KINGFISH –
Key Insights on Nearby Galaxies: a Far Infrared Survey with Herschel
Data Products Delivery – DR1
User's Guide
June 30th, 2011

1. Introduction

This document describes the first delivery (DR1) of the high level data products of the Herschel Open Time Key Project KINGFISH (Key Insights on Nearby Galaxies: a Far Infrared Survey with Herschel; P.I.: R.C. Kennicutt; Deputy-P.I.: D. Calzetti) to the Herschel Science Center.

KINGFISH consists of a sample of 61 galaxies (the SPIRE maps for 6 of which, NGC4254, NGC4321, NGC4536, NGC4569, NGC4579, and NGC4725, were obtained as part of the Eales et al. Herschel Reference Survey and re-reduced by us), which have been mapped with both PACS (3 bands) and SPIRE (3 bands) and measured spectroscopically with PACS. This delivery includes the SPIRE imaging of all 61 galaxies in KINGFISH.

More details can be found in the paper by R.C. Kennicutt et al. (2011, in preparation).

2. Content of the First Data Delivery

2.1 Sample and Summary of Data Products

The galaxies in the KINGFISH sample are listed in Table 1.

Table 1: Galaxies in the KINGFISH sample (listed in order of increasing RA)

Name	Name	Name	Name	Name	Name
NGC0337	IC0342	NGC3049	NGC3627	NGC4625	NGC5474
NGC0584	NGC1482	NGC3077	NGC3773	NGC4631	NGC5713
NGC0628	NGC1512	M81DwB	NGC3938	NGC4725	NGC5866
NGC0855	NGC2146	NGC3190	NGC4236	NGC4736	NGC6946
NGC0925	HolmbergII	NGC3184	NGC4254	DDO154	NGC7331
NGC1097	DDO053	NGC3198	NGC4321	NGC4826	NGC7793
NGC1266	NGC2798	IC2574	NGC4536	DDO165	
NGC1291	NGC2841	NGC3265	NGC4559	NGC5055	
NGC1316	NGC2915	NGC3351	NGC4569	NGC5398	
NGC1377	HolmbergI	NGC3521	NGC4579	NGC5408	
NGC1404	NGC2976	NGC3621	NGC4594	NGC5457	

The current delivery contains SPIRE images in 3 bands for all 61 galaxies in the sample. Summaries of the data products are given below, and details on the data processing are provided in section 3.

2.2 SPIRE Maps

For each galaxy, 9 maps, three for each of the SPIRE bands (one each flux, uncertainty, and coverage maps) are delivered as single-extension FITS files. The pixel scale of the SPIRE maps is wavelength-dependent: 6 arcsec at 250 μm, 10 arcsec at 350 μm, and 14 arcsec at 500 μm. The flux units are MJy/sr, which were converted from Jy/beam (the output of the HIPE pipeline, see section 3.2). The maps have a median background removed, and have orientation North up, East left. The uncertainty maps have the same pointing and calibration as the flux maps; the coverage maps have the same pointing as the flux maps.

2.3 File Name Convention

For each galaxy, multiple datasets are delivered, with the format:
 <name>_kingfish_spire<wavelength in μm>_v2.0[.unc, for uncertainty maps; .cov, for coverage maps].fits, where the preferred name is the NGC, IC, Holmberg (designated 'Ho') or DDO designation followed by the catalog number (with the exception of dwarf B in the M81 group, designated 'M81dwB', see Table 1) and the wavelength is 250, 350, or 500 μm.

Name	Name	Nar
DDO053	NGC0628	NGC2
DDO154	NGC1097	NGC3
DDO165 [2]	NGC1266	NGC3
HolmbergII	NGC1377	NGC3

3. SPIRE Imaging Data Products and Post-Level-1 Processing

3.1 Introduction

The KINGFISH SPIRE maps are created from multiple Herschel scans obtained in the SPIRE photometric mode (with the exception of IC342, which was measured in the SPIRE/PACS parallel mode), and fully processed with HIPE (version spire-5.0.1894), with modification to mask out the galaxy when measuring the background, to increase the size of the map by adding the data taken while the spacecraft turns around after each scan leg, to adjust the pointing, and to improve the calibration of temperature drifts with temperature (with help from P. Panuzzo). The KINGFISH observing strategy is to map each galaxy with two scanning directions oriented at approximately right angles to each other, with 2 (for targets with S_{160} at $R_{25} > 3$ MJy/sr) or 4 (for targets with S_{160} at $R_{25} <=$ 1 MJy/sr) repetitions (same pattern) for each, out to 1.5 times the optical radius.

3.2 Data Products

The output of our pipeline is 9 simple FITS files for each galaxy: 3 products (the calibrated image, the uncertainty, and the coverage map) for each of the 3 bands.

3.3 Image Processing

The raw KINGFISH SPIRE data are processed through the early stages of HIPE to calibrate the data in physical units. A line is fit to the data for each scan leg after masking out the galaxy, and this fit is subtracted from the data.
 Discrepant data (usually a rogue bolometer, of which there are <1 per map, on average) are also masked, and the data (plus the "turnaround" region, for the ~90% of the sample that didn't have visible streaks in that region) are mosaicked using the native mapper in HIPE. The map coordinates are then adjusted so that the position of the point sources (measured using StarFinder; Diolaiti et al. 2000, SPIE, 4007, 879) match those in the MIPS 24 μm images – this adjustment averaged 3 arcseconds, had a Gaussian distribution, and was dominated by offsets in right ascension. Finally, the images are converted to surface brightness units (MJy/sr), converted from Jy/beam (the output of the HIPE pipeline) using the beam areas (from the SPIRE Observer's Manual) of 426, 771, and 1626 square arcseconds at 250, 350, and 500 μm, respectively.

Photometric Uncertainties
Currently the estimated calibration uncertainties, from the SPIRE observer's manual, are 7%. The uncertainty in the beam size is ~1%, and when added in quadrature with the calibration uncertainty results in a total uncertainty still of ~7%.