Second reply to the reviewer #2:

A: Thank you very much for your comments and guideline. We took your advice to use the SOHO-ACE alignment (η - ζ) coordinate where η is the same as your w' (Fig 2a-b), and used triangle timing method in the η (w') direction to select small tilt angle in the η direction. For the ζ direction, we used the 1D shock model (that is applied to velocity change), which has large uncertainty as shown in Fig. 3 (contrary to the claim by Toth et al 2026). Toth et al simply overlooked the uncertainty in the velocity measurement in the Y-Z direction (this comes from the present format of OMNI database that does not show the measurement uncertainty). Since use the derived angle to "select ideal shock" rather than to "use the angle for general cases", we decided to add Subsection 2.2 dedicated for the measurement uncertainty.

As the result, we changed the location of "example" after the explanation of the method. As the reviewer kindly pointed out, this example is about 20-70 degrees tilted toward the ζ (which is nearly Z) direction.

---------- reviewer's comments and individual answers ----------

While the authors made some important improvements with respect to showing the 1D shock speed against the triangle speed, the claim that the shock normal is mostly in the X-Y plane is simply not true. Below I provide the proper general approach, and I hope the authors will use this in the next version.

A. Yes, we took general approach (with illustration to explain it in Fig 2a-b). Thank you very much.

Lines 119-121: The statement that CME shocks are tilted predominantly in the X-Y plane is not true and it is not based on any theoretical or observational evidence. The shape of a CME shock has pretty much nothing to do with the shape of the active region it is coming from. The shape is mostly determined by the background solar wind velocity and density, and to some extent the magnetic field structure interacting with the CME. None of these effects dictate that the shock normal would be in the X-Y plane.

A: Thank you for pointing our wrong statement. We removed it.

Line 143: It is clearly not true that the shock normal is along the X direction. The large jump in the Z velocity component is a clear evidence that the shock normal is tilted in the X-Z plane.
See Toth et al., Space Weather, 2026, doi:10.1029/2026SW005083 for a detailed discussion, including why the velocity jump is more reliable than the triangulation.

A: Thank you for pointing our wrong statement. Changed it the shock angle estimate on this example as summarized above.
On the other hand, as mentioned in Sect 2.2, Toth et al's statement on the accuracy is wrong.

Equations 1 and 2 need to be generalized to arbitrary shock

normal. There is no reason to concentrate on tilt in the Y direction. The current approach eliminates shocks based on the relative Y positions of the two spacecraft which has nothing to do with the shock. The proper generalization for equation 1 is

*V_triangle = x_s' + y_s'*tan theta_y + z_s'*tan theta_z*
*= x_a' + y_a'*tan theta_y + z_a'*tan theta_z*

where the x' = x/dt, y'=y/dt etc. This can be rearranged as

*x_a' - x_s' = (y_s' - y_a')*tan theta_y + (z_s' - z_a')*tan theta_z*

Rotating the coordinate system around the X axis to align the new Y axis (which we annotate as W) with the (y_s' - y_a', z_s' - z_a') vector we obtain

*x_a' - x_s' = (w_s' - w_a')*tan theta_w*

where |w_s' - w_a'| = sqrt((y_s' - y_a')^2 + (z_s' - z_a')^2)

There is of course another angle in the normal direction, but that is multiplied with 0, so it is arbitrary. Now we can express theta_w as

|tan theta_w| = |x'_s - x'_a| / |w'_s - w'_a|

This quantity can be used to select best, clean etc. shocks.

A: We used the general method (Fig 2a-b and Eq. (1)-(2)). After estimating the effect of the correction term based on Eq.(A2) on these full-form equation, we finally come to the simplified form (3)-(4).

Minor issues:

Line 72: "we do not use density data ..." This seems to have nothing to do with the paragraph.

A: We moved to Sect 2.2.

Line 160: This example enforces -> This example demonstrates
But as I showed in my previous comments, assuming a large tilt in the Z direction results in a reasonable agreement between the 1D shock propagation and the SC timing. So the large difference is due to the incorrect assumption that the shock normal is parallel with the X axis.

A: We changed entire paragraphs (stating large tilt angle in the ζ (nearly Z) direction.

Line 188: Why are you assuming a tilt angle in the X-Y plane? The separation of SOHO and ACE keeps changing with time, so it is not true that their separation in Y is always large, while in Z it is always small.
Line 206: Why X-Y direction?

A: We introduced the suggested coordinate system "η-ζ" (Fig 2a-b), together with error analyses (Fig 3).

Line 309: No, it is not optimum to assume that the tilt is in the X-Y plane.

A: We now introduced tilt angle in the ζ direction based on the velocity change.

Fig A1: Suffix "y" should be replaced with "w" (see above)

A: We use small character "y" instead of capital "Y" or "η". We added explanation.

Fig A2: Good that there is finally some work on tilt in the X-Z plane, but it is still described with incorrect statements about how likely it is.

A: Tilt angle effect is generalized by comparing "best" cases and "clean but not best" case.

The following typos and insufficient description are fixed:
Line 263: SOH case -> SOHO case
Line 266: .. the speed is -> .. the speed are
Line 264: In all estimate -> In all estimates
Line 266: For such a small differences -> For such small differences
Line 275: What is the "measured speed"? Measured solar wind speed behind the shock? Something else?
Fig 3 caption: potted -> plotted
Fig 5 caption:
plotted against in a logarithmic scale -> plotted in logarithmic scale
For examples -> For example
Fig A1: There is no suffix "sh". There is suffix "1D".
Line 402: For high Alfvenic Mach number shocks the tangential velocity is approximately constant across the shock.