MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

SELF-EVALUATION REPORT MODULE 3

EVALUATED UNIT: Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University

FORD: 1. Natural Sciences

MINISTERSTVO ŠKOLSTVÍ, MLÁDEŽE A TĚLOVÝCHOVY

MODUL 3 SOCIAL RELEVANCE

SOCIAL RELEVANCE / SOCIAL BENEFIT OF THE EVALUATED UNIT[1]

3.1 General self-assessment of the social benefit of R&D&I in the fields of research at the evaluated unit, and of the evaluated unit as a whole

The evaluated unit gives a concise, general but informative account of the benefit of R&D&I in the fields in the 2014–2018 reporting period.

Self-evaluation:

The Faculty is a predominantly research-oriented unit of CTU. In addition to the fields of basic research (e.g. mathematical physics, theoretical informatics and particle physics, including substantial contributions to international experimental collaborations in CERN and BNL), the Faculty employs its expertise in nuclear and related fields in various applications. These include the development of detectors for radiation of all types, study of the structure, dynamics and degradation of materials, processes in nuclear reactors and nuclear fuel, chemical preparation of nanomaterials, applied photonics, study of the migration and diffusion of radionuclides in the environment, nuclear medicine, and mathematical modelling of environmental processes. These fields of research benefit society in terms of improved safety and reliability of the essential energy infrastructure, lower radiation exposure from the environment or during medical procedures, accessible modern medical treatments, and novel measurement instruments for diverse applications and for improved care of the national heritage.

HTML links to additional documentation:

https://www.fjfi.cvut.cz/en/research

APPLIED RESEARCH PROJECTS

3.2 Applied research projects [2]

The evaluated unit presents a maximum of the five most significant (from the perspective of evaluated unit) applied research projects in the 2014–2018 reporting period from the complete list in the appendix (tables 3.2.1 and 3.2.2), particularly with regard to the results achieved or a project's potential for application.

[1] *In accordance with Section 22(1) of Act No 111/1998 on universities, amending certain acts (the Universities Act), as amended.*

[2] *Under Section 2(1)(b) of Act No 130/2002, applied research is theoretical and experimental work aimed at gaining new knowledge and skills for the developing of new or substantially improved products, processes or services; applied research includes industrial research or experimental development, or a combination of both. Under Article 2 of Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty, industrial research means planned research or critical investigation aimed at the acquisition of new knowledge and skills for developing new products, processes or services, or for bringing about a significant improvement in existing products, processes or services. It comprises the creation of component parts of complex systems, and may include the construction of prototypes in a laboratory environment or in an environment with simulated interfaces to existing systems as well as of pilot lines, when necessary for the industrial research and notably for generic technology validation; experimental development means acquiring, combining, shaping and using existing scientific, technological, business and other relevant knowledge and skills with the aim of developing new or improved products, processes or services. This may also include, for example, activities aiming at the conceptual definition, planning and documentation of new products, processes or services.*

Self-evaluation:

Advanced Detection Systems of Ionizing Radiation - The project aims at transferring know-how from the most recent microelectronic technologies into practical applications. The detectors developed offer a wide range of applications in dosimetry and in spectroscopic applications thanks to the universal solution of their architecture.

Advanced fuelS for Generation IV reActors: Reprocessing and Dissolution (ASGARD) – EU Large-Scale Integrated Project focusing on research into advanced/novel nuclear fuels for Generation IV reactors. CTU in Prague was responsible for the development of alternative options for the production of oxide fuels and for reprocessing inert fuels.

Ra-226 recycling and Ac-227 applications - Novel technologies for recycling and for valorising outdated radiation sources were developed, allowing the production of Ac-227 for radionuclide generators and other products. EU patent pending.

Multidisciplinary research centre for advanced materials exploited synergies among 6 scientific institutions to develop technologies for preparing materials and deeper theoretical understanding of materials. The most significant result is the development of entirely new lightweight ferromagnetic composites.

Prevention, preparedness and reduction of the consequences of serious accidents of the Czech nuclear power plants in connection with the new experience obtained from the stress tests after the Fukushima accident - The research focused on selected accident scenarios, which were not considered within the original design of the NPPs. Computational models simulating the course of serious accidents were designed and means for mitigating their consequences were suggested.

HTML links to additional documentation:

http://capads.fjfi.cvut.cz/

https://cordis.europa.eu/project/id/295825

3.3 Contract research [3]

The evaluated unit briefly comments on revenues from contract research for the 2014–2018 reporting period from the complete list in the appendix (tables 3.3.1 and 3.3.2).

Self-evaluation:
Contract research forms a minor part of the Faculty's research activities. It consists predominantly of reports, analyses and monitoring for state authorities in nuclear fields, in applied research institutes and in utility companies, fractographic analyses for industrial and utility companies, and mathematical models applied in manufacturing or in software development.

HTML links to additional documentation:

3.4 Revenues from non-public sources (besides grants or contract research) from research work

The evaluated unit briefly comments on revenues for the 2014–2018 reporting period for R&D&I from non-public sources, besides grants or contract research (e.g. licences sold, spin-off revenues, gifts, etc.). It presents a complete list in the appendix (table 3.4.1).

Self-evaluation:
The Faculty's revenues from non-public sources came from license fees on patents and software, and gifts from companies, e.g. NUVIA, ŠKODA and ŠKODA JS, which funded the Best Thesis Award, fellowships for students working on problems related to industry, and organizing of student conferences.

HTML links to additional documentation:

[3] *For a definition of contract research for the purposes of evaluation in the universities sector, see Article 2.2.1 of the Community framework for State aid for research and development and innovation (2014/C 198/01).*

APPLIED RESEARCH RESULTS

3.5 Applied research results with an existing or prospective economic impact on society

The evaluated unit briefly comments on a maximum of the five most significant (from the perspective of the evaluated unit) applied research results that have already been applied in practice, or that will realistically be applied, in the 2014–2018 reporting period from the overview in the appendix (table 3.5.1).

Self-evaluation:

A method for processing hazardous and radioactive wastes (patent) This method has great potential in the field of environmental protection by limiting the required size of radioactive waste repositories.

A system for measuring lattice parameters, especially on single crystal samples and polycrystalline materials (patent) A unique supplementary device for X-ray diffractometers that enables precise analyses to be carried out on single crystal and also polycrystalline substances to determine the dimensions of the crystalline cells.

A Space Surveillance and Tracking (SST) calibration standard demonstration unit (functional sample) This unit is based on a unique New Pico Event Timer (NPET) that was developed at the Faculty. The calibration standard for a worldwide network of laser stations involved in optical tracking of orbiting space debris was designed, developed and tested at the Faculty. Recently, a space qualified version of the device was developed for the ESA I-SOC space optical clock project.

A semiconductor strip sensor optimized for gamma radiation monitoring (functional sample) Novel sensors were designed and manufactured in cooperation between the Faculty and the ON Semiconductor company in a completely new manufacturing process in existing foundry production flows. This achievement will enable the production of cheap mass-produced miniaturized radiation detectors for Czech and international markets, with increased functionality and utility value.

A method for removing cobalt from aqueous solutions (patent application) An efficient technology for decontaminating aqueous phase contaminated by a radioactive cobalt isotope. This method finds application wherever solutions contaminated by ^{60}Co arise in industry and in medicine.

HTML links to additional documentation:

3.6 Significant applied research results with an impact other than an economic one on society

The evaluated unit gives a concise account of a maximum of the five most significant (from the perspective of the evaluated unit) applied research results with an impact other than an economic one on society in the 2014–2018 reporting period (typically results from disciplines in the humanities and social sciences) from the overview in the appendix (table 3.6.1).

Self-evaluation:

The research results of the faculty contribute (among others) to:

- **Preservation of cultural heritage.**
  The prime example is the analysis of **the technical condition of the historical Sigismund bell**, the heaviest bell in the country. Our team carried out a broad experimental program, determining the current state of the bell and its ringing conditions. The study indicated a need to modify the clapper and its mounting. Appropriate design proposals were made and have been implemented. Now the Sigismund bell can again safely ring without restrictions.
  Another example is a **portable device for confocal X-ray fluorescence analysis of cultural heritage objects.** The device can make non-destructive analyses of pigments in historical photographs, daguerreotypes and paintings. Its design allows in-situ measurements of paintings in depositories or even in exhibition areas, e.g. in the collections of the NTM and the NG in Prague.
- **Radiation safety and effective response to potential threats.**
  The **MONTE-1** device is used for **testing the equipment used for detecting gamma and neutron radiation in emergency situations**. MONTE-1 is used annually by the Czech Fire Rescue Service. The method can be adapted for testing newly-developed detection systems in hard radiation conditions.
- **Improved medical diagnostics.**
  The proposed procedure for **Discriminating between Alzheimer's disease and amyotrophic lateral sclerosis via affine invariant spherical harmonics analysis of SPECT images** is a new approach for improving the early diagnosis of Alzheimer's through advanced computerized evaluation of data from existing SPECT devices. The approach potentially offers a fast way to achieve significant improvements in diagnosis reliability.

HTML links to additional documentation:

COOPERATION WITH THE NON-ACADEMIC ENVIRONMENT AND TECHNOLOGY TRANSFER

3.7 The evaluated unit's most significant interactions with the non-academic application/corporate sphere

The evaluated unit gives a concise account of the most typical users of its outputs. It explains whether and how it identifies them and how it works with them. It provides examples of a maximum of ten of the most significant interactions with the non-academic environment in the 2014–2018 reporting period.

Self-evaluation:

The faculty's interaction with the non-academic sphere is largely predetermined by its nationwide unique orientation towards nuclear sciences. Thus the faculty cooperates with state regulatory and administrative authorities, e.g. the **State Office for Nuclear Safety**, the **National Radiation Protection Institute,** and the **Czech Radioactive Waste Repository,** with research institutions specializing in applied nuclear research, e.g. the **Nuclear Research Institute** and **Research Centre Řež,** with the **ČEZ** electricity company, which operates the country's two nuclear power plants, with companies operating in the nuclear industry **UJP Prague**, **NUVIA** and **ŠKODA JS,** with the radiodiagnostic and radiotherapy departments of hospitals, and others.

In terms of its importance and its extent, the second field of expertise finding corporate applications is material science. The faculty provides advanced analyses for various industrial partners, including **ČEZ**, **AERO Vodochody**, **Doosan Škoda Power** and **CRYTUR.**

HTML links to additional documentation:

3.8 System and support of technology transfer and intellectual property protection (can be extended to the whole university, emphasising the specific features of the evaluated unit)

The evaluated unit gives a concise account of its system of technology transfer. It conducts an evaluation of the quality of its applied research and the effectiveness of technology transfer using the data presented in the appendix (table 3.5.1). This commentary will highlight the number of filed and granted patents (Czech and international) and licences sold.

Self-evaluation:

The TT and IP protection system of CTU in Prague has a centralized base within the Rectorate.

HTML links to additional documentation:

http://evaluation-cvut.cz/files/H2020-Technologytransfer.pdf

3.9 Strategy for setting up and support of spin-off firms or other forms of commercialization of R&D&I results (can be extended to the whole university, emphasising the specific features of the evaluated unit)

The evaluated unit gives a concise account of the practical use of its intellectual property in the form of setting up spin-off firms or other forms of commercialising R&D&I results (both with or without the

participation of the university) established by the evaluated unit (university), another entity controlled by the evaluated unit (university), or an employee of the evaluated unit, presenting the model for their functioning and coordination, and control of intellectual property management of the evaluated unit (university).

Self-evaluation:

CTU has a Technology Transfer Office, the InQBay incubator, and a strategy for commercializing the university's IP.

HTML links to additional documentation:
http://evaluation-cvut.cz/files/H2020-Technologytransfer.pdf

RECOGNITION BY THE SCIENTIFIC COMMUNITY

3.10 The most significant individual awards for R&D&I

The evaluated unit presents a maximum of ten examples of the most significant R&D&I awards received (in the Czech Republic and in other countries) in the 2014–2018 reporting period.

Self-evaluation:
Faculty members won a significant number of national and international distinctions, among others:

Becquerel Prize for Nuclear - Petr Distler, 2018
Fellow of the Optical Society of America - Igor Jex, 2018
RHIC & AGS Thesis Award - best PhD thesis award for RHIC physics - Jan Rusňák, 2018
Medal of the Slovak Chemical Society at SAS - Jan John, 2017
ENEN PhD Event & Prize - Martin Ševeček, 2017
Neuron Prize for outstanding contributions to science - Pavel Exner, 2016
Siemens Award - Neda Neyková, 2016
CERN fellow - Zdeněk Hubáček, 2012-2015
Jaap Schijve Award of NLR and the Delft University of Technology - Martin Kadlec, 2015
Václav Votruba Prize for the best PhD thesis in theoretical physics - Jan Vysoký, 2015

HTML links to additional documentation:
https://www.osa.org/en-us/awards_and_grants/fellow_members/fellow_profiles/igor_jex/

3.11 Recognition by the international R&D&I community

The evaluated unit provides the following information / examples demonstrating recognition by the international scientific community in the 2014–2018 reporting period, with a commentary:

It presents a maximum of ten examples of its academic staff's participation on the editorial boards of international scientific journals (e.g. editor, member of the editorial board) in the appendix (table 3.11.1),
It presents a maximum of ten examples of the most significant invited lectures by the evaluated unit's academic staff abroad in the appendix (table 3.11.2),
It presents a maximum of ten examples of the most significant lectures by foreign scientists and other guests relevant to the R&D&I field in the appendix (table 3.11.3),
It presents a maximum of ten examples of the most significant elected memberships of professional societies (table 3.11.4).

Self-evaluation:
The members of the faculty are active members of the international scientific community. Their contributions are recognized by invitations to serve the community in various roles in editorial boards, committees and supervising bodies. The faculty is well integrated into international research networks.

HTML links to additional documentation:

POPULARISATION OF R&D&I

3.12 The most significant activities in the popularisation of R&D&I and communication with the public

The evaluated unit gives a concise account of its main activities in the area of popularisation of R&D&I and communication with the public in the 2014–2018 reporting period, and presents a maximum of ten examples that it considers the most significant.

Self-evaluation:
The faculty is very active in the field of popularization of science. It organizes:

- **Activities for high school students** comprising popular lectures, hands-on activities in the laboratories and research mini-projects, e.g. **Week of Science**, **CERN MasterClasses**, **Radiological physicists for a day,** and **Female scientist for a day**; and co-organizes scientific competitions like **Young Physicists' Tournament**, a **Mathematics Olympiad** and others.
- **Activities for the general public,** e.g. **presentation of faculty's unique facilities** during **Prague Night of Museums** and **Night of Scientists,** and **series of popular lectures,** e.g. weekly series **Tuesdays with Science** at the Děčín branch of the Faculty, **University of the Third Age courses**, and **active participation of academic staff** in television and radio interviews and in shows on science topics of current public interest.
- **Activities for the general academic community,** open to the interested general public, e.g. **regular Faculty Colloquia** and the activities of the **Prague EPS Young Minds Section,** which is hosted by the faculty.

Some of the outreach activities are organized in collaboration with the **Union of Czech Mathematicians and Physicists,** of which the faculty is a collective member.

HTML links to additional documentation:
http://www.physicsmasterclasses.org/
http://www.physicsmasterclasses.org/index.php?cat=country&page=cz_prague_ctu

APPENDICES (TABLES)

3.2 Applied research projects

3.2.1 Projects supported by a provider from the Czech Republic

As the beneficiary						
Provider	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
Czech Science Foundation (GACR)	Advanced Lagrangian and ALE methods for compressible fluids and elasto-plastic solids dynamics					39,89
Czech Science Foundation (GACR)	Advanced Lagrangian Methods for Computational Hydrodynamics	12,02				
Czech Science Foundation (GACR)	Advanced preparation methods and experimental research of doped perovskite thin-film systems for high density energy storages	77,29				
Czech Science Foundation (GACR)	Advanced simulation studies of ion acceleration by ultrashort intense laser pulses	12,35				
Czech Science Foundation (GACR)	Algorithms, Dynamics and Geometry of Numeration Systems	54,19	54,69	55,19	55,64	
Czech Science Foundation (GACR)	An information-theoretical perspective on complex systems				37,98	39,00
Czech Science Foundation (GACR)	Application of generalized statistics in critical phenomena and financial markets	15,04				

Czech Science Foundation (GACR)	Aspects of strong interactions in extreme conditions				56,70	58,22
Czech Science Foundation (GACR)	Complex functionally graded materials	192,90				
Czech Science Foundation (GACR)	Detection of stochastic universalities in non-equilibrium states of socio-physical systems by means of Random Matrix Theory		28,99	29,26	30,04	
Czech Science Foundation (GACR)	Diode pumped high power picosecond laser system	44,24	45,08	45,94		
Czech Science Foundation (GACR)	Equilibrium formation in quantum networks			42,91	44,06	45,24
Czech Science Foundation (GACR)	GaN-diode pumped Praseodymium laser systems	17,07				
Czech Science Foundation (GACR)	Harnessing the Power of Quantum Walks	73,73	74 ,41	75,09		
Czech Science Foundation (GACR)	Impact of radiation on distinctive physical properties of advanced materials for nuclear facilities	56,66	57,18	57,71		
Czech Science Foundation (GACR)	Investigation of shallow subsurface flow with phase transitions				93,24	86,11

Czech Science Foundation (GACR)	Lagrangian and ALE methods for mechanics of compressible fluids and elastic-plastic solids	37,59	37,94	38,29		
Czech Science Foundation (GACR)	Mid-infrared solid-state lasers	40,97				
Czech Science Foundation (GACR)	Modelling of the color structure of the events in hadron-hadron collisions					44,46
Czech Science Foundation (GACR)	Non-destructive evaluation via Barkhausen noise emission				4,75	4,87
Czech Science Foundation (GACR)	Novel effects and functionalities in subwavelength guided-wave photonic structures			66,62	68,40	70,23
Czech Science Foundation (GACR)	Optimization of solid-state laser active materials for the spectral range from near-up to mid-infrared					91,72
Czech Science Foundation (GACR)	Photonic Quantum Networks				92,56	95,04
Czech Science Foundation (GACR)	Plasma optics for ultra-intense laser physics experiments					97,22
Czech Science Foundation (GACR)	Pulse Source of Soft X-ray for Biomedical Applications	52,92				

Czech Science Foundation (GACR)	Quantum mechanics with non-self-adjoint operators: transition from spectra to pseudospectra					42,90
Czech Science Foundation (GACR)	Searching for signatures of saturation: energy dependence of J/Psi photoproduction with ALICE proton - lead data					54,95
Czech Science Foundation (GACR)	Solvable models of quantum walks and their applications	19,14	19,32	19,49		
Czech Science Foundation (GACR)	Spectral analysis of operators and its applications in quantum mechanics	14,20	14,33			
Czech Science Foundation (GACR)	Superintegrable systems in magnetic fields in three spatial dimensions				41,51	43,83
Czech Science Foundation (GACR)	Synchronously pumped optical parametrical oscillator for sensing applications	10,53				
Czech Science Foundation (GACR)	Temperature influence on spectroscopic and lasing characteristics of solid-state materials covering the spectral range from visible up to mid-infrared		69,71	70,36	72,24	
Czech Science Foundation (GACR)	Two scales discrete-continuum approach to dislocation dynamics	29,24	29,51			
Czech Science Foundation (GACR)	Ultra-intense laser interaction with specially-designed targets as a source of energetic particles and radiation		50,69	50,49	51,58	

Czech Science Foundation (GACR)	Vacuum structure in Quantum Field Theories	36,54	36,87	37,21		
Ministry of Education, Youth and Sports	Advanced fuels for generation IV reactors: reprocessing and dissolution	71,33	71,99			
Ministry of Education, Youth and Sports	Advanced methods for X-metrology and imaging	17,58	14,66	17,87		
Ministry of Education, Youth and Sports	Advanced statistical analysis and non-statistical separation techniques for physical processing detection in data sets sampled by means of elementary particle accelerators	96,18				
Ministry of Education, Youth and Sports	Application of magnetic and stress anisotropy for a study of surface integrity	1,82	1,83			
Ministry of Education, Youth and Sports	Asymptotic dynamics of quantum Markov processes					3,31
Ministry of Education, Youth and Sports	Brookhaven National Laboratory – participation of the Czech Republic			268,08	251,84	260,97
Ministry of Education, Youth and Sports	Center for advanced applied science					586,64[4]

[4] The project was initiated 1/8/2018, the sum corresponds to the actual approved expenditure for 2018. Provider transferred funds in 2019.

Ministry of Education, Youth and Sports	Computational Methods in the Thermodynamics of Multicomponent Mixtures	26,08	26,32			
Ministry of Education, Youth and Sports	Computer and technical infrastructure platform for the realization of a novel doctoral program in Quantum technologies				93,89	593,85
Ministry of Education, Youth and Sports	Developing the Physics for Inertial Confinement Fusion at the time of NIF ignition	27,24	22,80	27,4	8,09	
Ministry of Education, Youth and Sports	Development and Validation of Porous Media Fluid Dynamics and Phase Transitions Models for Subsurface Environmental Application	13,77	13,96	15,17		
Ministry of Education, Youth and Sports	Hadron structure in heavy ion collisions				31,60	53,46
Ministry of Education, Youth and Sports	High Temperature Plasma and Fusion Technology Laboratory PlasmaLab@CTU				125,56	224,54
Ministry of Education, Youth and Sports	Integration of prof. Guillermo Contreras in the activity of the Centre for Physics of Ultra-relativistic Heavy Ion Collisions at FNSPE CTU	108,23	112,08	116,12		
Ministry of Education, Youth and Sports	International doctoral programme in high-temperature plasma and nuclear fusion				41,02	66,02
Ministry of Education, Youth and Sports	Laboratories for the doctoral programme in Nuclear Safety, Security and Forensics				83,55	501,89

Ministry of Education, Youth and Sports	New families of special functions of several variables and their properties	2,9				
Ministry of Education, Youth and Sports	New challenges for extension theory of operators in modern physics					2,11
Ministry of Education, Youth and Sports	Novel plasmonic and metamaterial nanoscale structures		4,07	19,16	19,67	
Ministry of Education, Youth and Sports	A novel research-oriented doctoral program in Quantum Technologies				43,98	78,70
Ministry of Education, Youth and Sports	Nuclear Safety, Security and Forensics				74,52	152,87
Ministry of Education, Youth and Sports	Participation of the Czech Republic in experiments at the Brookhaven National Laboratory, USA		37,24	138,09	141,78	
Ministry of Education, Youth and Sports	Picosecond resolution photon detectors for deep space missions	5,08	5,13			
Ministry of Education, Youth and Sports	Research on crystal growth, spectral properties and laser performance of rare earth ion doped fluoride single crystals					6,59
Ministry of Education, Youth and Sports	Research on laser time transfer and SLR technology with picosecond accuracy and stability				4,71	5,42

Ministry of Education, Youth and Sports	Safety of actinide separation processes	10,68	10,78	1,81		
Ministry of Education, Youth and Sports	Strengthening and development of research at Czech Technical University in Prague with the use of research infrastructure VR-1 Training Reactor for research activities				177,17	175,72
Ministry of Education, Youth and Sports	Study of transmutation of Ra-226 and its separation from activation products	132,71	94,27			
Ministry of Education, Youth and Sports	Study on the rare-earth ions doped fluoride single crystals	17,25	18,91			
Ministry of Education, Youth and Sports	Support for activities in the Division of Nuclear and Radiochemistry (DNRC) EuCheMS	2,54	2,57			
Ministry of Education, Youth and Sports	Support for activities in the Division of Nuclear and Radiochemistry (DNRC) EuCheMS				2,89	2,96
Ministry of Education, Youth and Sports	Symmetry methods for differential equations and their discretizations			3,51	3,61	
Ministry of Education, Youth and Sports	VR - Research and development support of the Training Reactor operation	86,08	86,87			
Ministry of Education, Youth and Sports	VR-1 – Training Reactor for Research Activities			87,67	73,45	76,16

Ministry of Education, Youth and Sports	X-ray Optics for Astrophysics	19,94	25,58	22,97		
Ministry of Finance	Advanced analysis of experimental data in nuclear and particle physics			24,9		
Ministry of the Interior	Composite filters for purifying radioactive wash-fluids				126,78	147,95
Ministry of the Interior	Prevention, preparedness and reduction of the consequences of serious accidents at the Czech nuclear power plants in connection with new experience obtained from stress tests after the Fukushima accident	1 162,35	820,44			
Ministry of the Interior	The MONTE-1 new generation testing device at the VR-1 training reactor to allow advanced testing of the detection equipment of monitoring and intervening groups in the case of nuclear accidents and equipment for the early detection network	423,27	140,82			
Technology Agency of the Czech Republic	Advanced Ionizing Radiation Detection Systems	1 125,92	1 136,24	1 146,75	1 168,06	1 208,91
Technology Agency of the Czech Republic	ASIC detection for orbital cosmic radiation measurements				17,20	86,61

Technology Agency of the Czech Republic	New processes and materials for the separation of anionic contaminants from liquid radioactive waste			35,25	56,25	58,89
Technology Agency of the Czech Republic	Novel composite materials for separating medical radionuclides					78,85
Technology Agency of the Czech Republic	Ra-226 recycling and Ac-227 applications.	166,38	210,13	193,87		
Total		4 313,95	3 301,00	2 707,18	3 194,32	5 186,10

As another participant

Provider	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
Czech Science Foundation (GACR)	Bragg fibers for delivery of high laser powers	25,35	25,58			
Czech Science Foundation (GACR)	Bragg fibers for delivery of laser radiation in the1900-2300 nm spectral region			53,53	54,96	56,43
Czech Science Foundation (GACR)	Damage to model biomembranes and living cell surfaces induced by extreme ultraviolet laser radiation	26,15	26,39	26,63		
Czech Science Foundation (GACR)	Engineering of surface-modified optical processes in molecules and semiconductor quantum dots by plasmon resonances in metal nanoparticle assemblies.	16,34				

Czech Science Foundation (GACR)	Inorganic nanoscintillators: novel synthesis and size-dependent characteristics.	34,87	35,19	35,51		
Czech Science Foundation (GACR)	Large structures in the boundary layers over complex surfaces in high Reynolds numbers					31,47
Czech Science Foundation (GACR)	Multidisciplinary research centre for advanced materials	90,80	106,29	107,28	94,95	97,49
Czech Science Foundation (GACR)	Nanobiophotonics for future health care	41,22	42,19	43,69	45,46	47,38
Czech Science Foundation (GACR)	New substrates and approaches for sensitive and reproducible biomolecular sensing by means of surface-enhanced Raman scattering (SERS) spectroscopy	34,03	34,34	34,66	35,59	
Czech Science Foundation (GACR)	Novel approaches to surface-enhanced optical spectroscopy for ultimate and specific biosensing					30,30
Czech Science Foundation (GACR)	Preparation of NiTi shape memory alloys by reactive sintering	38,43	38,78	39,14		
Czech Science Foundation (GACR)	Processing of innovative iron-based intermetallics by mechanical alloying and spark plasma sintering				36,12	37,09

Czech Science Foundation (GACR)	Radiation processes generated by runaway electrons in tokamaks					50,23
Czech Science Foundation (GACR)	Study of nuclear matter in ultra-relativistic heavy-ion collisions at RHIC	81,76	82,51	81,86		
Czech Science Foundation (GACR)	Synthesis, characterization and tailoring the properties of luminescent nanocomposites				36,16	37,13
Czech Science Foundation (GACR)	Thermal Energy Storage Materials: Thermophysical Characteristics for the Design of Thermal Batteries				26,28	26,99
Ministry of Culture	Historical technologies and modern methods of research. The interpretative possibilities of specialized methods for research on medieval artworks using innovative technologies.	25,71	21,08	18,68	19,94	
Ministry of Culture	Physical and chemical analytical methods, and their application in research on items in the collection of the National Technical Museum with regard to their restoration and preventive conservation	15,00	15,50			
Ministry of Education, Youth and Sports	BIO-XUV Research Team Advancement at FBME CTU	217,74				

Ministry of Education, Youth and Sports	Collaboration of the Czech Republic with CERN	192,86	184,33			
Ministry of Education, Youth and Sports	Collaboration on experiments in the Fermi National Accelerator Laboratory, USA					87,74
Ministry of Education, Youth and Sports	Collaboration on experiments in the Fermi National Accelerator Laboratory, USA		15,94	58,63	60,20	
Ministry of Education, Youth and Sports	Collaboration on the NOvA and D0 Experiments at the Fermi National Laboratory, USA	52,12				
Ministry of Education, Youth and Sports	Facility for Antiproton and Ion Research – participation of the Czech Republic			31,00	40,07	32,96
Ministry of Education, Youth and Sports	Getting new knowledge of the microworld using the CERN infrastructure				14,24	101,24
Ministry of Education, Youth and Sports	The ATLAS-CERN international experiment	195,66	176,23			
Ministry of Education, Youth and Sports	Investigation of the microworld using the CERN Infrastructure			31,00	41,09	
Ministry of Health of the Czech Republic	New multistage nanodiagnostics for cancer imaging and for predicting the efficacy of antiangiogenic therapy			36,99	48,31	50,58

Ministry of Health of the Czech Republic	Quantitative mapping of the myocardium and flow dynamics using MRI in patients with non-ischemic cardiac disease - methodology improvement		30,09	48,27	46,71	47,97
Ministry of Education, Youth and Sports	Research Infrastructure for Experiments at CERN			454,67	413,60	425,93
Ministry of Education, Youth and Sports	Research Infrastructure for Fermilab Experiments			94,74	87,20	90,28
Ministry of Education, Youth and Sports	Study of new properties of nuclear matter in the STAR international experiment					105,41
Ministry of Education, Youth and Sports	Study of nuclear matter in extreme conditions - CBM and HADES experiments	8,72				
Ministry of Education, Youth and Sports	Ultra-trace isotope research in social and environmental studies using accelerator mass spectrometry					66,67[5]
Ministry of Industry and Trade	Development of the intermediate level for an upgrade of the SEJVAL radiation monitoring system			16,65	34,94	37,44
Ministry of Industry and Trade	Dose Guided Radiotherapy System					63,84

[5] The project was initiated 1/3/2018; the sum corresponds to the actual approved expenditure for 2018. The provider transferred funds in 2019.

Ministry of Industry and Trade	Ex-core equipment for neutron flux monitoring and safety functions of the nuclear reactor	78,63	75,14			
Ministry of Industry and Trade	Laser surface processing optimization of engineering components for enhancing their quality properties	47,94				
Ministry of Industry and Trade	Lightweight Orbital Radiation Detection System					86,57
Ministry of Industry and Trade	Material and process capability of thin Al foil				15,19	27,30
Ministry of Industry and Trade	MEXPAL - Methodology for an expert system for checking the cladding integrity of the fuel used in pressurized nuclear power plants	14,53				
Ministry of Industry and Trade	Monolithic pixel detector for the detection of ionizing radiation					90,47
Ministry of Industry and Trade	New laser rods and discs for modern diode pumped lasers			10,00	24,07	25,00
Ministry of Industry and Trade	A low power nuclear reactor for heat and electricity generation in the CR	38,14				
Ministry of Industry and Trade	A recyclable decontamination solution for decommissioning of nuclear facilities			36,99	49,37	50,70
Ministry of Industry and Trade	Research and development of new tungsten pseudoalloys for optimizing industrial applications and			18,50	45,58	46,80

	manufacturing technology					
Ministry of Industry and Trade	Research and development of technological methods for radiation-induced production of advanced nanomaterials					29,87
Ministry of Industry and Trade	Research and development of radwaste treatment technologies and of the radwaste management system for nuclear new builds	99,12				
Ministry of Industry and Trade	Safety of the New Generation of Nuclear Power Plants	60,00				
Ministry of the Interior	More accurate prediction of the radiological consequences of severe accidents at NPP aimed at identifying the risks				86,94	90,08
Ministry of the Interior	Research on modern methods for detecting and identifying hazardous CBRN substances and materials, hazard reduction methods and decontamination methods, research on modern methods for protecting staff and elements of the critical infrastructure	7,65	3,00			
Ministry of the Interior	Use of nanotechnology to minimize radionuclide contamination of the environment	29,86	22,39			

Technology Agency of the Czech Republic	ANDREA 3: Advanced SW for steady state and transient analysis of nuclear reactors					7,53
Technology Agency of the Czech Republic	Application of laser technologies in transportation engineering	33,71	34,01			
Technology Agency of the Czech Republic	Assurance of Safe and Long Term Operation of Nuclear Reactor Pressure Vessel Internals				11,32	16,18
Technology Agency of the Czech Republic	An uncertainty evaluation of core physics calculations and its impact on core reload safety assessment	5,63	13,93	15,72	8,81	
Technology Agency of the Czech Republic	Development of an innovative semi-destructive procedure for evaluating highly-active materials for a lifetime assessment of nuclear reactor components	28,15	28,41			
Technology Agency of the Czech Republic	Development of a procedure for evaluating the degradation of the properties of the irradiated materials properties of hard-to-replace components of nuclear power plants with the use of punch tests	22,88				
Technology Agency of the Czech Republic	Dynamic Lithium-ion battery management for hybrid electric vehicles	14,49	43,87	44,28	30,31	
Technology Agency of the Czech Republic	Improvement of nuclear power reactor neutron-physical characteristics using reactor operation records				15,46	18,09

Technology Agency of the Czech Republic	Improving the precision of computational methods used in nuclear reactor analysis leading to accurate results and efficient fuel usage	17,94	14,81			
Technology Agency of the Czech Republic	Increasing the utilization of nuclear fuel by optimizing the inner fuel cycle and by calculating the neutron-physical characteristics of nuclear reactor cores	37,77				
Technology Agency of the Czech Republic	Innovative methods for nuclear plant safety evaluation based on SHM technologies and related procedures - NEMENUS (NEw MEthods for NUclear Safety)					21,92
Technology Agency of the Czech Republic	Innovative methods for weld of high pressure devices using laser technologies				37,98	39,00
Technology Agency of the Czech Republic	Large-size Oxidic Single Crystals for High-tech Optoelectronic Applications	18,20	19,68	20,27		
Technology Agency of the Czech Republic	LPopt2 – An effective and reliable tool for optimized design of nuclear reactor loading patterns based on the pareto optimality approach				14,70	15,01
Technology Agency of the Czech Republic	Methods for combined analysis of neutron-physical core characteristics and fuel thermo-mechanical properties	22,88	19,06			

Technology Agency of the Czech Republic	Research on Ionic Liquids for Application in Separation Processes		35,92	38,36	36,50	39,85
Technology Agency of the Czech Republic	The Automated Atlas Segmentation of Anatomical Structures for Radiotherapy Planning Systems (RT ATLAS)					23,40
Technology Agency of the Czech Republic	Research on reprocessing used medical sealed sources for use in industrial and medical applications	23,97				
Technology Agency of the Czech Republic	Visualization of NPP Severe Accident Progress for Training on SAM (VINSAP)		41,09	42,5	42,23	
Total		1 698,25	1 185,75	1 439,55	1 554,28	2 152,34

3.2.2 Projects supported by a provider from another country

As the beneficiary						
Provider	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
European Commission (7 FP)	Cooperation in education and training In Nuclear CHemistry	62,90	70,00	31,90		
European Commission	A Modular European Education and Training Concept In Nuclear and RadioCHemistry				38,00	66,00
European Commission	GEN IV Integrated Oxide fuels recycling strategies				12,00	21,00
European Commission	Strengthening Cooperation and Exchange for Nuclear Education and Training between the European Union and the Russian Federation	7,00	15,00	15,00	7,00	

IAEA Vienna International Atomic Energy Agency	Development and Testing of Coated Fuel Cladding for VVER Reactors with Enhanced Accident Tolerance			4,00	4,00	
European Space Agency	Network for Exploration and Space Science				14,00	14,00
European Space Agency	Comparison of optical time-transfer links					
European Space Agency	Space Situational Awareness Programme P2-SST-VII Expert Coordination Centres (phase 1)			6,00	6,00	6,00
European Space Agency	ISS - Space Optical Clock Mission, phase-A study			4,00	4,00	4,00
European Commission	Cooperation in education and training In Nuclear Chemistry	63,00	63,00	26,00		
Total		132,90	148,00	86,90	85,00	111,00

As another participant						
Provider	Project title	Support (EUR thousand)				
		2014	2015	2016	2017	2018
European Commission	Safety of ACtinide Separation proceSSes	34,20	34,10	17,10		
European Commission	Advanced fuelS for Generation IV reActors: Reprocessing and Dissolution	49,34	49,30	40,00		
European Commission	Advanced Networking for Nuclear Education and Training and Transfer of Expertise			12,00	12,00	12,00
European Commission	Cooperation in education and training In Nuclear Chemistry	63,00	63, 00	26,00		
Total		146,54	146,40	95,10	12,00	12,00

3.3 Contract research

3.3.1 Research work contracted by a client from the Czech Republic

Client	Research title	Revenues (EUR thousand)				
		2014	2015	2016	2017	2018
AERO Vodochody	Assessment of the causes of fracture of parts of proceedings					7,79
AL INVEST Břidličná, a.s.	Verification of the application of a numerical model for thin aluminium foils			11,09		
Amec Foster Wheeler s.r.o.	Specification of input data needed for GoldSim software, analysis of the possibilities of realizing a repository model in the GoldSim environment			3,69	22,78	
Bileto s.r.o.	Design and processing of mathematical and stochastic models for predicting customer behaviour in transport (demand forecasts, reservations, customer portfolio segmentation), including related software development		4,21			
Continental Automotive s.r.o	Measurements of residual stresses				3,82	
CSRC, spol. S. r.o.	Cooperation in the design, construction and testing of equipment for accurate time transfer of laser pulses from the ground to the satellite for the ACES space project		18,17			
Czech Radioactive Waste Repository (SÚRAO)	Research on an evaluation of the uncertainty of safety analyses of the deep repository of radioactive wastes, and an analysis of their sensitivity to spatial and temporal changes in the parameters of the repository system critical for safety assessment	18,16	25,73	27,74		

Czech Radioactive Waste Repository Authority (SÚRAO)	Interaction of radium with cementitious materials	7,26				
ČEZ, a.s.	Biomonitoring of the effects of a nuclear power plant on the environment	10,08	10,26		10,63	10,91
ČZ a.s.	Fractographic analysis of selected turbocharger parts	5,44	5,13	9,43		10,13
DIAMO, state enterprise	Radionuclides in the flood area of Ploučnice in Srní potok			5,54		
Doosan Škoda Power s.r.o.	Fractographic analysis of power plant turbine blades	4,72	6,23	11,46		
ELEMENT MATERIALS TE	Measurement of residual stresses		4,06			
FERJENCIK MILOS ING.	Support for a safety analysis of Temelín nuclear power plant operation				5,02	
GE Aviation Czech s.r.o.	Measurements of residual stresses		6,98			
HVM PLASMA, spol. s r.o.	Parameter measurements and laser description	7,26	7,33			
CHARVÁT AXL, a.s.	Surface residual stress measurements on ground surfaces				8,89	4,15
Institute of Applied Mechanics Brno., s.r.o.	Metallographic analysis of damage to welded tubes cut at NPP Dukovany		11,36	5,54	25,06	17,54

Institute of Health in Ústí nad Labem	Design and processing of mathematical and stochastic models for predicting customer behaviour in transport (demand forecasts, reservations, customer portfolio segmentation), including related software development	7,11				
Institute of Physics of Materials of the Academy of Sciences of the Czech Republic, v.v.i..	Fractographic analysis of failure and fracture of creep test samples of welded heterogeneous joints of steels P91 and P92	13,50	13,63			
Magna Automotive (CZ) s.r.o.	Material expertise				5,69	
Mondi Štětí	Evaluation of paper micromorphology				3,79	
Nuclear Research Institute Řež, a.s	Technical report on the effect of ionizing radiation on the corrosion of selected materials for the storage package			11,09		
Nuclear Research Institute Řež, a.s	Research support for a safety assessment of a deep geological repository		99,42	100,87	123,28	83,13
Nuclear Research Institute Řež, a.s..	Refining information on the exposure of persons based on measurements		16,26			
NUVIA A. S.	Design of a monitoring system for ELI		4,65			
NUVIA A. S.	Simulations and calculations for verification of cyclotron cell shading structures for parameters after a					9,16

	cyclotron upgrade, including design modifications to existing cyclotron cell cubes					
PASQUALE ALESSANDR	Development of a tomographic model of aluminium casting		4,61			
Robert Bosch, spol. s r.o.	A condensation model for estimating the liquid water volume in an exhaust system	7,71	15,57	15,71	18,83	19,33
SKODA AUTO,A.S.	A mathematical-stochastic model for optimizing the engine compartment control process					40,94
Smart Brain s.r.o.	Assembly of noise measuring equipment	6,73	20,26	3,69		
State Office for Nuclear Safety	Critical background research			4,89		
State Office for Nuclear Safety	Revision of written and oral questions for nuclear research facilities				23,75	
State Office for Nuclear Safety	An educational text on the importance of natural radiation sources and the effects of ionizing radiation on humans					10,15
State Office for Nuclear Safety	An independent evaluation of unusual events in the operation of the Temelín nuclear power plant for the year 2018					15,47
State Office for Nuclear Safety	Testing and comparing in personal dosimetry	9,00	9,08	9,17	9,41	9,66
State Office for Nuclear Safety	An analysis of legislative requirements in the field of nuclear safety provision for nuclear research facilities	5,92				

ŠKODA JS a.s.	An assessment of selected parts of the safety documentation of the ŠKODA MNSR transport container			19,73		17,90
UJP PRAHA a.s.	An evaluation of fracture surfaces using SEM	5,44	5,49	7,39	8,88	7,79
WATREX Praha, s.r.o.	Development and testing of sorbents for chromatography		5,31			
Contract research under 4 000 EUR		23,52	16,37	43,74	14,84	29,09
Total		131,85	310,11	290,77	284,67	293,14

Note: List and describe contract research work with the revenue for the calendar year in question.

3.3.2 Research work contracted by a foreign client

Client	Research title	Revenues (EUR thousand)				
		2014	2015	2016	2017	2018
BSH Bundesamt für Seeschifffahrt und Hydrographie	Sorbent production KNiFC-PAN resin (0.1-0.7 mm		7,76	8,18		
JRC Petten European Commission - Institute for Energy	Fractographic analysis of specimens after SSRT or growth rate material test	4,50	6,75		3,69	
TrisKem International	Sorbent production AMP-PAN, KNiFC-PAN and analytical services	8,49	6,73	6,87		

Woods Hole Oceanographic Institution	Sorbent KNiFC-PAN	4,70				
Contract research under EUR 4 000		1,31	3,50	0,64	3,23	6,64
Total		19,00	24,74	15,69	6,92	6,64

Note: List and describe contract research work with the revenue for the calendar year in question.

3.4 Revenues from non-public sources (besides grants or contract research)

3.4.1 Overview of revenues from non-public sources raised for the 2014–2018 reporting period

Revenue type	Revenues (EUR thousand)				
	2014	2015	2016	2017	2018
Licences sold	0	5,15	1,85	0,07	0,07
Gift	11,74	14,80	8,00	8,30	8,40
Total	11,74	19,95	9,85	8,37	8,47

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

3.5 Applied research results with an economic impact on society

3.5.1 Overview of applied research results in the 2014–2018 reporting period

List and describe the results that have already been applied in practice, or that will realistically be applied, with an existing or prospective economic impact on society. Under "patents" and "licences sold", list all the results; under other results list a *maximum* of five items. Unless otherwise specified below, the definition of a result must correspond to the definitions under the Methodology for Evaluating Research Organisations and Research, Development and Innovation Purpose-Tied Aid Programmes, Appendix No 4: Definitions of Types of Results.

Results	Year	Title
European patent		
EP2384741	2015	Topical product
American patent		
Czech licenced patent		
CZ 305779	2016	System to measure lattice parameter, especially on single crystal samples and polycrystalline materials
CZ 305761	2016	Plastic scintillator on the basis of polystyrene used as detectors
CZ 305762	2016	Polystyrene plastic scintillator used as detectors

CZ 305286	2015	System for measuring residual tension in polycrystalline materials using X-ray diffraction method
Other foreign patents		
Licences sold	2017	Software license - Honeywell Prague Laboratory - BatterySim, High Fidelity Numerical Simulator of Lithium-Ion Cell Dynamics
	2016	Patent license Matex PM s.r.o, System for measuring lattice parameter, especially on single crystal samples and polycrystalline materials
	2015	Patent license Matex PM s.r.o, System for measuring residual tension in polycrystalline materials using X-ray diffraction method
	2015	Software license - Bileto, s.r.o. - Software for the Bileto reservation system
Significant analyses / surveys / studies	2016	Analysis of pipe welding joints from the Dukovany nuclear power plant
	2016	Biomonitoring of the deposition of radionuclides in the neighborhood of NPP Temelin
	2016	Study on various aspects of proton therapy
	2015	Development and testing of sorbents for chromatography
	2014	Characteristics of spent nuclear fuel of small modular reactors, and a comparison with current reactors
Spin-off with a stake held by the evaluated unit		
Spin-off with no stake held by the evaluated unit		
Prototypes	2018	Compact head for a microchip laser
	2018	Multilayer detection device based on semiconductor radiation detectors for in-situ characterization of cosmic rays
	2016	A semiconductor strip sensor optimized for gamma radiation monitoring (functional sample)
	2016	Space Surveillance and Tracking (SST) calibration standard demonstration unit (functional sample)
	2015	Equipment for photochemical preparation of metal nanoparticles or metal oxides
Varieties and breeds		

Other	2018	A method for removing cobalt from aqueous solutions - EU patent application
CZ 306880	2017	A method for processing hazardous and radioactive wastes - Czech patent

Note: "Licence" refers to a licence for a result of R&D&I in the broadest sense of the word (licences for patents, utility models, industrial designs; copyright licences for software and other works, and any other licences).

For the purposes of this methodology, a "spin-off" is a juridical person established to commercialise knowledge, usually with the inclusion/transfer of the rights to this knowledge to such juridical person. List all instances of legal persons.

3.6 Significant applied research results with an impact other than an economic one on society

3.6.1 Overview of applied research results for the 2014–2018 reporting period with an impact other than an economic one on society

Result type	Name	Anticipated impact
Prototype and Applied Certified Methodology	Prototype of a device for confocal X-ray fluorescence analysis (2015) and an applied certified methodology for confocal X-ray fluorescence analysis (2018)	Non-destructive 3D elemental analysis of cultural heritage objects without taking samples.
Applied Certified Methodology	A methodology for testing the detection system responses of mobile groups in a real field of fission radionuclides created by the VR 1 experimental low power training reactor	Tests on various detection systems for emergency monitoring during an elevated dose rate in real gamma-ray fields allow more reliable measurements of dose rates by first responders in the event of a nuclear accident or a radiation hazard.
Experimental program	Analysis of the attrition of the Sigismund bell in the St. Vitus Cathedral in Prague	Preservation of the Sigismund bell, the largest in the country, for future generations, including its ability to ring without restrictions.
CLA publication	DNA strand breaks induced by soft X-ray pulses from a compact laser plasma source	A significant contribution to the relevant field of science. Global impact, Number of citations, Development of new analytical instrumentation.
Article	Discrimination between Alzheimer's disease and amyotrophic lateral sclerosis via an affine invariant spherical harmonics analysis of SPECT images	Reliable early diagnosis of Alzheimer's Disease using improved algorithmic evaluation of Single Photon Emission Computed Tomography (SPECT) data.

Note: List and describe a maximum of five results (in line with the Definitions of Types of Results) that have already been applied in practice, or that will realistically be applied. These are typically results from disciplines in the humanities and social sciences, for which you should briefly describe their anticipated impact.

3.11 Recognition in the international R&D&I community

3.11.1 Participation of the evaluated unit's academic staff on the editorial boards of international scientific journals in the 2014–2018 reporting period

Name, surname and title(s) of the evaluated unit's member of staff	Title, publisher, city(-ies) and country(-ies) of origin of the scientific journal
Pavel Exner, prof. RNDr., DrSc.	Journal of Mathematical Analysis and Applications, Elsevier, Amsterdam, The Netherlands, Associate Editor
Tomáš Hobza, doc. Ing., Ph.D.	Kybernetika - International journal of the Institute of Information Theory and Automation, Nakladatelství Academia, Prague, Czech Republic, Editorial Board Member
Helena Jelínková, prof. Ing., DrSc.	Progress in Quantum Electronics, Elsevier, Amsterdam, The Netherlands, Editor
Jan John, prof. Ing., CSc.	Radiochimica Acta, International Journal for chemical aspects of nuclear science and technology, Berlin, Germany, Advisory Board
Milan Kálal, doc. Ing., CSc.	Laser and Particle Beams, Cambridge, United Kingdom, Editorial Board Member
Václav Klika, doc. Ing., Ph.D.	Journal of Non-Equilibrium Thermodynamics, De Gruyter, Berlin, Germany, Editorial Advisory Board Member
Ladislav Musílek, prof. Ing., CSc.	Journal for Radiation Physics, Radiation Chemistry and Radiation Processing, Elsevier, Amsterdam, The Netherlands, Associate Editor in Radiation Physics
Mojmír Němec, doc. Ing., Ph.D.	Journal of Radioanalytical and Nuclear Chemistry, Springer International Publishing, Heidelberg, Germany, Associated Editor
Pavel Šťovíček, prof. Ing., DrSc.	Journal Nanosystems: Physics, Chemistry, Mathematics, St. Petersburg, Russia, Editorial Board Member
Jan Vybíral, doc. RNDr., Ph.D.	Journal of Complexity, Elsevier, Amsterdam, The Netherlands, Associate Editor

Note: List a maximum of ten examples of academic staff's participation on the editorial boards of international scientific journals (e.g. editor, member of the editorial board, etc.).

3.11.2 The most significant invited lectures by the evaluated unit's academic staff at institutions in other countries during the 2014–2018 reporting period

Name, surname and title(s) of the evaluated unit's member of staff	Invited lecture title	Name of the host institution, conference or other event
Jan Pšikal, doc. Ing. Ph.D.	Laser-accelerated energetic protons from specially designed targets	35th European Conference on Laser Interaction with Matter, Rethymno, Greece, 22-26 October, 2018
Ladislav Pína, doc. Ing., DrSc.	Workshop on X-Ray Optics	The international society for optics and photonics, San Diego Convention Center San Diego, California, United States, 19-23 August, 2018
Jiří Limpouch, prof. Ing. CSc.	Laser interaction with extensive corona and porous targets	Suzhou, China, 3rd International Symposium on High Power Laser Science and Engineering, 9 – 13 April, 2018
Pavel Exner, prof. RNDr., DrSc.	Singular Schrödinger operators and Robin billiards: spectral properties and asymptotic expansions	9th Pan African Congress of Mathematicians (PACOM 2017), Rabat, Morocco, 2-7 July, 2017
Ivan Richter, doc. Dr. Ing.	Theory and design of Bragg grating filters in subwavelength grating waveguides	Shaw Centre in Ottawa, Photonics North 2017, Ottawa, Canada, 6-8 June, 2017
Jaroslav Bielčík, doc. Mgr., Ph.D	Highlights from the heavy-ion program in STAR	The National Research Nuclear University "MEPhI", the 2nd International Conference on Particle Physics and Astrophysics (ICPPA-2016), Moscow, Russia, 10- 14 October, 2016
Igor Jex, prof. Ing., DrSc.	Photons walking the line	Kolymbari, Greece, 4th International Conference on New Frontiers in Physics (ICNFP 2015), 23-30 August, 2015
Edita Pelantová, prof. Ing., CSc.	Construction of words rich in palindromes and pseudopalindromes	Nancy, France, 15e Journées Montoises d'Informatique Théorique, 23-26 September, 2014
Tomáš Čechák, prof. Ing., CSc.	Application of X-Ray Fluorescence in Investigations of Photographic Heritage	Valencia, Spain, 9th International Topical Meeting on Industrial Radiation and Radioisotope Measurement Applications, 6-11 July, 2014
Jan John, prof. Ing., CSc.	Solvent optimization for Future Minor Actinoids Partitioning for their Transmutation	Bhabha Atomic Research Centre, Mumbai 400 08/5, SESTEC 2014 India – Emerging Trends in Separation Science and Technology, 25-28 February, 2014

Note: List a maximum of ten examples.

3.11.3 The most significant lectures by foreign scientists and other guests relevant to the R&D&I field at the evaluated unit during the 2014–2018 reporting period

Name, surname and title(s) of the evaluated unit's member of staff	Lecturer's employer at the time of the lecture	Invited lecture title
Gernot Alber, Prof., Dr.	Institut für Angewandte Physik, Technische Universität Darmstadt, Germany	Introduction to Quantum Information (Quantum theory and local realistic theories, Quantum operations: A basic concept of quantum information, Quantum operations at work)
Artem V. Gelis, Prof. Dr.	Argonne National Laboratory, Lemont, Illinois, USA	Microfluidics in Actinide Solvent Extraction
Michio Jimbo, Dr.	Rikkyo University, Tokyo, Japan	Integrals of motion from quantum toroidal algebras
Viktor Kac, Prof. Dr.	Massachusetts Institute of Technology (MIT), Cambridge, USA	Integrable Hamiltonian partial differential and difference equations and related algebraic structures,
Boris Z. Kopeliovich, Prof. Dr.	Universidad Técnica Federico Santa María, Valparaiso, Chile	Charmonium production on nuclei: a story of surprises
Tsuyoshi Misawa, Prof. Dr.	Kyoto University, Japan	Nuclear Reactors in Japan and the Fukushima nuclear power plant accident
Carmel E. Mothersill, Dr.	McMaster University, Hamilton, Ontario, Canada	From Biophotons to Bystander Effect : The implications of non-targeted effects for Radiation Biology and Radiation Protection
Ian Walmsley, Prof. Dr.	University of Oxford, Great Britain	Photonic quantum networks
Maria Dorothea Schumann, Dr.	Paul Scherrer Institute, Switzerland	Exotic radionuclides, what are they good for?
Michael Stöger-Pollach, Dipl.-Ing. Dr.techn.	Vienna University of Technology, Wien, Austria	Analytical Transmission Electron Microscopy 1, 2, 3

Note: Relevant solely for the R&D&I field. List a maximum of ten examples.

3.11.4 The most significant elected membership in foreign or professional societies relevant to the R&D&I field at the evaluated unit during the 2014–2018 reporting period

Name, surname and title(s) of the evaluated unit's member of staff	Name of professional society	Type of membership
Jaroslav Bielčík, doc. Mgr., Ph.D.	Union of Czech Mathematicians and Physicists	Member of the National Committee, Chairman of the

		Physics Section of the Prague branch
Jesus Guillermo Contreras, prof., Ph.D.	ALICE experiment at CERN	Physics Board Member, Convener of The Physics Working Group: Ultra-peripheral and Diffractive Physics
Pavel Exner, prof. RNDr., DrSc.	European Mathematical Society	President
Petr Haušild, prof. Dr. Ing.	European Structural Integrity Society (ESIS)	Secretary of the ESIS National Committee
Helena Jelínková, Prof. DrSc.	CELSA (Central Europe Leuven Strategic Alliance)	Evaluation Committee, Research Council
Jan John, prof. Ing., CSc.	European Chemical Society	Secretary and Treasurer
Richard Liska, prof. Ing. CSc.	International Union of Pure and Applied Physics (IUPAP)	Member of the Commission on Computational Physics (C20)
Jan Mlynář, doc. RNDr., Ph.D.	European Physical Society (EPS)	Member of Council
Ivan Nedbal, prof. Ing., CSc.	Honorary Member of the Société Française de Métallurgie et de Matériaux (labelled in the international community as SF2M.)	The French Society of Metallurgy and Materials
Libor Šnobl, doc. Ing., Ph.D.	Centre de recherches mathématiques, Montréal	External Associate Member of the Mathematical Physics Laboratory

Note: List a maximum of ten examples.

SUMMARY LIST OF ADDITIONAL DOCUMENTATION IN MODULE M3

Document Title	Criterion	Location (HTML link)
Science at FNSPE CTU	3.1	https://www.fjfi.cvut.cz/en/research
Project Advanced Detection Systems of Ionizing Radiation	3.2	http://capads.fjfi.cvut.cz/
Project ASGARD	3.2	https://cordis.europa.eu/project/id/295825
TT and IP protection system	3.8	http://evaluation-cvut.cz/files/H2020-Technologytransfer.pdf
Technology Transfer Office	3.9	http://evaluation-cvut.cz/files/H2020-Technologytransfer.pdf
Igor Jex OSA Fellow	3.10	https://www.osa.org/en-us/awards_and_grants/fellow_members/fellow_profiles/igor_jex/
International Masterclasses	3.12	http://www.physicsmasterclasses.org/
International Masterclasses at FNSPE CTU	3.12	http://www.physicsmasterclasses.org/index.php?cat=country&page=cz_prague_ctu