SAMPLE ENVIRONMENT EQUIPMENT AT THE EUROPEAN SPALLATION SOURCE

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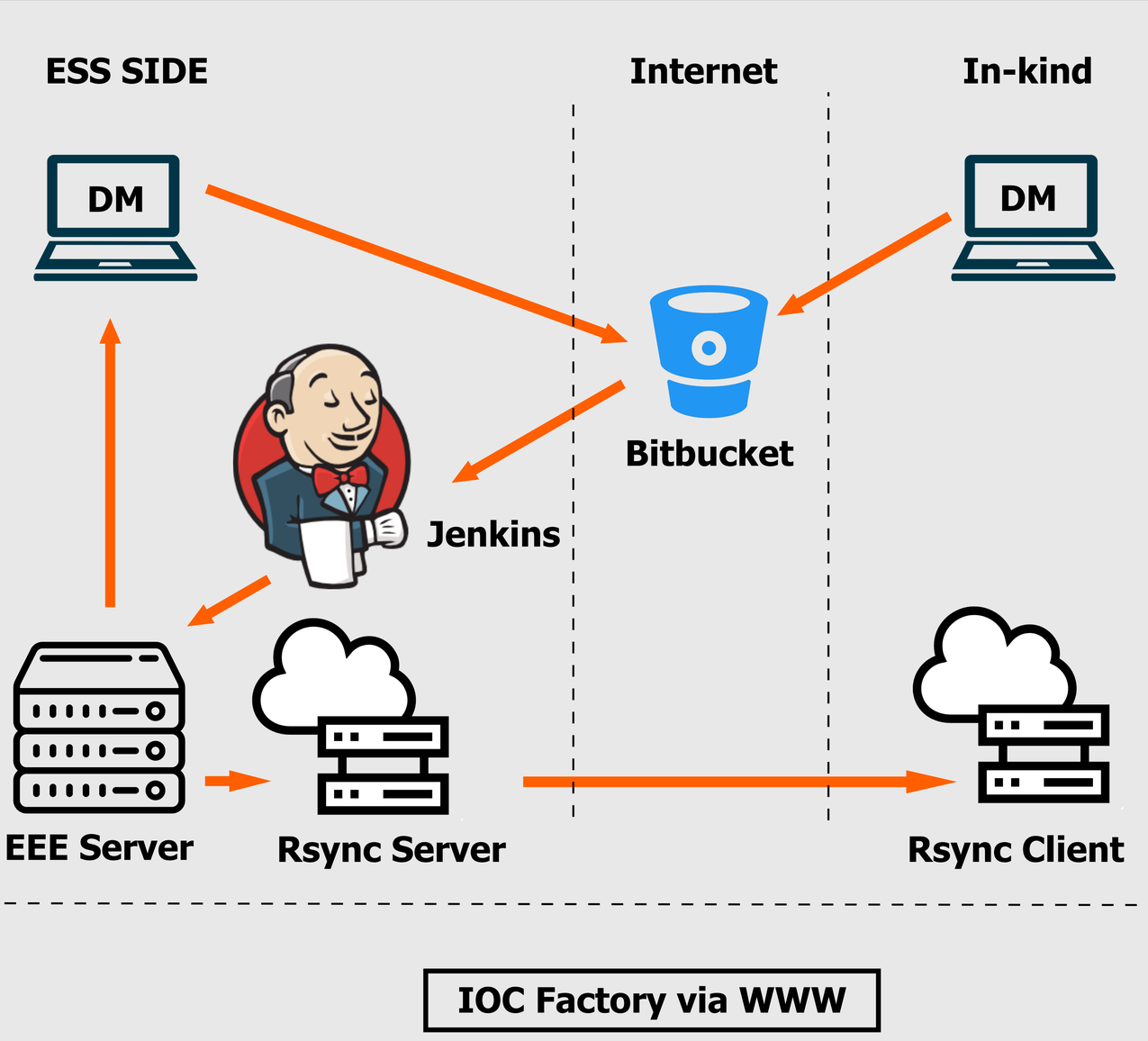
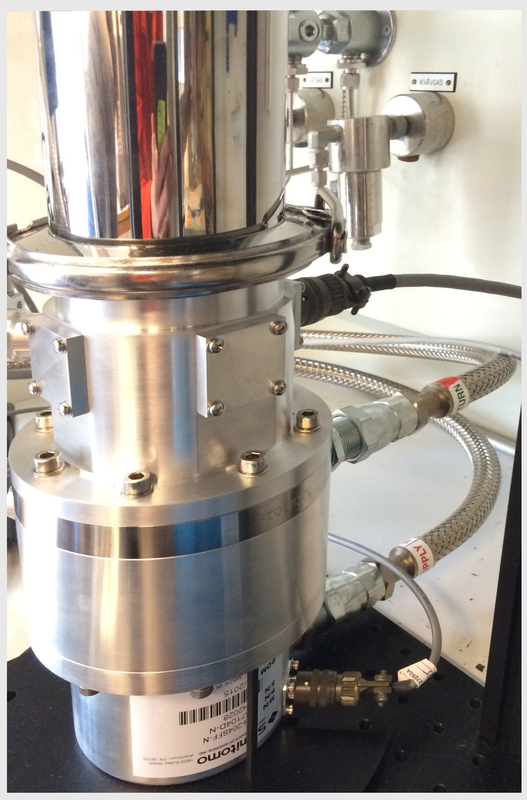
ABSTRACT The European Spallation Source ERIC (ESS) will consist of 22 different neutron instruments. Each instrument is able to use a large variety of devices to control the environment parameters of the sample during the experiments. Users must be able to control this equipment and the instruments as well as storing and retrieving experiment data. For this purpose, Experimental Physics and Industrial Control System (EPICS) will be used as the backbone control system. This work shows a typical use case where a Sample Environment System (SES) comprised by a Closed Cycle Refrigerator (CCR), spectrometer, temperature and pressure controller has been integrated into the ESS control system, from hardware to user interface.

Development workflow and software distribution at ESS and In-kind partners

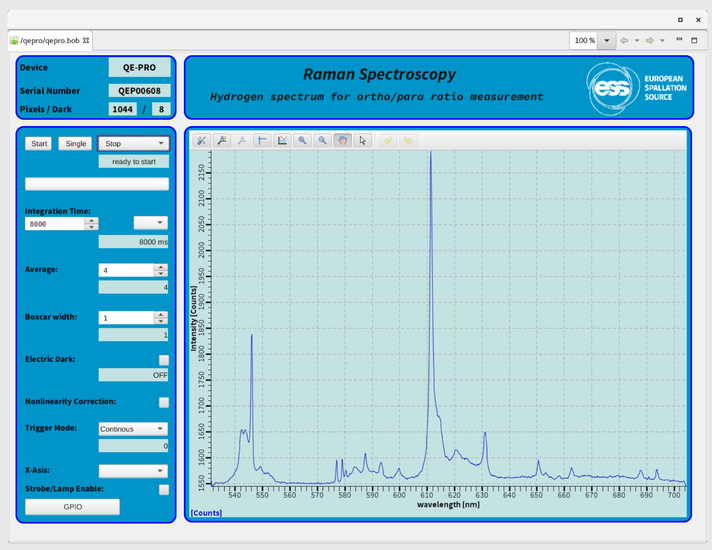
- **Development Machine (DM)** provides unified development environment, can be Virtual or Physical
- **ESS EPICS Environment** (**EEE**) on a centralised server, available through NFS. Provide bundles development environment for easy deployment
- **EEE server** also maintain boot service for **Control Boxes**.
- **Rsync Server**, to synchronise EEE server with **In-kind** servers by Owncloud.
- Git repository available also for In-kind partners.
- New module in a **Git repository** will be automatically installed by **Jenkins** on the ESS server and available for all In-kind partners.
- In-kind partners can use the same way to develop their own modules.
- Standardisation in production of Input Output Controller (**IOC**) by **IOCFactory**



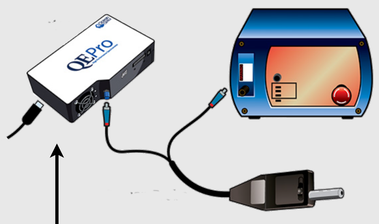
Janis Close Cycle Refrigerator



Example of Graphical User Interface for Raman spectrometer using CS Studio



Raman spectrometer + laser



Temperature controller

Pressure gauge

Data storage

Channel Access / pvAccess

Sample Environment System for ortho to para Hydrogen conversion

- **Hydrogen (H2**) exists in two quantum states, ortho and para depending on its spin orientation.
- **Ortho H2 must be avoided** in moderator after spallation process due to higher absorption for neutrons, thus conversion to para H2 is necessary.
- Para/ortho ratio can be measured by **Raman spectroscopy**.
- **Conversion** is done in low temperature (~20K) in the presence of paramagnetic substance.
- Cooling Hydrogen is done in a **Close Cycle Refrigerator**.
- In order to get high para H2 concentration (~99%) temperature and pressure must be well controled.
- **EPICS** is used as a backbone control system.
- **Lakeshore 366** was used to control. temperature with direct access to network.
- **Kurt L. Lesker 392** pressure gauge with Moxa adapter RS458 to TCP/IP to control pressure.
- **QEPro spectrometer** was used to measure Raman spectra, access via Control Box. (fanless PC).
- Data are archived on a data storage server and can be retrieved for future analysis.