# Experimental validation of acousto-elastic interaction in a combustion setup

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## Introduction

Gas turbines are often used for electricity production. The NOx emission of such a turbine is largely determined by the ratio between fuel and air, where using more air leads to lower NOx emissions. A drawback of an excessive air supply is a decreased combustion stability, which can lead to acoustic pressure oscillations in the combustion chamber. These oscillations cause structural vibration and thereby fatigue, which decreases the lifetime of the combustor. This problem is studied in the EU project 'DESIRE'.

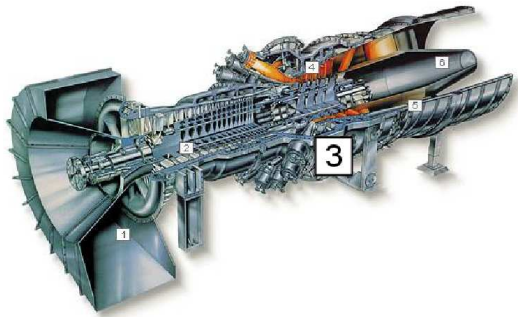


*Figure 1 : Gas Turbine, 3 is the combustion chamber.*

## Objective

The objective of the DESIRE project is to develop and experimentally validate models that can predict the vibration level of different liner designs [1] and use these to develop a more robust combustion chamber.

## Methods

Experimental validation of the numerical model is done on a specially designed test rig (figure 2). It consists of a flexible structure (liner) contained in a pressure vessel, similar to a gas turbine combustion chamber.

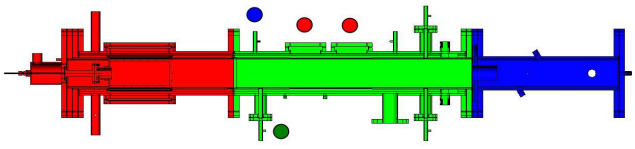

*Figure 2 : Cross section of the test rig design, the dots refer to the lines in figure 4.*

Measurement equipment includes static and dynamic pressure transducers, thermocouples, Planer Laser Induced Fluorescence and a laser vibrometer. Windows in the pressure vessel allow optical access to the liner for the vibrometer.

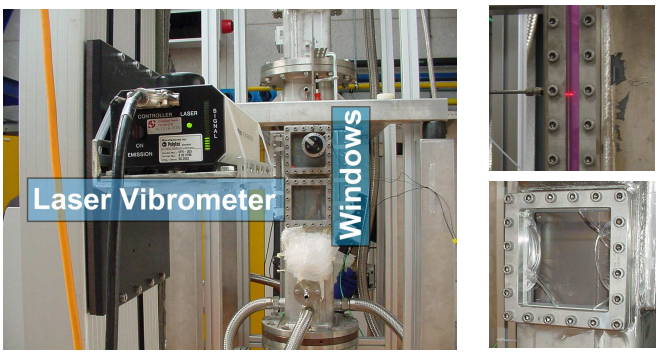


*Figure 3 : Laser vibrometer measurements on the liner.*

## Results

The test rig was completed in autumn 2004. Figure 4 shows an exploratory result, the vibration level and acoustic pressures in the combustion chamber and cooling passage.

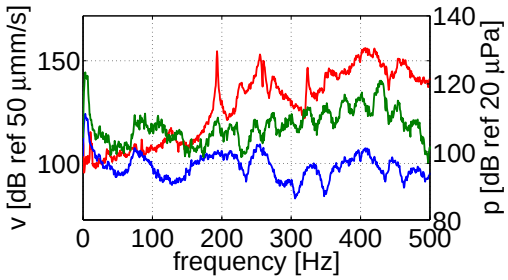


*Figure 4 : Signal level for structural velocity (red), pressure in the combustion chamber (green) and pressure in the cooling passage (blue), see figure 2.*

## Further research

- Performing more measurements
- Comparing with numerical models

## References

1. Huls, R.A. et al. (2004) A transfer function approach to structural vibrations induced by thermoacoustic sources, ICSV11, St. Petersburg, Russia.