

Development of Mr. (Multi-run) Manager Version 1.0

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1. Introduction

A need to handle a large number of calculations is increasing to perform a Level 3 PSA. For example, when performing a multi-unit Level 3 PSA, there exist enormous numbers of multi-unit accident scenarios which are the combinations of STCs (source term categories) of involved units. The number of multi-unit accident scenarios rapidly increases when the number of units or the number of STCs increases [1, 2]. In addition, conducting a full spectrum of Level 3 PSA considering all source terms rather than categorized representative source terms is a new trend of single-unit Level 3 PSA. Accordingly, it is needed to establish an automation system to run and manage a huge number of consequence analyses for both single-unit and multi-unit Level 3 PSA.

Mr. (Multi-run) Manager was developed to provide a solution to handle a large amount of parallel calculations of radiological consequence analyses using MACCS (MELCOR Accident Consequence Code System). Mr. Manager can perceive the source term information from a huge amount of

“CombineSource.out” files or “ATMOS.input” files that contain source term information for MACCS runs.

MUST (Multi-Unit Source Term) Converter was also developed to provide single-unit source terms or multi-unit source terms as a format of “CombineSource.out,” when MAAP (Modular Accident Analysis Program) is used as a severe accident analysis code. Detailed information of MUST Converter is introduced in Kim et al., 2021 [3].

Collaboration between MUST Converter and Mr. Manager is expected to provide a solution to users who want to perform a single-unit Level 3 PSA or a multi-unit Level 3 PSA which requires to handle many source terms. Key functions of Mr. Manager is introduced in this paper.

2. Key Features of Mr. Manager

“CombineSource.out” files should be saved in each folder as each source term. If a user does not use “CombineSource.out” files but uses “ATMOS.inp” files, then same features can be conducted for “ATMOS.inp” files by clicking “Edit” button and changing the name of source term file into “ATMOS.inp.”

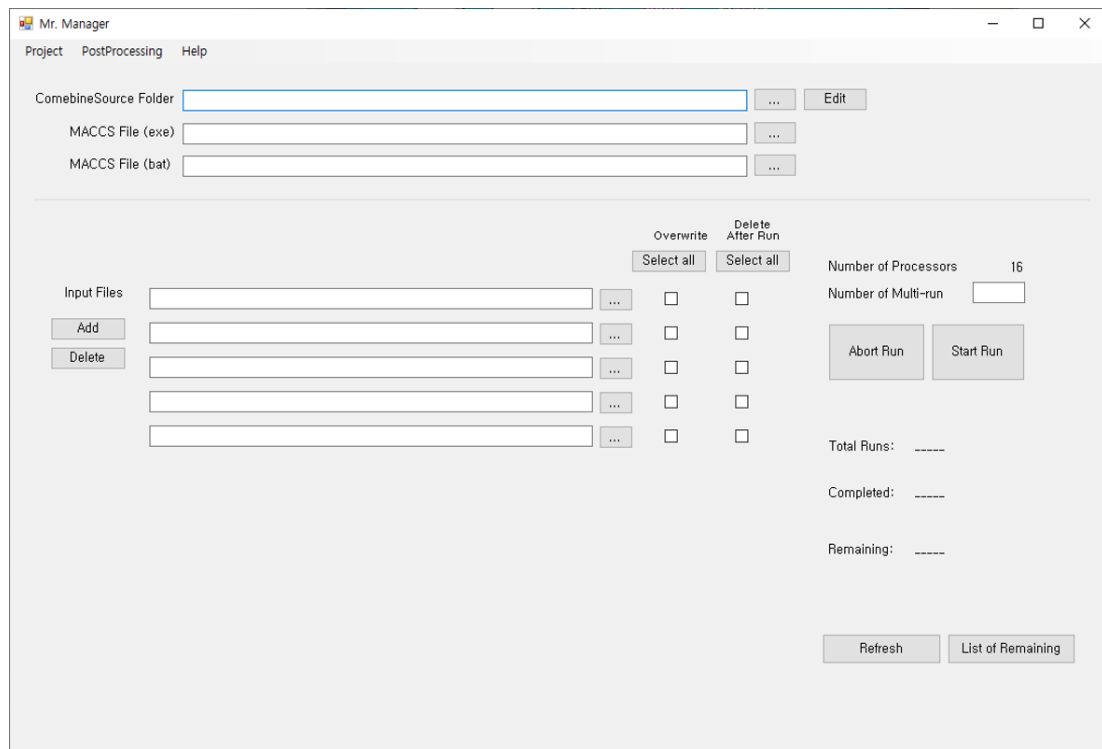


Fig. 1. Main Window of Mr. Manager

2.1 Loading Files

Mr. Manager loads three kinds of files which are mandatory files to run MACCS.

- Source term files in each folder (Source term folders)
- .exe file and .bat file for batch run of MACCS
- MACCS input files to be shared for the runs

MACCS receives source term information from "ATMOS.inp" file. "ATMOS.inp" file is a mandatory file to run MACCS and contains source term information inside or perceives source term information from "CombineSource.out" if it exists [4]. Hence, if "CombineSource.out" file is used as source term file, "ATMOS.inp" should be shared as one of the MACCS input files. Users can select the location where source term folders exist. Mr. Manager recognizes subfolders which contain source term files.

Runs of MACCS by Mr. Manager are executed by batch runs, so not only MACCS execution file but also batch file is needed.

Mandatory input files needed for MACCS run should be shared. The number of input files can be edited in the list by clicking "Add" or "Delete" button. Input files can be loaded individually or "drag & drop" is also allowed for multiple files or a folder containing input files. Before running MACCS, Mr. Manager conducts "copy & paste" input files of the list to each source term folder where each source term file exists. If a user check "Overwrite," Mr. Manager overwrites a file when the file already exists in a source term folder. After running MACCS, Mr. Manager deletes input files which are checked as "Delete after Run." If all input files are checked as "Delete after Run," only the original source term file and result file remain in the source term folder.

Additional function is installed in Mr. Manager when "OALARM.inp" file exists in a source term folder, which can be provided with "CombineSource.out" file from MUST Converter. If "OALARM.inp" file exists in a source term folder, Mr. Manager changes the value of "OALARM" in the copied "EARLY.inp" file as the value in the "OALARM.inp" file. This function allows users to consider different alarm times for each source term.

Example setting of Mr. Manager is presented in Fig. 2.

2.2 Execution of Multiple Calculations

Mr. Manager recognizes the number of processors of the PC where it is installed. Users can enter the number of concurrent calculations wanted to be maintained. By a performance testing, it was found that running multiple cases over the number of processors does not help to reduce net running time to finish the multiple calculations. Hence, it is recommended to set the number of multi-run as below the number of processors.

When a user clicks "Start Run" button, Mr. Manager runs multiple calculations of MACCS, maintaining the number of calculations as entered by the user. When a user clicks "Abort Run" button, Mr. Manager quits and closes all runs of MACCS.

Mr. Manager counts the total, completed, and remaining number of runs. Completed and remaining runs are updated when a MACCS run finishes and a new MACCS run starts. It can be also updated by clicking "Refresh" button. When a user wants to know which source terms are remaining to be run, clicking "List of Remaining" helps it.

All of this procedure can be managed by project-based so that users can continue running for remaining calculations, even if PC is restarted.

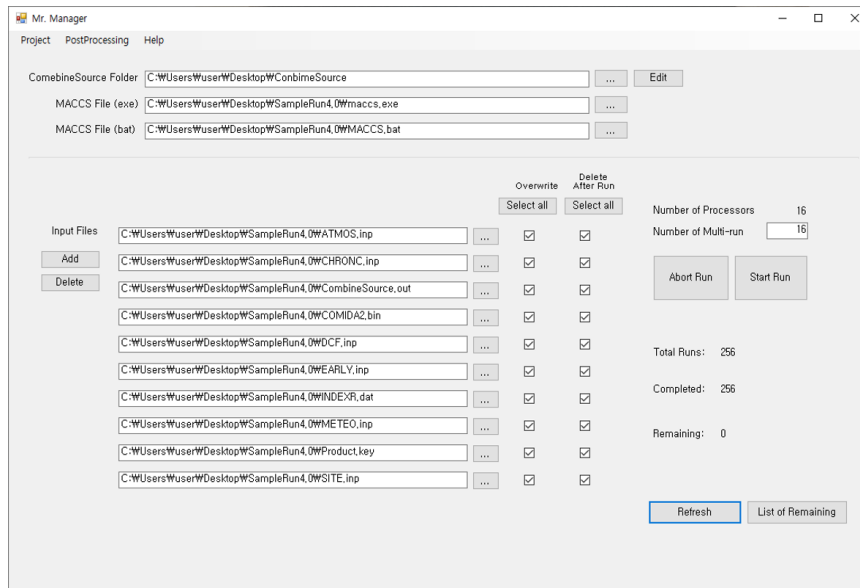


Fig. 2. Example Multi-run Setting of Mr. Manager

3. Verification & Validation of Mr. Manager

Mr. Manager does not conduct a calculation by itself but manages multiple runs of another software. Therefore, management functions of files and runs were tested and it was confirmed that Mr. Manager operates appropriately following the requirements and design of the software.

4. Conclusions

Mr. Manager Version 1.0 which can manage runs of enormous number of MACCS calculations has been developed and released. Source term files can be automatically produced and provided by MUST Converter from the results of MAAP analyses. It is expected that established system of two software can support to perform single-unit or multi-unit Level 3 PSA.

Since Mr. Manager is flexible for the names of common file (source term file in this study), .exe file, .bat file, and shared files, it is expected that Mr. Manager can be widely employed to manage and perform multiple calculations having a similar architecture.

5. Further Work

A workstation which has 128 processors was installed to support for running a huge number of calculations. It is expected that further studies about both single-unit and multi-unit Level 3 PSA can be carried out by the supports of established hardware and software.

Acknowledgements

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