INL/MIS-21-62345-Revision-0

RELAP5-3D V&V, V&V example for sodium applications

April 2021

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RELAP5-3D V&V

V&V example for sodium applications

A. Epiney

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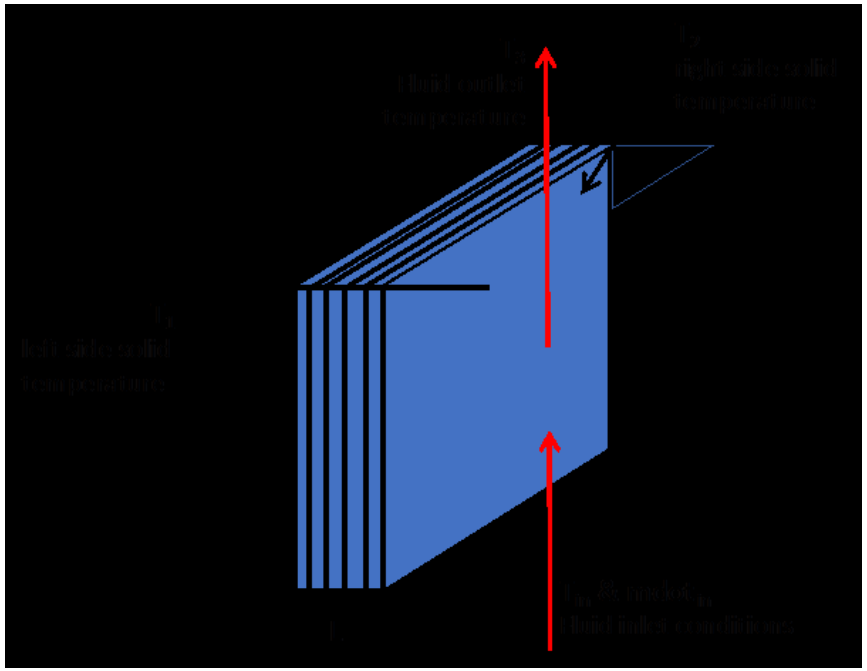
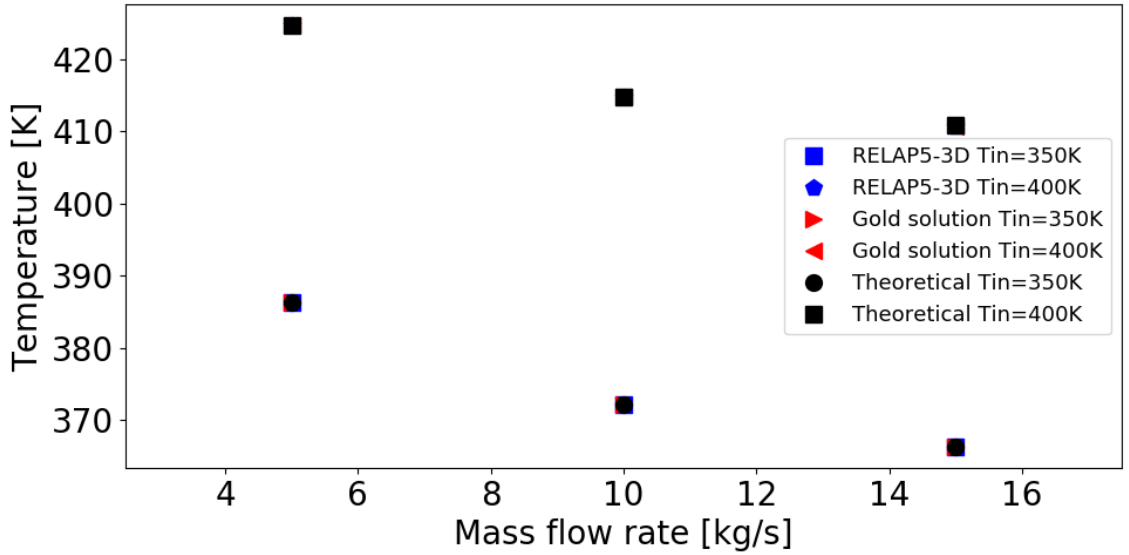
Idaho National Laboratory

Terrapower meeting
Friday, April 16, 2021 on TEAMS

Verification example (Plane wall with convection into water)

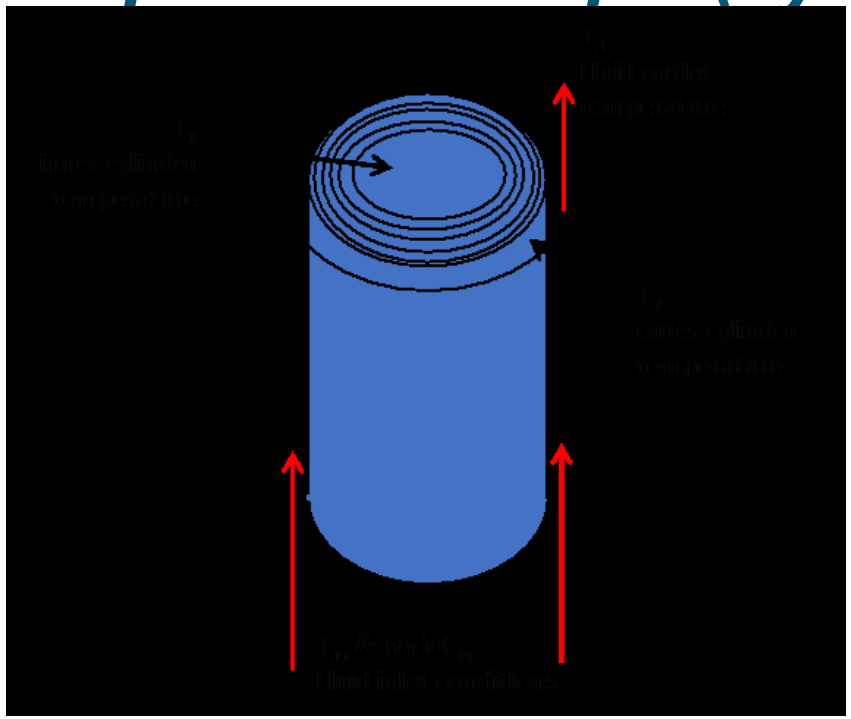


- Conduction Fourire's Law (1D) =>
- Convection into the fluid :
  - Dittus-Boelter
- Heat evacuated by the fluid:

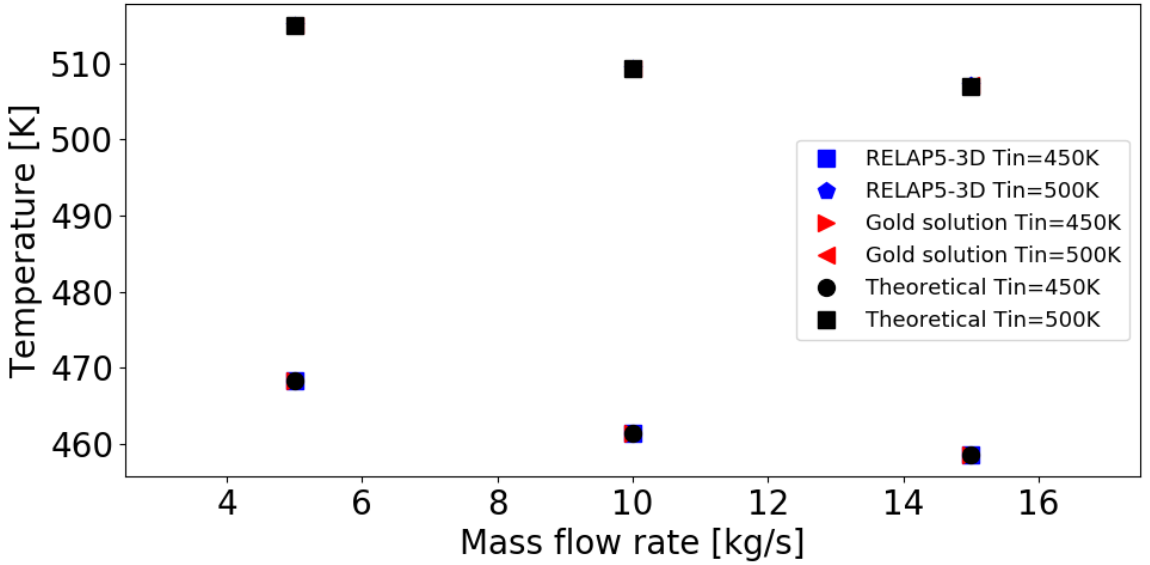


Right side wall temperature (T_2) for different water mass flow rates

Verification example (Cylinder with convection into sodium)



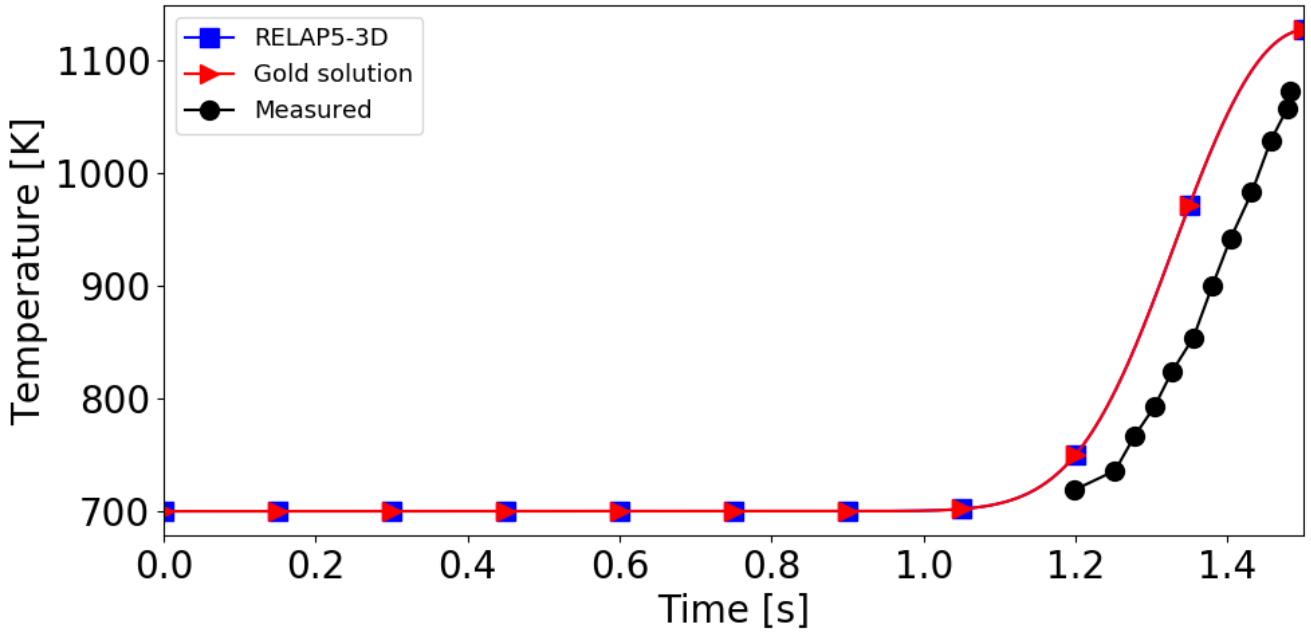
- **Analogue to water verification:**
- Conduction Fourire's Law (1D) with
  =>
- Convection into the fluid :
  - Liquid-metal (non-bundle)
- Heat evacuated by the fluid:



Right side wall temperature (T_2) for different sodium mass flow rates

Validation example (H-2 test at TREAT)

- The H-2 transient at TREAT consisted of a single Mox pin.
- The fuel was contained in a stainless steel clad.
- The coolant channel utilized sodium with a fixed inlet temperature and flow.
- The fuel was exposed to a RIA (Gaussian pulse, 450MJ and peak power of 1560MW).
- Failure time occurred at approximately 1.47s with ~85% of the energy deposited.



Evolution of the sodium temperature before fuel failure

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