Fire Dynamics
CFAST

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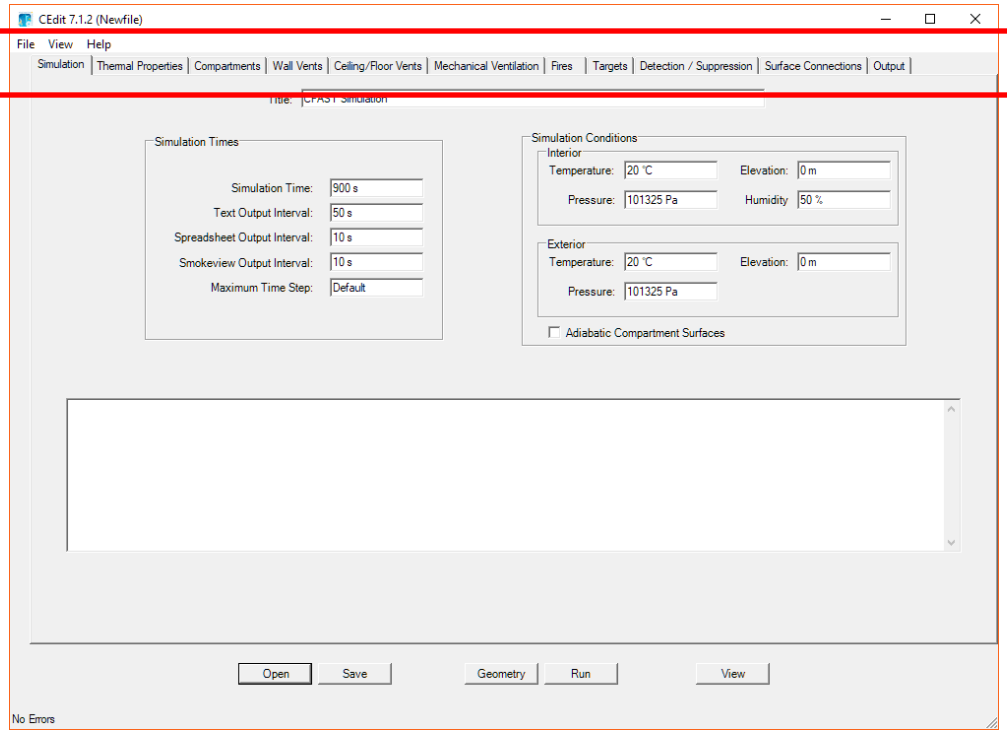
Download

- https://pages.nist.gov/cfast/
- Typical software installation process

Example 1

- Fill the blanks at each tab from left to right.
  - Simulation, thermal properties, compartments, …

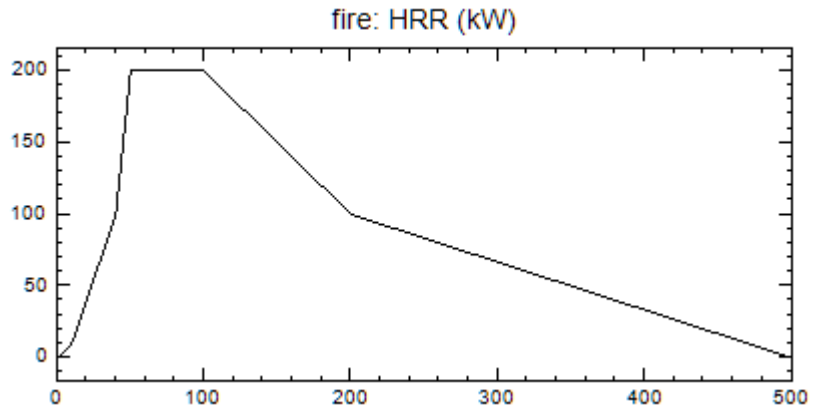


Example 1

- Thermal properties
  - Wall, ceiling, etc.
  - Concrete
    - 2200 kg/m3, k=0.00175 kW/m-K, cp = 1kJ/kg-K, emissivity = 0.94, thickness = 0.2 m
  - Gypsum board
    - 790 kg/m3, k=0.00016 kW/m-K, cp=0.9 kJ/kg-K, emissivity = 0.9, thickness = 0.016 m
- Compartments
  - Room
    - 2.4 m by 3.6 m by 2.4 m (H)
    - Normal(two zone model)
    - Wall and ceiling: gypsum, floor: concrete

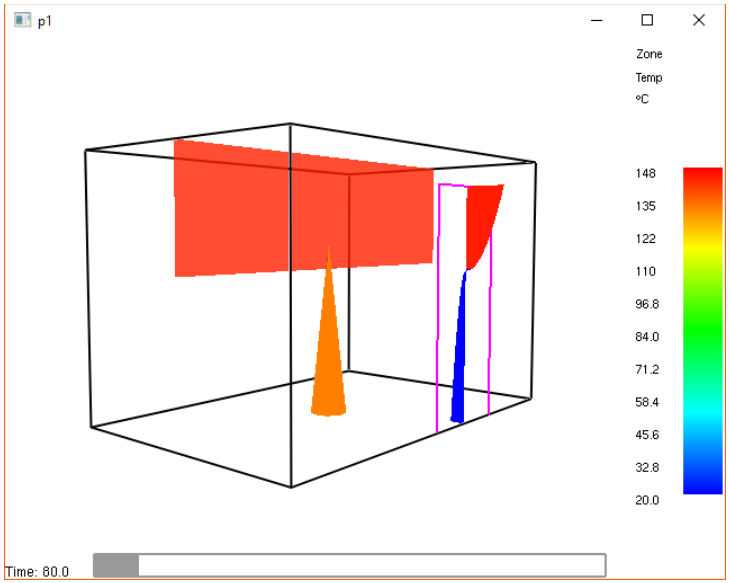
Example 1

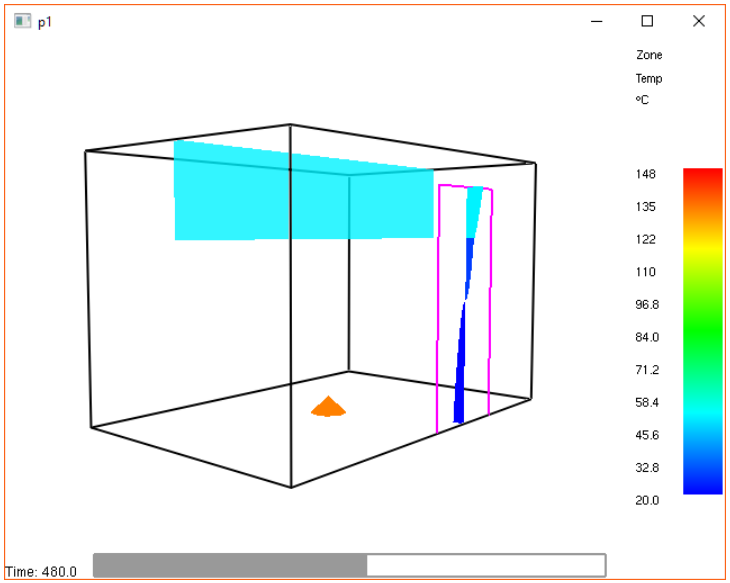
- Wall vents
  - From comp1 to outside
  - 0.9 m by 2.1 m(H) door initially open
- Ceiling/floor vents, mechanical vent.: none
- Fire curve
  - From spreadsheet



Example 1

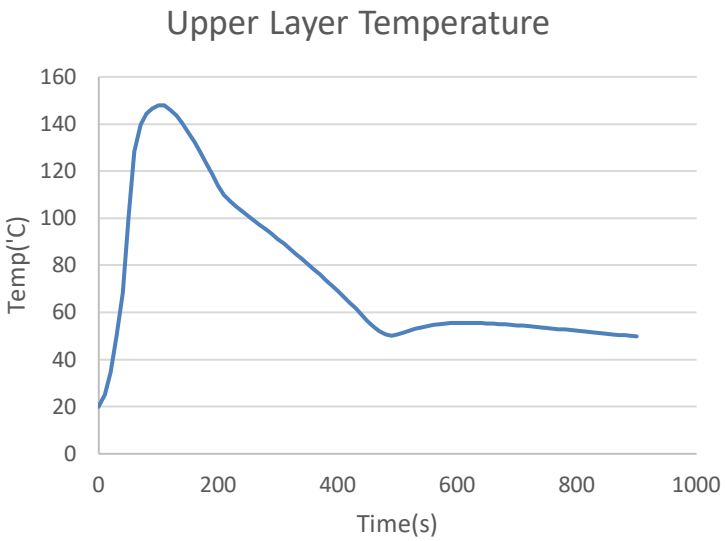
- Run the simulation
- Check the smokeview file (filename.smv)

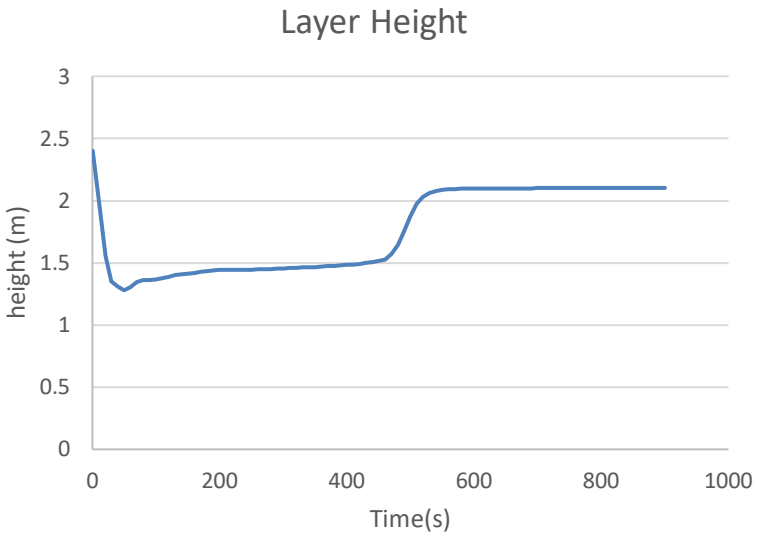




Example 1

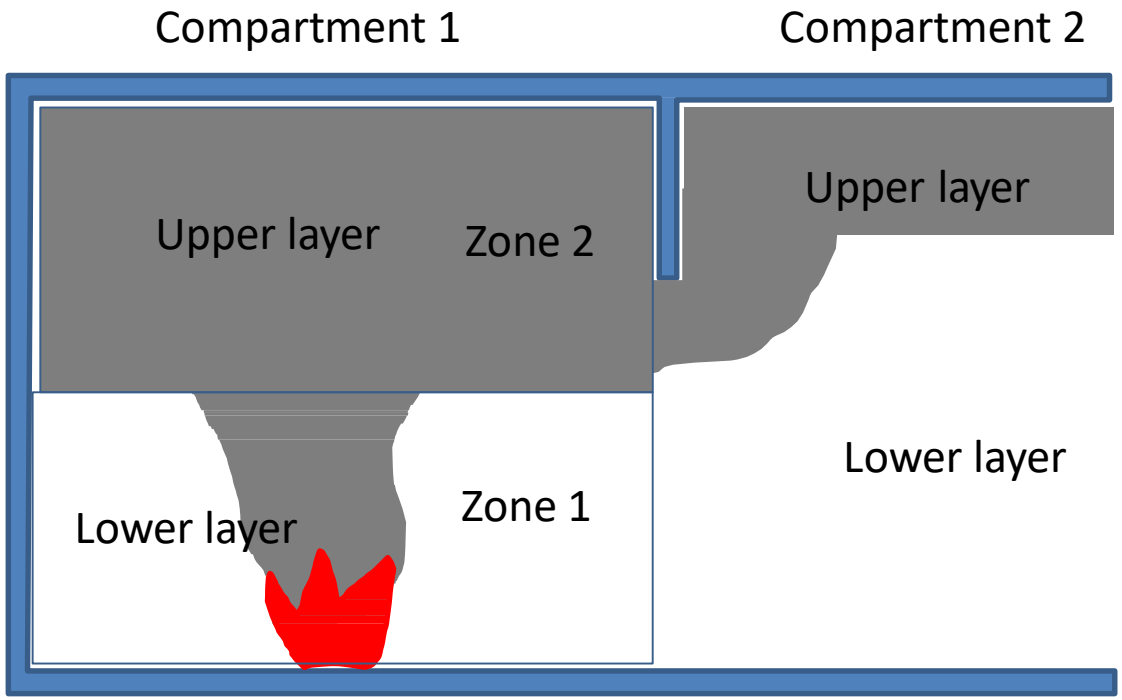
- Run the simulation
- Check the smokeview file (filename.smv)
- Check the filename_n.csv file





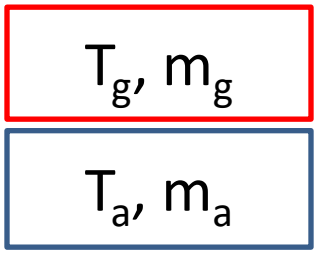
Two zone fire model

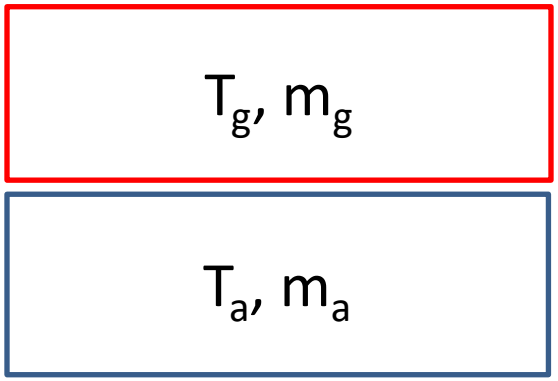
- Each compartment with 2 zones
  - Hot upper zone and cool lower zone



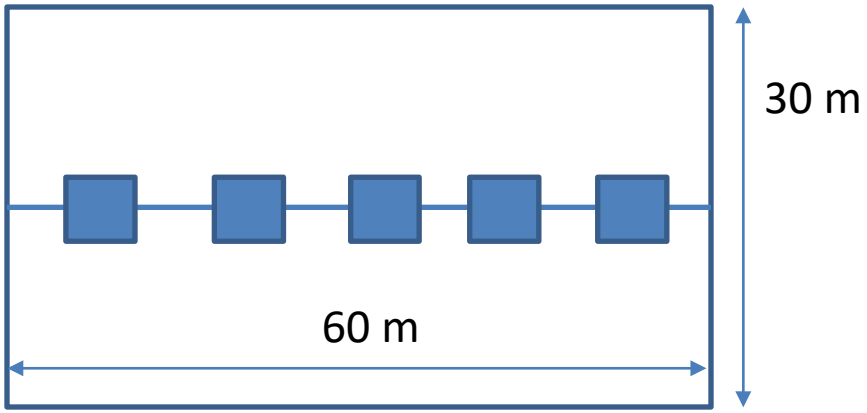
Two zone fire model

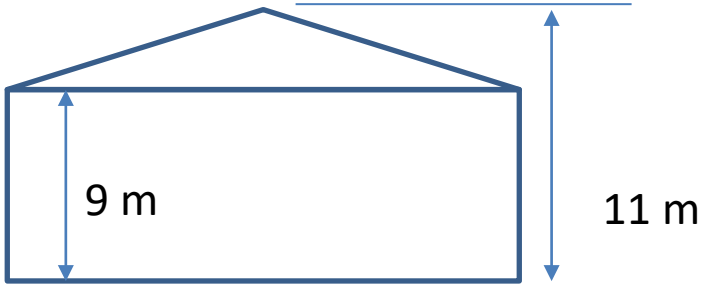
- Each compartment with 2 zones
  - **1 hot upper zone and 1 cool lower zone**
  - Zone size varies depending on the building and compartment dimension

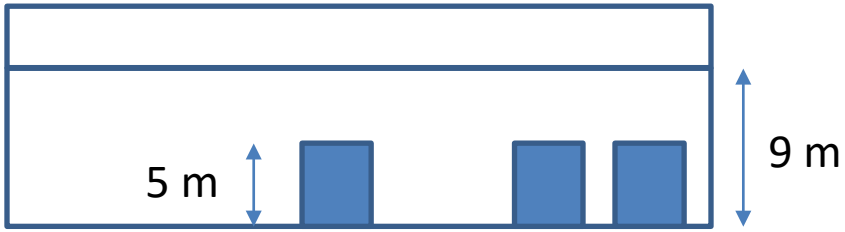


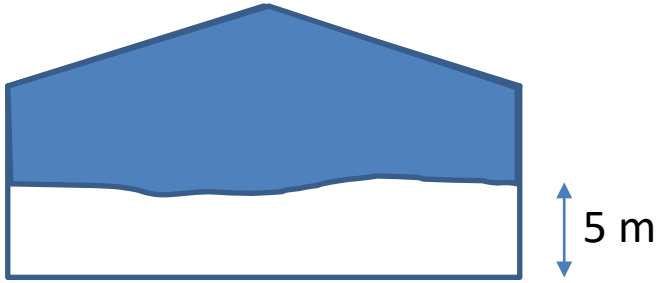


Example 2









Example 2

- Natural ventilation
  - Floor dimension (30 m by 60 m)
  - Pitched roof (11 m at the center, 9 m at both ends)
  - Three open 5 m by 5 m (H) roller shutter doors initially open
  - Fire size: constant 20 MW
  - The number of ceiling vents (square): 5
  - The minimum vent area to keep the upper layer above 5 m for 30 min?

Example 3

- Mechanical ventilation
  - Floor dimension (30 m by 60 m)
  - Pitched roof (11 m at the center, 9 m at both ends)
  - Three open 5 m by 5 m (H) roller shutter doors initially open
  - Fire size: constant 20 MW
  - The number of ceiling vents (square): 3
  - The opening area of a vent : 1 m^2
  - The minimum flow rate to keep the upper layer above 5 m for 30 min?