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

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Guidelines for the general PIK Instrumentation Concept

CREMLIN Deliverable D4.3

CREMLIN WP4: "Science Cooperation with the PIK Research Reactor in the Field of Neutron Sources"

Task 4.2 "Instrumentation Concept for PIK reactor"

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The Guidelines for the general PIK Instrumentation have been developed at regular meetings of the instrumental subcommittees of the NSAC (Neutron Science Advisory Committee) with PNPI scientists.

1. Four subcommittees – on large-scale structures, neutron diffraction, neutron spectroscopy and fundamental physics have covered the whole spectrum of neutron instrumentation at PIK. Moreover, two additional subcommittees have been organized to deal with the absolutely essential issues of neutron moderators/neutron optics and neutron detectors/monitors. All 6 subcommittees have been staffed with internationally recognized experts from leading neutron centers of EU, Russia and USA (see below). The chairing of subcommittees has been evenly shared between scientists from Russia and EU-countries.

Meetings of subcommittees took place mostly at the PNPI (Gatchina, Russia) where the PIK reactor is situated. However, one meeting has been organized at the margins of international workshop that has been attended by the majority of subcommittee members.

Overview tables on 6 Subcommittees, their composition and meetings:

Subcommittee 1: Spectroscopy	
Karin Schmalzl; Chair	FZ Jülich
Evgeny Klementjev	NPI Troitsk; Immanuel Kant Baltic Federal University IKBFU, Kaliningrad
Jörg Voigt	FZ Jülich

Pavel Alekseev	NRC KI, Moscow
Jiri Kulda	ILL, Grenoble
Michael Monkenbusch	FZ Jülich
Margarita Russina	HZB, Berlin

Meetings Subcommittee 1.:

- 16-17.06.2015 (Gatchina, Russia)
- 30-31.01.2017 (Gatchina, Russia)
- 17-18.04.2018 (Gatchina, Russia)

Subcommittee 2: Neutron Diffraction	
Alexander Kurbakov, Chair	PNPI NRC KI, Gatchina
Anatoly Balagurov	JINR, Dubna
Vyacheslav Em	NRC KI, Moscow
Peter Staron	HZG, Geesthacht
Werner Schweika	FZ Jülich
Martin Meven	RWTH, Aachen
Arsene Goukassov	CEA-LLB, Saclay

Meetings Subcommittee 2:

- 23 –24.06.2015 (Gatchina, Russia)
- 5-6.02. 2017 (Gatchina, Russia)
- 19-20.10. 2017 (Gatchina, Russia)
- 11-12.04. 2018 (Gatchina, Russia)

Subcommittee 3: Large-scale structures	
Alexander Ioffe, Chair	FZ Jülich
Evgeny Moskvin	PNPI NRC KI, Gatchina
Mikhail Avdeev	JINR, Dubna
Boris Toperverg	PNPI NRC KI, Gatchina
Ali Ezzeldin Metwalli	TUM, München
Stefan Mattauch	FZ Jülich

Meetings Subcommittee 3:

- 29-30.06.2015 (Gatchina, Russia)
- 8-9.02.2017 (Gatchina, Russia)
- 24-25.10.2017 (Gatchina, Russia)
- 16-17.05.2018 (Gatchina, Russia)

Subcommittee 4:Fundamental Physics	
Valery Nesvizhevsky, Chair	ILL, Grenoble
Vladimir Voronin	PNPI NRC KI, Gatchina
Walter Furman	JINR, Dubna
Egor Lychagin	JINR, Dubna
Hartmut Abele	TU Wien, Head of Group Neutron- and Quantum Physics
Stefan Baessler	UVAU University of Virginia / Oak Ridge
Oliver Zimmer	ILL, Grenoble
Michael Jentschel	ILL, Grenoble

Meetings:

- 2-3.04.2015 (Gatchina, Russia)
- 23-24.09.2015 (Gatchina, Russia)
- 3-4.05. 2018 (Gatchina, Russia)

Subcommittee 5:Neutron Optics and Moderatorars	
Ferenc Mezei, Chair	ESS, Lund
Alexey Bulkin	PNPI NRC KI, Gatchina
Victor Mitukhlyaev	PNPI NRC KI, Gatchina
Sergey Kulikov	JINR Dubna
Peter Link	TUM, München
Ulrich Rücker	FZ Jülich
Alexey Muzychka	JINR Dubna
Kim Lefman	Nils Bohr Institute, Uni Copenhagen & ESS, Lund
Tamasz Grosz	Budapest Neutron Centre
Konstantin Batkov	ESS, Lund

Meetings Subcommittee 5:

- 9-12.03.2015 (Gatchina, Russia)
- 6-7.07.2015 (Gatchina, Russia)
- 25-26.03.2018 (Gatchina, Russia)

Subcommittee 6: Detectors and Monitors	
Sergey Kulikov, Chair	JINR Dubna
Sergey Kosjanenko	PNPI NRC KI Gatchina
Dmitry Iljin	PNPI NRC KI Gatchina
Günter Kemmerling	FZ Jülich
Gregor Nowak	HZG, Geesthacht
Irina Stefanescu	ESS, Lund
Richard Hall-Wilton	ESS, Lund
Bruno Guerard	ILL, Grenoble

Meetings Subcommittee 6:

- 14 – 16.09. 2015 (Gatchina, Russia)
- 15 -16.06. 2018 (Juelich, Germany)

To synchronize the recommendations of different subcommittees and to come to final result, their chairs of subcommittees have met on 23.10.2017 at PNPI, Gatchina.

2. The subcommittees came up with specific recommendations for SANS, reflectometry, diffraction, spectroscopy and fundamental physics instrumentation.

3. As the result of discussions in the large-scale structure subcommittee, the absolute necessity for the 2nd cold neutron source has emerged. Moreover, it was pointed out that because SANS and reflectometry instruments are using rather collimated neutron beams, the implementation of this cold source as a low-dimensional high brilliance one will be of a great advantage. Such kind of the source filled with the liquid parahydrogen has been designed for the ESS and is currently under the construction at the Forschungszentrum Jülich.

4. The angular width of the neutron beam emitted from the low-dimensional cold source is about 10-15°, that matches very well to the area of the neutron guide hall of PIK to be illuminated by this source. This should allow for keeping the ideal geometry of the low-dimensional source and approach the theoretical gain of about 10 with respect to the conventional cold source.

5. This suggestion has been supported by the neutron moderators/neutron optics subcommittee that has also proposed to equip the PIK reactor with the very cold neutron source.

6. In the case of technological problems related to the placement of such a source in the existing beam tube, the fallback solution will be a conventional liquid hydrogen cold source.

7. The neutron guide system for a new source should be designed for the bi-spectral beam extraction.

8. During the design of neutron guide system one should foresee rather large sample areas to allow the use of a bulky sample environment.

9. It is recommended to seriously consider the possibility to install and use the hot neutron source that actually has been foreseen for the PIK project from the very beginning. One should mention that intense beams of hot neutrons will not be available at ESS, thus creating a natural niche for reactors.

10. It is recommended to develop a common electronic standard that should be implemented at all instruments to be built at PIK, otherwise the expected costs of the maintaining of different electronic systems may become unbearable.