Partial response to reviewer #1

We thank the reviewer for his/her detailed review and comments. For the sake of an interactive discussion to clarify the N-S asymmetry problem, this partial response is dedicated to **Comment A**. A full response to all the comments and revision to the manuscript are preparing and will be presented later.

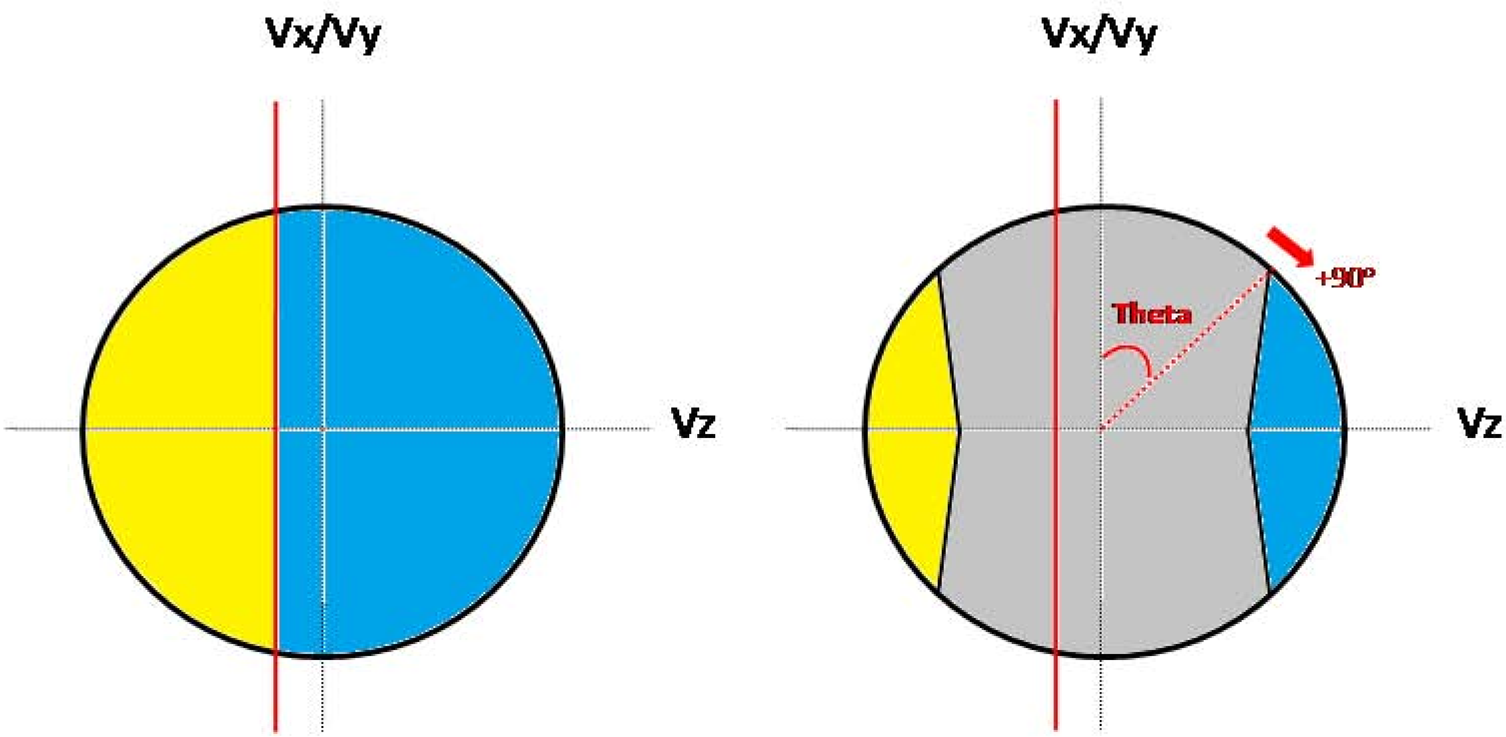
Comment (A) The theta distribution of ion fluxes (that is shown for quite broad energy range) can demonstrate a simple anisotropy induced by the current sheet motion (i.e., anisotropy related to change of the direction of plasma flow along the current sheet normal direction), and does not relate to a fine structure of a nonadiabatic ion velocity distribution. Much more work is needed to prove that Authors indeed observe some nonadiabatic ions and to properly remove the effect of flapping motion from observed ion distributions. To make a final conclusion about presence of nonadiabatic ions, Authors have to show ion velocity distributions in the current sheet reference frame and these distributions should be similar to model predictions for nonadiabatic ions (see, e.g., ion distrobutions in Burkhart et al. 1992 doi:10.1029/92JA00495 or Sitnov et al. 2004 doi:10.1029/2003JA010123).

Response: It seems that the explanation of the asymmetrical theta distribution by the reviewer can be shown as **Schematic 1A**, if we didn't misunderstand the reviewer's statement. In that case, original symmetrical distributions become asymmetrical between the left and right parts due to a reference frame shift (even small). The asymmetry will be more prominent in the smaller velocity and/or theta domain. However, the observational theta distribution is shown as **Schematic 1B** (see also **Fig.2** and **Fig.3** below). In this situation, symmetrical distributions in the larger velocity and theta domain (the yellow and blue parts) will maintain the original distributions, even though there is a rather small reference frame shift (<50km/s). The population in the smaller velocity and/or theta domain (gray part) is excluded automatically in the comparison of the symmetry between the theta distributions concentrated on $+90^0$ and -90^0. A slight distribution difference between the yellow and blue parts due to the frame shift is only in theory and is out of the instrument resolution.

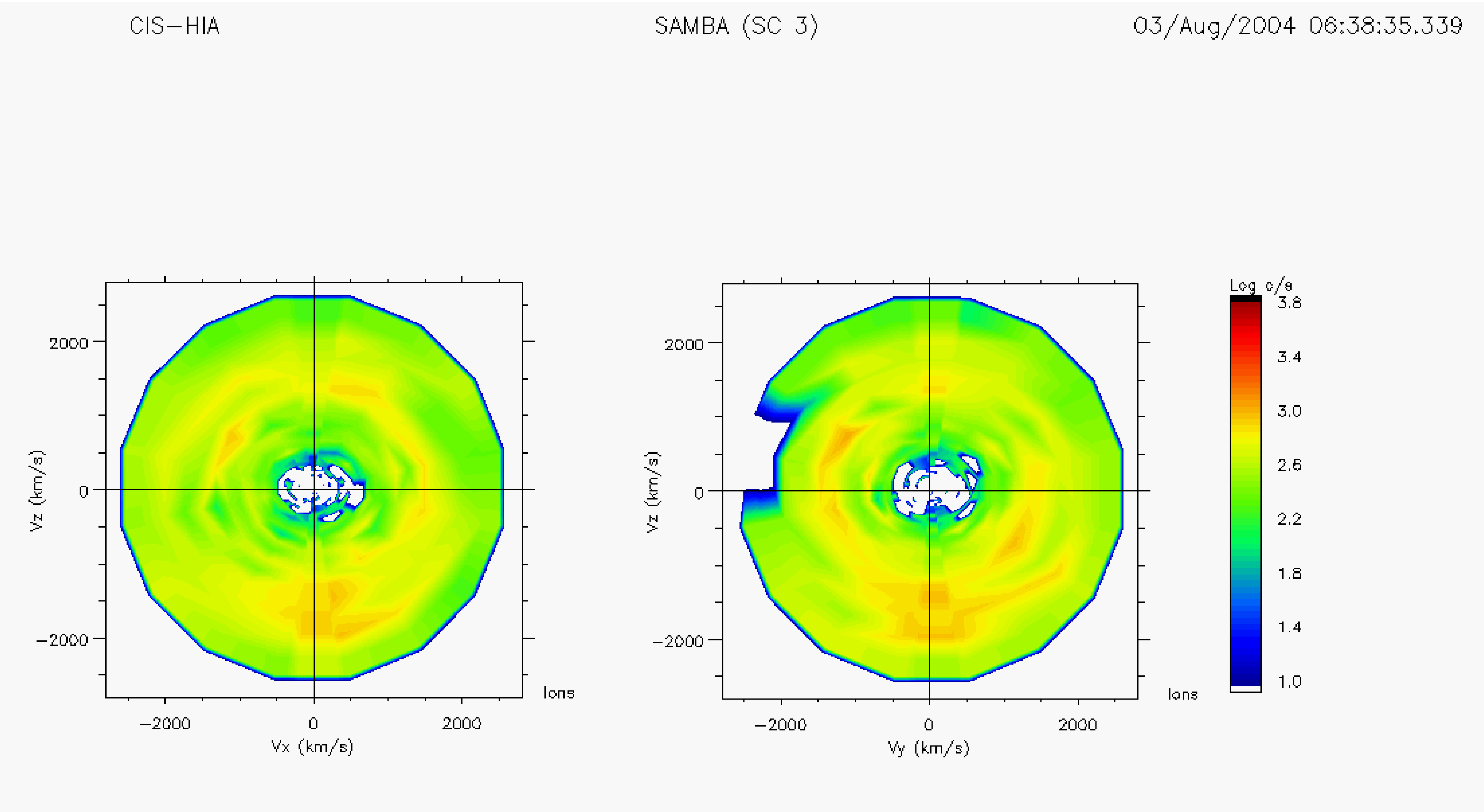
Fig.2 shows the ion distributions in the sheet bulk motion frame at the first sheet center crossing in the first event (03/08/2004). It can be seen that there is a distribution asymmetry between the top and bottom of the V_z-axis, which correspond to the blue and yellow part in **Schematic 1B** respectively. The asymmetric fluxes are $\sim 8\times10^4$ vs. $\sim 10^5$ count/spin, as mentioned in the manuscript. As we clarify above and also the frame shift has already been taken into account, this asymmetry seems not to be caused by the current sheet bulk motion.

To verify the asymmetry signature more clearly, **Fig.3** shows some theta-phi angular distributions in a single energy level (the x-axis is the phi angle from -180^0 to +180^0). The theta distribution asymmetries between +90^0 and -90^0 can be found in two higher energy levels, as shown in the two panels on the top. As a comparison, no asymmetry is displayed in lower energy levels, as shown in the two panels on the bottom. If it is interpreted by a frame shift according to the reviewer's explanation, the distributions in lower energy levels should also be asymmetrical. From the view of individual particles for these approximate monoenergy populations, the particle movement direction in the z-direction (~1500-2000km/s), both parallel and antiparallel, cannot be changed by a too small frame shift (<50km/s).

According to the reviewer's suggestion, we check some ion nonadiabatic signatures in the ion distribution in higher energy range (in the sheet bulk motion frame). An asymmetric profile of the V_x-V_y distribution (18-32keV) is shown in **Fig.4**, which seems to be one of the ion nonadiabatic scattering features and similar to the fig.12a in Burkhart et al. 1992 (for larger adiabaticity parameter <1). Of course, it is a preliminary result on the ion non-adiabaticity. Still, the observational evidences reveal the existence of the N-S symmetrical populations, if the reviewer agrees with this point, which is a direct consequence of nonadiabatic ions interacting with the current sheet. A complete identification of the ion nonadiabatic behaviors may be left to further investigations.



A B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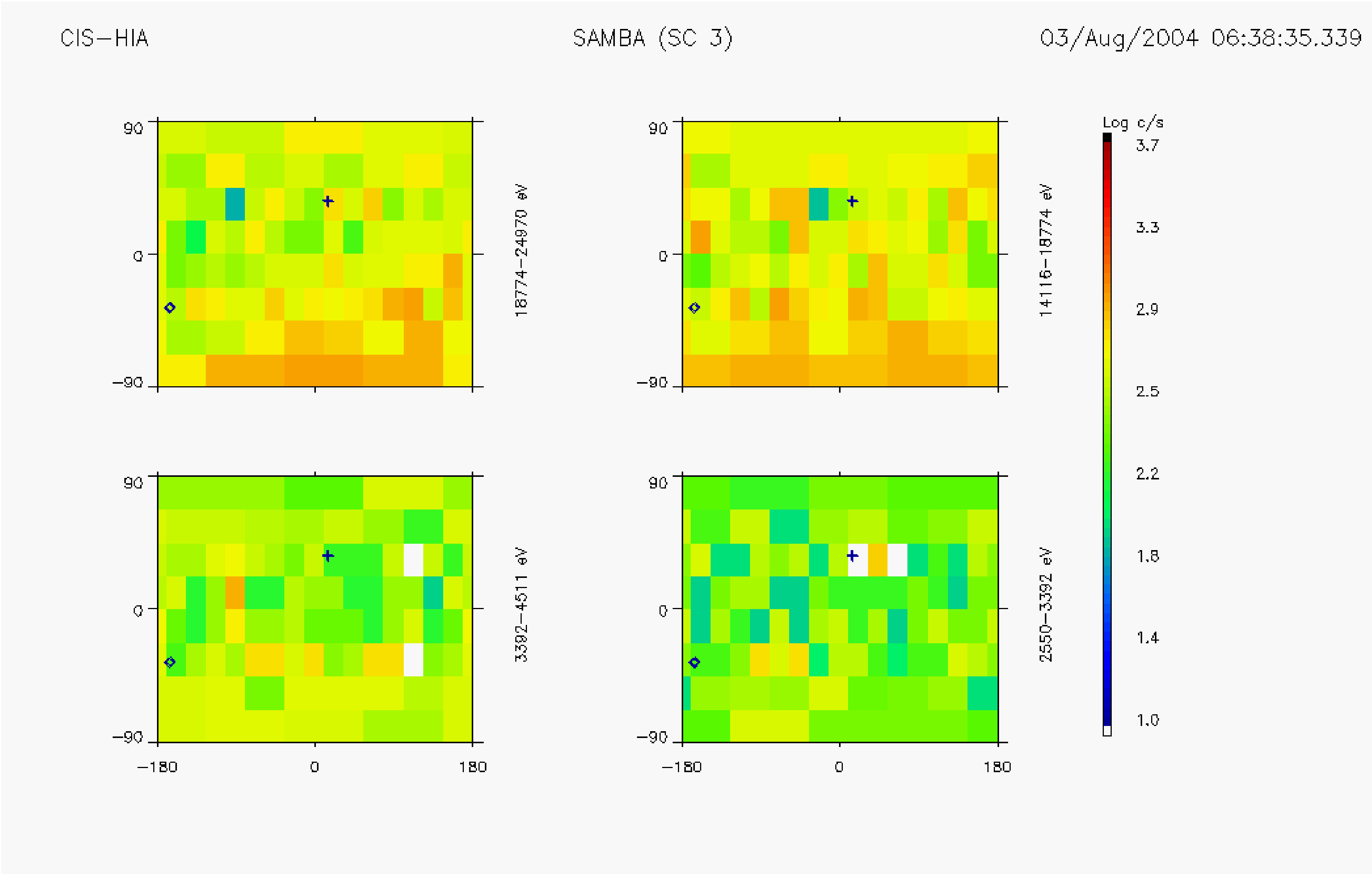
03/Aug/2004 06:38:35.339
Vz (km/s)
Vx (km/s)
Vy (km/s)
2000
0
−2000
Ions
Log c/s
3.8
3.4
3.0
2.6
2.2
1.8
1.4
1.0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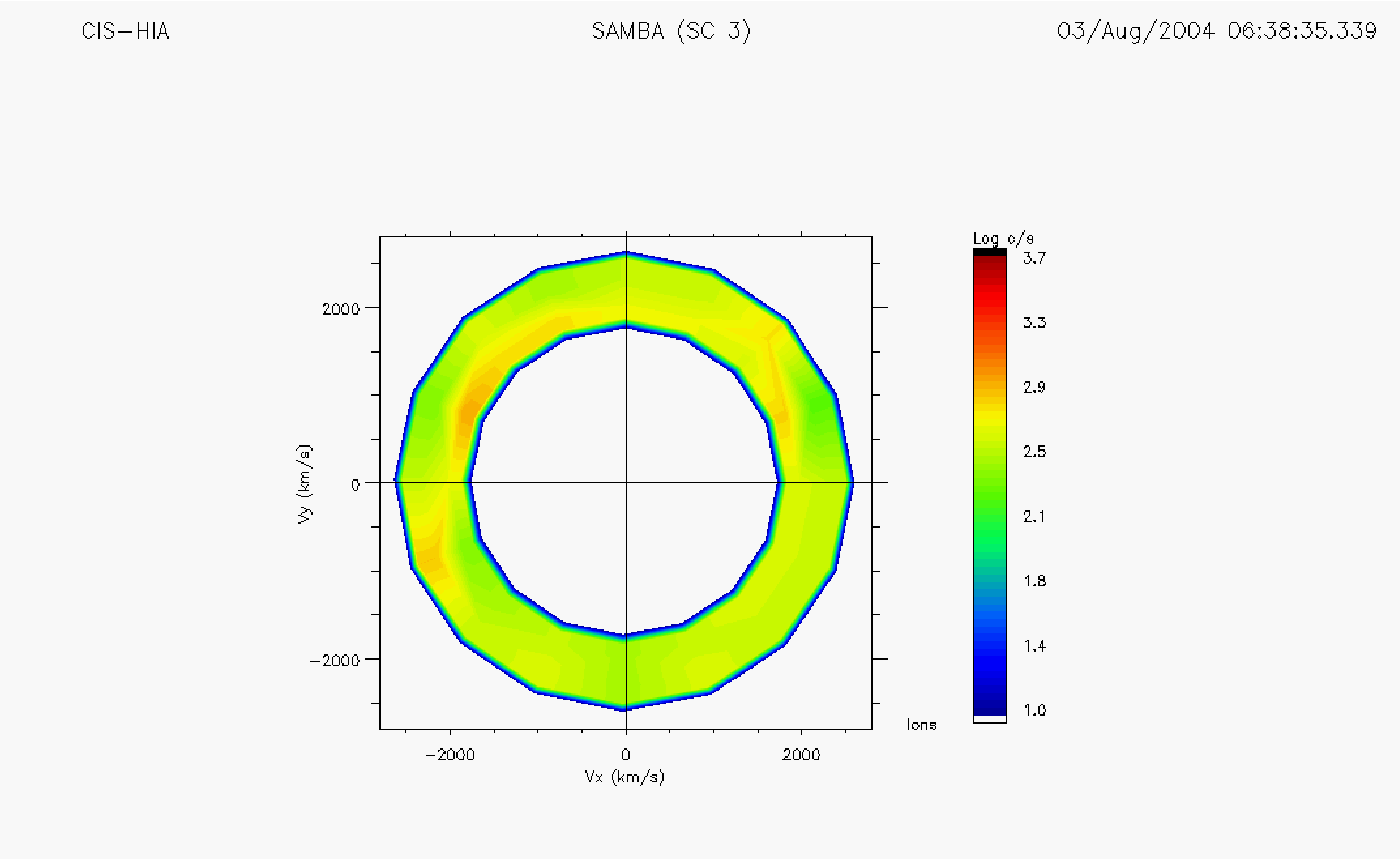
18774−24970 eV
14116−18774 eV
3392−4511 eV
2550−3392 eV
90
0
−90
−180
0
180
Log c/s
3.7
3.3
2.9
2.5
2.2
1.8
1.4
1.0



CIS−HIA
SAMBA (SC 3)
03/Aug/2004 06:38:35.339
Vy (km/s)
2000
0
−2000
Vx (km/s)
−2000
0
2000
Ions
Log c/s
3.7
3.3
2.9
2.5
2.1
1.8
1.4
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