HU to Electron Density Mapping: Comprehensive Report

This report summarizes the mapping between CT Hounsfield Units (HU) and electron density (RED), including: - HU definition and formula - Two models: Five-compartment and Fine composition - Graphical visualizations (bar, scatter, stacked composition) - References and calibration notes

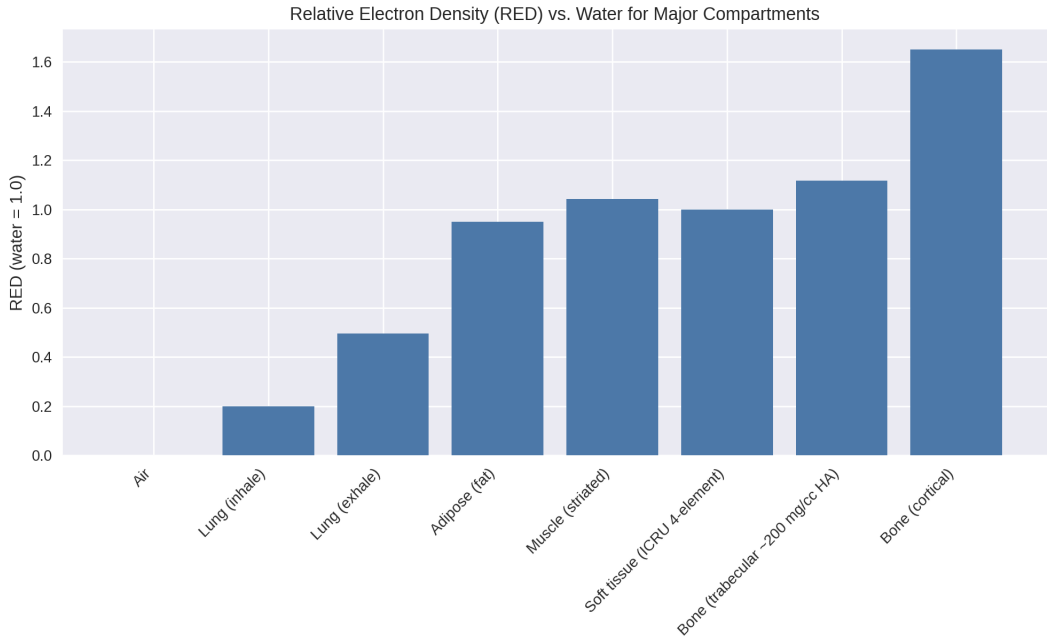
HU Definition Formula:

HU = 1000 × (μ_tissue – μ_water) / μ_water

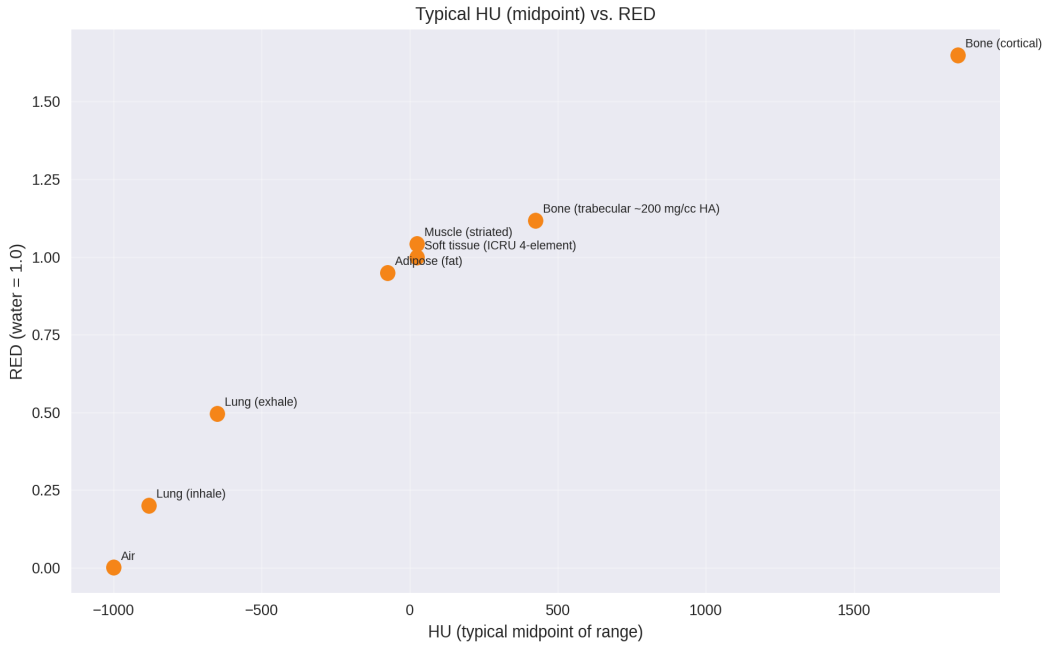
Five-Compartment Model Table:

Compartment	HU Range	Density (g/cm³)	RED	Key Composition
Air	-1000	0.0012	~0.001	N 75.5%, O 23.2%, Ar 1.3%
Lung	-850 to -910	0.205–0.507	0.20–0.50	Similar to soft tissue
Fat	-100 to -50	0.95	0.949	H 11.4%, C 59.8%, O 27.8%
Muscle	+10 to +40	1.06	1.043	H 10.2%, C 12.3%, O 72.9%
Soft Tissue	0 to +50	1.00	1.000	H 10.1%, C 11.1%, O 76.2%
Bone	+150 to +3000	1.16–1.85	1.117–1.695	H 3.4%, C 15.5%, Ca 22.5%

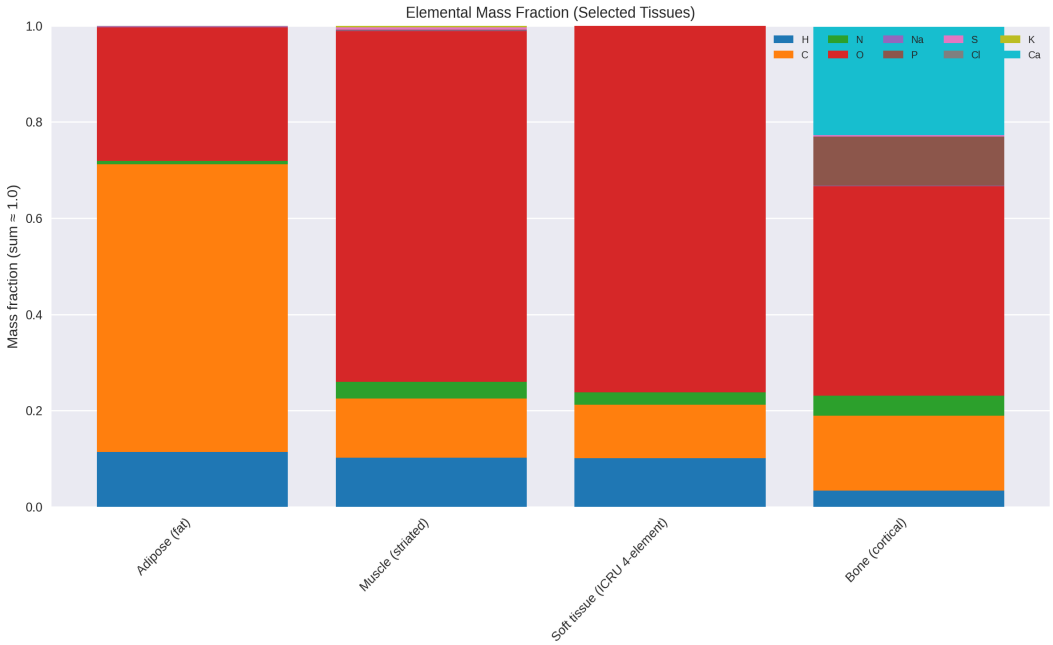
Graphs:



RED by Compartment



HU vs RED Scatter



Elemental Composition

References:

References: - ICRU-44/46, NIST tissue composition tables - Radiopaedia HU ranges - CIRS phantom data for RED calibration - DECT ΔHU mapping studies - Iodine enhancement and metal artifact mitigation literature