Figure 10: Spectra of the Seyfert 1 galaxy Mrk 1239. Lower spectrum in black: WFI slitless plus B50; upper spectrum in red: slit spectrum taken with ESO 1.52-m telescope.

fields in all the filters that will be used. The flattening of this kind of observations is an unsolved problem which will require further experimentation: the pixels exposed by the spectrum of an object each receive a different wavelength, monochromatic light, due to the object. When a flat field is obtained, those same pixels are illuminated by broad-band, or at best medium- or narrow-band light *of the same spectral composition throughout.*

Take rotated images in crowded fields

It is important to obtain images in at least two rotations if source crowding is important. Currently, the system allows only small rotations, less than 10 degrees, but this is more than enough to move zeroth and higher orders of neighbouring objects from the areas of interest.

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3. Especially with certain medium-band filters, the 0th order can be so faint that it is barely detectable except for the brightest sources.

The direct image should be sufficiently deep as to allow the detection of all objects of interest. In certain applications, this may require a pretty long integration in the same filter band(s) selected for spectroscopy. Consider for example a search for continuum-free emission-line objects with medium-band filters. Such objects are effectively point sources in the spectral images, so in order to reach similar depth in the direct image, almost comparable exposure times are needed.

Take flat fields in all filters

At the same time that the direct images are taken, one should obtain flat

VLT-Style Observing with the Wide Field Imager at the MPG/ESO 2.2-m Telescope at La Silla

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1. Introduction

The Wide Field Imager instrument of the MPG/ESO 2.2-m Telescope has been operating with the VLT-style Observing Software (OS) since the beginning of the year. Users can now prepare Observation Blocks in the same manner as for the VLT and other La Silla instruments. This uniformity of the user interface will make the system even more easy to use than before. This work is the result of the efforts of a large number of people: the sequencer scripts were written with extensive help from Paul Lesaux of the NTT team, and Emilio Barrios of the 3.6 team at La Silla. Figure 1 shows the control room with the new system in place.

Testing and development was done during the normally scheduled idle times around full moon, having thus little impact on the functioning of the telescope. This was possible only because of the dedication of all persons involved. Special thanks to the Team's Telescope and Instrument Operators (TIOs), Roberto Castillo, Francisco Labraña, Mauricio Martinez, Jorge Araya, Jose Cortes, who had to suffer during the initial times before the system achieved stability. We would also like to gratefully acknowledge the patience of those users of the system whose programmes were compromised by the initial teething problems.

2. Software Design

It was decided early on to keep the existing low-level subsystems and to build an interface layer from the existing Telescope Control System (TCS), Data Acquisition Integrated System (DAISY), which commands the instrument, and the WFI-specific installation of the FIERA control software, to the VLT compliant OS (for details on the TCS see *The Messenger*, No. 93, p.19, and No. 94, p.12). The resources available at the time did not permit the de-

Figure 1: The new control room layout. The Telescope Instrument Operator Jorge Araya in front of the new instrument workstation at the 2.2-m telescope control room.

velopment of a fully VLT compliant TCS. The hybrid solution for the TCS required us to write many interface functions between the upper VLT compliant layer, and the existing TCS. Thus, a good part of the functionality of a TCS was implemented as an integral part of the Sequencer scripts library (see below). These include the focusing (with temperature compensation and filter-specific offsets) and the autoguider functions. It is evidence of the power of the VLT software that such a "fake", but nevertheless functioning, TCS could be implemented with those tools. We are currently studying the possibility of updating the TCS to a fully VLT compliant one. If this is done we will be able to simplify the sequencer scripts (and thus bring them if not to full VLT compliance, at least closer to the VLT spirit).

Figure 2 shows a schematic view of the software layout with all its subsystems. To place the above diagram in the proper perspective, it is useful to think in terms of the following observing metaphor: The *Broker of Observation Blocks,* BOB, is the main programme, in charge of *executing* the observations. It runs on top of another layer which in this case is the Observing Software (OS). With the help of the p2pp tool, the Visiting Astronomer gives values to the parameters of an observing sequence, such as exposure time, number of exposures, filter, offsets, etc. These values, and their legal ranges are defined in what is called a *Template Signature File.* These are the files in the *instrument package.* p2pp has a graphical form editing interface which presents to the user all the variables that must be filled so that the sequence can be executed. An observing block can contain data for several sequences, stored in an *Observation Block Description* file (*.obd), which is just a file with the names of the sequences composing the OB, together with their variables and the values as-

signed to them by the visiting astronomer.

When the OB is executed, BOB calls the Tcl procedures coded by the 2p2 Team in a *sequencer file* and submits to them the values of the variables as entered by the Visiting Astronomer. The Software Team at La Silla wrote the modules in gray in the diagram; they are required to translate the instructions in the sequencer files into tasks understandable by the existing system. The beauty of the system is that it gives to the team in charge of the telescope / instrument the power and responsibility of writing the appropriate template signature and sequencer files, and it is precisely here where familiarity with the system is needed. It is also here where quick response to requests by observers could be accommodated, like the survey modality, described below, implemented at the WFI upon request from a group of observers at the Max Planck Institute in Heidelberg.

2.1 Observing efficiency

As of this writing the system stability has allowed observations to be conducted with a median efficiency of

66%. That is, during about two-thirds of the night time useful for observations the shutter was open (this has been monitored for only one month). The best value so far, for a whole night of observations, is 79%. If we keep in mind that the above figures include observing programmes with typical integration times of only 30 seconds, this is a rather positive result, as the single frame overhead can be anything from 1 minute to 2 minutes for filter changes and telescope re-positioning. We have just implemented a *fast* mode which will have a positive impact on the above figures.

2.2 The flow of the data

Because of the large size of the images involved (140 MB), it was not possible with the available resources to adhere strictly to the current VLT-style dataflow system. Among the modifications we had to implement are the incorporation of direct saving to DLTs in several of the workstations, and the separation of the dhs/oh workstations, which in the latest versions of the VLT data-flow system were merged into a single "dhs" machine (dhs = data handling system, oh = observation handling). Without this latter modification we experienced many freeze-outs of the system which were (to the relief of every one) alleviat-
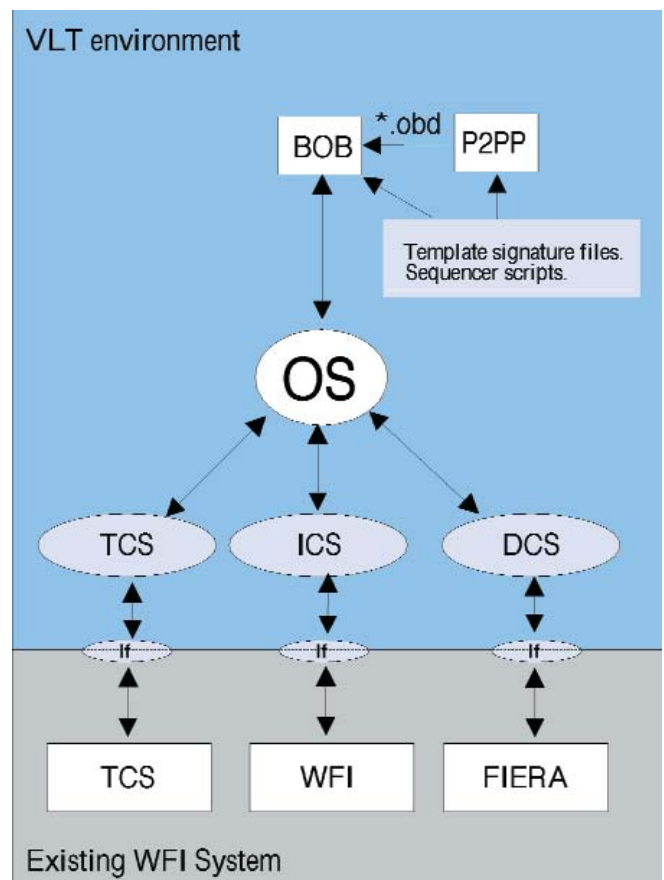

Figure 2: Schematic view of the observing software system for the WFI. The gray modules were written by the Software Team at La Silla. All others are original VLT software.
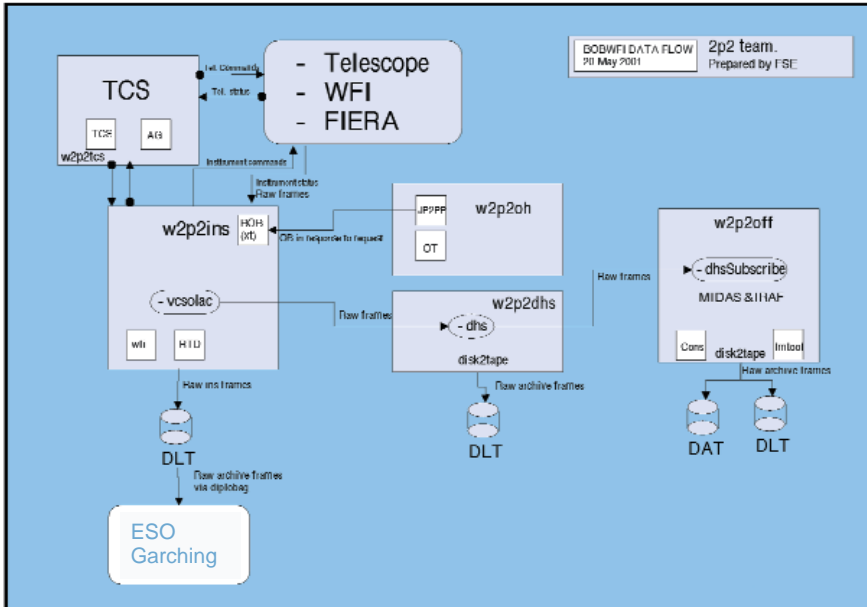
15

Figure 3: Data flow for the BOB@WFI system.

ed once p2pp was run on a different computer than the one where dhs runs.

Data saving continues to be a problem as it consumes a large amount of resources because we have not been able to automate it yet. This will change in the future, once the proper data flow for archiving is implemented.

Figure 3 shows the scheme which we are currently using. The data are backed up every morning from the instrument workstations (w2p2ins) to two DLTs (operations that, together with data verification, take many hours and extend into the early afternoon). One of the DLTs is sent to Garching, while the other is kept at La Silla. Once the tape is "ingested" by the archive in Garching it is returned to La Silla for its re-use (together with the copy that was kept at La Silla). The backup for the Visiting Astronomer is made on DAT tapes from the w2p2off machine. It must be requested daily as there is no room for backlogs. Only raw data are backed up for the Visiting Astronomers.

The backing up of reduced data is their responsibility.

The team is working on an automatic scheme to save data on the w2p2dhs and the w2p2off machines simultaneously to the taking of the data. The main routine has been written and is in the process of debugging. Once they have been fully tested out we will need to assess their impact on the observing efficiency.

3. The future

Among the immediate tasks of the 2p2 Team is the improvement of the Sequencer scripts by making them more efficient and versatile. To this end we are engaged in an effort to parallelise some of the observing tasks, so that the overhead per observation could be reduced. Recent experiments show that without guiding and without filter change, the best we can achieve is 55 s overhead per observation (as opposed to 68 s with the current system). This *fast* mode has resulted in

over 340 frames per night for a programme with a constant integration time of 30 s and no guiding. Such data rates put extreme stress on the operation, and more efficient data archiving methods are urgently needed.

We have also recently experimented with a survey modality of observation, which allows the Visiting Astronomers to align their offsets along lines of constant declination and right ascension for an equinox of their choice, and to specify offsets of any size in their templates. This modality, together with the proper rotation of the instrument will allow for the very precise repetition of previous observations of a large field. We expect to offer these improvements for P68.

One of the main motivations and driving forces behind the development of the VLT-style OS for the WFI is the decision of bringing the WFI to full service mode for period 68. As of this writing (beginning of Period 67), 20% of the assigned time is for service-mode observations. During this time the Team is gaining practice in the use of observing tools such as BOB, P2PP, and OT, to carry out the observations, and it is still getting some of the bugs out of the system.

As mentioned above, among the challenges that we face is the proper data archiving. ESO's Data Management Division is planning to install during July this year the first prototypes of their Next Generation Archive System Technologies, NGAST, units at the 2.2-m telescope. This prototype uses swapable SCSI-IDE magnetic disk technology based on a Linux PC system.

The next period with full service mode will be quite challenging, and if it is to succeed it will need the close collaboration between the team in charge of the WFI, the other support teams at La Silla, and the Data Management Division of ESO at Garching. These have certainly been challenging and interesting times and we are motivated by the support of the user community, and of everybody involved.

Achieving 1% Photometric Accuracy with the ESO Wide Field Imager

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Introduction

Characterising the accuracy and the precision of photometric observations is notoriously difficult. Although photon statistics, readout noise and other basic parameters offer useful insight into the lower limit of the achievable precision,

actual observations suffer from many additional problems: vagaries of the atmosphere, mismatch between instrumental and standard systems, uncertainties in the standard system, non-linearity of the detectors, and the like. Each source of error has special characteristics with different consequences

for the observations, as is summarised in Table 1.

The highly successful Wide Field Imager (WFI) on the ESO/MPG 2.2-m telescope offers the possibility of undertaking photometry over a half-degree field. Here we discuss findings concerning the photometric perform-