

**AN AUTOMATED TOOL FOR  
MODELLING THE AUXILIARY  
BUILDING OF BELGIAN  
NUCLEAR POWER PLANTS IN  
MELCOR 1.8.6**

EMUG 2015 - Brussels

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# PURPOSE OF THE MATLAB SCRIPT

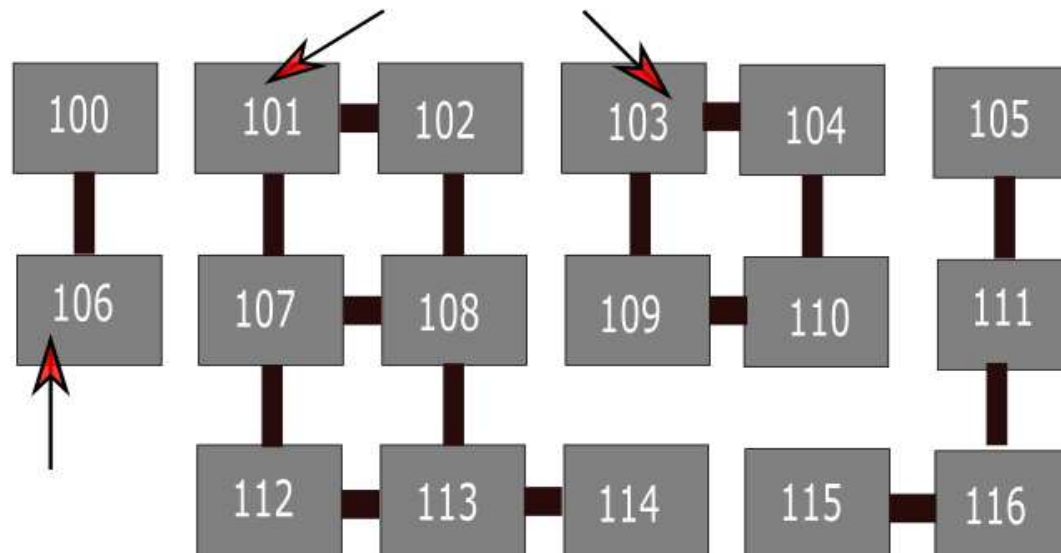
- Requested:
  - Modelling of the auxiliary building of all the nuclear power plants in Belgium
- Large data input
  - Manageable with an automated tool
  - Automatic reduction of the number of CVs, FLs and HSs

# METHODOLOGY

- The starting point for the automated tool
  - A database (rooms, connections, walls and ventilation lines) resulting from Fire Hazard Analysis projects and walk downs (performed by Tractebel Engineering) is used
- The input for the automated tool
  - Mass/energy source arrival
- 1) Creation of blocks
- 2) Grouping method to reduce number of rooms
- 3) Addition of the ventilation and design leakage to the model
- The output of the automated tool
  - Melcor User Input File

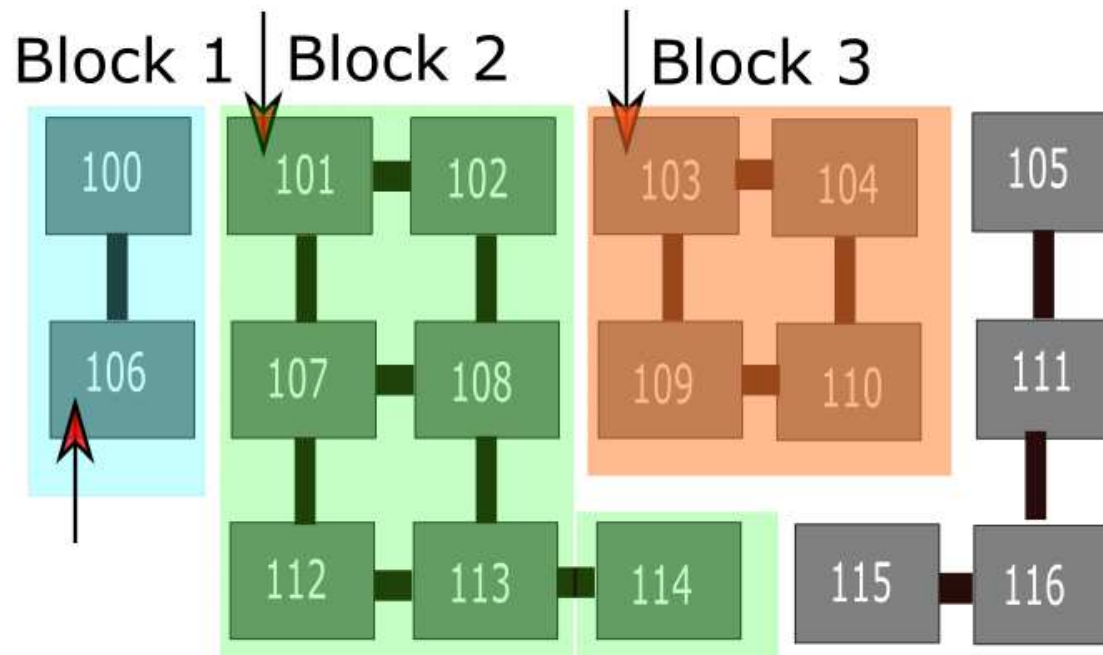
## OFF LINE DEMO

- Exact model of an auxiliary building (Tihange 1)
  - 218 rooms, 602 flow paths and 1032 heat structures
- Initial situation of the demo:
  - 16 rooms, 19 flow paths and 96 heat structures
  - Three arrivals of mass/energy



## OFF LINE DEMO

- Step 1: grouping in blocks
  - A block is started by a room with an arrival of mass/energy
  - One block is a set of rooms which are all connected
  - No interconnection between the blocks



## OFF LINE DEMO

- Step 2: grouping according to connection ratio
  - The user defines the final number of control volumes (5 for example)
  - Grouping based on a connection ratio:

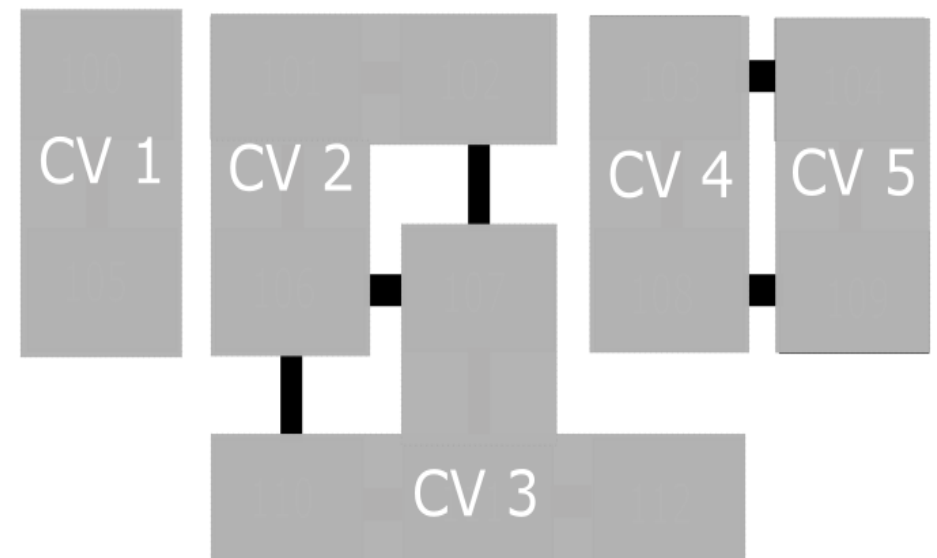
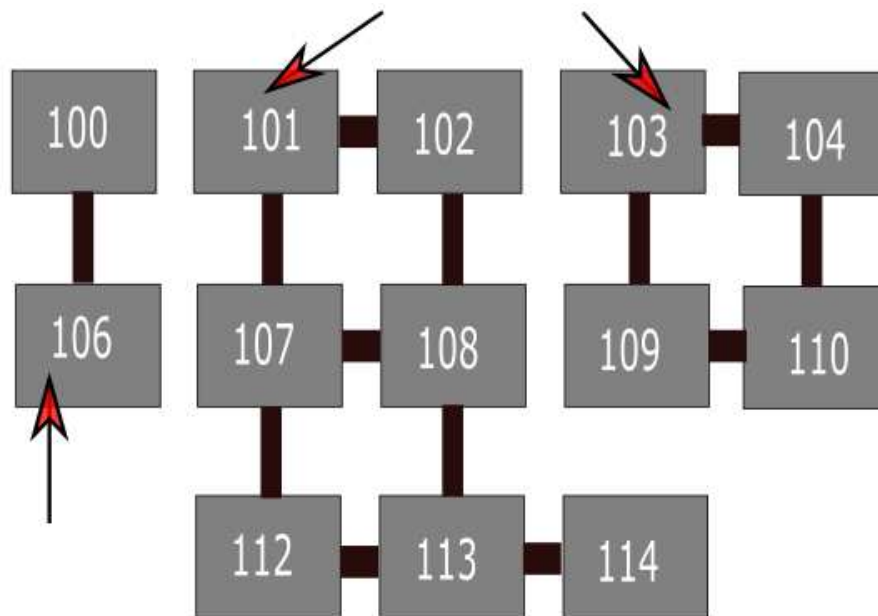
$$\frac{\text{volume of the connection}}{\text{biggest room volume of the connecting rooms}}$$

- 13 connections; 13 connection ratios
- Start grouping with the biggest connection ratio (13 CV to 12 CV)
- Continue grouping until the user defined CV number is reached



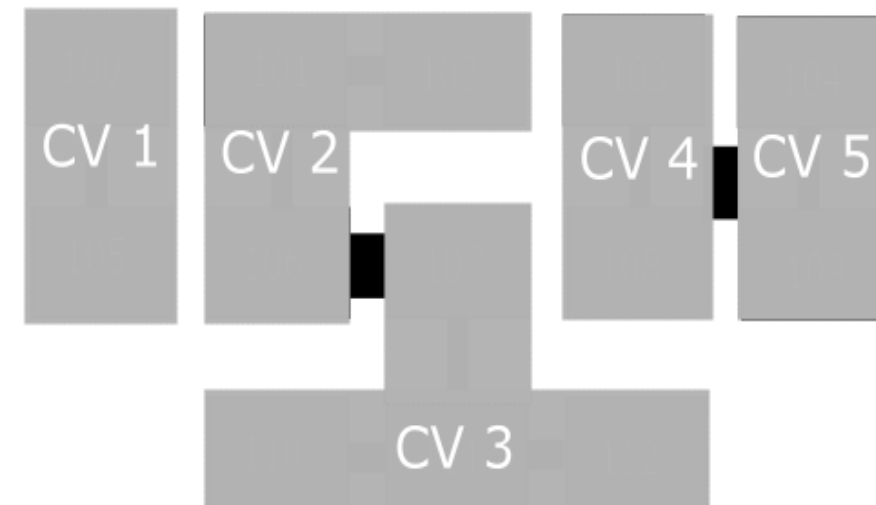
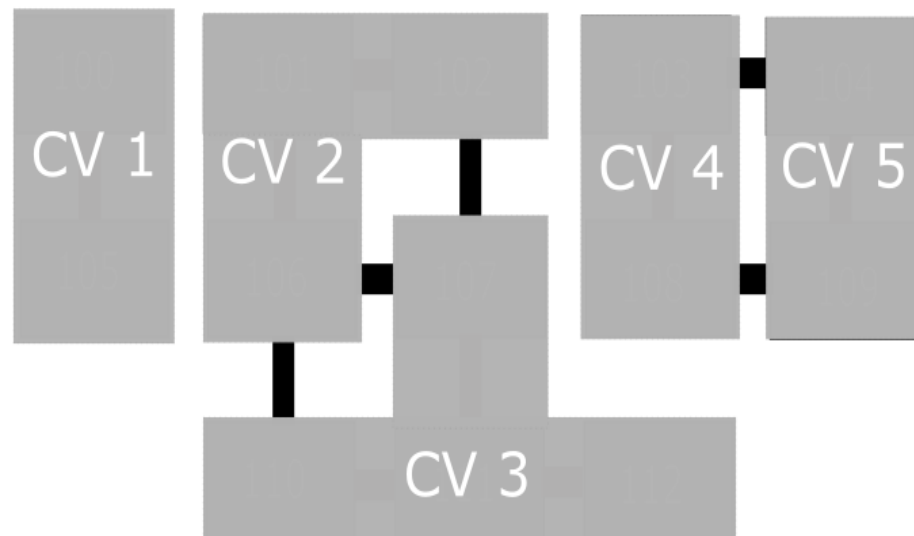
## OFF LINE DEMO

- Step 2: grouping according to connection ratio



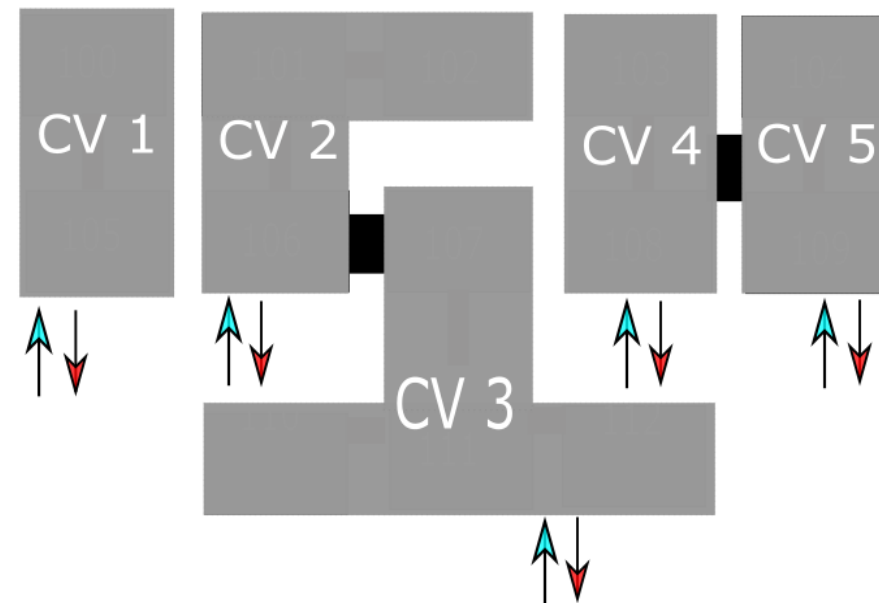
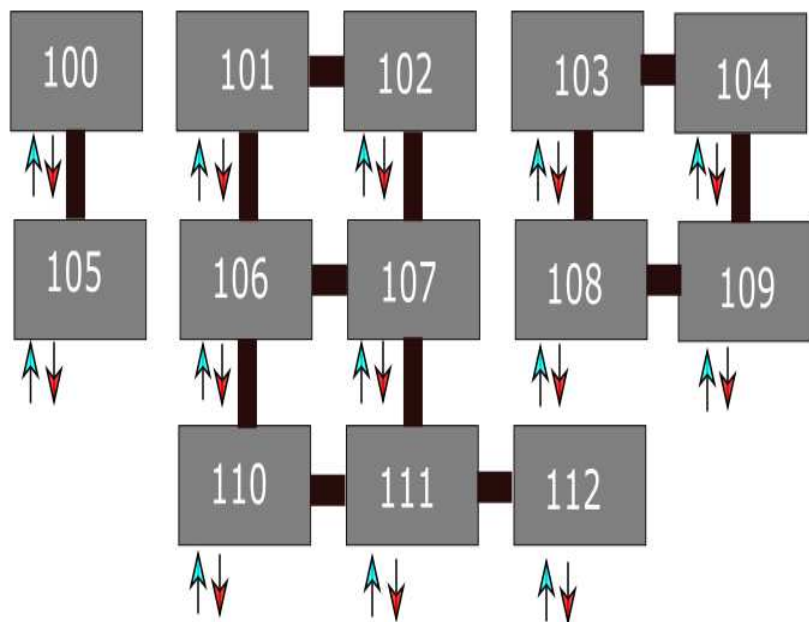
## OFF LINE DEMO

- Step 2: grouping according to connection ratio
  - Note that a decision has to be made at this point:
    - Grouping in one flow path, loss of accuracy, increase in simplification
    - Not grouping in one flow path, increase in accuracy, decrease in simplification



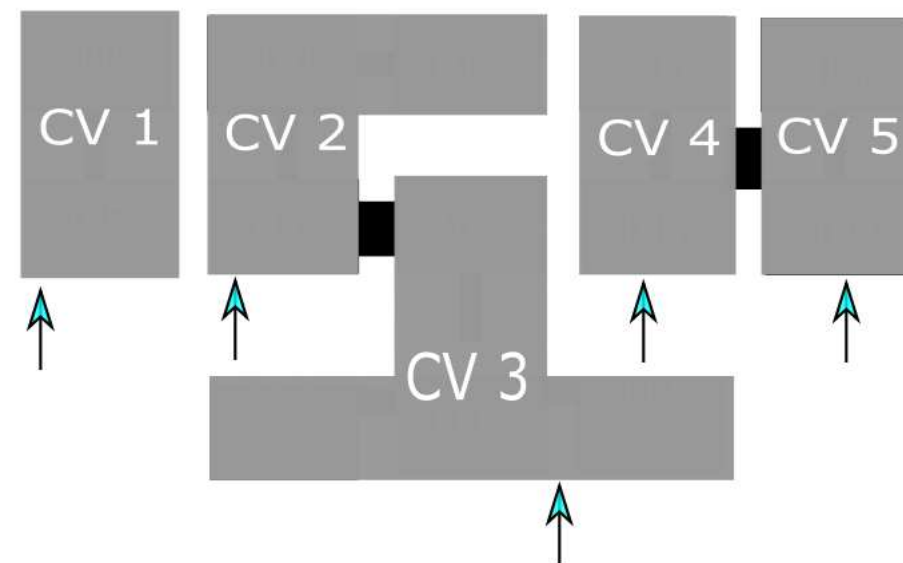
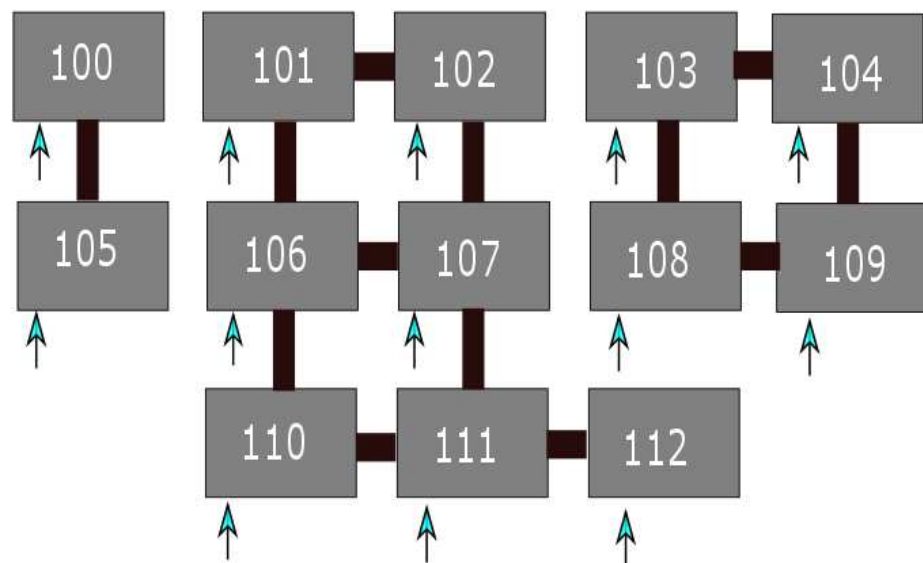
## OFF LINE DEMO

- Step 3: Extend the model with ventilation
  - Data resulting from the databases and plant specifications
  - Same methodology used as before, addition of the ventilation flow paths



## OFF LINE DEMO

- Step 3: Extend the model with design leakages
  - Design leakage between AB and AS
  - Design leakage between AB and environment.



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## CONCLUSION

- The auxiliary building of the nuclear power plants in Belgian has been modelled
- The user defined control volumes can be changed instantaneously
- The databases are checked for inconsistencies
  - Flow path height not consistent with From/To room elevation
- Whenever there is an update of the database
  - Auxiliary building model is generated instantaneously
- Consistencies in the modelling of all auxiliary buildings

# CONCLUSION

- There is a need for engineering judgment
  - The number of rooms
  - The number of connections
- Every decision is supported by the automated tool