SELF-EVALUATION REPORT FOR MODULE 3

THE NAME OF THE UNIT BEING EVALUATED:

Institute of experimental and applied physics,
Czech Technical University in Prague

FORD: 1. Natural Sciences

SOCIAL CONTRIBUTION OF THE EVALUATED UNIT

3.1 Introductory information about the unit under evaluation

The evaluated unit will describe its mission and vision and provide a general self-reflection of the societal contribution of R&D&I, along with its long-term goals in the fields it develops. The distribution of research activities by type of research will also be commented on.[1] The evaluated unit will describe its organisational structure and size (staffing, number of students, number of study programmes implemented, etc.) based on the data provided in annex tables 3.1.1 to 3.1.6.

Maximum 1000 words.

This is a non-rated indicator that serves as an introduction to the evaluated unit, providing context for data in indicators 3.2-3.7.

Self-assessment:

IEAP CTU is a distinguished university research institute, dedicated to both fundamental and applied R&D&I in the realm of microworld physics. Our focus spans subatomic physics, particle physics, astrophysics, detector technologies and imaging in biology, zoology, preclinical research and material research. Recently, we have expanded our R&D&I efforts into space payloads and coordination polymers in chemistry.
Our research is built on reciprocal cooperation with esteemed international partners and collaborations, including ESA, CERN, underground laboratories, and KM3NeT. We place a strong emphasis on developing our research infrastructure to support these endeavours.
IEAP CTU is organized into five specialized departments:
Department of Electronics and Software
Department of Experimental Physics
Department of Applied Physics and Technology
Department of Theory and Modelling
Department of Administrative and Technical Services.
We pride ourselves on our successful recruitment of researchers from abroad and early career professionals. As of 2023, we had 32 foreign researchers out of a total of 80, and 24.1 FTE early career researchers out of a total of 47.68 FTE researchers.
IEAP CTU is committed to supporting the professional education of both Czech and foreign students through Master's and Ph.D. theses, as well as student summer schools. Although we do not have our

[1] Basic, applied, contract, artistic research (see Definition of Terms in Methodology HEI2025+).

own study program, we host 15 students from various faculties of CTU and other universities, both domestic and international, who are working on their Master's and Ph.D. theses.
Our institute is actively involved in organizing short-term international schools, such as the IEEE NPSS schools of sophisticated detectors and applications, and international conferences like MEDEX (**M**atrix **E**lements for the **D**ouble beta decay **EX**periments) and ANIMMA (**A**dvancements in **N**uclear **I**nstrumentation **M**easurement **M**ethods and their **A**pplications). Additionally, our staff is dedicated to lifelong learning initiatives. IEAP CTU maintains direct and intensive cooperation with industry, resulting in patents, licenses, and collaborative projects.

Table 3.1.1 - Staffing per FTE[2]

Academic/ Professional position	Total / Of which women					
	year 1	year 2	year 3	year 4	year 5	Total
Professor	**1,85/0**	**2,05/0**	**2,45/0**	**2,0/0**	**1,35/0**	**9,7/0**
Associate Professor	**2,2/0**	**2,2/0**	**2,2/0**	**2,2/0**	**2,2/0**	**11/0**
Assistant Professor	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**
Assistant	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**
R&D Personnel[3]	**6,1/0**	**5,6/0**	**5,6/0**	**4,6/0**	**2,5/0**	**24,4/0**
Researchers in other categories[4]	**45,05/3,75**	**44,02/5,23**	**45,65/5,95**	**44,93/6,95**	**47,68/8,35**	**227,33/30,23**
Technical and economic staff[5]	**11,60/8,15**	**11,13/8,97**	**10,8/8,95**	**15,07/8,65**	**15,17/7,85**	**63,77/ 42,57**
Scientific, research and development staff involved in teaching activities	**0/0**	**0/0**	**0/0**	**0/0**	**0/0**	**0,0/0,0**
Early career researchers[6]	**33,6/3,0**	**29,1/3,9**	**25,6/5,9**	**25,4/5,8**	**24,1/6,2**	**137,8/24,7**
Total[7]	**66,8/11,9**	**65,0/14,2**	**66,7/14,9**	**68,8/15,6**	**68,9/16,2**	**336,2/72,8**

Note: The categories professor, associate professor, assistant professor, assistant, other scientific, R&D personnel, researchers in other categories and technical and economic staff are mutually exclusive, i.e. one staff member is reported under one category only. Scientific, research and development staff involved in teaching activities, as well as early career researchers are reported collectively for all the above-mentioned categories.

3.1.2 Age structure of R&D&I personnel of the evaluated unit and their structure by job title and gender in the first year of the evaluation period (numbers of physical employees and personnel)[8]

[2] The average number of hours worked is calculated as the ratio of the total number of hours actually worked during the reference period, from 1 January to 31 December, by all staff (including agreement on work activity, excluding agreement on work performance) to the total annual working time pool per full-time employee. The full- time status of the worker in the evaluated unit is always reported. If an employee holds more than one type of full-time job within the evaluated unit, the total sum of the two shall be reported.

[3] The category "R&D Personnel" includes technical and professional personnel who are not directly involved in R&D&I but are indispensable for the research activity (e.g. operators of research facilities).

[4] The category "Researchers in other categories" includes all other staff who cannot be classified under any of the above categories (e.g. independent researcher/scientist).

[5] Who participates in the management and support of R&D&I in the institution.

[6] See Definition of Terms in Methodology HEI2025+.

[7] Total is the sum of the categories: professor, associate professor, assistant professor, assistant, R&I personnel, researchers in other categories and technical and economic staff.

[8] The total number of employees/workers as of 31st December of the calendar year in question is to be entered, irrespective of the level of time worked, but only in an employment relationship (including agreement on work activity, excluding agreement on work performance). Other types of contractual relationships under the Civil Code that involve purchase of services are not included.

Academic/ professional position	Under 29 years		30-39 years old		40-49 years old		50-59 years old		60-69 years old		70 years and older	
	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women
Professor	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**4**	**0**
Associate Professor	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**
Assistant Professor	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Assistant	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
R&D Personnel[9]	**1**	***0***	**1**	**0**	**1**	***0***	**1**	***0***	**3**	***0***	**1**	**0**
Researchers in other categories[10]	**11**	***2***	**32**	**3**	**6**	***1***	**8**	***0***	**2**	***0***	**2**	**0**
Technical and economic staff[11]	**6**	**1**	**3**	**1**	**5**	**4**	**1**	**1**	**1**	**0**	**1**	**1**
Scientific, research and development staff involved in teaching activities	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Early career researcher[12]	**12**	***1***	**32**	**3**	**0**	***0***	**0**	**0**	**0**	**0**	**0**	**0**
Total[13]	**18**	***3***	**36**	**4**	**12**	***5***	**12**	***1***	**7**	***0***	**8**	**1**

Note: The categories professor, associate professor, assistant professor, assistant, other scientific, R&D Personnel, Researchers in other categories and Technical and economic staff are mutually exclusive, i.e. one staff member is reported in only one category. The categories of scientific, research and development staff involved in teaching activities and early career researchers are reported collectively for all the above-mentioned categories.

3.1.3 Age structure of R&D&I personnel of the evaluated unit and their structure by job title and gender in the last year of the evaluation period (numbers of physical employees and personnel)[14]

Academic/ professional position	Under 29 years		30-39 years old		40-49 years old		50-59 years old		60-69 years old		70 years and older	
	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women
Professor	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**3**	**0**
Associate Professor	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**
Assistant Professor	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Assistant	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

[9] The category "R&D Personnel" includes technical and professional personnel who are not directly involved in R&D&I but are indispensable for the research activity (e.g. operators of research facilities).
[10] The category "Researchers in other categories" includes all other staff who cannot be classified under any of the above categories (e.g. independent researcher/scientist).
[11] Who participates in the management and support of R&D&I in the institution.
[12] See Definition of Terms in Methodology HEI2025+.
[13] Total is the sum of the categories: professor, associate professor, assistant professor, assistant, R&I Personnel, Researchers in other categories and technical and economic staff.
[14] The total number of employees/workers as at 31.12. of the calendar year in question is to be entered, irrespective of the level of time worked, but only in an employment relationship (including agreement on work activity, excluding agreement on work performance). Other types of contractual relationships under the Civil Code that involve purchase of services are not included.

R&D Personnel[15]	**0**	***0***	**0**	**0**	**1**	***0***	**0**	***0***	**1**	***0***	**1**	**0**
Researchers in other categories[16]	**11**	***5***	**24**	**5**	**12**	***1***	**12**	***0***	**2**	***0***	**4**	**0**
Technical and economic staff[17]	**9**	**1**	**2**	**0**	**7**	**6**	**1**	**1**	**1**	**1**	**1**	**0**
Scientific, research and development staff involved in teaching activities	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Early career researcher[18]	**7**	***4***	**24**	**5**	**0**	***0***	**0**	**0**	**0**	**0**	**0**	**0**
Total[19]	**20**	***6***	**26**	**5**	**20**	***7***	**14**	***1***	**6**	***1***	**9**	**0**

Note: The categories professor, associate professor, assistant professor, assistant, other scientific, R&D personnel, researchers in other categories and technical and economic staff are mutually exclusive, i.e. one staff member is reported under one category only. Scientific, research and development staff involved in teaching activities, as well as early career researchers are reported collectively for all the above-mentioned categories.

Table 3.1.4 – Students

Type of study	year 1		year 2		year 3		year 4		year 5		Total	
	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women	Total	Women
Undergraduate	0	0	0	0	0	0	0	0	0	0	0	0
Master's[20]	0	0	0	0	0	0	0	0	0	0	0	0
Doctoral	0	0	0	0	0	0	0	0	0	0	0	0
Lifelong Learning Courses	86	34	30	12	70	34	70	37	71	32	327	149
Total	86	34	30	12	70	34	70	37	71	32	327	149

Table 3.1.5 - Study programmes in Czech/English

Type of study programme	Total[21] / Of which professional study programmes											
	year 1		year 2		year 3		year 4		year 5		Total	
Undergraduate	0	0	0	0	0	0	0	0	0	0	0	0
Master's	0	0	0	0	0	0	0	0	0	0	0	0
Doctoral	0	0	0	0	0	0	0	0	0	0	0	0

[15] The category "R&D Personnel" includes technical and professional personnel who are not directly involved in R&D&I but are indispensable for the research activity (e.g. operators of research facilities).
[16] The category "Researchers in other categories" includes all other staff who cannot be classified under any of the above categories (e.g. independent researcher/scientist).
[17] Who participates in the management and support of R&D&I in the institution.
[18] See Definition of Terms in Methodology HEI2025+.
[19] Total is the sum of the categories: professor, associate professor, assistant professor, assistant, R&I personnel, researchers in other categories and technical and economic staff.
[20] All master's degree students are listed, regardless of the length of their programme of study.
[21] The total number of study programmes for which admissions have been announced in a given academic year.

Lifelong Learning courses	3 / 0	1 /0	1 / 0	0 / 0	3 / 0	1 / 0	3 / 0	1 / 0	3 / 0	1 / 0	13 / 0	4 / 0
Total	3 / 0	1 / 0	1 / 0	0 / 0	3 / 0	1 / 0	3 / 0	1 / 0	3 / 0	1 / 0	13 / 0	4 / 0

Note: For each SP type, enter the number of SPs in Czech language in the first cell and insert the number of SPs in English language after the slash in the same cell (e.g. 15/3), enter the number of professional SPs in Czech language in the second cell and insert the number of professional SPs in English language after the slash. Follow a similar procedure in the last column of the table (Total).

3.1.6 – R&D&I capacities

R&D&I field	FORD	FORD share [%]	Predominant type of research	Total share of industry group [%]
1. Natural Sciences	1.1 Mathematics			78
	1.2 Computer and information sciences			
	1.3 Physical sciences	70	Balanced basic and applied research	
	1.4 Chemical sciences	3	Balanced basic and applied research	
	1.5 Earth and related environmental sciences	3	Balanced basic and applied research	
	1.6 Biological sciences	2	Balanced basic and applied research	
	1.7 Other natural sciences			
2. Engineering and Technology	2.1 Civil engineering			22
	2.2 Electrical engineering, Electronic engineering, Information engineering	18	Balanced basic and applied research	
	2.3 Mechanical engineering			
	2.4 Chemical engineering			
	2.5 Materials engineering	4	Balanced basic and applied research	
	2.6 Medical engineering			
	2.7 Environmental engineering			
	2.8 Environmental biotechnology			
	2.9 Industrial biotechnology			
	2.10 Nanotechnology			
	2.11 Other engineering and technologies			
3. Medical and Health Sciences	3.1 Basic medicine			
	3.2 Clinical medicine			
	3.3 Health sciences			
4. Agricultural and veterinary sciences	4.1 Agriculture, Forestry, and Fisheries			
	4.2 Animal and Dairy science			

	4.3 Veterinary science			
	4.4 Other agricultural sciences			
5. Social Sciences	5.1 Psychology and cognitive sciences			
	5.2 Economics and Business			
	5.3 Education			
	5.4 Sociology			
	5.5 Law			
	5.6 Political science			
	5.7 Social and economic geography			
	5.8 Media and communications			
	5.9 Other social sciences			
6. Humanities and the Arts	6.1 History and Archaeology			
	6.2 Languages and Literature			
	6.3 Philosophy, Ethics and Religion			
	6.4 Arts (arts, history of arts, performing arts, music)			
	6.5 Other Humanities and the Arts			
	Total	100 %	-	100 %

RECOGNITION BY THE RESEARCH COMMUNITY

3.2 Recognition by the research community

The evaluated unit will briefly comment on its position in the research community. It shall consider individual and other prestigious R&D&I awards, participation of its academic staff in the editorial boards of international scientific journals, elected membership in professional societies, major invited lectures given by the evaluated unit's academic staff abroad or by foreign scientists and other relevant guests at the evaluated unit. Additionally, it will address the involvement of staff in the evaluation of national or European project/programme calls over the previous five-year period based on the data provided in annex tables 3.2.1 to 3.2.5 (max. 10 most relevant items). If necessary, the evaluated unit shall list any additional services to the scientific community that it considers relevant.

Maximum 1000 words.

Self-assessment:

IEAP CTU has garnered significant recognition through several prestigious awards. Notably, we have received the ESET Science Award, chaired by Nobel Prize winner Kip S. Thorne, the Glenn F. Knoll Radiation Award from IEEE NPSS, and a Paper Award from the Physical Society of Japan. Our PhD students have also achieved remarkable accolades: M. Macko and J. Dudák were honoured for the best PhD thesis, A. Babič received a prize for theory, and early career researcher S. Gohl was awarded for an outstanding space article. In addition to these achievements, five of our staff members serve as editors, including topic editors, for various journals. Furthermore, six staff members are actively involved in the regular evaluation of papers for high-impact journals, including Nature. It is noteworthy that two of our early career researchers, O. Veselska and V. Shefali, participate in these evaluations. At IEAP CTU, we prioritize the role of our staff as reviewers

of scientific articles over editorial positions. This approach is particularly beneficial for our early career researchers, as reviewing articles provides them with valuable opportunities for professional knowledge development.

Total number of invited lecturers of our staff at foreign institutions reached 69 and the number of contributions in proceedings (invited or awarded) is 6. It includes the institutions in the most important countries (USA, Germany, Switzerland, Japan, China, Italy, France or Australia).
IEAP CTU organizes regular lectures given by outside experts in the frame of IEEE NPSS organization. The number of lectures given by invited foreign scientists and other guests relevant to our R&D&I during the evaluation period is 39. The selected lectures include respected speakers from highly developed countries (USA, Germany, Switzerland, United Kingdom, France, Greece etc.). The lectures cover fundamental and applied subjects (dark matter, neutrino physics, particle physics, astroparticle physics, different experiments - ATLAS, KATRIN, CHIPS).
Staff members are also active in evaluation of the research projects or programme calls in national or EU level (Czech Science Foundation, GACR; Scientific Agency VEGA in Slovakia; Ministry of Education, Youth and Sports in Czechia; Ministry of Interior, Czechia; National Sustainability Program NPU II, Czechia; European Strategic Forum for Research Infrastructure, ESFRI). Staff member is also active in inner grant competition (SGS) at CTU (support mainly for PhD students).
Instead of the above-described activities the IEAP staff members actively participated in different committees or collaboration boards on national or EU level. Examples are given here:
- I. Štekl, Representative of the Czech Republic in APPEC (Astroparticle Physics European Consortium), Appointed by Ministry of Education, Youth and Sports, Czech Republic
- I. Štekl, Representative of the Czech Republic in ESFRI Strategy Working Group for Energy (till 2022)
- S. Pospíšil and J. Hošek, members of the Committee for Cooperation with CERN
- S. Pospíšil and I. Štekl (deputy-chair), members of the Committee for Cooperation between the Czech Republic and JINR (appointed by the Ministry of Education, Youth and Sports of the Czech Republic)
- R. Hodák, member of the Institutional Board of the LEGEND experiment (https://legend-exp.org/)
- S. Pospíšil, elected member of the Joint Institute for Nuclear Research (JINR) Scientific Council (till 2022)
- M. Macko, Deputy physics coordinator, SuperNEMO collaboration
- V. Shefali obtained Royal Society of Chemistry membership
- I. Štekl, permanent representative of the plenipotentiary of CR in JINR (till 2022)
- I. Štekl, member of the Programme Advisory Committee for Nuclear Physics, JINR, (2015-2022)
- Y. Shitov, member of Institutional Board of the KM3NeT experiment
- I. Štekl, member of Institutional Board of the PICO experiment (https://www.picoexperiment.com/)
- S. Pospíšil, member of the MoEDAL (CERN) Collaboration Board, Convenor of the TMPX Subdetector Group
- A. Sopczak, Chair of the Nuclear and Plasma Sciences Chapter, Czechoslovakia Section IEEE
- M. Veselský, Spokesperson of the I581 experiment at the ISOLDE CERN facility
- V. Petousis, member of the Institutional Board of the ATLAS Roman Pots (CERN)
- B. Bergmann, Member of the Project Management Consortium of the Medipix collaborations (from 2020)
- S. Pospíšil, Member of the Committee nominated by the IEEE NPSS Radiation Instrumentation Technical Committee (RITC) for the evaluation of the applications for the 2021 Emilio Gatti Radiation

Instrumentation Technical Achievement Award, Early Career Award and Glenn Knoll Outstanding Achievement Award.
- I. Štekl and R. Hodák, IEAP team and deputy team leader for NP03 - Platform for Developing Neutrino Detectors at CERN Neutrino Platform
- M. Veselský and R. Hodák, IEAP team and deputy team leader for ISOLDE at CERN.

Table 3.2.1 - Prestigious R&D&I awards granted during the evaluation period

Name, surname and title(s) of the evaluated unit's staff member	Name of the award	Awarding institution
Fedor Šimkovic	ESET Science Award - Outstanding Personality of Slovak Science 2020	ESET company, International Committee (chair Kip S. Thorne, Nobel prize winner, 2017)
Fedor Šimkovic	Distinguished Scientists under the Chinese Academy of Science, President's International Fellowship Initiative, 2021	Chinese Academy of Science, President's International Fellowship Initiative
Fedor Šimkovic	Second prize of JINR Dubna for theory (series of articles "Neutrino mass, double-beta decay and nuclear structure"), 2020	JINR Scientific Council, Joint Institute for Nuclear Research (JINR), international intergovernmental institution
Yuta Orikasa	Outstanding Paper Award, 2022	Physical Society of Japan
Stanislav Pospíšil	The Glenn F. Knoll Radiation Instrumentation Outstanding Achievement Award for contributions to the development and application of pixelated radiation detectors in medical, high-energy and space science, 2020	IEEE Nuclear & Plasma Sciences Society
Miroslav Macko	Dean's award for Best PhD. thesis 2019 (The thesis "SuperNEMO Experiment: Study of Systematic Uncertainties of Track Reconstruction and Energy Calibration. Evaluation of Sensitivity to 0νββ with Emission of Majoron for 82Se was prepared under co-supervision of Ivan Štekl, IEAP CTU, and Dr. Fabrice Piquemal, CENBG, Université de Bordeaux.)	Faculty of Mathematics, Physics and Informatics, Comenius University in Bratislava, Slovakia
Andrej Babič (PhD student CTU, 2023 successfully defended PhD)	Second prize of JINR Dubna for theory (series of articles "Neutrino mass, double-beta decay and nuclear structure"), 2020	JINR Scientific Council, Joint Institute for Nuclear Research (JINR), international intergovernmental institution
Jan Dudák	Best dissertation "Energy Sensitive X-ray radiography and Tomography Optimized for Small Animal Imaging", 2019	Engineering in Medicine and Biology Group (EMB), Czechoslovak section, IEEE
Stefan Gohl	The Outstanding Paper Award for Young Scientists – Scientific Commission C, 2021	Committee on Space Research https://cosparhq.cnes.fr/
Adam Smetana	Second prize of JINR Dubna for theory (series of articles "Neutrino mass, double-beta decay and nuclear structure"), 2020	JINR Scientific Council, Joint Institute for Nuclear Research (JINR), international intergovernmental institution

Note: Provide up to 10 examples.

Table 3.2.2 Participation of academic staff of the evaluated unit in editorial boards of international scientific journals during the evaluation period

Name, surname and title(s) of the evaluated unit's staff member	Name of scientific journal, ISSN
Stanislav Pospíšil	Review Editor for Radiation Detectors and Imaging, Frontiers in Physics, ISSN 2296-424X
Hugo Natal Da Luz	Topic editor and Associate Editor, Frontiers in Detector Science and Technology, section Detectors Apparatus and Methods, Advancements and Applications in Neutron Detection and Spectrometry ISSN 2813-8031 Reviewer in Journal of Instrumentation, ISSN 1748-0221 (4x), Nuclear instruments & methods in Physics Research, ISSN 0029-554X (2x), IEEE Transactions on Nuclear Science, ISSN 1558-1578 (4x).
Fedor Šimkovic	Editorial Board, Atoms, ISSN 2218-2004
Christer Fröjdh	Editor, Journal of Instrumentation, ISSN: 1748-0221
Vlasios Petousis	Editor, Universe, special issue Exotic Scenarios for Compact Astrophysical Objects, ISSN ISSN 2218-1997
R. Hodák, S. Pospíšil, I. Štekl et al. (in total 10 editors and 12 editors, respectively)	Advancements in Nuclear Instrumentation Measurement Methods and their Applications, EPJ Web of Conferences, 2021. vol. 253, and 2023 vol. 288. ISSN 2100-014X
Yuta Orikasa (reviewer)	Nuclear Physics B, ISSN 0550-3213 (2x); Progress of Theoretical and Experimental Physics, ISSN 2050-3911 (5x); Physical Review D, ISSN 2470-0029 (9x); International Journal of Modern Physics A, ISSN 0217-751X (2x)
Jun Terasaki (reviewer)	Physical Review Letters, ISSN 0031-9007 (3x); Physical Review C, ISSN 2469-9985 (4x); Nature, ISSN 0028-0836 (1x); Chinese Physics, ISSN 1741-4199 (2x); European Physical Journal Plus, ISSN 2190-5444 (1x)
Daniel Vavřík(reviewer)	Nature communication, ISSN 2041-1723; Nuclear instruments & methods in Physics Research, ISSN 0029-554X; Tomography of materials and structures, ISSN 2949-673X
Oleksandra Veselska (reviewer)	Dalton Transactions, ISSN 1477-9234 (3x); Materials, ISSN 1996-1944 (2x); Chemical Communications, ISSN 1359-7345 (1x); Chemistry of Materials, ISSN 1520-5002 (1x); Inorganics, ISSN 2304-6740 (1x); Journal of Industrial and Engineering Chemistry, ISSN 1226-086X (1x); Crystals, ISSN 2073-4352 (1x); International Journal of Molecular Sciences, ISSN 1422-0067 (1x)
Shefali Vaidya (reviewer)	Dalton Transactions, ISSN 1477-9234

Note: Please provide up to 10 examples of academic staff participation in editorial boards of international scientific journals (e.g. editor, editorial board member, etc.).

Table 3.2.3 The most important invited lectures delivered by the academic staff of the evaluated unit at foreign institutions during the evaluation period

Name, surname and title(s) of the evaluated unit's staff member	Invited lecture title	Name of host institution, or name of conference or event	Year
Benedikt Bergmann	Timepix detectors in space: From radiation monitoring in low earth orbit to astroparticle physics	International workshop of radiation imaging detectors (IWORID) 2022, Italy (200 participants)	2022
Benedikt Bergmann	European Space Projects with Timepix	20th Anniversary Symposium on Medipix and Timepix, CERN, Switzerland (150 participants)	2019

Rastislav Hodak	Czech participation in the Underground Laboratory LSM	2nd French-Czech « BARRANDE » Nuclear Research Workshop", April 24-26, 2019, Honfleur, Normandie, France https://barrandewks2019.sciencesconf.org/	2019
Veronika Palusova (IEAP staff and PhD student at University of Bordeaux)	Neutron background simulations for the SuperNEMO experiment	GDR Deep Underground Physics plenary meeting, Paris, France; https://indico.in2p3.fr/event/25051/	2021
Lukas Fajt (early career researcher)	Neutrino and Dark Matter Detection	Invited lecture at ANIMMA 2021 conference, 20.6.2021, Prague, CR (296 participants)	2021
Ekaterina Rukhadze Medunová	Fluorescence measurements of optical active materials in response to liquid argon scintillation	German Physical Society, Munich, Germany	2019
Andre Sopczak	Overview of ATLAS forward proton detectors in Run-2 and outlook for Run-3 analyses	30th International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS2023). Michigan State University, USA	2023
Fedor Šimkovic	Neutrino telescope in Lake Baikal: Present and Future	ICRC2019, 36th International Cosmic Ray Conference, Madison, Wisconsin, USA	2019
Fedor Šimkovic	Massive neutrinos in nuclear processes	RIKEN, Tokyo, Japan	2019
Stanislav Pospíšil	Journey with pixel detectors in the world of physics	2020 IEEE NSS-MIC, Boston, USA	2020

Note: Provide up to 10 examples.

Table 3.2.4 - The most important lectures by foreign scientists and other guests relevant to R&D&I at the evaluated unit during the evaluation period

Name, surname and title(s) of the lecturer	Lecturer's employer at the time of the lecture	Invited lecture title	Year
Christian Bohm	University of Stockholm	Overview of TileCal, the ATLAS hadron calorimeter	2019
Aldo Bonasera	Texas A&M University; LNS-INFN	Nuclear Physics Using Lasers	2019
Lucie Tvrzníková	Lawrence Livermore National Laboratory, USA	Rare event searches: looking for dark matter and new neutrino physics	2019
Lutz Schimpf	Karlsruhe Institute of Technologie, Germany	KATRIN First neutrino mass result	2019
Jennifer Thomas	University College London	CHIPS and the new deal	2020
Xin Wu	University of Geneva	Particles in Space: Sciences and Instruments	2021
Lukáš Gráf	University of California	Beyond the Standard Model with Double Beta Decays	2022
Maxim Titov	CEA Saclay, Irfu, France	Gaseous Detector Technologies: from the RD51 to the DRD1 Collaboration	2023

Stefan Ritt	Paul Scherrer Institute, Switzerland	Particle Physics at PSI, Switzerland	2023
Charalampos Moustakidis	Aristotle University of Thessaloniki	The multi-messenger nuclear physics and astrophysics of neutron stars	2023

Note: Provide up to 10 examples.

Table 3.2.5 - Involvement in the evaluation of national/European research project/programme calls relevant to the R&D&I area at the unit during the evaluation period

Name, surname and title(s) of the evaluated unit's staff member	Name of the research project/programme call	Name of the contracting authority/guarantor of the project/programme call	Year
Benedikt Bergmann	Evaluation Panel 203 - Nuclear and Particle Physics, Astronomy and Astrophysics	Czech Science Foundation (GACR)	2023-2027
Karel Smolek	VEGA Commission for Mathematical Sciences, Computer and Information Sciences, and Physical Sciences	Scientific Grant Agency of the Ministry of Education, Science, Research and Sports of the Slovak Republic and the Slovak Academy of Sciences (VEGA)	2019
Karel Smolek	Evaluation panel to assess the implementation of development concepts and to profile the capacities of research organizations	Ministry of the Interior of the Czech Republic	2023
Martin Veselský	Evaluation Panel 203 - Nuclear and Particle Physics, Astronomy and Astrophysics	Czech Science Foundation (GACR)	2023
Miroslav Macko	Programme INTER – TRANSFER	Ministry of Education, Youth and Sports of the Czech Republic	2023
Ivan Štekl	National Sustainability Program NPU II (chair of Evaluation Board): 1) LQ1603, Research for SUSEN, budget in 2019 = 181 592 770 CZK, budget in 2020 = 216 032 262 CZK.	Ministry of Education, Youths and Sports of the Czech Republic	2019, 2020
Ivan Štekl	National Sustainability Program NPU II (chair of Evaluation Board): LQ1606, ELI: Extreme Light Infrastructure, budget in 2019 = 101 528 055 CZK, budget in 2020 = 380 521 945 CZK.	Ministry of Education, Youths and Sports of the Czech Republic	2019, 2020
Alan Owens	ESA Technical Evaluation Boards	European Space Agency	2019 -2023
Ivan Štekl	Monitoring of ESFRI Roadmap projects in Energy (e.g. MYRRHA – Multi-purpose hybrid Research Reactor for High-tech Applications)	Representative of the Czech Republic in ESFRI Strategy working group for Energy, appointed by Ministry of Education, Youth and Sports, Czech Republic	2019 - 2020
Karel Smolek	Student Grant Competition	Czech Technical University in Prague	2019 - 2023

Note: Provide up to 10 examples.

3.3 Research projects

The evaluated unit shall list at most 10 (considered most significant by the evaluated unit) research projects/activities (regardless of whether they are supported by public funds or based on contract research[22]) that it has implemented or participated in during the evaluation period[23]. This should be done from the full list in annex tables (Table 3.3.1-3.3.2)[24], regarding the results achieved or the application potential of the projects. The unit should also describe how the research projects contributed to the mission and purpose of the evaluated unit. If the evaluated unit has been a participant in a listed project, it shall indicate which other entities were involved and describe its contribution to the project. The interdisciplinary aspects of the projects will also be commented on, along with any collaboration with other units of the evaluated HEI.

Maximum 300 words per project.

Self-assessment:

In the period of 2018-2023 IEAP CTU received 21 projects as a main applicant and 19 projects as a co-applicant. IEAP also solved 4 contract research projects.

1) **Engineering applications of microworld physics** (2018-2022): interdisciplinary R&D&I (experimental subatomic physics; progressive detection techniques; astroparticle and neutrino physics; applications in radiobiology, biomedicine and radioecology; X-ray and neutron radiography and tomography; proton and hadron therapy; robotics systems for radiation safety; influence of radiation on electronics; environmental radioactivity monitoring). Team composition: leader IEAP CTU, the Faculty of Biomedical Engineering CTU, the Faculty of Transportation Sciences CTU, the Czech Institute of Informatics, Robotics and Cybernetics CTU, the National Radiation Protection Institute, 3rd Faculty of Medicine Charles University, Faculty of electrical engineering of University of West Bohemia and the Institute of Theoretical and Applied Mechanics, Academy of Sciences CR. Total budget = 196 mil. CZK (7.8 mil. EUR). All planned results were successfully obtained. The project is in phase of sustainability (till 2032).

2) **Center for the support of the population in case of actual or suspected occurrence of extraordinary nuclear and radiation events**, VJ01010116 (2021-2025): The project supports preparedness of CR for response to a nuclear accident. Research focuses on behaviour of the population in risk of panic (using the analogy of COVID pandemic and radiation emergency), esp. on coping risks and on identification of mechanisms eliminating fear development and propagation. Mathematical methods are being developed for early detection of a dangerous phenomenon in a media environment. Involvement of "citizen science" measurements of radiation for alleviation is studied. A radiation detector was developed and numbering 1000 distributed among individuals and institutions incl. training in data processing and interpretation. The project will strengthen the contact of a crisis management with self-governments allowing it even during communication failure. Team = IEAP CTU, the National Radiation Protection Institute, Institute of Sociology Academy of Sciences CR, The Institute for Postgraduate Medical Education. Total budget = 57 783 000 CZK (2.311 mil. EUR).

[22] For the definition of contract research for the purposes of evaluation in the HE segments, see Article 2.2.1 of the Community Framework for State Aid for Research, Development and Innovation 2014/C 198/01.

[23] Regardless of whether the projects are completed or still ongoing, provided that at least part of the project was implemented during the evaluation period.

[24] The evaluated unit shall only fill tables that are relevant to it.

3) **Laboratoire Souterrain de Modane – participation of the Czech Republic** (2016-2019, 2020-2022, 2023-2026): LSM-CZ is included in the Roadmap of the Large Research Infrastructures of the Czech Republic. LRI LSM-CZ organizes and supports cooperation with the Laboratoire Souterrain de Modane (LSM), which is the deepest underground laboratory in Europe. LSM is a multidisciplinary platform for fundamental experiments requiring an ultra-low radioactive background in particle, astroparticle and nuclear physics, biology or medicine. LSM supports applied R&D, e.g. in detector technologies. Other specialized scientific fields have been significantly involved in the activities of LSM, e.g. research of ultra-sensitive detection methods of radionuclides in the environment (to increase safety of nuclear objects), radiobiology (examination of the behaviour of cells in conditions of extremely low level of ionizing radiation), climatology or radioecology. LRI LSM-CZ also includes auxiliary infrastructure in the Czech Republic (CR). This solution is very financially effective and strengthens the reciprocal international cooperation. The objective of the LRI LSM-CZ is to enable access of Czech and international users to LSM by supporting the development, construction, maintenance and operation of scientific apparatuses and technological equipment located in the LSM, to support further development and use of the home infrastructure in the CR related to the activities within the LSM, to support the involvement of the Czech institutions in the most up-to-date research directions with an emphasis on reciprocity, training early stage experts and students, to support involvement of the Czech industrial companies in the delivery of progressive technologies and fulfilment of our institutions commitment to the individual LSM experiments. The obtained results are of different types, e.g. users' publications, results of technological R&D, student qualification theses, patents, industrial designs or functional samples, organizing conferences and summer schools or recruiting new experts for science and applied research in the CR.

4) **Radiation Monitor System in a Package** (RMSIP, ESA supported project, 2021-2025): IEAP CTU is the prime contractor with BD Sensors as subcontractor. Total budget = 12 000 kCZK (480 kEUR), budget of IEAP CTU = 6 250 kCZK (250 kEUR). The objective of the RMSIP activity is to design, develop and test a general-purpose radiation monitor with small size, easy interfacing and low unit cost that is capable of energy spectroscopy and particle identification. Such a miniaturized radiation detector will be beneficial for all ESA and commercial missions, providing a reliable real-time monitoring of the radiation environment at specific spacecraft locations. This can be useful for alerts in case of very intensive radiation fluxes (e.g. during solar storms) to take countermeasures to protect sensitive parts. Within this project we developed the radiation monitor HardPix which was launched into Earth orbit in 2023 and 2025 for SWIMMR project and is planned for other missions and projects like ERSA described in this evaluation. HardPix detector is currently our backbone instrument for scientific and commercial space missions, including planned exploration of the lunar surface.

5) **Development of a demonstrator for the Penetrating Particle Analyser Technology** (EC supported project, 2020-2023): participants University of Geneve, INFN, IEAP CTU. Budget of IEAP CTU = 12 992 kCZK (512,5 kEUR).
PAN is an instrument designed to precisely measure and monitor the flux, composition, and direction of highly penetrating particles (>100 MeV/nucleon) in deep space and interplanetary missions with an energy resolution better than 10% for nuclei from H to Fe at 1 GeV/n. The detector, limited to about 20 kg in mass and 20W in power consumption, is based on the magnetic spectrometer detection principle, and exploits the advantages provided by the integration of ultra-thin microstrip

silicon detectors, hybrid silicon pixel detectors and silicon photomultipliers. To demonstrate the concept of the PAN instrument a smaller version of the baseline instrument, Mini-PAN, was developed within this project. The contribution of IEAP CTU was the design, development and manufacturing of the hybrid silicon pixel layers responsible for particle localization and identification.

6) **Center of Advanced Nuclear Technology II** (Technological Agency CR, 2023-2028): main applicant Faculty of electrical engineering of University of West Bohemia, in total 23 institutions (IEAP CTU is involved in 3 task groups). 1) Support in operation of existing nuclear technologies (NT) (shorter downtime; cutting production and operating costs; operation automation; fuel types; higher efficiency). 2) Involvement in R&D and building of new NT (new reactors; new technologies in the entire fuel cycle; new fuels; increasing efficiency). 3) New business challenges (new markets, new export opportunities). 4) Increasing nuclear and radiation safety in CR (safety technologies and procedures; lowering radiation burden on personnel). 5) Concentration of unique resources of leading Czech R&D centres founded mainly with support of European Regional Development Fund (Operational Programme Research and Development for Innovation) 6) Creation of new human resources in NT (support of talented researchers, new study programs). 7) Support of the government and SUJB (knowledge transfer, qualified human resources).

7) **Research infrastructure for experiments at CERN** (Ministry of Education, Youth and Sports, 2016-2022, 2023-2026) - The large research infrastructure CERN-CZ organizes and supports the participation of universities and research institutions from the Czech Republic (CR) in the international laboratory CERN. The aim of CERN-CZ is to support the development, construction, maintenance and operation of scientific facilities in CERN experiments with Czech participation. This includes the local infrastructure and laboratories in the CR, which are necessary for the research, development and production of these detectors, and computing tools for large scale data processing. The project supports following activities of the institute: experiments ATLAS, MoEDAL-MAPP, AEgIS, activities at the ISOLDE facility, and within the Neutrino Platform.

8) **The experiment IS581 "(d,p)-transfer induced fission of heavy radioactive beams"** (Grant Agency CR, 2021-2023): IEAP CTU is the only applicant. The experiment was approved by the INTC (ISOLDE and n-ToF Experiments Committee). Its main goal is direct measurement of fission barrier height of heavy fissile radioactive beams delivered by HIE-ISOLDE facility using an active target ACTAR-TPC in inverse kinematics. The fission barrier heights of heavy fissile nuclei away from the line of beta-stability are practically unknown. The knowledge of fission rates (and thus fission barriers) of unstable heavy nuclei is of high importance for understanding of r-process nucleosynthesis in neutron star mergers (such as the recently observed gravitational wave event GW170817) as recently stated in the NuPECC Long range plan from 2017. The knowledge of fission barriers of unstable heavy nuclei can be also implemented in applications in nuclear energy. The experiment IS581 provides an opportunity to obtain a unique result of general interest using the recently commissioned HIE-ISOLDE facility.

9) **European Radiation Sensors Array** (ERSA, contract research for Space Application Services, Belgium, 2022-2025), Contract price 4 750 kCZK (190 kEUR). The ESA human spaceflight experiment to fly farthest from Earth now has a name: ERSA (European Radiation Sensors Array). Destined for the Gateway, an international outpost in lunar orbit, ERSA will monitor radiation and return vital

data. By monitoring radiation, the experiment will help researchers gain a complete understanding of cosmic and solar rays in unexplored areas as the orbital outpost is assembled around the Moon. It's hardware will actively monitor radiation at all times and return data for scientists from participating countries to consult. Developed by the European Space Agency (ESA), ERSA will fly on the outside of Gateway to study the solar wind and radiation from deep space. Equipped with five instruments, ERSA will measure energetic particles from the Sun, galactic cosmic rays, neutrons, ions, and magnetic fields, and provide data about the physics of radiation in the solar system. Two HardPix units, developed by IEAP CTU within the RMSIP project, are one of the five instruments. The contract is for the delivery of these two HardPix units to SpaceApps, the ERSA integrator.

10) **Space Weather Instrumentation, Measurement, Modelling and Risk** (SWIMMR, contract research for D-Orbit, Italy, 2022-2023), Contract price 2 700 kCZK (90 kGBP). SWIMMR is a £20 million, four-year programme that will improve the UK's capabilities for space weather monitoring and prediction. There will be an emphasis on space radiation, which can affect aircraft systems, changes in the upper atmosphere, affecting communications, and surges in the current in power grids and other ground-level systems. SWIMMR will develop and deploy new instruments, models and services to support the UK space weather community and the Met Office Space Weather Operations Centre. This programme will significantly add to the UK's capability to predict and mitigate the hazards of space weather, as well as providing a basis for wider international collaboration over the four-year lifetime of the proposal and beyond. The contract was for the delivery of the HardPix radiation detector to D-Orbit, who provides satellite services for SWIMMR. HardPix was launched into Earth orbit onboard D-Orbit ION satellite in June 2023.

Table 3.3.1 Projects supported by public funds

In the role of beneficiary						
Provider[25]	Project name	Support (in thousands CZK/EUR)[26]				
		year 1	year 2	year 3	year 4	year 5
ESF through MEYS	Engineering applications of microworld physics (2017–2022)	60508 kCZK / 2386903 €	31032 kCZK / 1224142 €	32032 kCZK / 1263590 €	34033 kCZK / 1342525 €	
MEYS	Van de Graaff Accelerator - A Source of Tunable Monoenergetic Neutrons and Light Ions (2016–2019)	3804 kCZK / 150059 €				
ESF through MEYS	Van de Graaff Accelerator - a Tunable Source of Monoenergetic	6752 kCZK / 266351 €	1565 kCZK / 61736 €			

[25] If the provider is from abroad, please indicate the provider's country of origin in brackets. For the determination of the country of origin of the provider, the place of residence of the provider is decisive.

[26] Indicate the total amount expressed in thousands of CZK and the conversion of the total amount into Euro.

	Neutrons and Light Ions (2017–2019)					
MEYS	Van de Graaff Accelerator - A source of Tunable Monoenergetic Neutrons and light Ions (2020–2022)		4440 kCZK / 175148 €	4261 kCZK / 168087 €	4332 kCZK / 170888 €	
MEYS	Laboratoire Souterrain de Modane – participation of the Czech Republic (2016–2019)	7240 kCZK / 285602 €				
ESF through MEYS	Underground laboratory LSM - Czech participation to European-level research (2017–2019)	6609 kCZK / 260710 €				
MEYS	Laboratoire Souterrain de Modane – participation of the Czech Republic (2020–2022)		9628 kCZK / 379803 €	9176 kCZK / 361972 €	8994 kCZK / 354793 €	
MEYS	Laboratoire Souterrain de Modane – participation of the Czech Republic (2023–2026)					6240 kCZK / 246154 €
ESA	Timepix based Miniaturised Radiation Monitor - MIRAM	4624 kCZK / 182406 €	4539 kCZK / 179 053 €			
ESA	Radiation Monitor System in a Package - HITPIX			535 kCZK / 21105€	6272 kCZK / 247416 €	2989 kCZK / 117909 €
ESA	Radiation Environment Monitor for Energetic Cosmic rays - REMEC				2321 kCZK / 91559 €	3848 kCZK / 151795 €
GA CR	Development of algorithms for X-ray all-sky monitoring with Lobster Eye optics and Timepix detector. (2018–2020)	2521 kCZK / 99448 €	2568 kCZK / 101302 €			
GA CR	Measurement of anomalies in angular correlation			4554 kCZK / 179645 €	4446 kCZK / 175385 €	4326 kCZK / 170651 €

	of electron and positron internally produced in excited 8Be and 4He (2021–2023)					
GA CR	Experiment IS581 "(d,p)-transfer induced fission of heavy radioactive beams" (2021–2023)			1901 kCZK / 74990 €	1972 kCZK / 77791 €	2111 kCZK / 83274 €
GA CR	Particle identification in high-energy physics experiments and space with advanced detection systems (2023–2027)					3640 kCZK / 143590 €
MEYS	A Novel Non He-3 based Dual Neutron Gamma Sensor (2017–2019)	3611 kCZK / 142446 €				
Ministry Interior CR	Center for the support of the population in case of actual or suspected occurrence of extraordinary nuclear and radiation events (2021–2025)			13843 kCZK / 546075 €	16096 kCZK / 634951 €	10343 kCZK / 408008 €
Visegrad funds	Visegrad Region High-Energy-Physics Prospects in Theory and Experiment - V4HEP					134 kCZK / 5286 €
MEYS	Radon adsorption in porous materials (2022–2023)				72 kCZK / 2840 €	72 kCZK / 2840 €
MEYS	Impact of lattice defects on nuclear recoil based energy deposition in cryogenic CaWO4 calorimeters (2023–2024)					45 kCZK / 1775 €
MEYS	SiC Timepix detector (2023 - 2025)					60 kCZK / 2367 €
Total		95669 kCZK / 3773925 €	53772 kCZK / 2121184 €	66302 kCZK / 2615464 €	78538 kCZK / 3098148 €	33808 kCZK / 133649 €
In the role of another participant						

Provider[27]	Project name	Support (in thousands CZK/EUR)				
		year 1	year 2	year 3	year 4	year 5
Min Cult CR	Mobile device devoted to imaging and analysis of the layered paintings and polychromy of the works of old art (2018–2022)	1433 kCZK / 56529 €	1454 kCZK / 57357 €	1551 kCZK / 61183 €	1339 kCZK / 52821 €	
Min Cult CR	Methods for consolidation of brittle porous beeswax seals (2023–2027)					791 kCZK / 31203 €
Min Ind Trade CR	Material and technological research of scintillation detectors (2018–2020)	986 kCZK / 38895 €	989 kCZK / 38895 €			
MEYS	PRINT3D CONTACTS (2017 - 2020)	684 kCZK / 26982 €	233 kCZK (9191 €			
MEYS	Cooperation of the Czech Republic with JINR Dubna in the theoretical and nuclear physics and application of nuclear methods in other fields (2018–2022)	299 kCZK / 11795 €	299 kCZK /11795 €	319 kCZK / 12584 €	323 kCZK / 12742 €	
Min Int CR	Detector of the radioactive contamination in wounds (2019–2022)	1382 kCZK / 54517 €	3002 kCZK / 118422 €	2416 kCZK / 95306 €	1809 kCZK / 71361 €	
Min Int CR	Radiation Monitoring Network for institutions and schools to assure early awareness and enhancing safety of citizens (RAMESIS) (2015–2019)	587 kCZK / 23156 €				
TA CR	Centre for Advanced Nuclear Technologies (CANUT) (2012–2019)	3651 kCZK / 144024 €				

[27] Ibid.

TA CR	Radiation and nuclear safety technologies development center: RANUS - TD (2012–2019)	3870 kCZK / 152663 €				
TA CR	Study of variant technical solutions for deep disposal of radioactive waste (2023–2025)					725 kCZK / 28600 €
EC	Innovative Photodetector Module for advanced Hybrid "Magnetic Resonance Imaging/Positron Emission Tomography" Scanners for Nuclear Medicine (2023–2027)					227 kCZK / 8966 €
EC	Development of a demonstrator for the Penetrating Particle Analyser (PAN) technology (2020–2022)		3883 kCZK / 153176 €	3771 kCZK / 148758 €	3861 kCZK / 152308 €	1477 kCZK / 58258 €
EC	Measurement and Instrumentation for Cleaning and Decommissioning Operations (2019–2021)	571 kCZK / 22508 €	3013 kCZK / 118847 €	2421 kCZK / 95484 €	2107 kCZK / 83124 €	342 kCZK / 13511 €
TA CR	Center of Advanced Nuclear Technology - CANUT (PB2 + PB4)	138 kCZK / 5444 €				
MEYS	HRAward (Development of capacity for strategic research management at CTU in Prague)	609 kCZK / 24024 €	528 kCZK / 20828 €	333 kCZK / 13136 €	278 kCZK / 10966 €	
TA CR	Center of Advanced Nuclear Technologies II					4950 kCZK / 195266 €
MEYS	Research infrastructure for experiments at CERN	2335 kCZK / 92110 €				
MEYS	Research infrastructure for experiments at CERN		2680 kCZK / 105712 €	2525 kCZK / 99606 €	2441 kCZK / 96292 €	

MEYS	Research infrastructure for experiments at CERN					2435 kCZK / 96055 €
Total		16545 kCZK / 652647 €	16081 kCZK / 634241 €	13336 kCZK / 526057 €	12158 kCZK / 479614 €	10947 kCZK / 431859 €

Table 3.3.2 - Contract research activities

Client[28]	Activity name	Revenue (in thousands CZK/EUR)				
		year 1	year 2	year 3	year 4	year 5
University of Houston	University of Houston - research services - Tlustos	0	0	332 kCZK / 13097 €	0	0
ESA	EL3PRO - Lunar surface prospecting mobile payload package pre-phase A study (principal investigator is OHB System AG)	0	0	0	148 kCZK / 5838 €	212 kCZK / 8363 €
ESA	ERSA - Delivery of the HardPix for the ESA Radiation Sensor Array (principal investigator is Space Applications Services NV/SA)	0	0	0	2345 kCZK / 92505 €	0
D-ORBIT	SWIMMR - HardPix Instrument	0	0	0	0	2291 kCZK / 90375 €
Total				**332 kCZK / 13097 €**	**2493 kCZK / 98343 €**	**2503 kCZK / 98738 €**

Note: List and describe contract research activities with a revenue in a given calendar year, regardless of the amount of financial revenue.

3.4 Research results with existing or prospective impact on society

The evaluated unit shall briefly comment on a maximum of 10 (considered most significant by the evaluated unit) research results already applied or realistically heading towards application during the evaluated period, based on the overview annex table 3.4.1 (it is recommended to indicate results with a link to projects listed in indicator 3.3). The evaluated unit must demonstrate in its description that the research results have led or will soon lead to positive impacts[29], on society (e.g. description of how the results are used by various users, the range of persons/institutions for which the result is relevant, measurable economic impacts, etc.). The evaluated entity shall indicate in its commentary whether the gender dimension is considered in these results and discuss the impacts of the results regarding sustainability.

Maximum range 300 words/result.

Self-assessment:

IEAP CTU maintains a balanced focus between fundamental and applied research. We recognize the importance of achieving results that positively impact society and facilitating their transfer to industrial partners. During the reporting period, our staff successfully prepared four patents (one in

[28] If the client is from abroad, indicate in brackets the country of origin of the client.

[29] See Terms definition.

the USA, two in the EU, and one in the Czech Republic), developed six prototypes, created eleven software packages, and produced one utility model and thirty-five functional samples.
The practical applications of our results span a wide range of fields, including space, preclinical research, healthcare, dosimetry, radioactivity suppression, accelerator technologies, art, and the detection of various types of radioactivity. These selected examples have already demonstrated measurable economic impact. Regarding gender dimension and sustainability, we are committed to fostering an inclusive and sustainable research environment. Since 2021, CTU has implemented a Gender Equality Plan, ensuring that the gender dimension is considered in research and institutional activities. The results contribute to sustainability by promoting inclusivity and equal opportunities in scientific and research progress (see Supporting documents).
Selected results (all closely connected to projects undertaken by IEAP CTU staff during the evaluated period) have also positively impacted the institute's budget:

1) Jakůbek, J.; Thilo, M.; Campbell, M. A single layer 3D tracking semiconductor detector, European Patent Office. Patent EP2758806: The result is based on cooperation between IEAP CTU, CERN and technological company ADVACAM (spin-off company of IEAP CTU, according to Ernst&Young the best Technological company 2021 in the Czech Republic). Broad impact of the result: space, imaging in biomedicine, material research, art.
Short description: The present invention relates to a pixel detector, comprising a semiconductor sensor layer, in which charges can be generated upon interaction with particles to be detected. The semiconductor layer defines an X-Y-plane and has a thickness extending in Z-direction. The detector further comprises a read-out electronics layer. The time difference information is indicative of a difference in the Z-components of the locations of charge generations in the corresponding neighbouring sensor volumes caused by a particle trajectory that is inclined with respect to the X-Y-plane.

2) Krejčí, F.; Jakůbek, J. Method of phase gradient radiography and arrangement of an imaging system for application of the method, European Patent Office. Patent EP2978377: The result is based on direct cooperation between IEAP CTU, and technological company ADVACAM (spin-off company of IEAP CTU, Technological company 2021 in Czech Republic). Broad impact of the result: imaging in biomedicine, material research, art.
Short description: The invention deals with a radiation imaging method including steps of generation of at least one radiation microbeam by a radiation source, radiation penetration through the examined object and its caption by a detector consisting of a system of pixels, while the difference between the position of a non-refracted microbeam detected without the examined object and the position of a refracted microbeam detected with the examined object defines refraction angle in a particular point of the examined object expressing the size of local gradient of refractive index corresponding to the phase gradient image (PGI) of the examined object.

3) Pospíšil, S.; Leroy, C., Method of refining positional resolution of a positron source in positron emission tomography, Czechia. Patent CZ 308094: The result is based on direct cooperation between IEAP CTU, and University of Montreal. Realization of this idea has an important impact on medicine (cancer treatment, precise definition of positron annihilation). In 2024 USA patent was accepted.
Short description: The method of refining the determination of the positron source in an object studied by the PET method consists of the following steps: An object containing a source of positrons, which annihilate mainly through the production of pairs of annihilation photons, is placed

in a system of n positional and energy sensitive gamma detectors formed of detection elements in which the photons can interact. The times and coordinates of the interaction points and energy E1 and E2 of the interacting photons of the detection elements concerned are determined and transmitted by the interface to the control and evaluation computer, in which the coincidence events registered by the detection elements x are assigned to individual pairs of annihilation photons. Both photon pairs with energy from 507 keV to 513 keV and pairs of annihilation photons with Doppler shifted energy outside this interval are recorded. The greater these shifts, the more likely it is that the annihilation occurred during flight closer to the place where the positron was born, which refines the determination of the positron source distribution in the study object.

4) Mamedov, F.; Štekl, I.; Smolek, K.; Hůlka, J.; Fojtík, P.; Čermáková, E., A system for creating and maintaining a radon-free space and a clean room without aerosols, Utility Model CZ32873: The developed system includes clean room with reduced amount of aerosols (e.g. ISO 5) and highly suppressed concentration of radon and its daughter products. The system was developed by IEAP CTU and NRPI (National Radiation Protection Institute). System has a broad range of applications e.g. in biology and medicine (DNA and cells in Zero Dose environment), electronics (production of chips in radon free environment) and detection technologies (production of detectors in Zero Dose environment). Two such systems already exist (underground laboratory, National Radiation Protection Institute). Technology transfer was performed by two companies - ATEKO (https://www.ateko.cz/en/) and CRAC (https://www.crac.cz/en/).

5) Slavíček, T.; Fojtík, P.; Biskup, B.; Macko, M.; Waheed, F.; Mašek, P.; Rovenská, V.; Malátová, I. et al., Detector of radioactive contamination of wounds and injuries, Functional Sample: The system was developed by IEAP CTU and National Radiation Protection Institute (located here). It is a unique system in the world.
Short description: Equipment intended for the qualitative and quantitative determination of radioactive contamination of a crow, which arose because of mechanical damage to the skin, and which is the route of entry of the radionuclide into the organism. This situation thus leads to a dose from internal radiation in the victim persons. The wound detector is designed to directly measure the contamination of the wound and its surroundings. His outputs serve to i) identification or to find a wound in the affected person; ii) identification of radionuclides in the wound; iii) characterization of the wound; iv) determining the activity of a radionuclide or a mixture of radionuclides in the wound. The wound detector serves to meet the requirements of ISO 20031 [ISO 2020] regarding direct measurement in the morning. Such measurement is desirable from the point of view of early estimation of potential internal irradiation of the affected person and possible accelerated medical intervention. The functional sample of the wound detector covers the alternatives of possible radioactive contamination in the sense i) various types of ionizing radiation emitted by the contaminant; ii) the presence of surface contamination; iii) places of first contact with the affected person (dosimetry or medical workplace). The system includes: Positioning bed · Collaborative robot · CZT detector with amplifier and signal digitization · Pixel detector · Digital camera · Microprobe with YAP:Ce scintillation detector · HPGe detector for measuring systemic activity · HPGe detector portable to a medical facility.

6) Malich, M.; Petro, M.; Janeček, J.; Smetana, A.; Holík, M.; Bergmann, B.; Gohl, S.; Granja, C. et al., MIRAM - Miniaturized Radiation Monitor for Space. Functional Sample: Miniaturized Radiation Monitor for Space, developed in cooperation with ESA (European Space Agency). The MIRAM - with two detection layers, based on the Timepix3 detector and Silicon diodes. The data is directly

processed on Orbit, because MIRAM also contains on-board Data Processing. This allows MIRAM to significantly reduce the amount of data sent to the Ground Station. The monitor was already purchased by Telecommunication Satellite Company.

7) Vavřík, D.; Žemlička, J., Laboratory RTG profilometer devoted for non-destructive inspection of layered structure utilizing sharp edge planar beam, Functional Sample: The result is based on direct cooperation between IEAP CTU and Institute of Theoretical and Applied Mechanics (ITAM AS CR). RTG profilometer targets the inspection of a layered structure deposited onto a massive substrate. The investigated object is irradiated by a planar, sharp X-ray beam passing over the surface at an acute angle. The scattered and XRF photons are recorded by a pinhole camera equipped with a semiconductor pixelated detector. Measurement of the layer thicknesses with micrometric precision is obtained by analysing changes in the signal produced at the sharp edge of the X-ray beam. The device primarily targets the investigation of medieval wooden panel paintings based on polychromy but it can be more general. It enables X-ray measurements, fluorescence imaging, creation of digitized 3D models, meets the functional and economic conditions of small-scale production. Advacam leverages this expertise to develop cutting-edge imaging solutions and its subsidiary InSightART now continues the innovative work initiated by the IEAP CTU, applying it specifically to the art world.

8) Rukhadze, E.; Hodák, R.; Štekl, I.; Hůlka, J.; Rulík, P.; Hýža, M., Automatic system of changing and measurements samples for HPGe detectors in very low radiation background. Functional Sample: The sophisticated system for automatic changing and measurements of low activity samples (up to 15 samples in the tray) with ultra-low background HPGe detectors was developed in direct cooperation between IEAP CTU, National Radiation Protection Institute (NRPI) and company NUVIA (https://www.nuvia.com). The system was constructed by NUVIA (Czech branch of French company Soletanche) based on technical proposal and in close cooperation with NRPI and IEAP CTU. The equipment was successfully tested by NRPI and IEAP CTU. It operates HPGe detectors placed in 30 cm shielding of low activity Pb incl. Suppression of the radon concentration below 100 mBq/m^3. It substantially increased the efficiency of measurement (24/7/365 regime). At present, it is used in environmental measurements.

9) Jakůbek, J., Detector of ionizing radiation enabling a coherent digital image, United States of America. Patent US10168437: A detector of ionizing radiation, e.g. x-ray radiation, allowing the creation of a continuous digital image of a scanned object. The detection surface is formed by a mosaic of detector segments arranged in a matrix and consists of a sensor layer arranged on a chip reader with the formation of tiers to engage an adjacent detector segment. The sensor layer is active over its entire area, and the matrix is provided with a means for positioning the detector segments to define their mutual lateral clearance less than the size of one pixel. The positioning means preferably comprises a carrier of rows. The resulting detection surface is active over its entire area and allows for the direct creation of continuous digital image without dead zones. Licence fee = 82 749 EURO.

10) Owens, A. Semiconductor Radiation Detectors, Boca Raton: CRC Press, 2019. Series in Sensors. ISBN 9781138070745, Monography: This comprehensive book grew out of the author's previous publication, "Compound Semiconductor Radiation Detectors" (2012). It is completely updated and expanded. Bringing together material scattered across many disciplines, the book provides readers with a consolidated source of information on the properties of a wide range of semiconductors; their growth, characterization and the fabrication of radiation sensors with emphasis on the X- and

gamma-ray regimes. It explores the promise and limitations of both the traditional and new generation of semiconductors and discusses where the future in semiconductor development and radiation detection may lie. The purpose of this book is two-fold; firstly, to serve as a textbook for those new to the field of semiconductors and radiation detection and measurement, and secondly as a reference book for established researchers working in related disciplines within physics and engineering.

Table 3.4.1 - Overview of research results in the period under evaluation

Type of result[30]	Year of application	Name
Patent US10168437, USA	2019	Detector of ionizing radiation enabling a coherent digital image
Patent EP2758806, European Patent Office	2019	A single layer 3D tracking semiconductor detector
Patent CZ 308094, Czech Republic	2019	Method of refining positional resolution of a positron source in positron emission tomography
Patent EP2978377, European Patent Office	2021	Method of phase gradient radiography and arrangement of an imaging system for application of the method
Prototype	2022	An innovative photodetection system for positron emission tomography
Prototype	2022	Updated uProbe concept
Prototype	2021	Robotic system with Timepix type detectors
Prototype	2020	USB & Ethernet Embedded Readout Interface for Timepix3 – Katherine Readout for Timepix3
Prototype	2019	Dual Ethernet Embedded Readout Interface for Timepix3 – Katherine Readout for Timepix3 (Telescope Edition)
Prototype	2019	Ethernet Embedded Readout Interface for Timepix2 – Katherine Readout for Timepix2
Software	2022	Wafeform analyzer for multichannel detection system
Software	2022	Coincidence pre-evaluator for multi-detection system experiments
Software	2021	StratiScan. Position control of the X-ray profilometer software
Software	2021	Plugin for control a network of Timepix3
Software	2021	Timepix3 calibration plugin
Software	2020	MIRAM data evaluation and preprocessing toolkit
Software	2020	J-PIX data acquisition toolkit
Software	2020	Online plugin for Timepix3 measurements displaying acquired data for presentation purposes
Software	2020	FITPix hardware library based on the parallel software architecture
Software	2020	ATLAS-TPX3 DAQ
Software	2019	ATLAS-TPX(3) luminosity evaluator
Utility Model CZ32873	2019	A system for creating and maintaining a radon-free space and a clean room without aerosols
Functional sample	2022	X-ray camera with variable focal length
Functional sample	2022	A freezer for vacuum chambers
Functional sample	2022	Nested neutron spectrometer system
Functional sample	2022	Radon-absorption testing setup

[30] Specify the specific type of result. Add rows as needed.

Functional sample	2022	Triangular holder for three Timepix3 detectors for use in vacuum chambers
Functional sample	2022	Optical signal readout from the high-voltage VdG accelerator terminal
Functional sample	2022	Programmable power supply to drive ion-beam-deflection dipole magnets
Functional sample	2022	Detector of radioactive contamination of wounds and injuries
Functional sample	2021	Ionization chamber with a set of changeable targets
Functional sample	2021	New set of solid deuterium targets
Functional sample	2021	System of accelerator cooling-water flow measurement
Functional sample	2021	N-type HPGe detector system
Functional sample	2021	Laboratory apparatus for humidity and Li-content measurement of sand samples
Functional sample	2021	Position sensitive Multiwire Proportional Counter with delay-line readout
Functional sample	2021	Time Projection Chamber operating with SAMPA front-end
Functional sample	2021	Optical remotely controlled accelerator-beam monitor with beam electric-current measurement
Functional sample	2021	3D profilometer camera using a Timepix hybrid pixel detector with a CdTe sensor
Functional sample	2020	Timepix3 Quad Chipboard
Functional sample	2020	SF6 Insulation-Gas System for Venerable HVE AN2500 Van de Graaff Accelerator
Functional sample	2020	Support System for Stabilization of the Exact Position of Accelerator Ion Guide
Functional sample	2020	MIRAM - Miniaturized Radiation Monitor for Space
Functional sample	2020	1nA and 1μA Precision Current Source for Calibration Purposes
Functional sample	2020	1nA-Resolution Direct-Current Meter and Integrator Operating in Wide Range of 1 nA – 100 μA
Functional sample	2020	Nanocomposite scintillator polystyrene - nano ZnO(Ga)
Functional sample	2020	Polyethylene naphthalate detector
Functional sample	2020	Polystyrene based detector without stabilizers
Functional sample	2020	Automatic system of changing and measurements samples for HPGe detectors in very low radiation background
Functional sample	2020	Sensitive compact Rn detector
Functional sample	2020	Ultra-low background HPGe detector IDEFIX
Functional sample	2019	Demonstrational monitoring network
Functional sample	2019	Neutron sensitive gamma ray spectrometer
Functional sample	2019	Pixelated gamma ray spectrometer
Functional sample	2019	Laboratory RTG profilometer devoted for non-destructive inspection of layered structure utilizing sharp edge planar beam
Functional sample	2019	Detector of reactor antineutrinos
Functional sample	2019	3D profilometer camera using Timepix hybrid pixel detector with Si sensor

Note 1: Please list and describe the results already applied in practice or heading towards application in practice with existing or prospective impact on the society (e.g. domestic or foreign patents, sold licenses, spin-offs, prototypes, varieties and breeds, methodologies, significant analyses, surveys, expert outputs for policymaking or other forms of non-publication outputs, etc.). Indirect results of research, development and creative activities with documented societal impact, e.g. expert activities, services to the public/government/scientific community, may also be reported.

3.5 Transfer of results into practice

The evaluated unit shall briefly describe its system for transferring results into practice. It shall also indicate up to five of the most typical users of its results, whether in the university environment or in the non-university application/corporate sphere, detailing how it collaborates with them and how it seeks out new users (using a maximum of five specific examples).

It will also indicate whether and how it commercialises R&D&I results (e.g. selling licences, setting up start-up or spin-off companies, etc.)[31], providing brief description of the commercialisation methods used. The effectiveness of the transfer of results and the commercialisation of R&D&I results will be described using a selection of results (max. five) listed in annex table (Table 3.4.1).[32]

Additionally, the evaluated unit shall briefly comment on the funds received during the evaluation period from non-public, non-grant sources (e.g. licences sold, spin-off revenues, donations, etc.). A full summary shall be provided in annex table (Table 3.5.1).

Maximum 500 words plus 200 words for each provided example of finding a new user of results and commercialization.

Self-assessment:

IEAP CTU has established a clear and stable system for transferring research results into practical applications. This system begins with the evaluation of novelty to determine the potential for patent application. We employ a part-time patent specialist to ensure high-quality review and effective economic solutions. The initial step involves applying for a patent in Czechia (effective economic solution and high quality of reviewing), followed by a nine-month period to decide on further applications in the USA or EU. The second step in our process is identifying potential users of our practical results. Our experience shows that direct cooperation with companies through common projects or activities is an effective way to meet the R&D&I needs of the market. This approach guarantees that our research aligns with customer demands. Our strategy also includes presenting our results on an international level through conferences, PR activities, articles in refereed journals, and international collaborations.
Users of our results can be divided into two groups:

1) long-term users of our results: ADVACAM, NUVIA, ATEKO (Czech technological companies), XIE (company, Germany), CERN (international institution)
2) new users of our results: SINTEF (Norway), KROMEK (UK, technological company), Siemens (Germany), Innovative Physics Limited (UK), JINR (an international institute, after 2022 the contact stops), CEA, CNRS (both research institutions, France), Institute of Electrical and Electronics Engineers (USA), STFC/UKR (UK), universities – Charles University, University of Chemistry and Technology, University of West Bohemia (all Czechia), University of Andres Bello (Chile), Marseille University (France).
Based on the above given lists several groups of users could be distinguished: i) Czech technological companies; ii) technological companies from abroad; iii) international institutions (e.g. CERN); iv) research institutions (e.g. CEA, CNRS, STFC); and v) universities in Czechia or abroad.

[31] In the case of military HEIs, their specific position is taken into account when evaluating the commercialisation/evaluation of R&D&I results.
[32] If the commercialisation of R&D&I results is carried out in this way.

The effectiveness and commercialization of R&D&I could be in our case proved by 5 selected examples (based on the Table 3.4.1):
a) services of the research infrastructure (accelerator VdG) for customers (Innovative Physics, Siemens) – it supports the attractivity of VdG and proves the effort for regular improvement of the accelerator and equipment installed around it.

b) licence fee (CERN, ADVACAM, University of west Bohemia, Jablotron) – the payment is based on the licence agreements signed between IEAP CTU and partners. Also, it shows the necessity to actively participate in Medipix/Timepix collaboration (IEAP CTU is among founding institutions of this collaboration).

c) delivery of sensitive Rn detectors (University of Andres Bello, Chile; CNRS) – nice example of successful technology development in home institutions and PR on international conferences.

d) delivery of educational kit with pixel detector (JINR, Marseille University, ELECTRI, STFC/UKRI) – successful story of transfer of R&D&I into teaching process. IEAP CTU supports activities of secondary teachers of physics and close cooperation with winners of national competitions in physics (summer practices). In such frames different tasks with pixel detectors in detection of different types of radioactivity were developed, including videos or textbooks.

e) contractual research based on our know-how (measurements of scintillation detectors, Monte Carlo simulations, measurement with micro-CT, delivery of specialized PCB, dedicated steel structure for detector SuperNEMO located underground).

The total amount of IEAP CTU income from the above-mentioned activities reached 295 545 EURO in the evaluated period. The whole income was used as additional support for our R&D&I (improvement of home infrastructure, new equipment, better conditions for early career researchers, extension of international cooperation etc.).

Table 3.5.1 - Summary of non-public revenues received during the period under evaluation

Type of revenue	Revenue (in thousands CZK/EUR)				
	year 1	year 2	year 3	year 4	year 5
Licence fee for educational kit MX-10, JABLOTRON company	25 kCZK/ 986 €	55 kCZK/ 2170 €	0	0	0
Licence fee based on Licence agreement, CERN	0	263 kCZK/ 10375 €	0	179 kCZK/ 7061 €	0
Licence fee, Licence agreement No. 350013-003, ADVACAM company, PIXELMAN software	329 kCZK/ 12978 €	276 kCZK/ 10888 €	659 kCZK / 25996 €	579 kCZK /22840 €	837 kCZK/ 33018 €
Licence fee, Licence agreement No. 350010/2014, University of West Bohemia	0	3 kCZK/ 118 €	0	0	0
Contract research, tests of scintillating detectors, NUVIA company	0	109 kCZK / 4300 €	0	0	0
Delivery of interface for TPX3, JINR Dubna	131 kCZK / 5168 €	0	0	0	0

R&D service, SINTEF (Norway)	0	0	0	74 kCZK /2919 €	0
Licence fee for Timepix3 chipboard, KROMEK company (UK)	0	0	0	0	693 kCZK / 27337 €
Sensitive Rn detector, Universidad Andres Bello, Chile	0	0	199 kCZK / 7850 €	0	0
Monte Carlo simulation for antiradon factory, ATEKO company	0	105 kCZK / 4142 €	60 kCZK / 2367 €	0	0
R&D services, SINTEF (Norway)	0	75 kCZK / 2960 €	76 kCZK / 2998 €	0	0
Measurement and computational reconstruction of calcite crystals on micro-CT systems, Charles University	0	0	60 kCZK / 2367 €	60 kCZK /2367 €	0
Micro-CT measurements and 3D reconstruction of historical artifacts, University of Chemistry and Technology, Prague	0	0	0	52 kCZK /2051 €	134 kCZK/ 5286 €
Educational kit with pixel detector, JINR Dubna	0	0	100 kCZK / 3945 €	0	0
USB Interface and PCB Canpix, X-RAY Imaging Europe (Germany)	0	131 kCZK / 5168 €	0	155 kCZK / 6114 €	195 kCZK / 7692 €
VdG neutron beam time, SIEMENS company	12 kCZK / 473 €	0	0	0	0
Sensitive Rn detector, CNRS (France)	0	133 kCZK / 5247 €	129 kCZK / 5089 €	730 kCZK / 28797 €	144 kCZK / 5680 €
Project of the steel support structure, CNRS (France)					
VdG neutron beam time, Innovative Physics Ltd (UK)	0	60 kCZK / 2367 €	0	0	0
Service (test of valves], DENSO Manufacturing	0	35 kCZK / 1381 €	0	0	0
Educational kit with pixel detector, Marseille Université (France)	0	0	0	209 kCZK / 8245 €	0
Service (PCB repair), CEA (France)	0	0	0	25 kCZK / 986 €	9 kCZK / 355 €
Katherine TPX interface, KROMEK company (UK)	0	0	0	0	147 kCZK / 5799 €
Educational kit with pixel detector, Institute of Electrical and Electronics Engineers (USA)	0	0	0	0	86 kCZK /3393 €
Educational kit with pixel detector, STFC/UKRI (UK)	0	0	0	0	159 kCZK / 6272 €
Total	**497 kCZK / 19605 €**	**1245 kCZK / 49116 €**	**1283 kCZK / 50612 €**	**2063 kCZK / 81380 €**	**2404 kCZK / 94832 €**

Note: Enter funds raised for R&D&I from non-public sources besides grants or contract research (e.g. licences sold, spin-off company revenues, donations, etc.) in the calendar year.

3.6 The most important activities in the field of popularization of R&D&I and communication with the public

The evaluated unit shall briefly describe its main activities related to the popularisation of R&D&I and communication with the public (e.g. popularisation lectures, citizen science initiatives, etc.) during the evaluated period and provide up to 10 examples that it considers the most significant.

Maximum 500 words plus 200 words for each example given.

Self-assessment:

The staff at IEAP CTU is committed to popularizing our research achievements and engaging with the public. We do this through various channels, including popularization articles, TV and radio interviews, educational videos featuring pixel detectors, and excursions to our research infrastructure, such as VdG accelerator. We also place significant emphasis on working with high school students. Through various popularization and educational events, we initiate cooperation with talented high school students, particularly winners of national physics competitions. We offer these students long-term summer internships at IEAP CTU, which often continue into their university studies and can eventually develop into employment relationships. Additionally, IEAP CTU organizes regular public visits under the theme “Science and Art.” We transformed our institute’s walls into an art exhibition space, showcasing paintings and other artworks. For example, in 2021, we held two such events, each attracting around 40 attendees. These events highlight the connections between modern scientific research in mathematics, physics life sciences and the world of art, presenting these relationships to the public.

Examples of popularization events and communication with public:

1) Regular lecture cycles at the University of the Third Age. The courses Secrets of the Microworld and Laws of the Microworld focus on the basics of nuclear and particle physics, the theory of relativity, and the principles of quantum mechanics. The lectures are presented in a format accessible to non-professionals from the public (usually 30–40 participants per each one-semester course). [See Lectures of the University of the Third Age in the Supporting Documents.]

2) Cooperation with secondary school teachers and students. Every year in July, IEAP organizes seminars for winners of the national round of Physics Olympiads. Interested talented high school students are then offered a long-term summer internship at the institute and involvement in ongoing research projects. This often leads to long-term cooperation and participants continue to work with the institute even after they enter university. IEAP staff participates in the organization of high school students’ competitions in physics (e.g. Physics Olympiad, Secondary School Professional Activity). In this context, every year, IEAP organises 2-day seminars for teachers of Czech secondary and primary schools dedicated to the detection of radioactivity using (in the institute developed) pixel detectors MX-10 and MiniPIX EDU, respectively. A book with relevant laboratory tasks was written. IEAP CTU also supported textbooks for secondary school students, e.g. V. Wagner, V. Vícha and Z. Janout (both IEAP), The Boundaries of the Mendeleev's Periodic Table (or how to produce and study elements heavier than ever), Union of Czech Mathematicians and Physicists, Astra Print Hradec Králové, 2019.

3) In 2022, on the twentieth anniversary, the IEAP Open Day was held in IEAP. Approximately 50 interested members of the public visited the IEAP laboratories and learned about the research conducted at the institute.

4) Exhibition in National Gallery – "In Depth and on the Surface" (2022-2023) - The exhibition presents the results of an interdisciplinary project for the applications of apparatus using semiconductor pixel detectors that will advance the possibilities of research methods for works of ancient art. Representatives of the natural, technical and humanities sciences from three specialized departments (Institute of Theoretical and Applied Mechanics of the Czech Academy of Sciences, IEAP CTU and the National Gallery Prague) collaborated on the project. [See web page In Depth and on the Surface of the National Gallery in the Supporting Documents.]

5) Particle Prague 2022 - the event organized by Prague's research institutes and universities offered high school students the opportunity to enter the world of particle physics. During their week-long stay in Prague, participating students had the opportunity to visit laboratories dealing with particle and nuclear physics, talk to experts, and try out the work of a physicist in mini projects. IEAP CTU actively participates and offers practical measurements with pixel educational kit and tasks in the VdG accelerator.

6) TV and radio interview in Czech Republic:
a) Interview of Robert Filgas in radio Czech Radio about IEAP Space program - September 2023 [See Interview of Robert Filgas in the Supporting Documents.]
b) S. Pospisil's speech at the Czech Television, Studio ČT24, on the use of technologies from CERN (24.5.2019). [See Interview of Stanislav Pospíšil at the Czech Television in the Supporting Documents.]
c) A. Owens' speech at the Czech Television, Studio ČT24, on the activities of IEAP at Space (5.6.2023). [See Interview of Alan Owens at the Czech Television in the Supporting Documents.]
d) I. Štekl's interview in the Czech Television, Studio ČT24 (25.7.2018)
[See Interview of Ivan Štekl at the Czech Television in 2018 in the Supporting Documents.]
e) I. Štekl's interview in the Czech Television, Studio ČT24 (24.6.2021)
[See Interview of Ivan Štekl at the Czech Television in 2021 in the Supporting Documents.]

7) Interviews abroad and on internet media:
a) Interview published in Slovakia in a newspaper or a journal: SME - 3x, Denník N - 3x, Hospodárske noviny - 3x, Denník Plus; in a TV: TA3, RTVS; in a radio: STVR - 3x; in a podcast: Týždeň - 2x; in a festivals and events for public - 2x.
b) Interview of IAESTE student Catalina Lesmes Ramirez of EAFIT University, Medellin, Columbia, about her study stay in IEAP CTU - 2019. The student is now a PhD student of CTU and an employee of IEAP. [See Interview IAESTE student in the Supporting Documents.]
c) ATLAS video briefing and press release, September 2023, ATLAS, CERN. Santu Mondal explained the first observation of the production of top quark pairs in proton-lead ion collisions on behalf of ATLAS collaboration. [See Video of Santu Mondal in the Supporting Documents.]

8) PR activity in radiation:
a) Project CzechRad (2019-2025): The project supports the preparedness of CR for response to a nuclear accident. Research focuses on behaviour of the population in risk of panic (using the analogy of COVID pandemic and radiation emergency), esp. on coping risks and on identification of

mechanisms eliminating fear development and propagation. Mathematical methods were developed for early detection of a dangerous phenomenon in a media environment. Involvement of "citizen science" measurements of radiation for alleviation were studied. Radiation detectors were developed and numbering 1000 distributed among individuals and institutions incl. training in data processing and interpretation. The project strengthened the contact of a crisis management with self-governments allowing it even during communication failure. [See web page CzechRad in the Supporting Documents.]
b) Project RAMESIS (Radiation Monitoring Network for institutions and schools to assure early awareness and enhancing safety of citizens); 2015-2019: Radiation monitoring system was implemented at selected institutions and schools. Training and informational materials for understanding radiation problems were prepared. [See web page RAMESIS in the Supporting Documents.]

9) Examples of articles in professional popularization journals and popularization talks:
a) 2023, Žemlička, J.: Art under the detailed view, Pražská technika. 2023, 28-31. ISSN 1213-5348.
b) 2022, Štekl, I.; Hůlka, J.; Fojtík, P., Today's Priority - World Events Warn, TecniCall. 2022, 22-23. ISSN 1805-1030.
c) 2023, Žemlička, J., In depth and on the surface, Science outreach lecture, Prague, The world of engineering (University of the third age), CTU. 2023-10-11.
d) 2022, Interview I. Štekl and S. Pospíšil, 20 very successful years of the Institute of Technical and Experimental Physics of the Czech Technical University, Technický týdeník, print run 9000 copies
e) Institute of Experimental and Applied Physics, CTU in Prague, journal Vesmír, 5/2021. Prezentation of IEAP CTU.
f) 2023, Bergmann, B., Timepix in particle and nuclear physics – from big machines and tabletop experiments. [Science outreach lecture] Praha: Single-Photon Detection - Imaging the Unseen Workhshop, ADVACAM s.r.o.. 2023-05-22.
g) 2022, Palušová, V.; Macko, M., Possibilities of cooperation on the SuperNEMO neutrino experiment [Science outreach lecture] FNSPE CTU in Prague: Science on Depertment of Physical Electronics, SPIE Student Chapter CTU in Prague. 2022-11-23.

10) Historical documents for nuclear and particle physics:
IEAP CTU initiated activity to capture the disappearing world of the beginnings of nuclear and particle physics in Czechia and Slovakia. The Institute of Contemporary History, Academy of Sciences (ICH AS CR) in cooperation with IEAP CTU organized a seminar Czechoslovak nuclear and particle physics: between JINR and CERN. Based on this activity, the book „Czechoslovak nuclear and particle physics: between JINR and CERN“was published, author E. Těšínská (ICH AS CR). It includes personal accounts of the Czech and Slovak experts of their cooperation with JINR and CERN (551 pages). The book was published in cooperation with ICH AS CR and IEAP CTU.

IMPLEMENTATION OF RECOMMENDATIONS

3.7 Implementation of the recommendations in Module 3

The evaluated unit will briefly describe how it has implemented the recommendations for Module 3 from the previous evaluation period, if applicable.

Maximum 1000 words.

Self-assessment:

Recommendations from last evaluation are shortened.

1) Items 3.2, 3.3 and 3.4:
"The institute must apply for international projects based on their expertise in detecting and monitoring systems. It aims to focus on smart detecting systems and achieve the title of the centre of excellence in detecting & monitoring systems. Keep working in collaboration with companies. IEAP contributed to 29 projects. The total budget has been limited below 7.5 M EUR. The total amount of revenues from contract research has been limited to less than 300,000 EUR, which is considered small. Revenues from non-public sources have been limited to below 200,000 EUR."
Response: Total staff number was increased from 84 to 95 (68,9 FTE, 47,68 FTE for researchers, 24,1 FTE early career researchers), while number of staff from abroad was increased from 24 to 32. It supports the attractiveness of IEAP CTU for young people and researchers from abroad. Number of projects was increased to 40 (21 IEAP as a beneficiary and 19 as another participant). The total budget was substantially increased (from 8 M€ to 17,6 M€).
IAEP CTU as a main beneficiary obtained the project "Engineering applications of microworld physics" financed as an Operation Programme Research, Development and Education with interdisciplinary R&D&I (experimental subatomic physics; progressive detection techniques; astroparticle and neutrino physics; applications in radiobiology, biomedicine and radioecology; X-ray and neutron radiography and tomography; proton and hadron therapy; robotics systems for radiation safety; influence of radiation on electronics; environmental radioactivity monitoring). Total budget was 7.8 M€. All results were successfully obtained. The project is in phase of sustainability (till 2032).
IEAP CTU concentrated effort to apply international projects in detecting systems and was successful with 3 space projects (Radiation Monitor system in a Package, ERSA, and PAN) financed by ESA and EU.

2) "Try to develop integrated prototypes, which may attract the interest of local and foreign companies in the field of sensors, detectors and monitoring systems. Try to organize international conferences in the field of sensors, detectors and monitoring systems."
Response: IEAP CTU substantially increased the number of application results, from 22 results in the previous period to 58 (4 patents, 13 software, 6 prototypes, 1 utility model, 34 functional samples). IEAP CTU with partners organized big international conference ANIMMA 2021 "Advancements in Nuclear Instrumentation Measurement Methods and their Applications" (296 participants) in Prague under the auspices of the Ministry of Industry and Trade of the Czech Republic represented by Karel HAVLÍČEK, Deputy Prime Minister. IEAP CTU regularly organizes a conference (MEDEX'19, MEDEX'22, MEDEX'23), which serves as an example of extending our activities in neutrino physics and dark matter searches.

3) "Choose an emblematic product/project which is within the capacities and know-how of your scientists and engineers in the field of detectors. Collaborate with an international patent office from the US or related to the US, under a beneficial contract."
Response: Our effort was concentrated in this direction to develop a sophisticated detection unit for broad applications in space called HardPix. It was financed by company D-Orbit (UK) in the frame of the Swimmer project. We signed an agreement with a US located patent expert to help us with the process in the USA (in 2024 we were able to obtain a US patent of authors S. Pospíšil and C. Leroy).

4) “Awards - Keep working on this correct track. Emphasis in emblematic products with unique characteristics will bring higher awards.
Recognition by the international community - Keep working in the same track, bearing in mind the smart specialization in well-chosen devices.
Popularization - Keep working in the same track, with emphasis on smart products delivered by your own research work.”
Response: IEAP CTU staff continued in all activities connected with recognition in the international community and popularization. We received 3 prestigious awards (ESET Science Award, Glenn Radiation Award IEEE NPSS, Physical society Japan), we have members of editorial boards and several of us actively participate as referees of journals with high impact factor (including Nature), number of invited lectures of IEAP CTU staff in abroad was 69 and 39 invited speakers had lecture in IEAP CTU. What is important is that in such activities also early career researchers participate. IEAP CTU has representatives on EU level, e.g. APPEC or ESFRI.

5) OVERALL ASSESSMENT
“The institute is working on the right track. Apart from that, deepening in the physics and the materials of the products developed by the Institute, will gain scientific knowledge and international recognition.
Apart from that, choosing a few emblematic projects based on the know-how gained at the Institute and developing them, will provide further international recognition. As an example, concerning space PhD technology, the monitoring and selection of space junk is important and could be such an emblematic flagship.
Then, the collaboration with a high-class international patent agency, based on paying after the product exploitation can result in a success story on exploitation. The Institute has the potential of a success story in detecting systems.
Finally, the Institute deserves the ability of awarding its own PhD works, with the proper collaboration with related Faculties, choosing proper methods for this, such as a chair in the Faculty.”
Response: IEAP CTU followed carefully the recommendation concerning deepening in physics – more effort was given to fundamental physics (neutrino physics, dark matter, theory of weak interactions, direct participation in deep underground laboratories, nuclear physics on ISOLDE at CERN). By the same way we followed recommendations concerning space technologies as a possibility to reach further international recognition – more effort was given to develop sophisticated detection units for space financed by ESA as well as by companies (in total, 8 projects).
Concerning our own PhD activities, it was decided to postpone the application and concentrate on the support of research students at the Bc., Master’s and Ph.D. levels. IEAP CTU financially supports students during their research activities in the institute. Under supervision or co-supervision of IEAP CTU staff 20 Bc. students, 21 Master’s students and 11 PhD students successfully defended their theses.

A LIST OF SUPPORTING DOCUMENTS/LINKS FOR MODULE 3

Document name	No. criteria	Location (link in HTML)
Gender Quality Plan	3.4	https://www.cvut.cz/sites/default/files/content/bc7aa86f-5423-498a-8b1d-a576bc0be306/en/20240410-gender-equality-plan-2021.pdf

		https://www.cvut.cz/en/hr-award-hrs4r
Lectures of the University of the Third Age	3.6	https://drive.google.com/drive/folders/15w00nBmuOc-AR-JCBqKVV3K0m49KSP1V?usp=drive_link
In Depth and on the Surface - web page of the National Gallery	3.6	https://www.ngprague.cz/udalost/3513/v-hloubce-a-po-povrc/5847
RAMESIS	3.6	https://www.suro.cz/aplikace/czechrad-wiki/index.php/Ramesis-archiv
CzechRad	3.6	https://www.suro.cz/aplikace/czechrad-wiki
Interview with IAESTE student	3.6	https://www.eafit.edu.co/noticias/estudiantes/2019/estudiante-de-ing-matematica-destacada-en-organizacion-europea-de-la-investigacion-nuclear
Interview with Robert Filgas	3.6	https://radiozurnal.rozhlas.cz/magazin-experiment-cesi-dobyvaji-vesmir-predstavujeme-ambiciozni-tuzemske-9064133
Video of Santu Mondal	3.6	https://videos.cern.ch/record/2298651
Interview of Stanislav Pospíšil at the Czech Television	3.6	https://www.ceskatelevize.cz/porady/10101491767-studio-ct24/219411058060524/
Interview of Alan Owens at the Czech Television	3.6	https://www.ceskatelevize.cz/porady/10101491767-studio-ct24/223411058290605/
Interview of Ivan Štekl at the Czech Television in 2018	3.6	https://www.ceskatelevize.cz/porady/10101491767-studio-ct24/218411058060725/
Interview of Ivan Štekl at the Czech Television in 2021	3.6	https://www.ceskatelevize.cz/porady/10101491767-studio-ct24/221411058320624/
Interview of Ivan Štekl and Stanislav Pospíšil in Technický týdeník	3.6	https://www.technickytydenik.cz/rubriky/archiv/20-velmi-uspesnych-let-ustavu-technicke-a-experimentalni-fyziky-cvut_56644.html
Information about IEAP CTU in the journal Vesmír	3.6	https://vesmir.cz/cz/casopis/archiv-casopisu/2021/cislo-5/ustav-technicke-experimentalni-fyziky-cvut-praze.html