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iDREAM: an industrial detector for nuclear reactor monitoring.

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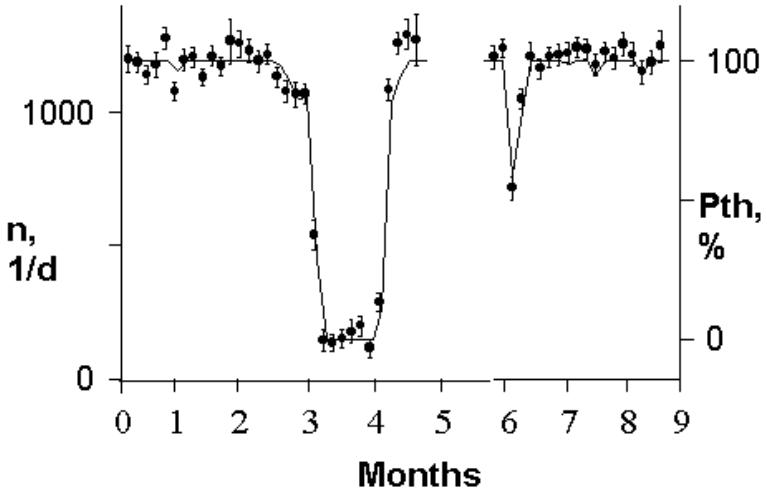
Introduction

Detector RONS

1970s – the neutrino diagnostic method proposition by L. Mikaelyan and A. Borovoj

A. Borovoj, L. Mikaelyan, About neutrino diagnostics of the inner-reactor processes. IAE-2546, 1975.



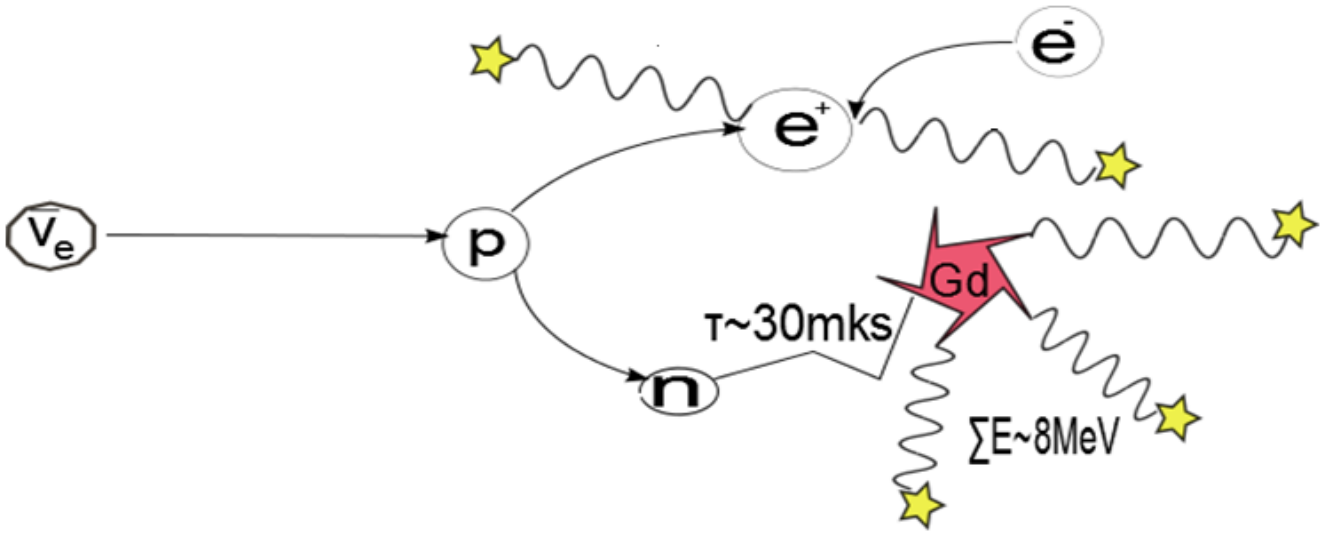
From 1982 to 1995 – Feasibility studies were provided at Rovno NPP

A. Afonin, A.Vershinskij, S. Egorov, Yu. Klimov, V. Kopeikin, A. Labzov, L. Mikaelyan, K. Ozerov, V. Sinev. Measurements in the flux of reactor neutrinos at the Rovno NPP with the RONS spectrometer. Preprint IAE-4746/2, 1988.

Monitoring method

Inverse beta-decay is the corner stone of the method:

$$\bar{\nu}_e + p \rightarrow n + e^+$$



Dependence of neutrino events number for 1 day from generated energy W:

$$N = \gamma \times A \times W$$

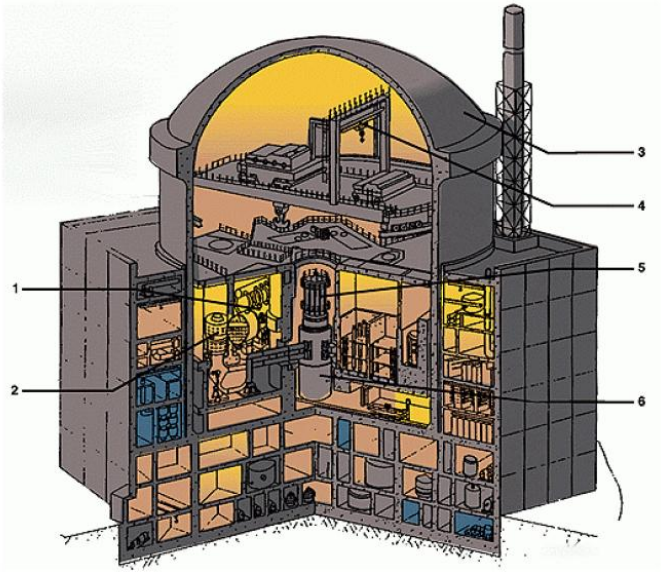
where A is a coefficient, γ is a correction which takes into account the nuclear fuel alteration

Project Goal

the Federal program "Development the nuclear power complex"

the Federal Targeted Program "The nuclear technologies of the new generation for the time period from 2010 to 2015 and for the period until 2020"

PWR-1000

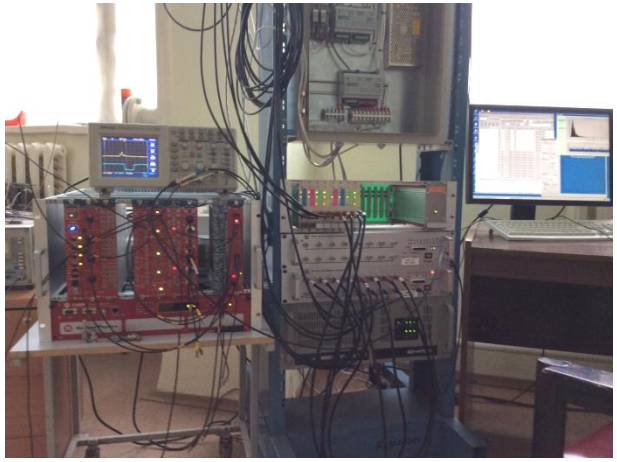


- Industrial type detector which meets different requirements from research detectors (“black-box”, long-term stability and etc.)
- Development of a collective-use laboratory (reconstruction of the lab at the Rovno NPP);
- Possible complete equipment for unified future PWR-1000 reactors.

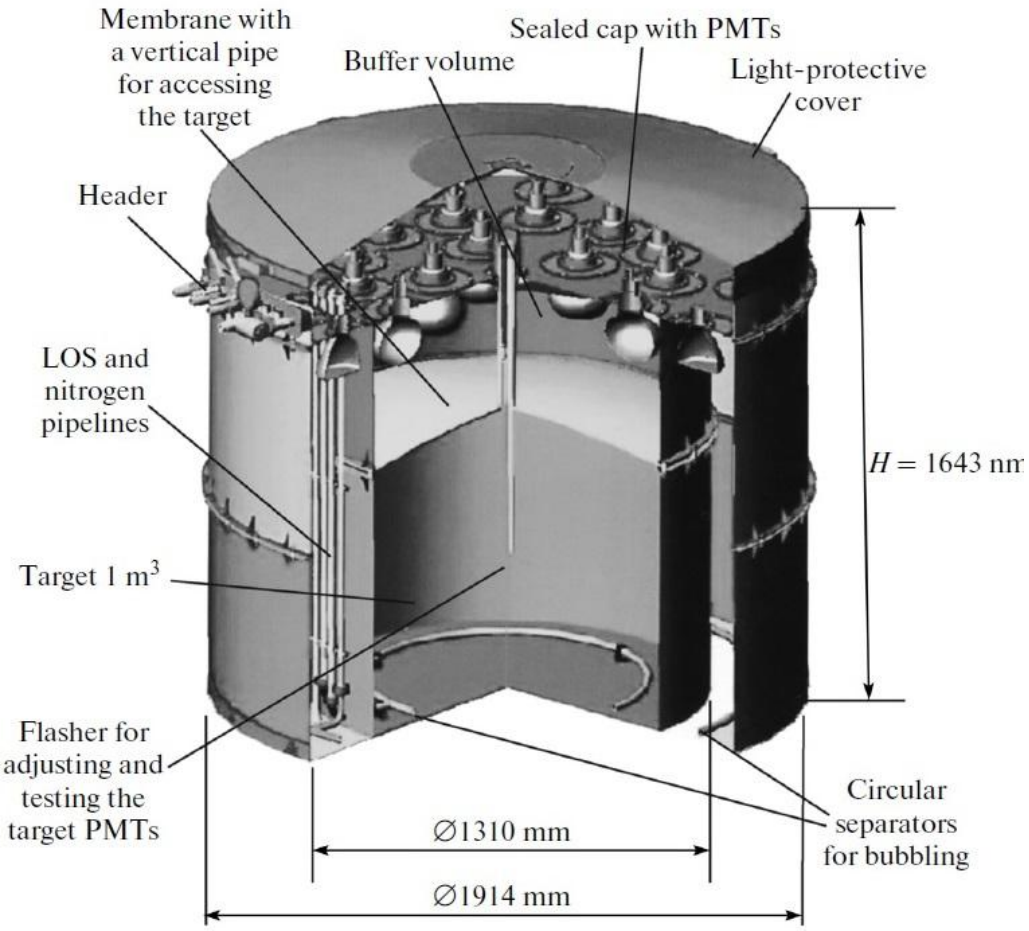
iDREAM –

industrial Detector for Reactor Neutrino Monitoring

Skobeltsyn Institute Nuclear Physics
MSU, NRC “Kurchatov Institute”,
Institute for Nuclear Research of the RAS



iDREAM construction



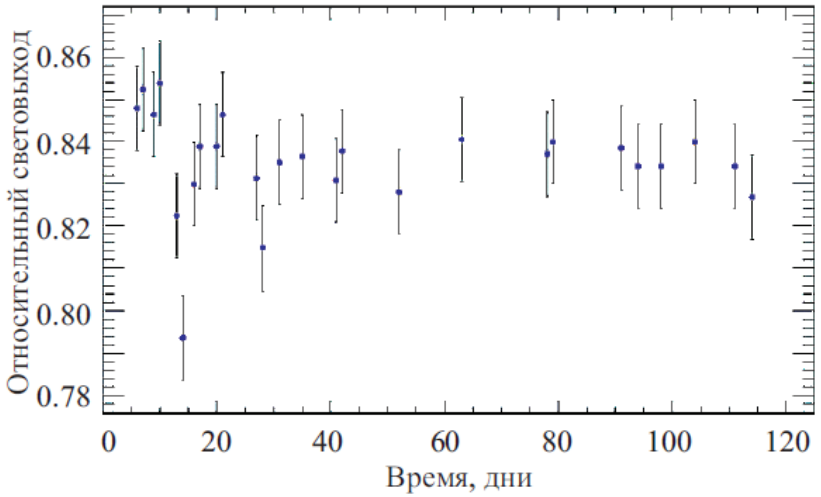
Liquid organic scintillator

$\sigma \sim 250000b$ the neutron- capture cross section with gadolinium

LAB + PPO(3g/L)+POPOP(0.03g/L) – master solution

Three Gd samples:

- Gd(TMHA)3 + TMHA
- Gd(TMHA)3
- Gd(TMHA)3 + TGP



The relative light output of the LOS with the Gd(TMHA)3 complex.

Novikova G Ya, Bakulina N I, and Morgalyuk V P 2014 Russ. J. Inorg. Chem. 59 244;

Summary

- Developed and adjusted detector construction
- The first physical start with distilled water carried out.
- Three LOS Samples are testing.
- Future shift to an underground laboratory in SINP MSU.
- Future in-situ experiment on NPP.

Acknowledgments
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Thank you for your attention.