Investigation on jet flow measurement in low pressure on the base of optical method

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The optical-based flow rate primary standard applied in measurement high pressure (up to 5.5MPa) natural gas is developed at PTB by the method of LDV-based boundary layer sensor. In other fields as flue gas measurement in large size but low pressure the traceability is also difficult. At NIM the optical method is tried to be extended to low pressure flow rate measurement. In this paper the sub-sonic nozzle with glass window, namely, jet rig is developed to achieve top-hat profile that fits to optical method. 2 different methods are employed to measure the velocity distribution of jet flow. Initially flow rate is integrated by points of velocity that measured by calibrated LDV along the profile. Additionally the boundary layer method based on 2D LDV is developed to achieve the faster flow rate measurement with better uncertainty. To prove the result the jet flow by optical method is compared to that measured by the sonic nozzle facility. The consistence between different methods suggests that the optical method is reasonable. With further step the jet rig designed in this paper could be calibrated in line depending on the new flow rate traceability chain as the relationship between differential pressure of subsonic nozzle and flow rate of optical method is established.