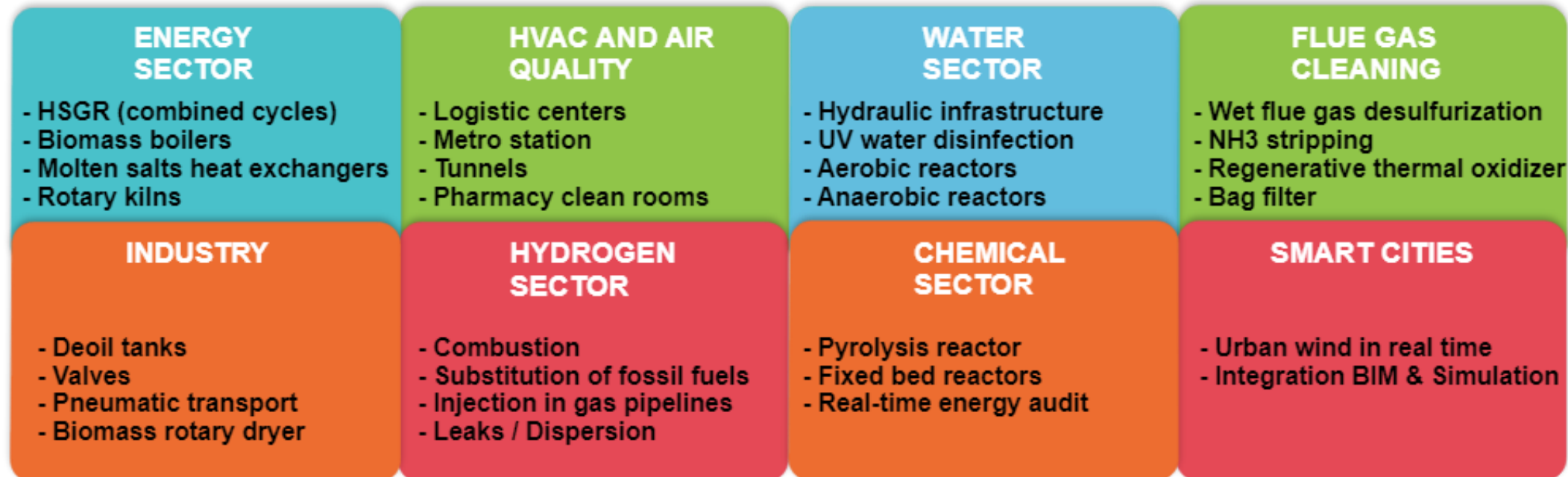# NABLADOT
SUMMARY OF ACTIVITIES
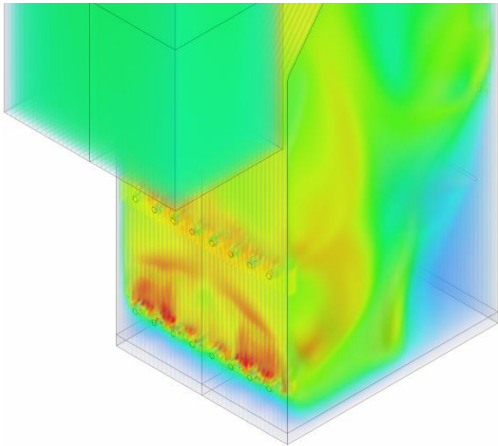
ANTONIO GOMEZ (R&D MANAGER)

AGOMEZ@NABLADOT.COM

+ Established in 2010 by researchers specializing in Computational Fluid Dynamics (CFD) at the University of Zaragoza (2010). We offer:

    + Innovative character

        + We actively engage in research and development projects at both national and European levels

    + Business focus

        + We offer solutions tailored to the technical and economic needs of the companies

+ Our team has experience across multiple sectors (see our Projects)

ENERGY SECTOR
- HSGR (combined cycles)
- Biomass boilers
- Molten salts heat exchangers
- Rotary kilns

HVAC AND AIR QUALITY
- Logistic centers
- Metro station
- Tunnels
- Pharmacy clean rooms

WATER SECTOR
- Hydraulic infrastructure
- UV water disinfection
- Aerobic reactors
- Anaerobic reactors

FLUE GAS CLEANING
- Wet flue gas desulfurization
- NH3 stripping
- Regenerative thermal oxidizer
- Bag filter

INDUSTRY
- Deoil tanks
- Valves
- Pneumatic transport
- Biomass rotary dryer

HYDROGEN SECTOR
- Combustion
- Substitution of fossil fuels
- Injection in gas pipelines
- Leaks / Dispersion

CHEMICAL SECTOR
- Pyrolysis reactor
- Fixed bed reactors
- Real-time energy audit

SMART CITIES
- Urban wind in real time
- Integration BIM & Simulation

+ We offer a wide range of services:

    + CFD simulation

    + Real time models (CFD simulation & Statisical Analysis & AI)

    + Statistical data analysis

    + Simulation & IoT (Sensors, Cloud Computing, Edge Computing)

    + Digital Twins

    + Collaboration in public funded R&D projects (wide experience in public funded R&D projects at national and European level)
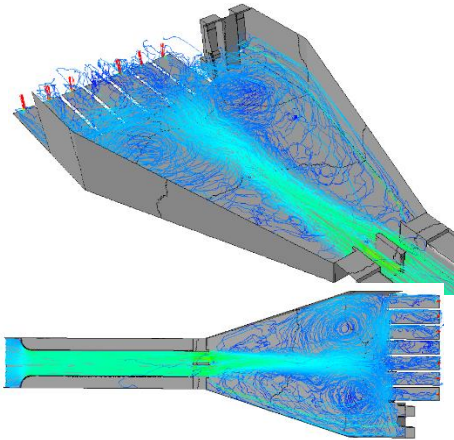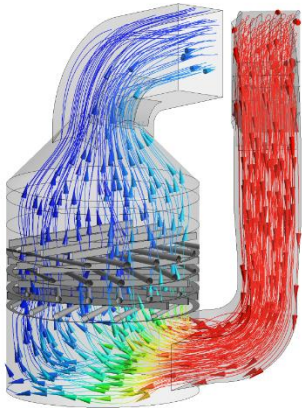
Energy
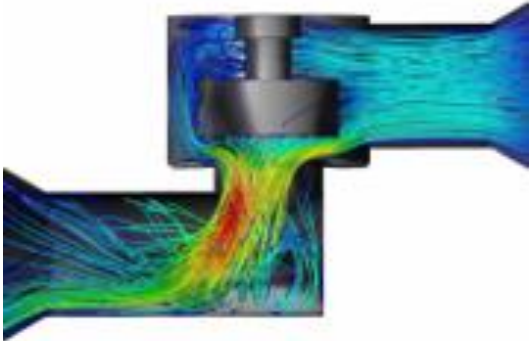**Biomass boilers**

HVAC and Air Qualityç
Logistics warehouses
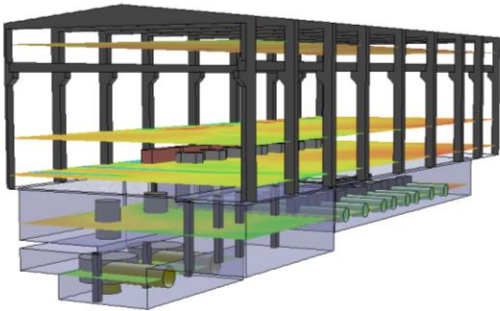
Water sector
Hydraulic infrastructures

Flue Gas Cleaning
Desulphurisation

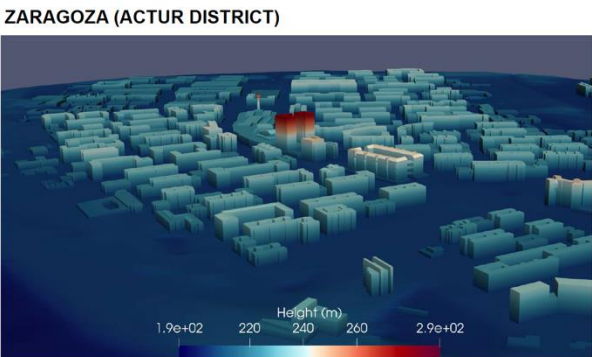**Industry**
Valves

Hydrogen
Hydrogen injection

Chemical sector
Pyrolisys reactor

Smart Cities
Wind forecast in real time

+ **Real-time model for the calculation of the CH4-H2 mix in natural gas pipes**

  + More details at: *C. Montañés et al., Comprehensive assessment of hydrogen injection in natural gas networks: Using dimensional analysis and reduced-order models for mixture quality prediction, International Journal of Hydrogen Energy,* https://doi.org/10.1016/j.ijhydene.2024.09.045

+ **Combination of CFD & Dimensional Analysis & Statistical Analysis**
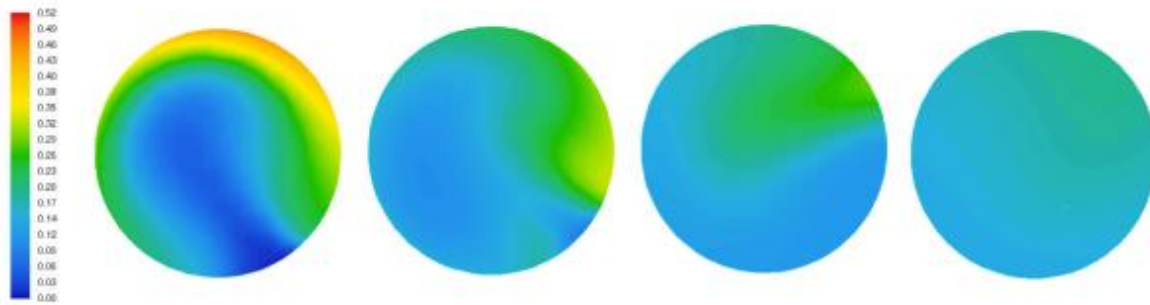
Fig. 3. Contours of H_2 mass fraction in sections of a pipe for L/d_{CH_4} equal to 2, 5, 10 and 50 (from left to right).
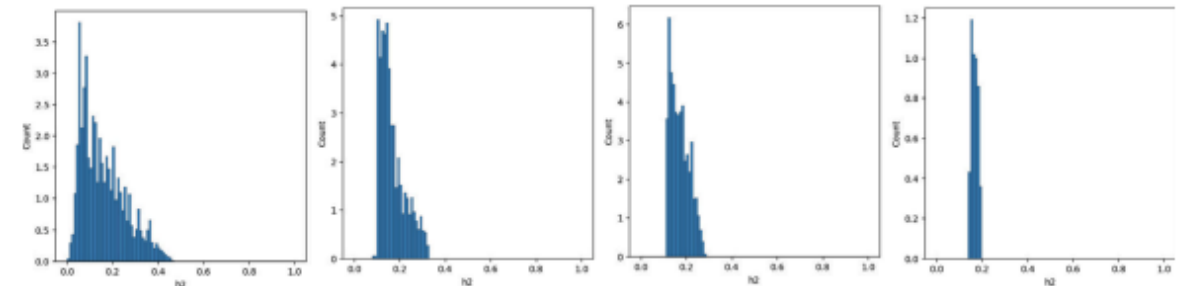
Fig. 4. Histogram of H_2 mass fraction (weighted with cross area) in sections of a pipe for L/d_{CH_4} equal to 2, 5, 10 and 50 (from left to right).
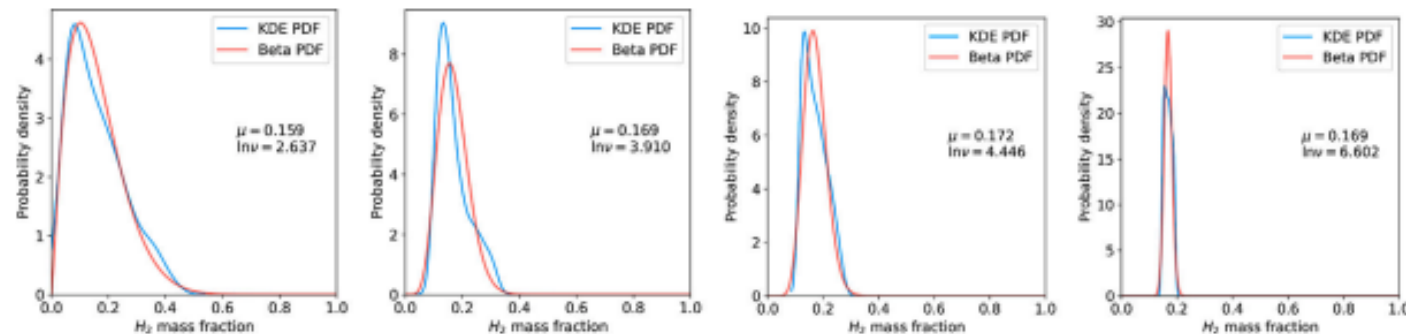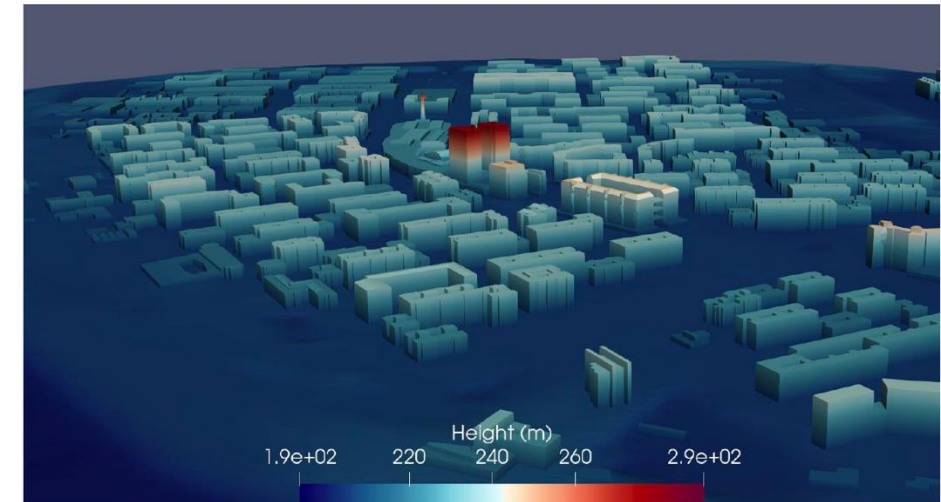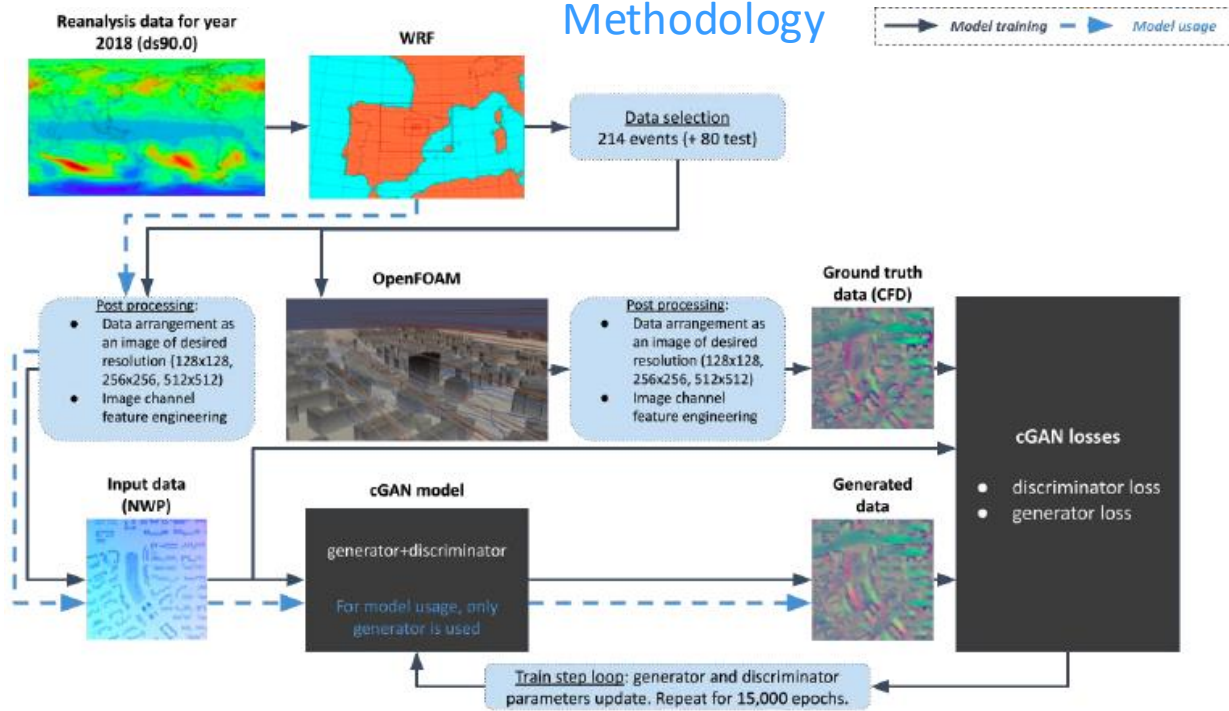
Fig. 5. PDF and beta approximation for H_2 mass fraction in sections of a pipe for L/d_{CH_4} equal to 2, 5, 10 and 50 (from left to right).

+ High resolution urban wind in real time
  + Numerical Weather Prediction Models & CFD & AI
  + Multiple applications
    + Small wind energy
    + Air Quality
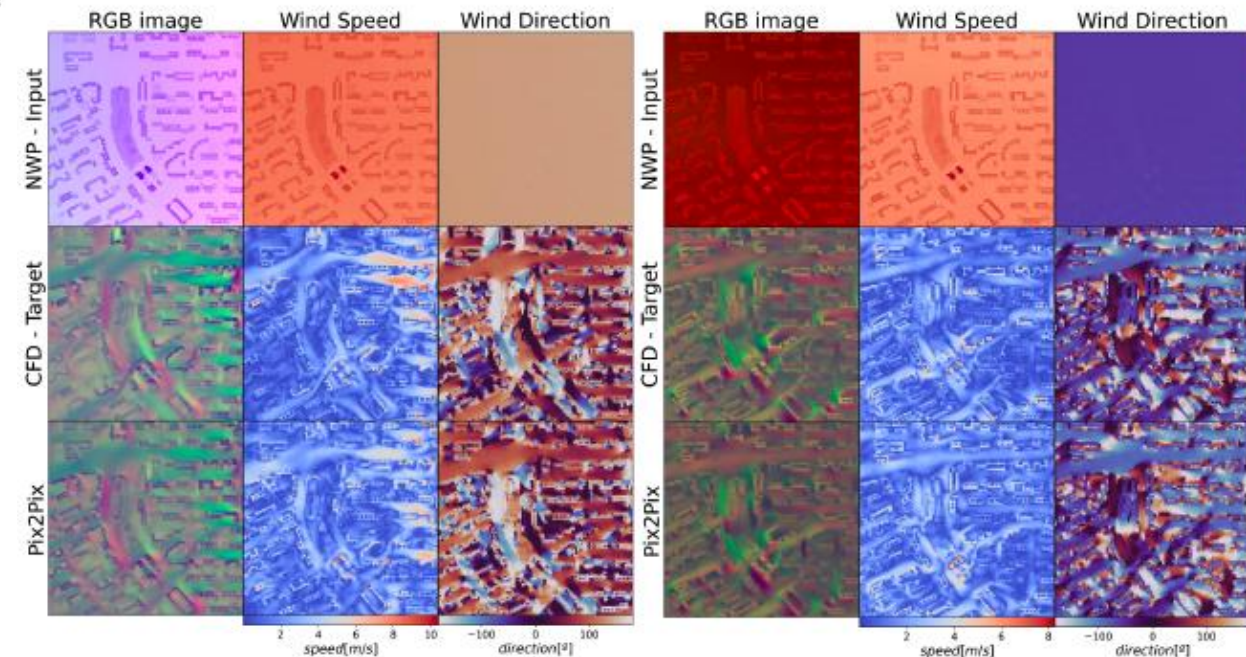   + Forecast of extreme events
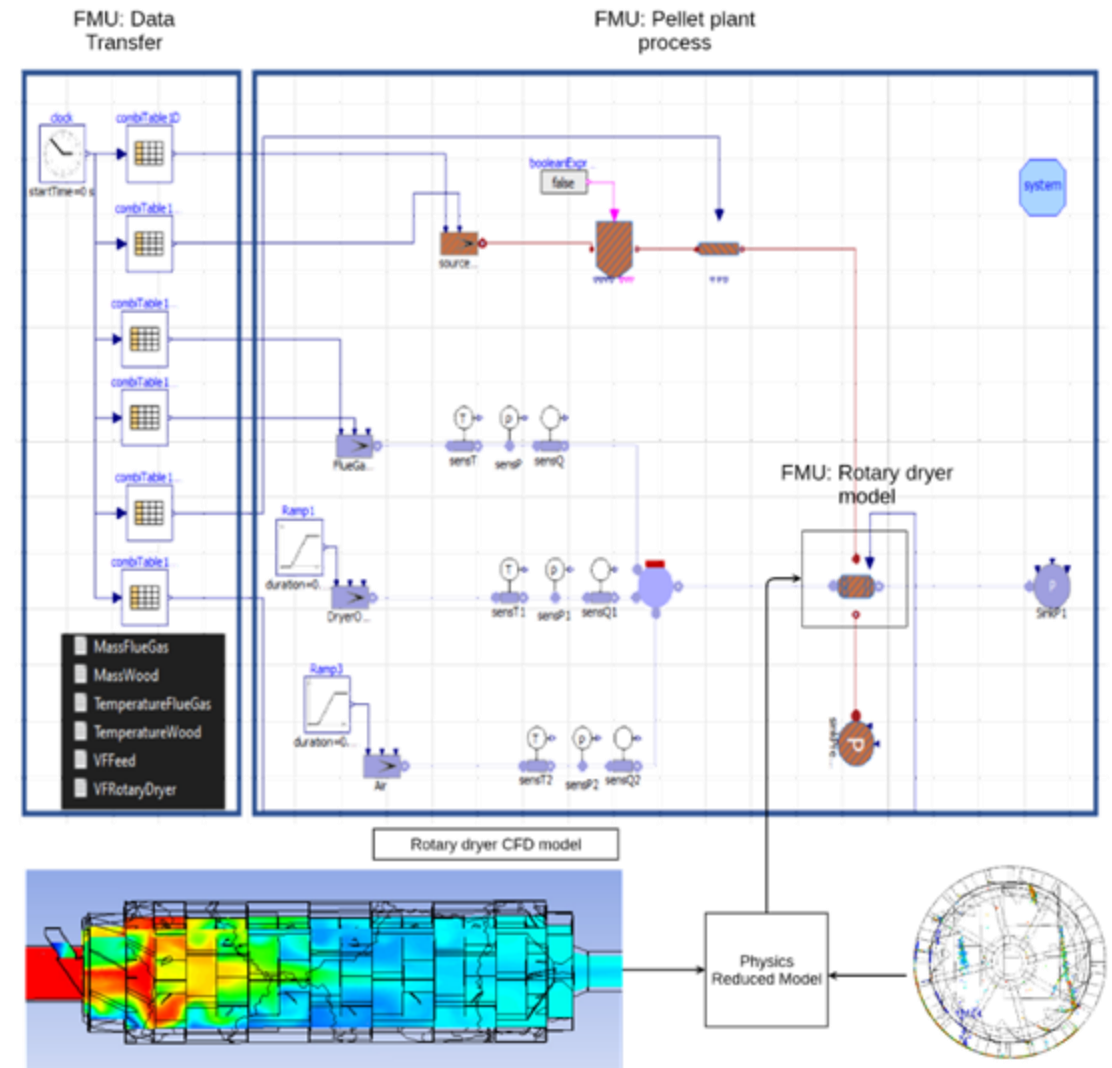 + References: here

ZARAGOZA (ACTUR DISTRICT)

Methodology

Results

+ Digital twin of a rotary biomass dryer

+ Digital twin features:

  + Automatic communication with SCADA data

  + Automatic data processing

  + Real-time simulations of the operation of the rotary dryer using SCADA data as input

  + Selection of optimal operation configuration based on simulation results and data analysis

  + Co-simulation of the process and system control using FMUs

+ The real-time model of the rotary dryer is developed from CFD simulations and Reduced Order Physics techniques

References: European Biomass Conference
Digital Twin Performance

IoT solutions applied to energy storage

+ Our solutions integrate simulation, IoT (sensors, SCADA, cloud computing, edge computing), and AI techniques. Our solutions include:
  + Advanced simulations (CFD)
  + Physics-based reduced order model
  + Real-time data analysis
  + **Optimization using real-time data-driven models (artificial intelligence) or synthetic data (generated through simulations)**
  + **Optimization using real-time physics-based models (Physics Reduced Order Model)**
 + Digital twin technology
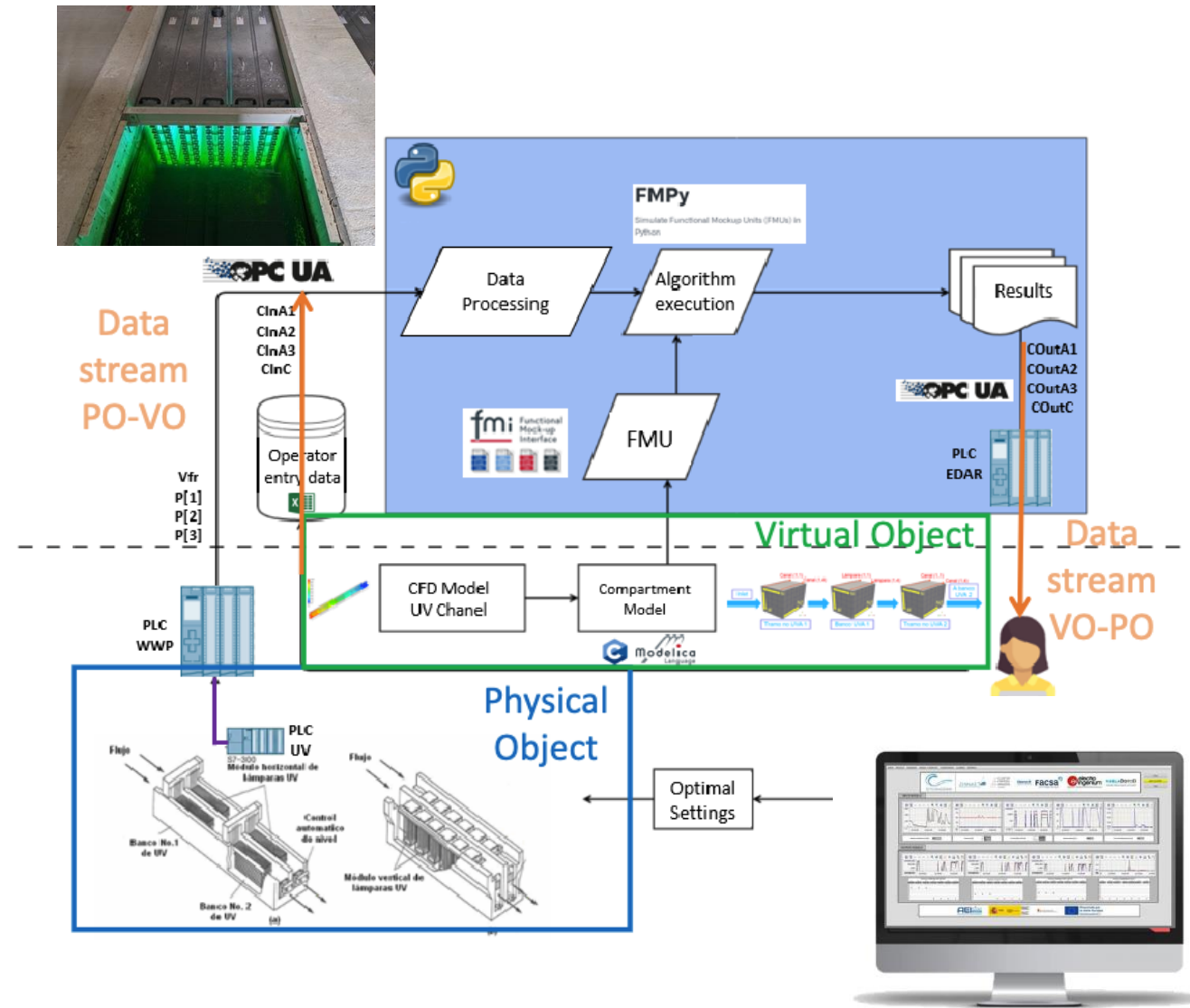
- ❑ Short-term forecasting (from minutes to hours) of electricity generation in PV power plants
- ❑ Nowcasting workflow combines:
  - ❑ Sky images (camera installation)
  - ❑ Sensor data (temperature, wind speed, and direction)
  - ❑ Weather forescast simulation
  - ❑ SCADA data
  - ❑ Artificial intelligence models
  - ❑ IoT architecture
- ❑ **Objective: Optimise the management of Energy Storage Systems**
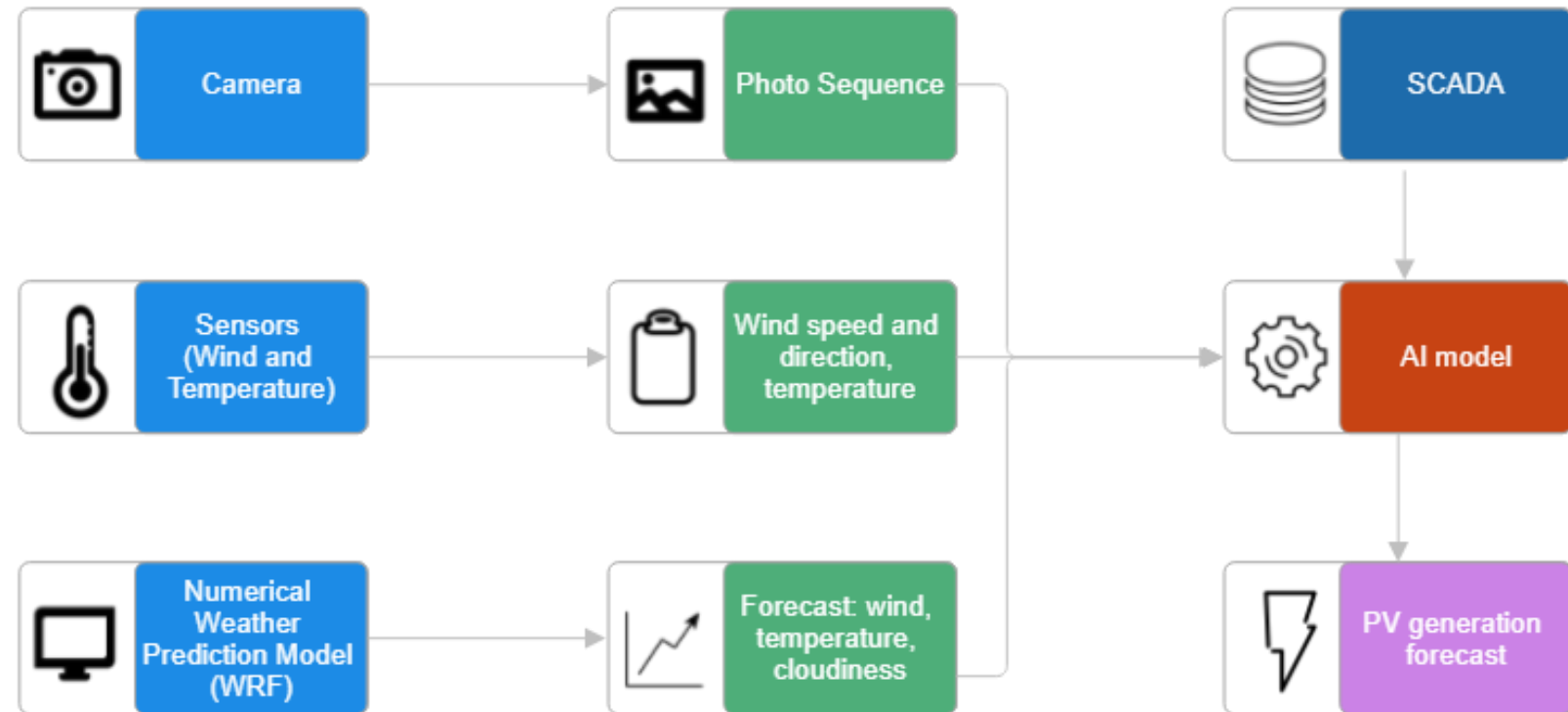
+ High resolution forecast of wind in real time

- + Numerical Weather Prediction Models & CFD & AI
- + References: here

+ Application

- + **Forecast of wind energy power generation (particularly, wind turbines in urban areas, small and mid-size wind turbines)**
- + **Management of energy storage systems connected**

ZARAGOZA (ACTUR DISTRICT)

Results

Methodology
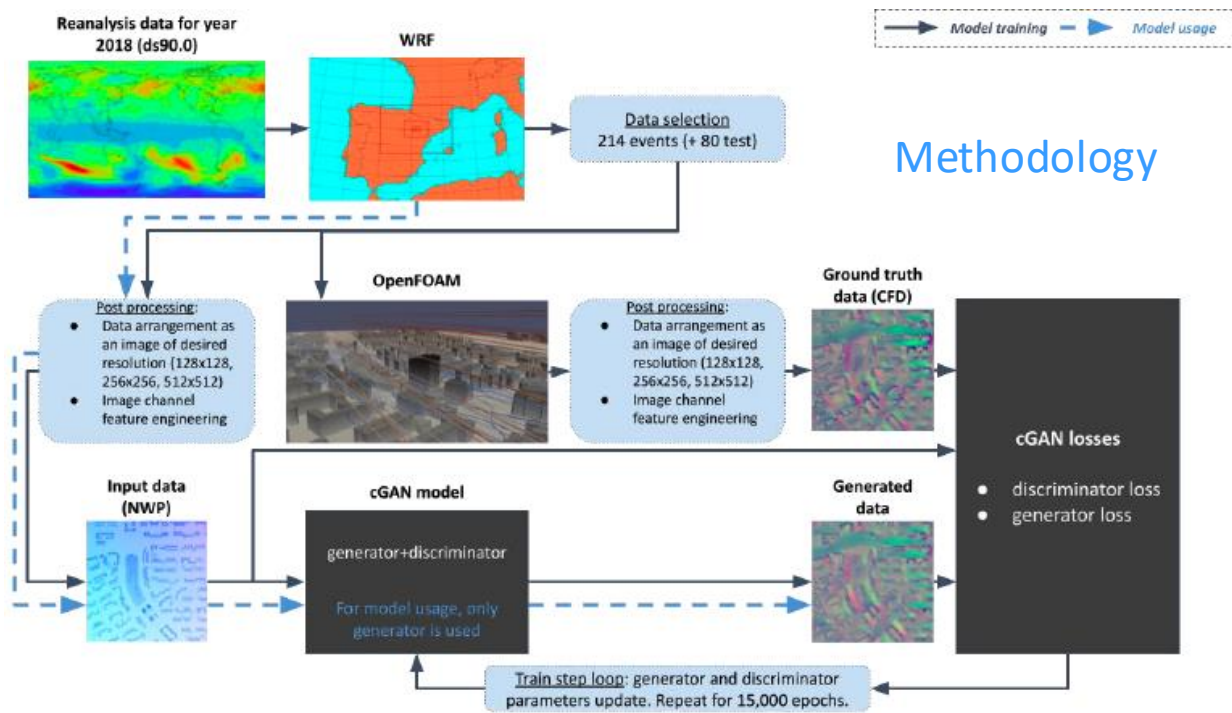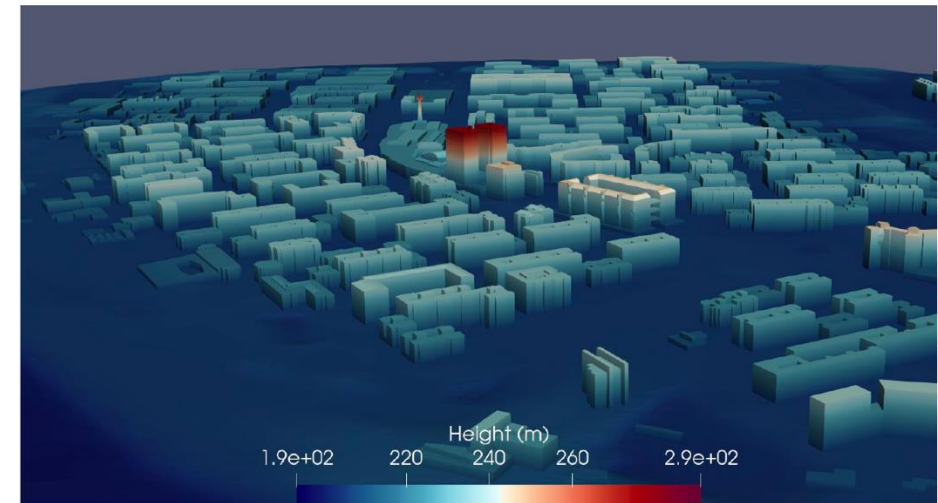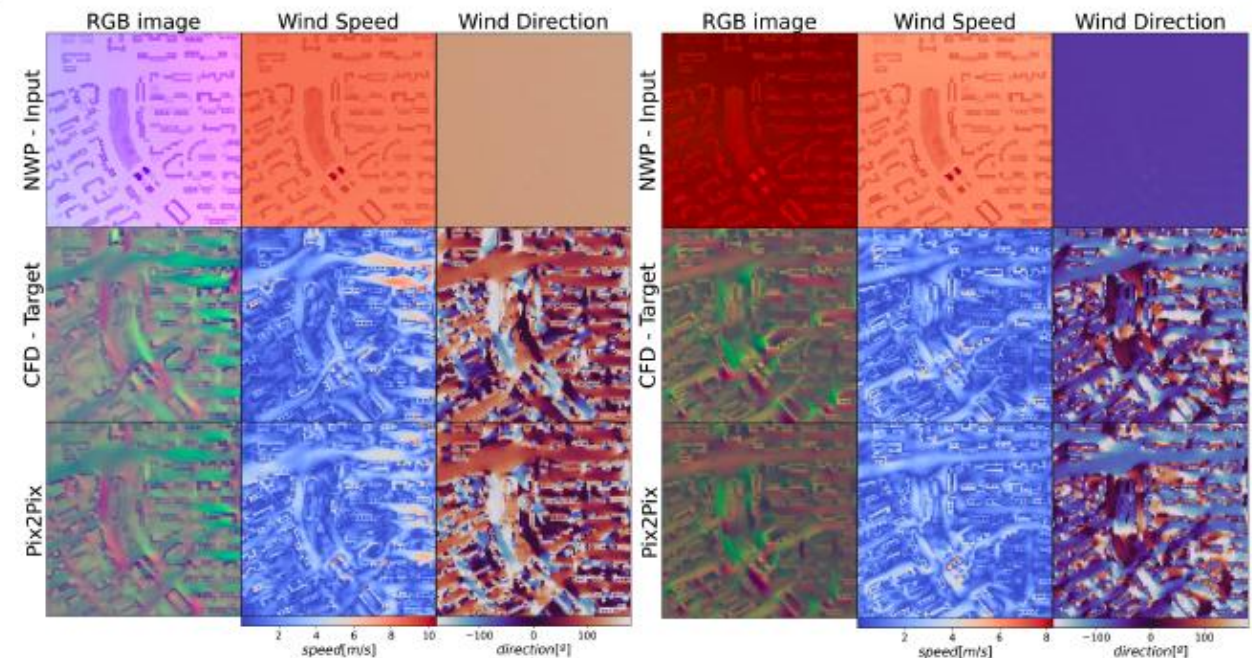
+ Integration of BIM models, logistics models, and simulation

+ Applied to the manufacturing industry (also applicable to other types of buildings).

+ Characteristics:

  + Detailed geometry

  + **Prediction of energy consumption/production, thermal comfort, and air quality**

  + Simulation, visualization, and analysis of production systems and logistics processes to optimize material flow and resource utilization at all levels of your plant planning, from global facilities and local plants to specific production lines.

  + Reading real-time data from sensors and automated systems
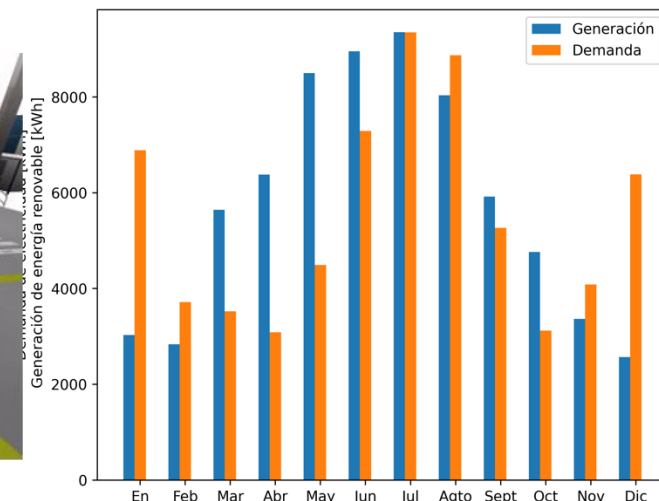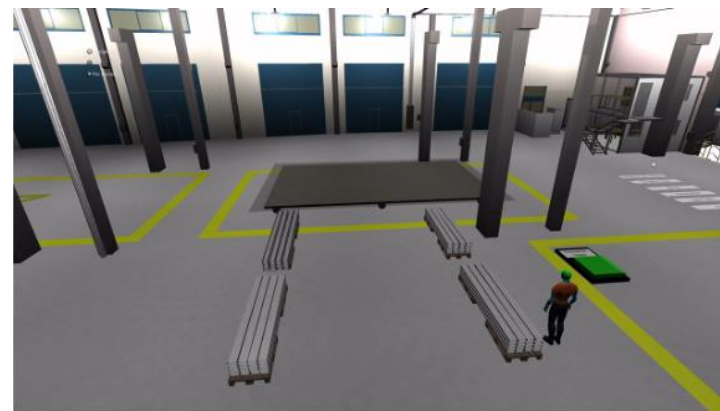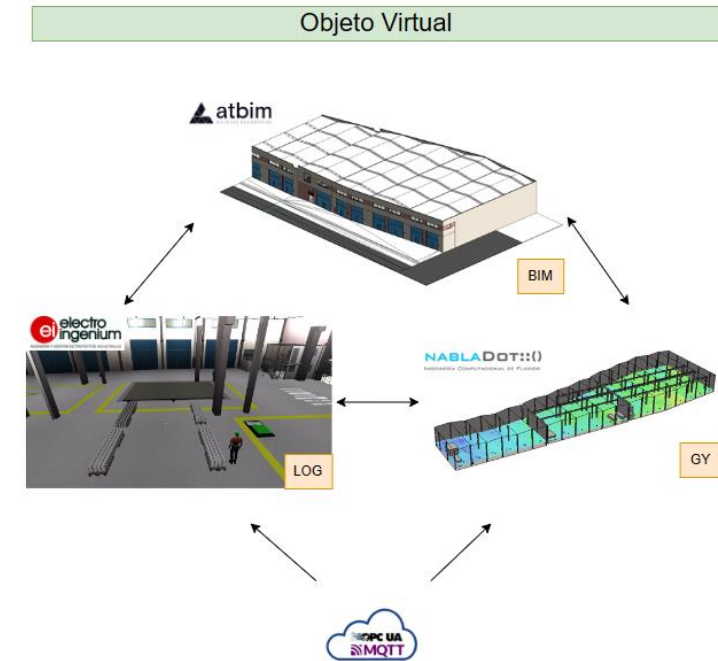
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