

**Diamagnetic Depression Observations at Saturn's magnetospheric cusp**

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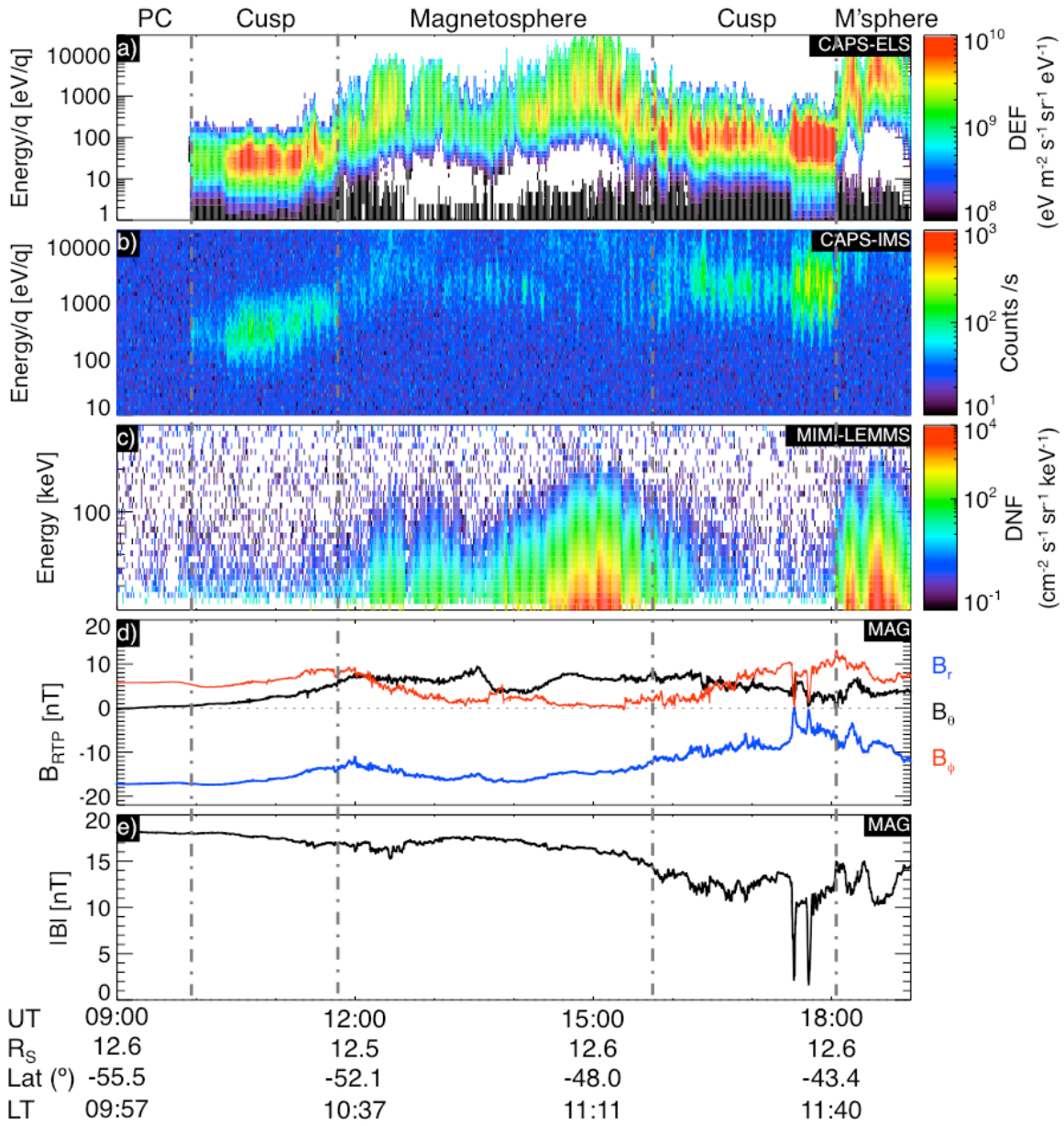
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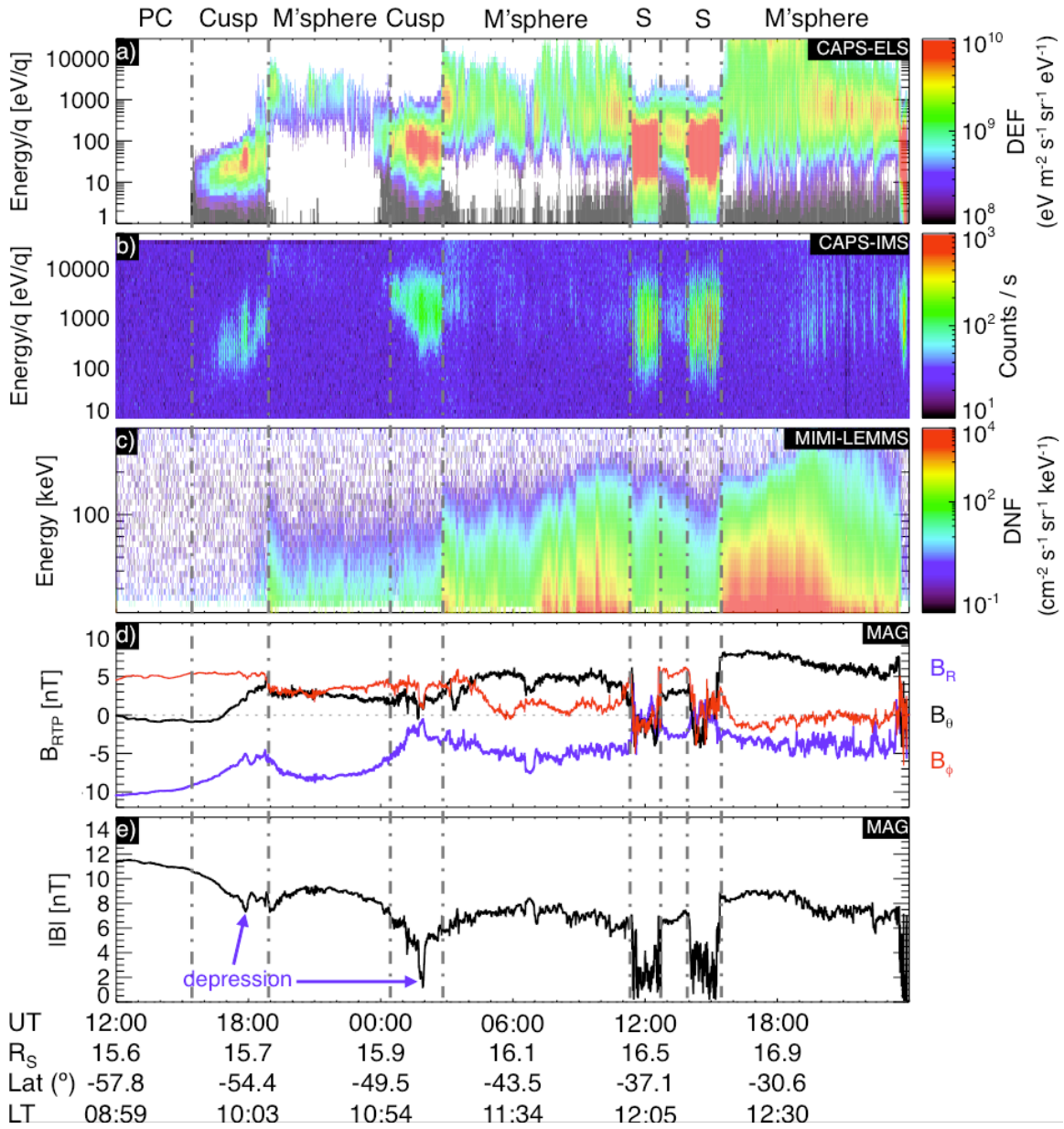
**Introduction**

Included in the online supporting material are in situ plasma observations from the Cassini spacecraft for the 16JAN07 and 1FEB07 events (Figures S1-S2) mentioned in the main article, and analysed in *Arridge et al.*, (2016).

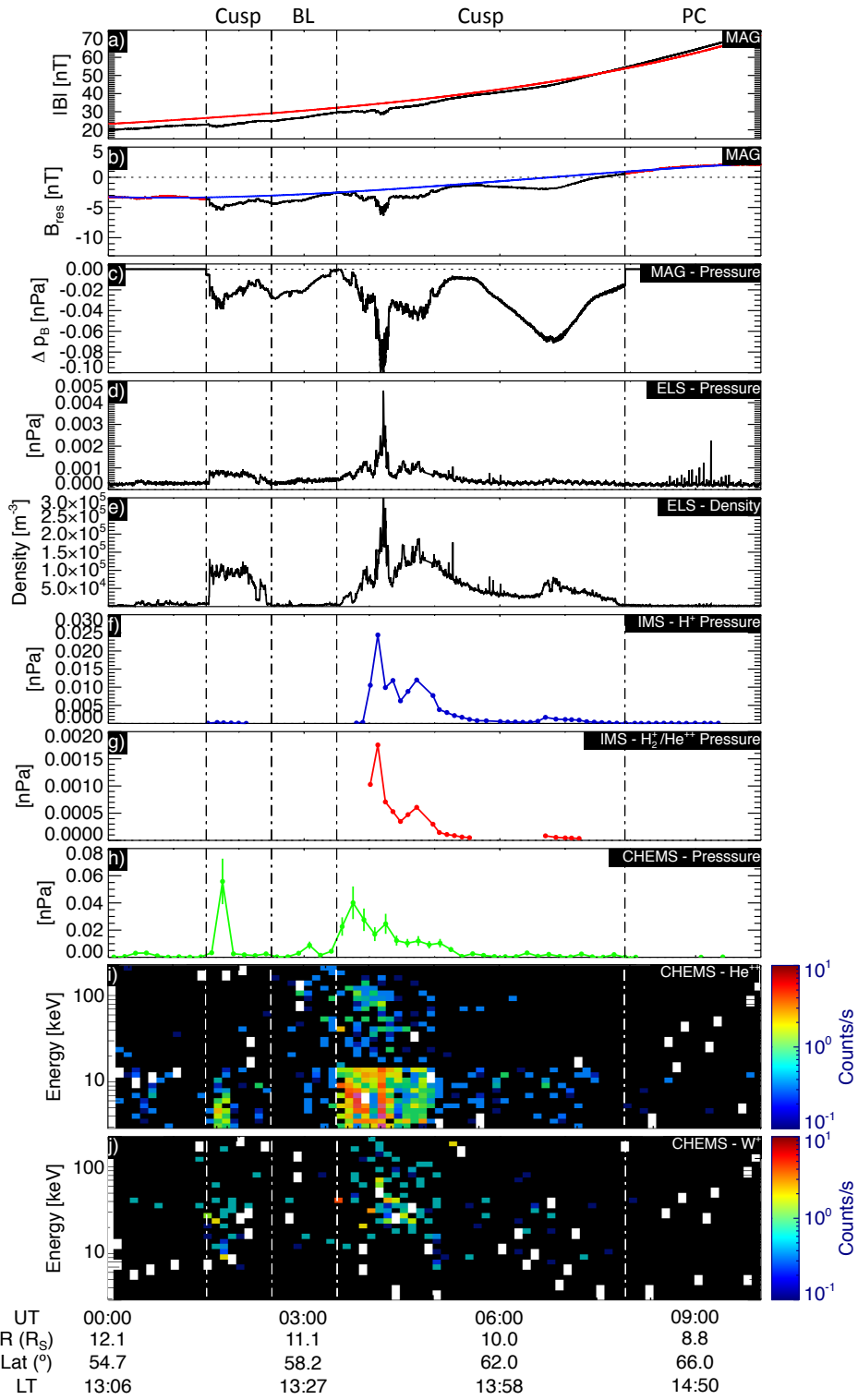
Further Figures (S3-S7) are of the events 25MAY08, 21JAN09, 14JUN13, 24JUL13, and 17AUG13 in the style of Figures 3, 5 and 6 of the main article.



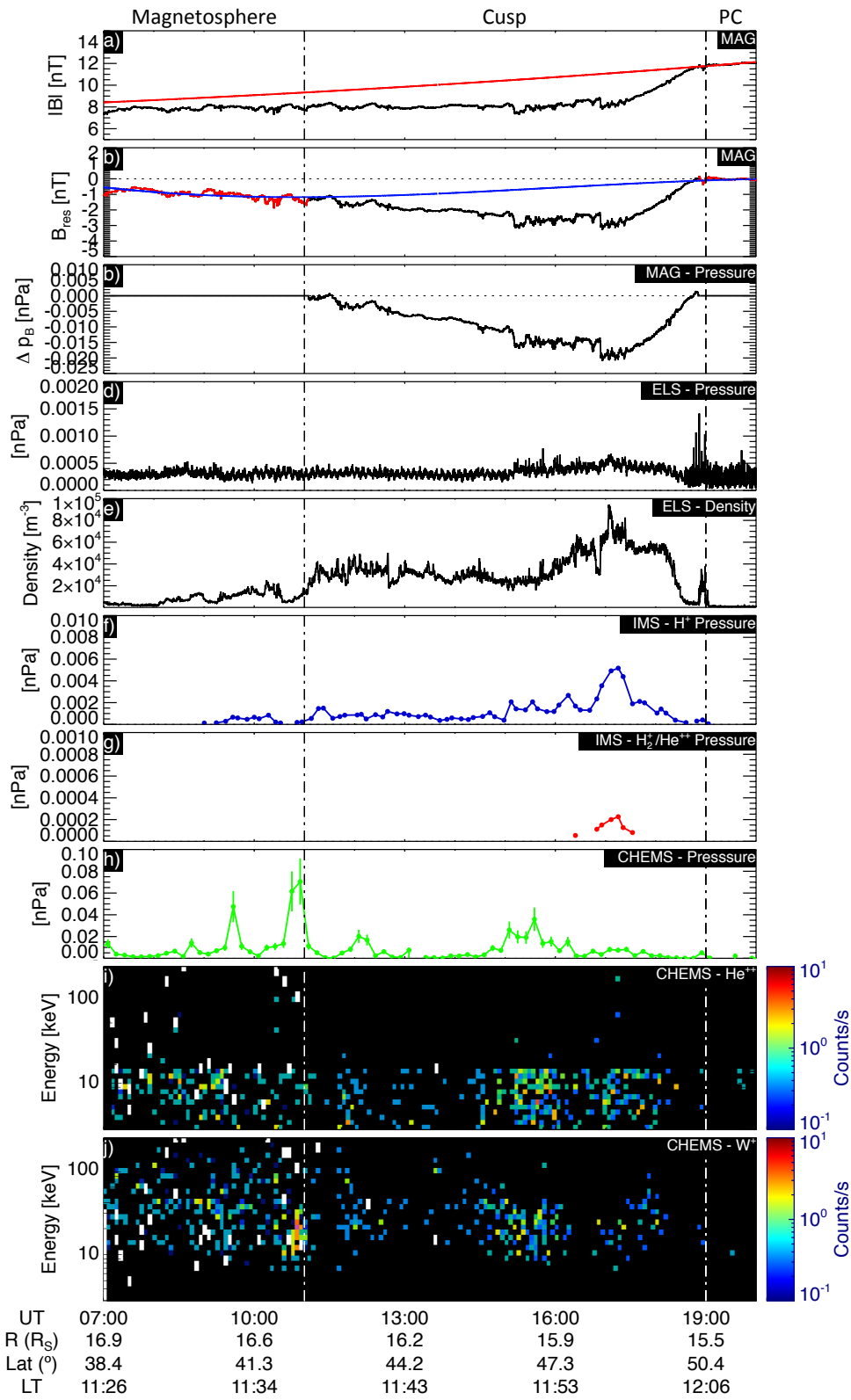
**Figure S1.** Observations from 16JAN07, with the cusp observed. The data are presented in the following order (from the top going down): a) electrons from CAPS-ELS, b) ions from CAPS-IMS, c) high-energy electrons from MIMI-LEMMS, d) the three components of the magnetic field in KRTP coordinates from MAG and e) the magnitude of the magnetic field also observed by MAG.



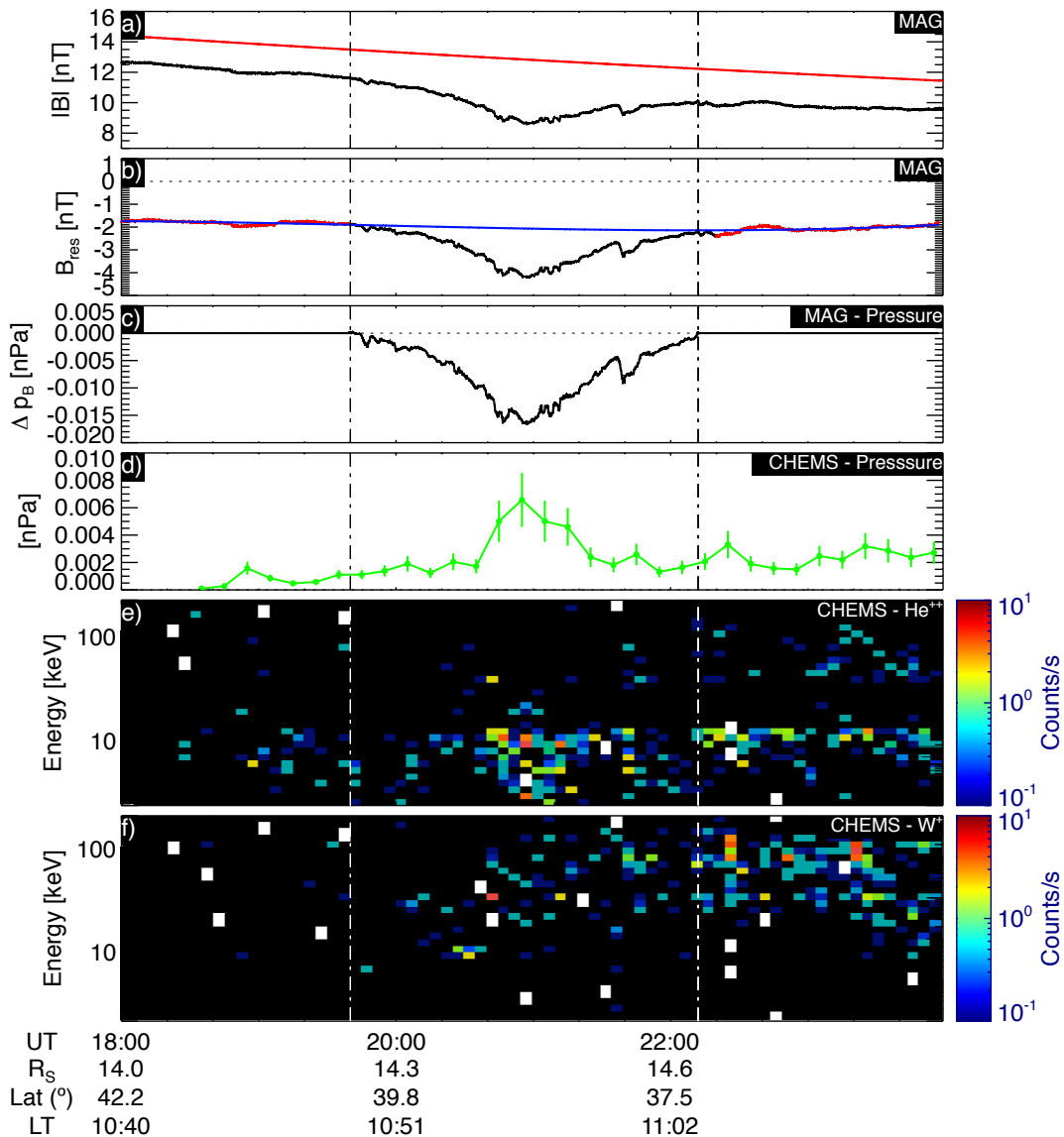
**Figure S2.** Cassini data presented for the 1st and 2nd of February 2007 observations. The figure starts at 12:00 UT on the 1st and ends at 24:00 UT on the 2nd. The data are shown in the following order: a) CAPS-ELS electron spectrogram (all anodes averaged), b) CAPS-IMS ion spectrogram from anode 5}, c) MIMI-LEMMS high energy electron spectrogram, d) the three components of the magnetic field in KRTP coordinates from MAG and e) the magnetic field magnitude from MAG. The polar cap is labelled as 'PC', the magnetosphere as 'M'sphere' and the magnetosheath as 'S'. The bow shock is crossed approximately 15 minutes before the end of the plot, however a dashed line has not been drawn as it would be bordering the edge of the figure.



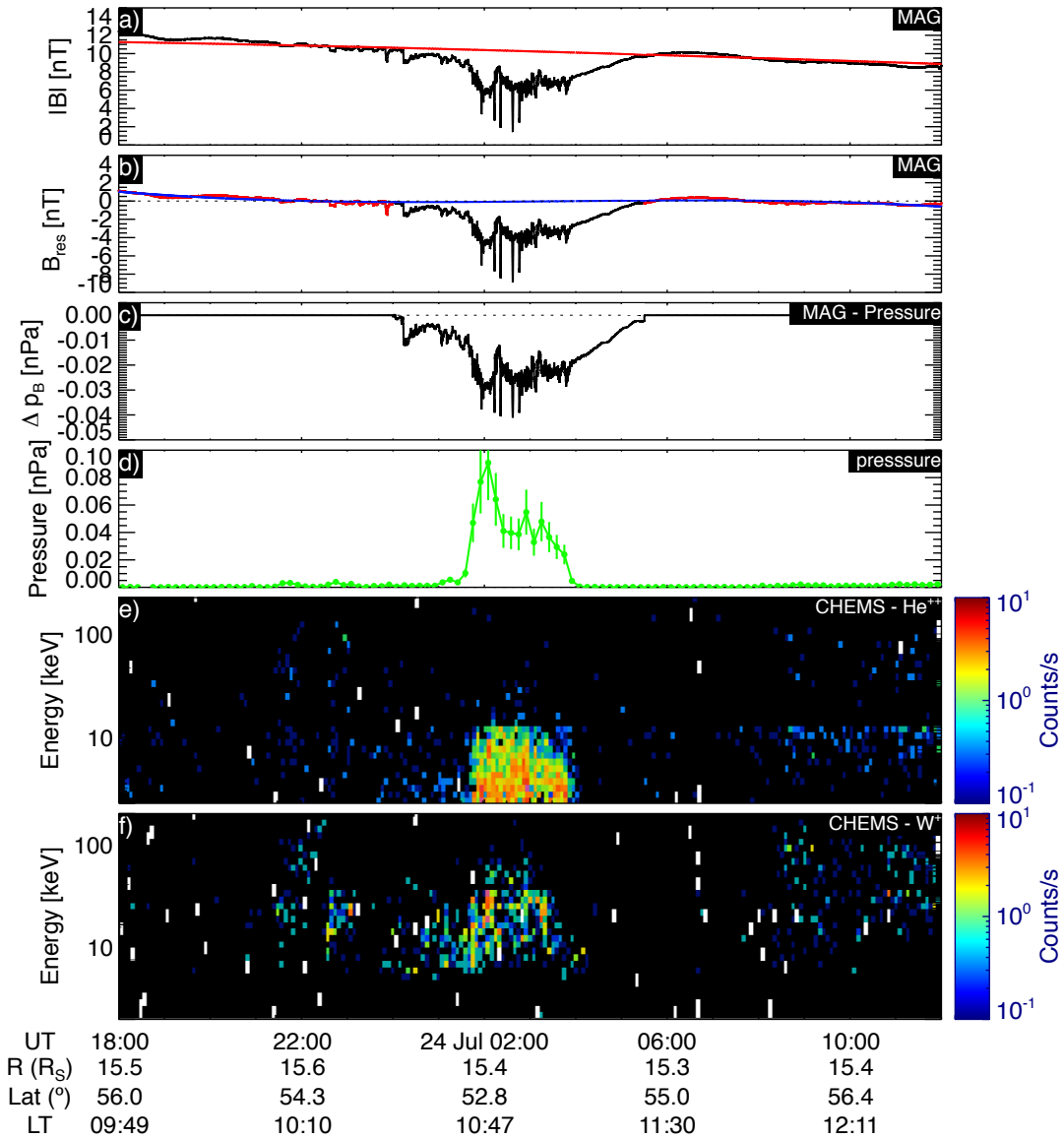
**Figure S3.** Magnetic and particle pressures presented for 25MAY08 in the same format as Figures 3, 5-6 of the main article. Time-energy spectrograms for  $\text{He}^{++}$  and  $\text{W}^+$  observed by CHEMS are also shown (panels i and j).



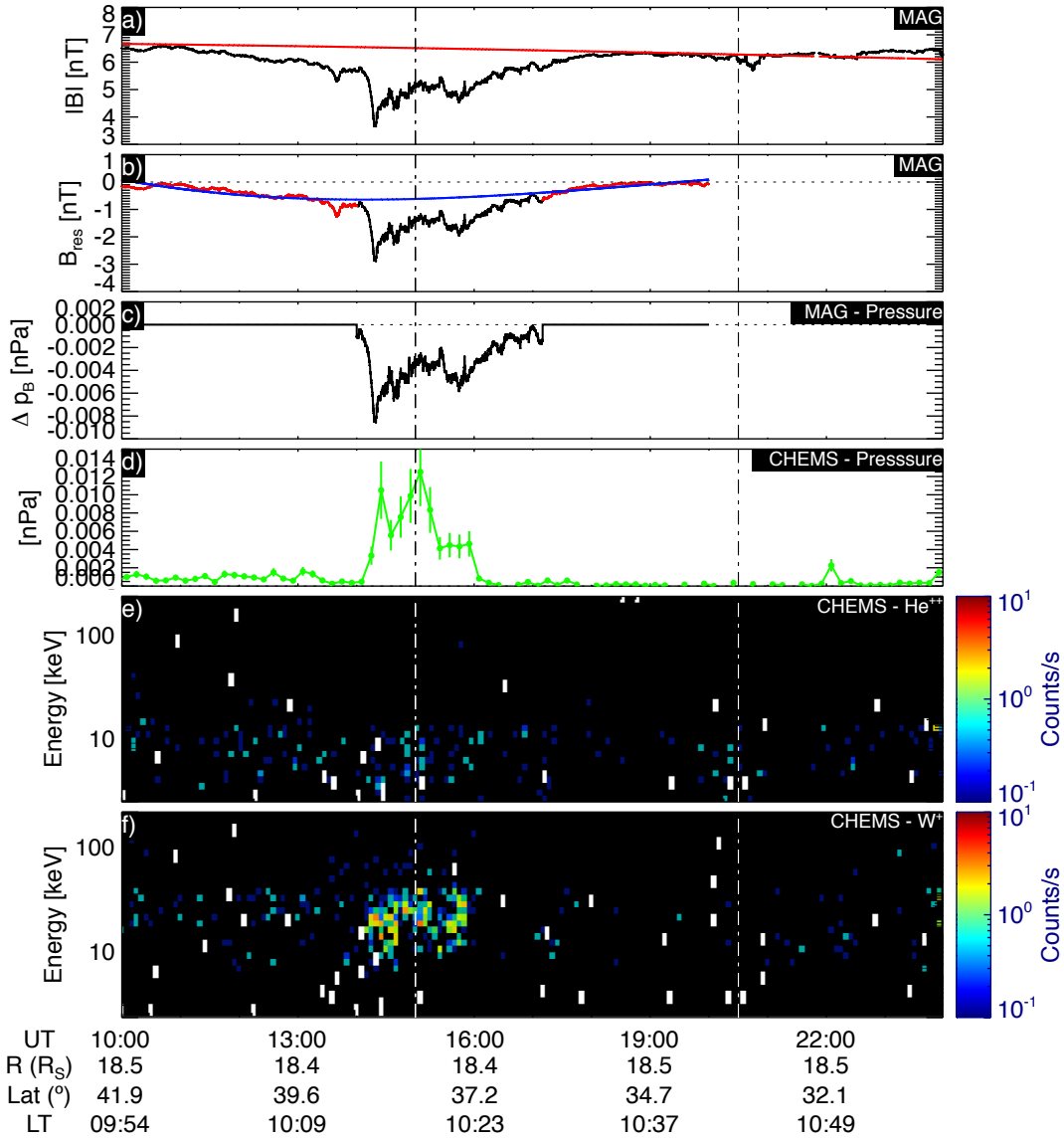
**Figure S4** Magnetic and particle pressure presented for 21 JAN 09 in the same format found in Figure S3.



**Figure S5** Magnetic and particle pressure presented for 14JUN13: a) magnetic field magnitude from MAG (black) and the magnetic field model (red), b) residual magnetic field with data (red) that is fit with a polynomial (blue), c) the magnetic pressure deficit due to the depression, d) high energy ion pressure from CHEMS, e) and f) He<sup>++</sup> and W<sup>+</sup> (respectively) energy time spectrograms from CHEMS



**Figure S6** Magnetic and particle pressure presented for 24JUL13 in the same format found in Figure S5.



**Figure S7** Magnetic and particle pressure presented for 17AUG13 in the same format found in Figure S5.

### References

Arridge, C., et al. (2016), Cassini observations of saturn's southern polar cusp, *Journal of Geophysical Research: Space Physics*, doi:10.1002/2015JA021957, 2015JA021957.