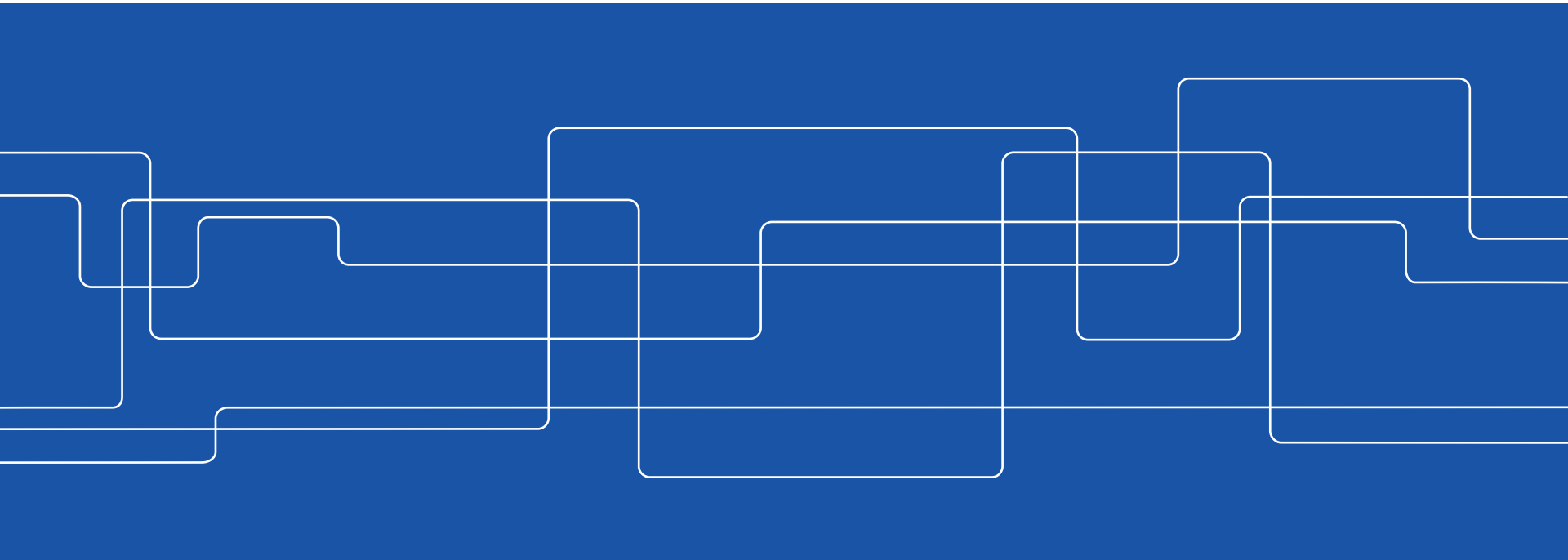
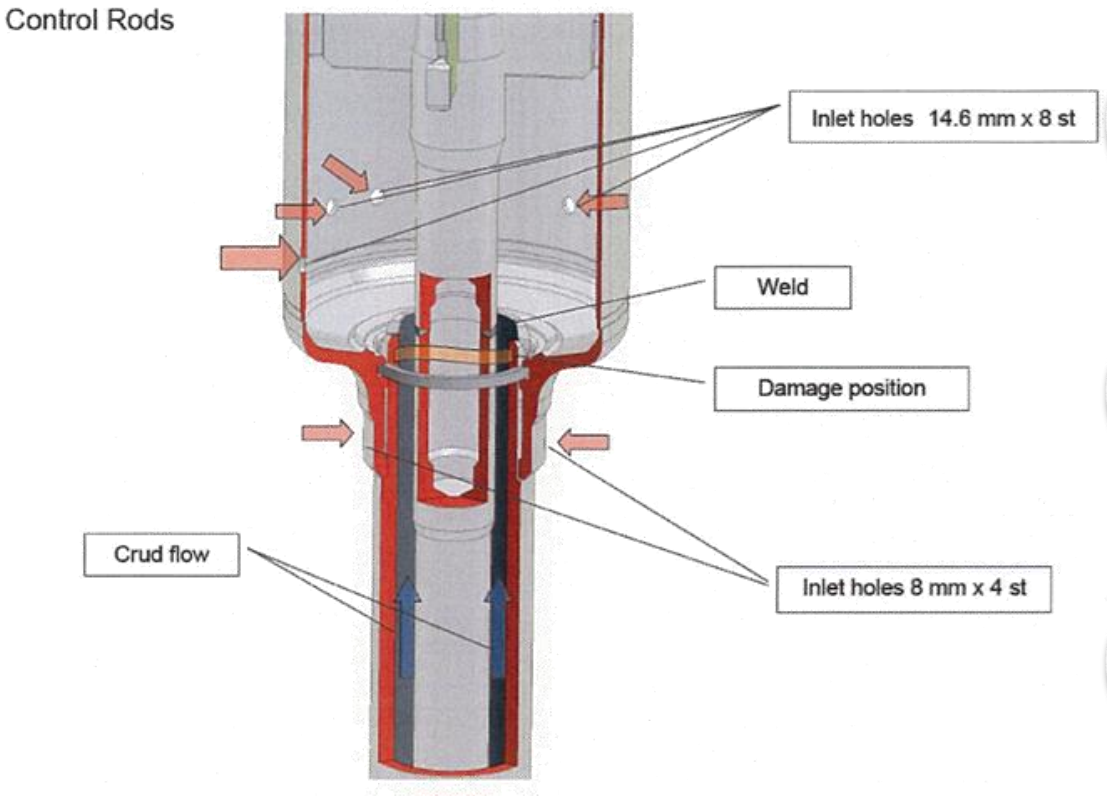
Issue 86-14

Sean Roshan



BACKGROUND

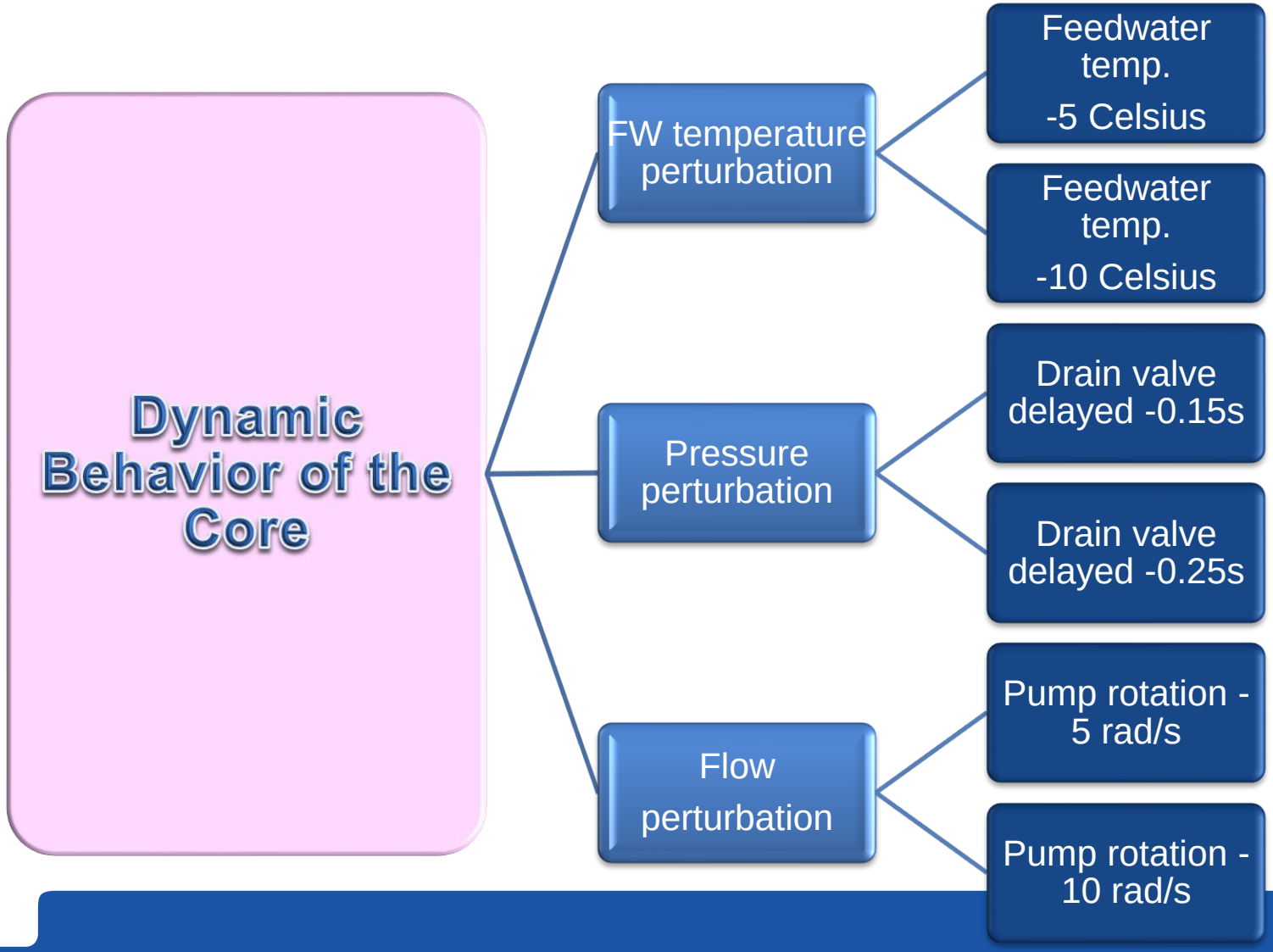


1. Operate the reactor at 129% power with CR 86%
2. Adopt the core-loading to the new Power & CR pattern
3. License the reactor for new conditions

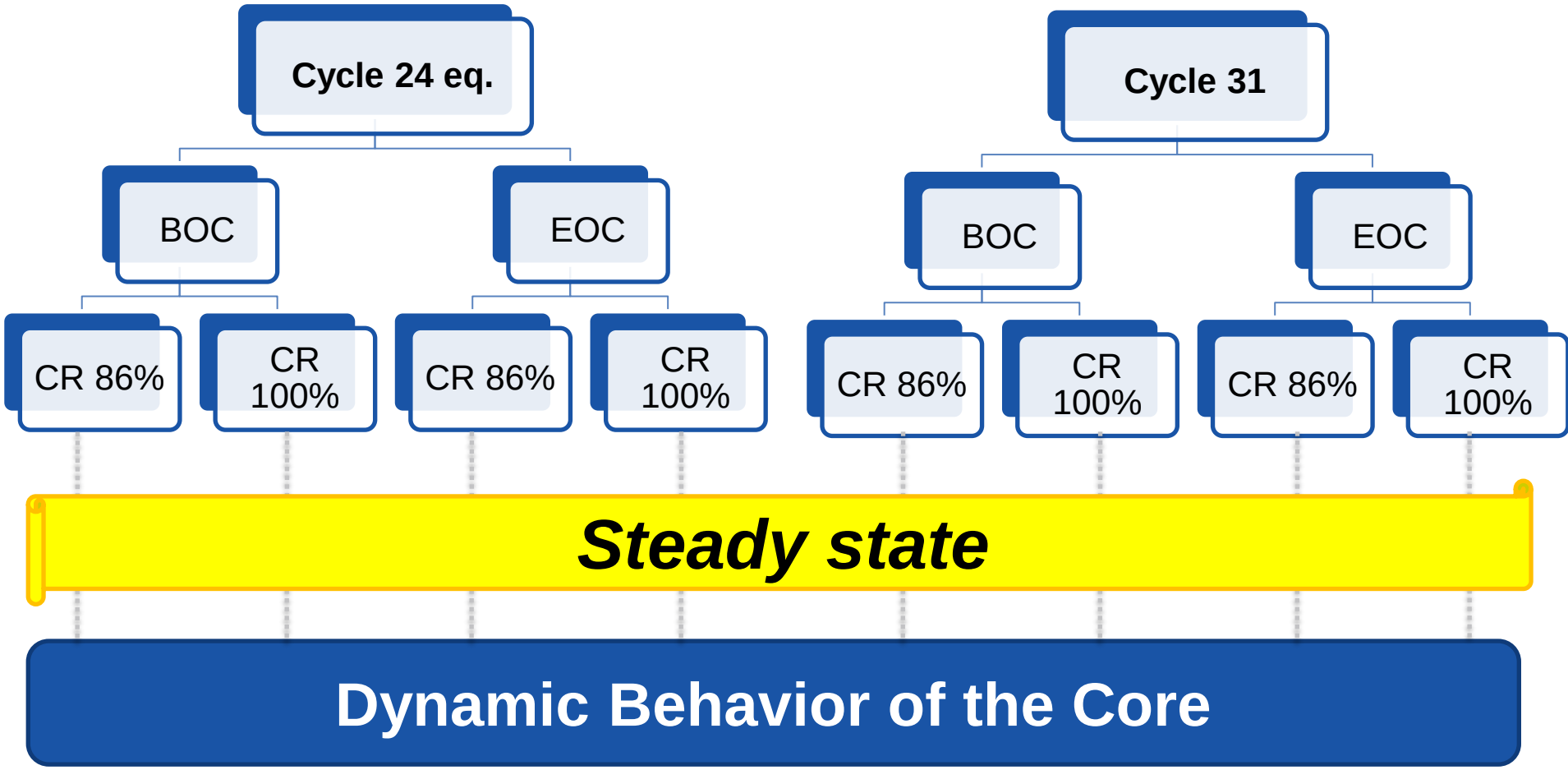
Compare effect of 14% CR insertion on following parameters

- Power level — NOT DONE
- Void coefficient — DONE
- Peaking factors
- (~1.6 radial/2.5 volume) — DONE
- Axial power shape — DONE
- Core pressure drop — DONE
- Dynamics of the core
  - Temperature perturbation — DONE
  - Pressure perturbation — DONE
  - Flow perturbation — DONE
- Partial scram effect — NOT DONE

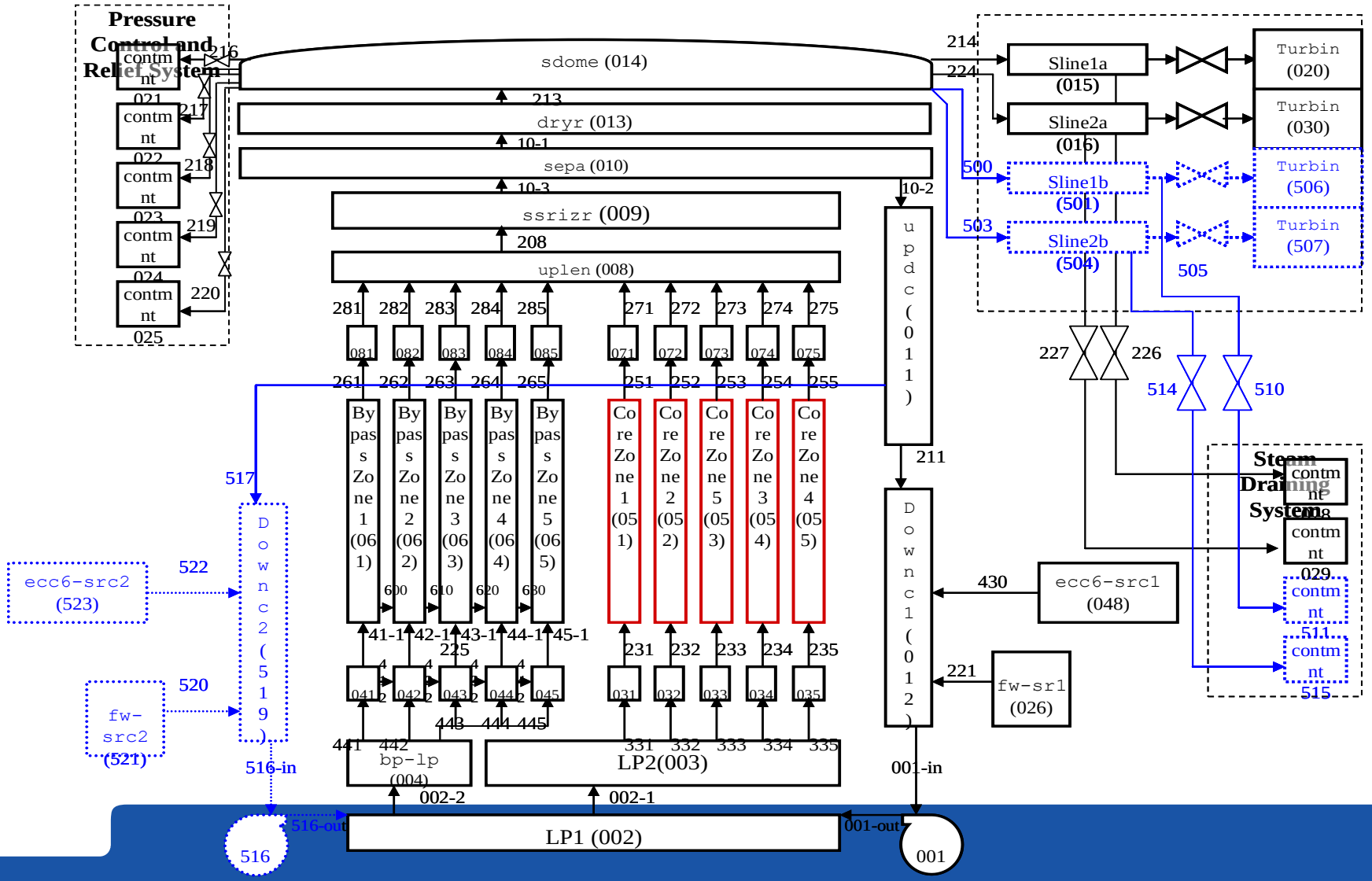
Test Matrix


Dynamic Behavior of the Core
FW temperature perturbation
Feedwater temp. -5 Celsius
Feedwater temp. -10 Celsius
Pressure perturbation
Drain valve delayed -0.15s
Drain valve delayed -0.25s
Flow perturbation
Pump rotation -5 rad/s
Pump rotation -10 rad/s

Test Matrix


Cycle 24 eq.
BOC
EOC
CR 86%
CR 100%
CR 86%
CR 100%
Cycle 31
BOC
EOC
CR 86%
CR 100%
CR 86%
CR 100%
Steady state
Dynamic Behavior of the Core

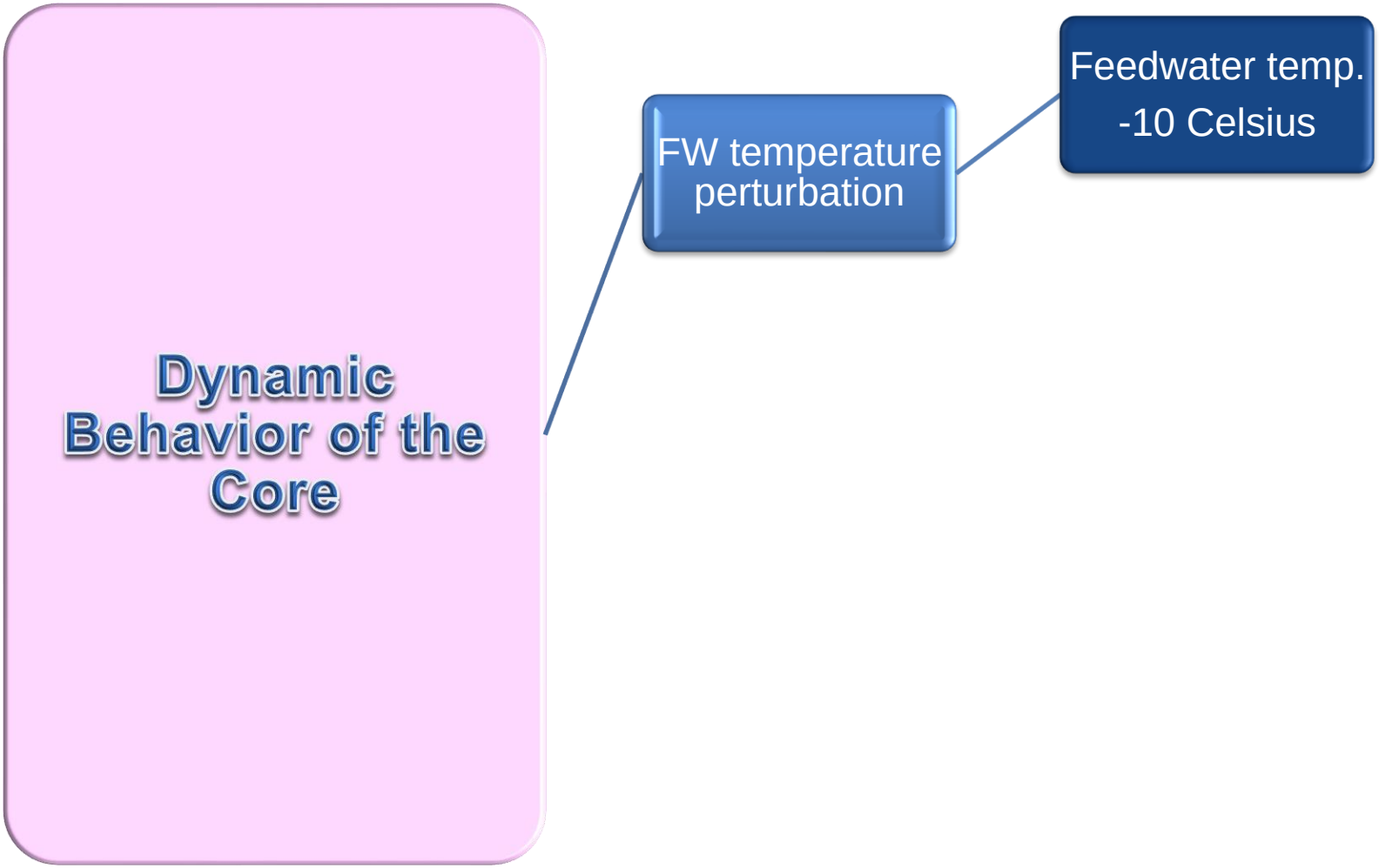
RELAP5 Nodalization



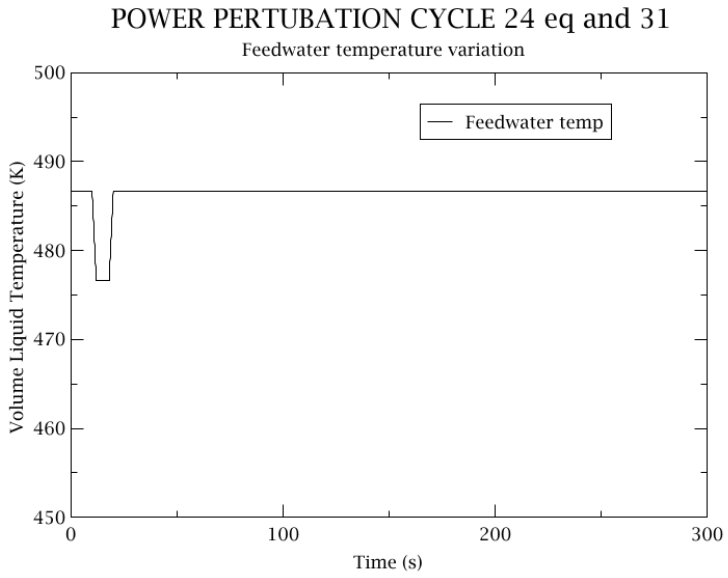
Steady state results

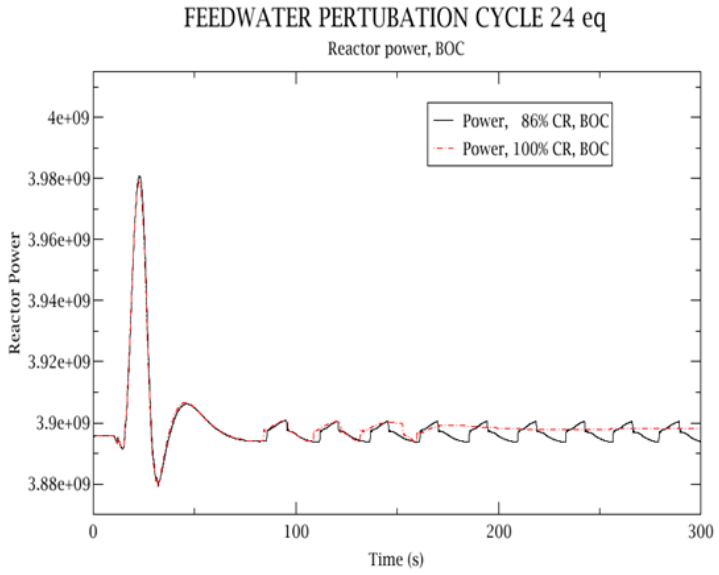
Value	O-3 fuel cycle **24**				O-3 fuel cycle **31**			
	BOC		EOC		BOC		EOC	
	CR withdrawal **100 %**	CR withdrawal **86 %**	CR withdrawal **100 %**	CR withdrawal **86 %**	CR withdrawal **100 %**	CR withdrawal **86 %**	CR withdrawal **100 %**	CR withdrawal **86 %**
TPC (1/MWt)	-9.9	-9.53	-9.3	-9.03	-9.93	-10.2	-9.53	-13.5
Core void (%)	0.454	0.418	0.409	0.377	0.488	0.435	0.567	0.500
Total flow (kg/s)	12186.	12250.	14468.	14524.	12130.	12246.	14067.	14268.
Volumetric Peak. Fact.	2.73	2.98	2.58	2.78	3.71	3.40	5.57	4.41
Pressure (MPa)	7.019	7.024	7.019	7.019	7.024	7.024	7.019	7.018
Vessel ΔP (MPa)	0.231	0.229	0.275	0.272	0.233	0.229	0.292	0.283

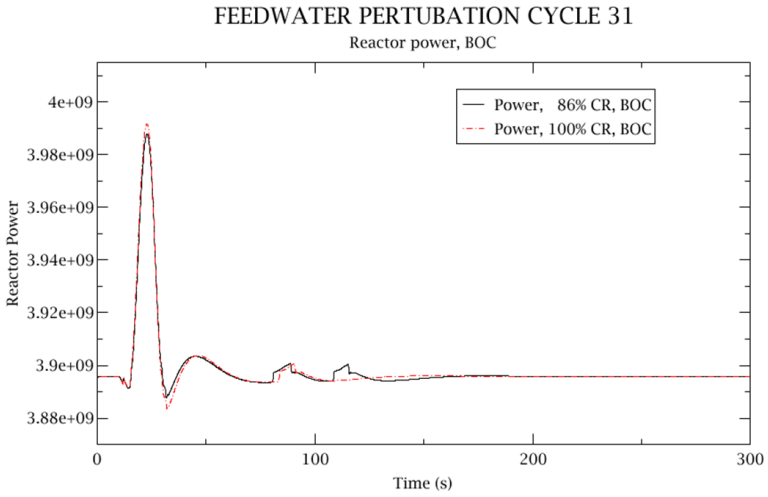
Case 1: FW Temperature Pertubation

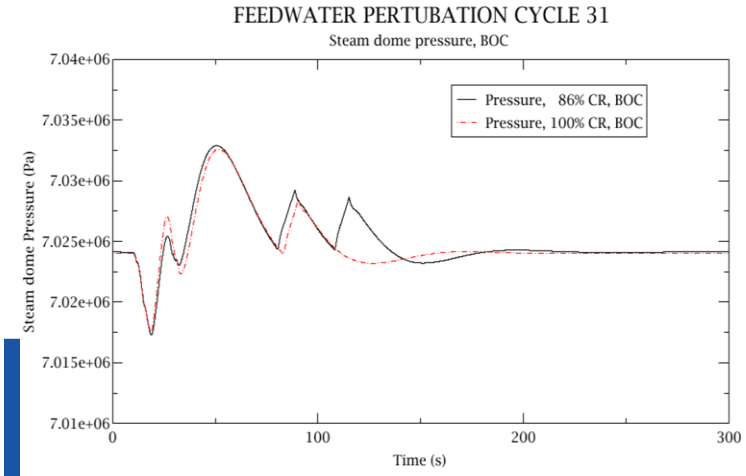


FW TEMP. PERTUBATION
Feedwater temp. reduction with 10ºC









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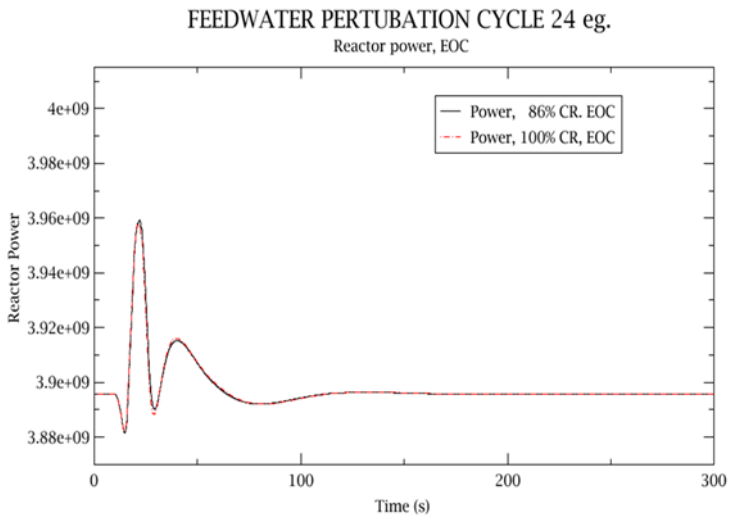

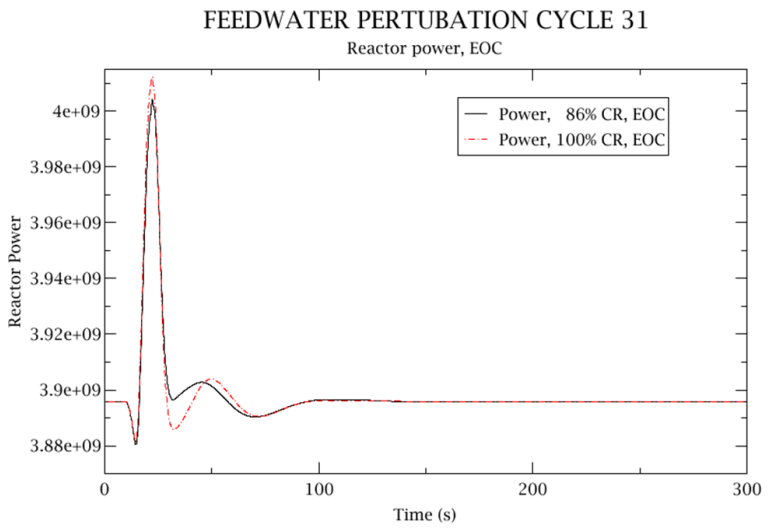

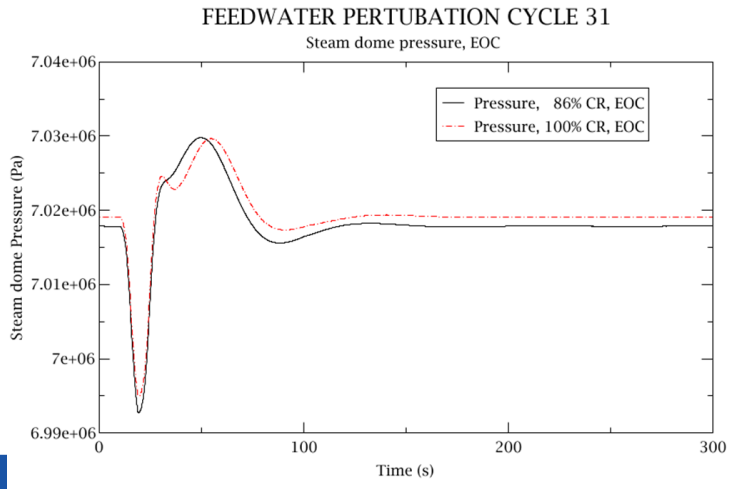

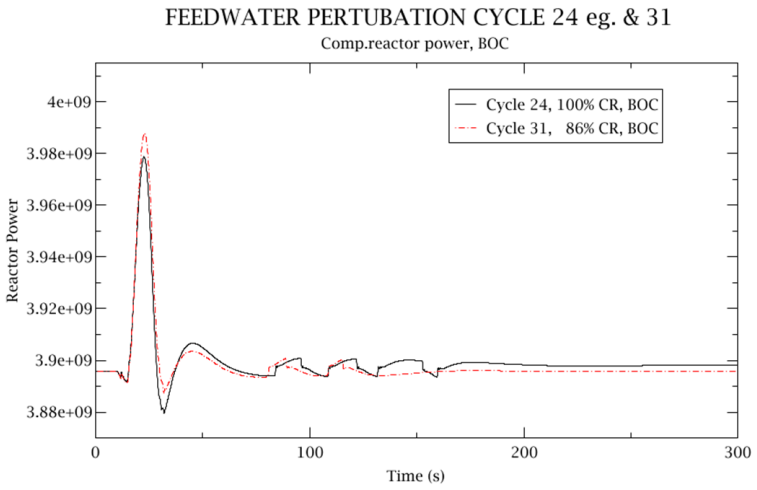

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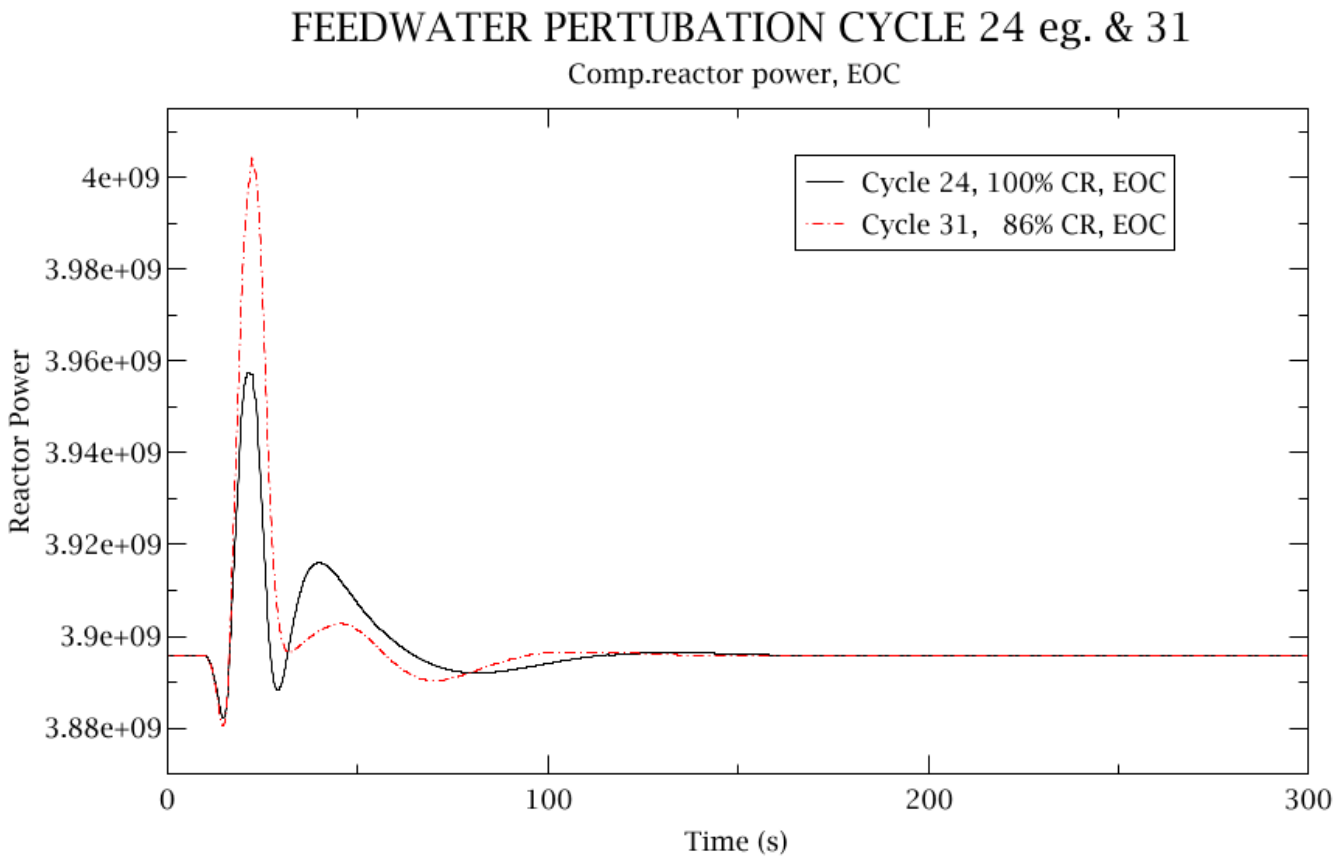
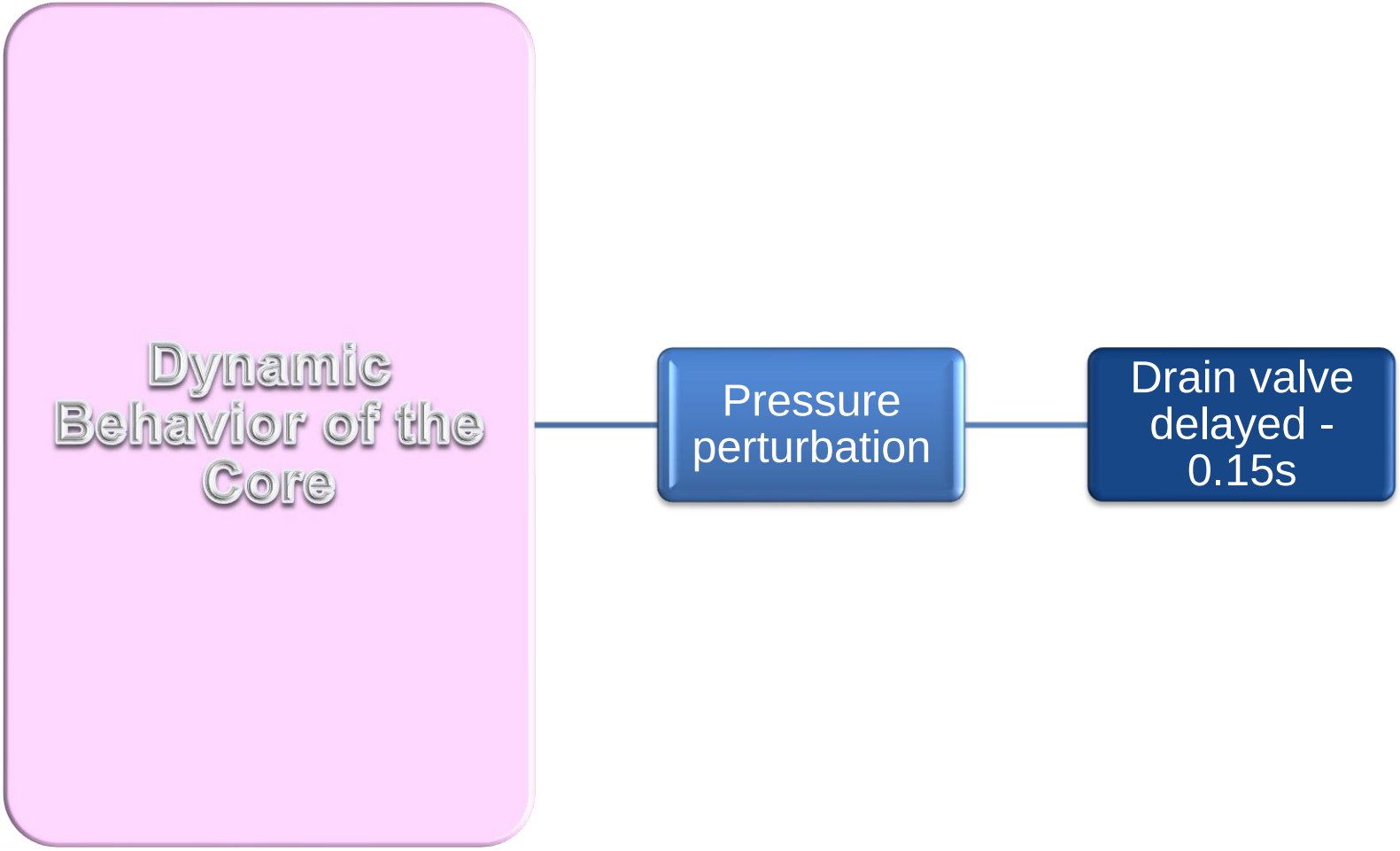
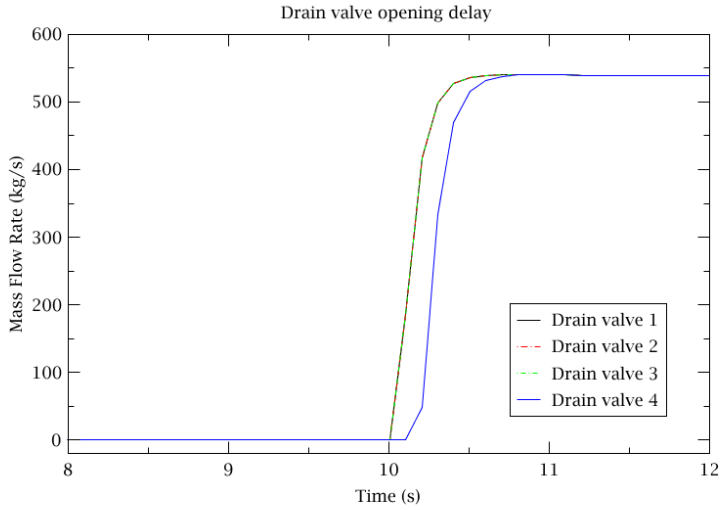


Case 2: Pressure Perturbation

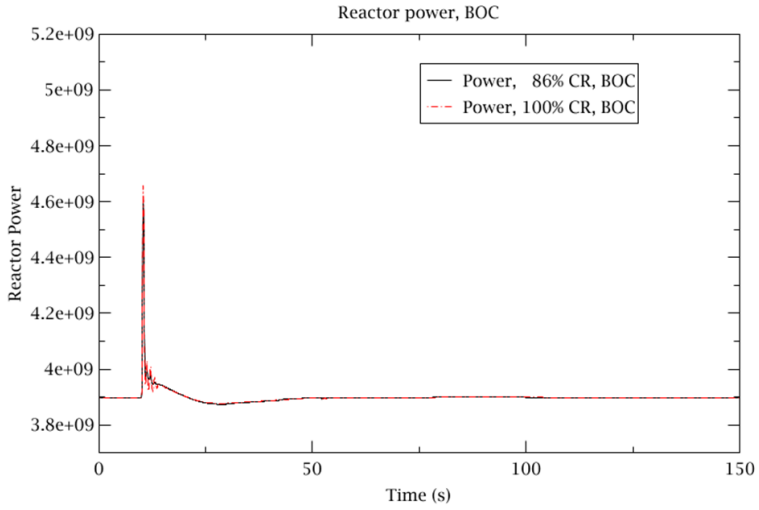


PRESSURE PERTUBATION
Drain valve opening delay at TT with 0.15s

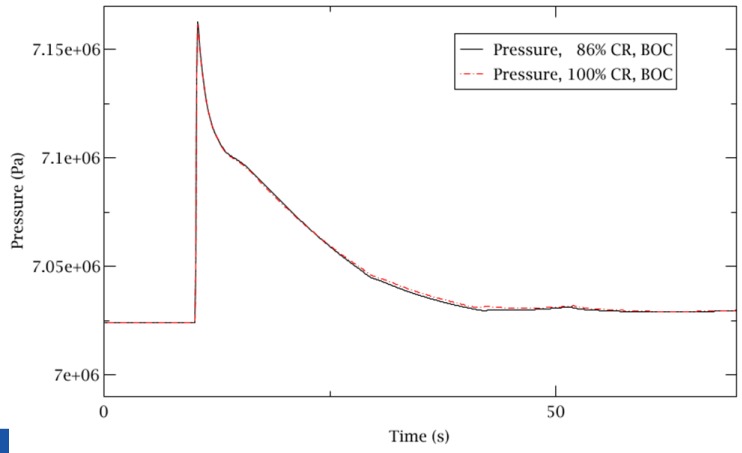
DRAIN VALVE DELAY PERTUBATION CYCLE 24 eq. & 31



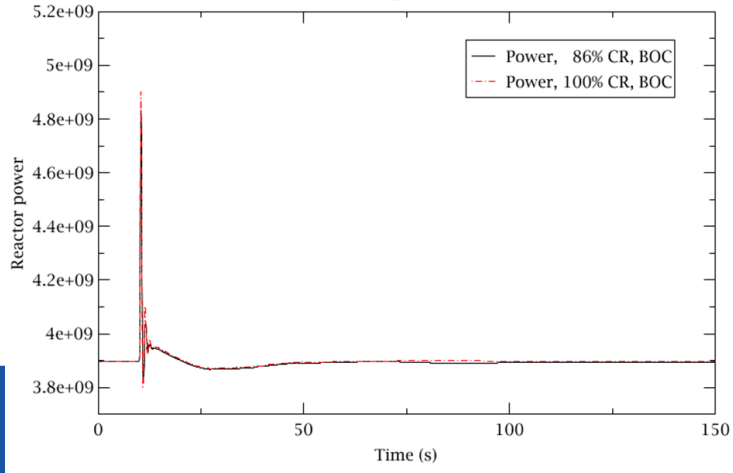
DRAIN VALVE DELAY PERTUBATION CYCLE 24 eq.



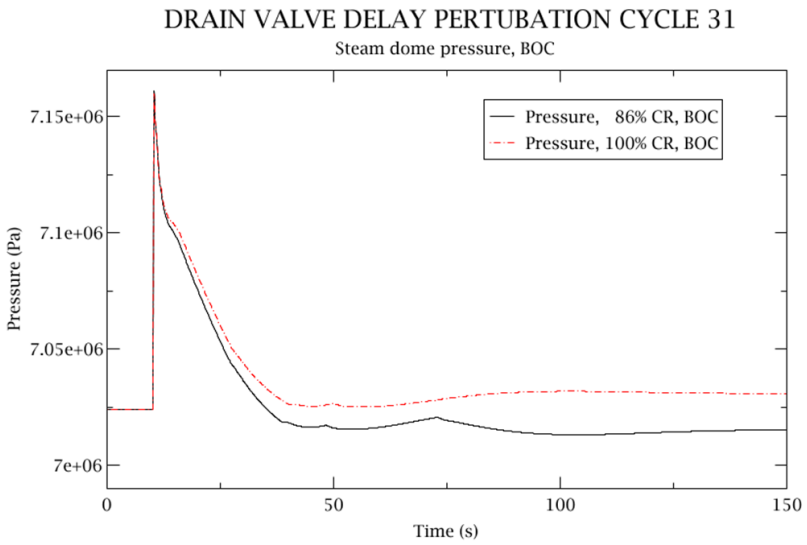
DRAIN VALVE DELAY PERTUBATION CYCLE 24 eq.

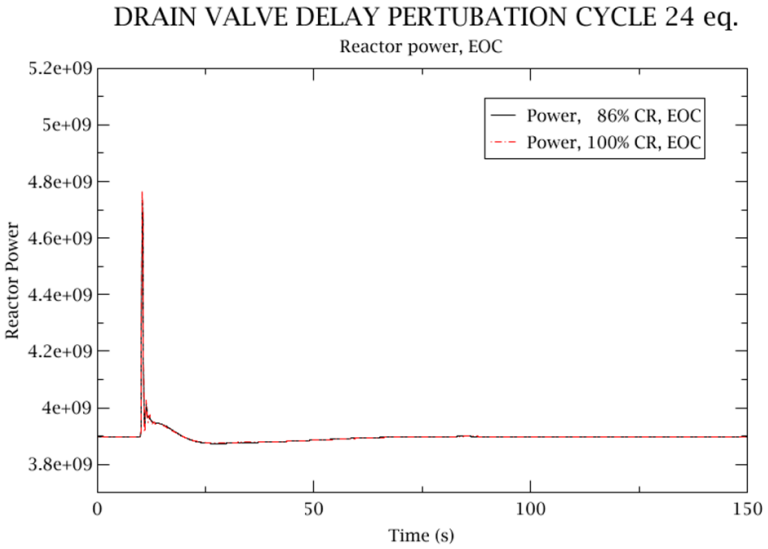


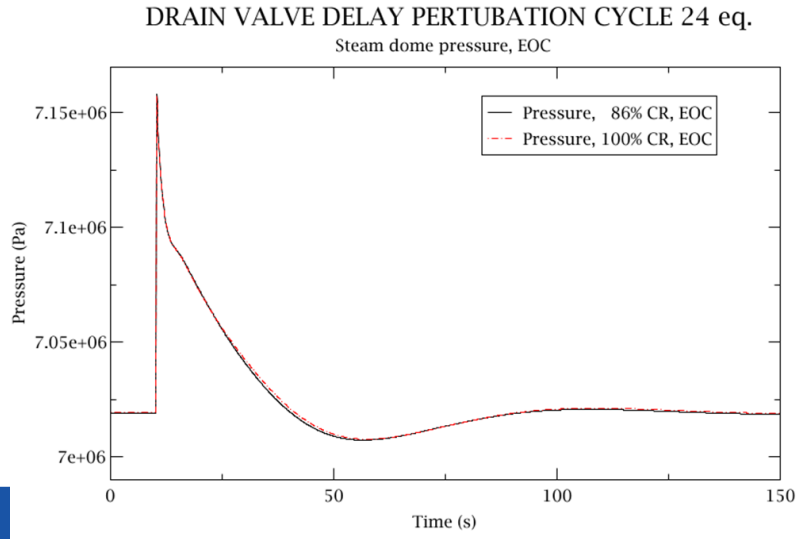
DRAIN VALVE DELAY PERTUBATION CYCLE 31

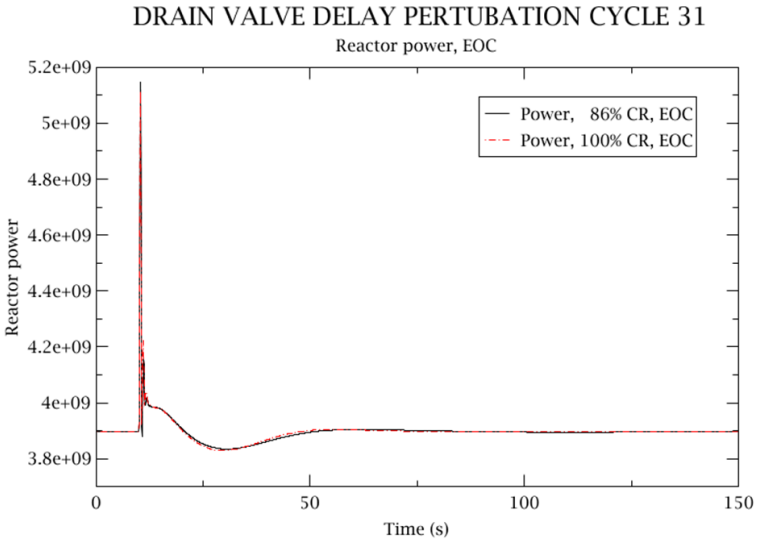


PRESSURE PERTUBATION
Drain valve opening delay at TT with 0.15s









PRESSURE PERTUBATION
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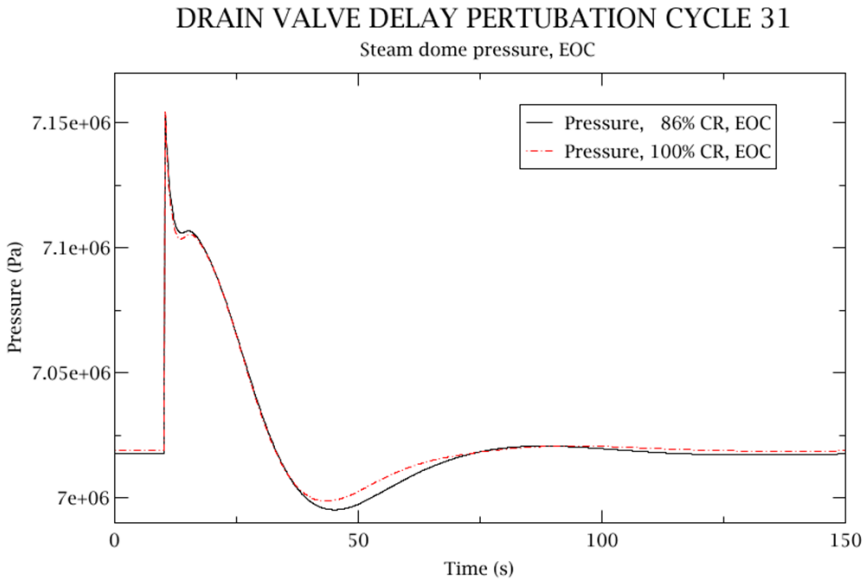
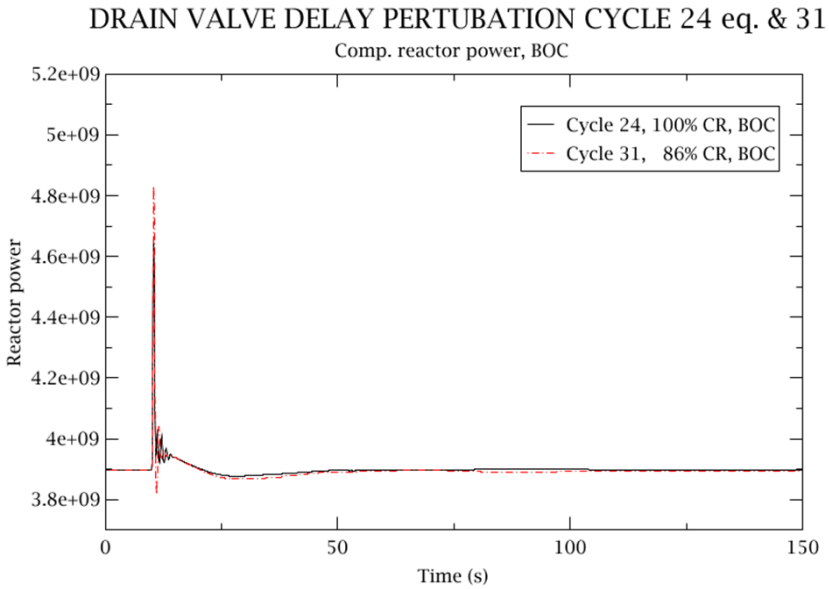
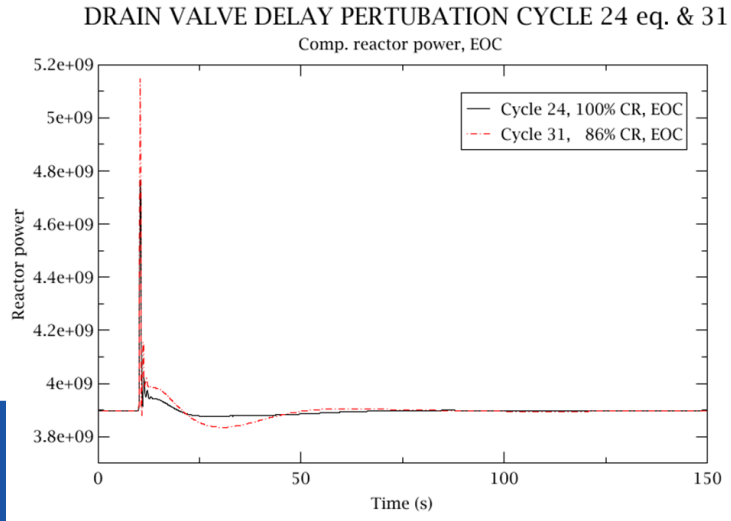






CONCLUSION

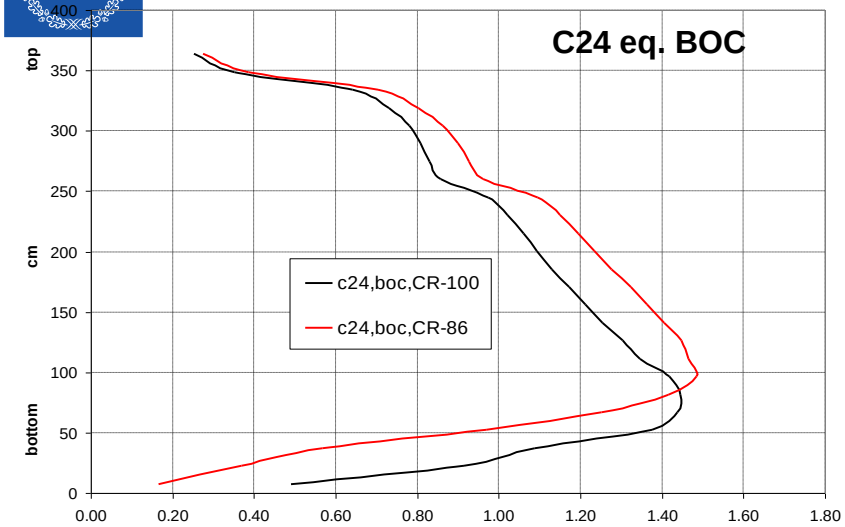
•TPC was c ted more negative tha fore, possibly due to very kewed axial power

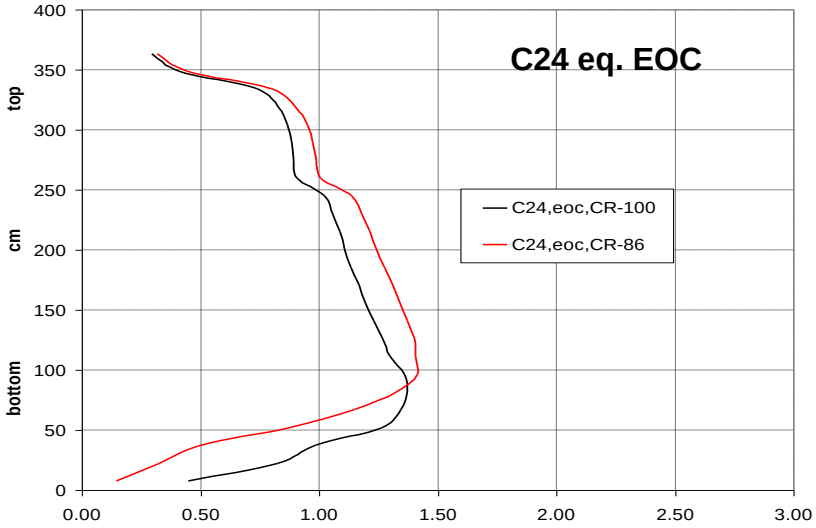
•Core pressure eases effect on the core stability shoul in

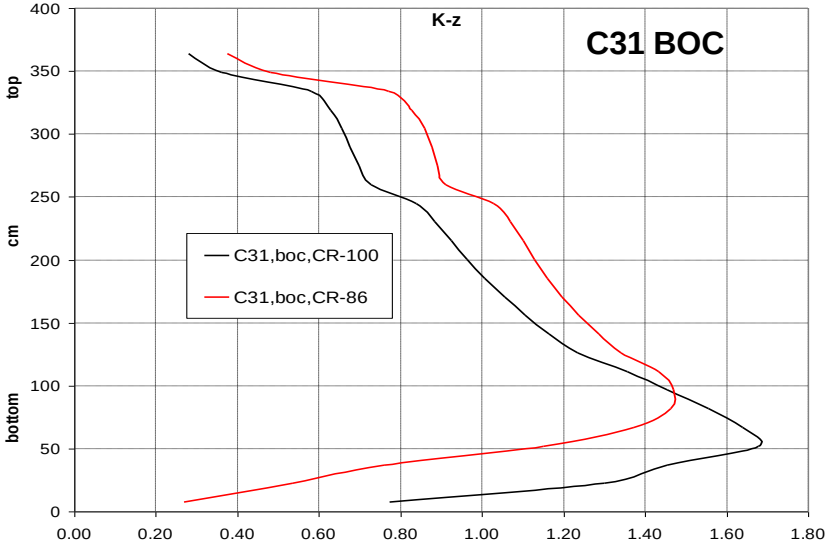
•Dynamic of the core w or cycle effect (c24 vs. c31), CR position eff 86%) and burnup effect (BOC vs. EOC). was found between the c24 core wi ou c31 with 86% CR out. The diff clearly du ent TPC.

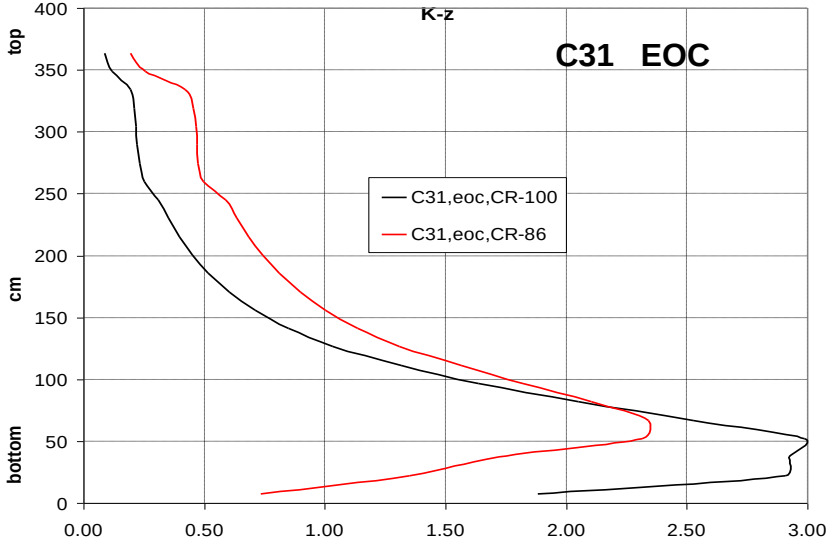
•THE OPE AT THE NEW CO DING AND CONTROL R D PATERN DOES NOT GNIFICANTLY EFFET THE REACTOR DYNAMIC BEHAVIOR

Steady state results









Axial Power profile is too bottom-skewed, causing large Peaking Factors