Alignment of Magnets for RI Production Beam Line at KOMAC

Dong-Hyuk Seo*, Dae-Il Kim, Tae-Sung Ahn, Han-Sung Kim, Hyeok-Jung Kwon, Yong-Sub Cho
KOMAC, KAERI, Gyeongju 226-1, Korea
**seodh@kaeri.re.kr*

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). 6 magnets (4 quadrupole, 2 dipole) are installed in 100MeV for RI production beam line in maintenance period. The fiducialization of magnet is measured for alignment. The alignment is performed using the fiducial points moved from permanent reference based on the layout. To align magnets, network align in tunnel is measured using by laser tracker. In this paper, the result of alignment after installation is presented.

2. Alignment

2.1 Layout

Fig. 1 is the picture of layout for magnets of RI production beam line. 4 quadrupole and 2 dipole magnets are installed in 100MeV beam line. The proton beam is curved 90° using two dipole magnets. 5 magnets placed in 20MeV and 100MeV beam line (4 quadrupole and 1 dipole) were moved and re-installed, and another dipole magnet was made newly.

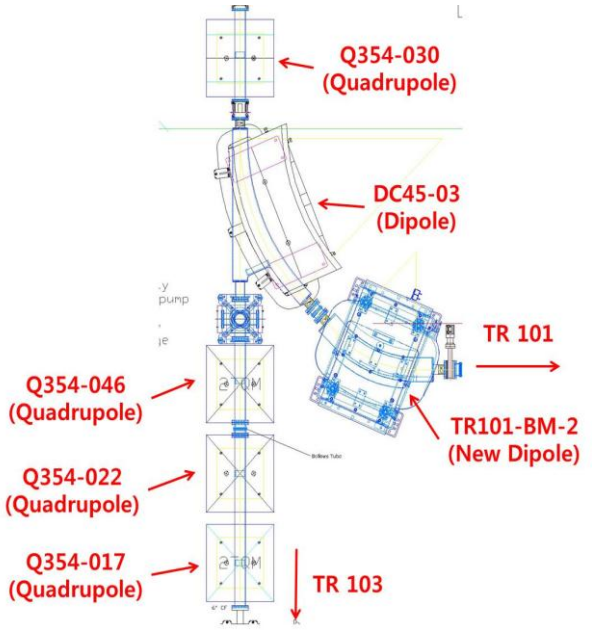

Fig. 1. Layout of magnets for RI production beam line

2.2 Fiducialization of new dipole magnet

The fiducializations of magnets were performed except new dipole magnet previously [2]. Fig. is the picture of a new dipole magnet. Each 4 points of 4 planes (top, bottom, each side) was measured for calculating 6 planes of magnet. 4 lines were calculated using 4 planes except top and bottom. 8 points were calculated intersecting top, bottom and 4 lines. Center points of each side were calculated with 2 diagonal points of each side, the origin point was calculated bisecting two center points of each side.

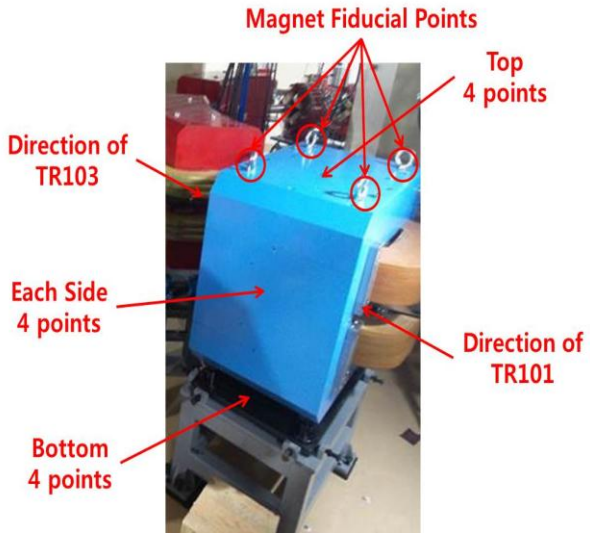

Fig. 2. Fiducial points of new dipole magnet

2.3 Network survey and alignment of magnets

The survey of align network was performed with laser tracker. Before the survey, the coordinate system was determined by using two permanent references (A1, A3) and NIVEL (Leica co.) [3].

As shown in Fig. 3, the position of magnet was marked by using two laser tracker systems under the real time position monitoring condition. The location of fiducial point for reference was measured using the layout. The alignment was performed with two laser tracker systems under the real time position monitoring condition based on the reference point. Fig. 4 is the picture of magnets after installation and alignment.

Fig. 2. Marking the position of magnets

Fig. 3. Installation and alignment of magnets

3. Results

3.1 Measurement of DTL tank fiducial points

Fiducial points of accelerator parts (DTL, magnet, etc.) were measured for the confirmation of proton linac position. Fig. 4 shows DTL tank fiducial points position of 100MeV linac measured after network. The tendency of DTL tank fiducial points in 2015 was similar to in 2014. Magnets of RI beam line were aligned with offset distance, -5.9 mm of X direction and +3.8 mm of Y direction, for matching the position of 100MeV DTL. The offset distance of 2 dipole magnets was added, -7.6 mm of X direction, which was the offset distance of beam line hole of TR101.

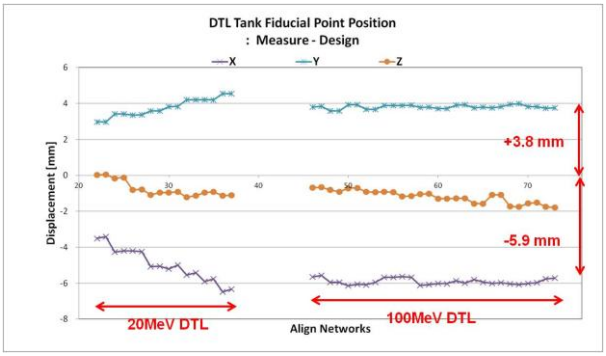

Fig. 4. DTL tank fiducial points position of 100MeV linac

3.2 Alignment of Magnets for RI Production beam line

Magnets were aligned using fiducial points on each magnet based on reference points. It was different between measured points and aligned points because there was an offset distance in magnet fiducial points. Magnets were aligned within ±150 ㎛ compared with reference points as shown in Fig. 5.

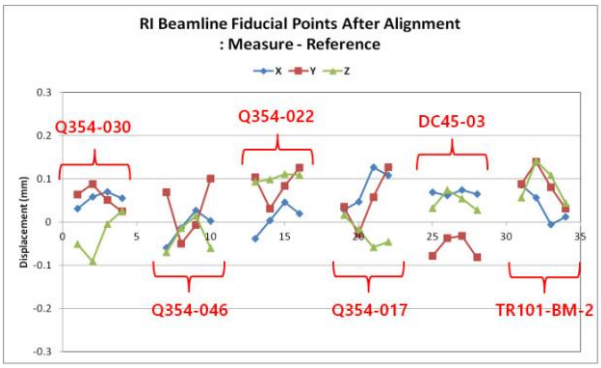

Fig. 5. Measurement of fiducial points of magnets

4. Conclusions

Magnets for RI production beam line were installed and aligned in 100MeV beam line. After alignment, vacuum pump (scroll, turbo molecular pump) is operated to maintain the vacuum state for RI production beam line. RI production beam line is installed well, and it is expected that RI will be produced after installing all of RI production system.

Acknowledgment

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REFERENCES

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