

# **12th Workshop on Accelerator Operations**

Tuesday 05 October 2021 - Friday 08 October 2021

Virtual Event



## **Book of Abstracts**

# Table of contents

<b>SESSION I: First reactions to the pandemic.....</b>	<b>4</b>
Collisions in a time of COVID.....	4
Corona - How did life change in the control room?.....	4
Make the main control room the safest place and move on.....	4
Operating the Australian Synchrotron During The Pandemic .....	5
Re-commissioning the CERN Accelerator Complex in times of Covid .....	6
How the ISIS accelerator weathered the Covid 19 storm.....	6
Operation of Indus Synchrotron Radiation Sources and its management during COVID-19 period.....	7
ALBA synchrotron operation during Covid-19 pandemic .....	8
ESRF-EBS: Implementation, performance and restart of user operation.....	8
<b>SESSION II: Running a Beam Particle Accelerator during the COVID-19 pandemic (II) .....</b>	<b>10</b>
What Happens to Accelerator Reliability and Maintenance in a Global Pandemic?.....	10
Impact of COVID-19 pandemic on SOLARIS operation .....	10
Sustainability of the operation in the Synchrotron SOLEIL during the COVID-19 pandemic.....	11
SNS Operations During the Covid-19 Pandemic .....	11
ESS Status: Preparing for Operations.....	12
<b>SESSION III: Lessons learnt from the pandemic .....</b>	<b>13</b>
Lessons learned and new questions for a team operating a Protontherapy facility.....	13
Controls in the Time of Covid.....	13
Reinforcement Learning and Fault Diagnosis - How models and digital twins may support accelerator operation.....	14
<b>POSTER SESSION .....</b>	<b>15</b>
Mutually isolated operator assignment and shift organization to prevent the spread of infection.....	15
Creating the New Operator Group at the CLS .....	15

Secondary activities of the SOLEIL operators .....	16
Advance Photon Source operation during and after the COVID-19 pandemic .....	17
OneButtonMachine - automatic operation application .....	17
Latest projects from ALBA's Operations group.....	18
Development for 3-D spiral injection scheme by use of electron gun .....	18
Running the BNL Collider Accelerator Complex during the COVID19 Pandemic.....	19
From New to Experienced: How the Pandemic Prepared the Operator Group at the Canadian Light Source .....	19
Fire and recovery at KEK electron/positron injector linac.....	20
Pulsed beam generation for the three- dimensional Spiral Injection Scheme test.....	20
Influence of COVID-19 on operations in the medical setting of a particle therapy facility .....	21

# SESSION I: First reactions to the pandemic

## Collisions in a time of COVID

**Author:** Travis Shrey, *Brookhaven National Lab*

Presentation of the experiences at RHIC shutting down and restarting with remote operations. Changes to the group, shifts and operating modes will be covered.

## Corona - How did life change in the control room?

**Authors:** Sonja Schumann; Miriam Klich, GSI

In March 2020 Covid hit our lives and changed everything.

At the beginning rules were decided day by day and changed, measures were taken, not only in the government but also in GSI. The beam time schedule was uncertain and no one knew if GSI would still be open the next day.

But everything continued running, changes for our safety like our new disinfectant dispenser and wearing a mask, were made. Step by step a new normal way of life began.

Some points of the new way of life are positive and some aren't.

We would like to show you a short overview about all the changes, of the ones we want to keep and the ones we don't and our everyday life of operating.

## Make the main control room the safest place and move on

**Author:** Stephan Reimann, *GSI/FAIR*

When the pandemic hit Europe in spring 2020, the GSI/FAIR accelerator facilities were in the middle of a user beam time and after the first external user groups affected by the travel ban had to cancel their participation, we were faced with the decision to cancel the beam time as well. However, some local research groups organised a way to continue their experiments on their own, in exchange for sleep. Additionally there were a lot of proposed accelerator related studies that had not yet been conducted.

So we made the main control room the safest place to be during the pandemic and just kept going. Despite many challenges, it eventually worked out so well that we scheduled another beam time period for first half of 2021, right into the 3rd wave of the pandemic. But this time we were prepared for anything ... right?

### Operating the Australian Synchrotron During The Pandemic

**Author:** Mike Lafky, ANSTO

My talk will focus on the synchrotron's operations team's response to Victoria's Covid-19 outbreak broken into four distinct periods.

From March of 2020 to May 2020 the state government restricted the number of workers allowed on site, and only permitted research on Covid-19 or research otherwise essential to national security.

Operations ran the accelerator "on demand" for the first time in its history – turning on the accelerators when required for Covid research and idling them when not in use. When not in use the operators developed machine checklists to verify mission-readiness.

From June 2020 to October 2020 the state government eased restrictions on research, so the synchrotron returned to regularly scheduled user beam periods, but with greatly reduced staff on site.

During this time Operators implemented contact-tracing in logs for staff and users.

From October 2020 to June 2021 lockdown restrictions eased and more staff returned to site. Some interstate travel was allowed, but with varying levels of restrictions. Covid testing requirements meant that visiting users would need to get a Covid test and self-isolate in the Synchrotron's guesthouse if they felt ill. Results took approximately 24 hours, and during that time Operators were called on to check in with isolating users.

The current epoch began with the arrival of the Delta variant in July of 2021. We have workshopped responses to a Covid-infected staff member coming to the synchrotron and expect interruptions to user beam when that occurs. We have communicated that to synchrotron and ANSTO management and developed a plan for return to delivery.

To date, the synchrotron has not had a single positive Covid-19 case. With the ongoing Deltavariant outbreak, I expect that to change soon, but nevertheless our experience is useful to share lessons learned in communicating expectations with government, management, and the user community.

# SESSION II: Running a Beam Particle Accelerator during the COVID-19 pandemic (I)

## Re-commissioning the CERN Accelerator Complex in times of Covid

**Author:** Rende Steerenberg, *CERN*

CERN was at the start of a 2-year long shut-down, scheduled to implement a major upgrade in the LHC injectors complex and to perform consolidation and maintenance on large parts of the LHC, when in March 2019 the Covid pandemic imposed itself. Installation work was adapted to comply to the new Covid related measures put in place and the schedule was shifted because of the lockdown.

The gradual commissioning of the renewed complex was launched in Autumn 2020 and was substantially impacted by the measures imposed.

This contribution will address the impact of Covid on the work organization for the commissioning and operation of the accelerator complex, the extra measures and tools that were put in place together with a brief overview of new tools and habits that are likely to stay around even after the Covid pandemic has extinguished.

## How the ISIS accelerator weathered the Covid 19 storm

**Author:** Julian Brower, *ISIS STFC*

The ISIS Neutron and Muon Facility in South Oxfordshire UK has recently had to deal with the ongoing Covid 19 global pandemic. The announcement by the Prime Minister of a national lockdown on 20th March 2020 resulted in significant alterations to our User programme and temporary suspension of operations. The 'new normal' evolved as ISIS slowly came back online in preparation for the User cycle beginning on 8th September, the biggest changes being to staffing the facility, initially remotely and progressively reintroducing attendance for key safety and equipment specialists.

Remarkably, only one User cycle was lost, and the machine exceeded expectations on return to operations. To achieve this staff developed new Covid secure ways of working in accelerator operations, controlling the machine, managing equipment maintenance and failures and dealing with the User

community remotely. In this snapshot talk of a monumental 18 months, with contributions from across the facility, I walk through our Covid 19 journey and show how our equipment and operational groups, running and maintaining the accelerator, contributed to this achievement; what we initially did at the start of lockdown, what we changed through the pandemic, what was learned and what has been kept moving forward from this unprecedented experience.

### Operation of Indus Synchrotron Radiation Sources and its management during COVID-19 period

**Authors:** Rakesh K. Nathwani; T. A. Puntambekar; Rajesh Kumar Sahu, *Raja Ramanna Centre for Advanced Technology (RRCAT), Indore (INDIA)*

Synchrotron Radiation Sources (SRS) Indus-1 and Indus-2 at RRCAT, Indore (India) are being operated in round-the-clock mode as a national facility. Indus-1 is a 450 MeV, 125 mA electron storage ring emitting radiation from mid-IR to soft x-ray with a critical wavelength of  $\sim 61 \text{ \AA}$ . Indus-2 is a 2.5 GeV, 200 mA electron storage ring providing synchrotron radiation emitted from its bending magnets has broad spectrum covering soft and hard X-ray regions with a critical wavelength of  $\sim 2 \text{ \AA}$ .

Normally both the machines are operated for  $\sim 320$  days in a year. Seventeen beamlines on Indus-2 and seven beamlines on Indus-1 are commissioned and are being utilized by a large number of researchers from universities, academic institutions and national laboratories. The facility is operated under license issued by Atomic Energy Regulatory Board (AERB) and by following all the prescribed safety norms. Trained and qualified personnel are deployed for the operation of the facility.

The outbreak of COVID-19 pandemic posed many challenges in smooth operation of the facility.

The facility had to be shutdown in March 2020, in the wake of nationwide lockdown declared by the government which lasted for more than two months. Measures were undertaken to ensure the safety of sub-systems and the Indus complex during lockdown and safe start-up of the facility in phased manner after the lockdown.

Post lockdown, operating the machines with constraint of working with reduced manpower, implementing the measures to contain the spread of COVID-19 among operation/maintenance staff and running the facility in compliance with the guidelines issued by the local administrative authorities from time to time for containment of virus, were also some of the key issues which were handled during the pandemic. This paper describes all these challenges and how they were overcome.

The second wave of COVID-19 which started in India by the end of March 2021, was much more devastating and severe. This affected a large number of the operation/ maintenance staff as well as their family members. In this tough situation the operation of the facility was maintained. By the third week of April 2021 lockdown was imposed again by local administration and the facility was shutdown. This time the facility was normalized much faster with the experience of previous year.

Finally, measures taken for containing the spread of COVID-19 during shift operation and long term measures like improving ventilation of the complex, additional exhaust fans, installing UV based air purification in control room and wash rooms, online meetings of coordination committee etc. which became 'new normal' are discussed in this paper.

#### **ALBA synchrotron operation during Covid-19 pandemic**

**Authors:** Ferran Fernández; Montse Pont, *ALBA synchrotron*

ALBA is a third generation 3GeV synchrotron light source near Barcelona (Spain). In operation for users since 2012, there are 8 beamlines in operation, 2 in commissioning and 3 under construction.

On March 2021 the Covid-19 pandemic forced Spain to a strict confinement, stopping abruptly the operation of the facility. One month after, we resumed operation with a "light" operation mode; dedicated initially to Covid-19 related experiments. Another month later, we were open again for users with almost the usual operation schedule. Due to the travelling difficulties most of the samples used the mail-in system. In this talk, we will discuss about the adopted measures to protect the operators in the control room along the pandemic, including the setting up of a secondary control room just "in case of", and the solutions implemented to reduce the impact of operating with a reduced staff on site, or how accelerator physics studies have been conducted via teleconferences.

#### **ESRF-EBS: Implementation, performance and restart of user operation**

**Author:** Jean-Luc Revol

**Co-authors:** Laurent HARDY; Andrea Franchi *ESRF*

The European Synchrotron Radiation Facility - Extremely Brilliant Source (ESRF-EBS) is a facility upgrade allowing its scientific users to take advantage of the first high-energy 4th generation light source. In



December 2018, after 30 years of operation, the beam stopped for a 12-month shutdown to dismantle the old storage ring and to install the new X-ray source. In December 2019, first beam was stored and accumulated in the storage ring, allowing the vacuum conditioning and tuning to be started. Beam was delivered to beamlines in March 2020 for their commissioning. On 25 August 2020, the user programme was restarted with beam parameters very close to nominal values. Since then, the ESRF operates for the user-community with high performance and availability.

In this presentation the milestones and key aspects of the commissioning and the return to user mode operation despite the Covid-19 pandemic are presented and discussed.

# SESSION II: Running a Beam Particle Accelerator during the COVID-19 pandemic (II)

## What Happens to Accelerator Reliability and Maintenance in a Global Pandemic?

**Author:** Reid Smith; *Brookhaven National Laboratory*

While a large percentage of the BNL population were required to lock-down, NSLS-II remained running, with 3 beamlines running studies on COVID-19 and potential vaccines. For 4 months, we operated in a mode dubbed Min-Safe– having bare minimum number on site for safe operations and study. The effects of no longer being in-person were drastic in nearly every part of operations.

In this talk I will highlight several major processes for NSLS-II that were forced to change very quickly, and what adaptations were made. Main focus will be the impact on run schedule, priority given to running vs repairs, and the added hurdles to maintaining the accelerator. I will also detail several nuances of our maintenance-planning, and how it has changed permanently since Min-Safe.

## Impact of COVID-19 pandemic on SOLARIS operation

**Author:** Adriana Wawrzyniak; *SOLARIS*

Coronavirus disease 2019 (COVID-19) was formally characterized as a pandemic on March 11, 2020.

On March 25th first lockdown in Poland was introduced. SOLARIS facility operation for users was cancelled until May 30th, 2020 at that time. The facility had to adjust to the new reality. Wearing masks, disinfection and social distance has become obligatory. To continue the work in those difficult times required to switch to the hybrid mode. During lockdown only minimal staff was kept at the facility to maintain the services. The most of the team was working remotely from home. All meeting has been organised via MS TEAMS and ZOOM platforms. In the control room the number of people has been limited to 3 persons at the time. Moreover the number of operators on a shift has been finally reduced to 1 person. In order to support the operation during lockdown the remote access to the control room and to the machine network was deployed as well as new tool to support the remote injection has been developed and implemented. Since the control room is a common area for many operators and

subsystem's owners it became obligatory to work there in masks and disposable gloves. Moreover each user after finishing his work has had to disinfect keyboards, mice and desks.

Regarding the users – also the remote access and experiments has been implemented, however the external users also were accepted at the facility but limited to max. 2 people per beamline. In 2020 due to the COVID19 pandemic, the beamtime was reduced by 5% in total, whereas in 2021 the total beamtime was not affected by the pandemic. During the presentation more details about the first reaction and running the accelerator during COVID-19 pandemic to be discussed.

### **Sustainability of the operation in the Synchrotron SOLEIL during the COVID-19 pandemic**

**Authors:** Samuel Garnier; Emmanuel Patry; SOLEIL

Synchrotron SOLEIL is the French third generation synchrotron light source in operation since 2007, providing photon beams to 29 beamlines with a maximum intensity of 500 mA, 5000 hours a year.

On March 16, 2020, the activity of the site had to stop because of the national lockdown related to the COVID-19 pandemic. It resumed progressively from May 11, 2020 with a shortened two-week machine shutdown restricted to priority maintenance. The beam restarted, as planned before the pandemic, on May 18, without any impact on the 2020 beam schedule (no change, either, in the 2021 beam schedule) and minor impact on accelerator projects. In order to ensure maximum sustainability of the operation, while ensuring the safety of the personnel with the use of teleworking, many adjustments have been made such as a modification of the control room, the installation of a secondary control room, the opening of direct connection to the TANGO control system from the SOLEIL offices and remotely, the installation of conference software, a specific organization of interventions....

Despite all these constraints, everyone's efforts have ensured continuity of service and for the year 2020 performance has not been affected (4th best year 98.8% and 105h MTBF).

### **SNS Operations During the Covid-19 Pandemic**

**Author:** Geoff Milanovich; *ORNL SNS*

Just like all workplaces, the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory had to adjust to new workplace regulations during Covid. Being part of a large lab was very beneficial for

operations. This talk will discuss how we met social distancing, cleaning, and testing protocols, changed meetings, and used remote tools to keep the accelerator running. Finally, I will discuss what changes we will keep in place going forward.

<b>ESS Status: Preparing for Operations</b>
---

**Author:** Marc Munoz; *ESS Eric*

The European Spallation Source is in the installation and commissioning process, with the plan to deliver the first neutrons in 2024. The installation and commissioning process are taking place during the COVID pandemic, with the subsequent impact both of the delivery of the In-Kind contributions, and in the way of working in the Control Room and Linac Tunnel.

At the same time, the Operations group is preparing for operate the commissioned components, ramping up the group with the hiring of dedicated Shift Leaders, and defining the required process. In this presentation we'll review the impact of COVID-19 in the project, the preparations for commissioning and operations, and the first experiences with commissioning.

## SESSION III: Lessons learnt from the pandemic

### Lessons learned and new questions for a team operating a Protontherapy facility

**Author:** Samuel Meyroneinc; *Institut Curie*

The Institut Curie– CPO facility consists in one cyclotron delivering a beam of protons for three treatment rooms. The activities of the BTI service are a mix of operations, technical support, maintenances and developments to keep the facility operational from 8h00 to 19h30, 5 days per week, 52 weeks per year with (only 4 Fridays off per year). Several evenings and part of week-ends are used for QA beams for clinics and for radiobiological experimentations.

During the period 2020-2021 and the Covid crisis, the CPO facility has operated many adaptations in relation to the several regulations requirements, but has never stopped. From these specific times, there are a first set of « lessons learned » (management of a new sly risk, advantages and drawbacks of the remote work and interactions, ...) but also a set of new questions (what is the admissible mental load for the teams when high uncertainties, what about « empowerment » and « esprit de corps » for the teams when there is less time altogether, what are the limits of the remote monitoring of the systems, of the people)

### Controls in the Time of Covid

**Author:** Ian Blackler; *BNL*

The Collider-Accelerator Department at Brookhaven National Laboratory was in the midst of run 20 for RHIC when the Covid-19 pandemic struck. After a brief shutdown, the complex was back up and running. This talk covers the software and controls changes and upgrades made to facilitate resuming running, along with those tools we found most useful in maintaining performance and safety. For example, communications software, device and personnel activity monitoring, and a wish list of the things that never quite made it.

**Reinforcement Learning and Fault Diagnosis - How models and digital twins may support accelerator operation**

**Author:** Annika Eichler; DESY

Within LEAPS, the League of European Accelerator based-Photon Sources, the idea of an LEAPS Integrated Platform (LIP) has been developed bringing together the fields of Digital Twinning, Machine Learning and Virtual Diagnostic. This platform should contain digital twins from the accelerator over the photon transport up to the experiments. This does not only allow the experimentalists to get familiar with the facilities and make more efficient experiments, but can also support the operators to increase the performance of the facility with respect to the wishes of the experiments. In addition, it offers the capability to test new algorithms for control and optimization also exploiting machine learning on the digital twin before bringing them to the real facility, and, if the digital twin parts are real-time capable, they can be even used online for control and diagnosis. All in all, the digital twin can support on the way towards an autonomous accelerator. Two research projects, which are followed at DESY along this line are presented, where the usefulness of the model, the digital twin, is underlined. The first is on reinforcement learning for accelerator operation, where the twin is exploited offline for training the controller and the goal is to support the startup and tuning procedure in the future. The second is on fault detection for superconducting radio frequency cavities, where the digital twin is used online to detect anomalies in the behavior.

## POSTER SESSION

### Mutually isolated operator assignment and shift organization to prevent the spread of infection

**Author:** Sojiro Sato<sup>1</sup>

**Co-authors:** Tetsuhito Kadowaki<sup>1</sup>; Masahiro Kawashima<sup>1</sup>; Eichi Takada<sup>2</sup>

<sup>1</sup> *Accelerator Engineering Corporation*

<sup>2</sup> *National Institutes for Quantum and Radiological Science and Technology (QST)*

Under the COVID-19 pandemic, shutdown due to an increase in the number of infected patients among accelerator operators was a concern that needed to be considered, and measures needed to be taken to ensure the safety of accelerator operators and to preserve operational performance.

In HIMAC, the accelerator operators were divided into two groups and isolated from each other in order to prevent the spread of infection among the accelerator operators and to ensure the continuity of therapeutic beam supply. The members of the group were fixed and rotated weekly into two groups, one for accelerator operation and the other for backup. The accelerator operation group was shifted from two 12-hour shifts to three 8-hour shifts, and the backup group was basically teleworked to minimize the number of people staying in the control room as much as possible. Except for handover during shifts, contact between shifts was kept to a minimum, and opportunities for contact between each operator were reduced as much as possible. In addition, we have improved the effectiveness of infection prevention measures by assigning personnel so that multiple people do not gather in the same place during breaks involving eating and drinking, which increases the risk of infection.

These innovations should have contributed to the prevention of the spread of infection among operators, but at the same time, they had no small impact on operation and maintenance. How they change affect our operations and what we learned for future work will be reported.

### Creating the New Operator Group at the CLS

**Author:** David Bilbrough; *Canadian Light Source*

Historically, the operation of the Canadian Light Source (CLS) was done by so-called volunteer operators.

The group consisted primarily of the accelerator physicists, engineers, and technicians within the Accelerator Operations and Development group. In June of 2019 that changed when the first group of full-time operators started at the CLS. By the time the hiring was done there were 10 new personnel in the operator group with a new supervisor to help them along. This poster will talk about the experiences, challenges, and successes that the group has dealt with since their inception a little over two years ago.

### Secondary activities of the SOLEIL operators

**Author:** Emmanuel Patry; SOLEIL

SOLEIL is the French third generation synchrotron light source in operation since 2007 and providing photon beams to 29 beamlines with a maximum intensity of 500 mA, 5000 hours per year.

For about ten years, the eight operators of the operation group have developed their own programs, first in GlobalSCREEN and then in LabVIEW and python, to ensure their main functions, namely to drive the accelerators with a 98-99% beam availability with top performance and stability. Today, they maintain these software programs and continue to develop new ones adapted to changing needs.

In addition to their primary operation roles, some members of the group also have support duties for other groups in the organization. One operator spent 20% of his time working with the accelerator physics group for 5 years. Currently, three operators devote 20% of their time in relation to other groups:

- Two for the cryogenic cell in charge of the proper operation of the cryogenic system with on-call duty.
- One for the control group in order to develop a prototype for web-based supervision.

One operator will occasionally join the Metrology and Alignment group.

Operators can also participate in specific projects with other groups:

- One operator developed an application used by the pulsed power supply teams to control a test bench.
- Two operators carried out a project for the Electronics and Control Acquisition group, which consisted of developing a program in python capable of completely automating the process of providing configuration settings for motorization systems.



These fruitful collaborations will continue as they allow the acquisition of additional technical skills useful for the operators and for the group in view of the forthcoming SOLEIL upgrade.

### **Advance Photon Source operation during and after the COVID-19 pandemic**

**Author:** Stanley Pasky<sup>1</sup>

**Co-authors:** Ronzhin, Dmitriy A. Dmitriy<sup>2</sup>; Weyer, DeeAnna L. Dee<sup>3</sup>

<sup>1</sup> *Argonne Associate*

<sup>2</sup> *Accelerator Operations Support 4 ASD*

<sup>3</sup> *Technician Sr ASD*

Remote operation, teleworking, social distances, are just a few new concepts that have changed the way we are now operating. New policies and procedure upgrades are in place that have had an impact not only on operations but also how maintenance activities and user interface take place.

What we experienced and how we have adjusted at Argonne National Laboratory, Advanced Photon Source.

### **OneButtonMachine - automatic operation application**

**Author:** Grzegorz Kowalski; *NSRC SOLARIS*

As the pandemic hit the world we found ourselves in a very different landscape that nobody was familiar with or prepared for. With the first COVID-19 case in the country, the way we lived our lives was turned upside down and inside out.

Accelerator operation was no different. Things we took for granted, such as having at least one operator on site, were no more. However, with users on the beamlines, the show must go on and the beam needs to be delivered.

In principle it was not a problem, everything could be done with remote access to the control room. As we quickly found out an entire new class of problems appeared with this approach. The most critical was probably the injection. Connection problems could easily lead to more current being injected than

the accelerator can safely handle. There was a need for a system that could control the injection process and stop it when the current limit was hit, without any intervention from the operator.

With this done, we thought about going further with this idea; automate every aspect of day-to-day accelerator operation. This is how the OneButtonMachine application was born.

### Latest projects from ALBA's Operations group

**Authors:** David Yépez Vindel; Javier Bañuelos Sánchez; Juan Carlos Giraldo González; Marc Sos Cambras; Oriol Salvador Serres Boldú; Pablo Lengua Mora; ALBA Synchrotron

ALBA is a 3 GeV, 3rd generation, synchrotron light source located in Barcelona (Spain), which is operating with users since May 2012. ALBA provides more than 4.000 hours of beam time per year to eight operational beamlines. Additionally, two beamlines are in commissioning and three in construction.

The Operator's group is composed of eight operators and their career profiles are wide ranging.

Operators shift load is about 50% of their time. The other 50% is devoted to give support to other accelerators groups, as for example Beam Diagnostics or RF, and develop projects to ease the operation.

Here we present an overview of these projects. These include Python and MATLAB scripts and GUIs to take/analyze data to investigate incidences or do some calculations for the different accelerator's groups, a survey robot or new operation procedures, among others.

### Development for 3-D spiral injection scheme by use of electron gun

**Author:** Hiromi Iinuma<sup>1</sup>

**Co-authors:** Hisayoshi Nakayama<sup>2</sup>; Honoka Hirayama<sup>1</sup>; Kazuro Furukawa<sup>2</sup>; Koudai Oda<sup>3</sup>; Muhammad Abdul Rehman<sup>2</sup>; Ryota Matsushita<sup>4</sup>; Satoshi Ohsawa<sup>2</sup>

<sup>1</sup> *Ibaraki-Univ.*

<sup>2</sup> *KEK*

<sup>3</sup> *Ibaraki Univ.*

<sup>4</sup> *The University of Tokyo*

Three dimensional beam injection is an one of major technical challenges for new muon g-2/EDM experiment at J-PARC. In order to validate a basic concept of this injection scheme, we have developed a compact beam line which includes electron gun and solenoid magnet for storage 80 keV electron beam. Although, entire beam line length is 2m only, we have three rotating quadruple magnets to apply “X-Y coupling” to the beam. X-Y coupling is the key of 3-D spiral injection scheme. In this report, we introduce an outline of this beam line, as well as beam diagnostic systems. Visualized the 3-D trajectory in the storage chamber, which is an ionized light emission in nitrogen, is also discussed. Finally, we discuss how to control X-Y coupling by use of three rotating quadruple magnets.

### **Running the BNL Collider Accelerator Complex during the COVID19 Pandemic**

**Author:** Rachel Terheide; *Brookhaven National Lab*

After the initial response to the COVID pandemic, there was a concentrated response from the lab at multiple levels to restructure where possible in the interest in safety. Because of this response, many new practices were established to ensure smooth operation and safety. The establishment of a task force, reduced staff on site, reduced interaction between those on site, masks, gloves, and available hand sanitizer are some examples of immediate restructuring that lasted the year of running under COVID19. Due to the lab response, there were some challenges with continuing to run including a two-month initial downtime, issues involved with running during the summer, and maintenance periods adjusted to allow for more remote access. Despite this, the percentage of time spent in failure was relatively low, relevant luminosity projections were met, and all of the goals for the run lasting between Dec. 2019 and Sept. 2020 were reached.

### **From New to Experienced: How the Pandemic Prepared the Operator Group at the Canadian Light Source**

**Authors:** Ethan Herman; Tylor Sove; Chelsea Randall; Priya Sharma; Blair Kuprash; Peter Bankole; *Canadian Light Source*

The pandemic has shifted the workforce around the world. With a relatively new operator group at the CLS, our group will present how we dealt with the pandemic right from the start. We will explain our situation involving the facility, working with staff and other important situations that have fallen on us

during this time and how we adapted to rapid change that better prepared us for the future of the CLS Operator group. Some important situations included planned and unplanned power outages and the prolonged damaged it had caused on equipment in the facility, an outbreak of COVID-19 with facility staff as well as our mental wellbeing during a period of absolute uncertainty.

### Fire and recovery at KEK electron/positron injector linac

**Author:** Kazuro Furukawa

**Co-author:** KEK Injector linac group; *KEK*

A high-power pulsed modulator was burnt at the accelerating structure assembly room adjacent to the electron positron injector linac building in KEK. It is considered that a capacitor in the pulse forming network was broken and caught fire. The container of the capacitor was plastic material and was filled with insulating oils that are combustible. The fire generated much carbon soot and some chemicals and they sneaked into the injector building. The operation of those facilities was interrupted. The fire and its recovery are reported.

### Pulsed beam generation for the three- dimensional Spiral Injection Scheme test

**Author:** Ryota Matsushita<sup>1</sup>

**Co-authors:** Kazuro Furukawa<sup>2</sup>; Hiromi Iinuma<sup>3</sup>; Tsutomu Mibe<sup>2</sup>; Hisayoshi Nakayama<sup>2</sup>; Kodai Oda<sup>4</sup>; Satoshi Ohsawa<sup>2</sup>; Muhammad Abdul Rehman<sup>2</sup>; Naohito Saito<sup>2</sup>

<sup>1</sup> *The University of Tokyo*

<sup>2</sup> *KEK*

<sup>3</sup> *Ibaraki-Univ.*

<sup>4</sup> *Ibaraki univ.*

A brand-new three-dimensional spiral injection scheme will be used to inject and store muon beams into the solenoid-type storage magnet for the muon g-2/EDM experiment at J-PARC. Since this is the first instance to employ this scheme, therefore a prototype experiment is underway at KEK.

The prototype experiment is utilizing an 80 keV electron beam to inject and store into the solenoid magnet of strength 82.5 Gauss with a diameter of 24 cm. Currently, preparation to kick and store the pulsed beam in the storage magnet by a kicker is in progress. For the pulsed beam, a beam chopper system was constructed and successfully generated the pulsed beam with a variable pulse width down to 60 ns. To confirm whether the pulsed beam could be generated as intended, the measurement of the pulse width using the ionizing emission of nitrogen gas and scintillating fibers was performed. In this poster, the generation of the pulsed beam using a chopper system and its detection will be discussed.

### **Influence of COVID-19 on operations in the medical setting of a particle therapy facility**

**Author:** Tatsuki Goto<sup>1</sup>

**Co-authors:** T. Shirai<sup>2</sup>; S. Yonai<sup>2</sup>; E. Takada<sup>2</sup>; N. Shinozaki<sup>3</sup>; T. Nakajima<sup>3</sup>; H. Uchiyama<sup>4</sup>

<sup>1</sup>*Accelerator Engineering Corp.*

<sup>2</sup>*National Institutes for Quantum and Radiological Science and Technology*

<sup>3</sup>*Accelerator Engineering Corp*

<sup>4</sup>*Accelerator Engineering Corp.*

At the National Institutes for Quantum and Radiological Science and Technology (QST), carbon-ion therapy has been carried out since 1994, and a total of more than 13,000 patients have been treated to date. Since the COVID-19 pandemic in 2020, all medical facilities are required to have robust measures against infectious diseases. In our facility, operators who work in the medical setting have indirect contact with patients and therefore need to have the measures equivalent to those taken by medical staff. Our measures focused on two things: avoiding contact between operators and patients, and ensuring that treatment could be continued in case anyone became infected. Rubbing alcohol has been installed in each treatment room and staff room to disinfect hands and equipment frequently. Operators were forbidden to use some of the passageways used by patients. There were also changes in the working style. Combinations of pairs or trios for operation were fixed in order to prevent the spread of infection. Even with these measures in place, one operator was infected with COVID-19, but the infection did not spread any further. This result may have been due to the thoroughness that comes with being in the medical setting. In this presentation, we will show the influence of COVID-19 on operations in the medical setting.