A rotating molecular jet in Orion: Magneto-centrifugal wind acceleration in action?

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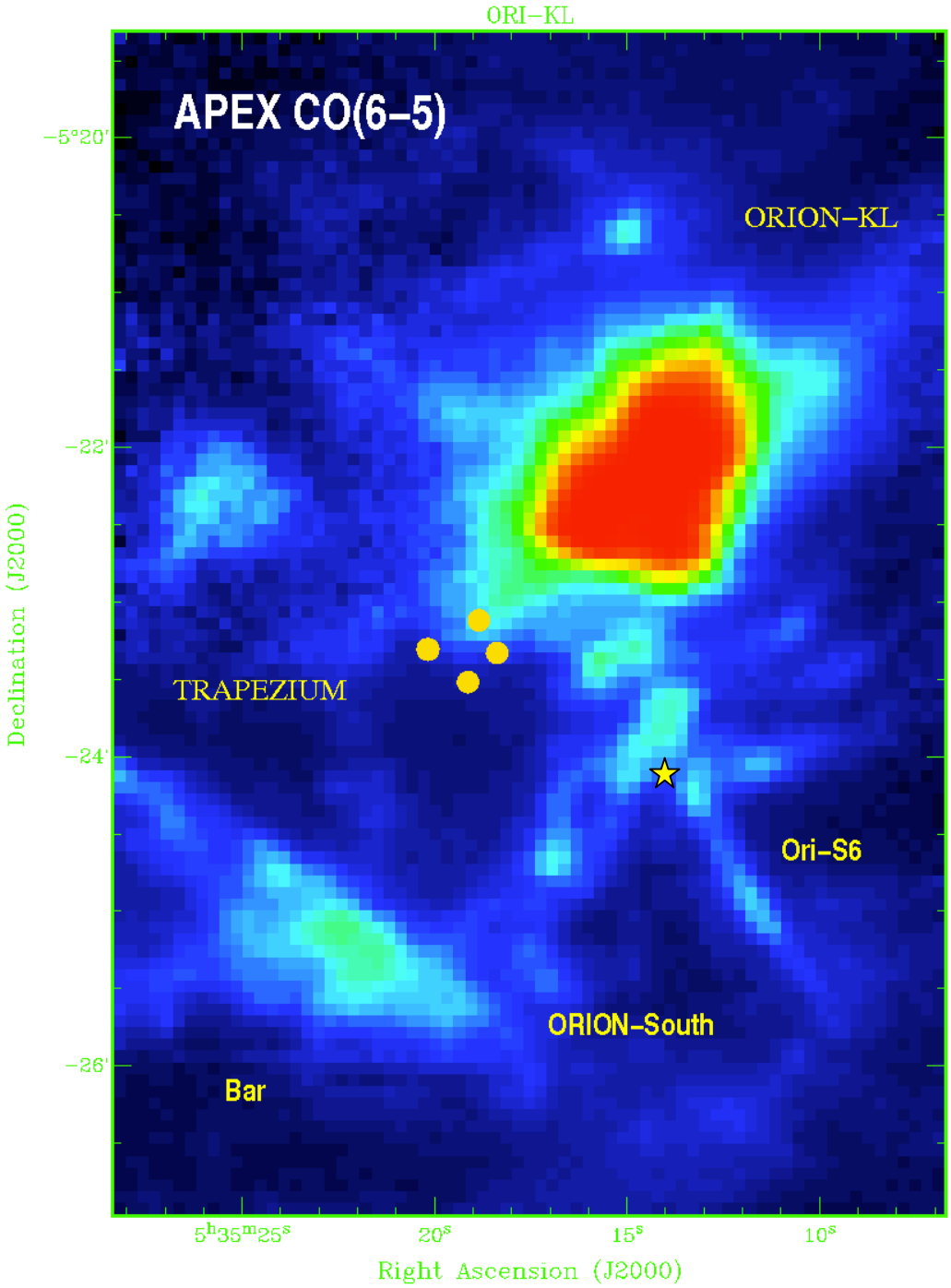
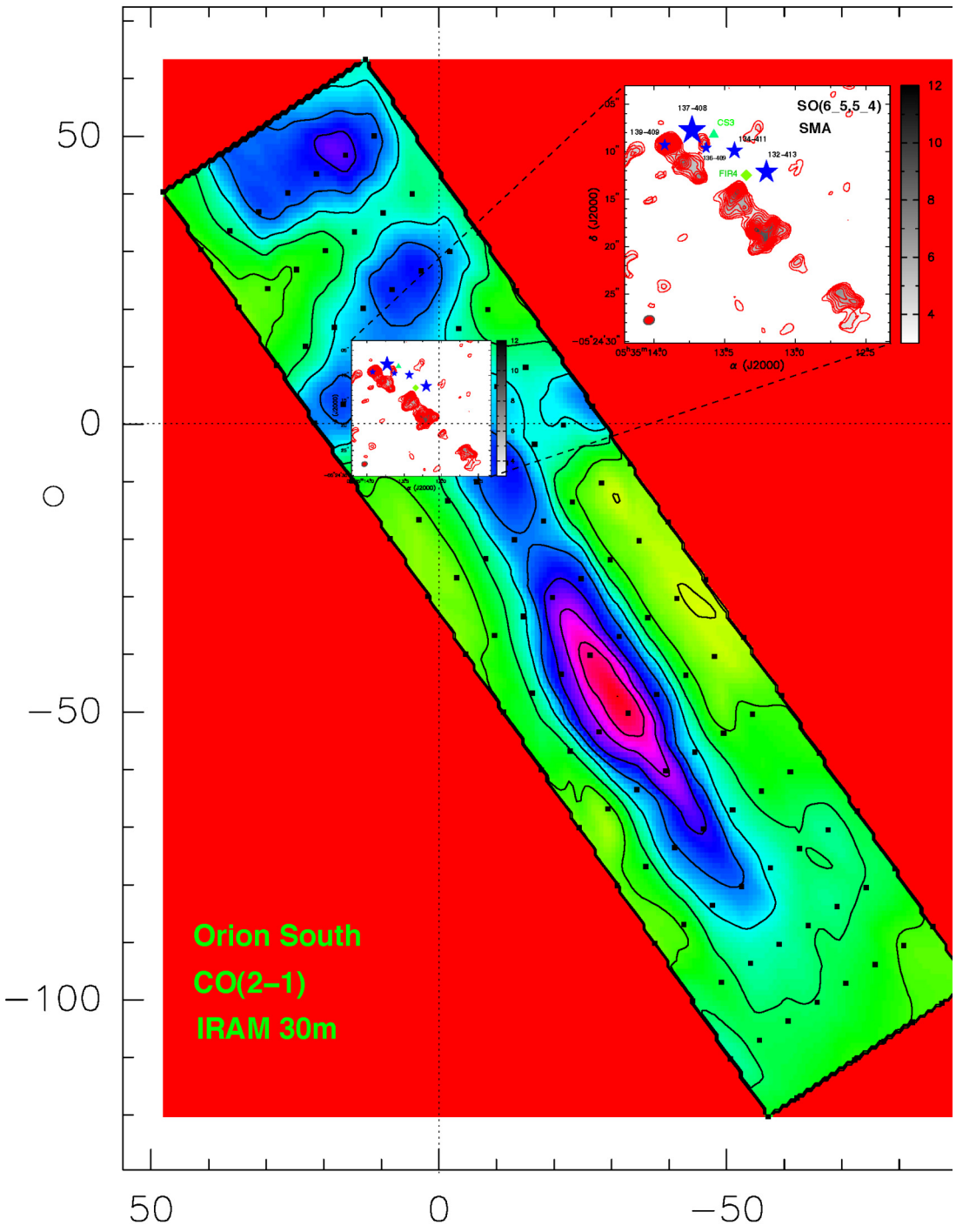
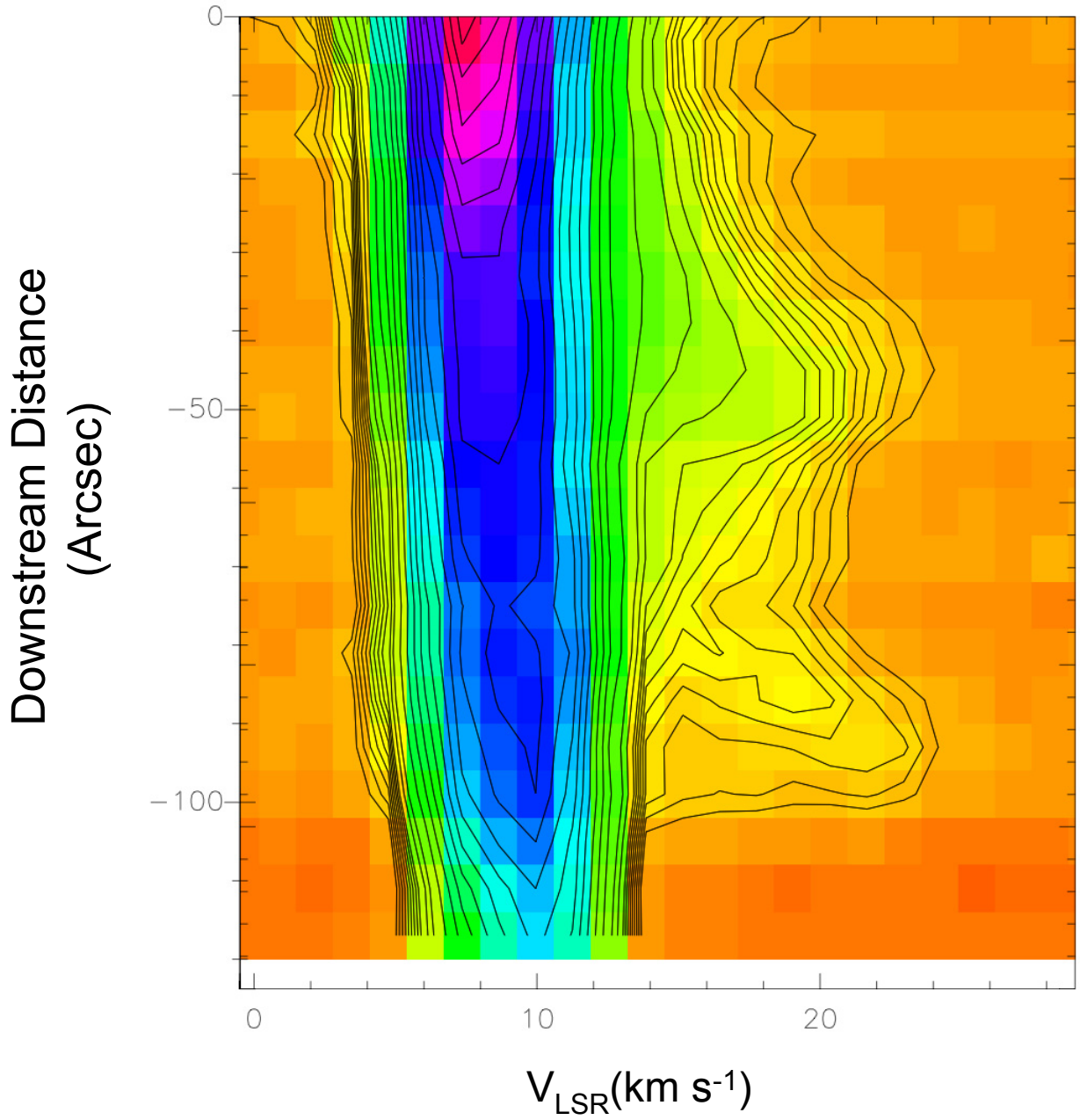
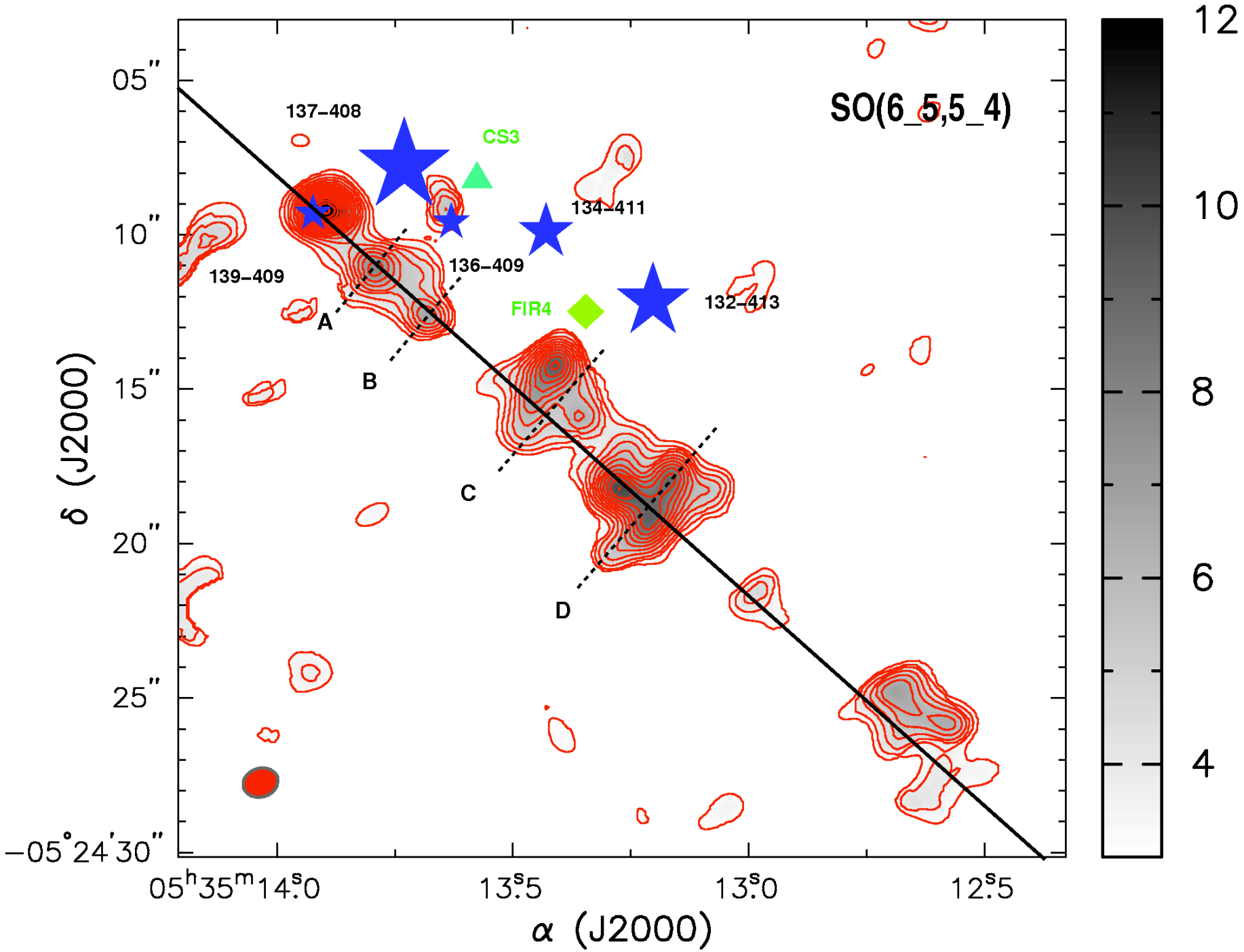
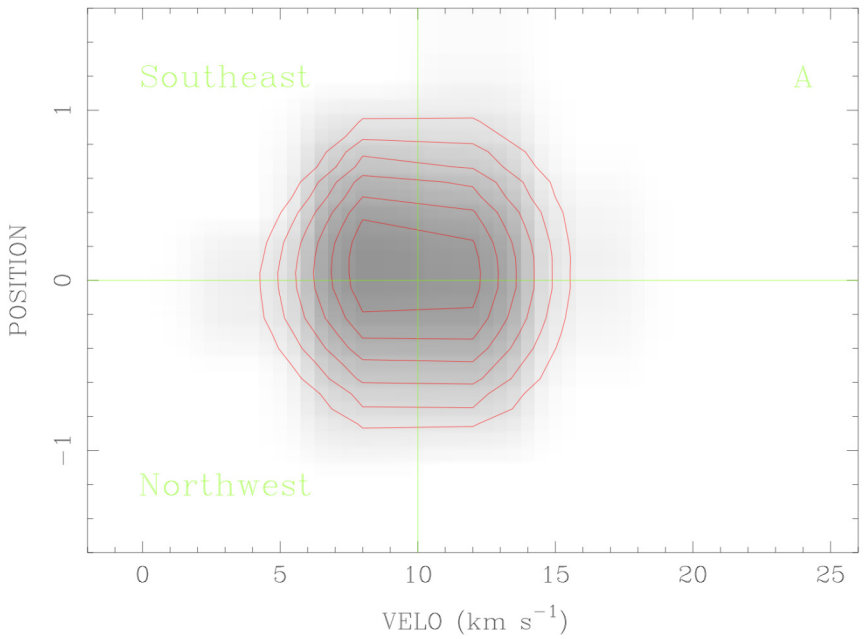

ORI−KL
APEX CO(6−5)
−5°20′
−22′
−24′
−26′
ORION−KL
TRAPEZIUM
Ori−S6
ORION−South
Bar
Declination (J2000)
5h35m25s
20s
15s
10s
Right Ascension (J2000)

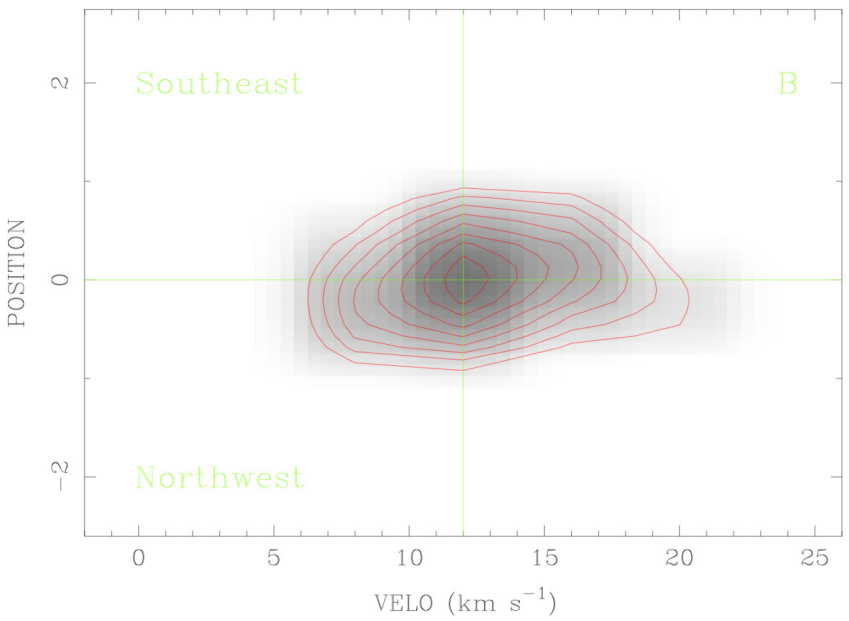
Ori-S6

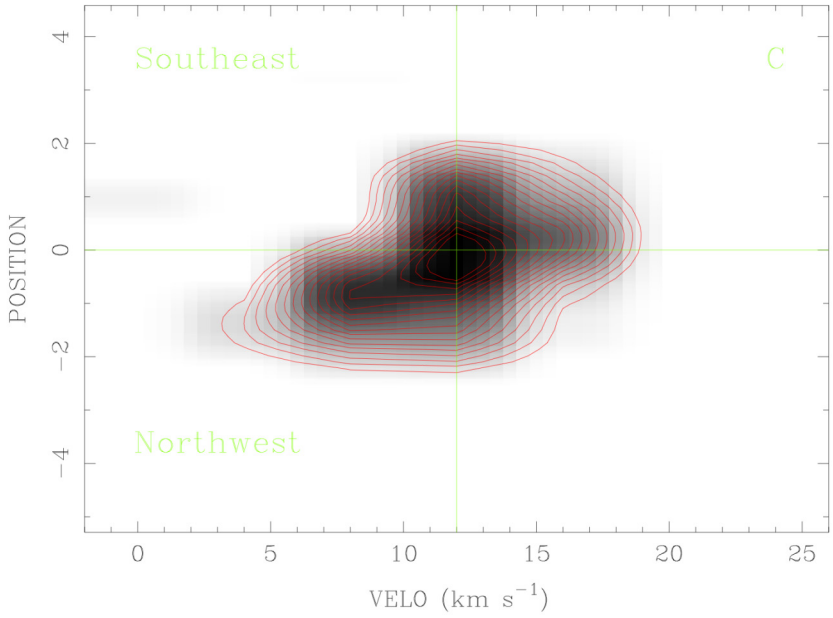

50
0
−50
−100
50
0
−50
Orion South
CO(2–1)
IRAM 30m
SO(6_5,5_4)
SMA
CS3
FIR4
137−408
139−409
136−409
134−411
132−413
δ (J2000)
α (J2000)

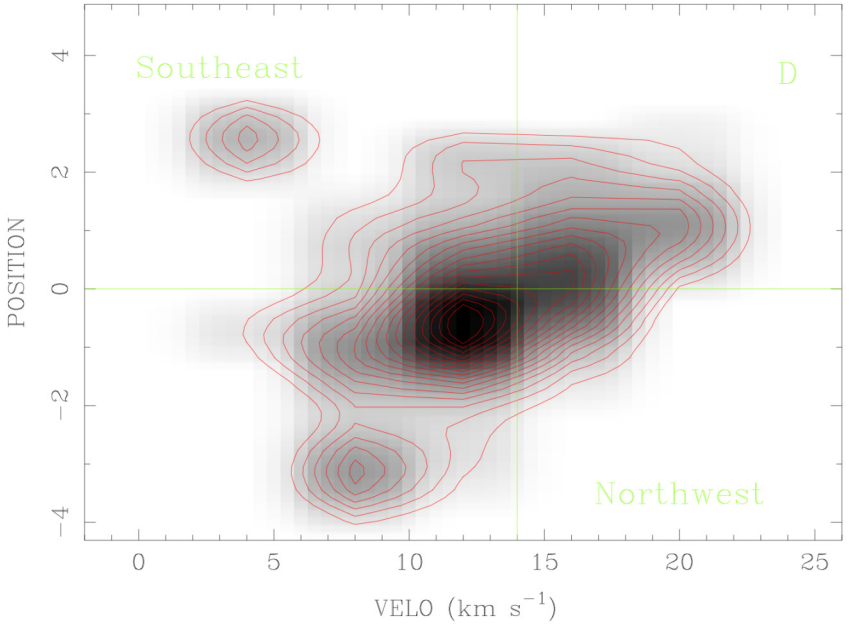

0
−50
−100
Downstream Distance
(Arcsec)
0
10
20
V_{LSR}(km s^{-1})


SO(6_5,5_4)
137–408
CS3
134–411
136–409
139–409
FIR4
132–413
A
B
C
D
05″
10″
15″
20″
25″
−05°24′30″
δ (J2000)
05h35m14.s0
13.s5
13.s0
12.s5
α (J2000)
12
10
8
6
4

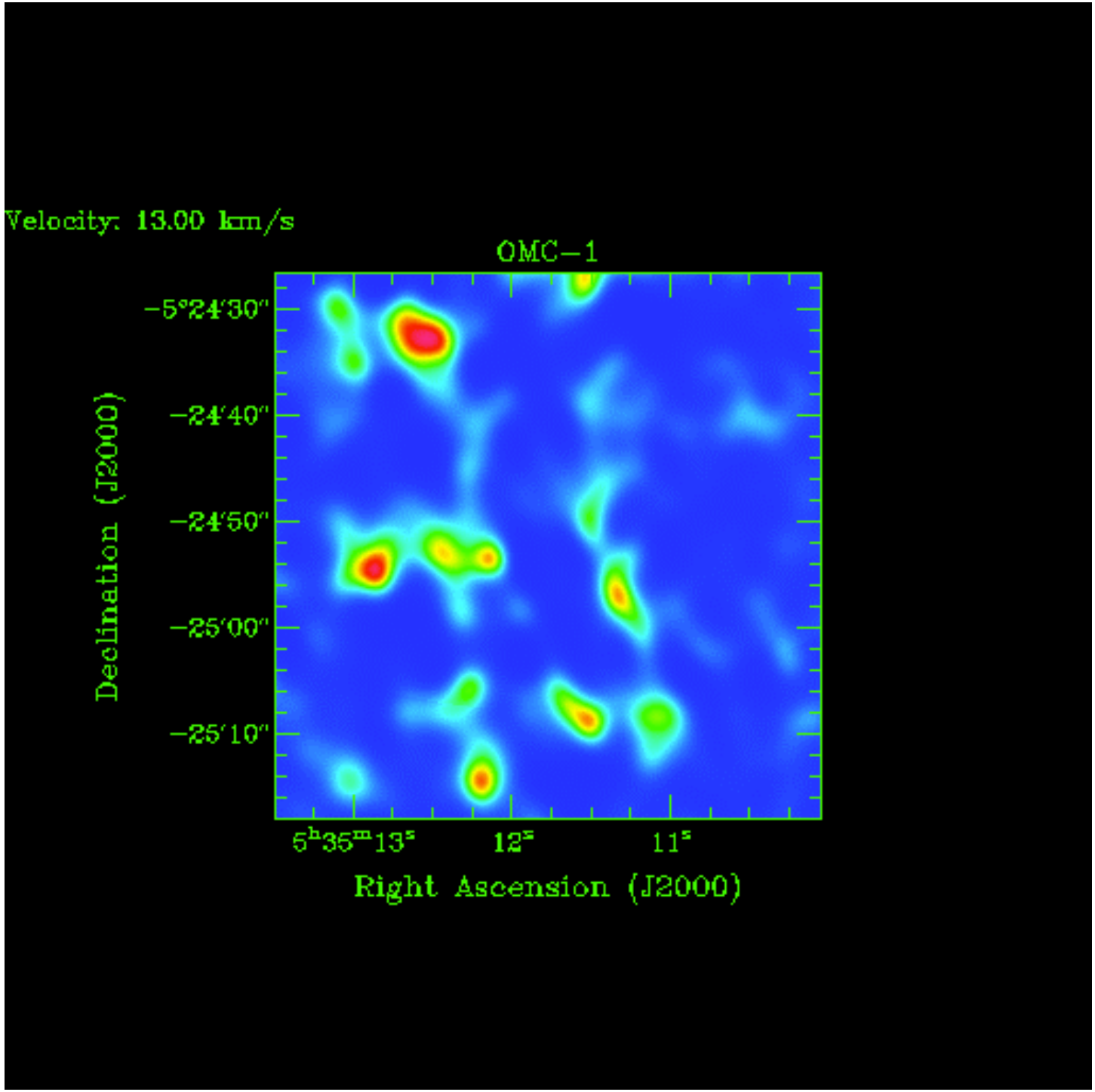

Southeast
A
Northwest
POSITION
VELO (km s^{-1})


Southeast
B
Northwest
POSITION
VELO (km s^{-1})

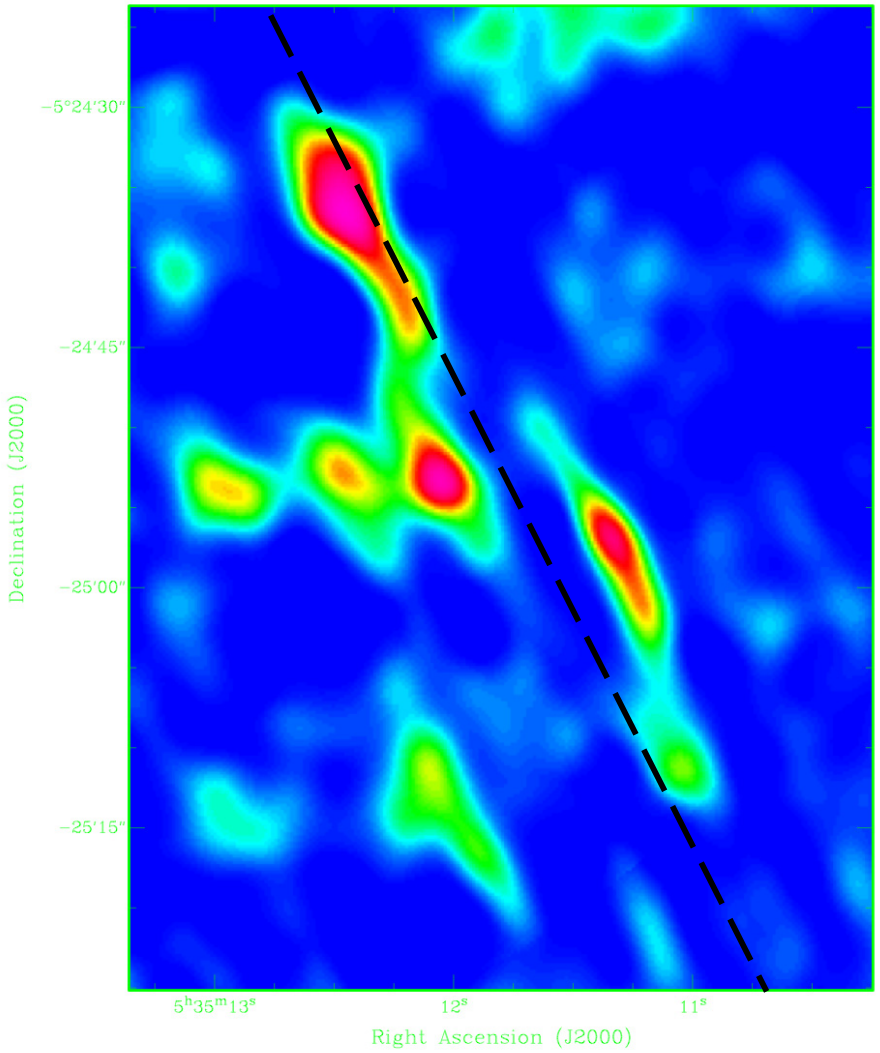

Southeast
C
Northwest
POSITION
VELO (km s^{-1})


Southeast
D
Northwest
POSITION
VELO (km s^{-1})

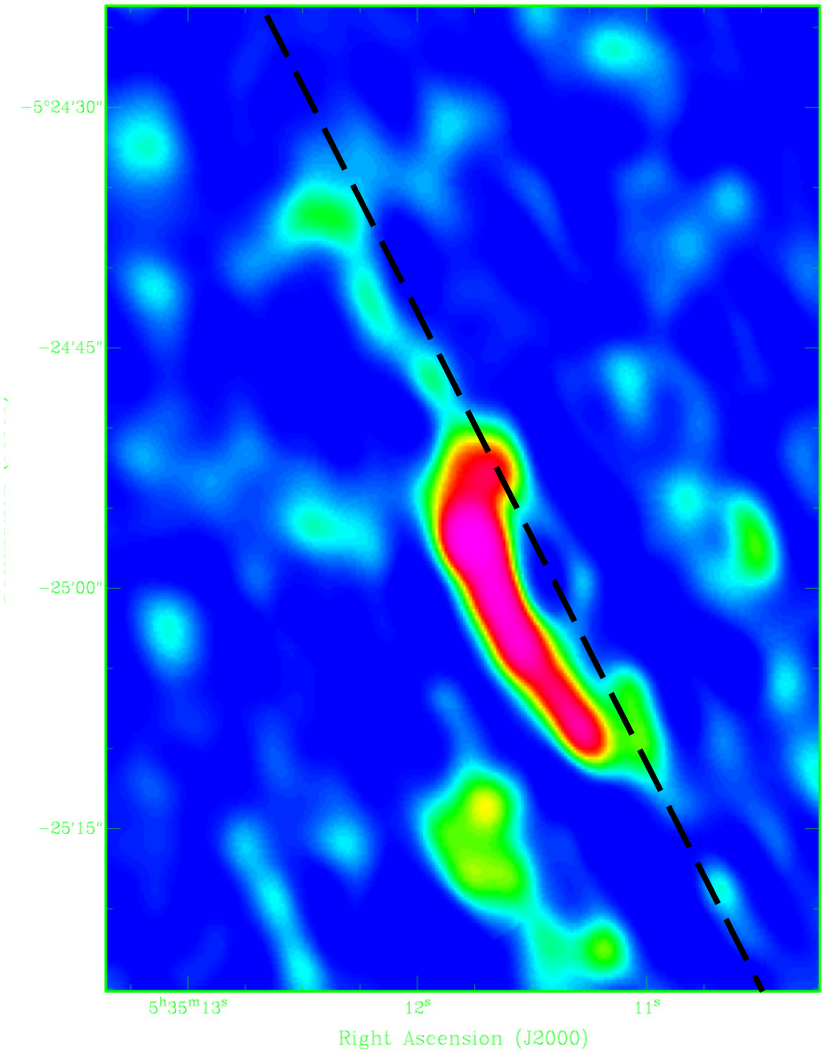
CO(2-1)

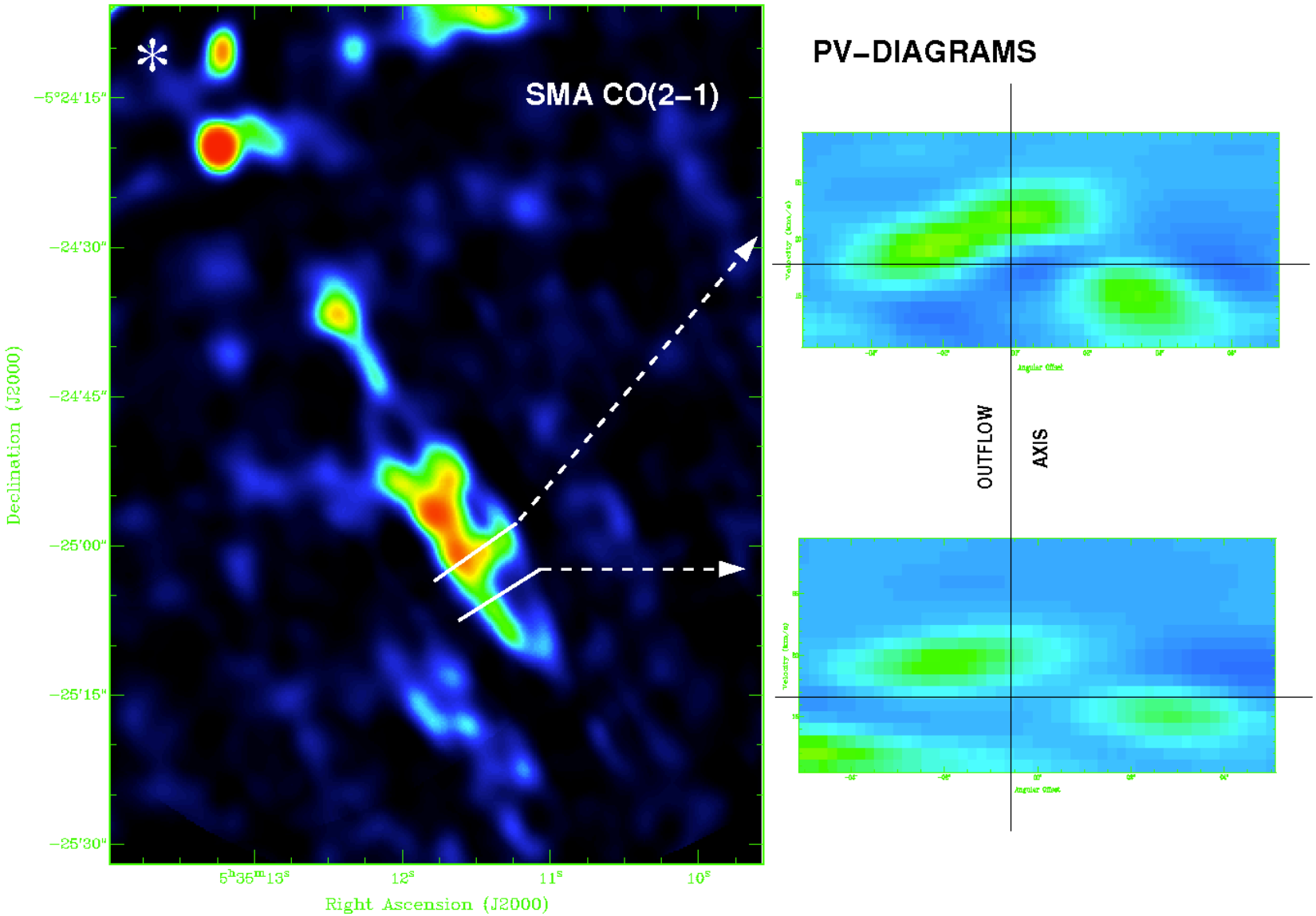

Velocity: 13.00 km/s
OMC−1
−5°24′30″
−24′40″
−24′50″
−25′00″
−25′10″
Declination (J2000)
5h35m13s
12s
11s
Right Ascension (J2000)

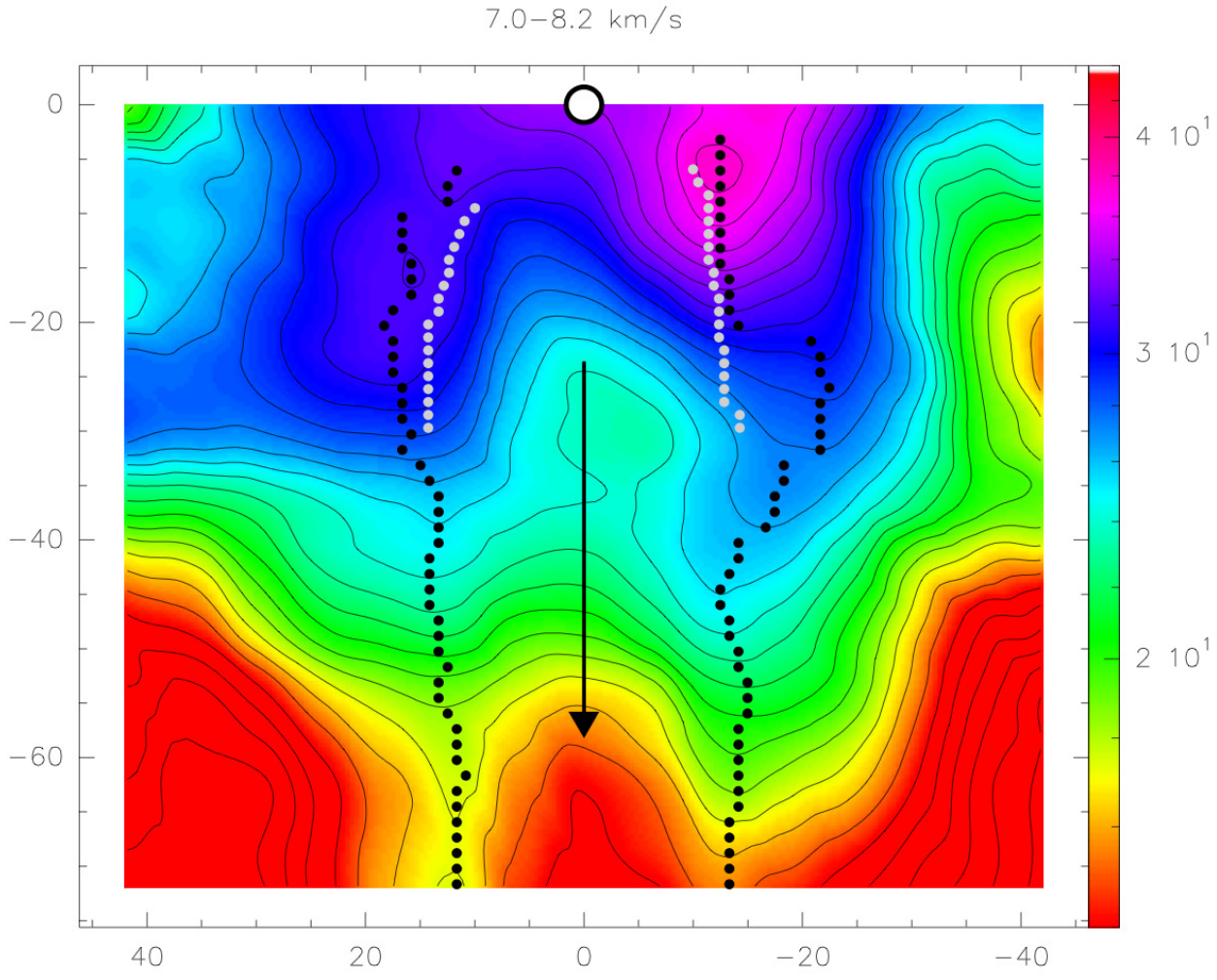
Blue (15-17 km s)

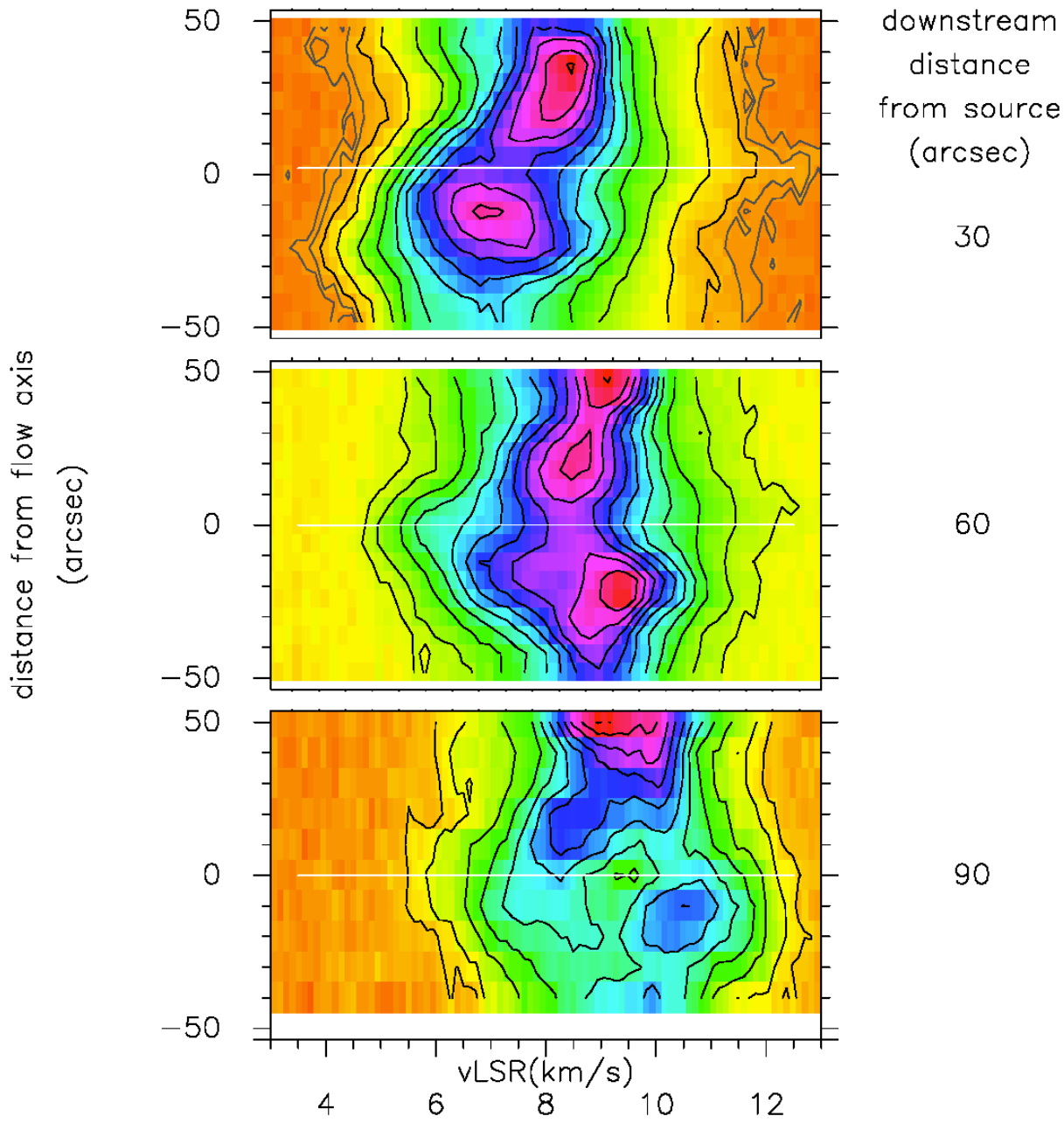


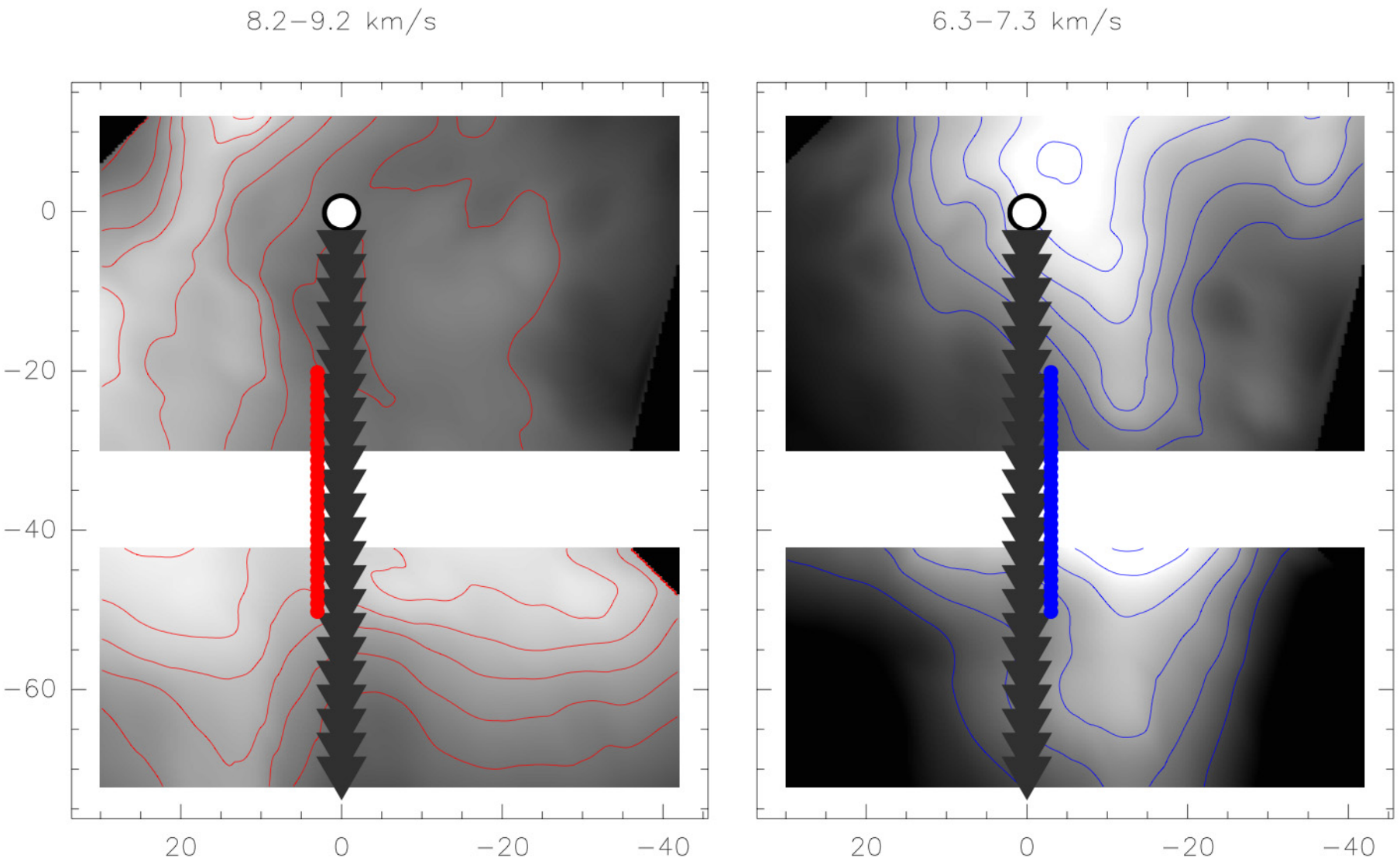
Red(17-19 km s)




SMA CO(2–1)
PV–DIAGRAMS
OUTFLOW
AXIS
−5°24′15″
−24′30″
−24′45″
−25′00″
−25′15″
−25′30″
Declination (J2000)
5h35m13s
12s
11s
10s
Right Ascension (J2000)
Velocity (km/s)
Angular Offset


7.0−8.2 km/s
0
−20
−40
−60
40
20
0
−20
−40
4 10^1
3 10^1
2 10^1


50
0
−50
50
0
−50
50
0
−50
distance from flow axis
(arcsec)
vLSR(km/s)
4
6
8
10
12
downstream
distance
from source
(arcsec)
30
60
90


8.2−9.2 km/s
6.3−7.3 km/s
0
−20
−40
−60
20
0
−20
−40
20
0
−20
−40

Summary

The outflow Ori-S6 presents red-blue asymmetries about its axis which on three levels suggest rotation:

1. Clumps (SO 6_5-5_4; diameter ~ 10^3 AU) close to the source:
   End-over-end velocity difference ~8 km/s

2. Inner jet shell (CO 2-1; diameter across several 10^3 AU) at some 1-2 x 10^4 AU from the source:
   Velocity difference some 2 km/s

3. CO tube (^{13}CO 2-1, C^{18}O 2-1; diameter ~10^4 AU) out to ~4-5 x 10^4 AU from the source:
   Velocity difference on the order 1 km/s

Very crude estimates suggest B to be of the order 1mG in 1 and 100 μG in 3, and the total angular momentum contained in 3 to be a few 10^{54} gr cm^2 s^{-1}