FROILOC® a novel food safety technology through localised cold and clean airflow

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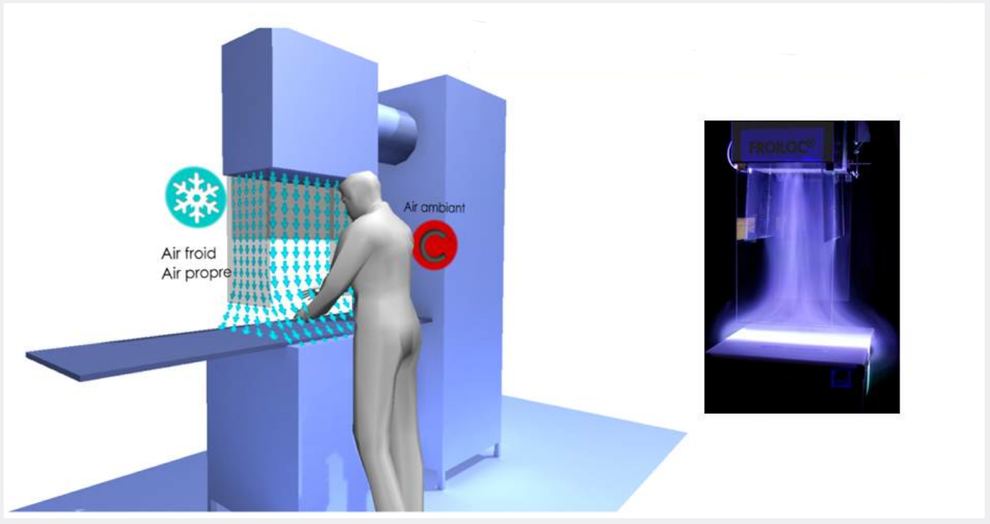
Irstea, UR OPAALE, 17 avenue de Cucillé - CS64427, 35044 Rennes, France

Some industries (food, pharmaceutical) require cold and ultraclean atmospheres. FROILOC® (Patent number: PCT/FR2012/050582) blows clean and cold air over the work space while improving thermal comfort for operators thanks to warmer temperatures in the ambient air of the workshop (Standard ISO7730, Criteria PMV). The installation includes a work space with two edges facing each other, the means for distributing airflow in a localised space (work surface) and a set of transparent guide walls located in the extension of the air distribution device. The arrangement of stable aeraulic barriers is achieved due to the specific layout of aspiration methods as well as the interior and exterior walls. The airflow temperature is between -2^o C and 4^o C whilst ambient air in the facility is at least 13^o C. A two-way access to the work zone allows two operators to work simultaneously and face-to-face.

FROILOC®: Technical description



(a) Principle

Improves the quality and channelling of airflow distribution
Reduces the risks of mixing blown air with ambient air. The clean and cold airflow is channelled over the work station receiving the products. The difference between the temperature of the diffused air and the ambient air is at least 10^o C and the cold air is between -2^o C and 4^o C.

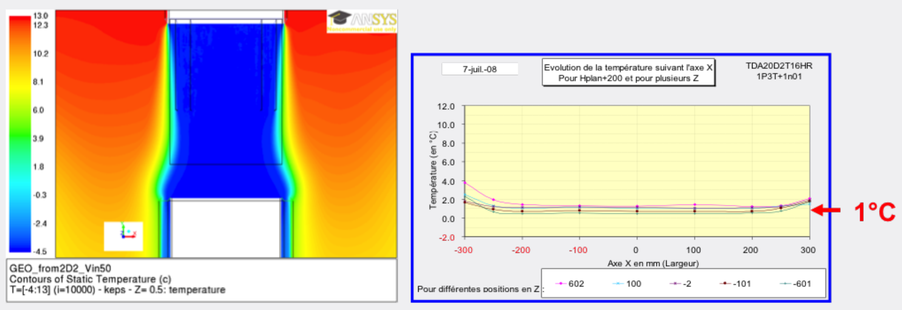
Improves sanitary performance Satisfies the ISO 14644-1 Standard (Clean Rooms and Related Controlled Environments): Level ISO5 for clean air in contact with sensitive products.

Improves work conditions (particularly in the agri-food industry) Lowers the risks associated with musculoskeletal disorders: the thermal comfort of the operators is improved (meets ISO7730 standard "Ergonomics in Thermal Atmospheres" and the PMV Index).

Reduces energy consumption

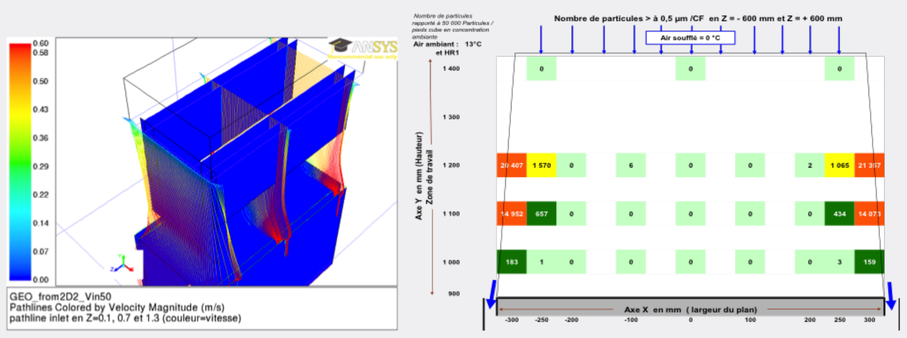
Two-way access to the work area Two operators working across from each other can handle products whilst keeping their partner within their field of vision.

FROILOC®: Results on temperature distribution

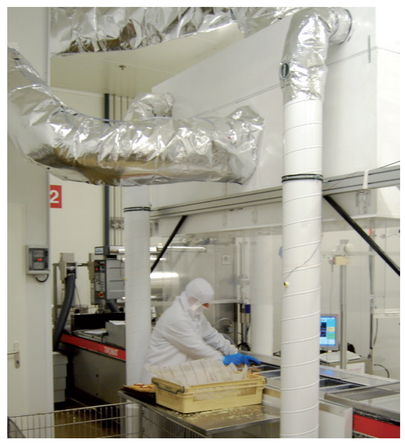


(b) Temperature map from simulation (FLUENT) (c) Temperature over the table from experiments

FROILOC®: Results on cleanness



(d) Particle trajectory from simulation (FLUENT) (e) Particle concentration map over the table from experiments

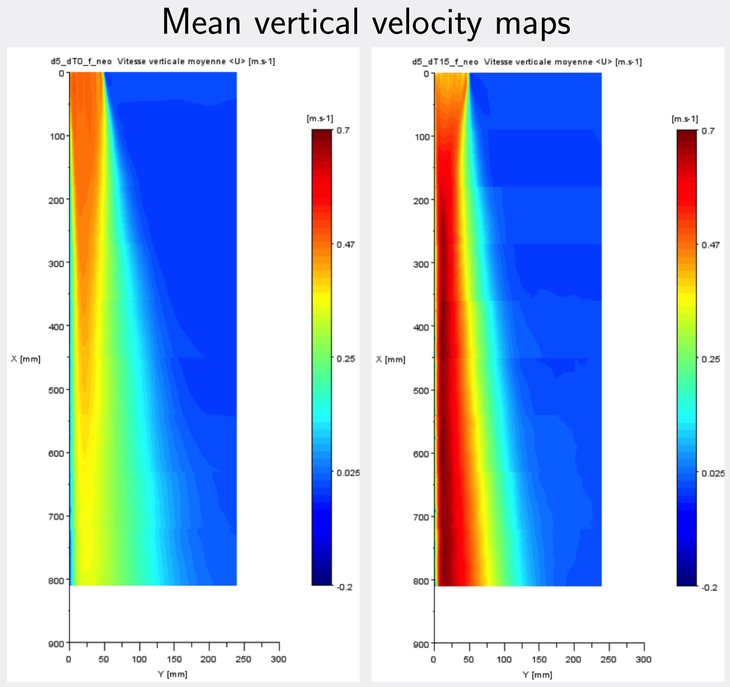


(f) FROILOC® in food industry

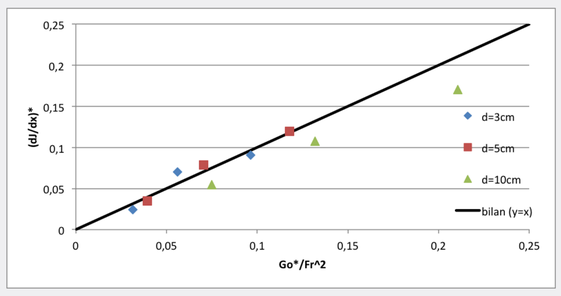
Focus on fluid mechanics

Horizontally stratified Wall jet

Mean vertical velocity maps



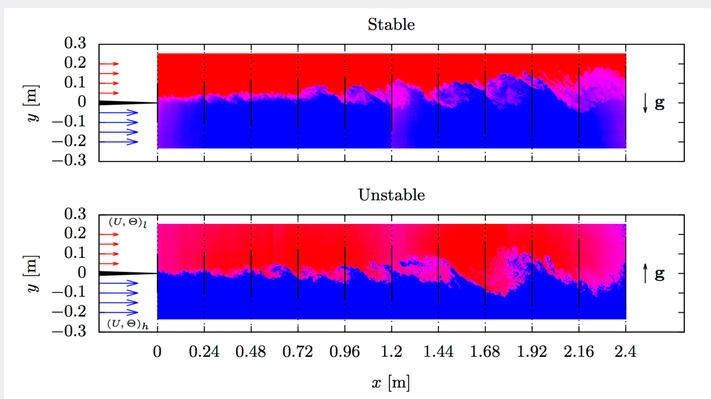
(g) Hot jet (h) Cold jet



(i) Balance between Momentum and buoyancy fluxes

⇒ Modelisation of the effects of initial momentum and buoyancy on the behavior of wall jet

Vertically stratified mixing layer



(j) Flow visualizations of the mixing layer in stably and unstably stratified configurations at low flux Richardson number

⇒ Study of the effects of buoyancy on entrainment and mixing in mixing layer

Contact: dominique.heitz@irstea.fr