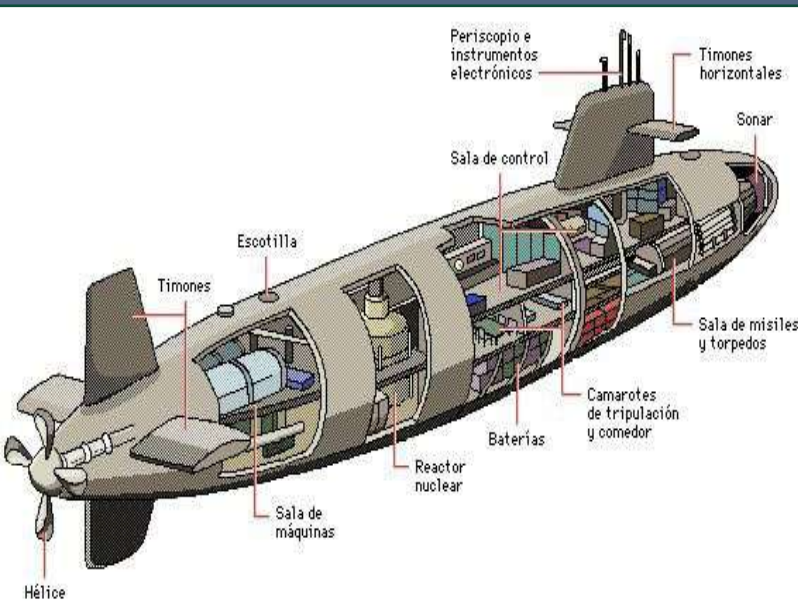


MULTIPHYSICS ANALYSIS OF A PRESSURIZED WATER REACTOR FOR MILITARY SHIPS

Authors:

David Sagástegui Calderón
DSc. Nain. M . Ramos

Nuclear powered ships



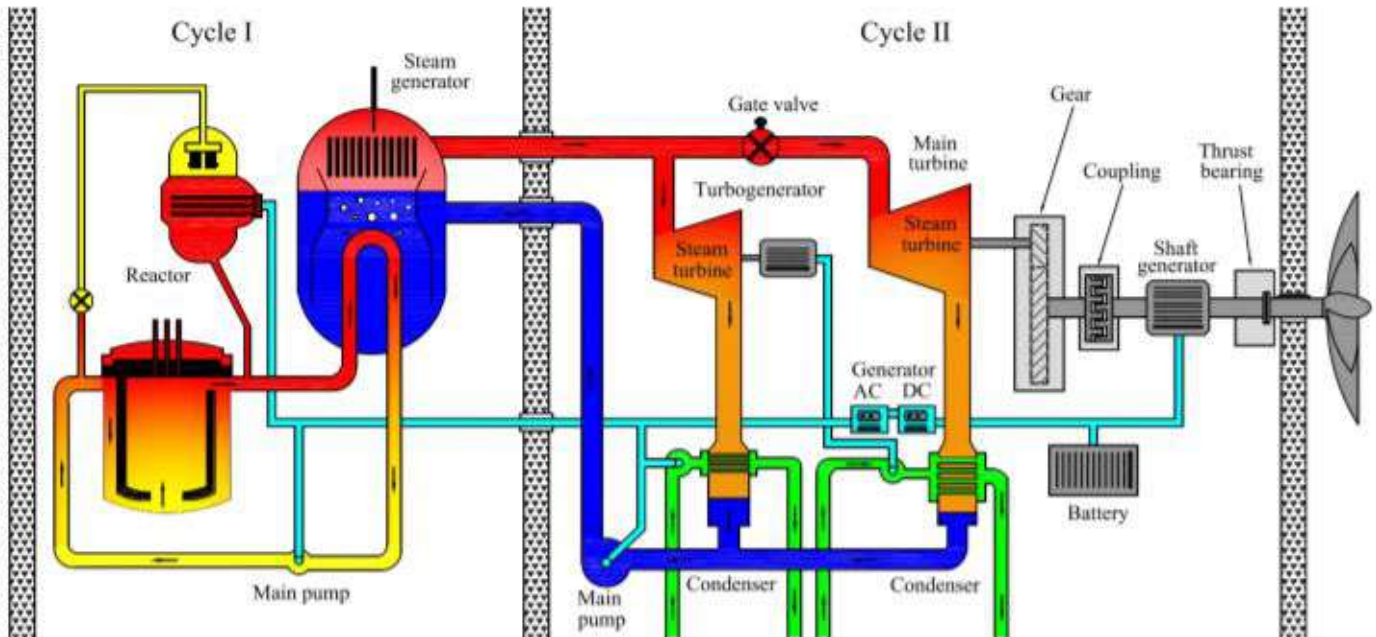
SUBMARINES

NS OTTO HAHN



Schematic of a nuclear-powered craft

In a nuclear powered ship, such as a submarine, the reactor generates heat through a controlled fission chain reaction of the nuclear fuel.

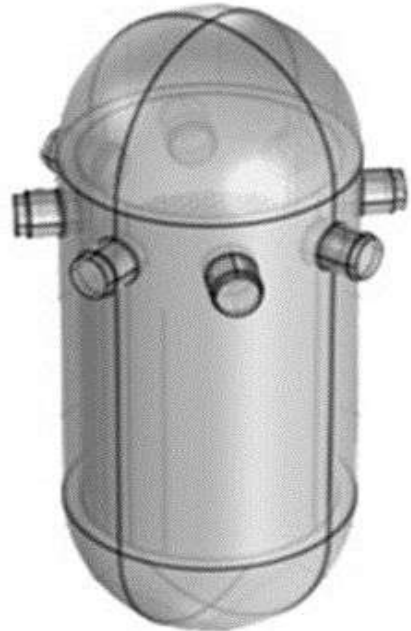


PWR Reactor

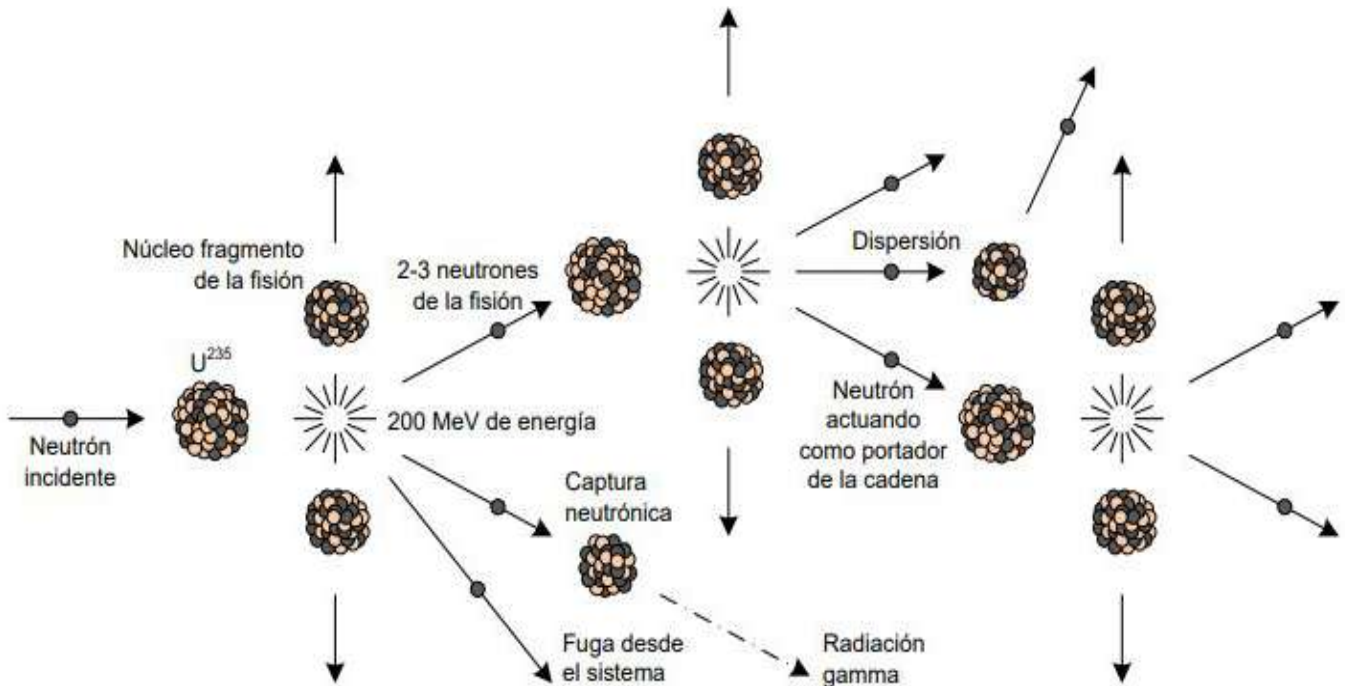
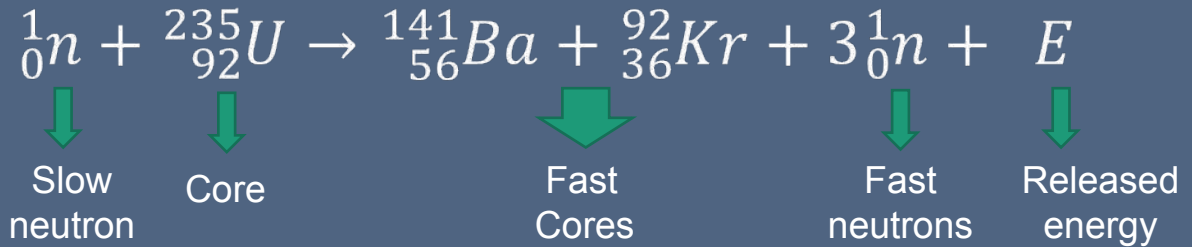


MHI PWR Reactor

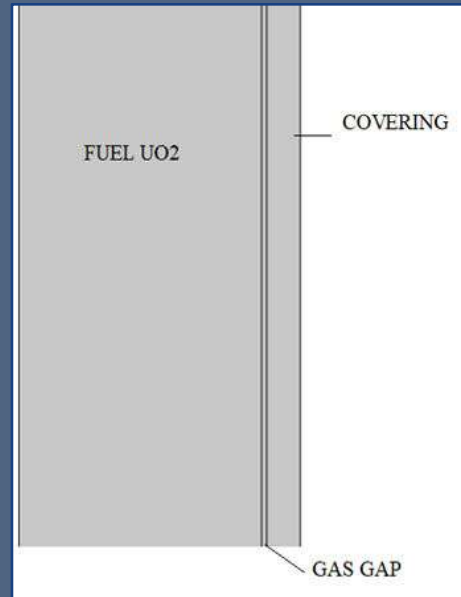
German PWR



Fission Reaction

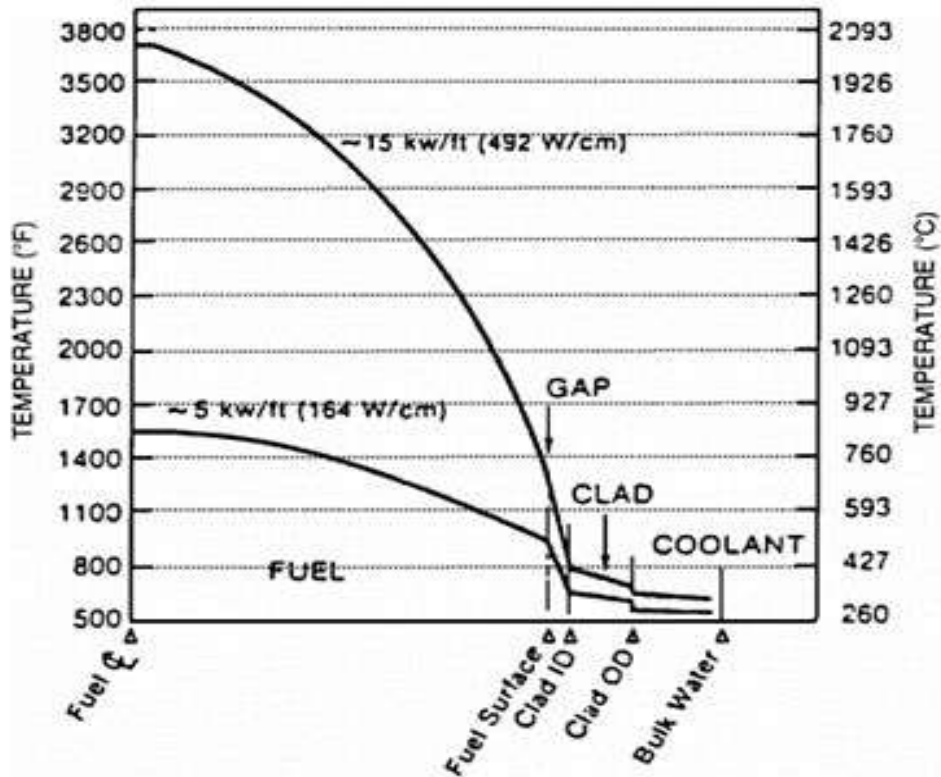


Fuel rods- Local Study

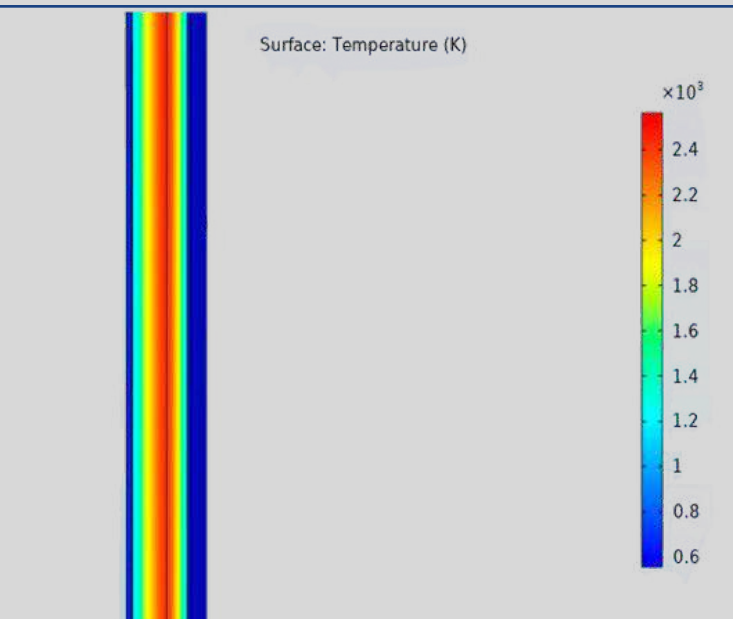


Medium	Width (m)	High (m)
Fuel UO2	4.09575e-3	4.2672
Gas gap	8.255e-5	4.2672
Covering	5.715e-4	4.2672

Typical radial temperature profile in PWR

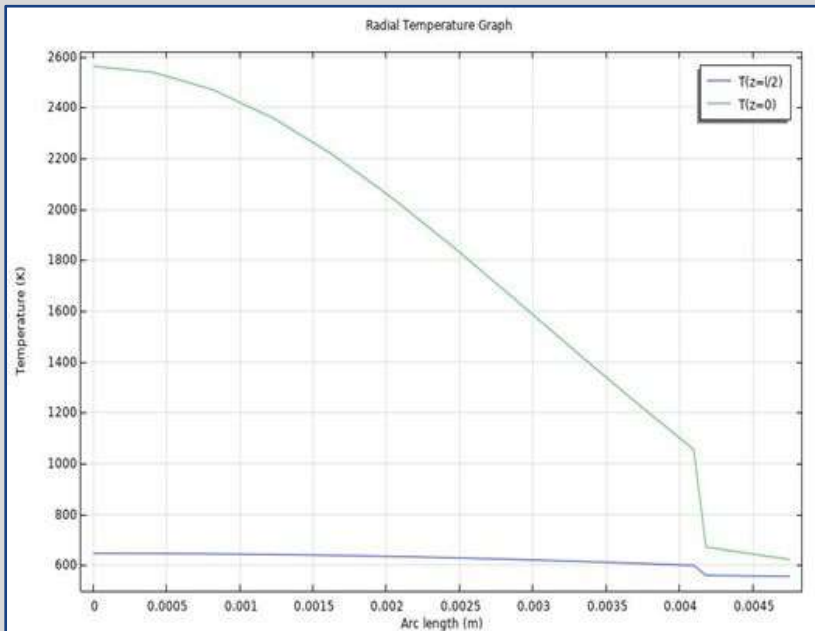


Results

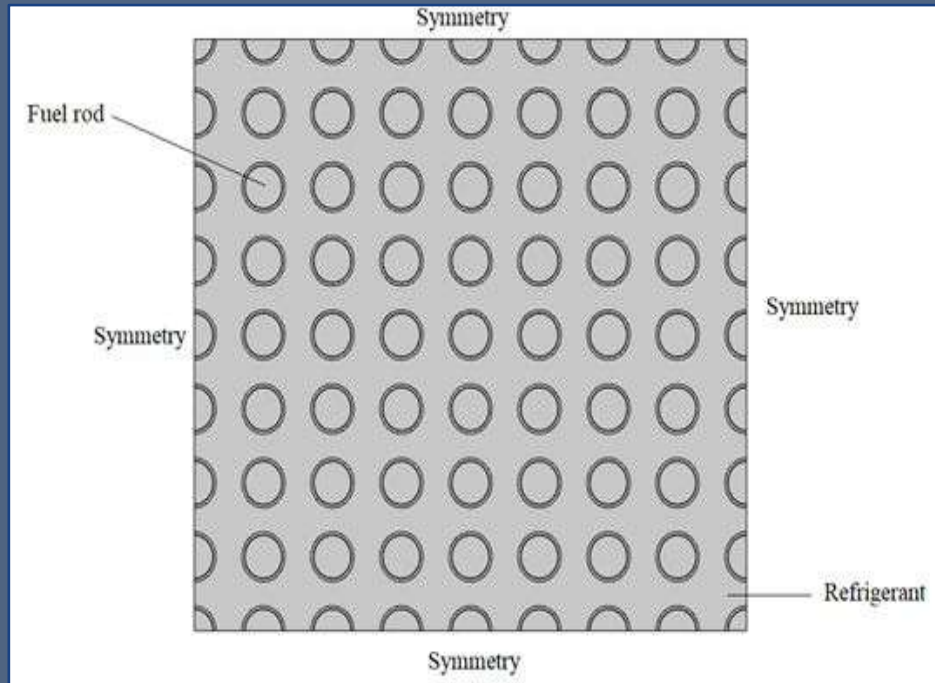


Temperature fields

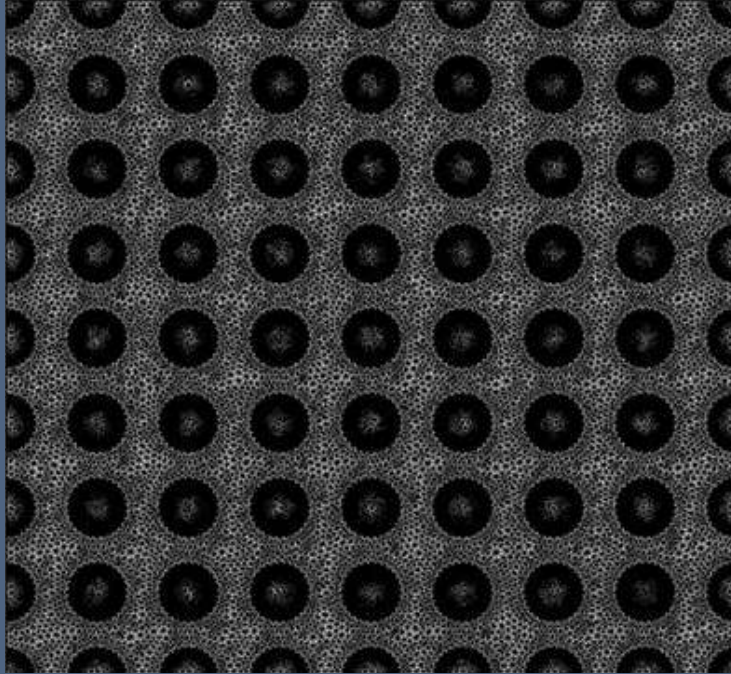
Temperature in radial direction



Fuel Element

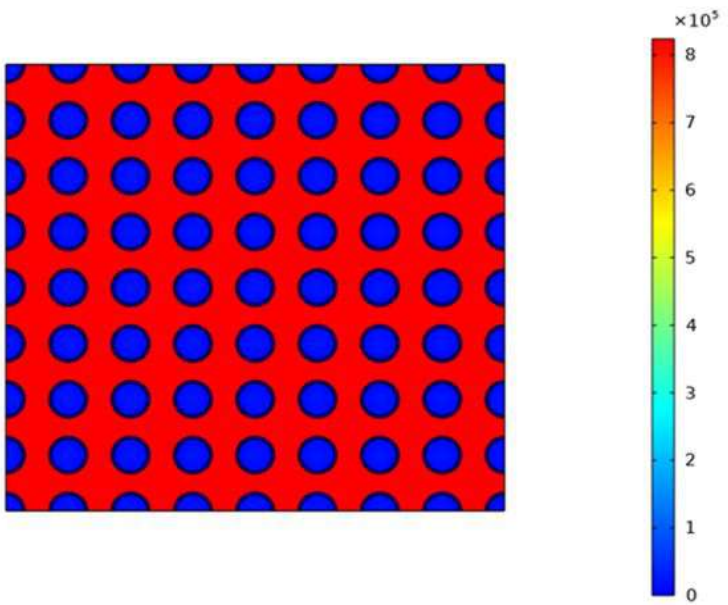


MESH



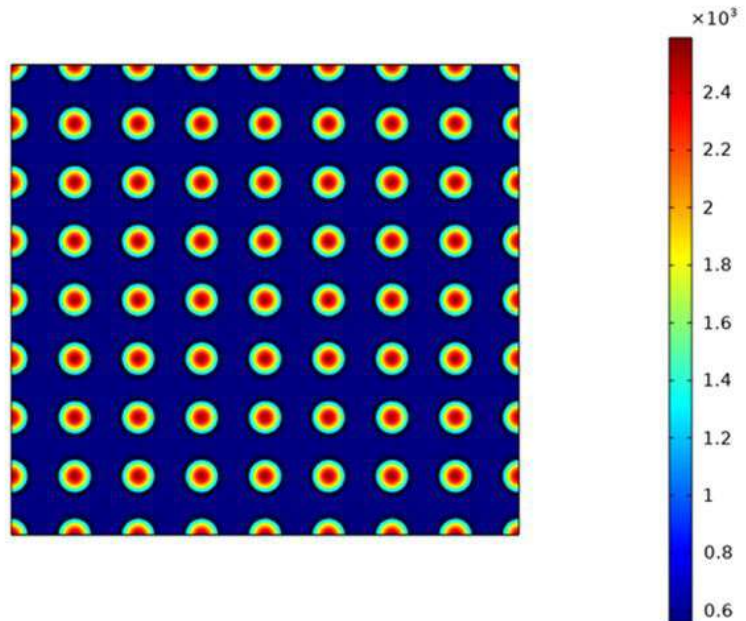
Domain	Max. element size	Min. element size
Refrigerant	0.00316	4.52E-5
Gas	0.00316	4.52E-5
UO ₂ , covering	0.00647	3.66E-5

Results

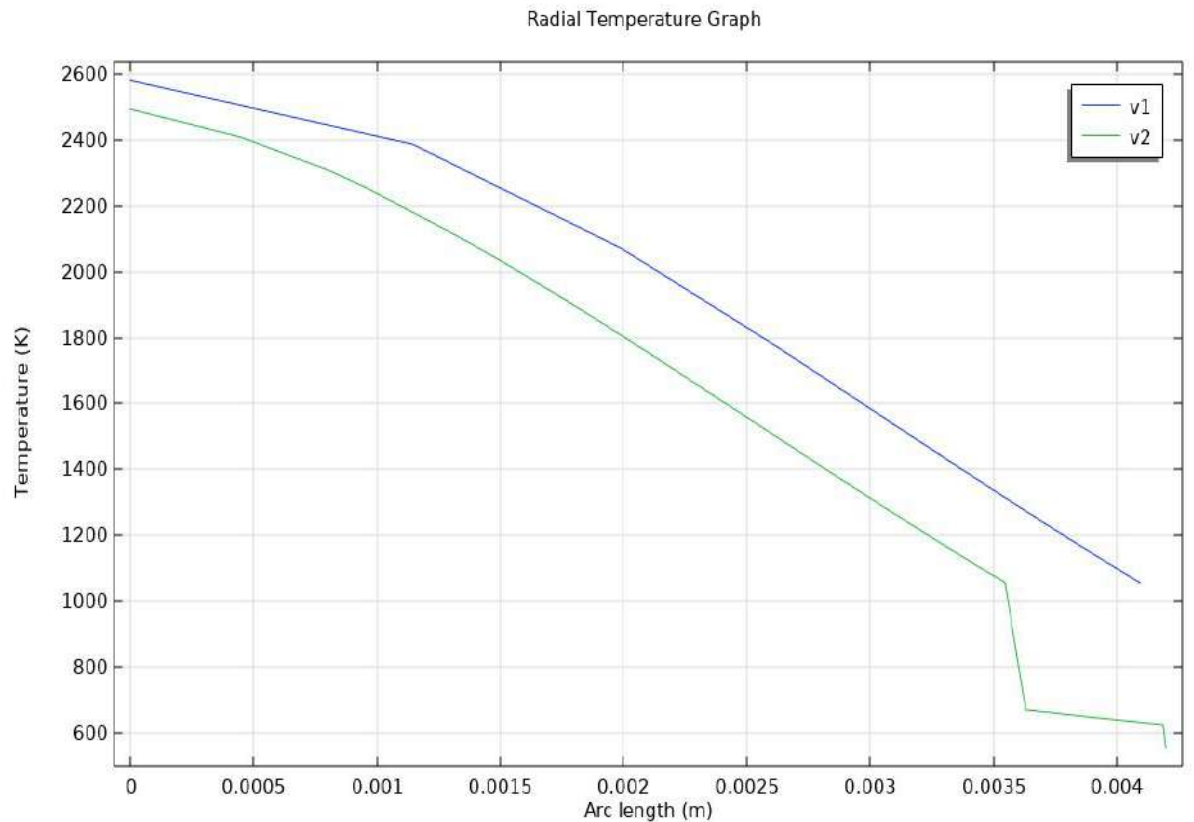


Internal energy in
the fuel element
($t=60$ s)

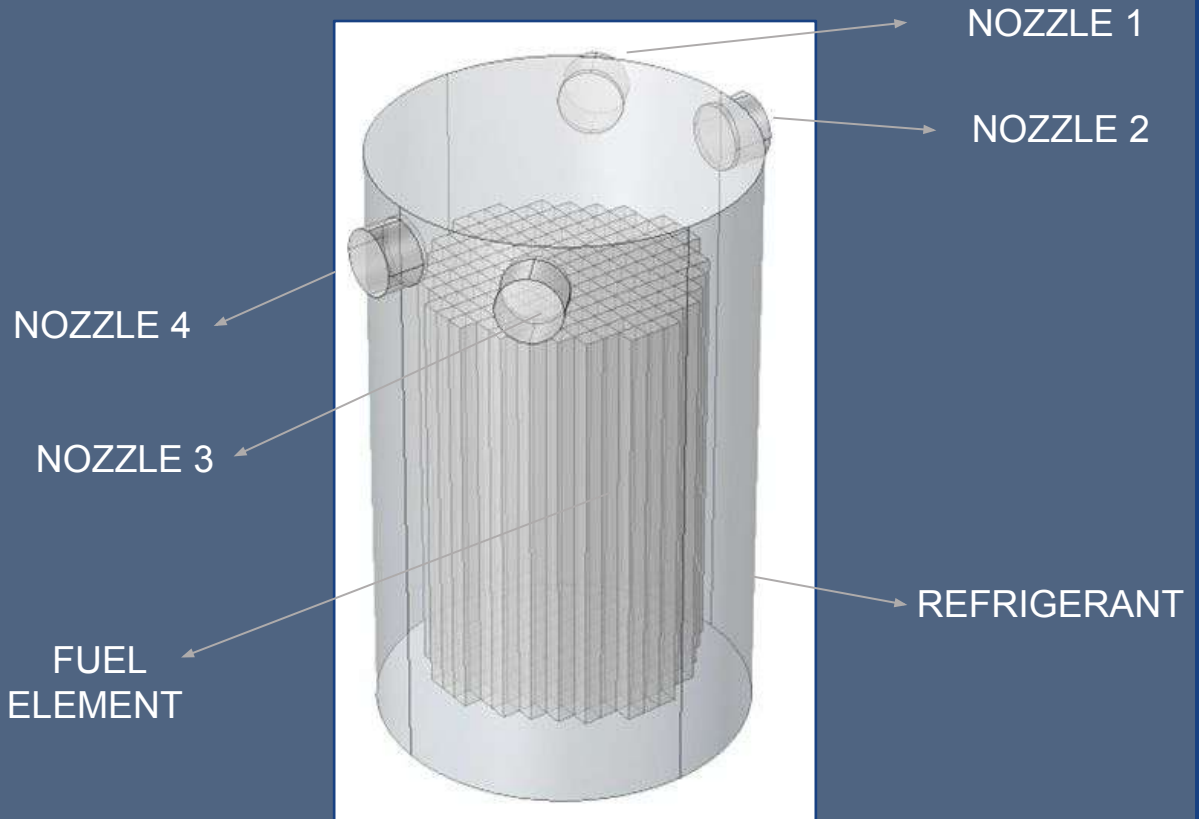
Temperature in
the fuel element
($t=60$ s)



Radial temperature profile at the rods of the fuel element ($t = 60\text{ s}$)

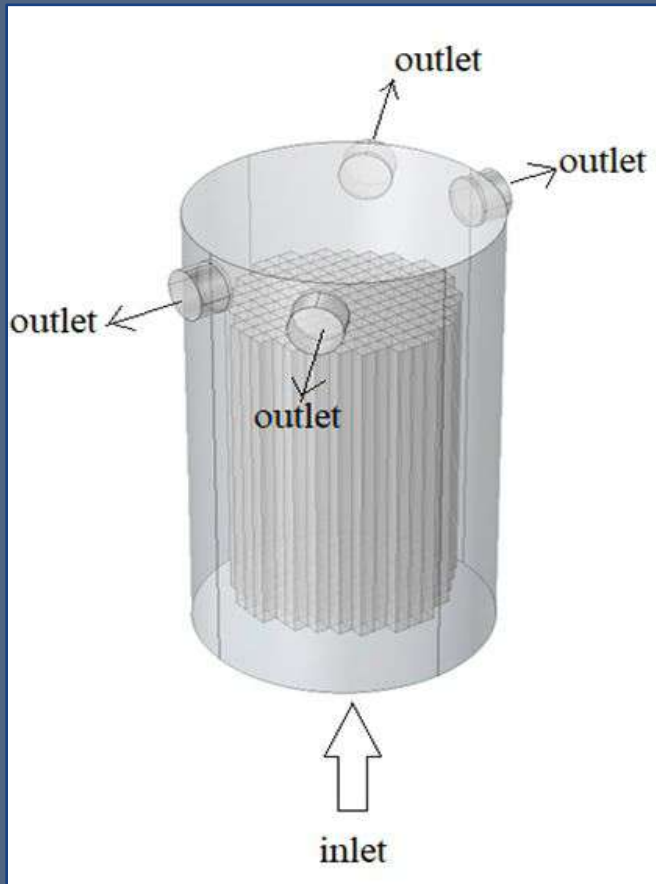


GERMAN PWR- GLOBAL STUDY



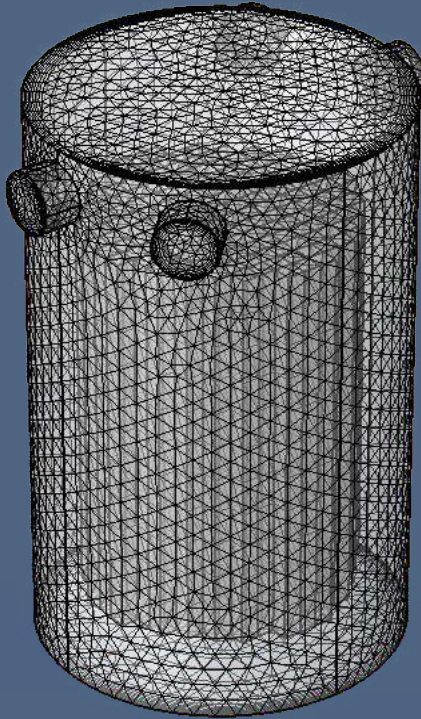
Element	Radio	Side	Height
Refrigerant	2185 mm	-	6900 mm
Nozzle 1,2,3,4	375 mm	-	500 mm
Fuel element	-	22 cm	4800 mm

FEATURES OF GLOBAL STUDY



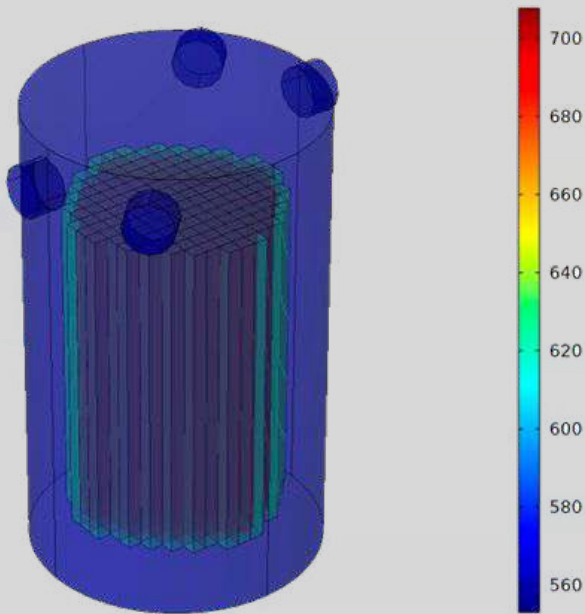
Features	Value
Temperature of fuel element	707.33 K
Heat Source	7.66862e8
Velocity (intlet)	19.5 m/s
Velocity (outlet)	5.5 m/s

MESH



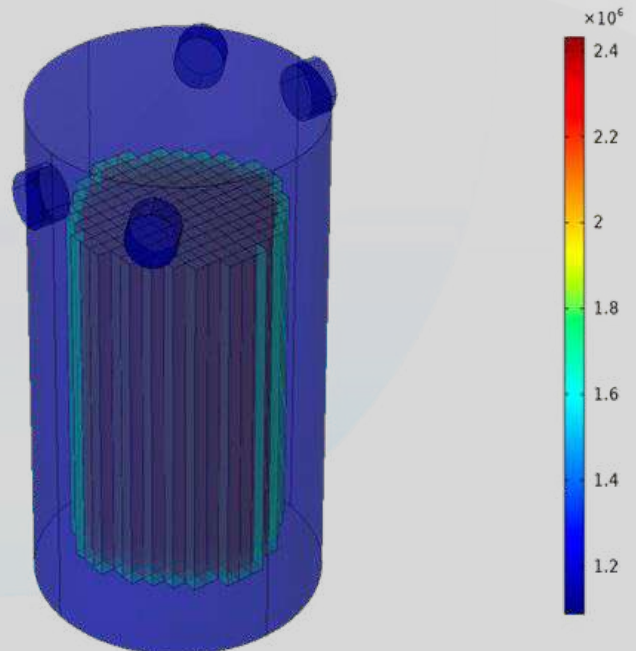
Domain	Max. element size	Min. element size
Refrigerant	0.253	0.0477
Fuel element	0.69	0.124

Results

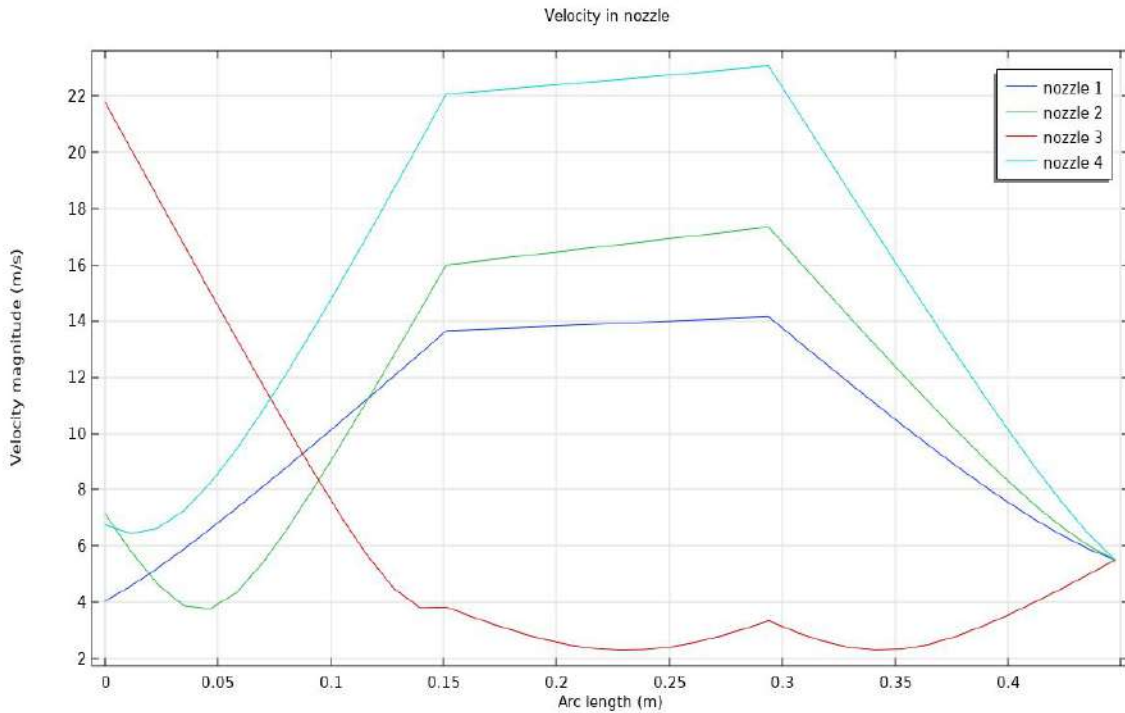


Temperature
fields

Internal Energy in
the PWR reactor



Velocity profile in the nozzles



THANKS

