EPICS Collaboration Meeting in April 2023

Monday, April 24, 2023 - Friday, April 28, 2023

Fermilab

Book of Abstracts

Contents

Plenary Session: Lightning Talks / 6

node-epics-ca: An EPICS Channel Access client for Node.js

Author: Lin Wang[1]

[1] *CSNS*

Corresponding Author: wanglin@ihep.ac.cn

node-epics-ca is an EPICS Channel Access client for Node.js, which is intended to be used in the Node.js web applications or web services that want to directly talk to EPICS IOCs instead of an HTTP PV server. It is an FFI (Foreign Function Interface) implementation that talks to the existing EPICS Channel Access shared libraries using a third-party Node.js FFI package called koffi. This talk will cover the implementation and usage of node-epics-ca.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session: Lightning Talks / 7

Mobile web client for PSI Elog

Author: Lin Wang[1]

[1] *CSNS*

Corresponding Author: wanglin@ihep.ac.cn

CSNS (China Spallation Neutron Source) has used PSI Elog as the logbook system for several years and has stored more than ten thousand logs. However, the Elog does not provide responsive or separate web pages for mobile web client. Therefore, a separate mobile web client has been developed and deployed at CSNS to provide functions of user login, reading logs, creating logs, editing logs and deleting logs for the Elog. This talk will cover the design and implementation of the mobile web client for PSI Elog deployed at CSNS.

Please select if talk will be in person or on zoom:

On Zoom

Welcome / 8

ACORN Project

Author: Erik Gottschalk[1]

[1] *Fermilab*

Corresponding Author: erik@fnal.gov

A brief overview of the ACORN Project and current status.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **9**

EPICS and IPv6

Authors: Kay Kasemir[1]; Michael Davidsaver[None]

[1] *ORNL/SNS*

Corresponding Author: kasemirk@ornl.gov

IPv6 has been around since 1995, but EPICS has so far only supported IPv4. This will be a high level introduction to IPv6, what basic changes are necessary to existing IPv4 code, and what has been done for PV Access.

Please select if talk will be in person or on zoom:

On Zoom

Welcome / **11**

Associate Laboratory Director's Welcome

Corresponding Author: valishev@fnal.gov

Please select if talk will be in person or on zoom:

Welcome / **12**

Introduction to Fermilab and the Fermilab Accelerator Complex

Corresponding Author: zwaska@fnal.gov

Welcome / **13**

EPICS for Fermilab's Flagship Project - PIP-II

Corresponding Authors: hanlet@fnal.gov, harms@fnal.gov

Plenary Session / **24**

EPICS IOC Implementation on SoC FPGA based LLRF controllers

Author: Shriraj Kunjir[1]

[1] *MSU FRIB*

Corresponding Author: shrirajkunjir@icloud.com

A brief overview of EPICS IOC implementation on SoC FPGA based new LLRF controllers. This presentation will include details of work completed so far, advantages, challenges and future work.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **25**

LANSCE migration to an all-EPICS control system as enabled by Data Access EPICS, Industrial I/O, and lvPortDriver

Author: Scott Baily[1]

[1] *LANL*

Corresponding Author: sbaily@lanl.gov

After 50 years of operation, the LANSCE Control System is now an entirely EPICS control system. The original RICE (Remote Instrumentation and Control Equipment) system was replaced mainly by two types of EPICS IOCs National Instrument's (NI) cRIO and a 2-form factor (VPX/cPCI crate) supporting three capabilities. Slow controls/monitoring use our Industrial I/O software, with EPICS device support talking to the FPGA via NI's C application programming interface. Interceptive beam diagnostics use our lvPortDriver to interface between LabVIEW real-time software and the EPICS IOC. VPX/cPCI systems use an EPICS IOC running on a soft-core processor implemented in the FPGA fabric. The soft-core IOCs have a special version of the channel access server (Data Access) that allows filtering of subscription updates. I will describe each architecture (including some recent improvements) and compare hardware and software lifecycle challenges for the various systems.

Please select if talk will be in person or on zoom:

In person

Welcome / **29**

While you're here (house rules)

Corresponding Author: hanlet@fnal.gov

Please select if talk will be in person or on zoom:

Plenary Session / 30

Moving on from VME without Breaking the Bank

Author: Mark Rivers[1]

[1] *Univ. of Chicago*

Corresponding Author: rivers@cars.uchicago.edu

Most APS beamlines are using VME crates as a major part of their control system.
The VME hardware is expensive and becoming obsolete, with replacements for many of the above items no longer available. The VxWorks software is also expensive.

I am leading an effort at sector 13 to completely eliminate the 7 VME systems during the dark year.

I plan to install the following to replace the VME systems:
• Galil DMC-4183 motor controllers to replace the OMS-58 and MAXv.
• Moxa terminal servers to replace the VME serial communication modules.
• Measurement Computing USB-CTR08 to replace the Joerger and SIS 3820 scalers and multi-channel scaler functions.
• Measurement Computing USB-3104 to replace the DAC128V for analog output.
• Measurement Computing USB-1808X to replace the IP-330.

The total hardware cost to replace 7 VME systems for 2 FOEs and 5 experimentation stations is less than $150K. This includes more than 370 motor channels.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / 103

The Evolution of Fill Pattern Measurement at NSLS-II

Author: Yong Hu[1]

[1] *Brookhaven National Lab*

The stored beam was achieved in the Storage Ring at NSLS-II (National Synchrotron Light Source II) in March 2014. Even since then, the beam diagnostics and control system has been providing valuable fill pattern measurement data for machine operation. The control hardware as well as software has evolved over the past decade.

Please select if talk will be in person or on zoom:

In person

Plenary Session / 104

ALS control system status report

Authors: Miroslaw Dach[1]; Tynan Ford[None]

[1] *LBNL*

Corresponding Authors: tford@lbl.gov, mdach@lbl.gov

ALS has a long history behind. The ALS-U upgrade project is on the way in parallel with the ALS routine operation. The intention of this presentation is to show the recent changes to the ALS control system which are aligned with the ALS-U upgrade project.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / 105

Fermilab Web-based Controls Application Framework R&D

Authors: Beau Harrison[1]; John Diamond[None]; Michael Guzman[None]; Michele McCusker-Whiting[None]; Richard Neswold[2]

[1] *AD Controls*

[2] *Fermilab*

Corresponding Authors: jdiamond@fnal.gov, mguzman@fnal.gov, neswold@fnal.gov, mccusker@fnal.gov, beau@fnal.gov

The Accelerator Controls Operation Research Network (ACORN) project is a DOE O 413.3B project with a projected cost over $135M that aims to modernize Fermilab's accelerator control system by 2028. A part of this modernization effort is to replace the existing user applications that are used by operators and experts to control and tune the accelerator complex. These applications use a diverse menagerie of outdated technologies including low-level UI frameworks such as Xlib and Java Swing. A goal of ACORN is to leverage modern web-based application frameworks for control system applications. Three candidate web UI frameworks were selected as part of the ACORN R&D – React, Fresh and Flutter. To evaluate the developer experience with these frameworks, 5 developers were given a simple task: use a framework to implement the user interface for a simple control room application: the telephone index. We present our findings and the reasoning behind our selected framework.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / 106

News from RTEMS for VMEbus systems

Author: Heinz Junkes[1]

[1] *Fritz Haber Institute*

Corresponding Author: junkes@fhi.mpg.de

Currently there are many new developments for RTEMS and VMEbus CPUs as a basis for EPICS 7.
These are briefly presented here.
The main focus is the support of PowerPC boards like beatnik (MVME6100), MVME3700, MVME5100 etc..
Also new board alternatives on QorIQ basis (MVME2500) are addressed.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **107**

EPICS for small labs

Authors: Abdulrhman Moshantaf[1]; Heinz Junkes[1]; William Kirstaedter[1]

[1] *Fritz Haber Institute*

Corresponding Authors: kirstaedter@fhi.mpg.de, junkes@fhi.mpg.de, moshantaf@fhi.mpg.de

Wir stellen ein System vor welches es möglich macht EPICS auch in kleinen Laboren (Chemie, Physik) zu etablieren.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **108**

PhantasyCalc - Integrating EPICS Data into a Spreadsheet Application

Author: Tong Zhang[1]

[1] *FRIB*

Corresponding Author: zhangt@frib.msu.edu

The effective management of distributed data in the EPICS control network is crucial for efficient data analysis and controls software application development. One approach that has gained popularity among a large group of individuals is utilizing spreadsheet applications like LibreOffice Calc for data processing. The development of "PhantasyCalc" offers a systematic solution for integrating information from the EPICS network into LibreOffice Calc, providing simple yet powerful ways to work with diverse data sources. As a result, the spreadsheet becomes a user-friendly and shareable data analysis solution.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / **109**

opi-generator - Generate OPI Screens for Control System Studio

Author: Tong Zhang[1]

[1] *FRIB*

Corresponding Author: zhangt@frib.msu.edu

Control System Studio (CS-Studio) is currently in the process of transitioning from Eclipse RCP to the next UI framework called Phoebus. To ease the transition of OPI (Operator Interface) screens developed for Eclipse-based CS-Studio to Phoebus, the "opi-generator" package provides a solution that generates properly formatted XML files for both CS-Studio and Phoebus from the same Python script. "opi-generator" is designed with a mechanism that can handle the differences in XML formats supported by the two platforms, and it also offers customizable support for unified screen style configurations.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **110**

BxB BPM and EPICS interface using the RFSoC FPGA

Author: Kiman Ha[1]

[1] *BNL(NSLS-II)*

Corresponding Author: kha@bnl.gov

I will present the RFSoC based 500 MHz BxB Beam Position Monitor development status and epics control system interface.
The RFSoC-based advanced BxB provides many capabilities for measuring BxB beam transients, multi-bunch coupling, bunch charging, and beam trip transients.
Also, Xilinx RFSoC FPGA supports a hard ARM CPU core for interface with EPICS control systems.
I will introduce BxB hardware architecture, FPGA data processing, extensive data capturing, and epics interface for a control system.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / **111**

EPICS Deployment at Fermilab

Author: Pierrick Hanlet[1]

[1] *Fermilab*

Corresponding Author: hanlet@fnal.gov

Fermilab has not been a traditional EPICS house, though there have been and still are some instances on site. We have now deployed an infrastructure designed to simplify, non-expert building of EPICS applications, both IOCs and user applications using a CI/CD pipeline. The status of this EPICS deployment at Fermilab will be summarized.

Please select if talk will be in person or on zoom:

In person

Plenary Session / 112

AI Based Stabilization of Sample Environments

Author: Morgan Henderson[1]

Co-authors: Ilya Pogorelov [1]; Jonathan Edelen [1]; Matt Kilpatrick [1]

[1] *RadiaSoft LLC*

Corresponding Authors: kilpatrick@radiasoft.net, mhenderson@radiasoft.net, jedelen@radiasoft.net, ilya@radiasoft.net

Image recognition and other tasks with visual components typically performed by humans remain integral to the establishment and maintenance of sample environments, including sample alignment, in neutron scattering and similar experiments. During this presentation, I will discuss the development of a user-friendly, EPICS-based interface designed for use by beamline operators which provides high-level access to system controls with the additional capability of deploying machine-learned models that reduce and simplify the workload of humans in executing controls tasks.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / 113

Data pool management across multiple front end architectures.

Author: Charles King[None]

Corresponding Author: kingc@fnal.gov

This talk will cover how Fermilab is currently handling the incorporation of EPICS IOCs into a traditionally all ACNET control system. Specifically, it will discuss the role of Fermilab's Data Pool Manager (DPM) which provides a common data acquisition interface across multiple hardware architectures and protocols thus simplifying the development of data analysis and display components.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session / 114

ADTimePix3

Author: Kazimierz Gofron[1]

[1] *Oak Ridge National Laboratory*

Corresponding Author: gofronkj@ornl.gov

Detectors based on TimePix3 chips are complementary to existing image-based detectors. In addition to the 2D image, the TimePix3 chip allows the collection of time information of each hit down to the nanosecond level. The timing capabilities allow new possibilities in particle and photon data collection, by providing not only characterization of accelerator source but also science related to timed dynamics. The timing capabilities of the TimePix3 detector allow neutron measurements such as energy using Time of Flight mode. EPICS driver for the TimePix3 detector is a major step in the development of the science within modern neutron and synchrotron facilities.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **115**

AI/ML hosted on FPGAs at Fermilab

Authors: Jose Rene Berlioz Rivera[None]; M. A. Ibrahim[1]

[1] *FNAL -AD/INST*

Corresponding Authors: cadornaa@fnal.gov, jberlioz@fnal.gov

This talk will include

- Discussion on FPGA-based system architectures, used in current AI/ML projects for accelerator applications.
- Lessons learned about interfaces along data signal path will focus on READS project.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **116**

Updates on EPICS Deployment at NSLS-II

Author: Anton Derbenev[1]

Co-authors: Yong Hu [2]; Jakub Wlodek [2]; Kunal Shroff [2]; Robert Schaffer [2]; Nate Maytan [2]

[1] *Brookhaven National Laboratory*

[2] *BNL*

Corresponding Author: aaderbenev@gmail.com

Apart from moving from Debian to RHEL as a baseline operating system, the NSLS-II facility has embraced a plethora of new powerful automation and orchestration tools. Changes to how we manage our systems have brought along new considerations and approaches in the areas of EPICS software packaging, distribution, IOC code management, and deployment. The talk covers updates in these areas, and outlines further opportunities to greater standardizing and automating. Specifically outlined are:

1. EPICS base, modules, and tools RPM creation, distribution, and licensing.
2. IOC code management via a monorepo, and specialized tools created to support the workflow.
3. Deployment of select EPICS applications.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / **117**

From spreadsheet to PVs with a click

Authors: Brad Webb[1]; Klemen Vodopivec[2]

[1] *ORNL*

[2] *control system & data acquisition software engineer*

Corresponding Authors: vodopiveck@ornl.gov, webbsb@ornl.gov

RegMap is a tool used at Spallation Neutron Source to assist PLC developers with creating and testing EPICS integration with ease. PLC tags are described as a single line in Excel or CSV spreadsheet with user friendly fields. The RegMap tool converts saved spreadsheet into an EPICS database file and an OPI screen file, and allows for quick development cycle of register based devices without extensive EPICS experience.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **118**

EPICS Base — What's New

Author: Andrew Johnson[1]

Co-authors: Ralph Lange [2]; Michael Davidsaver

[1] *Argonne National Laboratory*

[2] *ITER Organization*

Corresponding Authors: anj@aps.anl.gov, ralph.lange@gmx.de

EPICS Base 7.0.7 was released in September 2022, and the changes introduced there were described in a talk given by Ralph Lange at the EPICS meeting in Slovenia. This talk will briefly recap the main changes included in 7.0.7 and will then describe what has happened in Base since, including the code and documentation enhancements developed by attendees of the EPICS Codeathon hosted by Diamond in March.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **119**

TLS for PVA?

Author: Michael Davidsaver[1]

Co-author: George McIntyre

[1] *Osprey DCS*

Corresponding Authors: george@level-n.com, mdavidsaver@ospreydcs.com

Presenting a thread model and possibilities for applying Transport Layer Security (TLS) to the PVA protocol.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **120**

PVXS in your IOC

Author: Michael Davidsaver[1]

Co-author: George McIntyre

[1] *Osprey DCS*

Corresponding Authors: george@level-n.com, mdavidsaver@ospreydcs.com

Recent work on PVXS, including to as a replacement for pva2pva.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **121**

ESS Controls Status Update

Author: Timo Korhonen[1]

[1] *European Spallation Source ERIC*

Corresponding Author: timo.korhonen@ess.eu

In recent years, the construction of European Spallation Source, including the control system, has progressed very rapidly and we are operating a substantial number of IOCs in production. Our goal from early on has been to apply comprehensively the new emerging features of EPICS; accordingly the talk will cover the status of our use of EPICS 7. Our underlying system architecture, in particular our use of MTCA and our EPICS build and deployment systems will be presented. More details about our software layer will be covered in another talk.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / 122

EPICS Documentation update

Author: Timo Korhonen[1]

[1] *European Spallation Source ERIC*

Corresponding Author: timo.korhonen@ess.eu

A short overview of the EPICS documentation on the web will be presented, along with some new ideas to make the documentation easier to find and also make it easier to contribute to documentation.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / 123

OPC UA Device Support - Update

Author: Ralph Lange[1]

[1] *ITER Organization*

Corresponding Author: ralph.lange@gmx.de

In a collaborational effort (ITER/HZB-BESSY/ESS/PSI), a Device Support for the OPC UA industrial SCADA protocol is under development. Goals, status and roadmap will be presented.

Please select if talk will be in person or on zoom:

In person

Plenary Session / 124

Introduction to Machine Learning

Author: Gopika Bhardwaj[1]

[1] *Fermilab*

Corresponding Author: gopikab@fnal.gov

Machine Learning is a field of study that uses advanced algorithms and mathematical models to enable computers or machines to learn from data and make predictions or decisions without being explicitly programmed. In ML, data is used as a basis for training algorithms or models, which then

analyze the data and identify patterns or relationships within it. These patterns are used to make predictions or decisions when presented with new, unseen data.

For example, imagine you have a dataset of temperature measurements over time, and you want to predict the temperature for a future date. You can use ML algorithms to analyze the historical data, identify patterns in temperature changes, and create a model that can predict future temperatures based on those patterns.

Machine Learning is used in various applications, such as image and speech recognition, autonomous vehicles, predictive analytics, and many more.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **125**

Overview of Data and Control Systems at NASA's Armstrong Test Facility

Author: Richard Evans[1]

[1] *NASA's Neil A. Armstrong Test Facility*

Corresponding Author: richard.k.evans@nasa.gov

NASA's Neil A. Armstrong Test Facility (ATF, formerly Plum Brook Station) is a 6,400 acre (26 km^2) research campus in Sandusky, Ohio that operates a number of unique world-class test facilities which are used by NASA, other governmental agencies, and the private sector to conduct full service facility and test system preparation for complex and innovative research and flight programs. The test facilities at ATF are used to simulate the conditions of the upper atmosphere, deep space, planetary, lunar environments, and cryogenics. This talk will present a high-level overview of the ATF test facilities and test capabilities and highlight their individual data and control (DAC) system needs. The second part of the talk will describe a recent project at ATF to identify a common client-server DAC SW architecture that will result in safer and more reliable operations across the entire ATF DAC system portfolio and will lower total cost of ownership to ATF (and therefore) our customers.

Please select if talk will be in person or on zoom:

In person

Workshop: User Interface / **126**

Exploring Browser Frameworks: A Comparative Analysis and Deployment Demo

Authors: Beau Harrison[1]; John Diamond[None]; Michael Guzman[None]; Richard Neswold[2]

[1] *AD Controls*

[2] *Fermilab*

Corresponding Authors: jdiamond@fnal.gov, mguzman@fnal.gov, neswold@fnal.gov, beau@fnal.gov

This workshop will guide participants in selecting a browser-based application framework by discussing Fermilab's ACORN project, providing an overview of development tools, comparing browser

frameworks, discussing open-source adoption, and examining development and deployment pipelines. Attendees will gain a clear understanding of browser application frameworks and how to tailor a development process that aligns with their specific needs. The presentation will run for one hour, with 30 minutes for open discussion and Q&A.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **127**

ACORN Human Factors

Author: Rachael Hill[1]

[1] *Idaho National Laboratory*

Corresponding Author: rachael.hill@inl.gov

ACORN Human Factors: This presentation details an introduction to human factors and how Fermilab is enabling user-centered designs & processes for the ACORN project. Presentation topics include how a combination of design standardization and customization will enable more intuitive operations and reduce cognitive overwhelm & burnout.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session / **128**

Optimization of experiment and accelerator performance using beam synchronous EPICS data

Author: Alberto Lutman[1]

[1] *SLAC*

Corresponding Author: aal@slac.stanford.edu

Live observation of synchronized accelerator and photon data is crucial for best use of machine development time, and to setup demanding FEL configurations for the users. A Matlab class and a GUI have been developed and used in the last decade at the LCLS to acquire accelerator and photon data from different sources via EPICS and to present them. Data are synchronized on a pulse-to-pulse basis, processed, and displayed with low latency time, thus being useful for discovering correlations, live tuning, and understanding underlying physics while the data are taken. Scans are available by setting EPICS process variables and validating machine status by data timestamp. Consideration on the temporal latency, and the amount of data required for the system to be effective will be given.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session / **129**

Improving security in RTEMS and EPICS IOC applications

Author: Vijay Banerjee[1]

Co-author: Uchenna Ezeobi [1]

[1] *University of Colorado Colorado Springs*

Corresponding Authors: vbanerje@uccs.edu, uezeobi@uccs.edu

Cybersecurity is a rising concern in real-time and industrial control systems due to increased security threats toward these systems. In this talk, we discuss our ongoing efforts in security testing through modularization and fuzzing of the software stacks to detect vulnerabilities in different components. We have previously worked on modularizing the network stack of RTEMS into linkable static libraries. Our current efforts revolve around fuzzing using techniques such as model inference and machine learning to learn the state machine model of ICS protocol implementations to fuzz deeper states for stateful ICS protocol implementations (channel access, EPICS pvxs, etc.). We also discuss some ideas for our future work on improving the security posture of RTEMS-EPICS integration.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **130**

CS-Studio Phoebus & Logbook at ESS

Author: Susanne Regnell[1]

Co-authors: Kunal Shroff [2]; Georg Weiss [1]

[1] *European Spallation Source*

[2] *BNL*

Corresponding Author: susanne.regnell@ess.eu

ESS moved to CS-Studio Phoebus in 2019 and we have since then worked with the framework together with the community.
We have put in a lot of effort with the Logbook (Olog) and Save & Restore (based on MASAR).

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / **131**

Report from the 2023 Codeathon

Author: Ralph Lange[1]

Co-author: Ronaldo Mercado

[1] *ITER Organization*

Corresponding Author: ralph.lange@gmx.de

Back in March, Diamond was hosting the 2023 EPICS Codeathon event.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / **132**

EPICS Tools and Services Status

Author: Kunal Shroff[1]

[1] *Brookhaven National Lab*

Corresponding Author: shroffk@bnl.gov

An update on the recent developments from the EPICS Tools and Services collaborations. This includes the latest releases of Phoebus and improvements to middle layer services like Olog, Save Restore, ChannelFinder, etc.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session / **133**

NSLS-II HEX Beamline Motion Control with Power PMAC Controller

Author: Jun Ma[1]

[1] *BNL*

Corresponding Author: jma@bnl.gov

HEX (High Energy Engineering X-ray Scattering) beamline is the first beamline at NSLS-II to use Power PMAC controller as main motion controller. In this presentation, technical details from controller selection, configuration, feedback devices, coordinated motion, EPICS integration, GUI etc. will be discussed. Implementation examples on different beamline components like slits, mono, endstation etc. will be shared as well.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **134**

ChannelFinder

Authors: Kay Kasemir[1]; Kunal Shroff[2]; Michael Davidsaver[3]

[1] *ORNL/SNS*

[2] *Brookhaven National Lab*

[3] *Osprey DCS*

Corresponding Authors: shroffk@bnl.gov, kasemirk@ornl.gov, mdavidsaver@ospreydcs.com

ChannelFinder started as a simple directory service to address some of the limitations of EPICS's flat name space. Over the past few release the ChannelFinder infrastructure has expanded to provide additional features to manage the configuration of multiple services to supporting a pvAccess name server.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session: Lightning Talks / 135

Ophyd v2

Author: Ronaldo Mercado[1]

[1] *Diamond Light Source*

Corresponding Author: ronaldo.mercado@diamond.ac.uk

Diamond are working on developing Ophyd v2, part of the Bluesky framework.
Ophyd v2 uses lessons learnt from Ophyd and Malcolm, the hardware scanning engine at DLS.
The key design concerns are modularity, separation of logic and I/O,
easy to implement hardware triggered scanning solutions and a clear migration path.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / 136

(Yet Another) EPICS Diode

Author: Ralph Lange[1]

[1] *ITER Organization*

Corresponding Author: ralph.lange@gmx.de

To support ITER's remote participation plans while honoring cybersecurity requirements, we are currently developing a new implementation of an "EPICS Diode", mirroring EPICS PVs through a strictly one-directional network connection.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **137**

ACCELERATOR SYSTEMS CYBER SECURITY ACTIVITIES AT SLAC

Authors: Amedeo Perazzo[1]; Erwin Lopez[1]; Gregory White[1]; Bob Dalesio[2]; George McIntyre[1]; Kenneth Brobeck[1]; Matt Gibbs[1]; McCullough Mark[1]; Michael Davidsaver[2]

[1] *SLAC*

[2] *Osprey DCS*

Corresponding Authors: greg@slac.stanford.edu, lopez97@slac.stanford.edu, mmccul@slac.stanford.edu, mgibbs@slac.stanford.edu brobeck@slac.stanford.edu, perazzo@slac.stanford.edu, sly@slac.stanford.edu, bdalesio@ospreydcs.com, mdavidsaver@gmail.com

This talk describes four cyber security related activities of SLAC. First, a broad review of accelerator computing cyber and mission reliability; our analysis method, findings and outcomes. Second, lab and accelerator penetration testing, in particular, methods to control coordinate, and trap, potentially hazardous scans. Third, a summary gap analysis of recent regulatory orders from common practice at accelerators, and nominal plan. Finally, briefly, first steps in adding authentication and encryption to EPICS itself, as described in other talks.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / **138**

Exploring data acquisition options for distributed timing-synchronized FPGA-generated data

Author: Lucas Russo[1]

[1] *LBNL*

Corresponding Author: lerwys@gmail.com

In many facilities there is a need to acquire and store distributed timing-synchronized FPGA-generated data for offline data analysis, fault detection and more recently AI/ML applications. While FPGA devices can easily generate and transmit Gpbs worth of data, the task of acquiring, storing and retrieving them are not trivial. This talk, although not answering this question, tries to explore some options of doing that and asking for feedback and collaboration in ways of achieving that.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **139**

Background and Development Status of the EIC Common Platform

Author: James Jamilkowski[1]

Co-authors: Kevin Mernick [2]; Thomas Hayes [2]

[1] *BNL/EIC*

[2] *Brookhaven National Laboratory*

Corresponding Authors: jpjamilk@bnl.gov, hayes@bnl.gov, kmernick@bnl.gov

The Electron Ion Collider Project will involve the deployment of a large number of Front End Computers of a novel SoC design that is intended as a Common Platform across many sub-systems will a spectrum of performance requirements. We'll describe the previous experience building a custom carrier + daughter card platform, the current platform generation designs and statuses for EIC, as well as future development plans that will be needed to operate a large accelerator complex that is currently being developed.

Please select if talk will be in person or on zoom:

In person

Workshop: EPICS Core / **140**

Experiences Adopting EPICS from a New User Perspective for EIC

Author: James Jamilkowski[1]

[1] *BNL/EIC*

Corresponding Author: jpjamilk@bnl.gov

Perspective gained in the process of learning about EPICS systems and architectures as part of Electron Ion Collider design work will be shared from the point of view of a developer that is new to the ecosystem. Highlights related to positive and negative experiences will be addressed.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **141**

DATASTORE: Time correlated storage and access of experimental data

Author: George McIntyre[1]

[1] *Osprey DCS*

Corresponding Author: george@level-n.com

A high-volume, time-series, database for experimental data. Presentation of initial work carried out by Osprey DCS towards providing a specially designed timeseries database that can ingest and correlate data at high-speed, and can be used to feed ML systems.

Please select if talk will be in person or on zoom:

In person

Plenary Session: Lightning Talks / **142**

Fermilab Accelerator Directorate Robotics Initiative

Author: Brian Hartsell[1]

Co-authors: Adam Watts [1]; Susanna Stevenson ; John Stanton ; Noah Curfman

[1] *Fermilab*

Corresponding Authors: susanna@fnal.gov, hartsell@fnal.gov, ncurfman@fnal.gov, jstanton@fnal.gov, awatts@fnal.gov

The Fermilab Accelerator Directorate Robotics Initiative is working to develop and deploy robots in the accelerator tunnels to aid in observation and measurements in harsh environments to reduce personnel exposure and beam-off time. Longer term goals of the collaboration include telemanipulation of parts, autonomous navigation, and automation of repetitive tasks. One possible method of control of the robots involves utilizing the accelerator controls system. Current status of the initiative will be presented along with possible functional requirements required from the controls system to enable these technologies.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **143**

Considerations Involving the High Level Applications Services for the EIC Project

Author: James Jamilkowski[1]

Co-authors: Seth Nemesure [2]; Theodore D'Ottavio [2]

[1] *BNL/EIC*

[2] *Brookhaven National Laboratory*

Corresponding Authors: seth@bnl.gov, jpjamilk@bnl.gov, dottavio@bnl.gov

High Level Application service options for the Electron Ion Collider Project are currently under evaluation, both from the existing Relativistic Heavy Ion Collider proprietary Controls System and from the EPICS ecosystem. We will describe some early observations, concerns, and opportunities from amongst the more urgently required areas, including Logging, Name Lookups, Alarm notifications, and Sequencing tools.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **144**

EPICS in Context of Machine Learning, Beam Tuning and Offline Scientific Computing

Authors: Auralee Edelen[1]; Bob Dalesio[2]; Kay Kasemir[3]; George McIntyre[2]; Gregory White[1]; Jacqueline Garrahan[None]; Michael Davidsaver[2]

[1] *SLAC*

[2] *Osprey DCS*

[3] *ORNL/SNS*

Corresponding Authors: kasemirk@ornl.gov, bdalesio@ospreydcs.com, mdavidsaver@gmail.com, george@level-n.com, edelen@slac.stanford.edu, greg@slac.stanford.edu, jacquelinegarrahan@gmail.com

This talk contextualizes EPICS in accelerator optimization and "quite big" data experiment support, for other AI/ML session talks. EPICS 7 had the aim of better computing supporting for the next generation of machines and analytical tools. Many new data types, such as matrices, tables, images, and statistical descriptions, plus users' own data types, now supplement the simple scalar and waveform types of the classic EPICS. New EPICS based computational architectures for scientific computing are emerging for high-performance data processing, high fidelity archiving, pipelining, and classically offline physics. Python and matlab bindings support ML and science users. The result has been that controls are now being integrated with multi-particle modelling, machine learning, enterprise databases, experiment DAQs, and large legacy physics systems.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **145**

Experience with Machine Learning Enhanced Modeling and Optimization at SLAC

Author: Auralee Edelen[1]

[1] *SLAC*

Corresponding Author: edelen@slac.stanford.edu

This talk will cover the use cases, experience, and experimental results from using Machine Learning enhanced modeling and tuning methods at SLAC National Accelerator Laboratory and collaborating accelerator facilities. These applications range from intelligent online optimization with minimal prior data to deployment of fast-executing surrogate models to predict complicated beam dynamics behavior online. An emphasis will be placed on practical lessons learned and future needs, with an eye toward control system and computing infrastructure.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session / **146**

C2 Data Viewer: Visualization tool for EPICS7 Data Streaming

Authors: Elaine Chandler[1]; Guobao Shen[1]; Sinisa Veseli[1]; Thomas Fors[1]; Timothy Madden[1]

[1] *Argonne National Laboratory*

Corresponding Authors: echandler@anl.gov, gshen@anl.gov, tmadden@anl.gov, tfors@anl.gov, sveseli@anl.gov

A high-performance data acquisition system (DAQ) has been under active development to meet APS-U needs. It takes data from underneath FPGA (Field Programmable Gate Array), and streams it to its downstream users. The APS-U DAQ system software framework is implemented as a major portion of APS-U new control system software infrastructure, which is called C2. To visualize the DAQ data on the fly, a C2 Data Viewer (C2DV) is has been implemented using Python, which can be used for displaying live PV data streams for monitoring, troubleshooting and diagnostics purposes. It is now capable of handling both EPICS pvAccess (PVA) and Channel Access (CA) data, and includes several different applications: a scope viewer for plotting PVA waveforms, an image viewer for displaying Area Detector image data, and a striptool for monitoring PVA as well as CA scalar PVs. In this presentation we discuss various C2DV features, its usage at the Advanced Photon Source, as well as plans for future development.

Please select if talk will be in person or on zoom:

On Zoom

Workshop: areaDetector / **147**

areaDetector Lecture and Demonstration

Author: Mark Rivers[1]

[1] *Univ. of Chicago*

Corresponding Author: rivers@cars.uchicago.edu

I will present an overview and demonstration of the areaDetector framework. areaDetector is widely used for interfacing EPICS to a variety of 2-D detectors, including those for visible light imaging, spectroscopy, and X-rays. It has a rich set of plugins for image statistics, transformation, file saving, etc. I will present a demonstration using a simulation detector and a real camera.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **148**

The Use of a Component Database for the APS Upgrade Project

Author: Ned Arnold[1]

[1] *Argonne National Laboratory*

Corresponding Author: nda@anl.gov

The Component Database (CDB) (developed for the Advanced Photon Source Upgrade) and a tightly coupled version of the eTraveler (originally developed at FRIB) have been in use for over 5 years to support the design, fabrication, and installation of thousands of components. This talk will provide a brief introduction to the applications and then describe the numerous ways the captured data has been used ... many of which are beyond what was originally envisioned. A summary will include important "lessons learned" for future users of the tools.

Please select if talk will be in person or on zoom:

In person

Plenary Session / **149**

EPICS-TCA, a Node.js Library for EPICS Channel Access and PV Access Protocols

Author: Hao Hao[1]

[1] *Oak Ridge National Laboratory*

Corresponding Author: haoh@ornl.gov

We developed a native CA and PVA library in JavaScript's local runtime environment, Node.js. By using the asynchronous features of this programming language, this library can efficiently process a large amount of CA connections.

Please select if talk will be in person or on zoom:

In person

150

NSLS-II zDFE and zDFE+ Common Platform

Author: Joseph Mead[1]

[1] *Brookhaven National Lab*

Corresponding Author: mead@bnl.gov

The National Synchrotron Light Source II (NSLS-II) is a third generation light source has been operating for almost 10 years. The Diagnostics group is responsible for providing numerous systems for monitoring key aspects of the accelerator complex with the Beam Position Monitor Electronics (BPM) being its largest system. The in-house designed BPM electronics includes two boards: An analog front-end (AFE) and a digital front-end (DFE), both housed in a 1U chassis. The DFE board design lends itself well for use as a common hardware platform because of its multitude of connection

options, plenty of I/O capability, large FPGA and DDR memory. I will describe the updated Zynq based DFE (zDFE) and new Zynq UltraScale+ (zuDFE) platforms and how they are finding applications ranging not only for BPM's, but also for detector subsystems and beam line controls.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session / **151**

Machine Learning Operations for Accelerator Control

Corresponding Author: miceli@fnal.gov

An overview of Machine Learning Operations (MLOps) for accelerator control.

Please select if talk will be in person or on zoom:

In person

Workshop: EPICS Core / **153**

Other content related to EPICS Core

Plenary Session: Lightning Talks / **154**

Challenges and Perspectives of AreaDetector for Sirius High-throughput Detectors

Authors: Marco Montevechi Filho[1]; Érico Rolim[2]

[1] *CNPEM*

[2] *LNLS*

Corresponding Authors: erico.rolim@lnls.br, marco.filho@lnls.br

The PiMega detector family deployed at Sirius uses CERN's Medipix3RX ASIC, delivering nearly 210 Gbps worth of raw payload in the largest detectors. In new generations based on Timepix4, the worst case bandwidth considered can reach up to 1.8 Tbps.

Current software architecture has a strong decoupling between data acquisition software stack and the EPICS IOC, relegating to EPICS the role of slow viewer only at 10 Hz update rate. A great deal of AreaDetector functions such as buffering, file writing, ROIs, image viewers, flat field array processing, are reimplemented elsewhere.

We discuss possibilities of higher integration to AreaDetector framework in newer software designs and present the challenges considered in this effort, future perspectives for new high-throughput detectors and questions that arise about possible hardware acceleration implementations in the framework, focusing on making the best use out of the existing and open source frameworks such as the AreaDetector.

Please select if talk will be in person or on zoom:

On Zoom

Plenary Session: Lightning Talks / **155**

Upgrade legacy VME module to Ethernet/FPGA

Author: Yuke Tian[1]

[1] *Brookhanven National Lab*

Corresponding Author: ytian@bnl.gov

There are many VME modules in difference system in difference facilities. These VME module become obsolete due to the VME hardware obsolescence (such as front-end computer) and lack of support of operating systems (such as RTEMS) running on the VME systems. In this talk, we will discuss the migration path of the VME board to Ethernet on FPGA for control. The upgraded module can have the same VME formfactor for hardware compatibility reasons.

Please select if talk will be in person or on zoom:

In person

Welcome / **156**

Laboratory Director's Welcome

Corresponding Author: merminga@fnal.gov

Plenary Session / **157**

Ethernet as a Fieldbus: Scaling Distributed Systems Interfacing with EPICS and ACNET

Corresponding Author: rsantucc@fnal.gov

In order to increase data acquisition rates and to lower complexity at the embedded level, Fermilab Instrumentation is developing a Ethernet field bus to communicate with a centralized middle layer utilizing Redis. Each embedded node will stream data to the middle layer where post processing can be done via micro services in containers. All data, including raw and processed wave forms, will then be presented to the control system. This architecture allows for easy scalability, lowers complexity, and allows easy adaptation to current (ACNET) and future controls systems (EPICS).

Closeout Session (Workshop Reports) / **158**

Collaboration Meeting Closeout

Author: Karen White[1]

[1] *Oak Ridge National Laboratory*

Corresponding Author: ksw@ornl.gov

Closing remarks for the meeting. Announcement of next collaboration meeting.

Please select if talk will be in person or on zoom:

In person

159

Getting to and around Fermilab

Corresponding Author: lila@fnal.gov

Orientation Slides for In-Person Attendees

Please select if talk will be in person or on zoom:

Plenary Session: Lightning Talks / **160**

Autoparam module status update

Last year, Cosylab made a public release of Autoparam and ADS EPICS modules and we are happy to see that the community is adopting them: soon after the release, we started to receive pull requests for bugfixes and new features. Fermilab was the first user of Autoparam and has an earlier version of the module. With this report, I'd like to present what was improved since Fermilab adopted Autoparam, and what benefits upgrading would bring.

Closeout Session (Workshop Reports) / **161**

CS Studio / Phoebus Workshop Summary

Corresponding Author: hanlet@fnal.gov

Closeout Session (Workshop Reports) / **162**

Motor Control Workshop Summary

Corresponding Author: kmpeters@anl.gov

Closeout Session (Workshop Reports) / **163**

areaDetector Workshop Summary

Corresponding Author: rivers@cars.uchicago.edu

Closeout Session (Workshop Reports) / 164

EPICS Core Workshop Summary

Corresponding Author: mdavidsaver@gmail.com

Closeout Session (Workshop Reports) / 165

RTEMS Workshop Announcement

Corresponding Author: junkes@fhi.mpg.de

Closeout Session (Workshop Reports) / 166

Cybersecurity Workshop Announcement

Corresponding Authors: greg@slac.stanford.edu, tiradani@fnal.gov

Closeout Session (Workshop Reports) / 167

User Interface Workshop Announcement

Corresponding Author: beau@fnal.gov

Closeout Session (Workshop Reports) / 168

Local Organizing Committee Wrapup

Corresponding Author: erik@fnal.gov

Workshop: Cybersecurity / 169

A Technical Proposal for TLS in PV Access

Corresponding Author: george@level-n.com

Slides presented in the Cybersecurity workshop during the EPICS 2023 Collaboration Meeting at Fermilab.

Please select if talk will be in person or on zoom: