C H A P T E R 6

RESULTS AND QUALITY EVALUATION

This chapter contains information on the results of the tests that were performed on the SAR model using the test planning system. The SAR model performs video to baseband I/Q conversion, range compression, and postfiltering. The test vector is a pulse of the chirp signal returned by the targets in the swath. The MUT output is a one-dimensional target range profile and the detected target ranges after postfiltering. The gold values are either the expected target ranges in meters or the range bin numbers of the expected targets, depending on how the model is tested. The comparator computes the mean square error of the detected target ranges against the expected ranges. The test

vectors, the range profile, the postfiltering output, and a textual summary are displayed automatically after simulation by the test planning system.

This chapter also reports the experimental investigation into the quality of the test set generated by the SAR goal tree.

6.1 Results of Single Tests

This section shows the results of several single test cases under the user driven mode of the test planning system. Figures 5.3 and 5.4 have shown the base windows of the graphical user interface under the code generated option and the file I/O option of the user driven mode.

Example 1

This is an example where the target range is placed at 7,280 meters away from the radar. Figure 6.1 shows the generated test vector which represents the SAR return from the target. Figure 6.2 shows the FFT of the SAR algorithm output and the detected target after postfiltering. Figure 6.3 shows the X Window target report which lists detailed numeric data on the detected target(s) and their mean squared error if applicable. It indicates that the target is detected at range 7,279.95 meters with an error of 0.05 meters.
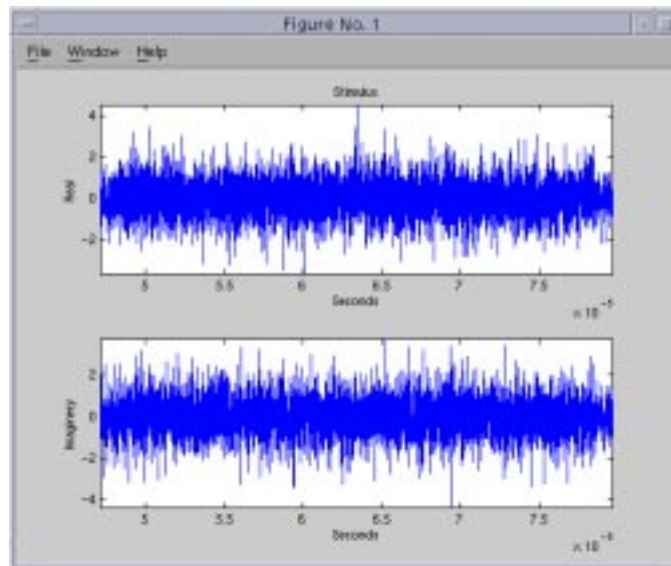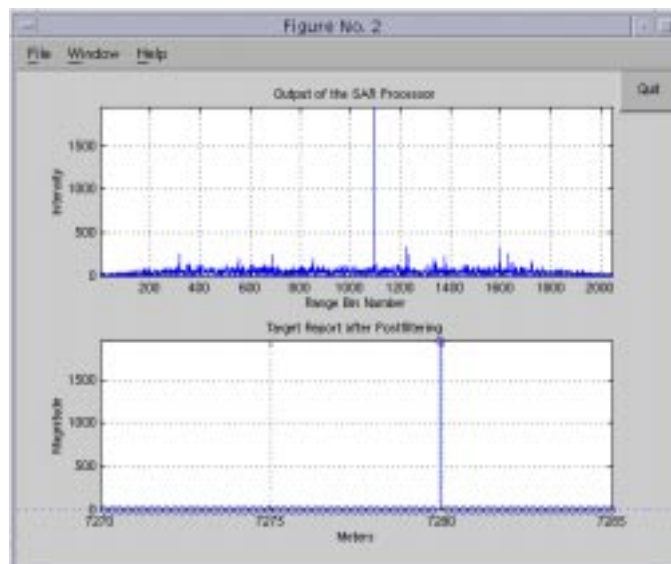
Figure 6.1 Test Vector Generated in Example 1

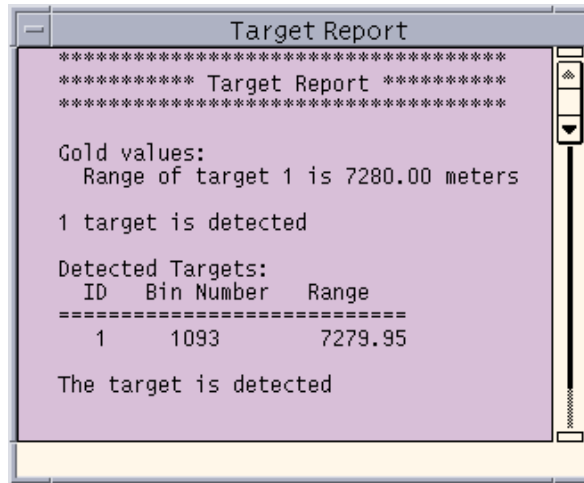**Figure 6.2 Range Profile and Detected Target in Example 1**

Figure 6.3 Target Report in Example 1

Example 2

This example aims to test how well the MUT can handle multiple targets. 6 targets are placed in the swath. The simulation result shows that all the targets are detected and the mean squared error of the detected ranges is 0.12 meters. Figures 6.4, 6.5, and 6.6 show the windows popping up after simulation.
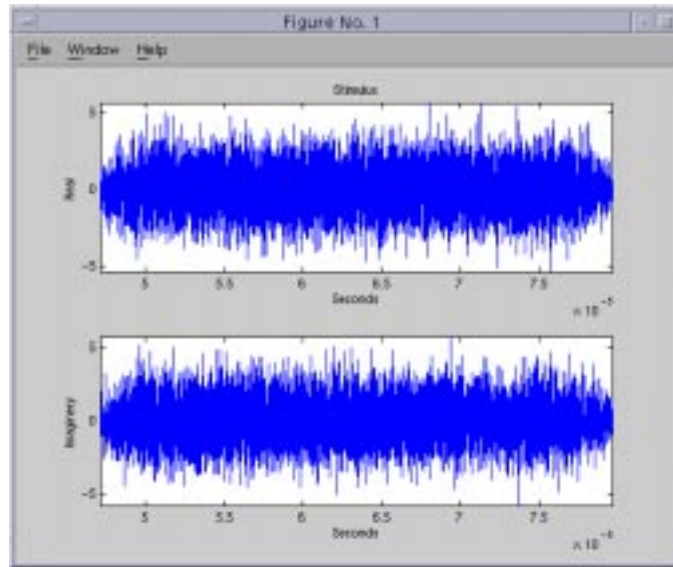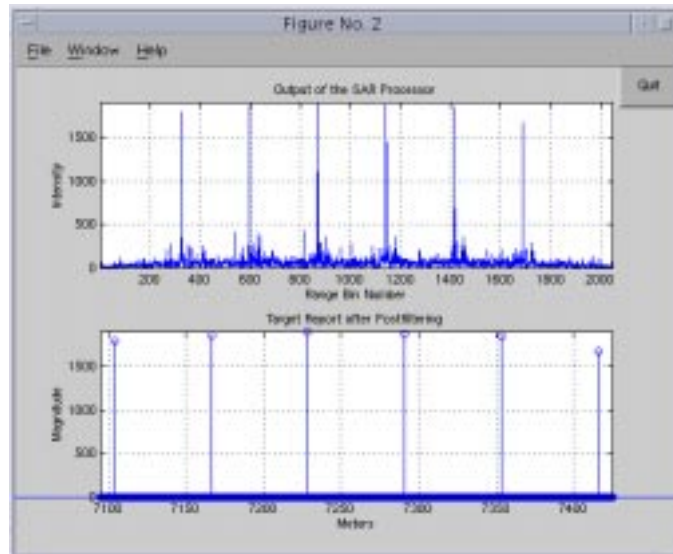
Figure 6.4 Test Vector Generated in Example 2

Figure 6.5 Range Profile and Detected Targets in Example 2

```
                    Target Report

*************************************
*********** Target Report **********
*************************************

Gold values:
   Range of target 1 is 7103.75 meters
   Range of target 2 is 7166.25 meters
   Range of target 3 is 7228.75 meters
   Range of target 4 is 7291.25 meters
   Range of target 5 is 7353.75 meters
   Range of target 6 is 7416.25 meters

6 targets are detected

Detected Targets:
   ID   Bin Number    Range
   ============================
    1      323        7103.84
    2      596        7166.28
    3      869        7228.72
    4     1142        7291.15
    5     1415        7353.59
    6     1688        7416.03

All of the 6 targets are detected

The mean square error = 0.12 meters
```
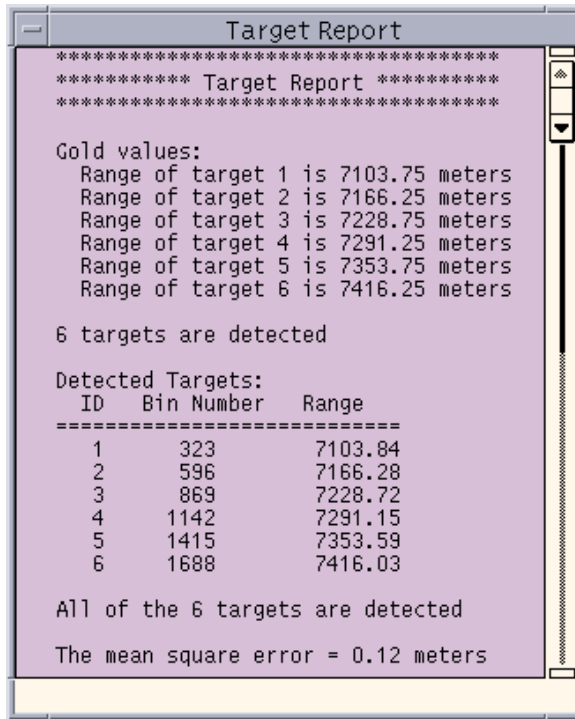
Figure 6.6 Target Report in Example 2

Example 3

This example aims at testing how well the MUT can discriminate two targets lying

closely to each other. Under the circumstance that two targets are closer than the MUT

can discriminate, they would be perceived as a single target with high reflection intensity.

In this example, the two targets are located at 7,264 meters and 7,265 meters away from

the radar, i.e., 1 meter apart. The simulation result shows that they can be discriminated

and the mean squared error is 0.11 meters. Figures 6.7, 6.8, and 6.9 show the windows
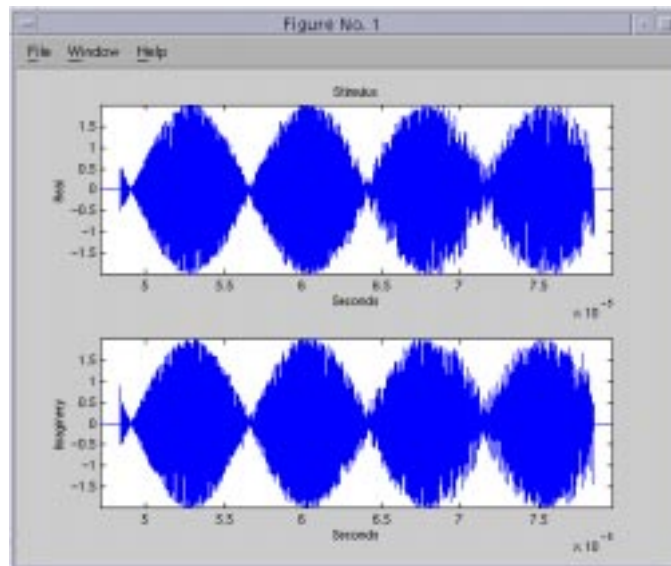
popping up after simulation.
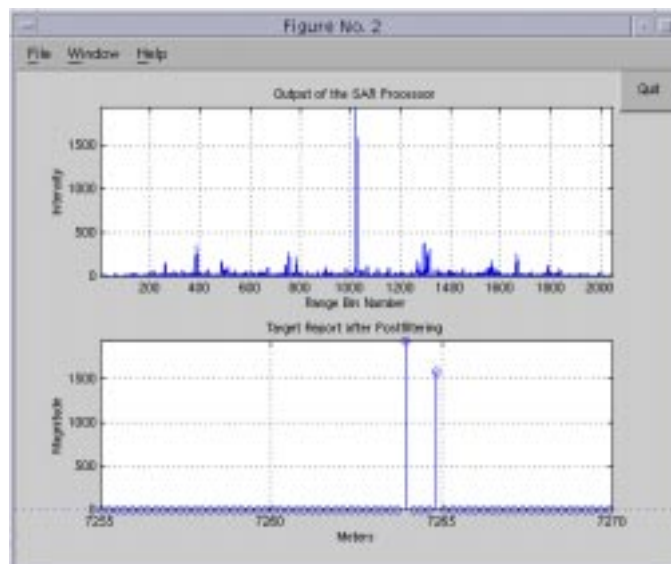
Figure 6.7 Test Vector Generated in Example 3

Figure 6.8 Range Profile and Detected Targets in Example 3

```
              Target Report
**********************************
********** Target Report **********
**********************************

Gold values:
    Range of target 1 is 7264.00 meters
    Range of target 2 is 7265.00 meters

2 targets are detected

Detected Targets:
    ID   Bin Number    Range
    ==============================
     1      1023        7263.94
     2      1027        7264.85

All of the 2 targets are detected

The mean square error = 0.11 meters
```
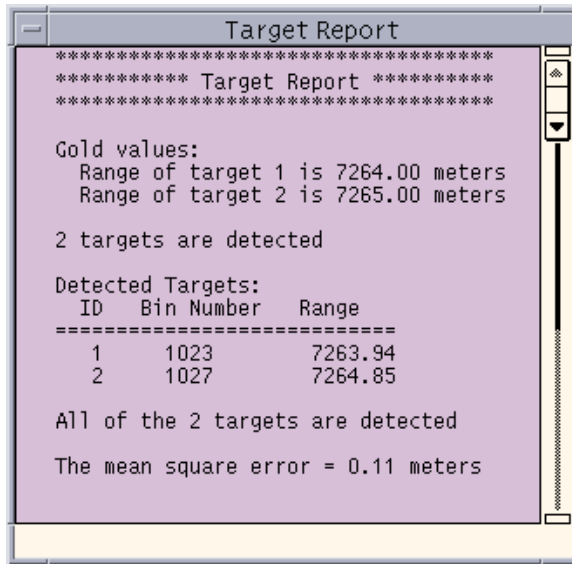
Figure 6.9 Target Report in Example 3

Example 4

This example imposes the Gaussian noise on the radar return to see whether the MUT is immune to it. The Gaussian noise standard deviation is set to 7 times as large as the amplitude of the transmitted radar signal. The simulation result shows that the noise level is beyond what the MUT can tolerate. In this example, one target is placed at 7,280 meters which is correctly detected and reported at range of 7,279.95 meters. Unfortunately, three ghost targets are also reported at ranges of 7,200.13 meters, 7,215.68 meters, and 7,286.58 meters. Figures 7.10, 7.11, and 7.12 show the test results.

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