DETERMINING PROFILE OF DOSE DISTRIBUTION FOR PD-103 BRACHYTHERAPY SOURCE

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1. INTRODUCTION

Palladium radioisotope is LDR (Low radiation Dose Rate) source. Main radioactive material was coated with titanium cylinder with 3mm length, 0.25mm radius. There are two parts of Pd-103 in the titanium cylinder. It is impossible to investigate differential effects come from two part as experimental. Because, the source dimensions are small comparatively measurement distances. So there is only simulation method. In dosimetric studies it is aimed to determine absorbed dose distribution in tissue as radial and angular.

In nuclear physics it is obligation to use computer based methods for researchers. Radiation studies have hazards for scientist and people interacted with radiation. When hazard exceed over recommended limits or physical conditions are not suitable (long work time, non economical experiments, inadequate sensitivity of materials etc.) it is unavoidable to simulate works and experiments before practices of scientific methods in life. In medical area, usage of radiation is required computational work for cancer treatments. Some computational studies are routine in clinics and other studies have scientific development purposes.

In design of a new brachytherapy source it is important to consider detailed contributions from all source components. In experiments it is impossible to determine inner factors of source rather than inadequate conditions.

In Pd-103 sample we obtained differential parameters. Using this data it will be easier to concept new source models. Separate calculations are agreed with accepted literature values acquired from massive calculations. In tissue dose distribution can be shaped more sensitive with this method. To do just computer simulation is available.

There are massive sources (I-125, Ir-192, etc.). Same process should be done by cutting the source into many radioactive parts in virtual experiments. This is the novel approach for sensitive database to use it in practical clinical treatments.

2. MATERIAL AND METHOD

In the capsule there are two radioactive partitions. Therefore total dose includes two contributions. Dose profile will be different comparatively massive (or single) source. Separate doses will be affect dose distribution around the source. Dose can be written as:

$D_{Total} = D_1 + D_2$, as generalized $D_{Total} = \Sigma D_i$

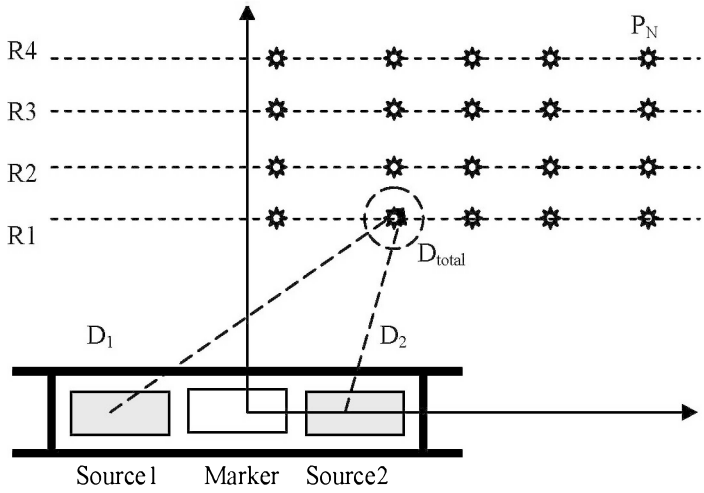


Figure 1. Dose points along Z axis of capsule on R levels (distances)

Doses were calculated using Monte Carlo method so the data of dose distribution is relative. This values are used in fraction so real dose is not needed. In Monte Carlo code dos is calculated in unit Gray/foton (generaly; Gray/particle). So the important parameters are dosimetric characteristics and dose distribution profile.

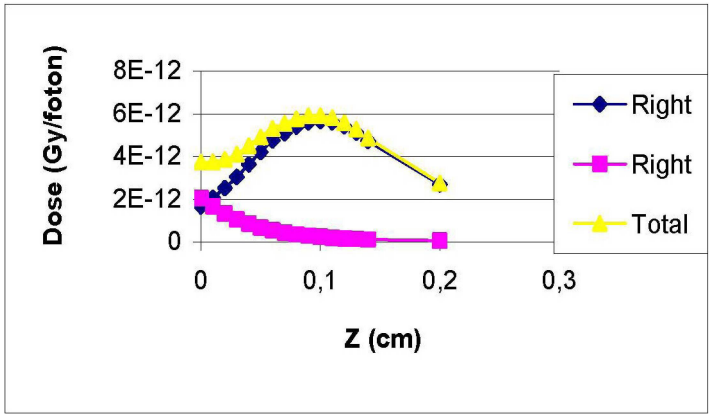


Figure 2. At R=0.1cm dose distribution along capsule

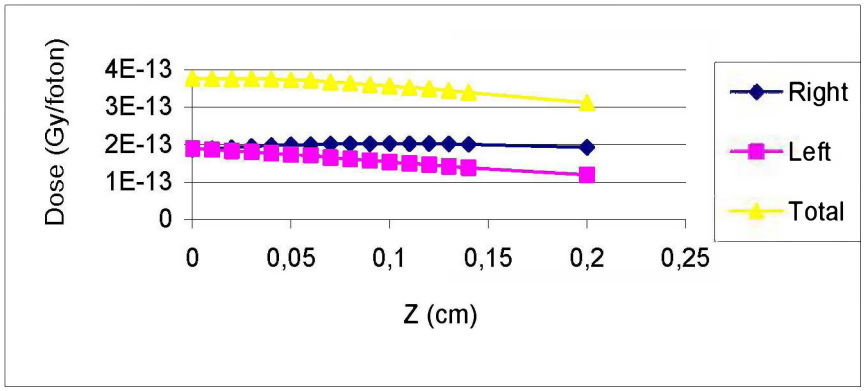


Figure 3. At R=0.5cm dose distribution along capsule

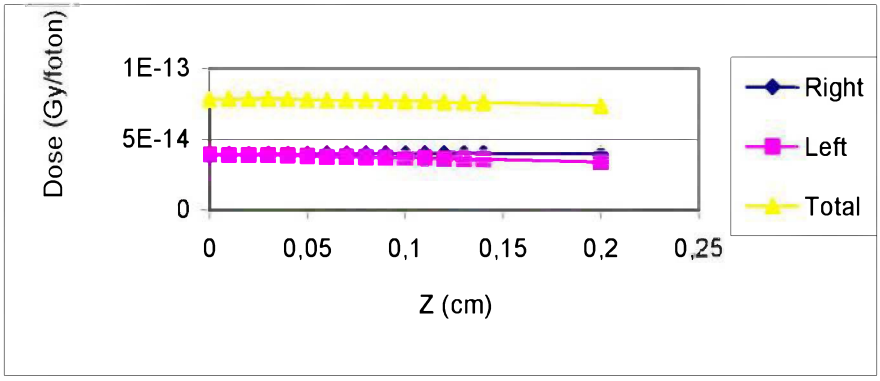


Figure 4. At R=1cm dose distribution along capsule

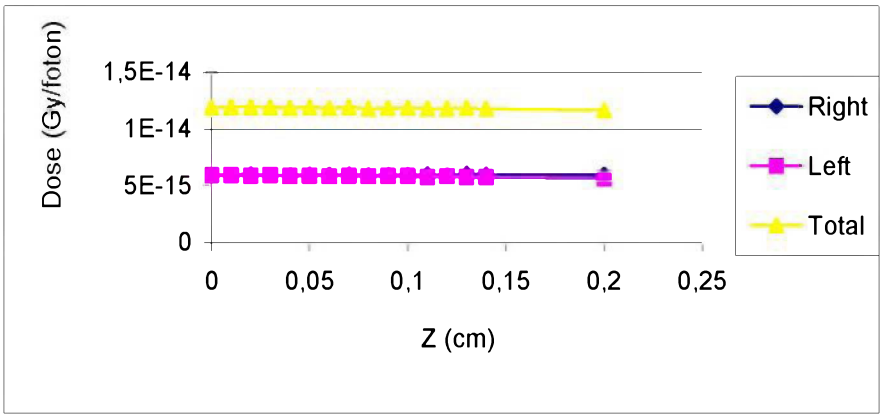


Figure 5. At R=2cm dose distribution along capsule

Calculations were performed for R= 0.1, 0.5, 1, 2cm on [0, z]. At R distance larger than 1cm, dos distribution shape is seems independent on seperate source effect. This graphics are symmetric because of the complate source is symmetrik around R and Z axis in cylindrical coordinates. Reslts are symmetrik on [0, -z]

3. CONCLUSION

Along capsule length on Ri lines dose distribution shape is different for small R (0.1 – 0.5cm) unlike normal distances [1cm - R]. It is important to determine dose in smal distances. Because dose shows rapid changes in this interval. Seperation of two source is responsible of the dose profile directly. This is effective in small radial region. At larger distance the effect cannot be seem. It is momentous designing of LDR sources for smal distance. Cancerous tissues will be mostly irradiated in this regions.

4. REFERENCES

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