Recent Developments in FDS

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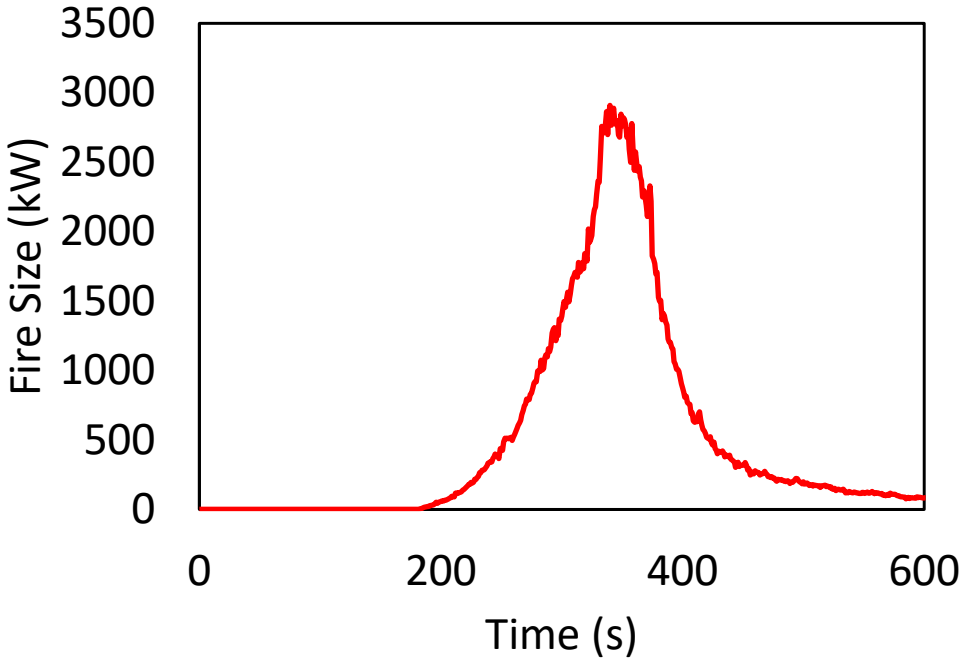
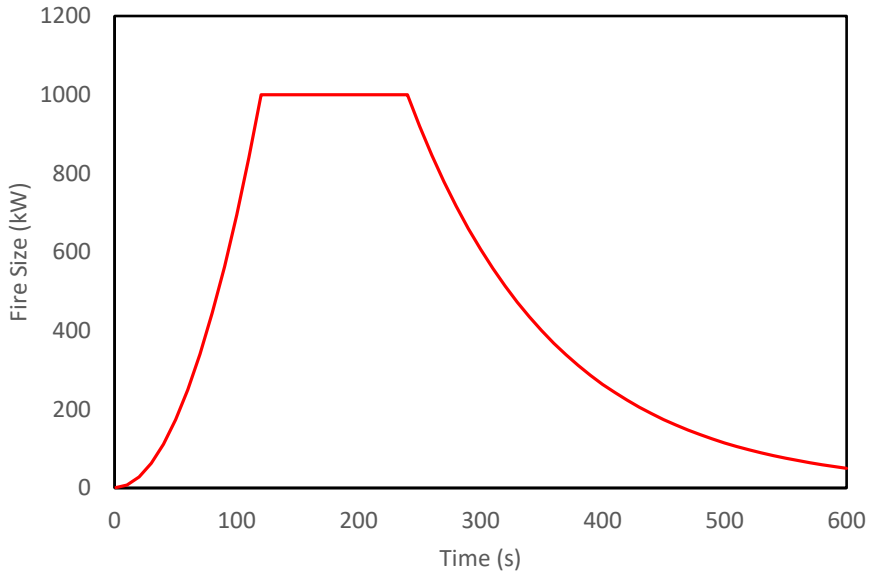


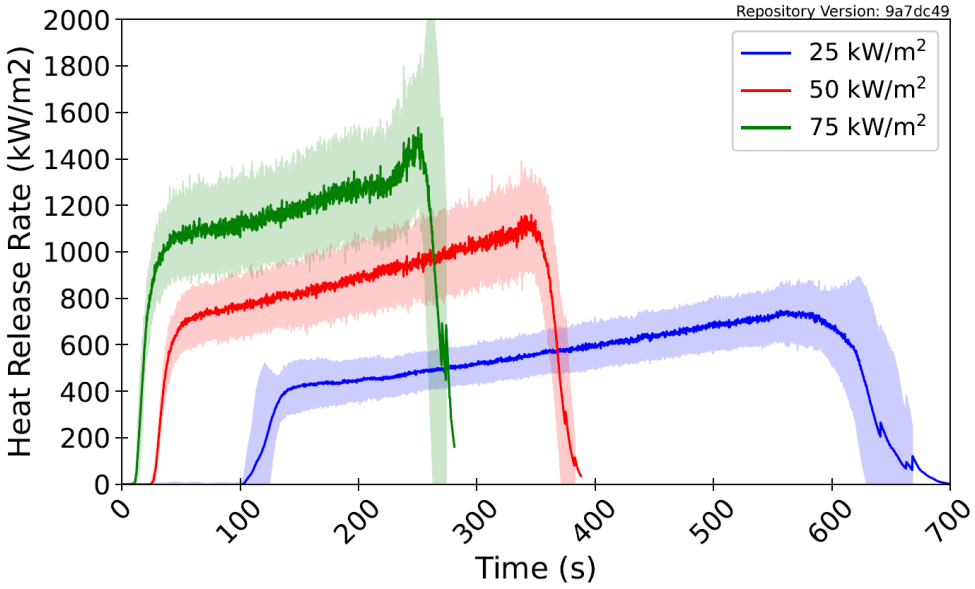
Actual HRR curve



Typical “t-squared” fire

Alternative Approach:

- Perform cone or similar testing
  - Ignition temperature
  - Post ignition burning rate
  - At ignition apply the measured burning rate from the cone curve closest to the expected exposure
- Pros
  - Relatively simple to define
  - Cone testing is cheaper than full object testing
  - Fire spread
- Cons
  - Cone exposure ≠ predicted exposure

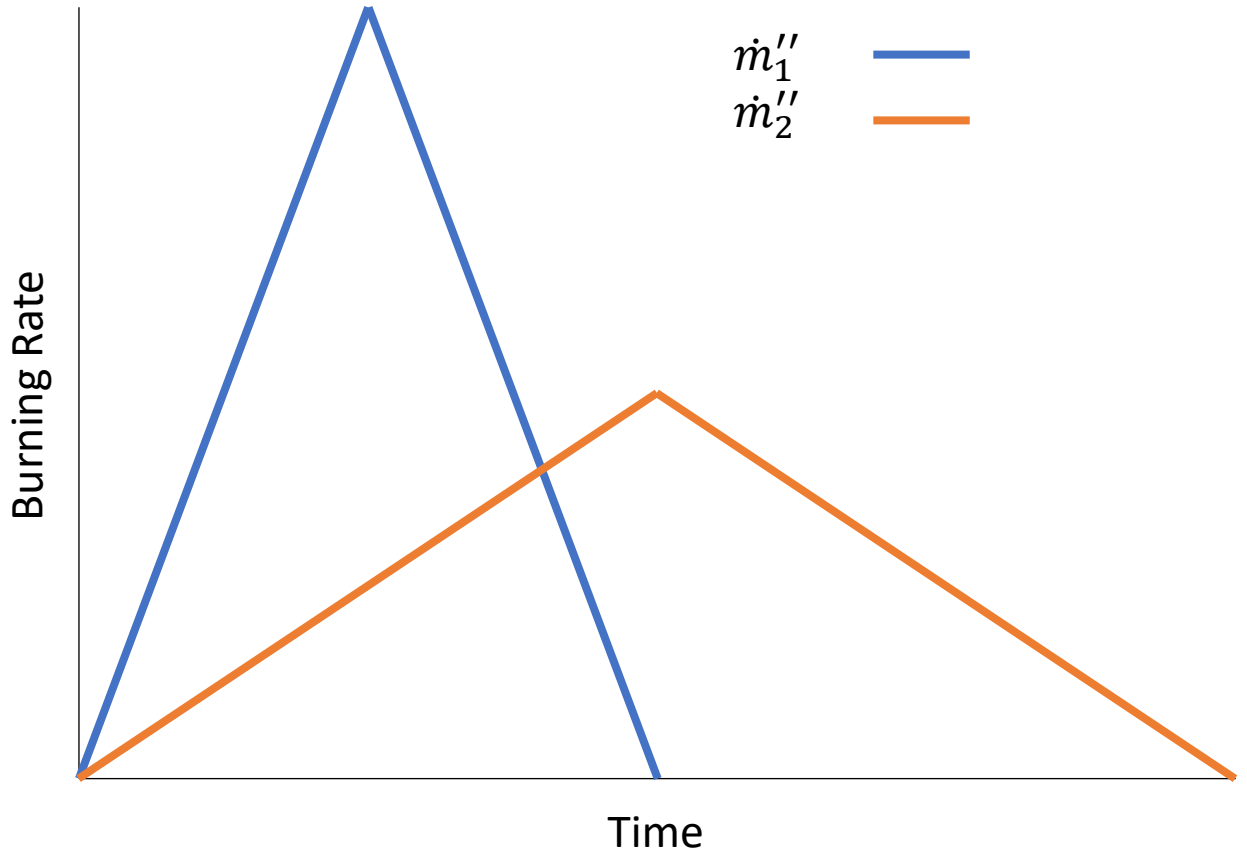


Exposure Scaling

50 kW/m^2 exposure in cone (blue)

25 kW/m^2 exposure in cone (orange)

Which curve to use in FDS?

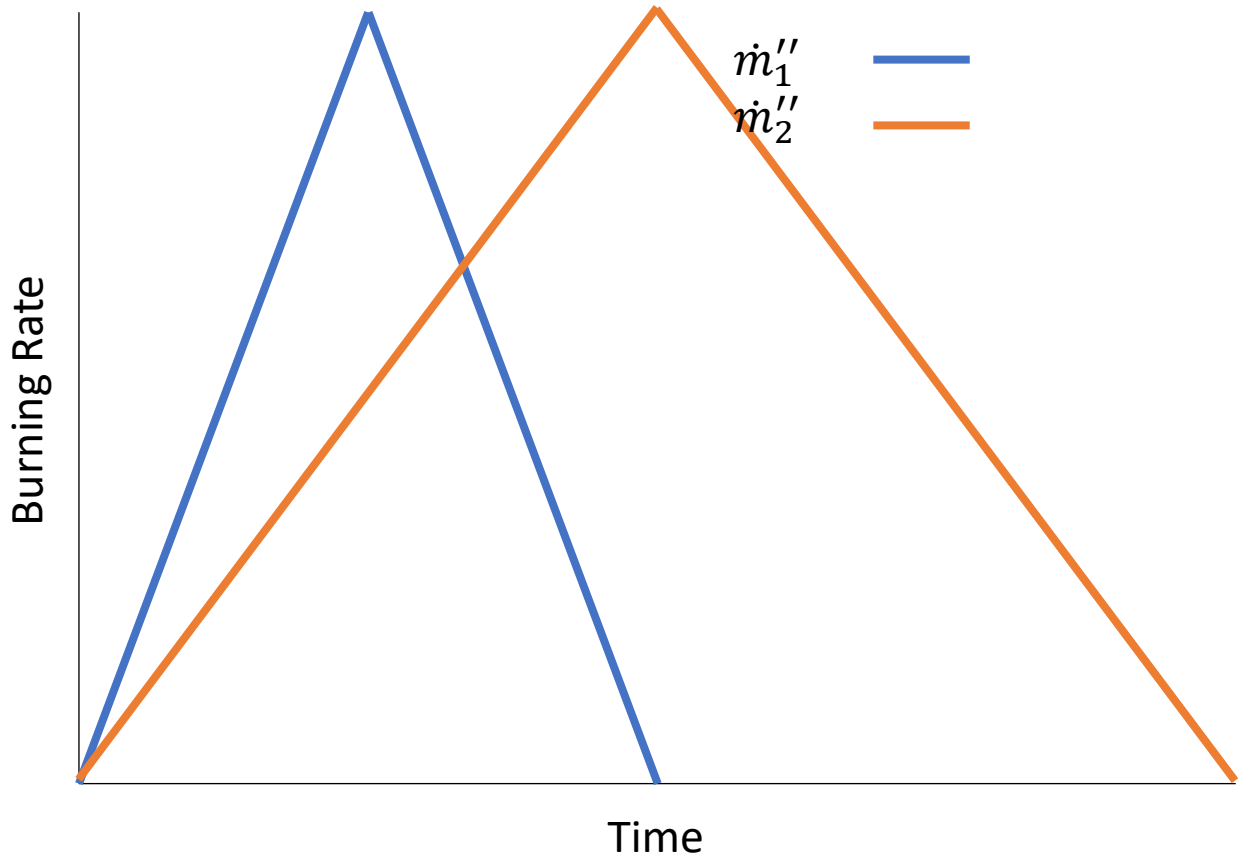


Thickness Scaling

Thin sample (blue)

Thick sample (orange)

Using the orange curve would mean twice the burning duration with the peak HRR delayed.



Inputs on the SURF line

`IGNITION_TEMPERATURE` at which the wall cell starts burning

`THICKNESS` of solid being modeled

`RAMP_Q(:)` HRRPUA ramp for each cone data set

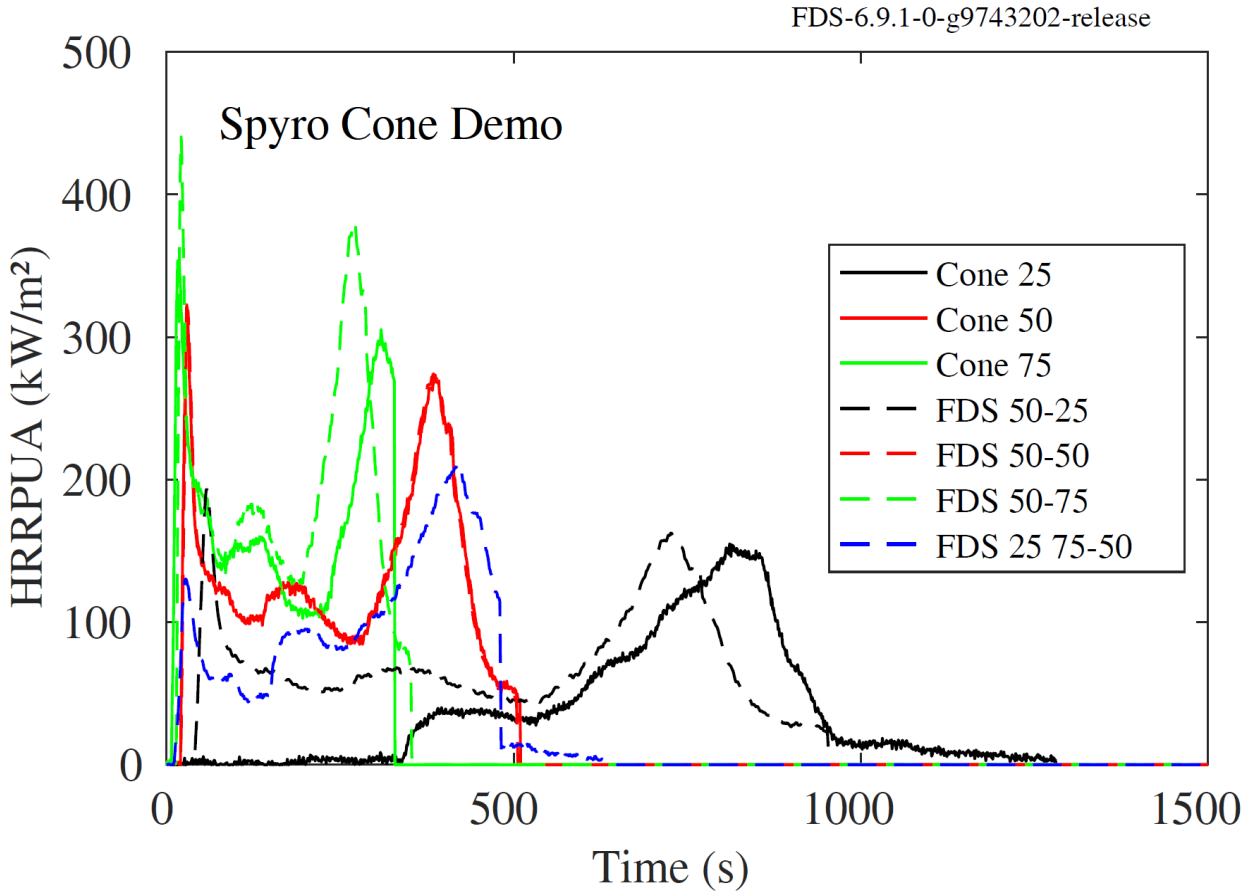
`REFERENCE_THICKNESS(:)` for each cone data set

`REFERENCE_HEAT_FLUX(:)` Heat flux for each cone data set

`INERT_Q_REF` is true if the cone test performed without oxygen

Verification

- Solid lines data (25, 50, 75 kW/m^2)
- Dashed sample color predictions using 50 kW/m^2 data
- Dashed blue predicts 50 using 25 and 75 kW/m^2 data.



Simulations of 165 Materials

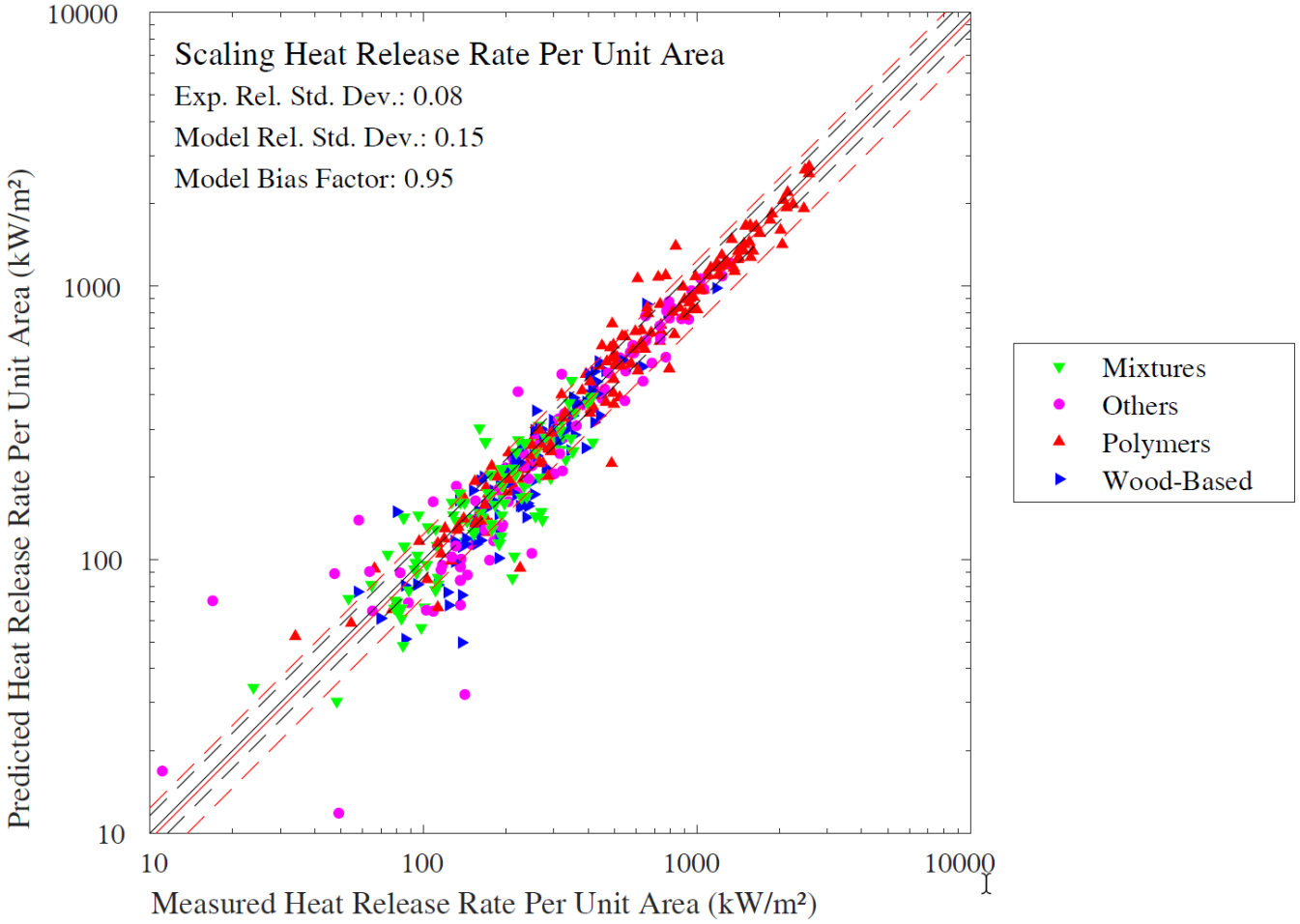
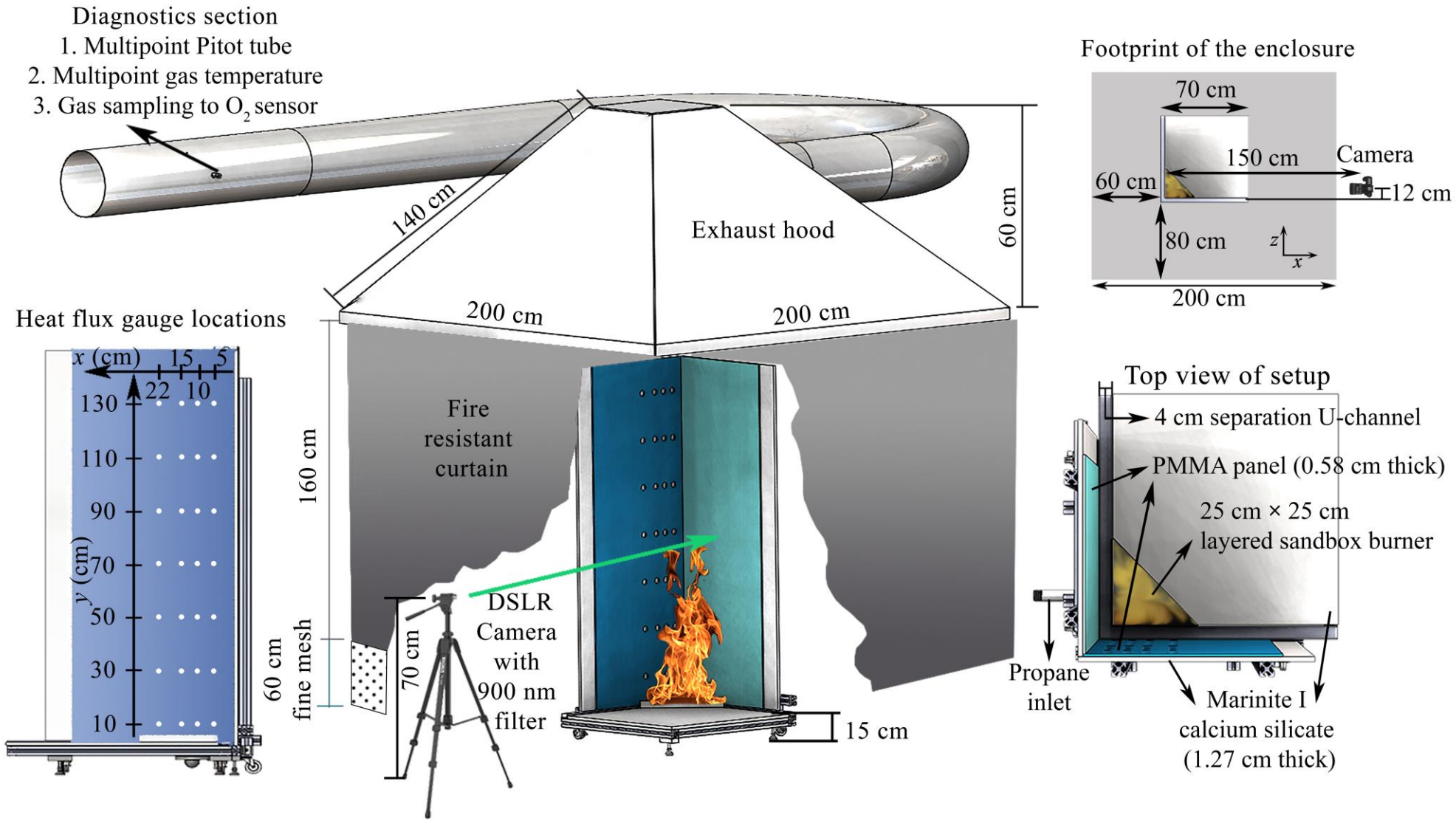


Table 3.34: Summary of Materials

Dataset	Mixtures	Others	Polymers	Wood-Based	Total
Aalto Woods	0	0	0	2	2
FAA Polymers	0	0	8	0	8
FPL Materials	0	0	0	8	8
FSRI Materials	0	26	30	15	71
JH Materials	5	1	4	5	15
RISE Materials	37	3	16	5	61
Total	42	30	58	35	165

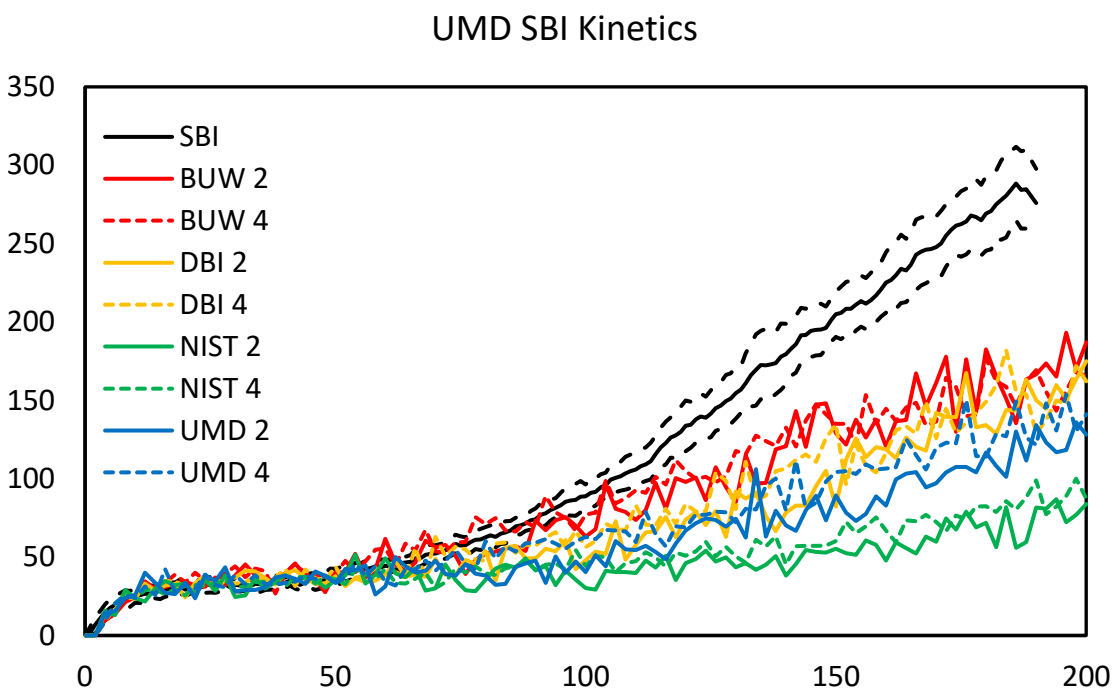
- Performed modeling for each tested flux without that flux
  - Test at 25, 50, and 75 kW/m^2
  - Model 25 using 50 and 75
  - Model 50 using 25 and 75
  - Model 75 using 25 and 50

Single Burning Item (SBI) Test, 6 mm PMMA

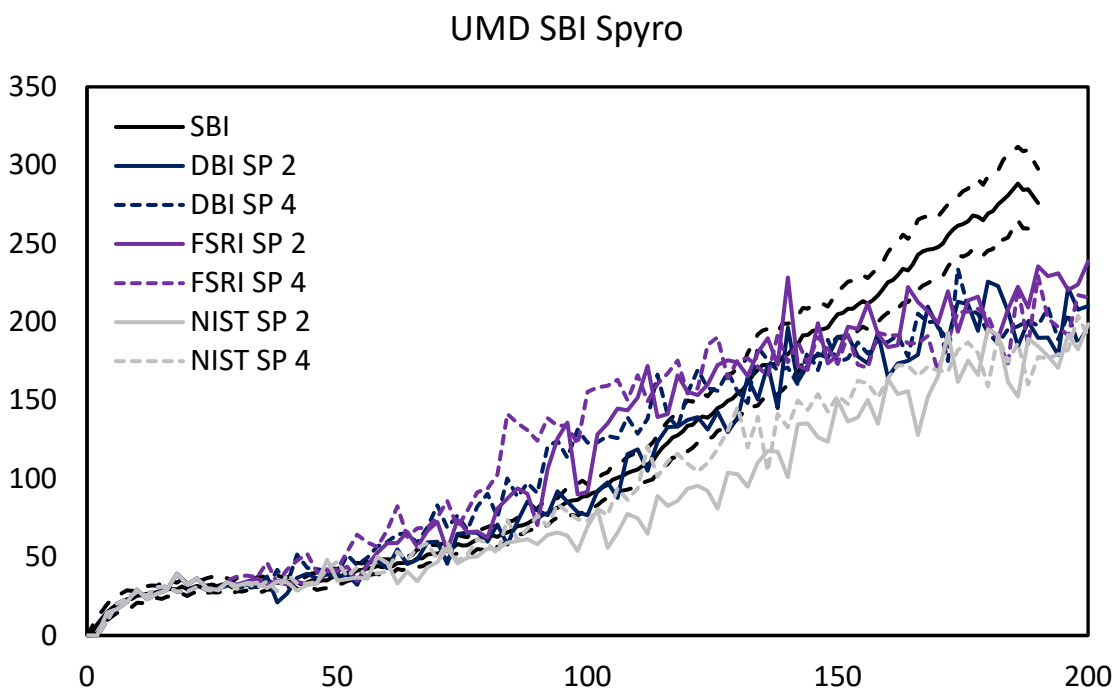


SBI Results, 6 mm PMMA, 2 or 4 cm Grid

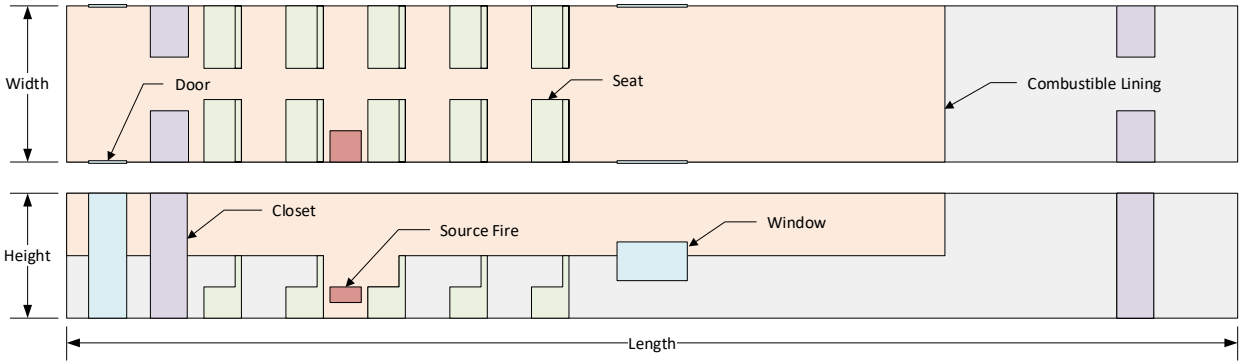
Detailed Kinetics



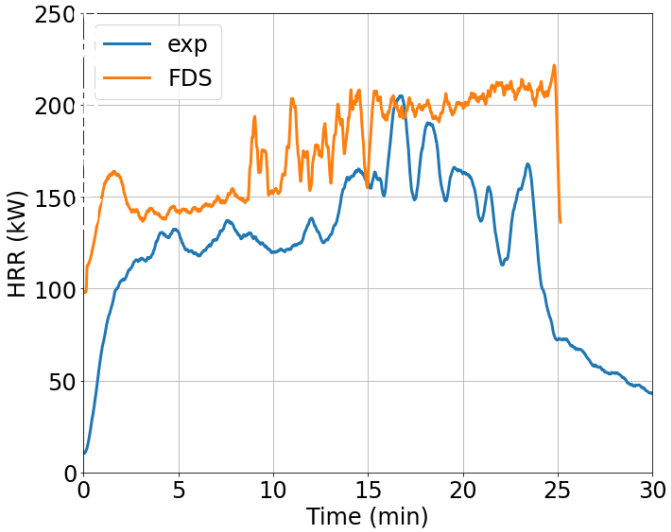
S-PYRO using various cone data sets



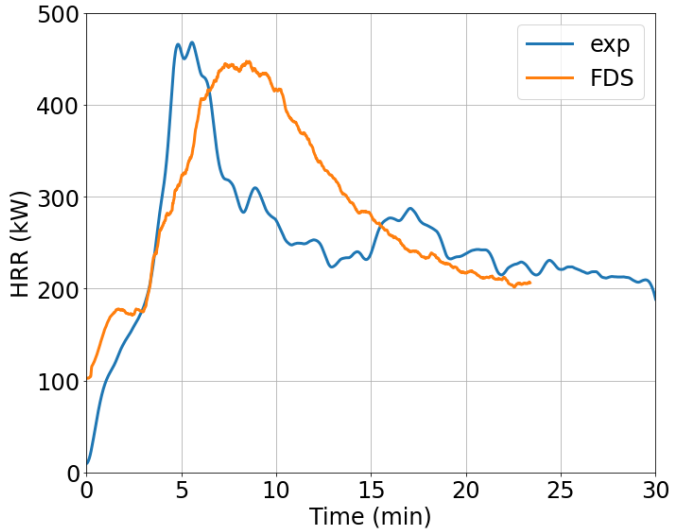
Scaled Railcars



Scaled Railcars

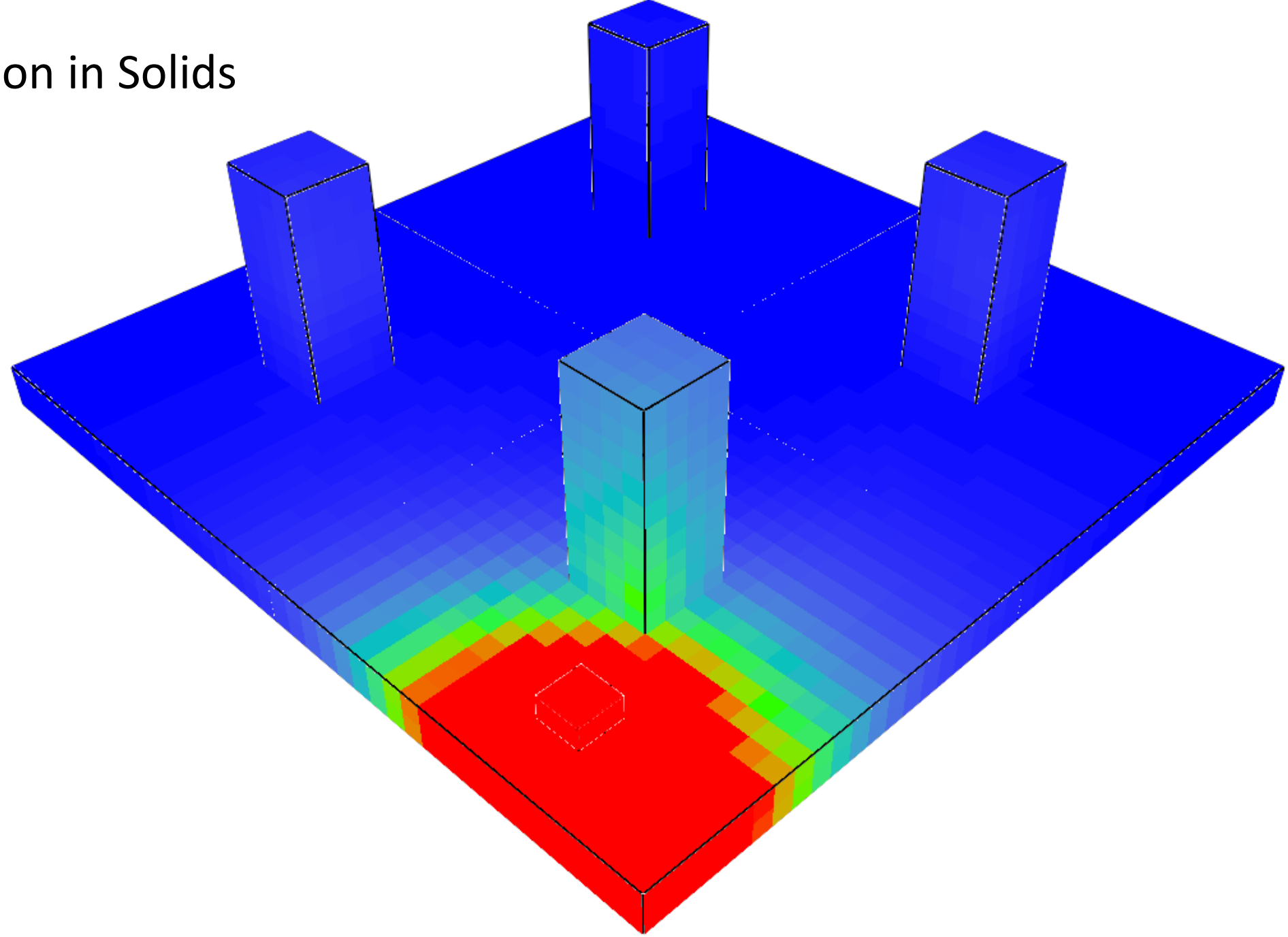


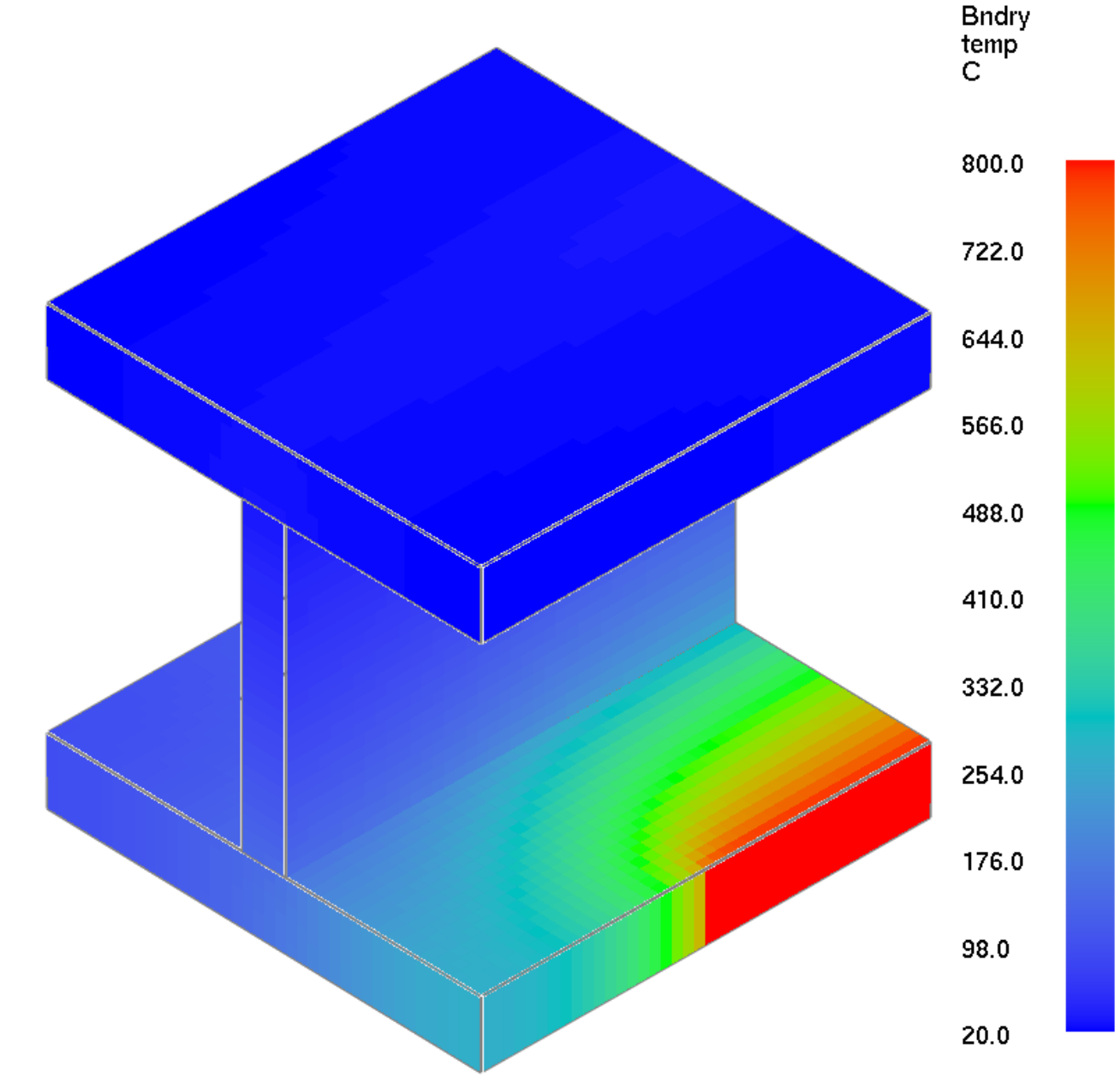
2 doors, 0 windows

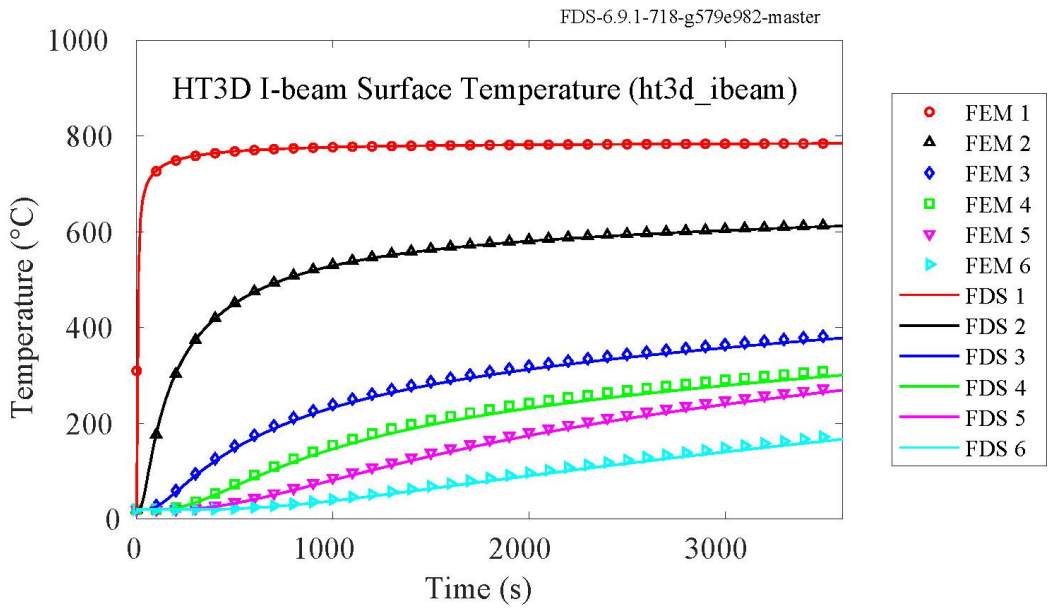


doors, 2 windows

3D Heat Conduction in Solids




Bndry
temp
C
800.0
722.0
644.0
566.0
488.0
410.0
332.0
254.0
176.0
98.0
20.0
Time: 3600.


FDS-6.9.1-718-g579e982-master
HT3D I-beam Surface Temperature (ht3d_ibeam)
Temperature (°C)
Time (s)
0
200
400
600
800
1000
0
1000
2000
3000
FEM 1
FEM 2
FEM 3
FEM 4
FEM 5
FEM 6
FDS 1
FDS 2
FDS 3
FDS 4
FDS 5
FDS 6

Validation fire tests on using the adiabatic surface temperature for predicting heat transfer

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