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METHOD AND RESULT OF EXPERIMENT FOR SUPPORT OF TECHNICAL SOLUTIONS IN THE FIELD OF PERFECTION OF A NUCLEAR FUEL CYCLE FOR FUTURE PWR REACTORS.

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Introduction

Topic covered.

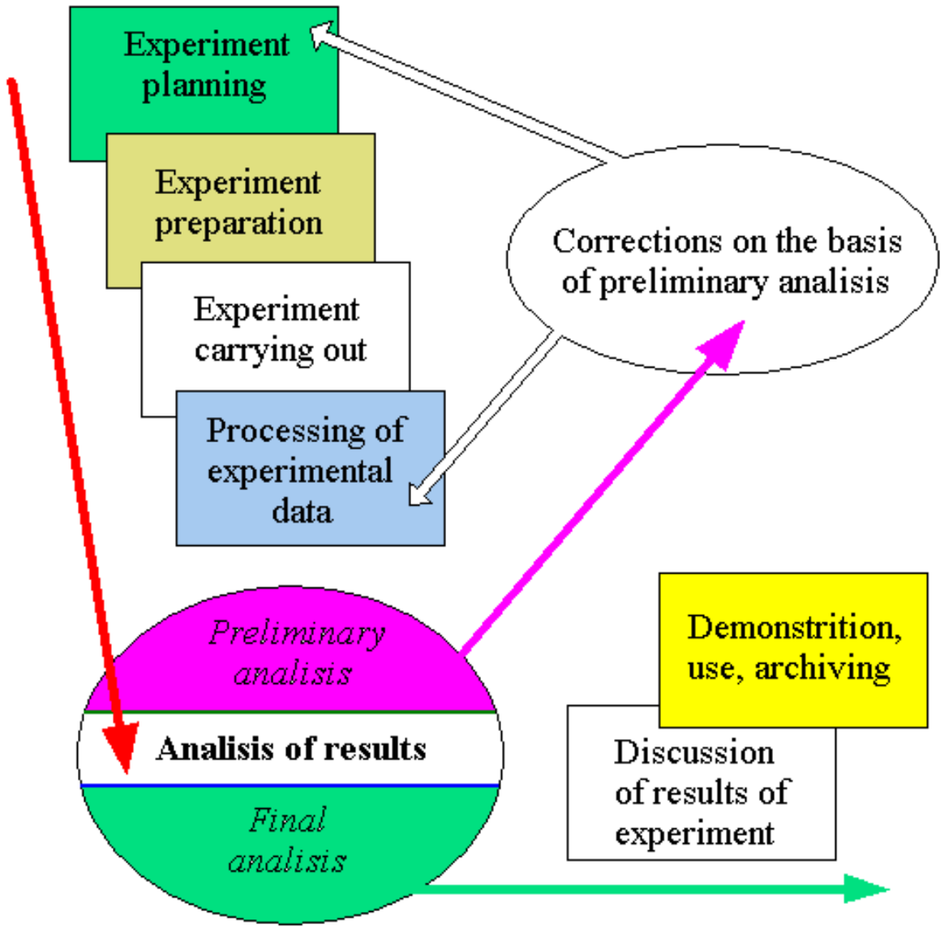
This report covers conceptual approaches of statement and carrying out of experiments to validate functional safety of PWR reactors of the future, at acceptance of technical solutions on use of fuel rods with the increased length of a fuel column in fuel assemblies.
The report represents main principles and criteria, which we use for quality check of technical solutions and developments in the field of perfection of a nuclear fuel cycle of PWR reactors of the future, first of all, from the point of view of a substantiation of safety of the future operation at change of fuel rod design. We explore the safety issues of operation of PWR reactors with fuel assemblies, including fuel rods with various length of a fuel column.

The main idea and aim.

Nowadays the validation of safety is based on calculation forecasts. According to calculation forecasts the distribution of power field in WWER-1000 fuel assemblies close to fuel assemblies with lengthened fuel column fuel rods is defined basically by the influence of compensatory volumes of not advanced fuel rods. Such situation arises in the beginning of a stage of introduction of new type fuel assemblies, when their amount in core is insignificant and regular fuel assemblies surround them.
An experimental research of a core of PWR reactors of the future in the situation, when fuel loading will include fuel assemblies with various length of a fuel column, is a necessary condition of verification of calculation forecasts. The primary goal of such researches is a modeling of the situations arising at the beginning and the end of a cycle of introduction of advanced fuel assemblies and definition of mutual influence of different type fuel assemblies on a power field distribution.

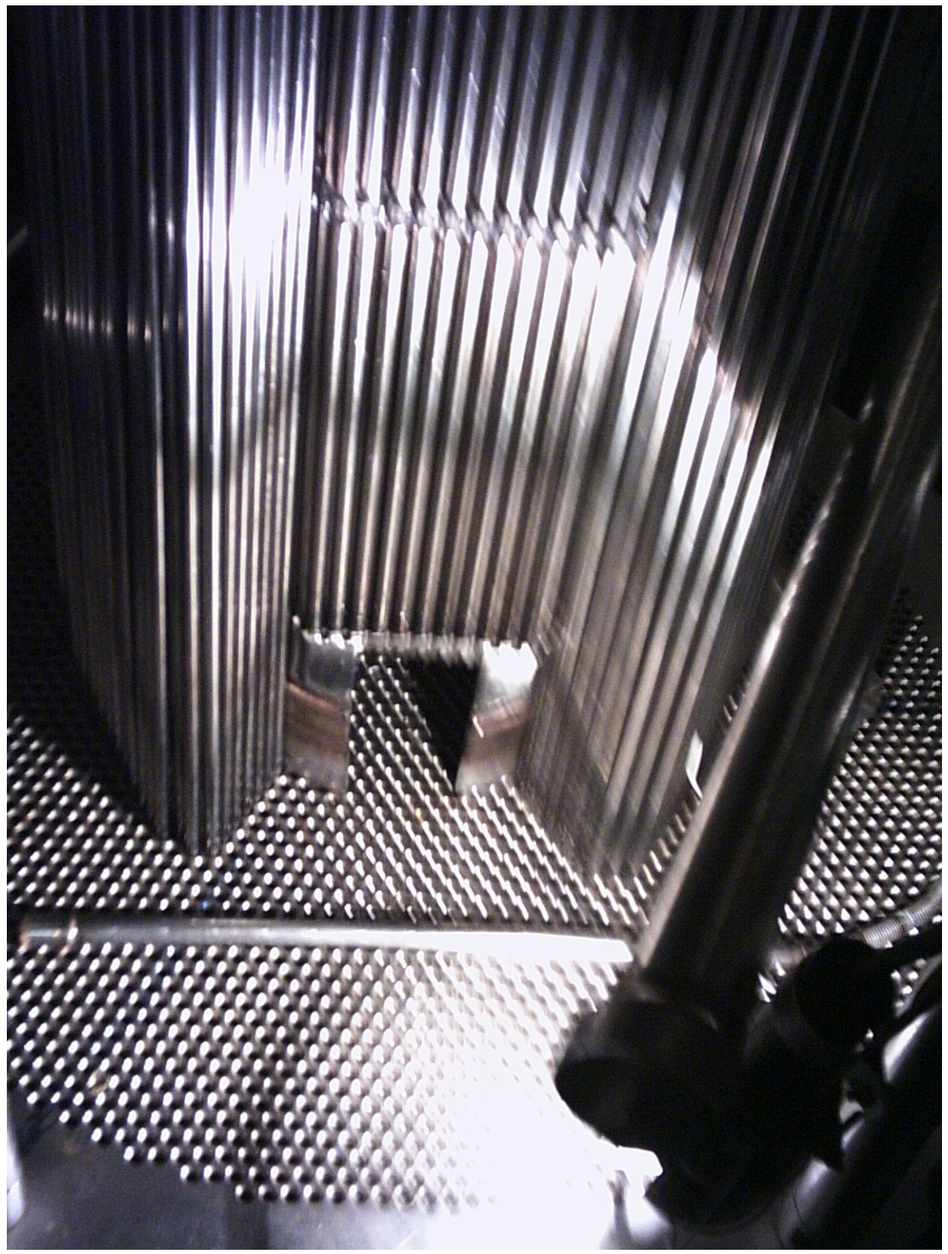
Method

Typical algorithm of carrying out of experiment.

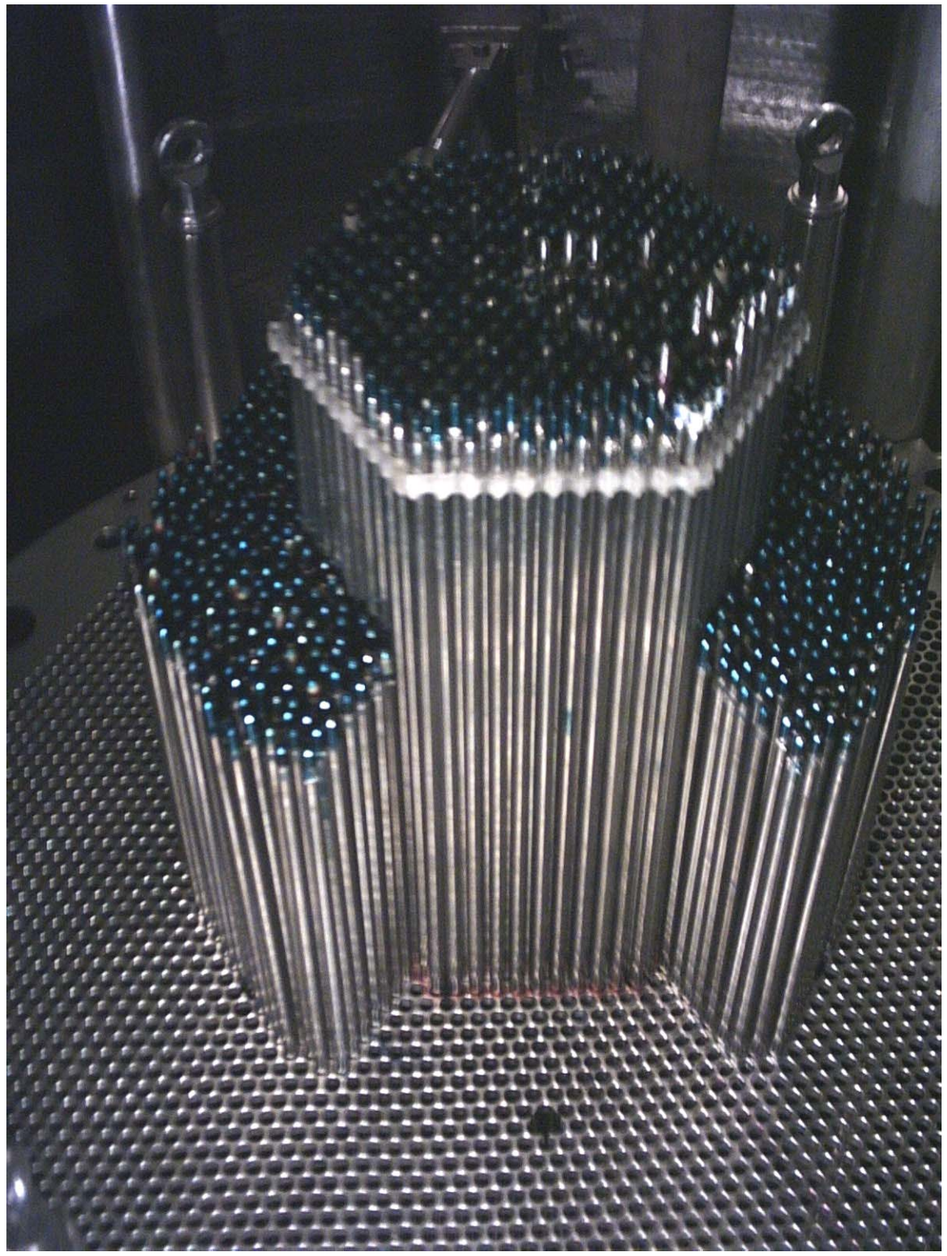


To explore different type fuel assembly's core, the internal part (331 cells, WWER-1000 fuel assembly model) was lifted on some height in comparison with associate's fuel rods. Relative axial distribution of power field has been measured in fuel rods, located in the middle of the first sequence, surrounding WWER-1000 fuel assembly model, and on edge of some.

The bottom of core (fuel rods of peripheral part are taken from sector of symmetry 60 deg.).

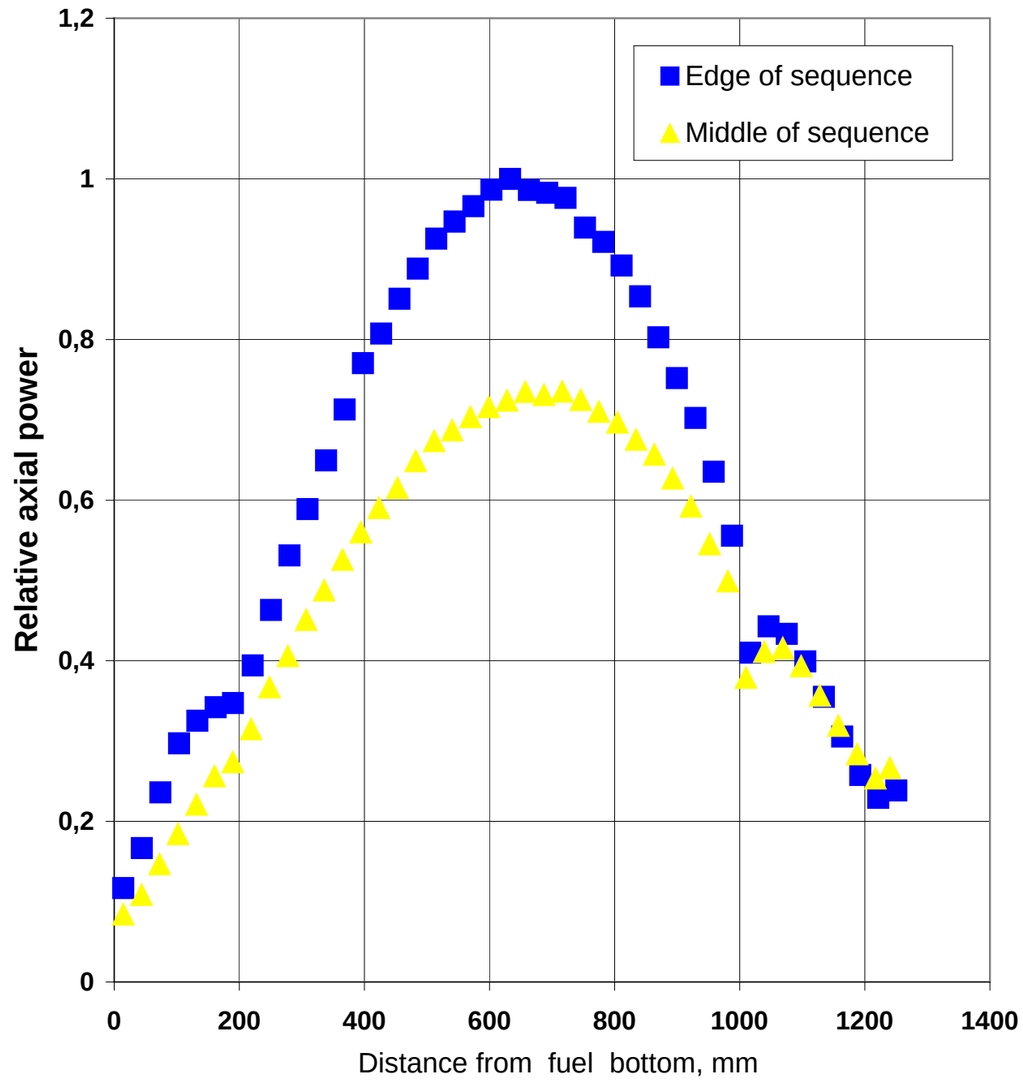


The top of core (fuel rods of peripheral part are taken from sector of symmetry 60 deg.).

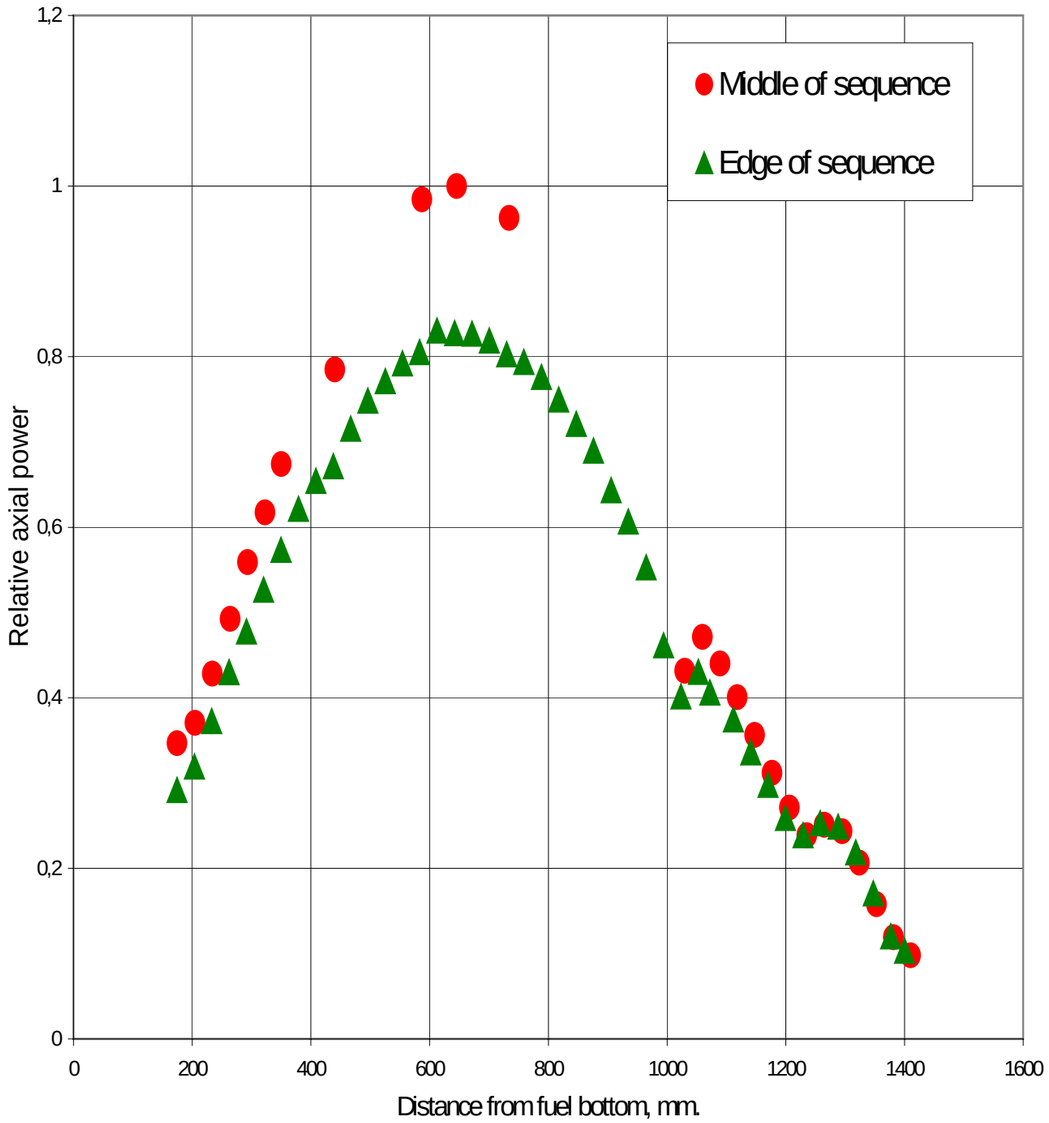


Results

Relative axial power distribution in fuel rods, located in the middle of the first sequence, surrounding WWER-1000 fuel assembly model, and on edge of some.



Relative axial power distribution in fuel rods, located in the middle of the last sequence of WWER-1000 fuel assembly model, and on edge of some.



Comparison of relative axial power distribution in fuel rods, located in the middle of the pre-last and last sequences of WWER-1000 fuel assembly model.