The PLANCK Newsletter

Issue 3 — *Information and news for the Planck community* — September 2002

From the Editors

J. Tauber & R. Laureijs

This issue comes out shortly before the Joint Consortium Meeting, of which you find some details here; we encourage you all to register and come to it. In addition to the usual "status reports", you will also find a description and first results of the Archeops balloon-borne experiment, some recent instrumental developments (sorption cooler, RFDM), and updates on the Planck Working Groups. A competition for the cover of the Planck Blue Book is announced which we hope will start your creative juices running.

As usual, if you have any feedback on this issue, or would like to propose contributions for forthcoming issues, please contact us directly at jtauber@rssd.esa.int and/or rlaureij@rssd.esa.int .

Inside This Issue

The Joint Consortium Meeting in Santander

Most of you are certainly aware of the preparations to hold a joint meeting of all Planck Consortia between 14 and 16 October. The meeting will be hosted by the Instituto de Física de Cantabria (Santander, Spain), and will be held at the beautiful location of the Palacio de la Magdalena in Santander. It is the first all-Planck meeting to be held since the large Workshop which took place at Estec in January of 2001, and it is hoped that it will foster as much fruitful interaction as the previous one.

The intention is to have a mixture of HFI/LFI combined and independent sessions, the former being largely structured around the Working Groups which are common to all Planck Consortia. The rough agenda includes:

- a combined session on the afternoon of Monday 14 October, covering general issues (e.g. mission status, the List of Planck Scientists, etc), as well as presentations on the activities of WGs 1 (Systematic Effects) and 2 (Component Separation)
- parallel LFI and HFI Consortium meetings on Tuesday 15 October
- a combined session on the morning of Wednesday 16 October, with presentations of the activities of the remaining WGs (3 to 7)
- the opportunity on the afternoon of Wednesday 17 October for the Planck WGs to meet in working sessions, which could be independent or combine several WGs. Some rooms will be available for this purpose. *The WG coordinators are asked to communicate their plans and needs to the meeting organizers.*

A detailed agenda is being worked out and will be sent out shortly. Be sure to register your participation via the Santander Meeting Web Page , where all the useful practical details are explained. Many thanks go in advance to our hosts in Santander and in particular to the main organizer, Enrique Martínez-González.

More about the Santander Group on page 6

The Planck Newsletter is published by the Planck Science Office, Research and Science Support Department of ESA, ESTEC, Noordwijk, The Netherlands. See also http://astro.esa.int/Planck .

From the Project Scientist

J. Tauber

As you will read from the various reports, the last half-year was full of critical events, triggered by a number of funding shortfalls in several elements of both Herschel and Planck. In some (but not all) cases the problems were resolved, based on joint efforts of ESA, the PIs, and the national funding agencies; but we are not yet out of the hot water, and we may still see important resolutions being taken this year.

Earlier this year, ESA accepted to shift the delivery dates of instrument models to accommodate the instrument development schedule. At the same time, a firm stance was taken by ESA's Director of Science, Prof. David Southwood, who reaffirmed his intention not to delay the launch of Herschel and Planck beyond the planned date in February 2007.
The satellite development will go through an important transition in October, as it shifts from Phase B (detailed design) into Phase C/D (manufacturing). The transition is marked by a Preliminary Design Review, currently underway. Once in Phase C/D, the pace of satellite activities will increase, and that of the instrument must also follow pace.
The latest instrument development milestone was the IBDR, or Instrument Baseline Design Review, at which point the instrument/spacecraft interfaces should be frozen. HFI successfully passed its IBDR before the summer. Unfortunately, due to some of the above-mentioned problems, the LFI development slowed down dramatically in the first part of this year; its IBDR had to be postponed and is not expected to be completed before the end of November.

In October all the Planck Consortia will hold a joint meeting in Santander. This meeting will continue the process of cementing the collaborative processes which will eventually lead to the production of the Planck science. Please make this meeting a success with your enthusiastic participation.
Finally, at the end of the year, it is planned to hold a review of the Planck Science Ground Segment, which includes both LFI and HFI Data Processing Centres and the Planck Science Office. This will also be an important milestone in the development of Planck.

News from the Herschel/Planck Project Team

A. Elfving (Herschel/Planck System Manager)

The Preliminary Design Review of the Herschel and Planck spacecraft is currently underway, and should be completed by early October. The launch mass of both Herschel and Planck remains a very critical issue and is a main attention for the whole industrial consortia to contain and, as far as possible, reduce the current mass estimates. This message is obviously also extended to the instrument development teams. A design issue which requires continued attention is the Planck Payload Module thermal design and the identification and proper accommodation of all instrument and cooling chain heat loads.

The procurement process to build-up the complete industrial consortium is still running with high intensity. By early October nearly all of the about 100 subcontractors will have been selected through competitive tender procedures. The Attitude Control and Measurement Subsystem contractor, Dutch Space, are now in the middle of the procurement of the sensors and actuators. Of specific importance for Planck is the star tracker selection, which will largely determine the reconstructed attitude measurement accuracy, and the 1-Newton thruster performance, influencing the residual nutation amplitude. The Planck Telescope Reflector Critical Design Review has been held with an agreement to start the manufacturing of the QM reflectors. The mould grinding and polishing at Sagem is at the final stage for the secondary mirror and just started for the primary mirror.

The definition and planning of the Planck qualification and test program is continuously being revised taking into account the uncertainties in the delivery dates and/or configuration of the payload elements, primarily the LFI instrument and the Sorption Cooler. Work-around solutions to maintain the main milestones for the cryogenic qualification model and the flight model are implemented as far as possible but will soon be exhausted.

The status of the Planck New Science Case

An updated scientific case for Planck is being prepared by the Planck Science Team, based on the proposals submitted in June 2001 by the Planck Consortia. This publication has been nicknamed the "Blue Book", and its preparation is quite advanced, with all chapters existing already in draft form. A new version is being produced for review at the next Planck Science Team meeting in October.

The Blue Book will appear in due course as an ESA SP-series publication, and is likely to remain for some years as the standard reference for Planck. As in all such publications, the editors would like to provide an attractive cover picture for the Book. The best way to achieve such a goal is to ask **YOU** to provide it. Please send us your ideas and/or actual suggested cover pictures, and the Science Team will select the best candidate. Don't forget that the Blue Book is targeted not only at the scientific community, but also at the "interested layman". The cover picture should be not only attractive, but in some way indicate to its audience the scientific field of Planck. Please send your candidates to the Project Scientist (jtauber@rssd.esa.int) by the 11th of October, so that the Science Team can select the best one at its next meeting. The winning design will be duly credited.

Good hunting !

News from the HFI

J.L. Puget

The HFI just went successfully through the Instrument Baseline Design Review (IBDR) held in February 2002. The overall instrument design is now completed. The building of the Cryogenic Qualification model (CQM) has already started for some elements and will proceed with a schedule, which has been consolidated and discussed with the ESA project team. The new delivery dates for the HFI models requested by ESA are October 2003 for the CQM and January 2005 for the Flight Model (FM), which still allow to keep the launch date for Planck. The present HFI schedule is nearly in agreement with the ESA milestones. For the CQM the HFI schedule shows a delivery in mid November 2003. The integrated LFI/HFI focal plane unit could be delivered about one month later. The coolers are the critical items on the schedule, namely the dilution cooler from Air Liquide for HFI and Sorption Cooler for the Planck payload.

Testing of the HFI CQM focal plane unit will start in the cryogenic facility at IAS in September 2003. This test does not involve the 18K and the 4K coolers. The full cryogenic chain will be tested in the cryogenic system test facility at CSL in Liège in 2004.

All groups building the various subsystems for HFI have been working hard with the HFI management to keep the schedule in line with the new required dates.

The HFI instrument is provided by a consortium of 4 countries (France, United Kingdom, and USA contributing for more than 90% of the cost, and Italy). In addition to these, Germany and RSSD are contributing only to the DPC at a level of about 2.5% of the cost. The three main partners have incurred overcosts from the expected ones at the end of Phase A. These overcosts are mostly due to re-evaluation of the cost of the three active coolers which are all sophisticated and mostly new developments (18 K Sorption Cooler for the USA, 4 K cooler for UK, Dilution cooler, for France). The other overcosts are due to the very high reliability for electronics components required by the Central Procurement Parts A (CPPA) and the increase of the price of Helium 3.

ESA proposed to fund the electronics parts ordered through the Herschel-Planck Central Part Procurement (CPPA). A very substantial increase of the NASA contribution and use of the contingencies in France and UK have absorbed a large fraction of the overcosts. The rest of the funding problems are associated with the Canadian contribution. The Canadian Space Agency informed the Herschel and Planck PIs that they would not be able to fulfill all their commitments. The solution is that ESA will fund the Planck Canadian contributions which will be compensated by Canada at later times. The last pending problem is the current regulator for the 4K cooler. This will probably be provided through a new Co-Investigator: Eduardo Battaner from Granada. In conclusion, 99.7% of the funding for the HFI is secured, the last item mentioned just above being likely to be confirmed this fall.

Calendar of (some) Events

Joint Consortium & Workgroup Meetings

Date: 14-16 October, 2002

Place: Santander, Spain

Science Team meetings

Date: 17 October, 2002

Place: Santander, Spain

Date: 20-21 January, 2003

Place: ESTEC, The Netherlands

LFI Baseline Design Review (2nd part)

Date: 3rd week of November (TBC)

Place: IASF, Bologna

Science Ground Segment Review

Date: 2-4 December, 2002 (TBC)

Place: Orsay, France

The ARCHEOPS Experiment

The balloon-borne experiment Archeops is in many ways a prototype for HFI. With a scanning strategy similar to that of Planck, Archeops can also test the use of a Planck-like redundancy. Both scientifically and technically, Archeops is complementary to Boomerang and Maxima. The coverage of a large fraction of the sky enables measuring the CMB angular power spectrum at low l rather than high l.

Below are some technical specifications of Archeops as compared to Planck:

- Spider web bolometers operating at 100 mK, identical to those of HFI (provided by JPL/Caltech),
- Cold optics with back-to-back corrugated horns at 10K with filters at 143, 217, 353 and 545 GHz operating at 1.6K (provided by QMW),
- Planck-like total power read-out electronics with sampling frequency ~ 180Hz and no $1/f$ noise down to the spin frequency,
- Helium cryostat at 4 K. Unlike Planck which has passive cooling to 55 K, 20 K hydrogen Sorption cooler and a 4K helium compressor cryocooler,
- Planck-like dilution cooler system to reach 1.6 K and 0.1K,
- Off-axis Gregorian telescope (with a 1.5 m primary) made of aluminium (Univ. of Minnesota). It is based on an early design of the Planck telescope which is very close to the final one, allowing an angular resolution of 8-10 arcmin,
- The gondola rotates at 2-3 rpm. Stellar sensors are used to get a very good *a posteriori* attitude reconstruction, better than one arcmin (Univ. La Sapienza, Rome).

Recent developments of Archeops are further described on page 5

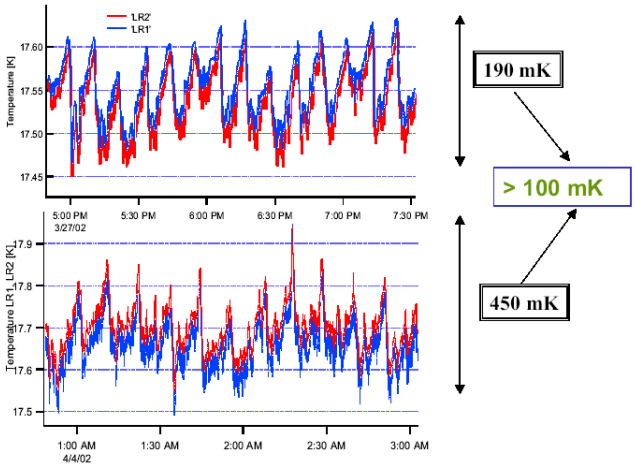
Sorption Cooler Test Results

C. Lawrence

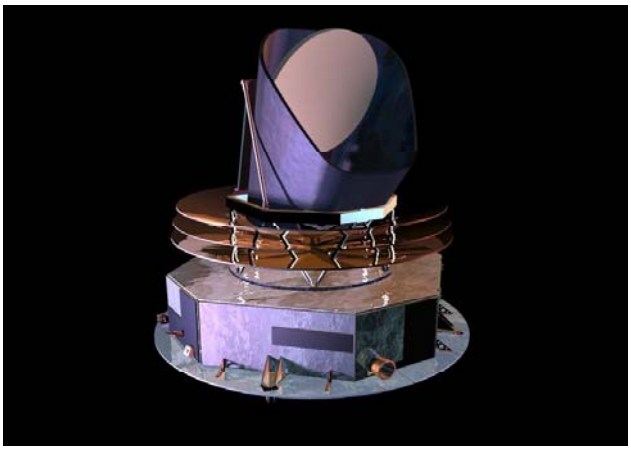
Testing continues on the EBB (Elegant Breadboard) sorption cooler. Since the first cooldown in January, all performance parameters of the cooler have been measured. Cooling capacity is measured to be within 3% of the predicted (specification) value for a given flow rate and precool temperature, with a measurement uncertainty in flow rate of ±5% and an uncertainty in parasitics from ground support equipment of ±4%. In other words, the cooling capacity is exactly as predicted. Pressures and temperatures are also as expected.

A procedure has been demonstrated for removing residual organic contaminants, gas-gap actuator capacity has been defined for flight (based on gas buildup in the gas gap volume observed during tests), a startup procedure has been developed and validated for flight, a J-T defrost capability has been demonstrated, and the size of both high- and low-pressure stabilization beds has been validated.

The EBB meets all performance requirements except one, temperature stability of the cold end. Rather than the specified maximum of 100 mK peak-to-peak on 1-hour timescales, the EBB achieves between 200 and 450 mK. An investigation into the stability shows two dominant sources of "excess" fluctuations: dynamic performance of the hydride material itself that is different from that observed in previous hydride materials; and variations from compressor bed to compressor bed in the thermal attachment of the gas-gap actuator. The latter factor will be better in the flight coolers, which use a different attachment design. A quantitative investigation of the improvement that can be expected has begun with further measurements on the EBB.



Temperature fluctuations measured at the cold liquid reservoirs of the EBB sorption cooler.



News from the LFI

R. Mandolesi, M. Bersanelli, & C. Butler

The design of the LFI radiometers has been completed and successfully tested on the "elegant breadboard" (EBB) models at 30, 70 and 100 GHz by LFI teams from the U.K., Finland and U.S.A. Performance testing of the breadboard radiometers indicated system noise temperatures at unprecedented low-noise levels. Extensive evaluation of the non-white noise component (typically with a *1/f*-like spectrum) showed acceptable levels. The power consumption in the front-end modules is also within the anticipated budget. Detailed analysis of the temperature stability in the front end is now being carried out using data available from the 20 K sorption cooler EBB model produced by JPL.

A number of critical interfaces with the spacecraft were frozen. Some details of the interface between the waveguide assembly and the Planck thermal shields ("V-grooves") are currently being discussed and finalised between Laben and Alcatel. Technically, the LFI is ready to proceed into the full qualification model (QM) phase. For some units, the QM models have already started production.

LFI has funding problems which are not yet completely solved. The main areas of concern are the Italian and Finnish budgets. The reason for the budgetary problems is the cost increase in the instrument development over the original estimates made in 1997/1998. Major efforts have been made within the LFI Consortium to resolve the issue. Italy needs an increment of about 15% in order to complete the baseline instrument, whereas the Finnish contribution shows a shortfall of more than 20%.

The funding problems could cause a delay in the delivery of the instrument models against the new ESA need dates of October 2003 for the Cryo-Qualification Model and January 2005 for the Proto-Flight Model. All efforts are being made by LFI to minimise possible schedule impacts, and it is expected that the funding situation will be resolved soon.

ARCHEOPS: Recent Developments and First Results

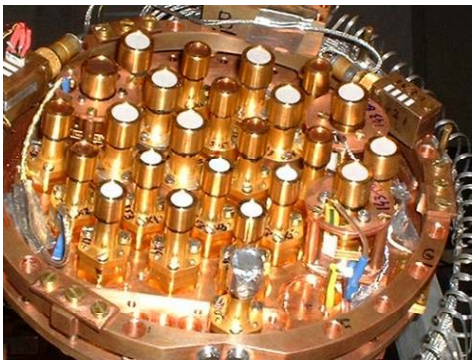
Archeops is an excellent test-bed of the concept of the HFI focal plane unit. The sensitivity of Archeops is only limited by the photon noise. The background emission from the warm telescope and Earth atmosphere is about 10 to 15 times larger than the background expected for Planck. Although this reduces the achievable instantaneous sensitivity by a factor 3 to 4, it is nevertheless rather close to the Planck instantaneous sensitivity.

Archeops flights

In 1999 the experiment flew for the first time from Trapani for a technical flight where limited night data were obtained. The gondola was fully tested and the focal plane temperature reached the required ~100mK. A strong parasitic signal was detected due to reflection on an element of the baffle. In the winter of 2000 the second flight was carried out from Kiruna (KS1). Unfortunately, this flight was short due to very strong high altitude winds. Last winter, there were two flights also from Kiruna. Flight KS2 had to be aborted due to a problem with the balloon. KS3 was fully successful and provided 12.5 hours of night data covering ~30% of the sky. With ~7 million night samples per bolometer, a total of about 110,000 pixels of 20 arc minute with 0.40 seconds/pixel-/bolometer was collected.

Excellent optical efficiency

Measurements of Jupiter confirmed beams with FWHM ~ 10' and enabled to determine the sensitivity of Archeops during the KS3 flight. The photometric point source calibration agrees at the 10% level with that obtained with extended sources such as the cosmological dipole and the Galaxy.



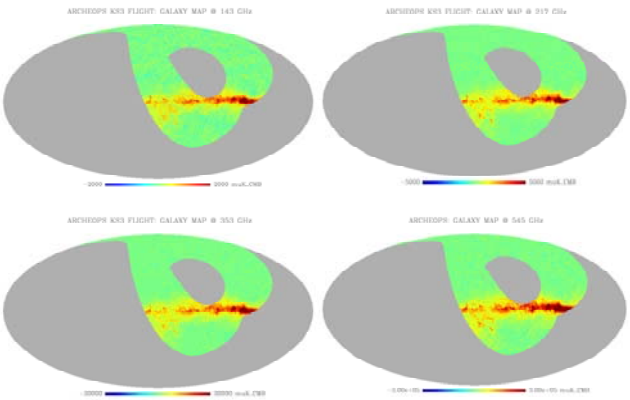
100 mK focal plane with the encasing of the spider Web bolometers (8 @ 143GHz, 6 @ 217GHz, 6 polarised @ 353GHz (3 OMT pairs), 2@ 545 GHz, 1 blind).

The best 8 detectors in the 143 and 217 GHz channels have an average sensitivity of 180 μK_{CMB} in one second of integration. One can thus expect 1σ sensitivities of about 100 and 150 μK_{CMB} at respectively 143 and 217 GHz per 0.3^{o} pixel. The sensitivity level that can be reached in 12 hours compares well with the MAP nominal sensitivity of 20 μK_{CMB} for one year of integration (MAP Web Page). This global sensitivity measurement obtained in flight is very hard to obtain from ground calibration.

One can deduce that the end-to-end optical efficiency reaches 50% for the best channels. This is excellent news since it confirms that the goal of 50% overall efficiency for HFI can indeed be reached. The HFI requirement is 25%, and the best estimate prior to this measurement was ~35%.

First results and prospects

Preliminary maps from the KS3 flight provide the first large-scale view of the Galaxy at these frequencies. The prospects for CMB measurements in the high redundancy regions are quite good. There are as many as 150 to 300 observations per HEALPIX pixel (at n_{side} =128). The sum and difference of the thermodynamic temperature maps at 132 and 217 GHz, directly demonstrate the good (CMB) signal to noise ratio.



Preliminary maps from the KS3 flight, illustrating the coverage and the cleanliness of the data. A simple map-making technique was used. These maps are not ready for scientific analysis since the timeline processing is still far from complete.

The Archeops data will substantially reduce the current uncertainties in the region of the CMB power spectrum between the COBE/DMR data and the Boomerang / Maxima / DASI / VSA/ CBI data.

The Archeops reflectors have been recently tested by Alcatel with a Planck-like baffle in order to evaluate the main lobe and the far side lobes at 30 and 100 GHz. These measurements allow a direct test of the software used to predict the Planck system optical properties. *(See also page 7).*

This article was contributed by F. Bouchet on behalf of the ARCHEOPS Consortium. The Consortium is headed by Alain Benoit from CRTBT, and is constituted of :

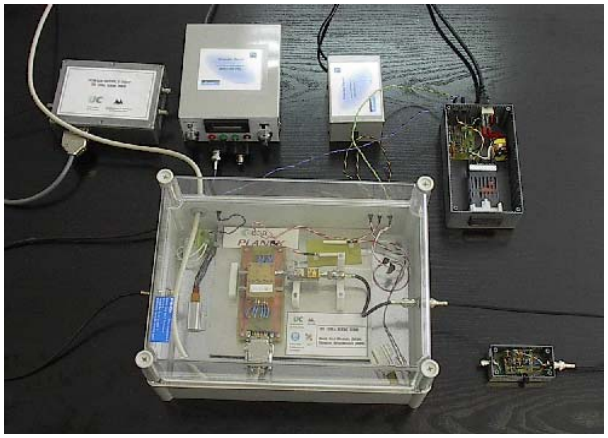
- France: CESR, CRTBT, CSNSM, IAP, IAS, ISN, LAL, LAOG, PCC/CdF, OMP, SPP/CEA
- Italy: Univ. La Sapienza (Rome), IROE CNR
- Russia: Landau Ins. of Theoretical Physics
- UK: QMW (Cardiff)
- USA: CALTECH, JPL, Univ. Of Minnesota

Further information may be obtained from the web site: http://www.archeops.org.

The Santander Group will host the next Planck Meeting

The Santander Group, LFI consortium member, will host the joint LFI-HFI Planck Meeting in October 2002. Besides hosting this meeting, the contribution of the Santander group to the Planck project is manifold.

The Santander group has been active in CMB research for more than 15 years. They have investigated theoretical aspects of the CMB, especially the statistical properties, and have developed data analysis methods for several CMB experiments such as the Tenerife Experiment, Cosmosomas, COBE, etc. The main Planck contribution is the design, construction and characterization of the LFI backend modules for the 30 and 44 GHz channels. This activity is a collaboration between the Instituto de Física de Cantabria, the Department of Communications Engineering at the University of Cantabria and the Department of Signal Theory and Communications at the Technical University of Catalunya, and is led by Enrique Martínez-González (PI) and Eduardo Artal (PM).



Laboratory setup for the noise characterization of the 30 and 44 GHz BEM in a temperature controlled enclosure.

The Santander group leads for the LFI consortium the following working groups: Non-Gaussianity (WG 4), Characterization of Physical Signal (WG5.6), and Point and Compact Sources (WG2.2). The last group participates in the LFI-DPC, developing algorithms for the detection and extraction of point sources from the time ordered data streams and maps in combination with component separation methods (MEM and ICA). The Santander group is the national management site for the LFI-DPC in Spain.

Members of the group are Beatriz Aja, Antonio Aliaga, Belén Barreiro, Laura Cayón, Luisa de la Fuente, Julio Gallegos, Oscar Gómez, Diego Herranz, Angel Mediavilla, Juan Pablo Pascual, María Salmón, José Luis Sanz, Marco Tucci and Patricio Vielva, from Santander, and Lluis Pradell and Pedro de Paco from Barcelona.

The status of the Planck Working Groups and the Planck Scientist List

From the Planck Science Team

The final redefinition of the Working Groups took place in January 2002, though a few of them were already in place and working since mid-2001. The WG coordinators were asked to submit reports to the ST in June; all the reports did arrive by August, and are available in Livelink Reports. These reports were reviewed by the Science Team at their meeting in early July, with the following conclusions:

WGs 1 (Systematic Effects) and 2 (Component Separation) are off to a good start, having had a number of meetings where the organisation and the work carried out has been reviewed. Minor adjustments in their organisation are required, and will be implemented by the coordinators.

WG 3 (the so-called "CTP group") is in good shape, being the one which started working in its present form at the earliest time. Several workshops have been held by the group, and in particular the last one (held in June) appeared to have been very effective. It was noted that the WG is feeding back information effectively into the DPCs. A short report on the recent activities of the WG is included in this Newsletter *(see page 7)*.

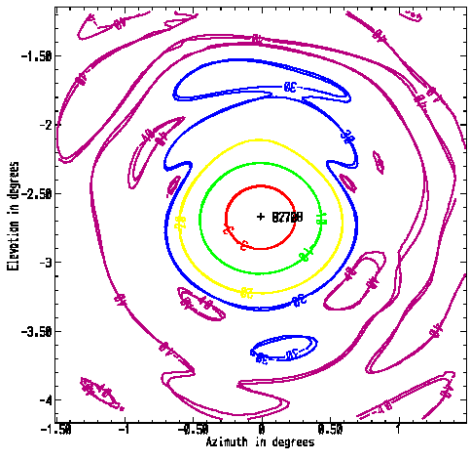
The remaining "science-oriented" WGs 4 (Non-Gaussianity), 5 (Clusters and Secondary Anisotropies), 6 (Extra-galactic Sources), and 7 (Galactic and Solar System Science) were found by the ST to be less advanced, due to a later start. In one case the WG has not yet held its kick-off meeting. The ST perceived a lack of real involvement in some of the subgroups; in some specific cases a large membership was not correlated with the limited level of work being carried out. Although the ST is concerned about this general situation, it hopes that an increase in activity may be triggered by the gradual increase of output from the "transverse" WGs (1, 2, and 3), and by the output of the simulation pipeline.

The ST expects to produce the first **Planck Scientist List** at the common Consortium meeting in mid-October. To arrive at this List, the Consortium PIs need to process the evaluation of work carried out by individuals, which is provided to them via the Instrument Teams, DPC Teams, or the WGs. Since the situation of the "science-oriented" WGs is not as advanced as was initially hoped for, it is likely that the first round (which will include activities up to the end of 2001) will be limited in large measure to those people whose work can be evaluated via the Instrument Teams and DPC Teams, leaving the membership of WGs 4 to 7 to be evaluated for the first time at the next (yearly) round. More on this topic at the Joint Consortium Meeting in Santander.

The first RF measurements of Planck

The RF verification of the Planck "optical" system is largely based on two models:
- a so-called RF Development Model, or RFDM, whose purpose is to validate the ability to model a large and complex RF structure such as Planck.
- a so-called RF Qualification Model, or RFQM, which will be used to verify that the Planck satellite fulfills all its optical and straylight requirements.

The RFDM is a system which is quite close (but not identical) to Planck, and consists of a large telescope (which was based on the Archeops reflectors - on loan from S. Hanany of the Univ. of Minnesota - and a Planck-like structure), and a large baffle surrounding it, similar to the one which will be present on Planck. The telescope is illuminated by feedhorns whose design is very close to that of LFI horns at 30 and 100 GHz. The antenna pattern of the RFDM was recently measured at 30 and 100 GHz by Alcatel Herschel/Planck engineers, at a Compact Antenna Test Range owned and operated by Alcatel Space. One of the most important objectives of this test campaign is to compare the pattern measurements of the RFDM to the corresponding numerical predictions, which were based on the software package GRASP8. Preliminary analysis of the measurements indicate a very good correlation with the predictions in the main beam area, as shown in the plot below. Analysis of mid- and far-sidelobes is more complex due to the interactions of the RFDM with the antenna range, and is still ongoing.
Congratulations go to Alcatel for the good work so far!



Predicted and measured main beam radiation patterns of the Planck RFDM (contours down to –40 dB from peak) (figure from Alcatel Space).

The real RF verification of Planck will take place on the RFQM, which consists of an identical copy to the Planck flight telescope and surrounding structures. The details of these measurements (which should take place between 2005 and 2006) are still to be resolved, but will undoubtedly involve an extensive test campaign in a Compact Test Range similar to that used for the RFDM tests, at frequencies in the range 30 to 350 GHz, and potentially up to 500 GHz. These measurements will constitute an essential input into the post-processing of the Planck data.

News from the CTP Working Group

C. Lawrence

The CTP Working Group (WG 3) held a week-long working meeting at the Institute of Astronomy, Cambridge, in June. The focus of the week was comparison of map-making methods. Several time-ordered-datasets (TODs) were generated for one year of observing with a single 100 GHz feed, using two different scan strategies, and both symmetric Gaussian beam shapes and realistic beams. Comparison of results is continuing. A lot of practical details had to be sorted out, from computer accounts to file formats to disk space to parameters passed from one piece of code to another. Perhaps the most significant achievement of the week and the work leading up to it was that for the first time, simulations could be and were run end-to-end, from TOD to maps. Before that, code existed covering all the needed steps individually, but the steps could not be connected.
This is a significant advance in our collective simulation capability.

The Early Release Compact Source Catalogue

A statement by the Planck Science Team

The LFI and HFI Consortia intend to produce a catalogue of compact sources detected by Planck very soon after the first full sky survey is finished, i.e. long before the final scientific products are due to be released to the public. This catalogue will be used for follow-up observations with both ground-based and space-based observatories, e.g. the Herschel Space Observatory. The early release of such a catalogue to the public would bring a significant benefit to the astronomical community at large, allowing a more complete exploitation of the catalogue, in particular with short-lived observatories such as Herschel. The potential characteristics and scientific usage, and the question of whether this early release to the public should take place, were discussed at Consortium meetings in October of 2001, and subsequently at the December 2001 meeting of the Planck Science Team. At that time, the ST decided to approve the concept proposed by LFI and HFI Consortia of
"producing an Early Release Compact Source Catalogue (ERCSC). The production details (responsibilities, funding, specifications of the catalogue, schedule, etc) remain to be worked out. The release of the ERCSC to the public will be subject to appropriate scientific validation, as per the Planck Science Management Plan, and will occur 9 months after the first full-sky survey is completed".

Estimated Instrument Performance Goals

Telescope	1.5 m (proj. aperture) aplanatic; shared focal plane; system emissivity 1%									
	Viewing direction offset 85° from spin axis; Field of View 8°									
Instrument	LFI				HFI					
Center Freq. (GHz)	30	44	70	100	100	143	217	353	545	857
Detector Technology	HEMT LNA arrays				Bolometer arrays					
Detector Temperature	~20 K				0.1 K					
Cooling Requirements	H_2 sorption cooler				H_2 sorption + 4 K J-T stage + Dilution cooler					
Number of Unpol. Detectors	0	0	0	0	4	4	4	4	4	4
Number of Linearly Polarised Detectors	4	6	12	24	0	8	8	8	0	0
Angular Resolution (FWHM, arcmin)	33	24	14	10	9.2	7.1	5	5	5	5
Bandwidth (GHz)	6	8.8	14	20	33	47	72	116	180	283
Average $\Delta T/T_I$ * per pixel#	2.0	2.7	4.7	6.6	2.0	2.2	4.8	14.7	147	6700
Average $\Delta T/T_{U,Q}$ * per pixel#	2.8	3.9	6.7	9.3		4.2	9.8	29.8		

* Sensitivity (1σ) to intensity (Stokes I) fluctuations observed on the sky, in thermodynamic temperature ($x10^{-6}$) units, relative to the average temperature of the CMB (2.73 K), achievable after two sky surveys (14 months).

A pixel is a square whose side is the FWHM extent of the beam.

* Sensitivity (1σ) to polarised intensity (Stokes U and Q) fluctuations observed on the sky, in thermodynamic temperature ($x10^{-6}$) units, relative to the average temperature of the CMB (2.73 K), achievable after two sky surveys (14 months).

PLANCK

Table last updated 6/9/2002

esa ASTROPHYSICS

The Scientific Performance of Planck

The "official" performance levels of the Planck instruments are provided via the Planck web pages under http://astro.esa.int/Planck and in particular at http://astro.estec.esa.nl/Planck/science/performance/perf_top.html . These levels have recently been updated to reflect the most up-to-date instrumental characteristics. Please consult these pages and use those levels as the basis of your publications and/or presentations. For reference a summary is included below.