BOREXINO SOLAR NEUTRINO EXPERIMENT
The Borexino Scintillator Purification and Containment Systems

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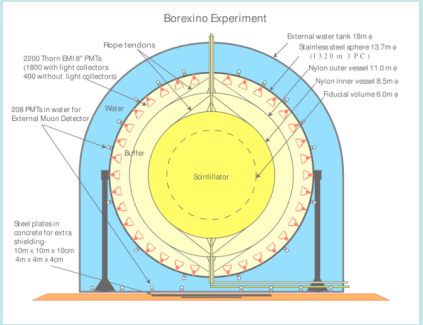
INTRODUCTION

Borexino is an international experiment located deep underground in the Gran Sasso National Laboratory of Italy. The experiment is dedicated to the observation of low-energy solar neutrinos. Primary goals of the experiment are observation of the mono-energetic ^{7}Be neutrinos at 862 keV, and precise measurement of their rates in order to test current models of the Sun and of neutrino oscillations. Future possibilities include observation of *pep*, *pp* and CNO-cycle solar neutrinos, as well as detection of geoneutrinos produced by radioactive isotopes in the Earth's crust, and observation of neutrinos from a nearby supernova. To perform these measurements, it is fundamental to achieve extraordinarily low radioactive backgrounds in the detector.

The design of Borexino is based on the principle of graded shielding, with the scintillator at the center of a series of concentric shells of increasing radiopurity, and the entire detector located 3500 m.w.e. underground. The 300 tons of scintillator, composed of pseudocumene (PC) and 1.5 g/L of the fluor 2,5-diphenyloxazole (PPO), are contained in a thin (125 μm) nylon Inner Vessel (IV) with a radius of 4.25 m. Within the IV, a fiducial mass of 100 tons can be defined by software selection of the events, based on their reconstructed position using timing data from the PMTs.



A second nylon outer vessel (OV) with radius 5.50 m contains a passive buffer fluid composed of pseudocumene and 5.0 g/L dimethylphthalate (DMP), a material that quenches the residual scintillation of PC so that spectroscopic signals arise dominantly from the interior of the IV. The OV acts as a barrier against radon and other background contamination originating from outside. Enclosing both scintillator and buffer regions is a stainless steel sphere (SSS), radius 6.85 m, that acts as a support structure for PMTs. The SSS holds the less dense organic fluids in position within a surrounding water tank used as a muon veto system and additional buffer layer.

The Borexino scintillator, and the scintillator containment vessel in intimate contact with it, are the most central parts of the detector; therefore, it is crucial that they are essentially free of radioactive backgrounds. The scintillator purification and containment systems hence play a central role in achieving the low backgrounds needed for the detection of the ^{7}Be solar neutrinos. In this poster, we describe the purification methods used to make the scintillator and buffer fluids sufficiently radio-pure. We also describe the Borexino nylon vessels that contain the scintillator and act as radon barriers.

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