High Resolution Beam Line for the Grand Raiden Spectrometer at RCNP

T. Wakasa[a], K. Hatanaka[a], Y. Fujita[b], G. P. A. Berg[a], H. Fujimura[a], H. Fujita[b], M. Itoh[a], J. Kamiya[a], T. Kawabata[a], K. Nagayama[a], T. Noro[c], H. Sakaguchi[d], Y. Shimbara[b], H. Takeda[d], K. Tamura[e], H. Ueno[f], M. Uchida[d], M. Uraki[a], and M. Yosoi[d]

[a] *Research Center for Nuclear Physics, Osaka University, Ibaraki, Osaka 567-0047, Japan*
[b] *Department of Physics, Osaka University, Toyonaka, Osaka 560-0043, Japan*
[c] *Department of Physics, Kyushu University, Higashi, Fukuoka 812-8581, Japan*
[d] *Department of Physics, Kyoto University, Sakyo, Kyoto 606-8502, Japan*
[e] *Department of Physics, Fukui Medical University, Matsuoka, Fukui 910-1193, Japan*
[f] *The Institute of Physical and Chemical Research, Wako, Saitama 351-0198, Japan*

We have designed and constructed a new beam line which can accomplish both lateral and angular dispersion matching with the Grand Raiden spectrometer (See Fig. 1). In dispersive mode, lateral and angular dispersions of the beam line are b_{16}=37.1 m and b_{26}=−20.0 rad, respectively, to satisfy matching conditions for Grand Raiden. In achromatic mode, the beam line satisfies the double achromatic condition of b_{16}=b_{26}=0. The magnifications of the beam line are $(M_x, M_y) = (-0.98, 0.89)$ and $(-1.00, -0.99)$ for dispersive and achromatic modes, respectively. In the commissioning experiments, we have succeeded to separate the first excited 2^+ state of ^{168}Er with E_x=79.8 keV clearly from the ground state in the (p, p') reaction. We achieved energy resolutions of ΔE=13.0±0.3 keV and 16.7±0.3 keV in full width at half maximum for 295 MeV and 392 MeV protons, respectively. These energy resolutions agree with the resolving power of Grand Raiden for an object size of about 1 mm.

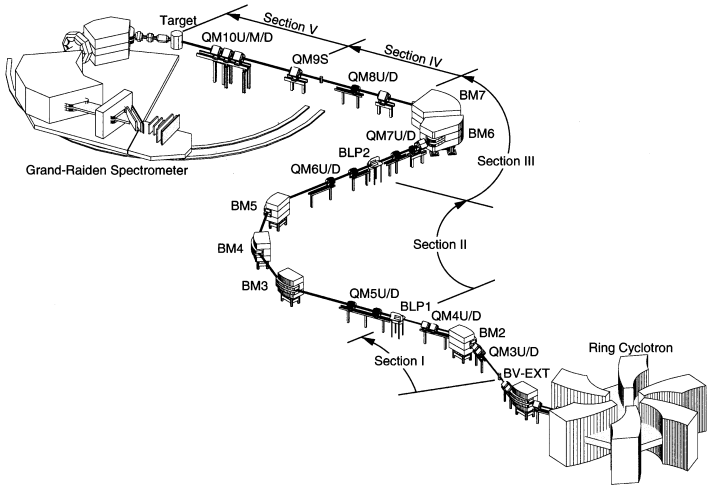

Figure 1: A schematic view of the WS beam line and Grand Raiden spectrometer at RCNP

References

[1] T. Wakasa et al., Nucl. Instr. Methods Phys. Res. A **482** (2002) 79.