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# Prompt-gamma measurements of 18O as contrast agent for proton range verification

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Although proton therapy is advantageous over more traditional radiotherapy from the point of view of dose delivery and sparing of organs at risk, its full potential has not been reached yet [1]. A lot of effort is focused on proton range verification techniques to improve dose localization. Several of these techniques profit from secondary emissions induced by protons to determine the proton range and to estimate the dose deposited in patients [2]. They include the generation and detection of PET radioisotopes, and the production of prompt gammas (PG) by proton-induced reactions. It is therefore crucial to have reliable cross section values of the reaction channels leading to the production of the most suitable PET and PG isotopes.

The radiation induced on natural tissues is not always the most suitable to perform proton range verification. Thus, the use of contrast agents that provide an increased induced radioactivity near the Bragg peak region has been suggested to improve the range verification capabilities [3,4]. Furthermore, in the specific case of PG, inducing low energy gamma-rays (1-2 MeV) could help to improve the proton range estimation. Our studies show several promising candidates.

Water-18 (H218O) has a great potential as a contrast in PG emission for or proton range verification thanks to the oxygen 18O isotope, due to the presence of intense and low energy, discrete γ-rays. We have performed measurements of PG production at low energies at CMAM [5] in the energy range 1–10 MeV using a set-up consisting of two pairs of collinear LaBr3(Ce) detectors and a fully digital acquisition system with high-rate capabilities. We will report results of 3 discrete γ-rays coming from the irradiation 18O with protons and its angular distribution with respect to the beam direction. This data will allow us to study the feasibility of water-18 as a contrast agent in proton therapy.

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**Primary author:** VALLADOLID ONECHA, VICTOR (Grupo de Fisica Nuclear (GFN) & IPARCOS, Universidad Complutense de Madrid (UCM))

**Co-authors:** ESPINOSA RODRÍGUEZ, ANDREA; SANCHEZ PARCERISA, DANIEL (UCM); UDIAS, Jose Manuel (Grupo de Fisica Nuclear (GFN) & IPARCOS, Universidad Complutense de Madrid (UCM)); Prof. FRAILE, Luis M (Universidad Complutense (ES)); GARCÍA DÍEZ, Miguel (Grupo de Física Nuclear, EMFTEL & IPARCOS, Universidad Complutense de Madrid, CEI Moncloa, Madrid, Spain); IBÁÑEZ, Paula (Grupo de Física Nuclear, EMFTEL & IPARCOS, Universidad Complutense de Madrid, CEI Moncloa, Madrid, Spain); ESPAÑA PALOMARES, Samuel (Universidad Complutense de Madrid); VINALS ONSES, Silvia (Universidad Autonoma de Madrid (ES))

**Presenter:** VALLADOLID ONECHA, VICTOR (Grupo de Fisica Nuclear (GFN) & IPARCOS, Universidad Complutense de Madrid (UCM))

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