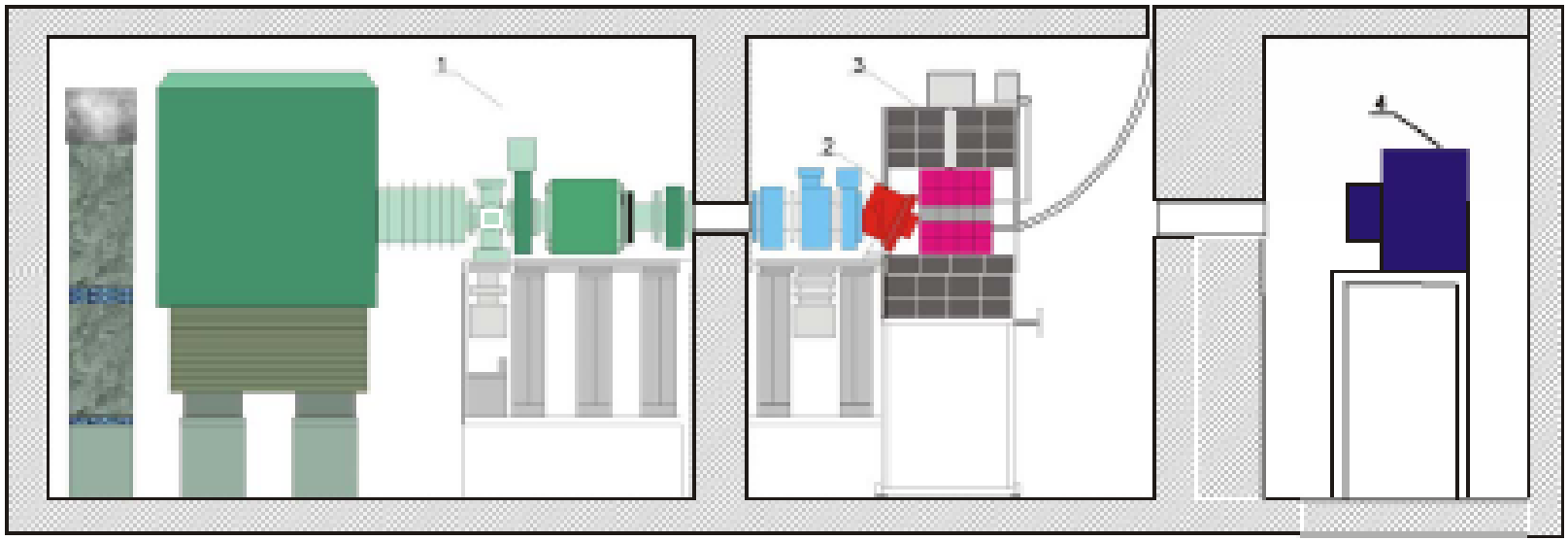
YALINA facility

Location: at the Joint Institute of Power and Nuclear Research, Sosny - ~20 km east of Minsk, Belarus

subcritical assembly driven by a **neutron generator** that operates in either pulsed or DC mode



Main research program

Experimental and theoretical research on transmutation of long-lived fission products and minor actinides in a sub-critical assembly driven by a neutron generator

- neutronics studies of a sub-critical system driven by external neutron source
- measurements of the transmutation rates of fission products and minor actinides
- investigation of kinetics of the sub-critical systems with external neutron sources
- validation of the experimental techniques for sub-criticality monitoring, neutron spectra measurements & nuclear data models & libraries
- investigation of dynamics characteristics of sub-critical systems with an external neutron source operated in pulse mode

Collaborators: RIT (Sweden); CIEMAT (Spain), FzK (Germany)

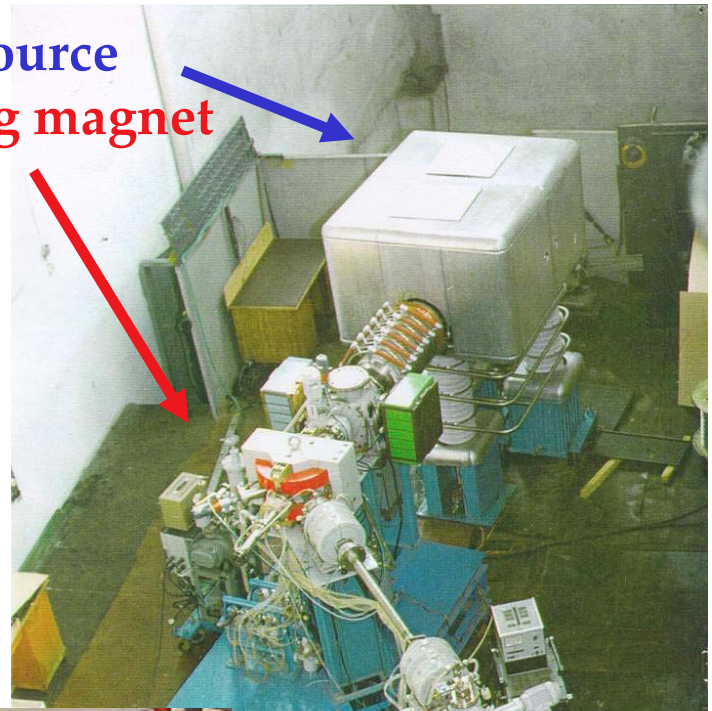
YALINA detector equipments

modest equipment …

- ^{3}He neutron detectors with 10 mm and 250 mm length
- Fission chambers - ^{235,nat}U and ^{232}Th
- Coaxial HpGe detector – 80% efficiency
- Planar (LEPS) Ge detectors
- Radioactive samples of ^{237}Np, ^{243}Am and ^{129}I

YALINA neutron generator

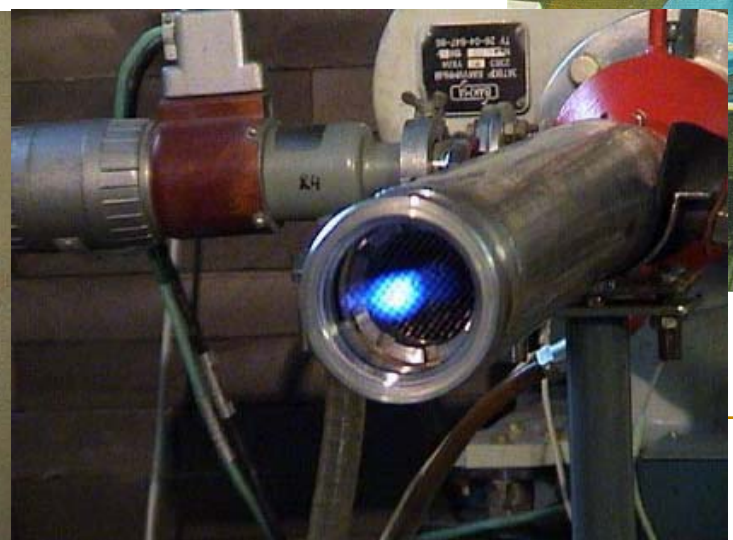
Deuteron energy		100 – 250 keV
Beam current		1 – 12 mA
Pulse duration		0.5 – 100 μs
Pulse repetition frequency		1 – 10000 Hz
Spot size		20 – 30 mm
(d,t)-target	Maximum neutron yield	~$2.0 \cdot 10^{12}$ ns^{-1}
	Reaction Q-value	17.6 MeV
(d,d)-target	Maximum neutron yield	~$3.0 \cdot 10^{10}$ ns^{-1}
	Reaction Q-value	3.3 MeV



water cooled, rotating targets

Ti-t and Ti-d

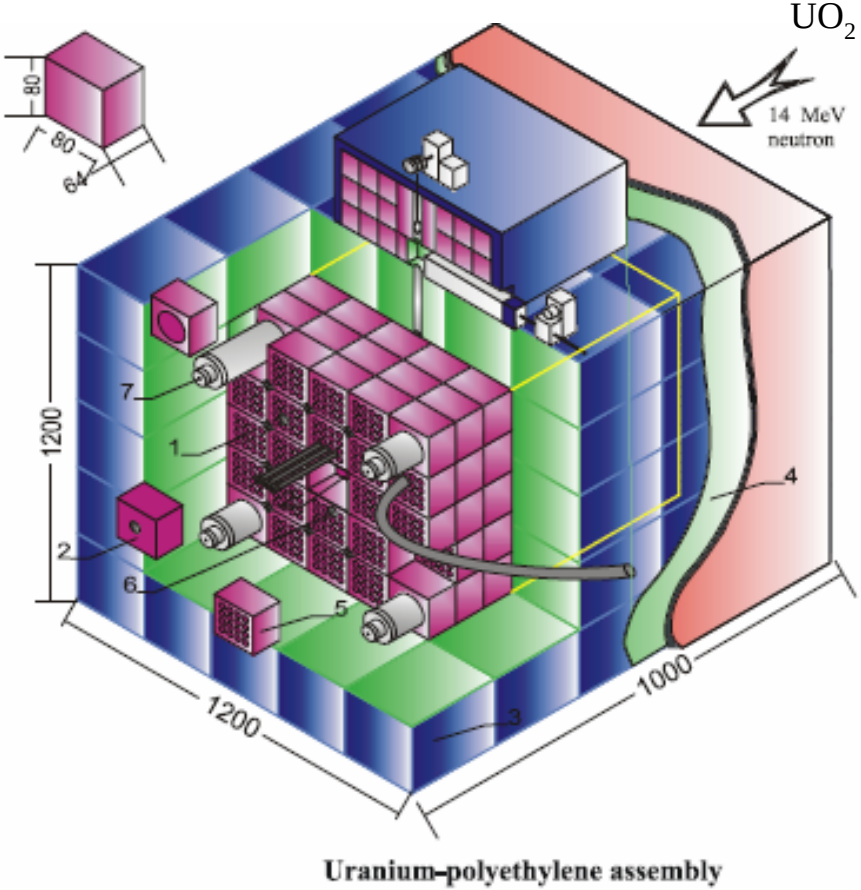
45 mm target



YALINA thermal assembly

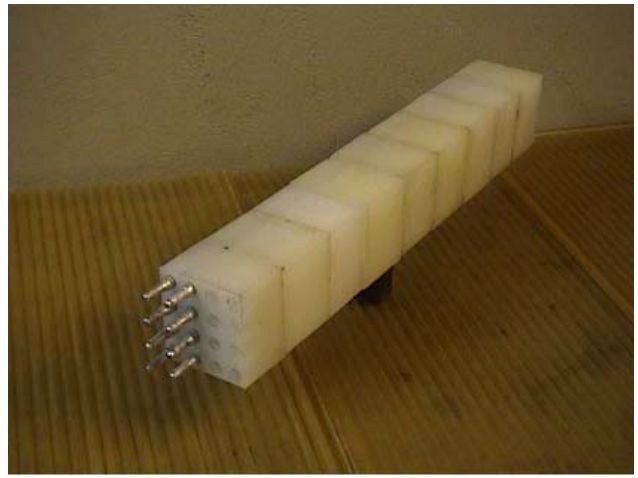
subcritical $k_{max} < 0.98$
with thermal neutron spectrum

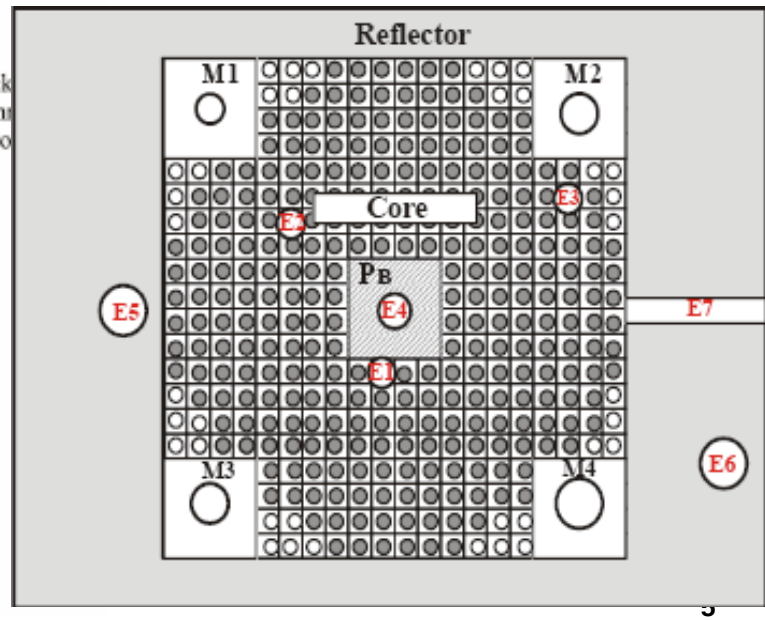
UO_2 10% enrich in ^{235}U



1 - core
2 - Pb target
3 - graphite reflector
4 - cadmium screen
5 - polyethylene block
6 - experimental chan
7 -detectors for neutro
monitoring

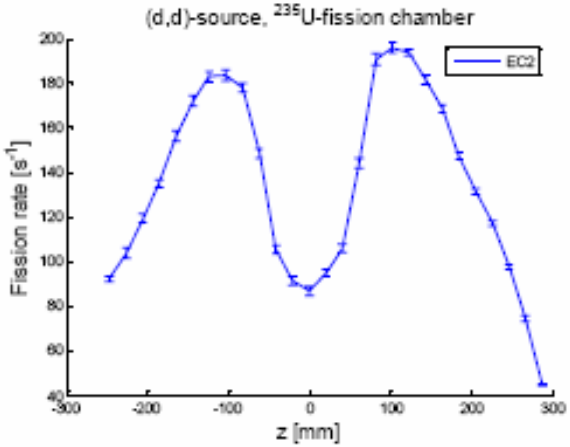
Uranium–polyethylene assembly

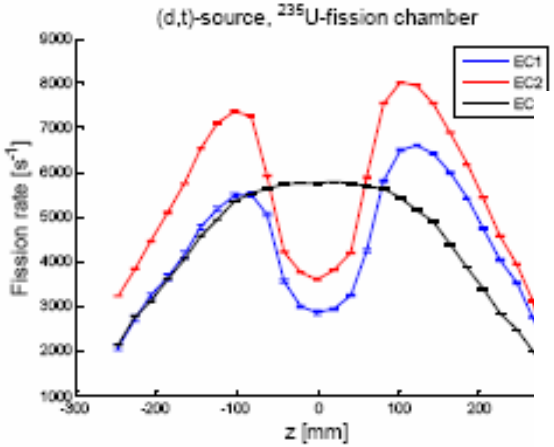


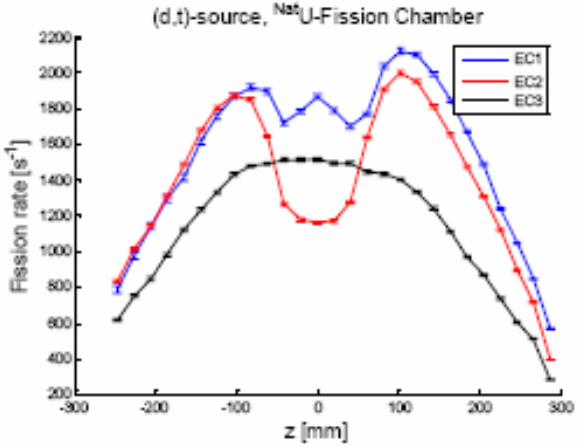


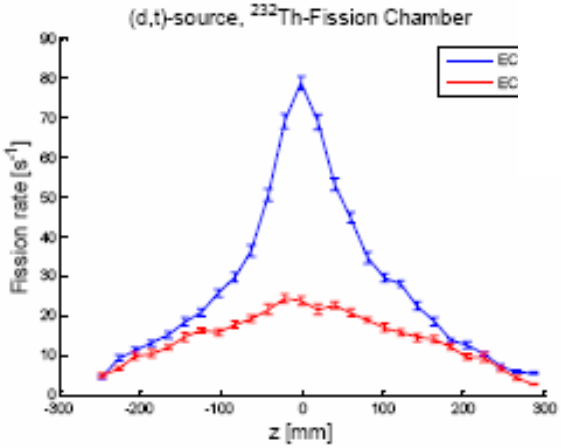
Some results from the thermal assembly

Axial rate distributions

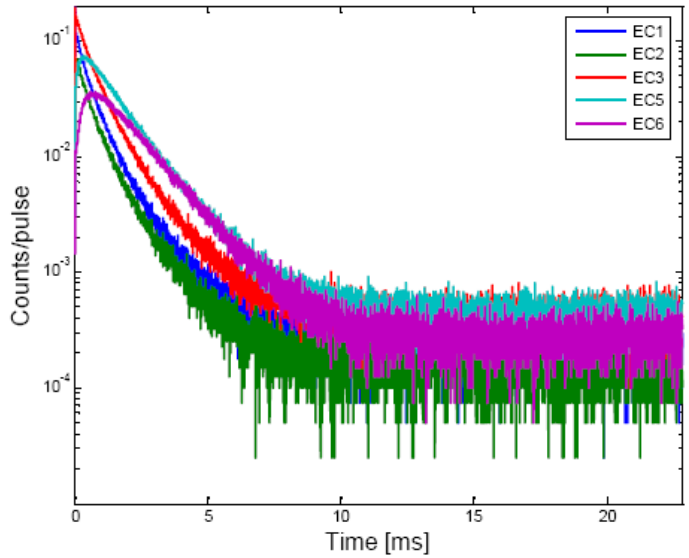






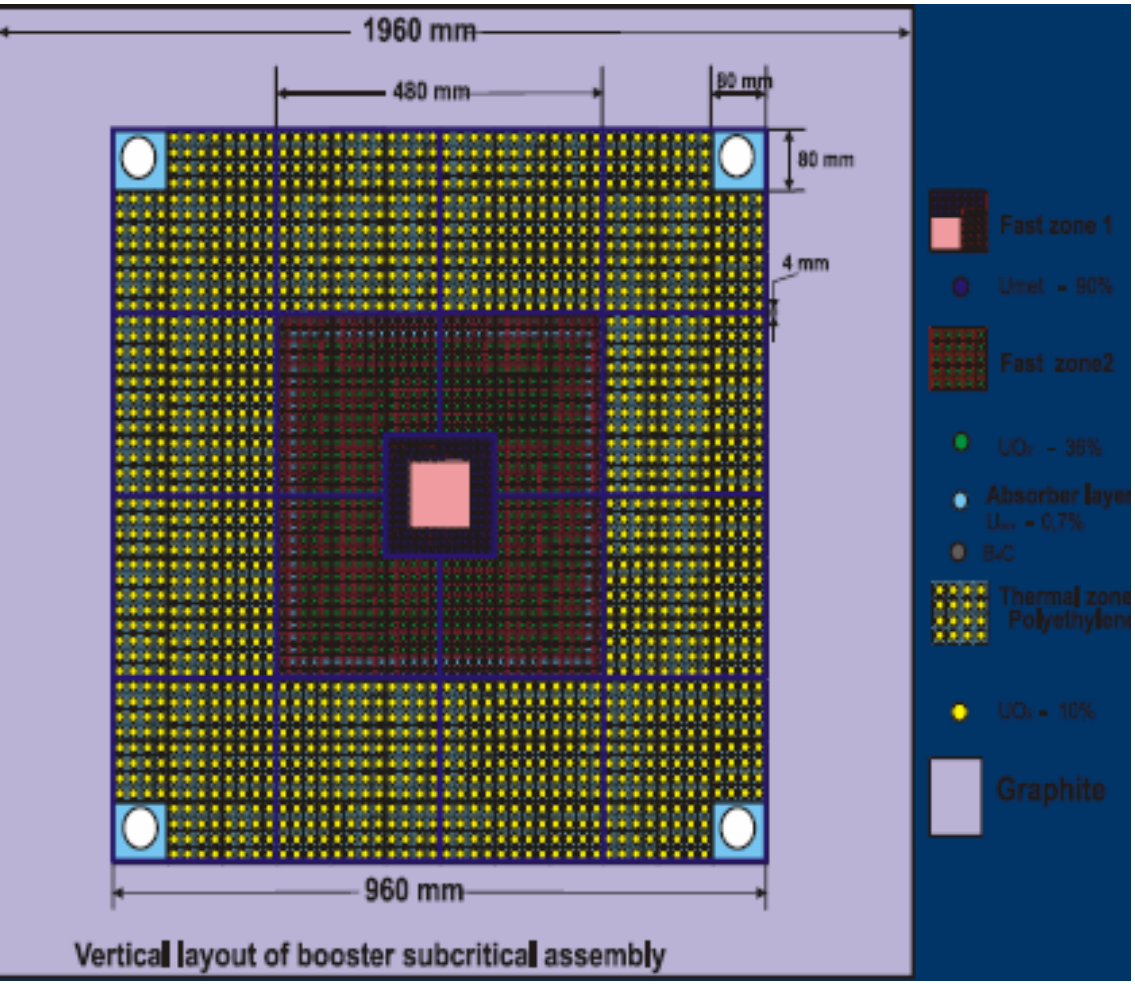


Reactivity PNS measurements



YALINA-B /buster configuration

The fast zone – considered as a volume source – close to the spallation target of SAD and MYRPHA experiments



Buster Zone (K_{eff}=0.67)

Fuel: metallic U (90% ^{235}U)
UO_2 (36% ^{235}U)

Moderator: Pb

Intermediate Zone

Fuel: metallic ^{nat}U (0.7% ^{235}U)
B_4C

Moderator: Pb

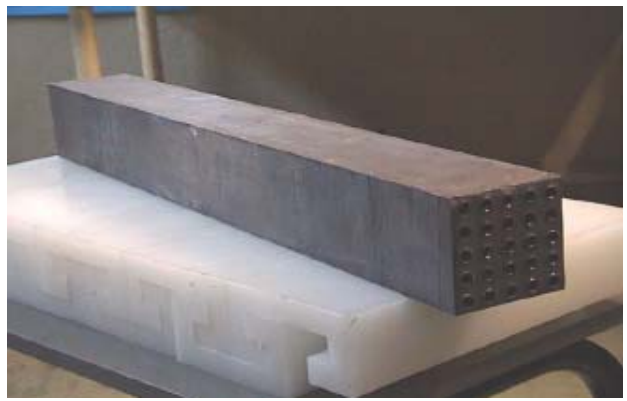
Thermal Zone (K_{eff}=0.95)

Fuel: UO_2 (10% ^{235}U)

Moderator: polyethylene

Reflector: graphite

YALINA-B /buster configuration



Future research program

- Validation of applicability of methods developed for critical reactors to determine k_{eff} for sub-critical systems
- Development of reactivity monitoring techniques for sub-critical systems with fast neutron spectrum
- Study of dynamics, coupling (feedback) for the system - "neutron generator –sub-critical reactor"
- Investigations of the core response due to fast reactivity insertions by movement of a B_4C rod in the experimental channels of the core
- Studying the features of coupling of spallation target and the core
- Studying the influence of shielding on physical parameters of the fast spectrum core
- Pu, MA and LLFP transmutation rates in fast & thermal neutron spectrum