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#10-130 On Teaching Experimental Reactor Physics in Times of Pandemic

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Practical exercises or hands-on experiments in Reactor Physics at a research reactor are an essential part of education and training in Nuclear Engineering. They are mostly performed at low power research reactors and/or critical and subcritical assemblies. Institutions that do not have their own research experimental facilities often visit other facilities to perform hands-on experiments. In times of pandemic, when mobility of people is very limited, such visits are practically impossible to perform hence other options has to be considered.

The Jožef Stefan Institute (JSI) TRIGA Mark II research reactor is regularly used for education and training. However, since spring 2020 the access to the reactor has been limited due to worldwide Covid-19 pandemic. In spring 2020 the reactor was completely shut down, practical exercises on experimental reactor physics had to be performed online using videoconference software, cloud services and research reactor simulator. In June 2020 the reactor started normal operations, however due to travel restrictions around the world and in Europe, students could not come to Slovenia. Hence a practical educational curse "Experimental reactor physics"for students from Uppsala University was organised remotely.

A five-day practical Educational Course was organised and performed using off the shelf but advanced software and hardware components such as: a remotely controlled dome camera in the control room, portable cameras that the lecturers could take to the reactor, two video-conference setups, remotely controlled laptop used to operate the data acquisition software and the Digital Reactivity Meter, a remotely controlled common whiteboard, a remotely-operated camera showing the reactor core, cloud document system.

The educational course program consisted of the same exercises that are offered during in-person exercises: Introduction to JSI TRIGA reactor, Critical experiment, Reactor response to step reactivity changes, Reactor operation, Void reactivity coefficient, Control rod worth measurements and Temperature reactivity coefficient.

The performance of the course was evaluated using an online anonymous survey taken by all the students and their mentors. The organizers provided both open-ended questions and questions that were answered using a rating scale. The aspects being evaluated included the technical content, quality of material, performance of the individual lecturers and the quality of the remote session. In general, the response was overwhelmingly positive with most questions with a rating scale answered with "excellent". Multiple participants complained about the occasional problems with the sound quality, as they could not clearly hear the speakers when they stepped too far away from the conference microphones. The organizers of the course agree that the first remote exercises on a research reactor in Slovenia were well organized and useful but observed difficulties in achieving the same level of student involvement as the in-person exercises.

In the paper we describe the education course and its implementation. This is followed by evaluation of the course and outlook for future improvements. The paper can serve as demonstration and a guide on how to organise remote hands-on exercises at a research reactor, using relatively cheap and widely available components. It is important to note that the purpose of remote hands-on experiment is not to replace the in-person ones but to provide an alternative in difficult times, such as pandemic or any other situation affecting free movement of people.

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