Budapest Research Reactor
Hungary,

Country Report
RROG 2019 in Mainz, Germany
14-17 May

BUDAPEST RESEARCH REACTOR
60 YEARS OF RESEARCH & INNOVATION

mta EK

BNC
Budapest Neutron Centre

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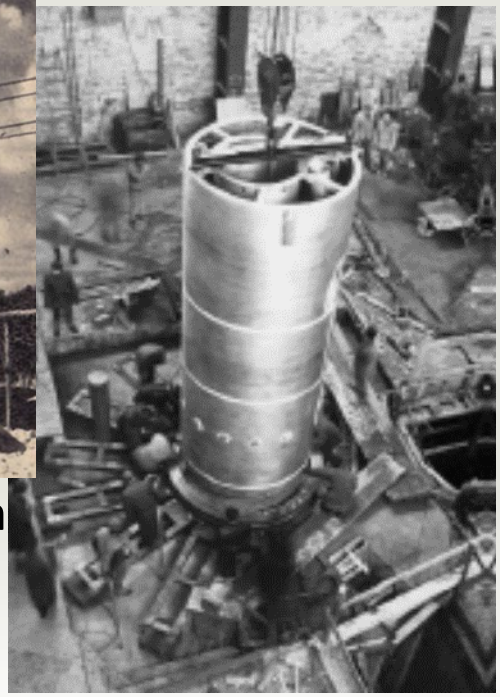
- The Hungarian scientist suggested to the government expert: we can build with russian colleagues only a research reactor because we havn’t enough specialist to operating. According to decision of Hungarian Government the research reactor was built in the KFKI facility.

In 1956- the first manager of the reactor; Dr. Lénárd Pál

The reactor building was under construction 1957



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The first starting process – 25.03.1959

Utilization of research reactor:

- research,
- isotope production (medicine),
- studies.

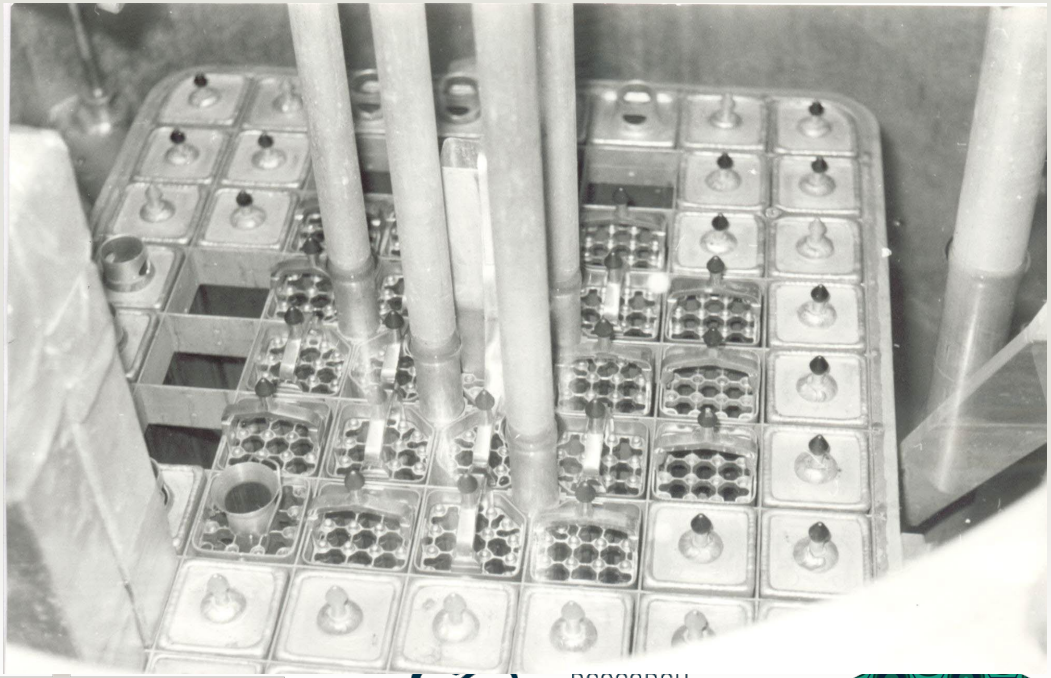
In accordance with the tasks at the foundation,

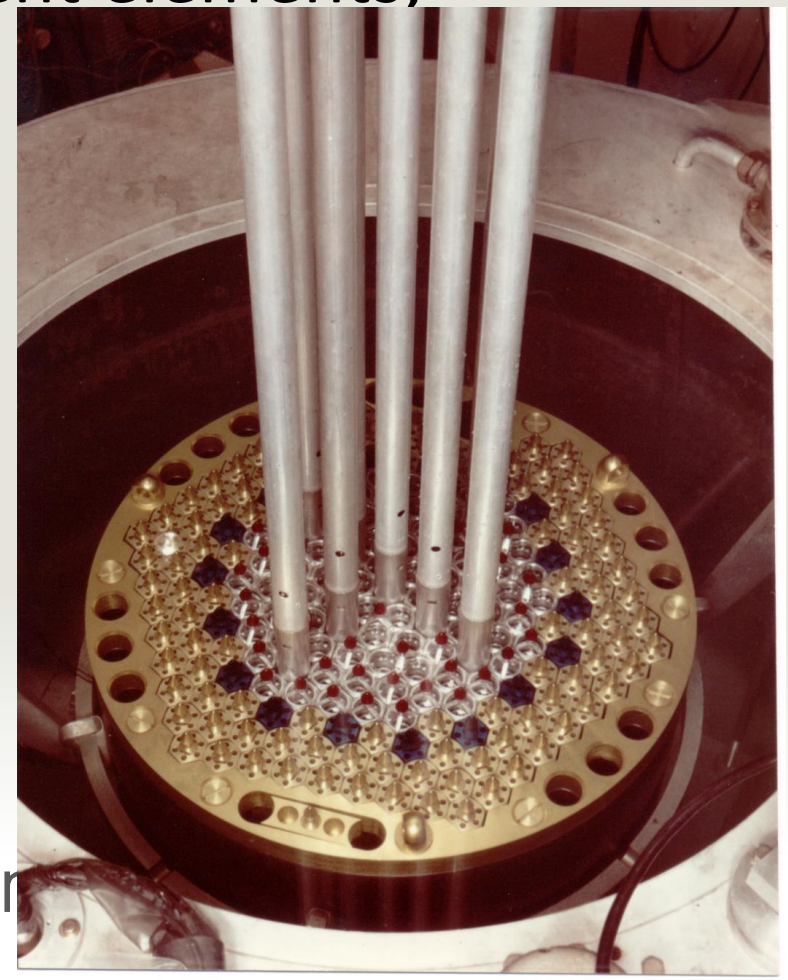
- the methods of measuring the radiation were developed,
- the necessary tools were built,
- the initial steps of the production of isotopes were made,
- nuclear analysis was introduced.

First Reconstruction in BRR

The first development took place in 1967, in which:

- metal beryllium reflector layer has been built around the active zone,
- original EK-10 type of fuel elements were replaced with VVR-SM type 36% enrichment elements,
- nominal power 2 MW>>5 MW





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With sincere respect to the operating staff

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The strategy before the 2nd reconstruction – 1980 (~2019)

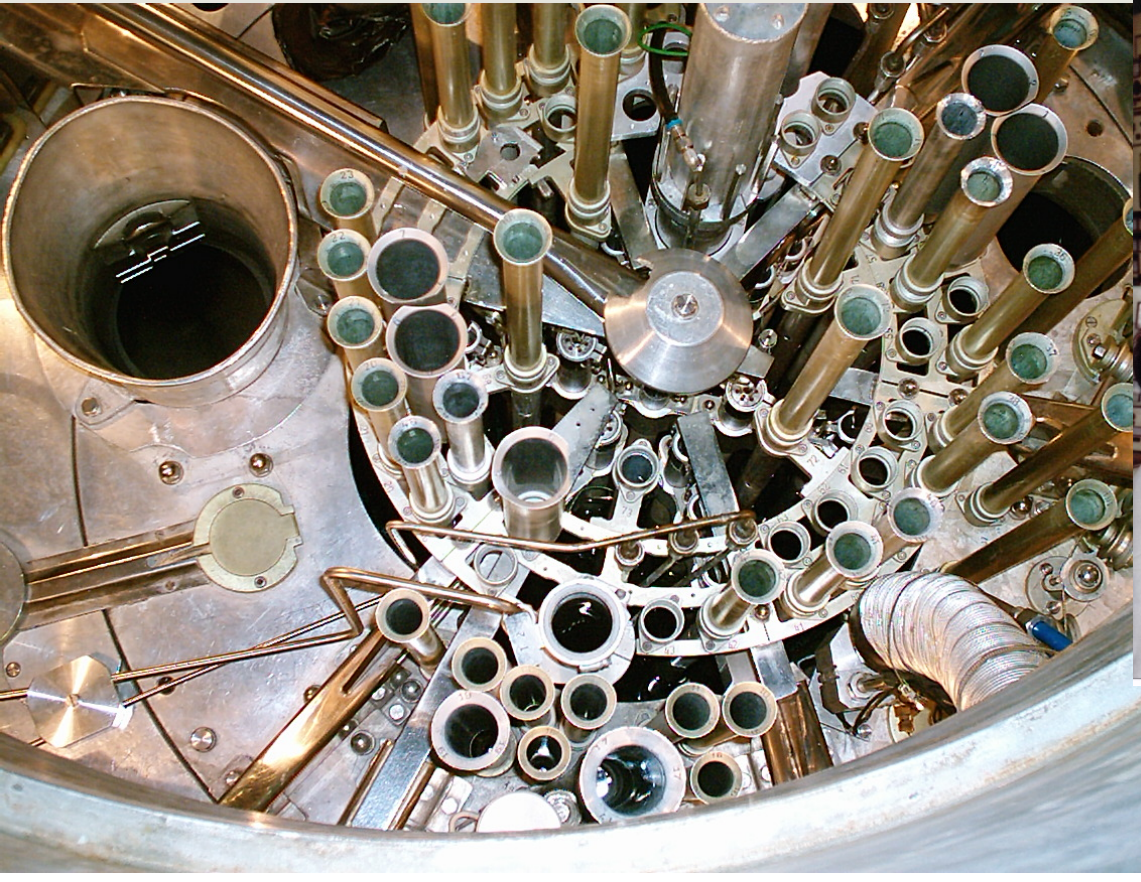
The arguments for further operation and upgrading of the reactor were grouped around 4 questions as follows:

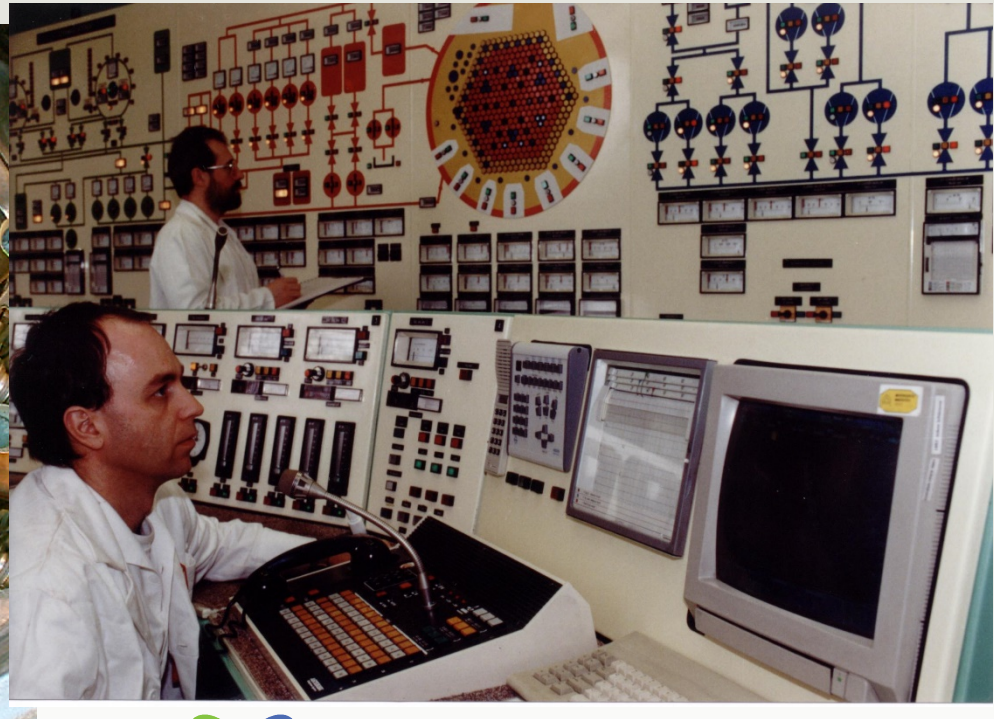
- radio isotope production: our reactor should continue to ensure the right quality and quantity of the isotope to the increased industrial and medical uses.
- Basic- and applied research: develop more research activities in the field of material science, activation analytics, radiochemistry, gamma spectroscopy and reactor safety operation.

- Developing nuclear technology and industrial applications: extension of the nuclear tests, neutron – neutron analysis of induced interactions, or eg. a special test in a pressure vessels of a nuclear power plant (can be achieved using only a research reactor).
- Education and training: training for nuclear engineering activities, participation in university and postgraduate training, and organization of domestic and international courses.

The second modernization – global reconstruction

- The last upgraded in our reactor was from 1986 to 1992, and it was starting again in 1993 after reconstruction. The new reactor provided high-energy, higher-flux neutrons offered new opportunities for nuclear-physical- and solid-state experiments.





BRR Operating - Utilization

Safety Operation
Operating Permit
Up to date Rules and regulations
Official contact to Authority
Fuel cycle design
Treatment of spent fuel
Treatment of Environmental issues

Isotope Production

Use of horizontal and vertical irradiation channels - BNC
*Since 1993 the **B**udapest **N**eutron **C**enter, like a consortium has been coordinating research work co-operated with the Research Reactor.*

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Remarkable Events

- 2002-2003 SR – operating license for a further 10 years
- 2008 First Stage of Spent Fuel Return Delivery - (232.5 kg)
- September 2009 HEU-LEU start of conversion (LEU fuel elements; VVR-M2 19.75%) - clearly low-enrichment zone from 2013.
- 2012-2013 SR - operating license for a further 10 years
- 2013-14 Returning further HEU spent fuels (49.2 kg)
- 2018-19 Preparing for the purchase of fresh fuel
- 2019 Ensuring the operating conditions for the remaining 4 years (spare parts managements, planned replacement of old systems)
- 2019 Preparing for a lifetime extension !? – extended SR

Technical info

Reactor type:	Tank-type with beryllium reflector, cooled and moderated with light water
Vessel:	Al-alloy (height: 5685 mm; ∅2300 mm)
Core geometry:	Hexagonal (length: 600 mm; ∅1000 mm)
Fuel:	LEU VVR-M2 (19,75 %)
Equilibrium core	190 fuel elements (5x38 age-group FAs)
Control:	18 control rods = 3 safety rods (B_4C); 14 shim rods (B_4C); 1 automatic control rod (SS - Stainless Steel)
Thermal power:	10 MW
Mean power density:	61.2 kW/litre (in the core)
Neutron flux density in the core:	$2,2*10^{14}$ n/cm^{2}s (thermal in flux traps) En<0.625 eV $1*10^{14}$ n/cm^{2}s (in fast channels) En>0.5 MeV
Cooling systems:	Two closed loops (primary and secondary loops)
Pr.cooling water:	$Q_{nominal}$: 1650 m^3/h; T_{inlet}: 45 °C; T_{outlet}: 50 °C

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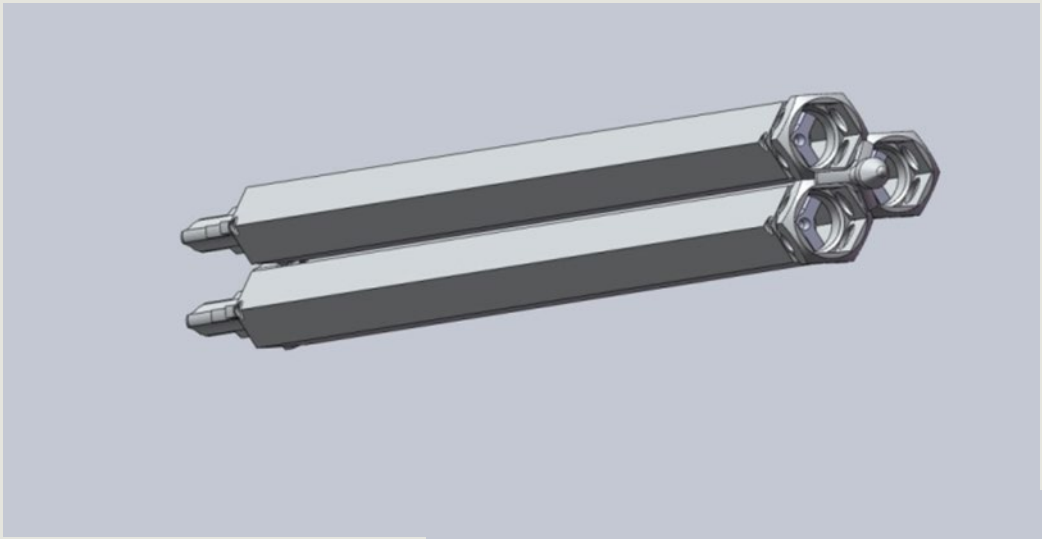
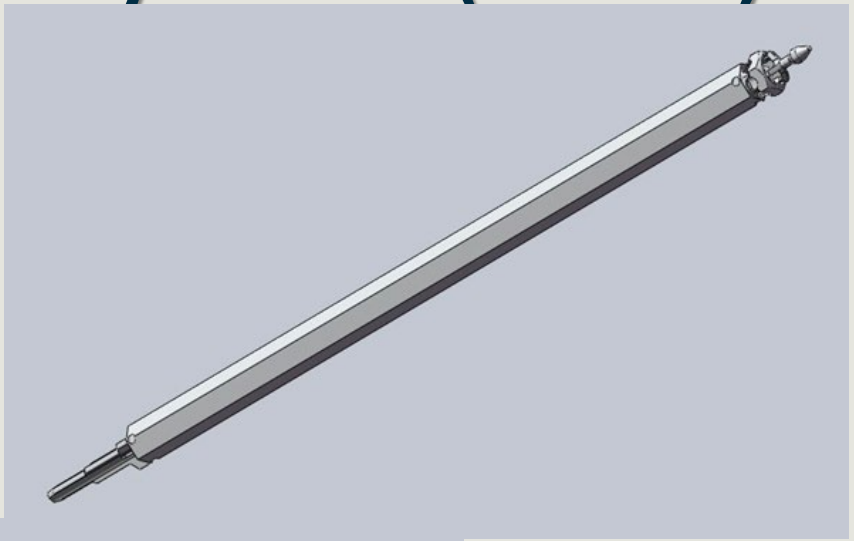
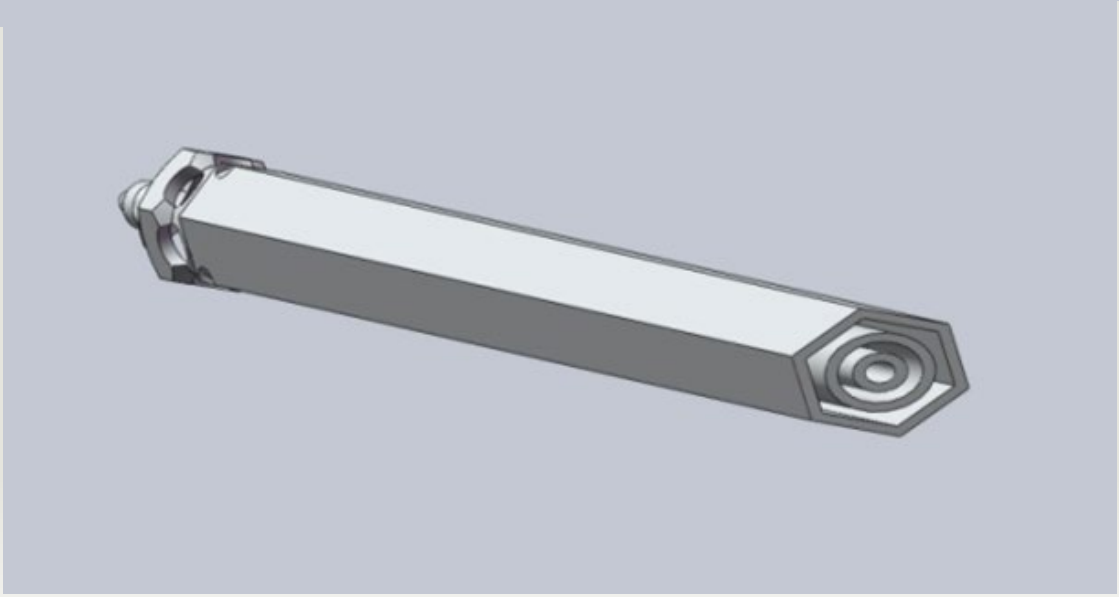
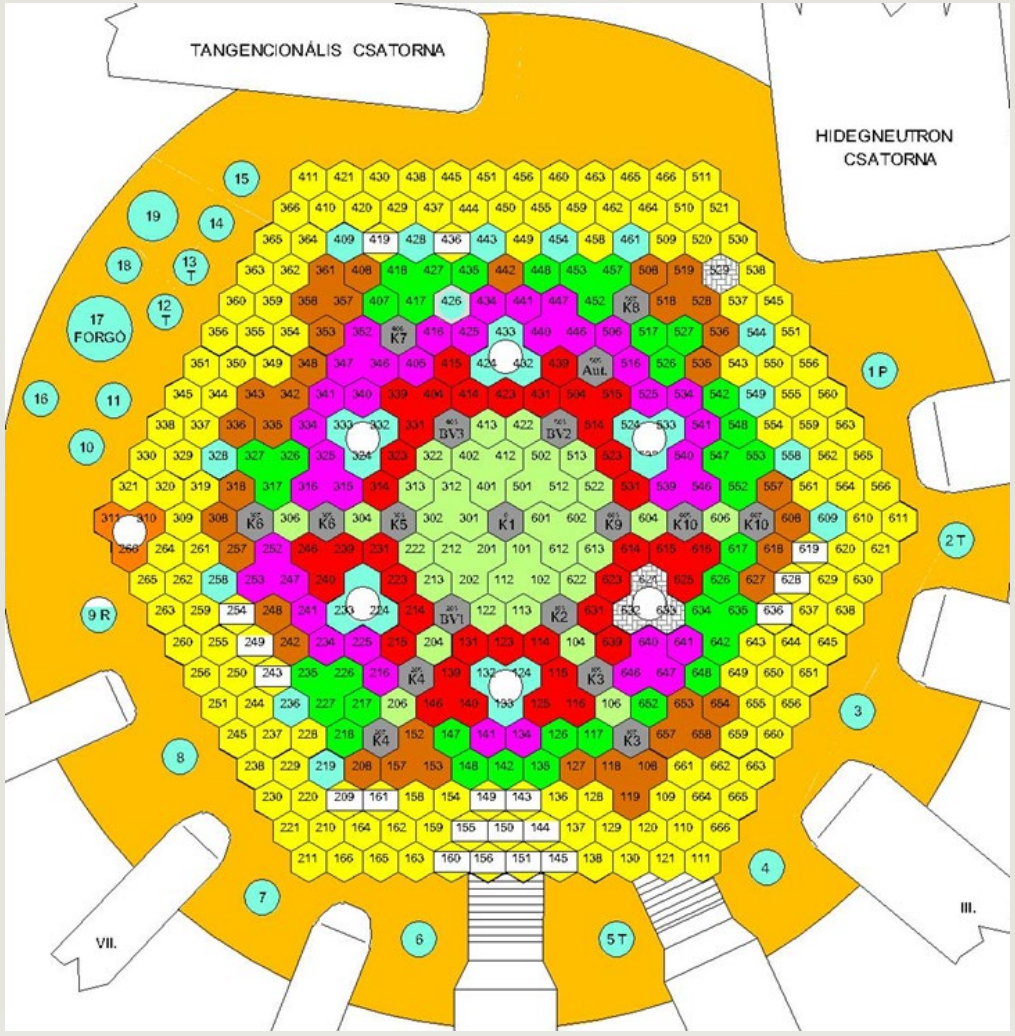
Fűtőelem – VVR-M2 alacsonydúsítású(19.75%)







Map of active core



Legend

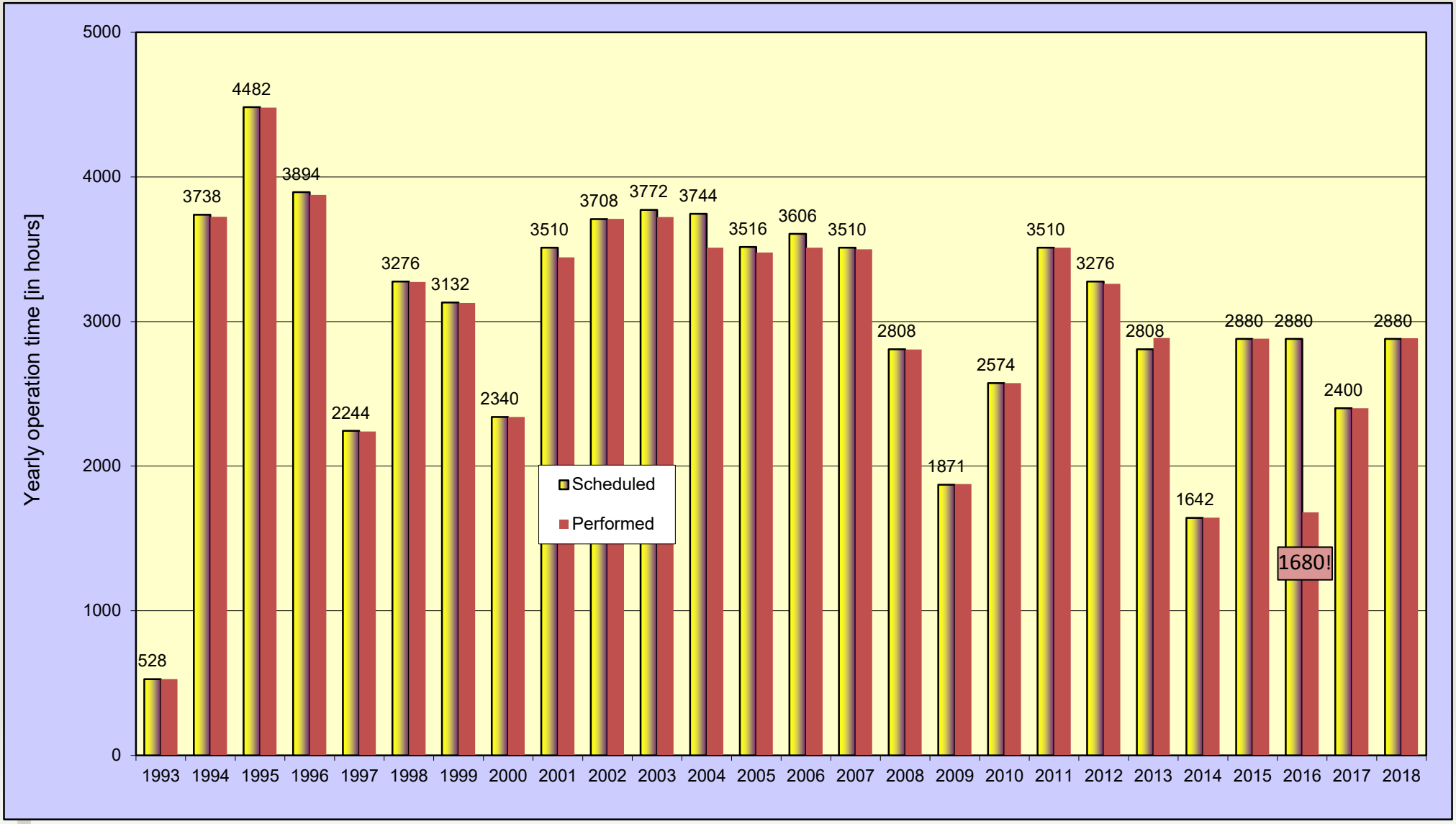
5 different age group of fuels

Be reflector

Irradiation channels

Control rods

Annual Operating Times



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Thank you for your attention!

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