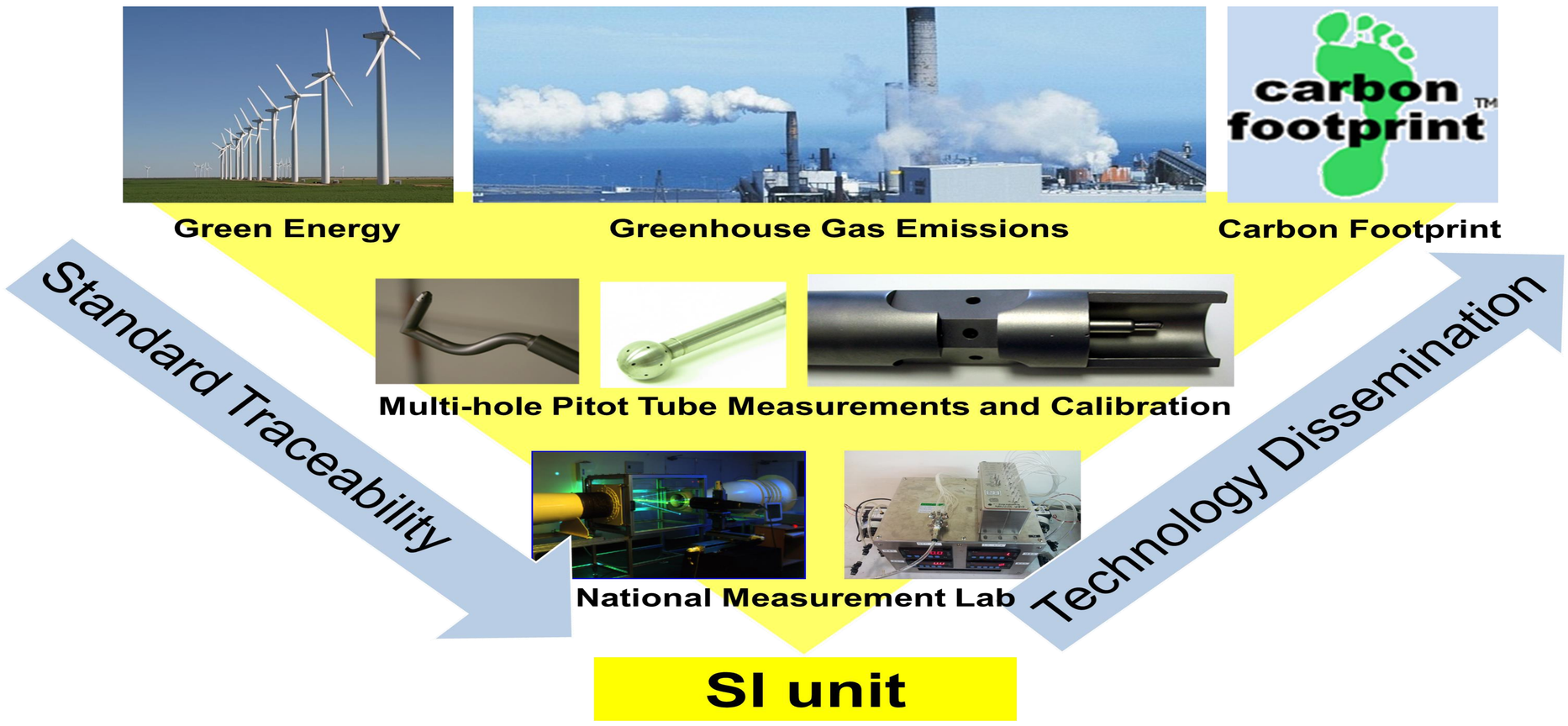
Pitot Tubes Calibration and System Integration of Automated 3D Traverse Stage with the Wind Tunnel

Hsin-Hung Lee, Chun-Min Su

Center for Measurement Standards, Industrial Technology Research Institute, Taiwan R.O.C.



Motivation

Smokestack emissions are one of the main pollution sources and already become a global challenge. Owing to the unstable flow conditions, complex gas compositions and selection of suitable instrumentation, stack flow measurements have drawn much attention. 3D pitot tubes can be used for three-dimensional swirl flow measurements in the smokestack and studied to evaluate its capability.

Method

To provide 3D pitot tube calibration service, automated traverse stage design integrated with wind tunnel system is necessary in order to decrease the operation time and labors. Accordingly, CMS started to design an automated 3D traverse system and integrated with the wind tunnel for 3D pitot tubes calibration. Meanwhile, PIV (Particle Image Velocimetry) technique was used to visualize the flow field in the wind tunnel and further studied the flow separation around the pitot tubes.

Fig. 1 Multi-hole pitot tube calibration facility at CMS

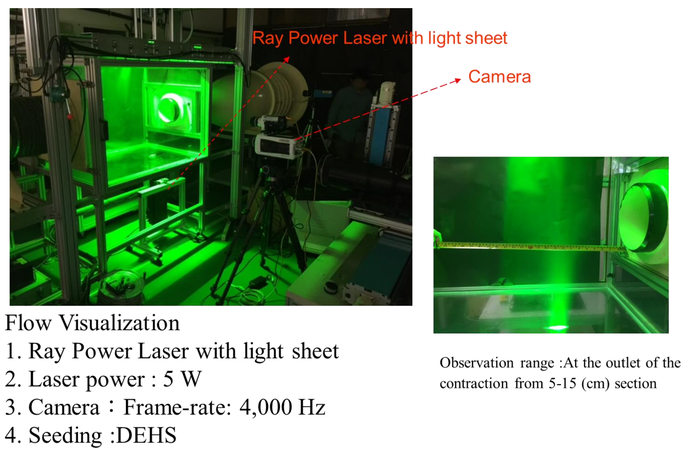


Fig. 2 Flow visualization by PIV technology

Results

The design has been proved to be feasible to operate in the wind tunnel and is able to change the pitch and yaw angle from -40 degrees to 40 degrees and -180 degrees to 180 degrees, respectively. Regarding the automated 3D traverse stage, automatic/manual wind tunnel control, data acquisition, and user-friendly interface were designed in.

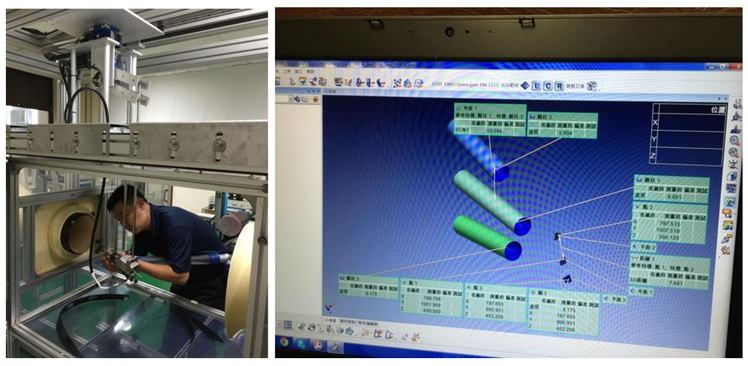


Fig. 3 Angle calibration in the wind tunnel

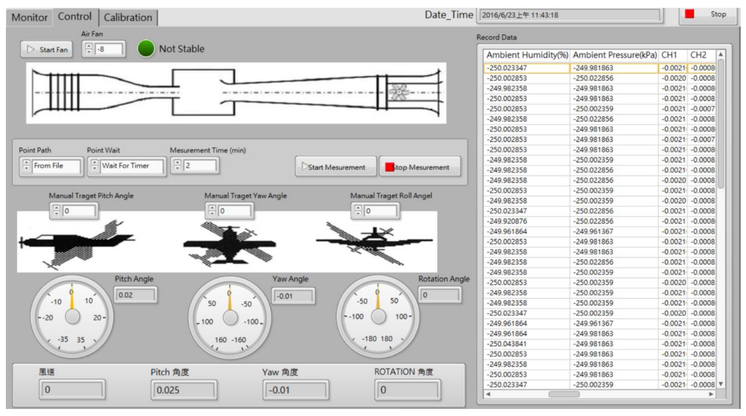


Fig. 4 User interface of automated 3D traverse stage

Conclusions

- To accelerate 3D pitot tube calibration, automated traverse stage design integrated with wind tunnel system is necessary and already established at CMS.
- Pitot tube characterization and flow visualization for different types of pitot tubes need to be further researched in order to fulfill the standard traceability and uncertainty evaluation.

Contact Information

Hsin-Hung Lee (李信宏)
Email: KyleLee@itri.org.tw
Tel: +886-3-5741221

工業技術研究院
Industrial Technology Research Institute