

# STEADY AND UNSTEADY CASING WALL PRESSURE MEASUREMENTS IN AN AXIAL COMPRESSOR STAGE

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The European research program VITAL provides a breakthrough to achieve more environmentally friendly aeroengines. One of the innovative architecture is the Contra Rotating Turbo Fan wherein the noise emitted by the tips of the fan blades is reduced by lowering the rotational speed of the low pressure shafts. This causes the low pressure compressor to be highly loaded, thus more concerned by the instability issues. An innovative compressor design representative of a low pressure stage of a contra rotating fan architecture is tested in the VKI R4 facility. The aerodynamic performances of this compressor are investigated, as well as the positive effect of a casing treatment on the stability margin.

The aim of the present Diploma Course project is to conduct a detailed experimental survey of the unsteady phenomena located in the tip region of the rotor blades as it is known to contain the main part of the rotor losses and to be often responsible for the instability inception. High frequency response pressure sensors are mounted in the casing from upstream to downstream of the rotor blade row (Figure 1). They allow recording about fifty samples per blade passage thus providing the time-resolved static pressure field at the casing surface, using a specific interpolation method (Figure 2). An analysis of the endwall flow is carried out, and the influence of the blade loading, as well as the Reynolds number, is surveyed. Moreover a comparison between the experimental results and the CFD calculations allows validating the numerical results.

Soon after the end of the project similar measurements will be conducted to characterize in detail the effect of a casing treatment on the endwall flow. The present project will then serve as a reference to study the influence of such a treatment on the unsteady phenomena, and finally to be able to propose some criteria for designing more efficient casing treatments.

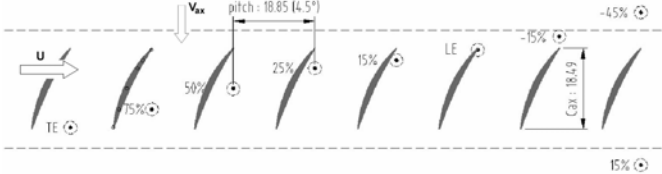
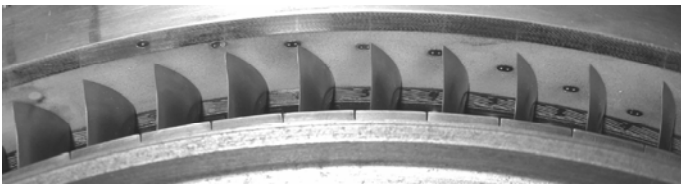


Figure 1: Disposition of the pressure sensors

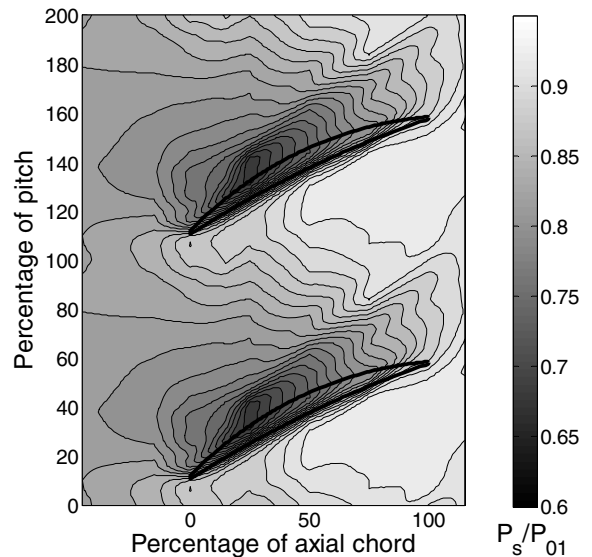


Figure 2: Time-resolved static pressure field at the casing surface