Accelerator Reliability Workshop (ARW) 2022

Sunday, October 16, 2022 - Friday, October 21, 2022

Marriott Newport News at City Center

Scientific Programme

ARW 2022 workshop subject matter.

Accelerator Support Systems

Reliable operation of accelerators requires reliable infrastructure support systems and utilities. Such systems include cryogenic plants, cooling water and ventilation systems, electrical infrastructure and backup powering. Maintenance, disruption, and/or malfunction of these systems has the potential to greatly impact accelerator downtime, reliability, and overall performance. This session explores the interfaces of these systems with accelerators, as well as associated issues and their optimization. Contributions to this session consider the feedback, means, and strategies (e.g., redundancies, backups, filtering, UPS, training and so on) to make accelerator components more resilient to support system issues, and to optimise recovery times.

Accelerator Support Systems

Maintenance & Obsolescence

All accelerators have reliability expectations. A data driven approach to maintenance has become a necessity as new accelerators increase in size and complexity. This can become more complex over the lifecycle of accelerator facilities when upgrades mix new and old components.
What approaches work best for maintaining high reliability your facility?
Have these approaches been shown to improve reliability and availability?
How do you handle obsolescence issues?
What are biggest struggles with optimizing maintenance activities and scheduling repairs?
What software programs are used to track and schedule maintenance? Commercial or home built?
Are there different approaches for new facilities vs upgraded facilities?

Maintenance & Obsolesence

Machine Learning & Reliability

Machine Learning has already been applied in some instances to particle accelerators. The recent advances (e.g. deep learning) and heightened interest in the community indicate that it will be an increasingly valuable tool to meet new demands for beam energy, brightness and stability.

The intent of this session is to introduce how problems in accelerator science and operation (in particular accelerator reliability) can be approached using ML techniques, and how these have the potential to provide benefits over classical approaches.

Machine Learning & Reliability

Reliability in Harsh Environments

Environmental factors create many challenges for reliable operation of accelerators. Most accelerators operate over large physical areas and must maintain high precision and safe operations. Challenges that must be considered include many factors which are outside the direct

control of the operator; such as varying temperatures, ground settling, earthquakes. Accelerators themselves produce radiation and temperatures from operation that impact equipment selection, precision and lifespan. What new materials and equipment are used to mitigate problems in a harsh environment? How to recognise and correct ongoing alignment changes (building movement, earthquakes etc).
Presenters are asked to share impacts on their systems from the harsh environments they operate in.
How they address the issues.
Lessons learned.

Reliability in Harsh Environments

Predicting Failure

Components and systems have different failure modes, and rates depending on where they are in their lifetime, which in turn is dependent on the operational cycle in which the components and systems are being used.
What are effective means and tools for predicting failure?
When should we use the tools?
What is the raw data which is needed and how do we obtain it?
How do we analyse and feed-back this information to drive improvement?

In this session, we encourage the presentation of uses cases, scenarios, and the tools, such as Root Cause Failure Analysis (RCFA), to conduct logical, structured, and deductive techniques that can identify the failure root-causes.

Predicting Failure

Reliable Protection Systems

Faced with the combination of increasing beam power, high operational availability requirements, and the reliance on often custom made, specialized and expensive equipment, machine protection in accelerator facilities is critical for protecting against long shutdown periods and the associated financial losses incurred though damage to equipment. Without any dedicated standards for the implementation of machine protection systems, defining a machine protection concept and method can be one of the key challenges faced by facilities to mitigate machine protection risks in a systematic way which requires a broad understanding of accelerator physics, engineering design, functional safety principles and gained facility experience. In this session it will be discussed some of the challenges and opportunities related to machine protection for accelerator facilities.

Reliable Protection Systems

Reliability of Medical Facilities

The largest number of particle accelerators are devoted to medical applications (diagnostic or therapy), but having a smaller size and energy compared to high energy physics research. These devices are also industrial products, as compared to research machines. During the two last

decades an increase of “large scale” medical facilities, comparable to those for research, have appeared. These Proton and Carbon facilities are now slowly moving to the biomedical and industrial world.

The session of ARW2022 will consider:
Return on experience or methods used in the existing centres, which consider reliability and a financial performance indicator.
Consideration of the medical accelerator and associated systems design; challenges and approaches of the industrial companies to achieve reliability of their products and processes.

Reliability of Medical Facilities

New & Innovative Accelerator Technology

Innovation in automation and robotics is an area of focus for increasing efficiency and productivity in the accelerator community.
How is the accelerator industry utilizing both "off the shelf" and "in house" technologies for handling repetitive tasks to reducing stress and increasing safety for the workforce?
How are we using Big Data analytics to discover useful, otherwise hidden, patterns to incorporate data-driven decisions for facilities and applying machine
learning techniques to model, explore and implement data driven solutions?
What type sensors are available (pressure, vibration, thermal, etc.). Uses of case scenario will be very greatly appreciated.

New & Innovative Accelerator Technology

Reliability Consideration Before / During Machine Upgrade

Reliability and availability requirements are taken into consideration before the design of systems and components is carried out. This is a common practice in many industrial applications and is becoming more common for projects in the accelerator domain. A systematic analysis of machine parameters and scenarios should serve as a basis to establish prediction and calculations to correctly dimension accelerator sub-systems and components. Knowing how to calculate reliability is important, but knowing how to achieve reliability is equally, if not more, important. Reliability practices must begin early in the design process and must be integrated into the overall product development cycle. This session will try to answer how to fold reliability considerations before and during a machine upgrade.

Reliability Consideration Before / During Machine Upgrade

Abstract Review

Abstract Review

Poster

Poster