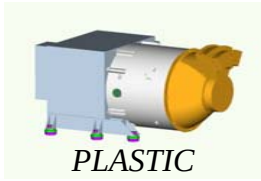


PLASTIC On-board Moments Calculation and Beacon Data

Lynn M. Kistler

Space Science Center

UNH

Moments

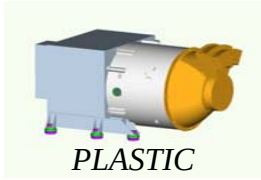
The on-board moments calculation is based on that done for CLUSTER/CODIF, and for PLASTIC/IMPACT/SWEA. They are simple sums (not fits) over the available data.

Density is given by:

$$n = \int \int \int f(\theta, \phi, v) v^2 \cos\theta d\theta d\varphi dv$$

Where θ is the polar (deflector) angle and ϕ is the azimuthal (position) angle.

Density Calculation



$$n = \frac{1}{t_{acc} G} \sum \frac{\Delta v_s}{v^2} \sum \cos\theta \Delta\theta_s \sum \Delta\varphi_s N(\theta,\varphi,v)$$

We can pull out the constants in the sums, to get

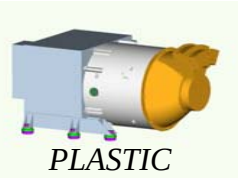
$$n = \frac{\Delta\theta_s \Delta\varphi_s (\Delta v/v)_s}{t_{acc} G} \sum_v \frac{1}{v} \sum_\theta \cos\theta \sum_\varphi N(\theta,\varphi,v)$$

So what is actually performed on-board is:

$$Sum1 = \sum_v \frac{1}{v} \sum_\theta \cos\theta \sum_\varphi N(\theta,\varphi,v)$$

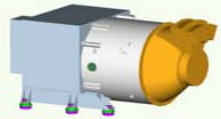
With the constants added later on the ground.

Density Calculation



- These sums are implemented using an array of counts of ions classified as H+ that fall in the solar wind sector. This arrays is passed to the moments routine for each ESA step and added to the sums.
- Two separate sets of moments are accumulated: one for S-channel and one for non-S-Channel
- The velocity and trigonometric functions are stored in tables for each of the 32 Position bins, 32 deflection steps, and 128 ESA steps.
- Because of processing limitations, the whole 32Px32D array is not sent used. Instead, a 16P x 8D array is sent.
- The D bins are centered on the peak. The 16P's cover the full 45 degrees, using every other bin.

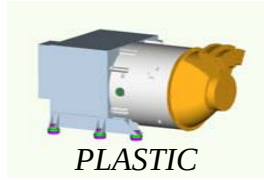
Higher Order Moments



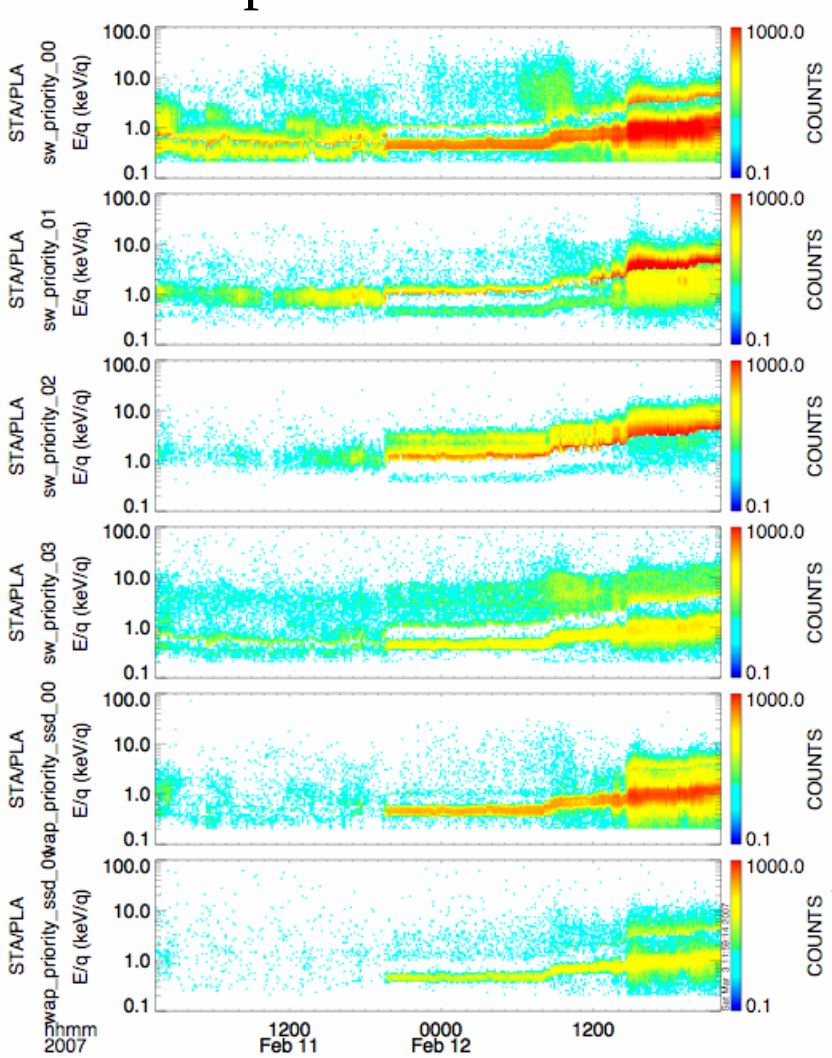
PLASTIC

The other moments (velocity, temperature, heat flux) are performed in a similar manner, using the appropriate velocity and and trigonometric functions.

PLASTIC SSD-side Priority Rates
Feb 11-12, 2007



Spacecraft A



SW H+

SW He++

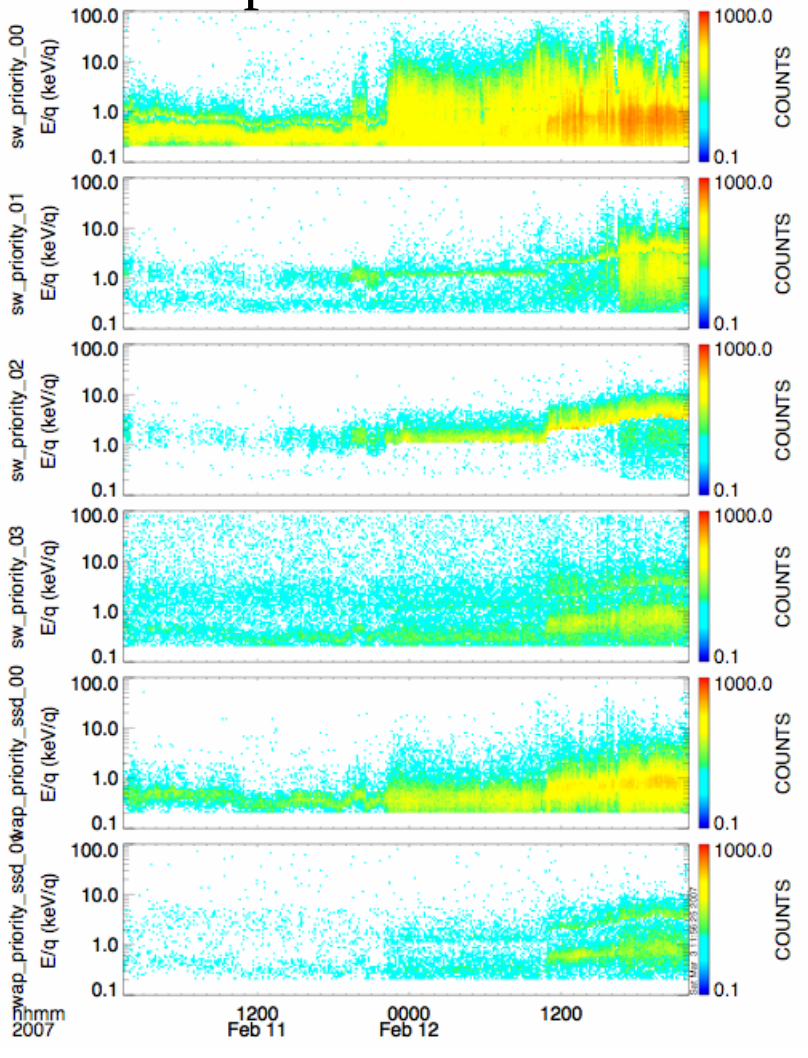
SW Heavies

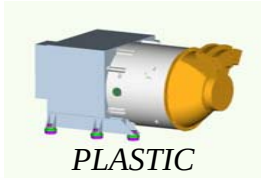
SW Other

WAP H+, He++

WAP Other

Spacecraft B



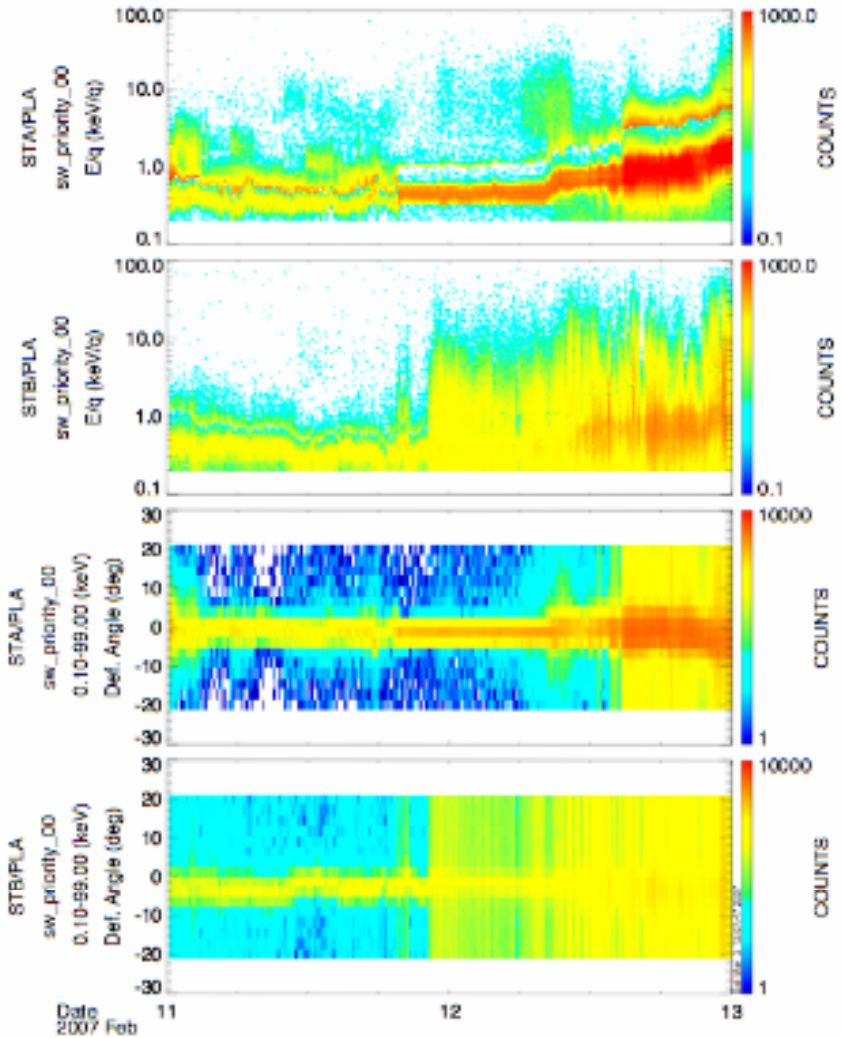


SC/A Energy spec

SC/B Energy spec

SC/A deflection

SC/B deflection



A - black

B - blue

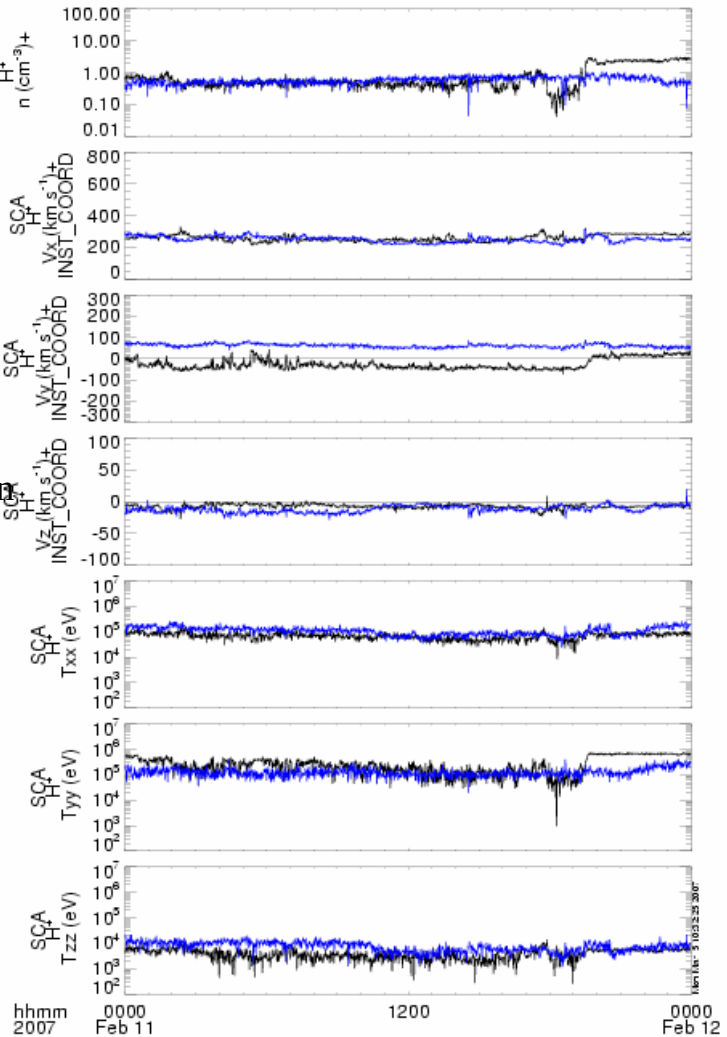
On-board moments

PLASTIC

Sunward direction

Position direction

Deflection direction



Feb 11

n

vx

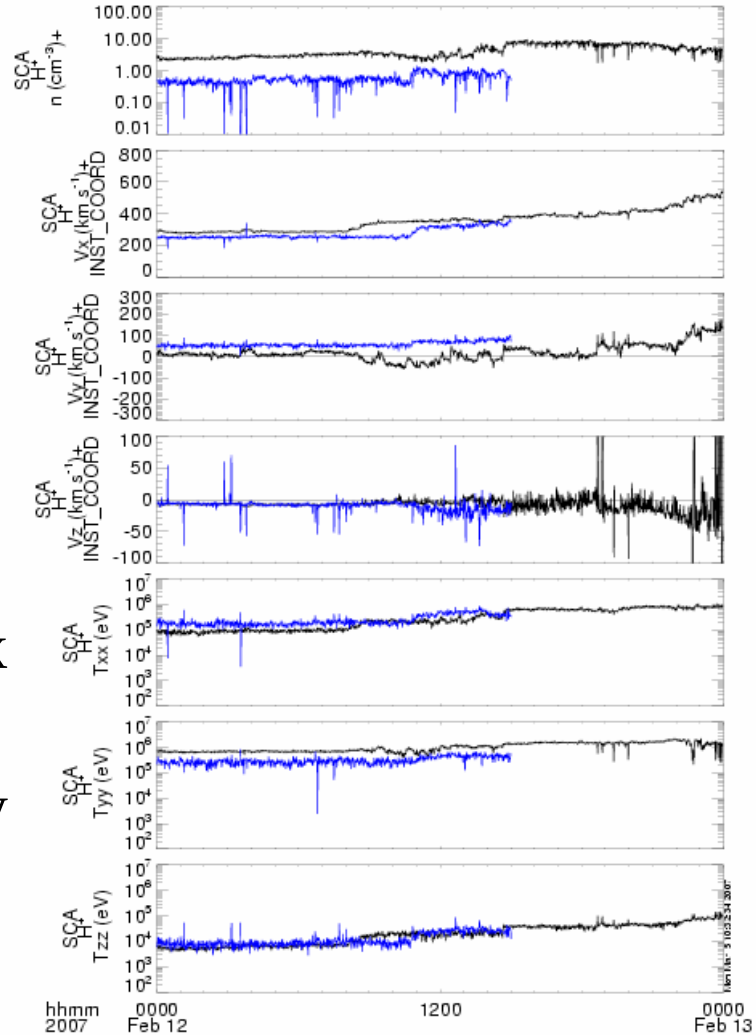
vy

vz

Txx

Tyy

Tzz

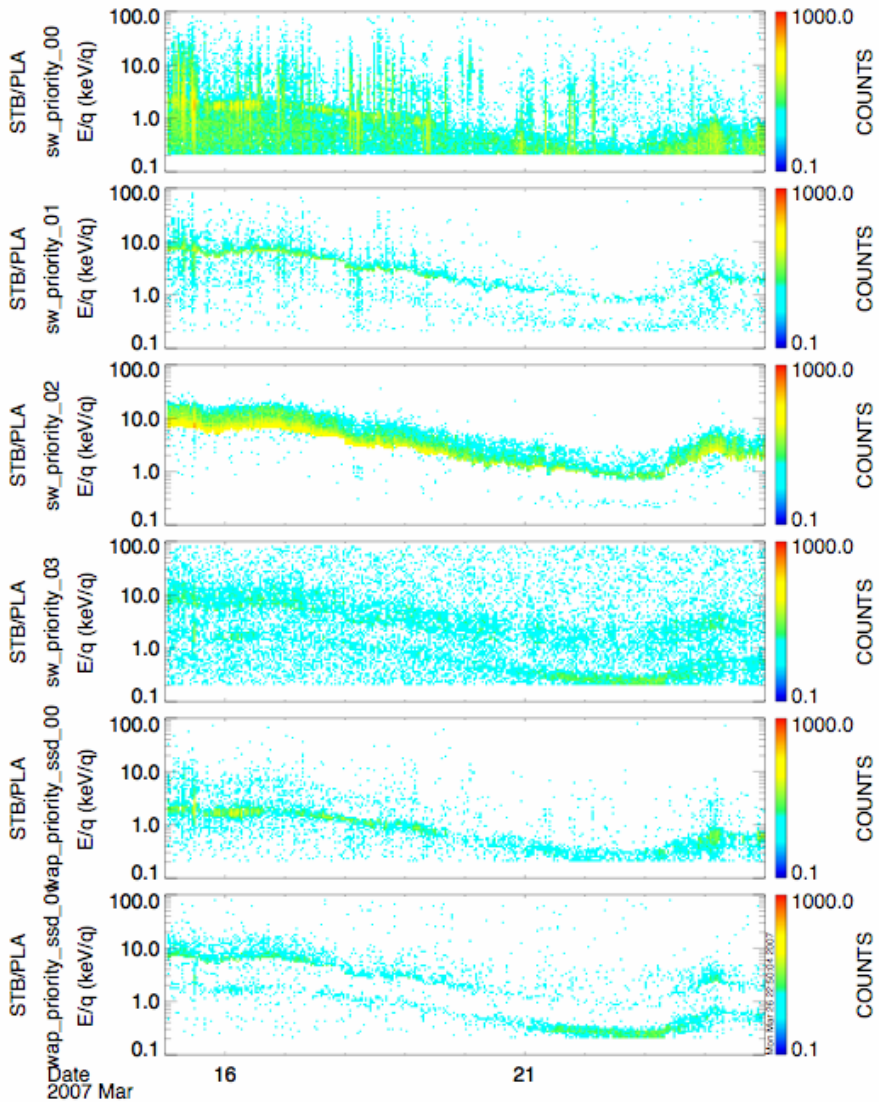


Feb 12

S/C B - 10 days March 15-24

PLASTIC

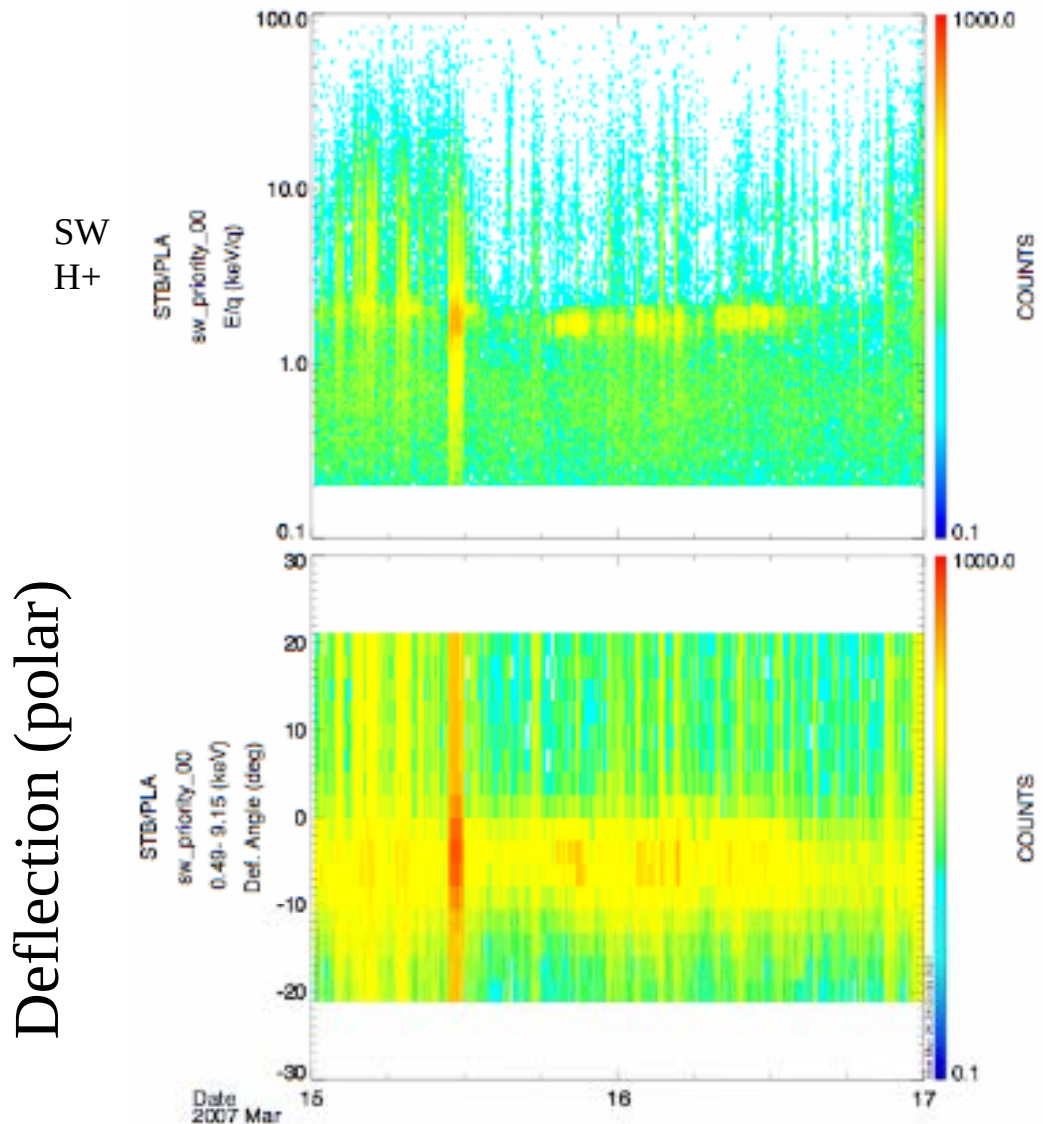
S/C B still not observing standard solar wind



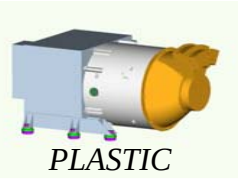
S/C B - 2 days March 15-16

PLASTIC

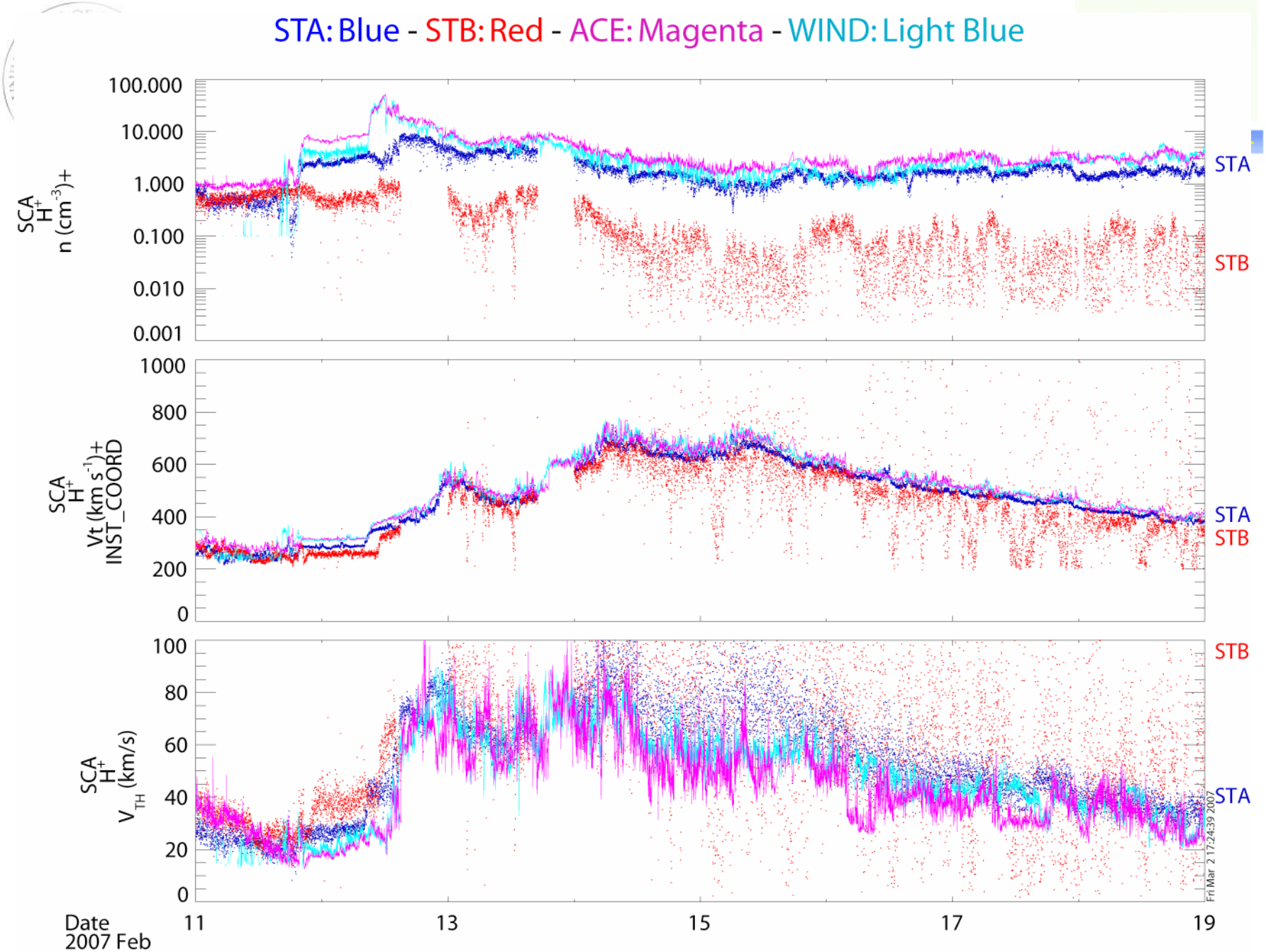
S/C B still not observing standard solar wind

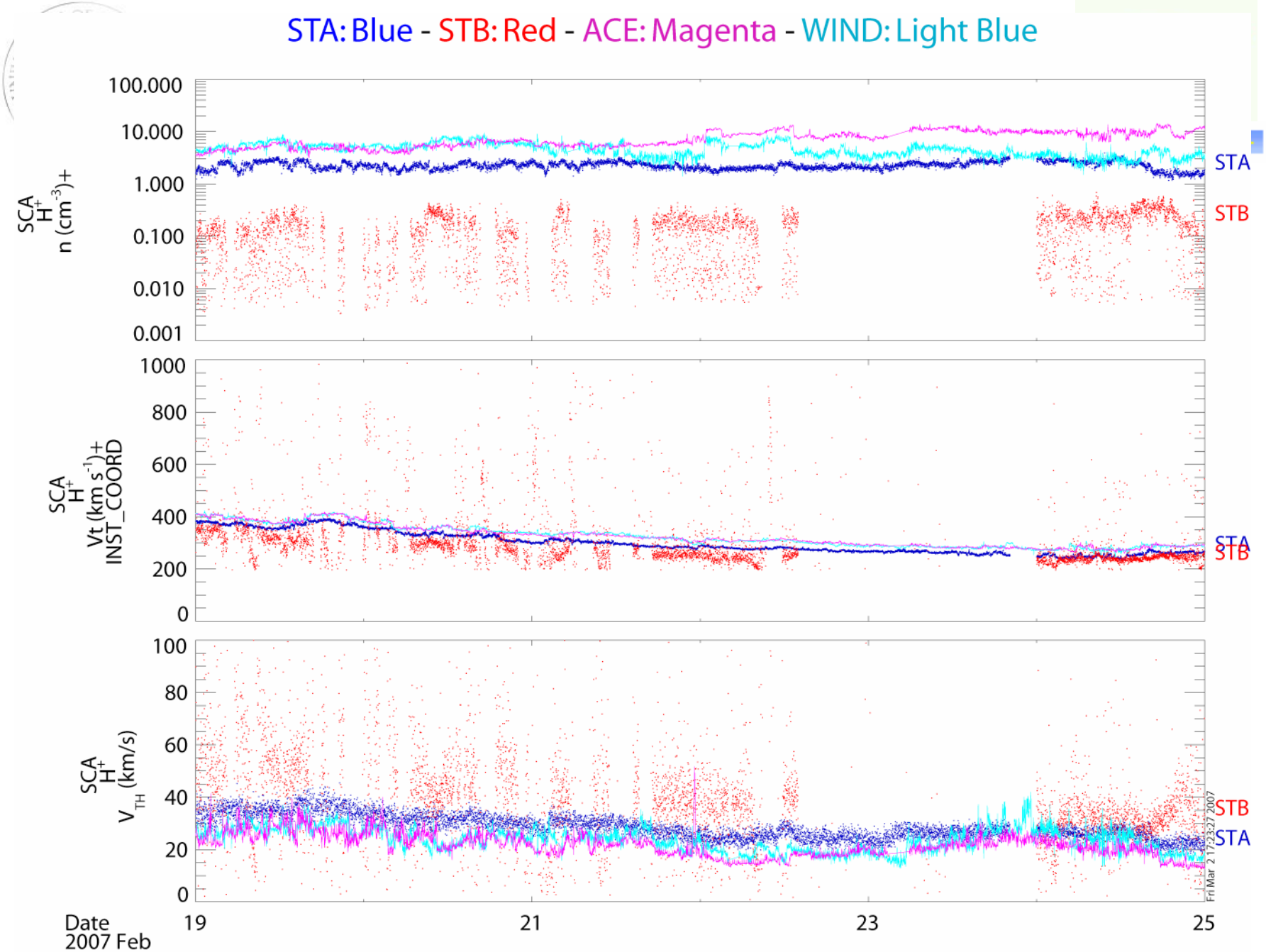


Issues

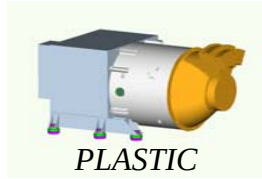


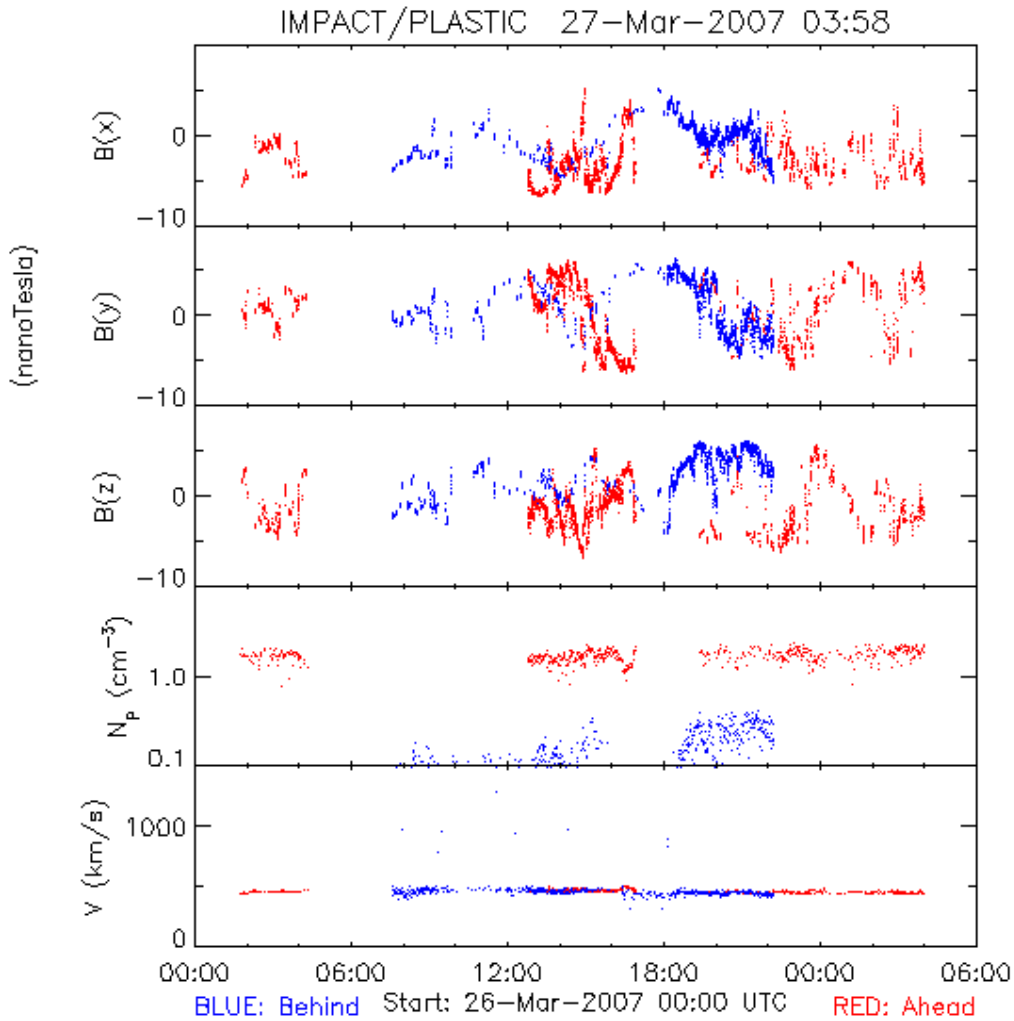
- Final Calibrations are not yet incorporated - density is currently off by ~x2
- S/C B is still in sheath, so densities low.
- Still validating the ecliptic angle.


STA: Blue - STB: Red - ACE: Magenta - WIND: Light Blue
SCA
H+
n (cm-3)+
100.000
10.000
1.000
0.100
0.010
0.001
STA
STB
SCA
H+
Vt (km s-1)+
INST_COORD
1000
800
600
400
200
0
STA
STB
SCA
H+
V TH (km/s)
100
80
60
40
20
0
STB
STA
Fri Mar 2 17:24:39 2007
Date
2007 Feb
11
13
15
17
19

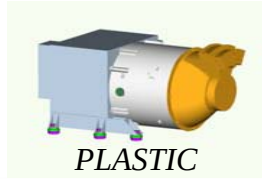

STA: Blue - STB: Red - ACE: Magenta - WIND: Light Blue
SCA H+ n (cm-3)+
100.000
10.000
1.000
0.100
0.010
0.001
STA
STB
SCA H+ Vt (km s-1)+ INST_COORD
1000
800
600
400
200
0
STA
STB
SCA H+ VTH (km/s)
100
80
60
40
20
0
STB
STA
Fri Mar 2 17:23:27 2007
Date 2007 Feb
19
21
23
25

Example of Beacon data on SSC web site





The End



PLASTIC