Contribution ID: **670** Type: **Oral Presentation**

Zoom-tomography applied to diverse porous media research at the MOGNO beamline from Sirius synchrotron

Tuesday, 23 May 2023 15:15 (15 minutes)

Synchrotron light sources present advantages over laboratory-based X-ray Computed Tomography (XCT) in terms of spatial and temporal resolution. The reasons are the smaller size of the X-ray source and the higher photon flux generally achieved in particle accelerators. In this context, Sirius, the Brazilian 4th generation light source, will count on a world-leading micro and nano X-ray imaging beamline, MOGNO, which will be focused on time resolved and multi-scale experiments (Archilha et al., 2022). The project of MOGNO has been presented at InterPore in 2018, before its construction had started. Now, after five years, the goal of this work is to present the current status of MOGNO and recent imaging of diverse examples of porous media using the cutting-edge zoom-tomography capability that has recently been validated.

The cone beam geometry of MOGNO covers up to 27 meters between the sample and detector, enabling continuous magnification of the image, also known as zoom-tomography. This beamline will be equipped with a direct area-detector that provides a maximum field of view (FOV) of ~85x85 mm2. At this maximum FOV, the sample is positioned close to the detector and the image resolution is 55 µm, which is limited by the pixel size of the detector. By moving the sample towards the X-ray source, specific regions of interest inside the sample can be selected with smaller FOVs down to ~150 µm and higher image resolutions up to 120 nm, which is limited by the projected size of the X-ray beam focus. However, the maximum FOV for a given experiment must respect the X-ray transmission dependency on the sample chemical composition. In this regard, MOGNO works in tender (22 and 39 keV) and high (67.5keV) X-ray energies, which makes it a versatile beamline that can be used to image a diversity of materials, ranging across rocks, soils, plants, fossils, biological tissues, etc. The zoom-tomography capability is on the spotlight as this will considerably benefit the currently represented research areas at MOGNO, such as geological, biological, material, earth/planetary, agriculture, and archeology (e.g., Moraes et al., 2022; Ferreira et al., 2022). These areas have in common the hierarchical nature of the materials. Therefore, we propose to show real examples of zoom-tomography at the MOGNO beamline applied to different porous media, for instance, of pre-salt reservoir rocks, roots growing in soil, plant stem, bone regeneration, fossil, and biological tissues. These samples attenuate the X-rays differently and thus impose different challenges in the image reconstruction, requiring robust computational methods capable of working with both light and hard samples, at times including phase retrieval algorithms. We expect to show opportunities for studies that can already be performed at this beamline, which will be open for scientific commissioning with external users in 2023.

Participation

In-Person

References

Archilha, N., Costa, G.S.R., Ferreira, G.R.B, Moreno, G.B.Z.L, Rocha, A.S., Meyer, B.C., Pinto, A.C., Miqueles, E.X.S., Cardoso, M.B., Westfahl Jr., H. MOGNO, the nano and microtomography beamline at Sirius, the Brazilian synchrotron light source. Journal of Physics: Conference Series Accepted (2022)

Moraes, I. C., Hesterberg, D, Bacchim Neto, F. A., Archilha, N., Pérez, C. A., Araújo, M. V. A., Ferreira, T. R., Monte Carlo simulations of synchrotron X-ray dose effects on root growth during in-vivo tomographic imaging. Scientific Reports (2022) (under review; https://doi.org/10.21203/rs.3.rs-2322828/v1)

Ferreira, T. R., Pires, L. F. & Reichardt, K. 4D X-Ray Computed Tomography in Soil Science: an Overview and Future Perspectives at Mogno/Sirius. Brazilian J. Phys. 2022 52252, 1–14 (2022). https://doi.org/10.1007/s13538-021-01043-x

MDPI Energies Student Poster Award

No, do not submit my presenation for the student posters award.

Country

Brazil

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

Primary authors: LOPES ARCHILHA, Nathaly (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM)); ROSAS FERREIRA, Talita (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM))

Co-authors: Dr ZELAYA, Victor R. M. (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM)); SILVA PINO, Daphne (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM)); Dr KERBER, Bruno B. (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM)); Dr CARVALHO, Murilo (Brazilian Biosciences National Laboratory (LNBio), Brazilian Center for Research in Energy and Materials (CNPEM)); CUNHA FERRAZ, Paola (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM)); MACUL MORENO, Larissa (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM)); MOREIRA PAIANO, Otávio (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM)); MIQUELES, Eduardo Xavier (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM))

Presenter: ROSAS FERREIRA, Talita (Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM))

Session Classification: MS10

Track Classification: (MS10) Advances in imaging porous media: techniques, software and case studies