

# Steady state and transient thermal-hydraulic performance of the IFMIF-HFTM irradiation rigs and containers with modeling of nuclear heating

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## Background: International Fusion Materials Irradiation Facility (IFMIF) High Flux Test Module (HFTM)

→ a dedicated device to irradiate material small specimens with neutrons having an energy spectrum peaked near 40? MeV with annual doses in the range of 20 - 150 dpa (displacement per atoms per fullpower year) → Design database for DEMO

### Experiments:

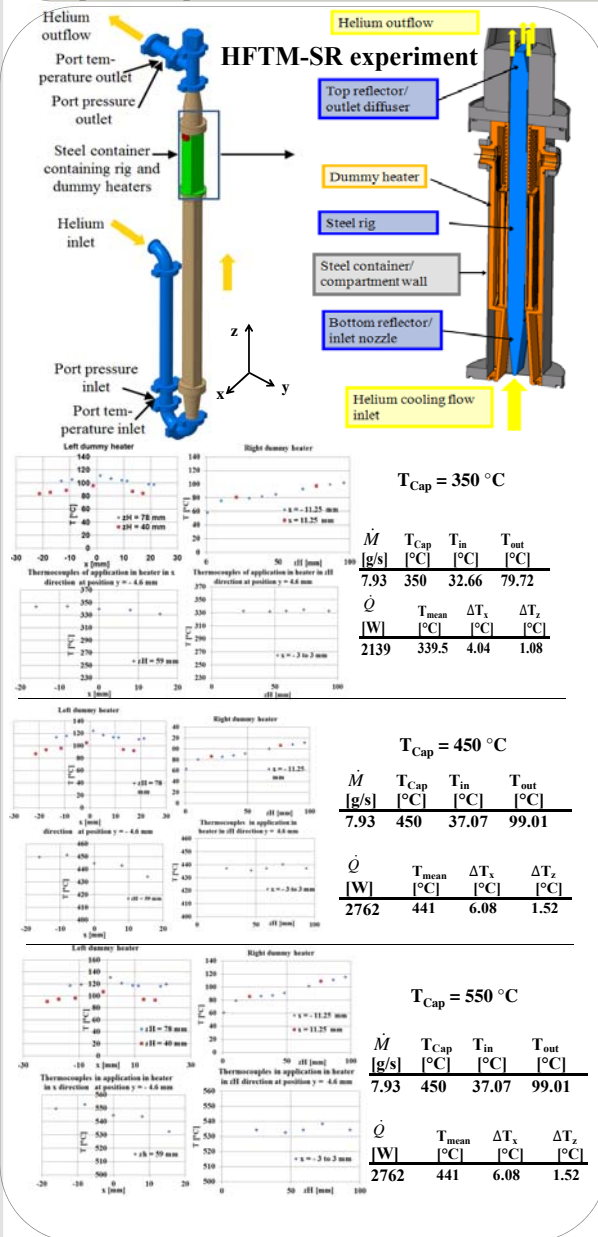
HFTM “single-rig” (HFTM-SR) experiments → a single 1:1 irradiation rig model is tested, the neighboring rigs were modeled with heater plates

HFTM “double compartment” (HFTM-DC) experiments → a fully equipped prototype with three heated rigs was tested. Heater cartridges substitute the nuclear heating.

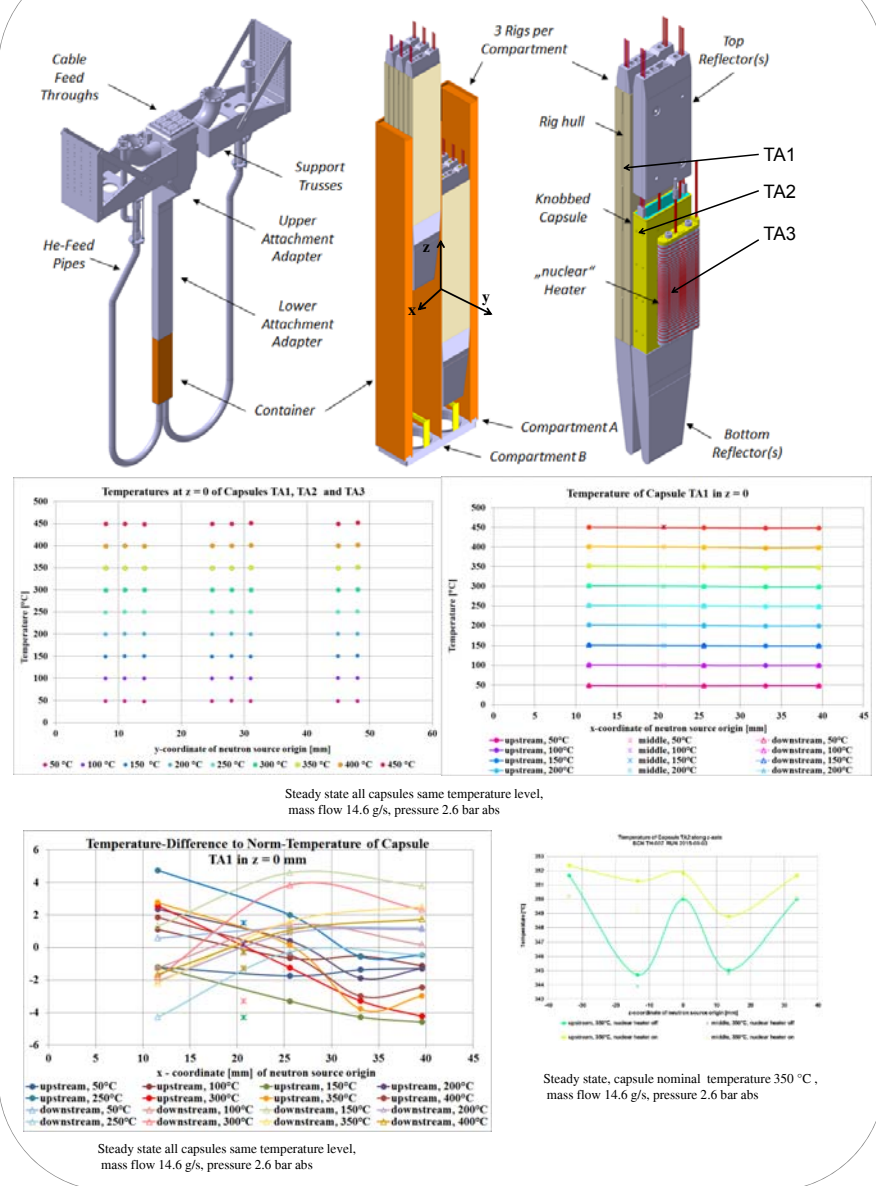
### Aims:

→ uniformity of temperature fields under different heater and flow conditions with and without nuclear heaters

→ temperature spread measured should be less +/- 3% of the nominal absolute temperature (+/- 19 K for 350 °C)



## HFTM “double compartment” (HFTM-DC)



### Conclusions:

- The full range of operation temperatures (250 - 550°C) required for the IFMIF HFTM could be well achieved and well controlled with and without “nuclear” heater power in HFTM-SR and HFTM-DC experiments
- Uniform temperature fields under different heater and flow conditions
- Temperature spread measured inside a capsule is in the range of +/-3K in the lateral x direction and +2K / -8K in the vertical z direction for the 350°C reference case for HFTM-DC experiment
- No unforeseen thermal hydraulic effects like oscillations, hysteresis etc.
- The pre-heating to 350°C: 135 sec., cool down to 50 °C roughly 315 sec.