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# ISOSPIN SYMMETRY OF TRANSITIONS PROBED BY WEAK AND STRONG INTERACTIONS

## Production test of neutron-deficient Zn isotopes for P136 proposal

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### Abstract

Production rates of neutron-deficient Zn isotopes have been studied at ISOLDE for the P136 proposal to fulfill the request of INTC. The results show that the best conditions to produce $^{58}$Zn for isospin symmetry studies are obtained with a combination of 1.4 GeV proton beam, a Nb-foil target, laser ionization and the high-resolution separator HRS. The beam time request is 25 shifts including 3 shifts for tuning of HRS and the ion source, 1 shift for on-line calibrations and 21 shifts for data-taking.

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# Production tests of neutron-deficient Zn isotopes for P136 proposal

In the P136 proposal by Y. Fujita et al. [1] the production of $^{58}Zn$ ($T_{½}$ = 86(18) ms) using $ZrO_2$ target was suggested to be studied. A yield test, requested by the INTC committee in February 2001 before the experiment based on proposal P136 can be approved, was performed in August (2001) using the High Resolution Separator (HRS) at ISOLDE. Results of that test are reported below. Also the comparison between $ZrO_2$ and Nb-foil target is presented. The comparison allows for fulfilling the request by the INTC.

The preceeding Nb-foil study was performed at 1997 at ISOLDE using the General Purpose Separator (GPS) [2]. The efficiency of laser ionization of stable Zn was about 5 % in both measurements. Typical release parameters for Zn out of a $ZrO_2$ felt target are $\tau_r$ = 70 ms, $\tau_f$ = 800 ms, $\tau_s$ = 13 s and a = 0.77 using the notation of Lettry et al. [3]. However the measured release of Zn from more than eight times thicker Nb-foil target (48 $g/cm^2$) is about as fast [2]. This same conclusion can be drawn from Fig. 1 where extracted yields are summarized. The yield of $^{58}Zn$ is 0.40(14) at/μC from a $ZrO_2$ target coupled to a resonance ionization laser ion source (RILIS) and 2.9 at/μC from a Nb-foil target coupled to RILIS [4]. In addition, the yields with $E_p$ = 1.4 GeV seems to be higher than for $E_p$ = 1.0 GeV (see Fig. 1). Thus, an additional gain is expected by using $E_p$ = 1.4 GeV for the Nb-foil target.

With both of these targets the largest isobaric contamination in $^{58}Zn$ beam comes from the thermally ionized $^{58}Mn$ ($T_{½}$ = 65.3(7) s). The intensity of the $^{58}Mn$ beam is at least three orders of magnitude larger than that of the $^{58}Zn$ beam in both of these cases. In the $ZrO_2$ target test HRS was not optimized to reduce $^{58}Mn$ intensity. Based on the well-studied case of $^{74}Rb$-$^{74}Ga$ the $^{58}Mn$ beam intensity can be reduced with HRS about one order of magnitude if the resolving power exceeds 5000 [5]. The mass difference between $^{74}Rb$ and $^{74}Ga$ is about 16.3 MeV while between $^{58}Zn$ and $^{58}Mn$ it is about 13.5 MeV. Also tantalum (Ta) as a hot cavity material instead of tungsten (W) will bring down the $^{58}Mn$ intensity with a factor of five since the work function of the Ta surface is smaller.

Further reduction of manganese intensity can be obtained by decreasing the cavity temperature.

As a conclusion we propose to use Nb-foil target + Ta ionizer coupled to RILIS and HRS for the experiment described in [1]. The production of $^{58}Zn$ with 1.4 GeV protons will be explored at the beginning of the run. However, even with the existing yield of $^{58}Zn$ the experiment can be successfully performed. The beam time request is 25 shifts including 3 shifts for tuning of HRS and the ion source, 1 shift for on-line calibrations and 21 shifts for data taking.

# References


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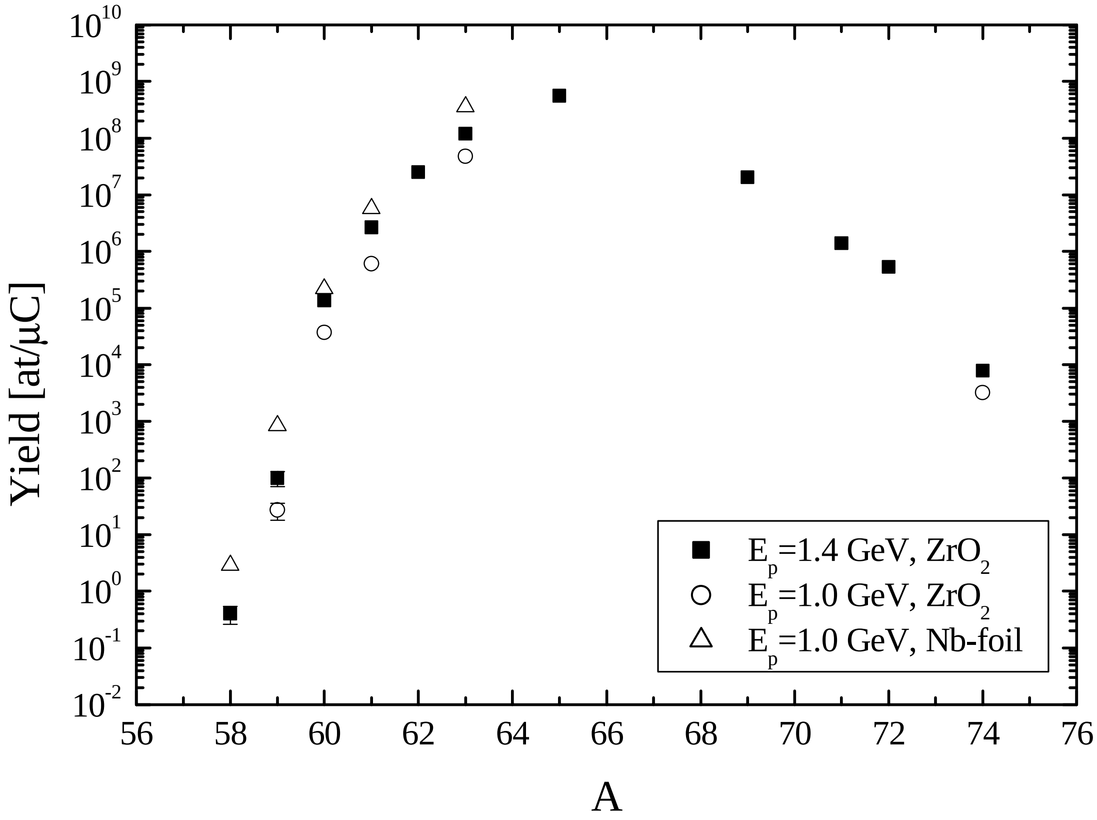


Figure 1: Yields of Zn isotopes with a $ZrO_2$ felt and Nb foil target.