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Broadband Tonpilz Transducers Based on Single Crystal Relaxor
Ferroelectrics: Design and Modeling

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Very broad bandwidth transduction capability has been made possible by high coupling piezoelectric single crystal materials. Recent work has shown that PMN-PT based tonpilz elements with a single resonance have a device electromechanical coupling coefficient greater than 0.86 and can easily achieve more than two octaves of source level bandwidth. Implementing single crystal based tonpilz elements reduces array packaging volume and weight while maintaining source level. In addition, high coupling projectors reduce transmit system complexity when compared to traditional materials.

This paper will describe approaches to creating broadband SONAR projectors using single crystal materials. Crystal anisotropy plays a key role in transducer design. This anisotropy requires final designs to be modeled in three dimensions. ATILA finite element code was used to capture all of the modes of vibration and performance predictions. Motor section geometries and material compositions will be compared. The model predictions will also be compared to measured data.