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.

Borexino is being constructed 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 200 photomultipliers serving as a veto for penetrating muons, the only significant remaining cosmic ray background at the depth of the Gran Sasso underground laboratory. 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. The installation of the structural part of the detector (water tank, stainless steel sphere) has been completed, and service systems (air control inside the sphere, clean rooms, etc.) are running in standard conditions.

The photomultipliers have been completely assembled, sealed and coupled with the optical concentrators. 1800 of them have been installed inside the SSS during 2001, the remaining 400 will be mounted after the nylon vessel installation.

The selection of the kind of nylon to be used for the vessels has caused some delay in the time schedule. The nylon has to fulfill mechanical, optical and chemical requirements, and particularly the Rn emanation from thin layers of nylon is very critical. The vessels have been manufactured inside a large clean room and will be delivered to Gran Sasso in spring 2002.

The 210 photomultipliers for the outer detector (muon veto) have been encapsulated and tested in Munich. The cables for the high voltage supply and signal readout and optical fibers for the calibration have been installed in the outer tank. The PMTs and the reflecting Tyvek sheets will be mounted during Summer 2002, after the completion of the inner detector installation. The dedicated electronics for the muon veto is under construction in Munich.

The delivery of the liquid scintillator for Borexino started in October 2001. Each batch of scintillator is tested in the CTF on its radiopurity and optical properties. First measurements carried out in November and December 2001 showed a sufficiently ^{14}C content of the scintillator (the ^{14}C content is crucial, as it can not be removed by chemical purification methods from the organic scintillator). In addition, the various purification systems constructed for Borexino (column purification, water extraction, vacuum distillation) are also being tested with CTF measurements for their purification efficiency. With these measurements also a possible contamination due to the purification system itself (e.g. due to an air leak) can be excluded.

The goal of the work in progress is to have Borexino ready for filling until fall 2002.

References

[1] G. Alimonti *et al.*, Borexino-Collaboration, 'Science and Technology of BOREXINO: A Real-Time Detector for Low Energy Solar Neutrinos', Astroparticle Physics **16** (2001) 205

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