Contribution ID : **25** Type : **Oral**

Experience of gas purification and radon control in Borexino

Thursday, 25 May 2017 09:20 (0:20)

Content

Borexino, located at the Gran Sasso Laboratory, is a liquid scintillator detector with active mass of 278 tons. The main goal of the experiment is the real-time registration of sub-MeV solar neutrinos through their elastic scattering on electrons. The lack of directionality of the light emitted by the scintillator makes it impossible to distinguish neutrino-scattered electrons from electrons due to natural radioactivity. This leads to a crucial requirement of the Borexino technology, namely an extremely low radioactive contamination of the detection medium. This has been achieved after very extensive R&D studies, and presently the detector purity is at an unprecedented level, never achieved so far in any other project. In this sense the Borexino detector is very unique world-wide and allows to study extremely week processes. Thanks to its very low background level, the collaboration was able to register in real-time almost entire spectrum of the solar neutrinos, including the most fundamental low energy pp neutrinos.

An important measure to achieve in Borexino the required radio-purity was careful material screening with very sensitive devices. For this purpose the world's most sensitive gamma ray spectrometer – GeMPI – was developed (detection limit of <10 micro_Bq/kg for U/Th). Even more important was the elimination of Rn-222 sources. Rn-222 is a relatively long-lived radioactive noble gas isotope which may diffuse into the fiducial volume of the liquid scintillator. A screening technique dedicated to measurements of Rn-222 with a few atom sensitivity will be discussed along with results obtained from various subsystems of Borexino. Studies of very weak radon diffusion/permeation through the Borexino scintillator vessel will also be outlined. One of the crucial points in the experiment was the radio-purity of gases used for blanketing, purging or purification purposes. A dedicated plant, which continuously produces almost Rn-222-free nitrogen (less than 1 atom in 4 m3 at STP) at high flow-rate (up to 200 m3/h) was installed underground. It is based on cryo-adsorption of radon from nitrogen liquid phase. We also successfully searched for nitrogen with a particularly low argon (below ppb) and krypton (below 0.1 ppt) concentrations. A special logistic procedures and a cryogenic system were developed in order to maintain the purity and make it possible to deliver the nitrogen to the experimental site. This is still the radio-purest gas used by any experiment ever. Production of synthetic air with a very low Rn-222 level by mixing oxygen with radon-free nitrogen will also be briefly described.

Summary

Primary author(s) : Dr. ZUZEL, Grzegorz (Jagiellonian University)

Presenter(s) : Dr. ZUZEL, Grzegorz (Jagiellonian University)

Session Classification : Session 4