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How versatile a cyclotron is for isotope production

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Radionuclides are used in different fields of medicine like oncology, neurology and cardiology, either for diagnostic or therapy. In most cases, radionuclides must be coupled to a carrier molecule to target the cells of interest. Many radionuclides may be of medical interest due to their emitted radiations (beta / alpha emitters, Auger emitters) and/or their half-lives that can be adapted to the carrier molecule transit time and to the pathology. Recently, the theranostic approach [1] has emerged. It combines imaging information and therapeutic use of radionuclides. This approach shows great promises especially because it may allow personalizing the treatment to each patient. The diagnosis test done prior to the treatment allows to determine patient response and to determine the needed injected dose for the therapeutic agent. After treatment, the imaging agent can be used to follow the patient response to the injected radiopharmaceutical. Finally, this approach allows a better control of the targeting and increases the benefit/toxicity ratio as useless treatments on patients with no response to the diagnosis test are avoided. All these points lead to a renewal interest on radionuclide production and in particular on metals for which chelation can be used to bind radionuclides to the vector molecules.
Radionuclide production is mainly done using neutrons in nuclear reactors and protons in accelerators. However, it is possible to use accelerators on more versatile ways than was done before in order to make available large quantities of radionuclide of interest with high quality and affordable prices.
The purpose of this presentation is to illustrate how versatile accelerator can be for isotope production and how they can help fulfill medical needs.
References
1. SC. Srivastava, JPM 2013 ; 47(1)31-46

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