

## MIDAS team and archiving status

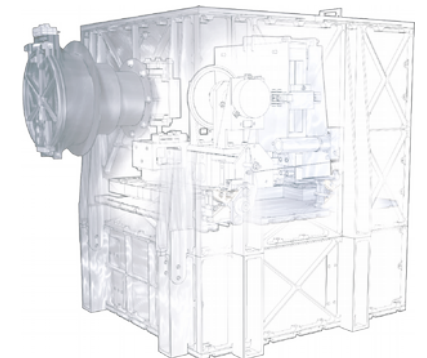
SWT #48, ESAC, Madrid

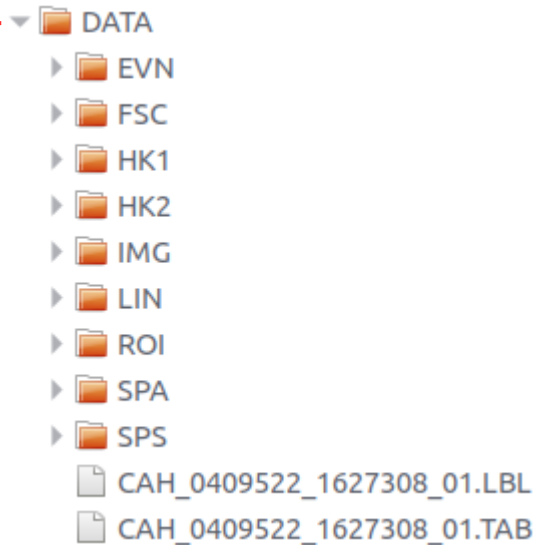
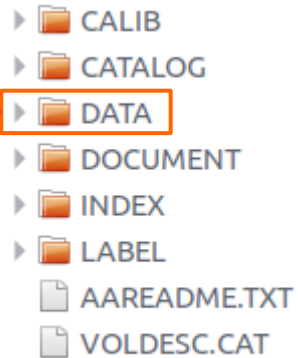
Mark S. Bentley

on behalf of the MIDAS team



@msbentley  
@RosettaMIDAS





- EVN – instrument events
- FSC – frequency scans
- HK1 – engineering HK
- HK2 – science HK
- **IMG – AFM scans/images**
- LIN – line scans (topography)
- ROI – feature detected onboard
- SPA – approach/retraction curve
- SPS – vibration monitoring
- CAH – cantilever history
- **TGH – target history**

- **Key data product:**
  - DATA/IMG/IMG\*ZS . [ LBL/IMG ]
    - ZS = Z Set-point (topography)
  - IMG file = BCR (standard AFM format)
    - can be opened with free/open source tools
    - data are rectangular height fields
  - 2D plots with any PDS3 viewer (e.g. NASAView)
- **Archive browser tool**
  - source code in DOCUMENT/CODE folder
  - browses science products and instrument HK
  - IDL (and license!) required

MIDAS Data Set Browser - Revision 7 2008-02-08 12:11:50Z

RO-X-MIDAS-3-MARS-PC3-5-V1.0

- └─ CALIB
- └─ CATALOG
- └─ DATA
  - └─ EVN
    - └─ FSC
      - FSC\_0623817\_0623820\_001\_01.
      - FSC\_0623817\_0623820\_002\_02.
      - FSC\_0623817\_0623820\_003\_03.
      - FSC\_0623817\_0623820\_004\_04.
      - FSC\_0623817\_0623820\_005\_05.
      - FSC\_0623817\_0623820\_006\_06.
      - FSC\_0623817\_0623820\_007\_07.
      - FSC\_0623817\_0623820\_008\_08.
      - FSC\_0623817\_0623820\_009\_09.
      - FSC\_0623817\_0623820\_010\_10.
      - FSC\_0623817\_0623820\_011\_11.

D:\Daten\Midas\Archiving\latest\RO-X-MIDAS-3-MARS-PC3-5-V1.0\DATA\FSC\FSC\_0623817\_0623820\_005\_05.

PDS\_VERSION\_ID = PDS3  
 LABEL\_REVISION\_NOTE = "2008-02-20 IWF:HJJ auto-generated"

RECORD\_TYPE = FIXED\_LENGTH  
 RECORD\_BYTES = 576  
 FILE\_RECORDS = 1

DATA\_SET\_ID = "RO-X-MIDAS-3-MARS-PC3-5-V1.0"  
 DATA\_SET\_NAME = "ROSETTA-ORBITER CHECK MIDAS 3 MARS PC3-5 V1.0"

PRODUCT\_ID = "FSC\_0623817\_0623820\_005\_05"  
 PRODUCT\_VERSION\_ID = "1.0"  
 PRODUCT\_CREATION\_TIME = 2008-02-20T16:28:25  
 PRODUCT\_TYPE = EDR  
 PROCESSING\_LEVEL\_ID = 3

MISSION\_ID = ROSETTA  
 MISSION\_NAME = "INTERNATIONAL ROSETTA MISSION"  
 MISSION\_PHASE\_NAME = "MARS SWING-BY"

INSTRUMENT\_HOST\_ID = RO  
 INSTRUMENT\_HOST\_NAME = "ROSETTA-ORBITER"  
 INSTRUMENT\_ID = MIDAS  
 INSTRUMENT\_NAME = "MICRO-IMAGING DUST ANALYSIS SYSTEM"  
 INSTRUMENT\_TYPE = "SCANNING PROBE MICROSCOPE"

Data File Attributes

PRODUCT = FREQUENCY\_SCAN\_DATA  
 PACKET\_ID = 3132  
 PACKET\_SEQUENCE\_CONTROL = 49156  
 PACKET\_LENGTH = 569  
 PACKET\_OBT\_SECONDS = 115238632  
 PACKET\_OBT\_FRACTION = 39911  
 PACKET\_PUS\_AND\_CRC = 64  
 PACKET\_TYPE = 20  
 PACKET\_SUBTYPE = 3  
 PACKET\_PAD\_FIELD = 0  
 STRUCTURE\_ID = 131  
 SOFTWARE\_VERSION = 100  
 START\_TIME = 115238615  
 START\_FREQUENCY = 116916224  
 FREQUENCY\_STEP = 1432  
 AC\_MAXIMUM = 17428  
 FREQUENCY\_AT\_MAX = 117099520  
 NUM\_SCANS = 1  
 SCAN\_CYCLE = 1  
 CANT\_TIP\_NUM = 5  
 CANT\_BLK\_NUM = 1  
 EXCITATION\_LEVEL = 3  
 AC\_GAIN\_LEVEL = 3  
 SPARE  
 DATA\_SAMPLES

Plot Parameter Selection  
 DATA\_RECORD\_1\_OF\_1

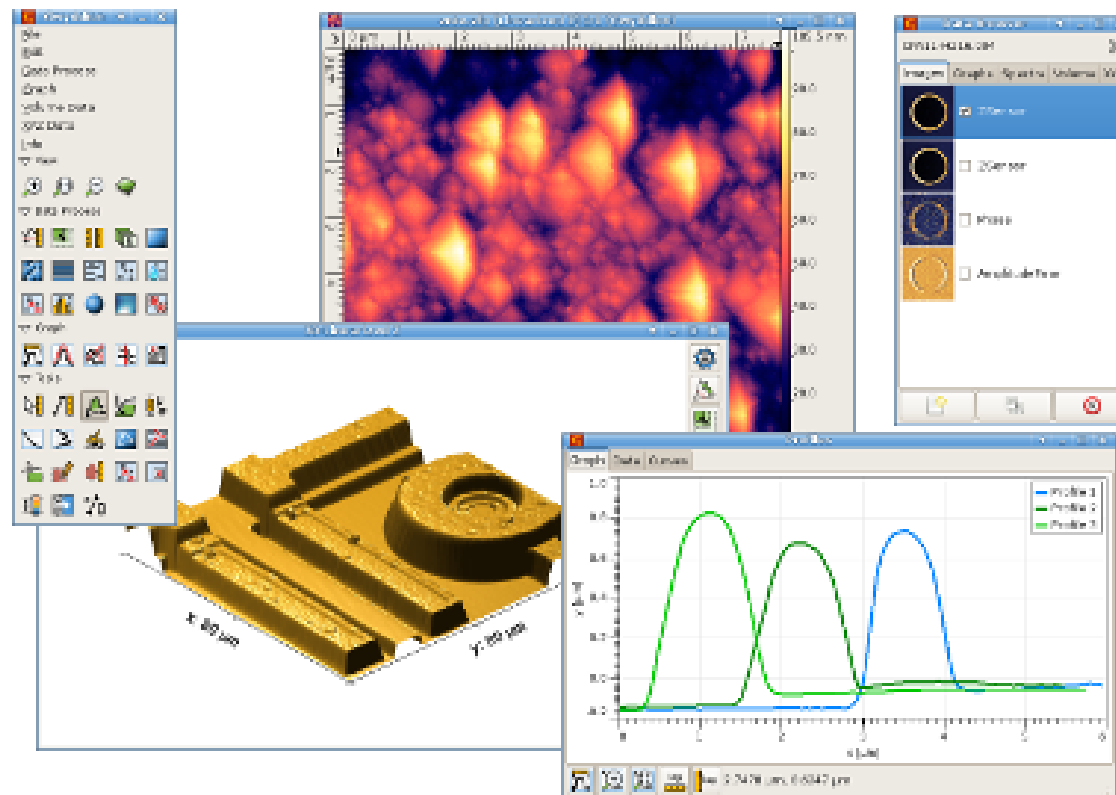
FSC\_0623817\_0623820\_005\_05.DAT

Amplitude [V]

Frequency [Hz]

Exit Data Set Browser

- Gwyddion – open-source AFM toolkit
  - <http://gwyddion.net/>
  - cross-platform, python shell for scripting



## - Example data

- Figure 3 from Bentley *et al.* (2016)

	Figure 1	Figure 2	Figure 3
target	14	12	12
cantilever	9	9	7
image resolution	256 x 256	256 x 256	192 x 192
image size	80 x 80 $\mu\text{m}^2$	20 x 20 $\mu\text{m}^2$	40 x 40 $\mu\text{m}^2$
pixel resolution	312 nm	80 nm	210 nm
z step size	0.7 nm	0.7 nm	0.7 nm
retraction height	1095 nm	977 nm	734 nm
duration	1 day, 05:05:33	08:14:15	11:16:30
start time	2015-04-29T05:21:40Z	2015-03-13T08:44:38Z	2015-01-18T20:59:28Z
filename	IMG_1509813_1512600_054_ZS	IMG_1507001_1508813_005_ZS	IMG_1501323_1504200_013_ZS

ESC2

ESC2

ESC1



The screenshot illustrates the workflow for opening an IMG file in Gwyddion. The main application window shows a topography image with a color scale from 0.0 to 2.3 micrometers. A file explorer window is open, displaying a list of files in the 'DATA' directory. The file 'IMG\_1501323\_1504200\_013\_ZS.IMG' is selected. The 'Data Browser' window shows the selected file's metadata, including its name and type.

Name	Size	Type	Mod
IMG_1501323_1504200_011_ZS.IMG	75.8 kB	Unknown	50
IMG_1501323_1504200_011_ZS.LBL	3.9 kB	Text	50
IMG_1501323_1504200_012_PH.IMG	75.8 kB	Unknown	50
IMG_1501323_1504200_012_PH.LBL	3.9 kB	Text	50
IMG_1501323_1504200_013_ZS.IMG	75.8 kB	Unknown	50
IMG_1501323_1504200_013_ZS.LBL	3.9 kB	Text	50
IMG_1501323_1504200_014_PH.IMG	75.8 kB	Unknown	50
IMG_1501323_1504200_014_PH.LBL	3.9 kB	Text	50
IMG_1501323_1504200_015_ZS.IMG	75.8 kB	Unknown	50
IMG_1501323_1504200_015_ZS.LBL	3.9 kB	Text	50
IMG_1501323_1504200_016_PH.IMG	75.8 kB	Unknown	50
IMG_1501323_1504200_016_PH.LBL	3.9 kB	Text	50

Just double-click the .IMG file!





- Two types of histories are tabulated
  - TGH: timestamped target SCAN vs EXPOSURE modes
  - CAH: timestamped cantilever (frequency scan/scan)
- To determine when dust was collected:
  - check the start/stop time of the image with dust
  - find the previous image showing *no* dust
  - check the CAH for exposures in between
    - can be more than one...
- Will be easier when the enhanced archiving is done
  - dust particle catalogue will be complete

- To *fully* understand an image, the entire sequence of instrument operations can be important...
  - Rotate wheel
    - select target, coarse Y
  - Translate wheel
    - via linear stage – select cantilever and coarse X
  - Perform resonance sweep of selected cantilever
    - (dynamic mode only)
  - Approach target + fine-tuning
  - Repeated resonance sweep
  - Start line-by-line scan
- Event history can be used to follow this (per image)

- EVN (instrument events)

- Simple ASCII table of event time, ID and name

```

+-----+-----+-----+-----+-----+
|      OBT      |      UTC      | count | ID |      name      |
+-----+-----+-----+-----+-----+
| 394343624.644 | 2015-07-01 03:55:01.316000 | 15060 | 42552 | EV_SHUT_CLOS_STARTED |
| 394343638.356 | 2015-07-01 03:55:15.028000 | 15061 | 42554 | EV_SHUT_CLOSED |
| 394343924.616 | 2015-07-01 04:00:01.288000 | 15069 | 42674 | EV_ABS_APPR_STARTED |
| 394343941.839 | 2015-07-01 04:00:18.511000 | 15071 | 42624 | EV_ABS_APP_POS_REACHED |
| 394344104.658 | 2015-07-01 04:03:01.330000 | 15075 | 42661 | EV_BACK_APP_STARTED |
| 394344121.796 | 2015-07-01 04:03:18.468000 | 15076 | 42768 | EV_APP_LVDT_ON_MIN_POS |
| 394344164.669 | 2015-07-01 04:04:01.341000 | 15079 | 42652 | EV_LIN_TO_ABS_STARTED |
| 394344195.213 | 2015-07-01 04:04:31.885000 | 15080 | 42631 | EV_LIN_POS_REACHED |
| 394344346.461 | 2015-07-01 04:07:03.133000 | 15085 | 42591 | EV_SEARCH_FOR_REF_PULSE |
| 394344362.788 | 2015-07-01 04:07:19.460000 | 15086 | 42587 | EV_SAVING_TABLE |
| 394344363.014 | 2015-07-01 04:07:19.686000 | 15087 | 42592 | EV_SEGMENT_FOUND |
| 394344523.742 | 2015-07-01 04:10:00.414000 | 15091 | 42641 | EV_F_SCAN_STARTED |
| 394344524.77 | 2015-07-01 04:10:01.442000 | 15092 | 42642 | EV_F_SCAN_CYCLE_STARTED |
| 394344542.532 | 2015-07-01 04:10:19.204000 | 15094 | 42643 | EV_F_SCAN_CYCLE_FINSHED |
+-----+-----+-----+-----+-----+

```

- Two types of HK packet
  - HK1 – basic engineering parameters
  - HK2 – extended parameters
- Binary TLM packets in archive
  - use PDS3 tools to read ENG data
- Any parameter can be plotted by archive tool
  - internally we have an HDF5 file with ENG HK
    - this could also be made available

- How else can we help you?
- Additional file formats?
  - internally MIDAS uses Gwyddion files
    - native format, multiple channels and types, meta-data
    - may try to provide access to these (not via PSA)
  - pipeline also produces PNG thumbnails
  - recently produced FITS files for a collaborator
- Image browser available
  - link to PSA products could be added



The screenshot shows a web browser window with the URL `midas.iwf.oew.ac.at/data/images/`. The browser tabs include Syno, [My], e Sche, Land, Inbo, Search, Zimb, Quic, BC-S, Data, and MID. The main content area displays a grid of microscopy images, each with a color scale and a label like "SCAN MD M031 S117 20...".

**Image Name**  
 SCAN MD M031 S118 2016-07-20T071945Z TGT13

**Meta data**  
 SCAN\_MD\_M031\_S118\_2016-07-20T071945Z\_TGT13.gwy  
 scan\_file:SCAN\_MD\_M031\_S118\_2016-07-20T071945Z\_TGT13  
 sw\_ver:667  
 start\_time:"2016-07-20 07:19:45.504204"  
 end\_time:"2016-07-20 08:49:04.505950"  
 duration:"1:29:19.001746"  
 channel:ZS  
 tip\_num:8  
 lin\_pos:0.43884946974898909  
 tip\_offset:-63.763427939269107  
 wheel\_pos:208  
 target:13  
 target\_type:SOLGEL  
 x\_orig:51073  
 y\_orig:24236  
 xsteps:128  
 x\_step:20  
 x\_step\_nm:76.276799999999994  
 xlen\_um:9.763430399999999  
 ysteps:128  
 y\_step:56  
 y\_step\_nm:77.777783999999997  
 ylen\_um:9.9555563520000003  
 z\_step:4  
 z\_ret:830  
 z\_ret\_nm:136.12  
 x\_dir\_L\_H  
 y\_dir\_L\_H  
 fast\_dir:Y  
 scan\_type:DYN  
 exc\_lvl:6  
 ac\_gain:3  
 x\_closed:False  
 y\_closed:True  
 aborted:False  
 dummy:False  
 res\_amp:7.4699015793087664  
 set\_pt:5.9757381551842528  
 fad:6.3492790112153807

Navigation buttons at the bottom: << Previous, Close Image, Next >>, Slideshow, Information, Actual Size. The user 'sfpg' is logged in.



SO LONG  
AND  
THANKS  
FOR ALL  
THE FISH

TELECONS  
DISCUSSIONS  
DATA  
FUN!