



РОСАТОМ



ТОПЛИВНАЯ КОМПАНИЯ РОСАТОМА

ТВЭЛ

ГОСУДАРСТВЕННАЯ КОРПОРАЦИЯ ПО АТОМНОЙ ЭНЕРГИИ «РОСАТОМ»

Activity in Developing ATF Russian Program

A.A. Bochvar Institute (VNIINM), Moscow, Russia



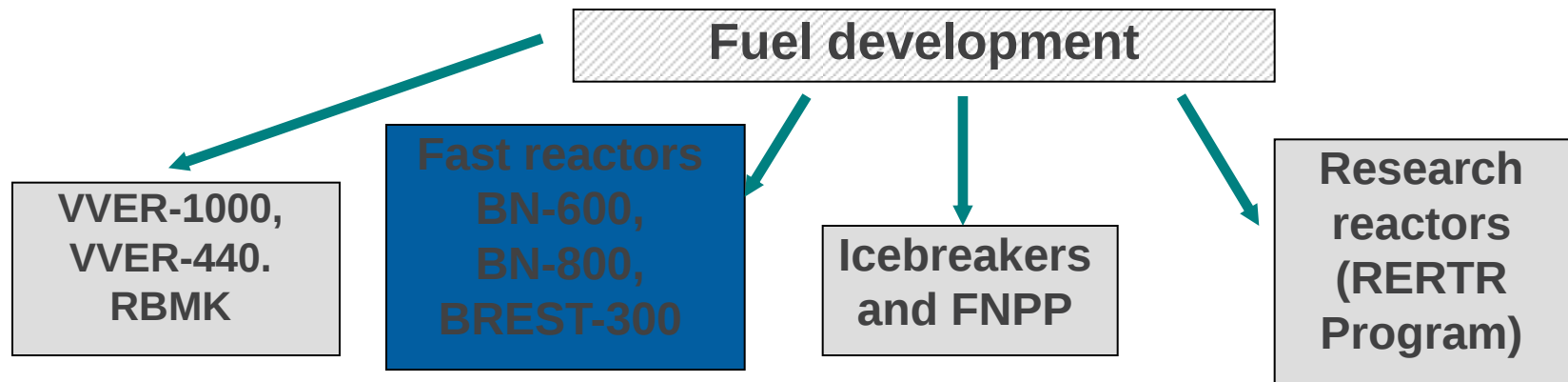
ВНИИНМ
имени А.А.Бочвара

The goal of ATF Russian Program

- *Development of novel materials and technologies for fuel elements commercial type VVER reactors (fuel and cladding) with higher efficiency in normal and accident conditions (LOCA including).*
- *The higher resistance of cladding material to accidents will permit in future to increase cladding temperature that will lead to improving technical and economical efficiency of LWRs.*

The Russian Program was worked out at A.A. Bochvar Institute and preliminary adopted in ROSATOM.

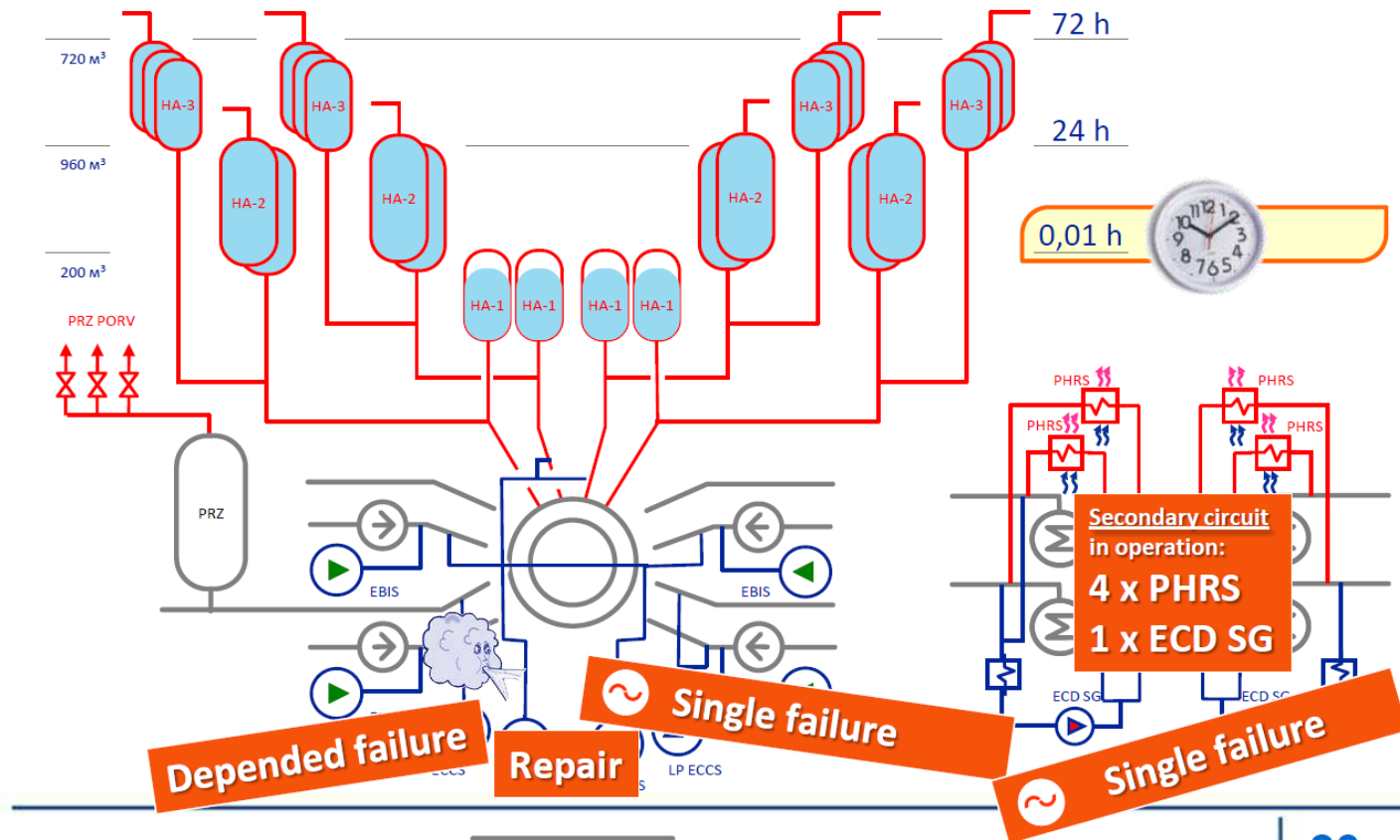
A.A. Bochvar Institute is the Chief Designer of fuel for various types of reactors (LWRs, fast, research and small reactors)



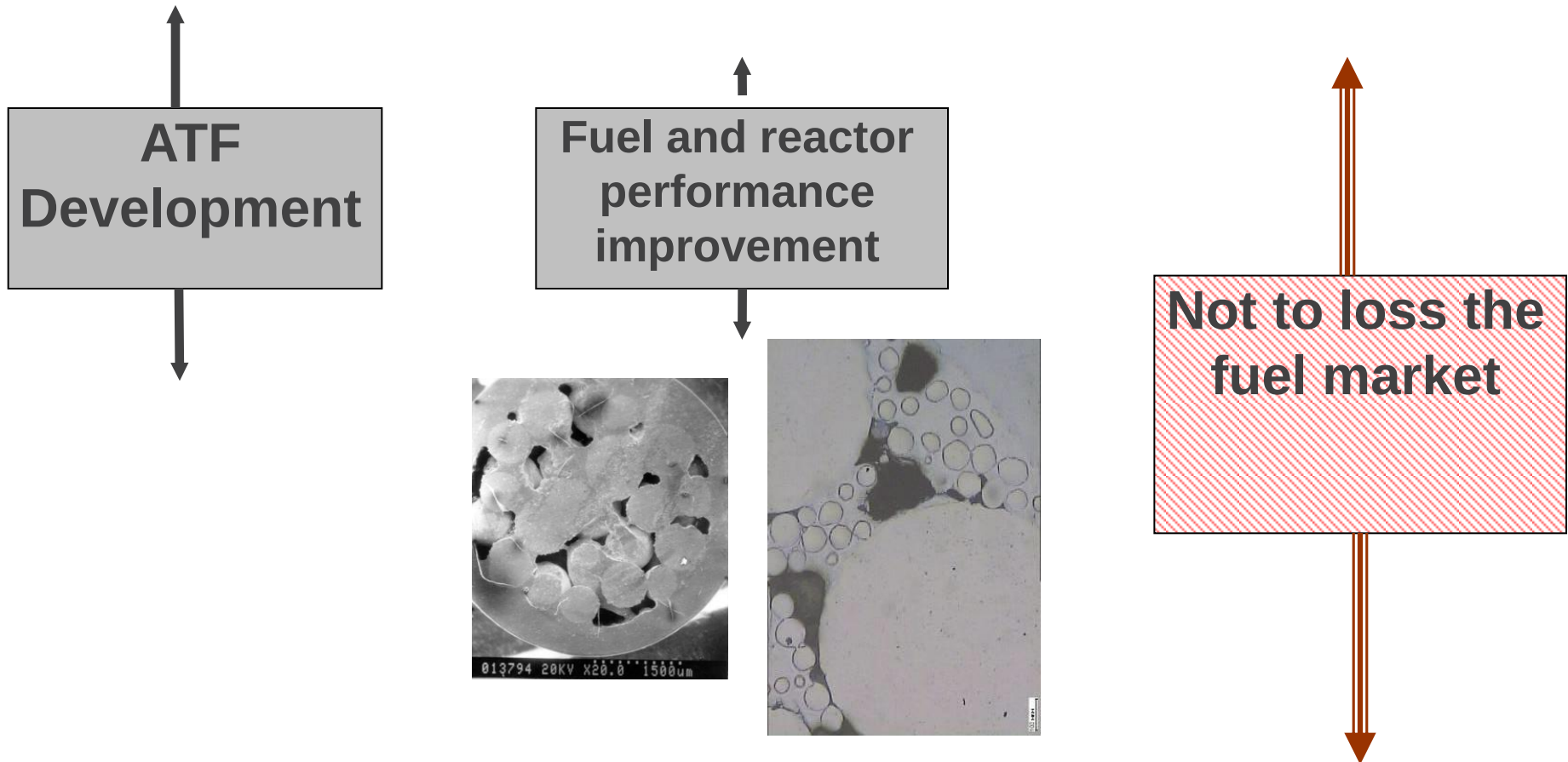
Ways to prevent accidents

- 1. To develop Accident tolerant fuel
- 2. To improve reactor system safety

EXAMPLE OF SAFETY SYSTEMS OPERATING DURING LB LOCA (DBA)

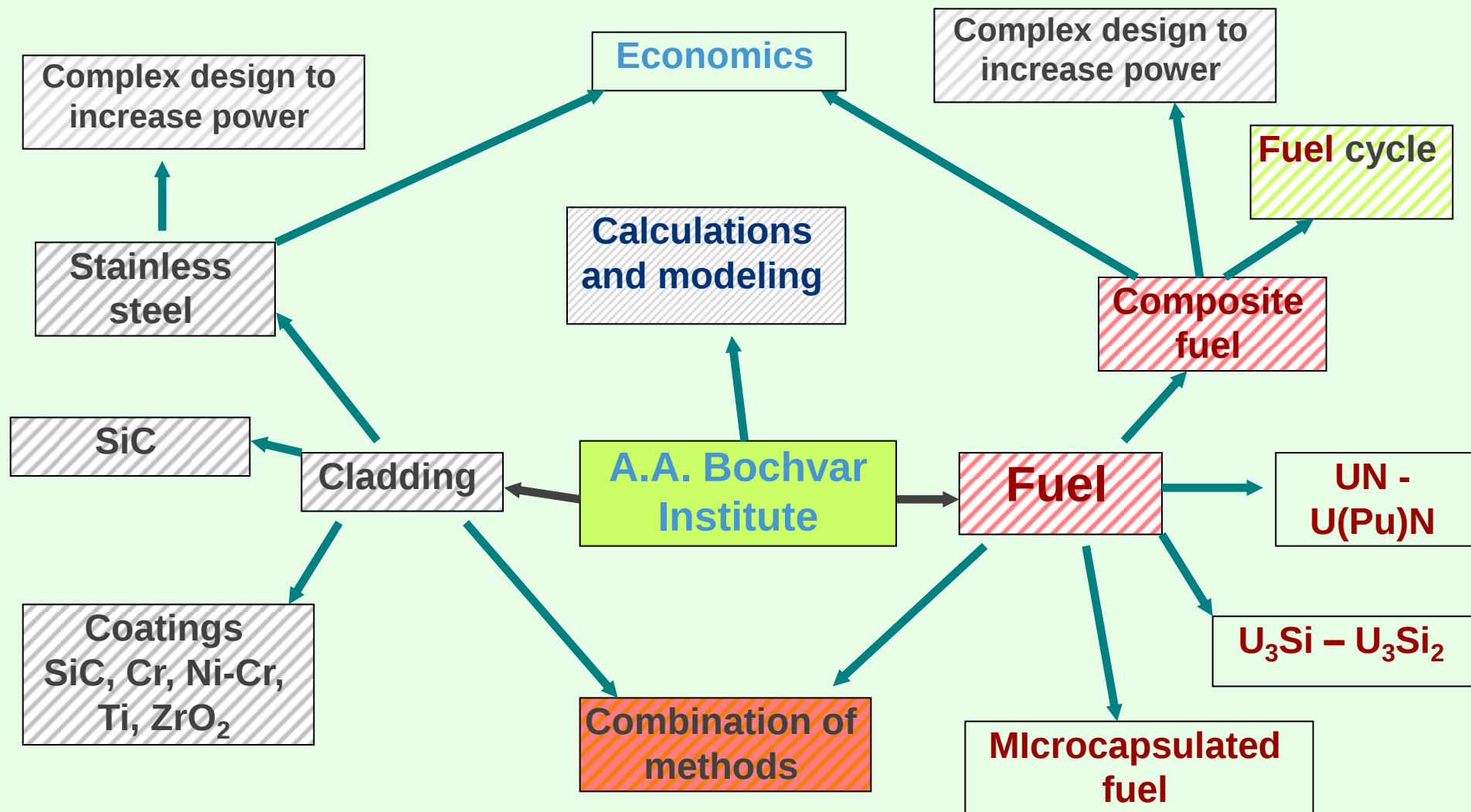


Reasons to start Russian Program on ATF



- *Arrows show how these 3 reasons change with time.*

Directions of ATF Developments in A.A. Bochvar Institute

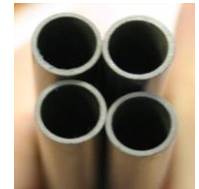
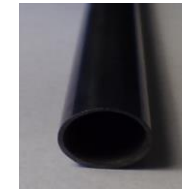


Scientific reserve in A.A. Bochvar Institute on ATF developments

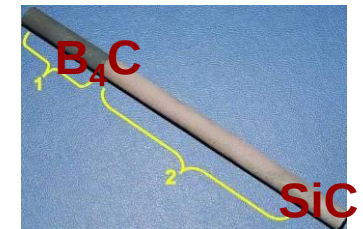
Steel cladding developments for small water cooled and fast reactors



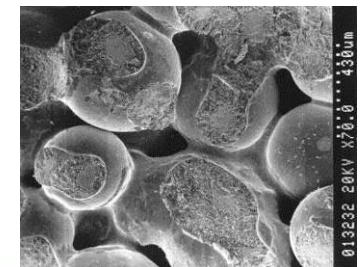
SiC composite developments



Coating of Zr claddings



High density composite fuel of dispersion type

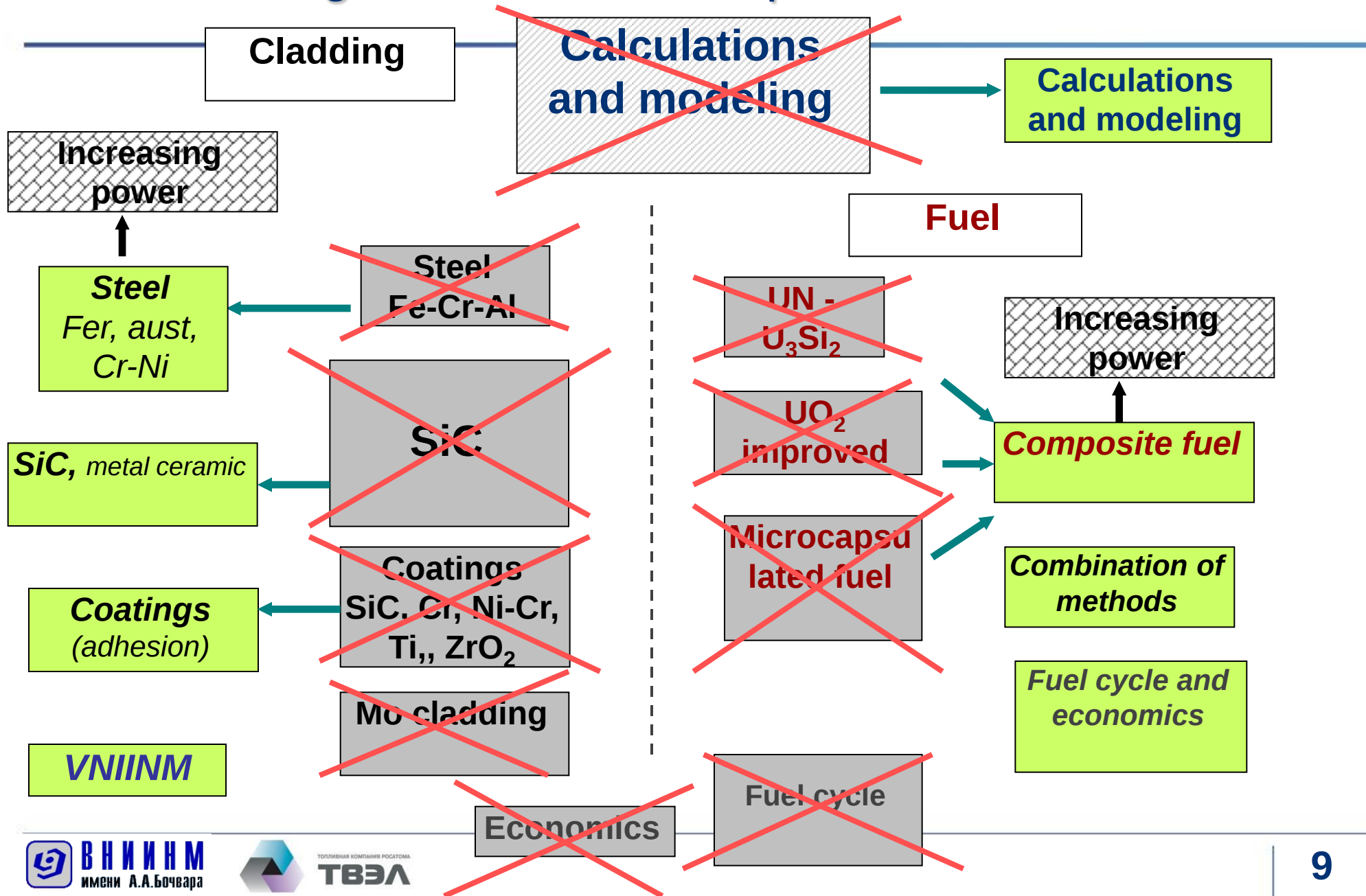


Program of ATF developments in Russia

Taking into account the international experience and our own developments A.A. Bochvar Institute worked out Russian Program on ATF development.

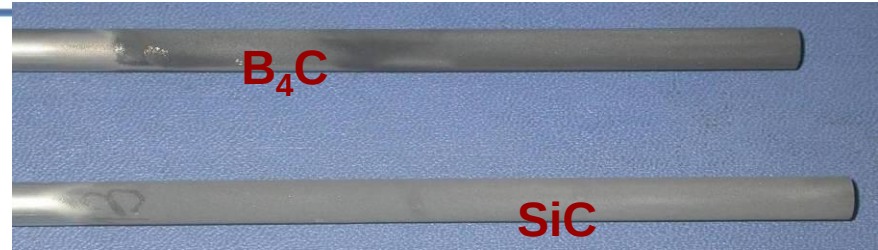
In comparison with international Programs it is optimized. We exclude obviously technologically complicated, expensive and little promise directions and add our own principally novel variants. This will permit to cut down expenses and increase the competitiveness of ATF

Program of ATF developments in Russia

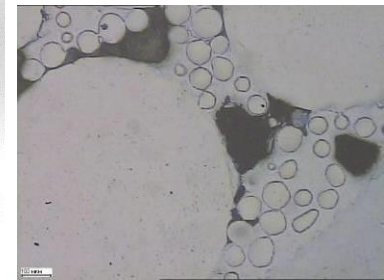
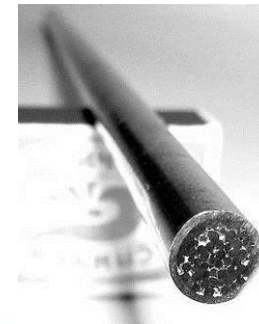
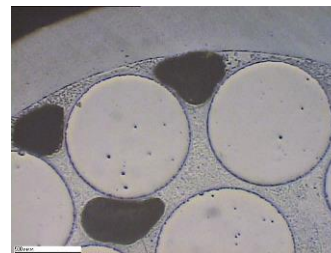


Program of ATF developments in Russia

- *Protective Coatings on Zr-based claddings (materials and technology)*
- *Steel claddings: Ferritic and Austenitic Steels, Cr-Ni alloy*
- *SiC – SiC composites (metal-ceramic included)*
- *Cold high density composite fuel of dispersion type .*



VNIINM



Program of ATF developments in Russia



For more effective Project executing two complimentary sections added

- 5. *Fuel element fabrication for in-pile tests, irradiation tests, post irradiation investigations*
- 6. – *Physical-neutron calculations, modeling and calculation of fuel behavior in accidents, validation experiments as well as calculations of technical and economical efficiency.*

Partial execution of the Program

- **The Program will be executed in 3 main stages**
- **First stage – ATF developments, validation and out-of-pile investigations.**
- **Second stage – in-pile tests and post irradiation investigations of the optimal ATF variants.**
- **Third stage – fabrication technology at the industrial Plants for optimal variants (selection from stages one and two)**
- *For second and third stages separate Program will be arranged.*

Work package to validate investigations

- 1) Novel materials and technology developments;*
- 2) Out-of pile investigations of characteristics and material properties (claddings, coatings, fuel) accident behavior included;*
- 3) Fuel fabrication, in-pile tests and examination of fuel behavior under irradiation in contact with cooling;*
- 4) Post irradiation examination of fuel to investigate the properties of cladding and fuel composition after life tests;*
- 5) Calculational and experimental research on validation of fuel serviceability. Codes verification for licensing of materials and technology;*
- 6) Application of novel materials and technological processes at the Industrial Plants*

Time and Stages of the Program execution

- *Program plan to execute in 2016-2022 using scientific reserve in considered technologies.*
- *We plan to attract to R&D the following Contractors: MSZ, NZChK, NIAR, Gidropress, KI, Luch, OKBM, TRINITI.*
- *The control of the Program execution will be held by TVEL CORPORATION*

***Thank you
for your attention!***