Evaluation of research and professional activity of research-oriented institutes of the Czech Academy of Sciences for the period 2015–2019

Final Report

Name of the Institute: Nuclear Physics Institute of the CAS, v. v. i.

Evaluated teams and their leaders:

1. Theoretical Physics (Jiří Adam)
2. Ultra-relativistic Heavy Ions (Filip Křížek)
3. Relativistic Heavy Ions, Neutrino Properties (Andrej Kugler)
4. Radioanalytical and Dating Methods (Jan Kučera)
5. Nuclear Reactions (Jaromír Mrázek)
6. Research with Beams of Ions and Neutrons (Anna Macková)
7. Neutron Diffraction (Pavel Strunz)
8. Dosimetry of Ionizing Radiation (Marie Davídková)
9. Radionuclides and Accelerators (Ondřej Lebeda)

Part A: Evaluation of the Nuclear Physics Institute

Strengths:
- Nuclear Physics and a wide range of applications
- Unique facilities for interdisciplinary use
- Recognized internationally
- Wide spectrum of activities, ranging from fundamental to applied physics, from theoretical to experimental physics
- Development of novel instrumentations

Weaknesses:
- Age structure and gender ratio
- Salary and attractiveness for technical personnel
- No collaboration between theory and experiment
- No coordination of outreach activities on institute level

Opportunities:
- Global reorganisation of research activities
- Rich scientific programme with high potential for outreach activities increasing the visibility
- Institute-wide human resource policies

Threats:
- Funding at a constant level
- Replacement of technicians

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The quality of the selected results of the 9 teams is below the average of all 33 teams evaluated in Phase 1. See also H1.3	
H1.2	**Contribution of workers on the outputs reached**
Some team have a wide collaboration with several other institutes in science and humanities. Thus, several papers have larger number of authors and consequently the number of reprint authors from NPI is inherently reduced. Still, the contributions of the members of NPI are essential to the output.	
H1.3	**Quality of all outputs and results**
The NPI runs several accelerators and instrumentations, that are not easily accessible otherwise, as a service including other institutions. This reduces the effective FTE available for writing. Also, when spanning various fields, in general the common publications do not make it in the specialized top-rate journals. Finally, many of the top papers are from the ALICE, STAR, HADES and KATRIN and are not evaluated because they have more than 30 authors. However, there is room for improvement.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Production of 83Rb/Kr and its use for KATRIN (Team 3 and Team 9) Basic data for astrophysics (Team 5) Compressed hot matter, i.e. jet properties as signals of the quark-gluon plasma (Team 2)	

Material science (Team 4, Team 6 and Team 7) Some of the outputs were only achievable at this institute.

H1.5	Contribution of the participation of the authors in large collaborations
Team 2 in STAR & ALICE Team 3 in HADES (FAIR) Team 3 & 9 in KATRIN Team 5 in GANIL/SPIRAL2 Team 7 with BEER at ESS Team members contribute in the planning, development of technical equipment as well in analysis. The Czech teams contribute to the scientific output.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The teams within the NPI provide basic data for the future energy production via fusion and for radio protection. Some spin-offs for industry gained a patent. Support of material science for possible future industrial applications.	

H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities
Work of the NPI is useful to society for radio protection and dosimetry, production of radiopharmaceuticals, dating and fundamental properties to understand the development of the universe (hot matter, neutrinos, nuclear structure). The NPI servers other sciences, but could improve its impact by an improved outreach programme towards secondary schools and their teachers.	

H2.3	Relation to practice
Training of students who do not remain in academia but enter national enterprises. Team 3, 4, 6, 8 and 9 perform research for practice gaining 590.000€ in revenues (and some more not invoiced). These are mainly activation studies for material science or age determination, detector development and calibrations, or production of radio-pharmaceuticals and dosimetry.	

H2.4	Participation in AV21 strategy
Several teams mention activities along the AV21 strategy.	

H2.5	Cooperation with regions of the Czech Republic
N/A	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
All teams are connected well with the international community. The degree of cooperation and size of the groups varies strongly, but overall seem to fit the respective purpose. Also, several national institutions cooperate.	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
Participation in many international collaborations, for several of which the institute acts as Czech representative; for some with leading experiments in the corresponding fields (ALICE, FAIR, KATRIN)	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Team members are involved in editorial or scientific boards in relation to their specific field. Members have been invited for representative talks at international conferences, however smaller teams to a lesser degree.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The individual teams have presented their own plans. In view of the insecure financial future (mainly, ending of CANAM) and some overlapping interests of various teams (e.g. neutrinos or neutron activation) a restructuring and concentration of the teams within the departmental structure to increase synergies might be in place.	
D2.2	**Assessment of the previous research objectives and their achievement**
The teams reached their set goals by and large.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
There were two recommendations: a) the age profile and continuity of technical staff, b) the time delays in construction of international facilities. Add a) Efforts have been reported, still some teams show a clear ‘velvet gap’ despite the increase in total numbers of staff and support staff. Due to good funding the salaries could be increased, but not sufficient young and capable staff could be recruited. Age and gender structure remain to be observed. Add b) ESS and FAIR construction are not completed while the Czech contributions are partially finished. The respective teams are aware of the situation.	
D2.4	**Success in receiving grants**
In the past the NPI was successful in receiving grants reaching 50% of the annual budget. The grants came from national academic and industrial sources as well as from international EU funds.	

D2.5	Adequacy of instrumental equipment
The cyclotron U120M needs repair. During the past period the NPI has constructed new laboratories and an accelerator. These and the related equipment seem to be adequate. The present excellence of craftmanship within the workshop is recognised and must be kept at this level.	
D2.6	**Effectiveness of management**
The successful expansion in budget, manpower and instrumentation points towards an efficient management. The distributions of topics and loads between the teams in view of the departmental structure remains unclear. The necessary strive towards an improved gender balance rests predominantly on the team level, resulting in a (partially) low success rate probably also due to the location of the institute.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The efforts towards the development of the corresponding strategies seems to be focused on the team level, thus rather variable. A coherent institute wide approach is less visible.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
Gender issues are approached on the team level and vary from team to team significantly. A common strategy on institute level is not established.	
D2.9	**Relation of the institute regarding the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N/A	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
The cooperation with national and international universities is strong due to the interdisciplinarity of the broad range of research topics. There is exchange of students and a few researchers teach at foreign universities.	
D3.2	**Effectiveness of joint research centres**
On national level there are common PhD theses supervised and consulted. Many papers are published in smaller and larger collaborations with different partners after completing joint research projects. The results are reported at conferences and workshops.	
D3.3	**Success rate in supervision of PhD students**
A total of 31 PhD theses were defended in the period 2015-2019. Considering the total manpower of the institute, this total seems to be not very high, however, a strong variation is observed between the teams: with some teams strongly committed to the training of PhD students, while others rather more tenuously involved, in some cases despite the fact that they are engaged in curiosity-driven research.	

D3.4	Participation of PhD students in the outputs
In general, each PhD student has participated strongly in either preparation, completion and/or analysis of the research project. The co-authored the respective printed outputs.	
D3.5	**Participation of the institute in master or bachelor studies**
29 bachelor and 39 master theses have been defended; more than 100 B&M theses have been supervised or consulted.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Varies strongly from team to team. A stronger involvement in general is advised.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
This topic is only addressed by the teams, but not coordinated on the institute level for improved impact. The research topics offer large possibilities for interesting communications towards a general public.	
D4.2	**Publishing activities and its quality**
News and press releases about activities in the institute are published on WWW-page. Information on other publishing activities are not available.	
D4.3	**Participation in professional organisations in the area of research and development**
Participation on the team level. An institute wide outreach-office coordinating efficiently the individual team activities with professional organisations is missing.	

Team categorisations and a brief commentary:

☐ strengthen the support of the team ☒ keep the support of the team at the current level ☐ reduce the support of the team
Please enter your comment here

Other comments of the commission:

The commission could not meet in person, neither the director nor the nine teams of the nuclear physics institute due to the pandemic situation. The ZOOM meeting with its tight schedule might cause some drawbacks in the communication. Nevertheless, the commission was impressed by the wide-ranging research fields.

The institute and teams offer services to external users as well as following their own research work. This challenges the efficient operation of the institute. In particular, the reason for the operation of some experimental facilities / accelerators in different teams is not obvious, and a restructuring of these actives might open opportunities for synergies and increase effectiveness. A clear separation of service and research is emphasized.

The nine teams do not resemble the structure of departments. Moreover, it is unclear why some topics are spread over several teams as, e.g., the neutrino properties and beta-decay or neutron activation, or why disjunct topics are compounded within one team.

The overall program of the institute is very rich. However, the scientific activities in the various teams would profit from a global scientific vision and strategy of the institute by setting scientific priorities, including a possible restructuring of teams and the scientific activities within the teams. This might be necessary for the effective use of the financial and human resources.

An institute-wide promotion of communications with proper branding by the NPI will strengthen the reception of outreach efforts and should increase the income of students. For the latter in particular, it would be rather supportive if the outreach strives also for the high school and the respective teachers. These efforts could go along with a coordinated and exciting PhD training programme.

A monitoring of the gender balance is recommended to take place at institute level. Strategies and best practices should be developed together with the teams to attract more women applicants to open positions.

The upgrading of teams 2 and 6 and the downgrading of teams 1 and 5 is understood to be relevant within the institute only.

Part B:

1 - Theoretical Physics

Strengths:

- reasonably international research environment;
- collaboration with experimental groups outside the institute (including international ones);
- good medium-term stability & age balance;
- collaborative intra-team atmosphere.

Weaknesses:

- fragmentation of research topics, with many very small groups each working on a different topic and little collaboration between groups;
- lack of collaboration with experimental groups within the institute, that are active in fundamental research;
- lower than desirable involvement in experimental international collaborations;
- small number of PhD students in comparison to the team size;
- limited involvement in outreach activities.

Opportunities:

- **s**trengthen the collaboration with international experimental groups;
- merge and strengthen the most promising research lines.

Threats:

- few physics students as a pool of prospective team members;
- lack of sustainability due to the financial situation critically depending on grants for younger team members and the current difficult in securing grants;
- very unbalanced gender distribution.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	**Quality of selected outputs of Phase I**
Results presented in Phase I-selected outputs are published on well-known, peer-reviewed journals (e.g., *Nuclear Physics, Physical Review*, *Physics Letters, Journal of Mathematical Physics*). The quality ranking is average, with a peak in the second quartile.	
H1.2	**Contribution of workers on the outputs reached**
Team scientists are first or corresponding authors of most of the papers.	
H1.3	**Quality of all outputs and results**
The quality of the overall output is not very high, with a strong peak in the second quartile in terms of journal ranking and in the lowest quartiles in terms of citation intensity.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Highlights of valuable investigations & findings concern: the structure of nuclei & hypernuclei, hadronic interactions near/above threshold energy, weak & electromagnetic interactions, field theoretical methods to deal with relativistic quantum systems where the number of constituents changes during the interaction, quantum theory on waveguides &	

graphs, Schrödinger and Dirac operators, optimal shapes in Physics & related problems (e.g., the Bareket conjecture), unconventional mathematical tools, constructing novel exactly solvable quantum models, Dirac materials, and PT-symmetric optical systems.

H1.5	**Contribution of the participation of the authors in large collaborations**
Some team members have long-term collaborations with experimental groups, e.g. Jefferson Lab Hall A (Hypernuclear), LNS Tohoku, and MAMI (Institut für Kernphysik Mainz) collaborations – providing theoretical support in planning & running experiments on open strangeness production.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	**Societal relevance of outputs and results pursuant to CAS and institute mission**
Based on team expertise & results, Theoretical Physics team members are variously involved in: teaching activities at Czech universities (in Prague, Ostrava) lectures, seminars, and bachelor, master, PhD student supervision; management of research-community life as board members of national and international committees / societies / foundations; professional-journal activities as editors or editorial-committee members of and public-relation activities, e.g. public lectures, media interviews, public observations, guided tours.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
N.A.	
H2.3	**Relation to practice**
N.A.	
H2.4	**Participation in AV21 strategy**
N.A.	
H2.5	**Cooperation with regions of the Czech Republic**
N.A.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	**Comparison of the team with similar international and national institutes**
The team compares favourably with similarly-sized Theoretical Nuclear Physics groups.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
The Theoretical Physics team has national collaborations with similarly–oriented groups of Czech universities (e.g. Prague, Ostrava). Individual members have international	

cooperations with colleagues from universities and research institutions in Canada, Chile, France, Germany, Israel, Italy, Mexico, Spain, Russia, USA.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Team members (co-)organized several well-attended (~50 people) workshop & schools in Czechia and abroad in 2015-2019.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	**Direction in line with the perspective of the planned research directions**
Plans for the next period are clear and well-stated. They are mainly based on extrapolation of successful research lines developed in the previous period 2015-2019.	
D2.2	**Assessment of the previous research objectives and their achievement**
As normal and expected of a Theoretical Physics group, activity & objectives in 2015-2019 have been borne out of individual efforts with no collective objectives, though a greater level of collaboration is suggested for upcoming and future activities. The successful publication list for the period testifies to the good results obtained.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
As recommended, the team focused on ex-students returning from postdoc experiences abroad and to new people joining the team as postdocs.	
D2.4	**Success in receiving grants**
Success in receiving grants has been low in 2015-2019 also due to underfunding of the Czech granting agency that theoretical groups have to rely on.	
D2.5	**Adequacy of instrumental equipment**
N.A.	
D2.6	**Effectiveness of management**
Management seems adequate but is burdened by a relative (and apparently physiological) lack of extra funds that for more experimentally or application-oriented teams come from grants.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The team is composed of (effectively) 28 scientists and 3 administrative & technical staff: this distribution seems adequate to run Team 1. Development strategies for 2020-2024 foresee continuation of current successful activities. The bulk of age distribution peaks at ages 25-45. As for all CAS/NPI employees, team members are encouraged to systematic professional growth also through yearly assessments of their accomplishments.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
Only one female scientist in the team.	

D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
N.A.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Scope of cooperation with universities is to attract students to work Theoretical Nuclear and Mathematical Physics thesis projects proposed by team members. This is important also in consideration of the generally low number of Physics students in Czech universities.	
D3.2	**Effectiveness of joint research centres**
The Mathematical Physics group has a long-time collaboration with the Doppler Institute at Prague's Czech Technical University.	
D3.3	**Success rate in supervision of PhD students**
4 PhD theses were successfully defended in 2015-2019 (involving 10 supervisors). Whereas this shows good effectiveness, the number of PhD students is unusually low in comparison to the size of the team (currently about 3 FTE PhD students with about 25 FTE team members).	
D3.4	**Participation of PhD students in the outputs**
PhD students regularly participate in research activities and co-author ensuing papers.	
D3.5	**Participation of the team in master or bachelor studies**
The team has provided 10 Bachelor-thesis supervisors, and11 Master-thesis supervisors.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Team staff help teaching specialized courses at universities in Prague and Ostrava.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Team members introduce atomic & nuclear physics and supervise student mini-projects in high schools, and give public lectures.	
D4.2	**Publishing activities and its quality**
No publications related to outreach	
D4.3	**Participation in professional organisations in the area of research and development**
Under the umbrella of CAS/NPI, the team participates with universities, schools and the Czech Ministry of Education in the area of research & development in order to provide continuing education to school teachers and fundamental Physics education to young students.	

Other comments of the commission:

2 – Ultra-relativistic Heavy Ions

Strengths:

- Strong involvement in international collaborations, with focussed expertise and coherent research goals
- Direct collaboration with theorists, some of which within the team.
- Balanced age and gender structure
- Strong involvement of PhD students and well-designed career development for young scientists

Weaknesses:

- The team has a relatively small degree of internationalization

Opportunities:

- Continuation of the activity within ALICE and STAR
- Involvement in the future accelerator EIC at Brookhaven National Lab
- The experience gained for the ALICE ITS could be useful for silicon-development related teams

Threats:

- Low level of postdoc funding
- Difficulty in retaining highly skilled personnel in computing

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The team did not take part in Phase I of the evaluation, since the number of publications with more than 30 Authors is the dominant part of the output of the group. However, their report on the research activity mentions several publications with less than 30 authors, some of which highly cited.	
H1.2	**Contribution of workers on the outputs reached**
The contribution cannot be evaluated bibliometrically due to the reason explained at the previous point. However, members of the team have given key contribution to several analyses, measurements, detector hardware and large-scale computing in the ALICE and STAR experiments.	
H1.3	**Quality of all outputs and results**
The contributions to the development, operation and the data analysis in ALICE and STAR as led to high quality publications in top journals. Moreover, some of the papers with a small number of authors mentioned in the report on the research activity are highly cited.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Jet and heavy flavor physics in heavy ion collisions as signals of the quark-gluon plasma; significant results in small x QCD.	
H1.5	**Contribution of the participation of the authors in large collaborations**
Essential and visible contribution to both ALICE and STAR during several phases of the experiment lifetime, including construction, operation and analysing of the results.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The activity of the team in large-scale computing is relevant also outside the physics research community, as witnessed by talks given at engineering and computer science international conferences.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities**
Mostly through developments in data science and artificial intelligence, which are of considerable societal relevance. Furthermore, relevance in addressing fundamental research questions, such as the formation of stars in the early universe.	
H2.3	**Relation to practice**
Little direct relation given the fundamental nature of the research performed	
H2.4	**Participation in AV21 strategy**
N.A.	
H2.5	**Cooperation with regions of the Czech Republic**
No direct interaction with Czech regions.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
The team is small in size, yet it has provided a significant contribution to two major international collaborations at CERN and Brookhaven, that compares very favourably to similar international teams, even of rather bigger size.	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
The activity is fully international, since 100% of it is within international collaborations at European (CERN) and U.S. (BNL) laboratories.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
There is a strong involvement of team members in the organization of international conferences, workshops and schools, as well as experimental collaboration meetings, Team members have given a large number of talks at international conferences, including one plenary talk at the EPS-HEP conference. Team members have been received ALICE and RHIC thesis awards; various awards to students, and for activities with students. Important membership in international advisory boards and committees, including a membership in a European Horizon 2020 evaluation panel.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The future directions are well in line with the current ones. These involve the continuation of experimental activity within the ALICE and STAR collaboration. Ambitious long-term plans involve the participation in activities at the future Electron-Ion Collider, also at Brookhaven (already approved) as well as in a possible next-generation heavy-ion experiment at CERN (not yet approved).	
D2.2	**Assessment of the previous research objectives and their achievement**
Research goals were completed with full success, with a large number of ALICE and STAR papers published with significant contributions from team members, and significant involvement in the upgrade of the ALICE Inner Tracking System.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The previous evaluation did not provide specific recommendations, rather, it highly praised the team and recommended that “the group should be supported as strongly as possible”.	
D2.4	**Success in receiving grants**
The team has had good success in securing various kinds of grants (inter-excellence, large infrastructure..), both at CERN and Brookhaven.	
D2.5	**Adequacy of instrumental equipment**
The Team has successfully exploited the local NPI cyclotron facility, e.g. for studies of radiation hardness. It has exploited the Tier-2 computing centre at the Institute of Physics and storage clusters both at the IOP and locally at the NPI.	
D2.6	**Effectiveness of management**
The management of the team is quite effective, also in interfacing with the management of the two large experimental collaborations in which most of the team activities take place, as demonstrated by significant management positions within the experiments secured for team members.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The team has specifically addressed successfully the career development of its younger members, both by promoting them within the large experimental collaborations, and also through teaching activities. The professional structure is generally satisfactory, with a very well-balanced age structure.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
The team has an unusually balanced gender structure, with about 50% female members.	
D2.9	**Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N.A.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
There is a substantial cooperation with universities through the involvement in large experimental collaborations and through postdocs and PhD students. Direct cooperation with the Tomsk Polytechnic University (Russia) through the supervision of undergraduates.	
D3.2	**Effectiveness of joint research centres**
N.A.	
D3.3	**Success rate in supervision of PhD students**
Sizable number of PhD theses defended in comparison to the size of the team.	
D3.4	**Participation of PhD students in the outputs**
Students participate very substantially in the activity of the team within international collaborations. This is also demonstrated by the recognitions mentioned at point D1.3 (prize for best thesis in large international collaborations).	
D3.5	**Participation of the institute in master or bachelor studies**
Sizable number of lectures given by Team members both at the Bachelor and Master level. Very large number of bachelor and master theses supervised.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Very high level of cooperation both at the national and international level, which is crucial in securing an influx of high-quality PhD students.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Significant activities: nationally for high-school students, internationally through participation in the outreach activities of CERN.	
D4.2	**Publishing activities and its quality**
Mostly through the participation in the activity of large international collaborations.	
D4.3	**Participation in professional organisations in the area of research and development**
On top of that through large international collaborations, direct participation in the form of chairmanship or membership to a variety of national and international organization, ranging from the Czech Science Foundation to the European Committee for Future Accelerators.	

Other comments of the commission:

Concrete discussions concerning the participation in the EIC should be started, and other Czech partners should be identified.

3 – Relativistic Heavy Ions. Neutrino Properties

Strengths:

- Strong involvement of both the heavy ion and neutrino groups in international collaborations
- Expertise in detector hardware, which is helpful for both heavy ion and neutrino physics and is the linking element between them
- Strong commitment to the career development of young scientists

Weaknesses:

- Currently unbalanced age profile with a big gap in the middle
- Gender unbalance
- Limited involvement in undergraduate teaching activity and in outreach

Opportunities:

- Increased involvement in the FAIR facility thanks to the Czech Republic becoming aspiring partner
- cross-fertilization in technical know-how between the heavy ion and neutrino groups.

Threats:

- Difficulty in coordinating the activity of two groups that make up the team
- Difficulty in rebalancing the age and gender profile
- Small group with significant responsibilities in various experiments

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The quality of the selected outputs is low: it is in fact the lowest or second-lowest of all evaluated teams. Specifically, only one paper has grading level 2, and no level 1. However, only a very small number of outputs has been selected for evaluation, allegedly in order to emphasize students' contributions. Note however that the main scientific output of the team is related to its participation in the HADES and KATRIN collaborations: this output could not be included in the evaluation because papers from these collaborations they have more than 30 authors.	
H1.2	**Contribution of workers on the outputs reached**
The contribution is relatively low, with only one paper with the team member as lead. However, the caveat of point H1.1 applies.	
H1.3	**Quality of all outputs and results**
The quality is bibliometrically not high, with more than half of the outputs in the lowest two quartile by journal ranking, and the majority in the lowest quartile by citation intensity. However, the caveat of point H1.1 applies.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Experimental studies of hadron properties in medium with the HADES collaboration, specifically the study of photon emission from baryon-rich hadronic matter. Contributions to the calibration of the KATRIN spectrometer.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The main scientific output of the two subgroups of the team is within two large experimental collaborations: HADES for the heavy ion group and KATRIN for the neutrino group. In both	

cases the team has given substantial contribution to the collaborations, both in hardware development, calibration, and, for HADES, analysis.

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The team also includes a group working on neutron spallation, which has applications both as a prospective energy source and for the transmutation of nuclear waste.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities**
The accelerator-driven transmutation technology group is part of the international project “Energy and Transmutation of Nuclear Waste”. Current research by the KATRIN group on the absolute scale of the neutrino mass addresses fundamental research questions, such as the possible nature of dark matter in the universe.	
H2.3	**Relation to practice**
The main goal of the accelerator-driven transmutation technology group is to develop a prototype of a neutron spallation facility.	
H2.4	**Participation in AV21 strategy**
N.A.	
H2.5	**Cooperation with regions of the Czech Republic**
There is no direct cooperation with regions of the Czech Republic.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
The team is of similar scope as the other international groups involved in the HADES and KATRIN collaborations.	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
The main activity of the Team is within two medium-size international collaborations, both performing experiments at facilities located in Germany. The team activity has led to the Czech Republic being recognized as the first “aspirant partner” of the European research facility FAIR that hosts HADES.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
The team has organized some user meetings related to FAIR and KATRIN, and team members has given some talks at international conferences.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The team is consolidating its role within HADES and its possible successor, CBM, at the same facility, while the neutrino group prepares for the main KATRIN runs (three 65-day campaign per year).	
D2.2	**Assessment of the previous research objectives and their achievement**
Activities within HADES and KATRIN as well as with neutron spallation were as planned. Some new, not planned activities were done in relation to R&D for the BM@N detector at Dubna.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The main previous recommendation was to reinforce the KATRIN group with some reshuffling of personnel. It was decided to add one postdoc each to the HADES and KATRIN groups.	
D2.4	**Success in receiving grants**
The team has secured a number of grants, both national and from JINR Dubna (Russia) directly related to its main activities in HADES, KATRIN, and neutron spallation.	
2.5	**Adequacy of instrumental equipment**
The team has successfully taken advantage of the NPI cyclotrons U-120M and TR-24 in order to produce a monoenergetic electron source from ^{83}Rb decay that is regularly provided to KATRIN. The team is also in the process of building the HADES electromagnetic calorimeter.	
D2.6	**Effectiveness of management**
The management of the team appears to be reasonably effective in keeping together two groups working on somewhat heterogeneous topics, mostly through their common expertise in detector hardware.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The age structure of the team is currently quite unbalanced, with a big age gap (no researchers of age between 41 and 55). Nevertheless, the team strives to attract students and young researchers and appears to have an effective strategy in fostering heir career.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
The team has only 2 female staff out of 23 members.	
D2.9	**Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N.A.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
The team mostly collaborates with universities through its involvement in the FAIR facility that hosts HADES, as well as in supervising theses at all levels.	
D3.2	**Effectiveness of joint research centres**
N.A.	
D3.3	**Success rate in supervision of PhD students**
A sizable number of theses was defended (4, plus 3 more being defended now), thus indicating a good success rate.	
D3.4	**Participation of PhD students in the outputs**
The team has a strong commitment in fostering the scientific activity of PhD students, with many of the main scientific results being part of PhD thesis work.	
D3.5	**Participation of the institute in master or bachelor studies**
Members of the team have given a certain number of lectures at the bachelor and masters level, and have supervised a fair number of theses (four masters and two bachelor).	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
The cooperation is concentrated on some team members, who teach regularly. There is a close cooperation with the Tomsk Polytechnic University, in terms of supervision of Master theses, which helps in attracting PhD students.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
One member of the team has engaged in various activities especially involving schools. Some popularization of KATRIN results has been done in the media.	
D4.2	**Publishing activities and its quality**
No publishing activities appear to have been done in outreach.	
D4.3	**Participation in professional organisations in the area of research and development**
The main activity is related to the involvement of the Team in promoting the Czech Republic as aspirant partner of FAIR.	

Other comments of the commission:
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4 -- Radioanalytical and Dating Methods

Strengths:

- Access to a research reactor with excellent equipment
- Interdisciplinary within science and humanities

Weaknesses:

- Relatively low level of public engagement activities
- Strong dependence on national grants

Opportunities:

- Exploiting the possibilities of the new RAMSES spectrometer
- Potential to engage with industry (e.g. on material testing)

Threats:

- Operating RAMSES at full capacity and capability

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
Overall, the team's output quality and productivity are about consistent with the average of all evaluated team. The quality of the selected results has a strong fraction in the first quartile (6 out of 17). It should be noted that some of the activities of the team are highly interdisciplinary and provide service (e.g. dating in archaeology) to support research in other fields, which should be seen as very positive.	
H1.2	**Contribution of workers on the outputs reached**
While the reprint authors are around 20%, the ratio is much improved within the total output. This should not be taken as a concern but a natural consequence of the character of the team's interdisciplinary research and service activities.	
H1.3	**Quality of all outputs and results**
Overall, the output is very good, and it covers a broad spectrum due to the interdisciplinary work.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
The team has contributed to important results across a wide range of disciplines, including archaeology, geology, agriculture, environmental research and materials science. Some particular highlights were presented in Geomycology where the team's methods allowed for identification of a significant concentration of toxic elements in an edible mushroom.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The team primarily works in smaller collaborations.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The application of elaborate activation methods assist research in other fields of science and humanities. The dating and environmental research is in great demand.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities**
The team collaborates with industry on nuclear isolation. In addition, it is the only lab who can provide low-iodine certification for foods.	
H2.3	**Relation to practice**
See H2.2.	
H2.4	**Participation in AV21 strategy**
Not addressed.	
H2.5	**Cooperation with regions of the Czech Republic**
Not addressed.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
As other reactors are shut down and expertise in neutron activation is still in high demand, this team (and institute) excels and can exploit these advantages. The new mass spectrometer RAMSES must show its quality.	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
The team has some sought-after skills and provides unique services (e.g. iodine certification) that are standing out internationally.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Members of the team have organized 3 conferences. They are actively involved in committees and editorial boards. They have been invited for talks at international conferences.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	**Direction in line with the perspective of the planned research directions**
The directions are in line with the overall goals. Reactor neutrons are exploited also in the next period, RAMSES improves the visibility.	
D2.2	**Assessment of the previous research objectives and their achievement**
The main objectives of the last assessment period where fulfilled.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The main concern from the past assessment regarding access to the reactor has been mitigated as there is now a long-term perspective for the facility.	
D2.4	**Success in receiving grants**
The group received several national grants and was involved in international interdisciplinary research that attracted additional grants. Where possible, engagement with European grant opportunities should be intensified in the future to diversify funding streams.	
D2.5	**Adequacy of instrumental equipment**
The facilities are adequate, in principle. RAMSES needs to be optimized for highest sensitivity.	
D2.6	**Effectiveness of management**
The management of the team seems effective. In particular, the RAMSES build-up is being accompanied by an international advisory board to bring in outside knowledge. This certainly should be carried on during the operations phase to ensure international competitiveness of the facility.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The age structure of the team is well balanced.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
Of the 14 researchers reported as currently working in the team, only 2 appear to be women. This is a lower fraction than what would be expected based on the typical undergraduate physics population of women (~20-25%). While the team stated it does not discriminate against any gender, it is recommended the team, together with the institute, monitor participation of women among the research workforce and develop strategies to increase recruitment of women (e.g. review the offer of care facilities, pro-active encouragement of women to apply for open positions, etc.).	
D2.9	**Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N/A	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Worldwide cooperation in different fields exist and are fruitful. About 25 national institutions cooperate and demonstrate the broadness of applications and demands.	
D3.2	**Effectiveness of joint research centres**
N/A	
D3.3	**Success rate in supervision of PhD students**
4 PhD students were supervised to completion. A success rate was not provided.	
D3.4	**Participation of PhD students in the outputs**
PhD students co-authored a number of publications, prepared proposal and presented their results at conferences.	
D3.5	**Participation of the institute in master or bachelor studies**
5 Bachelor and 4 master theses were defended.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
6 members of the team gave 63 courses, which is considered a high teaching profile.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The team has a relatively limited outreach programme with only few media appearances. Given the interdisciplinary nature of the group and the appeal of some of the topics to the general public, researchers should be encouraged and rewarded for increasing engagement with the public.	
D4.2	**Publishing activities and its quality**
Some popular articles have been published based on the team's research (e.g. on mushrooms and Tyho Brahe).	
D4.3	**Participation in professional organisations in the area of research and development**
Some of the team's researchers are members of professional bodies and editorial boards.	

Other comments of the commission:

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5 - Nuclear Reactions

Strengths:

- accelerators and neutron source with unique energies and intensity
- expertise in experimental setups

Weaknesses:

- size of the team
- dissemination of results

Opportunities:

- cooperation with international teams in unique parameter space

Threats:

- strong aims and obligations for experimental part for a small sized team at the risk of publishing results

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
A medium quality has been assessed in during Phase I with publications mainly driven by the collaborators.	
H1.2	**Contribution of workers on the outputs reached**
The strength of the team is the experimental work, designing and constructing essential parts of the setup. It is understood that the elaboration of solid fusion data is not well respected in general, however mandatory for a successful fusion research.	
H1.3	**Quality of all outputs and results**
The number of proceedings (31) equals almost the number of articles in journals (41). Compared to the FTE and fractional count the output in publication is relatively low. Most of them rank in the quartiles Q2-Q4.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Precise cross sections for the CNO cycle. Study of damage process-displacements per atom - using the positron-annihilation lifetime-spectroscopy (PALS).	
H1.5	**Contribution of the participation of the authors in large collaborations**
In kind contributions to equipment	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The astrophysical part constitutes basic research and thus in part contributes to the understanding of the evolution of the cosmos, whereas the nuclear data provide in part for a data base relevant for possible future energy production. Studies of nuclear activation	

and detailed damage processes are important not only for fusion reactors, but also for advanced fission schemes	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities**
The results are published and provided in open data bases for general use.	
H2.3	**Relation to practice**
Most results have no direct relation to practice. The fusion data serve at a pre-stage level for future energy production. Data on nuclear activation and detailed studies of damage by charged particles are of importance for the choice of reactor materials	
H2.4	**Participation in AV21 strategy**
Participation within AV21 for material damage studies. ADAR (Accelerator Driven Advanced nuclear Reactor)	
H2.5	**Cooperation with regions of the Czech Republic**
None	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	**Comparison of the teams and the institute with similar international and national institutes**
The team compares well with other of similar small size, proven by the many common projects on international level.	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
The team has several cooperations on international level.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
The team has organized 2 workshops and has presented its results at conferences and workshops.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	**Direction in line with the perspective of the planned research directions**
The focus of the team to exploit the experimental investments at SPIRAL and the neutron sources is strongly support.	
D2.2	**Assessment of the previous research objectives and their achievement**

The team has followed the suggestion to exploit experiments with the unique neutron source(s).	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The team has not entered the NUSTAR collaboration and concentrated on astrophysical and fusion relevant experiments. It has finished the installation of high-tech experimental equipment, however not taken advantage in publications thereof.	
D2.4	**Success in receiving grants**
The team has been working with several other international laboratories and has entered new international projects receiving respective grants (of unknown amount)	
D2.5	**Adequacy of instrumental equipment**
Adequate equipment has been built and is available. Needed to be exploited and experimental results to be published.	
D2.6	**Effectiveness of management**
Many small sized projects grouped around 3 topics, nuclear astrophysics, neutron generators and activation by charged particles. Synergetic effects are not visible.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The team clearly suffers from lack of students and postdocs. Improved measures for outreach and attractive teaching must be implemented. Data mining to support fusion research is necessary, but not attractive for young scientists.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
The attraction of any student per se is more vital than the gender issue.	
D2.9	**Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N/A	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	**Scope of cooperation with universities on national and international level**
The team is mainly involved in common research projects in the nuclear astrophysics section with international universities and laboratories in France and Italy. Cooperation with JINR, Dubna and Euratom concerns fusion related data.	
D3.2	**Effectiveness of joint research centres**
The team was not involved in joint research centres with universities.	
D3.3	**Success rate in supervision of PhD students**

One PhD defended his thesis; two more PhD have just started their work.	
D3.4	**Participation of PhD students in the outputs**
PhD students have contributed and participated in the scientific out by writing and presenting results at conferences.	
D3.5	**Participation of the institute in master or bachelor studies**
Four Bachelor and four Master students have defended their theses during the 5-year period.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Low, only one young person of this team.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	**Sufficiency of media strategy and activities in the area of research popularisation**
A French video has been rendered in Czech language. No genuine outreach of this team is recognizable; nothing own of the team for secondary schools has emerged. Hosting trainees within the university is not sufficient.	
D4.2	**Publishing activities and its quality**
Compared to the FTE the total number of papers has been low; the number of proceedings reaches the 75% level of journal papers; within Phase 1 evaluation the relative fractional count was much higher for category 3 than for 2.	
D4.3	**Participation in professional organisations in the area of research and development**
N/A	

Other comments of the commission:
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6 - Research with Beams of Ions and Neutrons

Strengths:
- multidisciplinarity
- modern equipment allowing for unique and competitive experiments
- team is eager to adopt to new scientific topics
- modernized team structure (establishment of MRNIB group)

Weaknesses:
- despite the relatively high number of publications, more emphasis should be given towards higher-ranking journals, which may also require to motivate collaborators

Opportunities:
- international cooperation at highest level
- contributions in widespread parts of science attractive also to the general public
- upgrading and constructing new equipment can expand the research opportunities

Threats:
- availability of and attractiveness for young technical staff with respect to adequate remuneration
- a loss of CANAM funding will lead to a serious situation of the team, eventually a new model for supporting CANAM needs to be found

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The outputs evaluated in Phase I are very good to excellent within the rather broad field of expertise. However, a considerable part of the outputs falls into the range of Q2 to Q4 within the present evaluation; other, topical selected evaluations lead towards higher rankings. Some improvement towards more higher-ranking journals appears possible.	
H1.2	**Contribution of workers on the outputs reached**
Output within national collaborations are almost exclusively lead by team members, while for international collaborations about 1/3 of the total has the reprint author from the team.	
H1.3	**Quality of all outputs and results**
The results of the team's research are very good to excellent in international comparison. The overall output has a good balance of leading authorship between own and other researchers. The low impact factors of some standard journals of the field is not the responsibility of the team; they do have some publication in higher ranking journals outside their field. It may be useful, however, to motivate the collaborators to also aim at higher ranking journals.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
For astroparticle physics and cosmology the measurement of the 7Be(n,p) cross sections must be seen as an important basis for the production chain of light nuclei. The 3D tomography and lithography, battery research, and the tissue engineering have high potential for future applications.	

H1.5	Contribution of the participation of the authors in large collaborations
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Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Several students of all grades are supervised and lead to their degrees. Members of the team are teaching at UJEP and the Prague, including service on several academic committees. There is an interesting outreach programme. Team members served on many international panels and advisory committees.	
H2.2	**System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities**
With the aim on excellent basic research there are no direct applications yet for the general society, apart from essential support of associated branches of sciences. In the future, some research directions, e.g. on battery research, may develop into an application-oriented field.	
H2.3	**Relation to practice**
Presently there is no direct relation to practice; the prospects of 3D tomography and tissue engineering must be investigated more deeply.	
H2.4	**Participation in AV21 strategy**
Not mentioned in the reports or presentation. However, the commission learned after the evaluation about the participation in the programme ‘Materials for Fusion Applications’.	
H2.5	**Cooperation with regions of the Czech Republic**
./.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
This team runs an internationally well-respected laboratory very efficiently serving a broad scientific community with various radio-analytical methods based on ion-beam and neutron induced reactions. It compares favourably with other laboratories of similar size at various European and international facilities.	
D1.2	**Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation**
There is a broad range of national and international cooperations, which are manifested by the listed cooperation partners and the publications showing a large fraction of leading authorship. The excellent expertise of the team is acknowledged by calls into internationally advisory or editorial boards.	

D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
The excellence of the work by the team is rewarded by several awards, calls into the organization of conferences or invited talks.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The research proposed for the next period is very well in line with the mission.	
D2.2	**Assessment of the previous research objectives and their achievement**
The team has increased its size and scope considerably during the previous period (creation of the MRNIB group), while keeping a high standard. Moreover, new instrumentation (e.g. LEIS) has been developed and implemented. Within the financial boundaries the previous research goals have been fully reached.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The number of researchers has doubled within the last period to 14 (basically by establishing the MRNIB group), while keeping the support team almost at the same level. Thus, the previous recommendations are fulfilled completely.	
D2.4	**Success in receiving grants**
The team has received many national and international grants. The cooperation with industrial partners provides additional contracts.	
D2.5	**Adequacy of instrumental equipment**
The equipment is currently at a high level allowing top-level research with high expectations for new developments	
D2.6	**Effectiveness of management**
The management of the team and its research is very efficient as shown by their results	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The research team possesses a very good age (50% < 35 years) and a reasonable gender (20%) structure for this field of physics. However, there might occur problems for the replacements of the technical staff. The present ratio researcher/technician is balanced, if the support and service for the various ion and neutron sources is taken into account. Depending on funding a desirable expansion of the activities is possible.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
The team management has reached a good gender ratio (within this field!) and created a balanced work-life condition.	
D2.9	**Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
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Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
The cooperation on national and international level is evidenced by the scientific outputs and the strong presence on various boards and panels. (e.g. 3 Czech universities, PALS; Messina, Jülich, PSI, Riken, JINR, BNL, Rossendorf).	
D3.2	**Effectiveness of joint research centres**
The neutron group of the team actively contributed within the Centre of Excellence (including the U. of Chemistry and Technology, Prague) and within the Inter-Excellence programme (partner: U.Chicago). The joint research permits the scientific exchange on highest level for the benefit methodology and student education.	
D3.3	**Success rate in supervision of PhD students**
2 PhD students defended their theses within the past 5 years.	
D3.4	**Participation of PhD students in the outputs**
The PhD student contribute significantly to the scientific output, as documented by the various publications.	
D3.5	**Participation of the team in master or bachelor studies**
One Bachelor and 7 Master theses have been defended.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
Considering the size and age of the team the teaching commitments are very good. (23 Bachelor, 14 Master and 1 PhD courses)	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Team members were strongly involved in popularisation of their field and activities as well as in the popularisation of general topics.	
D4.2	**Publishing activities and its quality**
The publication of material for high school teachers, thus for their students, must be emphasized particularly.	
D4.3	**Participation in professional organisations in the area of research and development**
Team members are engaged actively in national and international organisations of research and development, thereby organizing and structuring the research landscape and international conferences.	

Other comments of the commission:

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7 - Neutron Diffraction

Strengths:

- Unique expertise of team members within the Czech Republic
- Unique instrumentations
- Long term collaboration with neutron scattering users in the Czech Republic and abroad

Weaknesses:

- A missing long-term support for the infrastructure operation and development
- Low number of PhD

Opportunities:

- Active participation in ESS consortium which ensures access to a worl-class facility and provides further collaboration with universities and with the private sector
- General interest in material research from industrial partners

Threats:

- Unclear funding

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The quality of the selected outputs ranges around the average of the 36 teams within Commission 2.	
H1.2	**Contribution of workers on the outputs reached**
The contribution of team members is about 26 %, this lower contribution is most probably caused by the user oriented programme of the team. About 50% of the output has a reprint author from the team.	
H1.3	**Quality of all outputs and results**
The quality of all outputs is satisfactory: from all outputs (131) by journal ranking are 10 in quartile (decil) Q1*, 5 in quartile Q1, 25 in quartile Q2 and 41 in Q3.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
The combination of acoustic emission and neutron diffraction.	
H1.5	**Contribution of the participation of the authors in large collaborations**
Apart from contributions to many smaller sized collaborative efforts the ESS is the large collaboration. Sofar the contributions to the BEER diffractometer are sizeable compared to the FTE of the team.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The research of this team is concerned with structural issues of high-tech materials needed for modern industrial or medical technologies; also, in the design of the equipment needed.	

H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities
There is a strong outreach programme for the dissemination of the team's research towards the industrial partners.	
H2.3	**Relation to practice**
There is one research contribution to practice.	
H2.4	**Participation in AV21 strategy**
The team participated in programme 23 of AV21 as preparatory stage to a possible project Cultural Heritage.	
H2.5	**Cooperation with regions of the Czech Republic**
There is no direct cooperation with regions of the Czech Republic.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
The team has high qualification and competes at the same height on international level, being able to contribute cutting edge equipment at most modern facilities	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
There is good quality of international cooperations with a strong commitment towards ESS.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
There is a strong involvement of team members in committees and panels, they have organized several conferences and contributed through invited talks. A paper and a poster received an award.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The planned activities are in accordance with the overall goals, continuing with the material research via neutron diffraction method by employing the present equipment and widening towards the ESS with new installations.	
D2.2	**Assessment of the previous research objectives and their achievement**
The instrumentation at the LVR15 has been improved successfully leading to several exciting results.	

D2.3	Assessment of implementation of recommendations from past evaluation
The recommendation regarding scientific goals have been met successfully. However, there is only a slight improvement in the personal structure. The popularisation to attract young scholars has not been overwhelmingly successful.	
D2.4	**Success in receiving grants**
The team was successful above all with user and infrastructure projects as Centre of Accelerators and Nuclear Analytical Methods (CANAM) and European Spallation Source – participation of the Czech Republic (ESS Scandinavia-CZ). The team was successful also with the HORIZON-2020 project World class Science and Innovation with Neutrons in Europe 2020 (SINE2020, 2015-2019).	
D2.5	**Adequacy of instrumental equipment**
Present and new built equipment provides a solid basis for top level research and must be exploited during the next period. Planning of further extensions should be in accordance with plans for the LVR15 research reactor in Řež.	
D2.6	**Effectiveness of management**
The management of the team is sufficiently effective, this is reflected in the acquisition of grants and in the results of the team.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The team has a low fraction of female researchers, else, the the team has members distributed in all age categories with two peaks around 25 - 35 and 40 – 45 years. Irrespective of the future of the reactor LVR15 the team must strengthen its team to exploit the instruments at the LVR15 as well as the new installation BEER@ESS.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
The team management creates preconditions for work-life balance and makes approaches towards possible gender issues.	
D2.9	**Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
The research activities of the team are in line with the National Programme of Sustainability II.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
On national and international level, the research activities are well established between various universities worldwide.	
D3.2	**Effectiveness of joint research centres**
The joint research center AdMat with universities enabled to create an effective combination of top science and high quality education.	

D3.3	Success rate in supervision of PhD students
The 2 students who have started within the last period successfully defended their theses. Team members were involved in consultation of 4 more PhD.	
D3.4	**Participation of PhD students in the outputs**
The work of the PhD students was basis of journals with impact factor, 2 PhD students co-authored 3 publications each, which can be taken as effective good supervision.	
D3.5	**Participation of the institute in master or bachelor studies**
Only 1 master course was given; no thesis was consulted or defended.	
D3.6	**Assessment of cooperation intensity with universities in the form of teaching**
The teaching apparently is held at a rather low level, which might cause the low number of Bachelor and/or Master students.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
TV-clips and briefing of industrial partner is well organized, outreach activities regarding the general public and secondary schools are rather low	
D4.2	**Publishing activities and its quality**
Is good for industrial partners.	
D4.3	**Participation in professional organisations in the area of research and development**
Team members serve on Working Groups, panels and programme committees on national and international level.	

Other comments of the commission:

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8 - Dosimetry of Ionizing Radiation

Strengths:

- Balanced team age structure, attractive
- Broad spectrum of interdisciplinary fields covered
- Strong commitment to technical developments.
- National and international collaborations

Weaknesses:

- publications

Opportunities:

- attractive and high level of research for (female) students
- relations to local research and industry

Threats:

- The general threats to the NPI institute probably apply to a lesser amount for this team, but should be regarded

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The selected output is of good quality. For excellent output the team is below the physics average.	
H1.2	**Contribution of workers on the outputs reached**
The total number of outputs attests a strong activity of the team. One- third or less of the papers had a team member as reprint author.	
H1.3	**Quality of all outputs and results**
Amongst the large number of publications a good portion is excellent. A wide area of more technical topics (lower indexed) is covered at a medium quality level; however, the spread of the fields is enormous	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
Radio-damage at low exposures and biophysical modelling	
H1.5	**Contribution of the participation of the authors in large collaborations**
Top contributions in wide spanning interests of metrology and modelling, also sensor development	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Metrology of dosimetry, biophysical modelling for proton therapy, results of CRREAT.	

H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities
There is a strong outreach programme. The air and space dosimetry data are high relevance. Metrology and service of national radiation safety: Accredited Metrology Centre: Calibrations of dosimetry systems for Czech Republic, Office for Nuclear Safety (Tomotherapy)	
H2.3	**Relation to practice**
There is a good record on air and space dosimetry and surveillance. Independent dosimetry audits of new radiotherapy technologies.	
H2.4	**Participation in AV21 strategy**
The team is involved in the programme VP16.	
H2.5	**Cooperation with regions of the Czech Republic**
Very active: Calibrations of dosimetry systems for Czech Republique, Independent dosimetry audits of new radiotherapy technologies, Office for Nuclear Safety (Tomotherapy),	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
A creative and internationally successful team in the field of dosimetry	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
There is good quality work performed in international cooperation on e.g. space experiments. Very high visibility, partner in European Networks.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
There is an excellent report on student awards, conferences and workshops mostly national and invited talks.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The planned activities in general continue the previous path focussing on various topics of dosimetry, they are in in with the goals of the institute and CAS.	
D2.2	**Assessment of the previous research objectives and their achievement**
In the main the set goals have been achieved, apart from access to underground laboratories.	

D2.3	Assessment of implementation of recommendations from past evaluation
No special recommendations were given	
D2.4	**Success in receiving grants**
The team has successfully acquired various national and international grants.	
D2.5	**Adequacy of instrumental equipment**
The available equipment seems to adequately serve the requests. The team is successfully acquiring and developing new tools	
D2.6	**Effectiveness of management**
The management seems to work professionally and effectively.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
The team has a healthy age structure as it can attract many young students. Availability of long-term technical support must be observed.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
The team leader aims to provide good work-life balance; optimal to have a female team leader as example for entering young female students.	
D2.9	**Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
N/A	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Many cooperation with national and international universities provide the fruitful basis of data exchange and common publications	
D3.2	**Effectiveness of joint research centres**
N/A	
D3.3	**Success rate in supervision of PhD students**
7 PhD students, 3 already defended.	
D3.4	**Participation of PhD students in the outputs**
The PhD students contribute to the scientific output and outreach.	
D3.5	**Participation of the institute in master or bachelor studies**
8 bachelor/master courses are given per semester.	

D3.6	Assessment of cooperation intensity with universities in the form of teaching
The team takes a high teaching load.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
A strong and interesting set of lectures was presented at Science Weeks. Excursions and experiments are offered.	
D4.2	**Publishing activities and its quality**
Proceedings of the Czech Society for Radiation Protection.	
D4.3	**Participation in professional organisations in the area of research and development**
Team members serve at panel and advisory boards on international level; M.Davidkova presides the Czech Society for Radio Protection.	

Other comments of the commission:
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9 - Radionuclides and Accelerators

Strengths:

- High technical knowhow for a set of accelerators in a rather unique combination including a radio-chemical laboratory
- Broad interests and widespread cooperations

Weaknesses:

- Manpower and spread of activities
- Age and spare parts of some equipment

Opportunities:

- Demands on service inside CAS and abroad for activities in various fields

Threats:

- Financial uncertainties around CANAM follow-up
- Future replacement on technical support team

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The quality of the selected papers is very excellent, a broad range of fields is covered.	
H1.2	**Contribution of workers on the outputs reached**
In the top decile there is no reprint author from the team. However, within the first 2 quartile this fraction is between 30 and 50%.	
H1.3	**Quality of all outputs and results**
The total number of outputs with respect to the number of researchers with strong instrumental obligations is rather good. The quality is adequate.	
H1.4	**The most valuable discoveries and findings in the fields, their importance for the field**
High power neutron source and 83Rb/83Kr source.	
H1.5	**Contribution of the participation of the authors in large collaborations**
The team provides strong contributions in development and maintenance of a vital infrastructure for many successful projects of various size. Even if theses are not summarized within a formal collaboration, effectively it is. The team is essential inn the KATRIN experiment, it is involved also in EATRIS and in IAEA medical data production.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The team provides and services accelerators and instumentations used also by other teams of the NPI as well accommodates external users.	

H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities
The teams keeps alive the technology and methodology for applications in fundamental research and in medical applications	
H2.3	**Relation to practice**
Production of radioisotopes for clinical use, data for material science in connection to fusion. Provides services for industry.	
H2.4	**Participation in AV21 strategy**
Not mentioned	
H2.5	**Cooperation with regions of the Czech Republic**
No direct interaction with Czech regions	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
The team operates a unique set of accelrators at a high level	
D1.2	**Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation**
The team has many fruitful cooperation mostly with European institutes and/or accelerator facilities. The neutron sources are of unique quality and intensity. Without the 83Rb/Kr production the KATRIN experiment would be of low use/value.	
D1.3	**Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)**
Team members serve on Czech commissions and counsils. They have organized a workshop.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
Yes, repair, design and construction of existing beam facilities	
D2.2	**Assessment of the previous research objectives and their achievement**
The research goals of the previous period were reached by and large.	
D2.3	**Assessment of implementation of recommendations from past evaluation**
The proposed increase in manpower was not achieved satisfactorily due to the economic and financial limitations.	

D2.4	Success in receiving grants
Several grants mainly for the operation of the accelerators and participation in international organisations. Few individual grants as principal investigators.	
D2.5	**Adequacy of instrumental equipment**
3 accelerators and neutron generator in combination with the radio-chemical laboratory serve well the needs. Team operates Europe's most efficient neutron source.	
D2.6	**Effectiveness of management**
The management makes effective use of manpower and equipment.	
D2.7	**Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth**
Age gap bewteen 50 and 65. Long-standing problem of aquiring experienced workers to form new groups devoted to new research areas.	
D2.8	**Creating work-life balance conditions, assessment of approach towards possible gender issues**
Personal dominated by technical personal. Gender ratio in scientific area well balanced with about 40%.	
D2.9	**Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.**
D2.9 criterion is only relevant for the evaluation of the Institute of Physics (project ELI).	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
On both levels cooperations are established leading to very good output.	
D3.2	**Effectiveness of joint research centres**
83Sr/Kr production for KATRIN, labelled compounds and medical radioisotopes prove the effectiveness of cooperations.	
D3.3	**Success rate in supervision of PhD students**
1 PhD defended and 5 more supervised/consulted. Below average, however, difficult to attract students for accelerater operation dominated team	
D3.4	**Participation of PhD students in the outputs**
The 5 PhD students from the technical university Prague contributed to the outputs,	
D3.5	**Participation of the institute in master or bachelor studies**
1 master student was supervised, another defended his thesis, 19 Master courses were held	

D3.6	Assessment of cooperation intensity with universities in the form of teaching
2 team members presented 19 master courses	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Radio and TV presentations as well as participation on Science EXPO. However, outreach programmes on high school level is missing	
D4.2	**Publishing activities and its quality**
Fewer publishing activities, which can be understood that the focus of the team is mainly on the operation of the accelerators.	
D4.3	**Participation in professional organisations in the area of research and development**
Team is providing access / service other research areas and industry.	

Other comments of the commission:

- the team acts as a service team providing accelerator access to other teams from inside and outside as well as a research group generating scientific results. This is a challenge for any team, which is handled very well.

Final report was elaborated by:

Commission 2 - Physical sciences
Evaluated teams No.: 1, 2, 3, 4, 5, 6, 7, 8, 9

Commission Chair: Prof. Martin Stutzmann
Commission Deputy Chair: Karol Flachbart
Commission Members:

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- Ingo Dierking
- Niall English
- Stefano Forte
- Peter Grabmayr
- Sebastian Hoenig
- Thomas Kuehl
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