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Partial Alignment for Improvement of Beam Transmission at KOMAC

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1. Introduction

100MeV proton linac placed in KOMAC (Korea Multi-purpose Accelerator Complex) has been operated and provided to beam users [1]. There are two maintenance periods every year, winter (Jan-Feb) and summer (Jul-Aug). In maintenance period, proton linac is re-aligned for the improvement of beam transmission. 4 newly steering magnet are installed in beam line. To align the steering magnet, network align in tunnel is measured using by laser tracker. In addition, the position of ion source is away from the position of RFQ in the result of the survey of network align. The alignment of steering magnet after installation is performed. At the same time, the position of accelerator component is checked and aligned partially. In this paper, its results are presented.

2. Alignment

2.1 Network survey

The coordinate system was setup before the survey using the NIVEL (Leica co.), which can be arranged on direction of gravity. The coordinate system was determined by using two permanent references (A1 and A3, received construction value) and NIVEL [2].

In the survey of align network, the laser tracker was moved in entire tunnel for overlapping at least 5 points between the first and second position of laser tracker. Thermal expansion rate was considered to compensate the positioning to determine the positions for accelerator components [3].

2.2 Partial alignment

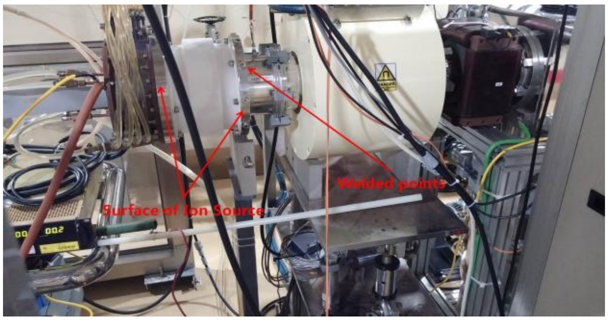

Fig. 1. Picture of ion source in tunnel

The ion source was re-aligned because the position of ion source was away from other components. Center points determined with the ion source surfaces as shown in Fig. 1. The ion source was re-aligned using one center point determined with welded points and turning bolts with ion source and solenoid magnet. After re-alignment, center points were determined again and compared with other components.

2.3 Steering magnet fiducialization

Fig. 2 is the picture of a steering magnet. There are 4 fiducial points in the top side of magnet. The X-axis of magnet was determined by measuring the surface of the flange and calculating the circular fitting. The origin point was calculated bisecting each side center point of the flange surface. The Y-axis was determined using the top side surface of magnet, and the Z-axis was determined automatically.

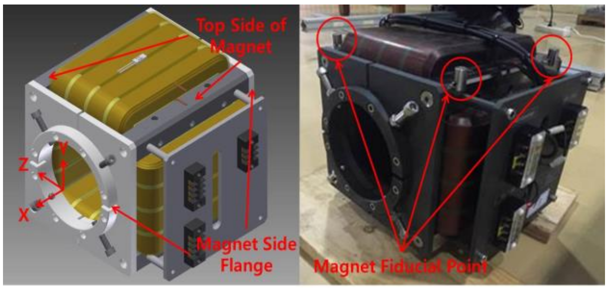

Fig. 2. The coordinate system and fiducial point of magnet

2.4 Alignment of steering magnets

4 steering magnets were installed in beam line, 2 steering magnets in 20MeV beam line, another in 100MeV beam line. The distance between magnets is 780mm in 20MeV beam line, 480mm in 100MeV beam line. As shown in Fig. 3, steering magnets were aligned by using two laser tracker systems under the real time position monitoring condition.

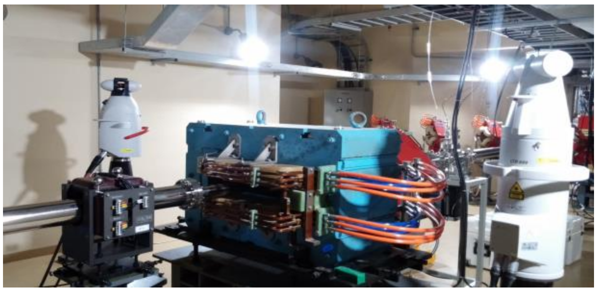

Fig. 3. Align of steering magnet

3. Results

3.1 Re-alignment of ion source

Fiducial points of accelerator parts (DTL, magnet, etc.) were measured for the confirmation of proton linac position. Fig. 4 shows the center displacement of 100MeV linac measured after re-alignment in winter maintenance period this year. The center displacement of ion source was away from others. The ion source was re-aligned, and the center points of ion source were moved near to the center of RFQ, -1.5mm of X direction, +2.7mm of Y direction, for matching the center. The center displacements of RFQ and 20MeV DTL are different compared with the center displacement of 100MeV DTL aligned in August 2014.

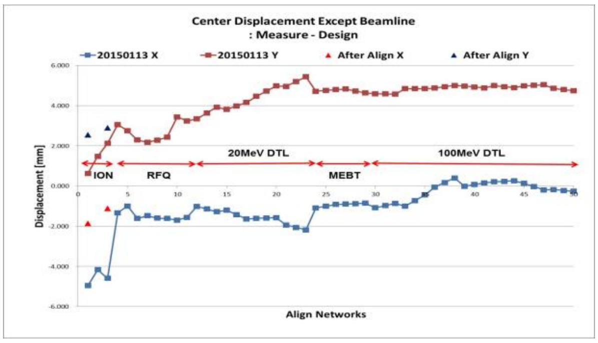

Fig. 4. Center displacement of 100MeV linac

3.2 Steering magnets for beam line

The position of origin point for steering magnet is determined and measured based on the drawing of accelerator tunnel. Steering magnets were aligned using fiducial points on each magnet. It was different between measured points and aligned points because there was an offset distance in beam line magnet fiducial points. Table 1 shows offset distances about magnet fiducial points. Steering magnets were aligned within ±100 ㎛ compared with the reference. In Fig. 5, one magnet in 20MeV beam line was aligned +1.9mm of X direction, because there was limitation about the movement of magnet.

Table 1: Offset distance about the initial fiducial point

Beam line	Offset distance		
	X	Y	Z
20MeV	-1mm	+5mm	-1.5mm
100MeV	0mm	+5mm	-2mm

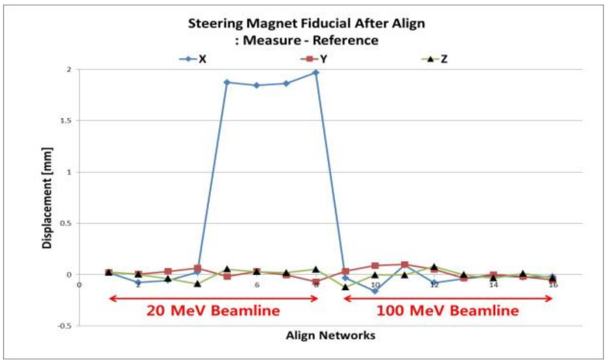

Fig. 5. Measurement of steering magnet position

4. Conclusions

The ion source and steering magnets were aligned for improving the beam transmission. It is expected that the re-alignment of accelerator components can reduce the beam loss which can occur for the dislocation among them. The center displacements of RFQ and 20MeV DTL are different to 100MeV DTL, so it is necessary to re-align in next maintenance period.

Acknowledgment

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REFERENCES

[1] Kyung-Tae Seol, et al., “Initial Operation Results of the KOMAC 100MeV Proton Linac” Transactions of the Korean Nuclear Society Spring Meeting, Jeju, Korea, 2014

[2] Bum-Sik Park, et al., “Installation and Operation of the Beamlines for the 100-MeV Proton Linac” the proceedings of IPAC2013, Shanghai, China, p. 3378 (2013)

[3] Dae-Il Kim, et al., “Displacement Analysis of Building Movement by using the Survey of Align Network at KOMAC” Transactions of the Korean nuclear Society Autumn Meeting, Pyeongchang, Korea, 2014