

# FULL STACK PLC TO EPICS INTEGRATION AT ESS



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- The European Spallation Source is currently under construction in Lund, Sweden
  - Even if the beam power was reduced to 2MW, the facility is still expected to be world leading shortly after it becomes operational, the first beam on target is expect for 2025!
- ICS Automation Section, coordinates the design, development, maintenance, test and EPICS integration of Basic PLC-based Control Systems of the different parts of the facility
- PLC industry standard systems has been chosen based on the required signal speed:
  - for mid-range performance (< 100 kHz) Beckhoff/EtherCAT has been chosen
  - to handle slower signal (< 10 Hz), the equipment selected was Siemens
- Engineer workstations:
  - TIA Portal (Siemens) and TwinCAT 3 (Beckhoff)
- Communication protocols:
  - PLC-IOC: step7 TCP/IP (Siemens)
  - IOC-PLC: Modbus TCP/IP (Siemens)
  - PLC-IOC-PLC: ADS (Beckhoff)

- Tools for PLC code archiving and versioning:
  - Versiondog (mainly Siemens) and GitLab
- Development & Deployment VMs:
  - Two clusters of Windows VMs were setup; one is used to deploy projects to the ESS DMZ Technical Network (for production), and the other one to the ICS Lab Network (for testing purpose)
  - Both clusters can access the centralized the Siemens license server, as well as the Control Management Ecosystem services
  - Cyolo is the tool used give users access in a safe and controlled way to the VMs connected to the TN.
  - With the Cyolo App users can access the Siemens License Server from their own laptop while connected to the office network, if they want to do local PLC project development

- The Control Management Ecosystem has been built to facilitate management and maintenance of integrated control systems and it is composed of a number of different services and complimentary tools:
  - *Naming Service* to assist users to register ESS Names according the ESS Naming Convention, and *pVValidator* which is a python script to help to validate EPICS PVs
  - *CCDB* a control DB to manage the very complex configuration of the ESS control systems, the operators and engineers work with an abstracted model of the facility and the control systems
  - *PLCFactory* a python-based software tool that is used to generate the set of codes necessary to achieve integration between a PLC and EPICS. PLCFactory is intended to simplify programming PLCs and creating the communication interface between EPICS and PLCs. It can also create archive and alarm configurations
  - *CE Deploy & Monitor Tool* a deployment tool that installs and manages the runtime of IOCs on a host machine. It also provides IOC configuration control and history, allowing for easy troubleshooting and the ability to revert to previous versions if necessary
- Future Upgrades
  - Control Management Ecosystem: refactoring and simplify the integration all of the services and tools
  - PLC-EPICS communication protocol: OPC UA ?