

# THE OPTICON FP6 PROGRAMME AND ESO

*THE OPTICON FP6 PROGRAMME WHICH STARTED AT THE BEGINNING OF 2004 IS ALREADY PLAYING A LARGE ROLE IN COORDINATING OPTICAL AND NEAR-IR EUROPEAN ASTRONOMY. ESO, A FULL PARTICIPANT TO THIS ENDEAVOUR, IS REAPING VERY SIGNIFICANT BENEFITS FOR ITS COMMUNITY, IN PARTICULAR THROUGH THE DEVELOPMENT ACTIVITIES AIMED AT VALIDATING ENABLING TECHNOLOGIES FOR NEXT-GENERATION INSTRUMENTATION OF 8–10 M CLASS TELESCOPES AND THROUGH A NUMBER OF “STRUCTURING” NETWORK ACTIVITIES.*

GUY MONNET, ESO

**O**PTICON STANDS FOR Optical Infrared COordination Network for Astronomy. It is part of the sixth Framework Programme (FP6) of the European Commission (EC) and was preceded by a smaller scale version in FP5. It was selected by the EC in the summer of 2003. The EC contribution to the 5-year programme, officially started January 1, 2004, is 19.2 M€ with matching human and financial resources coming from the 47 European groups<sup>1</sup> participating in this endeavour. The coordinating Institute is the University of Cambridge, with Gerry Gilmore as Project Coordinator and John Davies (UK-ATC) as Project Scientist.

The OPTICON high-level goal is the integration of (optical/IR) astronomy across Europe through three interrelated activities, Networking, Transnational Access to medium-size telescopes and critical technological developments through so-called Joint Research Activities. This paper gives an “ESO-centric” view on the programme and its present and future impact on the Organisation. Please consult the OPTICON web pages at <http://www.astro-opticon.org/> for an official view of the whole programme.

OPTICON activities started as planned at the beginning of 2004, albeit rather slowly at first until EC funds finally became available in October. Most activities are currently delayed by a few months only, with quite a number on schedule. Below is a summary of the progress made since the project start, with the emphasis put on developments that directly impact on ESO.

## JOINT RESEARCH ACTIVITIES (JRA)

### JRA1: ADAPTIVE OPTICS (AO)

The goal of JRA1 is to “develop the concepts, designs and technologies required for the next generation of Adaptive Optics capabilities which will equip 8–10 m telescopes over

the next decade”. The activity is coordinated by ESO, with in addition INSU/CNRS, INAF-Arcetri, MPIA, NOVA, ONERA, GRANTECAN and University of Durham as participating Institutes.

The programme has fully started with four design studies delivered in 2004: a) two competing feasibility studies of VLT extreme AO systems aimed at Planet finding (LAOG, MPIA, ESO); b) conceptual design of a multi-laser ground layer AO system for MUSE & HAWK-I (ESO, NOVA); c) design of a multi-object wavefront sensor prototype for the LBT (ARCETRI, MPIA) and d) theoretical study of a high-order wavefront sensor (ONERA). A 60-actuator magnetic micro-deformable mirror prototype was also produced and tested at LAOG. Following a 2004 call for tenders, a contract with CILAS (F) was signed end of March 2005 for the delivery of a 1370 actuators second-generation piezo-deformable mirror (INSU/CNRS, MPIA, ESO). The call for tenders for the mirror drive electronics is being finalized. This type of mirror is essential for the VLT Planet Finder and would also be required for MUSE, should the choice of a stand-alone MUSE AO system be made. A request for information for a 2 k actuators micro-deformable mirror (INSU-LAOG) has also been issued recently.

### JRA2: FAST DETECTORS FOR ADAPTIVE OPTICS

The goal of JRA2 goal is to “bring together the best European groups and manufacturers working in the field of detectors and initiate new fast detector developments that are required for the future of European telescopes using Adaptive Optics”. The activity is coordinated by INSU-CNRS (LAOG), with in addition ESO, IAC and ONERA as participating Institutes.

The programme fully started in 2004 with the detector specifications issued (ESO) and the controller conceptual design completed and reviewed (LAOG). Following a 2004 call for tenders, E2V (UK) has been selected for the development of the 240 × 240 pixels



CCD detector for wavefront sensing based on L3CCD technology. The contract has been signed and development of a prototype controller has been launched by LAM for the testing of the chip.

### JRA3: FAST READOUT HIGH-PERFORMANCE DETECTORS

The goal of JRA3 is to “investigate the scientific applications and technological challenges required to develop new high-speed detectors for applications in astronomical research and define, fabricate and fully characterize a high-speed low-noise detector for Adaptive Optics applications having high sensitivity”. The activity is coordinated by UCAM, with in addition PPARC, ESO, MPG, NOTSA, NUIG, LSW, UFSD and Warwick as participating Institutes.

The programme fully started in 2004 with Preliminary Design Reviews of all relevant technologies (LSW), of fast controllers (UCAM) and of a camera head (PPARC). A test report on the L3-CCD has also been issued. Definition of a test sensor based on PN-chips with high 1 micron QE was completed in early 2005 and an offer was received.

### JRA4: INTEGRATING INTERFEROMETRY IN MAINSTREAM ASTRONOMY

The goal of JRA4 is to “Develop tools that will enable a larger number of astronomers without specialized technical knowledge to use interferometers for their research and the growth of the interferometric community in Europe”. The activity is coordinated by INSU/CNRS (LAOG), with in addition UCAM-CAV, INAF, MPIA, MPIfr, ULg, Konkoli Observatory, ONERA, CAUP,

<sup>1</sup> The list of participating entities, including their short names, can be found at: [http://www.astro-opticon.org/OPTICON\\_participants\\_table.pdf](http://www.astro-opticon.org/OPTICON_participants_table.pdf)

TECHNION, NCU/UMK, UNIGE, OO and UNIVIE as participating Institutes.

One major activity directly related to ESO has been the development of seven parallel concept studies (PRIMA faint object, IFSPEC, APRESMIDI, VITRUV, VIDA, Bulk Optic, DARWIN homothetic mapper) for potential second-generation VLTI instruments that were presented at the April ESO/EII Workshop. The co-phasing and fringe-tracking development and the advanced software needed to facilitate the use of modern interferometric facilities by general users have progressed well: they are directed towards both the VLTI and the LBT.

#### JRA5: SMART FOCAL PLANES

The goal of JRA5 is to “develop technologies for Integral Field and Multi-Object Spectroscopy and Imaging, including technology road-mapping to establish the most promising avenues and links with industries and research organizations”. The activity is coordinated by PPARC (UK-ATC), with in addition UCAM-IoA, CSEM, CRAL, LAM, IAC, INAF-Padua, ASTRON, Universität Bremen, University of Durham, Reflex, TNO/TPD and AAT Board as participating Institutes or Industries.

The programme fully started in 2004 with a first draft of the technology roadmap (UK-ATC), the beam manipulator technology (for KMOS) chosen (UK-ATC) and a review of European micro-technology capabilities for MOEM based smart slit masks completed (LAM). In the first months of 2005, the Image slicer activity is advancing rapidly, in particular with the development of slicer galvanic (Padua) and optical (Reflex sro) replication techniques. Beam Manipulators are being studied with Starbug prototypes tested at AAO and innovative field selection concepts explored at LAM. Studies of Fiber Systems (UCAM-IoA) and reconfigurable slits/masks (CSEM, IAC & ASTRON) are also progressing.

#### JRA6: VOLUME PHASE HOLOGRAPHIC GRATINGS

The goal of JRA6 is to “address the current difficulties with Volume Phase Holographic Gratings which prevent their full exploitation in astronomical instrumentation and promote the role of the European institutions and industries in the development of these novel devices”. The activity is coordinated by INAF-Brera, with in addition ESO, IAC, ULg (ATHOL) and POLIMI as participating Institutes.

The programme fully started in 2004 with a) preparation for the fabrication and testing of cryogenic IR-VPHG prototypes; b) a high-contrast polymer selected and characterized to be used for polymer-based VPHG and c) preliminary design of new VPHG-based concepts (high-resolution spectrograph and tunable filter) and set-up of a dedicated laboratory at Brera Observatory for extensive testing of the concepts. In addition, the characteristics of a prototype UV-VPHG have been defined and its substrate procured. The objective is to test it as an upgraded UVES cross-disperser on the VLT.

#### OPTICON

##### TRANS-NATIONAL ACCESS PROGRAMME

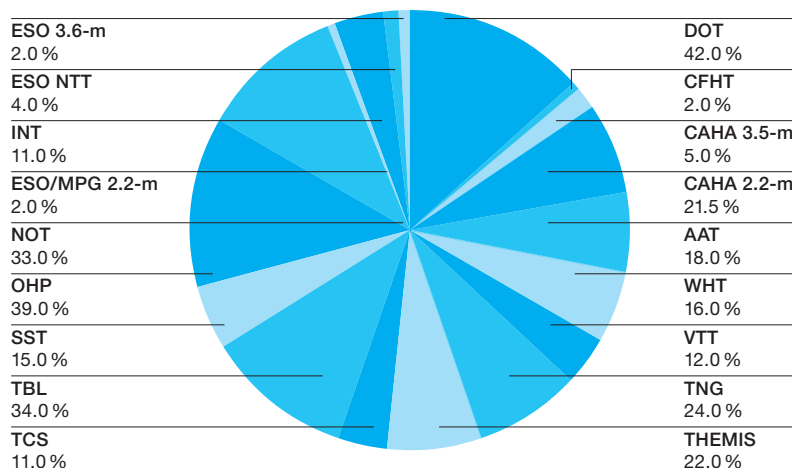
This programme involves access to 18 medium-size telescopes, including the ESO 3.6-m and NTT, and the ESO/MPG 2.2-m. The Trans-National Access Office has been established at IAC-Canaries. The programme has been widely advertised by both the Office and the other participants. The total access provided in 2004 has been 313.5 days/nights or 21.7 % of the total to be given under the five-year programme. Telescope distribution is given in the pie chart. It is rather uneven, with 37 % of the total coming from only three telescopes (DOT at ORM, OHP 1.93-m and Pic du Midi 2-m TBL). ESO’s part is in particular very small, with eight nights only attributed under the programme in 2004. The bar chart shows the distribution by country of

the principal investigator home institution. Special efforts are being made in 2005 by the Access Office and the Telescope Director’s Forum to enhance the participation of users from Central and Eastern Europe and of users from countries with no similar research infrastructures.

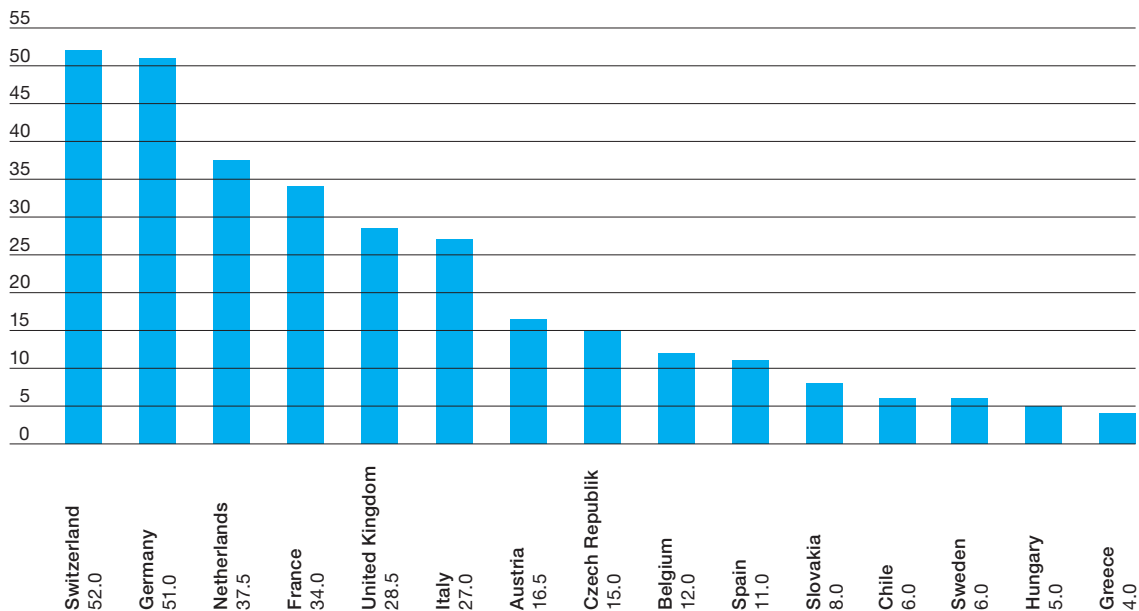
#### NETWORKING ACTIVITIES

Networking Activities have all started. Here are some highlights:

- NA1: OPTICON Management. OPTICON web pages have been set according to a common standard. URL is <http://www.astro-opticon.org/meetings.html>.
- NA2: Coordination and Integration of ENO facilities. Many activities related to site characterization of the Canary Islands’ Observatories have been carried out with coordination of night-time seeing measurements with DIMMs, of day-time measurements at Teide Observatory and preparation for the installation of an Automatic Weather Station to obtain meteorological, dust content and extinction data.
- NA3: Structuring European Astronomy. The critically needed ELT science case has progressed considerably, with an international meeting at Berlin in May 2004 and an OPTICON meeting at Florence in November 2004. The “final” document will be available by July with a “glossy” summary already accessible from the OPTICON web site. The key technology sub-network has defined an initial technology roadmap based on three high-priority ELT instruments (high contrast imager for planet finding; multi-imaging patrol field imager for Virgo stars; multi-object integral field spectrograph for high-z galaxies).
- NA4: Mechanisms for synergy in space-ground coordination. Coordinators have been identified in all major European large astronomical infrastructures and a number of Laboratory test facilities (space or



Total amount of access per telescope from January 1, 2004 to December 31, 2004.



Amount of access per principal investigator home institution from January 1, 2004 to December 31, 2004.

ground based). Full start of the definition of synergic mechanisms is foreseen in 2005.

- NA5: Interferometry Forum. The European Interferometric Initiative (EII) has been developed ([www.strw.leidenuniv.nl/~eurinterf](http://www.strw.leidenuniv.nl/~eurinterf)). The Fizeau visitors exchange programme is very active with visitors from the Czech Republic, Israel, Poland and Hungary received in respectively French, Italian, Dutch and German laboratories. A workshop on next-generation interferometric infrastructure was held on August 23–26 in Liège.
- NA6: OPTICON Telescope Network. This includes the Telescope Directors Forum, the Operation of the Trans-National Office which administers the OPTICON Access programme on medium-size telescopes (see previous Chapter) and an

activity to enhance practical research experience, particularly with respect to observing protocols. Last July, a school with 20 participants demonstrated successful use of ground and space archival data at ESO/ST-ECF.

#### CONCLUSION

The OPTICON programme is proving as an essential tool for European Astronomy. Particularly important for ESO in view of its mandate are 1) the development of key technological concepts and components (Adaptive Optics, fast detectors, Interferometric instrument concepts, smart focal plane components, high-efficiency dispersers) for second-generation VLT/VLTI instruments and as a step towards future ELT instrumentation; 2) the networks aiming at bringing together key astrophysical activities in Europe, with

the Interferometric Forum and the development of the ELT science case by the community of prime importance for ESO, and 3) the OPTICON Telescope Network as a tool for better inter-observatory coordination of observing time, even if its impact on ESO is currently small. ESO is now involved in several other structuring programmes supported by the EC, like RadioNet – the OPTICON sister programme for radio astronomy, the ELT Design Study, the VO-TECH European Virtual Observatory Technical Centre, and soon ASTRONET, the strategic planning exercise for European Astronomy. Within that complex web, the European astrophysical community is being put together to define and impulse the major science goals and infrastructure developments for the next decades, including the ones that will ultimately be implemented by ESO.



ESO Science Archive has been opened to the world-wide community in April 2005. The current total archive holding is now about 50 TB.