**Annales
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Discussions**

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comment

Interactive comment on "Total Reflection of the Strahl within the Foot of the Earth's Bow Shock" *by* Christopher A. Gurgiolo et al.

Anonymous Referee #1

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This paper presents a detailed analysis of electron data from the PEACE instrument on board the Cluster spacecraft together with magnetic field data from FGM, showing a full reflection of the field-aligned component of the solar wind electron distribution (the strahl) at the Earth's bow shock. The mechanism of reflection occurs at the shock foot, where the variations in the magnetic field are low, ruling out the possibility of mirroring. By using the electron velocity distribution functions (eVDFs) and computing the return electron densities, under the assumption that all the return electrons are in the foreshock region, authors can also determine when the spacecraft is actually immersed in the foreshock. The analysis made on the eVDFs is described accurately and is convincing, while other methods (developed in previous works) are just mentioned. I believe that the results are worth of publication in Annales Geophysicae although I

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[Discussion paper]

recommend to revise some parts in the description of the methodology.

1) Line 185: "correctness of the break point should be verified using \phi-\theta plots', please clarify this statement. Do you refer to the energy limits chosen for the calculation of the electron density? Since this is somewhat 'arbitrary', how can you establish that the breakpoint is the correct one?

2) Sections 4.2 and 4.3: authors just refer to other papers for the shock normal determination method and for the energization method. Since these techniques are extensively used in the analysis, I recommend to describe them with more details (for example I would suggest to report in Section 4.3 Eq.(9) in Paschmann et al., 1980). Otherwise the text results unclear.

3) Regarding the estimation of the pitch angle spread, what is the time window over which you compute the average magnetic field?

4) Line 415: please specify what you mean for "low to medium level turbulence"? Do the authors refer to an estimate of \delta B/B?

5) Figure 2: Please delete from the header 'Full, Strahl'. In the caption change '0.09 eV' with '0.09 cm^(-3)'.

6) Please discuss in Section 5.4 how all the sources of errors can influence the main results presented in the paper. For example: how can they affect the foreshock determination? I suggest to discuss more quantitatively this aspect.

7) Line 423: please add here references to simulations, as the already quoted Leroy et al., GRL 1981; Krauss-Varban and Wu, JGR 1989 Additional references: Leroy et al., JGR 1982; Scholer and Terasawa, GRL 1990.