ABSTRACT

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A new facility for dynamic turbomachinery and wind-tunnel testing

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Due to high levels of efficiencies reached over the recent years, current improvements in turbomachinery development become smaller from on each step to the next. New concepts like the geared turbo fan designs for aircraft engines lead to a new generation of low pressure turbines.

At the same time, especially for ground based turbomachines (e.g. steam and gas turbines for power plants), modes of operation changes from stable (aerodynamic) full load condition to interrupted operation at part load / aerodynamic off design operation.

Thus, the Leibniz University of Hannover is building up a completely new test facility for different turbomachinery applications like scaled radial and axial turbines and compressors, as well as wind tunnel and gas burner test rigs. The facility will be completed in mid 2019.

The facility includes the installation of up to eight rotating test rigs with a maximum power of 3 MW as well as several open loop as well as closed cascade and wind-tunnel applications. The test facility is powered by a 6.5 MW compressor station, providing compressed air to several test rigs.
This new compressor station can provide a mass flow rate up to 25kg/s at a maximum pressure level of 8 bar. Due to independend adjustment of pressure and temperature level, test rig scaling and operation can be done independently for Mach-Number correlation as well as Reynolds-Number .

The facility presented in this paper will also be able to change test rigs boundary conditions with high dynamic load gradients in order to account for unsteady operation and flow condition of real turbomachines.

This paper will provide an overview of the design and the capabilities of this new test facility in general, as well as for the design of modern turbomachinery test stands. The concept of burst protection as well as efforts to create a maximum level of stable and controlled rig environment with special regard to reproducibility of measured data will be shown.

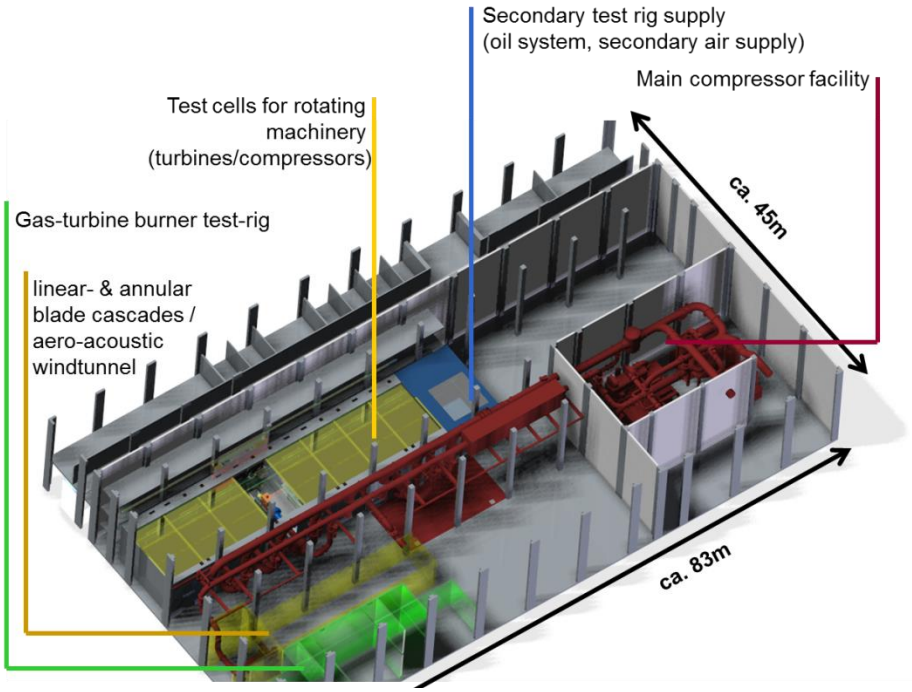

Fig. 1: Modell overview of the new test facility