

SPIRE Simulations

Kevin Xu (NHSC/IPAC) & Andreas Papageorgiou (School of Physics and Astronomy, Cardiff University)





Why do we need simulations?

- The "truth" maps of simulated observations provide unbiased benchmarks for map-maker comparisons.
- Allowing for the effects of noise, deviations from the "truth" are objective measures for biases introduced in map-making process.





Simulation Strategy

• All simulations have two layers: noise layer & truth layer







Noise Layer: 3 dark fields (one for each mode)

- Taken from real observations of dark fields, which are test cases themselves.
- Including instrumental noise, confusion noise, and other artifacts (e.g. the burp effect).
- Simulations in the same obs mode have the same noise layer.







Truth layer: 4 sky models

(1) Artificial sources: including both point sources (PSFs) and extended sources (exponential disks).



(2) Cirrus region: MIPSGAL 24µm image of the Galactic disk region with $57.5 < I^{\parallel} < 59.5, -1 < b^{\parallel} < +1;$ convolved with the SPIRE PSF (of a given band).







Truth layer: 4 sky models

- (3) Galactic center: Galactic center: $-2.5 (357.5) < I^{II} < 1.5, -2 < b^{II} < +2;$ convolved with the SPIRE PSF (of a given band); saturated pixels and other bad pixels were repaired. Scaled to peak flux of 300 Jy/beam,
- 4 deg

(4) M51: MIPS 24 24µm image of M51, convolved with SPIRE PSFs.







	Table 1: Simulated Data Sets (8 Cases in total)					
Case	Mode	Truth Layer	Noise Layer	Map Size	Depth	Bands
1 2 4 5	Nominal Nominal Nominal Fast-Scan	artificial sources cirrus region M51 artificial sources	Lockman-North Lockman-North Lockman-North Lockman-SWIRE	$0.7 d \times 0.7 d$ $0.7 d \times 0.7 d$ $0.7 d \times 0.7 d$ $3.5 d \times 3.5 d$	7 repeats 7 repeats 7 repeats 2 repeats	PSW, PMW, PLW PSW, PMW, PLW PSW, PMW, PLW PSW, PLW
6	Fast-Scan	Galactic center	Lockman-SWIRE	$3.5 d \times 3.5 d$	2 repeats	PSW, PLW
8	Parallel	Calactia conter	ELAIS NI ELAIS NI	$1.3 d \times 1.3 d$	5 repeats 5 repeats	PSW, PLW
9 10	Parallel	cirrus region	ELAIS N1 ELAIS N1	1.3 d× 1.3 d 1.3 d× 1.3 d	5 repeats 5 repeats	PSW, PLW







SPIRE

Simulating TOD (Time Ordered Data):

f_simu (time) = f_noise (time) f_truth [RA_noise (time), Dec_noise (time)]



esa



Remarks:

- The simulations contain instrumental noise (including the "burp effect"), confusion noise due to back ground sources, and noise due to glitches. These are brought into the simulated cases by the "noise layer" (real observations of dark fields).
- However, they do not include effects due to saturation, pointing error, photon noise and electrical cross talks (both are significant for very bright sources such as those in the Galactic center).
- The TOD provided by the simulations are already deglitched using the standard SPIRE scan-map pipeline, which may not desirable for some map-makers (e.g. Unimap).

