



ČVUT

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UČENÍ TECHNICKÉ
V PRAZE

FireLAB UCEEB CTU in Prague and Fire Separation Distances Research

Daniela Šejnová Pitelková



UNIVERZITNÍ
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BUDOV

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WHO AM I?

- **PhD. Student**
- **Bachelor of Fire Safety Engineering**
- **Master of Integral Safety of Structures**
- **Post-gradual student of Civil Engineering focused on Fire Safety**

EXPERIENCES

- **Fire consultant and designer of Fire safety of building (since 2017)**
- **Technician and researcher in FireLAB, UCEEB CTU in Prague (since 2019)**
- **Researcher and teacher at Department of Architectural Engineering, Faculty of Civil Engineering, CTU in Prague (since 2021)**

**ZAG, Fire laboratory,
research team FRISSBE**

ZAG

FRISSBE
fire-safe sustainable built environment

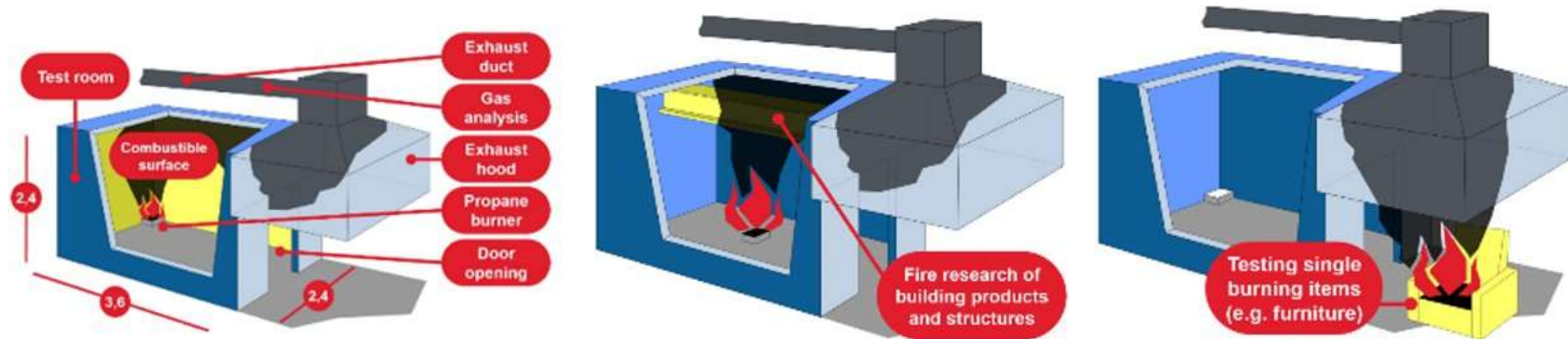


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TESTING EQUIPMENTS AND METHODS



- **Large-scale reaction-to-fire tests for wall/ceiling tiles**
(room corner test according to ISO 9705, EN 14 390)
- **Examinations of individual burning objects (in the room also free burning)**
medium-dimensional indicative tests of fire resistance of walls and ceilings
- **Efficiency tests of fire extinguishing systems**
- **Chemical analysis of combustion products by FTIR method**
- **Consulting activities in the field of fire engineering and fire safety of buildings**

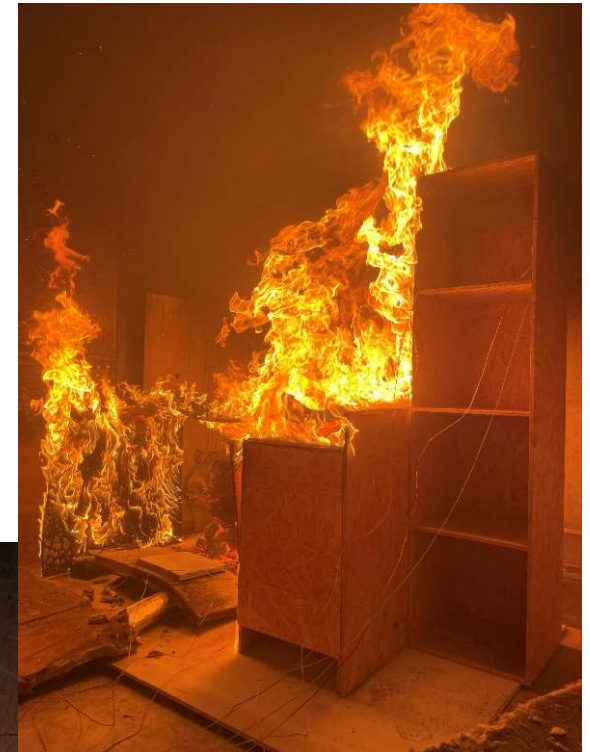
TESTING EQUIPMENTS AND METHODS



- **miniFUR2 fire furnace with natural ventilation for preliminary fire resistance testing of wall or ceiling structural components**
- **Temperature according the standard fire curve (ISO 834)**
- **Virtual miniFUR2 fire furnace (CFD model)**
- **miniFUR3 fire furnace currently under development**

Research | Pyroboard

- Experiments of **various scales** to obtain validated **data for the thermal degradation and combustion** of engineered wood board applicable in **CFD fire simulations**
- **UCEEB + Technical Institute of Fire Protection + University of Chemical Technology**
- **Project VI20192022120** is supported by the Ministry of the Interior of the Czech Republic – **"Safety research of the Czech Republic"** Programme 2015–2022



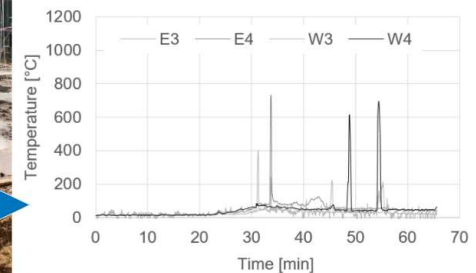
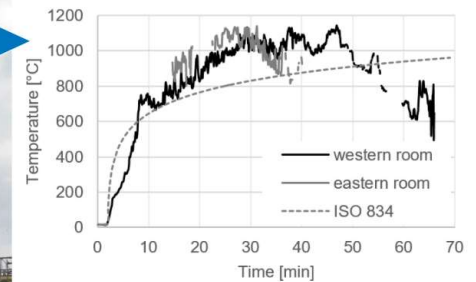
Research | Facade fire testing

- **Standardized and non-standardized tests on fire spread on combustible and incombustible materials mounted on ventilated facade systems**



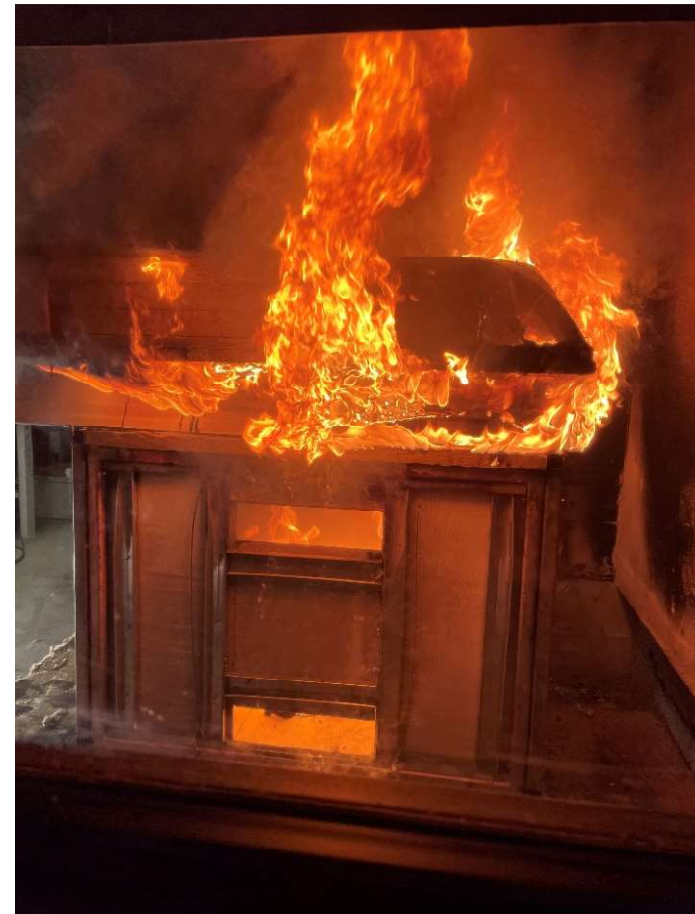
Research | Straw-bale house

- **Full-scale fire test**
- **Fire safety evaluation of load-bearing straw-bale construction**
- **Behaviour of unusual environmental-friendly materials in fire**
- **Experimental determination of fire openness and separation distances**



Research | graduation thesis

- **Students dealing with fire safety of buildings have the opportunity to see **the real fire through their thesis****
- **Mid or large scale tests**
- **Co-working with industry**



MAIN RESEARCH TOPICS

- **Facades and spread of fire through exterior**
- **Fire separation distances**
- **Experimental studies**
- **FDS simulations**



DISSERTATION THESIS

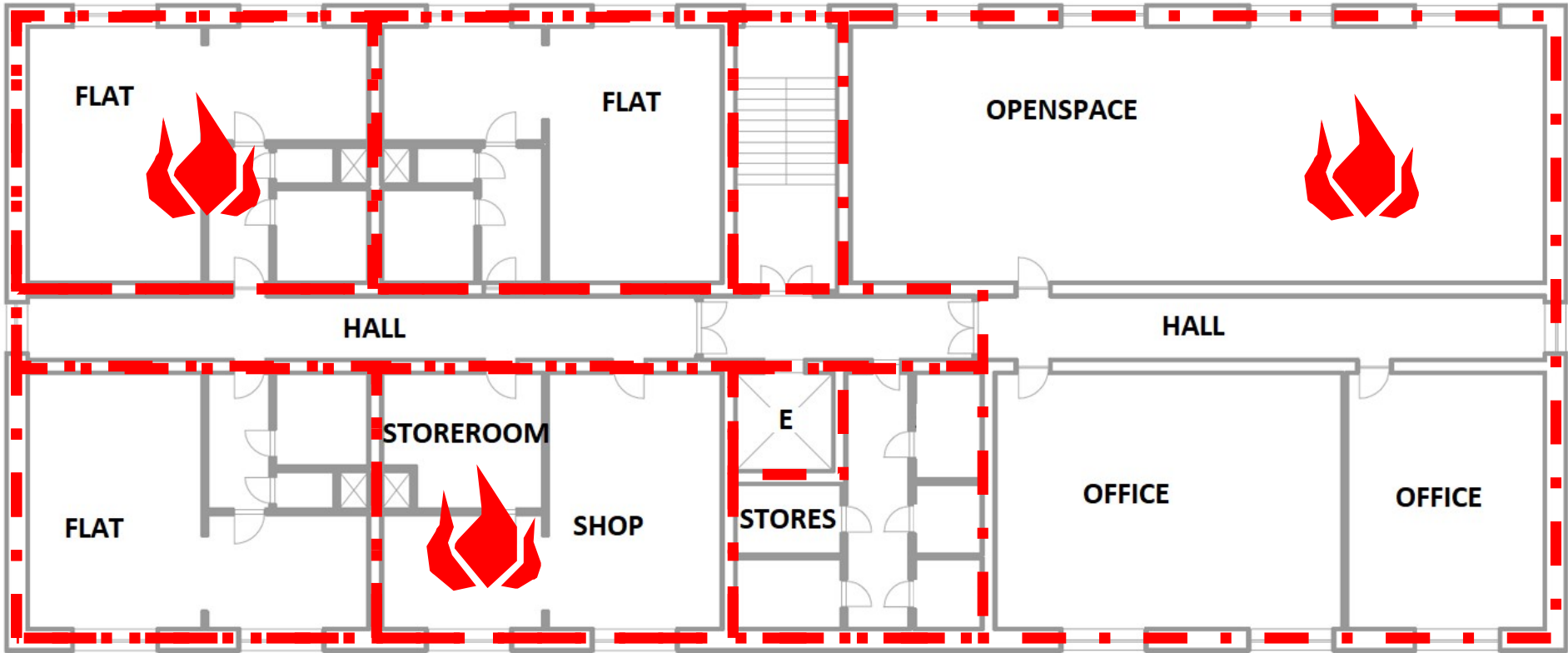
WHY?

- **Spread of fire through exterior**
- **New types of facades**
 - **Amount of unprotected areas, cladding systems, etc.**
- **Improvement of existing solution for determining the fire separation distances in Czech technical standards for specific arranged of unprotected areas**

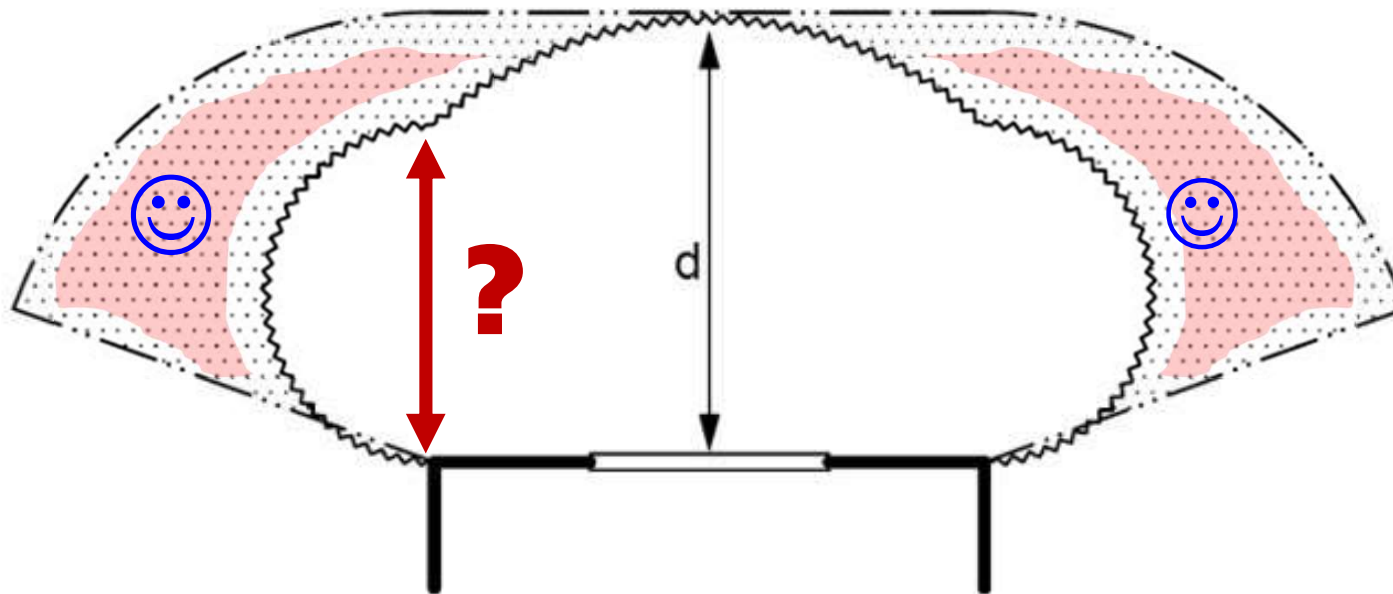
AIM

- **Detailed description of the fire hazard area**
- **Useable methods for Fire Safety Solution**

PRINCIPLES



— . . —
STANDARDS



CONFIGURATION (VIEW) FACTOR



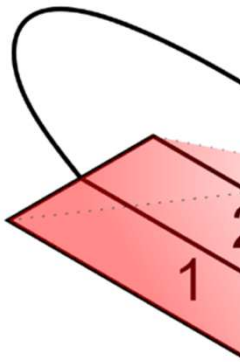
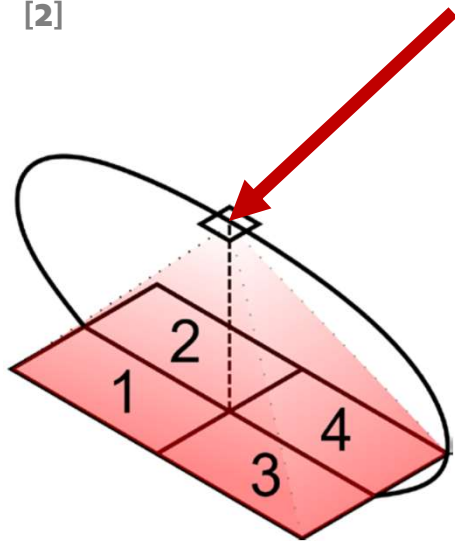
MORE ACCURATE CALCULATION USING BY STEFAN-BOLTZMANN LAW

PRINCIPLES

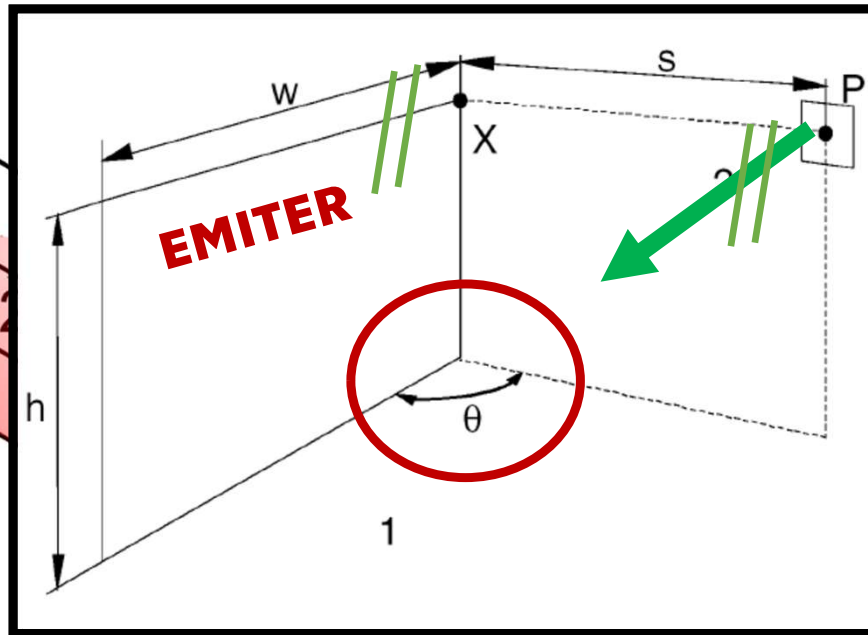
CONFIGURATION FACTOR

[2]

RECEIVER

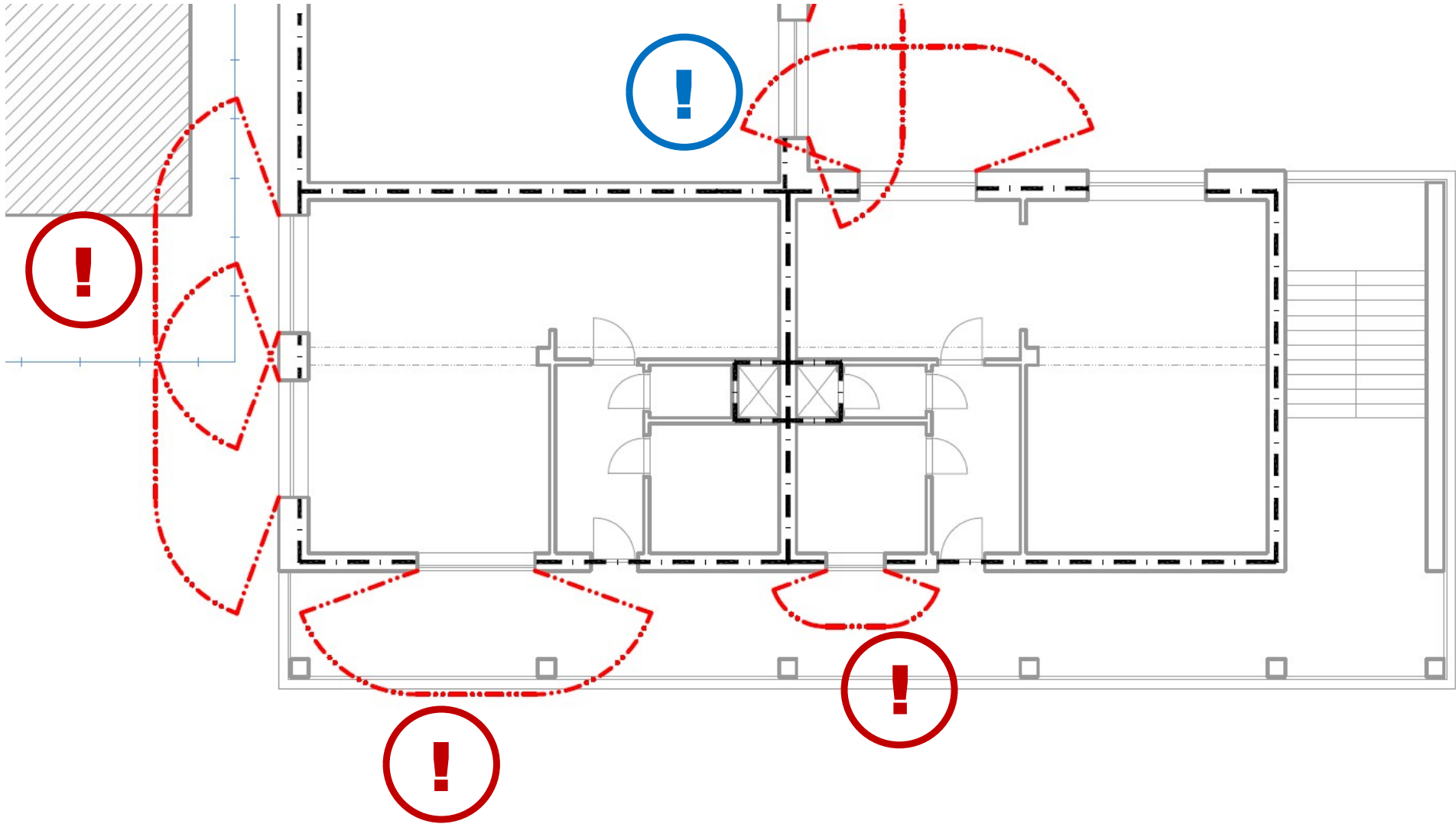


**EMITER
(Window)**



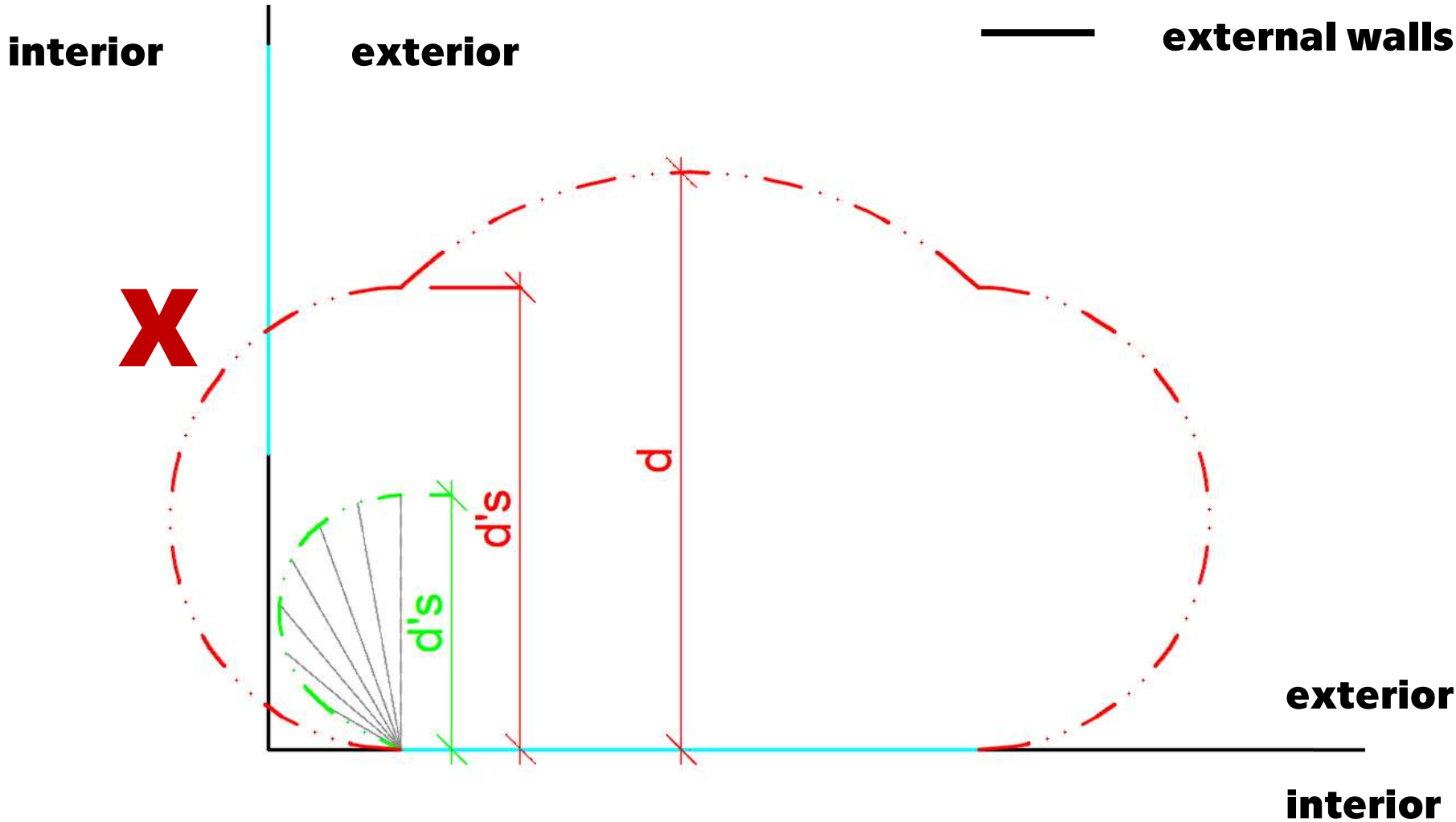
[1]

PRINCIPLES



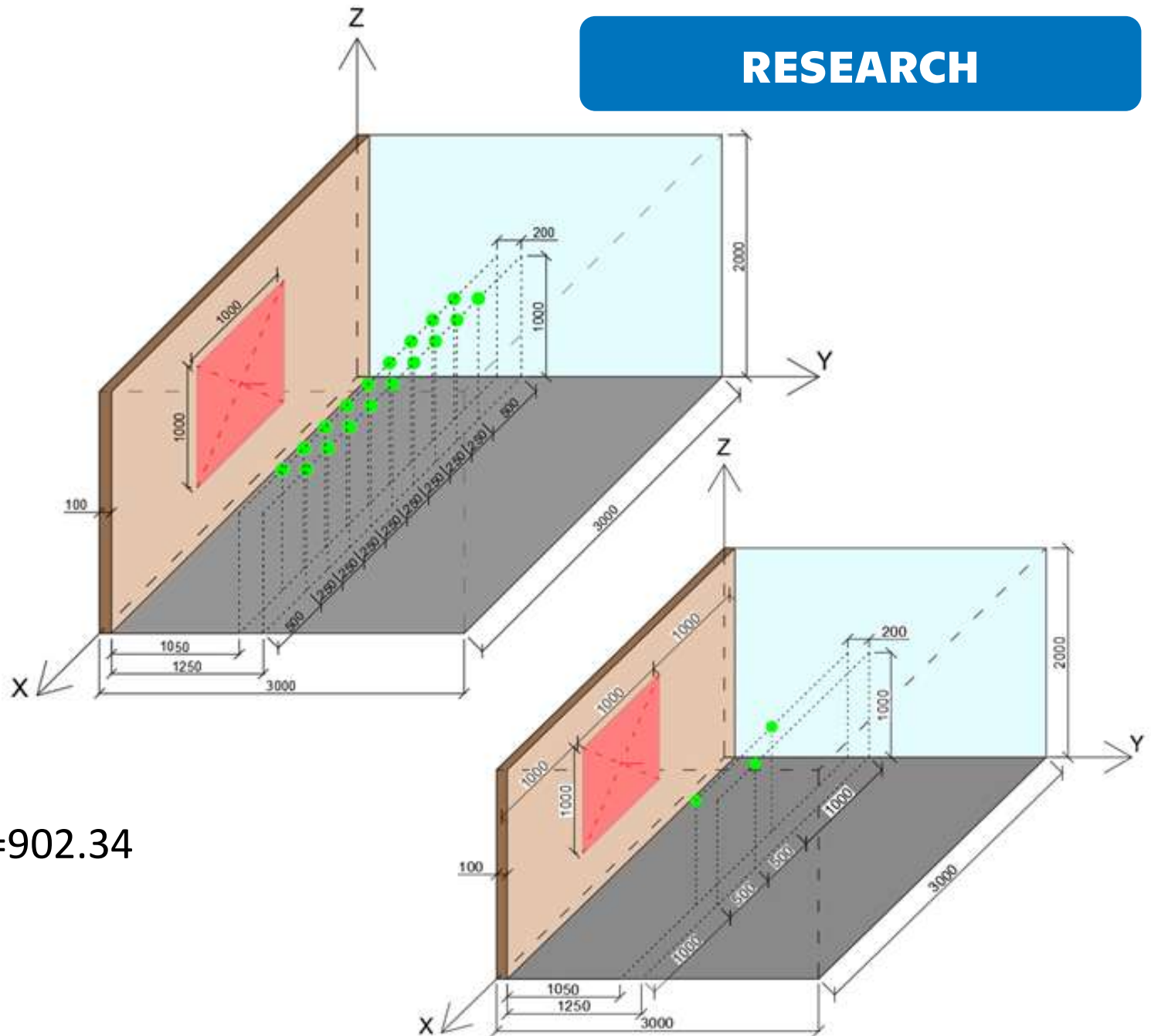
PRINCIPLES

— windows
 — external walls



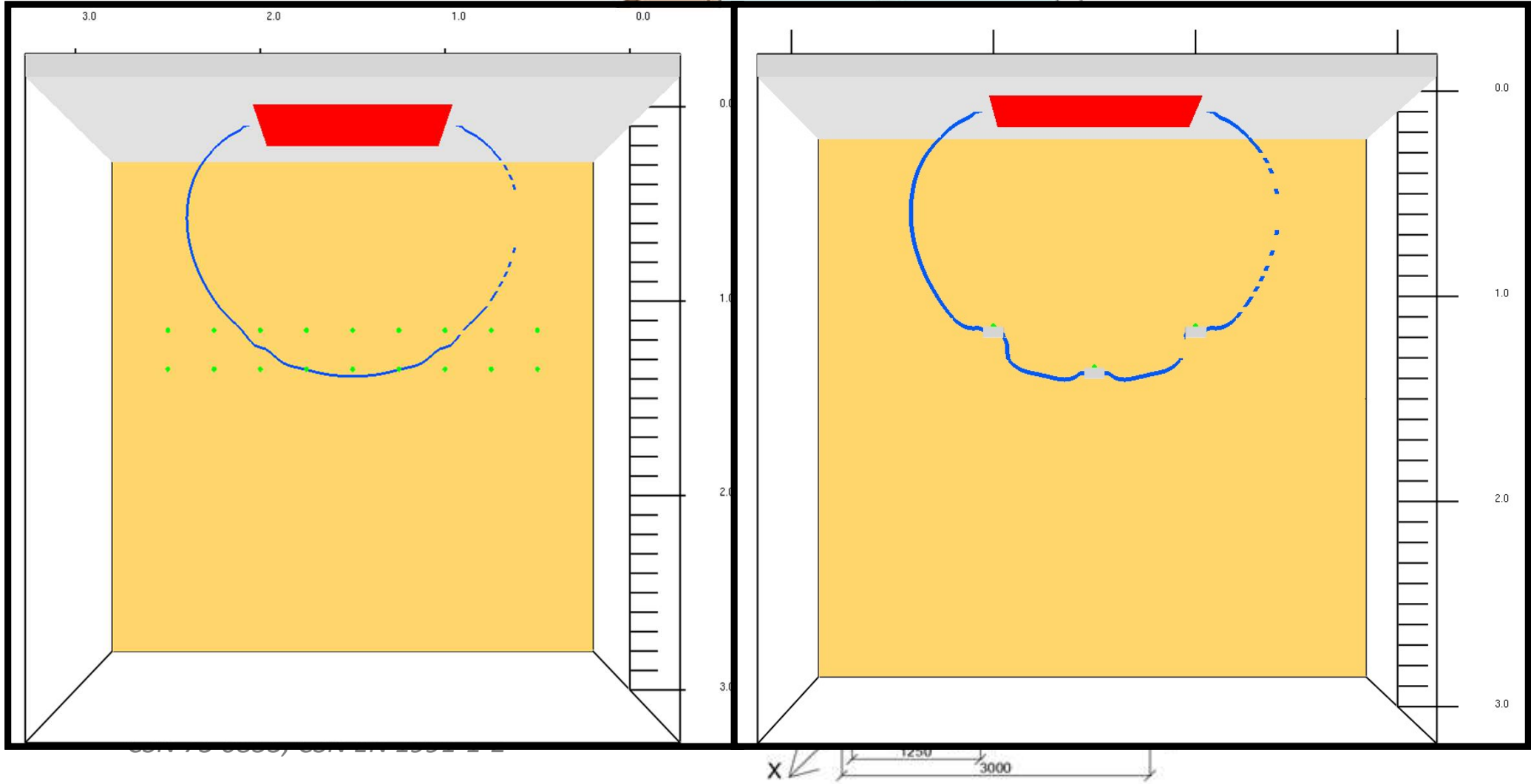
IS THIS REALLY TRUE?

RESEARCH



TMP_FRONT=902.34

RESEARCH



Outcome - Smokeview

RESEARCH

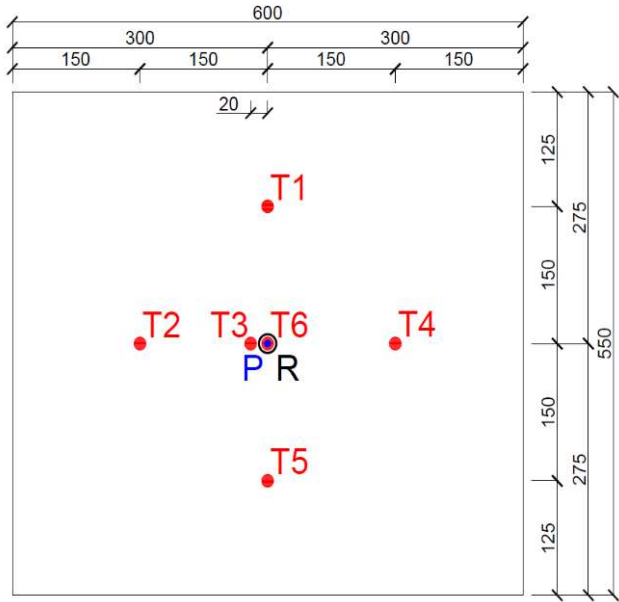
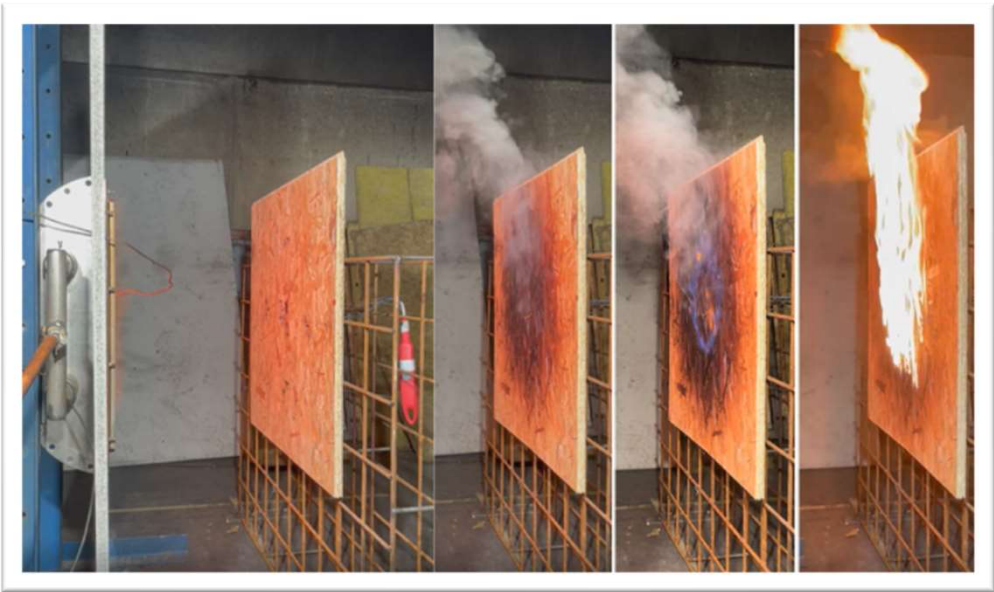
Changed parameter	Change of computing time	Max. deviation	Computing time
Dimensions of cells Big ones → small ones	YES	~ 11 – 20 %	Min, hours, days
Width ratio to its height 1:1 – 1:4	YES	~ 0 – 8 % <i>(od poměru 1:1)</i>	100 % → 13 %
Time step increment (TSI)	YES	~ 7 – 12 %	~ 130 – 155 %
Angle increment (AI)	YES	~ 7 – 12 %	~ 170 %
Combination (TSI a AI)	YES	~ 7 – 12 %	~ 290 – 375 %
Number of Solid Angles	YES	~ 2 – 22 %	Až ~ 325 %
Path Length – influence to absorption coefficient	NO	~ 0 – 20 %	-
Humidity	NO	~ 7 – 17 %	-

Deviation from $I_{crit} = 18,5 \text{ kW}\cdot\text{m}^{-2} \rightarrow$ in maximum 22 % ($4 \text{ kW}\cdot\text{m}^{-2}$).

[3]

Main impact - **PATH_LENGTH** and **Number of Solid Angles**

RESEARCH

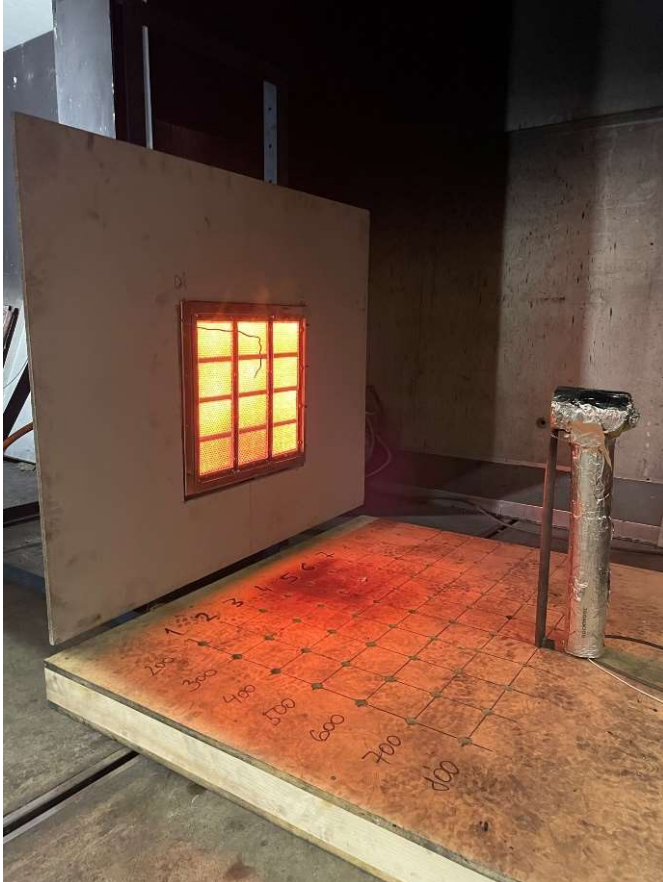


Experiment	Start [s] Note: Time of protocol	End [s]	Time of exposure [s]	Spontaneous ignition	Piloted ignition	Max. temperature [°C]
No.1	1563	3474	1911 (32 min)	NO	NO	410
No.2	1189	2592	1403 (23 min)	NO	NO	584
No.3	619	920	301 (5 min)	NO	YES	206
No.4	613	831	218 (3,6 min)	NO	YES	183

[4]

Straight wall →

Corner



A PAPER IS IN PROCESS

CHANGING BOUNDARY CONDITIONS

- 1) Uninsulated adjacent wall**
- 2) Insulated adjacent wall**

THANK YOU FOR YOUR ATTENTION

References:

[1] ČSN EN 1991-1-2 Eurokód 1: Zatížení konstrukcí - Část 1-2: Obecná zatížení - Zatížení konstrukcí vystavených účinkům požáru. B.m.: Český normalizační institut. 2004

[2] Pitelková, D.; Hejtmánek, P.; Mózer, V., Comparison of Various Approaches for Determination of Separation Distances. Transactions of the VSB - Technical University of Ostrava, Safety Engineering Series. 2020, 15(1), 38-46. ISSN 1805-3238.

[3] Pitelková, D.; Hejtmánek, P.; Mózer, V., Využití CFD při predikci požárně nebezpečného prostoru, Available online at: <https://www.tzb-info.cz/pozarni-bezpecnost-staveb/23115-vyuziti-cfd-pri-predikci-pozarne-nebezpecneho-prostoru>, 2021.

[4] Pitelková, D.; Hejtmánek, P.; Mózer, V.; Vorlíčková, E., Degradation of OSB Exposed to the Critical Heat Flux for Determination of Fire Separation Distances. (In publication proces, presented at the conference Young Scientist 2022, Slovakia 2022/06).

