COOPERATIVE DEVELOPMENT OF A HANDHELD SPECTROMETER FOR RADIATION DETECTION IN THE CONTEXT OF THE ESTONIA-LATVIA "HADEDE" PROJECT

RADIĀCIJAS NOTEIKŠANAS NOLŪKAM IZMANTOTA PORTATĪVA SPEKTROMETRA KOOPERATĪVA IZSTRĀDĀŠANA IGAUNIJA - LATVIJA "HADEDE" PROJEKTA IETVAROS

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The European Union Basic Safety Standards Directive (96/29/Euratom) has been revised to a new version (BSS Directive 2013/59/Euratom) which the EU countries have to comply with since 2018. The updated BSS sets out standards aiming to protect the health of workers, medical patients and general public against the radiation from a broadened range of sources. Member states have to ensure that an appropriate program to monitor the level of radioactivity in the environment must be in place. With this in mind, the HADEDE project is initiated to improve the radiation measurement technology using know-how already available but not yet combined in Estonia and Latvia. Application of electric Stirling coolers for cooling germanium detectors to cryogenic temperatures in radiation spectrometers allows to create a portable device for field applications without the need for bulky dewars with liquid nitrogen. Power consumption and weight of modern hand-held devices available on the market, are relatively large. This limits the duration of operation without recharging batteries and makes field applications suboptimal. The implementation of this project involves cross-border cooperation of experts in different technical fields to solve a practical problem that is essential to both countries.

The goal of project HADEDE is to establish a cooperation between two SMEs (1 - Estflow Consulting OÜ, Tartu, Estonia and 2 - Baltic Scientific Instruments, Riga, Latvia) to design and manufacture a next-generation hand-held spectrometer. The project will combine the benefits of computer modeling and simulation expertise available in Tartu, Estonia with the strengths of custom manufacturing and long term experience in detector technologies in Riga, Latvia. The target is to achieve improved cooling solution for the spectrometer based on the Stirling principle. To achieve this it is crucial to reduce heat losses in the vacuum chamber of cryostat with the germanium detector. This will allow the use of a low-power Stirling cooler, a major power consumer in the device. This also reduces the size and weight of the hand-held spectrometer and makes its application more comfortable.

The main activites can be divided into two groups: (i) modeling and simulation of the design and (ii) manufacturing of the prototype, testing and final assembly. State-of-the-art Computational Fluid Dynamics code will be used to analyse the heat transfer and cooling capabilities of the design. Rigorous testing will be performed to gain confidence in the validity of the model.

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