

angeo-2018-90 reply to referees2

In this revised version, we have tried to respond to the referee's constructive suggestions.  
*Angeo-2018-90-RC2*

*In this revised version we have tried to address the referee's concerns:*

*1/ ... the performed analysis, the conclusions about the location of reflection are rather too strong and should be better presented as a possible hypothesis which proof will definitely require some additional analysis ...*

We have changed the title of the paper and modified the discussion and conclusions. It is perhaps worth reiterating that this analysis was carried out on all the available burst mode data. To expand the analysis in the future, one would have to use data from, for example, the MMS mission. Whether a useful population of foreshock events can be found in MMS data is a subject for future study.

*3/ A substantial part of the whole analysis is based on many "subjective" threshold values...*

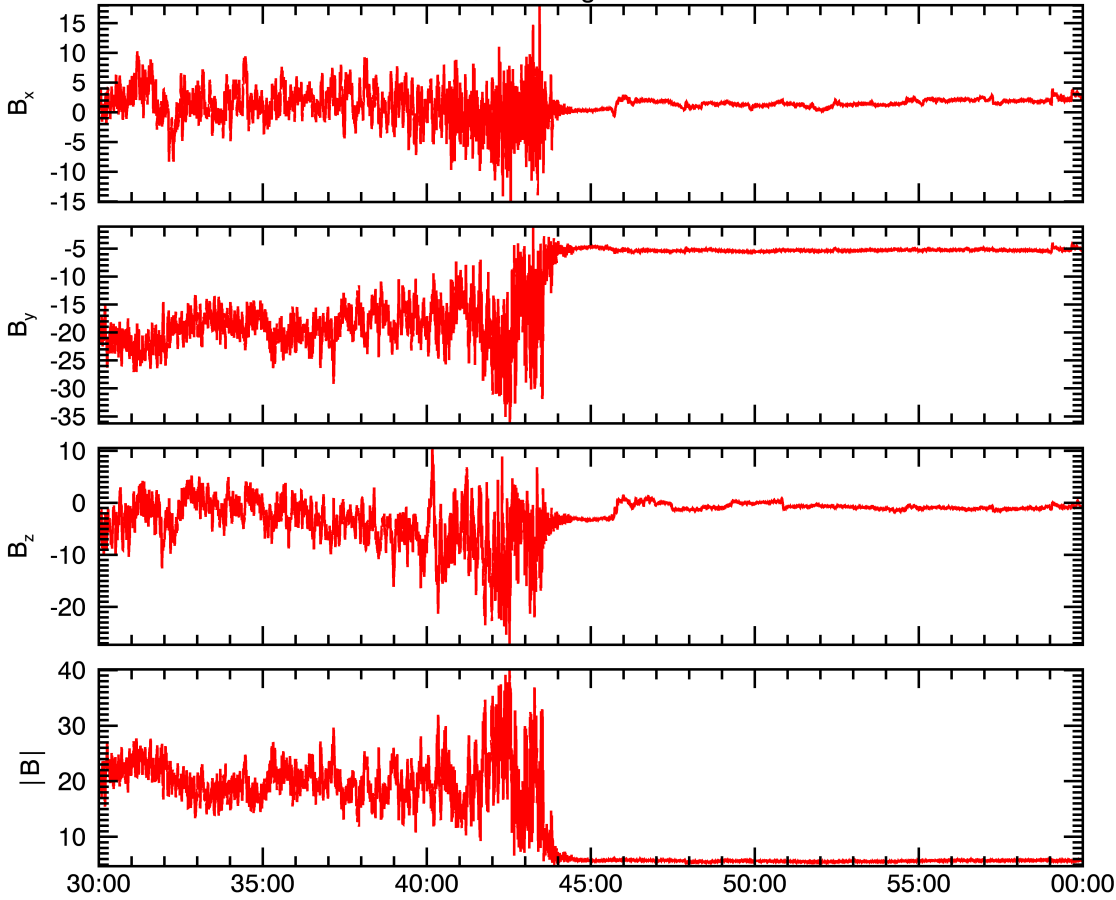
We have tried to be as quantitative as possible given the observational constraints. We feel that the examples are compelling. Regardless of the fine points, it is nonetheless clear that from these examples and from the phi-theta plots that the reflection of the strahl is not coincident with any increase in the magnitude of the magnetic field and, consequently, there is no evidence that magnetic mirroring is playing an important role in the reflection. To be more quantitative would require more examples, which are, unfortunately, not available.

*4/ For the complete picture it could be of interest to plot not only the variation of the B-field magnitude (Figure 14) but also of the individual components to see how the magnetic background is stable or not. This is highly relevant namely when discussing the B angle to the shock normal.*

We attach a plot of the components, but since the plot does not add any information other than confirming that the computed shock normal is a good estimation of the geometry of the event, we have chosen not to include it in the paper. Should the referee disagree, we would be happy to include it, but, frankly, don't think that it would add anything significant to the analysis.

In this plot, the data have been rotated into the shock normal coordinate system and the  $B_{\dot{n}}$  component is continuous across the shock in the rotated system (rotated Bx), indicating a relative good normal calculation.

CLUSTER-2/FGM Magnetic Field Data 5VPS



*5/ (and /6) The PT plots should display some color bar to give information about the scale of the color maps. In the present form it is impossible to see what is the level of variation and how the strahl/reflected electrons are significant wrt to the core-halo part....*

The color bars are normalized for each energy. The variation with energy is too large to use a uniform color bar for each event. Consequently, in this usage, the “PDF” does not sum to unity.

*7/ When plotting the NR/NS ratio, consider adding a line  $y=1$  so the reader can better see what is the variation around the "total" reflection. Also the y-scale on Figure 13 for this ratio can be adjusted accordingly, here the max value is too high*

Unfortunately, these plots were made using software created by the (deceased) first author and we do not have access to the scripts that generated the plots. Consequently, although we agree that it would be useful to make the changes suggested, we are unable to do so.

*line 65 - It is often... a verb is missing?*

Fixed.

*line 74 - remove "it" after mirroring*

Fixed.

*line 76 - though -> through*

Corrected.

*line 129 - What is UDF Analysis, it is generally known or should be described here (or removed)*

That analysis package has been used in previous publications; we have removed the reference.

*line 178 - (also related to comment 3/) high/low density wrt what? What about to consider normalizing the NR by NT? Would it make the foreshock determination more robust?*

We think that the description is clear and, for the reasons mentioned above, cannot easily change the normalization, nor do we think that doing so would substantially change the determination of the foreshock.

*line 212 - What is QGM? Either remove or explain a bit.*

We've removed QGM.

*line 303 - The meaning of the last sentence is not clear even from the context.*

We don't know what is unclear here.

*line 308-309 - Would the return population "become more gyrotropic" (full ring) when plotting the PT plot in the solar wind frame?*

Since the electron speeds are much greater than  $V_{sw}$ , changing the reference frame of the plot (again, not easily doable), should not make any significant difference.

*line 387 - remove "eV", the energization factor has no units*

Fixed.

*line 408 - effect -> affect?*

Fixed

*line 526 - are -> is*

Fixed.

*line 533-539 - This paragraph should be placed later in the Conclusions. First one should recall the MAIN results.*

We have done that and slightly reworded the conclusions.