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#11-156 A strong link between education and research thanks to experiments conducted on calorimetric sensors under irradiation conditions in nuclear research reactors.

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With the revival of the nuclear sector, recruitment needs for the next ten years are very high in France (over 10,000 employees per year). Several initiatives at different academic levels are conducted to promote the nuclear field, its various applications and its shortage occupations, to attract students, graduates and attracted already-employed professionals to this field, and to provide them strong skills by means of training leading to a diploma or continuing job education or professional development.

In this context, the Filière Instrumentation (Instrumentation unit) of the Physics Department of the Sciences Faculty at Aix-Marseille University (AMU) has expanded its actions over the past 6 years in nuclear instrumentation, measurement and metrology.
Its increased involvement is achieved in partnership with various key players (in France such as CEA, INSTN, EDF, "Campus des Métiers et des Qualifications d'Excellence –Industrie du Futur Sud –Région PACA"and "Université des Métiers du Nucléaire", CAPGEMINI···and abroad such as the Nuclear Reactor Laboratory of the MIT, Jožef Sfefan Institute, ENEEP, CNESTEN, SCK-CEN, ···) and with a strong link between education and research. This latter is realized within the framework of a joint laboratory (LIMMEX: Laboratory of Instrumentation and Measurement Methods under EXtreme conditions) created in 2009 by between AMU (IM2NP institute) and the CEA (IRESNE institute) in collaboration with the Jules Horowitz Reactor program.

Actions are carried out in particular at master level. For instance, the actions are:
- International mobility corresponding to intense short study-periods abroad on the thematic "Nuclear Instrumentation and measurement in research reactors"for work-study students (apprentices) in the first year of the Master Instrumentation, Measurement, Metrology (MOBIL-APP program, created in 2018),
- A second year of master dedicated to Instrumentation and Measurement Science for major Nuclear research facilities (IMSci-Nu master track, created in 2022 with ISFIN institute) with new courses and research projects linked to work performed on sensors designed, studied and qualified in the LIMMEX laboratory,
- A 1-week winter school on instrumentation and measurement for fission and fusion facilities (research reactors, tokamaks, SMRs/AMRs, NPPs) including lectures, a visit to the CEA, poster session (IMSci-Nu School, created in 2022),
- Different types of scholarships to attract new talents such as study grants, internship scholarships and mobility scholarships (founded by EDF, A*MIDEX foundation through the its TIGER project, ISFIN institute and the "Excellence Nucléaire Sud"project and more recently by "Université des Métiers du Nucléaire"),
- A new 28-hour course on the fundamentals of engineering for nuclear power plants in operation (Master 3I, funded by the OPPEN project, currently being set up).

The presentation will deal with the strong link between education and research.
The presentation will show how experimental work carried out during irradiation campaigns in nuclear research reactors is used to introduce students to the nuclear sector and train them in the field.
The presentation will start with examples of irradiation campaigns realized to characterize calorimetric sensor prototypes developed in the LIMMEX laboratory for the online measurement of the nuclear heating rate in in-core experimental channels of research reactors (MARIA, JSI TRIGA, MITR reactors). The research work is based on a comprehensive approach from out-of-flux laboratory conditions to nuclear irradiation conditions by coupling experimental studies, 1-D calculations and 3-D simulations.

Then the presentation will detail the different activities for students using these irradiation campaigns from their preparation to their realization and the associated comprehensive approach: specific lectures and seminars, student research project topics, escape games, hands-on activities on a new bench, on computers and on a new virtual reality room, study-cases in real-time during irradiation campaign, ⋯
The presentation will conclude to the transformative effects on the pedagogical approach and the student interest.

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