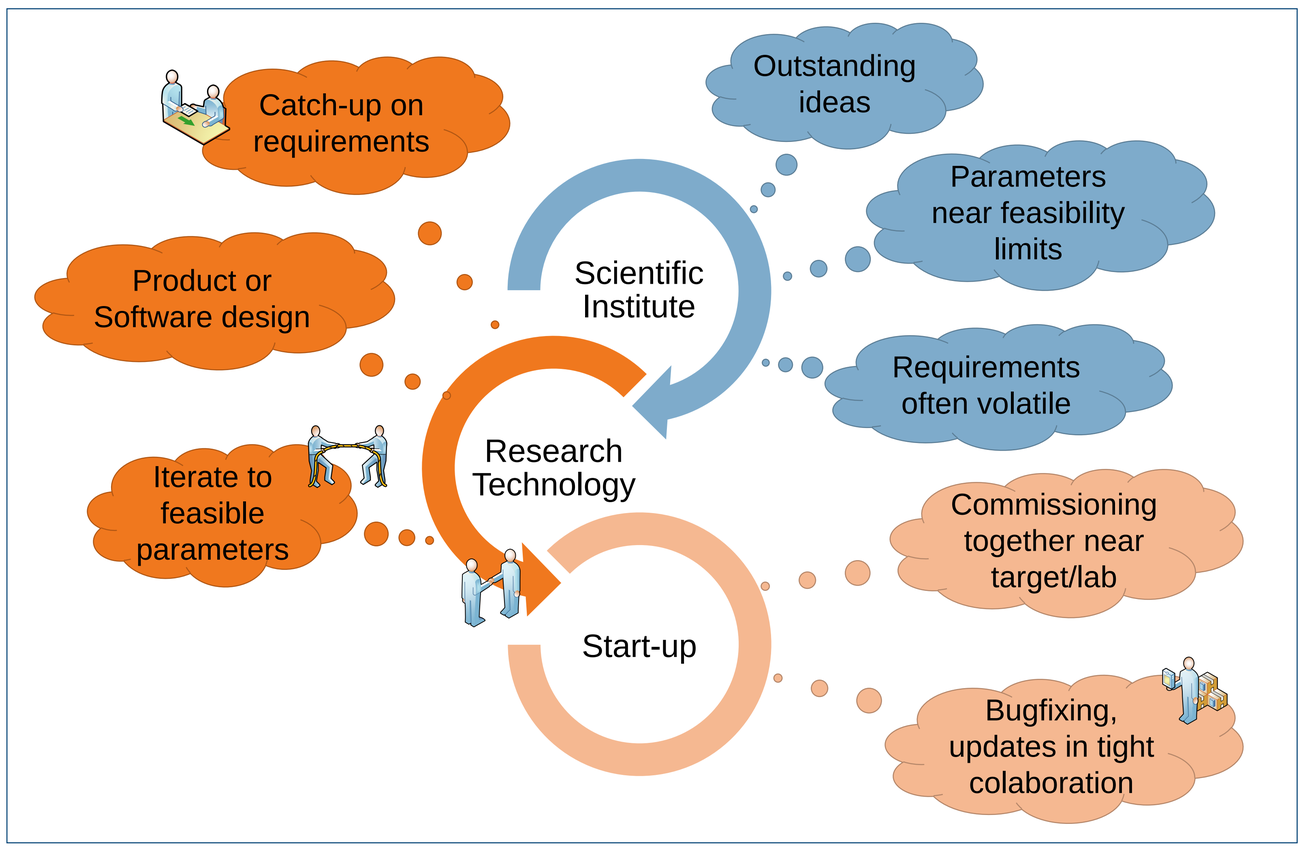
Challenges in automating experimental setups

HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF

Nicole Wagner, Department of Research Technology (HZDR)

Working Environment



Picture 1: Collaborative working

Experimental scientists always have a need for high flexibility in realizing their setups. That poses a huge challenge for the engineers who try to catch up and have the goal to minimize the variety of devices or to standardize the interfaces between the components. This area of conflict mostly covers motion tasks, machine safety and data acquisition. Scientists and engineers work hand in hand to find the best matching system architecture.

Software Development: Motion-Control

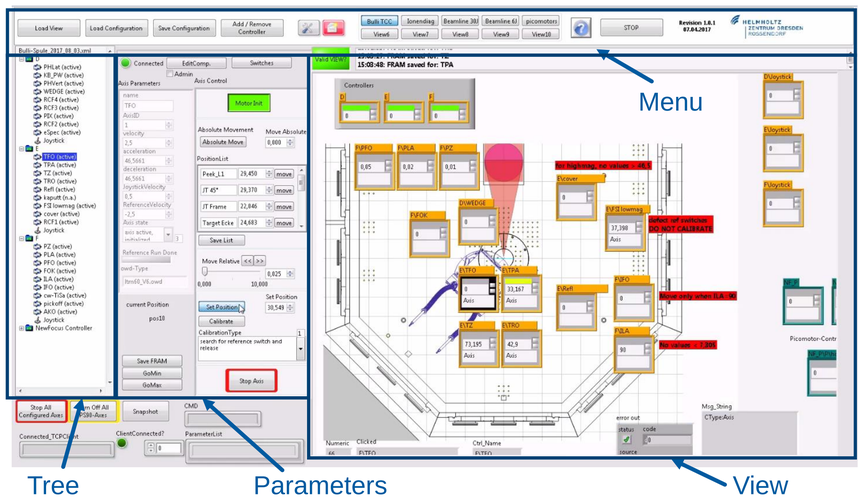
The software Motion-Control is able to combine multiple instances of two types of industrial motion-controllers in one flexible user-interface.

Current Status:

- Support for New focus controllers and Owis PS90
- Tree for user-defined setup and named axes
- User-defined views for optimized overview in experiment
- Snapshot logging of current positions

Planned:

- Integration of own piezo racks
- API for remote control with TCP and OPC/UA
- Performance and stability optimization



Picture 2: User Interface of the Motion-Control software

Hardware Development: Piezo Rack

The Piezo Rack was designed and built for connecting a high number of piezo/pico motors into one cabinet rack. The software interface is completely in our hand – we already used it to integrate with several control systems and provide a UDP interface. This is available for custom integrations done by the user.

Picture 3: Piezo Rack with motors [2]

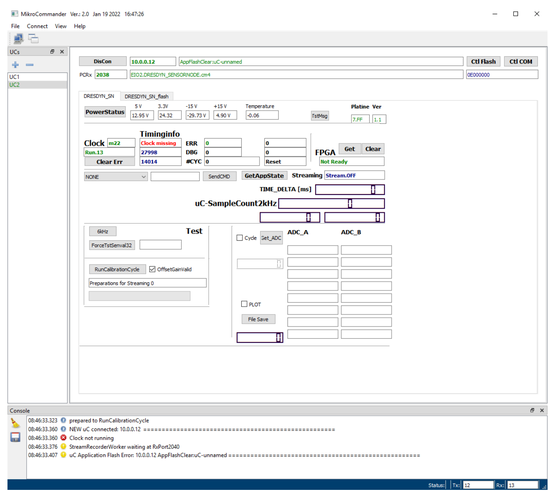
Hardware-Features:

- Large channel-count on small space (19“/3U for 36 motors)
- Control of various piezo motors
- Independent of manufacturer
- Low costs per channel in comparison to other manufacturers (material)
- Pc-based user-interface is MikroCommander
- One interlock input per rack
- Ideas for additional cards: closed-loop-control
- Ready for series production

Additional Features:

- Interface via Ethernet with open protocol or API
- HMI-Interface: MikroCommander (© HZDR) for commissioning
- Chronological view of alarms
- Available integration for EPICS, Karabo and LabVIEW
- Scientific institute developed a wireless controller to remote control the piezo rack and other motion controllers

Picture 4: Handheld controller [1]



Picture 5: MikroCommander

System Implementation: Penelope Machine Interlock System

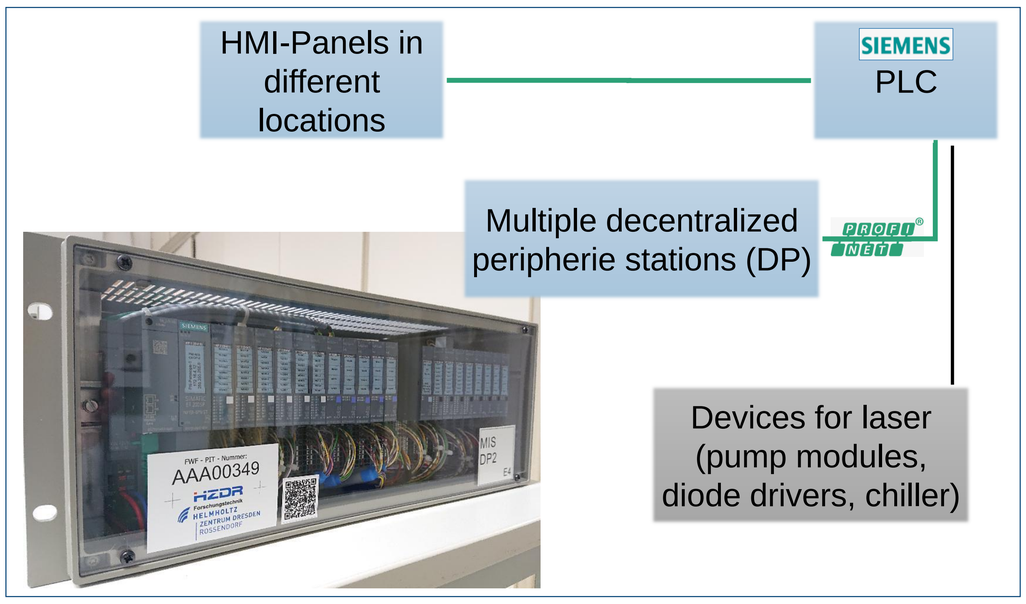
In the field of machine safety and environmental monitoring, we typically use reliable and safe industrial technologies like PLCs by Siemens communicating over industrial standardized protocols like OPC/UA or Profinet.

Current Status:

- Integrating 32 chiller devices
- More than 32 laser diode driver
- 16 pump modules
- modular and pluggable connection stations (Fischer connectors)

Planned:

- Readout and visualization of environment sensors (temp., humidity, ..)
- Control and visualization of vacuum pumps and sensors
- Communication interface via OPC/UA



Picture 6: Architecture MIS

Department of Research Technology · Instrumentation
Nicole Wagner · n.wagner@hzdr.de · www.hzdr.de

[1] S. Grams/C. Eisenmann (FWKT)
[2] N. Winkler (FWFE)

DRESDEN concept
SCIENCE AND INNOVATION CAMPUS