

# **Evaluation of the Research and Professional Activity of the Institutes of the Czech Academy of Sciences (CAS) for the period 2010–2014**

## **Final Report on the Evaluation of the Institute**

**Name of the Institute: Nuclear Physics Institute of the CAS**

**Fields, in which the Institute registered its teams:**

**Chemical sciences**

Observer representing the Academy Council of the CAS: Jiri Ctyroky

Observer representing the Institute: Vladimir Wagner

**Commission No. 4: Chemical sciences**

Chair: Dr Habil, Academician Christian Amatore

Date(s) of the visit of the Institute: November 30 - December 4, 2015

Programme of the visit of the Institute: see attached Minutes from the visit

Evaluated research team:

- **Neutron Activation Analysis**

## **A. Evaluation of the Institute as a whole**

### **General Evaluation**

As follows from the written documents and the presentation made by the Institute Director, the Institute's mission is to provide basic researches and infrastructures in nuclear physics and related disciplines, and offers its nuclear expertise and methods in interdisciplinary basic and applied research in other natural sciences. Hence, the Institute plays a major role in the Czech Republic's programs in nuclear physics by developing advanced theoretical and experimental researches using its own research facilities or through participation in large international collaborations (ALICE at CERN-LHC, STAR at RHIC-BNL, HADES-GSI, KATRIN, GANIL, INFN-LNS).

Accordingly, it hosts a large Czech infrastructure, CANAM (Center of Accelerators and Nuclear Analytical Methods, CAS) in the Rez scientific campus and offers/maintains other nuclear physics experimental facilities (Radiopharmaceutical, Radiation dosimetry), participates as the Czech Republic representative at the creation of the European Spallation Source (ESS), a pan-European multi-disciplinary research center under construction in Lund (Sweden). Within this context, the Institute has recently proposed two other research infrastructures to actualize both CANAM and ESS.CZ: FAIR.CZ and SPIAL2.CZ.

Owing to its missions, the Institute is structured into Sections/Departments subdivided into Units/Groups/laboratories that altogether involve > 60 scientists (with PhD degree), ca. 20 postdoctoral fellows, > 35 research assistants (with BS or MSc degree), > 15 doctoral students, represent altogether 62% FTE, technical and administrative staff (30% FTE), and workers (8% FTE). Owing to its international activities, the Institute hosts a rather high number of foreign scientists (19%) and post-docs (42%). However, as recognized by its Director, the age distribution is far from optimum though this appears to have gradually improved over the period presently evaluated.

Finally, since most of the Institute teams were not evaluated by this Committee, only one of its component was evaluated in detail because of its relevance to chemical and biochemical issues. However, the general reports provided by the Director about the structure, scientific and educational accomplishments of the Institute were found excellent in every respect.

*Nota Bene: Since the Committee evaluated only a minor component of the Institute research structure, it did not feel appropriate commenting on the items 1-3 beyond the overall positive appreciations given above.*

## **B. Evaluation of the individual teams**

### **Evaluation of the Team: Neutron Activation Analysis**

#### **1. Introduction**

This Team has a long tradition in the Institute and occupies a special niche among the other departments, being more closely related to topics with strong relevance to chemistry and biochemistry than to physics, for which it takes an impressive advantage of its unique access to the Institute facilities and equipment. As such, the Team has a somewhat unique position in the Czech Republic and can address with success many issues of important scientific and societal relevance.

The Team uses the research reactor located in the Rez scientific campus as its neutron source and is adequately equipped for its specialized researches. Beyond its focus on its own researches, the Team offers its high expertise and know-how to collaborate with a number of organizations ranging from purely scientific to governmental ones.

This allows a rather modest staff number (9 researchers and 3 students) to brilliantly investigate several fields where its nuclear physical approaches (essentially high sensitive neutron activation analysis, NAA, which complemented, when required, with photon activation analysis, PAA, or X-ray fluorescence analysis ,XFA) prove extremely powerful. Namely, the team is excellently active in (i) geo- and cosmo-chemical research, (ii) geo-mycology, (iii) environmental research, (iv) agriculture and nutrition, (v) material research, (vi) reference materials and quality-assurance, and (vii) cultural heritage issues.

#### **2. Strengths and Opportunities**

The Team know-how, its qualified access to only neutron source in the country and the vast past experience of its Director provide the team with a unique position in the Czech Republic.

The team has developed strong scientific contacts with a few other groups in the world who are addressing analogous issues, thus being part of a restricted excellent network.

The Team is highly motivated and has a reasonable age structure. This is an important promise for keeping its important know-how and expand it in the future to maintain its far-reaching national and international collaborations.

### **3. Weaknesses and Threats**

Albeit its present excellence, the group is facing two main problems whose solutions are unfortunately beyond its power.

A first one is related to the age of his present leader who will be probably retired in close future. Owing to the fact that the Director seems to be the present “soul” of the team, his replacement at the head of the Team has to be planned with great care.

The second one is and might be the access to the neutron source. Presently, this involves the research nuclear reactor located on the campus, which is now ~60 years old and it is the property of a private company (production of radiopharmaceuticals) installed on the campus. As a consequence, the reactor operation plans may change according to the company interest resulting in a difficult organization of the team’s accesses. More detrimental is the probable planned shutdown of the reactor. This is presently scheduled for 2024 but the date might be changed to an earlier date. The long-time director of the Team will be probably retiring in a close future. The research topics of the Team are relatively wide but it originates from the specific research of the Team.

### **4. Recommendations**

With the determined help of CAS, the Institute should develop a strategy to plan in advance how the neutron source might be replaced when the present reactor will be shut down. Indeed, this Team has a unique position in the Czech Republic and its excellent know-how, expertise, research topics as well as the unique services that it offers are indeed highly important to be maintained.

Similarly, the Institute should be concerned with the search for a new Director who can embrace the Team’s activities with a success comparable to that exhibited by its present Director.

### **5. Detailed evaluations**

As its name indicates, the main activity of the Team relies mostly on neutrons activation for a wide range of very sensitive elemental analyses. This is used to

provide unique knowledge and information in several areas with excellent scientific and societal implications where trace levels need to be determined. This approach seems hard to replace by another suitable physical method while allowing a so large range of topics.

The Team publishes in both local (as its work is locally very important) as well as in international journals and contributes to a substantial part of results of whole Institute. The Team has had, due to wide collaborations, access to very interesting scientific/societal problems where his expertise and know-how are essential.

The members of the Team are extensively involved in teaching at universities and supervise students at different levels. As evident during on-site the discussions, the Team activities and researches relevance to scientific and societal issues make that the Team does not experiences any problem to attract qualified students.

The Team is unique at the national level and its outputs could be hardly supplanted. Similarly, the Team has a good visibility at the international level among groups working with neutron activation analyses and, accordingly, collaborates with such groups worldwide. It has participated in several international methodological projects (validations) and helps solving problems originating in foreign groups.

The present age structure of Team is prone to ensure its vitality and an excellent continuation of its researches (though, great care must be taken by the Institute in searching for the replacement of the Team present Director who will be probably retiring in a close future).

The only but very acute problem that the Team will have to face in future years relates to the planned reactor shutdown. The current Team leader is aware of the problem and, together with the Institute Director, has suggested a reasonable plan how to deal with the situation. This is part of the excellent strategy and research plans that are defined.

**Date:** December 26, 2015

**Commission Chair:** Dr Habil, Academician Christian Amatore