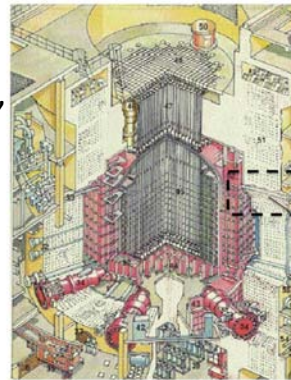


Buoyancy-Driven Flow in AGR Horizontal Annular Penetration Cavity

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- In AGCRs, boiler penetrations protrude horizontally out of vessel. Smaller tubes bring CO₂ from vessel, surrounded by hot CO₂, flow driven by natural convection $Ra = 1.5 \cdot 10^6$
- No measured data => highly resolved LES to predict heat transfer to/from the central tube, and how far the flow goes inside the penetration.
- LES gives large-scale structures also captured by RANS models in a time-dependent flow solver.
- The overall heat transfer rate is fairly constant along the penetration length, with higher values towards open end.
- The temporal power density spectra show a range of dominant peaks: different unsteadiness concentrated in the bottom half of the penetration.
- Reasonable agreement between the LES (a) and URANS schemes, including for local Nusselt number. Low-Re SST (b) requires a finer mesh than k-eps (c) =>
- Many validation test cases, inclined cavities, co-axial pipes available in thesis.



The AGR



The horizontal annular penetration

