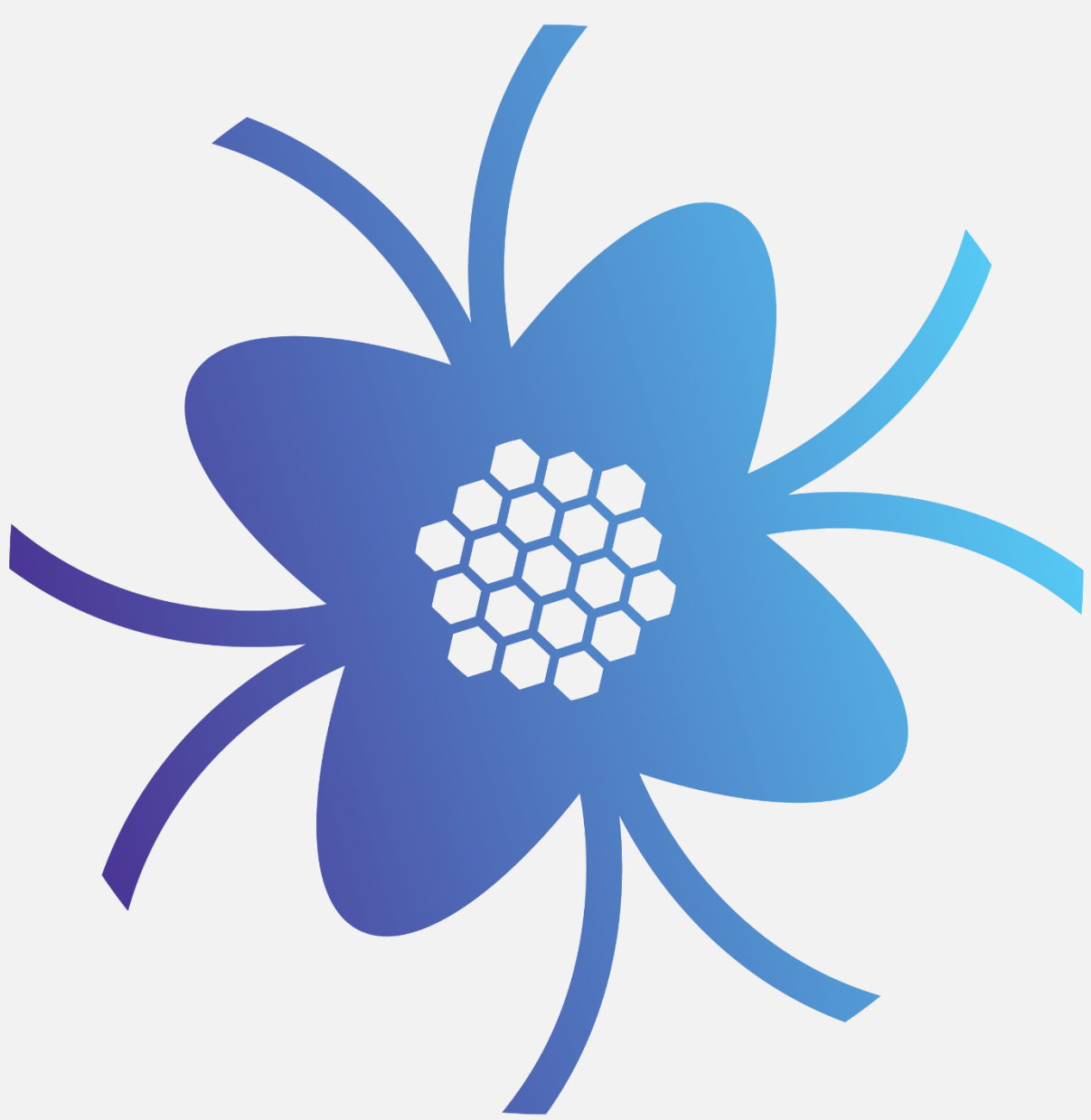




Neutronic Characterisation of a Reconfigurable Reflector for the VERONICA Multipurpose Research Reactor

Blaž Levpušček^{1,2}, Anže Pungerčič^{1,2} and Luka Snoj^{1,2}

¹Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia

²Faculty of Mathematics and Physics, University of Ljubljana, Jadranska ulica 19, 1000 Ljubljana, Slovenia

blaz.levpuscek@ijs.si

MOTIVATION

- Different applications require **different neutron spectra**.
- Reconfigurable reflector**: tailor the neutron spectrum to specific applications.

METHOD

- OpenMC** model of VERONICA.
- Homogeneous reflector study**: evaluated D₂O–C–Be reflector.
- Reconfigurable reflector study**: effect on core parameters and neutron spectra.

CONCLUSION

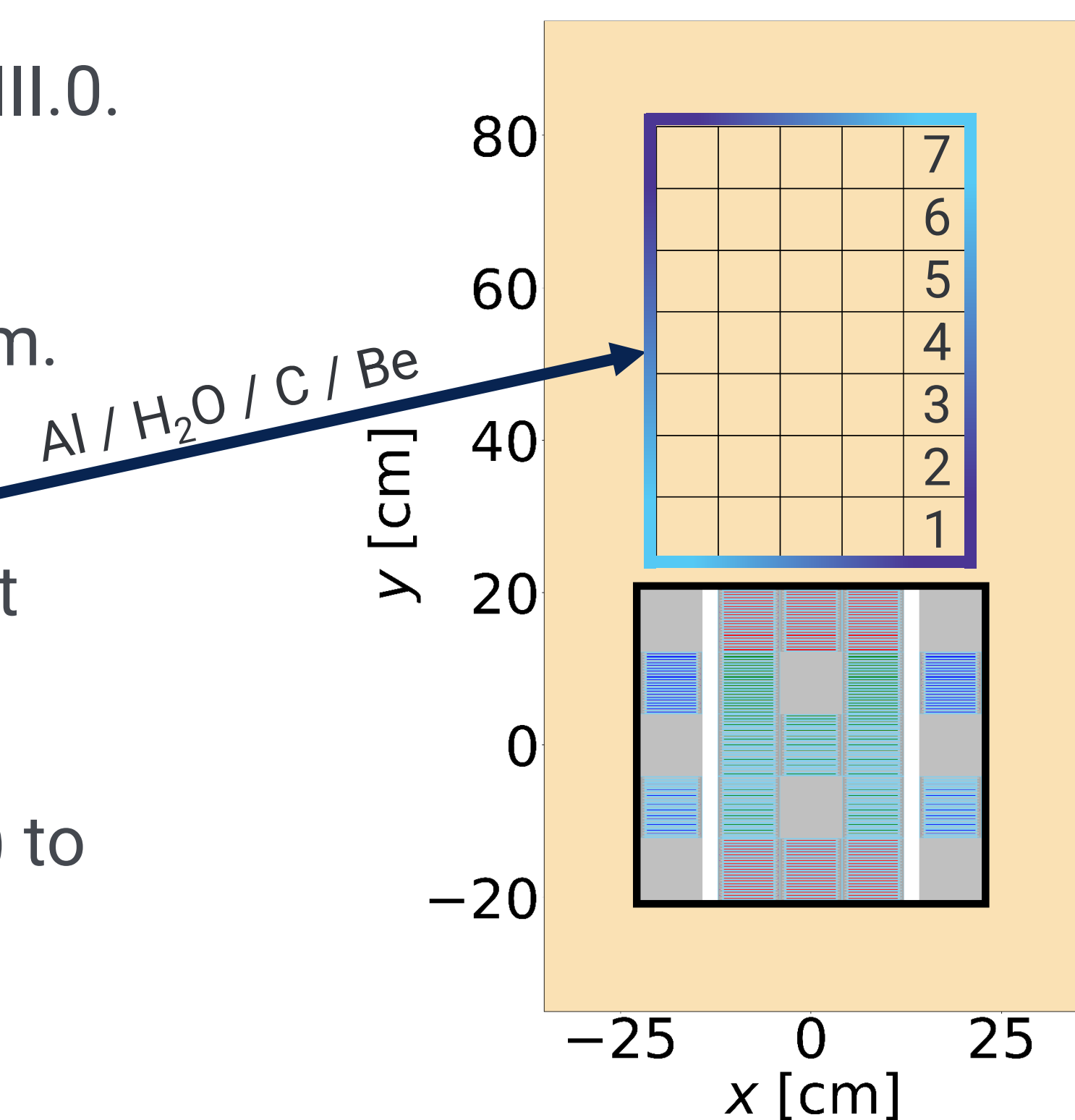
- Reconfi. reflector changed k_{eff} by up to **–3.3%** and **power peaking** by up to **+15%**.
- Reconfiguring the reflector changes the **thermal-to-fast** flux ratio from **3 (Al) to 356 (D₂O)**.

REACTOR MODEL

- OpenMC with ENDF/B-VIII.0.
- P = 10 MW.
- U-Si plate-type fuel.
- Reflector radius = 125 cm.

Reconfigurable reflector:

- 7×5 array of fuel-element sized positions.
- Filled with different materials (Al, H₂O, C, Be) to different row depths n
- D₂O reflector chosen as reference.



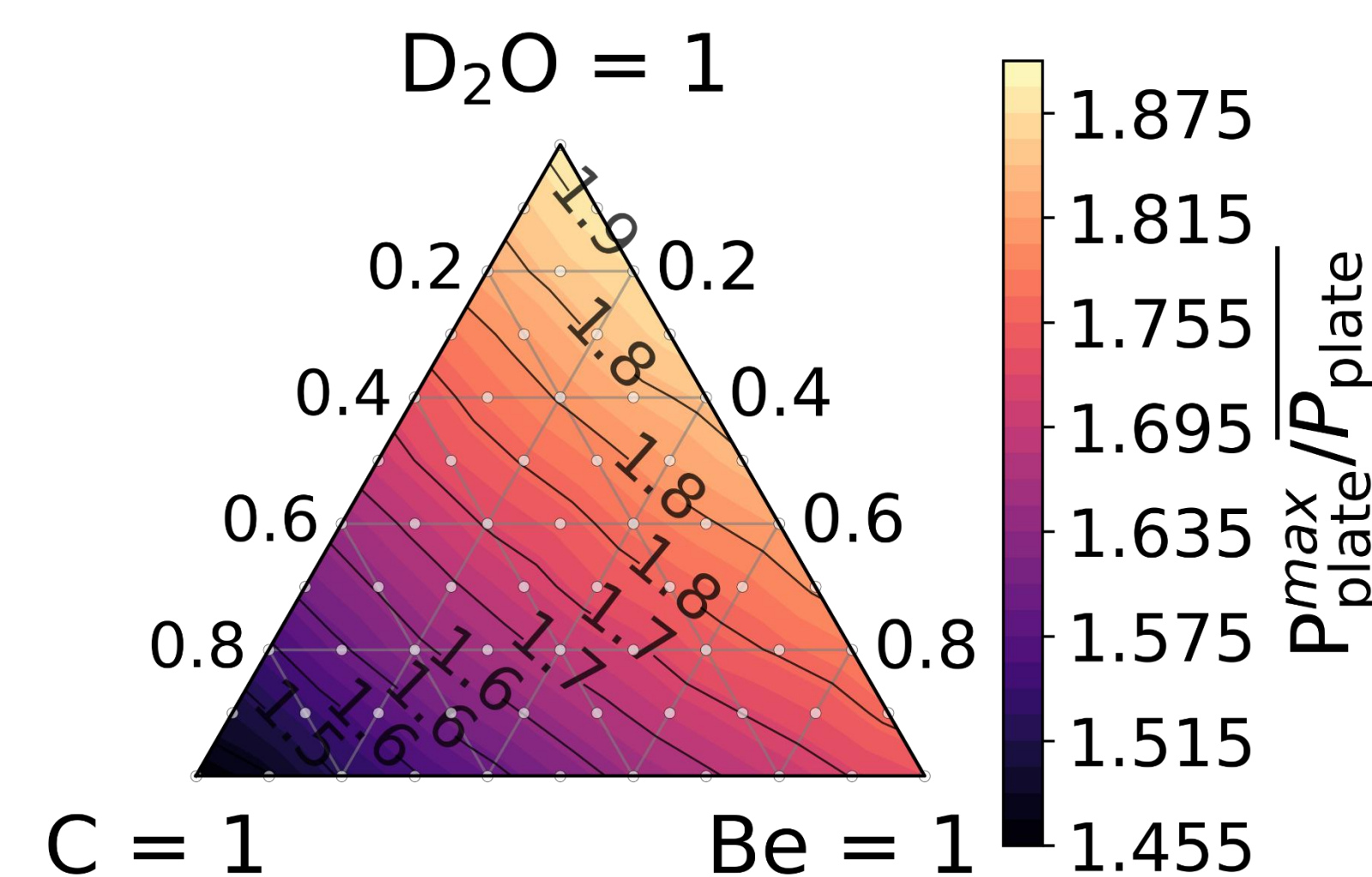
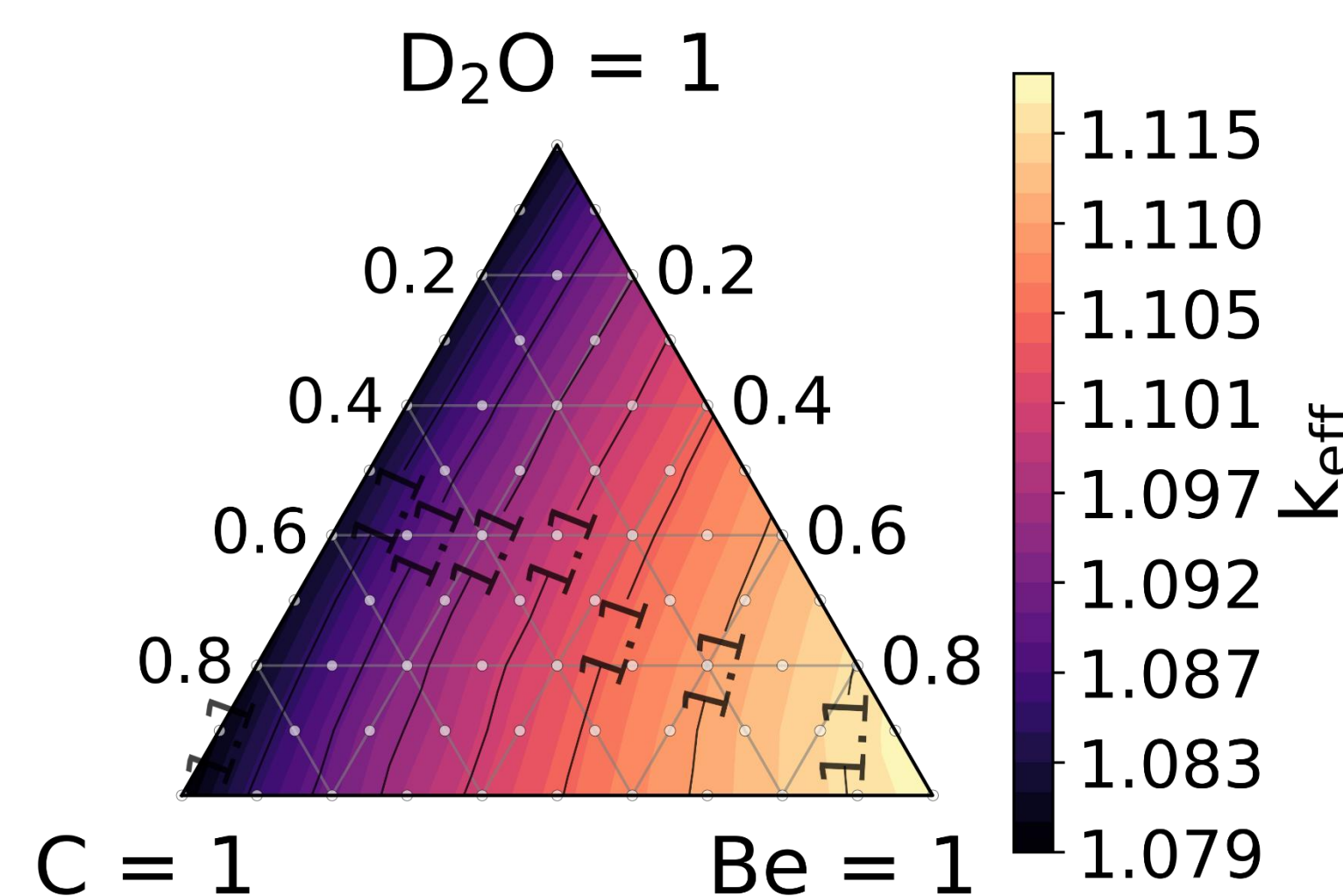
HOMOGENEOUS REFLECTOR STUDY

Volume fraction of D₂O, C and Be was varied over the whole reflector. Results shown on ternary plots.

Be: highest k_{eff}

C: lowest plate power peaking

D₂O: highest thermal flux far from core



RECONFIGURABLE REFLECTOR

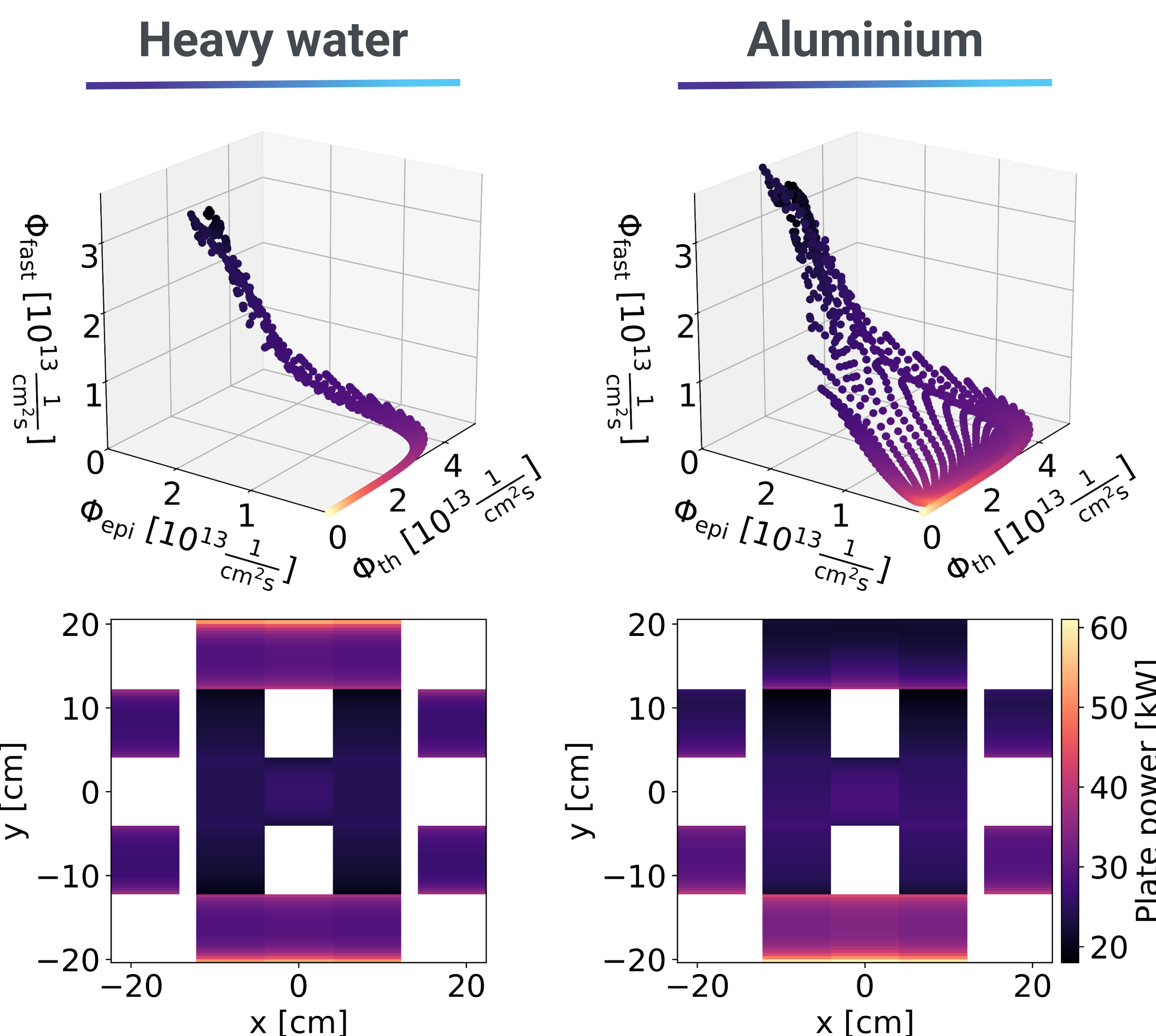
Changing the reflector material affects both ...

... neutron spectrum in reflector

Each point represents the local three-group neutron flux (Φ_{th} , Φ_{epi} , Φ_{fast}). Reconfiguring the reflector expands the accessible irradiation conditions.

... fuel plate power distribution

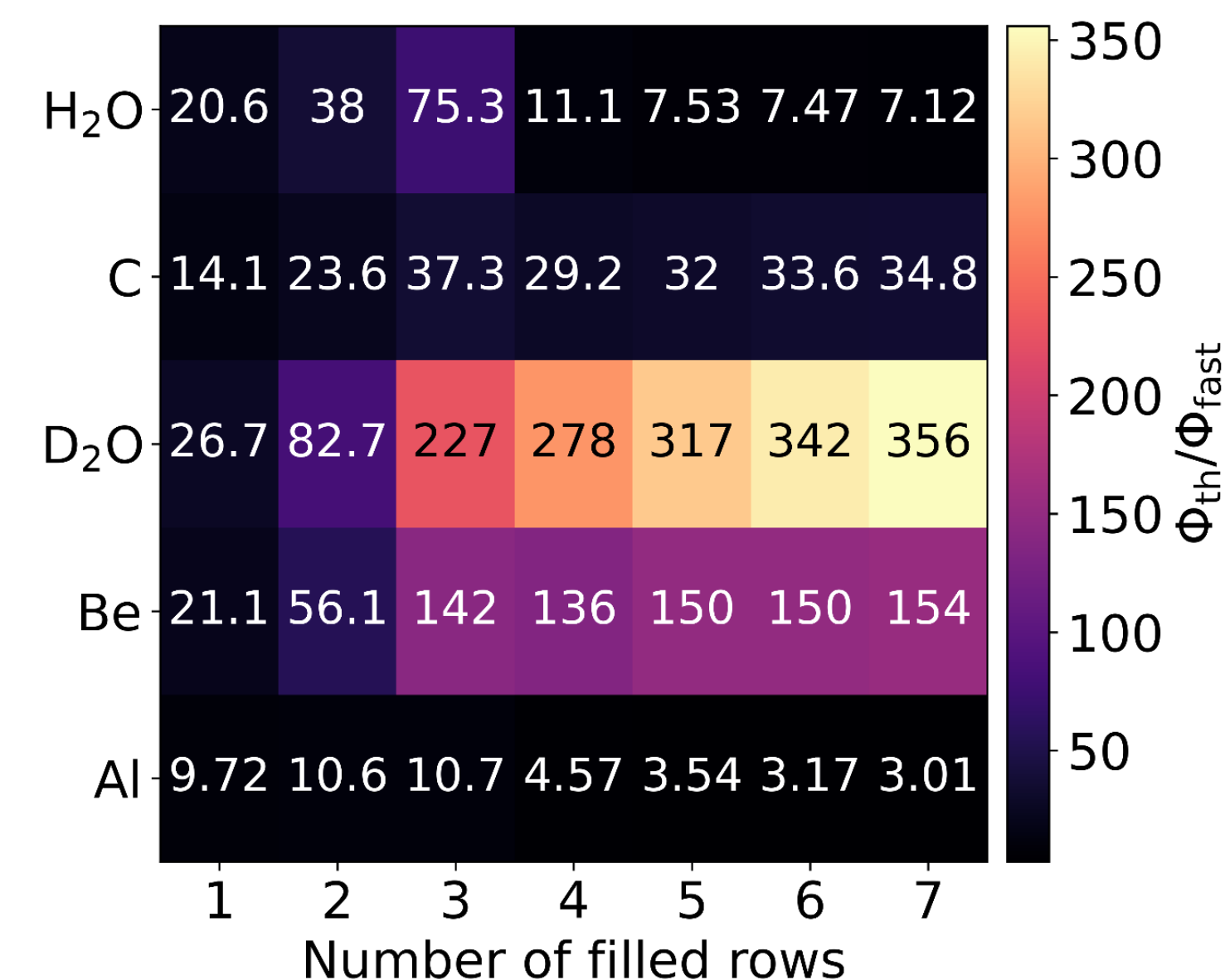
Changing the reconfigurable reflector can introduce power tilt and increase plate power peaking



Spectrum changes

$\Phi_{\text{th}}/\Phi_{\text{fast}}$: **3 → 356**

More than **two orders** of magnitude of spectral tailoring through material choice and filling depth



Core feedback

Changing the reconfig. reflector material **affects the core**.

Replacing D₂O:

- k_{eff} : **down by –3.3%**
- F_p : **up by +15%**.

