NTech Lehrstuhl für Nukleartechnik

OECD/NEA Oskarshamn-2 Stability Benchmark

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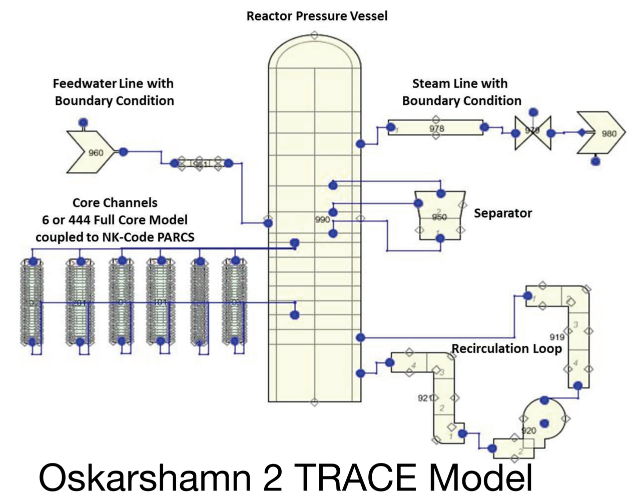
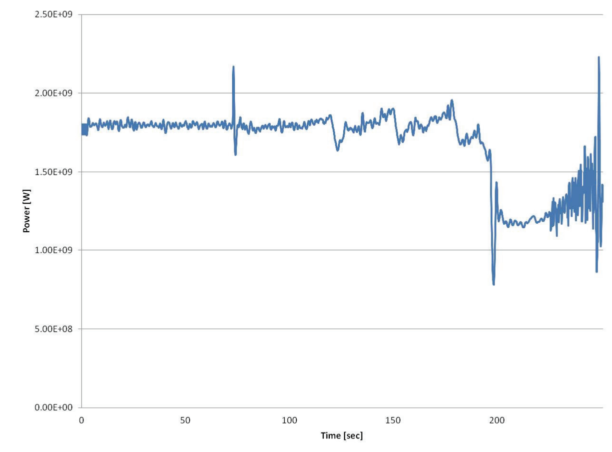
- Background: transient measurements of February 25,1999
- Event Description: A control system logic failure and a loss of feedwater preheaters caused a high feedwater and low flow condition without reactor scram. Due to an interaction of the automatic power and flow control system, the plant moved into a low flow and high power regime. The reactor power started to oscillate with diverging amplitudes which triggered automatic scram at high power (132%).
- The benchmark provides a framework for neutron kinetics / thermal hydraulics coupled code validation for BWR.
- NTech participates in the benchmark by the application of a coupled TRACE/PARCS model.



Oskarshamn 2 TRACE Model

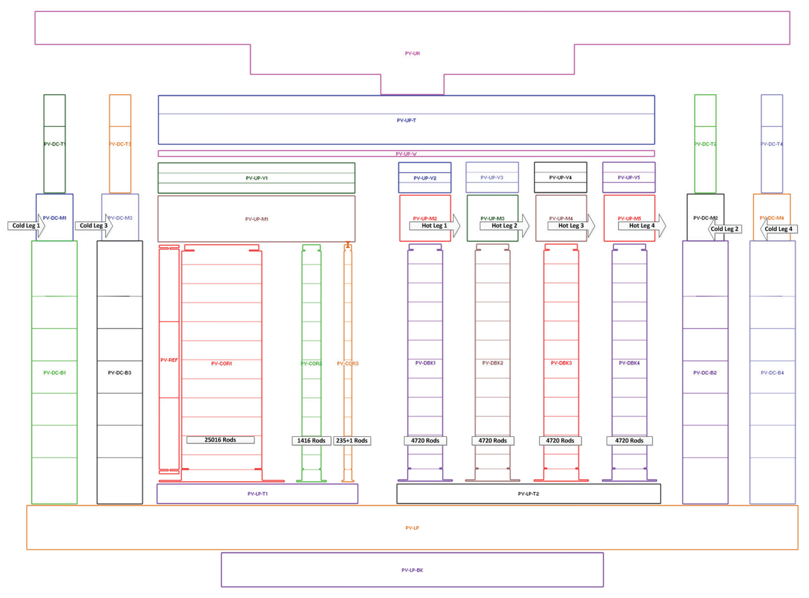


TRACE/PARCS Simulation: Power vs. Time

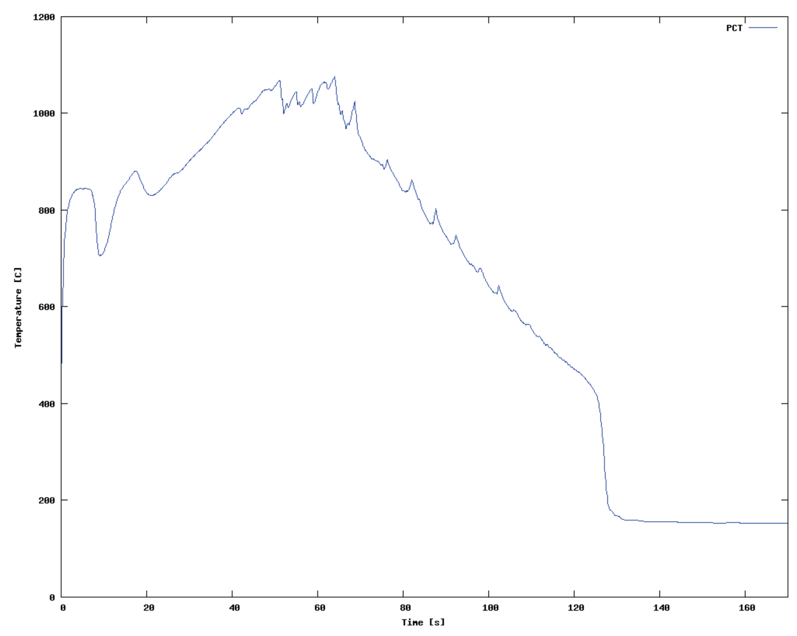
Safety Assessment with Systemcodes

Cristian Sabin Ceuca (ceuca@ntech.mw.tum.de)

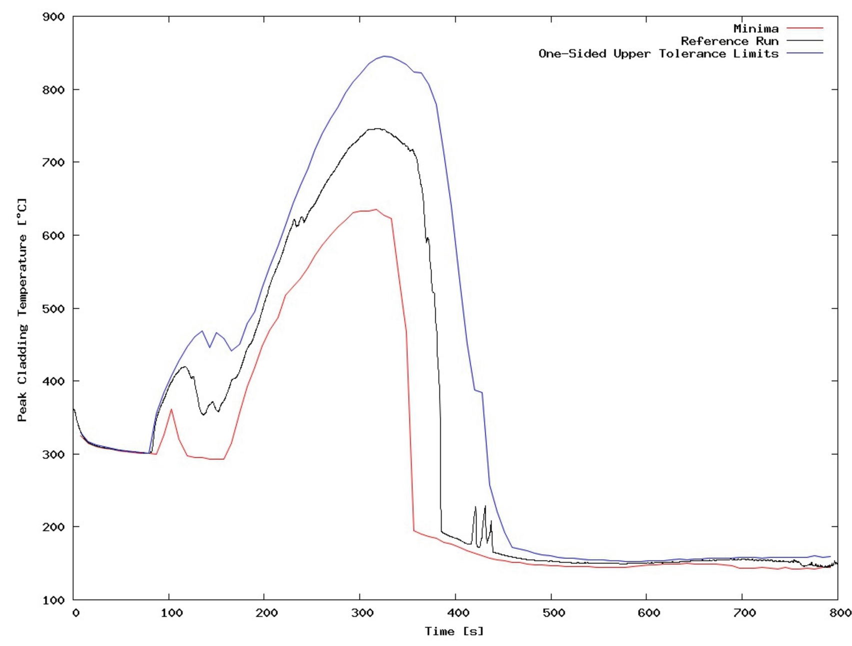
- Analysis of Design Basis Accidents like Loss of Coolant Accidents for Large Breaks (LBLOCA) and Small Breaks (SBLOCA) with the System Code ATHLET (GRS)
- Sensitivity and Uncertainty Evaluation with SUSA (GRS)



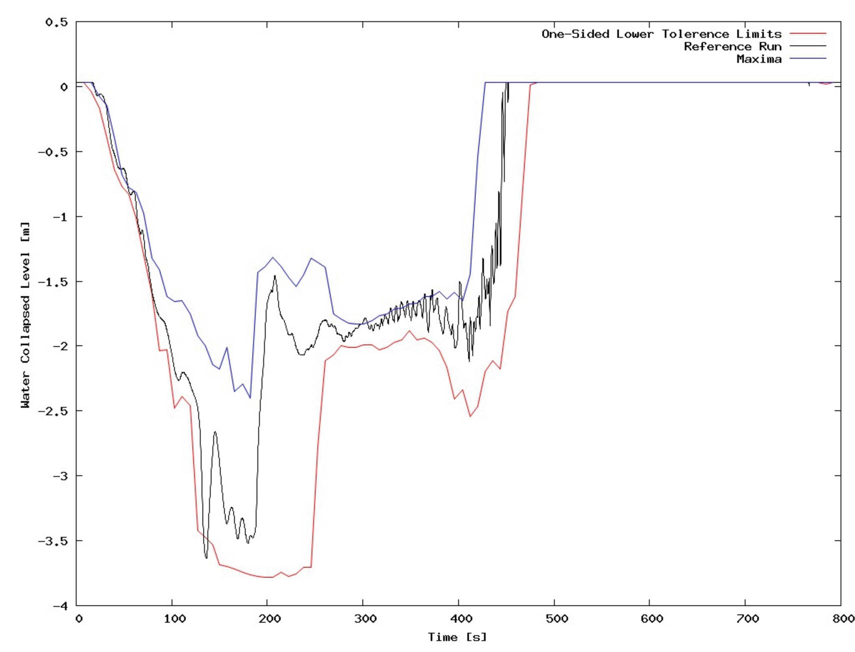
Nodalisation Scheme of a Generic Pressurized Water Reactor Core for the LOCA Analysis with ATHLET



LBLOCA: Peak Cladding Temperature vs. Time for the Hottest Rod



SBLOCA Sensitivity Study: Peak Cladding Temperatures vs. Time for the Hottest Rod with several varied Parameters



SBLOCA Sensitivity Study: Reactor Water Level vs. Time with several varied Parameters

Sensitivity and Uncertainty Analysis of Nuclear Systems

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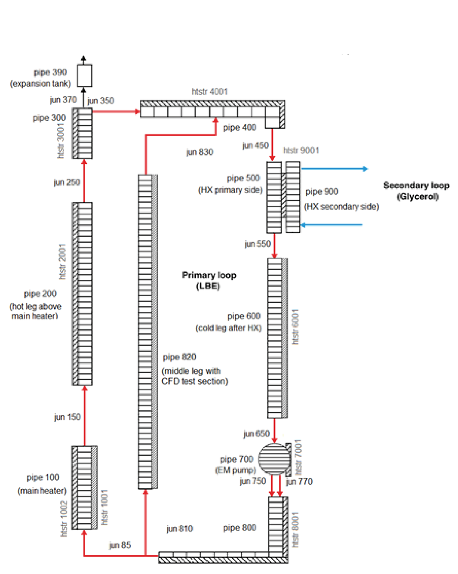
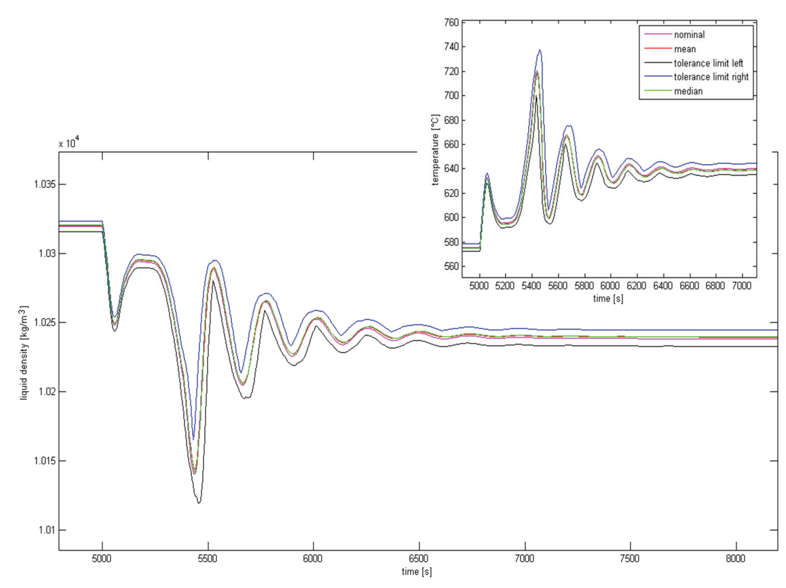
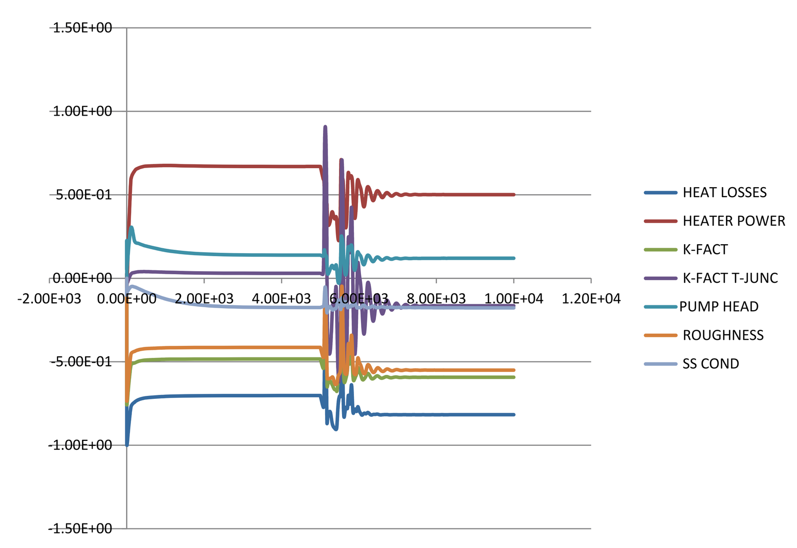
- Given a nuclear system, calculate the plausible range of results considering the uncertainty of the input parameters.
- Calculate which input parameters have a bigger impact in the uncertainty of the system.
- Calculation of the uncertainty in coupled calculations System code / CFD code.
- Part of the EU project Thermal Hydraulics of Innovative Nuclear Systems (THINS).
- The calculations are made on the TALL facility, wich is built by KTH, Stockholm, Sweden



Nodalisation of the TALL facility



Uncertainty analysis for Temperature and density



Temperature sensitivity to input parameters

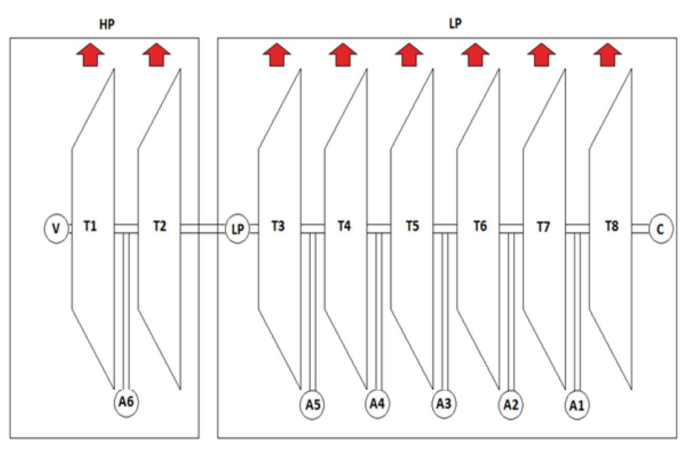
Plant Specific Dynamic Modelling of LWR Turbo-generator Sets

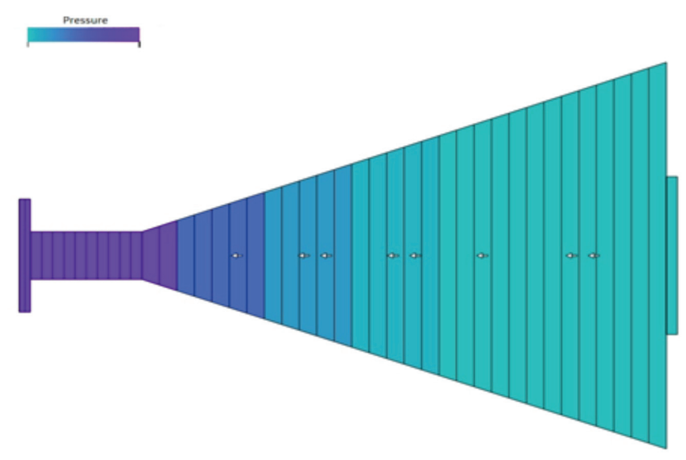
Ovidiu Melinte (melinte@ntech.mw.tum.de)

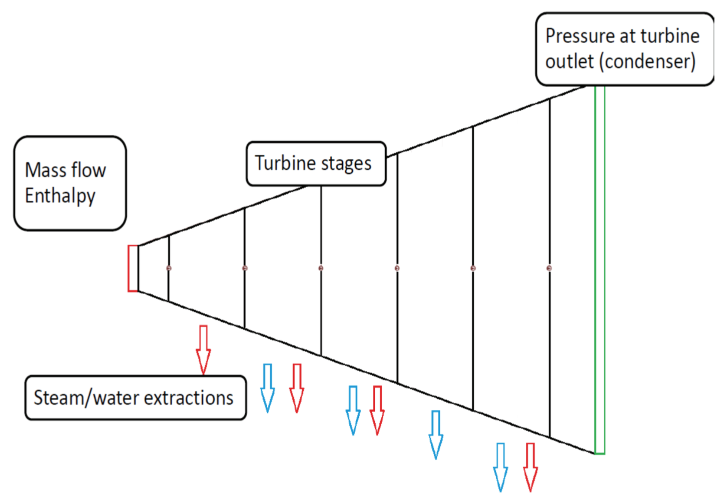
- Goal – development of a dynamic turbine model which can be used with ATHLET and similar codes for realistic simulation of the time dependent behaviour of turbines found in currently operating nuclear power plants under operational incident and accident conditions.
- The model should be based on:
  - – basic principles
  - – generic turbine design data
  - – specific models with free parameters which can be fitted to relevant plant measurements

Thermodynamic approach:

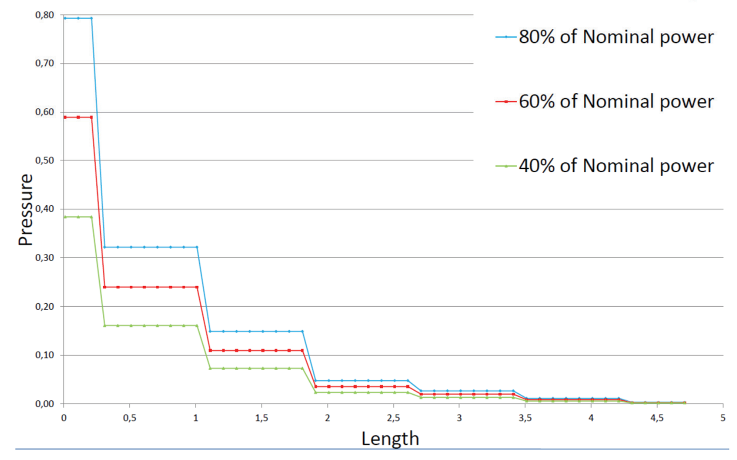
- Model developed within the framework of a diploma project in GRS (Gesellschaft für Anlagen- und Reaktorsicherheit), in collaboration with the NTECH Chair
  - Test version Implemented in ATHLET
  - No need for geometrical data
  - Thermodynamic approach
  - Based on the Stodola's Cone Law







- Configuration of the GRS turbine model



Example of pressure distribution at different power levels (normalized)

Further steps required:

- Improve errors for the steady state simulation
- Transients simulation
- Better modelling of extraction lines
- Modelling of separator & reheater
- Consideration of plant measurements
- Modelling of the generator
- Calculation of turbine speed

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