Lab-Wide Instrumentation Poster Session

Report of Contributions

Contribution ID: **0** Type: **poster**

FE65_P2: Prototype Pixel Readout Chip in 65nm for HL-LHC Upgrades

FE65_P2: a mixed-signal ASIC test chip produced in 65nm CMOS as part of an R&D effort by the RD53 collaboration is presented here.
RD53 was established to design the next generation of readout chips for hybrid pixel detectors to cope with the demanding conditions in the HL-LHC at CERN and implementations of its findings will be used in the ATLAS and CMS detector upgrades.

The FE65_P2 establishes the efficacy of several candidate concepts for the first major prototype in the collaboration, these include:

- A synthesized digital sea with analog 'islands'
- A 50x50 micron pixel matrix
- And more!

Primary authors: MEKKAOUI, Abderrezak; GNANI, Dario (Researcher); GARCIA-SCIVERES, Maurice; CARNEY, Rebecca; HEMPEREK, Tomasz (Collaborator)

Contribution ID: **1** Type: **poster**

Multi-Color Gas Phase Spectroscopy and Dynamics

We have recently developed several new experimental approaches to explore sub-picosecond molecular dynamics using synchrotron radiation. Following the manipulation of electronic excited states of a gaseous target using two or more laser pulses, we probe the final states using soft x-ray photons as a function of x-ray energy, laser pulse energy and wavelength, laser-laser time delay and laser-synchrotron time delay using transient absorption techniques.

Our focus in this presentation is on the development and first experiments with a 40-micron photoabsorption gas cell, space and time overlap tools and data acquisition systems.

Primary authors: SLAUGHTER, Daniel; LARSEN, Kirk; TROY, Tyler

Co-authors: BELKACEM, Ali; BANDYOPADHYAY, Biswajit; RUDE, Bruce; CRYAN, James; AHMED, Musahid

Contribution ID: **2** Type: **poster**

Anion fragment momentum imaging

Electron attachment involves a resonant collision of a low energy (typically 0-15 eV) electron with a molecule, resulting in a metastable anion that dissociates or decays by autodetachment. Both of these processes drive a system away from it's equilibrium state and the former process, dissociative electron attachment results in energetic anionic and neutral fragment molecules. The anionic fragment carries information about the neutral co-products in it's momentum distribution.

We measure the anion fragment momentum using a dissociative electron attachment reaction microscope, that was recently developed and built in-house. The details of the experimental design and some experimental examples will be presented.

Primary author: SLAUGHTER, Daniel

Co-authors: BELKACEM, Ali; WEBER, Thorsten

Contribution ID: **3** Type: **poster**

Real-Time Volumetric Gamma-Ray Imaging for General Search and Mapping Scenarios

This work explores the coupling of computer vision algorithms for real-time scene reconstruction with mobile gamma-ray imaging platforms. These algorithms, solutions to a class of problem known as simultaneous localization and mapping (SLAM), provide estimates of the location and orientation (i.e. pose) of the system, as well as a point-cloud model of the surrounding scene as the sensor traverses the environment. The SLAM package used in this work is RGBDSLAM, and open-source SLAM solver that uses data from rgb-d cameras; the most notable example of which is the Microsoft Kinect. A Microsoft Kinect and the RGBDSLAM software have been integrated into multiple gamma-ray imaging platforms; one HPGe-based and another based on CZT. An iterative algorithm based on Compton imaging has been developed to reconstruct 3D distributions of gamma-ray sources from the pose estimates and the interaction information from the position-sensitive gamma-ray detectors. The 3D model is also incorporated into the image reconstruction to decrease reconstruction time and improve image quality.

Primary author: BARNOWSKI, Ross

Contribution ID: **4** Type: **poster**

Instrumentation and Diagnostics for Bi-Alkali Photocathode Production

Bi-Alkali photocathodes have been widely used in photomultiplier tubes and night vision equipment. They have high quantum efficiency (QE) and low thermal emittance in the visible light spectrum and are of crucial importance to Free Electron Laser (FEL) based light sources. But the photocathode production process has not been well defined, and performance of cathodes can vary wildly when produced under the same conditions using standard methods of fabrication (Yo-Yo reaction.)

Advanced tools for characterization of cathode performance during and after fabrication are critical to the understanding of the growth process. We have developed a new instrumentation and diagnostics system for bi-alkali photocathode production that includes a high resolution Ultraviolet/Visible light monochromator and a transverse momentum measuring system (Momentatron) to quickly characterize the performance of photocathodes produced with different fabrication techniques

Primary author: NASIATKA, James

Co-authors: PADMORE, Howard; FENG, Jun

Contribution ID: **5** Type: **poster**

Electronic Noise in High Purity Germanium Radiation Detectors

A unique class of physics experiments requires the detection of low energy depositions in large volume radiation detectors. The high purity germanium (HPGe) detector remains the leader in energy resolution achievable from kg-scale detectors. This poster will present the fundamental sources of electronic noise which limit the low energy threshold in HPGe detectors. Improvements will be demonstrated which can enable the next generation of physics experiments.

Primary author: Dr BARTON, Paul (LBNL)

Co-authors: Dr AMMAN, Mark (LBNL); Dr KAI, Vetter (LBNL, UCB)

Contribution ID: **6** Type: **poster**

Towards time-resolved ambient-pressure X-ray photoelectron spectroscopy

Light-induced charge carrier separation, transport, trapping and recombination at semiconductor electrodes are of central importance for the functioning of many photo-electrochemical devices like dye-sensitized solar cells. Here we present a setup that is capable of capturing the dynamics of these processes directly in the time domain, with element specificity and under realistic working conditions using time-resolved ambient-pressure X-ray photoemission spectroscopy (APXPS) techniques at beamline 11.0.2 of the Advanced Light Source.
By combining time-tagging and pump-probe approaches, we are able to take advantage of the full X-ray flux available during multi-bunch operating mode. This highly efficient detection scheme will enable time-resolved APXPS experiments at high background pressures which intrinsically suffer from low photoemission signal levels.
The viability of the time-resolved APXPS setup is demonstrated by resolving transient charge carrier dynamics in nano-porous ZnO electrodes in response to visible laser excitation: for bare ZnO substrates, ultrafast impurity-state mediated electron-hole pair recombination on the nanosecond timescale is observed at the surface, whereas charge carrier relaxation in dye-sensitized electrodes evolves much slower over several microseconds.

Primary author: Dr NEPPL, Stefan (LBNL - Chemical Sciences)

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Contribution ID: **7** Type: **poster**

Analyzing Organic Liquid for use in TPCs to Detect Antineutrinos

The measurement of ionization electrons in organic liquids has the potential to allow detection of antineutrinos with unprecedented energy and spatial resolution. Previous experience with the ionization of organic liquids suggested the performance of these organic liquids was highly sensitive to trace impurities. We developed a purification process and test chamber to assess these concerns. Here we report successful measurement of the ionization current as well as individual ionization charge pulses caused by gamma ray interactions within a small test volume of a candidate organic liquid, and observed no evidence of degradation due to impurities over a one month period.

Primary author: DWYER, Daniel

Co-authors: MICALLEF, Jessica; GARCIA-SCIVERES, Maurice; BARTON, Paul; SORENSEN, Peter

Contribution ID: **8** Type: **poster**

Committing SINS at the ALS: Broadband Synchrotron Infrared Nano-Spectroscopy

By combining scattering-type-scanning near-field optical microscopy (s-SNOM) with infrared light from a synchrotron source, synchrotron infrared nano-spectroscopy (SINS) enables sensitive molecular and phonon vibrational chemical imaging, spanning the mid- and far-infrared regions (300-5000 cm-1) with <25 nm spatial resolution. This highly powerful combination provides access to a qualitatively new form of nano-chemometric analysis with the investigation of nanoscale, mesoscale, and surface phenomena that were previously impossible to study with IR techniques. We have installed a SINS end-station at Beamline 5.4 at the Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory, making the s-SNOM technique widely available to subject matter experts, such that it can be broadly applied to biological, surface chemistry, materials, or environmental science problems. We discuss recent applications of the SINS technique, highlighting the diverse user science performed at this endstation.

Primary author: Dr BECHTEL, Hans (Advanced Light Source)

Co-author: Dr MARTIN, Michael (Advanced Light Source)

Contribution ID: **9** Type: **poster**

In situ environmental cells for Hard X-ray micro-Tomography on ALS-beamline 8.3.2

Hard x-rays can penetrate several mm of material allowing the imaging of sample interiors. The microtomograpy instrument at beamline 8.3.2 allows for 3D imaging of material samples up to several mm in diameter in a variety of in-situ sample cells that mimic application specific- often extreme - conditions for the material. 3D imaging in realistic and extreme environments elucidates the details of the failure mechanisms and provides a wealth of data that can be used to validate and refine computational models. Validation of such models is necessary to enable rapid, computationally-based design and optimization of new classes of high performance materials.

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Contribution ID: **10** Type: **poster**

A GEANT4 Simulation Framework for the Optimization of a CCD-based Diagnostics for Next Generation MeV Photon Sources

Laser plasma accelerators generate GeV electrons with acceleration distances of a few centimeters. This technology enables compact Thomson scattering photon sources at energies of 1-10 MeV, which have applications in radiography, photo-fission and nuclear resonance fluorescence for nuclear nonproliferation and homeland security. Knowledge of the energy-angle distribution of the photon bunch is crucial to source development as well as to enabling new applications. However, diagnosing Thomson sources is challenging due to the high intensity, ~108 photons per shot, and milli-radian angular divergence. We develop a simulation framework in Geant4 for a diagnostic system composed of a thin scatterer and a scientific CCD electron tracker. The uncertainties introduced by the scatter and the tracker in reconstructing a 1.73 MeV mono-energetic photon sources are evaluated, which determine the intrinsic limit of the current design on measuring the energy-angle distribution. With the flexibility the framework provides, an optimal diagnostic system will be designed.

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Contribution ID: **11** Type: **poster**

Position Sensitive HPGe Detectors Using Proximity Charge Sensing

Electrode segmentation is a necessity to achieve position sensitivity in semiconductor radiation detectors. Traditional segmentation requires high granularity and increasingly smaller electrode sizes. These electrodes are complicated to fabricate and many electrodes are required in order to instrument large detector areas, each with their own readout electronics.
To simplify the fabrication process we have moved the readout electrodes onto a printed circuit board that is positioned above the detection material. In this scheme, charge will be shared among electrodes, allowing for interpolation, such that fewer electrodes are required to instrument large area detectors.
This method of readout promises to simplify detector fabrication while maintaining the position resolution that is required by fields such as homeland security, nuclear nonproliferation and arms verification, as well as nuclear physics and medical imaging.

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Contribution ID: **12** Type: **poster**

Next Generation Cosmic Microwave Background Polarimetry Experiment

Cosmic Microwave Background is weakly polarized. A curl component of the polarization, the B-mode, carries wealth of information such as sign of inflation, property of neutrino and evolution of large scale structures. Searches for the B-mode polarization in the CMB are going through an interesting period. Past year, CMB experiments reached sensitivity to make a detection of B-mode from weak gravitational lensing from large scale structures. Also an upper limit from polarization measurement on the primordial inflationary gravitational wave surpassed constraint from temperature anisotropy measurement.

Cosmic Microwave Background community is conducting a study for a next generation experiment call CMB Stage-IV (CMB-S4). CMB-S4 is aiming to deploy 500,000 detectors. This is two orders of magnitude increase in detector count from current experiments. This brings new challenges of mass production and quality control. Our approach is to bring automation and industrialization into the CMB instrumentation. We will discuss how we automated detector quality control, detector packaging and read-out electronics packaging. We will also discuss how we mass produce read-out electronics using lithography technique, and our approach to industrialize anti-reflection coat optical elements using ceramic plasma spray.

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Contribution ID: **13** Type: **poster**

Exploring the boundaries of low-energy, real-time, data-intensive processing with neuromorphic computing

Neuromorphic architectures like IBM TrueNorth promise to deliver massively data parallel computing combined with unprecedented energy efficiency, potentially offering an avenue for next generation high-performance systems in the post-Moore's law era. To better understand the range of problems to which neuromorphic computing is advantageous, we have assembled a diverse portfolio of real-time, data-intensive scientific applications.
Here, we explore neuromorphic computing as a low-power computing platform for both on-sensor processing and its potential role in a hybrid exascale computing platform. Specifically, our goals are: (1) understand the challenges of using spiking neural networks, and (2) evaluate neuromorphic hardware relative to von Neumann architectures. This will provide under 'problem space'for which neuromorphic computing is applicable.

Primary author: Dr BOUCHARD, Kristofer (LBL)

Contribution ID: **14** Type: **poster**

Instrumentation of high-density sensors and electronics for brain recordings

Our goal is to demonstrate a high spatio-temporal resolution system to record neural activity >1000 channels that could be translatable to humans, and directly scaled to >10000 channels. Current state-of-the-art systems have electrodes with many mm spacing, and discrete electronics, or integrated circuits with □100 channels per chip. Microfabrication techniques allow very high-density electrode arrays, but without correspondingly dense readout electronics. In Year 1 we developed a ~2,000 "pixel"system (E-Chip), with an electrode pitch of 100 µm (33% better than proposed) covering an area of roughly 5 mm2. Each pixel has a gain and bandwidth programmable front end, and will is multiplexed to high-speed analog readout (20kHz) and has 9-wires. The E-Chip is designed to work as a cortical surface sensor (e.g. micro-electrocorticography, ECoG), but the same basic technology could be used to design multi-electrode depth recording electrodes (E-Shanks), which could be combined with the E-Chip surface recordings. Indeed, we have begun fabrication of such multi-channel depth recorders. The data acquisition (DAQ) system is a clone of those we have developed for high-speed imaging: based on a high-reliability Advanced Telecommunications Computing Architecture (ATCA) platform, the system as is can handle >10000 pixels at 20 kHz, with simple extensions to higher channel counts.

Primary authors: Dr BOUCHARD, Kristofer (LBL); DENES, Peter

Contribution ID: **15** Type: **poster**

Acoustic Diagnostics for Superconducting Accelerator Magnets

Over the past few decades, acoustic measurement technology has emerged as a versatile & non-invasive tool for structural analysis, failure detection, and process control. We present acoustic emission sensing and data analysis techniques developed by the Superconducting Magnet group for monitoring mechanical disturbances in high-field superconducting accelerator magnets. Localized movements and micro-structural failures can cause magnets to suddenly transition (quench) into a normal state; a proper diagnostics of such events is essential for understanding limitations of magnet performance. We also discuss our development of an active quench detection method using ultrasonic beams to localize hot spots in coil windings. This active method can be essential for adequate quench protection of future magnet systems based on high-temperature superconductors.

Primary authors: RODRIGUEZ-GONZALEZ, Arnaldo (Lawrence Berkeley National Laboratory); MARTCHEVSKII, Maxim (Lawrence Berkeley National Laboratory)

Contribution ID: **16** Type: **poster**

A Novel approach to fiber connections for the Dark Energy Spectroscopic Instrument

The Dark Energy Spectroscopic Instrument (DESI), which will be in- stalled on the Mayall telescope at Kitt Peak in 2018, plans to measure the spectra of more than 30 million galaxies and quasars to map the large scale structure of the universe to study Baryon Acoustic Oscillations (BAO). DESI simultaneously collects spectra from 5,000 objects using robotically-actuated fibers which enable the focal plane to be fully reconfigured in less than 3 minutes. The fibers will run 40 meters from the focal plane to the coude´ room where they feed ten 3-arm spectrographs over a wavelength range of 360 - 980 nm. The focal plane assembly will be integrated independently of the spectrograph slits and long fiber cables in order to ease integration flow, and the two subsystems will be connected before final integration on the telescope. In order to retain maximum throughput and minimize the focal ratio degradation (FRD) when connecting the fiber system, we are employing fusion splicing as opposed to mechanical connectorization. We report results from the splicing process, measuring a collimated FRD increase of less than 0.5 degrees for a f/3.9 input beam for the first time in a fiber-fed astronomical instrument.

Primary authors: Dr POPPETT, Claire (Space Sciences Lab); Dr EDELSTEIN, Jerry (Space Sciences Laboratory); FAGRELIUS, Parker (UC Berkeley)

Contribution ID: **19** Type: **poster**

Magnet Test Facility Upgrades at LBNL

The Magnet Test Facility (MTF) at LBNL belongs to the Superconducting Magnet Group, and serves a core mission of testing performance characteristics of high field superconducting accelerator magnets. Several magnet parameters, such as maximum quench current, training behavior, and field quality are tested and characterized at MTF. The facility is currently being upgraded to expand the magnet characterization range. Three key new systems are going through a series of tests: the High Current Power Supply (HCPS), the Energy Extraction System (EES), and the Quench Detection System (QDS).
As a magnet quenches, its resistance grows via quench propagation and the internal temperatures as well as the voltage in the coils increase rapidly. To protect the magnet from thermal and voltage induced damage, a prompt detection of the developing quench and subsequent energy extraction should be accomplished. Once a quench is detected by the QDS, the power supply is shut down and the energy of the magnet is extracted by the EES by means of a dump resistor. This dump resistor needs to be configurable and its resistance selected depending on the magnet inductance.
An overview of the new facility focusing on the new systems as well as operational experience from the first magnet tested after the new Power Supply installation is presented.

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Contribution ID: **20** Type: **poster**

A Micromanufactured Diode Beamstop

Many experimental techniques utilize highly concentrated beams of x-rays directed at samples of materials of different types. When x-rays interact with these samples, a portion of them are deflected by the sample materials. These deflected x-rays then travel to a detector, and experimenters use the patterns of deflected x-rays captured by the detector to obtain information about the experimental samples. However, much of the x-ray beam passes through the experimental samples without interacting with them. This portion of the x-ray beam also travels toward the detector. If this were allowed to interact with the detector, it would overwhelm (and slowly damage) the detector, and the interaction from the x-rays and the sample could not be observed. In order to prevent this, a beamstop is placed between the sample and the detector to capture the non-deflected x-rays. In order to be fully effective and useful, a beamstop should be as small as possible to prevent obstruction of the deflected x-rays from the sample but dense enough to completely absorb the non-deflected x-rays.

The non-deflected x-rays (also known as direct beam) carry information about the intensity, size, and position of the x-ray beam that would be valuable to experimenters if it could be captured and characterized in real time during an experiment. Attempts by others to build beam characterization instrumentation directly into a beamstop have met with little success; generally the resulting device has been larger than the ideal or produced unacceptable scattering that affected the primary experiment. Our integrated beamstop and intensity measurement device (the DBS) overcomes these limitations in a completely novel, highly compact form. The core principles of the DBS are applicable to a wide range of miniature, non-invasive, real-time x-ray sensing and dose control applications.

Micromachining and assembly techniques have been used to produce the DBS. The DBS allows direct beam to be measured continuously in real time with sub-millisecond time resolution. The active portion of the assembly is very compact, and measures less than 1mm in diameter. The passive portion of the assembly is 1.25 mm in diameter, and could be made even smaller. The incorporation of active beam intensity measurement capability does not compromise the beamstop attenuation characteristics in any way, and images remain free of beamstop scatter or bleedthrough at integrated doses well in excess of 10^13 photons.

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

HIPSTER: A 24-channel low-noise digitizer ASIC with multi-Gb/s serial data interface

HIPSTER (High-Speed Image Processing System Targeted for Electron Readout) is a noise-optimized digitizer ASIC primarily intended for reading out low-noise, high-speed detectors while reducing physical interconnect. The front end of the ASIC comprises 24 analog channels each with programmable gain and a 12-bit, 75 MS/s ADC. The back end of the ASIC comprises six 4.5 Gb/s serial transmitters that conform to the JESD204B data communications standard. The ASIC also includes an integrated frequency synthesizer to generate the required multi-GHz clocks. HIPSTER was implemented in 180 nm CMOS technology.

Chip functionality has been demonstrated. Performance tuning and evaluation are ongoing.

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

Autonomous mm-Scale RFID Sensors for High Density In-Situ Soil Monitoring

Better understanding of plant and microbial communities would be dramatically enabled by an ability to monitor their behavior in-situ, dynamically and in a variety of environments. To address this need, we are designing a mm-scale autonomous sensor platform that can incorporate on-chip and post-processed sensors to be deployed in order to monitor complex soil systems. The sensors are powered using RF energy harvesting with an on-chip antenna and therefore, do not require a bulky battery that needs to be replaced. Recent advances in sensor technologies, which allow a variety of sensor types to be post-processed on conventional CMOS, will expand the quantities which can be monitored. The small size of these sensors allows for high-density monitoring of soil. With in-situ sensing, we hope to enable monitoring of root architecture and growth; root exudates and enzymes; the dynamics of C, N, other nutrients and redox sensitive species; and gas and moisture fluxes among other applications.

Primary authors: GRACE, Carl; FONG, Erin; DENES, Peter

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

Status of the STAR Event Plane Detector (EPD)

The first phase of Beam Energy Scan (BES) program of the Relativistic Heavy Ion Collider (RHIC) was an exploration of the QCD phase diagram. The second phase is an exploration for criticality and phase transition signals. For the Solenoidal Tracker at RHIC (STAR) a quantitative understanding of these signals requires an increase in statistics in for 7, 11, 14, and 19GeV AuAu collisions as well as dedicated hardware upgrades. The Event Plane Detector (EPD) is a proposed high η hit detector that would replace the STAR Beam Beam Counter (BBC –a 32 channel hit detector $3.3 < \eta < 5.0$ used for BES triggering and first order event plane reconstruction) for BES II, which is scheduled to begin in 2019. The EPD would provide improved triggering, increased detector coverage in jet-like η-ϕ correlation measurements, improved resolution for event plane determination independent of the STAR Time Projection Chamber (TPC –a charged particle tracker $|\eta| < 1$), and provide a TPC independent centrality definition. Divorcing the determination of the event plane positions as well as collision centrality from the TPC via a forward detector is crucial for correlation measurements performed at mid-rapidity.

The EPD design consists of two scintillator discs at $\pm$ 3.75m, each is separated into ~500 tiles. A tile has embedded wavelength shifting fiber coupled to clear fiber outside of the tile which is, in turn, coupled to a silicon photomultiplier (SiPM) –an inexpensive and magnetic field insensitive replacement for traditional phototubes. A pre-prototype of the detector, featuring scintillator with embedded fiber coupled to SiPMs was integrated into STAR during the 2015 run. Currently tile designs varying geometry and detector specifications are being fabricated and tested along with latest generation SiPMs. Additionally simulations have been performed to optimize tile η/ϕ segmentation, size, and shape. A newly machined prototype featuring the anticipated geometry of the EPD will be put in place during the 2016 STAR run.

Primary author: LOMNITZ, Michael

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

The MAJORANA low noise low background front-end electronics

The Majorana Demonstrator will search for the neutrinoless double beta decay ($\beta\beta(0\nu)$) of the isotope 76Ge with a mixed array of enriched and natural germanium detectors. One of its major goals is to demonstrate a path forward to achieving a background rate at or below 1 cnt/(ROI-t-y) in the 4 keV region of interest (ROI) around the 2039-keV Q-value of the 76Ge $\beta\beta(0\nu)$-decay. Such a requirement on the background level significantly constrains the design of the readout electronics located in the direct vicinity of the detectors. We present here the low background low noise front-end electronics developed for the low-capacitance P-type point-contact (PPC) germanium detectors of the Majorana Demonstrator. This resistive-feedback front-end is fabricated on a radioactivity-assayed fused silica substrate where the feedback resistor consists of a sputtered thin film of high purity amorphous germanium and the feedback capacitor is based on the stray capacitance between circuit Au traces.

Primary author: ABGRALL, Nicolas

Contribution ID: **25** Type: **poster**

Data Intensive Super Computing at NERSC

The Data and Analytics Group at NERSC (National Energy Research Scientific Computing Center) offers a wide range of services intended to facilitate scientific data analysis. We have tools and expertise in data management, analysis, transfer, visualization, as well as sharing data via scientific web portals and workflow tools. An overview of the data-focused services at NERSC will be presented.

Primary author: GERHARDT, Lisa

Contribution ID: **26** Type: **poster**

The MAPS-based PXL detector for the STAR Experiment

The PiXeL detector (PXL) of the STAR experiment at RHIC is the first application of the state-of-the-art thin Monolithic Active Pixel Sensors (MAPS) technology in a collider environment. The PXL detector was completely designed, fabricated and assembled at LBNL, and the RNC group is still the main responsible for maintenance, operations and data analysis.
The PXL, together with the Intermediate Silicon Tracker (IST) and the Silicon Strip Detector (SSD), form the Heavy Flavor Tracker (HFT), which has been designed to improve the vertex resolution and extend the STAR measurement capabilities in the heavy flavor domain, providing a clean probe for studying the Quark-Gluon Plasma.
The two PXL layers are placed at a radius of 2.8 and 8 cm from the beam line, respectively, and accommodate 400 ultra-thin (50 µm) high resolution MAPS sensors arranged in 10-sensor ladders to cover a total silicon area of 0.16 m2. Each sensor includes an array of nearly 1 million pixels with a pitch of 20.7 µm. The sensor features 185.6 µs readout time and 170 mW/cm2 power dissipation. The detector is air-cooled, allowing a global material budget of 0.4% radiation length on the innermost layer. A novel mechanical approach to detector insertion allows for the installation and integration of the pixel sub detector within a 12 hour period during an on-going STAR run.
The detector was successfully commissioned and took data in Au+Au collisions at 200 GeV during the 2014 RHIC run. With improved reliability, material budget, and tracking capabilities, the HFT took data in p+p and p+Au collisions at 200 GeV in the 2015 RHIC run.
In this poster we present detector specifications, experience from the construction and operations, and lessons learned. We also show preliminary results from 2014 Au+Au data analyses, demonstrating the capabilities of charm reconstruction with the HFT.

Primary author: CONTIN, Giacomo

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

Gas Cell For In Situ Soft X-ray Absorption Spectroscopy of Materials

A simple, portable gas cell design for soft X-ray absorption spectroscopy of materials during gas interaction is presented. The cell can be attached to the rear port of any suitable beamline, and is designed to be loaded and sealed within a glove box to enable the study of air- or moisture-sensitive materials. The cell operates in transmission-absorption mode and can handle gas pressures of at least 300 Torr, but less than 1 atm. Pressure can be cycled during operation, enabling studies of the same sample under vacuum and different pressures of gas. The cell has been successfully utilized to study CO2 adsorption in metal-organic frameworks, including the Mg K-edge of Mg-MOF-74 and the N and O K-edges of diamene-appended analogs. Future applications could include studies of gas interactions with any thin film or porous sample. Future applications, as well as planned improvements to the design (temperature control, gas mixtures, etc.), are also discussed.

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

Radiological Multi-sensor Analysis Platform

Gamma-ray spectroscopy and imaging are well-established methods of detecting radioactive sources in a variety of scenarios. However, the natural gamma-ray background can significantly reduce detection sensitivity, especially when the source is weak and the background varies substantially. Mobile detection platforms, in particular, must contend with background that is not necessarily known or measurable a priori. This project aims to systematically measure and characterize the spatial and temporal variations of the background in order to assess their impact on detection sensitivity and specificity for homeland security applications.

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

Fast Beam Chopper

A fast beam chopper is designed and commissioned for the 88-Inch Cyclotron at Lawrence Berkeley National Laboratory. The Cyclotron accelerates protons through uranium with frequency of operation from 5.5 MHz to 16.5 MHz. The new chopper uses a fast square wave pulser from BEHLKE and is connected to two parallel electrostatic deflector plates that can be biased to +/- 1000V. The new chopper is part of an effort to select single bunches with the goal of measuring the neutron time-of-flight by spacing bunches to avoid the "wrap around"effect, where slow neutrons from the previous bunch superimpose to fast neutrons from the actual bunch. Details of the electronic design and results will be presented.

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

Characterization of Single Event Latchup Cross-Section for ALPIDE

We investigated the probability of latchup in a prototype of ALPIDE (ALICE PIxel DEtector), a silicon pixel detector proposed for use in the ALICE inner tracking system. This sensor uses MAPS (Monolithic Active Pixel Sensors) technology and features integrated electronics.
Single Event Latchups (SELs) are a common problem with CMOS technology. When a heavy ion travels through the detector, it can initiate a low impedance path, potentially shorting the circuit. Resultant uncontrolled increases in current can permanently damage the sensor. The parasitic structure exhibits positive feedback and will continue to exist unless disrupted by power-cycling the system. We measured the cross section for latchup by using beams of heavy ions from the LBNL 88 inch cyclotron to deposit energy in the sensor.

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

Intense pulsed ion beams with NDCX

Recent experiments and capabilities with the Neutralized Drift Compression Experiment will be described.

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Contribution ID: **32** Type: **poster**

Quantitative cellular imaging of Soft X-Ray tomography

Soft X-ray tomography (SXT) reveals cellular structures based on the unique organic composition of each structure and, because of the short wavelengths of light used for imaging, achieves nanoscale spatial resolution. The absorption properties of these soft x-rays, which are in the so-called "water window"(284 eV , 4.4 nm to 543 eV, 2.3 nm), enable high contrast images because water doesn't absorb these x-rays while carbon and nitrogen in biological samples are highly absorbing. Since absorption adheres to the Beer-Lambert law, quantitative information about each cellular structure is generated yielding a unique linear absorption coefficient (LAC) value. Neither chemical fixation nor contrast enhancement agents are required, allowing specimen observation in the most native state. The penetration ability of these X-rays also enables tomographic imaging to visualize the entire cell rather than just a few thin sections. To do this we use a tapered capillary as sample holder, which enables full rotation angles to achieve three-dimensional isotropic resolution. SXT has been successfully applied to image a variety of cell types, including bacteria, yeast and mammalian cells. We extended the SXT observation modality by incorporating information from different contrast mechanisms, combining fluorescence and x-ray imaging to place molecular information on top of structural information. I will present several applications of these techniques, including examples of phenotypic consequences of genetic manipulations and a quantitative, 3D analysis of changes during cell differentiation and cancer.

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