Alignment of Drift Tubes for the 100MeV Proton Linear Accelerator for the PEFP

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1. Introduction

A 100-MeV linac developing by PEFP(Proton Engineering Frontier Project) is consisted with an ion source, a low-energy beam transport (LEBT), a 3-MeV radio-frequency quadrupole (RFQ), and a 100-MeV drift tube linac (DTL). There are 4 DTL tanks to accelerate 20-mA proton beams up to 20-MeV and 7 tanks to accelerate from 20MeV [1, 2] to 100MeV [3]. For these accelerators, we finished the installation of the drift tubes(DT). In this paper, results and procedures of DT alignment are described.

2. Alignment

2.1 Tolerance

According to the beam dynamics study, installation tolerances of the DT were determined as listed in table 1. Transverse (Δx , Δy) and longitudinal displacement (Δz) from the design values are described as follow;

Table 1: Installation tolerances for DT alignment

	Δx , Δy	Δz	θ_z
At both ends of DT(Measurement position)	± 0.5mm	± 0.1mm	± 1°
At center of the DT magnet	± 0.05mm	± 0.1mm	

2.2 Alignment procedures

We aligned 85 drift tubes in 4 DTL tanks and 2 MEBT tanks. Two laser trackers (Leica LT600, LTD840) were used to measure the positions. 7 DTL tanks and 2 MEBT tanks are stored in a temporary building before the completion of the accelerator tunnel construction as shown in fig. 1. So, the alignment procedures were conducted in the vinyl house where air conditioner was installed to minimize environmental effects for laser trackers. Additionally, DTL tank wall temperature also controlled by using the line heater as 27±0.5°C.

As shown in fig. 2, two laser trackers were installed at front and end position of DTL tank. The drift tube position can be monitored in real time by using two laser trackers which have the same coordinate system

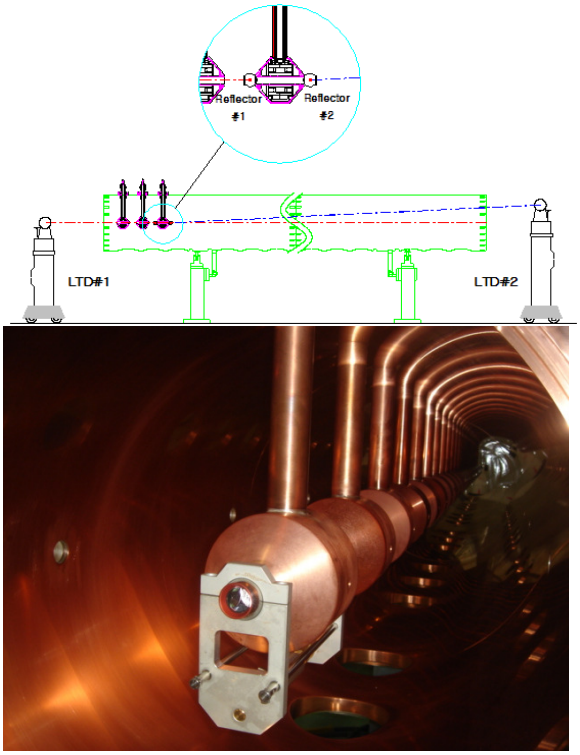

Fig. 2. Drift tube align procedure was accomplished with two laser trackers to real time position measurement.

Fig. 1. Stored linac components and vinyl houses in Kyung-ju site

The drift tubes were fixed on tanks and their position was adjusted with bolts for x, y, z axis directions.

3 Alignment results

The deviations of drift tube's center position were shown in fig. 3 to fig. 7 comparing to the design value. The deviation of the measured values meets the required tolerance. The displacement of transverse (Δx , Δy) is aligned within ±40 ㎛ and longitudinal displacement (Δz) and rotational errors also meet the required tolerance.

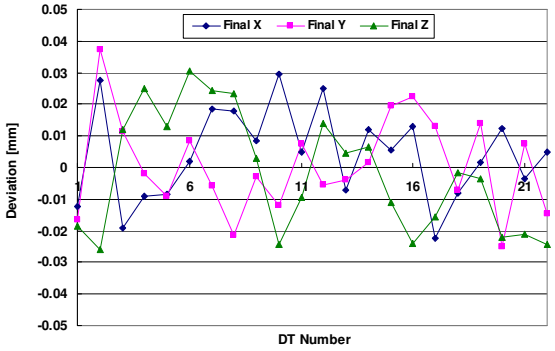

Fig. 3. Installation results of DT's center position for DTL104

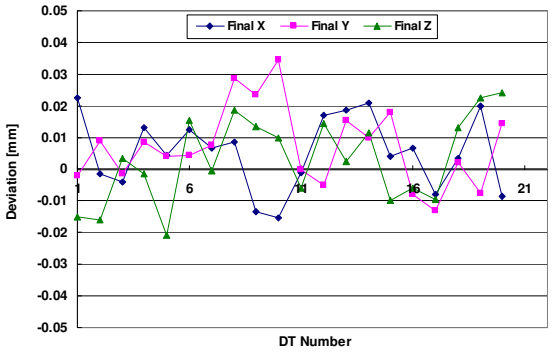

Fig. 4. Installation results of DT's center position for DTL105

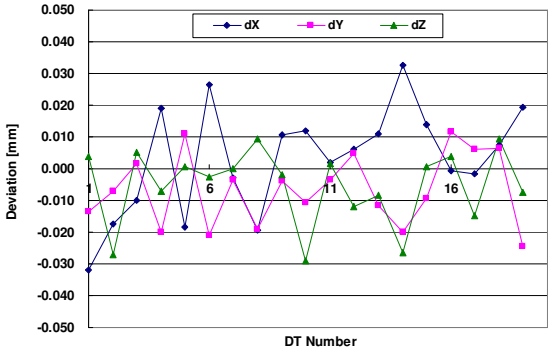

Fig. 5. Installation results of DT's center position for DTL106

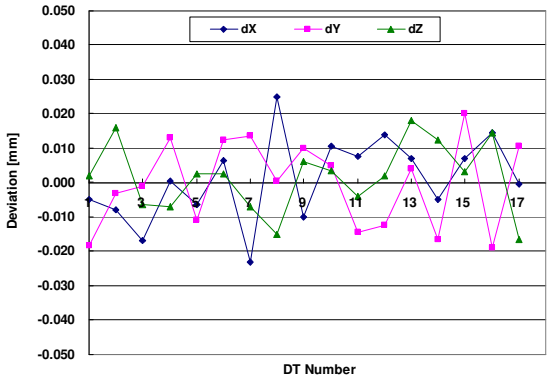

Fig. 6. Installation results of DT's center position for DTL107

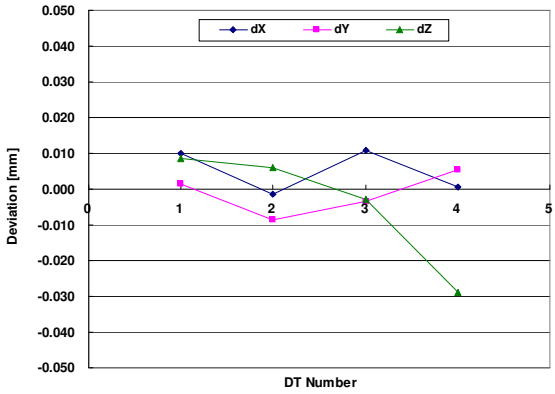

Fig. 7. Installation results of DT's center position for two MEBT tanks

3. Conclusions

27 drift tubes were installed in PEFP's DTL 102. Which were aligned within ±40 ㎛ accuracy which satisfies the requirement of the alignment for the PEFP's DTL. We adopted two laser trackers for monitoring the position of DT in real time. It is most effective method to align DTs and we will align all DTs of 100MeV DTL using this method.

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REFERENCES

[1] M. Y. Park, Y. S. Cho, J. H. Jang, Y. H. Kim, H. J. Kwon, "Fabrication Status of the PEFP 20 MeV DTL", Proceedings of EPAC 2004, Lucerne, Switzerland, p. 1369, 2004.
[2] Y. S. Cho, H. M. Choi, S. H. Jan, I. S. Hong, J. H. Jang, H. S. Kim, K. Y. Kim, Y. H. Kim, H. J. Kwon, "Development of PEFP 20MeV Proton Accelerator", Proceedings of EPAC 2006, Edindurgh, Scotland, p. 1609, 2006.
[3] J. H. Jang, Y. S. Cho, H. J. Kwon, Ky Kim, Y. H. Kim, "Design of the PEFP 100MeV Linac", Proceedings of LINAC 2006, Knoxville, Tennessee USA, p. 130, 2006.