The Guiding Environment. The design of a guiding environment to stimulate older adults with early stage dementia to enable them to live longer in their own homes.

Optimization of air curtain technology through temporal and spatial jet excitation

Introduction
Air infiltration is responsible for a major share of building energy losses, in addition to contributing to the transport of contaminants and negatively affecting the thermal comfort conditions in indoor environments. In building applications, air curtains (turbulent impinging jets) are used to generate an aerodynamic barrier that reduces infiltration and separates a controlled environment, in terms of temperature, pressure or concentration, from an unconditioned environment, while allowing an easy access of people, vehicles and material across the two environments. The aerodynamic seal provided by air curtains aims to improve thermal comfort, air quality, energy efficiency and fire protection in buildings (Figure 1). The performance of air curtains is commonly assessed based on the heat and/or mass exchange between the environments separated by the air curtain through the criterion known as “separation efficiency”. Understanding how the separation efficiency depends on the involved transport processes and their influencing parameters, is essential for the optimization of current air curtains and the development of new air curtains.

Methodology
Numerical simulations using Computational Fluid Dynamics (CFD) are conducted to analyze the fundamental flow behavior, systematically evaluate the performance of air curtains under different operational settings and environmental conditions (i.e., crossjet temperature and pressure variations) (Figure 2), and parametrically optimize the air curtain efficiency through the incorporation of temporal and/or spatial jet excitation strategies. These simulations are being accompanied with dedicated water tank experiments (Figure 3) and field measurements for validation.

Aims of the Project
The alteration of jet and vortex characteristics, by means of passive and active changes in jet parameters, can have a major effect on the entrainment processes of impinging jets. Furthermore, external forces, derived from environmental conditions, alter the flow pattern of the jet and thus can influence the transport of heat and mass across the jet. Therefore, the present project strives to optimize the separation efficiency of air curtains by exploring the impact of jet excitation and environmental parameters on the air curtain jet and vortex behavior.