

## ***Interactive comment on “Enhanced timing accuracy for Cluster data” by K. H. Yearby et al.***

### **Anonymous Referee #1**

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#### General Comments:

This paper has scientific significance in the sense that it provides the necessary information for understanding how sufficient timing accuracy can be achieved on the Cluster mission for cross spacecraft correlation of wave data in the absence of systems onboard for synchronizing the clocks through direct communication between the spacecraft. The timing accuracy for Cluster wave data is obtained through ground processing and analysis of timing information from more than one source, which is adequately explained and described. The paper further provides the reader with an insightful discussion of the various sources of timing error so that the reader can judge how much influence each error has on the overall timing accuracy. The methods used to obtain the timing accuracy are justified, with cross validation of results obtained from different time sources. The time correction (TCOR) files which were produced using

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these methods are archived at the Cluster Active Archive (eventually the Cluster Final Archive).

The paper is well organized and well written and the figures are very insightful and helpful. I have no hesitation in recommending that this paper be fully published in GI.

#### Specific Comments:

The paper provides a very helpful, though short, discussion of why timing accuracy is important for wave observations, particularly for obtaining wave properties through correlated cross-spacecraft wave measurements. The timing accuracy required to determine these properties will vary by the frequency of the waves, the spacecraft separation, and the environment in which the waves are detected. Thus, some specific types of waves are highlighted to demonstrate this. It would be exceedingly useful to the readers of this paper if a common reference, or even some Cluster specific references, could be given that discuss in more detail the specific needs of timing accuracy for obtaining wave properties through cross-spacecraft analysis. Some possible useful ones might be:

1. Chapters 2 and 3 in:

Analysis Methods for Multi-Spacecraft Data, G. Paschmann and P. W. Daly (Eds.), The International Space Science Institute, Bern, Switzerland by ESA Publications Division, The Netherlands, 1998.

2. Chapters 5 and 6 in:

Multi-Spacecraft Analysis Methods Revisited, G. Paschmann & P. W. Daly (Eds.), The International Space Science Institute, Bern, Switzerland by ESA Publications Division, The Netherlands, 2008.

#### Technical Corrections:

1. The word “Data” should be inserted in Line 3 on page 517 between “Wide-Band” and

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“(WBD)” to properly identify the acronym, thus: “The Wide-Band Data (WBD) Plasma Wave ...”.

2. The word “effect” in Line 3 on Page 521 should probably be the more commonly used “affect”, in this case used as a verb.

3. Fig. 5 does not seem to be referenced or specifically discussed anywhere in the body of the paper. This needs to be taken care of before final publication.

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