



ESO

European Organization for Astronomical Research in the Southern Hemisphere
Organisation Européenne pour des Recherches Astronomiques dans l'Hémisphère Austral
Europäische Organisation für astronomische Forschung in der südlichen Hemisphäre

MAD Science Demonstration Run 3 Data Guidelines

The MAD Science demonstration run 3 took place in Paranal from August 11th to 21st, 2008.

The data taken during those nights are publicly available worldwide.

The approved observing programs with the corresponding targets are listed in Table 1:

PI	Program	Target (Band)	Comments/Status
H. Bouy	Star formation in the core of SFR: Lupus III.	Lupus (K, H, J, BrG)	Completed
A. Calamida	A new spin to constrain the absolute age of 47 Tucanae.	47 Tucanae (K, J)	Completed
A. Di Cecco – N. Sanna	The absolute age of the Galactic Globular Clusters and A new spin to constrain the absolute age of metal rich GCs.	NGC 6752 (K, J) NGC 6352 (K) NGC 6352 (J) NGC 6496 (K) NGC 6496 (J) NGC 7099 (K, J)	Completed Completed 78% Completed Completed 78% Completed Completed
F.R. Ferraro	Hunting for optical companions to binary MSPs in Terzan5.	Terzan 5 (K, J)	Completed
F. Marchis	Velocities and hazes in Jupiter's South Equatorial Belt.	Jupiter (K, Kcont, BrG)	Completed
S. Ortolani	The Age of metal rich and moderately metal poor globular clusters in the Galactic bulge	HP1 (K, J) NGC 6342 (K, J)	Completed Not executed
G. Piotto	Search for multiple stellar populations in NGC 6388	NGC 6388 (K, J)	Not executed
A. Seifahrt	A MAD View of the M16 elephant trunks	M16 Field 1 (K, H, J, BrG) M16 Field 2 (K, H, J, BrG) M16 Field 3 (K, H, J, BrG)	Completed Not executed Not executed
E. Tolstoy	The Large Magellanic Cloud	NGC 1928 (K)	Completed
E. Valenti	Toward the determination of the galactic Bulge formation timescales	NGC 6441 (J, K) - Long NGC 6441 (J, K) - Short	Completed Completed

Table 1: Approved MAD SD 3 programs. PDF files containing the original proposals can be found in the MAD data release page.

DATA description

Please note that MAD data are not completely VLT compatible. As such, the files generated by the instruments have somewhat basic headers, which lack some of the information needed for data reduction. One example is the band (filter), which has no corresponding header keyword. In order to supply the missing information we used a special file naming convention:

Label_filter_object_cameraPosition_sequenceNumber_day_repetition.fits

Where:

Label – unique label for each target (e.g. VA)

Filter – K, H, J, BrG, Kc.

Object – either o=science pointing or s=sky position pointing, or ao= autojitter object or as=autojitter sky or a= autojitter (object only, no sky)



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Camera position – pX where X corresponds to a jitter position (0,1,2,3...)

Sequence Number – nX where X corresponds to a consecutive image obtained on the same position (X=0,1,2,3,...). It is the equivalent of NINT.

Day – day of the year when the image was taken (e.g. 229=2008-08-15 (local time), 2008-08-16 (UT time)).

Repetition – non-consecutive repetition of the same setting (0001, 0002, etc.).

E.g. *VA_J_ao_p0_n0_229_0003.fits* and *VA_K_as_p2_n0_229_0002.fits* are two images taken the same night (2008-08-15) of NGC 6441 (VA): the first file is an autojitter object, third sequence, first camera position in J band; the second file is an autojitter sky, second sequence, second camera position in K band.

As another example: the series of frames:

JF_ao_Kc_p0_n0_230_0001.fits
JF_ao_Kc_p0_n0_230_0002.fits
JF_ao_Kc_p0_n0_230_0003.fits

Correspond to 3 frames of Jupiter observed on August 16th in Kcont band for the same camera position (p0). The corresponding sky frames are:

JF_as_Kc_p0_n0_230_0001.fits
JF_as_Kc_p0_n0_230_0002.fits
JF_as_Kc_p0_n0_230_0003.fits

Calibration data have a slightly different naming convention. There are three types of labels, corresponding to the three types of calibration data taken with MAD:

1. **Dark frames** – usually taken every day for the DIT (detector integration time) used for science and other calibrations.
These files are named *calib_dark_DIT_p0_nX_day_00XX.fits*. For example, *calib_dark_10_p0_n0_225_0001.fits* is a dark frames with integration time of 10 sec. All darks are taken at camera position 0 (p0 corresponding to center field, x=0,y=0)
2. **Twilight sky flat fields** – usually taken each night, during twilight, but not always, depending on weather conditions and opportunity. The files are named *calib_flat_filter_p0_nX_day_00XX.fits*. The filter is either K, H, J, Kcont or BrG. All images are taken with the telescope at zenith and the IR camera fixed at position 0 (p0)
3. **Standard star images** – open loop observation of a standard star. The files are named: *calib_std_filter_p0_n0_day_00XX.fits*. The standard stars were observed either in camera position p0 and manually dithered across the array or using the autojitter template.



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DATA Retrieval: Science data

The packages are made by target. MAD data are:

Target (Band)	Label
Lupus III	BO
47 Tucanae	CA
NGC 6752	DC1
NGC 6352	DC2
NGC 6496	DC3
NGC 7099	DC4
Terzan 5	FE
Jupiter	JF
HP1	OR1
M16	SE1
NGC 1928 Field 1	TO1
NGC 1928 Field 2	TO2
NGC 6441	VA

Calibration Data: calibration data are collected in a single package for SD run 3 (August 2008).

Nightlogs

Manual logs were taken each night to record files, activities and comments. The users can download the logs in simple txt ASCII format for each night from the MAD SD page.

Night	Day of the year	File
2008-08-11	224-225	log_2008-08-11.txt
2008-08-12	225-226	log_2008-08-12.txt
2008-08-13	226-227	log_2008-08-13.txt
2008-08-14	227-228	log_2008-08-14.txt
2008-08-15	228-229	log_2008-08-15.txt
2008-08-16	229-230	log_2008-08-16.txt
2008-08-17	230-231	log_2008-08-17.txt
2008-08-18	231-232	log_2008-08-18.txt
2008-08-19	232-233	log_2008-08-19.txt
2008-08-20	233-234	log_2008-08-20.txt
2008-08-21	234-235	log_2008-08-21.txt

In addition, please find below a night-by-night breakdown:

Night	On sky observations
2008-08-11	Twilight flats, K DC2 – N6352, K SE1 – M16, K Std star S234E, K DC3 – N6496, K Std star S889E, K DC4 – N7099, K CA – 47Tuc, K



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2008-08-12	Twilight flats, J Std star S867V DC2 – N6352, J DC3 – N6496, J DC4 – N7099, J
2008-08-13	Twilight flats, H Std star S867V BO – Lupus, H DC2 – N6352, K DC1 – N6752, K CA – 47Tuc, K TO1 – N1928, K Std star P533D, K Std star P533D, J
2008-08-14	Twilight flats, BrG Std star S867V BO – Lupus, BrG SE1 – M16, BrG SE1 – M16, K OR1 – HP1, K DC1 – N6752, K DC4 – N7099, J CA – 47 Tuc, J Std star S294D, (J,K) TO1 – N1928, K
2008-08-15	Twilight flats, K BO – Lupus, K VA – N6441, (K,J) CA – 47Tuc, J Std star S294D, (J, K) TO2 – N1928, K
2008-08-16	Twilight flats, J JF – Jupiter, (K, Kcont, BrG) OR1 – HP1, J
2008-08-17	Twilight flats, Kcont Technical tests, K FE – Terzan 5, K Std Star S234E, K
2008-08-18	No observations, bad weather
2008-08-19	Twilight flats, J BO – Lupus, J SE1 – M16, (J, H,K, BrG)
2008-08-20	Twilight flats, H Std star S867V, J FE – Terzan 5, J DC1 – N6752, J CA – 47Tuc, K
2008-08-21	Twilight flats, K Technical tests, (K, H) FE- Terzan 5, K Std star S234E, (K, J) DC1 – N6752, J



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Additional Notes on the data

- 1) **Camera/Images Orientation:** at difference with the data taken in SD1 and SD2, the images taken in SD3 have North down and East Left.
- 2) **Gradients in the IR array quadrants:** even after sky subtraction, sometimes some gradients are seen in each quadrant. Those can be subtracted out by means of simple modelling with a 2-D function, which is apparently identical in each quadrant (albeit rotated).
- 3) **Keywords:** MAD is a non-standard VLT instrument, and as such its headers are different, and much shorter than those of other VLT instruments. In particular note the following:
 - a. There is no filter keyword, since the filter wheel is moved manually. One has to rely on the ORIGFILE keyword to check the filter. Note that for Dark frames this information is not needed. Dark frames were taken with a special blocking filter, named Blank #2.
 - b. DIT and NDIT keywords are present and have the usual meaning. The NINT keyword is not available. The consecutive exposure sequence number is also in the ORIGFILE (n0, n1, etc)
 - c. IRCP.ALPHA and IRCP.DELTA give the coordinates of the IR camera position in arcseconds on sky. These coordinates correspond to the IRCALIST and IRCDLIST observers specified for their observations. Note that each different camera position is also indicated in the ORIGFILE as the label pX (p0,p1,etc).
- 4) **Light leak and de-rotator:** both problems have been solved. Data taken during SD3 show no light leak, as described in the guidelines of SD1 and SD2. Moreover, de-rotation worked fine even at meridian crossing.
- 5) **AO Guide stars:** in some cases it has been necessary to select different AO guide stars than those requested in the phase II proposal, either because they were too faint or not suitable for good correction in the selected science fields. In two cases we observed with two GSs only, namely for Jupiter and Terzan 5. Users are encouraged to read the nightlogs for details.
- 6) **IR detector temperature:** during the run we had to set the IR detector temperature to different values. This impacts calibrations. Users are warned to check in the nightlogs when the temperature was changed and calibrate their data using calibrations (e.g. darks) taken with the same temperature settings (typically the same day).

Contacts

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