Appendix 1 - CDS 5 year report 2011-2016 as presented to HCERES

2. Centre de Données astronomiques de Strasbourg (CDS)

The Centre de Données Astronomiques de Strasbourg (CDS) is a world-wide renowned reference data centre that plays a vital and unique role in the international astronomy community. It is a fully science-driven data centre with the core role of providing added value to published and reference data, and enabling scientific research with the data through innovative services and tools. The CDS services are heavily used and recognized, and it is at the forefront of global efforts for the sharing of scientific data in astronomy and beyond.

The initial CDS charter, established in 1972, has proved to be sufficiently general and prescient to provide the long term guiding vision of the CDS that has helped the CDS adapt over its lifetime to changing scientific needs, and to big developments in information technology.

The initial and still highly relevant CDS charter is to:

- Collect 'useful' data on astronomical objects, in electronic form
- Improve them by critical evaluation and combination
- Distribute the results to the astronomical community
- Conduct research using the data

The CDS is labelled as national Research Infrastructure by the French Ministry of Education and Research (MENESR) in the national Research Infrastructure Roadmap. It is also an internal team of the Observatoire de Strasbourg since 1972, in the framework of a CNRS-INSU - Université de Strasbourg agreement, and it receives input on its strategic planning from an international Scientific Council that meets on an annual basis.

The CDS role is recognized in the international community via our partnerships with major actors of the discipline including the journals, observatories, agencies and other complementary reference data centres. An important recent certification of the quality of the CDS services is the award of the Data Seal of Approval in 2014. CDS was the first natural science repository to obtain the DSA, and only the second French data service to get it, the first one being the CINES, which has a national mandate to preserve data from Universities and Research.

CDS participates in and leads many aspects of the development of the astronomical Virtual Observatory within Europe (Euro-VO), and in the International Virtual Observatory Alliance (IVOA). It is also a pillar of the French network of data services and of the national participation in the VO development. CDS achievements in defining data infrastructures are also recognized by the demand in the wider scientific and societal context, for our input to the RDA, and to the Digital Agenda for Europe.

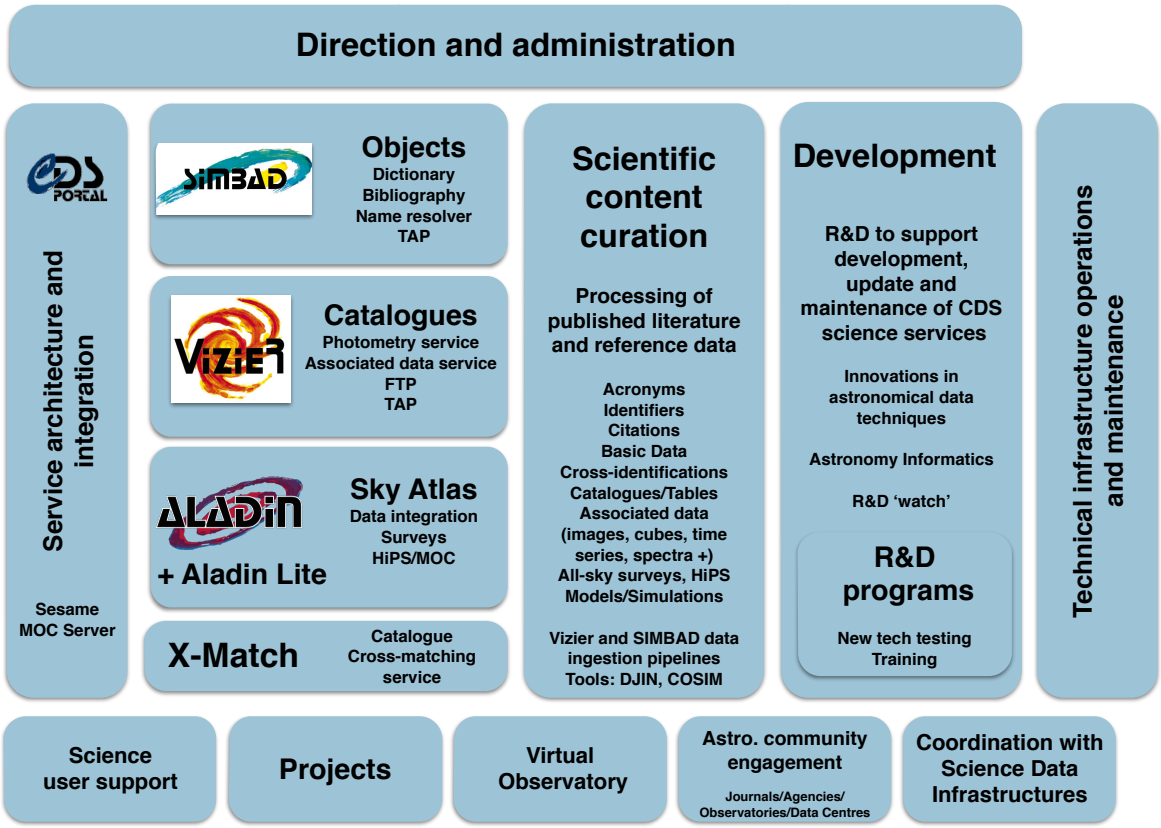
Organisation and strategic planning of CDS work

The CDS work is carried out by an integrated team of scientists, software engineers and "documentalistes" (highly specialised librarians) with a deep level of interaction and coordination between the different types of activities. It relies on the general services of the Observatory for support activities including computer and network systems, administration and logistics.

The diagram above provides an overview of the activities of the CDS. The reference services are: SIMBAD, the reference database for the identification and bibliography of astronomical objects; VizieR, the federation of tabular data, catalogues, tables published in journals, observations logs, surveys; Aladin, a tool to discover, integrate, visualise and manipulate distributed information (images, databases, catalogues, user data); and CDS X-Match a fast positional catalogue cross correlation service for large catalogues.

The work of the CDS in the 2011-2016 period has followed a well defined strategic plan that has been evaluated and updated on an annual basis in coordination with the CDS Scientific Council. This reference period has seen a number of significant results and changes at the CDS.

A major evolution of CDS has been the changes in the staff. There was a change of director in September 2015, with Mark Allen becoming the fifth director of the CDS, succeeding Françoise Genova after 20 years as director. Several key CDS staff, who had been present since the early 1970s and were at the origin of the pioneering role played by the CDS, have departed . Marc Wenger, the engineer in charge of SIMBAD, retired in September 2014, and François Ochsenbein, the astronomer in charge of VizieR, has emeritus status until August 2016. The new leadership of SIMBAD and VizieR are in place and ensure full responsibility of the services. The long term CDS secretary Chantal Bruneau retired in 2014. New recruitments of scientists (Pierre Ocvirk, Ada Nebot), a documentalist (Mihaela Buga), engineer (F-X. Pineau) and secretary (C. Halter) have also been made.



2.1 Global Highlights of 2011-2016

An indication of the wide and heavy use of the services is the high number incoming queries to CDS services that have increased from ~500,000 per day in 2010 to ~800,000 per day in 2015. Recent improvements to the ADS allows us to count the number of papers in which the services are cited, not only in the acknowledgement section but in the full text, showing that in 2014, 679 refereed papers cited the word SIMBAD, 306 the word VizieR, and 58 the word Aladin in reference to our service. The map figure indicates the significant global geographic coverage of queries to the CDS SIMBAD service over the reference period.

CDS has lead the development, implementation and dissemination of "hierarchical progressive surveys" (HiPS) scheme based on the HEALPix sky tessellation. This hierarchical approach to Big Data in astronomy has been designed to be fully scalable and easy to implement, and has proved to be a major structural development for spatial sky indexation of CDS services. A paper published in Astronomy and Astrophysics (Fernique et al. 2015) provides a detailed scientific description. The implementation of HiPS in Aladin and Aladin Lite provides access to some 250+ image surveys, and this represents the fastest growing data hosted by CDS. Tools are provided inside Aladin to allow data producers to build their own HiPS data, and a network of "HiPS nodes" is operational, involving major partners including ESA, JAXA, CADC, IRAP/ CADE, SSC-XMM and other data providers. CDS is also leading the standardisation of HiPS in the IVOA. Furthermore, Aladin Lite the embeddable sky atlas widget has been a runaway success as many global data centres and projects adopt the HiPS approach.

The CDS has lead the European Virtual Observatory effort into a distinct new phase in 2015. A paper describing how Euro-VO coordinated the VO activities in Europe was published in Astronomy and Computing. The early part of the reference period saw the successful completion of the Euro-VO ICE and CoSADIE projects. The new phase of the European Virtual Observatory began in May 2015, with the start of the ASTERICS cluster (Astronomy ESFRI and Research Infrastructure Cluster), a 15 M€ project proposed by a consortium led by ASTRON in The Netherlands. The continuation of Euro-VO efforts are now pursued in ASTERICS as an integrated part of the coordination of large infrastructures (ESFRI and pathfinders) in astronomy.

Highlights related to the strategic axes

The top level strategic drivers for 2011-2016 have been to i.) maintain the services at the highest possible level in terms of content and functionalities, ii.) add functions to the core services in line with CDS expertise, user needs and R&D results, and iii.) to take into account the change in scale of CDS activities due to the increase of publication volume and large surveys. Many of the activities of the CDS in 2011-2016 have been

organized along strategic axes of: Evolution of Astronomy, Technological evolution, Virtual Observatory Aspects and most recently the CDS role in scientific data curation. Here we identify results in these areas (as documented in annual Science Council reports)

Evolution of Astronomy

CDS has built on its reputation for the distribution of catalogue data. A collaboration is set up with ESO for the distribution of their large survey catalogues. Long term collaboration has been on-going with ESA, for instance the distribution of Planck catalogues in VizieR, and collaborative work for the provision of Herschel catalogues. CDS is an official member of Gaia project and the planning work for the first data release in 2016 has been done. Preliminary discussions were held with the Pan-STARRS project and with the French LSST teams.

The CDS expertise in HEALPix sky tessellation is a strategic element for tackling large surveys, both for catalogues and for images. Both Aladin and VizieR ingestion pipelines were deeply updated to facilitate survey ingestion. HiPS has lead to very significant increase in the number of sky surveys stored in Aladin and includes the capacity to link images to the original archive images. The use of HiPS for catalogue and 3-d data cubes has also been developed.

The CDS developed its role in the evolving landscape of scientific data curation – in the context of Open Data – Open Science. For the CDS, "Big Data" such as the very large surveys, and smaller, "Long Tail" data (mostly the results of research by teams and individuals), should be seen by the users on equal grounds. VizieR has been adapted to deal with this diverse range of data attached to publications as well as with large survey catalogues.

Technological Evolution

At the beginning of the reference period in 2011 one of the main drivers for technological evolution was identified as the Web 2.0/3.0 paradigm. The opening of the user annotation system for SIMBAD and Vizier was a typical Web 2.0 functionality implemented at the CDS, along with the MyCDS system for users to store results of CDS service queries. Development of modular CDS components included the VizieR "Photometric Viewer" (released 2013), and SimPlay which served as a precursor to Aladin Lite. The web 3.0 approach combines the semantic web, mobility and universality and the work done on new user interfaces (mobile interfaces, service mash-up through the CDS portal) belongs to that domain. Virtual Reality techniques have also been a topic of R&D for CDS in this timeframe.

CDS has put special care into evaluating the relevance of the so-called "Big Data" technologies for our needs. For the moment we continue to use SQL-like methods, and as explained we make full usage of the "Big Data" capacities of HiPS and MOC, which are fully scalable. But we make sure to follow the technological evolutions around Big Data to seize opportunities, with in particular evaluation of Hadoop/Spark and Docker technologies.

VO Aspects

CDS has participated strongly in the VO with one priority being to implement the CDS services in the VO. This has been done, in particular with the release of TAP interfaces for SIMBAD (2012) and VizieR (2013) which allows users to build complex queries. Also the VizieR and SIMBAD web pages have been SAMP-enabled, allowing users to send query results to VO services such as TOPCAT, which can be seen now as one of VizieR's user interfaces.
CDS services, tools and modular components have been used by others, notably by ESA for the implementation of their new multi-mission user interface ESA-Sky. Many other agencies, projects and data centres have implemented Aladin Lite in their web pages.

The Euro-VO International Collaboration Empowerment (EuroVO-ICE) project (September 2010 – August 2012) was active at the beginning of the reference period. This was a small Coordination Action initially foreseen for one year, but which was was extended for another year as a bridging project that allowed the structure of Euro-VO to remain active.

The main Euro-VO project that took place was the Collaborative and Sustainable Astronomical Data Infrastructure for Europe (CoSADIE) project, the fourth EC-funded project led by CDS to coordinate European VO activities. CoSADIE ended in February 2015 after a six month extension to the initial two-year duration. CoSADIE included three strands of work: "Increasing awareness and gathering requirements from the user and provider communities" (INTA and GAVO), "Coordinating technical activities and defining the technical needs to maintain the VO Framework" (UEDIN), "Outreach towards education and the general public interested in astronomy" (INAF), and assessed the strategies, governance and financial sustainability of the European Virtual Observatory. A detailed assessment of all the elements of Euro-VO sustainability was performed (Report on Euro-VO sustainability -- Genova et al., 2015), including in particular a detailed assessment of technological sustainability (Technical sustainability of European Virtual Observatory -- Allen et al., 2015).

The Euro-VO partners, INSU/CDS, INAF, INTA, and the Universities of Edinburgh (UEDIN) and Heidelberg (UHEI), signed a MoU to indicate their willingness to continue to develop the Euro-VO together. The project has been working in close collaboration with the Astronet ERA-NET, which gathers European funding agencies.

Its sustainability assessment was fully endorsed by Astronet, and Euro-VO sustainability is one of the items of the work programme of the successor of the Astronet ERA-NET, which ended in July 2015.

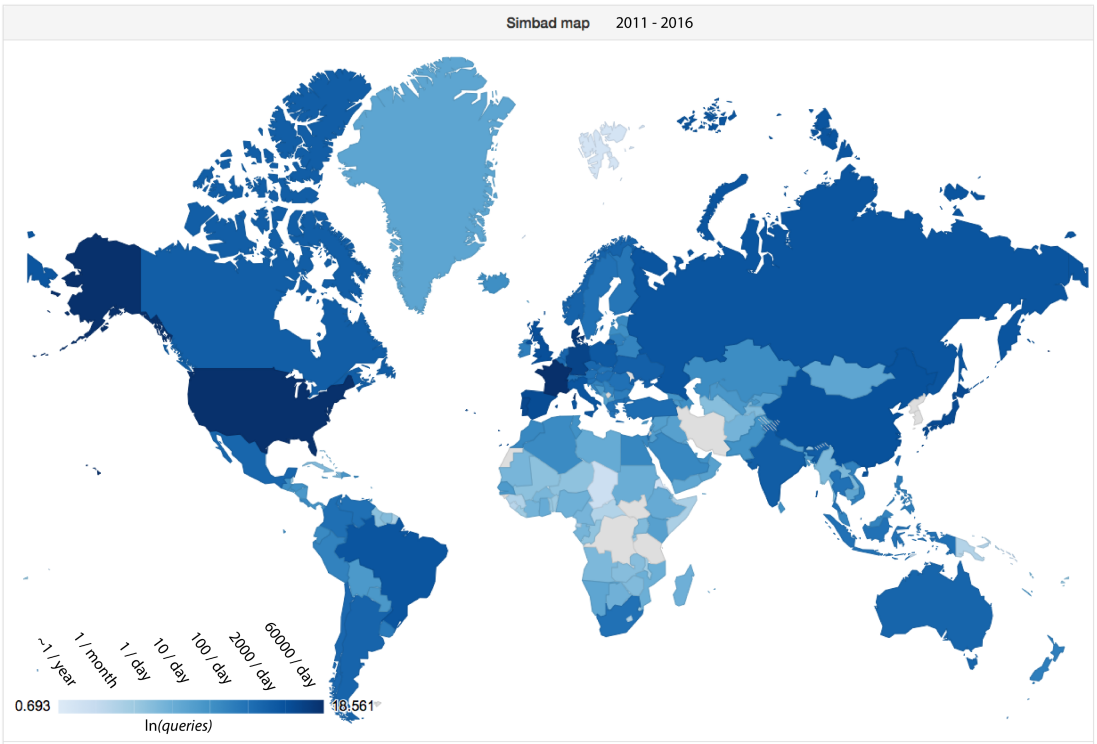
Euro-VO was brought into a new phase with the ASTERICS project, which started on 1 May 2015. The ASTERICS Work Package 4, “Data Access, Discovery and Interoperability”, gathers the European VO teams with the ESFRI and ESFRI-like projects, CTA, SKA, KM3Net, and the EGO/Einstein Telescope. It is important to note that the project gathers astronomy and astroparticle physics, in particular to tackle the aspects linked to new messengers, and that pathfinder projects are associated with the ESFRIs to be able to deal with real data (HESS, MAGIC and VERITAS for CTA, LOFAR and JIVE for SKA, ANTARES for KM3Net, and VIRGO/LIGO for the ET). ESO (VLT-E/ELT) is associated with the project, and ASTERICS WP4 continues to work closely with ESAC.

CDS has been at the forefront of the development of methods for scientific data sharing since its creation in 1972. Scientific data sharing is one of the highlights of astronomy, and one of the most visible outside the discipline. This is a hot topic internationally and in Europe, including at the political level, with as keywords ‘Open Data’ and now ‘Open Science’, one of the three priorities of the new Commissioner for Research, Science and Innovation Carlos Moedas with ‘Open Innovation’ and ‘Open to the World’. Astronomy provides a rare operational example of a world-wide, operational disciplinary research data infrastructure, used by the scientific community in its daily research work. All data providers can contribute, and all scientists can use the data and tools, as well as other people interested in astronomy. This data infrastructure is based on two different elements: data from data archives, data centres such as the CDS, journals, laboratories and teams, including modelling results, and the ‘glue’ which enables seamless access to data, namely the Virtual Observatory framework of standards and tools.

CDS staff have played major leadership roles within the IVOA. F. Genova, Executive Board member representing France, Chair of the Standing Committee on Standards and Processes, Chair of the Data Curation and Preservation Interest Group. M. Allen, chair of the Standing Committee on Science Priorities, editor of the bi-annual IVOA newsletter. S. Derriere, chair of the Semantics Working Group 2008-2012. M. Louys (CDS collaborator from ICube), Chair of the Data model Working Group (2007- May 2011), Chair of the Semantics Working Group since May 2015 . P. Fernique, Chair of the Applications Working Group since 2014 and Deputy Chair 2012-2014. A. Schaaff, Chair of the Grid and Web Service Working Group 2013-2015 and Deputy chair 2011-2013. F. Bonnarel, chair of the Data Access Layer Working Group since May 2014, and Deputy Chair 2013-2014. CDS staff have made significant contributions to the IVOA standards documents as authors and editors. Of the 21 standards developed by the IVOA in the 2011-2016 period, 12 of these have at least one CDS author, and 6 of these have CDS staff amongst the editors. It is important to understand that these standards, now included in the ADS, should be considered as refereed publications, since they are subject to high level of review in the IVOA standards process before reaching the Recommendation status.

2.2 CDS Services

2011 saw a complete refurbishing of the CDS web pages and in 2012-2013 major reliability improvements were made including a systematic analysis of all the relevant elements that was performed with the Observatory system engineer and participation of all CDS services. A homogenized back-up system has been installed and a new mirror was set up in South Africa at the SAAO/NRF in 2014.



SIMBAD

The COSIM tool (Comparisons of Objects for SIMBAD) was developed to cross-match lists of objects with SIMBAD taking into account as many parameters as possible to prepare object ingestion. After a period of intensive tests and updates in 2013-2014 it became operational in 2014. COSIM enables semi-automated data ingestion allowing the documentalistes to concentrate their attention on “difficult” individual cases which require all their expertise.

Several new important features were implemented in SIMBAD, in particular to improve the integration in the VO to improve the links with VizieR. SimWatch was released in 2015 to allow users to receive notifications about new papers on their selected objects. A new reorganized list of SIMBAD object types was built and a new system of priority and compatibility relations between the object types has been implemented based on the astronomical expertise of the whole team.

Special operations on SIMBAD content included an update of binary stars in 2012, and quality flags were implemented for redshifts, and for parallaxes and proper motions. A massive coordinates cleaning operation in SIMBAD was performed in 2012-2013 with ~100,000 object coordinates revised with the quality flags, error ellipses, references, and wavelength range. Another major improvement to SIMBAD is the parameterized sorting of SIMBAD references for an object, released in September 2013, which helps users identify the most relevant references for their purpose. Sorting capabilities can now take the nature of the citation into account (whether the citation is in the title, abstract, or table and the number of occurrences in the article).

Vizier

At the beginning of the period in 2011 new procedures for the ingestion of very large catalogues in Vizier were implemented. Major large catalogues added to Vizier in the period include UCAC4, UKIDSS, SAGE, SDSS DR9, AllWISE, IPHAS-DR2, VIDEO DR2, VVV, VIKING DR1, APASS, GaiaSimu Universe Model Snapshot.

One of the major highlights for Vizier is the development of the CDS “Photometric viewer” widget (released in 2013) which constructs and displays a set of photometric points at a given sky coordinate from all possible Vizier tables. This new feature builds on a very large task of including the details of many photometric systems into the VizieR metadata, such as accurate filter/photometric and magnitude systems and frequency/wavelength/energy ranges of the photometric data.

The interface of VizieR with TOPCAT is one of the VO success stories. This link was strengthened in 2014 by implementing a direct link between TOPCAT and the CDS cross-match service. This is a significant optimization of the number of queries and the network transfer of data, bringing the computation near the data, which is one of the current Big Data trends. In 2014 new interface for data submission was developed to facilitate author submission of data, a frequent request from our providers. A new VizieR home page was released at the beginning of 2015 including the implementation of Aladin Lite in VizieR results pages.

Significant developments to improve VizieR pipeline for non-tabular data attached to papers were pursued, based on the ObsCore VO standard. Also an important agreement was made with the AAS to use ObsCore as a common description framework. The VizieR associated data service has been been developed using the Saada data publishing tool in collaboration with Laurent Michel (High Energy Team), and has been available in test mode in 2016. Among the datasets already implemented are the CoRoT data (150,000 time series), and the LAMOST DR1 spectra. These are queriable with an interactive interface, and a feature of the service is that these are also made automatically available to the VO using the relevant IVOA standards.

Aladin

The Aladin interactive sky atlas has flourished in the past 5 years as an integral part of the structuring developments of HiPS and MOC. Major versions have been released, the most recent being version 8 in 2014 and version 9 in 2016. There has been an explosion in the usage statistics of the database, and also the number of sessions launched, both increasing by more than 300% per year in 2012-2013 as users became aware of these new capabilities, and continuing to increase at around 30% in 2016.

The approach has been to give users a very easy way to explore the many hundreds of surveys, with links to the original archival data. The emphasis on preserving the scientific properties of the data (by using FITS inside HiPS) distinguishes Aladin from other all-sky visualisers. The tools for generating the data itself (*hipsgen* and *hipsgen-cat*) are included inside Aladin, allowing users and data providers to build their own HiPS data. The documentation has been provided on newly revised Aladin web pages in 2014 including video format help.

Aladin Lite, a spectacular “light” version of Aladin running in the browser and geared towards simple visualisation of a sky region, was released in May 2013. There have been many implementations of Aladin Lite, including some 30 whose development we have followed. And ~10 where we have provided some level of help for implementation or customization, including ESASky, ADSASS, Glimpse 360, IRAP/CADE, NOAO DataLab, and the JAXA JUDO2 Akari viewer. There were Aladin Lite visualisations of the probability maps of gravitational wave sky locations, including in the spectacular first announcement, via its integration into the LIGO Skymap Viewer.

Other improvements include integrated access in Aladin to the Vizier photometry service, full-screen display mode, and display of dynamical proper motions – an important feature in particular for Gaia. Since 2013 Aladin is able to visualize data cubes and polarization maps. Aladin has also been integrated into external proposal and observation preparation tools of ESO (ESO GuideCam) and STScI/MAST Astronomers Proposal Tool.

X-Match

The CDS Cross-Match service has reached a stable, operational phase with increasing usage (674 jobs in 2015, 492 in 2014, 450 in 2013). The main usage through the API (programmatic access) comes from Topcat and STILTS (more than 90% of all requests). Other tools accessing the service include the Astroquery package of the popular AstroPy Python library, and also the US based VAO/MAST portal. This service provides the fastest positional cross match service, and has been presented at ADASS 2014 (Pineau 2014).

2.3 R&D

In 2013-2014 we made an assessment of various techniques to easily browse, explore and visualize large tabular datasets. We developed our own version of the Nanocubes data structure, allowing fast interactive visualization of a catalogue with hundred million rows for a few attributes. In 2012-2013 we tested the available Cloud technologies that were then just becoming coming in both public and private domains. In 2015-2016 a dedicated effort (4 month intern) made experiments with Hadoop and Spark technologies for the CDS X-Match service.

The MOC server was developed and has been in production since 2015 supporting spatial indexed queries of Aladin the VO Vizier registry. Stress tests showing stability up to 1.5 million requests per day, showing that the system is scalable to future needs. Other R&D includes the development of a Python library to handle MOCs (MOCPy), also 3D Visualization of various astronomical data in a Web browser (BoF and poster in ADASS 2015). Experiments of information extraction text-mining tools
(especially GROBID, https://hal.inria.fr/inria-00493437) for CDS purposes were performed. Prototype systems were made for Aladin to access IVOA SIAV2 compliant servers. We also made a specific development of the Graphic Charter of the CDS to improve the CDS graphic identity and to provide templates for communication materials.

CDS staff authored several papers in the special issues of the refereed journal Astronomy and Computing on the astronomical Virtual Observatory. In addition to papers on mobile applications (Schaaff) , the Simple Application Messaging Protocol (Boch), and Data models (Louys), one highlight is the paper by Genova, Allen at al. 2015 describing the methods successfully used to build the European Virtual Observatory. Publications in the ADASS and LISA Conference Proceedings also describe technological and methodological advances. The LISA papers describe in particular the collaboration set up between the CDS and the journals, and the original methods developed by CDS to deal with data attached to publications as well as the specific work of CDS documentalists.

2.4 Projects

In 2013 CDS became officially involved in the Gaia project. It will distribute Gaia catalogues in the framework of the Gaia Data Processing Archive Access Co-Ordination Unit (CU9). The ARCHES (Astronomical Resource Cross-matching for High Energy Studies) project (Jan 2013 – Dec 2015) was coordinated by Christian Motch, from the High Energy Astrophysics team. The CDS participation in the project produced a leading edge cross-match software, allowing computation of probabilities for an arbitrary number of catalogues. Existing statistical methods had to be generalized to handle more than two catalogues. The work has been tested with the different scientific applications included in the project, and it will be released in the CDS cross-match service, and the data products will be available in Vizier. The cross-match work was successfully presented in an oral paper at the 2014 ADASS meeting. A paper describing the method was submitted to Astronomy & Astrophysics in June 2016. The CDS is also involved in the outreach aspects via R&D for the 'ARCHES Walker' application.

The ASTRODEEP project for 'Unveiling the power of the deepest images of the Universe' is funded by the European Commission for 4 years starting in January 2013, and is coordinated by Adriano Fontana (INAF Roma). The project aims at getting the best scientific return from the exploitation of the deepest sky surveys, studying the birth and early phase of galaxy evolution. The role of the CDS is to develop a dedicated portal for the internal validation and manipulation of the data, but also to publish the final catalogues through VizieR, and images through Aladin. The portal is based on Aladin Lite for displaying and exploring images in the browser, and linking of heterogeneous data products (catalogues, individual thumbnails, spectra) is done via integration with the Saada data publishing tool developed by Laurent Michel (High Energy Team).

The VIALACTEA – 'The Milky Way as a Star Formation Engine' project funded by the European Commission (2013-2016), is coordinated by Sergio Molinaro (INAF Roma). CDS staff (L. Cambresy, H. Arab) participate in the scientific aspects of the project, which aims at exploiting the combination of all the new-generation Infrared to Radio surveys of the Galactic Plane from space missions and ground-based facilities. The main

task for CDS in the project is to deliver a 3D extinction cube of the Galactic plane. A first version has already been provided in October 2015.

CDS participates in the Research Data Alliance which is a recent but high profile organisation that aims at "building the social and technical bridges that enable open sharing of data". Astronomy has historically been at the forefront for the sharing and reuse of data. The RDA work towards common frameworks for network, computing and data infrastructures is in line with the CDS strategy. F. Genova was invited to participate in the series of European projects set up in support to the RDA, the third such project began in September 2015

2.5 Science Team Activities (see UMR application for more details)

A key element of the success and sustainability of the CDS is that it is fully integrated into the scientific structure of the observatory, and that the team includes active scientists. CDS team scientists ensure the quality and relevance of the CDS services on the long term, and importantly they also pursue their own independent scientific research. The CDS scientists are critical to the funtioning of the CDS, guiding the scientific aspects of data curation, identifying priorities for the scientific capabilities of the services, and supporting the use of the services. To do this, the CDS scientists must be capable astronomers in their own right, and also have a high level of commitment to enabling the science of their peers in the community.

The services rely on the wide expertise of the team, so the diversity of scientific interests of CDS scientists has been strongly supported. The team covers scientific domains of: Stellar Astronomy – stellar X-ray emission (A. Nebot), AGB stars and YSOs (C. Loup); Galactic Astronomy – Milky Way dynamics (A. Siebert), ISM and star formation (L. Cambrésy); Extragalactic Astronomy – galaxy formation and epoch of reionization (P. Ocvirk), cluster galaxies and galaxy evolution (B. Vollmer), ionization processes in active and merging galaxies (M. Allen). A number of scientific topics are directly related to CDS activities in the domain of information research and processing: semantics and information discovery (S. Derriere), scientific classification (C. Loup), cross-matching methods (F.-X. Pineau, S. Derriere, T. Boch), image processing (M. Louys, B. Vollmer, F. Bonnarel) and many of the science team members contributing to the recent breakthroughs in hierarchical scientific data representations (HiPS).

In addition to covering a diversity of science topics, the CDS scientists work together to support the CDS services by combining their expertise in thematic areas that are important for the cohesion of the CDS reference services. This includes expertise in combining and managing multi-wavelength data, expertise in very large surveys, time domain astronomy, simulations and models, and interoperable systems.

For the CDS the requirement is for scientific diversity, and not on building a critical mass on particular science topics. CDS scientists participate in many collaborations with colleagues in their fields from other institutions. In the reference period there is a notable participation in projects such as ARCHES, ASTRODEEP and VIALACTEA. CDS science team members are also integrated into the scientific activities of the Galaxies and High Energy teams with common publications. Recent recruitments to the CDS who have transferred from other teams help maintain these links (Galaxies – Ocvirk; High Energy – Nebot, Pineau).