

Can air safety be improved while reducing energy costs?

Hi-tech innovation may have the answer

Prakash Sarnobat, and Simon Lannon
SarnobatP@cardiff.ac.uk

Large ventilation rates are currently used for pathogen control.....

- HOSPITALS THROUGHOUT THE WORLD have an unprecedented opportunity to reduce the risk of cross-infection, while reducing the energy use by up to 30%.
- Traditionally, air cleanliness has been associated with the high costs of excessive ventilation, but this is about to change.



.....But visible-violet light kills pathogens in an energy efficient manner

- Three scenarios were investigated: Natural Ventilation and Displacement Ventilation in a hospital ward, where buoyancy was the main driving force. Mixing ventilation was also considered.
- Pathogen concentrations were evaluated for ventilation rates of both 4 and 6 Air Changes per Hour (ACH), both with and without HINS.
- Visible-violet High Intensity Narrow Spectrum (HINS) lights were placed on the ceiling. This has the effect of deactivating bacteria, and this is modelled by a sink term throughout the entire domain.
- Pathogen concentrations were again evaluated in the presence of the HINS lighting.

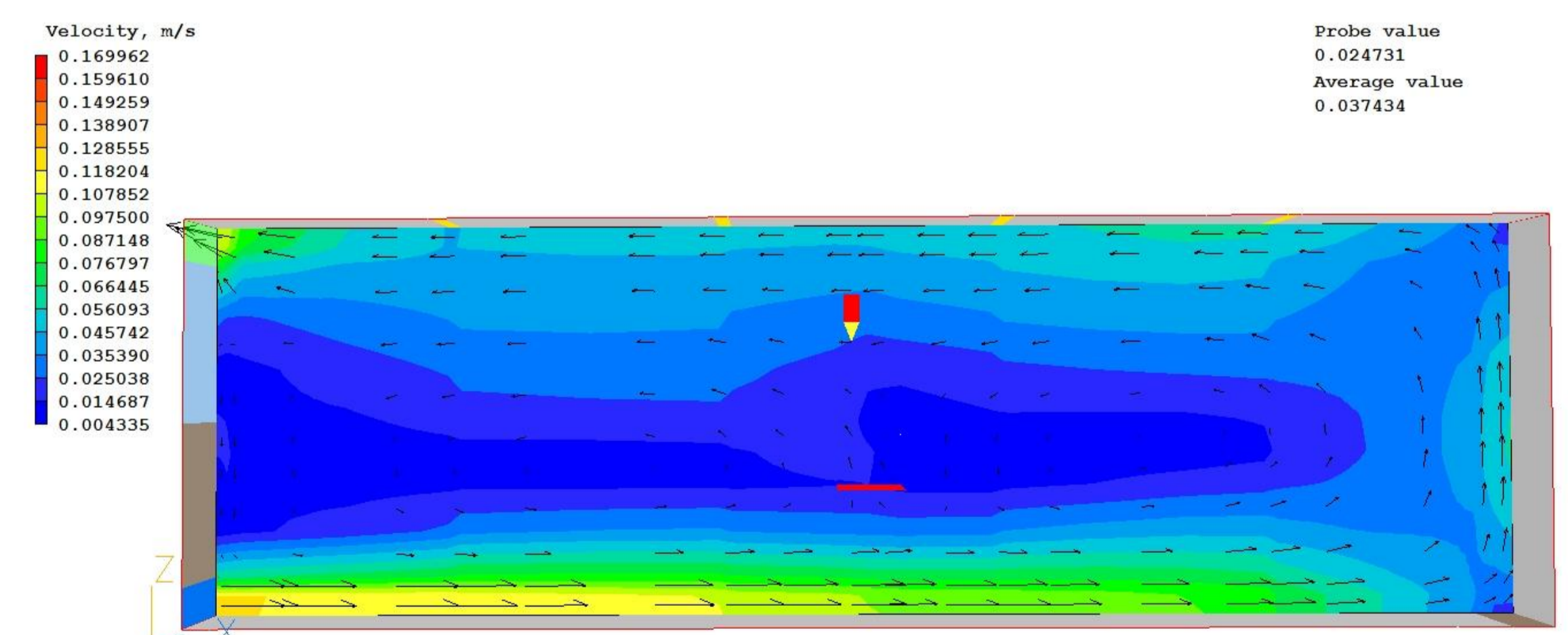
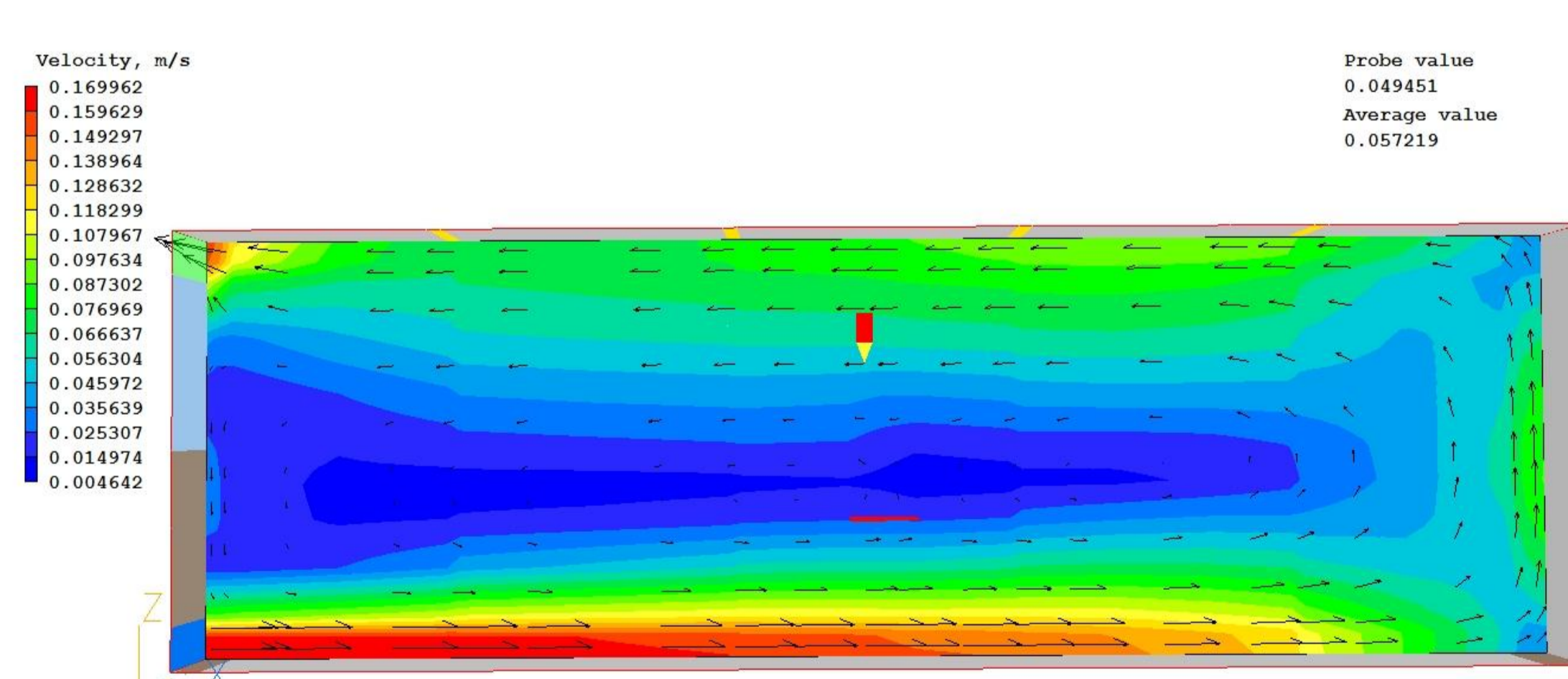


This can significantly reduce ventilation requirements

- The pathogen concentrations under a ventilation rate of 4 ACH with HINS are of a similar magnitude to what would be obtained under 6 ACH without HINS.
- There are two interpretations of this result:
 - If Natural Ventilation cannot provide 6 ACH, then 4 ACH may be acceptable when HINS lighting is operating.
 - Both Mixing and Displacement Ventilation can use a lower ventilation rate of 4 ACH instead of the usual 6 ACH, provided that HINS lighting is operating. Saving of up to 50W per HINS device.

Air velocities (same pathogen levels)

Left:
Without light - 6 ACH
Right:
With light - 4 ACH



So, what next?

- Perform 3D simulations, and compare with the effectiveness of UV disinfection.
- Also consider thermal comfort due to reduced ventilation rates.
- Create a validation template for HINS modelling, and publish paper.
- Apply this innovative strategy in sectors outside Healthcare, e.g. Food preparation and manufacturing.

Visible-Violet Revolution!