Nanotomography: Resolution, scale, and physical properties

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Flow properties, NMR relaxation parameters and mechanical behaviour of reservoir rocks depend on their internal structure. Their structural parameters, such as porosity, pore connectivity and pore size distribution can be derived from 3D tomograms. The highest resolution tomograms are obtained from synchrotron radiation methods, providing insight into micro and nanostructure inside rocks.

We examined how the nanometre scale properties, that we derive from tomograms, are affected by the size of the sample. High resolution limits the field of view (FOV), meaning that the sampled size might not be representative of the whole rock. Wider FOV however, samples larger volumes but obscures the fine details, which are determinant for the flow properties. To overcome this shortcoming, we imaged the same sample at resolution ranging from about 2 μm to 45 nm (Fig. 1), where the measured volume ranged from $(460\ \mu m)^3$ to $(17\ \mu m)^3$. Information uniquely available in one dataset supplemented the other so this approach virtually reduced the FOV limitations that are inherent to imaging methods. This allowed a direct comparison between extracted rock properties that depend on instrument resolution and can help us predict how such properties scale with sample size.

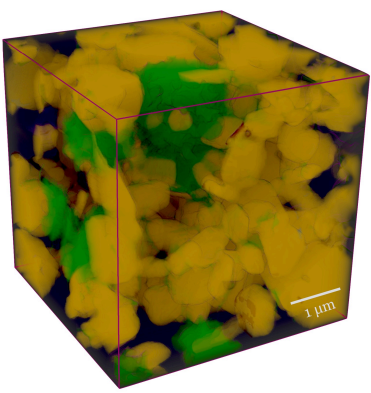

Figure 1: 3D tomogram showing the inner structure from a sample of chalk. The green particles have lower density. Resolution is 40 nm.

[1] D. Müter, H. O. Sørensen, D. Jha, R. Harti *et al*. (2014) *Appl. Phys. Lett.* **105**, 043108.