FORS1 and ISAAC Science Verification at Antu/UT1

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The UT1/Antu Science Verification (SV) programme with the Test Camera, which was carried out in August 1998, included one major project (the multi-colour coverage of the HDF-S) plus a number of short programmes meant to address problems in a wide range of astrophysical areas. For the SV of the two instruments now attached to UT1/Antu (FORS1 and ISAAC) the same approach was followed, giving high priority to those programmes that potentially serve a wide section of the community. The aim of this strategy was to maximise the probability success and the scientific return, while providing the best possible service to the community and pushing to the limit the capabilities of telescope and instruments. The many goals of the SV of the VLT and its instruments are extensively discussed elsewhere (Giacconi et al. 1999, *A&A*, 343, L1, and references therein).

The scientific programmes were selected according to the following selection criteria:

- outstanding scientific interest
- very challenging for VLT+Instrument capabilities
- sufficiently complete datasets to allow prompt scientific exploitation
- requiring most frequently used instrument modes
- existence of many potential users within the ESO Community
- complementarity with other available datasets (e.g. HST).

SV observations were planned to be executed on January 14–21 for FORS1 and on February 18–25 for ISAAC. However, this schedule could not be met due to a combination of meteorological and technical reasons, which delayed the Commissioning of the two instruments. In order to deliver to the ESO users the UT1/Antu telescope in due time (April 1, 1999), only part of the SV plans could actually be completed.

Nevertheless, part of the FORS1 SV observations were successfully executed during January 1999 by the VLT Commissioning Team, and transferred to the SV Team for the data reduction and preparation for public delivery. These SV data were part of the ESO Press Release of February 27, and were presented to the VLT Opening Symposium in Antofagasta on March 1.

For SV observations with the ISAAC instrument the SV Team could acquire data only during part of the night of February 28. These data have been later supplemented by additional observations of SV targets carried out in March by the ISAAC Commissioning Team. The Commissioning Teams having executed the January and March observations included: F. Comerón, J.-G. Cuby, R. Gilmozzi, C. Lidman, G. Rupprecht, J. Spyromilio.

All the SV data have been reduced and calibrated by the SV Team, and prepared for public release.

Although not as deep, complete and optimally calibrated as originally envisaged, these SV data still demonstrate the enormous scientific potential of the VLT and its first instruments. These are science grade data that all astronomers in the ESO community can now scientifically exploit, thus having an early access to FORS1 and ISAAC data.

The FORS1/ISAAC SV Team includes the following scientists: J. Alves, S. Cristiani, R. Hook, R. Ibata, M. Kissler-Patig, P. Møller, M. Nonino, B. Pirenne, R. Rengelink, A, Renzini, P. Rosati, D. Silva, E. Tolstoy, and A. Wicenec.

The SV Team took responsibility for the selection of the targets, the data reduction and quality evaluation. The team also ensured that the results were promptly disseminated and eventually fully exploited by promoting the involvement of scientists from the community. The SV Team remains the prime contact for the astronomers interested in using the SV data, will assist them as required, and will be responsible for collecting feedback from them.

Both FORS and ISAAC are imaging spectrographs, and a major imaging as well as a major spectroscopic programme were planned for them. For FORS1 a multiobject spectroscopy (MOS) programme was designed since this is the most challenging technique.

For the imaging programme the aim has been to obtain very deep, multicolour images in optical and near-IR bands of a moderate redshift galaxy cluster (Fig. 1).

For the FORS1 MOS programme the SV observations concentrated on Lyman-break galaxies. Targets were selected from databases that are accessible to ESO users, with emphasis on existing publicly available data such as the EIS Deep Fields. Therefore, SV focused on targets in the so-called AXAF field. Moreover, during the second Commissioning phase of FORS1 in December 1998, the FORS1 Commissioning Team led by I. Appenzeller collected MOS observations of candidate Lyman-break galaxies in the Hubble Deep Field South (HDF-S), drawn from the EIS-Deep Survey. The data have been reduced by the SV Team, and they are now part of the present release (e.g. Fig. 2).

The SV Team acknowledges the effort made by the EIS Team for the prompt release of the survey products that made possible spectroscopic follow-up observations in a timely fashion.

The SV Team also prepared a broad range of small programmes and backup programmes to be executed in case the

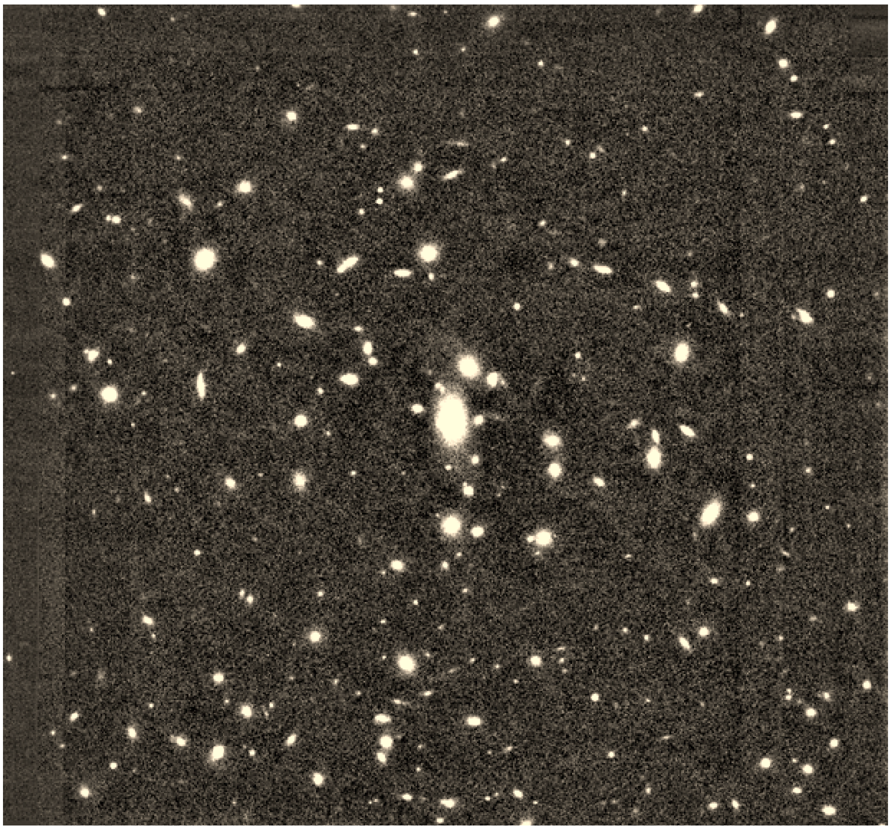

Figure 1: ISAAC K_s image of the cluster MS1008-12. Total exposure is 60 minutes; seeing ~ 0.45″; field 2.5′ × 2.5′.

weather conditions would not meet the requirements of the main programmes (e.g. poor seeing, high cirrus, etc.). Most of these projects could not be executed, for the reasons mentioned above. However, science grade data were obtained for the following programmes:

• FORS1 Broad-band imaging of Antlia, the dwarf irregular galaxy recently discovered in the Local Group.

• ISAAC Spectroscopy of the Highly-magnified Galaxy MS1512–cB58 at z = 2.72.

The FORS1/ISAAC SV data were released through the ESO web site on May 10, 1999 and are accessible at http://http.hq.eso.org/science/sv/

Few more data taken by the Commissioning Team are yet to be fully reduced and evaluated, and will be released as soon as possible.

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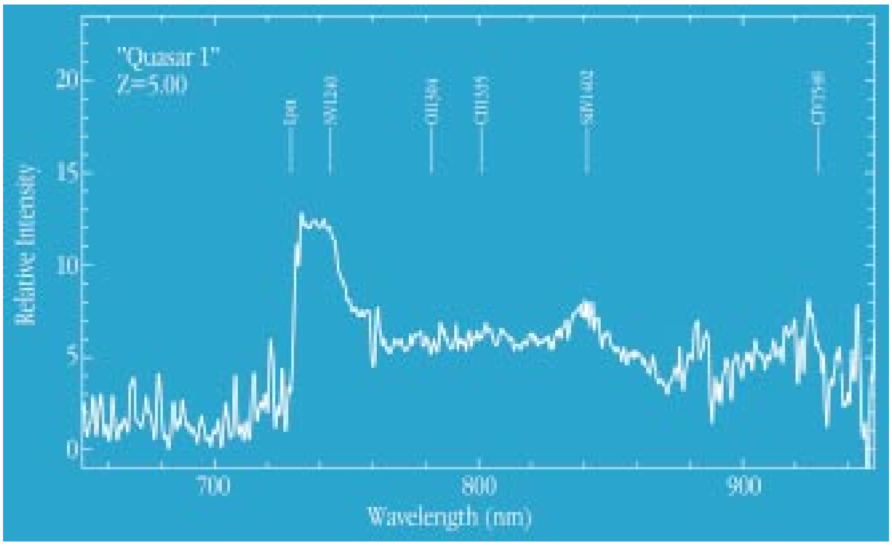

Figure 2: FORS1 Spectrum of "Quasar 1", discovered by X. Fan et al. within the Sloan Digital Sky Survey Collaboration. The redshift is no less than 5.0.

UT2/Kueyen: a Stellar Astronomer's Dream Comes True

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Stellar astrophysics is today a mature science. Many of the fundamental questions have received reasonably satisfactory answers, leaving more subtle, harder and harder problems yet to be solved. A typical example of success is offered by the quantitative knowledge of stellar evolution. We have now a fairly complete understanding on how stars of all masses evolve, from the main sequence all the way to the white dwarf stage or supernova explosion. Perhaps it is not too exaggerated to say that just details remain here and there to be worked out. On the other hand, an example of a hard, still unsolved problem is star formation. Many beautiful images of star-forming regions have been obtained, and still the physics of star formation defies our understanding: predicting from first principles the initial mass function and the star-formation rate has so far proved to be beyond our grasp. Star formation is indeed a very complex physical process, dominated by hydrodynamical/magnetohydrodynamical phenomena that can hardly be formulated by simple algorithms, and that even the biggest computers cannot properly handle. Hence, progress in this field has been slow, and is likely to remain slow for a while. In general, still poorly understood are all those phenomena in which hydrodynamics (especially if chaotic) plays a prominent role, such as convection, mixing, mass loss, common envelope phases, etc. It is important to realise that most often the limit to our understanding does not come from insufficient observations, but rather from the intrinsic complexity of the involved physical processes (not unlike the case of many problems in solar physics). This is to say that even the VLT will not accelerate much the progress in some areas of stellar astronomy. Therefore, while the VLT is entering its fully operational life, it is worth addressing the question of its role vis-à-vis stellar astronomy.

As is well known, the ESO astronomical community has a very strong tradition in stellar astrophysics, with a majority of astronomers in virtually all member states being dedicated to stellar studies. Yet, for the first VLT Observing Period (P63), only 19% of the requested (and allocated) time was for stellar proposals. About 72% of the time was requested for extragalactic astronomy proposals, and the rest was shared by Interstellar Medium and Solar System projects. Nearly the same proportions are also maintained in P64. Does this signal a low interest of the stellar community towards the VLT? At a time when observational cosmology is experiencing its most rapid progress, and a brand new branch of astronomy – exoplanets – is exploding, what space is left to stellar astronomy?

The minority role played by stellar astronomy in P63 and P64 should not be over-interpreted. Indeed, the instrumentation offered at UT1/Antu for these two periods was very attractive for extragalactic studies, but FORS1 and ISAAC could satisfy the needs of only a fraction of the stellar community. By good fortune, UT1/Antu is just the first telescope of the VLT quartet, and the situation is likely to change dramatically already with UT2/Kueyen, which is now being commissioned. Indeed, with this second VLT unit the dreams of many stellar astronomers are about to come true.

UT2/Kueyen will be a spectacular, unique machine for high spectral resolution studies. Figure 1 shows the instrumental complement of this telescope. The Cassegrain focus will feed FORS2, capable of a resolution ($R = \lambda/\Delta\lambda$) up to ~ 4000, and multiplex up to ~ 100.

The high-resolution echelle spectrograph – UVES – will occupy one of the two Nasmyth platforms, and will reach $R \simeq$ 120,000. Both these instruments will be offered to the users in P65, starting April 1, 2000, and the deadline for the submission of proposals is October 1, 1999. Finally, at the other Nasmyth platform the fibre positioner (OzPoz) will be installed in the summer of 2001, along with the medium-high-resolution spectrograph GIRAFFE.

With the installation of OzPoz and GIRAFFE, the high multiplex machine called FLAMES will take shape. FLAMES is OzPoz+GIRAFFE+UVES, plus the software to orchestrate them. In the MEDUSA mode, OzPoz will send 132 fibres to GIRAFFE, capable of getting the spectra of as many objects with R = 7000 or R = 15,000. OzPoz could also dispatch 8 fibres to the other Nasmyth platform, and feed UVES promoting this spectrograph to high multiplex at $R \simeq 40{,}000$. It will also be possible to use GIRAFFE and UVES simultaneously, observing the eight brightest objects in a given programme with UVES at higher resolution, while gathering lower-resolution spectra of over 100 fainter objects with GIRAFFE. More extensive information on UT2/Kueyen instrumentation can be accessed on http://http.hq.eso.org/instruments/.

While it is easy to imagine several extragalactic applications for each of these