FARMER CHAMBER RESPONSE TO DIFFERENT FILTER BOX AND SURROUNDING CONFIGURATIONS

- ARE BEING PERFORMED THE TID TESTS PROPERLY? -

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ABSTRACT

The use of a **filter box for TID test** is a recommendation present in the most relevant test method standards. However, the absence of specific details can produce **discrepancies** between different radiation facilities and **dosimetry** procedures.

INTRODUCTION

TEST EQUIPMENT

TEST SETUP

EXPERIMENTAL RESULTS

The following spheres represent the dose rate change respect to the reference value in function of the faces of the filter box (orange), the cover of the filter box (yellow), and the boundary conditions (green). The volume of the spheres is directly proportional to the absolute value of the relative dose rate, and the bright halo indicates a negative value.

When B=B2, F3 is closer to F4 (reference) than F1 and F2, probably because the main contribution of low-energy photons comes from the wall. When B=B3, the difference between using C4 or C1-C3 is especially high, but it seems that the type of faces has no influence. The maximum absolute dose rate change is 3.3%, and 80% is below 2%.

The different dose rates measured at B1-B4 with different C-F parameters bear no relation per se because B1-B4 correspond to different SDD, but it can be observed that the type of cover and the type of faces affect all boundary conditions equally (at this facility).

When B=B4, the influence of the type of cover is especially emphasized; C2 cover gives the value nearest to reference. However, when B=B1 or B2, the influence of the type of cover and even the type of faces is not so significant, as expected, probably because the low-energy photons contribution is very low.

TEST PARAMETERS

FILTER BOX COVER

- C1:** open
- C2:** 2mm Al
- C3:** 5mm PMMA
- C4:** 2mm Al + 1.5mm Pb

FILTER BOX FACES

- F1:** open 5 sides
- F2:** Al 5 sides
- F3:** Al+Pb back side
- F4:** Al+Pb 5 sides

BOUNDARY CONDITION

- B1:** surrounded by free space
- B2:** 20cm before concrete wall
- B3:** just before 83mm Pb
- B4:** just after 16mm Pb

REFERENCES

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- [3] Ionizing Radiation (Total Dose) Test Procedure, MIL-STD-883 TM 1019 Test Method Standard for Microcircuits, DLA.
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CONCLUSIONS AND FURTHER WORK

- ❑ Dose enhancement effects depend strongly of the boundary conditions and the used filter box.
- ❑ This work reveal the needed of including different facilities (source configuration, layout, geometries, etc.) and other dosimetry systems to analyse the influence of these parameters.
- ❑ This qualitative analysis leads us to conclude that the generic recommendation of the test methods about the ideal filter box could be improved, considering important parameters of the radiation facilities.
- ❑ A deeper dose enhancement factor study is mandatory to understand the physics behind and incorporate practical recommendations in the applicable TID test methods.
- ❑ Currently, CNA¹, ATN², ESA (European Space Agency), UML (University of Massachusetts Lowell) and PTW are planning a collaborating and ambitious project to carry out a more complete study about this matter.