SPIRE ICC

User Requirements Document
Astronomical Observation Preparation

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Draft 3

18 May 2001

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User Requirements Document Interactions with PACS and HIFI ICCs

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1 Modification history

Date	Version	Author	Change description
16/07/00	D1	M. Sauvage	Document creation
5/12/00	D2	M. Sauvage	Rephrased some requirements, used document template.
18/05/01	D3	M. Sauvage	Numbered requirements for cross-checks

2 Introduction and context

This subsection of the SPIRE ICC URD is intended to cover the topics described in the URD Scope Description as follows:

> **Requirements for the need to be able to prepare astronomical observations using the instrument. Those preparing observations might be ICC calibration scientists or astronomers interacting with the ICC via the FSC.**

One should note that the FSC indeed expects the SPIRE ICC to provide a software tool to allow the preparation of SPIRE observations by non-specialist SPIRE users. One should also note that this is different from a tool that would allow to actually enter an observation into the database of schedulable FIRST observations. It is expected that this tool will be produced and developed in the FSC, incorporating the AOT to instrument logic "translator" developed by the SPIRE ICC (which is not referred to either in this section, see below).

This document is written under the following assumptions:
- SPIRE observing modes (the AOTs) have been defined and documented.
- The logic that converts AOT parameter values into actual command sequences for SPIRE exists or is well documented.
- A detailed knowledge of the instrument performances will have been gathered from ground-based calibration.

We also remind that the aim of such a facility is to allow the preparation of astronomical observations. Therefore its aims are not to fully simulate the observation (e.g. from a model of the sky to a model of the output data, an aspect covered in another section of the URD). It should rather help observers compute the value of the different AOT parameters that will allow them to reach their scientific/calibration goals in terms of signal-to-noise ratio.

Following the above remarks, it is clear that the main users of the facility will be observers (from the ICC or external to it). However, one can foresee that the instrument capacities will vary. This should then be reflected in this observing time estimator tool. Therefore, developers of the system can also be thought of as users, in the sense that the necessity of being able to adapt the system to new instrument conditions also place requirements on it.

Therefore the requirements are distributed in 3 sections:
- Systems requirements that cover issues dealing with the conception, functioning and upgrading of the system

- Observers requirement that deals more specifically with those driven by the main users of the system.
- Host requirements, which stems from the fact that the ICC will be the host for the system development and quite likely its use as well, and this implies the definition of some interfaces and policies with the users.

In the rest of this document, the above-mentioned facility or system will be called "time estimator tool". This is only for simplicity reasons. It may very well be the case that this “tool” is not materialized as an independent system, but is in fact a particular property of a larger facility (e.g. the interactive analysis, etc…). This term also applies to any parameter file that may be required to run the tool.

As a final note, we mention that the URD listed here could be considered more as URD on the tool itself, rather than on the ICC. However, given that it is the ICC's responsibility to develop and maintain such a tool, it seems that any requirement on the system actually places a requirement on the ICC.

Note: (MS) in short, it seems to me that for a system that has to be developed in the ICC, any requirements such as "the system shall be able to do that" can be rephrased as "the ICC shall ensure that the system is able to do that".

3 System requirements

3.1 development – UR-AOP-100

3.1.1 Readiness – UR-AOP-110

The time estimator is one the key element in estimating the actual feasibility of given science programs (the other one being the simulator tool described in another section of the URD). Therefore it should in principle be available at the time the Guaranteed Time science program is elaborated.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

3.1.2 Flexibility - UR-AOP-120

Almost by definition, the time estimator tool will be used from or at different institutes. It is therefore advisable that the tool be available in such a way that it requires little or no modification to run on different platforms.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

3.1.3 Supported AOTs - UR-AOP-130

Although this is already implicit, the time estimator should support all official SPIRE observing modes, for both broad-band imaging and spectro-imaging.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

3.1.4 Files for instrument parameters - UR-AOP-140

The instrument parameters (noise levels, sensitivities, transmissions, …) accessed by the time estimator tool must be able evolve as rapidly as our knowledge of them. The system shall be designed in such a way that the resources required by this task are kept to a minimum.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Yearly
4 - Phase	Ground Segment Testing

3.1.5 Values of instrument parameters - UR-AOP-150

To avoid mismatches between predicted times and actual observing times, values of the instrument parameters should strictly reflect our knowledge of them. No rounding should occur.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

3.1.6 Instrument's logic - UR-AOP-160

The instrument's logic and principally its timing, should be followed as close as possible. This is in order to include all possible dead-times (telescope motion, buffer times to avoid command collisions…) so that the time computed to reach a certain goal is as close as possible to the actual observing time. Any modification of the instrument's logic shall be reflected in the time estimator tool as soon as possible.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Yearly
4 - Phase	Ground Segment Testing

3.1.7 Outputs - UR-AOP-170

The time estimator tool is however not meant to produce a meaningful instrument command sequence, which is of no use to the observer. In designing the output content and format, one must remember that parameters such as sensitivity, signal-to-noise, observing time, should be easily accessible to the user. The output of one estimation shall be in a form that allows a quick comparison with outputs from previous estimations.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not Applicable
4 - Phase	Ground Segment Testing

3.2 Maintenance - UR-AOP-200

3.2.1 Documentation - UR-AOP-210

It is expected that, due to the rather long lifetime of the FIRST telescope, the time estimator tool will be maintained by persons that may not have participated in its development. Thus the tool shall be well documented, both in its algorithmic part and in its structure, to allow quick identification of the parts to upgrade.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not Applicable
4 - Phase	Ground Segment Testing

3.2.2 Versions - UR-AOP-220

It is almost inescapable that the time estimator will be upgraded to reflect either real changes in the instrument performances, modification of AOTs, or improvements regarding the knowledge of the instrument. These changes should therefore proceed through clearly identified and documented versions in order to minimize the risk of users unknowingly running obsolete versions.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Yearly
4 - Phase	Ground Segment Testing

3.2.3 Evolving calibration - UR-AOP-230

Given the foreseen lifetime of FIRST/SPIRE, it is clear that the tool will be used during the mission, and there is a high probability that instrument parameters will vary. Thus care should be taken to reflect any modification of the instrument parameters that could be introduced in other ICC subsystems in this system as well.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Yearly
4 - Phase	Ground Segment Testing

4 Observer requirements

4.1 Inputs - UR-AOP-300

4.1.1 Minimal input - UR-AOP-310

The tool shall allow the user to rapidly explore the parameter space for a given observation. Therefore a minimal set of input values shall be defined that ensure that all these values are absolutely mandatory for the computation, and cannot be meaningfully replaced by default values.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

4.1.2 Sources - UR-AOP-320

The tool is not intended to provide an accurate simulation of the actual observation, but rather allow the observer to find an instrumental set-up that will permit to reach the scientific goals. Therefore the tool should be able during its computation to distinguish between point and extended source (selected by the user), but it is not required that it is able to simulate the observation of a given map.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

4.1.3 Backgrounds - UR-AOP-330

In the operating wavelength range of SPIRE, the background can be important and place limitations to the observing capabilities of some AOT. Since the FIR/Submm background is not constant on the sky, the time estimator tool should be able to provide the user with suitable background data or allow the to enter background values.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

4.1.4 Spectral energy distribution - UR-AOP-340

SPIRE has broad imaging bands and is also a spectrometer. Therefore a complete description of the targets also includes their spectral energy distributions. The time estimator tool should allow its user to choose between various spectral energy distributions and modify their parameters at will. A meaningful default set of values shall also be defined

1 - Source	Here

2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

4.1.5 Noises - UR-AOP-350

All sources of noise should be included in the computation of the estimated signal-to-noise ratio, i.e. all instrumental but also all sky sources of noise. Confusion noise should thus be considered as well in the computation. Given that the value of the confusion noise can be definition-dependent, the noise sources and their amplitude should be well-documented.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

4.2 Outputs - UR-AOP-400

4.2.1 Synthetic output formats - UR-AOP-410

It is foreseen that users will play with the time estimator tool, make a number of test cases, and then use them off-line to design an observing strategy. Therefore the tool shall be able to create synthetic outputs where the values of input parameters (sources, background, AOT parameters), the time estimator tool version number, and the result of its computations (preferably on a graphic form) are all available.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

4.2.2 Easy replay - UR-AOP-420

A mechanism shall be defined that allow the parameters of a given time estimation to be stored and replayed, without forcing the user to enter/select them one by one from independent notes. This will also allow quick comparison between different versions of the tool.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

4.3 Interaction with the tool - UR-AOP-500

4.3.1 Main command mode - UR-AOP-510

The main mode of interaction with the time estimator tool should be through a graphical user interface, allowing selection of input information from buttons, menus and command boxes.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

4.3.2 Replay mode - UR-AOP-520

The tool should be able to read its complete set-up from a single user-defined location (e.g. a file) so that the user can rapidly configure the tool in a given set-up and replay a test case.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

5 Host requirements - UR-AOP-600

5.1 Common elements - UR-AOP-610

It is clear that the system described here shares some common modules with the instrument simulator described in another section of this URD, although it is intended toward simpler-minded users that do not make a complete simulation of the sky they want to observe. Therefore the ICC shall make sure that common modules between the time estimator tool and the instrument simulator are identified and developed only once, or at least by the same team.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

5.2 Overview - UR-AOP-620

A number of systems are already identified that provide some sort of simulation of the instrument. The ICC shall regularly survey the internal consistency of all these systems, and take appropriate actions when such a consistency is no longer maintained.

1 - Source	Here
2 - Importance	Essential
3 - Frequency	Yearly
4 - Phase	Ground Segment Testing

5.3 User's training - UR-AOP-630

First users of the time estimator tool will be members of the SPIRE consortium. The ICC shall therefore ensure that it has the proper resources, both in manpower and documentation, to provide the necessary training for the consortium members.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

5.4 Interface with the FIRST Science Center – Development - UR-AOP-640

The time estimator tool is expected to be delivered or made available to the FSC for use by the broader community of FIRST observers. The SPIRE ICC shall ensure that the development choices made for the time estimator tool comply with the FSC expectation.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

5.5 Interface with the FIRST Science Center – Delivery - UR-AOP-650

General observers will use the time estimator tool independently of the ICC, and will only interact with the FSC. In SPIRE's interest, the ICC shall make sure that along with the tool's actual delivery, necessary expertise and documentation are also transferred to the FSC.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing

5.6 Interface with the FIRST Science Center – Person - UR-AOP-660

It is expected that the FSC will probably not be able to handle all user's question on the time estimator tool, or will discover problems in the tool's functioning. The ICC shall identify a contact person, in the team responsible for the development and maintenance of the time estimator tool, to ensure proper information exchange between the ICC and the FSC.

1 - Source	Here
2 - Importance	Highly desirable
3 - Frequency	Not applicable
4 - Phase	Ground Segment Testing