

Warsaw, 9 January 2024

**Scientific Council of the Research Centre for
Priority Research Area
“High Energy Physics and Experimental Technology”
Excellence Initiative - Research University
The Warsaw University of Technology**

Resolution No. 1/2024

On the basis of the Strategy of the Priority Research Area “High Energy Physics and Experimental Technology”, hereinafter referred to as “HEP POB”, in accordance with §7 section 2 item 1 of the Regulations of the Research Centres for the Priority Research Areas of the Warsaw University of Technology, attached to the Decision No. 38/2020 of the Rector of the Warsaw University of Technology, and in particular the allocation plan for the strategic objectives of the HEP POB in the year 2024, granted by Resolution No. 17/2023 of the IDUB Project Steering Committee of 12 December 2023, the Scientific Council resolves as follows:

§ 1

- a) detailed categories of expenditure for **strategic goals related to key activities in the area of the HEP POB** shall mean:

1. Supporting a specialised **ELHEP Design and Implementation Laboratory** for the development of new research initiatives, equipment and software integration for new projects and collaborations, enhancing resources for algorithm implementation, simulation for particle physics, nuclear physics and non-condensed matter physics phenomena and computation and simulation in the area of Big Data and particle physics models.

The total amount of planned support for these goals shall not exceed PLN 500,000.00.

Supporting the participation of teams from WUT in large international research collaborations of the Big Science and Big Data class, based on formalised international agreements. In particular, supporting the establishment of new formal collaborations and the development of existing ones, supporting the computational infrastructure for these projects and supporting student internships in international scientific laboratories and other research institutions.

The total amount of planned support for these goals shall not exceed PLN 500,000.00.

The total amount of planned support for **strategic goals related to the key activity in the POB HEP area** shall not exceed **PLN 1,000,000.**

- b) **Strategic funding for Quantum Technology**

1. **Support for Quantum Computer Technology Laboratory:
QuantCompTechLab**

Justification: it is necessary to continuously enhance and expand the current staff resources for quantum technologies at WUT in conjunction with the existing technical needs of the infrastructure at CEZAMAT PW including postulated activities such as: (i) further development of the quantum computer stack based on ARTIQ and the QisDAX extension; (ii) development of a theoretical model

for 2D ion traps, specifically, the requirements for the control system and optoelectronics; (iii) development of a theoretical model for a physically realisable QKD system, in particular the requirements for the control system and optoelectronics; (iv) conceptual and simulation work on DRTIO secure encryption using PQC protocols.

The total amount of planned support for these goals shall not exceed PLN 450,000.

2. The development of infrastructure of the QuantCompTechLab laboratory

Justification: it is necessary to constantly continue work on the creation of a dedicated technical, scientific and teaching quantum infrastructure at WUT by continuing the construction of the following elements to support further basic and experimental research as well as those which are teaching tools for experimental physics: (i) work to create elements of an independent quantum computer infrastructure for education and research needs based on a new type of 2D ion trap operating at cryogenic temperatures; (ii) work to improve the precision of the trap control system, in particular to increase the precision of the ion trapping RF signal generation from 50ppm to 1ppm and to improve the stability of the HV DC trapping signals from 20ppm to a fraction of a ppm; (iii) improved precision is required in particular for qubit number scaling above 20 and for 2D ion traps; (iv) work on secure remote access to the quantum computer infrastructure by implementing dedicated secure cryptographic key transmission using QKD solutions.

The total amount of planned support for these goals shall not exceed PLN 350,000.

3. Experimental and operational testing of the Quantum Computer infrastructure

Justification: The infrastructure of the Quantum Computer is a technically complex system facilitating the realisation of preset processes of changes of quantum states serving ultimately for the realisation of quantum algorithms and research work for the development of ion control methods for increasing the efficiency of the realisation of quantum algorithms, such as: (i) it is planned to extend the existing ion trap with a precise qubit addressing path; (ii) theoretical work and research experiments are necessary for the qualitative analysis of the ion trap control path, and identification of the main factor limiting the coherence time with respect to the shot noise of the trapping RF field and the short-term stability of the voltage at the DC electrodes; (iii) it is planned to equip the existing ion trap with a so-called “shuttling”; (iii) it is planned to equip the existing ion trap with a “shuttling” device to significantly increase the possibility of realising advanced quantum algorithms.

The total amount of planned support for these goals shall not exceed PLN 100,000.

4. Technical and organisational activities for the Quantum Technologies Hub in terms of infrastructure

Justification: The concept of the University Research Centre for Quantum Technologies at the Warsaw University of Technology must effectively combine the needs of the technical infrastructure used in the QuantCompTechLab (control systems) and the IT infrastructure (the quantum stack under development) with the activity of designing, building and experimenting on these devices. The basis for building a multi-qubit quantum computer unit with its technical infrastructure is based on the long-standing

achievements to date in developing control systems, including those for large-scale particle physics experiments at CERN. The opportunity for development in collaboration with international centres will serve to enhance the technical capacity and develop the training potential (professional and student) through various forms of information exchange (organisation of workshops and seminars, participation in conferences) and initiation of joint non-academic projects (also based on Q-cluster or inter-centre collaborations).

The total amount of planned support for these goals shall not exceed PLN 100,000.

The total amount of planned support **Quantum Technology-related goals** shall not exceed **PLN 1,000,000.**

c) Goals related to the WUT strategic research direction in the theme of Nuclear Energy

1. Funding the activities of the Rector's Proxy for Nuclear Energy

In accordance with the decision of the Head of the IDUB Steering Committee, the financing of the activities of Professor A. Kisiel, the Rector's Proxy for Nuclear Energy, should be financed from the strategic funds of the HEP POB, in particular: speeches delivered at conferences and expert meetings, study visits and representation of WUT in meetings with interested business partners, etc.

The total amount of planned support for these goals shall not exceed PLN 50,000.

2. Development of human resources in the field of nuclear energy at WUT

There is a need to enhance the current human resources at WUT, in particular it is desirable to recruit experts in the themes of nuclear reactors, radiation detection, radiological protection issues and electronics dedicated to these needs: creation and implementation of new educational content in this field at WUT in first-, second- and third-cycle degree programmes, also within existing faculties such as the Faculty of Power and Aeronautical Engineering, Faculty of Physics, Faculty of Electronics and Information Technology, Faculty of Mechatronics, Faculty of Mathematics and Information Science, Faculty of Chemistry, Faculty of Chemical and Process Engineering, Faculty of Building Services, Hydro and Environmental Engineering, Faculty of Electrical Engineering and others. In particular, the content should be linked to the existing infrastructure at WUT, the infrastructure at friendly institutions in the Mazovia region, and potentially new dedicated infrastructure that may be created as part of the activities listed below.

The total amount of planned support for these goals shall not exceed PLN 350,000.

3. Operation and maintenance of the "Regional Clean Energy Training Centre" at WUT

WUT has taken on the role of an institution to put into practice the activities of the "Regional Clean Energy Training Centre", including the coordination of training activities with other educational institutions in Poland and in the region. It is also anticipated that, as part of the Centre's activities, study visits to other similar centres around the world will be required, as well as support for the development and expansion of courses offered for students of all WUT faculties in the field of nuclear energy.

The total amount of planned support for these goals shall not exceed PLN 300,000.

4. Preparation of the concept and potentially the design of the infrastructure of the Laboratory of Nuclear Technology, Radiation Detection and Radiation Protection

The commencement of the operation of the “Regional Clean Energy Centre” (according to the concept of the Ministry of Climate and Environment and the US DoE), together with the simultaneous launch of new specialities and specialised subjects at the Faculties of Power and Aeronautical Engineering and Physics, and the significant interest of industrial partners show the necessity of further development of these activities. With reference to the necessity to educate new human resources, there is a need for a dedicated teaching and research infrastructure in this field at WUT: a subcritical training set, a neutron source for physical, materials electronic and radiation protection research, a nuclear radiation detection laboratory, an electronics laboratory for radiation detectors, a radiation protection laboratory, and an environmental laboratory. The creation of such a laboratory requires a significant outlay of resources, hence the need to prepare a detailed design, potential location of such infrastructure, e.g. at the CEZAMAT site or the South Campus of the Warsaw University of Technology. Scientific projects in the fields of nuclear physics, reactor physics, nuclear energy and related fields may also be financed as part of this action.

The total amount of planned support for these goals shall not exceed PLN 300,000.

The total amount of planned support for the **goals related to Nuclear Energetics** shall not exceed **PLN 1,000,000.00**.

§ 2

- a) Funding of tasks compliant with the categories listed in § 1, with the exception of the task listed in § 1 item c.1, will be implemented based on applications submitted to the **Scientific Council of the HEP POB**, which will be qualified for funding by the Scientific Council by Resolution.
- b) The application, prepared in accordance with the form in Annex No. 1, shall be submitted by the Head of Task to the Secretary of the Scientific Council of the POB HEP to pob.hep@pw.edu.pl and shall include:
 - i. Justification for conducting the task under one or more of the categories listed in §1.
 - ii. Substantive description of the planned activities.
 - iii. Timetable for implementation of the actions.
 - iv. Cost estimate with justification for planned expenditures and planned distribution of funds among the WUT Organisational Units. If the implementation of the project will cover the years 2024 and 2025, the cost estimate must include a breakdown of funds by year.
 - v. Declared task outcomes, in relation to the declared performance indices of the Excellence Initiative - Research University project.
- c) The tasks whose implementation begins in 2024 may be continued in the following year. Completion of all activities planned in the task must take place by 31 December 2025 at the latest. Due to the completion date of the IDUB project, it is not envisaged that projects can be extended beyond 31 December 2025.
- d) The Scientific Council of the HEP POB will evaluate applications on an ongoing basis until the end of 2024 or until funds are used.

- e) In the process of evaluating the Application, the Scientific Council may invite the Head to present the concept of the task at a meeting of the Scientific Council.
- f) The final wording of the Application selected for funding, including the formulation of the Task, the expected deliverables and the cost estimate, will be determined by negotiations between the Head of Task and the Scientific Council of POB HEP.
- g) No later than 30 November 2024, the Scientific Council may ask the Heads of the tasks implemented to submit an intermediate report on the implementation of the activities planned for 2024 and evaluate the correctness of their implementation.
- h) No later than one month after the completion of the task, the Head shall submit a final report on its completion to the Scientific Council. The Scientific Council will evaluate the correctness of the execution of the task on its basis.
- i) If the Scientific Council negatively evaluates the performance of the task presented in the intermediate or final report, the Head will not be allowed to apply for funding under competitions organised by the POB HEP or similar initiatives of the Warsaw University of Technology for a minimum period of one year from the task completion date.

§ 3

This resolution enters into force upon its adoption by the Scientific Council of POB HEP.

Professor Adam Kisiel
Chairperson of the Scientific Council
of the Research Centre for Priority Research Area
“High Energy Physics and Technology of Experiment”

An application form for funding a task as part of POB HEP strategic goals for 2024

Task name:		
Team	name, surname, academic title/degree, position	unit, phone number, e-mail
Head of task		
Chief task implementers		
....		
Categories of strategic costs	2024 (2025 – in a separate column, if necessary)	comments/justification
I. Total direct costs, including:		
1. Equipment		
2. Remuneration with related items		
3. Other direct costs		
II. Surcharges (15%)		
III. Total costs		
Task description (up to 1,000 words), including the justification of compliance with POB HEP strategic goals		
Declared indices achieved as a result of task implementation, In relation to indices declared in the ID-UB PW project		
Other comments crucial for this project		

Comment 1: If the task will be conducted in more than one organisational unit, please indicate the budget breakdown between the units.

Comment 2: If the project will be conducted in 2024 and 2025, the costs for 2024 and 2025 and the sum of the costs for the whole duration of the project should be given separately.