Theory and experiments of super-resolution focusing using a time-reversal sink have been investigated in high-frequency regime [Rosny and Fink, Phys.Rev.Lett. 89] and in audible range [Bavu, Besnainou, Gibiat, Rosny and Fink, Act.Acust., 93]. This technique, generalized to the case acoustic and vibrational imaging of active sources, allows super-resolution imaging and provides a new method of characterization of active sources in a known background medium.

This imaging technique involves a measurement in the background medium using an array, and the simulation of the backpropagating-field in a fictive medium. An ideal numerical time-reversal sink (NumTRAS) is then used to refine results and obtain high-contrast, high-resolution imaging of initial sources.

The algorithm has been validated in parallel supercomputer simulations, in both vibrational and acoustics fields and has been used to detect active vibrational sources in a clamped Mindlin plate and active sound sources in an anechoic room. All results show high-resolution imaging capabilities when compared with classical time-reversal backpropagation. NumTRAS provides an alternative to other imaging and source detection techniques, such as acoustic holography and beamforming. Beyond the applications of acoustic and vibrational non-destructive evaluation of industrial structures, NumTRAS has applications in evaluation of musical structures and is being tested to detect and characterize moving sources.