

Survey of Alignment Network for Floor by using the Vertical Instrument at KOMAC

Dae-Il Kim ^{a) b) *}, Mun-Ho Jo ^{a)}, Sang-Hun Lee ^{a)},

Yu-Seok Kim ^{b)}

^{a)} Korea Atomic Energy Research Institute, KOREA Multi-purpose Accelerator Complex,
181 Mirae-ro, Geoncheon-eup, Gyeongju-si, Gyeongsangbuk-do 38180

^{b)} Division of Nuclear & Energy System Engineering, Dongguk University,
123 Dongdae-ro, Gyeongju-si, Gyeongsangbuk-do 38066

1. Introduction

100-MeV proton linear accelerator at KOMAC (KOREA Multi-purpose Accelerator Complex) has been operating since 2013[1]. The alignment of the accelerator device uses a laser tracker. Because it utilized a laser tracker, the accelerator tunnel is equipped with a fixing holder for the 1.5" reflector for the laser tracker called the alignment network (AN). After the ANs survey, the deformation of the network position and the alignment state of the accelerator is confirmed by comparing it with the accumulated records [2][3]. In this paper, the contents and results of height measurement of floor networks using a laser tracker and digital level are reported.

2. Methods

In the course of the ANs survey, it was found that the measured values in the vertical direction were different from those of the HLS (Hydrostatic Leveling System) [4]. In order to improve this difference, the ANs were additionally installed during the ANs survey process, and the result of the ANs survey using the laser tracker was compared with the height result measured with a laser level to check the reliability of the measurement of the laser tracker.

2.1 Alignment Networks Survey

The ANs survey is carried out by repeating the process of measuring and moving the ANs installed on the wall of the accelerator tunnel using a laser tracker [2].

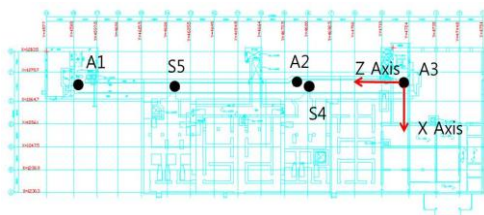


Fig. 1. Coordinate system of the accelerator tunnel

2.2 Adding Alignment Networks

In order to reduce the error in the results of the tunnel ANs survey by using the laser tracker, the ANs were additionally installed on the floor and wall. In the entire area of the accelerator tunnel, 85 additional units were installed for floors and 56 units for walls. The reflector mount used as the floor and wall of ANs was selected from a commercial product (Brunson, USA) that has reliability in close contact with the 1.5" reflector. Fig. 2 shows the arrangement of the floor and wall ANs.



Fig. 2. Reflector mount for the floor(left) and the wall(right)

The process of the ANs survey was carried out including the additionally installed the ANs. In the movement of the laser tracker, the number of overlapping ANs has more than doubled. Fig. 3 shows the results of the SA program of the ANs survey including additional ANs.

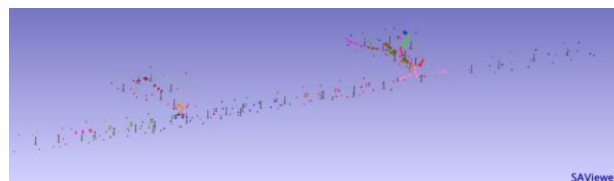


Fig. 3. ANs survey in accelerator tunnel

2.3 Height of the Alignment Network for the Floor

To verify the comparison with the floor ANs measured using a laser tracker, the height of the floor ANs was measured using a digital level (LS-15, Leica). As a measurement characteristic of the digital level, it was measured only in the linear accelerator section except for the complicated accelerator such as beam line section. For height measurement, a 1.5" reflector was placed on the AN for the floor and the measuring leveling bar of the digital level was fixed on top. Fig. 4 shows how to measure the height using a digital level. The left is a picture of measuring the height of the reference measuring leveling bar, and the right is a picture of fixing the measuring leveling bar of the digital level with a 1.5" reflector on an AN for floor.



Fig. 4. Measuring the height of the ANs for the floor using a digital level

3. Results

Fig. 5 shows the height of the ANs for the floor measured using a laser tracker and a digital level. Each measurement represents the height difference relative to the first AN(TB1). Overall, the trends of the two results are the same. The rise and fall of the height according to the position of the floor have the same tendency.

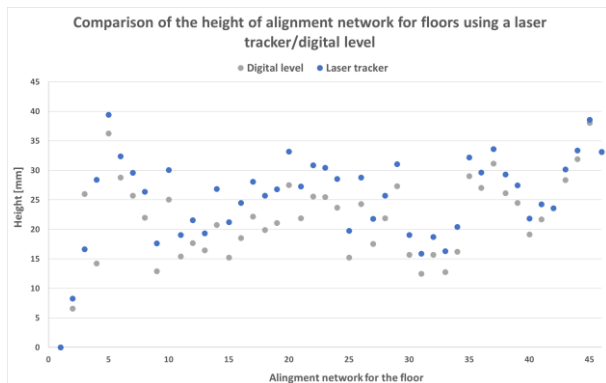


Fig. 5. Comparison of the height of ANs for floor using a laser tracker and a digital level

4. Conclusions

To check the alignment of the accelerator, a process called ANs survey is performed using a laser tracker. The results confirmed the difference with the HLS trend monitoring real-time tunnel floor height. In order to reduce the device error for the movement of the laser tracker, ANs were additionally installed on the floor and wall of accelerator tunnel. And ANs survey was performed. The height for the floor ANs was additionally measured using a digital level. The results of both measuring instruments for height showed the same trend. From the current results, it is difficult to quantitatively determine the measurement error of the instrument. From a long-term perspective, it is necessary to quantify and correct the error of the instrument by accumulating data.

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