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Combined PIV-LIF measurements in a turbulent liquid-liquid Taylor Couette flow. FLORENT RAVELET, RENE DELFOS, JERRY WESTERWEEL, TU-DELFT, LAB. FOR AERO AND HYDRODYNAMICS TEAM — We are building up an experiment to study the dispersion process of two immiscible fluids in a turbulent Taylor-Couette shear-flow. The two cylinders (radius $r_i = 110$mm and $r_o = 120$mm with a gap height of 180mm) are counterrotating at a maximum speed of 30rad/s. The liquids are a low-viscous oil and a refractive index matched NaI-water solution to get transparent dispersions. The viscosity ratio is close to one and the density ratio is 1.6. Different phase ratios are used in the experiments. When the two cylinders are counterrotating, a dispersion is formed above a certain threshold in speed, with a sharp increase in the torque measured on the inner cylinder. Again lowering the speed, hysteresis is present in our system. Since we do not use surfactants, the dispersions are not stable: a balance between turbulent breakup and coalescence gives a certain droplet size distribution. We study the dynamics of the droplets by LIF: the oil phase is marked with a fluorescent dye, the flow is illuminated with a Nd:YAG laser, and imaged using a low-pass filter to only catch the fluorescence light. We are also measuring the 3 components of the velocity field in a plane normal to the mean flow by stereoscopic PIV, and we will compare the dilute two-phase flow with a single-phase flow.

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