Improvement of Lifecycle Information Management System at KOMAC

Kyung-Hyun Kim (KAERI)*, Hyeok-Jung Kwon (KAERI), Han-Sung Kim (KAERI), Mun-Ho Jo (KAERI)
Korea Multi-purpose Accelerator Complex, Korea Atomic Energy Research Institute, Gyeongju 38180, Korea
**Corresponding author:kimkh@kaeri.re.kr*

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1. Introduction

The Korea Multi-purpose Accelerator Complex (KOMAC) has 11 sets of Drift Tube Linac (DTL) tank in order to accelerate the proton beam from 3-MeV to 100-MeV [1]. The stability of accelerated beam depends of and is affected by various factors including, for example, radio frequency (RF) power, ion source and cavity resonance stability [2]. The Equipment Lifecycle Information Management System (ELIMS) at KOMAC has been developed for managing efficient accelerator operation [3]. ELIMS has a critical role in keeping equipment stability.

2. Methods and Results

2.1 System description

ELIMS has the server computer and smart pads which are available for data synchronization by connecting cable under the offline condition as per Figure 1.

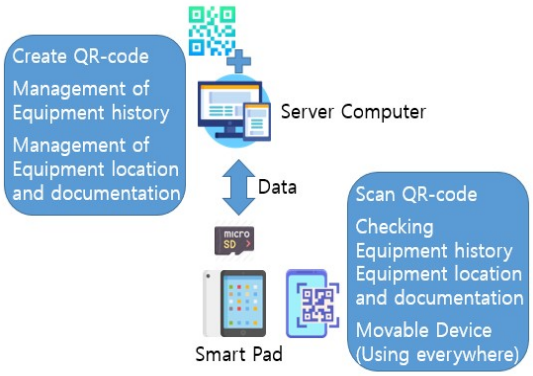


Fig. 1. Equipment Lifecycle Information Management System schema [3]

2.2 Data merging with Aging Matrix

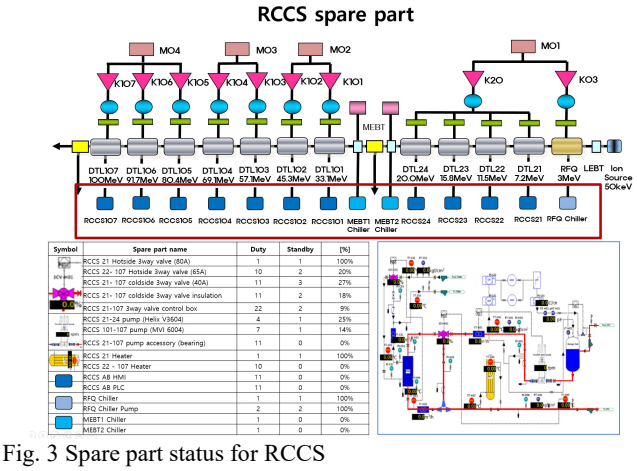
ELIMS handled over 500 numbers of main equipment but we noted the necessity of combining between ELIMS and an aging matrix. The aging matrix was one of the databases which shows the equipment deterioration related to accelerator. The aging matrix data is consisted with installation data, spare part number and expected available operation data as per Figure 2.

No	System	High catagory	Middle category	Name	Spec	Serial Number	Location	Inst. Date	Expt. Date	Action	Spare part	Lead time
302	Power	Modulator	M01	PLC chassis	PLC, 1756-A10	1756-A10	Modulator rm	2013	15	Replace	0	6
309	Power	Modulator	M01	Ethernet module	PLC, 1756-ENBT	1756-ENZT	Modulator rm	2013	15	Replace	1	6
310	Power	Modulator	M01	Analog input module	PLC, 1756-IF8	1756-IF8	Modulator rm	2013	15	Replace	1	6
311	Power	Modulator	M01	Digital DC input module	PLC, 1756-IB32	1756-IB32	Modulator rm	2013	15	Replace	2	6
313	Power	Modulator	M01	DC 24V input module	PLC, 1756-IB16	1756-IB16	Modulator rm	2013	15	Replace	1	6
315	Power	Modulator	M01	Analog input module	PLC, 1756-IF16	1756-IF16	Modulator rm	2013	15	Replace	2	6
406	Power	Modulator	M02	PLC chassis	PLC, 1756-A10	1756-A10	Modulator rm	2013	15	Replace	0	6
408	Power	Modulator	M02	Ethernet module	PLC, 1756-ENBT	1756-ENZT	Modulator rm	2013	15	Replace	1	6
409	Power	Modulator	M02	Analog input module	PLC, 1756-IF8	1756-IF8	Modulator rm	2013	15	Replace	1	6
410	Power	Modulator	M02	Digital DC input module	PLC, 1756-IB32	1756-IB32	Modulator rm	2013	15	Replace	2	6
412	Power	Modulator	M02	DC 24V input module	PLC, 1756-IB16	1756-IB16	Modulator rm	2013	15	Replace	1	6
414	Power	Modulator	M02	Analog input module	PLC, 1756-IF16	1756-IF16	Modulator rm	2013	15	Replace	2	6
505	Power	Modulator	M03	PLC chassis	PLC, 1756-A10	1756-A10	Modulator rm	2013	15	Replace	0	6
507	Power	Modulator	M03	Ethernet module	PLC, 1756-ENBT	1756-ENZT	Modulator rm	2013	15	Replace	1	6
508	Power	Modulator	M03	Analog input module	PLC, 1756-IF8	1756-IF8	Modulator rm	2013	15	Replace	1	6
509	Power	Modulator	M03	Digital DC input module	PLC, 1756-IB32	1756-IB32	Modulator rm	2013	15	Replace	2	6
511	Power	Modulator	M03	DC 24V input module	PLC, 1756-IB16	1756-IB16	Modulator rm	2013	15	Replace	1	6
513	Power	Modulator	M03	Analog input module	PLC, 1756-IF16	1756-IF16	Modulator rm	2013	15	Replace	2	6
604	Power	Modulator	M04	PLC chassis	PLC, 1756-A10	1756-A10	Modulator rm	2013	15	Replace	0	6
606	Power	Modulator	M04	Ethernet module	PLC, 1756-ENBT	1756-ENZT	Modulator rm	2013	15	Replace	1	6
607	Power	Modulator	M04	Analog input module	PLC, 1756-IF8	1756-IF8	Modulator rm	2013	15	Replace	1	6
608	Power	Modulator	M04	Digital DC input module	PLC, 1756-IB32	1756-IB32	Modulator rm	2013	15	Replace	2	6
610	Power	Modulator	M04	DC 24V input module	PLC, 1756-IB16	1756-IB16	Modulator rm	2013	15	Replace	1	6
612	Power	Modulator	M04	Analog input module	PLC, 1756-IF16	1756-IF16	Modulator rm	2013	15	Replace	2	6

Fig. 2. Aging matrix data sample

2.2 Critical spare part status

Pursing the stable operation of accelerator, managing a critical spare part is essential. ELIMS does not have the critical spare part status so we redeveloped our management system for indicating the critical spare part status. The below Figure 3 shows the spare part status for Resonance Control Cooling System (RCCS) which is cooling system for accelerator's drift tube.



Symbol	Spare part name	Duty	Standby	[%]
	RCCS 21 Hotside 3way valve (80A)	1	1	100%
	RCCS 22- 107 Hotside 3way valve (65A)	10	2	20%
	RCCS 21- 107 coldside 3way valve (40A)	11	3	27%
	RCCS 21- 107 coldside 3way valve insulation	11	2	18%
	RCCS 21-107 3way valve control box	22	2	9%
	RCCS 21-24 pump (Helix V3604)	4	1	25%
	RCCS 101-107 pump (MVI 6004)	7	1	14%
	RCCS 21-107 pump accessory (bearing)	11	0	0%
	RCCS 21 Heater	1	1	100%
	RCCS 22 - 107 Heater	10	0	0%
	RCCS AB HMI	11	0	0%
	RCCS AB PLC	11	0	0%
	RFQ Chiller	1	1	100%
	RFQ Chiller Pump	2	2	100%
	MEBT1 Chiller	1	0	0%
	MEBT2 Chiller	1	0	0%

Fig. 3 Spare part status for RCCS

2.3 Result

The aging matrix data and the critical spare part data were all incorporated in ELIMS. Equipment number is increase from over 500 to 1600 in ELIMS due to inclusion of the critical component for main equipment. The aging matrix information can be added or modified

by using the system and extracted from ELIMS with designated format.

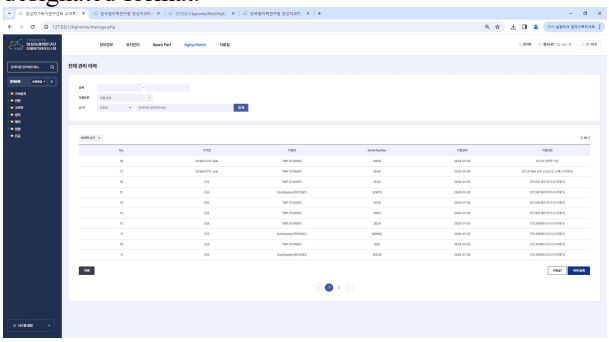


Fig. 4 Aging matrix data in ELIMS

In addition, the critical spare part status was implemented in ELIMS with the categories including accelerator, power, RF, cooling, control and alignment [Figure 5].

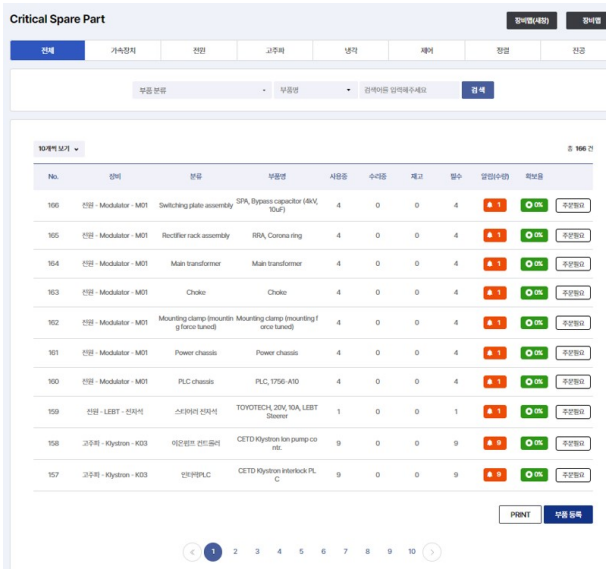


Fig. 5 Critical spare part status in ELIMS

3. Conclusions

We developed and improved ELIMS for application to all accelerator equipment containing the aging matrix data and the critical spare part. This system will help the operator recognize equipment maintenance history and spare part status easily.

ACKNOWLEDGMENT

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REFERENCES

[1] B.H. Choi, Proceedings of Particle Accelerator Conference 2005 (Knoxville, TN, USA, 2005), P.576

[2] H.S. Kim, “Operational Parameters Stability of KOMAC Proton Linac” Transaction of the Korean Nuclear Society Spring Meeting, 2016.

[3] M.H. Jo, Upgrading Equipment Lifecycle Information Manage System at KOMAC, 19S-370, Transaction of the Korean Nuclear Society Spring meeting, 2019.