HZB Helmholtz Zentrum Berlin

Undulator Control at BESSY

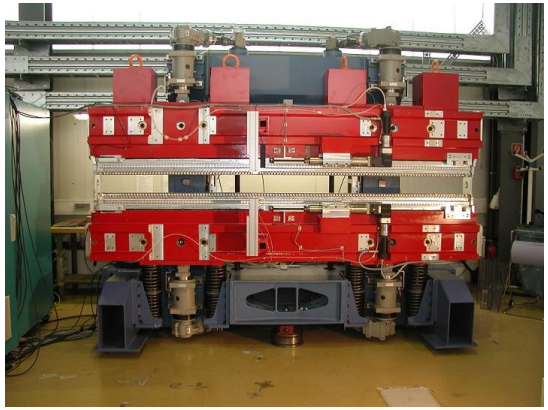
Overview

- Undulator Components
- Model for communication
- Ways to communicate
- Standard movement
- Simultaneous movement of gap and shift
- Dynamic speed control
- Documentation

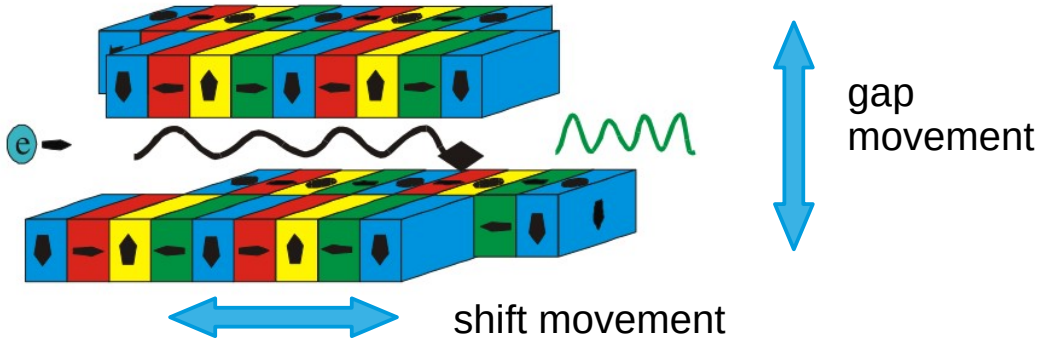
Undulator components, shown at UE49

- 2 split bars of permanent magnets above and below vacuum chamber
- Motors control vertical movement towards chamber: gap drive
- Motors control horizontal movement of split bars: shift drive

UE49

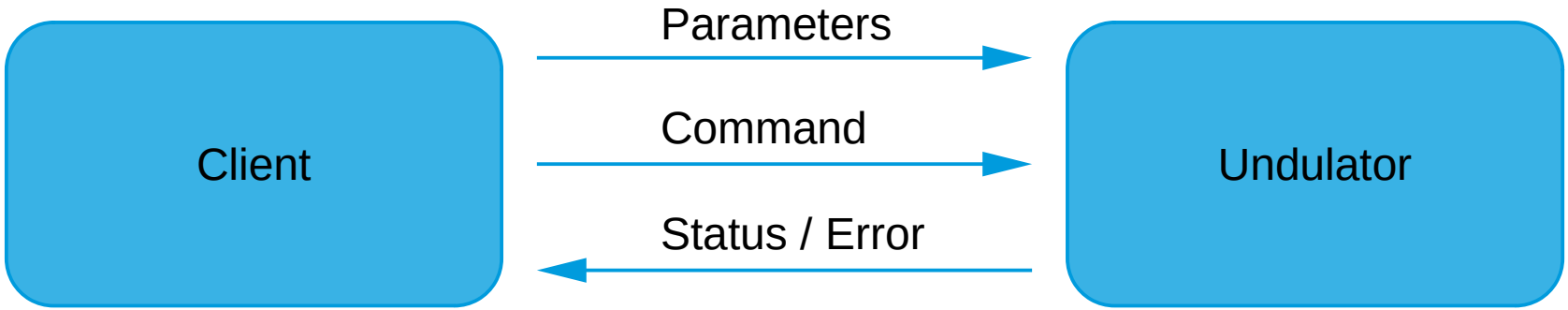


magnet layout



Model for communication

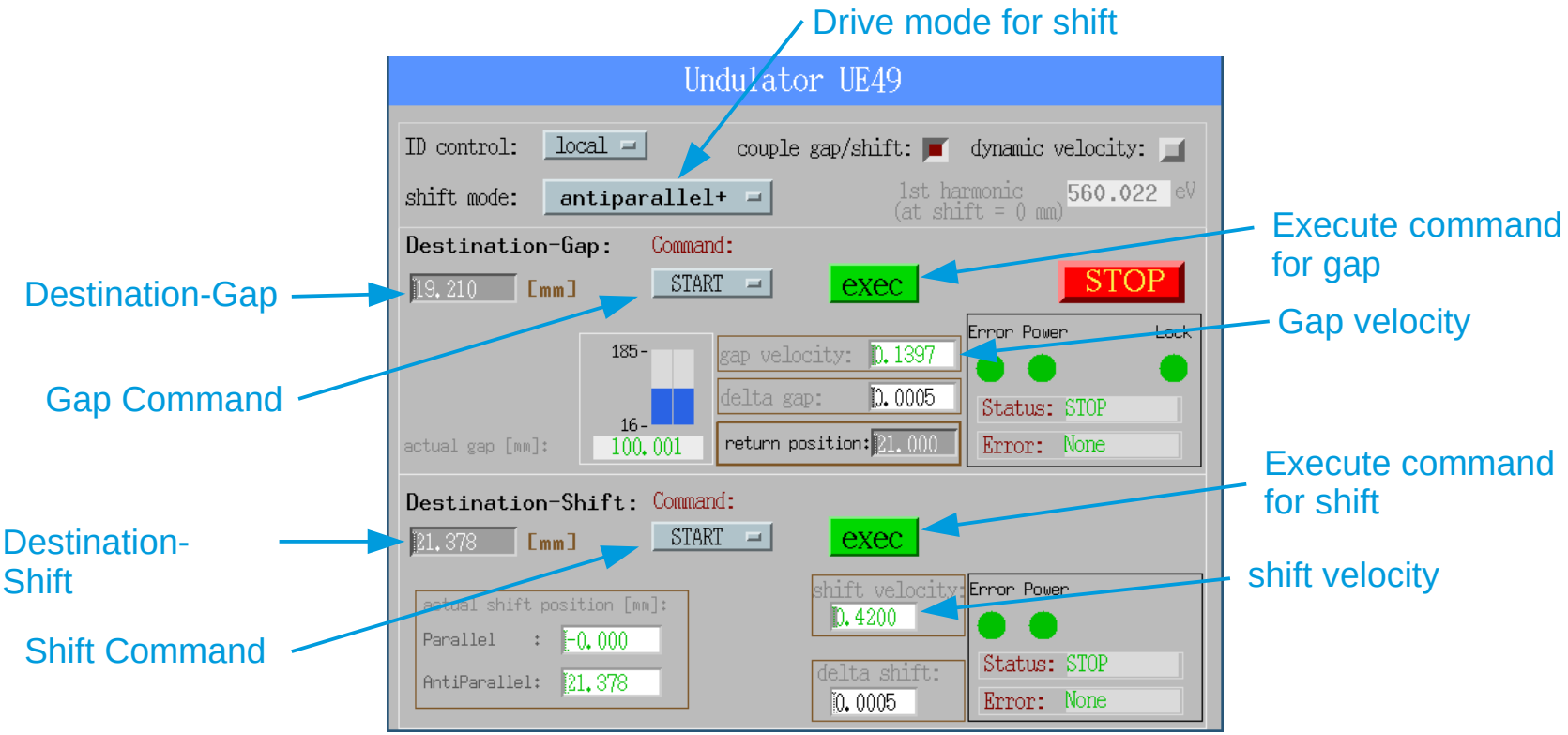
- Command, e.g. “START”, “STOP”
- Parameters, e.g. “destination gap”
- Status and Error, e.g. “run”, “stop”



Ways to communicate

- Channel access
  - Easy to use, many CA clients exist
  - Only a network connection is needed
  - Access control via channel access gateway
- CAN Bus
  - CAN Interface needed at the client
  - CAN bus cable to undulator needed
  - Better real-time capabilities

Standard movement: ID user panel



Standard movement: principle steps

Gap- and shift drive work like independent devices, you have to do the following for the gap- and the shift drive:

- Set movement parameters:
  - Destination
  - Velocity (optional)
  - Drive mode (optional)
- Give Command “RUN”
- Monitor run-counter, status and error during movement

Standard movement: end of move detection

How to properly detect that a movement is finished

- The status usually is either „RUN“ or „STOP“
- Longer movements change the status from “STOP” to “RUN” and back again to “STOP”
- For very short movements, the status may remain „STOP“ all the time
- The run-counter is guaranteed to increase each time a movement is finished.

⇒ If you must wait for a movement to finish, always monitor the run-counter

Simultaneous Movement of Gap and Shift

The command always goes to gap- and shift drive. Both drives start and stop moving at exactly the same time. These are the steps:

- Select “couple gap/shift”
- Set movement parameters
  - Destination for gap and shift
  - Velocity for gap and shift (optional)
  - Drive mode for shift (optional)
- Give Command “RUN” (to gap drive, starts shift, too)
- Monitor gap/shift run counter, status and error during movement

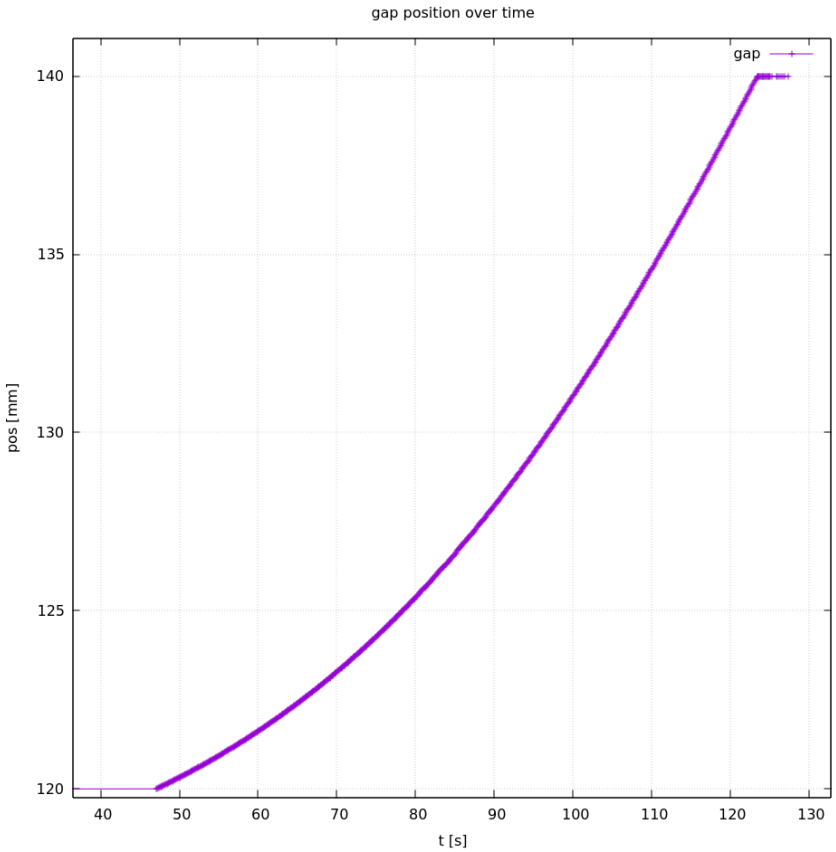
Dynamic speed control

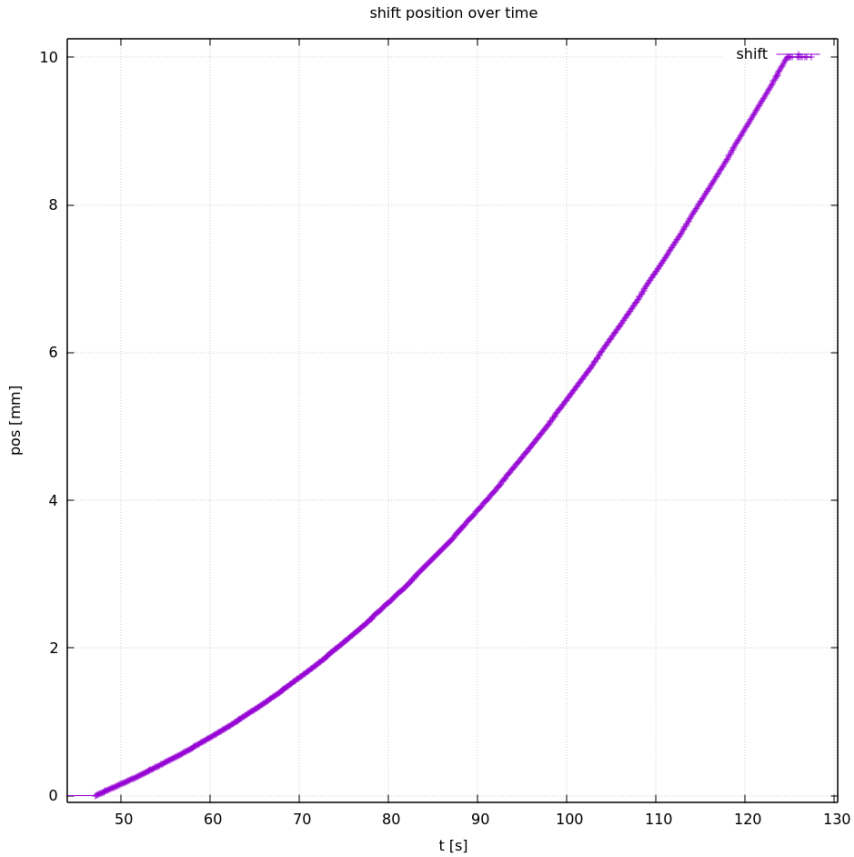
- Gap and shift movement speed can changed during movement from 0% to 100% with a resolution of 16 bits each.
- Available for Channel Access and CAN Bus
- Gap- and shift velocity guaranteed to change at the same time since they are transferred as a single value (Channel Access: waveform, CAN Bus: 32 bit data frame)

Dynamic speed control – test setup

- Speed setting with a python script using caproto library
- Set velocity dependent on current gap with a rate of about 10 Hz
- v(x) is a quadratic function, taken from a table with linear interpolation
- Position is taken from Ndi[n]PmsPos records that are updated with 10 Hz with camonitor
- Current velocity is calculated from measured positions and time stamps
- Results plotted with gnuplot

Dynamic speed control – test results

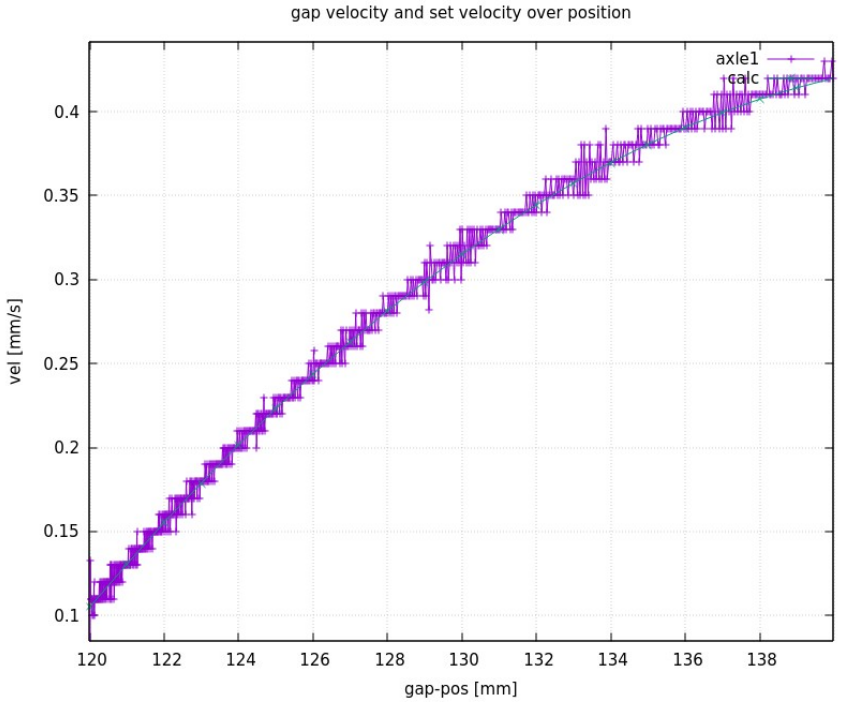




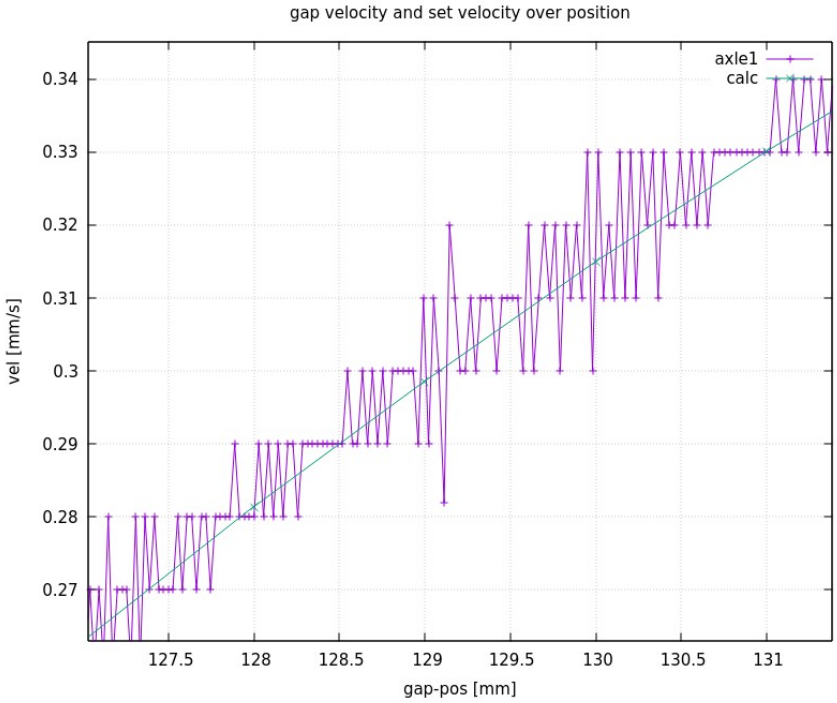
Dynamic speed control – test results

Measured velocity versus set-velocity

Full scan

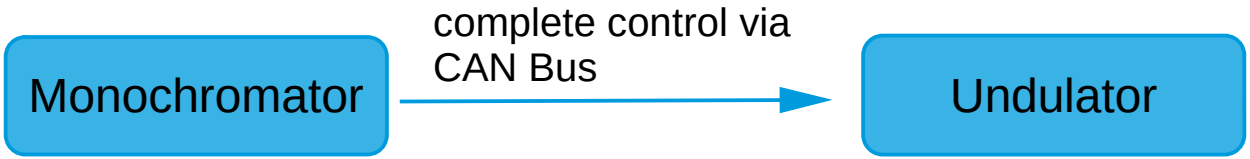


detail

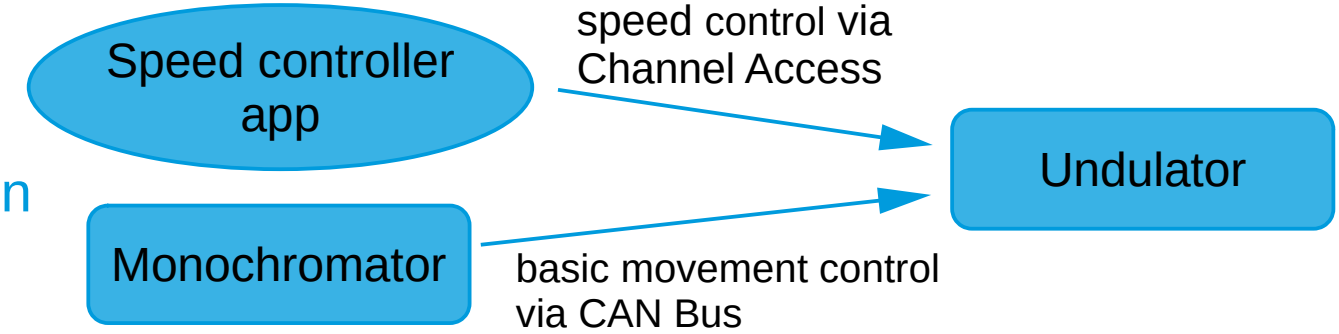


Dynamic speed: possible configurations

Speed control by monochromator



Speed control by external application



Speed control on insertion device

Documentation

- Main web site
  https://www-csr.bessy.de/control/idcp-documentation/
- Common user interface
  https://www-csr.bessy.de/control/idcp-documentation/idcp_user_interface.html
- CAN Bus Interface
  https://www-csr.bessy.de/control/idcp-documentation/wup_can.html
- Dynamic Speed
  https://www-csr.bessy.de/control/idcp-documentation/idcp_user_interface.html#dynamic-speed