H

Research & Development

Airlinx is committed to continual improvement with product competitiveness and product quality.

Since 2010 Airlinx has provided funding along with other Ausindustry businesses into research and development.

These projects have included:

- Developing a Predictive Model for Optimal Design of Ventilation System
- Wood Dust Exposures and its Effects on Respiratory Health
- Developing a Virtual Platform for HVAC Diffuser Performance

Airlinx has also partnered with Australian and overseas universities in a project that investigates air quality with the ventilation in Boeing aeroplane cabins.

From 2015 Airlinx has engaged in a project with seven other private industries and nine Australian universities to research and develop a high efficient and low cost air ventilation solution to public rail transport. To improve air quality with optimised ventilation and using computational fluid dynamics (CFD) the airflow and temperature in high speed trains cabins could be precisely predicted. Being able to visualise the diffusion, particulate contaminates could also be visualised and may lead to a reliable assessment of risk exposure in concerned cabins.

Airlinx engages with RMIT final year students who are completing their capstone projects. This involves putting their research into professional engineering practice to produce useful and original engineering solutions for industry relevant scientific issues.

RMIT UNIVERSITY

SCHOOL OF AEROSPACE, MECHANICAL AND MANUFACTURING ENGINEERING

FINAL YEAR PROJECTS

2014

PERFORMANCE ASSESSMENT OF HVAC DIFFUSERS BY EXPERIMENTAL MEASUREMENTS

Authors: Pendlebury Andrew Steven, Xiangdong Li, Jiyuan Tu

HVAC systems are used in the vast majority of commercial buildings in the western world, to achieve thermal comfort for the occupants.

This report looks into the performance of a number of different HVAC diffusers manufactured by Airlinx in Nobel Park. Testing for this will take place in a design built testing room in the Nobel Park facility. This performance data will be compared to competitor product and used to assist customers in selecting the correct diffusers for their application.

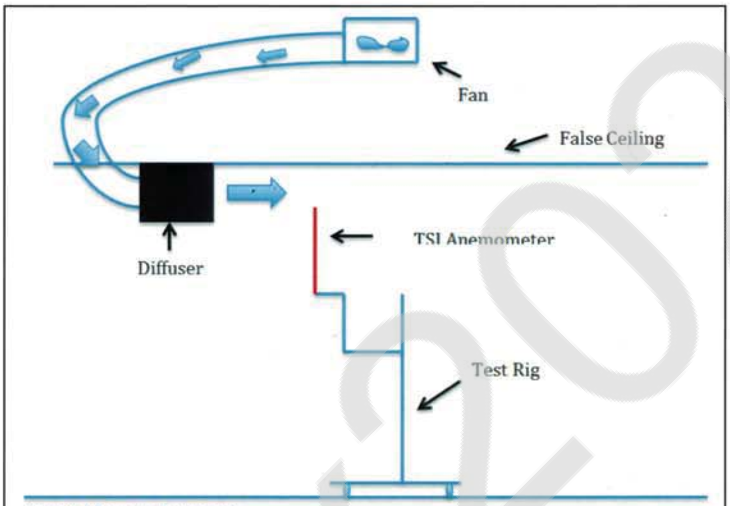


Figure 9 Schematic of test set up

DIFFUSER MODELLING, MEASUREMENT AND PERFORMANCE

Authors: Li Tsz Hin, Xiangdong Li, Jiyuan Tu

Diffusers are used to drive ventilation. A number of different diffusers need to be characterised and tested to assess their performance. Such diffusers may be linear and swirl. An experimental test room has been designed and built specifically for this purpose. A number of diffusers are needed to be characterised and CFD modelling techniques will be used to visualise performance. This work is sponsored by Airlinx, where the testing will take place. Through this project, students would gain direct experience of resolving engineering problems in the industry.

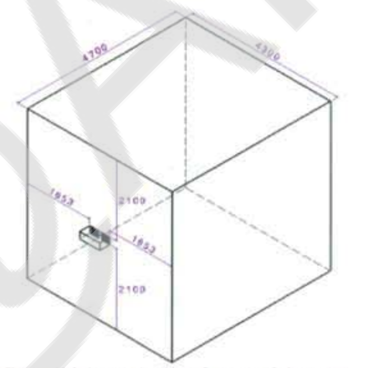


Figure 4(a). Isometric view of set up of the room and the diffuser box

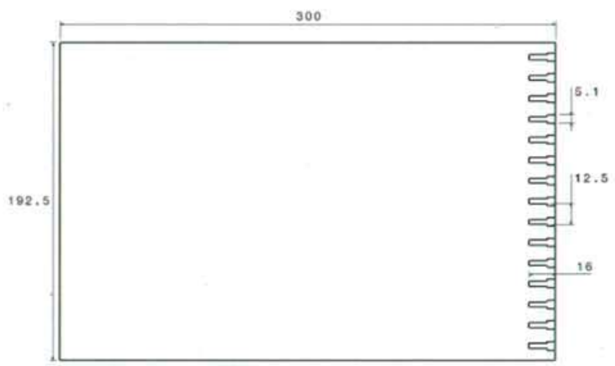


Figure 4(b). Side view of the diffuser box with the blades

DIFFUSER MODELLING, MEASUREMENT AND PERFORMANCE

Authors: Corado Oscar, Xiangdong Li, Jiyuan Tu

HVAC diffusers must undergo performance assessments in order to determine whether they can meet current standards to supply thermal comfort and system efficiency to individuals who spend 90 per cent of their time indoors. By creating a contained field and mapping the airstream using velocity vectors, the behaviour of air exiting a diffuser can be studied.

Figure 13: Airlinx fan with selected data points (Red) and indicated areas (Green). Each point is separated by 14mm.

EFFECT OF VENTILATION CONFIGURATION ON THERMAL COMFORT AND PARTICLE INHALATION OF COMMERCIAL AIRCRAFT PASSENGERS

Authors: Melin Cedric, Xiangdong Li, Kiao Inthavong

Commercial aircraft cabin have a sub-optimal air quality when considering both passenger thermal comfort and particle exposure. The current state-of-the-art design and research have difficulties with integrating key ventilation parameters such as air inlet variables with regard to detrimental pollutant doses on airline users. It is also reasonable to assume that the actual cost benefit of investing in commercial aircraft cabin (CAC) ventilation is dwarfed by safety, fuel consumption and future environmental regulations. In such a context, solving complex interactions to improve air quality in CAC using experiments is time consuming and onerous. Therefore, the use of a computational fluid dynamic (CFD) to simulate CAC environment will provide engineers with numerical data to effectively pinpoint improvement areas and efficiently conduct experimental work. The purpose of this study is to chart passenger thermal comfort and the characteristics of particulate pollutant transport under a range of ventilation configuration within a typical CAC environment. From a research point of view, preference is given to construct a numerical mock up of a CAC with greater emphasis on passengers as a point of reference to evaluate future CAC design. The research philosophy objective is to create a 'CAC-CFD-Unit' that could be used for successive research and shared with research collaborators.

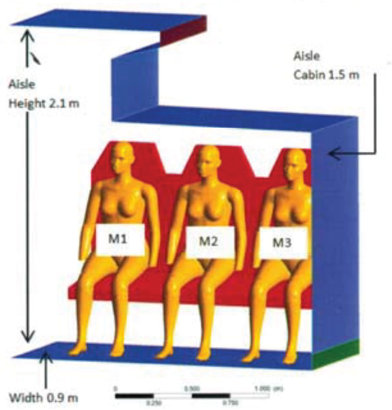


Fig. 1. Mock aircraft geometry constructed in Ansys ICEM

Diffuser Modelling, Measurement and Performance

Students conducted research into the Modelling, Measurement and Performance of Diffusers, This research was conducted by Oscar Corado, Andrew Pendelbury, Nedialko Dimov and Tsz Hin Li.

This section shows a portion of their research.

PROJECT OBJECTIVES

- To conduct an experimental test to determine the performance of various diffusers.
- Understanding the behaviour of the airstream exiting a diffuser from test outcomes.
- Velocity fields will be translated into a map, graph, or equivalent informative diagram.
- Heating Ventilation and Air Conditioning is used world wide for thermal comfort
- Performance assessment based around flow rate
- Effect on flow field and throw

CFD Approach

- Becoming a popular tool for research in the sciences of fluid dynamics and heat transfer
- Providing an alternative cost-effective means of simulating real fluid flows
- Higher capacity to simulate flow conditions that are not reproducible in experimental tests
- Provide detailed visualization and comprehensive information when compared to analytical and experimental fluid dynamics
- Limitations: numerical errors exist in computations   difference in computed results and reality
- Results obtained must always be thoroughly examined before they are believed.

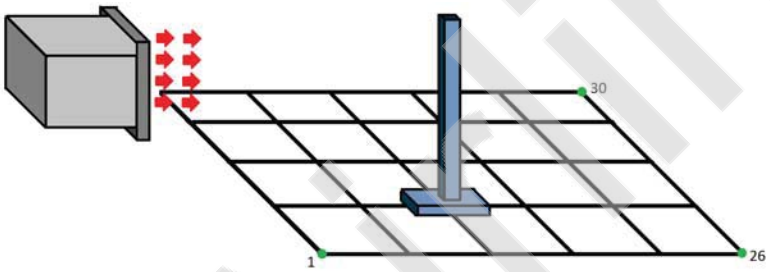
Airlinx Test Room

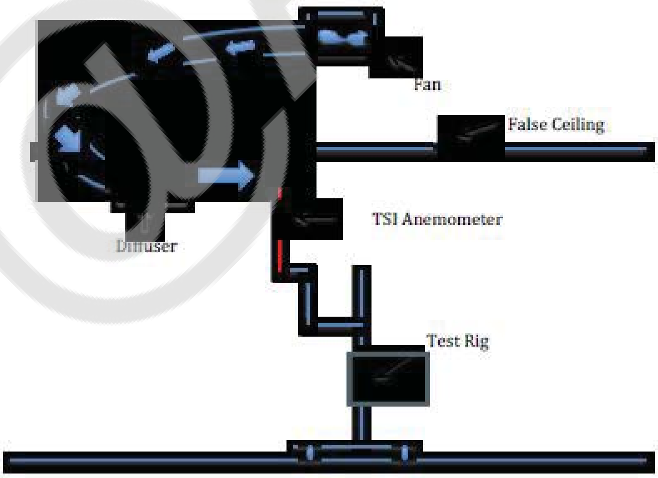
Bar Grille with Double Deflection

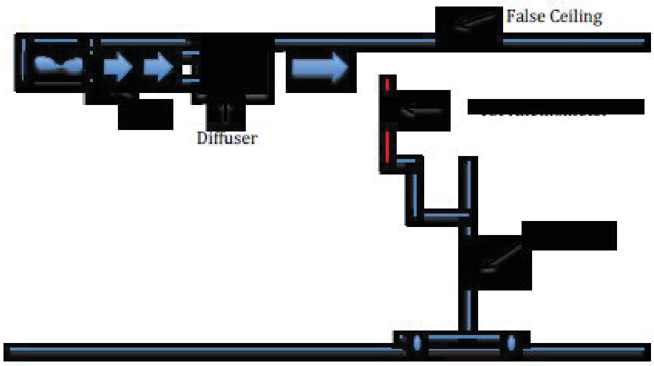


Swirl Lay-in Versus Square Lay-in Diffuser









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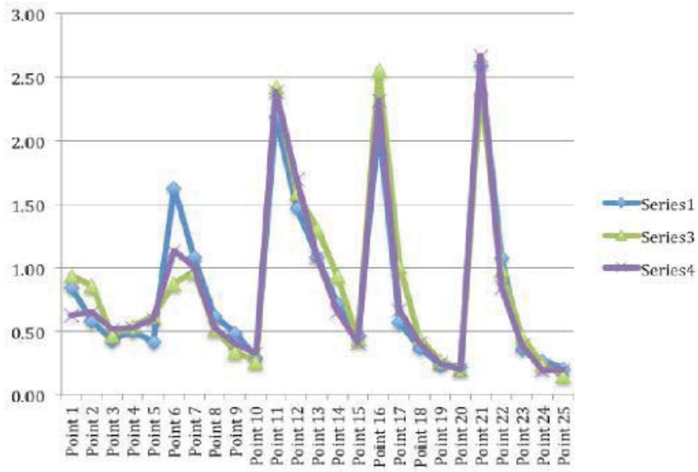
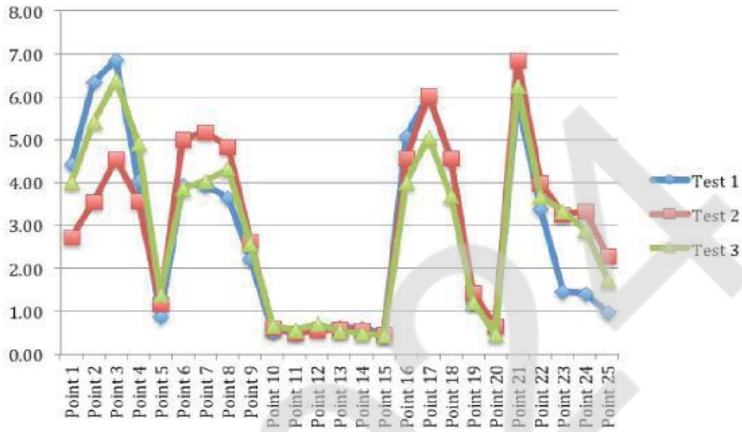
Calibration Testing



150mm Dia Fan Ave. Flow Rate: 93.12l/s

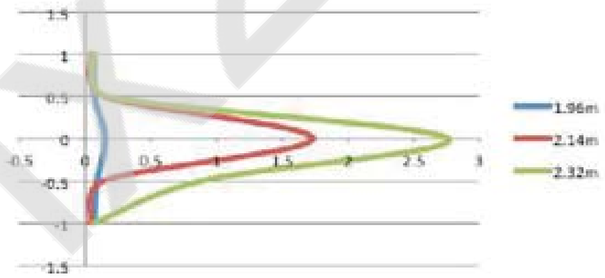


200mm Dia Fan Ave Flow Rate :316.49 l/s

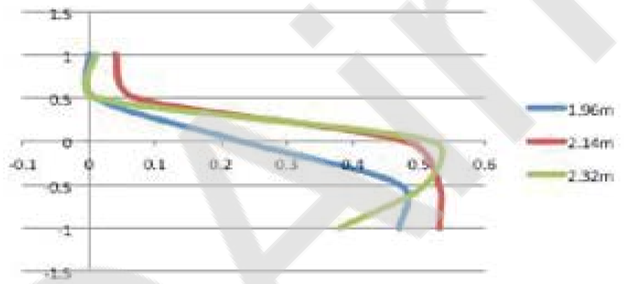
O Degree Thin Gauge Velocity Profiles

150mm Fan at 1m

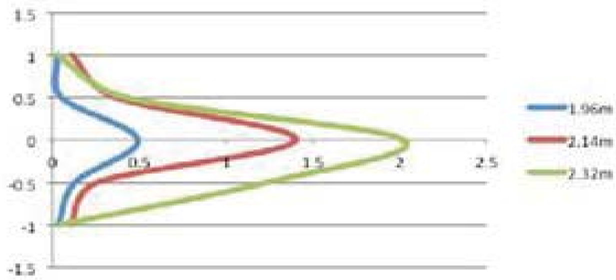
200mm Fan at 1m



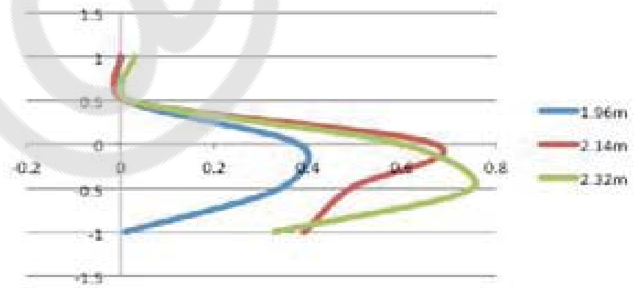
150mm Fan at 3m



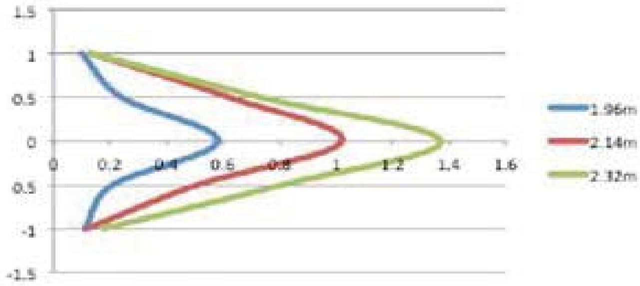
200mm Fan at 2m



150mm Fan at 2m

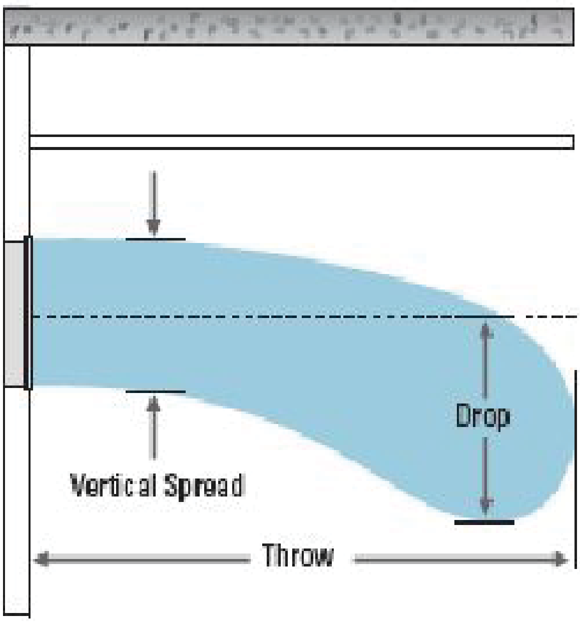


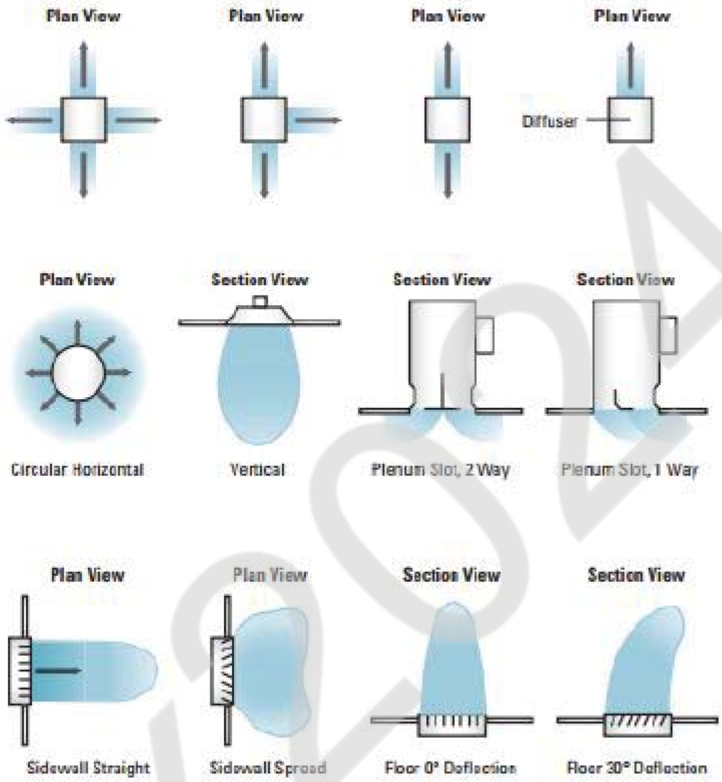
200mm Fan at 3m



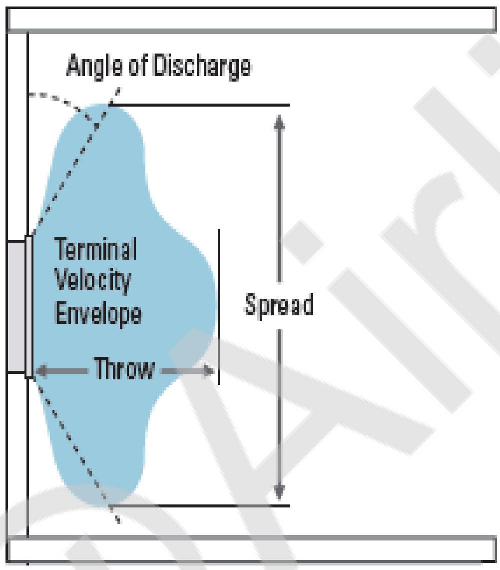
Air Patterns

Understanding the behaviour of air exiting a diffuser will avoid purchasing and utilising over sizes HVAC systems.



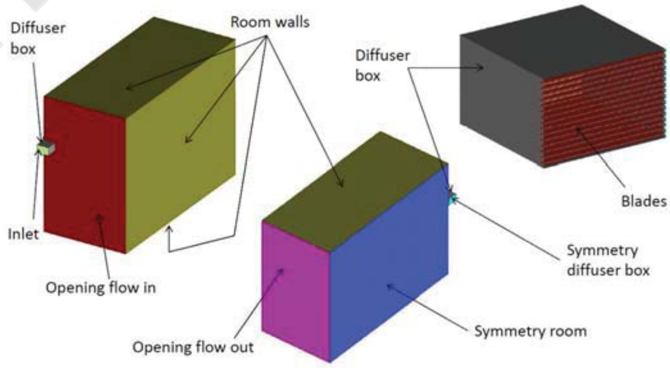


Plan View



Parts Allocation

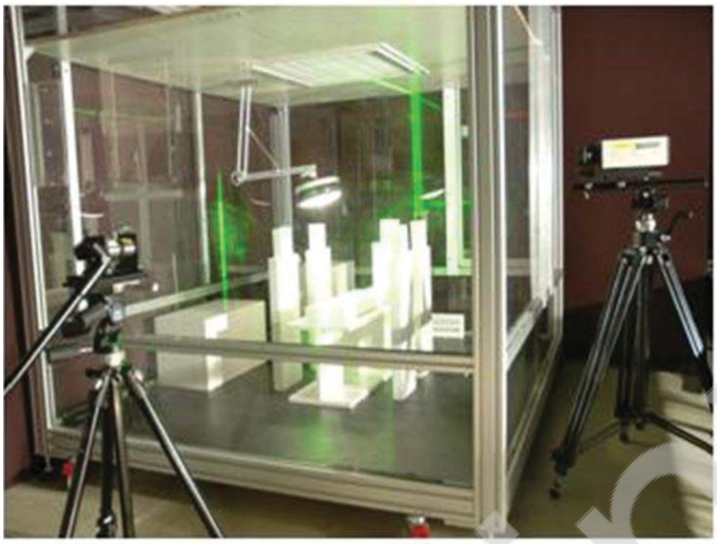
- To have better control of mesh size of individual part
- Allow boundary conditions to be applied in later stage



For the detailed paper into the research conducted by RMIT, please contact Airlinx.

Airlinx Research and Development

Airlinx started as a manufacturer and supplier of air-conditioning duct hardware and accessory products to the HVAC industry, with particular emphasis on commercial-industrial requirements. We are committed to providing our industry with excellent user-friendly products and we can successfully say that this has been a pivotal part of our growth.



The above image shows a model operating room and the experimental set-up for flow measurement using the PIV and LDA/PDA techniques.

Now Airlinx is rapidly expanding its services in providing Research and Development, manufacturing and supplying, and consultancy services to the development and application of many HVAC systems. The company is gradually developing vital research links with a number of companies in the Asia region such as in China and Hong Kong to further expand the company's profile of the provision of services.

The HVAC companies face significant technical challenges today. In an increasingly competitive global market, HVAC systems need to make use of advance technologies and improved component performance.

Airlinx is currently a major player in providing design and expert advice through various research and development activities in collaboration with RMIT University in Melbourne and the research organization CSIRO. Advance experimental techniques such as Particle Imaging Velocimetry (PIV) and Laser Doppler Anemometry/Phase Doppler Anemometry (LDA/PDA) are used to study the indoor airflow patterns and contaminant particle concentration. The wealth of information generated will assist in developing strategic long term decisions as to the development path needed for the longevity and prosperity for building ventilation system design in the domestic and international market places.

Over the last decade, the cutting edge computational fluid dynamics (CFD) techniques have been widely employed and pursued as a tool to achieve innovative designs for HVAC systems. Airlinx has used CFD for the analysis and optimisation of air duct, diffuser and other ventilation components. CFD helps reveal flow structures and comprehensive flow field information where the experiment cannot provide adequate resolution.

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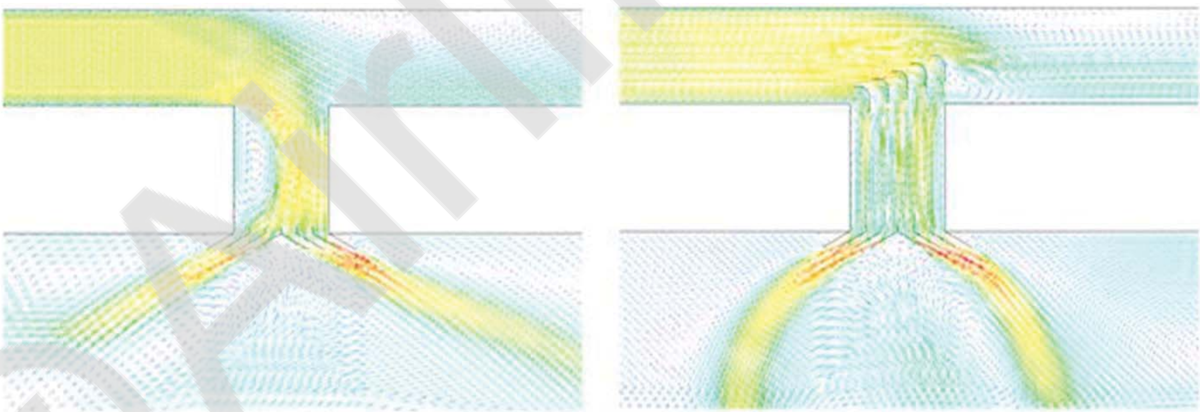

Two figures compare our computer simulation of air flow pattern within the duct system that consists of a branch duct, outlet collar and diffuser. It is showed that the flow pattern from the diffuser is more symmetric with turning vanes (right hand side) than without turning vale (left hand side). More simulation can be performed to study various types of turning vanes affecting of flow distribution, and then, optimised design and flow distribution can be realised.

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