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Scans on calibration standards

Due to the lack of information on the repeatability and accuracy of the probe, several scans were made on the calibration standard. These are intended to demonstrate the probe's ability to detect and size small defects. It should be keep in mind that the calibration standard produces a larger signal than defects of a similar depth. Also, the calibration standard has none of the od deposits that are present in the generator. Finally, while these notches represent the best approximation to the actual defects that we have, they are essentially two dimensional, while the defects are three dimensional. In Figure 1 we show a contour plot of the 20% flaw standard. The accuracy of this depth measurement is very poor, due to the small amplitude of the signal and the small amount of phase shift with depth. The notch is only 0.5-inches long,

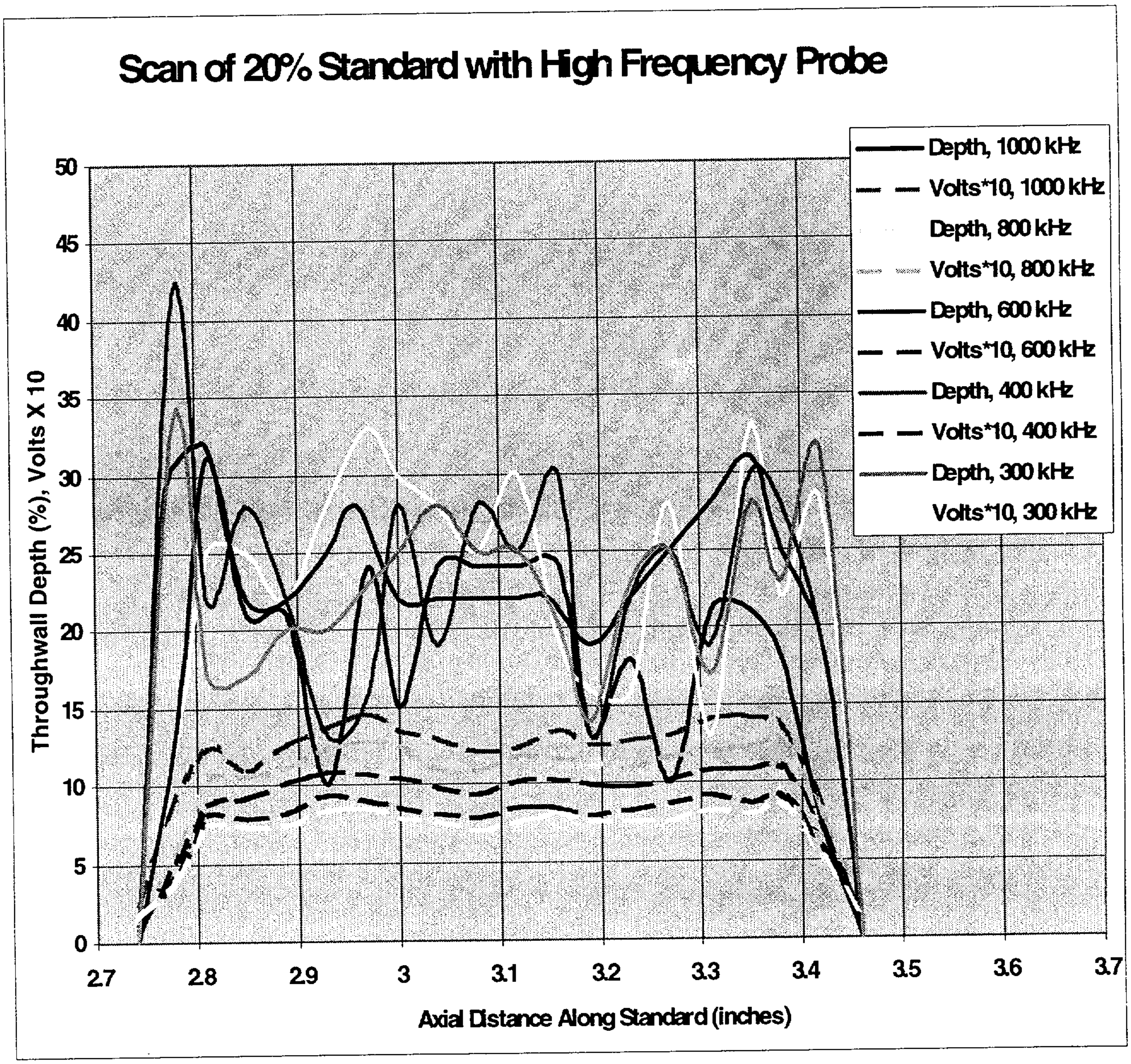

Figure 1 Contour measured on the 20% standard notch at different frequencies with the smaller high-frequency probe.

J167

so there is a considerable look-ahead for the probe. The defect signal is about 0.69-inches long if the low-voltage phase measurements are used. It is somewhat shorter(0.65-inches) if the half-voltage value is used. The probe "look-ahead" for this notch is 0.075-inches to 0.095-inches.

In figure 2 we show the measured response of the probe to the 40% notch. The depth spread for this notch is only about 5%, which is much better than the previous one. The ends of the notch produce rather large depth signals, but, due to the very low voltage, would probably not be

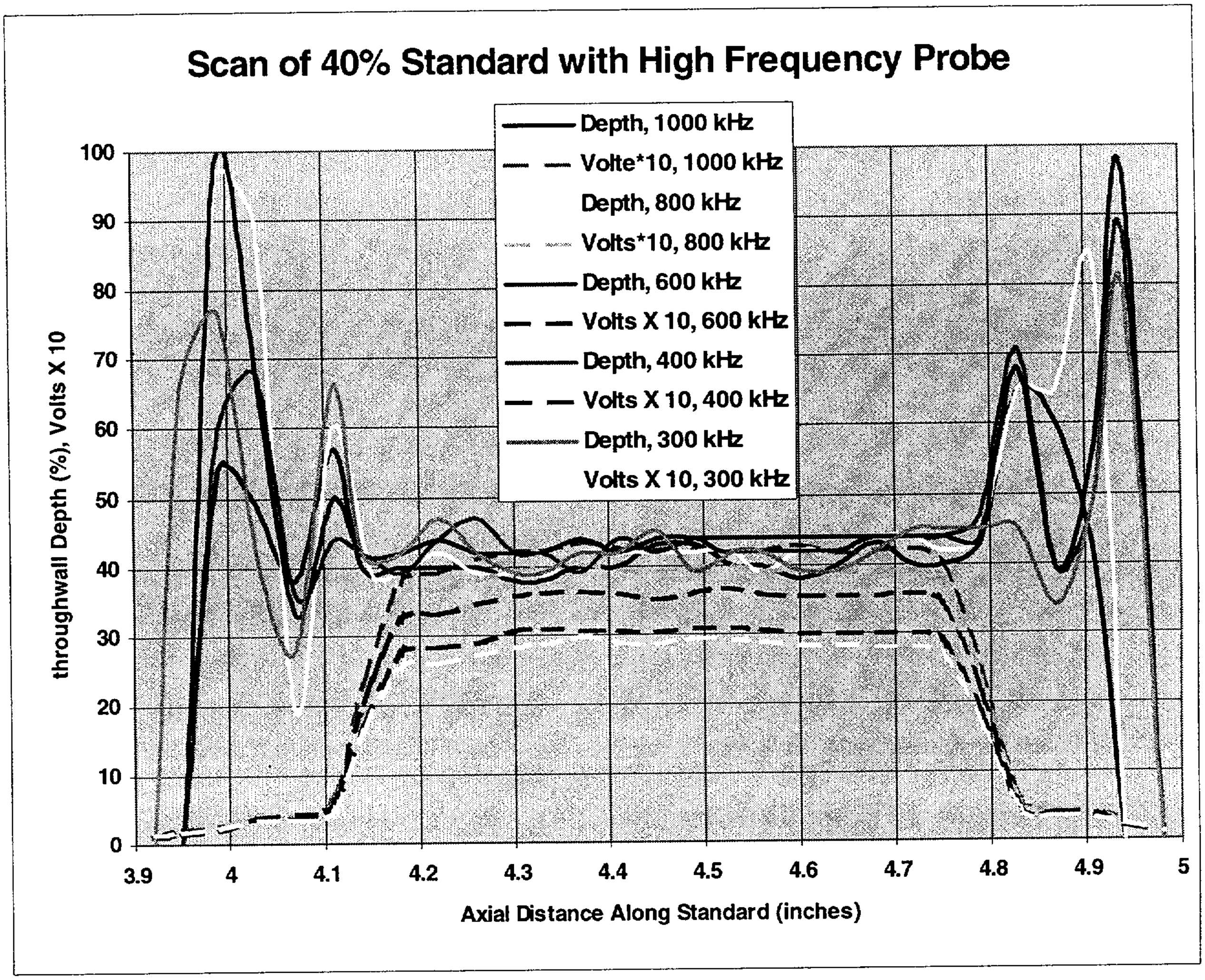

Figure 2 Contour measured on the 40% standard notch at different frequencies with the smaller, high-frequency probe.

called. The probe "look ahead", measured from the 0.5 volt amplitude, which is about the smallest that would be used in the field, is 0.11-inches. The 5% depth spread represents only about a 3 degree phase shift, which is about as small as can be reasonably expected. This notch is a much better reference for setting the phase shift on the standard, since its signal-to-noise is much better. The 4-volt signal it produces is much higher than the random noise measured. In determining the 15 degree phase setting for this notch for the calibration set-up, the analyst should make several measurements along the notch to see which ones are the most stable and use

that one.

In Figure 3 we show the response of the probe to a 60% notch. This response is more like that of the 40% notch. The depth spread is only about 5% total, and the notch edges produce a apparent

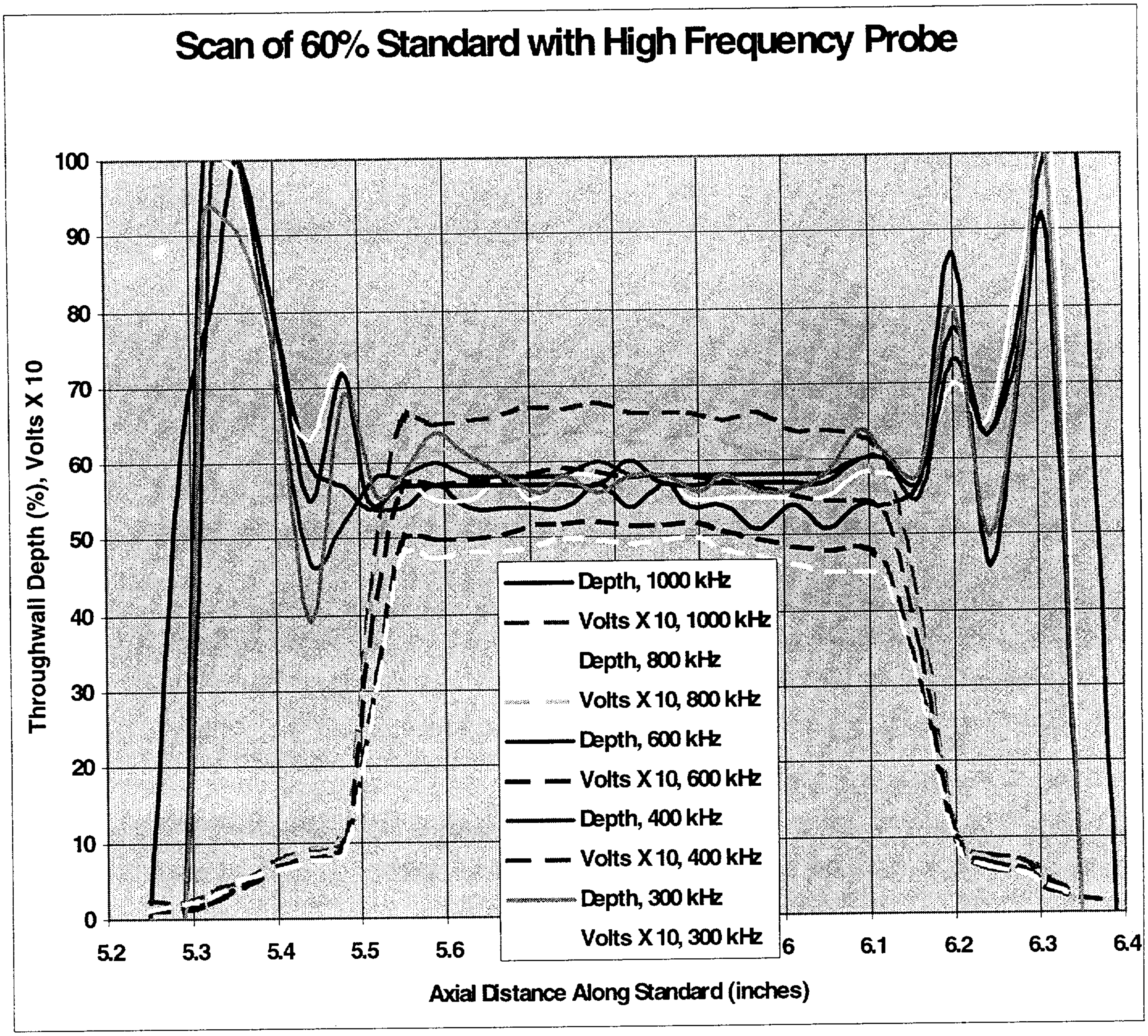

Figure 3 Contour measured on the 60% standard notch at different frequencies with the smaller high-frequency plus-point probe.

deep signal at the notch edges. The edge values were clipped at 100% deep, since the software does not allow depths beyond that. When the phase exceeds the 100% id value, the defect becomes an od defect, with values decreasing from 100% as the phase increases. The "look ahead" for this probe is somewhat larger, depending on the amplitude value that we use as the "cut-off" value. If 0.5 volts is used, the "look-ahead" is 0.22-inches. If we assume that the field

defect will only produce about half the signal that a notch does, the "look-ahead" will be only 0.11-inches.

The amplitude that an IDSCC indication produces depends on how many ligaments are conducting eddy-currents across the crack face. The contaminants that produce the corrosion are insulating at room temperature, but due to the path of corrosion, there can be "good material" that bridges the crack face and conducts the currents, reducing the eddy-current signal from that of a notch. The stress-corrosion cracks have complex, three-dimensional structures and are not well represented by notches until they become large and have opened up somewhat. Their signal amplitude will vary with cracks of the same depth. The ones that we have seen and contoured have amplitudes from 50% of that of a notch (tubes 2-69, 2-71, 2-72) to 15% (tube 2-24). We may be over estimating the signal amplitude that the average notches produce since we would only detect the notches that produce the higher amplitudes. This is why it is important to pressure test some NDD tubes to see what opens up, even if it does not leak. I do not know that there are a population of defects in the tubes that we still are not detecting, but there is that possibility.

Using the value of 50% for the IDSCC voltage amplitude correction, we would use 0.11-inches for the larger defects, down to 0.075-inches for the smaller defects. The depth values of the crack-tails, measured at low voltages, should be discarded.