SADE

Safety Analyses for Dynamical Events

SAFIR2018 Final seminar 22.3.2019
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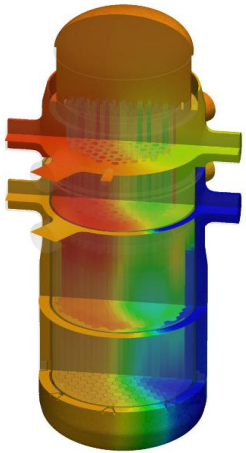
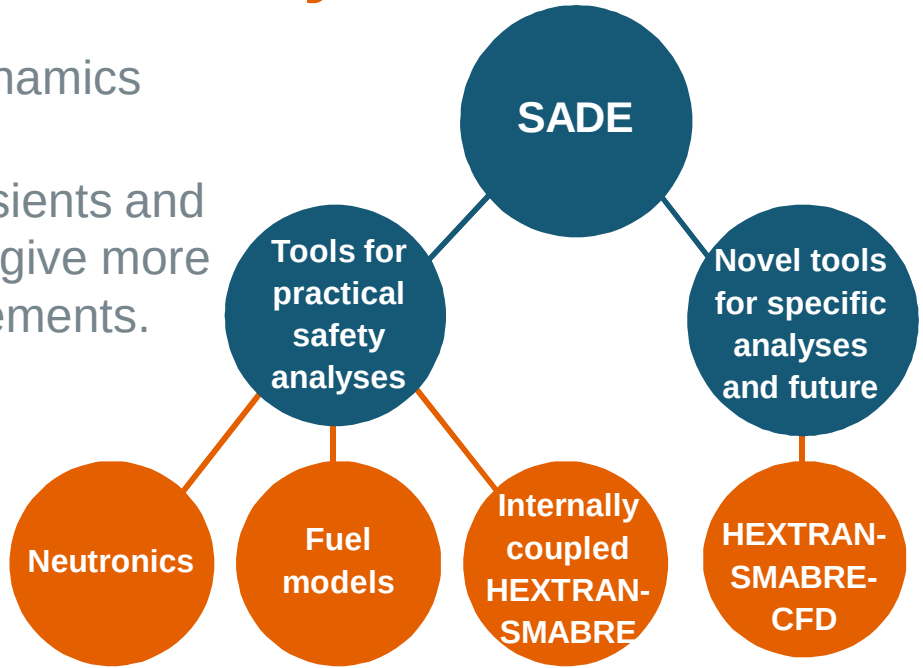
VTT – beyond the obvious

SADE – Safety Analyses for dynamical events

- 4-year project focused on reactor dynamics and thermal hydraulics
- Aim of the project was to model transients and accidents in such a way that we can give more reliable answers to the safety requirements.





Main tools VTT's **reactor dynamic codes** **HEXTRAN** (VVER) and **TRAB3D** (other PWR, BWR) and **system code SMABRE**

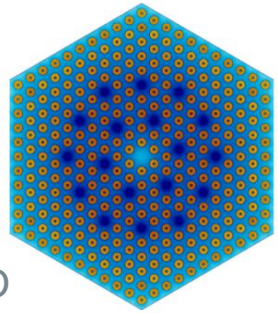
\+ **PORFLO, OpenFOAM**

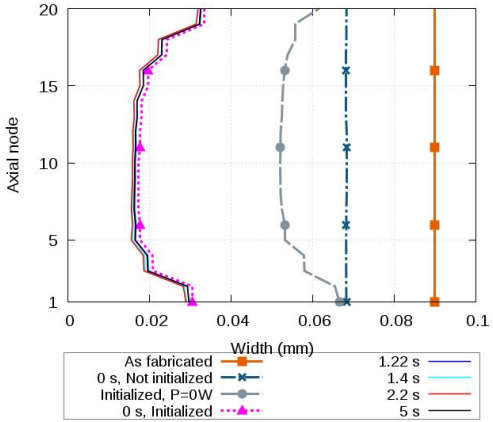
Tools for safety analyses: improvements in core modelling

§ During the project Serpent 2 was adopted
- as a tool for group constant generation for TRAB3D and HEXTRAN
- as an analysis tool.

à further refinements in neutronics solution of HEXTRAN and TRAB3D
- modelling of axially heterogeneous fuel
- pin-wise power distributions

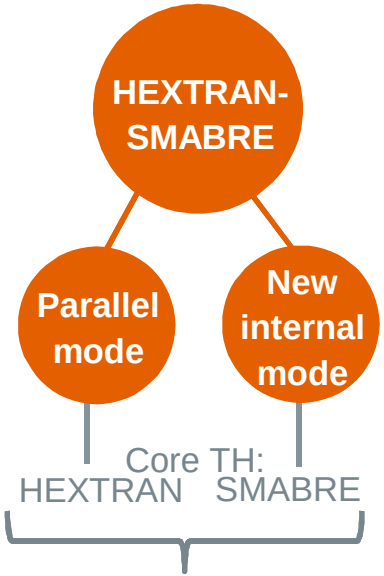
§ Coupling between reactor dynamics codes and fuel behaviour code FINIX was renewed.



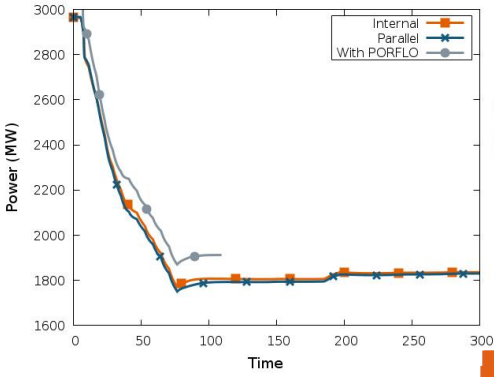


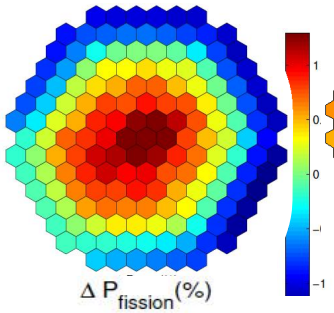
Figures: Top: 2D assembly used for group constant generation for the V-1000 calculation case.
Bottom: Gas gap width in a fuel rod during HEXTRAN-FINIX simulation of VVER-440 CRE.

Tools for safety analyses
Internally coupled HEXTRAN-SMABRE

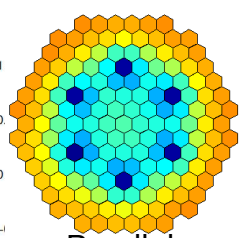


RCP transient (VVER-1000); MSLB(VVER-440, VVER-1000)

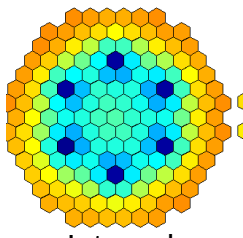




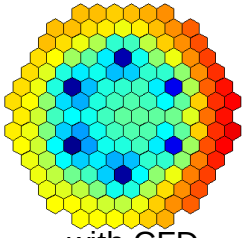
internal vs parallel



Parallel

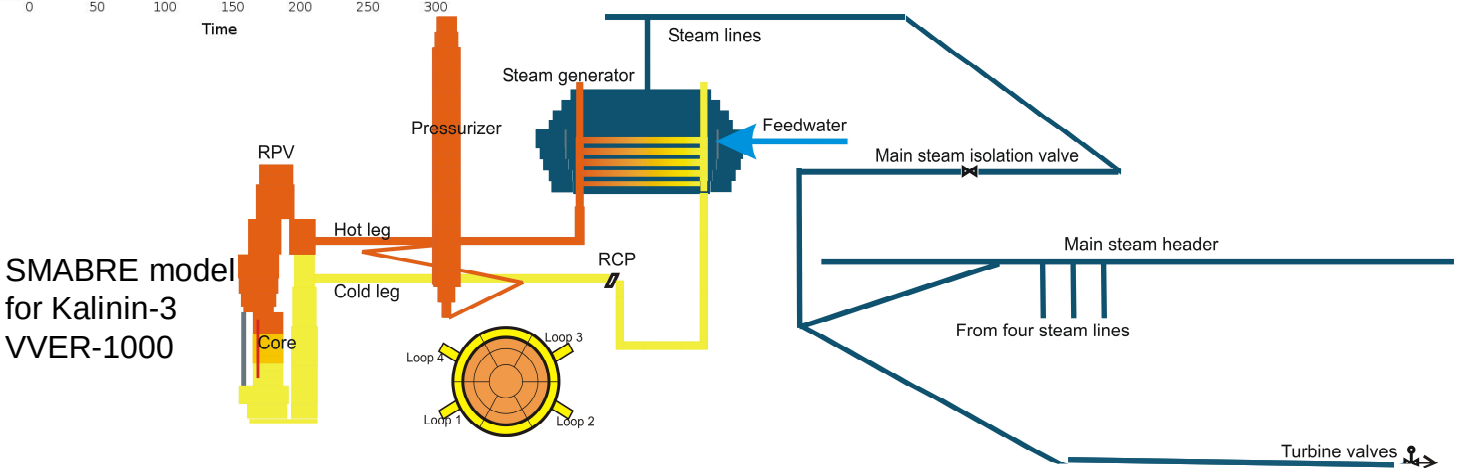


Internal



with CFD

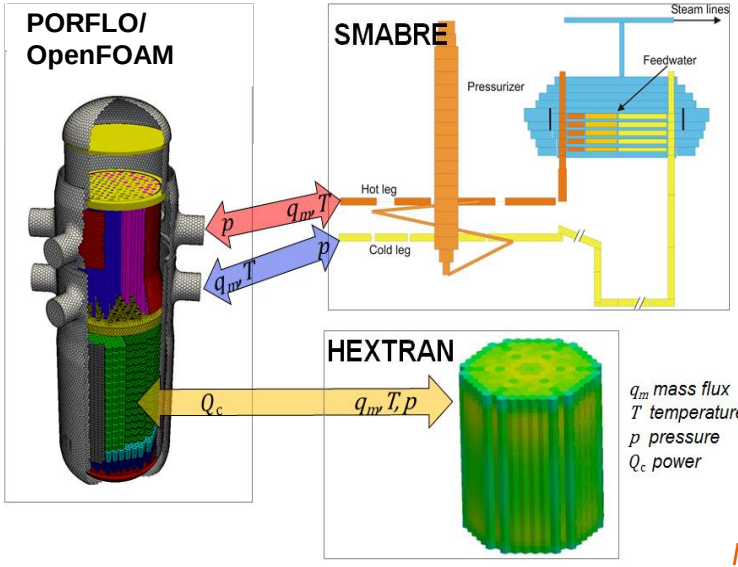
Power 50s vs steady state



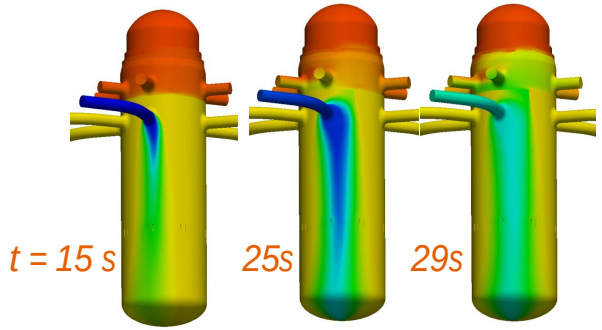
SMABRE model for Kalinin-3 VVER-1000

Novel tools:
Coupling of CFD, neutronics and plant model

A true two-way coupling



VVER-440: loop reconnection



VVER-1000: MSLB; switching off RCP