

PLC Use at European XFEL

PLC Based Controls at ICALEPCS 2019

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The PLC installation at European XFEL

We are based on industrial components produced by Beckhoff Automation GmbH (IPCs) and PLC (61131-3 compliant) implemented with TwinCAT for all x-ray photon-system (mainly TC3.1, TC2.11 in undulator systems). These offer:

- TwinCAT based software with full-fledged diagnostic tools and interface to Automation Interface
- EtherCAT Fieldbus – RT, fast and truly open communication standard
- Cable redundancy
- EtherBridge PLC-to-PLC RT intercommunication
- Wide variety of control terminals and motors available off the shelf (servos, steppers, ADCs, DACs, encoders, communication, I/O.....)
- Integrated EtherCAT equipment (up to now: PI, Elmo MC, Technosoft, Festo, tested Newport-Hexpod)

The PLC installation and use at European XFEL (cont.)

We have production installations:

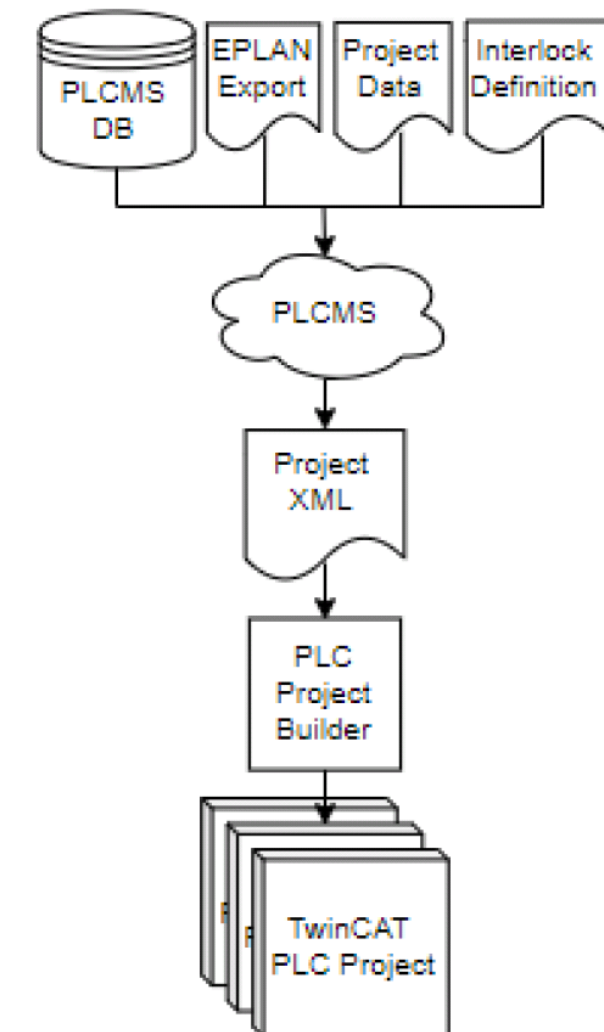
- ~120 xC6920-0050 (TC3.1, Win 10 LTS)
- ~100xC6925 (TC2.11, WinXP, cell control, undulators)
- 3x C5210 (TC2.11, CCN, undulators)
- ~25 xCP6609 (TC2.11: WinCE integrated touch panel PC for movable equipment, PumpCart&BakeoutOven)

For test setups (legacy):

- ~10-15 x C6015 (TC3.1: WinCE specially for in-the-field level-0 tests)
- ~25x C6920-0030 (TC3.1: WinCE)
- < 10 x CX9020 (TC3.1: WinCE)
- < 5 x CX1020 (TC2.11 obsolete, to be replaced)

The PLC code at European XFEL (not undulator system)

- Automatic PLC project generation from:
 - Electrical documentation Eplan P8, xml exports
 - Interlock definition, via spreadsheet
 - Using Python 3 + Object Relational Mapping (ORM) + SQL database backend
- Version control under GitLab (plus Subvesion for the generated projects)
- Self-description, including names and parameteres, of all *SoftDevice* instances at connect time to karabo (EuXFEL SCADA)
- Issues and feature planning & tracking via Redmine
- Deployment and configuration via Puppet
- Monitoring via Nagios



Already installed equipment in photon systems (undulators not included)

■ Gauges and temperature sensors:	>600
■ Vacuum pumps:	>600
■ Analog signals to be digitized and processed:	>300
■ LED:	>100
■ Stepper motors:	>2200
■ Piezo motors:	>220
■ DC motors:	~3
■ Servo motors (standard and <i>small servo</i> technology):	>15x linear, ~ 6x 3-phase
■ Incremental encoders:	>1000
■ Absolute encoders:	>230