

Integrated Toolkit for accelerator operation management of KOMAC facility

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1. Introduction

Korea Multi-purpose Accelerator Complex (KOMAC) has been operating a 100 MeV proton linear accelerator. To accelerate proton beams and monitor its operation, we have implemented a control system based on Experimental Physics and Industrial Control System (EPICS) framework, which widely used to control a linac [1]. Control System Studio (CSS) has been adopted for user interface to access EPICS Input Output Controller (IOC) via Channel Access (CA) protocol. Figure 1 shows the structure of KOMAC control system.

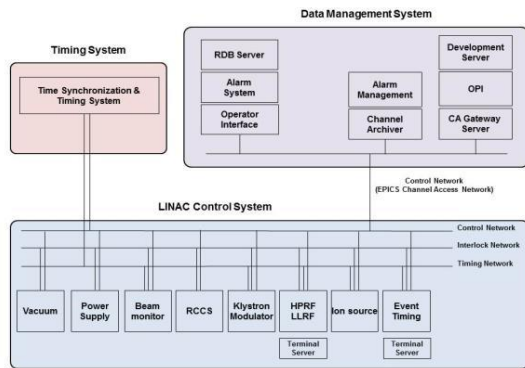


Fig 1. The structure of KOMAC control system

The control system is comprised of three systems, linac control, timing sequence and data management system. Through a control system, a data management system is a system for analyzing and archiving data observed such as beam service time, RF operating time. Results are shown in client-friendly format. High level applications have been developed to analyze a linac, and an operational management system at KOMAC was implemented in java web framework

2. Operational management system

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Operating parameters to operating linac are managed with EPICS IOC PVs. Therefore the operational management system is implemented using JAVA

language that communicated with EPICS IOC via CA protocol. Operation management system consists of three parts, database to archive data, daemon program to monitor EPICS IOC PVs and Application calculate and show data in fixed format. Figure 2 shows Operational record system architecture.

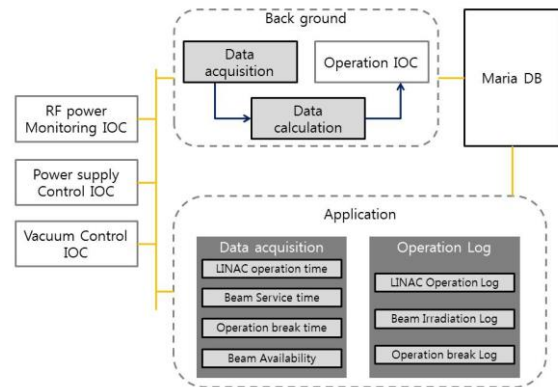


Fig 2. The operational record system architecture.

Database for operation management system was configured with MariaDB. The Database for system has Auto_Log tables to archive data. Auto_Log table archives radio frequency (RF) power status in the form of 1 and 0 and the time that events are occurred. Auto_Log table are used for calculating linac operating time and beam service time. The daemon program archive data into the data base as monitoring PVs and application calculate the data in fixed format using stored data in database.

The daemon program monitors EPICS IOC PVs such as RF power, gate valve status and bending magnet and writes data taken from EPICS IOC PVs into database. To access EPICS IOC, CAJ and JAC libraries are imported and to access database, mysql_connector library is used. The Daemon program has two functions, EPICS monitoring, scheduler. The Daemon program monitors RF power, gate valve status and magnet status. RF power is used for calculating operation time, and if RF power exceeds limit or is below a limit, that time and status are inserted in Auto_Log table. Gate valve status and magnet status is used for 20 MeV and 100 MeV beam service time through which gate valve and magnet is operating. Every hour, Daemon program calculates operation time and beam service time using stored data in database and writes data into EPICS IOC PVs matched with them. And every midnight the

program turn RF power status to 0 and computes daily operation time and beam service time.

The application computes and shows data in specified format. The application comprised of calculating operation and beam service time and inserting information and time of operation break. Operation time is computed three ways, weekly operation time, yearly operation time and user selected period. Operation time is calculated with comparing time that RF power status turn 1 to 0 and is shown in hours. Weekly and yearly operation time is automatically calculated and is shown in various formats. Figure 3 shows operation time tab of operational management application.

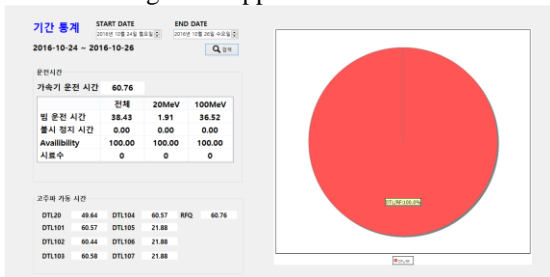


Fig 3. The operation time tab of operational records management application

Break time is computed manually using insert break time tab. Clients insert break time and information of the reason of break. Using inserted data application calculated the proportion of break reasons and availability of linac. Figure 4 shows operation break tab of operational management application.

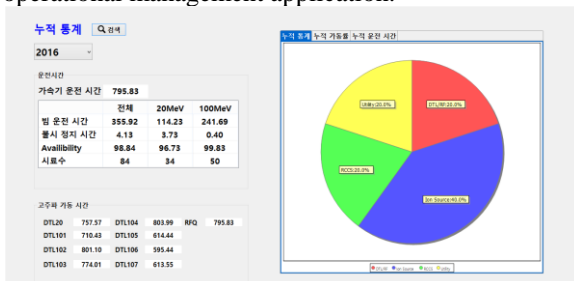


Fig 4. The operation break tab of operational records management application.

3. Conclusions

The operation management system archives operation time, beam service time and break time of devices in the linac. The data shown in application is compared with calculated data to confirm the accuracy and stability. The operation records management system shows the operation status of linac and utilized to plan the linac operation and maintain linac.

The operation system will be utilized the Machine Protection System to calculate break time and information automatically. High-Level Applications developed at KOMAC will be assembled to provide various functions in one application. And KOMAC also

has been developing web-based application which operators and users can access from any where

ACKNOWLEDGMENT

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REFERENCES

- [1] Experimental Physics and Industrial Control System (EPICS). URL: <http://www.aps.anl.gov/epics>.
- [2] MariaDB reference manual. Oracle Corporation. URL: <https://mariadb.org/>