

## Displacement Analysis of Building Movement by using the Survey of Align Network at KOMAC

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### 1. Introduction

100MeV proton linac has been operated and provided to beam users in KOMAC (Korea Multi-purpose Accelerator Complex). Proton linac is composed of a 50keV proton injector, a 3MeV RFQ, 20MeV DTL tanks, 100MeV DTL tanks, beam dump and beam line for 20MeV and 100MeV [1]. To align the accelerator components, the align networks based on reference point were installed on the wall inside tunnel. The survey works of align networks were accomplished by using the laser tracker [2]. In this paper, the survey of align networks is performed and its results are presented.

### 2. Measurement

#### 2.1 Coordinate System

To setup the coordinate system, the vertical axis (+Y) was setup by the NIVEL (Leica co.) which can be arranged on direction of gravity. The Z axis is determined by using two permanent references to link the construction coordinate system [2].

#### 2.2 Align network

The distance between each align networks in tunnel, the length is 135m, the 5m for -X direction of the right side and 10m for +X direction of the left side on beam direction as shown in the Fig. 1. The total number of the align networks is 42 and is positioned the 1.8m of height. The align network was designed for the 1.5" reflector of the laser tracker (AT900, Leica). This kind of align networks were also installed on the wall of beam-line halls, target rooms, the klystron gallery, the modulator gallery [3].

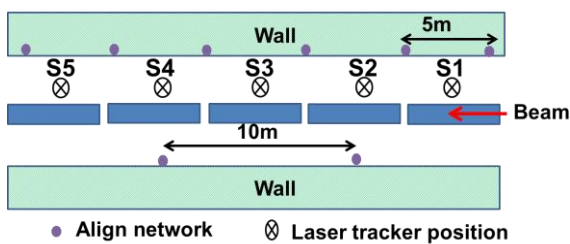


Fig. 1. Layout of align networks in the tunnel.

#### 2.3 Temperature Compensation

Thermal expansion rate, the tendency of matter to change in volume in response to a change in temperature, was considered to compensate the positioning to determine the positions for accelerator components. There is  $1.2 \times 10^{-5}/^{\circ}\text{C}\cdot\text{m}$  for the concrete [2].

#### 2.4 Survey

In the survey of align network, the laser tracker was moved 27 times in entire tunnel. At least 5 points were overlapped between the first and second position of laser tracker for good distribution as calculation process of Axyz program.

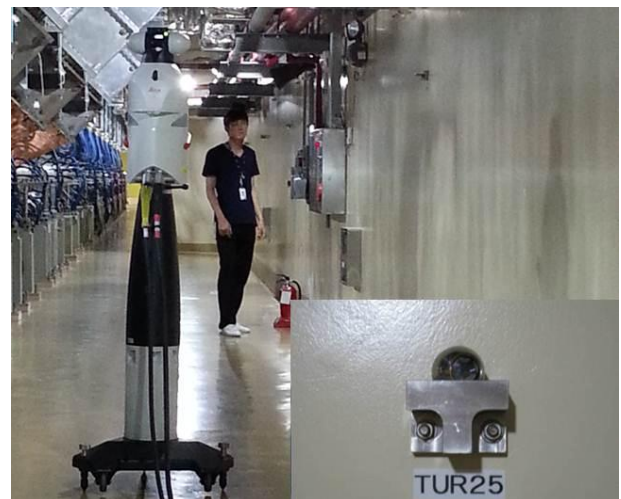


Fig. 2. Survey of align network

### 3. Results

#### 3.1 Displacement of align networks

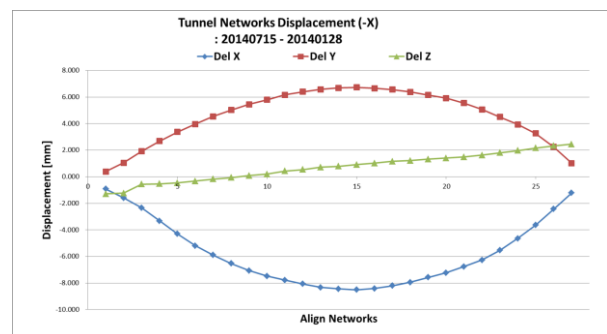


Fig. 3. Align networks displacement of -X direction

Fig. 3 and Fig. 4 show the align networks displacement compared measurements in January and July this year. The displacement of X and Y axis direction are deformed as a bow.

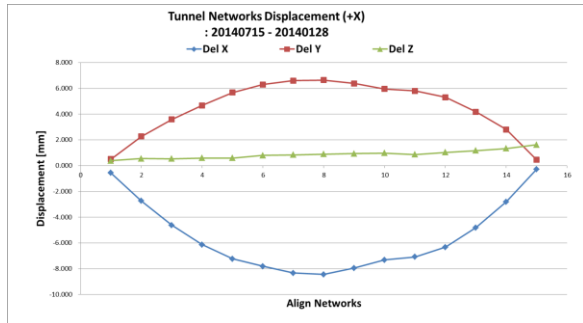


Fig. 4. Align networks displacement of +X direction

In displacement of -X and +X direction, it is similar to the tendency. The maximum displacements of each direction are about -8mm of X direction, about 6mm of Y direction, 2mm of Z direction. Fig. 5 shows the locations of the align networks according to the different measuring time on 100MeV DTL area of the -X side of the tunnel. The locations of align networks show like move in up and down along the time.

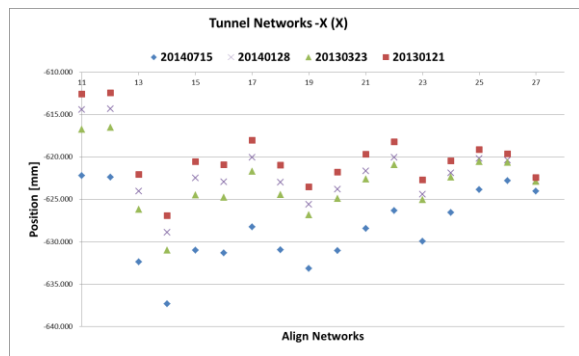


Fig. 5. Positions of align networks

#### 4. Conclusions

In recent survey of align networks, it was monitored to move the locations. The analysis of displacement was confirmed by compare the align networks. This analysis was used to re-align the accelerator components which can be compensated location of reference points. The displacement monitoring should be performed during the long-term period and need to find the other method for real-time, not the survey of align networks.

#### Acknowledgment

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#### REFERENCES

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