SPIRE Instrument Control Center: Time Estimator Use-Cases

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Contents

Introduction

This is intended to give a few more information difficult to capture in the use-case, mostly regarding the scope of the time estimator, its users, and other random notes.
An important fact about the time estimator is that it is a deliverable to the HCSS, to be used principally by astronomers wishing to propose SPIRE observations. This places a constraint on ease-of-use, which will have to be taken into account when creating the tool. Another constraint that this raises is the fact that all overheads have to be included in the time provided by the time estimator to its user. Indeed while it is within the reach of diplomatic skills to explain to the consortium why observing times have to be increased suddenly, without the instrument having suffered any degradation, it is devastating for the instrument's public image to have to do that with the general astronomical community.
Given that the time-estimator will also be used by highly experienced ICC and instrument team members, it will likely include expert features to allow them exploring the SPIRE capacities in more detailed.

There are also a number of general open points that are collected here, but also appear in the use-cases.

- **Help in selecting observing modes**: At a number of occasions, there may be more than one way to use SPIRE for a given observation, but only one that is clearly best adapted to the scientific aims of it. How will the user know this? In a high-profile version of the simulator, this knowledge is embedded in it, and through sets of questions and/or forms, the tool leads the user to the appropriate more. In a low-profile version, all of this information is captured in an accompanying reference document.
- **Inputs for the time estimator**: this can take many aspects, from the most simple ones, i.e. a set of numbers describing a map size, line wavelengths, sensitivity goals, etc…, up to complex ones such as maps or spectral cubes resulting from simulations. Does the time estimator need to interface to all these inputs? Some early discussions would tend to lead to a strong no…
- **How does the time estimator actually computes time**? This can be through an approximation of the time needed to perform each observation block in the observation, which is obviously based on experiment but prone to errors, or through the actual generation of the telecommands and the computation of their timing (i.e. using the actual instrument logic). The latter offers the possibility to check the output of the time estimator for consistency.
- **Specialization of observing modes**: some very versatile observing modes, e.g. jiggle mapping, or spectral scan, can have some of their parameters set to standard values for specialized observations, e.g. mapping in only one filter, measurement of famous universal lines. These are going to be defined in collaboration with the consortium, but in case this specialization occurs, the time estimator has to allow the user a quick access to those standard set-ups.
- **Calibration time**: it is still unclear whether some or all observing modes will require systematic calibration measurements associated with the observation itself. We have to keep in mind that, should it be the case, any time needed for calibration would have to be computed as well by the time estimator and factored in the global result provided to the user.

- **Saturation**: it is possible to saturate the detectors (i.e. they become highly non-linear and a flux increase produces no more measurement increase). How is the user informed that the observation he/she is trying to estimate will saturate? In number of use-cases, no flux is provided by the user.

There is a last point related with the time estimator, but not part of the time estimator: a number of observational parameters, scan direction, chopping direction may be of little relevance to the time estimation, or inaccessible to the user at the time of observation preparation. They will however need to be set at some point, and optimized. We should have a tool to help us choose settings for these parameters in the most suitable way.

Finally, for use-case specialists, all use-cases presented here are user-level. There should be one summary level use-case to bring them all and (hopefully not in darkness) bind them. It will be written eventually.

UC-EST101: Estimate the sensitivity of an observational set-up

Level: **user**
Scope: **Time estimator**
Version: **1.0**
Status: **Draft**
Date: **4 September 2002**

Brief description:
This use-case deals with the situation where an observer, who has selected an observation set-up for SPIRE, wishes to know the sensitivity this will reach. It is generally invoked in the preparation of surveys, or in the very exploratory part of proposal creation. The observational set-up covers both the photometer and the spectrometer part of SPIRE.
In the Main Success Scenario, TE is the time estimator tool, it is not an actor, but it performs some actions.

Phase:
Probably after the ILT, and onward to the operational phase. This particular functionality of the TE can also be used post-operations, to investigate the suitability of existing observations in new science programs.

Actors:
AST: astronomer, an HCSS actor.

Triggers:
The feasibility of an observation has to be tested.

Preconditions:
Allowed operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing, including dead times) are known.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
The sensitivity allowed by the user-defined set-up is provided in a user-friendly format. A minimum amount of unsolicited output is provided (e.g. command sequences and the like).

Stakeholders and interests:
PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.
PI: SPIRE PI: needs to make sure the consortium is in a position to select observing modes for the guaranteed time.

Main Success Scenario:

1. AST: starts the time estimator
2. AST: selects the configuration to be tested
3. TE: validates that the mode is a valid SPIRE observing mode
4. TE: computes the achievable sentivity
5. TE: provides AST with the sensitivity figure in an appropriate format.

Extensions:

2a: AST cannot set the configuration yet it is a valid SPIRE configuration.
    2a1: AST: files a software problem report

3a: the selected mode is not a valid SPIRE observing mode
    3a1: TE: informs the AST of the problem, with a diagnostic, and exits.

References:

Open Issues:

In my mind, the time estimator is a relatively simple tool. This is the reason why this use-case implies that only valid observing modes can be tested. This would not be the case if the time estimator were really an instrument simulator. However, whatever the time estimator really is, we need that simple facility.
The user-provided data may be ridiculously small (i.e. a simple figure) so the minimum post conditions may be setting strong constraints with little benefits. What user-provided data to preserve will in fact depend on the implementation of the TE.

Comments:

At step 2, the way to select the configuration could be to point the time estimator to a configuration file, provided by the user. This is why I've written in the minimal post conditions that no user-provided data should be damaged in the process. As this use-case covers both the spectrometer and the photometer part of SPIRE, the sensitivity is expressed in units relevant to each of the modes.
At the end of the Main Success Scenario, the time estimator is ready for another computation or for exit.
In all these computations, the background level plays an important part. Tuning it is an essential functionality of the TE.
Since SPIRE will always observe with all its arrays in either photometric or spectrometric mode, there is no need to select filters.

Related work packages:

- Define the available modes of SPIRE.
- Measure the detector sensitivities and the different noise sources.
- Build the time estimator.

UC-EST102: Estimate the time needed to reach a given sensitivity

Level: **user**
Scope: **Time estimator**
Version: **1.1**
Status: **Draft**
Date: **12 September 2002**

Brief description:
In this use-case, the user knows the sensitivity he/she needs to reach. The time estimator is used to obtain the time required by SPIRE to reach this sensitivity. In practical terms, this generally means that the observer already knows which object(s) are going to be observed and how (but see the open issues section). This applies both to the photometer and the spectrometer.
The time estimator appears in the main success scenario, as TE, not because it is considered an actor, but because it performs some actions that need to be described.

Phase:
Probably after the ILT, and onward to the operational phase.

Actors:
AST: astronomer, an HCSS actor.

Triggers:
The feasibility of an observation has to be tested.

Preconditions:
Allowed operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing including idle time) are known.
Knowledge on the most suitable mode for a given observation is acquired and available.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
AST is provided with the time requested to perform the observation under the most-suitable instrument setting. This information is in a user-friendly form and a minimum amount of unsolicited output is produced (such as command sequences and the like).

Stakeholders and interests:
PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.
PI: SPIRE PI: needs to make sure the consortium is in a position to select observing modes for the guaranteed time.

Main Success Scenario:

1. AST: starts the time estimator
2. AST: provides time estimator with the sensitivity goal
3. TE: prompts user for instrument set-up
4. AST: provides instrument set-up to TE
5. TE: computes time needed to reach sensitivity goal
6. TE: outputs results in user-friendly form

Extensions:

2a: AST is interested only in a particular wavelength range (spectrometer) or waveband (photometer)
   2a1: AST: time estimator with wavelength range or band of interest
   2a2: TE: goes to main success scenario step 3

3a: TE knows how to select instrument set-up from science objectives
   3a1: TE: prompts user for science objectives (in standardized form)
   3a2: TE: selects appropriate mode and ask for AST validation
   3a3: AST: validates TE's choice
   3a4: return to Main Success Scenario at step 5

   3a3a: AST refuses TE's choice
      3a3a1: AST overrides TE's choice and goes to step 4

5a: Sensitivity goal is out of SPIRE's reach.
   5a1: TE informs AST that sensitivity cannot be reached.

References:

Open Issues:
At this time I don't know whether the user really needs to know how the observation is going to be performed. An "intelligent" time estimator may be able to propose the most appropriate observing mode, given some indications on the source and science type. In fact this information will probably be in the knowledge base of SPIRE. The question is how to connect it "automatically" to the time estimator.
The user-provided data may be ridiculously small (i.e. a simple figure) so the minimum post conditions may be setting strong constraints with little benefits. What user-provided data to preserve will in fact depend on the implementation of the TE.

Comments:
At the end of the main success scenario, the TE is ready for another computation, i.e. it does not need to be restarted.
The way the sensitivity goals are provided to the TE could be through a simulation of the sky, either an image or a spectrum. Note that the TE has to be able to deal with simple inputs such as a sensitivity figure in Jy/Beam, or any relevant figure (line flux, etc…) depending on the chosen side of SPIRE, photometer or spectrometer.
In all these computations, the background level is expected to play a strong part. Tuning it is an important aspect of the TE's functionality.

Since SPIRE will always observe with all its arrays in either photometric or spectrometric mode, there is no need to select filters. However, the user may be interested in a small part of the wavelength range of the spectrometer, or in one filter in which case there has to be a way to let the TE know that the sensitivity figure applies to a restricted part of SPIRE capacities.

Related work packages:

- Define the available modes of SPIRE.
- Obtain and organize knowledge on the most suitable observing modes for a given observation.
- Measure the detector sensitivities and the different noise sources.
- Build the time estimator.

UC-EST103: Estimate the time needed to map a given area

Level: **user**
Scope: **Time estimator**
Version: **1.1**
Status: **Draft**
Date: **12 September 2002**

Brief description:
In this use-case, the sensitivity is less an issue than the area. The user's objective is to obtain a map of a given object on the sky (generally extended). Of course some minimum sensitivity has to be achieved, but not at the price of a smaller mapped area.
The time estimator appears in the main success scenario, as TE, not because it is considered an actor, but because it performs some actions that need to be described.

Phase:
Probably after the ILT, and onward to the operational phase.

Actors:
AST: astronomer, and HCSS actor.

Triggers:
The feasibility of an observation has to be tested.

Preconditions:
Allowed operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing including idle time) are known.
Since there may be more than one way to map an area of the sky, knowledge on how to choose between the different mapping modes of SPIRE, with respect to the science objectives has been obtained and is available.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
AST is provided with the time requested to perform the map under the most-suitable instrument setting, as well as with the achieved sentivity of the map, with the map coverage explicitly provided (e.g. a map of the sensitivity projected on the sky). This information is in a user-friendly form and a minimum amount of unsolicited output is produced (such as command sequences and the like).

Stakeholders and interests:
PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.
PI: SPIRE PI: needs to make sure the consortium is in a position to select observing modes for the guaranteed time.

Main Success Scenario:

1. AST: starts the time estimator
2. AST: provides time estimator with the size of the area to map
3. AST: provides time estimator with the minimum sensitivity to achieve.
4. TE: prompts user for instrument mapping set-up (e.g. scan map or ra-dec)
5. AST: provides instrument set-up to TE
6. TE: computes time needed to reach mapping and sensitivity goals
7. TE: outputs results in user-friendly form including the sensitivity map.

Extensions:

3a: Sensitivity figure only applies to one filter
- 3a1: AST: indicates to TE which array is going to be used for science.
- 3a2: TE: returns to main success scenario at step 4.

4a: TE knows how to select instrument set-up from science objectives
- 4a1: TE: prompts user for science objectives (in standardized form)
- 4a2: TE: selects appropriate mode and ask for AST validation
- 4a3: AST: validates TE's choice
- 4a4: return to Main Success Scenario at step 5

- 4a3a: AST refuses TE's choice
  - 4a3a1: AST overrides TE's choice and goes to step 4

4b: There is only one way to map the sky
- 4b1: TE goes directly to step 6.

5a: Mapping and sensitivity goals are out of SPIRE's reach.
- 5a1: TE diagnoses the problem to the best of its knowledge (map too large, sensitivity too high, incompatible map size and sensitivity) and exits this computation.

References:

Open Issues:

In case there is more than one mapping mode in SPIRE, I don't know whether the user really needs to know which is the best suited to the observation. An "intelligent" time estimator may be able to propose the most appropriate observing mode, given some indications on the source and science type. In fact this information will probably be in the knowledge base of SPIRE. The question is how to connect it "automatically" to the time estimator.
The user-provided data may be ridiculously small (i.e. a simple figure) so the minimum post conditions may be setting strong constraints with little benefits. What user-provided data to preserve will in fact depend on the implementation of the TE.

Comments:

At the end of the main success scenario, the TE is ready for another computation, i.e. it does not need to be restarted.

The way the map and sensitivity goals are provided to the TE could be through a simulation of the sky. Note that the TE has to be able to deal with simple inputs such as a map size in arcminutes and a sensitivity figure in Jy/beam.
In all these computations, the background level is expected to play a strong part. Tuning it is an important aspect of the TE's functionality.
Given that there are at least two ways of mapping the sky (scan map, where we do not control the orientation of the map, and ra-dec, which is more a set of pointings, but where the orientation of the array will also be unknown), a single sensitivity figure is not very useful. What is really needed is a map of the covered sky showing the spatial sensitivity variations, and any holes in the map if they exist.
Since SPIRE will always observe with all its arrays in either photometric or spectrometric mode, there is no need to select filters. However, the user may be interested only in one of the three wavebands, which may relax many constraints on how to achieve the sensivity goal (or increase them). There should be a way to indicate that to the TE and optimize the computation accordingly.

Related work packages:

- Define the available modes of SPIRE.
- Obtain and organize knowledge on the most suitable observing modes for a given observation.
- Measure the detector sensitivities and the different noise sources.
- Build the time estimator.

UC-EST104: Estimate the time needed to obtain a spectral energy distribution

Level: **user**
Scope: **Time estimator**
Version: **1.0**
Status: **Draft**
Date: **4 September 2002**

Brief description:
This use-case deals with the spectrometer. We separate between the spectral energy distribution and the line flux because they imply different spectral resolution and scan length, which may lead to different observing modes of SPIRE.
In a spectral energy distribution observation, the science target is to obtain a full scan of the SPIRE wavelength band, with an emphasis on the broad spectral shape rather than on individual features.

Phase:
Probably after the ILT, and onward to the operational phase.

Actors:
AST: astronomer, and HCSS actor.

Triggers:
The feasibility of an observation has to be tested.

Preconditions:
Allowed operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing including idle time) are known.
Since there may be more than one way to obtain the spectral energy distribution of an object, knowledge on how to choose between the different spectrometer observing modes of SPIRE, with respect to the science objectives, has been obtained and is available.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
AST is provided with the time requested to derive the spectral energy distribution under the most-suitable instrument setting, as well as with the achieved spectral resolution and sentivity along the spectrum. This information is provided in a user-friendly form and a minimum amount of unsolicited output is produced (such as command sequences and the like).

Stakeholders and interests:

PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.
PI: SPIRE PI: needs to make sure the consortium is in a position to select observing modes for the guaranteed time.

Main Success Scenario:

1. AST: starts the time estimator
2. AST: provides time estimator with the characteristics of the SED to measure
3. AST: provides time estimator with the minimum sensitivity to achieve.
4. AST: provides time estimator with the maximum spectral resolution to achieve
5. TE: prompts user for instrument set-up
6. AST: provides instrument set-up to TE
7. TE: computes time needed to reach observing goals
8. TE: outputs results in user-friendly form, including achieved sensitivity and spectral resolution

Extensions:

5a: TE knows how to select instrument set-up from science objectives

    5a1: TE: prompts user for science objectives (in standardized form)
    5a2: TE: selects appropriate mode and ask for AST validation
    5a3: AST: validates TE's choice
    5a4: return to Main Success Scenario at step 7

    5a3a: AST refuses TE's choice
        5a3a1: AST overrides TE's choice and goes to step 6

5b: There is only one way to obtain spectral energy distributions

    5b1: TE goes directly to step 7.

5a: Sensitivity and spectral resolution goals are out of SPIRE's reach.

    5a1: TE diagnoses the problem to the best of its knowledge (sensitivity too high, spectral resolution too high, incompatible spectral resolution and sensitivity) and exits this computation.

References:

Open Issues:

In case there is more than one way to measure a spectral energy distribution with SPIRE, I don't know whether the user really needs to know which is the best suited to the observation. An "intelligent" time estimator may be able to propose the most appropriate observing mode, given some indications on the source and science type. In fact this information will probably be in the knowledge base of SPIRE. The question is how to connect it "automatically" to the time estimator.

Comments:

At the end of the main success scenario, the TE is ready for another computation, i.e. it does not need to be restarted.

The way the SED, the sensitivity and spectral resolution goals are provided to the TE could be through a simulation of the sky and source. Note that the TE has to be able to deal with simple inputs such as a mean flux density and a wavelength interval.
In all these computations, the background level is expected to play a strong part. Tuning it is an important aspect of the TE's functionality.

Related work packages:

- Define the available modes of SPIRE.
- Obtain and organize knowledge on the most suitable observing modes for a given observation.
- Measure the detector sensitivities and the different noise sources.
- Build the time estimator.

UC-EST105: Estimate the time needed to obtain a line flux

Level: **user**
Scope: **Time estimator**
Version: **1.0**
Status: **Draft**
Date: **4 September 2002**

Brief description:
This use-case deals with the spectrometer. We separate between the spectral energy distribution and the line flux because they imply different spectral resolution and scan length, which may lead to different observing modes of SPIRE.
In the line flux measurement, the accurate measurement of the continuum shape is of little important. What matters is that the spectrum is accurately measured in an around the line, usually with a quite high spectral resolution. The zero point of the spectrum is also not that important, unless an equivalent width measurement is the science target.

Phase:
Probably after the ILT, and onward to the operational phase.

Actors:
AST: astronomer, an HCSS actor.

Triggers:
The feasibility of an observation has to be tested.

Preconditions:
Allowed operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing including idle time) are known.
Since there may be more than one way to measure line fluxes, knowledge on how to choose between the different spectrometer observing modes of SPIRE, with respect to the science objectives, has been obtained and is available.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
AST is provided with the time requested to measure the line(s) of interest under the most-suitable instrument setting, as well as with the achieved spectral resolution and sentivity along the spectrum. The accuracy of the continuum level measurement is also provided. This information is provided in a user-friendly form and a minimum amount of unsolicited output is produced (such as command sequences and the like).

Stakeholders and interests:
PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.

PI: SPIRE PI: needs to make sure the consortium is in a position to select observing modes for the guaranteed time.

Main Success Scenario:

1. AST: starts the time estimator
2. AST: provides time estimator with the characteristics of the line(s) to measure
3. AST: provides time estimator with the minimum sensitivity to achieve.
4. AST: provides time estimator with the maximum spectral resolution to achieve
5. TE: prompts user for instrument set-up
6. AST: provides instrument set-up to TE
7. TE: computes time needed to reach observing goals
8. TE: outputs results in user-friendly form, including achieved sensitivity, spectral resolution, and continuum measurement

Extensions:

5a: TE knows how to select instrument set-up from science objectives

5a1: TE: prompts user for science objectives (in standardized form)
5a2: TE: selects appropriate mode and ask for AST validation
5a3: AST: validates TE's choice
5a4: return to Main Success Scenario at step 7

5a3a: AST refuses TE's choice
5a3a1: AST overrides TE's choice and goes to step 6

5b: There is only one way to measure line fluxes
5b1: TE goes directly to step 7.

5a: Sensitivity and spectral resolution goals are out of SPIRE's reach.
5a1: TE diagnoses the problem to the best of its knowledge (sensitivity too high, spectral resolution too high, incompatible spectral resolution and sensitivity) and exits this computation.

References:

Open Issues:

In case there is more than one way to measure a line flux with SPIRE, I don't know whether the user really needs to know which is the best suited to the observation. An "intelligent" time estimator may be able to propose the most appropriate observing mode, given some indications on the source and science type. In fact this information will probably be in the knowledge base of SPIRE. The question is how to connect it "automatically" to the time estimator.

Comments:

At the end of the main success scenario, the TE is ready for another computation, i.e. it does not need to be restarted.
The way the line(s) characteristics, the sensitivity and spectral resolution goals are provided to the TE could be through a simulation of the sky and source. Note that the TE has to be able to deal with simple inputs such as a line wavelength, width, and flux, continuum level.

In all these computations, the background level is expected to play a strong part. Tuning it is an important aspect of the TE's functionality.

Related work packages:

- Define the available modes of SPIRE.
- Obtain and organize knowledge on the most suitable observing modes for a given observation.
- Measure the detector sensitivities and the different noise sources.
- Build the time estimator.

UC-EST106: Obtain the sensitivity as a function of varying allowed SPIRE parameters

Level: **user**
Scope: **Time estimator**
Version: **1.0**
Status: **Draft**
Date: **4 September 2002**

Brief description:
When exploring ways to achieve a given science objective, the user will often want to see how the achieved sensitivity changes when a given SPIRE observing parameter is changed (i.e. scan speed in a mapping mode, spectral resolution in a spectrometer mode). This use-case is present to make sure there is an efficient way of producing this information, i.e. ensuring that the only way is not for the user to run series of simulations for each different value of the parameters.

Phase:
Probably after the ILT, and onward to the operational phase. This particular functionality of the TE can also be used post-operations, to investigate the suitability of existing observations in new science programs.

Actors:
AST: astronomer, an HCSS actor.

Triggers:
The feasibility of an observation has to be tested.

Preconditions:
Allowed operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing including idle time) are known.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
AST is provided with an object clearly showing the evolution of the sensitivity as a function of the parameter that varies. This object can be a graph, a table or any other user-friendly format. It can be made permanent (i.e. written to a file, printed) for later browsing. A minimum amount of unsolicited output is produced (such as command sequences and the like).

Stakeholders and interests:
PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.

PI: SPIRE PI: needs to make sure the consortium is in a position to select observing modes for the guaranteed time.

Main Success Scenario:

1. AST: starts the time estimator.
2. AST: selects a SPIRE observing mode.
3. AST: selects a parameter to vary and provide range of values.
4. TE: shows variation of sensitivity with selected parameter.

Extensions:

References:

Open Issues:
The achieved sensitivity of a mode may depend on the mean flux falling on the detectors. Therefore there could be an extra step where this information is provided to the TE, or where the TE asks for it.
The user-provided data may be ridiculously small (i.e. a simple figure) so the minimum post conditions may be setting strong constraints with little benefits. What user-provided data to preserve will in fact depend on the implementation of the TE.

Comments:
At the end of the main success scenario, the TE is ready for another computation, i.e. it does not need to be restarted.

Related work packages:

- Define the available modes of SPIRE.
- Obtain and organize knowledge on the most suitable observing modes for a given observation.
- Measure the detector sensitivities and the different noise sources.
- Build the time estimator.

UC-EST107: Obtain the observation efficiency as a function of varying allowed SPIRE parameters

Level: **user**
Scope: **Time estimator**
Version: **1.0**
Status: **Draft**
Date: **12 September 2002**

Brief description:
When exploring ways to achieve a given science objective, the user may not always be aware of all the idle time generated by the chosen set-up. The time estimator should provide a way to explore how the observation efficiency (i.e. the ratio of time collecting signal useful to the observation to the total time) varies with all the allowed parameter ranges available to the observation of interest. All time estimations should give the SPIRE efficiency reached by the chosen set-up, but this use-case ensures that there is a quicker way to assess the changes in efficiency than to run series of simulations.

Phase:
Probably after the ILT, and onward to the operational phase.

Actors:
AST: astronomer, an HCSS actor.

Triggers:
The astronomer has only a fixed amount of time to observe and whishes to make the most of it.

Preconditions:
Allowed operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing including idle time) are known.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
AST is provided with an object clearly showing the evolution of the efficiency as a function of the parameter that varies. This object can be a graph, a table or any other user-friendly format. It can be made permanent (i.e. written to a file, printed) for later browsing. A minimum amount of unsolicited output is produced (such as command sequences and the like).

Stakeholders and interests:
PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.

PI: SPIRE PI: needs to make sure the consortium is in a position to select observing modes for the guaranteed time.

Main Success Scenario:

5. AST: starts the time estimator.
6. AST: selects a SPIRE observing mode.
7. AST: selects a parameter to vary and provide range of values.
8. TE: shows variation of efficiency with selected parameter.

Extensions:

References:

Open Issues:
The user-provided data may be ridiculously small (i.e. a simple figure) so the minimum post conditions may be setting strong constraints with little benefits. What user-provided data to preserve will in fact depend on the implementation of the TE.

Comments:
At the end of the main success scenario, the TE is ready for another computation, i.e. it does not need to be restarted.

Related work packages:

- Define the available modes of SPIRE.
- Measure the detector sensitivities and the different noise sources.
- Build and time the instrument logic (because this is where the efficiency comes from).
- Build the time estimator.

UC-EST108: Obtain the sensitivity as a function of varying any SPIRE parameters

Level: **user**
Scope: **Time estimator**
Version: **1.0**
Status: **Draft**
Date: **12 September 2002**

Brief description:
In the early exploration of the instrument performance, which observing mode to offer, etc…, the ICC and instrument team will often want to see how the achieved sensitivity changes when a given SPIRE observing parameter is changed (i.e. scan speed in a mapping mode, spectral resolution in a spectrometer mode). This use-case is present to make sure there is an efficient way of producing this information, i.e. ensuring that the only way is not for the user to run series of simulations for each different value of the parameters. It is very different from UC-EST106 because here it allows the user to select any SPIRE parameter and to vary it in a range that can possibly extend out of ranges considered as safe.
This is an expert-only feature of the time estimator.

Phase:
Probably after the ILT, and onward to the operational phase.

Actors:
IS: the ICC scientist, considered an expert user with respect to the time estimator and the exploration of SPIRE capacities.

Triggers:
The science capacities of SPIRE have to be explored.
SPIRE observing modes have to be trimmed down to a reasonable number.

Preconditions:
The broad operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing including idle time) are known.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
IS is provided with an object clearly showing the evolution of the sensitivity as a function of the parameter that varies. This object can be a graph, a table or any other user-friendly format. It can be made permanent (i.e. written to a file, printed) for later browsing. A minimum amount of unsolicited output is produced (such as command sequences and the like).

Stakeholders and interests:
PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.
PI: SPIRE PI: needs the observing mode of SPIRE to be as adapted as possible to the foreseen scientific uses of the instrument.

Main Success Scenario:

9. IS: starts the time estimator.
10. IS: selects a SPIRE observing mode.
11. IS: selects a parameter to vary and provide range of values.
12. TE: shows variation of sensitivity with selected parameter within provided range.

Extensions:
4a: IS has selected parameter that is not allowed to the general user or has chosen range of values that exceeds the recommended one
 4a1: TE: informs IS of the situation
 4a2 TE: shows variation of sensitivity with selected parameter within provided range.

References:

Open Issues:
The achieved sensitivity of a mode may depend on the mean flux falling on the detectors. Therefore there could be an extra step where this information is provided to the TE, or where the TE asks for it.
How do we unlock the expert use of the TE? Clearly having this possibility open to any user will only generate confusion.
The user-provided data may be ridiculously small (i.e. a simple figure) so the minimum post conditions may be setting strong constraints with little benefits. What user-provided data to preserve will in fact depend on the implementation of the TE.

Comments:
At the end of the main success scenario, the TE is ready for another computation, i.e. it does not need to be restarted.

Related work packages:

- Broadly define the available modes of SPIRE.
- Measure the detector sensitivities and the different noise sources.
- Build the time estimator.

UC-EST109: Obtain the observation efficiency as a function of varying any SPIRE parameters

Level: **user**
Scope: **Time estimator**
Version: **1.0**
Status: **Draft**
Date: **12 September 2002**

Brief description:
In the early exploration of the instrument performance, which observing mode to offer, etc…, the ICC and instrument team will may not always be aware of all the idle time generated by the chosen set-up. The time estimator should provide a way to explore how the observation efficiency (i.e. the ratio of time collecting signal useful to the observation to the total time) varies with all the allowed parameter ranges available to the observation of interest. All time estimations should give the SPIRE efficiency reached by the chosen set-up, but this use-case ensures that there is a quicker way to assess the changes in efficiency than to run series of simulations. It is very different from UC-EST107 because here it allows the user to select any SPIRE parameter and to vary it in a range that can possibly extend out of ranges considered as safe.
This is an expert-only feature of the time estimator.

Phase:
Probably after the ILT, and onward to the operational phase.

Actors:
AST: astronomer, an HCSS actor.

Triggers:
The science capacities of SPIRE have to be explored.
SPIRE observing modes have to be trimmed down to a reasonable number.

Preconditions:
The broad operational modes of the instrument are defined.
Instrument properties (detector sensitivities, instrument transmission, command timing including idle time) are known.

Minimal post-conditions:
No user-provided data are lost.

Success post-conditions:
IS is provided with an object clearly showing the evolution of the efficiency as a function of the parameter that varies. This object can be a graph, a table or any other user-friendly format. It can be made permanent (i.e. written to a file, printed) for later browsing. A minimum amount of unsolicited output is produced (such as command sequences and the like).

Stakeholders and interests:
PS: Project Scientist: needs to make sure astronomers are provided with a tool that will allow them to prepare their observations.
PI: SPIRE PI: needs the observing mode of SPIRE to be as adapted as possible to the foreseen scientific uses of the instrument.

Main Success Scenario:

13. IS: starts the time estimator.
14. IS: selects a SPIRE observing mode.
15. IS: selects a parameter to vary and provide range of values.
16. TE: shows variation of efficiency with selected parameter within provided range.

Extensions:
4a: IS has selected parameter that is not allowed to the general user or has chosen range of values that exceeds the recommended one
- 4a1: TE: informs IS of the situation
- 4a2 TE: shows variation of efficiency with selected parameter within provided range.

References:

Open Issues:
How do we unlock the expert use of the TE? Clearly having this possibility open to any user will only generate confusion.
The user-provided data may be ridiculously small (i.e. a simple figure) so the minimum post conditions may be setting strong constraints with little benefits. What user-provided data to preserve will in fact depend on the implementation of the TE.

Comments:
At the end of the main success scenario, the TE is ready for another computation, i.e. it does not need to be restarted.

Related work packages:
- Broadly define the available modes of SPIRE.
- Measure the detector sensitivities and the different noise sources.
- Build and time the instrument logic (because this is where the efficiency comes from).
- Build the time estimator.