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WP3: Collaboration PIK

Stefan Mattauch

Jülich Centre for Neutron Science at MLZ,
Forschungszentrum Jülich GmbH, Garching, Germany

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WP3 Leader FZJ, co-leader NRC KI PNPI

NRC "Kurchatov Institute"
Petersburg Nuclear Physics Institute

Joint Institute
for Nuclear Research
Dubna

WP3:
Collaboration with PIK

St Petersburg
University

Budapest Neutron
Scattering Centre

Objectives

The objective of this work package is to strengthen the scientific and technical cooperation between PIK and European neutron research infrastructures in mutual interests of European and Russian researches.

The WP3 will achieve its objective by undertaking research and activities in three key areas:

- Joint development of advanced cold neutron sources,
- Joint development of the instrumentation concept for reactor PIK,
- Establish international bodies at PIK,
- Development of the neutron user-based education platform and an user system,
- Support strategic coordination of PIK in a whole

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Tasks

- Task 3.1: High-brilliance cold neutron source
- Task 3.2: Bi-spectral neutron extraction system
- Task 3.3: Development of advanced Very Cold Neutron Source
- Task 3.4: General blueprint for the instrumentation at PIK
- Task 3.5: Prototype of advanced polarized neutron diffractometer for PIK reactor
- Task 3.6: Establishing the scientific advisory committees at PIK
- Task 3.7: Instrument-specific education and training programs for engineers and scientists
- Task 3.8: User System
- Task 3.9: Support strategic coordination of PIK

Task 3.1: High-brilliance cold neutron source (FZJ, NCRKI-PNPI, MTA EK) M1-M48

- The neutron instrumentation at the PIK reactor requires effective neutron moderators, particularly, cold neutron sources.
- The conceptual design study and optimization of the second cold neutron source at the reactor PIK.

Task 3.2: Bi-spectral neutron extraction system (FZJ, NCRKI-PNPI, MTA EK) M1-M48

- Special attention will be given to the bi-spectral extraction of the neutron beams allowing for a significant enrichment of the cold neutron spectra by thermal neutrons and therefore resulting in the increase of the Q-range pooled in a single measurement.
- Partners will design the neutron optical system and numerically simulate its performance in conjunction with Task 3.1 .
- Results of these simulations will be used for the further optimization of neutron optical system (=>Task 3.4).

Task 3.3: Development of advanced Very Cold Neutron Source (ILL, NRC KI-PNPI, JINR, PTI, UCA, UNIMIB, ESS) M1-M48

- Very Cold Neutrons would optimally provide large gains for long-wavelength neutrons with respect to existing cold sources,
  - => strongly enhancing the capabilities of various neutron scattering techniques and the scientific reach of some particle-physics experiments

Task 3.4: General blueprint for the instrumentation at PIK (NRC KI-PNPI, FZJ, TUM, HZG, CEA-LLB) M7–M48

- Partners will carry out extensive simulation work to define the optimal positioning of instruments on the neutron beams and provide the conceptual design of the neutron blueprint (->Task 3.1 / 3.2)
- This work will be done under the supervision of the instrumental subcommittees of the SAC (-> Task 3.6) that will provide recommendations aiming maximal complementarity of Russian and international neutron instruments.

Task 3.5: Prototype of advanced polarized neutron diffractometer for PIK reactor (CEA-LLB, NRC KI-PNPI) M1-M48

- A working prototype of a single crystal diffractometers at the PIK reactor will be constructed.
- The prototype will be cost effective, contain all main elements necessary for performing diffraction experiments and will be kept modular.
  => the prototype can be upgraded and transformed into a highly performing diffractometer by local means.

- LLB will conduct calculations, optimization and assure the design of the secondary spectrometer for polarized single crystal diffractometer
  - Including: sample unit, detector unit and sample environment unit
  - Software: necessary for the data analysis adapted for area detectors.
- Prototype of the diffractometer will be delivered to the PIK reactor
  - Including: installation and commissioning

Task 3.6: Establishing the scientific advisor committees at PIK (NRC KI-PNPI, FZJ) M1–M48

The management and organisation of an international large-scale research infrastructure relies to a significant extend on international cooperation and exchange of knowledge and best practice experience.

- Setting up an Scientific Advisory Committee (SAC) for WP-3 (annual)
  - strategical recommendations with respect to priorities to be made in the development of the instrument suite after analysing the situation in the European landscape of the neutron instrumentation.
- Setting up national/international subcommittees (bi annual):
  - instrumental lines: Diffraction, Spectroscopy, Large-Scale Structures, Fundamental physics.
  - technical lines: Moderator and Neutron Optics, Sample Environment, Detectors (WP7)
- The SAC and the subcommittees will be staffed with national/international recognized experts in their corresponding field of neutron scattering and neutron instrumentation from Europe and Russia

Task 3.7: Instrument-specific education and training programs for engineers and scientists (NRC KI-PNPI & all partners) M1-M48

The design of neutron instrumentation for PIK requires a special training programme for young Russian engineers and scientists. It will be organized as:

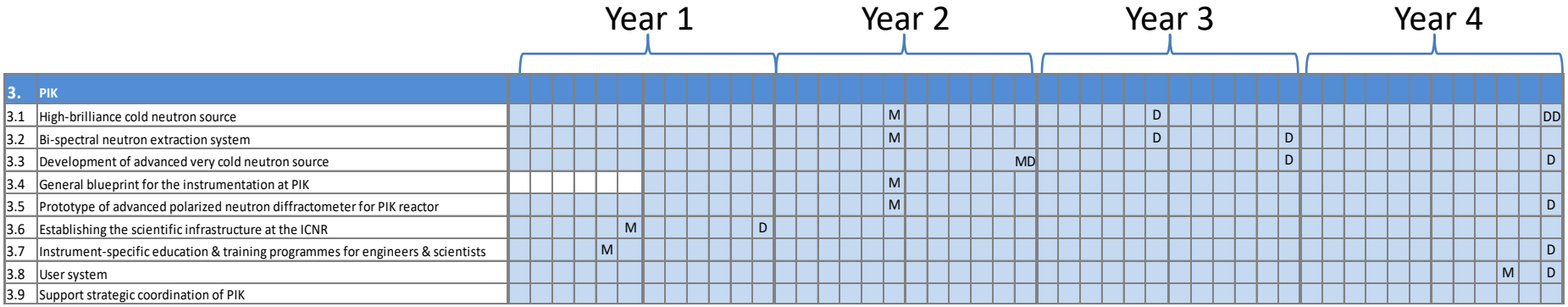
- a number of workshops, schools and training courses in connection with existing well-established international neutron schools and courses
- specialized workshops (neutron diffraction, reflectometry, modern simulation methods of instrument design, etc.), all with international experts.
- Close cooperation with task 9.1 of WP9 TRAIN.
- The solid links between the scientific communities of the SPSU providing the education in Neutron scattering and NRC KI – PNPI as a future student's employer will be established.
- Foreseen Phd students at SPSU being involved in the simulation work under task 3.4 will be a first start.

Task 3.8: User System (TUM, NRC KI-PNPI, JINR, ILL) M1–M48

- Concept for a User System at PIK in close cooperation with WP 8 ACCESS :
  - For the management and administration of international users
  - detailed analysis of the local requirements for access
  - Entire chain: Access, submission of a proposal, evaluation, result, experiment planning, statistical analysis (instrument operation, publications, etc.), additional user services (housing, visa applications, etc.).

Task 3.9: Support strategic coordination of PIK (NRC KI-PNPI & all partners) M1–M48

- PIK is a massive project:
  - tight project management and coordination between all tasks
    - Strong links to WP7 (Detectors), WP 8 (ACCESS) and WP9 (TRAIN)
    - with all stakeholders in PIK.
- Within CREMLINplus meetings will be organized (e.g. back-to-back, VC):
  - Overall PIK project planning, technical issues with international experts in regular intervals, CREMLINplus annual meetings.
- CREMLINplus: provides support in strategic coordination of the PIK project
  - including risk management of the PIK project development.



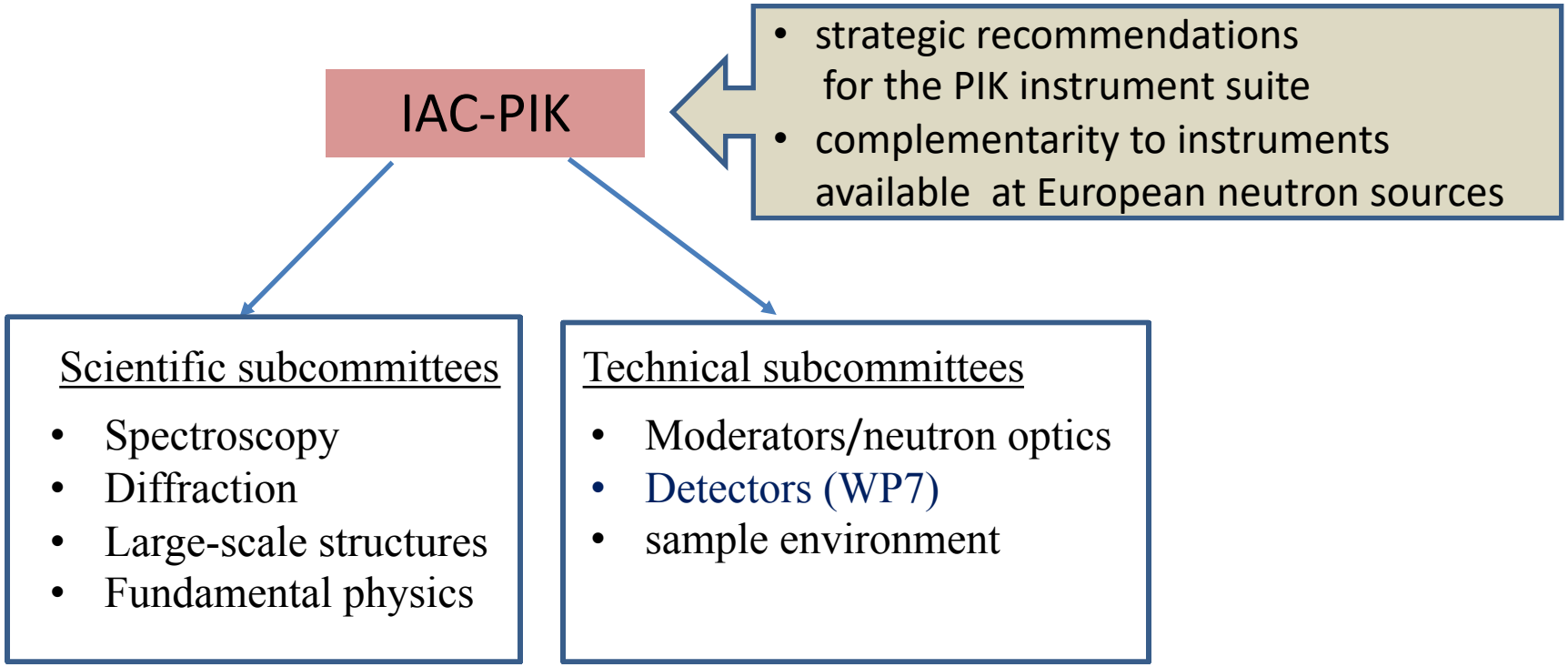
Deliverables

D3.1 Definition of optimal suite of instruments (M12)
D3.2 Model calculations of VCN yields of converter/reflector VCN source (M24)
D3.3 Conceptual design high brilliance cold source model (M30)
D3.4 Design, construction and test of cryogenic device and reflector (M30)
D3.5 Design and simulations of neutron guides from high-brilliance source (M30)
D3.6 Design and simulations of neutron guides for bi-spectral instruments (M30)
D3.7 Final design of bi-spectral extraction system (M36)
D3.8 Prototype of VCN source (M36)
D3.9 Final conceptual design of the high-brilliance cold source (M48)
D3.10 Experiments with prototype of VCN source (M48)
D3.11 Conceptual design & specifications for the guide system from the high-brilliance source (M48)
D3.12 Prototype of polarized neutron diffractometer ready for the installation at PIK (M48)
D3.13 Reports of the schools, courses and workshops on “Polarized Neutron Physics” (M48)
D3.14 Report of the established state-of-the-art user system for PIK (M48)

Expected Impact for WP3 I:

Strengthening the structured cooperation between European and Russian Research Infrastructures:

International PIK-SAC and neutron instrument subcommittees will contribute to a sustainable structuring of the cooperation in neutron research.



Expected Impact for WP3 II:

Promote the harmonisation of procedures and develop the framework conditions to improve access of European scientists to Russia.

- A proposal system for users of neutron beams at PIK
- decisions for proposals will be based on international peer-review
- open access also for European scientists to the PIK facilities.

WP number	WP 3		Lead beneficiary			FZJ		
Work package title	PIK - Collaboration with PIK							
Participant number	15	8	6	10	11	17	19	20
Participant short name	**FZJ**	**NRCKI-PNPI**	JINR	PTI	SPSU	HZG	TUM	CEA-LLB
PMs per participant	84	414	72	18	48	30	42	69

Participant number	22	24	27	30	33			
Participant short name	ILL	UCA	MTA EK	UNI MIB	ESS			
PMs per participant	46	3	36	6	24			

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Thank You