Recommendations and Report from the 70th STC Meeting


1) La Silla-Paranal Observatory

   a. Recommendations on Workhorse instruments

      Following on previous recommendations (STC-67, STC-68, STC-69), the STC insists on the necessity for the development of a well-defined strategy for the replacement/refurbishment of ESO’s workhorse instruments. Such a clear strategy is seen as essential for maintaining the scientific eminence of VLT well into the ELT era and allow member states to have a comprehensive view of the overall program. To be effective, this strategy must be defined rapidly, which would also help place potential new initiatives/opportunities in the appropriate context.

   b. Recommendations on surveys

      The ESO workshop on wide field spectroscopy has shown the strong interest of the European astronomical community in such surveys. Well organized and motivated teams presented the most pressing science cases, where ESO can play a leading and unique role during the period 2010-2016, with considerable depth of details. Several of the cases are expected to have a huge scientific impact:

      - the exploration of large scale structure and dark energy from the baryon acoustic oscillations at redshift 1< z <3 or the redshift distortion at redshift z >1.
      - the star formation history and evolution of galaxy haloes in ultra-deep redshift surveys (I_AB ≥ 25) of galaxies, up to redshift z~7.
      - the spectroscopic follow up Magellanic Clouds.
      - the spectroscopic follow up of GAIA.

      Following the conclusions of the workshop, the STC recognizes the scientific importance and the timeliness of large spectroscopic surveys. It recommends that ESO considers the following two step approach:

      o Step 1 : Short term

      The STC recommends using current instruments (including the assumed successful upgrade of VIMOS by summer 2010) to begin large public spectroscopic surveys as rapidly as possible. For this, it recommends that ESO issue a call for proposals for public spectroscopic surveys. While STC leaves the practical organization to ESO, the following guidelines were unanimously recognized as being essential:

      ▪ The Public Survey Panel should evaluate the proposal and attribute the appropriate number of nights according to scientific merit.
      ▪ Cross-membership (OPC, STC, PSP) among the survey panel members ensures quality standards across all observing programs of ESO.
      ▪ Only proposals involving a number of nights well in excess of what is possible as a large program should be considered.
The STC suggests that ESO consider whether extending this mode of operation to other areas is indicated.

- **Step 2: Long term**

STC reiterates with vigour its conviction that large-scale public spectroscopic surveys should be available at ESO. It urges ESO to issue a call for instrument concepts and associated science on the shortest possible timescale compatible with ESO highest strategic interests. The call should be broad enough so as not to be restricted to the UTs nor even to ESO facilities.

c. **Recommendation on the proposal for the VLTI Visitor Instrument PIONIER**

The STC discussed the proposal for the instrument PIONIER to be installed as a visitor instrument on VLTI. PIONIER is an instrument that combines four ATs or UTs for aperture synthesis imaging and precision interferometry and could be operational as early as summer 2010.

The STC appreciated the enhancements this instrument could provide in a very short time to the imaging capabilities of VLTI. This would provide an interesting extension of the science capabilities of VLTI awaiting the time at which the second generation instruments will become operational. In addition, it was noted that work required to accommodate PIONIER will be required by the second-generation VLTI instruments as well.

The STC therefore recommends that ESO consider entering in discussions with LAOG for a speedy implementation of PIONIER on VLTI under the condition that:

- PIONIER should in no case interfere with the commissioning of PRIMA or the current schedule of the second-generation instruments.
- The commissioning of PIONIER can be used in order to improve the readiness VLTI for the arrival the second generation instruments.

d. **Recommendation on AOF on UT4**

Recognizing the importance of AOF to many of ESO’s future projects, the STC recommends that ESO develop a roadmap leading to the commissioning of AOF on UT4. The roadmap should include the impact this commissioning will have on the operations of the telescope.

2) **ALMA**

a) **Recommendation on keeping the specifications despite the delays**

The STC took note with satisfaction of the progress made in all aspects of ALMA. In particular, the STC was pleased to hear that the situation regarding the manufacturing of the European antennas and front ends appears to have significantly improved. The STC stresses the importance of keeping the specification of the antennas and receivers and not lowering them in order to make up for accumulated delays.

b) **Recommendation on early science at ALMA**

Recognizing the importance of maximizing the impact of ALMA science, the STC endorses the recommendation of the ESAC that early science should begin with no less than 16 antennas.

c) **Recommendation on the AEM 12m antenna at ATF in Socorro**

The STC supports the present efforts of the ESO DG regarding the fate of the antenna and trust his judgment to deal with this matter in the best interest of science in general and ESO in particular.

d) **Advice on the preparation of ALMA science**

The STC recognizes the need for a coordinated effort in ensuring the availability of suitable
data (in adequate format) pertinent to the identification of molecular emission lines. Knowledge of frequencies, collision or chemical reaction rates, for example, will be essential to a proper scientific exploitation of ALMA data. The ALMA project should investigate if organizing/guiding current dispersed efforts within the ARCs framework could be a cost effective way to improve a timely science return of the project.

e) **Comment on the new arc node in the Czech Republic**  
The recent proposal for a new ALMA Regional Center Node in Ondrejov, Czech Republic, represents a valuable contribution to the ALMA project, with a strong geographical interest and leading to the strengthening of the areas of solar and laboratory astrophysics within the ALMA project. The STC, following the rules for acceptance of a new ARC node in the European ARC Network, awaits the comments from the ARC Coordinating Committee and the ESAC on the plan just submitted by the Astronomical Institute in Ondrejov before issuing its recommendation.

f) **Comment on the sensitivity levels of ALMA bands**  
The STC enthusiastically takes note of the excellent, better than specifications, sensitivity levels reached by the development teams on most ALMA bands.

3) E-ELT  
Following the presentation of the progress made on all aspects related to E-ELT, STC would like to associate itself with ESE in expressing its satisfaction with the excellent work being performed by the project team and would like to congratulate it as well. STC endorses fully the report by ESE and would like to underline a few of the most essential issues raised in the report.

a) **Recommendation 1**: ESO should recommend a means for allowing information flow from SSAC to ESE consistent with the need for discretion in the site characterization process.

b) **Recommendation 2**: ESE chair and ESO should fill the missing telescope expertise on the panel.

c) **Recommendation 3**: ESO management should improve reporting to ESE so that the panel can be assured that the site characterization group has sufficient personnel and resources.

d) **Recommendation 4**: ESE recommends breaking out the science item in the “Health Chart” into separate entries for the DRM delivery and telescope conformance to the science program.

e) **Recommendation 5**: The E-ELT office should work with the SWG to assess the science gain / cost tradeoff of a high site on a timescale consistent with SSAC activity.

f) **Recommendation 6**: The E-ELT Project Office should evaluate the applicability of the water vapor analysis to other E-ELT sites.

g) **Comment on requests**: We stress the importance of the requests (as opposed to recommendations) made by ESE which are all related to providing ESE with the information deemed necessary in order for the sub-committee to provide knowledge-based advice to STC and ESO.

4) STC and sub-committee membership  
The STC met for the first time in its new composition. The full 19 members of the STC, including the members at large from Canada and Australia, were able to attend the meeting. Despite this large number, the discussions were carried out in excellent spirit and were very effective. All the items on the Agenda could be addressed.

As stated in its Terms of References, the STC nominated its vice-chair during this first meeting. The
committee unanimously accepted the nomination of A. Marconi (I) as ST vice-chair.
In order to finalize STC representation in the sub-committees, it was proposed to members of STC who are not yet members of a sub-committee to join one if they so desire. As a result, all members of STC but one, including the members at large, are now members of a sub-committee.

Appendices

1 Report from the 3 STC sub-committees
   a. LSP sub-committee meeting, April 17, 2009 p 5
   b. ALMA sub-committee meeting, January 9, 2009 p 8
   c. ESE sub-committee meeting, April 16, 2009 p 14

2 Report on the ESO workshop on wide field spectroscopic surveys, March 9-10, 2009 p 20

3 Appendix 3: STC 70th Meeting Agenda p 25
Appendix 1a:

Report from the LSP sub-committee meeting of the STC on April 17, 2009

Report prepared by Joris Blommaert, Bill Cotton, Yannick Mellier (Chair), Roberto Ragazzoni and Guy Perrin.

1. VST and VISTA

The committee is pleased to see the very good progresses done on both VST and VISTA. In view of the progress of the commissioning of VISTA the telescope should be ready for science operation this fall. We congratulate the new VST teams for the considerable works done on the mechanics, the optics and the electronic control of the telescope. It is most likely the VST will be ready for science operation by spring 2010.

2. AOF and LGSF

The committee notices the progresses done on the 5 AO systems, LGSF, GRAAL, GALACSI, ASSIST and the Laser room. GALACSI seems to be on time for MUSE. As the performances of GRAAL seem strongly dependent on the turbulence profile, the committee encourages the teams to clarify the characteristics of the model they use and to make clear assessment on its sensitivity to this model. The committee notices that the improvement of the image quality over the whole field of HAWK-I with GRAAL is about 25%. The committee wonders whether GRAAL could be better suited for another instrument. We encourage ESO to explore such alternative configurations for the ESO community.

Due to the complexity and to the large number of modalities, the committee is concerned about the huge impact the installation, verification and commissioning of AOF will have on the VLT operation. It will have non negligible effects on the manpower requirements on the mountain and on the related consumption of time that would otherwise be allocated for science. We recommend ESO to work out a detailed plan and to consider the option to spread such efforts in a prolonged timescale in order to minimize the impact on the science operation.

The committee applauds the continuous strong efforts of the team to improve the reliability of the LGSF, as well as the approach used for the procurement of the four LGS systems to be implemented in the AOF. These are tremendous efforts and we suggest that a fraction of these is furthermore devoted to investigate, at least at a conceptual level, a backup solution based solely, or mostly, upon NGS in order to assess a plan in case the reliability of the LGS in development would turn out to require much more time and works than expected to reach the scientific requirements.

3. Wide field spectroscopic surveys

Following the success and the outcome of the workshop on wide field multi-object spectroscopic surveys (see the report on the workshop in Appendix 2), the committee endorses the proposition that ESO set immediately a call for Public Surveys for very ambitious wide field spectroscopic surveys (several hundred of nights) with VIMOS, GIRAFFE/FLAMES or the NTT/FORS1 MOS facility (if feasible). The call should be sent as soon as possible in order to start the surveys in 2010. The spectroscopic surveys with VIMOS should not start before the major upgrade that ESO plan in summer 2010.

It was not clear what could be the best way to proceed for the down selection of the projects: OPC or separate committee with external referees. Since the surveys should start by 2010, the final amount of nights that should be devoted to the surveys can be removed from the pool of nights of ESO telescopes after the selections.

The committee also approves the proposition to set a call for a next generation wide field, multiplex
spectrograph. The call should be open to any instruments, for any ESO telescopes, and should contain the following broad specifications:

- Multiplex gain > or << 500;
- Field of view : at least 20';
- Wavelength coverage 350 nm to 1.7 micron;
- Spectral resolution 1000 to 40000;
- No substantial modifications of VLTs

The response should contain a concept as well as clearly identified scientific and technical teams for the design and the construction.

The committee also discussed the need for a global roadmap for wide field spectroscopic facility at ESO. It is clear that the call should be very open in order to provide new facilities that will be needed soon, for GAIA, but also far beyond, in order to prepare the next generation super-wide and super-multiplex spectroscopy instruments for the ESO community.

4. VLTI

PRIMA commissioning and reduction of vibrations:

The committee congratulates the teams for the remarkable long term efforts and the significant improvements done on both PRIMA commissioning and the actions carried out to reduce vibrations. We encourage the teams to continue these efforts, in particular on the reduction of vibrations produced by ISAAC and VISIR.

The issue of the ATs:

Operation of the ATs turns out to be an issue, as failures are encountered on a regular basis. Problems could not be fixed by AMOS in the framework of the contract and ESO could not directly fix the problems to avoid jeopardizing binding contractual terms. As the contract comes to an end, the LSP sub-panel asks ESO to fix ATs as soon as possible to allow optimum use of the VLTI. The ATs are required for imaging and for astrometry with PRIMA.

Imaging with VLTI:

The LSP sub-panel encourages ESO to find a strategy to ease imaging with VLTI. Among possibilities presented by ESO, the combination of the 3 quadruplet scheme and of the joker weeks seem to be an interesting path to explore, including any variations on such schemes. ESO has to find a way to interact with the community to define the best quadruplets to choose. Requirement of short spacings for MIDI should not be forgotten. Special care should be taken in Service mode operations for imaging as objects are usually variable and observations at different baselines cannot be taken several weeks apart. This specificity of VLTI must be taken into consideration by ESO at the observing proposal form and operation levels.

PIONIER:

The LSP sub-panel recognizes the strong interest of a fast track instrument such as PIONIER to provide VLTI with a competitive H and K imaging capability before the 2nd generation of instruments becomes operational. PIONIER on the VLTI will outperform all present-day imaging capabilities in the world. Its expected performances are perfectly suited for the science cases proposed by the PIONIER team, namely, the imaging of HAeBe and T Tauri stars, the observation of hot dusts in debris disks, and the characterization of hot Jupiters. The LSP committee notices however that the performances of PIONIER depend on the ATs and therefore urge ESO to provide quickly a plan to fix the AT problems. Further discussions between the PIONIER team and ESO are therefore recommended. During discussions, the impact of the project on the ESO VLTI teams must be addressed. In the same vein, the main contributor to PIONIER, LAOG, being member of the GRAVITY consortium, it must be made clear that the building of PIONIER will have no impact on the building of GRAVITY and that no delay is to be feared.
Policy of ESO with respect to the 6th AT:
During the LSP meeting, the committee has been informed of the new position of ESO regarding the 5th and 6th ATs. It differs from what the community has understood, namely that ESO would pay a 6th AT if the community could bring the 5th one. We encourage ESO to communicate this position to the community, as it has a major impact on VSI.

Agenda of the LSP Meeting
Friday 17th April 2009
09:00 - 09:10 Welcome (Y. Mellier)
09:10 - 09:35 Adaptive Optics Facility (AOF) (R. Arsenault)
09:35 - 10:00 Laser Guide Star status report (R. Tamai)
10:00 - 10:25 Large Spectroscopic Surveys (Y. Mellier)
10:25 - 10:40 VST Status Report (J. Spyromilio)
10:40 - 10:55 VISTA Status Report (M. Cullum)
10:55 - 11:15 Discussion
11:15 - 11:30 *** Coffee Break ***
11:30 - 12:00 VLTI: Infrastructure status report (P. Haguenuer)
12:00 - 12:30 VLTI: Prima status report (F. Delplancke)
12:30 - 13:00 VLTI: Pionier: proposal for a visitor instrument on the VLTI (A. Richichi)
13:00 - 14:00 *** Lunch at ESO ***
14:00 - 17:00 Closed session
17:00 - 18:00 Meeting with ESO staff
End of Meeting
Appendix 1b:

Report from the ESAC sub-committee meeting of the STC on January 9, 2009

ESO, Garching, January 9, 2009

ESAC members: Jose Afonso (chair), Jorma Harju, Peter Schilke, Frederic Gueth, Michiel Hogerheijde, Susanne Aalto, Roberto Maiolino, John Richer (via telecon)

Other participants (part-time): Paola Andreani, David Rabanus, Bruno Leibundgut, Leonardo Testi, Wolfgang Wild, Martin Zwaan, Eelco van Kampen, Tom Wilson, Ewine van Dishoeck

Apologies: David Field, C. Waelkens, A. Benz

The ESAC met in Garching on January 9th, 2009. The agenda of the meeting is attached as an appendix to this report.

Executive Summary

1) The ALMA project is currently advancing at a fast pace, but not enough to prevent significant delays to be occurring, in many fronts. The committee finds particular worries in the European Antenna construction, where recent problems are apparently not being solved in the most efficient and productive way. ESO is currently trying to strengthen the communication with the AEM consortium, trying to help to improve the situation, a course of action that is strongly supported by the ESAC.

2) The ESAC notes the end-of-operations of the ATF, a completely successful facility, which has helped to test and produce both ALMA hardware and software, providing a substantial contribution for shorter and smoother AIV and CSV activities. The ESAC notes the beneficial role of having a dedicated interferometry facility working as a test-bed for computing, and note the possible interest of considering the feasibility of implementing such a mode at the ALMA site in the future, if at all feasible and possible, as a way to shorten some of the project’s delays.

3) The ESAC considered the current plans for ALMA Time Allocation procedures, and recommends that the operations teams be included in future discussions, as the implementation of such plans is fundamental to ALMA. Concerning the referee vs meeting paradigm for evaluation of proposals, the committee strongly advocates that some form of interaction between evaluators is necessary, ideally in a face-to-face mode, and at the very least through a videoconference mode. The latter is deemed to be currently not yet appropriate, due to technological limitations.

4) A new set of milestones is being proposed for ALMA, which the ESAC considers appropriate. For Early Science, the committee recommends that the current set of requirements is assumed, namely that this phase starts with a minimum of 16 antennas. Consequently, the start of Early Science should be allowed to shift. A careful management of the general user expectation will be necessary, so that the community is not left with conflicting information about the start of operations.

5) The ESAC was pleased with the responses to the latest ALMA Computing Review and with the implementation of a CIPT long-term planning. Also, the ESAC notes the setting up of dedicated in-house ALMA-specific CASA tests, namely for large datasets, as previously recommended by the ESAC. This is a necessary step to guarantee the adequacy of CASA to ALMA data.

6) Concerning the ALMA helpdesk user support, made through the ARCs, the ESAC considers it would hurt the unified ALMA project to have regional independent helpdesks being setup. The ESAC recommends the implementation of a single user helpdesk, with tickets being distributed to different partners or institutions following the submission of the ticket by request-handling software.

7) The ESAC was pleased with the preparation activities and resources ramping up of the European
ARC, and with the creation of the European ARC implementation plan. It is of particular note the hiring, by ESO, of two persons that will devote efforts for CASA development, as this was an expertise seriously lacking in Europe.

8) The ESAC received the proposal for a new ARC node in Ondrejov (Czech Republic). Besides the obvious geographical interest, the ESAC considers that new and relevant expertise, namely in the fields of solar observing and laboratory astrophysics, would be a valuable contribution for the ALMA project. However, before recommending acceptance of this new ARC node, the committee advises on a preliminary preparatory phase dedicated to bringing up the ALMA expertise to the level displayed by the current ARC nodes, preferentially in collaboration with the ARC network and possibly collaborating on the Commissioning activities. The ESAC would also like to see a development and implementation plan for the ARC node in Ondrejov for the coming years.

9) The ESAC is particularly concerned with the scientific exploitation of the ALMA data, in particular in the field of astrochemistry, where data such as frequencies, collision or chemical reaction rates, are still clearly not sufficient, nor in adequate format, for ALMA purposes. Concerning the ALMA development plan, the committee recommends the ALMA project to recognise the importance of this issue, and find ways to incentive relevant work. For example, making existing models and physical databases easily accessible for analysis of ALMA data to the general ALMA user would be a very efficient, and relatively inexpensive, way to maximize the science output of the observatory. This could be made within the ARCs framework, and could start by organizing and guiding currently dispersed efforts.

10) The ESAC recognises the important results from APEX, and notes that current and planned instruments for APEX are of great interest for the community. The committee waits with interest the formal scientific justification for the extension of the project beyond 2012, recognising the importance of APEX parallel operations with ALMA and before CCAT starts operations.

Full ESAC Report

ESAC/STC renomination update
The ESAC was informed that the new STC membership has been decided, and that new ESAC membership should be defined over the next few weeks. The ESAC chair would like to thank the commitment of ESAC’s current members, most of which have served well beyond their term, helping to keep the ESAC a functional and efficient advisory committee through the restructuring period that is now nearing completion.

ALMA project update
The ESAC was briefed on the ALMA project status by the European ALMA Project Manager, Wolfgang Wild, and the ALMA European Project Scientist, Leonardo Testi. One item of obvious concern by the ESAC is the European ALMA Antennas. It is not clear the construction difficulties encountered over the last few months are being dealt with in the most efficient and productive way by the AEM consortium. The project, and in particular ESO as the European partner, is obviously concerned with the communication within the consortium, and are looking into ways of improving it, something which is strongly supported by the ESAC.

The committee takes note of the significant developments on the delivery of Front-Ends, the first of which have now been installed – although only units at engineering level, and with significant delays. Also of note are the impressive results on the development of Band 10, where improved material technology has resulted in better than specifications performance. We wait for repeatability and confirmation of these results.

The ESAC also takes note of the new Schedule Control Board, which creates a much more stringent procedure for accepting schedule changes in the project. Such initiatives are critical to minimize the already considerable delays to the project, and are part of the overall Project’s approach to this
problem.
The committee notes the shutting down of the ATF. This has been a facility that has enormously helped the project to test ALMA prototype hardware and software, paving the way for smoother ALMA AIV and CSV activities. The committee would like to congratulate the Science, Engineering, and Computing teams for the excellent work in maintaining the ATF for over 5 years and in contributing to a shorter and smoother commissioning of the ALMA observatory.

The Committee discussed the current plans for the Time Allocation Procedures for ALMA. The ESAC would like to start by pointing out that the Operations team should be involved in the discussions, as they will be a fundamental part of the implementation of the end-result.

One particular point of debate relies with the procedures for evaluation of proposals. The referee paradigm, where referees analyse and grade proposals individually with no mutual interaction, is not well regarded by the members of this committee and, is believed, by the community at large. It is this Committees’ view, from its members own experience, that some form of interaction between the evaluators is necessary to perform a fair evaluation of proposals. Face to face meetings are deemed necessary, at the very least using videoconference facilities, although it is considered that the technology is not currently at the appropriate level to make this a viable alternative to personal interaction.

Among the many different problems within the TAC procedures, the ESAC also considered the time sharing issue between partners, and how this could be accounted for with proposals that likely will have contributions from different partners. One possibility is to give the option to the PI of deciding, when submitting a proposal, the fraction of the project that should be charged to each partner, and not considering only the PI affiliation. This would provide with the PI the opportunity to give a fair overview of the amount of work to be done by the probable multi-partner team responsible by the proposal.

The ESAC also discussed the new milestones being proposed for ALMA. Overall, the milestones are very adequate to the project. Concerning the Early Science, the current set of requirements should be assumed, and the date for ES be allowed to shift accordingly. It is this Committees’ understanding that 16 antennas are necessary for the start of ES, considering that ALMA should perform, by then, “significantly better than existing capabilities”. However, such approach requires a careful management of the general user expectation, so that the community is not left with conflicting information about the start of operations.

**ASAC Charges**

The ESAC discussed the current ASAC charges.

Charge A. ASAC should continue to monitor and assess the readiness of ALMA software, in particular to review the outcome of software CDR number 6 and the ongoing work on detailing the software requirements for Early Science.

The ESAC was informed by Gianni Raffi on the result of the latest ALMA Computing Review. The committee was satisfied with the responses to the Review comments. The ESAC notes the efforts to implement of a CIPT long-term planning, which comes at a good timing. The ESAC also notes with pleasure that CASA is now receiving more dedicated in-house ALMA-specific tests (e.g., large datasets tests), by the ARCs. Also, workshops for future CASA users are now becoming a regular event in Europe, which is much needed and in the interest of the ALMA success.

The ESAC notes the fundamental role of the ATF for Computing activities, helping to debug fundamental ALMA procedures and software. As a consequence, the CIPT is not currently, and hopefully not for the next year, in the critical path. Just at shutdown, the ATF’s reached an exemplar performance, with an essentially complete end-to-end exercise being performed. We note the beneficial role of having a dedicated interferometry facility working as a test-bed for computing, and note the possible interest of considering the feasibility of implementing such a mode at the ALMA site in the future, if at all feasible and possible, as a way to shorten some of the project’s delays.
Charge B. The ASAC should review the plans for provision of ALMA Regional Centers and report to the Board’s March 2009 meeting.

The ESAC discussed the status and readiness of the ALMA Regional Centers, and in particular the European ARC, with Paola Andreani providing a status review presentation. The committee was informed that the discussion is currently open on the issue of one single project helpdesk versus regional helpdesks. The ESAC considers that having independent helpdesks will be hurtful for the ALMA project, which is set on having a unified image to the astronomical community. Furthermore, it seems to this committee that the issue of distributing requests to the different partners, according to user institution, or technical problem presented, is only a technical problem, to be handled automatically by request-handling software.

The ESAC was pleased with the preparation activities and resources ramping up of the European ARC. In particular is of particular note the hiring, by ESO, of two persons that will devote efforts to software development for CASA, as this was an expertise seriously lacking in Europe. Also, it is of note the creation of an implementation plan for the European ARC, which the ESAC would like to see in the near future.

The proposal for a new ARC node in Ondrejov (Czech Republic) was discussed. This proposal is from a consortium of institutes lead by the Astronomical Institute of the Academy of Sciences of the Czech Republic, and includes the Institute of Chemical Technology in Prague and collaborations are planned with other institutes in the country. Among the expertise the collaboration would bring to the ALMA project, the ESAC would like to note (a) the very strong and interesting expertise in solar observing, a subject area that is relatively under-represented in the (European) ARC network and (b) the laboratory astrophysics expertise, a valuable contribution to the necessary building up of molecular databases so lacking for ALMA. The proposal also has a high geographical interest, as it would serve especially the future ALMA user community in Central and Eastern Europe. However, the ESAC considers that the expertise displayed is still not at the same level as the other ARC nodes, and advises on a initial phase dedicated to building up this expertise. Collaborating with the remaining ALMA nodes (or directly with the central node) would serve this purpose, for example, allowing having a postdoc working for some period at one of the existing ARC nodes. Also, human resources for the necessary community support need to be available. Overall, a development and implementation plan needs to be devised, to reveal how the proposing node plans to reach the standards of the remaining nodes in the coming years. The ESAC would like to see these plans as a way to improve the current proposal and bringing to ALMA and to the European ARC network a significant contribution.

Charge C. ALMA Development Plan

The ESAC also discussed the ALMA Development plan. After considering the report of the Development Plan Working Group, the issue of the scientific exploitation of the ALMA data, in particular in the field of astrochemistry, was discussed.

The final data product of ALMA will be calibrated datasets. The further analysis is considered a science activity beyond the scope of the observatory funding. This is certainly the right approach in as far as pure science is concerned, e.g. development of physical models of star or galaxy formation, chemical models or algorithms for radiative transfer. One can also argue that the acquisition of fundamental physical data such as frequencies, collision or chemical reaction rates should be outside the scope of ALMA activities, although many of the needed data and rates are of no interest apart from astronomers, and thus funding for producing them is difficult to get. However, making these models and data available in an accessible form to ALMA users should be of concern to ALMA. Many of these models exist already and are even publicly available, but not in a form that is easy to use, and it is not straightforward how to compare the model output with the measured ALMA data sets. The frequency or rate data bases are in a similar state: they do exist in some fashion, but neither are they necessarily complete, nor in a form that is easily accessible by e.g. being in a VO compatible format. This should be a particular concern if the customer base of ALMA is to be broader than the current millimeter/submillimeter experts. Development resulting in making existing models and physical databases easily accessible for analysis of ALMA data to the general ALMA user would be a very
efficient, and relatively inexpensive, way to maximize the science output of the observatory. This could in practice mean to wrap the models in a way to be accessible from CASA, create model output that can directly be compared to ALMA datasets, provide reliable documentation, and making the databases complete and VO compatible.

The ESAC thus recommends that the ALMA project recognises the importance of this issue, and find ways to incentive relevant work, perhaps within the ARCs framework. This is not necessarily a recommendation for supporting laboratory work, but rather a recommendation for organizing and guiding some dispersed efforts that are currently too few to allow for the best use of ALMA data in the near future.

APEX project status and plans

The ESAC was informed of the APEX status by David Rabanus. The committee notes the important scientific results coming from APEX, which is clearly patent in the involvement of the observatory in the ESO highlights for 2008. The current and planned instruments for APEX are of great interest for the community, and the extension of the project beyond 2012 is currently being discussed by the APEX partners. The ESAC waits with interest for a scientific justification, currently being prepared, for the APEX parallel operations with ALMA and before CCAT begins operations.

Outreach

Finally, the ESAC discussed the Outreach activities. It is with pleasure that the committee has heard that the global ALMA newsletter is planned for the very near future, obviously making redundant the current European ALMA newsletter. This is one further action that will help in creating a unified project image for the user. The ESAC also discussed the need for a workshop on spectral line work for the future, in an effort to try to help setting up a coherent effort for this science topic fundamental for ALMA.

Agenda of the January 2009 ESAC meeting

ESO – ALMA building, room 054

9:30-9:35: Welcome and ESAC/STC renomination update
9:35-11:00: ALMA Project Update
- overview (all IPTs) (Wolfgang Wild)
- Sci IPT update (Leonardo Testi)
- ALMA Commissioning positions in Chile (Leonardo Testi)
11:00-11:15: coffee break
11:15-12:15: ASAC Charge: Software
- Report from Software Review (Gianni Raffi)
12:15-13:15: lunch break
13:15-14:15: ASAC Charge: ARC status and progress
- European ARC Status and Development (Paola Andreani)
- Procedures for selecting a new node (Paola Andreani)
- Proposal for a new node from Czech Republic (Paola Andreani)
14:15-15:00: ASAC Charge: ALMA development plan
- Introduction (Leonardo Testi/ASAC subcommittee members)
- ESAC discussion – coordinate input for ASAC
- European priorities – initiatives to get community input (all)
15:00-15:15: coffee break
15:15-16:00: APEX status and update
- APEX update and current issues (David Rabanus - videocon)
16:00-16:30: Outreach, EC funding (Leonardo Testi)
   - New ALMA website in Chile (www.almaobservatory.org)
   - Newsletter & Messenger
   - Workshops (algorithms in Oxford), ideas for 2009?
   - Conferences (ALMA-ELT, JENAM09, mm/submm-Taiwan, Disks 09)
   - EC funding status: Radionet, COFUND, ITN

16:30-16:45: A.O.B.
Appendix 1c:

Report from the ESE sub-committee meeting of the STC on April 16, 2009

European ELT Science and Engineering (ESE) Committee Report
April 2009

ESE Participants
Colin Cunningham, Marijn Franx (via Videolink), Raffaele Gratton, Roland Gredel, Tom Herbst (chair), Isobel Hook, Florian Kerber (secretary), Didier Queloz, Gerard Rousset (via Videolink)

ESO Participants
Sandro D’Odorico, Roberto Gilmozzi, Jorge Melnick, Markus Kissler-Patig, Bruno Leibundgut, Jason Spyromilio, Roberto Tamai

The meeting took place at ESO on 16 April 2009 and followed the attached agenda. The ESE report follows, with comments, actions, and recommendations appearing in the approximate chronological order of the presentations and discussion.

Note: In the following, we distinguish between Recommendations and Requests.
Recommendations contain suggestions and advice, while Requests solicit a response, usually in written form, to the ESE.

General Remarks

The ESE was generally very satisfied with progress on the E-ELT program and congratulates the Project Office for its efforts.

There were no documents available prior to or at the meeting. Some printed materials would help, since it is difficult to assess information in real time based on PowerPoint presentations only. For example, there was some seeing measurement presented in a complex plot, and merely understanding the content and presentation of this information consumed at least 15 valuable minutes at the meeting. Two possible strategies for improving the situation are to have all presentations on the BSCW server well in advance, or perhaps supplying draft versions of the STC fact sheets.

09:00 Introduction (THe, BLe), ESE membership: telescope expertise, expiration of terms

The meeting began with a discussion of ESE membership. There have been a few changes induced by expiration of STC terms, personal commitments, and so forth. Specifically, Jean-Gabriel Cuby has left the ESE and we thank him for his service. Both Raffaele Gratton and Marijn Franx have agreed to continue on the ESE, despite changed service with other committees.

There was also a discussion about the roles of ESE and SWG in the specific areas of science effort and oversight. After some discussion, which included ESO personnel, all panelists were satisfied with the clarification of our role. In short, the SWG takes responsibility for developing the science case for E-ELT, including the Design Reference Mission (DRM) and the Design Reference Science Plan (DRSP). The ESE, on the other hand, advises the STC on science matters, including the output of the SWG. In short, the SWG performs the work of generating the science plan, while the ESE evaluates this and other science (and engineering) efforts and assists STC in advising Council. The panel noted that there are SWG members on the ESE itself, and this could, in principle, raise conflict of interest questions. It was agreed, however, that any such conflicts are out in the open and can be managed.
There was also some debate about the exact role of the site selection advisory committee (SSAC). This body was impaneled to advise the director general on possible E-ELT sites. Of course, the ESE requires information on site characterization activities and the timeline for selection in order to properly execute its function, yet there is no clear mechanism in place for us to receive this information.

**Recommendation 1:** ESO should recommend a means for allowing information flow from SSAC to ESE. One option is to permit Roland Gredel, who is a member of both bodies, to discuss SSAC activities. The ESE recognizes the need for discretion in such discussions, and is willing to act under a non-disclosure agreement.

**Request 1:** The ESE requests that ESO write up formal Terms of Reference for the ESE. Because of the obvious overlap in matters of science and site selection, these Terms of Reference should describe our relationship and communication paths to SWG and SSAC.

ESE continues to operate without sufficient telescope expertise on the panel. Control systems and mechanical engineering expertise are also poorly represented. Over the past several months, a number of the ESE members have been informally discussing potential new members who could fulfill this role. The ESE is not a self-appointed body. We therefore agreed to the following Recommendation:

**Recommendation 2:** ESE will provide the list of potential telescope systems, control systems, mechanical engineering etc. experts to Bruno Leibundgut, who should work with E-ELT personnel and the chair of ESE to fill this gap. The ESE notes that this may require two people.

**09:20 Adoption of minutes, review of action items (THe, RGi)**

The ESE appreciated the review of action items from the previous meeting, and was unanimous in recognizing that such a review is essential to effective execution of our duties. The panel noted that in a few instances, no action had been taken. Specifically, the Project Office did not address our request for the “Top 10” risk items and their mitigation strategies, the thermal analysis of the telescope, and the seeing report. As a result, we repeat those requests here:

**Request 2:** The E-ELT Project Office should deliver a report on how the seeing distribution at sites influences instruments (and hence science). A similar activity took place in the site selection working group for OWL instruments. Given the potential urgency of this information in making optimal science and instrumentation choices, the ESE requests that the E-ELT Project Office immediately provide an estimated date for delivery of this report.

**Request 3:** The E-ELT Project Office should conduct a thermal analysis of the telescope. While this request focused exclusively on the secondary mirror in our previous report, further discussion at the meeting suggested a somewhat wider scope, including telescope structures, spiders, and other elements visible to science instruments.

**Request 4:** At each semi-annual meeting, the E-ELT Project Office should provide ESE with the top 5 or top 10 risk items and their mitigation strategy. This list should include all risks, including technical, financing, and political matters, to the overall E-ELT program, not just Phase B. A standard format for such reports would allow easier comparison and monitoring of progress. For the Spring 2009 meeting, the ESE would like to receive this list in e-mail form before the end of April.

**09:50 Status of Programme (RGi)**

The ESE welcomed the presentation of the status of the E-ELT program and specifically the plans for
both internal and external reviews. The panel noted the absence of an SWG observer at the mid term review in May.

There was an extended but essential discussion of the characterization of the surface layer turbulence based on an extrapolation of MASS and DIMM measurements. The ESE was concerned that the LuSci instrument resolves the lowest 250 meters of atmospheric turbulence and may be essential to proper evaluation of telescope sites. Unfortunately, however, the lack of sufficient instrumentation, and more importantly personnel, will severely limit the time coverage at all sites except Paranal. On the other hand, extending the site characterization process will drive the decision point into or beyond the instrument selection milestone, again resulting in potentially less than optimal choices.

**Recommendation 3:** The ESE has the general impression that site characterization and related activities do not have sufficient attention and priority in the overall management of the program. Furthermore, requests from the ESE are usually not responded to appropriately. Activities have suffered from significant delays since the start of the program. We recommend that the ESO management confer as soon as possible to improve upon the situation to ensure that the site characterization group has sufficient personnel and resources.

**Recommendation 4:** After some discussion during the meeting, the ESE supports the PI’s suggestion of breaking out the science item in the “Health Chart” into separate entries for the DRM delivery and telescope conformance to the science program.

During the closed session, the ESE discussed potential procurement difficulties associated with the primary mirror segments and fallback strategies if M4 problems arise. The panel recognized that assessing these issues requires more knowledge of the (approximate) construction timeline. The ESE therefore has the following request:

**Request 5:** The ESE requests a draft of the construction phase time line, with critical path items indicated.

**10:30 Phase B progress: telescope (JSp)**

The ESE shares the Project Office’s concern about M1 segment supplier issues and encourages the observatory to focus appropriate attention and resources on this.

The panel acknowledged the difficulties with the end-to-end integrated modeling contract. Apparently, opinions vary somewhat on the value of this type of analysis. The ESE is unable to comment on this issue, due to lack of expertise. This is a perfect example of why we need telescope expertise on the panel.

The ESE welcomes the attention paid to seismic issues and especially the reduction of acceleration forces at the secondary mirror. The shear pin strategy seems to be a good solution. The panel also welcomed the DSL consultancy and thinking outside of the box on real-time computing issues.

During closed session, the ESE posed the following question:

**Request 6:** Lasers are notoriously inefficient in converting Watts of electricity into Watts of sodium light in the sky. Has thermal dissipation been part of the side-launch laser analysis?

**11:30 Instrumentation Phase A progress and report on mid-term reviews (SDo)**

The ESE acknowledges the presentation of the four possible procurement models for instruments.
Unfortunately, there was insufficient time to properly debate the merits of the various schemes. This is an important issue and merits discussion at the next meeting. Nevertheless, the ESE had a few initial reactions: The ESE is concerned that instrument financing (ESO vs institutes vs national agencies) has not received sufficient attention. The actual cost of the instruments can drive which procurement model is viable, and ESE has very limited information in this area. Getting the procurement model right could spell the difference between success and failure of the instrument program, and by extension the scientific productivity of the telescope. This needs further elaboration, tradeoff, and discussion.

There was an extended discussion of possible integration of LTAO wavefront sensors (WFS) into the instruments. The debate was prolonged by some misunderstanding of exactly what was being suggested, and again, documentation on the issue would have streamlined the discussion. The ESE supports the Project Office’s decision to focus attention/coordination on this after completion of the phase A instrument studies but notes that optimizing WFS for each instrument will enhance science, very likely at additional cost.

13:30 Site Selection update (RGi)

The ESE welcomes the evaluation of a high site (Cerro Tolonchar). The possibility of locating E-ELT at more than 4500 meters altitude makes the tradeoff of altitude versus science versus construction/operation cost even more urgent. To our knowledge, this analysis has not been done. Such a study is admittedly difficult, given manpower and schedule. In particular, any additional site-selection activity places the decision point very close to that of the instrumentation in spring of 2010.

Recommendation 5: The E-ELT office should work with the SWG to assess the science gain / cost tradeoff of a high site on a timescale consistent with SSAC activity.

13:50 Atmospheric water vapour over Paranal: update (FKe)

The ESE appreciated the follow-up report on water vapor measurements at Paranal. This led to the following recommendation:

Recommendation 6: The E-ELT Project Office should evaluate the applicability of the water vapour analysis to other E-ELT sites.

14:05 Science issues (MKi/IHo) incl SWG report and presentation on normalized point source sensitivity

The ESE appreciated Isobel Hook’s report on SWG activities, particularly in the area of instrument selection/optimization criteria and the plans for future workshops. The ESE recognizes that this communication is valuable and leads to the following request:

Request 7: The ESE requests reports on SWG progress at its semi-annual meeting.

The ESE appreciated the presentation on normalized point source sensitivity.

14:50 Project cost estimates and financial plans (JSp)

The ESE acknowledged the report on the state of the cost estimates and financial plans. While economic issues are not within the purview of the ESE, the panel welcomed and appreciated the fact that these items are well on track.
The next ESE meeting is planned for 7-8 October 2009.

Summary of Requests and Recommendations

**Recommendation 1:** ESO should recommend a means for allowing information flow from SSAC to ESE. One option is to permit Roland Gredel, who is a member of both bodies, to discuss SSAC activities. The ESE recognizes the need for discretion in such discussions, and is willing to act under a non-disclosure agreement.

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**Request 6:** Lasers are notoriously inefficient in converting Watts of electricity into Watts of sodium light in the sky. Has thermal dissipation been part of the side-launch laser analysis?

**Request 7:** The ESE requests reports on SWG progress at its semi-annual meeting.

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**ESE Meeting**  
**April 16th, 2009**  
**Agenda**

09:00 Introduction (THe, BLe)  
ESE membership: telescope expertise, expiration of terms  
09:20 Adoption of minutes, review of action items (THe, RGi)  
09:50 Status of Programme (RGi)  
10:10 Coffee break  
10:30 Phase B progress: telescope (JSp)  
11:30 Instrumentation Phase A progress and report on mid-term reviews (SDo)  
12:00 Closed session  
12:30 Lunch  
13:30 Site Selection update (RGi)  
13:50 Atmospheric water vapour over Paranal: update (FKe)  
14:05 Science issues (MKi/THo) incl SWG report and presentation on normalized point source sensitivity  
14:50 Project cost estimates and financial plans (JSp)  
15:30 Coffee break  
15:50 Closed session  
16:50 Feedback to ESO  
17:00 End of meeting
Appendix 2:

REPORT on the ESO workshop on wide field spectroscopic surveys
Garching, March 9-10, 2009

Report prepared by Y. Mellier and J. Melnick

1. Introduction
The ESO workshop on wide field spectroscopic surveys results of the concerns expressed several times by STC about the short and long term role of the European community on large spectroscopic surveys. The recommendation by STC during its 69th meeting in October 2008:

A Short-term Path to Successful Implementation of Spectroscopic Surveys

With the upgrades of GIRAFFE and VIMOS, ESO will provide to the ESO community highly competitive facilities to run wide-field spectroscopic surveys as early as 2009. These instruments will be unique during the next 5 years and will put the ESO community in a strong leading position in the field. STC then requests that a joint STC-ESO workshop be organised as early as possible in order to review the scientific potential of these instruments for public wide-field spectroscopic surveys and to identify potential scientists in the ESO community who would lead these survey efforts. The workshop would also be an opportunity for the community to propose new concepts for the next generation wide field instruments on ESO telescopes consistent with the STC recommendations from STC-67 and STC-68. Depending on the outcome of the workshop, ESO could then call for Large Programmes or Public Surveys in order to begin wide field spectroscopic surveys as soon as the VIMOS upgrade is completed successfully.

The workshop was then organised on a very short time scale in order to provide a report to STC in April.

2. Organisation
The workshop was organised at ESO, in Garching, in March 10 and 11, 2009. The scientific organisation of the workshop was done by Y. Mellier (STC), J. Melnick, B. Leibundgut and L. Pasquini (ESO). The first day focused on extragalactic astronomy and cosmology; the second day on the Galaxy and its neighborhood.

The program and the presentations of speakers are archived and publicly available at http://www.eso.org/sci/meeting/ssw2009/index.html. As a preamble to each day, J. Melnick presented statistics of VIMOS and GIRAFFE usage since the beginning of operations. A summary and open discussion took place at the end of each day. At the end of the second day Y. Mellier drew some conclusions and recommendations.

More than 100 European scientists registered to the workshop. The presentations were of a high scientific level, very much focused on science goals with wide field spectroscopy, making the workshop a great success: a pleasure to attend and very helpful to define the science requirements.

3. The Workshop
3.1 VMOS and GIRAFFE
During the presentation of the present status of VIMOS and GIRAFFE, J. Melnick pointed out that both instruments have an oversubscription of about 2, which is surprisingly low, in regards of their scientific potentials for large programs. It was clear that VIMOS and GIRAFFE could be used for surveys without much penalty to other programs, in particular for VIMOS on UT3, which is not oversubscribed by the other UT3 instrument VISIR (although this may change as there are plans to install ISAAC on UT3). J. Melnick emphasised that the rather poor efficiency of VIMOS today is not
acceptable and VIMOS must be upgraded prior to start massive surveys with it. According to the presentations done by F. Selman, the VIMOS instrument scientist on Paranal, the expected gain will be a factor of about 1.5 by improving the following points:

- Improve the reliability of the VIMOS: drop the failure rate from 10% to 2%;
- Improve the stability of the focal plane and remove the flexure residual (+/- 2 pixels);
- Upgrade the detector in the red;
- Redesign the mask exchange unit;
- Redesign the Grism exchange unit and the filter exchange unit
- Put a new shutter
- Improve the instrument and data processing software

The upgrade of VIMOS needs to stop observations during three months. ESO has scheduled the upgrade during the summer of 2010, so wide field surveys could start before fall 2010. L. Guzzo pointed out that this should not delay VIPERS since most data will be obtained by 2010. Instead, the upgrade will be also useful for VIPERS.

In contrast, GIRAFFE is already very efficient and in good shape. The only obvious upgrade that can be done immediately concerns the detector. Red sensitive CCDs will improve the efficiency by a factor... GIRAFFE can then start survey almost now.

3.2 Extragalactic astronomy and Cosmology

The scientific presentations clearly showed that wide field spectroscopic surveys for extragalactic astronomy and cosmology focuses on three main science goals:

- The large-scale structure of the universe, the properties of the galaxian and dark matter power spectra. The main drivers are the origin of cosmic acceleration and the nature and properties of dark energy (using baryon acoustic oscillation and redshift distortion) as well as the properties of the primordial fluctuations.

The needs for exploring larger volumes in order to increase the number of galaxies observed were clearly expressed. These data are also needed to better calibrate photometric redshifts over the whole extragalactic sky up to $I_{AB}$~ 22-23 and beyond, with fair sampling of all redshift ranges and all galaxy populations. The niche of VIMOS in this field is a kind of low spectral resolution (R=500-1000) super-VIPERS survey that focuses on existing or on-going imaging surveys like CFHTLS, KIDS/VIKING or DES, which demand extensive spectroscopic follow up. By using existing surveys, the target selection can be optimised and redshift slice selections can then be also possible.

- The evolution of galaxies and baryons at high redshift ($z>$2 up to 6-7). These surveys focus on the star formation history or the galaxian mass function as function of redshift or environment, and the merging history of haloes and the calibration of photometric redshifts of very deep samples. The zCOSMOS and the VVDS-Deep surveys are good examples of such deep spectroscopic surveys. These redshift surveys must go as deep as $I_{AB}$=24-25, with typical spectral resolutions of R=500-1000. A. Renzini pointed out the strong need for an infrared spectrograph that could sample galaxies in the redshift range 1.5<z<2.5 or Lyman-alpha emission line galaxies at redshift 7.

- The content and internal physical properties of galaxies: chemical abundances; internal kinematics; the physics of merging processes; and the interplay between black hole and mass of galaxies. The targets are galaxies at redshift $z>1$, but the science goals demands spectral resolutions of about R=2000.

Overall, a broad range of science goals were expressed. The science requirements can be summarized as follow:

- Spectral resolution: R=300-3000
- Wavelength coverage: 350 nm-2.2 microns
- Number of objects: $10^8 - 10^9$ to $10^7$ for the biggest and widest surveys envisioned
- Multiplex: 200-1000
- Depth $I_{AB}$ 22.5-25.0 with typical S/N of 10 to 30 in the continuum
3.3 The Galaxy and its neighborhood

The Galaxy and nearby Universe wide field spectroscopic surveys were presented on the second day. They focused on the science goals described in the ESA/ESO working group report on the Milky-Way Galaxy. The synergy with GAIA was emphasised by several speakers.

The main science drivers are:
- The origin of the Galaxy, the galaxy assembly, the merging history, the properties of streams, and the formation of galactic haloes;
- The internal dynamics of the Galaxy: central SMBH, bar/bulge, dark matter, rotation curve, and spiral structure;
- The mass cycle and the mass distribution in the Galaxy;
- The star formation history and the origin of the IMF, the ages of stellar population, and the interaction of the Galaxy with the intergalactic medium;
- The amount and distribution of metal poor and extremely metal poor stars in the Galaxy;
- The chemical evolution and chemical enrichment of galaxies, and,
- The use of the Galaxy and the Local group as representative templates, to explore the high redshift universe. Are the properties of the Galaxy consistent with Lambda-CDM?

The scientific presentations described a very broad range of science goals and projects. The RAVE survey and the future VST and VISTA surveys of the Galaxy, the Magellanic Clouds or the Local group show the route drawn prior to GAIA.

Overall, a broad range of science goals were expressed. The science requirements can be summarized as follow:
- Spectral resolution: $R=5000-40000$
- Wavelength coverage: 370 nm-1.2 micron
- Number of objects: $10^5 - 10^6$ for the biggest and widest survey;
- Multiplex: 200-1000
- Depth $G=14.0 - 20.0$ (to match GAIA), with typical S/N of 20 to 100 in the continuum;
- Sky coverage: 500 (a minimum is 20x20 deg$^2$ to map the inner Galaxy)- 5000 deg$^2$
- Targets: the Galaxy (Bulge, bar, spiral structure, globular clusters, halo population, streams), the Magellanic Clouds, the Local Group

3.4 Summary

The workshop clearly pointed out the following points:

**On a short time scale:**
- VIMOS on UT3 and GIRAFFE on UT2 are both undersubscribed and can therefore provide immediately facilities for scientific programs that demand important or even massive spectroscopic surveys. This is in particular the case for VIMOS;
- The science presentations have shown several mature and important science goals in extragalactic astronomy and cosmology, where Europe can play a leading role over the next 5 years using VIMOS. Several experienced and well-organised teams have proposed big public surveys to study the large-scale structure of the universe, the very high redshift universe ($z>2$), and the internal properties of galaxies in the redshift range 0.3$<z<1$. The science requirements perfectly match those expected with the upgrade of VIMOS provided that a significant amount of nights (200 to 500) is allocated. VIMOS should then be proposed as a redshift machine, without multiple options that would increase the complexity of the technology and the operation of the instrument.

A call for large surveys is timely and will put the European scientist at the forefront of several main
science goals in the field, with no competitors over the period 2009–2014. In order to start immediately the spectroscopic surveys, several presentations focussed on target fields where deep catalogues exist already or are planned on a short time scale (CFHTLS, KIDS/VIKING, DES).

- From the Galaxy and the nearby universe presentations, many interesting scientific projects have been proposed, but with a range of requirements primarily focussed on (1) wide field (>0.5 deg$^2$), blue sensitive and multiplex 100 and (2) wide field (~3 deg$^2$) infrared (z,J,K) multiplex 500. Nevertheless, it seems that several projects could start already with FLAMES/GIRAFFE, though the field of view is lower than requested for most projects, or possibly with VIMOS or at the NTT with EFOSC or FORS1. A massive survey would be hard on this telescope, but we should encourage the teams working in the field to write proposals immediately and submit large programs using these facilities. The GAIA science team had a preparatory meeting in Nice before the ESO workshop in order to get organised and prepare surveys. The timing seems perfect to start, in particular projects that does not targets selected from GAIA.

- Both extragalactic and galactic presentation expressed the need for a near infrared multi-object spectrograph, covering the range 1.1 to 1.7 microns. Although KMOS can fill small projects, it cannot fulfil the requirements of most wide field surveys proposed during the workshop (small field of view, too low spectral resolution for the Galaxy and nearby universe projects).

**On a longer time scale:**

If we summarize the needs expressed by the European scientists present at the workshop, it is clear that there are three main demands:

- **For both cosmology and galactic astronomy communities**: an extension of present-day wide field spectroscopic facilities to the near infrared;
- **For galactic astronomy**: an extension of the field of view, if possible, and of multiplex gain to 500 to explore dense stellar fields;
- **For cosmology**: an increase of the field of view (at least 1 deg) and of the multiplex gain (1000++). Several major future science goals discussed by J. Miralda-Escudé or T. Shanks do need huge volumes and numbers of galaxies. They are beyond the reach of present-day ESO facilities. Another issue raised during the discussions is the spectroscopic follow up of LSST that seem almost unfeasible.

Several options have been discussed during the meeting. A most simple would be to explore a super-GIRAFFE concept, with the following requirements:

- Field of view: 20’ to 30’
- Multiplex: 500
- Spectral range: 370 nm to 1.7 microns
- Spectral resolution: R=1000 to 40000

Such an instrument would be very good for the Galaxy and the nearby universe and would partly fill some requirements for extragalactic astronomy and cosmology, provided sky subtraction of faint galaxies is feasible in the near infrared. Keeping in mind GAIA will be launched by mid-2012, it would be most valuable to have the facility on the VLT by 2014. Its capabilities are close to FMOS at Subaru, but VLT will permit to observe the Bulge of the Galaxy as well as the Magellanic clouds. It seems then timely to propose a call for a super-GIRAFFE like instrument as soon as possible.

In summary, the participant of the workshop provided strong scientific cases to start wide field spectroscopic surveys now, using the upgraded VIMOS or FLAMES/GIRAFFE instruments, or the NTT telescope. ESO should therefore make immediately a scientific call for ambitious Public Surveys in order to start observations before the end of 2010 over the period 2009-2015. In parallel, ESO should make a call for a new wide field spectroscopic facility, in order to increase the multiplex and the wavelength coverage of GIRAFFE. The instrument should not embark ESO in any major modifications of VLTs. The call should leave open any option; however, the super-GIRAFFE
design that was presented during the workshop looks a good reference concept to start with in order to define its science requirements.

During the workshop, several speakers and many participants expressed the scientific needs for a new super-wide field spectrograph, covering a field of view of several square-degrees and with a number of apertures of several thousands. ESO pointed out that any options that would imply major modification of one of the VLTs is hopeless since the present configuration is needed for VLTI. An upgrade of the NTT has already been discussed at STC, but it was abandoned after discussions with ESO. This option could be useful for the nearby universe and GAIA, but useless for cosmology in 10 years from now. O. Le Fèvre went to more radical view and proposed we start the study of a new telescope. T. Shanks proposed an interesting concept, the VISTA Extreme Multiplex Spectrograph (VXMS). This instrument is equipped with 12 different spectrographs and could cover 3 deg² with 12000 slits. This project may be an extraordinary spectroscopic machine for European astronomers and would be a perfect facility to follow LSST sources. So, VXMS deserves further study. It would be wise ESO set a working group that explores this instrument in to more details, as well as some new concepts for the horizon 2020.
Appendix 3:

ESO Scientific Technical Committee
70th Meeting Garching, 22 - 23 April, 2009

AGENDA (ESO/STC-451)
Items marked with [*] are for recommendation

APRIL 22

09:00    Closed session
10:00    Closed session with DG
10:30    Welcome
10:35    1. Adoption of the Agenda
          2. Approval of the Minutes of the 69th STC Meeting
10:45    3. Report of the Director General (incl. VST, VISTA)

11:15    Coffee Break

4.    Directorate of Operations
11:30    4a. Directorate of Operations Overview (A. Kaufer)
12:00    4b. Discussion of Directorate of Operations Fact Sheets

12:15    Lunch

5.    Directorate of Programmes
13:30    5a. Directorate of Programmes Overview (A. Moorwood)
13:45    5b. Discussion of Directorate of Programmes Fact Sheets

6.    Second generation VLT/I instrumentation
14:00    6a. Conclusions of the Spectroscopic Surveys Workshop (Y. Mellier)
14:30    6b. ESO response (M. Casali)
14:50    Discussion

7.    VLTI visitor instruments
15:00    7a. Pionier 4-beam imager (A. Richichi)
15:15    Discussion

15:30    Coffee Break

15:50    7b. Report from the La Silla Paranal Subpanel (Y. Mellier)
16:30    Discussion

17:00    Closed session
APRIL 23

8. **E-ELT**
   - 08:30 8a. Report from the Programme Office (R. Gilmozzi)
   - 08:45 8b. Report from the Telescope Project Office (J. Spyromilio)
   - 09:15 8c. Report from the Instrumentation Office (S. D'Odorico)
   - 09:35 8d. Report from the ESE Subpanel (T. Herbst)
   - 09:55 Discussion

10:15 *Coffee Break*

9. **ALMA**
   - 10:30 9a. Project Status Report (L. Testi)
   - 11:00 9b. Discussion of ALMA Fact Sheets
   - 11:10 9c. Report from ESAC (J. Afonso)
   - 11:25 Discussion

STC-452C-ALMA

10. **Directorate for Science**
   - 11:45 10a. Overview of Directorate for Science (B. Leibundgut)
   - 12:05 10b. Discussion of Directorate for Science Fact Sheets

STC-452D-DSC

12:15 11. Other topics

12:30 *Lunch*

13:30 Closed Session

16:00 Meeting with DG and Directors

16:30 *End of Meeting*