Decay Properties of P-Rich Nuclei near ^{100}Sn $\diamond$

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Neutron deficient nuclei near ^{100}Sn have been produced by fragmentation of a 1 A·GeV ^{112}Sn beam in a beryllium target. The fragments were separated in the 0° magnetic spectrometer FRS at GSI, Darmstadt, and identified with detector systems, tracking the ion position through the FRS and measuring the energy loss and the time of flight [1]. The unambiguously identified ions were stopped in an implantation detector [2].

The implantation zone of our detector consists of four two-sided Si-strip detectors ($64 \times 25 \times 0.5\,\mathrm{mm}^3$) with a strip pitch of 0.5 mm on both sides (x and y direction), mounted in a compact stack. By correlating the implantation position of an identified ion with its decay position we were able to suppress the background effectively and to determine the halflives of the implanted ions. Around the implanation zone two 10 mm thick stacks of Si detectors were mounted for the β-energy measurement. For gamma spectroscopy about 25% of the solid angle were covered by a segmented Clover germanium detector.

The nuclei with even Z near the proton dripline below ^{100}Sn are waiting points in the rp-process and their halflives determine the flux towards heavier nuclei and the respective isotopic abundances. We measured for the first time the halflives of these nuclei from ^{80}Zr up to ^{92,93}Pd.

On the other hand the rp-process flux is determined by the proton dripline. Therefore we investigated the possibly proton-unstable nuclei ^{77}Y and ^{81}Nb. ^{77}Y ions could be identified and we observed their decay with a short halflife, consistent with a superallowed beta decay. From the non-observation of ^{81}Nb we deduce a halflife shorter than 200 ns, considering the flight time through the fragment separator. Furthermore we identified for the first time two ^{76}Y and one ^{78}Zr ions (see fig.1). From their observation we estimate a halflife longer than 100 ns for these rare isotopes.

We also investigated the six cases of odd-odd $N = Z$ nuclei between ^{78}Y and ^{98}In, which are the heaviest nuclei where one can hope to study pure Fermi beta transitions. In a very preliminary analysis of our data we are able to show that even ^{90}Rh and ^{94}Ag are Fermi beta emitters. Like the three lighter members of this series ^{78}Y to ^{86}Tc which were recently detected at GANIL [3]. Our new data on these nuclei are in good agreement.

Finally we measured the halflives of so far unknown Rh and Tc isotopes near the $N = Z$-line. First (preliminary) results and their statistical errors are shown in the table below. Up to now only a part of the data is analyzed.

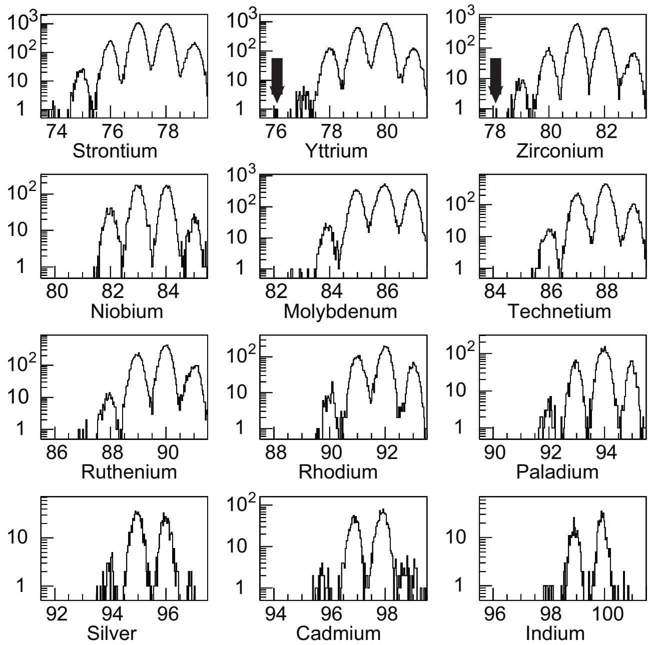

Fig. 1: Identification plots. The arrows in the yttrium and zirconium plots indicate the new isotopes ^{76}Y and ^{78}Zr.

isotope	^{77}Y	^{78}Y	^{80}Zr	^{82}Nb
halflife	53^{+29}_{-14} ms	67^{+18}_{-12} ms	$5.7^{+0.9}_{-0.7}$ s	44^{+8}_{-6} ms
isotope	^{84}Mo	^{85}Mo	^{86}Tc	^{87}Tc
halflife	$3.6^{+1.0}_{-0.7}$ s	$6.3^{+1.3}_{-1.0}$ s	45^{+10}_{-7} ms	$1.9^{+0.2}_{-0.2}$ s
isotope	^{88}Ru	^{89}Ru	^{90}Rh	^{91}Rh
halflife	$1.1^{+0.4}_{-0.2}$ s	$1.6^{+0.3}_{-0.2}$ s	44^{+60}_{-16} ms	$1.8^{+0.3}_{-0.3}$ s
isotope	^{92}Rh	^{93}Rh	^{92}Pd	^{93}Pd
halflife	$2.9^{+1.5}_{-0.8}$ s	$5.7^{+1.3}_{-0.9}$ s	$0.7^{+0.4}_{-0.2}$ s	$9.3^{+2.5}_{-1.7}$ s
isotope	^{94}Ag	^{98}In	^{99}In	
halflife	38^{+38}_{-13} ms	to be analyzed	to be analyzed	

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References

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