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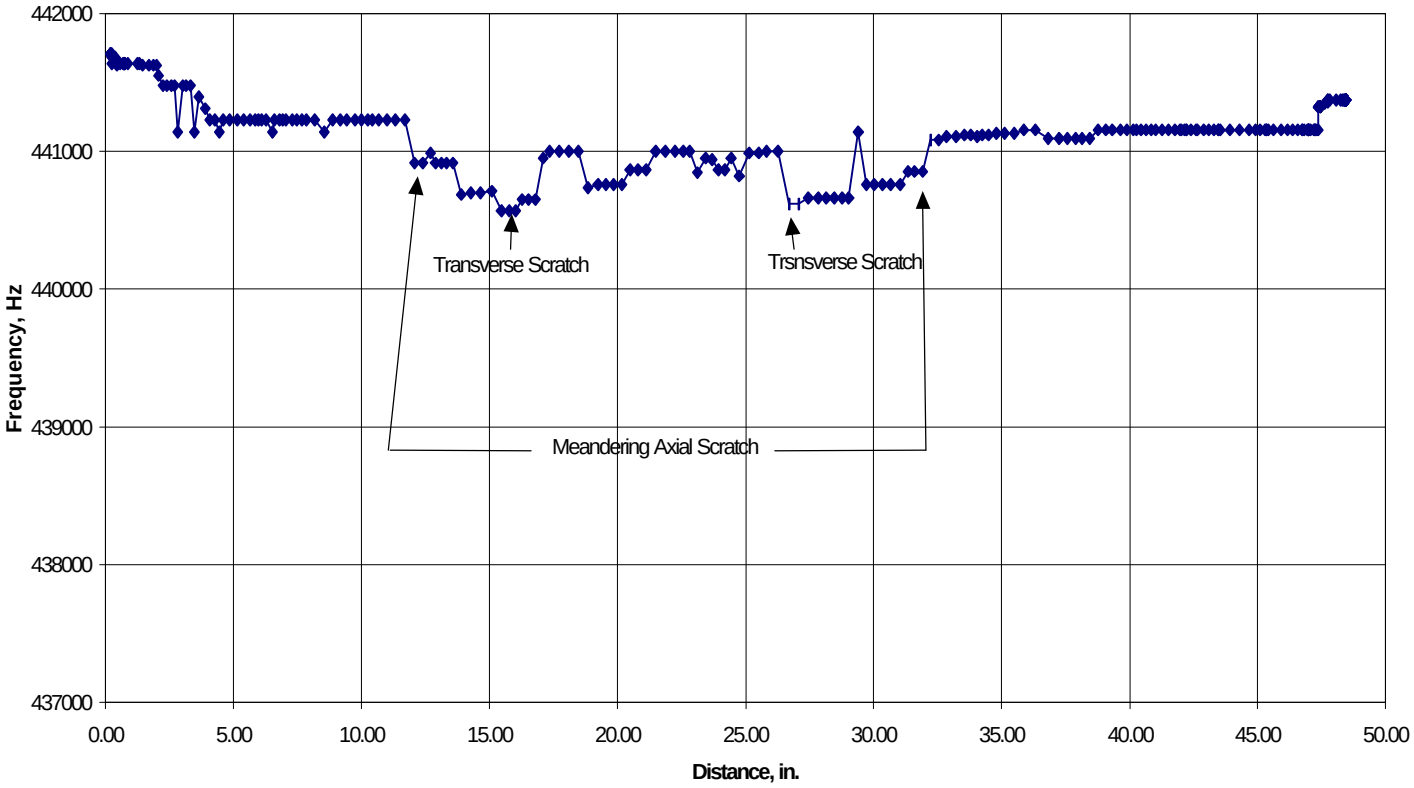
Case Study: Surface Defect Analysis of Copper Tubing

Tests were conducted on Copper tubing of various diameters and wall thickness. These samples were tested in standard resonance mode EMAT's (electromagnetic acoustic transducers) configured for aluminum and steel rod. A rotary encoder input was utilized to generate the data plots of resonant frequency versus distance this data was recorded on the ARIS lab unit.

File Name: Copper Tube .500" -5 N:7 RM-Transducer

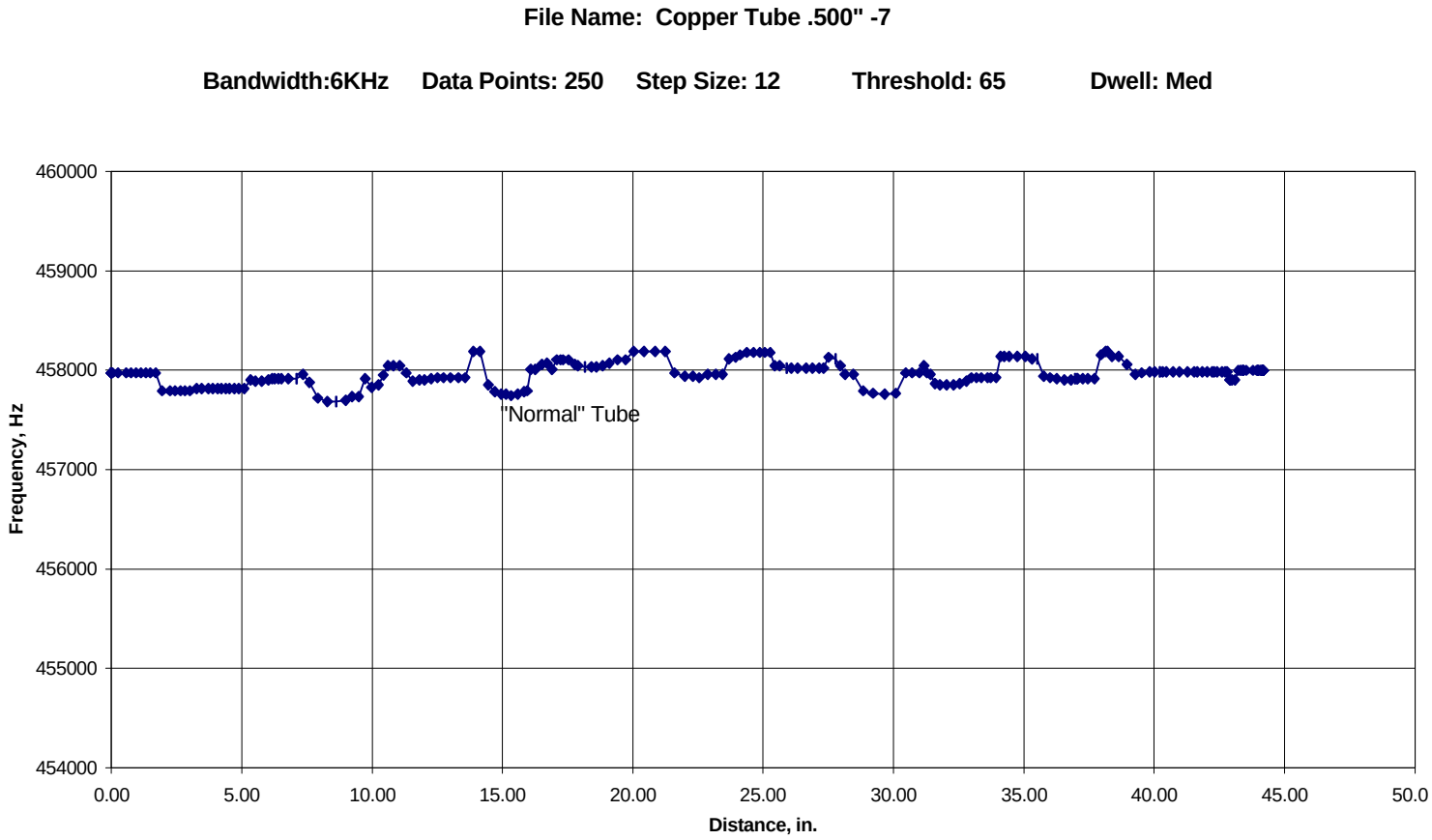
Bandwidth: 5KHz Data Points: 250 Step Size: 12 Threshold: 65 Dwell: Med



This first chart details the resonant frequency of a .5 " diameter copper tube with a .025" nominal wall thickness. This sample had several transverse scratches with a long meandering axially oriented scratch. The ends of the tube were relatively free of visible defects.

The following chart details the resonant frequency response of a "defect free" sample of the same diameter tube with a wall thickness of .035" nominal. This wall thickness generates a different dispersion characteristic for the axial shear waves used in this test and hence the difference in base

resonant frequency of 458 kHz as detailed in the data. However, the peak to peak spread in the frequency data is less than 400 Hz.



The third plot is of a .625" diameter copper tube with surface nicks the nicks are evidenced by the drops in the resonant frequency. Although this data was recorded with a rather low resolution RM-EMAT the areas of where heavier defect clusters are located significantly affect the resonant frequency for this tube. A higher wavelength count transducer will provide less dispersion of the acoustic waves and thus will yield greater spatial resolution and finer detail.

File Name: Copper Tube 625-1

Bandwidth: 5KHz Data Points: 250 Step Size: 12 Threshold: 20 Dwell: Fast