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Search for small temporal modulations of half-lives of radionuclides in the IMS Quality Control data

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Half-lives of radioisotopes are thought of as absolute constants of Nature. However, since the 1980s several experiments indicated that small percent or sub-percent level temporal modulations may exist, potentially correlated to variations of the solar neutrino flux. The issue has been debated by the nuclear theory community, since it would imply some new mechanism influencing weak decays, and of fundamental importance for nuclear physics. One problem is that high quality data collected over extensive period of time are scarce.
As regular part of their operation, the IMS monitoring stations take so-called quality control data daily, measuring a source of known isotopes for 30 minutes. The stations are at diverse geographic locations and using standardized equipment and sources. Such data are ideal to investigate long-term, small modulations of the half-lives due to an external influence, like solar neutrinos.
We obtained and analyzed 15 years' worth of quality control data from 11 IMS stations for annual and higher frequency modulations. We will present the results of this analysis, including an upper limit of the amplitude of the modulations and suggestions for the design of a future high-sensitivity experiment, dedicated to settle the issue of temporal modulations of half-lives due to solar influence.

Promotional text

Eighteen years of International Monitoring System was analyzed for evidence of time variance of nuclear decay contents. Additional, special experiments on the equipment were analyzed to asses the effects of periodic sample movement.

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