International Master of Science in Fire Safety Engineering

International Master of Science in Fire Safety Engineering (IMFSE)

Commonly organized by

Ghent University (Belgium, coordinator)

Lund University (Sweden)

The University of Edinburgh (UK)

Universitat Politècnica de Catalunya (Spain)

International Master of Science in Fire Safety Engineering (IMFSE)

Associated Partners

University of Queensland (Australia)

University of Maryland (USA)

ETH Zurich (Switzerland)

University of Science and Technology of China

The IMFSE contributors

IMFSE: the programme

- 2 years fulltime
- 4 semesters
- 120 ECTS credits
- Erasmus+ course: International Mobility!
- Joint degree

IMFSE mobility scheme

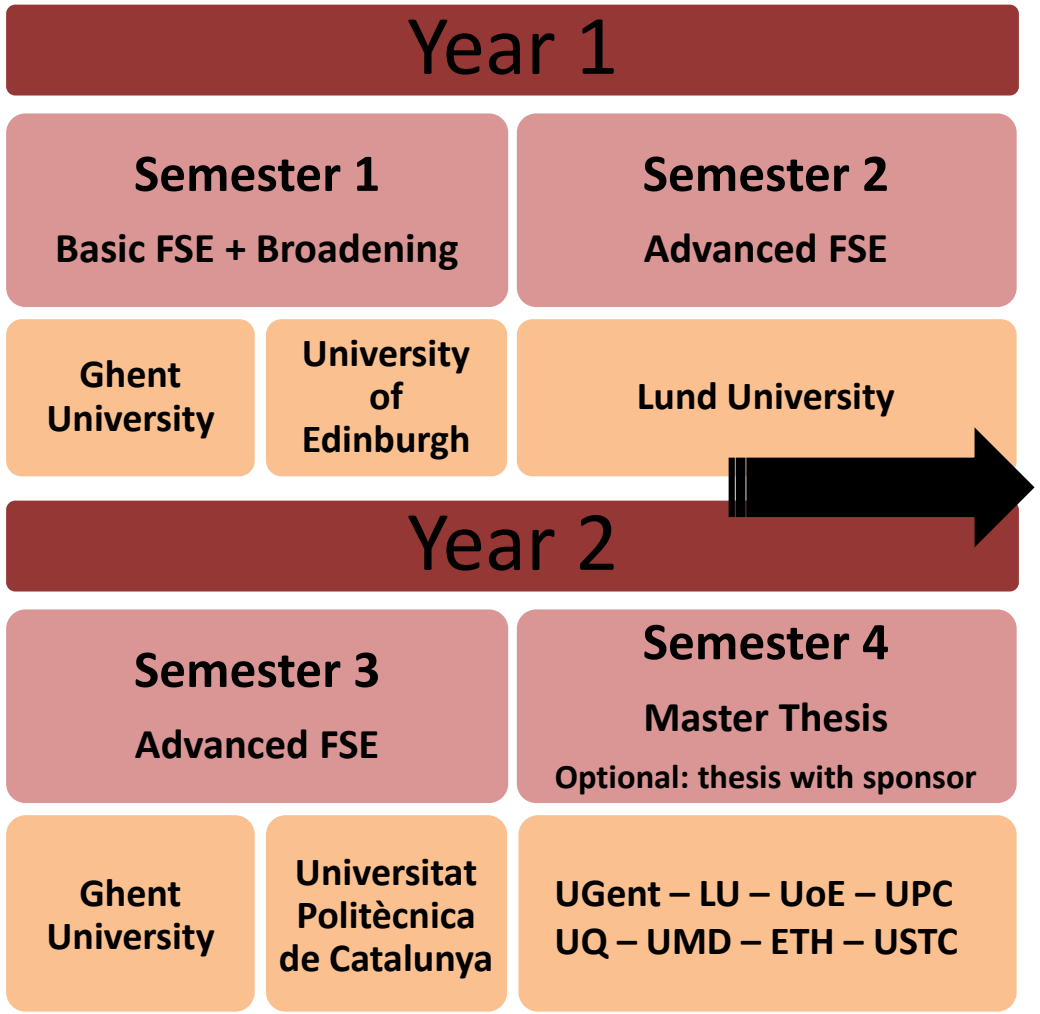
Year 1

Semester 1 Basic FSE + Broadening		Semester 2 Advanced FSE
Ghent University	University of Edinburgh	Lund University

Year 2

Semester 3 Advanced FSE		Semester 4 Master Thesis Optional: thesis with sponsor
Ghent University	Universitat Politècnica de Catalunya	UGent – LU – UoE – UPC UQ – UMD – ETH – USTC

IMFSE mobility scheme



Optional
internship between year 1 and year 2

Application procedure

- Online application
- Partner Country and Programme Country students
- Admission requirements
- Full scholarships and tuition fee waivers available
- Application deadlines:
  - Scholarship applicants: 31 January 2024
  - Self-sponsored applicants:
    - Students who need a visa: 31 March 2024
    - Students who don’t need a visa: 31 May 2024

Application requirements

- Minimum: Bachelor degree in
  - civil / structural / mechanical / electrical / chemical / industrial engineering
  - material sciences
  - chemistry
  - physics, applied physics
  - architecture, urbanism and spatial planning
  - or a related discipline

- Sufficient knowledge of English
  - TOEFL / IELTS / Trinity / Cambridge CAE & CPE / ESOL

Website: www.imfse.com

E-mail: IMFSE@UGent.be

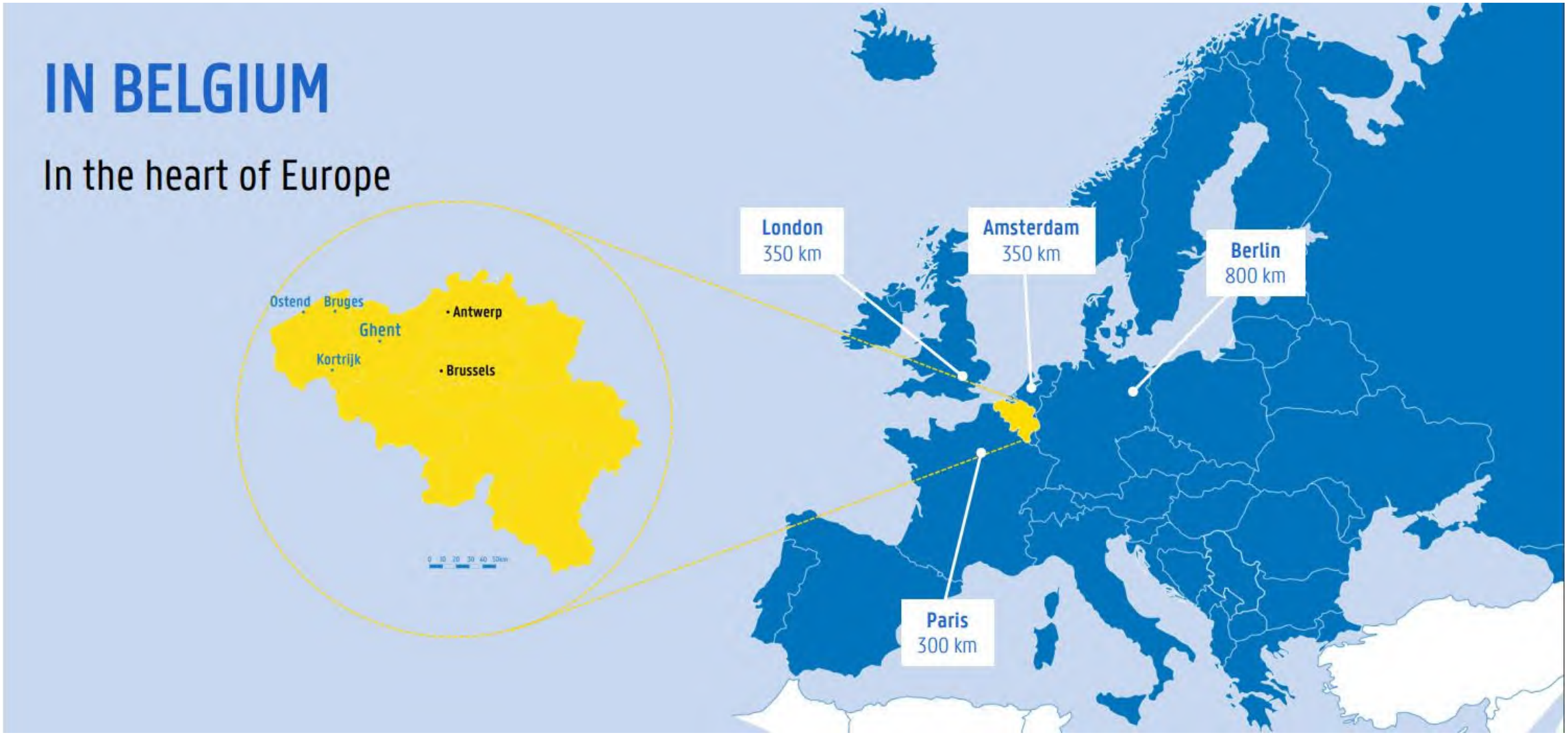
GHENT UNIVERSITY

Belgium

Ghent

Location on the map

GHENT UNIVERSITY



Facts & figures about Ghent

The historic heart of Flanders *A city of all times*
Medieval Manhattan *Europe's best kept secret*

Founded in the 7th Century - Metropolis in the Middle Ages

Home to incredible medieval architecture, important museums, great culinary traditions and some wonderful festivities.

Population: 260,000 – Students: 70,000

Getting there & around

Highly developed transport system

- 50 minutes by train from Brussels airport
- 90 minutes by train/bus from Charleroi airport

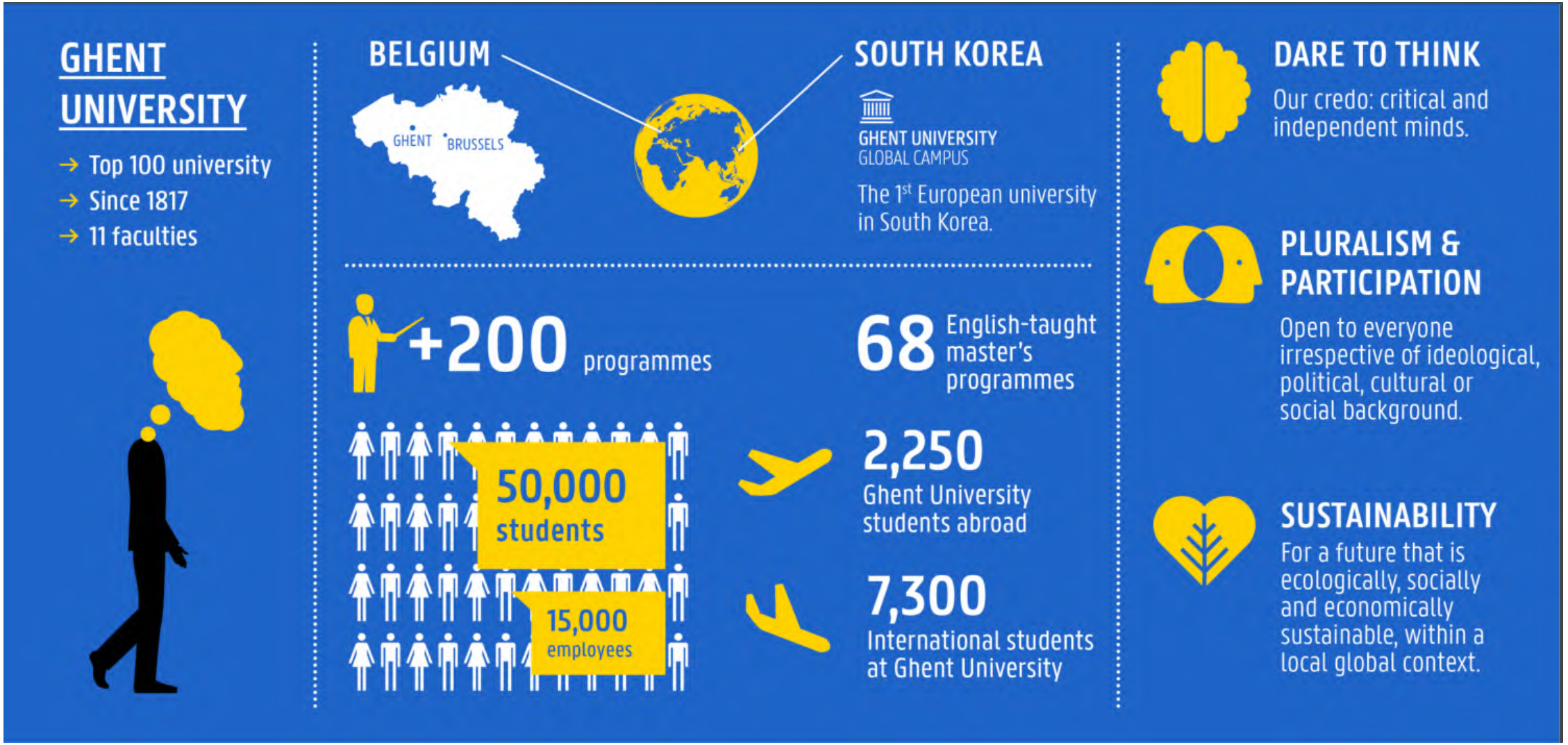
Ghent has

- 3 train stations with connections to all major cities
- an extensive network of public transport (bus & tram)

Ghent city center:

all walking distance, very bicycle-friendly!

Ghent University

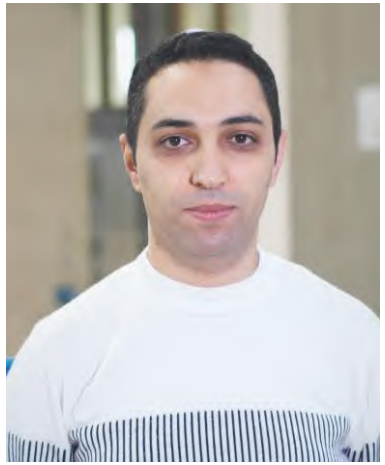


This is Ghent University full presentation: https://styleguide.ugent.be/files/uploads/ThisisGhentUniversity_EN_20231019.pdf

Ghent University

- Faculty of Engineering and Architecture
  - The Department of Structural Engineering and Building Materials
    - **IMFSE**
    - MFSE
    - PGFSE

The Team



Ass.-Prof Tarek Beji

Prof Bart Merci

Ass.-Prof Ruben Van Coile

+ 3 postdocs

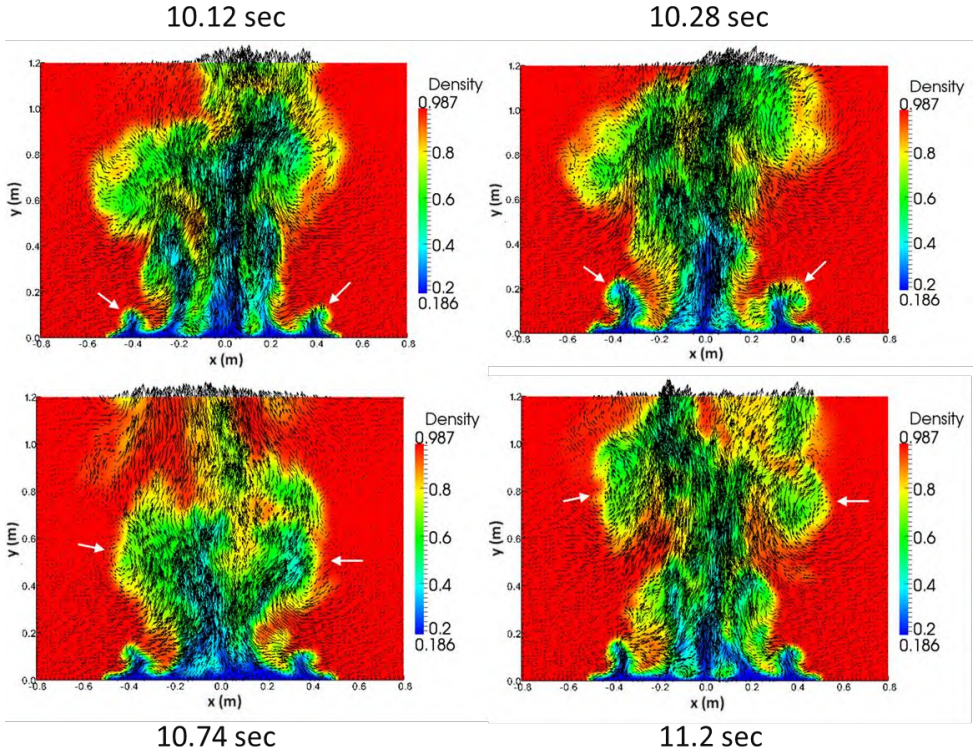
+ 6 PhD students

+ 2 IMFSE administrators

Research in Fire Dynamics

Core activity: numerical modeling and theory development.

Most advanced: CFD (Computational Fluid Dynamics).



Research in Fire Dynamics

GHENT UNIVERSITY

Numerical study of liquid pool fires in a confined and mechanically ventilated compartment

Computational Fluid Dynamics (CFD)

Framework: Fire Dynamics Simulator (FDS)

Objectives

- Model developments
  - ➢ liquid heat-up
  - ➢ evaporation
- Assessing current capabilities of FDS
- Modeling of oscillatory combustion in the enclosure

A simulation of oscillatory combustion by a heptane pool fire in an enclosure (side view and top view).

Research in Fire Dynamics

Fire tests: in collaboration with WFRGent NV.

Research in Structural Fire Engineering

GHENT UNIVERSITY

Research paths:

I. **Structural behaviour** during and after fire, (also) **in relation to new trends in construction**

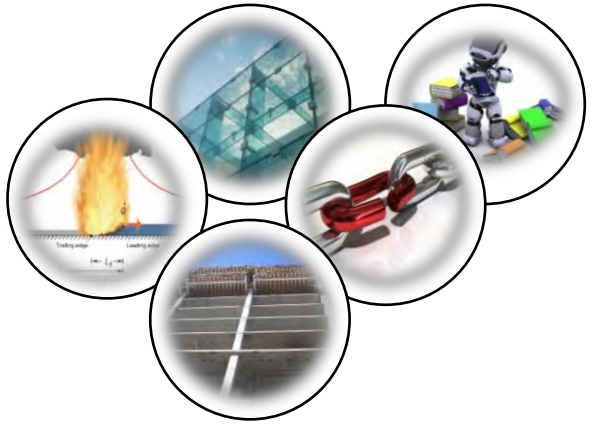
II. **Application of machine learning** techniques to structural design and fire safety

III. **Target definition** for structural fire safety engineering

IV. **Engineering methods and tools** for computer-based structural fire safety design

Projects:

- Glass & fire
- Prestressed concrete hollow-core slabs
- Multi-dimensional optimization
- Advanced calculation methods for SFE



See you in Belgium!

UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

Universitat Politècnica de Catalunya. Barcelona, Spain








UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Where are we?

- Population: 1.7 million (3.5 million in the metropolitan area)
- 270,000 students
- Human settlements since the neolitic (5000 BC), current old city center funded by the Romans around 100 BC
- Mediterranean climate (mild winters and warm to hot summers, few rainy days)

- City of culture, traditions and creativity
- Gastronomy – Catalan cuisine

Transport

Well communicated city:

- International airport *Josep Terradellas* (El Prat)
- High speed train
- Sea Port
- Metro
- Tram
- Bus
- Biking (270 km cycling paths)

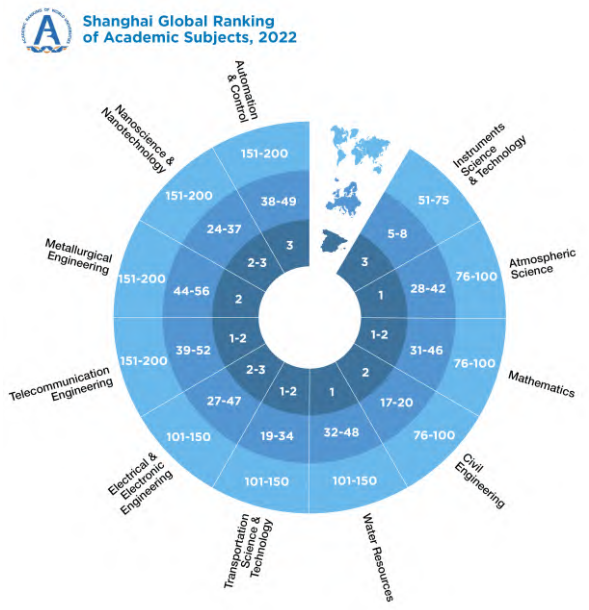
UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

The Universitat Politècnica de Catalunya · BarcelonaTech

The Universitat Politècnica de Catalunya · BarcelonaTech (UPC) is a public institution dedicated to higher education and research, specialized in the fields of engineering, architecture and science, created 50 years ago.

The UPC today

29,812 students	3,523 teaching and research staff	2,074 administrative and service staff	65 bachelor's degrees	84 master's degrees	45 doctoral programmes
18 schools	275 lifelong learning programmes	19 patents last year	317 million euros 2022 budget	72,7 million euros R&D income	70,151 alumni

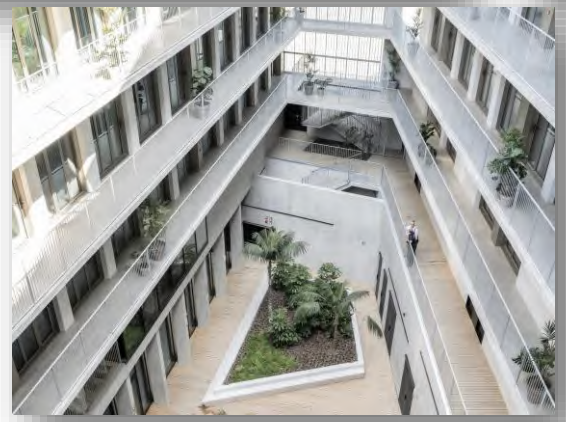


UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Campus Diagonal-Besòs
The Barcelona East School of Engineering

The **Barcelona East School of Engineering** (**EEBE**) is located at the new Diagonal-Besòs Campus of the UPC, with about **3,500** students and **400** professors and researchers.






Bachelor's degrees

- Biomedical Engineering
- Chemical Engineering
- Electrical Engineering
- Energy Engineering
- Electronics and Control Engineering
- Materials Engineering
- Mechanical Engineering

Master's degrees

- Chemical Engineering – *Smart Chemical Factories*
- Interdisciplinary and Innovative Engineering
- Research in Mechanical Engineering

Erasmus Mundus

- International Master of Science in Fire Safety Engineering (IMFSE)
- Advanced Materials Science and Engineering (AMASE)
- Hydrogen Systems and Enabling Technologies (Hyset)

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

The Centre for Technological Risk Studies

The **Centre for Technological Risk Studies** (**CERTEC**) is a UPC research group located at the EEBE with large experience on technological, environmental and natural risks. This trans-disciplinary nature grants it with unique characteristics to deal with fire hazard characterization, vulnerability analysis and civil protection challenges.

The CERTEC Team

Prof. Eulàlia Planas

Prof. Elsa Pastor

Ass. Prof. Alba Àgueda

Ass. Prof. Pascale Vacca

Post-doc. Ronan Paugam

Prof. Emeritus
Joaquim Casal

+ 5 PhD students

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

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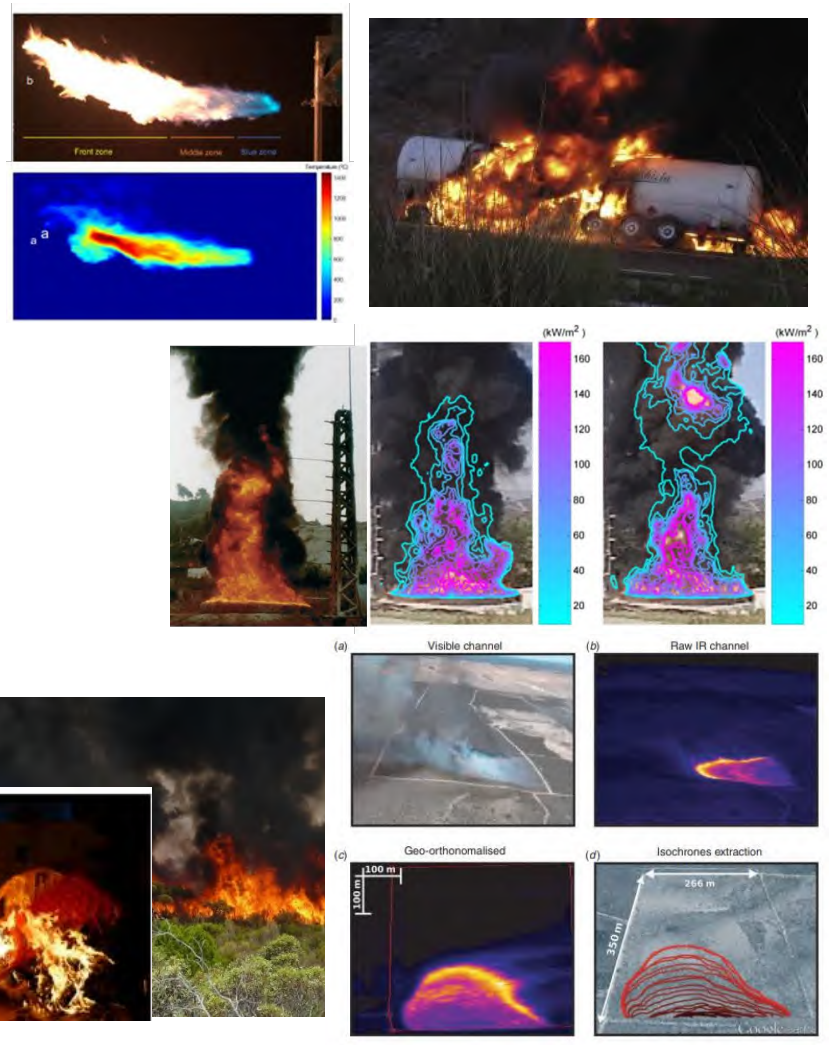
Research

- **Industrial Major accidents modelling:** Mathematical modelling and prediction of effects and consequences of fires (pool, jet and flash fires), explosions (semi-confined gas explosions, BLEVEs, vessels explosions) and flammable / toxic clouds.
- **Risk analysis:** Development of new methodologies to identify and analyse technological risk (frequencies, probabilities) in process plants and in transport of dangerous goods.
- **Wildfire monitoring:** Development of infrared image processing systems to quantify fire propagation metrics (rate of spread, fire intensity, flame geometry) and aerial fire attack effectiveness.
- **Wildfire behaviour prediction:** Development of fire behaviour simulation tools for operational decision-making and for the evaluation of Earth Observation products.
- **Fire impact modelling at the Wildland-Urban Interface:** Development of methodologies of structure vulnerability analysis for WUI risk management at home-owner and community level.

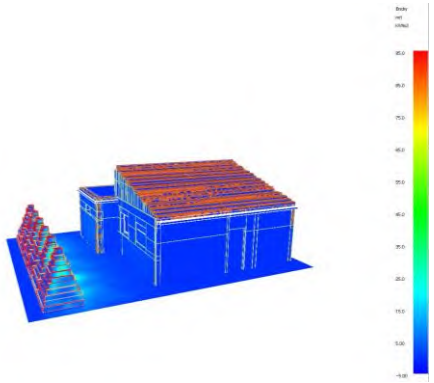


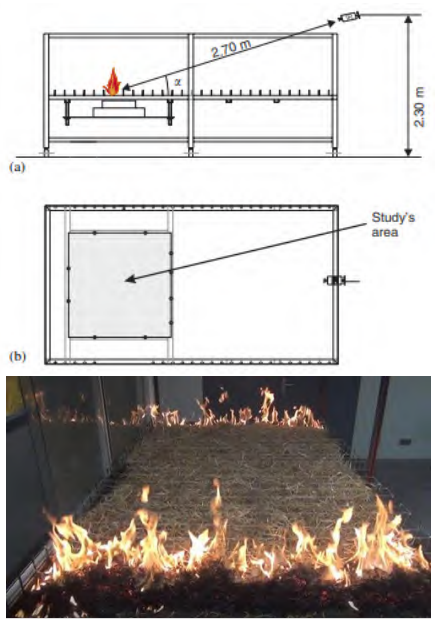
UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

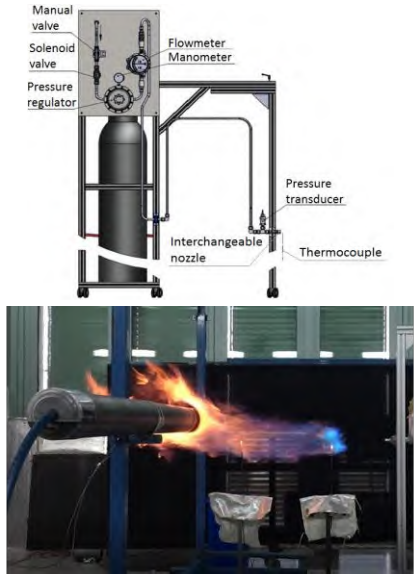
The Centre for Technological Risk Studies

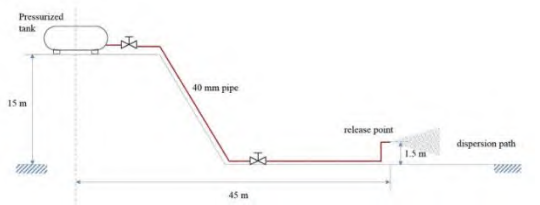
Infrastructure

- **FlamesLab** facilities (Forest fires combustion table, Jet-fires laboratory set-up, Flash-fire small apparatus)
- Hydrocarbon fires and cloud dispersion facilities (large scale)
- Prescribed burns with the Catalan Fire & Rescue Service
- Computational resources (CERTEC cluster)









UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

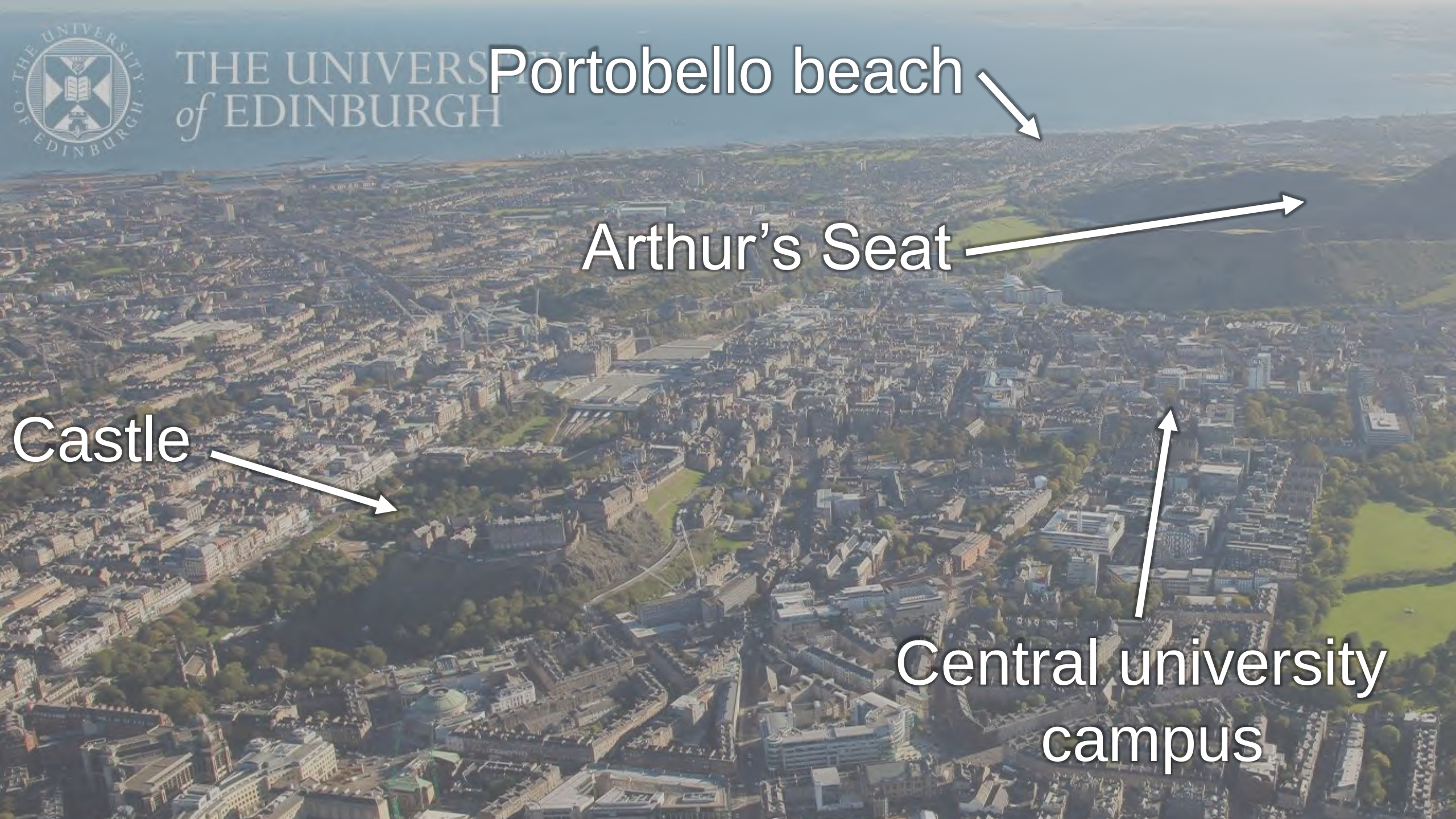
The IMFSE Students at UPC

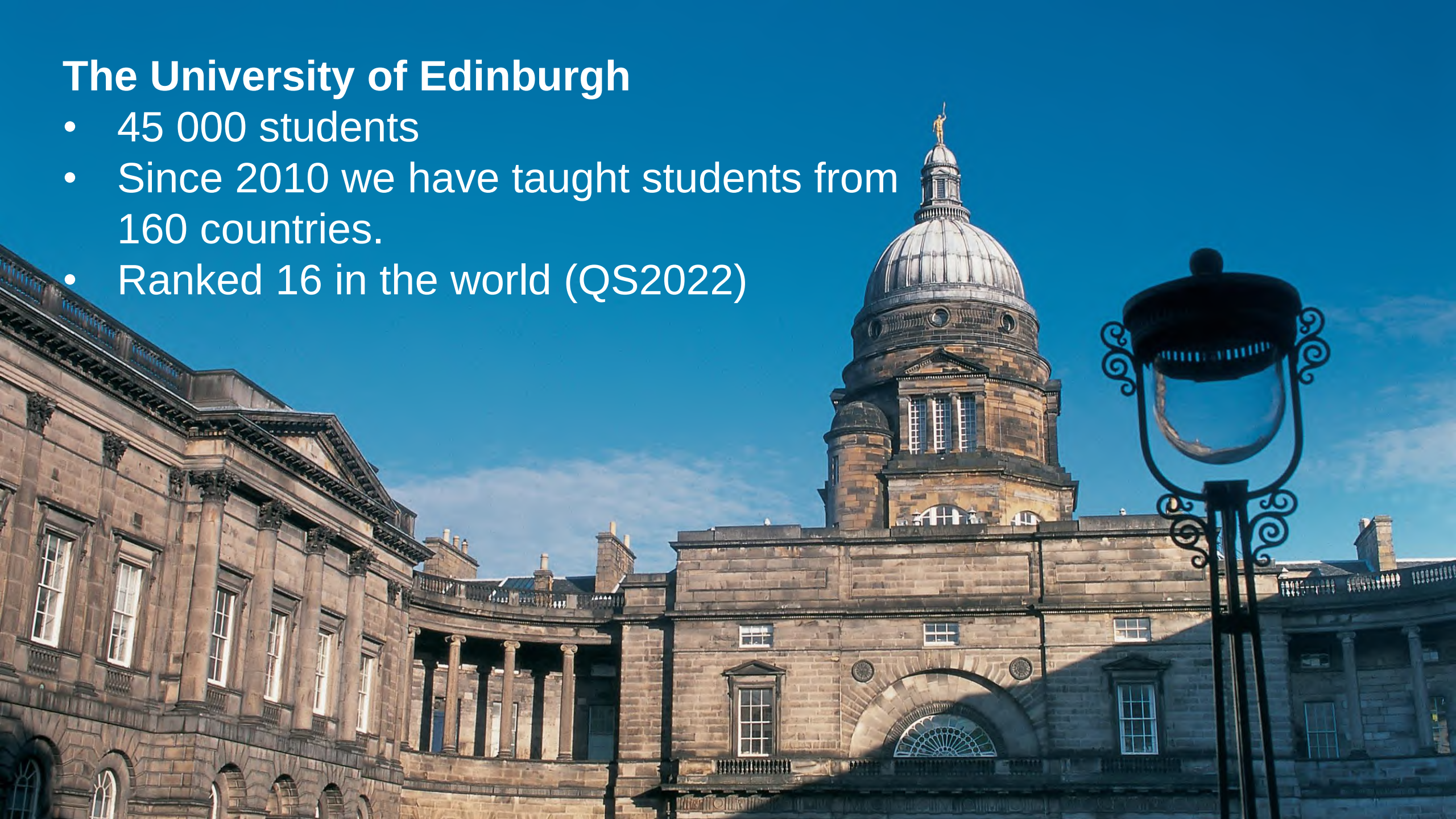
Field trips

Social activities


THE UNIVERSITY of EDINBURGH
The City of Edinburgh

Capital city of Scotland
Population of around 500,000
Well connected through airport and rail
UNESCO World Heritage Site
Many historical and cultural attractions
2nd best student city in the UK


THE UNIVERSITY of EDINBURGH
Portobello beach
Arthur's Seat
Castle
Central university campus



The University of Edinburgh

- 45 000 students
- Since 2010 we have taught students from 160 countries.
- Ranked 16 in the world (QS2022)

King’s Buildings campus

Fire and Edinburgh

- Edinburgh had worlds first municipal fire brigade, 1824
- Department of Fire Engineering, 1973
- MSc in Fire Engineering taught here in 1974
- First Fire Symposium held in Edinburgh, 1975
- Worlds first textbook in fire by Prof. Drysdale, 1985
  - *Introduction to Fire Dynamics* 3rd Edition, 2011

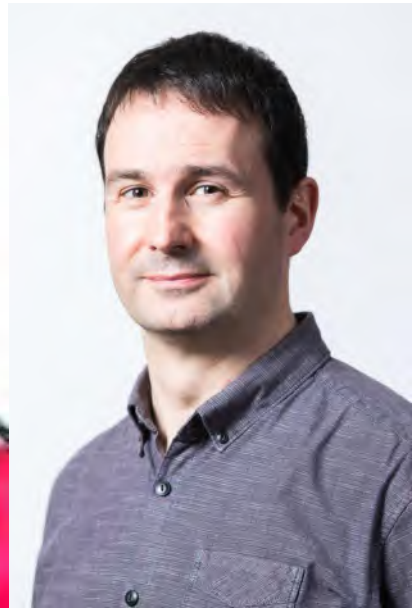
IMFSE Curriculum at Edinburgh

Semester 1:	Fire Science Laboratory (20 credits)	Fire Safety Engineering (10 credits)	Fire Science and Fire Dynamics (10 credits)	Structural Design for Fire (10 credits)	Research Methods for Engineers (10 credits)
Semester 4:	Dissertation				

Fire teaching team at Edinburgh

Ayshu Biju

Student support advisor



Dr Ricky Carvel

Fire Dynamics
Tunnel fires
Suppression
Backdraft

Dr Rory Hadden

Material flammability
Wildfires
Smouldering

Dr Angus Law

Construction systems
Regulation
Design

Dr Stephen Welch

Fire modeling
CFD
Turbulent combustion

Prof Luke Bisby

Materials
Mechanics
Policy
Regulation

Fire lab

Social life

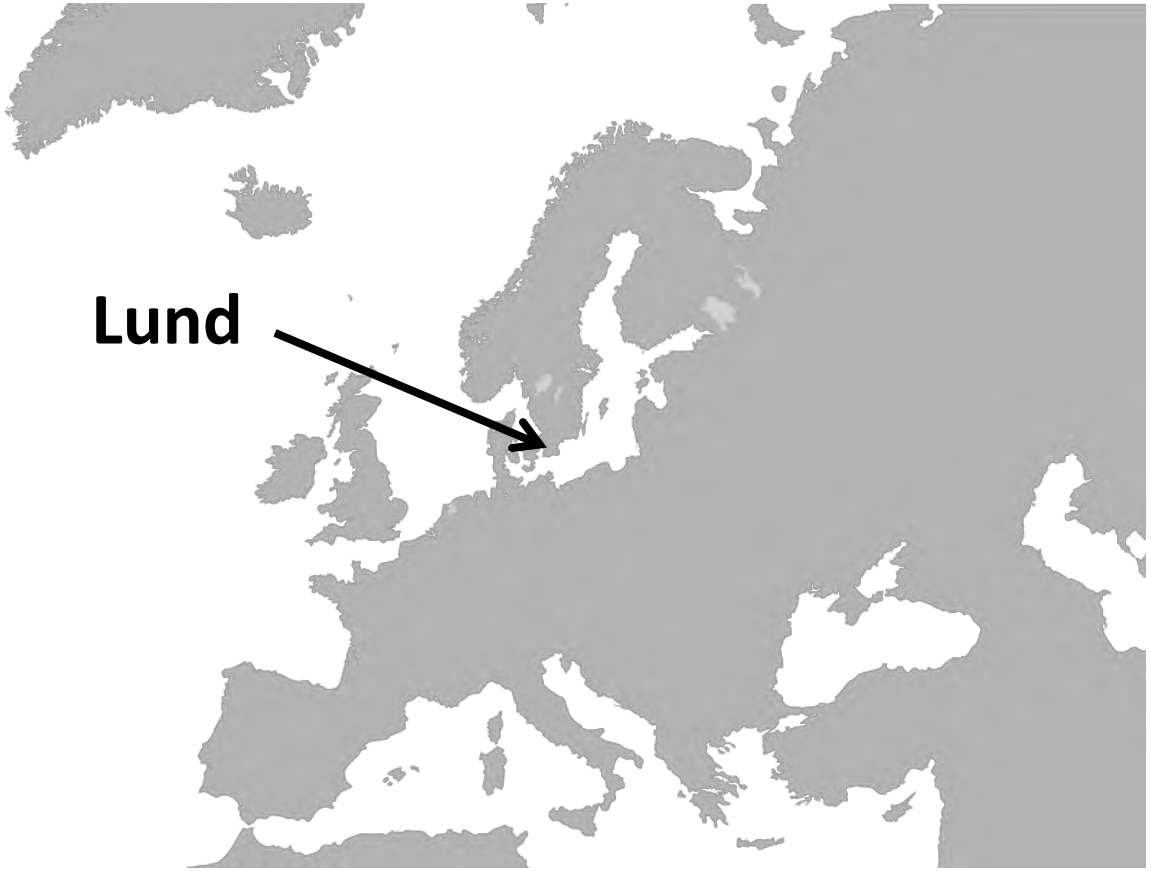

THE UNIVERSITY
of EDINBURGH

Lund, Sweden

Photo: Fredrik Rosengren


Photo: Kenneth Rouna

Where are we?



Lund

- ”*The city of ideas*”
- Founded in the 10th century
- Mixture of rich history and innovative technology
  - Home of Bluetooth and Tetrapack innovations
- Population: 92,000

Transport

- Easy to reach
- 30 minutes by train from Copenhagen Airport
- 30 minutes by car from Malmö Airport
- Great public transport, with a network of buses/trains both intercity and in-city
- Everything in the city is ”Walking distance”

Lund University

- Founded 1666
- Students: 45,000
- Employees: 7,500
- Scandinavia's largest research university
- Cooperates with a large number of institutions around the world

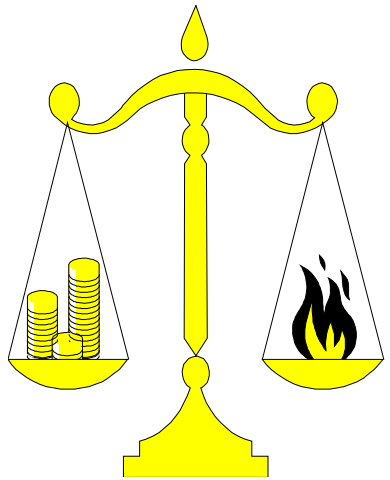
The Department of Fire Safety Engineering - History

- One of the first universities in the world with fire engineering research, on-going since early 1960's and still growing!
- In 1986, the department initiated a university level education for fire protection engineers

The Department of Fire Safety Engineering - Staff

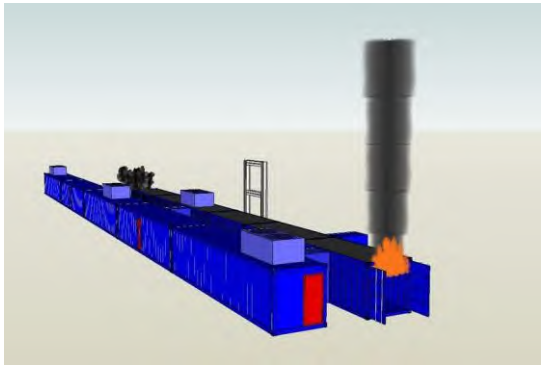
- 14 members of research staff and 14 PhD students (6 internal and 8 industrial at the moment)
- More than 1000 fire protection engineers have graduated.

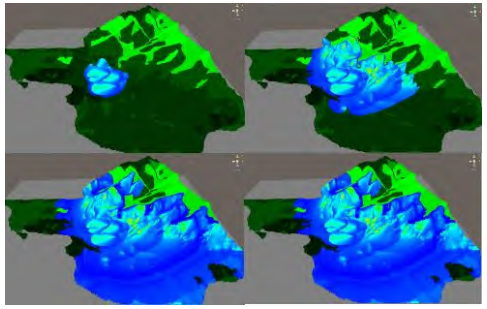
The Department of Fire Safety Engineering - Education



- Swedish Programme for FSE (responsible for education)
  - About 50 students every year, 1000+ Alumni students
- International Erasmus Mundus IMFSE
  - About 25-30 international students per year

The Department of Fire Safety Engineering - Research





- Five major research areas:
  - Fire performance based design of buildings/Risk Analysis
  - Human Behaviour
  - CFD modelling
  - Fire dynamics
  - Wildfires

Welcome to Lund University!













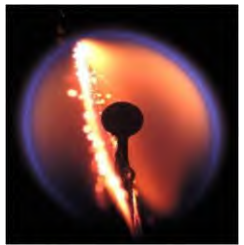



University of Maryland

University of Maryland

Current research areas

- suppression, detection, egress (J. Milke)
- structures, fire forensics, mass timber (S. Ni)
- toxicity, wildfire monitoring (F. Raffan-Montoya)
- pyrolysis, flammability, flame spread (S. Stoliarov)
- soot, mg-combustion, firebrands (P. Sunderland)
- fire/wildfire modeling (A. Trouvé)



Fire Safety Engineering at The University of Queensland

UQ Fire

THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Fire safety engineering at the University of Queensland

Dr David Lange, Associate Professor in Structural and Fire Safety Engineering
Mechanics of structures in fire, reliability and risk-based design methods, resilience

Dr Anwar Orabi, Lecturer in Civil and Fire Safety Engineering
Numerical analysis, Structural fire engineering, Integration of CFD and FE tools, Software development

Dr Sergio Zarate, Lecturer in Fire Safety Engineering
Fire testing, flame spread, bushfires

Dr Luis Yerman, Research Fellow in timber durability
Smouldering, timber, durability

Dr Hons K. Wyn, Research Officer
Smouldering, fire testing, analytical methods

Dr Cristian Maluk, Senior Lecturer in Civil Engineering (currently on leave)
Fire performance of construction materials, fire safety design, novel materials

Mr Jeronimo Carrascal, Research Officer (currently on leave)
Fire testing, bushfires, fire-fighting protective equipment

Mr Nate Lobel, Industry Fellow in Fire Safety Engineering
Fire safety engineering design, education and accreditation

Mr Tristan Goode, Industry Fellow in Fire Safety Engineering
Fire safety engineering design, methodologies and analysis

Dr Felix Wiesner, Honorary Fellow in Fire Safety Engineering
Fire performance of timber, durability, structural fire engineering, experimental techniques

Dr Juan Hidalgo, Honorary Fellow in Fire Safety Engineering
Fire safety of timber construction, modern infrastructure, composites, bushfires

Dr Gerardo Soret, Honorary Fellow in Fire Safety Engineering
Fire safety engineering, emergency response

Dr Martyn Mclaggan, Adjunct Fellow in Fire Safety Engineering
Façade fire safety, flame spread

Dr Andres Osorio, Adjunct Lecturer in Civil Engineering
Combustion and fire dynamics, bushfires, modern construction materials











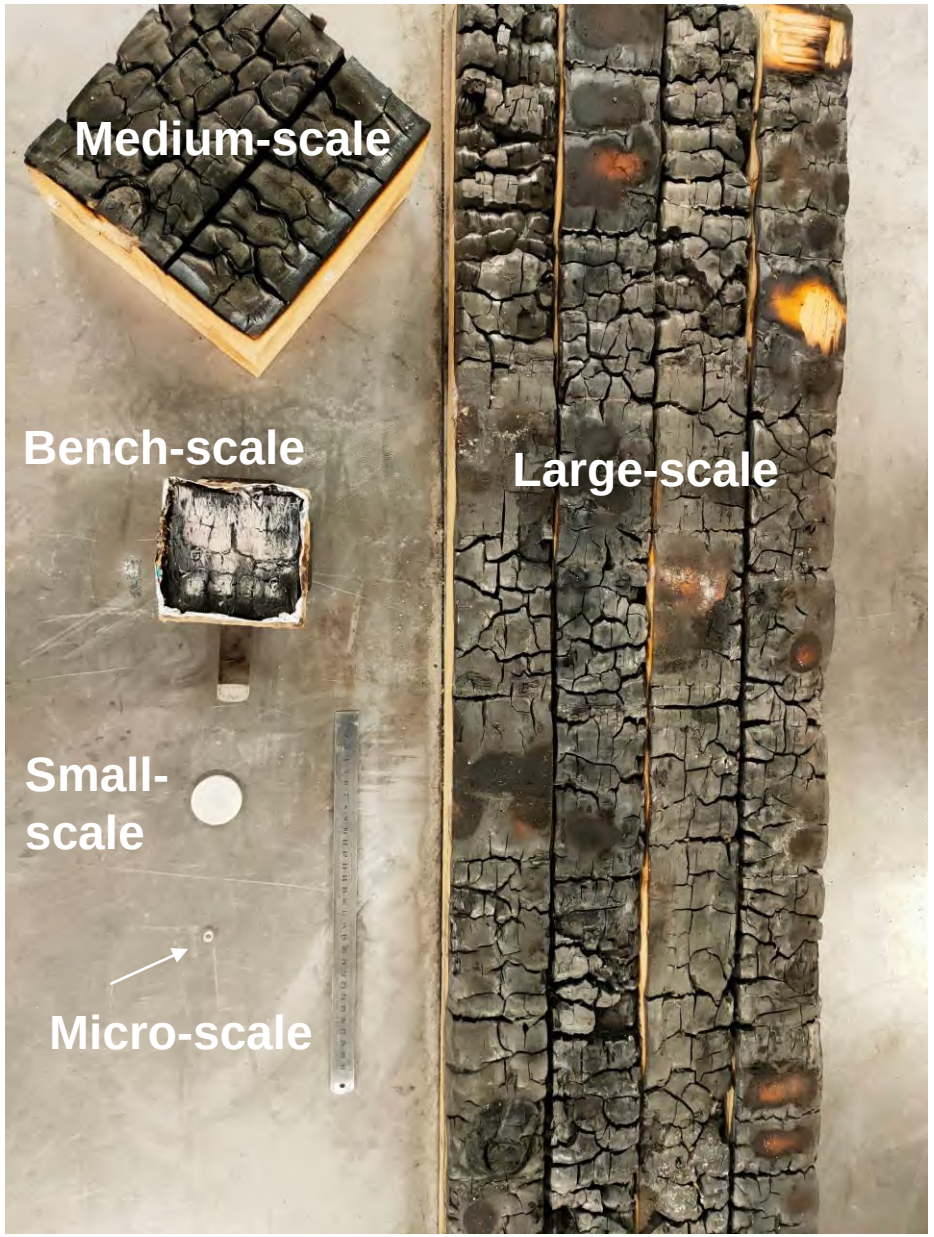



www.civil.uq.edu.au/fire-people

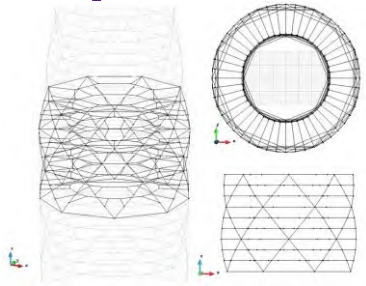
State-of-the-art Fire Laboratory

Multi-scale investigation of performance in a range of fire conditions

Micro and Small-Scale	
Instrument	**Main Outcomes**
Thermal Gravimetric Analysis up to 1,500°C **(TGA)**	Mass change vs temperature – Pyrolysis temperature - Inorganic residue
Differential Scanning Calorimetry 1,500°C **(DSC)**	Enthalpy of reactions - Specific heat - Phase change characterisation
Fourier Transform Infrared and Mid-Infrared **(FTIR)**	Qualitative analysis of chemical compounds in gas and solids
Energy Dispersive X-ray Fluorescence **(EDXRF)**	Quantification of inorganic elements in solids
Transient Plane Heat Source up to 700°C **(TPS)**	Thermal Conductivity - Thermal diffusivity - Specific heat capacity
Bomb Calorimeter	Gross Heat of Combustion
Bench-Scale	
Mass Loss Calorimeter up to 100 kW/m^2	Critical heat flux for ignition – Mass loss rate (MLR) vs heat flux
Cone Calorimeter (coiled heater) up to 100 kW/m^2	Heat Release Rate (HRR) - Effective Heat of Combustion - Smoke yield - -Specific Extinction Area (SEA)– MLR
Fire Propagation Apparatus (IR lamps) up to 70 kW/m^2	
Flash Point Tester	Flash point of flammable liquids
IBFTA Integrated Battery Fire Testing Apparatus	Battery calorimetry, ignition and thermal runaway characteristics under a range of environmental and exposure conditions
Medium and Large-Scale	
Small H-TRIS (200mm x 200 mm) up to 200 kW/m^2	Fire performance of products or assemblies under a wide range of time-histories of incident radiant heat flux
Large H-TRIS (600mm x 600 mm) up to 100 kW/m^2	
Large Calorimetry Hood (up to 2MW fires)	HRR – MLR -Effective Heat of Combustion – SEA -Smoke yield
Lateral Ignition and Flame Spread test (LIFT)	Flame Spread parameter, critical heat flux for flame spread
Radiant and Convective Wind Tunnel	Bushfire flame spread analysis



Examples of Current Research themes

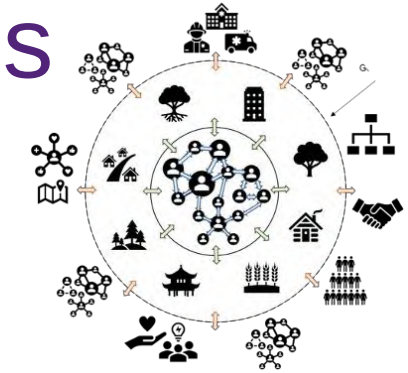


Structural fire engineering

Timber structures, Diagrids, Structural fragility, AI and ML, GiD, OpenSEEs

Fire dynamics

Compartment fire dynamics, Timber compartment fires, flame spread, bushfires

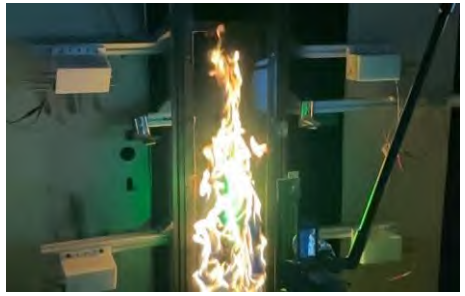


Fire safety and resilience

Community resilience, informal settlements, structural resilience

Timber and fire

Smouldering, durability, compartment fire dynamics, structural timber



Facades and fire

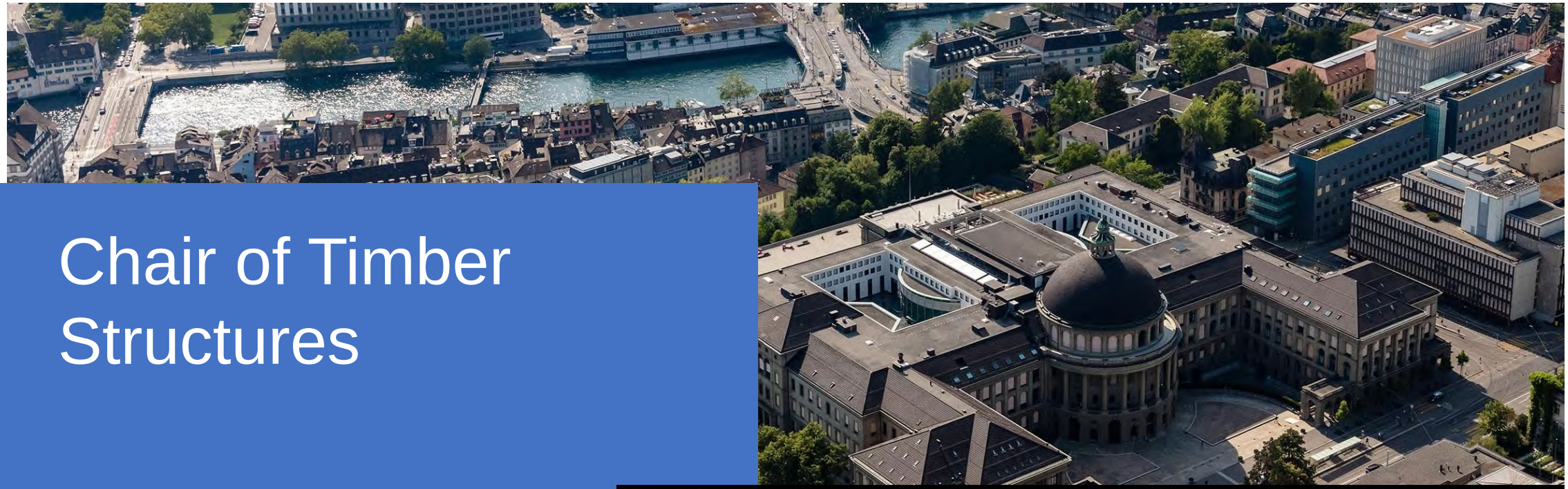
Flame spread, design approaches, risk mitigation

Lithium-ion battery fires

Testing methodologies, design approaches

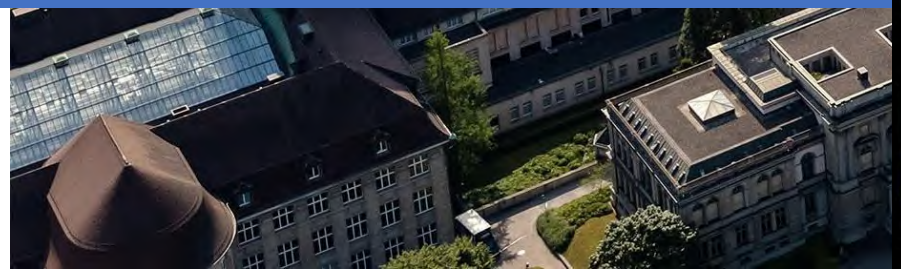
ETH zürich

ibk
Institute of Structural Engineering



Chair of Timber Structures

Prof. Dr. Andrea Frangi



D BAUG

Research

Objective

- Enhance use of sustainable timber for structures
- Improve safety and economy of timber structures

Structural Timber and Connections

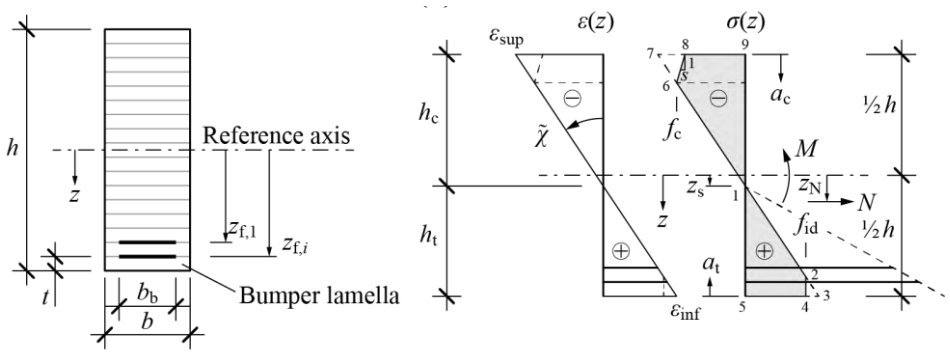
Improve knowledge and reliability of members & connections with regard to safety and economy
Better use of material

Innovative Timber Structures

Improve efficiency and competitiveness of timber
Optimised use of timber in combination with other materials

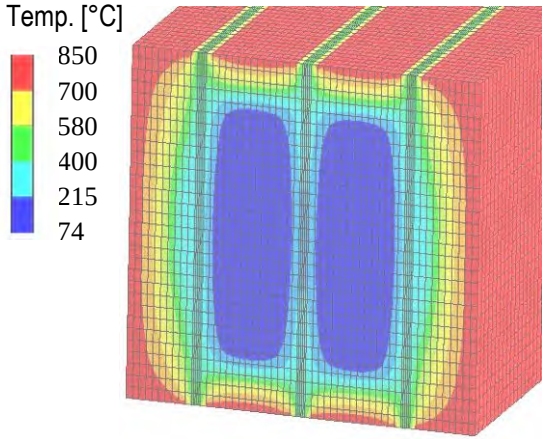
Fire Safety Engineering

Improve fields of application of timber structures based on advanced knowledge with regard to fire safety



Analytical model for fibre reinforced glulam

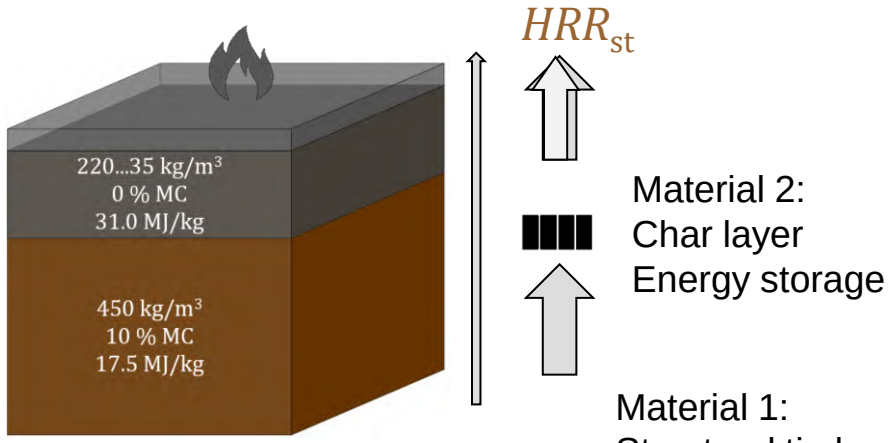
ETH House of Natural Resources

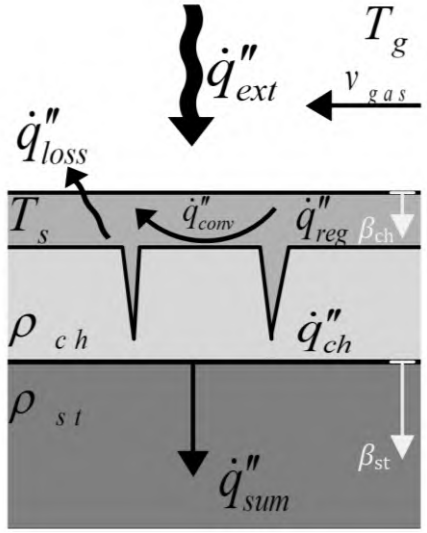


FE-thermal analysis of dowel-type connection with slotted-in steel plates

Fire safety timber engineering

- Severity of design fires
- Contribution of timber to the fire load
- Charring of wood as a function of fire exposure
- Self-extinguishment of charred wood
- Fire performance of encapsulated timber
- Dangers of combustible facade claddings
- ….










E-THERM
ETH zürich
FIRE SIM
E-THERM
technologicka zarizeni

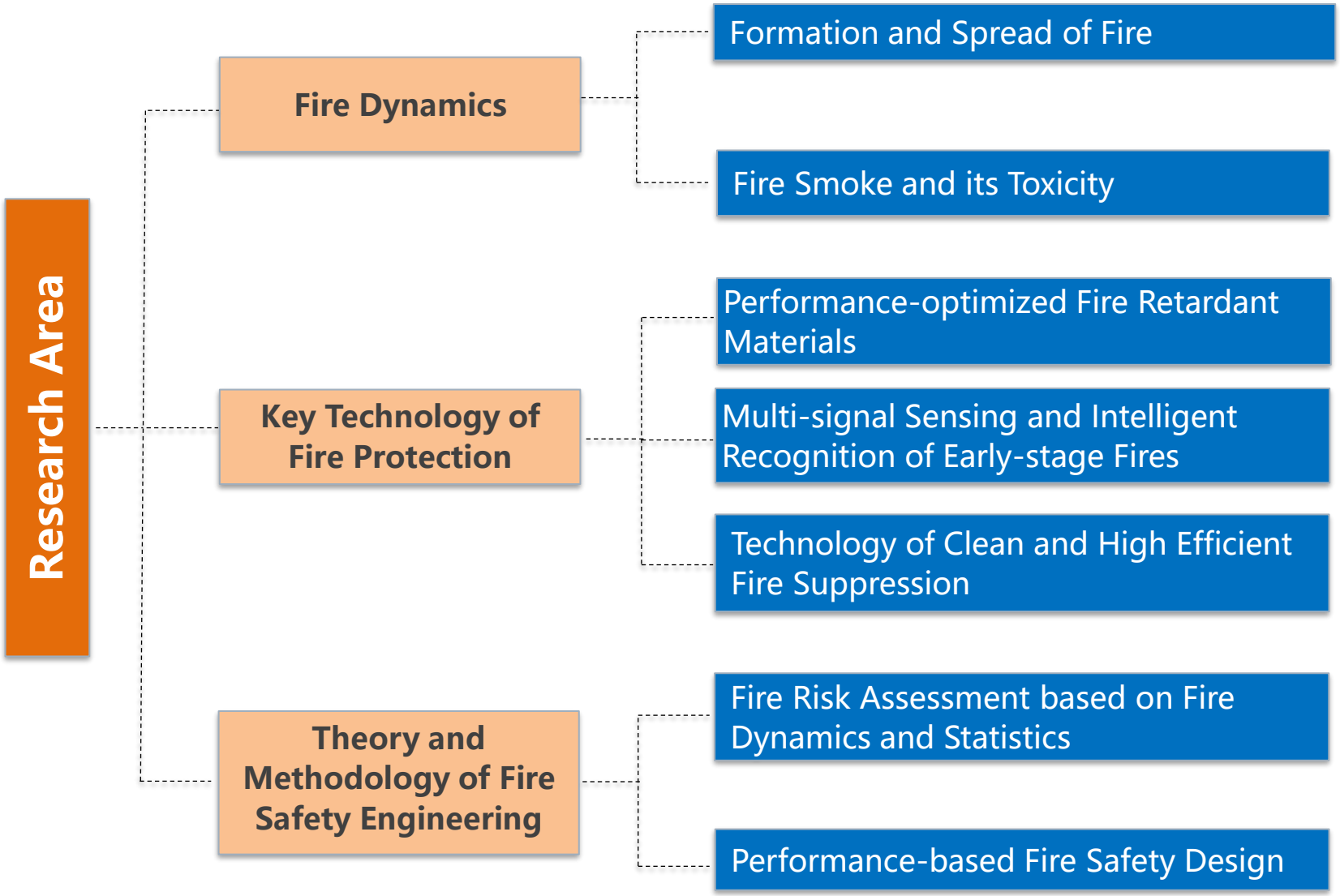
University of Science & Technology China

Introduction to State Key Laboratory of Fire Science

Naian LIU

State Key Laboratory of Fire Science, University of Science and Technology of China

Research Area of SKLFS



Calendar & Deadlines

Scholarship applicants

- Application deadline: 31 January 2024
- Feedback: March 2024

Self-sponsored applicants

- Application deadline: 31 March/May 2024
- Feedback: April/June 2024

Once you are admitted…

Acceptance letter (visa!)

The Practical Guide

More guidance through

- Email correspondence
- IMFSE student network

Once you are admitted…

VISA

➔ Before you come to Europe

➔ Start well in advance!

Accommodation

➔ Online application via housing department

➔ Private market

Contact details

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Scan me

תודה
Dankie
Gracias
Спасибо
شكراً
Merci
Takk
Köszönjük
Terima kasih
Grazie
Dziękujemy
Dėkojame
Ďakujeme
Vielen Dank
Paldies
Kiitos
Täname teid
谢谢
Thank You
Tak
感謝您
Obrigado
Teşekkür Ederiz
감사합니다
Σας ευχαριστούμε
ขอบคุณ
Bedankt
Děkujeme vám
ありがとうございます
Tack

Q&A session