

The Challenge of Maintaining FDS and CFAST

Kevin McGrattan

National Institute of Standards and Technology

kevin.mcgrattan@nist.gov

Fire Model Survey

Courtesy, Combustion Science and Engineering

The screenshot shows a web browser window displaying the 'Fire Model Survey' website. The page title is 'International Survey of Computer Models for Fire and Smoke'. The main content area is titled 'ZONE MODELS' and includes a note: 'Red text indicates a link'. The models are organized into two sections: 'Actively Supported' and 'Archived'. A sidebar on the left provides navigation options under 'Select A Model:' and includes a note about needing Adobe Acrobat Reader to view models.

Actively Supported

ARGOS (2014)	B-Risk (2014) (2013)
CFAST/FAST (2014) (2007) (2002)	

Archived

ASET (2002)	ASET-B (2007) (2002)
BRANZFIRE (2014) (2013) (2007) (2002)	BRI-2
CALTECH	CCFM.VENTS (Friedman 1992)
CFIRE-X (Friedman 1992)	CIFI (2002)
CISNV	COMPBRN-III (Friedman 1992)
COMP2 (2002)	DACFIR-3
DSLAYV (2007) (2002)	FASTlite (2002)
FFM	FIGARO-II (2002)
FIRAC	FireMD
Firepro	FIREWIND (2002)
FIREX (2002)	FIRIN
FIRM (2002)	FIRST (2002)

CFAST Graphical User Interface

The screenshot displays the CFAST graphical user interface (GUI) for configuring a fire simulation. The window title is "CEdit (PRS_D1)". The main menu includes "File", "View", and "Help". A secondary menu bar contains "Simulation", "Thermal Properties", "Compartments", "Wall Vents", "Ceiling/Floor Vents", "Mechanical Ventilation", "Fires", "Targets", "Detection / Suppression", "Surface Connections", and "Output".

The "Fires" tab is active, showing a table of fire configurations:

Num	Compartment	Fire	Ignition by	Set Point	X Position	Y Position	Z Position	Peak Q
1	Comp 1	Tetra-Propylene	Time	0	2.5	3	0	509

Below the table are buttons for "Add New", "Add t²", "Duplicate", "From File", and "Remove".

The "Fire 1 (of 1)" configuration panel shows the following settings:

- Name: Tetra-Propylene
- Compartment: Comp 1
- C: 12
- H: 26
- O: 0
- N: 0
- Cl: 0
- Heat of Combustion: 40000 kJ/kg
- Soot Yield: [empty]
- CO Yield: [empty]
- TS Yield: [empty]
- Radiative Fraction: 0.35
- Position X: 2.5 m
- Position Y: 3 m
- Position Z: 0 m
- Ignition Criterion: Time
- Set Point: 0 s
- Ignition Target: [empty]

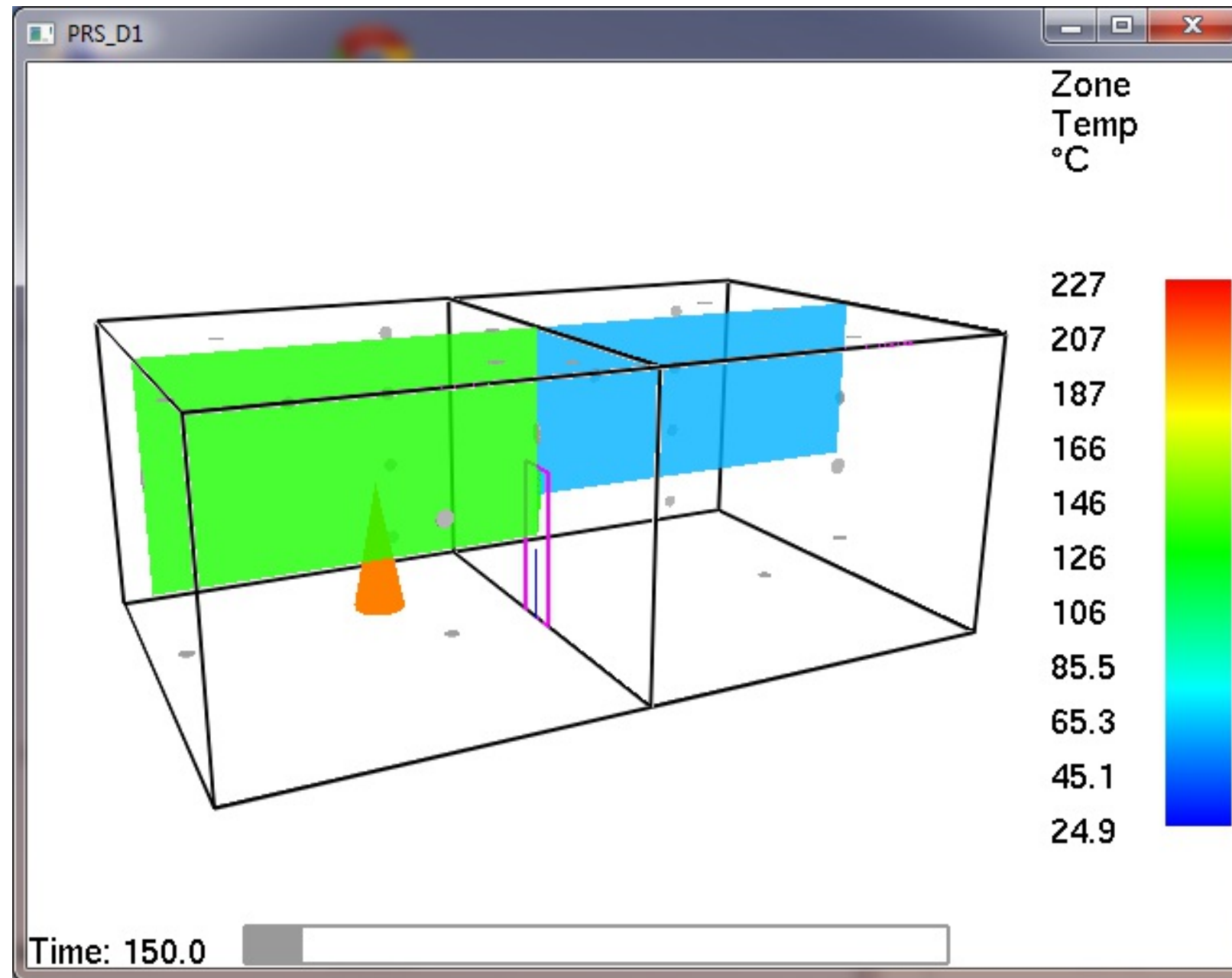
A table below the configuration panel shows the fire's performance over time:

Time (s)	HRR (kW)	Height (m)	Area (m²)	CO Yield	Soot Yield	TS Yield
0	0.0	0.40	0.360	0.0250	0.043	0
16	16.0	0.40	0.360	0.0250	0.043	0
74	289.0	0.40	0.360	0.0250	0.043	0
151	331.0	0.40	0.360	0.0250	0.043	0
214	494.0	0.40	0.360	0.0250	0.043	0
275	507.0	0.40	0.360	0.0250	0.043	0
323	509.0	0.40	0.360	0.0250	0.043	0
359	498.0	0.40	0.360	0.0250	0.043	0
442	392.0	0.40	0.360	0.0250	0.043	0
499	293.0	0.40	0.360	0.0250	0.043	0
568	233.0	0.40	0.360	0.0250	0.043	0

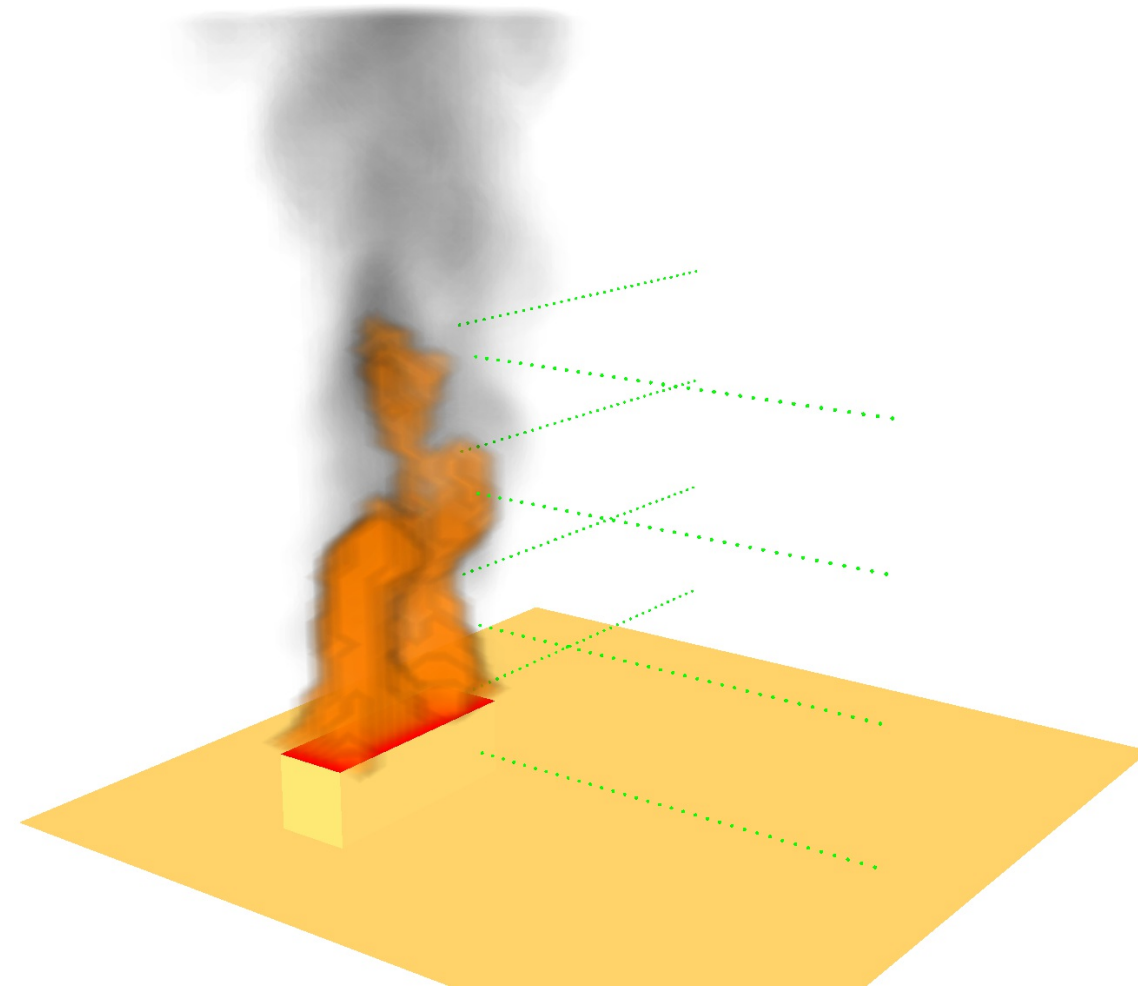
To the right of the table is a graph titled "Tetra-Propylene: HRR (kW)". The graph plots Heat Release Rate (HRR) in kW against time in seconds. The HRR starts at 0, rises to a peak of approximately 509 kW at 323 seconds, and then gradually decays to 0 by 1000 seconds.

At the bottom of the GUI are buttons for "Open", "Save", "Geometry", "Run", and "View". The status bar at the bottom left shows "No Errors" and the bottom right shows "Output: Validation CFAST Window".

CFAST in Smokeview



Radiation Measurements



Rob Fleury and Mike Spearpoint
U of Canterbury, New Zealand

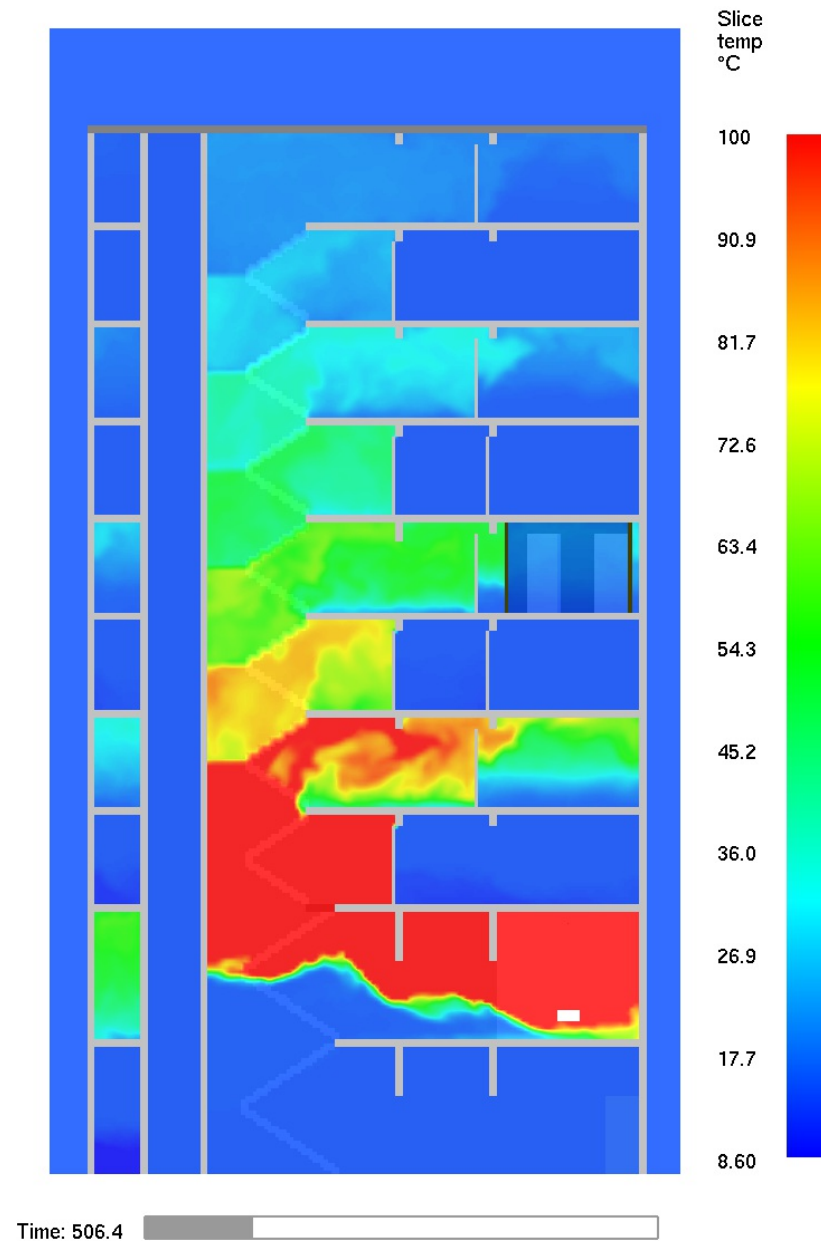
Smoke Movement in Stairwells

Modeling:

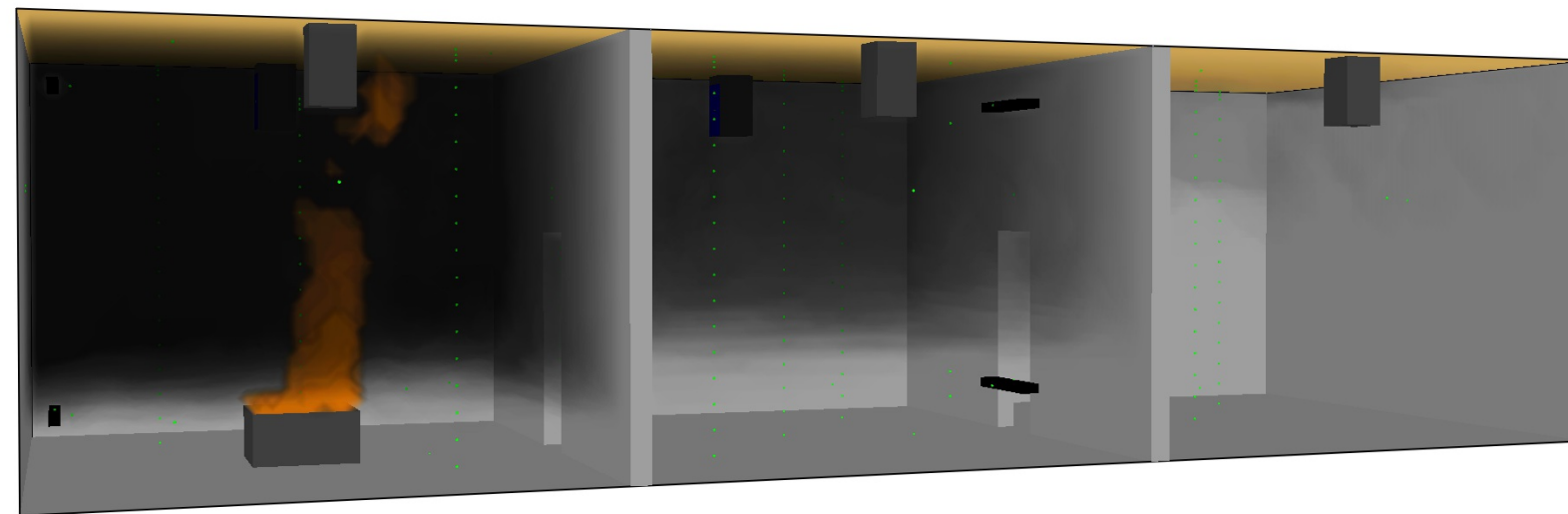
Paul Tyson, U of Ulster

Experiments:

Cathy Wang, National Research Council, Canada



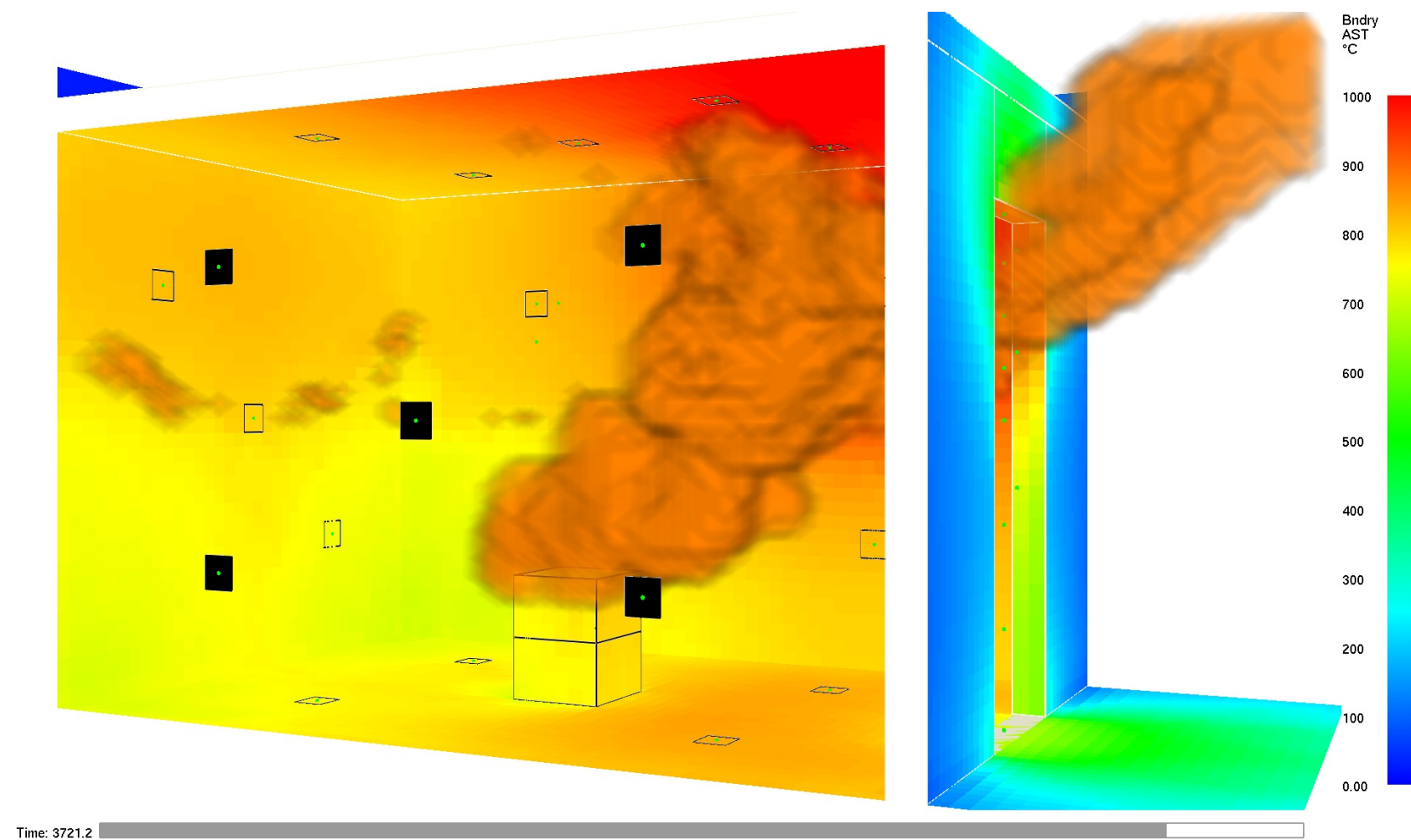
Ventilation Effects



Time: 120.1

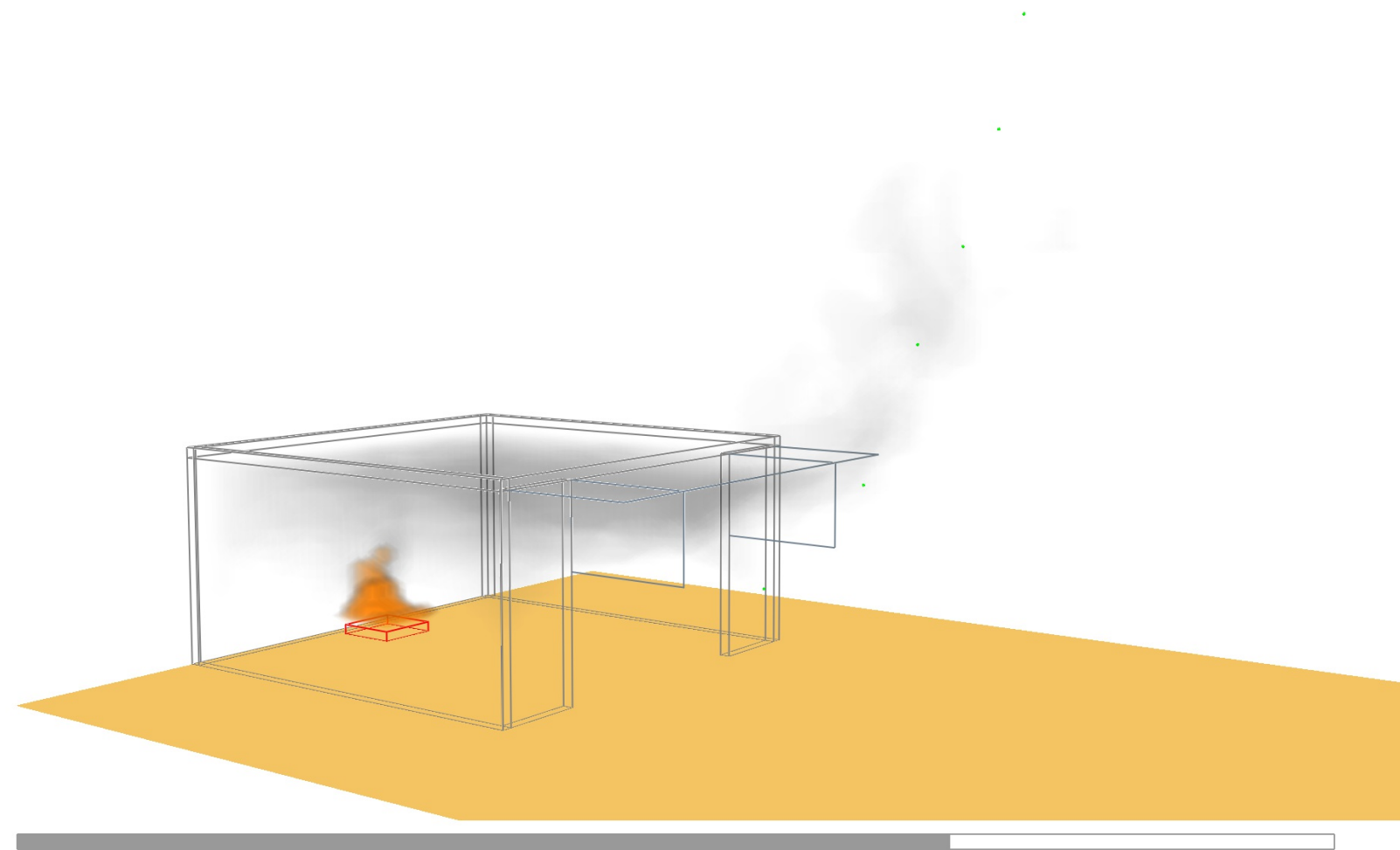
Modeling: Jonathan Wahlqvist, Simo Hostikka, Topi Sikanen
Experiments: OECD PRISME Project

Adiabatic Surface Temperature and Plate Thermometers



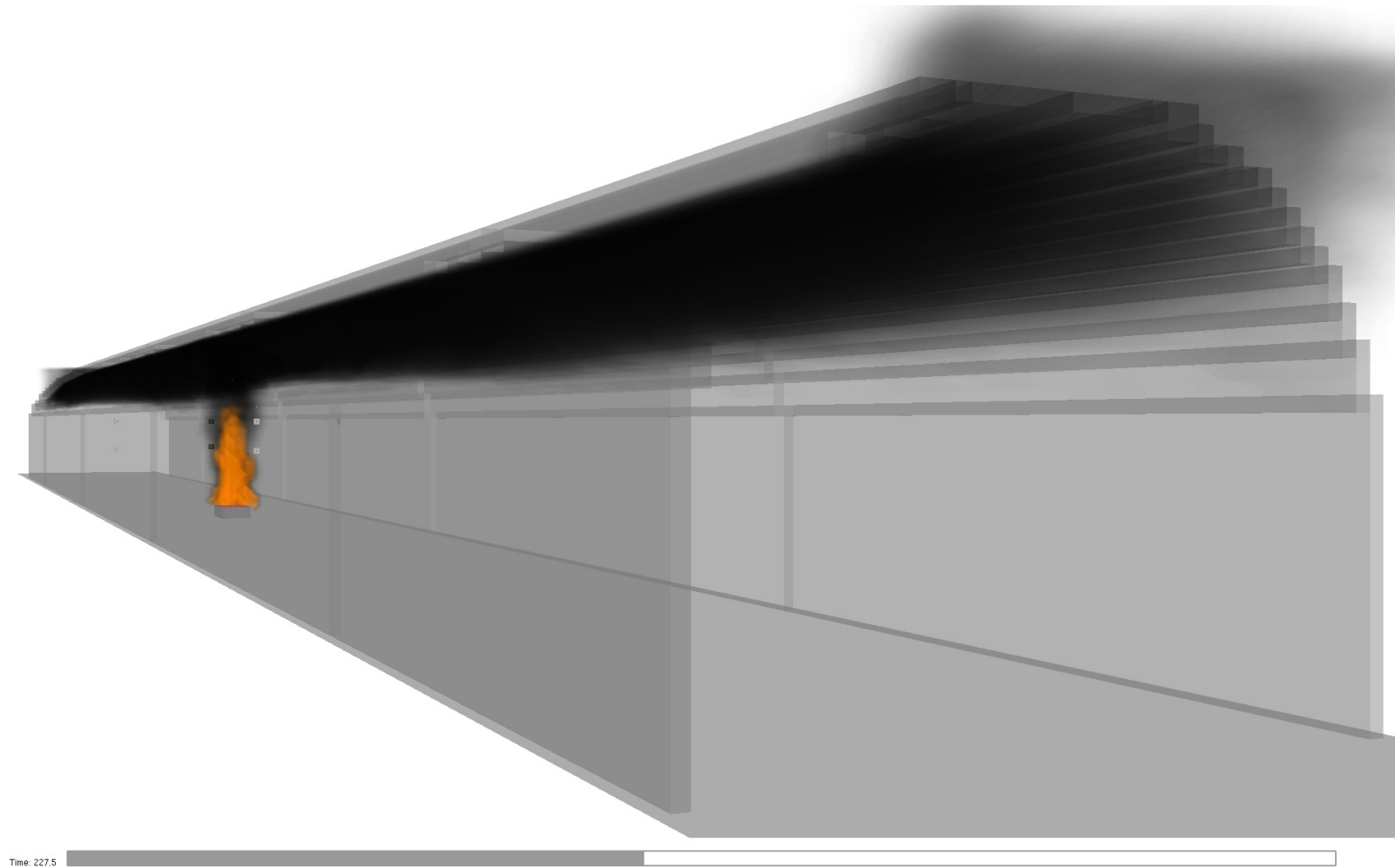
Modeling: J. Sjöström, U. Wickström, A. Byström
Experiments: SP Sweden

Spill Plumes



Roger Harris and Mike Spearpoint
U of Canterbury, New Zealand

Tunnel Fires



Gabriele Vigne and Jimmy Jönsson, ArupFire

FDS Validation Guide

Table 15.1: Summary statistics for all quantities of interest

Quantity	Section	Datasets	Points	$\tilde{\sigma}_E$	$\tilde{\sigma}_M$	Bias
HGL Temperature, Forced Ventilation	5.16	5	132	0.07	0.20	1.15
HGL Temperature, Natural Ventilation	5.16	11	191	0.07	0.07	1.05
HGL Temperature, No Ventilation	5.16	3	32	0.07	0.12	1.16
HGL Depth	5.16	10	198	0.05	0.05	1.04
Ceiling Jet Temperature	7.1.17	17	947	0.07	0.14	1.05
Plume Temperature	6.1.7	8	107	0.07	0.16	1.18
Oxygen Concentration	9.1.9	8	160	0.08	0.15	0.99
Carbon Dioxide Concentration	9.1.9	9	157	0.08	0.12	0.99
Smoke Concentration	9.2.2	1	14	0.19	0.60	2.54
Compartment Over-Pressure	10.6	4	75	0.17	0.17	0.91
Target Temperature	11.2.6	7	1258	0.07	0.17	1.02
Surface Temperature	11.1.7	5	1009	0.07	0.13	1.04
Target Heat Flux	12.2.5	5	348	0.11	0.26	0.99
Surface Heat Flux	12.1.10	7	633	0.11	0.22	0.99
Velocity	8.1.0	7	222	0.08	0.09	0.99
Sprinkler Activation Time	7.2.1	5	232	0.06	0.16	0.95
Smoke Detector Activation Time	7.3	1	142	0.27	0.27	0.58
Smoke Detector Activation Time, Temp. Rise	7.3	1	142	0.33	0.33	1.02
Cable Failure Time	11.2.7	1	35	0.12	0.15	1.14
Sprinkler Actuations	7.2.2	3	38	0.15	0.30	0.87
Burning Rate	14.8	3	47	0.08	0.39	1.01
Carbon Monoxide Concentration	9.3.5	5	69	0.19	0.41	0.93

