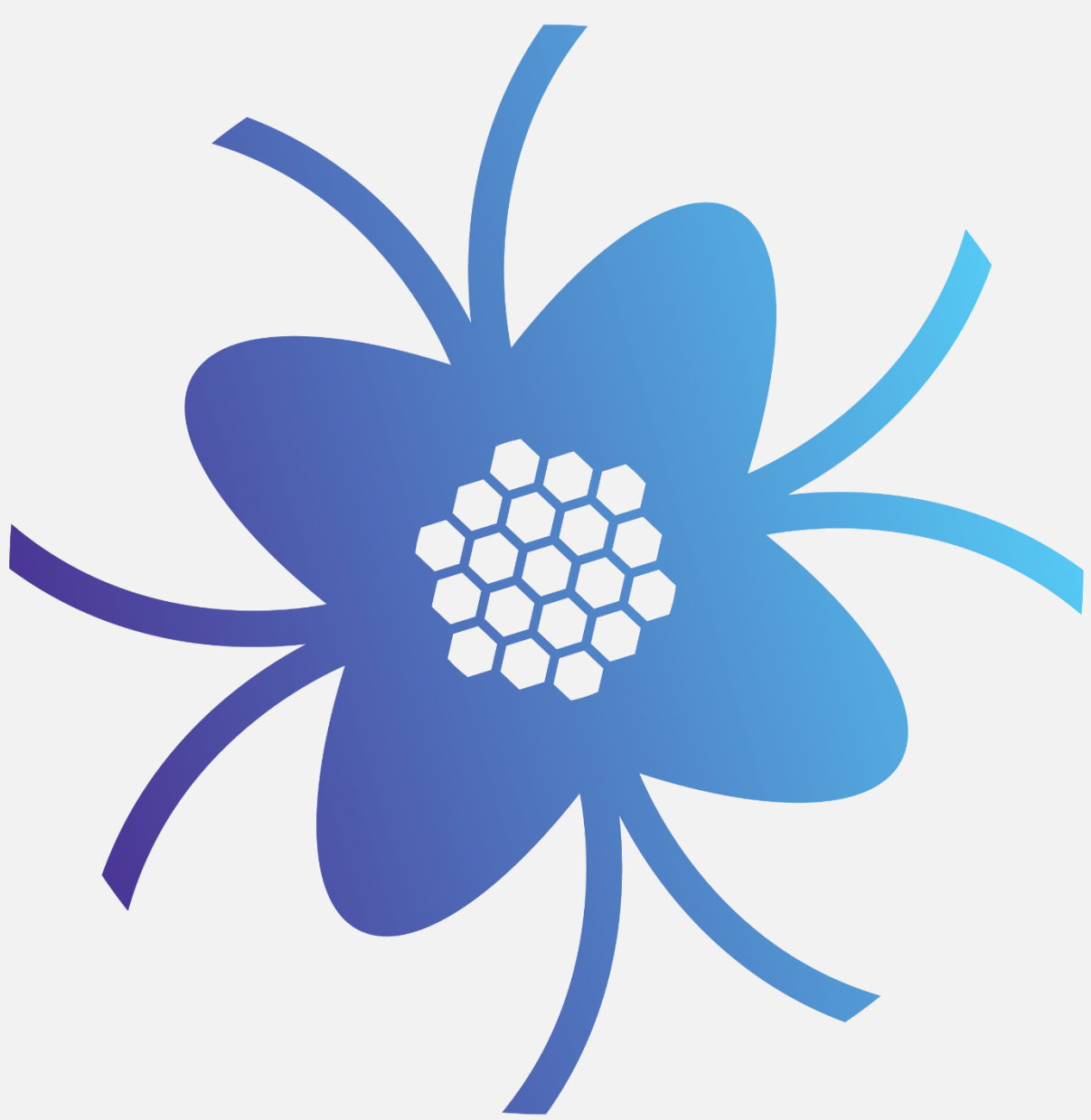




## Progress in the Technical Design of the VERONICA Research Reactor

A. Pungerčič<sup>1,2</sup>, B. Levpušček<sup>1,2</sup>, K. Ambrožič<sup>1,2</sup>, V. Radulović<sup>1,2</sup>, I. Tiselj<sup>1,2</sup>, N. Thiollay<sup>3</sup>, C. Destouches<sup>3</sup>, R. Jacqmin<sup>3</sup>, X. Wohleber<sup>4</sup>, A. Lyoussi<sup>3</sup>, J. F. Villard<sup>3</sup>, C. Vaglio-Gaudard<sup>3</sup> and L. Snoj<sup>1,2</sup>

<sup>1</sup>Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia

<sup>2</sup>Faculty of Mathematics and Physics, University of Ljubljana, Jadranska ulica 19, 1000 Ljubljana, Slovenia

<sup>3</sup>CEA, DES, IRESNE, Cadarache F-13108 Saint-Paul-Lez-Durance, France

<sup>4</sup>CEA, DRF, IRFU, F-91190 Saclay, France

### SUMMARY

**New Slovenian RR: Two reactors in one facility** – a zero-power platform and a 5-10 MW multipurpose reactor.

Proposal of the **initial technical design**:

- **MPRR** (Compact core + D<sub>2</sub>O reflector + Multiple irradiation capabilities).
- **ZPR** (Flexibility in fuel type and loading).

Initial **MPRR Monte Carlo analysis (5 MW)** performed:

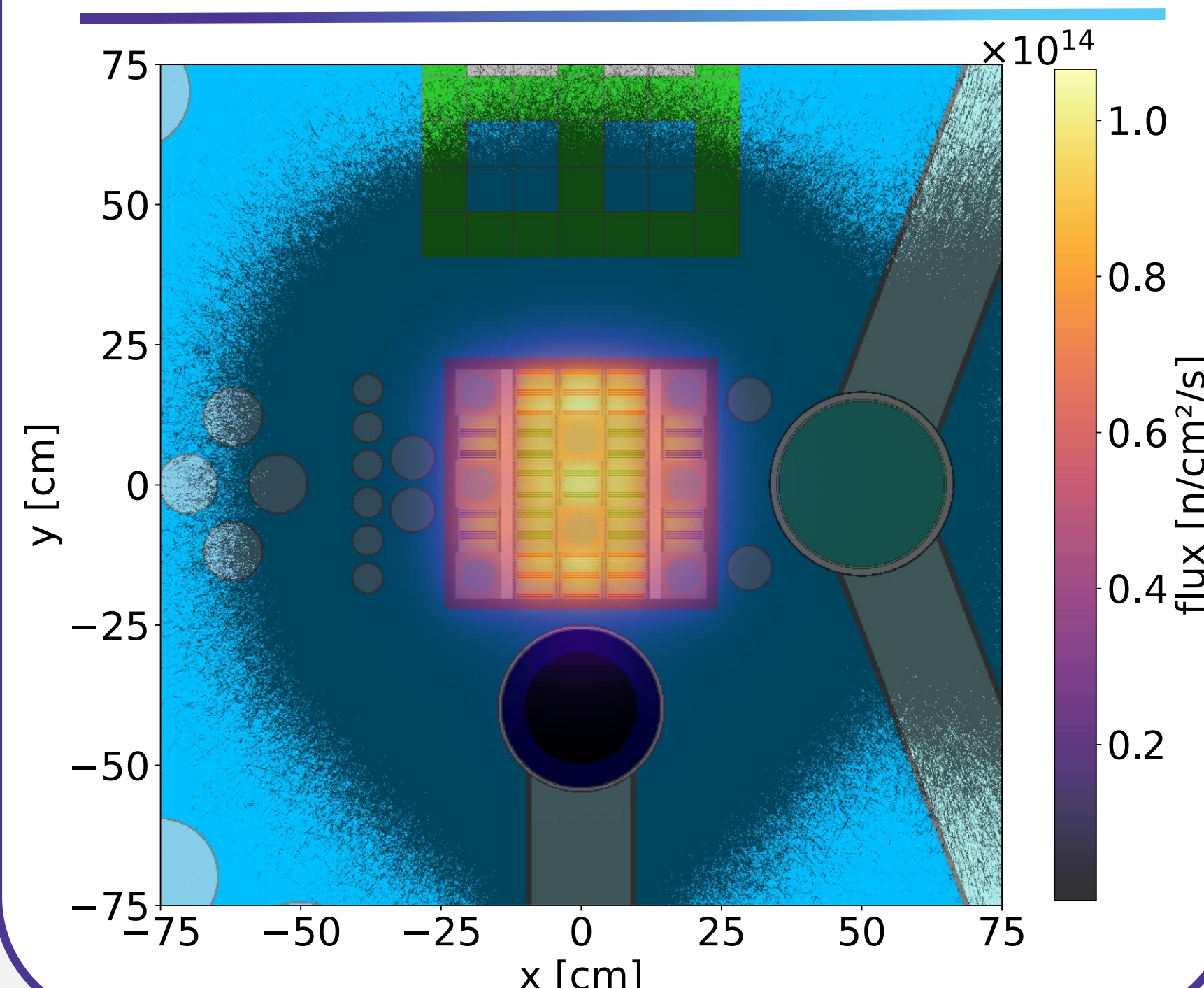
- **Thermal** neutron flux: max.  $10^{14} \text{ n cm}^{-2} \text{ s}^{-1}$
- **Fast** neutron flux: max.  $0.5 \cdot 10^{13} \text{ n cm}^{-2} \text{ s}^{-1}$
- **Be** in prog. reflector locally **increases**  $\Phi_{\text{th}}$

## MULTI-PURPOSE RESEARCH REACTOR – Initial Monte Carlo analysis (5 MW)

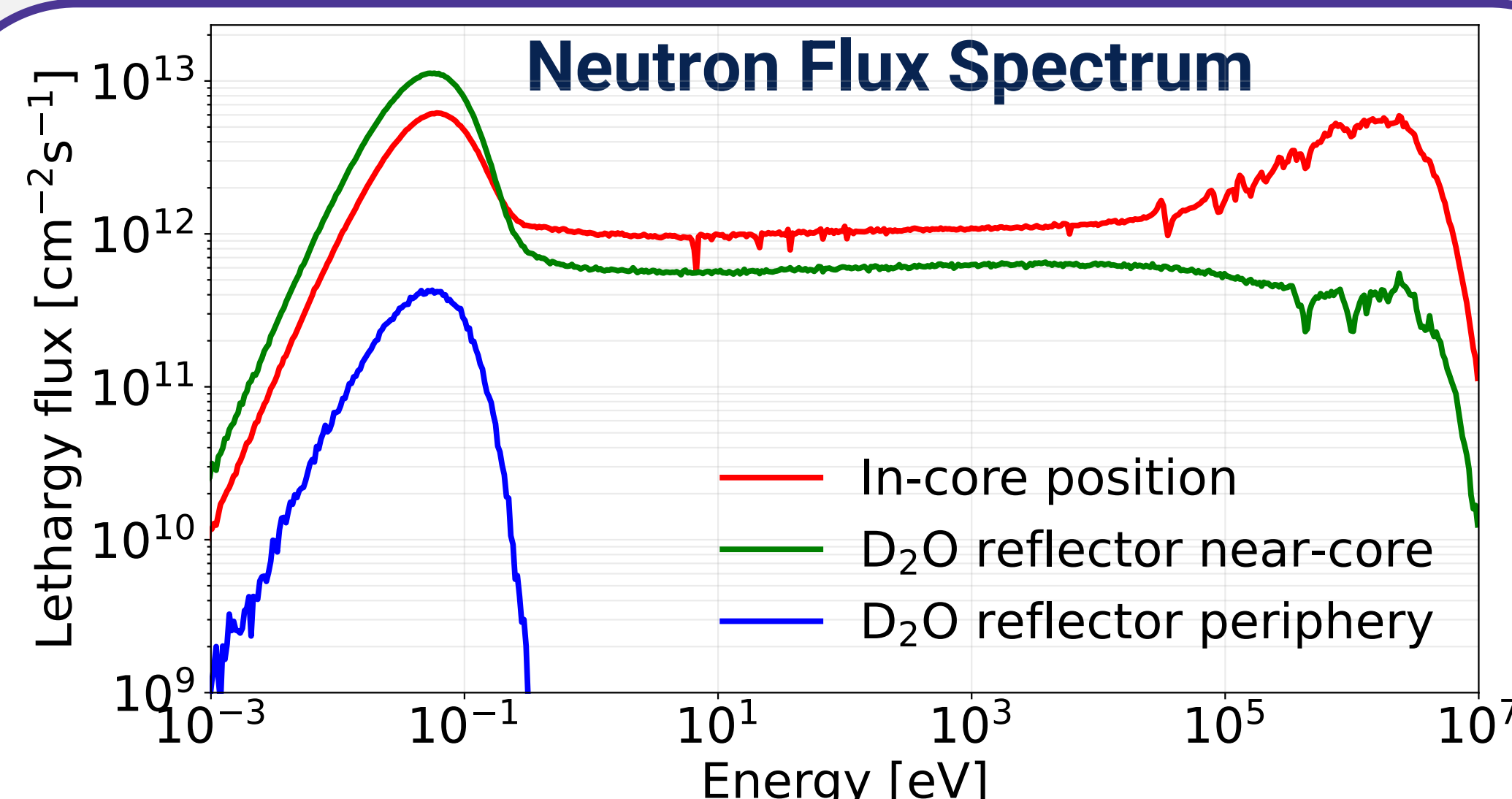
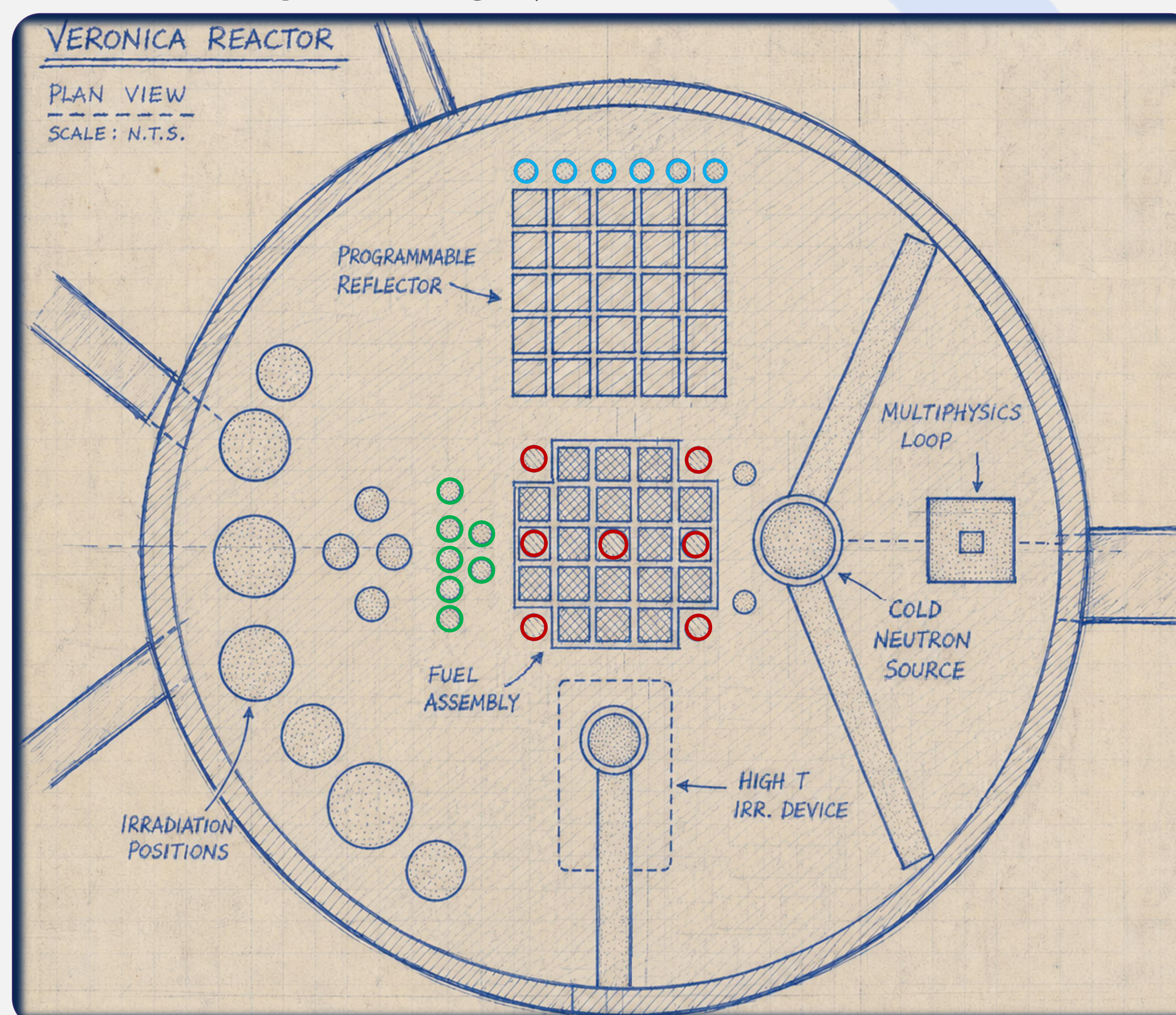
### Irradiation capabilities

- **Spectrum-shifting device** – A programmable reflector
- **Multi-physics experimental loop** – Variable TH environment for N-TH studies
- **High- and low-temperature irradiation ports**
- **7 in-core, >20 reflector** irradiation positions
- Several **neutron beam ports**

### Fast flux in-core distribution



MPRR conceptual design (18 U-Si assemblies + D<sub>2</sub>O reflector)



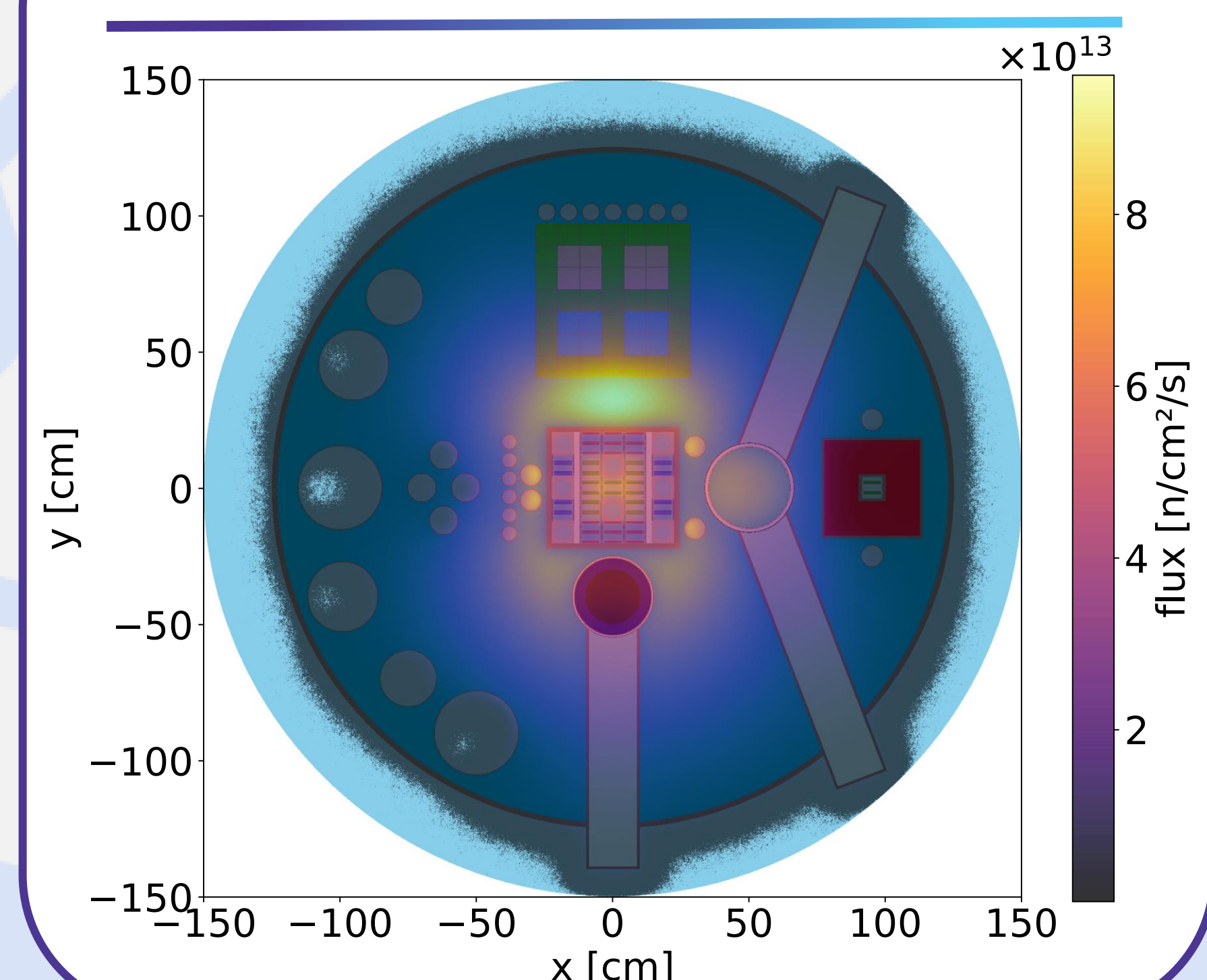
### Computational analysis

- OpenMC Monte Carlo code
- ENDF-B/VIII.0 nuclear library
- Fluxes normalized to 5 MW

### Neutron flux levels ( $\text{n cm}^{-2} \text{ s}^{-1}$ )

| Thermal                 | Epi-thermal             | Fast                    |
|-------------------------|-------------------------|-------------------------|
| $(3 - 5) \cdot 10^{13}$ | $(1 - 2) \cdot 10^{13}$ | $(1 - 5) \cdot 10^{13}$ |
| $(1 - 4) \cdot 10^{13}$ | $(1 - 5) \cdot 10^{12}$ | $(1 - 3) \cdot 10^{12}$ |
| $(1 - 3) \cdot 10^{12}$ | $< 10^8$                | $< 10^7$                |

### Thermal flux distribution



## ZERO-POWER REACTOR

### Key characteristics

- **Separate low-power critical assembly** – Operation independent of MPRR
- **Flexible core configuration and fuel loading** – Reconfigurable lattice pitch, core size and shape, fuel type
- **External heating system** – For the study of thermal feedback effects
- **Highly instrumented core** – On-line measurements of integral and differential reactor parameters

### ZPR conceptual design (Flexible core)

