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Automated Magnetic Field Scanning System

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Jefferson Laboratory

Background

Kirk Davis





The building that now holds the vertical testing area at Jefferson Laboratory was once occupied by the Space Radiation **Effects Laboratory in the 1960's. This** laboratory had a cyclotron, which is a type of particle accelerator. As a result of this, the rebar within this particular building is now slightly magnetized.

Jefferson Laboratory tests Superconducting **Radiofrequency (SRF) devices within dewar** cavities in the vertical testing area. These devices perform poorly under the influence of any magnetic field. Because of this, scientists must find a way to cancel the negative effect caused by the building's magnetic rebar.





To achieve this, a set of coils are wrapped around the testing cavities. When current is driven through the coils, a magnetic field is created that opposes the magnetic field from the building, thus neutralizing it. To optimize this method, an accurate reading of the uncompensated magnetic field must be taken. This data is used to create a field that will exactly negate the building's magnetic field.

An SRF cavity within a liquid helium dewar is shown in the image at the left.



Our team developed an automated system which accurately measures and records magnetic field data from within the dewars at Jefferson Laboratory. This device serves the purpose of optimizing an existing system of current carrying coils which are used for cancellation of residual magnetic fields. This process will ensure that the initial conditions for testing of the **Superconducting Radiofrequency devices are free of unwanted** magnetic fields that could cause unreliable testing data.





Because Jefferson Lab has different sizes of dewars, the device must be modular. The system includes concentric rings which can be used to adjust the diameter of the mounting apparatus.

Sensor Housing



A housing is attached to the bottom of the pole to protect the centerline sensor. An arm extending from the housing holds additional sensors for off-centerline readings.

Current Carrying Coils





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Automated Magnetic Field Scanning System



In order to gather readings that are off-centerline, a ball bearing ring attached to the top platform allows the entire pole, including the extension arm, to rotate 360°.

Vertical Movement



The primary function of the system is to read measurements on the centerline. A rack and pinion paired with a stepper motor moves the pole linearly in and out.

K = # of coilsN = # of turns

Residual

Magnetic

Field

Compensated Magnetic **Field**

VIRGINIA COMMONWEALTH UNIVERSITY

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Make it real.