Table 1 Research Themes for the NEST Fellows 2024

No.	Organisation	Research Theme		Number of NEST Fellows	Term	Radiation Worker/ Non-Radiation Worker and so on	Field
		Title	Summary				
3-1	The University of Tennessee U.S.A.	Advanced Radiation Measurement Gamma sensing	Learn radiation measurement technologies regarding gamma detection by working with Rad IDEAS group researchers. Investigate how segmented gamma sensors may be expected to perform at high count rates. Investigate integration for robotic-pipe-crawler-assisted D&D.	1 person	1 ~ 3 months (Aug.2024 ~ Nov.2024)	Radiation Worker	Applied Physics, Radiation
3-2		Alpha sensing	Learn radiation measurement technologies regarding alpha particle detection by working with Rad IDEAS group researchers. Investigate how pixelated alpha sensors with high timing resolution may be expected to perform at high count rates. Investigate integration for robotic-pipe-crawler-assisted D&D.	1 person	1 ~ 3 months (Aug.2024 ~ Nov.2024)	Radiation Worker	Applied Physics, Radiation
4-1	McMaster University Canada	Environmental Radiobiology	Dose reconstruction for field data-sets of non-human species in the Fukushima Exclusion Zone (FEZ)	The environmental risks associated with radiation exposure in the FEZ are far from clear. Much of the data correlates abnormalities or effects with ambient dose of radiation at the time the organism was examined but we now know that cumulative dose and dose experienced by ancestors of the current population can induce changes that are transgenerational. Calculating the historic dose is therefore important. This project will reconstruct the dose for data obtained from field radioecologists working in the FEZ and will validate effects seen by comparing results with laboratory data. The training for a student will involve dose modelling and at least two established methods of dose reconstruction. Hands on training will also involve laboratory experiments using tissue culture in our Level 2 biosafety laboratory and exposure of arthropods to radiation in the Tandem Accelerator facility at McMaster which is a world class centre with multiple radiation sources. This is in order to validate the data generated from modelling exercises. Further training will involve preparation of presentations and papers for publication.	1 person	1 ~ 3 months (Aug.2024 ~ Nov.2024)	Non-Radiation Worker	Radiobiology, interested in modelling effects
4-2		Sorption mechanisms of key radionuclides for radioactive waste disposal	Sorption mechanisms of key radionuclides for radioactive waste disposal	Sorption behaviors of key radioniclides have been studied by experiments and physicochemical modelling. To justify the sorption behavior, the sorption mechenisms in the molecular scale is required. In this project, the sorption behavior will be studied using Density Functional Theory.	1 person	1 ~ 3 months (May 2024 ~ Aug.2024)	Non-Radiation Worker	Quantum Chemistry Simulation
5-1	Technical University of Munich Germany	Robotics & Remote System	Design, Assembly and Programming of a 3D Printed Low-Cost Robot Arm	In the project, participants learn to design a 4DoF robot with an arm length of 700mm, a self-weight of 2.5 kg (without power supply/battery) and a payload of 500g with Matlab, to print in selective laser sintering, to assemble the components and to equip a PC-independent controller with Arduino microcontroller. After the end of the project, the goal is to further develop these robots independently and to be able to produce such robots in large quantities in 3D printing within a few days in the event of a disaster.	Max. 1 people	several months (Aug.2024 ~ Dec.2024)	Non-Radiation Worker	Master degree, interest in robot mechanics, microcontroller electronics, and programming in C and Matlab!Acceptable number of the NEST
5-2		Mechanisms Design and Precision Engineering of Revolute Joints	Mechanisms Design and Precision Engineering of Revolute Joints	In this project the participants shall learn to design motion machines, mechanisms like four-joint with Matlab and to realize them in 3D printing. Besides mathematical basics it is also necessary to gain knowledge about the production of mechanical fits and articulated joints with 3D printing. Precision joints between 1mm and 3mm are taught and their production in additive manufacturing from standard parts.Terms and its start time	Max. 1 people	several months (Aug.2024 ~ Dec.2024)	Non-Radiation Worker	Master degree, interest in higher mathematics, mechanism design, and fundamental problems in precision engineering and micro engineering

6-1	Pohang University of Science and Technology (POSTECH) Korea	Robotics & Remote System	Underwater precision 3D mapping and sensing technology utilizing underwater robot for the decommissioning	Underwater environments have many restrictions on decommissioning tasks. A fully/semi-autonomous underwater robot is a few feasible methods to carry out the task. In this research, the robot's navigation and localization methods will be studied in intricate underwater structures. Using the sensor-fusion and SLAM technique, the precision 3D mapping method will also be studied. For the task area's sensing, variable robotic sensing systems such as underwater laser, high-resolution image sonars will be studied. The modeling and simulation of the robot tasks will be carried out. Depending on the study, actual under robot tests will be conducted in the indoor tank and field.	1 person	1 ~ 3 months (Aug.2024 ~ Nov.2024)	Non-Radiation Worker	Robotics
7-1	Department of Fusion and Technology for Nuclear Safety and Security - Laboratory of Diagnostic and Metrology (ENEA) Italy	Robotics & Remote System	Advanced 3D imaging techniques for nuclear environments	Generation of 3D models in nuclear environment is a challenging scientific/technological task for the specific constraints related to high radiation levels and restricted access to the areas under inspection. ENEA has been extensively working to develop laser-based devices qualified for operation in these harsh environments and with tests carried out in TRIGA RC1 nuclear reactor and Tokamak Fusion machine. ENEA in its laboratories of Frascati and Casaccia, both located in the Rome periphery, may provide to NEST Fellows, hands-on training on methodologies, issues in optical design, characterization in radiation environment, data acquisition and 3D model representation, test in real world environment. The specific themes of interest for the NEST Fellows are: Radiation hardened 3D laser scanner, In Vessel Viewing and ranging System and Real Time 3D imaging with automatic object recognition	Max. 3 people	1 ~ 3 months (Aug.2024 ~ Nov.2024)	Non-Radiation Worker	Laser, Computer & Information, Electronics,
7-2		Remote Spectroscopic Analysis	LIBS, LIF and Raman techniques for remote spectroscopic analysis	Laser based spectroscopic techniques offer a powerful solution for remote inspections in nuclear environments and for material characterization including nuclear debris. The scenarios of deployment of spectroscopic systems include inspections in primary containment vessel through open accesses, onboard unmanned ground vehicles (UGV) and large distance stand-off detection. ENEA may provide to NEST Fellows in its laboratories of Frascati (south of Rome), hands-on training on methodologies, issues in optical design, characterization in radiation environment, data acquisition and analysis. In particular, ENEA has been working extensively during last twenty years on Laser Induced Breakdown Spectroscopy (LIBS), Laser Induced Fluorescence (LIF) and Raman for remote chemical characterization of target materials and their surface contamination. The R&D activity has been finalized to the realization of compact devices for operation in areas with limited access and at distance of few meters but also to more complex systems qualified for remote operation up to 100m.	Max. 2 people	1 ~ 3 months (Aug.2024 ~ Nov.2024)	Non-Radiation Worker	Linear Laser Spectroscopy: LIBS, Raman, LIF spectroscopy [Require] Experience in Laser Spectroscopy

7-3		Advanced Radiation Measurement	Neutron counting	The ENEA Nuclear material characterization lab of ENEA Casaccia (north of Rome) carries out radiological characterization measurements for nuclear materials and radioactive waste. It studies, develops, and applies innovative radiological characterization techniques both destructive and non-destructive for radioactive materials. Currently, the lab is involved (among the other activities) in studying non-destructive techniques, based on passive neutron counting, for quantifying presence of neutron-multiplying materials, such as plutonium, in small samples. This type of materials is difficult to be measured through gamma spectrometry and usually needs destructive analysis involving alpha spectrometry. Starting from Monte Carlo simulations, Neutron Coincidence Counting and Neutron Multiplicity Counting are studied and applied to quantify Pu-240 effective mass in small samples. The detection system is a Small Sample Neutron Counter including several He-3 tubes embedded in a polyethylene structure creating a sample cavity. ENEA may provide to NEST Fellows in its laboratories of Casaccia (north of Rome), hands-on training on methodologies, experimental developments, data acquisition and analysis.	Max. 1 people	1 ~ 4 months (open, ends before Dec.2024)	Radiation Worker	Nuclear Physics, Applied Physics, Radiation Detector
9-1	The University of Manchester (UK)	Robotics & Remote Inspection	Development of cooperative underwater robots for decommissioning operations (*1)	This project will support the development of a system for cooperative manipulation using underwater robots equipped with grippers for decommissioning operations such as retrieving and transporting large pieces of debris. The research will focus on various aspects related to control and multi-agent coordination, including real-time obstacle avoidance and servo-visual control, depending on the researcher's skills.	1 person	3 ~ 4 months (open, ends before Dec.2024)	Non-Radiation Worker	Robotics, Computer & Information
9-2			Development of robotic gloveboxes for decommisioning operations (*1)	This project will support the development of robotic gloveboxes, for example for post-operational clean-out operations (POCO). The research will focus on the use of manipulators with a large number of degrees-of-freedom and investigate important aspects in robotic control, such as dexterous teleoperation in cluttered enviroments, assistive teleoperative strategies, and their combination with machine-learning methodologies and simulation, depending on the researcher's skills.	1 person	3 ~ 4 months (open, ends before Dec.2024)	Non-Radiation Worker	Robotics, Computer & Information
9-3			Development of a robotic inspection system for exploration and characterisation of unstructured environments (*1)	This project aims to contribute to the development of an advanced robotic inspection system, specifically designed for environment exploration and characterization in nuclear decommissioning. The system will enhance the sample retrieval process, functioning in collaboration with human operators. The research will focus on one of the following aspects: the design of tactile end-effectors, robotic navigation and control, contaminant detection, the design of artificial sensory feedback, and human-robot shared control strategies, depending on the researcher's interests and expertise.	1 person	3 ~ 4 months (open, ends before Dec.2024)	Non-Radiation Worker	Robotics, Computer & Information
9-4			Development of a Unmanned Aerial Systems capable of inspection in confined spaces (*1)	This project aims to contribute to the development of an unmanned aerial system (UAS) capable of inspections in confined spaces. Confined spaces pose a significant challenge for autonomous exploration using an UAS. This is particularly true as UAS needs to fly as quickly as possible to preserve flight time and thus increase the inspection area. This project aims to explore methods of mitigating of some of the risk associated with high speed flight in such a confined environment. The research will focus on various aspects, such as path planning, obstacle avoidance, autonomous exploration, mission planning, machine learning and SLAM depending on the candidate preference and experience.	1 person	3 ~ 4 months (open, ends before Dec.2024)	Non-Radiation Worker	Robotics, Computer & Information

11-1	CEA France	Robotics & Remote System	Development of technology to support remote operation of the robot (*1)	Introduce a fellow to the tool box developped in our lab for simulating, in VR, tasks related to the different operations needed during decommissioning. Namely Teleoperation with Haptics feedback, laser cutting, fine manipulation and point cloud handling. Simulation may serve as validating mission parameters and de-risking as well as training.	1 person	1~ 3 months (Aug.2024 ~ Dec.2024)	Non-Radiation Worker	Computer & Information

(*1) The applicants for the NEST Fellows have to be affiliated with Japanese organizations