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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 ν flux. Additionally, its next-generation short-baseline ^{144}Ce-^{144}Pr $\overline{\nu}_e$ 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 $sin^2(\theta_{14})/\Delta m^2_{14}$ 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}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 (~10^{-7} m/s) that might prove to be a hindrance for the required background stability.

Primary author: Dr BRAVO BERGUÑO, David (INFN Milano)

Co-author: Dr MEREU, Riccardo (Milano Politecnico)

Presenter: Dr BRAVO BERGUÑO, David (INFN Milano)

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