

# **Accelerator Reliability Workshop 2026 (ARW2026)**

**Sunday, 15 November 2026 - Friday, 20 November 2026**

**Hotel Aomori**

## **Scientific Programme**

## Beyond Firefighting: Implemented Lessons Learned for Improved Reliability

Previous ARW workshops have shown that many facilities are highly effective at identifying technical failures and implementing rapid fixes to maintain operation. While this approach can restore functionality quickly, it often reinforces a reactive “firefighting” culture that depends heavily on a small number of highly experienced staff.

Such an approach is difficult to sustain over the long lifetimes typical of accelerator facilities. It assumes continued availability of specialized expertise and often consumes the time of key personnel who might otherwise focus on longer-term improvements.

The challenge is therefore to move beyond reactive maintenance and embed operational lessons into the way facilities design, operate, and maintain their systems.

This session will explore how lessons learned from operations can be systematically incorporated into procedures, design practices, and organizational workflows to produce measurable improvements in reliability.

## Diligent Incident and Fault Tracking and Effective Use of Data

Incident and fault tracking systems are critical tools for improving accelerator reliability. Beyond documenting downtime, these systems provide the data needed to identify trends, guide operational decisions, and support long-term improvements in facility performance.

Maintaining high-quality reliability data, however, requires sustained effort from multiple stakeholders. Clear definitions, consistent reporting practices, and cultural buy-in are essential to ensure that events are recorded with sufficient accuracy and detail. In practice, several challenges arise. A single dataset must often support multiple users with different objectives, data collection methods may evolve over time, and the people collecting data are not always the same as those analyzing it.

This session will present practical approaches to incident and fault tracking that can be implemented at accelerator facilities, with discussion focused on:

**Effective use of data** – consolidating failure information, supporting targeted reliability improvements, enabling reliability modeling, and informing predictive maintenance strategies.

**Cultural buy-in** – building and sustaining engagement among operators, engineers, and management to ensure consistent and transparent reporting.

**Balancing perspectives** – aligning the needs of data users with the practical constraints of those responsible for collecting the data.

**Long-term coherency** – maintaining data integrity as tools, systems, and operational objectives evolve over time.

**Digital transformation** – developing structured, high-quality datasets that can support emerging tools such as machine learning, automated analysis, and advanced reliability modeling.

## Superconducting Systems

Superconducting systems play a central role in many modern accelerators, and their reliability directly affects beam availability, operational stability, and maintenance requirements.

This session focuses on advances that improve the robustness and reliability of superconducting accelerator systems and their supporting RF, cryogenic, and control infrastructures.

Topics of interest include:

**SRF and magnet system architectures** and their impact on reliability, fault tolerance, and operational continuity across RF, cryogenics, LLRF, and interlock systems.

**Automated diagnostics and prediction**, including data-driven or machine-learning approaches for quench prediction, cavity condition monitoring, failure forecasting, and anomaly detection.

**Reliability-by-design for superconducting systems**, including maintainability, requirements engineering, risk management, and strategies for ensuring quality and integration of in-kind subsystem contributions.

This session is intended for researchers and engineers developing and maintaining reliable superconducting systems for modern accelerator facilities.

## Production Facilities and Commercial Applications

Accelerators used for medical treatment, isotope production, and commercial irradiation operate under reliability constraints that differ significantly from those of research facilities. Operational metrics such as treatment throughput, isotope yield, and market demand introduce additional pressures that influence maintenance strategies, upgrade decisions, and acceptable operational risk.

This session will examine how reliability is managed in production environments where downtime directly impacts patient care or product delivery.

Topics may include:

Balancing treatment time, verification, and quality assurance in medical accelerator operations

Operating facilities with minimal or no scheduled maintenance windows

Integrating new commercial systems with existing accelerator infrastructure

Establishing equipment lifecycles, which may include end-of-life or replacement timing for aging production machines

The goal of this session is to share operational experience and identify reliability practices used in health care and commercial industry that may also benefit research accelerator facilities.

## Simulation versus Test Benches for Accelerator Reliability

Simulation and physical test benches both play important roles in establishing accelerator reliability. Simulation enables rapid, low-cost exploration of design options and operating scenarios, while test benches provide high-fidelity validation under realistic conditions.

Simulation allows teams to evaluate design concepts early, perform Monte Carlo and “what-if” analyses, and model complex physics before hardware is built. However, its predictive value depends strongly on the accuracy of assumptions and input data.

Test benches provide the experimental validation needed to confirm design assumptions, reveal unmodeled behavior, and generate high-quality data on failure modes, reliability, and component lifetime. Testing across full operational ranges or to failure, however, can be expensive and time-consuming.

This session will explore how simulation and experimental testing can be combined effectively to guide design decisions, refine reliability models, and improve confidence in system performance prior to deployment.

## **Innovative Systems and Robotics for Reliable Accelerators**

As accelerator facilities grow in scale and complexity, new technologies in automation, robotics, advanced sensing, and intelligent data systems are creating opportunities to improve reliability, safety, and operational efficiency.

This session explores how these technologies can be applied to support more dependable accelerator operation. Contributions may include advanced automation architectures and applications of open-source software, AI/ML techniques, IoT-enabled monitoring.

Within this broader automation landscape, robotics will be considered as one element of integrated reliability strategies, including telemanipulation systems, mobile robots, and automated tooling for remote intervention and maintenance. Additional capabilities may include interconnected sensors and standardized data platforms used to detect anomalies earlier; resulting in improved failure prediction, optimize maintenance implementation, and support faster decision-making during faults or recovery.

The session will also examine how open-source frameworks and shared development approaches can accelerate innovation while maintaining transparency and long-term maintainability of reliability-critical tools.

## **Integrated Reliability across accelerator sub-systems – Importance of robust interface definition**

Modern accelerator facilities consist of complex subsystems developed by multiple teams, institutions, and in-kind contributors. In such environments, overall reliability is often determined not by individual component performance, but by the quality of the interfaces between systems.

This session focuses on how reliability is established - or lost - at subsystem boundaries.

Contributions are invited on topics including:

Defining interface requirements early in the design process, including reliability, availability, maintainability, and operability considerations

Verification strategies, including what to test, how to test, and when systems are ready for integrated testing

Failure modes arising from interface mismatches, timing issues, or incomplete requirement definition

Coordination challenges in distributed or in-kind development projects

Maintainability and lifecycle considerations at subsystem interfaces

Operational experience where interface definition affected commissioning, availability, or long-term reliability

A central theme is that interfaces are not owned by a single system; they require shared definition, shared accountability, and coordinated integration.