



METHODOLOGY FOR ESTIMATING THE RISK OF STEEL STRUCTURES DAMAGE

PhD Students' Seminar on Fire Safety Science

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The Main School of Fire Service

Warsaw, Poland



Fire experience



Source: own picture



Source: own picture



Prescriptive-Based Building Design



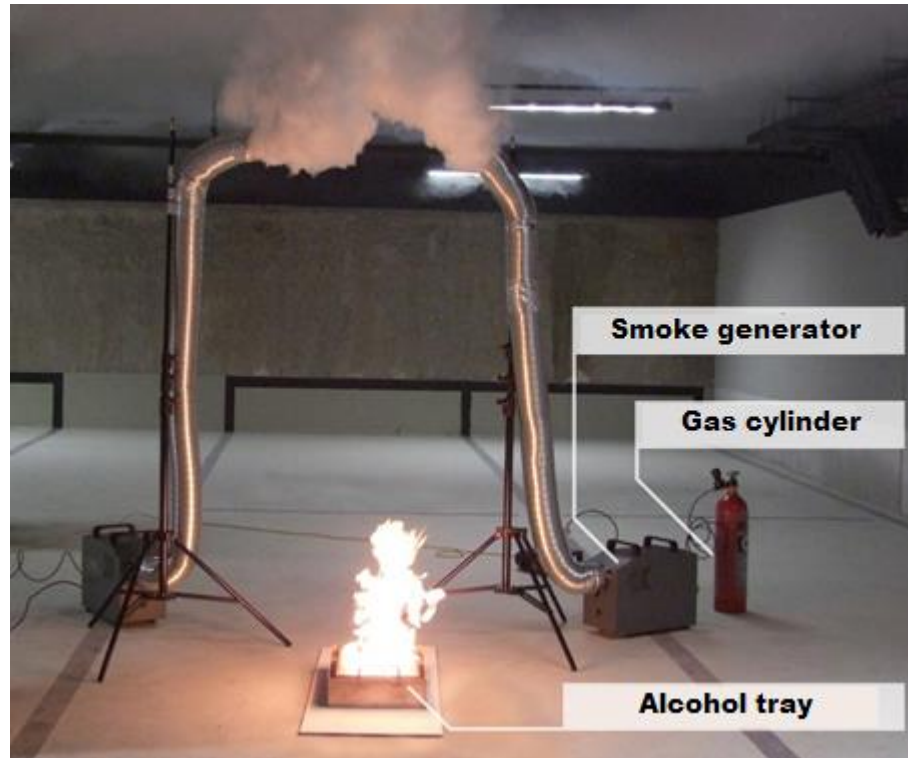
Source: <http://www.sitpkrakow.pl/>



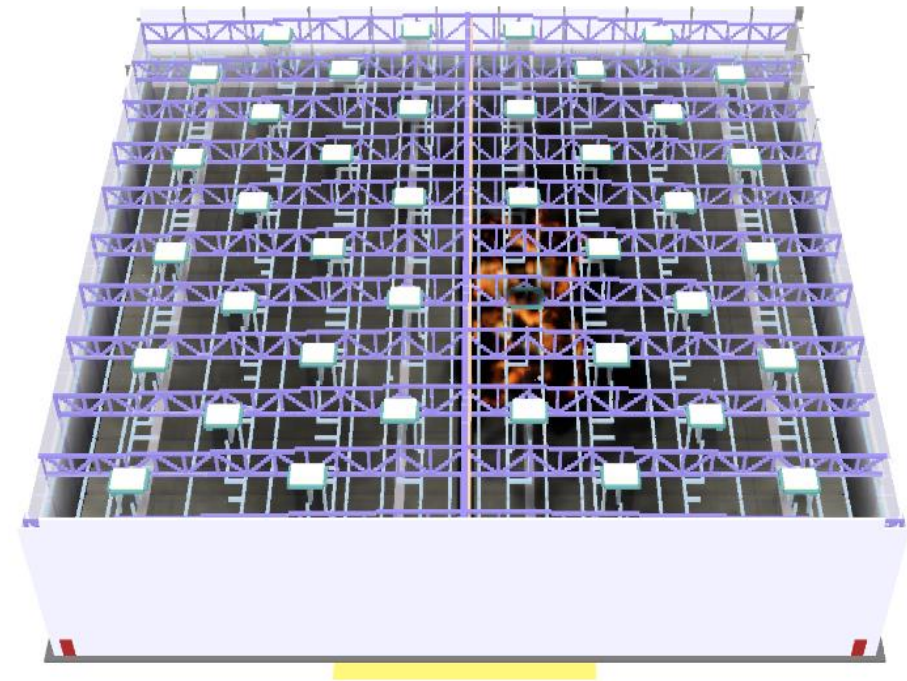
Source: <http://www.sitpkrakow.pl/>



Fire Safety Science in practice



Source: own study



The 470

Source: own study



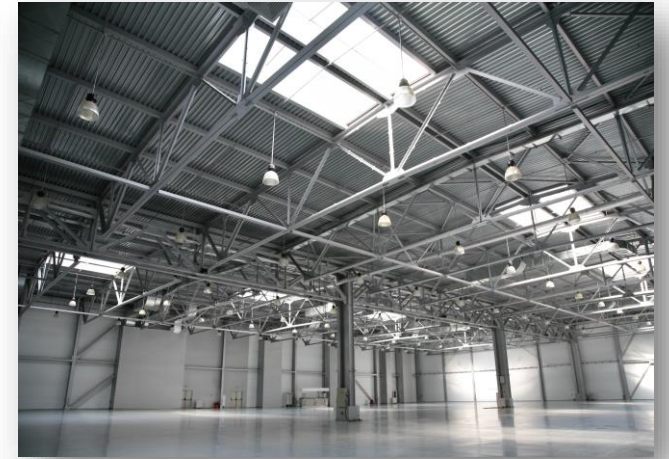
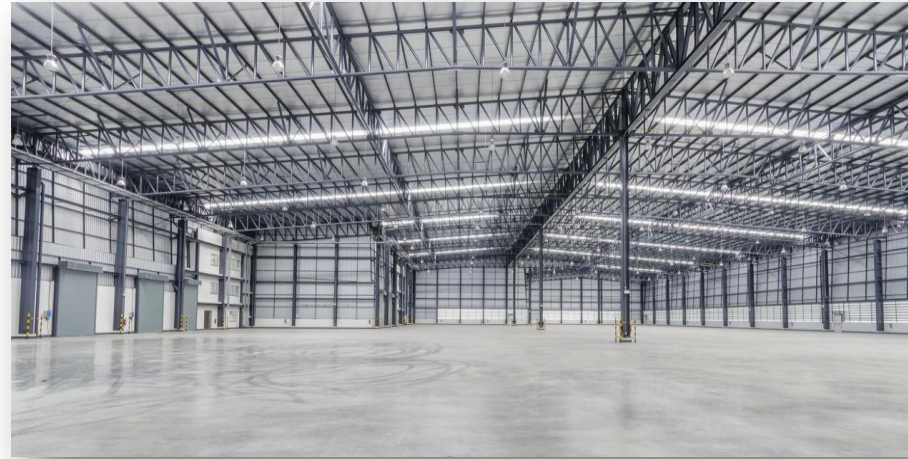
Recent changes in Polish technical and construction regulations



Regulation of the Polish Minister of Infrastructure of April, 2002,
on the technical conditions which should be met by buildings and their location.



Load-bearing capacity time for warehouses



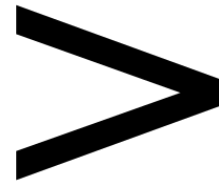
Source: www.inzynieria.com



Performance-based building design



ASET



RSET

Source: own study



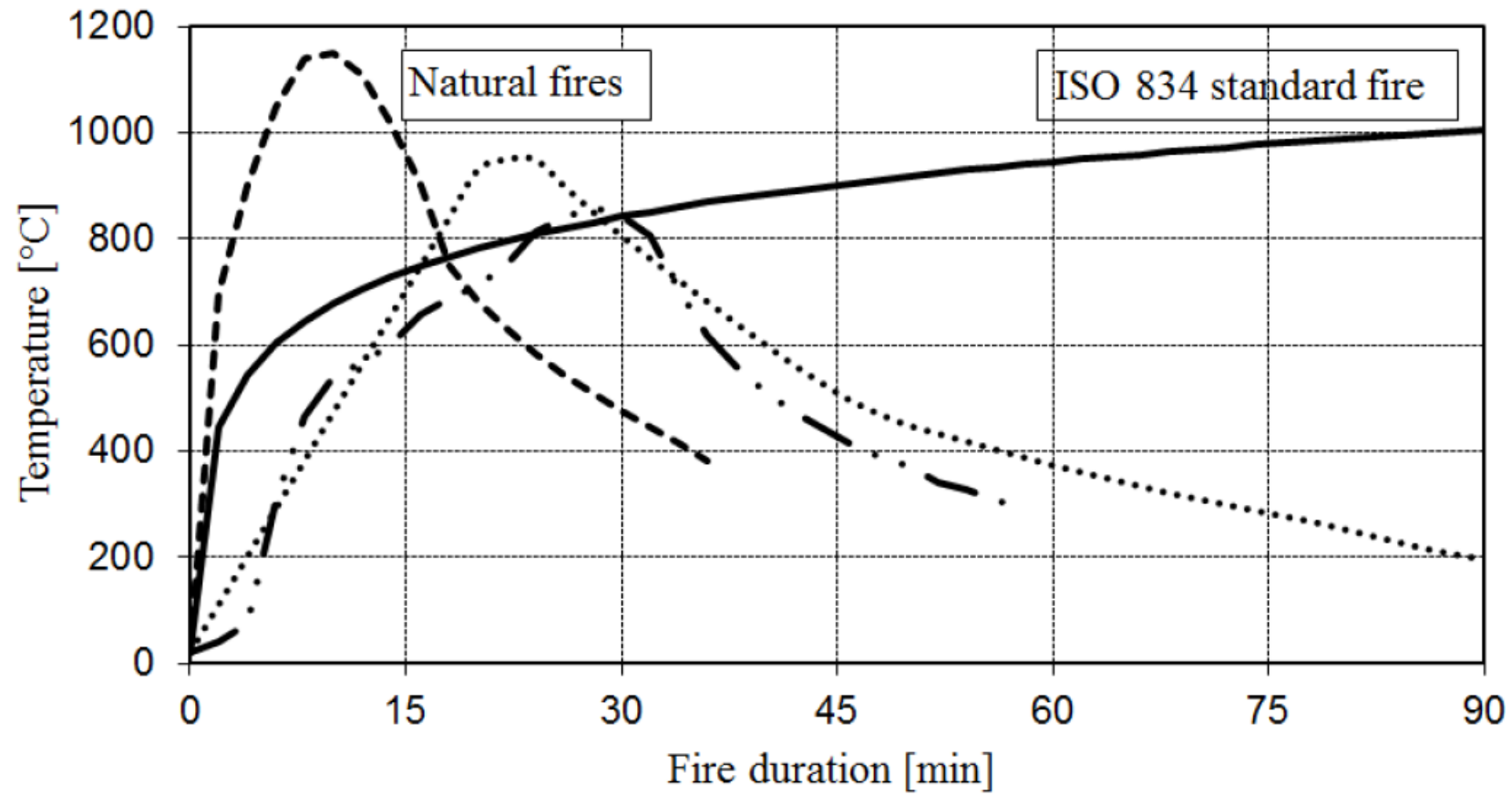
Verification of load-bearing capacity at specific temperatures

$$\theta_{a,cr} = 39.19 \ln \left[\frac{1}{0.9674 \cdot \mu^{3.833}} - 1 \right] + 482$$

$$\theta_{a,cr} = 39.19 \ln \left[\frac{1}{0.9674 \cdot 0.7^{3.833}} - 1 \right] + 482 = 526^{\circ}\text{C}$$



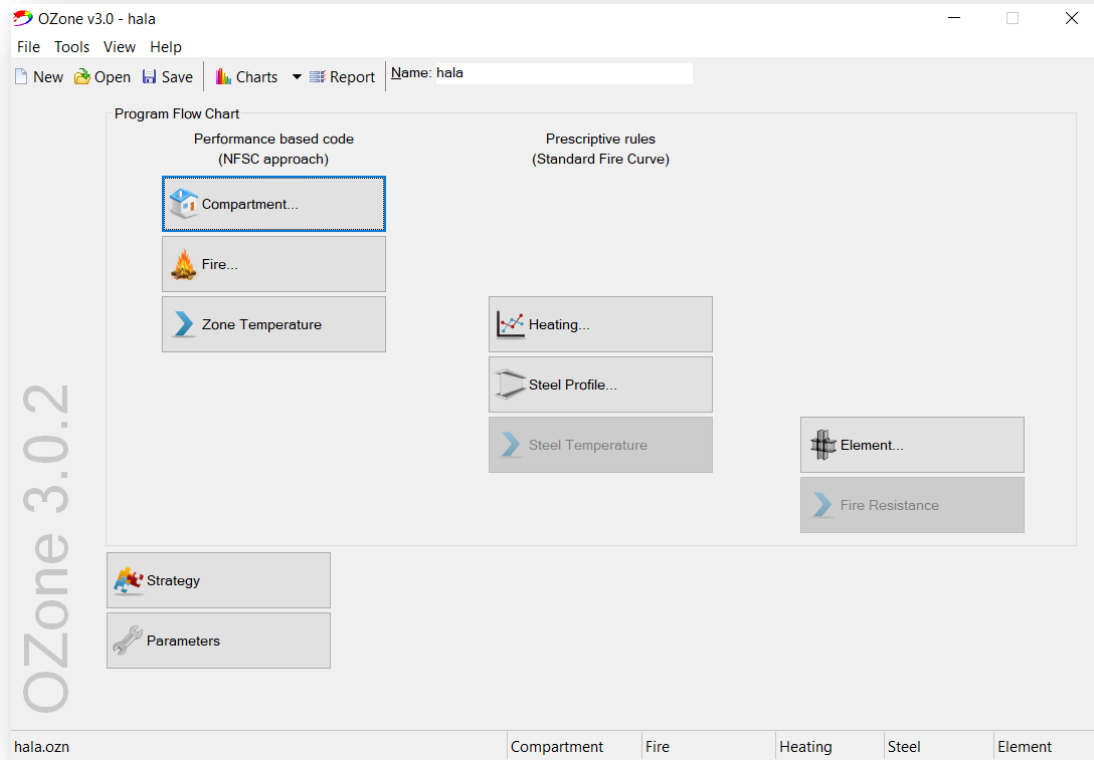
Natural fire model for the structural fire design



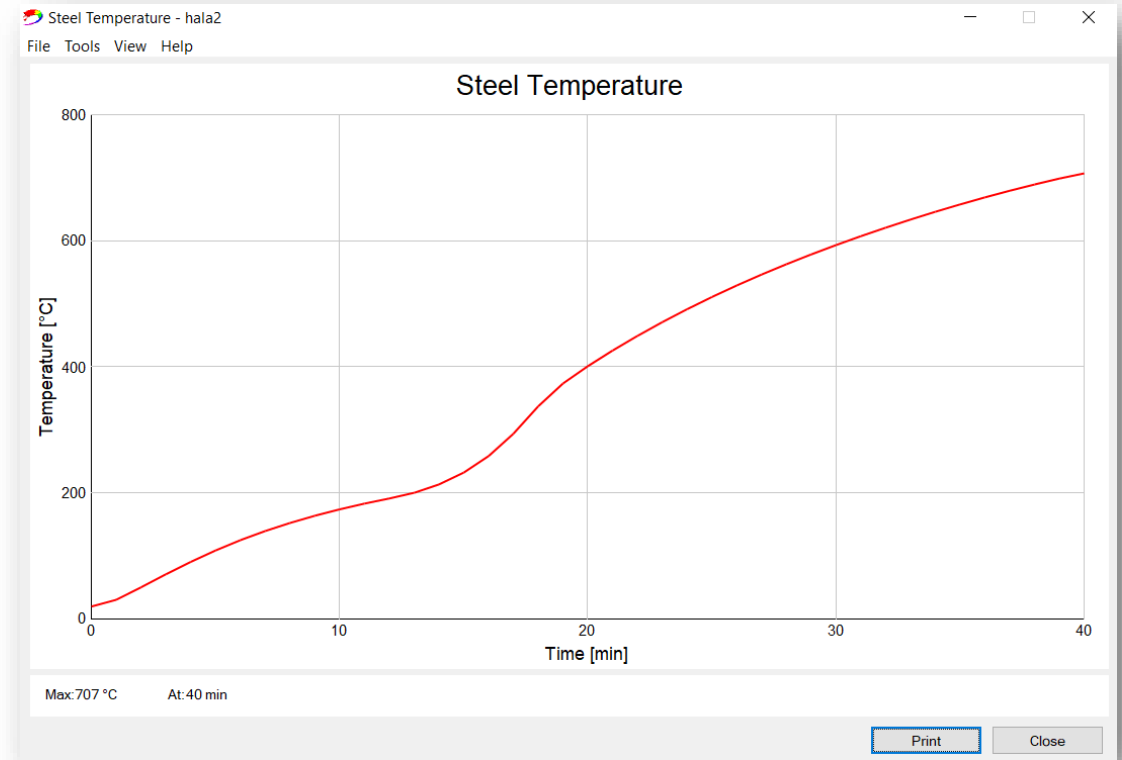
Source: Lyzwa, J., Zehfuss, J.: Thermal material properties of concrete in the cooling phase. ASFE conference 2017



The computer code Ozone V3



Source: Main window (Ozone)



Source: Chart window (Ozone).

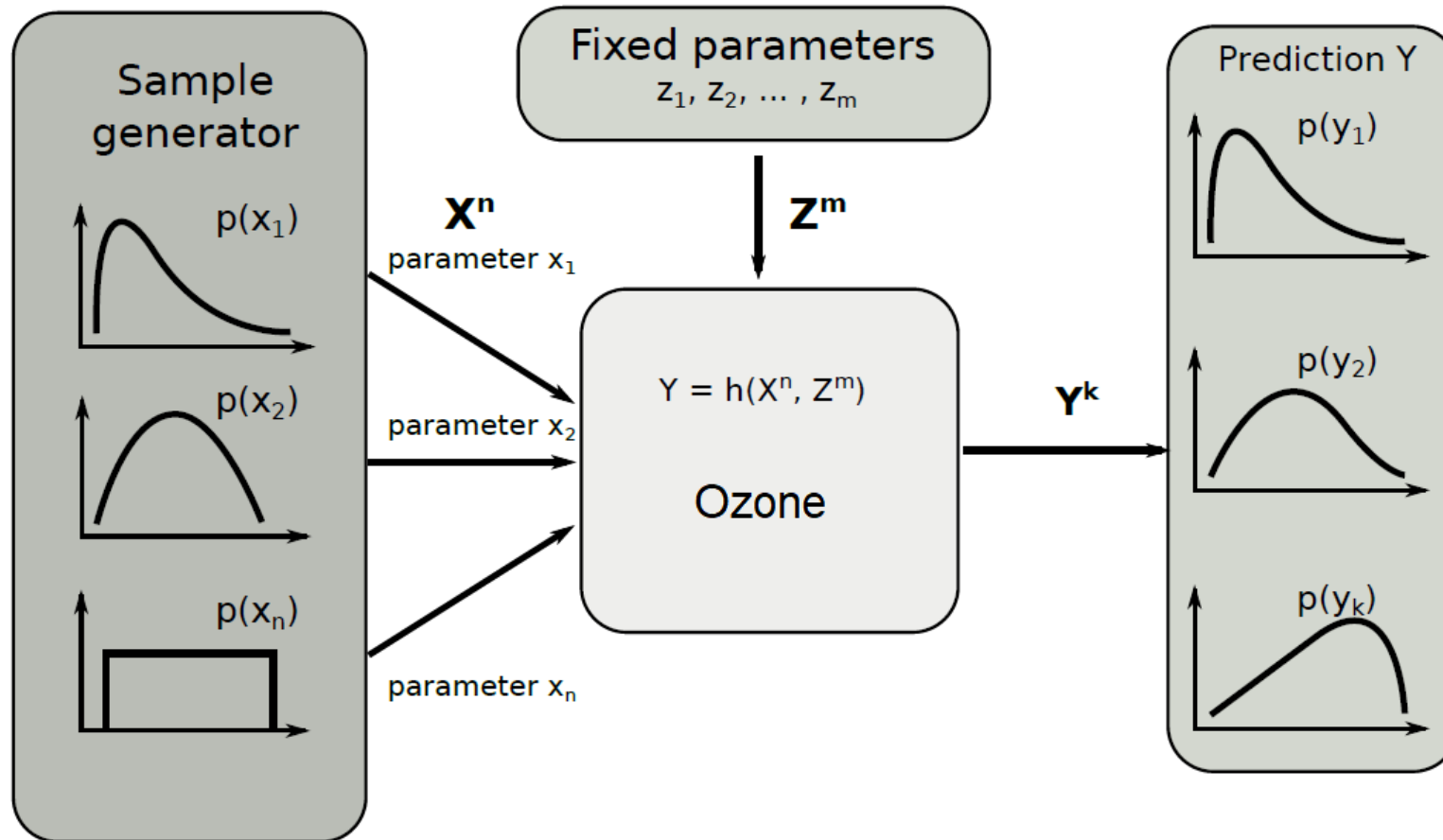


Risk assessment

$$R = P \times S$$



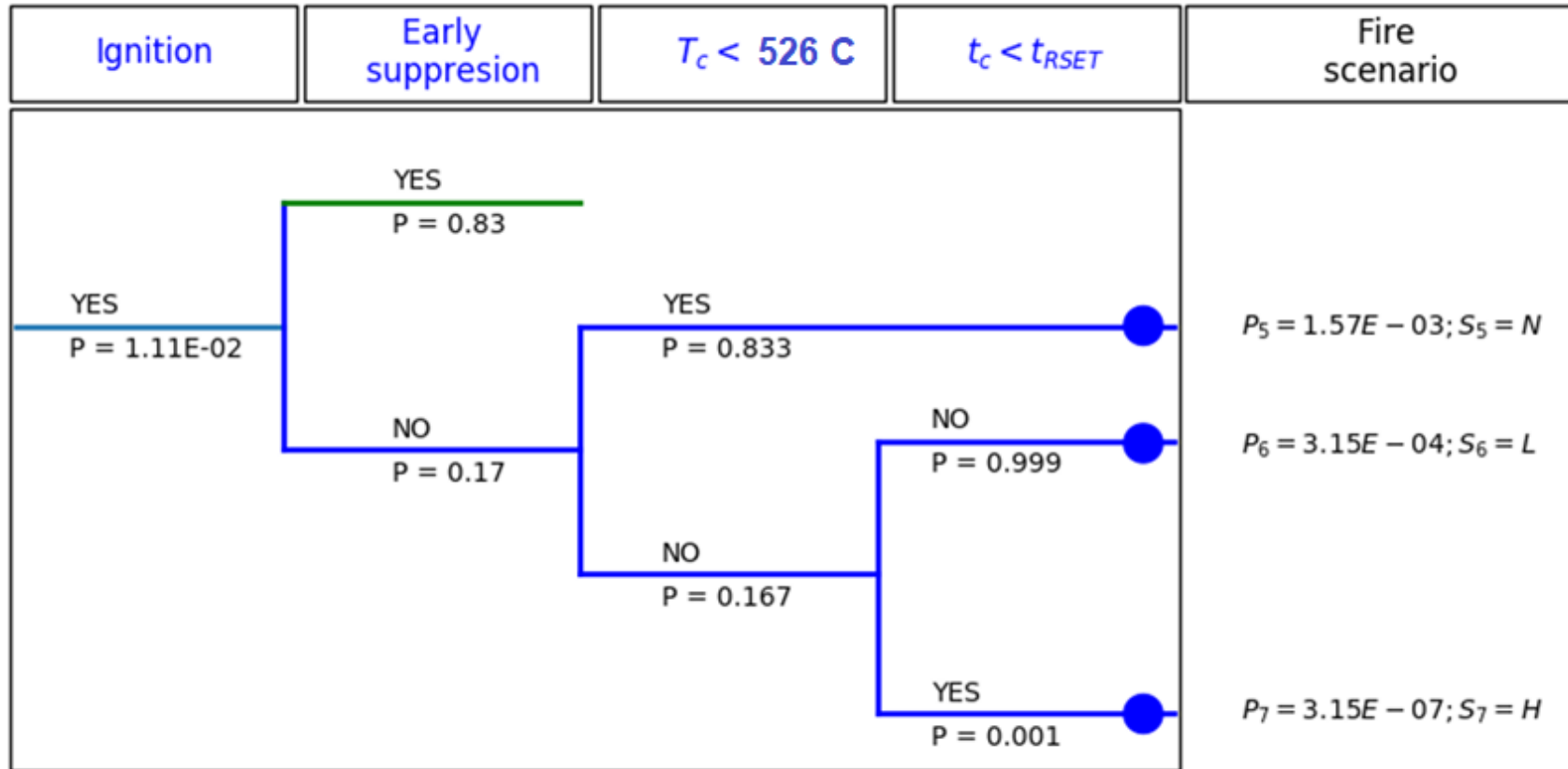
The computer code MultiZone



Source: own study



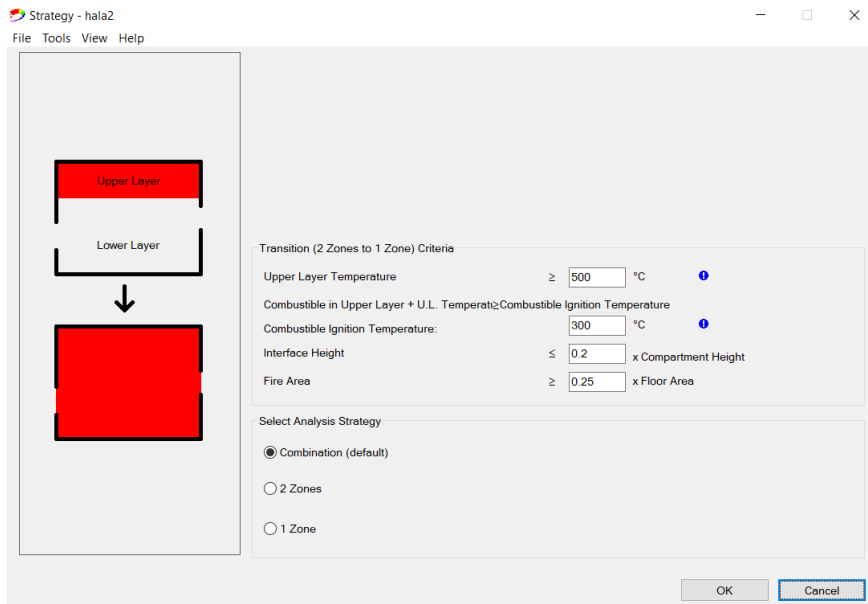
The event tree for the traumatic injury base risk calculation



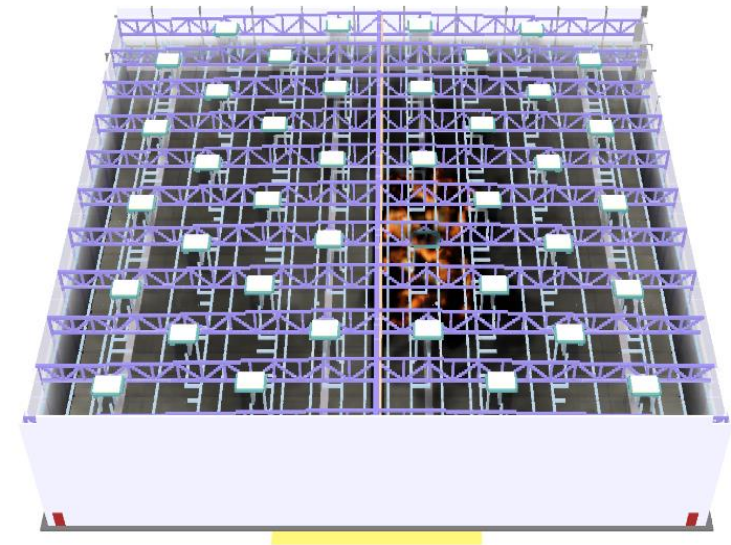
Source: own study



Computational fluid dynamics, CFD



Source: strategy for compartment fires (Ozone)

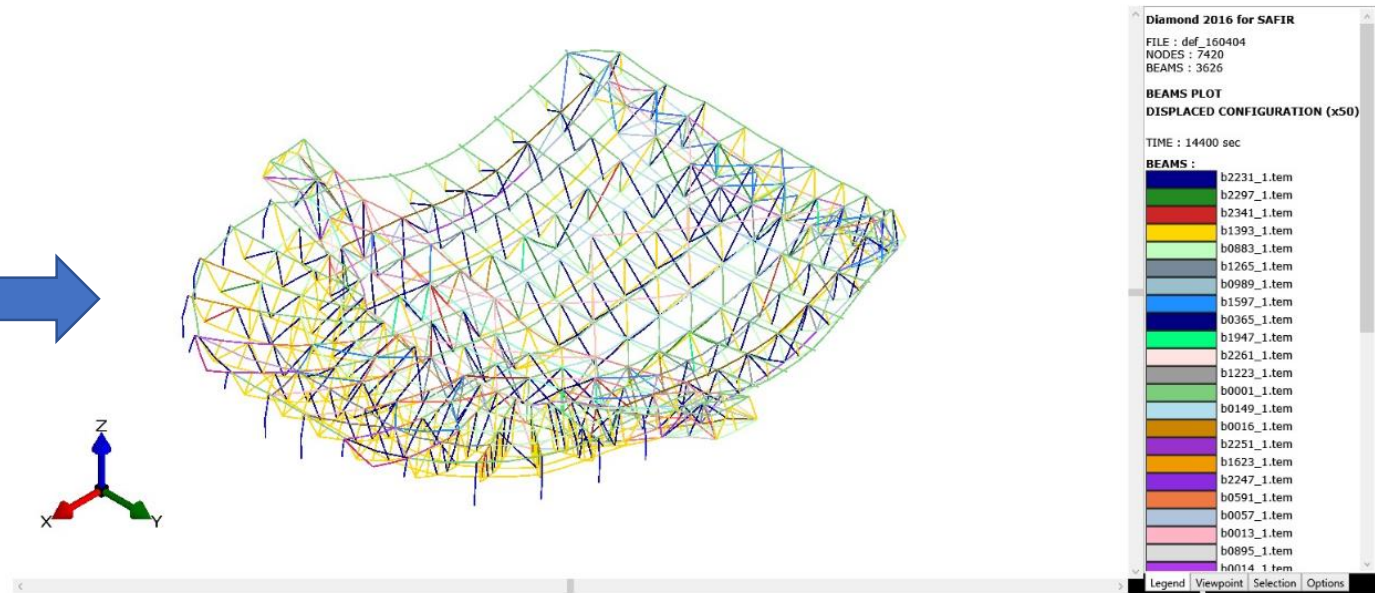
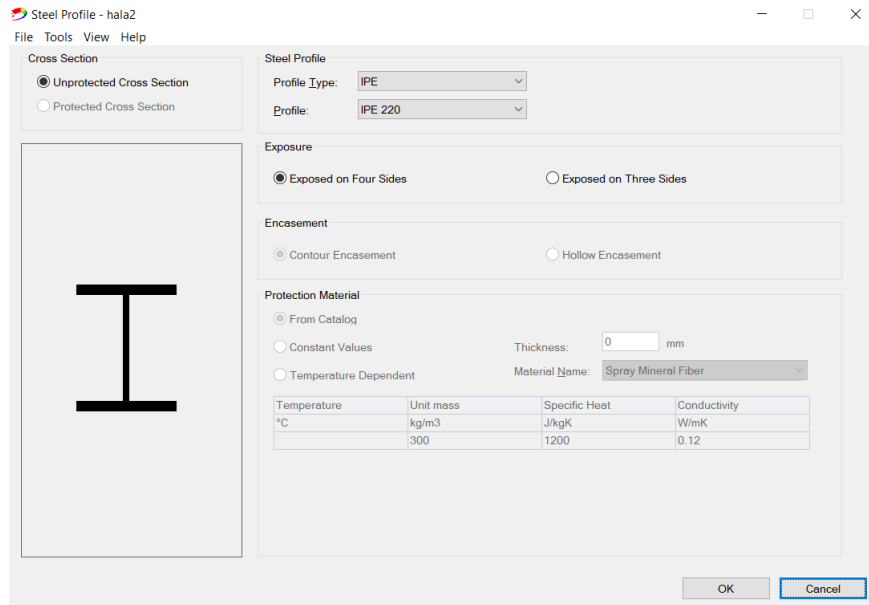


Ther 472

Source: own study



Finite element method, FEM



Source: steel profile window (Ozone)

Source: https://www.uee.uliege.be/cms/c_2383458/en/safir



„These days, there’s not much you can understand about what is going on around you if you do not understand the uncertainty attached to pretty much every phenomenon.”

- J.N. Tsitsiklis

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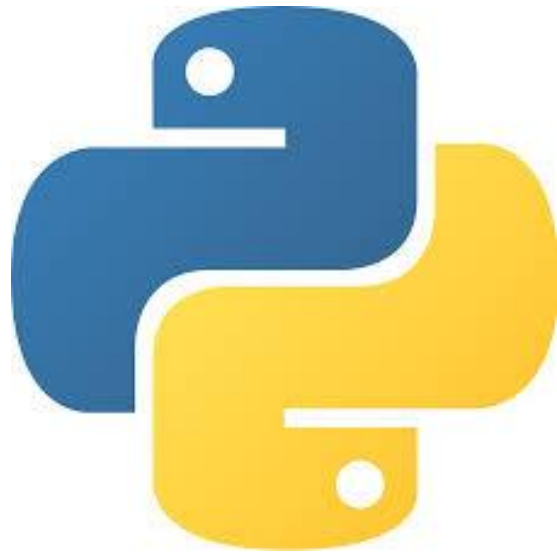


MultiZone

„Software“ for stochastic risk assessment
of steel constructions in fire conditions



How does it work ?



The OZone software interface is shown on the right side of the slide. It features a white background with an orange header bar. On the left, there is a small window icon containing a colorful, abstract graphic. The text in the header bar reads 'ArcelorMittal Global Research and Development Esch' and 'University of Liege'. The main title 'OZone' is displayed in a large, bold, black font, with 'Version 3.0.4' below it. At the bottom, a progress bar is shown with the text 'Loading Tables...'.



OZone3 – analysis engine

OZone 3.0.4

File Tools View Help

New Open Save Charts Report Name: _____

Program Flow Chart

Natural Fire

Compartment... Fire... Thermal Action

Thermal Analysis

Heating... Steel Profile... Steel Temperature

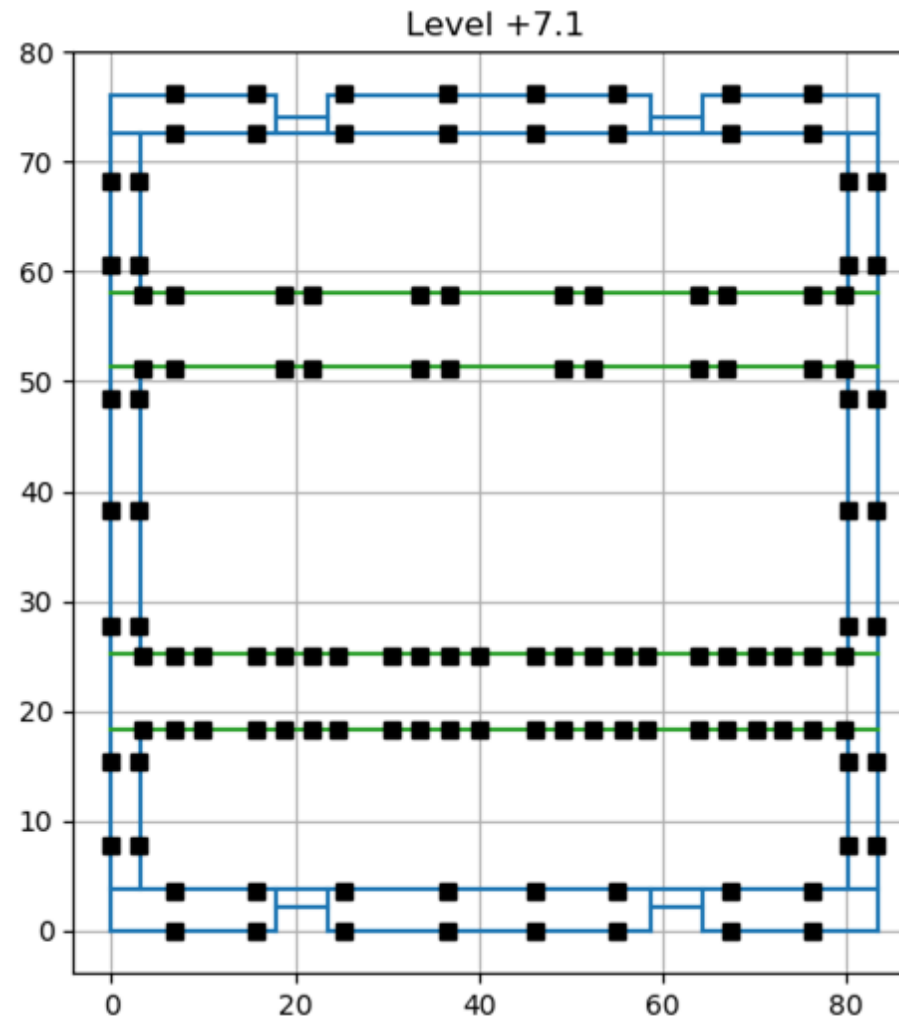
Strategy Parameters

OZone 3.0.4

Compartment Fire Heating Steel

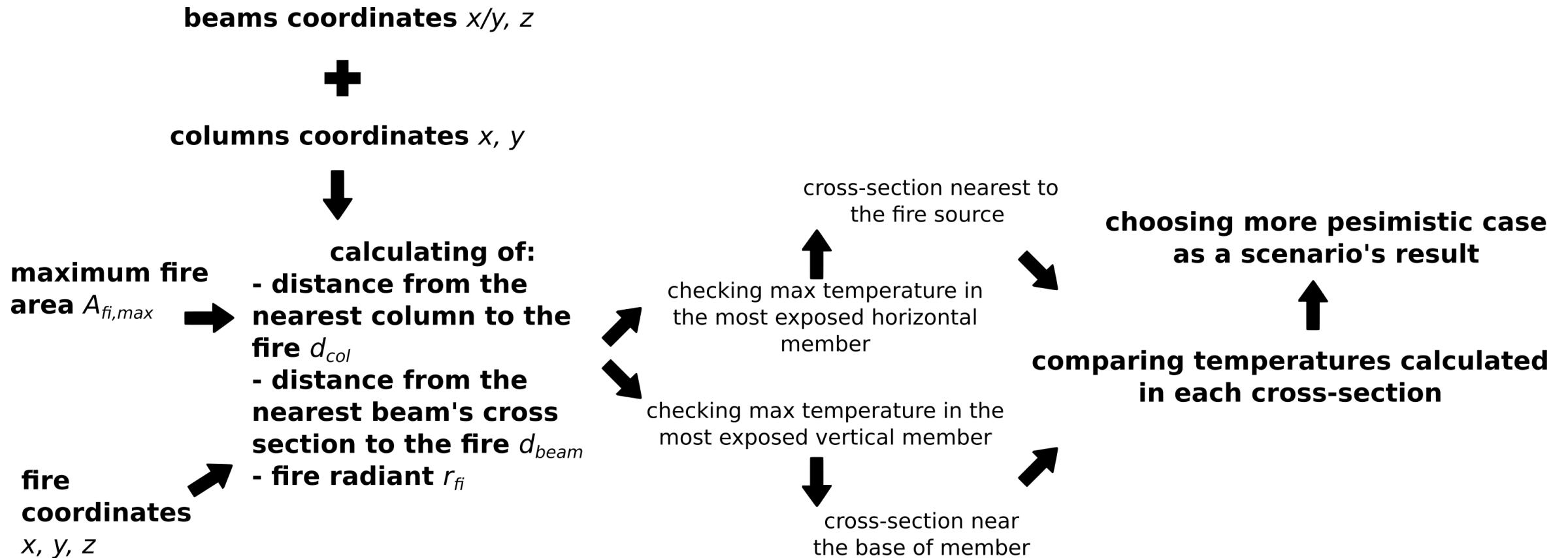


Construction geometry



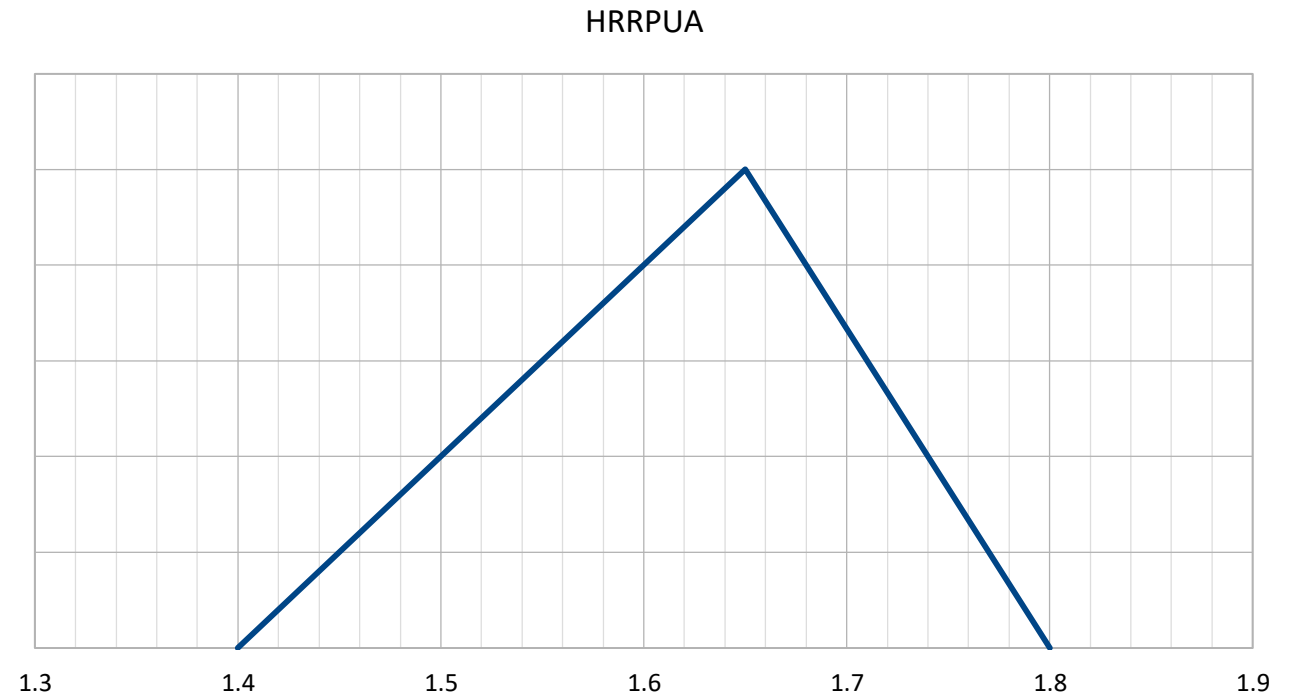
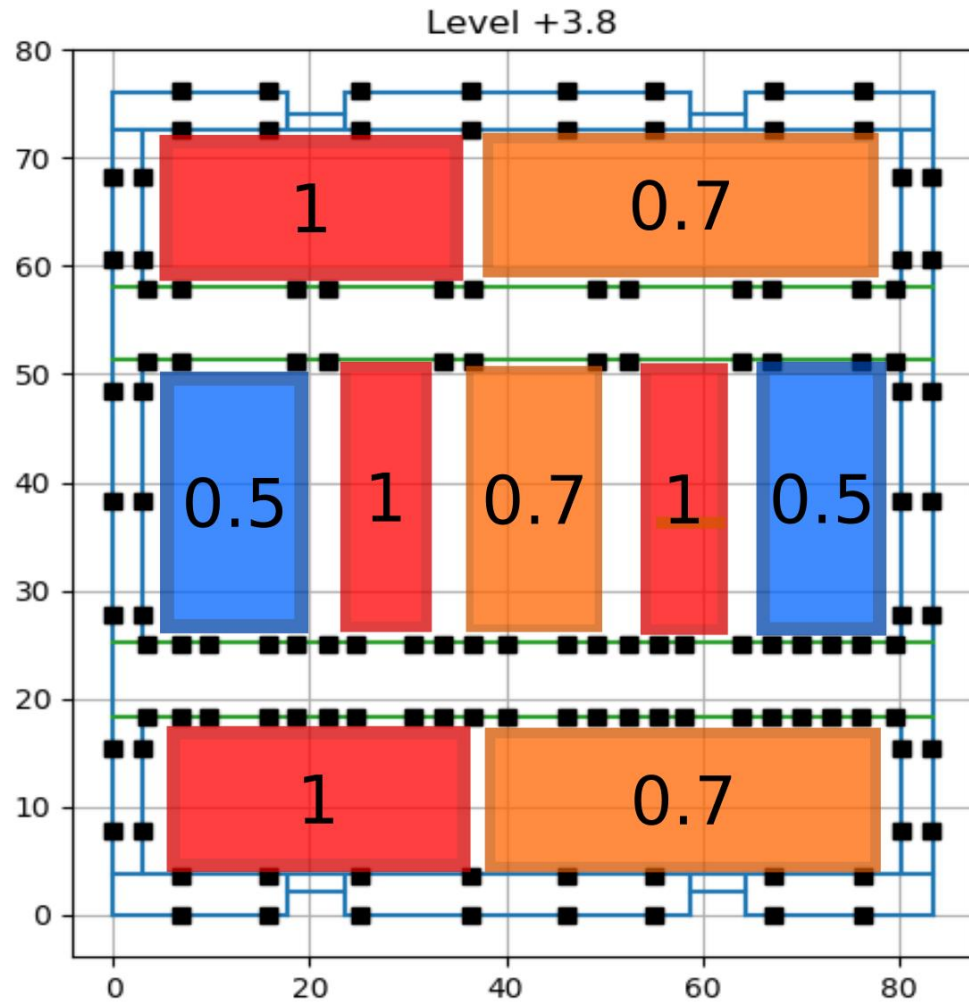


Construction – fire mapping





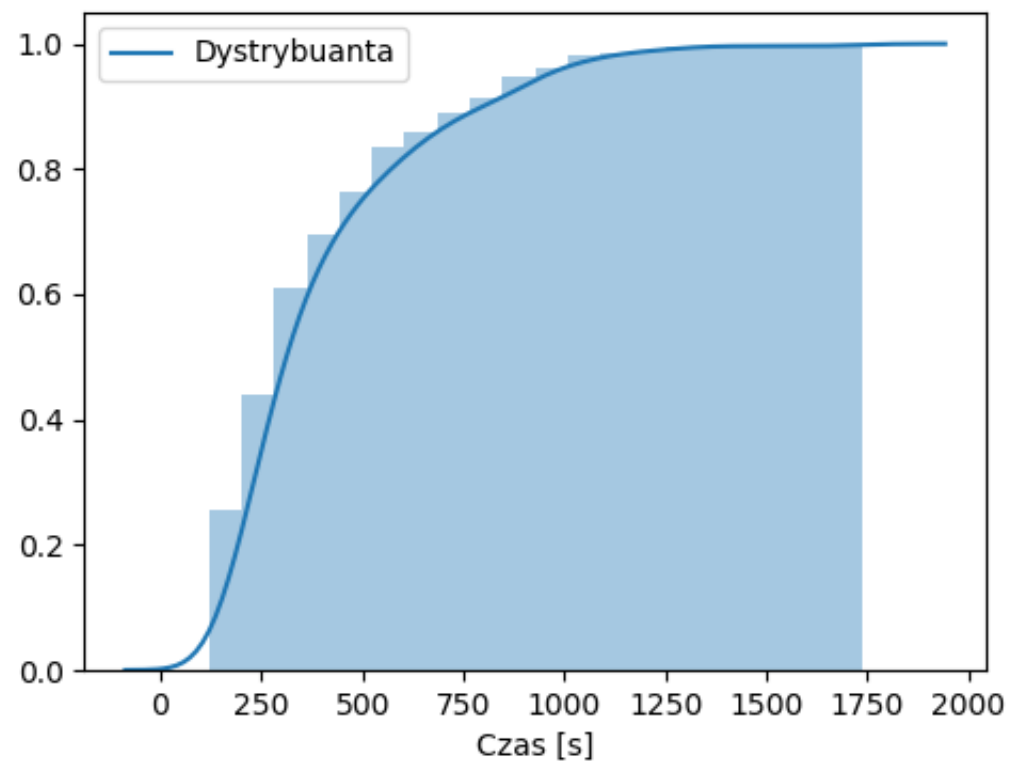
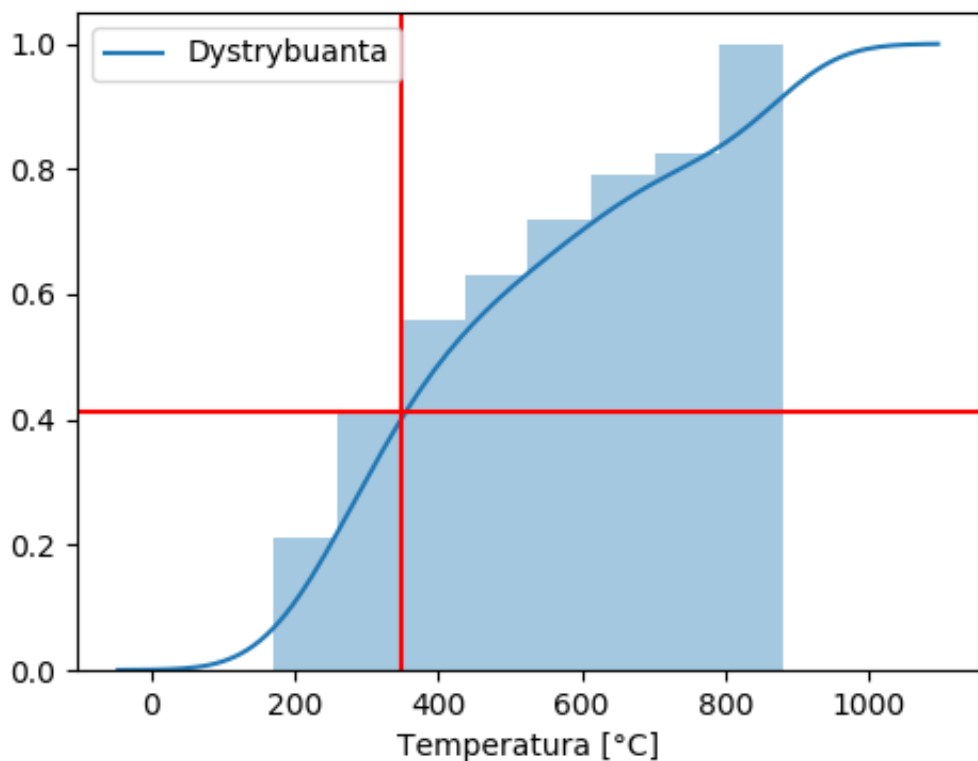
Sampling





Results

38	880.2	180	0.423	15.3	69.3	5.3	0.885	0.59999999999999943
39	208.3	0	14.23	14.4	70.6	0.0	0.925	1.89999999999999915
40	39.9	0	14.23	27.0	75.4	0.1	0.875	6.70000000000000003
41	880.2	120	0.423	53.1	69.5	7.2	0.865	0.79999999999999972
42	880.2	120	0.423	35.2	69.0	7.2	0.93	0.299999999999999716
43	303.7	0	0.423	57.7	73.0	0.6	0.905	0.5





Thank you for attention!



GitHub

/ kowalskiw / multi_zone

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