Contribution ID: **119** Type: **Oral presentation**

# Investigation of pore scale phenomena in CCS applications using X-ray Micro Computed Tomography

*Monday 16 June 2025 16:00 (15 minutes)*

The effects of climate change make atmospheric CO2 reductions a necessity. This effort is mostly represented by Carbon Capture and Storage (CCS): the removal of CO2 from the atmosphere and its transport to safe and permanent storage. Injecting, trapping and storing CO2 within the subsurface requires a deep understanding of the geological and geophysical processes that are involved. At the pore scale, X-ray micro-Computed Tomography (CT) has emerged as a powerful method for in-situ studies due to a spatial resolution of the order of µm for home-laboratory based CT and nm for synchrotron facilities. Its non-invasive nature makes CT highly suitable for in-situ CO2 experiments. We showcase state-of-the-art studies from the X-ray Physics Group at NTNU relating to challenges in CCS. In-situ CO2 injection experiments can be performed and monitored using CT to observe salt precipitation in saline aquifers as well as corrosion of steel pipelines and casings in contact with cement. The former can restrict storage capacity and injection rates while the latter can lead to well leakage. Low concentration impurities in CO2 can compromise the efficacy of plugs and caprock seals over time. To study the mechanical degradation of the rocks, millimeter scale triaxial cells, with continuous X-ray monitoring, are utilized to carry out mechanical stress tests. In summary, our CT-based experiments cover a wide range of processes relating to CCS. In addition, we will share insights into how we perceive the path forwards in terms of improved instrumentation, complementary methods, and algorithms.

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**Session Classification:** Parallell A1

**Track Classification:** 7. Subatomic physics and astrophysics: Subatomic physics