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RoboLab - Providing Remote Access to a Physical Radiation Laboratory

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The ability to work remotely has been critical for the past two years due to the pandemic. Many students were hindered in developing their experimental skills due to restricted access to campus and laboratories. A partial remedy to such situations can be to provide remote access to physical laboratories. This enables a student to perform real experiments without being physically present. In addition, remote access laboratory experiments can be used as preparation for performing physical hands-on experiments in order to maximize the learning outcome of the very resource-intensive laboratory time in radiation laboratories.

With new technologies constantly improving and being made available, one can say that remote is rapidly becoming the new "today"for future generations. "RoboLab"started in 2006 as a pilot project ran by University of Oslo used for teaching students about neutron activation and the effects of gamma absorption. Based on remotely controlled equipment in a real nuclear laboratory, the experiments can be performed without the usual safety training before entering such facilities. Furthermore, institutions without laboratories classified for radioactive work, or just laboratories with limited equipment and radioactive sources, can access experiments they otherwise would not be able to perform. Although hands-on training cannot be substituted with this type of experiments, RoboLab can highly increase awareness, preparation and knowledge prior to entering a laboratory. During the conditions of a restricted access to campus and teachings at many universities, the RoboLab has shown to be a viable alternative to hands-on exercises.

The technical foundation of the RoboLabs is the LabView programming environment developed by National Instruments. LabView provides the possibility to quickly and easily develop web-based "virtual instruments" . A cloud-based NI platform establishes communication between the users and the server and allows the operator to securely access and interact with the setup located at UiO –or at any other institution hosting a RoboLab system –from any part of the world through a web browser, without installing additional plug-ins.

The first representation of such system is a "Neutron Activation of Silver"-experiment at the University of Oslo (UiO). The application, accessed through a regular web browser, enables the students to irradiate a plate of natural silver with neutrons for a preselected time, make a transfer to a NaI detector and measure the disintegration rate as a function of time during the decay of two short-lived silver isotopes. Another experiment provided by UiO is absorption of gamma rays in matter. Lately an experiment to teach how a radionuclide generator can be made was developed and is ready for pilot runs. It absorbs 234-Th on a cation-exchange column and subsequently 234m-Pa can be eluted and a decay curve measured. This work is part of the A-CINCH EurAtom project and co-funded by the Norwegian Research Council.

Based on the RoboLab concept developed at UiO three other remote controlled exercises was developed at the Leibniz University Hannover, also as part of the CINCH project series. These exercises are: HPGe gamma-spectrometry; Autodeposition on different metals; An ion exchange column with "on-line" detection.

The RoboLab remote controlled experiments demonstrates the flexibility offered by adding digital teaching methods to the traditional toolbox.

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