

# Effect and Appropriate Use of **TIME\_SHRINK\_FACTOR** in FDS

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# TIME\_SHRINK\_FACTOR

- Reduces the time necessary to transfer heat to surfaces by reducing the specific heat of the materials by that factor

```
&TIME TIME_SHRINK_FACTOR=10. /
```

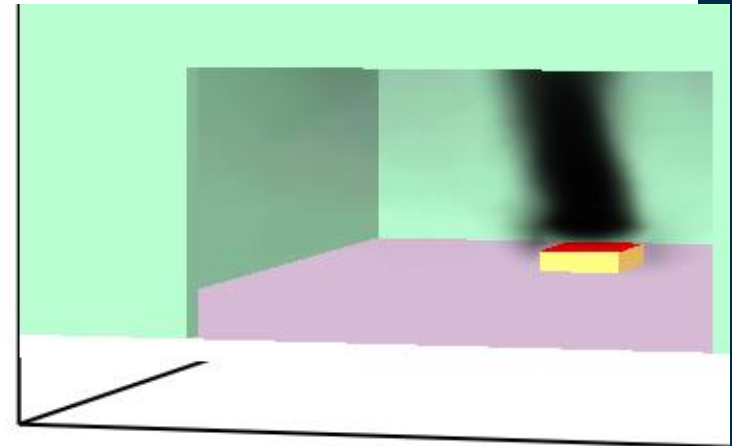
# TIME\_SHRINK\_FACTOR

- Reduces the device activation time and simulation time by the same factor

C:\Windows\System32\cmd.exe

```
Time Step: 2900, Simulation Time: 161.54 s
Time Step: 3000, Simulation Time: 167.33 s
Time Step: 3100, Simulation Time: 173.12 s
Time Step: 3200, Simulation Time: 178.79 s
Time Step: 3300, Simulation Time: 184.21 s
Time Step: 3400, Simulation Time: 189.72 s
Time Step: 3500, Simulation Time: 195.73 s
Time Step: 3600, Simulation Time: 201.78 s
Time Step: 3700, Simulation Time: 207.75 s
Time Step: 3800, Simulation Time: 213.44 s
Time Step: 3900, Simulation Time: 219.21 s
Time Step: 4000, Simulation Time: 224.54 s
Time Step: 4100, Simulation Time: 230.03 s
Time Step: 4200, Simulation Time: 235.26 s
Time Step: 4300, Simulation Time: 241.25 s
Time Step: 4400, Simulation Time: 247.10 s
Time Step: 4500, Simulation Time: 252.91 s
Time Step: 4600, Simulation Time: 258.62 s
Time Step: 4700, Simulation Time: 264.17 s
Time Step: 4800, Simulation Time: 269.85 s
Time Step: 4803, Simulation Time: 270.00 s
```

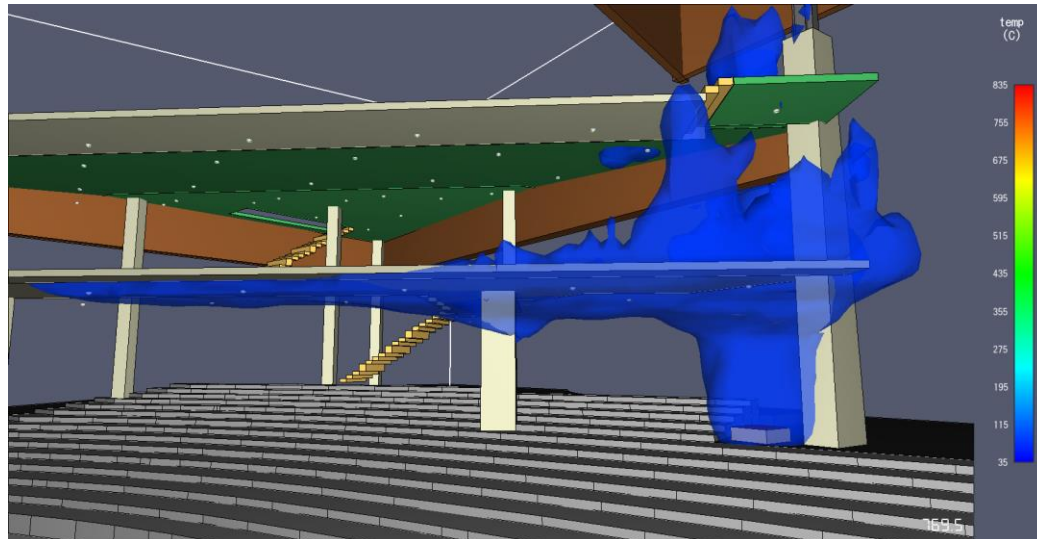
STOP: FDS completed successfully <CHID: 914TSP>



Time: 2700.0

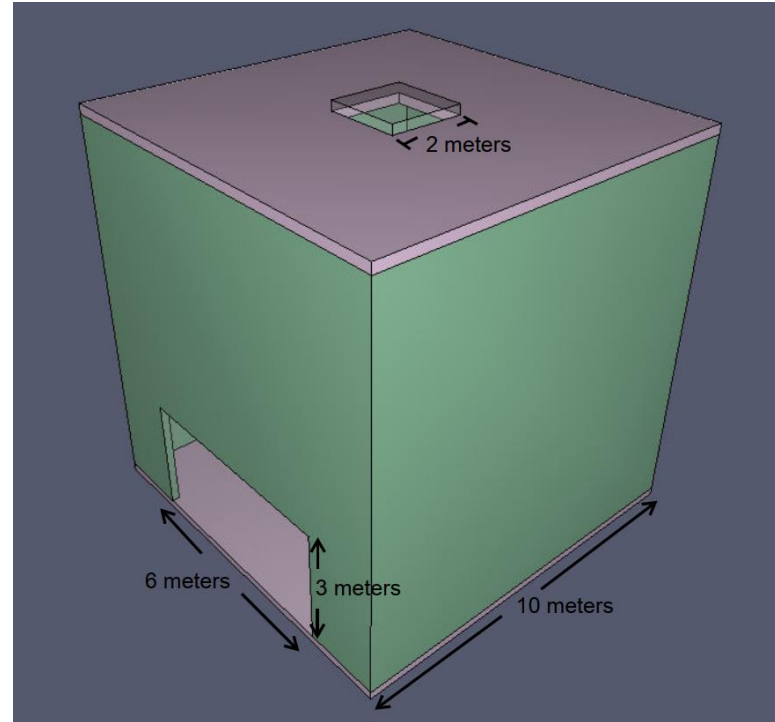
# FDS and Fire Protection Engineering Design

- Atrium Smoke Control
- Building Fire Exposure
- Performance Based Approach
- Code Modification



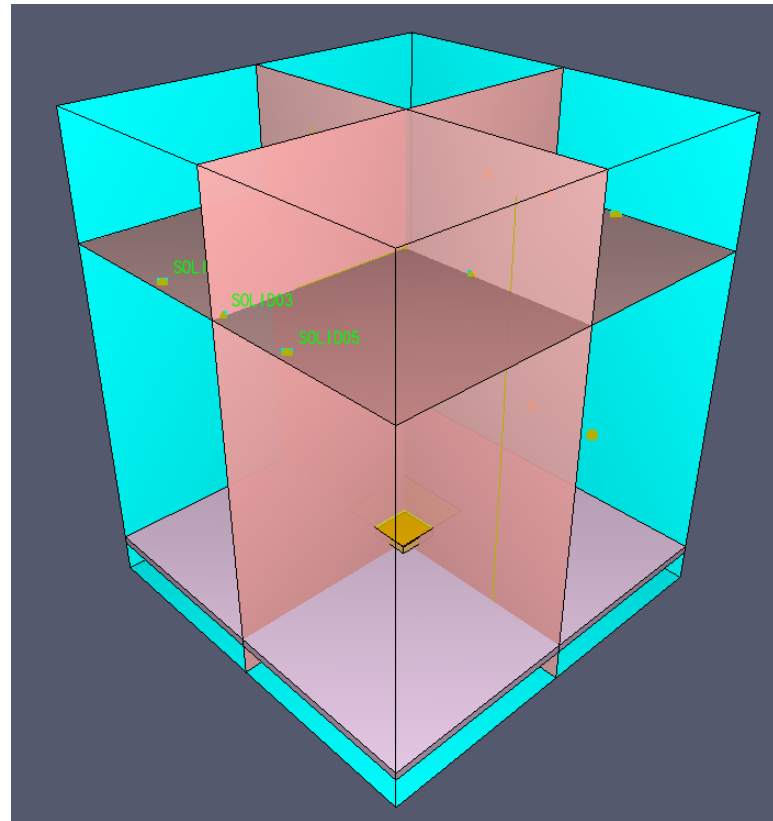
# Defined Inputs

- Mesh and Boundaries
- Fuel Properties
- Obstruction Properties
  - Concrete and Gypsum
- Room Geometry
- Fire Location (center of floor)
- Fire Size (500 kW)
- Natural Makeup air and Exhaust



# Defined Outputs

- Slice files
  - Temperature, Visibility, Velocity
- Thermocouples
  - Gas temperature of smoke layer
  - Gas temperature near wall
- Wall Temperature
  - Upper and Lower
- Beam detector
- Boundary Quantity
  - Incident heat flux
  - Wall temperature
- Volume and Mass Flow above Fire
- Smoke Layer Height



# Simulation Matrix

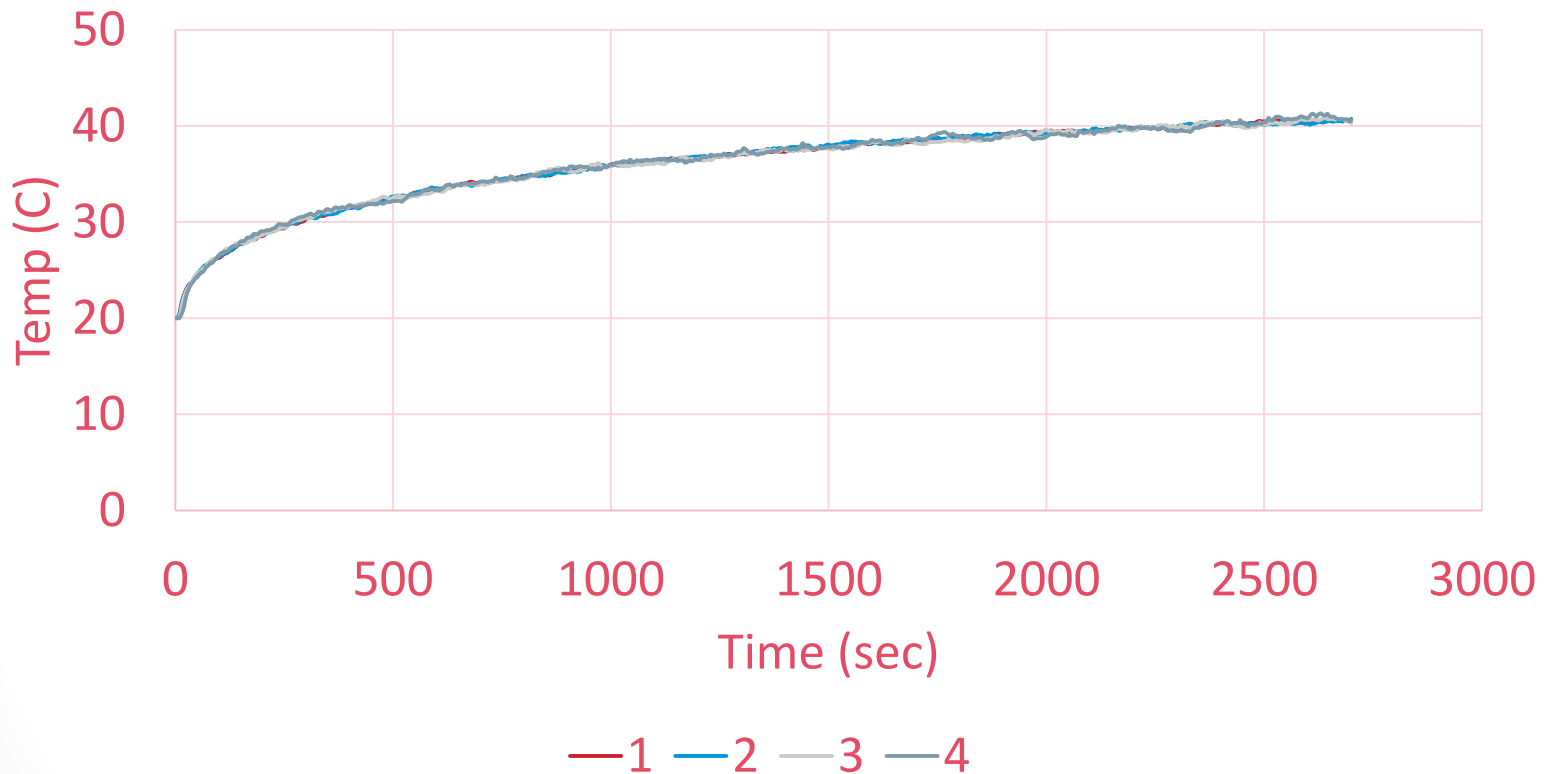
Scenario	Heat Release Rate		Time Shrink Factor			
	Steady	Growth	None	2	5	10
1	X		X			
2	X			X		
3	X				X	
4	X					X
5		X	X			
6		X		X		
7		X			X	
8		X				X

# Simulation Run Time Results

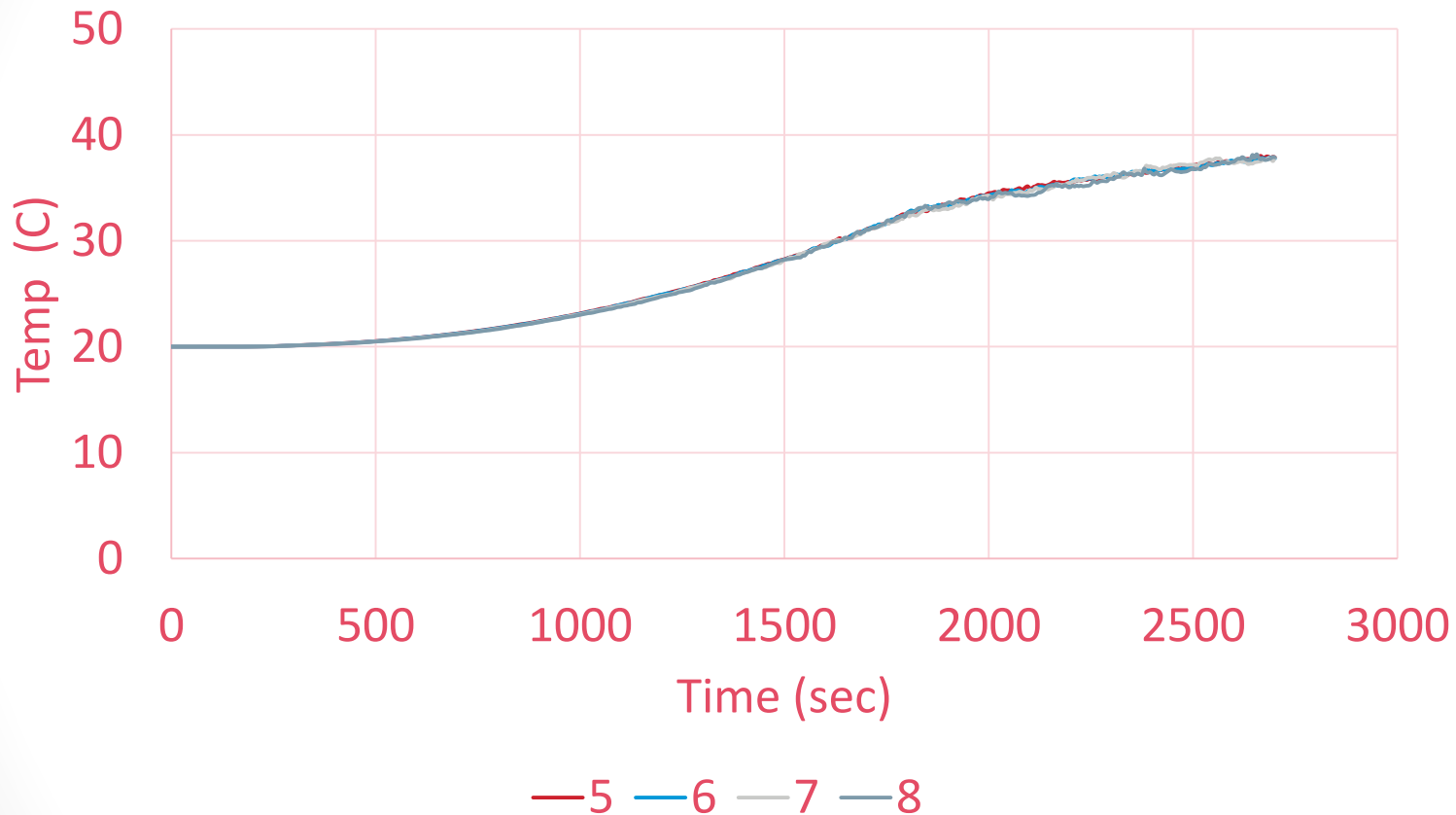
Scenario	Simulation Time	
	TSF	Run Time Reduced
1	NA	NA
2	2	1.9
3	5	4.7
4	10	9.2
5	NA	NA
6	2	2.1
7	5	5
8	10	10



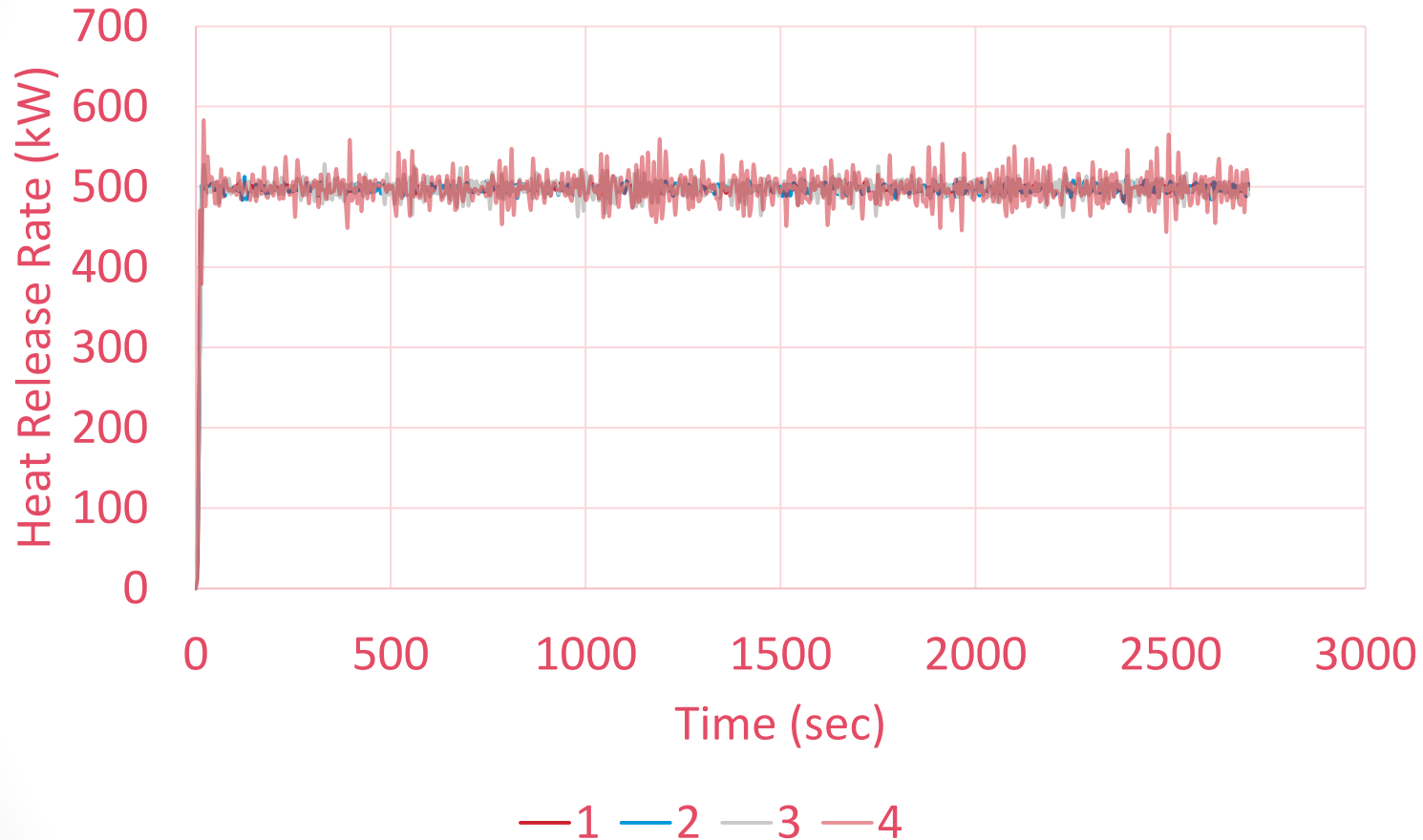
# Lower Wall Temperature (Steady)



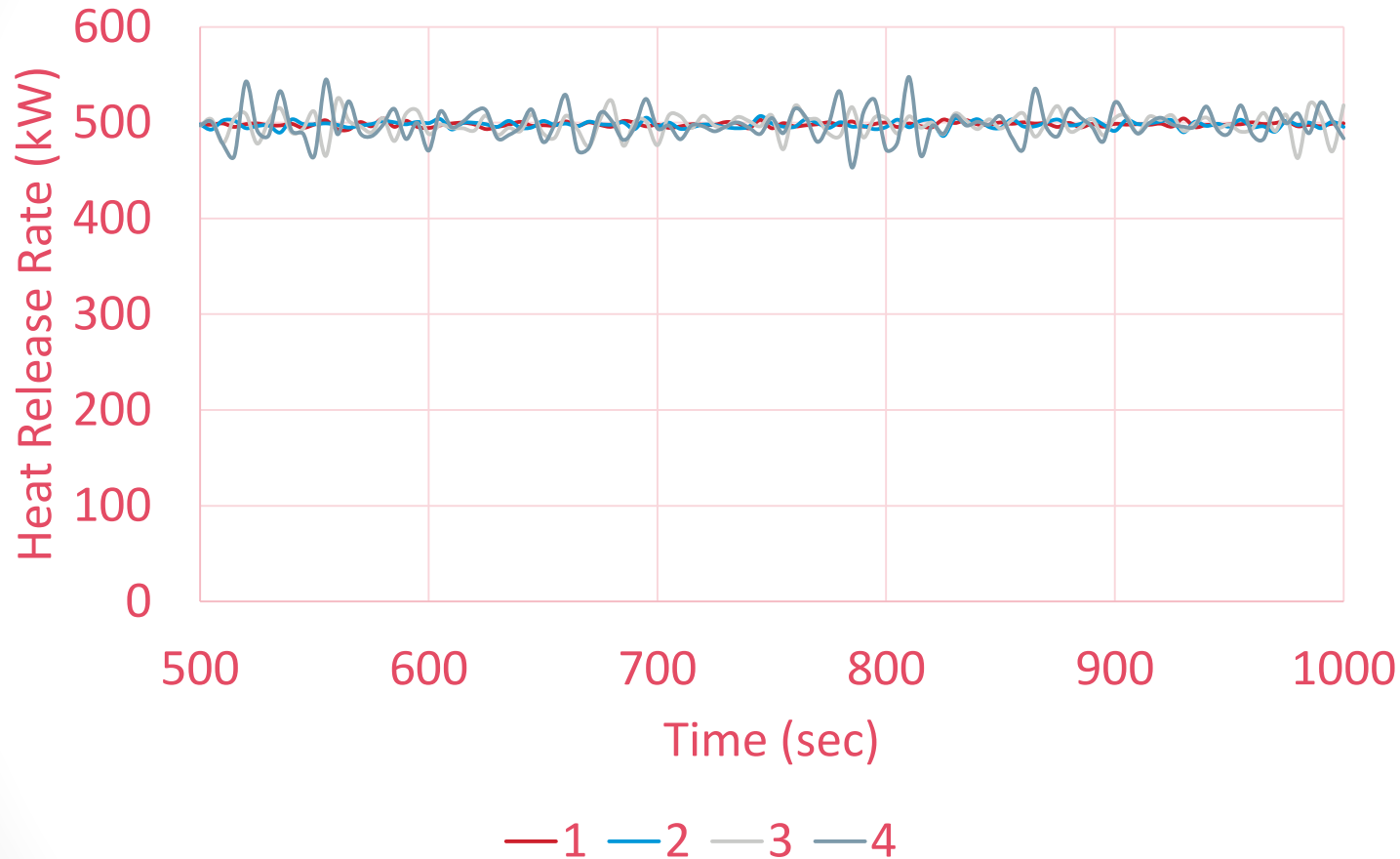
# Lower Wall Temperature (Growth)



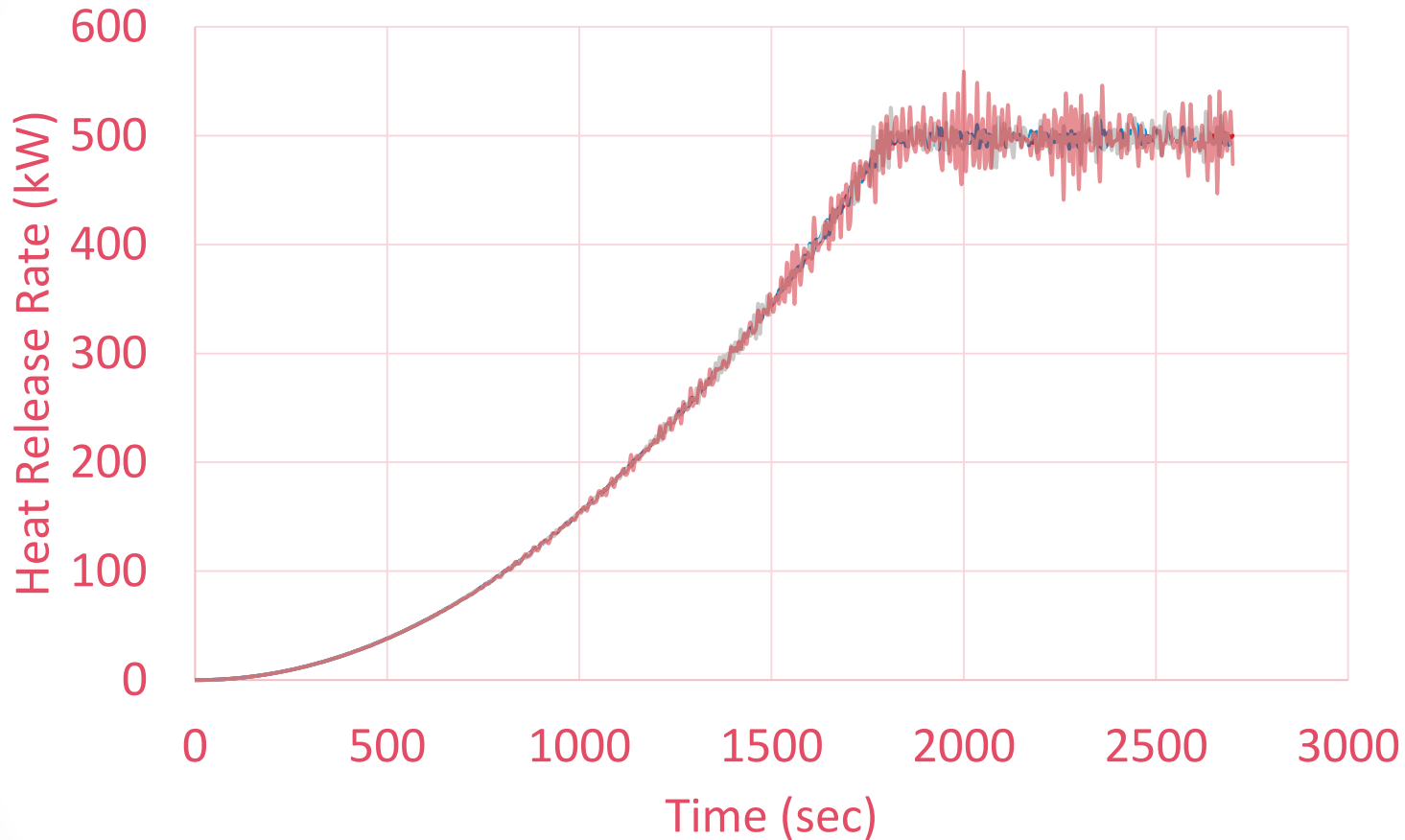
# Heat Release Rate (Steady)



# Heat Release Rate (Steady)

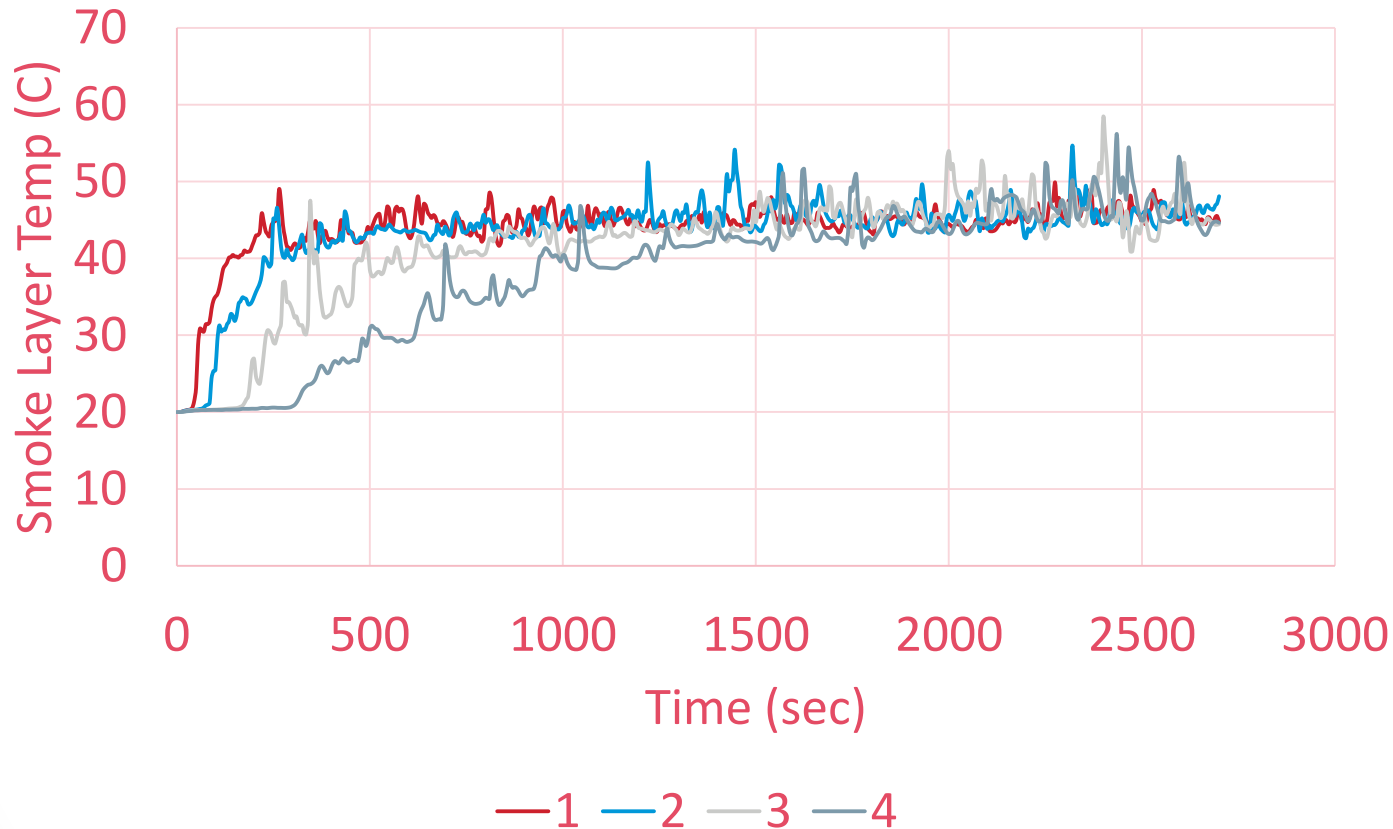


# Heat Release Rate (Growth)

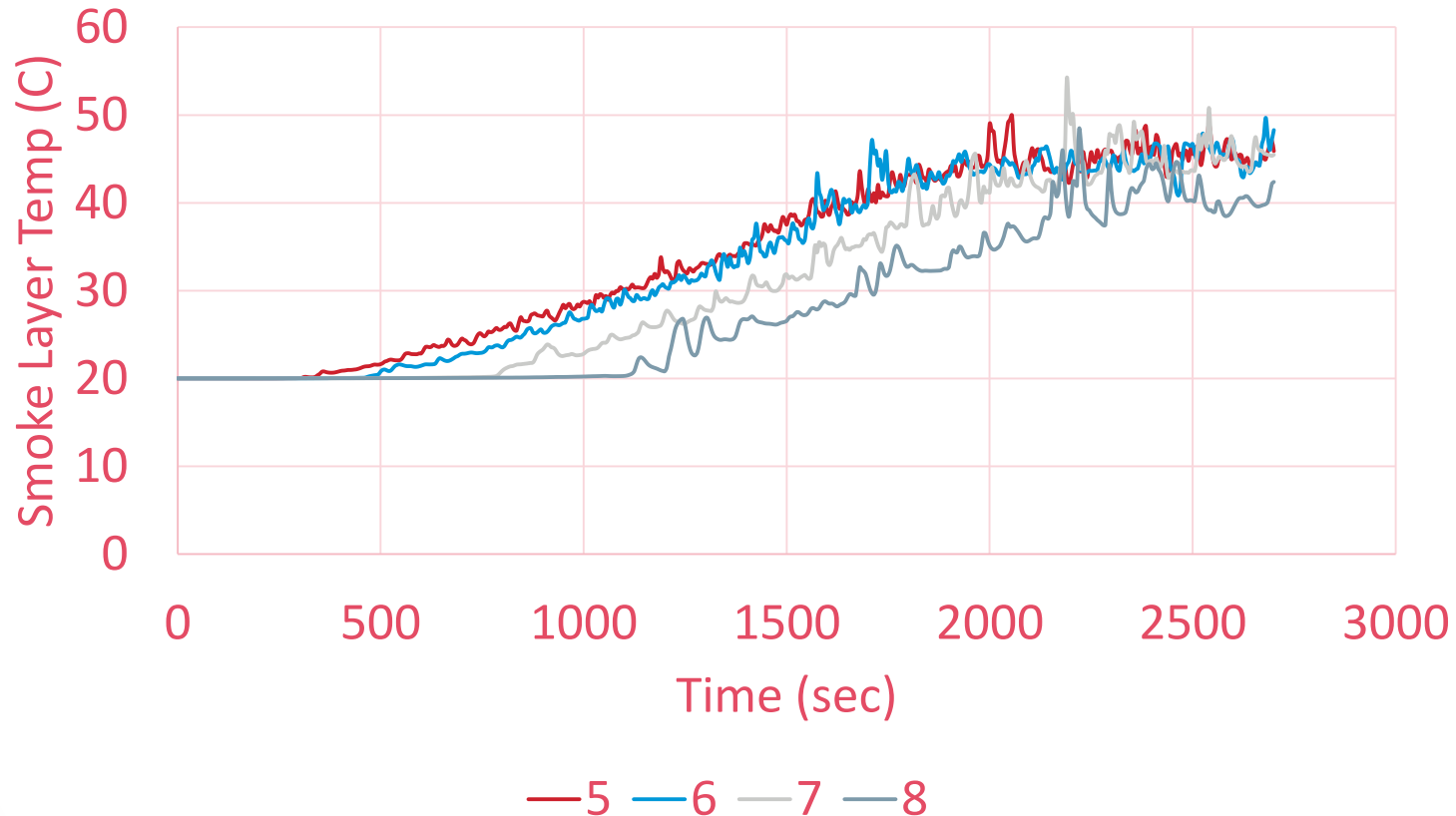


—5 —6 —7 —8

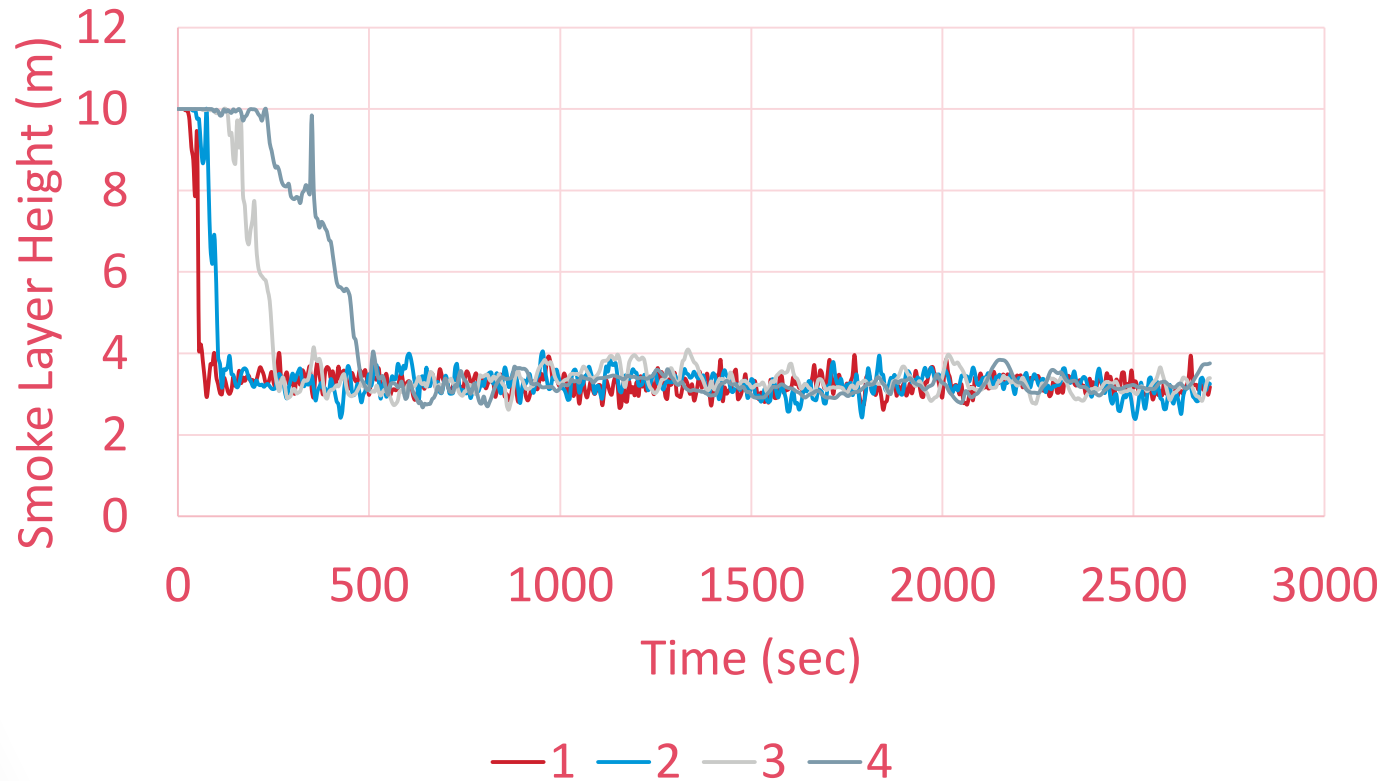
# Smoke Layer Temperature (Steady)



# Smoke Layer Temperature (Growth)

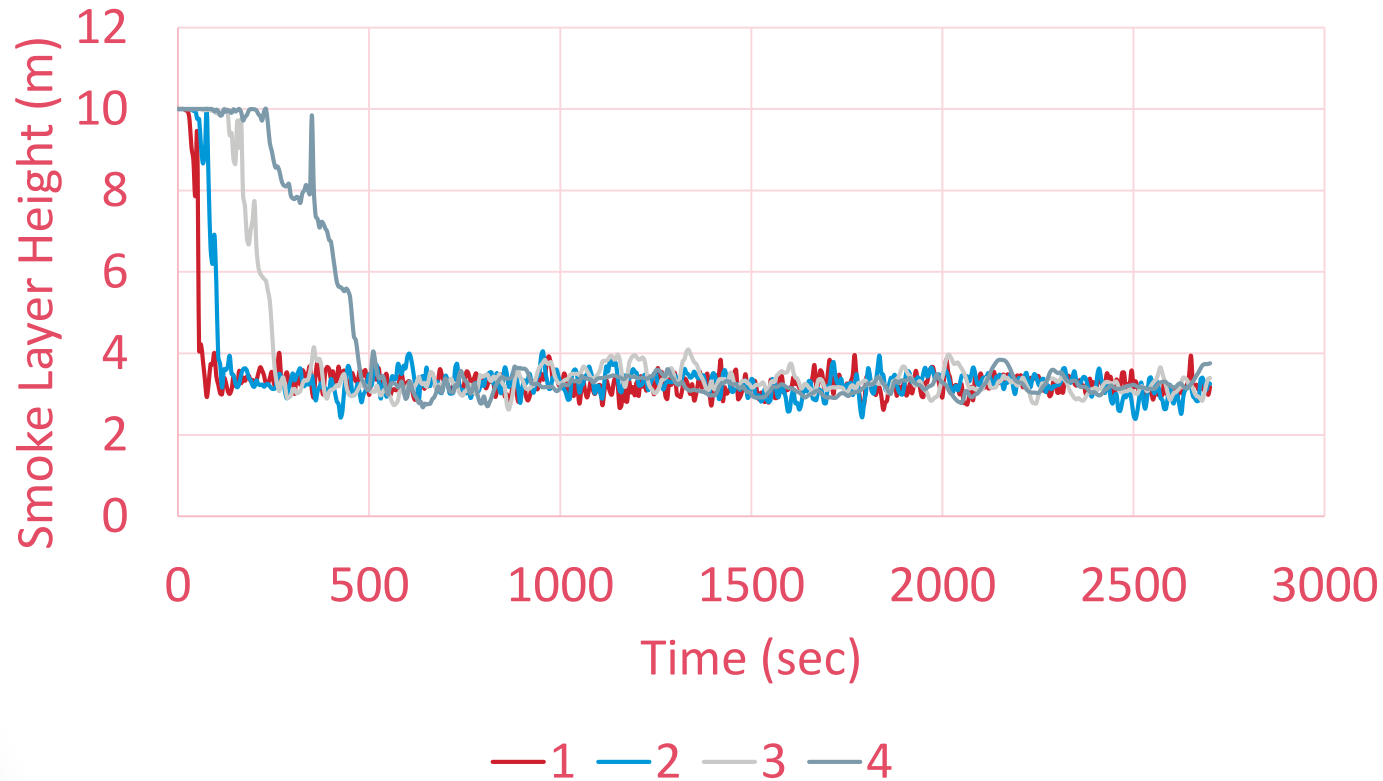


# Smoke Layer Height (Steady)

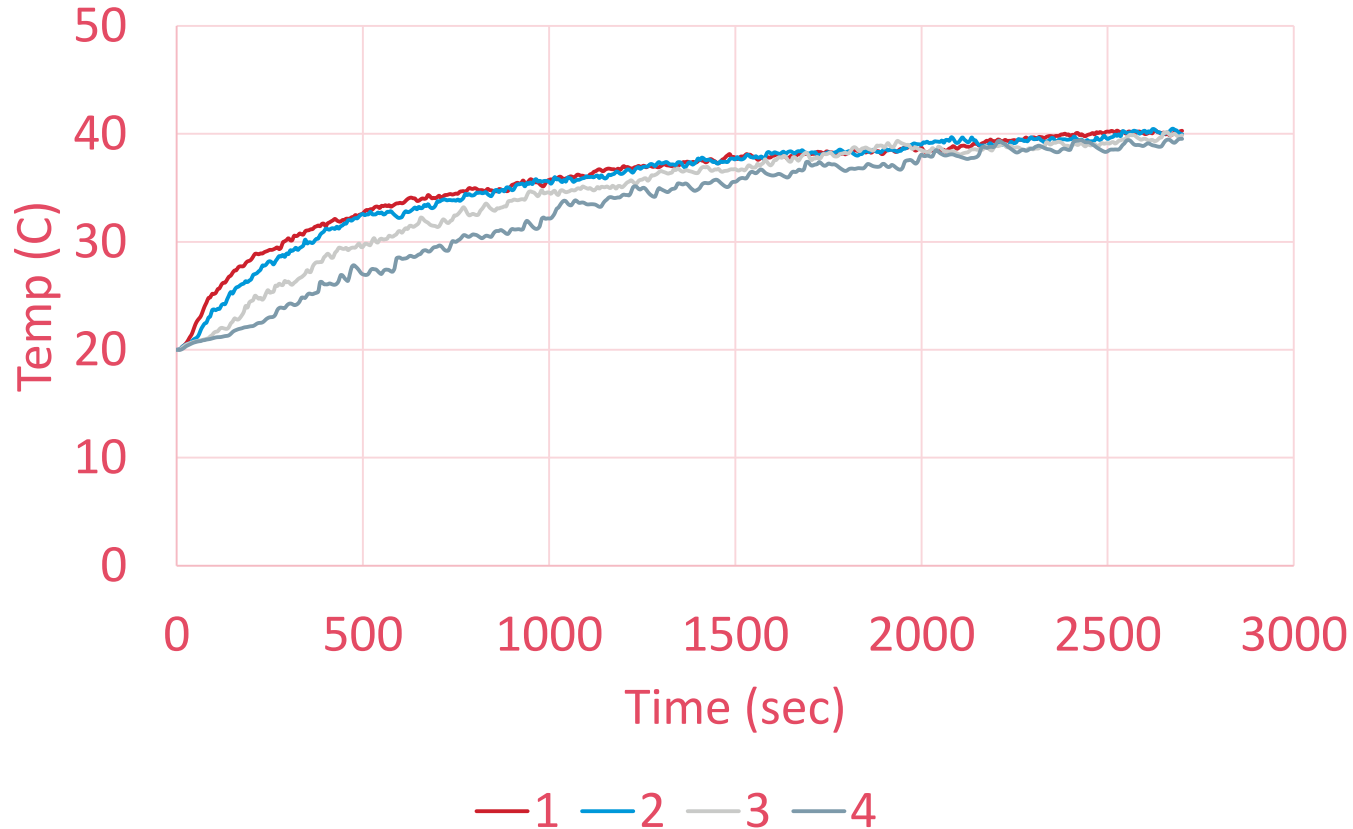




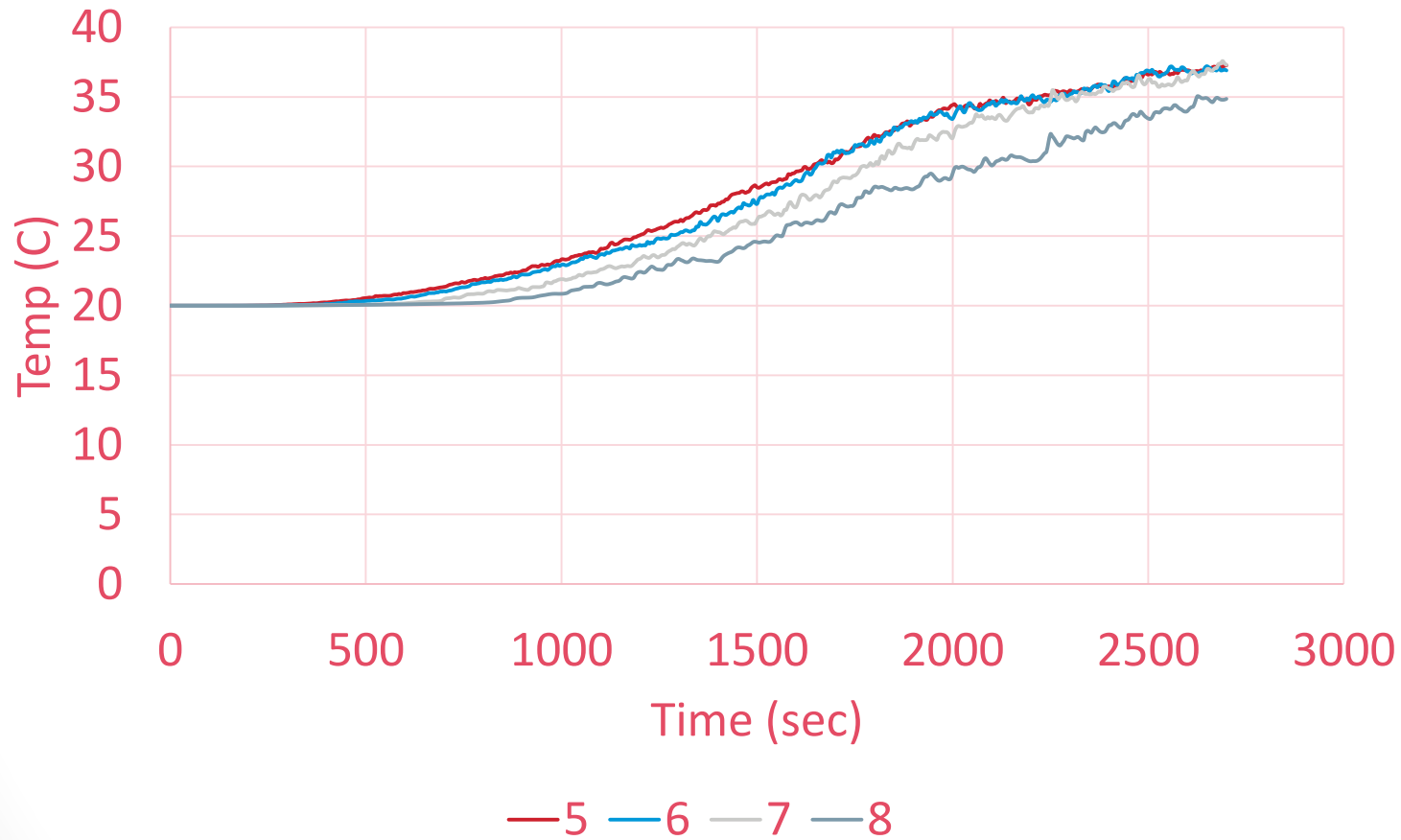
# Smoke Layer Height (Growth)



# Upper Wall Temperatures (Steady)

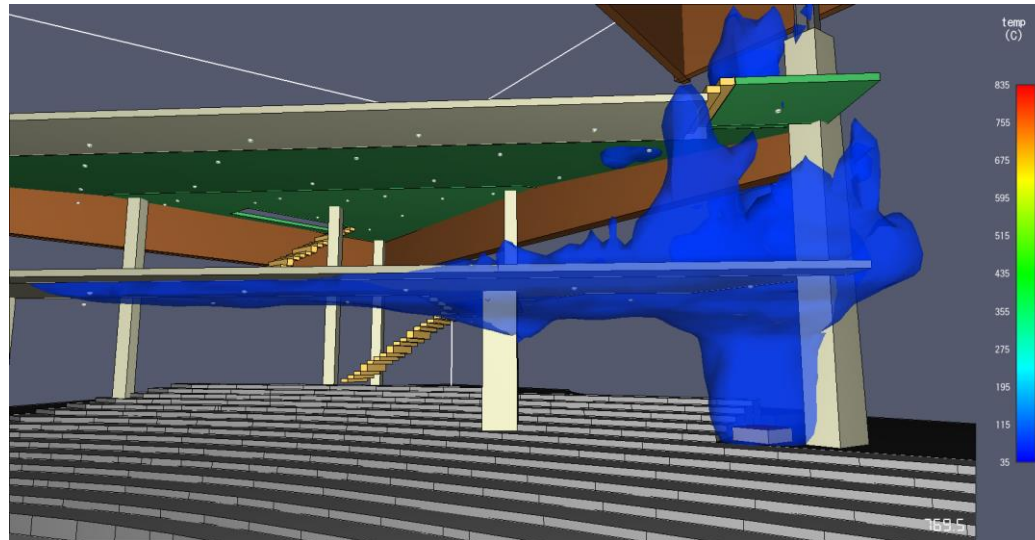


# Upper Wall Temperatures (Growth)



# Practicing Fire Protection Engineering

- Atrium Smoke Control
- Building Fire Exposure
- Performance Based Approach
- Code Modification



- Size of TIME\_SHRINK\_FACTOR
- Size of fire
- Size of Simulation
- Duration of TIME\_SHRINK\_FACTOR
- What results are you interested in?
- Perform your own test case

**THANK YOU**