

SPIRE Small-Scan-Map AOT and Data Products

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Introduction

This note covers the release of the SPIRE Small Map AOT for scheduling of observations.

The original SPIRE Small Map mode was initially a 64-point Jiggle Map. However, after analysis and investigation it has been decided that the original 64-point Jiggle Map should be replaced by a 1x1 Small-Scan-Map.

The two small map modes have been compared using metrics for map coverage, quality and sensitivity with the new Small-Scan-Map mode either outperforming or meeting the performance of the original 64-point Jiggle Map in all areas. The new Small-Scan-Map map provides;

- Increased total mapping area
- Higher mapping speed
- Improved observer flexibility
- Higher data quality
- Improved redundancy
- Lower fundamental confusion limit

Small Scan Map Mode as the SPIRE Small Map Mode

The Small Scan Map mode is defined as follows;

- 1x1 orthogonal scan paths
- Scan Angle ± 42.4 degrees (fixed)
- Fixed scan path with guaranteed coverage of 5 arcmin diameter circle
- Fixed scan speed = $30''/s$
- Calibration flash made only at end of Observation
- Nominal bias settings (optimised for faint or moderately bright astronomical sources). Bright Source Settings not yet released
- Map offsets not yet released
- Otherwise identical to the SPIRE Large Scan Map mode

Sensitivity estimation

Sensitivity follows the Large-Map mode and the user is referred to the Large-Map mode release note.

Preliminary estimates of SPIRE's limiting sensitivity for point or compact sources in scan map mode indicate that

- (i) the performance predicted by HSpot for instrument noise is a reasonably accurate indication of the in-flight instrument noise levels (1sigma Jy/beam PSW=9.6mJy, PMW=13.2mJy, PLW=11.2mJy);
- (ii) the extragalactic confusion levels (rms sky fluctuation in a map from which detected point sources have been carefully removed) is on the order of 6 – 8 mJy in all bands, also consistent with pre-flight expectations. Note that these confusion limits are 22% lower than the estimates from the original 64-point Jiggle Small Map mode.

This is subject to caveats concerning the flux density calibration (see Large Map mode release note), and the fact that galactic confusion noise can vary considerably over the sky.

At present users may assume that the original sensitivities for the small-map mode (original 64-point Jiggle Maps) correspond to 3 repetitions of the new Small-Scan-Map mode. Note that the total observation time (including overheads) for **three** Small-Scan-Map repetitions is equivalent to a **single** original 64-point Jiggle Map repetition, i.e. there is no difference in the sensitivities for an equivalent total observation time.

Map Coverage

For a given observation the area covered by both scan legs defines a central square of side 5 arcmins although the length of the two orthogonal scan paths are somewhat longer than this. In practice, due to the position of the arrays on the sky at the time of a given observation, the **guaranteed** area for scientific use is a circle of diameter 5 arcmins.

Beam profiles

Identical to the Large Map Mode (See Large Map Mode Release note)

Flux density calibration

Identical to the Large Map Mode (See Large Map Mode Release note)

Pointing

Identical to Large Map mode, source positions may be off by a few arcseconds due to the spacecraft absolute pointing error of approx. 2" plus another systematic term of 1-3" in the case of SPIRE, which is being investigated.

Pipeline status

The current Small-Scan-Map pipeline (referred to as POF-10) is derived from the Large-Map (POF-5) pipeline and supersedes the original 64-point Jiggle pipeline (POF-3). The pipeline is available from HIPE v.2.2 onwards. The algorithms and calibration files are at present identical to the Large-Map (POF-5) pipeline. In the future, small tuning modifications of parameters may be made. Similarly to the Large-Map mode the pipeline provides usable Level-1 and Level-2 products, but has not yet been fully optimised for removal of all instrument and observatory systematics. Further improvements in processing are in development. New calibration files which could improve data quality running the pipeline from Level 0.5 to Level 2 will also become available in the future.

There are currently caveats on several aspects of all scan map pipelines and the user is referred to the Large-Map release note for discussions on baseline subtraction between the Level 1 timeline and Level 2 product maps, deglitching algorithms, etc.

Current maps are produced using a naive mapmaker. The status of the alternative MadMap algorithm is given in the Large-Map release note.