Integrated Development Environment for SPACE Problem Analysis

by C. S. Jang

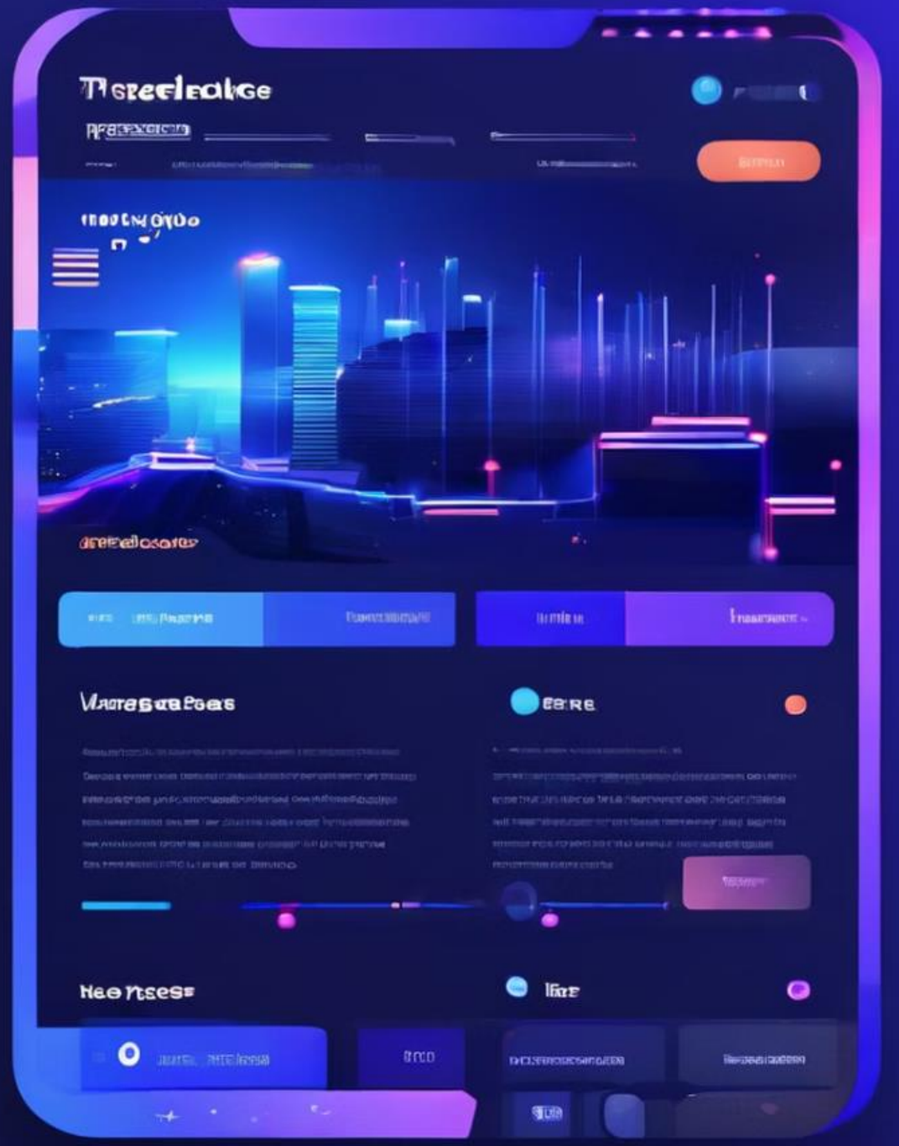
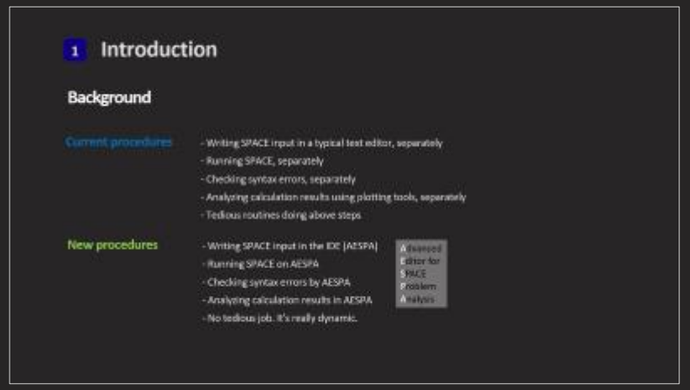
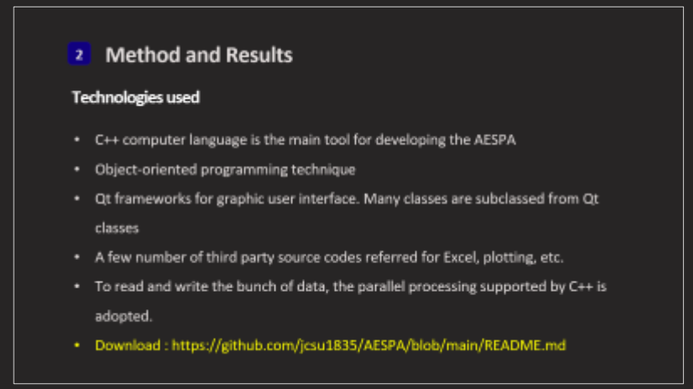


Table of Contents





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

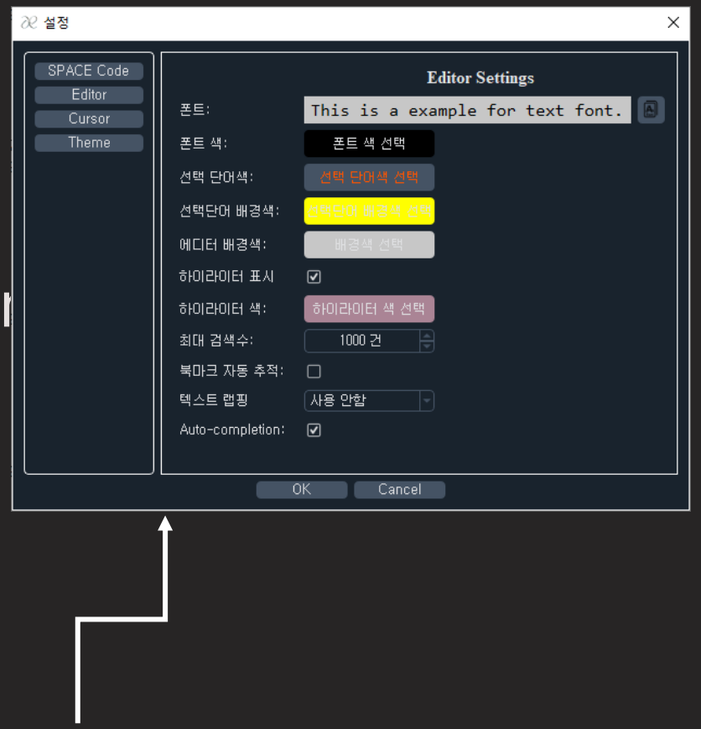
Technologies used

- 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.
- 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

2 Method and Results

2-1. Input Edit Funtion (1)

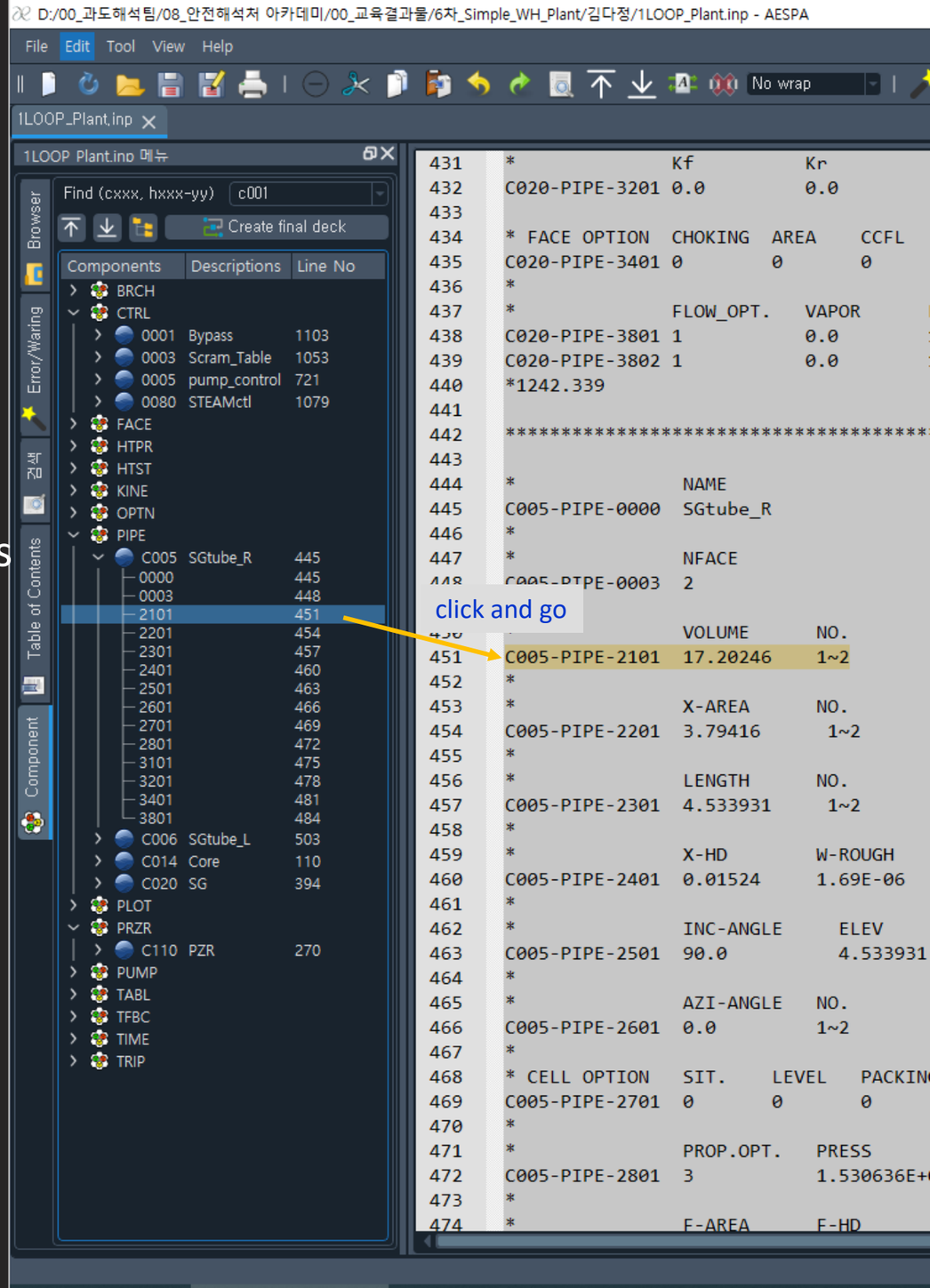
- One of main functions of the AESPA
- Edit, insert, replace, find, delete, copy, paste on rows
- Edit, insert, replace, find, delete, copy, paste on columr
- Drag-n-drop system is adopted.
- Redo-undo stack technologies supports
- Texts zoom-in and zoom-out
- The appearance of editor such as font, font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



2 Method and Results

2-1. Input Edit Function (2)

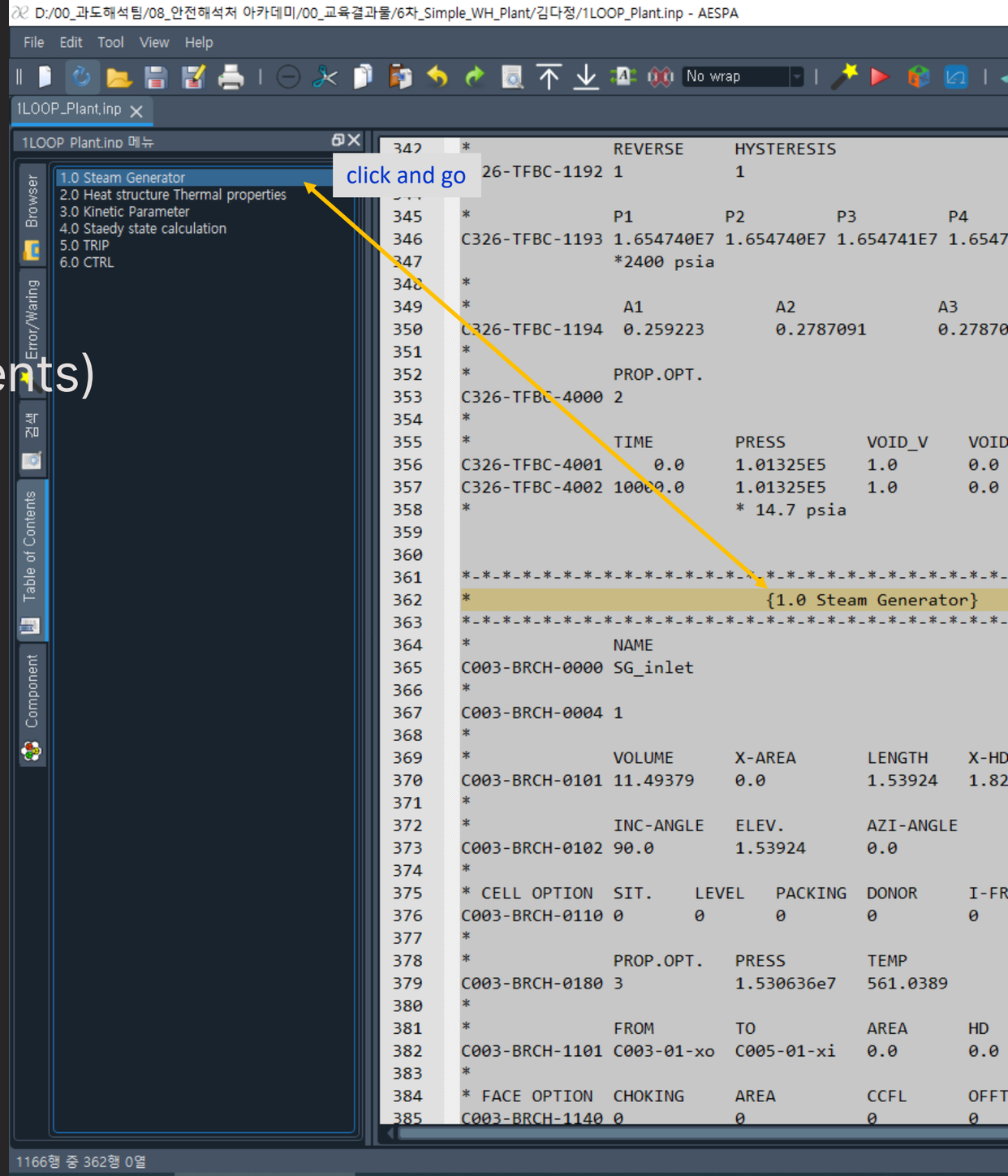
- Automatic input organizing
  - Input file with no errors
  - Generates input categorization based on component types
  - Supports Click-n-Go
  - Browser keeps inputs up to date
- SPACE input template support
  - Automatically insert minimum required inputs
  - SPACE input template including =, @, OPTN,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



2 Method and Results

2-1. Input Edit Function (3)

- User-supplied TOC (Table Of Contents)
  - Users make their own TOC with brackets, {}
  - Users can shared important input parts through TOC
  - Supports Click-n-Go

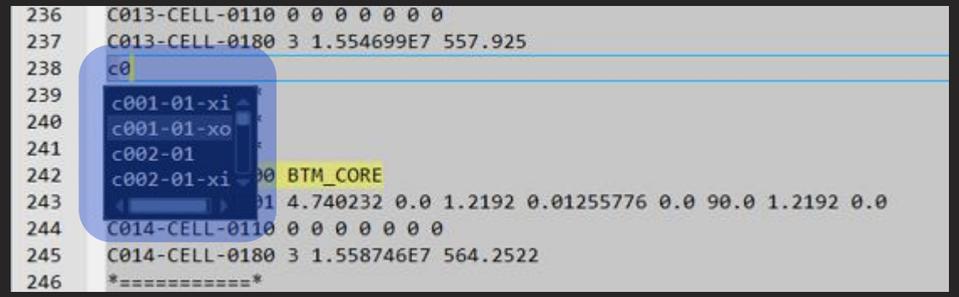


2 Method and Results

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.

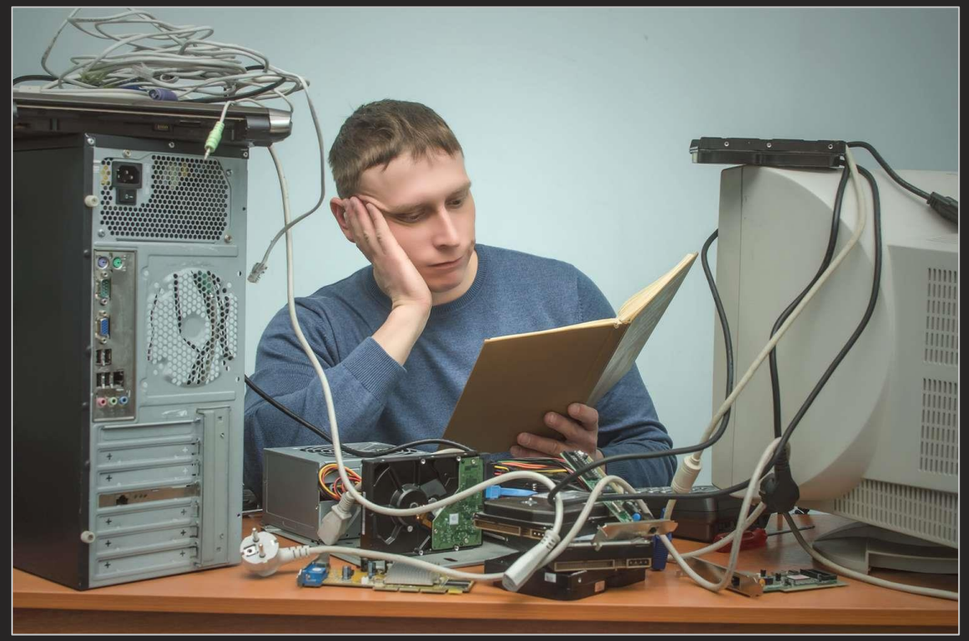


2 Method and Results

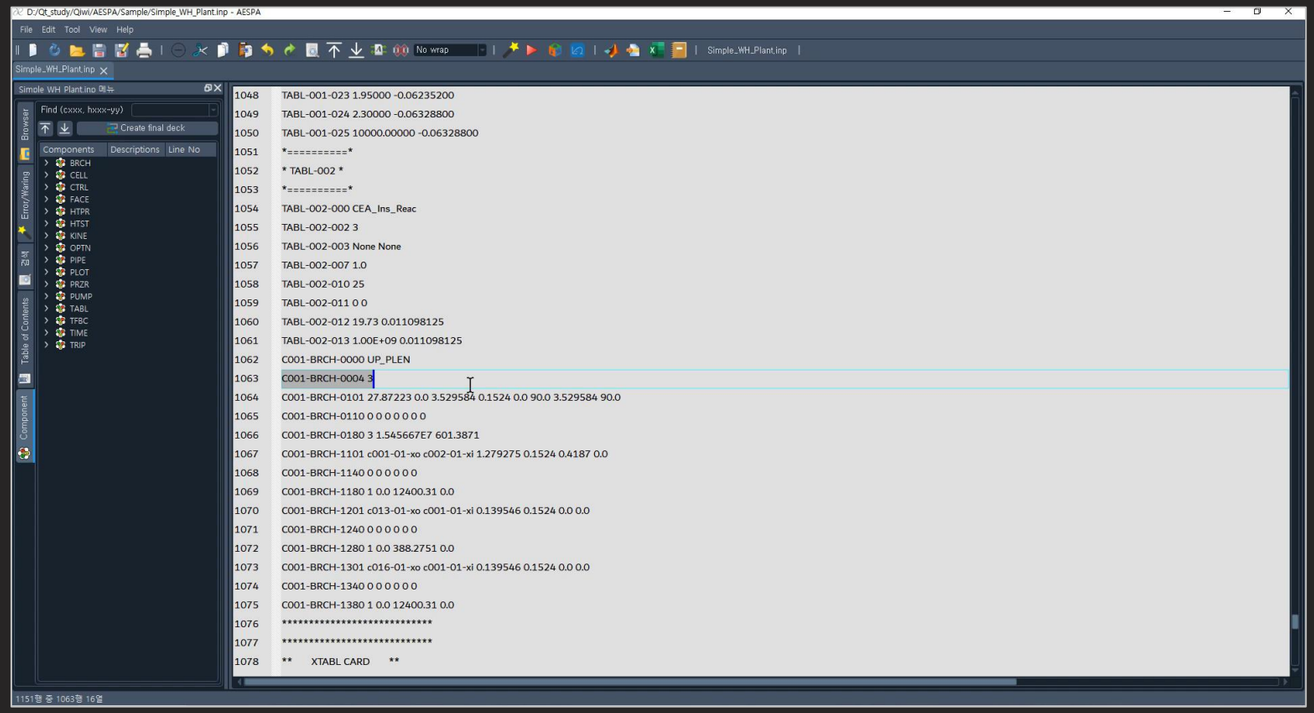
2-1. Input Edit Function (5)

- On-click user's manual

  - No longer need to try to look for the paper manual
  - Just click the input card whenever you need a description
  - Reduce human errors and working time



```
595  H001-00-4003 587.12 r 1~10 z 3~3
596  H001-00-5001 1000 0.3250 0.0 0.0083333 1~3
     Data1(I) 열원 형태 (Source type)
         0 = 열원 없음 (No heat source)
         xx = 일반 테이블 xx번에서 열원 출력을 가져옴
         1000 = 점동특성 계산에서 총 원자로 출력 (Fission + Decay)
         1001 = 점동특성 계산에서 총 붕괴열
         1002 = 점동특성 계산에서 핵분열출력
         1003 = 점동특성 계산에서 핵분열 생성물의 붕괴열
         1004 = 점동특성 계산에서 Actinide 원소의 붕괴열
         1005 = 3차원 동특성(KIN3) 연계계산에서 총 원자로 출력
         2xxxx = 제어계통에서 계산된 출력 사용, xxxx는 제어계통 (CTRL) 번호
     Data2(R) 내부 열원 증배 계수 (Internal source multiplier)
     Data3(R) 좌측 경계 셀 대한 감속재 직접가열 증배 계수 (Direct heating multiplier for left side)
     Data4(R) 우측 경계 셀 대한 감속재 직접가열 증배 계수 (Direct heating multiplier for right side)
     Data5(C) 열구조체 범위: 예) 1~5
597  H001-00-6001 0 0 0 0 0 0 0 0 0 0 0 0 1~3
```

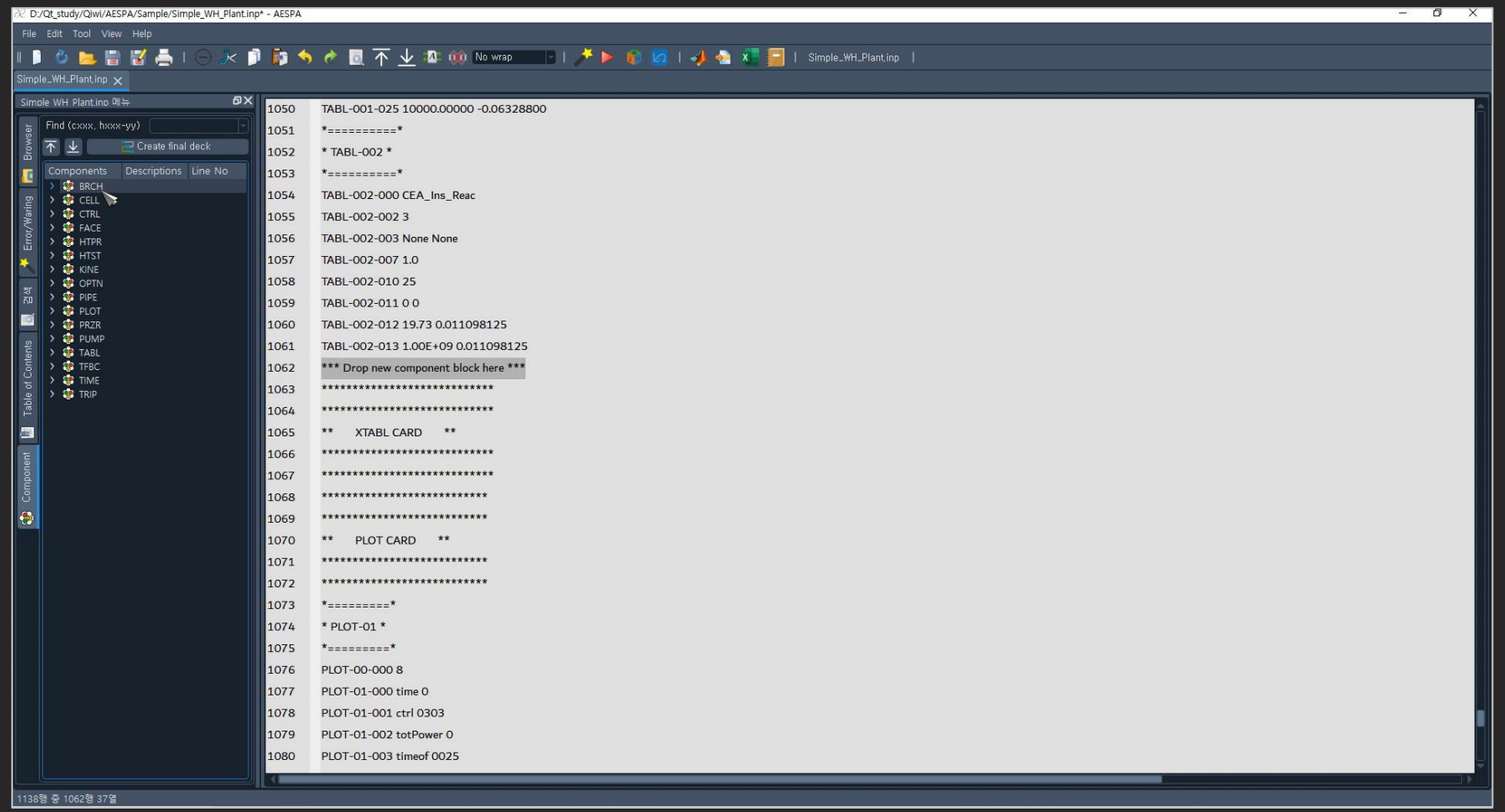


2 Method and Results

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

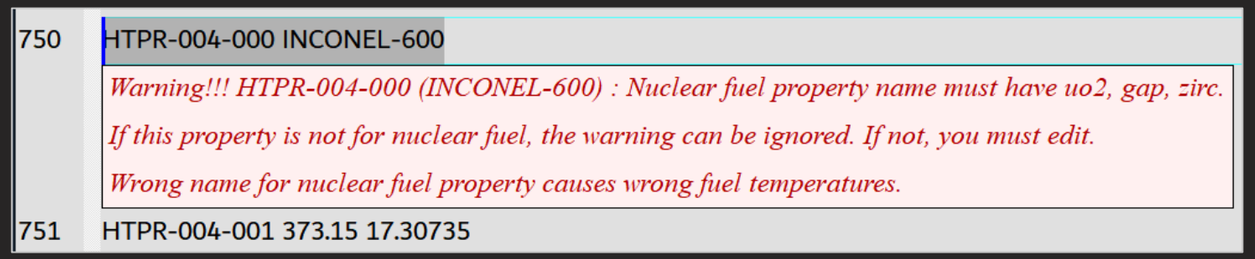


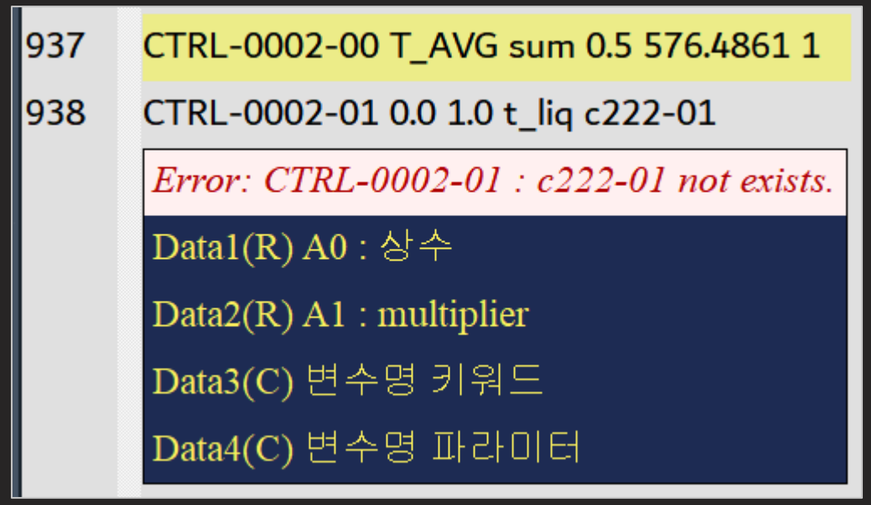
2 Method and Results

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

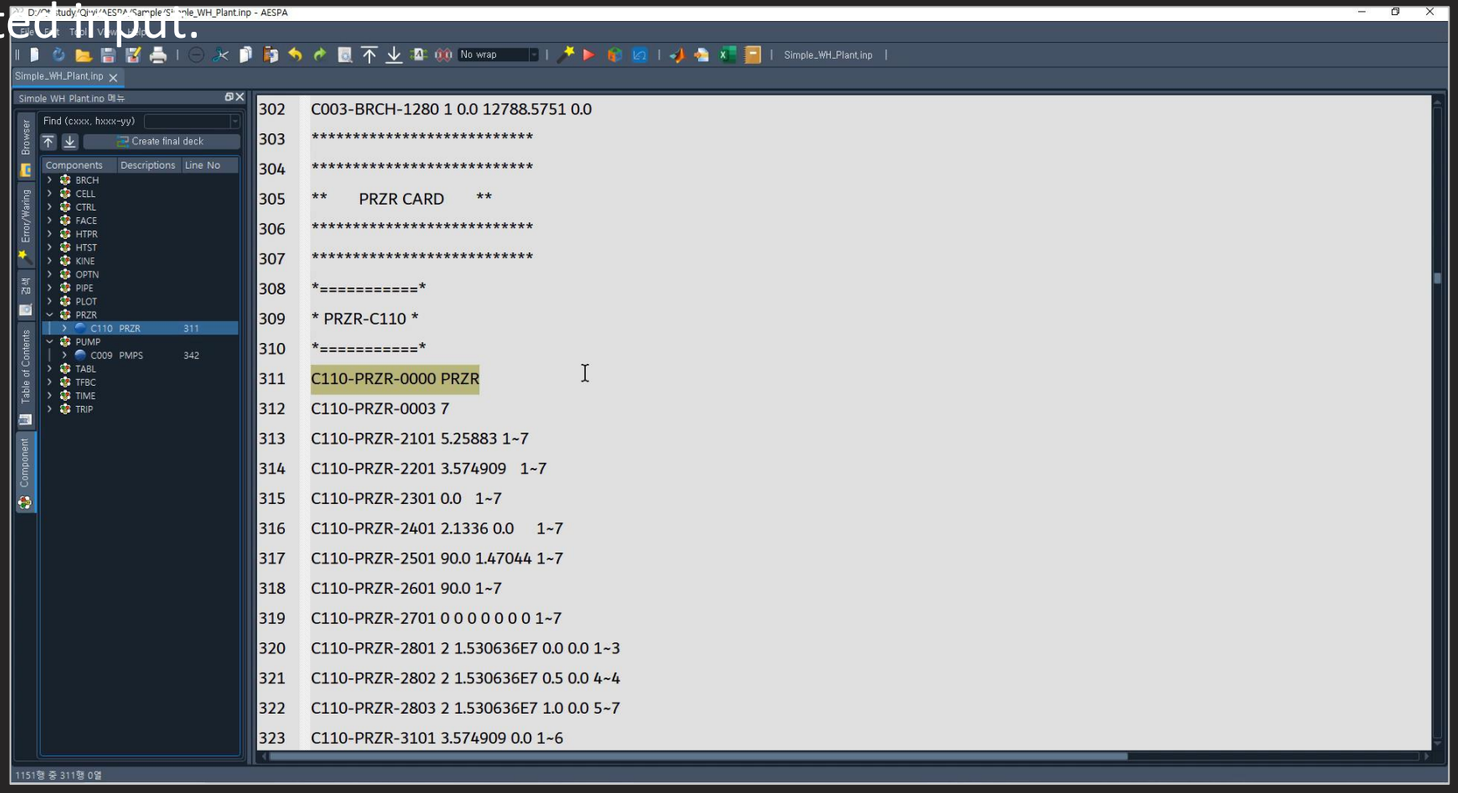




2 Method and Results

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

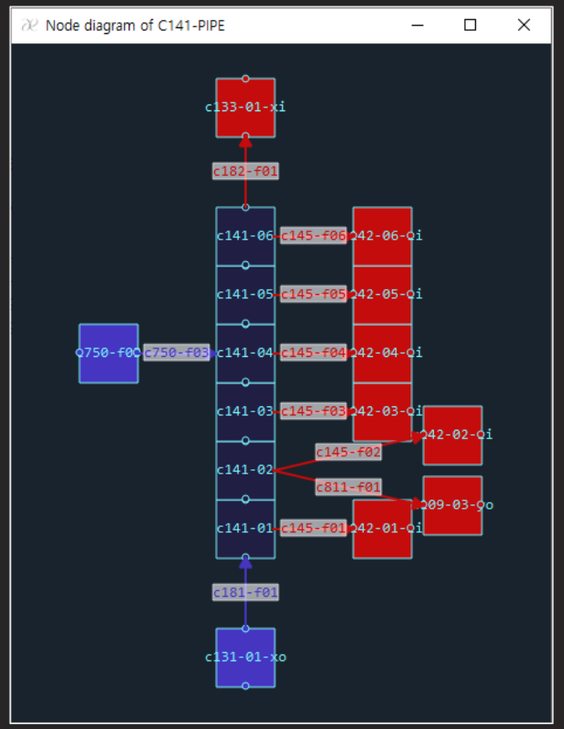
- Display the node diagram of a selected one
  - for CELL, BRCH, PUMP, PIPE, PRZR, SEPR
  - copy and paste diagram as image into document
  - click-n-go to navigate the related input.
  - help designers get insights

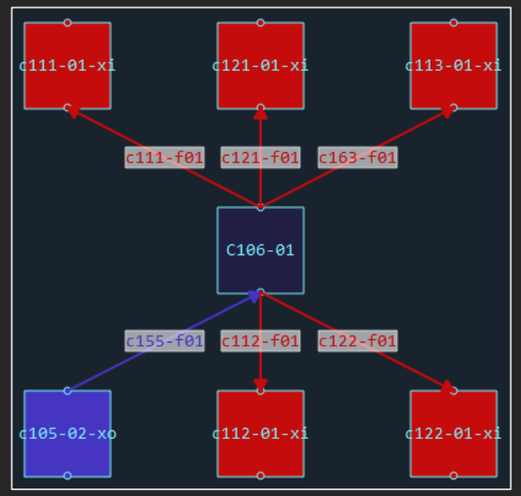


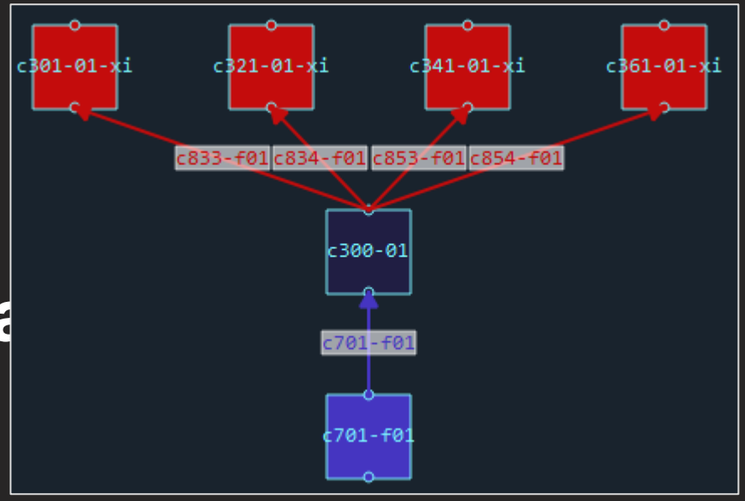
2 Method and Results

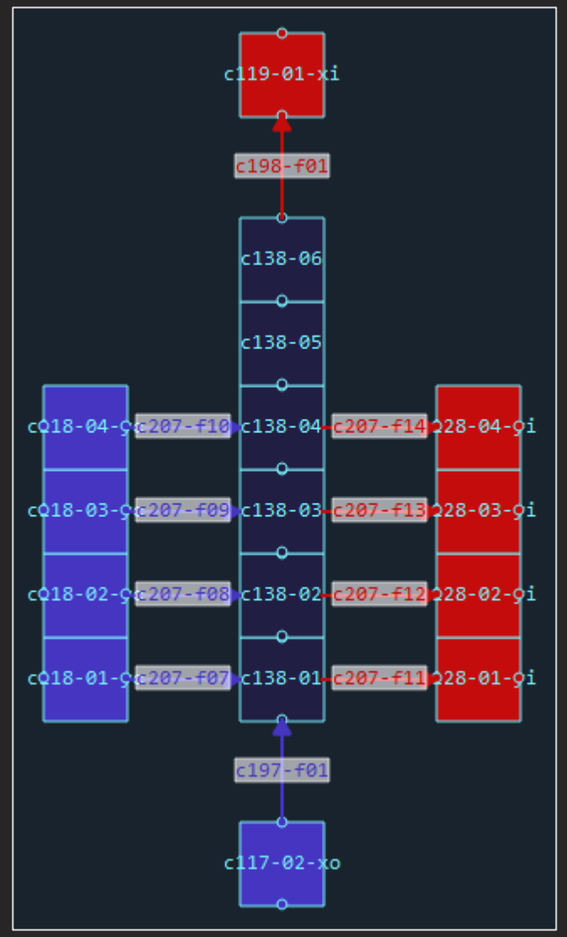
2-3. On-Click Node Diagram Genera

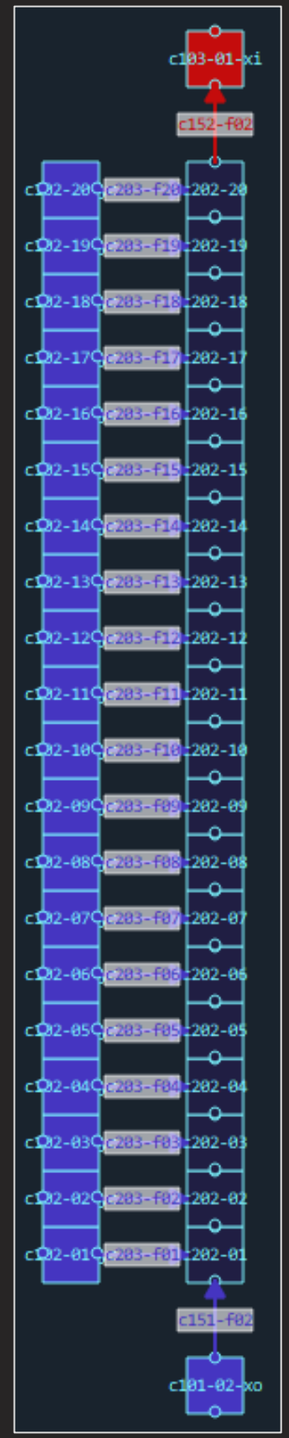
- Zoom-in and Zoom-out
- Moving
- It's hard to draw by hand.







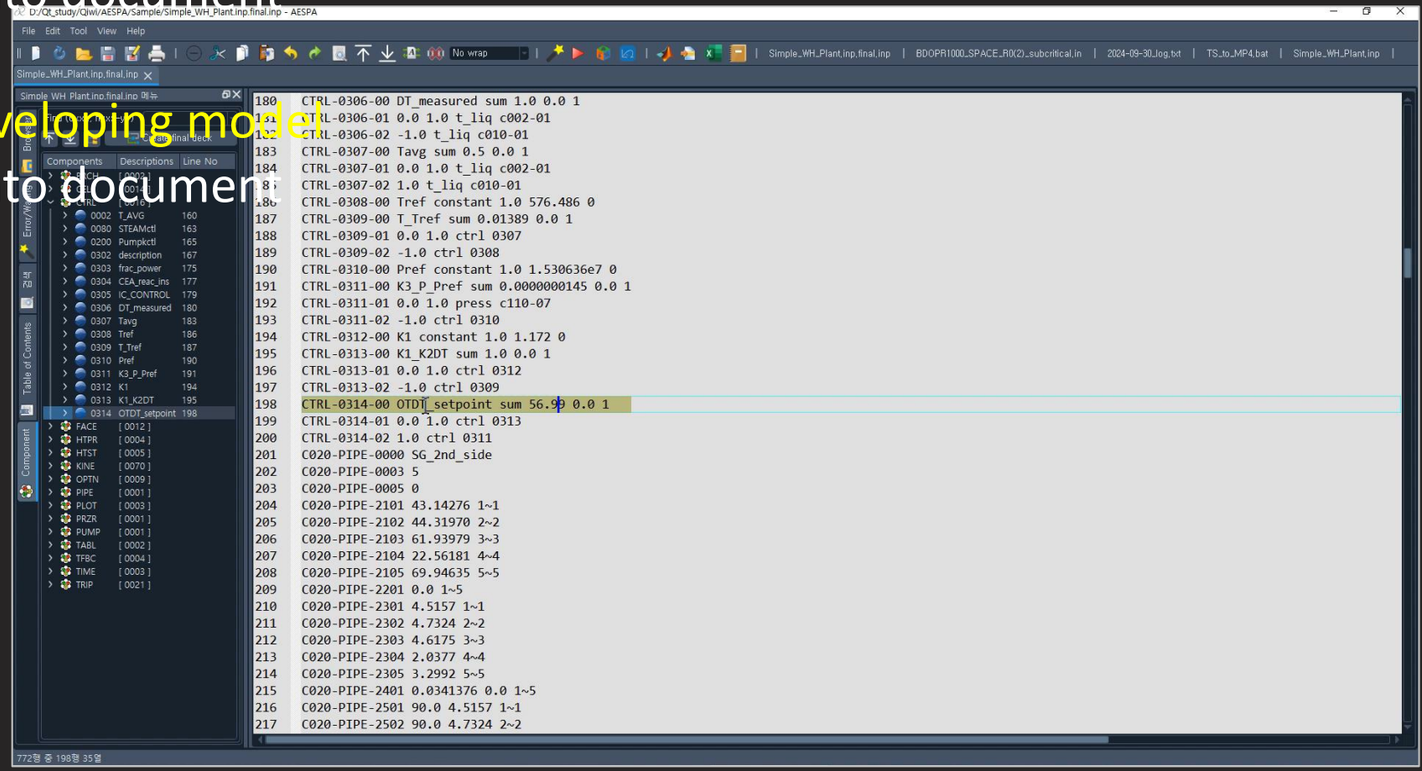




2 Method and Results

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

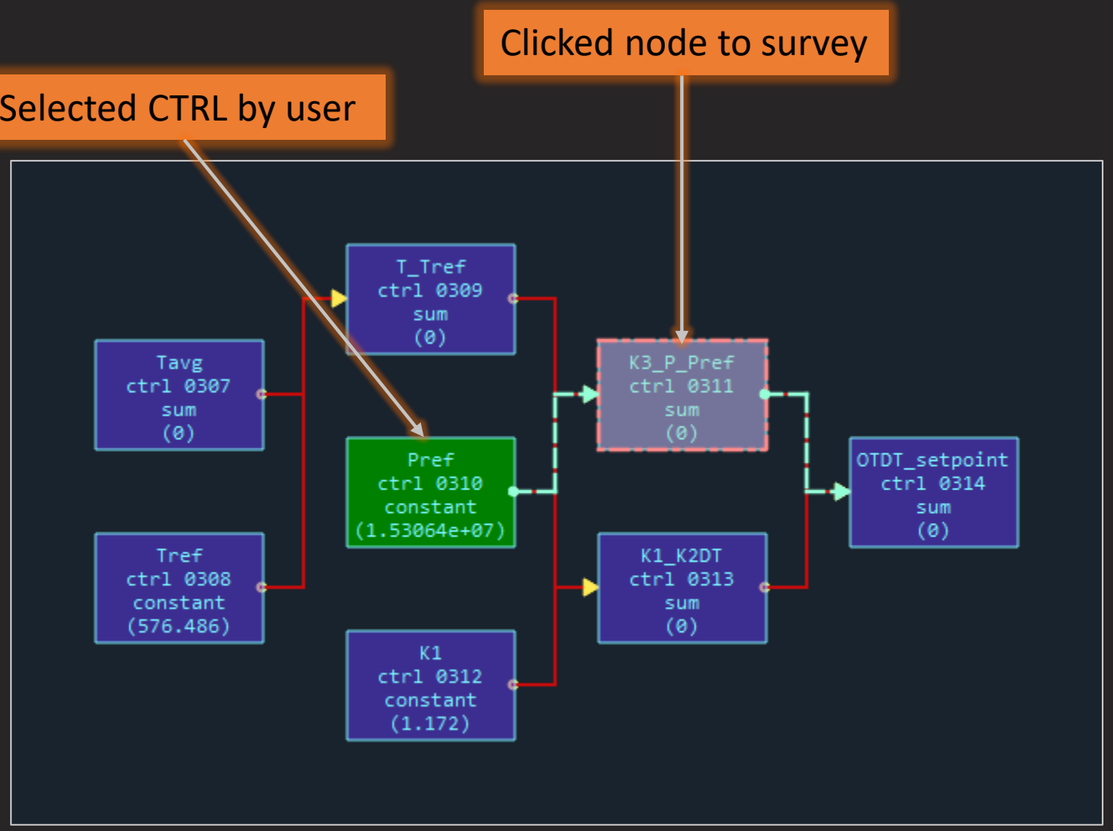
- Display the CTRL node diagram of a selected controller
  - diagram shows description, controller ID, type and initial value (target value)
  - click-n-go to navigate the related input.
  - copy and paste diagram as image into document
  - moving, zoom-in, zoom-out
  - help designers get insights while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

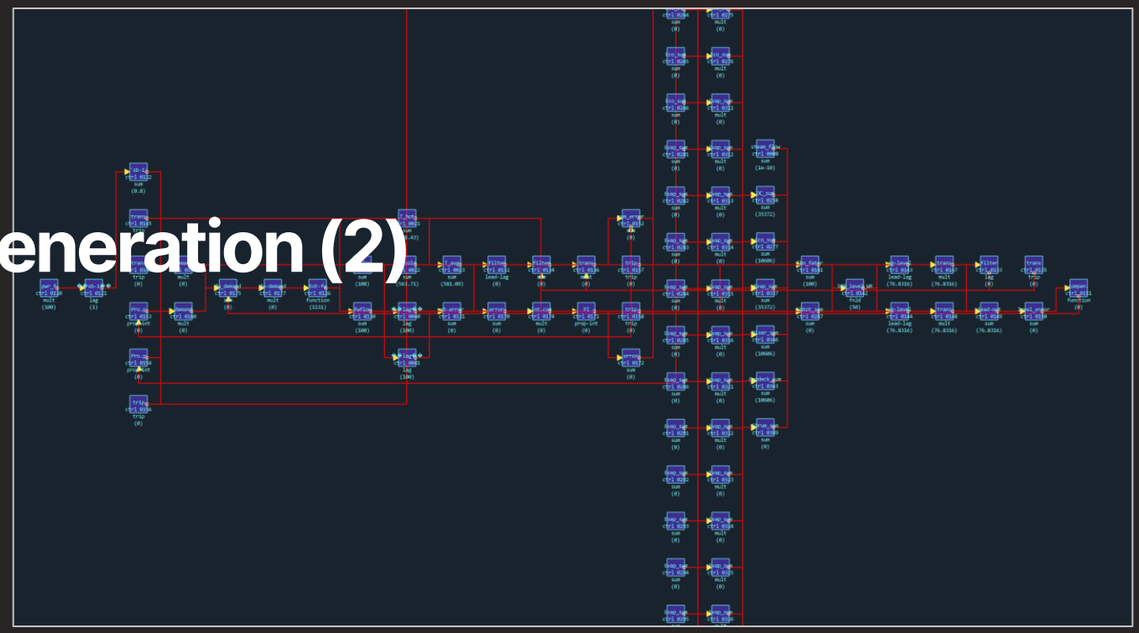


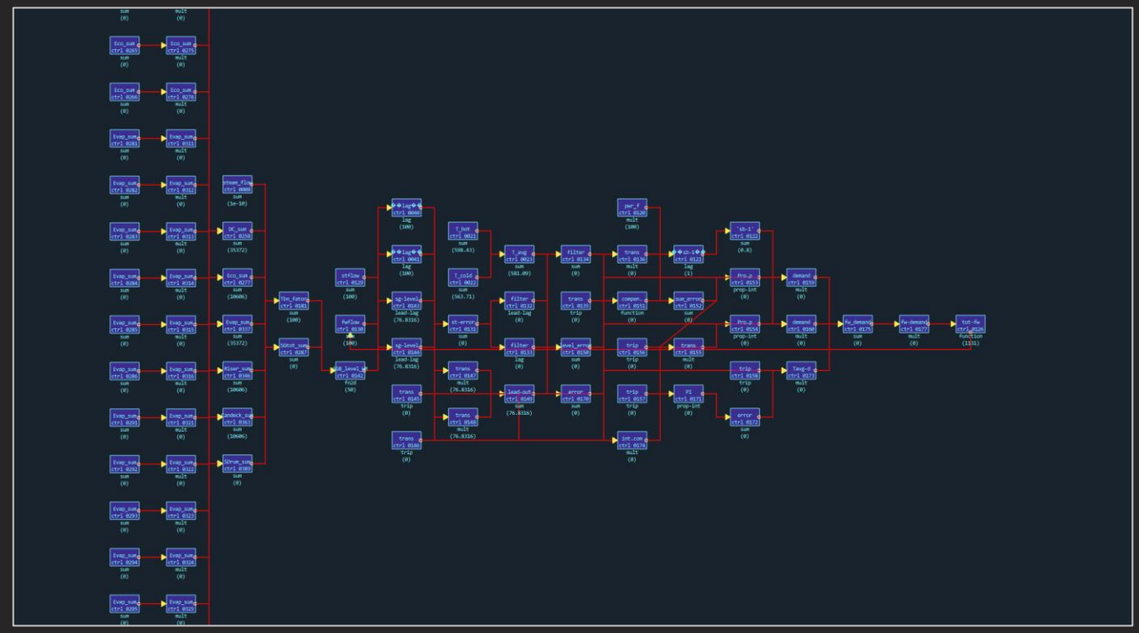
2 Method and Results

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

- Samples : from simple to complex



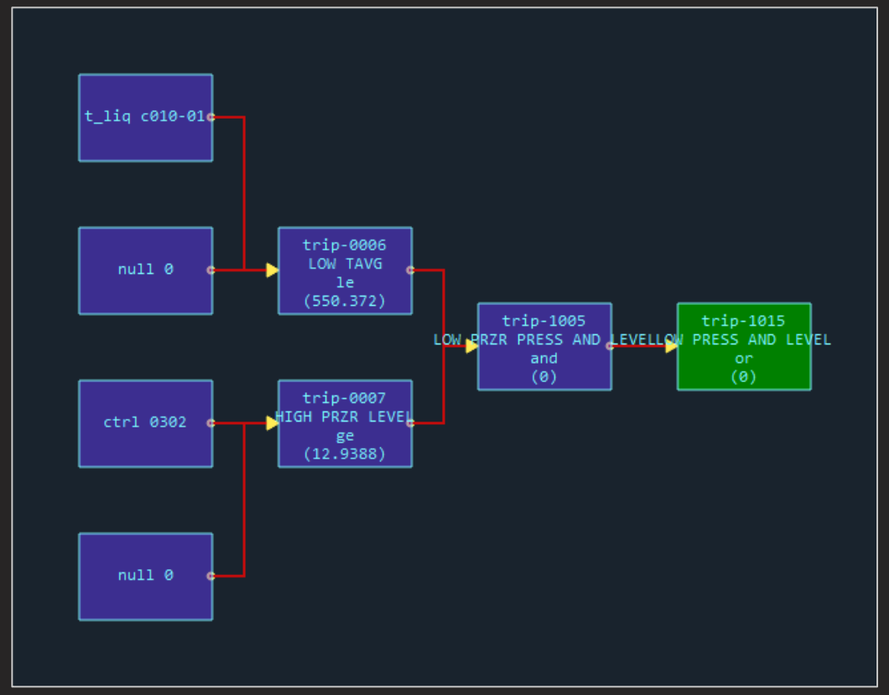


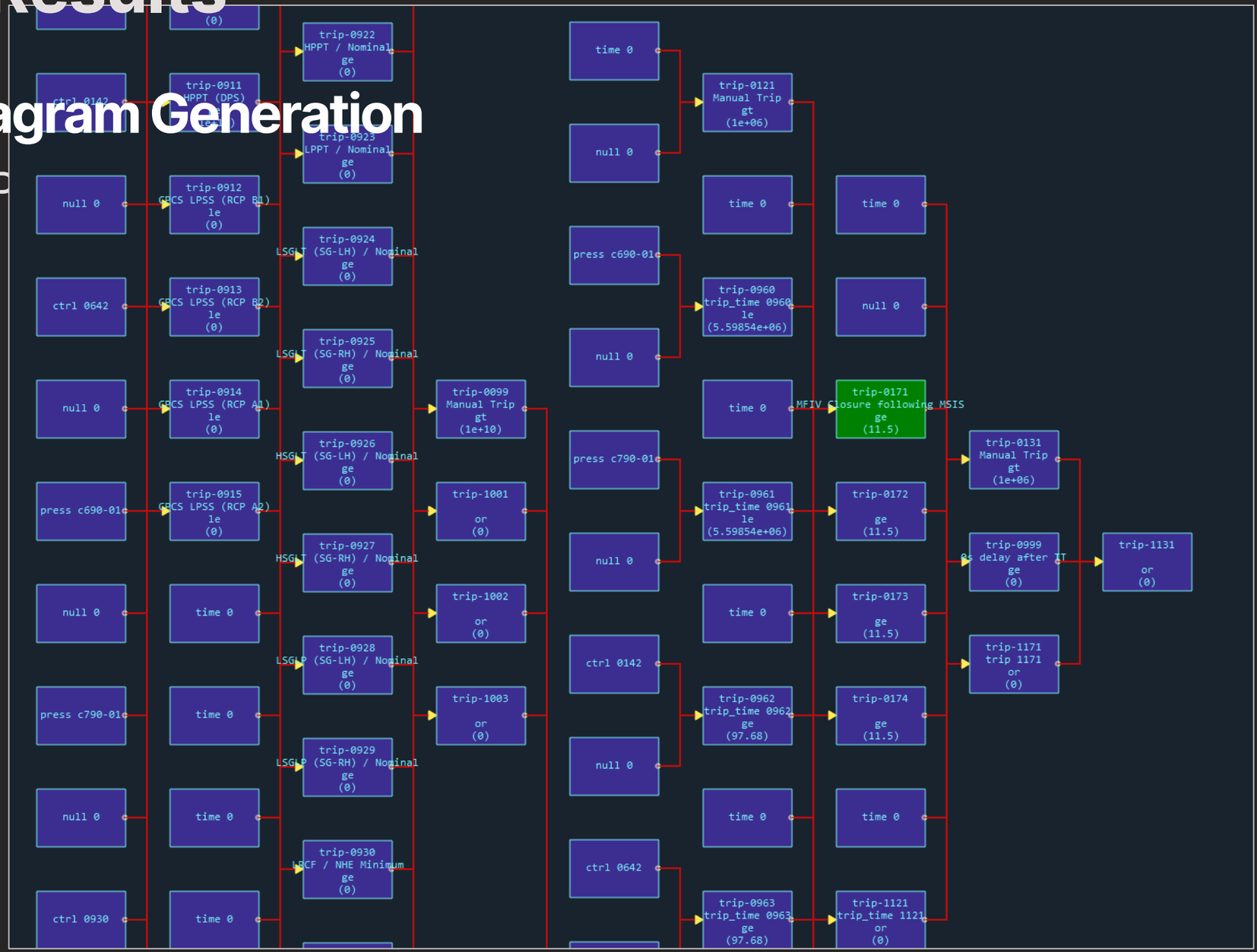


2 Method and Results

2-5. On-Click Trip Diagram Generation

- Link diagram for TRIP

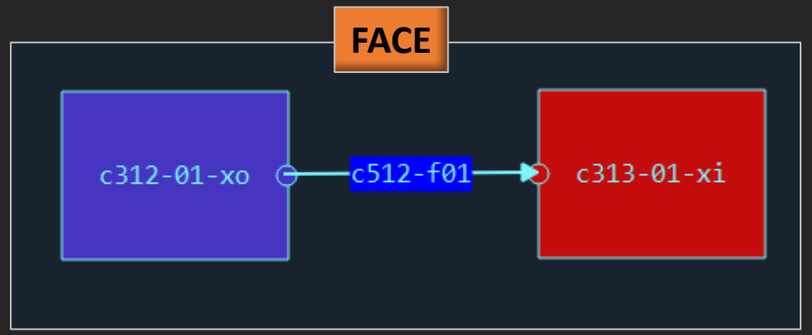


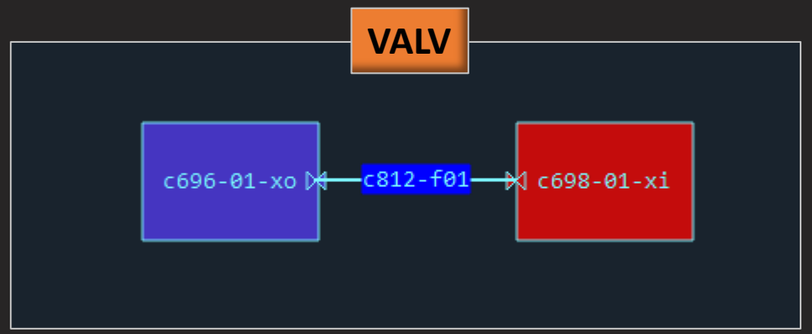


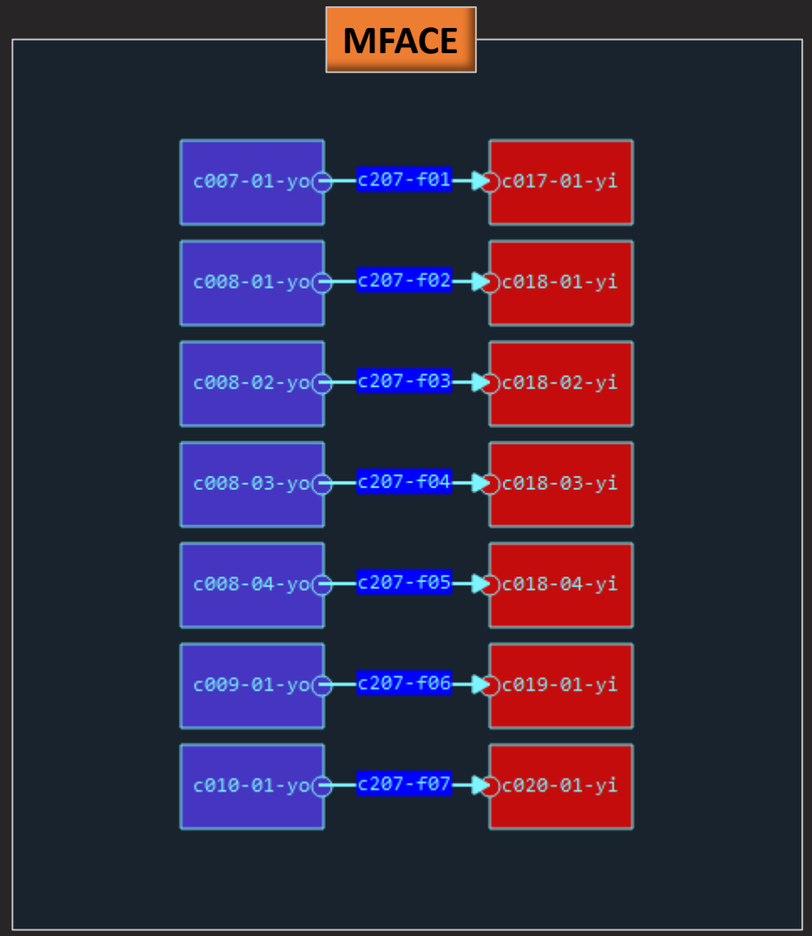
2 Method and Results

2-6. On-Click Face Diagram Generation

- Link diagram for FACE, VALV, MFACE, TFBC



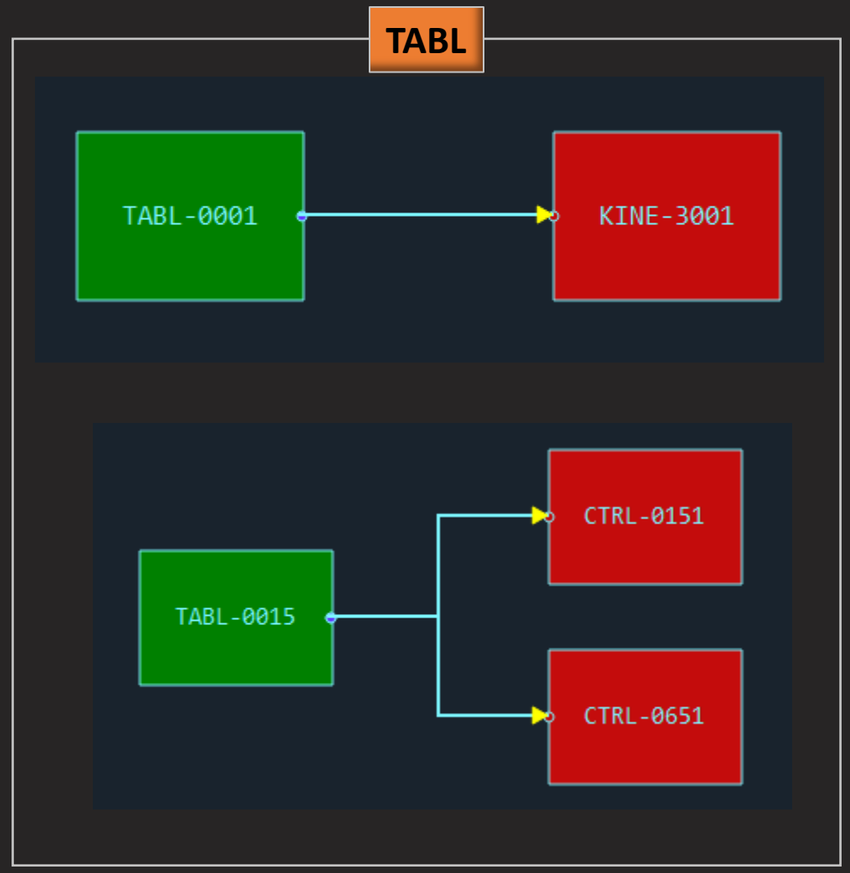


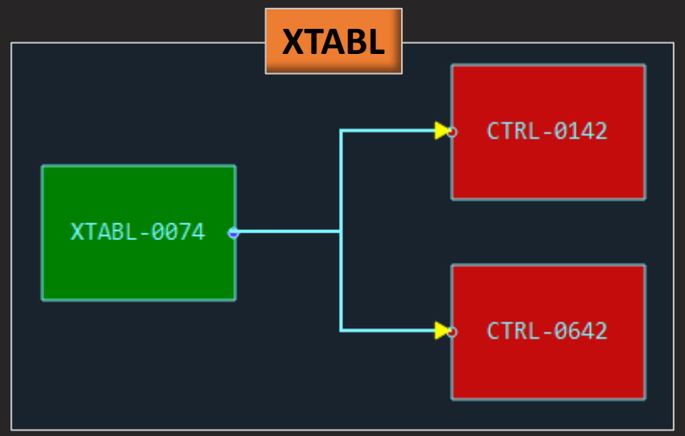


2 Method and Results

2-7. On-Click Table Diagram Generation

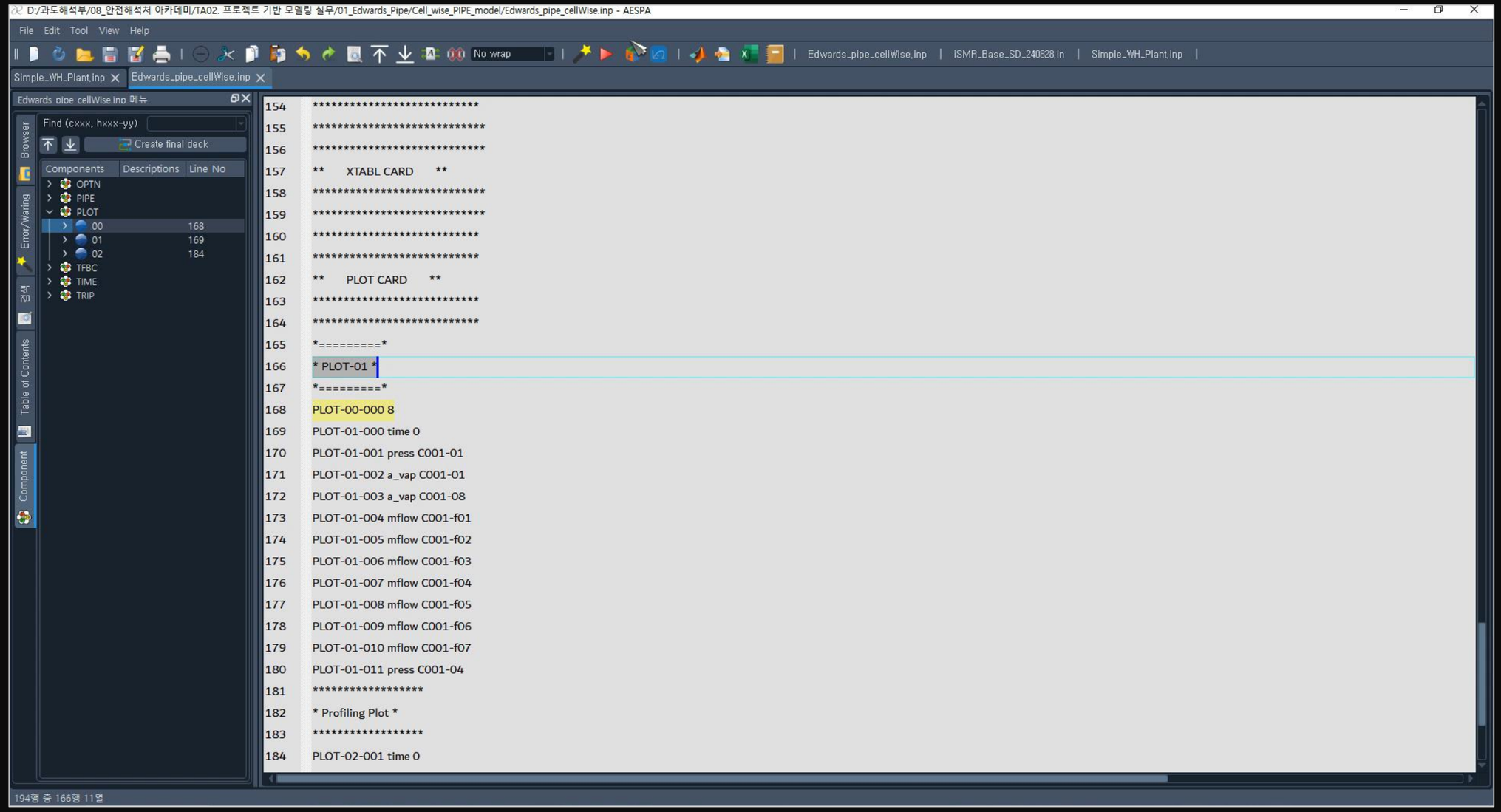
- Link diagram for TABL, XTABL





2 Method and Results

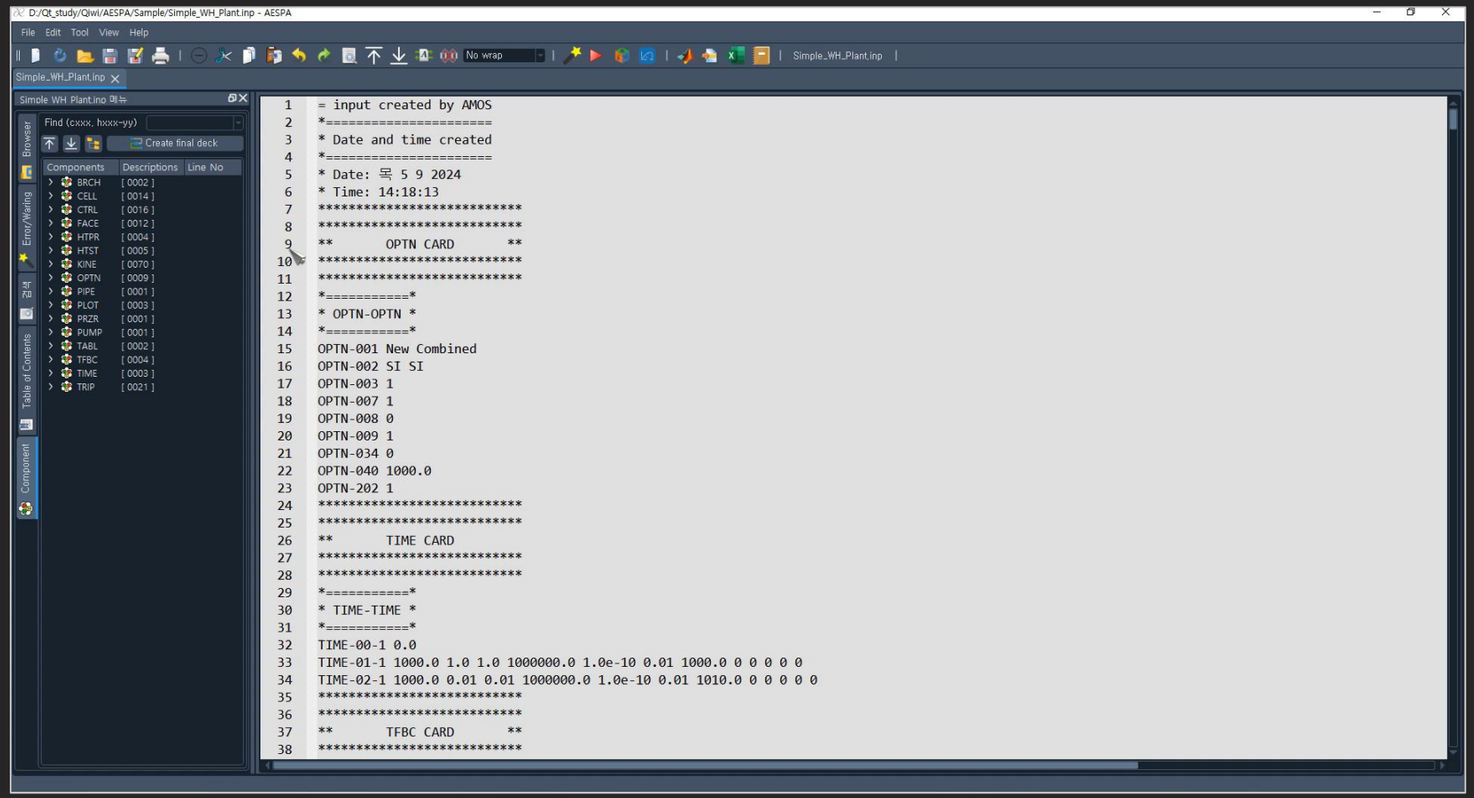
2-8. Execution of SPACE code with real-time plots



2 Method and Results

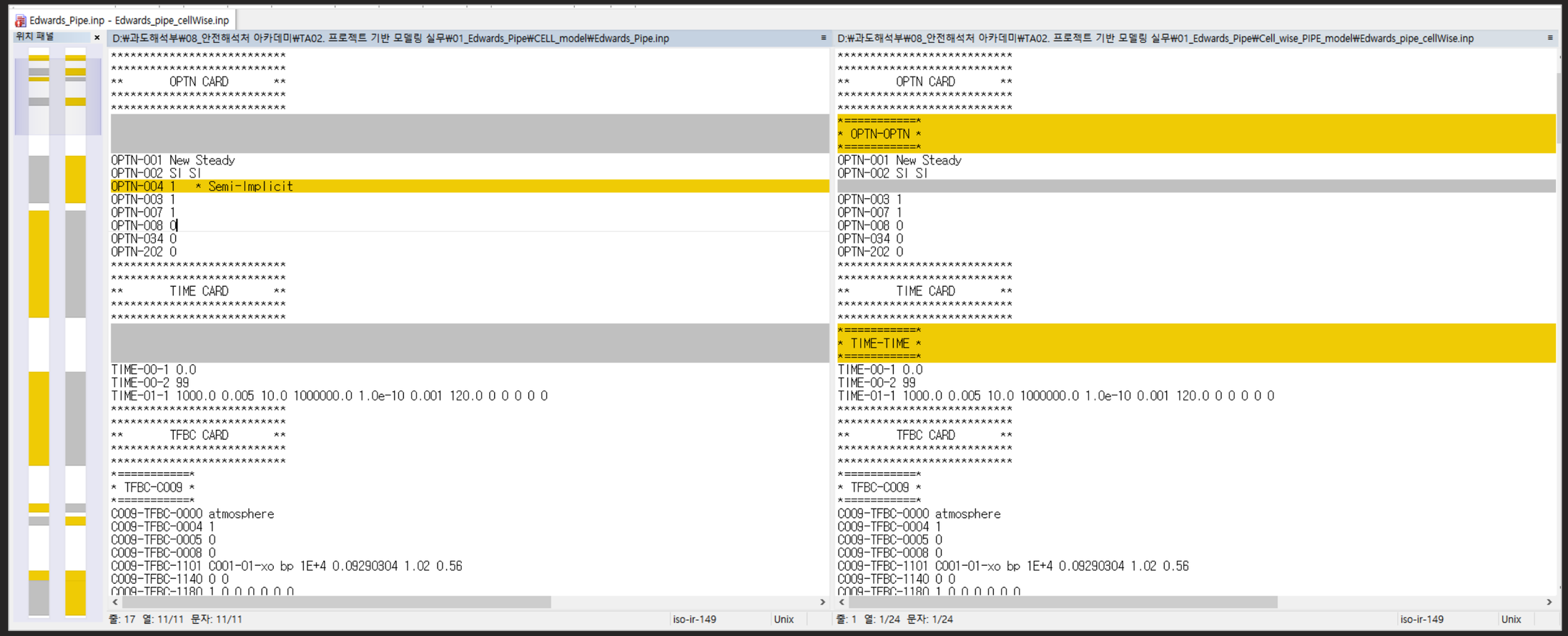
2-9. File and Directory Comparisons (1)

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



2 Method and Results

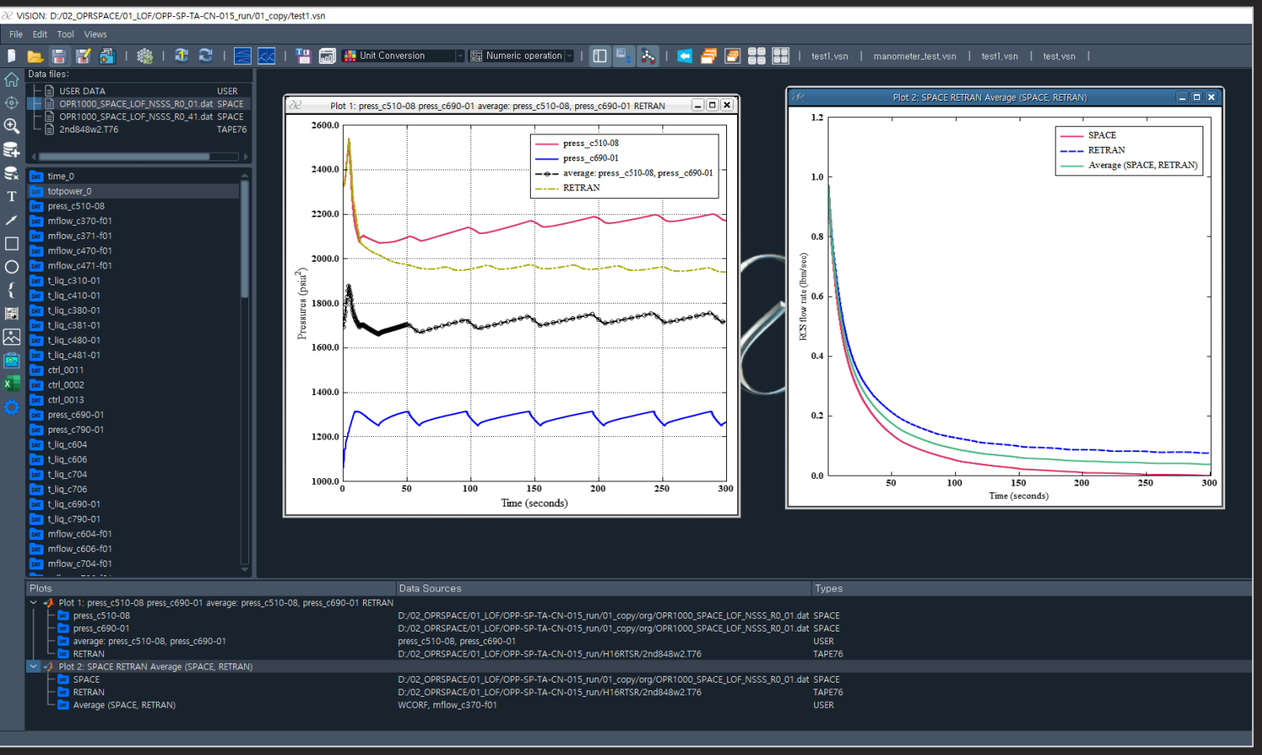
2-9. File and Directory Comparisons (2)

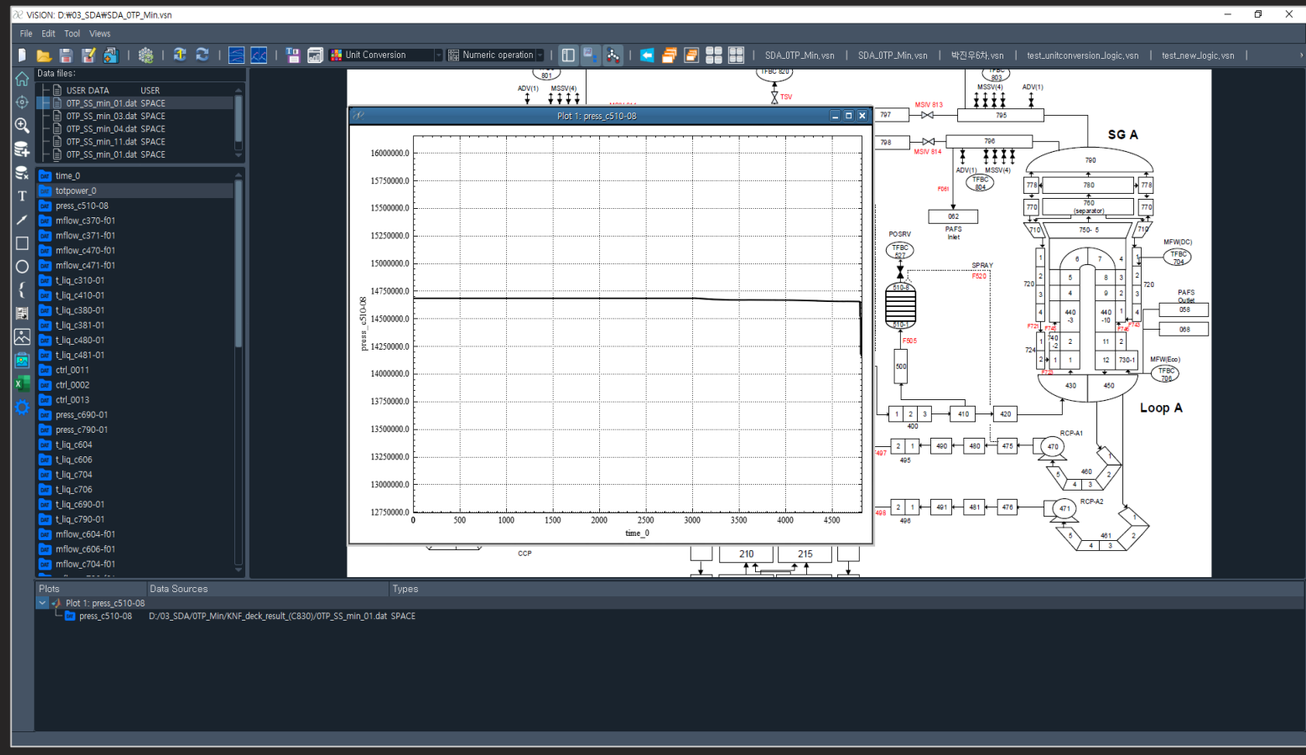


2 Method and Results

2-10. Offline Plotting

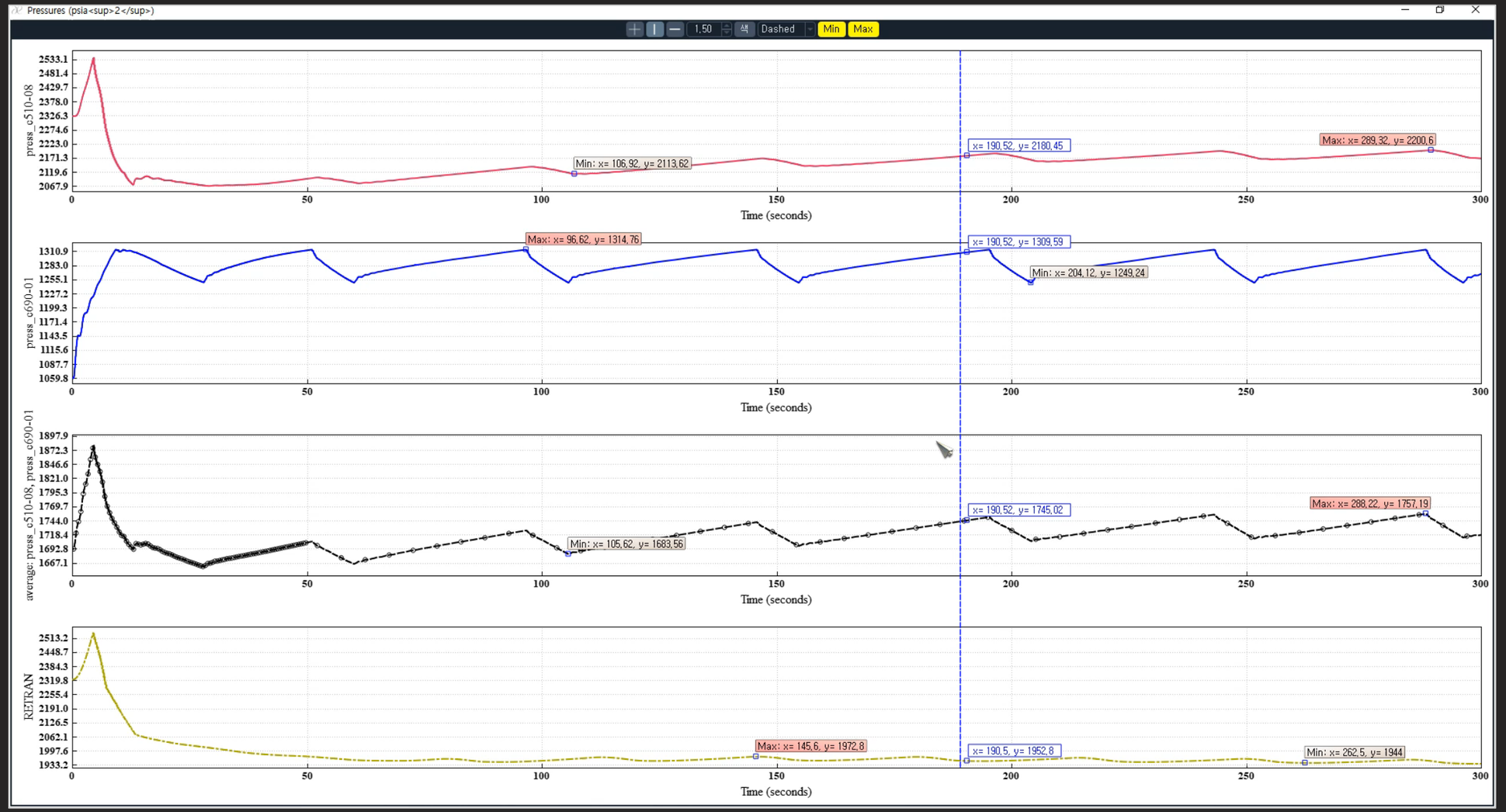
- use the offline plot function to get plots quickly
- SPACE-format, CESEC-format and custom-format data files can be added
- Set nodalization as background to know where the plots are for.





2 Method and Results

2-11. Analyzing calculation results through comparing graphs

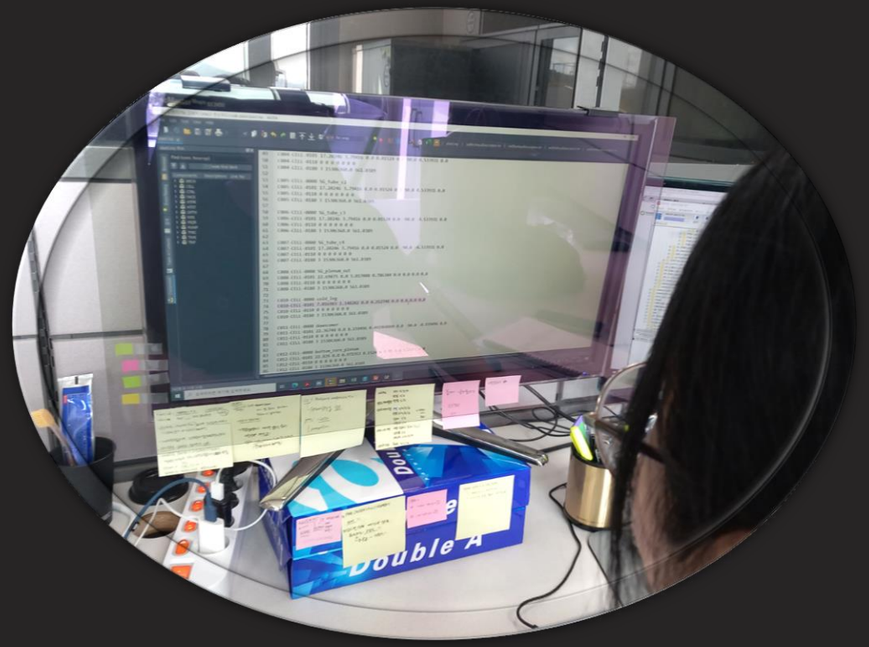


2 Method and Results

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	• Show the link map of CTRL, TRIP and T/H component • Introduce path finding logic for links between nodes • Introduce mini radar map for large scale diagram
Enhance the plot	Introduce another kinds of plot

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

Thank you for your attention