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Development of Unified Spectrometric Module Based on HPGe Detectors with Electric Machine Cooling

The development results of unified spectrometric module based on HPGe detectors with electric machine cooling for application in nuclear physical equipment of various application are presented. Unified module has cryostat with HPGe detector of the required size, electric machine cooler and electronic unit. The analysis of the cooling processes dynamics and HPGe detectors heating in cryostats, cooled by liquid nitrogen and EMC is made on the sample of the typical cooling circuits. Much attention is paid to design technological aspects of the cryostat development, cooled with electric coolers.

With Solidworks software package the modal analysis of the cryostat cover and HPGe detector with various registration efficiency and weight was carried out. Based on the modal analysis of HPGe detector assembly the design of the holders where axial vibration mode was removed to the area of higher harmonics with smaller amplitudes was selected.

The design of the developed unified module is reviewed. To increase EMC efficiency the additional radiators with heat tubes are installed and active method of blow off was applied. It secured the temperature decrease of EMC extender and accordingly provided the heat mode comfort for EMC operation what increases the safety of the developed module.

The spectra of radioisotopes Co-57 and Co-60 are presented, registered by unified spectrometric module with HPGe detector with gamma radiation registration efficiency of 40%. The energy resolution by energies 122 and 1332 keV is 0,98 and 1,85 accordingly. The overall sizes of the unified module is 280×315×265 mm, its weight with the detector is about 20 kg. The module provides the radiation registration in any spatial position. It allows easy installation of the developed module on various equipment. The samples of the manufactured devices with unified spectrometric module are presented.

Keywords: HPGe spectrometer, Stirling electric cooler.