STANFORD LINEAR ACCELERATOR CENTER

SPECIFICATION

STANFORD SYNCHROTRON RADIATION LABORATORY

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Author(s): Jack Tanabe, Nanyang Li		Date: Jan. 16, 2001

First Line:
SPEAR3

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Magnet System

Title:
Horiz/Vert Corrector Magnetic Measurement

H/V Corrector Magnet

Magnetic Measurement

Specification

垂直／水平校正磁铁

磁铁测量

生产说明书

Approved: SLAC Project Engineer
Richard Boyce

Date:

Approved: SPEAR3 Magnet Engineer
Domenico Dell'Orco

Date:

Approved: IHEP Administrative Representative
Haoyun Zhang

Date:

Approved: IHEP Technical Representative
Huamin Qu

Date:

Update / 修 改

1. GENERAL / 概述

This document is presented in both English and Chinese text; in case of differences, the English version shall be used.

本文含中英文两种文字，如有不符之处，以英文为准。

1.1 Scope of the Specification / 说明书范围

This specification covers the design and fabrication of an uncompensated rotating coil for the measurement of the transfer function and the error multipoles of the combined function corrector magnet in both the horizontal and vertical steering modes. It describes the magnet conditioning prior to measurements and lists the current levels at which the magnet measurement raw and reduced data are collected. It sets forth the "hardcopy" and electronic copy documentation requirements of the reduced data.

本说明书说明了用于测量校正铁水平和垂直场的传递函数和高阶误差的非补偿模式旋测线圈的设[illegible]及纸文件和磁盘文件要求包括的内容。

1.1. Reference Document / 参考文件

Engineering Note M361 Horiz/Vert Corrector Magnet Design Summary/校正铁设计总括

1.2 Scope of Work / 工作范围

IHEP shall design and fabricate an uncompensated rotating coil with sufficient length to measure the entire integrated field for the corrector with and without its magnetic shield, perform rotating coil measurements for both vertical and horizontal steering modes, and reduce and present the data characterizing the transfer function and the field quality of the corrector at the specified excitation levels.

高能所应设计和制造一个具足够有效长度的非补偿旋测线圈，测量校正铁在设屏蔽和不设屏蔽两种情况下，几种不同规定激磁场平下的垂直和水平校正场特性，处理测量数据，计算传递函数和场质量。

1.2.1 Measurement Tooling £¯ 测量工具

IHEP shall design and fabricate one rotating uncompensated integral coil for corrector magnet measurements. IHEP shall supply SLAC an engineering note that shall include the details of the measurement coil engineering design and means for correcting the "drift" shall be described. Sketches shall be included which describe the orientation of the coil drive axis. IHEP shall assemble a magnetic measurement system using the rotating coil to collect the raw output and reduce the measurement data. IHEP may use existing equipment if available and appropriate. The coil shall be delivered to SLAC after IHEP completes all corrector magnets measurement.

高能所应设计和制造一个校正铁测量用的非补偿积分旋测线圈。高能所还应提供给SLAC测量线圈物理和机械设计的详细说明。其中包括测量中所采用的修正"漂移"方式，同时还应附有示意图，说明线圈转轴的方位。高能所[illegible]建立与其匹配的相应测量系统，取数和处理数据。高能所可使用现有的适用设备。待高能所完成所有校正铁的测量后，该线圈应发SLAC。

1.2.2 Measurement Work £¯ 测量工作

IHEP shall measure the transfer function and field uniformity of the prototype magnet for both vertical and horizontal excitation modes with and without shield and submit the results to SLAC for approval prior to manufacturing the production quantities of corrector magnets. IHEP shall measure the field uniformity of each production magnet with and without shield and submit the measurement data to SLAC.

高能所应在设屏蔽和不设屏蔽两种状态下测量样机的垂直和水平场的传导函数和场分布均匀性，将测量结果交SLAC，由SLAC审核批准━产铁的正式投产。高能所随後在设屏蔽和不设屏蔽两种状态下测量每一块生产校正铁的场分布均匀性，将测量数据交SLAC。

2. TOLERANCE OF INTEGRAL FIELD £¯场线积分误差

The field quality requirements for prototype and production magnets are defined in terms of field uniformity. The integrated field deviation normalized to the center field is +/-2% for both intergral vertical and horizontal steering field between Y = +/- 4 mm and X = +/- 10 mm with and without shielding when coils are excited at 30 Amp.

样机和生产铁的场的质量以场的均匀性为衡量标准。当线圈通30安培电流时，在设屏蔽和不设屏蔽两种状况测量，其Y=±4毫米和X=±10毫米范围内场均匀性误差相对于中心场的比值应小于2％。

3. MEASUREMENT £¯测量

3.1 Rotating Coil Positioning £¯旋测线圈的定位

The measurement coil center shall be located at the beam center showed in drawing SA444-406-07 C0 within a 0.5 mm radius.

测量线圈的中心应位于图纸SA444-406-07
C0ËùÊ¾µÄÊøÁ÷ÖÐÐÄ¡£Æäî»ÖÃÆ«²îÓ¦ÔÚ0.5ºÁÃ×°ë¾¶ ÄÚ¡£

3.2 Conditioning Cycle / 标准化循环

Prior to measurements, each magnet shall be conditioned three times. The current rate of rise and return to zero shall be approximately linear (avoid step functions) and shall take no less than 10 seconds per cycle. The maximum conditioning current shall be 33 Amp.

每块磁铁测量前，须经三次标准化循环。电流的提升和回零应相对呈直线（避免阶梯作用），各循环不应低于10秒。标准化循环最大电流为33安培。

3.3 Measurement Current £¯测量电流

Since the corrector magnet will be operated for negative as well as positive steering angles, negative as well as positive measurement currents are required. The “positive” magnet polarity for both the horizontal and vertical steering magnet can be arbitrary but must be clearly marked for each magnet prior to measurements. The polarity designation shall be consistent for all production magnets. It is permissible to remove and reattach the power supply with opposite polarity prior to making the measurements at negative currents if a bipolar power supply is not available at IHEP. The measurement currents shall be:

由于校正铁要同时具备正、负两种偏转角校正功能，所以测量时也需要正、负两种测量电流。磁-
胶痛怪毙U 〉乃 健罢 绷 臃绞娇梢允侨我馊范ü 摹５ -每块铁测量之前都要明确标明所测的极性。所有批量铁的所谓“正”或“负”极性采用统一模式。如果高能所没有双向电源，允许用不同的接线方式转换磁铁的“极”性。

测量电流为：

Winding Type 绕组	**Measurement Currents 测量电流**
Horizontal 水平	15, 20, 25, 30, 20, 15, -15, -20, -30 Amps
Vertical 垂直	15, 20, 25, 30, 20, 15, -15, -20, -30 Amps

3.4. Field Measurements £¯ 场质量测量

The corrector magnet shall be measured without the shield installed first. After the measurement the shield shall be installed and the magnet shall be remeasured.

校正铁应在安装屏蔽前先行测量一次。然后安装上屏蔽再测量一次。

4. MEASUREMENT RESULT £¯ 测量结果

4.1 Paper Document £¯ 纸文件

A hardcopy of all the pertinent magnetic measurement information shall be attached to the completed corrector and shipped along with the magnet to SLAC. The information included in this hardcopy shall be the magnet identification number, date and operator, a tabulation of the magnet measurement currents for both the vertical and horizontal modes, with and without the attached shield, the integrated dipole fields, and the multipole spectrum information at all measurement currents and conditions.

有关测量数据的纸文件应与完工的校正铁一起发往SLAC。纸文件应为表格形式，表格内容应包括磁铁身份号，测量日期，测量人，垂直和水平场各测量电流，设屏蔽和不设屏蔽状态，各场平和状态下的积分二极场以及高级分量数据。

4.2 Magnetic Media £¯ 磁盘文件

The raw integrator output before performing data reduction shall be stored in magnetic media and kept at IHEP. The raw data should include identifying information (magnet serial number, date, time, ambient temperature and operator). The reduced data, described in 4.1 shall also be archived in a magnetic media. A floppy disc containing the raw integrator output as well as the reduced data for one or more magnets shall be made and shall accompany the magnets as they are shipped to SLAC.

在做数据分析之前积分器输出的原始数据应由高能所磁盘存档。原始数据应包括鉴别资料（磁铁身份号，日期，时间，环境温度和测量人员）。处理后数据，4.1款所述内容也应存入磁盘。含一块或多块铁的所有这些数据的磁盘拷贝应与磁铁同时交付SLAC·