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Interactive comment on "Magnetometer in-flight offset accuracy for the BepiColombo spacecraft" *by* Daniel Schmid et al.

Anonymous Referee #1

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The submitted manuscript presents an approach to calibrating offsets on the magnetometers onboard BepiColombo's Mercury Planetary Orbiter and Mercury Magnetospheric Orbiter spacecraft. This calibration analysis includes the use of mirror mode wave observations as a method to determine the spin-axis offset. Mio would be able to utilize this approach as a complementary method to an analysis of Alfvenic fluctuations in the pristine solar wind. MPO, on the other hand, will not measure the solar wind and therefore, observations within Mercury's magnetosphere must be used to calibrate measurements. The manuscript presents an analysis of the compressional fluctuations in Mercury's space environment by analyzing four years of MESSENGER magnetometer data. While the analysis presented here is sound and nicely justified, the paper did not convincingly demonstrate that this calibration technique would be

sufficient to perform scientific investigations with the MPO magnetic field observations. The conclusion describes that 780 hours of observations within the magnetosphere are needed to achieve an accuracy better than 1.0 nT; however, many MESSENGER publications including magnetic field data report on signatures that require measurements within this level of uncertainty. Additionally, the manuscript did not describe whether it is expected that MPO will be able to collect compressible fluctuations for 780 hours or more during the mission lifetime. Finally, the major conclusion for application to MPO is that "the 3D mirror mode method developed by (Plaschke et al., 2017) should be applicable to MPO…" but the paper does not describe this method or how it differs from the analysis presented here. The analysis in this paper only provides a single-axis offset – how does this methodology provide vector calibration? Prior to publication, these issues need to be addressed regarding a demonstration of the 3D mirror mode and the ability to use MPO calibrated data with an accuracy of $\sim$1.0 nT for mission science. Additional comments are listed below:

Paragraph beginning at line 65: The text should also include a description of performing spacecraft rolls as a well-established method for determining offsets. This has been done with routinely with many missions, most recently including MAVEN at Mars and Parker Solar Probe.

Please change all references to MESSENGER into the past tense: Line 100: "MESSENGER is highly" -> "MESSENGER was highly" Line 101: "altitudes ranges" -> "altitudes ranged" Line 101: "form" -> "from" Line 102: "MESSENGER crosses the magnetopause" -> "MESSENGER crossed the magnetopause" Line 107: "MESSENGER is a three-axis-stabilized" -> "MESSENGER was a three-axis-stabilized"

Line 150-152: Please define the mean-field-aligned coordinates system and how it is calculated.

Line 225 – 227: "Note that, although standard deviation of the individual offsets Ozn might be large, a larger number of samples or events helps lower the value of the standard deviation of the mean offset Ozn (standard error in Table 2)." However, given the small percentage of occurrence rate showed in table 1 – will a large number of samples actually be possible?

Line 270-273: "We find that the offset determination method proposed by Plaschke and Narita (2016) is well applicable to the data from the Hermean environment. It can hence be used for in-flight calibration of the magnetometers onboard Mio and MPO." – While the offset analysis presented here is sound and well-described, it does not demonstrate the application of Plaschke et al (2017) to the MPO dataset, which is most important to derive calibrated vector measurements..

Line 274: "As is been seen in. . ." please revise wording

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