Fast dosimetry
and analysis
of dynamic fields

Fast LA48 / ME48F

Linear Array for Fast Profile Measurements in 10 ms Intervals

Introduction

The LA48 option for PTW water phantoms is well-known and well-established all over the world. This option comprises the following components:

- LA48 linear ionization chamber array of 47 ionization chambers
- ME48 preamplifier
- MULTIDOS electrometer
- MEPHYSTO software module.

In this configuration the MEPHYSTO software is able to display a complete beam profile on the computer screen approximately every second.

To respond the request for fast measurements, for instance to investigate the start-up behaviour of a LINAC a fast version of the ME48 preamplifier, the ME48F fast preamplifier has been developed.

The ME 48F System

The central quality of the preamplifier ME48F is the very low time constant. This enables to correctly follow very fast input signals. The measuring time for all 47 signals is 2 ms, to be followed by a 8 ms processing time interval. Thus, profiles can be measured every 10 ms (or up to 100 profiles/s) while keeping the measuring time itself as short as 2 ms. As an accessory, an interface and power supply is required. Both devices, the ME48F fast preamplifier and the power supply are located in the treatment room in the vicinity of the LA48 linear array. With a cable of 25 m length this measuring equipment is connected to a special data acquisition board (DAB) in the PC. A special software package allows the measurement of up to 100 profiles per second as well as the storage of the profiles in a MEPHYSTO export file. MEPHYSTO can import up to 250 profiles at the same time for further evaluation.

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Results

Figures 1 to 4 depict measuring results on a Siemens MD2 accelerator. Figure 1 shows the dose rate as a function of time and profile coordinate.

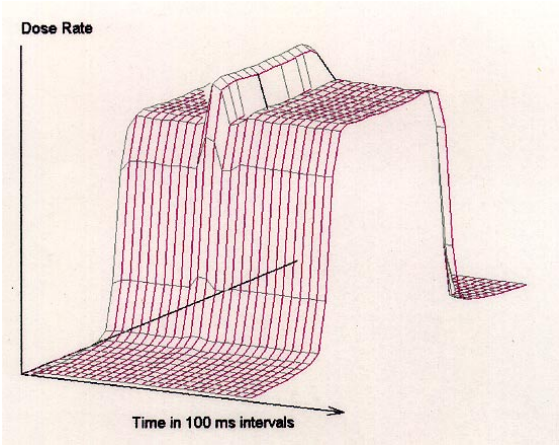

Figure 1: *Start-up behaviour for 6 MV photons. Measuring time was 2 ms for every profile of 47 points.*

100 profiles per second have been measured, figure 1 shows only every tenth measured profile.

It can be seen from figure 1 that for the first second the accelerator runs with default parameters, the final dose rate is attained after the control circuits have been activated, resulting in a temporary dose rate overshoot.

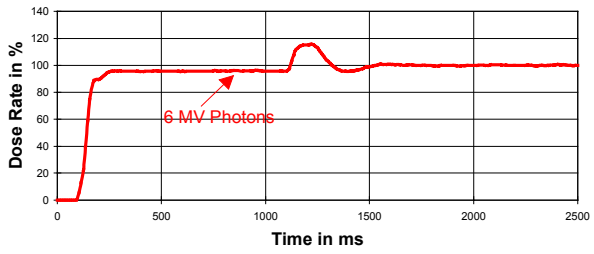

Figure 2: *Time dependence of the central detector signal for 6 MV photons.*

Figure 2 shows the signal of the central ionization chamber versus time.

Figure 3 shows the start-up behaviour for 14 MeV electrons. Note that the axes have been swapped compared with figure 1.

The time dependence of the central detector signal is shown in figure 4 for both 14 MeV and 8 MeV electrons.

It can be seen that the start-up behaviour of the same LINAC depends on the nominal electron energy.

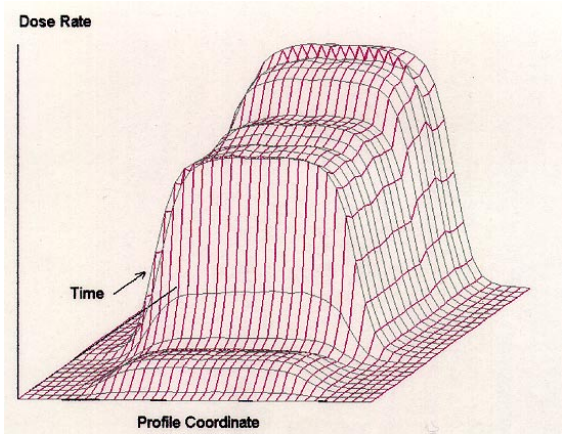

Figure 3: *Start-up behaviour for 14 MeV electrons. Compared to Figure 2, the time and coordinate axes are swapped.*

Due to the growing importance of conformal radiation therapy the start-up behaviour of a LINAC is becoming more and more important.

It should be noted, however, that the start-up behaviour of the beam presented in figures 1 to 4 is different from the "beam on" behaviour of the beam during subsequent treatment intervals in conformal therapy.

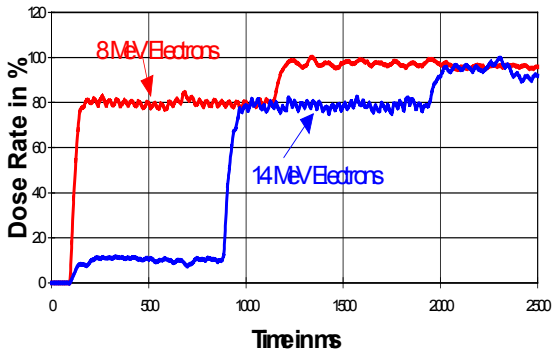

Figure 4: *Time dependence of the central detector signal for 8 MeV and 14 MeV electrons.*

While according measurements are not available at the time being, they could easily be made using the above described system

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