

STEREO substorm observation in the tail and sheath at 200-360 Re: plasmoids, energetic electrons, Alfvén disturbances

**J. Sauvaud¹, Andrea Opitz¹, C. Jacquy¹, B. Lavraud¹,
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1 CESR (CNRS/UPS), Toulouse, France

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STEREO DATA

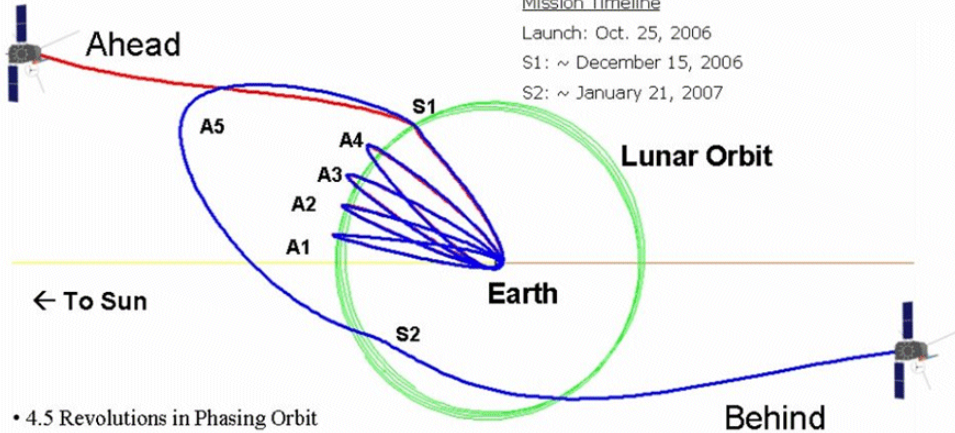
SWEA	electrons	9-2000 eV
STE	energetic electrons	~ 2 - 100 keV
PLASTIC	ions	0.2 - 86 keV
MAG	magnetic field	

Mission Timeline

Launch: Oct. 25, 2006

S1: ~ December 15, 2006

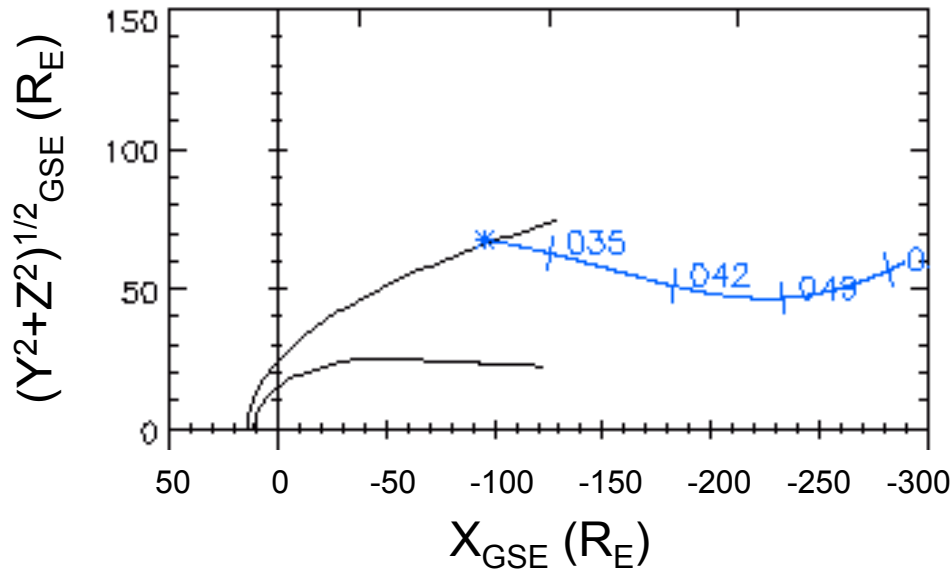
S2: ~ January 21, 2007



- 4.5 Revolutions in Phasing Orbit
- First lunar swingby, S1

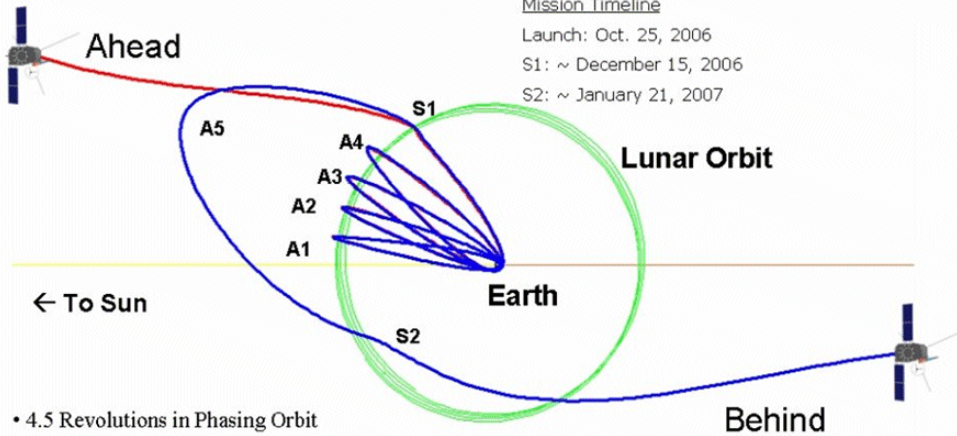
Terrestrial magnetosphere by STEREO

2007 February STEREO-B



DOY 2007

Mission Timeline
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 S1: ~ December 15, 2006
 S2: ~ January 21, 2007



- 4.5 Revolutions in Phasing Orbit
- First lunar swingby, S1

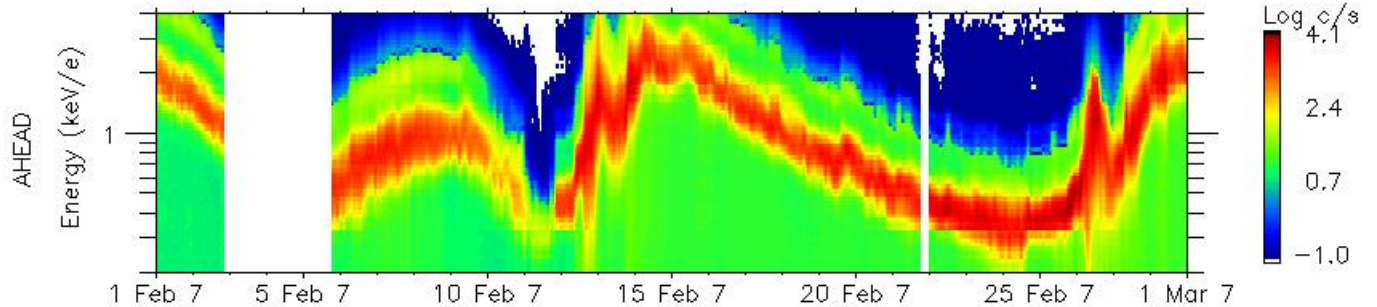
Terrestrial magnetosphere by STEREO

PLASTIC

2007 February

Ion data

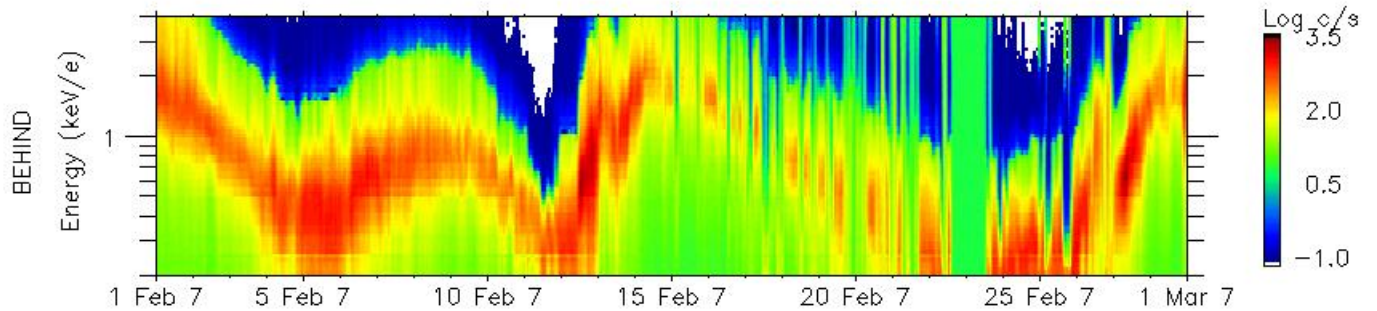
Solar wind



Magnetosheath

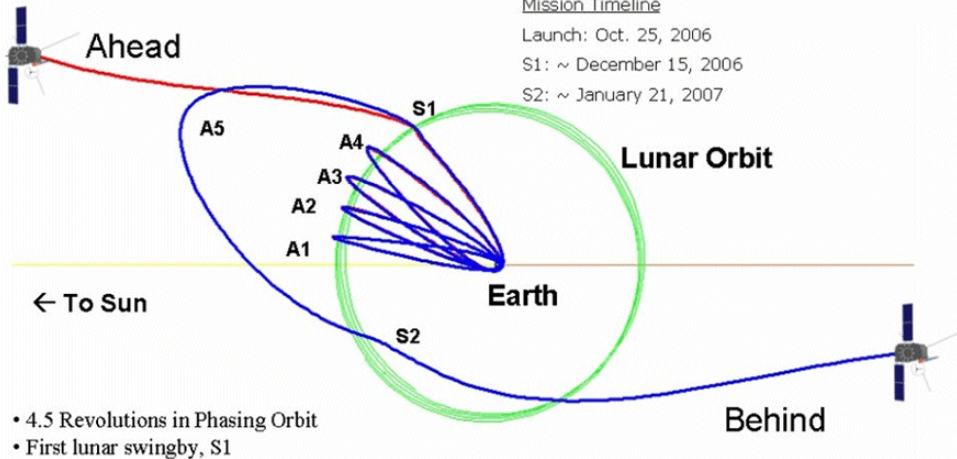
Lobe/mantle

Plasmasheet



Mission Timeline

Launch: Oct. 25, 2006
S1: ~ December 15, 2006
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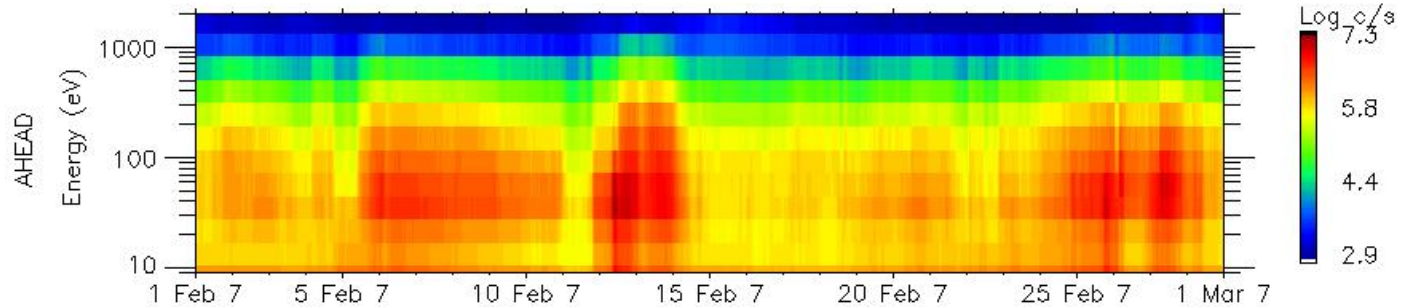
Terrestrial magnetosphere by STEREO

SWEA

2007 February

Electron data

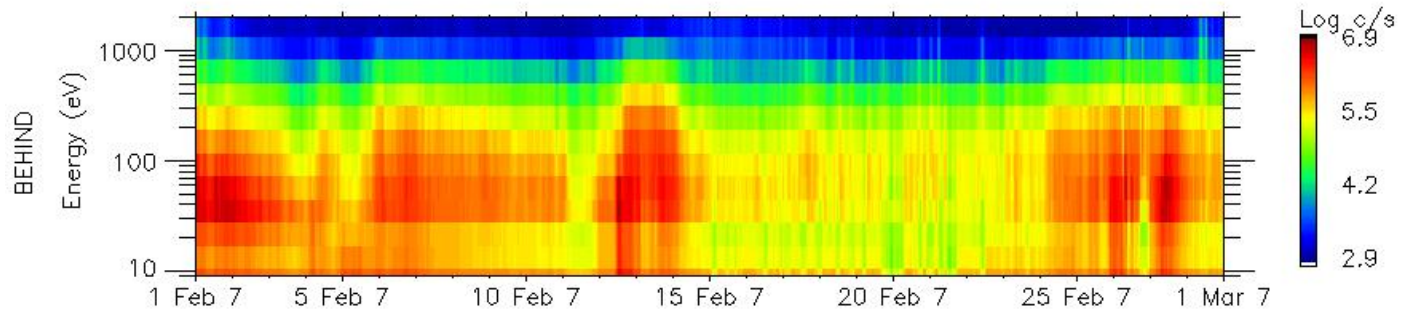
Solar wind



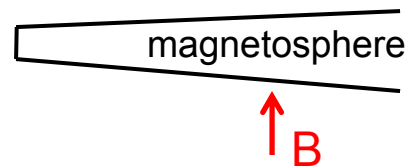
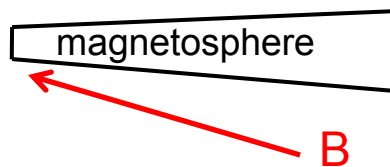
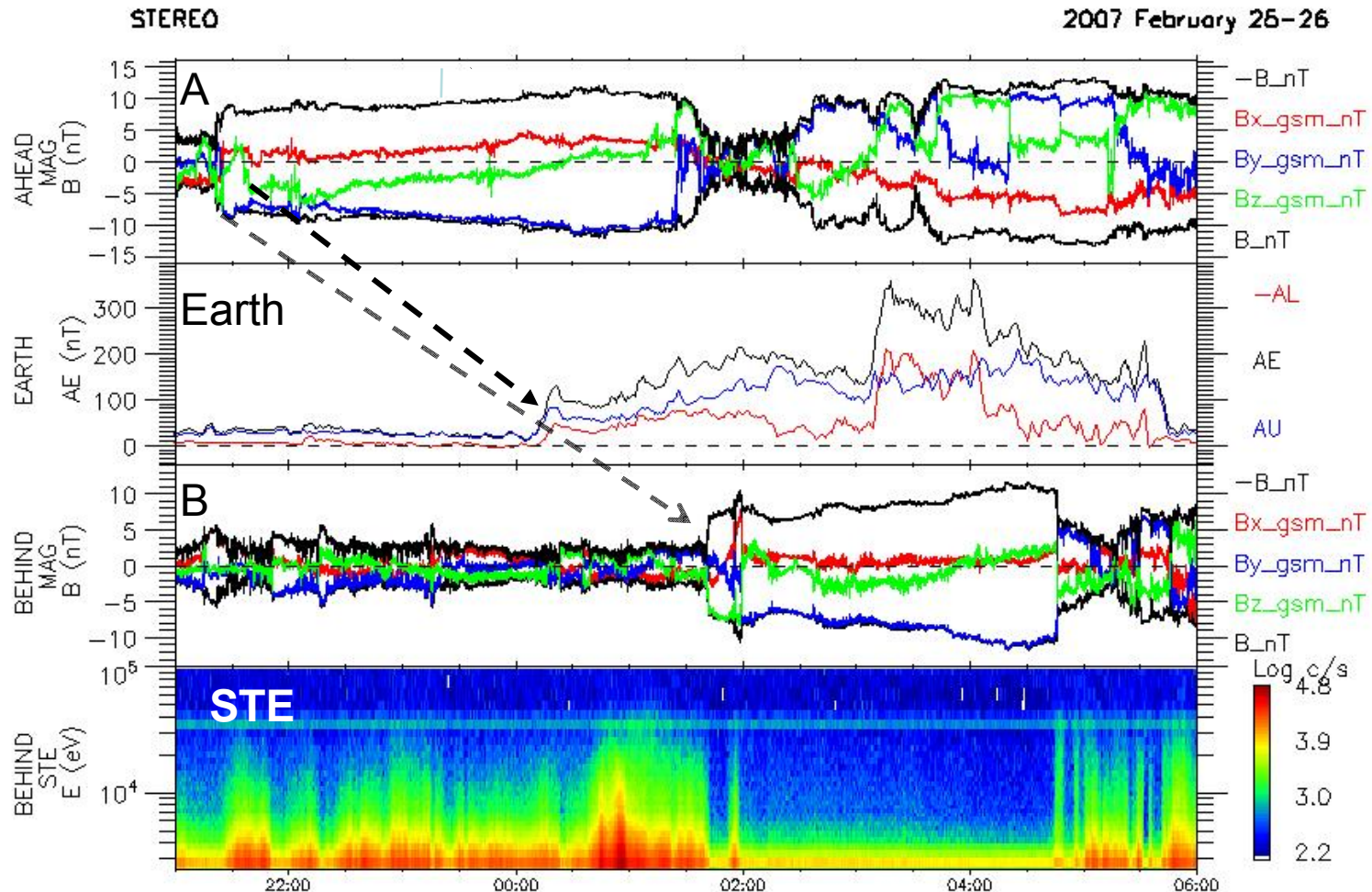
Magnetosheath

Lobe/mantle

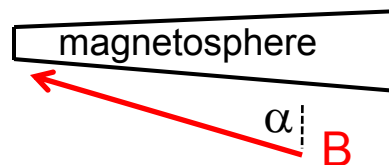
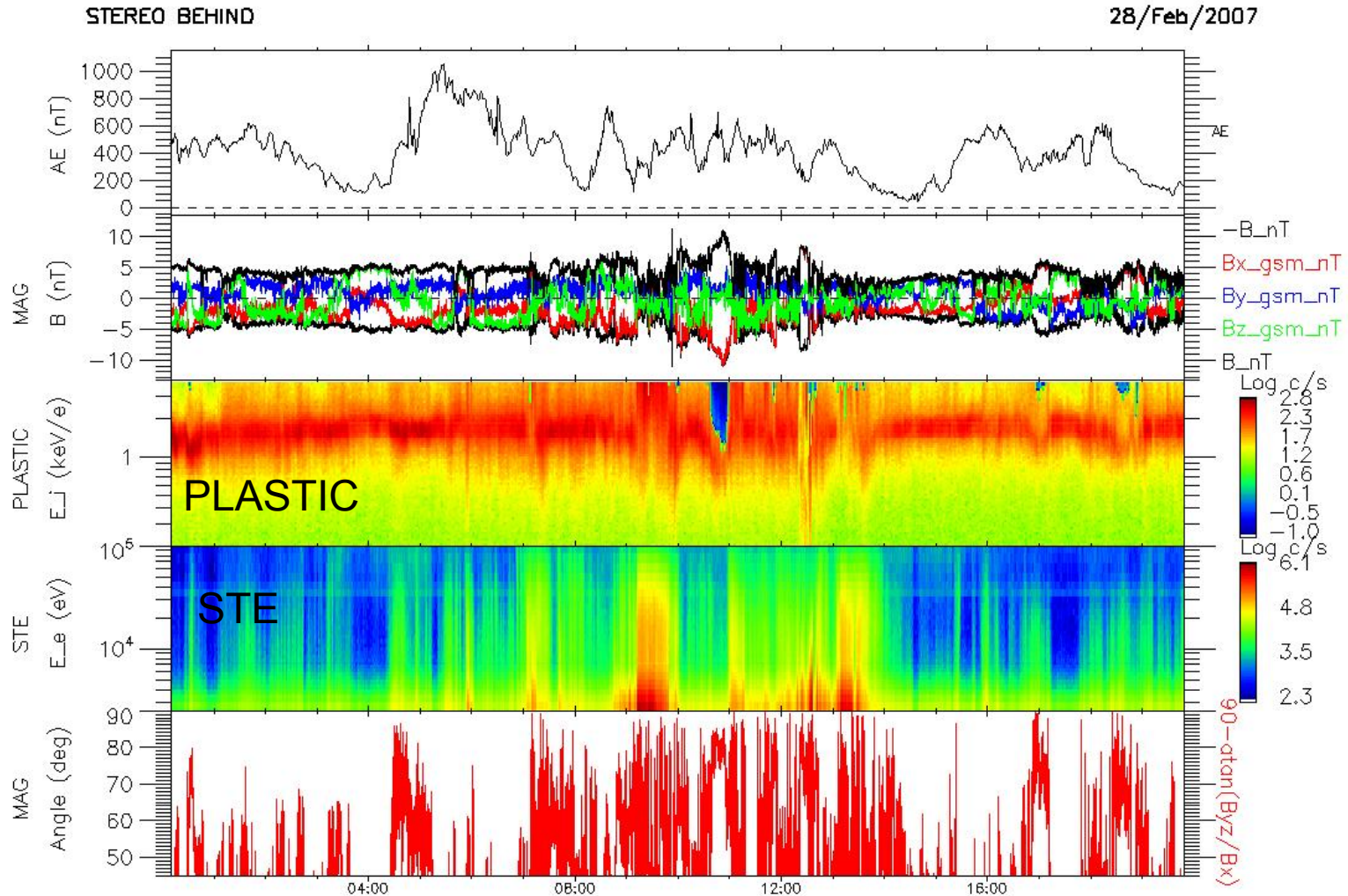
Plasmasheet



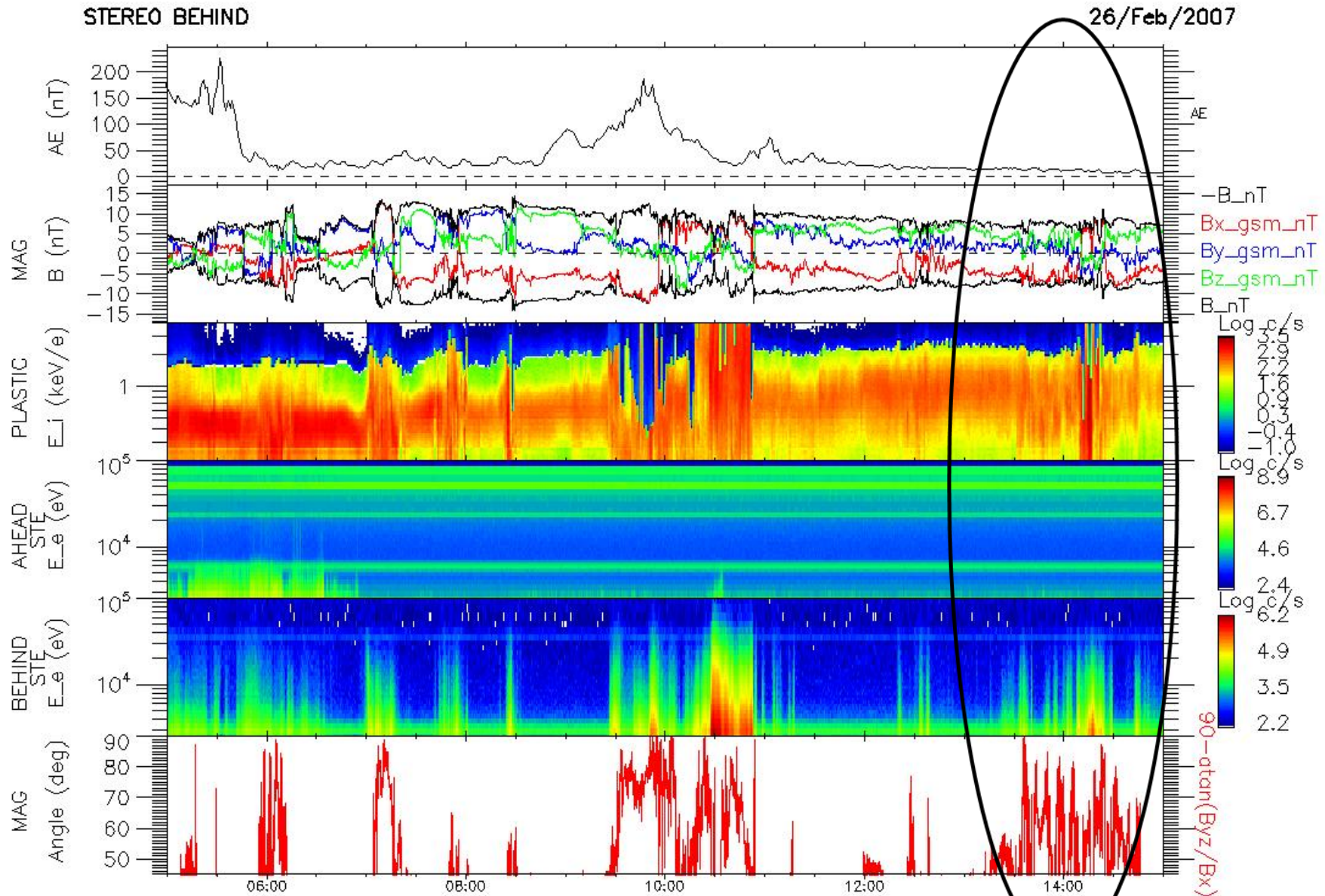
Energetic electrons in the magnetosheath Suppression during strong B_y IMF



Energetic electrons at Bx IMF



Release of trapped energetic electrons?

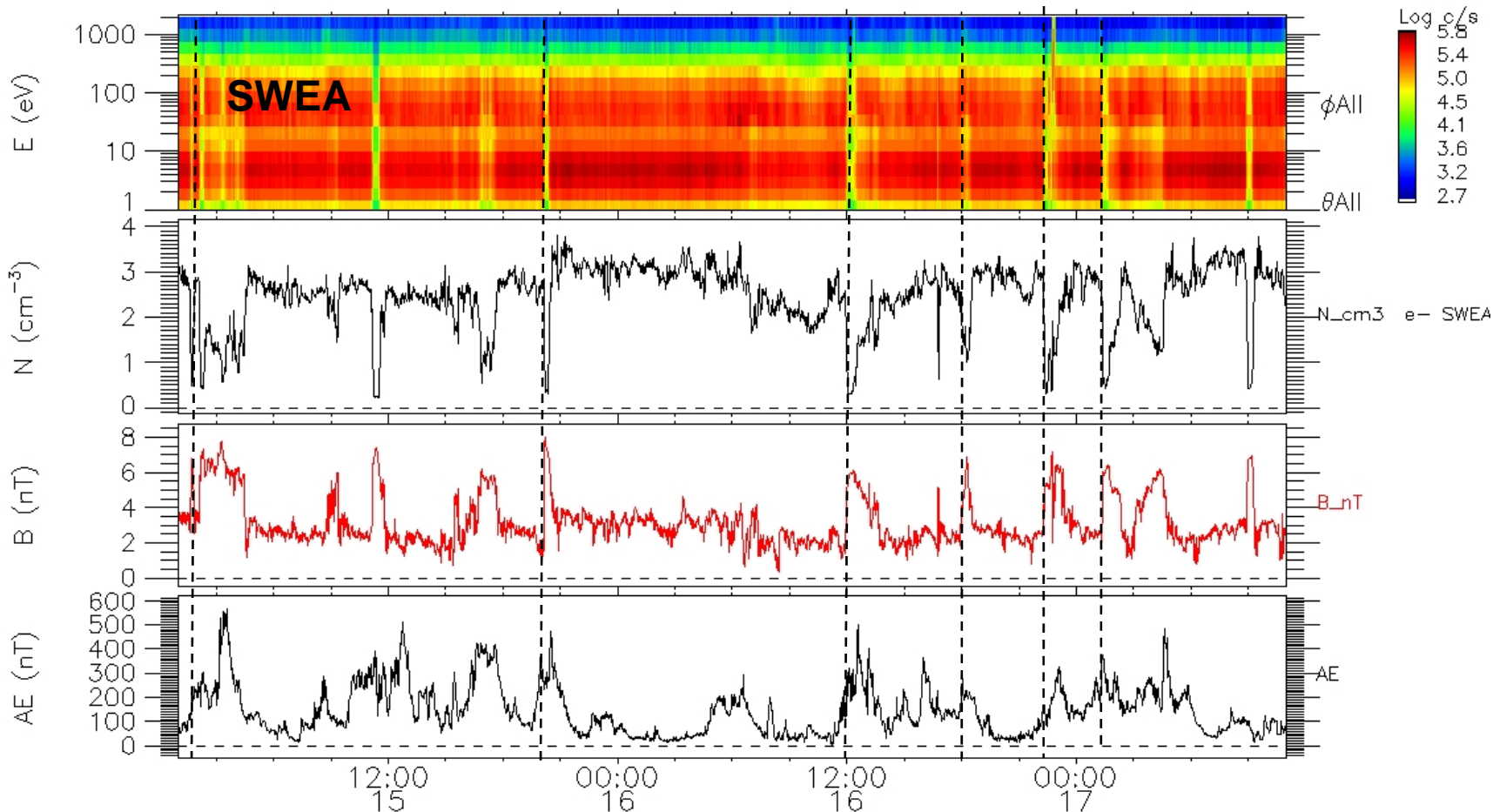


AE enhancements and related far tail dynamics

STEREO BEHIND

BEHIND (SC 2)

15/Feb/2007



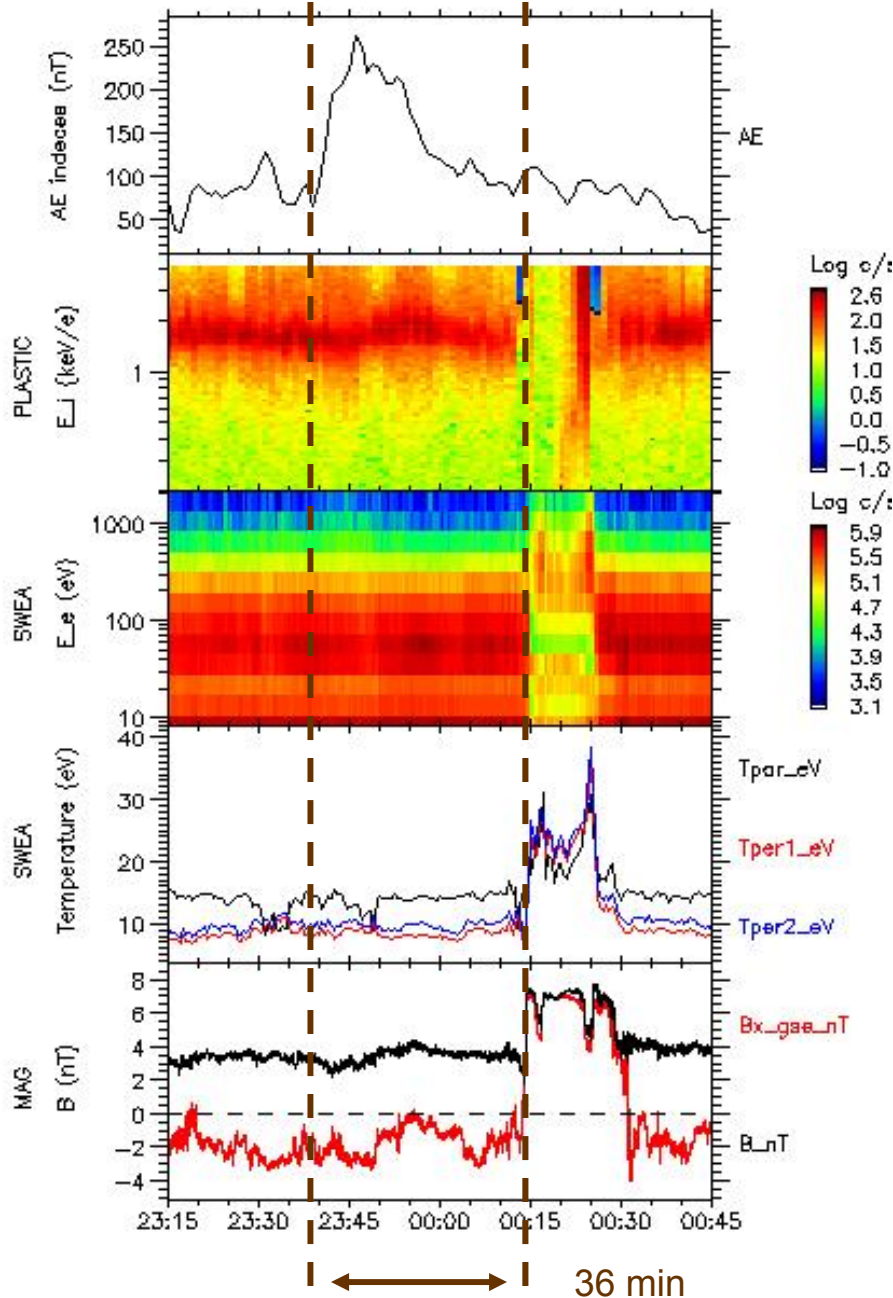
XGSM_RT	-211.83	-216.11	-220.37	-224.63	-228.88
YGSM_RT	18.97	29.16	29.29	23.11	35.70
ZGSM_RT	43.21	36.74	36.41	40.53	30.09

AE ↗

STEREO B Msheath → Msphere

STEREO BEHIND

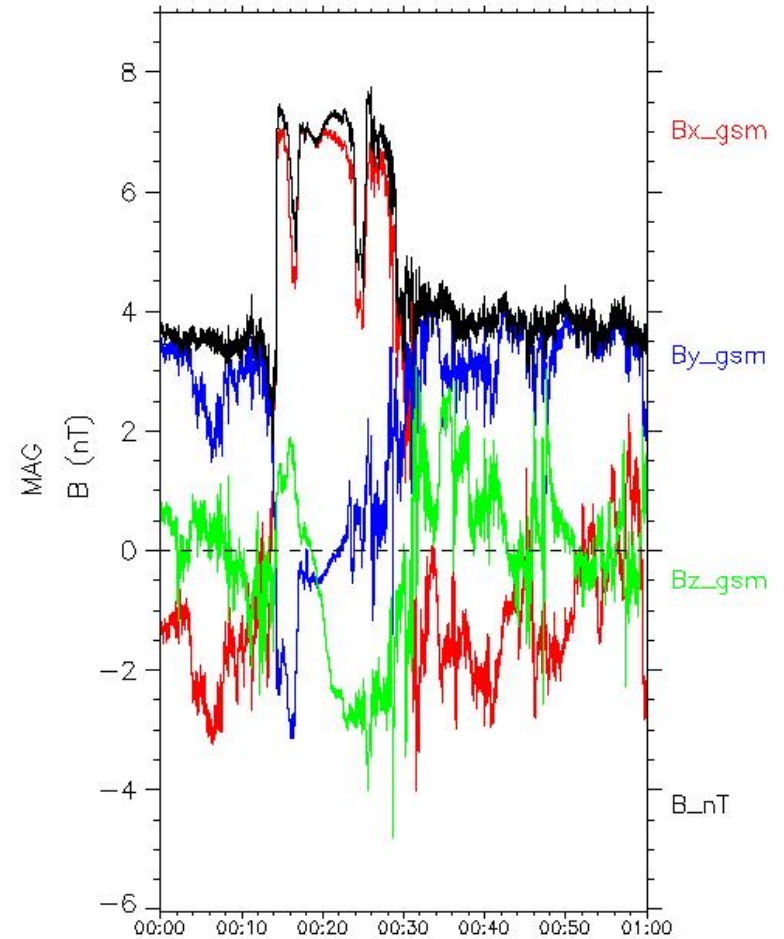
2007 February 14–15



Plasmoid at 211 R_E

STEREO BEHIND

2007 February 14–15

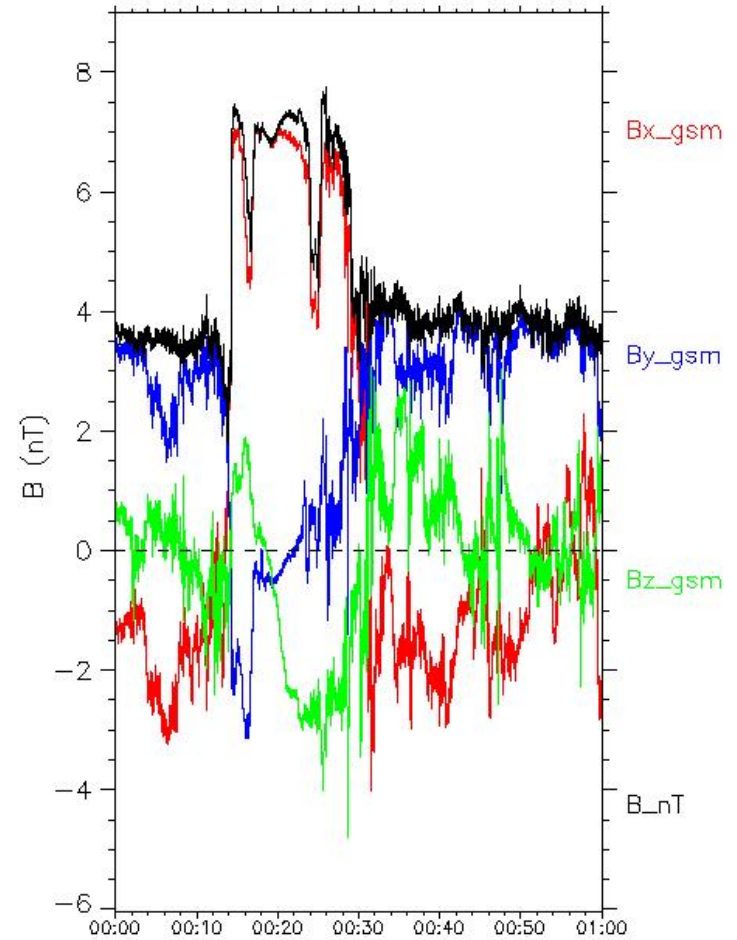
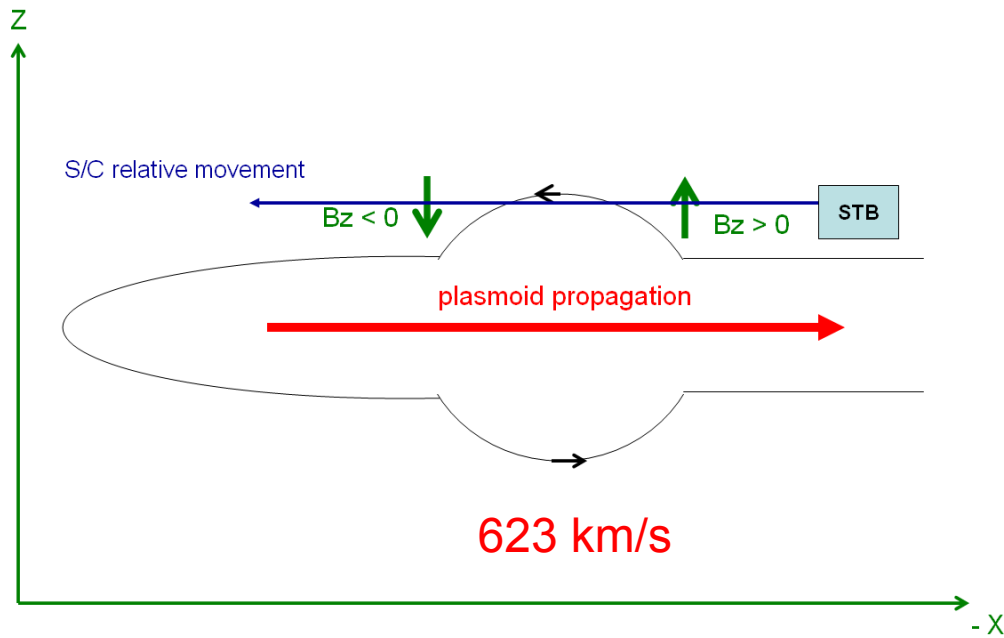


→ $211 R_E / 36 \text{ min} = 623 \text{ km/s}$

Plasmoid at 211 R_E

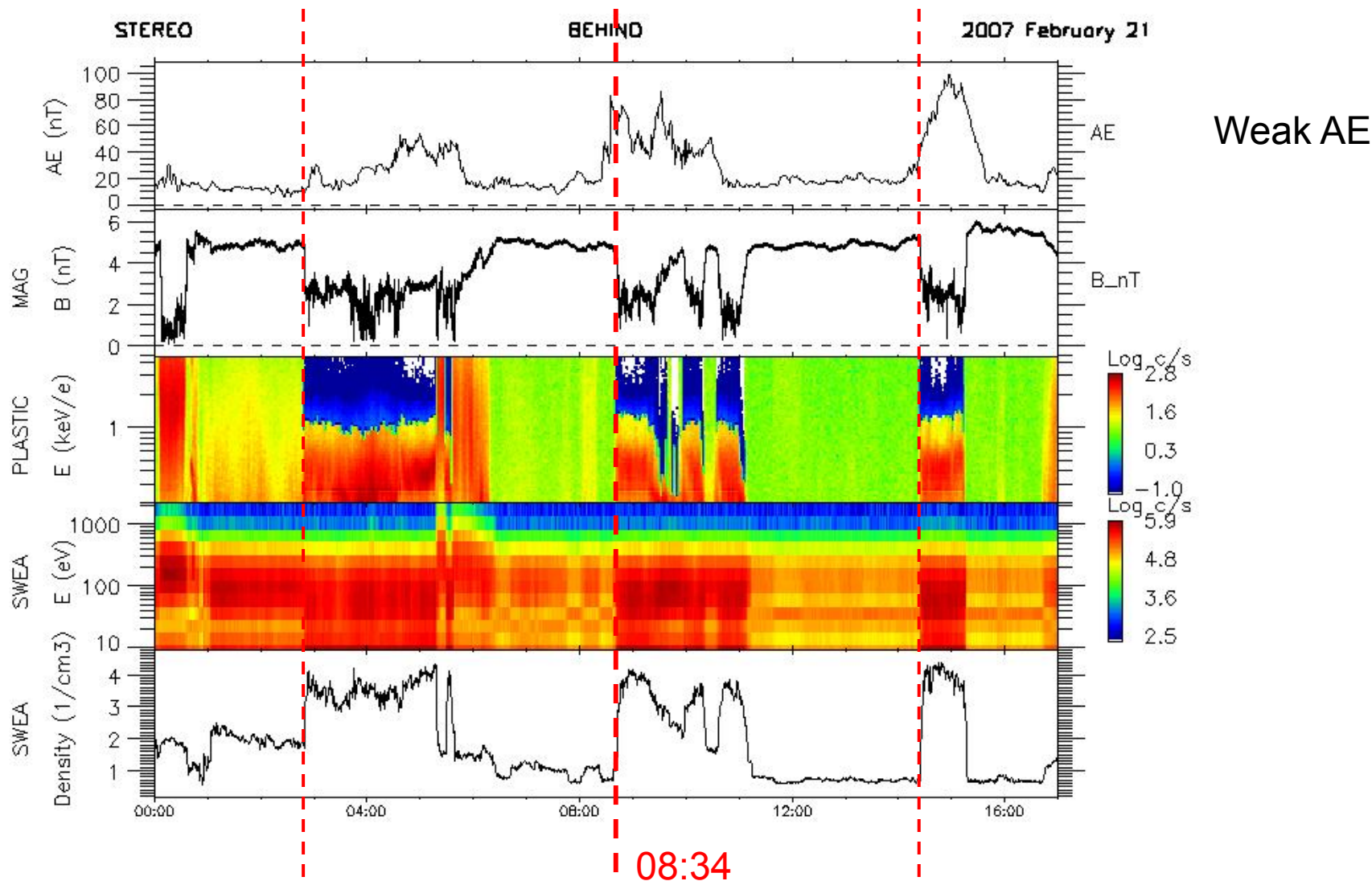
STEREO BEHIND

2007 February 14–15

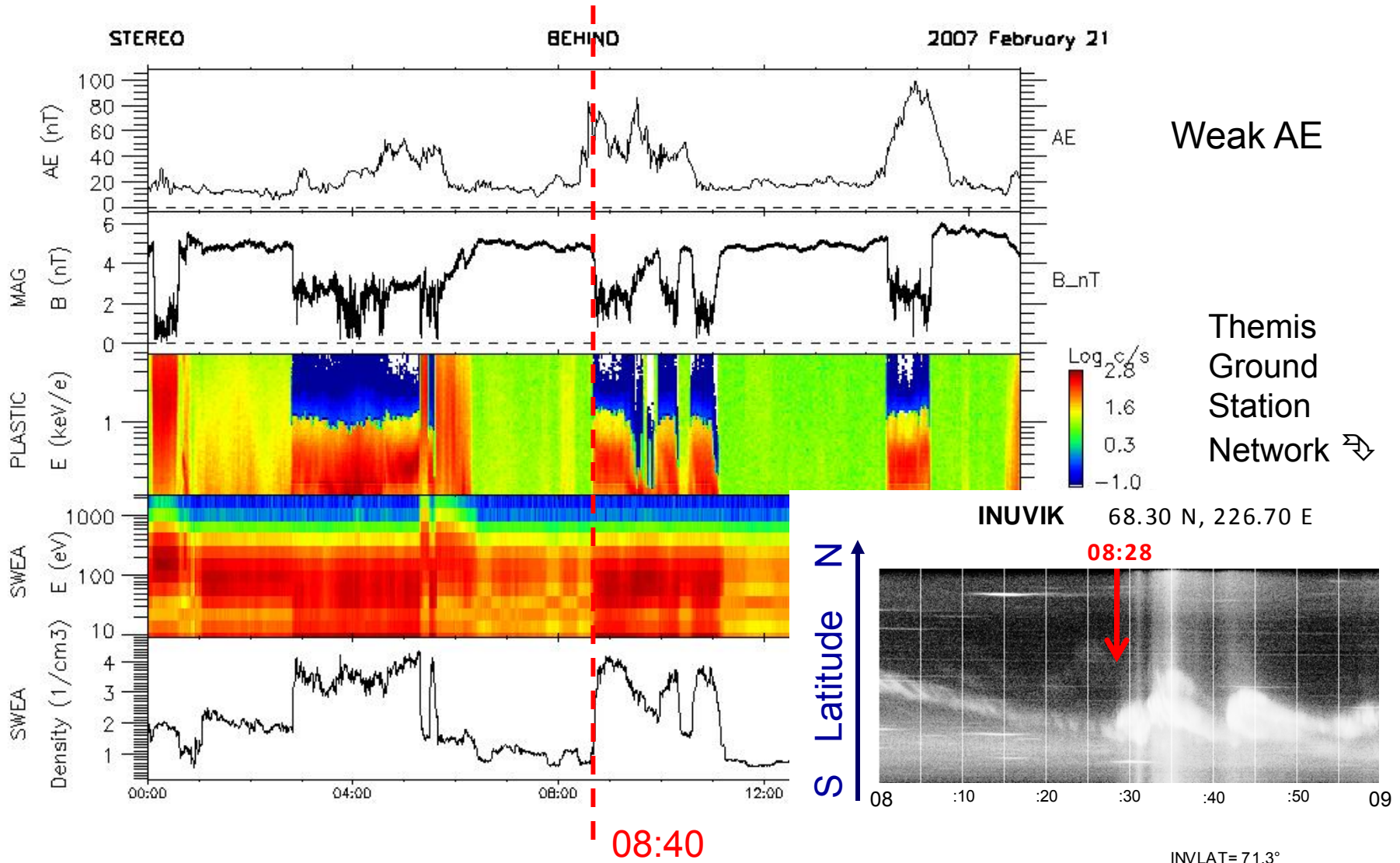


→ $211 R_E / 36 \text{ min} = 623 \text{ km/s}$

Very fast response of the far tail ($255 R_E$) of the Earth magnetosphere to weak substorms: a STEREO view

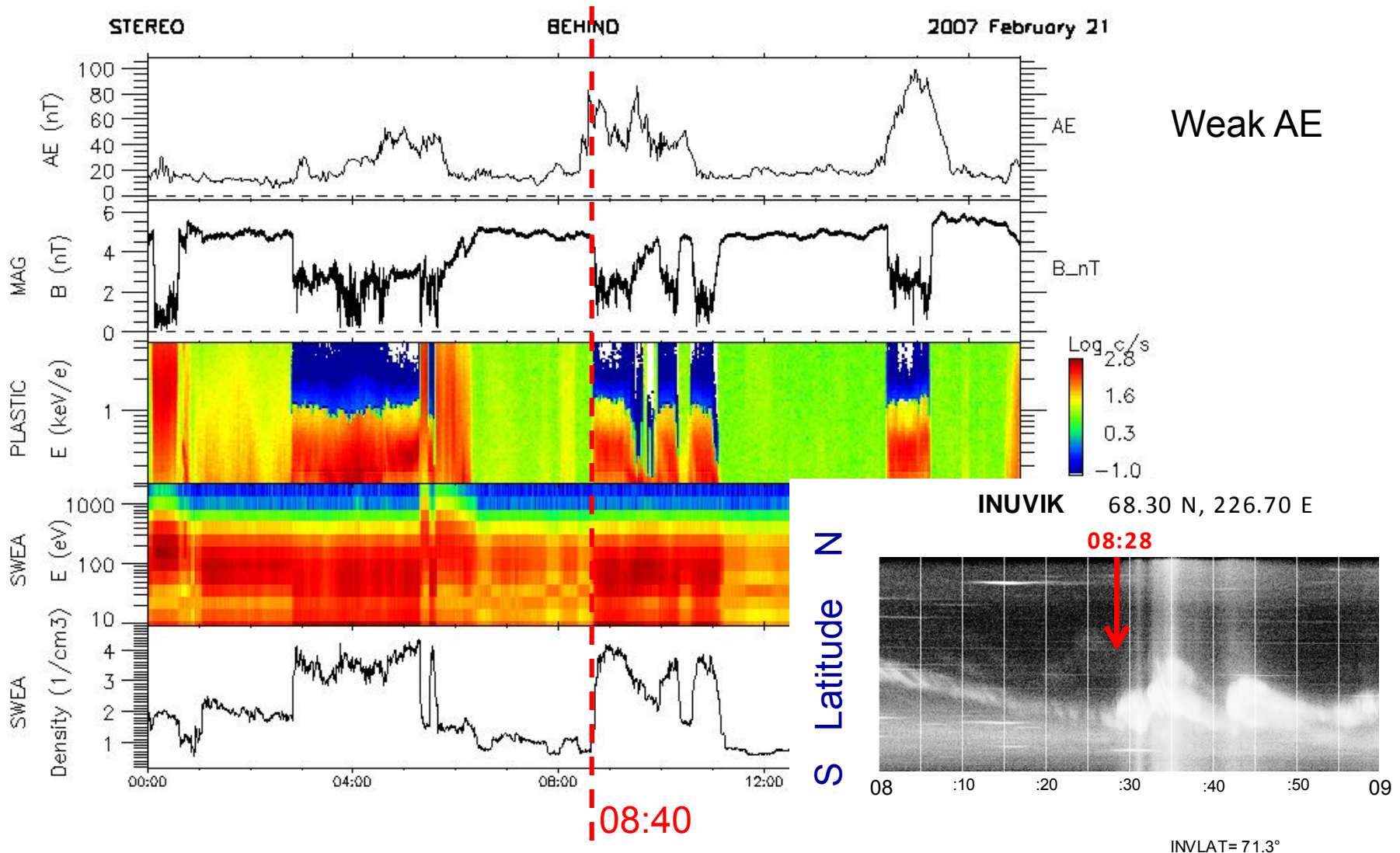


Very fast response of the far tail ($255 R_E$) of the Earth magnetosphere to weak substorms: a STEREO view



Very fast response of the far tail ($255 R_E$) of the Earth magnetosphere to weak substorms: a STEREO view

→ $245 R_E / 12 \text{ min} \approx 2200 \text{ km/s}$



Conclusions

- STEREO-B travelled in February and early March 2007 in the terrestrial magnetosheath and experienced several incursions into the terrestrial magnetotail, while STEREO-A was in the solar wind
- Energetic magnetospheric electrons are detected in the magnetosheath if the measured magnetic field direction is near to the x-direction ($\pm 30^\circ$). Also detected in the far plasmashet during disturbed periods
- Large substorm results as expected in the ejection of a plasmoid with an average velocity of about 600 km/s
- Very fast response of the distant tail to weak substorms probably due to the propagation of fast wave (~ 2200 km/s)



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