Readjusing the supporting magnet of the Superconducting Gravimeter T016

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The superconducting gravimeter (SG) T016 was installed at the Kamioka station, Gifu, Japan in October 2004. It was noticed in 2007 that the initially adjusted gradient of the supporting magnetic field, which corresponds to the mechanical spring constant, was too large, resulting in an insufficient gain of the open-loop response and therefore a problematic closed-loop response of the gravity sensor. This might have a slight effect on the noise level of the gravimeter. Here we report readjustment of the magnetic field of T016 and a measurement of the improved frequency response.

Readjustment of the magnetic field was made in November 2008. The initial value of the gradient was 0.53 V / 10 mA @ BD = 1 (here we quote the inverse of the gradient). When the gradient was weakened to about 2 V / 10 mA @ BD = 1, we observed a doubly stabilized state of the superconducting sphere. Finally, the gradient was set to 1.14 V / 10 mA @ BD = 1, about two times weaker than at first.

After the adjustment of the magnetic field, we measured the frequency response to verify the effect of the weakened gradient. The DC gain of the open-loop response (which takes a similar numerical value as the inverse magnetic gradient) was found to be 1.212. Comparing this with the previous value (0.524) obtained in October 2007, we can conclude that the gradient has changed by a factor of 2.31. The mechanical eigenfrequency after the readjustment was 0.16 Hz. The closed-loop response of T016 as an accelerometer is now greatly improved in that the gain is flat to higher frequencies and also that the phase shift is significantly smaller.

It is because the instructions given in the old operating manual was followed that the magnetic gradient was initially adjusted to a too large value for T016. With the gravity card revision 2, the recommended range of the gradient should be 0.7 to 2.0 V / 10 mA at BD = 1. Care must be taken about this modification when the revised card is used with GEP-2.