EX 6

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To: KP_DO.kp1_po(WLS) W Schmidt

Date: Tue, Jul 11, 2000 8:35 AM

Subject: Three 1997 C-scans

Wayne:

Here is a report in progress that has three of the six C-scans. The first scan of each is the 1997 scan, the second the 2000 midrange probe scan, and the third the high-frequency scan.

Caius

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Growth Studies for Indian Point2 Steam Generator U-bend Defects

The growth studies for Indian Point2 are based on the Eddy-current readings taken in 1997 and 2000, both with the midrange plus-point probe. In general, the accuracy of the readings is poor when the signal-to-noise is poor. Readings made with the high-frequency probe are somewhat more accurate, since they have a better signal-to-noise ratio. There is a tendency for eddy-current analyst to be conservative when reading the depth of defects. When there is room for error, they tend to pick the greater depth. Therefore, all other factors being equal, noisy data tends to produce deeper defect readings that clean data.

The C-scans are also included with these profiles. They can be used to judge the quality of the data that we are using to make our defect depth readings.

Tube row 2 col 69 of Steam Generator 24

Figure 1 shows the profile of tube Row 2 Col 69 of Steam Generator 24. The profile of the tube taken from the high-frequency data is shown in Figure 2.Although there is considerable noise present in the C scans using the midrange probe, as shown in Figure 3, this is probably the most accurate profile of all the tubes. The noise features between the midrange scans in 1997 and 2000 are similar enough to verify that this is the same defect at the same location. The 1997 scan shows a considerable amount of noise, and much of the depth profiling is guessing. As can be seen in Figure 1, the defect voltage is only about 1 volt, and there is a considerable amount of noise on the tube, relative to the defect signal.

The signal amplitude has increased to about 2.5 volts in 2000 with the same type of probe, calibrated in the same manner. This indicates a growth in the crack, although it may well be in the widening of the crack, rather than the crack getting deeper. The crack also appears longer in 2000 than in 1997. This may be due to the increase in amplitude causing the ends of the crack which were present in 1997 but below the noise, to now become visible. There were other signals in 1997 that may have been part of the defect or part of the noise ridge that the defect was riding on.

The signal has increased to about 4 volts in the profile shown in Figure 2, using the high frequency data. The noise has also increased, and this signal-to-noise ratio gives a much more accurate profile than either curve in Figure1.

The average defect depth was computed from the axial distance of 6.55 to 6.84-inches. The 1997 average depth this was 52.6 %, and the average 2000 depth was 62.7-inches. This results in an average growth of 10% of the wall thickness during the cycle. This crack growth rate is probably more accurate than the next two.

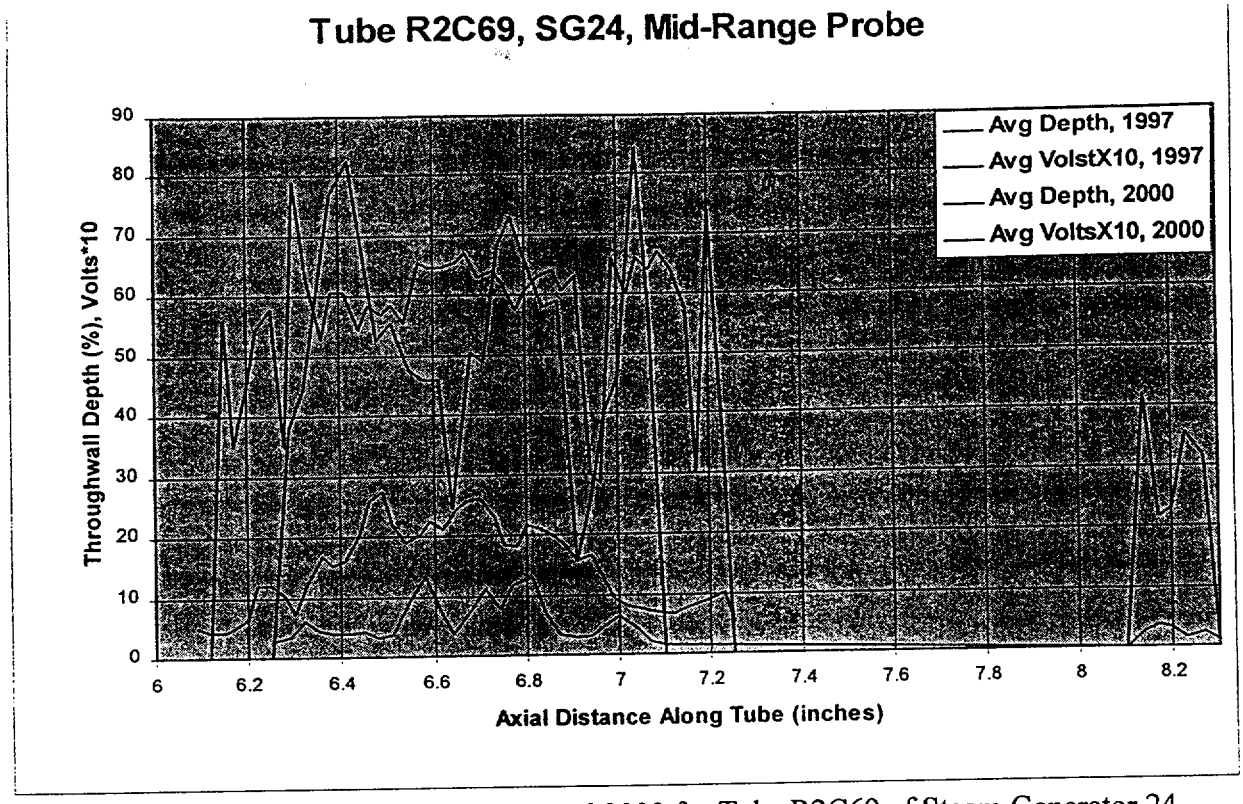


Figure 1 Profile of Growth between 1997 and 2000 for Tube R2C69 of Steam Generator 24

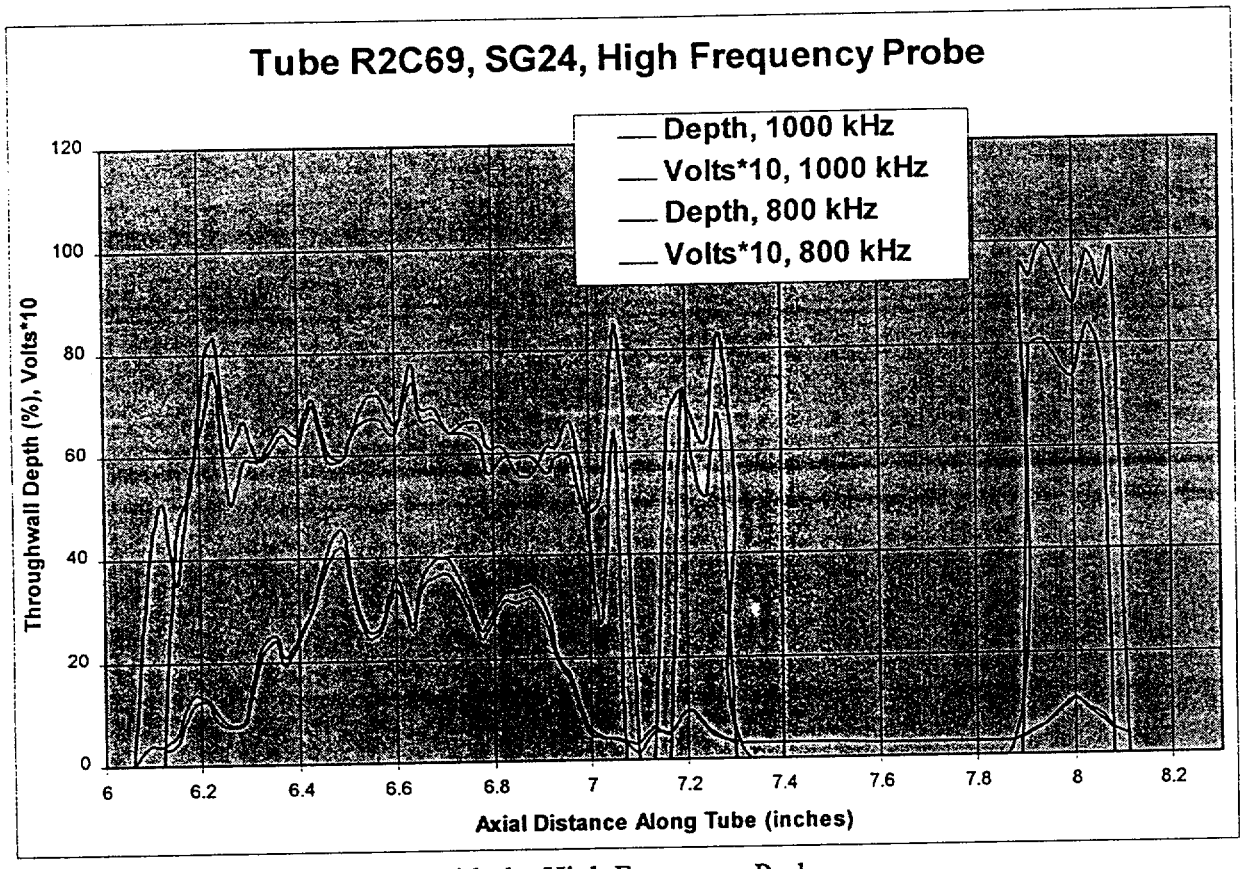
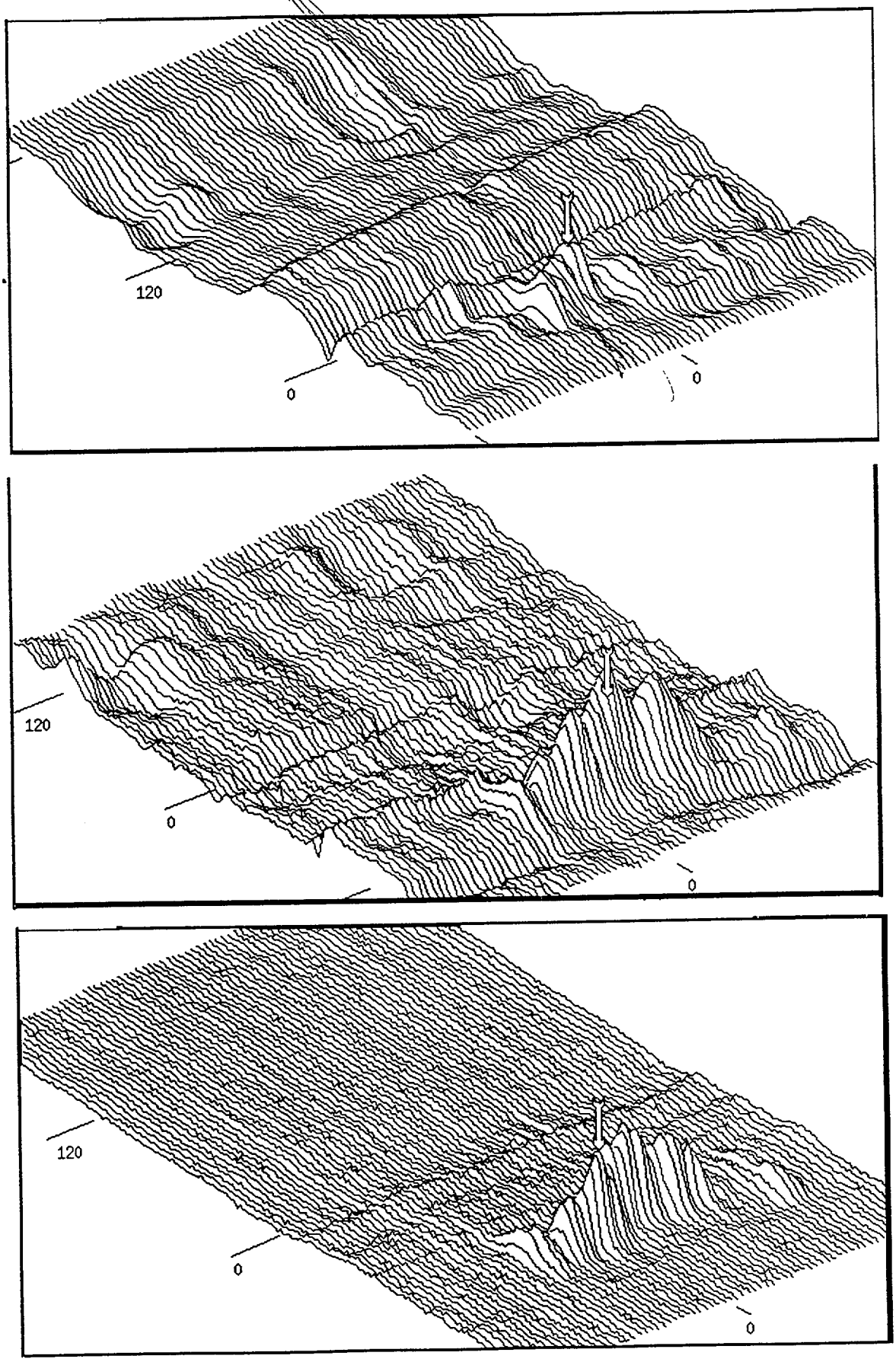


Figure 2 Profile of Tube R2C69 with the High Frequency Probe.

Figure 3 C-scan of tube row 2 col 69 of Steam Generator 24 in with the midrange plus-point probe in 1997 and in 2000 and with the high-frequency plus-point probe in 2000



Tube Row 2 Col 72 of Steam Generator 24

Figure 4 shows the profile of the crack growth in tube Row 2, Col 72 in steam generator 24 between 1997 and 2000 using the high frequency probe. The later profile done with the high-frequency probe, as shown in Figure 5 is more accurate.

As we can see in Figure 6, there is considerable noise present in the C- scan in 1997 with the midrange probe. The crack is sitting in a ridge of noise, and barely extends above a ridge of deposits. The crack barely extends above a 1-volt amplitude for a short length, and this is the only part of the crack that we can profile reliably.

The C-scan in 2000 with the midrange probe shows very little of the ridges present in the 1997 scan, but shows a series of spikes. These spikes are believed to be noise pulses associated with the data acquisition, possibly a problem in the slip rings. The ridges that I attributed to od deposits in the 1997 scan have vanished. There is a wave in the 1997 and 2000 scans that is similar. The signal amplitude has increased to a maximum of about 3.2-volts, making the defect easier to detect and more accurate to profile. There is a clear amplitude increase in this crack.

The C-scan for the high-frequency scan of this crack was taken from the opposite direction, so the features will be reversed between it and the two midrange probes. This is the most accurate profile, with the lowest signal-to-noise ratio. The maximum measured voltage is about 3.7-volts for the scan with this probe.

The average defect depth was computed from the axial distance of 7.66 to 7.77-inches. The 1997 average depth this was 79.2 %, and the average 2000 depth was 59.3%. This results in an average decrease of 19.1% of the wall thickness during the cycle.

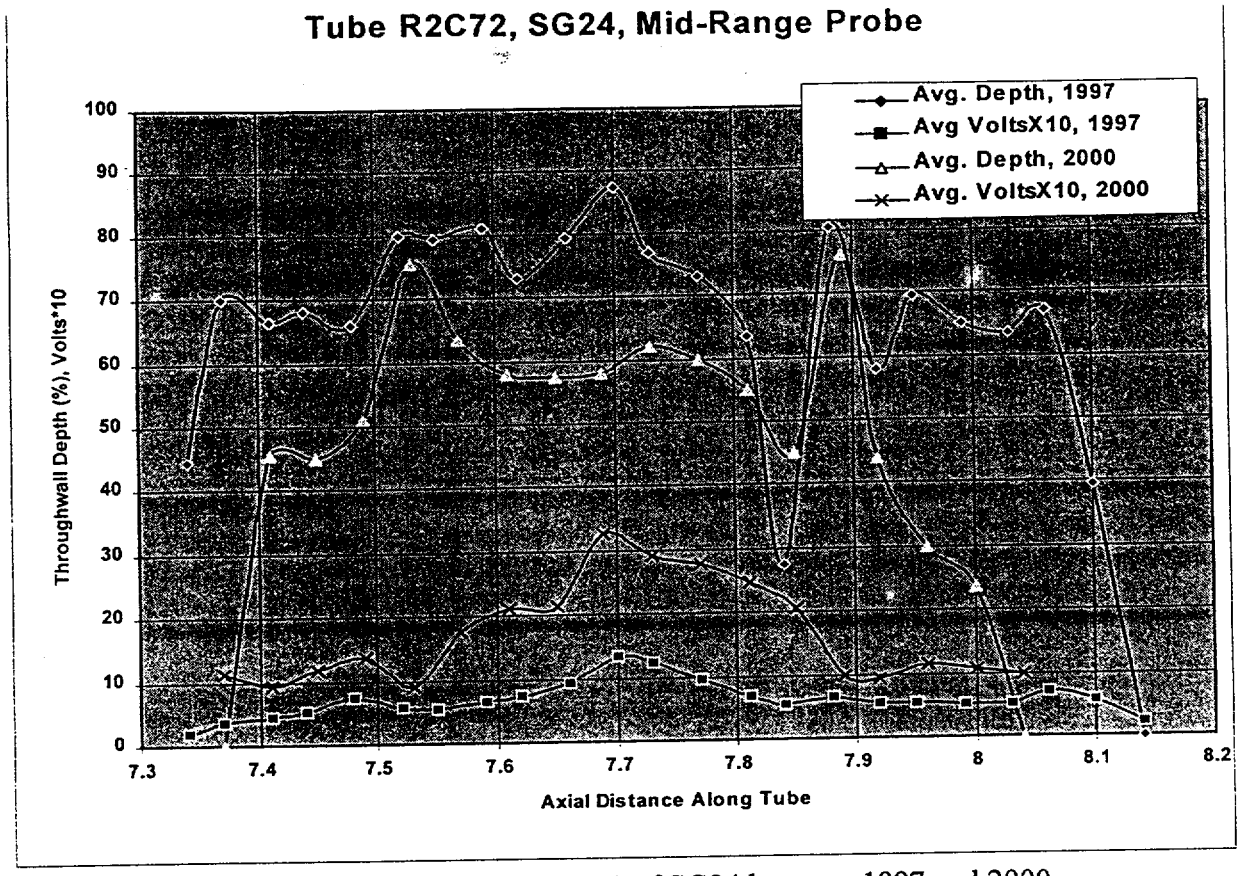


Figure 4 Profile of crack growth of tube R2 C72 of SG24 between 1997 and 2000

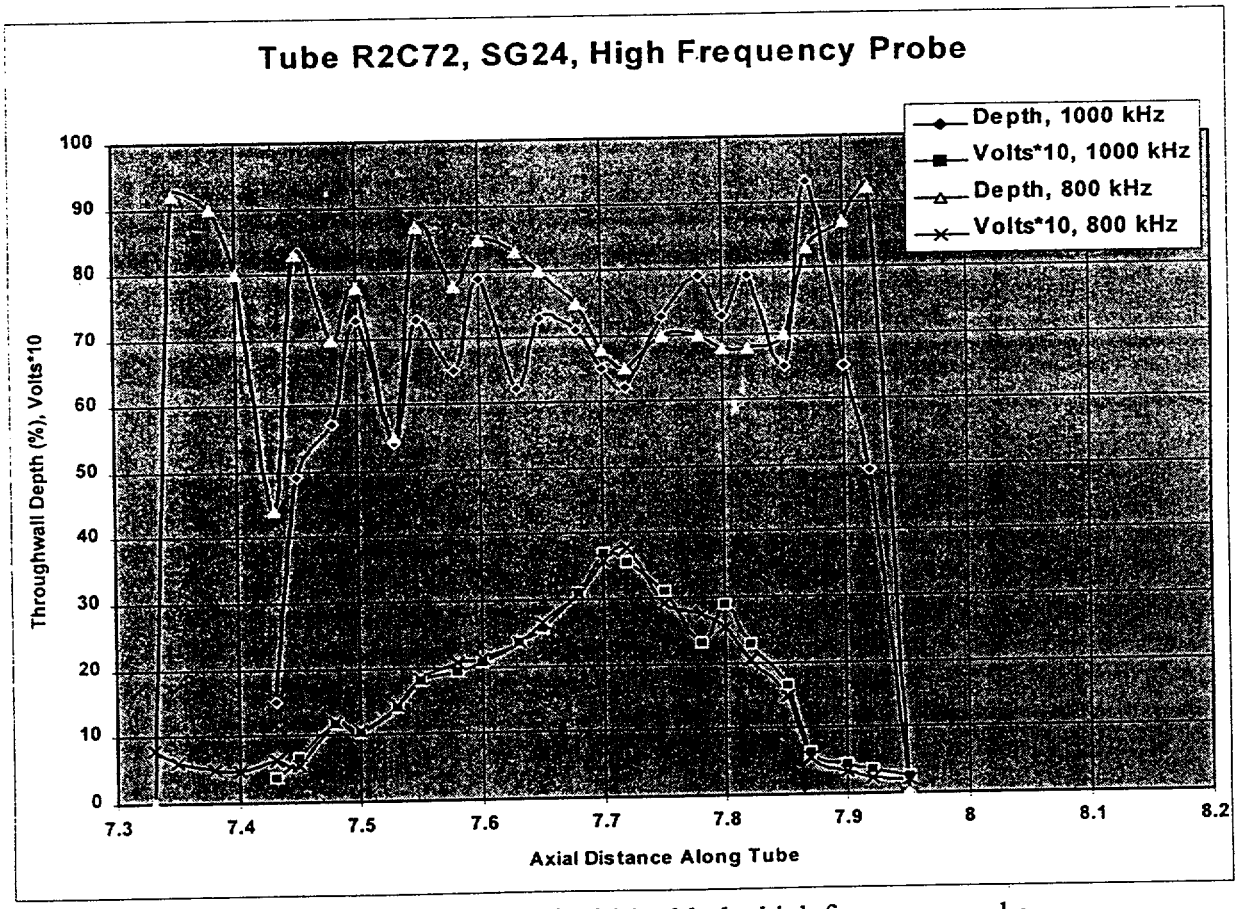
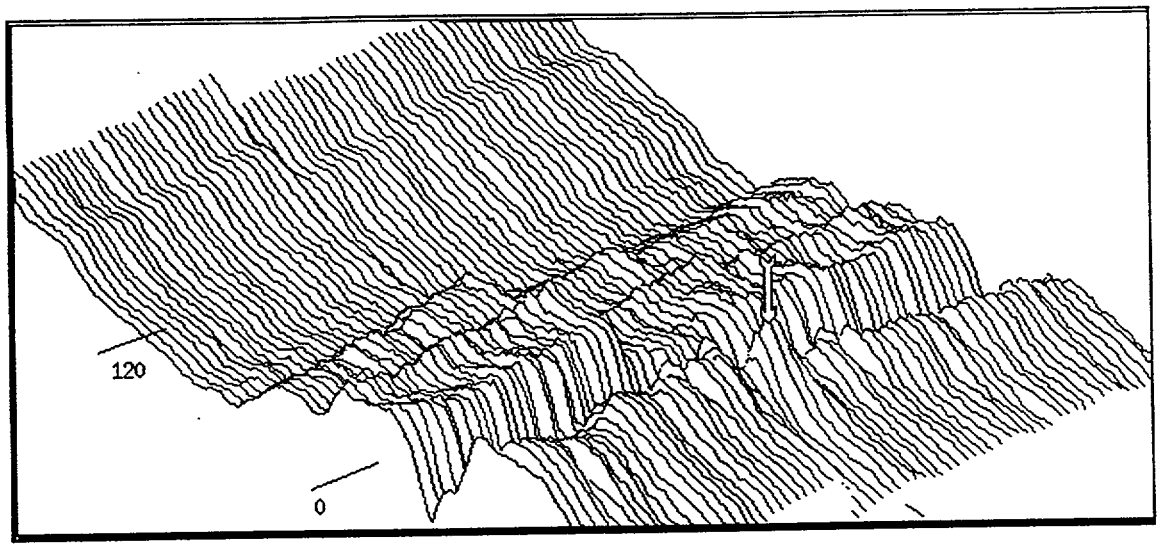
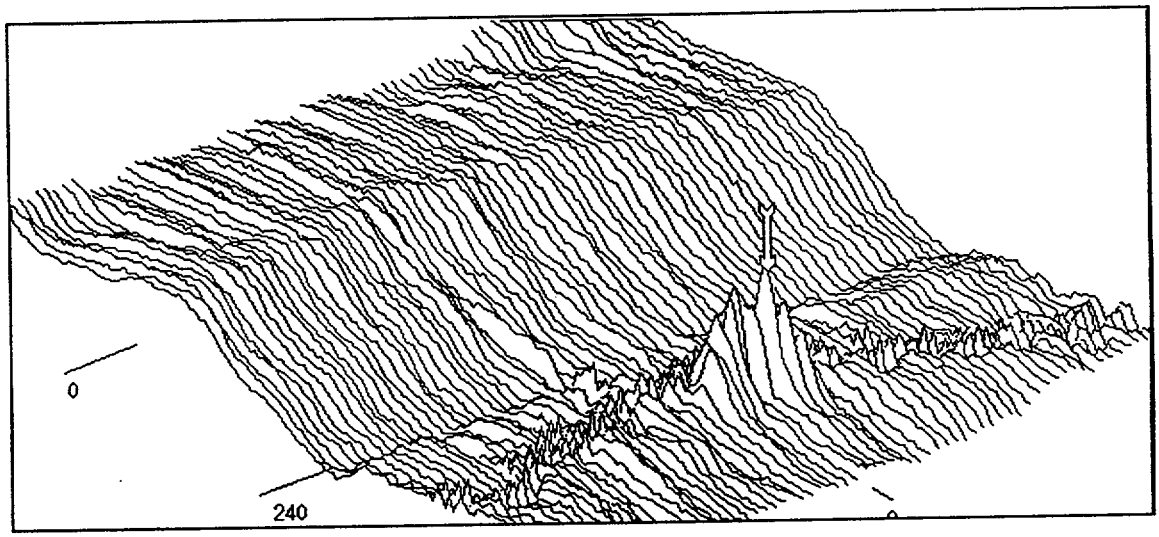
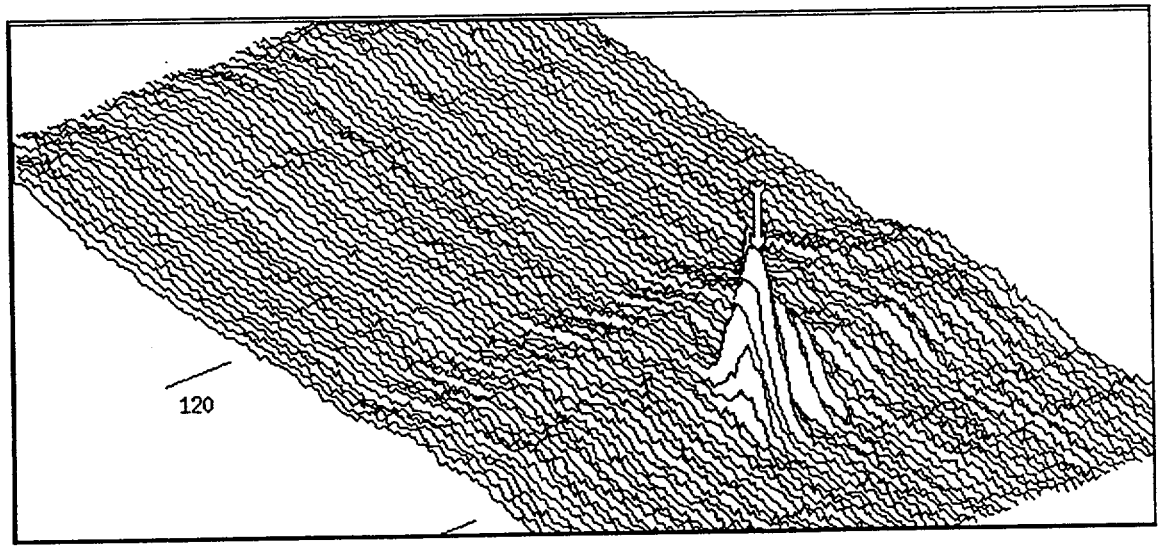


Figure 5 Profile of crack in tube R2 C72 of SG24 with the high frequency probe.

Figure 6 C-scan of tube row 2 col 72 of Steam Generator 24 in with the midrange plus-point probe in 1997 and in 2000 and with the high-frequency plus-point probe in 2000







Tube row 2 col 87 of Steam Generator 21

This tube was identified as having several cracks, but only one has been profiled, as shown in Figure 7. This crack was also profiled with the high-frequency probe, as shown in Figure 8.

As we can see from the C-scans, in Figure 9, this crack is sitting in a relatively clean area of the tube. It is the crack under the arrow in all three C-scans. A small part of the crack is showing in the ridge in the 1997 scan, but the noise dominated when profiling was attempted using the 1997 data. The small, center portion of the crack is the only part that can be profiled with any accuracy.

The 2000 midrange scan is in the opposite direction as the 1997 midrange scan and the 2000 high frequency scan. The voltage amplitude increased from about 1-volt to 1.8-volts during the operating cycle. The crack depth appeared to have decreased slightly.

In the high-frequency scan, the measured voltage increased to 3-volts, and the measured depth appears to have increased also. This is probably due to the short length of this crack. The smaller, higher frequency probe is not as susceptible to end-effects as the larger midrange probe.

The average defect depth was computed from the axial distance of 6.53 to 6.59-inches. The 1997 average depth this was 63.7 %, and the average 2000 depth was 40%. This results in an average decrease of 23.7% of the wall thickness during the cycle.

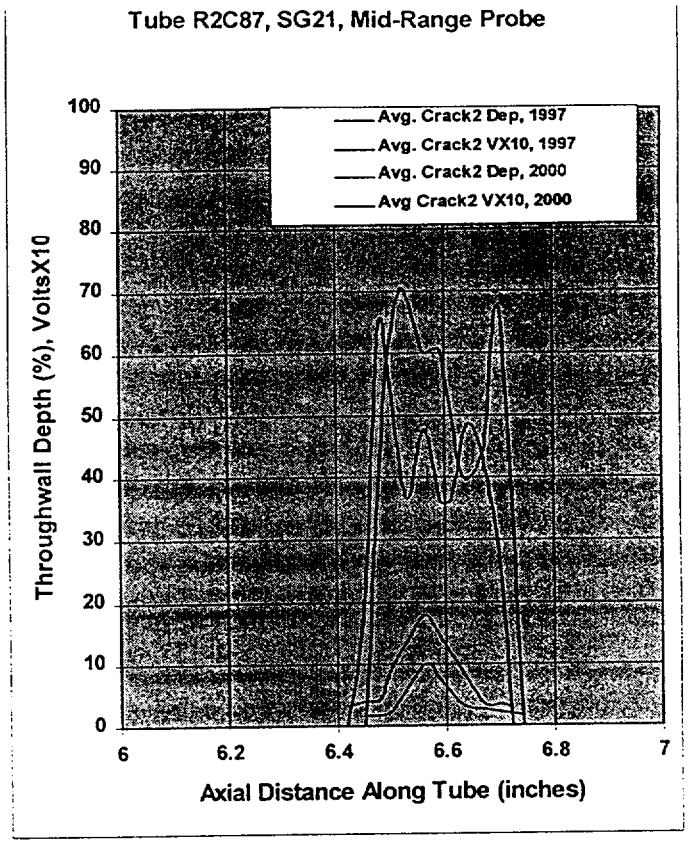


Figure 7 Profile of crack growth of tube R2 C87.

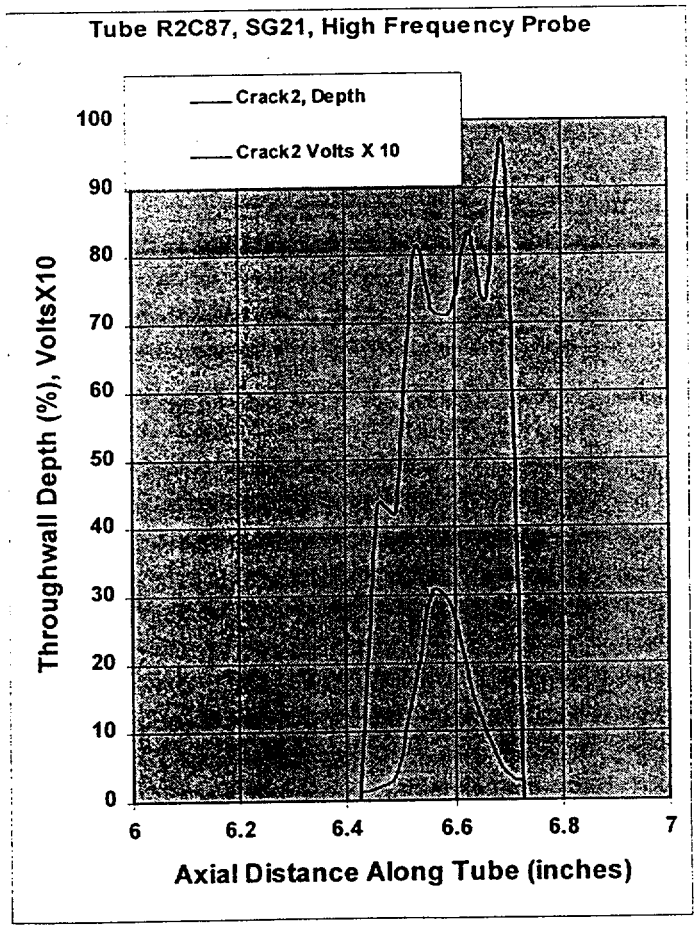
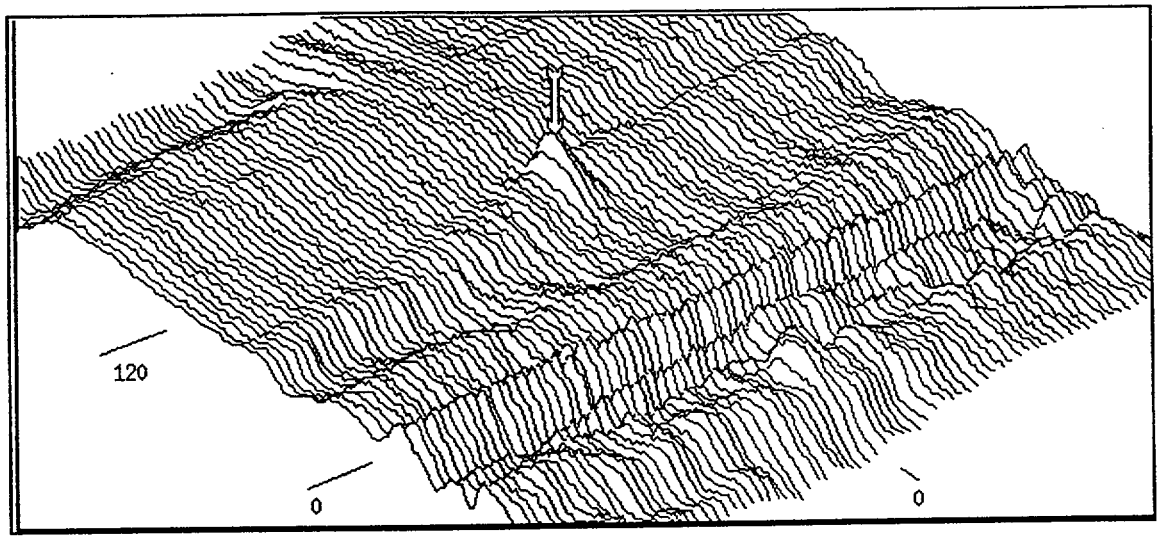
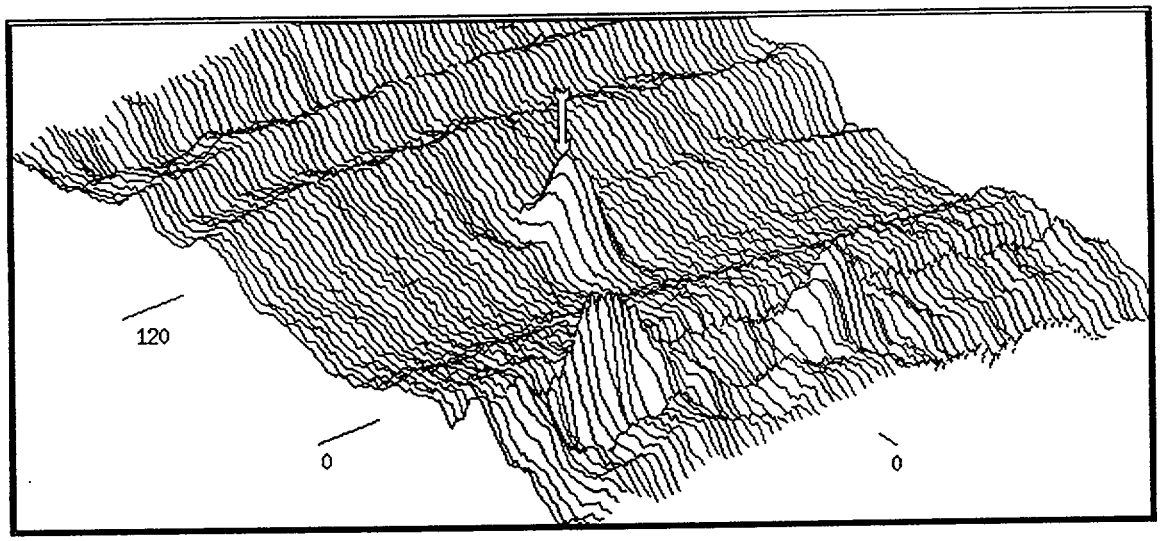
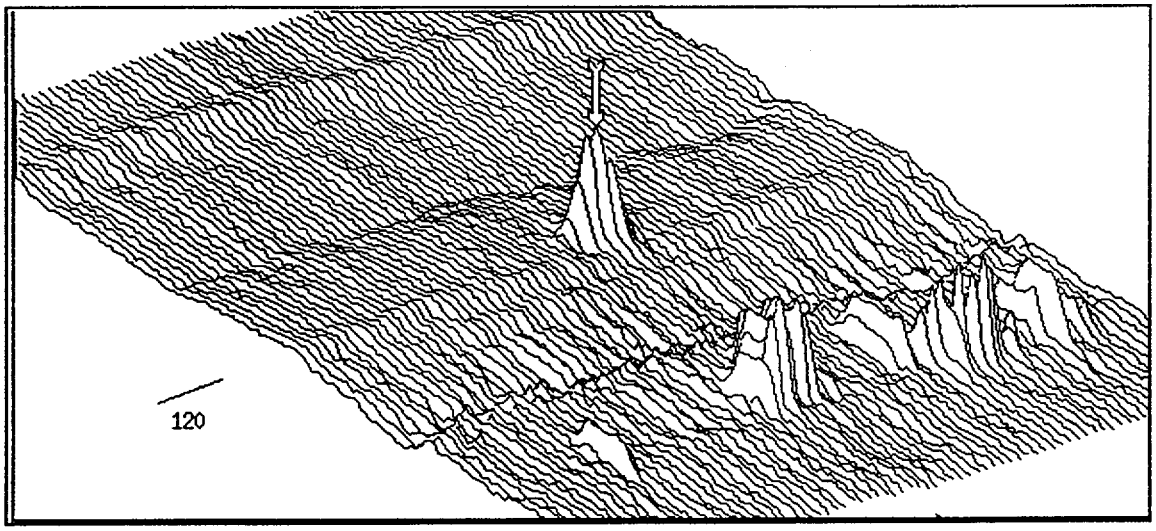


Figure 8 High-frequency profile of tube R2 C87.

Figure 9 C-scan of tube row 2 col 87 of Steam Generator 21 in with the midrange plus-point probe in 1997 and in 2000 and with the high-frequency plus-point probe in 2000



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