Field Profile Measurement of the PEFP DTL101 Tank

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1. Introduction

The Proton Engineering Frontier project (PEFP) proton linear accelerator has been developed and will be installed in Gyeongju site [1-2]. The 20MeV accelerator has been operated and the DTL tanks for the 100MeV accelerator have been manufactured in Korea Atomic Energy Research Institute (KAERI) site [3]. The DTL tanks and some components for the 100MeV accelerator were moved to the Gyeongju office after the construction of the provisional office in Gyeongju site. The field profile and resonant frequency of the DTL101 tank were measured and compared to confirm the drift tube (DT) alignment before and after the movement. For the field tuning, the slug tuners and the end-plates with the half DT of the DTL101 were installed and the field profile was measured.

2. DTL Tanks Movement and Measurements

The 100MeV DTL tanks were moved by the vehicles with the air suspension to minimize the vibration during the movement as shown in Figure 1.

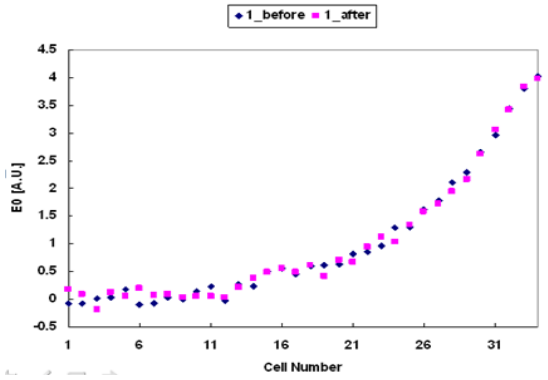
Fig. 1: 100MeV DTL tanks movement

Table 1: Resonant frequency of the DTL101

	Before	After
Ambient Temp. [℃]	~27	~27
Tank wall-Temp. [℃]	27.6	24.8
Humidity [%]	~50%	~50%
Mode011 freq. [MHz]	346.14527	346.20788
Mode012 freq. [MHz]	348.34192	348.36281
Mode013 freq. [MHz]	351.01922	351.03625

The field profile and resonant frequency of the DTL101 tank were measured to confirm the DT alignment before and after the movement. The slug tuners and the post couplers were not installed and the end-plates with the half DT of the DTL102 were installed on the DTL101 tank. Table 1 shows the resonant frequency of the DTL101 before and after the movement. Figure 2 shows the field profile measured in the DTL101 with the end-plate of the DTL102. The field profile of the TM011, TM012 and TM013 were measured and compared, and the field difference was within ±2% at the cells more than normalized field of 0.8.

(a)



(b)

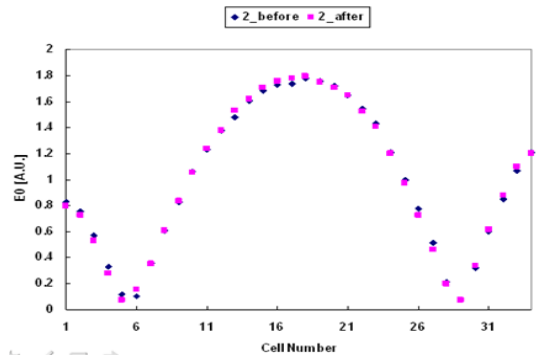


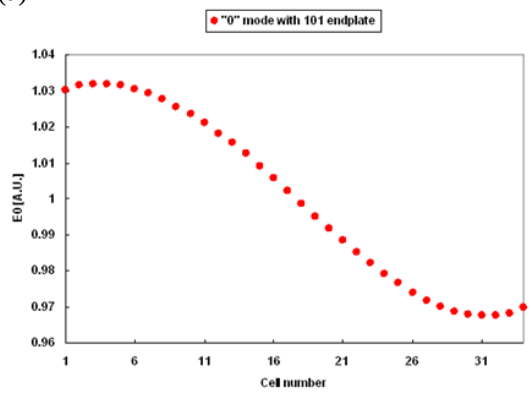
Fig. 2: Field profile of DTL101 with DTL102 end-plates before and after the movement. (a) is TM011, (b) is TM012

3. Field Profile Measurement

The accelerating mode (TM010) was not measured in the DTL101 with the DTL102 end-plates. The field profile of the DTL101 with its own end-plates and the DTL101 with the DTL102 end-plates was calculated by using MDTFISH code and is shown in Figure 3. As shown in Figure 3, the accelerating field of the DTL101

with the DTL102 end-plates was not built at the high energy side, so the field of TM010 was not measured at the pickup position of the high energy side.

(a)



(b)

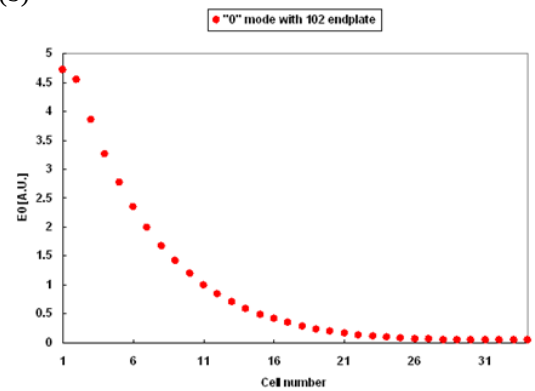


Fig. 3: The calculated TM010 field profile of the DTL101. (a) is with its own end-plates, (b) is with the DTL102 end-plates.

For the field tuning, its own end-plates were manufactured and installed on the DTL101. The movable slug tuners were also installed with the same length. Figure 4 shows the frequency spectrum measured by using the network analyzer (N5071C, Agilent). The accelerating mode of the TM010 was measured and the field profile was also measured several times at the same conditions by using the bead-pull method as shown in Figure 5. The normalized field was within ±4% and the standard deviation was 1.6%.

Fig. 4: Frequency spectrum of the DTL101

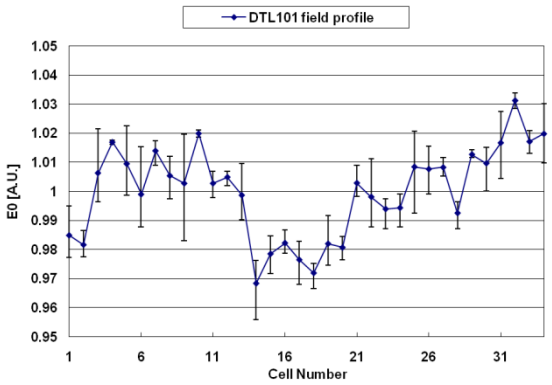


Fig. 5: Initial field profile of the DTL101

4. Summary

The 100MeV DTL tanks were moved to the Gyeonju office and the field profile of the DTL101 with the DTL102 end-plates was measured and compared. The field difference was within ±2% at the cells more than normalized field of 0.8. For the field tuning, its own end-plates were manufactured and installed on the DTL101. The field profile was measured within ±4% at the accelerating mode of the TM010.

The DT position will be measured to confirm the alignment exactly before and after the movement. The field tuning will be performed with the measured field profile.

Acknowledgements

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