



NATIONAL RESEARCH CENTRE

«KURCHATOV INSTITUTE»



PETERSBURG NUCLEAR PHYSICS INSTITUTE

Russia, 188300, Leningrad District, Gatchina, Orlova Roscha

# REACTOR COMPLEX PIK

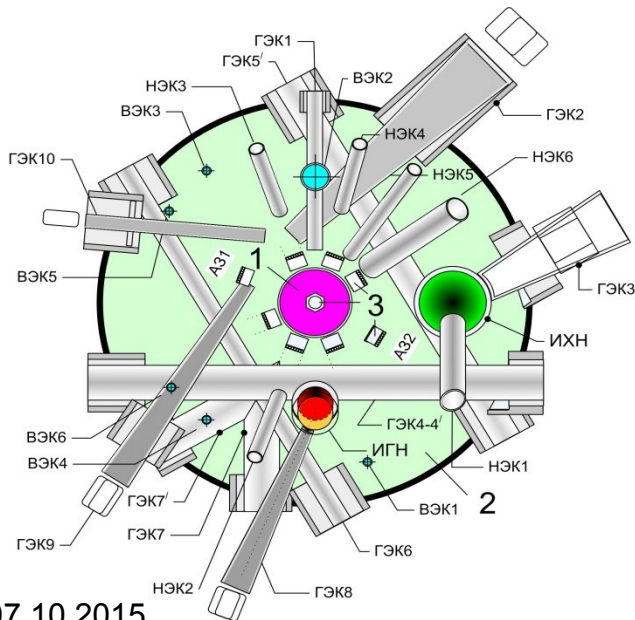
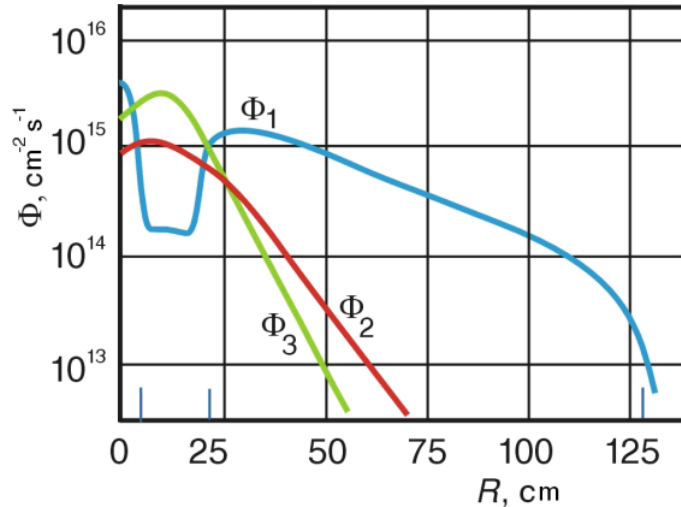
## PRESENT STATUS AND TRENDS

Vladimir V. Voronin

CREMLIN Opening Conference,  
7 October 2015, NRC "Kurchatov Institute"



# PIK reactor parameters



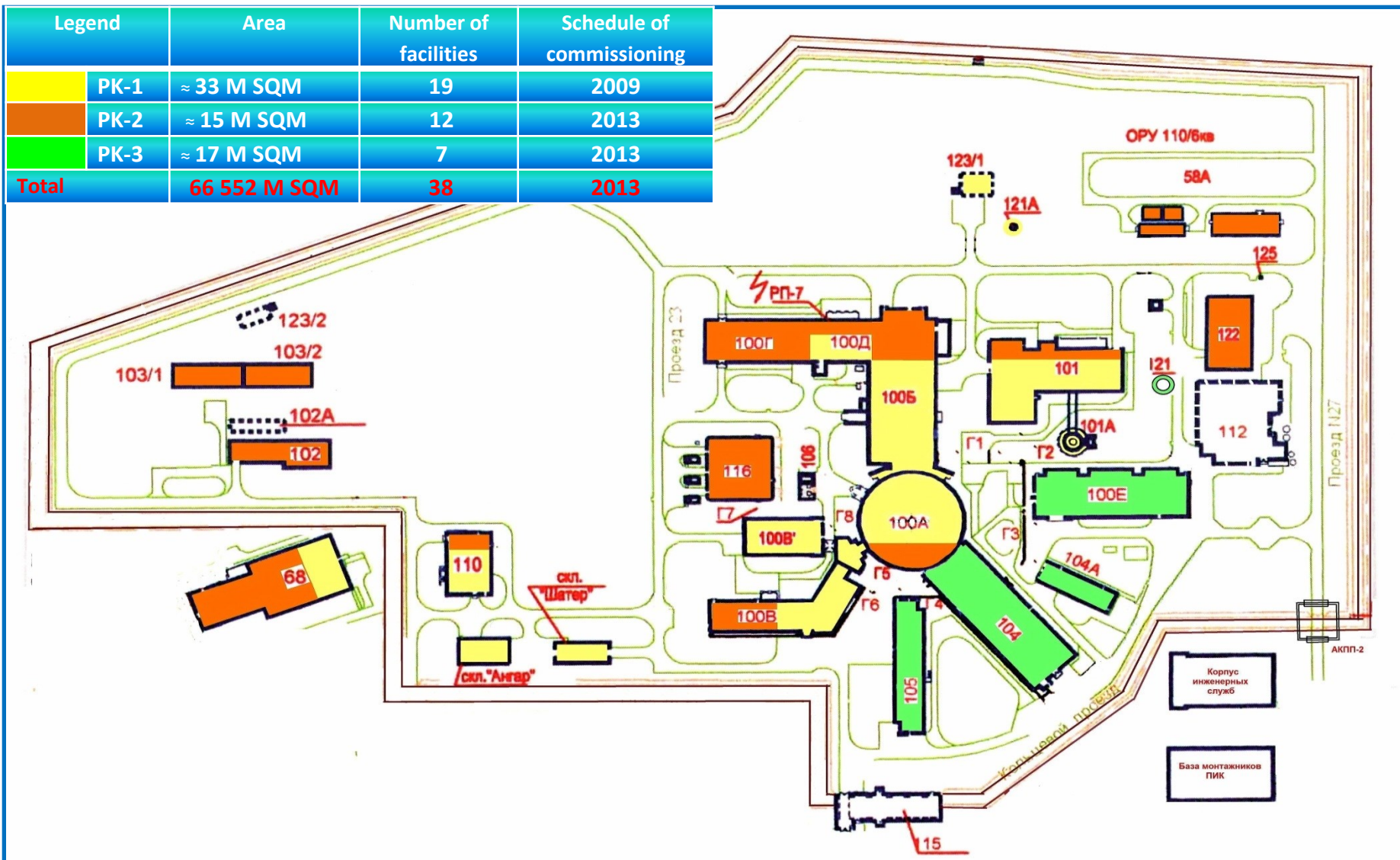
	Value
Power	100 MW
Reactor core volume	50 l
Core height	500 mm
Coolant	H <sub>2</sub> O
Reflector, moderator	D <sub>2</sub> O
Maximal neutron flux in moderator	1.3x10 <sup>15</sup> n/cm <sup>2</sup> c
Maximal neutron flux in central trap	5x10 <sup>15</sup> n/cm <sup>2</sup> c
Operation cycle	~30 day
Experimental channels	
- Horizontal (HEC)	10 (3 through)
- Vertical (VEC)	6
- Inclined (IEC)	6
- Central (CEC)	1



# Layout of reactor complex PIK



Legend	Area	Number of facilities	Schedule of commissioning
PK-1	≈ 33 M SQM	19	2009
PK-2	≈ 15 M SQM	12	2013
PK-3	≈ 17 M SQM	7	2013
<b>Total</b>	<b>66 552 M SQM</b>	<b>38</b>	<b>2013</b>





## Central part of reactor complex PIK







## Main entrance to the reactor PIK





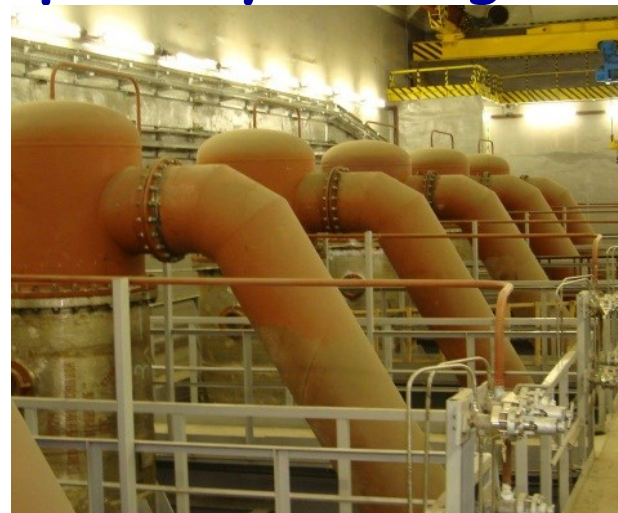
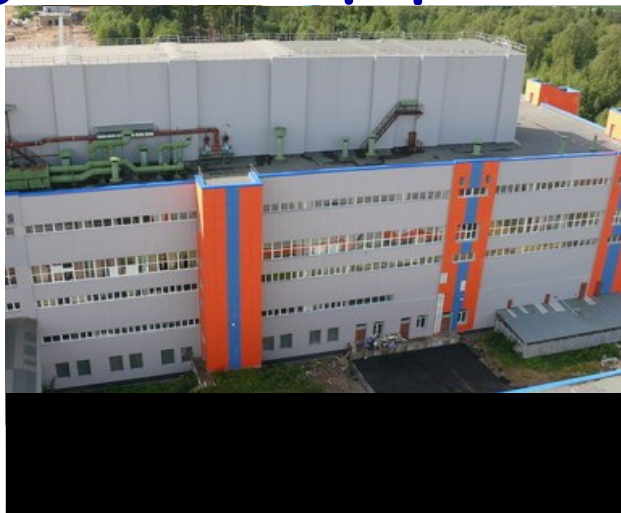
## Technical engineering infrastructure







# Building 100B - Equipment of primary cooling





# Building 100G - Equipment of secondary cooling







## Building 116 – backup diesel power station, backup control panel, training and modeling complex





## Building 122 - Emergency storage of liquid radioactive waste







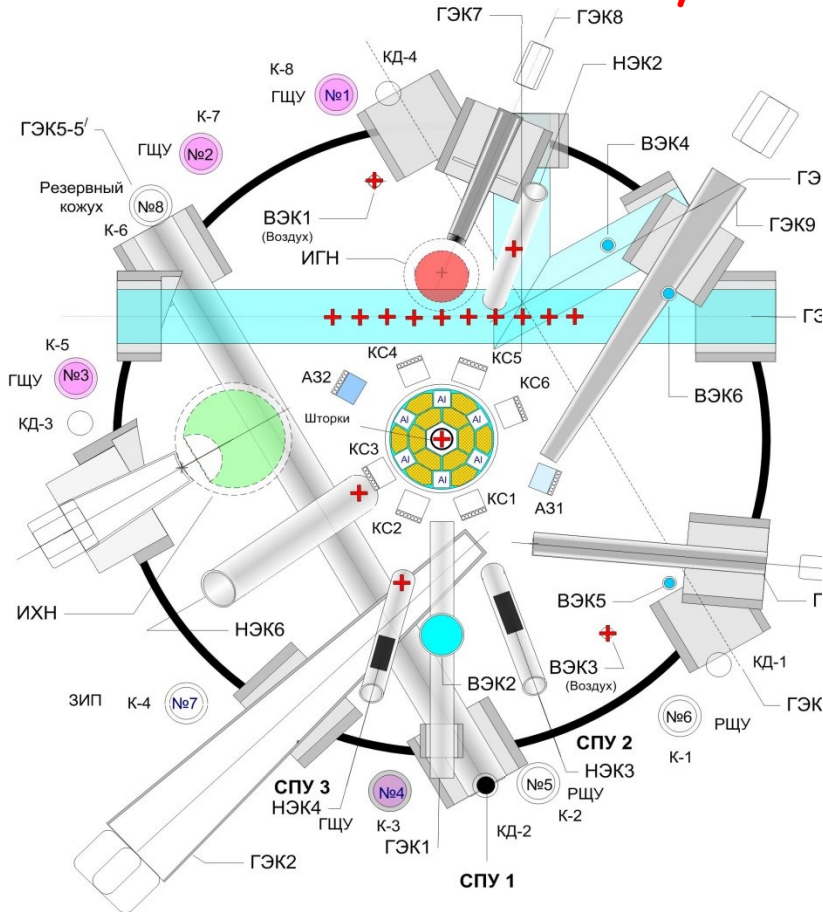
## Building 104 - Neutron guide hall



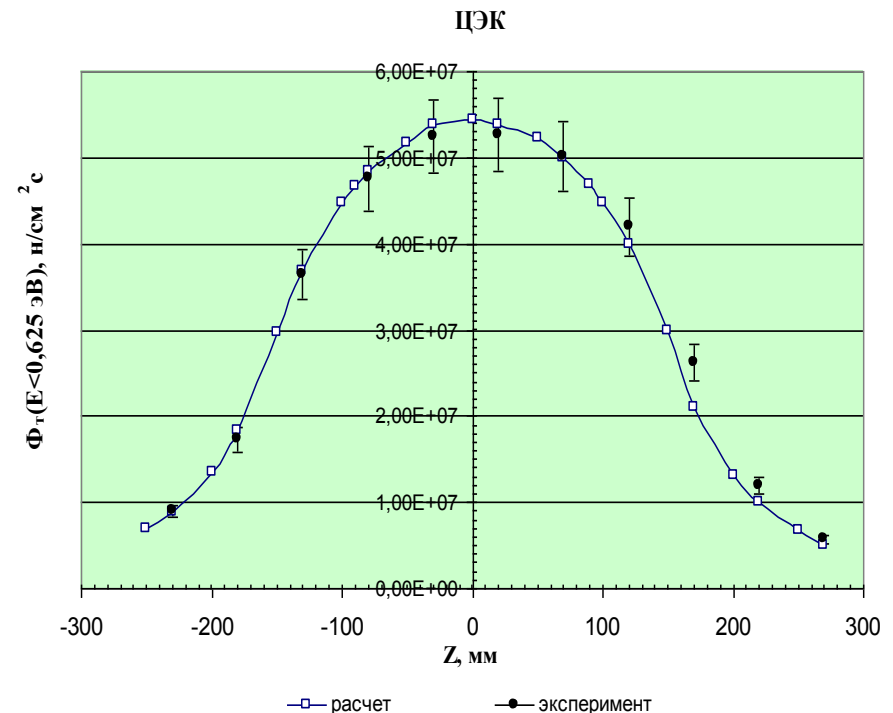




**Febr. 2011 a critical state of the fuel assembly was achieved and a complete test of the reactor systems was produced without coolant at  $W = 100$  W**



Thermal neutron flux density per 1 W of the reactor power in the central experimental channel



Placement of the experimental channels and detectors of the regular and additional equipment of control system during first criticality



## Roadmap of the PIK Engineering Infrastructure Modernization

	2012	2013	2014	2015	2016	2017	2018
<b>1. Project</b>							
1.1. Project development	■	■					
1.2. State expertise		■					
Project Realization							
<b>2. Installation for Tritium Extraction</b>							
2.1. Elaboration of the engineering documentation			■				
2.2. Production of the special equipment				■	■		
2.3. Delivery of standard equipment					■	■	
2.4. Construction				■	■	■	
2.5. Assembly						■	■
<b>3. Modernization of the Safety System</b>							
3.1. Modernization of the main & reliable power supply				■	■	■	
3.2. Modernization of reinforcement elements of safety system pipe lines				■	■		
3.3. Modernization of control devices of safety system				■	■	■	■
<b>4. Modernization of the Elements of radwaste &amp; spent nuclear fuel Management System</b>							
4.1 Modernization of elements & receiving units for radwaste				■	■	■	
4.2. Modernization of transportation elements & units for transfer of spent nuclear fuel					■	■	■
<b>5. Examination, presentation to Construction Supervision and Expertise Department, commissioning</b>						■	■



The project aiming to equip RC PIK with the modern experimental stations for the multidisciplinary research will be started and completed within the period between 2015 and 2020.



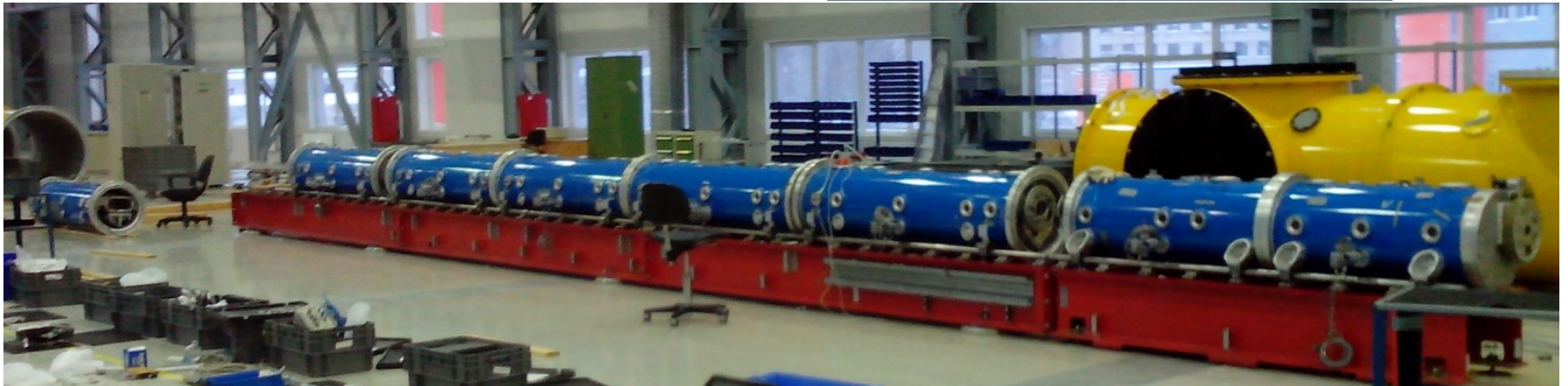
The Government of the Russian Federation has approved the idea to organize the **International Center for Neutron Research** based on the reactor complex PIK.





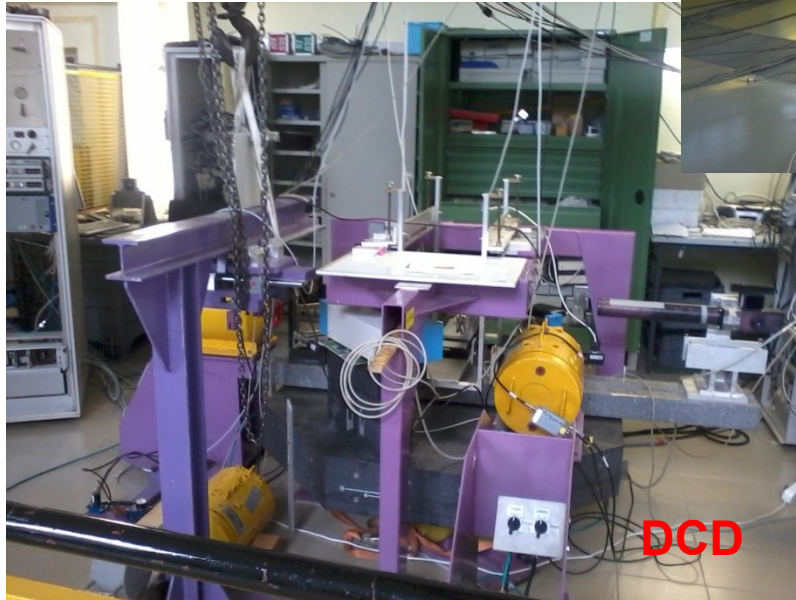
## ONGOING INTERNATIONAL COOPERATION

The ongoing cooperative activity had already resulted in transfer of the **7 neutron stations** (with the total cost of 30 mln. euro) from the Helmholtz Center Geesthacht (Germany) to the Petersburg Nuclear Physics Institute of NRC "Kurchatov Institute" (Russia). Agreement was signed 05.03.2010





# Neutron station for PIK





# Road map of the instruments construction

Instruments\Year	2014	2015	2016	2017	2018
<b>NERO</b>	Modeling	Construction	Modernization	Modernization	Modernization
<b>ARES</b>	Modeling	Modeling, Construction	Modernization	Modernization	Modernization
<b>SANS2</b>	Modeling	Modeling, Construction	Construction	Modernization	Modernization
<b>SANS3</b>	Modeling	Modeling, Construction	Construction	Modernization	Modernization
<b>DCD</b>	Modeling	Modeling, Construction	Construction	Construction	Modernization
<b>POLDI</b>	Modeling	Modeling	Technical drawing	Project	Construction
<b>TEX</b>	Modeling	Modeling	Technical drawing	Project	Construction





# Next Step - Full scale instrumentation program



National Research Centre "Kurchatov Institute"  
B. P. Konstantinov Petersburg Nuclear Physics Institute

# General Concept for Instrumentation Program of Neutron Research Centre PIK

## CONTENTS

Forewords

Introduction.....	3
Neutron science.....	5
Neutron instruments.....	7
<i>Atomic scale diffraction</i> .....	8
<i>Inelastic scattering</i> .....	9
<i>Small angle scattering</i> .....	10
<i>Reflectometry</i> .....	11
<i>Fundamental interactions and particle physics</i> .....	13
Technological aspects and achievements.....	16
<i>Cold and ultra cold neutrons sources</i> .....	16
<i>The neutron guide system</i> .....	20
<i>Neutron detectors</i> .....	21
Conclusion.....	23

2014



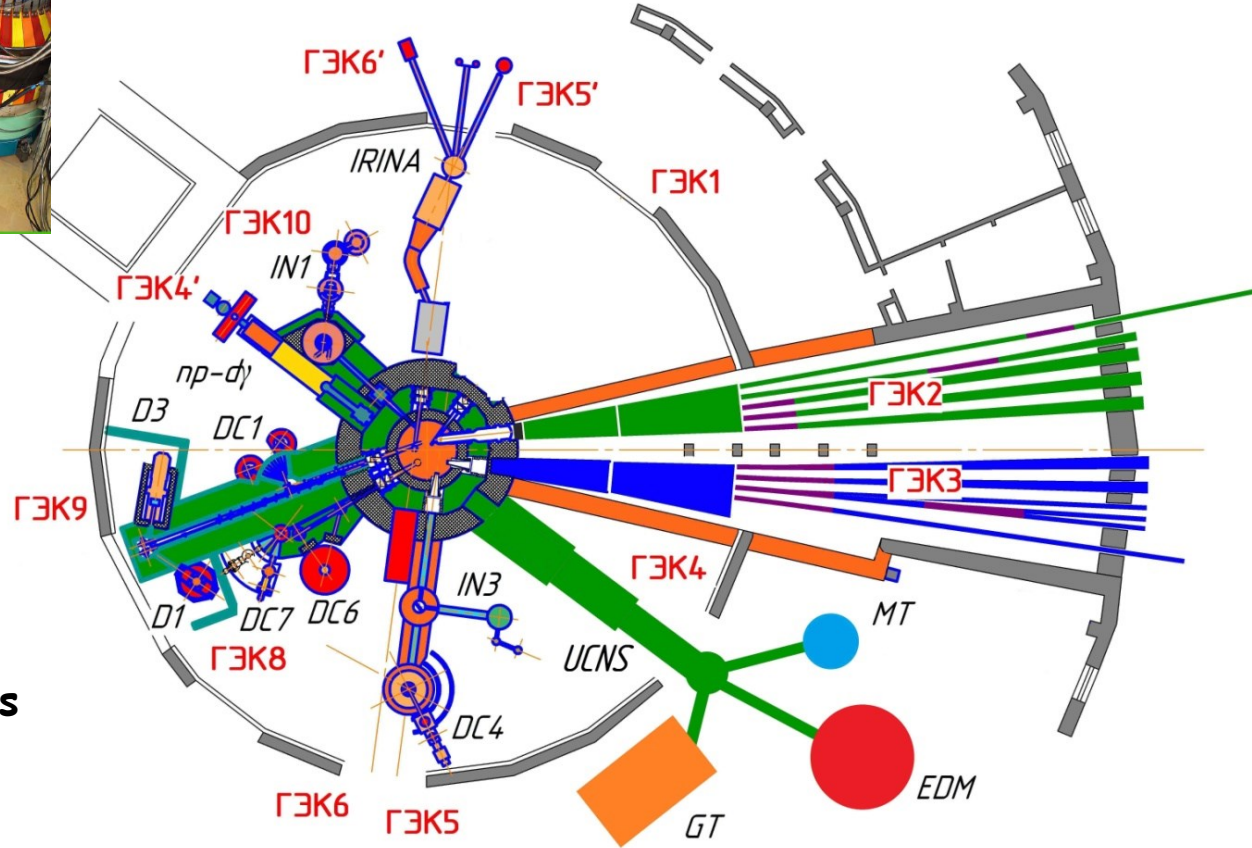
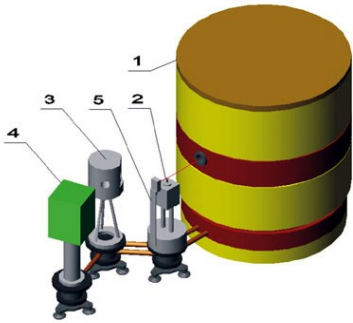
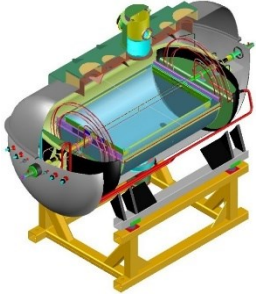
## Three step of the PIK reactor complex construction

1. Modernization of PIK reactor complex (2018)
2. Reconstruction of PIK laboratory complex (first phase) **one CN source and 12 experimental stations will be install**
3. Creation of the experimental station complex at PIK reactor (second phase) **CN and UCN sources and 20 experimental stations will be created**





# Hall of horizontal channels (14 instr.)



For condense matter physics

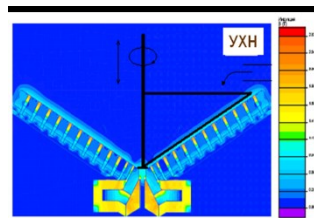
DC4, DC6, DC2

D1, D3, DC1, IN1, IN3

For nuclear and particle physics

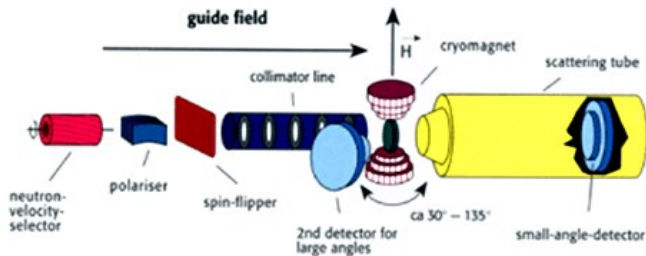
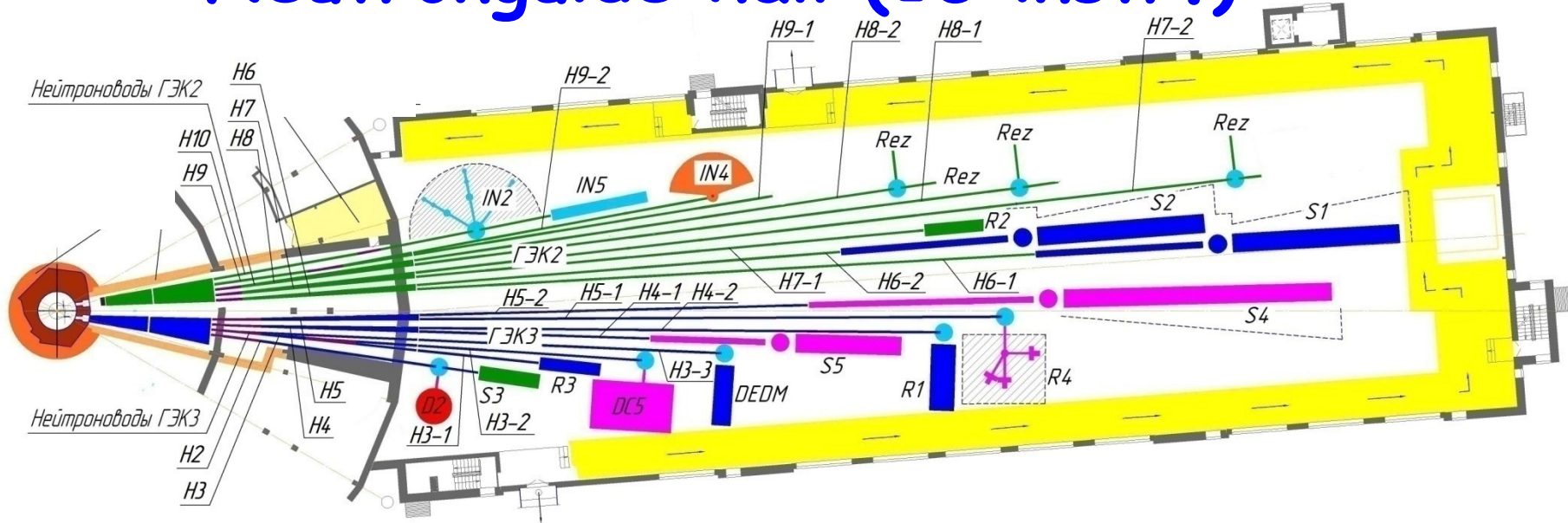
MT, GT, EDM

IRINA, Neutron decay, n4



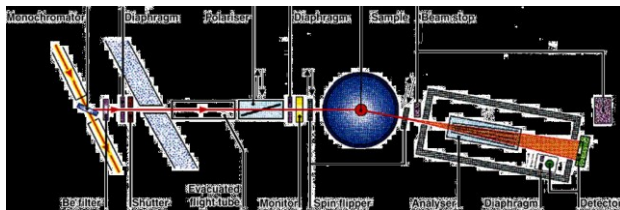


# Neutronguide hall (15 instr.)



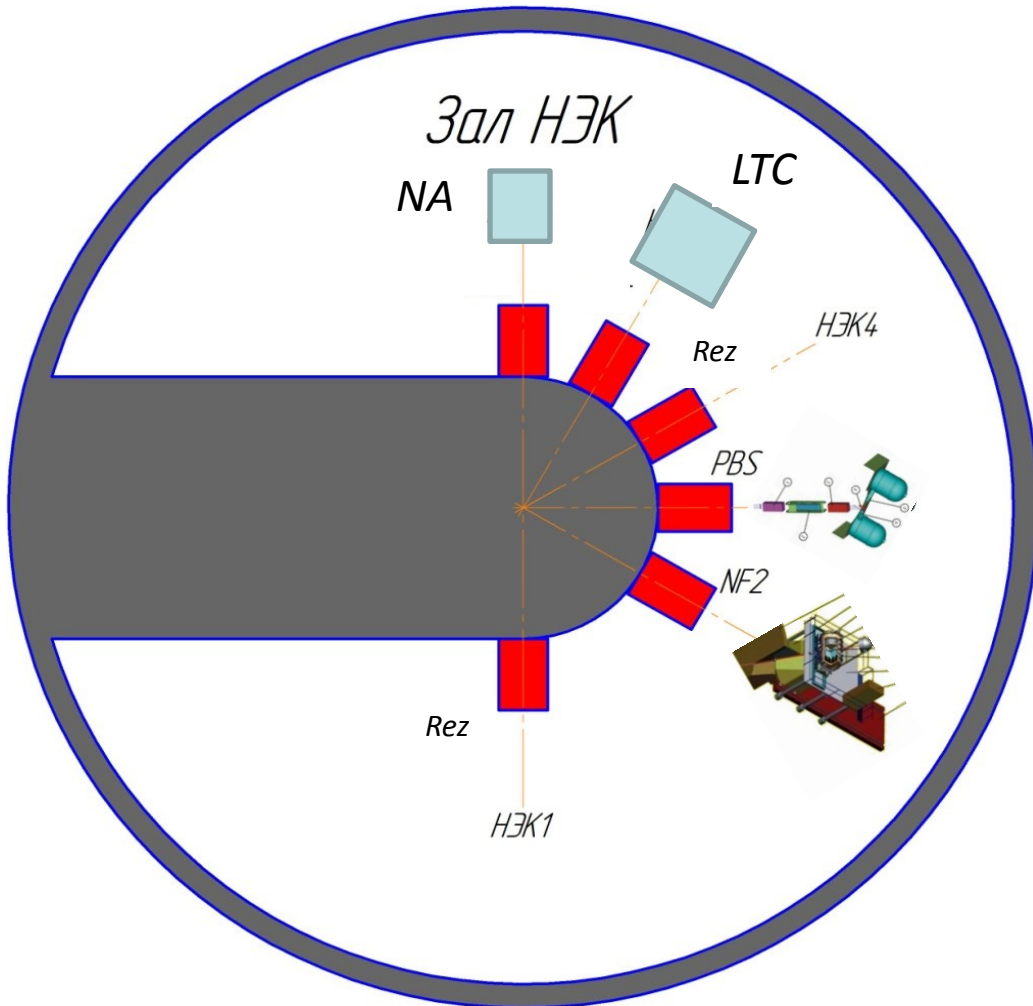
For condense matter physics  
**D2, R1, DC5, S-4, S-5, R4**  
**IN2, IN4, IN5, S1, S2, S3, R2, R3**

For nuclear and particle physics  
**DEDM**



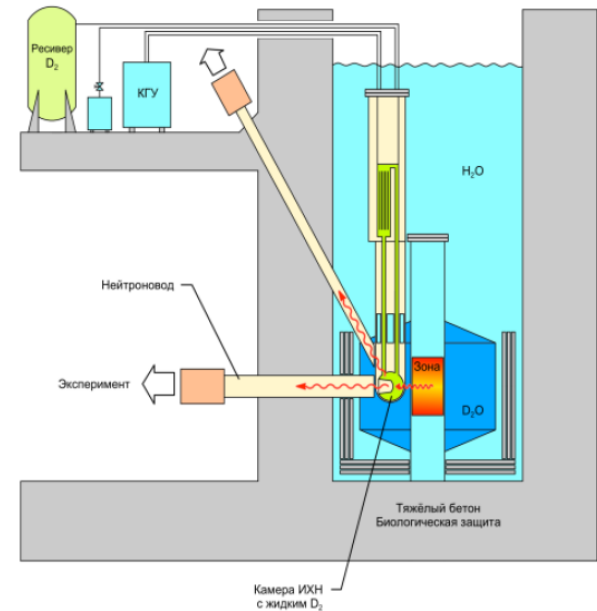


# Hall of Inclined Channels (4 instr.)



For condense matter physics  
**LTL**

For nuclear and particle physics  
**NF2, PBS, NA**







Thank you for  
your attention



Welcome to  
Gatchina!

