Report on the ESO/OPTICON

Instrumentation School on Use and Data Reduction of X-shooter and KMOS

held at ESO Headquarters, Garching, Germany, 9–13 May 2016

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The NEON Archive Schools have since 1999 provided opportunities for young researchers to gain practical experience of the reduction and analysis of archive data. Twenty-four participants from 17 nationalities gathered to learn about the end-to-end cycle of observation proposal, data reduction and archive usage for X-shooter and KMOS. A brief description of the school is presented and the content of the main sessions is described.

The Network of European Observatories in the North (NEON) Archive Schools[1] provide training and practical experience for young researchers through the example of archive data. The purpose of this NEON School, jointly sponsored by ESO and OPTICON[2], was to provide the students with an introduction to the end-to-end cycle of observation proposal, data reduction and archival usage for the X-shooter and *K*-band Multi-Object Spectrograph (KMOS) instruments. These are two 2nd generation Very Large Telescope (VLT) instruments: a single-object wide-band spectrograph and a multi integral-field unit spectrograph, respectively. Additional training included proposal and observation preparation tools.

The first two days of the School were devoted to X-shooter data reduction. A general session on Wednesday addressed the topics of observation proposals, advanced data reduction and archive usage for both instruments. The last two days covered KMOS observation preparation and data reduction. A total of 24 participants, of 17 different nationalities, attended the School at ESO Headquarters (see Figure 1).

The meeting was organised around a set of computer workstations, where groups of up to four students could gather for the hands-on tutorial sessions. Ample time was reserved for discussions, and the students gave short presentations on the results obtained from their practical exercises, commenting on the tools they used in extended feedback sessions. At the end of the first session on Monday afternoon, a "Beer and Brezen" event in the garden outside the meeting room allowed the students and tutors to get better acquainted and to enjoy a sunny Bavarian evening.

X-shooter observation preparation and data reduction

Opening the first session, Joël Vernet provided insights on the optical design and performance of the X-shooter echelle spectrograph, with its emphasis on optical stability, high throughput and low background light. Sabine Möhler described the data from the instrument and the specific features of the calibration and science exposures. Andrea Modigliani described the data reduction chain and the most relevant algorithms involved in the X-shooter calibration cascade. Sabine Möhler and Wolfram Freudling then introduced the ESO Reflex scientific workflow environment[3], which was used as the processing platform for data reduction (Freudling et al., 2013).

Completing the series of X-Shooter presentations, Giacomo Beccari spoke about the preparation of X-shooter observations, and the documents and tools available to the observer: User Manual; Exposure Time Calculators; Phase 2 Proposal preparation (P2PP) system. He also covered the optimal selection of instrument setups and configuration of the templates. His main message (also valid for any other instrument) was: read the manuals! The tutors for the X-shooter hands-on data reduction sessions, Andrea Modigliani, Giacomo Beccari, Sabine Möhler, Analisa De Cia, Michael Hilker, and Valentin Ivanov, provided guidance to the students on the practical use of ESO Reflex for the calibration and data processing of three different X-shooter data sets.

From proposal preparation to Science Archive access

The general session on Wednesday opened with a talk by Gaitee Hussain on the process of proposal submission and best practice for the preparation of successful observation proposals. Marina Rejkuba presented the VLT end-to-end dataflow system with emphasis on the tools for preparation and execution of observations. Advanced topics of

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Figure 1. The NEON School students and organising team gathered in the precincts of the ESO Headquarters building.

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Figure 2. NEON School presentations were held in the Fornax room at ESO Headquarters.

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Figure 3. Valentin Ivanov (left) and Michael Hilker (right) provide support to NEON School students during a KMOS hands-on tutorial.

data reduction were discussed in another presentation by Sabine Möhler, on the correction of telluric lines with the molecfit tool[4], followed by a talk by Wolfram Freudling on the advanced use of ESO Reflex[3] (Freudling et al., 2013). Concluding the session, Magda Arnaboldi described the VLT Science Archive Facility (SAF[5]), and the Science Data Products made available both from external user programmes and surveys, and from in-house data reprocessing.

KMOS observation preparation and data reduction

The second half of the workshop was devoted to KMOS data reduction and observation preparation. Suzie Ramsay summarised the KMOS science drivers, its optical design, instrument modes, and the most important calibration strategies. Lodovico Coccato presented the KMOS data reduction process, with an overview of the calibration and science data, the data reduction cascade and the KMOS workflow. On the last day of the workshop, Michael Hilker presented the observation preparation for KMOS, with the specific preparation tool KARMA (Figure 2). The tutors for the KMOS hands-on tutorial, Lodovico Coccato, Anja Feldmeier-Krause, Yves Jung, and Michael Hilker, guided the students through the reduction of data sets downloaded from the SAF (Figure 3).

In summary, this NEON Instrumentation School was an excellent opportunity not only for the participants to learn about the preparation of observations and the handling of instrument data, but also for the tutors to meet directly with the users of various ESO tools. Useful feedback could thus be gathered on the practical problems that can occur when going through the whole process from data collection, reading of the documentation, to use of the data reduction tools. Issues encountered by novice users were especially obvious. It was unanimously recognised that such hands-on sessions were very useful and should be extended to other ESO instruments. This NEON Instrumentation School is thus fulfilling a wish expressed by users, and is a nice complement to the standard NEON Observing Schools, such as the one that took place in La Silla in February 2016 (Dennefeld, Melo & Selman, 2016). The slides of all talks are provided on the workshop webpage[6].

Acknowledgements

This ESO/OPTICON School would not have been so successful without the efficient work of many people: Martine Peltzer who helped with organising the meeting; ESO-Garching logistics who organised both the accommodation of the students and the configuration of the meeting; the ESO IT team who efficiently installed and configured the presentation equipment and the computers for the hands-on sessions; and Artur Szostak and Enrique Garcia who provided support for the installation of the scientific software. The financial support of ESO and of the European Commission (through the I3 OPTICON programme) was instrumental in the success of this school. We would like to gratefully acknowledge the contribution of the Scientific Organising Committee (Magda Arnaboldi, Sandra Castro, Wolfram Freudling, Marina Rejkuba and Martino Romaniello) and, last but by no means least, thanks to all the tutors for devoting their time, talents and effort to ensuring the success of the School.

References

Dennefeld, M., Melo, C. & Selman, F. 2016, The Messenger, 164, 47
Freudling, W. et al. 2013, A&A, 559, A96

Links

[1] NEON Schools: http://www.iap.fr/opticon/past_neon_schools/
[2] OPTICON: http://www.astro-opticon.org
[3] ESO Reflex: http://www.eso.org/reflex
[4] molecfit telleuric absorption correction tool: http://www.eso.org/sci/software/pipelines/skytools/
[5] ESO Science Archive Facility (SAF): http://archive.eso.org/cms.html
[6] NEON School Web Site, with list of participants: http://www.eso.org/sci/meetings/2016/garching_school2016.html