Advanced Fire Engineering in Practice
Software Tools

FDS – CFD Analysis Of Temperature Development In An Enclosure From A Fire With A Defined Heat Release Rate
- Benchmark case -

Kalliopi Zografopoulou, M.Sc., Doctoral Candidate
Professor Euripidis Mistakidis

Laboratory of Structural Analysis and Design
Dept. of Civil Engineering - University of Thessaly
Volos, Greece, web page: http://lsad.civ.uth.gr

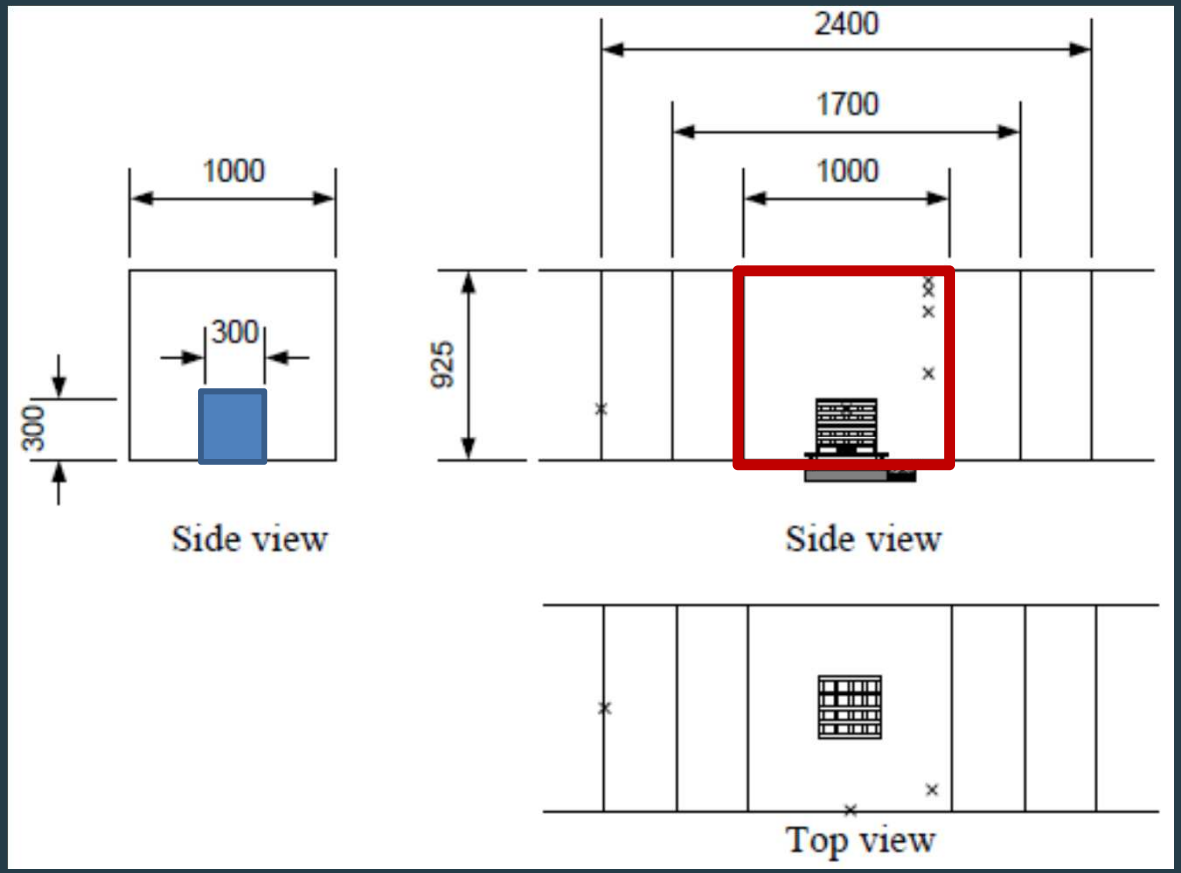
Benchmark case

Based on the experiments of Lonnermark and Ingason (Brandforsk project, 2005)

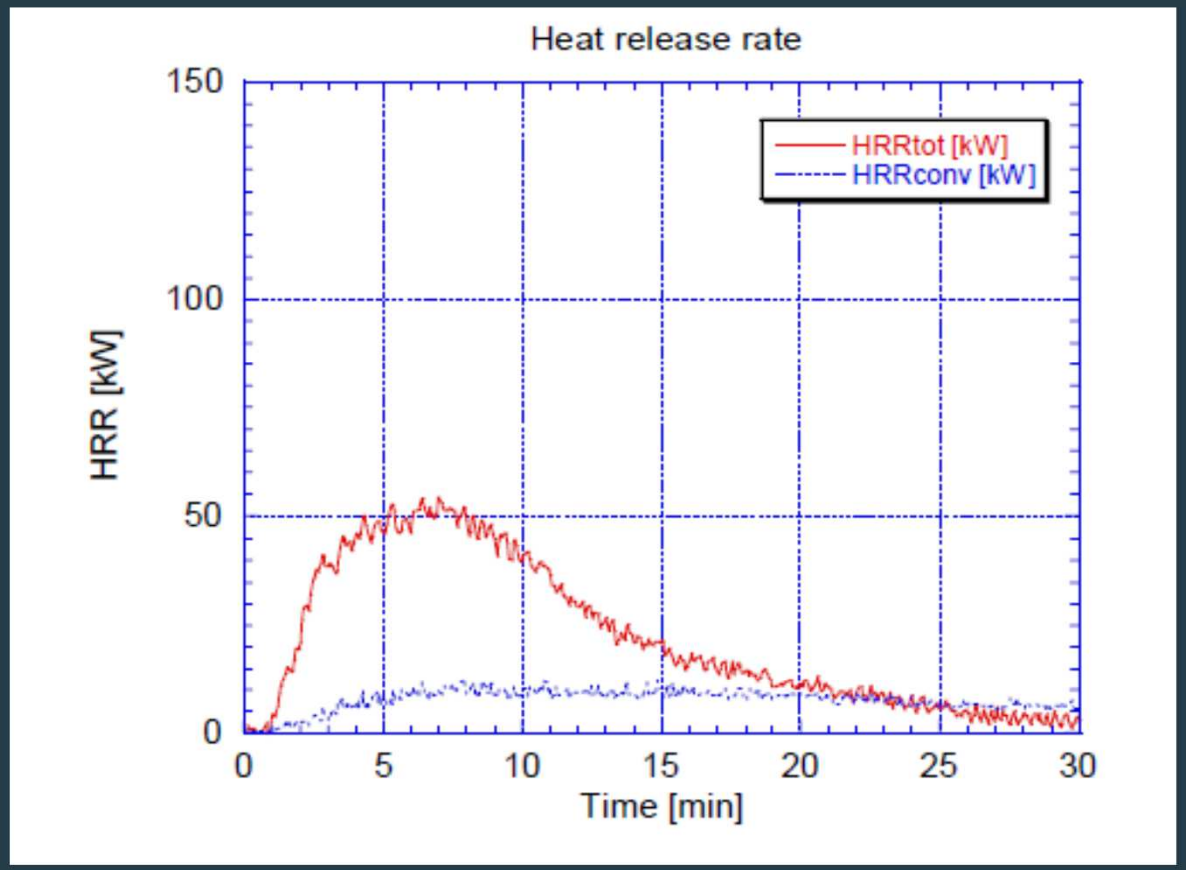
A series of experiments was performed to test the influence of the compartment's dimensions on the fire development

The test with the smallest enclosure dimensions of 1.00 x 1.00 x 0.925 m is used as the benchmark case

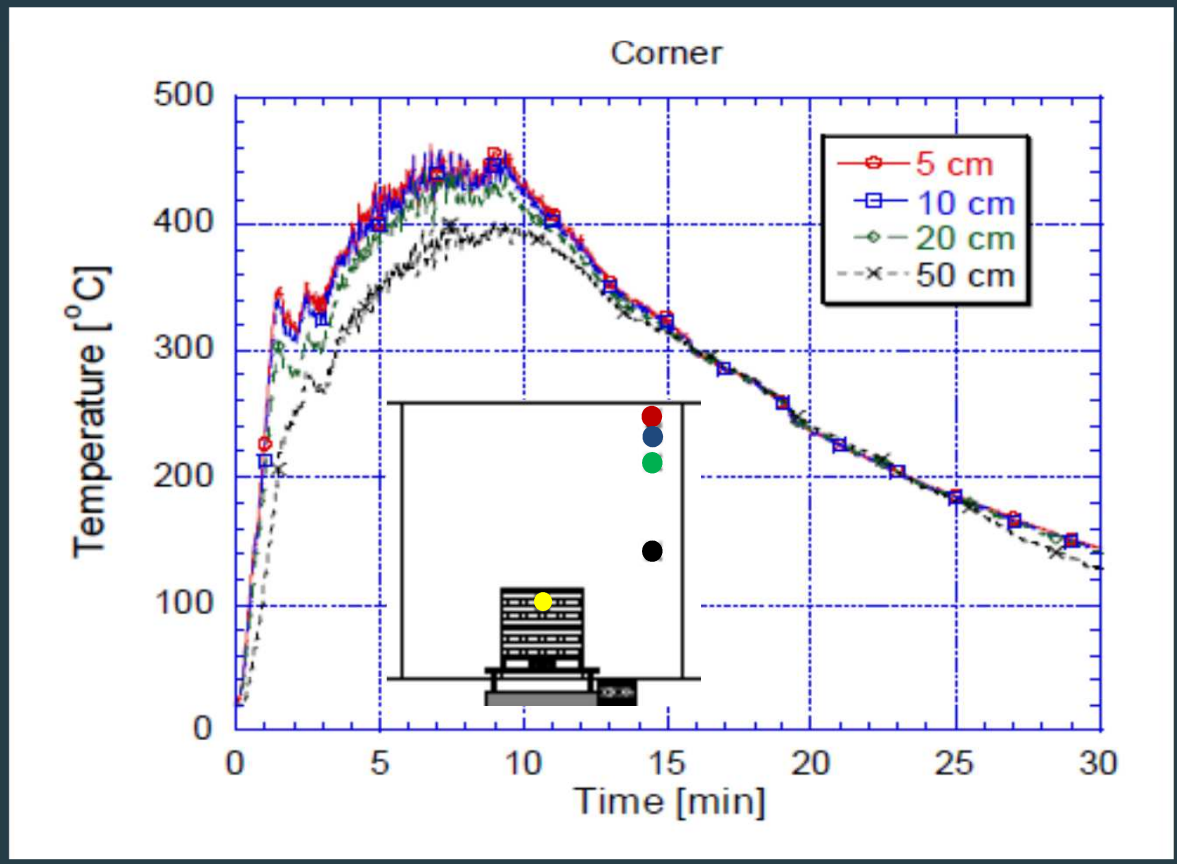
Enclosure 1.00 x 1.00 x 0.925 m
Opening of 0.30 x 0.30 m



Wood crib
Recorded Heat Release Rate



Recorded temperature–time histories by five thermocouples in the enclosure

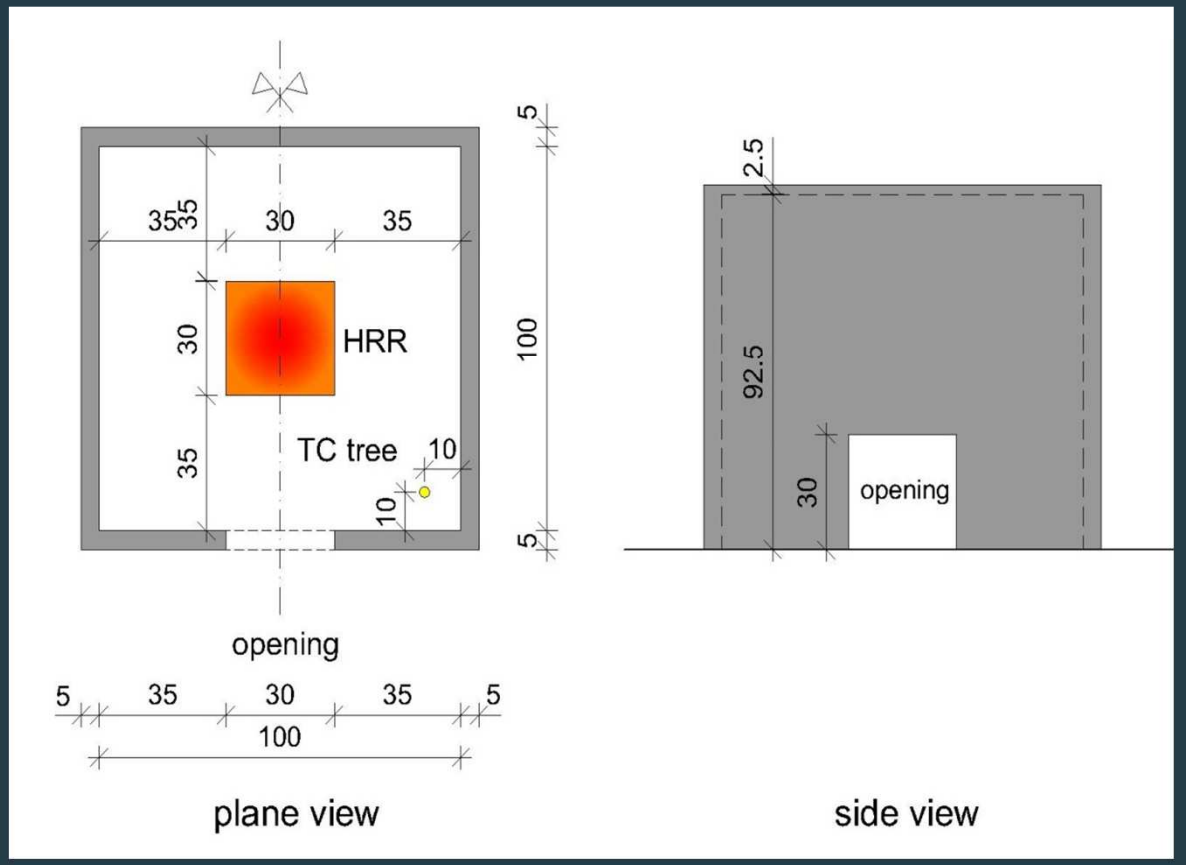


Fire Dynamics Simulator (FDS)

Computational Fluid Dynamics code for the simulation of thermally driven flows with an emphasis on smoke and heat transport from fires.

- Direct Numerical Simulation (DNS)
- Large Eddy Simulation (LES)

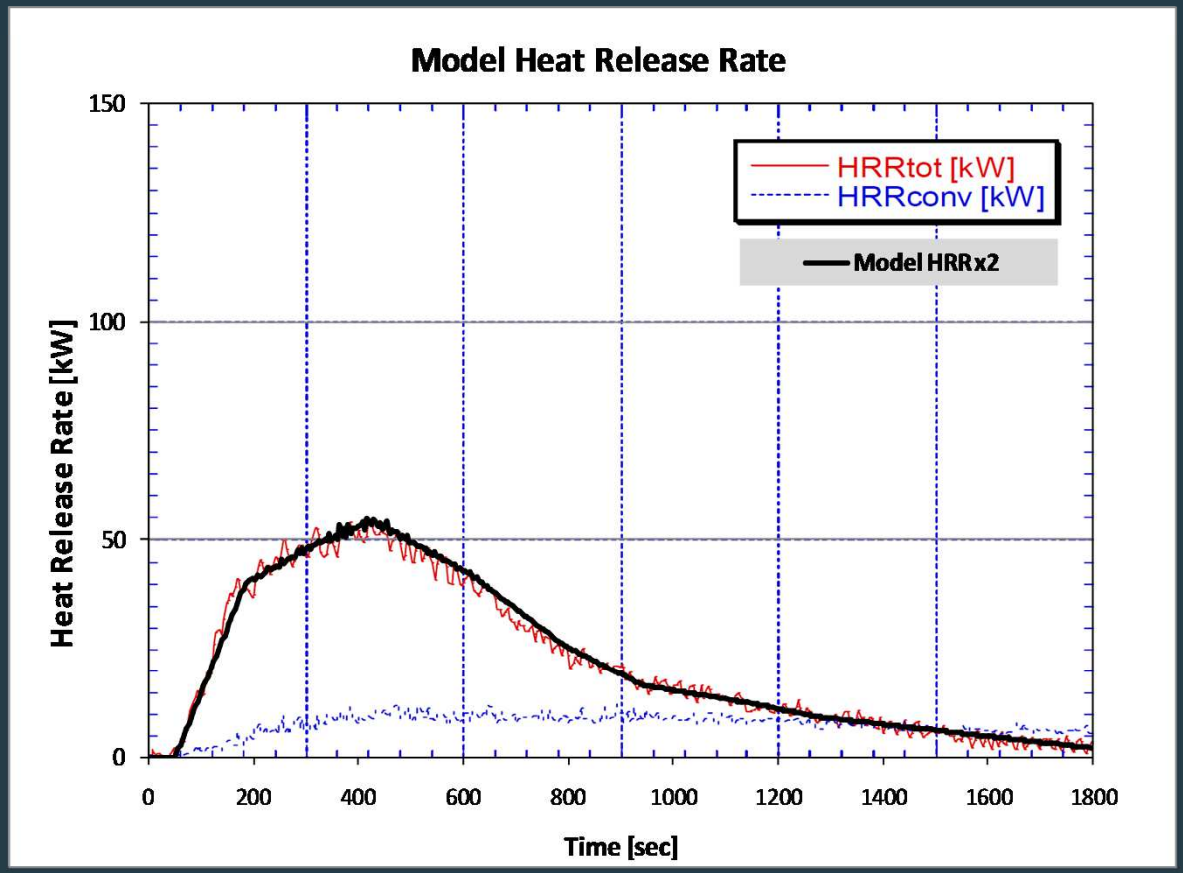
The same as in the experiment



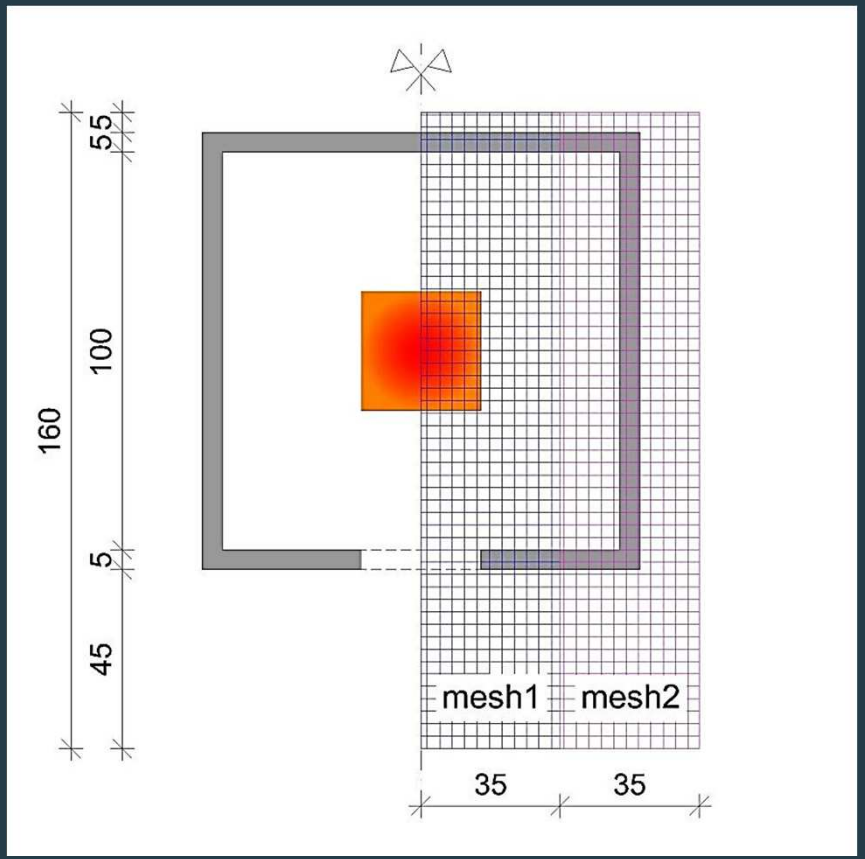
Wall Materials

Gypsum Plaster		
Specific Heat [kJ/(kg. K)]	0.84	
Conductivity [W/(m.K)]	0.48	
Emissivity	0.90	
Absorption Coeff. [1/m]	0.0005	

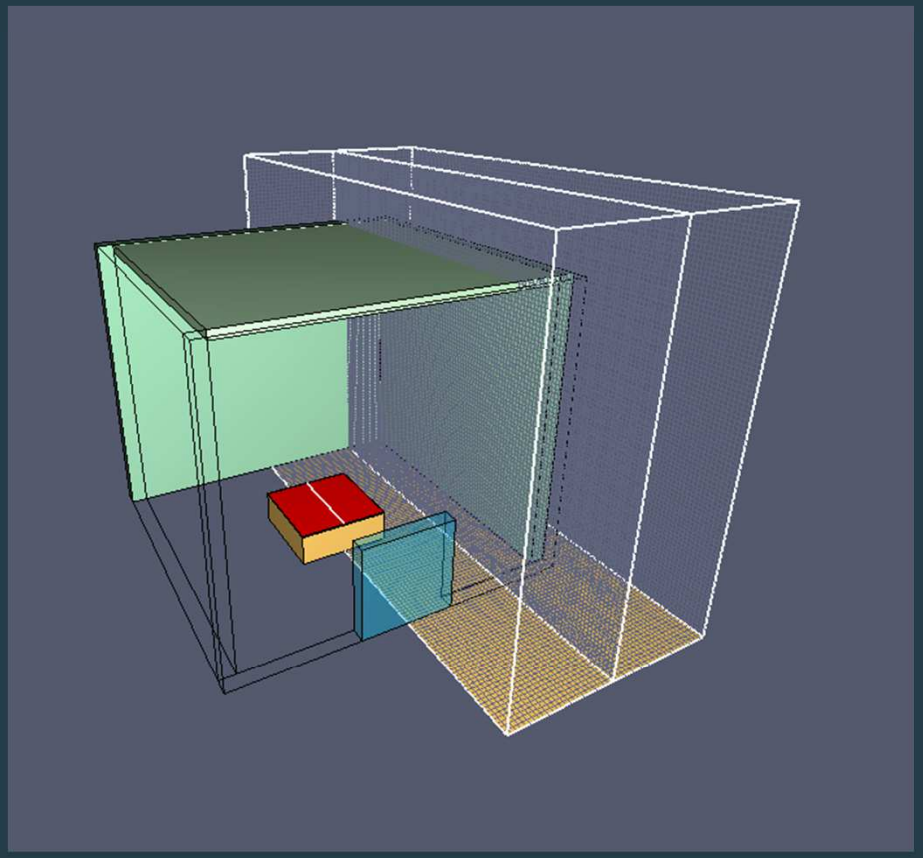
Heat Release Rate curve of the experiment as input



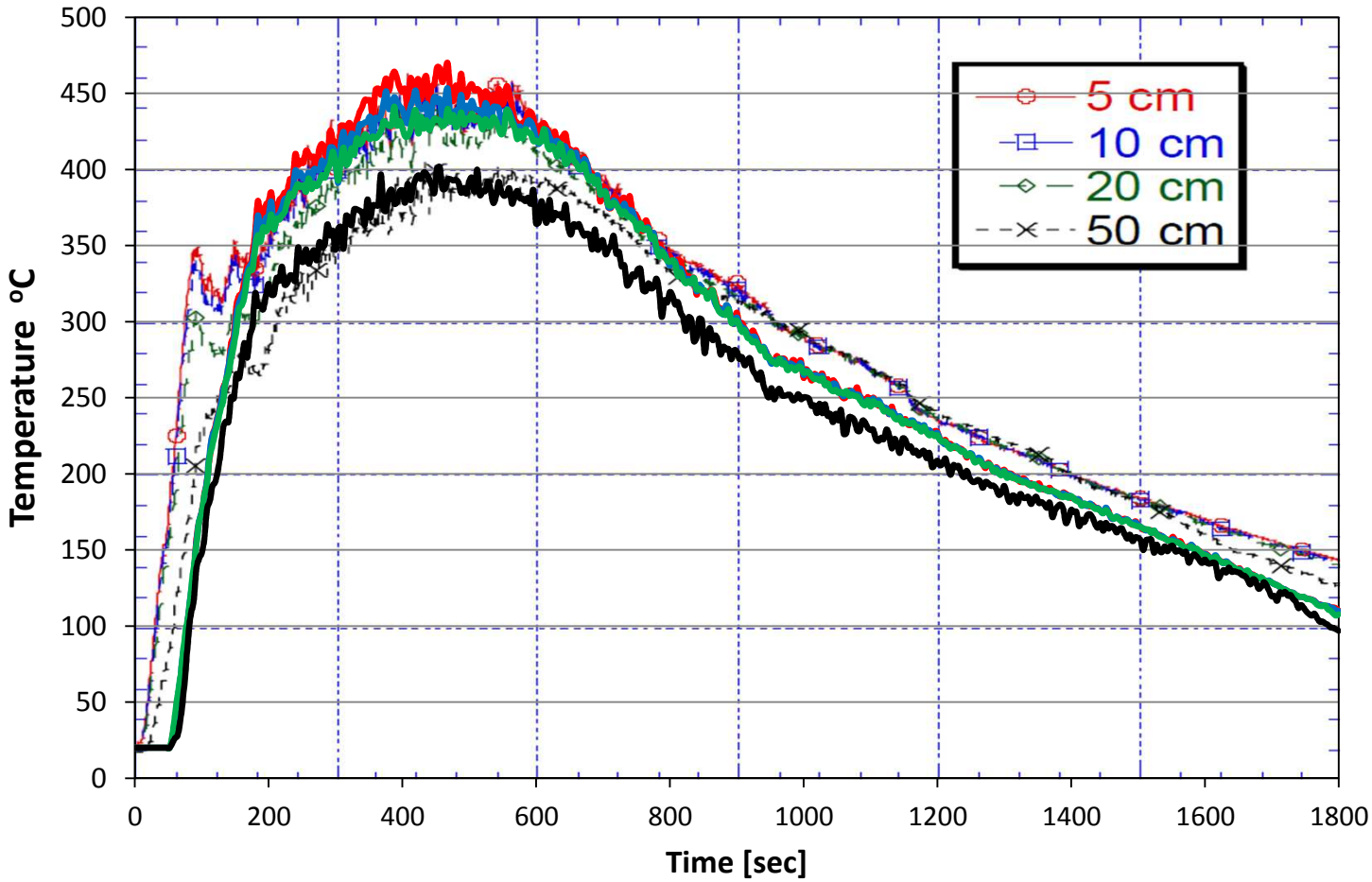
Two parallel meshes
2x259.200 cells of 0.01x0.01x0.01 m
Half of the model simulated - symmetry



- Large Eddy simulation
- Simulation time 1800 sec
- Simulation time step ≤ 0.1 sec



- **Introduction**
- **Experiment**
- Geometry
- Fire
- Results
- **Model**
- Software
- Geometry
- Materials
- Fire
- Computational Mesh
- Analysis
- **Results**
- **Summary**



- ✓ Relatively simple problem
- ✓ Basic problem of temperature calculation from a defined fire (HRR curve)
- ✓ Most parameters set to default values
- ✓ Easy to replicate
- ✓ Compared to experimental results

Benchmark problem

Thank you for your attention

E-mail: kazograf@gmail.com

Laboratory of Structural Analysis and Design
Dept. of Civil Engineering - University of Thessaly
Volos, Greece, web page: http://lsad.civ.uth.gr