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MAX-PLANCK-GESELLSCHAFT

STEREO Observations of the Influence of the HCS on energetic ions in CIRs

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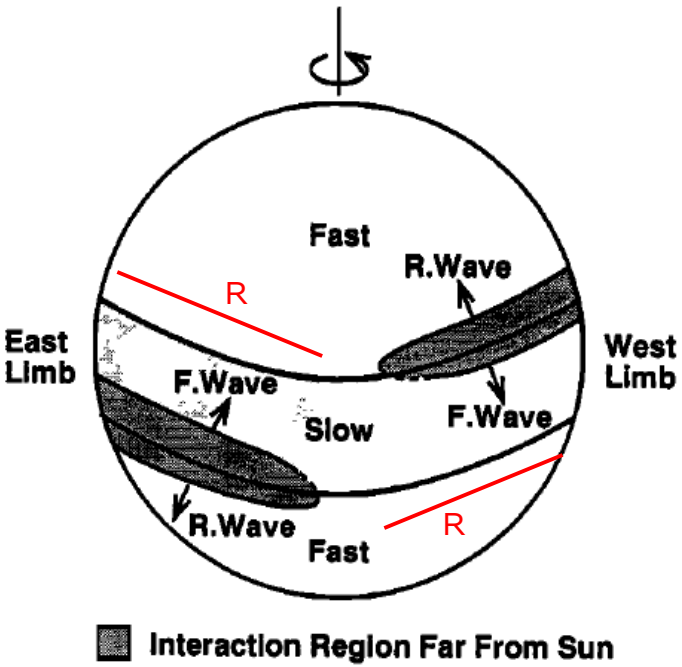
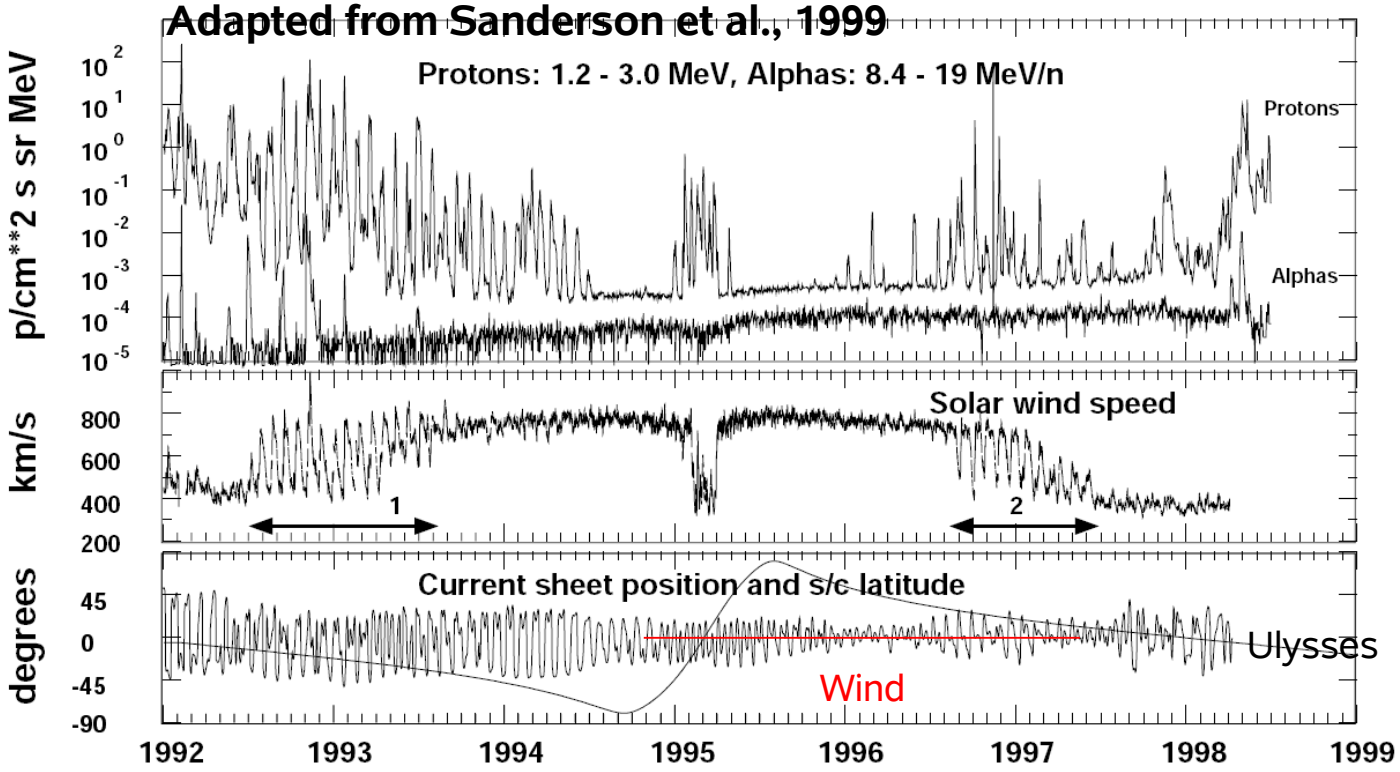
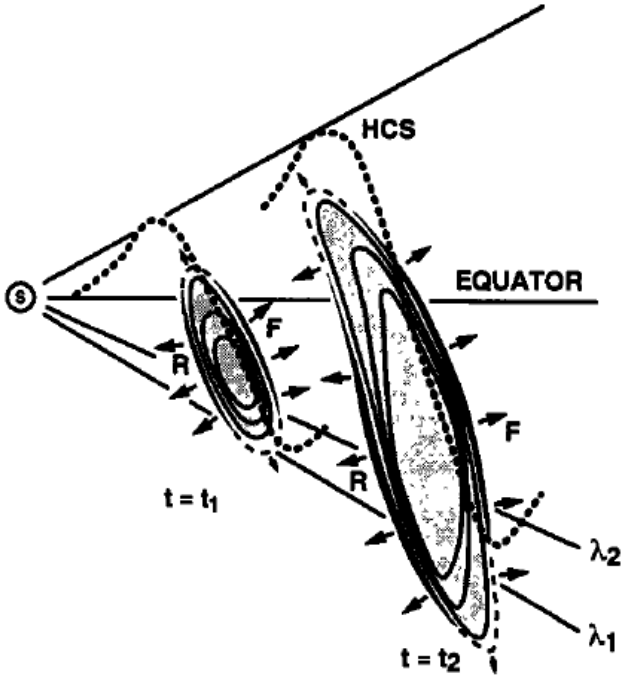


Adapted from Sanderson et al., 1999





Adapted from Gosling et al., 1993

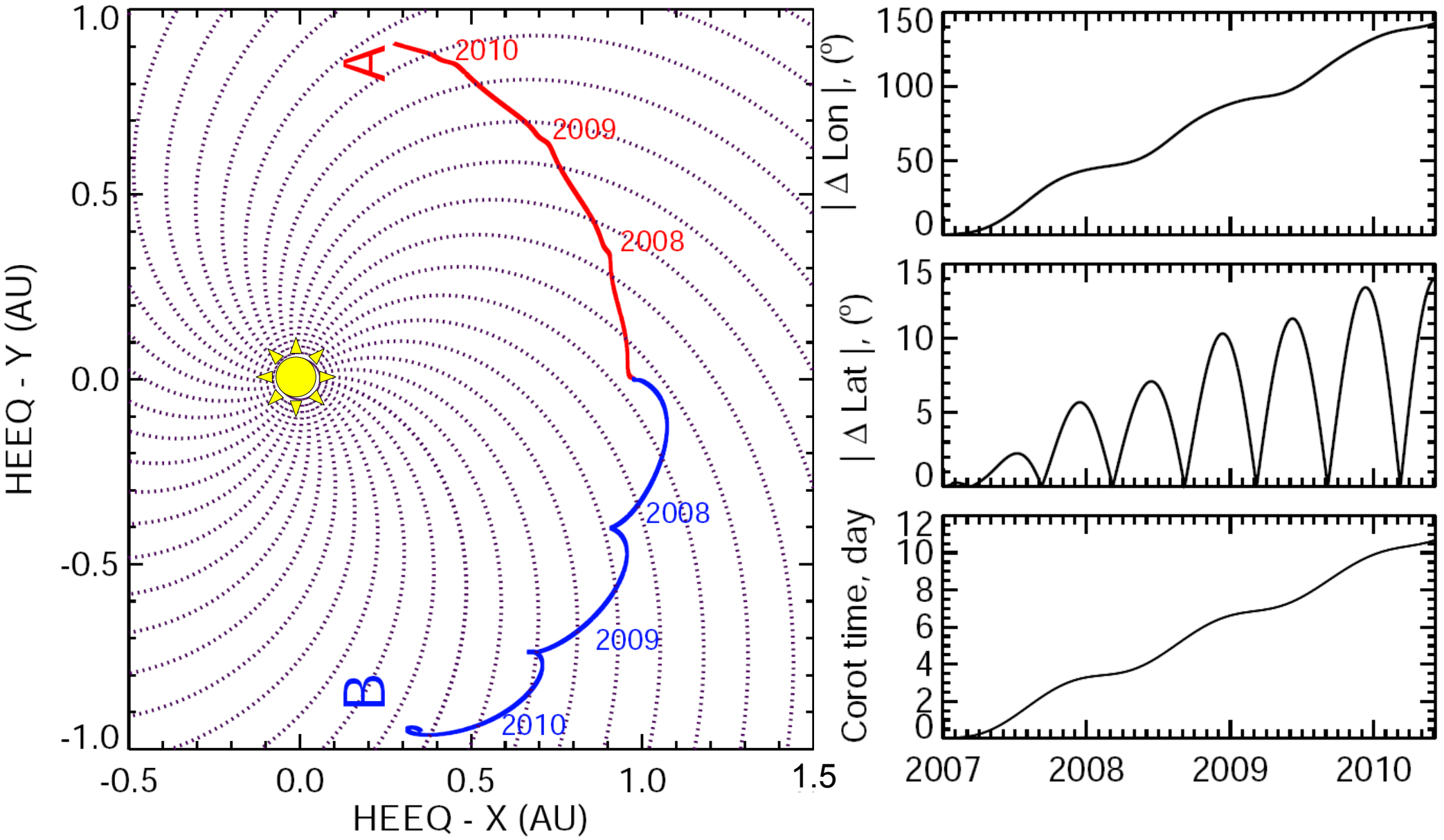
Model of CIRs: the strength of the compression region depends on the tilt angle and the heliolatitude (Gosling and Pizzo,1999)

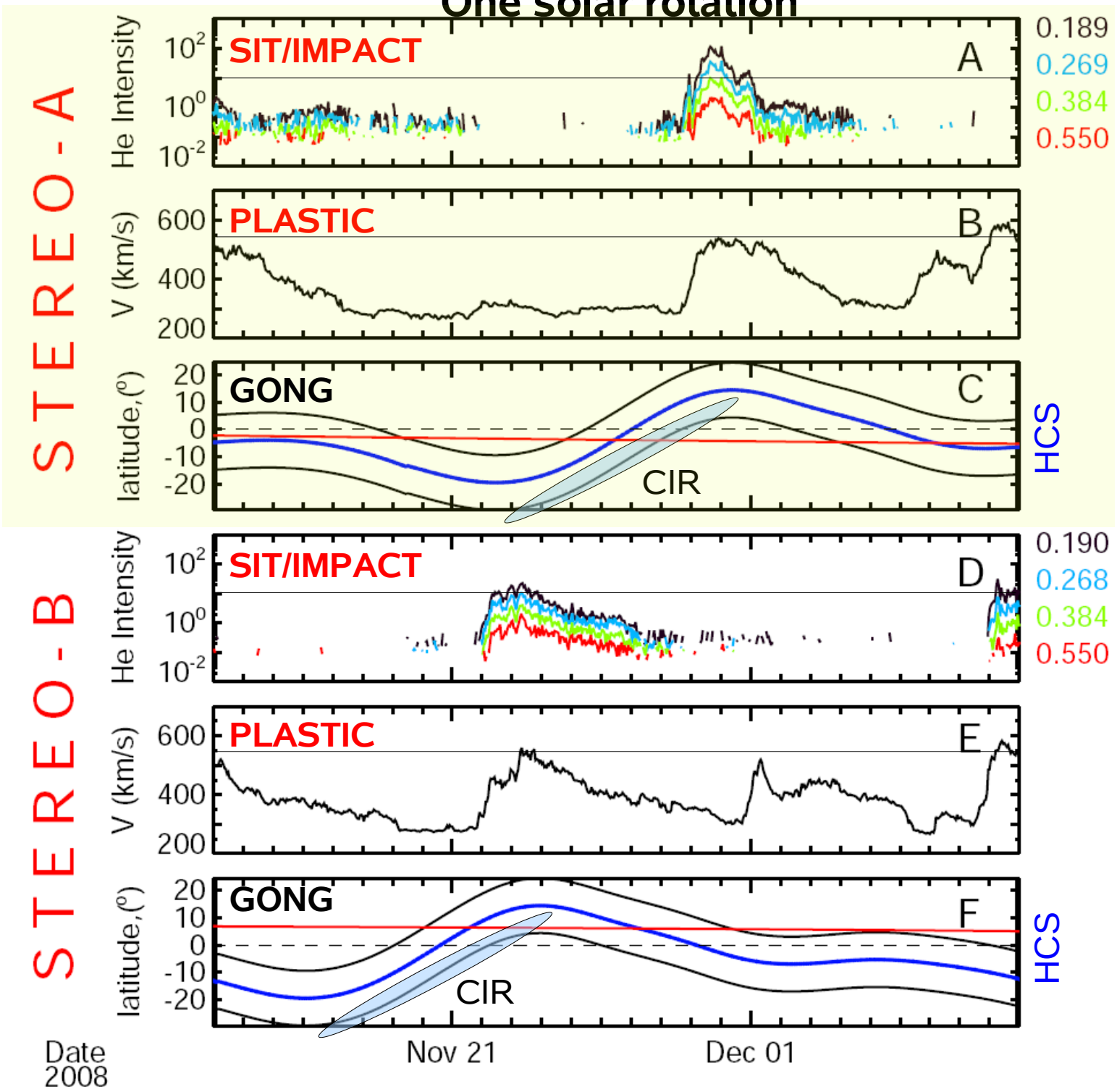
Observations show the CIR particle intensity:

- **depends on heliolatitude with an e-folding latitude 6°-8° (Ulysses; Richardson et al. 1998)**
- **changes as the tilt of the current sheet changes and as the position of the s/c changes relative to the current sheet (Wind, Ulysses; Sanderson et al. 1998,1999)**

What we can tell more from the two STEREO observations ?

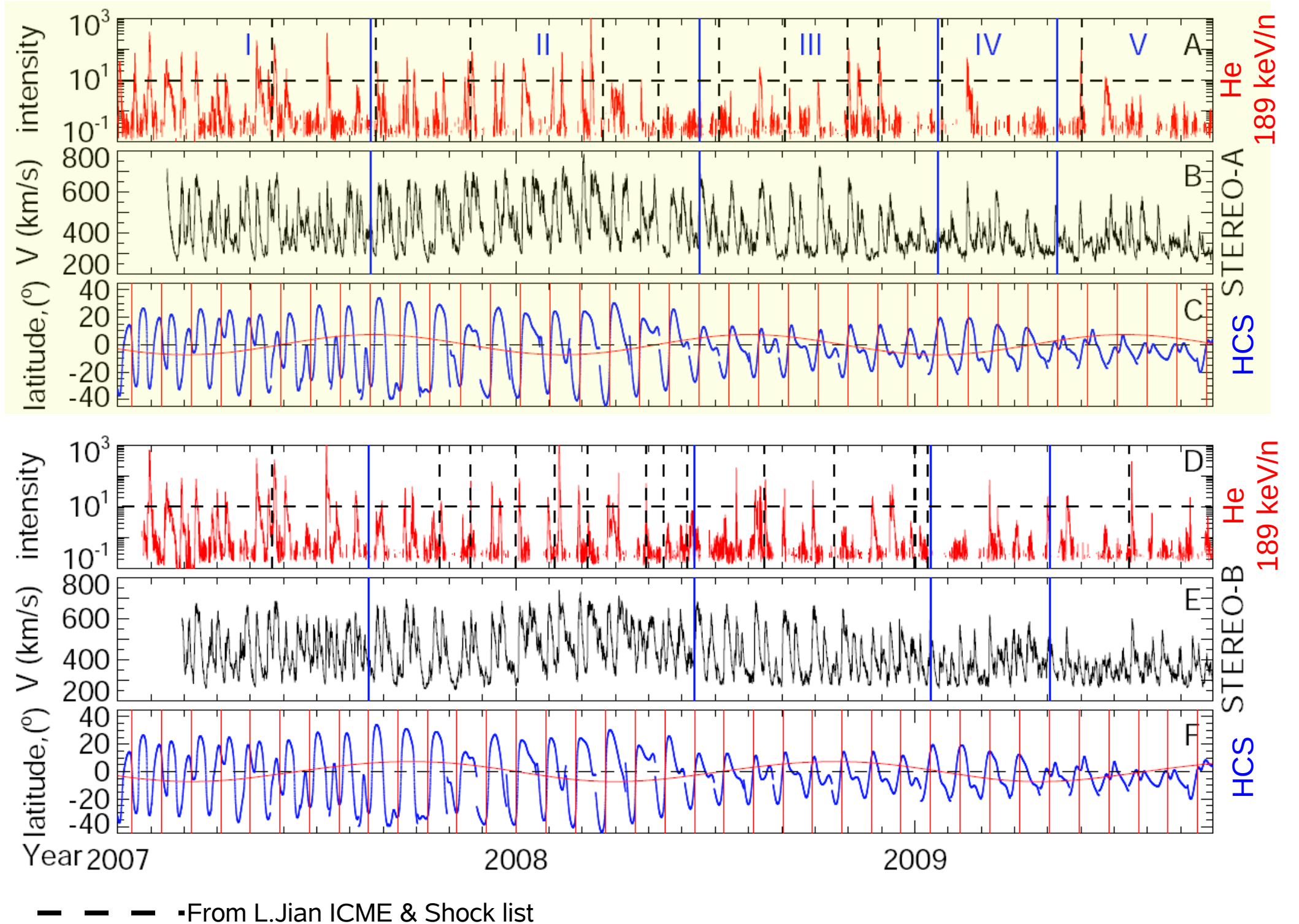
Parameters of the orbit

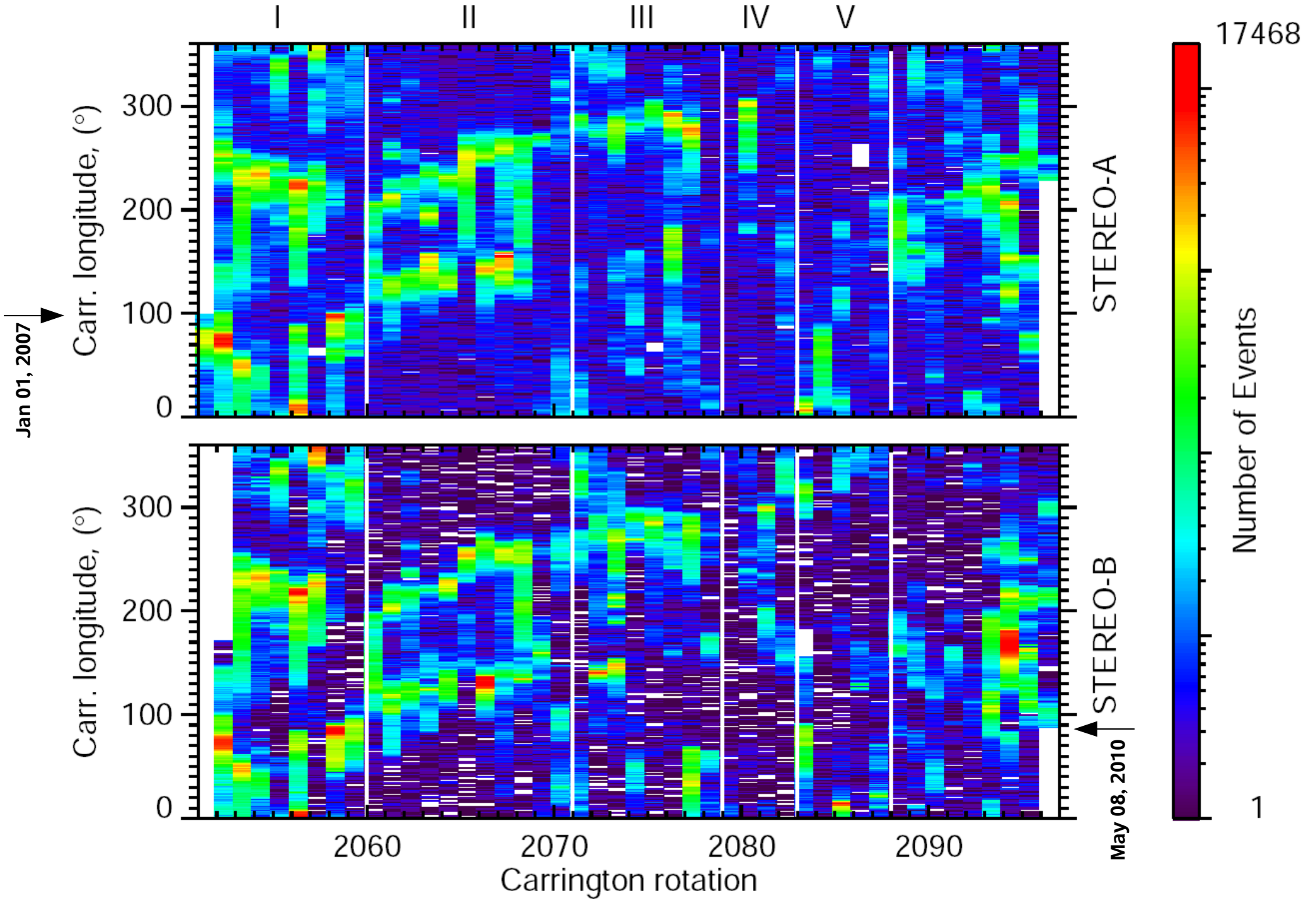




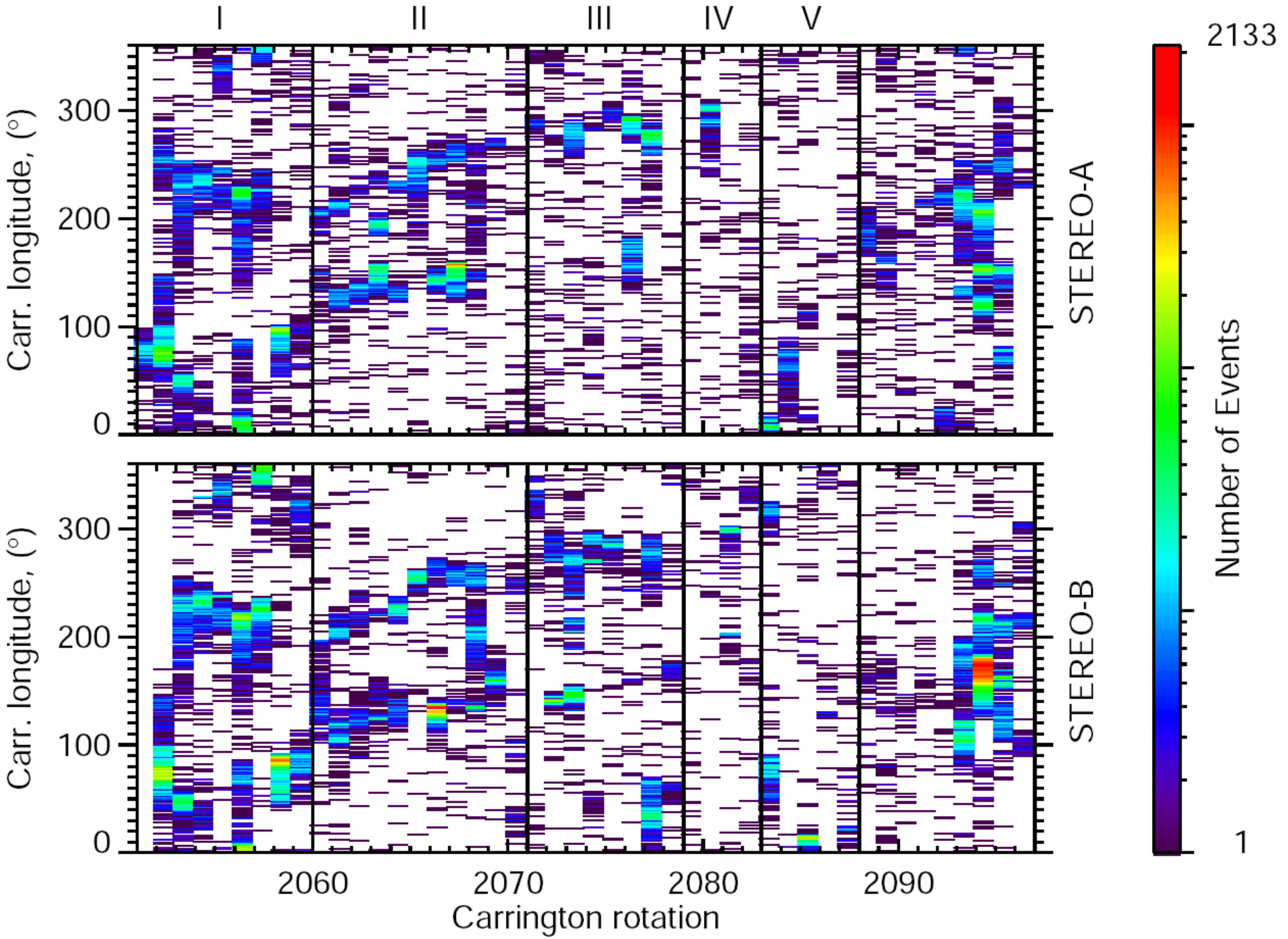
- we can sample the same CIRs twice at different heliolatitudes during periods which are shorter than one solar rotation

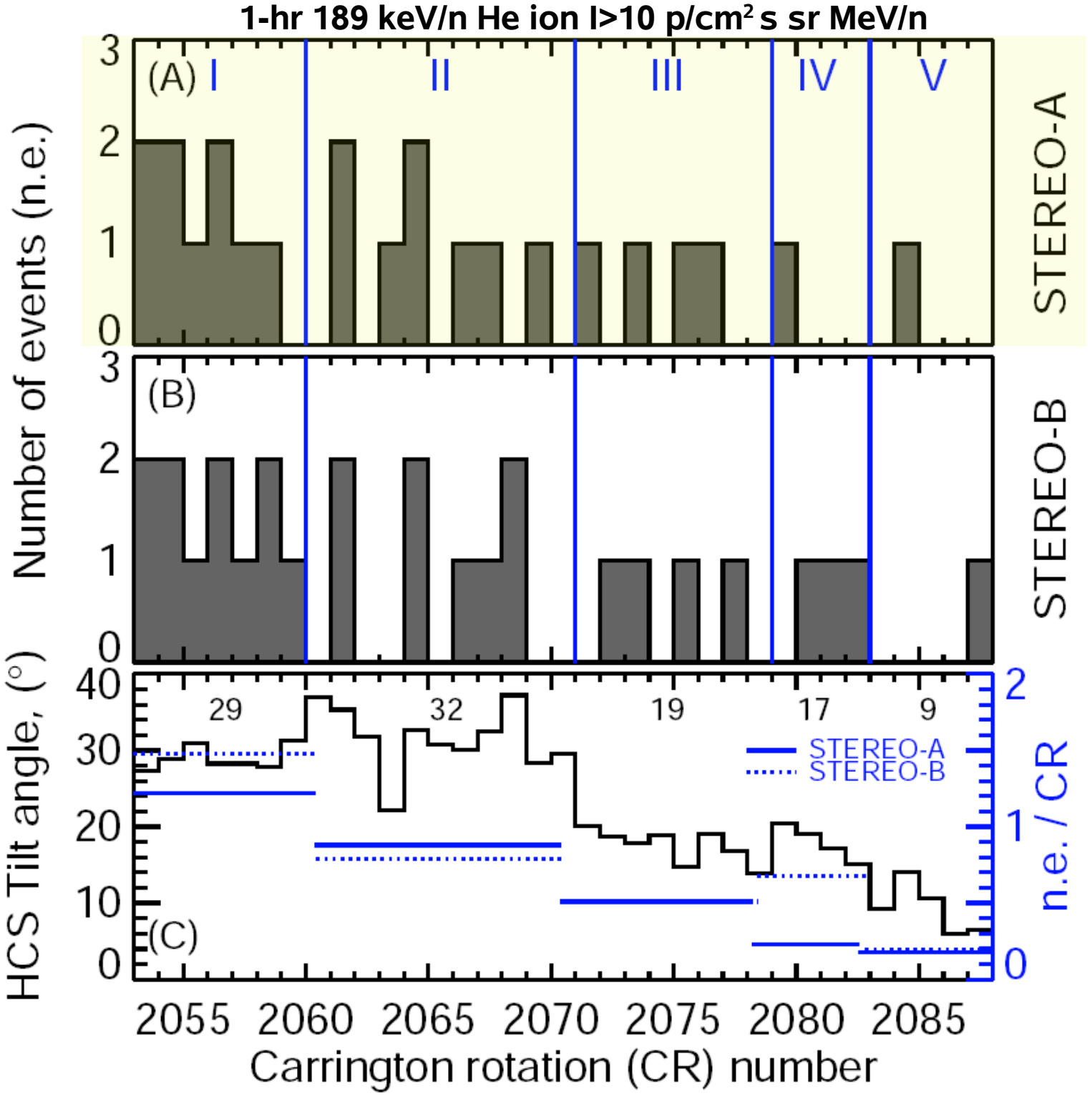
- with two s/c we can disentangle the effects of the tilt angle and the latitude gradient in CIRs


intensity
V (km/s)
latitude,(°)
I
II
III
IV
V
A
B
C
D
E
F
He
189 keV/n
STEREO-A
STEREO-B
HCS
Year
2007
2008
2009
From L.Jian ICME & Shock list

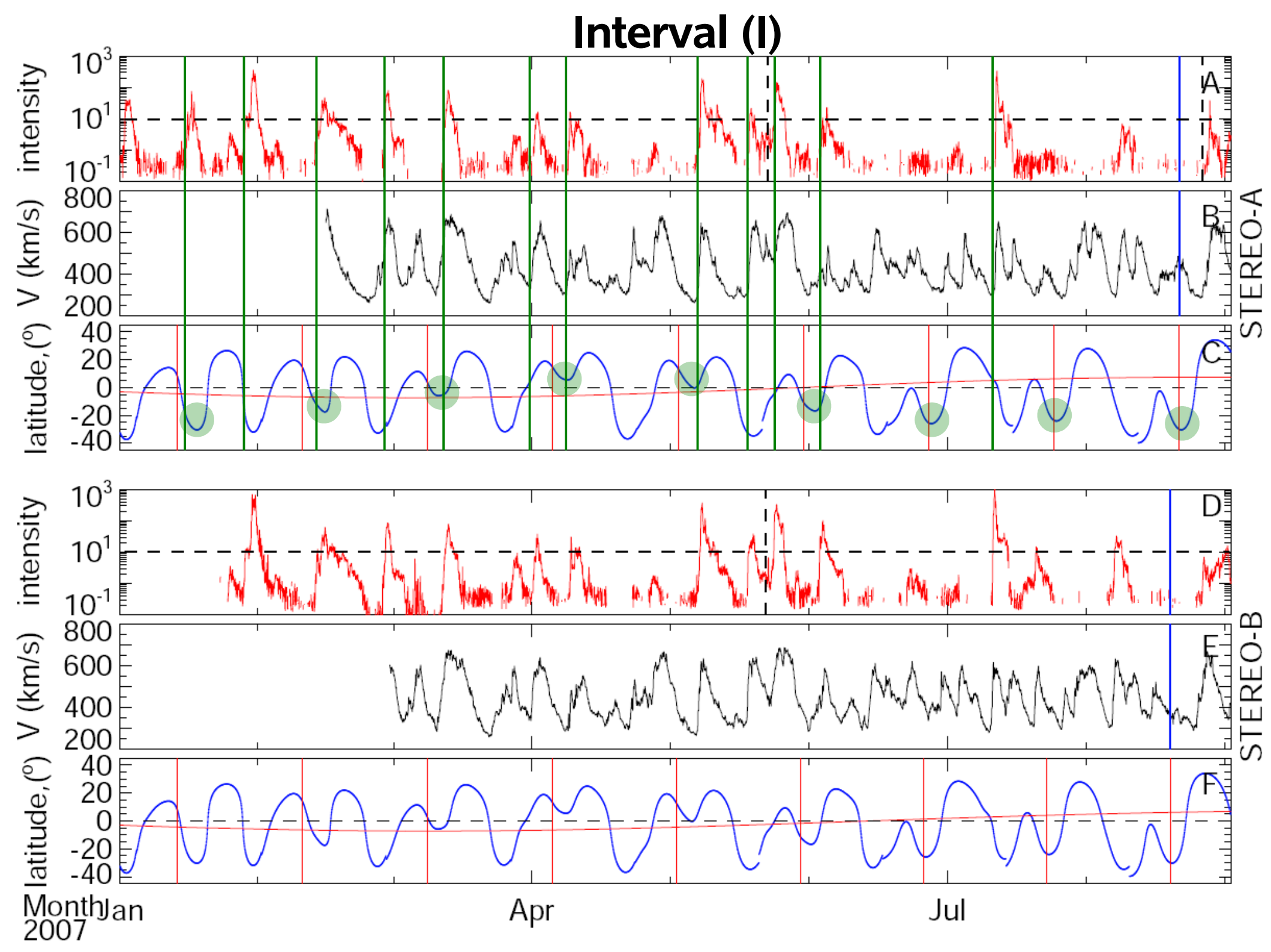

Helium 0.16-0.23 MeV/n PHA data
I
II
III
IV
V
Carr. longitude, (°)
300
200
100
0
STEREO-A
STEREO-B
Jan 01, 2007
May 08, 2010
2060
2070
2080
2090
Carrington rotation
17468
1
Number of Events

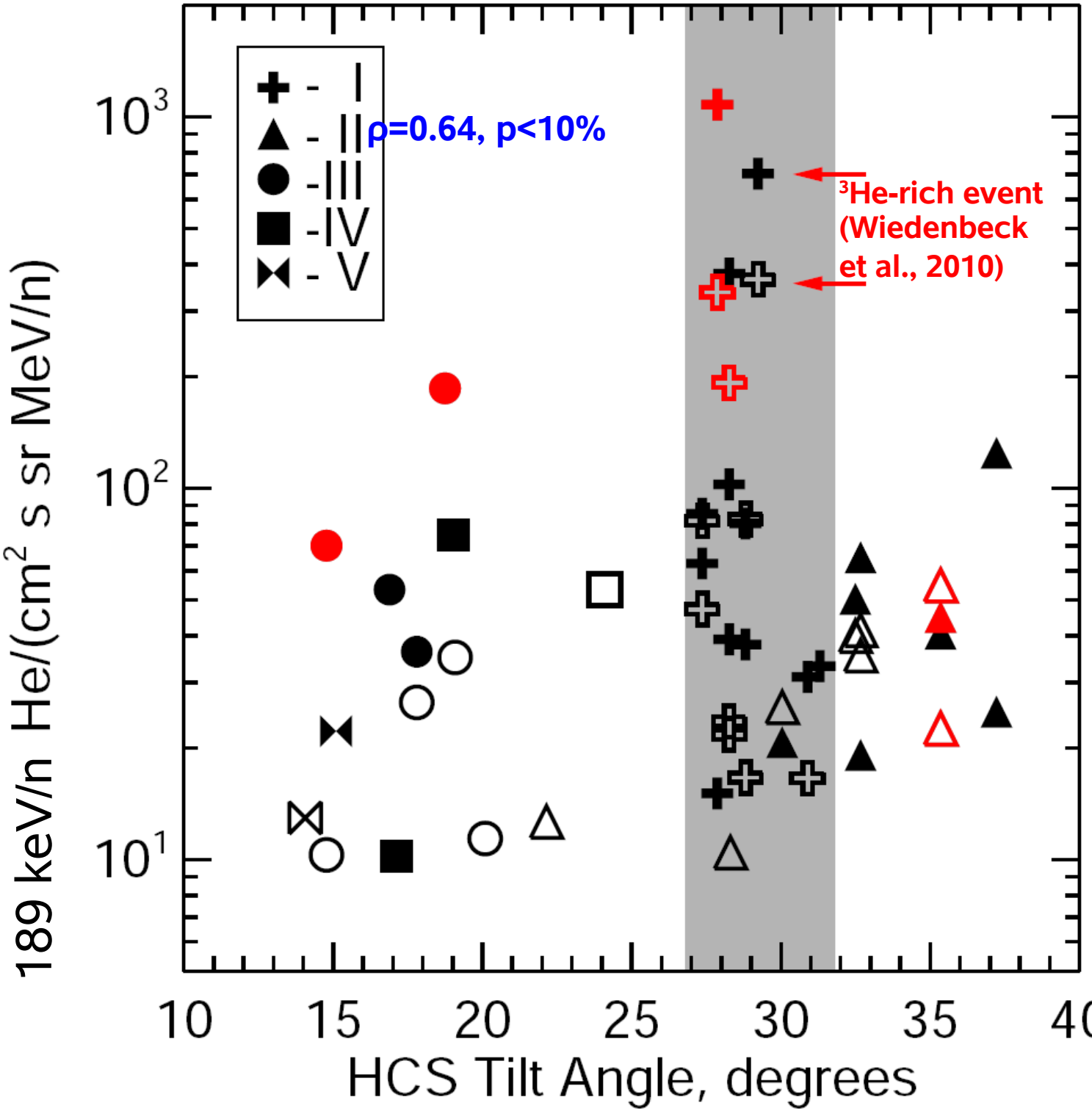
Oxygen 0.11-0.16 MeV/n PHA data



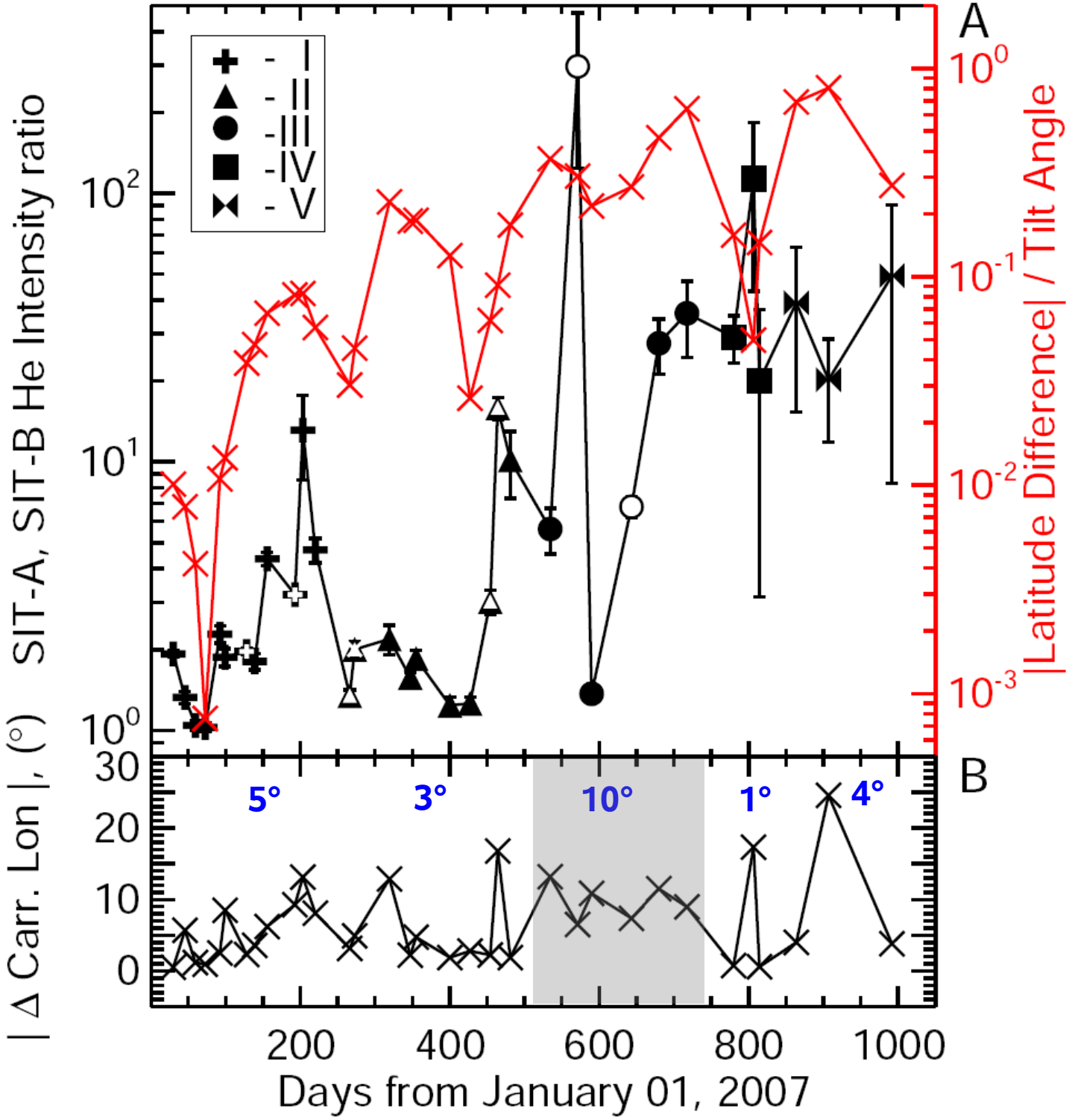


- **the CRs with 2 CIR events - the period of enhanced tilt angles**
- **(IV-V) there exist periods lasting for 4 solar rotations without any CIR activity**
- **<n.e./CR> decreases with the tilt angle through (II)-(V)**
- **large differences between number of events on STA and STB in a period of low tilt angles (III-IV); almost no differences when tilt angle increases to higher values (I-II)**

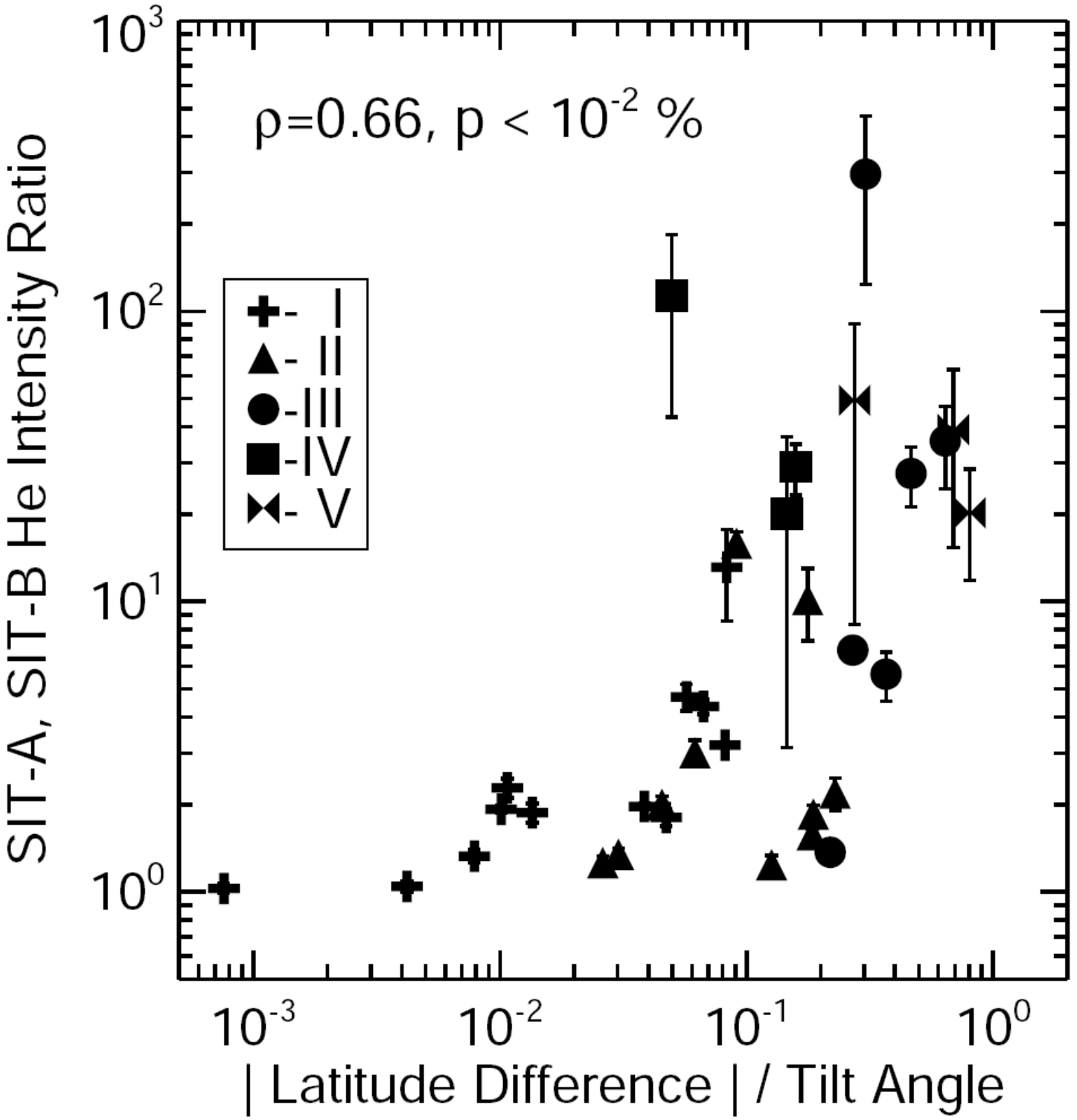

Interval (I)
intensity
V (km/s)
latitude,(°)
A
B
C
D
E
F
STEREO-A
STEREO-B
Month
2007
Jan
Apr
Jul



- **(I) - broad range of ion intensities - CIR events with high intensity – events with in-situ shocks, preceded by SEP event, assoc. with warps in the current sheet**
- **re-acceleration of the particles from transient events by the CIRs may lead to the enhanced ion intensities**
- **(II) - a clear correlation between tilt angle an ion peak intensities**
- **(III-V)- no clear relation; the s/c heliolatitude becomes comparable to the tilt angle- a factor leading to the lack of the organization by the tilt**



- **the ratio time profile - well ordered with the time profile of the lat. diff.**
- **when the lat. diff. becomes comparable to the tilt angle, the ratio slowly increase**
- **in period (II) the ratio does not increase as seen in period (I) but remains in the range 1÷2 → the lat. diff. do not play large role when tilt angle is high**
- **the higher value of the shift in the source longitude in interval (III) - the ratio show large variations - the diff. between intensities - related to changes in the coronal structure of the source region on time scales < the corot. delay between the two s/c**



- positive correlation between the intensity ratio and latitude differences divided by the tilt angle
- the latitudinal range covered by STEREO is quite narrow (~ 15°)
- the s/c position relative to the CIR - an important factor of the differences between particle intensities observed with STEREO-A and STEREO-B

Summary

- the high rate of the occurrence of the CIR ion enhancements is observed during periods of high tilt angles with the large warps in the current sheet; the rate decreased with the current sheet tilt angle

- the differences between the number of CIR events on STEREO-A and STEREO-B were very small when the tilt angle was high; during periods of low tilt angles the differences may increase to high values

- the CIR intensity differences between STEREO-A and STEREO-B are positively correlated with latitudinal differences between the two s/c relative to the tilt angle

- the He ion CIR intensity is positively correlated with the tilt angle during periods of a highly tilted current sheet; no clear relation between ion intensity and tilt angle is observed in the period of low tilt angles

- the lack of the correlation likely results from the combination of the latitude intensity gradient and the temporal changes in the intensity over the corotation time interval between observations on STEREO-A and -B