Replies to the Referee 1

'RC1: 'Comment on angeo-2021-24', Anonymous Referee 1, 18 May 2021

General Statement: This manuscript summarizes the particles and fields measurements and initial results returned by the BepiColombo Mercury mission during its first Venus flyby (VFB-1) on 15 October 2021. While nearly all aspects of such flybys are driven by requirements related to the spacecraft's safety and timely arrival at their primary destinations, these events constitute special opportunities that have produced important "bonus" science on previous missions. The manuscript is well-constructed and the writing is quite good. All key aspects of the VFB-1 operations and instrument performance are well-documented. New science results from the initial analyses of these measurements indicate that Venus' draped magnetic field tail extends at least 48 Rv downstream of the planet and that the period for tail "flapping" is much broader than previously observed, at least 3 to 7 min. Some minor suggestions are provided below, however, the manuscript reports important new observations of the solar wind interaction with Venus and significant new science results. Further, the BepiColombo VFB-1 data set is documented in detail for future scientific studies to follow. Accordingly, I recommend that the manuscript be published with only minor revisions.

Specific Comments and Suggestions: Lines 41-49: I think you should not spend too much time on history, but first surveys of the Venus magnetotail were carried out by the Venera 9 and 10 orbiters in 1975-1976 (for details see Verigin et al., Plasma analysis, JGR, August, 1978; Eroshenko et al., induced magnetic tail, Cosmic Research, 17, 17, 1979). This is very near the time of Mariner 10 primarily magnetosheath flyby, but for the sake of completeness you might consider referencing Venera and 9 and 10's historic contribution.

Answer: For completeness we have mentioned the Venera 9 and 10 orbiters in the text here.

Section 2 "The Data": The description of the BepiColombo mission and the impact of the stacked science spacecraft and SEP carrier cruise configuration may be too brief for Readers who are not already familiar with the mission. You do note the impact of the cruise configuration on the field-of-view of some individual particle instruments in isolated sentences later in the text. However, I would recommend at least a brief overview of BepiColombo's cruise configuration (e.g., MMO behind heat shielding; MPO MAG further from "SEP carrier module" but still seeing some stray B-field contamination) early in Section 2 to provide context for the instrumental considerations that follow.

Answer: We have added a short paragraph at the beginning of Section 2 to describe the cruise phase formation of the spacecraft, indicating that instruments can be impeded in their performance.

Section 3.2: The smoothed magnetic field data and the limited number of cross-tail current sheet crossings may preclude this analysis, but did you examine the angular rotation of B as BC traversed the cross-tail current sheet,? If you did, then were the rotations ¡ 180 deg and, if so, by how much? After the draped IMF flux tubes that make up the "induced" tail slip about the Venus ionosphere and move downstream, they start to "unkink" as the ionospheric plasma and pickup ions from the dayside and flank interaction regions are accelerated by the J x B (aka "magnetic sling-shot" effect – just like in a comet tail) in the cross-tail current sheet. This effect was observed

very clearly in the Pioneer Venus Orbiter data with the magnetic field rotations across the current sheet decreasing (i.e. increasingly below 180 deg) as the downtail distance grew and the speed of the O+ in the cross-tail current sheet increased toward solar wind speeds (Slavin et al., JGR, 1989). Given that, as you point out, the BepiColombo VFB1 Tail encounters were further downtail than the PVO sampling a measurement of the magnetic field rotation across the current sheet crossings would be of great interest, if it is possible with these data?.

Answer: We would like to thank the referee for this interesting question. We know that the magnetotail is flapping, and thus there should be a possibility to check this "unkinking" of the field lines in the tail. We should keep in mind though that the spacecraft remains at $Z_{\mathrm{VSO}} \approx 1$ whilst crossing the tail in the Y_{VSO}-direction. This means that only large oscillations of the tail will probably make the spacecraft cross from one lobe to the other, something discussed in the oscillations and flapping sections in the text. Nevertheless, we used low-pass filtered data, for periods longer than 30 minutes, to study the large-scale cone angle and looked at large rotations. These were found and indeed there is an indication that the rotation gets smaller as BepiColombo moves farther down the tail, from $\sim 132^{\circ}$ at X = -15 to $\sim 60^{\circ}$ at X = -45.