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BENCHMARK FOR MEASUREMENTS IN A PLANAR DIFFUSER WITH A HIGH INLET TURBULENCE LEVEL

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ABSTRACT

The design of turbo-machinery diffusers is of primary importance for the characteristic a compressor or pump. Nowadays the decelerating flow in the impeller and the diffuser is mostly assessed by numerical simulations and the validation of the numerical simulations with experimental results from modern measurement methods is essentiell. A dedicated test rig for planar diffuser flows of different opening angles is available at EPFL (Fig. 1) and has been modified to take the flow conditions such as inlet blockage and inlet turbulence level) of a typical turbo-machinery diffuser into account. The flow in this diffuser was analysed with LDA at different opening angles in the range of attached and stalled flow regimes. The measurements show that a three-dimensional separation of the flow sets-in in a corner at moderate opening angles and grows with increasing diffuser angles to a big separation zone downstream. The frequency analysis of the LDA data give some dominant frequencies which can be attributed to small and big scale separation zones. These measurements provide an accurate basis for the validation of diffuser flow simulations used in turbo-machinery design.

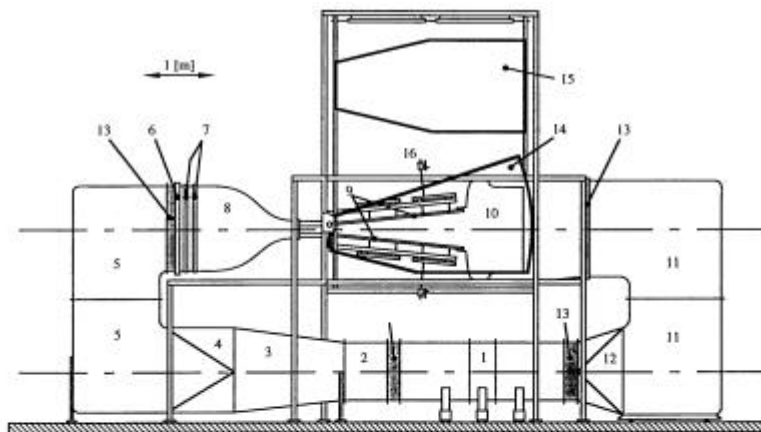


Figure 1: Experimental set-up for investigating two-dimensional, subsonic diffuser flows (IMHEF/EPFL)

Caption:

- | | |
|---|---|
| 1. fan | 9. diverging upper and lower test section walls |
| 2. coarse mesh screen | 10. plenum chamber |
| 3. conical diffuser | 11. elbow with turning vanes |
| 4. transition from round to rectangular section | 12. transition from round to rectangular section |
| 5. elbow with turning vanes | 13. flexible coupling |
| 6. steel honeycomb | 14. front sidewall (plexiglas) |
| 7. fine mesh screen | 15. rear sidewall (retractable for test section access) |
| 8. contraction | 16. ballscrew for angle adjustments |

