Cornell University
Cornell High Energy Synchrotron Source

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Compact PPM Undulator for Cornell High Energy Synchrotron Source*

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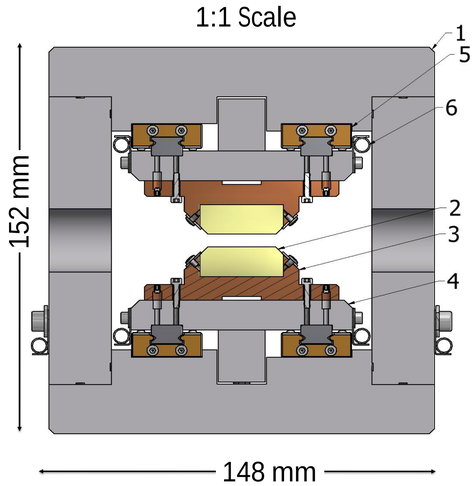
Project is motivated by the needs of Cornell High Energy Synchrotron Source (CHESS)

Undulator Concept (AP scheme[1])



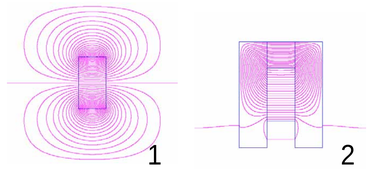
(1) – thick aluminum plates comprising the undulator frame;
(2) – permanent magnet blocks soldered to copper holders (3);
(4) – base plates holding PM block/holder assemblies;
(5) – miniature rails; (6) – cooling lines.

PPM structure, 24.4mm period, 1.1T peak field, 5mm constant gap . Dimensions: 1m x 152mm x 146mm, Weight - 83kg (with driver attached)

[1]R. Carr, Nucl. Instrum. Methods Phys. Res., Sect. A 306, 391 (1991)

Design and construction aspects

NdFeB (40SH) PM block soldering.



1. Single NdFeB (40SH) PM block, T_demag ~ 132^{0}C
2. PM block in steel jacked, T_demag ~ ***228^{0}C !***

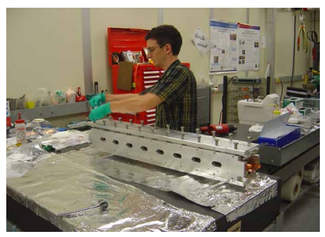
For soldering used 63/37 Sn/Pb alloy with 183^{0}C melting point .

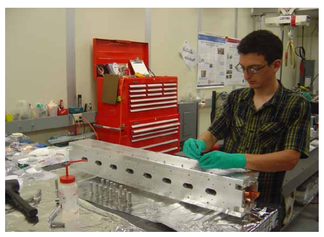
(US Patent 7,896,224)

Driver design

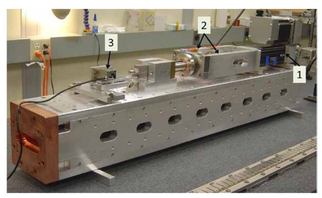
The magnet array (1) is moved by a pulling a stainless steel (SS) rod (3) connected to the magnet array via a SS plate (2). The SS tube (4) attached to undulator frame (6) by the blocks (5) provides the path for the reaction forces.

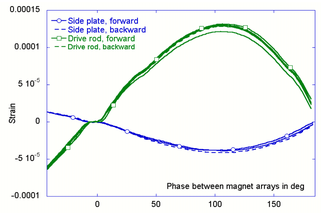
Undulator Assembly





Driver Test

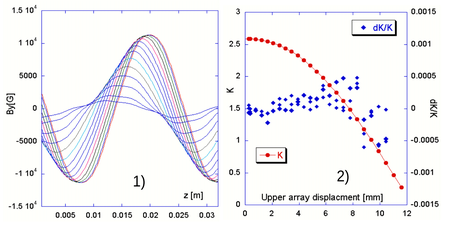




Two strain gauges were attached to driver rod and side plate. Strain data is in good agreement with model

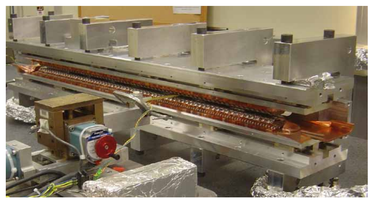
Magnetic field properties

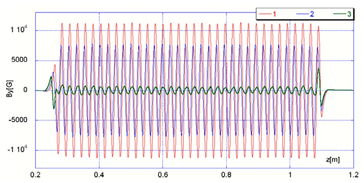
Short (33mm) scan result

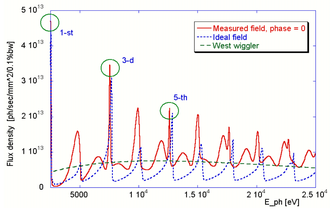


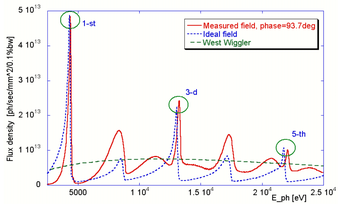
1. Field profile for various phases between magnet arrays
2. K as a function of phase

Full length scan result

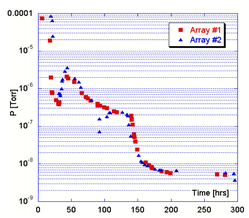


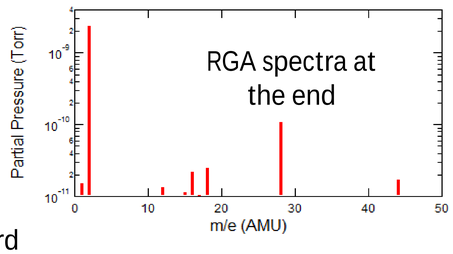






Vacuum property





70^{0}C, 100hrs baking record

Outgassing rate ~1.0x10^{-7} Torr*l/s per magnet array

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