

Spatially and Qualitatively Hierarchical Reconstruction of TDLAS Tomography via Deep Learning

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Tunable diode laser absorption spectroscopy (TDLAS) tomography enables non-intrusive temperature imaging in combustion fields, yet suffers from an underdetermined inverse problem due to limited line-of-sight projections. This report presents our deep learning-based frameworks that address this challenge through hierarchical reconstruction strategies. A spatially hierarchical network progressively reconstructs temperature fields across multiple resolutions, capturing both global structures and local details. Complementarily, a quality-hierarchical approach decomposes the reconstruction into stages with increasing fidelity requirements, ensuring robustness against noise. Experimental results demonstrate that our methods achieve superior reconstruction accuracy and spatial resolution compared to conventional algorithms, offering a promising pathway toward practical combustion diagnostics.