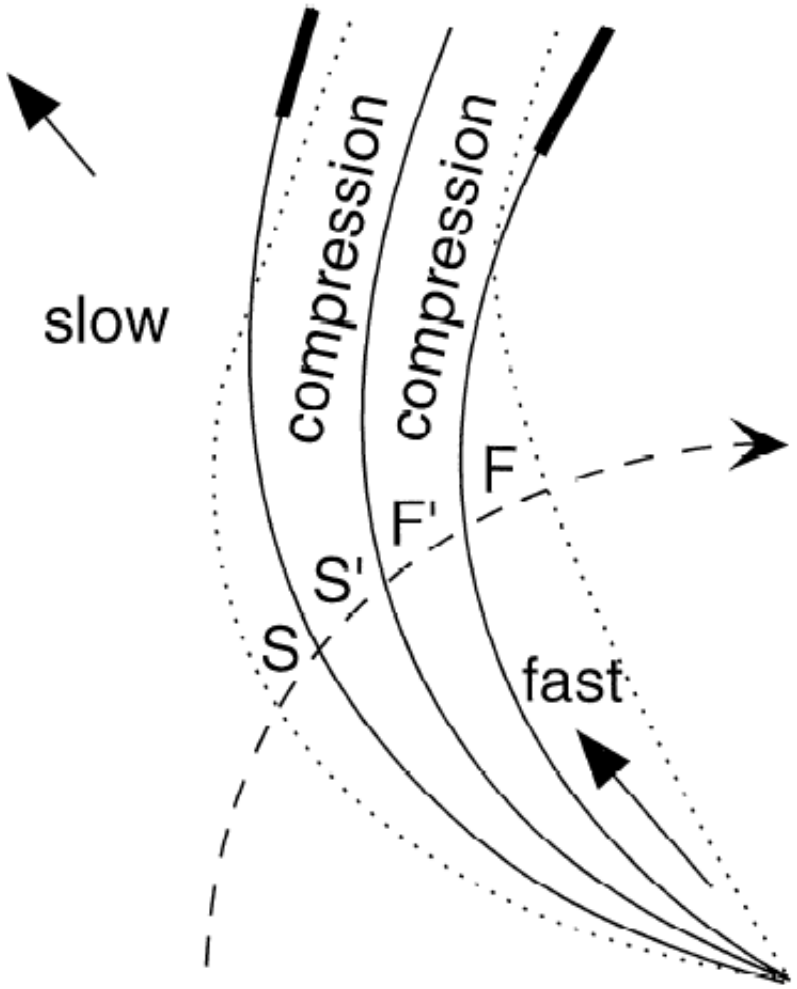
STEREO observations of suprathermal ion composition in CIRs around small SEP events

R. Bucik (1), R. Gomez-Herrero (2), A. Korth (1), U. Mall (1), G. Mason (3)

(1) Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany, (2) Christian-Albrechts-University Kiel, Kiel, Germany, (3) JHU, Applied Physics Laboratory, Laurel, MD, USA

STEREO SWG science workshop, Meudon, France



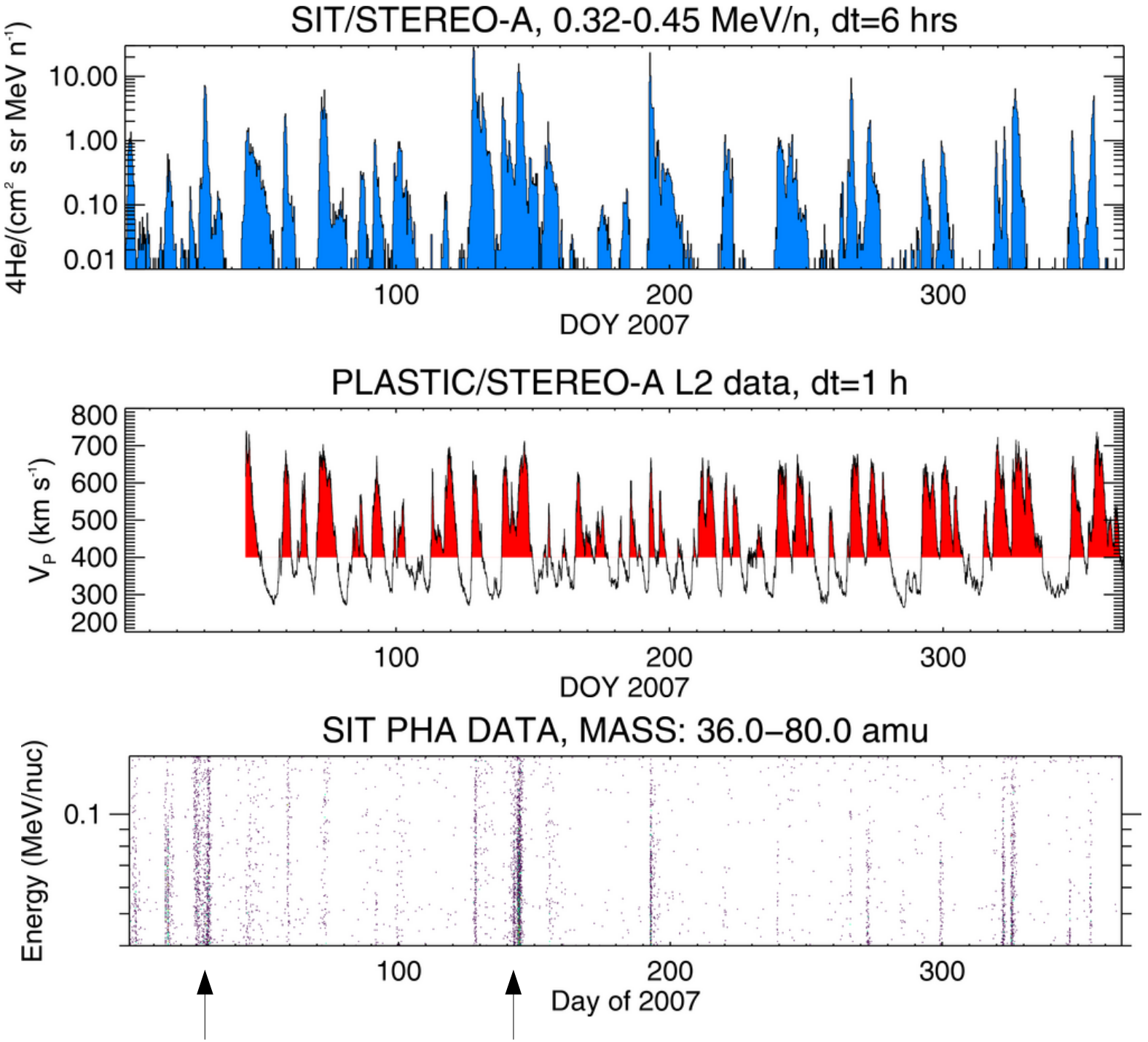
(Chotoo et al, 2000)

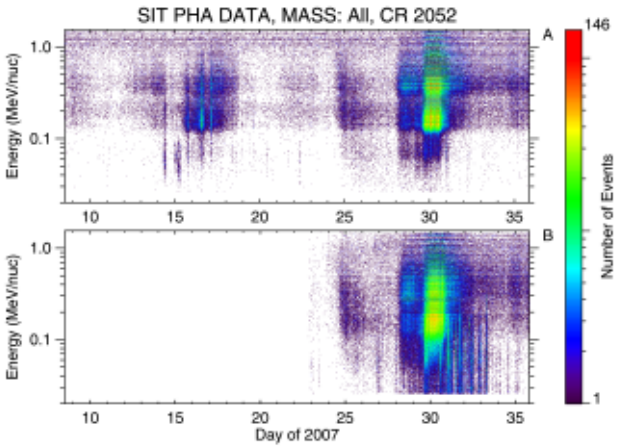
- Observations of corotating enhancements suggest that these events are not accelerated out of a background low energy SEP source population (Richardson et al., 1993)

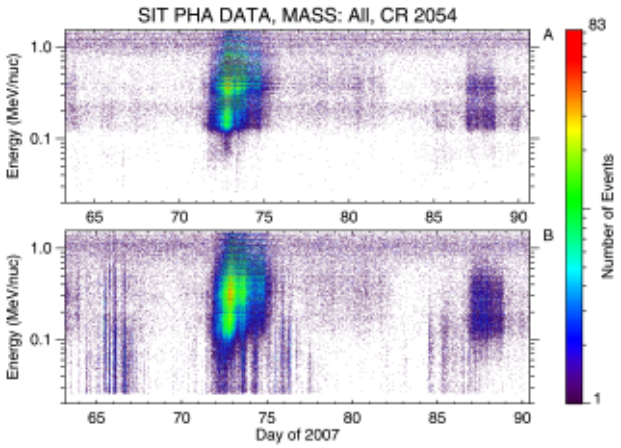
- At high heliolatitudes - SEP-like elemental composition in CIR prior to reverse shock - related to ICME transit (Simnett et al., 1995)

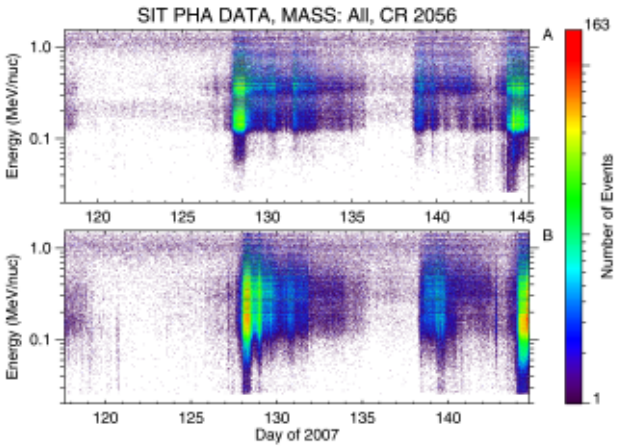
- On occasion, CIR possibly re-accelerate 'remnants' from earlier SEP (Richardson, 2004)

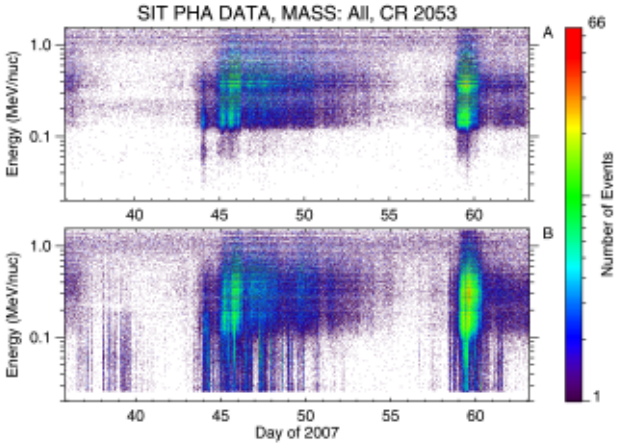
- So, relative contribution from SEP source population is poorly understood

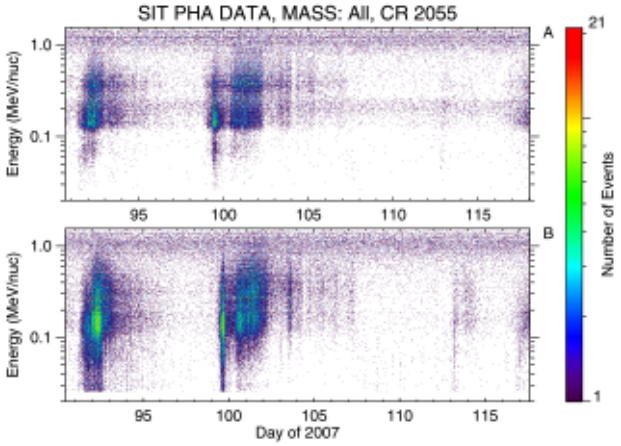

SIT/STEREO-A, 0.32-0.45 MeV/n, dt=6 hrs
4He/(cm² s sr MeV n⁻¹)
10.00
1.00
0.10
0.01
100
200
300
DOY 2007
PLASTIC/STEREO-A L2 data, dt=1 h
V_P (km s⁻¹)
800
700
600
500
400
300
200
100
200
300
DOY 2007
SIT PHA DATA, MASS: 36.0–80.0 amu
Energy (MeV/nuc)
0.1
100
200
300
Day of 2007

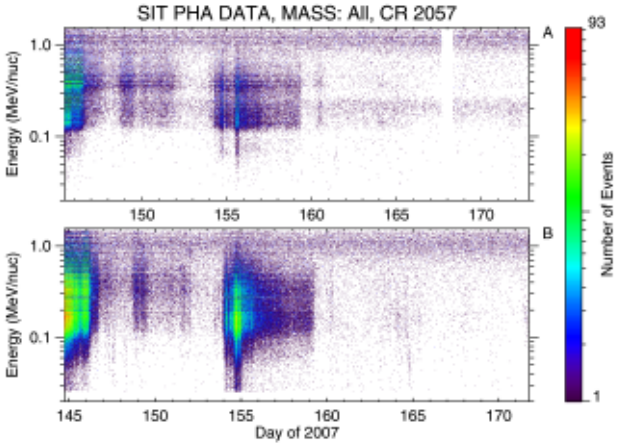

SIT PHA DATA, MASS: All, CR 2052
Energy (MeV/nuc)
1.0
0.1
A
B
10
15
20
25
30
35
Day of 2007
146
1
Number of Events

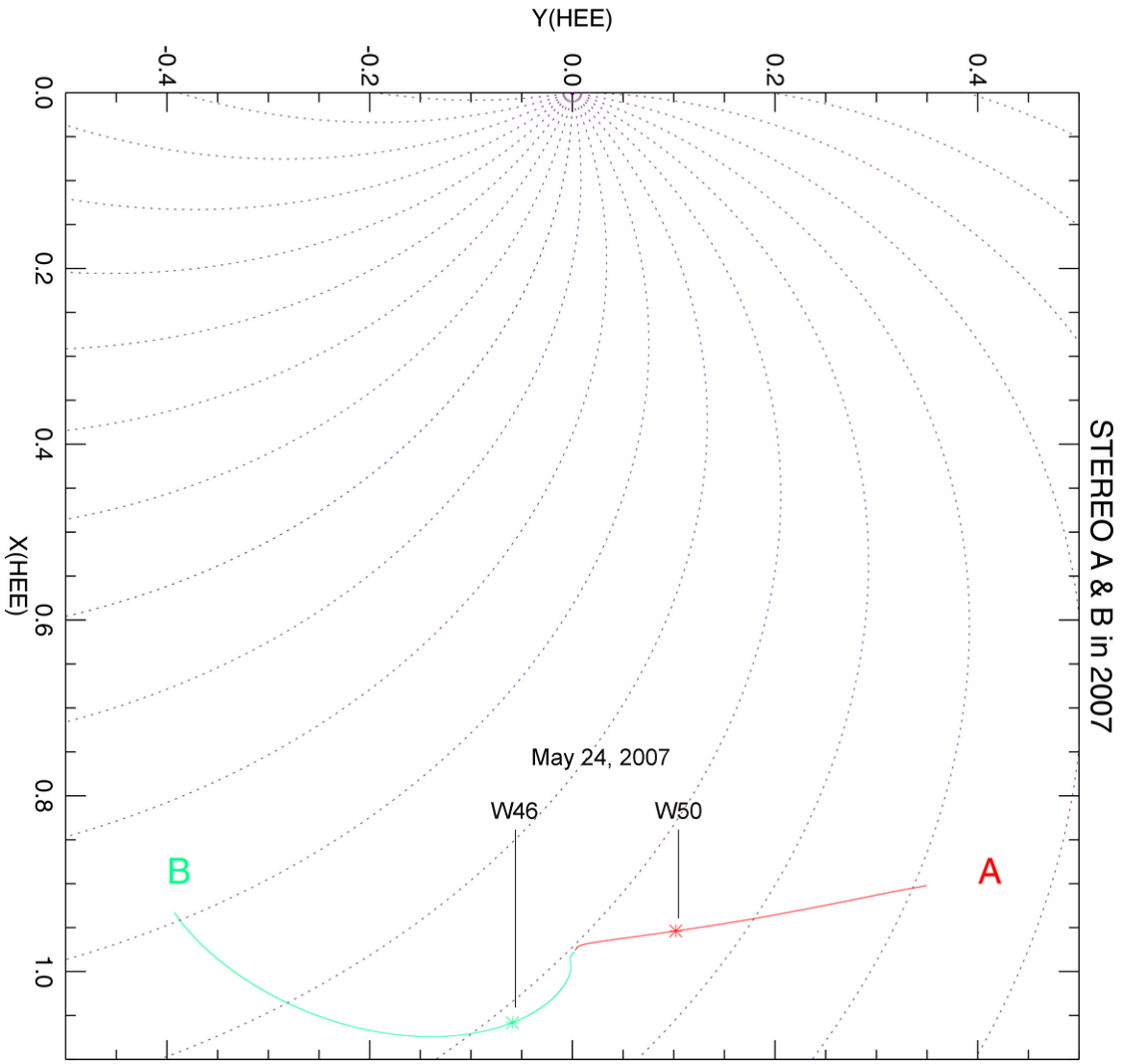

SIT PHA DATA, MASS: All, CR 2054
Energy (MeV/nuc)
1.0
0.1
A
B
65
70
75
80
85
90
Day of 2007
83
1
Number of Events

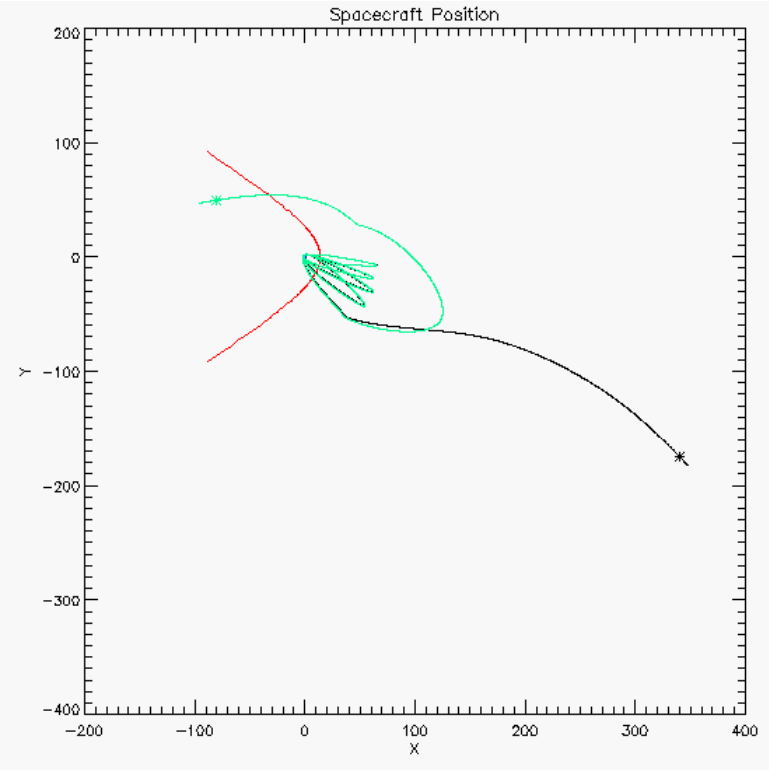

SIT PHA DATA, MASS: All, CR 2056
Energy (MeV/nuc)
1.0
0.1
A
B
120
125
130
135
140
145
Day of 2007
163
1
Number of Events


SIT PHA DATA, MASS: All, CR 2053
Energy (MeV/nuc)
1.0
0.1
A
B
40
45
50
55
60
Day of 2007
66
1
Number of Events


SIT PHA DATA, MASS: All, CR 2055
Energy (MeV/nuc)
1.0
0.1
A
B
95
100
105
110
115
Day of 2007
21
1
Number of Events

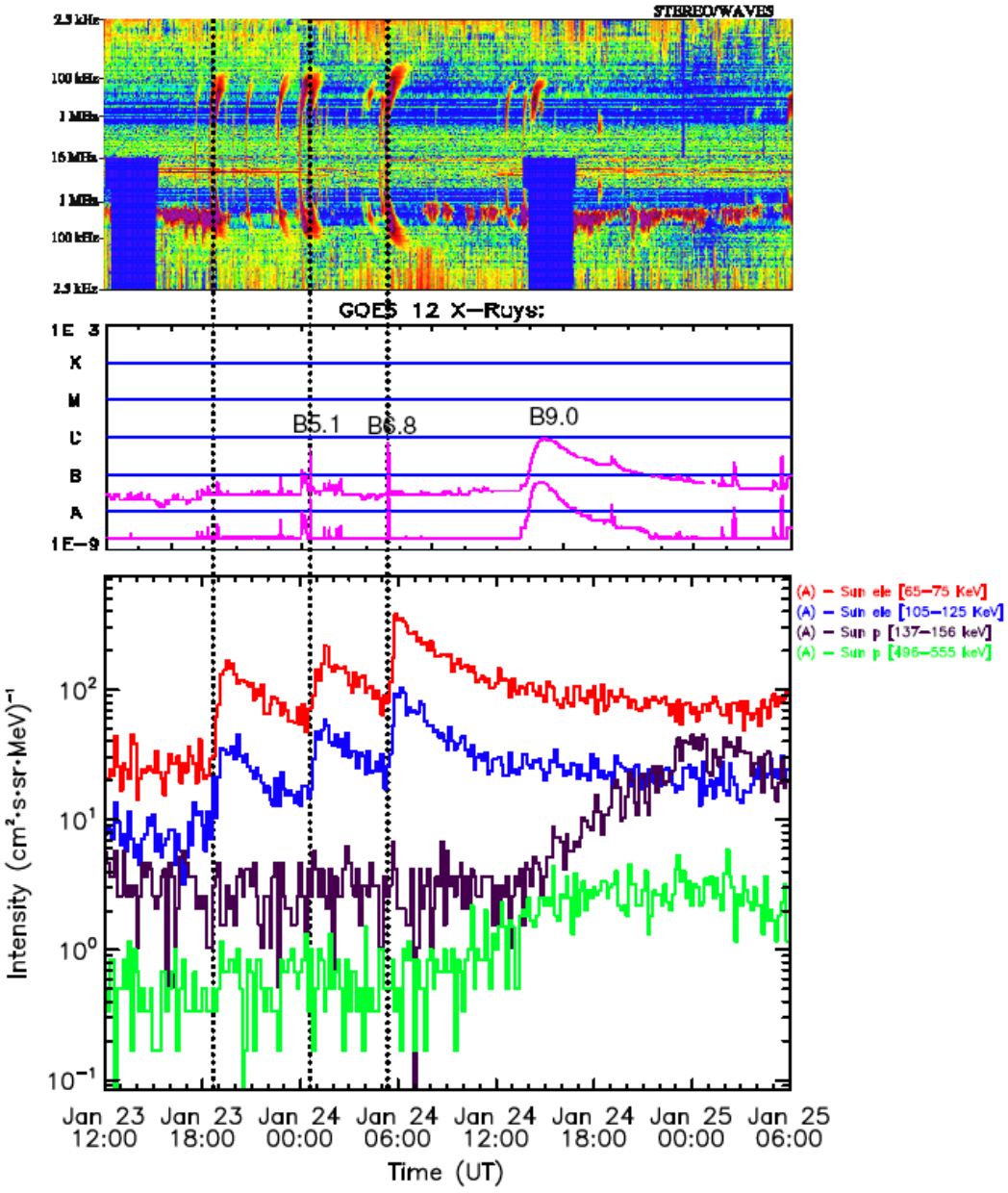

SIT PHA DATA, MASS: All, CR 2057
Energy (MeV/nuc)
1.0
0.1
A
B
145
150
155
160
165
170
Day of 2007
93
1
Number of Events

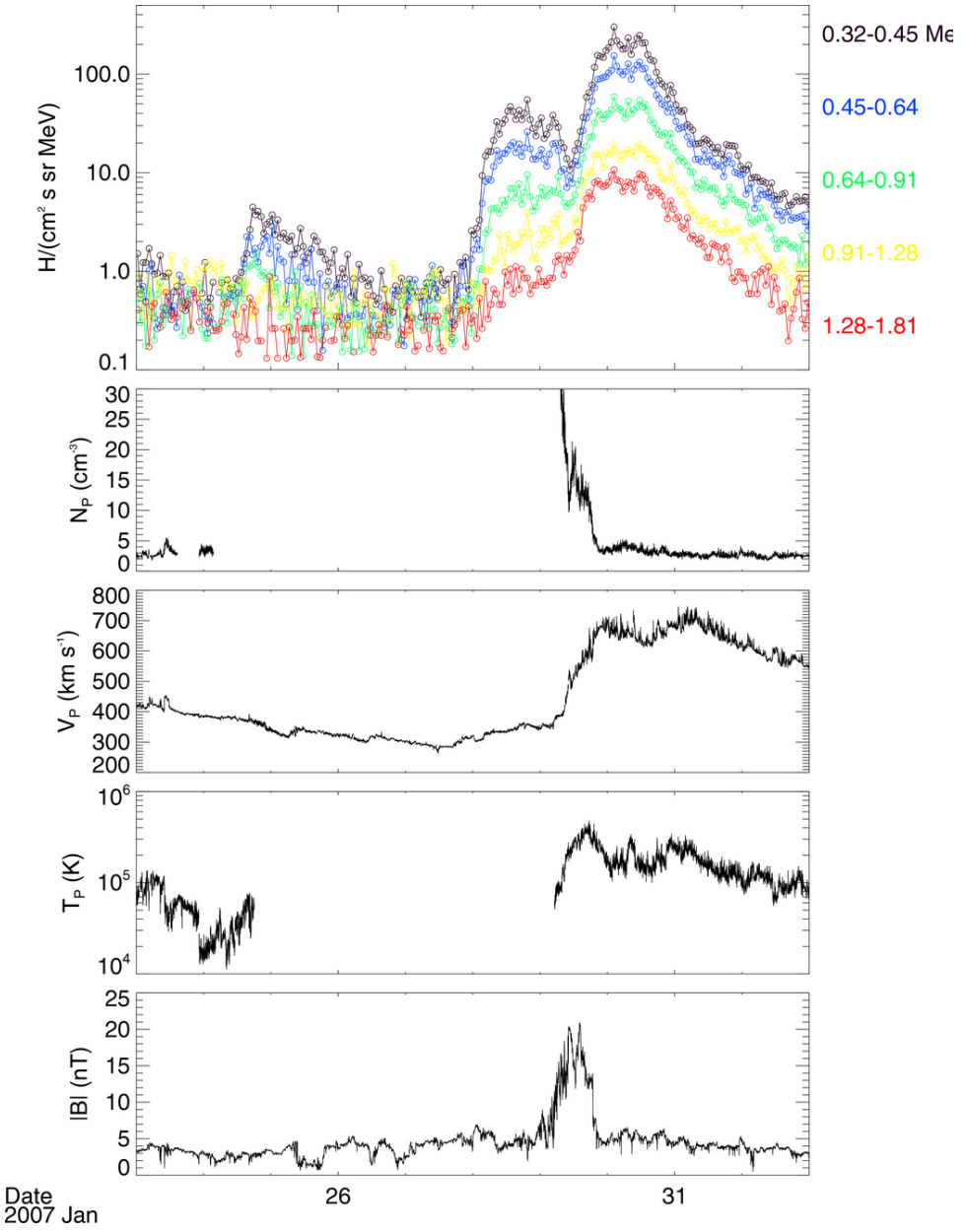

Y(HEE)
-0.4
-0.2
0.0
0.2
0.4
0.0
0.2
0.4
0.6
0.8
1.0
X(HEE)
STEREO A & B in 2007
May 24, 2007
W46
W50
B
A

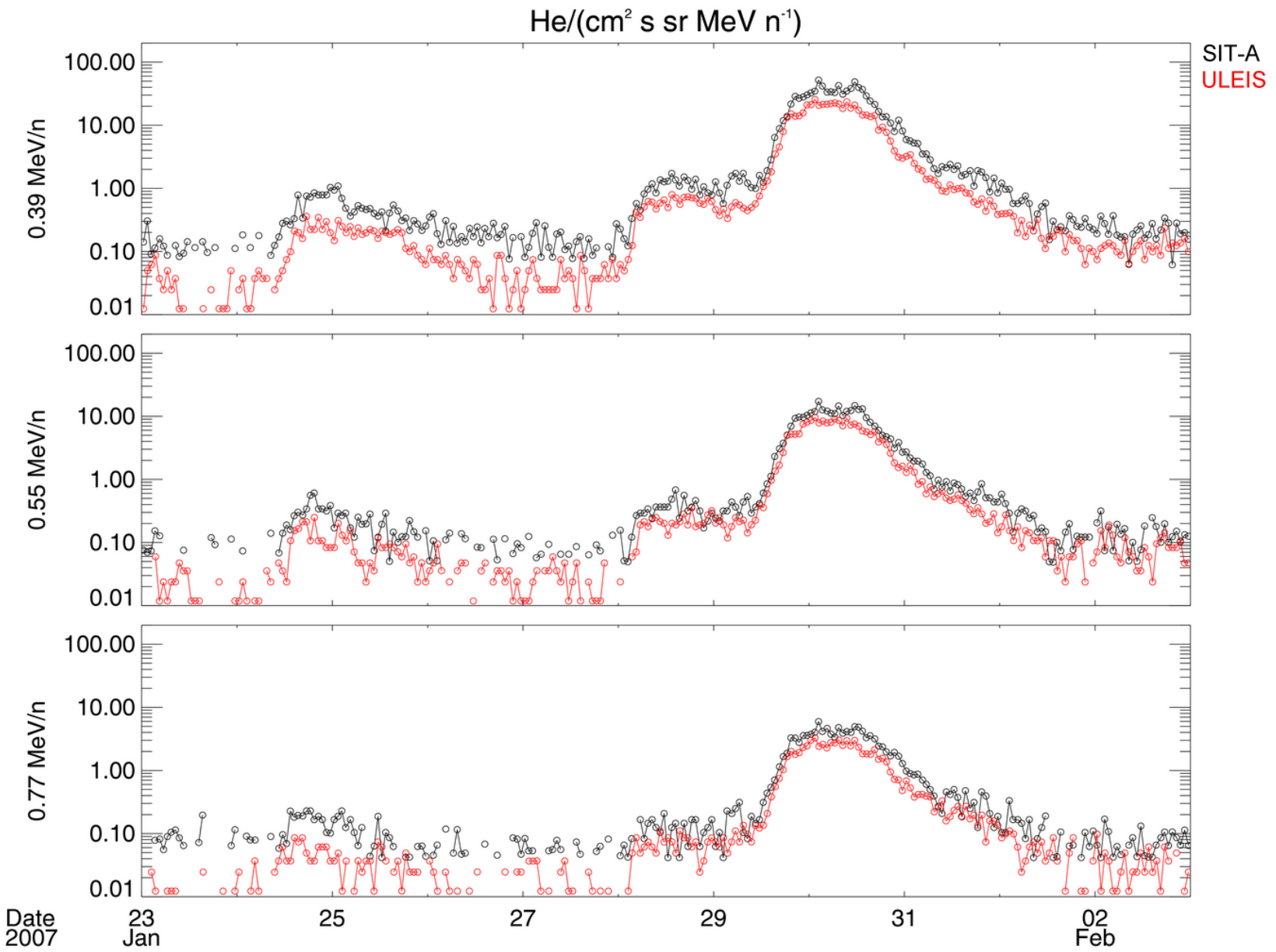

Spacecraft Position
200
100
0
-100
-200
-300
-400
Y
-200
-100
0
100
200
300
400
X

January 2007 events

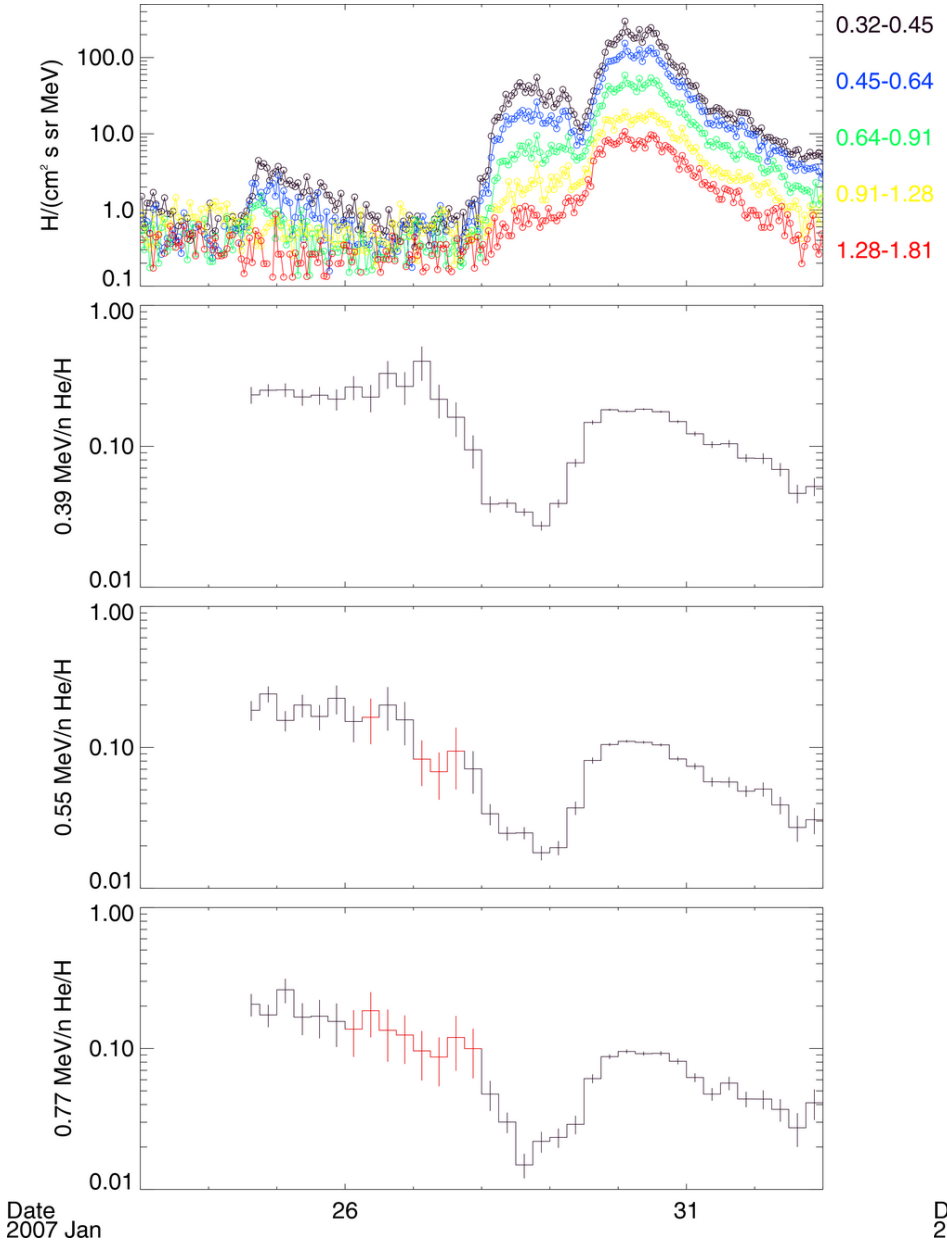
W62 W64 E79



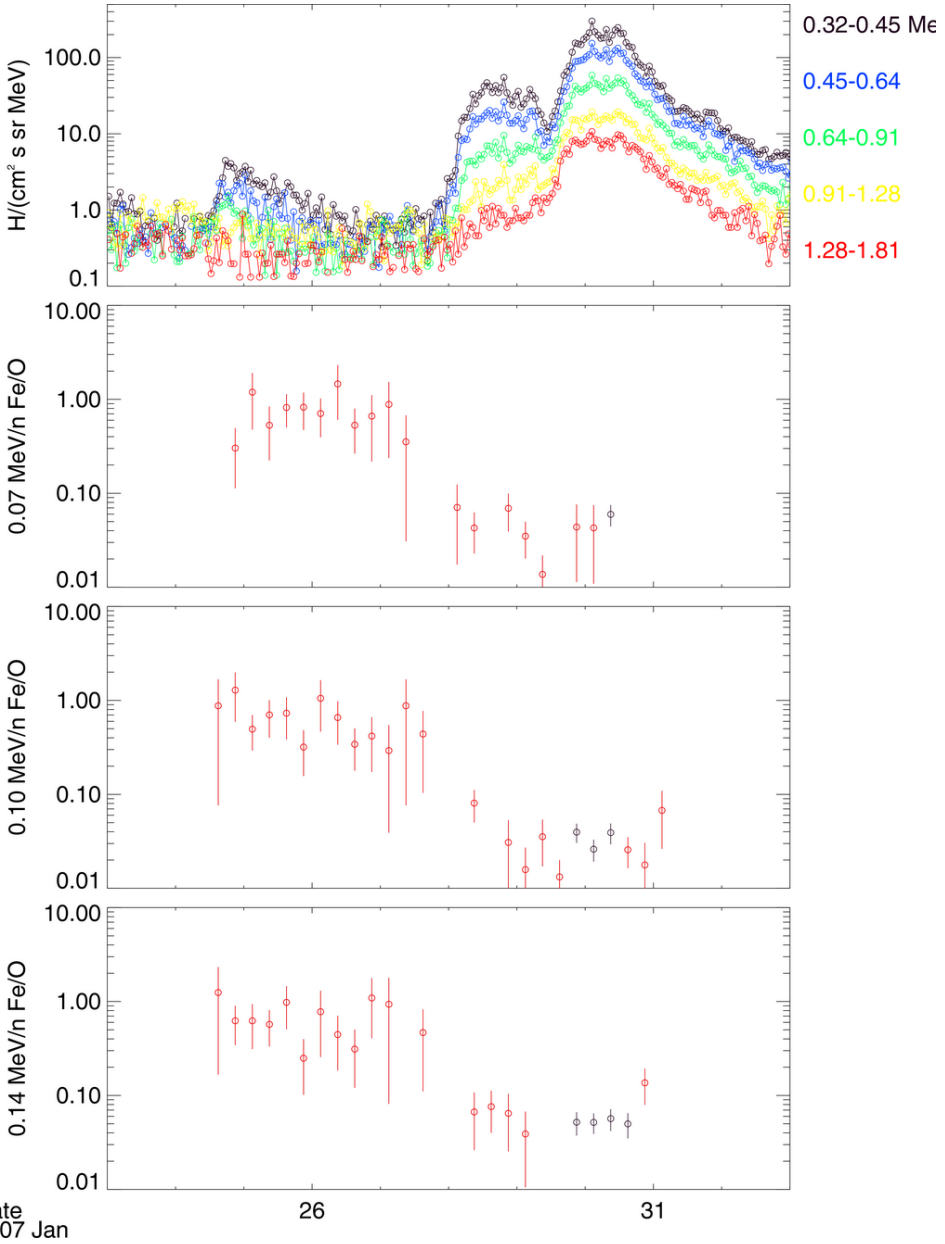



He/(cm² s sr MeV n⁻¹)
SIT-A
ULEIS
0.39 MeV/n
0.55 MeV/n
0.77 MeV/n
100.00
10.00
1.00
0.10
0.01
Date
2007
23
Jan
25
27
29
31
02
Feb

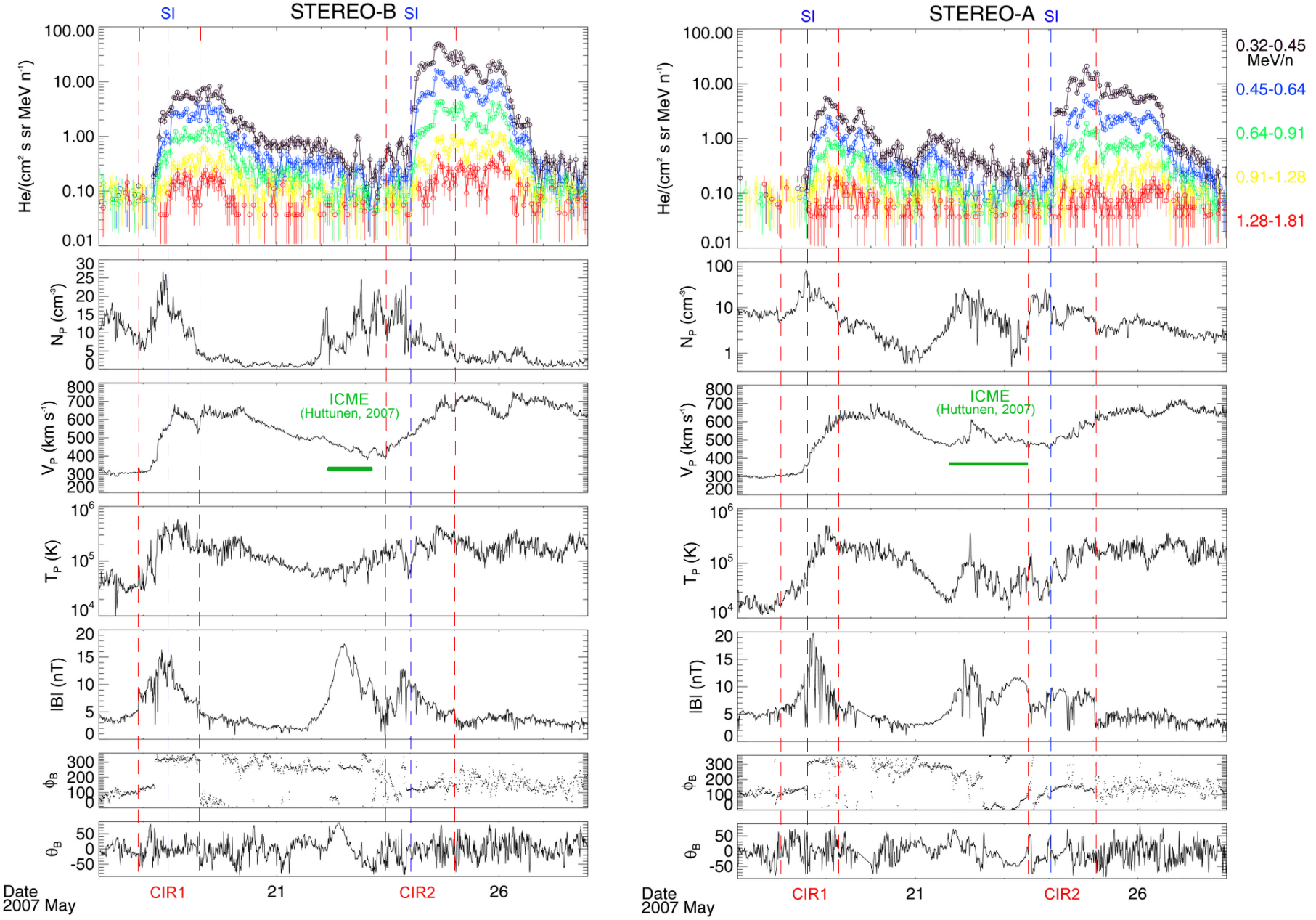
He/H ratio



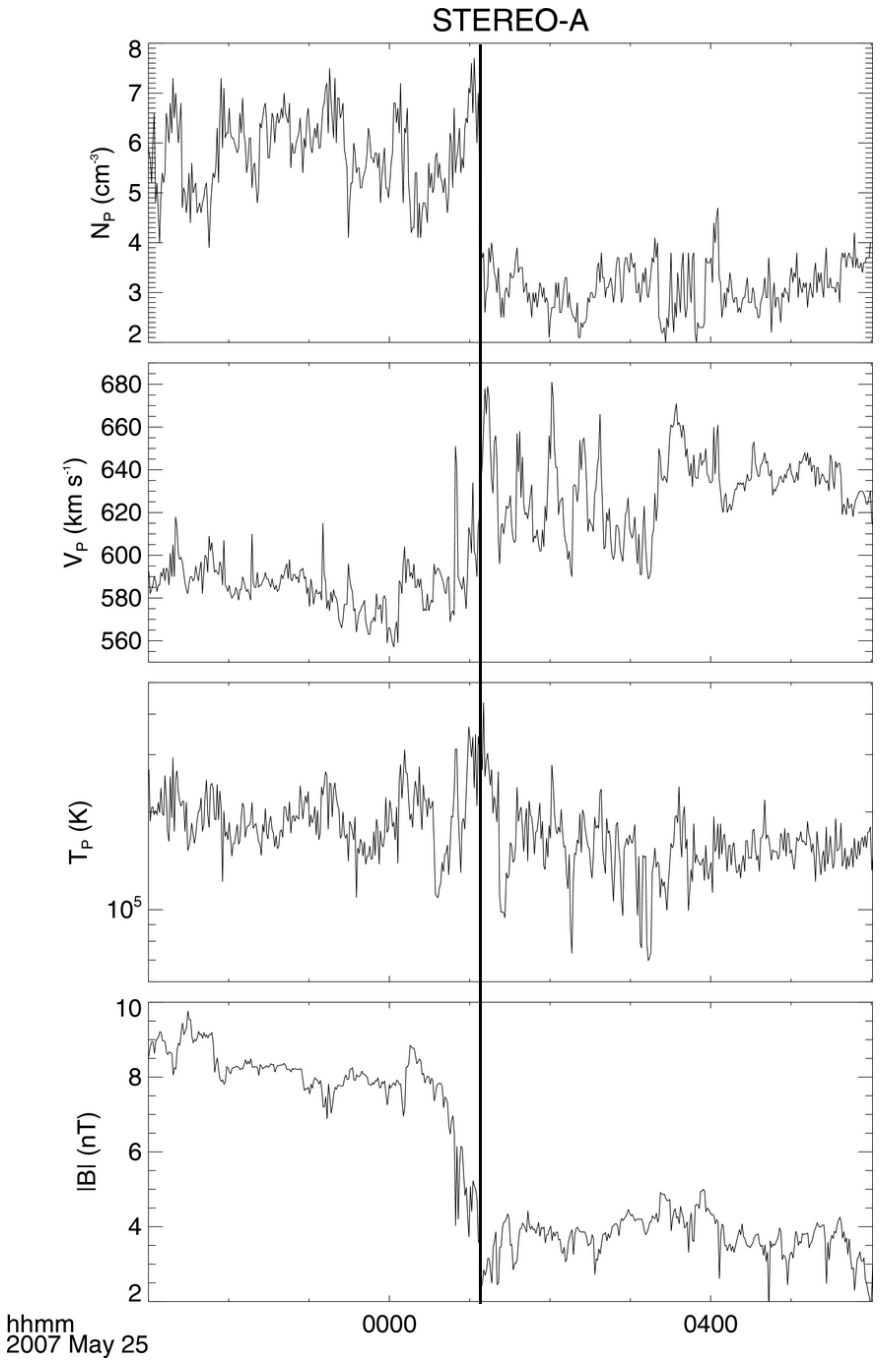
Fe/O ratio

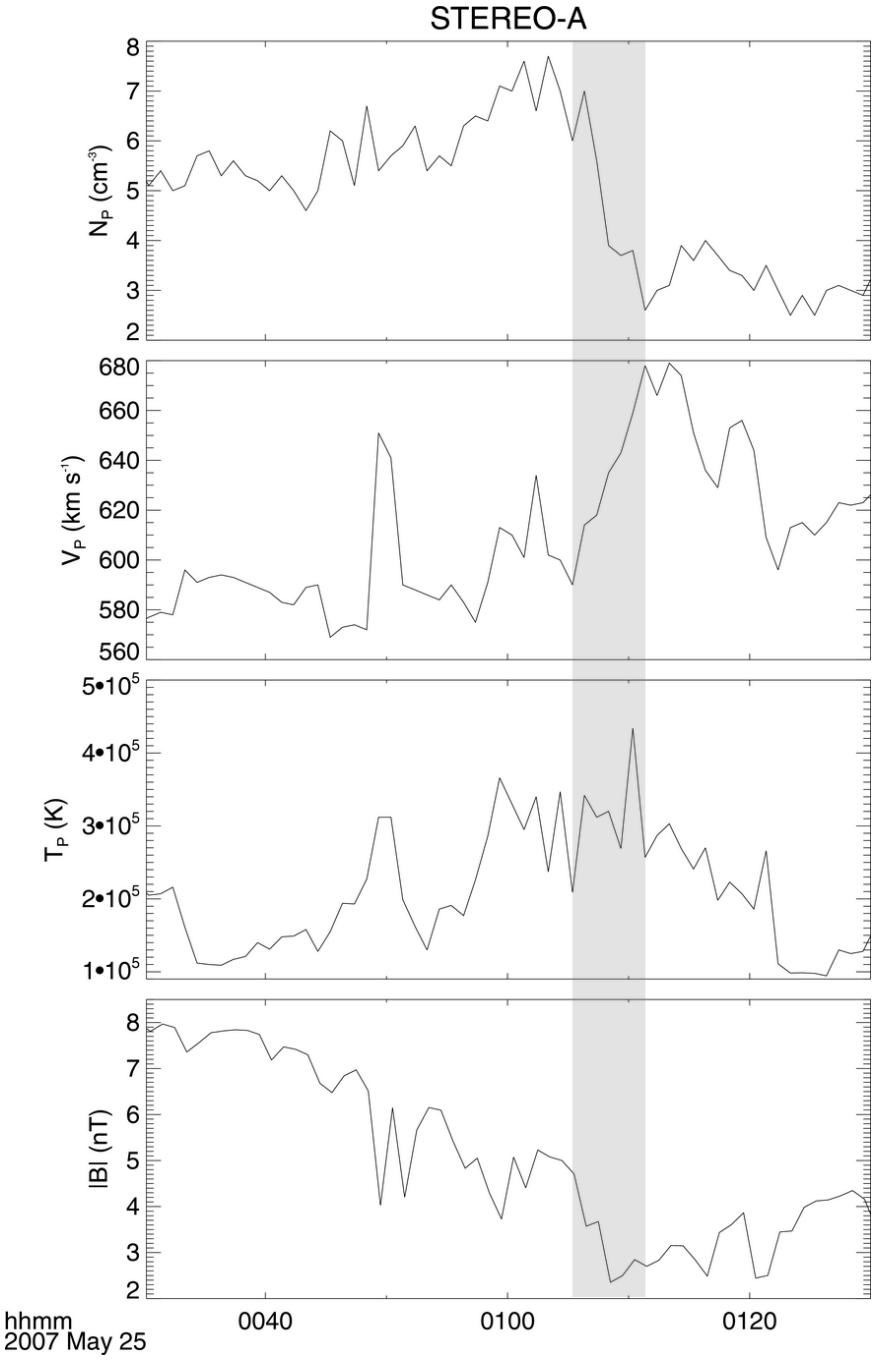


May 18 and 24, 2007 CIR events

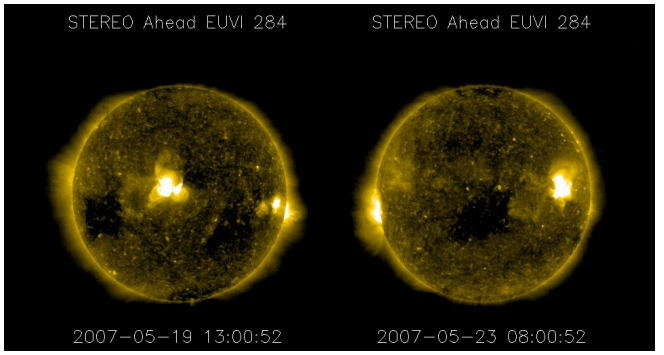


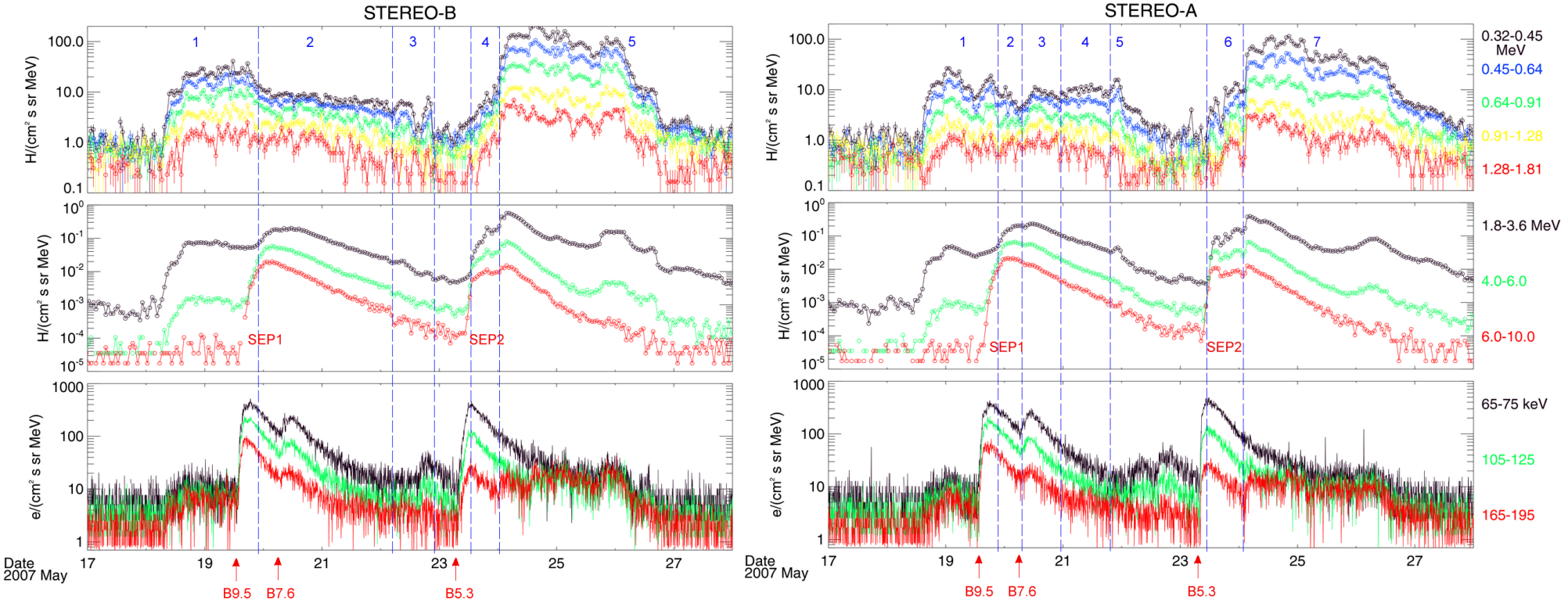
CIR2 reverse shock ?



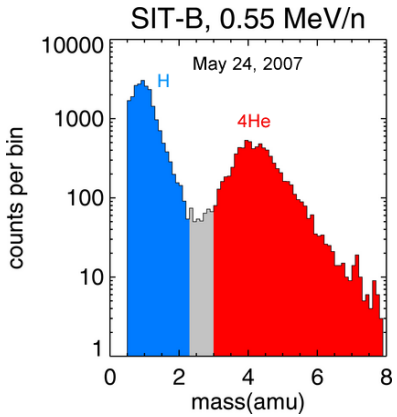


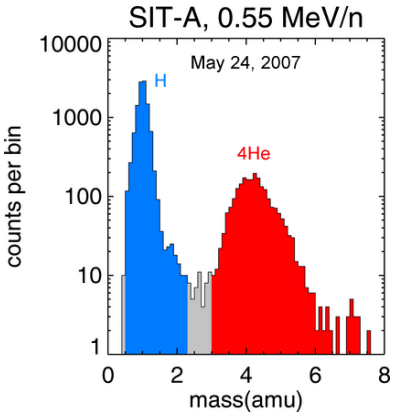
May 2007 two SEP events

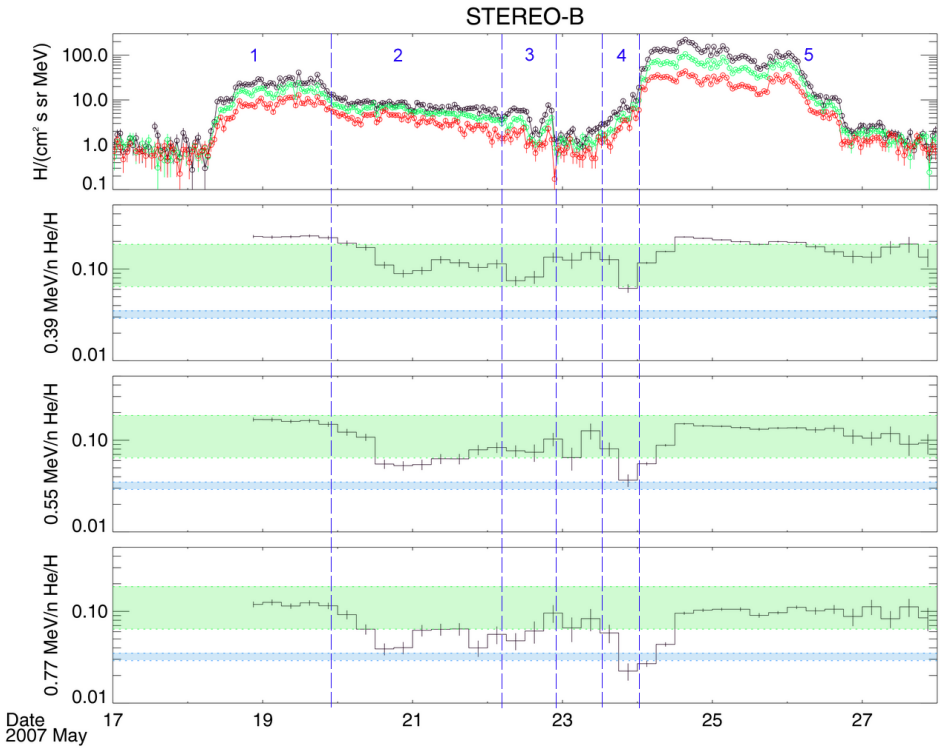


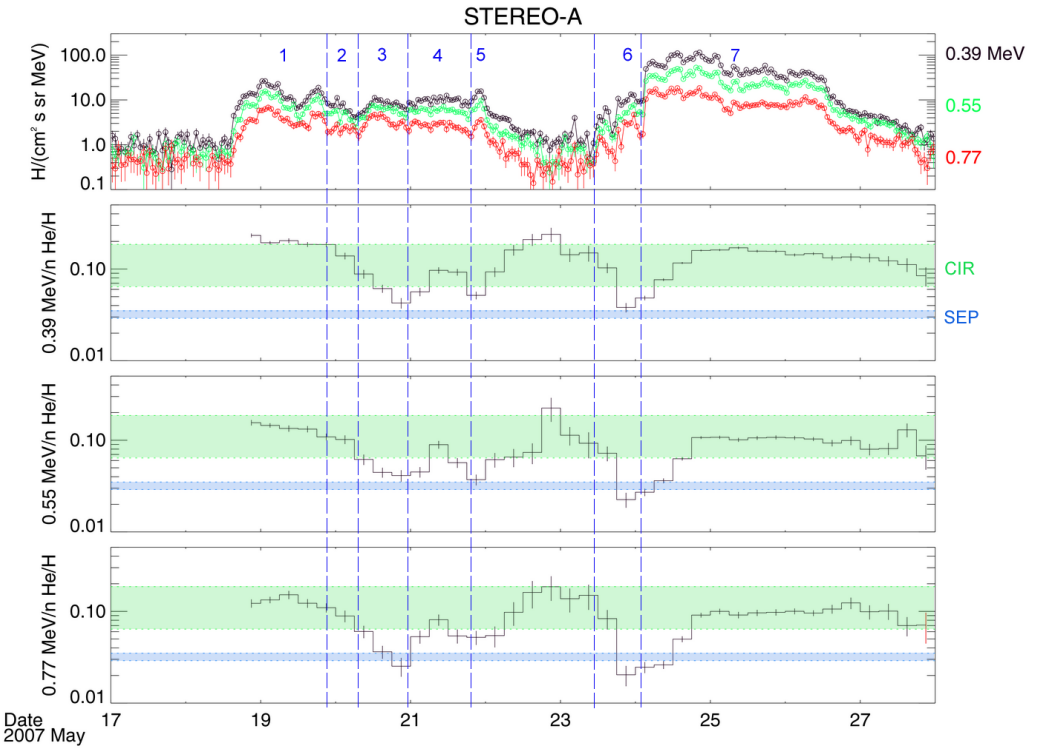


He/H ratio

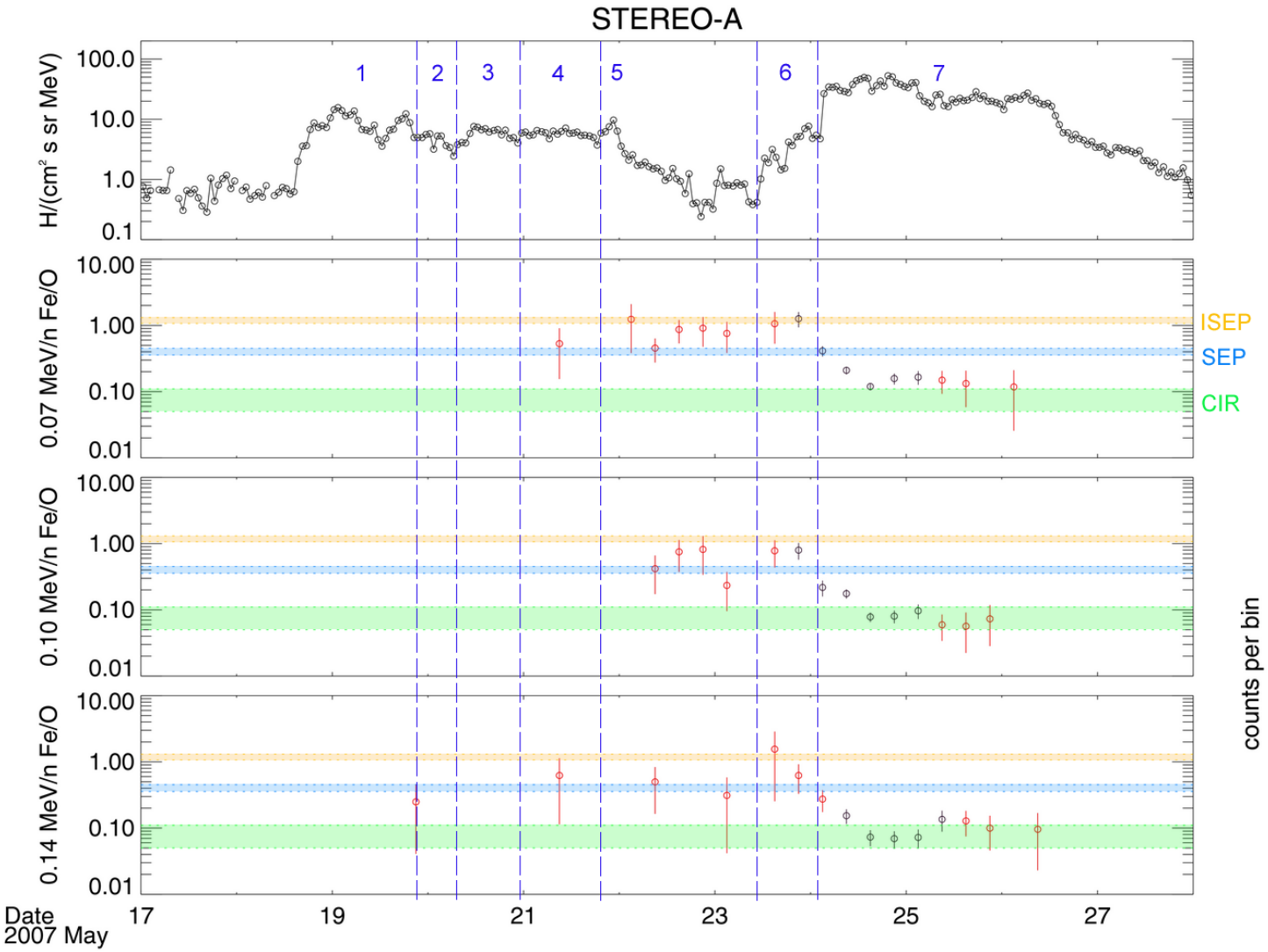

SIT-B, 0.55 MeV/n
May 24, 2007
H
4He
counts per bin
mass(amu)

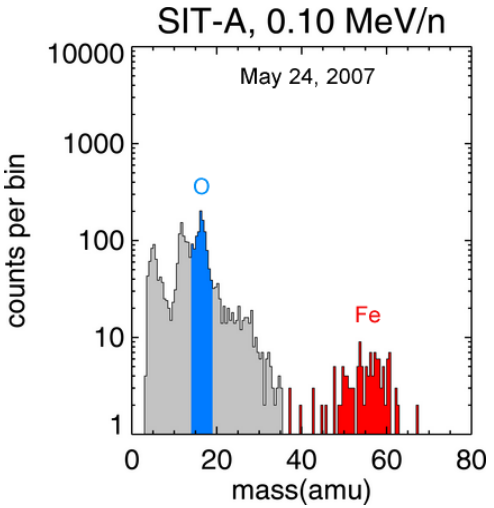

SIT-A, 0.55 MeV/n
May 24, 2007
H
4He
counts per bin
mass(amu)

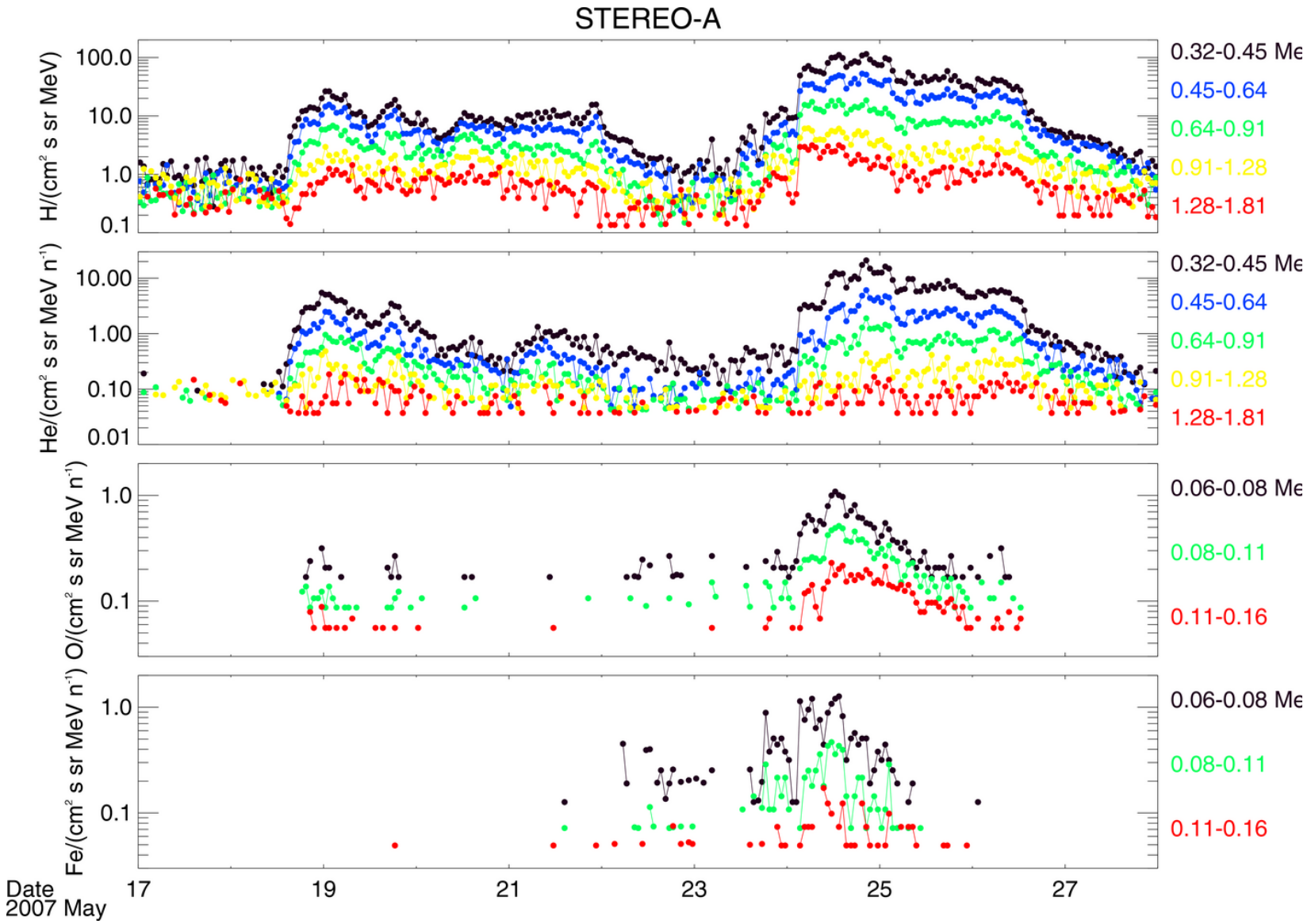

STEREO-B
H/(cm² s sr MeV)
0.39 MeV/n He/H
0.55 MeV/n He/H
0.77 MeV/n He/H
Date
2007 May


STEREO-A
H/(cm² s sr MeV)
0.39 MeV
0.55
0.77
CIR
SEP
0.39 MeV/n He/H
0.55 MeV/n He/H
0.77 MeV/n He/H
Date
2007 May

Fe/O ratio

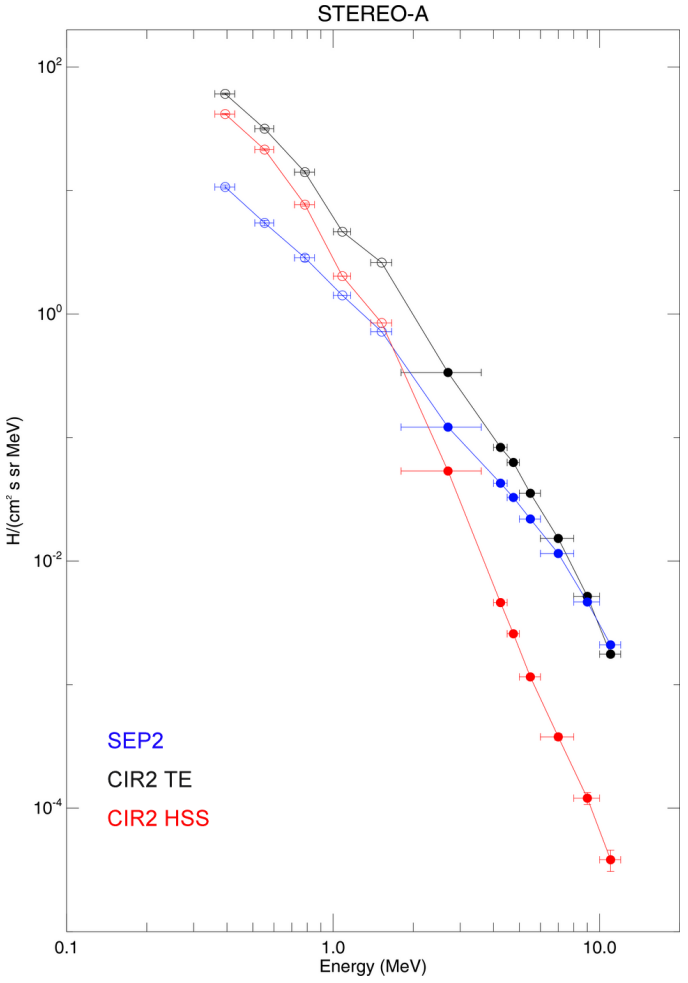

STEREO-A
H/(cm² s sr MeV)
100.0
10.0
1.0
0.1
1
2
3
4
5
6
7
0.07 MeV/n Fe/O
0.10 MeV/n Fe/O
0.14 MeV/n Fe/O
10.00
1.00
0.10
0.01
ISEP
SEP
CIR
Date
2007 May
17
19
21
23
25
27

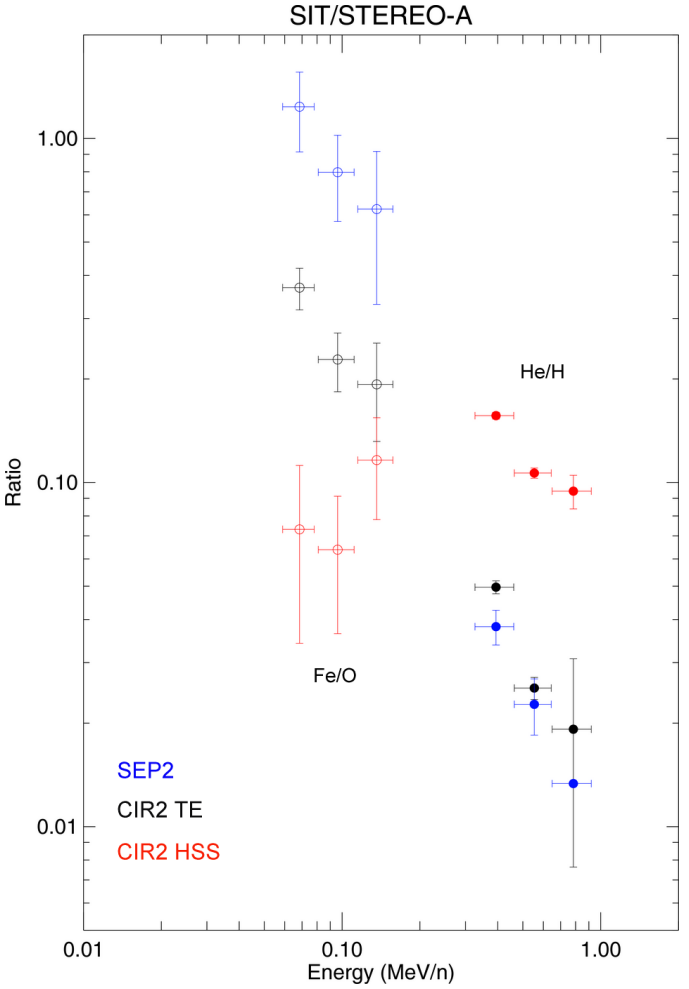

SIT-A, 0.10 MeV/n
May 24, 2007
counts per bin
10000
1000
100
10
1
O
Fe
0
20
40
60
80
mass(amu)

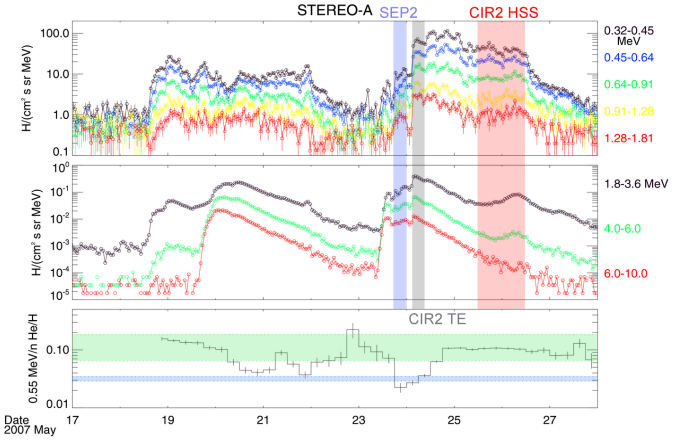

STEREO-A
H/(cm² s sr MeV)
100.0
10.0
1.0
0.1
0.32-0.45 Me
0.45-0.64
0.64-0.91
0.91-1.28
1.28-1.81
He/(cm² s sr MeV n⁻¹)
10.00
1.00
0.10
0.01
0.32-0.45 Me
0.45-0.64
0.64-0.91
0.91-1.28
1.28-1.81
O/(cm² s sr MeV n⁻¹)
1.0
0.1
0.06-0.08 Me
0.08-0.11
0.11-0.16
Fe/(cm² s sr MeV n⁻¹)
1.0
0.1
0.06-0.08 Me
0.08-0.11
0.11-0.16
Date
2007 May
17
19
21
23
25
27

Corotating time delay

Energy spectra







Conclusion

- Fe - enrichment in January 2007 events was connected with weak impulsive SEP event on 24 January; however, following CIR shows Fe abundance consistent with CIR event averaged Fe abundance suggesting no remnants from preceding event were contributing to the CIR.

- Fe – enrichment in May 2007 was related with ICME passage as well as with SEP event on 23 May; no Fe ions were measured during the SEP event on 19 May.

- Fe - enrichment inside CIR (behind stream interface) on May 24 might have been influenced by ICME injection as suggested by difference in energy spectra from preceding SEP event

Acknowledgements

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