Advanced Multiphysics Thermal Hydraulic Models for the High Flux Isotope Reactor

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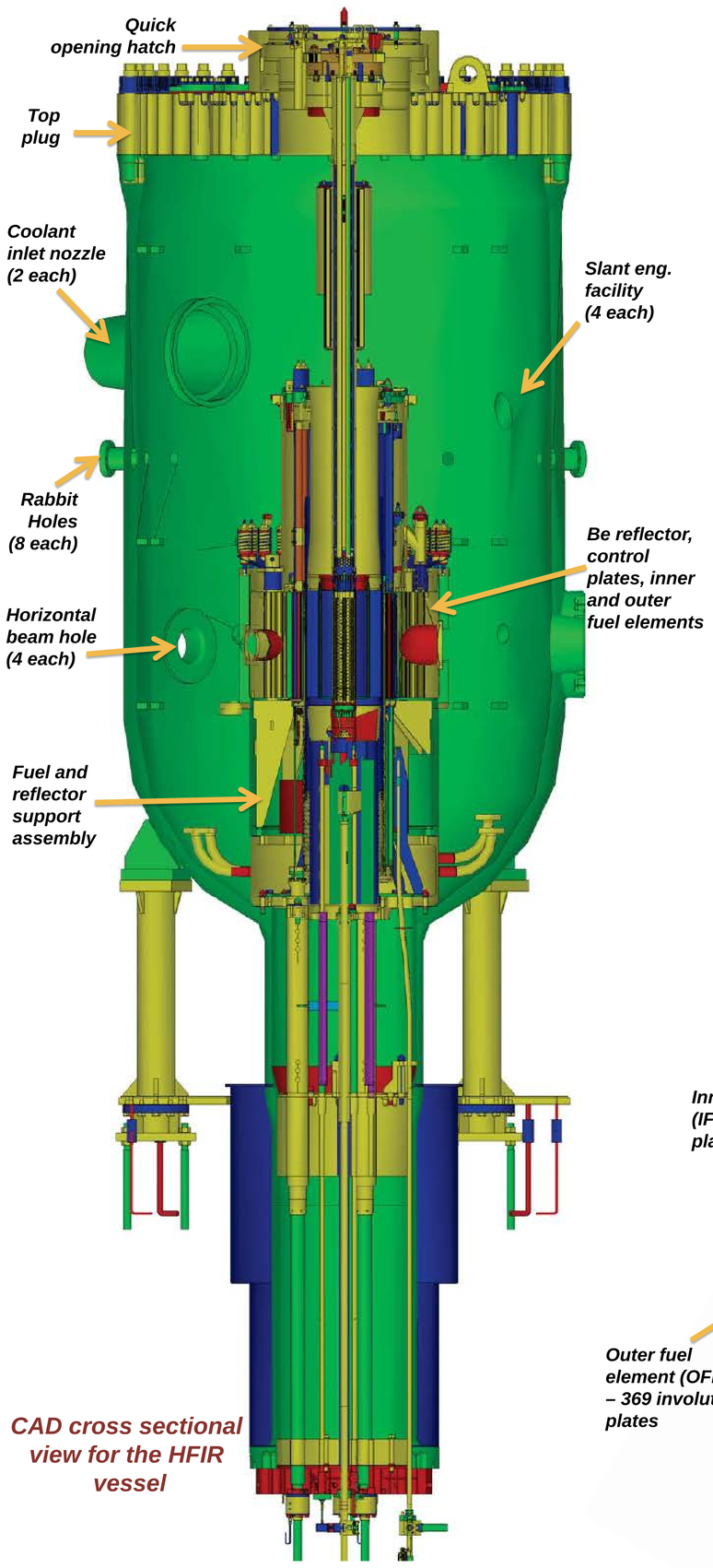
High Flux Isotope Reactor (HFIR)



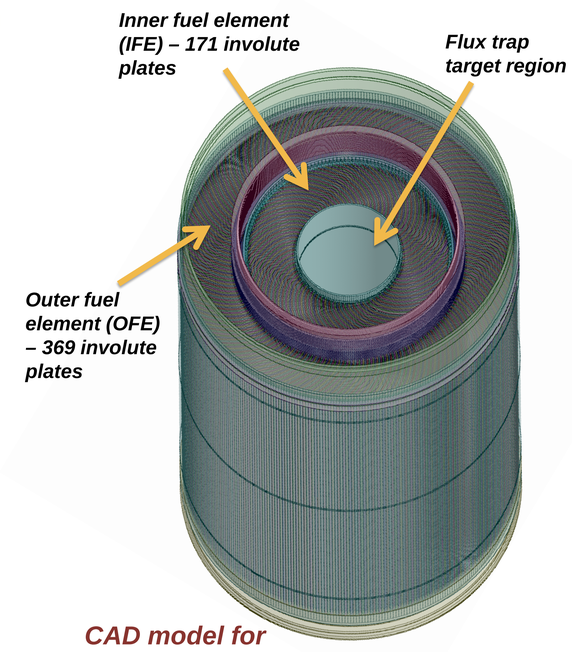
CAD cross sectional view for the HFIR vessel

Operated since 1966 with one of the world's highest thermal neutron fluxes ~2.5x10^{15} neutrons/(cm^2-s)

Involute-shaped fuel plates, beryllium reflected, light water-cooled and -moderated, pressurized, flux-trap type research reactor

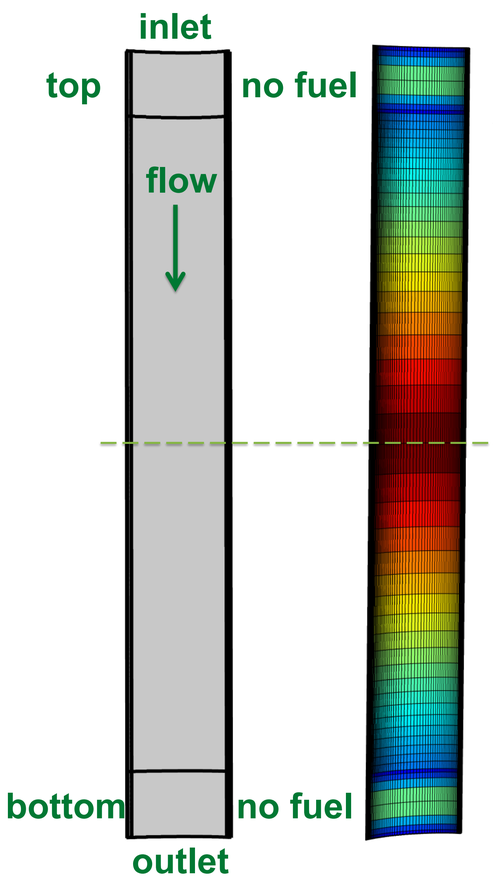
Highly enriched uranium (~93% ^{235}U/U) fuel embedded in aluminum-6061 clad

Cold and thermal neutron scattering, materials irradiation, isotope production, neutron activation analysis

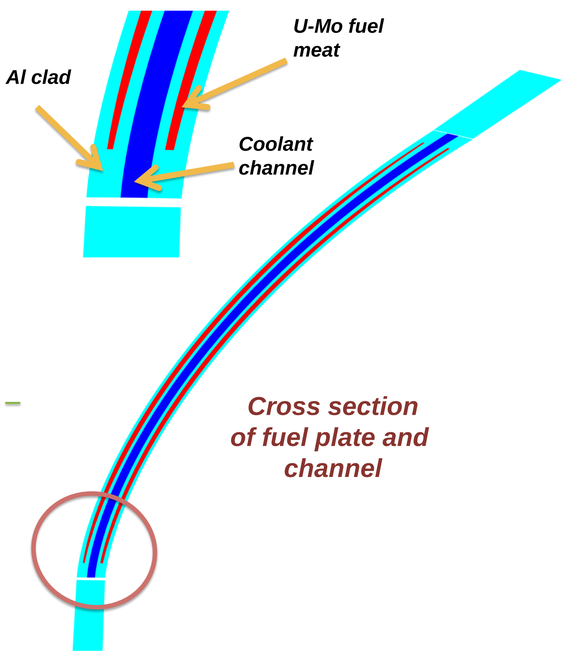


CAD model for the HFIR core

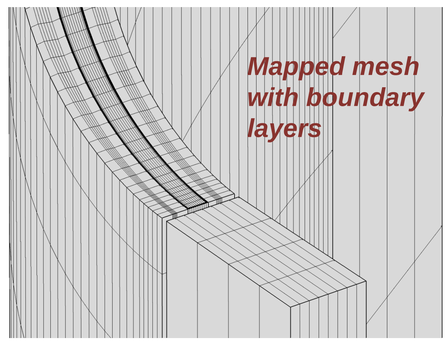
COMSOL Thermal-Hydraulics Models for the HFIR Core



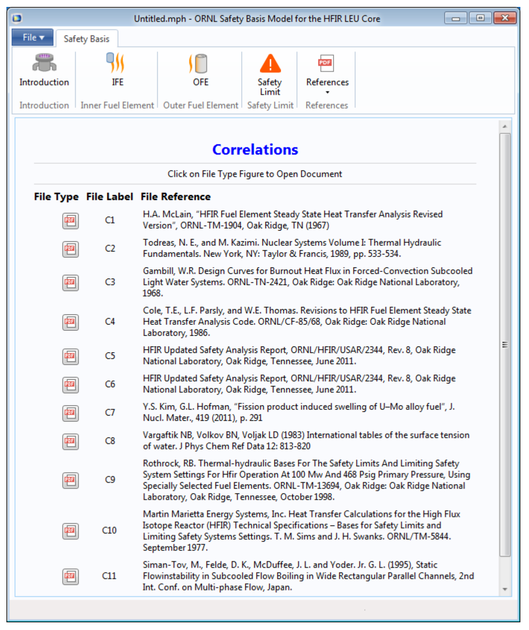
COMSOL geometry and meshing for the HFIR plate-channel model

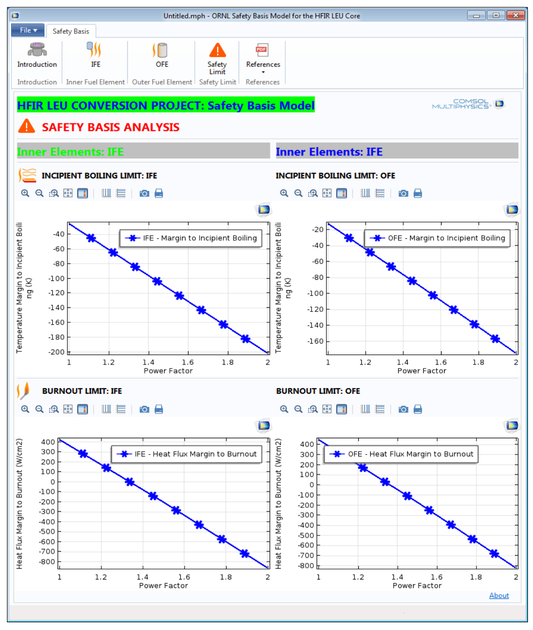


Cross section of fuel plate and channel

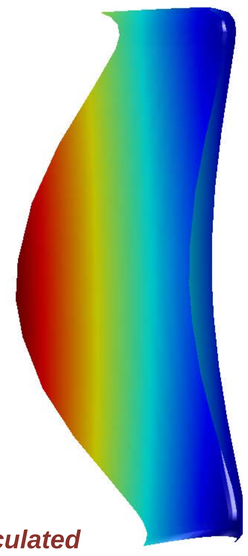


Application Builder Layer for Embedding Input References and Custom Features

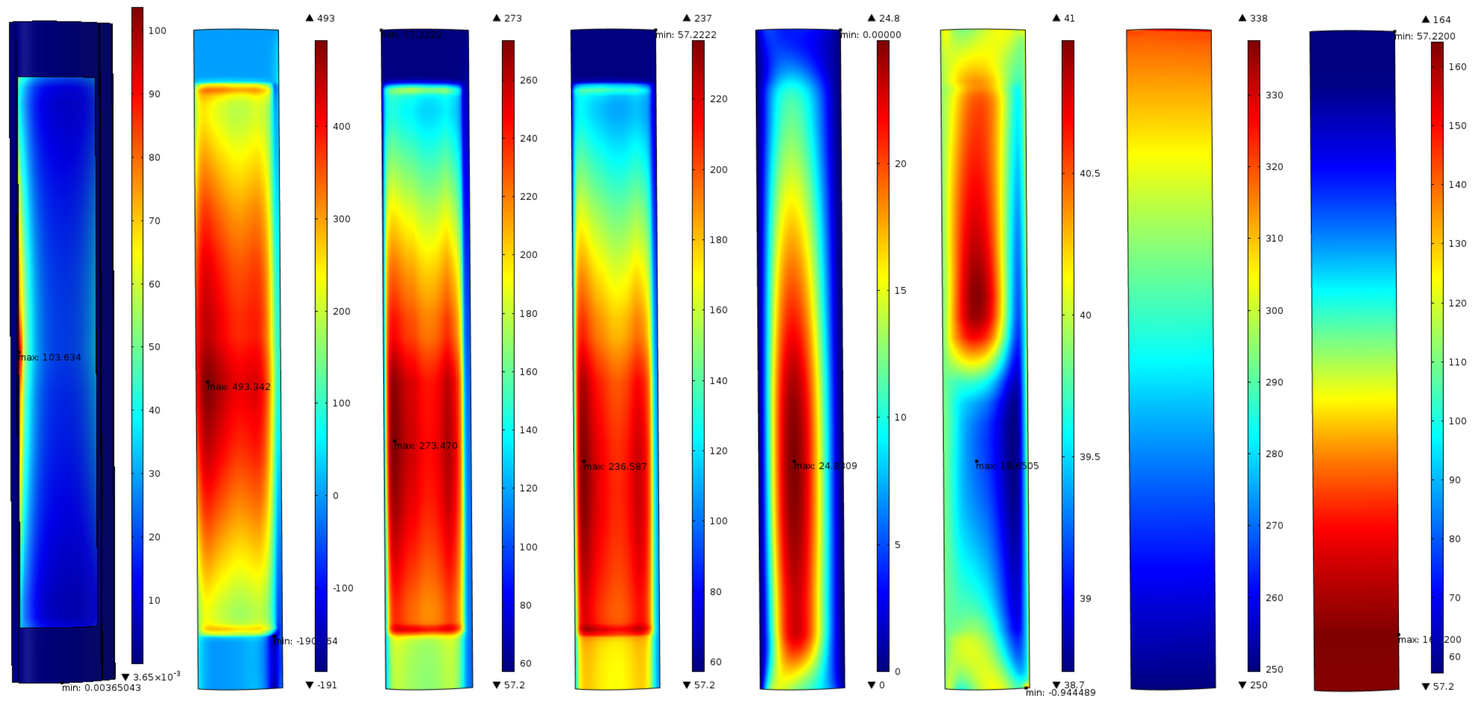




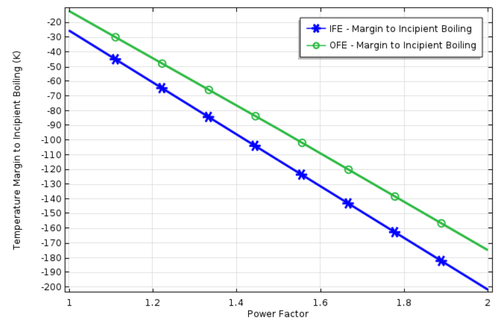
Safety Basis Results for 100 MW LEU IFE Core at the Beginning of Cycle



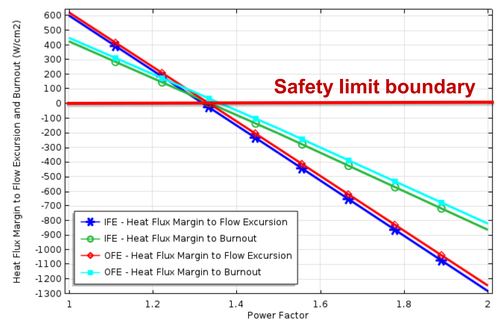
MCNP calculated volumetric heat source profile for the LEU fuel meat



Volumetric heat source (kW/cm^3) | *Clad surface heat flux (W/cm^2)* | *Fuel meat centerline temperature (C)* | *Clad surface temperature (C)* | *Fuel plate deflection (mil)* | *Coolant channel thickness (mil)* | *Coolant pressure (psi)* | *Bulk coolant temperature (C)*



Bergles-Rohsenow incipient boiling correlation



Modified Saha-Zuber flow excursion correlation and Gambill burnout correlation

Excerpt from the Proceedings of the 2015 COMSOL Conference in Boston