Quick Start Guide
To HELL
(Herschel Explanatory Legacy Library)

Contents

1. What is HELL?

The knowledge gained by a space mission is not just measured in terms of data obtained, or the number of refereed publications, it is also measured in terms of the amount of technical knowledge and experience that is accumulated in solving the complex scientific and engineering problems entailed in designing and running a space mission from its initial concept to its final archive phase. This collective memory of a mission is one of the most important legacies that it provides. One of the issues with this collective memory us that, at different phases of a mission, unless the accumulated knowledge is documented , it may be lost as project members pass on to new missions and new challenges. The aim has been to conserve this collective knowledge as far as is possible for a future when no personnel remain who have experience of working for Herschel.

HELL is the Herschel Explanatory Legacy Library, a library of Herschel documentation that puts at the Legacy user's fingertips the most important documents of the thirty-five years of history of the Herschel mission. It has been one of the major products of the active archive phase of the Herschel mission: to build up a library of documentation that preserves the collective memory of Herschel. HELL is the result of a careful selection of the estimated more than one hundred thousand documents generated by the Herschel mission over its lifetime from initial concept, preserving the approximately 1% of documents generated that are the essential legacy of Herschel. The end result is a library of over 1200 documents that preserve the most essential knowledge of the Herschel mission.

2. How is HELL structured?

The HELL library is part of the Herschel Legacy Web Pages, a collection of information about all aspects of the Herschel mission and is arranged like a traditional library by areas and sections, with content for all types of readers from those who seek the most basic background information, to those – probably working on other missions – who seek the most detailed technical explanations.

2.1   The documentation pyramid

HELL is arranged in a pyramidal structure as shown in Figure 1. The documentation is divided into sections with documentation specific to each of the three instruments – HIFI, PACS and SPIRE – with observatory documentation, not specific to any instrument, as a fourth section giving a mission-wide perspective. Within each section there is a common format

Level 0.   At the top of the pyramid is the relevant Handbook. There is one for each instrument and an overall Observatory Handbook as the top level of the documentation pyramid. This gives an overview of the observatory or the particular instrument and can be considered as Level 0: the starting point for a legacy user to familiarise him or herself with Herschel and its instruments. From this handbook hangs the rest of the documentation in three levels of relevance.

Level 1.   This is a small number of the most fundamental background documents to understand an instrument, or for introducing users to its data. They assume little or no prior knowledge and are a suitable starting point for users and potential users with minimal technical background to orientate him or herself.

Level 2.   This is a larger number of more technical background documents that provide greater depth of knowledge. In general, the user should find enough information in the Level 2

documentation to be able to familiarise him or herself with an instrument and its data and to answer most questions.

Level 3.   This is the most detailed, technical and historical documentation. Level 3 documents are much greater in number and offer a mixture of historical, highly technical and, at times, out of date documentation (in this case giving information on the past state of an instrument or system that may be required by some high-level users). In general, Level 3 documentation is provided "as is" and with all appropriate caveats. The documentation in Level 3 provides information for users who need far more technical detail to understand a particular system or issue.
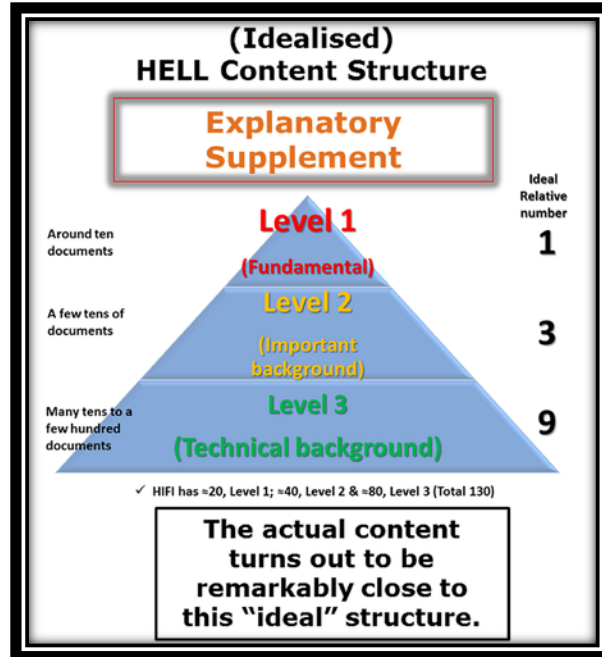
Figure 1: The idealised HELL structure for one of the instruments. In reality, the structure is actually quite close to this idealised concept.

In a few cases, Level 3 documents may contain restricted or proprietary information provided to ESA that is of interest to and fundamental for ESA employees and that forms a fundamental part of the documentation legacy of Herschel, but which cannot be made available to general users. These documents, a small fraction of the total (<5%), are password protected.

The way that the HELL knowledge flow works is illustrated in Figure 2.

2.2   Division by Areas
Within each level, the documentation is arranged in one of four areas:

- Overview
- Data products
- Calibration and performance
- Data processing
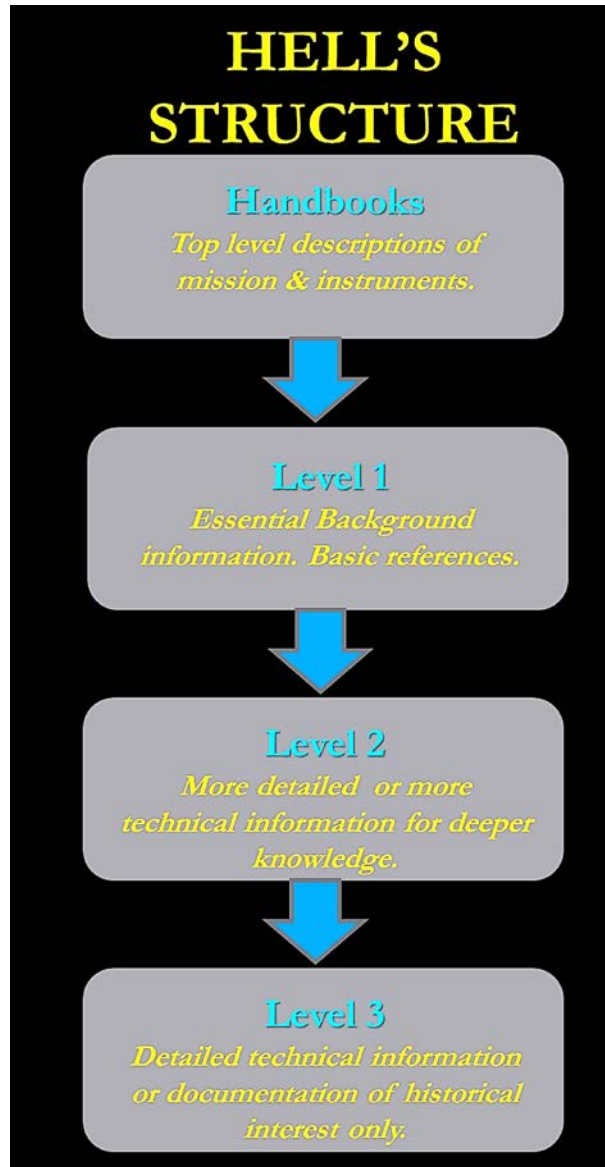
Figure 2: HELL knowledge flow. Generally a new user will start at the top and will work down through the levels until reaching the ultimate depth of knowledge that he or she requires.

2.1.1 Overview

Overview is what it says on the label: general background. So, if we go to, for example HIFI Level 1, the very first document in Overview is the fundamental reference paper for the HIFI instrument from the 2010 Special Edition of Astronomy and Astrophysics dedicated to Herschel. For each instrument and for the observatory too, that is the paper that you should read even if you read no other document. Below it you will find Quick Start Guides and Fact Sheets that are the most fundamental introductory information.

2.1.2 Data Products

If you are a future user of Herschel, the chances are that you are interested in Herschel data as the most fundamental legacy of the Herschel mission. Within the Data Products section you will find all the documentation that you require to understand Herschel data and Herschel data products. Within this area

you will find documentation explaining the different types of Herschel data products available to users, their uses, their content and their validity.

2.1.3   Calibration and Performance

The third general area of documentation is the performance of each instrument and how it was calibrated. Here you can find the information that you need to put Herschel data in its proper context: what was the PSF or the beam profile? How was flux calibration made? What was the instrument sensitivity? What performance issues need to be taken into account when using the data? How accurate is the pointing?

2.1.4   Data Processing

Here you will find all the information that you need to understand how Herschel data was processed and reduced. Should you wonder if you need to re-process data to get a better result than the product in the data archive, this is where you should start. Here you will find data reduction guides, description of the pipelines, specifications, etc.

2.3   Division by Keywords

Within a particular area you will find the documentation further divided by keywords. This is not so critical in Level 1 where there are few documents, but becomes essential in Level 3 where you may find dozens or even as many as one hundred documents in a particular area. As an example, if you have PACS spectrometer data, you want to find documentation relevant to the PACS spectrometer and not to the photometer so, you will often find a particular area divided into "Photometer" and "Spectrometer" and, where appropriate, a third division for documentation that is not specific to a particular sub-instrument.

Similarly, particularly in Level 3, documents are divided by keywords. And documentation collected under a keyword by antiquity.

For example, you go to PACS Level 3, Performance and Calibration and you will find the (many) documents divided into "Calibration", "In-flight performance and testing", "Pre-flight testing"".

 "In-flight testing is then further sub-divided into "Commissioning" (CoP Phase), "Performance Verification" (PV Phase), "Pointing", "Beams", "Detector", "Chopper", etc.

These same keywords are used to tag documents in the documentation repository.

3. HELL Content and Infrastructure

HELL hangs from the ESA public web server, Cosmos, within the structure of [Web pages for ESA missions](). All documentation is placed within the Cosmos Document Facility (better known to people who have worked at or with ESA as LiveLink, but now formally "Liferay") for long-term storage. This is effectively ESA's permanent security copy of documentation as it is guaranteed that the Cosmos Document Facility will be maintained as long as ESA still exists or, if replaced, it will replaced with a compatible system that will preserve the documentation. This system now has an estimated two million documents from different missions and departments in ESA.

However, the Cosmos Document Facility does not permit tags and, anyway, is not searchable by external search engines. In other words, even if an external user searches on the document tags that we use, a document in the Cosmos Document Facility will not be visible to the search.

3.1 The ESA Document Management System

Obviously, we wish the documentation in HELL to be visible to external users. In particular, we want a user searching the Internet for, for example, information the Herschel mission, to be able to locate the documents in HELL and to discover, in doing so, that a large library of documentation exists. In other words, we would like HELL to be accessible not just to people who know that it is there and search for it specifically, but also to serendipitous users who find a document link and decide to follow it like Theseus following Ariadne's thread and, in consequence, learn about Herschel and Herschel's data.

To make this possible, we use the ESA Document Management System (DMS) as a repository. This is Cosmos's own documentation repository so, although not a system that may exist necessarily eternally, it comes with the guarantees of the Cosmos infrastructure.

The DMS is searchable by Internet and does permit tagging.

All documents in HELL are placed in the ESA Document Management System (and, in parallel, in the Cosmos Document Facility), along with their summary or abstract and are tagged to allow them to be easily located by search engines.

The exception is the few non-public documents, for which the link in HELL is directed to the Cosmos Document Facility to maintain confidentiality. In the inventory spreadsheets these documents are highlighted with pink background.

3.2 HELL Content in the DMS

Documents are, with a very few necessary exceptions, stored in the DMS in PDF format. Each document is stored with a descriptive file name, abstract, date and version number, authors and keywords to allow easy retrieval.

Where possible, documents are genuine PDFs that are searchable internally and allow internal links to be followed. However, some older documents are inevitably PDFs of scans of documents, or pseudo-PDFs that neither conserve internal links nor permit internal searches for content.

One of the exceptions to the PDF format rule are the document inventories. Spreadsheets are provided in Excel and in CSV format for each instrument and for all documentation in HELL to be sorted on multiple criteria and allowing searches to be made on document class or keywords to retrieve all documentation of a class of interest.

Similarly, in a few cases, a link in HELL may be to a download page, or to a page that links to other documents originally in the Herschel Twiki pages, which are now no longer maintained: these may be Twiki pages converted to PDF to allow the links to be followed.

3.3 Documentation Long-Term Preservation Guarantees

Even though all documents placed in the Cosmos Document Facility are, in principle, guaranteed for the lifetime of ESA, the fact that we effectively have two, independent copies of documents in two

independent long-term repositories, effectively means that even in the event of a major IT disaster, HELL can be reconstructed as we have a table linking the URL of every document placed in the DMS to the URL of the copy in the CDF.

4. Entering HELL

If you wish to enter the Gates of HELL you may find them at the following URL:

https://www.cosmos.esa.int/web/herschel/legacy-documentation

This link takes you to the following Portal (Figure 2):
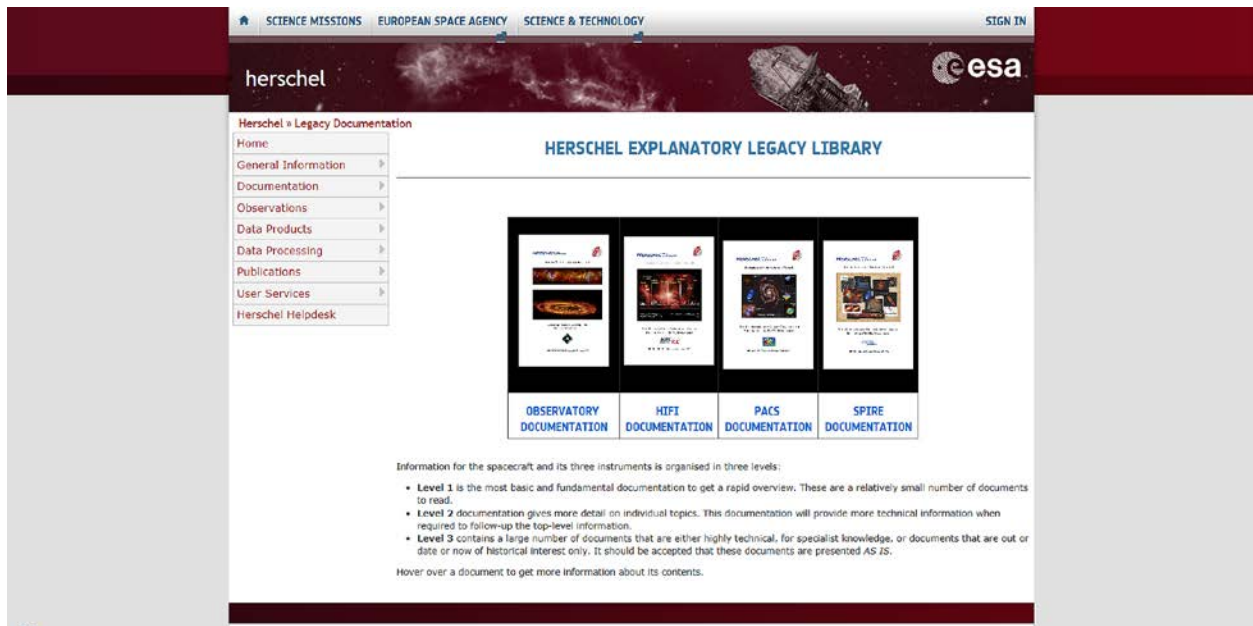
Figure 3: The HELL main Portal.

Suppose you are searching for information about a particular instrument. How might you surf the content of HELL to find what you need? Here is a typical example of your work flow.

Select the instrument that interests you, or the observatory pages. Let us suppose that we want information on HIFI. To get it we click on HIFI.

We will enter the HIFI Level 1 page, as shown in Figure 3.
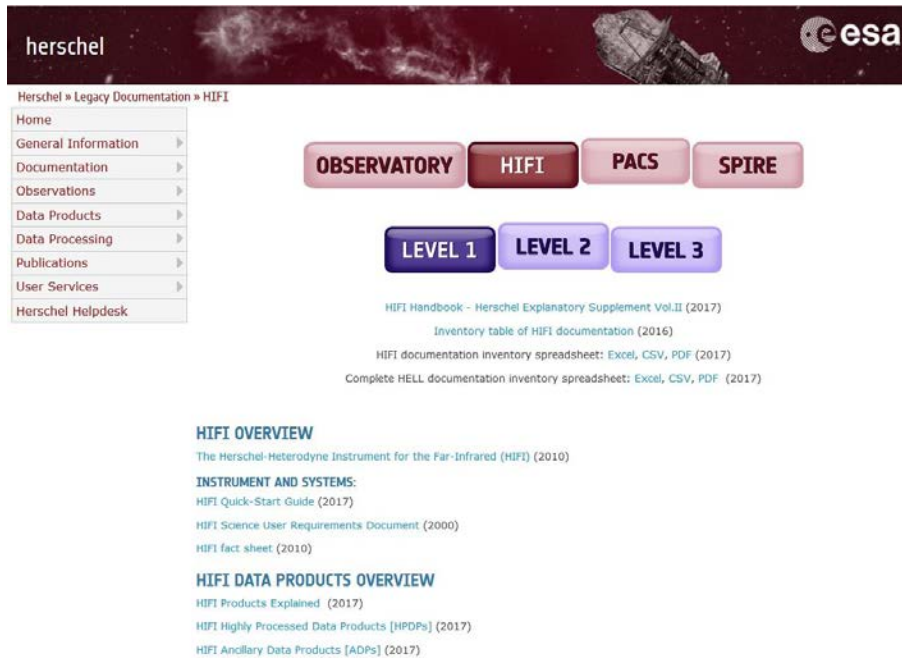
Figure 4: The HIFI Level 1 page. "HIFI" and "Level 1" are highlighted to show that this is the active page.

Here we can see the organization by areas and by keywords.

At the top of the page we find:

- The HIFI Handbook – the complete guide to HIFI.
- A Twiki inventory table of HIFI documentation (as supplied by the HIFI ICC).
- The HIFI inventory spreadsheet as Excel and CSV in the same format as for the other instruments.
- The complete observatory inventory spreadsheet as Excel and CSV.

Below we find the HIFI Overview documents and then the HIFI Data Products Overview documents.

The document link gives only the title and the year of publication to minimise clutter.

If, however, we hover over a document, we see a tooltip with more information, as in Figure 4. At very least, the document name, or alternative name, the reference (journal reference for published papers, internal document number for Herschel documents), version number, date of release and author(s). Where necessary, additional information on the content of the document may be available in the tooltip.

4.1   A Typical HELL Workflow

Suppose that you have some HIFI data, but what to understand more about HIFI before working with it. What is your typical workflow using HELL?

We use the case of HIFI here, but it would be the same for PACS or SPIRE.
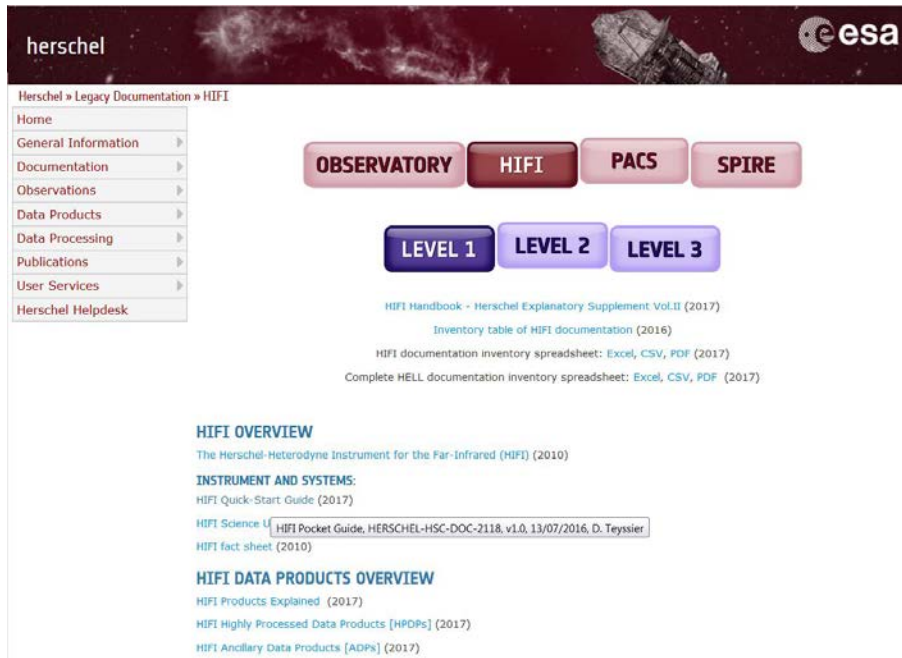
Figure 5: An illustration of a tooltip which appears when hovering over a document. This gives more information on the document, in this case, the original title, the number in the Herschel document numbering system (i.e. the formal reference), the version, the date that the version was published and the author.

If you want a quick overview of the instrument, the HIFI Fact Sheet, or the HIFI Quick Start Guide are good places to start. The HIFI Factsheet, as the other instrument Factsheets, present some basic background to the instrument in a very visual way. The Quick Start Guides are what they say on the wrapper a quick summary of the most important information found in the instrument Handbook, so they are a great place to start if you want to find out the basics and to know what else you should study.

Click on the HIFI Quick Start Guide as in Figure 5:

Figure 6: The link to the HIFI Quick Start Guide.

And you will enter the document, as in Figure 6.
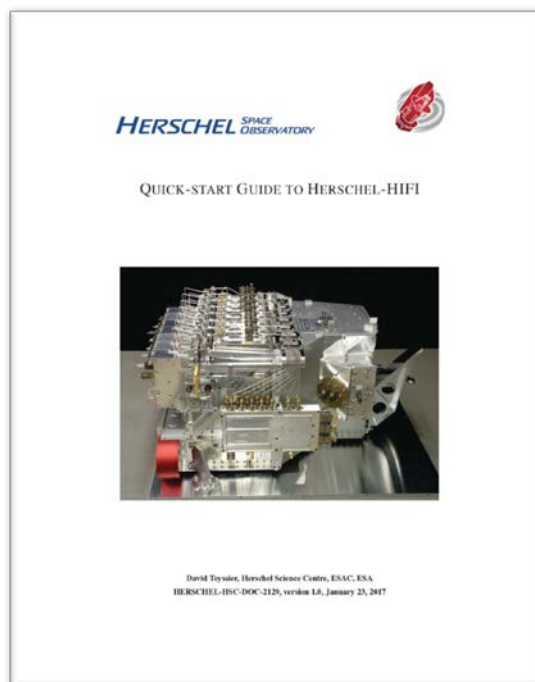
Figure 7: The cover page of the HIFI Quick Start Guide.

If all you need is a simple, top level introduction to HIFI, the Quick Start Guide may be all you need. However, it may just be the starting point for your questions. If you have some HIFI data, before starting to analyse it, you may well want to understand a bit better how it was taken. Drop down to Level 2 and select the HIFI Observers' Manual, as in Figure 8.

Figure 8: HIFI Level 2 documentation with the HIFI Observers' Manual highlighted.

This is a short guide for users on how to prepare HIFI observations for submission and, as we see in the title page (Figure 9), was written for the last Announcement of Opportunity for observing time with Herschel, so represents the state of the art.

Figure 9: The title page of the HIFI Observers' Manual. Here you will find out state of the art information on how HIFI observations were prepared for submission.

You now know quite a lot of useful background to HIFI and you know about how HIFI observations were prepared. You may well though have some kind of technical question that occurs to you and need to get into real detail about the instrument to resolve it. If you drop down into Level 3, you will find the real technical detail that you need as in Figure 10.
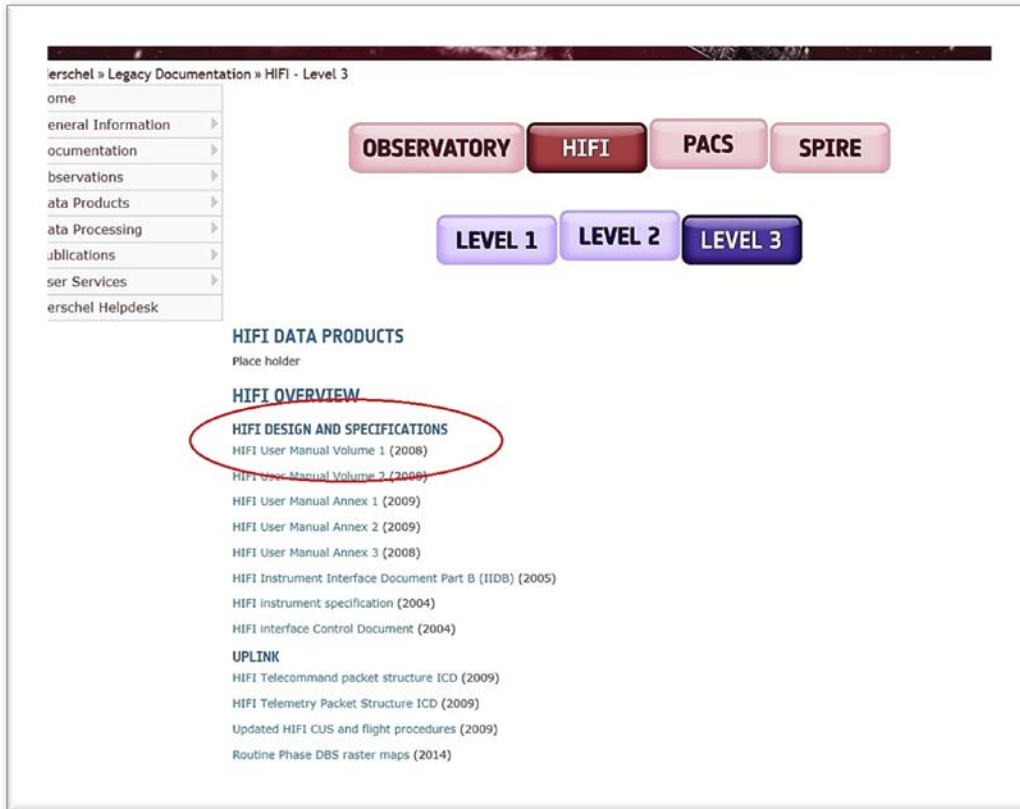
Figure 10: The HIFI level 3 documentation page in HELL. Here you will find highly technical documentation for the deepest knowledge.

Here you will find the HIFI User Manual, or the HIFI Instrument Specification document, which enter into a depth of technical detail (Figure 11).
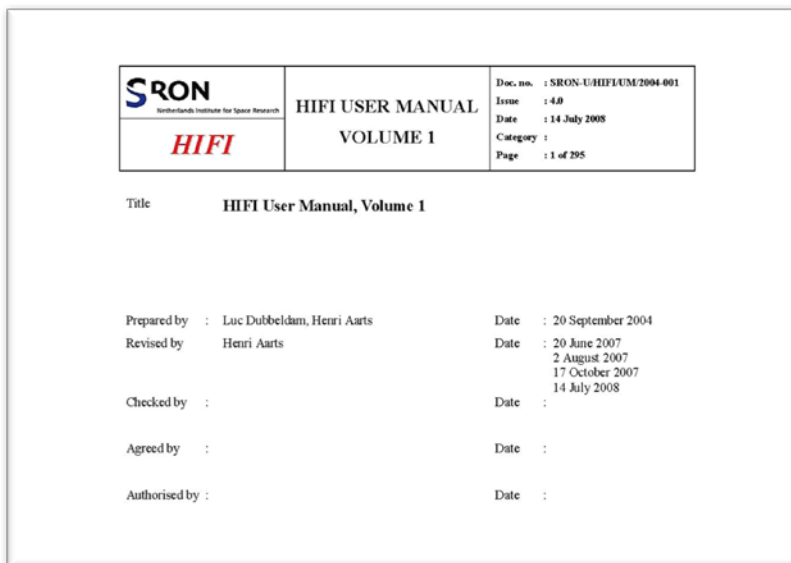
Figure 11: The HIFI User Manual. The detailed technical manual for the HIFI instrument, as flown.

4.2 Workflow Summary in HELL

A summary of how a typical user might use HELL is shown in Figure 12. This is just one example of how you may surf the different levels of documentation.
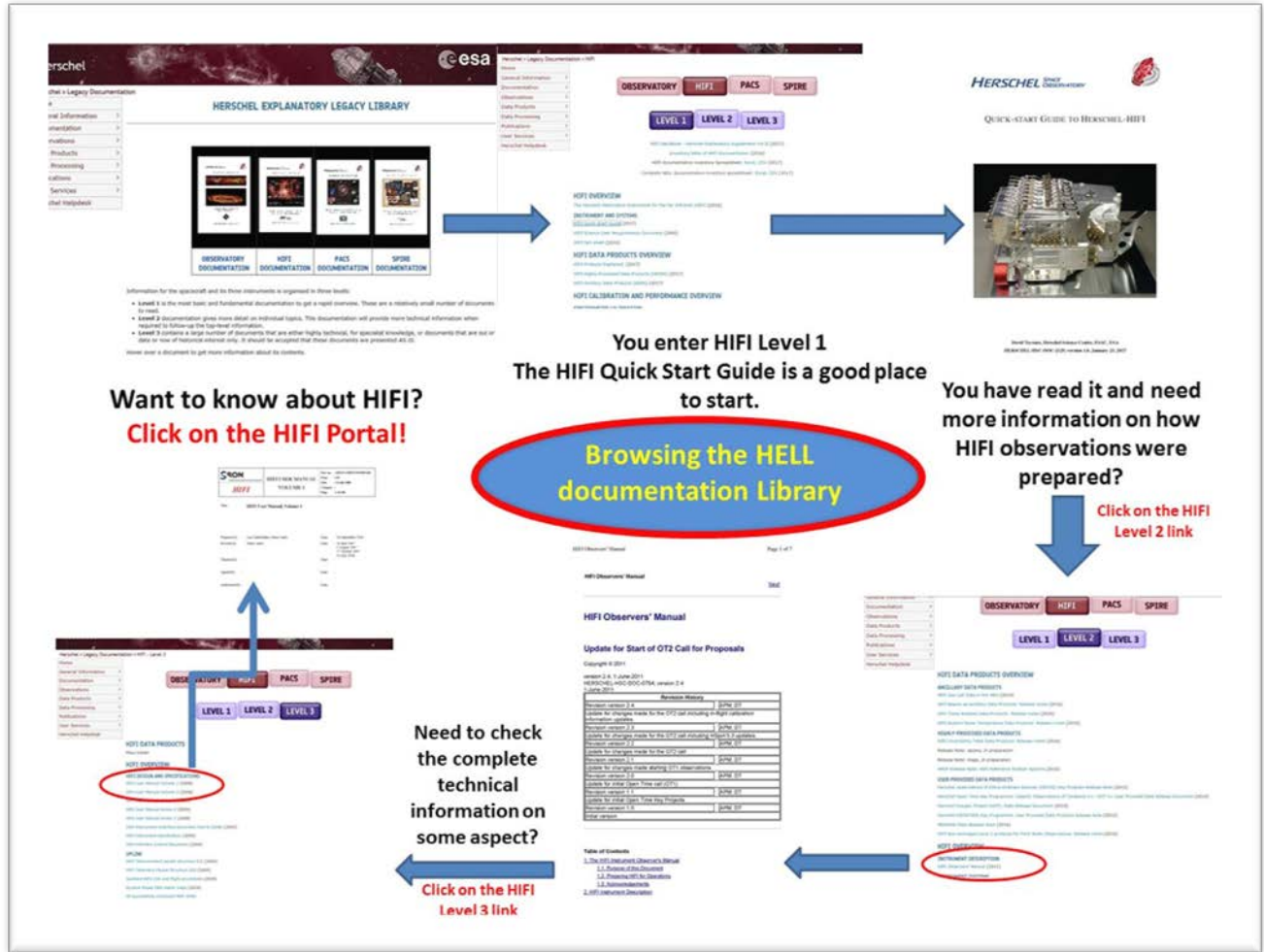
Figure 12: A typical workflow summary for browsing HELL.

5. Using the Documentation Inventory Spreadsheets

At the top of each Level 1 page you will find the documentation inventory spreadsheets. They are presented in six formats, as shown in Figure 13:

- The HIFI documentation inventory in Excel, CSV and PDF format.
- The complete HELL documentation inventory in Excel, CSV and PDF formal.
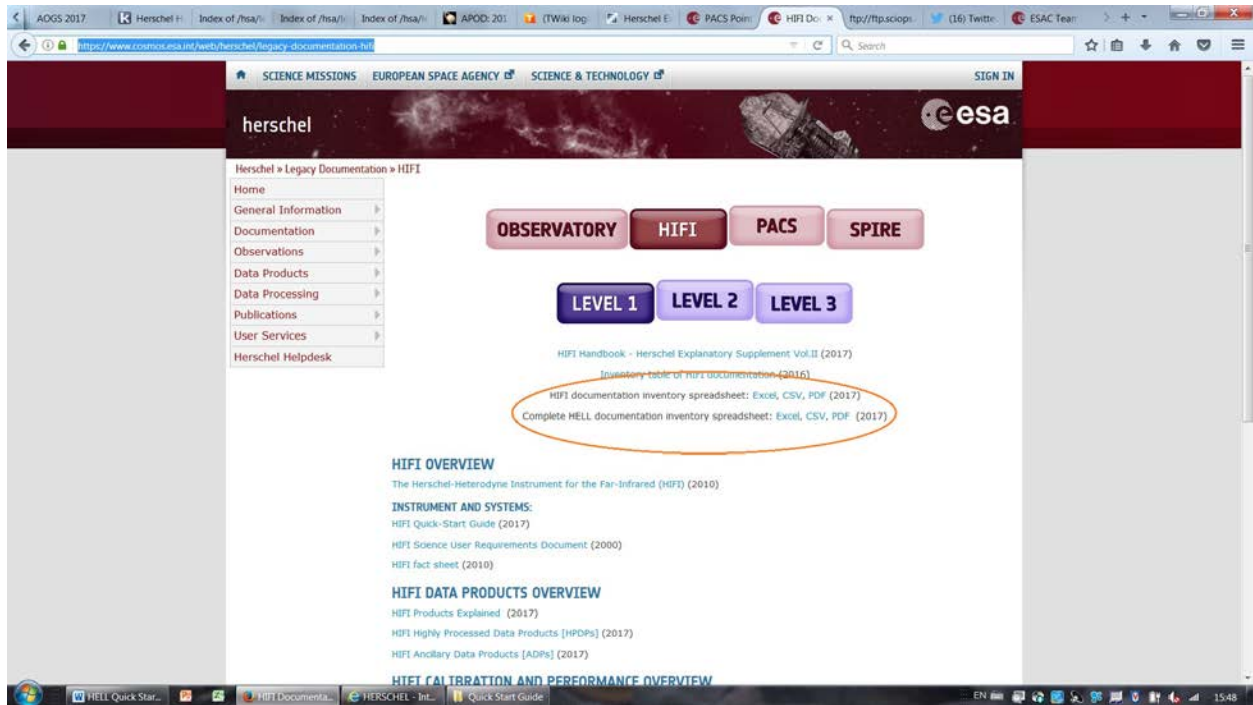
Figure 13: The links to the documentation inventory spreadsheets.

When you open one of the spreadsheets you find the complete information for the documentation inventory. If you open the HIFI inventory you will find, logically enough, only the HIFI documents. This is a much smaller listing to handle. If, in contrast, you are interested in a particular subject, for example, pointing and how pointing affected performance, you may want to do a search independent of instrument.

5.1   Spreadsheet contents

The columns give:

- A document reference number (sequential), the level of the document (1 for basic background, 3 for the most technical)
- Document title, the document reference and link (obviously, you can only follow the link in Excel or PDF).
- The next two columns give you the author(s) and the publication year (for published papers), or date and version number (for documents).
- We then have the two principle keywords in the next two columns and, in the third keyword column, potentially multiple additional keywords as necessary to define the content.
- The final two columns are the applicability of the document (photometer, spectrometer, bolometers in general, or a warning that the document is of restricted access) and, if available, the DOI for the document or paper (sometimes as a tiny url).

5.2   Using the spreadsheets

The spreadsheets are a catalogue of the contents of HELL. An example of the information presented is shown in Figure 14. By sorting and filtering the columns, you can select only documents that are Level 1,

or only documents with a particular keyword, or applicable to the photometers, or published in a particular journal. Or you can order by year of publication to obtain the most recent documents.

Figure 14: A partial view of the HIFI documentation inventory spreadsheet, showing the basic information that is recorded. Some columns are hidden off to the right.

You can filter the Excel spreadsheet on a particular column by clicking on the filter button at the top of a column as in Figure 15. In this case we have activated the level filter and selected just Level 1.

Figure 15: Activating the filtering in the Excel documentation inventory spreadsheet. In this case the filter will show only Level 1 documentation when activated.

The result of this action is that the Excel spreadsheet will display *only* the Level 1 documentation (Figure 16).

Figure 16: The Excel spreadsheet filtered to show only Level 1 documentation.

You can also use the spreadsheets simply to browse the contents of HELL looking for items of interest.

6. Summary

This Quick Start Guide shows you some of the ways that you can use HELL. Of course, the best way is just to play with it and see what you can find and what you can do with the contents.