

## Neutrinos, wine and fraudulent business practices

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The Neutrino Ettore Majorana Observatory (NEMO) experiment, located in the Modane Underground Laboratory, between Italy and France, is looking for the very rare neutrinoless double beta decay. The detector is built out of materials containing no measurable radioactive isotopes such as U, Th, Ra and their progeny. To ensure the best radiopurity for the materials, we had to develop ultra-low background  $\gamma$ -ray spectrometers on the basis of HPGe crystals.

Four such spectrometers are hosted in the low-background environment PRISNA platform at our Institute in Bordeaux. We use them also for inter-disciplinary research, notably for dating wine by measuring its  $^{137}\text{Cs}$  content without opening the bottle.  $^{137}\text{Cs}$ , with a half-life of 30 years is a man-made isotope. Its origin comes mainly from the numerous atmospheric atom bomb tests during the 1950's and 1960's. The released activities were spread worldwide, then deposited on earth and on grapevines. Each year harvest is a "record" of that year's fallouts, which leads to a reference curve " $^{137}\text{Cs}$  activity vs vintage". If there is no  $^{137}\text{Cs}$  radioactivity in a given wine, this means it dates back from preatomic era. This foolproof method is used to demonstrate that some alleged old vintage wines are counterfeits.

Starting in 2010, a technical unit for service-delivery activities at PRISNA is now in charge of such measurements for a wide panel of public and private clients and it helped to clean up the market.

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