Development of nuclear magnetic resonance scanners for the nondestructive measurement of water fractions in boring cores

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Boring cores are often obtained to test the prediction by the geophysical explorations and to support the geophysical data analyses. Because pore water contents affect the physical properties of rocks and soils, the quantification of the water volume fraction in the cores is one of the most important subjects in the on-site or laboratory core analysis. I am developing a nondestructive core scanner to measure the water volume fraction along porous wet cores. The low-field time-domain proton nuclear magnetic resonance technique is employed for the scanner. Water protons in a static magnetic field produced by permanent magnets are excited by the radio-frequency coil, and the resultant proton transverse relaxation signals are acquired as raw data, which can be translated into water volume fractions, and pore-size distributions and permeabilities of the porous media. The previous version of the on-site core scanner [1] shown in the figure is being improved by employing a new design, single-sided magnetic circuit [2-3], to increase the accuracy and operationability. The current status and future perspective of the new scanner being developed would be presented.

References:
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[3] Nakashima, Y. et al. (2020) Nondestructive quantification of moisture in powdered low-rank coal by a unilateral nuclear magnetic resonance scanner. International Journal of Coal Preparation and Utilization (in press). https://doi.org/10.1080/19392699.2020.1722656

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A soil core (diameter, 4cm) is being scanned by NMR. [1]