

RETRAN MARS

**Development of Nuclear Reactor Transient Analyzer
Based on Best-Estimate Codes, RETRAN and MARS**

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RETRAN MARS

가 가

Abstract

KAERI has developed a nuclear reactor transient analyzer based on the best-estimate system codes, RETRAN and MARS. The nuclear reactor transient analyzer consists of the best-estimate codes and the graphical user interface (GUI) for easy-to-use of these best-estimate codes. This paper presents various features of the GUI for nuclear reactor transient analyzer. The nuclear reactor transient analyzer is developed to assist all level of code users, ranging from beginner to experts, in their input preparations, code executions in a user-friendly basis, and output visualization to give an in-depth understanding of transient thermal-hydraulic behaviors in nuclear power plants. In addition, the interactive control function makes it possible to simulate operator actions during the transient simulation. This will extend its application to compact simulator.

1.

RELAP5, TRAC, CATHARE, RETRAN[1], MARS[2]

가

가

가

SNAP[3] RETRAN

PEGASYS[4]

RELAP5 TRAC

가 [5]. RETRAN 1, 2
 가 . MARS EPRI
 가 RETRAN .

(Nuclear Plant Analyzer)

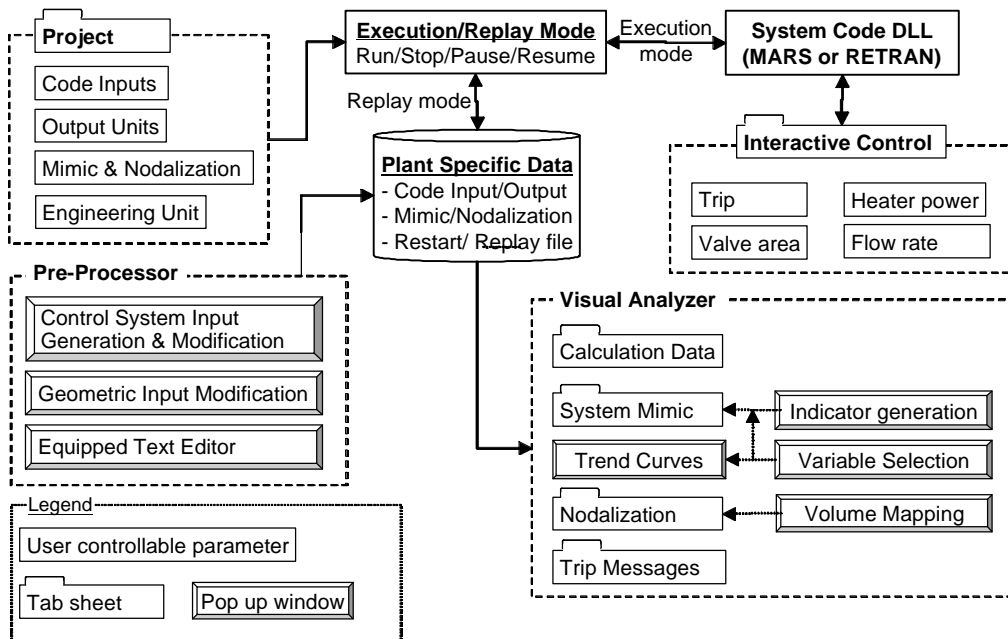
- RETRAN, MARS .
- .
- .
- Mimic, Nodalization, Trend graph Trip .
- .
- PC 가 가 .

2.

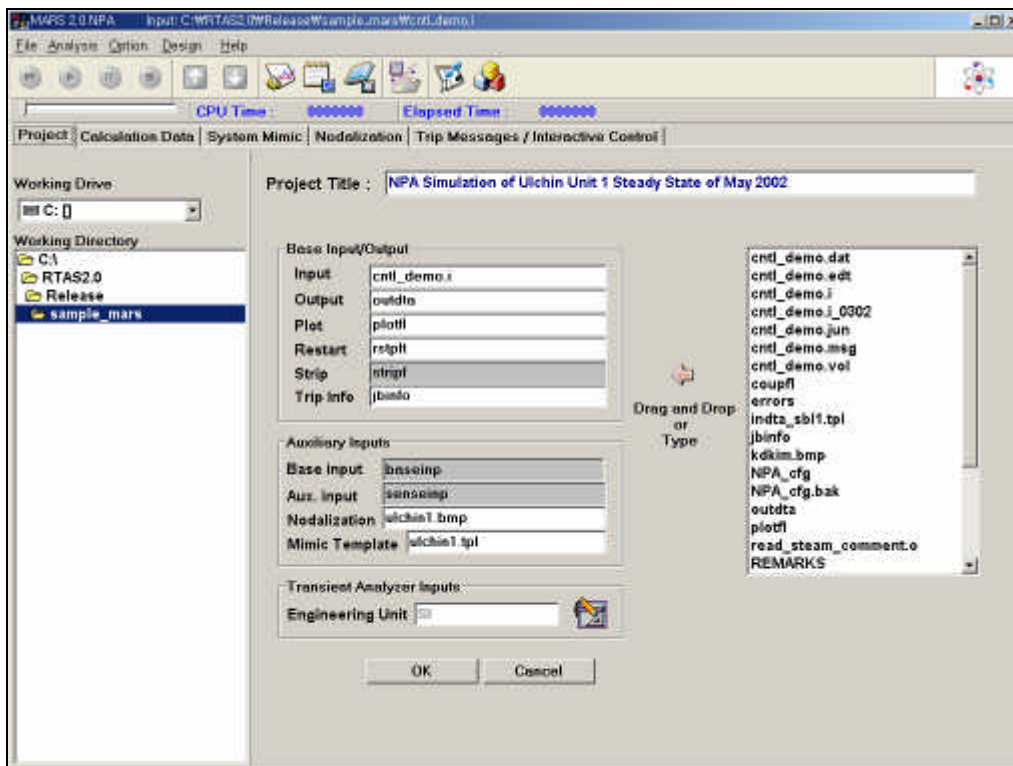
1 Project, Pre-processor, Execution control, Visualization Interactive Control .
 Project , , Plant Mimic template , Nodalization Bitmap
 Mapping , Pre-processor
 Project Tab ,
 , Pop-up . Execution control
 (Replay) / / /
 , Interactive Control
 Interactive control . Visual analyzer
 RETRAN MARS
 Mimic , Nodalization window NSSS
 , Trend .

3. Project

Project Tab Default project
 가 .
 2 .



1.



2. Project Tab ()

Project Tab
Nodalization

가

Drag-and-Drop

가

Plant Mimic

Project

가 SI British 가

Pop-up

3

Units	Conversion factors		
INDEX	SI	British	KORI-204
1	m ³	m ³	m ³
2	J/kg-K	Btu/lb-F	J/kg-K
3	m	ft	m
4	deg	deg	deg
5	KPa	mm-FHG	KPa
6	sec ² /km ²	sec ² /ft ²	sec ² /km ²
7	J	Btu	J
8	N-sec ² /m ⁵	lb-sec ² /ft ⁵	N-sec ² /m ⁵
9	kg/hr-sec	lb/hr-sec	kg/hr-sec
10	W/m ² -K	Btu/sec-ft ² -F	W/m ² -K
11	W/m ²	Btu/sec-ft ²	W/m ²
12	W/m ² -K	Btu/sec-ft ² -F	W/m ² -K
13	1/K	1/F	1/K
14	kg/hr-sec	lb/hr-sec	kg/hr-sec

3. Pop-up

4. Pre-Processor

Pre-processor

가, ii)

i)
, iii)

4.1

가
Control logic diagram
element

가 . 가
Control logic diagram element
Text Editor

가가
4
Logic diagram

4.2

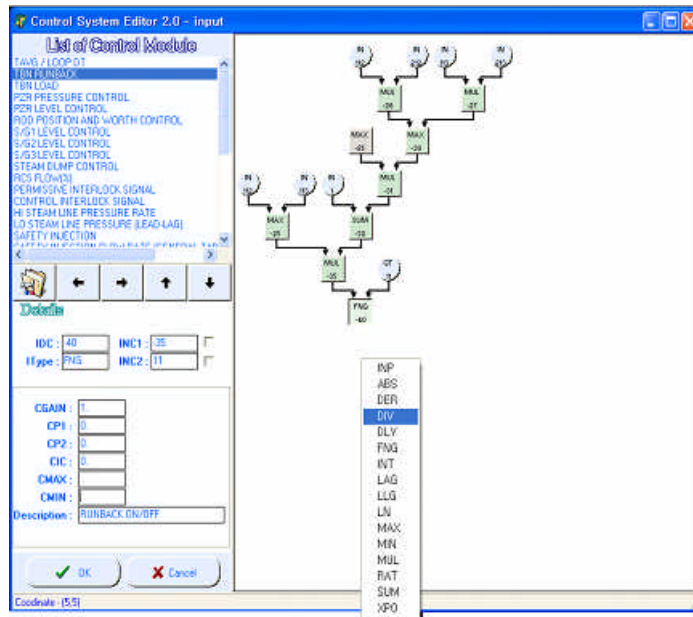
RETRAN MARS

Card

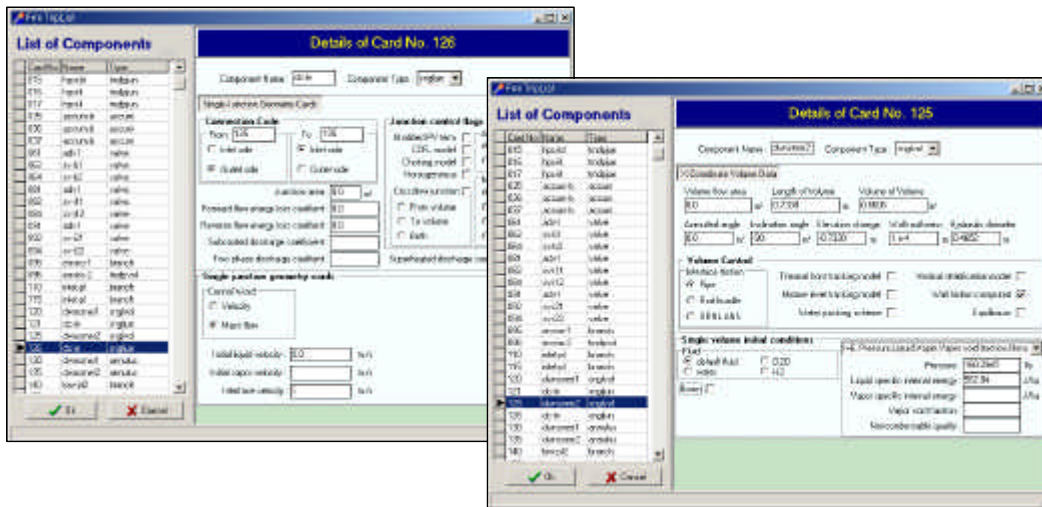
가

Pop-up

5



4.



5.

Pop-up

Design

가

4.3

가 Pop-up

가

가 UltraEditor가 UltraEditor Notepad

5. Execution Control

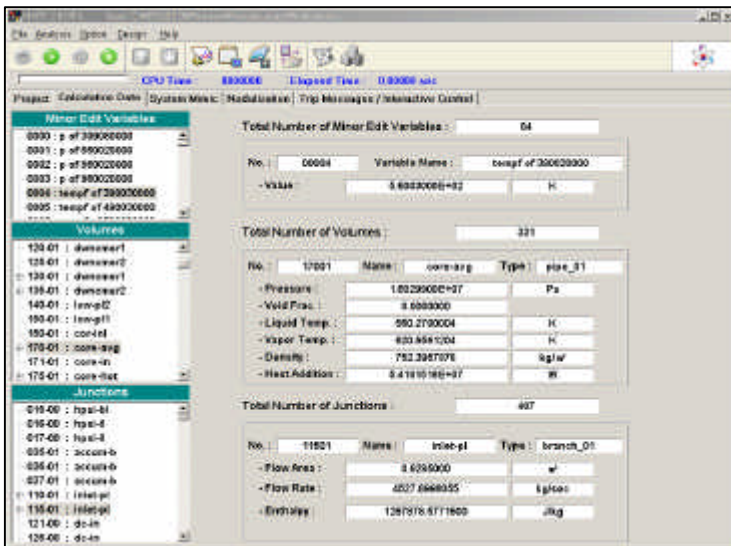
가 Project Tab
 , fast mode, slow mode 가
 Project Tab OK Button 가
 Tab page ,
 Pause , Pause
 I/O

6. Visual Analyzer

Visual Analyzer . Visual Analyzer i) Tab, ii)
 Mimic Tab, iii) Nodalization Tab, iv) Trend
 graph Pop-up , v) Trip Pop-up

6.1

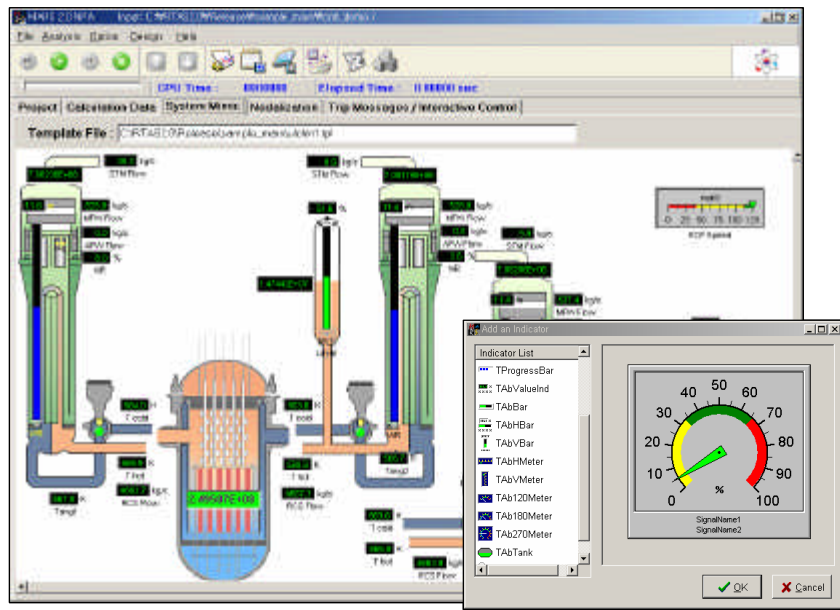
Minor edit
 Minor edit



Minor edit card
 description
 , RETRAN
 RETRAN
 Minor edit description
 가

6.2 Plant Mimic

가 .
 가 Mimic
 가 bitmap
 가
 가 mimic



7. Plant Mimic

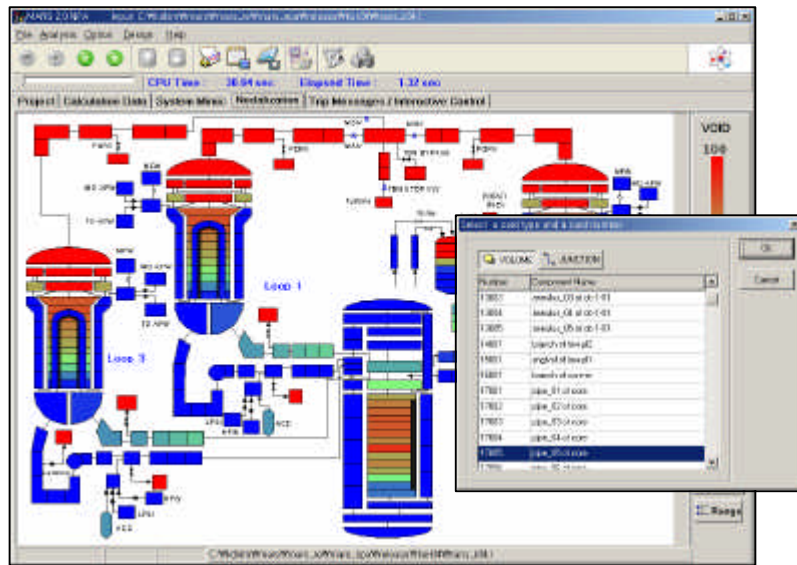
Pop-up

Plant mimic indicator
 'run-time object inspector'
 'assign value'
 mapping

6.3 Nodalization

Mimic Trend
 Nodalization
 Mimic 가
 가
 Mapping Pop-up
 Nodalization
 Mapping bitmap
 Mapping 가

click status bar



8. Nodalization Mapping Pop-up

6.4 Trip Message

Trip message
, scroll bar
message
(10).

Trip Trip
Trip message Trip
normal reset

6.5 Trend Graph

trend graph

Trend graph

. Trend graph
minor edit variable

. Trend graph

frequency

Trend graph

7. Interactive Control

- On/off : RCP ,
- Valve area : Dump valve, PORV
- : SI flow, Charging flow
- : 가

가

가

NSSS

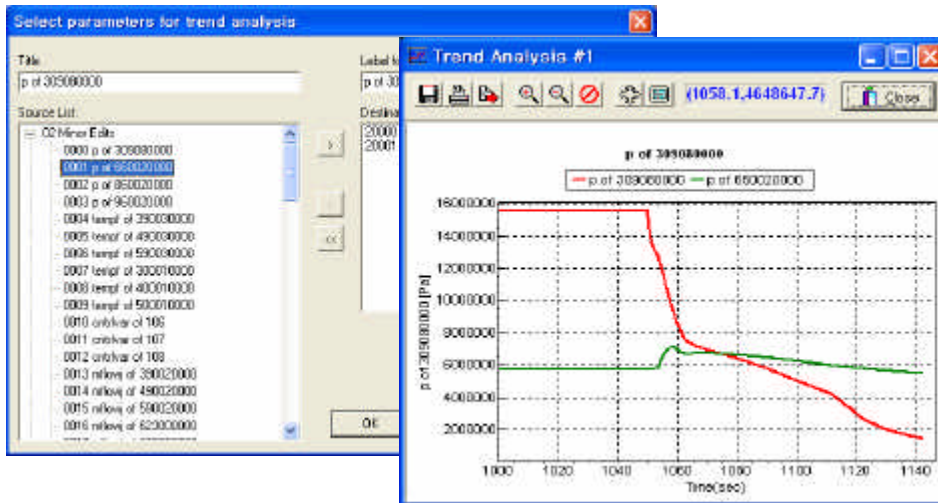
가

가

가

Interactive Control

Compact Simulator



9. Trend Graph

가

“ (Interactive control window) ” 가
 “ ” 가
 On/off On Off (True or False) On/off
 area, , (Valve
 Target value Rate (10).

가
가

Trip Messages		Interactive Control					
Time(sec)	ID	Trip condition	Description	Value	Auto/Manual	Trip Target	Setpoint/Time
7.4375e+1	050	T	PCS LB PRESS BEV TRIP	0.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
8.0600e+1	052	T	PCS 1 LB FLOW TRIP	0.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
8.0600e+1	148	T	RR TRIP	0.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
8.4100e+1	022	T	PCS LB PRESS TRIP	True	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.2800e+1	050	T at 2.0000e+8	Rebo begins to drop		<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.8000e+1	548	T at 1.0000e+0	Manual TRIP TRIP	True	<input type="checkbox"/> Auto <input checked="" type="checkbox"/> Manual	10.00	0.00
9.8500e+1	190	T	TRIP TRIP	True	<input type="checkbox"/> Auto <input checked="" type="checkbox"/> Manual	10.00	0.00
9.7650e+1	025	T	PCS 1.1 PRESS TRIP	True	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.8800e+1	496	T at 5.0000e+1	SI (RRTR)		<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9800e+1	240	T	Lowflow Trip	0.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9800e+1	758	T	RRU TRIP	0.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9800e+1	755	F	RRU ON/OFF		<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9800e+1	040	T	PCS LB LVL TRIP	0.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9800e+1	051	T at 9.0000e+0	RRTR Trip	9.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9800e+1	050	T at 9.0000e+0	RRTR Trip	9.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9800e+1	050	T at 9.0000e+0	RRTR Trip	9.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9775e+1	180	T at 8.0000e+0		8.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9775e+1	180	T at 8.0000e+0		8.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9775e+1	180	T at 8.0000e+0		8.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9775e+1	180	T at 8.0000e+0		8.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9775e+1	180	T at 8.0000e+0		8.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9775e+1	180	T at 8.0000e+0		8.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00
9.9775e+1	180	T at 8.0000e+0		8.000	<input checked="" type="checkbox"/> Auto <input type="checkbox"/> Manual	10.00	0.00

10. Trip Message Interactive Control

4.

가 가
가 가
가 가
가 가
가 가
Interactive Control 가
Compact simulator
3, 4 가
가 가

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2. Jeong, J.J., et al., "Development of a Multi-Dimensional Thermal-Hydraulic System Code, MARS 1.3.1", Annals of Nuclear Energy, 26, 1611-1642, 1999.
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