Momentum Distributions of ^{47}Ca and ^{55}Ti Produced in 1n Knockout ◇

P. Maierbeck, R. Gernhäuser, R. Krücken, T. Kröll, H. Alvarez-Pol [a], F. Aksouh [b], T. Aumann [b], K. Behr [b], E. A. Benjamim [a], J. Benlliure [a], V. Bildstein, M. Böhmer, K. Boretzky [b], M.J.G. Borge [c], A. Brünle [b], A. Bürger [d,e], M. Caamano [a], E. Casarejos [a], A. Chatillon [b], L. V. Chulkov [b], D. Cortina Gil [a], J. Enders [f], K. Eppinger, T. Faestermann, J. Friese, L. Fabbietti, M. Gascon [a], H. Geissel [b], J. Gerl [b], M. Gorska [b], P. G. Hansen† [g], B. Jonson [h], R. Kanungo [b,i], O. Kiselev [b], I. Kojouharov [b], A. Klimkiewicz [b], T. Kurtukian [a], N. Kurz [b], K. Larsson [b,h], T. Le Bleis [b], K. Mahata [b], L. Maier, T. Nilsson [f], C. Nociforo [b], G. Nyman [h], C. Pascual-Izarra [c], A. Perea [c], D. Perez [a], A. Prochazka [b,j], C. Rodriguez-Tajes [a], D. Rossi [b,k], H. Schaffner [b], G. Schrieder [f], S. Schwertel, H. Simon [b], B. Sitar [j], M. Stanoiu [b], K. Sümmerer [b], O. Tengblad [c], H. Weick [b], and S. Winkler

[a] USC, Santiago de Compostela, Spain [b] GSI, Darmstadt, Germany [c] CSIC, Madrid, Spain
[d] CEA, Saclay, France [e] ISKP, Bonn, Germany [f] TU Darmstadt, Germany
[g] MSU, East Lansing, USA [h] Chalmers University of Technology, Göteborg, Sweden
[i] St Mary's University, Halifax, Canada [j] Comenius University, Bratislava, Slovakia
[k] Johannes Gutenberg Universität, Mainz, Germany

Knockout reactions at relativistic energies are a tool to study exotic nuclei. Using this reaction inclusive cross sections and momentum distributions can be determined. By measuring γ-ray transitions in coincidence also single particle occupancies can be deduced [1]. One of the main topics of theoretical and experimental investigations is the evolution of the structure of neutron rich nuclei. The shell structure is expected to change locally due to the residual interaction between valence orbitals. In the region around ^{54}Ca a new shell closure at N=34 is predicted [2].

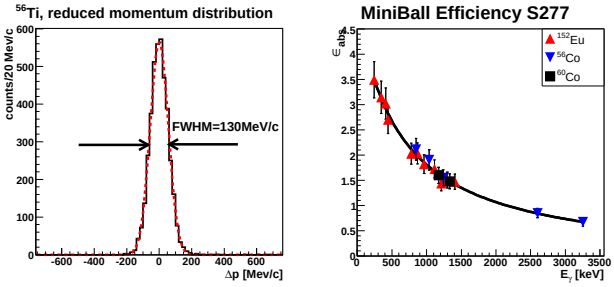

Fig. 1: **Left panel:** ^{56}Ti reduced momentum distribution. The red line (dashed) is a gaussian fit with FWHM = 130 MeV/c.
Right panel: Total photopeak efficiency of the MINIBALL array, measured with ^{56,60}Co and ^{152}Eu sources

We have performed a knockout experiment on ^{48}Ca and ^{56}Ti at the SIS-FRS facility at GSI. The secondary ^{56}Ti beam was produced by fragmentation af a 500 AMeV ^{86}Kr beam on a ^{9}Be target. The first two dipole stages of the FRS were used to identify the projectiles at the mid focus where the knockout target (^{9}Be, 1720 mg/cm^2) was located. For the detection of γ-rays emitted from excited reaction products, the MINIBALL spectrometer [3] was used. The second half of the FRS provided the identification of the residual nuclei and the measurement of the momentum transfer in the reaction [4,5].

Figure 1 shoows the experimental momentum distribution for primary ^{56}Ti beam ($\frac{\Delta p}{p}$ = 0,27%, left panel) and the photopeak efficiency of the MINIBALL setup measured with ^{56,60}Co and ^{152}Eu sources (right panel).

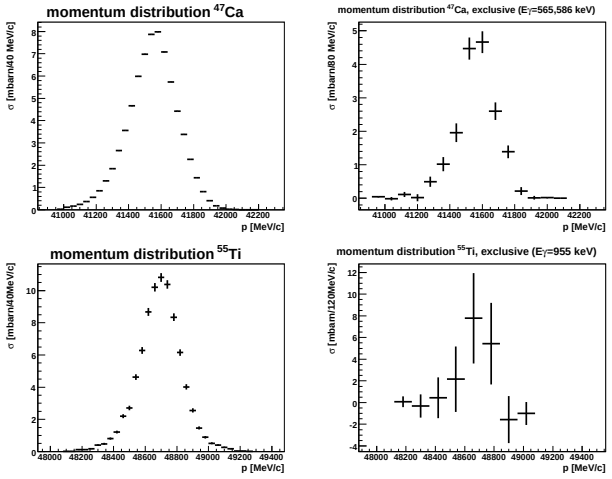

Fig. 2: Momentum distributions of ^{47}Ca (**upper row**) and ^{55}Ti (**lower row**) nuclei produced in 1n knockout reactions. On the left side the inclusive distributions are shown. For the distributions on the right side, a γ-transition with E_γ = 565/586 keV (^{47}Ca) and E_γ = 955 keV (^{55}Ti) respectively was measured in coincidence.

The resulting momentum distributions of the 1n knockout nuclei ^{47}Ca and ^{55}Ti are shown in figure 2. Composition of different states lead to the inclusive distributions, which reflect the single particle spectroscopic factors. For the exclusive distributions in the case of ^{47}Ca a γ-transition with E_γ = 565/586 keV and in the case of ^{55}Ti with E_γ = 955 keV was measured in coincidence.

The analysis of the experiment is ongoing. The results will be published soon.

References

[1] D. Cortina-Gil *et al.*, Phys. Rev. Lett. **93** (2004) 062501
[2] M. Honma *et al.*, Phys. Rev. **C65** (2002) 061301
[3] J. Eberth *et al.*, Prog. Part. Nucl. Phys. **46** (2001) 289
[4] P. Maierbeck *et al.*, Annual report 2006
[5] P. Maierbeck *et al.*, GSI annual report (2007), in print

◇ Work supported by the BMBF (06MT238), by the DFG cluster of excellence 'Origin and Structure of the Universe' and by the EC through I3-EURONS (RII3-CT-2004-506065)