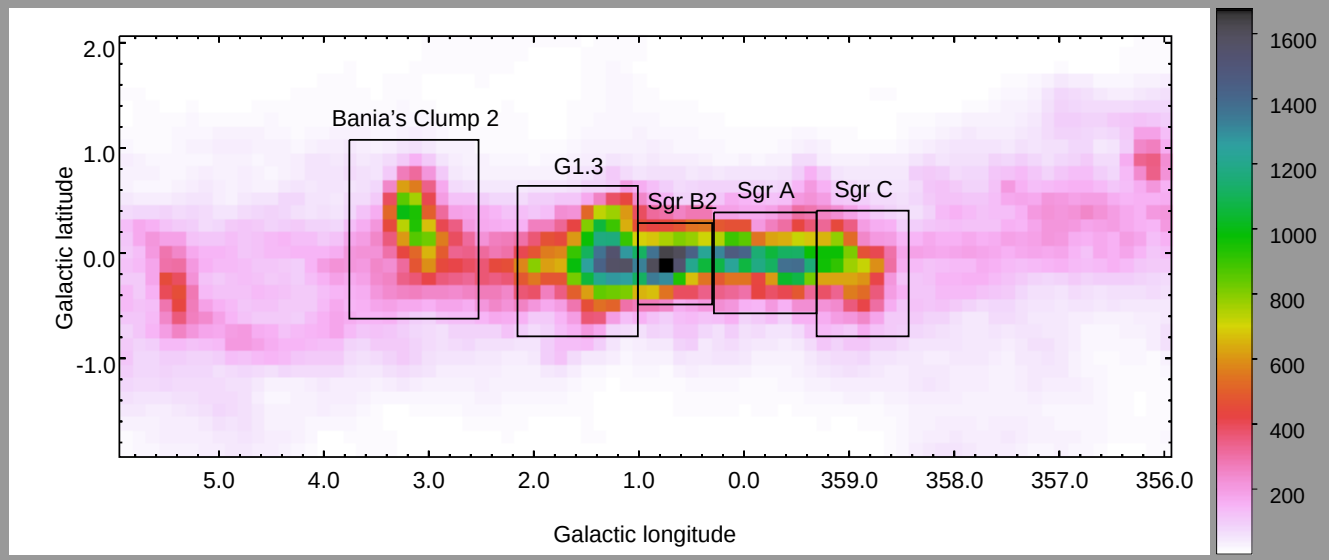
The Mopra Southern Galactic Plane CO Survey: The Central Molecular Zone

Rebecca Blackwell[1]

[1]University of Adelaide

Celebrating Mopra Workshop, 10/12/2015



Other CMZ CO Surveys

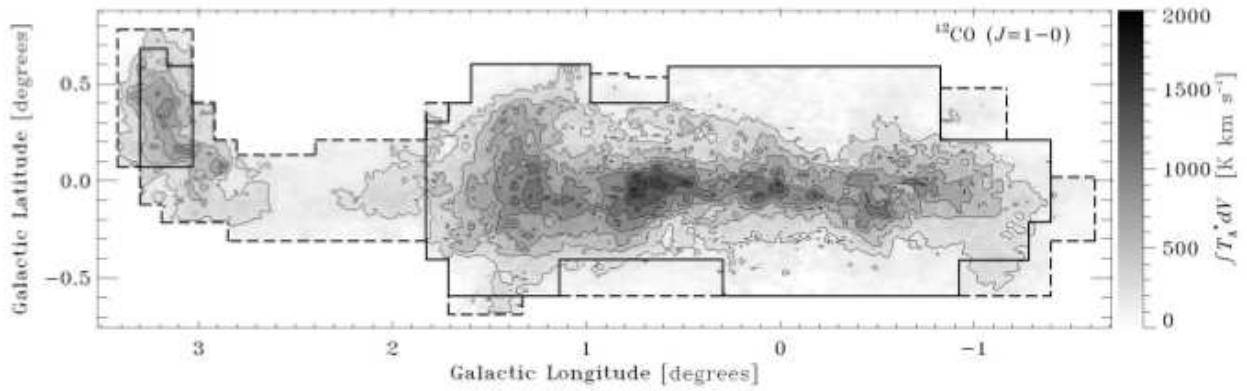


FIG. 2.—Maps of the ^{12}CO $J = 1$–0 and ^{13}CO $J = 1$–0 line emission integrated over the velocity range $V_{LSR} = -220$ to $+220$ km s^{-1}. Contours are drawn at every 200 K km s^{-1} for ^{12}CO and at every 100 K km s^{-1} for ^{13}CO. Mapping areas are indicated by solid lines (four beams) and dashed lines (three beams).

Oka et al. (1998) *A Large-Scale CO Survey of the Galactic Center*

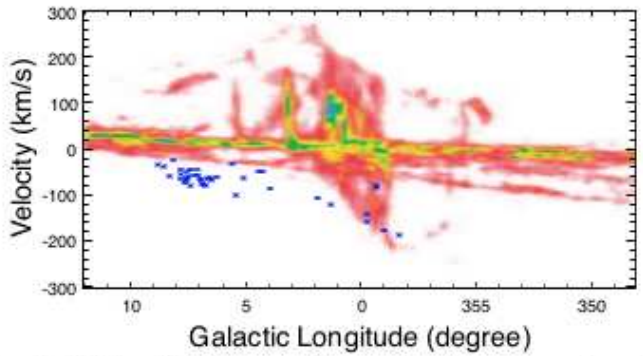


Figure 3. ^{12}CO $\ell - V$ diagram of the galactic center region. The crosses indicate the locations of the newly identified clouds at $|b| > 1°$.

Mizuno & Fukui. (2004) *Physical properties of molecular clouds as revealed by NANTEN CO survey: from the galactic center to the galactic warp*

Other Mopra CMZ Surveys

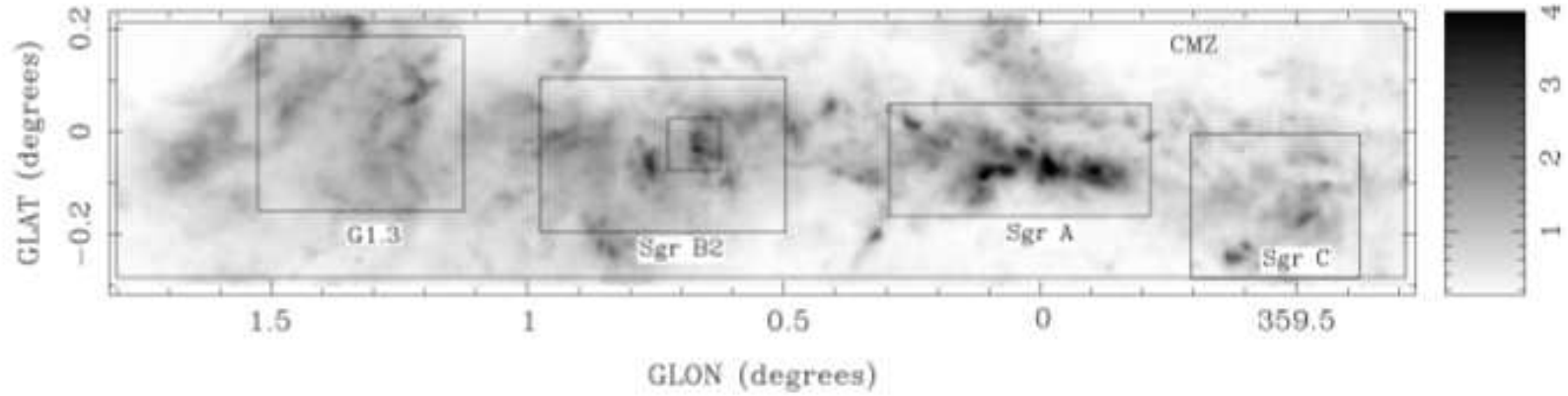


Figure 11. The six areas selected for analysis: around Sgr A, Sgr B2, Sgr C, G1.3, a smaller area at the Sgr B2 core, and the larger CMZ area, plotted on the peak HCN emission.

Jones et al. (2012) *Spectral imaging of the Central Molecular Zone in multiple 3-mm molecular lines*

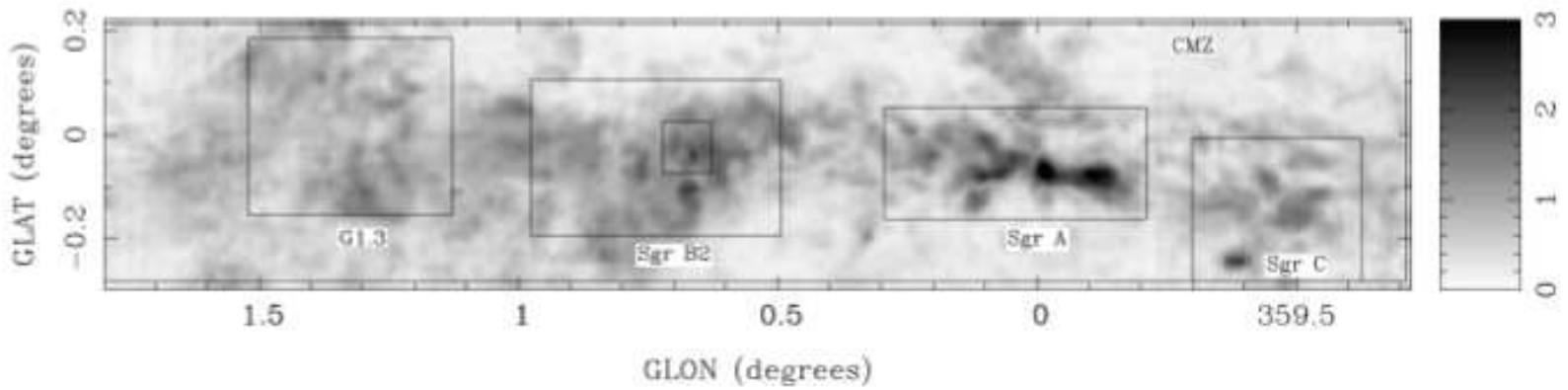
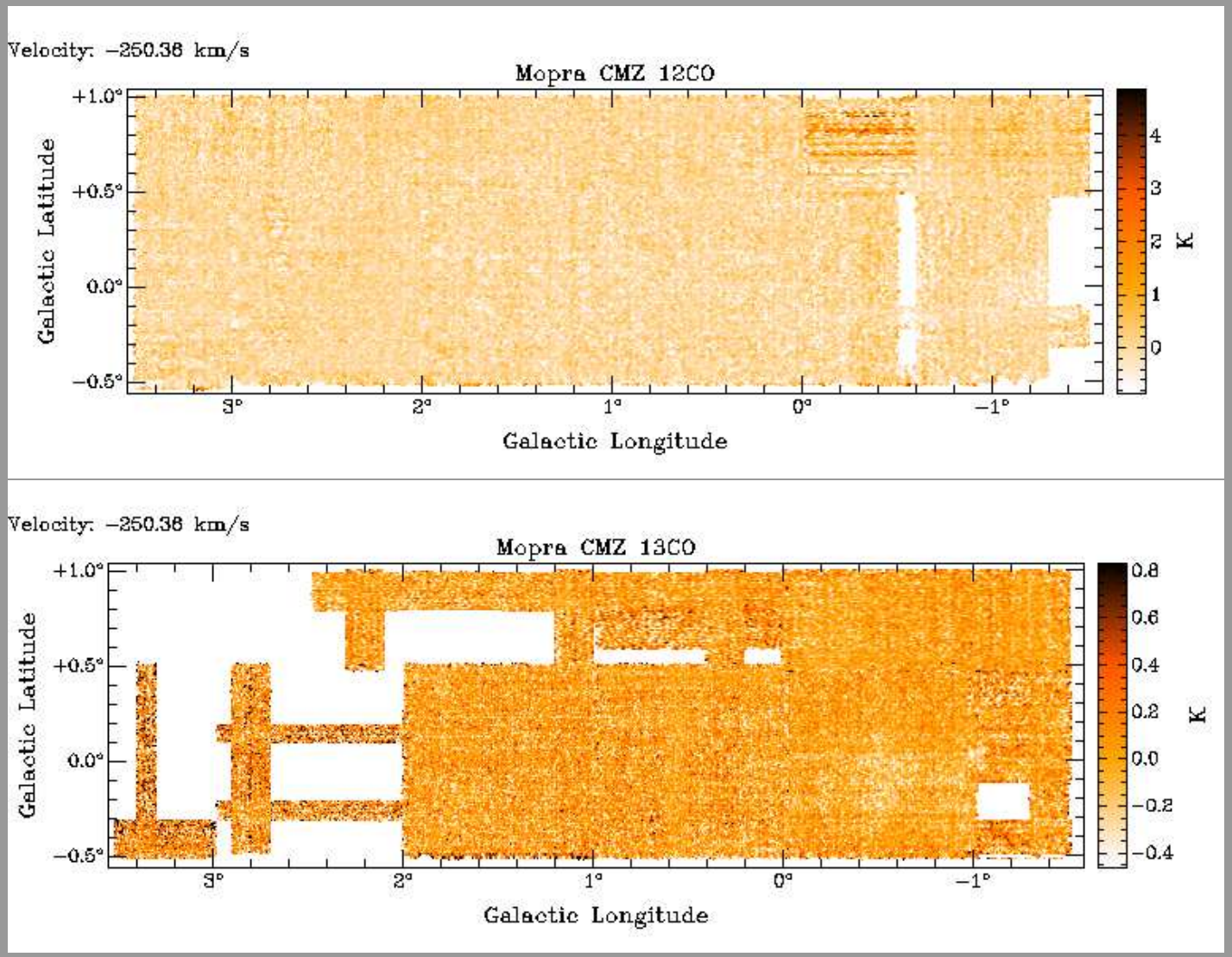


Figure 7. The six areas selected for analysis: around Sgr A, Sgr B2, Sgr C, G1.3, a smaller area at the Sgr B2 core, and the larger CMZ area, plotted on the peak CS emission.

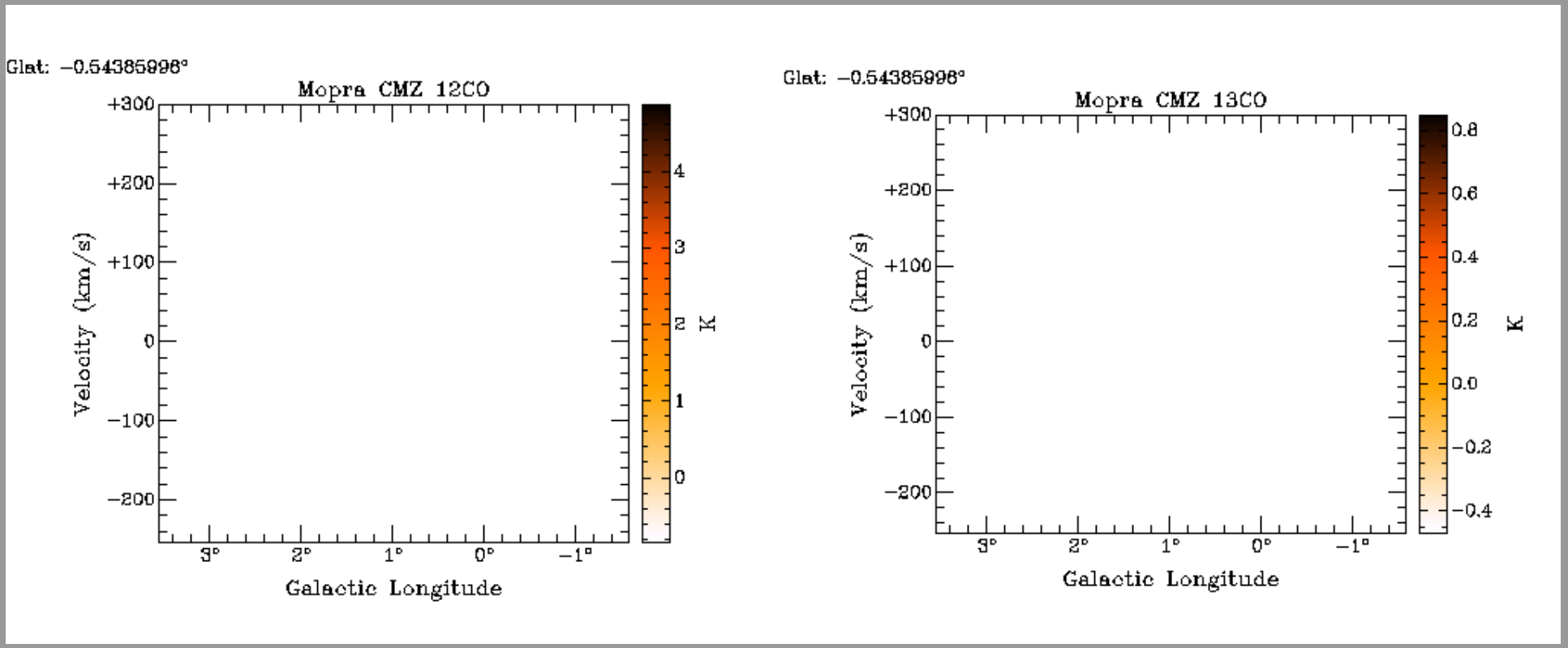
Jones et al. (2013) *Spectral imaging of the Central Molecular Zone in multiple 7-mm molecular lines*

Mopra ^{12}CO and ^{13}CO data films



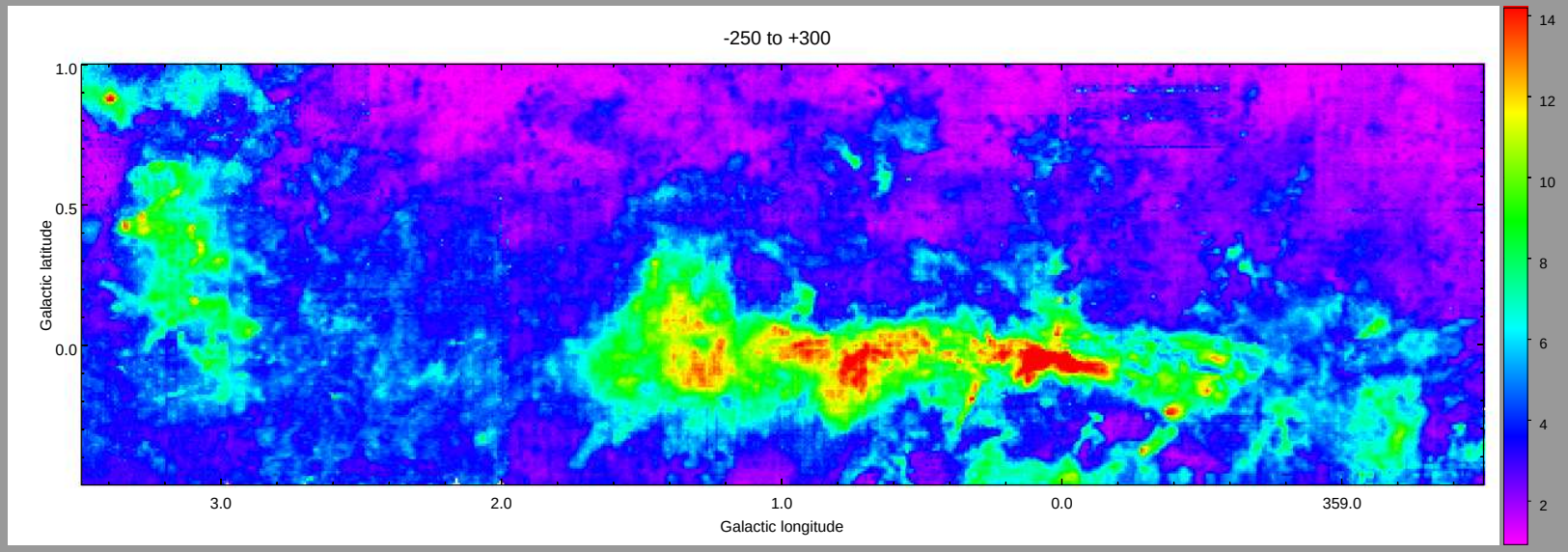
One image per channel, Δz is 1km/s. Artefact removal is in its final stages.

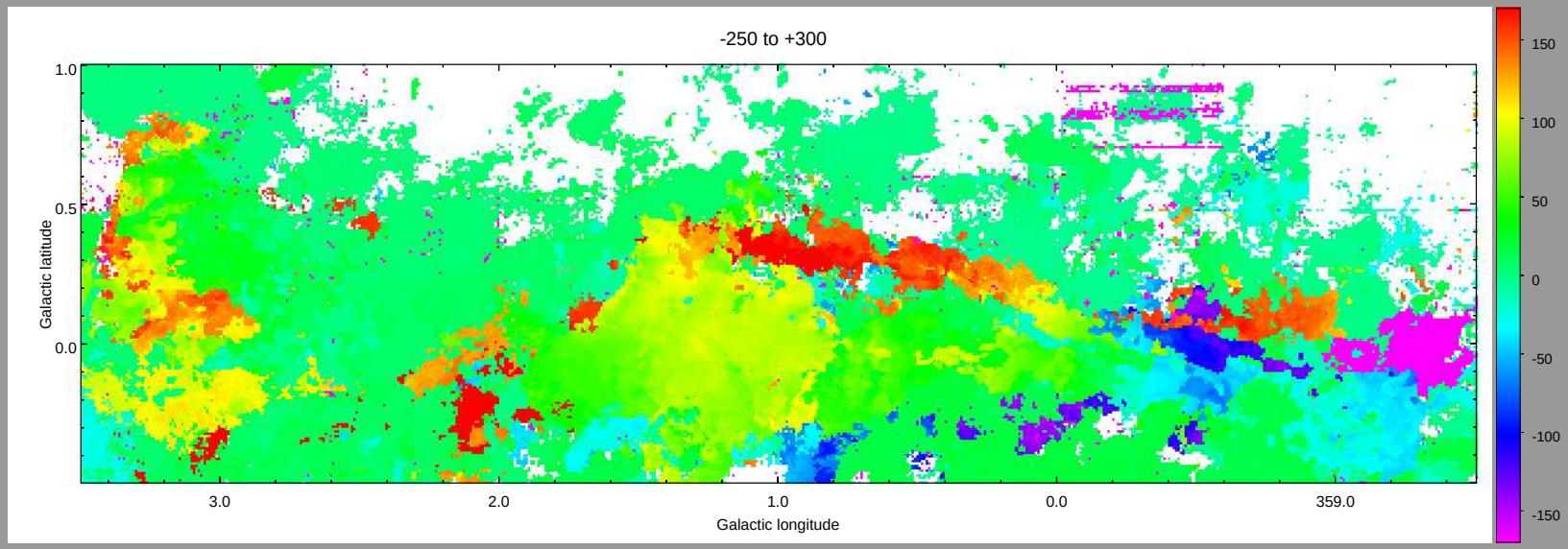
Position-Velocity films



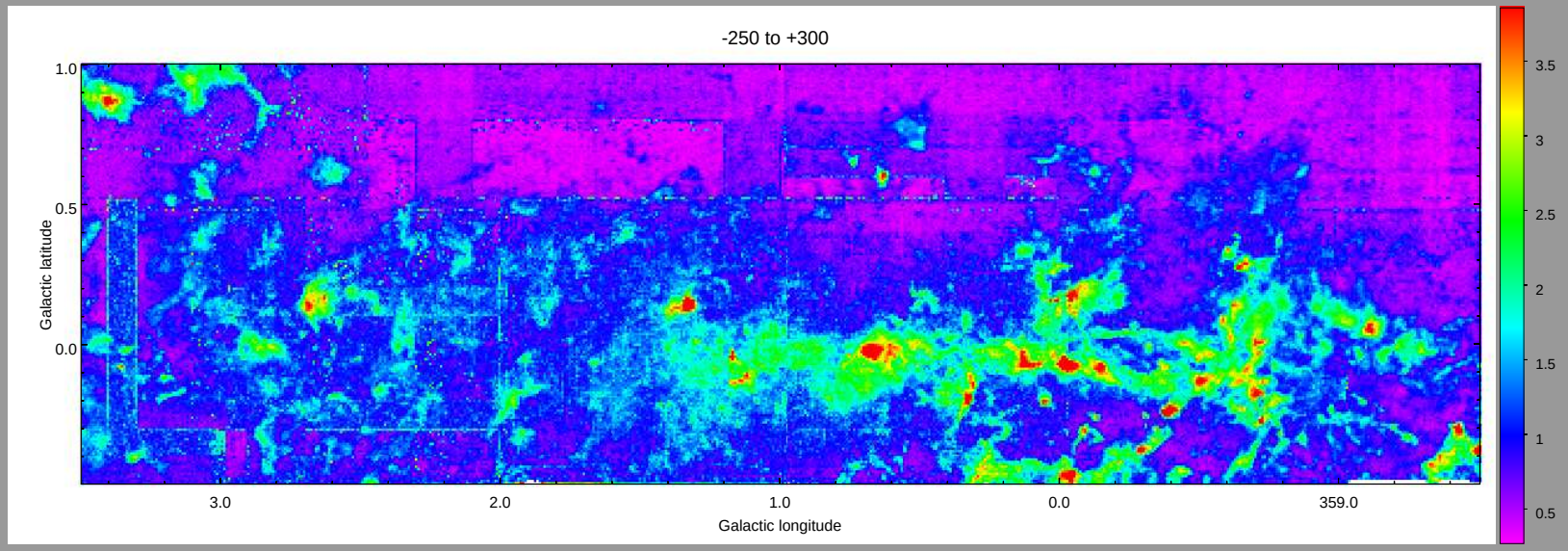
One image per channel, Δb is 30". Artefact removal is in its final stages.

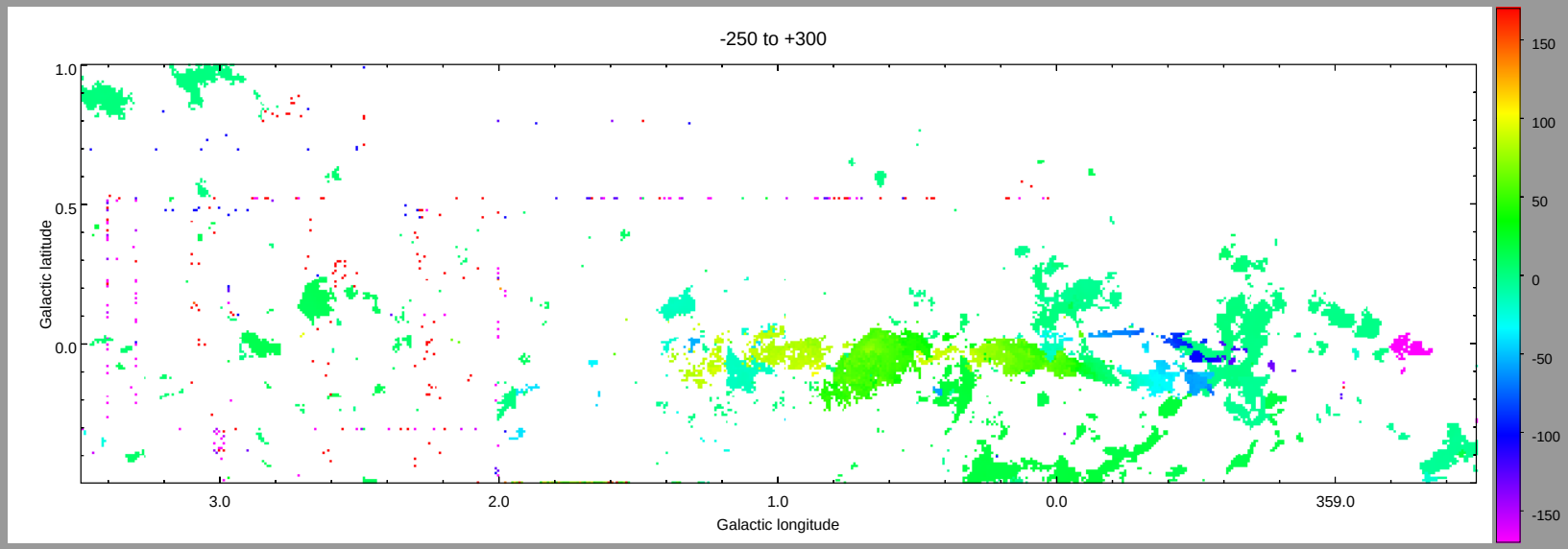
^{12}CO Peak pixel intensity and velocity



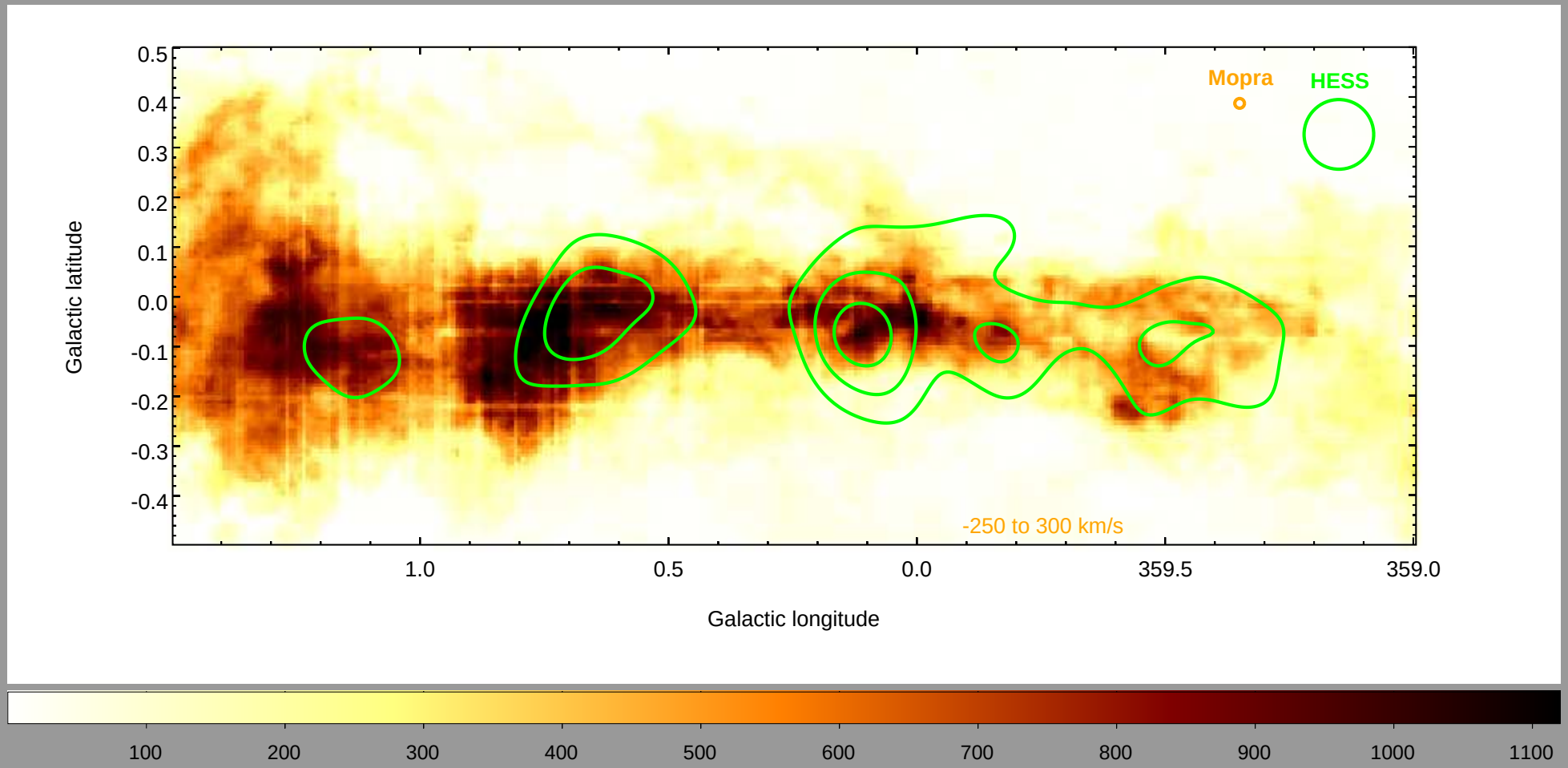


^{13}CO Peak pixel intensity and velocity



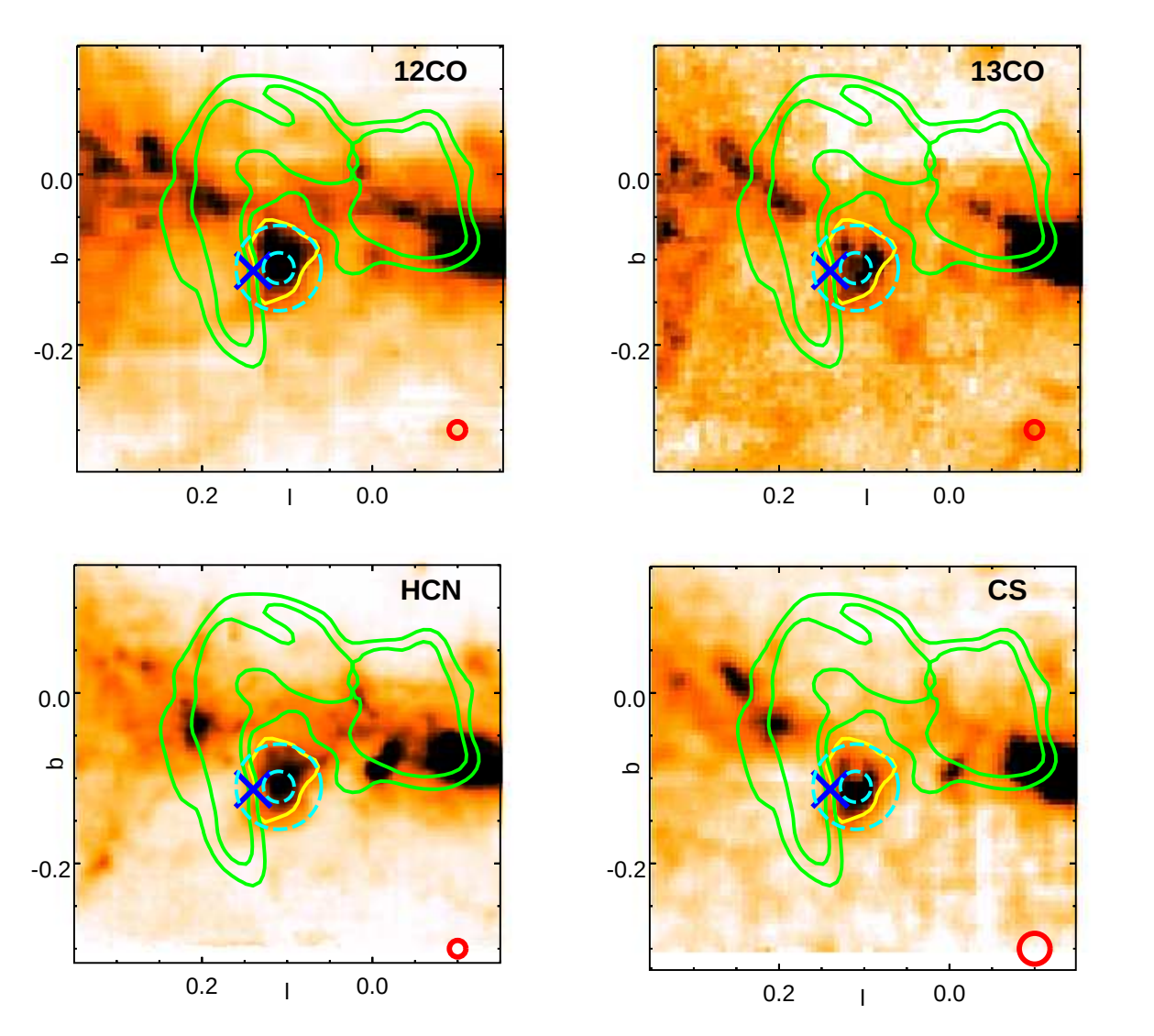


Galactic Centre Overview



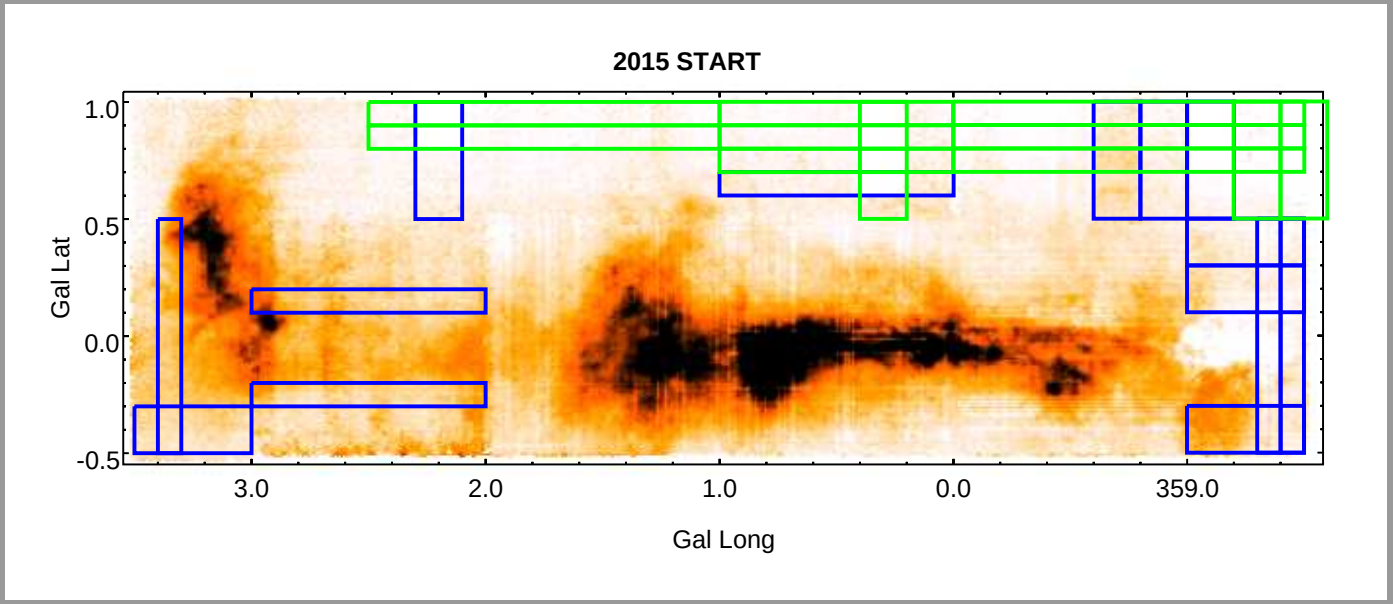
Integrated ^{12}CO between -250 km/s and $+300$ km/s, overlaid with the H.E.S.S. TeV Galactic Ridge γ-ray contours at 300, 325, and 350 excess photon counts.

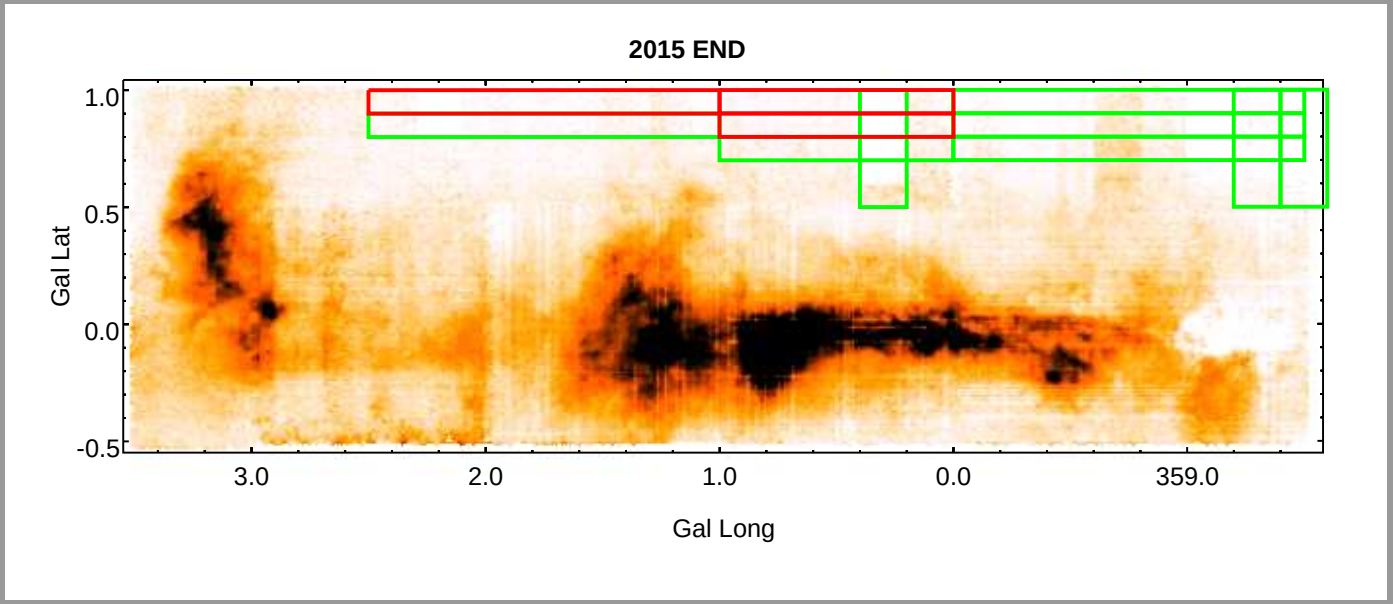
Arc Source Example



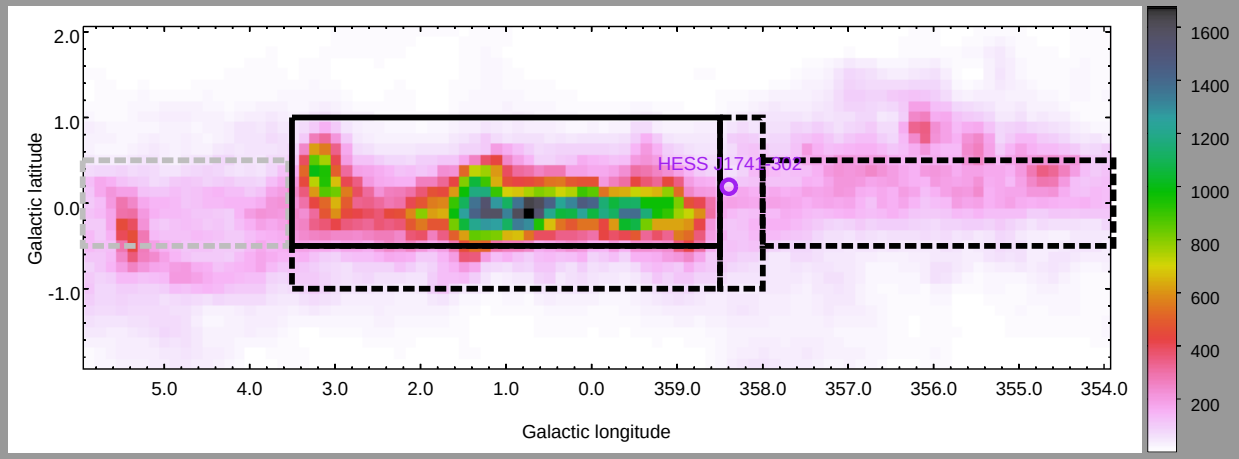
3cm radio contours (Law et al, 2008) are shown in Green, over integrated gas (independently scaled to 95% of emission), with the centroid position of the γ-ray emission indicated by the blue X. The Mopra beamsize at 3mm and 7mm (Jones et al 2012, 2013) is included for the appropriate lines, indicated by the red circles. The primary extent of the Arc Source clump of gas is shown in the yellow contour, taken from the ^{12}CO. The dashed concentric cyan circles, with radii of 180" and 65" respectively, are used to take spectra of the major extent of the clump, and the core at Mopra 7mm beam resolution.

Retaken scans: 2015 and outstanding for 2016

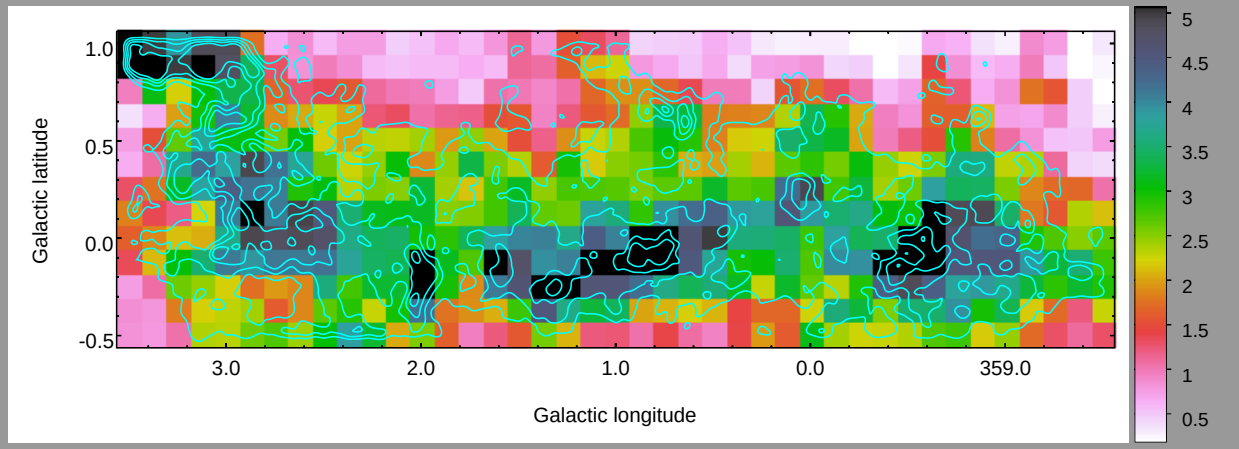




Complete the CMZ Survey - Connect to the Plane Survey!



Dame et al. (1987) *A composite CO survey of the entire Milky Way*.
Overlaid with (solid black) Mopra CMZ mapped region, and (dashed black) survey extensions.



Dame et al. (1987) ^{12}CO emission between -0.65 km/s and $+0.65$ km/s, overlaid with Mopra CO contours in the same range.