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L1 CPR product status

TOMIYAMA Nobuhiro^{*1}, NAKATSUKA Hirotaka^{*1}, HORIE Hiroaki^{*2}

^{*1}) Japan Aerospace Exploration Agency (JAXA),

^{*2}) National Institute of Information and Communications Technology (NICT)

- This presentation will cover recent events in CPR operations focus on the status of the L1b processor & product and their future update plans.

- As a recent major event of CPR operation, there was a long-term interruption of the CPR observation.
 - ✓ CPR outage from May 2 – May 13, 2026.
 - ✓ CPR has a “Software Auto Restart” function to restart HPT (High Power Transmitter) activation, however it was interrupted unexpectedly.
 - ✓ The issue is mainly related to an incorrect setting of timeout variables for avoiding unexpected HPT condition, which was found to interfere with SWAR re-activation.
 - ✓ The issue had already been corrected with the proper setting, then CPR is now on the stable conditions.
 - ✓ **This event and its countermeasures never affected the CPR performance and there was no need for the CPR L1b processor update.**

Introduction (cont'd)



➤ The following table shows the L1b processor update history after public release of L1b product. You can refer the details of update contents in the release note:

https://www.eorc.jaxa.jp/EARTHCARE/document/doc_index_e.html

Ver.	Release	Main update-point
vCa	14 Jan. 2025	[Major update] CPR L1b products were released to the Public.
vCb	13 Mar. 2025	Modification of the radiometric levels
vCc	9 Jul. 2025	Change of observation altitude in MIX sub-mode observation
vCd	6 Aug. 2025	Resolution improvement of the Noise Floor Power
vDa	16 Oct. 2025	[Major update] Equalization of the echo power level difference which now exists before/after vCb.
vDb	23 Mar. 2026 (adopted from: 25 May 2026)	This is a minor update related to a system upgrade. There are no changes to the L1 processing or L1b product compared with “vDa”.

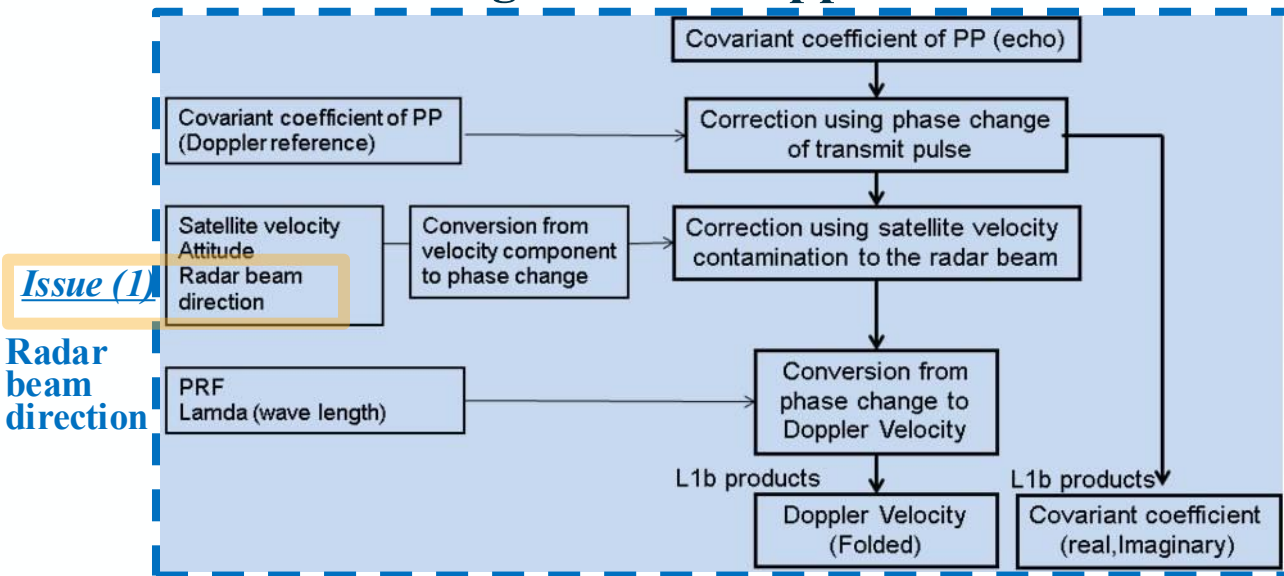
➤ In the evaluation of observational data and calibration data, the need to change calibration coefficients or other processing parameters in the CPR L1b process has not been confirmed.

➤ However, there are two open issues in current CPR L1 processor, **Issue(1):** Beam pointing error correction and **Issue(2):** DEM update. And JAXA will reflect these points in next update.

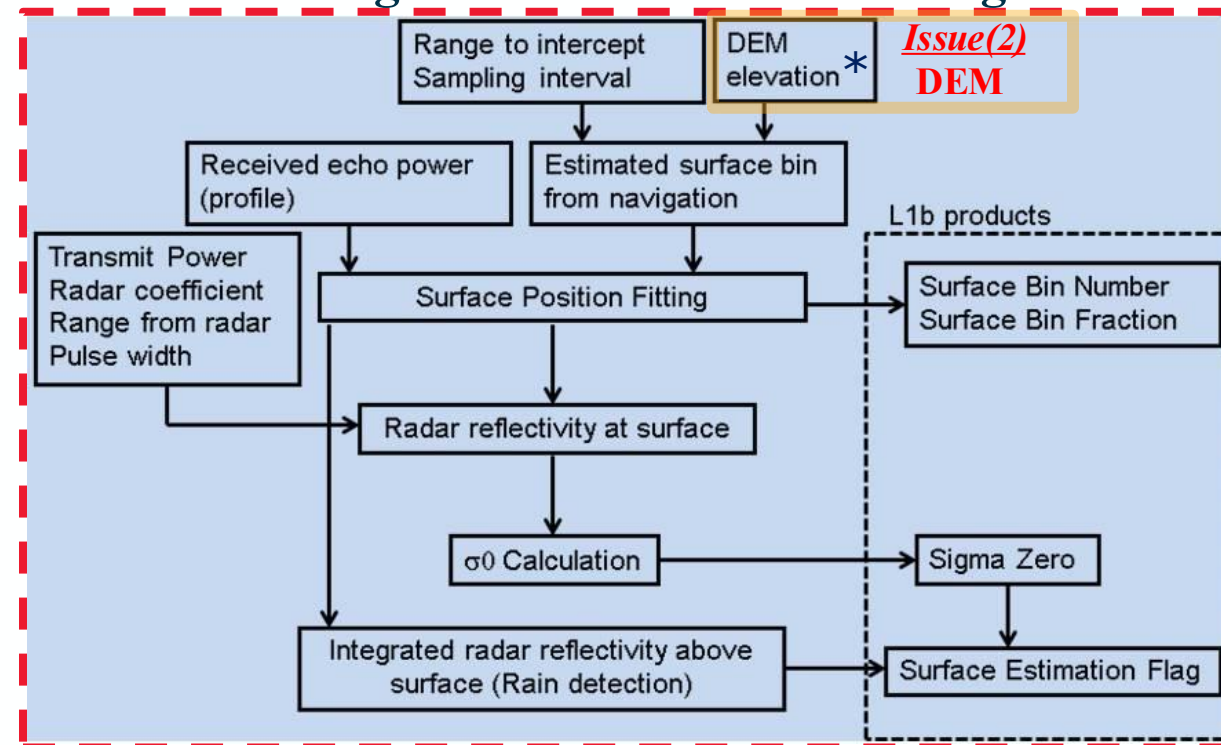
Open Issues

- Beam pointing error directly affects the accuracy of Doppler velocity calculation. The pointing errors caused by thermal distortion of the CPR antenna shall be corrected in the CPR L1b product.
- The value of DEM data is used as an initial reference point for calculating the ground surface position, and if the surface detection fails, the height of DEM is output in L1b product even though the quality flag is set.

Processing flow for Doppler calculation*



Processing flow for surface echo range

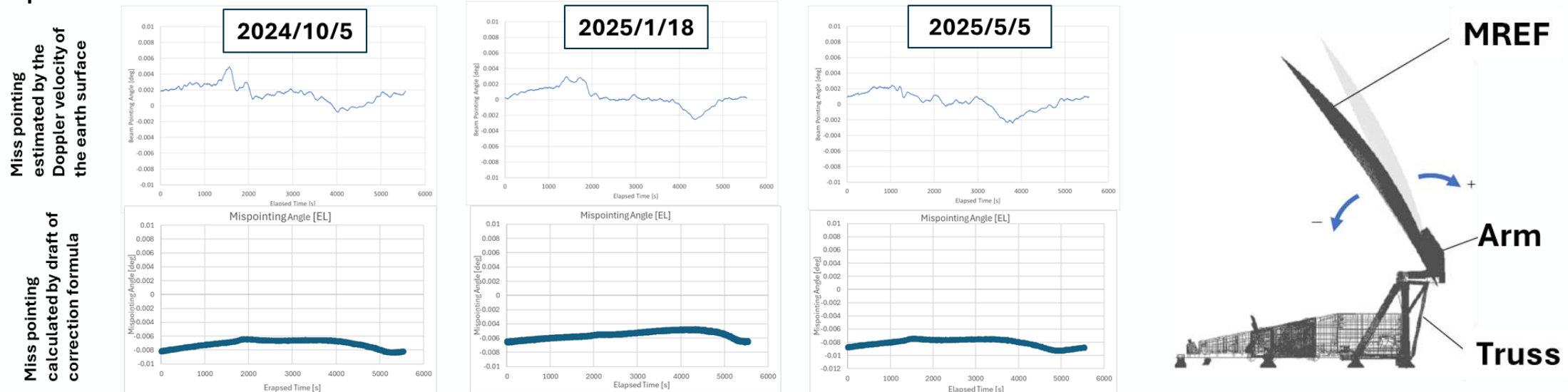


- These figures derived from the ATBD document (SEC-140039 EarthCARE/CPR L1b ATBD:
https://www.eorc.jaxa.jp/EARTHCARE/document/doc_index_e.html

Beam pointing error correction



- Although it has been estimated that the accuracy of the Doppler velocity meets the specifications, evaluation of the Doppler velocity on the Earth's surface revealed that the Doppler velocity of the L1b product contains a slight error including the miss-pointing of the CPR.
- Therefore, in current L2 echo product, Bias correction products are implemented.
- JAXA had estimated that the root cause of this error was derived from the thermal distortion of the Main Reflector (MREF) and it could be calculated with MREF temperatures. But as the result of initial review, it was found that overall pointing error profile estimated from the surface doppler velocity in the product could not simulated only with MREF temperatures. Then JAXA continues the review by adding Arm and Truss temperatures.

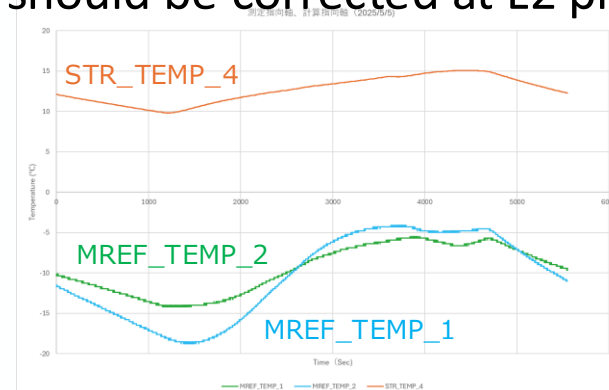
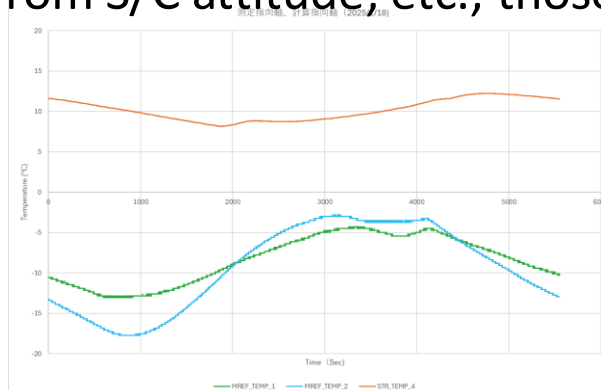
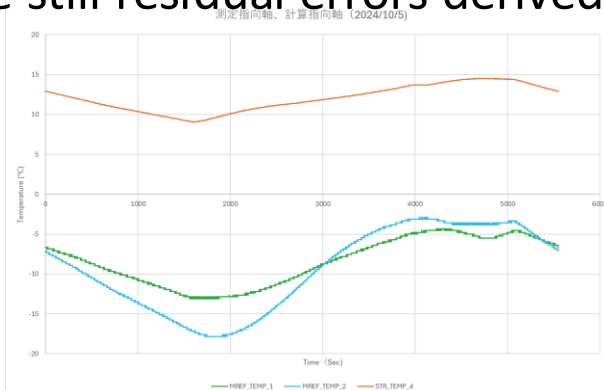


Beam pointing error correction (cont'd)

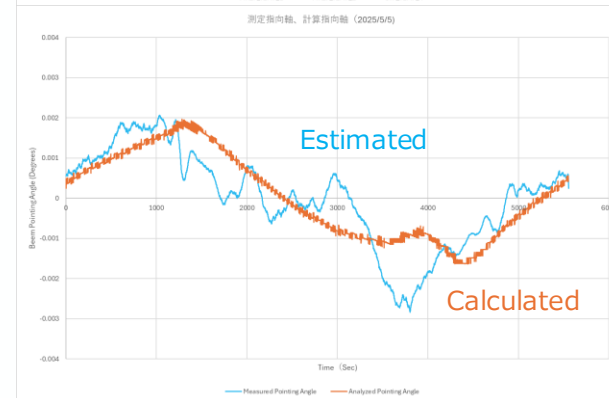
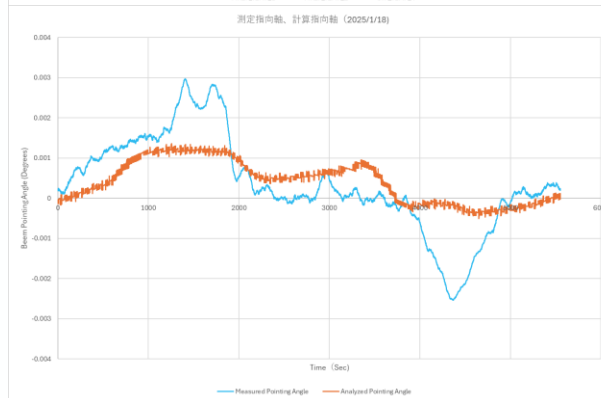
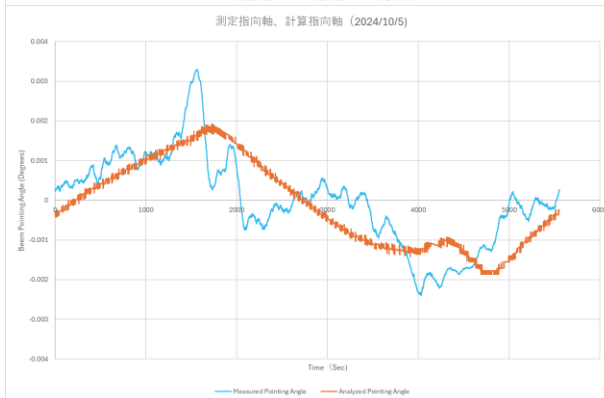


- Through the latest reviews (Thermal analysis review and Structural analysis review), JAXA confirmed that the overall profiles are captured adequately using MREF and STR temperatures and established the coefficients of the correction formula.
- JAXA plan to implement updated correction formula for removing the CPR related mis-pointing. Although there are still residual errors derived from S/C attitude, etc., those should be corrected at L2 processors.

MREF and TRUSS
temperatures
measured in orbit



Mispointing calculated
by new correction
formula



2024/10/5

2025/1/18

2025/5/5

Beam pointing error correction (cont'd)



- In the new version “**vEa**”, which will adopt the beam pointing error correction, JAXA plans to update the product format and the L1b product includes two types: one with correction applied and one without for the following parameters.

- dopplerVelocityAtSurfaceBin
- SatelliteVelocityContaminationInLOS
- dopplerVelocity
- pitchAngle
- rollAngle
- yawAngle

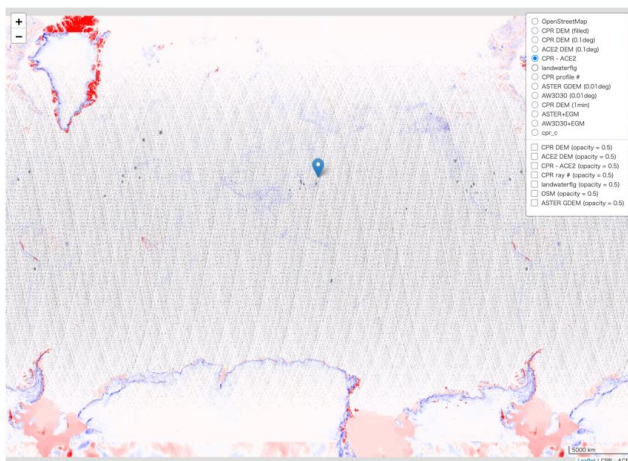
Two types are distinguished with the suffix of the parameter names: “**WithTDC**”, “**WithoutTDC**”

- The parameter values without correction (“WithoutTDC”) in version “vEa” are same with the values in the current version “vDa/vDb”. Therefore, if you have already performed any pointing error correction yourself for current CPR L1b product and wish to continue doing so, please use the data named “~WithoutTDC” in version “vEa”.

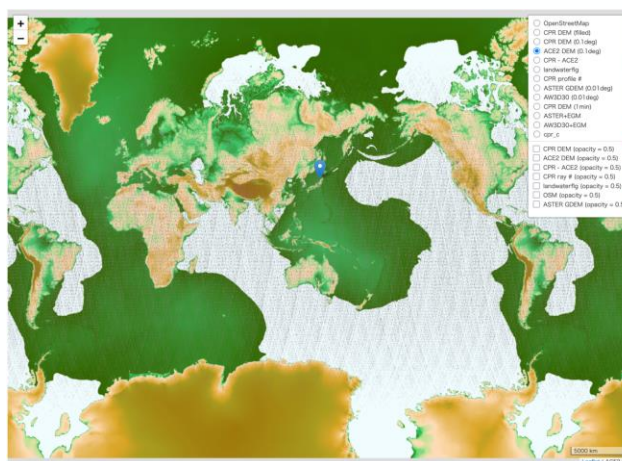
DEM update plan (under discussion)

- In CPR L1b processor, ACE-2 DEM (Digital Elevation Model) has been used. However, it was found that a suspicion of incorrect elevation value around Greenland and Antarctic, etc.. Therefore, JAXA use AW3D DEM for CPR L2 processor.
- JAXA and ESA are considering replacing the DEM used in L1 processing with more reliable one. And AW3D + REMA(for higher latitude region) is the candidate for replacing.
- JAXA currently plan to reflect of DEM update in next major update to “vEa” with adopting beam pointing error correction.

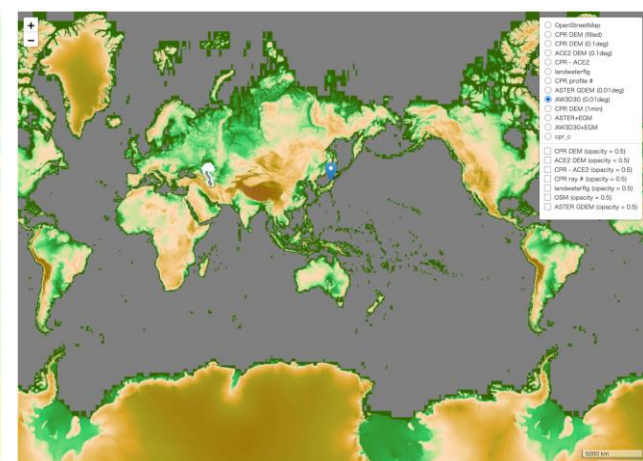
CPR DEM-ACE2 DEM



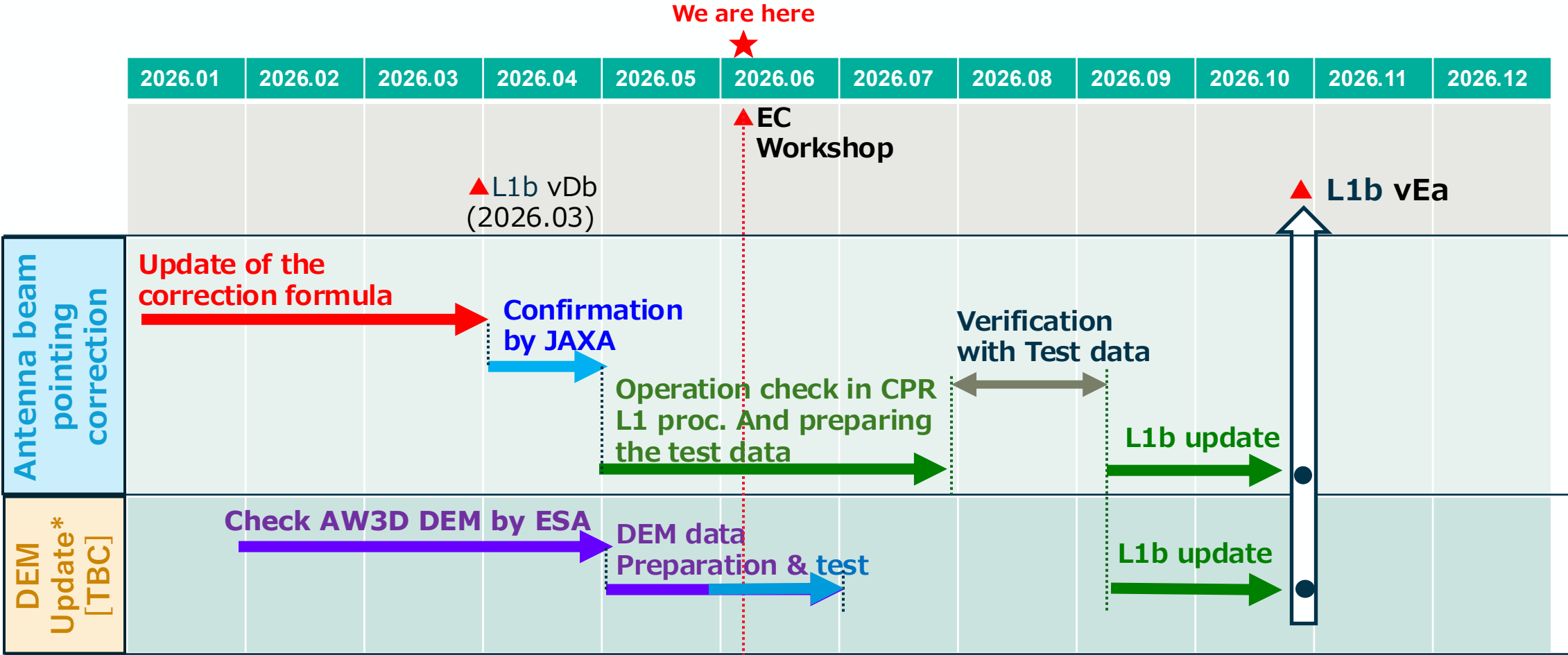
ACE2 DEM



AW3D



CPR L1b Update Plan for “vEa”



*JAXA & ESA are currently discussing replacing DEM files in EarthCARE Level 1 product.
If it is agreed to replace the DEM, it will be reflected in version “vEa” as a major update scheduled as above.