Response to Interactive comment on “Low-Noise Permalloy Ring-Cores for Fluxgate Magnetometers” by David M. Miles et al. by Anonymous Referee #1 on 18 June 2019.

We thank the referee for the constructive comments which we have incorporated into the manuscript. Referee #1 raised several questions and issues which we address below; the referee’s comments are in plain text our responses in *italics* and any content added to or changed in the manuscript are in *“quoted italics*

The authors present the production of 6-81 permalloy based low-noise ring-cores essential for high-quality, science-grade fluxgate instrumentation. This is very important work for the community since especially the North American market dramatically lacks manufactures for this type of magnetic sensing element due to the fact that Infinetics Inc. stopped the production in 1996. The paper is very well written, clearly understandable and an appropriate number of citations is included.

There are two general remarks:

1) The authors miss to mention the ring-core development activities in Europe. This fact gets especially obvious with the citation of Carr et al., 2005 as a potential use of Infinetics ring-cores. This is not correct. The outboard sensor was produced by Ultra Electronics (Kellock et al., 1996 and Carr et al., 2007) in the UK and the inboard sensor was developed by the Technical University in Braunschweig, Germany (Fornacon et al. 1999 and Auster et al. 2008). In addition, there has also been a very relevant ring-core production at the DTU in Kopenhagen (e.g. Nielsen et al., 1999).

We agree with the reviewer that the outboard sensor on Double Star was manufactured by Ultra Electronics. However, there is significant, albeit circumstantial, evidence that it was manufactured from Infinetics S1000 ring-cores. Around 1993 there was a management buy-out at Ultra Electronics that appears to have included Domain Magnetics/Dowty Aerospace who are known to have held significant stock of Infinetics ring-cores. The Double Star sensor has comparable geometry to the Cassiope/e-POP sensor suggesting that its ring-cores are at least geometrically similar to the Infinetics S1000 and have similar noise performance of <7 pT/√Hz at 1 Hz (Carr, 2006). Finally, Ultra Electronics has stated the ring-cores were manufactured in the USA (Carr, personal communication, 2013).

Text added: “In some cases, the providence of the ring-cores is complicated and difficult to know for certain. For example, the outboard sensor on Double Star was manufactured by Ultra Electronics (Carr et al., 2005), the inboard sensor having been developed at the Technical University in Braunschweig, Germany (Auster et al., 2008; Fornacon et al., 1999). However, there is significant, albeit circumstantial, evidence that the Ultra Electronics sensor was manufactured from Infinetics S1000 ring-cores. Around 1993 there was a management buy-out at Ultra Electronics that appears to have included Domain Magnetics/Dowty Aerospace who are known to have held significant stock of Infinetics ring-cores. The Double Star sensor has comparable geometry to the Cassiope/e-POP (Wallis et al., 2015) sensor suggesting that its ring-cores are at least geometrically similar to the Infinetics S1000. Ultra Electronics sensors also have similar noise performance of <7 pT/√Hz at 1 Hz (Carr et al., 2007; Kellock et al., 1996) . Finally, Ultra Electronics has stated the ring-cores were manufactured in the USA (Carr, 2013 personal communication).”

The pointer to the ring-core production at DTU is well made and was raised by both reviewers. We have added a description of these activities, and other European work in the new Section 7 Discussion.

Text added: - See new Section 7

Auster, H.U., Glassmeier, K.H., Magnes, W., Aydogar, O., Baumjohann, W., Constantinescu, D., Fischer, D., Fornacon, K.H., Georgescu, E., Harvey, P., Hillenmaier, O., Kroth, R., Ludlam, M., Narita, Y., Nakamura, R., Okrafka, K., Plaschke, F., Richter, I., Schwarzl, H., Stoll, B., Valavanoglou, A., Wiedemann, M., 2008. The THEMIS Fluxgate Magnetometer. Space Sci Rev 141, 235–264. https://doi.org/10.1007/s11214- 008-9365-9

Carr et al., A Magnetometer For The Solar Orbiter Mission, The Second Solar Orbiter Workshop, 16-20 October 2006, Athens, Greece, ESA Publ. Div. (2007) https://www.researchgate.net/publication/41625175_A_Magnetometer_For_The_Solar_Orbiter_Mission

Fornacon, K.-H., Auster, H.U., Georgescu, E., Baumjohann, W., Glassmeier, K.-H., Haerendel, G., Rustenbach, J., Dunlop, M., 1999. The magnetic field experiment onboard Equator-S and its scientific possibilities. Annales Geophysicae 17, 1521–1527. https://doi.org/10.1007/s00585-999-1521-3

Nielsen, O.V., Brauer, P., Primdahl, F., Risbo, T., Jørgensen, J.L., Boe, C., Deyerler, M., Bauereisen, S., 1997. A high-precision triaxial fluxgate sensor for space applications: layout and choice of materials. Sensors and Actuators A: Physical 59, 168–176. https://doi.org/10.1016/S0924-4247(97)80169-0

2) The authors primarily focus on the noise level of the ring-cores at 1 Hz and forget about the offset stability with ring-core temperature. This is a very important parameter for a "science grade" fluxgate instrumentation. This shortcoming should be discussed in Section 6 (Performance of the Ring-Cores) and/or Section 8 (Future Work).

We agree – investigations of offset stability would be particularly valuable given the limited existing literature on the topic.

Text added: "The presented work has focused on manufacturing ring-cores that meet the commonly accepted noise level of < 10 pT / √Hz at 1 Hz. Future work will need to include investigation of other performance metrics including changes in the offset stability, gain, and noise of the ring-core with temperature."