Global Ultraviolet Imager (GUVI)

TIMED Mission Instrumentation

Mission Summary

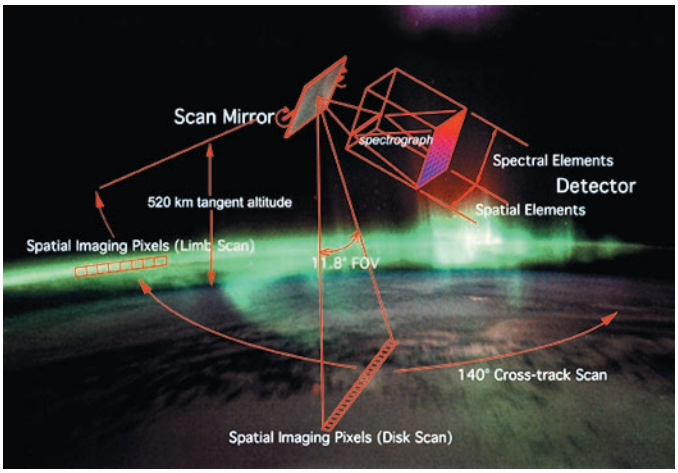
GUVI supports the TIMED mission science objectives to determine the:

1. Spatial and temporal variations of constituent number densities and temperature in the thermosphere,
2. Relative importance of auroral inputs, Joule heating, and solar EUV for the thermal structure of the lower thermosphere.

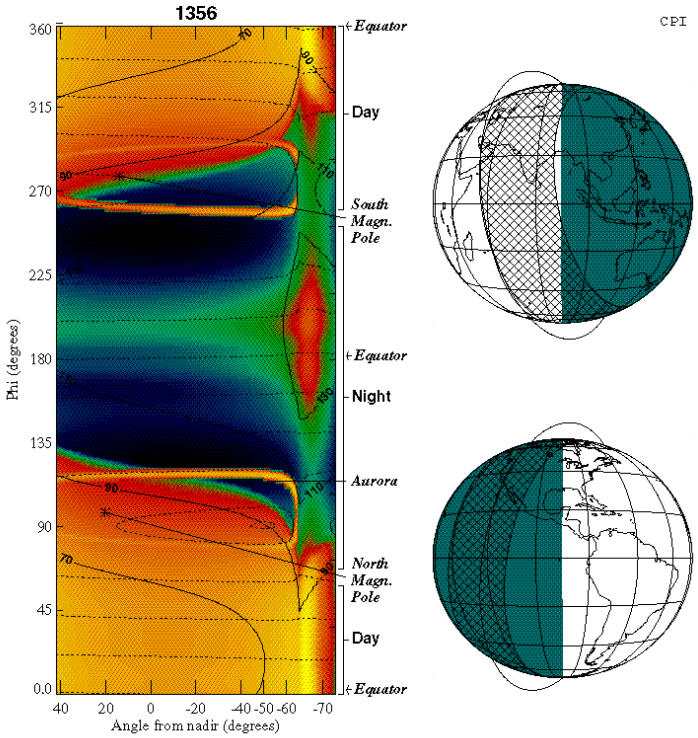
GUVI is a far ultraviolet (115 to 180 nm) scanning imaging spectrograph which provides horizon-to-horizon images in five selectable wavelength intervals or "colors." These colors (HI 121.6 nm, OI 130.4 nm, OI 135.6 nm, and N_2 Lyman-Birge-Hopfield bands 140 to 150 nm and 165 to 180 nm) are chosen in order to produce the GUVI key parameters (Table 1).

Instrument Characterisitics

GUVI uses a scan mirror to sweep its 11.78° field-of-view through an arc of up to 140° in the plane perpendicular to the orbital plane. This instantaneous field-of-view is mapped via an $f/3$ Rowland circle spectrograph into 14 spatial and 160 spectral "pixels." The detector is a microchannel plat intensified wedge-and-strip anode sealed to be which provides a two dimensional readout. A detector processor bins the data into the five selected colors.



Scanning imaging technique used by GUVI.



Calculation of the OI 135.6 nm radiation field as seen by GUVI. The right hand side shows the extent of the GUVI swath below the orbital path. The left hand side is an example of a typical GUVI browse image. The day, auroral, and night regions are delineated. The sunlit oval and the Equatorial Arcs are clearly visible.

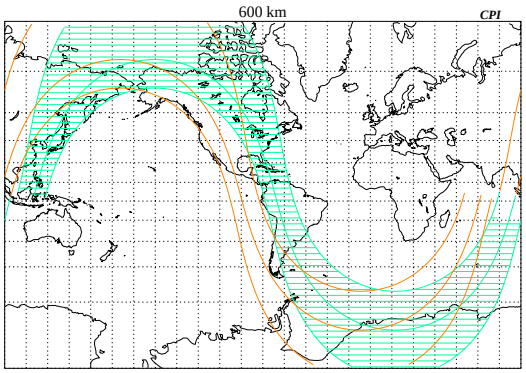
Orbital Coverage

GUVI scans from horizon-to-horizon and up onto the limb which is away from the Sun. For a nominal 600 km orbital altitude, GUVI will scan up to 520 km tangent altitude. A typical orbit includes day, night and auroral observations. The swath width is about 3000 km. Successive orbits provide overlapping coverage at the poles and nearly contiguous coverage at the equator.

Data Processing

The GUVI Payload Operations Center (POC) will host the data processing hardware and software as well as the primary GUVI data archive. The GUVI data catalog, browse data products and data request facility will be available to users.

Our goal is to process GUVI data and provide a provisional certification for release within 48 hours of receipt at the GUVI POC. Routine data processing will take the data to at least Level 2 (Tables 1, 2 and 3).



The 625 km altitude of the TIMED spacecraft provides GUVI with nearly complete coverage of the globe on successive orbits.

GUVI Data Levels

	Brief Description
1A	time and position tagged data
1B	calibrated and geolocated
1C	binned and mapped
2B	routine key parameters
3	multiple orbits
4	higher level analysis

GUVI Key Parameters

Aurora	Night	Day
Boundary Specification	Electron Density Profile (EDP)†	Solar EUV Flux Index, Q_{euv}
Proton Boundary	Total Electron Content (TEC)‡	O/N_2 Ratio (disk)
Electron Flux, Q_e		Thermospheric Temperature, T
Average Electron Energy, E_e		O, N_2, and O_2 (limb)
E-layer EDP		

†On the limb only ‡Along the GUVI instrument's line-of-sight

Key Parameter Accuracies

Dayside Science

Features	Spatial Scale	Altitude	Precision*	Inferred	Accuracy
Limb					
OI (135.6)	–	130-300 km	±3%	N_2O_2,O	±15%
LBH (1)	250 km Horizontal	–	±7%	Solar EUV	±10-15%
LBH (2)	–	–	±10%	Temp	±8%
HI (121.6)	100 x 100 km²	110-300 km	±1%	H	±10%
Disk					
OI (135.6)	100 x 100 km²	130-300 km	±3%	[O]/[N_2]	–
LBH (1)	–	–	±5%	N_2,O_2, O	±20%
HI (121.6)	100 x100 km²	110-300 km	±1%	H	±10%

*View at 300 km tangent altitude and 75° solar zenith angle

Auroral Zone Science

Features	Spatial Scale	Altitude	Precision*	Inferred	Accuracy
OI (135.6)	10 x 10 km²	100-150 km	±7%	Q_e(Ergs/cm²/s)	±20%
LBH (1)	–	–	±9%	E_o (Kev)	±25%
LBH (2)	–	–	±13%	Sp(Mho)	±30%
HI (121.6)	–	–	±9% *	$Q_{protons}$	±21%

*0.1 ergs/cm²/s proton precipitation flux and Class II aurora for electrons

Nightside Science

Features	Spatial Scale	Altitude	Precision	Inferred	Accuracy
	100 x 100 km²	Lower F Region	±5%	EDP	±9%
O emissions	–	–	–	TEC	±22%
	100 x 100 km²	100 - 300 km	±11%	–	Cross sections
All colors	–	–	–	Energetic Particles	–

GUVI Science Team Members

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For more information go to theGUVI web page:
http://guvi.jhuapl.edu