



HAL
open science

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

Georges Arroyo, Johan Carlier, Philippe Georgeault, Anthony Guibert, Dominique Heitz, Laurence Wallian

► To cite this version:

Georges Arroyo, Johan Carlier, Philippe Georgeault, Anthony Guibert, Dominique Heitz, et al.. FROILOC® a novel food safety technology through localised cold and clean airflow. 8th International Conference on the Food Factory of the Future, Oct 2016, Laval, France. , 2016, 10.13140/RG.2.2.21607.65441 . hal-01413485

HAL Id: hal-01413485

<https://hal.science/hal-01413485>

Submitted on 13 Dec 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

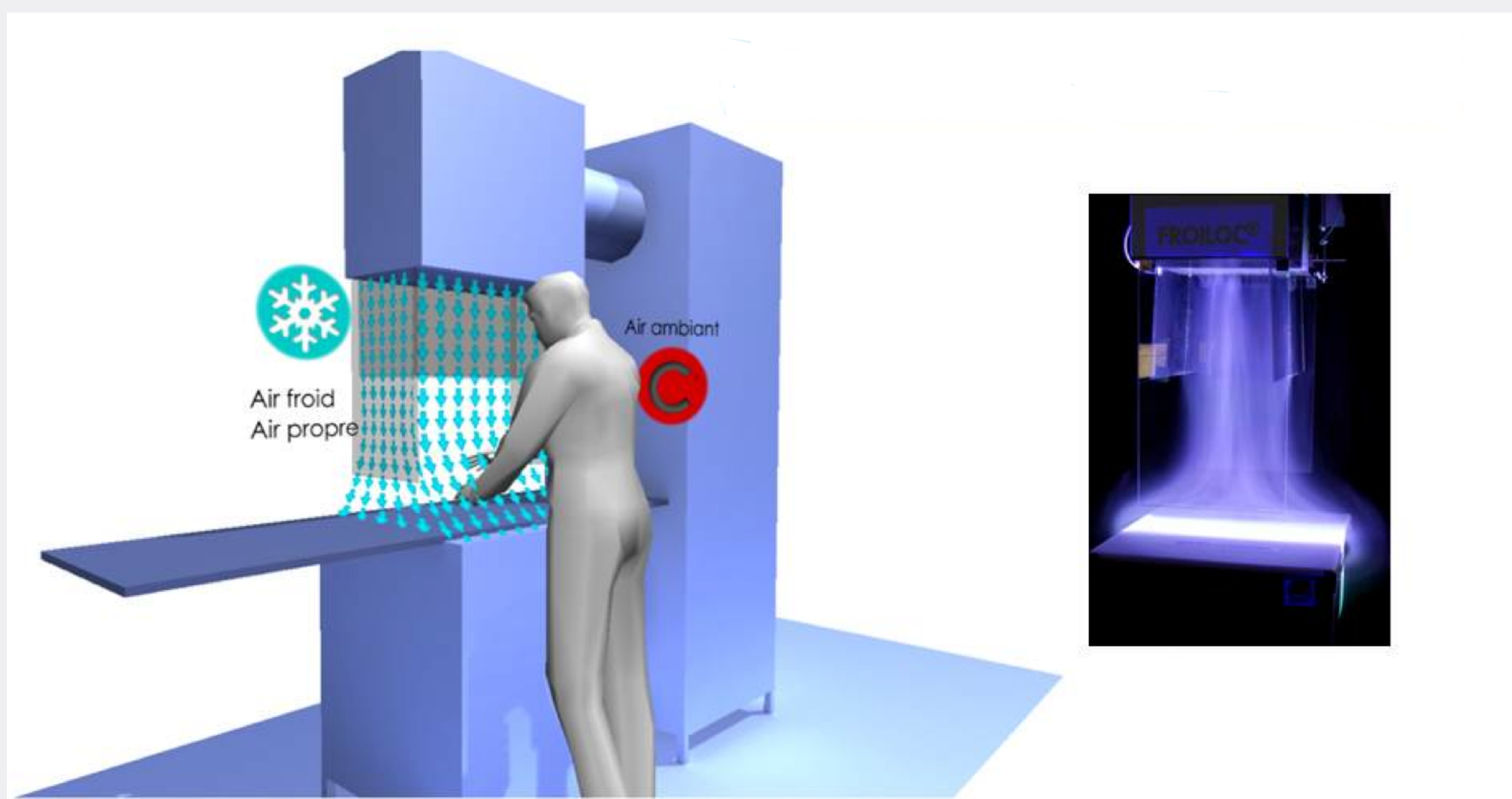
L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0 International License

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 aerualic 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°C and 4°C whilst ambient air in the facility is at least 13°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°C and the cold air is between -2°C and 4°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.

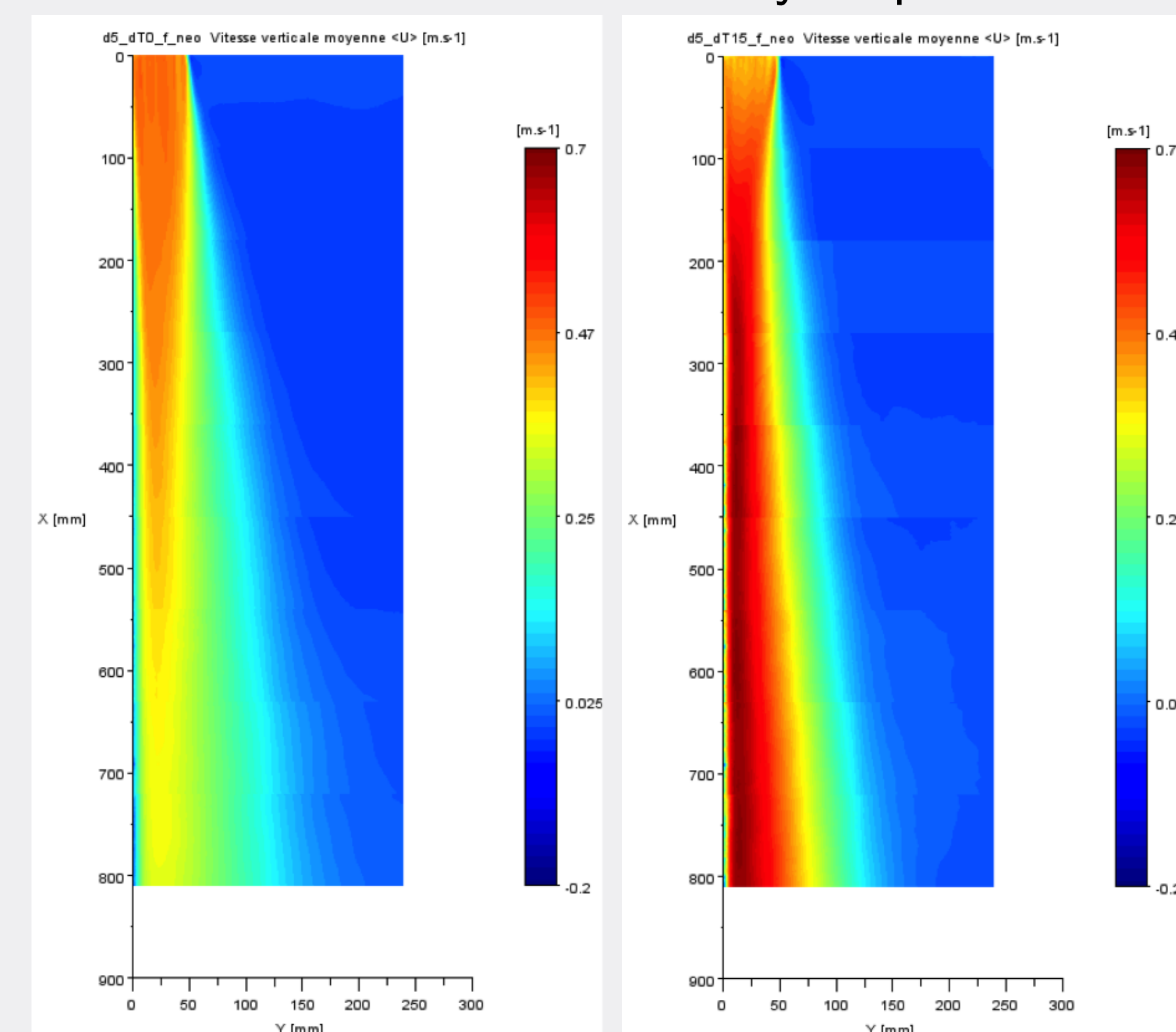


(f) FROILOC® in food industry

Focus on fluid mechanics

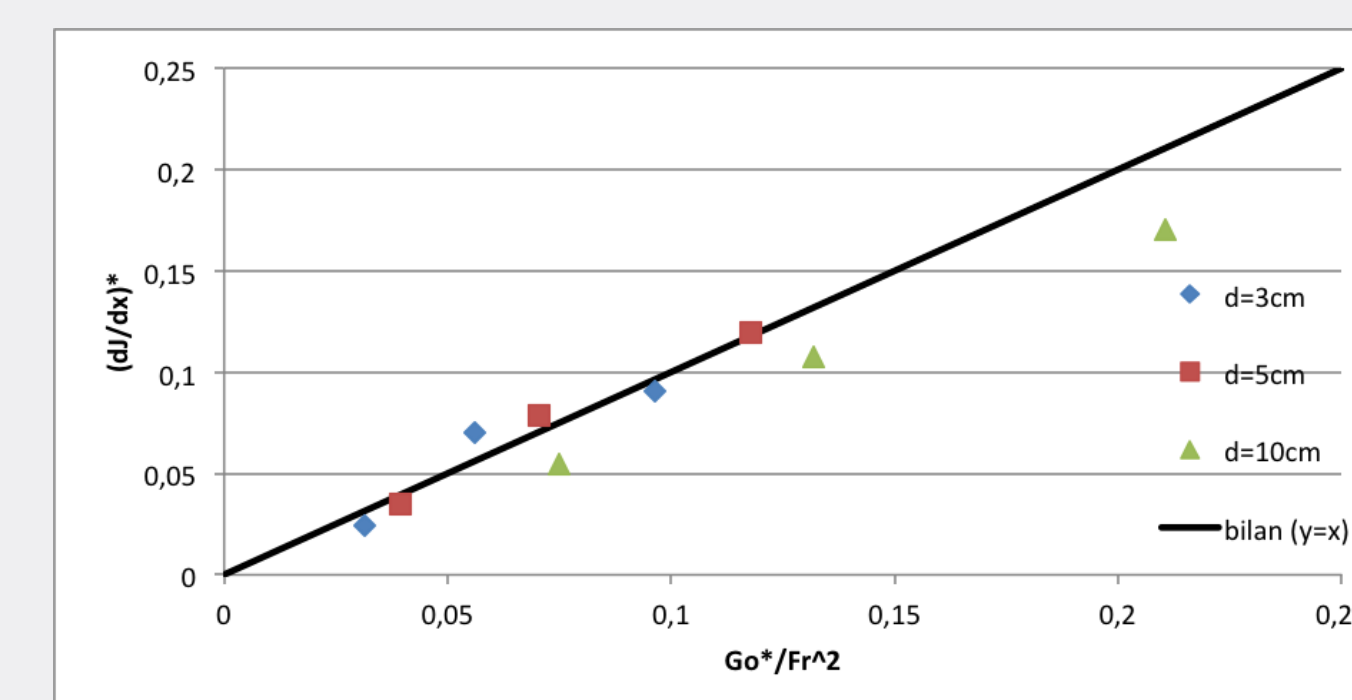
Horizontally stratified Wall jet

Mean vertical velocity maps



(g) Hot jet

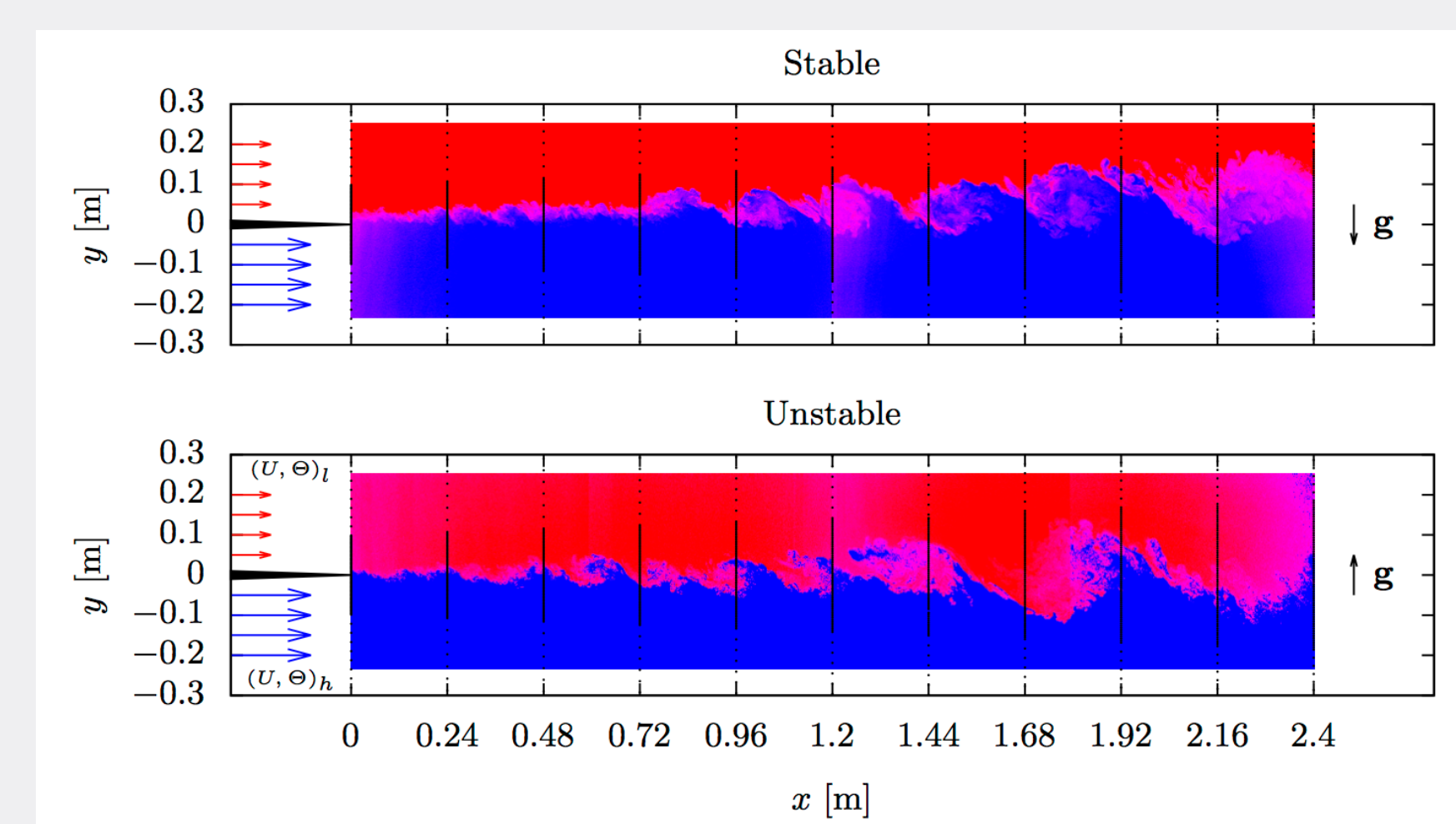
(h) Cold jet



(i) Balance between Momentum and buoyancy fluxes

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

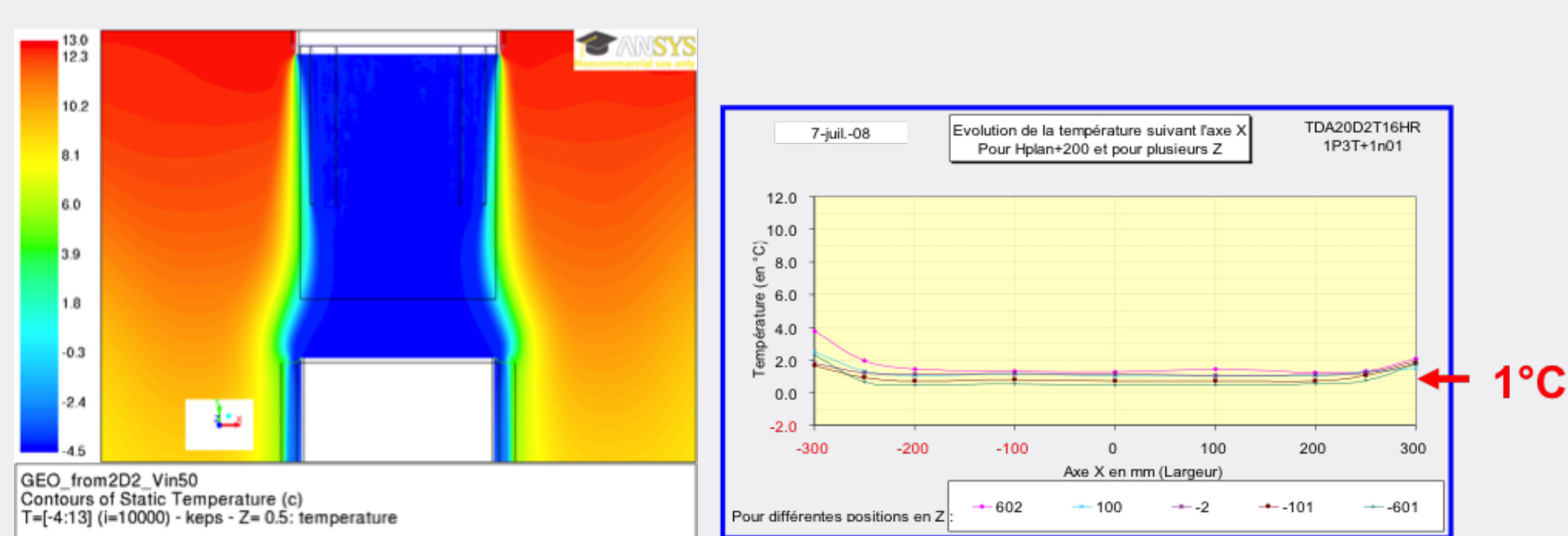
Vertically stratified mixing layer



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

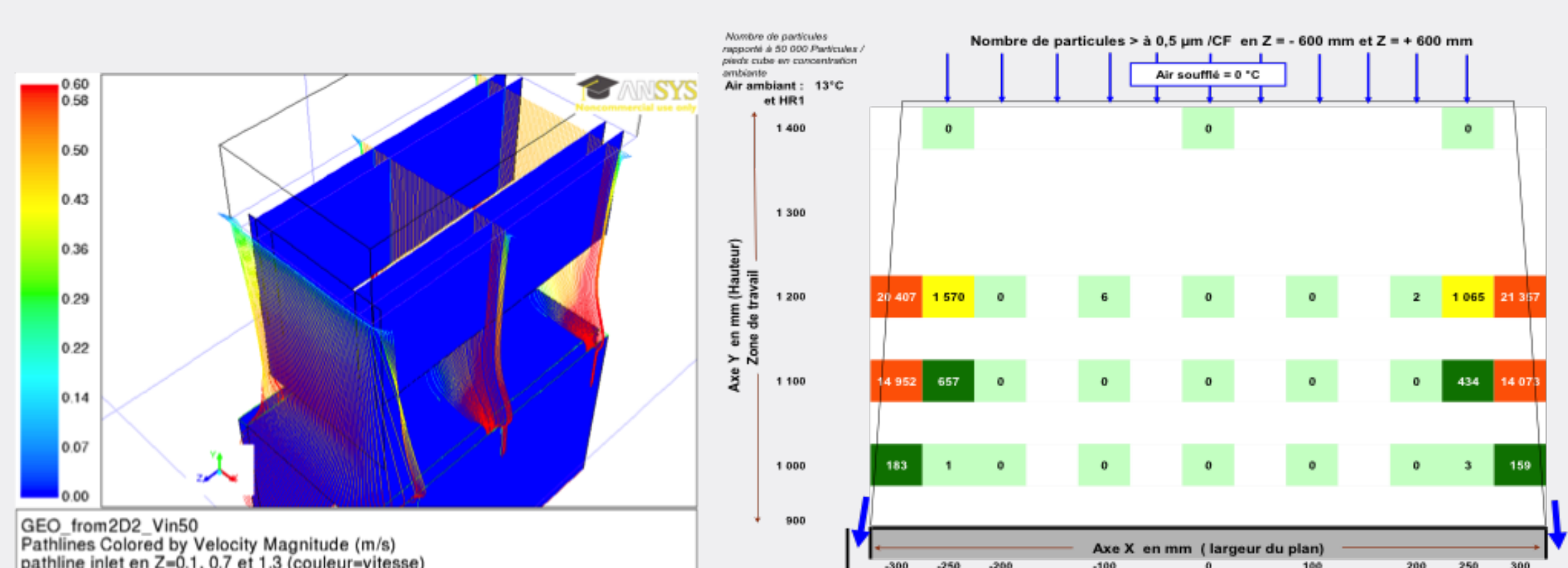
⇒ Study of the effects of buoyancy on entrainment and mixing in mixing layer

FROILOC®: Results on temperature distribution



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

FROILOC®: Results on cleanness



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