Single Beam Caesium SERF Magnetometry for MEG

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Spin exchange relaxation free (SERF) optically pumped magnetometers (OPM) have in recent years been a hot topic for biomagnetic field detection with the ultimate goal of replacing SQUIDs as the industry standard. Magnetoencephalography (MEG) is one the fields that is in question as if they can be detected and understood could lead to a better understanding of how the brain functions while also having the advantage over SQUIDs of being far cheaper to build and operate due to them not needing to be cryogenically cooled [1,2]. Exploring the possibility of using a single beam caesium (Cs) based SERF sensor for this as there are benefits of operating temperature over other alkali metals such a rubidium (Rb) and potassium (K) while the single beam configuration lends itself to miniaturising the device alongside using a MEMS cell. A sensitivity of 292 fT/sqrt(Hz) has currently been achieved which is still a factor of 30 away from the target sensitivity of 10 fT/sqrt(Hz) in the 1 - 100 Hz range, but with ongoing progress.

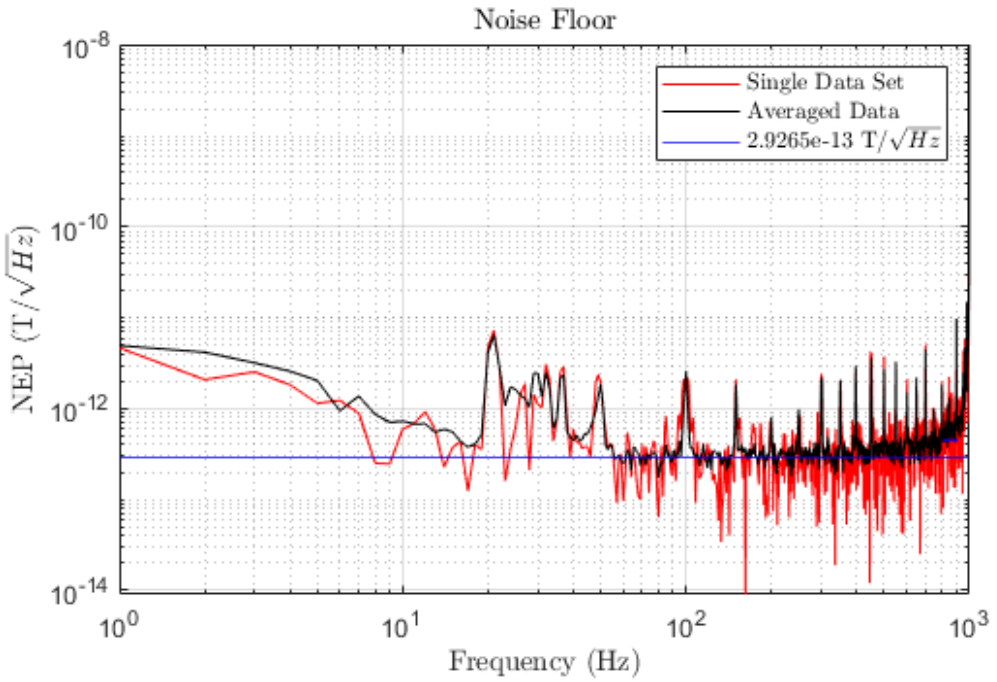

Figure 1: Sensitivity measurement showing the current highest value. This is achieved by averaging ten samples the reduce the noise in the higher frequency range

References

[1] Boto, Elena, et al. "On the potential of a new generation of magnetometers for MEG: a beamformer simulation study." PloS one 11.8 (2016): e0157655

[2] Iivanainen, Joonas, et al. "On-scalp MEG system utilizing an actively shielded array of optically-pumped magnetometers." Neuroimage 194 (2019): 244-258.