DMO Factsheets

01 April 2018 – 31 March 2019

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Users Committee is invited to take note of this document
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**Highlights**

- The first data release from the Next Generation Transit Survey was published in the ESO Science Archive in November 2018.
- The user front-end part of the Phase 1 project (p1, namely cycle configuration and proposal submission) has been deployed first to submit DDT proposals on April 1st, and will go public for all programs in September 2019. Feedback of early users is welcome and considered.
- The web-based Phase 2 tool (p2) along with its programmatic interface (API) have been successfully used for preparation of Service Mode Phase 2 package for all Paranal instruments for the first time in P102. Feedback from users is overall very positive.
- The new ESO Archive Science Portal has been released, and is publicly accessible [http://archive.eso.org/scienceportal](http://archive.eso.org/scienceportal). It provides a rich web interface for graphical and interactive data discovery and comprehensive programmatic and tool access. It includes a completely re-hauled web interface, with interactive tools such as sky view, data aggregation and previews, and programmatic and tool access via suitable VO protocols.
- An external review of the Dataflow system roadmap has been conducted, and the review meeting took place in Garching on 3-4 May 2018. Positive feedback about the conclusion of this successful process and its results as been received from STC.
- The European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures (ESCAPE) project has received funding of 16 M€ through the EU H2020 programme. As part of ESCAPE, DMO will host an activity to apply machine/deep learning to ESO science archive content, starting early 2019: [https://www.eso.org/public/announcements/ann18084/](https://www.eso.org/public/announcements/ann18084/)

**APEX**

- The science verification for the SEPIA660 (band 9) receiver at APEX was successfully completed in October 2018. The receiver was then formally accepted by the APEX Board on 5 November 2018. This ESO deliverable represents the first new facility receiver in the new APEX agreement.
- A new facility backend and IF processor has been installed, which doubles the instantaneous bandwidth of all APEX heterodyne receivers (except SEPIA180 – band 5) from 4 to 8 GHz per bandwidth and polarization.
- The nFLASH facility instrument is scheduled to be installed during the second half of 2019.
- APEX data are routinely transferred through the ALMA data link at a rate of 100Mb/s since Q2 2018. This greatly improves the efficiency, reliability and speed of the APEX data flow. During 2018 science operations, all data were available to the users within 24 hours after they were taken.

**User Support Department**

The DMO User Support Department provides ESO-wide science operations services in the following areas:

- User support in proposal and observation preparation (Phase 1, Phase 2, Service Mode)
- Support to the La Silla Paranal Observatory in Service Mode programme execution
• Observation status tracking and reporting (Service Mode)
• Definition of user requirements and supervision over the development and implementation of operations support tools
• Visiting Astronomers travel organisation and logistics support

Support domain: VLT/I, VISTA, VST (minimal services to La Silla)

Users and Operations Support

• Results of the yearly **Service Mode User Support Feedback Campaign** carried out in September 2018, that targeted Period 101 and 102 Service Mode PIs and their active Phase 2 delegates, have been analysed and all the users who identified themselves received feedback via e-mail. Of 616 targeted users 24.8% provided feedback. The analysis shows continued high users’ satisfaction with the ESO User Support. Users showed comparable satisfaction with the new p2 and the old P2PP tools. The complete results are publicly available in the online report.

• **Phase 2 tools**: *(i)* web-based Phase 2 tool (p2) along with its programmatic interface (API) have been deployed and successfully used for preparation of Service Mode observations for all Paranal instruments, with overall positive feedback. As of March 2019, the stand-alone P2PP3 has been decommissioned and is not in use any more for Paranal observation preparation; *(ii)* A new Finding Chart generation tool has been developed and made available to users via p2. The new service called p2fc that automatically generates ESO compliant finding charts has been invoked more than 8000 times during P103 Phase 2 preparation and 78% of all P103 Service Mode OBs had p2fc generated finding charts. As of April 2019, p2fc will be available in the Observing Tool on Paranal to generate on-the-fly finding charts, thus improving moving target observations. *(iii)* Target of Opportunity (ToO) observations triggering has been included in p2. Starting from P103 in April 2019, at the time of triggering the observations ToO users finalize their OBs and provide all information (coordinates, finding charts, etc) necessary for successful observation.

• **Science Verification support**: *(i)* MUSE+GALACSI Narrow Field Mode SV was shifted from August to September due to technical failure of one of the lasers, and then carried during Service Mode nights. The results are available from the MUSE SV webpage. *(ii)* The plans for the upcoming SV of MATISSE and NAOMI with GRAVITY and PIONIER and the status of the proposal selection is available from MATISSE and NAOMI links under: [http://www.eso.org/sci/activities/vltsv.html](http://www.eso.org/sci/activities/vltsv.html).

• **Workshops/Schools**: *(i)* USD and BOD represented ESO operations delivering presentations and hands-on tutorials at the 2018 ITSO/AAO Observational Techniques Workshop in Sydney, Australia in May. *(ii)* As part of the KMOS@5 science workshop a half-day hands-on tutorial for data reduction was organized. No request for remote participation for this session was received.

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**Phase 1/2**

• Period 102: 468 new VLT/I, VISTA, VST Period 102 Service Mode runs completed their Phase 2 observation preparation and were ready for observations starting from October 2018. This included new Large Programme runs scheduled on ESPRESSO, FORS2, KMOS, X-SHOOTER, SPHERE, MUSE, OmegaCAM and Public Surveys on VISTA and VST. Their distribution per instrument as approved by the OPC for Period 102 is summarized in Table 1 below.
• Period 103: 490 new VLT, VLTI, VISTA, and VST Period 103 Service Mode runs received Phase 2 support by USD in preparation for the upcoming observing semester April - September 2019. These include new Public Surveys runs on VISTA (there were no new VST Public Surveys allocations), and new Large Programme runs on FORS2, KMOS, X-SHOOTER, SPHERE, MUSE, ESPRESSO, GRAVITY, PIONIER and OmegaCAM. Their distribution per instrument as approved by the OPC for Period 103 is summarized in Table 2 below.

• A detailed estimate of pending Service Mode observations (as of Jun/Dec 2018, when telescope scheduling for P102/P103 began) was prepared and delivered to OPO, so that time at already over-committed RA/constraint bins could be pre-reserved in the schedule. Similarly, the bi-annual evaluation of carryover candidates was carried out in Jul/Aug 2018 and Jan/Feb 2019. After a consultation with heads of OPO and PSO, all PIs of A-ranked runs, Large Programmes and Public Surveys were notified via email on 29 August 2018 (for P101 carryovers to P102) and 28 February 2019 (for P102 to P103 carryover possibility).

Table 1 – Distribution of Service Mode runs per instrument as approved by the OPC for Period 102 (October 2018 – March 2019).

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Runs</th>
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<td>HAWK-I</td>
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<td>X-SHOOTER</td>
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<td>SINFONI</td>
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Table 2 – Distribution of Service Mode runs per instrument as approved by the OPC for Period 103 (April – September 2019).

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<td>X-SHOOTER</td>
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Instrument/Project-specific Support

- **Public Surveys**: *(i)* All first-generation VISTA public surveys, except VHS, have been completed. The second-generation surveys are progressing well, and several are expected to be near completion at the end of P104. Therefore, in P104 call for Large Programmes included VISTA. *(ii)* VST Public Surveys: The VPHAS+ public survey has been completed upon request by the PI at the level of 90% completion of the originally intended area. KiDS and ATLAS are nearing completion. *(iii)* The progress reports for VISTA and VST (see Figures below) are prepared once per year in October, showing in addition to first-generation VISTA surveys also the progress of the 6 second-generation VISTA Public Surveys.

- **Projects**: *(i)* Observing Tools: the evolution of the Phase 2 tools project progressed according to plan: the web-based p2 replace P2PP3 for all Paranal instruments observation preparation in the second part of 2018 and has been decommissioned in March 2019. The improvements for operations of ToO observations, as well VLTI and AO instruments operations improvements are being implemented. *(ii)* GuideCAM tool had new releases for support of HAWK-I and MUSE AO modes and for HAWK-I FastPhot Mode. Following a review of GuideCam in January 2019 a decision has been taken to move the tool to web technology and interface it with p2. *(iii)* A new python-based software (eso_fcmaker) for generation of ESO compliant finding charts has been developed by USD in collaboration with PSO based on fcmaker by F. Vogt (PSO). The p2fc demo and production servers implementing p2 to eso_fcmaker API have been deployed in December for P103 Phase 2 observation preparation period. The service has been very successfully used to enable automatic preparation of finding charts for 10 VLT instruments. *(iv)* User Portal (UP): The root cause for frequently reported error messages when accessing UP and WASP during the September Phase 1 proposal preparation period has been identified and the fixed applications were deployed to operations in the course of Q1 2019. An update of UP in the context of the revised Phase 1 system is under way. In the future users will be required to include further information that will enable analysis based on gender and seniority. *(v)* The yearly User Portal database clean-up carried out in April 2018 resulted in 118 accounts merged and de-activated. *(vi)* User Requirements document for ETCs v2.0 with improved integration with p1 and p2 tools has been delivered and input provided for the project implementation plan.

- **Instruments-support**: *(i)* USD provided support for the MUSE Narrow Field AO mode Science Verification (SV) scheduled in August and eventually carried out in September 2018. The SV showed need for careful selection of Natural Guide Star (NGS), as 4 out of 16 scheduled programmes turned out not to be feasible either due to faint or extended NGS. 5 programmes were completed fully, another 5 partially and two were not started. The information about the SV call, and the observations is available from: [http://www.eso.org/sci/activities/vltsv/musesv.html](http://www.eso.org/sci/activities/vltsv/musesv.html). *(ii)* The preparation for the VLTI MATISSE as well as NAOMI with GRAVITY and PIONIER Science Verification is ongoing with the selection of proposals and observations preparation being completed. The observing runs are scheduled during April/May 2019. Public information is available through MATISSE and NAOMI SV webpages: [http://www.eso.org/sci/activities/vltsv/musesv.html](http://www.eso.org/sci/activities/vltsv/musesv.html) *(iii)* USD provided support to a variety of instruments-related projects, including: FORS-Up –project scientist from USD led the Phase A study which, after the review in March, should result in the proposal for instrument upgrade; CRIRES+: participation in the Test Readiness Review, GuideCam requirements review and update, test of the templates readiness through software simulation of acquisition sequence; 4MOST – participation in FDR and Call for Proposals Readiness Reviews as board member, implementation of 4MOST ETC, supporting consortium in developing the
operation model; SOXS – input to PDR; NIRPS – review of operations document in preparation for PAE review; ELT-MICADO – participation in PDR as board member and operations input for PSF reconstruction; ELT-METIS – participation in sub-system PDR for operations and representation in the PDR board.

**Figure** - The VISTA Public Surveys Progress status at the beginning of Period 10 (Oct 1, 2018). The completion is computed with respect to the time allocated for each survey. All 1st generation surveys, except VHS, are completed, and the 2nd generation surveys started in 2017. VINROUGE has lower completion due to dependence on suitable triggers from LIGO-VIRGO.

**Figure** - the VST Public Surveys Progress status at the beginning of Period 102 (October 1, 2018). The completion is computed with respect to the time allocated for each survey. Note that VPHAS+ is completed upon request by the PI, and following approval by PSP.
Back-end Operations Department

The Back-end Operations Department (BOD) within the Data Management and Operations Division (DMO) is responsible for the following activities:

- Processing and quality certification of the data stream from Paranal
- Generation of data products for distribution through the archive
- Phase 3, i.e. collection, verification and archiving of data products from the community (Public Surveys, Large Programmes, etc.)
- Scientific oversight to the reduction of ESO data, including scientific guidance for the development of pipelines
- Continuation and further development of ESO Reflex as front-end tool to ESO data reduction algorithms
- Operations of the ESO Science Archive Facility
- Scientific and operational development of the ESO Science Archive Facility

BOD Organization

The Back-end Operations Department (BOD) comprises the following organizational units: BOD Management, Data Processing and Quality Control Group (QCG), Science Data Products (SDP) Group, Archive Science Group (ASG), including the ESO Survey Team, and Archive Content Handling Group (ACH).

BOD Operations

The health check and trending services continue to be a core service of Data Processing and Quality Control Group (QCG), both to the community and to the La Silla Paranal Observatory. VLT/VLTI data are transferred within minutes to Garching, where they are processed. Relevant quantities measuring the health status of the instruments are, then, extracted from the processed frames and the results are fed back to Paranal within one hour. This real-time Quality Control system includes a calibration completeness monitor, an automated product scoring system and the Health Check suite of tools to monitor the trend of the instrumental characteristics. In combination with the User Portal, the fast data transfer also allows for access of the PIs to their proprietary data within few hours from acquisition at the telescope. The main highlights for the reporting period were the activities support of the integration and commissioning of the ESPRESSO and MATISSE instruments on Paranal. Both instruments are now in regular science operations.

The operations of the ESO Science Archive Facility have continued nominally, under the organizational umbrella of the Archive Content Handling Group (ACH). Selected statistics on archive usage and related operational metrics are reported in the plots below. Let us just highlight here that the number of unique users accessing processed data from the Science Archive Facility continues to grow, reaching a grand total of more than 3500. This represents an increase of almost 1000 new users since last April. Both products generated at ESO and those returned to the archive by the respective PIs are in great demand. The user base of the former is now stably increasing at a faster pace compared to the latter. About 32% of the ESO refereed papers published in 2018 are classified as “archive papers”. It is the first time that the fraction of archive papers is above 30%, and the seventh year in a row in which the fraction of archive papers is above 20% (an archive paper is defined as one in which data is used for which none of the authors was PI or CoI in the original observing proposal). We continuously monitor this and other trends and key performance indicators.

The Archive Science Group (ASG) oversees enabling the scientific exploitation of the ESO Science Archive Facility. In this context, they are the interface to our user community for the Phase 3, i.e. the collection of data products from the PIs of Large Programmes and Public Surveys, their validation and their ingestion into the ESO archive. The following Phase 3 releases from external users occurred in the reporting period: Large Early Galaxy Census
(LEGA-C, DR2), X-Shooter GRB Afterglow Legacy Sample (XS-GRB, DR1), Next Generation Transit Survey (NGTS, DR1), Galaxy Cluster At VIRCAM (GCAV, DR1), VISTA Variables in the Via Lactea eXtended (VVVX, DR1), Kilo-Degree Survey (KiDS, DR4), VISTA Star Formation Atlas (VISIONS, DR1), Ultra-VISTA (DR4), UVES Spectral Quasar Absorption Database (SQUAD, DR1). It is worth noting that two of these releases, namely XS-GRB and SQUAD, were made on a voluntary basis by the respective PIs in order to ensure the legacy value of their datasets.

The following release of science grade data products generated in-house by running the corresponding data reduction pipelines took place in the reporting period: VIMOS imaging (data before April 2016 were provided at ESO with the same pipeline setup as earlier products generated by CASU in Cambridge as part of the UK in-kind project, after that date and until the decommissioning of the instrument in March 2018 data were processed at ESO with the same pipeline setup as earlier products), APEX (this first release is concerned with the Boomerang Nebula), stacked OB-level 1D spectra for FLAMES-GIRAFFE to replace individual exposures.


Access to the ESO Science Archive was re-hauled to offer enhanced functionalities: a completely re-hauled web interface, with interactive tools such as sky view, data aggregation and previews, and programmatic and tool access via suitable VO protocols. A community forum is also available to gather feedback and foster discussions between users and ESO and among users themselves. Early user adoption is very encouraging, with close to 5000 unique IP addresses having contacted the services. A first estimate suggests that this corresponds to about 1600 unique users, but we are still working to refine the conversion.

The Science Data Products (SDP) group was established as part of ESO’s effort to improve the data products delivered to users. Significant progress was made in bringing the SPHERE pipeline to a state in which it can be of general use. The pipeline now provides zeropoints and Strehl ratios for IRDIS B J, B H, and B Ks and ZIMPOL V, N R, N I STD, FLUX observations. For this purpose, we also determined the attenuation of the neutral density filters for both IRDIS and ZIMPOL and defined a new standard star catalogue for ZIMPOL in addition to fixing some bugs. After fixing a bug and changing a parameter setting, the IFS wavelength calibration now provides as good a result as possible with such low resolution and sparse sampling. The pipeline now provides QC parameters for ZIMPOL polarimetric standard stars (both unpolarized and highly polarized). While working on these issues other problems were discovered and fixed. Also, the recipe to determine the distortion of IRDIS imaging data now provides useful results and enables proper monitoring. In addition, it allows the user to align the images from the two cameras in case no appropriate on-sky data for that purpose were observed during the night. We will now carefully evaluate the reach of these recent improvements to decide the way forward, including evaluating the impact that devoting to them the required level of resources would have on other activities is being evaluated. The expectation is that it will not be negligible, likely affecting the archive release of reduced data from other instruments, so the opportunity of doing so must be very carefully evaluated.

A new version of the KMOS pipeline was released in preparation for the production of reduced data for the archive. The most notable feature of this pipeline is that it can apply telluric corrections to the reduced spectra based on detailed modeling of the atmosphere with molecfit. This will be the first time that such a correction will be applied to data to be published in the ESO archive. The full history of data from KMOS was processed with the new pipeline and in undergoing testing and validation.

A new version of MUSE pipeline was released (v2.6). This new version accounts for the variation of the filter transmission curve over short wavelength scale (particularly evident in Wide Field Adaptive Optics mode) and it can reduce Narrow Field Mode data. The MUSE ZAP workflow in this release has been also updated to be compatible with it.
The European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures (ESCAPE) project has received funding of 16 M€ through the EU H2020 programme. By bringing together key pan-European astronomy and particle physics facilities on the ESFRI Roadmap, the ESCAPE project will address the challenges in open science and data accessibility faced by European researchers. As part of ESCAPE, we will host an activity to apply machine/deep learning to ESO science archive content. The recruitment process is ongoing (the deadline for applications was March 31st, 2019).

Selected plots of statistics on archive usage and related operational metrics

![Selected plots of statistics on archive usage and related operational metrics](image)

**Figure** - Growth with time of the user community accessing science processed data that are readily available from the ESO Science Archive Facility. These processed data are either contributed by the community, mainly from Large Programmes and Public Surveys, or generated at ESO by running the corresponding data processing pipelines.

**La Silla Paranal Observatory data holdings: raw data**

![La Silla Paranal Observatory data holdings: raw data](image)

**Figure** - Raw data holdings for LPO. Selected sources of science files are represented by the different lines. “LPO Total” (purple line) represents the total holdings, including calibration files.
La Silla Paranal Observatory data holdings: data products

Figure - Data product holdings for LPO: EDPs=External Data Products, i.e. data products returned from the community (mostly Public Surveys and Large Programmes); IDPs=Internal Data Products, i.e. data products generated in-house.

La Silla Paranal Observatory data delivery

Figure - Outflow of data for LPO: EDPs=External Data Products, i.e. data products returned from the community (mostly Public Surveys and Large Programmes); IDPs=Internal Data Products, i.e. data products generated in-house by running the corresponding instrument pipelines with a standardized set of processing parameters; APEX and HARPS Tarballs contain data products generated at the Observatory by running the corresponding data reduction pipelines.

Notes
EDPs (External Data Products): these are data products returned to the ESO Science Archive Facility by external consortia (Public Surveys, Large Programmes, individual users, etc.) for the benefit of the community at large.

IDPs (Internal Data Products): these are data products generated internally by ESO by running the corresponding instrument pipelines and published to the community at large through the Science Archive Facility.
**Data Flow Project Activities**

A comprehensive road-map of the projects required to bring the overall Data Flow System to support both ELT and VLT (and La Silla) at the time of beginning of ELT operations has been released. It comprises ongoing (e.g. Phase 1 and Phase 2) and future upgrade projects. It considers the obsolescence plan of the current tools and the requirements from new ELT and VLT instrumentation. Special consideration was given to the integration across all end-to-end data-flow processes. This plan is the basis for all developments in this area for the next 6 years.

**End-to-End Science Operations**

- The ELT project has released its science operation requirements. DMO and PSO evaluated their impact and provided feed-back and requests for clarifications to ELT project. The second, iterated version is now formally released. Most requirements have only minor or no impact, and are fully compatible with the requirements considered in earlier drafts. A handful of requirements will require tweaks or adjustments (but no major change). Overall, the ELT Science Operation requirements are integrated. The next step will be the integration of the ELT Operation Concept Document, which is expected to be released soon.

- Similarly, requirements on the DFS from MOONS/4MOST have been integrated.

- Following a recommendation from STC, an external review process has taken place (3-4 May) to evaluate the dataflow development roadmap. The board assembled was composed of external, high-level specialists of operations from the community including STC and UC. The board’s terms of reference included the review of the effectiveness of the development plan (“are we doing the right things?”), its efficiency (“are we doing the things right?”) and to evaluate whether synergies with other observatories and organizations are adequate. The board submitted 408 RIXes to the project team, all of which were addressed before or during the review meeting. The review was overall very positive for all three questions: the plan is deemed complete for the VLT, well defined for the ELT, and with appropriate synergies where possible. Furthermore, the board produced 14 recommendations, among which it expresses its strong supports the plan’s “agile” software development approach, and recommends to strengthen the role and participation of the Programme Scientists in the development plan, and to explore the possibility to prioritize the completion of the P1/P2 project. Since the review report was received, various actions have taken place to implement the recommendations. Among them, the formal and informal communications with the Programme Scientists have been enhanced, the ELT science operation requirements have received and iterated (see above), and a staged roll-out of the P1 interface is pursued (see P1 below).

**Phase 2 Web Project**

Phase 2 web is a strategic dataflow project with the following goals:

- **Phase 2 programmatic interface** – provide a programmatic (HTTP) interface allowing the implementation of instrument- or science case-specific observation preparation tools and scripts to programatically create OBs and to dynamically update their execution priority and potentially other properties throughout the ongoing observing period. This interface can also be used for the “mass production” of OBs (e.g. for surveys), for which manual OB creation with a graphical user interface is not feasible. The programmatic interface is programming-language agnostic.

- **Web-based phase 2 user interface (p2 UI)** – In order to discontinue the P2PP Java desktop tool and its complex OB check-in/out paradigm and in order to simplify quick rollout of bug fixes and new features, a modern web-based user interface was built on top of the phase 2 programmatic interface allowing to define OBs directly in the ESO database. This
provides the basis for future extensions to nested scheduling containers such as time-links of concatenations.

After the first operational usage of the new phase 2 infrastructure in Q1 2018 to enable service mode observation preparation for UT2 and the survey telescopes further progress was made as follows

- OT's ESPRESSO support, i.e. filtering/ranking of several queues from different telescopes was finalized
- For the first time in July 2018, all VLT observation preparation in all observing modes was offered in p2. The subsequent USD review and actual observations on Paranal passed smoothly. Consequently, we were able to discontinue the Java desktop client p2pp v3 and its associated server in Q1 2019, thereby reducing required SW maintenance.
- The new web-based observation preparation user interface makes it much easier to integration additional services. Two services were integrated already:
  - Upon the press of a button, investigators can now ask for the automatic generation and attachment of an instrument-specific finding chart for one or several OBs. This feature integrates the USD-developed p2fc (p2 finding chart) service.

![Figure 1: auto-generated finding charts of a UVES OB in p2, integrating the p2fc service](image)
**Figure 2:** Automatic generation of finding charts for a complete observing run

**Figure 3:** The new ToO trigger workflow integrated into p2
- A new “Target of Opportunity” workflow was designed and realized inside p2, which makes it much easier for investigators to trigger a ToO observation, significantly reducing the required amount of manual information to be provided.
- Detailed requirements analysis was carried out in preparation of more advanced features of this project, specifically the alignment of atmospheric constraints and various improvements to VLTI observations which will be realized throughout 2019.
- The plan to roll out the same phase 2 infrastructure also to La Silla was finalized and implementation has started, specifically in support of the upcoming instruments NIRPS and SOXS. Operational deployment is planned for October 2019.
- The phase 2 demo is publicly available at [https://www.eso.org/p2demo](https://www.eso.org/p2demo)

**Unified GuideCamTool**

The goal of the unified GuideCamTool is to offer, in a common, consistent interface the instrument-specific observation preparation. Users can visualize the instrument field-of-view on a sky image, define the central pointing of the telescope, plan observations that involve a sequence of telescope offsets, select telescope guide stars, tip-tilt stars and/or AO guide stars. We took the strategic decision to move any further GuideCam development from Java desktop to web.

- In June, GuideCamTool Release 2.2.0 was published delivering support for MUSE Narrow Field Mode (NFM).
- In December, GuideCamTool Release 2.3.1 was published delivering support for HAWK-I fast photometry mode, a revision of the MUSE narrow field mode based on user feedback, improved integration with the p2 API (observing offsets, target properties, …) and various bugfixes, refer to [https://www.eso.org/sci/observing/phase2/SMGuidelines/GUCT.generic.html](https://www.eso.org/sci/observing/phase2/SMGuidelines/GUCT.generic.html)
- Guidecam 2.3.1 is expected to be the final "desktop" release, in 2019 we will fully focus on moving the application into the web striving for tight integration with p2.
- Requirements for the new, web-based GuideCam Tool were analysed and consolidated with the project scientist(s), including detailed UI mockups to define the user interaction and guide the user in a workflow.
- Implementation of the web-based GuideCam Tool has started fully integrated into p2.
- First supported instrument is XSHOOTER. HAWK-I is also being developed to make sure that the infrastructure covers all requirements.
- First public release supporting XSHOOTER basic functionalities (pointing, blind offset, guide star selection) is planned for June.
- Over the course of 2019, a standard has to be defined how instrument consortia (MOONS, MICADO, HARMONI, …) can develop instrument-specific functionalities, e.g. fibre positioning, based on the new GuideCam architecture.
Phase 1 Web Project
The purpose of this strategic project is to develop an entirely new web-based proposal.
submission system with dramatically improved user interface and workflow, much more configurability and flexibility and simpler yet more sophisticated possibilities to express observing strategies. It should significantly reduce the amount of time needed to deal with the “technicalities” of proposal submission, allowing investigators to focus on their science goals.

- The project has gained high conceptual stability with the fundamental conceptual decision to also drive the phase 1 proposal submission by a subset of the phase 2 instrument packages, thereby achieving usage of a single, consistent instrument abstraction throughout phase 1, phase 2 and the upcoming new Exposure Time Calculators (ETC), finally resolving the complete disconnect between those three realms. This is the foundation for providing a much improved and integrated user experience to the community.

- Throughout the entire reporting period, the implementation of proposal submission continued in a highly agile fashion with frequent project scientist feedback and many changes and improvements against the original requirements.

- Requirements for integrating p1 with the new ETC project were analyzed and consolidated (but not yet implemented).

- In order to deliver the proposal submission work package as soon as possible to the community, a “p1to1” data migration tool was developed, to migrate proposals from the new phase 1 DB to the current one, so that the community can already work with the new system while, for a transition period, the downstream refereeing workflow of OPO will still be carried out with the current tools, which however is entirely transparent to the community.

- Requirements for the new user portal, a dedicated work package of the phase 1 project, have been consolidated and implementation has started. The new user portal shall …
  - allow the association of scientific and technical keywords to a user profile in order to assign the most suitable referees to observation proposals
  - ensure that each account has a well-defined institute so that institutional conflicts between referees and investigators can be detected more reliably
  - allow to specify additional profile information such as gender, year of Ph.D., ORCID ID

- The phase 1 demo environment is publicly available at https://www.eso.org/p1demo, the production environment at https://www.eso.org/p1

- The new proposal submission has been launched on April 1st 2019 for DDT proposals, and will be followed by support for all other proposal types in Q3.
Figure 6: observing setups in the new phase 1 system
The ETC project

The project to overhaul the Exposure Time Calculators and integrate them in the end-to-end Data Flow will use the same instrument abstraction as the P1 and P2 systems (i.e. the “Instrument Packages”, authoritatively maintained at the instrument level on the observatory). It also uses the same technology stack and interfaces as the other web-based products (P1, P2, ASP).

The ETCs infrastructure will be updated to current standards (improving maintainability), using the RESTful API concepts, where the “business logic” is handled on the server-side, and the interface if fully on a web browser. This will make the main stand-alone ETC interface easier to maintain (even in the case of a future technology change), make it richer (interactive graphics, etc, thanks to the existing powerful web frameworks), and make possible the integration of the ETC in other systems (P1 and P2, and in the future the Quality Control system). The APIs will also enable users to call the ETCs directly from other tools and from scripts, which was a requirement from various instrument projects.
In parallel with the infrastructure upgrade, the individual instrument simulation engines are also improved, and their configuration will be cleaned-up (tracking down the source of various empirical scaling factors that were introduced to match the actual throughput of the instruments).

**Status:**

- The requirements have been released, and the project plan has been formalized; development is proceeding.
- The central simulation engine has been upgraded; the main APIs have been implemented.
- A “standalone” web user interface is being developed; The visualization of the simulated spectra and S/N is being finalized.
- The first supported instruments are CRIRES+, 4MOST (new instruments without previous ETC support) and FORS2 (benchmark VLT instrument).
- The other instruments will follow, together with the integration of the ETC with the other systems (P2, then P1 and QC).

**Archive Services Project**

The deliverables of the first release ASP 1.0 of this project are

- ESO Archive Science Portal – a modern web application to browse and explore the archive contents interactively. The results are presented both in tabular and graphical form, including interactive previews, allowing the user to retrieve only the data which are useful for their research.
- Programmatic and Tool Access – allowing users to perform ad-hoc and complex queries to the archive using standard protocols maintained by the International Virtual Observatory Alliance. The usage of standard protocols allows interoperability with popular data visualization and analysis tools like Topcat and Aladin.

**Status**

- All ASP 1.0 components (scienceportal, tap_obs, tap_cat, datalink, ssap, preview generator & server) have been operational and publicly accessible since end of April ’18, specifically the science portal is available at [http://archive.eso.org/scienceportal/home](http://archive.eso.org/scienceportal/home)
- The new services were announced in the ESO Science Newsletter [http://www.eso.org/sci/publications/announcements/sciann17122.html](http://www.eso.org/sci/publications/announcements/sciann17122.html) and in the ESO Messenger [https://www.eso.org/sci/publications/messenger/archive/no.172-jun18/messenger-no172-2-7.pdf](https://www.eso.org/sci/publications/messenger/archive/no.172-jun18/messenger-no172-2-7.pdf)
- Additional features and improvements implemented in the reporting period
  - Simple previews for cubes
  - Ability to bookmark and share a scienceportal session
  - Improved scaling and navigation features in spectral viewer
  - Access to entire dataset, individual ancillary files and data documentation from dataset page
  - Responsive design supporting different screen sizes
  - (multi)Footprint selection, sky selection table
  - Grid view mode for query parameters
  - support for mobile and touch screen devices
• A proposal for a second release ASP 2.0 of the project has been prepared and accepted, requirements analysis has started.

Figure 8 The archive science portal at http://archive.eso.org/scienceportal/home

Evolution of Operational Services

Existing operational services were extended with the following features

• **Night Log Tool** – The “Incoherent Combined Coude Focus” report compiling ESPRESSO OB executions carried out on the different UT telescope into a single overall report, also distributed via PDF. Support for instrument MATISSE.

• **Phase 1** – The recommendation of the Time Allocation Working Group to reduce the number of secondary phase 1 proposal referees

• **TaToo** – Support for the long-term scheduling of ESPRESSO observations both in 1UT as well as in 4UT mode

• **OT/vOT** – Live, on-the-fly generation of finding charts for moving targets in the service and visitor mode observing tools on Paranal

• **OT** – OB Mass Classification panel to classify OB executions on the survey telescopes at the end of the night only, thereby reducing required manual work

• **OT** – Replacement of seeing with the “ATM” constraint combining seeing and coherence time into several discrete categories (poor, medium, good, excellent)

• **Ambient Site Monitor** – Realized a meteoChile service consisting of an API that returns data collected at the meteorological stations at the ESO sites (Paranal, LaSilla and APEX) formatted according to the meteo-chile standards. The benefits to ESO are
twofold. First, it will be a stepping stone towards formal certification of ESO meteorological stations. Second, it will result in improved weather forecasts for the observatories.

- **ACE** – Support to delegate an observing run to multiple users (rather than only a single one) for phase 2 observation preparation

- **Database of Events** – started development of an infrastructure to edit and display the history of events (e.g. earthquakes, upgrades, maintenance, etc.) affecting the quality of calibration data, to be used also by the calSelector

- **OCA (Organisation, Classification, Association)** – Added support for calibration breakpoints and integrated the enhanced “OCA” rules engine into the calSelector, to improve the association of calibration files when requesting science files from the archive

- **Phase 3 Infrastructure** – Support for the ingestion of catalogues produced by the Next Generation Transit Survey (NGTS)

- **Web Security** – All public dataflow web applications were migrated to be exclusively served via the secure HTTPS protocol to establish state-of-the-art web security