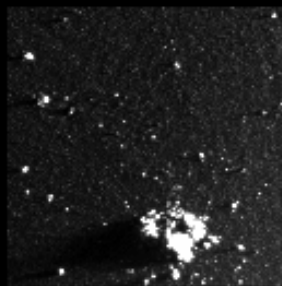


COSIMA Archive Review

Eberhard Grün



COSIMA Data Archive

RO-C-COSIMA-3-V2.0 Archive

18.1 GB, 77 directories, 28770 files

- **CATALOG directory**
description of mission, instrument, data set, persons, references
- **DATA directory**
with 72 sub directories, one for each target. Here, I specifically looked at:
 - **SUB_2D0**, 2.2 GB, 8462 files
- **DOCUMENT directory**
COSIMA paper files
- **INDEX directory**
index table for each data product
- **LABEL directory**
format descriptions

COSIMA PSA ICD

(FMI_S-COS-ICD-001-AD-05)

Main Level 2 (Reformatted Data Record) products are:

- Time-of-flight spectra, with automatically calibrated mass scale and relevant housekeeping data.
- Onboard calculated peak list and relevant housekeeping data. The spectrum is given as counts per integer mass lines, separated to organic and in-organic masses.
- Scan over substrate position or some measurement control parameter and relevant housekeeping data.
- Substrate images.
- Onboard calculated substrate dust grain feature (position, size, brightness) lists and relevant housekeeping data.
- HK data for the spectra and images is given in already calibrated form.

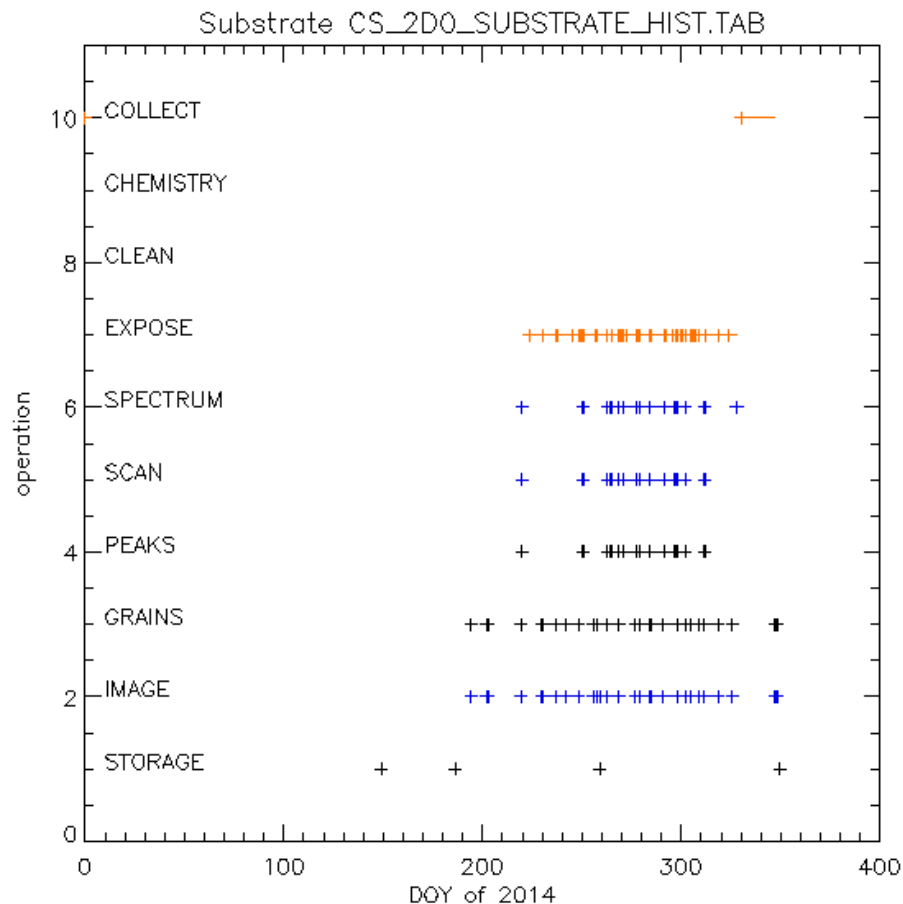
No Level 3 products (calibrated mass scales, dead-time corrections, calibration data) are provided!

COSIMA Operations Overview

DATASET.CAT:

- From 2014-08 onward the D0 substrates were used to collect dust
- From 2014-10-23 onward due to an instrument failure, the SIMS data became scientifically unusable
- From mid 2014-12 CF substrates were exposed
- From mid 2015-02 C7 substrates were exposed.

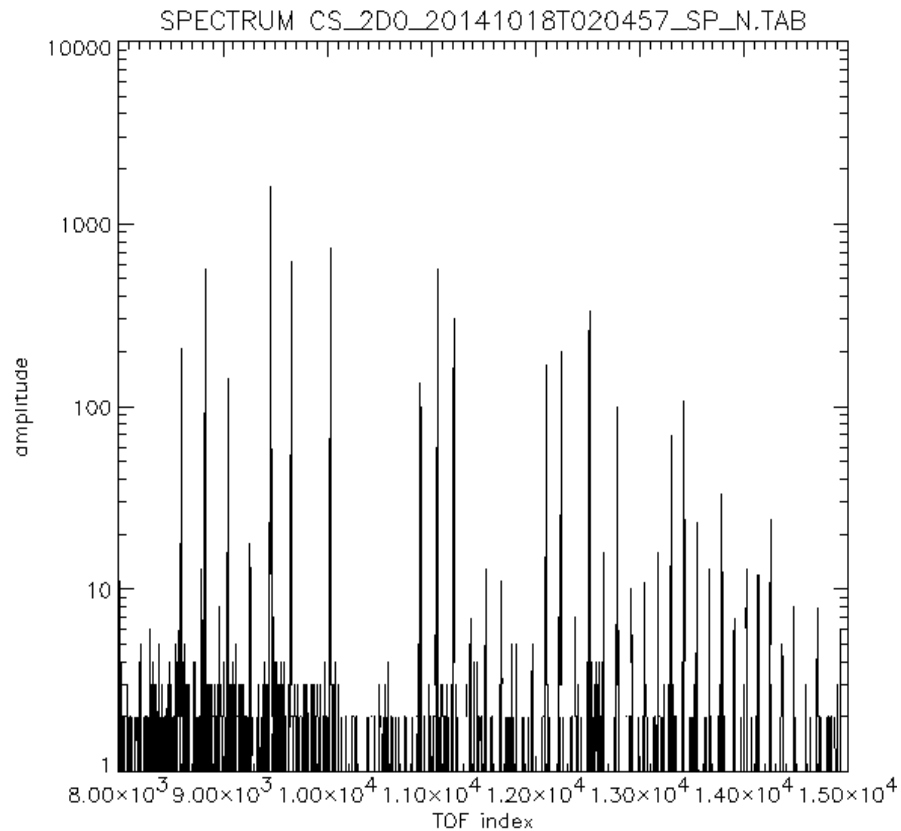
Substrate CS_2D0 Activities



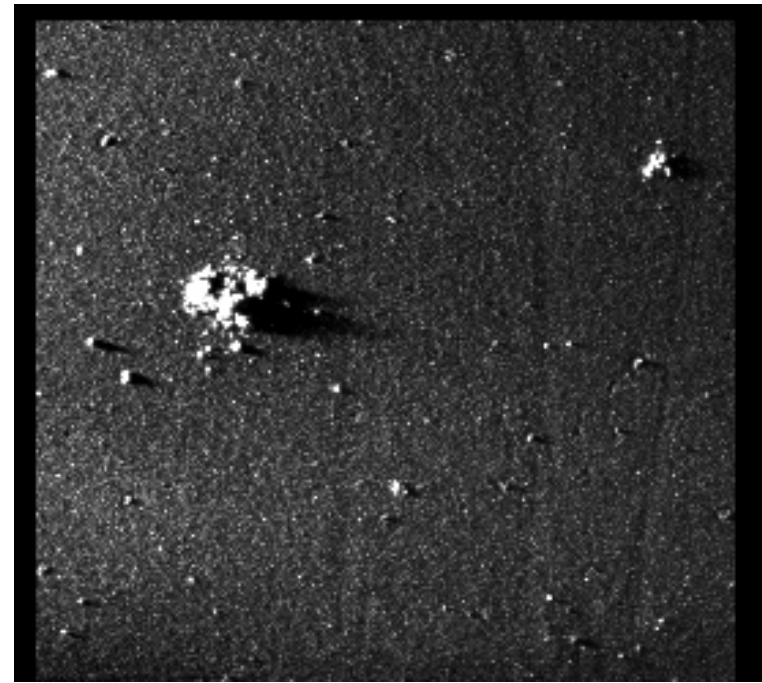
- Dust collection: COLLECT, EXPOSE
- Composition measurement: SPECTRUM, SCAN
- COSISCOPE imaging: IMAGE
- Preliminary on-board evaluations:
Peak lists: PEAKS
Grain lists: GRAINS

Principal COSIMA Data Products

TOF spectra



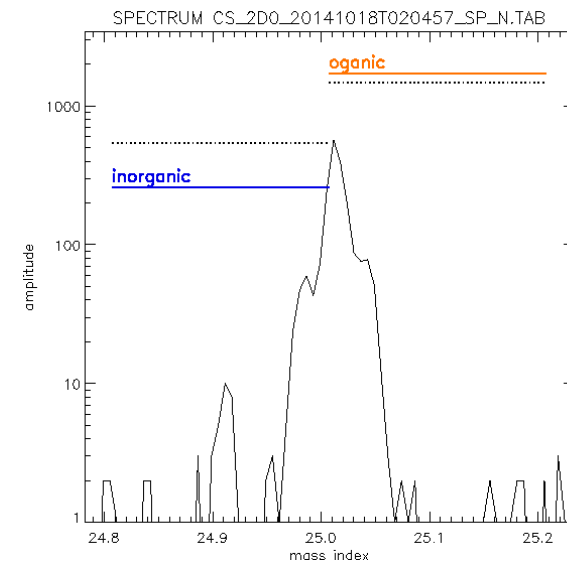
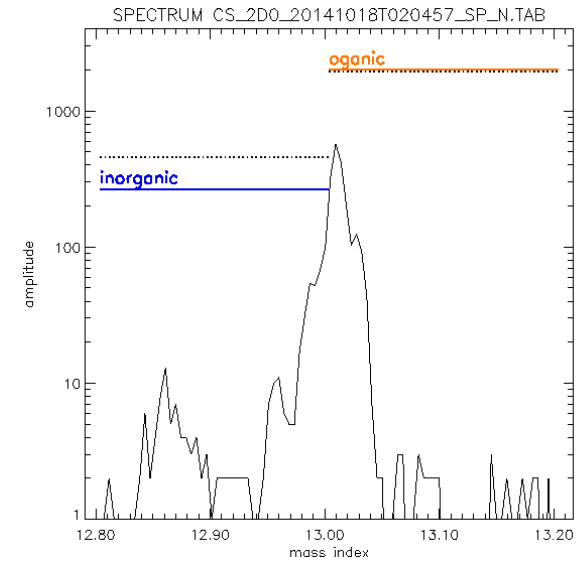
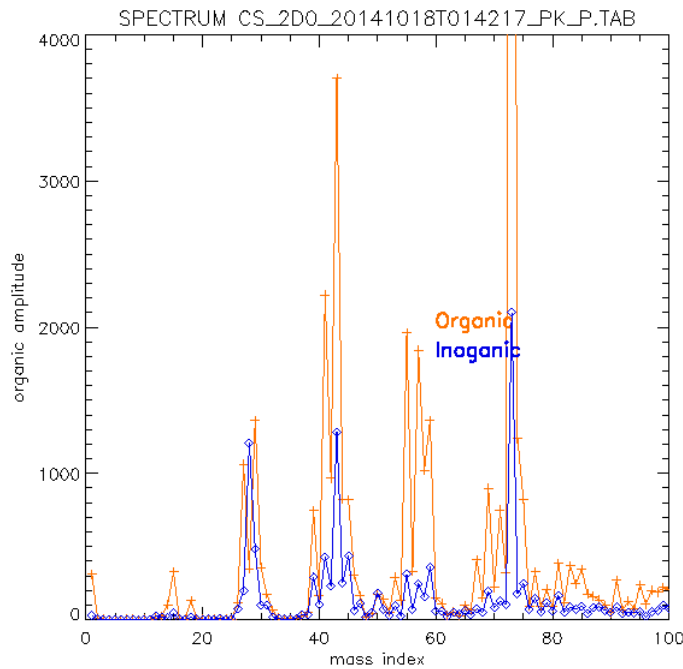
COSISCOPE images



CS_2D0_20141031T114844_IM_M.FIT

Informative COSIMA Data Products 1

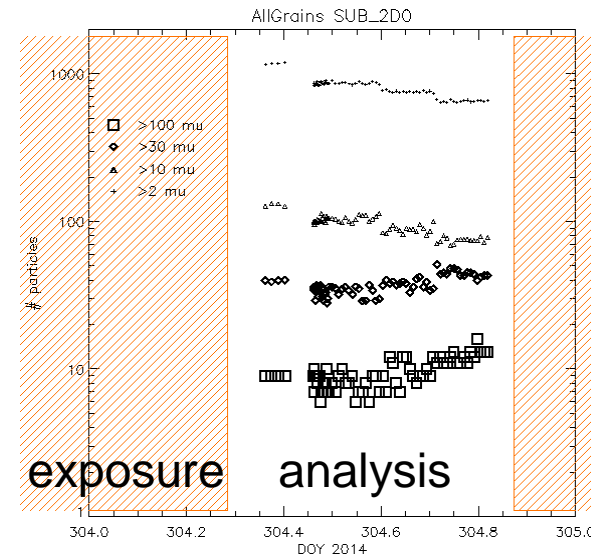
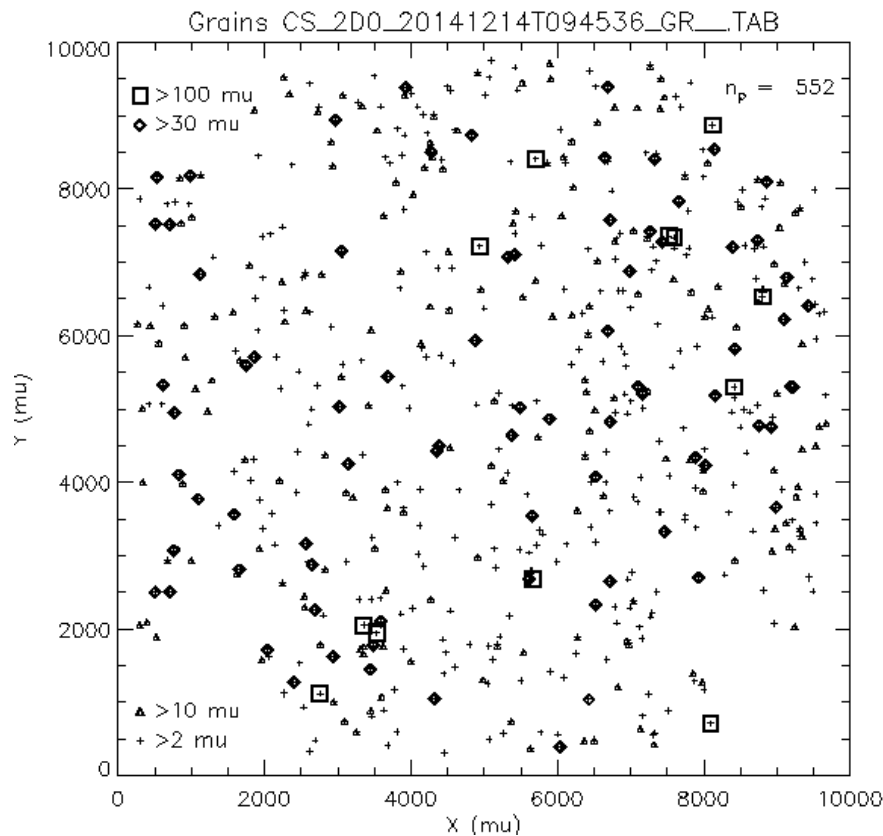
Peak lists from automatic mass scales
and organic/inorganic separation



Not for scientific analysis!

Informative COSIMA Data Products 2

Grain grain lists



Repeated grain counts vary greatly, depending on target positioning and illumination

Not for scientific analysis!

Recommendations

PSA	1.	Ancillary data: not just SPICE	Major
CS	1.	Collector Aperture Geometry	Major
CS	2.	Calibration: Mass scale and dead time correction	Major
CS	3.	Composition Calibration	Major
CS	4.	Completeness of images	Major
CS	5.	Particle Name List	Major
CS	6.	Conditions During Image Taking	Editorial
CS	7.	Test images	Editorial
CS	8.	Consistent labeling of grain lists	Editorial

PSA 1. Ancillary data: not just SPICE

Rosetta results appeal to space researcher, astronomers, cosmophysicists, and cosmo-chemists. Only the former are familiar with SPICE software.

Comparing dust data from COSIMA, GIADA, MIDAS, RPC, and OSIRIS requires that one has a good understanding of the corresponding observation geometries.

SPICE is a powerful tool kit to get orbit and attitude information for Rosetta and most other space missions. But in order to make use of it expensive software infrastructure (like IDL or Matlab) is needed which is no problem for most space science institutions but for independent scientists (like me) it may not be available.

Even JPL Horizons web site and the Rosetta 3dtool provide ephemerides and other relevant parameters in various formats including plain ASCII tables.

Therefore, it is requested that the Rosetta Science Archive provides orbit attitude, and instrument pointing information in useful and easily accessible form (e.g. ASCII tables) like <http://ssd.jpl.nasa.gov/horizons.cgi>.

RO-AR-RID-ESA/PSA-101-EG

CS 2. Calibration: Mass scale and dead time correction

Interpretation of COSIMA mass spectra requires a precise mass scale and the correction of dead-time effects. The COSIMA Team (Silen et al., and Lehto et al., *Geosci. Instrum. Method. Data Syst. Discuss.*, 2014) is currently developing sophisticated methods to solve both problems.

It is requested that mass spectra calibration and dead-time corrected data are submitted to PSA.

CS 3. Composition Calibration

COSIMA is a specialized instrument with unique characteristics. For calibration the only two laboratory setups in Göttingen and in Orleans have been used by the COSIMA Team:

- spectra of inorganic compounds by Krüger et al., PSS, 2015 and
- spectra of solid organic grains by LeRoy et al., PSS, 2015.

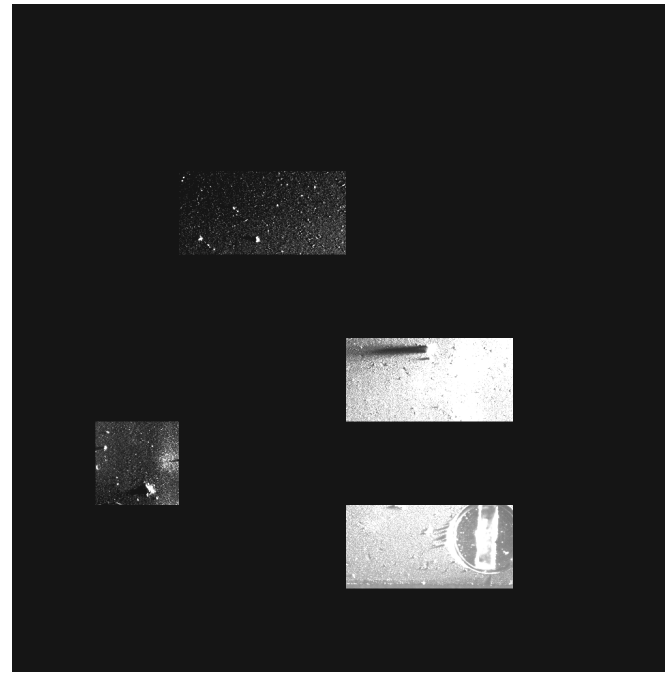
It is requested that these calibration data are submitted to PSA in a similar format as flight data.

CS 4. Completeness of images

CS_2D0_20141213T072140_IM_P.FIT



CS_1D0_20141213T060040_IM_P.FIT



Frequently, only partial images are given without notification which sub-images are contained in the FITS file. It is requested that the image label file (*IM_x.LBL) contain the appropriate information.

RO-AR-RID-COSIMA-104-EG

CS 5. Particle Name List

Papers (e.g. Hilchenbach et al., ApJ, 2016 or Langevin et al., Icarus, 2016) that describe COSIMA results like particle compositions or structural properties identify the grains by names like:

Estelle, Nyle, Veronique, Stefanie, Yuri, Charlotte, Gabriel, Pavel, Donia, Konstantin and others.

These grain names including the collector target, their x, y positions and other properties like type, size, and height should be given in a table.

RO-AR-RID-COSIMA-105-EG

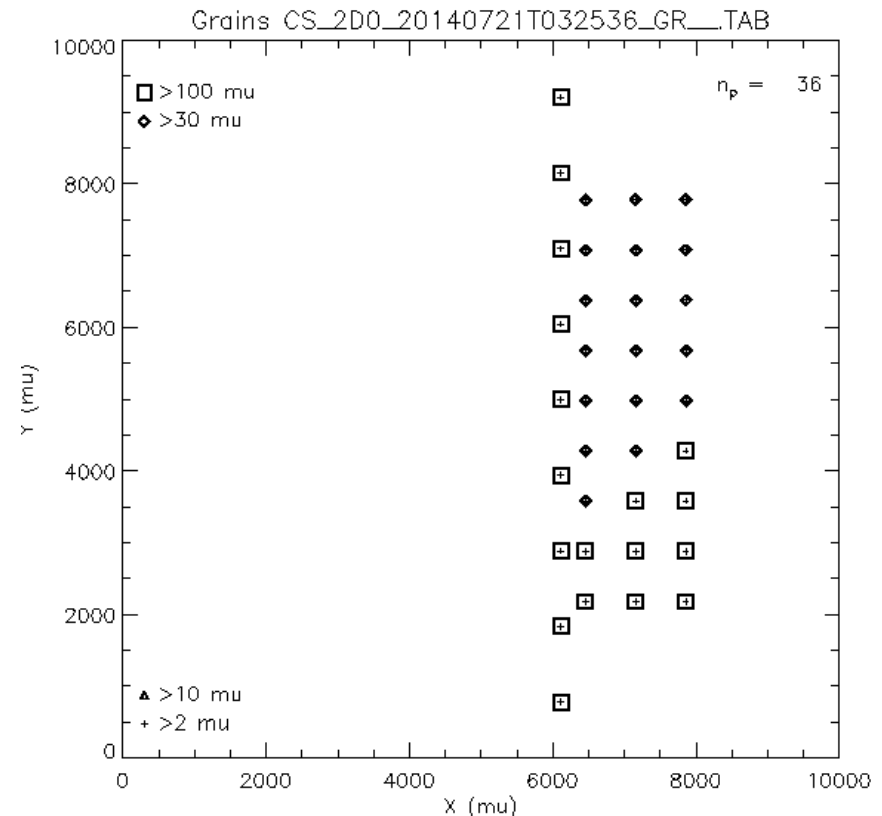
CS 6. Test images

Occasionally particle lists refer to test images:

[CS_2D0_20140721T032536_GR__.TAB](#)

[CS_2D0_20140721T172540_GR__.TAB](#)

Which are not identified in the header or otherwise. Appropriate identification should be given.

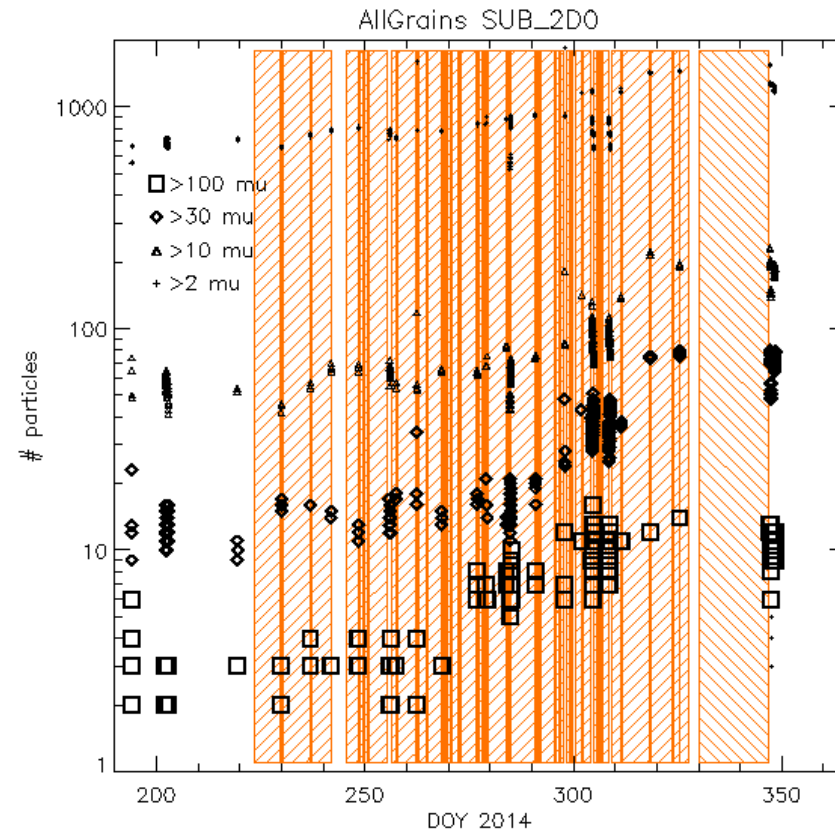


[RO-AR-RID-COSIMA-106-EG](#)

CS 7. Conditions During Image Taking

Analysis of grain lists
GR__.TAB show
significantly varying
numbers of particles due
to different conditions
during image taking
(illumination, substrate
offsets and rotations).
This should be indicated
in the data description.

RO-AR-RID-COSIMA-107-EG



Analysis of grain lists *GR__.TAB
red: exposure and collection periods
black symbols: particle counts for different
sizes

CS 8. Consistent labeling of grain lists

Substrate history data label grain lists sometimes as "GRAINS" sometimes as "IMAGE", cf. CS_2D0_SUBSTRATE_HIST.TAB:

```
2014-10-06T06:59:18,2014-10-06T06:59:43,      24,"  GRAINS",  0,  0, -1,"CS_2D0_20141006T065918_GR_.TAB","CS_2D0_20141006T065918_G_HK.TAB"
2014-10-06T07:07:14,2014-10-06T09:00:14,    6780,"  EXPOSE", -1, -1, -1,"                N/A","                N/A"
2014-10-06T09:00:30,2014-10-10T18:49:11,   380921,"  EXPOSE", -1, -1, -1,"                N/A","                N/A"
2014-10-10T20:41:28,2014-10-10T20:44:06,     157,"  IMAGE",  0,  0, -1,"CS_2D0_20141010T204128_IM_M.LBL","CS_2D0_20141010T204128_G_HK.TAB"
2014-10-10T20:41:28,2014-10-10T20:44:06,     157,"  IMAGE",  0,  0, -1,"CS_2D0_20141010T204128_IM_P.LBL","CS_2D0_20141010T204128_G_HK.TAB"
2014-10-10T20:41:28,2014-10-10T20:44:06,     157,"  IMAGE",  0,  0, -1,"CS_2D0_20141010T204128_GR_.TAB","CS_2D0_20141010T204128_G_HK.TAB"
2014-10-10T20:59:36,2014-10-10T21:02:14,     157,"  IMAGE",  0,  0, -1,"CS_2D0_20141010T205936_IM_M.LBL","CS_2D0_20141010T205936_G_HK.TAB"
2014-10-10T20:59:36,2014-10-10T21:02:14,     157,"  IMAGE",  0,  0, -1,"CS_2D0_20141010T205936_IM_P.LBL","CS_2D0_20141010T205936_G_HK.TAB"
2014-10-10T20:59:36,2014-10-10T21:02:14,     157,"  IMAGE",  0,  0, -1,"CS_2D0_20141010T205936_GR_.TAB","CS_2D0_20141010T205936_G_HK.TAB"
```

This needs to be explained or corrected.

RO-AR-RID-COSIMA-108-EG

Completeness and scientific integrity of the COSIMA data sets

- Data quality: only reformatted raw data is provided, except for HK data
- Data processing level: 2 (REFDR)
- Usage of proper units: only HK data
- Documentation of provided data is mostly sufficient for data processing
- Needs of the scientific community are not met because no calibrated data is provided
- Cross-instrument and cross-mission data analysis is strongly handicapped because no easily readable orbit, attitude, and instrument pointing information is available.