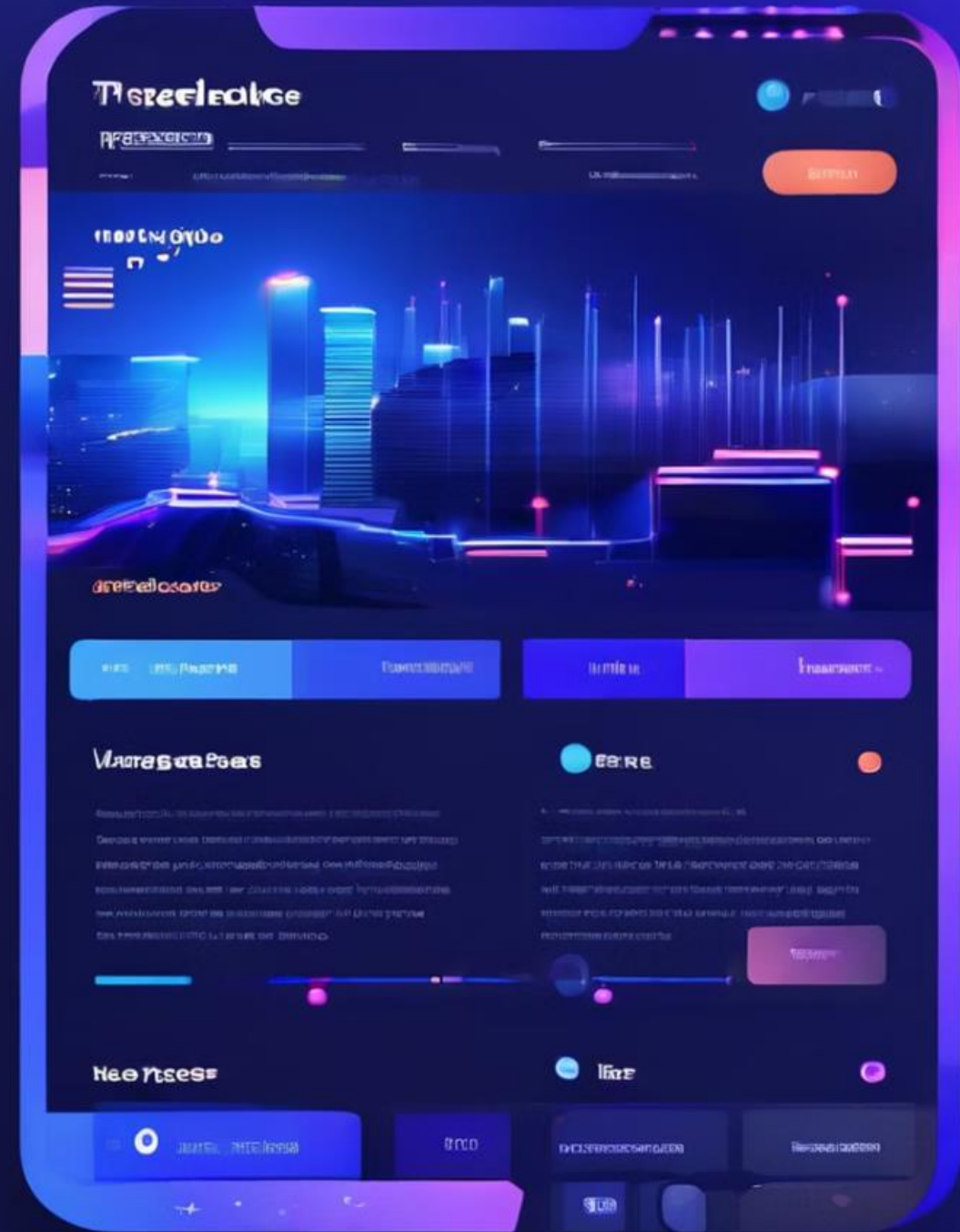


# Integrated Development Environment for SPACE Problem Analysis



by C. S. Jang





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## 2 Method and Results

## 3 Conclusions

### 1 Introduction

#### Background

#### Current procedures

- Writing SPACE input in a typical text editor, separately
- Running SPACE, separately
- Checking syntax errors, separately
- Analyzing calculation results using plotting tools, separately
- Tedious routines doing above steps

#### New procedures

- Writing SPACE input in the IDE (AESPA)
- Running SPACE on AESPA
- Checking syntax errors by AESPA
- Analyzing calculation results in AESPA
- No tedious job, it's really dynamic.



### 2 Method and Results

#### Technologies used

- C++ computer language is the main tool for developing the AESPA
- Object-oriented programming technique
- Qt frameworks for graphic user interface. Many classes are subclassed from Qt classes
- A few number of third party source codes referred for Excel, plotting, etc.
- To read and write the bunch of data, the parallel processing supported by C++ is adopted.
- Download : <https://github.com/jcsu1835/AESPA/blob/main/README.md>

### 3 Conclusions

#### Future of AESPA

|                        |   |
|------------------------|---|
| Maintenance            | Fix hidden bugs and errors  |
| Upgrade error notices  | Make more intelligent and accurate error notices  |
| More advanced link map | <ul style="list-style-type: none"><li>• Introduce link map of C++, Qt and Qt component</li><li>• Introduce path finding logic for links between nodes</li><li>• Introduce rich color map for large scale diagrams</li></ul> |
| Enhance the plot       | Introduce another kinds of plot   |

Free Download : <https://github.com/jcsu1835/AESPA/blob/main/README.md>



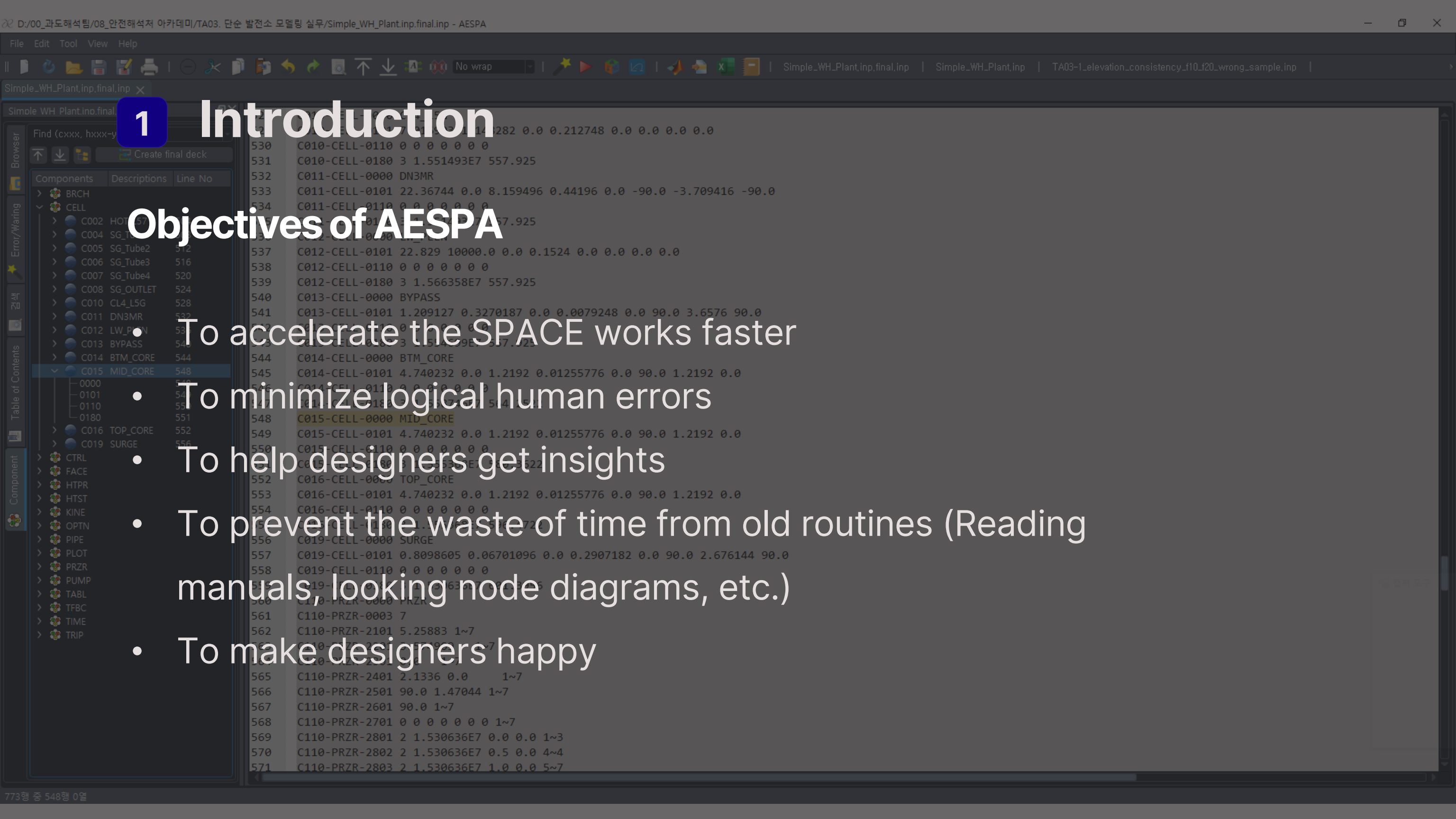
# 1 Introduction

## Background

- Current procedures**
- Writing SPACE input in a typical text editor, separately
  - Running SPACE, separately
  - Checking syntax errors, separately
  - Analyzing calculation results using plotting tools, separately
  - Tedious routines doing above steps

- New procedures**
- Writing SPACE input in the IDE (AESPA)
  - Running SPACE on AESPA
  - Checking syntax errors by AESPA
  - Analyzing calculation results in AESPA
  - No tedious job. It's really dynamic.

Advanced  
Editor for  
SPACE  
Problem  
Analysis



# 1 Introduction

## Objectives of AESPA

- To accelerate the SPACE works faster
- To minimize logical human errors
- To help designers get insights
- To prevent the waste of time from old routines (Reading manuals, looking node diagrams, etc.)
- To make designers happy



## 2 Method and Results

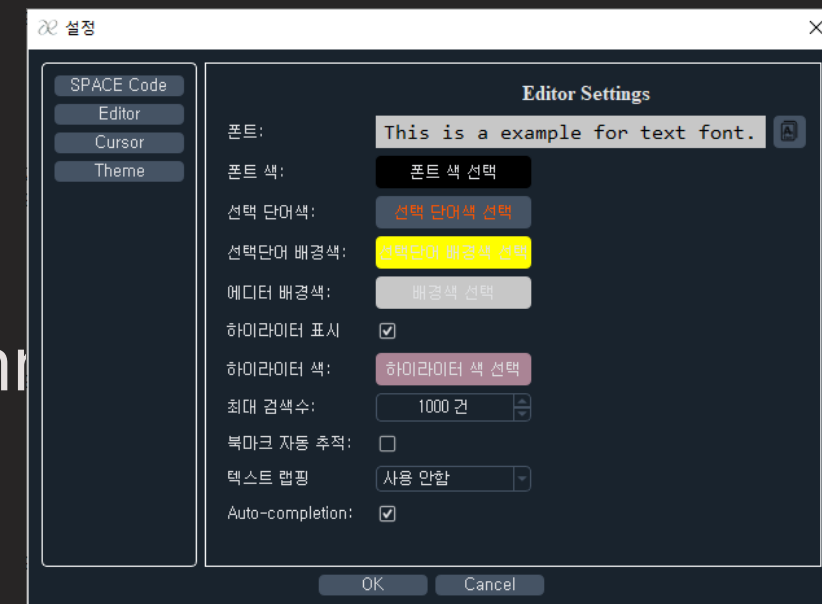
### Technologies used

- C++ computer language is the main tool for developing the AESPA
- Object-oriented programming technique
- Qt frameworks for graphic user interface. Many classes are subclassed from Qt classes
- A few number of third party source codes referred for Excel, plotting, etc.
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## 2 Method and Results

### 2-1. Input Edit Funtion (1)

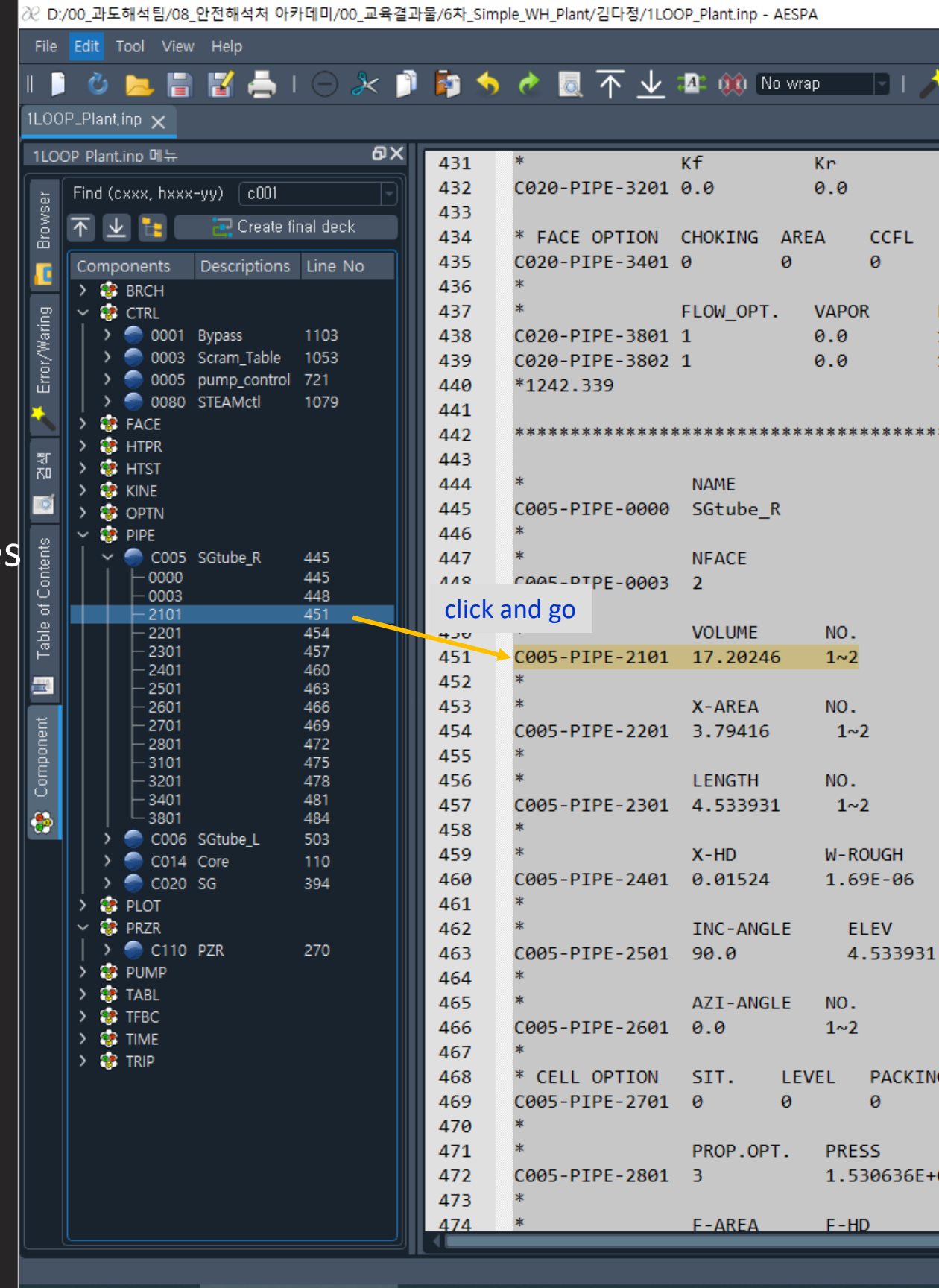
- One of main functions of the AESPA
- Edit, insert, replace, find, delete, copy, paste on rows
- Edit, insert, replace, find, delete, copy, paste on column
- Drag-n-drop system is adopted.
- Redo-undo stack technologies supports
- Texts zoom-in and zoom-out
- The appearance of editor such as font, font colors, background color, etc., can be customized by users.



## 2 Method and Results

### 2-1. Input Edit Function (2)

- Automatic input organizing
  - Input file with no errors
  - Generates input categorization based on component types
  - Supports Click-n-Go
  - Browser keeps inputs up to date
- SPACE input template support
  - Automatically insert minimum required inputs
  - SPACE input template including =, @, OPTN, TIME
  - Reduce designer's working time



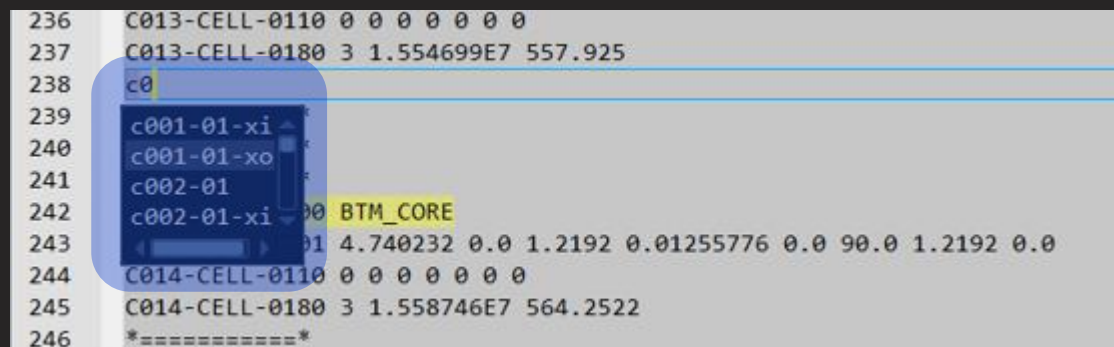




## 2 Method and Results

### 2-1. Input Edit Function (4)

- Auto-completion mechanism
  - searches important keywords automatically
  - recommends words after typing 2 characters
  - Designers can know which components were already used.



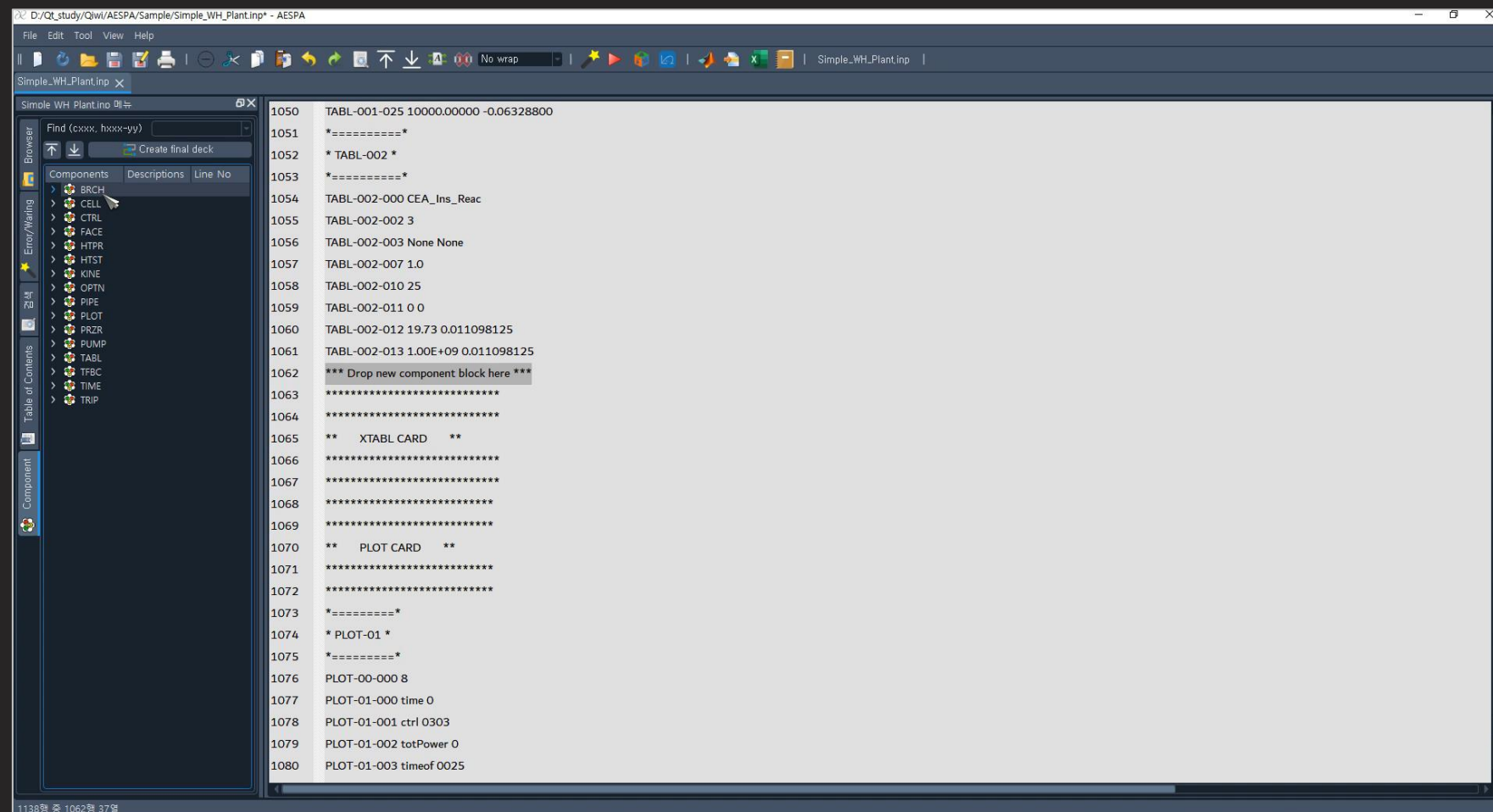
```
236 C013-CELL-0110 0 0 0 0 0 0
237 C013-CELL-0180 3 1.554699E7 557.925
238 c0
239 c001-01-xi
240 c001-01-xo
241 c002-01
242 c002-01-xi BTM_CORE
243 01 4.740232 0.0 1.2192 0.01255776 0.0 90.0 1.2192 0.0
244 C014-CELL-0110 0 0 0 0 0 0
245 C014-CELL-0180 3 1.558746E7 564.2522
246 *=====*
```



## 2 Method and Results

### 2-1. Input Edit Function (6)

- Copying component block
  - Copy latest component input among same multiple inputs
  - Just select component and drag-n-drop it at designated line



## 2 Method and Results

### 2-2. Input Errors Check

- Checking the input errors before execution of SPACE code
  - Display warnings or errors under the line of related input
  - Can fix a problem with on-click user's manual quickly

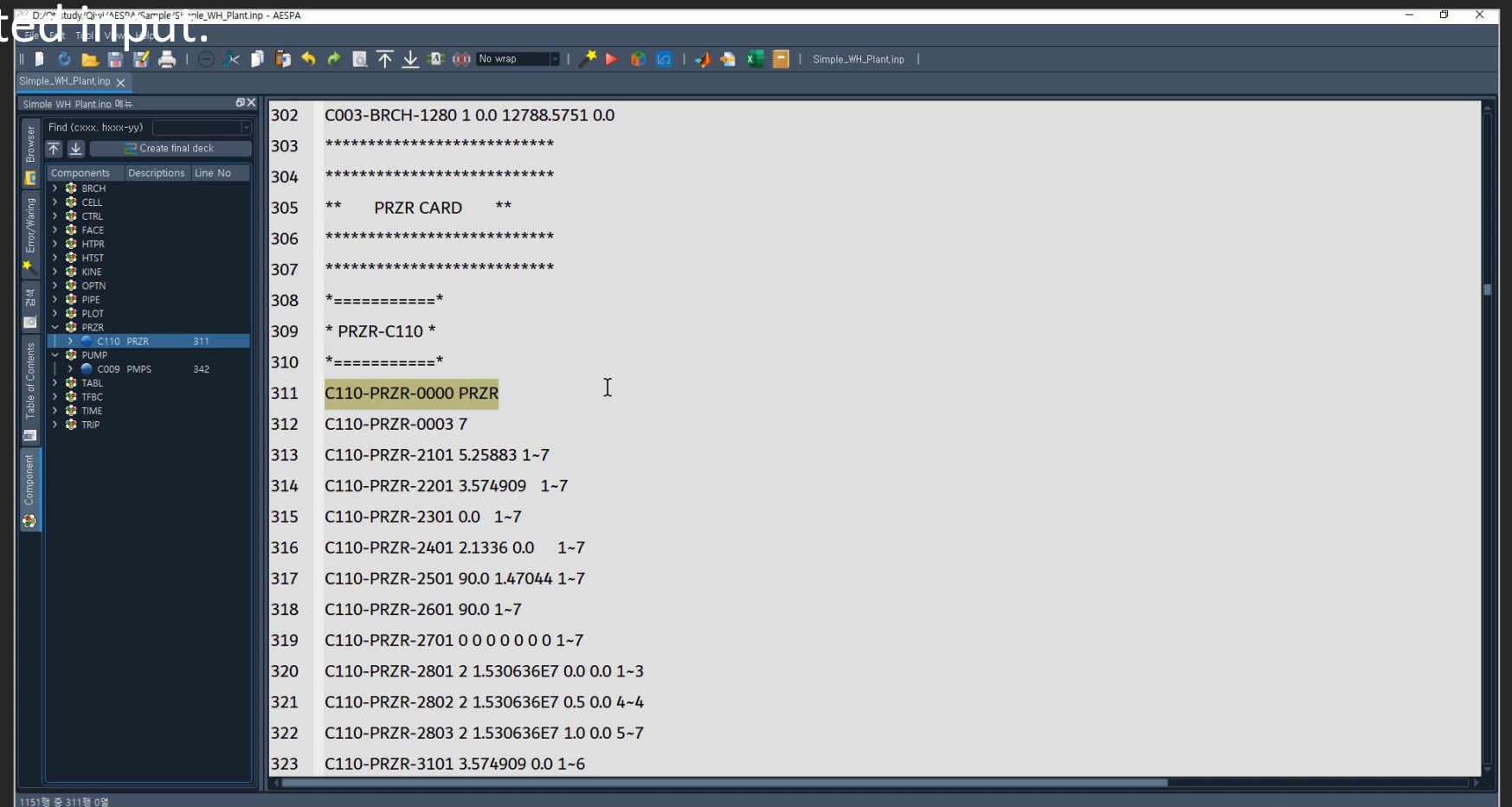
```
750 HTPR-004-000 INCONEL-600
Warning!!! HTPR-004-000 (INCONEL-600) : Nuclear fuel property name must have uo2, gap, zirc.
If this property is not for nuclear fuel, the warning can be ignored. If not, you must edit.
Wrong name for nuclear fuel property causes wrong fuel temperatures.
751 HTPR-004-001 373.15 17.30735
```

```
937 CTRL-0002-00 T_AVG sum 0.5 576.4861 1
938 CTRL-0002-01 0.0 1.0 t_liq c222-01
Error: CTRL-0002-01 : c222-01 not exists.
Data1(R) A0 : 상수
Data2(R) A1 : multiplier
Data3(C) 변수명 키워드
Data4(C) 변수명 파라미터
```

## 2 Method and Results

### 2-3. On-Click Node Diagram Generation (1)

- Display the node diagram of a selected one
  - for CELL, BRCH, PUMP, PIPE, PRZR, SEPR
  - copy and paste diagram as image into document
  - click-n-go to navigate the related input.
  - help designers get insights

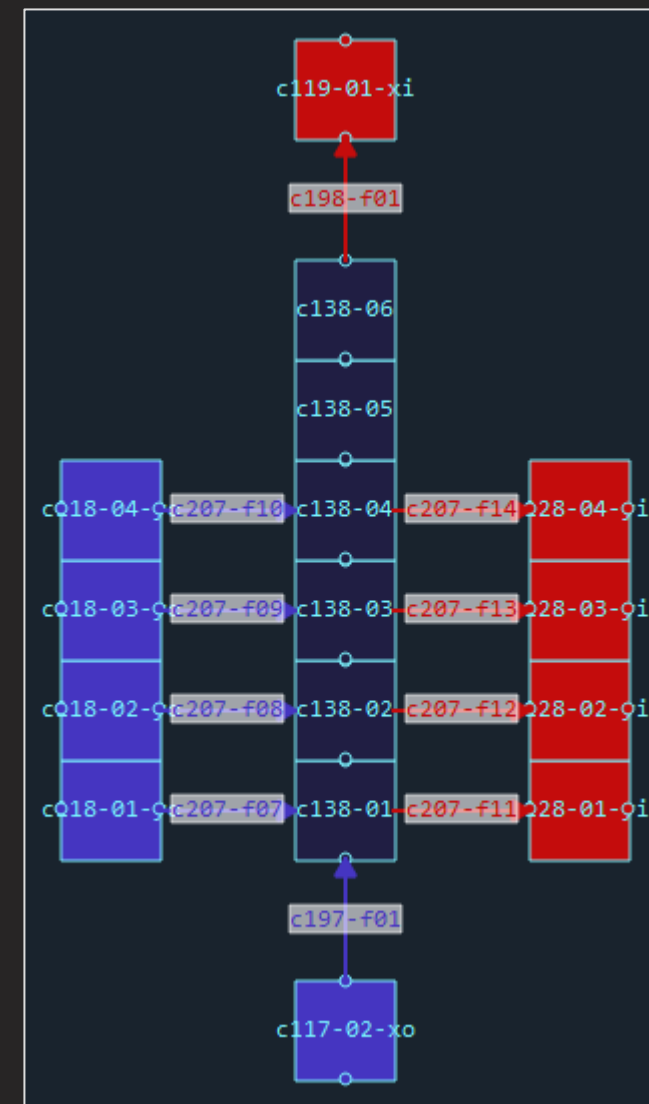
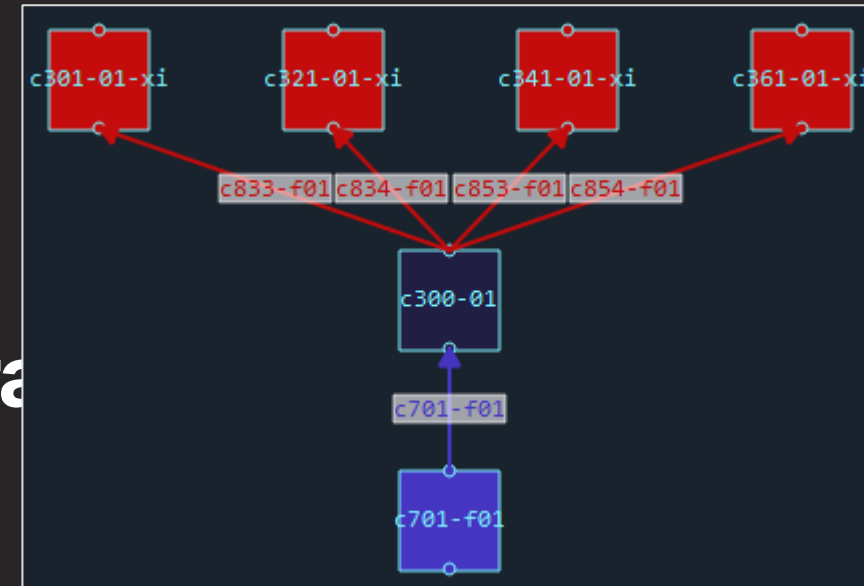
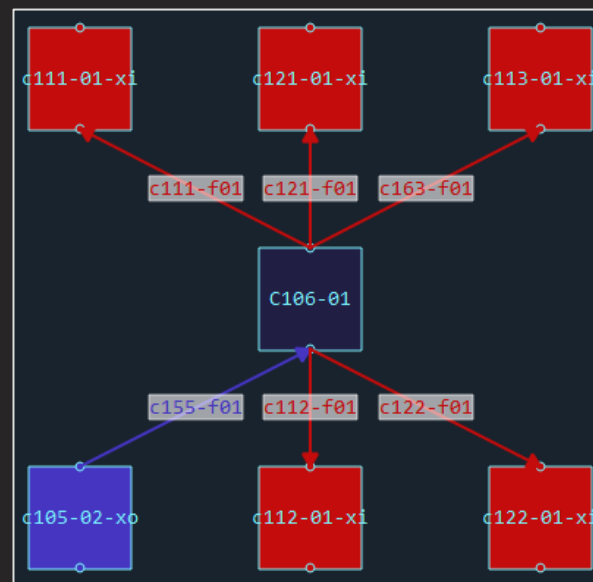




## 2 Method and Results

### 2-3. On-Click Node Diagram Generation

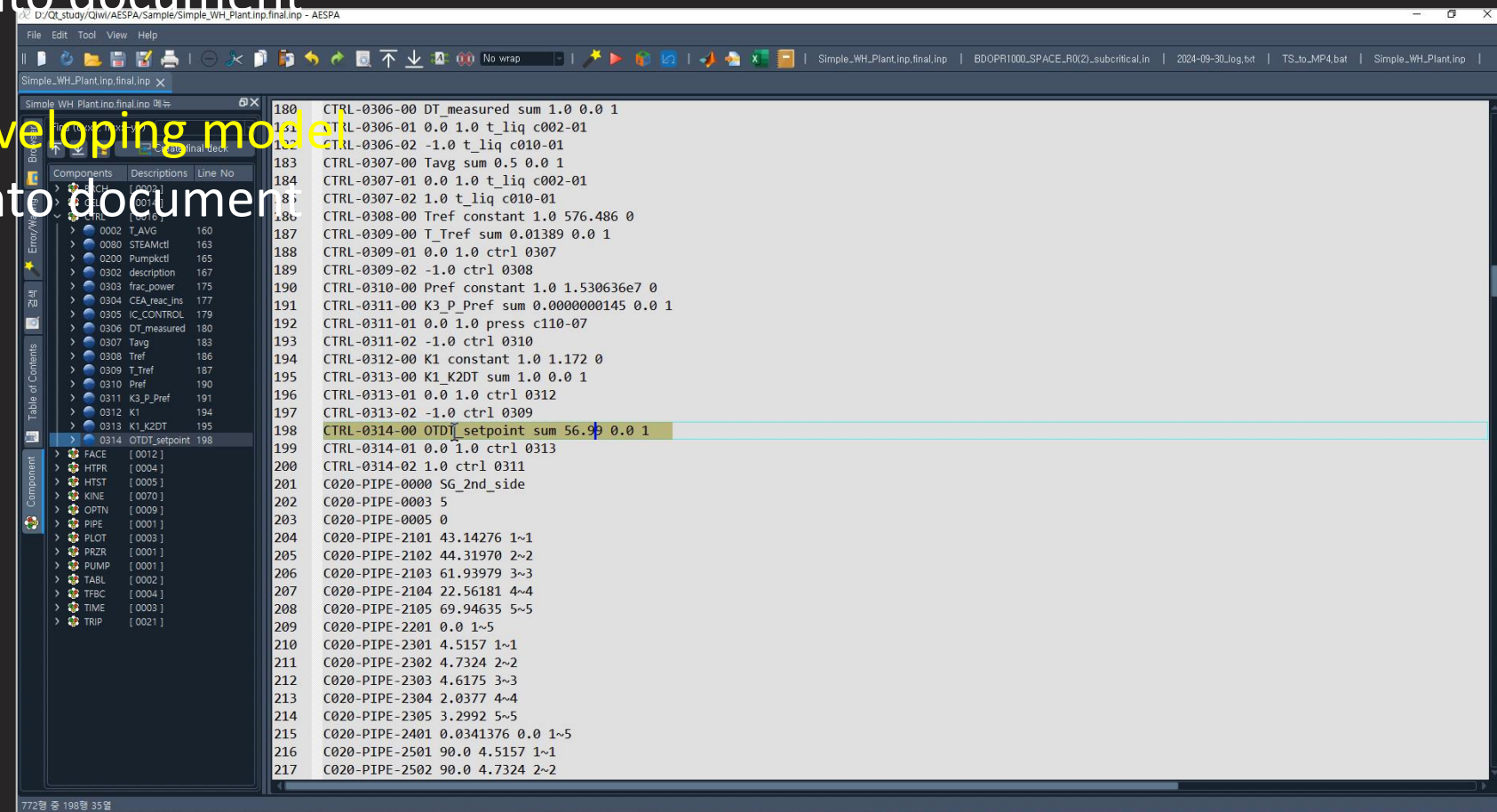
- Zoom-in and Zoom-out
- Moving
- It's hard to draw by hand.



## 2 Method and Results

### 2-4. On-Click Controller Diagram Generation (1)

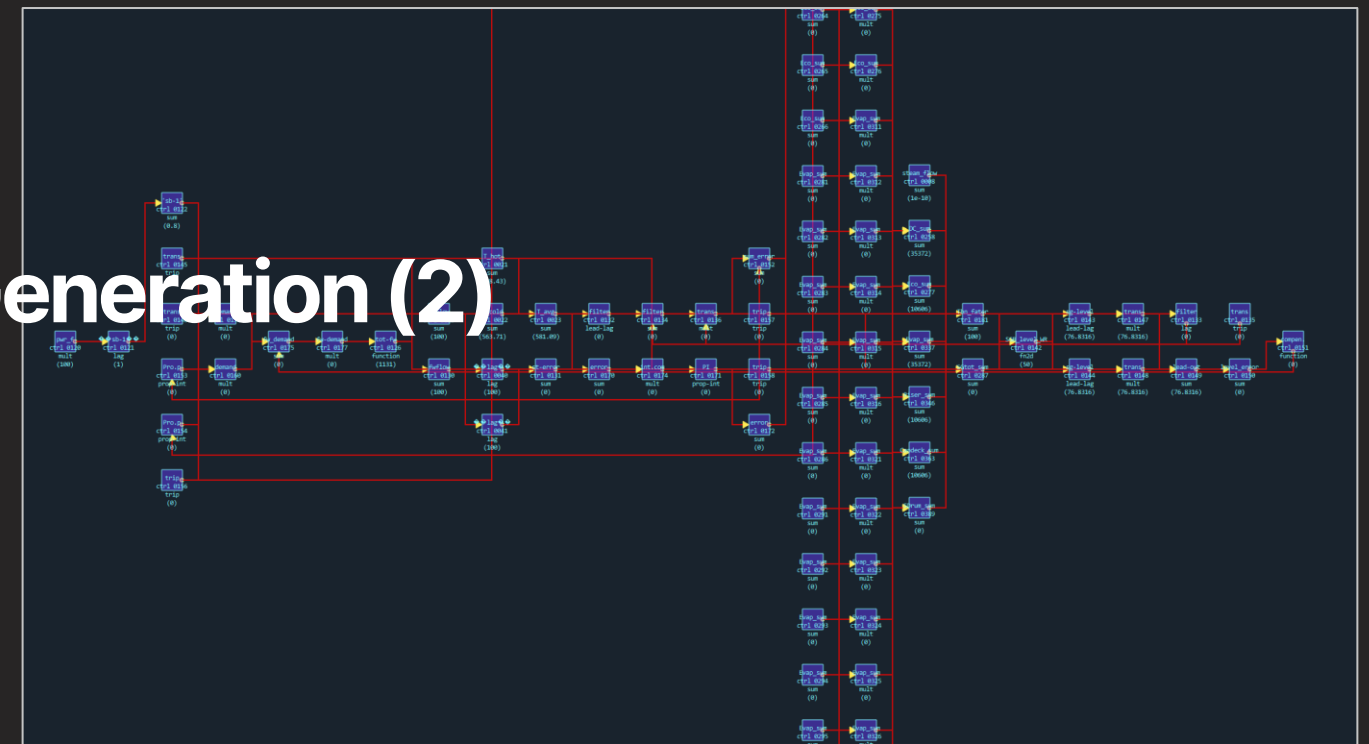
- Display the CTRL node diagram of a selected controller
  - diagram shows description, controller ID, type and initial value (target value)
  - click-n-go to navigate the related input.
  - copy and paste diagram as image into document
  - moving, zoom-in, zoom-out
  - help designers get insights while developing model
  - copy and paste diagram as image into document



## 2 Method and Results

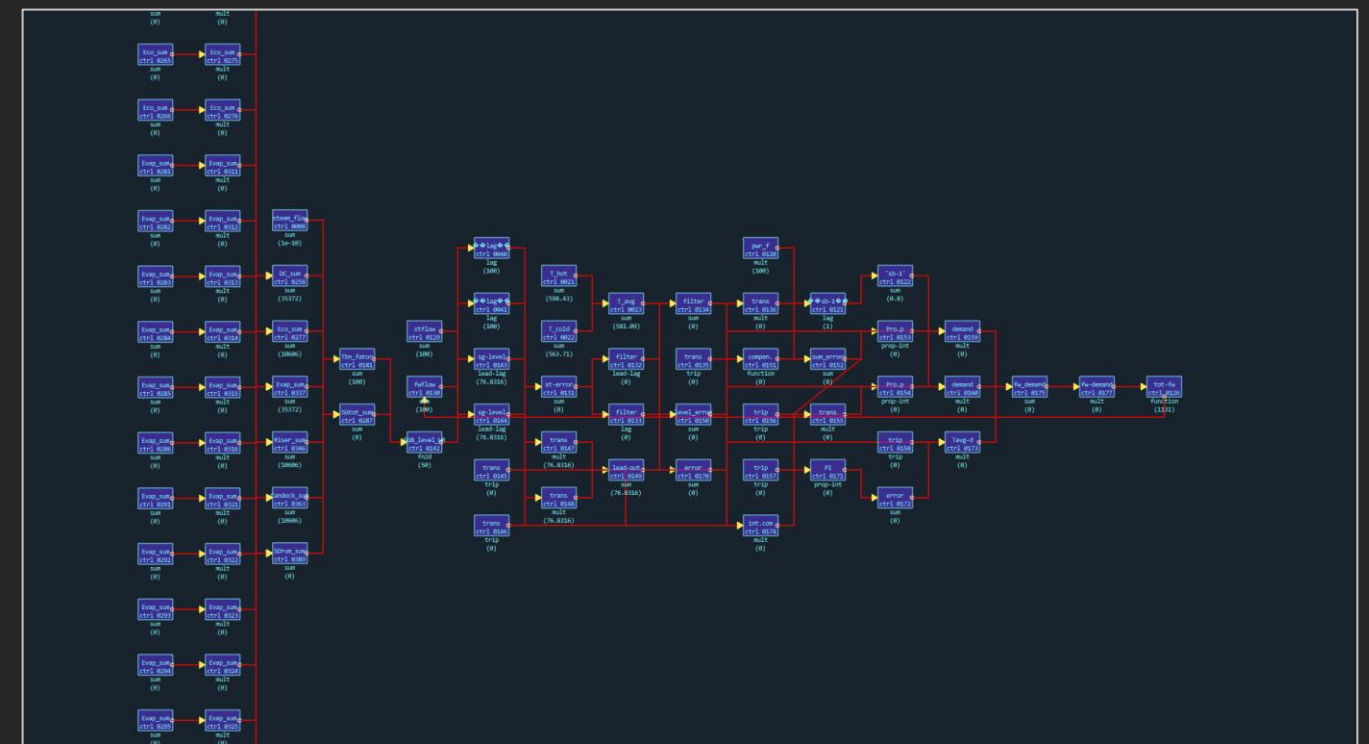
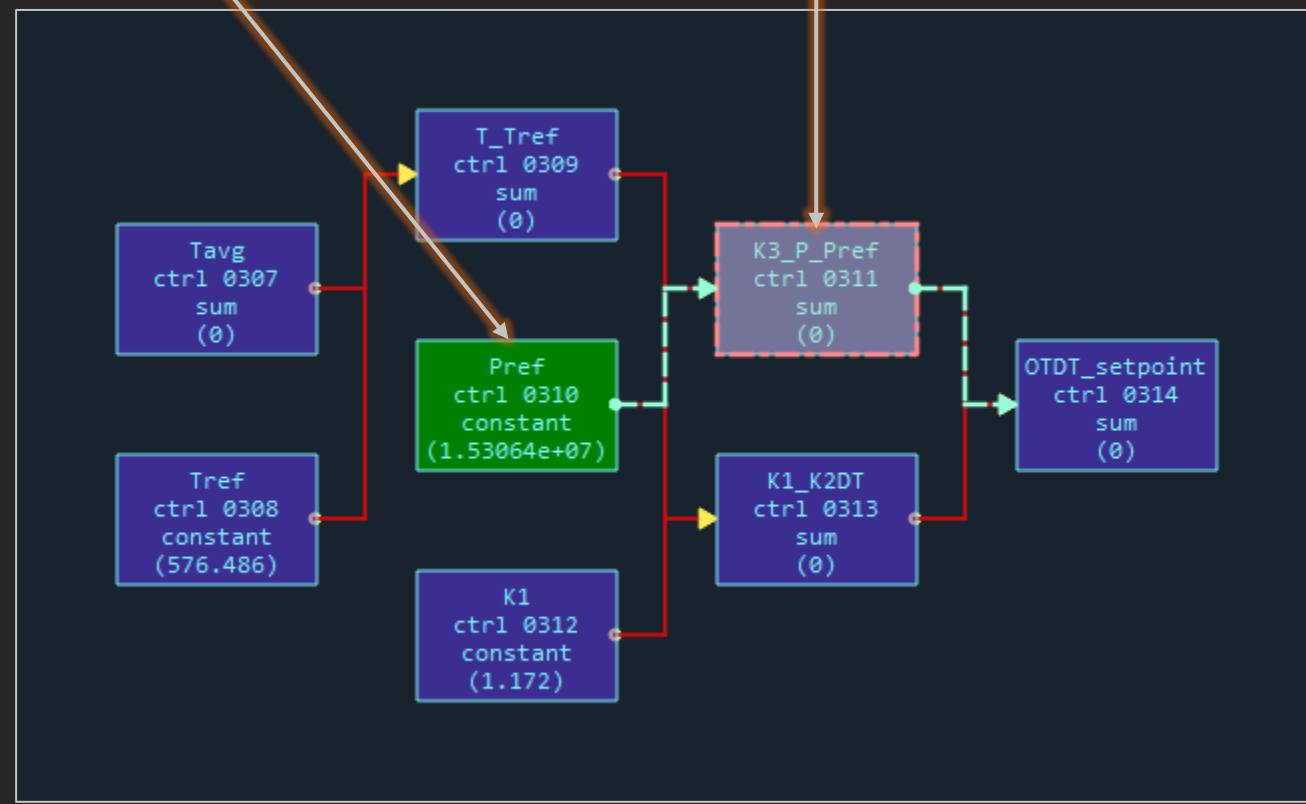
### 2-4. On-Click Controller Diagram Generation (2)

- Samples : from simple to complex



Clicked node to survey

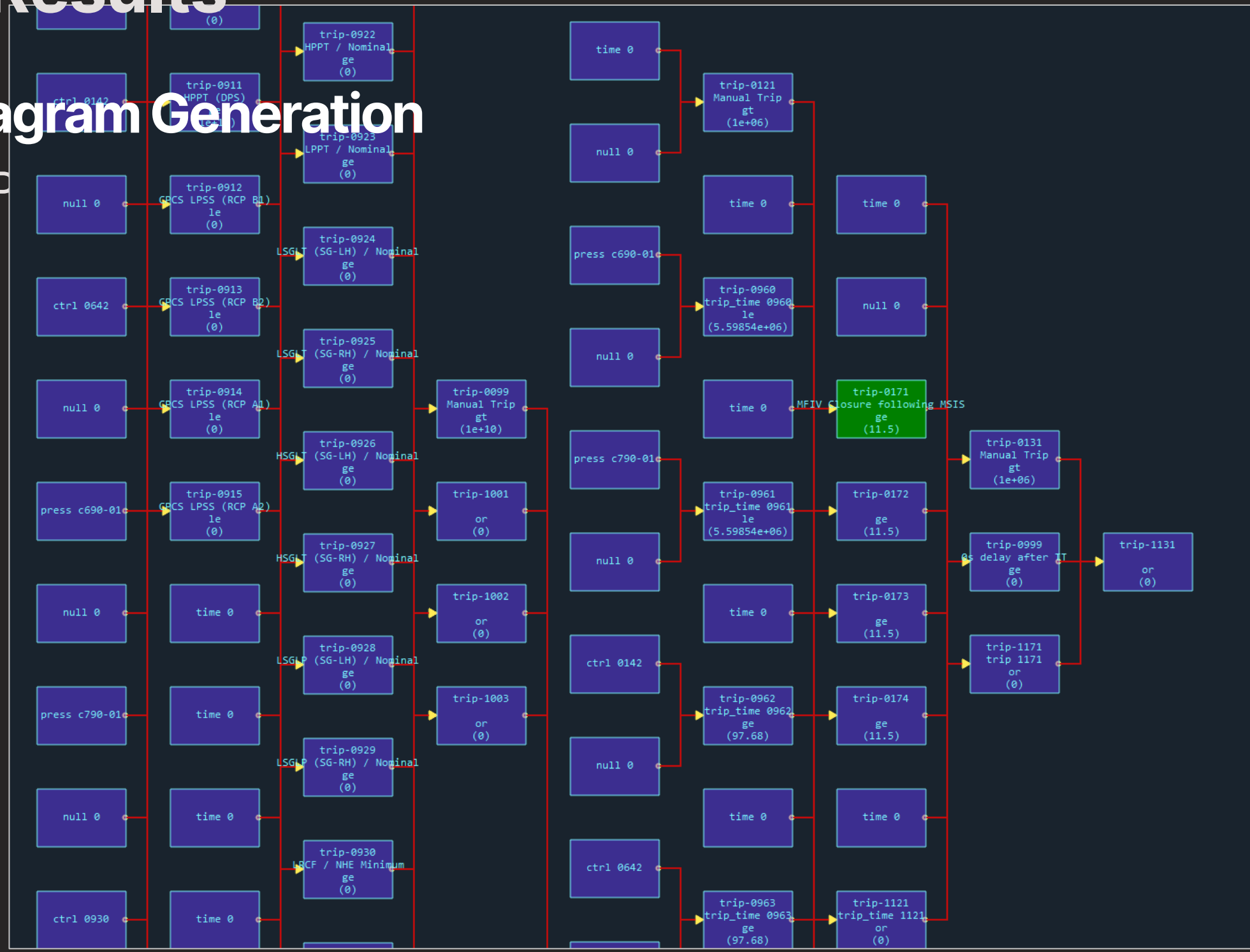
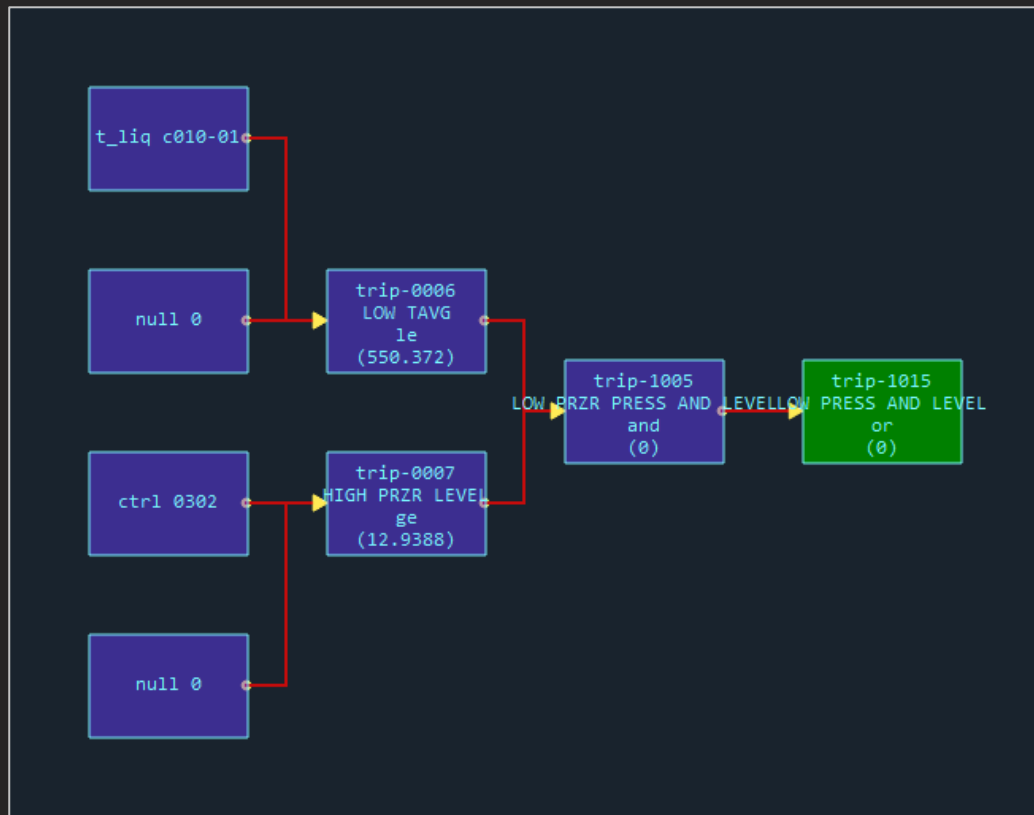
Selected CTRL by user



## 2 Method and Results

### 2-5. On-Click Trip Diagram Generation

- Link diagram for TRIP

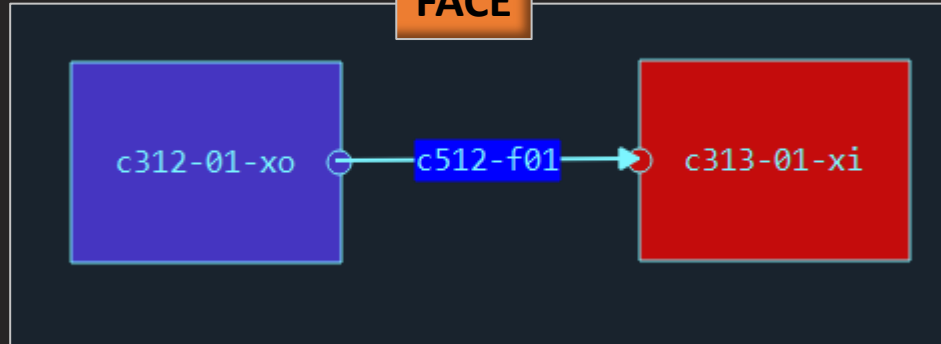


## 2 Method and Results

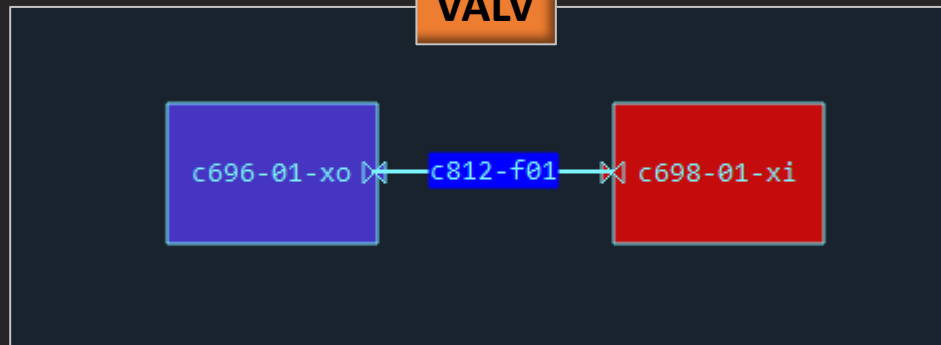
### 2-6. On-Click Face Diagram Generation

- Link diagram for FACE, VALV, MFACE, TFBC

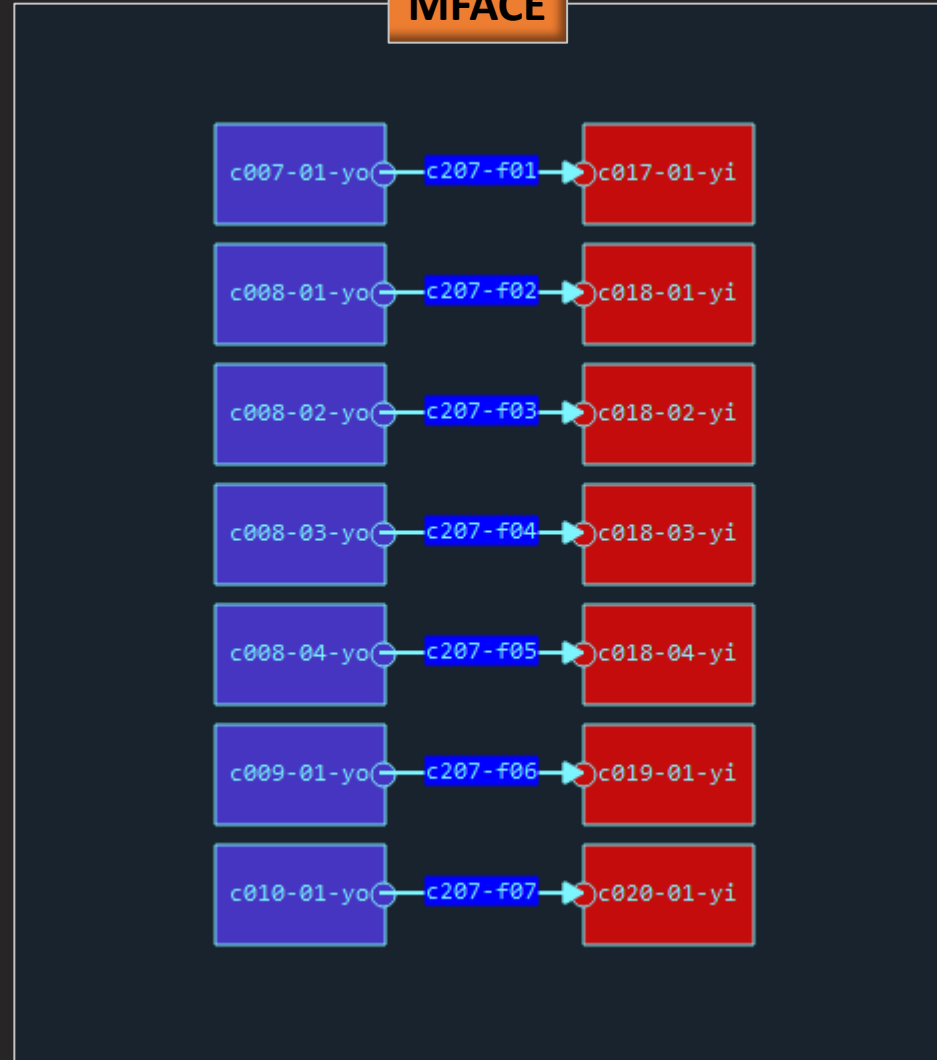
FACE



VALV



MFACE



TFBC

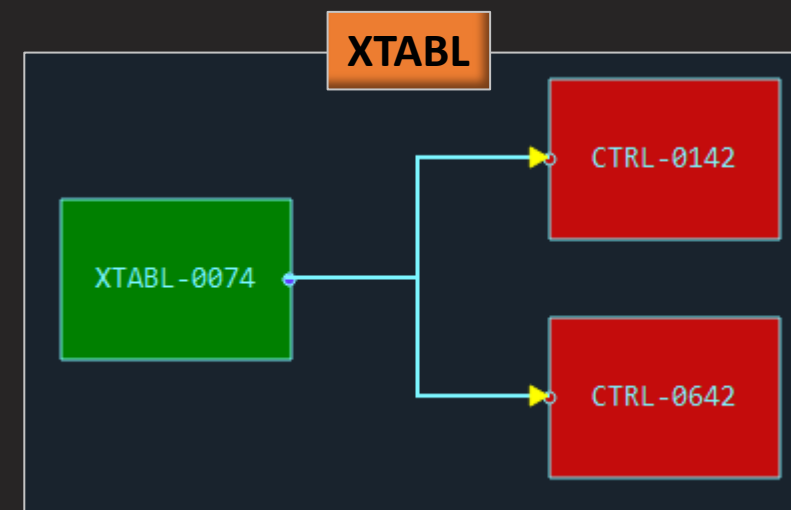
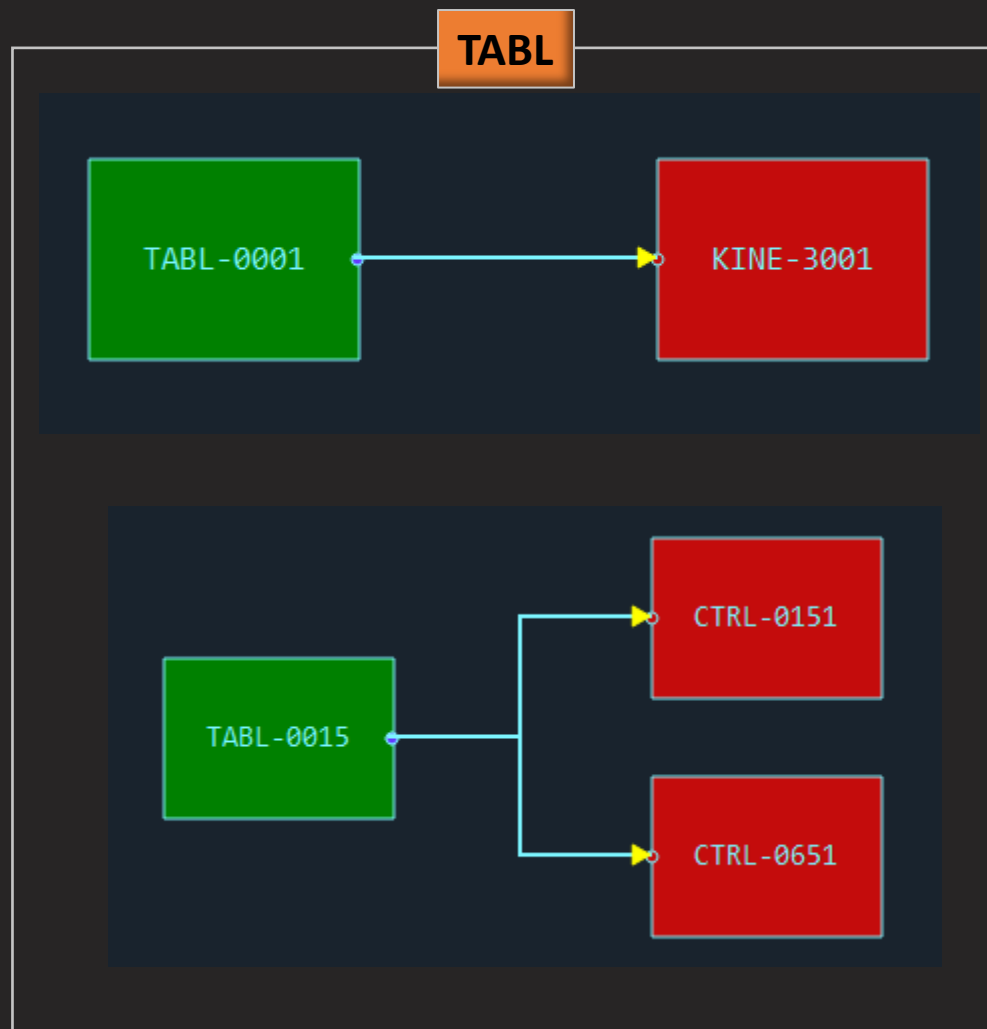




## 2 Method and Results

### 2-7. On-Click Table Diagram Generation

- Link diagram for TABL, XTABL



# 2 Method and Results

## 2-8. Execution of SPACE code with real-time plots

The screenshot shows a software interface with a code editor on the right and a component browser on the left. The code editor displays a table of plot data with the following content:

```
154 *****  
155 *****  
156 *****  
157 ** XTABL CARD **  
158 *****  
159 *****  
160 *****  
161 *****  
162 ** PLOT CARD **  
163 *****  
164 *****  
165 *=====  
166 * PLOT-01 *  
167 *=====  
168 PLOT-00-000 8  
169 PLOT-01-000 time 0  
170 PLOT-01-001 press C001-01  
171 PLOT-01-002 a_vap C001-01  
172 PLOT-01-003 a_vap C001-08  
173 PLOT-01-004 mflow C001-f01  
174 PLOT-01-005 mflow C001-f02  
175 PLOT-01-006 mflow C001-f03  
176 PLOT-01-007 mflow C001-f04  
177 PLOT-01-008 mflow C001-f05  
178 PLOT-01-009 mflow C001-f06  
179 PLOT-01-010 mflow C001-f07  
180 PLOT-01-011 press C001-04  
181 *****  
182 * Profiling Plot *  
183 *****  
184 PLOT-02-001 time 0
```

The component browser on the left shows a tree structure with the following components:

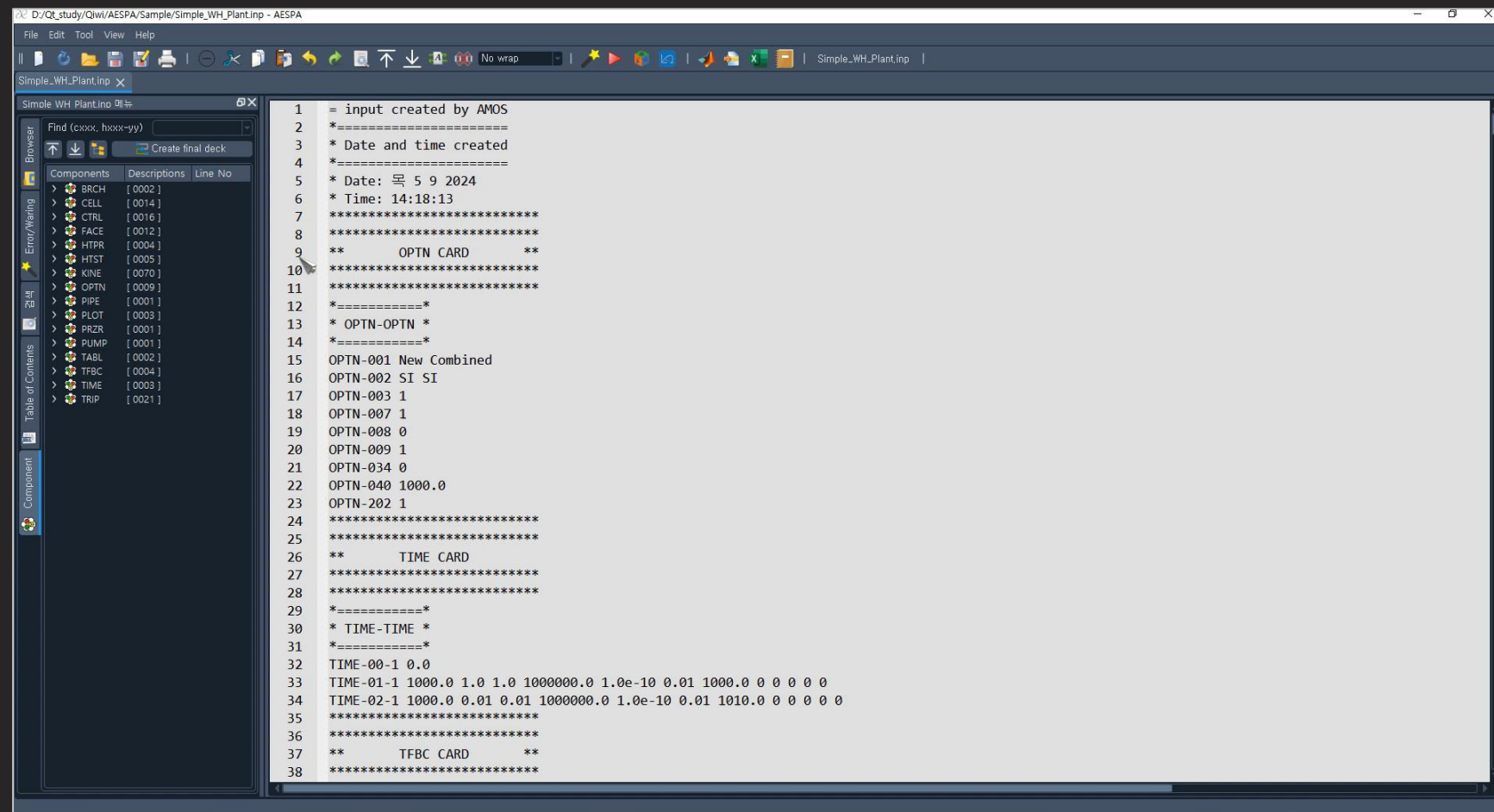
- OPTN
- PIPE
- PLOT
  - 00 168
  - 01 169
  - 02 184
- TFBC
- TIME
- TRIP

The status bar at the bottom left indicates 194 lines and 166 columns.

## 2 Method and Results

### 2-9. File and Directory Comparisons (1)

- Compare files to know the differences
- 3 files can be compared at one time
- Clean input deck generation for fancy comparisons



```
1 = input created by AMOS
2 *=====
3 * Date and time created
4 *=====
5 * Date: 목 5 9 2024
6 * Time: 14:18:13
7 *****
8 *****
9 **      OPTN CARD      **
10 *****
11 *****
12 *=====
13 * OPTN-OPTN *
14 *=====
15 OPTN-001 New Combined
16 OPTN-002 SI SI
17 OPTN-003 1
18 OPTN-007 1
19 OPTN-008 0
20 OPTN-009 1
21 OPTN-034 0
22 OPTN-040 1000.0
23 OPTN-202 1
24 *****
25 *****
26 **      TIME CARD      **
27 *****
28 *****
29 *=====
30 * TIME-TIME *
31 *=====
32 TIME-00-1 0.0
33 TIME-01-1 1000.0 1.0 1.0 1000000.0 1.0e-10 0.01 1000.0 0 0 0 0 0
34 TIME-02-1 1000.0 0.01 0.01 1000000.0 1.0e-10 0.01 1010.0 0 0 0 0 0
35 *****
36 *****
37 **      TFBC CARD      **
38 *****
```

## 2 Method and Results

### 2-9. File and Directory Comparisons (2)

```
Edwards_Pipe.inp - Edwards_pipe_cellWise.inp
D:\과도해석부#08_안전해석처 아카데미#TA02. 프로젝트 기반 모델링 실무#01_Edwards_Pipe#CELL_model#Edwards_Pipe.inp
D:\과도해석부#08_안전해석처 아카데미#TA02. 프로젝트 기반 모델링 실무#01_Edwards_Pipe#Cell_wise_PIPE_model#Edwards_pipe_cellWise.inp

*****
*****
**      OPTN CARD      **
*****
*****

OPTN-001 New Steady
OPTN-002 SI SI
OPTN-004 1 * Semi-Implicit
OPTN-003 1
OPTN-007 1
OPTN-008 0
OPTN-034 0
OPTN-202 0
*****
*****
**      TIME CARD      **
*****
*****

TIME-00-1 0.0
TIME-00-2 99
TIME-01-1 1000.0 0.005 10.0 1000000.0 1.0e-10 0.001 120.0 0 0 0 0 0
*****
*****
**      TFBC CARD      **
*****
*****
* TFBC-C009 *
*****
C009-TFBC-0000 atmosphere
C009-TFBC-0004 1
C009-TFBC-0005 0
C009-TFBC-0008 0
C009-TFBC-1101 C001-01-xo bp 1E+4 0.09290304 1.02 0.56
C009-TFBC-1140 0 0
C009-TFBC-1180 1 0 0 0 0 0
<

*****
*****
**      OPTN CARD      **
*****
*****
* OPTN-OPTN *
*****
*****

OPTN-001 New Steady
OPTN-002 SI SI

OPTN-003 1
OPTN-007 1
OPTN-008 0
OPTN-034 0
OPTN-202 0
*****
*****
**      TIME CARD      **
*****
*****
* TIME-TIME *
*****
*****

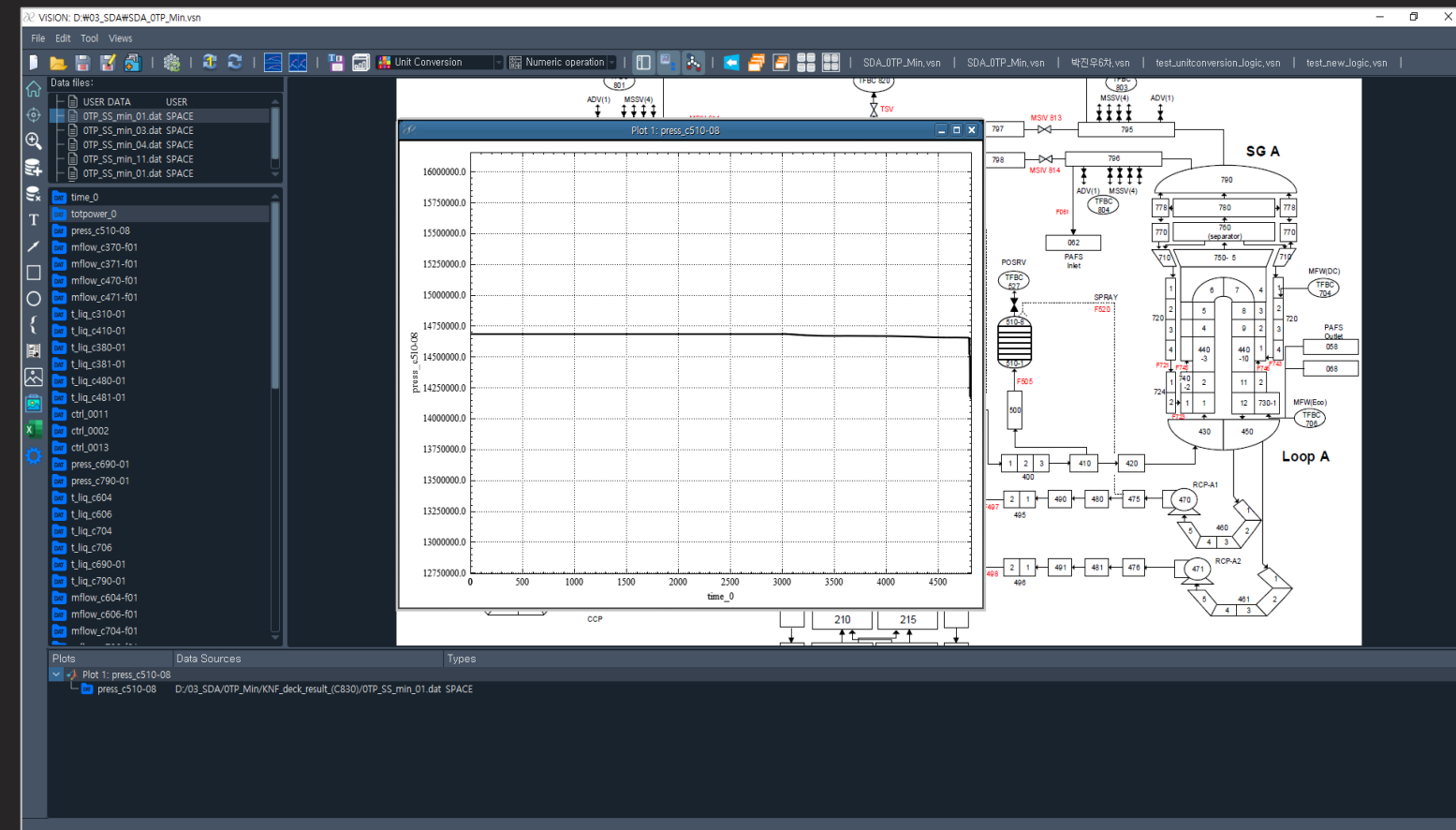
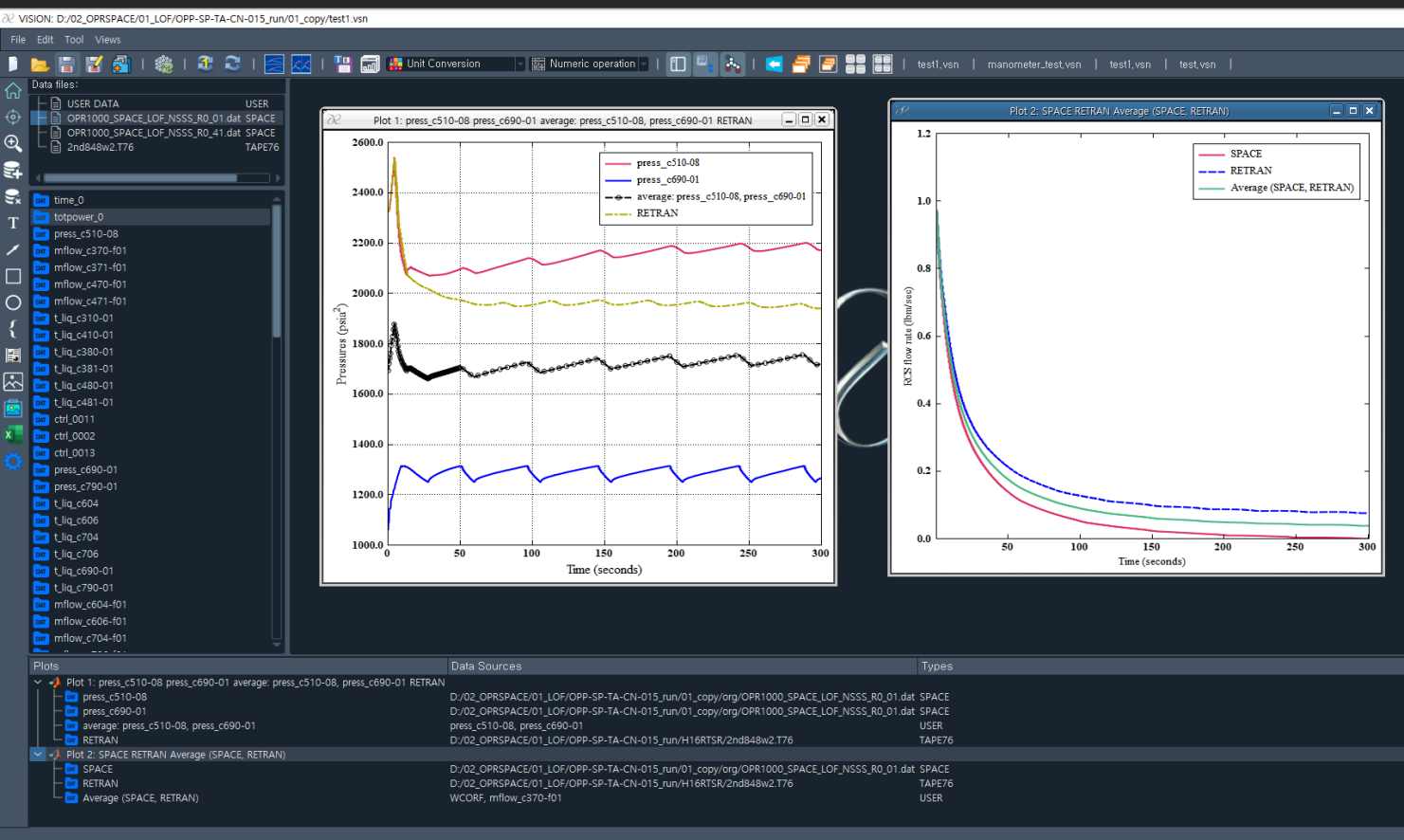
TIME-00-1 0.0
TIME-00-2 99
TIME-01-1 1000.0 0.005 10.0 1000000.0 1.0e-10 0.001 120.0 0 0 0 0 0
*****
*****
**      TFBC CARD      **
*****
*****
* TFBC-C009 *
*****
C009-TFBC-0000 atmosphere
C009-TFBC-0004 1
C009-TFBC-0005 0
C009-TFBC-0008 0
C009-TFBC-1101 C001-01-xo bp 1E+4 0.09290304 1.02 0.56
C009-TFBC-1140 0 0
C009-TFBC-1180 1 0 0 0 0 0
<

줄: 17 열: 11/11 문자: 11/11
iso-ir-149 Unix
줄: 1 열: 1/24 문자: 1/24
iso-ir-149 Unix
```

# 2 Method and Results

## 2-10. Offline Plotting

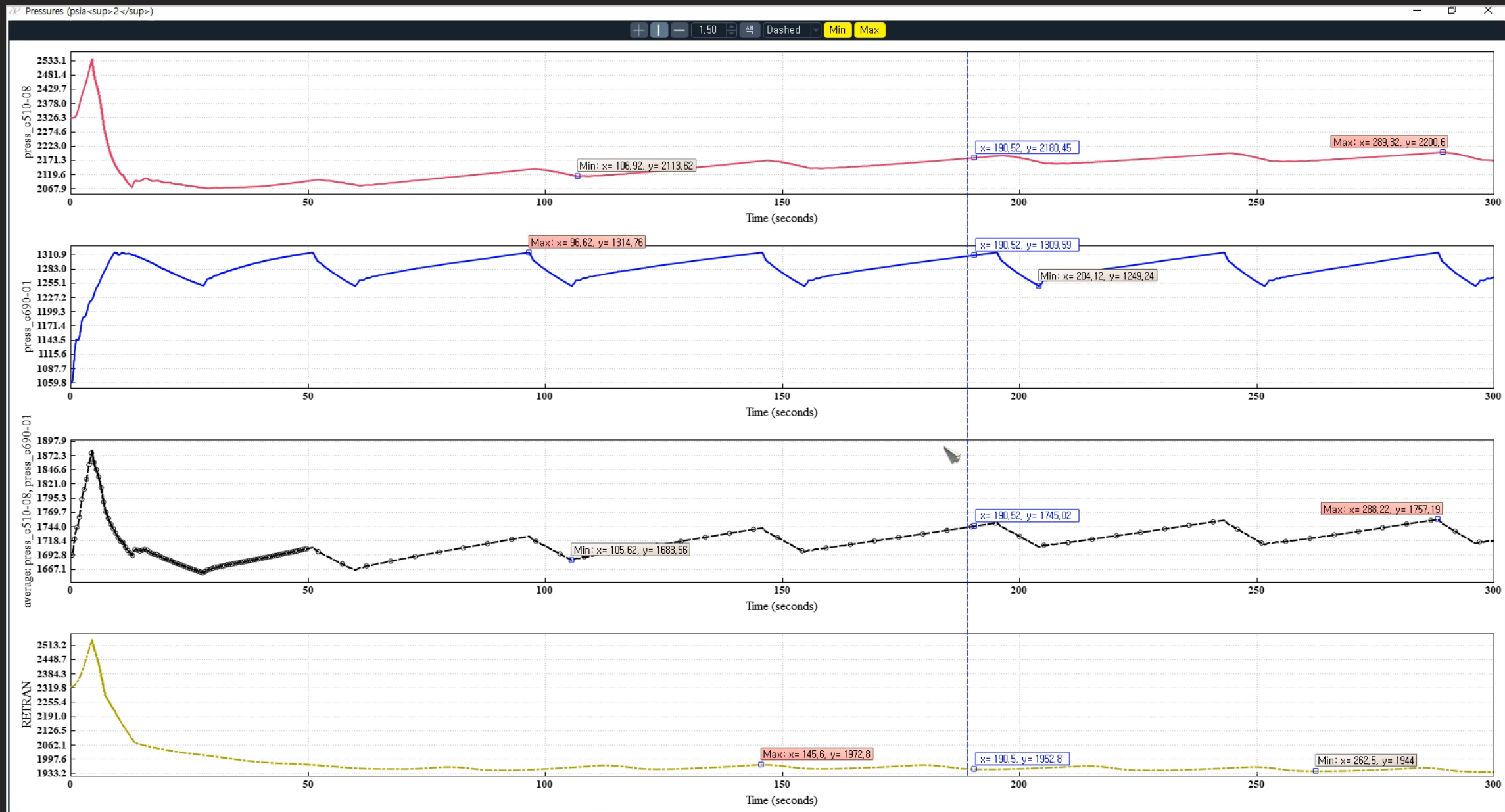
- use the offline plot function to get plots quickly
- SPACE-format, CESEC-format and custom-format data files can be added
- Set nodalization as background to know where the plots are for.





## 2 Method and Results

### 2-11. Analyzing calculation results through comparing graphs

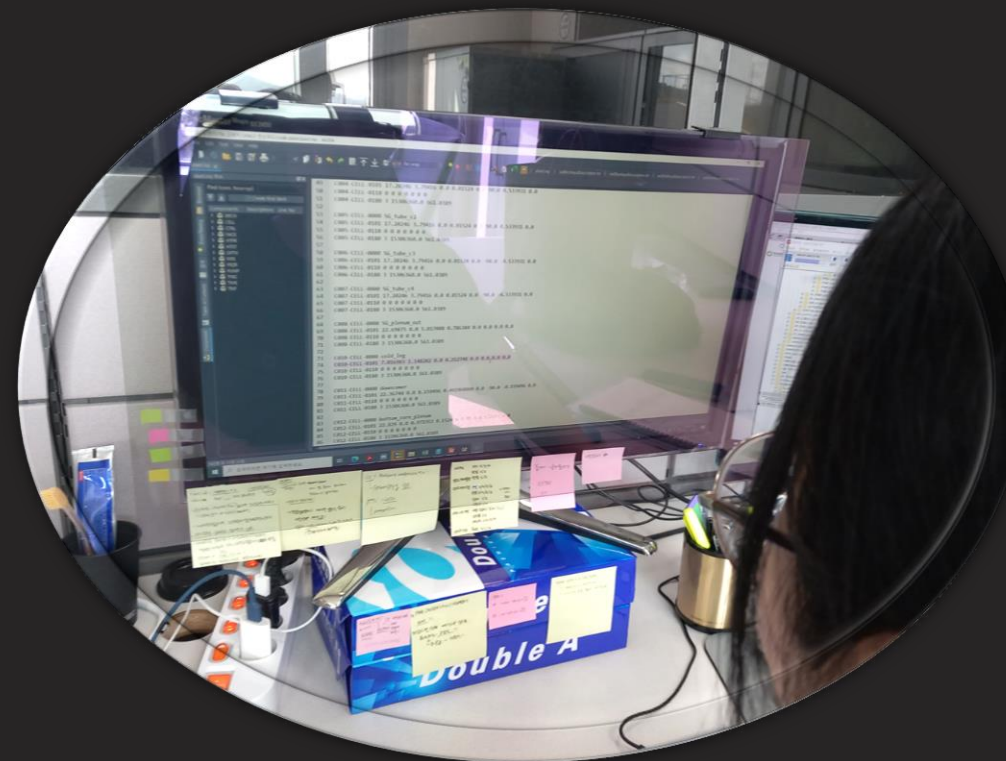


## 2 Method and Results

### 2-12. Examples applied

- i-SMR Non-LOCA analysis
- Many design works using the SPACE code
- Education program for SPACE code

A beginner of SPACE code is making a new SPACE input using the AESPA



# 3 Conclusions

## Future of AESPA

|                        |   |
|------------------------|---|
| Maintenance            | Fix hidden bugs and errors  |
| Upgrade error notices  | Make more intelligent and accurate error notices  |
| More advanced link map | <ul style="list-style-type: none"><li>• Show the link map of CTRL, TRIP and T/H component</li><li>• Introduce path finding logic for links between nodes</li><li>• Introduce mini radar map for large scale diagram</li></ul> |
| Enhance the plot       | Introduce another kinds of plot   |



Free Download : <https://github.com/jcsu1835/AESPA/blob/main/README.md>

**Thank you for your attention**

