Publication Digest

In 2016 there was a steep increase in the number of refereed papers that use ESO data in the research they present. With 940 articles published in a single year, the ESO user community has set a new all-time record, surpassing last year's number of papers by more than 70. About 60 % of these papers involved VLT/VLTI data, while around 20 % were provided by facilities located at La Silla. Both observing sites show a stable output of data papers in comparison with previous years. 11 % of all ESO data papers utilised observations made with the survey telescopes VISTA and VST, while 5 % and 14 % of the papers used data obtained during APEX and ALMA ESO observing time, respectively. VISTA with VST, APEX and ALMA were the largest motors for the increase in papers in 2016, as their productivity has increased since 2015 by 15 % (from 94 to 108 papers), 48 % (33 to 49), and an impressive 76 % (73 to 129), respectively.

The numbers of papers resulting from the individual observing sites, as well as the total number per year, are shown in the table. An overview of ESO publication statistics is available on a dedicated webpage (http://www.eso.org/sci/libraries/telbib_pubstats_overview.html), which includes links to the corresponding records in the *telbib* database.

A total of 566 refereed papers published in 2016 were based on VLT/VLTI data with UVES and FORS being the most productive instruments again, contributing to 123 and 118 papers respectively. Perhaps surprisingly, the Multi Unit Spectroscopic Explorer (MUSE), which entered operations in 2014, already appears among the top five most productive VLT instruments in 2016; it almost tripled its number of publications from 17 in 2015 to 47 in 2016. SPHERE, for which observing data started to appear in publications only last year, has increased its productivity by almost a factor of two (16 papers in 2015, 29 in 2016).

An integral part of the commissioning of a new instrument at the VLT is the Science Verification phase, which includes a set of scientific observations chosen to verify and demonstrate to the community the instrument's capabilities. For MUSE, commissioning and Science Verification data have led to 46 papers so far — 70 % of all the 66 papers published to 2016; for SPHERE, the equivalent number of commissioning and Science Verification papers was 49 % of the total by the end of 2016 (22 out of 45 papers).

The pie chart (following page) shows VLT/VLTI instruments, ranked by the number of papers to which they contributed in 2016. Further statistics for individual instruments can be found in the "Basic ESO Publication Statistics" report, available at http://www.eso.org/sci/libraries/edocs/ESO/ESOstats.pdf.

Almost 200 papers used data from La Silla telescopes operated by ESO in 2016. This number is quite stunning, considering that the number of facilities operated by ESO on La Silla has decreased over the past years. For instance, the Wide Field Imager (WFI), which has not been operated by ESO since October 2013, contributed data obtained during ESO observing time to 15 refereed papers. The statistics of individual La Silla instruments are once again led by HARPS, which produced 83 papers in 2016, accounting for more than 40 % of all papers from this observing site (83 out of 198).

As usual, non-ESO telescopes and instruments hosted at La Silla, such as the Swiss 1.2-metre Leonhard Euler Telescope, the Gamma-Ray burst Optical/

	VLT/VLTI	La Silla	Survey telescopes	APEX	ALMA	Total
1996		350				350
1997		389				389
1998		405				405
1999	29	324				348
2000	52	300				342
2001	105	316				399
2002	159	288				408
2003	260	305				512
2004	342	316				588
2005	359	297				607
2006	413	279		12		640
2007	495	312		1		718
2008	486	289		8		689
2009	473	260		15		660
2010	510	277	2	28		738
2011	555	286	13	27		786
2012	614	270	30	40	16	865
2013	565	273	38	44	40	840
2014	563	267	73	47	47	871
2015	555	211	94	33	73	865
2016	566	198	108	49	129	940
Total	**7101**	**6212**	**358**	**304**	**305**	**12 960**

Refereed papers using ESO data, 1996–2016.
Papers can use data from more than one facility.
VLT/VLTI: papers using data generated by VLT and VLTI instruments, including visitor instruments for which observing time is recommended by the ESO OPC, for example, VLT ULTRACAM, VLTI PIONIER.
La Silla: papers using data generated by facilities on La Silla, including visitor instruments for which observing time is recommended by the ESO OPC, for example, NTT ULTRACAM. Papers based on data from non-ESO telescopes or observations obtained during reserved periods (for example national allocations of time) are not included.
Survey telescopes: papers using data generated by ESO's survey telescopes VISTA and VST.
APEX: papers using data generated by APEX, including visitor instruments for which observing time is recommended by the ESO OPC, for example, Z-Spec. Only papers based (entirely or partly) on ESO APEX time are included.
ALMA: papers using data generated by ALMA. Only papers based (entirely or partly) on European ALMA time are included.

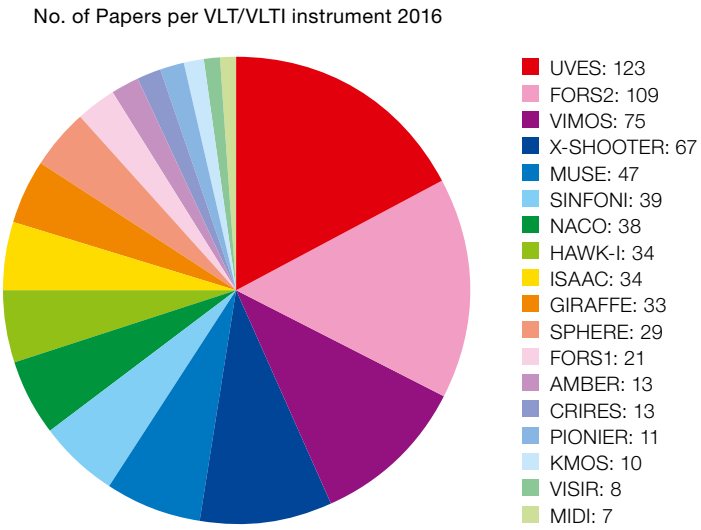
Near-infrared Detector (GROND), and the Danish 1.54-metre telescope, are not included in the ESO publication statistics since their observing time is not evaluated by the Observing Programmes Committee (OPC).

ESO's two public spectroscopic surveys, Gaia-ESO, using FLAMES spectra obtained with UVES and/or the GIRAFFE spectrograph at the VLT, and the Public ESO Spectroscopic Survey of Transient Objects (PESSTO), carried out with the Son OF ISAAC (SOFI) and the ESO Faint Object Spectrograph and Camera 2 (EFOSC2) instruments at the NTT, were very productive in 2016, leading to 17 and 16 refereed papers, respectively.

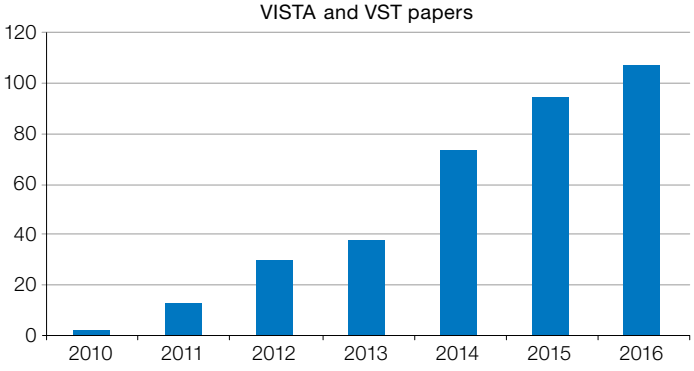
The telescopes specifically dedicated to surveys, VISTA and VST, also continue to be very successful. They provided data for 108 papers in 2016, an increase of 14 % compared to the previous year. The development of the number of VISTA and VST data papers since 2010 is shown in the bar chart.

APEX provided data for almost 50 papers based on ESO observing time in 2016. ATLASGAL, the APEX Telescope Large Area Survey of the GALaxy, was once again an important pillar: half of the APEX papers (25) used data from this survey which combines data obtained during ESO, MPIfR, and Chilean observing time with the Large APEX BOlometer CAmera (LABOCA). Among the APEX publications was also the first one studying data obtained by the Architectures de bolomètres pour des Télescopes a grand champ de vue dans le domaine sub-Millimétrique au Sol instrument (ArTeMiS). In 2016, APEX achieved the highest annual number of publications since its inception in 2006. If observing time from all project partners is considered, APEX provided data for 77 refereed articles this year; observations with ESO time were hence used in 64 % of all APEX data papers.

ALMA achieved impressive results in 2016. A total of 229 papers used observations from all ALMA partners (ESO, North America, East Asia, Chile). Of these, 129 (or 56 %) were based on data taken during ESO observing time, which constitutes an increase of almost 80 % in comparison with the previous year



Refereed papers published in 2016 using VLT/VLTI data. Note that papers can use observations from more than one facility. FLAMES papers are assigned to GIRAFFE and/or UVES.



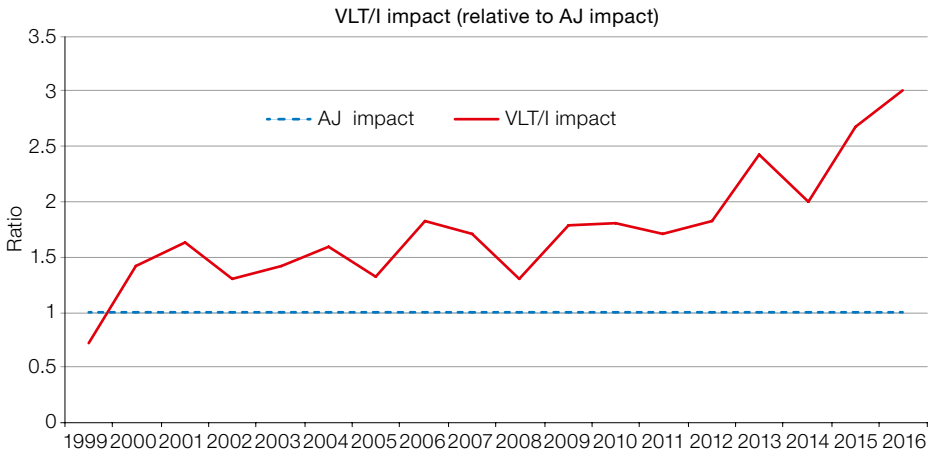
Number of refereed publications per year using data from ESO's survey telescopes, VISTA and VST.

(73 papers based on ESO observations in 2015, 129 in 2016). As a result, almost 40 % of all papers featured in ESO Press Releases presented ALMA observations (from all partners) in 2016 (18 out of 46).

The first ALMA paper appeared in 2012. In 2016, a clear trend can be seen towards synergies in the evolution of refereed publications from ALMA and VLT observations. While the fraction of papers that used data from both telescopes was around 1 % until 2015, almost 4 % (21 out of 566) of the VLT data papers also deployed ALMA observations in 2016. Another trend surfaced in ALMA papers: in the early years of ALMA data papers, the use of archival data resulted typically from Science Verification data (between 80 and 100 % of the ESO ALMA archival data papers from 2012 to 2015). In 2016, this fraction has dropped to 70 %, indicating that ESO papers increasingly deploy ALMA archival observations from programmes other than Science Verification.

The ALMA bibliography is maintained jointly by the librarians at ESO and the NRAO in the USA as well as by the National Astronomical Observatory of Japan (NAOJ). Publications based on data from all ALMA partners are recorded in *telbib*, but only those based on European observing time are counted in the ESO statistics, unless otherwise noted.

The ESO Science Archive Facility (SAF) continues to be the backbone of the organisation's research data ecosystem. Observing data from ESO telescopes are made available to the user community as raw data and in various forms of data products. In 2016, the facilities located at Paranal (VLT, VLTI, VISTA and VST) led to 654 refereed publications. As in previous years, approximately a quarter of them



Impact of VLT/VLTI papers relative to AJ papers, using the median number of citations.

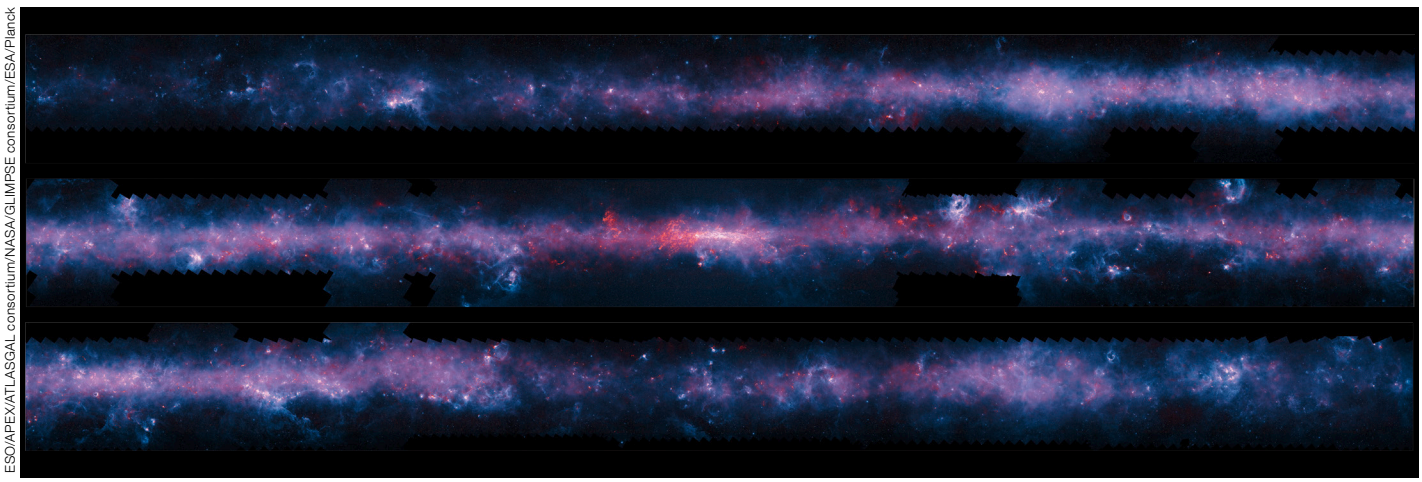
(158 papers, or 24 %) used archival data, either exclusively or in combination with principal investigator (PI) observations. Some 43 % of these (68 out of 158) made use of Data Products, calibrated data which are either provided by external users such as the ESO Public Survey consortia and the Large Programme teams or produced by ESO using science-grade reduction pipelines. Once again, this highlights the important role the SAF plays in providing data to astronomers.

While the above-mentioned numbers show the continued success of ESO's observing facilities, it is also necessary to evaluate the statistics in context. In order to do so, we investigated the impact of VLT/VLTI papers. The impact of scientific publications is typically measured through the total or average number of citations these papers have accumulated. However, here we apply a methodology suggested by Crabtree (Crabtree, D., 2014, "A bibliometric analysis of observatory publications for the period 2008–2012", Proc. SPIE 9149, 91490A). For each publication year, the median number of citations of VLT papers published in a given year was calculated and divided by the median number of citations of papers published in the Astronomical Journal (AJ) in the same year. The result is shown in the image above, treating the median AJ citation as a "measuring stick" and normalising it to 1 for all years. On average, the impact of VLT papers is higher than that of AJ papers by a factor of 1.7. More recent VLT papers (published 2013–2016) are even cited approximately 2.5 times more often than an average AJ paper, suggesting that VLT papers may have a more immediate impact among the astronomy community than the typical AJ paper.

The statistics presented here are derived from the ESO Telescope Bibliography (*telbib*), a database of refereed papers published by the ESO user community that links publications with the data in the ESO Science Archive Facility. *telbib* is developed and maintained by the ESO Library. It is compiled by scanning articles published in the major astronomical journals for ESO-related keywords (e.g., telescope and instrument names). Journals routinely screened for ESO-related keywords are: A&A, A&ARv, AJ, ApJ, ApJS, AN, ARA&A, EM&P, ExA, Icar, MNRAS, *Nature*, NewA, NewAR, PASJ, PASP, P&SS, and *Science*. All papers included in the database have been inspected visually by the curators to ensure that they directly use ESO observational data. Further information about *telbib* and various statistics and reports can be found on the web (http://www.eso.org/sci/libraries/telbib_info.html).

The full list of papers published by the ESO user community in 2016, based on data generated by ESO facilities, can be found at http://telbib.eso.org/ESODataPapers2016.php. Publications by ESO scientists, with or without use of ESO data, are available as a separate list at http://www.eso.org/sci/libraries/telbib_info/AR/ESOStaffPapers2016.pdf.

The southern plane of the Milky Way from the ATLASGAL survey.



ESO/APEX/ATLASGAL consortium/NASA/GLIMPSE consortium/ESA/Planck