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<u>Authors</u> T. Luo, E. Wallen, A. Zimund		<u>Title:</u> Bucking coil measurements	<u>Location</u> LBL B77	<u>Date</u> July 17, 2017

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1 Introduction

A bucking coil has been built for LCLS-II injector at LBL. It will be welded to the back of the RF gun to cancel the solenoid fringe field on the cathode. Before the welding, we measure the magnetic field of this buiking coil.

2 Setup

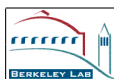
The measurement is carried out at Undulator Measurement Facility at LBL. A 2D Hall probe and Kluger bench for undulator field measurement are reprogramed for this task. The bucking coil is placed vertically with mating surface perpendicular to the Hall probe trajectory. The coil is connected to the power supply up to 5 A. Thermometer is connected to monitor the coil temperature. Since we only go as high as 5 A, with thermometer monitoring and short operating time, we didn't use cooling water. The setup is shown in Figure 1.

3 Procedure

Considerable amount of effort is spent on adjusting the level of the mating surface to make it perpendicular to the Hall probe trajectory, thus the scanning is along the coil center. We also determine the coordinates of the mating surface center and the cathode surface center.

We carried out two measurements:

1. The Bz field at the cathode surface around the center. The Hall probe is placed 8.18 mm above the end of the coil and scanned in a area of 20mm * 20mm around the center, with 1 mm interval. The current is set at 5 A.
2. The Bz field along the central axis. The current is set from -5 A to 5 A, with 1 A interval. Due to limit space of the motion, we can only measure the completed fringe field on one side of the coil.

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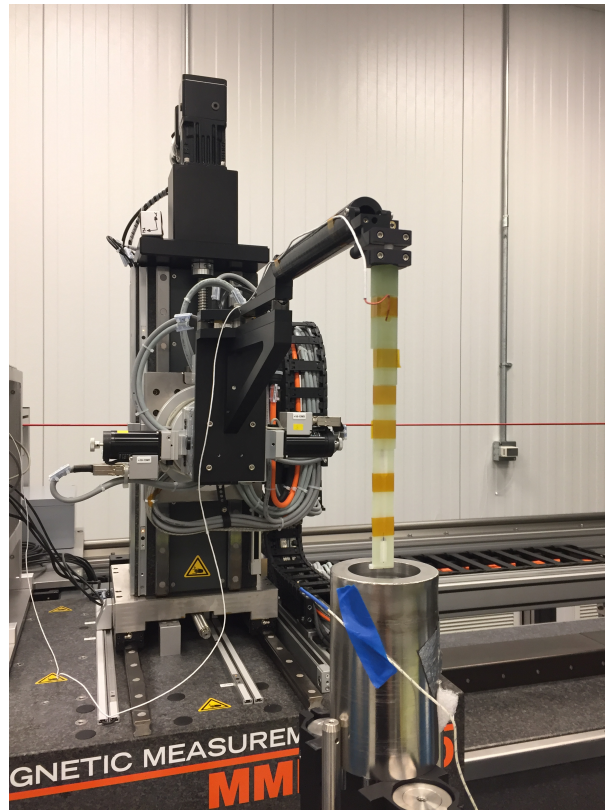


Figure 1: The measurement setup.

For the definition of current polarity, we have labeled the two coil leads with "P" and "N". The "+" sign means the current flows in from "P" and flows out from "N", vice versa. For the definition of B_z field direction, the positive value means the B_z field points in the direction of the beam, vice versa.


4 Measurement results

4.1 B_z at the cathode surface

With 5A current, the B_z field measured at cathode surface is plotted in Figure 2.

4.2 B_z along the coil center

The B_z field scan along the central axis is shown in Figure 3.

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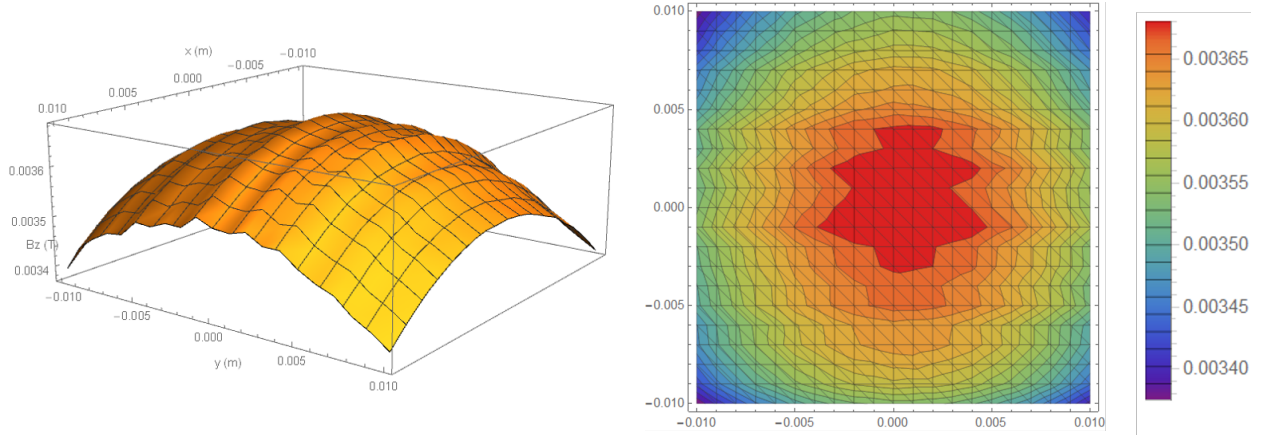


Figure 2: B_z field at cathode surface measured at 5 A. Left: 3D plot; right: 2D contour plot.

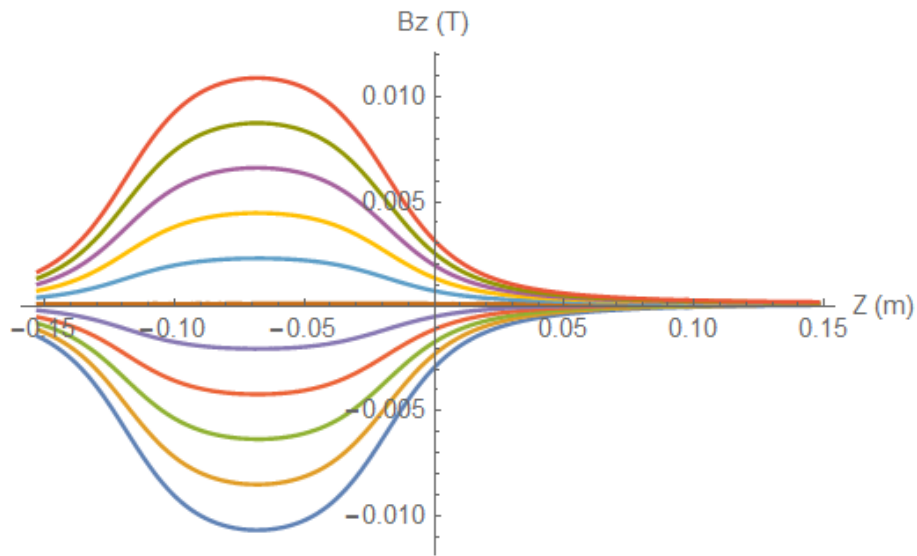


Figure 3: B_z field along the central axis, where $z = 0$ is the location of cathode surface. Each line represents one current value, from -5 A to 5 A, with 1 A interval.