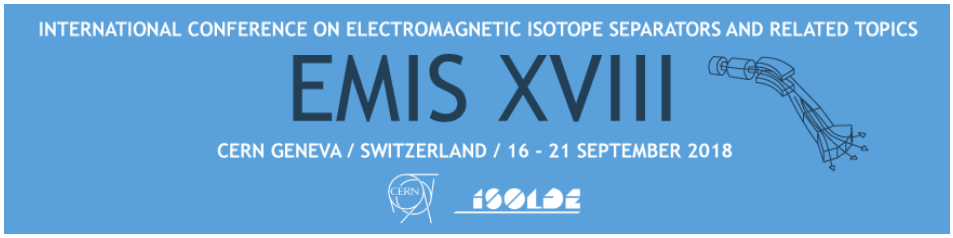

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Production of theranostic Tb isotopes: electromagnetic isotope separation before or after irradiation ?

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Terbium has a quadruplet of so-called theranostic isotopes useful for the preparation of radiopharmaceuticals: 152Tb (PET imaging), 155Tb (SPECT imaging), 161Tb (beta- therapy) and 149Tb (alpha therapy). All isotopes belong to the same element, thus assuring identical pharmacokinetics, an essential requirement for theranostics. 149,152,155Tb with high radioisotopic purity is so far only available from spallation of Ta targets combined with on-line mass separation at CERN-ISOLDE or TRIUMF-ISAC.
Additional production at cyclotrons is urgently required to satisfy the great demand for medical applications. These isotopes could in principle also be produced by 155Gd(p,n)155Tb, 152Gd(p,n)152Tb and 152Gd(p,4n)149Tb reactions respectively, provided targets of sufficient isotopic enrichment become available. Commercially available 152Gd reaches only 30% enrichment, but »90% enrichment is required to minimize co-production of longer-lived Tb isotopes in (p,n) reactions.
We present a demo experiment performed at the tandem accelerator of the MLL Garching where 152Tb was produced by irradiating a unique ion-implanted 152Gd target (>99% enriched) with 8 MeV and 12 MeV protons respectively. At these energies only 152Tb was observed while upper limits are derived for co-production of other Tb isotopes. This radioisotopic purity would enable direct use for human applications, only requiring a chemical Tb/Gd separation from the target material.
We will discuss prospects to efficiently separate more 152Gd and 155Gd with the SIDONIE mass separator at CSNSM Orsay and thus prepare cyclotron targets suited for high current irradiations.
We thank the MLL staff for smooth operation of the tandem accelerator.

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