Contribution ID: **62** Type: **Oral**

Ultra-trace element determination by neutron activation analysis in acrylic material

Wednesday, May 24, 2017 3:50 PM (20 minutes)

The radio purity of materials is the essential condition upon which rely the latest experiments in nuclear and particle physics. In fact, from the radio purity of the materials depends the most reduction of the experiment intrinsic background.

In cases of observation of neutrino oscillation, double beta and dark matter, the greatest risk is the fact that the common radioactive background - generated from the decay product of radio nulides such 232Th, 238U and 40K - goes to exactly overlap in the observable energy regions of interest.

As a natural effect it is crucial to develop high-sensitivity analysis techniques to select the most suitable materials to be used in the experiment in order to reduce the radioactivity contribution at the background coming from the different components of the detector.

Acrylic is a widely used material in many experiments in the physics of rare events, in particular it's often used in the main part of the detector for its optical and mechanical properties. Therefore it is of fundamental importance its careful selection.

A methodology based on neutron activation analysis (NNA) combined with treatment of the sample surfaces has been developed to determine K, Th and U content in some acrylic samples. Particular attention was paid to the preparation of the sample to be irradiated, by phase of realization up to the handling and final cleaning.

By this methodology a ppt level has been achieved. The reported limit on the presence of 40K in acrylic are among the best ever achieved.

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Session Classification: Session 2