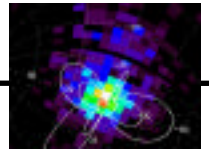
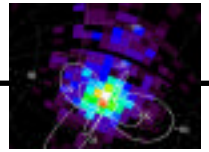


IMAGE

HENA Storms and Substorms

Don Mitchell

October 31, 2000



The IMAGE Mission HENA Instrument

(High Energy Neutral Atom instrument)

Co-Investigators:

Doug Hamilton, Johnny Hsieh, Charles Curtis, Hank Voss

APL Primary Contributors

Ed Roelof, Pontus Brandt, Don Williams, Barry Mauk (Science)

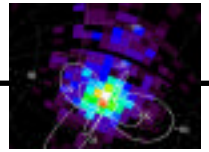
Martha Kusterer (Ground Software)

Steve Jaskulek, Chuck Schlemm, Ray Thompson, John Boldt, Paul Wilson, Ed Keath, Bruce Andrews, Nick Paschalidis, Stefano Livi (Hardware)

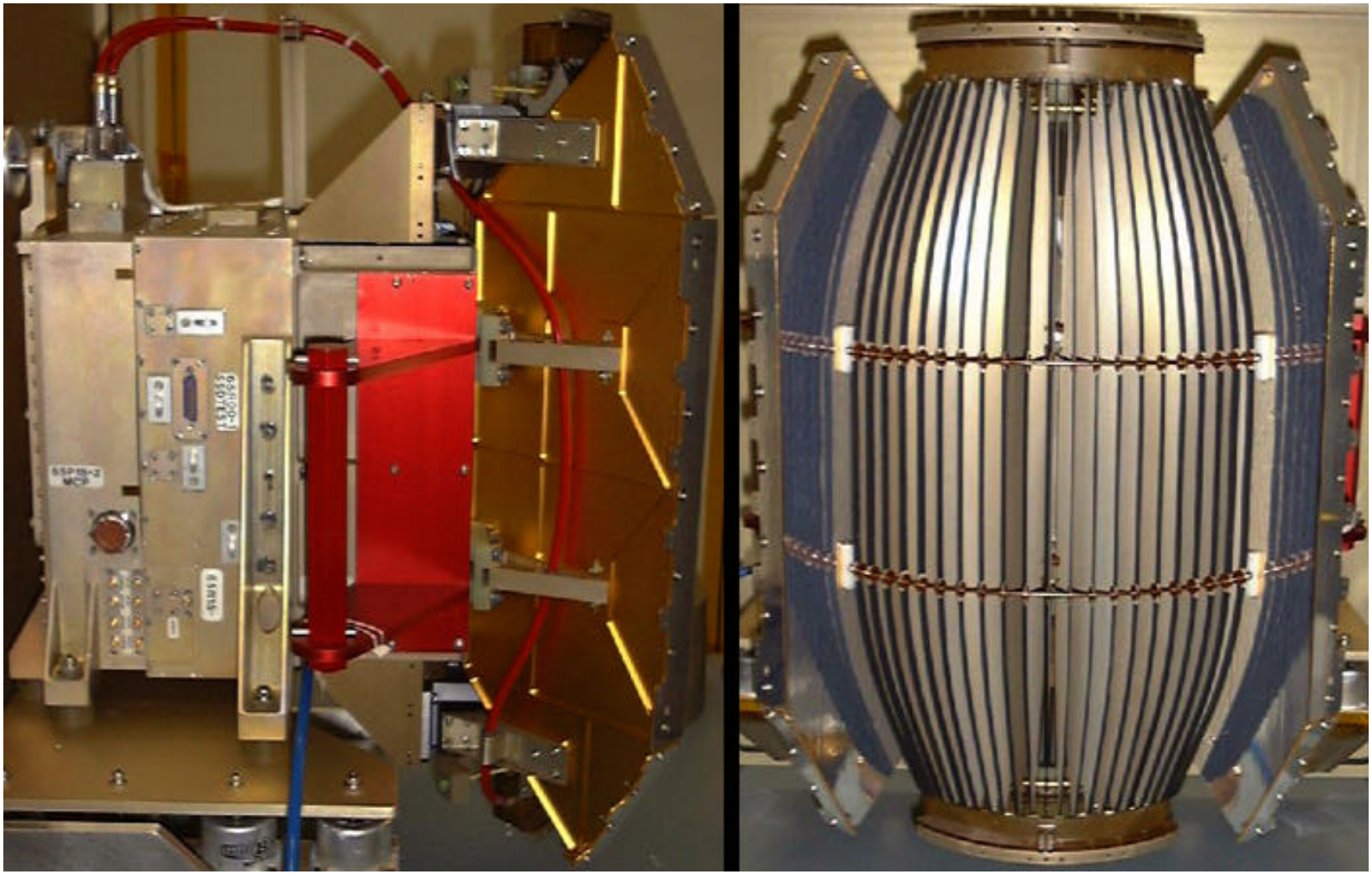
John Hayes (Flight Software)

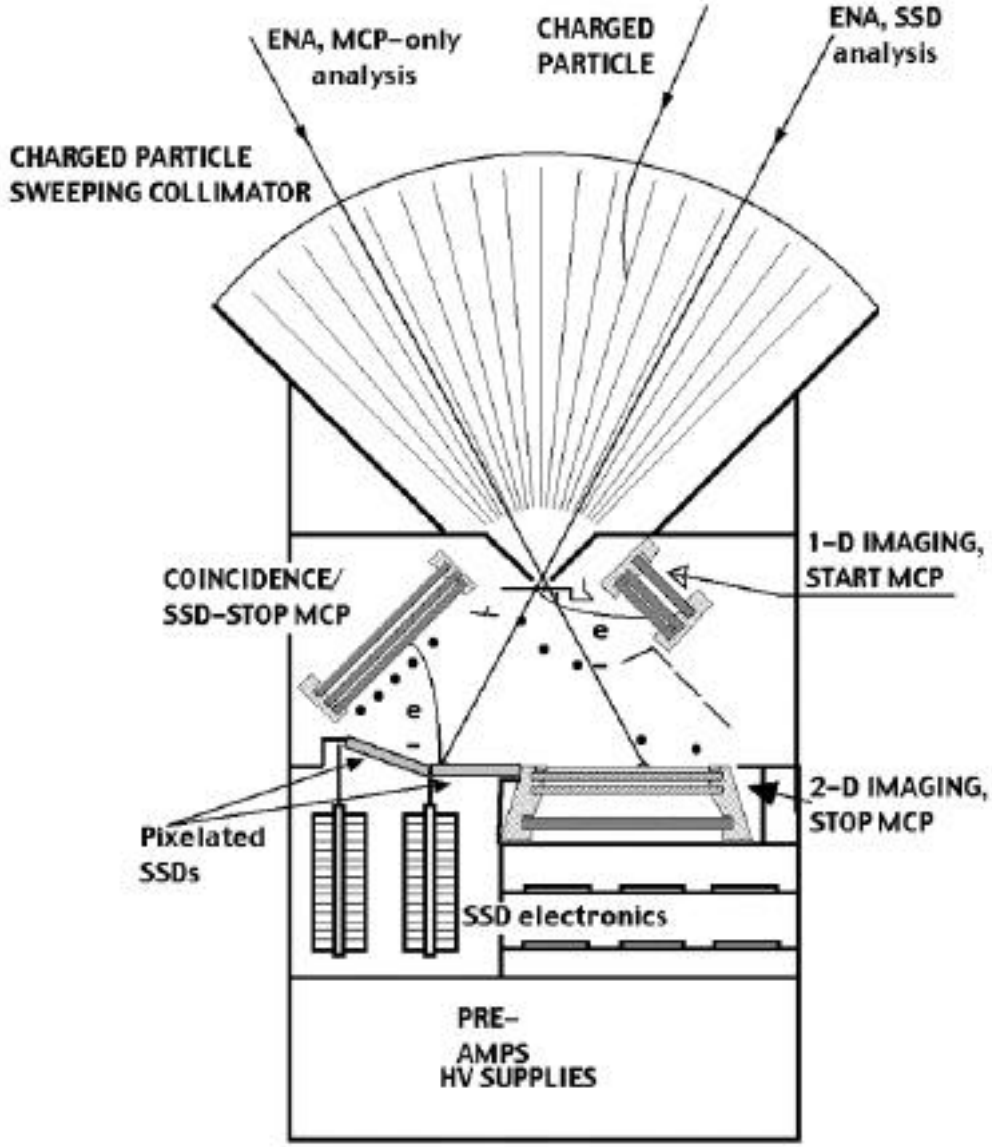
Barry Tossman (Program Management)

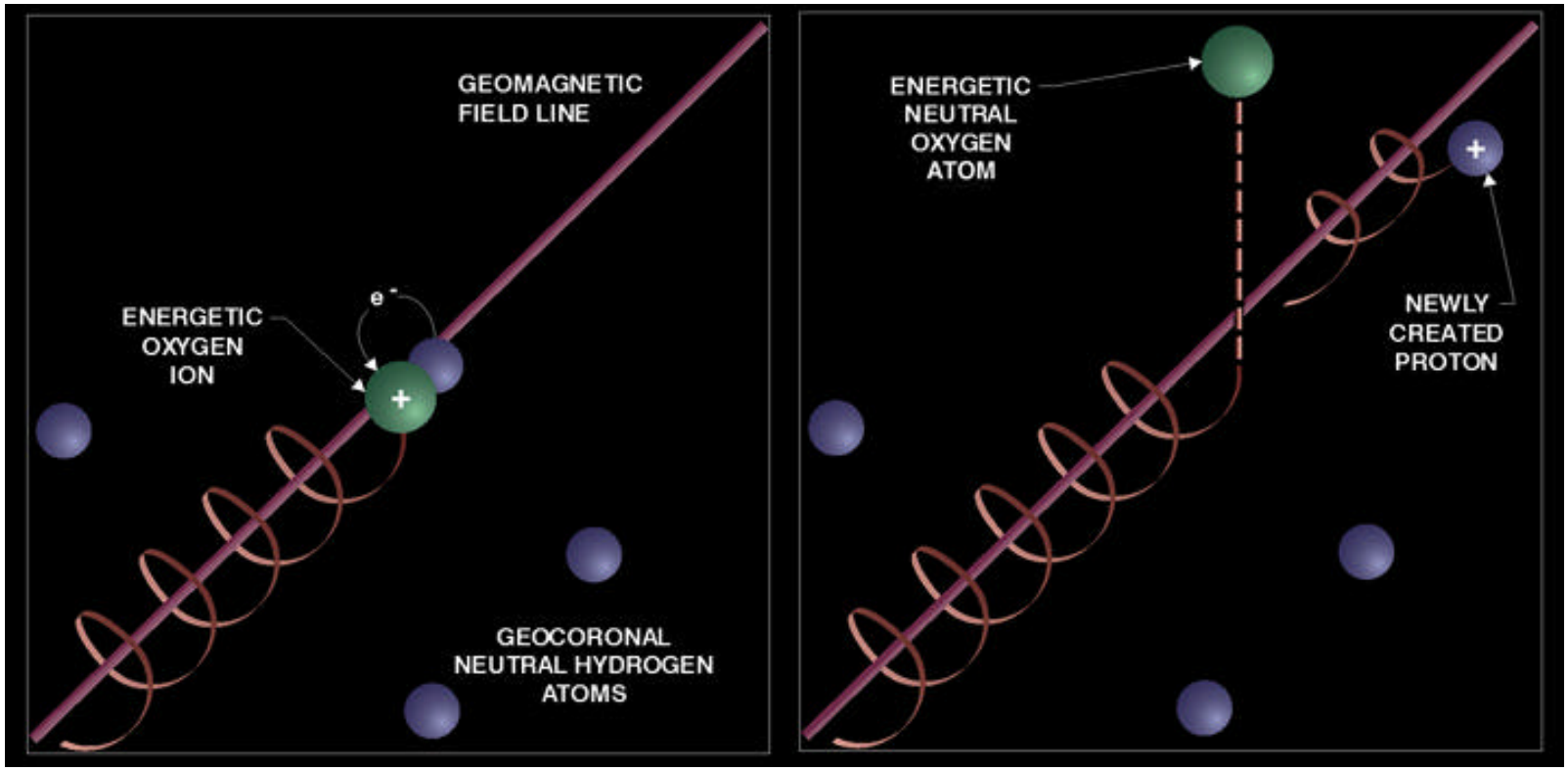
The IMAGE Mission HENA Instrument

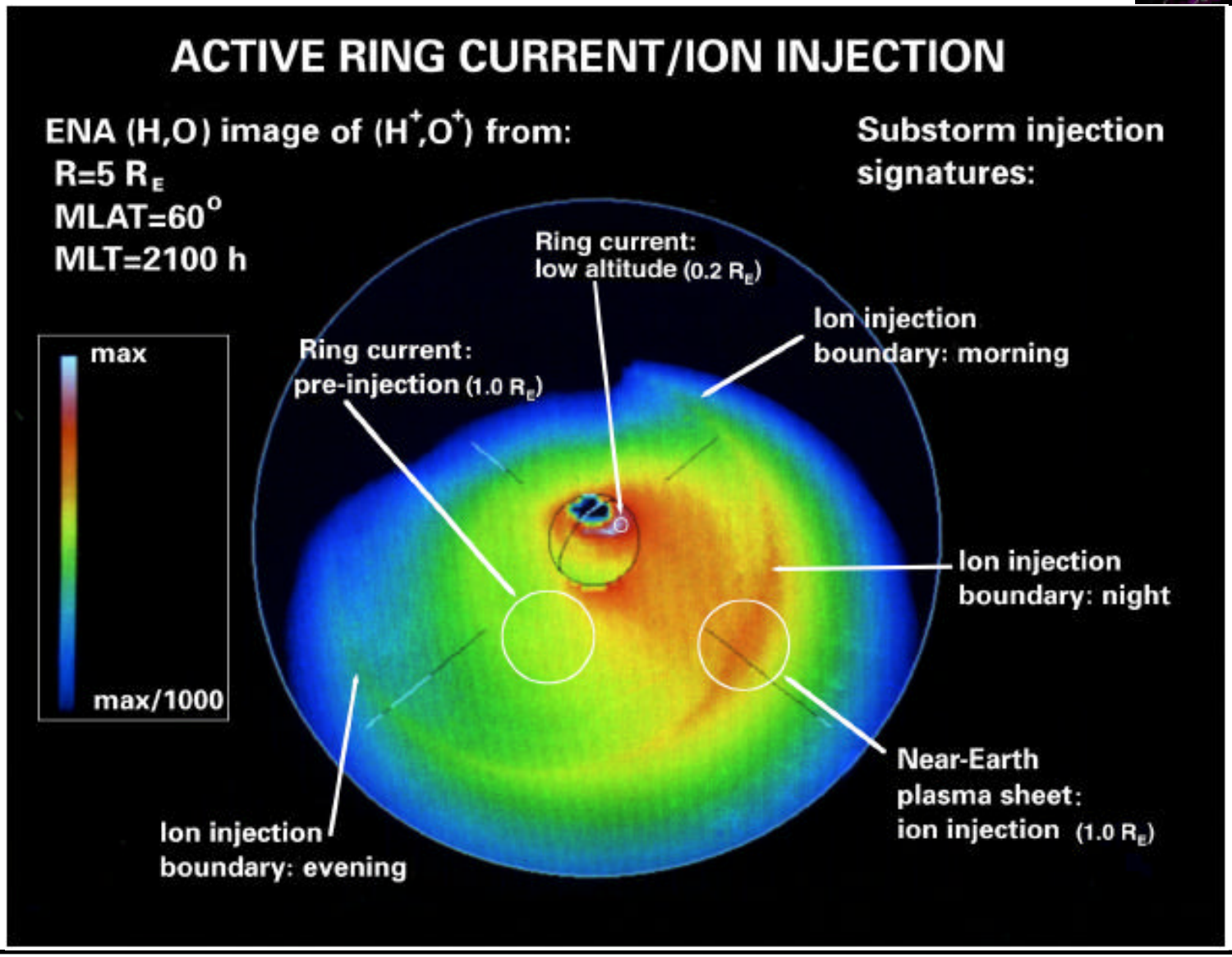


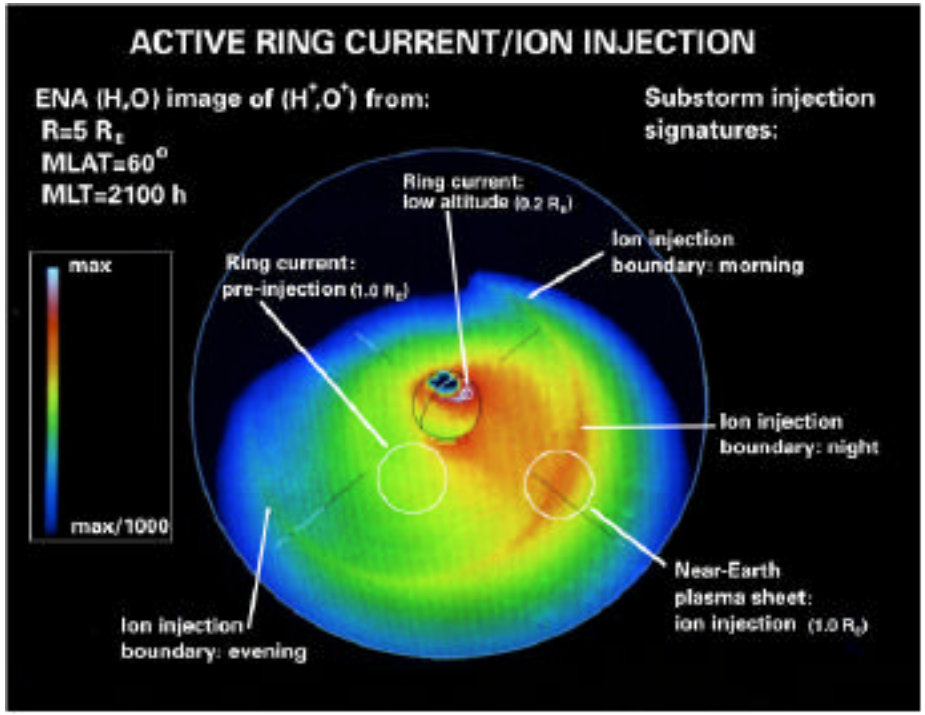
(High Energy Neutral Atom instrument)

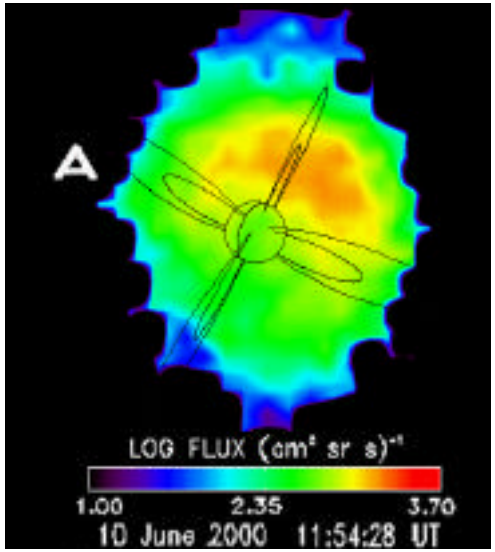


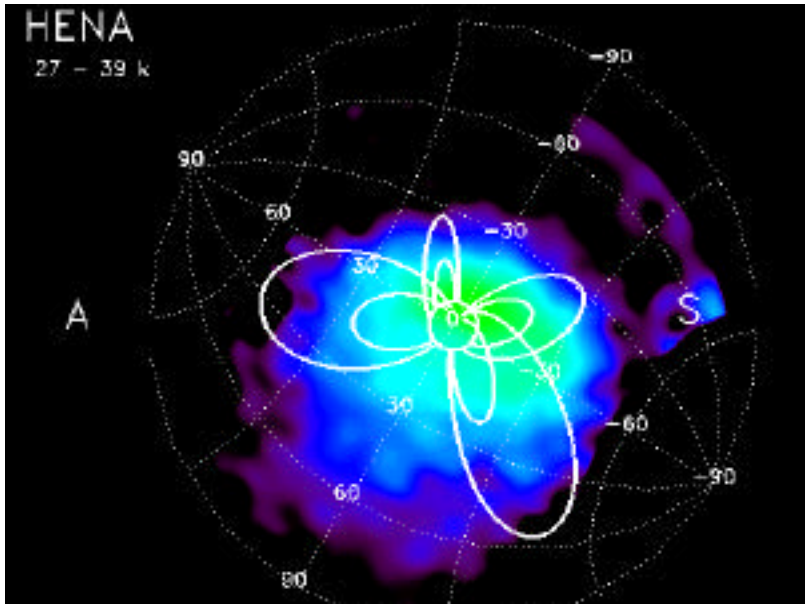

ENA, MCP–only analysis
CHARGED PARTICLE
ENA, SSD analysis
CHARGED PARTICLE SWEEPING COLLIMATOR
1–D IMAGING, START MCP
COINCIDENCE/ SSD–STOP MCP
e
e
2–D IMAGING, STOP MCP
Pixelated SSDs
SSD electronics
PRE–AMPS
HV SUPPLIES


GEOMAGNETIC
FIELD LINE
ENERGETIC
OXYGEN
ION
e-
+
GEOCORONAL
NEUTRAL HYDROGEN
ATOMS
ENERGETIC
NEUTRAL
OXYGEN
ATOM
+
NEWLY
CREATED
PROTON

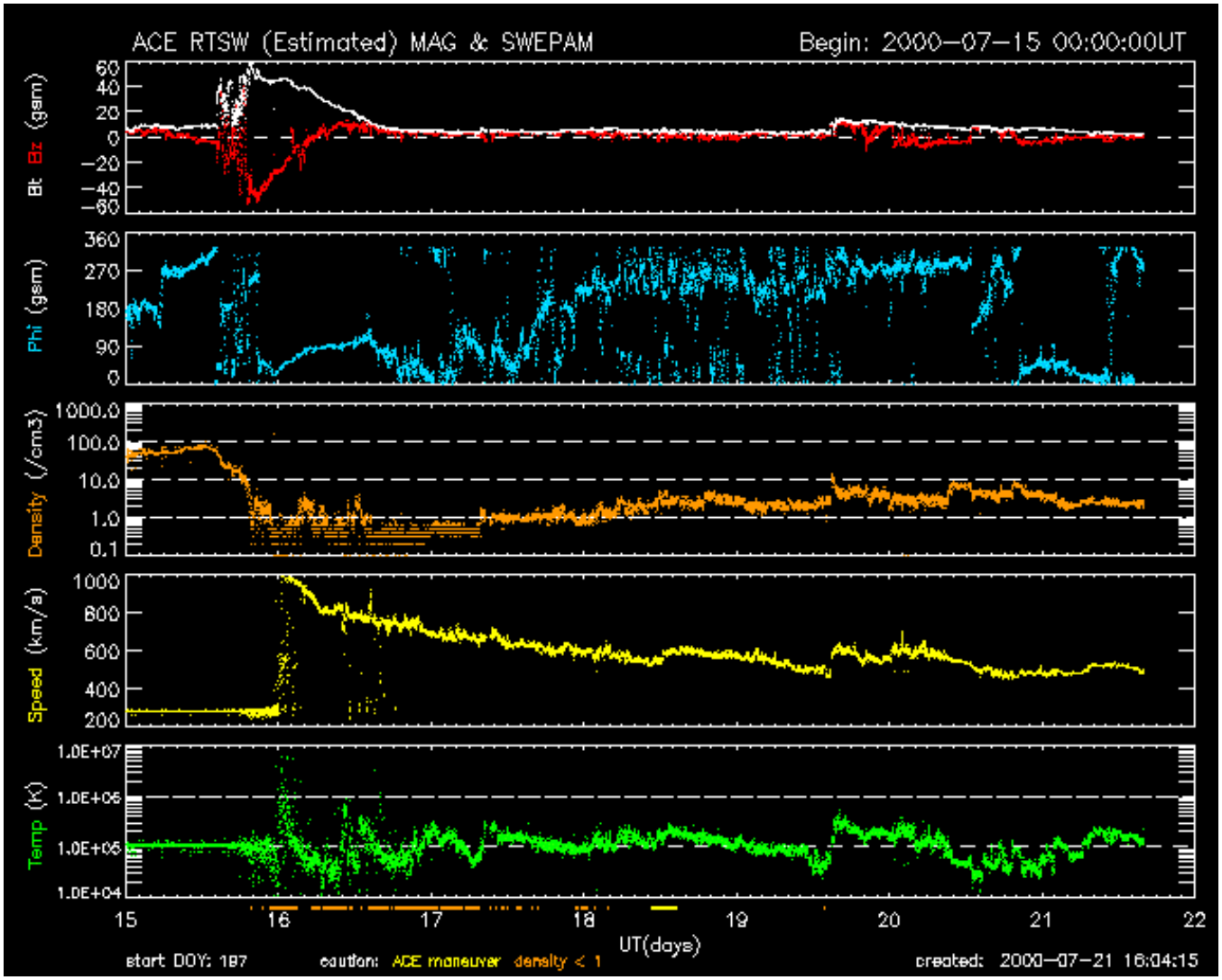

ACTIVE RING CURRENT/ION INJECTION
ENA (H,O) image of (H^+,O^+) from:
R=5 R_E
MLAT=60°
MLT=2100 h
Substorm injection signatures:
max
max/1000
Ring current: low altitude (0.2 R_E)
Ring current: pre-injection (1.0 R_E)
Ion injection boundary: morning
Ion injection boundary: night
Near-Earth plasma sheet: ion injection (1.0 R_E)
Ion injection boundary: evening

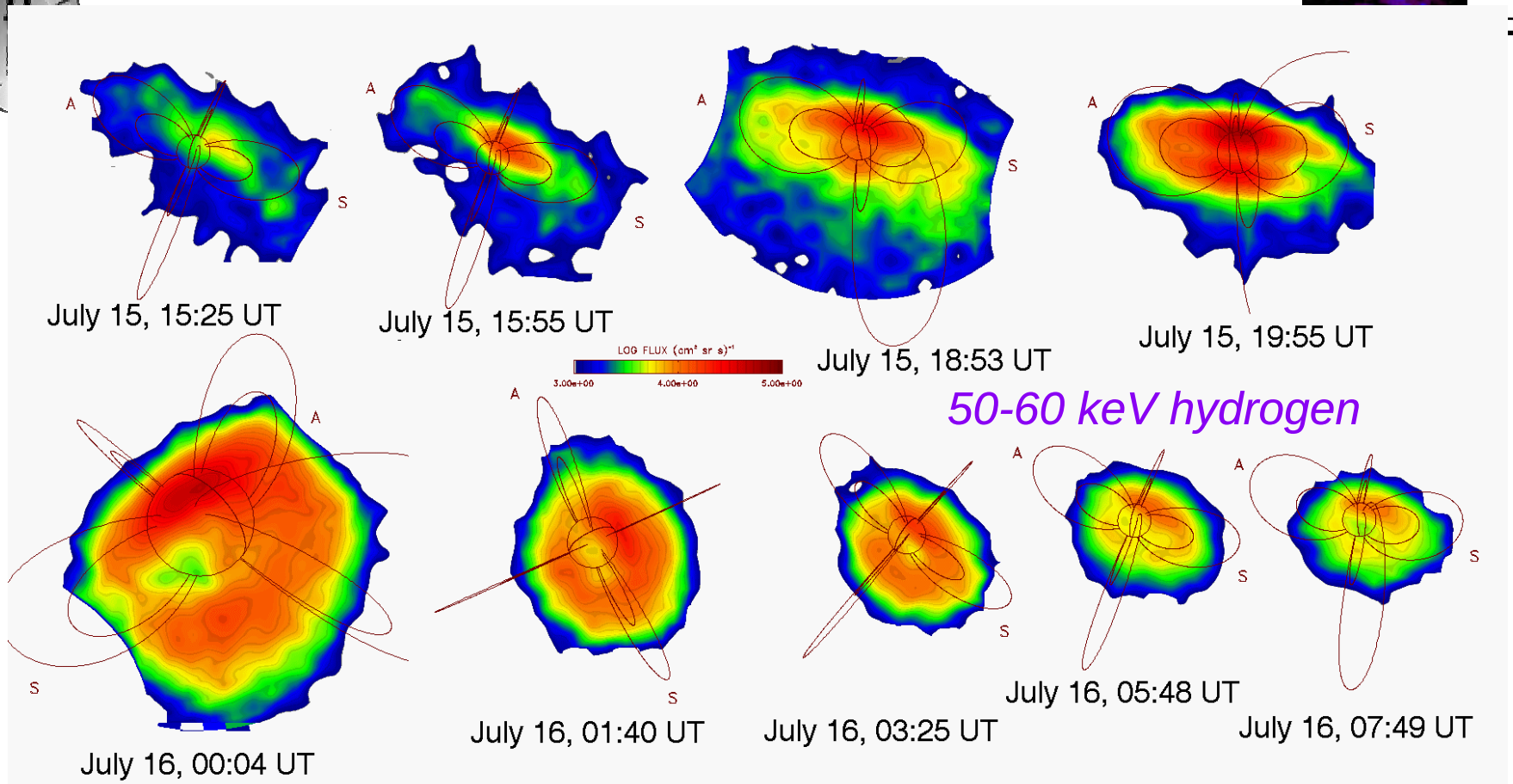

ACTIVE RING CURRENT/ION INJECTION
ENA (H,O) image of (H+,O+) from:
R=5 RE
MLAT=60°
MLT=2100 h
Substorm injection signatures:
Ring current: low altitude (0.2 RE)
Ion injection boundary: morning
Ring current: pre-injection (1.0 RE)
max
max/1000
Ion injection boundary: night
Near-Earth plasma sheet: ion injection (1.0 RE)
Ion injection boundary: evening

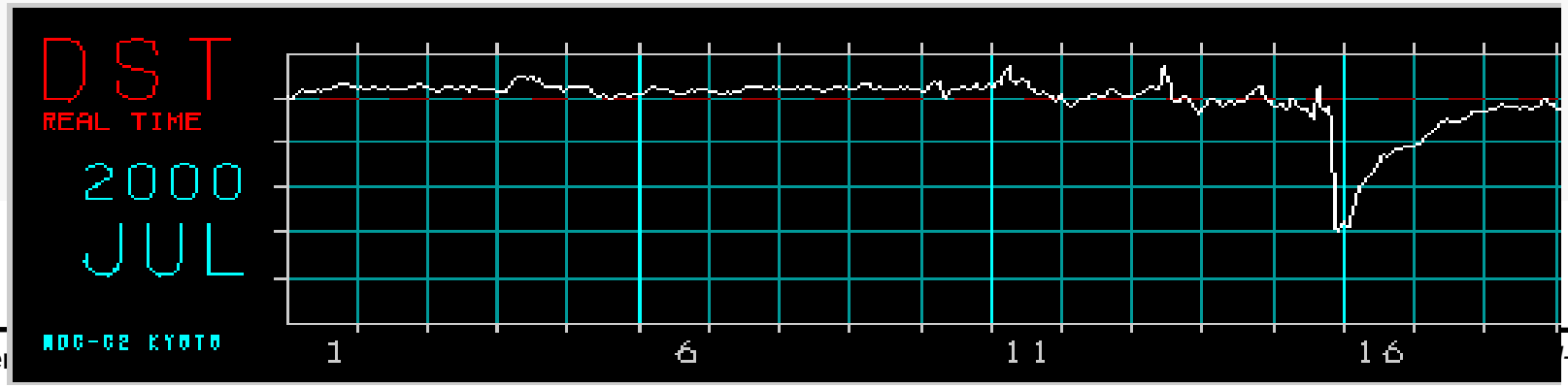

A
LOG FLUX (cm² sr s)⁻¹
1.00
2.35
3.70
10 June 2000 11:54:28 UT


HENA
27 – 39 k
A
S
90
60
30
0
-30
-60
-90

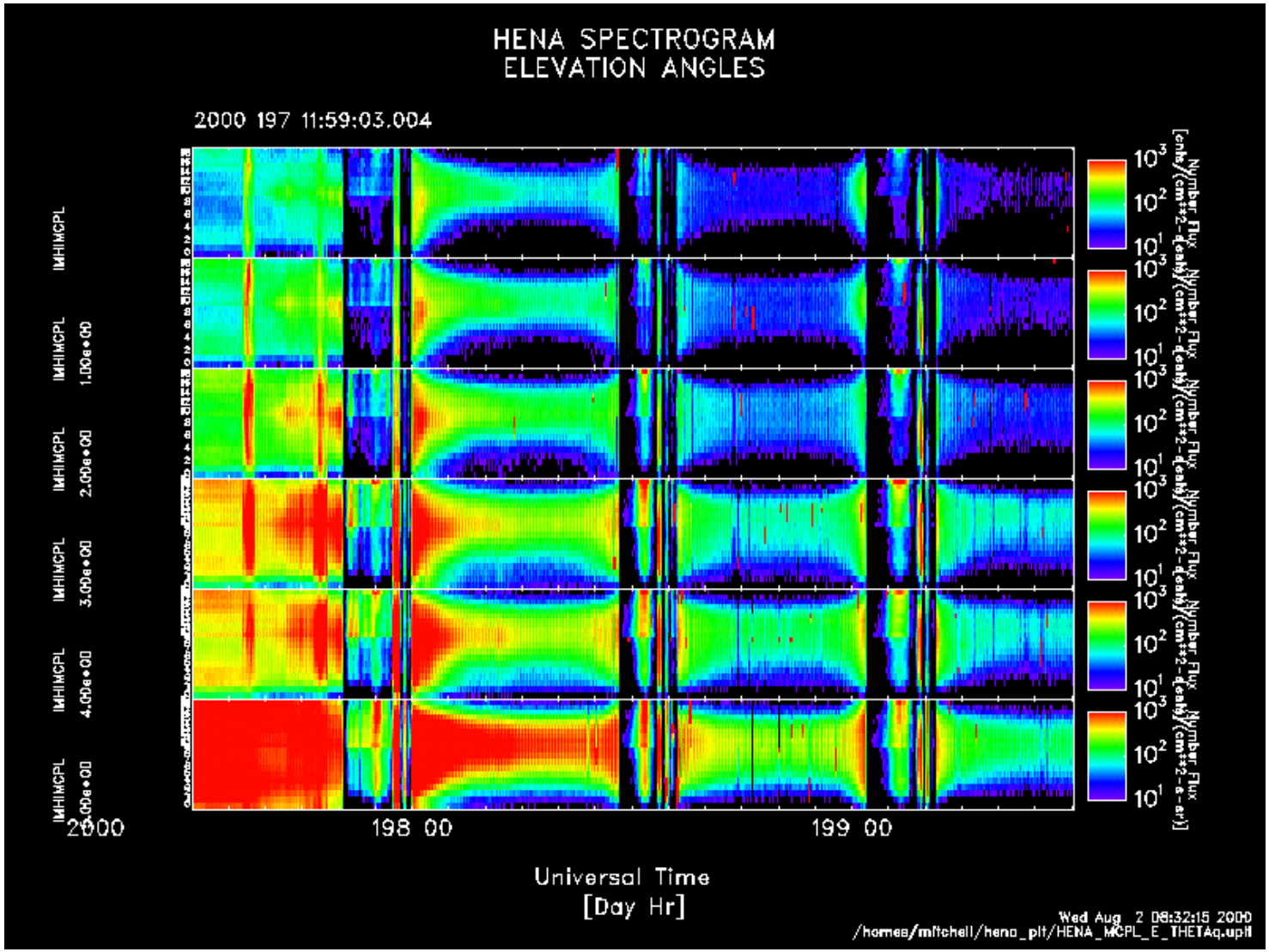
ACE Data for July 15-16 Storm

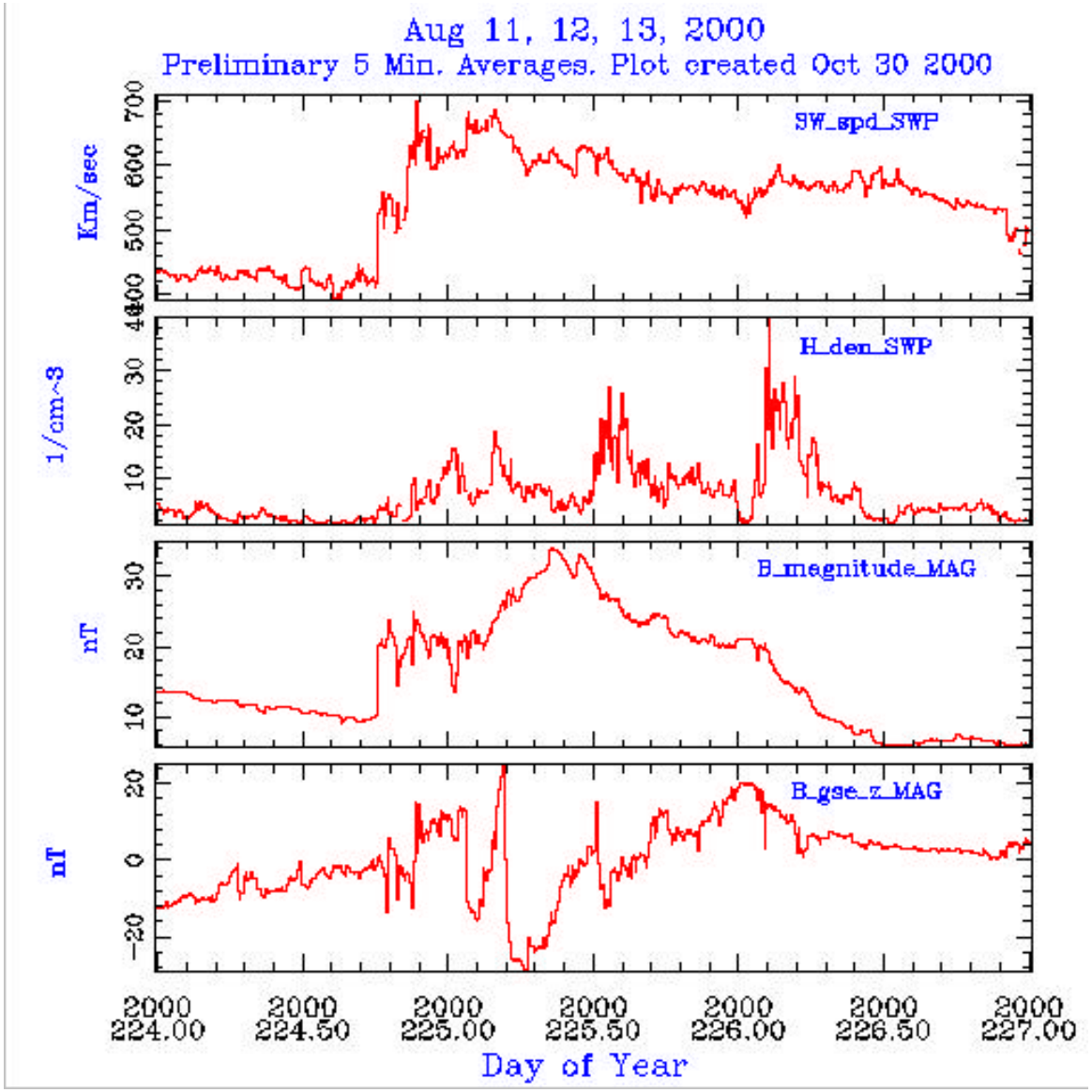



A
S
July 15, 15:25 UT
July 15, 15:55 UT
July 15, 18:53 UT
July 15, 19:55 UT
LOG FLUX (cm² sr s)⁻¹
3.00e+00
4.00e+00
5.00e+00
50-60 keV hydrogen
July 16, 00:04 UT
July 16, 01:40 UT
July 16, 03:25 UT
July 16, 05:48 UT
July 16, 07:49 UT

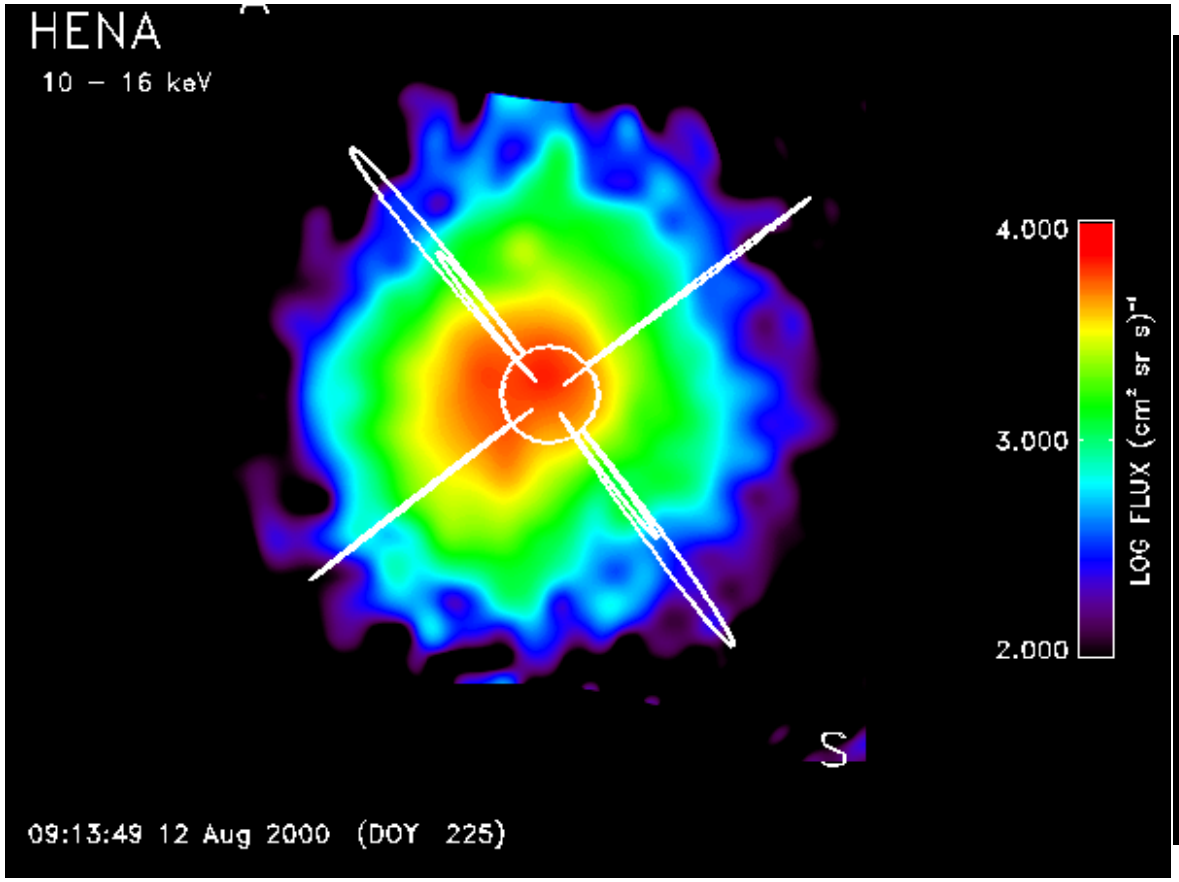

DST
REAL TIME
2000
JUL
NDC-CE KYOTO
1
6
11
16

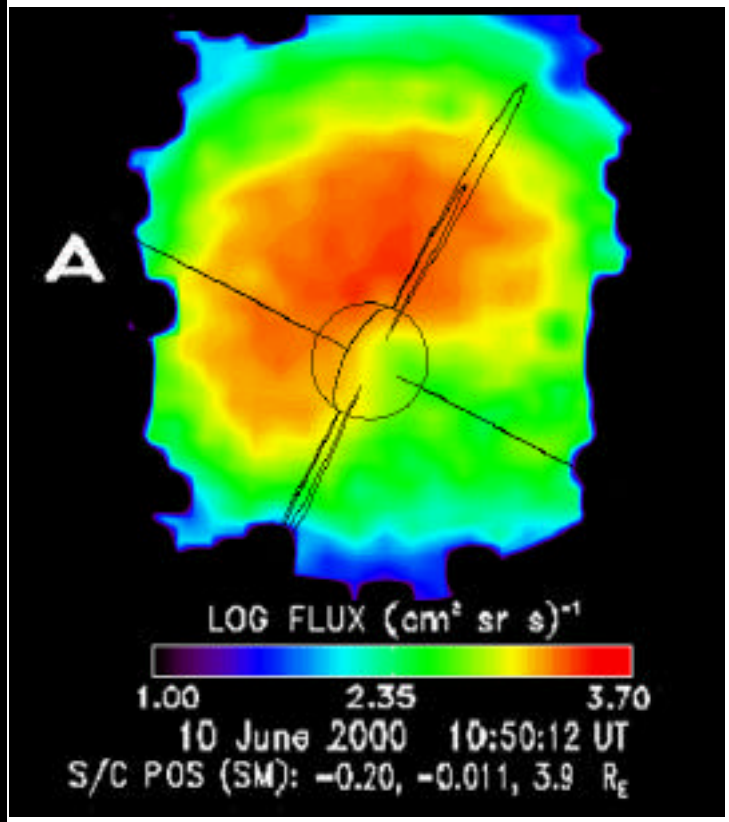
Browse Format



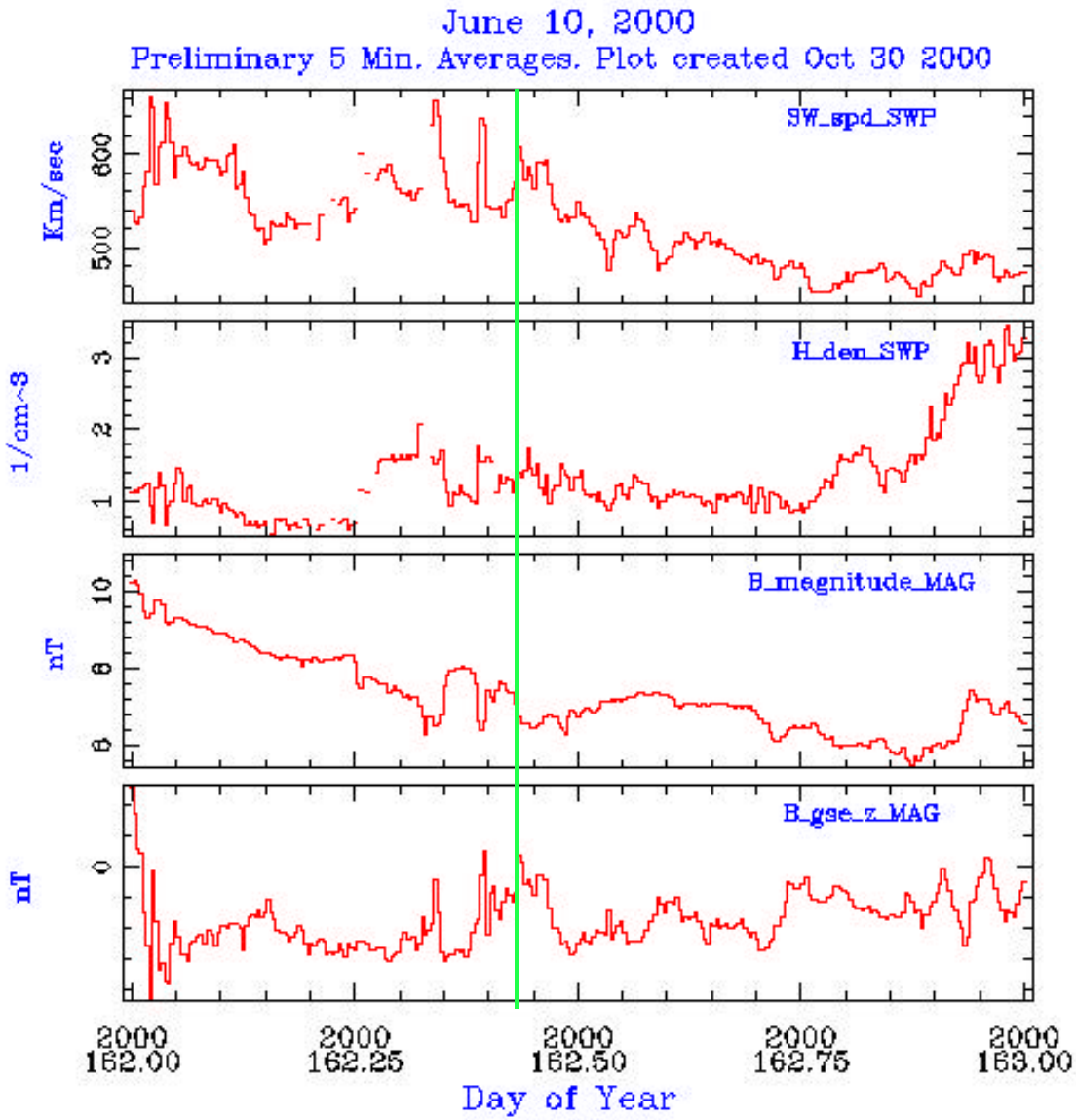

Aug 11, 12, 13, 2000
Preliminary 5 Min. Averages. Plot created Oct 30 2000
SW_spd_SWP
Km/sec
H_den_SWP
1/cm^3
B_magnitude_MAG
nT
B_gse_z_MAG
nT
2000 224.00
2000 224.50
2000 225.00
2000 225.50
2000 226.00
2000 226.50
2000 227.00
Day of Year

Comparison of large storm, substorm

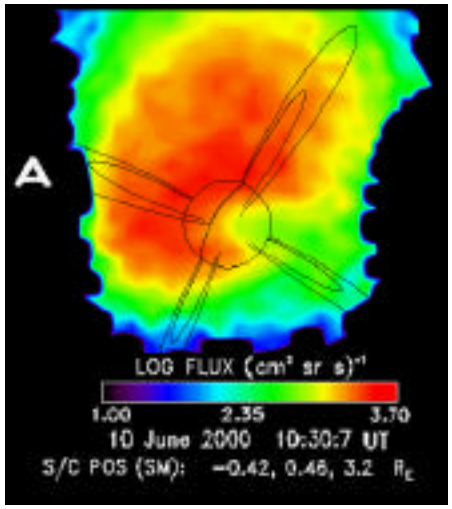


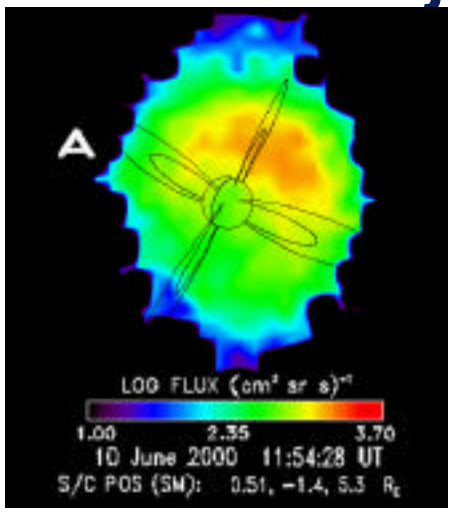


Note that the intensity beyond L~4 is *Lower* in storm (left image)

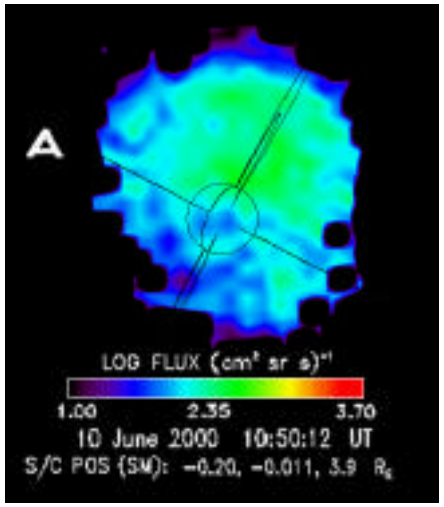

June 10, 2000
Preliminary 5 Min. Averages. Plot created Oct 30 2000
SW_spd_SWP
Km/sec
600
500
H_den_SWP
1/cm^3
3
2
1
B_magnitude_MAG
nT
10
8
6
B_gse_z_MAG
nT
0
2000 162.00
2000 162.25
2000 162.50
2000 162.75
2000 163.00
Day of Year

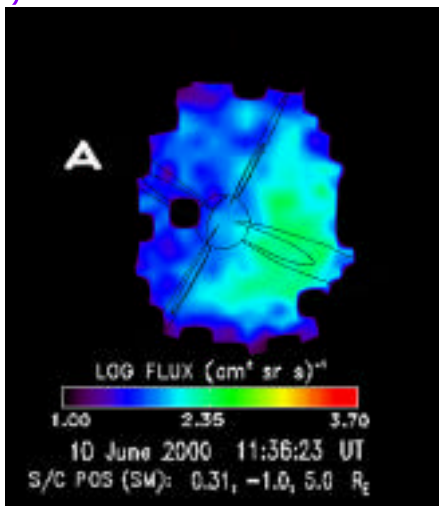
Substorm Injection



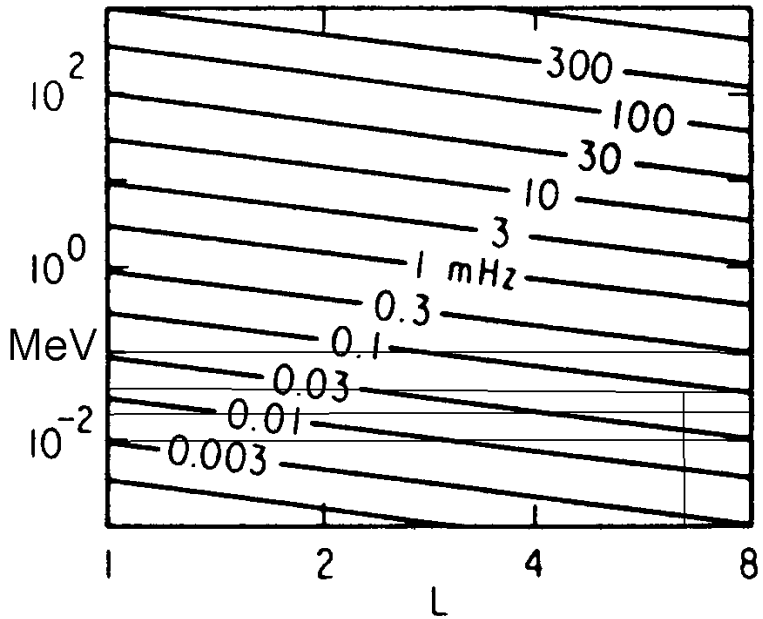


<---- ~1.5 hours, 22 keV ----->



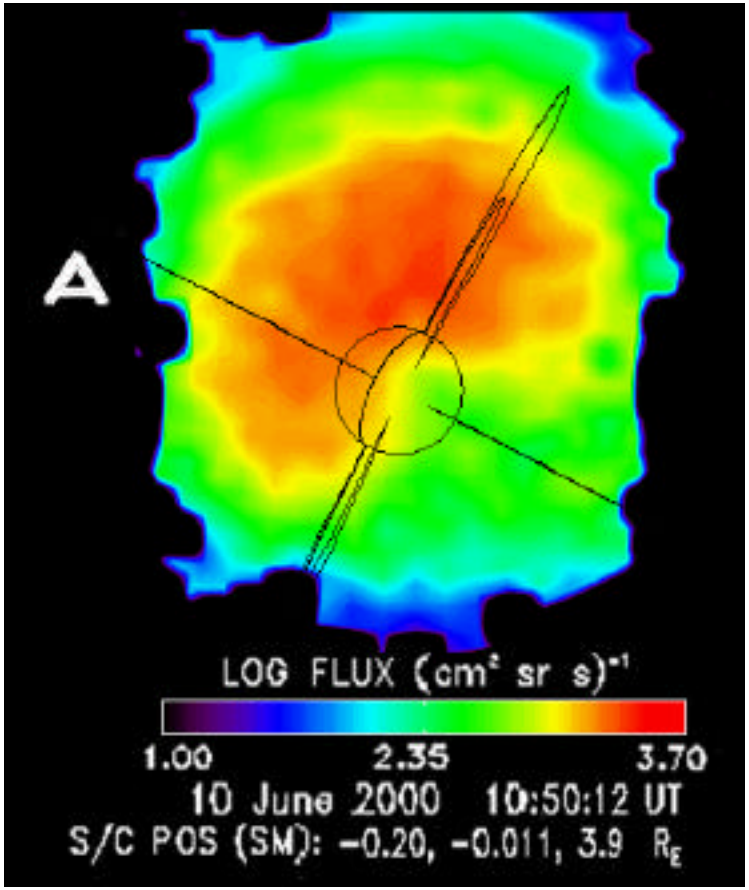


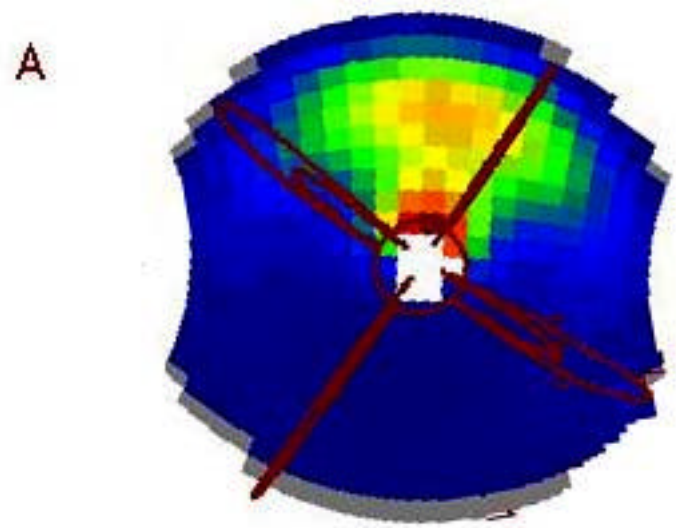
<---- ~0.75 hours, 45 keV ----->



All energies drift at a rate consistent with injection at about L = 7

Forward Modeling Fit

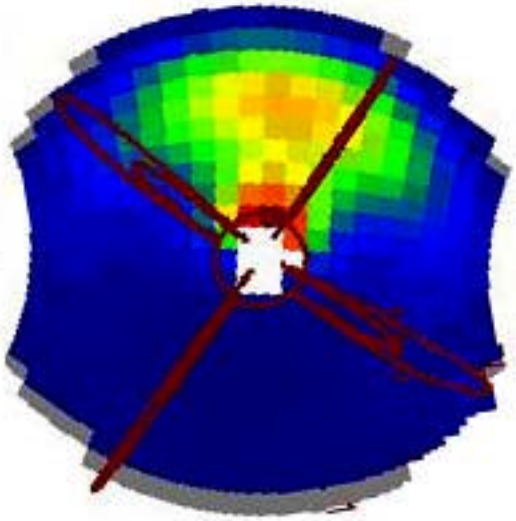


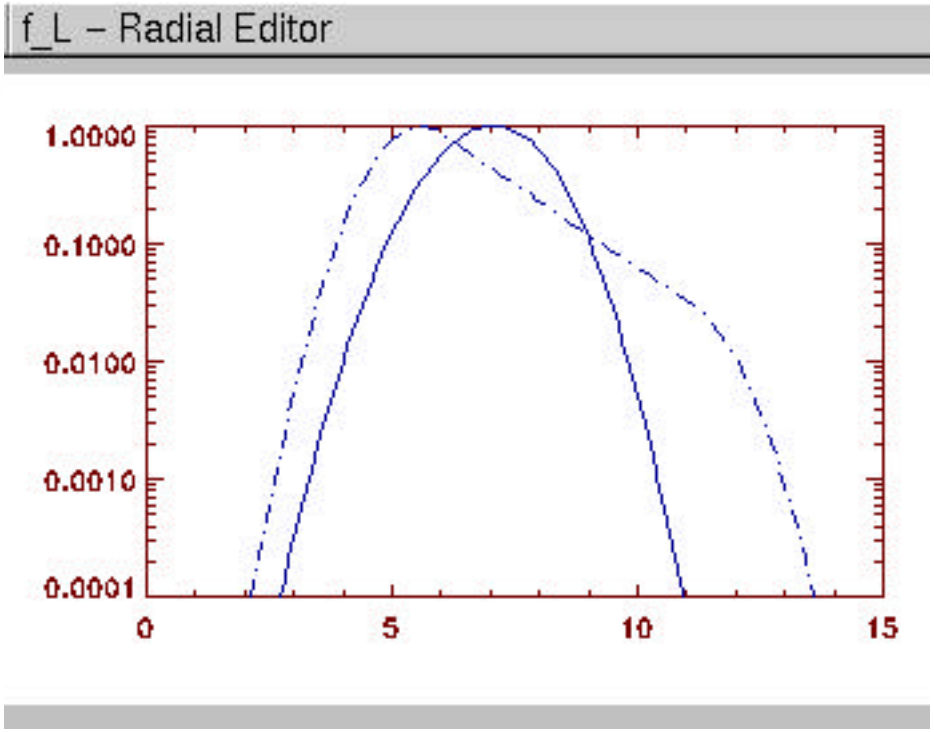


Simulation of ENA emission in the midnight/dusk quadrant. Ring current was limited to a narrow band near L=7.

20 keV H, Substorm Injection

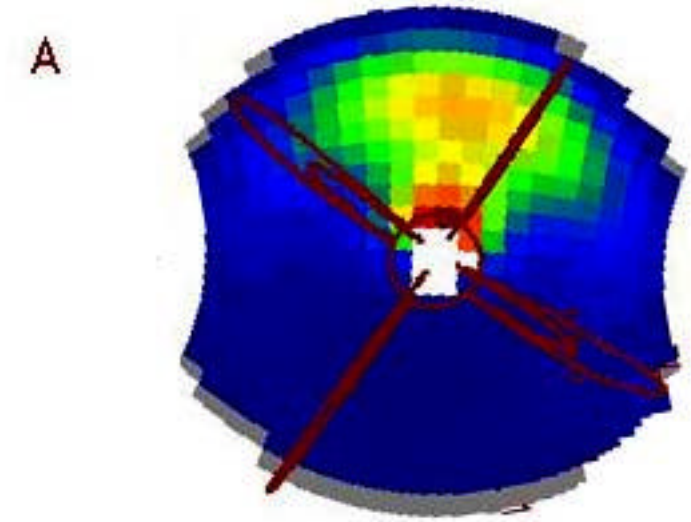
Radial Profile (7 Re, based on drift)

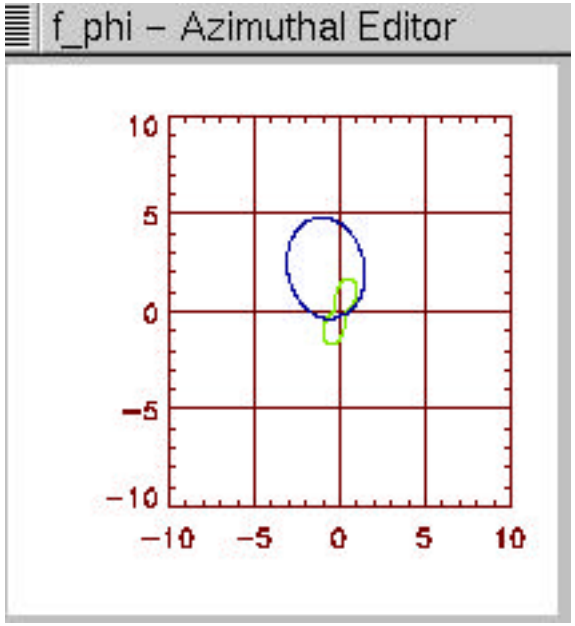




Simulation of ENA emission in the midnight/dusk quadrant. Ring current was limited to a narrow band near L=7.

Azimuthal profile

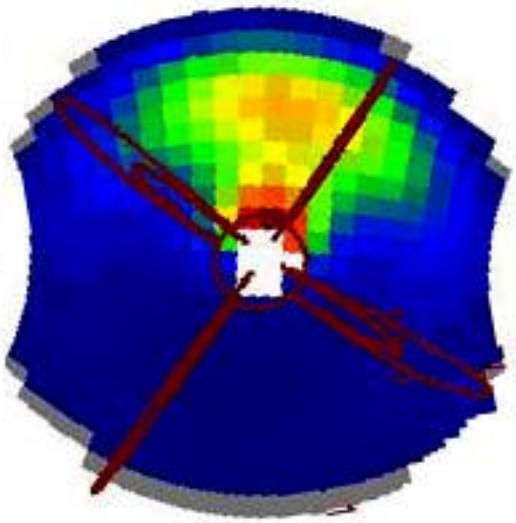


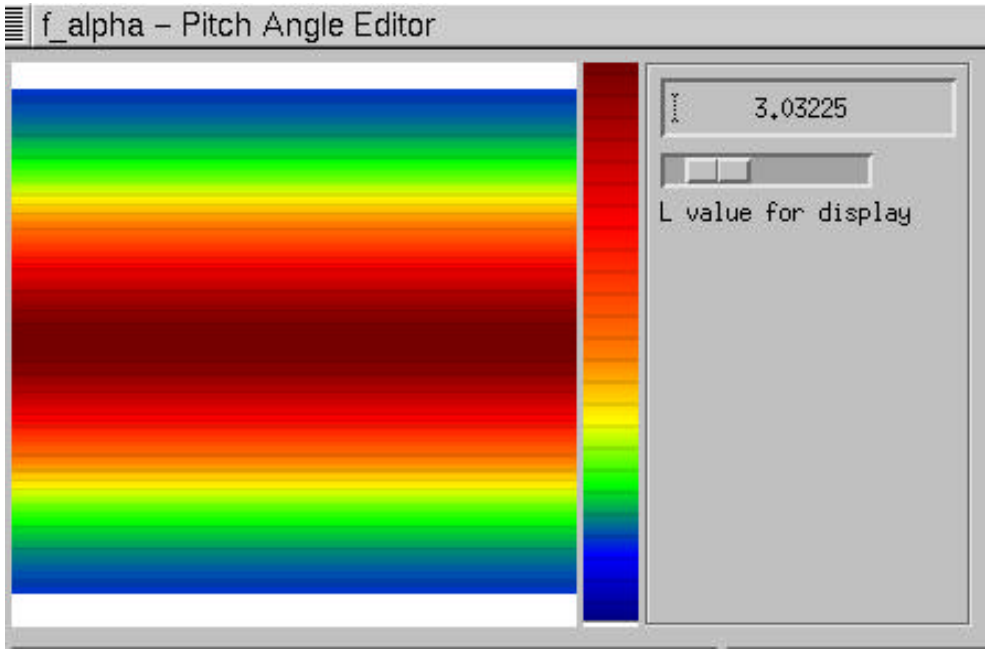


Simulation of ENA emission in the midnight/dusk quadrant. Ring current was limited to a narrow band near L=7.

Pitch Angle fit

A





Simulation of ENA emission in the midnight/dusk quadrant. Ring current was limited to a narrow band near L=7.