INTEGRATION OF EtherCAT HARDWARE INTO THE EPICS CONTROL SYSTEM AT iThemba LABS

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Introduction

iThemba LABS has adopted EtherCAT as its communication bus standard as of 2015. Building on prior community development, an open-source software stack has been developed. A variety of EtherCAT hardware have been successfully integrated into the EPICS control system.

Control at iThemba LABS

1980s – Mini computers and CAMAC
1990s – OS/2 and SABUS
2000s – Move to EPICS
2015 – Adoption of EtherCAT

Migration to EtherCAT

EtherCAT is an open real-time Ethernet fieldbus developed by Beckhoff (Verl, Germany) and maintained by the EtherCAT Technology Group (ETG) . iThemba LABS adopted EtherCAT as its new industrial communication bus due to its high-speed performance, existing integration with EPICS and availability of off-the-shelf hardware.

Software Stack

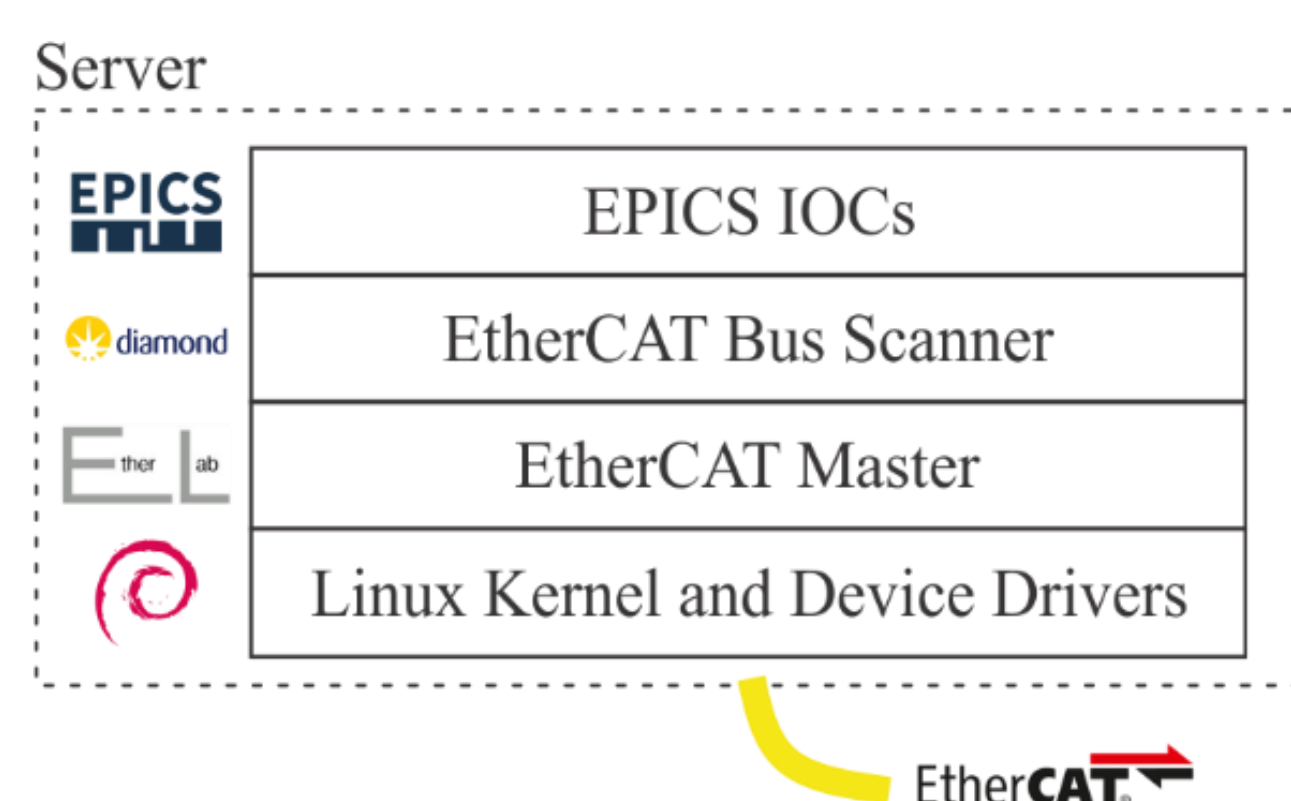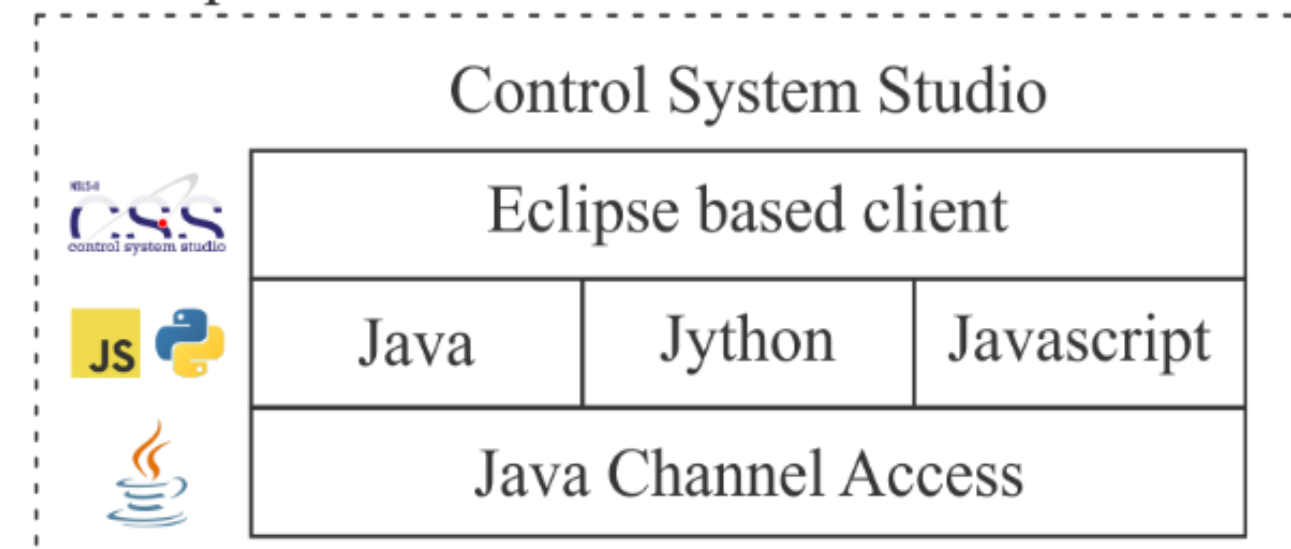Control System Studio client interfaces.

Server stack built on open EtherLab master and a bus scanner and Asyn drivers developed by Diamond Light Source UK.

Hardware Integration

EtherCAT terminals
- 25 year hardware support
- Wide selection of I/O cards
- Ease of integration and stability with open master

EtherCAT slave I/O interfaced into EPICS at iThemba LABS:
- Analogue I/O: ±10 V and 0 to 20 mA; 12 to 24-bit
- Digital I/O: 5 to 24 V, potential free and negative switching I/O
- Temperature: thermocouples and RTDs
- Communication: RS232, RS485 and RS422
- Motion: Servo, DC and Stepper motors
- Position: pots, absolute and incremental encoders
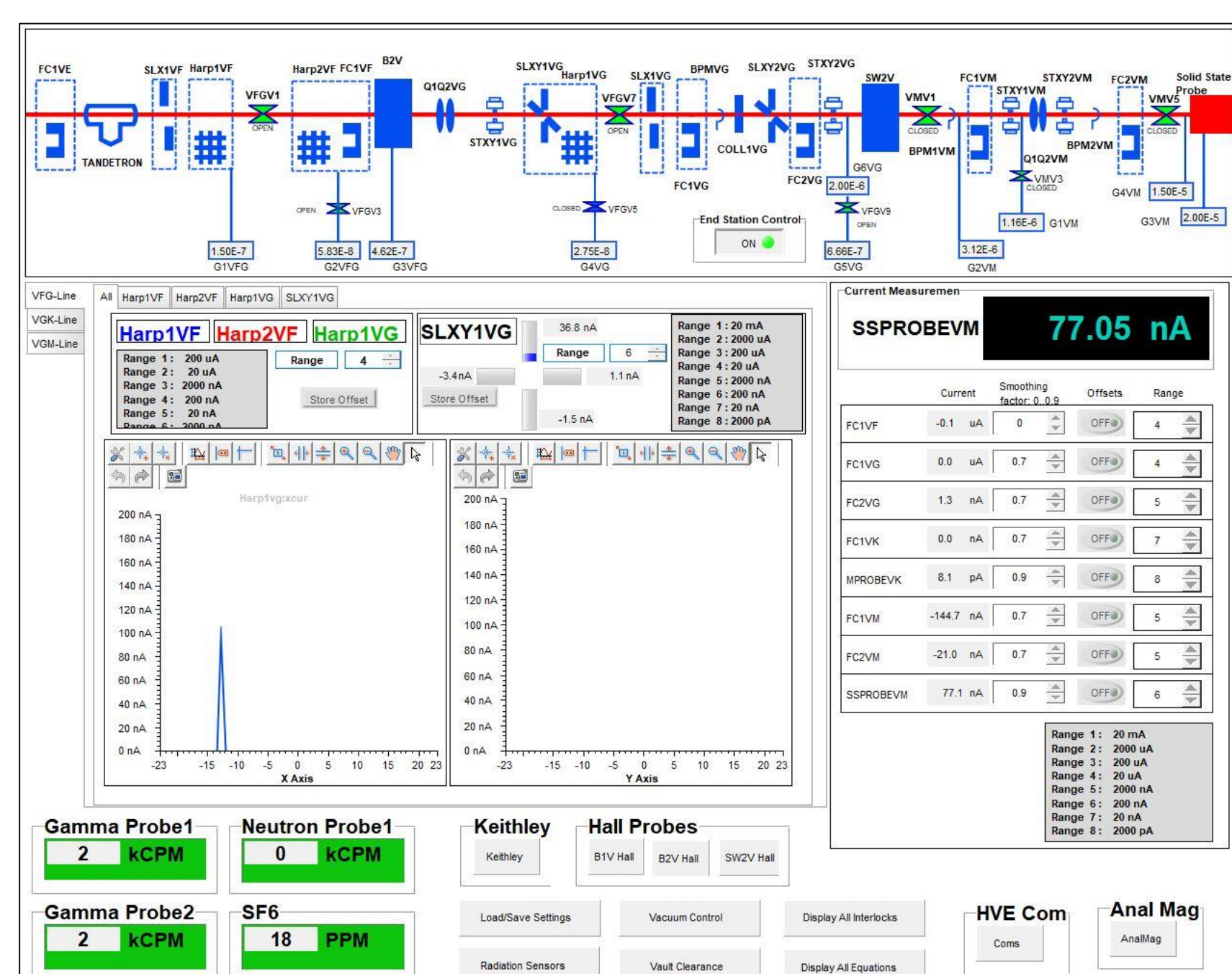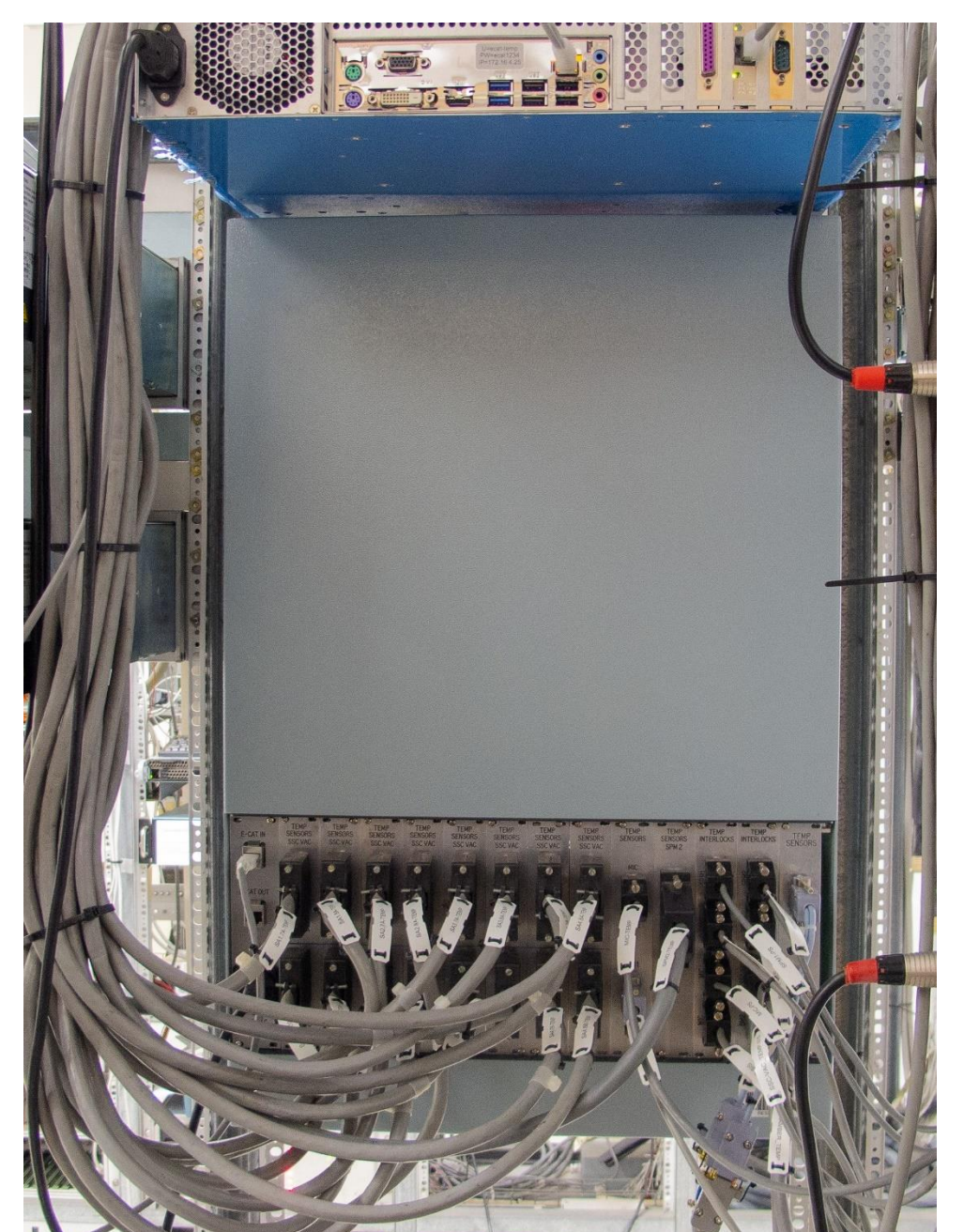
System Installations

19-inch rack mount enclosures

Custom Unistrut mount enclosures

Custom 19-inch rack mount enclosures

CS-Studio user interfaces

React Automation Studio user interfaces

Conclusions

Building on prior open-source development, a stable and mature EtherCAT software stack has been developed. The move to off-the-shelf hardware has mitigated obsolescence risk, shortened product development time and increased product life cycles. This process has also expedited the migration of our control system onto the EPICS platform.