

END-WALL FLOW INVESTIGATIONS IN COMPRESSOR CASCADE

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For low aspect ratio blades, core flow suppression by secondary flow is significant. Passive vortex generators(VGs), requiring precise design, are to be utilized on end-walls of a compressor stage which was scaled from compressible to incompressible regime. In order to observe effects of the VGs, a cascade test is designed including end-wall geometry, measurement chain and a variety of VGs. A variety of previous numerical simulations around the VGs are helpful in order to obtain a comparable data base of VG characteristics. The scale up of the compressor blade to incompressible regime has been derived according to a chosen cascade facility, C1.

Besides an unavoidable pressure loss behind the VGs, they should be sufficient in decreasing the boundary layer thickness. After the guidance of numerical simulations around an uncontrolled blade, measurements are conducted behind the cascade with and without VGs. Before any unsteady measurement regarding vortices, flow velocity and time averaged pressure are measured behind the blades and also behind VGs. A 5-hole probe has been calibrated for that purpose.

5-hole probe calibration maps are obtained according to non-nulling technique. Calibration maps are shown in *Figure 1*. The angle of the probe with respect to the flow main stream is varied between $\pm 25^\circ$ in two axes perpendicular to each other and measurements are recorded at every 5° .

Four different planes behind the cascade are scanned with the 5-hole probe, thus 3-D velocity field information is obtained. Since any measurement in the very close vicinity of the end-wall cannot be conducted because of the probe thickness, the data field is extrapolated to the end-wall, considering that the first measurements are still in the boundary layer. A shape factor comparison coming out from the 5-hole probe measurements is presented in *Figure 2*.

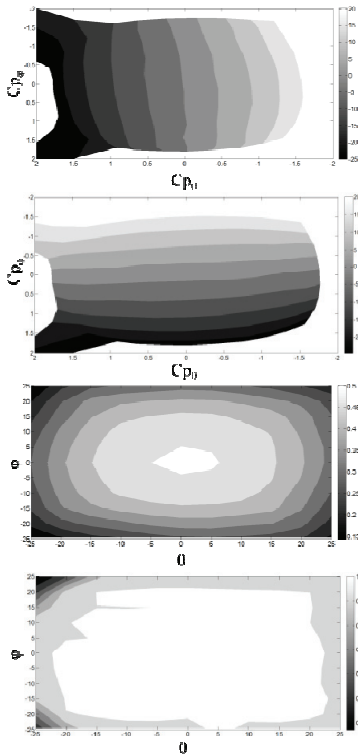


Figure 1 : Calibration maps for the 5-hole probe

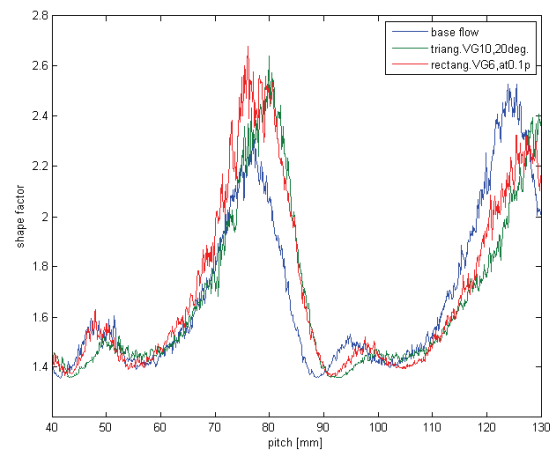


Figure 2 : Shape factor on the cascade end-wall for different VG control cases