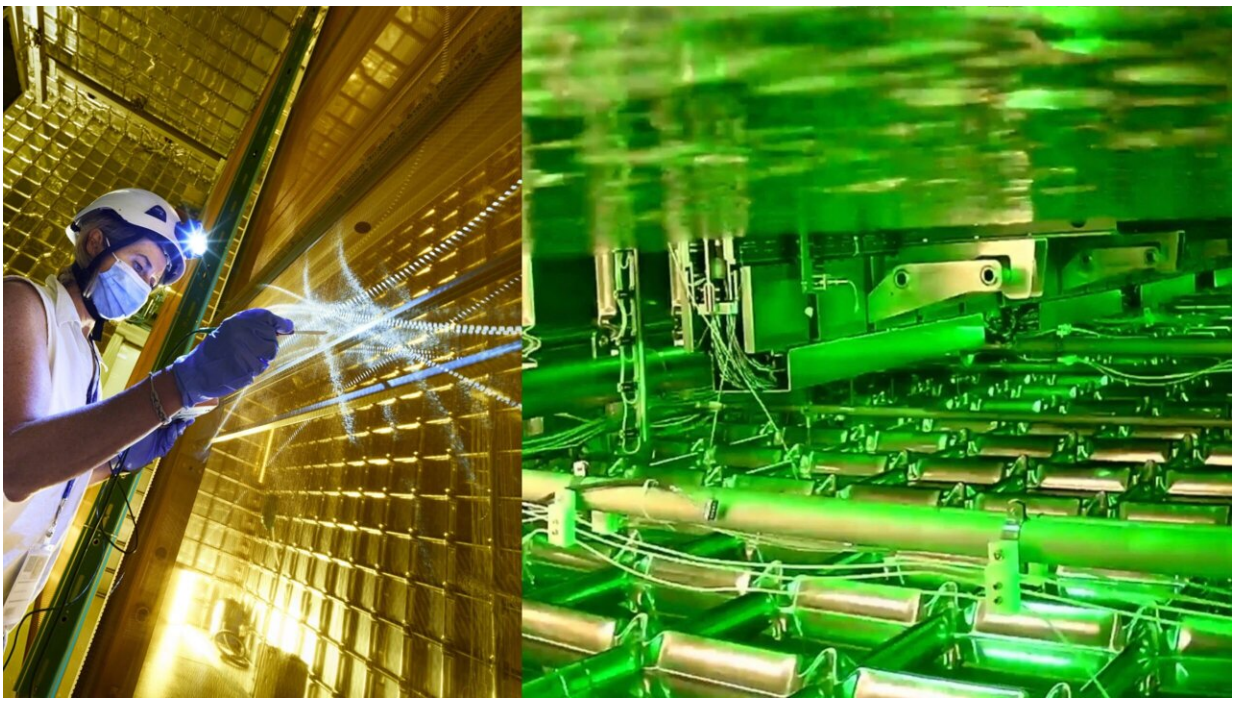
ProtoDUNE's argon filling underway, a significant step toward next era of neutrino research

April 12 2024, by Chetna Krishna



ProtoDUNE begins liquid argon filling. Credit: CERN

CERN's Neutrino Platform houses a prototype of the Deep Underground Neutrino Experiment (DUNE) known as ProtoDUNE, which is designed to test and validate the technologies that will be applied to the construction of the DUNE experiment in the United States.

Recently, ProtoDUNE has entered a pivotal stage: the filling of one of its two particle detectors with liquid argon. Filling such a detector takes almost two months, as the chamber is gigantic—almost the size of a three-story building. ProtoDUNE's second detector will be filled in the autumn.

ProtoDUNE will use the proton beam from the Super Proton Synchrotron to test the detecting of charged particles. This argon-filled detector will be crucial to test the detector response for the next era of neutrino research. Liquid argon is used in DUNE due to its inert nature, which provides a clean environment for precise measurements.

When a neutrino interacts with argon, it produces charged particles that ionize the atoms, allowing scientists to detect and study neutrino interactions. Additionally, liquid argon's density and high scintillation light yield enhance the detection of these interactions, making it an ideal medium for neutrino experiments.

Interestingly, the interior of the partially filled detector now appears green instead of its usual golden color. This is because when the regular LED light is reflected inside the metal cryostat, the light travels through the liquid argon and the wavelength of the photons is shifted, producing a visible green effect.

The DUNE far detector, which will be roughly 20 times bigger than protoDUNE, is being built in the United States. DUNE will send a beam of neutrinos from Fermi National Accelerator Laboratory (Fermilab) near Chicago, Illinois, over a distance of more than 1,300 kilometers through the Earth to neutrino detectors located 1.5 km underground at the Sanford Underground Research Facility (SURF) in Sanford, South Dakota.

Provided by CERN