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Strategy and data analysis for the discovery of CNO solar neutrino by Borexino

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Borexino is a large liquid scintillator experiment designed for real-time detection of low-energy solar neutrinos. It is located at the underground INFN Laboratori Nazionali del Gran Sasso, in Italy. During more than ten years of data collection, it has measured all the neutrino fluxes produced in the proton-proton-chain, i.e. the main fusion process accounting for ˜99% of the energy production of the Sun. Recently, Borexino provided the first observation of solar neutrinos emitted from the Carbon-Nitrogen-Oxygen (CNO) fusion cycle. The key difficulty of this measurement is represented by the 210Bi contaminating liquid scintillator, whose spectral shape is very similar to the one induced by CNO neutrinos. The only way to break this correlation is to determine the 210Bi rate independently and to constrain it in the multivariate fit. Such strategy relies on the connection between the 210Bi and the α-decays of its daughter 210Po, that can be identified on an event-by-event basis via pulse shape discrimination techniques. To suppress convective motions introducing non-equilibrium 210Po in the fiducial volume of the analysis, it was necessary to thermally stabilise the detector.
The purpose of this presentation is to provide a description of the detector thermal stabilisation process, the 210Bi constraint determination, and the analysis strategy adopted to extract the interaction rate of CNO neutrinos.

Author: PELICCI, Luca (Forschungszentrum jülich)

Co-author: ON BEHALF OF BOREXINO COLLABORATION

Presenter: PELICCI, Luca (Forschungszentrum jülich)

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