ALMAWebQL relative velocity/rest frequency guide

August 7, 2017

1 relative velocity calculation

Given V_{SRC} and $F_{band\_lo} < f < F_{band\_hi}$, V_{LSRK} from the top x-axis is calculated according to

$$V_{LSRK} = c\frac{1-(f/F_{REF})^2}{1+(f/F_{REF})^2} \oplus V_{SRC}$$

where $\oplus$ denotes the Lorentz relativistic velocity addition. By default $f = F_{LSRK}$. Upon checking the F_{REST} checkbox $f = F_{REST}$ is used and the top velocity axis is re-drawn.

2 rest frequency calculation

Given V_{SRC} , $F_{band\_lo} < f < F_{band\_hi}$ and setting $\beta = V_{SRC}/c$, upon checking the F_{REST} checkbox the bottom x-axis switches from displaying F_{LSRK} to F_{REST} , where

$$F_{REST} = f\sqrt{\frac{1+\beta}{1-\beta}}$$

3 reference frequency F_{REF} user input by pressing the 'f'-key

By default the reference frequency F_{REF} is initialised with $\left(F_{band\_lo} + F_{band\_hi}\right)/2$. Upon hovering a mouse over the bottom frequency x-axis and pressing the 'f'-key, the value shown in the "REF FRQ" input field will change to the current F_{LSRK} frequency pointed to by the mouse. If the F_{REST} checkbox is checked, instead of F_{LSRK} the current F_{REST} frequency value will be used to set F_{REF} , and the top velocity axis will be refreshed accordingly. New F_{REF} can also be typed in directly into the "REF FRQ" text field.

4 test cases

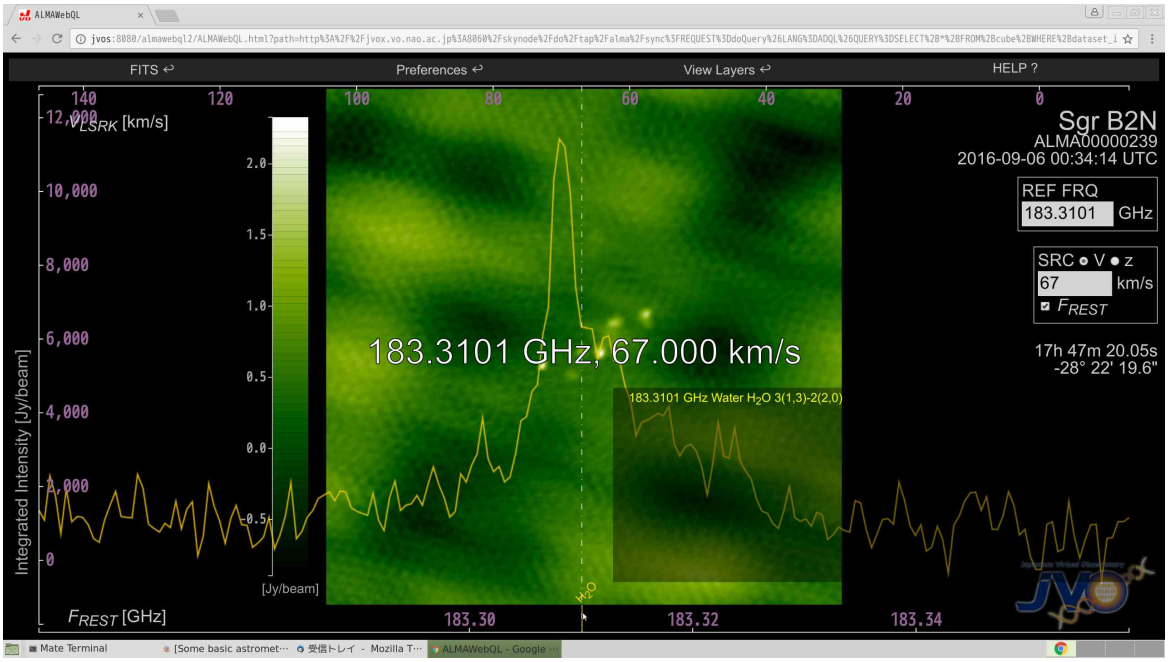

Figure 1: $V_{SRC} = 67$ km/s

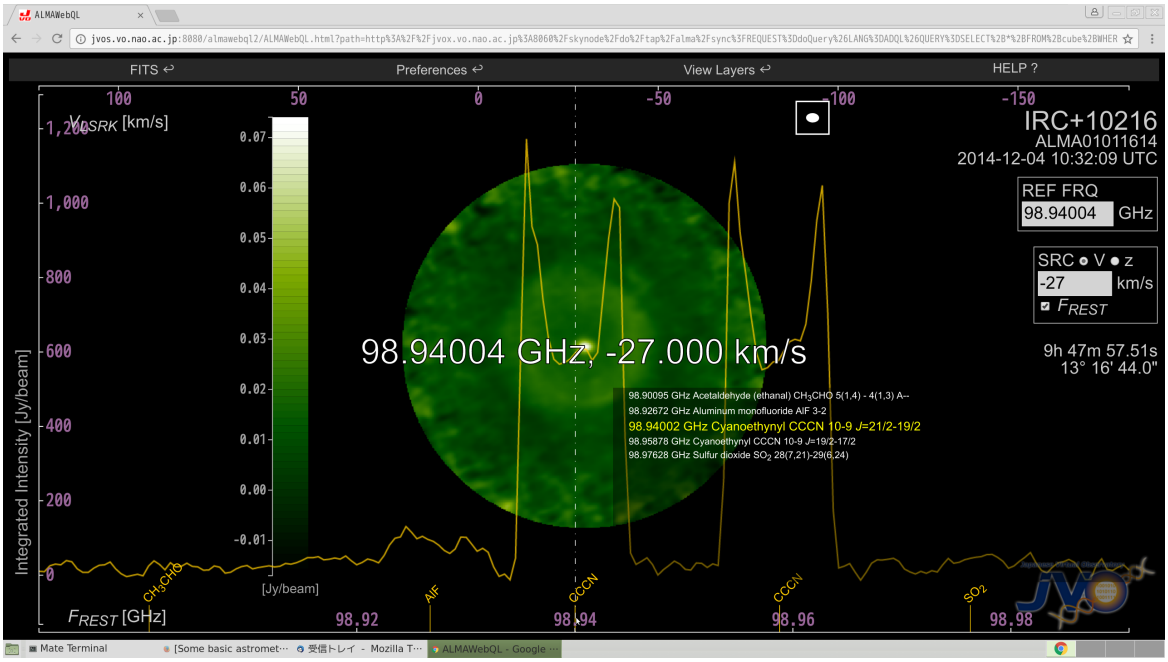

Figure 2: $V_{SRC} = -27$ km/s