HRSC Level4 Data

Angelo Pio Rossi

arossi@issibern.ch

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Basic Information on HRSC Level4 Data

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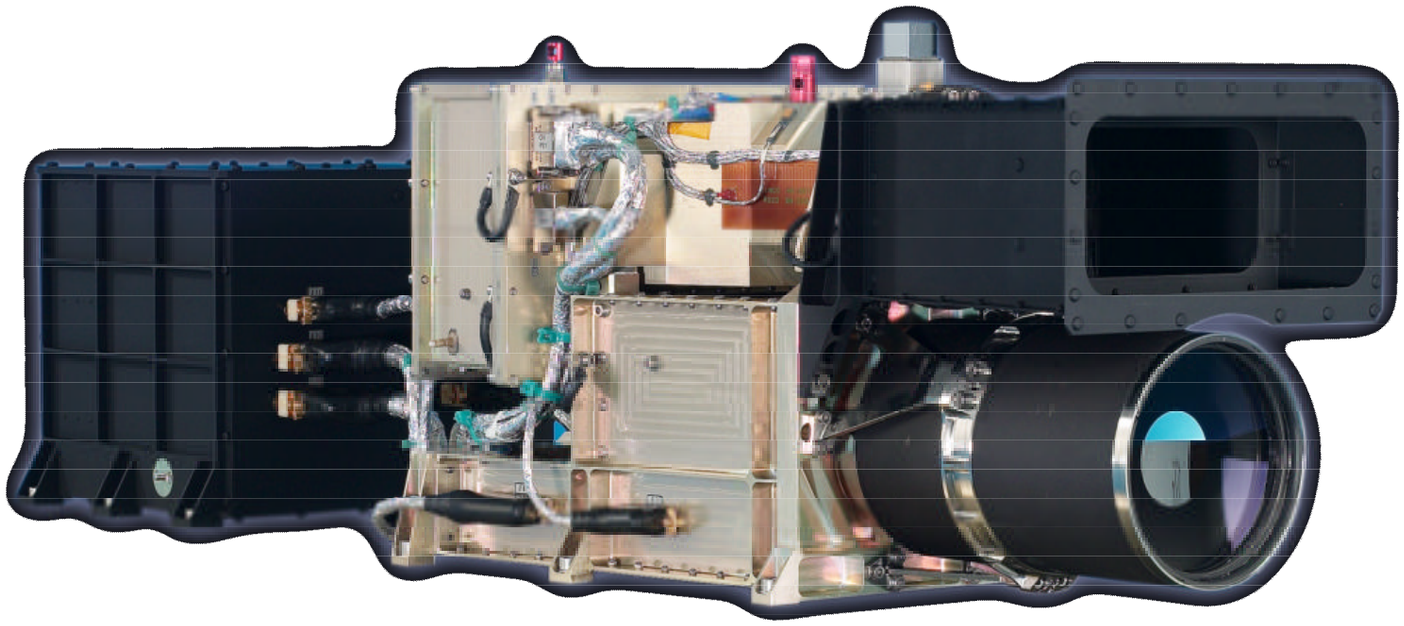
HRSC Level4 data

- HRSC Level4 data consist of orthorectified color imagery and stereo-derived Digital Elevation Models (DEMs), used for orthorectifying those images.

High Resolution Stereo Camera



HRSC:
Focal length 175 mm

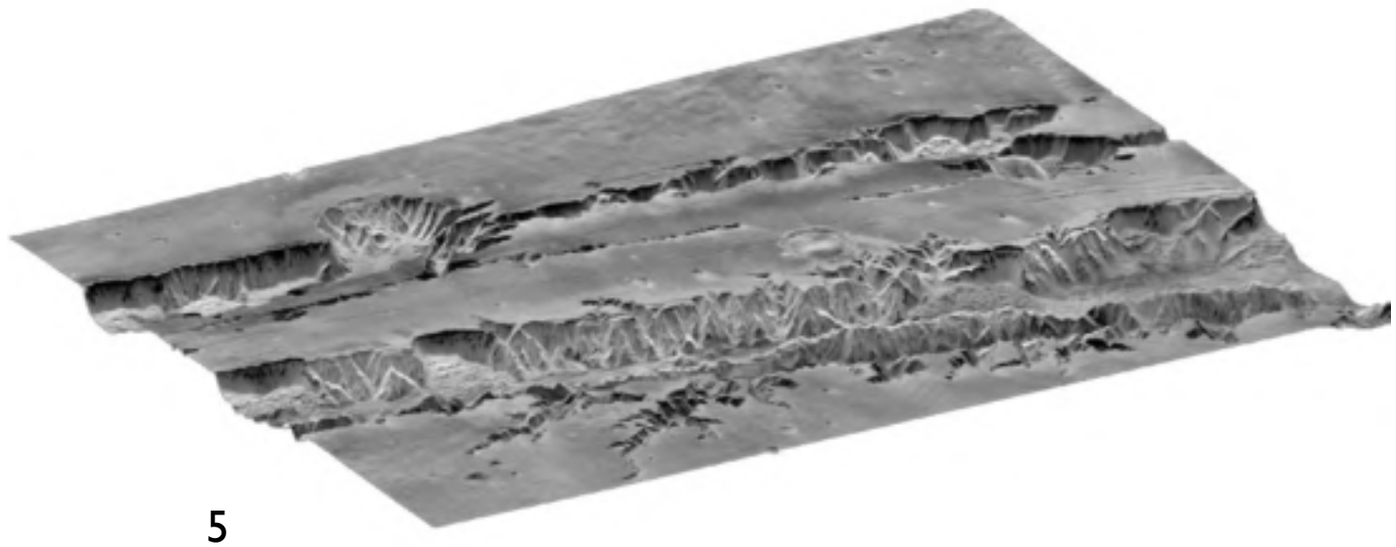
SRC:
Focal length 975 mm

Extensive information on the HRSC instrument is available on the ESA-SP 1240 article on HRSC:

http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=34967

HRSC stereo

HRSC stereo
imaging principle



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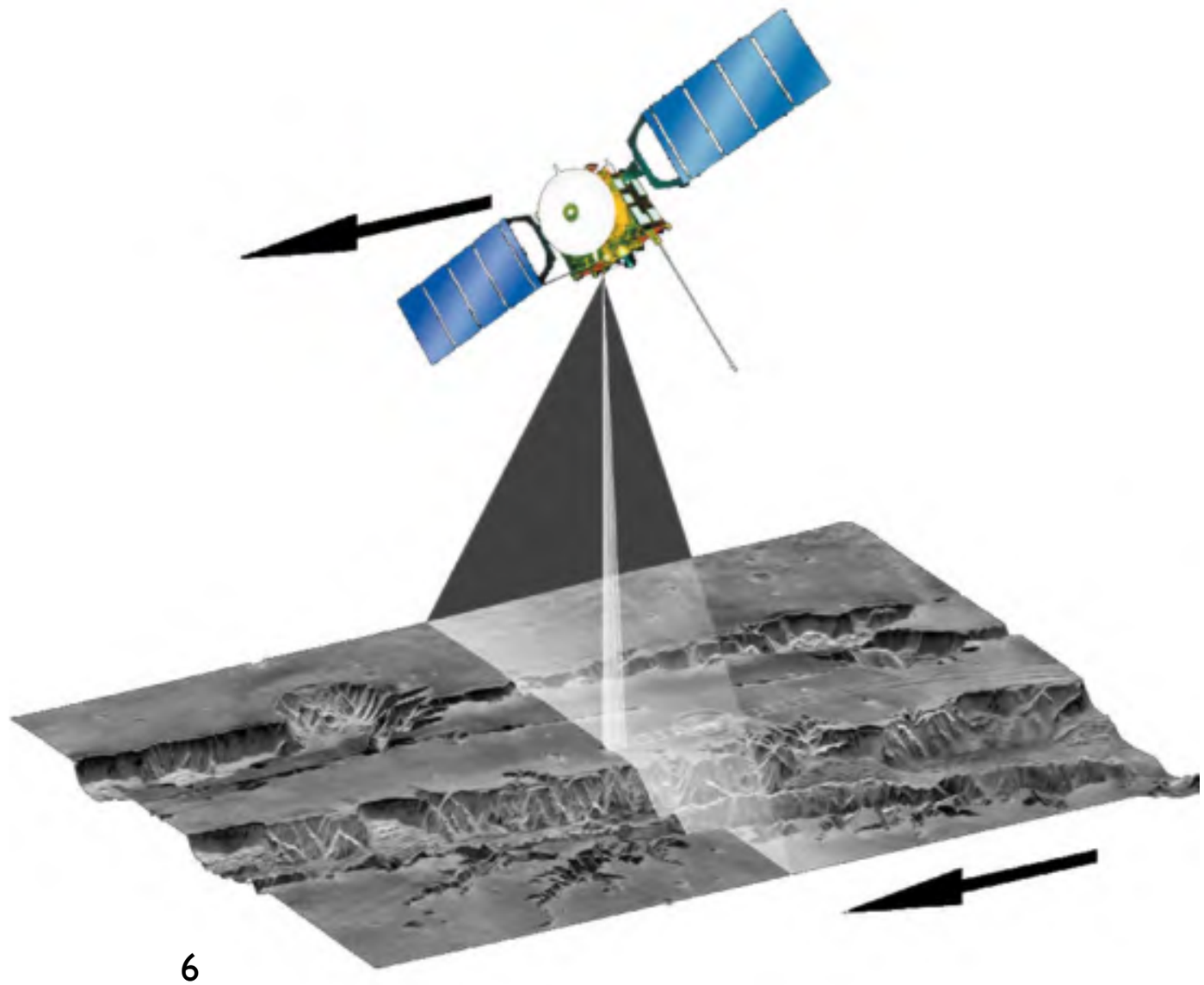
HRSC stereo

HRSC stereo
imaging principle



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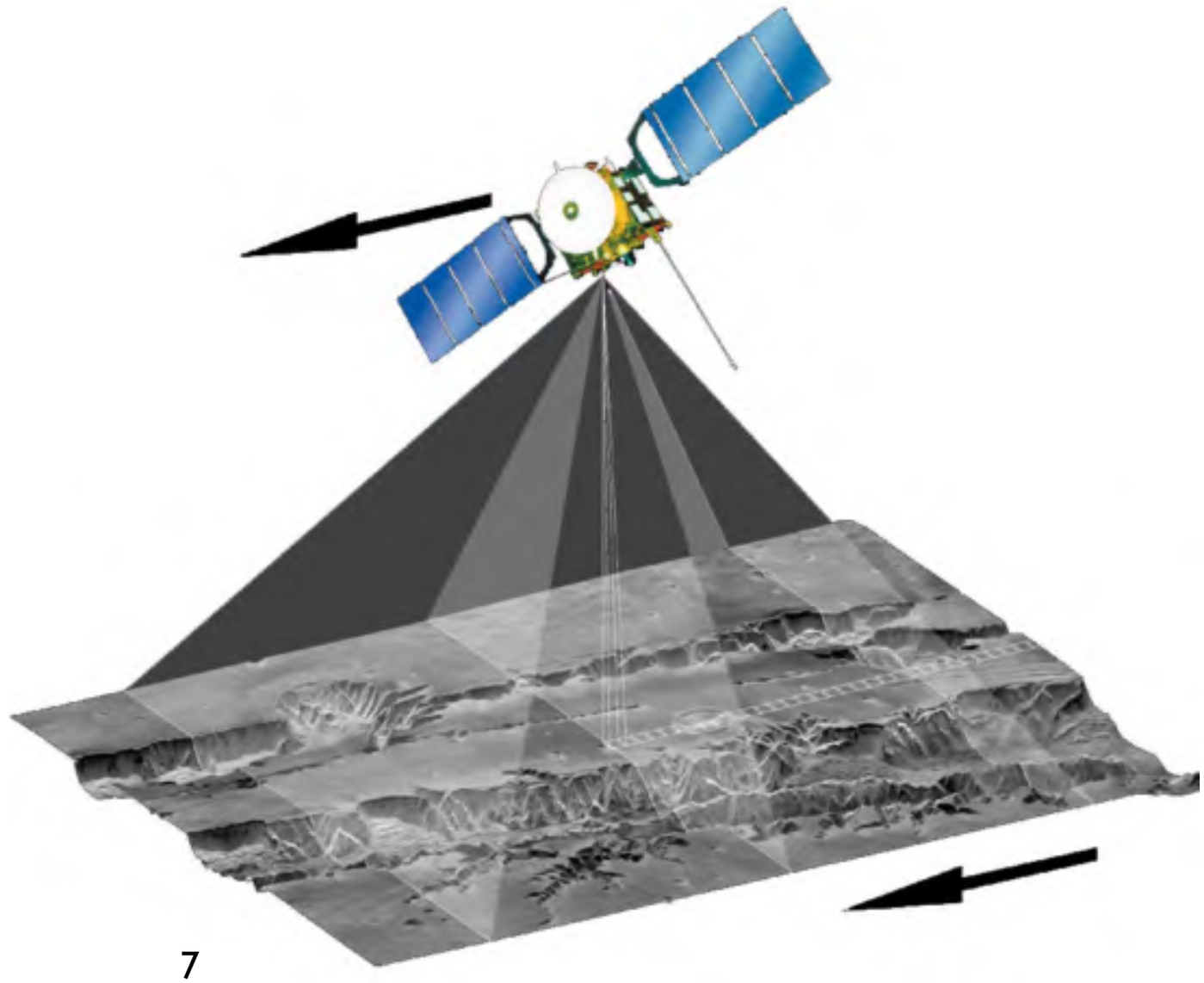
HRSC stereo

HRSC stereo
imaging principle



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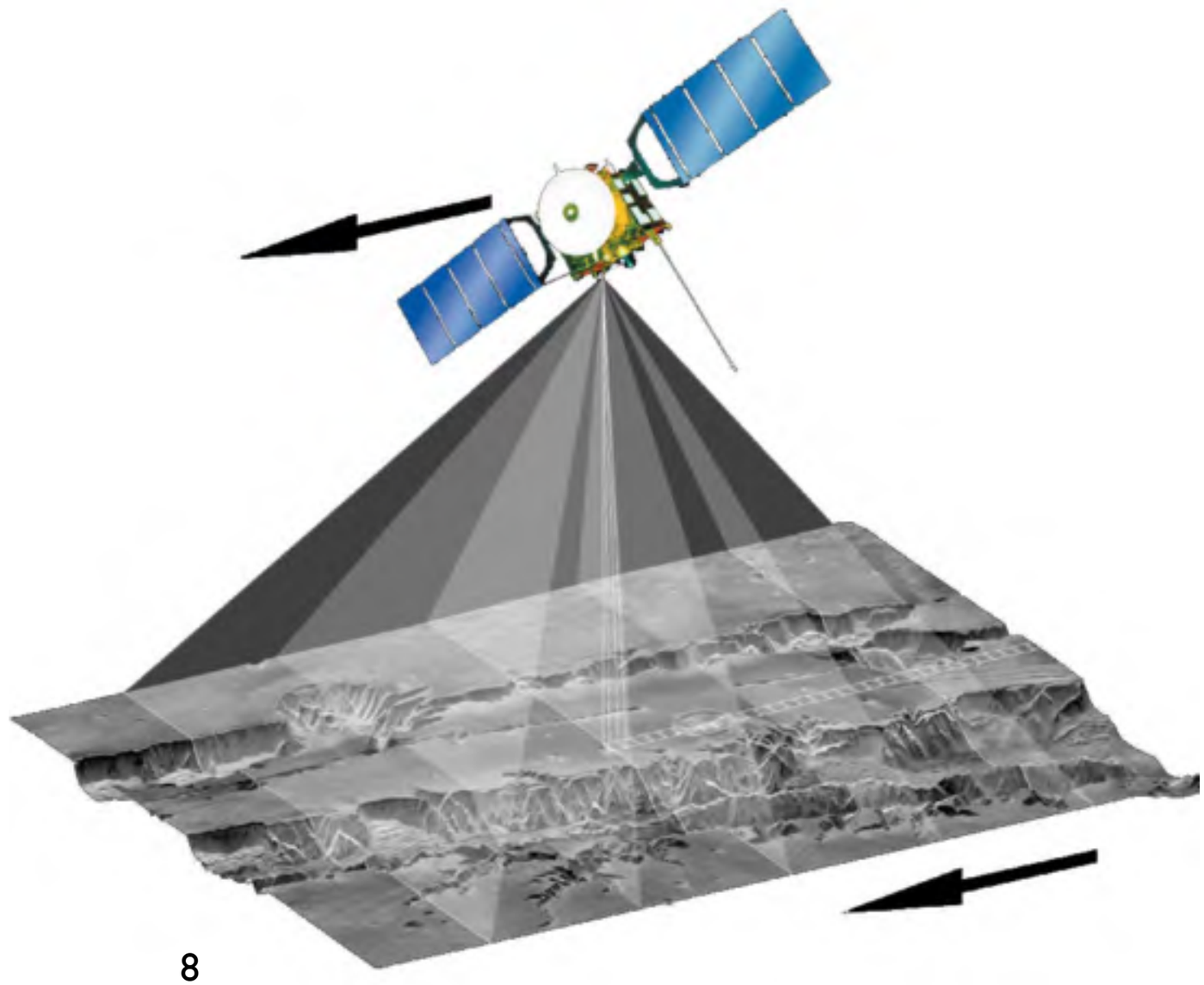
HRSC stereo

HRSC stereo
imaging principle



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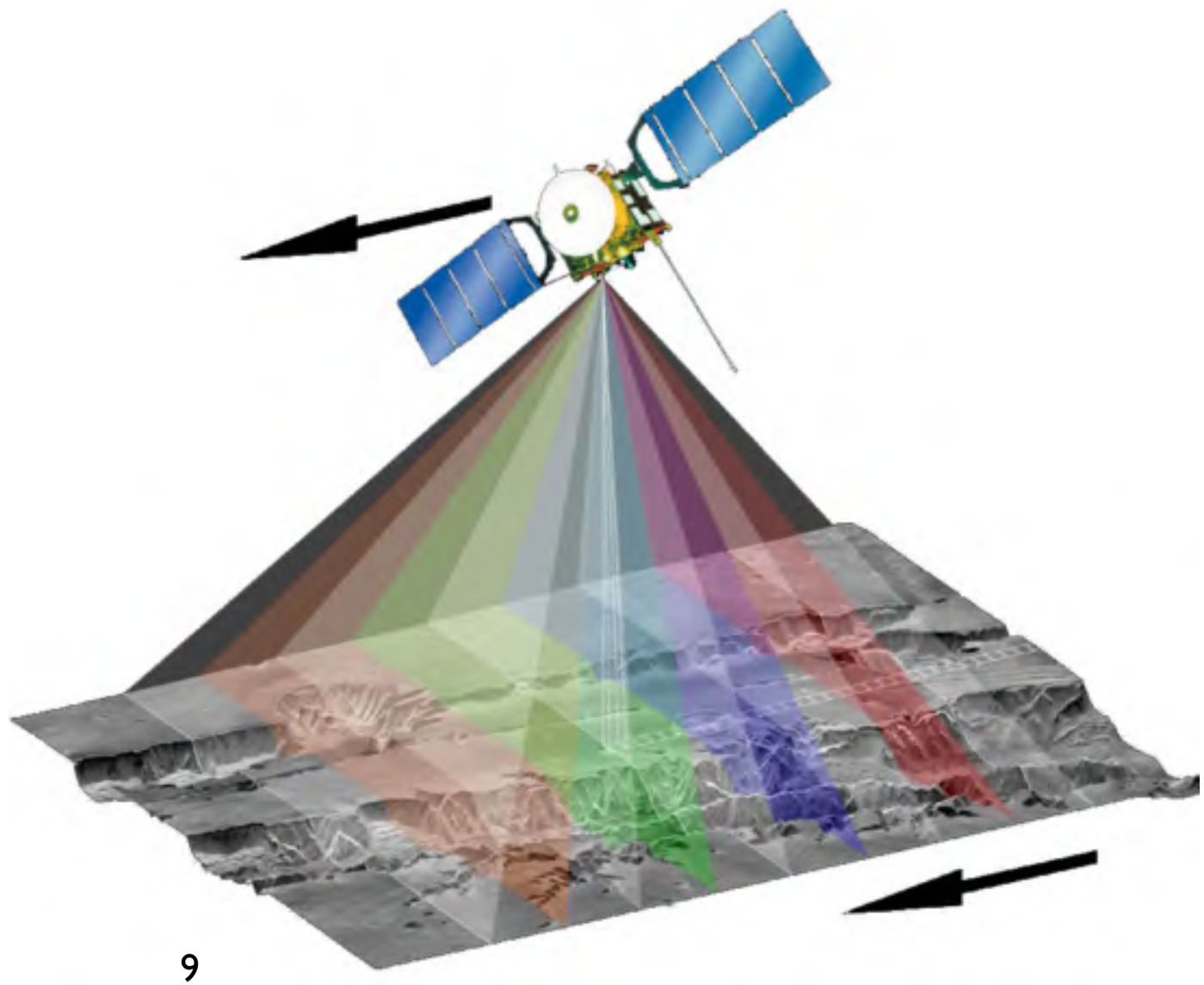
HRSC stereo

HRSC stereo
imaging principle



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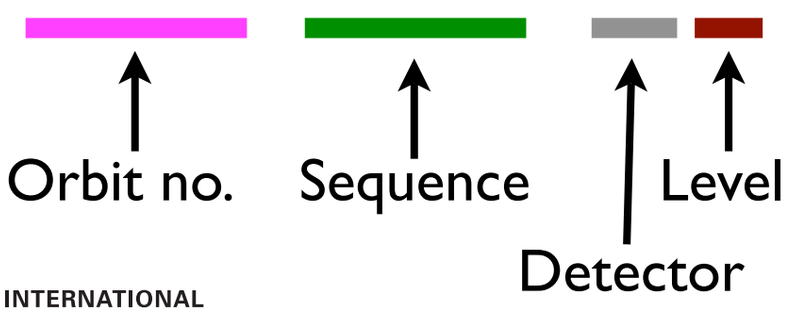
File naming conventions

HRSC - filenames

H0010_0009_BL4.IMG	BL = blue
H0010_0009_DA4.IMG	DA = DEM aeroid*
H0010_0009_DT4.IMG	DT = DEM sphere
H0010_0009_GR4.IMG	GR = green
H0010_0009_IR4.IMG	IR = near IR
H0010_0009_ND4.IMG	ND = nadir
H0010_0009_RE4.IMG	RE = red



* DA4 products are comparable with MOLA aeroid (MEGDR)

http://pds-geosciences.wustl.edu/missions/mgs/megdr.html

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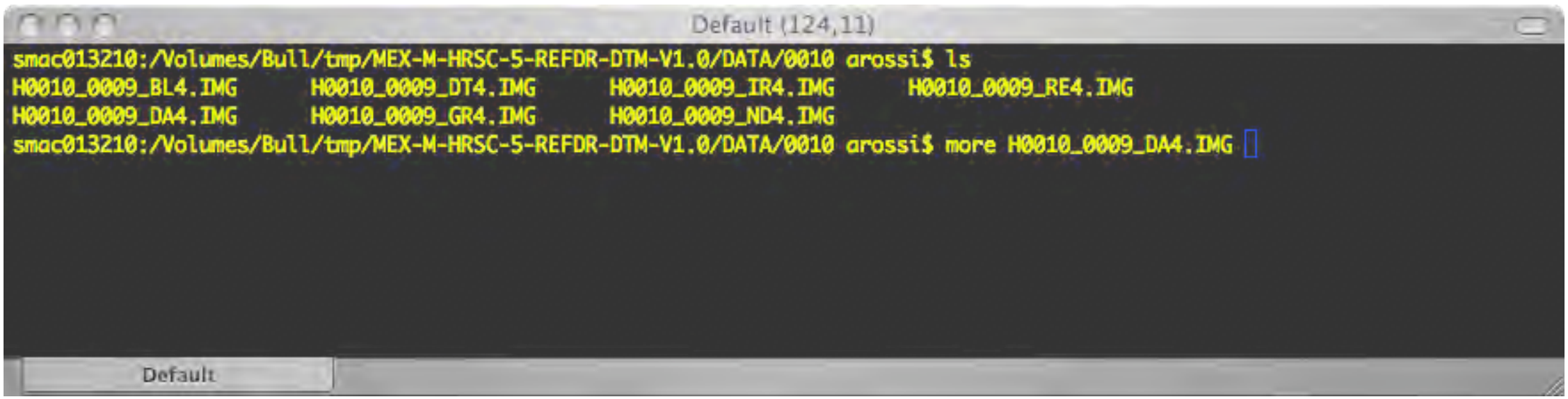
Level4 PDS Labels

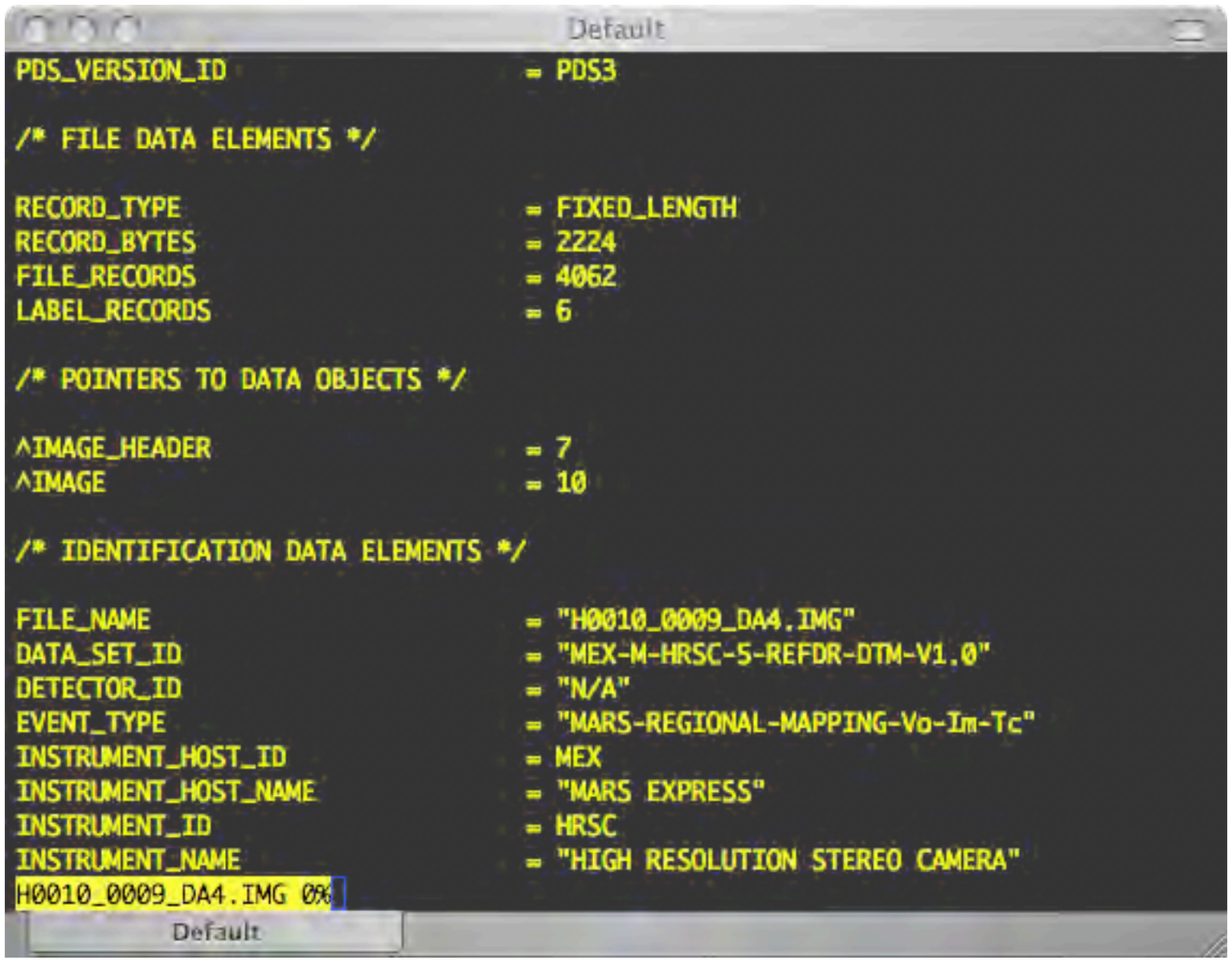
Level4 PDS Labels

- The PDS header in HRSC Level4 (as in other HRSC datasets) is attached at the beginning of the file and it is in plain ASCII.
- You can quickly access the header with the unix command "more" (or using PDS viewers, e.g. NasaView on Windows)
- Below the PDS header, a VICAR header (also in ASCII) is present, containing consistent information (with different formatting/syntax)



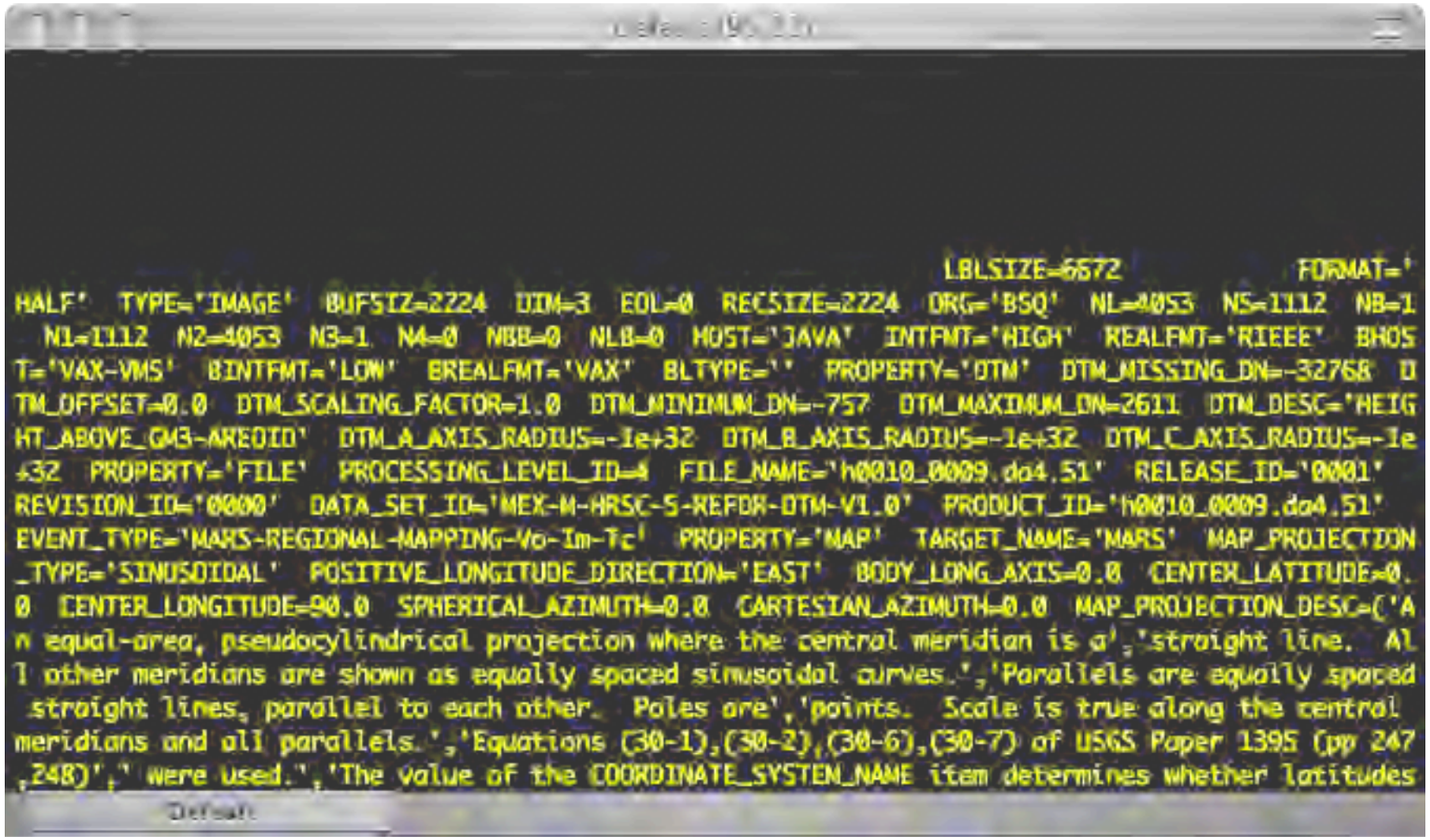
Level4 PDS Labels

That's the result, by using the "more" command:



Level4 VICAR Labels

Pressing the space bar few times more, it's possible to access the VICAR Label



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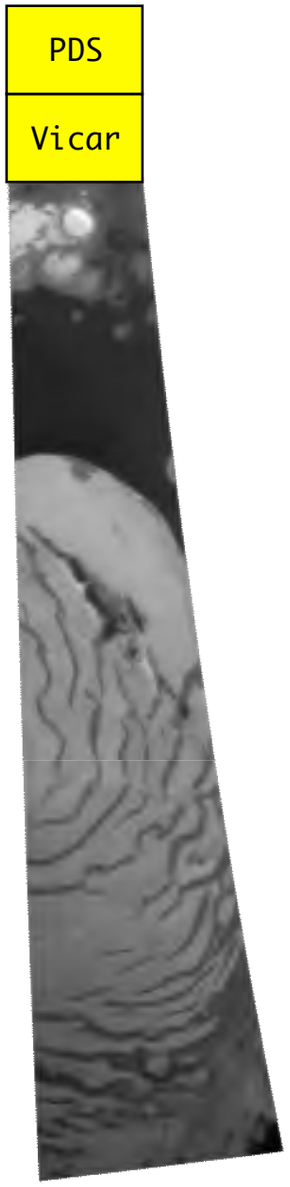
HRSC PDS & Vicar labels

label(s) →

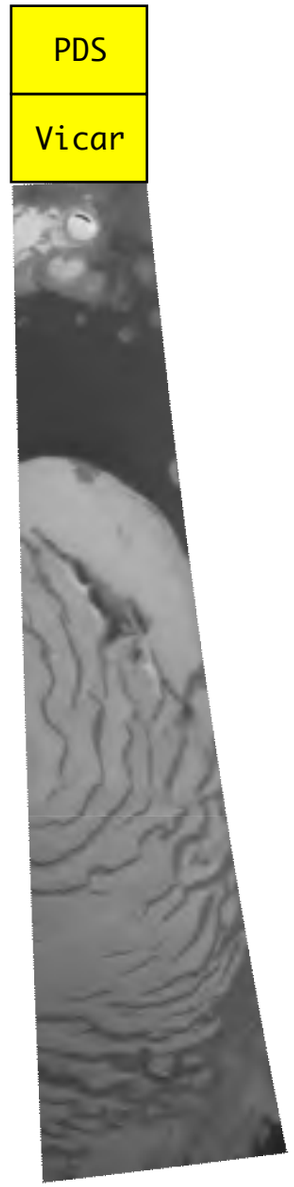
image →

processing level →

Level2



Level3



Level4

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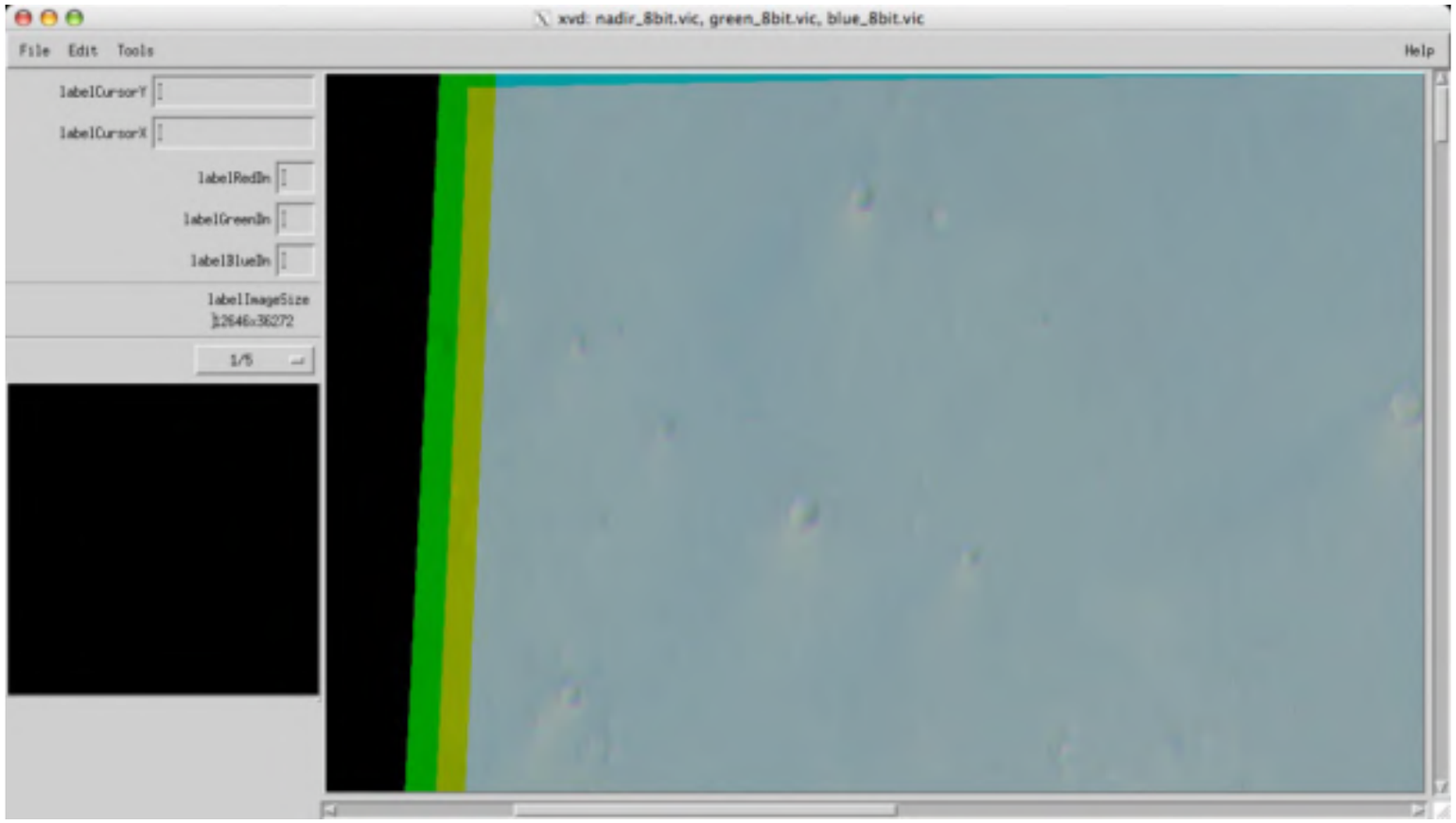
XVD (image viewer)

"xvd" is an image viewer for HRSC data (part of the "miniVICAR" package, see below)



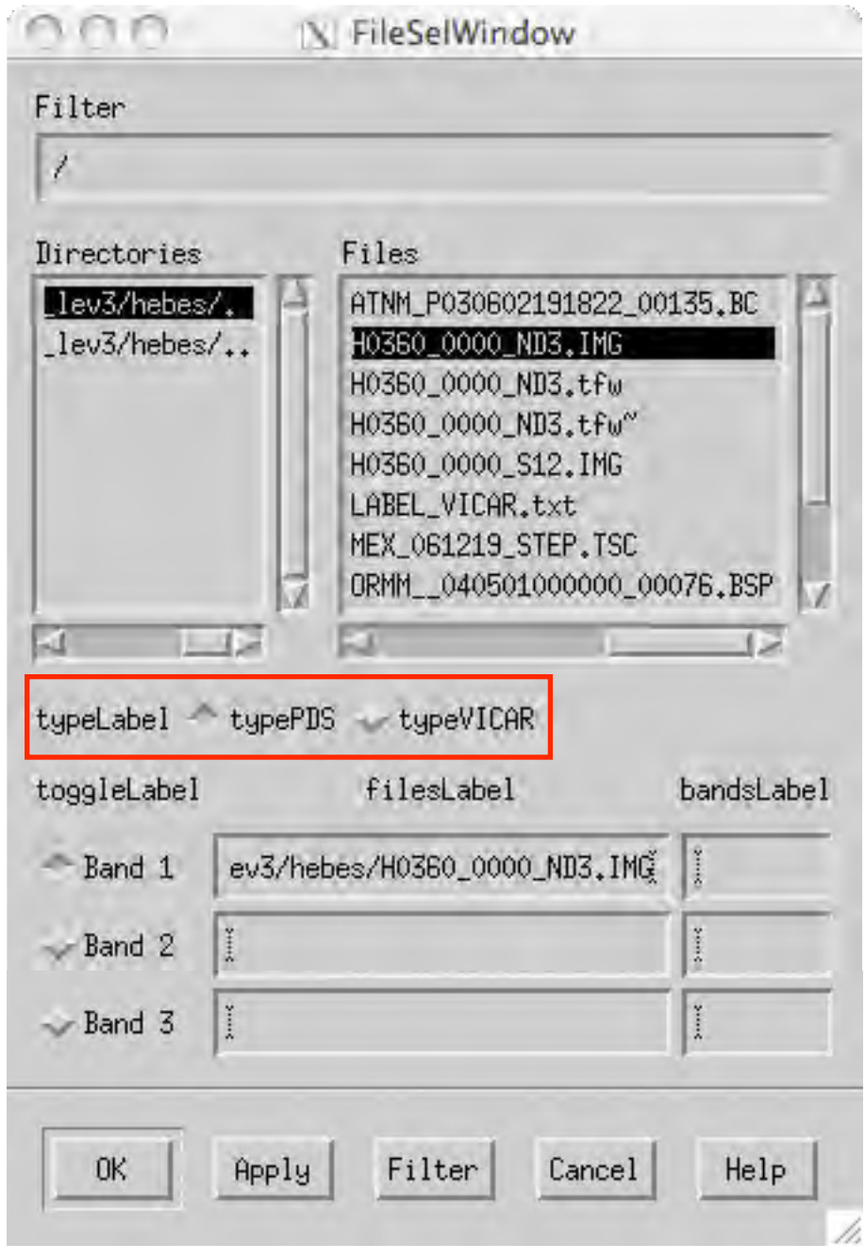
SOURCE CODE:

ftp://psa.esac.esa.int/pub/mirror/MARS-EXPRESS/HRSC/MEX-M-HRSC-3-RDR-V2.0/SOFTWARE

LINUX x86 BINARY

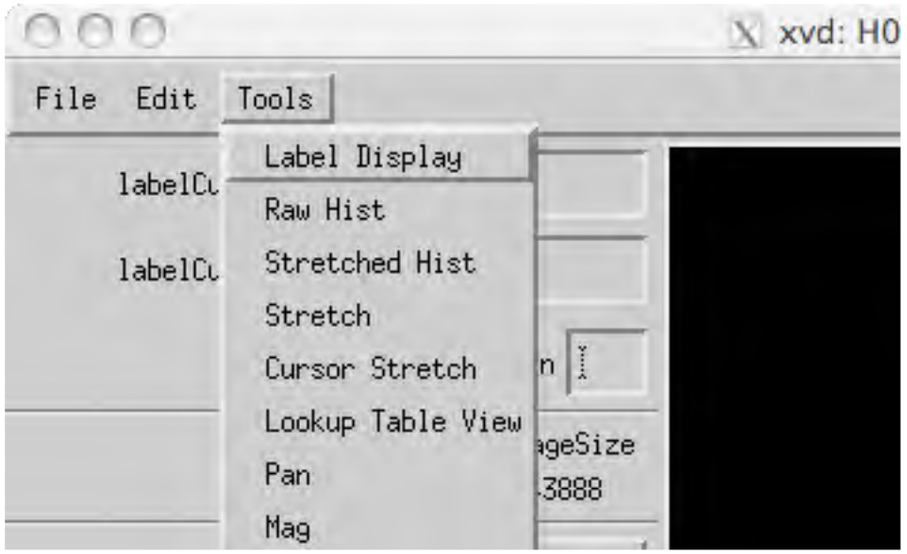
ftp://gorilla.estec.esa.int/pub/projects/workshop/04_MEX_DW_june_2007/software_data/minivicar/

Viewing labels



a) choose label opening the file

Both PDS and VICAR
labels can be viewed in xvd



b) view the label from xvd

Viewing labels

PDS

```
 PDS_VERSION_ID  =  PDS3

/* FILE DATA ELEMENTS */

   RECORD_TYPE  =  FIXED_LENGTH
   RECORD_BYTES  =  10383
   FILE_RECORDS  =  43891
   LABEL_RECORDS  =  2

/* POINTERS TO DATA OBJECTS */

   ^IMAGE_HEADER  =  3
   ^IMAGE  =  4

/* IDENTIFICATION DATA ELEMENTS */

   FILE_NAME  =  "H0360_0000_ND3.IMG"
   DATA_SET_ID  =  "MEX-M-HRSC-5-REFDR-MAPPROJECTED-V2.0"
   DETECTOR_ID  =  MEX_HRSC_NADIR
   EVENT_TYPE  =  "MARS-GLOBAL-MAPPING-Te-Fl-Lc"
   INSTRUMENT_HOST_ID  =  MEX
   INSTRUMENT_HOST_NAME  =  "MARS EXPRESS"
   INSTRUMENT_ID  =  HRSC
   INSTRUMENT_NAME  =  "HIGH RESOLUTION STEREO CAMERA"
   MISSION_NAME  =  "MARS EXPRESS"
   MISSION_PHASE_NAME  =  MC_Phase_6
   PROCESSING_LEVEL_ID  =  3
   PRODUCT_CREATION_TIME  =  2006-07-28T17:46:42.000Z
   PRODUCT_ID  =  "H0360_0000_ND3.IMG"
   RELEASE_ID  =  0006
   REVISION_ID  =  0000
....
....
....
```

VICAR

```
************************************************************
     +++++ System Label of file H0360_0000_ND3.IMG +++++
           3 dimensional IMAGE file
           File organization is BSQ
           Pixels are in BYTE format from a JAVA host
           1 bands
           43888 lines per band
           10383 samples per line
           0 lines of binary header of type
           0 bytes of binary prefix per line

************************************************************

************************************************************
      +++++ Property Label of file H0360_0000_ND3.IMG +++++

    -------------------------------------------

  PROPERTY = 'M94_ORBIT'

    ORBIT_NUMBER=360
    ASCENDING_NODE_LONGITUDE=221.55
    ORBITAL_ECCENTRICITY=0.606
    ORBITAL_INCLINATION=86.56
    PERIAPSIS_ARGUMENT_ANGLE=298.62
    PERIAPSIS_TIME='2004-05-02T21:06:37.000Z'
    PERIAPSIS_ALTITUDE=266.17
    ORBITAL_SEMIMAJOR_AXIS=9261.67
    SPACECRAFT_SOLAR_DISTANCE=2.42487e+08
    SPACECRAFT_CLOCK_START_COUNT='1/0031612651.56187'
    SPACECRAFT_CLOCK_STOP_COUNT='1/0031613373.19695'
    START_TIME='2004-05-02T21:18:50.969Z'
    STOP_TIME='2004-05-02T21:25:19.970Z'
    SPACECRAFT_POINTING_MODE='NADIR'
     ....
     ....
     ....
```

HRSC Level4: PDS Label

```
  PDS_VERSION_ID  =  PDS3

/* FILE DATA ELEMENTS */

   RECORD_TYPE  =  FIXED_LENGTH
   RECORD_BYTES  =  4448
   FILE_RECORDS  =  16222
   LABEL_RECORDS  =  4

/* POINTERS TO DATA OBJECTS */

   ^IMAGE_HEADER  =  5
   ^IMAGE  =  7

/* IDENTIFICATION DATA ELEMENTS */

   FILE_NAME  =  "H0010_0009_ND4.IMG"
   DATA_SET_ID  =  "MEX-M-HRSC-5-REFDR-DTM-V1.0"
   DETECTOR_ID  =  MEX_HRSC_NADIR
   EVENT_TYPE  =  "MARS-REGIONAL-MAPPING-Vo-Im-Tc"
   INSTRUMENT_HOST_ID  =  MEX
   INSTRUMENT_HOST_NAME  =  "MARS EXPRESS"
   INSTRUMENT_ID  =  HRSC
   INSTRUMENT_NAME  =  "HIGH RESOLUTION STEREO CAMERA"
   MISSION_NAME  =  "MARS EXPRESS"
   MISSION_PHASE_NAME  =  MC_Phase_0
   PROCESSING_LEVEL_ID  =  4
   PRODUCT_CREATION_TIME  =  2007-09-12T09:51:10.000Z
   PRODUCT_ID  =  "H0010_0009_ND4.IMG"
   RELEASE_ID  =  0001
   REVISION_ID  =  0000

/* TIME DATA ELEMENTS */

   SPACECRAFT_CLOCK_START_COUNT  =  "1/0021823325.32303"
   SPACECRAFT_CLOCK_STOP_COUNT  =  "1/0021823574.56834"
   START_TIME  =  2004-01-10T14:02:37.354Z
   STOP_TIME  =  2004-01-10T14:05:52.359Z
```

```
/* ORBITAL DATA ELEMENTS */

   ASCENDING_NODE_LONGITUDE  =  228.73
   MAXIMUM_RESOLUTION  =  10.9 <m/pixel>
   FOOTPRINT_POINT_LATITUDE  =  (-7.58311,-7.58301,-7.58299,-7.58273,
                                 -7.58226,-7.58206,-7.45314,-6.54993,
                                 -6.42084,-6.29176,-3.83528,-3.70593,
                                 -3.57647,-3.44703,-3.05877,-2.9293,
                                 -2.54097,-2.4115,-2.1526,-2.02312,
                                 -1.75578,-0.54222,-0.407438,-0.272588,
                                 -0.137804,0.536112,0.670818,0.805564,
                                 0.944211,1.08433,1.36458,1.78472,
                                 1.92468,2.20468,2.34463,2.62439,2.76429
                                 ,2.90423,3.04552,3.33583,5.99029,5.9894
                                 ,5.98919,4.50036,4.35543,4.21045,
                                 3.92057,3.63047,3.48535,3.3402,3.19512,
                                 3.04999,2.90854,2.76868,2.62877,2.48876
                                 ,2.34888,2.06899,1.92907,1.78908,
                                 1.64902,1.36895,1.22893,1.08885,
                                 0.948709,0.136115,0.00133861,-0.672748,
                                 -0.807603,-0.942449,-1.07729,-1.21214,
                                 -1.61668,-1.75151,-1.88638,-2.27792,
                                 -2.40742,-2.53686,-2.66616,-2.7956,
                                 -3.18394,-3.31343,-3.44297,-3.57247,
                                 -3.7019,-3.83127,-4.47818,-4.60762,
                                 -4.73687,-4.99552,-5.90031,-6.02952,
                                 -6.28787,-6.417,-6.54613,-6.67523,
                                 -7.32047,-7.4495,-7.57848,-7.58311)
   FOOTPRINT_POINT_LONGITUDE  =  (90.9662,90.5386,90.529,90.2679,89.9883
                                 ,89.9836,89.9846,89.9894,89.9903,
                                 89.9915,89.9999,90.0008,90.0005,90.0006
                                 ,90.0016,90.0016,90.0022,90.0022,
                                 90.0026,90.0026,90.002,90.0022,90.0025,
                                 90.002,90.0021,90.001,90.0012,90.0009,
                                 89.9998,89.9993,89.9974,89.9958,89.9958
                                 ,89.9942,89.9937,89.9933,89.9925,
                                 89.9909,89.9901,89.989,89.9734,91.0013,
                                 91.0064,90.9943,90.9923,90.9895,90.989,
                                 90.9864,90.9842,90.9824,90.9827,90.9827
                                 ,90.9816,90.9802,90.9783,90.9743,
                                 90.9743,90.9726,90.9733,90.9727,90.9708
                                 ,90.9696,90.9701,90.9696,90.9678,
                                 90.9637,90.9636,90.9613,90.9605,90.9601
                                 ,90.96,90.9595,90.9595,90.9599,90.9595,
                                 90.9592,90.9582,90.9586,90.9625,90.9629
                                 ,90.9631,90.9617,90.959,90.9573,90.9571
                                 ,90.9581,90.9592,90.9571,90.9598,
                                 90.9601,90.9631,90.9632,90.964,90.9646,
                                 90.9649,90.9656,90.9671,90.9664,90.9662
                                 ,90.9662)
```

HRSC Level4: PDS Label

```
ORBIT_NUMBER  =  10
ORBITAL_ECCENTRICITY  =  0.717
ORBITAL_INCLINATION  =  86.63
ORBITAL_SEMIMAJOR_AXIS  =  12956.1
PERIAPSIS_ALTITUDE  =  274.15
PERIAPSIS_ARGUMENT_ANGLE  =  357.88
PERIAPSIS_TIME  =  2004-01-10T14:03:56.000Z
SPACECRAFT_ORIENTATION  =  (0.0,1.0,0.0)
^MEX_ORIENTATION_DESC  =  "MEX_ORIENTATION_DESC.TXT"
SPACECRAFT_POINTING_MODE  =  NADIR
^MEX_POINTING_DESC  =  "MEX_POINTING_DESC.TXT"
RIGHT_ASCENSION  =  -1e+32
DECLINATION  =  -1e+32
OFFSET_ANGLE  =  -1e+32
SPACECRAFT_SOLAR_DISTANCE  =  2.22398e+08
TARGET_NAME  =  MARS

/* CAMERA DATA ELEMENTS */

   DETECTOR_TEMPERATURE  =  18.3705 <degC>
   FOCAL_PLANE_TEMPERATURE  =  9.195 <degC>
   INST_CMPRS_NAME  =  "DISCRETE COSINE TRANSFORMATION (DCT)"
   INST_CMPRS_RATIO  =  19.6744
   INST_CMPRS_QUALITY  =  4
   INST_CMPRS_QUANTZ_TBL_ID  =  0
   INSTRUMENT_TEMPERATURE  =  13.0691 <degC>
   LENS_TEMPERATURE  =  9.3989 <degC>
   MACROPIXEL_SIZE  =  1
   MISSING_FRAMES  =  0
   PIXEL_SUBSAMPLING_FLAG  =  N
   SIGNAL_CHAIN_ID  =  0

/* RADIOMETRIC DATA ELEMENTS */

   BANDWIDTH  =  177.0 <nm>
   CENTER_FILTER_WAVELENGTH  =  677.5 <nm>
   RADIANCE_OFFSET  =  5.19192 <W*m**-2*sr**-1>
   RADIANCE_SCALING_FACTOR  =  0.0209549 <W*m**-2*sr**-1>
   REFLECTANCE_SCALING_FACTOR  =  0.000550593
   MEX:REFLECTANCE_OFFSET  =  0.136418
```

```
/* DIGITAL TERRAIN MODEL DEFINITIONS */

   GROUP  =  MEX:DTM
   MEX:DTM_A_AXIS_RADIUS  =  -1e+32
   MEX:DTM_B_AXIS_RADIUS  =  -1e+32
   MEX:DTM_C_AXIS_RADIUS  =  -1e+32
   MEX:DTM_DESC  =  "N/A"
   MEX:DTM_MISSING_DN  =  -2147483648
   MEX:DTM_OFFSET  =  -1e+32
   MEX:DTM_SCALING_FACTOR  =  -1e+32
   END_GROUP  =  MEX:DTM

/* DATA OBJECT DEFINITIONS */

  OBJECT = IMAGE
     INTERCHANGE_FORMAT  =  BINARY
     LINES  =  16216
     LINE_SAMPLES  =  4448
     SAMPLE_TYPE  =  UNSIGNED_INTEGER
     SAMPLE_BITS  =  8
     BANDS  =  1
     BAND_STORAGE_TYPE  =  BAND_SEQUENTIAL
     MINIMUM  =  126
     MAXIMUM  =  296
     MEAN  =  227.783
     STANDARD_DEVIATION  =  28.9402

  END_OBJECT = IMAGE
```

HRSC Level4: PDS Label

```
/* MAP OBJECT DEFINITIONS */

  OBJECT = IMAGE_MAP_PROJECTION
     ^DATA_SET_MAP_PROJECTION_CATALOG  =  "DSMAP.CAT"
     A_AXIS_RADIUS  =  3396.0 <km>
     B_AXIS_RADIUS  =  3396.0 <km>
     C_AXIS_RADIUS  =  3396.0 <km>
     CENTER_LATITUDE  =  0.0
     CENTER_LONGITUDE  =  90.0
     COORDINATE_SYSTEM_NAME  =  PLANETOCENTRIC
     COORDINATE_SYSTEM_TYPE  =  "BODY-FIXED ROTATING"
     EASTERNMOST_LONGITUDE  =  91.0064
     FIRST_STANDARD_PARALLEL  =  "N/A"
     LINE_FIRST_PIXEL  =  1
     LINE_LAST_PIXEL  =  16216
     LINE_PROJECTION_OFFSET  =  -4454.1
     MAP_PROJECTION_ROTATION  =  0.0
     MAP_PROJECTION_TYPE  =  SINUSOIDAL
     MAP_RESOLUTION  =  4741.71043093333 <pixel/degree>
     MAP_SCALE  =  0.0125 <km/pixel>
     MAXIMUM_LATITUDE  =  5.99029
     MINIMUM_LATITUDE  =  -7.58311
     POSITIVE_LONGITUDE_DIRECTION  =  EAST
     REFERENCE_LATITUDE  =  "N/A"
     REFERENCE_LONGITUDE  =  "N/A"
     SAMPLE_FIRST_PIXEL  =  1
     SAMPLE_LAST_PIXEL  =  4448
     SAMPLE_PROJECTION_OFFSET  =  -51.3
     SECOND_STANDARD_PARALLEL  =  "N/A"
     WESTERNMOST_LONGITUDE  =  89.9734

  END_OBJECT = IMAGE_MAP_PROJECTION
```

MAP PROJECTION LABELS

```
/* IMAGE HEADER DATA ELEMENTS */

  OBJECT = IMAGE_HEADER
     HEADER_TYPE  =  VICAR2
     INTERCHANGE_FORMAT  =  ASCII
     BYTES  =  8896
     ^DESCRIPTION  =  "VICAR2.TXT"

  END_OBJECT = IMAGE_HEADER
END
```

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