Cremlin Connecting Russian and European Measures for Large-scale Research Infrastructures

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Recommendations on the state-of-the-art user system for PIK

CREMLIN Deliverable D4.5

WP4: Science Cooperation with the PIK research reactor in the field of neutron sources

Task 4.5: User System

Lead partners: TUM

Introduction

In the forthcoming year(s) the neutron source PIK will come online with a thermal power level providing unperturbed neutron fluxes in its moderator > 10^{14} n cm^{-1} s-1, which will increase to > 10^{15} n cm^{-1} s^{-1} once full thermal power of 100 MW is reached. These thermal fluxes and the installation of a cold moderator make PIK highly attractive for the national and international scientific community using neutrons for basic science, engineering and medicine. Acknowledging that competition creates excellence, it is in the interest of PIK to establish a user system providing the base for a competitive use of the neutron source.

Taking notice that Petersburg Nuclear Physics Institute (PNPI), member of the National Research Center “Kurchatov Institute” is currently discussing within the Russian Federation and with international partners about the legal frame for such a user system, and being aware that this structure is yet not established the following thoughts will restrict to generic aspects of such an internationally open, competitive user system.

PIK as part of the European network of high performance neutron sources

Research performed with neutrons lies at the heart of many challenges and questions encountered by modern society. Pressing needs are advanced medical demands for an aging society, the search for better and more reliable materials or the construction of ever better facilities for the storage and manipulation of information. An urgent need is to transform and store energy in a sustainable and affordable way for a wide variety of applications, from household use over information technology to transportation; i.e. a knowledge-based society of high technological, scientific and industrial capabilities urgently needs access to neutrons.

Therefore, neutron facilities are an integral part for a strategic scientific, industrial and medical infrastructure and strongly support a wide array of other scientific and strategic fields. Focus areas are biological, soft-matter, medical, magnetic and materials research as well as industrial and health care needs.

Large scale infrastructures bind considerable amount of resources within national and trans-national research budgets. Therefore, it is essential to optimise these scarce resources, to overcome the fragmented research infrastructure spending, and to join forces to address these challenges.

PIK as a future national high performance neutron source operated by Petersburg Nuclear Physics Institute (PNPI), member of the National Research Center "Kurchatov Institute" and financed by the Russian Federation will give the Russian scientific community the unique possibility to strengthen its competitiveness in the field of science with neutrons. Scientific excellence needs competition and this scientific competition happens on an international level. Scientific competition is more than only competing; it is also based on international cooperation.

The neutron landscape in Western Europe might illustrate the success of this approach. Multinational sources like the Institute Laue Langevin and the future European Spallation Source together with national high performance neutron sources like ISIS, MLZ and SINQ form a network giving access to European users solely on the base of scientific excellence, i.e. beam time is allocated in an open call process to the scientific most interesting proposals. Unambiguously this network of European high performance neutron sources forms the backbone of the world leading European neutron user community (8,000 users per year, consistently growing high impact publications).

Besides providing technology to research infrastructures industry is increasingly a direct user of large-scale infrastructure, in particular of neutron sources. Dedicated initiatives can help increase knowledge and technology transfer from science to industry.

An efficient transnational collaboration is essential for Europe to secure its world leadership in the area of neutron research infrastructures. Simplified transnational user access is of paramount importance for a European key competence, which promotes world-class research across national borders and boosts competitiveness.

In a more general way the importance of transnational access to research infrastructures for a modern high tech society has been summarized in the European Charter for Access to Research Infrastructures, published by the EUROPEAN COMMISSION, Directorate-General for Research and Innovation[1]. *"Research Infrastructures, including e-infrastructures, are at the core of the knowledge triangle of research, education and innovation and therefore play a vital role in the advancement of knowledge and technology and their exploitation. By offering high quality services to Users from different countries, engaging young people, attracting new Users and preparing the next generation of researchers, Research Infrastructures help in structuring the scientific community and play a key role in the construction of an efficient research and innovation environment. …. Because of their ability to assemble a critical mass of people, knowledge and investment, Research Infrastructures contribute to regional, national, European and global development and are one of the most efficient tools to facilitate international cooperation in science."*

[1] European Charter for Access to Research Infrastructures, Principles and Guidelines for Access and Related Services (https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf).

A transnational user access system for PIK

Clearly, access to a transnational user system for PIK should be based on scientific competitiveness, i.e. beam time should primarily be allocated on the base of scientific excellence, originality, quality and technical feasibility and is essentially free of direct financial charges. In turn, the user has the obligation to make available the acquired scientific results to a greater public, i.e. to publish. As a prerequisite all accessible instruments have to be supported by competent scientific and technical staff for a smooth operation of the instrument and support of the user performing the experiment. Today, the user (group) participates in most cases at the experiment. Future development might bring an increased demand of experiments performed by the local contact with only remote access for the user.

Access for industry might need a different access system. In case industry wants exclusive ownership of the data and the results beam time has to be payed to an extent to cover the real pro rata cost of the large-scale facility, instrument installation and its operation.

Such a user system needs a well-structured organization, i.e. a **user office** incorporating elements such as

- **Internet user platform:** This internet platform presents all information needed for application of beam time, legal requirements for access and access to the facilities, Users must comply with security, safety and environmental rules and with procedures in force, in particular concerning the notifications on introduction of material and instrumentation that could induce risks to the facility and/or environment.
- **Regular call for proposals:** Making the balance between the wish of the user to get beam time in a short amount of time after submission of a proposal and the time needed to organize review of the proposals and scheduling the beam time a period of ½ year for each proposal call is a well established compromise.
- **Rapid access:** Prompt or accelerated access to beam time is recommended for a limited number of instruments and for a limited quota of beam time. Justification for accelerated access comes from urgent needs, as for example for finishing a publication or a PhD work. Rapid access needs a simplified and rapid evaluation of the proposal.
- **Review panel of the scientific proposals:** Ideally, such a review committee structures along scientific fields and its members are internationally renowned experts. They are nominated by the Scientific Directorate or alternatively by an International Advisory Committee of the user facility. Typically, members serve for a period of 3 years. The review panel establishes a priority list for allocation of beam time. The final decision for allocation remains in the responsibility of the scientific directorate, following to a maximum extent the recommendations of the review panel. Beside the evaluation of the scientific interest criteria like proven availability of high quality samples, availability of adequate sample environment, control of safety risks, publications records of the applicants, availability of reports from previous experiments at the facility are to be considered. This kind of information has to be delivered to the review panel by the user facility prior to the review meeting.
- **Assistance for travelling to the facility and accommodation** of the scientists
- **Smooth access to the facility**: Neutron instruments operate 7 days a week over 24 hours. Accordingly access for the user to the instrument over 7 days a week and 24 hours a day has to be guaranteed.
- **Help for all legal aspects** such as safety and security measures for the access
- **Quality assurance**, reporting system for executed experiments and publication archive: Any executed experiment has to be followed by a short but meaningful report. The ultimate goal of any experiment is a peer reviewed publication. The user has the obligation to deliver the

experimental report in due time (i.e. not later than 6 months after finishing the experiment) and in general to include the local contact on the author list of the scientific publication.

Administration of all these tasks has to be supported and largely automatized by a **capable computing system**. Such advanced user software support exists at international neutron and synchrotron sources. In order to save resources and to generate synergies it is highly recommended to resort to one of those.

With the rapid progress in computation and automation infrastructures and their services become more accessible and enabling new ways of collaboration between users and the large-scale facility. From a user´s perspective, the **remote access** can lead to a situation in which the physical location of the research infrastructure becomes less relevant. From an infrastructure perspective direct access to the instrument may become more restricted.

Inherent to the collaboration between user and infrastructure, both share the ownership of the collected data and to a certain extent also that of the achieved results. To create an area of common trust it is advised to set down clear formulations of this shared ownership (intellectual property rights, data protection, confidentiality, liability). Part of this is the good practice to participate the local contact at the authorship of publications. It may be argued that the acquisition of the data has been paid by public money/tax payer. For an efficient use of this public money the data should be made available after a certain waiting period – > 1 year – to the general scientific community for further evaluation (**public data ownership**). While this is already practice in astrophysics neutron infrastructures are yet in a process of discussing such an approach. PIK as an upcoming new infrastructure should take a clear position to this challenge in relation to data ownership and to the necessity of providing transparency. The exponential growth of data moreover poses challenges to its effective handling and its costs of curation and storage.

Commercial access for industry (ownership of the results) needs a business plan and a policy defining how (fast) access is granted, support to access, support for performing the “experiment” including data evaluation and confidentiality.

Top science and education go hand in hand. It is estimated that in more than 1/3 of all experiments at neutron sources work for master or doctoral thesis is involved. Student formation is an inherent part of world-class research and boosts competitiveness. Any peer review system of proposals has to reflect this. **A joint graduate program as part of the transnational access at PIK** might be a unique opportunity to boost competitiveness across national borders.

Any user system needs feedback from its users. **Elected user representatives and regular user meetings** are a means to organize this feedback, to foster transparency and to assure scientific quality.

To facilitate the 24 hour access of the user to the experiment, a **guest house** near by the facility is highly recommended. Successful examples of such guest houses exist at the ILL, SINQ and HZB.

Allocation of beam time to the transnational user system.

According to actual planning instrumentation at PIK will be a joint effort by PNPI, further Russian expert centres and international partners from Europe. Each of these partners will contribute by technical expertise, in-kind delivery, cash investments and human resources. Some scenarios even foresee a future operation of instruments by groups external to PNPI. Arguing with this engagement the involved partners will ask for pro-rata access to beam time, reflecting the particular engagement. A priori such a pro-rata access is in conflict to an open transnational user system based solely on scientific competition.

Following successful examples like MLZ or ILL a first criterion for beam time allocation should be the scientific quality. Over periods of years it will be monitored whether the allocated beam time to users from a given country reflects the engagement of said country, i.e. the beforehand agreed pro-rata. In case of considerable disequilibrium, measures to re-equilibrate the usage to the agreed pro-rata are recommended.

In any case available beam time cannot be fully devoted to the transnational access. Conditioning, further development of an instrument and starting the operation of new instruments need reserved time. The same holds for commercial beam time. Further time may be reserved for educational programs like neutron courses, training of students, etc.