

Design of a backlash-free control unit and aerodynamic measurements at a wing-fuselage connection of a sailplane

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1. Outline

The target of this bachelor thesis is the design of a backlash-free control unit and aerodynamic measurements at a wing-fuselage connection of a sailplane in the Regensburg Wind Tunnel (RWT) with the objective to complete the automation of the measuring process and to raise the quality and reproducibility of the measuring results.

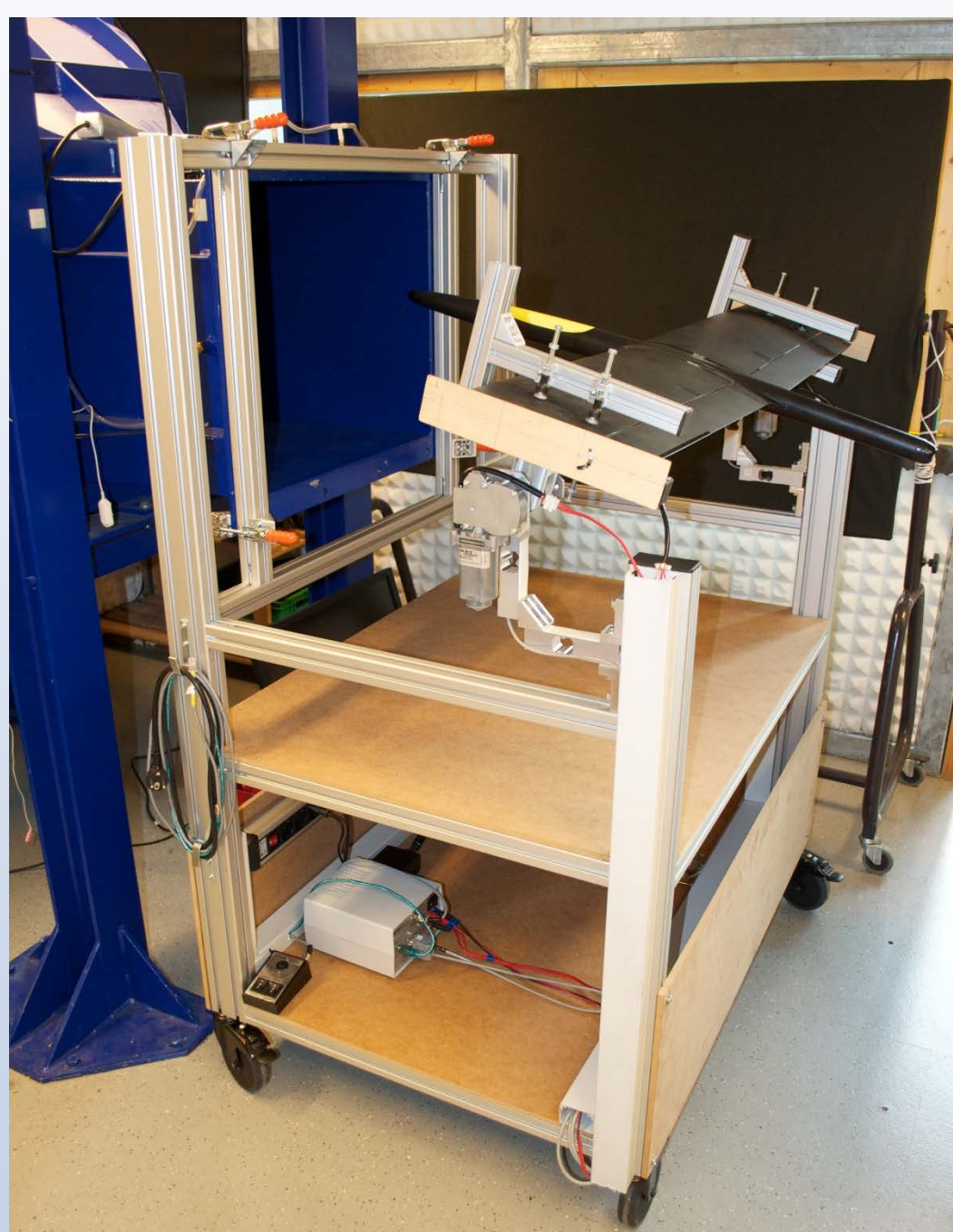


Fig. 1: Test stand in the old configuration mounted in the Regensburg Wind Tunnel

The RWT was put into operation in May 2006, consists of a closed circuit (Göttingen-type) and has an exchangeable test section (open, $\frac{3}{4}$ open, closed). The covered speed range goes up to 48 m/s and the rate of turbulence reaches 0.5 % when operated in the open section.

2. New control units

In order to reach a higher repetitious accuracy and a backlash-free regulation of the angle of approach a new control unit was designed and mounted at the test stand. Through a crank, which is connected to a 24 V DC-linear actuator, the rotary axis turns. For a synchronous actuation of both units a new LabView Program was developed. This setup gives the possibility to change the angles with an accuracy of 0,01°.

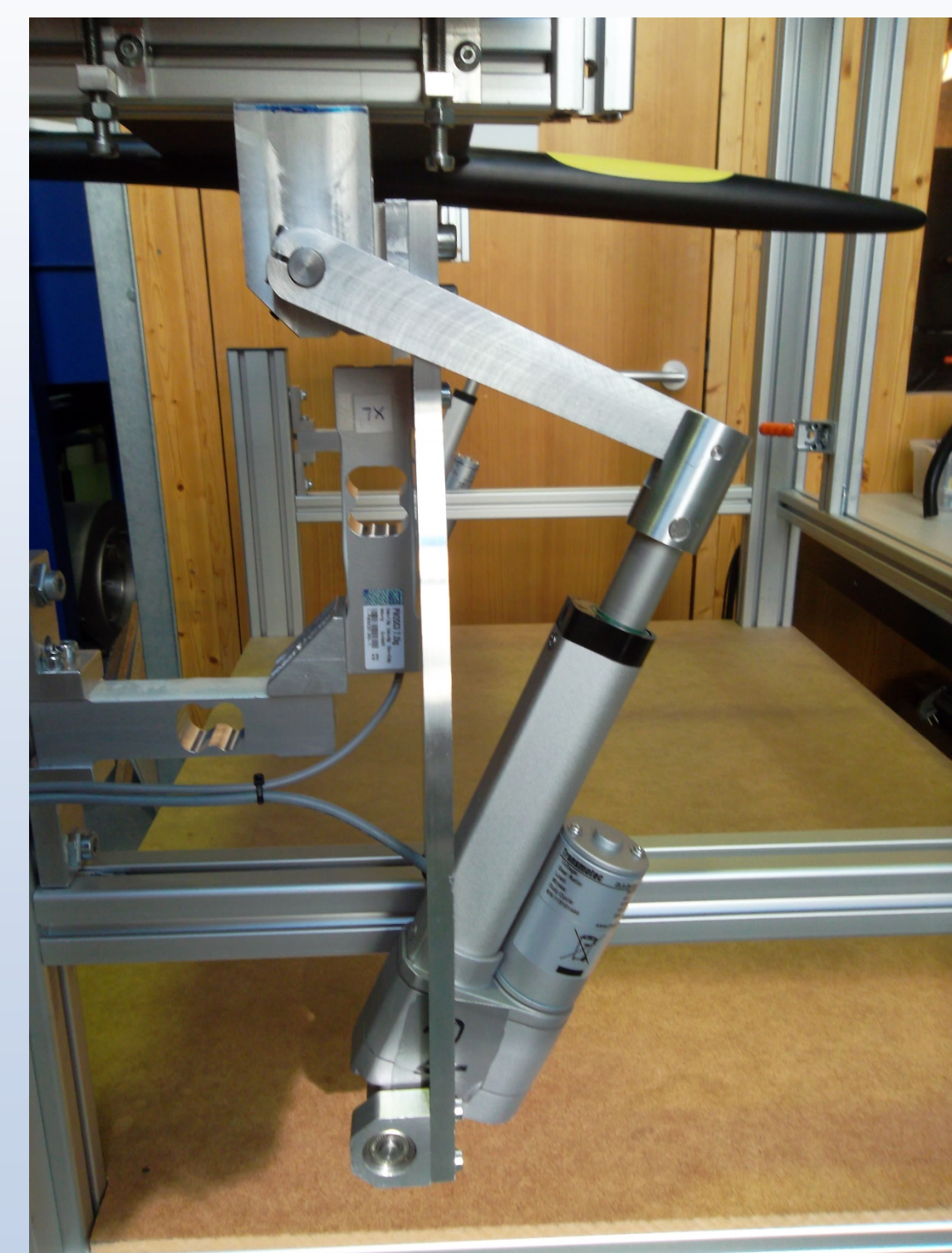


Fig. 2: Test stand with installed aircraft model and the new control units

3. Automated LabView program

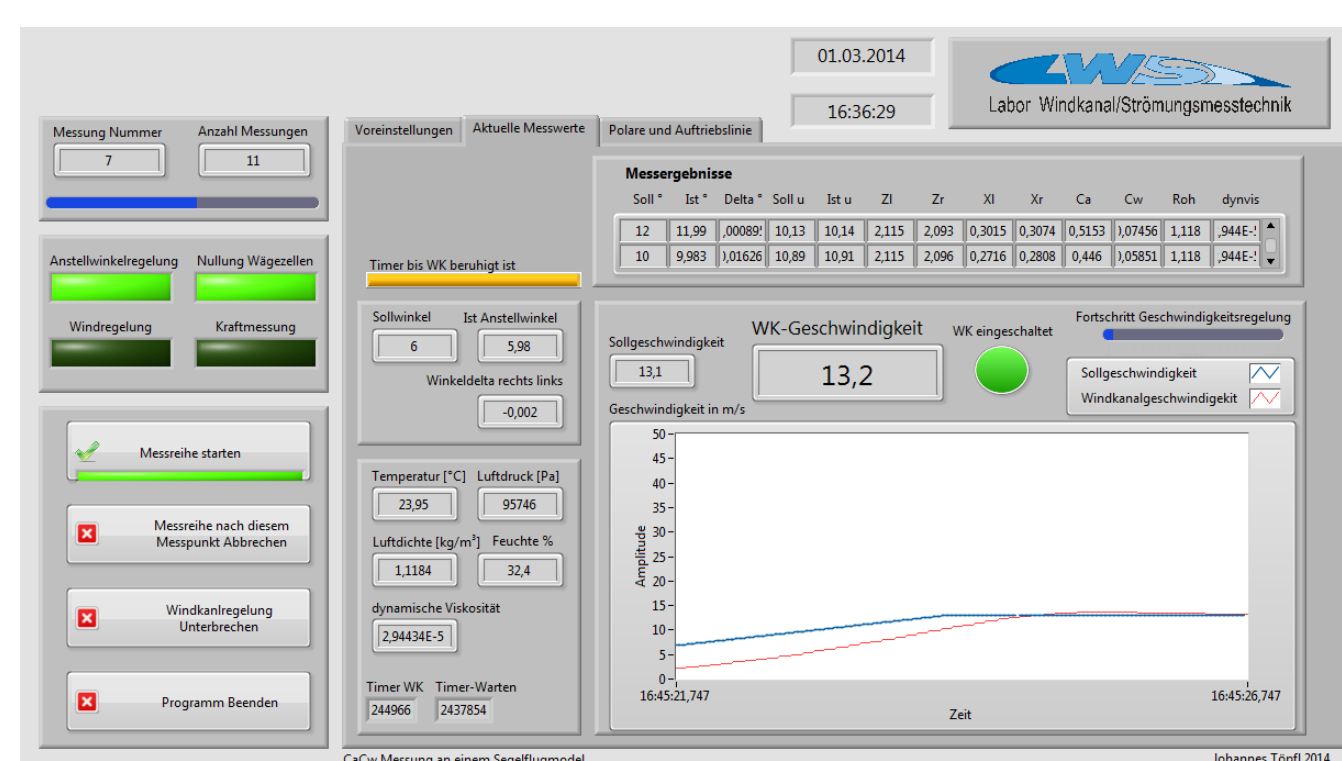


Fig. 3: This register is showing live measurements while running the test sequence

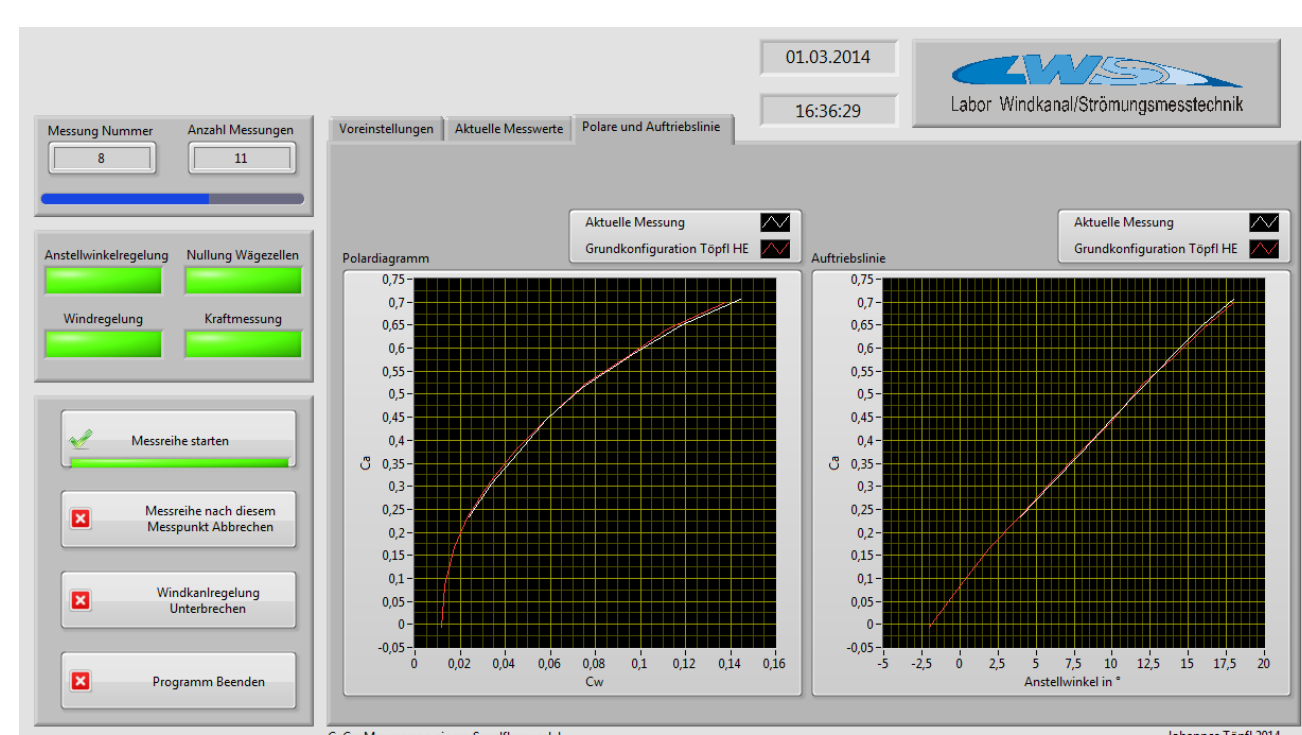


Fig. 4: Automated LabView program for the entire test sequence

A new LabView® application performs the entire test sequence on a complete automated basis. It records the lifting and resisting forces under several user defined angles of attack and displays online the coefficients of lift and drag on an appealing graphical user interface.

4. Test measurements

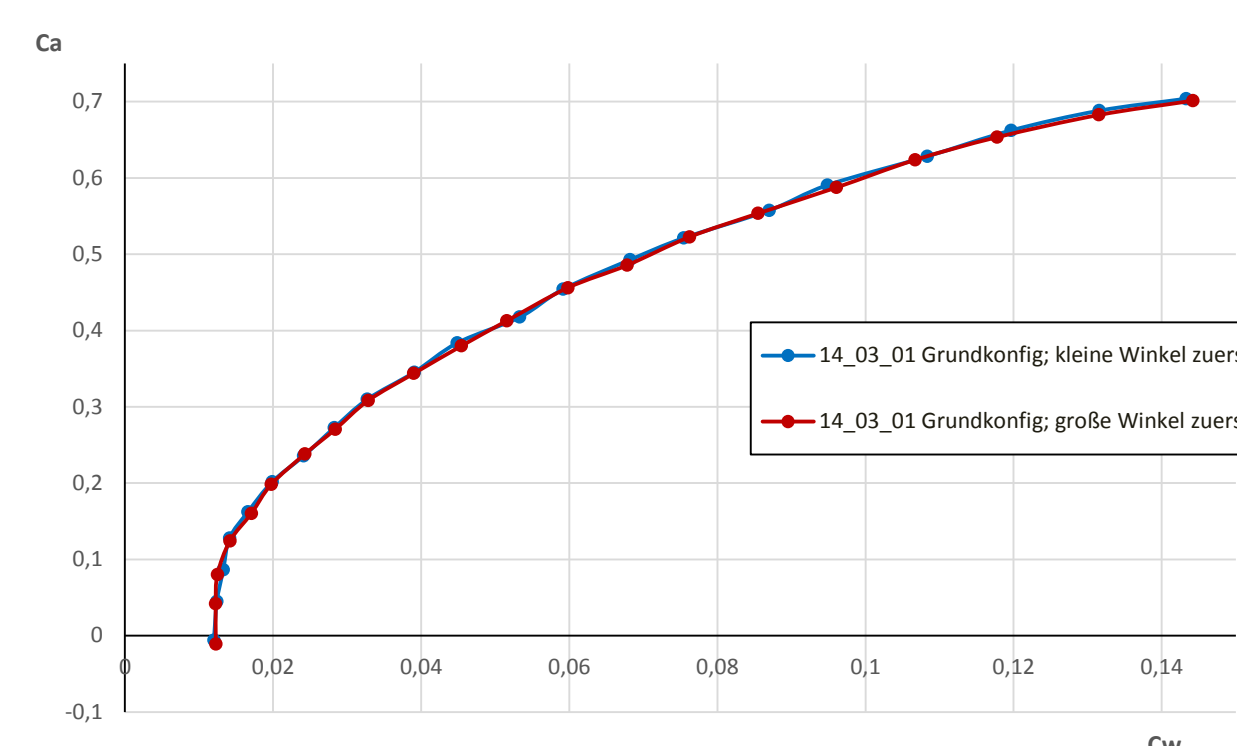


Fig. 5: Polar-curves of two test measurements showing the reached reproducibility through the made changes

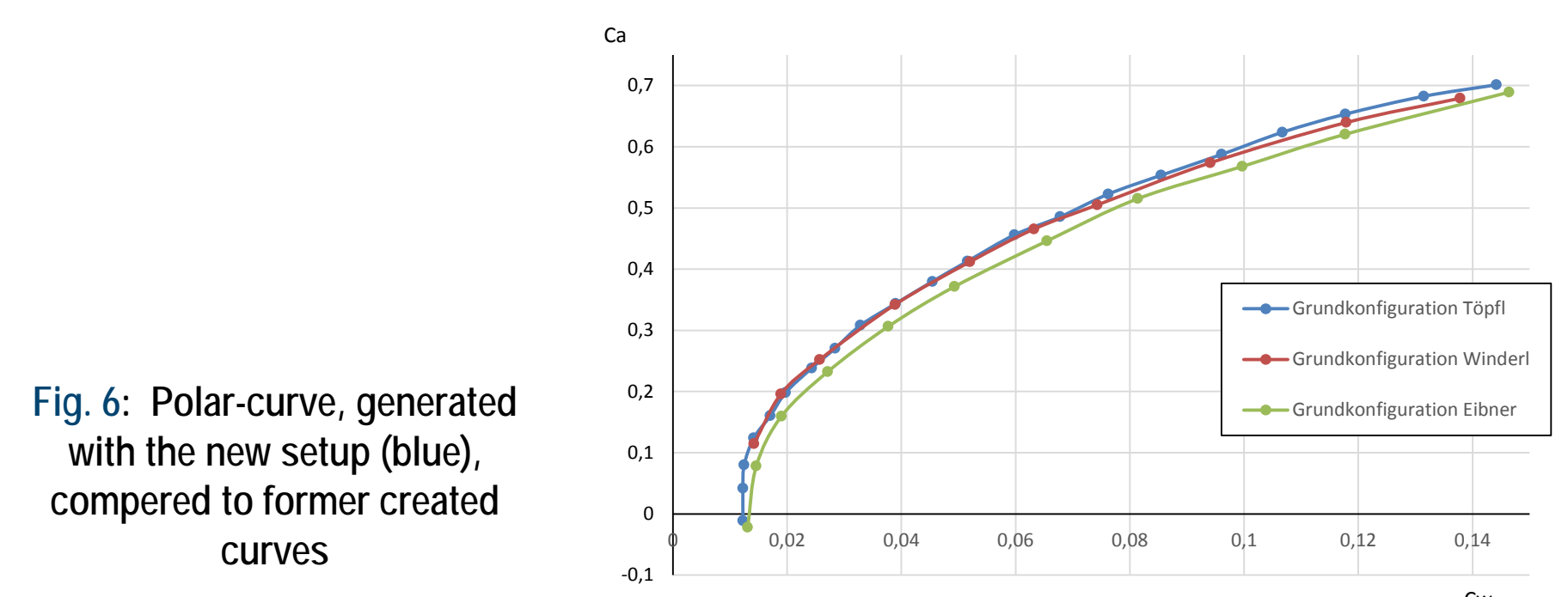


Fig. 6: Polar-curve, generated with the new setup (blue), compared to former created curves

The charts above show different test measurements. Fig. 5 shows two complete test series with a angle step of one degree between two points. The high consistency shows the reached reproducibility through the new control units and the automated LabView program.