



Contribution ID: 15

Type: Oral presentation

LARAMED – Laboratory of RADionuclides for MEDicine: Status of the research facility at INFN LNL

Friday, September 22, 2017 11:00 AM (25 minutes)

LARAMED is a new research infrastructure, now under construction at Legnaro National labs (LNL), which will take advantage of the high performance BEST 70p cyclotron (70 MeV, 750 μ A) recently commissioned in the framework of SPES project. LARAMED project is indeed the LNL proposal for an international-class level and well-established research center, which main goals cover different topics, ranging from nuclear physics (excitation function experimental measurements), to engineering aspects (high power production targets) and radiochemistry issues (improvements of separation purification techniques). LARAMED has been conceived, since the beginning, to meet a double research scope: either to develop a more efficient production for well-established radionuclides already playing a key role in nuclear medicine (NM), or to investigate yet unexplored production routes for novel radionuclides, having potential interest for medical applications, but still unavailable in NM. Ultimately, the major objective of this project is to establish a production facility at LNL for a number of relevant medical radionuclides to be distributed to hospitals and clinical departments, both for routine use in patients' treatment and clinical research purposes.

The LARAMED infrastructure comprises three dedicated irradiation bunkers, each one having specific beam-lines and target stations. One devoted to research purposes, the so-called RadioIsotope LABORatory (RILAB), while the remaining two being available, through settled collaboration agreement with a commercial partner, for routine radionuclides production such as $^{82}\text{Sr}/^{82}\text{Rb}$, $^{68}\text{Ga}/^{68}\text{Ge}$ etc., the so-called RadioIsotope FACTory (RIFAC). Both RILAB and RIFAC bunkers will be connected to dedicated radiochemistry laboratories through pneumatic pipelines, designed to transfer irradiated targets into hot cells for separation, purification and handling of the radionuclides of interest. Moreover, a dedicated low-current beam line will be available as well for high-precision determination of nuclear excitation functions.

LARAMED was designed according to the following research lines: (1) high-precision determination of nuclear reaction's cross-sections potentially useful for obtaining novel medical radionuclides, including re-evaluation of previously investigated reaction routes; (2) development of new target technology suitable for operating with high-current, high-energy proton beams, especially for an improved production of $^{64}/^{67}\text{Cu}$ isotopes; (3) development of alternative, more efficient procedures for obtaining important medical radionuclides, including $^{99\text{m}}\text{Tc}$, $^{64}/^{67}\text{Cu}$, ^{52}Mn , ^{82}Sr , ^{68}Ge and ^{89}Zr , ^{63}Zn , ^{186}Re and $^{44}/^{47}\text{Sc}$; (4) development of fully-automated dedicated radiochemical procedures for target processing, separation and purification of medical radionuclides; (5) design and development of novel radiopharmaceuticals for targeted guided imaging and therapy in oncology.

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