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Guillaume Bal, Emil Sidky and Fatma Terzioglu* (fterzioglu@uchicago.edu). *Uniqueness and stability of reconstruction in Multi-Energy Computed Tomography*. Preliminary report.

Multi-Energy Computed Tomography (ME-CT) is a medical imaging modality aiming to reconstruct the spatial density of materials from the attenuation properties of probing x-rays. For each line in two or three dimensional space, ME-CT measurements may be written as a nonlinear mapping from the integrals of the unknown densities of a finite number of materials (typically bone, water and contrast agents) along said line to an equal or larger number of energy-weighted integrals corresponding to different x-ray source energy spectra. Image reconstruction from ME-CT data may thus be achieved in two steps: first the reconstruction of line integrals of the material densities from their energy-weighted integrals, and then the reconstruction of material densities from their line integrals. The second step is the standard linear x-ray CT problem whose invertibility is well-known. The first step is however a nonlinear map with no known analytical inverse. In this talk, we focus on the first step and present a sufficient criteria that guarantee global uniqueness and stability of ME-CT reconstructions. We also present a new ME-CT material reconstruction algorithm whose convergence is ensured using our criteria. (Received September 11, 2020)