

RESPONSE TO REVIEWER COMMENTS

We thank the reviewer for their careful and constructive reading of the manuscript. The comments identified genuine gaps in precision and consistency across several sections and addressing them should have substantially improved the manuscript. We respond to each point below and have revised the manuscript accordingly (changes marked in red).

MAJOR COMMENTS

1. Figure 13 (Tudat Doppler comparison), quantitative interpretation. We agree that the original figure and text conflated the raw and detrended residuals. We have reworked both. The raw observed-minus-computed residuals at Hartebeesthoek have an RMS of 36.2 mHz, dominated by a near-constant fitted offset of 32.9 mHz. After removing this offset and slope, the detrended RMS is 3.8 mHz. The revised text explicitly states that this detrended value is the short-timescale scatter only, not the absolute measurement-prediction agreement. The new figure shows both the raw and detrended residuals. We also now report the comparison for the other stations: Yarragadee and Hobart agree with Hartebeesthoek in order of magnitude; Katherine could not be included owing to a backend convergence issue; Ceduna's residual is elevated, consistent with the reference-frequency instability already noted in the manuscript.

2. Distinguishing VLBI detection/imaging from an astrometric measurement. We agree this distinction was blurred. We have added explicit statements, consistent with each other, in the Abstract, Introduction, Section 3.1, and Conclusions: the phase-referencing observations demonstrated interferometric detection and imaging of JUICE but did not yield an independent PRIDE astrometric position of the spacecraft in this campaign.

3. Section 3.5, phase fluctuation and TEC interpretation. We have rewritten the relevant paragraph to remove the apparent contradiction between the ionosphere, electronic-noise, and tropospheric/spacecraft attributions. The ionospheric TEC values are now stated to come directly from IGS GIM maps; the quoted uncertainties are the standard deviation of the per-scan line-of-sight estimates over the session; and the residual (21.0 tecu) is now explicitly described as an equivalent TEC converted from leftover phase fluctuation.

4. Figure quality and readability. All figures named by the reviewer (Figs. 5–7 and 10–15) have been regenerated in vector (PDF) format with larger fonts. The caption of the Figure 2 now includes the geographic coordinates of every station in its caption.

MINOR COMMENTS

- **Introduction** (μ as accuracy): Done as requested. The tens-to-hundreds-of- μ as figure is now explicitly attributed to Mars Express/Venus Express heritage and stated as the target performance for JUICE.
- **Section 2.1** (maser coherence): Done as requested. The text now states each station carries an independent hydrogen-maser reference providing local frequency stability.

- **Section 2.1** ("12 GHz" bandwidth): Done as requested. Clarified as a 12 GHz instantaneous bandwidth spanning 2–14 GHz.
- **Section 2.2** (Doppler noise definition / Table 3 discrepancy): Done as requested. Doppler noise is now explicitly defined, and Table 3 has been recomputed.
- **Section 2.2** (integration time): Done as requested. The manuscript now states the SWspec (1 s/10 Hz for most sessions) and dPLL (always 10 s/0.2 Hz) integration parameters, and that all reported Doppler figures use the dPLL output.
- **Section 3.1** (SBD attribution): Done as requested. The attribution to the SPICE kernels has been softened and the other contributing error sources (station clocks, propagation, instrumental delays, coordinate uncertainties) are now listed explicitly.
- **Figure 5** (self-cal astrometric meaning): Done as requested. The caption now states explicitly that the inter-scan offsets carry no astrometric meaning.
- **Section 3.2** (Aug 13 offset): Done as requested. The coordinate error is now quantified (~20 arcmin, spacecraft only) and identified as the dominant cause.
- **Figure 6** (tenfold noise increase): Done as requested. A physical explanation (ground maser reference vs. onboard USO stability in two-way vs. one-way mode) has been added.
- **Table 2/Section 3.3** (observing-time consistency): Table 3's caption now clarifies that its "Length" column reports the duration of valid recorded data, distinct from the nominal tracking.
- **Table 3** (SNR values): Done as requested. The table has been recomputed with corrected values, and the Ceduna anomaly is explained in the text.
- **Figure 3** ("60 dBs"): Done as requested; corrected to "dB".
- **Figure 10** ("closest approach"): Done as requested. The caption now defines this as the epoch of minimum physical JUICE–Moon distance from the mission trajectory, not the apparent geometry seen from Hartebeesthoek.
- **Figure 15** (Kolmogorov vs. electronic noise): Done as requested. The caption now restricts the Kolmogorov/turbulence interpretation to the scintillation band, distinct from the higher-frequency electronic-noise peaks.
- **Figure 16** (solar-wind model parameters): Done as requested. The caption now states that the nominal/slow/fast curves use the model and wind-speed/density parameters in the 2014 paper.
- **Section 4** ("radial" velocity): Done as requested; corrected to "apparent transverse" velocity.
- **Section 4** (calibrator angular separation): We have not added the specific separation values here, since the revised Section 3.2 discussion (see above) already establishes that pointing loss.
- **Conclusions** ("continuous-tracking" mode): Done as requested. The statement is now scoped explicitly to the non-VLBI (single-dish) experiments.
- **Conclusions** ("nine experiments"): Done as requested. This is now explicitly scoped to the full two-year JUICE campaign, and the language softened to "most yielding reliable correlation."