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ISOLTRAP the mass measurement tool of ISOLDE/CERN and its power to enhance the radio isotope production for medical purposes

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The ISOLDE facility at CERN provides a wide choice (>1000 different radioisotopes) of mass-separated ion beams. These serve a variety of disciplines, including radiochemistry, radiobiology and preclinical studies for nuclear medicine. Recently the quadruplet of terbium (Tb) isotopes covering all modalities of nuclear medicine gained considerable interest [1]. Neutron-deficient lanthanide isotopes such as 149,152,155Tb are produced at ISOLDE by 1.4 GeV proton induced spallation of tantalum foil targets. The radionuclides diffuse out of the 2000 ℃ hot target and are surface or laser ionized, accelerated to 30-60 keV and mass separated. Due to the chemical similarity of the lanthanides the separated beam is not mono-isotopic but also contains isobars of the selected mass plus sidebands of oxide ions 16 mass units less. Most of these are radioactive with different half-lifes and a wealth of gamma rays which renders difficult a quick on-line assessment of the beam composition by gamma ray spectrometry.
We present a new tool for this purpose, the so called multi-reflection time-of-flight mass spectrometer (MR-ToF MS) [2] which is used at the high-resolution mass spectrometer ISOLTRAP [3]. With the support of the spectrometer it is possible to analyse the composition of the collected beam immediately and vary the production parameters in order to enhance even more the purity of the isotope of interest.

References:
[1] C. Müller et al., J. Nucl. Med. 53, 1951 (2012).
[2] R.N. Wolf et al. Int. J. Mass Spectrom. 349-350, 123–133 (2013).
[3] S. Kreim et al. Nucl. Instrum. Methods B 317, 492–500 (2013).

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