# Simulation and Field Measurement of Quadrupole Magnets for KOMAC 20MeV Beam line

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## 1. Introduction

Korea Multi-purpose Accelerator Complex (KOMAC) was developed at Gyeongju in Korea in 2012. KOMAC including a 50-keV ion source, a 3-MeV RFQ, and a 100-MeV DTL. And beam line consists of 20-MeV and 100-MeV for user. Proton beam transferred from the linac to the beam line using by dipole magnets and transferred proton beam focused and decreased beam loss and by quadrupole magnets [1].

In this paper, quadrupole magnets the same as installed at the beam line simulated and analyzed for magnetic fields. Also quadrupole magnets will be measured field stability and evaluated reliability on long time operation. Control system consisted of Lab-view program and communication method consisted of Ethernet and Rs-232 with optical fiber for devices safety from high voltage and/or high current. As a results the DC power supply is controlled, magnetic fields data is acquired and coil temperature is measured. Magnetic field with hall sensor and temperature with K-type thermo-couple are measured with conversion factor using by voltmeter.

## 2. Experiment

### *2.1 Simulation*

The quadrupole magnets is simulated using by Poisson code. Condition of simulation are 1/8 geometry and 2800 ampere-turn. Magnetic field density of simulated is shown in Fig. 1.

Magnetic field on the middle plate (x, y, z = 20 mm, 0, 0) is 459.5 G as measured value and 465.3 G as simulated value.

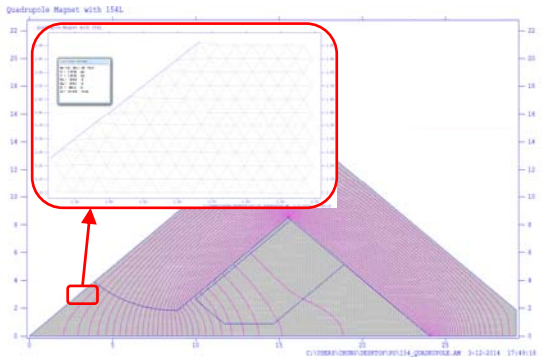

Fig. 1. Geometry and magnet field density of a quadrupole magnets using by Poisson code.

### *2.2 Quadrupole Magnet [2, 3]*

The parameter of quadrupole magnets at KOMAC beam line is summarized in Table 1. Outline of quadrupole magnet is shown in Fig. 2.

Table 1. Specifications of quadrupole magnets.

| | | |
|---|---|---|
| Maximum Field | T | 1 |
| Bore radius | mm | 55 |
| Magnet length | mm | 154 |
| Ampere turn | A·T | 6048 |
| Maximum current | A | 108 |

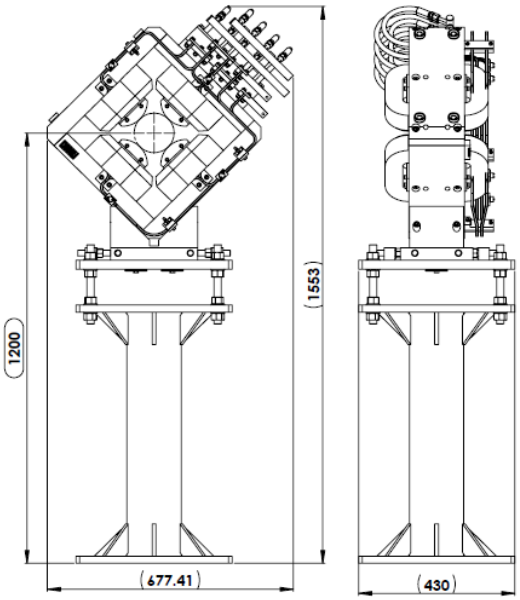


Fig. 2. Outline of Quadrupole magnets.

### *2.3 Experimental Set-up*

Devices control and data acquisition consists of Labview based, and devices protect is used optical communication for isolation from high voltage, high current and/or arc incident. K-type thermocouple for Temperature and hall sensor for magnetic field are measured by volt-meter. Fig. 2 shown schematic diagram of the experimental system and set-up view shown in Fig. 4.

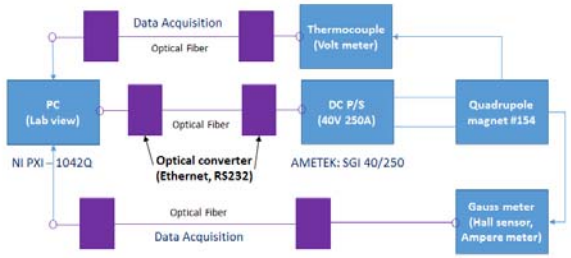


Fig. 3. Schematic diagrams of the experimental system.

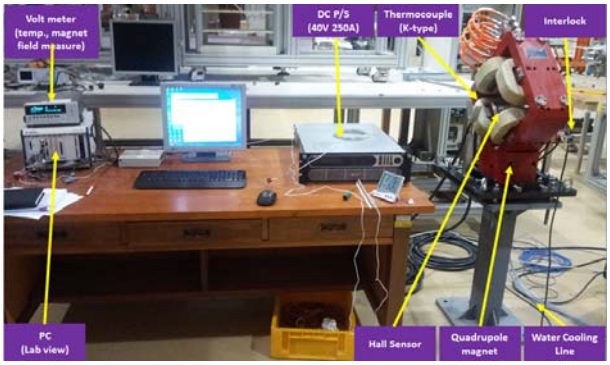


Fig. 4. Overall view of experimental system with quadrupole magnets.

## 3. Summary

Fabricated and simulated quadrupole magnets are almost the same. The system configuration and based on data acquisition were completed. Data will be acquired for field stability and reliability of quadrupole magnets by long time operation. The optical communication also will be tested. In this work, it will be validated the stability of the electromagnet to control and the safety and reliability in operation of acceleration.

## ACKNOWLEDGEMENT

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