Radon Suppression and Cleanliness Issues for the Borexino Nylon Vessels

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Borexino is an unsegmented, real time liquid scintillator detector for low energy solar neutrinos at the Gran Sasso underground laboratories in Italy. Its main goal is to measure the flux of the monoenergetic (862 keV) neutrinos emtted in electron capture reactions on ^{7}Be in the core of the Sun.
Radioactive elements naturally present in the detector components are recorded as scintillation events below 1 MeV and would represent an irreducible background for the experiment. For this reason, low radioactivity levels are required for all the central components of the detector.
The innermost active scintillator volume is contained within a spherical volume by a thin nylon membrane. A second, concentric membrane is provided which defines a spherical buffer shell around it; it prevents radon emanated by the photomultiplier tubes and the other external components from diffusing into the inner buffer region, according to a graded-shielding design.
The assembly of the nylon vessels took place in a dedicated clean room. Many aspects of the clean techniques adopted will be presented, including criteria used for material selection, measurements performed to quantify radioactive contamination and some specific features of the clean room. Special emphasis will be given to the design and performance of a charcoal-based radon filter of original design which supplies all the needed breatheable make up air to the clean room. The filter is based on a Vacuum Swing technique and has been running continuously for the past year.