HRXSS Dipole Degauss Procedure.

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# Magnetic Measurements

When not being used, the remnant pole tip field of each Hard X-Ray Self Seeding (HXRSS) dipole must be < 5 Gauss [1] or < an integrated field of 1.82x10-4 T-m (1.82 G-m). Using a bipolar step method [2], several Main coil degauss current sequences were tested and one was selected which gave a low integral field measurement for the all the HXRSS dipole magnets, when both the Main and Trim coils set to zero current. The integral remnant field for all four dipole was measured to be much lower than the remnant field requirement. All measurements were made with the trims at zero current, the Main coil was put through the degauss cycle and then the Main coil was disconnected from the power supply using the same relay circuit that will be used when the magnets are installed.

The degauss fields were calculated using the formula I = (-1)n \* fn\*Imax, where

n = 0:49, f=0.88 and Imax = 6.0 amps. There are additional 0 currents at the beginning and the end of the sequence. When the above formula and bookend zeros are used a 52 point current sequence is calculated:

{0.0, 6.0000, -5.2800, 4.6464, -4.0888, 3.5982, -3.1664, 2.7864, -2.4521, 2.1578, -1.8989, 1.6710, -1.4705, 1.2940, -1.1387, 1.0021, -0.8818, 0.7760, -0.6829, 0.6010, -0.5288, 0.4654, -0.4095, 0.3604, -0.3171, 0.2791, -0.2456, 0.2161, -0.1902, 0.1674, -0.1473, 0.1296, -0.1141, 0.1004, -0.0883, 0.0777, -0.0684, 0.0602, -0.0530, 0.0466, -0.0410, 0.0361, -0.0318, 0.0280, -0.0246, 0.0216, -0.0190, 0.0168, -0.0148, 0.0130, -0.0114, 0.0}.

The degauss trim functions were carried out using a ramp rate of 10 A/sec and a wait time of 2 sec after each ramp. The ramp style is a three linear ramp where the first 90% of the ramp is at full ramp rate (10 A/sec in the case), the next 9% is at 1/10th the rate (1A/sec) and the last 1% is at 1/100th the rate (0.1A/sec). The degauss cycle procedure takes 142 seconds.

To test the degauss procedure each dipole was ramped through the degauss current sequence and then the MCOR power supply was disconnected from the Main coils of the dipoles using a switch. The integrated gradient of each dipole was measured and then the power supply disconnect switch was switched back on. At least four measurements were made for each magnet and the mean values of the integrated remnant fields are listed in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Magnet | Mean Remnant Integrated Field (T-m) | Standard Deviation (T-m) | # of measurements. | Pole Tip Field  (T) |
| BXHS1 | -5.3354E-05 | 2.2338E-06 | 8 | -1.4674E-4 |
| BXHS2 | 6.97668E-06 | 5.18758E-06 | 6 | 1.9188E-6 |
| BXHS3 | -1.5151E-05 | 2.8442E-06 | 4 | -4.1669E-5 |
| BXHS4 | -5.0338E-05 | 2.4897E-06 | 5 | -1.3844E-4 |

The mean remnant integrated field of all of the magnets are all less than the tolerance of 1.82x10-4 T-m. The Pole Tip field is calculated using the magnet effective length of 0.36360 m. Using the degauss cycle procedure described above will give an integrated remnant field for each dipole lower than the tolerance.

# Tunnel Measurements and Ramp Rate Change.

After all four dipoles were installed, the degauss routine prescribed above was run and it was found that the pole tip fields measured exceeded the expected fields. It was determined that with all four magnets hooked to one MCOR driver card, the inductance was too large for the card to ramp at 10 A/s. The ramp rate was lowered to 2 A/s and the degauss then worked as measured in the Magnetic Measurements lab. It should be noted that lowering the ramp rate shouldn’t change the end point of the degauss field, since it is the current sequence that is the most important factor is a degauss procedure.