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JRA4

KICK-OFF MEETING - DESCRIPTION OF WP 1.1

ADVANCED INSTRUMENTS: FEASIBILITY AND PRE-DESIGN STUDIES

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CHANGE RECORD

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1. Objectives of the work package

All current large telescope projects include an interferometric component, because this technique provides higher angular resolution than possible with single apertures. It is clear that the capabilities of the present interferometric facilities cannot be used efficiently with the existing focal-plane instrumentation. For example, the VLTI infrastructure supports the coherent combination of up to eight telescopes for synthesis imaging, but there is presently no instrument that can accommodate more than three input beams. Similarly, unlocking the potential of the VLTI for precise astrometry requires the development of strategies and software to support such observations and the reduction of the data. To take full advantage of the large European investment in interferometric facilities, it is thus mandatory to also pay appropriate attention to the "secondary" areas of instrument building and data analysis tool development. It is the goal of this proposal to enhance the scientific productivity of the existing and soon-to-be facilities by strengthening these important areas, and by systematically developing the relevant capabilities in the user community.

While the operators of the large observatories (such as ESO or the LBT consortium) provide the infrastructure for interferometry, the utilization of these facilities is large left to the users, who have to provide focal-plane instrumentation, and data reduction and analysis tools. ESO has been served well for many years by a division of tasks in which ESO itself provides the observatory infrastructure and telescopes, and the focal-plane instruments are contributed by consortia formed by institutions in the member countries. This approach has also been successfully used for the first generation of VLTI instruments, and it forms the basis for the future development of the VLTI, which is a key component of ESO's long-range plan. It is clear that the continued success of this strategy hinges on the expertise available in the users community, and in the ability of this community to address the technological challenges through coordinated research and development efforts. Each one of the projects contained in the present proposal aims to enhance these capabilities, in a way that is fully consistent with the established mechanisms of coordination between the observatories and their users, and with the increasing integration of European astronomy.

Building a modern focal-plane instrument, or writing a data analysis software package, are tasks that require substantial resources and a mix of expertise that is rarely found within a single institution. The existing VLTI instruments have all been built by international consortia, and comprehensive software development projects are more and more carried out through international collaborations. Optical / infrared interferometry stands to benefit even more from further European integration, because so far only a relatively small number of institutions have been engaged in the technical development of the field. It is thus appropriate to target this area for a Joint Research Project funded by the European Union. The inclusion of a larger number of institutions, from a larger number of countries, will bring new ideas and human capital into interferometry, and thus broaden the technical knowledge base needed for the further development of the existing and future facilities.

The new interferometers are currently being equipped with first-generation focal-plane instruments, which have consciously been designed to be relatively simple and limited in their capabilities. A new generation of advanced interferometric focal-plane

instruments will therefore be needed to take advantage of the wide range of capabilities offered by the new large facilities. The interferometry JRP will support up to eight initial studies (***task A***), which cover a wide range of concepts that have been proposed for future instruments. It is the purpose of these studies to identify the most promising of these concepts, and to assess their technical and financial viability. The highest-priority concepts will be studied in more detail; in this phase feasibility and pre-design study analyses will be carried out (***task B***). Expertise in interferometer technology varies widely between partners of this JRP. Whereas some countries have large established interferometric communities, which are capable of building complete instruments and of undertaking full technology development projects, other countries have either small communities or little technical expertise in interferometry. It is one of the aims of the Interferometry JRP to bring these countries to a level at which they can participate meaningfully in the definition, design, and construction of supporting interferometric instruments. This will be done through targeted technology studies and demonstrations, on topics identified by the instrument concept studies (***task C that is related to Work Package 1.1 and 1.2***).

2. Participants and budgets

(as known so far)

	Matching Fund	EU fund	Total
U. Vienna (AT)	42	35	77
U. Liége (BE)	35	35	70
Academy Sciences (CZ)	25	25	50
Fringe (DE)	100	90	190
JMMC (FR)	260	60	320
U. Cambridge (UK)	30	30	60
Obs. Konkoly (HU)	25	25	50
U. Torino (IT)	40	0	40
Technion (IL)	25	25	50
NOVA (NL)	80	80	160
U. Torun (PL)	20	20	40
U. Porto (PT)	40.4	40	80.4
Total	722.4	465	1187.4

Table 1: Total budget of the Work package

	Matching Fund	EU fund	Total
U. Vienna (AT)	0	35	35
Fringe (DE)	20	20	40
JMMC (FR)	60	40	100
U. Cambridge (UK)	5	5	10
U. Torino (IT)	40	0	40
NOVA (NL)	10	10	20
U. Porto (PT)	5	5	10
Total	140	115	255

Table 2a: Budget for task A (concept studies)

	Matching Fund	EU fund	Total
U. Vienna (AT)	42	0	42
Fringe (DE)	80	70	150
JMMC (FR)	200	0	200
U. Cambridge (UK)	25	25	50
NOVA (NL)	70	70	140
U. Porto (PT)	10	10	20
Total	427	175	602

Table 2b: Budget for task B (feasibility and pre design studies)

	Matching Fund	EU fund	Total
U. Liége (BE)	35	35	70
Academy Sciences (CZ)	25	25	50
JMMC (FR)	0	20	20
Obs. Konkoly (HU)	25	25	50
Technion (IL)	25	25	50
U. Torun (PL)	20	20	40
U. Porto (PT)	25.4	25	50.4
Total	155.4	175	330.4

Table 2c: Budget for task C (technology and part of WP1.2)

3. Current list of projects

The initial list of projects has been established during the construction phase of the European Initiative for Interferometry (document *Call_for_ideas_replies.pdf* established on 16 February 2003 by Eric Bakker). The final list will be established during the kick-off meeting of the JRA. The present table has been established after iterations with the declared PIs during the Call for Ideas.

We have separated the projects according:

A. directly related to already planned developments at ESO
B. Extensions to or usage of already existing instruments on Paranal, not in ESO planning
C. Multi beam combiner projects
D. Instruments related to spectroscopy

B, C, D are really new developments and have to be accepted by ESO. B (and maybe also parts of D) are using existing instruments which have to be extended and slightly modified to cope with the goals of the projects. One of the first decisions that we should take will be whether or not we consider all the projects in the list as to be included in the framework of the Work Package (task A).

#	Project	PI	Confirmation	Collaborators
A1	PRIMA Phase reference imaging and faint source observations at VLTI	G. Perrin (JMMC/LESIA)	Yes	JMMC/Bordeaux,JMMC/OCA, JMMC/LAOG, MPE
B1	High spectral resolution interferometry using UVES and	A. Quirrenbach NOVA	YES	SRON, NOVA, …

	CRIRES			
B2	APRESMIDI VLTI mid-IR 4 beams combiner	B. Lopez (JMMC/OCA)	YES	MPIA, MPIfR, NOVA JMMC/CRAL,JMMC/LAOG, JMMC/Bordeaux
C1	VITRUV 6-8 telescopes beam combiner based on IO	F. Malbet (JMMC/LAOG)	YES	JMMC/CRAL CAUP LETI, IMEP
C2	VIDA 6-8 densified pupil beam combiner for direct imaging	O. Lardiere (JMMC/LISE)	YES	JMMC/OCA, ONERA, IRCOM
C3	4-8 way beam combiner for the VLTI	C. Hanniff Univ. Cambridge	YES	
C4	6 way homothetic beam combiner for DARWIN and VLTI	J.W. den Herder SRON	YES	Leiden, Delft
D1	Spectrally resolved interferometric instrument with 2" of field	R. Petrov (JMMC/LUAN)	NO	MPIfR, JMMC/OCA, JMMC/CRAL
D2	IR spectrograph for very high resolution interferometric spectro astrometry	G. Wiedemann Univ. Jena, Hamburg	YES	

Table 3: current list of projects

4. Coordination of the Work Package: open points for discussion

1) The coordination need to be organized at different levels:
   - Between the WPLs and the project PIs (status report).
   - For the structure and work of the Working Group.
   - Between the WPLs and the JRA coordinator and with the EII structure.
   - Though it is important to fully develop the ideas for these advanced instruments, coordination with ESO will be necessary at a certain level. This should be clear as early as possible for all participants.

2) The procedure of selection of projects first for the concept studies and second for the feasibility studies has to be accurately defined.
   Some points are open for discussion during the kick-off meeting:
   - Structure and membership of WG 1.1.
     (Besides the WGLs: PIs, Network representatives, ESO, ….)
   - Discussion of projects.
     In the current list of projects, we have already remove the following ones:
     - 20 μm extension of MIDI (NL+D, Quirrenbach&Leinert)
     - PRIMA differential delay line (NL+D+CH, Quirrenbach&Henning& Queloz), known as DDL proposition
     - Extension of VINCI in the L and M bands (Coudé du Foresto)
     - The proposals concerning technical developments for fringe tracking have been shifted to WP1.2
   - Proposition to select a smaller number of projects in mid 2004. A progress meeting will certainly be necessary at this date and could be organized during the SPIE meeting in Glasgow (UK end of June 2004)).
   - Definition of a common performance metrics to be done (costs, throughput, S/N, …) for the selection in mid 2005 for the feasibility studies. What will be the deliverables during the initial 18 months?

- Creation of consortia: should this be done before or after the initial concept study phase (e.g. for the multi beam combiner projects)
- As documented in "JR4_document_opticon_2.pdf" the participants, their projects and their efforts in person-months have already been determined for the full 3 years. Are we going to open this discussion again or do we proceed on the basis of this selection.
  (Internal remark: Document JR4_document_opticon_2.pdf says explicitly that up to 8 initial studies will be supported. In this context the question arises if support from the WG or the network is provided beyond the EU-funds and how this support could look like).
- We have to agree on the procedure of the selection of projects which will be supported for the next phase, i.e. the feasibility and pre-design studies. Here we see the difficulty that the EU-money seems to have been distributed already for these phases 2 and 3, and so we have to discuss how to proceed.
- Also we have to agree on the schedule and the procedure of the future deliverables and communication structures.

5. Mechanism of follow-up

– According to document JR4_document_opticon_2.pdf there will be bimonthly teleconferences or – as an alternative – a short report on the status of the project. The WPLs will collect these status reports and make them available on the WP1.1 web-page.
– A formal progress report will be requested from each participant each 6 months.
– It is planned to organize an annual progress meeting.

6. Frequency and objectives of face to face meeting

An annual progress meeting is foreseen every 12 months

7. Web-page address and mailing list

The web address for WP1.1 is:
http://eii-jra4.ujf-grenoble.fr/wp1.html

Mailing list of the participants:
advanced-instruments@eii-jra4.ujf-grenoble.fr
http://eii-jra4.ujf-grenoble.fr/wws/info/advanced-instruments

8. References

– Call_For_Ideas_European_Interferometry_Initiative_v2.1.pdf, Bakker, 3.2.2003
– Call_for_ideas_replies.pdf
- JR4_document_opticon_2.pdf

9. Proposition for the agenda of the Kick-off meeting

2 hours and 45 minutes have been allocated to the Work Package 1.1. We propose the following schedule:

- Presentation of the objectives of the work packages (WPLs): 5mn
- Presentation of the current list of projects for the concept studies (WPLs): 15 mn
- Discussion on the list of projects: 20 mn
- Introduction on the questions that have to be debated and discussion
  - Selection procedure for the feasibility phase (5 mn+45 mn)
  - Mechanism of follow-up (5 mn+15 mn)
  - Use of funds (5 mn+15 mn)
- Management: 10 mn
- Buffer: 25 mn

If necessary, a meeting of the PIs will be organized during the evening (so the PIs have to be invited) in order to finalize the discussions, e.g. on the procedure of selection (definition of deliverables, common metrics, etc. …).
A synthesis will be presented the second day of the kick-off meeting by the WPLs.

Appendix A. Presentation of the project of Table 3

Project A1. PRIMA faint objects, G. PERRIN

Initially one of the primary goals and instruments of VLTI, PRIMA has been divided into several steps. Two contracts have been passed by ESO to the industry to provide the fringe sensor unit and the dual feed capability. Next steps are not yet clearly defined and extra ideas and manpower to help ESO will certainly be a plus. PRIMA has different goals:

- stabilize the phase to allow long integrations and increase the sensitivity of VLTI (on-axis and offaxis);
- measure the differential phase to perform phase referencing imaging;
- measure differential phase to perform accurate astrometry.

These goals are currently not fully addressed by ESO. A consortium led by the Netherlands (Leiden) is proposing to help ESO achieve the astrometry part of the goals for exoplanets detection with an instrument using 4 ATs. Phase referencing imaging and faint objects are not covered by a concrete project as for now. Symmetrically to the Leiden-led proposal, this proposal aims at generating the expertise and a concept study to provide VLTI with these capabilities which are unique.

Defining the science goal should be part of the study (and should capitalize on what was done by the ESO coordinated groups). Motivations are clearly imaging of astrophysical objects in general and detection and imaging of faint objects in particular. A preliminary list of astrophysical fields is as follows:

- galactic center
- gravitational lensing
- AGN, quasars
- exoplanets: direct determination of mass, inclination and albedo (to be compared with
- astrometry)
- exoplanets: around young stellar objects for which spectroscopy is inefficient
- high mass stars
- young stellar objects
- small bodies in the solar system
- clusters

The core of the proposal is to perform a concept study of the PRI-part of PRIMA and, depending on fundings, to do the necessary R&D to demonstrate and acquire expertise on key points. The long term goal is phase-reference imaging at VLTI with 4, 6 and 8 telescopes. This long term goal includes the capability to increase the sensitivity of VLTI. A progressive approach would give strength to the project and would allow to achieve valuable scientific results rapidly at the earliest phases of the project. A first demonstration step would consist in building the instrument for two UTs with first scientific goals being focused on faint objects like the galactic center. Once this demonstration phase has been achieved, one could proceed by adding one and two more UTs thus increasing the imaging capabilities on faint sources. Later, ATs can be

added to the system and high quality images can be obtained on relatively faint objects using phase reference imaging with up to 8 telescopes. This approach is progressive and will allow to learn from each step thus clarifying the current unknowns.

Collaborators:

Observatoire de Bordeaux, Observatoire de Paris, Observatoire de la Côte d'Azur,

Observatoire de Grenoble, MPE

Garching (TBC), ESO (TBC)

Volume of participation:

- concept study from 06/2003 thru 04/2004: 3 man-year;
- phase A from 05/2004 thru 05/2006: 6 man-year + 300 keuros for R&D and tests;
- half of it is matched by participating institutes.

Project B1. High Spectral Resolution Interferometry using UVES and CRIRES A. QUIRRENBACH

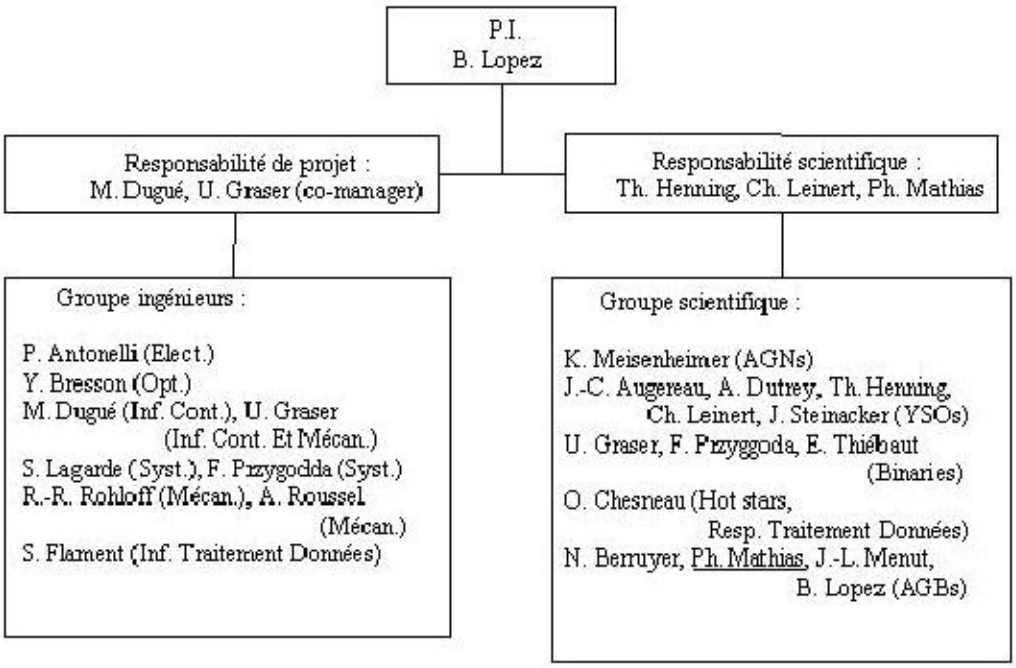
Project B2. APRESMIDI, B. LOPEZ

APreS-MIDI: APerture Synthesis in the MID-Infrared.
Imaging instrument recombining 4 beams of the VLTI.
The recombinator, APreS-MIDI is an optical interface that upgrades the performances of the present MIDI instrument. The MIDI Mid-IR detector is employed in the APreS-MIDI concept.
Software package: image reconstruction algorithms (like JMMC one)
Funding: contribution of OCA/Fresnel and Max Planck Heidelberg in terms of manpower. Preliminary study already started.
Kick-off for the study: planned for January 2004
Additional comments: The hardware costs of ApreS-MIDI is estimated to be 400 kEuro.
European support for funding this phase of study is requested.

- Estimated milestones:
  - 2003: concept study, signal to noise ratio estimates.
  - 2004: detailled design. phase of study.
  - 2005: manufacturing of the elements, integration and tests of APreS-MIDI.
  - 2006: Commisssioning and first science observations.
- The real manpower involved (it may be superior to the manpower declared) for the next 18 months (in month-FTE) : 12 months FTE
- Will you use EU-funds for this project and how much (total and for the first 18 months)

Yes : ->= 1 year join post-doctoral position for F. Przygodda.
- Contribution to regular consortium meetings : 15 k€
- Contribution to a laboratory optical bench : 5 k€

A short description of the structure of the group (task distribution in the collaboration)



Project C1. VITRUV, F. MALBET

Fabien Malbet, Laboratoire d'Astrophysique de Grenoble (LAOG), France
Name(s) and institution(s) of the collaborators

- J.-P. Berger, P. Kern, K. Perraut, P. Petrucci, F. Ménard, A. Chelli, G. Duvert, J.-B. Lebouquin (PhD student) and E. Tatulli (PhD student), Laboratoire d'Astrophysique de Grenoble (LAOG/JMMC), France
- P. Labeye, CEA/LETI, Grenoble, France
- I. Schanen, IMEP/INPG Grenoble, France
- E. Thiébaut, Centre de Recherche en Astrophysique de Lyon (CRAL/JMMC), France
- P. Garcia, I. Carvalho, Center for Astrophysics - University of Porto (CAUP), Portugal

Contacts with:

- D. Ségransan, Observatoire de Genève, Switzerland
- C. Haniff, D. Buscher, University of Cambridge, UK
- Th. Henning, Max-Planck Institut fúr Astronomie, Heidelberg, Germany

The science objectives of VITRUV are to investigate the morphology of compact astrophysical objects in optical wavelengths like the environment of AGN, star forming regions, stellar surfaces. This instrument will take full advantage of the VLTI site with 4 very large telescopes and 4 auxiliary telescopes. The instrument concept is to built aperture synthesis images like the millimeter-wave radiointerferometer of the IRAM Plateau de Bures. VITRUV coupled to the VLTI will have similar and even better resolution than ALMA. The astrophysical specifications although not yet finalized will be a temporal resolution of the order of 1 day, spectral resolution from 100 to 30,000, image dynamic from 100 to 1,000, a field of view of 1 arcsec for an initial wavlength coverage from 1 to 2.5 microns that could be extended from 0.5 to 5 microns. The technology that is favored at this stage is integrated optics. A possible planning could be

2003-2004: astrophysical specifications, system study, accompanying R&D,
2005: VLTI-4T prototype,
2007-2008: 6T/8T final combiner.

The real manpower involved (it may be superior to the manpower declared) for the next 18 months (in month-FTE)

About 42 month-FTE (LAOG: 24, CAUP: 9, LETI: 4, CRAL: 3, IMEP: 2)

Will you use EU-funds for this project and how much (total and for the first 18 months)

- + CAUP: 15 kEuro
- + travel/accomodations for meetings and collaboration

A short description of the structure of the group (task distribution in the collaboration)

The project is in conceptual study. Three working groups have been formed:

- Astrophysical science group: P. Petrucci (chair), K. Perraut, F. Ménard (should be enlarged soon: P. Garcia?),
- System study group: J.-P. Berger (chair), J.-B. Lebouquin, E. Tatulli, P. Labeye, I. Schanen, K. Perraut, P. Kern, A. Chelli, G. Duvert, I. Carvalho
- Image reconstruction group: E. Thiébaut (chair), E. Tatulli, J.-P. Berger, P. Garcia (?)

Collaboration: the goal is to built an 2nd generation ESO/VLTI instrument. We are open to collaboration, in particular in the following domains: cold spectrograph, photon-counting visible detector, astrophysical group, image reconstruction.

Project C2. Project C2: VIDA, O. LARDIERE

VIDA (Vlti Imaging with a Densified Array), a densified pupil combiner proposed for snapshot imaging with the VLTI, Olivier LARDIERE, Osservatorio di Arcetri, 50125 Firenze, Italie

This proposition aims at studying the concept of a new generation imaging instrument for the VLTI. A large european cooperation is foreseen for such a project and we will enjoy propositions of collaboration. Direct snapshot imaging (Fizeau or densified pupil mode) seems now to become possible in IR and visible wavelengths with current interferometric arrays. The "densified pupil" or "hypertelescope" imaging mode can concentrate most light into a high-resolution Airy peak contrary to the Fizeau mode (also called "homothetic mapping"). Thus, a full-luminosity image is directly obtainable, although in a reduced field, for stellar coronagraphy and exoplanet finding, in the presence of sky background (including zodiacal, and exo-zodiacal emission). The current VLTI is able to combine light from two telescopes coherently. In subsequent phases, a combiner is foreseen for cophasing up to 8 telescopes (UT and AT). This limited number of apertures currently considered for the VLTI does not take full advantage of hypertelescope imaging, but offers a significantly better dynamic-range than in the Fizeau mode (gain of 3.8mag with the 4 UTs). Beyond its science value for compact objects and exoplanets characterization, the proposed instrument can serve as a precursor for many-element post-VLTI interferometers or future hypertelescopes.

The following studies are proposed for completion by the EII network :

2003-2005: Science cases, Concept study:

- Focal instrumentation (spectral resolution, λ, polarimetry…?)
- AO and co-phasing requirements.
- Beam-combiner schemes (bulky optics or optical fibers + integrated optics?)
- Coronagraph study and simulations
- Multi-field imaging, field reconstruction and image deconvolution
- Global system analysis and feasibility on the VLTI infrastructure (PRIMA internal metrology, dual-feed train.)

2004-2005: Realisation of a laboratory and sky testbench.

- AO and cophasing requirements validation
- Image reconstruction validation

2005-2008 : Realisation and integration of VIDA

Manpower involved for the next 18 months (in month-FTE): 30 FTE have been declared from 2003 to 2008.

- Arcetri : (OL:40%, MC:5%)*18=8
- OCA Grasse : (FP:100%, DM:30%, AS:10%, J-MC:10%, SL:10%)*18=28
- LISE: (AL:10%, FM:10%,VB:10%, JD:10%,)*18=7
- OHP: (LA: 10%,)*18=2
- Meudon: (PR: 5%,)*18=1
- IRCOM: (LD:10%)*18=2
- ONERA: (GR:10%)*18=2

Total= about 50 month-FTE

Will you use EU-funds for this project and how much (total and for the first 18 months)? :

- Missions: 15k€ (1k€ per FTE)
- Equipment for the lab/sky demonstrator
  Shack-Hartmann WFS : 5k€
  Others : 20k€
- Salaries: a 3-year post-doc: 80k€ + taxes

Total asked for the next 18 months :72k€
Total asked: 140-200k€ (until 2008)

A short description of the structure of the group (task distribution in the collaboration) :

- OCA : science cases, concept study, prototyping and observations.
- Arcetri : concept study, simulations and performances analysis, image deconvolution.
- LISE : concept study, phasing algorithms.
- OHP : prototyping, observation support?
- Marseille ?: Exoplanets science cases, focal instrumentation.
- Meudon : coronagraphic performances, pupil masking.
- ONERA : fringe tracking and adaptive optics
- IRCOM : optical fiber beam-combiner and integrated optics
- LAOG ? : science cases (join efforts for VIDA and VITRUV concepts ?)

Project C3. 4-8 way beam combiner for the VLTI, C. HANNIFF

Chris Haniff, Astrophysics Group, Cavendish Laboratory, University of Cambridge.
We are the only UK participants in this activity. It may be possible to partner with others proposing multi-way beam combiners but I would suggest that this take place after the initial concept studies have taken place.

Our activity will be associated with the development of a concept for a bulk-optics 8 way near-IR combiner for the VLTI. We expect to investigate possible optical and mechanical designs and to study performance metrics such as throughput, tolerances, stability, wavefront quality and cost. we also intend to assess optimization with respect to available detectors and to investigate the performance of such a combiner in the presence of smaller numbers of beams being available and/or optical operation.

In view of the small amount of effort allocated to this activity in our budget, we expect the majority of our effort to be expended in the initial concept definition phase, rather than the subsequent feasibility and design studies.

The real manpower involved (it may be superior to the manpower declared) for the next 18 months (in month-FTE)

We expect to deploy 15 man months of effort (7.5 supported by the EU and 7.5 supported by our existing staff and colleagues) on this activity in the 18 months after we are able to hire a suitable post-doc.

The 7.5 man months of effort described above will use up our EU-funds associated with this component of our work, and as explained we expect this work to be completed well in time for the delivery of the concept reports in June 2005.

Within our group, we expect the EU-supported post-doc to work closely with the PI and Drs Buscher and Young, as well as our mechanical engineer and (if funds can be secured) a suitably qualified graduate student. We expect this closely-knit team to be

Project C4. 6 way homothetic beam combiner for Darwin and VLTI, J.W. den HERDER

Project title: Fizeau beam combiner for DARWIN
Name PI: Jan-Willem den Herder, Institute Space Research Organisation of the Netherlands

Name of Co-Is: Not yet formally decided but collaboration will be formalised including:

- Leiden Observatory (group lead by Prof Quirrenbach)
- Delft University (optics group lead by Prof Braat)

Furthermore we hope to be able to setup, in the context of JRA4-WP1.1 collaborations with other groups in Europe addressing similar projects. Actually we were expecting that based on the initial interest the program would stimulate collaborations (e.g. see whether it is possible to join forces on the aspect of beam combiners)

Short description:
The current baseline design for the imaging mode of DARWIN is based on a Michelson Interferometer. It is expected that applying homothetic mapping for a Fizeau Interferometer will enlarge the field of view significantly and would also allow for an optimal sensitivity. Special items which are investigated include the co-phasing on an off-axis reference star, the optimal design and required accuracies for the mapping of the exit pupils (feasibility of zooming optics) and the effect of the dynamic behavior of a constellation of free flying satellites. In the context of this work we will also investigate the possibilities to enhance the spectral capability of the interferometer. It is expected that part of these issues overlap with requirements and design options for a beam combiner on VLTI.

Manpower:
The planned manpower for this project includes 0.5 staff position (simulating the optical-dynamical environment), one post-doc position (optical design, this position is currently vacant) and a Ph-D student (wide field aspects and homotetic mapping).

No EU funds are currently avaialble. When additional funding (through the JRA4-WP1.1) could become available we like to strengthen the exchange of knowledge with relevant VLTI developments. Preferably one position and relevant travel money would be required.

Structure of the group:

- PI, permanent staff (50%)
- simulation opt-mechanical environment, permanent staff (50%)
- optical design (post doc, vacancy currently advertised, 100%)
- Ph D student (homothetic mapping, wide field imaging, 100%)

Not included is the required position (through this program) for the interface/synergy with the VLTI design activities in Europe

Project D1. Spectrally resolved interferometric instrument, R. PETROV

Not yet confirmed.

Collaborators: S. Robbe-Dubois, E. Aristidi (Dr.), S. Lagarde (Research engineer, Cote d'Azur Observatory), F. Jeannaux (Assistant enginer), A. Robini (Study engineer). F. Vakili (Dr.), S. Jankov Dr.) + thesis students.

At the time of writing we agreed on the phone to collaborate on such or very similar project with the Bonn MPIfR group, but we did not have time to set up a common text. We are also willing to collaborate on this topic with other Institutes such as the OCA in Nice/Calern and CRAL in Lyon or others, who might have made similar proposals. A leadership of the project by our institute is absolutely NOT a prerequisite for such collaboration.

Project D2. IR spectrograph for very high resolution interferometry, G. WIEDEMANN

Not yet fully confirmed.

For VLTI: IR spectrograph for very high-resolution interferometric spectroastrometry; investigation of stars and extrasolar planet systems

For VLTI: IR wavelength-chopping Fabry-Perot: differential interferometer for very high resolution interferometric imaging of exoplanet systems and exoplanet detection (near-IR and K,L,M bands)