Spectroscopy of Single-Particle States in Oxygen Isotopes via $^AO(\vec{p}, 2p)$ Reaction with Polarized Protons

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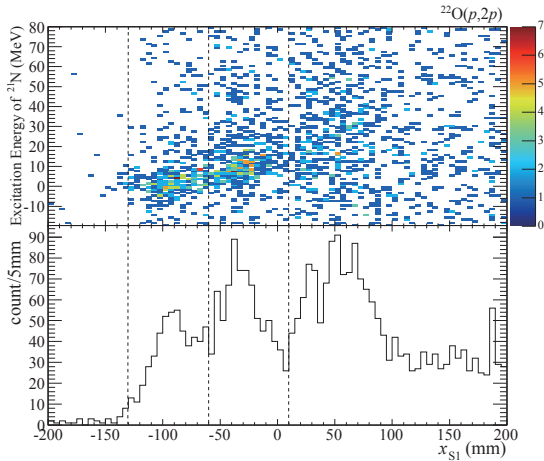R. Yokoyama,[*1,*2] K. Yoshida,[*2] and J. Zenihiro[*2] for the SHARAQ04 collaboration

Fig. 1. Correlation between the excitation energy of ^{21}N and x_{S1}.

Fig. 2. Excitation energy spectrum for ^{22}O$(p, 2p)$ for each x_{S1} region. The red lines show the background estimated from the $2p$ coincidence events occurred in the carbon target.

We performed $^{14,22-24}$O$(\vec{p}, 2p)$ reaction measurements (SHARAQ04 experiment) with a polarized proton target at RIBF to measure single-particle spectra and to determine spin-orbit splitting of 1p proton single-particle orbits in $^{14,22-24}$O as a function of their neutron number. For the experimental setup, see ref.[1]. In this report, current status of the analysis for ^{22}O$(p,2p)$ is described.

The $(p, 2p)$ reaction was identified via the particle identifications of incident nuclei and two scattered protons. Particles were identified via the Time-of-Flight(TOF)-ΔE method on an event-by-event basis. Then the proton separation energy of the incident nuclei and the excitation energy of the residual nuclei were calculated from scattering angles and TOF of scattered protons.

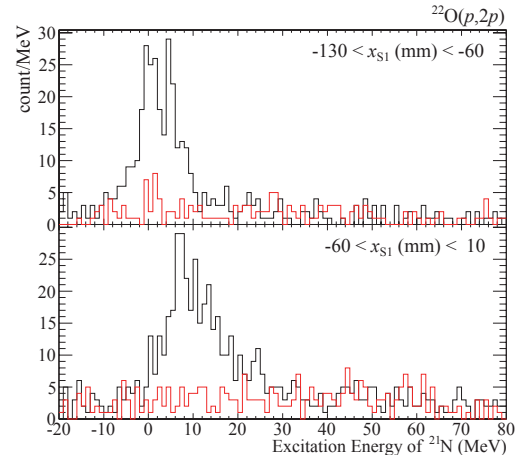Position of the residual nuclei and TOF from the target are also measured at a focal plane S1 at the downstream of the reaction point for the identification of the residual particle in order to improve the S/N ratio and to separate the excited states of ^{21}N. Figure 1 shows the correlation between the excitation energy and the position of the residual nuclei at the S1 focal plane (x_{S1}) after applying a TOF gate. At S1, particles with larger $B\rho$ come to the smaller x_{S1} region. There are two clear loci in the x_{S1} region of $(-130, -60)$ and $(-60, 10)$. The former corresponding to ^{21}N and the latter should be ^{19}N or ^{20}N generated through the neutron emission of ^{21}N. It will be clarified by $B\rho$ analysis.

Figure 2 shows the excitation energy spectra of ^{21}N for different x_{S1} regions. The red lines show the background originated from the carbon contamination of the polarized target and obtained from the measurement with a carbon target. At least two discrete states are observed in these plots.

The cross sections, spectroscopic factors, and the spin-polarization observables such as the vector analyzing power are expected to be obtained through subsequent analyses in the near future.

References
1) S. Kawase et al.: RIKEN Accel. Prog. Rep., **46**, 30 (2013)

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