

April 30, 2001

From: Ed Churchwell, Chip Kobulnicky, and the GLIMPSE team
TO: Tom Soifer
Re: 3 minute overheads on AORs

Dear Tom,

The GLIMPSE team has devised a strategy for using SIRTf/IRAC to efficiently make a fully-sampled, double-coverage, 4-band map of the Galactic plane from $|l|=10-70$ deg, $|b|<1$ deg in the 400 allocated hours. The basic strategy is to map 1-2 degree "segments" of the plane during 2-4 hour intervals. Figure 1 illustrates how a series of IRAC maps will be used to efficiently cover a representative "segment" near Galactic longitude 52 deg on a particular day (2002 Nov 02; note that the orientation of the IRAC array varies with respect to the Galactic Plane by up to a degree per day).

In this particular example, the "segment" is covered (once) by a series of 14 "Chained" AORs in which the telescope moves only a few arcminutes from one AOR to the next. In Figure 1, successive AORs are shaded for clarity. Each AOR within the "Chain" is comprised of an IRAC "Map" with dimension NxM. Each exposure is 2 s using the planned 2-s full-frame AOT. Including readout+compression time, each exposure requires 18 s (estimated based on current information available from SSC).

The table below details how a series of chained AORs (Figure 1) covers a contiguous 2×1.2 deg region once.

Map rowXcol	#exp	Est. time (18s xNxM) (sec)	Admin. overhead tax (sec)	% of AOR due to overhead
AOR1 : 2x2	4	72	180	250%
AOR2 : 2x6	12	216	180	83%
AOR3 : 2x10	20	360	180	50%
AOR4 : 2x14	28	504	180	36%
AOR5 : 2x18	36	648	180	28%
AOR6 : 2x22	44	792	180	23%
AOR7 : 2x23	46	828	180	22%
AOR8 : 2x23	46	828	180	22%
AOR9 : 2x23	46	828	180	22%
AOR10: 2x22	44	792	180	23%
AOR11: 2x18	36	648	180	28%
AOR12: 2x14	28	504	180	36%
AOR13: 2x10	20	360	180	50%
AOR14: 2x6	12	216	180	83%
<hr/>				
Total Segment	422	7596 s	2520 s	33%
		=127 m	= 42 m	
		=2.12 h	=0.70 h	

Total Time Charged to Project: 2.82 hours
Total Spacecraft time required: 2.12 hours

Under current SSC guidelines, each AOR is subject to a 3 minute overhead "tax" which is meant to account for slewing between targets. Acquisition and settle time on each target is accounted for separately. Under this scenario, the time required to cover a typical "segment" of the Galactic Plane is increased by 33%. Because the GLIMPSE survey makes use of many short ***spatially adjacent*** AORs in order to pave the Galactic Plane most efficiently, this program is impacted severely by the current implementation of the 3 minute *per AOR* overhead.

Why this observing strategy, we are often asked?

We believe that the present observing strategy using variable-sized IRAC maps in array coordinates is the most efficient way possible to accomplish the proposal objectives with *virtually no redundant overlap between exposures and minimal inefficiencies at the boundary of the survey region*. We have considered several alternative observing strategies and rejected them as less efficient (i.e, they require more spacecraft time) than the current scheme.

Larger AORs w/square maps: results in huge inefficiencies where AORs overlap (due to roll angle variations throughout the year) and creates severe coverage irregularities (sawtooth) near the survey boundaries at $b=+1.0$ and $b=-1.0$.

Mapping in celestial coordinates instead of array coordinates: IRAC images don't tile together nicely; leads to patchy coverage

Hexagonal maps: same problems as large AORs; square IRAC frames fill small hexagons inefficiently, and large hexagons have severe edge effects at the $b=+1.0$, $b=-1.0$ survey boundaries.

Using the currently-proposed observing scheme, we propose an alternative method for imposing the overhead slew tax whereby each "segment" of the Plane is charged the 3 minute overhead. Under this proposal, the total time required to complete the example "segment" above becomes 2.12 hours instead of 2.82 hours. We believe this to be a reasonable proposal since all of the spacecraft slews within a given "segment" are on the order of a few arcminutes, and all observations within a segment are performed contiguously (during the same 12-hour downlink period). Such small moves would require far less time than the currently-stipulated 180 s which must be the estimated "average" slew from a random point in the sky.

The GLIMPSE survey comprises approximately 80 segments, each of which is covered twice. Under the current SSC guidelines, ~56 hours of the 400 allocated hours would be devoted to the "3-minute overhead tax" and would prohibit us from accomplishing the survey as proposed. Under our proposal, each "segment" is taxed only twice, i.e., once for each pass. Under our proposal, the slew overhead is 8 hours for the entire 400 hour survey.

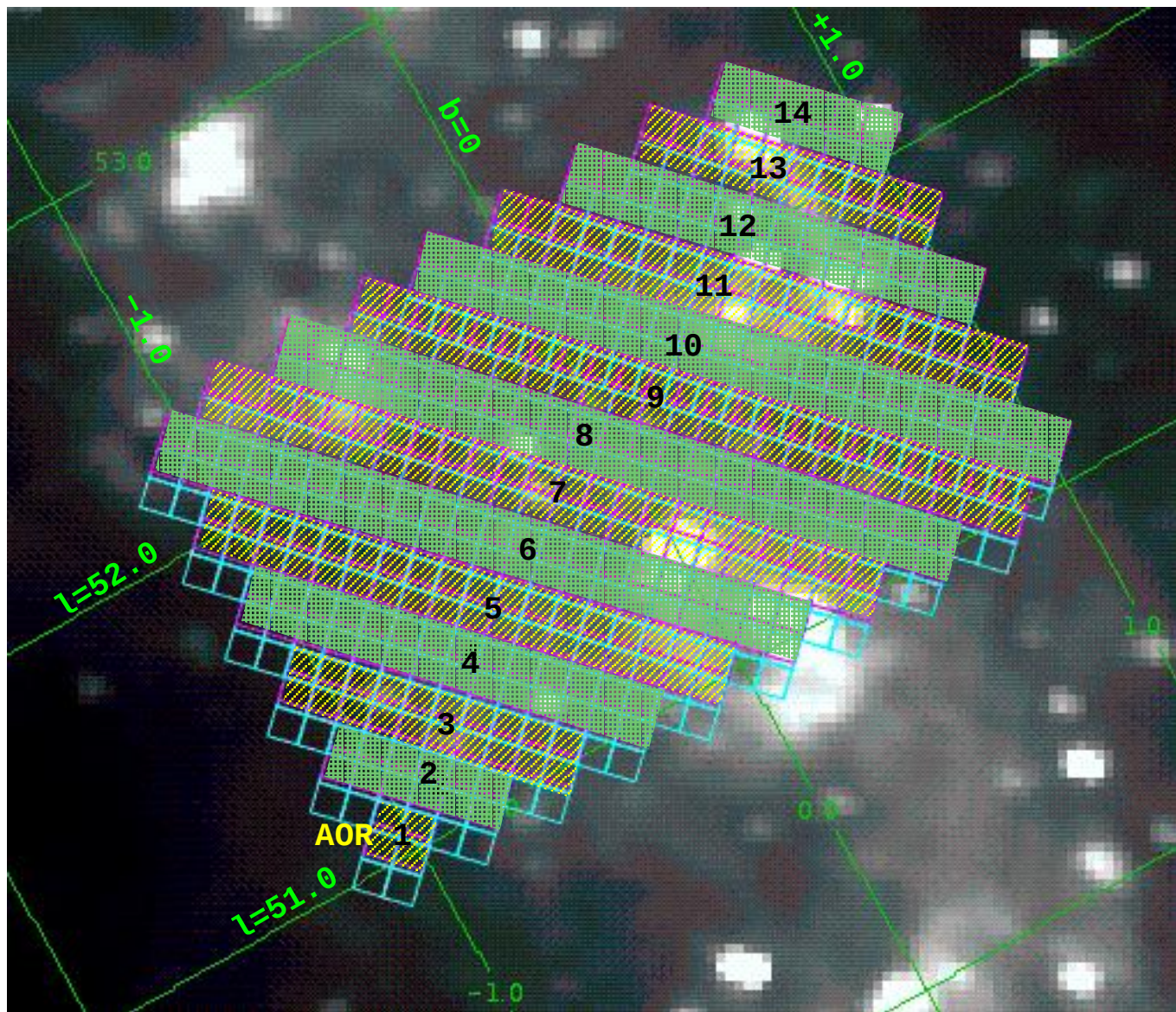


Figure 1: Schematic showing how IRAC "maps" will be used to cover the Galactic Plane in "Segments". Each "segment" covers 1-2 degrees along the Plane and from $-1 < b < 1$. This example shows how 14 IRAC "maps" cover a 1.2×2 deg region near $l=52$ deg.