Real flows in energy machines are extremely complex, difficult not only for mathematical description, but above all for experimental validation. Simplifications, which are often used to describe flow phenomena, lead to the omission of very important physical phenomena that actively participate in the generation of thermodynamic losses. The overall goal of the project is devoted to the problem of identifying non-stationary effects in transonic two-phase flows. Particularly important experimental verification and validation of the numerical codes used, as well as the improvement and development of the capabilities of measuring systems is the main research topic of many scientific centers, including the Department of Power Machines and Devices (KMIUE). In numerical modeling of both homogeneous and heterogeneous condensation, the numerical results must be subjected to accurate "calibration" by means of experimental studies. For this reason, it is also extremely important to improve and correctly calibrate the available experimental research methods.

The project has two parallel research paths. One of them is experimental research on two types of stator and rotor steam turbine blades, as well as to implement advanced experimental research methods to study flow phenomena in the transonic flow of water steam. The second is to supplement these studies with non-stationary flow analysis using advanced numerical codes.

The experimental tests proposed in the project will be conducted on the existing test channel installation for wet steam flow tests, which is integrated with the installation of a small steam power plant. The stand is a universal experimental tool for testing steam flow in a wide range of temperatures, pressures and wetness. The installation has the option of changing the configuration to use a nozzle tunnel with different configurations with moist air and steam as the working medium.

Parallel to the experiment, methods for analyzing experimental data will also be developed, including:

• Schlieren type "Z +" techniques with a new method using the RGB range to analyze the density distribution,

• techniques for determining the wetness mass fraction and the number and average droplet radius developed at KMiUE,

A very valuable result of the research will be new experimental data on wet steam flow for two types of stator and rotor turbine blade geometry, which can be used to develop more accurate correction relationships or modeling numerical codes, e.g. condensation steam flow. The analyzes proposed in the project are part of research aimed at improving energy machinery and equipment. This is a key problem from the point of view of energy technologies, because even a slight decrease in the efficiency of individual elements of the selected energy installation significantly reduces electricity production or thermal efficiency.

Experimental studies also carried out in previous years at KMIUE, as part of various projects in cascade channels supplemented by numerical analysis show great potential in the possibility of obtaining high-quality research results during the project implementation.