# Mass Measurements of A=80 Isobars with SARA ◇

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Accurate mass measurements were performed using the second cyclotron of SARA (Système Accélérateur Rhône-Alpes) of the ISN (Institut des Sciences Nucléaires) in Grenoble as a time-of-flight (TOF) mass spectrometer.

## 1. Experimental Method

The beam of the first cyclotron produces secondary nuclei in a target placed between the two cyclotrons. These reaction products are selected and guided by the magnetic deflection of the transfer line into the second cyclotron, where they are accelerated only, when they satisfy the classical relation: $\omega_{RF2} = h_2\, qB/m$, where $h_2$ is the harmonic of the second cyclotron. Different isobars are accelerated simultaneously. Their Z-identification is done with a ΔE–E solid state telescope placed in the extraction line of the second cyclotron. The time of flight TOF through the cyclotron is determined with a channel-plate detector placed in front of the second cyclotron and the ΔE–signal of the solid state telescope placed at the exit of the cyclotron.

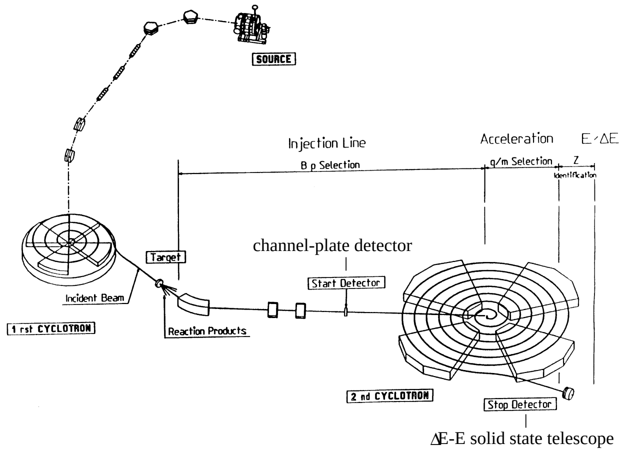


Fig. 1: Experimental set-up for mass measurements at SARA

## 2. Measurements and Preliminary Results

In the previous measurements at SARA the reactions $^{40}$Ar + $^{nat}$C and $^{40}$Ca + $^{nat}$C were used to test this method by measuring the well known masses in the A=48 region [1–3]. Our recent measurement in 1995 was the first use of SARA to determine masses of nuclei far from stability. The secondary ions with m/q = 80/27 were produced by a fusion evaporation reaction, using a 300 MeV $^{58}$Ni beam on an $^{27}$Al target. For example $^{80}$Y which is very interesting, due to the 2.2 MeV difference between the experimental mass value [4,5] and the recommended value by Audi and Wapstra [6].

Using the well known mass of $^{80}$Sr ($m_{atom}$ = 79.924528 u ± 9$\mu$u) as a reference, we obtained the masses of $^{80}$Rb and $^{80}$Y. The determination of the well known mass of $^{80}$Rb was a test (in addition to our former test measurements) for the high accuracy of this method.

We obtained a mass value of 79.922559 u ± 42$\mu$u for $^{80}$Rb, corresponding to a precision of $5.3 \cdot 10^{-7}$ and an accuracy of $4.6 \cdot 10^{-7}$ compared to the value given by Audi & Wapstra.

Concerning the mass of $^{80}$Y, we obtained a preliminary mass value of 79.934030 u ± 350$\mu$u, corresponding to a precision of $4.4 \cdot 10^{-6}$. Fig. 2 compares our mass value with the recommended value of Audi & Wapstra and the former experimental value.

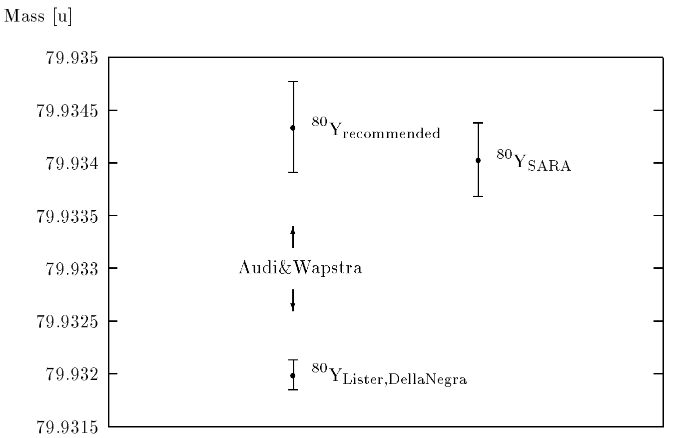


Fig. 2: Comparison between the $^{80}$Y mass values given by Audi & Wapstra [6] and from our experiment at SARA

## 3. Conclusions

Our recent measurements were the first use of SARA to determine masses of nuclei far from stability. Concerning the mass of $^{80}$Y, we found a good agreement between our preliminary result and the recommended value of Audi & Wapstra [6], but a disagreement with the former experimental value of Lister et al. [4] and Della Negra et al. [5].

In contrast to many other mass measurement techniques, masses of very short-living isotopes can be obtained using this method at SARA, since it takes less than 100$\mu$s from the production to the end of the measurement.

### References

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