



## SiDet Bump Bond Results for the First Five RTI Production Plaquettes

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This document describes the results of several different bump bond tests performed at SiDet on the first five RTI production plaquettes. Good agreement is evident between the light and forward bias tests performed at SiDet and the light test performed at Purdue. The quality of bump bonds on these plaquettes appears to be quite good.

## I. PLAQUETTES USED AND TESTS PERFORMED

On 24 July 2006 the first five RTI production plaquettes were received at SiDet from Purdue. Given the previous experience with RTI preproduction plaquettes, a quick determination of the bump bond characteristics of these plaquettes was made a priority. The RTI plaquettes received were P\_1x5L\_017\_C, P\_2x3B\_017\_C, P\_2x3T\_017\_C, P\_2x4T\_021\_C, and P\_2x5\_021\_C.

These plaquettes were tested at SiDet on 26 July 2006. They were tested at both  $+20^\circ\text{C}$  and  $-15^\circ\text{C}$ . These tests were performed on test stands 2 and 3 using version 2.3.3 of the PTA renaissance software. Bump bond test A, and the forward bias test were performed at both temperatures. The light test was also performed  $+20^\circ\text{C}$ .

The results of these tests are detailed in the sections below.

## II. P\_1X5L\_017\_C

Table I lists the number of bad bump bonds found per readout chip for all bump bond tests performed on this plaquette. The Purdue light test results are also listed. Figure 1 shows the bump bond test A results, Figure 2 shows the forward bias test results, and Figure 3 shows the SiDet light test results.

TABLE I: The number of bad bump bonds found per readout chip for P\_1x5L\_017\_C. The first number is for the test performed at  $+20^\circ\text{C}$ . The number in parantheses is for the test performed at  $-15^\circ\text{C}$ . The results from the light test performed at Purdue are also listed.

ROC	Number of Bad Bump Bonds			
	Bump Bond Test A	Forward Bias Test	SiDet Light Test	Purdue Light Test
0	1 (3)	1 (1)	1	1
1	3 (2)	5 (5)	5	5
2	8 (0)	0 (0)	0	0
3	0 (0)	0 (0)	0	0
4	9 (1)	1 (1)	1	1

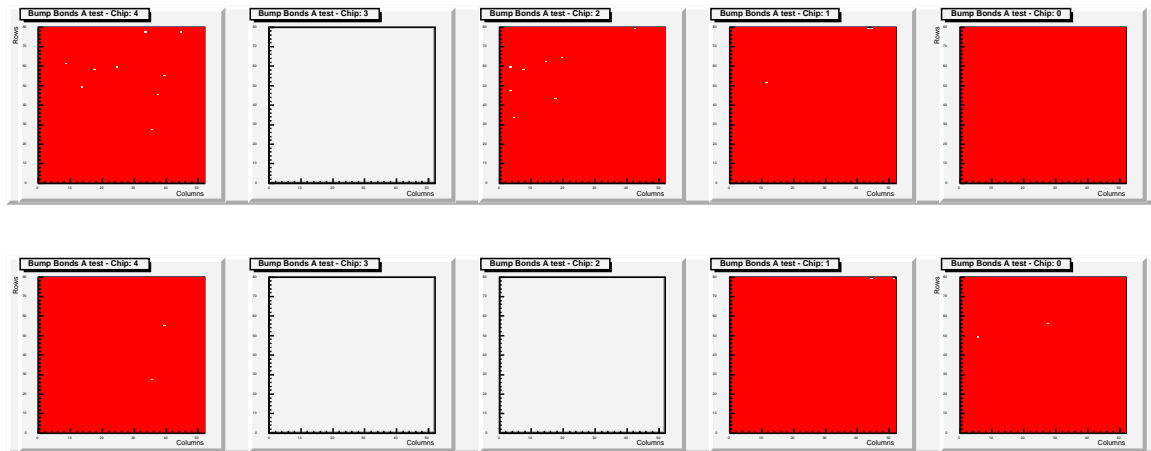


FIG. 1: Bump bond test A results for P\_1x5L\_017\_C. The top plot was performed at  $+20^\circ\text{C}$  and the bottom plot was performed at  $-15^\circ\text{C}$ .

## III. P\_2X3B\_017\_C

Table II lists the number of bad bump bonds found per readout chip for all bump bond tests performed on this plaquette. The Purdue light test results are also listed. Figure 4 shows the bump bond test A results, Figure 5 shows the forward bias test results, and Figure 6 shows the SiDet light test results.

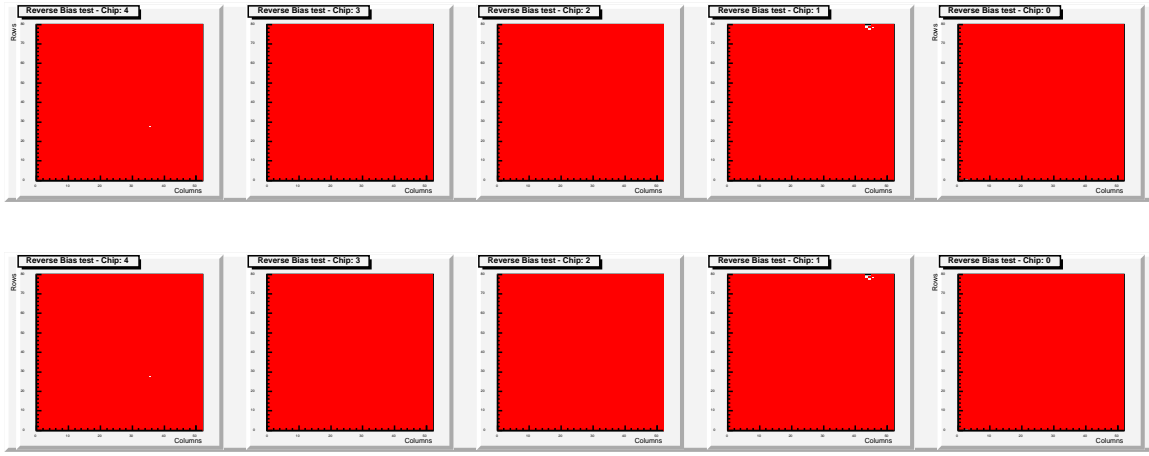


FIG. 2: Forward bias test results for P\_1x5L\_017\_C. The top plot was performed at  $+20^{\circ}$  C and the bottom plot was performed at  $-15^{\circ}$  C.

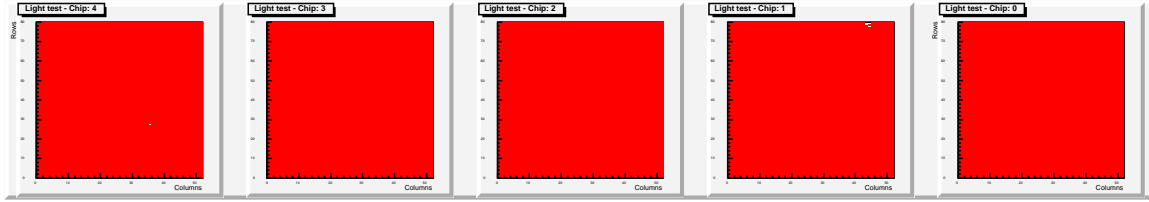


FIG. 3: SiDet light test results for P\_1x5L\_017\_C. The test was performed at  $+20^{\circ}$  C.

TABLE II: The number of bad bump bonds found per readout chip for P\_2x3B\_017\_C. The first number is for the test performed at  $+20^{\circ}$  C. The number in parantheses is for the test performed at  $-15^{\circ}$  C. The results from the light test performed at Purdue are also listed.

ROC	Bump Bond Test A	Number of Bad Bump Bonds		
		Forward Bias Test	SiDet Light Test	Purdue Light Test
0	3 (4)	1 (1)	0	1
1	0 (0)	0 (0)	0	0
2	2 (0)	0 (0)	0	0
3	0 (0)	0 (0)	0	0
4	0 (0)	0 (0)	0	0
5	0 (0)	0 (0)	0	0

#### IV. P\_2X3T\_017\_C

Table III lists the number of bad bump bonds found per readout chip for all bump bond tests performed on this plaquette. The Purdue light test results are also listed. Figure 7 shows the bump bond test A results, Figure 8 shows the forward bias test results, and Figure 9 shows the SiDet light test results.

#### V. P\_2X4T\_021\_C

Table IV lists the number of bad bump bonds found per readout chip for all bump bond tests performed on this plaquette. The Purdue light test results are also listed. Figure 10 shows the bump bond test A results, Figure 11 shows the forward bias test results, and Figure 12 shows the SiDet light test results.

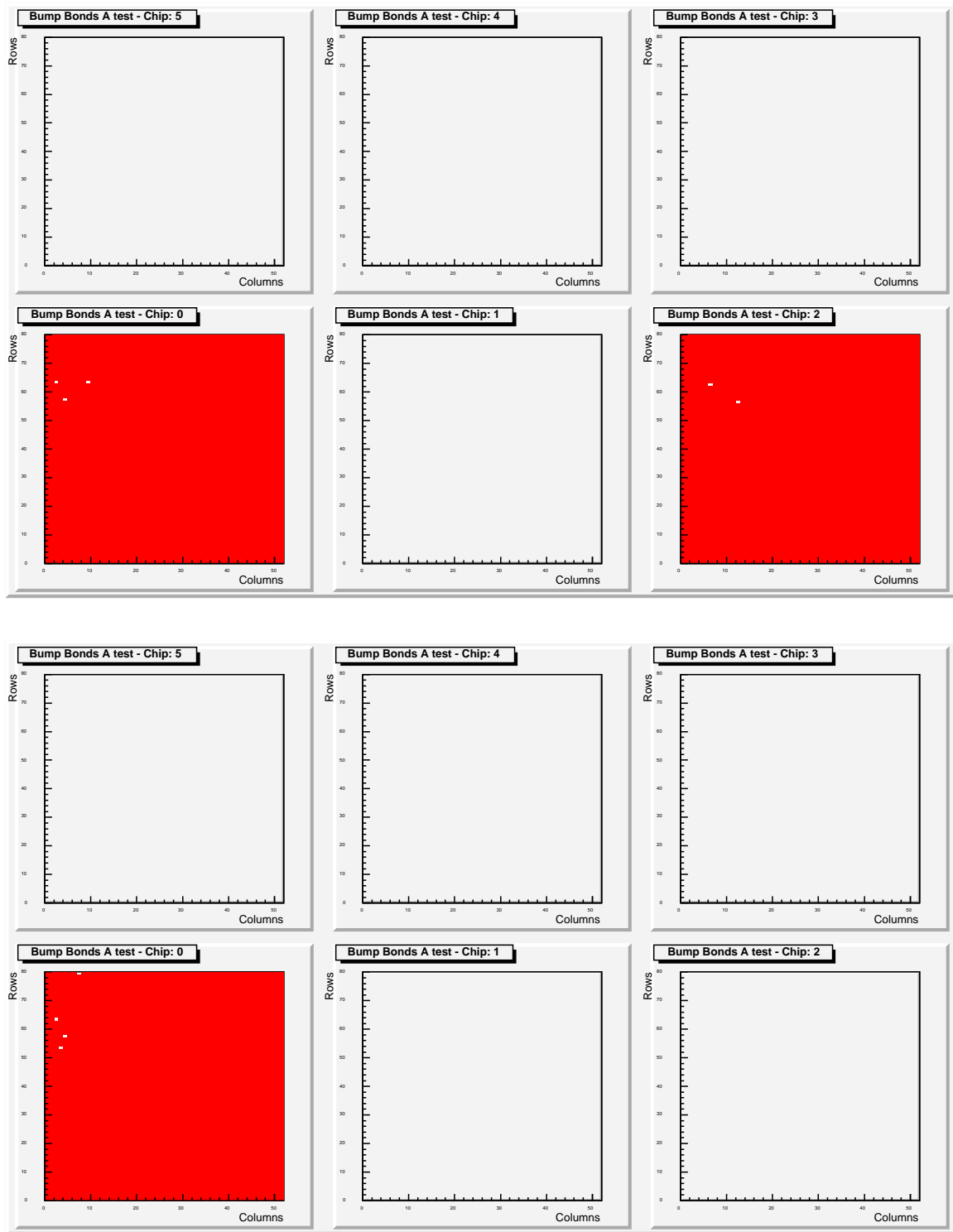


FIG. 4: Bump bond test A results for P\_2x3B\_017\_C. The top plot was performed at +20° C and the bottom plot was performed at -15° C.

## VI. P\_2X5\_021\_C

Table V lists the number of bad bump bonds found per readout chip for all bump bond tests performed on this plaquette. The Purdue light test results are also listed. Figure 13 shows the bump bond test A results, Figure 14

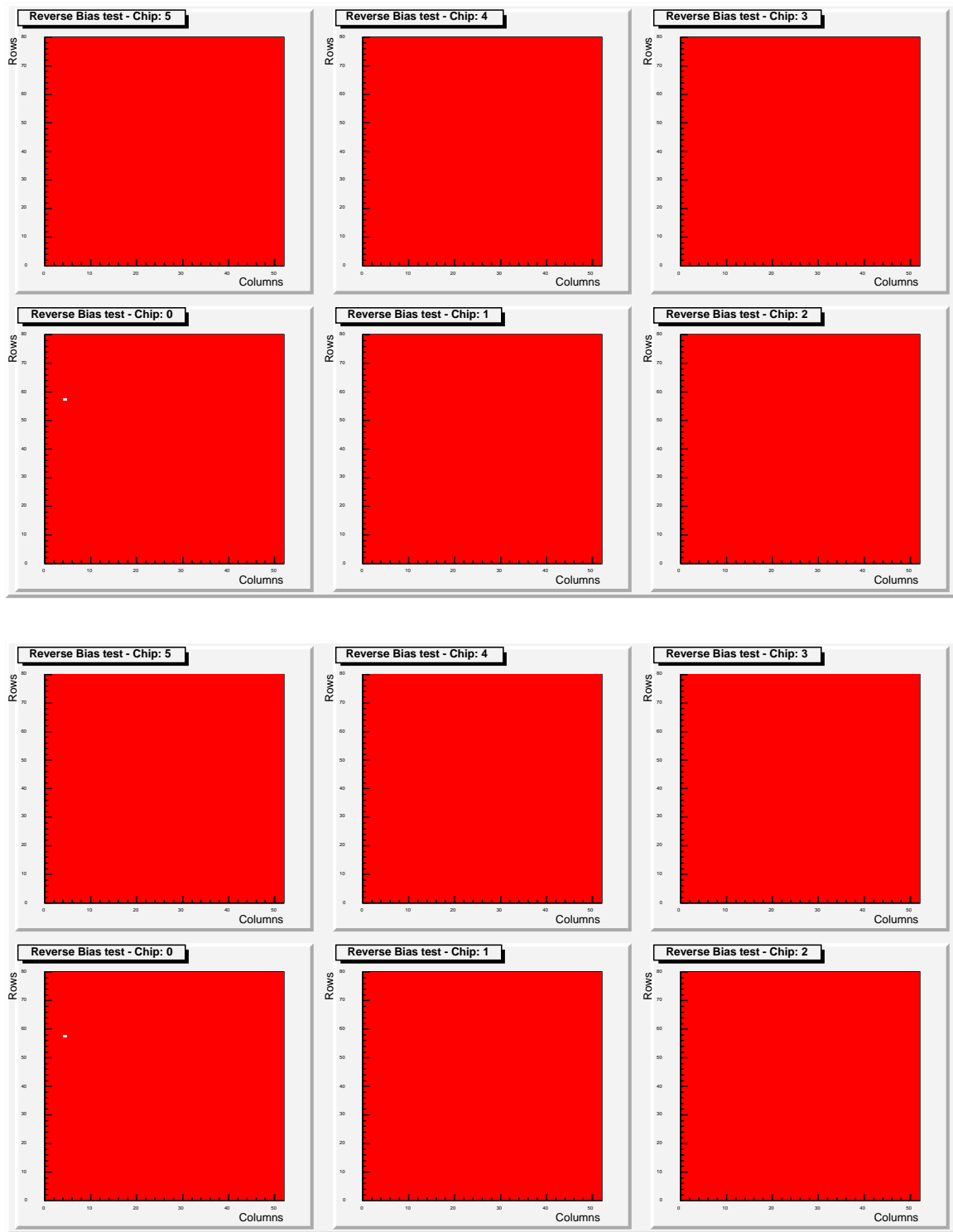


FIG. 5: Forward bias test results for P\_2x3B\_017\_C. The top plot was performed at  $+20^{\circ}$  C and the bottom plot was performed at  $-15^{\circ}$  C.

shows the forward bias test results, and Figure 15 shows the SiDet light test results.

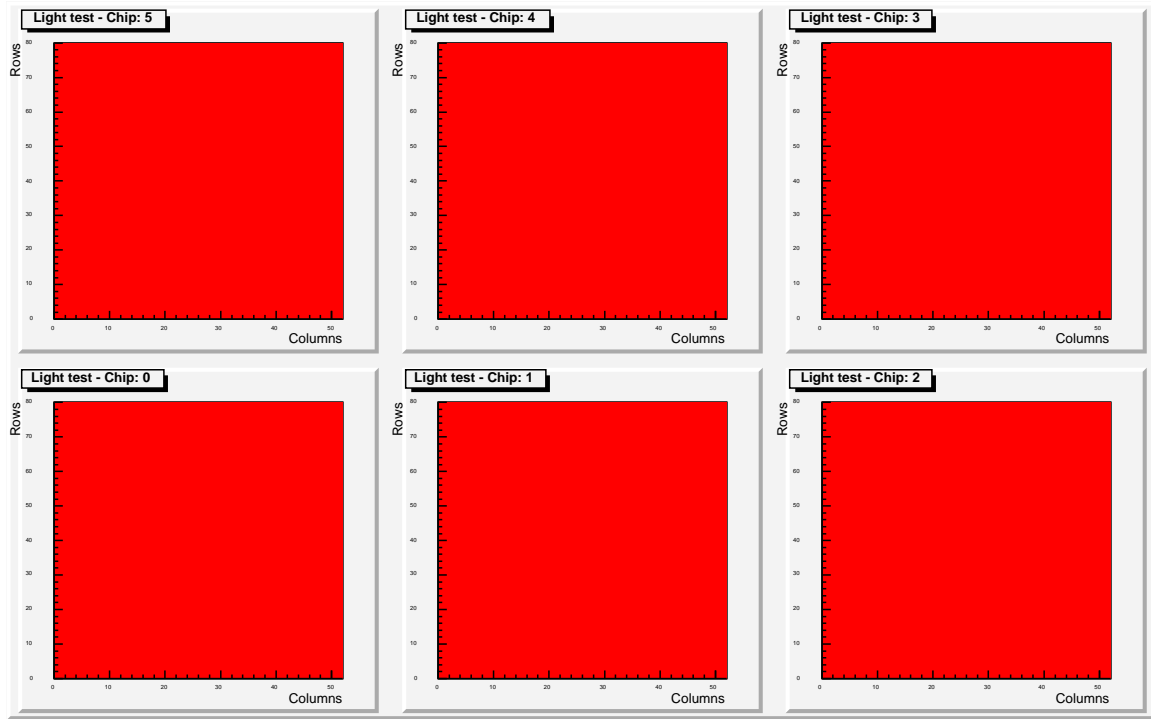


FIG. 6: SiDet light test results for P\_2x3B\_017\_C. The test was performed at  $+20^\circ$  C.

TABLE III: The number of bad bump bonds found per readout chip for P\_2x3T\_017\_C. The first number is for the test performed at  $+20^\circ$  C. The number in parentheses is for the test performed at  $-15^\circ$  C. The results from the light test performed at Purdue are also listed.

ROC	Bump Bond Test A	Number of Bad Bump Bonds			Purdue Light Test
		Forward Bias Test	SiDet Light Test		
0	0 (0)	0 (0)	0	0	
1	12 (0)	0 (0)	0	0	
2	4 (1)	0 (0)	0	0	
3	3 (1)	1 (1)	1	0	
4	8 (4)	1 (1)	1	1	
5	4 (2)	1 (1)	1	1	

TABLE IV: The number of bad bump bonds found per readout chip for P\_2x4T\_021\_C. The first number is for the test performed at  $+20^\circ$  C. The number in parentheses is for the test performed at  $-15^\circ$  C. The results from the light test performed at Purdue are also listed.

ROC	Bump Bond Test A	Number of Bad Bump Bonds			Purdue Light Test
		Forward Bias Test	SiDet Light Test		
0	0 (0)	1 (1)	1	1	
1	3247 (10)	0 (0)	0	0	
2	0 (2)	0 (0)	0	0	
3	0 (1)	0 (0)	0	0	
4	1 (0)	0 (0)	0	0	
5	0 (0)	0 (0)	0	0	
6	0 (0)	0 (0)	0	0	
7	4 (0)	0 (0)	0	0	

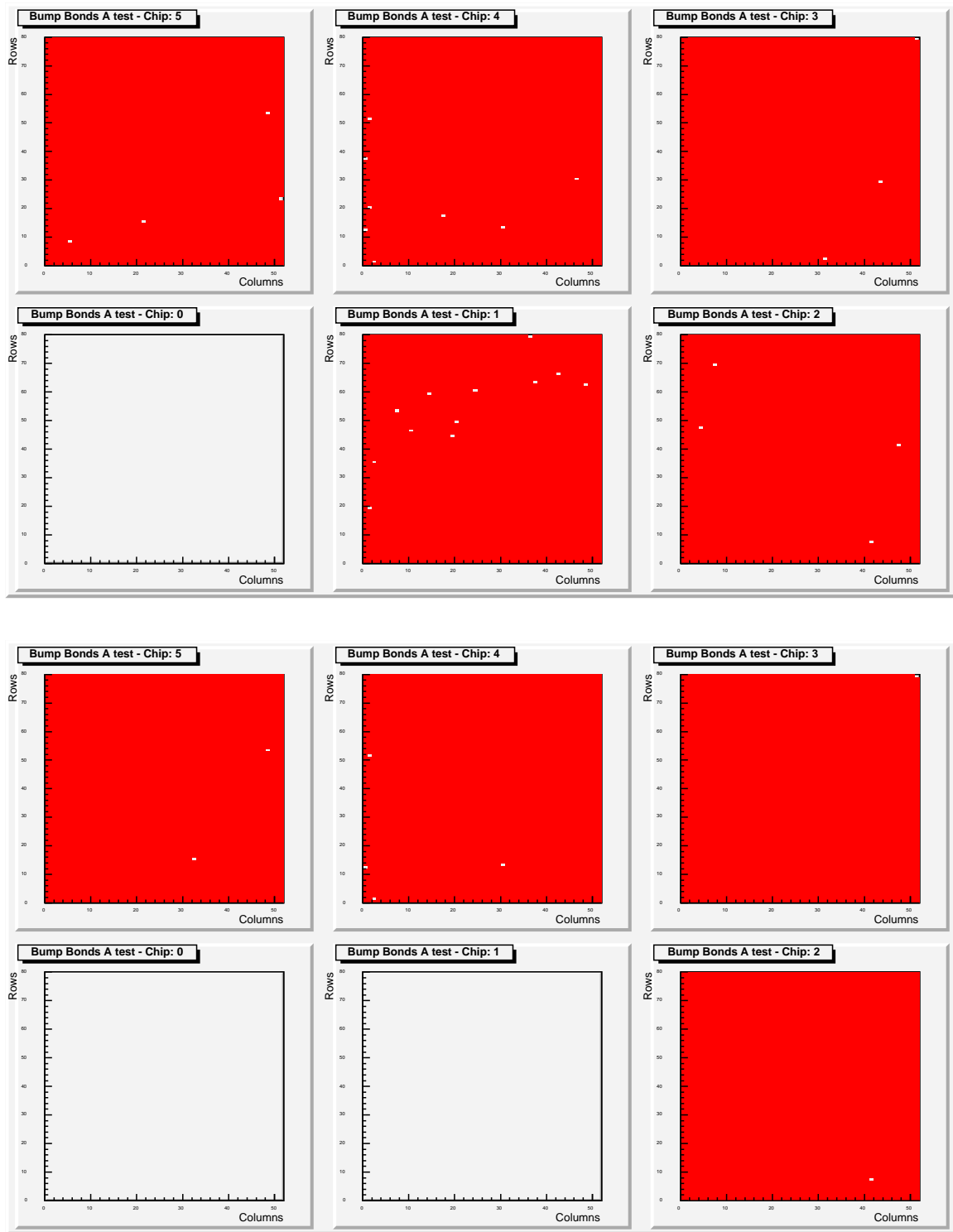


FIG. 7: Bump bond test A results for P\_2x3T\_017\_C. The top plot was performed at  $+20^{\circ}$  C and the bottom plot was performed at  $-15^{\circ}$  C.

## VII. CONCLUSION

The light and forward bias tests performed at SiDet show excellent agreement, both with each other and at different temperatures. These tests also agree very well (in the total number of bad bumps per readout chip) with the light

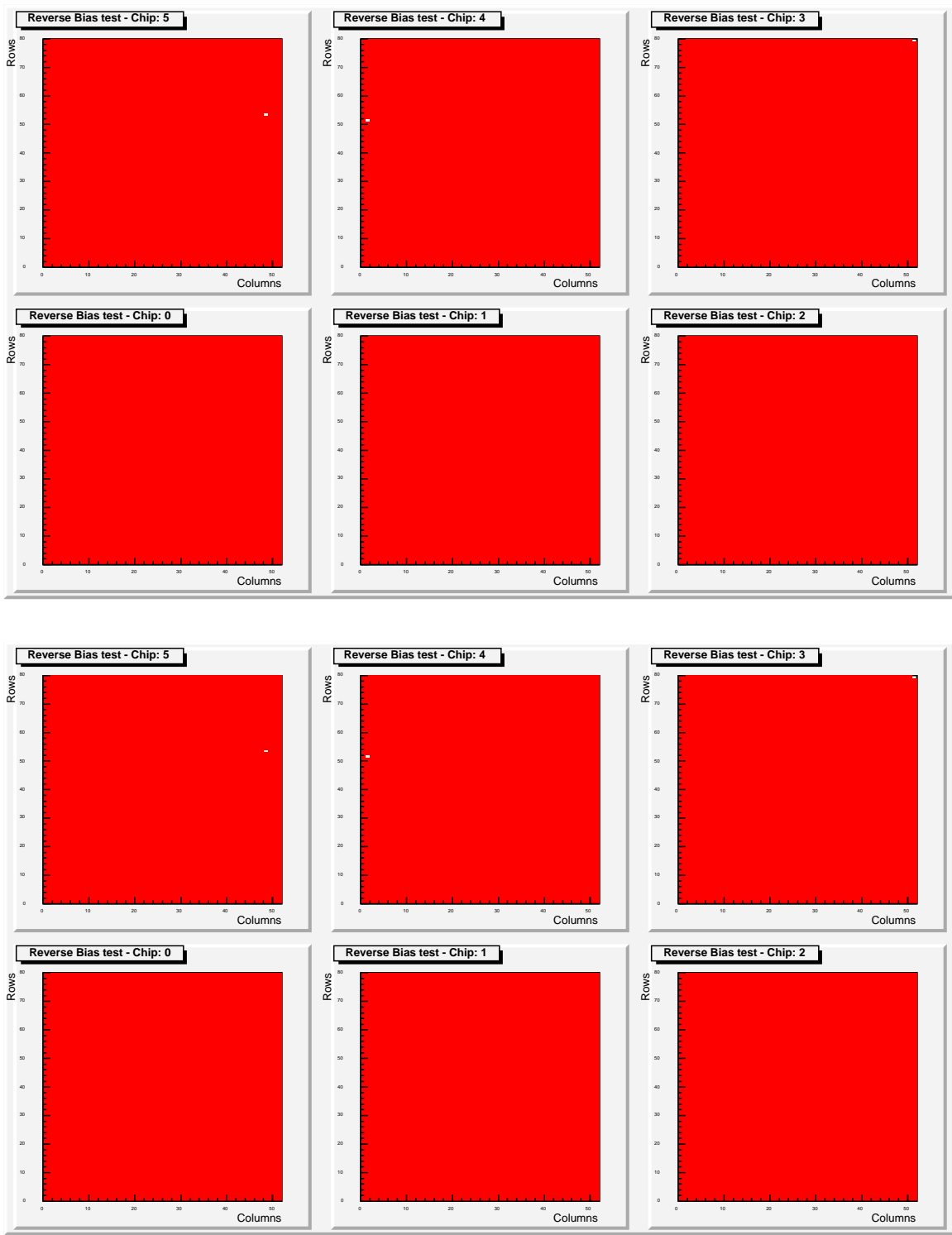


FIG. 8: Forward bias test results for P\_2x3T\_017\_C. The top plot was performed at  $+20^{\circ}$  C and the bottom plot was performed at  $-15^{\circ}$  C.

test performed at Purdue.

The quality of bump bonds on these modules appears to be quite good, and much improved over the RTI preproduction plaquettes. The two readout chips with the largest number of bad bump bonds have 62 and 17 bad bump bonds (according to the light and forward bias tests). These chip both occur on P\_2x5\_021\_C. This number of bad bump bonds represents 1.5% and 0.4% of the total pixels on the readout chip, respectively. The total number of bad



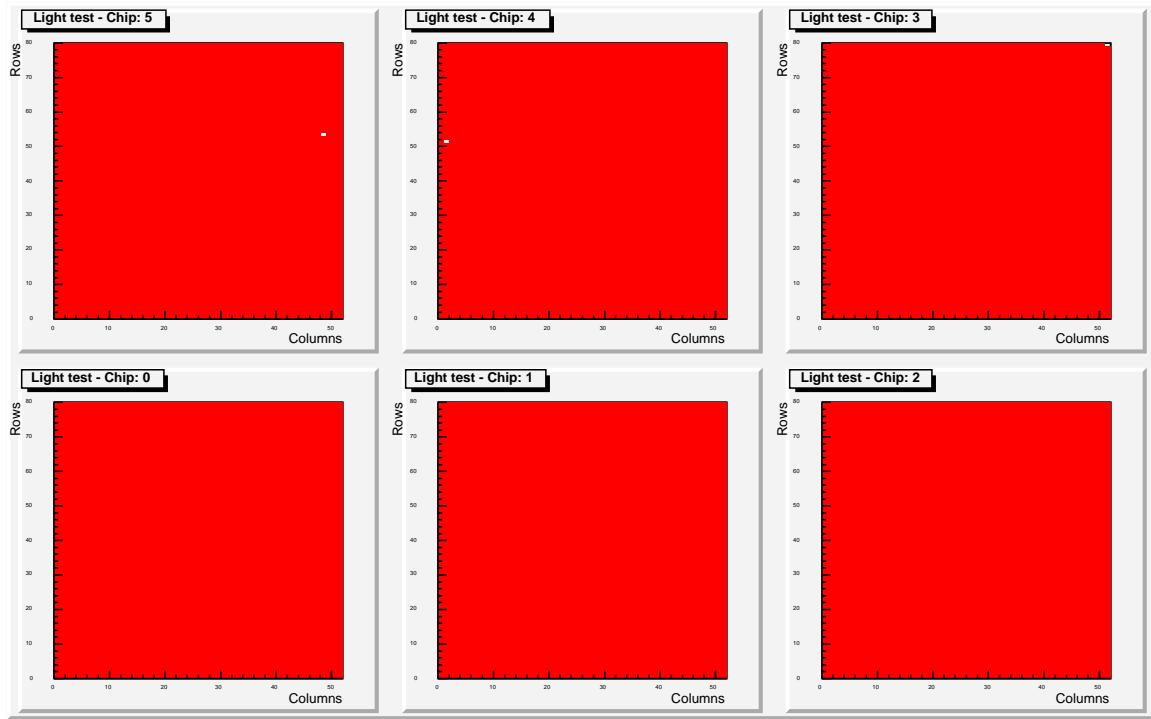


FIG. 9: SiDet light test results for P\_2x3T\_017\_C. The test was performed at  $+20^\circ$  C.

TABLE V: The number of bad bump bonds found per readout chip for P\_2x5\_021\_C. The first number is for the test performed at  $+20^\circ$  C. The number in parentheses is for the test performed at  $-15^\circ$  C. The results from the light test performed at Purdue are also listed.

ROC	Bump Bond Test A	Number of Bad Bump Bonds		
		Forward Bias Test	SiDet Light Test	Purdue Light Test
0	1 (1)	1 (1)	1	1
1	1 (2)	0 (0)	0	0
2	7 (0)	0 (0)	0	0
3	3 (0)	0 (0)	0	0
4	19 (18)	17 (17)	17	17
5	62 (62)	62 (62)	62	58
6	1 (0)	0 (0)	0	0
7	2 (1)	1 (1)	1	1
8	4 (0)	0 (0)	0	0
9	1 (0)	0 (0)	0	0

bump bonds on the plaquette P\_2x5\_021\_C is 81, or 0.2% of the total number of pixels.

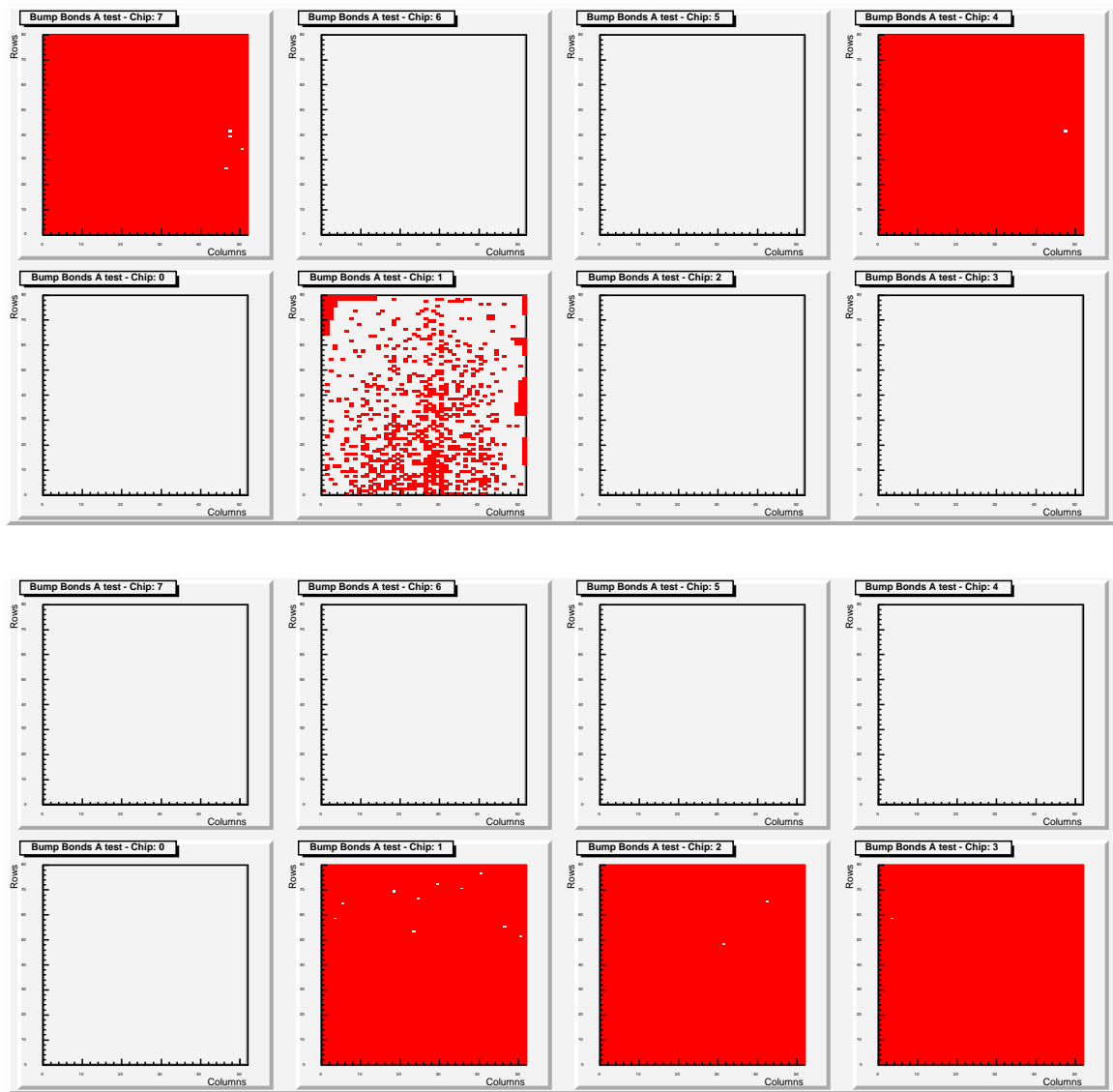


FIG. 10: Bump bond test A results for P\_2x4T\_021-C. The top plot was performed at  $+20^{\circ}$  C and the bottom plot was performed at  $-15^{\circ}$  C.

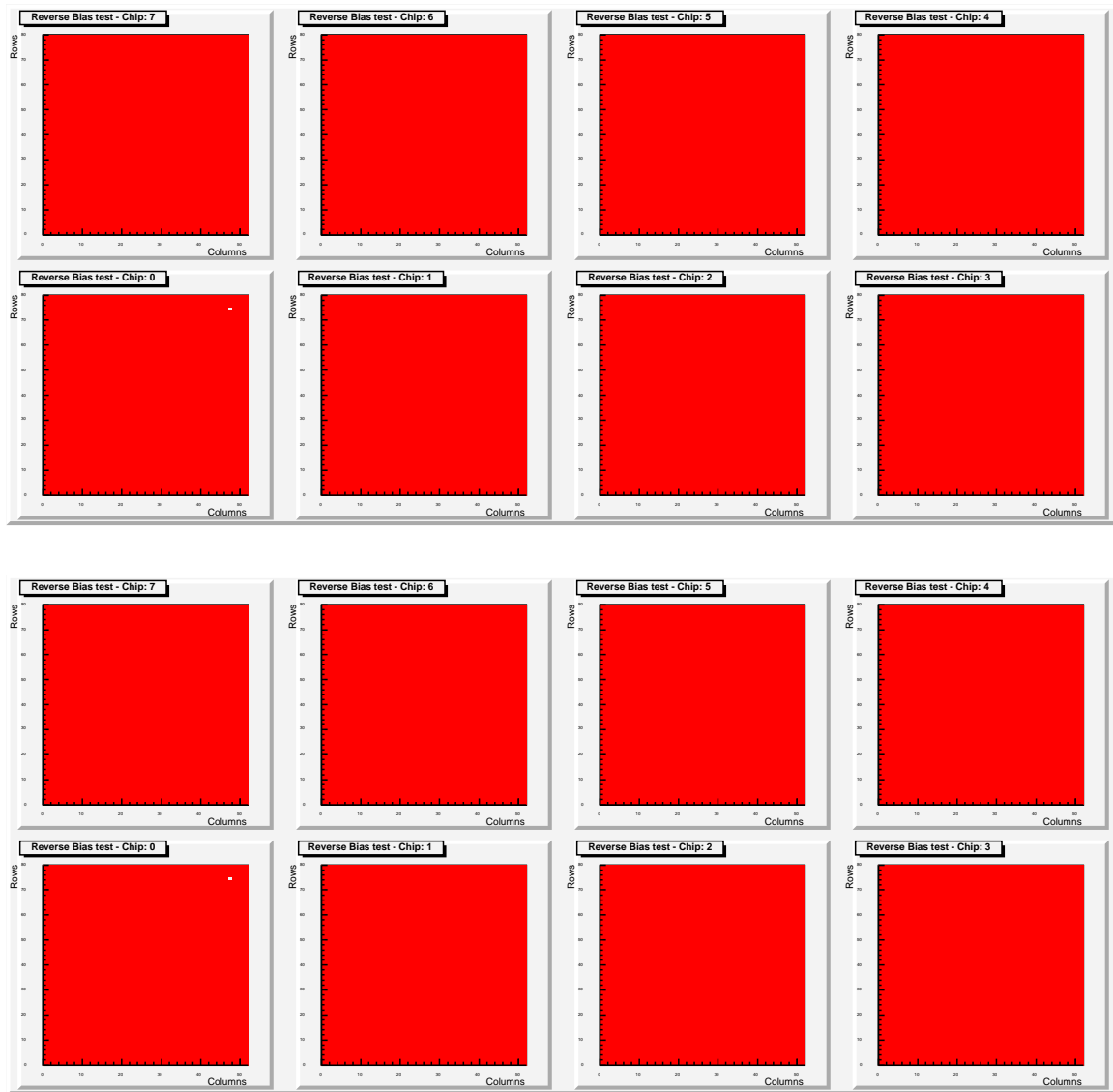


FIG. 11: Forward bias test results for P\_2x4T\_021\_C. The top plot was performed at +20° C and the bottom plot was performed at -15° C.

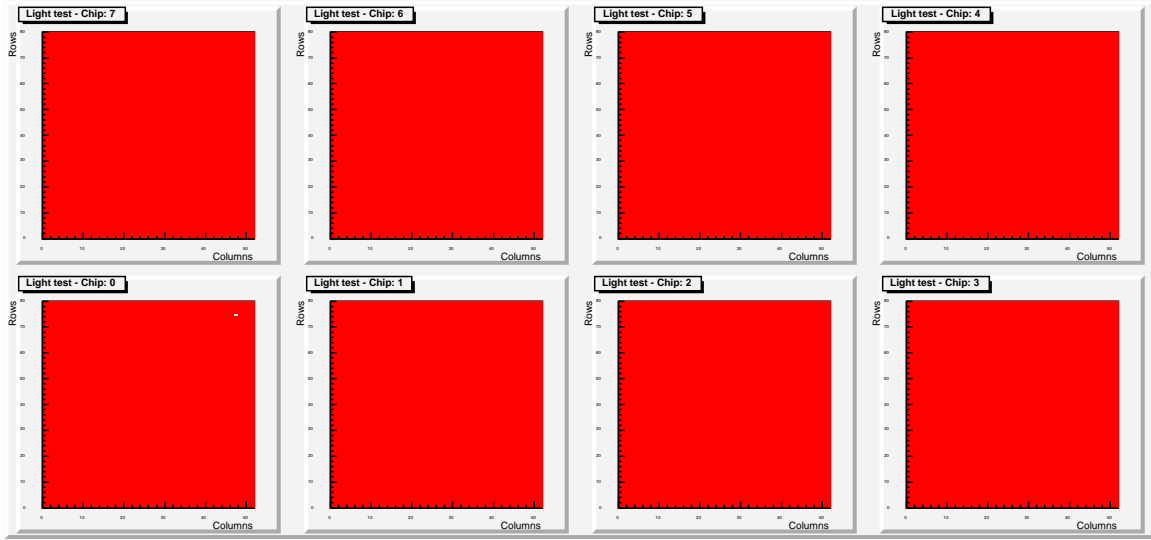


FIG. 12: SiDet light test results for P\_2x4T\_021\_C. The test was performed at +20° C.



FIG. 13: Bump bond test A results for P\_2x5\_021\_C. The top plot was performed at +20° C and the bottom plot was performed at -15° C.



FIG. 14: Forward bias test results for P\_2x5\_021\_C. The top plot was performed at  $+20^{\circ}$  C and the bottom plot was performed at  $-15^{\circ}$  C.

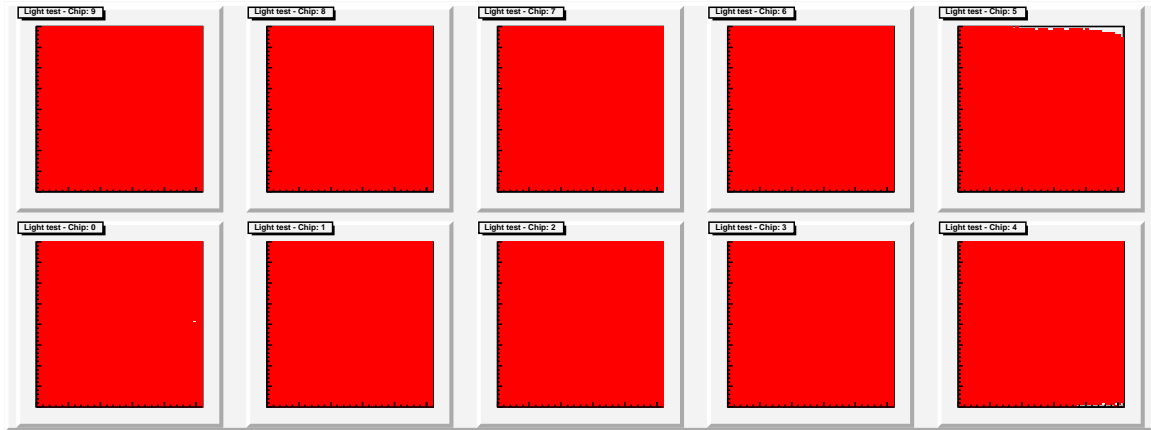


FIG. 15: SiDet light test results for P\_2x5\_021\_C. The test was performed at  $+20^{\circ}$  C.