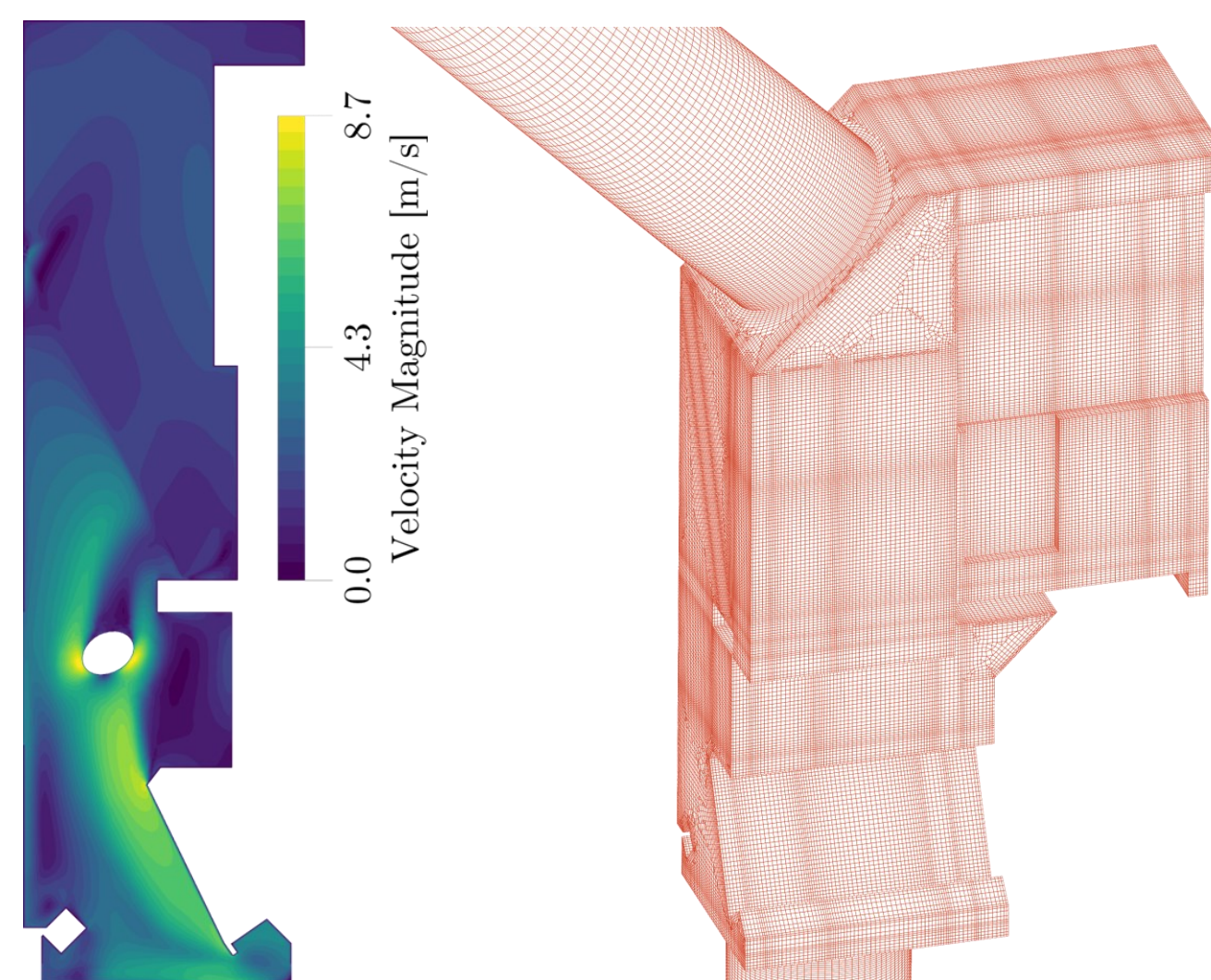
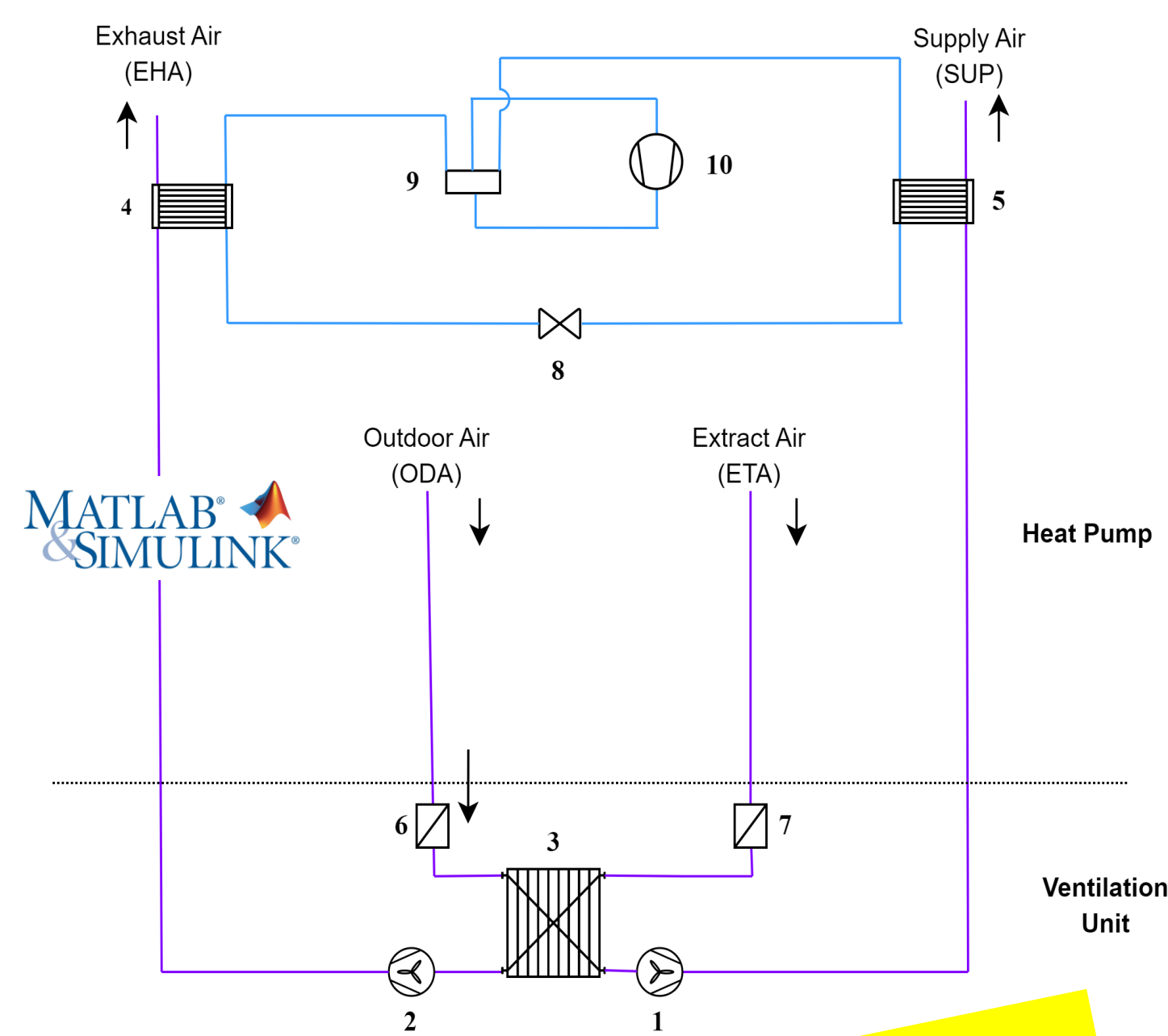


RENEWABLE ENERGY, ENERGY EFFICIENCY AND TRANSPORT PHENOMENA IN BUILDINGS

Roberto Sedoni, Ludovico Campanelli, Danila Trane, Mattia Grespan, Adriano Leonforte, Marco Cavazzuti, Paolo E. Santangelo, Diego Angeli

DIGITAL TWIN OF A MULTIFUNCTIONAL VENTILATION UNIT

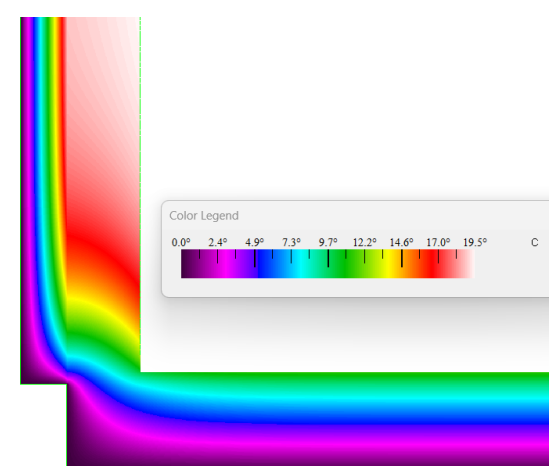
The objective of the research project is to develop a digital-twin of an innovative system that combines a ventilation unit and an air-to-air heat pump to optimize energy consumption and provide comfort in residential buildings



The lumped-parameter model is calibrated either by experimental data or by CFD analysis.

INDOOR AIR QUALITY

Risk assessment associated to mold growth

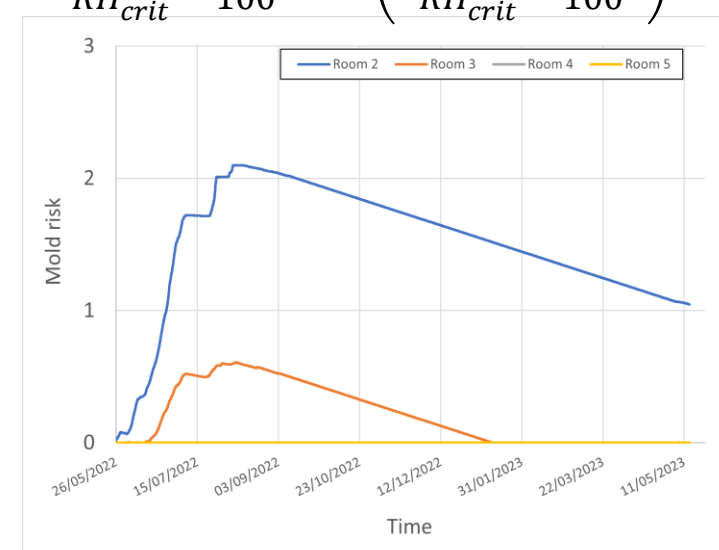
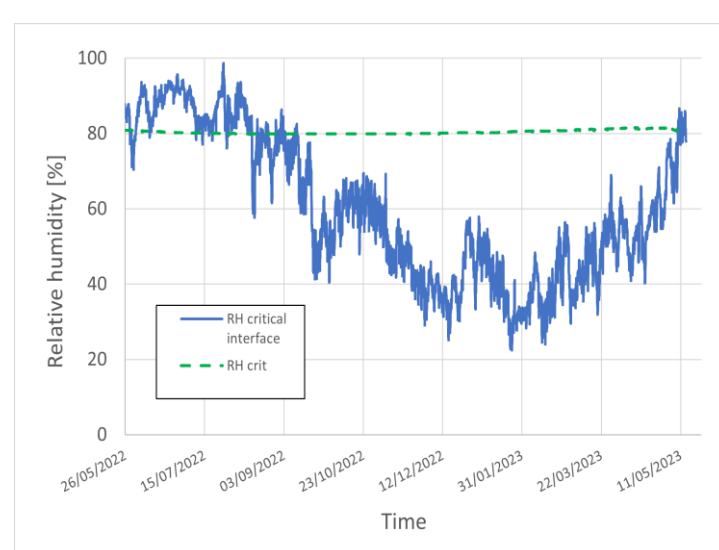


$$\frac{dM}{dt} = \frac{k_1 k_2}{7 \exp(-0.68 \ln(T) - 13.9 \ln(RH_{wall}^{\%}) + 66.02)}$$

$$k_2 = \max[1 - \exp(2.3(M - M_{max})), 0]$$

M_{max}

$$= A + B \frac{RH_{crit}^{\%} - RH_{wall}^{\%}}{RH_{crit}^{\%} - 100} - C \left(\frac{RH_{crit}^{\%} - RH_{wall}^{\%}}{RH_{crit}^{\%} - 100} \right)^2$$

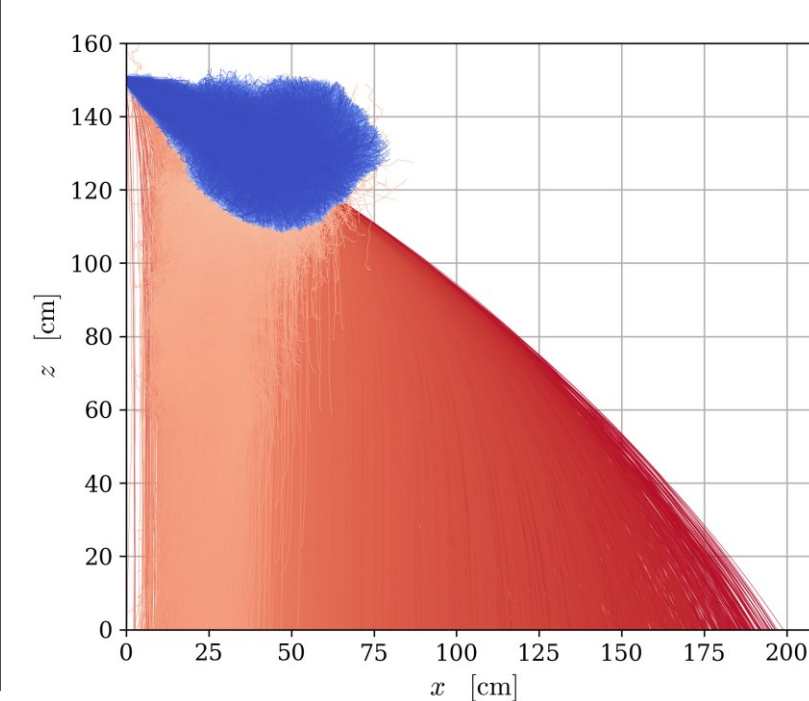


Risk assessment associated to exhaled droplets

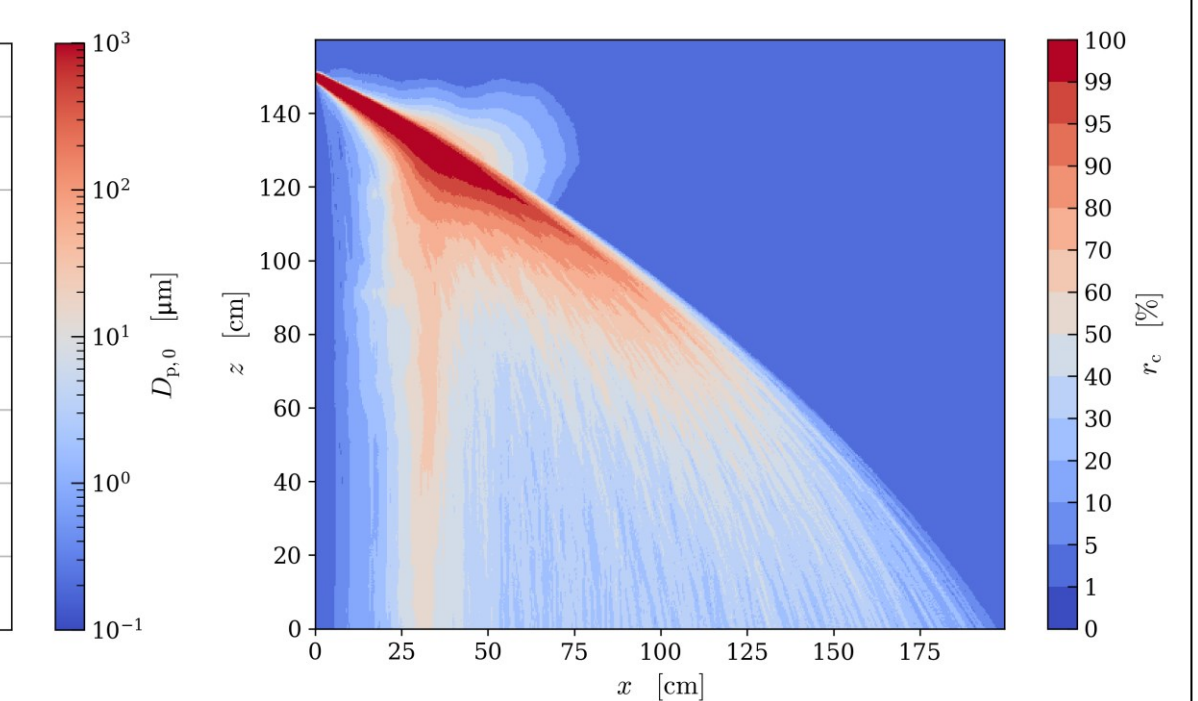
Statistical model describing the coughing scenario of a SARS-CoV-2 infected individual.

Spatial risk maps are derived by post-processing the droplets trajectories

Trajectories

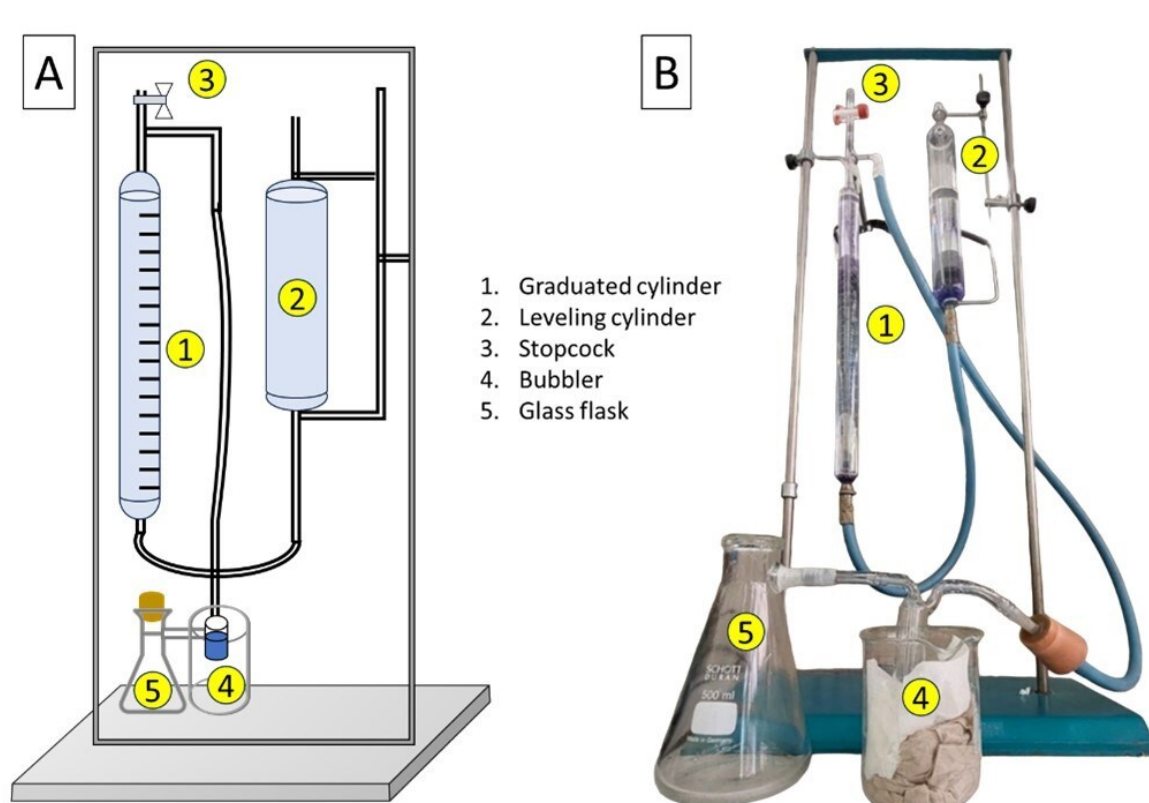


Risk

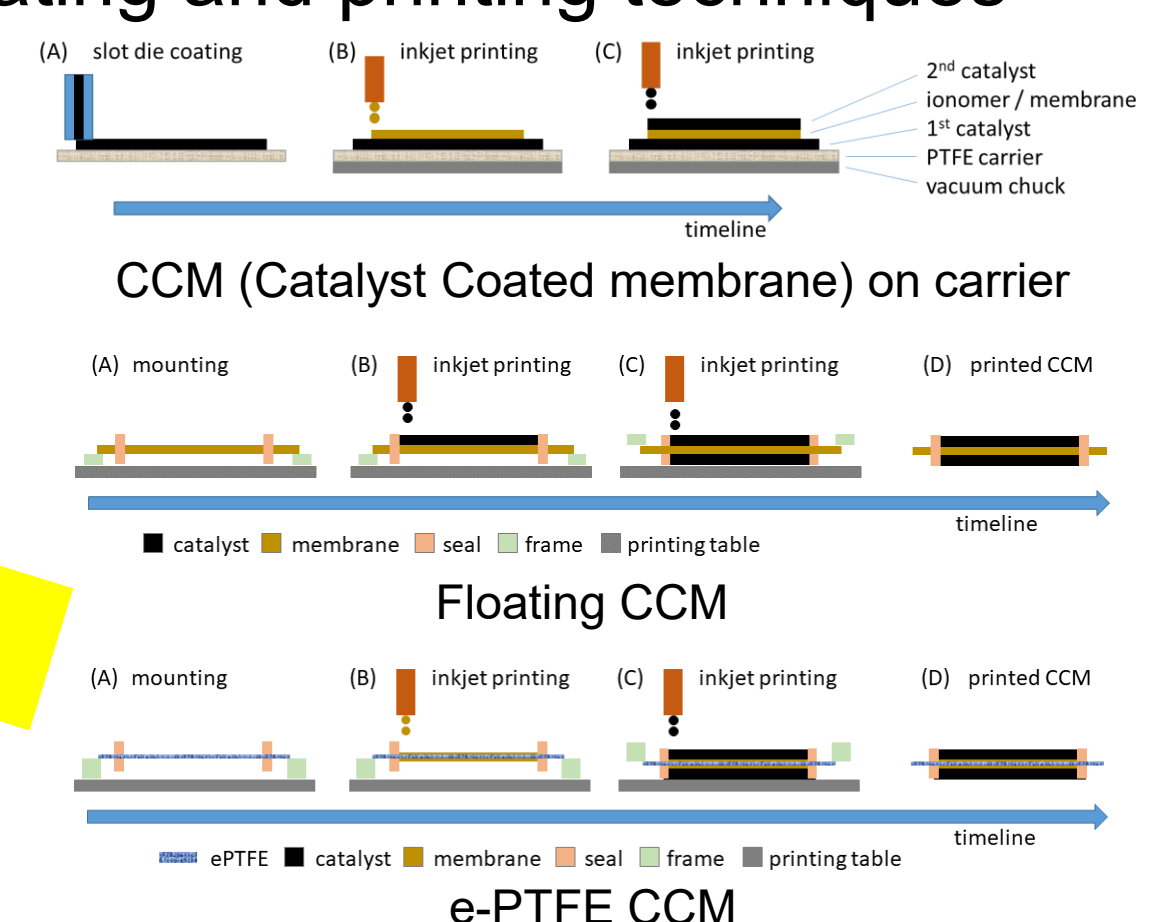


HYDROGEN PRODUCTION AND FUEL-CELL MANUFACTURING

Hydrogen production by aluminum/water reaction:
Experimental study of chemical kinetics as a NaOH/H₂O solution is involved



Deposition of functional layers for PEMFC (Polymer Electrolyte Membrane Fuel Cells) manufacturing:
Focus on coating and printing techniques



In collaboration with
Laboratorio di Reologia @ DIF, UNIMORE