Status of the Borexino Solar Neutrino Experiment ◇

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1. Introduction

Borexino is the first experiment planned to measure in real time the reactions induced by the low energy (< 1 MeV) solar neutrinos. The main experimental goal is the study of the 0.862 MeV ^{7}Be solar neutrino line through the detection of $\nu - e^-$ scattering. The measurement of the event rate induced by neutrinos from this source is still now a key point both from the point of view of the standard solar model confirmation and in the experimental proof of the neutrino flavour oscillation hypothesis.

The Borexino detector is under construction in Hall C of the Gran Sasso underground laboratory in Italy at an rock overburden of about 3600 mwe. Liquid scintillator (total mass ≈ 300 t, fiducial volume ≈ 100 t) will be target and detector material at once, allowing a high statistics measurement of the ^{7}Be solar neutrino flux (≈ 43/d according to the standard solar model, ≈ 9/d for full flavour conversion). The scintillator is contained in a transparent spherical nylon vessel (8.5 m diameter, 0.1 mm thickness) and surrounded by 1000 tons of a transparent buffer liquid. The scintillator is viewed by 2200 photomultipliers supported by a stainless steel sphere (13.7 m diameter), which also separates the inner part of the detector from the external shielding, provided by 2400 tons of pure water. The outer water shield, contained in a steel tank with 18 m diameter, 17 m height is instrumented with 208 photomultipliers serving as a veto for penetrating muons (Outer Detector). All surfaces of the Outer Detector will be covered with reflecting Tyvek sheets in order to increase the light yield.

A detailed description of the Borexino detector design is given in reference [1].

2. Status of the experiment

The construction of the Borexino detector is near completion in the hall C of the Gran Sasso underground laboratory. In the year 2002 several important tasks have been carried out: Between October 2001 and June 2002 270 tons of PC have been transported to Gran Sasso and are now stored in hall C. This amount corresponds to the full inventory of the Inner Vessel. A series of measurements of the ^{14}C content of the scintillator were made with the CTF, making possible a constant monitoring of the scintillator features over the whole procurement campaign. The values of the ratio ^{14}C/^{12}C in the different PC batches varies between 1.3 and $4.7 \cdot 10^{-18}$, well within the specifications set by the collaboration.

The CTF has also allowed a careful check of the purification systems which will be used for Borexino: an online and a batch Silica gel column purification were performed, as well as water extraction and nitrogen stripping.

The liquid handling system for Borexino has made substantial progress: two new Silica gel columns were designed, constructed and tested in Munich, and were finally installed in Module-0 (see fig. 1).

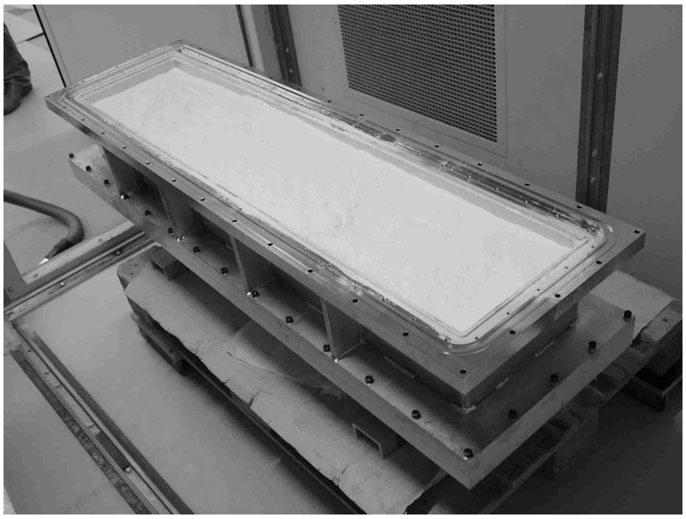

Fig. 1: One of he two new Silica gel columns for Borexino. Picture of the column housing, filled with Silica gel, before closing the upper flange.

The nylon vessel for the scintillator containment has been completed and shipped to Gran Sasso in August 2002. Several tests of the installation procedure have been performed since then. The final installation is foreseen for summer 2003.

The Inner Detector electronics is fully installed now, and has been tested with realistic scintillator signals. For this purpose a small quartz vessel with ^{222}Rn loaded scintillator has been prepared in Munich. The delayed coincidence of the ^{214}Bi and ^{214}Po decay provided a significant tag to identify the scintillator signals.

In the Outer Detector, 62 of the 208 photomultipliers have been installed in 2002, the rest will be mounted together with the reflecting Tyvek sheets after the completion of the work inside the SSS. The Outer Detector electronics and calibration system has been installed. An air run of the Outer Detector is planned for spring 2003 in order to test the calibration procedure.

References

[1] G. Alimonti *et al.*, Borexino-Collaboration, Astroparticle Physics **16** (2001) 205

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