



Advanced Nondestructive Characterization of Pipeline Materials

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Main Objective

This project was awarded to Iowa State University in order to investigate the possibilities for developing a suitable nondestructive in-the-ditch measurement method for the values needed to determine the actual pressure rating of a pipeline: yield strength, tensile strength, fracture toughness and transition temperature.



Figure 1. Ultrasonic pipeline inspection.

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Figure 2. Samples provided by industry partners.

Results to Date

Preliminary ultrasonic measurements have been done on a small number of samples at multiple "zones" per sample. Velocity, attenuation, and grain noise were measured on three samples with the expectation that these properties would differ between samples. The variation between samples was smaller than expected and parameters such as curvature and surface roughness led to larger variation within the samples than was anticipated. We will address these issues by expanding our sample set and refining our inspection techniques.

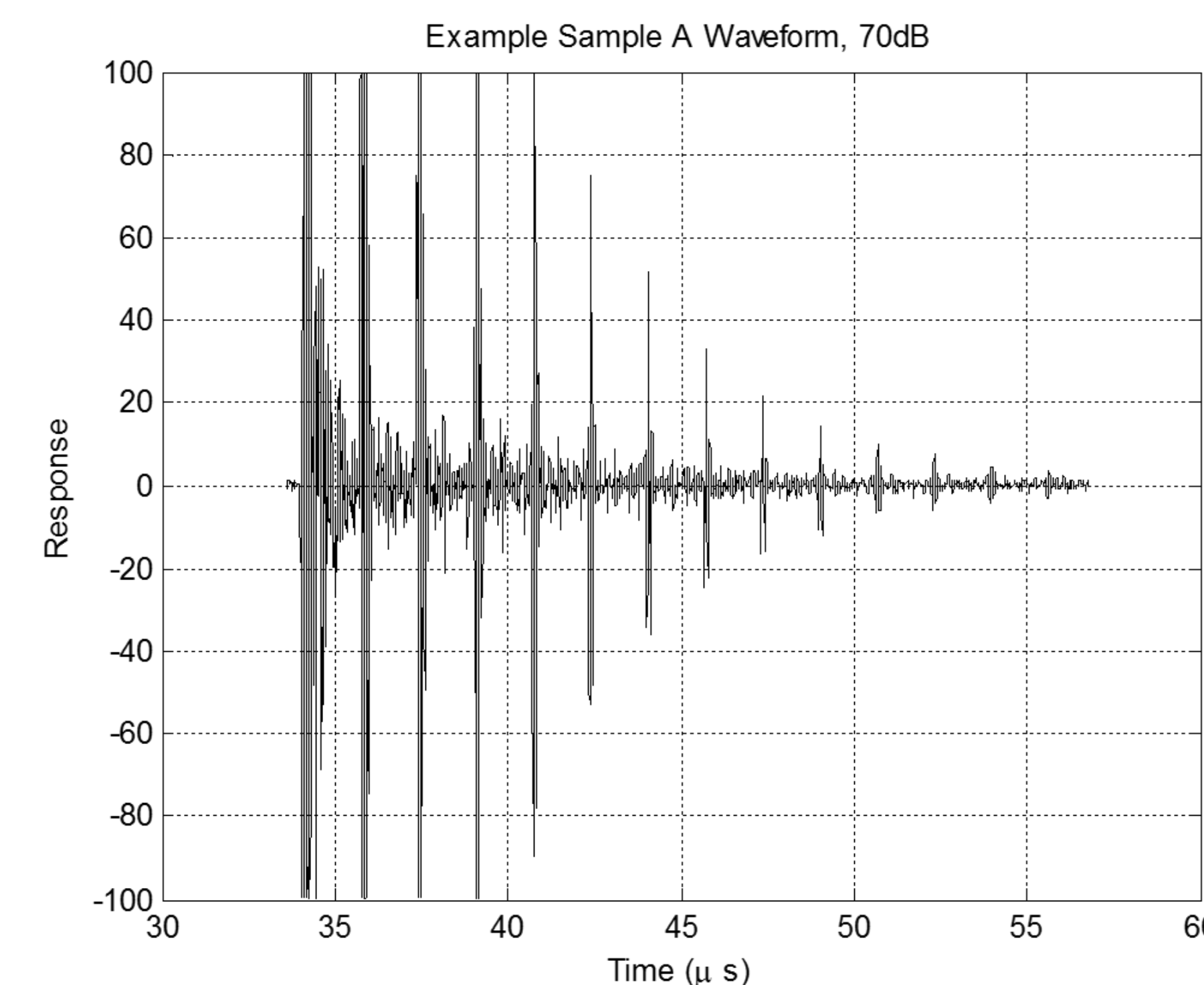


Figure 5. Example ultrasonic waveform.

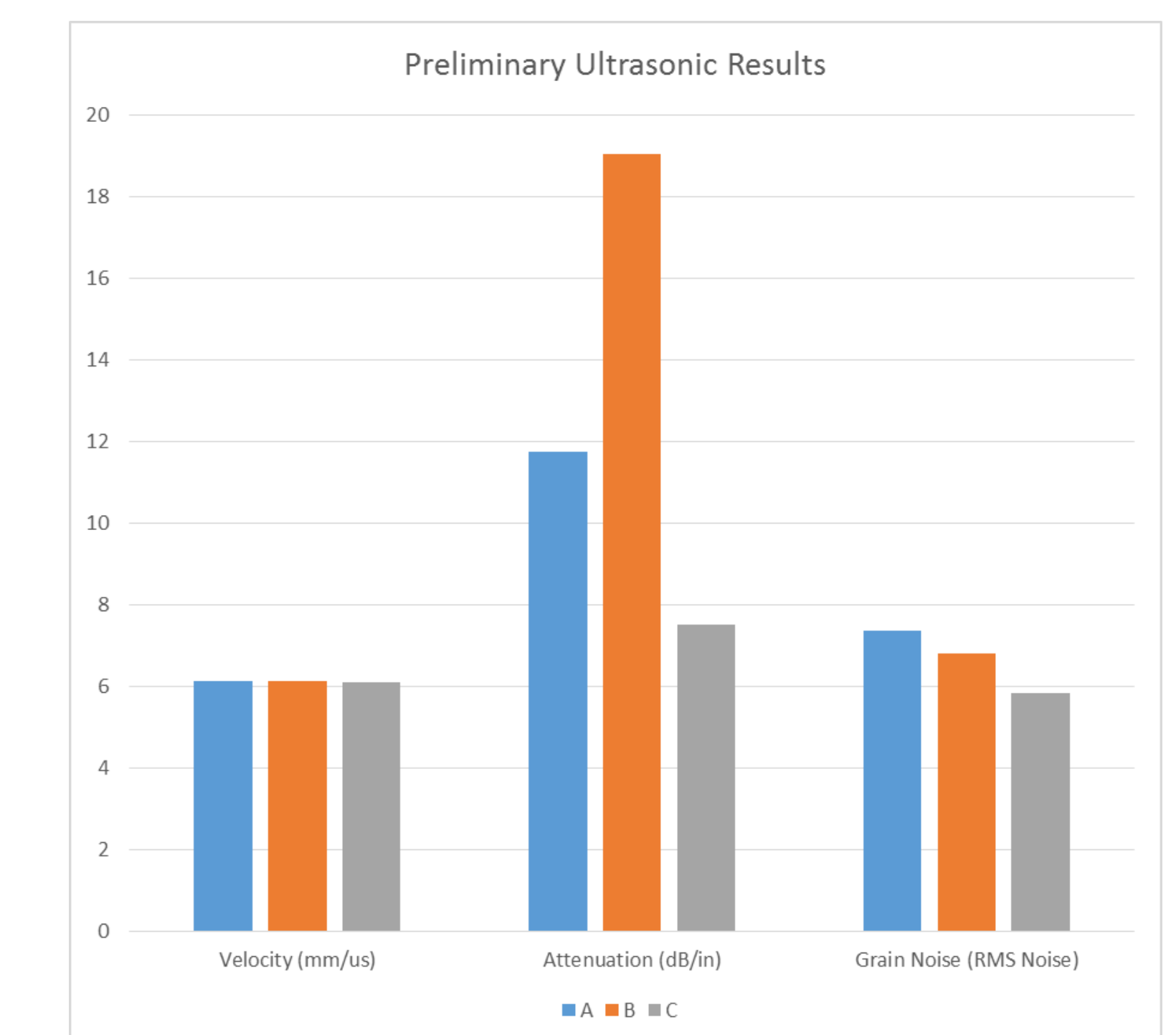


Figure 6. Preliminary ultrasonic velocity, attenuation, and grain noise results.

Project Approach

This project will look for correlations between nondestructive measurements (ultrasonic, electromagnetic, and radiographic) and material and microstructural properties of interest. The goal of this project is to identify these meaningful relationships and demonstrate that they can be used to characterize pipeline materials.

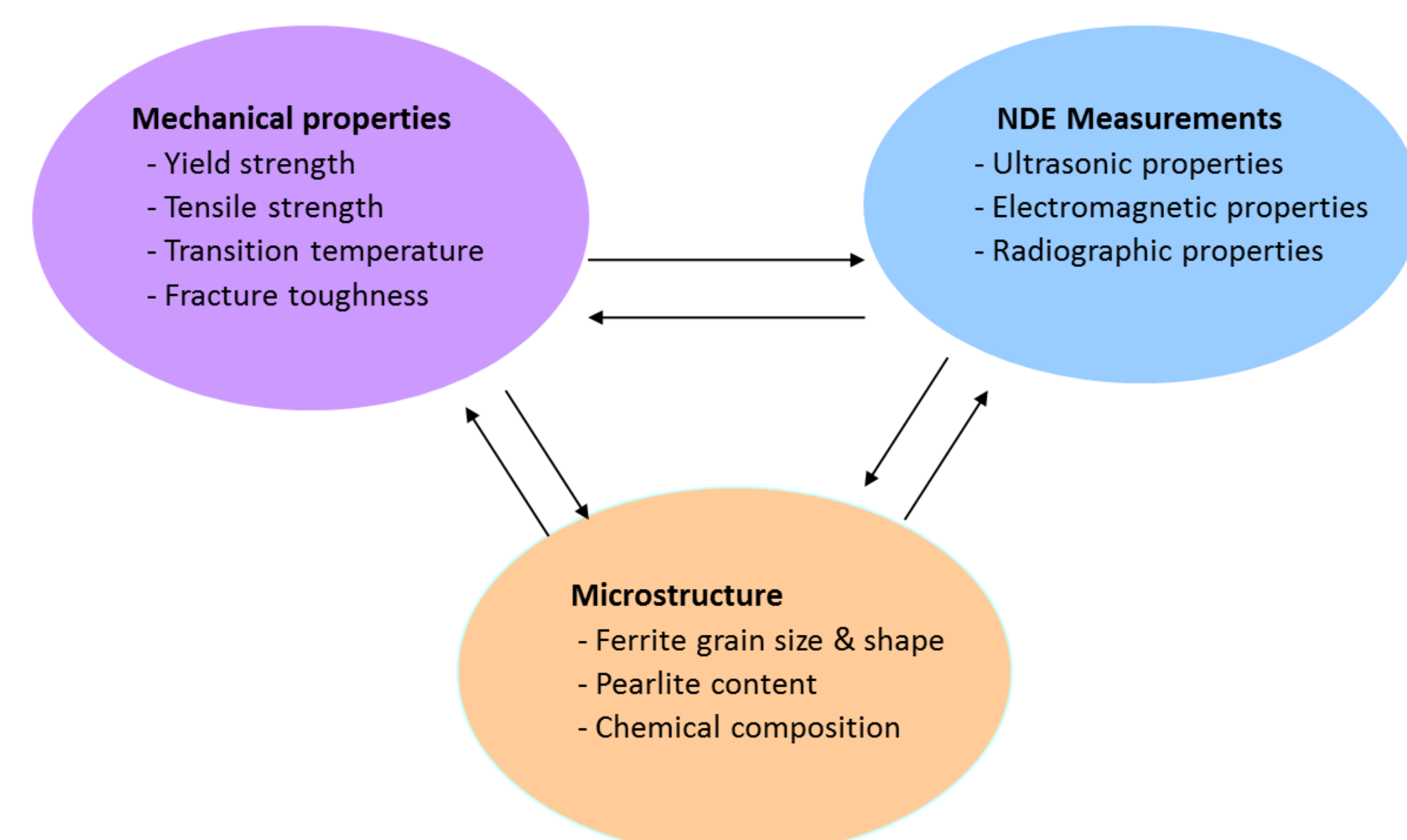


Figure 3. Problem overview.

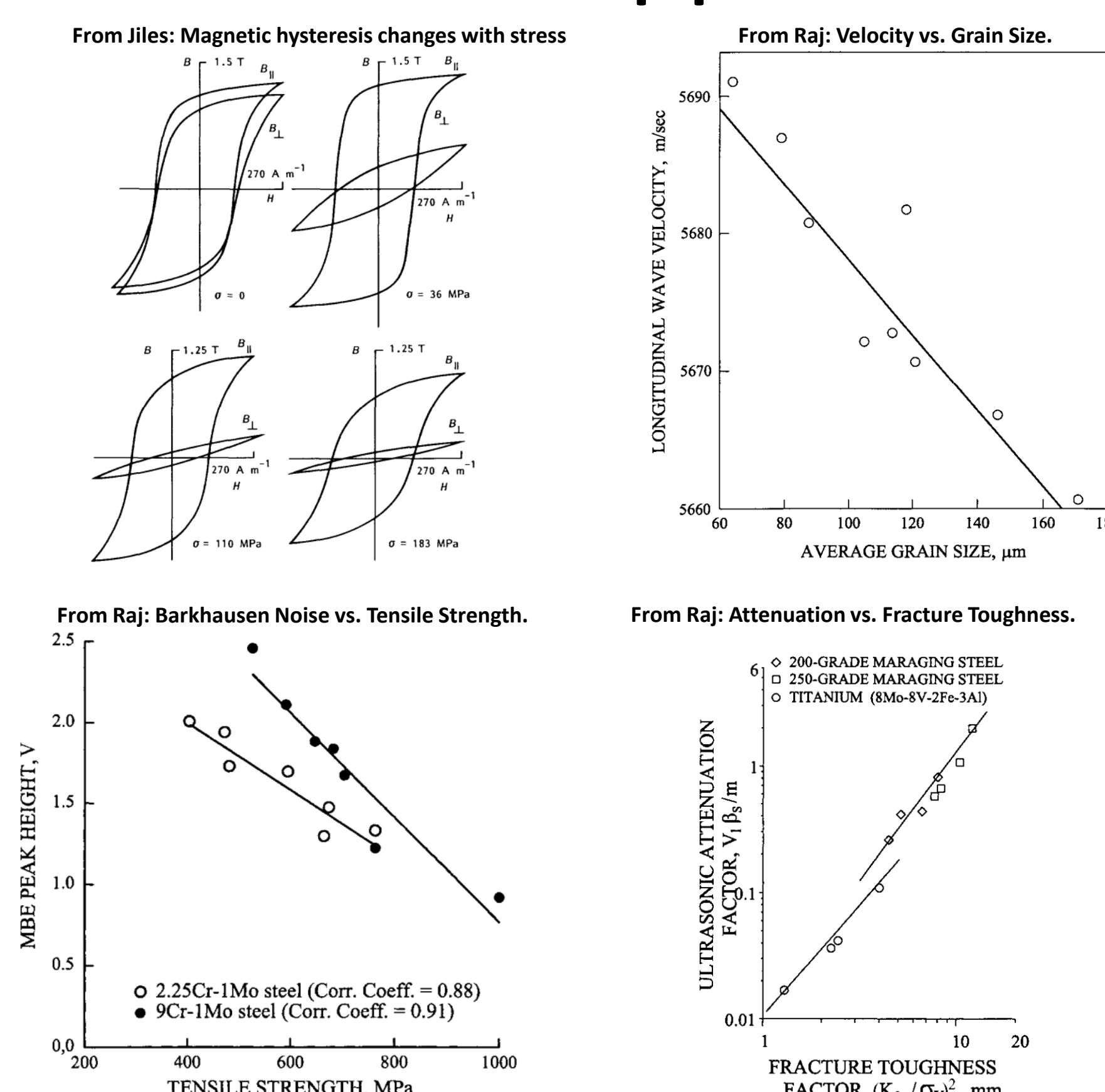


Figure 4. Project concept: NDE measurements relating to different material properties.

Acknowledgments

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References

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