SRXSS Dipole Degauss Procedure.

Scott Anderson

7/19/2013

When not being used, the remnant pole tip field of each Soft X-Ray Self Seeding (SXRSS) 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 = 0:51, f=0.88 and Imax = 9.0 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 54 point current sequence is calculated:

{0.0, 9.0000, -7.9200, 6.9696, -6.1332, 5.3973, -4.7496, 4.1796, -3.6781, 3.2367, -2.8483, 2.5065, -2.2057, 1.9410, -1.7081, 1.5031, -1.3228, 1.1640,

-1.0243, 0.9014, -0.7933, 0.6981, -0.6143, 0.5406, -0.4757, 0.4186, -0.3684, 0.3242, -0.2853, 0.2510, -0.2209, 0.1944, -0.1711, 0.1506, -0.1325, 0.1166,

-0.1026, 0.0903, -0.0795, 0.0699, -0.0615, 0.0541, -0.0476, 0.0419, -0.0369, 0.0325, -0.0286, 0.0251, -0.0221, 0.0195, -0.0171, 0.0151, -0.0133, 0.0}.

The degauss trim functions were carried out using a ramp rate of 1 A/sec and a wait time of 5 sec after each ramp. The ramp style is a three linear ramp where the first 90% of the ramp is at full ramp rate (1 A/sec in the case), the next 9% is at 1/10th the rate (0.1 A/sec) and the last 1% is at 1/100th the rate (0.01A/sec). The degauss cycle procedure takes 484 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 Meas | Calculated Mean Pole Tip Field  (T) |
| BXSS1 | -2.3692e-05 | 1.4833e-05 | 12 | -6.52e-05 |
| BXSS2 | -1.8325e-05 | 4.4747e-06 | 4 | -5.04e-05 |
| BXSS3 | -1.3600e-05 | 2.3195e-06 | 4 | -3.7404e-05 |
| BXSS4 | -1.7775e-05 | 4.5419e-06 | 4 | -4.8886e-05 |

The mean remnant integrated field of all of the magnets are all less than the tolerance of 1.82x10-4 T-m. The Calculated Mean Pole Tip field is calculated using the magnet effective length of 0.36360 (length + gap) m.

Using the degauss cycle procedure described above will give an integrated remnant field for each dipole lower than the tolerance.

When the magnets were installed in the field the degauss procedure was checked and yielded between 0.8 and 1.2 Gauss for the pole tip field for the 1 A/s ramp rate and 5 sec settle time. The measurements were made at the middle of the pole in z and the on the –x side, since the vacuum chamber takes up most of the pole width. To speed up the procedure the degauss was changed to use a 2 A/s ramp rate and a 2 sec settle time. After this degauss the yielded a pole tip field between 0.4 and 0.8 Gauss, again measured at the middle of the pole in z and the on the –x side. The 2 A/s rate and 2 sec settle degauss will be used for running.