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MEMORANDUM: April 17, 1978

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TO: Al Smith

FROM: Chaim Richman

SUBJECT: Timing of the High LET Dose with the Range Shifter Cycle

I am glad that you have asked me about this experiment because it represents an interesting new way of doing high LET dosimetry. Let me say, however, that it was not my intention of doing this with patients. I want to work it out further in a phantom, and if all goes well, I will recommend that it be used with patients.

This study began in the following way: a few people, including Chuck Kelsey, had asked me what the origin was of the small but reproducible peaks in the high LET dose distribution in depth for beam 8L (now known as RS8D23). I decided to study this question and it became readily apparent that the peaks were produced at the positions where the range shifter stopped in its motion in that cycle. In other words, the range shifter gives stars at each depth when the total range is 18 gm/cm^2 (for this tune).

If that is the case, then a time profile of high LET dose for a fixed position of the detector in the phantom would yield no high LET counts until the range shifter fluid plus the phantom material gave a total mass of 18 gm/cm^2 water equivalent. After passing this point in time there should be no counts until the next time that the range shifter passed through this point either in that cycle or in subsequent cycles.

This is the experiment that we did at the end of the last running period. And it turned out as we expected. Fig 1 shows the high LET counts as a function of time. The detector was 7.6 μm in thickness and was 14.8 gm/cm^2 in the phantom. No counts were observed until the range shifter reached its bottom position of 3.1 gm/cm^2, making a total of 17.9 gm/cm^2. Counts were observed for the time spent in that position and then no counts were observed until the next cycle and so on in subsequent cycles. The experiment was repeated for five different positions of the detector with similar results (mutatis mutandis).

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It turns out that the experimental arrangement is easy enough. The pulse height analyzer is operated in the multichannel scaling mode, wherein it stores the high LET counts in successive channels as a function of time.

The significance of this experiment is that it enables us to check the amount of tissue in front of a high LET detector in a patient during treatment by measuring the time at which counts are obtained and correlating this with the amount of the fluid in the range shifter at that time.

It is well known that the data from CAT scans involves certain approximations for pions since it is obtained from measurements with X-rays. Therefore a check on the amount of tissue present with the radiation being used in treatment is worthwhile.

This method of timing the high LET dose can probably also be used with any motions of the treatment table to check some of the parameters of dynamic scanning.

CR:br
Attachment

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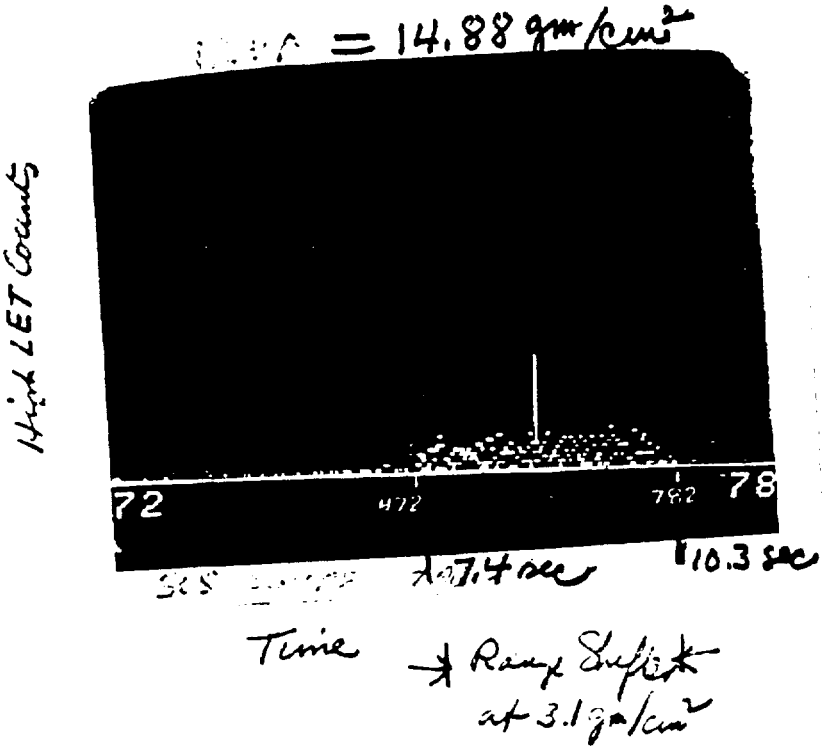

Fig. 1

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