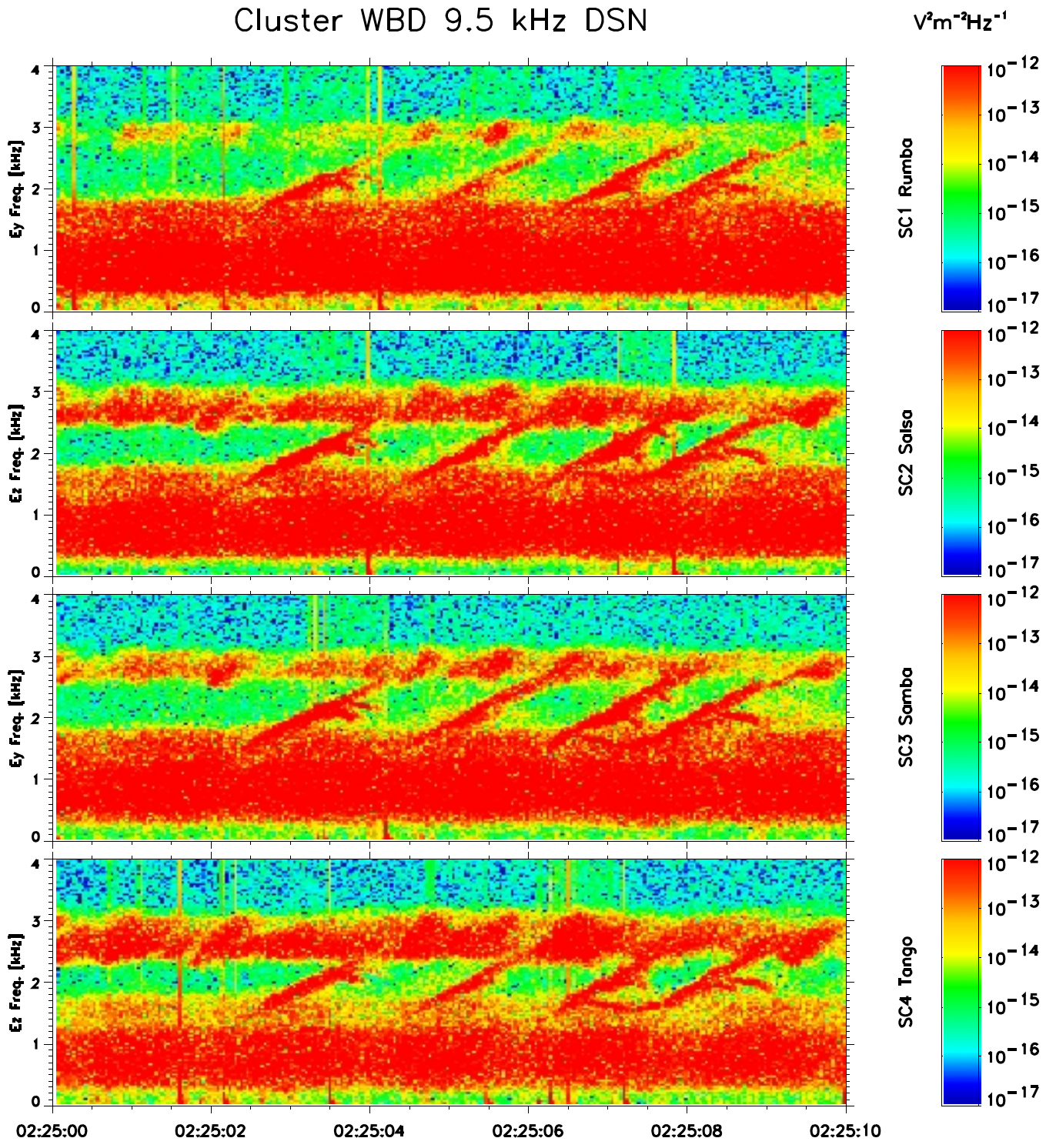
- 1.5-2.5 kHz fine-structured triggered emissions observed on all 4 spacecraft for ~ 10 seconds
- Triggered emissions appear as risers and hooks.



R_E	4.63	4.63	4.63	4.63	4.63	4.62
λ_m	−19.29	−19.28	−19.26	−19.24	−19.23	−19.21
MLT	12.53	12.53	12.53	12.53	12.53	12.53
L	5.20	5.20	5.20	5.20	5.20	5.20

UT_OBT: 2003-08-31T02:25:00 to 2003-08-31T02:25:10

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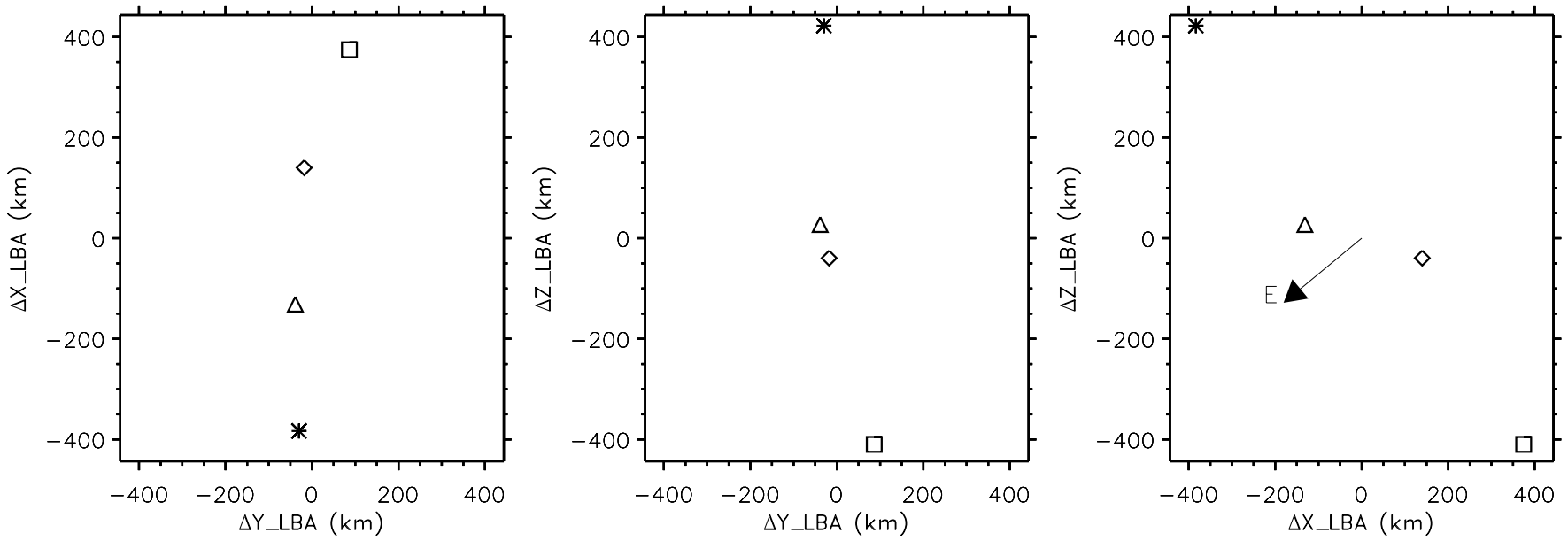
Cluster Relative Positions

SCET: 2003-Aug-31T02:25:00.000



Cluster	1 ∗	2 ◇	3 △	4 □
GMLat	−17.39°	−18.72°	−18.30°	−19.56°
Re	4.61	4.64	4.61	4.63
L	5.07	5.17	5.11	5.22
MLT	12.52	12.52	12.52	12.54

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DISCUSSIONS AND CONCLUSIONS- VLF TE (1)

- Electromagnetic VLF Triggered Emissions are observed on Cluster as fine-structured risers, fallers and hooks in the Fourier-transformed spectrograms.
- The triggered emissions are observed within 20 degrees north and south of the magnetic equator at around 4-5 Re.
- Correlation distances are as great as 800 km both along and cross B.
- These emissions are seen propagating both toward and away from the magnetic equator at group velocities around 1×10^7 m/s.

DISCUSSIONS AND CONCLUSIONS- VLF TE (2)

- Data from the HYDRA and PWI instruments on the POLAR spacecraft within the plasmasphere have demonstrated that VLF emissions are triggered near the magnetic equatorial plane during times when the energetic electron flux near 20 keV exceeds 10^6/cm^2-s-sr-keV and the energetic electron pitch angle distribution is highly anisotropic [Bell, et al. 2000]. It is believed that the emissions are generated through a gyroresonance interaction between the energetic electrons and the VLF input waves.

- The available Cluster RAPID energetic electron data during some of the triggered emission events suggest that the flux of energetic electrons near 20-30 keV exceeded 10^6/cm^2-s-sr-keV. Thus there is reason to believe that the triggered emissions may also be generated through gyroresonance.

- To test this hypothesis we calculate the total amplification that a VLF wave would experience as it propagates across the magnetic equator in the presence of the measured RAPID energetic electron fluxes.

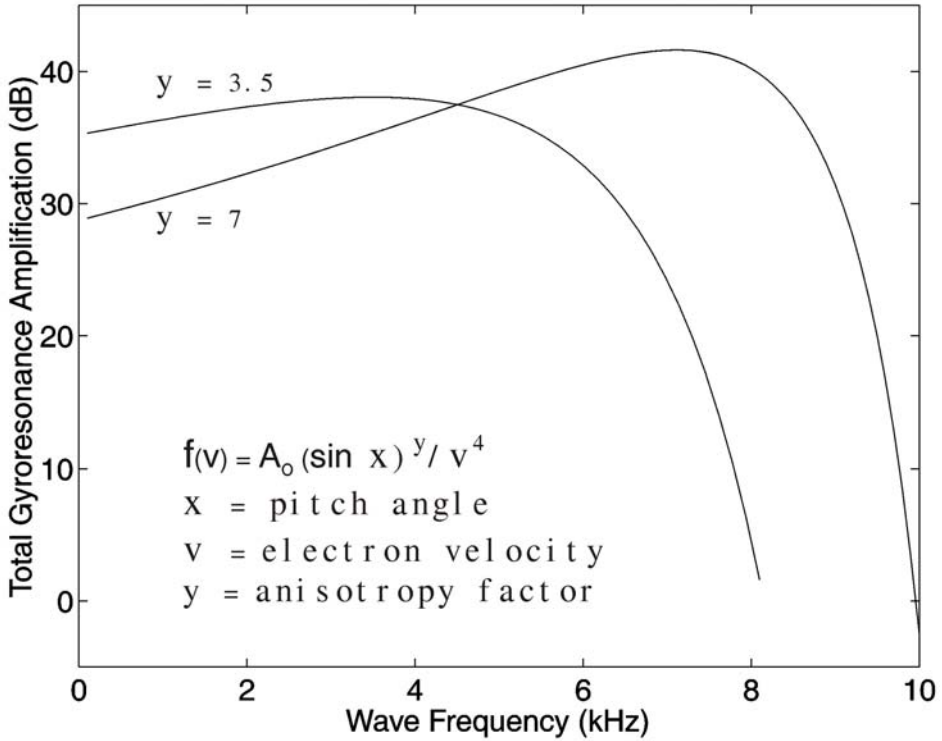
DISCUSSIONS AND CONCLUSIONS- VLF TE (3)

- To calculate the amplification we need to know the form of the energetic electron distribution function. Since we cannot determine the energetic electron distribution function directly from the RAPID data, we assume the form is similar to that observed on POLAR during triggered emission events. The general form is shown in the Figure.

- The total gyroresonance amplification across the magnetic equator is shown in the Figure for a range of wave frequency and two values of the anisotropy factor y. The value of y must exceed 2 in order for amplification to take place. The amplification rate is an increasing function of y. However as y increases, the energetic electrons are confined to a smaller region about the magnetic equator. This results in a smaller interaction region, and thus the total gain at some frequencies can decrease as y increases.

- It is clear from the Figure that the RAPID fluxes could provide enough gyroresonance amplification to grow the VLF triggered emission elements from the background noise.

DISCUSSION AND CONCLUSIONS-VLF TE (4)



Total gain due to gyroresonance which propagates across the magnetic equator at L=4.1 in the presence of a flux of energetic electrons equal to 10^6 /cm^2-s-sr-keV at 20 keV and varying with x, v and y as shown. This flux is consistent with RAPID fluxes during VLF triggered emission events