PROGRESS AND STATUS IN SNS MAGNET MEASUREMENTS AT ORNL*

T. Hunter, S. Heimsoth, D. LeBon, R. McBrien, and J. G. Wang
SNS/ORNL, Oak Ridge, TN 37831-8218, USA

Abstract

The Spallation Neutron Source (SNS) contains more than 600 magnets. Among them, about 400 magnets for the Linac and transfer lines are being measured on site at Oak Ridge National Laboratory. These magnets include Permanent Magnet Quadrupoles, Electro-magnetic Quadrupoles, Dipoles and Correctors. The Permanent Magnet Quadrupoles are installed in the Drift Tube Linac (DTL) and are the only Permanent Magnets in the machine. These measurements are for magnets installed in the DTL, Coupled Cavity Linac (CCL), Superconducting Linac (SCL), High Energy Beam Transport (HEBT), and the Ring to Target Beam Transport (RTBT) line. All magnets have met specifications. Approximately three fourths of the magnets have so far been measured and installed. This presentation outlines the magnet measurements for SNS at ORNL and overviews the activities and accomplishments to date.

INTRODUCTION

The magnet measurement activity at ORNL is summarized in the chart below. Measurements are completed for the DTL, CCL, SCL and the HEBT. Measurements for RTBT magnets are underway.

Location	Magnet Type	Designation	Design	Quantity	ORNL Tasks # of Tests	Prototype?	Completed
DTL	EMD		LANL	24	24	Yes	24
	PMQ		LANL	160	160	Yes	160
CCL	Quad	R175QN40	LANL	1	1		1
	Quad	R177QN80	LANL	50	50	Yes	50
	Quad	R24QN80	LANL	2	2		2
SCL	Quad	8Q35	LANL	66	66	Yes	66
HEBT	Dipole	8D533	BNL	8	8	Yes	9
	Dipole	8D406	BNL	1	1		1
	Quad	12Q45	BNL	33	33	Yes	33
	Quad	21Q40	BNL	8	8		8
	Corrector	16CD20	BNL	15	15	Yes	15
	Corrector	27CD30	BNL	4	4		4
RTBT	Dipole	17D244	BNL	1	1		
	Quad	21Q40	BNL	23	23		8
	Quad	30Q44	BNL	2	2		
	Quad	30Q58	BNL	2	2		
	Corrector	27CD30	BNL	15	15		
	Corrector	41CD30	BNL	1	1		
Total				416	416		381

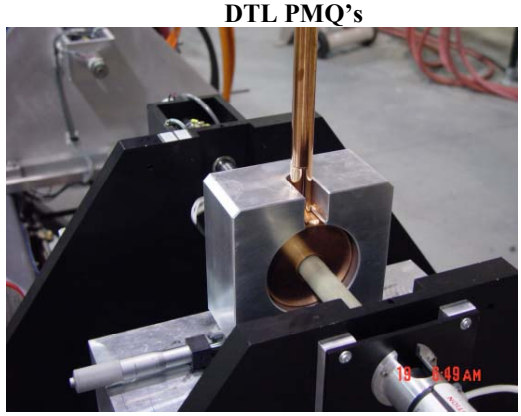
For Quadrupoles, magnetic center is located using the measurement coil center. The magnet is then current cycled and then G*L vs. Current is measured. Harmonics vs. Current are determined from these measurements. During measurements, cooling flow and delta-P, inlet and outlet temperature are recorded. Magnet Voltage vs. current is recorded.

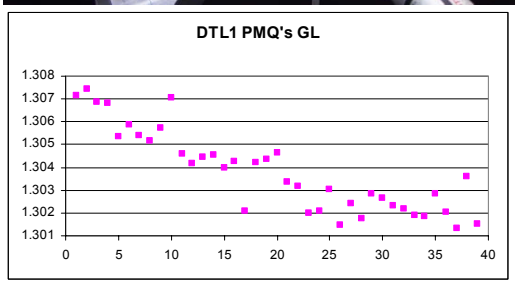
*SNS is managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. Department of Energy. . SNS is a partnership of six national laboratories: Argonne,Brookhaven, Jefferson, Lawrence Berkeley, Los Alamos and Oak Ridge

Each Quadrupole is fiducialized with respect to magnetic center. For Dipoles the situation is the same except that B*L vs. Current is measured. Correctors are the same as Dipoles but are not fiducialized.

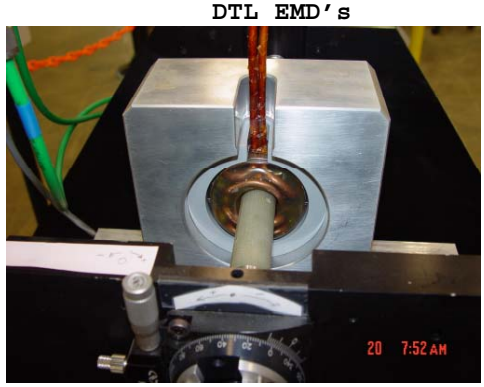
All Quadrupoles and correctors were measured using "Halbach" style coils [1]. The HEBT Dipoles were mapped using a planer coil that moved in the horizontal direction. What follows are pictures and graphs that show results of these measurements starting with the DTL and continuing on through the RTBT.

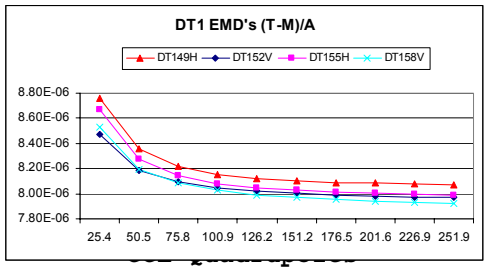
DTL PMQ's

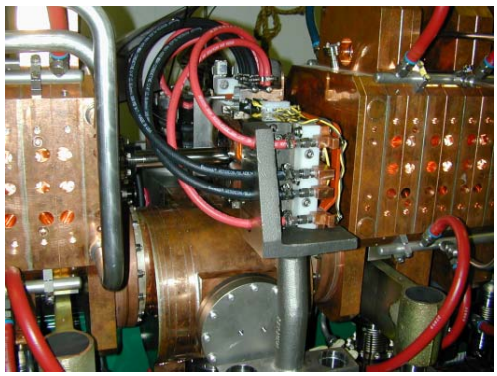


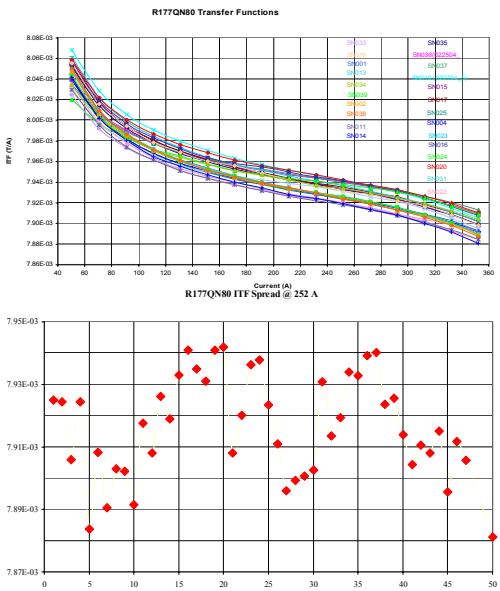


DTL EMD's





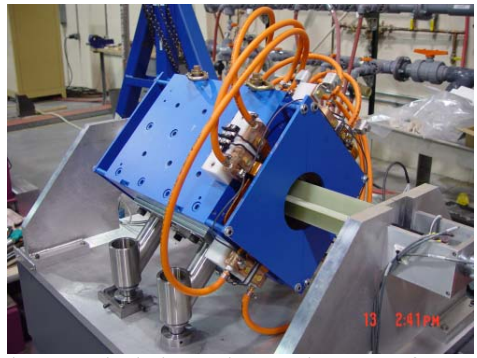




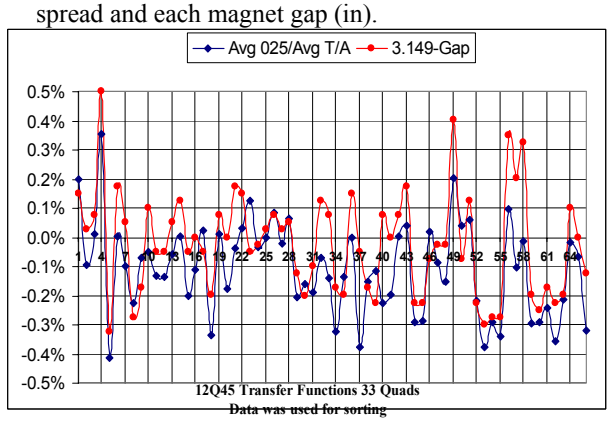
The above two graphs show the CCL Quad Transfer Functions vs. Current and the spread in Transfer Functions among all the magnets.

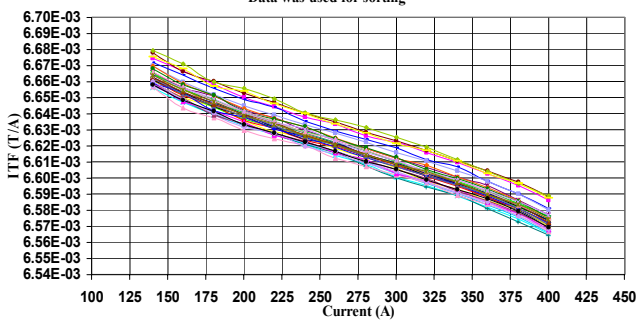
SCL 8Q35 MEASUREMENTS

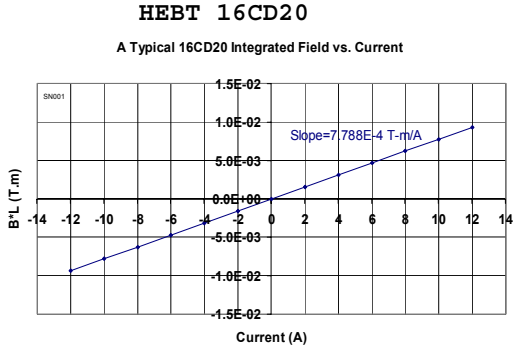
The SCL magnets are composed of nine singlets, 28 doublets and one spare. The doublets match within 0.1% of each transfer function.



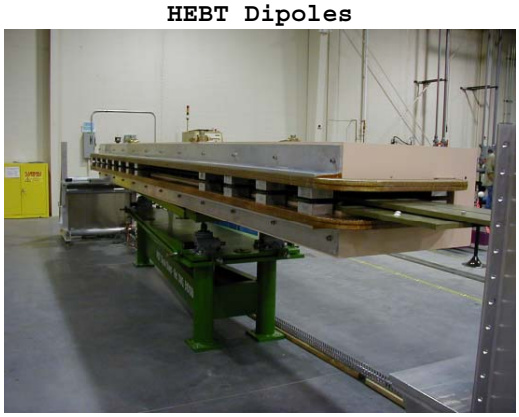
The Graph below shows the Transfer Function spread and each magnet gap (in).

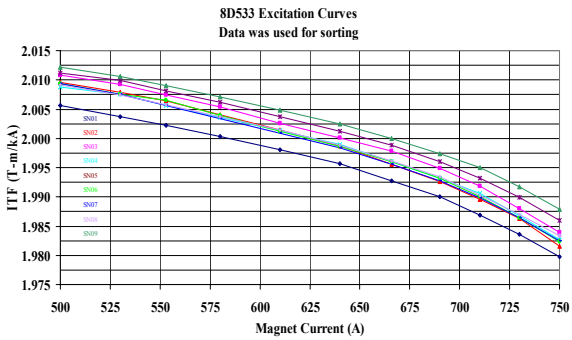




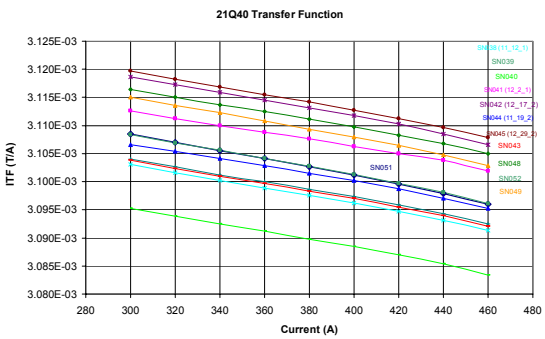


HEBT Dipoles

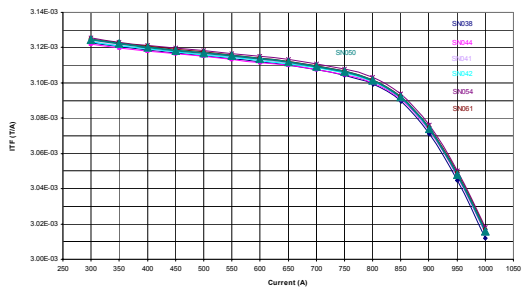




HEBT 21Q40

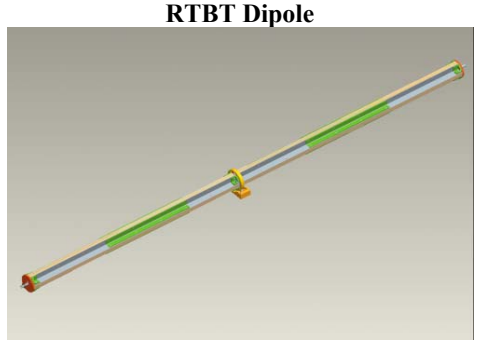


RTBT 21Q40



In the RTBT there will be three sets of four Quads and one set 0f three Quads. Each set will be on a common power supply. The Quads within each set have to be matched within 0.1%. In the above data, there are one set of four and one set of three matched to 0.1%.

RTBT Dipole



The RTBT dipole will be mapped using the above rotating "Halbach" style planer coil. At the moment, this coil is being assembled her at SNS. The magnet will be mapped in-situ using the installed power supply.

ACKNOWLEDGEMENTS

The author would like to thank Doug LeBon, Steve Heimsoth, Robert McBrien and J.G Wang for their good spirit and dedication over the last three years. They made all this possible. The author also thanks Danny Crisp who designed the above coil and Nick Grennell who performed design work on the 21Q40 system

REFERENCE

[1] K. Halbach, "The Hilac Quadrupole Measurement Equipment", Engineering Note, LBL, March 3, 1972