Progression Towards Adaptability in the PLC Library at the EuXFEL

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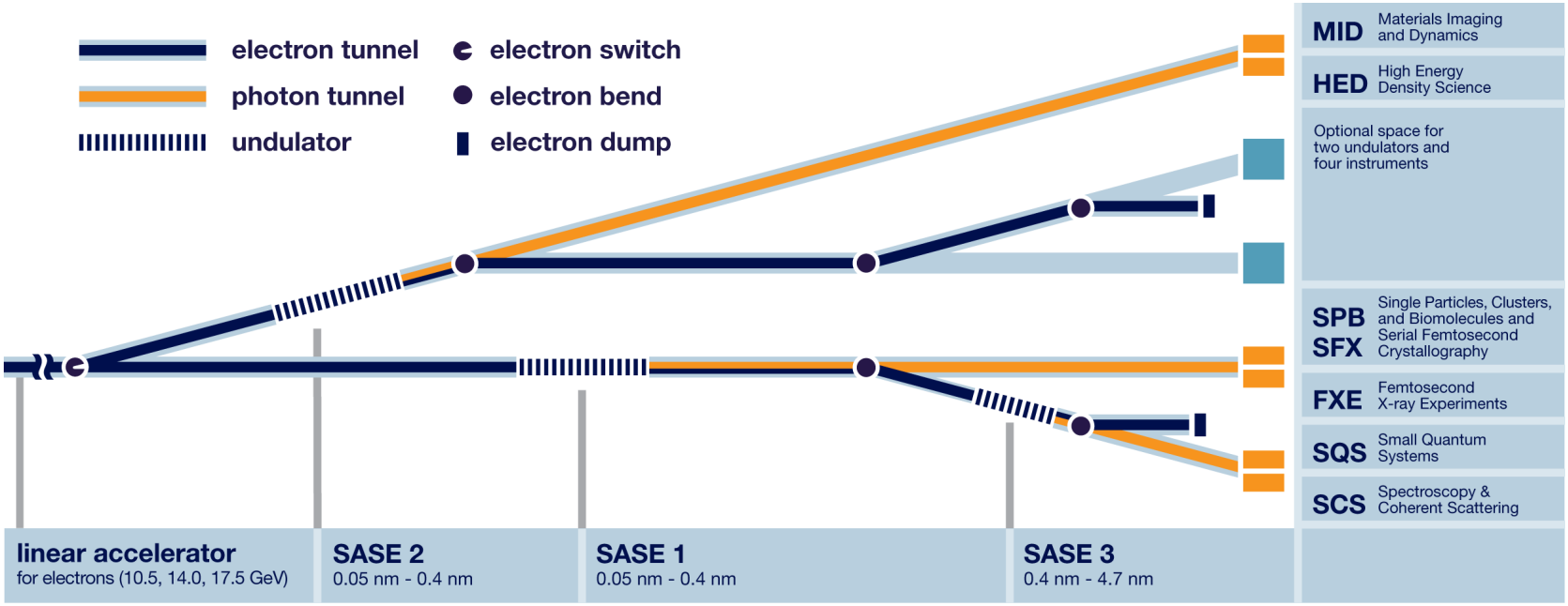
European XFEL at a glance



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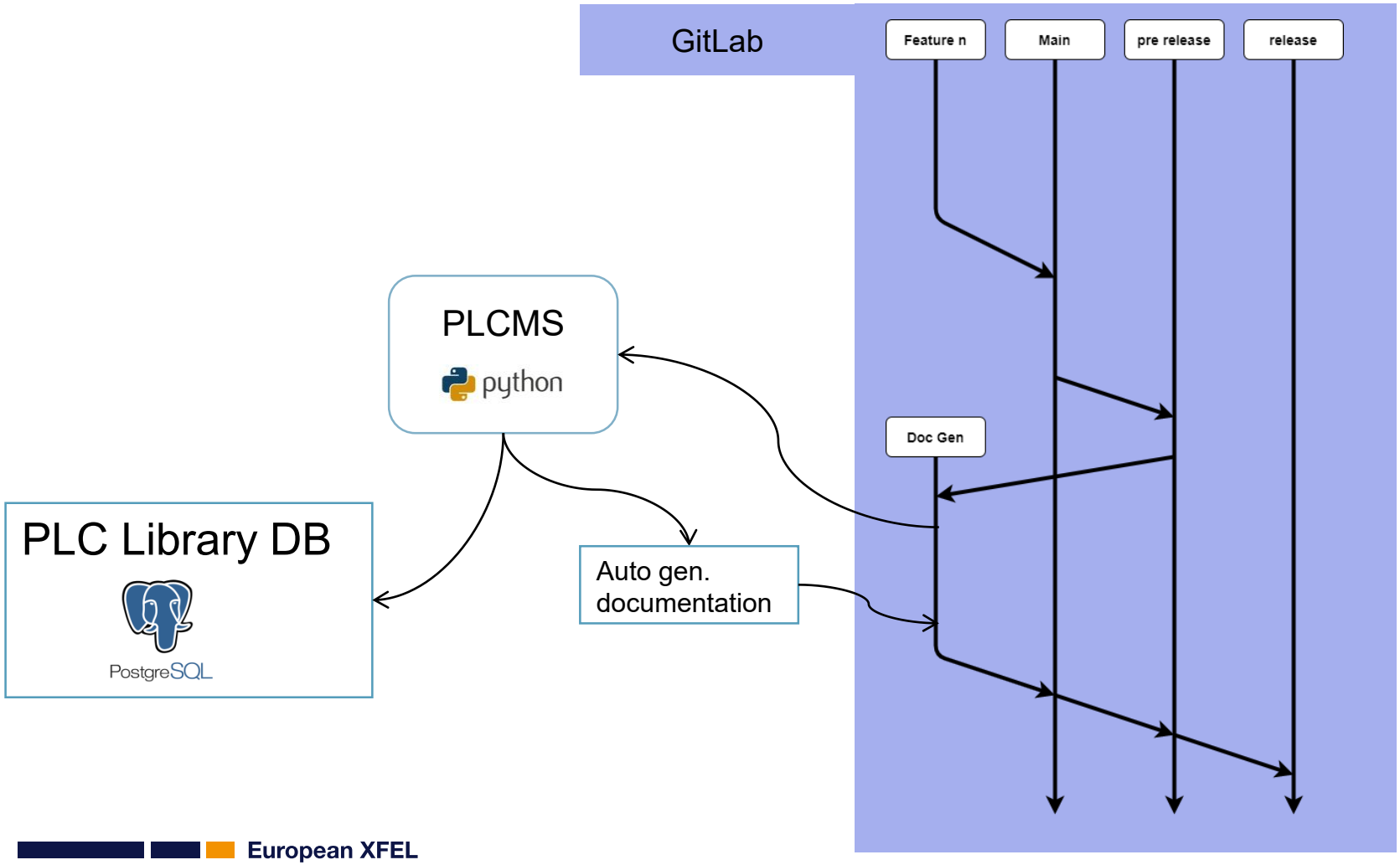
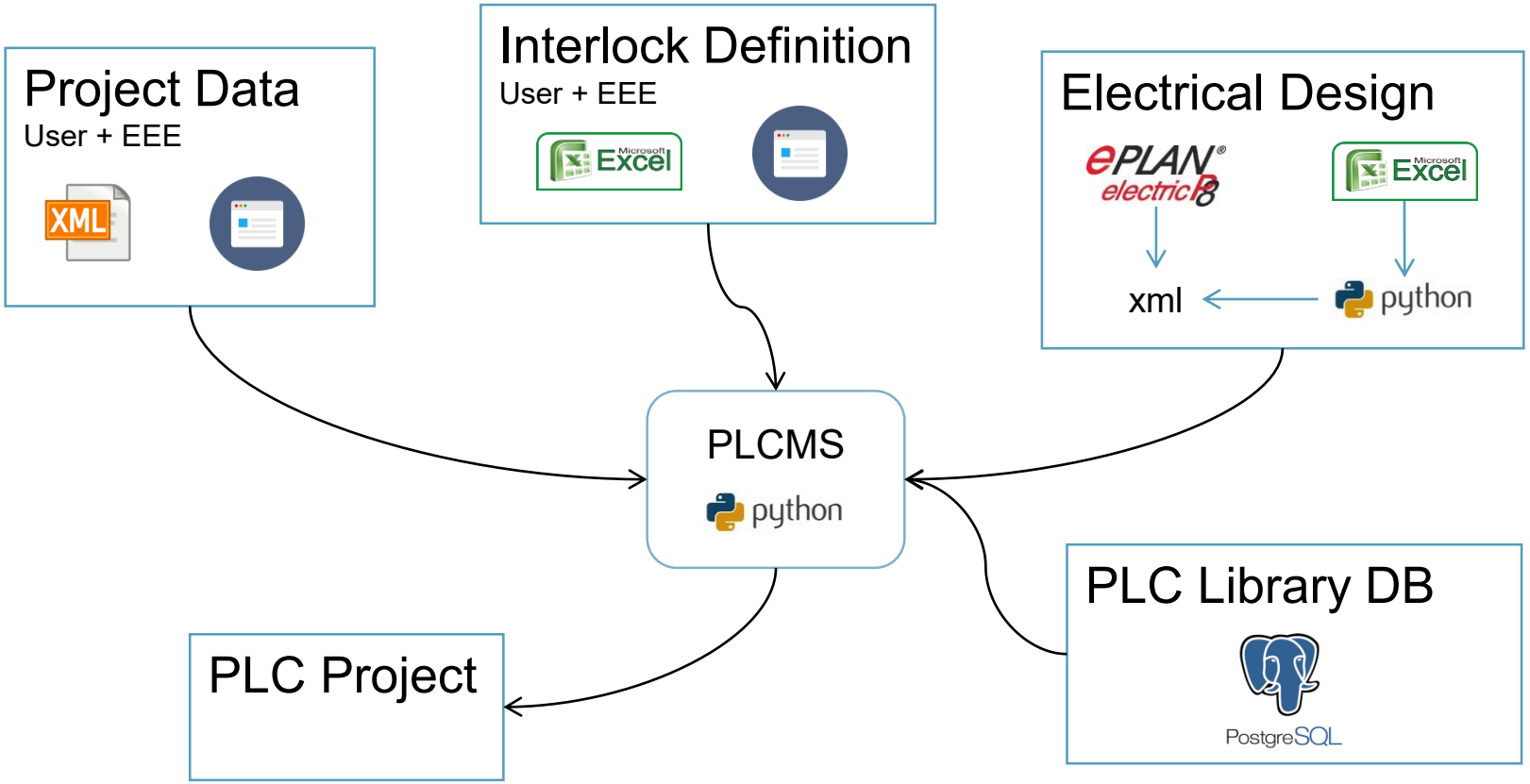
PLCs at EuXFEL

- EEE (Electronic and Electric Engineering)
  - EEE-PLC (PLC Development and Support)
  - EEE-FS (Fast Electronics)
  - EEE-EDS (Electronic Developments and Services)
  - EEE-EE (Electrical Engineering)
- Other groups using PLCs
  - Undulator
  - Safety
- PLC systems of EEE in operation
  - 137 PLC in 7 Instruments and all tunnels
  - Ca. 10.000 Softdevices
  - Ca. 9.500 EtherCAT Fieldbus Terminals

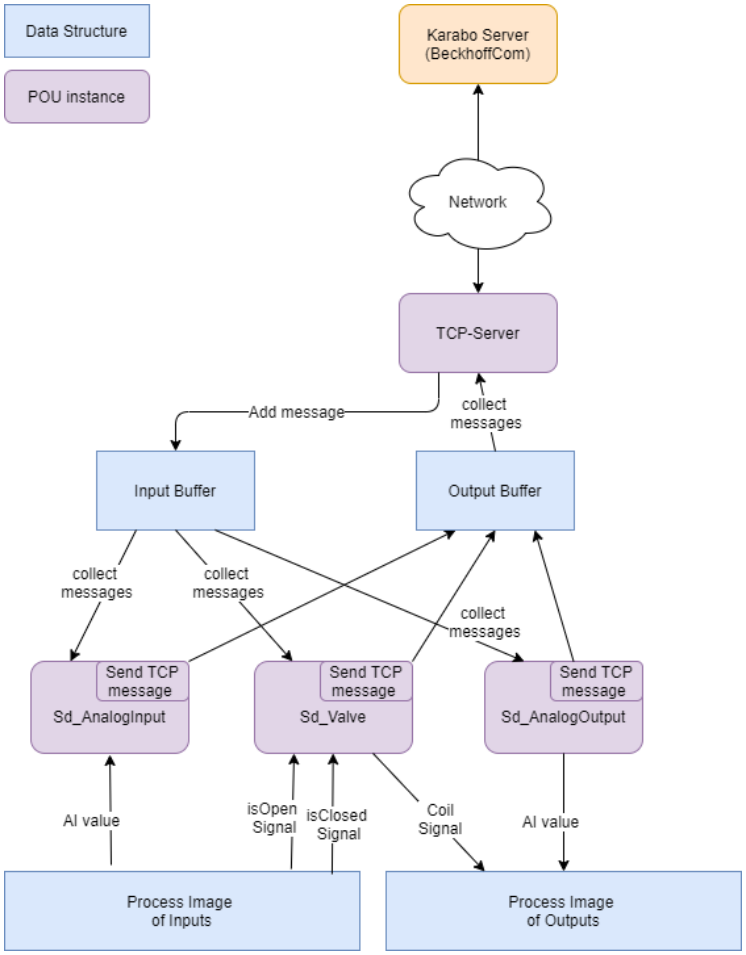
PLC library build and release process



PLC project build process



Structure of the current library

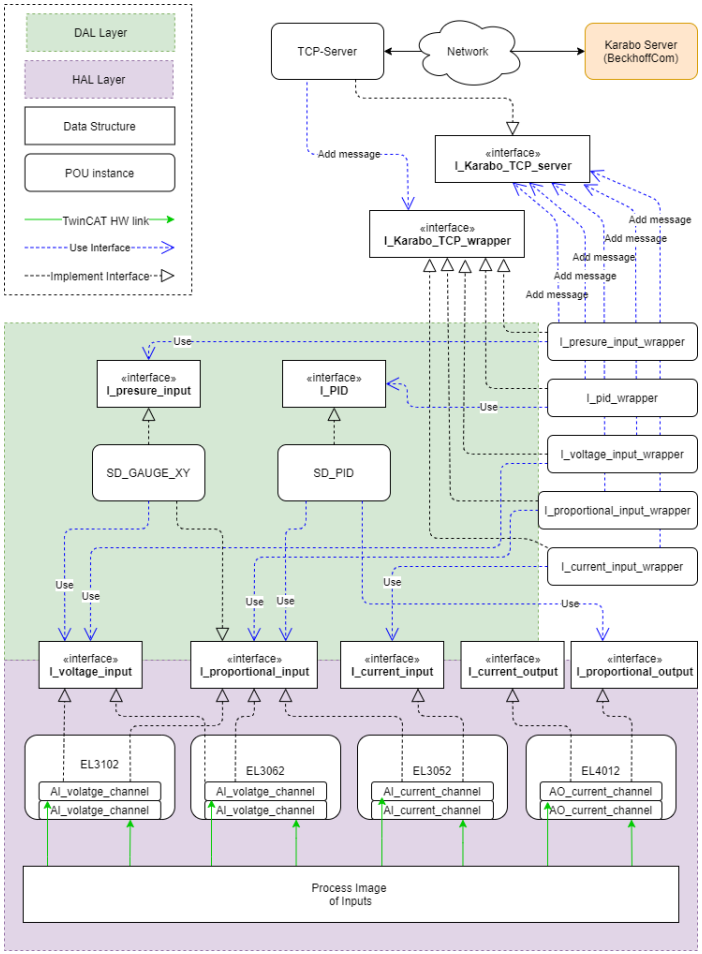


- Softdevices
  - Abstraction of components within beamlines
  - Pumps, valves, motors, etc.
- Karabo communication
  - Self description of PLC
  - Partially implemented within softdevices
- Direct hardware mapping

Goals of the future EuXFEL PLC library

- Increase modularity of the library
  - Use interfaces for peer to peer communication
  - Different layers of abstraction
  - Decouple control system interface implementation
- Faster component development
  - Reduced complexity of components (softdevices)
  - Enable automated testing
  - Custom code in projects
- Increase flexibility of system operations
  - Allow hardware relinking during runtime
  - Partial regeneration of projects
  - Reconfiguration of components without PLC restart

Structure of the future library



- Layered Architecture
  - Hardware abstraction layer (HAL)
  - Device abstraction layer (DAL)
  - Beamline component abstraction layer
- Decoupled communication
  - Reduced complicity of communicating components
  - Could allow us to implement interfaces to other control systems
  - Improved testability of components
- Remapping during runtime
  - Through the use of interfaces
  - Mapping manger
  - Locally stored mapping configuration
- Simpler implementation of components
  - Through higher cohesion of components
  - Fewer responsibilities
  - Clean interfaces (interfacing / implementation)

Migration Strategy

- Hardware Abstraction Layer
  - Added as soon as all EtherCAT terminals used at EuXFEL are implemented
  - Used with new Softdevices first
  - Existing Softdevices will be connected through adapters
- Layers and Interfaces
  - Existing Softdevicse implement commands and properties through methods
  - Softdevices can be refactored step by step
  - HAL will make another layer
- Updated Communication Protocol
  - When Selfdescription-Service on IPCs is implemented, Selfdescription of PLC will be disabled
  - Existing Softdevices will get adopters
- Add Configuration Persistence
  - Can be added step by step to Softdevices, when configuration-server on IPC is implemented
  - Fall back to hardcoded configurations possible during migration