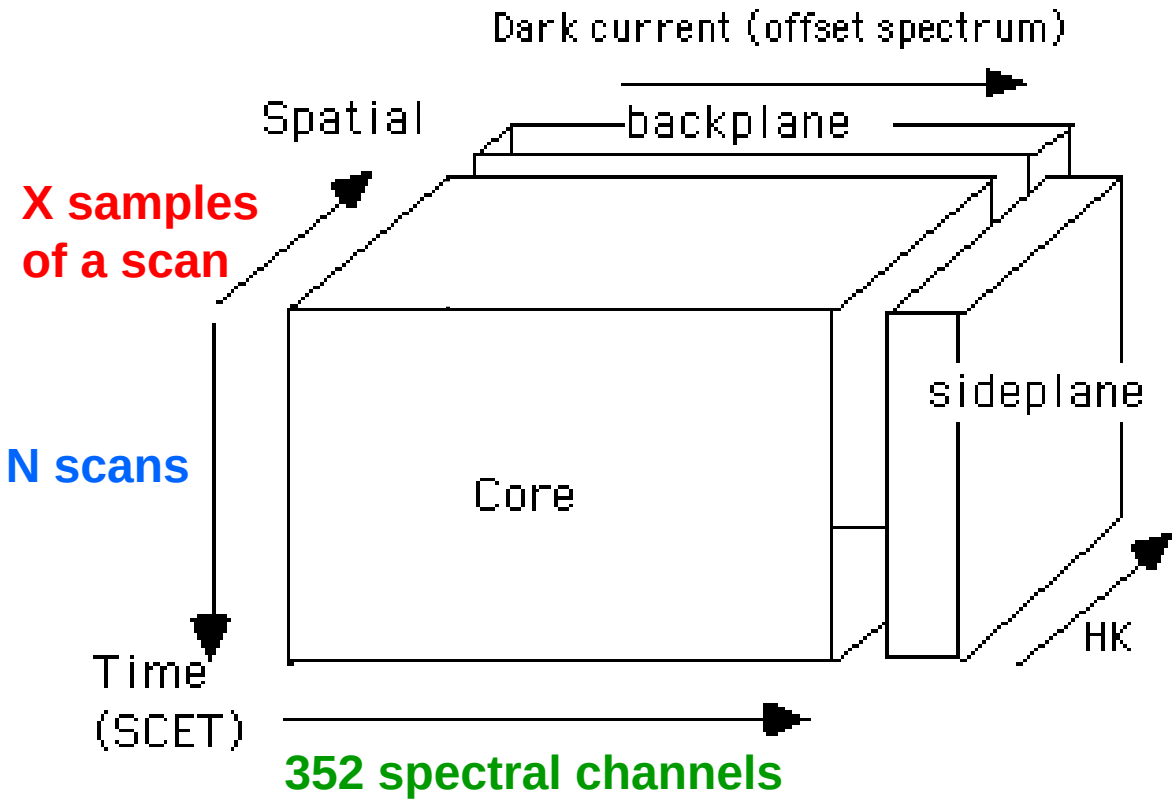
# OMEGA DATA SET AND ARCHIVE

- **Access through the Planetary Science Archive at ESTEC with a mirror in the PDS data base**
- **availability : 6 month period + 6 months**
  **first 6 months set (orbits 1 to 599) : end of January, 2005**
  **second 6 months set (orbits to 1300) : end of July, 2005**
- **The data and tools available to the « wide science community » will be identical to that available to CoI's during the proprietary period**
- **Basic policy :**
  - **no « final truth » calibrated data set (level 2)**
  - **level 1B is the prime data set, with associated geometry cubes (for each pixel: longitude, latitude, incidence, emergence, phase, distance, MOLA altitude)**
  - **reduction software to level 2 is provided (IDL)**

# STRUCTURE OF THE PSA OMEGA ARCHIVE
## (PDS COMPLIANT)

```
ROOT |
     |- AAREADME.TXT
     |- VOLDESC.CAT
     |- CATALOG
     |    |
     |    |- CATINFO.TXT     PDS catalog
     |    |- MISSION.CAT
     |    |- INSTHOST.CAT     references
     |    |- INSTRUMENT.CAT
     |    |- REF.CAT
     |
     |- DOCUMENT
     |    |
     |    |- DOCINFO.TXT     Overview
     |    |- OMEGA_EAICD.HTM
     |    |- OMEGA_EAICD_FIG1.PS
     |    |- OMEGA_EAICD_FIG2.PS
     |    |- OMEGA_EAICD_FIG3.PS
     |    |- OMEGA_EAICD.PDF
     |    |- OMEGA_DESC.TXT
     |    |- OMEGA_HK.TXT
     |    |- OMEGA_CALIBRATION.TXT
     |
     |- INDEX
     |    |
     |    |- INDXINFO.TXT    Overview of directory
     |    |- INDEX.LBL       Label to INDEX.TAB
     |    |- INDEX.TAB       List of data file contents
     |
     |- SOFTWARE
     |    | SOFT01.LBL
     |    | SOFT01.ZIP
     |    | SOFTNN.LBL
     |    | SOFTNN.ZIP
     |
     |- DATA
     |    | ORB00
     |    | ORB01
     |    | .....
     |    | ORBNN
     |    | GEM00
     |    | GEM01
     |    | .....
     |    | GEMNN
```

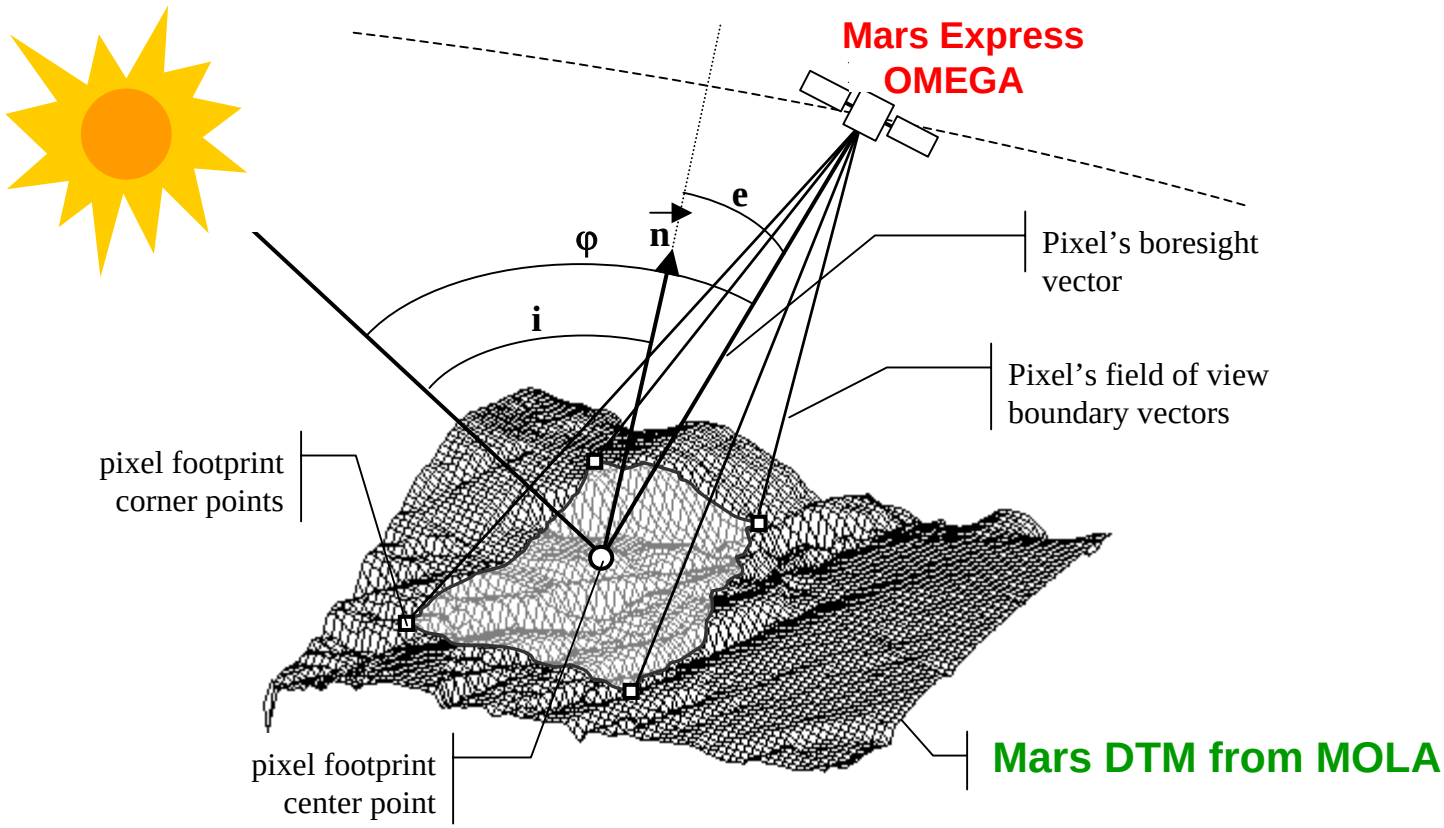
# OMEGA SCIENCE DATA CUBE (ORBNNNN_M.QUB)




**One cube for each observation: fixed set of parameters**
**(scan length, integration time, downtrack summing…)**

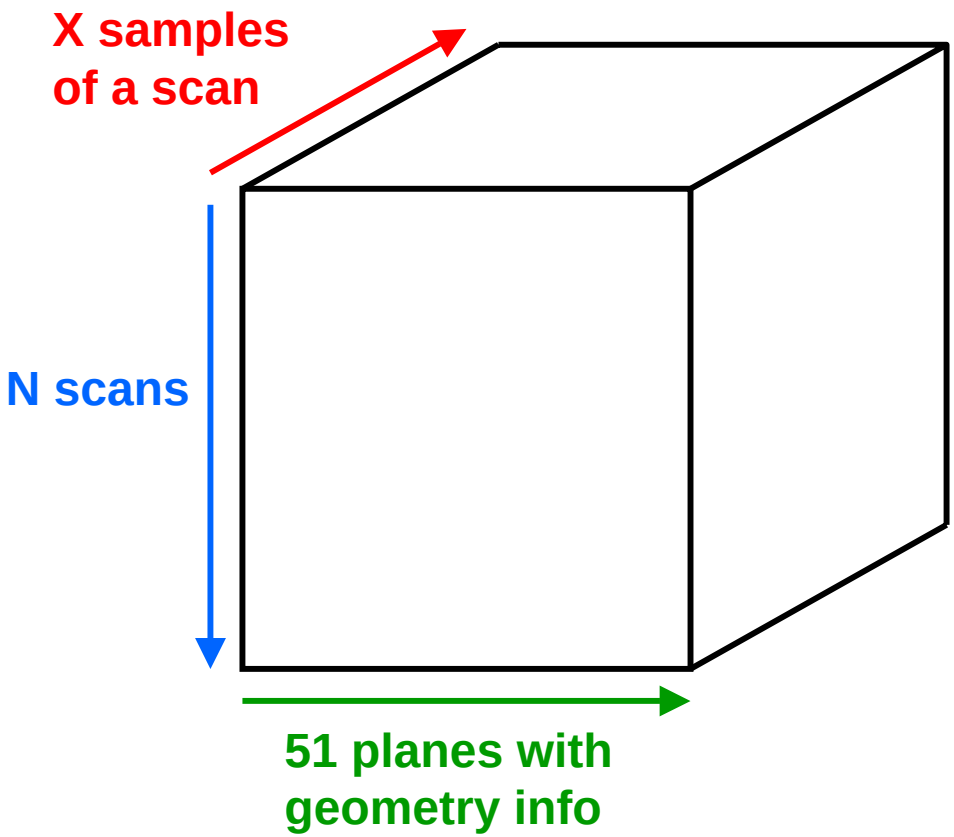
**Typically 4 to 7 cubes for orbit NNNN (ORBNNNN_0, ORBNNNN_1, ….)**
**Calibration data for the VIS channel at the beginning of each cube**
**Calibration data for the IR channel at the beginning of cube ORBNNNN_0**

# Overview of the pixel observation geometry of OMEGA



# OMEGA GEOMETRY CUBE (ORBNNNN_M.NAV)

X and N (spatial axes) are eqal to that of the data cube




Information on position (longitude, latitude), photometric parameters (incidence, emergence, phase), slant distance,
altitude of the intersection with the MOLA reference surface
altitude + 65.536 km of the closest approach for limb observations

POSITIONS ARE DERIVED FROM SPICE KERNELS. FINE TUNING IS REQUIRED

# THE OMEGA REDUCTION SOFTWARE (IDL)

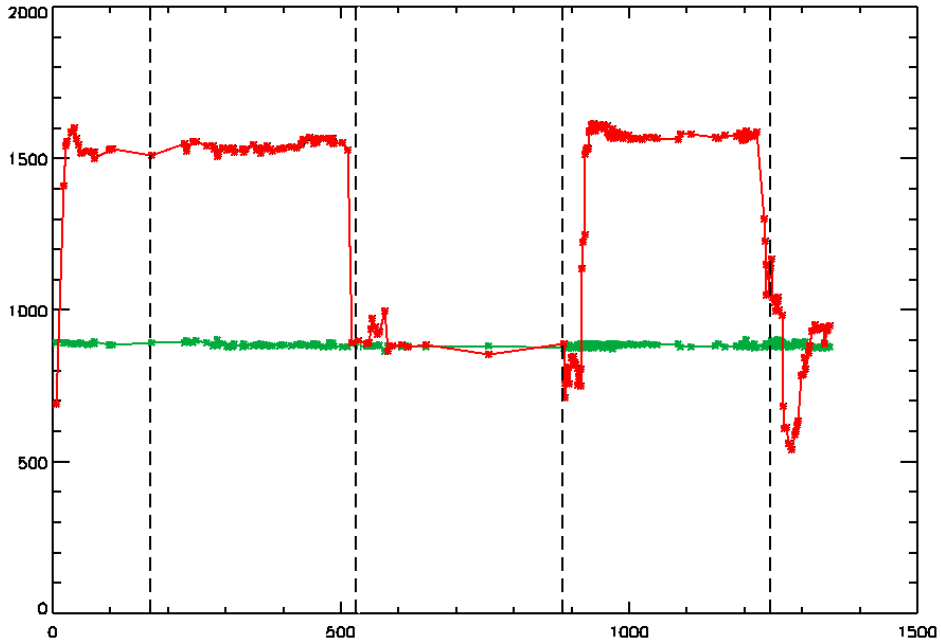
- provided as a ZIP file in the SOFTWARE directory (revisions: SOFT00.ZIP, SOFT01.ZIP..)
- unzipping the latest ZIP file creates a subdirectory SOFTNN
- all files from the SOFTNN subdirectory must be copied to the working directory
  A users' guide and information on updates is provided in SOFTNN_readme.txt
- omega_path must be edited so as to point to the proper directories
  for the QUB and NAV files respectively (which can be the same)
  the path must end with a \ for windows, with a / for linux
- a QUB file and its NAV file can then be read by typing:
  IDL *(CR)*
  IDL> .run readomega *(CR)*
  OMEGA observation: ORBNNNN_M *(CR)* (name without the extension)
- readomega compiles required procedures, then creates the following arrays

| | |
|---|---|
| idat: raw data | sdat0: dark current and offset |
| jdat: radiance | dat1: housekeeping info |
| specmars: solar spectrum ($\rightarrow$ I/F) | wvl: table of wavelengths |
| geocube: geometry information | mtf: photometric function |
| exposure: 3 values (C, L, Vis) | summation: co-added successive scans |

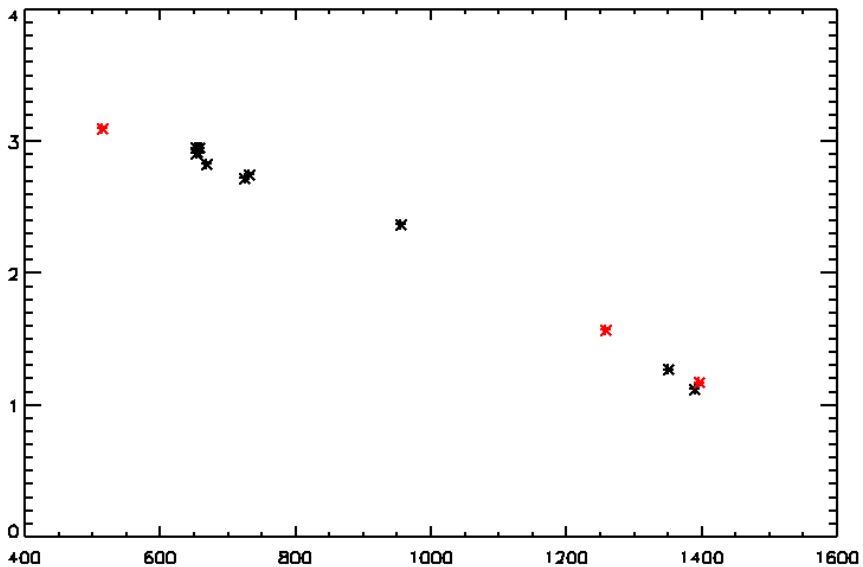
- detailed information on the content of these arrays is provided in the EAICD

# EVOLUTION OF THE L CHANNEL (128 to 255, 2.53 µm to 5.1 µm)

- Internal cal level is very stable for the C channel
- variations by more than a factor of 2 for the L channel over 1 year of operations
- lesser impact for the signal from Mars
- the photometric function for the L channel applies only to high level regions (close to ground calibration levels):
  - orbits 0018 to 0500
  - orbits 0905 to 1206




Level of internal cal, spectel 102 (green, C) and 165 (red, L)



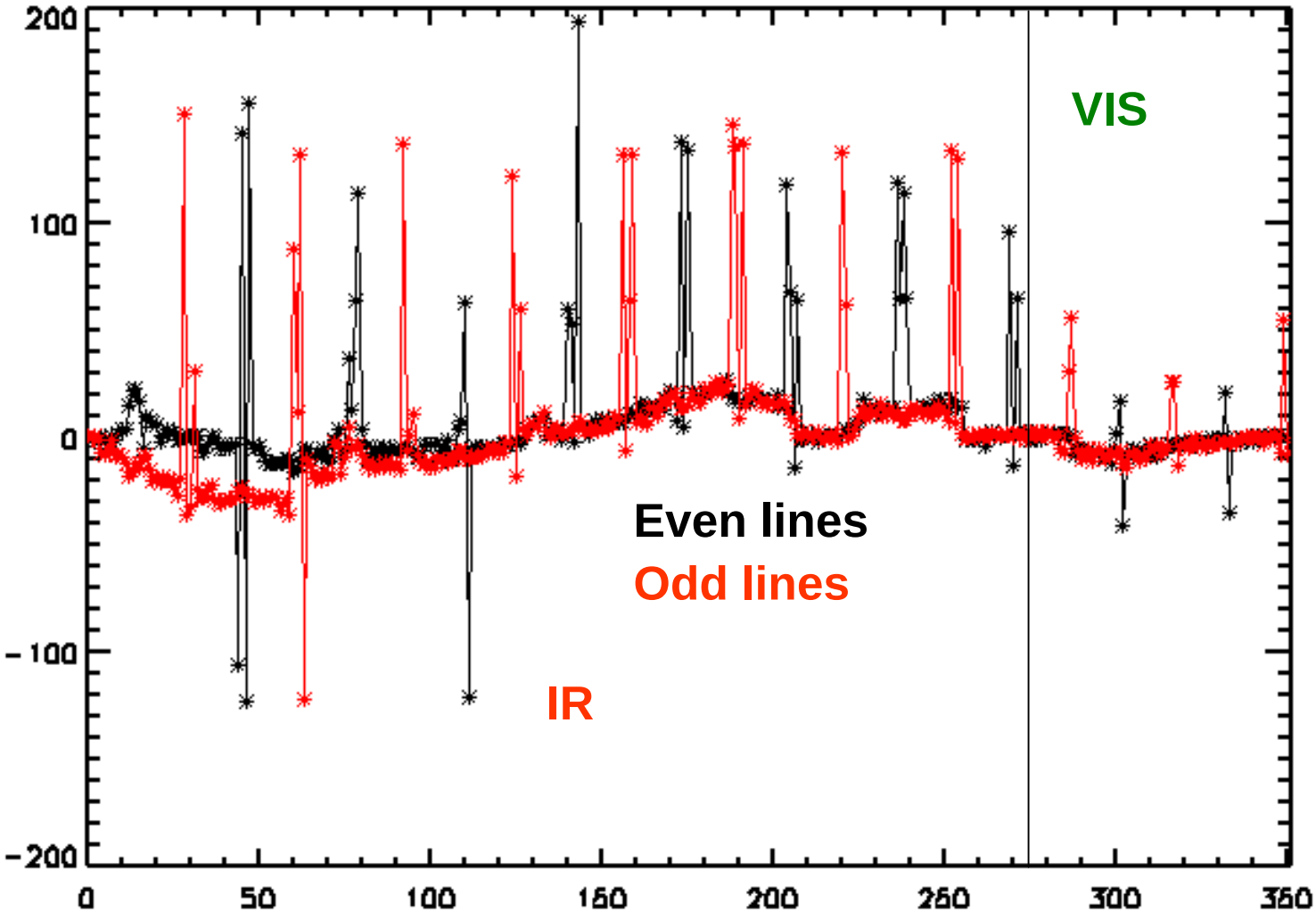

C to L angular distance / level of the internal cal

- the C to L angular distance (nominally ~ 1 pixel = 1.2 mrad) increases up to 3 mrad (nearly 3 pixels) for low levels of the internal calibration

C to L co-registration is required so as to obtain a reliable full spectrum

common reference: MOLA DTM (provided in geocube)

# SPURIOUS VALUES FOR PIXELS 80-95 (128 pixel modes) FOR SOME WAVELENGTHS SINCE ORBIT 0513




Difference between pixel 80 and pixel 79

# DARK CURRENT AND SATURATION (IR)

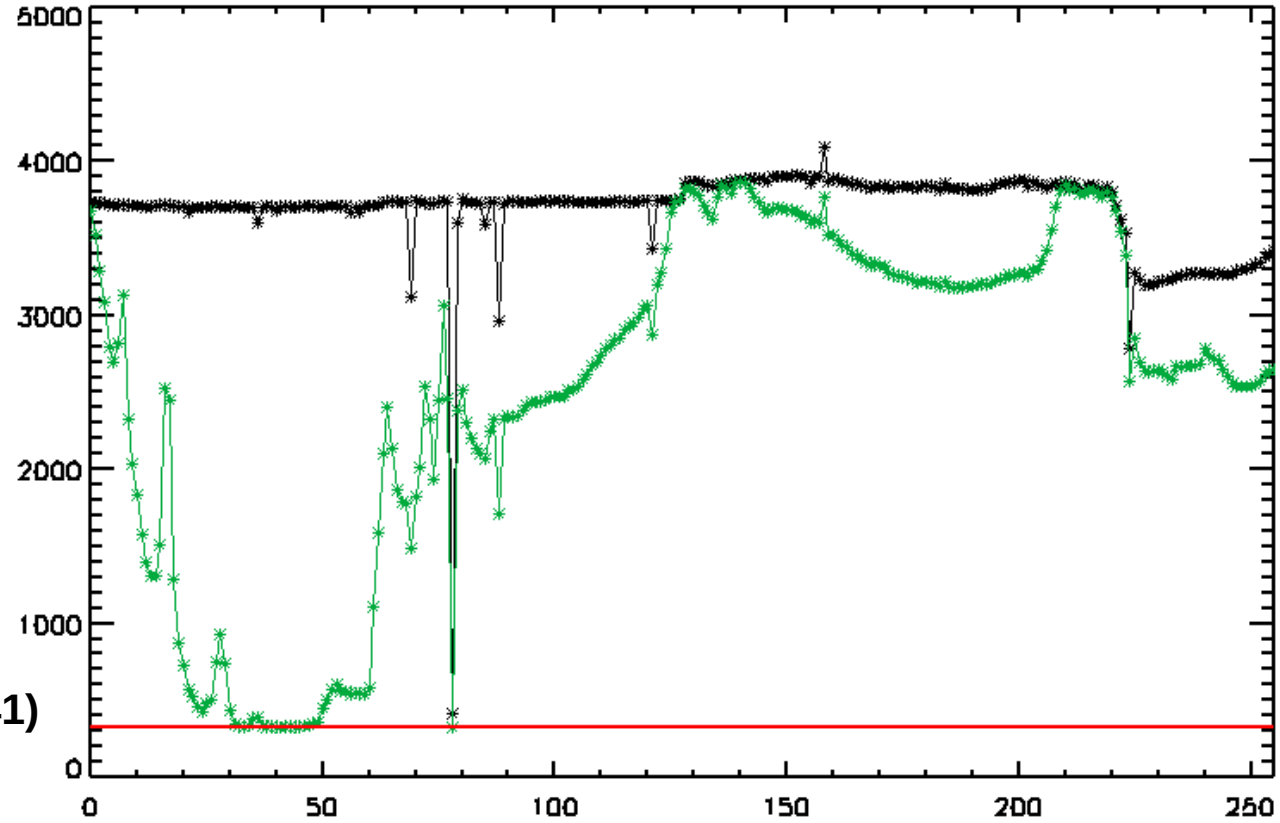
- OMEGA uses a « pre-charge » design
  black: sdat0(0:255,n)

- dead and hot spectels: low pre-charge levels

- photons reduce charge:
  raw signal (green) is lower than pre-charge

  idat = pre-charge - raw

  saturated level: ~ 327 DN
  (most vulnerable: spectel 41)




- Saturation reveals itself as a spurious absorption close to 1.5 µm
  this can be checked by plotting sdat0(0:255,n) – idat(i,0:255,n)
  if the raw signal reaches values in the 330 range, the signal is saturated

- there is some hysteresis at near saturation, which impacts the value of the dark current for 16 pixel modes

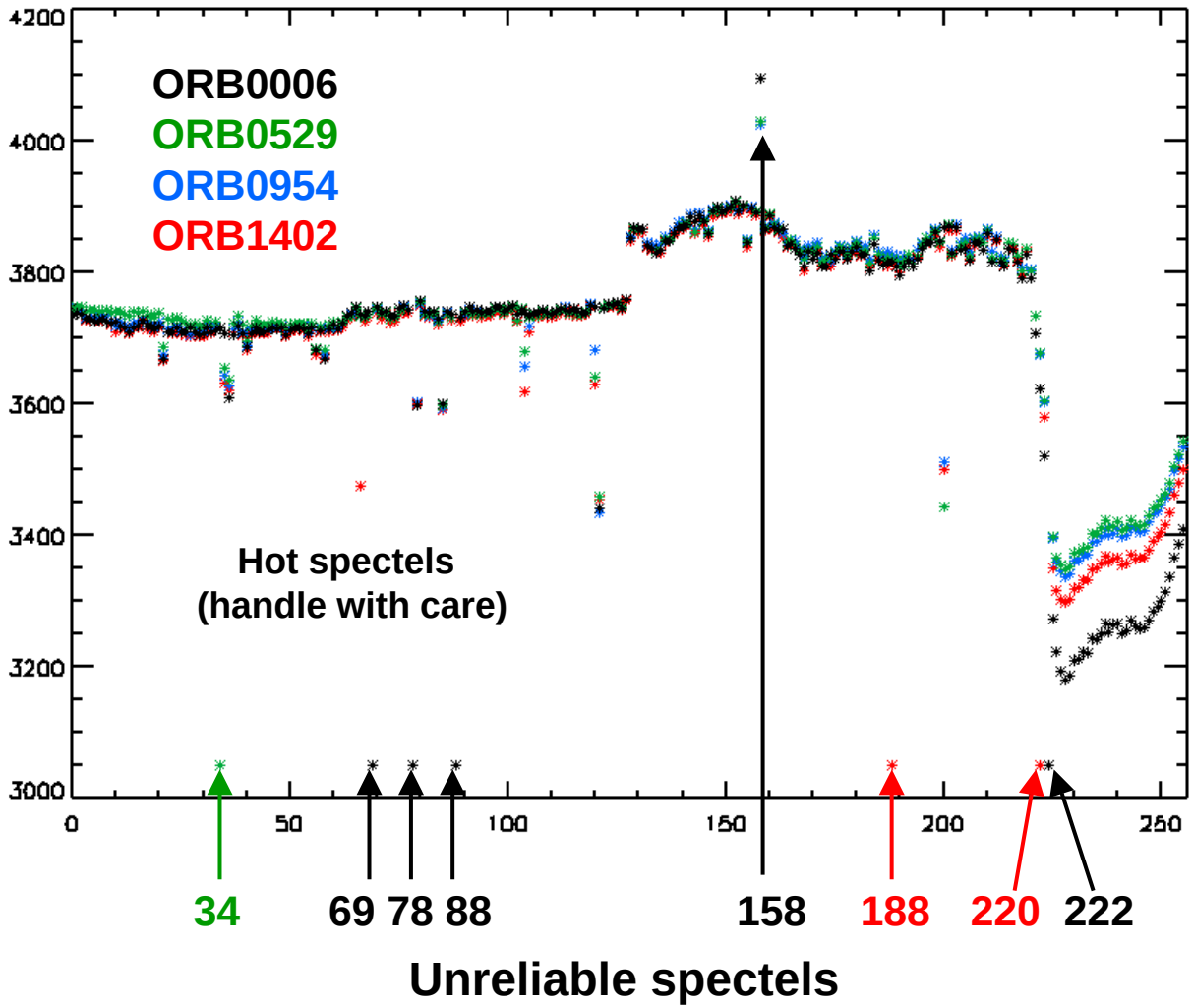
# DEAD AND HOT PIXELS: EVOLUTION WITH TIME

- **Hot and dead spectels are not (fully) reliable.**
- **They increase over time due to detector degradation**
- **sdat0 must be checked regularly**

**5 spectels have been dead hot or cold (158) since the beginning**

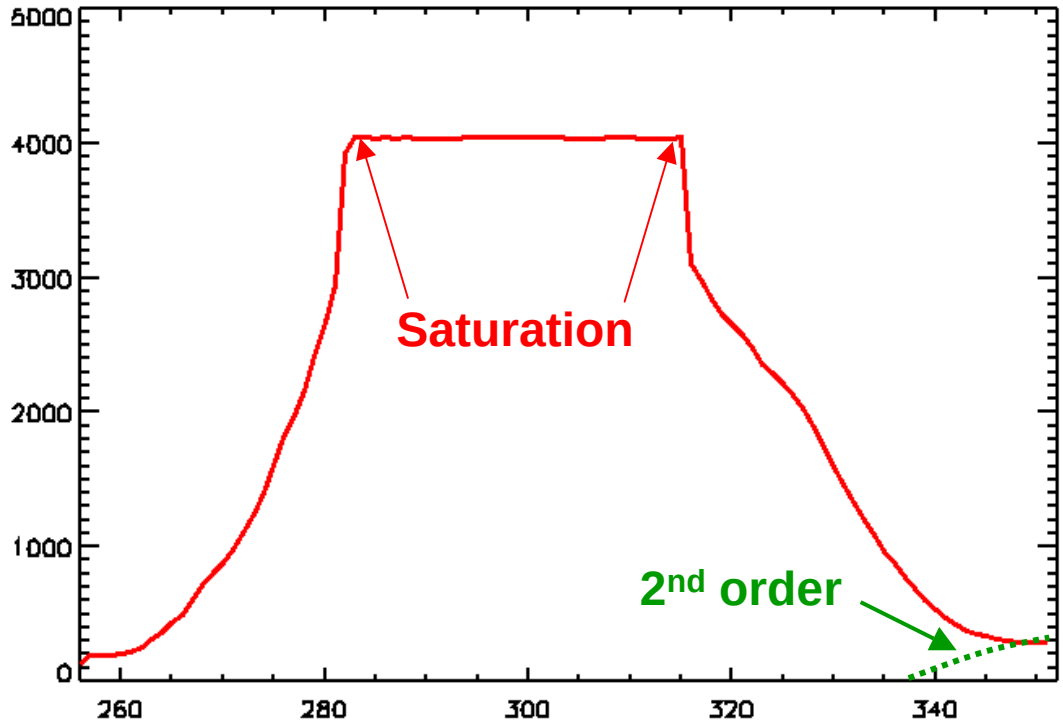
**Cosmic ray degradation resulted in the loss of 3 additional spectels: 34 since orbit 0432 188 very recently (1402)**

**new hot spectels (lower by < 100 DN) can still be used in spectral ratios, but the photometric function has changed → « spikes » in jdat**



# VISIBLE CHANNEL: FLAT FIELD, 2nd ORDER, SATURATION

- a flat field must be applied as there are 128 rows of 96 spectels
- The visible channel reaches physical saturation (4040 DN) close to digital saturation (4095 DN)
- idat can be larger for modes with 128 pixels (summation by 2 in the VIS channel + possible summation of 2 or 4 successive scans : « summation » parameter )
- The PSF is large (~ 4 pixels) in the cross-track direction
- Offset by ~ 4 pixels and 4 lines relative to the C channel (IR)




A second order contribution is observed beyond spectel 335 (0.95 µm)

« readomega » takes care of the VIS flat-field, second order and summation

There are still some cross-calibration problems between the VIS and IR channels

# LINEARITY ISSUES AND CONFIDENCE LEVELS

## OMEGA, in particular the IR channel can provide S/N > 1000

- even minor instrumental effects are prominent
- there is a non linearity at a level of a few % which changes with time
- a given spectral ratio can slightly vary with illumination (idat level) as well as from actual mineralogical variations
- ratios of spectra at similar idat levels can confirm identifications