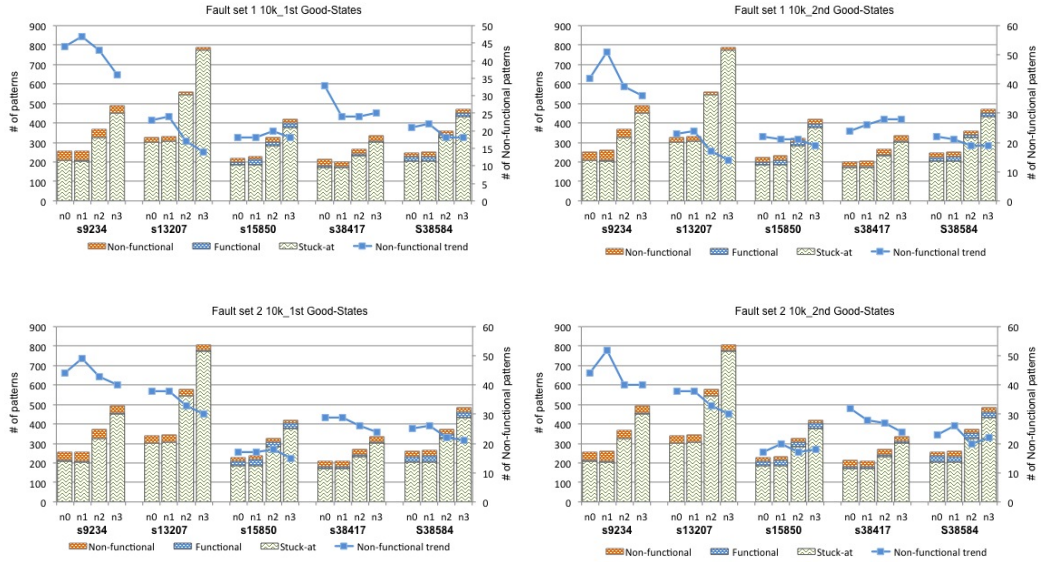
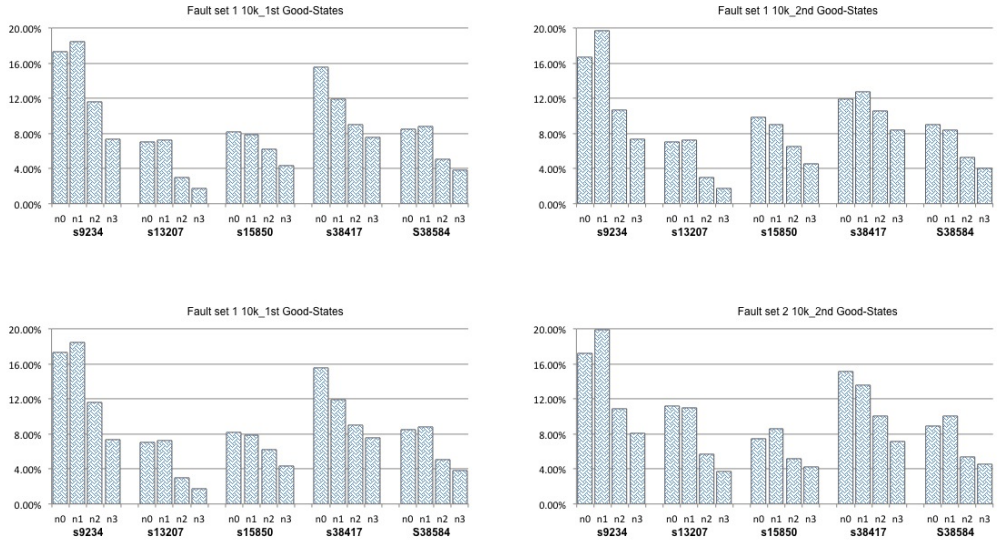
Stuck-At VS. Cell-Aware Detection



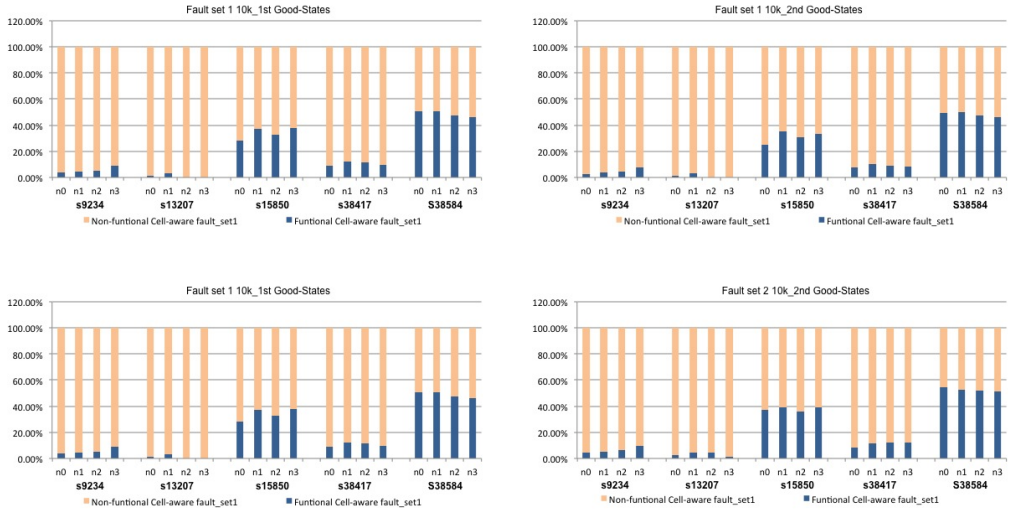
In the above figures we can see that two different generations of 10 000 good-states used on two different permutations of a UDFM(User Defined Fault Model) yielded similar results. Another observation is that in each of the four cases there are more patterns that test for non-functional defects than those that tests for functional defects that are generated by cell aware ATPG, even in comparison with the large number of patterns generated by stuck-at ATPG, the number of non-functional patterns is significant. The number of functional test patterns is negligible compared to the large amount of patterns generated by the stuck-at ATPG. Because adding all of the non-functional tests to the test set adds significant costs, these figures suggest that using n-detect with a higher degree of n can decrease the number of non-functional tests which will decrease the added costs associated with testing all of the non-functional defects.

Increase in Test Set Length



These graphs represent the total percentage of patterns that test for non-functional defaults generated by cell aware ATPG out of all of the total patterns for each of the five circuits that were tested. Here again we see that two different sets of 10 000 good-states, as well as two different UDFM's achieved similar results. As the n-detect redundancy increases we see a sharp decrease in the percentage of patterns that check for non-functional defects. Although even when we use n3 there remains 3 4% of patterns testing non-functional defects this is still a dramatic decrease from the normal percentage which is around 17 18% of all test patterns. This percentage decrease is not due to a decrease in the actual number of non-functional test patterns(as seen in figure 1), but an overall increase in the number of stuck-at ATPG patterns generated in response to the desired functional test redundancy of the n-detect pattern generation.

Functional & Non-functional Distributions



The above figures show the distribution of percentages of functional, and non-functional test patterns generated over all the patterns not generated by stuck-at ATPG. Once again the results were similar for all of the tested patterns and UDFMs. We can see that the non-functional test patterns that were generated accounted for a large percentage of the total patterns that were generated by cell aware ATPG. In s13207 the non-functional test patterns accounted for 97-100% of all the cell aware generated patterns, whereas in s38584 non-functional test patterns only accounted for 50-54% of the total cell aware generated patterns.

Benchmark	**s9234**				**s9234**				**s9234**				**s9234**		
n **number**	**n0**	**n1**	**n2**	**n3**	**n0**	**n1**	**n2**	**n3**	**n0**	**n1**	**n2**	**n3**	**n0**	**n1**	**n2**

This table shows the number of functional faults in each circuit, because faults are inserted in each of the gates we can see that the larger the circuit, the more faults are inserted.

Here are charts for each of the five circuits that were tested. They show the number of functional faults that were detected based on the UDFM used and the iteration of the test. The bars above each of the n-detect numbers represent the faults detected in each set of gates: AND, NAND, NOR, and OR respectively, with 2,3, and 4 input pins each. We noticed that some

faults were detected only 2 or 3 times, whereas others were detected as many as 8 000 times. The faults that were detected many times are likely the most crucial faults. N-detect does not detect many important functional faults, even as n increases. This suggests that increasing the redundancy of the test set with n-detect is ineffective for examining these crucial functional faults.