

## A Study on the Ion Beam Extraction using Duo-PiGatron Ion source for Vertical Type Ion Beam Facility

Bom Sok Kim\*, Chan young Lee, Jae Sang Lee

KOrea Multi-purpose Accelerator Complex(KOMAC), Korea Atomic Energy Research Institute(KAERI),  
150 Deokjin-dong, Yuseong-gu, Daejeon, 305-353, Korea

\*Corresponding author: kbs0721@kaeri.re.kr

### 1. Introduction

In Korea Multipurpose Accelerator Complex (KOMAC), we have started ion beam service in the new beam utilization building since March this year. For various ion beam irradiation services, we are developed implanters such as metal (150keV/1mA), gaseous (200keV/5mA) and high current ion beam facility (20keV/150mA). One of the new one is a vertical type ion beam facility without acceleration tube (60keV/20mA) which is easy to install the sample. After the installation is complete, it is where you are studying the optimal ion beam extraction process. Detailed experimental results will be presented.

### 2. Methods and Results

#### 2.1 Vertical Type Ion Beam Facility

In Vertical Type Ion Beam Facility, and is configured as shown in Figure 1. 60keV 20mA Duo-PIGatron ion source and BPM(Beam position monitor), which is installed in the ion source chamber and the target chamber has been installed the faraday cup for the extraction beam profile. BPM(NEC's 82 model), the hole size is 50mm, which is installed in a position where the ground electrode of the ion source distance of about 360mm. The Faraday-cup which is installed in the target chamber is arranged at a position from the ground electrode of the ion source distance of about 1580mm. The specs of developed Vertical Type Ion Beam Facility are as table I.

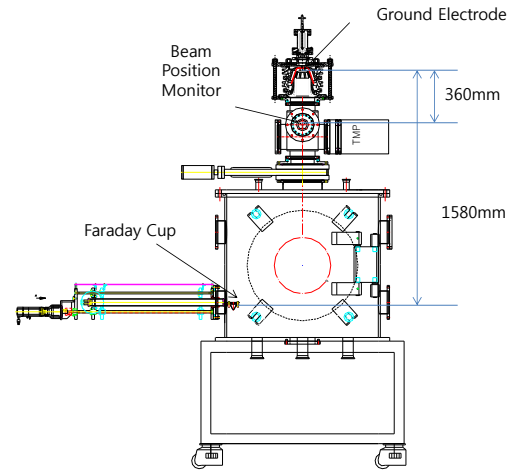


Fig. 1 Vertical Type Ion Beam Facility

Table I: Vertical Type Ion Beam Facility Spec.

Ion source Type	Duo-PiGatron
Max. Extraction Voltage	60kV
Max. Beam Current (He gas)	20mA
Max. Beam Size	250mm

#### 2.2 Beam extraction

The structure of the shape and the electrodes of Duo-PIGatron ion source that is installed on a Vertical Type Ion Beam Facility, it is shown in Figure 2. We were successfully extracted of the beam 60keV 20mA using He gas. In the case of nitrogen ion beam extraction, shows the most sharp beam shape at about 60keV 6mA, it was shown in Figure 3. X-Y stage for the large area irradiation of vertical type ion beam facility was not installed. We being studied optimum extraction conditions for large area ion beam using BPM and Faraday-cup.

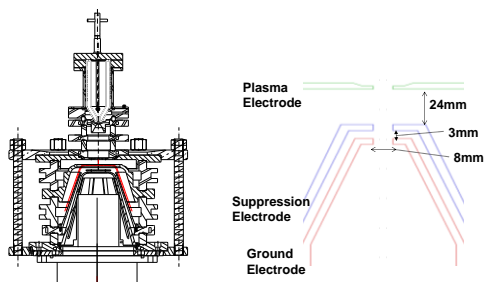


Fig. 2 Duo-PiGatron Ion source for Vertical Type Ion Beam Facility



Fig. 3 Beam Shape of Duo-PiGatron Ion source for Vertical Type Ion Beam Facility (Nitrogen, 60keV 6mA)

### 2.3 Beam position monitor

The beam shape extracted from the ion source by using BPM82 (NEC) as shown in FIG. 4 (a), were measured beam shape. The result of the 30keV, 3mA nitrogen ion beam extraction, calculation results had to be obtained beam shape, such as 4 (b), the beam width of the X-axis is approximately 44.7mm. Currently, it is being studied for the shape of the X, Y-axis.

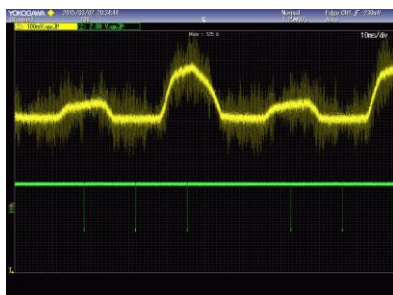


Fig. 4. (a) Beam position monitor, (b) Beam position results of BPM at 30keV 3mA nitrogen

### 2.4 Faraday-cup

The beam profile of Duo-PiGatron for Vertical Type Ion Beam Facility is being measured by one way moving magnetic type modified faraday cup. It is intended to indicate the measurement results Figure 5, the beam width to give a similar result as 196.2mm theoretical calculations at about 198.5mm. (Table 2.)

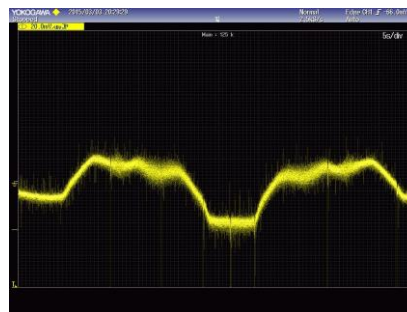


Fig. 5. Faraday cup beam profile of 30keV 3mA nitrogen

Table 2: Extraction beam diameter

	Beam Position Monitor (mm)	Faraday-cup (mm)	Faraday-cup (mm) Theoretically
30keV, 3mA Nitrogen	44.7	198.5	196.2

### 3. Conclusions

Vertical Type Ion Beam Facility without acceleration tube of 60keV 20mA class was installed. We successfully extracted 60keV 20mA using Duo-PiGatron Ion source for Vertical Type Ion Beam Facility. Use the BPM and Faraday-cup, is being studied the optimum conditions of ion beam extraction.

### ACKNOWLEDGMENTS

This work was supported through KOMAC (Korea of Multi-purpose Accelerator Complex) operation fund of KAERI by MSIP (Ministry of Science, ICT and Future Planning).

### REFERENCES

- [1] C. Schwerdt, M. Riemer, S. Kohler, Galvatech'04, AIST, Chicago, ILL, Warrendale, 2004, p. 783
- [2] C.-Y. Lee and J.-S. Lee, J. Korean Phys. Soc. 59, 699 (2011).
- [3] T. Prosek, A. Nazarov, U. Bexell, D. Thierry, J. Serak, Corros. Sci. 50 (2008) 2216.
- [4] N.C. Hosking, M.A. Strom, P.H. Shipway, C.D. Rudd, Corros. Sci. 49 (2007) 3669.