DARWIN Reactor Core:
Fuel and Moderator Temperature Feedback

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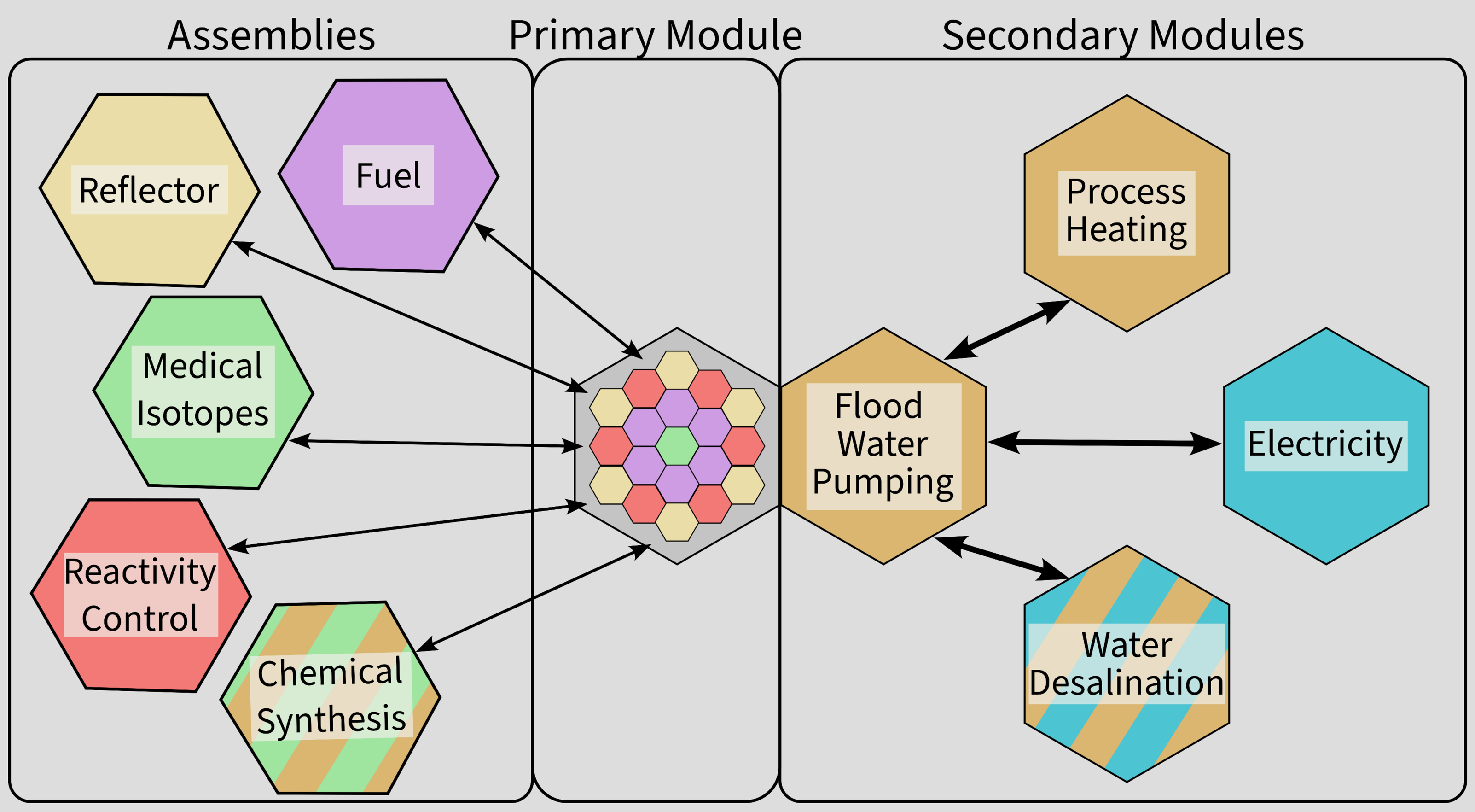
INTRODUCTION & MOTIVATION

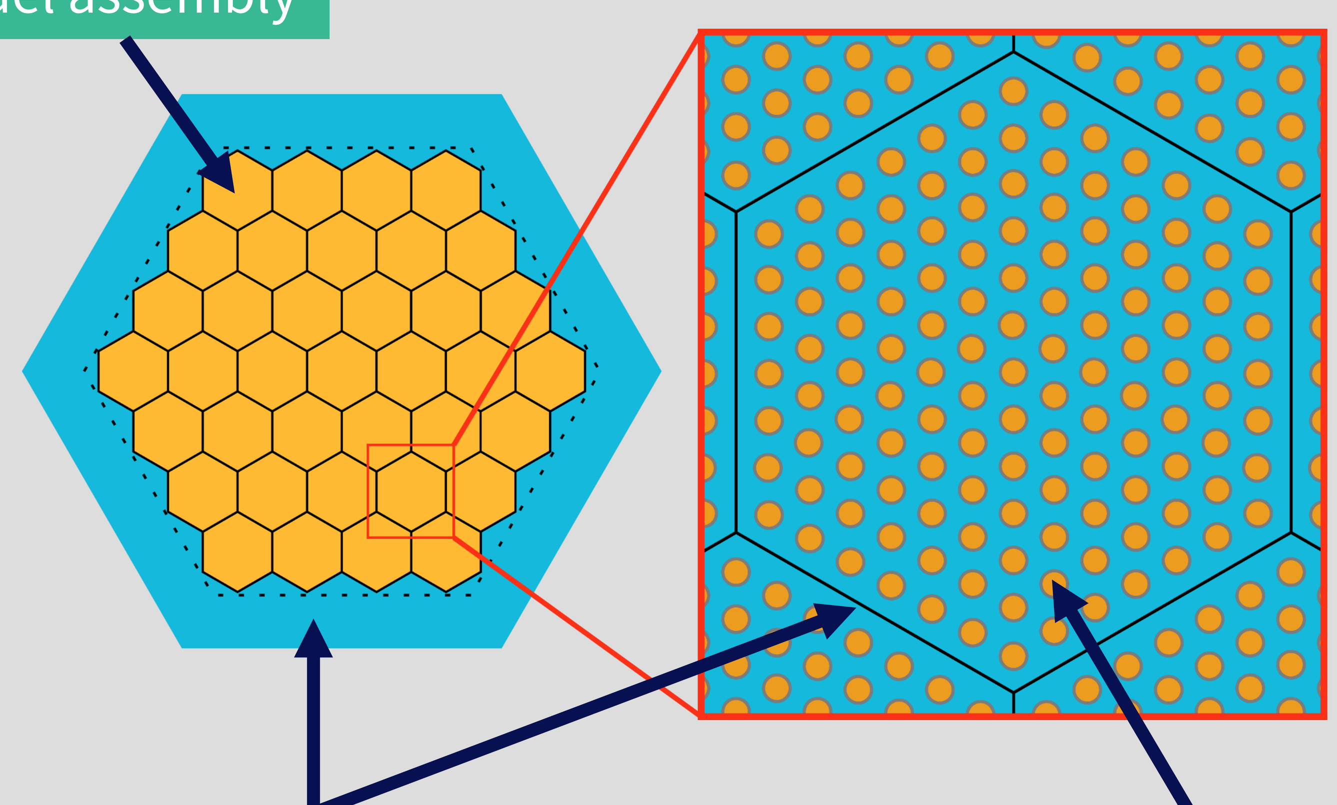
- Dispatchable Adaptive Reactor With Interchangeable compoNents
- Flexible design for urgent and emergency situations
- Modular design
- Searching for phase space limits



COMPUTATIONAL MODEL

Serpent 2.2.0 & ENDF/B-VII.1 ND library

Fuel assembly



Light water with boron
$c_B \in [0 \text{ ppm}, 2500 \text{ ppm}]$
$T_m \in [560 \text{ K}, 600 \text{ K}]$

Fuel pin:
- Fuel ($T_f \in [564 \text{ K}, 1081 \text{ K}]$)
- gap (He gas)
- cladding (zircaloy-4)

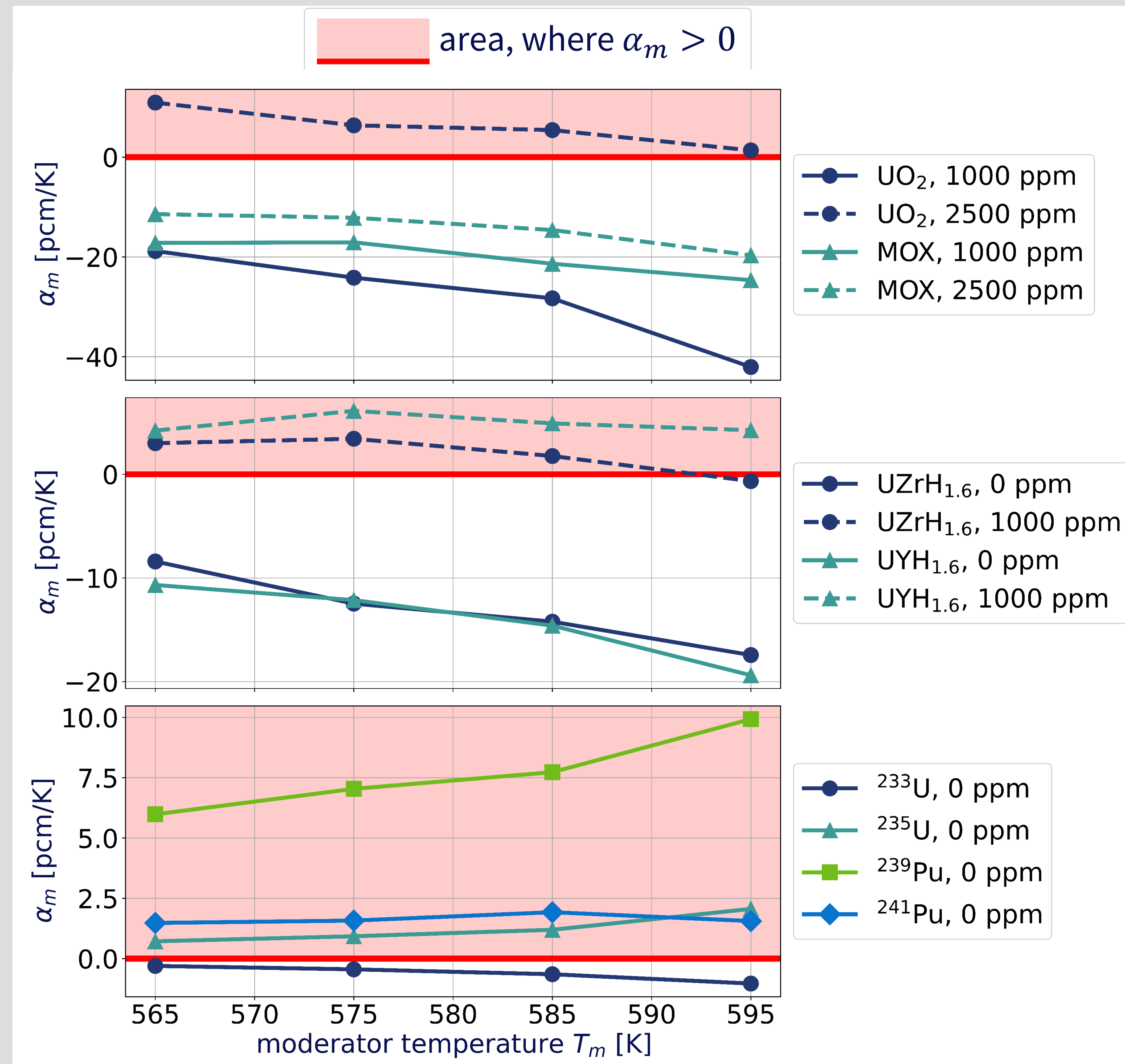
Fuel:
- Ceramics: UO_2, MOX (UO_2+PuO)
- Hydride: $UZrH_{1.6}$, $UYH_{1.6}$
- Metallic single isotope: ^{233}U, ^{235}U, ^{239}Pu, ^{241}Pu

CONCLUSIONS

- Limit of c_B for 3 % enriched UO_2 at ~2000 ppm and at ~1000 ppm for hydride fuels
- Sensitivity to boron increases with higher U content
- $\alpha_m > 0$ for single isotope fuels (except ^{233}U)
- $\alpha_f < 0$ for all cases, but its magnitude decreases with higher enrichment, PuO content in MOX, and uranium fraction in hydride fuels
- α_f for single isotope fuels an order of magnitude weaker than other cases

RESULTS

MODERATOR TEMPERATURE FEEDBACK COEFFICIENT



FUEL TEMPERATURE FEEDBACK COEFFICIENT