

MINUTES OF SECOND MEETING

23 -24 February 2011

Members Attending: E. Falgarone, P. Hartogh, L. Hunt, R. Kennicutt (Chair), L. Kristensen, G. Meeus, M. Meixner, A. Noriega-Crespo, D. Rigopoulou, G. Stacey, A. Weiss

HSC Staff Attending: G. Pilbratt, B. Altieri, P. Garcia-Lario, A. Marston, B. Merin, L. Metcalfe, S. Ott

SUMMARY

The Herschel Users' Committee notes with satisfaction the attention that has been given to the recommendations in its previous report. Improvements are evident in nearly all aspects of the support for observers, especially in the areas of community support, documentation, calibrations, and the web site in general. The recent addition of three staff positions at the HSC is noted, and is strongly justified in light of the increased workload brought with the initiation of the general observer programme.

Listed below are the highest priority recommendations arising out of the meeting. The relevant sections of the main report are indicated in parentheses. The first set of recommendations addresses instrument-specific issues.

1. PACS Spectroscopy Calibration:
While recognising that significant progress has been made recently, the need to be able to derive fully-calibrated range spectra which are publishable (with known errors) remains as a high priority. Algorithms for the de-fringing of the full-range spectra would be very much appreciated (Section 3.1).
2. PACS and SPIRE Spectral Mapping:
Although significant has been made in recent months in processing of point source spectroscopy with PACS and SPIRE, spectral mapping remains beyond the reach of all but the most expert observers. The Committee recommends continued attention to this challenging task as a high priority. An especially acute need is a spectral line mapping pipeline for the unchopped line scan mode. These capabilities are needed to allow observers to validate their data and the efficacy of their observing strategies before the Cycle 2 deadline (Section 3.2).
3. HIFI Sideband Ratio Calibration, De-fringing and Baseline Stability:
The HIFI sideband ratio calibration remains the major source of uncertainty, and despite the difficulties inherent in this calibration it remains as the highest priority for HIFI science. The other major limiting factors at present are fringing and baseline instabilities. Ongoing efforts to address the fringing problem should remain a high priority. Although the HUG understands that baseline instabilities are not likely to be addressed in the pipeline, documentation to advise observers in dealing with them would be very helpful (Section 3.3).
4. PACS Mapping of Extended Emission:
Considerable progress has been made in the improving the extended-source calibration for PACS imaging, and in comparisons with MIPS and IRAS. This information should be disseminated to the PACS observer community as quickly as possible (perhaps via a debriefing telecon?), and the information incorporated as appropriate into the PACS Observer's Manual (Section 3.4).

5. **Processing of Large Maps with PACS and SPIRE:**
Many of the Key Programmes involve large-area mapping with PACS and/or SPIRE. No single technical issue is delaying the scientific exploitation of these data, but a number of significant improvements would be very beneficial. The memory requirements for processing large maps has been challenging for observers, and many of these objects are most susceptible to the issues about the calibration and mapping of extended emission as noted above. Astrometric information is needed to stitch together the individual AOR frames into the large maps. Guidance and documentation is needed on the astrometric accuracy expected from the HSC for such matching.

The remaining recommendations address general programmatic issues relating to Herschel observing and science.

6. **Planning and Prioritization of Data Processing:**
The HUG notes with satisfaction the continuing improvements to the data processing software and associated documentation and web pages, and the contributions of the Data Processing Users' Group (DPUG) in this area. The Committee remains concerned, however, that priorities are not always sufficiently science-driven. At this critical phase of the mission the top priority should be development of the basic pipeline tasks for removing instrumental artifacts and calibrating the data. We encourage the DPUG to play a stronger role in defining these priorities, in consultation with the HUG and the other key Herschel stakeholders (Section 6.3).
7. **Calibration and Documentation:**
The HUG is impressed with the improvements which have been made to instrument calibrations, their incorporation into HIPE, and the associated documentation in the Observers' Manuals and on-line web pages. Continued improvements in this information remain as a high priority for users, and ideally will include uncertainties, applicable flux ranges, and transparent version documentation and control (Section 5.1).
8. **Phase 2 Proposal Handling and Proposal Duplications:**
The Phase 2 time allocation process for OT1 has been complicated significantly by an enormous number of duplications between approved programmes, and by the large number of reductions applied to proposals by the HOTAC and its panels, often without specific instructions on which targets or AORs should be removed. In order to reduce the level of these problems for Cycle 2 we recommend that information on duplications between proposals (within the bounds of what is practical) be provided to the time allocation committees. Reducing the trimming of proposals (and when it is necessary specifying the parts to be trimmed) would also reduce the problems encountered in Phase 2, and shift the burden of programme selection from the HSC to the HOTAC and its panels, where it belongs (Section 7.1).
9. **Replacement Time for Duplicated Observations:**
The HUG also learned that in OT1 projects which lost observations due to duplications were allowed to select new targets for replacement observations. The Committee believes that this practice ultimately compromises the quality of the data collection obtained by Herschel, and imposes an unnecessary administrative burden on the HSC. For OT2 the HUG strongly recommends that duplicated observations be awarded to the highest-ranked proposal, and the remaining duplicated observations be returned to the general observing time pool.

10. **Priority 2 Observations:**
In OT1 the HOTAC awarded approximately 1500 hours of "Priority 2" time, which currently is used to fill holes in the spacecraft observing schedule. However no formal policy exists for how such observations will be prioritized after this year, or whether Priority 2 observations will be protected in the OT2 proposal competition. A written policy needs to be established and disseminated well in advance of the OT2 proposal deadline (Section 7.2).
11. **Interest Groups, Tiger Teams, Workshops:**
As Herschel approaches the second anniversary date after its launch, the time may be ripe to re-energize the data processing interest groups which are designed to share information among and between observers and the "insiders" in the ICCs and HSC; currently the groups remain insulated from each other. The HUG continues to believe that there are specific challenges in data processing and calibration which are most effectively handled by small teams which include expert observers both inside and outside of the Herschel team (Sections 5.2, 6.2)
12. **Proprietary Data Period:**
Herschel has entered a phase where the proprietary data period is ramping down from the original 12 months to 6 months by this summer. Despite the longstanding policy and a posting on the Herschel website very few observers are aware of this policy. This information should be announced, preferably as part of an e-News issue (Section 8.1).
13. **User Feedback:**
The current formal channels for observer input to the HSC (Helpdesk, HUG, and DPUG) have been served reasonably well for the Key Programme phase, but may not provide adequate feedback from the general Cycle 1 users. The HSC, perhaps in partnership with the HUG and/or the DPUG, should consider conducting a survey of users, similar to the data products survey but covering all aspects of observer support. The HUG will take up this topic again at its May 2011 meeting (Section 6.1).

1. INTRODUCTION

The Herschel Users' Group (HUG) held its second meeting at ESAC on 23-24 February 2011. Since its first meeting in October 2010 the committee was enlarged to include four representatives of the OT1 community: Leslie Hunt (Arcetri), Gwendolyn Meeus (UAM), Gordon Stacey (Cornell), and Axel Weiss (MPIfR). The Committee now has a wide range of expertise both in science and in the observing modes of Herschel.

Prior to the meeting the HUG Chair contacted all PIs of Key Programmes for feedback on issues to be raised at the meeting. Responses were received from two projects and incorporated into the discussions at the meeting. In parallel the Data Processing Users' Group (DPUG) is conducting a poll of users, and results from that survey were discussed. The HSC provided a formal written response to the HUG report, which was circulated and discussed at the meeting.

The agenda (Appendix 1) included presentations by HSC staff (followed by discussions) on mission status, instruments, calibrations, software, and community support activities. Much of the presentations addressed responses to recommendations from the first HUG report. A new topic for this meeting was the time allocation process and the impact of the accepted OT1 proposals on the HSC staff.

2. GENERAL ISSUES AND RESPONSE TO FIRST HUG REPORT

The meeting began with a presentation on Herschel status by the Project Scientist (Göran Pilbratt) and the Science Operations Manager (Leo Metcalfe). A copy of the presentation can be found on the HUG website. The spacecraft and instruments remain healthy, and scheduling of science observations is close to optimal. During its meeting the HUG toured the HSC and attended demonstrations of the long-term and short-term planning work that produces the observing schedule for Herschel, and another demonstration of the data validation and pipeline processing. These visits gave the Committee members a much better understanding of the work done and an appreciation for the effort devoted to these vital functions. Overall we commend the HSC for the efficient scheduling and scientific exploitation of the mission.

During the presentations the HUG learned that three new staff positions had been established at the HSC to bolster support for community support, instrument calibration, and data processing. This was most welcome news, as it is clear that the HSC staff is stretched and the new hires should help them to deal with the increased workload which is inevitable with the addition of new OT1 and OT2 observers to the system. The HUG was also satisfied to hear of continued strong collaboration between the HSC and NHSC.

As documented in detail later the Committee notes with satisfaction the attention that has been given to its recommendations in its previous report, and signs of the improvements are evident, especially in the areas of community support, documentation, calibrations, and the web site in general. We believe that an effective working relationship has been established and we hope it will continue through the remainder of the mission. Despite the significant progress important issues remain, of course, including areas identified as priorities in the previous report. The remainder of this report summarises the highest priority issues for the HUG. Section 3 addresses the most important instrument-specific issues, and Sections 4-7 address more general issues, organised by programme area.

3. INSTRUMENT-SPECIFIC ISSUES

The Committee first notes that considerable improvements have been made across a wide range of areas including instrument calibration, documentation, pipeline data processing, and observer support generally. Further evidence from these improvements comes from the steady flow of high-quality scientific papers following the early surge of SDP results.

Against this generally positive backdrop, however, a number of key areas remain where Herschel science is being delayed or in some cases completely stalled by the lack of critical calibrations, pipelines, and/or documentation for observers. The HSC is aware of most of these and highlighted them in their own presentations. The summary below is intended to convey the most serious of these from the perspective of the Herschel observer community, in rough priority order (though every issue listed is important).

3.1 PACS Spectroscopy Calibrations and Pipelines

In its first report the HUG called attention to the primitive state of the reduction pipelines for PACS range spectroscopy, and the lack of an approved AOT for spectral line mapping. Since then significant improvements have been realised in both areas. For PACS spectroscopy, the urgent need is to be able to derive fully-calibrated spectra that are publishable (with known errors). At present the calibration is problematic for short-range spectroscopy, as well as for extended sources (see below), or sources that are mispointed. An offset-dependent (and wavelength-dependent) calibration would be especially useful. Algorithms for the defringing of the full-range spectra would be very much appreciated.

We note that since last year the PACS spectroscopy pipeline has improved greatly, and the detailed explanations are very helpful. It would be helpful to include more guidance to users on when manual intervention in the processing is recommended, so that one knows for each specific case (point source vs. extended, faint vs. bright, etc.) where to change the relevant parameters.

3.2 PACS and SPIRE Spectral Mapping

Although significant progress has been made in recent months in the processing of point source spectroscopy with PACS and SPIRE, spectral mapping remains beyond the reach of all but the most expert observers. This HUG is aware that this has become a top-level priority for the ICCs and the HSC, and this attention is welcome. Nevertheless, with much unreduced data standing idle and large numbers of Cycle 1 programmes using these observing modes, the HUG feels obliged to continue pushing on this issue until it is solved.

A specific concern is that few observers have prior experience or expertise in FTS spectroscopy, and it appears that only a handful of people in the world are truly skilled with processing the SPIRE FTS data. For these reasons documentation, ideally including data processing handbooks or "cookbooks" will be especially important. In this regard the current vacancy on the Data Processing Users' Group for SPIRE spectroscopy is a concern, and we hope this gap can be filled soon.

In October 2010 a PACS unchopped line scan AOT was released, which has begun to relieve the large backlog of PACS spectral line mapping programmes. Analysis of these data by general observers awaits release of a full reduction capability in HIPE, which is being developed. This should be a high priority, as it will allow KP and OT1 observers to process early observations and validate the efficacy of their observing strategies before the Cycle 2 deadline (a justification that applies generally to all of the spectroscopic processing mentioned earlier).

3.3 HIFI

As with many other areas the HUG was pleased with the way in which the initial recommendations in this area were received. In particular we are pleased to see that the continued support for CLASS remains a priority. The HIFI ICC has been very active and effective in addressing a handful of calibration issues (e.g., beam position information, separate H & V polarization maps, and polarization maps, purification of bands 5a & 5b, etc).

As noted in the minutes of its first report, scientific exploitation of HIFI data is principally limited by three issues in the data processing (in order): sideband ratio calibration, defringing, and baseline stability.

Sideband gain ratio: This is still the main source of calibration uncertainty; while the difficulty of measuring this ratio is appreciated (the measurements are a full PhD project), it is recommended that this remains the top priority, and that results are communicated to the community in a timely manner through the HIFI web-page. After its meeting the HUG learned that significant progress is being made on this problem. The exception is the diplexer bands 3 and 4, where it remains nearly impossible to determine observationally. During the extensive discussion of this topic a number of specific suggestions arose. In cases where only ground-based sideband calibrations are available it would be helpful to provide access a table or file with this information for all bands and frequencies. Since HIFI is in space several tunings have been changed and it raises the question of whether the new tunings have modified the numbers on the sideband ratio collected on ground. Obviously a number of full range spectral scans have been performed within key programs (and possibly during calibration observations). Can HIFI take advantage of these data for a flight-based sideband calibration?

De-fringing: The removal of sideband ripples especially in the HEB bands is not trivial. As long as the mechanisms causing the baseline ripples are not fully understood it is difficult to model. Once the instrument team understands exactly what happens the physics behind should be made publicly available. It seems to be that a PhD student is working on an optimized algorithm for the baseline removal and the thesis will be published hopefully soon. At first glance it looks like that modeling the baseline ripple in the SIS bands is more easy and can be handled by fitting sinusoidal functions. However practice shows that this is not always the case, at least not with the function offered by HIPE. The experience with baseline ripples on planetary spectra with large continuum background shows that the HIPE function causes unwanted changes in the shape of the spectra. The implementation of more advanced baseline removal methods (e.g. Lomb periodogram) would be helpful. Some HUG members are aware of a new attempt at removing the fringes in the HIFI spectra based on the measurements on the hot load calibration. This method seems to have been abandoned because it loses the information on the continuum level. It may still be applicable to observations that combine HIFI with PACS observations to accurately measure the continuum level and therefore should be pursued. This is an illustration of the lack of interaction between instrument teams and observers that still has to be improved. A dedicated spot on the web pages might point to ongoing developments, asking for tests by interested observers and feedback. An alternative is an active Data processing Interest Group (or tiger team) on that specific issue.

Baseline instabilities: These are not dealt with in the standard pipeline, and the pipeline will not be modified to deal with them. For challenging cases, the PI will need to raise a ticket with the Helpdesk to get support from the ICC. This recommended process needs to be communicated clearly to the community.

In addition to the high-priority issues raised above a few other suggestions arose in the course of our discussions.

Calibration of absolute flux: if possible the results of the different calibration sources (Mars, Uranus, Neptune) should be combined in order to achieve a better absolute flux calibration. Also direct cross calibrations with WMAP and Planck are recommended.

HSpot: In the HSpot version available for the OT1 call the precision for the aimed noise levels was limited to integers of mK. For deep extra galactic observations this may not be sufficient, in particular if the user selects large spectral resolution width in order to use high chopper frequencies for maximum base line stability. In these cases it would be highly desirable to set the noise level at least with an accuracy of 0.1mK in the AORs. If possible this should be changed for the OT2 call.

3.4 PACS Mapping of Extended Emission

In its first report the HUG raised major concerns about the photometric calibration and linearity of the PACS maps of extended sources. At this meeting the HUG heard a presentation by Bruno Altieri, summarising the results of an extensive analysis being carried out by the PACS ICC. After proper treatment of flux in the extended wings of the PACS PSFs the flux scales at 70 and 160um appear to be coming into agreement with MIPS measurements. Disagreements with IRAS fluxes remain and need to be resolved. Confirmation for these results comes from an independent analysis being carried out by the HERITAGE team. Using the HIPE environment flux calibration, the HERITAGE tests suggest that the PACS data is significantly higher in flux than MIPS 160 and the IRAS 100 um. The new PACS calibration that takes into account the very extended PSF and brings the results in closer agreement, but the 100 um data appears to still be discrepant. Taken together great progress has been made on the problem over the past 4-5 months, giving us tentative hope the remaining problems appear minor and resolvable. Final

resolution of the issue will help the superb PACS maps to become one of the major Herschel legacies.

We are very pleased that the PACS and Herschel teams have aggressively addressed this issue. However few in the wider Herschel observer community are aware of this work, and it should be made clear to the community that these efforts are ongoing, and will only be incorporated in HIPE version 7.0, as a calibration update; in the meantime, results should perhaps be treated with caution. Results from the work by the ICC should be disseminated in a more formal way as soon as possible.

These analyses reveal areas where the current pipeline processing of extended sources could be improved. If possible, various options could be included in HIPE, or better yet, a timeline-based mosaic scheme (such as Scanamorphos) may need to supplant the current approaches in the pipeline. The HUG is aware that such discussions are ongoing within the ICC and the HSC, and it merely underscores the large volume of science which currently is being held up awaiting a clear resolution of the issues, followed by modifications to the data processing and observer documentation.

In its first report the HUG cited this problem as an excellent exemplar of an issue that might be addressed effectively by a calibration workshop or "tiger team" of experts from the ICC and selected KP teams. Recent events seem to make this approach more sensible than ever. At a bare minimum it would be useful to have a cross Herschel project joint discussion or debrief from the project about these results, to inform all parties.

3.5 Large Maps (SPIRE, PACS, and SPIRE/PACS Parallel Mode)

If one excludes the specific issue of extended emission, the flow of SPIRE and PACS imaging and photometry appear to be going well both in observations and data processing. However a handful of vexing issues continue to affect observations of large fields, many of them made in PACS/SPIRE parallel mode. Significant questions about faint source extraction and the limit of confusion remain, as well as with the treatment of borders in large maps. More documentation on calibration and astrometric fidelity would be very helpful.

3.6 Other Issues Discussed

SPIRE photometry of faint sources: SPIRE appears to be working quite well, both in terms of data quality and ease of reduction, and has provided much of the spectacular Herschel data emerging so far. We concur with the assessment presented in the Herschel Data Processing Status and Plans report of 23 February 2011. However, there are still significant questions about faint source extraction and the limit of confusion (perhaps best addressed with the 'tiger team' approach), and the treatment of map borders in large maps.

Cross-calibration of instruments: Overall it seemed that cross calibration between the different instruments provided consistent results. We would recommend that these efforts continue, for example using KP data if needed.

4. COMMUNITY SUPPORT

The HUG has noted many major improvements in the availability of information, the structure and contents of the Herschel web pages, and the responsiveness of the HelpDesk. The implementation of these improvements against a major increase in workload from OT1 makes these outcomes especially impressive.

4.1 Helpdesk and Communications with Observers

In its last report the HUG recommended several actions designed to improve communication between the HSC and users. Many of these have been implemented, including tighter tracking of unanswered Helpdesk tickets, notification of data entering the archive (at least for OT1 users), and synchronization of the observers' and operational databases. The Committee is aware of the strain that Phase 2 processing of OT1 proposals has imposed on the group, and the implementation of these improvements to process against that backdrop is commendable.

It has become clear from the many discussions at both of our meetings that the HSC regards the HelpDesk as the most important "one-stop shopping" interface for all Herschel observers. Likewise it is important that observers make full use of this service, as it helps the HSC to keep in tune with the concerns and difficulties being faced by users. Since the last HUG team meeting the community support group has implemented mechanisms to ensure that HelpDesk tickets are answered promptly. However the HUG shares their view that the HelpDesk may not be as visible as it should be. Since the Herschel web pages are widely visited by observers one way to increase visibility would be to liberally insert links to the HelpDesk on every relevant web page, or perhaps more easily to highlight the HelpDesk link in the left sidebar.

It is clear from the discussions at the meeting that most observers who work outside of the core Herschel team are unaware of many recent developments. We recommend that more frequent use be made of the e-News messages to disseminate important announcements and other changes.

4.2 Workshops

The HUG welcomes the proposed development of tutorials on the web. However, the Herschel Data Processing workshops have been most helpful to the community and should be maintained. A large fraction of the OT1 and OT2 observers will not have attended these workshops and the load on the HSC and NHSC staff for their organisation in the coming year may go beyond their capability. An alternative to the workshops at ESAC would be to rely on the institutions of large groups of observers to organize such workshops. In that case, the HSC/NHSC staff would travel but their time and resources would be dedicated to the formation of the observers, not to practical organization.

4.3 Impact of OT1 on Community Support Group

In its last report the HUG expressed concern about the likely impact of Cycle 1 on the workload of the community support group and the HSC staff in general. As reported at this meeting by the head of the CSG (Pedro Garcia-Lario), OT1 has heavily impacted the group, especially in terms of handling the Phase 2 proposal submissions. As discussed in Section 7, the large number of OT1 proposals affected by duplications has been the single largest drain on the time of the CSG staff. We hope that steps can be taken to avoid a repeat of this situation in Cycle 2, by adopting clearer policy guidelines for handling duplications and if possible by addressing more of them during the HOTAC process. These are described in more detail later in the report.

4.4 Web Pages

Since the last HUG meeting major improvements have been made to the Herschel web pages, extending from their overall organization to the contents of specific pages. Specific improvements are too numerous to cite completely, but those which were noted by Committee members include the consolidation of documentation for each instrument on single summary pages, the updated page on data products known issues, the change of the observing log into a searchable page, and the new pages on policies and general

information. The main menu itself is expanded and makes it easier to find specific pieces of information generally. The HUG appreciates the effort needed to implement these improvements and it commends the HSC for its responsiveness.

Prior to this meeting, HUG members were asked to review the current web pages to identify specific items which were missing or could be improved. An unprioritised list of the resulting suggestions is given in Appendix 2.

5. INSTRUMENT SUPPORT AND CALIBRATION

Once again the HUG has noted that substantial progress has been made on several fronts since its last meeting, including on nearly all of the high-priority issues that were identified in its previous report. We refer readers to Section 3 of these minutes for detailed comments on individual instruments. During the discussions of this topic a number of general issues relating to calibration and their documentation were raised.

5.1 Documentation of Instrument Calibrations and Uncertainties

A key need in advance of GT2 and OT2 is to provide users with up-to-date numbers on instrumental sensitivities and other performance specifications, incorporated into HSpot.

Although the latest generation of observers' manuals for the instruments have incorporated much better and well documented information on instrument calibrations, it still would be helpful for the HSC to adopt a common set of standards and conventions for providing this information. Specific types of useful information include the following:

- Information on accuracy of calibrations is essential. Although some information of this kind is provided in the PACS and SPIRE observing manuals it is incomplete, and relatively little information is available for HIFI.
- The fact that there are multiple versions of HIPE available in the community, and that therefore there are Herschel Archival products processed with different versions could lead to some confusion on what calibration was applied or used. This can be documented explicitly the calibration uncertainties associated with each HIPE version (and date). For example:

PACS Photometry at 70 & 160um: 15% and 30% uncertainty, respectively.
HIPE V1.0.3 through V4.2.0 [June 2009 through September 2010] and PACS
Photometry at 70 & 160um: 7% and 15% uncertainty, respectively. HIPE
V4.2.0 through V6.0.0 [October 2010 through April 2010]

- As fantastic as the bolometers are, they do suffer from some limitations (like any other detector), so when a calibration uncertainty is quoted it is important to know over what range of flux densities it is valid. Using examples above, one could additionally specify:

PACS Photometry at 70 & 160um: 7% and 15% uncertainty, respectively.
70um: over 10mJy - 100Jy 160um: over 200mJy - 100Jy HIPE V4.2.0 through
V6.0.0 [October 2010 through April 2010]

- Something to consider by both the PACS & SPIRE ICCs is to analyze how their photometric calibration behaves as a function of scanning speed. Considering how many projects are using PACS-SPIRE parallel mode this is certainly a value added to their overall calibration.

5.2 Coordination of Activities: Tiger Teams and Interest Groups

In its first report the HUG explored whether some particularly vexing calibration and instrument issues might be best attacked by small informal "tiger teams" comprised of ICC members (and possibly HSC members) along with a few expert observers from the KP teams. The groups would address highly focused problems that are producing science bottlenecks for multiple teams (the prime example cited was processing of PACS/SPIRE extended emission). The teams would meet for short time periods and help provide detailed definition to problems based on experiences.

Although in its response to the first HUG report the HSC has expressed its willingness to explore this approach, it has not yet been attempted. The HUG considered the topic again at this meeting, and discussed a wider array of options for coordinating expertise of observers and the ICCs for these types of issues. Some of the roles envisaged for the tiger teams might be addressed by the data processing interest groups which operate loosely under the DPUG (Section 6). However for such groups to be effective they would need some strong leadership and coordination from above. Data calibration workshops could also serve as useful forums for users from the whole mission to come and discuss data calibration efforts and results. Currently the Herschel team organises workshops which are restricted to members of the instrument and Herschel teams, but it may be time to consider broadening participation to at least a few invited experts from the OT teams.

6. DATA PROCESSING

The discussion of data processing included separate presentations on processing and the DPUG (by Stephan Ott and Bruno Merin, respectively), as well as a demonstration of the initial pipeline processing and data validation. As in most other areas the HUG was impressed with the number of improvements to HIPE and its associated documentation over the past 4-5 months, and with the responsiveness of the HSC to the many issues raised in the last HUG report.

6.1 Data Processing Users' Group (DPUG)

Under its current leadership the DPUG is becoming an effective group for identifying and prioritising data processing needs and activities. As recommended in the first HUG report and endorsed in the HSC response a close collaboration between the HUG and the DPUG can be an effective (and needed) way to provide clearer science-driven input and prioritisation of the data processing development activities. We take up this issue directly in Section 6.3.

Among its current activities the DPUG has conducted a survey of Herschel users, specifically the first authors of the SDP papers (or others on the teams who were closely involved in the data processing). Although responses from the survey are still being collected, the preliminary results already reveal valuable information on the way in which users download and use HIPE, as well as documenting the main parts of the package used, patterns of version usage, and extensive other information. We commend the DPUG for embarking on the survey, and suggest it be publicized so other interested users can complete the survey. The final results should be disseminated to the observer community, ideally via a dedicated area of the Herschel web pages.

Although the DPUG enjoys a relatively high visibility within the HSC and the Herschel team its activities and even its existence are largely invisible in the general Herschel observer community. The DPUG is not even mentioned on the Data Processing Overview page. The Users' Survey is a first step in assuming a more visible presence, and the HUG recommends that it go further by establishing a top-level web link on the

Herschel pages (under the heading of Herschel Data Processing or even under General Information, next to the HUG link). The page could include information on the membership of the DPUG, its terms of reference, and key reports such as the results of the Users' Survey. Inquiries from the community should still flow through the Helpdesk, but a Helpdesk link on the DPUG page might help direct more feedback from observers to the HSC.

The HSC (not necessarily the DPUG) should consider soliciting feedback on other topics related to data and science results, such as calibration and top-level feedback on data processing and related issues. The HUG would be happy to assist in the construction and evaluation of such a survey.

6.2 Data Processing Interest Groups

In addition to the DPUG the HSC created and hosts a set of 9 data processing interest groups (one each for PACS and SPIRE photometry, PACS and SPIRE spectroscopy, HIFI, spectral mapping, large maps, and general HIPE and HIPE contributions groups). These are designed to serve a function that is distinct from that of the DPUG. The DPUG draws mainly on internal members of the project but is quite large, and has a broad charge to gather feedback and make recommendations on the priorities for development. The interest groups are more loosely organized around topics of interest and are supposed to be user-led. However it seems that many of the groups are inactive, and some no longer have leaders. This inactivity could reflect lack of need in the eyes of the user community, but we suspect that under inspired leadership they (at least some) could be effective, especially for addressing some of the key bottlenecks identified earlier in this report. The Herschel team, perhaps through the DPUG, may need to select an active volunteer from the community to run these interest groups and provide at least a communication resource; e.g. telecon line and TWIKI site, to collect information. Selecting someone who is younger, e.g. assistant professor level or perhaps a capable postdoc, and directly involved with the data would be best.

6.3 Prioritisation of Data Processing Activities

The key need in this area identified by the HUG is a clearly defined process for translating the scientifically-driven priorities of the Herschel observer community into data processing development priorities within the HSC. In our view this requires collaboration between the HUG, the DPUG, and the data processing management team at the HSC.

The role of the HUG is to identify the key problem areas where data processing needs are holding up or seriously compromising Herschel science. Section 3 of this report provides this prioritised list of specific instrument-related needs. More generally, the HUG strongly recommends that software development activities focus on core pipeline processing (i.e., removal of instrumental artifacts and calibrations) over less essential capabilities (e.g., post-pipeline utilities, plotting, visualization) at this critical stage of the mission. This need for focus on core data processing capabilities has been almost a universal chorus in the Committee's interactions with Herschel observers.

Although the HUG can identify and prioritise top-level needs of the observer community it is not in a position to translate these priorities to corresponding priorities for the data processing and user software development; it lacks the expertise and detailed knowledge of the resources available to the HSC and the Herschel mission for addressing the issues. On the other hand the DPUG is well positioned to serve this role. Although it is clear that much of this role already is carried out by the DPUG, the HUG also observed some troubling signs that non-scientific factors may be influencing priorities more than they should, for example with an excessive emphasis on high-level user utilities which often duplicate existing packages and which inevitably divert some effort away from the primary data processing work.

6.4 HIPE User and Developer Releases

At its previous meeting the HUG reported that there was considerable confusion in the observer community about the purposes of and relationships between the periodic User builds of HIPE and the daily-updated developer builds. The official recommendation from the HSC is that most observers should rely on the HIPE User releases, which are well-documented, and to only use the more intermediate developer builds at their own risk, without expectation of updated documentation or close support from the HSC. The HUG endorsed those guidelines, and is glad to see clear guidance given on the HIPE download page. The information on recommended version for different applications is especially useful. However we also note that much of the information given on the Data Processing Overview page, where most new observers will go first, is out of date and should be brought into conformance with the information on the other pages.

The question of frequency of User Releases was discussed by the Committee. Clearly there is a tension between providing the latest tools and minimizing confusion with more HIPE versions than are necessary. As a rough guide we advise that major releases should not occur more frequently than every 3 months; otherwise, there is a tendency to confuse coordination of data reduction efforts by big teams, and render incompatible results more probable.

6.5 Specific Feedback on Data Processing and Documentation

In response to requests for specific feedback from the HSC Appendix 3 contains specific suggestions for improvements to the documentation on data processing.

Two general recommendations deserve mention here in the main report.

6.5.1 As mentioned earlier it is important to maintain consistency between information given in the instrument manuals, those in the respective HIPE documentation, and those actually being implemented in the HIPE software itself. We understand that this version control and coordinated updating is now being implemented.

6.5.2 The HUG reiterates its recommendation for providing information on "recipes" for most common data processing tasks. These can be a mix of script libraries (carefully documented), cookbooks, and tutorials. These utilities are widely used and appreciated by the observer community, and thus should remain a high priority on an ongoing basis. The current Herschel pages are a good start.

7. OT1/OT2 AND RELATED ISSUES

Since the first HUG meeting the OT1 selection process was completed and the HSC has been managing the Phase 2 proposals for the accepted proposals. Plans now are being finalised for (the final) OT2 process. Although the OT1 process proceeded relatively smoothly in many respects a few important issues arose which were addressed by the HUG.

7.1 Duplications

Duplication of observations is a difficult problem for time allocation processes on all heavily oversubscribed facilities, but the extent of the problem for OT1 was unexpected, and has strained the resources of the HSC during Phase 2. Although duplications between OT1 proposals and Key Programmes were checked during the time allocation process, it was not possible to check and document all duplications between the OT1 proposals themselves. This is common practice for most space observatories, where the

oversubscription is so large that it only makes sense to carry out thorough checking after the time allocation committee has selected a tentative list of approved proposals.

For Herschel OT1 however the number of proposals affected by duplications was far beyond expectation, nearly 2/3 of all of the approved programmes! As a result the HSC Community Support Group has devoted enormous effort into identifying the duplications and then negotiating resolutions with the PIs affected. This problem has been compounded by the fact that no formal duplication policy was in place. As a general rule the HSC staff are relying on cooperation between teams, and when projects have given up observations they have been allowed to propose replacement observations to make up for the lost time.

It is too late to change procedures for Cycle 1, but the HUG has serious reservations about this handling of duplications (many of them shared by members of the Community Support group as well). On the practical side the duplications have overloaded the HSC staff and delayed the completion of the OT1 Phase 2 iterations. However the HUG's greatest concern with the procedures is scientific. By effectively allocating observing time for the same observations (or similar replacement observations) 2, 3, or more times, valuable helium is being spent on redundant science that could be assigned more valuably to other programmes. This policy goes against the basic principle that time should be awarded for an observation, not a programme, and the even more important principle that observing time be awarded solely on the basis of scientific merit, as judged by the HOTAC. Although the HUG is confident that many of the "replacement" observations will add valuable science to the Herschel programme and data archive we seriously doubt whether the time overall is as well spent as it would be if the duplicate observations simply were returned to the observing pool.

A related problem encountered in Phase 2 was the approval of programmes whose time was reduced by the HOTAC. Such time reductions were applied frequently by the panels and the HOTAC itself, but it was left to the PI teams to decide which targets and AORs to eliminate. This additional uncertainty in the nature of the approved projects complicated the management of duplications immensely. The combination of both factors-- huge numbers of unresolved duplications and undefined reductions in observing programmes-- not only placed unrealistic burden on the HSC staff, it also effectively delegated to PIs and the HSC staff decision-making authority over a considerable fraction of the observations allocated (albeit with the approval of the Project Scientist), a responsibility which we believe properly rests with the HOTAC.

In order to avoid revisiting the same problems in OT2 the Committee recommends that the HSC and HOTAC consider a few modifications to the Phase 1 and Phase 2 processes, which are aimed at maximising the scientific productivity of the last Herschel observations and reducing the delays and strain on the HSC staff in Phase 2.

- 7.1.1 When the HOTAC and its panels believe it is necessary to reduce the time given to a proposal they should specify which targets and observations to remove. The panels should be informed of the logistical overheads that result from indiscriminate cuts to proposals, and be encouraged to impose them only when there is a strong scientific justification.
- 7.1.2 When duplications are discovered the observations should be given to the highest ranking of the projects involved. This would require a mechanism for cross-ranking proposals reviewed in different panels.
- 7.1.3 Time released from eliminating duplications should return to the overall time allocation pool. It should not be given to observers to replace arbitrarily.

- 7.1.4 The HSC Support Group should present HOTAC with a list of duplications (we understand that it is impossible to go through all submitted AOTs) but simple checks on "targets" should be executed. A simple program should be able to handle "first order checks" on duplications.
- 7.1.5 In general the HSC should not engage in negotiations for data sharing or team building when duplications are discovered; the time should go to the highest-ranked proposal. (In exceptional cases the HOTAC may recommend the merging of two projects.)
- 7.1.6 The Herschel Space Observatory should update its duplication policy, and disseminate it to the observer community well in advance of the OT2 deadline.

7.2 Scheduling of Priority 2 Observations

In OT1 most observing time was allocated at Priority 1, and every effort will be made to execute those observations before the end of the mission. A smaller number of proposals were approved with Priority 2 status. The HSC's expectation on how many of these programmes will be completed has never been defined, but in the current year they are being used exclusively as "filler" programmes, to fill gaps in the observing schedule which occasionally arise. Currently filler observations are rare (a few percent of the schedule or less). A written policy needs to be established and disseminated well before the OT2 proposal deadline.

7.3 Uniqueness of Herschel Capability in Proposal Evaluation

In the weeks after the OT1 results were announced members of the HUG received a number of complaints about the review process from unsuccessful proposers (including other members of the HUG itself!). Many of these comments were of the same generic nature as one encounters for other observatories, with quality of the feedback received from panels and the HOTAC being the most frequent single complaint. Unfortunately the feedback will be less relevant for OT2, as it will be the last Herschel call.

One specific concern did seem worth passing back to the HSC and the HOTAC. It appears that a number of successful proposals contained sources that can be observed either from ground (albeit possibly with longer integration times) or from SOFIA. This applies in most cases to HIFI proposals, which operates at high spectral resolution where the ground and SOFIA often are more competitive than for broadband imaging or lower-resolution spectroscopy, and in some cases even for PACS spectroscopy. Some of the SOFIA instruments are technically advanced and more sensitive than the corresponding Herschel instruments, and the SOFIA mapping capability is better than the one offered by Herschel. On the other hand HIFI is still orders of magnitude more sensitive for some specific applications (e.g., spectroscopy of water). We recommend that the HOTAC and its panels specifically consider the uniqueness of Herschel science, and that proposers be reminded to address the need for Herschel time explicitly.

8. GENERAL TOPICS

8.1 Proprietary Period

Following existing policy, the proprietary period for Herschel observations is now ramping down from 12 months to 6 months by this summer. Few observers are aware of this policy, and it should be disseminated, perhaps via an e-News message.

8.2 User-Generated Data Products

The HUG endorses the efforts of the HSC to collect user generated data products, with links on the Herschel website. The website should make very clear that support for these products is handled by the HSC via the HelpDesk, not by the contributing teams. We also note that local hosting of data products by the Key Programme teams is only workable as a temporary expedient at best, and plans should move forward for a central repository (or repositories) organised via the HSC and NHSC.

9. CONCLUDING REMARKS

The next HUG meeting will be held at ESAC on May 3-4, 2011. Important topics for the next meeting will include the OT2 call, follow-up on recommendations from this report, and mechanisms for collecting feedback and communicating with OT1 observers.

The HUG wishes to express its thanks to Göran Pilbratt and the HSC staff for hosting a productive and smooth running meeting.

APPENDIX 1: AGENDA



Herschel Users' Group

DRAFT Agenda for HUG#2, ESAC room B65, 23-24 February 2011

Wednesday 23 February 2011

- 0930 Introductions and Closed Session of Committee
- 1000 Herschel Status Reports (Göran Pilbratt, Leo Metcalfe)
- 1100 Coffee Break*
- 1130 Discussion of Status Reports
(including response to HUG recommendations)
- 1230 Community Support (Pedro Garcia-Laria)
- 1330 Lunch*
- 1430 Tour of HSC, Meet Staff
- 1515 Data Processing and DPUG
(Bruno Merin, Stephan Ott, Bruno Altieri)
- 1615 Coffee Break*
- 1645 Instrument-Specific Issues (group discussion)
- 1730 Other Issues
- 1800 Closed Session: Discussion, Identification of Key Issues
- 1845 Adjourn
- 2100 Dinner*

Thursday 24 February 2011

- 0930 Calibration (Tony Marston)
- 1000 Discussion of HUG Activities, General Discussion
- 1100 Coffee Break*
- 1120 Closed Session: Discussion and Draft Recommendations
- 1300 Briefing with Project Scientist, Preliminary Recommendations
- 1330 Adjourn, Lunch*

APPENDIX 2: SPECIFIC FEEDBACK ON WEB PAGES AND DOCUMENTATION

HUG members also provided considerable feedback on the contents of the Herschel web pages and the accompanying documentation. As before this list is not intended to be exhaustive, but rather consolidates suggestions from the Committee member, without priority ranking.

Web Pages

- A2.1 In general, it would be helpful to emulate some of the best features of the individual instrument pages in their counterpart pages, not only for the sake of information but for consistency as well.
- A2.2 A general concern raised in the first HUG report was the lack of cross-linking of information across the tree of web pages (e.g., instrument pages and data processing pages), to make it easier for observers to find specific documentation. This is improved now but could be extended further as part of the ongoing development of the pages.
- A2.3 Adding a simple search function to the web pages would provide another way for observers to find the documentation they need. We recommend the addition of a search capability if it can be easily implemented.
- A2.4 As discussed in Sections 3 and 5 considerable work is progressing on the instrument calibrations, and for users updated information is a top priority. We look forward to the new and updated web pages on the calibration. It should be noted that many of the currently posted documents are outdated (e.g. the PACS spectroscopy performance and calibration is from March 2010, and still lists the flux factors 1.3 and 1.1).
- A2.5 The SPIRE page "Tips to re-reduce your data" section which is proving very valuable for users. Ideally this information would be added for PACS and HIFI as well.
- A2.6 The long list of top-level links in the left border of the main HSC web page is growing quickly, and would be helpful to consolidate some of these links. For example the section 'Herschel Observing' contains numerous links to sometimes very short pages, and it could be simplified by combining some of these pages. For example, a single link could direct users to a single page of observing programmes, which in turn would have links to the four programme lists). The links relating to scheduling, observing status, and propriety time could be consolidated in the same way.
- A2.7 The file with the Data Processing known issues could be displayed more prominently, as it is very important for the user. Also, the link from the PACS site provides a .pdf, of the webpage, which does not include real links. Maybe it is better to just link it to the webpage itself?
- A2.8 Pocket Guides (cookbooks) for each instrument should become available.
- A2.9 It would be good - for the public - to add a gallery of Herschel images on the web, with different categories of the objects. Now they are shown in between the news items, but soon there will be many more that could be shown and of interest to the public. (This probably would be hosted at a separate URL from the other HSC pages.)

Documentation

- A2.11 Different sets of documentation are available for different instruments, although the SPIRE link (<http://herschel.esac.esa.int/hcss-doc-5.0/>) is quite complete. Nevertheless, there is a new edition of the PACS Data Reduction Guide (February, 2011) which does not appear in the hcss link, although it does appear in the PACS instrument section. A HIFI Users' Manual exists (linked from the HIFI instrument section), but without a date within the document (dates would be important because of the rapid evolution occurring in the reduction algorithms). Although much progress has been made on documentation, the effort should not stop here since the information provide is heterogeneous both in form and substance.
- A2.12 It would be quite helpful to provide pdf versions of all manuals; this has been done for some but not for others. pdf format for documentation is convenient in some cases because it can be consulted off-line and perhaps even printed in a compact form if necessary."
- A2.13 The SPIRE Data Reduction Guide (DRG) exists on the HCSS-doc URL, but apparently is not referred to by the SPIRE web pages. We realize the online documentation is a work in progress, but perhaps some standard documentation goals could be defined (e.g., a DRG for each instrument, linked to the appropriate instrument-specific web page; a Users' Guide for each instrument; and how the content of these should differ.) In fact, it could be helpful and save energy if the content of the Users' manuals were incorporated in the DRGs or vice-versa so that the ICC teams and the users themselves would have a well-defined point of reference.
- A2.14 In general it would be helpful to have a link from the instrument pages to the reduction page, and preferably done in a homogeneous manner for all instruments.
- A2.15 PACS imaging: The new PACS DRG is quite good, but does not mention any of the problems with extended emission or flux calibration. In particular, only reductions with MADMap are presented in the DRG, despite the presentation by Bruno Altieri and Marc Sauvage which suggested that HPF+PhotProject better recovered global fluxes. It might be useful to implement in HIPE various options for pipeline reduction, including the possibility to favor extended emission.
- A2.16 PACS spectroscopy: Although the new DRG is an important step, there is still an acknowledged need for complete documentation for unchopped spectroscopy and wavelength switching (now obsolete) modes, see e.g., p. 73 of the DRG. This is especially important in light of the ever decreasing proprietary time for these observations.
- A2.17 Nothing is mentioned about the calibration accuracy, at least not in the HIFI manuals (there is some discussion in the PACS OM and rather more in the SPIRE OM). It is essential to address this in the data reduction manuals, and make this information available to the community.

APPENDIX 3: SPECIFIC FEEDBACK ON DATA PROCESSING DOCUMENTATION

The documentation and the cookbook in the "Hifi User Manual" (UM in the following) are well written and provide a good overview on the different levels of data processing and the options available within HIPE. There are, however, a few shortcomings in the documentation which are addressed below.

- A3.1 For the intensity calibration of the HIFI data (Level 2) values for the aperture/forward/main beam efficiencies and sideband gain ratios are available within HIPE and applied to the data. This information should also be made available in a consistent way outside HIPE as many users may continue their data processing from Level 1 in CLASS or other packages.
- A3.2 The information on calibration is quite confusing in general in particular as the units of Level 2 data has changed for HIPE 5.1 It would be very useful to clearly state at each level (1 & 2) which temperature scale is referred to (T_a , T_a^* , T_{mb}) E.g. for the DoFluxHotCold routine the manual only states: "This transforms the intensity scale to Kelvin units." Even worse the calibration section (5.5.2 p 72) of the Observer Manual states: "NOTE: Prior to HIPE 5.1, the HIFI final processed spectra in level2 of the data were in T_a , not T_a^* . This means that to go to the main beam temperature, T_{mb} , users needed to divide by η_{mb} ONLY. In HIPE 5.1, users have to multiply by η_l/η_{mb} in order to get to the main beam temperatures." But the forward efficiencies, η_l , are not tabulated in any available document (although experienced user can calculate them from the tabulated efficiencies). It would be very useful to remove these shortcomings and clearly state at each level which temperature scale is referred to and give e.g. in the Observer Manual or in a dedicated calibration manual (see below) the corresponding relations. The forward efficiencies should be added to Table 5.5 (p 72) in the Observers Manual. No document is available on the sideband gain ratios, so this information is not available for the "CLASS community" and it is also not clear which values are applied by the corresponding function in HIPE.
- A3.3 One of the most severe artifacts on the HIFI spectra are standing waves and other baseline instabilities. The User Manual gives an overview on the tools to deal with these artifacts (baseline fitting, fringe fitting) but it falls short on addressing how this is done in the best possible way. A short cookbook on this important data processing aspect would be highly desirable (e.g. presumably the effect can already be minimised by optimising the subtraction of the off-position spectra). The description of the FitFringe task refers to FitFringe manual. This document, however, is not available on the HIFI web-pages.
- A3.4 The document addresses the relative performance of the HIFI spectrometers (comparing WBS and HRS). However, nothing is said about the performance/stability of individual AOS. From my experience units 1 and 4 have significantly higher instabilities than 2 and 3 in the WBS mode. This should be addressed in more detail as for broad line which completely cover one (or more) AOS units, their stability is essential to derive line intensities and line shapes (see also the comment on the calibration accuracy).
- A3.5 While the calibration scheme for HIFI is nicely explained in the document describing the efficiency measurements on Mars, nothing is said on the overall calibration accuracy (which is a standard value to quote in any publication). This analysis should also invoke the sideband gain ratios and the stabilities of individual spectrometers as this will affect the calibration of brought lines. In general it would be nice to collect all this information in a dedicated calibration memo. So far no information is available concerning the coupling of the HIFI beam to extended emission, which is in contrast to the SPIRE/PACS calibration efforts.

A3.6 In the SPIRE Users' Guide: In the Section, II.1 (Related Documentation), it is stated:

"Guidance on how to use the Javadoc is provided in the Scripting and Data Mining guide:?????. Some Javadoc pages may have links to more in-depth developer documentation. Be aware that these are not fully fledged help documents and are most useful to system developers or advanced users only." [sic]

This implies that the idea of extracting 'recipes' or 'cookbooks' from the Java scripts is perhaps not as advanced as we would like them to be at this point. Also, the guide referred to appears to be missing (is cited as "?????"). We appreciate the enormous effort of the HSC and ICCs have expended to make Herschel the superb facility it is, but its short lifetime makes imperative the need to exploit the data in a fairly robust way on short-term timescales.

A3.7 SPIRE Spectrometer: The photometer's naive map maker is now being used to create better spectral cubes. Level 1 products now contain all measured extended flux-calibrated spectra while Level2 products are created by averaging fluxes over each pixel. Faint source reduction within HIPE is now possible and includes proper dark sky subtraction with much improved results. Reduction of intermediate sampling or fully sampled maps is still incomplete in HIPE but we were told that it will soon be implemented. Tools must become available asap to cover the needs of the OT1 observers.

A3.8 SPIRE Photometer: A tool that flags signal jumps in timelines is being implemented which will improve temperature drift corrections. However issues related to baseline drift corrections are still being worked on.