Tuning data processing for DTL (Drift tube linac)

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I. Introduction

The 20 MeV DTL for PEFP proton accelerator is now constructing in KAERI site. The frequency tuning of the RF cavity is very important to obtain the required beam quality and also to reduce power loss. We established the measuring system and data processing algorithm for electric field measurement of PEFP DTL. The electric field is measured by using well-known bead perturbation method. Generally the frequency shift by small metal bead is measured but our system is based on the phase shift measure. The details for this system will be reported other paper in this conference [1-4].

Next we established the data processing algorithm of the measured phase shift. We aim at two main results at this work. The first is to shorten the processing time and second is to have the reproducibility for various measurement conditions. We measured the phase shift of J-Parc (Japan proton accelerator research complex) DTL3 using our measuring system.

II. Calculation and Results

The calculation variables from the data are the average electric field Ez, transit time factor, and the distortion parameter, etc. Usually the base line of the phase is varies because of the temperature and humidity differences during the bead test. The procedure of the data processing is as follows.

1. CalibrationoftheTimetoZ-axisdistance
2. CompensationoftheBaseline
3. AveragedEzcalculationfromthephaseshift
4. Eo calculation of the field by the average averaged field

First, we found the centers of the 1st and last gap to get the calibration factor. Then we transformed the time to tank length using this factor. The base line compensation is very important due to the contribution to the total integration area is high about the 10% of the final Eo profile. In figure 1, the simple diagram foe base line fitting is represented. The key issue for the fitting is the determining the increasing and decreasing points. To get the fitting point we simulated using the Superfish code for 3 different cells. The result of the simulation is shown in figure 2.

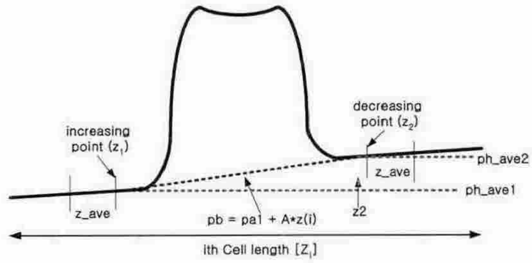

Figure 1 . The schematics for the base line fitting

Using these results, we determined the increasing/decreasing points (z1, z2) to 10 % of the cell length, and the 5% from the z1/z2 to the averaging calculation. From these results, we compensated of the phase value to the base line. Next we calculated the Ez by integrating from z1 to z2 and found the Eo for each cell. The calculated result is shown in figure 3. The difference to the J-Parc result is +- 2 %, and this is within the measurement error. We confirmed the measurement and the calculation scheme, and now we are coding data processing program using Visual Basic.

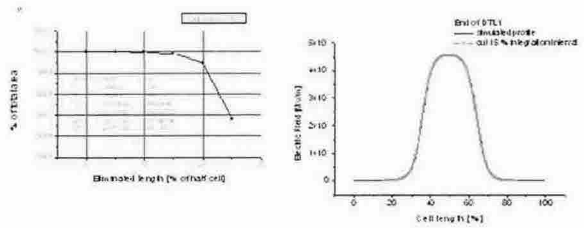

Figure 2. (a) The simulation result and (b) the contribution to the integration as the elimination of the cell length

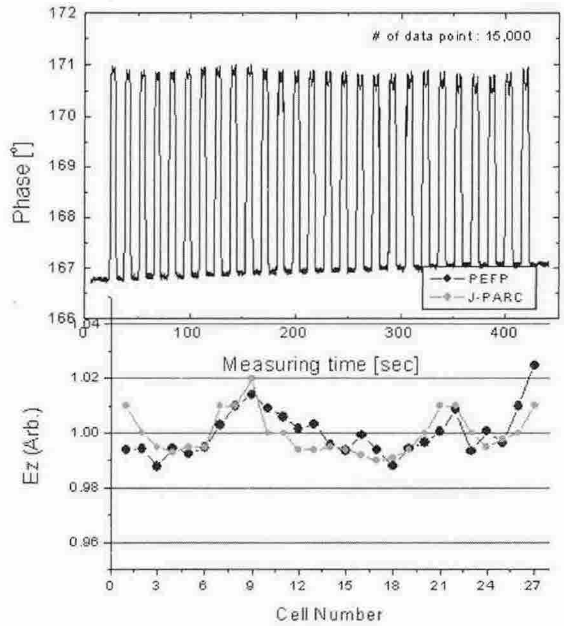

Figure 3. (a) Law data of the measurement and (b) the calculation result comparing the J-Parc result.

III. Acknowledgement

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We thank to the J-Parc DTL tuning team for cooperation of the measurement.

IV. References

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