PIV IN A ROTATING CHANNEL

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The main goal of this project is an experimental study of the flow in micro gasturbines impellers and internal cooling channels. This flow is characterized by a low Reynolds number, high Coriolis forces (due to high rotational speeds), surface roughness (because of manufacturing techniques) and a considerable heat transfer due to the closeness of the hot turbine and the compressor.

A new facility has been built to study these effects. It consists of a 0.7m long divergent channel, mounted on a rotating disk, respecting the main scaling parameters of the radial impeller passage: Re number from $3 \cdot 10^3$ to $3 \cdot 10^4$, Rotational number between 0.1 and 0.55, and Bouyancy numbers up to 0.73

Velocity fields in the rotating channel were measured by means of Particle Image Velocimetry. Measurements are taken with a high speed camera and a continous laser, both rotating with the channel on the disk. This provides a direct, hence more accurate measurements of the relative velocity as well as time accurate measurements of the flow variations. A compact Laser Diode System is used to provide illumination: it is coupled to a fiber cable and a line generator. Volume flow is measured as a function of the pressure drop occuring in a Venturi tube connected to the rotating channel and adjusted by means of an upstream fan / throttle valve combination. A protective cage with a circular passage, connected to an aspiration system, collects the seeding particles at the channel exit.

Computations with NUMECA Fine code have been run for Re = 11285 and Ro = 0 to 0.33 in order to compare the velocity profiles obtained with PIV to those obtained with the solver to see the influence in low Re number turbulence of Coriolis forces.

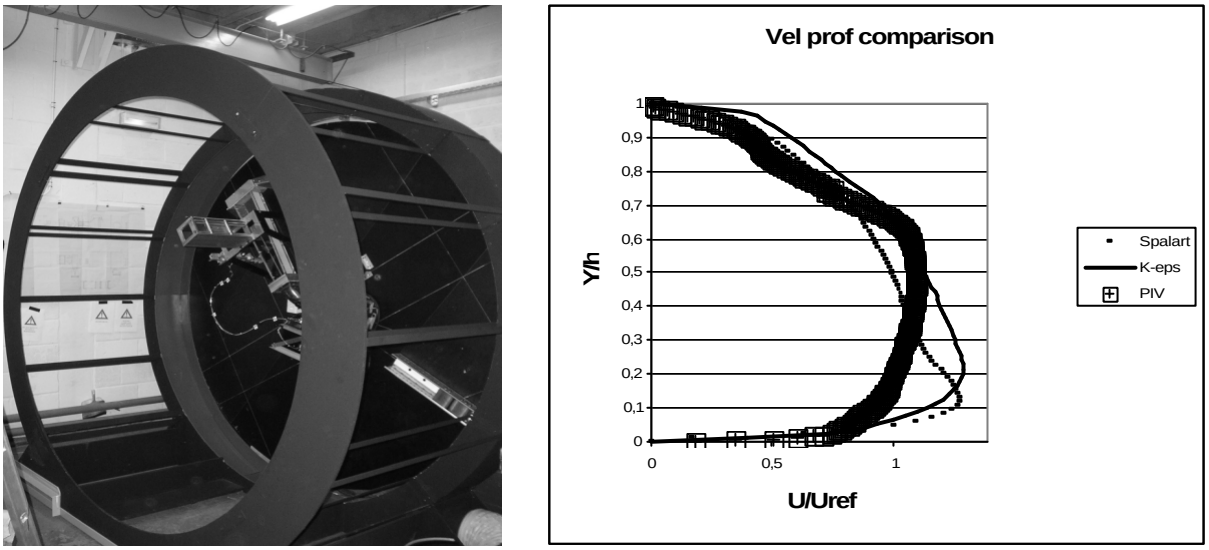

Figure 1: Front view of the rotating facility and velocity profile comparison for Re=11285 and Ro =0.33