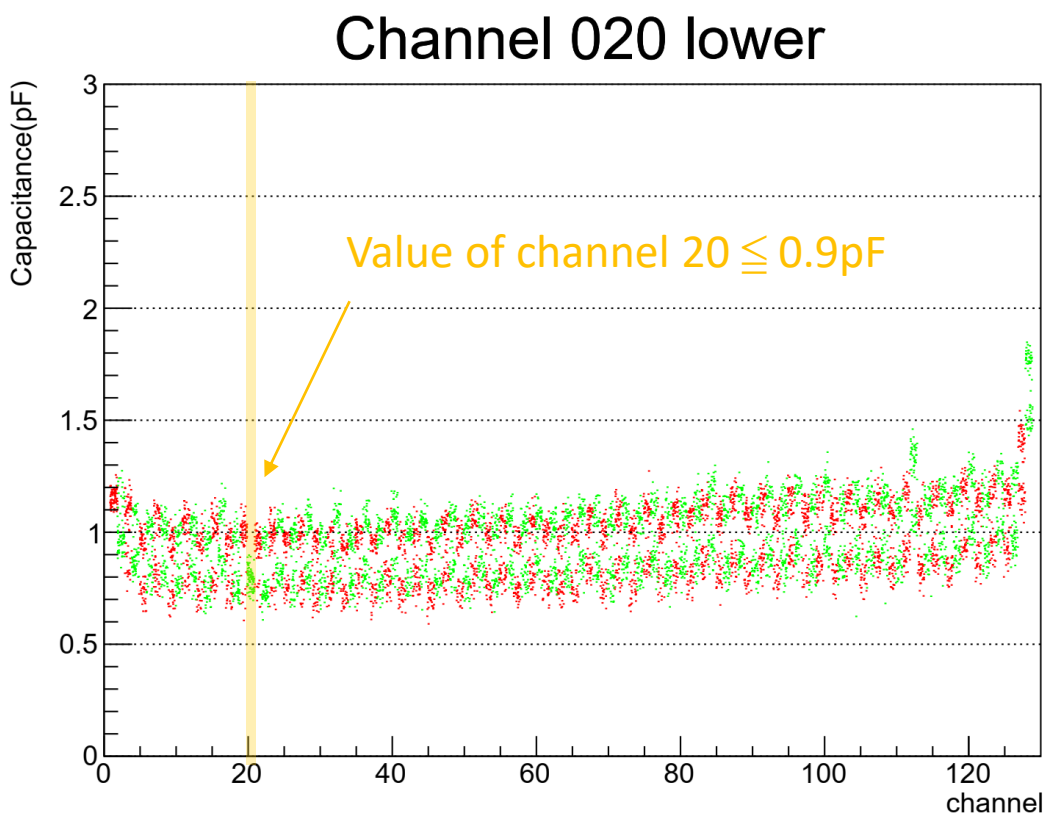
- From looking all chip result in Cap2_Graph.pdf. Seems there are not fix trend in top or bottom pads, so I plot the histogram to count all chip together to observe behavior.
- Right plot include all odd chips of sensor 1131-1148. The plot shows there are obvious two lines in measurement.
- The probability 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

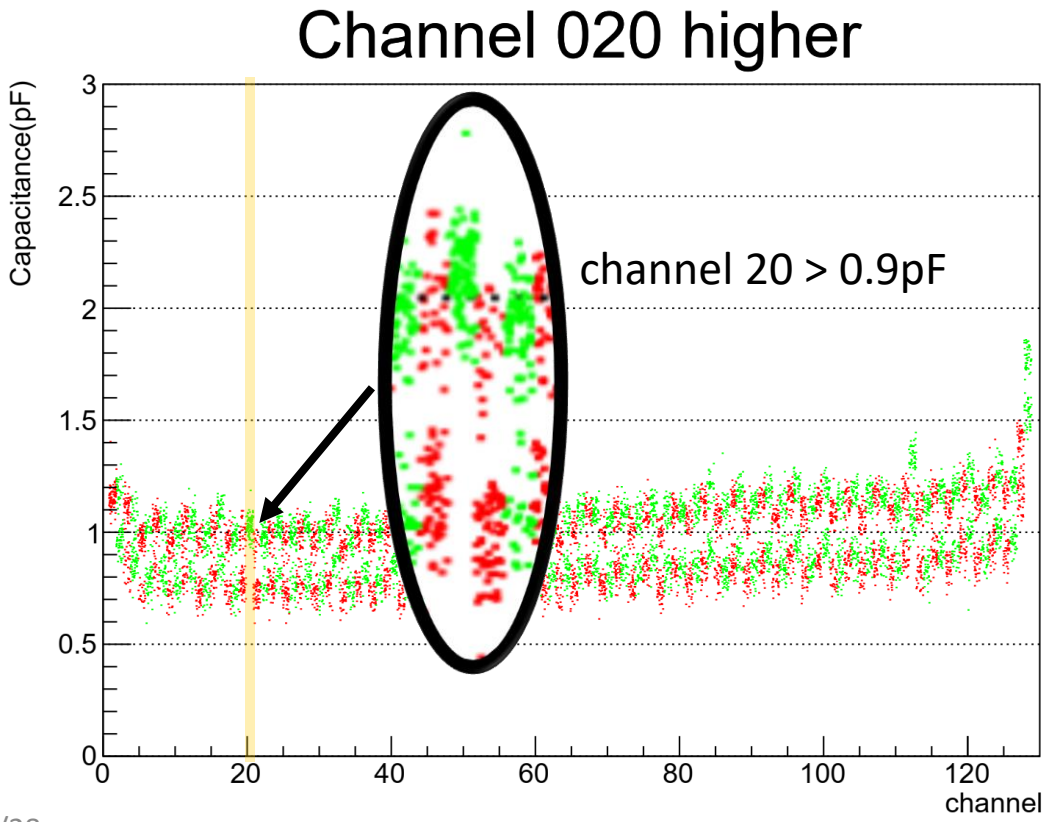
- I focus on the value of channel 20. If value of channel 20 in a chip is higher, this chip measurement are drawn in left plot. If channel 20 is lower, draw the chip in right plot.
- Comparing two plots can find even if one channel fix on one state, the status of other channels still are random.

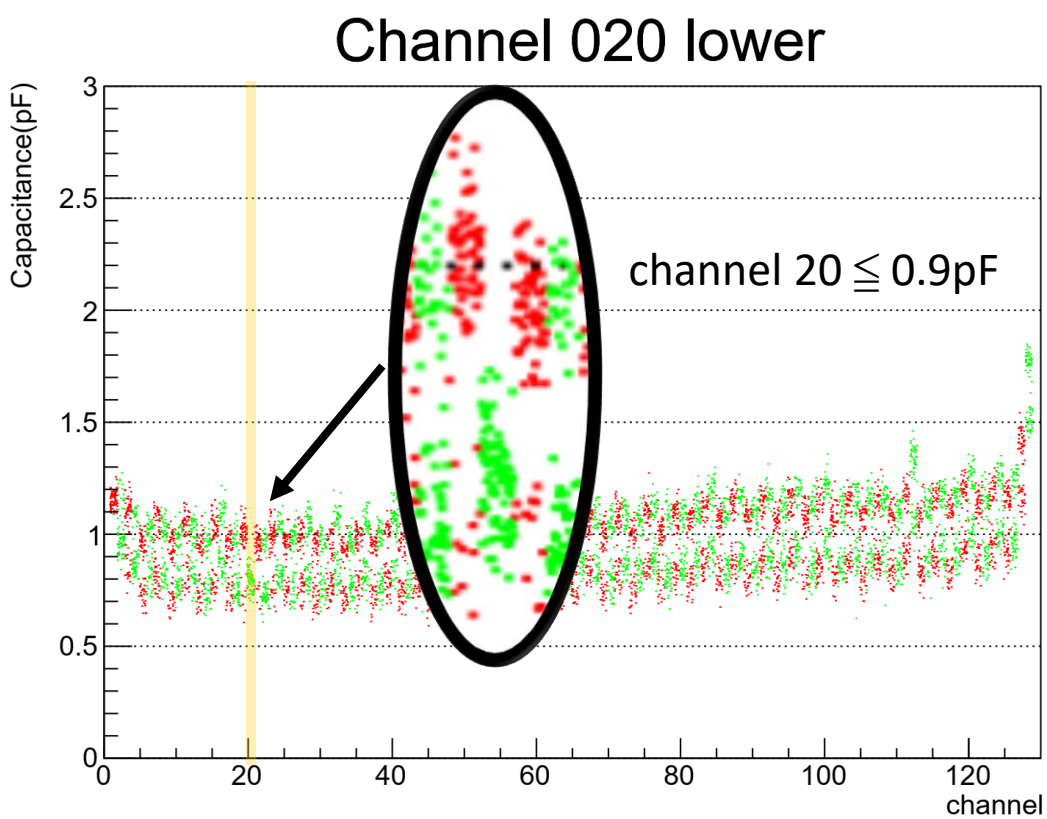




Fix the Status in One Channel

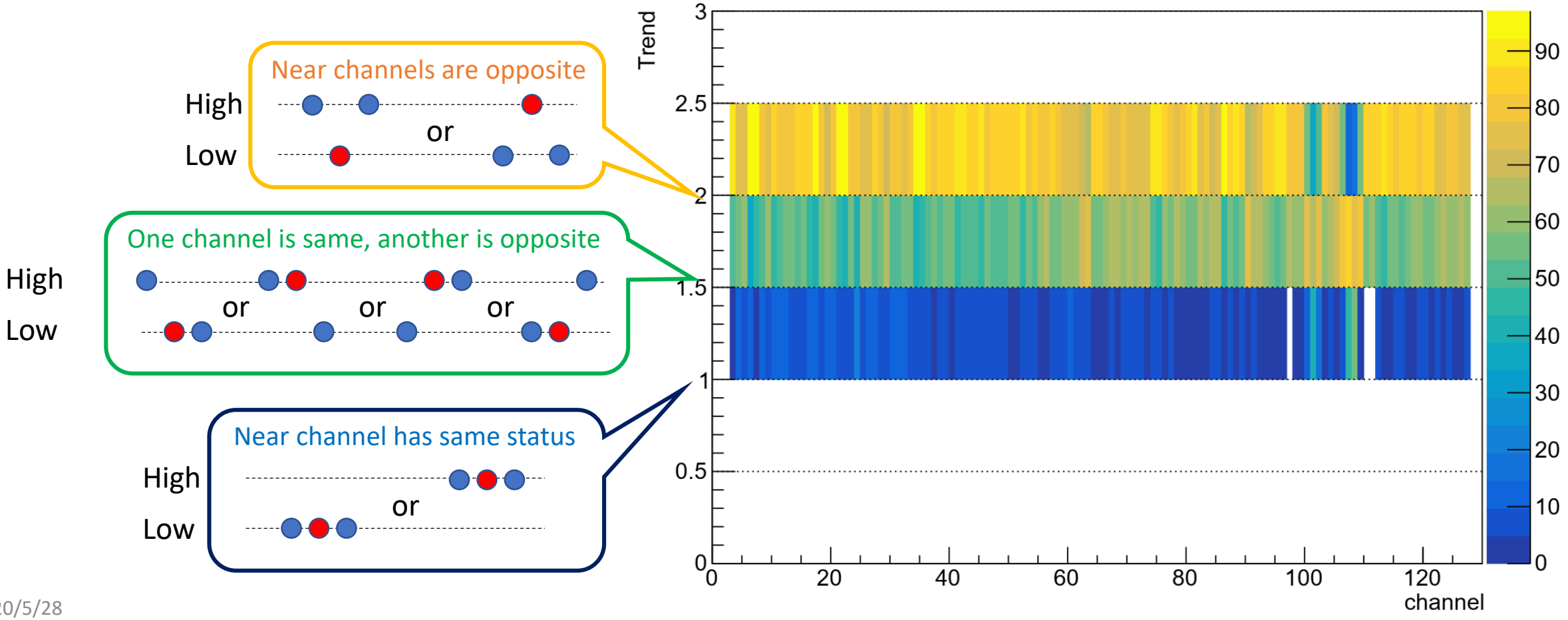
- However, if we focus on near channels, we find the near channels has higher probability to show opposite status.
- This behavior not only show in channel 20. When I check channel 60 with same method, I can find the same behavior.
- In next slide, I try to present the relation in all channels.





Relation between Near Channels

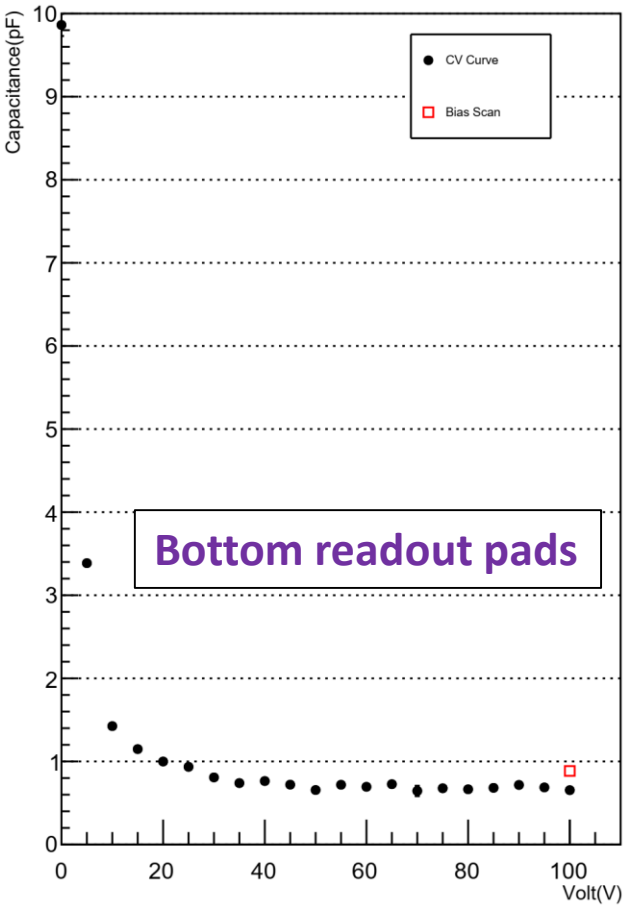
- Divide all channels into high or low status (like the digital data).
- If the status both are opposite in near channels, fill the value 2 to target channel in histogram.
- If the status both are same in near channels, fill the value 1 to target channel in histogram.
- Other situation fill value 1.5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



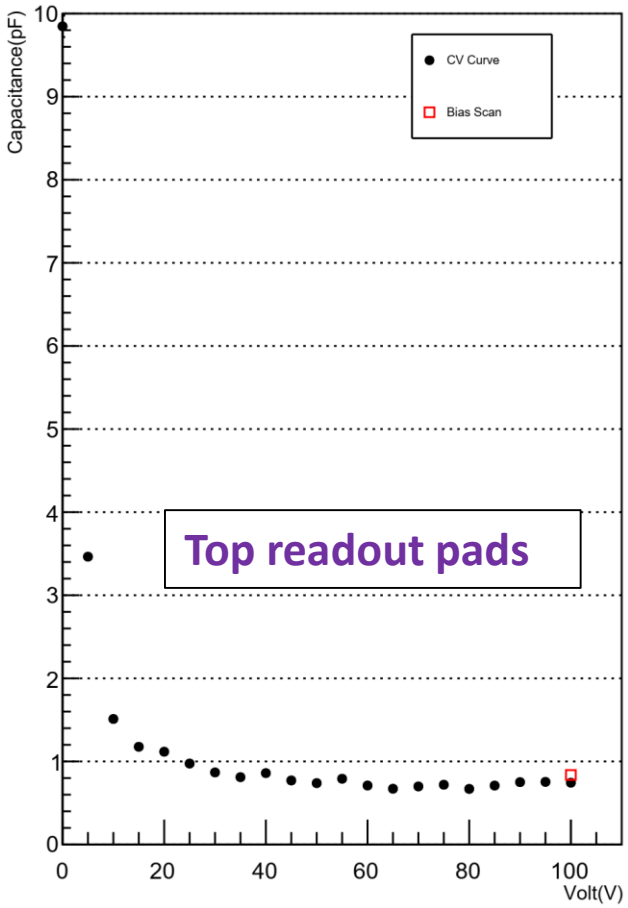
CV Cure vs Bias Scan Result

- Measure cv curve on some channels to observe the difference between channels and compare to bias scan result.
- All plots show in CV1_graph.pdf.
- Compare the value between the curve and 100V bias scan. The values are not always the same, but the difference is lower or equal to fluctuation of background measurement.

No.1148 Chip19 channel009

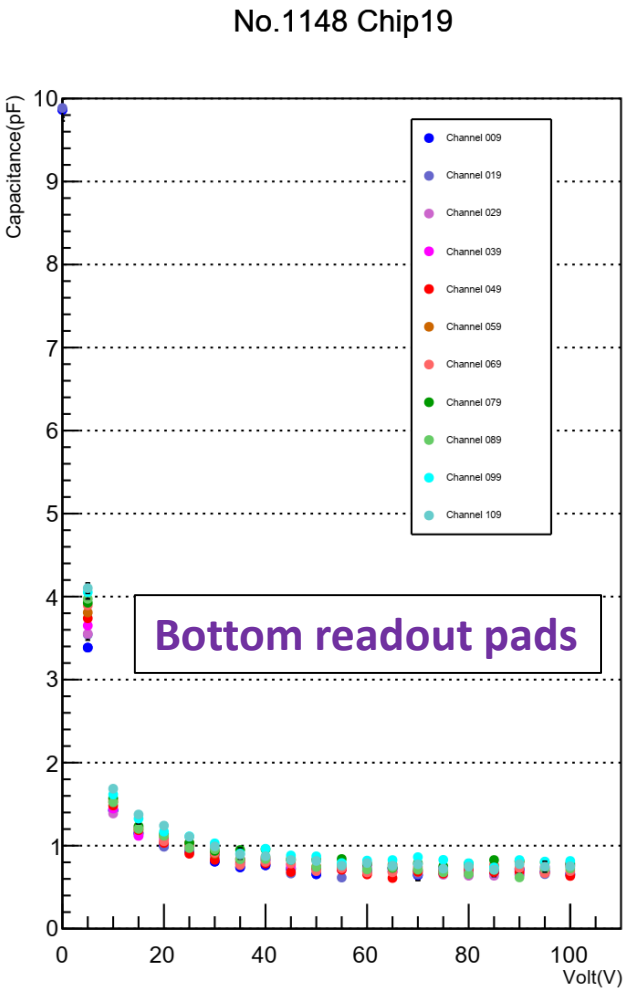


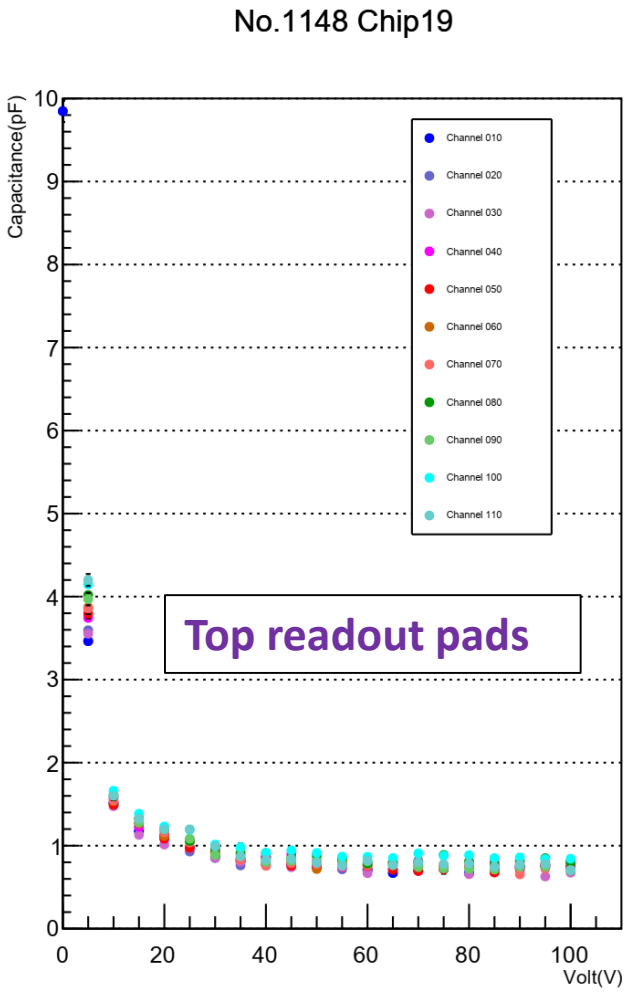
No.1148 Chip19 channel010



CV Cure vs Bias Scan Result

- Compare the cure between different channels. The higher channel usually has higher capacitance, because it has longer metal wire.
- In consideration of different length between top and bottom pads I divide top and bottom channel to different plots





Conclusion

- The background of measure system is good.
- The results of bias scan are similar with CV curve result, so the scan method is work.
- The geometry in the sensor provide different capacitance showed histogram in slide 6, but the difference smaller than two lines trend.
- This trend isn't caused by measure system or metal length. We still can't identify the reason. The top and bottom both can show the lower value or higher value, but we find usually continuous channels show the opposite trend.
- Although the measure has two lines trend, the measurement is stable and this difference is small. The different value about 0.3pF. Although the geometry is different, according to Phobos measurement, if the structure has some defect, I think the variety is more obvious than two lines difference.

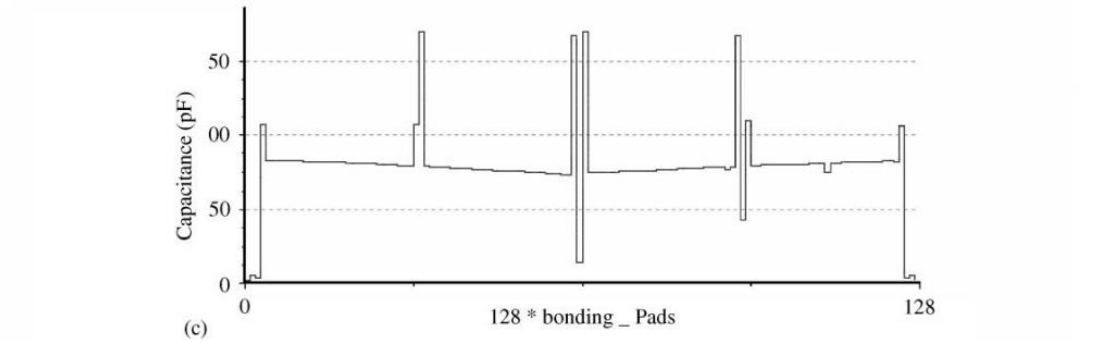


Fig. 4. Test results of one octagon silicon sensor. The (a), (b) and (c) plots represent IV test, polysilicon test and CV test, respectively.

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Back up

CV量測

- 將不同的channel用不同的顏色標示在上圖中(由於root網站假日安全憑證到期，當時這張圖顏色我沒法查詢參數做細調)
- 單獨將5V時的數據拉出來對channel作圖，電容值隨channel的增長斜率大約是0.007pF/channel
- 金屬導線寬12um，每個頻道中間會多出56um的導線長度，而上下排pad會多出170um的導線長度