SPACE analysis of loss of SI injection concurrent with SBLOCA for SMART-ITL

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Background and Objective

- The PIRT for SMART100-DECs has been developed to identify the T-H phenomena that could happen during the DECs without core melting of SMART100.
- Based on the PIRT, we also derive the improvement or validation items for T-H model of the SPACE.
- In this regard, T-H models of the SPACE has been improved to simulate the SMART applications.
- Objectives of this paper

To validate the capability of the SPACE for SMART applications, SMART-ITL F102 test for SBLOCA concurrent with partially passive safety injection fail was selected.

SMART-ITL F102 test

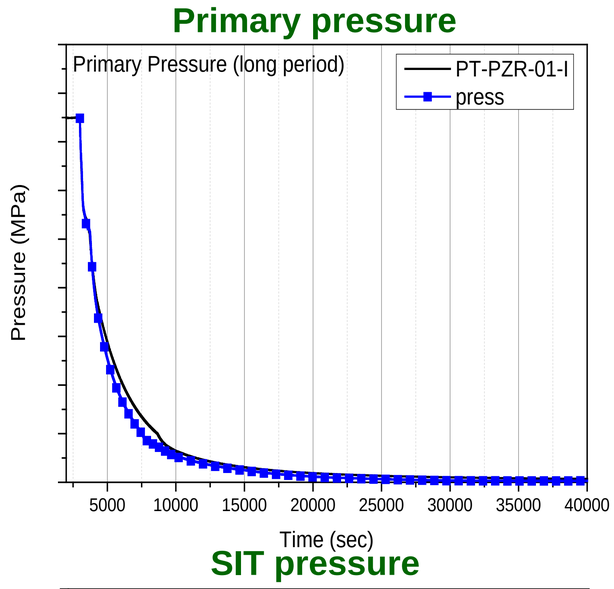
- Scenario
  - SBLOCA initiates by the break at SI line.
  - RCS pressure begins to decrease and a reactor trip signal is generated by Low PZR pressure.
  - Although CMTAS and PRHRS were generated, all the CMTs and PRHRS are assumed to be failed.
  - When RCS pressure reaches to the SITAS set-point, only SITs are injected into the SI line.
- Sequence of Events

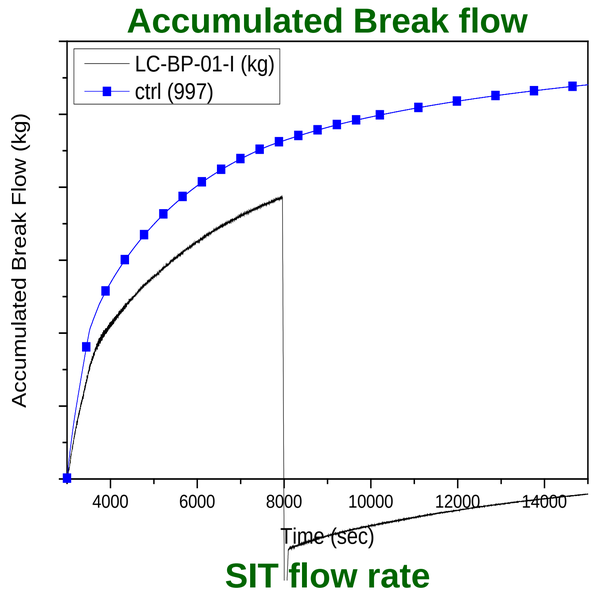
Event	Setpoint
Initiation of Break	-
Generation of RCS trip signal - Turbine trip - RCP coastdown - FW stop - CMTAS	LPP+1.1 s
Control Rod Injection	LPP+1.6 s
PRHRAS	LPP+5.2 s
MSIV / FIV close	PRHRAS+5.0 s
SITAS	P_{PZR} =2 MPa+1.1 s
SIT injection	SITAS+1.1 s
Test Ended	

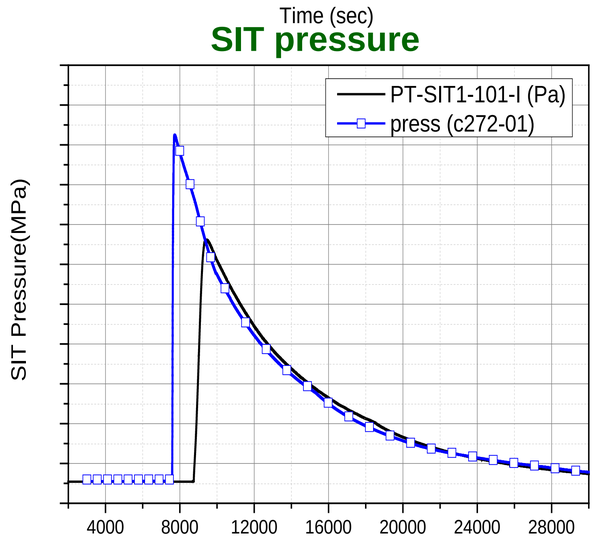
Steady-state condition

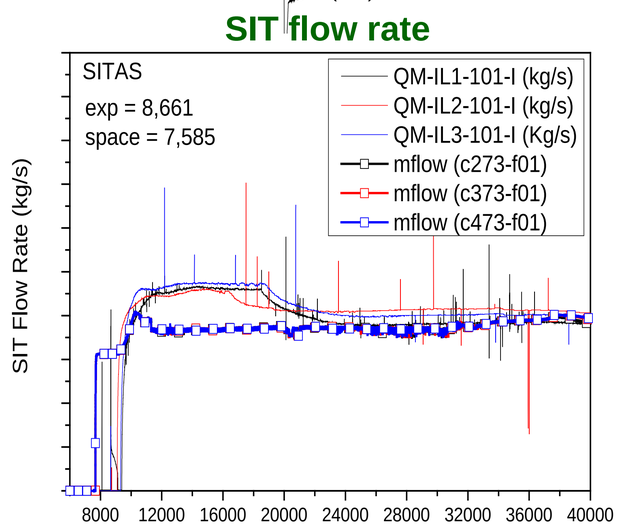
	EXP	SPACE	Diff(%)
Initial Core Power (kW)	1,711	1,711	BC
Core inlet & Outlet (K)	568.55	568.30	-0.043
	594.75	594.17	-0.098
SG primary Inlet & Outlet (K)	594.95	593.96	-0.166
	571.45	570.00	-0.253
RCS flow rate (kg/s)	11.525	11.52	adjusted
Pressure (MPa)	15	15	BC
PZR temp (K)	613.15	615.25	0.342
PZR water level (m)	3.115	3.074	-1.316
SG sec. Inlet & Outlet (K)	502.85	502.86	BC
	590.15	593.93	0.639
SG flow rate (kg/s)	0.784	0.784	BC
FW Pressure (MPa)	5.72	5.72	BC
MS Pressure (MPa)	5.63	5.69	1.066

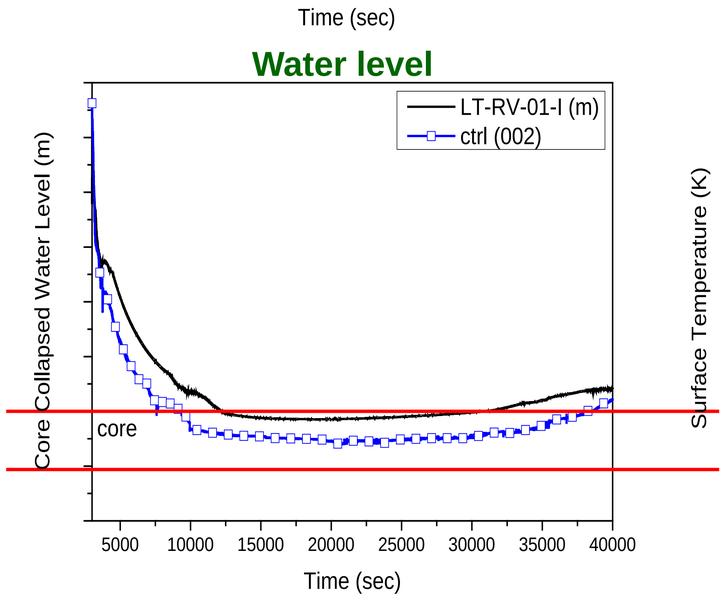
Transient results

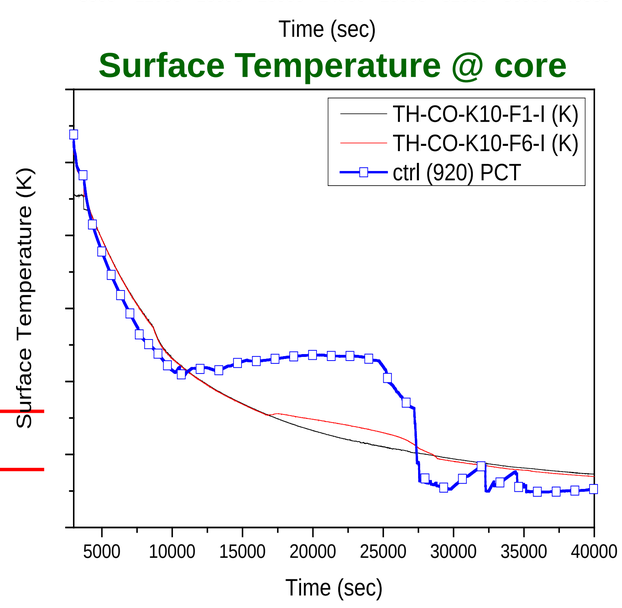












Conclusions

- The SPACE calculation for major parameters show reasonable agreements with the SMART-ITL test.
- The improve T-H model of the SPACE for SMART applications well implemented and we can conclude that the SPACE can be utilized for SMART applications.
- As a further work, we will conduct the sensitivity study for the break flow to more accurately predict the behavior of SBLOCA in the SMART-ITL test.