

Fields Data Analysis

- Introduce Data
- Transform Data
- Manipulate data:
 - Get E field from Voltages
 - Get density proxy from scpot
 - Get Ez from $E \cdot B = 0$
 - Get E vector from Ex,y
 - Get $V = E \times B$ from Ex,y

<http://www.igpp.ucla.edu/public/vassilis/ESS265/20080416>

Find Spacecraft Locations

<http://sscweb.gsfc.nasa.gov/tipsod>

Satellite Chooser

coordinates:

fr: 2007-07-20 16:00
to: 2007-07-20 19:00

Field-Line Tracing: Enabled Not Enabled

db sampling:

Satellite	Color	Shape	Pattern
<input type="checkbox"/> ST5-C		Sphere	Solid
<input type="checkbox"/> STEREO-Ahead		Sphere	Solid
<input type="checkbox"/> STEREO-Behind		Diamond	Solid
<input type="checkbox"/> THEMIS-A (P5)		Cylinder	Solid
<input checked="" type="checkbox"/> THEMIS-B (P1)		Cube	Solid
<input checked="" type="checkbox"/> THEMIS-C (P2)		Sphere	Solid
<input checked="" type="checkbox"/> THEMIS-D (P3)		Diamond	Solid
<input checked="" type="checkbox"/> THEMIS-E (P4)		Cone	Solid
<input checked="" type="checkbox"/> THEMIS-A (Pred)		Cylinder	dash
<input type="checkbox"/> THEMIS-B (Pred)		Cube	dash
<input type="checkbox"/> THEMIS-C (Pred)		Diamond	dash
<input type="checkbox"/> THEMIS-D (Pred)		Sphere	dash
<input type="checkbox"/> THEMIS-E (Pred)		Cone	dash
<input type="checkbox"/> TIMED		Sphere	Solid
<input type="checkbox"/> UARS		Cone	Solid

File Options Tools Help

Projection: parallel perspective

Thickness: Symbol: Orbit: Axis & grid:

Axis Span (RE) Value is: 10.0

Major Ticks Value is: 10.0

Key: --- X --- Y --- Z

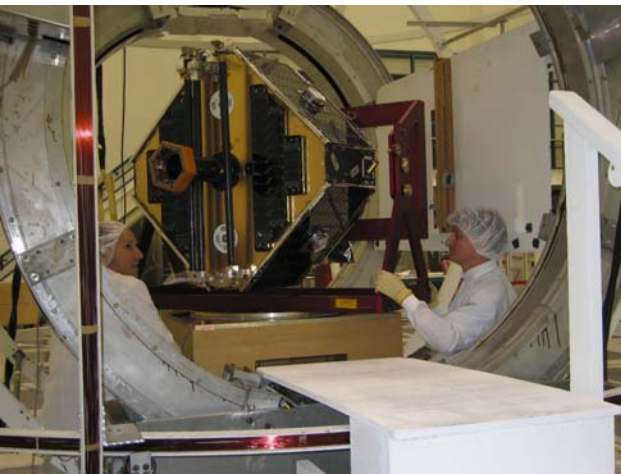
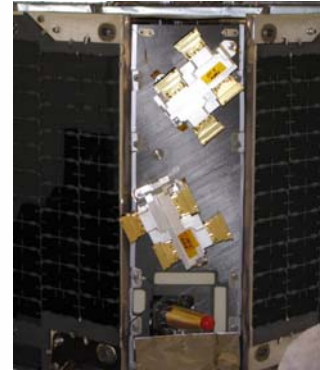
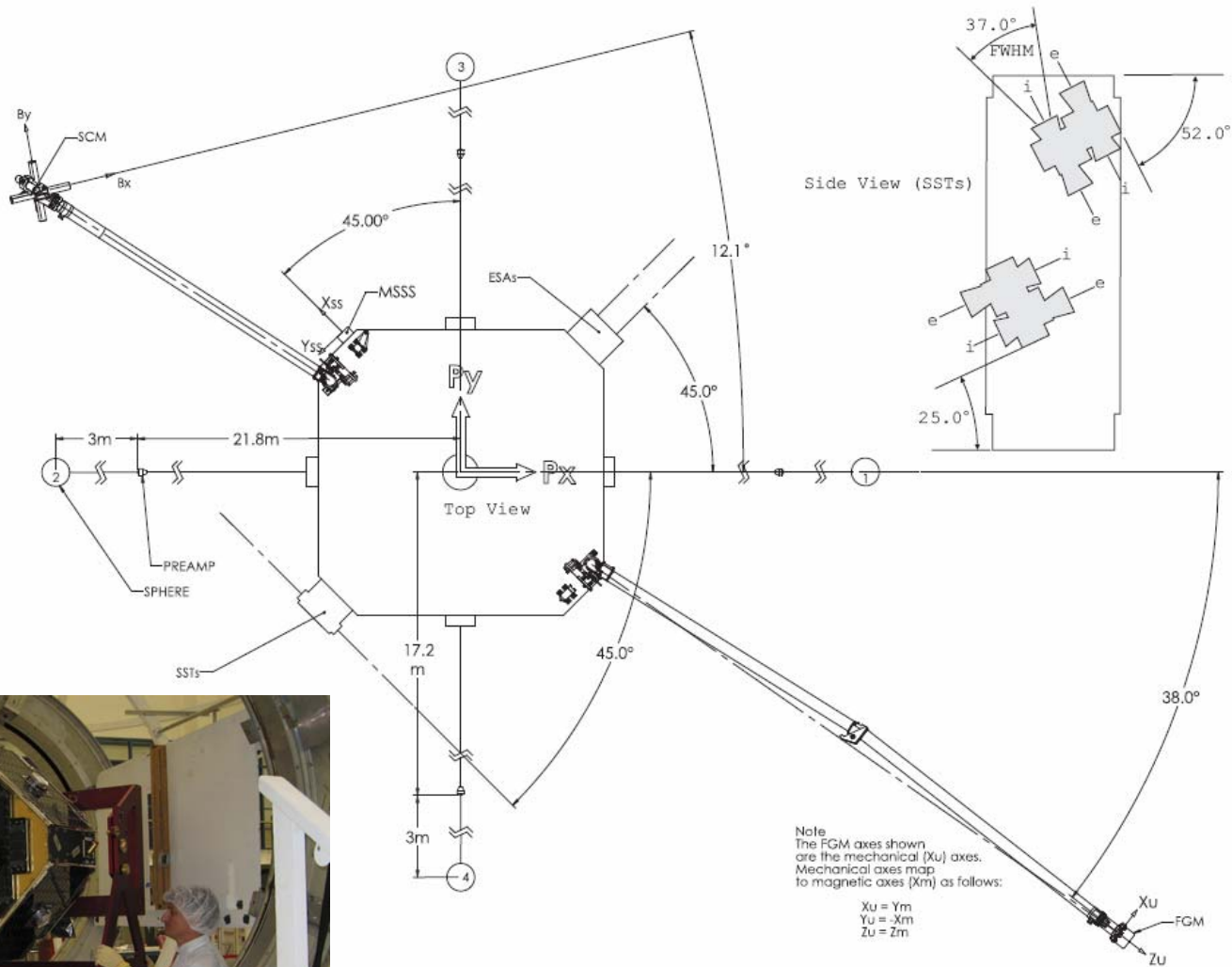
Location Info: Orbits Magnetopause Footpoints North South Closest Magnetopause Bowshock Neutral Sheet Earth Bowshock Footpoints South Axis Neutral Sheet Footpoints Closest Labels xy Plane Geographic Grid Planar Views zy Plane Ground Stations Animation Bar xz Plane Sunlight

Cartesian Spherical

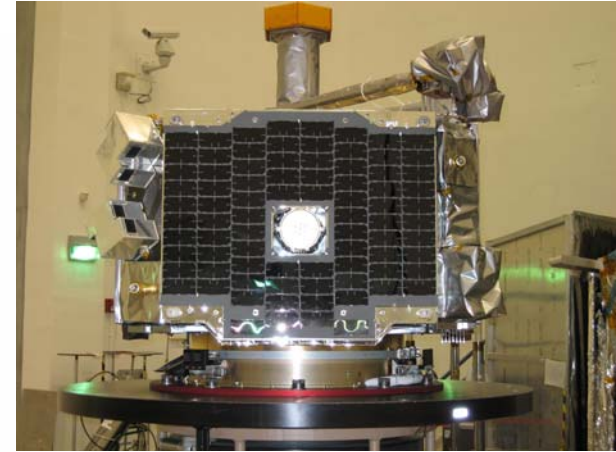
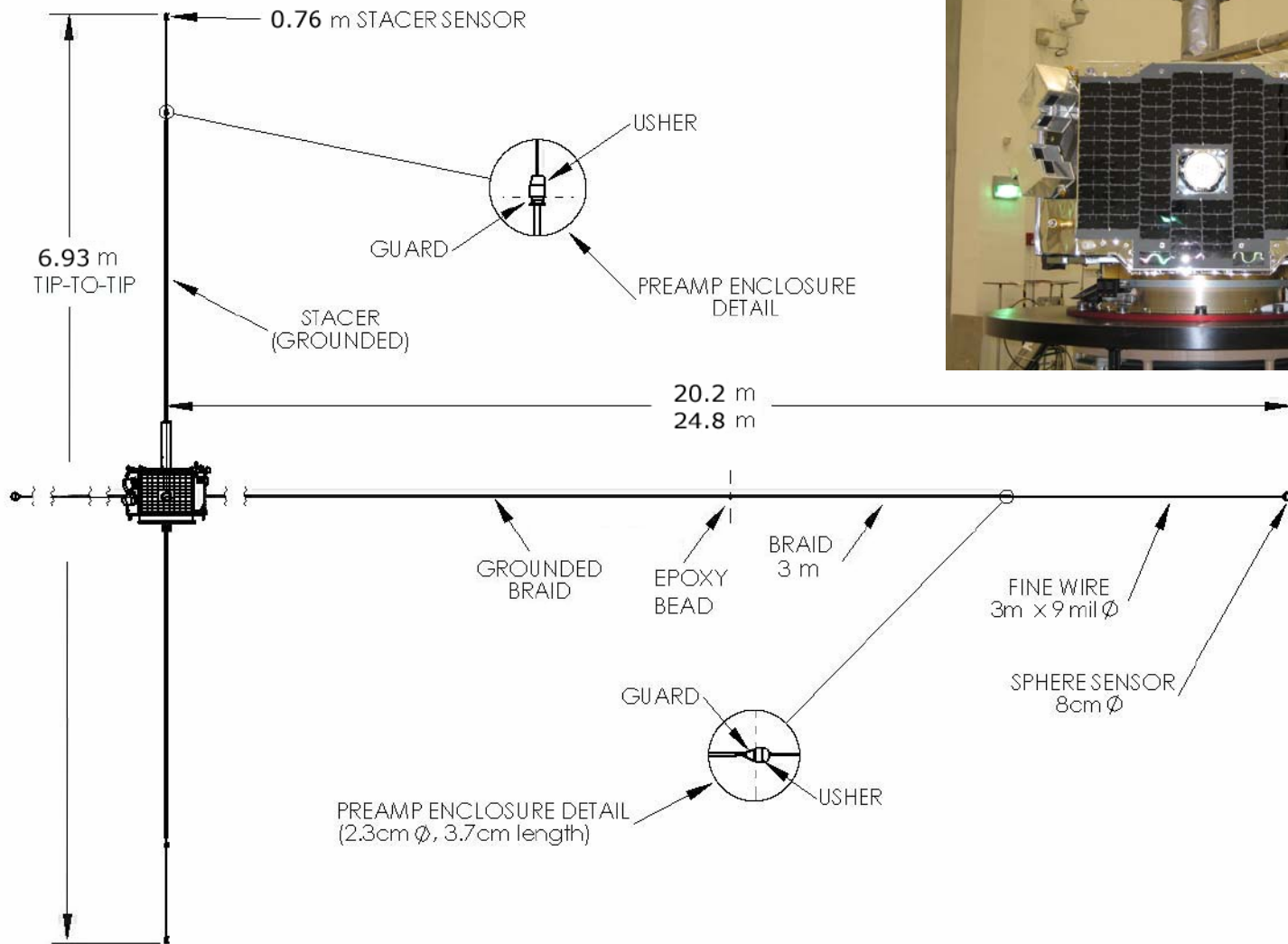
Magnetopause Bowshock Neutral Sheet

Satellite	Color	X	Y	Z
THEMIS-B (P1)		11.571	-1.732	-3.215
THEMIS-C (P2)		11.065	-2.003	-3.07
THEMIS-D (P3)		11.067	-2.041	-3.057
THEMIS-E (P4)		10.893	-1.997	-3.037
THEMIS-A (Pred)		9.47	-2.754	-2.57

Reminder: Instruments Top view



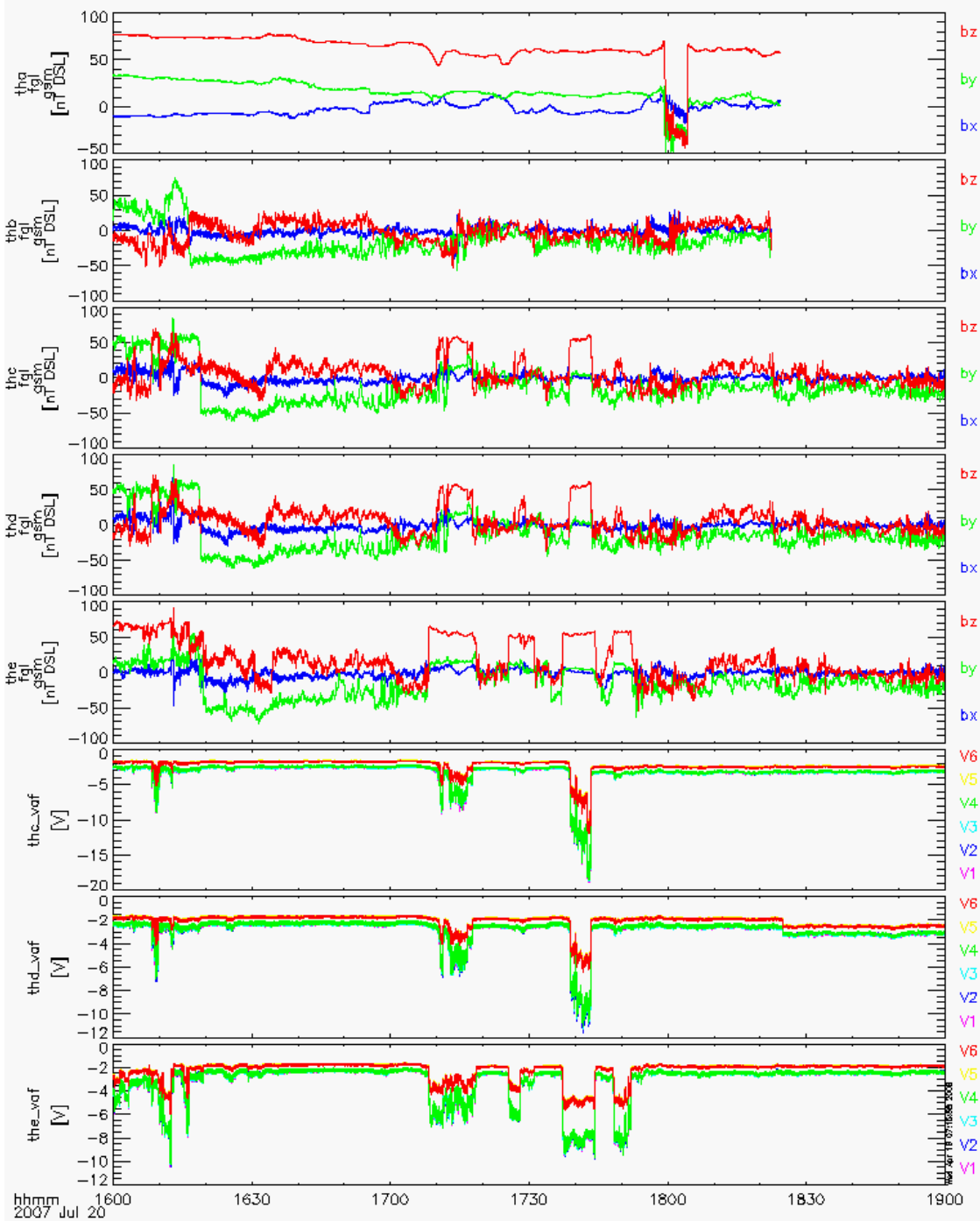
Reminder: Booms Side view



```

timespan,'7 7 20/16:00',3,/hours
;
thm_load_state,/get_supp
;
thm_load_fgm,/get_supp
thm_load_efi,/get_supp
;
; see what you have introduced
;
tplot_names
;
; plot data to see where probes are
tplot,'th?_fgl_dsl';
thm_cotrans,'th?_fg?','in_coord='dsl', $
  in_suff='_dsl',out_coord='gsm', $
  out_suff='_gsm'
;
; check transformed data are there
;
tplot_names
;
tplot,'th?_fgl_gsm th?_vaf'
tlimit

```



```

pro scpot2dens,scpot,dens,Te=Te
; takes SC potential (V>0), produces density. Te = const.
; Te (eV), dens(percc), scpot(volts)
if not(keyword_set(Te)) then Te=1.
dens=exp((12.-scpot)/(3.36+0.14*scpot))/sqrt(Te) ; natural exp.
return
end

```

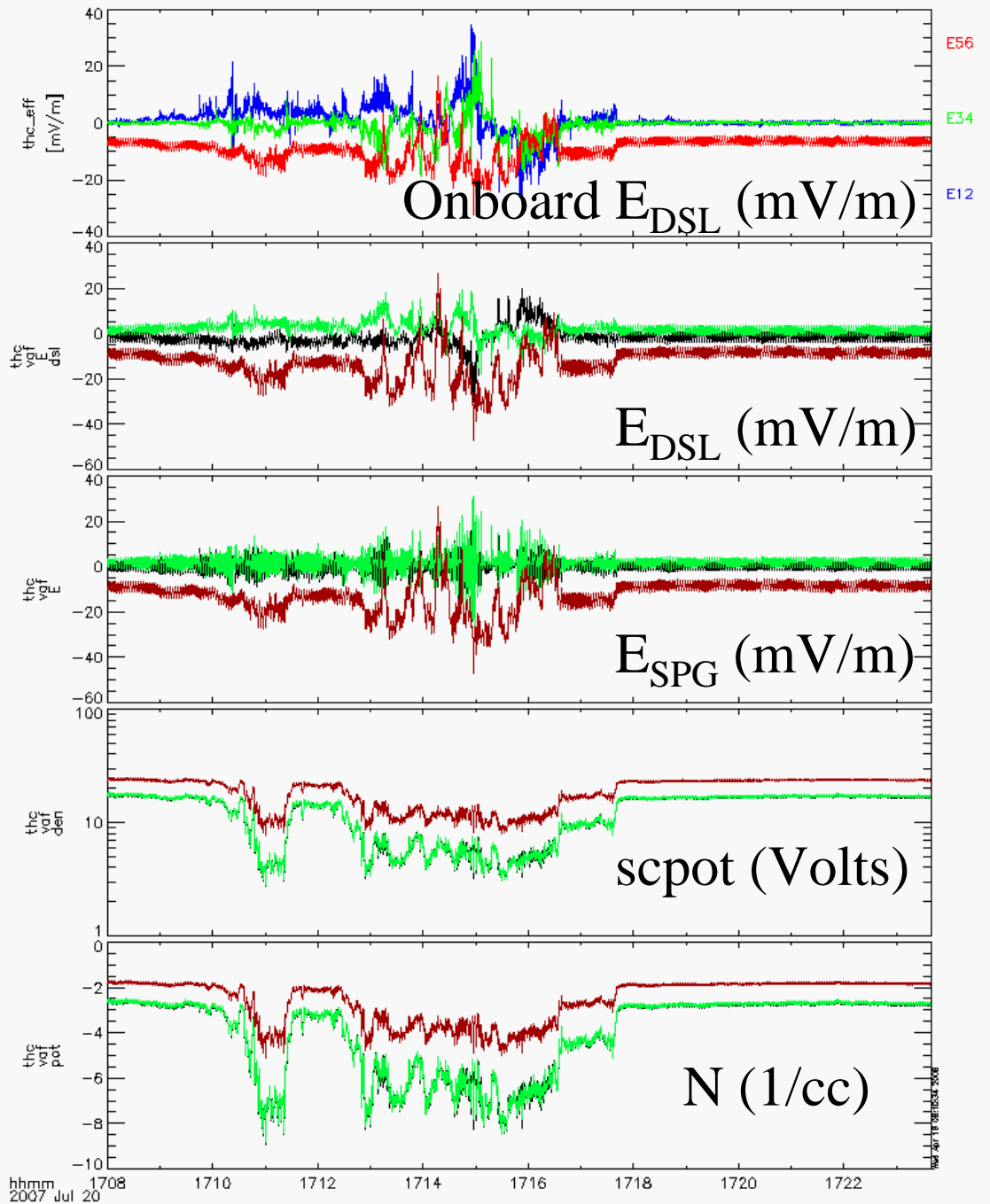
; compute scpot, Efield

```

;
L12=46.6
L34=37.4
L56=7.
;
get_data,'the_vaf',data=the_vaf
the_vaf_V12=(the_vaf.y(*,0)+the_vaf.y(*,1))/2.
scpot2dens,-the_vaf_V12,the_vaf_N12,Te=0.5
the_vaf_E12=-1000.*(the_vaf.y(*,0)-the_vaf.y(*,1))/L12
the_vaf_V34=(the_vaf.y(*,2)+the_vaf.y(*,3))/2.
scpot2dens,-the_vaf_V34,the_vaf_N34,Te=0.5
the_vaf_E34=-1000.*(the_vaf.y(*,2)-the_vaf.y(*,3))/L34
the_vaf_V56=(the_vaf.y(*,4)+the_vaf.y(*,5))/2.
scpot2dens,-the_vaf_V56,the_vaf_N56,Te=0.5
the_vaf_E56=-1000.*(the_vaf.y(*,4)-the_vaf.y(*,5))/L56
;
store_data,'the_vaf_pot',data={x:the_vaf.x, $
y:[[the_vaf_V12],[the_vaf_V34],[the_vaf_V56]]}
store_data,'the_vaf_den',data={x:the_vaf.x, $
y:[[the_vaf_N12],[the_vaf_N34],[the_vaf_N56]]}
store_data,'the_vaf_E',data={x:the_vaf.x, $
y:[[the_vaf_E12],[the_vaf_E34],[the_vaf_E56]]}
;
; transform Efield into despun coordinates
thm_cotrans,'the_vaf_E',in_coord='ssl', $
out_coord='dsl',in_suff='',out_suff='_dsl'
;
tplot_options,'the_vaf_den',ylog=1
tplot,'the_eff the_vaf_E_dsl the_vaf_E the_vaf_den the_vaf_pot'

```

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; Obtain Ez, V, assuming E*B=0, from Ex, Ey

```
thm_load_fit & tplot,'th[c-e]_fgs_dsl th[c-e]_efs_0'
```

```
tlimit,['2007-07-20/17:00','2007-07-20/17:30']
```

```
;
```

```
; Get ExB
```

```
sc='c' & Exoffset=2.0 & Eyoffset=-0.0 & angle=10. ; degrees
```

```
tanangle=tan(angle*PI/180.)
```

```
get_data,'th'+sc+'_efs_0',data=thx_efs_dsl
```

```
get_data,'th'+sc+'_fgs',data=thx_fgs_dsl
```

```
igood=where(abs(thx_fgs_dsl.y(*,2)/sqrt(thx_fgs_dsl.y(*,0)^2+
```

```
thx_fgs_dsl.y(*,1)^2)) ge tanangle,janygood)
```

```
ibad=where(abs(thx_fgs_dsl.y(*,2)/sqrt(thx_fgs_dsl.y(*,0)^2+
```

```
thx_fgs_dsl.y(*,1)^2)) lt tanangle,janybad)
```

```
;
```

```
thx_efs_dsl.y(*,0)=thx_efs_dsl.y(*,0)-Exoffset
```

```
thx_efs_dsl.y(*,1)=thx_efs_dsl.y(*,1)-Eyoffset
```

```
thx_efs_dot0_dsl=thx_efs_dsl
```

```
;
```

```
if (janybad ge 1) then thx_efs_dot0_dsl.y(ibad,*)=!VALUES.F_NAN
```

```
if (janygood lt 1) then print,'*****WARNING: NO GOOD 3D ExB data'
```

```
if (janygood ge 1) then thx_efs_dot0_dsl.y(igood,2)=$
```

```
-(thx_efs_dsl.y(igood,0)*thx_fgs_dsl.y(igood,0)+$
```

```
thx_efs_dsl.y(igood,1)*thx_fgs_dsl.y(igood,1)+$
```

```
thx_efs_dsl.y(igood,2)*thx_fgs_dsl.y(igood,2))/ $
```

```
thx_fgs_dsl.y(igood,2)
```

```
;
```

```
thx_exb_dot0_dsl=thx_efs_dot0_dsl
```

```
store_data,'th'+sc+'_efs_dot0_dsl',data={x:thx_efs_dot0_dsl.x,y:thx_efs_dot0_dsl.y}
```

```
options,'th'+sc+'_efs_dot0_dsl',colors',[2,4,6]
```

```
tcrossp,'th'+sc+'_efs_dot0_dsl','th'+sc+'_fgs',newname='thx_exb_temp'
```

```
tdotp,'th'+sc+'_fgs','th'+sc+'_fgs',newname='thx_bdotb_temp'
```

```
div_data,'thx_exb_temp','thx_bdotb_temp',newname='thx_exbob2_temp'
```

```
get_data,'thx_exbob2_temp',data=thx_exbob2_temp
```

```
store_data,'th'+sc+'_Vexb_dot0_dsl',data={x:thx_exbob2_temp.x,y:thx_exbob2_temp.y*1000.}
```

```
options,'th'+sc+'_Vexb_dot0_dsl',colors',[2,4,6]
```

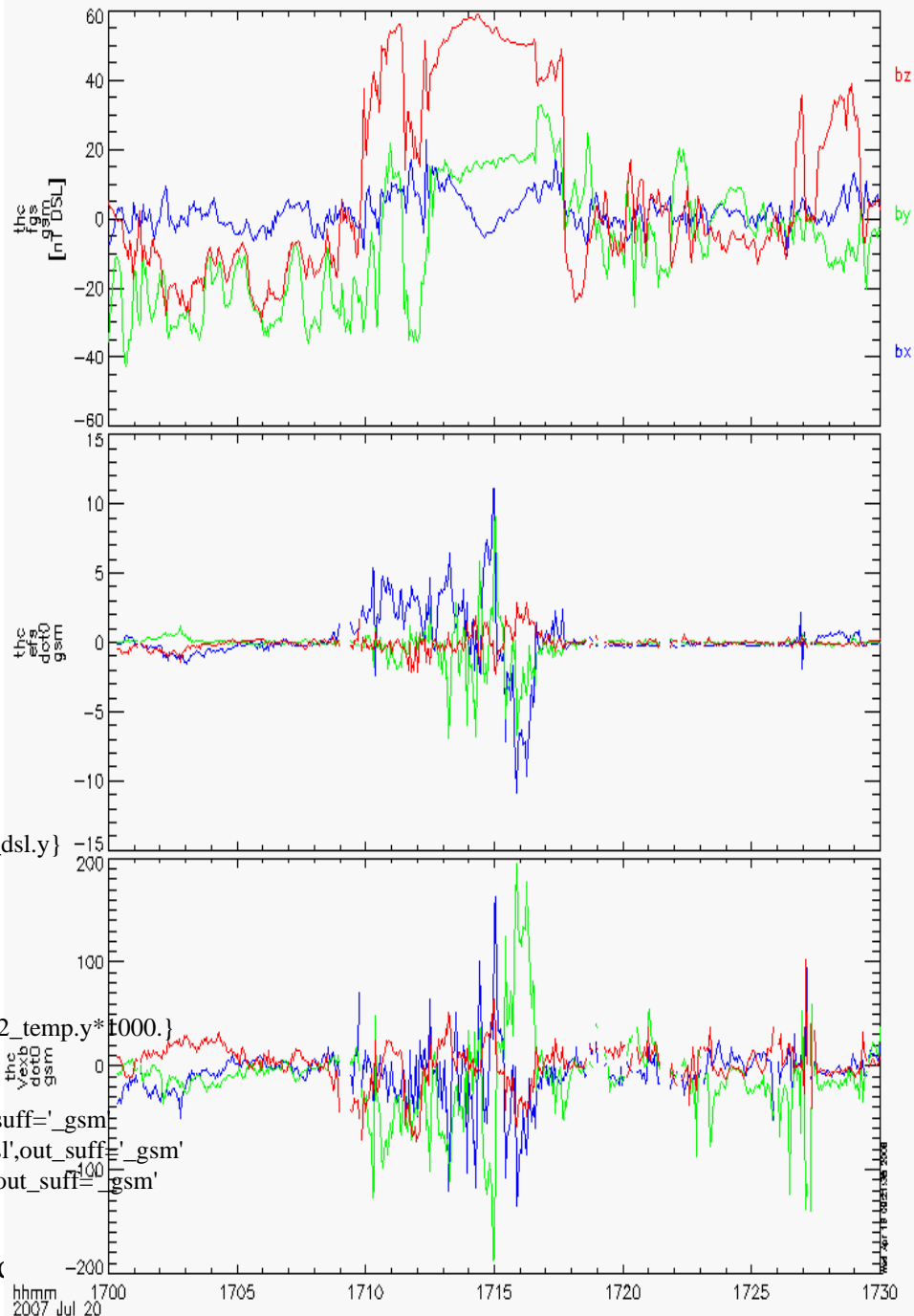
```
tnormalize,'th'+sc+'_fgs',newname='th'+sc+'_fgs_unit'
```

```
thm_cotrans,'th'+sc+'_fgs_unit',in_coord='dsl',out_coord='gsm',in_suff='',out_suff='_gsm'
```

```
thm_cotrans,'th'+sc+'_Vexb_dot0',in_coord='dsl',out_coord='gsm',in_suff='_dsl',out_suff='_gsm'
```

```
thm_cotrans,'th'+sc+'_efs_dot0',in_coord='dsl',out_coord='gsm',in_suff='_dsl',out_suff='_gsm'
```

```
tplot,'thc_fgs_gsm thc_efs_dot0_gsm thc_Vexb_dot0_gsm'
```



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Field

hhmm
2007 Jul 20

1705

1710

1715

1720

1725

1730