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State atomic energy corporation “Rosatom”

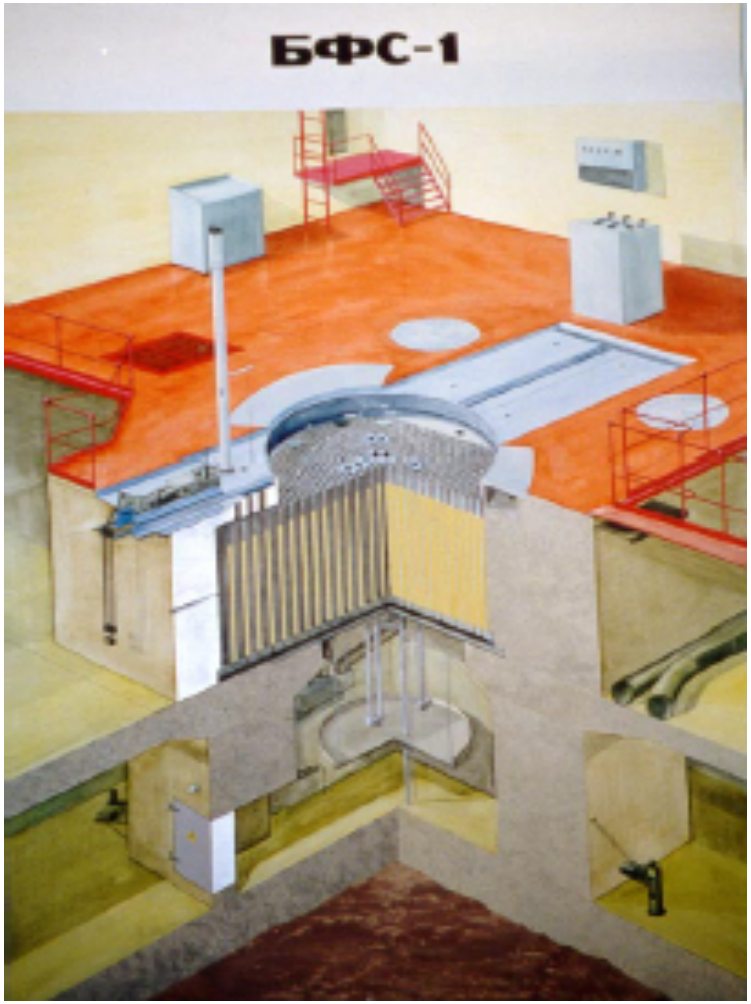
Experience of international cooperation in the field of experimental studies on BFS critical assemblies

Dmitry Klinov
First Deputy Director General for Science, IPPE

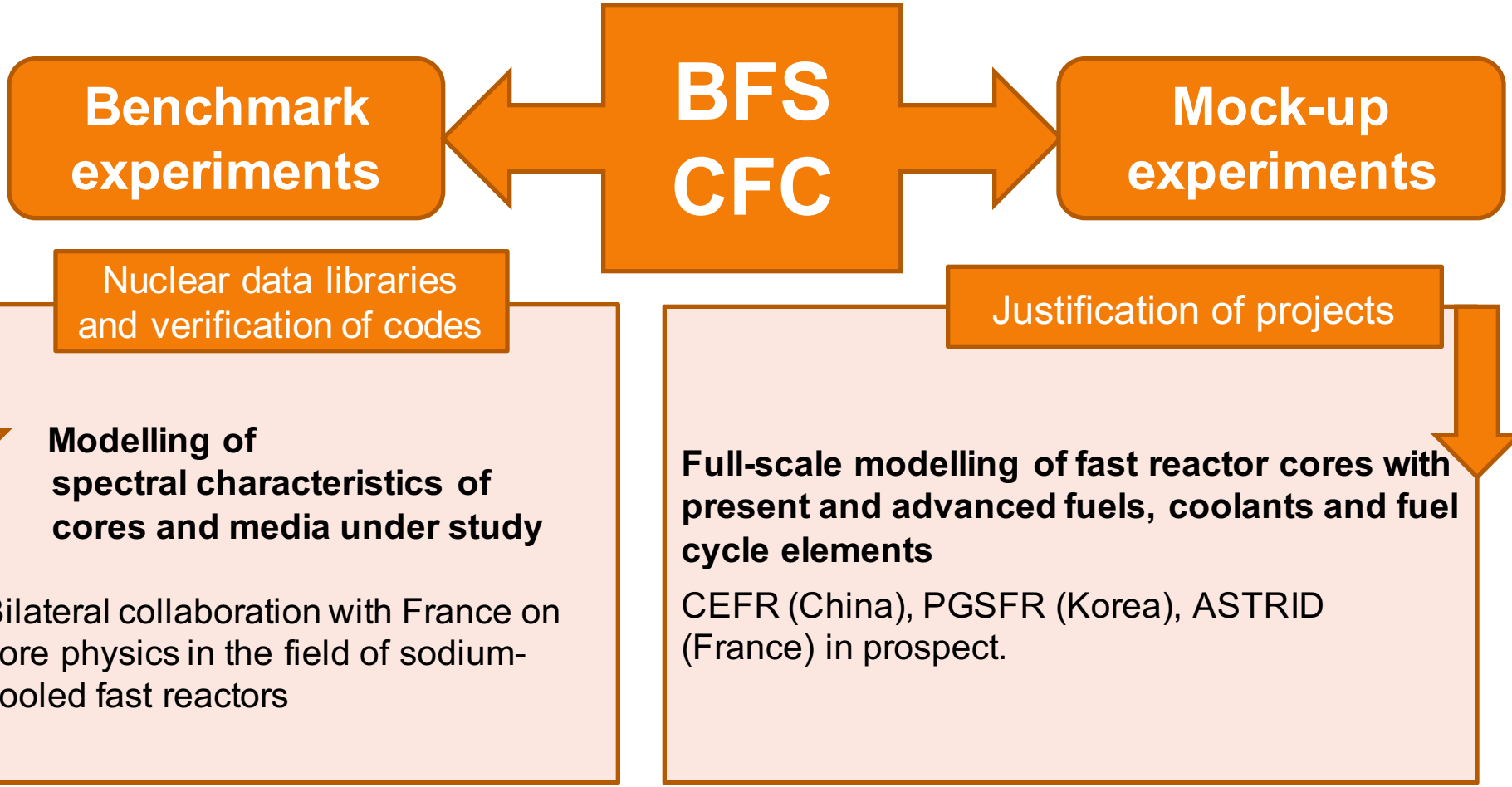
ATOMEXPO-2018,Sochi

May 15, 2018

The BFS complex of critical facilities



BFS solutions



Retrofitting and updating – rise to a new level

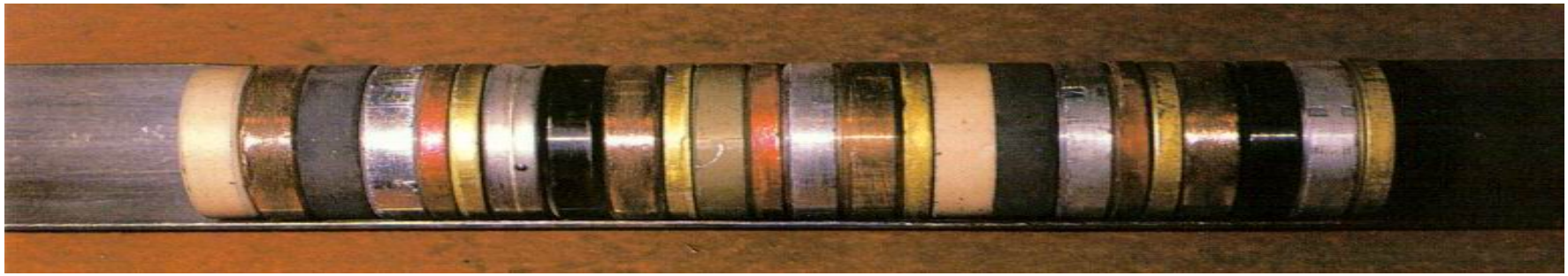
- The outcome of retrofitting and upgrading:

- All safety-critical systems have been upgraded, most of the engineering systems have been replaced; the amount of nuclear materials (including new materials) for modelling nuclear reactors has been significantly increased.

- The principal targets have been achieved:

- groundwork has been done for obtaining the licence and the necessary permissions in time, which will enable the BFS operation for many future years;

- the range of experimental studies has been expanded considerably due to the new materials produced for simulating power reactor cores and nuclear fuel cycle chains.



International cooperation

Country	Methodological studies	Integral experiments	Core simulations
East Germany	Heterogeneous and bilinear reactivity effects	Structural materials and fission products	-
China	-	-	CEFR
ISTC (International Science& Technology Center)	-	Minor actinides	- Reactor with ROX-fuel; - BN-800 (with Pu and inert diluent, without U); - Pu and minor actinide burner reactor
Korea	-	Minor actinides	KALIMER-650, SFR-100, SFR-300, PGSFR-150
USA	β_{eff}	-	- Geological disposals; - BN-600 with uranium fuel and non-fertile blanket
France	SPHINX, β_{eff};	Minor actinides (SUPERPHENIX, CAPRA)	Optimization of ASTRID
Japan	β_{eff}	-	Hybrid core of BN-600

Cooperation with the French Republic

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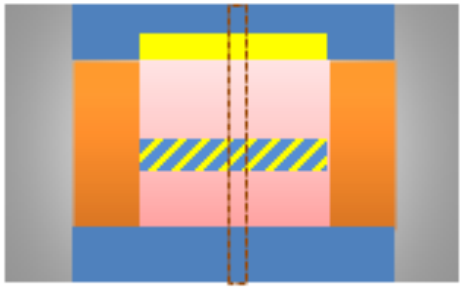
Investigation sequence

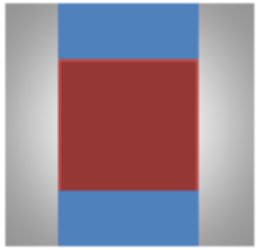
1. 1st phase: axially homogeneous core & sodium plenum. BFS-2

2. 3rd phase: axially heterogeneous core & sodium plenum + central control rod. BFS-2



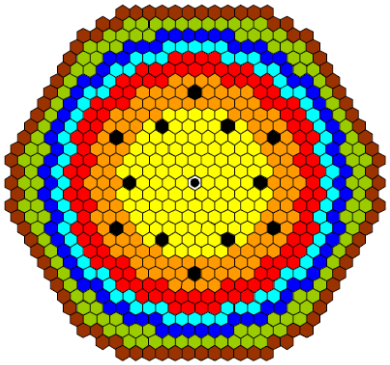
3. 2nd phase: axially heterogeneous core & sodium plenum + central control rod. BFS-1

4. 4th phase: axially homogeneous core without sodium plenum (reference core). BFS-1



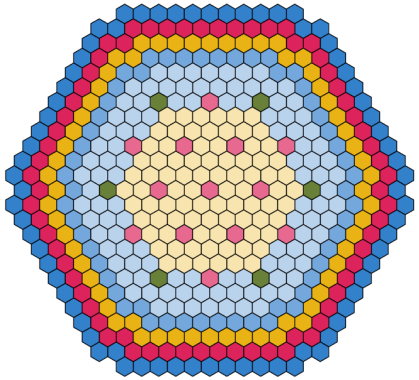
Cooperation with the Republic of Korea

KALIMER (Korea Advanced Liquid Metal Reactor)

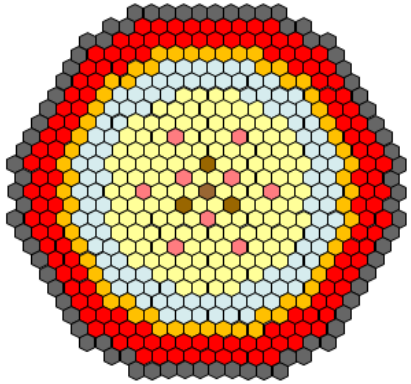


KALIMER-600
BFS(1)-73
BFS(1)-75
1997-2000

Sodium-cooled Fast Reactor

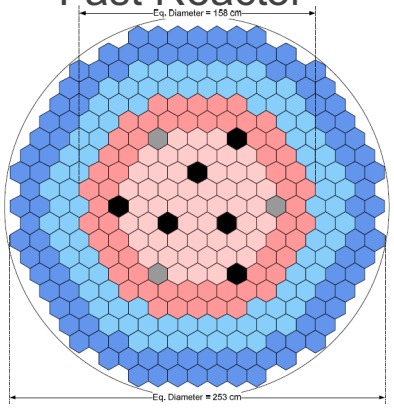


SFR-300
BFS(2)-76
2010-2011

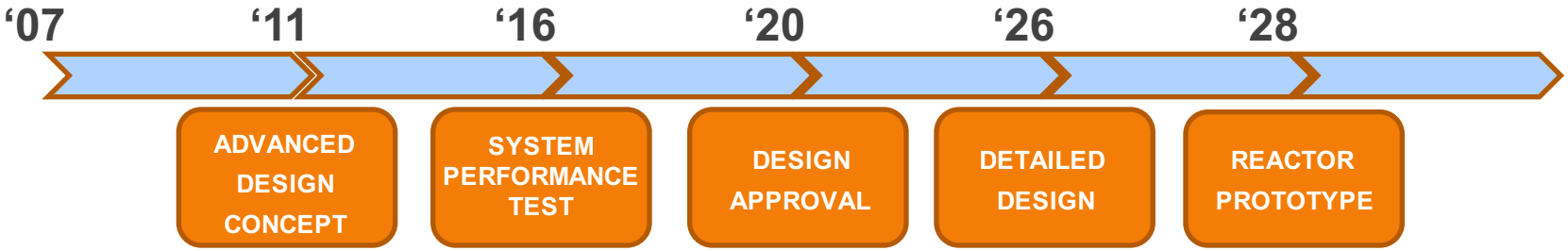


SFR-100
BFS(1)-109
2012-2013

Prototype Gen-IV Sodium-cooled Fast Reactor



PGSFR-150
BFS(2)-84
2014-2016



Cooperation with the People's Republic of China

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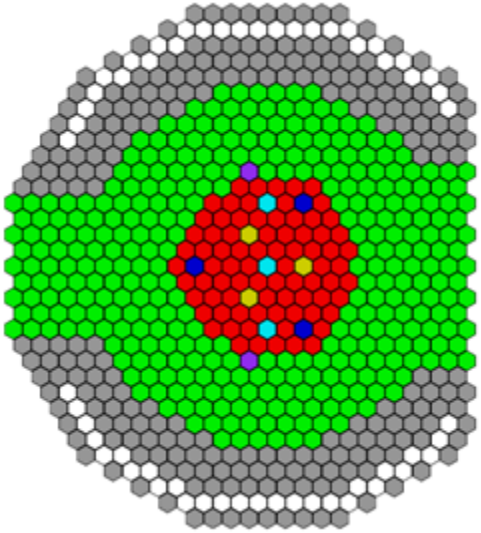
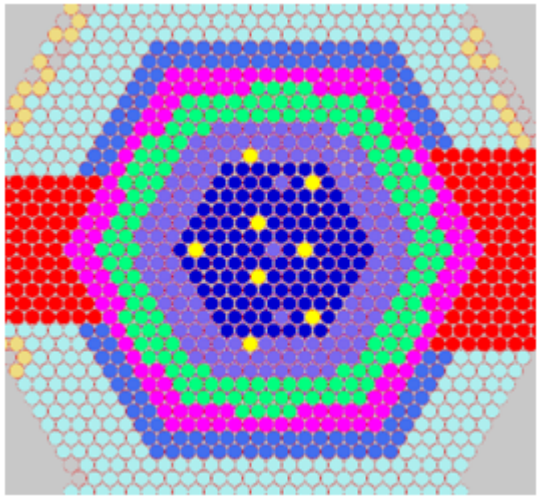
PROJECT



1995-1998

FULL-SCALE MODELING



1995 – 2000 (UOX)

BFS-65,83

2018 (MOX)

BFS-119

FIRST CRITICALITY

2010

~ 2025

Uniqueness of the BFS complex of critical facilities

- The only critical facility in the world which offers the possibility of studying neutronic characteristics (NC) of any reactor type – from research reactors (MBIR) to large power units (BN-1200)
- Simulation of almost any stage of the fuel cycle – from fuel fabrication to geological disposal of the radioactive waste
- Modelling of neutron spectra in any energy range
- The variety of available materials allows us to study NC of different fuel and coolant types
- Validation of calculation codes and neutron data

What are the benefits of international cooperation at BFS?

- The resource base is enlarged and the BFS experimental capabilities are increased due to various experimental objectives
- New experimental techniques are mastered, those already existing are improved
- Calculation analysis and evaluation of the experiment are performed using state of the art calculation codes and neutron data (ENDF\B, JEF, JENDL etc.)
- This makes it possible both to improve the Russian neutron data library (ROSFOND) and to provide our foreign partners with data for their libraries
- Owing to the international cooperation, dozens of experiments carried out at the BFS have undergone careful expert examination and are included in ICSBEP and IRPhEP Handbooks

BFS experiments + MBIR experiments = «flat-to-flat» experiments

- Experiment programme proposal
  - selection of the fuel composition of any type
  - keeping the project geometry
- Performance of the measurements to the highest specifications
- Detailed description of the experiment in accordance with international standards (ICSBEP, IRPhEP)
- Experiment evaluation
- Calculation analysis of the experiment
- Construction of a benchmark-model
- Development and fabrication of a wide range of experimental devices to be placed into a reactor
- Radiation to the required parameters in the required conditions
- A set of post-irradiation studies

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THANK YOU FOR YOUR ATTENTION!

Контактная информация

Dmitry Klinov,
First Deputy Director General for Science

IPPE, Obninsk, RF

+7 (484) 399-44-78

dklinov@rosatom.ru

www.ippe.ru