

## Thermal management and modeling for precision measurements in Borexino's SOX and solar neutrino spectroscopy programs

The Borexino liquid scintillator neutrino observatory is set to perform the first direct, high-precision, wide-band solar neutrino spectroscopy of the solar neutrino spectrum's main components, including improving the knowledge of the CNO  $\nu$  flux. Additionally, its next-generation short-baseline  $^{144}\text{Ce}$ - $^{144}\text{Pr}$   $\bar{\nu}_e$  source program (CeSOX) intends to unambiguously measure or disprove signs of anomalous oscillatory behavior in the low L/E regime, also exploring the anomaly-favored  $\sin^2(\theta_{14})/\Delta m_{14}^2$  sterile neutrino phase space. Both programs rely on the detector's unprecedented and record-setting background levels, which are tightening its requirement for background stability. Aiming to minimize background fluctuations (particularly in  $^{210}\text{Po}$ ), a new Temperature Monitoring and Management System was deployed. Computational Fluid Dynamics (CFD) simulations are also being actively developed in order to model, characterize and ultimately predict the subtle fluid currents ( $\sim 10^{-7}$  m/s) that might prove to be a hindrance for the required background stability.

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