# Scaling Effects During Impulsive Spin-up and Spin-down - A Study into Vorticity Propagation

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The study focuses on the formation of a boundary layer and the corresponding behaviour of vorticity during impulsive spin-up and spin-down motions of a rotating tank. In particular, the difference between the dispersion of vorticity in a quiescent flow and in a flow with an established pressure gradient and a counter-oriented vorticity is investigated. A rotating tank is accelerated from rest to a rotational speed (spin-up) until the flow settles into a solid-body rotation and afterwards stopped completely, until eventually the initial quiescent state is reached (spin-down). Focusing on scaling effects of the occurring phenomena near the side walls, a wide range of Reynolds numbers is of interest. Multiple (numerical and experimental) approaches are pursued to understand the complex interplay of viscous effects, pressure gradients, Coriolis effects and centrifugal forces on vorticity propagation. Numerical investigations cover the low Reynolds number regime via direct numerical simulation (DNS) and provide valuable insights into the flow development. To overcome the limitations caused by computational recourses, phase-locked planar/stereo particle image velocimetry (PIV) experiments were performed in an acrylic container at KIT. Both studies delivered consistent results but also revealed deviations, which can be attributed to the varied rotational speeds of the tank. During spin-down, occurring instabilities lead to enhanced convective mixing of the flow. Radial plumes inject low momentum fluid in radial direction, temporally increasing the time scale of the spin-down process. The field of available Reynolds numbers is planned to be completed by additional PIV studies in the one-of-a-kind CORIOLIS platform in Grenoble. The gathered data allows a comprehensive comparison of the observed phenomena, which might lead to a deeper understanding of the acting forces during the different stages of the process. The momentum of the radial plumes and their influence on both, the retracting solid body rotation and the wall shear stress at the outer wall of the tank can be investigated.