
# Minutes of the thirteen GBOG meeting

held at Observatoire de Paris, on 11-12 June 2013

prepared by: C. Soubiran, and the GBOG WG
approved by:
reference: Gaia-CD-MN-LAB-CS-012
issue: 1
revision: 0
date: 2013-08-01
status: Issued

# Document History

| Issue | Revision | Date | Author | Comment |
|---|---|---|---|---|
| D | 0 | 2013-06-12 | CS | Creation |
| 1 | 0 | 2013-08-01 | CS | Include comments from GBOG members |

# 1 Overview of the meeting

## 1.1 Participants

S. Els, PO, (by skype)
L. Eyer (LE), Geneva Observatory
U. Heiter (UH), Uppsala University
E. Joliet (EJ), ESAC - Madrid
O. Marchal, Observatoire de Paris (partly)
P. Sartoretti (PS), Observatoire de Paris (partly)
R. Smart (RS), OATo - Torino (partly by skype)
C. Soubiran (CS), LAB - Bordeaux
W. Thuillot (WT), IMCCE - Paris (partly)
A. Vallenari, (AV) Padova Observatory
L. Wyrzykowski (LW), IoA - Cambridge (partly by skype)

Were excused: P. Bendjoya, G. Clementini, Y. Frémat (YF), E. Pancino (EP), G. Seabroke (GS)

## 1.2 Presentations

Presentations are available on svn :

`http://gaia.esac.esa.int/dpacsvn/DPAC/WG/GBOG/meeting/GBOG_M13/`.

# 2 Introduction

General information relevant for GBOG since the meeting in October 2012 : OR3 took place from 22/04 to 30/04 and dealt with some GBOG related data (SSO, Alerts, GBOT), OR4 will take place in the period 28/08-06/09, Sebastian Els is now project coordinator, Antonella Vallenari is DPACE Deputy (both have participated to previous GBOG meetings), CU9 kick-off meeting in Barcelona.

The DPAC initialization activities will take place during the commissioning by Astrium and ESA. DPAC, SOC, MOC, Astrium work closely together on the commissioning plan (AB-036). Normal operations should start some 6 months after launch. DPAC initialization will be done on EPSL, NSL, EPSL again. One month of EPSL will be about 100 measurements. There is a validation in CU3-CU8 and also in CU9. Each CU needs to define its own validation plan. Auxiliary data will be used during commissioning and intialization (e.g. EPC and observed spectra in RVS range for Astrium). Cross-match of the auxiliary data with IGSL is needed.

Here are some topics for the meeting :

- clarify GBOG participation to CU9 since there are 4 WP dealing with GBOG (and other) data (WP 944 Validation : Confrontation with external archives, WP 957 Operations: auxiliary data, WP 974 Science enabling applications: auxiliary and external data, WP 974 Science enabling applications: internal auxiliary data)
- summarize the needs for commissioning/initialization and status of the auxiliary data
- solve some practical issues (IGSL Xmatch)
- review the information on the wiki pages which have to be updated

We will have to re-evaluate our long term plan of observations in about one year (after initialization).

# 3 CU1

EJ reported on storage usage at DPCE. From last year usage, the storage is used at 518G over 4TB allocated for GBOG auxiliary data purposes. This is double size than last meeting (6 months ago). Still missing README metadata description for different catalog stored. Please update!

IGSL query on magnitude was not done because the use case is not manageable with current tools. CU9 is probably a better place where to find this kind of tool and expect to answer this use case.

EJ mention once more about a Dal example project put under `http://gaia.esac.esa.int/dpacsvn/DPAC/CU1/software/Tools/DalCu8Spectra/` to be used as playground for gbin conversion and database store with DAL - Seems never been used although there seems to be a need to understand how the DAL/MDB and other DPAC related code are to be used to process Gaia input/output data using DPAC tools.

A discussion was held on how to cross-match external auxiliary catalogues with IGSL. This was not clear for CS and PS how to do it simply for CU6. Other CUs do not seem to have (yet) the problem. The auxiliary catalogues provide the name of objects and eventually their coordinates and magnitudes, but the ICD identify the objects by sourceId only known in IGSL. CU6 catalogs and IGSL have hundreds million of entries, so the cross-match by coordinates is not straightforward. However IGSL already provides the cross-match of several large catalogs ad the table SourceCatalogIDs gives the correspondance between names (see below). So if the auxiliary data are provided with an identification of the objects in one of these catalogs, e.g. 2MASS, the cross-match can be done on the name and not the coordinates which is safer.

EJ did a brief summary on MainDB and IGSL. Several solutions are proposed by EJ for the cross-match and one in particular, the MdbExtractIngest to take advantage of the multithread infrastructure and the DM transformation step in the ingestor part. EJ has been offered support to do the crossmatch. EJ has shown his implementation of the DmTransform in Ingestor tool to be used to ingest crossmatched sourceId into database from gbin auxiliary catalog. This has been handover to CU6 and is under evaluation. PS and Olivier Marchal realized during the discussion that already need a change in Datamodel and external ids from Caroline Soubiran. Agree to evaluated and used by CU6 (PS and Olivier Marchal present) and may fulfill probably other needs.

During discussion it is realized that several persons are not able to activate MDB and GaiaTools because of the wrong Java version on their computer. This the case for those runing their Mac on Snow Leopard where Java 7 cannot be installed easily.

# 4 CU3

## 4.1 IGSL

The 3rd version of IGSL will be soon released and made available in the MDB. RS presented a draft of his TN which describes how this compilation was built from the best astrometric and photometric catalogs available today. He explained its content and format. IGSL includes $\sim$1.2 billion entries with positions, proper motions when available, and magnitude estimates in the blue, red, G and Grvs bands. The IGSL is crucial for GBOG because it allows the interconnection of the auxiliary catalogs needed for calibration to the MDB through the sourceId names. All the GBOG auxiliary tables must be cross-matched with the IGSL before launch to provide the sourceId of each object. CU5 and CU7 have no problem with this cross-match, while CU6 was wondering how to perform it. After discussion with EJ and presentation by RS it was clearer. There is no need to cross-match with the coordinates since IGSL already did it for large catalogues. The table SourceCatalogIDs gives the correspondance between names in the different catalogues included in the IGSL. All the objects we are dealing with in the GBOG are in principle at least in one of these catalogs, except SSO. So the cross-match can be done

with the names instead of the coordinates which is easier.

## 4.2 QSOs

MA presented some slides prepared by G. Bourda. VLBI observations of quasars are proceeding well. There are several papers and communications by G. Bourda already available. The observing program for faint sources is done in 3 steps : detection, imaging and astrometry. The 2 first steps are completed but the astrometry is not finished. In parallel, the ICRF2 sources which were found to be suitable for the Gaia alignment will be regularly observed by the IVS, the proposal has been accepted. The WG in charge of defining the ICRF3 is aware of the lack of southern sources. Collaborations are being undertaken in order to improve the situation, based on recent VLBI observations of southern sources.

A new version of the Gaia Initial QSO Catalogue has been recently released by AA-003. It is now included in the MDB. Among the $\sim$1.2 million objects listed, a fraction is labelled as defining source for the Gaia reference frame.

## 4.3 EPC

There are 3 versions of the EPC. EPC3 relased in October 2011 is finally the one included in the IGSL and which will be used for the commissioning. The upgrade of EPC3 to EPC4 was limited and was not considered of high priority. It has the U band for the SEP with the class parameter corrected, with no change at NEP. EPC5 will include RVs and APs useful for CU6 and CU8 initialization and validation. It will also have improved astrometry from meridian observations.

The group of people in charge of the SEP spectroscopy for EPC5 has a workshop after the GBOG meeting to progress in the analysis of the $\sim$4500 spectra of about 700 stars that were observed in the 3 runs on FLAMES. The RV analysis is lead by YF, while the AP analysis is lead by P. Jofre from Bordeaux. She is moving to Cambridge in September but will continue on that project. The determination of RV and AP has progressed quite slowly in the previous months but it is still expected to provide the catalog by the end of the year. The RV will be used by CU6 for the verification of the faint star processing, and the AP will be used also by CU6 until CU8 provide them for the choice of the mask for the correlation. In CU8, this will be an external catalogs to check the AP pipeline output. More generally this catalog will be useful for the validation of CU9 since it contains a nice variety of stars in different stellar populations, including LMC filed and cluster stars.

### 4.4 GBOT

MA is doing a lot of communication about GBOT and participated to several meetings. Contracts are being made or have been made with Liverpool Telescope, ESO (WFI, 40 hrs in P92), Euler, Pic du Midi 1.06 m, Las Cumbres Optical Global Telescope network. The pipeline and database are operational. GBOT participated to OR3 (Apr 2013) with Liverpool and Las Cumbres. During the OR3 the brightness of Planck was significantly fainter than usual[1], which resulted in a lower astrometric precision than we would expect for Gaia's currently assumed brightness. However this also allowed us to explore our options in the case of Gaia being significantly fainter than expected. Proposals are being written to get VLBI measurements.

## 5 CU4

WT presented the latest developments of the follow-up network for SSO (DU459/Gaia-FUN-SSO) which is proceeding well. The network will be ready by January next year. The plan for validation is currently being defined. For the validation phase, a limited number of alerts will be selected on criteria which have to be defined, and they will be sent not to the whole network but only to the concerned observatories. The network has recently increased with 4 new observatories. It has now 45 sites and 67 operating instruments. Several training campaigns on known asteroids have been organised involving up to 18 stations. Training alerts are now planned with increasing difficulties (fainter objects, larger uncertainties on position and so on...)

## 6 CU5

### 6.1 SPSS

CS presented some slides on behalf of EP, which summarize the status of the observations of the SPSS for CU5. The situation is critical for the absolute photometry because the quality of the nights has been re-evaluated and some datasets were degraded. It means that new observations will be requested. For the auxiliary campaign dealing with the short and long term photometry, the situation is much better and the observations will be completed next year.

For the pre-launch release, about half of the full sample of SPSS will be provided, based only on the good observing nights. This represents 109 SPSS, primary and secondary standards, including a good fraction of the standards at the Ecliptic poles. They are well distributed in spectral type. They will be used to test the PhotPipe operations. All this is described in details in EP-011.

[1] During most times the birghtness of Planck was near $R = 18mag$ which is also close to the conservative guess for Gaia, based on our experience with the former mission WMAP, which is in principle a smaller version of Gaia

## 6.2 Alerts

LW, on behalf of the CU5 Alerts group, presented by skype the current status of the AlertPipe and the status of the alerts follow-up network. The AlertPipe is now in a good shape, all the hardware is in place and the data ingestion was successfully tested during the OR2 and OR3. The verification of the alerts will happen in 3 stages. The first one is already on-going now, with the internal tests of the data flow and detection capabilities on the simulated data. The second stage will be on EP, mainly the SEP, relying on the OGLE-IV data published in Soszyński et al. (2012), mainly to identify known variable stars. The third stage will involve external observers, who will be asked to observe potential transients, found during the NSL in the first 3-6 months. Probabilities of each class must be estimated properly. For partners involved in the verification, a MOU is done in form of formal time proposals. T. Prusti and A. Brown are involved in this process. The network of telescopes is currently being composed with about 40 potentially interested partners. Intensive tests are on-going, the centralised calibration and data storing interface is in place in Cambridge. The next workshop on Gaia Alerts will take place in IAP, Paris, 19-21 June 2013. The network organization will be supported by OPTICON FP7 grant (2013-2016).

# 7 CU6

CS presented the update for ground-based observations in CU6. The auxiliary data relevant for GBOG is described in DK-015 and includes 4 parts : the RV standard stars for the zero-point, a compilation of RV from the literature to check the pipeline output in the early phases, a compilation of APs from the literature to be used before CU8 provides them, particularly important for self-calibrating stars but also for fainter stars, and high resolution, high S/N spectra in the RVS range to be used as templates for the stars themselves, for the calibration of the LSF, and also needed for CU6 commissioning by Astrium.

The catalogue of RV standards in now published (Soubiran et al., 2013) and will request additional observations in 2 years. The compilation of literature RVs is not the highest priority and is pending for now.

A first version of the AP compilation is now ready with a TN to describe it (CS-011). It should be released within a few days. It includes 1 million Teff and 16000 stars with known (Teff, logg, [Fe/H]) taken from the literature. In parallel T. Zwitter has produced a catalogue of 104 million stars with Teff derived from the 2MASS point source catalogue using the effective temperature versus J-K colour relations by Casagrande et al. (2011). Both catalogs will be merged into the single table auxAtmParam with the data model defined in DK-015. Next versions will include large sets of spectroscopic atmospheric parameters (AMBRE, RAVE, and Gaia ESO survey for instance).

Spectra in the RVS range have also been provided as described in LCH-001. Bordeaux is now working on an improved version including more data and cleaner spectra. Some spectra have been provided to Astrium.

How the auxiliary data can be used for the science perfomance verification of RVS will be described in DK-016.

Note that the brightest SPSS stars will also be used by the CU6 pipeline for the estimation of $G_{RVS}$.

# 8 CU7

LE presented the CU7 GBOG status. There are 6 programs. Among them one is on hold. Furthermore there are tests for Science Alerts (photometric alerts and measurements of Apophis) and GBOT programs which were done. Most activities of these two latter activities are coming from Italian and ”Swiss” telescopes. For GBOT, Geneva is waiting for a document from Martin Altmann to progress on the participation of Euler to GBOT. For the regular programs, the progress this past cycle has been a bit slow. The programs which progressed were presented. In addition to the ”official programs”, observations were done for Cepheids by R .Anderson and in collaboration with L. Szabados. It led to the discovery of binary cepheids, demonstrating the efficiency of an instrument like Coralie, with its stability and online reduction. Additional focus was given on the activities in Geneva to reach for the photometry an online reductions. To reach the milli-mag level has revealed itself tough and is taking a significant effort. An other activity has been developed by F. Bouchy to use ground based CORAVEL data with Hipparcos, to learn about to handle at the same time photometric and RV data.

# 9 CU8

## 9.1 Cool stars

UH presented the update of the Benchmark stars project which involves a large group of collaborators, most of them also involved in the Gaia ESO Survey. There are 3 papers in preparation : for the fundamental Teff, logg (Heiter et al.), for the library of high resolution spectra (Blanco et al.) and for the determination of [Fe/H] (Jofre et al.). For this later paper, several nodes are applying different codes but with common inputs. For solar type and subgiant FGK benchmark stars well determined reference atmospheric parameters have been obtained. For cool giants, different analysis methods result in different stellar parameters, also when prescribing the input data. A new determination of [Fe/H] for 33 stars is provided, including several poorly studied cool giants. The large programme for the observation of cool AP reference stars with NARVAL on the TBL is now completed. It includes 30 field stars and 70 stars at NEP in the magnitude

range 6-10, 15 M dwarfs up to V=12, and about 100 stars in 14 open clusters. An overview of SNR, luminosity class, and metallicity coverage will be prepared. The spectra will be analysed the same way as the Benchmark stars, together with archive spectra.

### 9.2 Hot stars

UH presented some slides prepared by Alex Lobel. Similarly to cool stars there are Benchmark stars and AP reference stars. Benchmark Stars are used for improving the quality of spectrum synthesis codes (e.g., in the Gaia RVS). They are carefully selected to have narrow lined spectra with vsini$<$ 50 km/s. Up to now, 14 OBA stars have been observed with Mercator Hermes with SNR of 800 to 1000. 6 more are planned. Optical spectra of the Benchmark Stars will be provided in the public domain through the SpectroWeb database . Reference stars are used as training data for APs determination by ESP-HS. For the typical SNR is 150 and above. There are 2194 targets observed in a 'Filler Programme'. 421 have already been observed. They will be provided in the HHighRespect databased coming online late 2014. First tests based on Giraffe GES spectra show good agreement between hot star APs obtained from optical and from RVS wavelength regions.

## 10 CU9

It is recalled that EP-009 has been released in February. This TN describes the GBOG auxiliary data products potentially interesting to release in CU9 and gives details on their use for Gaia, their scientific potential, the expected data products and the current storage. All these auxiliary data will continue to evolve during the mission because we will acquire new data and improve our methods for reduction and analysis. An important issue is thus to provide with each DR of the Gaia catalog the proper version of the calibration data with its documentation.

According to the CU9 founding document (XL-033), there are 2 WP deal with GBOG data. WP 957 Operations: auxiliary data, coordinated by EP, is in charge of defining the requirements for the preparation of a web interface to access/browse all DPAC auxiliary data, and similarly of defining the requirements on the underlying database when needed. WP 974 Science enabling applications: auxiliary and external data, coordinated by P. Marrese, will make a census of all the auxiliary data used in DPAC to calibrate Gaia data or to train Gaia algorithms, and make provisions to maintain the census updated if and when new data come in. Another task of WP 974 will be to cross-match the external data to the MDB (note that for GBOG data used by CU3 to CU8, the cross-match will in principle be done within each CU using the IGSL SourceCatalogIDs which provides the correspondance between names in most of the catalogs used for our auxiliary data, see CU1 section).

There have been discussions about merging WP957 and WP974 where CS was in cc. Since EP is not present to discuss the pro and con of this merging, it is decided to have a dedicted email

exchange with EP and P. Marrese on the subject.

There is now a new WP 976 - internal auxiliary data (or similar name) coordinated by EP. The cross match with IGSL and Gaia, when necessary before a release, will still be carried out by WP 974 - external auxiliary data. The merge between WP 976 and WP 957 will be discussed in the near future.

EP and GS were the two GBOG representives in GAP, but now that CU9 is in place, other GBOG members should feel free to join those WPs dealing with auxiliary data and help on the various tasks.

A fraction of the auxiliary data gathered in GBOG will be used not for calibration but for validation. However this is not yet clear what validation will be done within CU3 to CU8 and within CU9. According to XL-033, WP 944 Validation : Confrontation with external archives, coordinated by C. Babusiaux, will use external and potentially more precise data to search for possible biases within the Gaia data. The EPC5 with the SEP spectroscopy could have an important role in the early phases of the mission for the validation of the data acquired during EPSL and released in DR1. EPC5 will give information on the stellar content of the 2 fields which are relevant for all the CUs. The photometry, RV, and APs concern a large variety of stars, field stars in different populations of the Milky Way, but also field stars and cluster stars in the LMC. New binaries and variable stars could also be identified from this dataset. EPC is not forseen to be used for calibration, so that it provides an independant dataset for validation. It is thus important to complete the SEP analysis ASAP in order to provide EPC5 to CU9.

AV presented the latest news about the CU9 status, with a summary of the KO meeting in Barcelona. CU9 was endorsed by ESA SPC in February. It has support from FP7 GENIUS. The current scenario defined by DPACE/GST will certainly evolve due to operation constrains. DR1 at launch +22 months gives only 3 months for the validation which is considered short. Validation will be first done at the CU level. CUs are requested to set a detailed plan for validation. Validation at CU9 level will combine data from the different CUs and will be done in a statistical way to check consistency of the whole data set (e.g. proper motion vs. distance or photometry vs. spectroscopy). There will be comparisons to model and external data as said above. CU9 work will start with simulated data from GOG including UM and end-of-mission parameters. CU9 membership is currently being reviewed for SDP in September. Data access policy during validation will be defined by the GST. Validation activities should be automated as much as possible and run at the DPCs. Some individuals will have a limited direct access to data for validation during operations, only for small subsets of necessary data.

# 11 AOB

A GBOG telecon will be organised in automn, once the mission launched. A meeting in spring 2014 will be organised once we know better about the results of the commissioning and initialization. Some new observations migh be requested at that time.

CS has modified the main wiki page of the GBOG which was quite outdated. We have now several papers on GBOG data products and many TN notes. Each CU representative is asked to complete the CU publication section.

# 12 AIs

- EJ : supervise the cross-match of auxiliary catalogs to IGSL done in the CUs
- CS : write minutes
- CS : clarify with EP and P. Marrese the role of GBOG in CU9
- All : update the README file on the GBOG disk at DPCE
- All : update the section on GBOG publications and TN on the wiki

# 13 References

**[AA-003]**, Andrei, A., Anton, S., Taris, F., et al., 2013, *Gaia Initial QSO Catalogue - The MDB version*,
`GAIA-C3-TN-GPA-AA-003`,
URL `http://www.rssd.esa.int/cs/livelink/open/3208445`

**[AB-036]**, Brown, A., Bastian, U., Seabroke, G., et al., 2013, *Gaia performance assessment at IOCR*,
`GAIA-CO-TN-LEI-AB-036`,
URL `http://www.rssd.esa.int/cs/livelink/open/3204018`

Casagrande, L., Schönrich, R., Asplund, M., et al., 2011, A&A, 530, A138, ADS Link

**[LCH-001]**, Chemin, L., Soubiran, C., Jasniewicz, G., et al., 2013, *Library of empirical spectra covering the RVS range*,
`GAIA-C6-TN-LAB-LCH-001`,
URL `http://www.rssd.esa.int/cs/livelink/open/3168711`

**[DK-015]**, Katz, D., Soubiran, C., Chemin, L., et al., 2012, *Auxiliary data in CU6 processing*, GAIA-C6-TN-OPM-DK-015, URL http://www.rssd.esa.int/llink/livelink/open/3149104

**[DK-016]**, Katz, D., Cropper, M., Panuzzo, P., 2013, *CU6 commissioning and initialization activities*, GAIA-C6-TN-OPM-DK-016, URL http://www.rssd.esa.int/cs/livelink/open/3167957

**[XL-033]**, Luri, X., O'Mullane, W., Alves, J., et al., 2013, *Delivering the promise of Gaia, response to ESA's Announcement of Opportunity*, GAIA-C9-PL-UB-XL-033, URL http://www.rssd.esa.int/cs/livelink/open/3165853

**[EP-009]**, Pancino, E., 2013, *A census of potential GBOG auxiliary data products for GAP/CU9*, GAIA-CD-TN-OABO-EP-009, URL http://www.rssd.esa.int/cs/livelink/open/3162160

**[EP-011]**, Pancino, E., Altavilla, G., Cocozza, G., et al., 2012, *DU13 plan for activities in the last year before launch*, GAIA-C5-PL-OABO-EP-011, URL http://www.rssd.esa.int/cs/livelink/open/3153916

Soszyński, I., Udalski, A., Poleski, R., et al., 2012, actaa, 62, 219, ADS Link

Soubiran, C., Jasniewicz, G., Chemin, L., et al., 2013, A&A, 552, A64, ADS Link

**[CS-011]**, Soubiran, C., Lecampion, J., Chemin, L., 2013, *Auxiliary data for CU6 - atmospheric parameters*, GAIA-C6-TN-LAB-CS-011, URL http://www.rssd.esa.int/cs/livelink/open/3214057

# 14 Acronyms

| Acronym | Description |
|---|---|
| 2MASS | Two-Micron All Sky Survey |
| AP | Astrophysical Parameter |
| ASAP | As Soon As Possible |
| CU | Coordination Unit (in DPAC) |
| DAL | Data Access Layer |
| DM | Data Model |
| DPAC | Data Processing and Analysis Consortium |
| DPACE | Data Processing and Analysis Consortium Executive |
| DPC | Data Processing Centre |
| DPCE | Data Processing Centre ESAC |
| DR | Data Release |
| EPC | Ecliptic Pole Catalogue |
| EPSL | Ecliptic Pole Scanning Law |
| ESA | European Space Agency |
| ESAC | European Space Astronomy Centre (VilSpa) |
| ESO | European Southern Observatory |
| FLAMES | Fiber Large Array Multi-Element Spectrograph (VLT) |
| FP7 | Seventh Research Framework Programme |
| GAP | Gaia Archive Preparations (DPAC WG) |
| GBOG | Ground-Based Observations for Gaia (DPAC) |
| GBOT | Ground-Based Optical Tracking |
| GENIUS | Gaia European Network for Improved User Services |
| GES | Gaia ESO Survey |
| GOG | Gaia Object Generator |
| GST | Gaia Science Team |
| ICD | Interface Control Document |
| IGSL | Initial Gaia Source List |
| IMCCE | Institut de Mécanique Céleste et de Calcul des Ephémérides |
| IVS | International VLBI Service for geodesy and astrometry |
| IoA | Institute of Astronomy (Cambridge; also denoted IOA) |
| KO | Kick-Off |
| LAB | Laboratoire d'Astrophysique de Bordeaux |
| LMC | Large Magellanic Cloud (special, high-density area on the sky) |
| LSF | Line Spread Function |
| MDB | Main DataBase |
| MOC | Mission Operations Centre |
| MainDB | MAIN DataBase |
| NEP | North Ecliptic Pole |
| NSL | Nominal Scanning Law |
| OATo | Osservatorio Astronomico di Torino |

| | |
|---|---|
| PO | (DPAC) Project Office |
| QSO | Quasi-Stellar Object |
| RAVE | RAdial Velocity Experiment |
| RV | Radial Velocity |
| RVS | Radial Velocity Spectrometer |
| SDP | Software Development Plan |
| SEP | South Ecliptic Pole |
| SNR | Signal-to-Noise Ratio (also denoted SN and S/N) |
| SOC | Science Operations Centre |
| SPC | Science Programme Committee (ESA) |
| SPSS | Spectro-Photometric Standard Star |
| SSO | Solar-System Object |
| TBL | Telescope Bernard Lyot (Pic du Midi, France) |
| TN | Technical Note |
| UM | User Manual |
| VLBI | Very Long Baseline Interferometry |
| WFI | Wide-Field Imager (ESO 2.2-m telescope) |
| WG | Working Group |
| WP | Work Package |