

# Peripheral neutron dose model verification for real IMRT cases

Irazola L<sup>1,2</sup>, Terrón JA<sup>2,1</sup>, Sánchez-Nieto B<sup>3</sup>, Romero-Expósito M<sup>4</sup> and Sánchez-Doblado F<sup>1,2</sup>

<sup>1</sup>Departamento de Fisiología Médica y Biofísica, Universidad de Sevilla, Spain

<sup>2</sup>Servicio de Radiofísica, Hospital Universitario Virgen Macarena, Sevilla, Spain

<sup>3</sup>Instituto de Física, Pontificia Universidad Católica de Chile, Santiago, Chile

<sup>4</sup>Departamento de Física, Universitat Autònoma de Barcelona, Spain



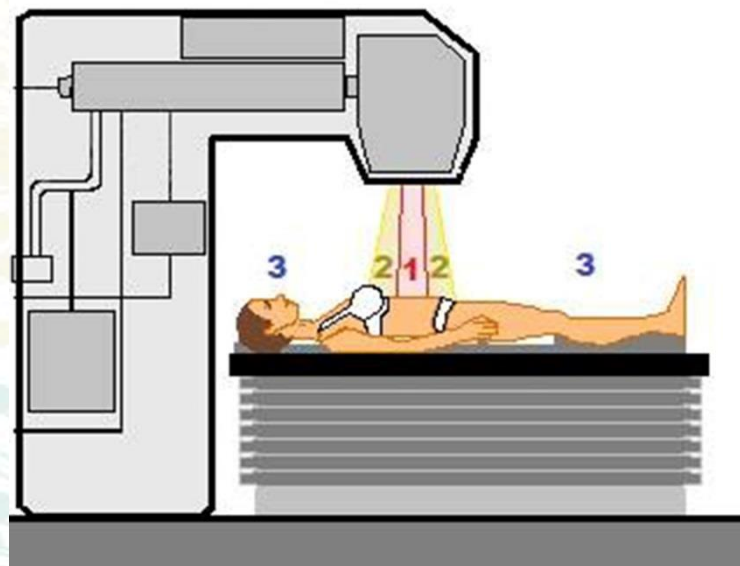
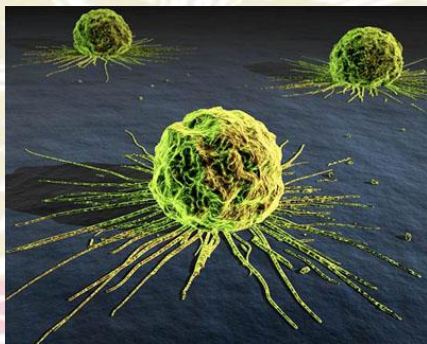
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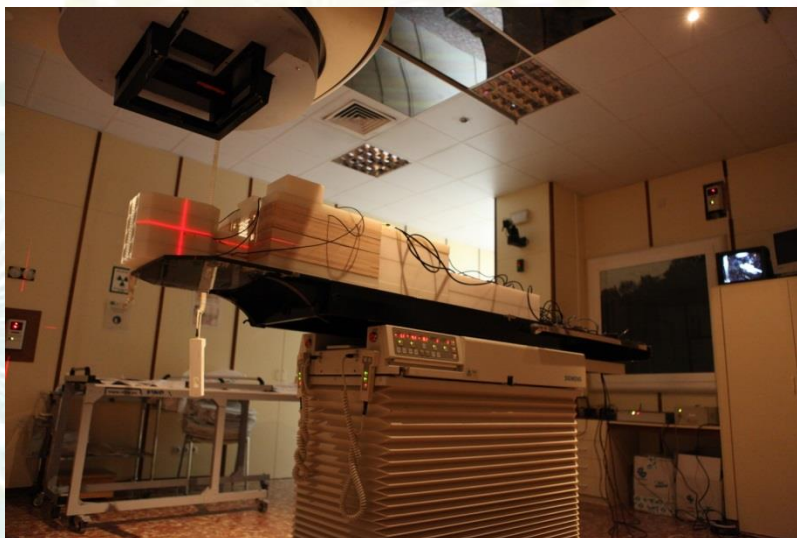


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## *Introduction:*

Peripheral doses (region 3) are directly related to second cancer risk after radiotherapy.





Our group developed a methodology to estimate neutron contribution to peripheral organ doses by terms of two general models, namely **abdomen** and **head and neck** [1].

[1] Phys Med Biol 2012;57:6167–6191.

## *Purpose:*

This work aims to verify the validity of the generic models in real treatments, in order to evaluate the need of further improvements for specific locations.



## *Material and Methods:*

Neutron doses were calculated in 12 representative organs from measured thermal neutron fluences with TNRD detectors at 16 points inside the phantom (Figure a) [2],

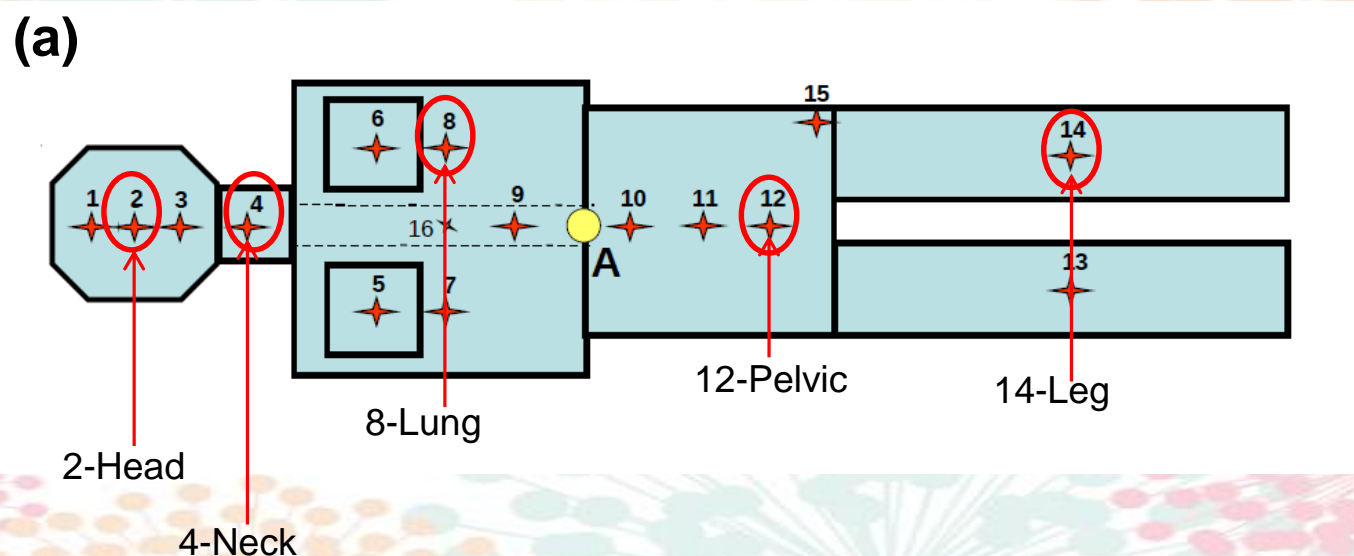


Figure (a) Anthropomorphic phantom in the treatment couch

## *Material and Methods:*

Two high energy (15 MV) treatments (lung and prostate, Figures b-c) have been considered.

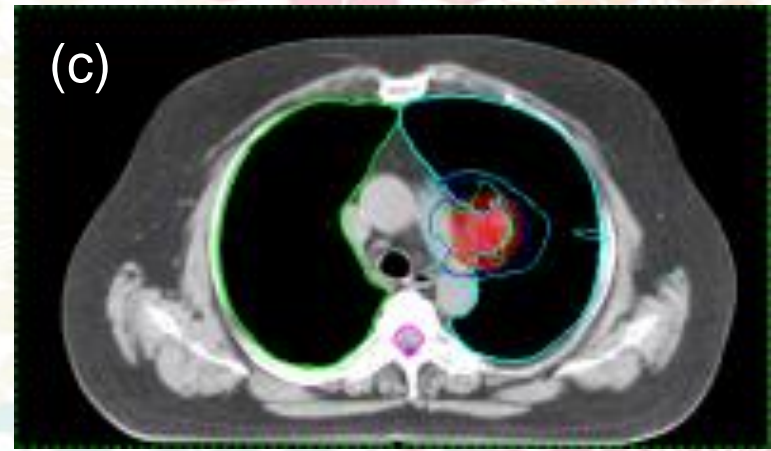
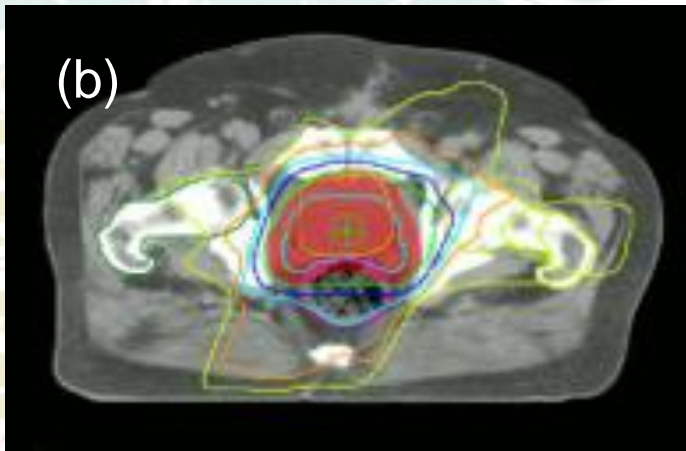


Figure (b) prostate and (c) lung treatments.

Following the methodology described in [3] and using model coefficients ( $M_{k,j}$ ), neutron doses (PND) were estimated by terms of number of delivered MU and facility characterization ( $c^*$ ).

$$PND_{k,j} = c^* \cdot MU \cdot M_{k,j}$$

[3] Radiother Oncol 2013;107:234-241.

One session of the treatment was delivered, corresponding to 479 MU and 569 MU for prostate and lung treatments, respectively

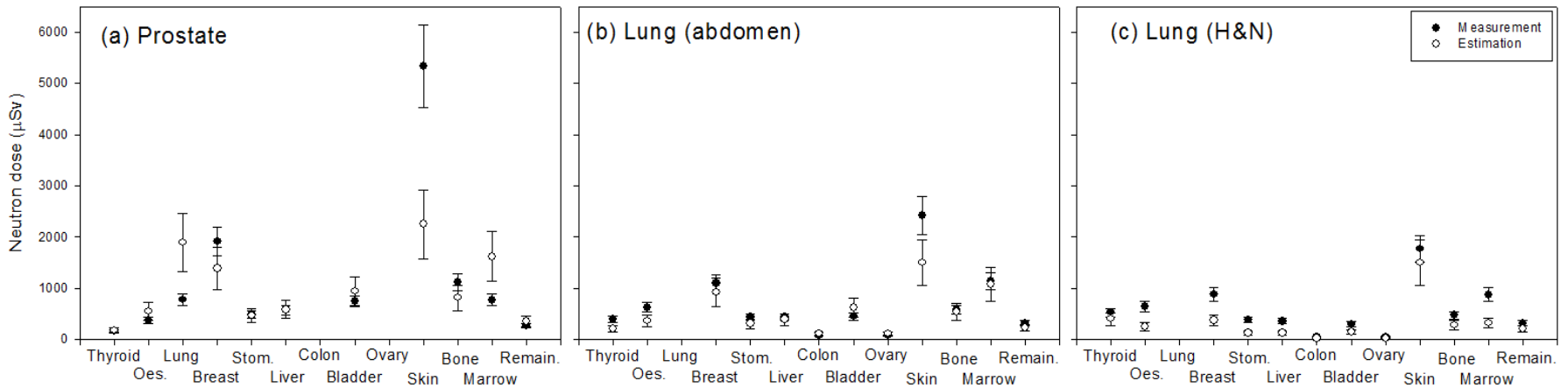


Then measurements have been compared to estimations obtained with the prediction models [4].

[4] Med Phys 2015;42:276-281,



# Results:



Comparison of experimental measurements in an anthropomorphic phantom (black) and theoretical estimation (white) using: abdomen model for (a) prostate and (b) lung; and H&N model for (c) lung calculations.

## ***Conclusion:***

The generic model has shown to be good enough to cover the common high-energy specific treatments as those studied here.

It seems to be no need of more specific models, while some improvements have to be done for particular points.



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