GEMS: underwater spectrometer for long-term radioactivity measurements

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Abstract

GEMS (Gamma Energy Marine Spectrometer) is a prototype of an autonomous radioactivity sensor for underwater measurements, developed in the framework of the KM3NeT Design Study (DS) EC project. The spectrometer is sensitive to gamma rays produced by K decays and it is also able to detect other natural (e.g. U, Th) and anthropogenic radionuclides (e.g. Cs). The decay of K, contained in sea salt, particulate and sediments, is one of the main sources of photon background in the underwater environment. GEMS was first calibrated in the laboratory using reference sources, also in order to evaluate the performance of the instrument. In November 2008 GEMS was deployed at a depth of 3200 m in the area of Capo Passero (in the Ionian Sea) to evaluate the performance of the instrument. In November 2008 GEMS was deployed at a depth of 3200 m in the area of Capo Passero (in the Ionian Sea) to evaluate the performance of the instrument. In November 2008 GEMS was deployed at a depth of 3200 m in the area of Capo Passero (in the Ionian Sea) to evaluate the performance of the instrument.

Experimental Calibration

We performed a calibration of the instrument utilizing its response in presence of some reference radionuclides. The spectrometer was calibrated in the laboratory using reference sources, also in order to evaluate the performance of the instrument. In November 2008 GEMS was deployed at a depth of 3200 m in the area of Capo Passero (in the Ionian Sea) to acquire data autonomously. After recovery of the spectrometer in June 2009 (May 2009) it was found that the instrument had worked within the specifications and acquired data over the full deployment period. These data allowed us to investigate over a long period the possible variations of activity at the Capo Passero site. GEMS is suitable to be used either in autonomous mode or as payload of small cruise observatories or vehicles.

First long-term deep-sea mission

- Deployed at a depth of 3200 m in the area of Capo Passero (in the Ionian Sea) to evaluate the performance of the instrument. In November 2008.
- First calibrated in the laboratory using reference sources, also in order to evaluate the performance of the instrument.
- Recovered 09/05/09 after 6 months of deployment.
- Example of result obtained: photon detection as a function of energy.

Next Developments

- Extend the analysis to the other radionuclides.
- Perform the study of the correlations with the oceanographic variables.
- Sea floor Gamma Ray measurements around active faults and seepage sites.

References


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