Simplified Alignment in Replacement of Drift Tube for 20 MeV Proton Linac at KOMAC

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1. Introduction

100 MeV proton linac at KOMAC (Korea Multi-propose Accelerator Complex) has operated and provided accelerated proton beams to users since 2013 [1]. There are normally two maintenance periods every year, winter (Jan-Feb) and summer (Jul-Aug). In this maintenance period, totally 7 DT's (Drift Tube) with 4ea for DTL tank 21, 2ea for DTL (Drift Tube Linac) tank 22 were replaced and realigned in 20 MeV DTL tank. In this report, simplified procedure for DT alignment is described and results of replacement for DTs with DTL tank 21 and DTL tank 22 are presented.

2. Alignment

DT replacement takes place throughout the maintenance lifecycle and requires multiple operators in different fields such as RF, vacuum and alignment. As the number of proton beam users increases, the proton beam service period is increased and the accelerator maintenance period is reduced. In this regard, we try to simplify the procedure for the conventional DT replacement process.

2.1 Alignment procedure

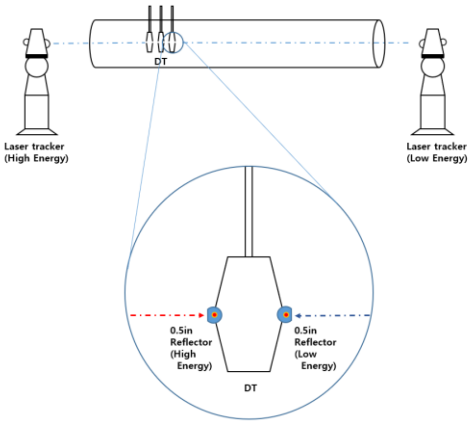

Fig. 1. Setup of laser trackers for DT alignment

The alignment process for DT replacement from DTL tank 21 to DTL tank 107 begins with measuring the center of the installed DT. First, install two laser trackers at both ends of the DTL Tank as shown in Fig. 1. Second, after installing the laser tracker, install the dedicated jig on the DT as shown in the Fig. 2. Third, When the jig installation is completed, data for DT center measurement and replacement will be measured. [2]. In the existing procedure, several processes are added, such as DTL tank fiducialization and DT position measurement, but this time, only the front and rear DT of the DT to be replaced were measured to determine the location of the DT to be replaced.

Fig. 2. Installation of Jig for measure the center of DT

2.2 Simplified alignment procedure

The existing measurement method using a DT center measurement jig had the disadvantage that it took a long time to set up two laser trackers and install a DT dedicated jig. Also, the DTL tank 21 has a narrower gap between the drift tubes than other DTL tanks, so it is not easy to install the jig.

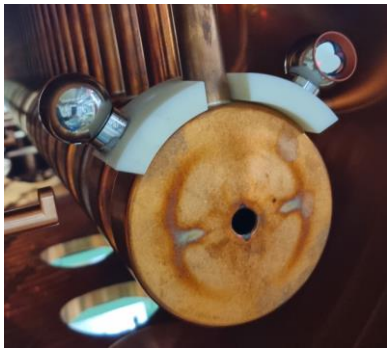

Fig. 3. New type jig to measure DT coordinate

During this maintenance period, a dedicated jig was produced to replace the DTL Tank 21 DT. As shown in Fig. 3, it is a type that is mounted using the stem of DT.

This jig eliminates the need to stand the laser tracker towards the center of the DT. And, there are questions about the consistency of the contact between the jig and the DT surface, but the DT separation and installation is convenient.

3. Results

The alignment results of DT replacement show from Fig. 4 to Fig. 7 comparing to the value before alignment.

The required tolerance for DT alignment is ±50 μm. Displacements before and after alignment were aligned within ±50 μm except for 2 points. (DTL Tank 21 DT no.8, Y value aligned within ±70 μm, DTL Tank 22 DT no.7, X value aligned within ±60 μm). The data in the z-direction was not presented due to the difficulty in representing the data.

3.1 DTL Tank 21 Alignment results

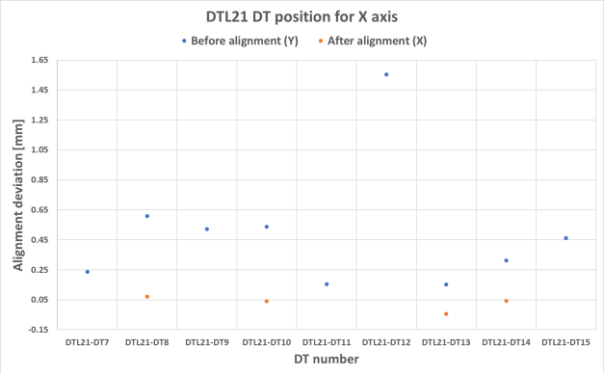

Fig.4. Alignment results of DT position for X - axis

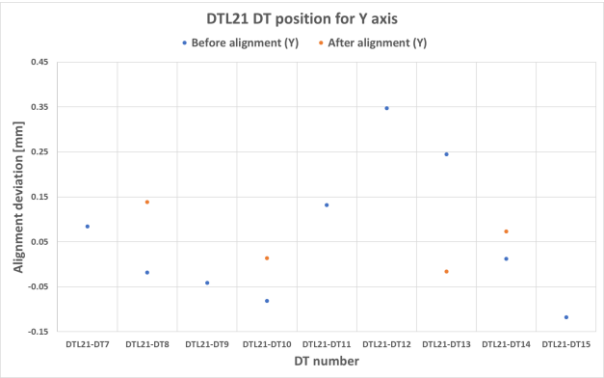

Fig. 5 Alignment results of DT position for Y - axis

3.2 DTL Tank 21 Alignment results

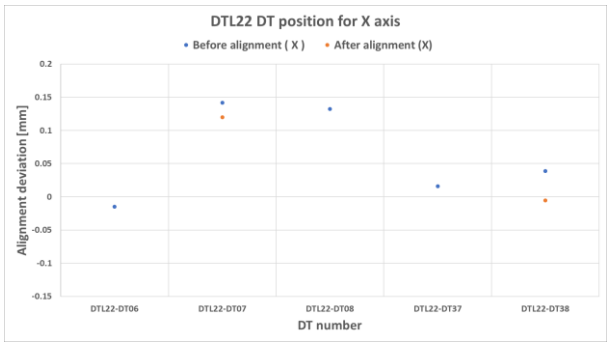

Fig.6. Alignment results of DT position for X - axis

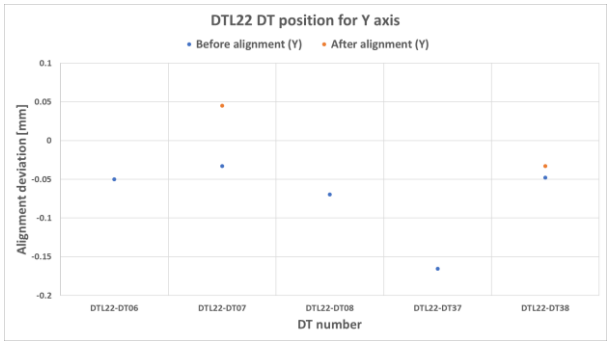

Fig.7. Alignment results of DT position for Y - axis

4. Conclusions

During the winter maintenance period of the accelerator, 6 DTs of DTL Tanks 21 and 22 were replaced. Regarding alignment, they were aligned within ±50 μm except for the two DTs. In addition, the measurement method was changed to simplify the alignment procedure, and a jig for fixing the reflector was devised. Afterwards, it seems necessary to compare it with the existing procedure according to the simplification of the alignment process.

REFERENCES

[1] Yong-Sub Cho, Beam Commissioning of the 100 MeV KOMAC Linac, Proceedings of LINAC2014, Genava, Switzerland, 2014.

[2] Bum-Sik Park, Hyeok-Jung Kwon, Han-Sung Kim, Yong-Sub Cho, “Alignment of Drift Tubes for the 100MeV Proton Linear Accelerator for the PEFP”, Transactions of the Korean Nuclear Society Spring Meeting, Taebaek, Korea, May 26-27, 2011.