Contribution ID: **285** Type: **Oral Presentation**

#9-285 Compton imaging for dosimetry and real time monitoring in boron neutron capture therapy

Wednesday, June 11, 2025 3:20 PM (20 minutes)

Boron Neutron Capture Therapy (BNCT) is an experimental form of radiotherapy that uses boron, injected to the patient attached to a target molecule that accumulates selectively in cancerous cells. This therapy exploits the large neutron capture cross-section of boron to deliver a targeted dose from neutron irradiation. One of the primary challenges in current BNCT is the accurate determination of the dose delivered to the patient. The state-of-the-art methods are very limited and rely on several assumptions and extrapolations from boron concentration in blood before and after the irradiation. Since neutron captures in boron produce 478 keV gamma rays in 94% of reactions, this radiation could be potentially used for real-time dose monitoring using various imaging techniques. To date, SPECT and Compton imaging have been explored; however, the main challenges remain in achieving the spatial resolution required, true online capabilities and dealing with the harsh radiation backgrounds induced by the neutron beam during treatment. The i-TED Compton Camera array, originally designed for nuclear physics measurements with neutron beams, is an excellent candidate for overcoming this challenge in BNCT. Its unique -large efficiency- design with one scatter-detector and four absorber detectors, as well as its low neutron sensitivity make i-TED especially well suited for this gamma-ray energy and this application. Profiting from this, some adaptations of the original i-TED imager are being carried out to optimize its performance for the BNCT dosimetry application. In this context, an evaluation of the detectors has been performed to optimize them for 478 keV gamma rays. Moreover, given the need for imaging of large areas (e.g. the human head or torso) we are integrating 3D image reconstruction with list mode Maximum Likelihood Expectation Maximization algorithms into our imaging suite. A series of experimental campaigns are carried out in order to test and validate the i-TED capabilities and performance towards BNCT, including a first campaign at the Institut Laue Langevin for proof-of-concept of sensitivity and imaging of 478 keV gamma rays from neutron irradiated cell lines; and a second campaign aiming at reproducing realistic conditions in terms of background and boron concentrations comparable to actual BNCT treatments. A summary of our most recent developments and experiments will be presented.

Primary author: TORRES-SÁNCHEZ, Pablo (Instituto de Física Corpuscular (CSIC-UV))

Co-authors: GAMEIRO, Bernardo (Instituto de Física Corpuscular (CSIC-UV)); RUIZ-RUIZ, Carmen (U. Granada); MICHELAGNOLI, Caterina (Institut Laue-Langevin); MÉNDEZ-MALAGÓN, Cristina (U. Granada); DOMINGO-PARDO, César (Instituto de Física Corpuscular IFIC-CSIC); PORRAS, Ignacio (U. Granada); LADARESCU, Ion (Instituto de Física Corpuscular IFIC-CSIC); BALIBREA CORREA, Javier (Instituto de Física Corpuscular IFIC-CSIC); DAUGAS, Jean--Marie (Institut Laue-Langevin); LERENDEGUI MARCO, Jorge (Instituto de Física Corpuscular (CSIC-UV)); PORRAS-QUESADA, Maribel (U. Granada); RUIZ-MAGAÑA, María José (U. Granada); PEDROSA-RIVERA, María (U. Granada); ÁLVAREZ-RODRIGUEZ, Patricia (U. Granada); KOESTER, Ulli (Institut Laue-Langevin); BABIANO, Victor (Instituto de Física Corpuscular IFIC)

Presenter: TORRES-SÁNCHEZ, Pablo (Instituto de Física Corpuscular (CSIC-UV))

Session Classification: #09 - Environmental and Medical Sciences

Track Classification: 09 Environmental and Medical Sciences