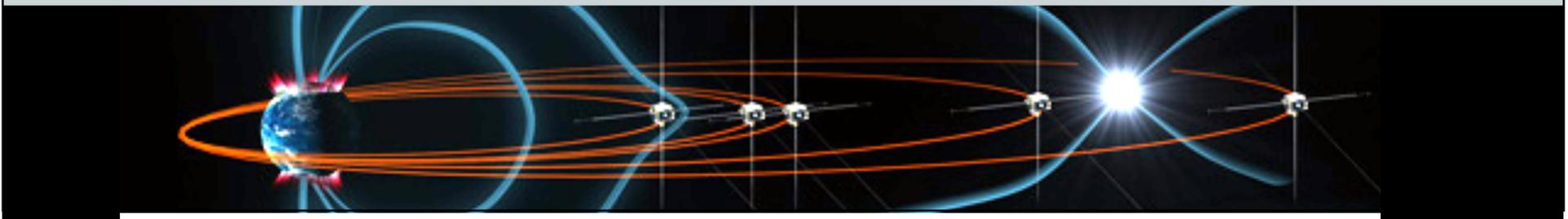




The THEMIS and CLUSTER satellite missions: status, operational planning and opportunities for collaboration

Jim Wild and the spacecraft working group

Jo Baker, Donald Danskin, Robert Fear, Adrian Grocott,
Keisuke Hosokawa, Shinichi Watari and Sessai Yukimatu



What am I talking about?

Cluster

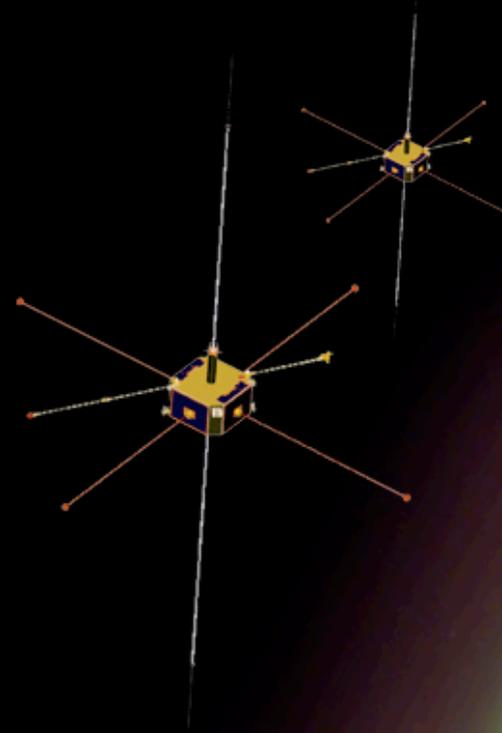
- Multi-spacecraft ESA mission
- 4 identical spacecraft equipped with plasma, field and wave instruments
- Fly in a tetrahedral formation
- Allow spatial/temporal ambiguities to be resolved
- Launched in 2000
- Mission extended to 2009



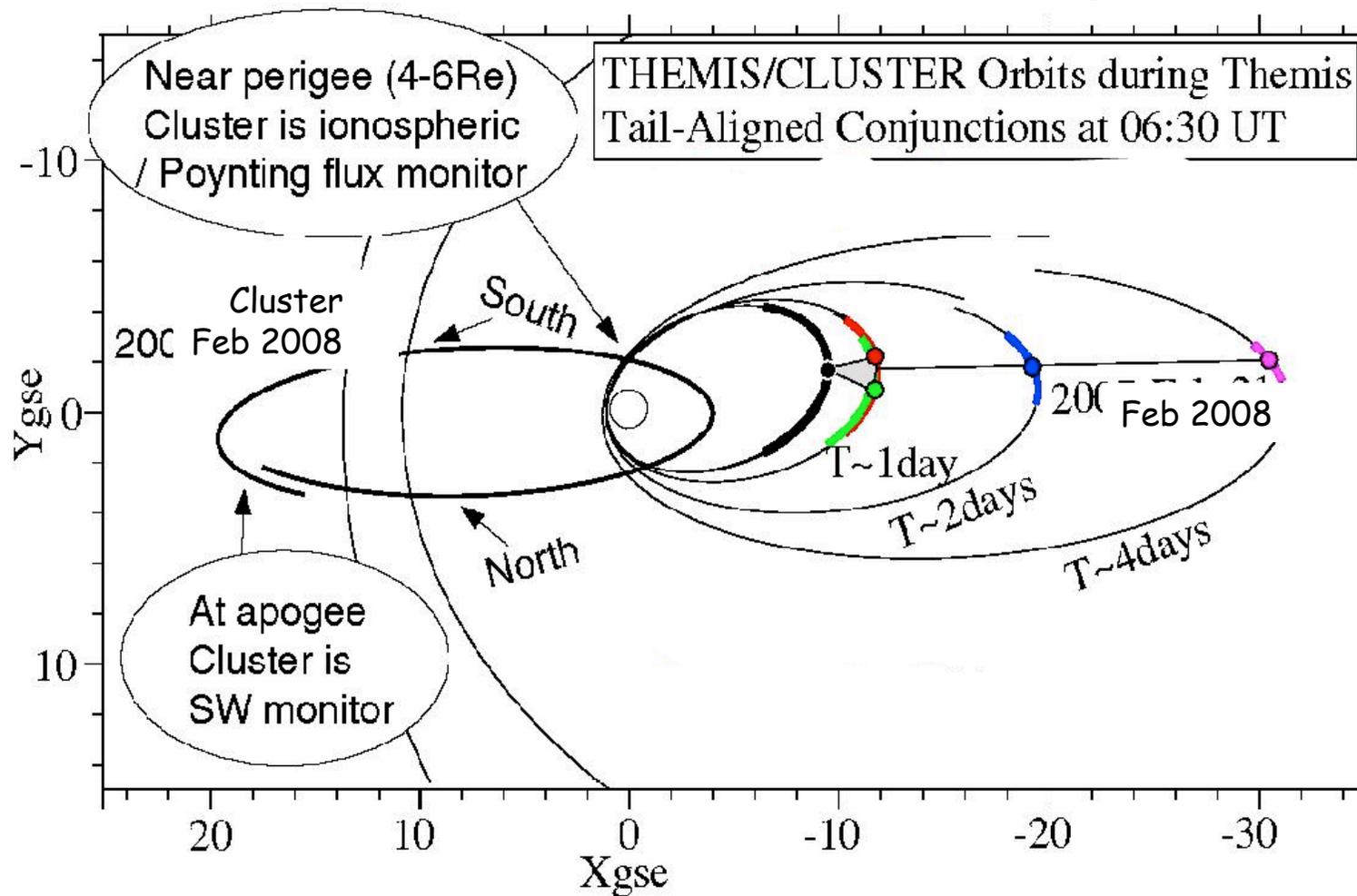
THEMIS?

Time History of Events and Macroscale Interaction during Substorms

- Multi-spacecraft NASA mission
- 5 identical spacecraft equipped with plasma, field and wave instruments
- Orbits configured such that spacecraft line up in the magnetospheric tail plasma sheet every 4 days
- Designed to determine the timing of various phenomena during substorm onset
- Launched in 2007
- Mission extended to 2012



Cluster Collaboration with THEMIS: tail



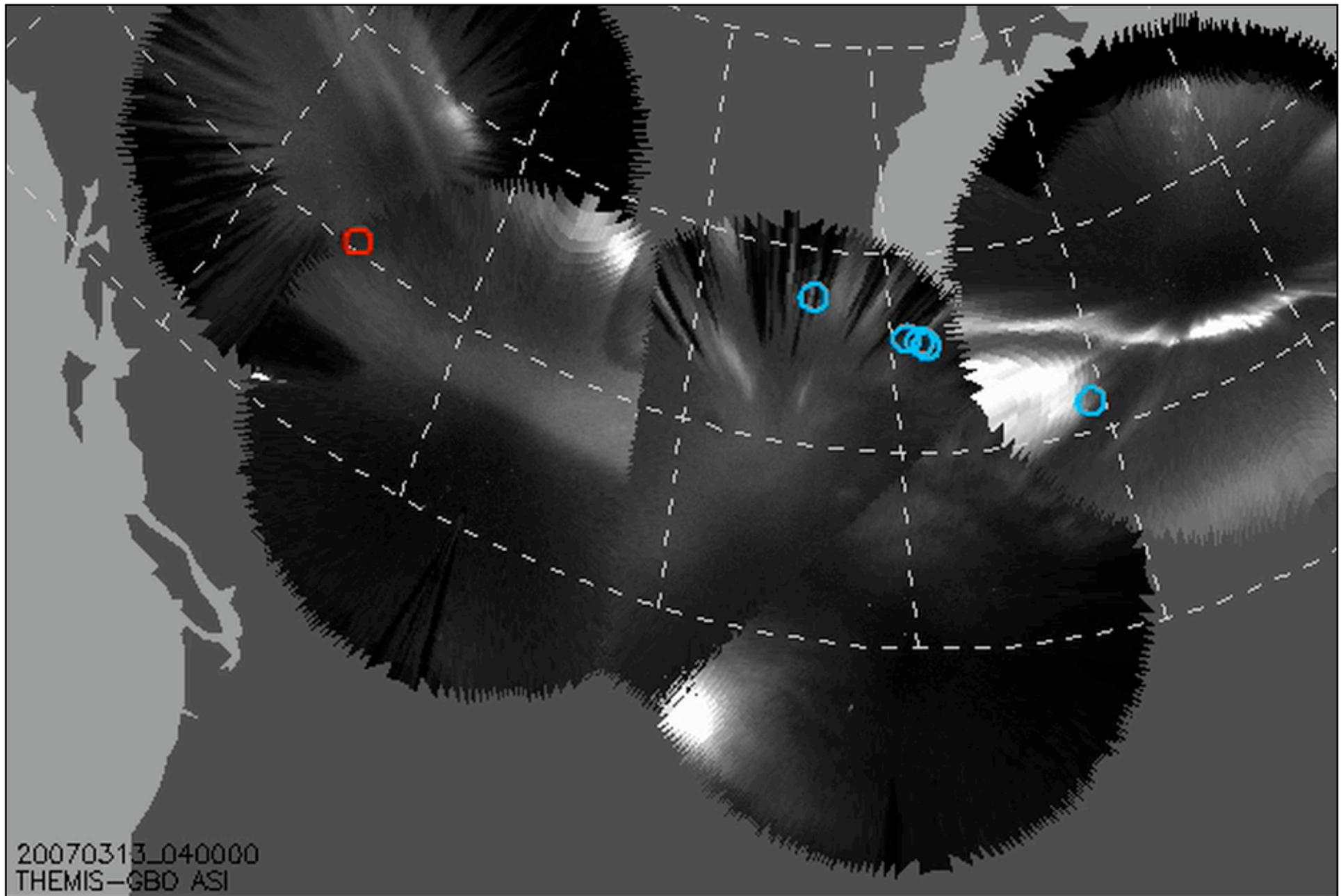
- THEMIS in the tail and Cluster in solar wind/auroral zone
- THEMIS in dusk flank and Cluster in dawn flank (+3 months)
- THEMIS in SW and Cluster in the tail (+3 months)
- THEMIS dawn flank and Cluster in dusk flank (+3 months)

SuperDARN operations

- Run themisscan mode
 - special time
 - 3s sounding
 - full scan interleaved camped beam
- Typically 6-10 days scheduled per month
- Orbits/footprint plots

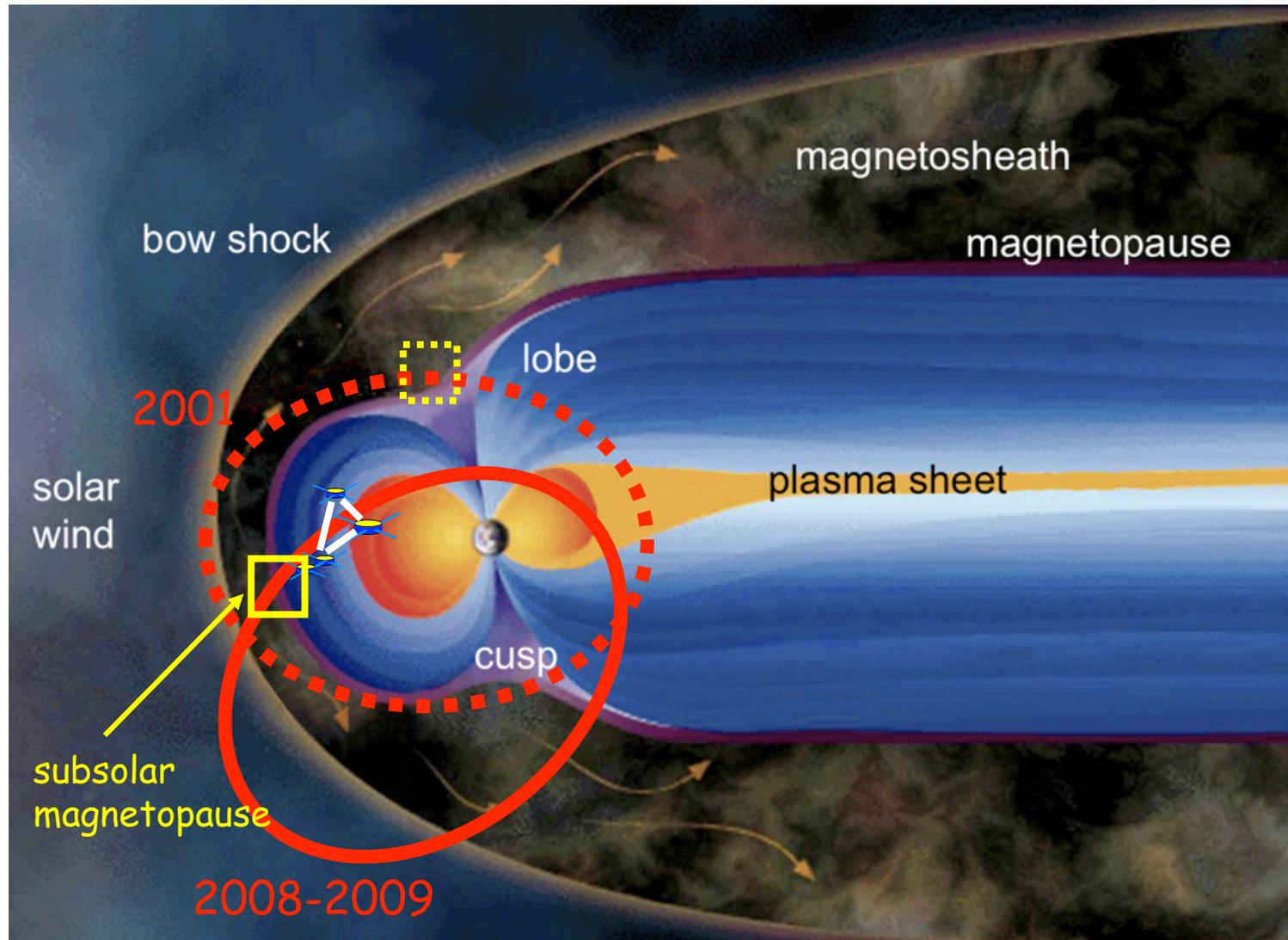
www.dcs.lancs.ac.uk/~wildj/themis/



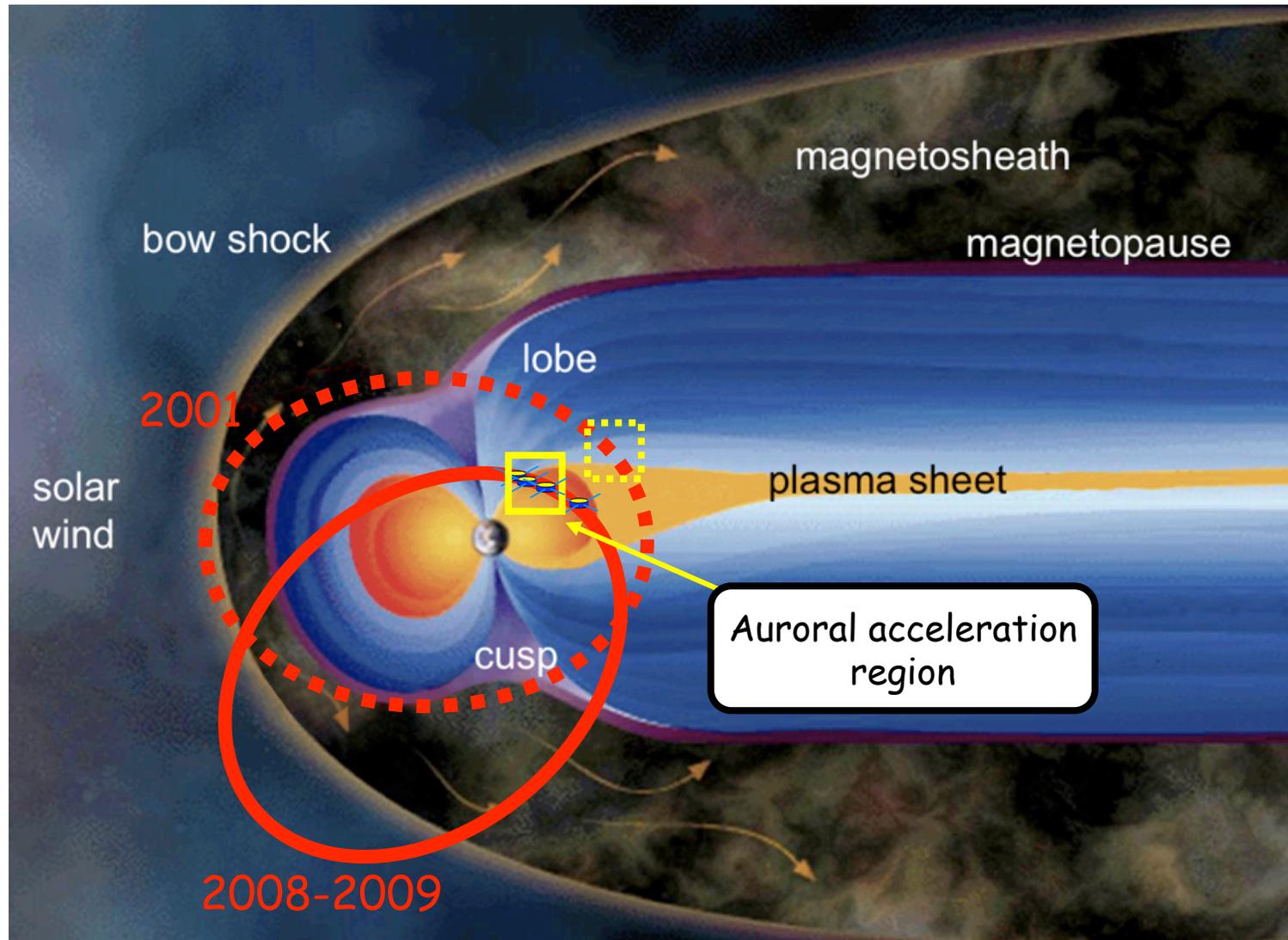


THEMIS First results: Donovan *et al* (GRL, in press)

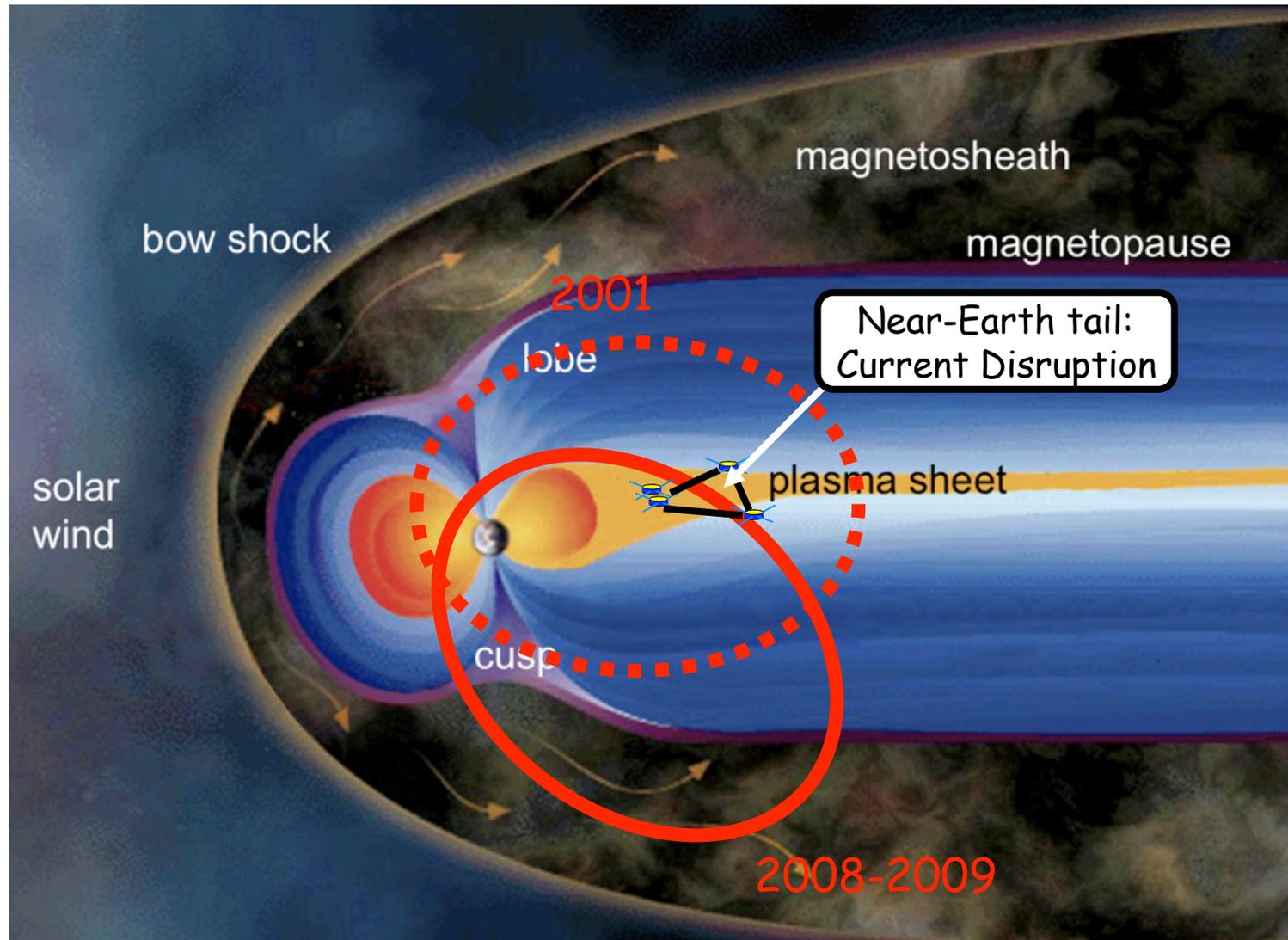
New Regions visited by Cluster in 2008/9: Subsolar magnetopause



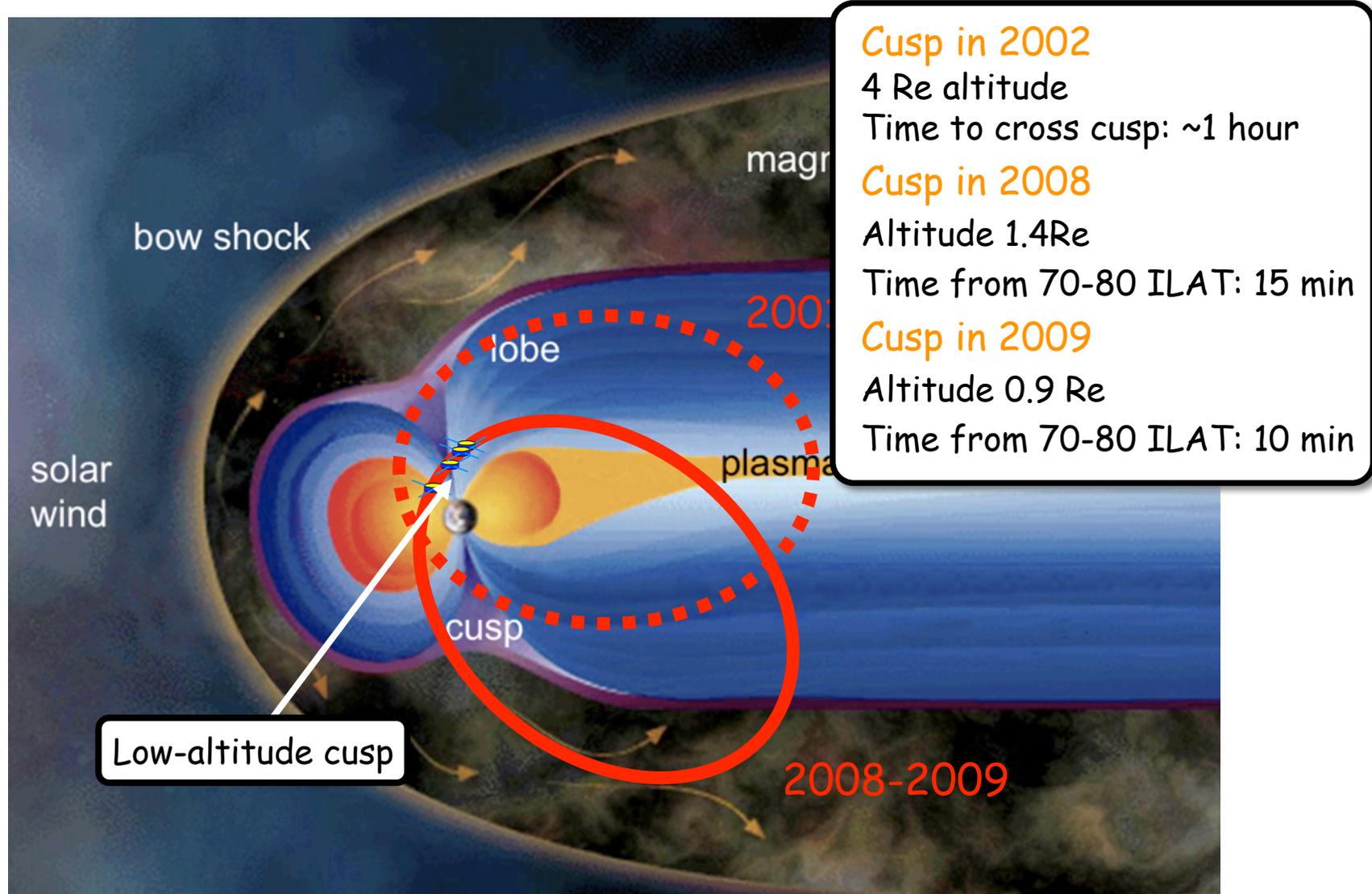
New Regions visited by Cluster in 2008/9: Auroral acceleration region



New Regions visited by Cluster in 2008/9: Near-Earth neutral sheet



New Regions visited by Cluster in 2008/9: Low-altitude cusp

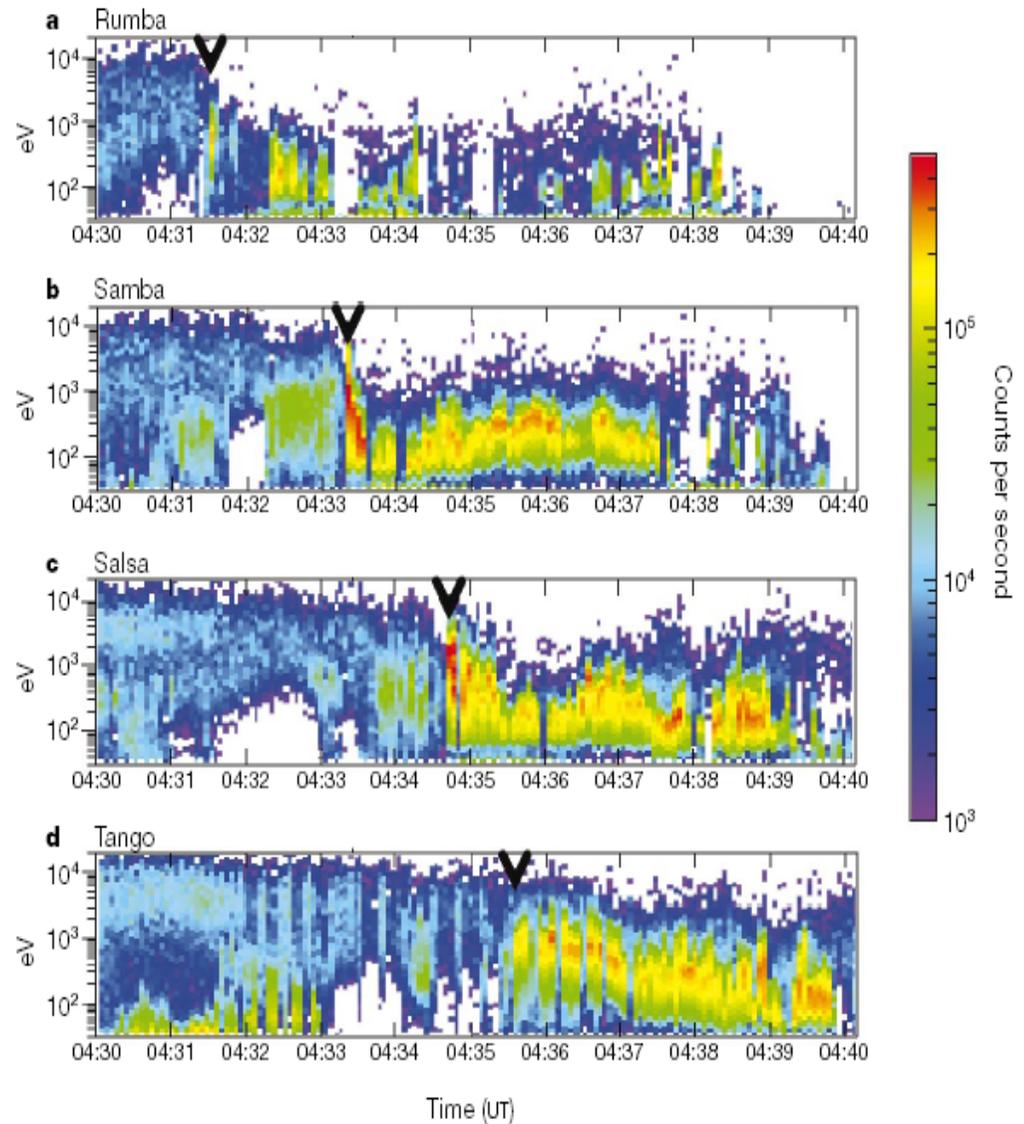
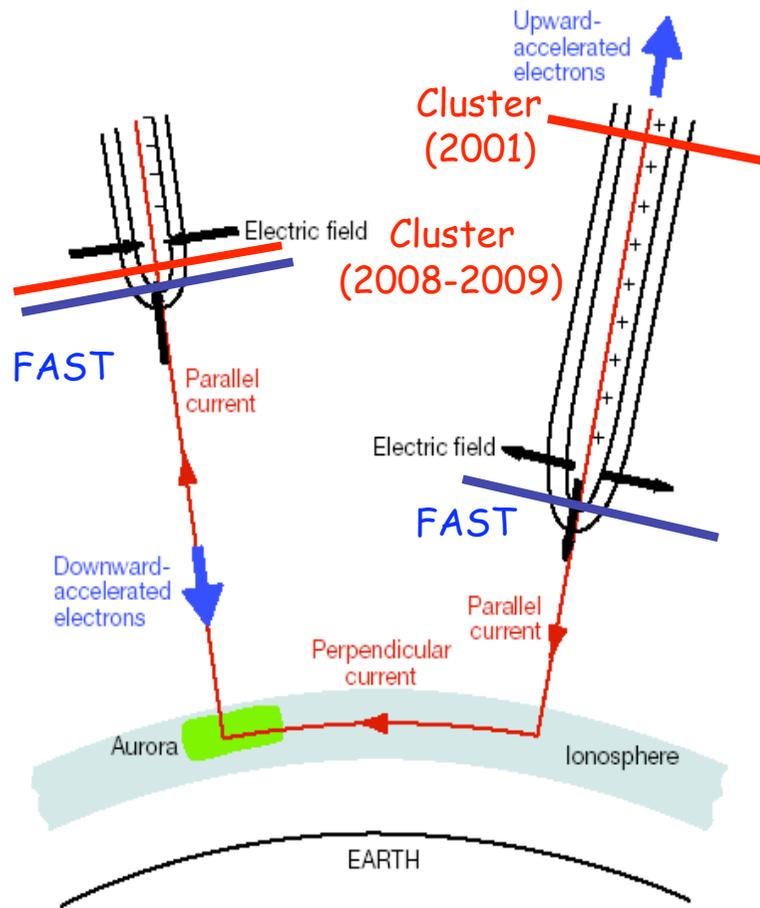


Low-altitude cusp

Cusp in 2002
4 Re altitude
Time to cross cusp: ~1 hour

Cusp in 2008
Altitude 1.4 Re
Time from 70-80 ILAT: 15 min

Cusp in 2009
Altitude 0.9 Re
Time from 70-80 ILAT: 10 min

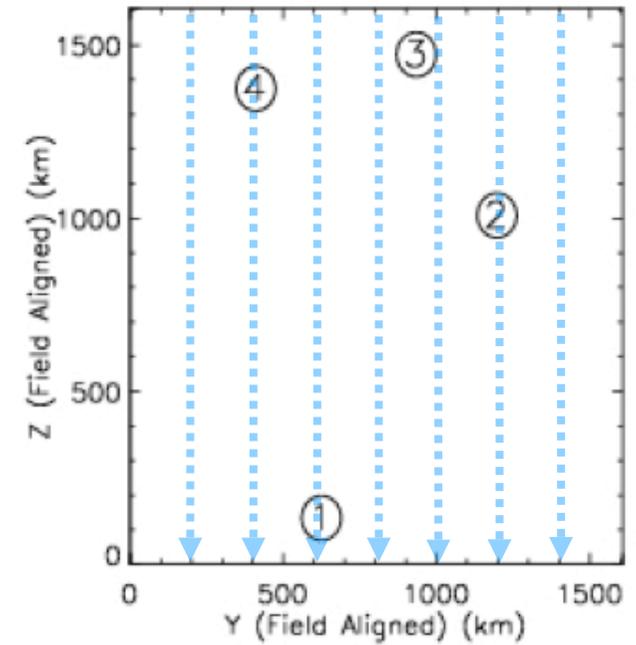
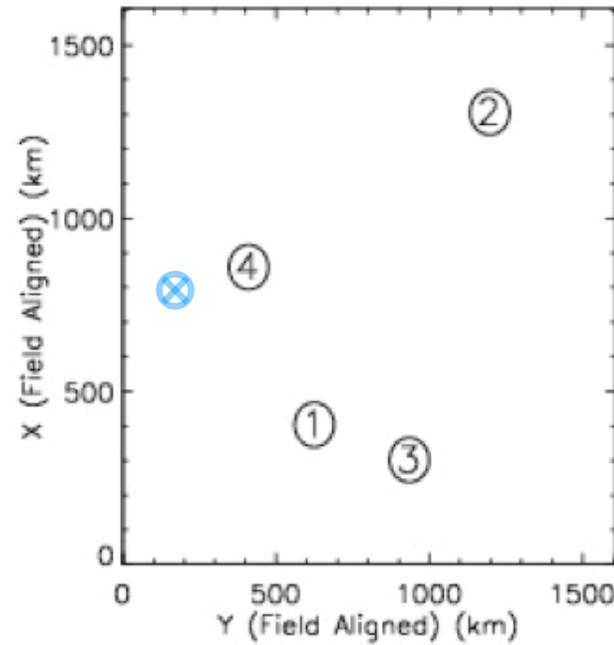
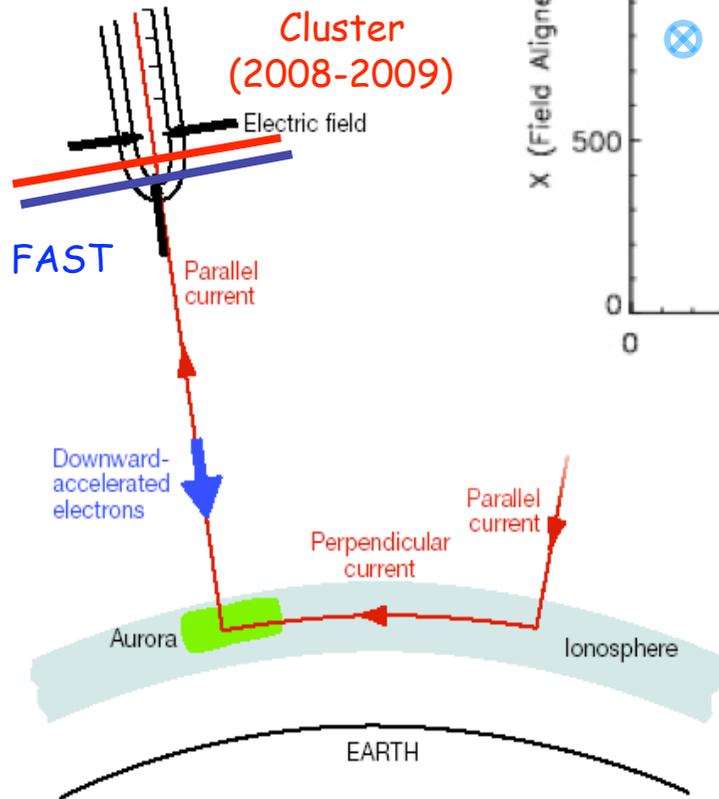


- Temporal evolution of auroral acceleration?
- Study auroral acceleration with 4 s/c (2008-2009)

AURORAL ACCELERATION REGION CONFIGURATION

2009/06/05

16:55:23



$\sim 1 R_E$ Altitude

THE TAKE-AWAY MESSAGES

Cluster: new regions, new configurations, new separations, unprecedented data access (Cluster Active Archive)

THEMIS: new mission, new strategy, new capabilities, open access data (CDAWeb + public THEMIS tools)

Cluster + THEMIS = First super constellation ever

OBVIOUS SYNERGY BETWEEN THESE MISSIONS
(SPACE & GROUND-BASED)

The future is exciting!

Both ESA + NASA currently considering mission extensions

New regions and science for Cluster

THEMIS prime conjunctions will occur over the Scandinavian sector!