# Digital Core-Enabled High-Resolution Formation Evaluation via Coupled Physics and Data Analytics

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**Abstract.** Dual energy X-ray computed tomography (DECT) scans of 30 meters of U.S. midcontinent core were acquired and post-processed to filter out imaging artefacts, align core sections, remove incongruities including core breaks and plug gaps, and erode mud-invaded zones. Mineral standard calibration curves were then leveraged to derive photoelectric (PEF) and bulk density logs at millimeter spatial (including depth) resolution, from which companion bulk mineralogy tracks of sandstone, limestone, shale, and porosity were calculated using a distributed endmember mixing model. Results demonstrate good agreement with sub-sampled x-ray fluorescence-derived PEF, helium porosity, and x-ray diffraction mineralogy measurements. Selected sections of these data were then combined with underlying DECT greyscale image stacks, 25 and 50 micron resolved visible and ultraviolet line images, respectively, of the slabbed surface of the core, and 15 centimeter resolved total and spectral natural gamma logs as inputs to a wireline petrophysics-supervised machine learning model to generate synthetic logs of rock mechanical fraccability, permeability, and fluid producibility in sections that were not used for the training dataset. Model success was largely dependent on the quantity of input data, among other factors, underpinning the value of the high resolution, high throughput, multimodal formation evaluation datasets afforded by digital core analysis methods like DECT and line imaging.