AI4EIC 2023 Annual Workshop

Report of Contributions

https://indico.bnl.gov/e/AI4EIC2023

Contribution ID: **2** Type: **not specified**

Performance optimization for a scintillating glass electromagnetic calorimeter at EIC

Tuesday, 28 November 2023 10:15 (25 minutes)

Successful realization of EIC scientific program requires designing and constructing high-performance particle detectors. Recent developments in the field of scientific computing and increased availability of high performance computing resources have made it possible to perform optimization of multi-parameter designs, even when the latter require longer computational times (for example simulations of particle interactions with matter). Procedures involving machine-assisted techniques used to inform the design decision have seen a considerable growth in popularity among the EIC detector community. Having already been realized for tracking and RICH PID detectors, it has a potential application in calorimetry designs. A SciGlass barrel calorimeter originally designed for EIC Detector-1 has a semi-projective geometry that allows for non-trivial perfomance gains, but also poses special challenges in the way of effective exploration of the design space while satisfying the available space and the cell dimension constraints together with the full detector acceptance requirement. This talk will cover specific approaches taken to perform this detector design optimization.

Primary authors: KALINKIN, Dmitrii (University of Kentucky); CRAFTS, Joshua (affiliate@jlab.org;member@jlab.org); F
Renee (University of Kentucky); HORN, Tanja (Cath)

Presenter: KALINKIN, Dmitrii (University of Kentucky)

Session Classification: AI/ML for ePIC and Beyond

Contribution ID: **6** Type: **not specified**

Scalable AI/ML Workflow Management Across Distributed Heterogeneous Resources With PanDA

Thursday, 30 November 2023 14:40 (25 minutes)

The Production and Distributed Analysis (PanDA) system originating in LHC's ATLAS experiment has been steadily evolving upon a technical foundation of proven scalability and extensibility, extending in recent years to new experiments (Rubin Observatory, sPHENIX) and new capabilities in managing large scale, complex workflows across diverse geographically distributed resources. AI/ML has been a particular focus, with support for processing intensive workflows benefiting from extensive automation and access to large scale resources, such as hyperparameter optimization (HPO). This presentation will introduce PanDA, its complex workflow management capabilities and their practical application in HPO and other AI/ML workflows. Finally, PanDA's role in a new R&D program providing a scalable and distributed workflow engine for AI-assisted EIC detector design will be described.

Primary authors: WEBER, Christian (Brookhaven National Laboratory); Dr ZHANG, Rui (University of Wisconsin-Madison); MAENO, Tadashi (BNL); GUAN, Wen (BNL); WENAUS, Torre (BNL)

Presenter: GUAN, Wen (BNL)

Session Classification: AI/ML in Production, Distributed ML

Contribution ID: **7** Type: **not specified**

Interpretable Machine Learning applications to Jet Background Subtraction

Wednesday, 29 November 2023 15:30 (25 minutes)

Reconstructing jets in heavy collisions has always required dealing with the challenges of a high background environment. Traditional techniques, such as the area based method, suffered from poor resolution at low momenta due to the large fluctuating background there. In recent years, the resolution has been improved by using machine learning to estimate the background. While machine learning tends to lead to improvements in general (wherever it is applied), care must be taken to ensure these improvements do not come at the cost of interpretability or bias from models used for training. We demonstrate a middle path – using machine learning techniques to translate "black-box" models (such as neural nets) into human interpretable formulas. We present a novel application of symbolic regression to extract a functional representation of a deep neural network trained to subtract background for measurements of jets in heavy ion collisions. With this functional representation we show that the relationship learned by a neural network is approximately the same as a new background subtraction method using the particle multiplicity in a jet. We compare the multiplicity method to the deep neural network method alone, showing its increased interpretability and comparable performance. We also discuss the application of these techniques to background subtraction for jets measured at the EIC.

Primary authors: MENGEL, Tanner (University of Tennessee (UTK)); STEFFANIC, Patrick (UT--Knoxille); HUGHES, Charles (Iowa State University); OLIVEIRA DA SILVA, Antonio Carlos (Iowa State University); NATTRASS, Christine (University of Tennessee, Knoxville)

Presenter: HUGHES, Charles (Iowa State University)

Session Classification: AI/ML for Data Analysis and Theory

Contribution ID: **8** Type: **not specified**

Object Condensation for Track Building in a Backward Electron Tagger at the EIC

Tuesday, 28 November 2023 10:40 (25 minutes)

Quasi-real photoproduction measurements at the Electron Ion Collider will require a far backward electron tagger to detect electrons scattered at small angles close to the beam line. A high occupancy is expected in the electron tagger, leading to many possible permutations of hits deposited by the electrons into single electron tracks. To avoid a slow and computationally expensive combinatorial approach to track building, machine learning algorithms such as object condensation methods can be used to recognise objects such as tracks from hits in a detector. We demonstrate how these object condensation methods are particularly well suited to track building in the far backward electron tagger, achieving an efficiency in track finding at or above 95% and a purity at or above 90%, in the presence of noise and hit detection inefficiencies.

Primary authors: GLAZIER, Derek; Dr TYSON, Richard (University of Glasgow); Dr GARDNER, Simon (University of Glasgow); LIVINGSTON, Kenneth (University of Glasgow)

Presenter: Dr GARDNER, Simon (University of Glasgow)

Session Classification: AI/ML for ePIC and Beyond

Contribution ID: **9** Type: **not specified**

A Large Language Model-based Assistant for the Electron Ion Collider

Thursday, 30 November 2023 10:50 (20 minutes)

A large-scale physics experiment is distinguished by a wide collaboration and array of research topics, and frequently encounters obstacles in information exchange coordination and data analysis. We introduce an assistant model designed to enhance collaboration and streamline data analysis. This model acts as an intelligent intermediary for research teams, enabling information exchange, offering expert insights, and supporting decision-making for researchers. Moreover, it can process and interpret experimental data in real-time, facilitating quicker researcher decisions. In this work, we focus on the Electron Ion Collider (EIC), the next generation facility for Quantum Chromodynamics. The EIC has already engaged hundreds of collaborators, producing a wealth of research outputs. Significantly, it has integrated artificial intelligence and machine learning into various facets of its scientific endeavors. Using Large Language Models (LLMs) for summary generation and tailored prompt engineering, we introduce a framework for the EIC. We showcase proof-of-concept studies, efficiently curating information from a vector database containing technical notes and other EIC community contributions. Demonstrating the viability of our method, we present a web application that visualizes the outcomes from our proof-of-concept studies. We conclude with insights for potential advancements and discussions on future endeavors.

Primary authors: Dr SURESH, Karthik (William & Mary); FANELLI, Cristiano (W&M)

Presenter: Dr SURESH, Karthik (William & Mary)

Session Classification: Foundation Models and Trends in Data Science with Tutorials

Contribution ID: **10** Type: **not specified**

The Optimal use of Segmentation for Sampling Calorimeters

Tuesday, 28 November 2023 11:20 (25 minutes)

One of the key design choices of any sampling calorimeter is how fine to make the longitudinal and
transverse segmentation. To inform this choice, we study the impact of calorimeter segmentation on energy reconstruction. To ensure that the trends are due entirely to hardware and not to a sub-optimal use of segmentation, we deploy deep neural networks to perform the reconstruction. These networks make use of all available information by representing the calorimeter as a point cloud. To demonstrate our approach, we simulate a detector similar to the forward calorimeter system intended for use in the ePIC detector, which will operate at the upcoming Electron Ion Collider. We find that for the energy estimation of isolated charged pion showers, relatively fine longitudinal segmentation is key to achieving an energy resolution that is better than 10% across the full phase space. These results provide a valuable benchmark for ongoing EIC detector optimizations and may
also inform future studies involving high-granularity calorimeters in other experiments at various facilities

Primary author: TORALES ACOSTA, Fernando (Staff@lbl.gov;Member@lbl.gov;Other@lbl.gov)

Co-authors: ARRATIA, Miguel (University of California, Riverside); ANGERAMI, Aaron; MILTON, Ryan (UCR); NACHMAN, Benjamin; KARANDE, Piyush; KARKI, Bishnu (University of California, Riverside)

Presenter: TORALES ACOSTA, Fernando (Staff@lbl.gov;Member@lbl.gov;Other@lbl.gov)

Session Classification: AI/ML for ePIC and Beyond

Contribution ID: **11** Type: **not specified**

ML-based Calibration and Control of the GlueX Central Drift Chamber

Tuesday, 28 November 2023 14:23 (23 minutes)

The GlueX Central Drift Chamber (CDC) in Hall D at Jefferson Lab, used for detecting and tracking charged particles, is calibrated and controlled \textit{during} data taking using a Gaussian process. The system dynamically adjusts the high voltage applied to the anode wires inside the chamber in response to changing environmental and experimental conditions such that the gain is stabilized. Control policies have been established to manage the CDC's behavior. These policies are activated when the model's uncertainty exceeds a configurable threshold or during human-initiated tests during normal production running. We demonstrate the system reduces the time detector experts dedicate to calibration of the data offline, leading to a marked decrease in computing resource usage without compromising detector performance.

Primary authors: LAWRENCE, David (Jefferson Lab); MCSPADDEN, Diana (Jefferson Lab); JESKE, Torri (Jefferson Lab); Dr GOODRICH, Michael (Jefferson Lab); Dr JARVIS, Naomi (Carnegie Mellon University); BRITTON, Thomas (JLAB)

Presenter: LAWRENCE, David (Jefferson Lab)

Session Classification: Calibration, Monitoring, and Experimental Control in Streaming Environments

Contribution ID: **12** Type: **not specified**

Beam Condition Forecasting with non-destructive measurements at FACET-II

Wednesday, 29 November 2023 10:40 (20 minutes)

Beam diagnostic technology is one of the foundations of large particle accelerator facilities. A challenge with operating these systems is the measurement of beam dynamics. Many methods such as beam position monitors have an inherent destructive quality to the beam and produce perturbations after the measurement. The ability to measure the beam conditions with non-destructive edge radiation allows for us to have a more stable understanding and predictability of the beam condition. We are developing a machine learning workflow for the downstream prediction and future forecasting of the beam condition utilizing the non-destructive edge radiation measurements and novel graph neural networks in collaboration with FACET-II at SLAC. Our methods divide the problem into two different aspects. First, we are developing machine learning algorithms with the beam physics integrated within each layer of the network. Second, developing an online surrogate model of edge radiation using SRW will allow for automatic generation of new beam states due to the changing parameters of accelerator facilities over time. We plan to integrate and test our prediction system at the SLAC facility to perform beam condition prediction and verification at FACET-II.

Primary author: KILPATRICK, Matt (RadiaSoft)

Presenter: KILPATRICK, Matt (RadiaSoft)

Session Classification: AI/ML for Accelerators

Contribution ID: **13** Type: **not specified**

Bayesian Optimization Techniques for Accelerator Control and Characterization

Wednesday, 29 November 2023 10:00 (20 minutes)

Future improvements in accelerator performance are predicated on increasing capabilities in online control of beams inside accelerators. Machine learning techniques have been the focus of work at SLAC to increase our ability to autonomously optimize and characterize beam dynamics inside accelerator facilities. Bayesian optimization algorithms, which leverage statistical surrogate models of objective functions to effectively address complex optimization challenges, are well situated for solving online optimization challenges in accelerator science. We describe Bayesian optimization techniques that have been developed to solve a wide range of online accelerator control problems, including single and multi-objective optimization, autonomous characterization, with or without constraints, high dimensional parameter spaces, and in the presence of hysteresis effects. These techniques can be used to effectively automate routine accelerator facility processes and enable novel capabilities in current and future accelerator systems.

Presenter: ROUSSEL, Ryan (SLAC National Laboratory)

Session Classification: AI/ML for Accelerators

Contribution ID: **14** Type: **not specified**

Machine learning for digital twin development and polarization optimization at BNL hadron injectors

Wednesday, 29 November 2023 10:20 (20 minutes)

Polarization optimization collaboration (BNL, Cornell, JLab, SLAC, RPI)

Presenter: LIN, Lucy (Cornell University)

Session Classification: AI/ML for Accelerators

Contribution ID: **15** Type: **not specified**

Machine Learning applications for collider luminosity maximization

Wednesday, 29 November 2023 11:00 (20 minutes)

The luminosity of a collider can be affected by many parameters at the same time. It is not easy to distinguish the effects of one parameter from all other parameters separately. Therefore, optimizing the performance of a collider such as RHIC, EIC becomes a multi-objective optimization problem with possible noisy signals and involves many parameters. Therefore, machine learning (Bayesian and Gaussian Process) could be a good tool for the luminosity optimization. Here, we talk about a Bayesian optimization method which is developed at LBNL GPTune and its planned application to RHIC luminosity optimization, as well as its possible application to EIC collider.

Presenters: QIANG, Ji (LBNL); LI, Sherry (LBNL); FUNG, Will (MSU); GU, Xiaofeng (Collider Accelerator Department, BNL); KAN, Yi-Kai (LBNL); HAO, Yue (Michigan State University / Brookhaven National Laboratory)

Session Classification: AI/ML for Accelerators

Contribution ID: **16** Type: **not specified**

Anomaly detection at an X-ray FEL

Wednesday, 29 November 2023 11:35 (20 minutes)

Modern light sources produce too many signals for a small operations team to monitor in real time. As a result, recovering from faults can require long downtimes, or even worse subtle performance issues may persist undiscovered. Existing automated methods tend to rely on pre-set limits which either miss subtle problems or produce too many false positives. AI methods can solve both problems, but deep learning techniques typically require extensive labeled training sets, which may not exist for anomaly detection tasks. Here we will show work on unsupervised AI methods developed to find problems at the Linac Coherent Light Source (LCLS). Whereas most unsupervised AI methods are based on distance or density metrics, we will describe a coincidence-based method that identifies faults through simultaneous changes in sub-system and beam behavior. We have applied the method to radio-frequency (RF) stations faults — the most common cause of lost beam at LCLS — and find that the proposed method can be fully automated while identifying 50% more events with 6x fewer false positives than the existing alarm system. We will also show work on a general outlier detection method, including an example of finding a previously unknown beam-scraping event.

Presenter: RATNER, Daniel (staff@stanford.edu;member@stanford.edu)

Session Classification: AI/ML for Accelerators

Contribution ID: **17** Type: **not specified**

Uncertainty estimation and RL applications at JLab

Wednesday, 29 November 2023 11:55 (20 minutes)

Standard deep learning models for classification and regression applications are ideal for capturing complex system dynamics.
Unfortunately, their predictions can be arbitrarily inaccurate when the input samples are not similar to the training data. Implementation of distance aware uncertainty estimation can be used to detect these scenarios and provide a level of confidence associated with their predictions.
We present results using UQ for ML methods for 1) anomaly detection at Spallation Neutron Source (SNS) accelerator and 2) the Fermi National Accelerator Lab (FNAL) Booster Accelerator Complex.
We also present an application of reinforcement learning to improve accelerator controls.

Presenter: SCHRAM, Malachi (Thomas Jefferson National Accelerator Facility)

Session Classification: AI/ML for Accelerators

Contribution ID: **18** Type: **not specified**

Using Machine Learning to Improve Dynamic Aperture Estimates

Wednesday, 29 November 2023 12:15 (20 minutes)

The dynamic aperture (DA) is an important concept in the study of nonlinear beam dynamics. Several analytical models used to describe the evolution of DA as a function of time, and to extrapolate to realistic time scales that would not be reachable otherwise due to computational limitations, have been successfully developed. Even though these models have been quite successful in the past, the fitting procedure is rather sensitive to several details. Machine Learning (ML) techniques carry the potential to address some of these challenges. Two applications of ML approaches will be presented and discussed in detail. Firstly, ML has been used to efficiently detect outliers in the DA computations. Secondly, ML techniques have been applied to improve the fitting procedures of the DA models, thus improving their predictive power

Presenter: VAN DER VEKEN, Frederik (CERN)

Session Classification: AI/ML for Accelerators

Contribution ID: **19** Type: **not specified**

Discussion

Wednesday, 29 November 2023 12:35 (25 minutes)

Session Classification: AI/ML for Accelerators

Contribution ID: **20** Type: **not specified**

The EXCLAIM collaboration approach to deeply virtual exclusive processes

Wednesday, 29 November 2023 14:00 (25 minutes)

Presenter: LIUTI, simonetta (university of virginia)

Session Classification: AI/ML for Data Analysis and Theory

Contribution ID: **21** Type: **not specified**

Decoding inverse problems in QCD with ML-based algorithms

Wednesday, 29 November 2023 14:25 (25 minutes)

Presenter: LI, Yaohang (Old Dominion University)

Session Classification: AI/ML for Data Analysis and Theory

Contribution ID: **22** Type: **not specified**

What can AI do for lattice-QCD parton distribution calculations?

Wednesday, 29 November 2023 14:50 (25 minutes)

Presenter: WEN, Huey (MSU)

Session Classification: AI/ML for Data Analysis and Theory

Contribution ID: **23** Type: **not specified**

Hadronization Models Using Machine Learning

Wednesday, 29 November 2023 16:20 (25 minutes)

Presenter: SZEWC, Manuel (University of Cincinnati)

Session Classification: AI/ML for Data Analysis and Theory

Contribution ID: **24** Type: **not specified**

High Dimensional Unfolding using Machine Learning

Wednesday, 29 November 2023 15:55 (25 minutes)

Presenter: NACHMAN, Benjamin

Session Classification: AI/ML for Data Analysis and Theory

Contribution ID: **25** Type: **not specified**

Discussion

Wednesday, 29 November 2023 16:45 (15 minutes)

Session Classification: AI/ML for Data Analysis and Theory

Contribution ID: **26** Type: **not specified**

Tutorial: Continual Learning

Wednesday, 29 November 2023 09:00 (1 hour)

Presenter: COSSU, Andrea (University of Pisa)

Session Classification: Tutorial 1

Contribution ID: **27** Type: **not specified**

Machine learning as a service for HEP using cloud

Thursday, 30 November 2023 14:00 (20 minutes)

Presenter: GIOMMI, Luca (University of Bologna)

Session Classification: AI/ML in Production, Distributed ML

Contribution ID: **28** Type: **not specified**

Particle identification with machine learning from incomplete data in the ALICE experiment

Thursday, 30 November 2023 14:20 (20 minutes)

Presenter: KARWOWSKA, Maja (CERN, Warsaw U. of Tech.)

Session Classification: AI/ML in Production, Distributed ML

Contribution ID: **29** Type: **not specified**

The Exa.TrkX Project

Thursday, 30 November 2023 15:05 (25 minutes)

Presenter: JU, Xiangyang (Lawrence Berkeley National Laboratory)

Session Classification: AI/ML in Production, Distributed ML

Contribution ID: **30** Type: **not specified**

ATLAS data analysis using a parallelized workflow on distributed cloud-based services with GPUs

Thursday, 30 November 2023 15:45 (25 minutes)

Presenter: SANDERSARA, Jay (CERN)

Session Classification: AI/ML in Production, Distributed ML

Contribution ID: **31** Type: **not specified**

Online Track Reconstruction and Physics Analysis in CLAS12

Thursday, 30 November 2023 16:10 (20 minutes)

Presenter: GAVALIAN, Gagik (Jefferson Lab)

Session Classification: AI/ML in Production, Distributed ML

Contribution ID: **32** Type: **not specified**

MLaaS4HEP, Machine Learning for Columnar High Energy Physics Analysis

Thursday, 30 November 2023 16:30 (20 minutes)

Presenter: KAUFMAN, Elliott (Princeton University)

Session Classification: AI/ML in Production, Distributed ML

Contribution ID: **33** Type: **not specified**

Discussion

Thursday, 30 November 2023 16:50 (10 minutes)

Session Classification: AI/ML in Production, Distributed ML

Contribution ID: **34** Type: **not specified**

Introduction: ePIC Overview

Tuesday, 28 November 2023 10:00 (15 minutes)

Presenter: LAJOIE, John (Iowa State University)

Session Classification: AI/ML for ePIC and Beyond

Contribution ID: **35** Type: **not specified**

AID(2)E: AI-Assisted Detector Design at EIC

Tuesday, 28 November 2023 11:45 (25 minutes)

Presenter: FANELLI, Cristiano (W&M)

Session Classification: AI/ML for ePIC and Beyond

Contribution ID: **36** Type: **not specified**

Flash Talks

Tuesday, 28 November 2023 12:10 (45 minutes)

Session Classification: AI/ML for ePIC and Beyond

Contribution ID: **37** Type: **not specified**

Discussion

Tuesday, 28 November 2023 12:55 (5 minutes)

Session Classification: AI/ML for ePIC and Beyond

Contribution ID: **38** Type: **not specified**

Introduction and Overview of Foundation Models

Thursday, 30 November 2023 10:00 (30 minutes)

Presenter: TERAO, Kazuhiro (SLAC National Accelerator Laboratory)

Session Classification: Foundation Models and Trends in Data Science with Tutorials

Contribution ID: **39** Type: **not specified**

The Trillion Parameter Consortium

Thursday, 30 November 2023 10:30 (20 minutes)

Presenter: STEVENS, Rick (ANL)

Session Classification: Foundation Models and Trends in Data Science with Tutorials

Contribution ID: **40** Type: **not specified**

Chatlas - the ATLAS AI Assistant

Thursday, 30 November 2023 11:10 (20 minutes)

Presenter: MURNANE, Daniel (LBL)

Session Classification: Foundation Models and Trends in Data Science with Tutorials

Contribution ID: **41** Type: **not specified**

TrackBERT - Generalist Learning of Trackers for Downstream Tasks

Thursday, 30 November 2023 11:45 (20 minutes)

Presenter: JU, Xiangyang (Lawrence Berkeley National Laboratory)

Session Classification: Foundation Models and Trends in Data Science with Tutorials

Contribution ID: **42** Type: **not specified**

Adversarial Methods for Generative Data Understanding

Thursday, 30 November 2023 12:05 (20 minutes)

Presenter: YEATS, Eric (Duke)

Session Classification: Foundation Models and Trends in Data Science with Tutorials

Contribution ID: **43** Type: **not specified**

Toward a generative modeling analysis of CLAS exclusive 2π photoproduction

Thursday, 30 November 2023 12:25 (20 minutes)

Presenter: ALGHAMDI, Tareq (ODU)

Session Classification: Foundation Models and Trends in Data Science with Tutorials

Contribution ID: **44** Type: **not specified**

Discussion

Thursday, 30 November 2023 12:45 (15 minutes)

Session Classification: Foundation Models and Trends in Data Science with Tutorials

Contribution ID: **45** Type: **not specified**

Tutorial: Hackathon

Friday, 1 December 2023 09:00 (1 hour)

Presenters: GIROUX, James (William & Mary); SURESH, Karthik (William & Mary); Dr MORAN, Patrick (William & Mary)

Session Classification: Tutorial 3

Contribution ID: **46** Type: **not specified**

LHCb Calibration/Alignment

Tuesday, 28 November 2023 14:00 (23 minutes)

In Run II of the LHC, a new scheme for the software trigger at LHCb allows splitting the triggering of events in two stages, allowing to perform the detector alignment and calibration in real time. The real-time alignment and calibration procedure is a fully automatic procedure at LHCb that is executed at the begining of each fill of the LHC. The alignment estimates the position of detector elements and the correct alignment contributes to achieve the best quality data for offline analysis. The procedure is implemented for the full tracking system at LHCb with the event reconstruction run as a multithreaded process. The procedure performs an update of the alignment constants, while the calibration constants are evaluated for each run. This allows identical constants to be used in the online and offline reconstruction and improves the correlation between triggered and offline selected events. The operational and technical point of view of this procedure during data-taking is discussed with the focus on performance and optimisations done regarding the new computing framework and the new detectors.

Presenter: MITRESKA, Biljana (Dortmund Tech. U.)

Session Classification: Calibration, Monitoring, and Experimental Control in Streaming Environments

Contribution ID: **47** Type: **not specified**

Gaussian process for near real-time calibration and control of GlueX Central Drift Chamber

Presenter: LAWRENCE, David (Jefferson Lab)

Session Classification: Calibration, Monitoring, and Experimental Control in Streaming Environments

Contribution ID: **48** Type: **not specified**

Towards Fast Calibration with the ePIC Barrel Hadronic Calorimeter

Tuesday, 28 November 2023 14:46 (23 minutes)

Measurement of jets and their substructure will provide valuable information about the properties of the struck quarks and their radiative properties in Deep-Inelastic Scattering events. The ePIC Barrel Hadronic Calorimeter (BHCal) will be a critical tool for such measurements. By enabling the measurement of the neutral hadronic component of jets, the BHCal will complement the Barrel Electromagnetic Calorimeter (BECal) and the ePIC tracking system to improve our knowledge of the jet energy scale. However, to obtain a physically meaningful measurement, the response of the combined BECal + BHCal system must be properly calibrated using information from both. With Machine Learning, this can be done in such a way that is both computationally efficient and easy to deploy in a production environment, making such an approach ideal for quasi-real time calibrations needed in a streaming readout environment. We present a potential machine-learning based algorithm for fast calibration of the combined system which could be deployed in such an environment and discuss progress towards its implementation.

Presenter: ANDERSON, Derek (Iowa State University)

Session Classification: Calibration, Monitoring, and Experimental Control in Streaming Environments

Contribution ID: **49** Type: **not specified**

Hydra: Computer Vision for Data Quality Monitoring

Tuesday, 28 November 2023 15:29 (23 minutes)

Hydra is a system which utilizes computer vision to perform near real time data quality management, initially developed for Hall-D in 2019. Since then, it has been deployed across all experimental halls at Jefferson Lab, with the CLAS12 collaboration in Hall-B being the first outside of GlueX to fully utilize Hydra. The system comprises back end processes that manage the models, their inferences, and the data flow. The front-end components, accessible via web pages, allow detector experts and shift crews to view and interact with the system. This talk will give an overview of the Hydra system as well as highlight significant developments in Hydra's feature set, acute challenges with operating Hydra in all halls, and lessons learned along the way.

Presenter: BRITTON, Thomas (JLAB)

Session Classification: Calibration, Monitoring, and Experimental Control in Streaming Environments

Contribution ID: **50** Type: **not specified**

Fast 2D Bicephalous Convolutional Autoencoder for Compressing 3D Time Projection Chamber Data

Tuesday, 28 November 2023 15:52 (23 minutes)

Presenter: HUANG, Yi (Brookhaven national lab)

Session Classification: Calibration, Monitoring, and Experimental Control in Streaming Environments

Contribution ID: **51** Type: **not specified**

Autonomous selection of physics events: A RHIC demonstrator for EIC physics

Tuesday, 28 November 2023 16:15 (23 minutes)

With ever-increasing collision rates producing larger data volumes and the search for rarer physics processes, it is becoming apparent that autonomic decision making can play a key role in tagging physics events of interest to specific groups or filtering data streams to manageable levels. A demonstrator for separating events with a heavy flavor decay from background events in proton-proton collisions at the Relativistic Heavy Ion Collider (RHIC) with the sPHENIX detector is presented. Due to data volume limitations, sPHENIX is capable of recording 10% of the minimum-bias collisions at RHIC using streaming readout in addition to its 15 kHz hardware trigger of rare events. This demonstrator will use machine-learning algorithms on FPGAs to sample the remaining 90% of the collisions, determine the event topology and send a decision to the data acquisition system to record events of interest. The design of the demonstrator and its use at sPHENIX will be refined for deployment at the EIC for the tagging of heavy flavor decays and DIS-electrons.

Presenter: DEAN, Cameron (MIT)

Session Classification: Calibration, Monitoring, and Experimental Control in Streaming Environments

Contribution ID: **52** Type: **not specified**

Tutorial: Reinforcement Learning

Thursday, 30 November 2023 09:00 (1 hour)

Session Classification: Tutorial 2

Contribution ID: **53** Type: **not specified**

Discussion

Tuesday, 28 November 2023 16:38 (22 minutes)

Session Classification: Calibration, Monitoring, and Experimental Control in Streaming Environments