ISBN: 978-3-95450-231-8 ISSN: 2673-5490 doi: 10.18429/JACoW-IPAC2023-THPA120

ATLAS OPERATIONS SHIFT LOG SOFTWARE UPGRADE AND IMPLEMENTATION*

G. Dunn†, A. Cravatta, B.R. Blomberg, C. Peters, D. Potterveld, M. R. Hendricks,
Argonne National Laboratory, Lemont, IL, USA
J. Running, Hexagon j5 Operations Management Solutions, Cape Town, South Africa

Abstract

The Argonne Tandem Linear Accelerator System (ATLAS) at Argonne National Lab uses an electronic shift log to record machine performance, save beam tune data, relay information between shifts, and track the facilities operational status for budget reporting. In early 2021, the legacy shift log was retired and upgraded to a modern platform with increased reliability and expanded functionality. This contribution details the development and implementation, future expansion plans, and discusses 2 years of operational experience.

INTRODUCTION

ATLAS's unique feature is its ability to change the accelerated ion beam and its properties rapidly. Changes in beam current are a part of routine operations, and changes in beam energy can happen in a couple of hours. Changing to a different ion generally takes less than 24 hours. ATLAS can deliver any ion from hydrogen to uranium [1,2] and has 8 available end stations to deliver the beam. ATLAS is a 24/7 facility with a wide range of frequent beam changes requiring control room operators to maintain accurate shift logs documenting all operational activities and any unusual events during their shifts. These logs are critical for ensuring the safety and reliability of the accelerator, as well as for facilitating communication between shifts and ensuring that experiments are conducted in a consistent and reproducible manner.

We recently upgraded our electronic logbook to ensure reliability in data collection and clear communication between control room shifts and other ATLAS subgroups. The previous version was developed in house and worked faithfully for many years. However, there were limitations associated with the aging system we wanted to address and the outdated nature of the software complicated further code adjustments. The previous logbook was limited to a single computer capable of making entries, and while the basic functionalities were fulfilled, many features are better supported on a third-party platform. These included remote editing of entries, tablet support, file attachment for images and screenshots, and digitization of some procedures.

In this contribution, we discuss our upgrade to a new platform, operational experience thus far, and expansion plans.

J5 OPERATIONS LOGBOOK

j5 is a total operations management platform comprised of several interconnected modules [3]. ATLAS has utilized the Operations Logbook, Shift Handover, and Work Instructions. It is worth mentioning that j5 offers additional modules, but these are the only ones used at ATLAS. j5 Logbook runs as a web application from a central server located at Argonne National Laboratory, and users access j5 logbook via a supported browser. j5 can run on Windows or Linux and supports many popular databases.

j5 logbook was chosen as a platform to develop an upgraded logbook for various reasons, including browser-based access, configuration options, LDAP security authentication, support, and modules that matched the needs of ATLAS. The team at Hexagon developed the basis for the logbook on specifications and desired functionality provided by ATLAS. This configured version of the j5 logbook runs on a server managed by the Physics division, and further development was done with editing software provided by Hexagon.

MODULES

Shift Log

ATLAS control room operators use the j5 logbook to record and track the accelerator's performance and status, including the beam parameters, machine settings, and any relevant issues or problems encountered during operation. Tuning the beam takes 24 hours on average and happens in several stages. Operators track which stage has been completed and which stage they are on via the logbook, allowing operators on the following shifts to quickly see the work that has already been completed and understand where things stand in the lengthy tuning process.

Within each entry, a user can select from a custom hierarchy of run modes that indicate the machine's status at that time down to the minute (Fig. 1). Any description of the status, actions taken, observations, or anything else can be logged in a notes section. Relevant files can also be attached to shift log entries, enhancing text descriptions or communicating visual or auditory observations much more efficiently than a text description could manage.

* This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under contract number DE-AC02-06CH11357
† gdunn@anl.gov

ISBN: 978-3-95450-231-8 ISSN: 2673-5490 doi: 10.18429/JACoW-IPAC2023-THPA120

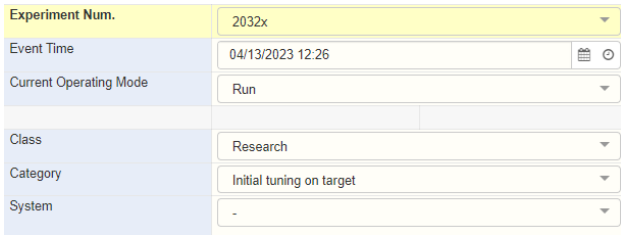

Figure 1: Shift log entry hierarchy of categorization.

The shift log serves a dual purpose for ATLAS; in addition to the previously mentioned uses, the shift log tracks the number of research hours, start-up time, and downtime for the facility. This is done by assigning a current mode to each shift log entry (Fig. 2). If an event occurs that would alter the current mode of the accelerator, the control room operators would make an entry with a new mode of operation. j5 logbook attributes the time between entries to the first entry mode. A user can then specify a time frame, a month for example, and the j5 logbook sums all the time attributed to each mode (Fig. 3).

Accelerator Development	98.28	hours (13.23 % staffed hours)
Experiment Downtime	33.27	hours (4.48 % staffed hours)
Non-Experiment Downtime	4.78	hours (0.64 % staffed hours)
Research	421.57	hours (56.74 % staffed hours)
Scheduled Downtime	10.77	hours (1.45 % staffed hours)
Start-Up	115.78	hours (15.58 % staffed hours)
Start-Up Downtime	58.53	hours (7.88 % staffed hours)
	743	total staffed hours
	0	unstaffed hours

Figure 2: Computed run-mode hours over a specified period.

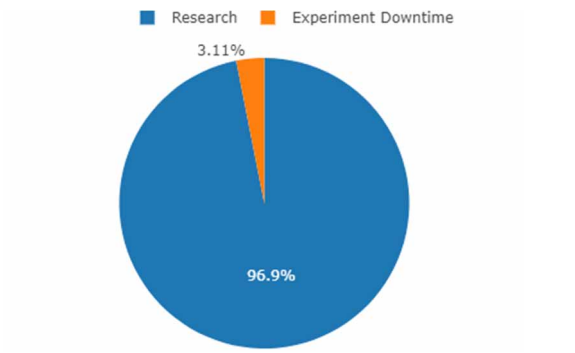

Figure 3: Shift handover visual showing run-modes occurring during the shift.

Shift Handover

The shift handover provides a platform for incoming operators to see all shift log entries since their last shift. The outgoing operator can leave important notes here. These may be items that do not affect the operational mode of the facility but are deemed necessary for the on-shift operator to know. The shift handover details the incoming and outgoing chief shift operator and safety watch. Identifying these roles is essential information as ATLAS often operates in a mode where there is one on-duty operator and another individual who is not necessarily a qualified operator but acts as a safety watch to the on-duty operator. Both operators are presented with valuable statistics regarding the previous shift. Lastly, the shift handover must be read and approved by the outgoing and incoming chief shift operator, thus adding a layer of accountability.

Work Instructions

The work instructions module allows custom procedures to be completed throughout a shift. Currently, ATLAS only uses this module for machine walk-throughs (Fig. 4). This procedure used to be done with paper and pen, and involves an operator on shift walking throughout the facility recording specific values, and checking for other issues. Implementing this module has allowed the recorded values to be stored digitally in a database for easy parsing and analysis in the future.

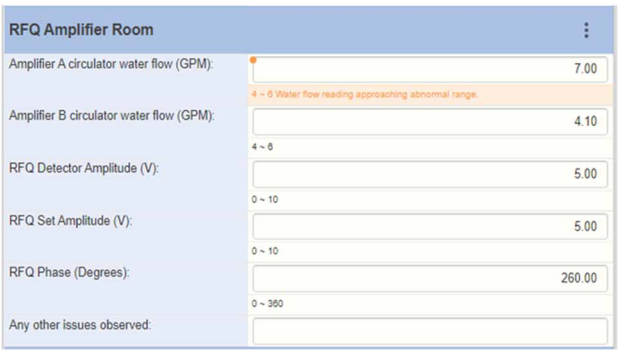

Figure 4: One section of the machine walkthrough form.

Mobile Application

j5 has an application available for phones and other mobile devices. This application provides access to most of the modules used by ATLAS in a mobile friendly environment. Examples of the mobile application interface can be seen in Fig. 5.

With this mobile application, a j5 user can use a mobile device, Android and iPhone, to quickly make entries and share images when walking around the facility. ATLAS operators use a tablet during machine walk-throughs to enter device values and share images of any critical findings.

ISBN: 978-3-95450-231-8 ISSN: 2673-5490 doi: 10.18429/JACoW-IPAC2023-THPA120

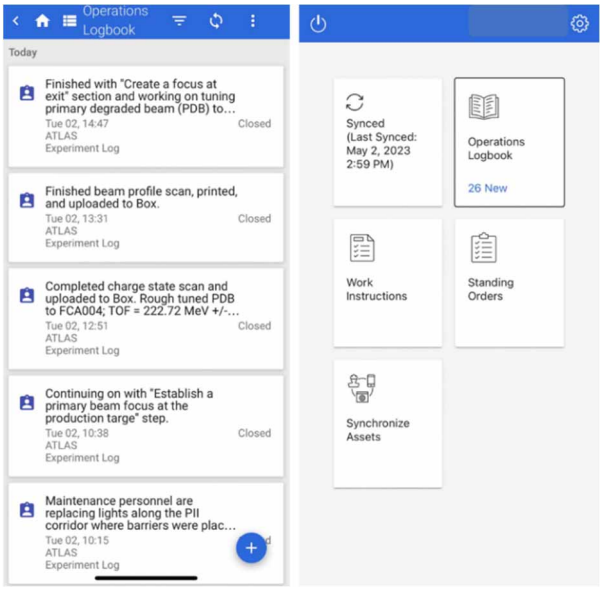

Figure 5: Mobile application shift log entries on the left and accessible modules on the right.

PERMISSIONS

Each j5 user is assigned to a user rights group. The user rights group determines what level of permission a user has with regard to viewing, adding, editing, and deleting entries in the various modules. j5 allows for the customization of permissions for each rights group. We decided to use the default permissions that came with j5 and from there, assigned ATLAS staff, users, and various Argonne Physics division employees to rights groups depending on the level of permissions we felt was appropriate for their role.

OPERATIONAL EXPERIENCE

ATLAS operators have used the j5 logbook for two years as the primary logging tool during each shift. The accessibility provided by the j5 platform's web-based system has greatly improved, as the responsibility of making entries is no longer relegated to a single person. This means during particularly busy days anyone involved can make a shift log entry which other operators can then edit on their own devices. Another benefit provided through a web-based system is the ability to link entry URLs inside other entries, providing quick access for referencing previously entered information.

One of the requirements for the logbook upgrade was file attachments, and for good reason. This has proven extremely useful for disseminating visual information to other shifts, particularly for equipment readback values and locations of essential devices. It has also been used for attaching data sets collected throughout the shift and even video files of occurrences.

Another feature of the j5 logbook that was not present in the previous ATLAS logbook is sort and search functionality. All entries stored in the database can be sorted by entry type, date range, and many other values. On top of these sorting filters a user can also search the available entries using keywords in a search bar, which has proven extremely useful when looking for mentions of specific equipment or past events.

FUTURE EXPANSIONS

While the current version of the logbook in use at ATLAS has been functional for two years now, many improvements planned for future development. The j5 logbook has many features that are currently not utilized at ATLAS, such as a list of all pieces of equipment that attribute to down-time. Implementation of this feature would allow more accurate tracking of equipment causing excessive downtime and may indicate a need for repair or replacement.

Another desired expansion would be logbooks specific to each ATLAS sub-group. Currently, only accelerator operators make entries into a general logbook which can be accessed and read by all members of ATLAS. It may be beneficial for each sub-group to make entries into their own version of the logbook to create a centralized platform of information.

Additionally, we are interested in any other modules available now or in the future that improve our efficiency in collecting data relevant to the beam and beamline devices. Efforts are underway to implement artificial intelligence and machine learning (AI/ML) to tune sections of the accelerator [4]. Handwritten data has been identified as a bottleneck to collecting the volume of data necessary to develop AI/ML models. j5 logbook provides a platform for us to further move away from hand written data.

CONCLUSION

j5 electronic logbook has provided an effective interface for control room operators to communicate machine status to other ATLAS staff and users. The various modules work well to facilitate work instruction, shift changes, and generate reports regarding operational hours. Moving forward, we would like to use more available modules to enhance our functionality and capture more data relevant to the beam and facility, thereby improving our operational efficiency.

REFERENCES

[1] L.M. Bollinger *et al.,* "ATLAS: A Proposal for a Precision Heavy Ion Accelerator at Argonne National Laboratory", ANL, Illinois, United States, Rep. ANL-78-XX-68, 1978.

[2] P. N. Ostroumov *et al.*, "Completion of Efficiency and Intensity Upgrade of the ATLAS Facility", in *Proc. LINAC'14*, Geneva, Switzerland, Aug.-Sep. 2014, paper TUPP005, pp. 449-451.

[3] j5 Operations Management Solutions, `https://hexagon.com/products/j5-operations-management-solutions`

[4] B. M. Mustapha *et al.*, "AI-ML Developments for the ATLAS Ion Linac Facility", in *Proc. IPAC'21*, Campinas, Brazil, May 2021, pp. 4122-4125. `doi:10.18429/JACoW-IPAC2021-THPAB181`