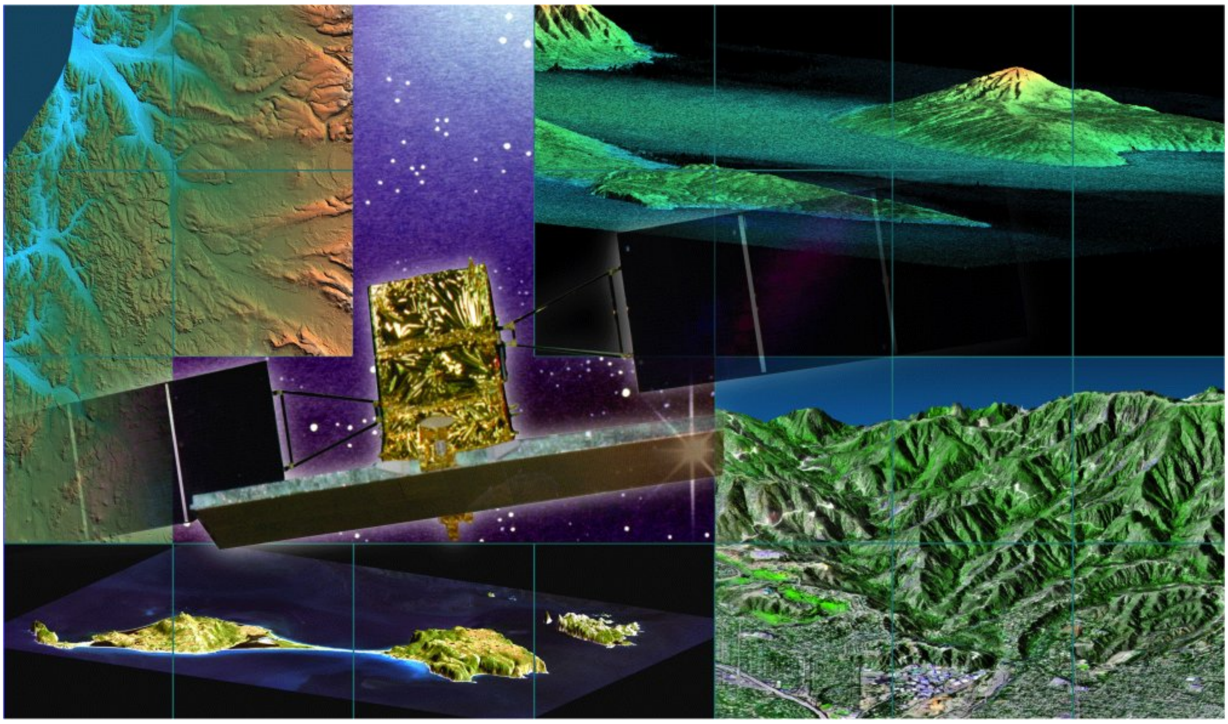
Italian Space Agency

COSMO-SkyMed Mission

COSMO-SkyMed SAR Products Handbook



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1 Scope of the Document

Scope of the Document is to provide COSMO-SkyMed System Users with a SAR Product Handbook giving a quite detailed description of the COSMO SAR Products.

2 COSMO-SkyMed SAR Products Overview

This chapter, after a brief summary of the COSMO-SkyMed SAR Measuring Modes, describes the three major classes of COSMO-SkyMed SAR products and the related products tree.

2.1 The COSMO-SkyMed SAR Mesurement Modes

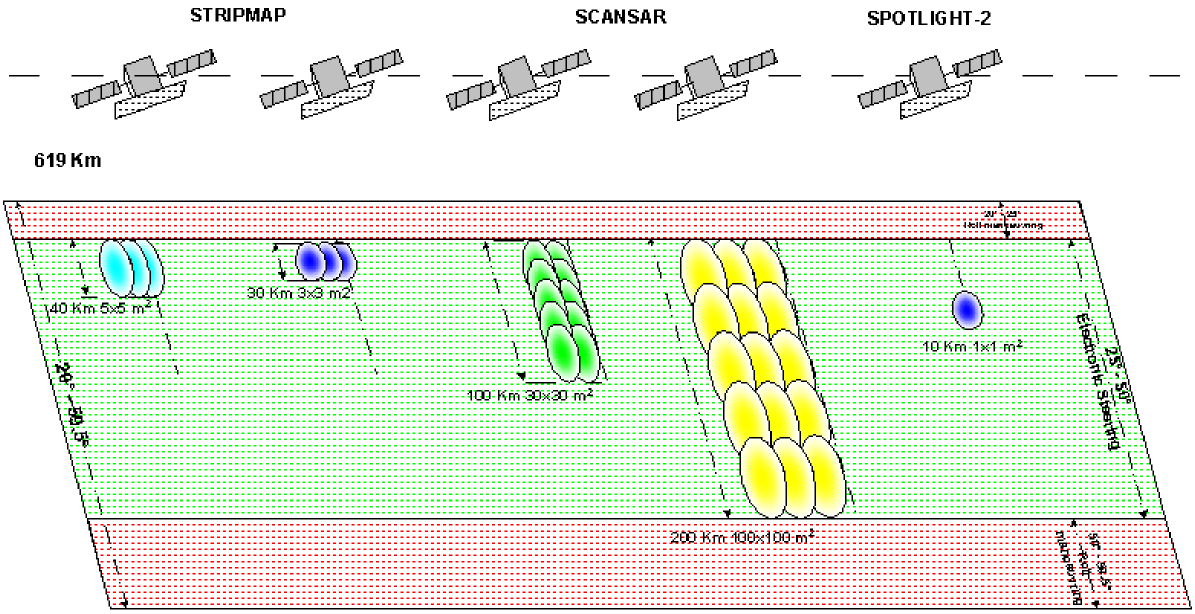


Fig. 1 - COSMO SAR Measurement Modes and related characteristics

The COSMO-SkyMed SAR instrument can be operated in different beam which include:

- Spotlight (mode 2 and mode 1) (Note: mode 1 is for Defence use only and is not further described)
- Stripmap (himage and pingpong)
- Scansar (wideregion or hugeregion)

The characteristics of SAR measurement modes are briefly delineated hereafter:

- SPOTLIGHT, allowing SAR images with spot extension of 10.x10. km^2 and spatial resolution equal to 1.x1. m^2 single look (Spotlight 2);
- STRIPMAP (HIMAGE achieving medium resolution, wide swath imaging, with swath extension ≥40 km and spatial resolution of 3x3 m^2 single look;
- STRIPMAP (PINGPONG), achieving medium resolution, medium swath imaging with two radar polarization's selectable among HH, HV, VH and VV, a spatial resolution of 15 meters on a swath ≥30 km;
- SCANSAR (WIDE and HUGE region), achieving radar imaging with swath extension selectable from 100.x 100. km^2 (WIDE REGION) to 200.x 200 km^2 (HUGE REGION), and a spatial resolution selectable from 30x30. m^2 to 100.x100 m^2

Fig. 2 - Examples of COSMO-SkyMed SAR products

The common quality parameters of all the SAR products are:

- PSLR ≤ -22 dB
- ISLR ≤ -12 dB
- Azimuth Point Target Ambiguity ≤ -40 dB
- Radiom. Accuracy ≤ -1 dB (single look)
- Radiom. Linearity ≤ -1.5 dB
- Radiom. Stability ≤ -1 dB
- Total NE°σ ≤ -19 dBm2/m2

2.2 The major classes of COSMO SAR products

The COSMO-SkyMed products are divided in the following major classes:

- Standard products
- Higher level products
- Service products (for internal use only)

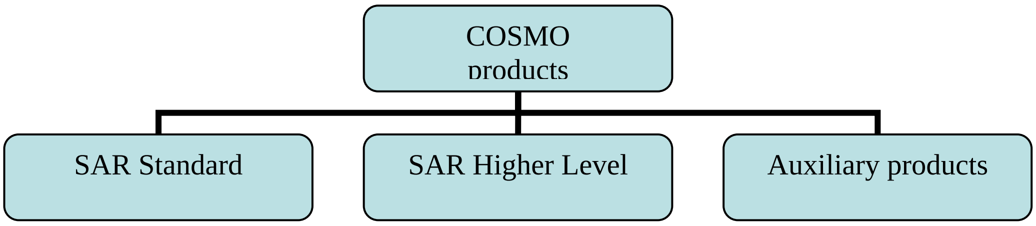


Fig. 3 – The 3 classes of COSMO-SkyMed products

The SAR Standard products are the basic image products of the system, are suitable for many remote sensing applications based on direct usage of low level products and are subdivided into 4 typologies, coded as:

- Level 0 RAW data, defined as "on board raw data (after decryption and before unpacking) associated with auxiliary data including calibration data required to produce higher level products". This data consists of time ordered echo data, obtained after decryption and decompression (i.e. conversion from BAQ encoded data to 8-bit uniformly quantised data) and after applying internal calibration and error compensation; it include all the auxiliary data (e.g.: trajectography, accurately dated satellite's co-ordinates and speed vector, geometric sensor model, payload status, calibration data,..) required to produce the other basic and intermediate products.
- 1A, Single-look Complex Slant product, RAW data focused in slant range-azimuth projection, that is the sensor natural acquisition projection; product contains In-Phase and Quadrature of the focused data, weighted and radiometrically equalized
- 1B, Detected Ground Multi-look product, obtained detecting, multi-looking and projecting the

Single-look Complex Slant data onto a grid regular in ground; Note: Spotlight Mode products are not multilooked

- 1C/1D, Geocoded product GEC (1C level product) and GTC (1D level product), obtained projecting the 1A product onto a regular grid in a chosen cartographic reference system. In case of Lev 1C the surface is the earth ellipsoid while for the Lev 1D a DEM (Digital Elevation Model) is used to approximate the real earth surface. In Lev 1D data is constituted by the Backscattering coefficient of the observed scene, multilooked (except for Spotlight Mode), including the annexed the Incidence Angles Mask

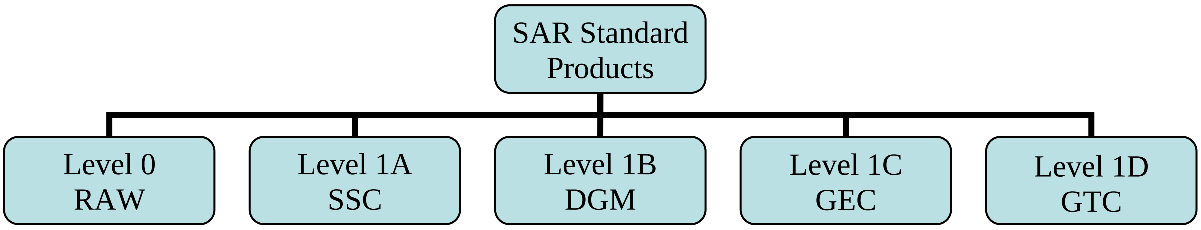


Fig. 4 – The 5 types of COSMO-SkyMed SAR Standard Products

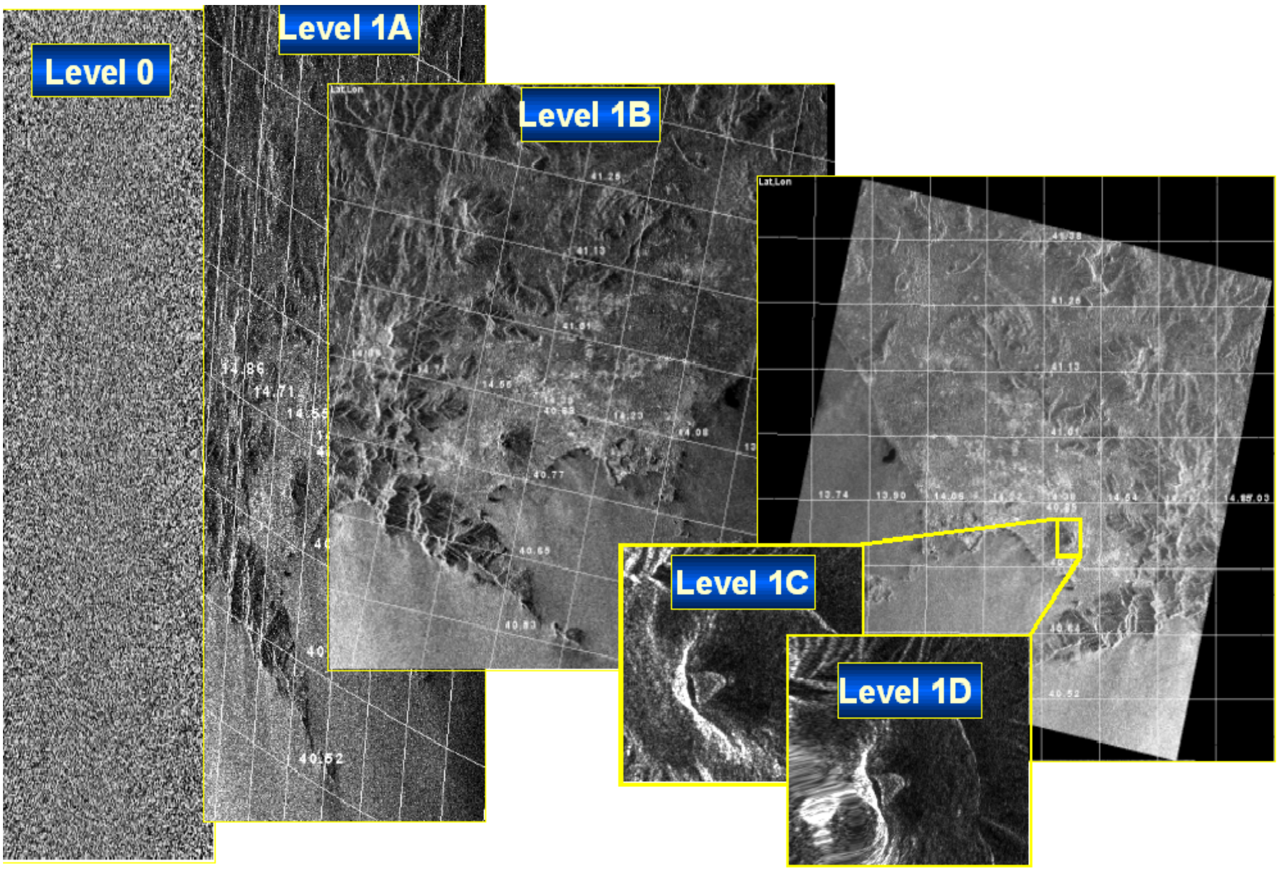


Fig. 5 – The 5 types of COSMO-SkyMed Standard Products (examples from ERS1)

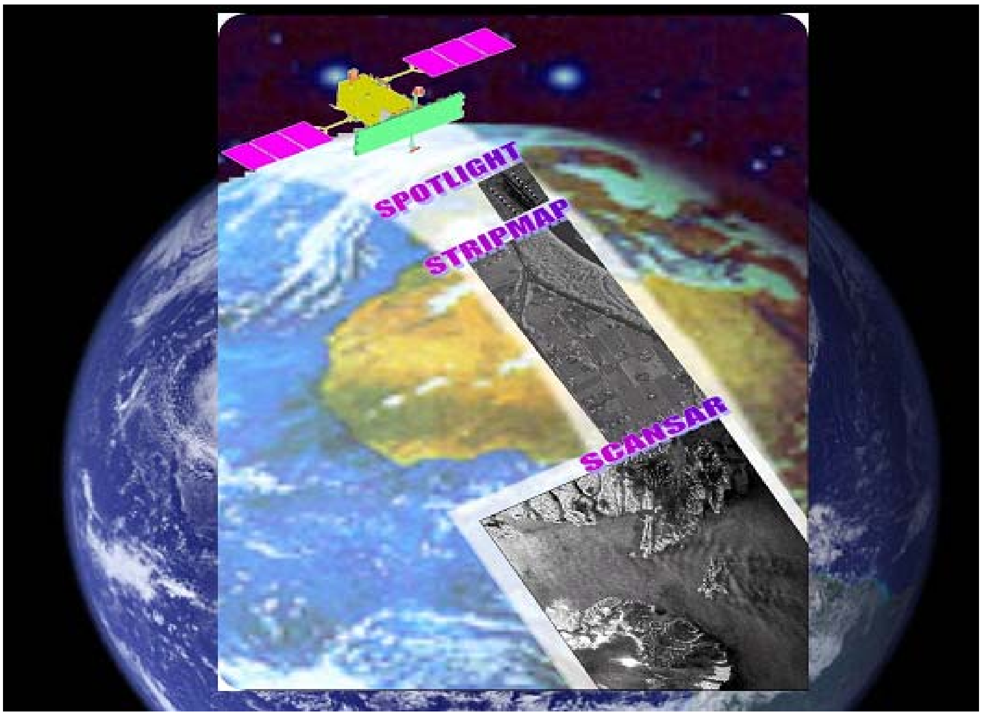


Fig. 6 – A pictorial view of the 3 major types of COSMO-SkyMed Acquisition Modes

The previous products types shall be considered as product classes rather than products types since each of the four modes in which the SAR instrument operates, namely Stripmap, Polarimetric, ScanSAR, Spotlight, originate the related 1A/B/C/D products.

The SAR Higher Level products, suited for mid or even high level remote sensing applications, are composed by the following products:

- Quicklook, reduced spatial resolution image for browsing purposes
- Co-registered products, a set of image layers coregistered together (i.e. merged in vertical direction), for interferometry, change detection and so on
- Mosaiked products, a set of image joined together (i.e. merged in horizontal direction), for large spatial coverage representation
- Speckle filtered image, an image with an increased equivalent number of looks (ENL)
- Interferometric products (interferometric coherence and phase), in support of the interferometric applications
- DEM, Digital elevation data and related height error map obtained with interferometric techniques

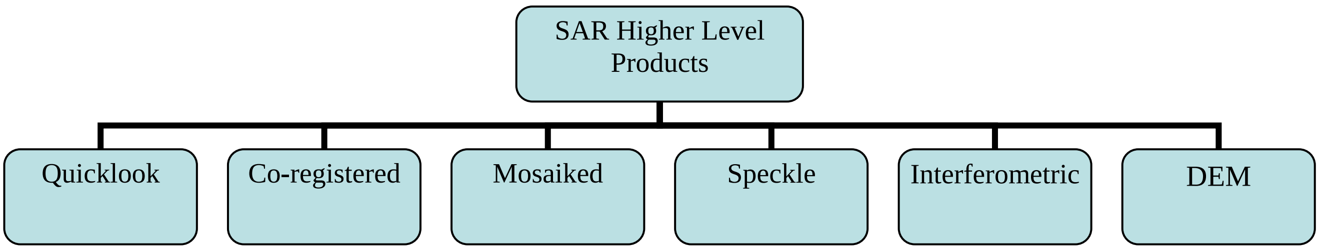


Fig. 7 – The 6 types of COSMO-SkyMed SAR Higher Level Products

Service products are used internally either like auxiliary data for production chain or like further analysis performed on all products delineated above. Such product are basically constituted by the Orbital product and the Quality Control product.

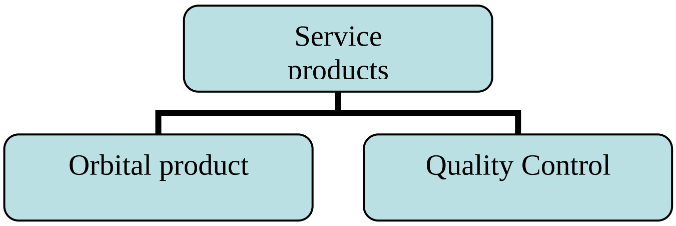


Fig. 8 – The 2 types of COSMO-SkyMed Service Products

3 Products Description

The COSMO-SkyMed products are divided in the following major classes and briefly described in next sections:

- Standard products
- Higher level products
- Service products (for internal use only)

3.1 Standards Products

The foreseen standard processing levels (from level 0 up to 1D) are compliant with the definitions given in international standards for Earth Observation (e.g. CEOS guidelines). A further categorization defines the standard processing through three successive stages:

- Pre-processing
- Processing
- Image geo-localization

Pre-processing stage involves the operations that are normally required prior to the main data analysis and extraction of information (i.e. Level 0 processing). Processing stage mainly performs radiometric and geometric corrections of the imagery (i.e. Level 1A and Level 1B processing). The last thread of this elaboration chain is the projection of the imagery on known reference system (i.e. Level 1C and Level 1D processing).

The following standard processing levels are conceived for COSMO:

- Level 0 (RAW), containing for each sensor acquisition mode the unpacked echo data in complex in-phase and quadrature signal (I and Q) format. The processing performed on the down linked X-band raw signal data are:
  - frame synchronization
  - transmission protocol removal
  - packet data filed re-assembly
  - data decompression
  - statistics estimation
  - data formatting
- Level 1A products (SCS), whose processing is aimed at generating Single-look Complex Slant (SCS) products. The SCS product, obtained after the L1A processing, contains focused data in complex format, in slant range and zero Doppler projection. The processing performed on L0 input data are:
  - gain receiver compensation
  - internal calibration
  - data focusing
  - statistics estimation of the output data
  - data formatting into output
- Level 1B Products (MDG), whose processing is aimed at generating Detected Ground Multi-look (MDG) products, starting from input (L1A) data. A MDG product, obtained after L1B processing, contains focused data, detected, radiometrically equalized and in ground range/azimuth projection. The processing performed on L1A input data are:
  - multi-looking for speckle reduction
  - image detection (amplitude)
  - ellipsoid ground projection
  - statistics evaluation
  - data formatting
- Level 1C Products (GEC), whose processing is aimed at generating Geocoded Ellipsoid Corrected (GEC) products. A GEC product, obtained after L1C processing, contains focused data, detected geo-located on the reference ellipsoid and represented in a uniform pre-selected cartographic presentation. The processing performed on L1B input data are:
  - multi-looking for speckle reduction
  - ellipsoid map projection
  - statistics evaluation
  - data formatting

- Level 1D Products (GTC), whose processing is aimed at generating Geocoded Terrain Corrected (GTC) products. A GTC product, obtained after L1D processing, contains focused data projected onto a reference elevation surface in a regular grid obtained from a cartographic reference system. The image scene is located and accurately (x, y, z) rectified onto a map projection, through the use of Ground Control Points (GCPs) and Digital Elevation Model (DEM). The processing performed on L1B input data is actually GEC processing with the use of the DEM for map projection.

The standard processing model is shown in the following figure:

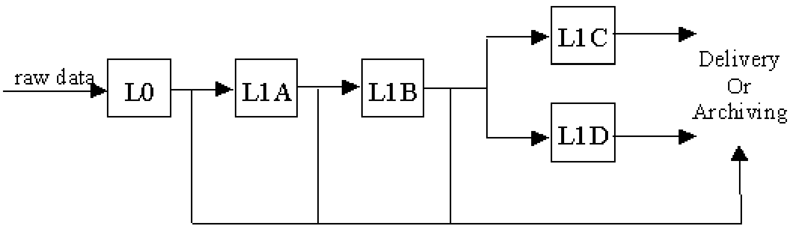


Fig. 9 - Standard Processing Model

This model is valid for the different SAR measurement modes (Spotlight, Stripmap, ScanSAR), whilst the level processor is different for each product type.

In the following section the main specific characteristics of the products are shown (Size and Geometrical resolution), along with the related sensor configuration (Swath and Incidence angle), for product acquired in Civilian sensor modes.

A common characteristics of all standard products is the value of the geolocation accuracy which is:
- an error of less than 25 m (20 m goal) with respect to the WGS84 reference ellipsoid (without ground control points or DEM) 3-sigma with respect to the WGS84 reference ellipsoid
- an error of less than 15 m with DEM and ground control points, to control slant range to ground range projection.

Note: the Equivalent Number of looks (which is between 1 for Lev 1A products and 15 for Lev 1B-1C-1D products in Scansar Hugeregion modes) can be increased (from 1.3 up to 4.1 times the original value) using the Higher level Speckle Filtered product, even in case of geocoded products.

Spotlight product characteristics
The following table summarizes the basic features for the COSMO-SkyMed products originated from data acquired in Enhanced Spotlight Mode.

	LEV 0	LEV 1A	LEV 1B	LEV 1C LEV 1D
Swath [km2]	~10 km x ~10 km			
Incidence angle [deg]	~20° ÷ ~60°			
Polarization	selectable among HH or VV			
Product Size [MB]	750÷1700	700÷1450	841	≤1682
Equivalent Number of looks	NA	1	1	1
Ground Range resolution [m]	NA	≤1.0	≤1.0	≤1.0
Azimuth resolution [m]	NA	≤1.0	≤1.0	≤1.0
Geolocation Acccuracy	NA		≤25	≤25 ≤15

Stripmap products characteristics
The following table summarizes the basic features for the COSMO-SkyMed products originated from data acquired in Himage Mode.

	LEV 0	LEV 1A	LEV 1B	LEV 1C LEV 1D
Swath [km^2]	~40 km x ~40 km			

Incidence angle [deg]	~20° ÷ ~60°			
Polarization	selectable among HH or HV or VH or VV			
Product Size [MB]	800÷1250	1150÷1800	390÷590	≤1118
Equivalent Number of looks	NA	1	~ 3	~ 3
Ground Range resolution [m]	NA	≤3.0	≤5.0	≤5.0
Azimuth resolution [m]	NA	≤3.0	≤5.0	≤5.0
Geolocation Acccuracy	NA		≤25	≤25 ≤15

Polarimetric products characteristics
The following table summarizes the basic features for the COSMO-SkyMed products originated from data acquired in PingPong Mode.

	LEV 0	LEV 1A	LEV 1B	LEV 1C LEV 1D
Swath [km^2]	~30 km x ~30 km			
Incidence angle [deg]	~20° ÷ ~60°			
Polarization	The two polarimetric channels contains: HH,VV or HH,HV or VV,VH			
Product Size [MB]	120÷200	430÷650	45÷70	≤140
Equivalent Number of looks	NA	1	~ 3.7	~ 3.7
Ground Range resolution [m]	NA	≤15.0	≤20.0	≤20.0
Azimuth resolution [m]	NA	≤15.0	≤20.0	≤20.0
Geolocation Acccuracy	NA		≤25	≤25 ≤20

ScanSAR Wideregion products characteristics
The following table summarizes the basic features for the COSMO-SkyMed products originated from data acquired in WideRegion Mode.

	LEV 0	LEV 1A	LEV 1B	LEV 1C LEV 1D
Swath [km^2]	~100 km x ~100 km			
Incidence angle [deg]	~20° ÷ ~60°			
Polarization	selectable among HH or HV or VH or VV			
Product Size [MB]	840÷1100	1300÷1800	85÷150	≤300
Equivalent Number of looks	NA	1	~ 13	~ 13
Ground Range resolution [m]	NA	≤7.0	≤30.0	≤30.0
Azimuth resolution [m]	NA	≤16.0	≤30.0	≤30.0
Geolocation Acccuracy	NA		≤30	≤30 ≤30

ScanSAR Hugeregion products characteristics
The following table summarizes the basic features for the COSMO-SkyMed products originated from data acquired in HugeRegion Mode.

	LEV 0	LEV 1A	LEV 1B	LEV 1C LEV 1D
Swath [km^2]	~200 km x ~200 km			
Incidence angle [deg]	~20° ÷ ~60°			
Polarization	selectable among HH or HV or VH or VV			
Product Size [MB]	460÷590	580÷730	28÷40	<80
Equivalent Number of looks	NA	1	~ 23	~ 23
Ground Range resolution [m]	NA	≤20.0	≤100.0	≤100.0

Azimuth resolution [m]	NA	≤30.0	≤100.0	≤100.0
Geolocation Acccuracy	NA		≤100.0	≤100.0 ≤100.0

3.2 Higher Level Products

Higher Level Product include the following types briefly summarized hereafter:

- Quick-Look Products
- Speckle Filtered Products
- Co-registered Products
- Interferometric Products
- Digital Elevation Model (DEM) Products
- Mosaicked Products

Two further products exists, but since they are envisaged for Defence Users only, are here only listed and not further described:

- Products for Band Reduction
- Defence Applications product

Quick Look Products

These products are synoptic of the entire datum allowing a look to the image content in a faster way than the one obtained by processing the image according to the standard algorithms. It is an image easy to visualize: this image shall be easily opened and viewed with conventional image software and self explanatory from the geo-location point of view. The main characteristics of the Quicklook produc are:

- the product is detected
- the product it's ground projected
- the product has integer pixels with values scaled in the range 0 - 255
- depending by the look side and orbit pass, the order of the columns or lines within the image is reversed (with respect the level 0 data) in order present the image in the closest way respect a map
- the product has curves (iso-latitude and iso-longitude) which allow the visualization of the geographic coordinates within the image

The Quick Look Products have a degraded processing bandwidth and so the resolution is consequently scaled. The characteristics of the product in terms of geometric resolution and geometric accuracy are however specified and kept under control, in order to allow the usage of this product (whose primary scope is the image browsing) even in remote sensing applications. In the following table the Quick Look Products characteristics of resolution and geometric accuracy are summarized.

	Spotlight	Stripmap	Polarimetric	ScanSar Wideregion	ScanSar Hugeregion
Product Size [MB]	17	20÷30	4÷7	8÷15	4÷7
Ground Range resolution [m]	≤ 50	≤ 100	≤ 200	≤ 300	≤ 600
Azimuth resolution [m]	≤ 50	≤ 100	≤ 200	≤ 300	≤ 600
Equivalent Number of looks	≥10	≥10	≥10	≥10	≥10
Geometric accuracy [m] Case of high qualitry GPS data (Selective Avaiability OFF)	≤ 50	≤ 60	≤ 100	≤ 150	≤ 300
Geometric accuracy [m] Case of low qualitry GPS data (Selective Avaiability ON)	≤ 150	≤ 150	≤ 150		

Speckle Filtered Products

The Higher Level Speckle Filtered Product deals with the improvement of the radiometric resolution of the SAR images by means of the reduction of the intrinsic multiplicative-like speckle noise. Speckle is a multiplicative noise-like characteristic of coherent imaging systems (such as the SAR), which manifests itself in the image as the apparently random placement of pixels which are noticeably bright or dark. In fact the speckle is a real electromagnetic effect that originates from the constructive or destructive interference (within a resolution cell) of multiple returns of coherent electromagnetic radiation. The COSMO SkyMed SAR Standard Products described above, provide speckle reduction via multi-looking, which may be not suitable for all potential high-level applications of the COSMO data: classification, feature extraction, change analysis and detection, soil parameters estimations. For that fact, the Speckle Filtering processor tries to cope with any generic application that could benefit of a speckle noise suppression, improving the radiometric resolution of the SAR Standard images thus allowing a better estimation of the radiometric quantities and minimizing, whenever possible, side effects (degradation of the spatial resolution, artefacts, feature alteration). As such, the Speckle Filtered Product is derived by post-processing of the SAR Standard Level 1A or 1B products. The filtered product is formally equivalent to a 1B standard product and may be further processed by the SAR Standard chain. Many types of filters are allowable, beloning to various classes (Non-Adaptive, Adaptive MMSE, Adaptive MAP, Morphological). Speckle filtered products can be generated starting from level 1B products and hence originating a product at same level. The expected increase in the Equivalent Number of Looks for the various allowable filters is shown in next table.

Filter	Equivalent number of looks increasing factors
Mean	≥4.1
Median	≥3.0
Lee	≥4.1
Enhanced Lee (dumping factor = 0.5)	≥4.1
Kuan	≥4.1
Frost (dumping factor = 0.5)	≥2.9
Enhanced Frost (dumping factor = 0.5)	≥4.1
Gamma MAP	≥3.7
Crimmins (iteration = 8)	≥1.3

The following table shows the geometric resolution of the speckle filtered products obtained applying a filter having a kenel size of 5 x 5 to 1B products, in the various acquisition modes. Note that the 1B speckle filtered product can be used for the geocoded (Lev 1C-1D) products generation, hence originating speckle filtered geocoded products.

	Spotlight	Stripmap	Polarimetric	ScanSar Wideregion	ScanSar Hugeregion
Product Size [MB]	same as input				
Ground Range resolution [m] Azimuth resolution [m]	≤4.5	≤25.0	≤90.0	≤140.0	≤460.0

Co-registered Products

Two different images covering the same area can be made superimposable by means of the co-registration which is the process of lining-up two images, one “master” and the other one is the “slave” image, such to fit exactly on top of each other without adding artifacts in image intensity and phase components. The input images are co-registered using the master as reference. Co-registered images can be taken from simultaneous illuminations of the same scene at different frequencies (multi frequency images), from acquisitions taken at different time using different sensors, from multiple passages of the same satellite (multi temporal images). In general, images have different geometry, thus to be superposed the slave image must be re-sampled into the master geometry. The images may be fully or only partly overlapped and even more than two images can be co-registered at the same time. The co-registration process generates as many output images as the input are: one master image and multiple slave images in input give one co-registered master image and the multiple co-registered slave images. The type of the images is preserved: input real or complex images produce output real or complex co-registered images respectively. As such, the higher level Co-registration products are derived in any acquisition mode, by post-processing of the SAR Level 1A (complex images) or level 1B (real images) SAR standard products, respectively generating a product complex or real (co-registered product). Co-registered products can be further processed by the SAR standard processing chain. The coregistration of two generic image products acquired by one or many satellites, cannot be done is every acquisition condition but is subject tio some constraints. Few examples of such constraints are:

- images shall be acquired with the same instrument mode
- images shall be acquired with the same look side and orbit directions
- in case of 1A products, images shall be acquired with the same subswath (i.e. having the same Beam)

The main performance of the coregistered product is the coregistration accuracy (expressed in pixel units) which is shown in next table.

	All acquisition modes
Coregistration accuracy of a couple of detected images having at least an overlap of 30% [pixel]	1
Coregistration accuracy of a couple of complex images in interferometric configuration having at least an overlap of 50% [pixel]	1/30

Mosaicked Product

Mosaicking is the capability of assembling Level 1B, geocoded or DEMs images or strips into a common grid, in order to generate a large-scale map. When assembling geocoded images, mosaicking is a relatively simple process. However, images that have to be assembled generally do not perfectly match: an overlap between contiguous frames, or a gap, is present. Therefore there is the need to blend these data together (by a proper feathering on the overlapping zones), and choose which portion must be discarded, or how to fill the gaps. In order to have mosaicked products with the high resolution as the inputs one, no undersampling process is applied to the input images to mosaic, so the combination of a large area with a high resolution produces very large products. Nevertheless, it could be possible to define a mosaic product with a very large coverage (say, the coverage of an entire state), provided that the input images are adequately undersampled before being assembled. Mosaiking products can be originated starting from level 1B or 1C or 1D products and also DEM (and associate height error map) and can start from product acquired in similar or different modes. In case of assembling Level 1B images, the resulting mosaiked product is kept into the same ground range/azimuth projection. When assembling geocoded products (Lev. 1C, 1D, DEM), the input tiles to be mosaicked must share the following features:

- cartographic projection (UTM rather than UPS)
- the projection zone
- the reference ellipsoid and datum

and the mosaiked product projection depends on the projection of the input products. The relation between input tiles and mosaiked product resolution ratio is affected by the mosaiking strategy, which can be selected among:

- Default
- On request

In the first case, the resolution is the same of the less resoluted tile (i.e. the largest value) for input tiles of levels 1B, 1C, 1D while the opposite (less resoluted images are interpolated to the finest spacing) is used when the input is a DEM. In the second case, resolution can be selected as a multiple of the input tiles resolution.

When assembling Level 1B images, one of the following circumstances could be verified:

1. tiles acquired during the same satellite pass and the same instrument duty cycle;
2. tiles deriving from the coregistration process (see section 5.3)
3. tiles acquired on the same nominal orbit/track (not in the same satellite pass, that is at different epochs) but at different off-nadir angles;
4. generic tiles (acquired at different satellite tracks, swaths, look side and orbit direction)

In the cases 1 and 2, as the input tiles share the same azimuth and range grid, the assembling process is similar to that one detailed for the geocoded product

In the cases 3 and 4, mosaicking among scenes that could be carachterized by different orientation angles is requested; in such case, after having identified the master tile (the azimuth and range directions of the output mosaick must be referred to), slave tiles are at first regridded on the same grid of the master one by a very coarse approach based on correlation to the master orbit and a warp model derivation and application; such approach will be allowed only supposing that input tiles had been processed with orbital data derived from POD facility (hence, not processed with state vectors embedded into the downlinked RAW data). Finally, the mosaicking process is completed applying feathering on the overlapping zones. However, feathering is a configurable parameter of the Processing Request File and can be turned off during the CalVal activities.

In the case of mosaicking of GTC, only the SAR image is included into the output product, that is the GIM layer is not mosaicked. In the case of mosaicking of DTM, The mosaicked HEM is also included into the output product.

The following table shows the mosaiked product main characteristics in case of 1B,1C,1D products.

	Spotlight	Stripmap	Polarimetric	ScanSar Wideregion	ScanSar Hugeregion
Product Size [MB]	~ 3200	~28800	~3600	~800	~128
Maximum Coverage [km^2]	20 x 20	300 x 300	300x 300	300x 300	400x 400
Ground Range resolution [m]	as input				
Azimuth resolution [m]					

The following table shows the mosaiked product main characteristics in case of DEM products.

	Spotlight	Stripmap	ScanSar Wideregion	ScanSar Hugeregion
Product Size [MB]	~ 355	~7200	~800	~128
Maximum Coverage [km^2]	20 x 20	300 x 300	300x 300	400x 400

Interferometric Products

Synthetic Aperture Radar interferometry is an imaging technique for measuring the topography of the surface and its changes over time. A radar interferometer is formed relating the signals from two spatially separated antennas; the separation of the two antennas is called baseline. COSMO-SkyMed constellation can be used for interferometric applications, which allow to produce three-dimensional SAR images by combining two radar images of the same point on the ground (one “master” and the other one is the “slave” image) obtained from slightly different incidence angles. COSMO-SkyMed constellation offers two different possibilities to achieve the interferometric baseline, namely: (1) the “tandem-like” interferometry configuration (i.e. "one-day" of relative phasing between the satellite couple), and (2) the “tandem” interferometry configuration (i.e. two satellites flying in close proximity). As such, the Interferometric products are derived by processing SAR Level 1A co-registered data, taken in any acquisition mode (except PolarimetriC), to generate in automatic way the following product classes:

- Wrapped interferometric phase (and the annexed layer including demodulation phase estimated on flat terrain) of two coregistered SAR images of Level 1A
- the coherence map

Some constraints exists in the generation of the interferometric products. As examples cannot be used as inputs:

- polarimetric products or products having different trasmit-receive polarizations
- products acquired on different subswaths or different look side or orbit direction

The interferometric products maintain the same geometry of the input 1A prioducts and hence are in a slant range/azimuth projection. Spacing features of the interferometric products are inherited from the co-registered input images couple but due to interferometric multilooking, spacing and corresponding size is reduced according to the following table:

	Spotlight	Stripmap	ScanSar Wideregion	ScanSar Hugeregion
Range reduction factor	3	4	6	6
Azimuth reduction factor	4	5	3	5

DEM Products

The Digital Elevation Model (DEM) products are derived by mean interferometric processing of the SAR Level 1A coregistered products, in any acquisition mode except Polarimetric, in automatic way. DEM products consist of the ellipsoidal height map and the associated height error map. The attributes defining the DEM products are derived from the SAR image couple, with some substantial changes (e.g. due to the change of the image projection). The DEM product is presented in UTM/UPS cartographic coordinate system respect to WGS84 ellipsoid, different from the input geometry (slant-range). The product is composed by:

- ellipsoidal height map
- associated height error map

The attributes defining the DEM products are derived from the SAR image couple, with some substantial changes (e.g. due to the change of the image projection). The DEM product is presented in UTM/UPS cartographic coordinate system respect to WGS84 ellipsoid, hence different form the input geometry (slant-range). In the case of DEM product originated from ScanSAR interferometric couple, output is presented in a single layer having elementary beams mosaicked in the range direction. The same constraints already shown for interferometric product also exists in the generation of the DEM products. The DEM and Error map are represented in the same geometry, with the same pixel spacing and have the same size. The main characteristics of the DEM is the height accuracy, the horizontal accuracy and the posting (shown in next tables). The accuracies are strongly dependent by the coherence value and by the geometric configuration of the acquisition and scene, as well as the quality of the input ground control points used during the geometric calibration. For this reason the tables show two groups of performances:

- Relative accuracies: errors in absence of any calibration, true height not known
- Absolute accuracies: true errors within specified Baseline, Incidence angle, terrain slope, availability of Ground Control Points.

Symbols Explanation: $B\perp$=Value of orthogonal baselines, ϑ=Iincidence angle, α=Maximum terrain slope for the 95% of point of the projected region

Relative accuracies	Spotlight	Stripmap	ScanSar Wideregion	ScanSar Hugeregion
	$B\perp = 100 \div 3500$ (valuated with an accuracy better of 20%) Coherence ≥ 0.8			
Relative height accuracy[m]	≤ 3.8	≤ 6.9	≤ 17.1	≤ 76
Relative horizontal accuracy [m]	≤ 2.9	≤ 4.5	≤ 9.4	≤ 32.8

Absolute accuracies	Spotlight	Stripmap	ScanSar Wideregion	ScanSar Hugeregion
	$B\perp = 400 \div 600$ $50° < \vartheta < 60°$ $\alpha \leq 30°$	$B\perp = 200 \div 300$ $50° < \vartheta < 60°$ $\alpha \leq 25°$	$B\perp = 100 \div 150$ $50° < \vartheta < 60°$ $\alpha \leq 20°$	$B\perp = 50 \div 75$ $50° < \vartheta < 60°$ $\alpha \leq 15°$
Absolute height accuracy[m]	≤34.6	≤36.3	≤45.2	≤174.8
Absolute horizontal accuracy [m]	≤30.7	≤30.9	≤31.3	≤101.4
Posting [m x m]	3x3	10x10	30x30	90x90

Format of the products

The data packaging organization adopted as distribution format for the civilian standard products is HDF5. The support format detailed below will be used to store image layers and the relevant ancillary information, forming the output product to be distributed to the final user. The HDF5 (Hierarchical Data Format) format and software, was developed and supported by NCSA (National Centre for Supercomputing Applications University of Illinois) since 1988 and is freely available. It is used worldwide in many fields, including environmental science, the study of neutron scattering, non-destructive testing, and aerospace research. Scientific projects that use HDF include NASA's Earth Observing System (EOS), and the Department of Energy's Accelerated Strategic Computing Initiative (ASCI). HDF5 files are organized in a hierarchical structure, with two primary structures:

- groups
- datasets

A grouping structure contains instances of zero or more groups or datasets, together with supporting metadata. Any HDF5 group or dataset may have an associated attribute list. An HDF5 attribute is a user-defined HDF5 structure that provides extra information about an HDF5 object. Attributes are described in more detail below.

Distribution Media

Besides the digital format of the products, the following media types will be used for non-electronic product distribution: DVD, CDROM, Magnetic cassette. Electronic distribution will be based on a FTP access to the COSMO site.

3.3 Service Products

The Service Products (only foreseen for internal use) are:

- Orbital product: necessary to perform SAR images geo-location. These products are qualified for several accuracy and latency features according to given processing procedures and ancillary input data
- Quality Control product: necessary to assess the quality of SAR imagery generated by standard- and non-standard processors. The Quality Control (QC) function is able to elaborate products by its own, in order to visualize them and to perform temporal evolution analysis and cross correlation studies. Furthermore, the QC function takes into account the ancillary data, for example the COSMO Orbital Product for the orbital residual trend analysis, and exploits support data (GCP/GRP, DEM, etc) coming from external sources (entities).

4 Standard Products Format Description

The data packaging organization adopted as distribution format for the civilian standard products is HDF5. The support format detailed below will be used to store image layers and the relevant ancillary information, forming the output product to be distributed to the final user.

4.1 Format Overview

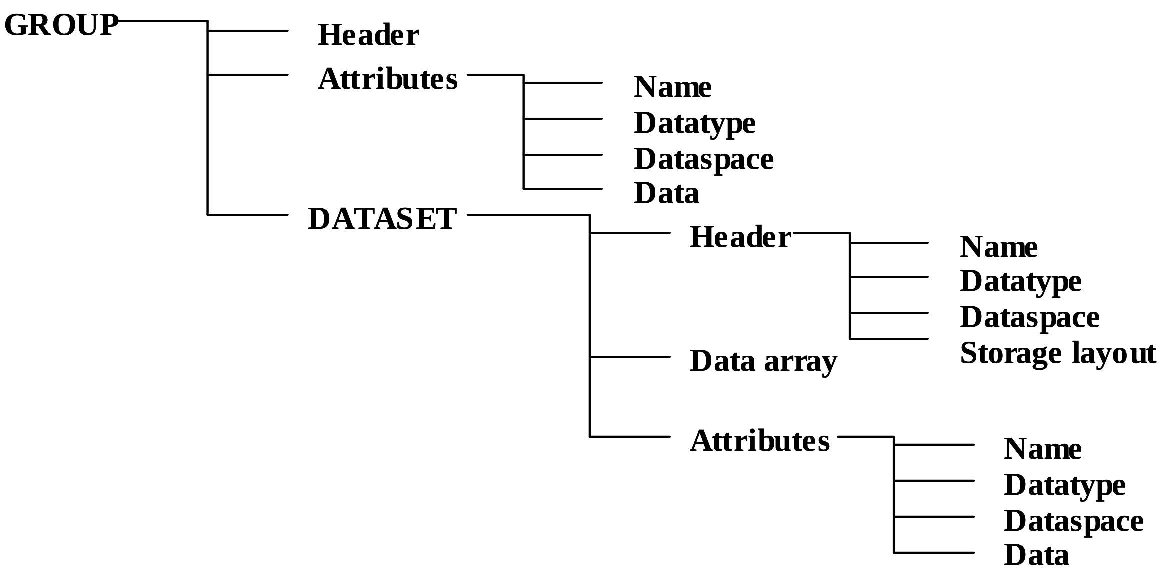
The HDF5 (Hierarchical Data Format) format and software, was developed and supported by NCSA (National Centre for Supercomputing Applications University of Illinois) since 1988 and is freely available. It is used worldwide in many fields, including environmental science, the study of neutron scattering, non-destructive testing, and aerospace research. Scientific projects that use HDF include NASA's Earth Observing System (EOS), and the Department of Energy's Accelerated Strategic Computing Initiative (ASCI). For more information or software the following link is available http://hdf.ncsa.uiuc.edu.

HDF5 files are organized in a hierarchical structure, with two primary structures:

- groups
- datasets

A grouping structure contains instances of zero or more groups or datasets, together with supporting metadata. Any HDF5 group or dataset may have an associated attribute list. An HDF5 attribute is a user-defined HDF5 structure that provides extra information about an HDF5 object. Attributes are described in more detail below. Details concerning the complete specification and the internal organization of the format can be found in “Interoperable Catalogue Systems (ICS) Valids, CEOS/WGISS/PTT/Valids, Issue 0.6, February 2001”.

The hierarchical organization of the HDF5 format is graphically represented in next figure.



4.1.1 Groups

An HDF5 group is a structure containing zero or more HDF5 objects. A group has two parts:

- A group header, which contains a group name and a list of group attributes.
- A group symbol table, which is a list of the HDF5 objects that belong to the group.

Working with groups and group members is similar in many ways to working with directories and files in UNIX. As with UNIX directories and files, objects in an HDF5 file are often described by giving their full (or absolute) path names.

/ signifies the root group.
/foo signifies a member of the root group called foo.
/foo/zoo signifies a member of the group foo, which in turn is a member of the root group.

4.1.2 Datasets

A dataset is a multidimensional array of data elements, together with supporting metadata.
A dataset is stored in a file in two parts

- A header
- A data array

4.1.2.1 Dataset header

The header contains information that is needed to interpret the array portion of the dataset, as well as metadata (or pointers to metadata) that describes or annotates the dataset. Header information includes the name of the object, its dimensionality, its number-type, information about how the data itself is stored on disk, and other information used by the library to speed up access to the dataset or maintain the file's integrity.

There are four essential classes of information in any header:

- Name
- Datatype
- Dataspace
- Storage layout

4.1.2.1.1 Name

A dataset name is a sequence of alphanumeric ASCII characters.

4.1.2.1.2 Datatype

HDF5 allows one to define many different kinds of datatypes. There are two categories of datatypes:

- atomic datatypes (which differentiates in system-specific, NATIVE or named)
- compound datatypes (which can only be named).

Atomic datatypes are those that are not decomposed at the datatype interface level, such as integers and floats.
NATIVE datatypes are system-specific instances of atomic datatypes.
Compound datatypes are made up of atomic datatypes.
Named datatypes are either atomic or compound datatypes that have been specifically designated to be shared across datasets.

Atomic datatypes include integers and floating-point numbers. Each atomic type belongs to a particular class and has several properties: size, order, precision, and offset. In this introduction, we consider only a few of these properties. Atomic classes include integer, float, date and time, string, bit field, and opaque. (Note: Only integer, float and string classes are available in the current implementation.) Properties of integer types include size, order (endian-ness), and signed-ness (signed/unsigned). Properties of float types include the size and location of the exponent and mantissa, and the location of the sign bit.

The datatypes that are supported in the current implementation are:

- Integer datatypes: 8-bit, 16-bit, 32-bit, and 64-bit integers in both little and big-endian format.
- Floating-point numbers: IEEE 32-bit and 64-bit floating-point numbers in both little and big-endian format
- References
- Strings
- NATIVE datatypes. Although it is possible to describe nearly any kind of atomic data type, most applications will use predefined datatypes that are supported by their compiler. In HDF5 these are called native datatypes. NATIVE datatypes are C-like datatypes that are generally supported by the hardware of the machine on which the library was compiled. In order to be portable, applications should almost always use the NATIVE designation to describe data values in memory.

The NATIVE architecture has base names that do not follow the same rules as the others. Instead, native type names are similar to the C type names. A compound datatype is one in which a collection of simple datatypes are represented as a single unit, similar to a struct in C. The parts of a compound datatype are called members. The members of a compound datatype may be of any datatype, including another compound datatype. It is possible to read members from a compound type without reading the whole type. Named datatypes. Normally each dataset has its own datatype, but sometimes we may want to share a datatype among several datasets. This can be done using a named datatype. A named data type is stored in the file independently of any dataset, and referenced by all datasets that have that datatype. Named datatypes may have an associated attributes list. See Datatypes in the HDF User's Guide for further information.

4.1.2.1.3 Dataspace

A dataset dataspace describes the dimensionality of the dataset. The dimensions of a dataset can be fixed (unchanging), or they may be unlimited, which means that they are extendible (i.e. they can grow larger). Properties of a dataspace consist of the rank (number of dimensions) of the data array, the actual sizes of the dimensions of the array, and the maximum sizes of the dimensions of the array. For a fixed-dimension dataset, the actual size is the same as the maximum size of a dimension. A dataspace can also describe portions of a dataset, making it possible to do partial I/O operations on selections.

Given an n-dimensional dataset, there are currently four ways to do partial selection:

- Select a logically contiguous n-dimensional hyperslab.
- Select a non-contiguous hyperslab consisting of elements or blocks of elements (hyperslabs) that are equally spaced.
- Select a union of hyperslabs.
- Select a list of independent points.

Since I/O operations have two end-points, the raw data transfer functions require two dataspace arguments: one describes the application memory dataspace or subset thereof, and the other describes the file dataspace or subset thereof.

4.1.2.1.4 Storage layout

The HDF5 format makes it possible to store data in a variety of ways. The default storage layout format is contiguous, meaning that data is stored in the same linear way that it is organized in memory. Two other storage layout formats are currently defined for HDF5: compact, and chunked. In the future, other storage layouts may be added. Compact storage is used when the amount of data is small and can be stored directly in the object header. Chunked storage involves dividing the dataset into equal-sized "chunks" that are stored separately. Chunking has three important benefits. It makes it possible to achieve good performance when accessing subsets of the datasets, even when the subset to be chosen is orthogonal to the normal storage order of the dataset. It makes it possible to compress large datasets and still achieve good performance when accessing subsets of the dataset. It makes it possible efficiently to extend the dimensions of a dataset in any direction.

4.1.3 HDF5 Attributes

Attributes are small named datasets that can be attached to one of the following structures:

- primary datasets
- groups
- named datatypes

Attributes can be used to describe the nature and/or the intended usage of a dataset or group. An attribute has two parts:

- name
- value

The value part contains one or more data entries of the same data type. When accessing attributes, they can be identified by name or by an index value. The use of an index value makes it possible to iterate through all of the attributes associated with a given object.

4.2 Products Organization

Specific data organization will be detailed to meet the storage needs of data acquired with all the instrument modes allowed by the COSMO-SkyMed constellation.

4.2.1 Naming Convention

The following naming convention will be used for the identification of the COSMO-SkyMed SAR Standard Products files and the most of the Higher Level Products files. Differences in the convention used for some Higher-Level product is detailed into the specific subsection

CSKS<*i*>_<*YYY_Z* >_<*MM*>_<*SS*>_<*PP*>_<*s*><*o*>_<*D*><*G*>_<*YYYYMMDDhhmmss*>_<*YYYYMMDDhhmmss*>.h5

The semantic of the variable sub-strings is reported in the following table:

Sub-string code	Meaning	Allowed values
<i>	Identifier of the satellite within the SAR constellation that acquired the scene	1 2 3 4
<YYY_Z>	Product Type	Standard Products: RAW_B SCS_B SCS_U DGM_B GEC_B GTC_B
<MM>	Instrument Mode used during the acquisition	HI (Himage) PP (PingPong) WR (WideRegion) HR (HugeRegion) S2 (Spotlight 2)
<SS>	Identifier of the swath (or subswath combination in the case of ScanSAR mode) used for the data acquisition	[0A-0B-01-...-24] for Himage Mode [0A-0B-01-...-23] for PingPong Mode [00-...-07] for WideRegion Mode [00-...-05] for HugeRegion Mode [0A-...-0D-01-...-33] for Enhanced Spotlight Mode
<PP>	Polarizations used during the acquisition	HH = Horizontal Tx/Horizontal Rx for Himage, ScanSAR and Spotlight modes VV = Vertical Tx/ Vertical Rx for Himage, ScanSAR and Spotlight modes HV = Horizontal Tx/ Vertical Rx for Himage, ScanSAR VH = Vertical Tx/ Horizontal Rx for Himage, ScanSAR CO = Co-polar acquisition (HH/VV) for PingPong mode CH = Cross polar acquisition (HH/HV) with Horizontal Tx polarization for PingPong mode CV = Cross polar acquisition (VV/VH) with Vertical Tx polarization for PingPong mode
<s>	Identifier of the Look Side	L = LEFT R = RIGHT
<o>	Identifier of the Orbit Direction	A = Ascending D = Descending
<D>	Delivery Mode	F = Fast Delivery mode S = Standard Delivery mode

<G>	State of the Selective Availability during the acquisition, affecting Orbital Data derived by GPS Instrument	N = ON F = OFF
<YYYYMMDDhhmmss>	Sensing Start Time rounded to the closest integer second	YYYY = year MM = month DD = day of the month hh = hour mm = minute ss = second
<YYYYMMDDhhmmss>	Sensing Stop Time rounded to the closest integer second	As for sensing start time

Table 4-1 – File naming convention

4.2.2 Hierarchies organization

The HDF5 allows the hierarchical organization of the information to be stored. In order to standardize the data organization and the access to the image layers stored by the HDF5 support format, each level of the HDF5 hierarchy has been univocally assigned to the storage of a specific level of information of the SAR products according to the scheme described below.

4.2.2.1 / - Root group for Instrument Modes (Processing Level): All (0/1A/1B/1C/1D)

For each Instrument Mode and processing level it includes:

- the attributes to be considered applicable to the whole acquisition/product, hence that are subswaths-independent
- one or more group named S<mm> detailed below
- zero or one dataset named MBI (Multi Beam Image) detailed below
- zero or one dataset named QLK (Quick Look) detailed below
- zero or one dataset named GIM (Geocoded Incidence Mask) detailed below

4.2.2.2 S<mm> groups for Instrument Modes (Processing Level): All (0/1A/1B/1C/1D)

It includes:

- the attributes dependent on the specific subswath used within the full multi-beam swath in the case of ScanSAR mode and within the access area otherwise (for example the PRF)
- one or more dataset named B<nnn> detailed below
- zero or one dataset named SBI (Single Beam Image), in the case of ScanSAR modes, detailed below
- zero or one dataset named QLK (Quick Look) detailed below
- zero or one dataset CAL including all the ShortCal pulses acquired during the acquisition's sequence of the scene echoes.
- zero or one dataset REPLICA including all the reconstructed replica chirp.
- zero or one one dataset NOISE including all the Noise measures performed during the acquisition's sequence of the scene echoes.

In the case of Himage and Spotlight products <mm> = 01

In the case of ScanSAR products <mm> ∈ {01, 02, 03, 04, 05, 06} used in increasing order from the nearest subswath to the farthest one. Moreover, S01 group will always include the earliest acquired burst.

4.2.2.3 B<nnn> dataset for Instrument Modes (Processing Level): All (0)

It includes:

- the attributes dependent on the time sequential data block (the burst) to be considered applicable for the acquired raw data (for example the Sensing Start Time)
- the data array with the raster layer.

In the case of Himage and Spotlight products <nnn> = 001

In the case of ScanSAR products <nnn> ∈ [001, 999] used in increasing order from the earliest acquired burst to the latest one. The same number of bursts will be always included in each S<mm> group of the distributed product.

4.2.2.4 B<nnn> group for Instrument Modes (Processing Level): All (1A/1B/1C/1D)

It includes the attributes dependent on the time sequential data block (the burst) to be considered applicable for the acquired raw data (for example the Sensing Start Time)

4.2.2.5 SBI dataset for Instrument Modes (Processing Level): Himage, Spotlight (1A/1B/1C/1D) and ScanSAR (1A)

It includes:

- the attributes dependent on the subswath used within the access area to be considered applicable for the distributed product (for example the Line Time Interval)
- one raster data array representing the product to be distributed

4.2.2.6 MBI dataset for Instrument Modes: ScanSAR (1B/1C/1D)

It includes

- the attributes dependent on the mosaicked full scene to be considered applicable for the distributed product (for example the Line Time Interval)
- one raster data array representing the range/azimuth mosaicked product to be distributed

4.2.2.7 QLK Dataset

It includes the quick look of the distributed product.
See 4.2.4 for further details.

4.2.2.8 GIM Dataset

It includes the raster layer representing the mask (coregistered with the GTC product) of the incidence angles at which each pixel included into the level 1D product had been acquired.

4.2.2.9 START group for Instrument Modes (Processing Level): All (0)

It includes the dataset of Calibration (CAL) and Noise (NOISE) measurements performed during the acquisition initialization sequence extracted from the downlinked RAW data

4.2.2.10 STOP group for Instrument Modes (Processing Level): All (0)

It includes the dataset of Calibration (CAL) and Noise (NOISE) measurements performed during the acquisition termination sequence extracted from the downlinked RAW data

4.2.2.11 NOISE dataset for Instrument Modes (Processing Level): All (0)

It includes the Noise data from the downlinked RAW data.

- The dataset START/NOISE (respectively STOP/NOISE), includes the Noise measurements performed during the acquisition Initialization (respectively Termination) sequence;
- The dataset /S<nn>/NOISE, includes all the Noise measures performed during the acquisition's sequence of the scene echoes

4.2.2.12 CAL dataset for Instrument Modes (Processing Level): All (0)

It includes the Calibration data from the downlinked RAW data. Three cases can be identified:

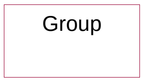
- the dataset /START/CAL, includes all the Calibration measurements (Tx1a, Tx1b and Rx performed on each row of the antenna plus an additional ShortCal pulse) performed during the acquisition's Initialization sequence;
- the dataset /STOP/CAL, includes all the Calibration measurements (Tx1a, Tx1b and Rx performed on each row of the antenna plus an additional ShortCal pulse) performed during the acquisition's Termination sequence;
- the dataset /S<nn>/CAL, includes all the ShortCal pulses acquired during the acquisition's sequence of the scene echoes.

4.2.2.13 REPLICA dataset for Instrument Modes (Processing Level): All (0)

It includes the replica chirp reconstructed from the calibration data included into the downlinked RAW data. It includes a number of lines equal to the number of measured ShortCal pulses

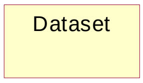
4.2.3 Graphical representation of the hierarchical organization for each Instrument Mode and Processing Level

The hierarchical organization for each Instrument Mode and Processing Level is graphically represented in the following diagrams
A not colour filled structure



represents a HDF5 structure group.

A colour filled structure



represents a generic HDF5 dataset including data array and the relevant attributes.
Suffixes <mm>/<nnn> between angular brackets indicates that the cardinality of the group/dataset is greater than one.

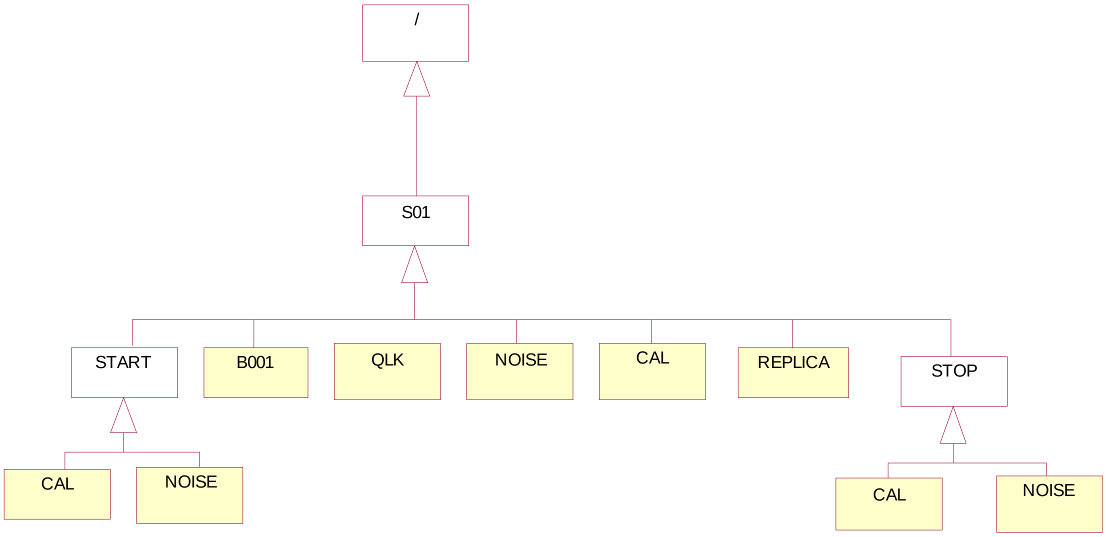


Fig. 10 – Himage/Spotlight Mode – Level 0

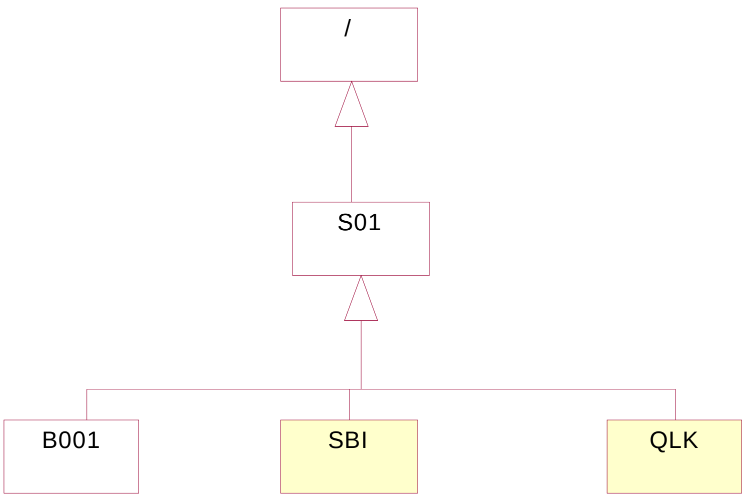


Fig. 11 – Himage/Spotlight Mode – Level 1A/1B/1C

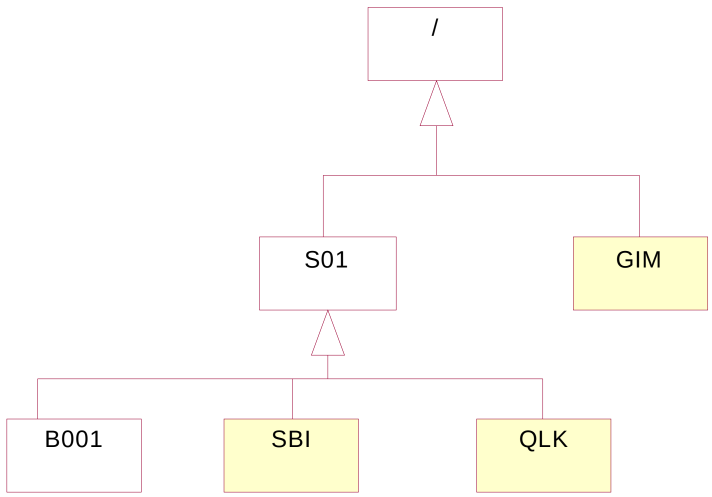


Fig. 12 – Himage/Spotlight Mode – Level 1D

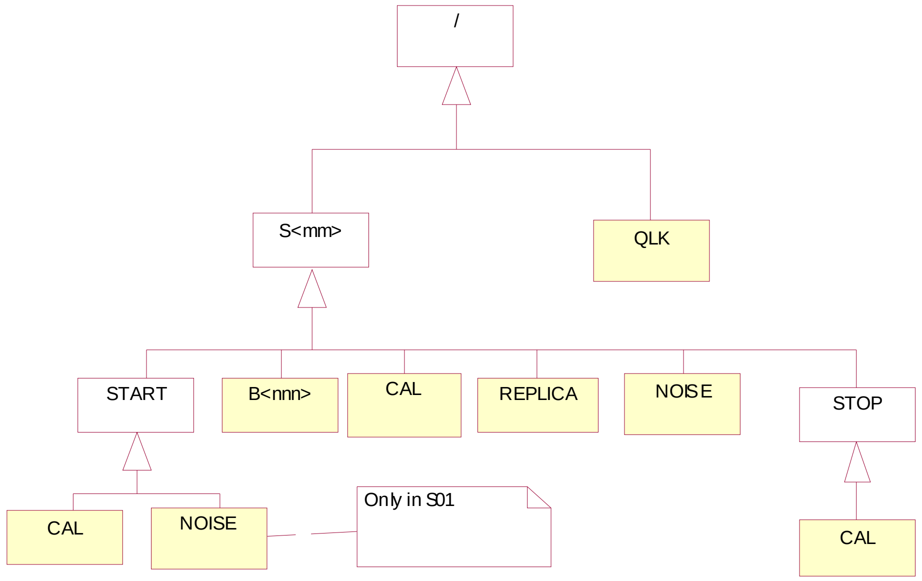


Fig. 13 – ScanSAR Mode – Level 0

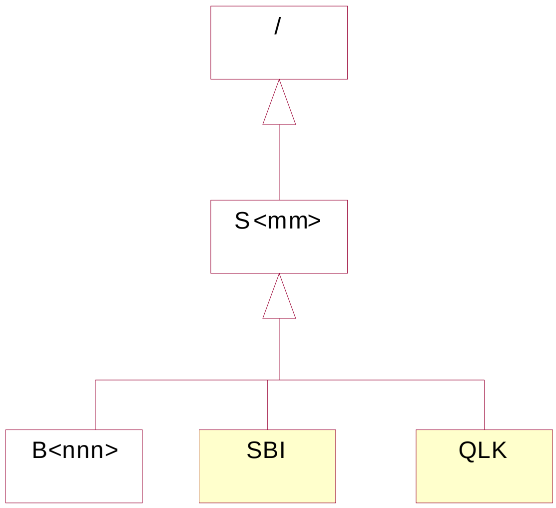


Fig. 14 – ScanSAR Mode – Level 1A

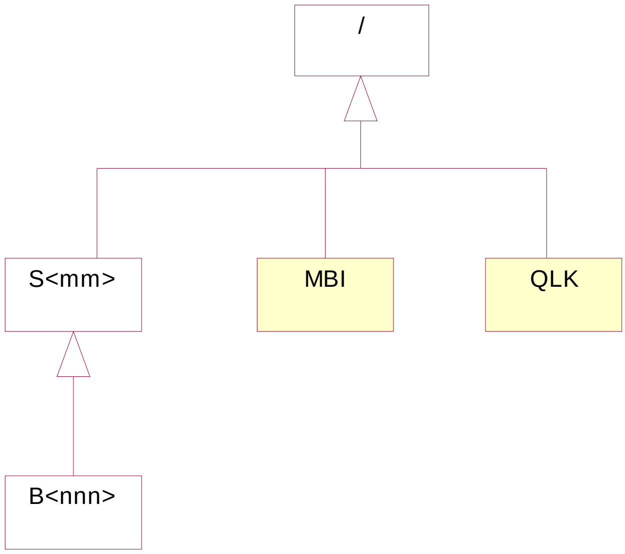


Fig. 15 – ScanSAR Mode – Level 1B/1C

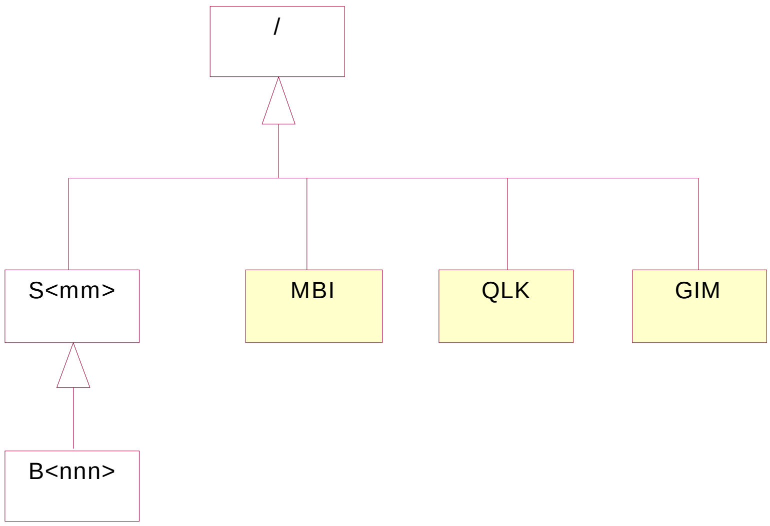


Fig. 16 – ScanSAR Mode – Level 1D

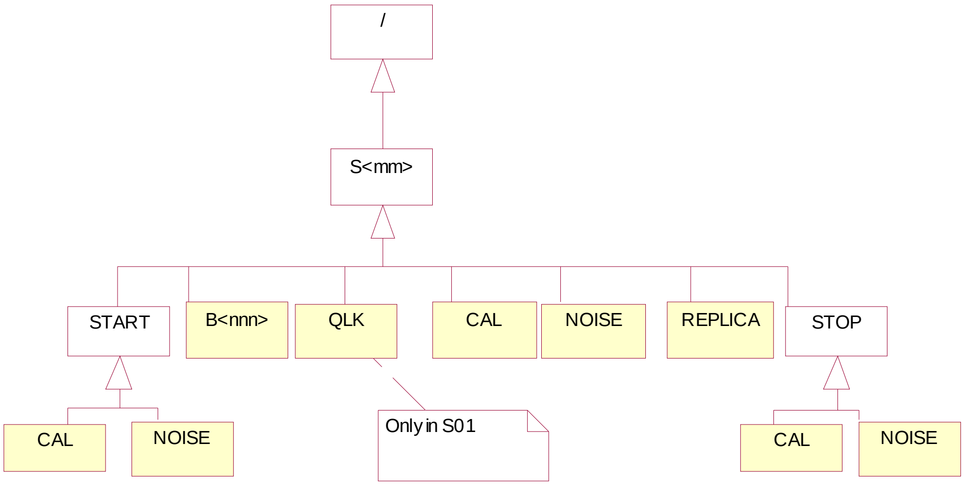


Fig. 17 – PingPong Mode – Level 0

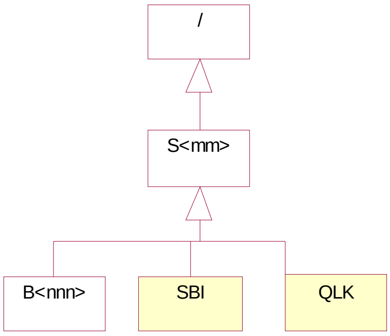


Fig. 18 – PingPong Mode – Level 1A/1B/1C

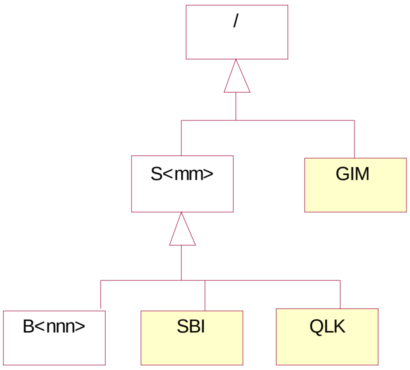


Fig. 19 – PingPong Mode – Level 1D

4.2.4 Quick Look layer

A synoptic of the entire datum allowing having a look to the image content is annexed to all SAR standard and higher-level product. For product at processing level 1, the quick look is originated by undersampling of the full resolution raster layer, obtained by a filter (realized by a kernel of configurable size) moving in the raw and columns directions at steps derived by the ratios of the output and input spacing. Following tables details features of the quick look layer.

Products	Sample Information	Projection
Lev. 0	Focused image, detected, extracted from the Quick Look generated at the ISF screening time. In the case of PingPong product, the Quick Look layer is annexed only to data included into S01 group.	Ground Range/Azimuth
Lev. 1A	The same sample information of the distributed product the quick look is annexed to, detected, undersampled both in range and azimuth direction with the following factors depending on the sensor mode: SMART: 25 Enh. Spotlight: 25 Himage: 30 PingPong: 25 WideRegion: 15 HugeRegion: 15 One image per subswath (resp. polarization) in ScanSAR (resp. PingPong) Mode	Slant Range/Azimuth
Lev. 1B	The same sample information of the distributed product the quick look is annexed to, undersampled both in range and azimuth direction to the pixel/line spacings depending on the sensor mode	Ground Range/Azimuth
Lev. 1C/1D	As for level 1B	UTM (-80° ≤ center latitude ≤ 84°) UPS (otherwise)

Table 4-2 – Features of the Quick Look layers

Dataset	Sample Format	Bits per Sample	Samples per Pixel	Type Represent.	Invalid Value
Quick Look annexed to the Full resolution product	Unsigned Integer	8	1	Little Endian	0

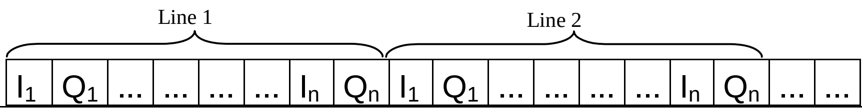
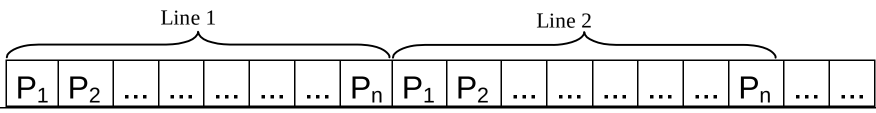
Table 4-3 Data type for Quick look layer

4.2.5 Ancillary information organization

The attributes to be appended (in terms of HDF5 Attributes) to the COSMO-SkyMed SAR standard products, depending on the processing Level (from Level 0 up to Level 1D) are listed in the Appendix section, at the end of this document. For each attribute the corresponding HDF5 storage structure is reported.

4.2.6 Data storage policy

The arrangement used for storage of raster data layers of the SAR Standard Products into HDF5 datasets is listed in the following table:

Samples per pixel	HDF5 data type
Two (Complex data)	Tri-dimensional array having: • the first dimension (the slowest varying) corresponding to the number of lines of the data array • the second dimension corresponding to the number of columns of the data array • the third dimension (the most fast varying) corresponding to the pixel depth, hence used for representation of Real and Imaginary part of each pixel • Such representation, will be used for complex types independently on the sample format (byte, short, integer, long, long long, float, double) and sign (signed, unsigned). Data organization in file is shoed in the following schema 
One (Real data)	Bi-dimensional array having: • the first dimension (the slowest varying) corresponding to the number of lines of the data array • the second dimension corresponding to the number of columns of the data array Such representation will be used for images on single-sample pixel, independently on the sample format (byte, short, integer, long, long long, float, double) and sign (signed, unsigned) 

The following chunking policy for data storage is recommended.

Dimension	Chunk Size
Image Length (Lines)	128
Image Width (Columns)	128
Image Depth (Samples)	2

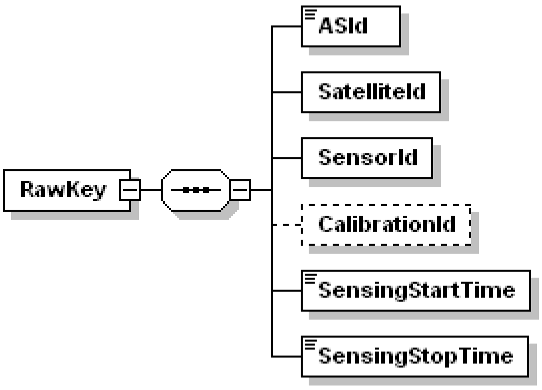
5 Higher Level Products Format Description

5.1 Quick-Look Product

The Quick Look Product will be a synoptic of the entire datum allowing having a look to the image content in a faster way than by processing the image according to the standard algorithms. The Quick Look product (in the following referred as QLF) is originated from the Level 0 file in the archiving format used at UGS; it is originated on the entire Image Segment File at the screening time, and it is mainly used for cataloguing purposes.

The Quick Look File consists of the following datasets:

- ACQMetadata Dataset: This dataset contains the XML file relating to the metadata used by ACQ to internally catalogue a new L0F.
- QLF Dataset: It is composed by binary records containing the image data. See Table 4 3 “Data type for Quick look layer” for details.
- RawKey Dataset: This dataset contains the RawKey.xml file formatted 8-bit signed char. The organization of this file is shown below.



Parameter	Description
ASId	Acquisition Station Identifiers
SatelliteId	Satellite Identifier
SensorId	Value = SAR
CalibrationID	CAL_EXT (in case of EXTCAL mode) CAL_IFCAL (in case of IFCAL mode) CAL_TR (in case of TRCAL mode) CAL_BITE (in case of BITE mode)
SensingStartTime	The first time annotated into the raw data Time stamp just in case of IFCAL, TRCAL and BITE mode.
SensingStopTime	The last time annotated into the raw data Time stamp just in case of IFCAL, TRCAL and BITE mode.

```
<?xml version="1.0" encoding="UTF-8"?>
<!--==============================================================-->
<!--                External DTD Reference        -->
<!--==============================================================-->
<!--                Data format include                   -->
<!ENTITY % DataFormat.dtd SYSTEM "DataFormat.dtd">
%DataFormat.dtd;
<!ENTITY % ASId.dtd SYSTEM "ASId.dtd">
%ASId.dtd;
<!ENTITY % SatelliteId.dtd SYSTEM "SatelliteId.dtd">
%SatelliteId.dtd;
<!--                                              -->
<!--==============================================================-->
<!--                              Root           -->
```

```
<!--================================================================-->
<!ELEMENT RawKey (ASId, SatelliteId, SensorId, CalibrationId?, SensingStartTime, SensingStopTime)>
<!--================================================================-->
<!--                List of elements                    -->
<!--================================================================-->
<!ELEMENT SensorId EMPTY>
<!ATTLIST SensorId
      Value (SAR) #REQUIRED
      %StringFormat;
>
<!ELEMENT CalibrationId EMPTY>
<!ATTLIST CalibrationId
      Value (CAL_EXT | CAL_TR | CAL_IF | BITE) #REQUIRED
      %StringFormat;
>
<!ELEMENT SensingStartTime (#PCDATA)>
<!ATTLIST SensingStartTime
      %DateFormat;
      Format CDATA #FIXED "YYYY-MM-DD hh:mm:ss.nnnnnn"
>
<!ELEMENT SensingStopTime (#PCDATA)>
<!ATTLIST SensingStopTime
      %DateFormat;
      Format CDATA #FIXED "YYYY-MM-DD hh:mm:ss.nnnnnn"
>
<!-- end RawKey.dtd -->
~
~
```

Image specification of the QLF product, are listed in section #4.2.4.

5.2 Speckle Filtered Products

The COSMO-SkyMed processor generating “Higher Level Speckle Filtered Product” deals with the improvement of the radiometric resolution of the SAR images by means of the reduction of the intrinsic multiplicative-like speckle noise.

5.2.1 Output Format

The basic CSK SAR output format is based on the Hierarchical Data Format version 5 developed by NCSA at the University of Illinois, fully detailed in NCSA, “HDF5 Document Set”, release 1.4.1 April 2001, web site: http://hdf.ncsa.uiuc.edu/HDF5/doc/.

5.2.1.1 Data Type

The following table summarizes the data types to be used for storage of the Speckle filtered data arrays, independently on the SAR operation mode.

Product	Dataset	Sample Format	Bits per Sample	Samples per Pixel	Type Represent.	Invalid Value
SPF_B	Speckle Filtered signal amplitude	Unsigned Integer	16	1	Little Endian	0

Table 5-1 - Data types for Speckle Filtered products

5.2.1.2 HDF5 Organization

The Speckle Filtered Product strictly follows the SAR Level 1B format organization

5.3 Co-registered Product

Two different images covering the same area can be made superposable by means of the co-registration which is the process of lining up two images, a so-called master image and a slave image, in a way that they fit exactly on top of each other without adding artifacts in the image intensity and phase components.

5.3.1 Output Format

The basic CSK SAR output format is based on the Hierarchical Data Format version 5 developed by NCSA at the University of Illinois, fully detailed in NCSA, "HDF5 Document Set", release 1.4.1 April 2001, web site: http://hdf.ncsa.uiuc.edu/HDF5/doc/.

5.3.1.1 Data Type

The following table summarizes the data types to be used for storage of the co-registered data arrays, depending on the processing Level (Level 1A or Level 1B) of the input data to the coregistration processor, independently on the SAR operation mode.

Product	Dataset	Sample Format	Bits per Sample	Samples per Pixel	Type Represent.	Invalid Value
CRG_A	Coregistered SAR Data	Signed Integer	16	2	Little Endian	[0, 0]
CRG_B	Coregistered SAR Data	Unsigned Integer	16	1	Little Endian	0

Table 5-2 Data types for Co-registered products

5.3.1.2 HDF5 Organization

The Co-registered Product strictly follows the SAR Level 1A and 1B format organization, depending on the processing level of the input images.

5.4 Interferometric Products

Synthetic aperture radar interferometry is an imaging technique for measuring the topography of the surface and its changes over time. The Interferometric products are derived, by post-processing of the SAR Level 1A coregistered products, in any acquisition mode except PingPong. Interferometric products includes the following products' class:

- the interferometric phase (interferogram)
- the coherence map.

5.4.1 Output Format

The basic CSK SAR output format is based on the Hierarchical Data Format version 5 developed by NCSA at the University of Illinois, fully detailed in NCSA, "HDF5 Document Set", release 1.4.1 April 2001, web site: http://hdf.ncsa.uiuc.edu/HDF5/doc/.

5.4.1.1 Data Type

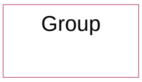
The following table summarizes the data types to be used for storage of the Interferometric data arrays, independently on the SAR operation mode.

Product	Dataset	Sample Format	Bits per Sample	Samples per Pixel	Type Represent.	Invalid Value
IPH_B	Interferogram	Floating Point	32	1	Little Endian	QNaN
	Demodulation Phase	Floating Point	32	1	Little Endian	QNaN
COH_B	Coherence	Floating Point	32	1	Little Endian	QNaN

Table 5-3 Data types for Interferometric products

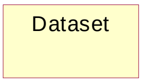
5.4.1.2 HDF5 Organization

The hierarchical organization of the IPH_B product for each Instrument Mode is graphically represented in the following diagrams.
A not color filled structure



represents a HDF5 structure group.

A color filled structure



represents a generic HDF5 dataset including data array and the relevant attributes.
Suffixes <mm>/<nnn> between angular brackets indicates that the cardinality of the group/dataset is greater than one.
In the following figures:

- SBI dataset includes the interferometric phase layer
- DPH dataset includes the demodulation phase layer

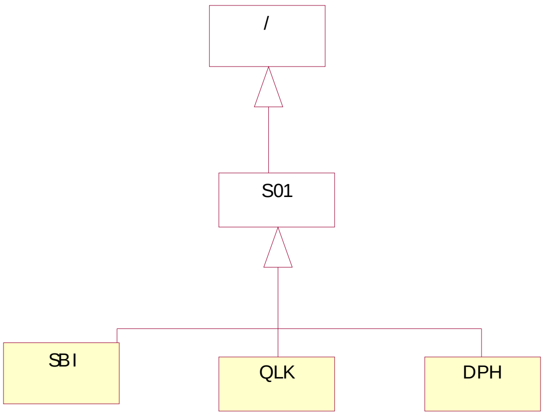


Fig. 20 – Himage/Spotlight Mode – IPH_B Product

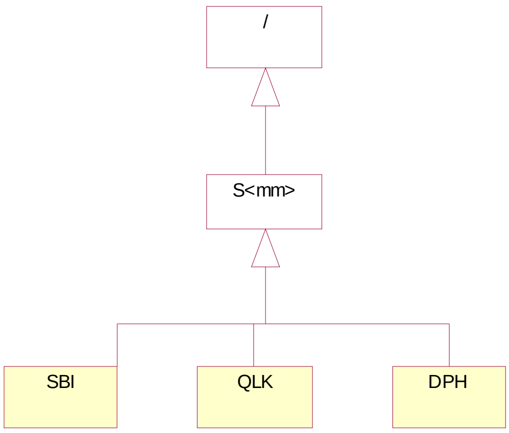


Fig. 21 – ScanSAR Mode – IPH_B Product

In the following figures SBI dataset includes the coherence layer

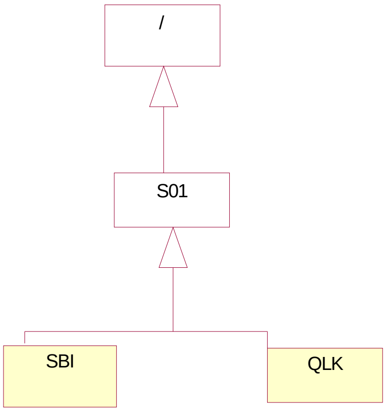


Fig. 22 – Himage/Spotlight Mode – COH_B Product

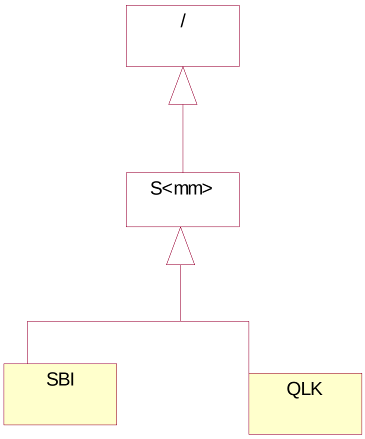


Fig. 23 – ScanSAR Mode – COH_B Product

5.5 DEM product

The interferometric DEM products are derived, by post-processing of the SAR interferometric products. DEM products consist of the ellipsoidal height map and the associated height error map. The attributes defining the DEM products are derived from the SAR image couple, with some substantial changes (e.g. due to the change of the image projection). The DEM product is presented in UTM/UPS cartographic coordinate system respect to WGS84 ellipsoid, different form the input geometry (slant-range). In the case of DEM product originated from ScanSAR interferometric couple, output is presented in a single layer having elementary beams mosaicked in the range direction.

5.5.1 Output Format

The basic CSK SAR output format is based on the Hierarchical Data Format version 5 developed by NCSA at the University of Illinois, fully detailed in NCSA, "HDF5 Document Set", release 1.4.1 April 2001, web site: http://hdf.ncsa.uiuc.edu/HDF5/doc/.

5.5.1.1 Data Type

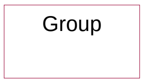
The following table summarizes the data types to be used for storage of the DEM product data layers, independently on the SAR operation mode.

Product	Dataset	Sample Format	Bits per Sample	Samples per Pixel	Type Represent.	Invalid Value
DTM_H	Height Model	Floating Point	32	1	Little Endian	QNaN
	Height Error Map	Floating Point	32	1	Little Endian	QNaN

Table 5-4 Data types for DEM product

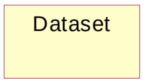
5.5.1.2 HDF5 Organization

The hierarchical organization of the DEM product for each Instrument Mode is graphically represented in the following diagrams.
A not color filled structure



represents a HDF5 structure group.

A color filled structure



represents a generic HDF5 dataset including data array and the relevant attributes.
Suffixes <mm>/<nnn> between angular brackets indicates that the cardinality of the group/dataset is greater than one.

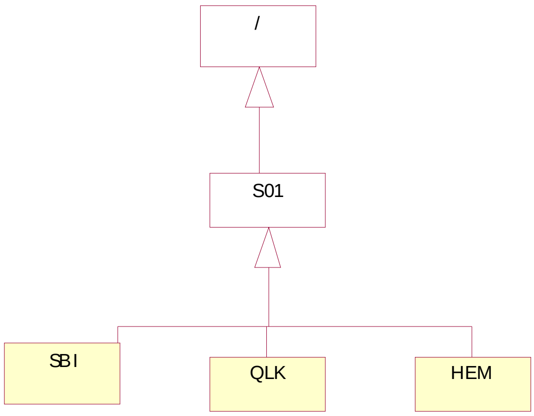


Fig. 24 – Himage/Spotlight Mode – DEM Product

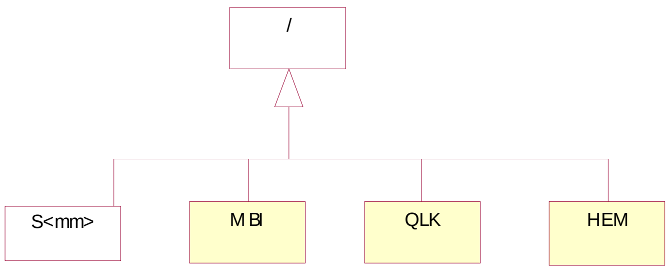


Fig. 25 – ScanSAR Mode – DEM Product

5.6 Mosaicked Product

Mosaicking is the capability of assembling Level 1B, geocoded or DEMs images or strips into a common grid, in order to generate a large-scale map.

5.6.1 Output Format

The basic CSK SAR output format is based on the Hierarchical Data Format version 5 developed by NCSA at the University of Illinois, fully detailed in NCSA, “HDF5 Document Set”, release 1.4.1 April 2001, web site: http://hdf.ncsa.uiuc.edu/HDF5/doc/.

5.6.1.1 Data Type

The following table summarizes the data types to be used for storage of the Mosaicked data arrays, independently on the SAR operation mode.

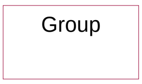
Product	Dataset	Sample Format	Bits per Sample	Samples per Pixel	Type Represent.	Invalid Value
MOS_B	SAR Image	Unsigned Integer	16	1	Little Endian	0
MOS_C	SAR Image	Unsigned Integer	16	1	Little Endian	0
MOS_D	SAR Image	Unsigned Integer	16	1	Little Endian	0
MOS_H	Heght	Float	32	1	Little Endian	QNaN
	Height Error Map	Float	32	1	Little Endian	QNaN

Table 5-5 - Data types for Mosaicked products

5.6.1.2 HDF5 Organization

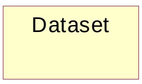
The hierarchical organization of the Mosaicked product for each Instrument Mode is graphically represented in the following diagrams.

A not color filled structure



represents a HDF5 structure group.

A color filled structure



represents a generic HDF5 dataset including data array and the relevant attributes.

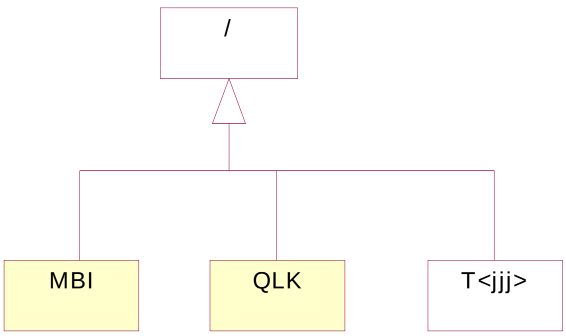


Fig. 26 – Himage/Spotlight/ScanSAR Modes – Mosaicked Level 1B/1C/1D Products

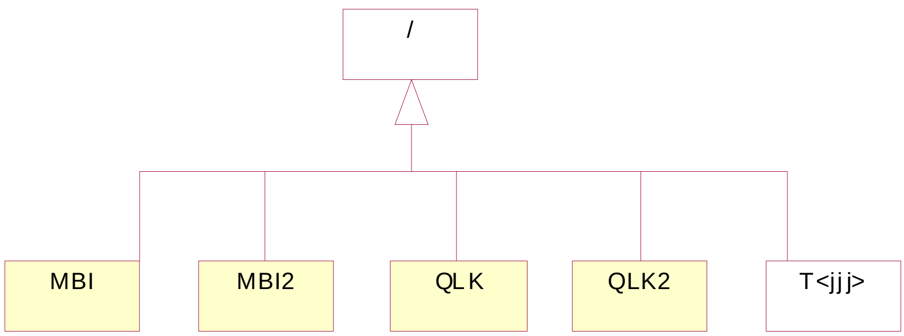


Fig. 27 – PingPong Mode – Mosaicked Level 1B/1C/1D Products

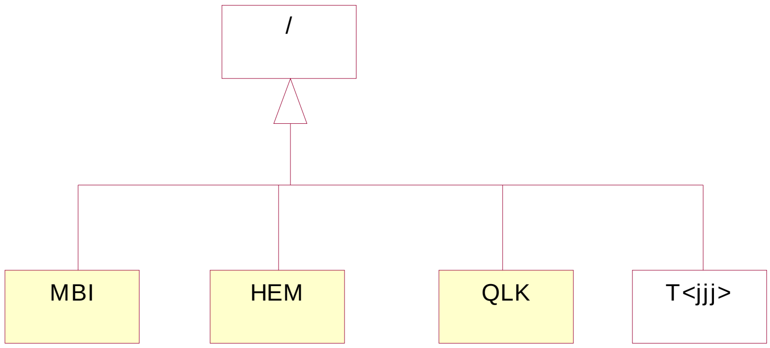


Fig. 28 – Mosaicked DEM Product

6 Appendix: Product Attributes

Next table lists, defines and specifies all attributes included in at least one of the SAR Standard or Higher Level Product. The presence of an attribute in a given product is indicated by the last columns, one for each SAR Product; the following symbols are used depending on the operation to be executed for attribute confirmation:

- “a” is used when it is in complete charge of the processor which generates the product, independently on the presence and correctness of the attribute in the input product (e.g. this is the case of some attributes of the “Formatting” class)
- “m” means the attribute is modified (i.e. it is present in the input product and the input value is used to determinate the output one)
- “x” means the attribute is copied from the input product (i. e. its correctness depends on that one of the input value)

In the symbols usage, the exceptions applicable to some sensor modes or deriving from special algorithmic implementations are not taken into consideration.

As far as the column “HDF5 struct” included into next table, it gives the dataset/group where the attribute is annexed. In the case more than one location is indicated, in most cases only one of them is available into the product (therefore ambiguities are absent); for exceptions, see the description of the attribute. Attributes of the dataset MBI and QLK, are also included in dataset MBI2 and QLK2 of the mosaic ked product.

Concerning with the “Data Type” field the following semantics have to be considered.

Data Type	Number of bits	Sign feature	Type Representation	Default Invalid Value	HDF5 type
UByte	8	Unsigned		0	H5T_STD_U8LE
UShort	16	Unsigned	Little Endian	0	H5T_STD_U16LE
Short	16	Signed	Little Endian	-(215)	H5T_STD_I16LE
UInt	32	Unsigned	Little Endian	0	H5T_STD_U32LE
Int	32	Signed	Little Endian	-(231)	H5T_STD_I32LE
ULong	64	Unsigned	Little Endian	0	H5T_STD_U64LE
Long	64	Signed	Little Endian	-(263)	H5T_STD_I64LE
Float	32	Signed	Little Endian IEEE	QNaN	H5T_IEEE_F32LE
Double	64	Signed	Little Endian IEEE	QNaN	H5T_IEEE_F64LE
String	-	-	-	“N/A”	H5T_C_S1

As far as the attributes of the intermediate products (special or temporary), it states that with respect to information listed in the following table, their presence is conditioned by the availability of the relevant group/dataset in the HDF hierarchical organization (e.g. the QLK dataset Is not present into special product SCS_E).

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Acquisition	EndOfCoverage	End Date and Time of the item temporal coverage in the string format: *YYYY-MM-DD hh:mm:ss.dddddd*	Root	String																x
Acquisition	Final On Board Time	Value of the on-board time (derived from the on-board counter annotated in the Level 0 data) corresponding to the last line of the Level 0 file used as input. It is not referred to the Reference UTC attribute, but to the last time the on board counter was zeroed.	B<nnn>	Double	s	a	x	x	x	x	x	x				x	x	x		
Acquisition	Frame	WRS Frame Number	Root	UInt 5char																x
Acquisition	Gain	Gain Value in milli-dB	Root	Int 9digit																x
Acquisition	Initial On Board Time	Value of the on-board time (derived from the on-board counter annotated in the Level 0 data) corresponding to the first line of the Level 0 file used as input. It is not referred to the Reference UTC attribute, but to the last time the on board counter was zeroed.	B<nnn>	Double	s	a	x	x	x	x	x	x				x	x	x		
Acquisition	Leap Sign	Sign of the occurrence of the leap second (if occurred during the scene acquisition)	Root	Short		a	x	x	x	x	x	x				x	x	x		
Acquisition	Leap UTC	UTC time of the occurence of the leap second (if occurred during the scene acquisition); equal to "NULL" if no leap second occurred	Root	String	Epoch	a	x	x	x	x	x	x				x	x	x		
Acquisition	MOS Latest Tile UTC	Final acquisition time of latest mosaicked tile	Root	String	Epoch										a					
Acquisition	MOS Oldest Tile UTC	Initial acquisition time of the oldest mosaicked tile	Root	String	Epoch										a					
Acquisition	Orbit Number	Orbit Number relevant to the Scene Start Time. Set to zero if not available.	Root	UInt		a	x	x	x	x	x	x				x	x	x		

Area	**Attribute name**	**Description**	**HDF5 Struc.**	**Data Type**	**Unit / ASCII repr.**	**RAW**	**SCS**	**DGM DSM**	**GEC**	**GTC**	**SPF**	**CRG**	**IPH COH**	**DEM**	**MOS**	**PBR**	**RGC**	**AZP**	**DOP**	**QLK**
Acquisition	OrbitNumber	Absolute Orbit Number corresponds to ISF start time where the ISF start time is intended the same of the field StartOfCoverage.	Root	UInt 8char																x
Acquisition	PassEquatorXLongitude	Nadir Equator Crossing Longitude for this Pass Example: 160.98	Root	Double Int digits: *3* decimals: *2*																x
Acquisition	Polarization	Polarization. Allowed values: VV *Vertical Vertical* HH *Horizontal Horizontal* VH *Vertical Horizontal* HV *Horizontal Vertical* CO *Co-Polar* CH *Cross-Polar H* CV *Cross-Polar V*	Root	String 2char																x
Acquisition	Programmed Image ID	Image ID as it was programmed by Ground Segment and downlinked in the packet header	Root	UShort		a	x	x	x	x	x	x				x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Acquisition	QuickLookFirstLineTime	Date and Time at Zero doppler of the first line of the QLF layer in the string format: YYYY-MM-DD hh:mm:ss.dddddd the possible reverse Late/Early is taken into account	Root	String																x
Acquisition	QuickLookLastLineTime	Date and Time at Zero doppler of the last line of the QLF layer in the string format: YYYY-MM-DD hh:mm:ss.dddddd the possible reverse Late/Early is taken into account	Root	String																x
Acquisition	Scene Sensing Start UTC	Initial acquisition time of the scene in UTC, derived from the OBT extracted from the downlinked product. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data. For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	String	Epoch	a	m	m	x	x	x	x			x	x	m	m		
Acquisition	Scene Sensing Stop UTC	Final acquisition time of the scene in UTC, derived from the OBT extracted from the downlinked product. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data. For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	String	Epoch	a	m	m	x	x	x	x			x	x	m	m		
Acquisition	Selective Availability Status	Status of the Selective Availability during the acquisition, affecting Orbital Data derived by GPS Instrument	Root	String		a	x	x	x	x	x	x				x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Acquisition	SensorModeDescription	Descriptive text of specific sensor mode Allowed values: SP_ENHANCED SP_SMART SCN_WIDE SCN_HUGE STR_HIMAGE STR_PINGPONG	Root	String 50char																x
Acquisition	SensorModeId	Specific sensor mode Allowed values: S2 S1 WR HR HI PP	Root	String 20char																x
Acquisition	StartOfCoverage	Start Date and Time of the item temporal coverage in the string <u>format</u>: *YYYY-MM-DD hh:mm:ss.dddddd*	Root	String																x
Acquisition	Track	WRS Track Number	Root	UInt 5char																x
Calibration	ADC Characterization	Look Up Table for ADC Characterization; it associates the signal power detected in the 8 bits RAW data to the ideal analog level in dB. For future usage	Root	Double(256, 2)		a	x	x	x	x	x	x				x	x	x		
Calibration	ADC Compensation	Flag showing the application of the ADC compensation. For future usage	Root	UByte			a	x	x	x	x	x				x				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Calibration	Antenna Pattern Compensation Reference Surface	Designator of the surface used for the compensation of the range antenna pattern. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product Set to invalid value in the case of mosaicked DEM	Root	String			a	m	x	m	x	x			x	x	a	a		
Calibration	Azimuth Antenna Pattern Compensation Geometry	Geometry used for the compensation of the azimuth antenna pattern. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String			a	m	x	x	x	x				x	a	a		
Calibration	Azimuth Antenna Pattern Gains	Antenna two-way power azimuth pattern gain values, corresponding to the Antenna Pattern angles obtainable by other specific tags	S<mm>	Double(N1)	dB	a	x	x	x	x	x	x				x	x	x		
Calibration	Azimuth Antenna Pattern Origin	Angular offset in degrees from azimuth beam centre, the first value of the azimuth antenna pattern gains is referred to.	S<mm>	Double	deg	a	x	x	x	x	x	x				x	x	x		
Calibration	Azimuth Antenna Pattern Resolution	The angular step in degrees the values of the azimuth antenna pattern gains are referred to.	S<mm>	Double	deg	a	x	x	x	x	x	x				x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Calibration	Calibration Constant	It is the Calibration Constant value (K) of the subswath. It includes all constant proportionality terms between the target energy in the input product and the actual backscattering of the scene. It excludes terms related to Range Spreading Loss, Incidence angle and Antenna Pattern compensation operators. The multiplier term (1/sqrt(K)) have to be applied to calibrate the signal amplitude. It is applied to the output SAR image if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product is set to "Not Calibrated". The attribute, in any case, must be left unchanged.	S<mm>	Double		a	x	x	x	x	x	x				x	x	x		
Calibration	Calibration Constant Compensati on Flag	Flag showing the application of the calibration constant. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product Set to invalid value in the case of mosaicked DEM	Root	UByte			a	m	x	m	x	x			m	x	a	a		

Area	**Attribute name**	**Description**	**HDF5 Struc.**	**Data Type**	**Unit / ASCII repr.**	**RAW**	**SCS**	**DGM DSM**	**GEC**	**GTC**	**SPF**	**CRG**	**IPH COH**	**DEM**	**MOS**	**PBR**	**RGC**	**AZP**	**DOP**	**QLK**
Calibration	Calibration Constant Estimation UTC	Calibration constant estimation date	S<mm>	String	Epoch	a	x	x	x	m	x	x				x	x	x		
Calibration	Incidence Angle Compensation Geometry	Geometry used for the compensation of the incidence angle. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String			a	m	x	m	x	x				x	a	a		
Calibration	Incidence Angle Compensation Reference Surface	Designator of the surface used for the compensation of the incidence angle. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product Set to invalid value in the case of mosaicked DEM	Root	String			a	m	x	m	x	x			x	x	a	a		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Calibration	Range Antenna Pattern Compensation Geometry	Geometry used for the compensation of the range antenna pattern. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String			a	m	x	m	x	x				x	a	a		
Calibration	Range Antenna Pattern Gains	Antenna two-way power range pattern gain values, corresponding to the Antenna Pattern angles obtainable by other specific tags	S<mm>	Double(N2)	dB	a	x	x	x	m	x	x				x	x	x		
Calibration	Range Antenna Pattern Origin	Angular offset in degrees from range beam centre, the first value of the range antenna pattern gains is referred to.	S<mm>	Double	deg	a	x	x	x	m	x	x				x	x	x		
Calibration	Range Antenna Pattern Resolution	The angular step in degrees the values of the range antenna pattern gains are referred to.	S<mm>	Double	deg	a	x	x	x	m	x	x				x	x	x		
Calibration	Range Spreading Loss Compensation Geometry	Geometry used for the compensation of the range spreading loss. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String			a	m	x	x	x	x				x	a	a		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Calibration	Reference Incidence Angle	Reference incidence angle (a) used at processing time (by the divisor term sqrt(sin(a)) applied to the signal amplitude) for the normalization of the incidence angle correction. It should be univocally defined for the entire SAR access area for the cross-equalization of data acquired at different swaths. It is set to invalid value if unused. Processing algorithms oriented to image calibration (e.g. L1D processor), must remove this factor on the SAR image and set the attribute to invalid value.	Root	Double	deg		a	x	x	m	x	x				x	a	a		
Calibration	Reference Slant Range	Reference slant range R used at processing time (raised by the relevant exponent) for the normalization of the range spreading loss compensation. It should be univocally defined for the entire SAR access area for the cross-equalization of data acquired at different swaths. It is set to 1 if unused. Processing algorithms oriented to image calibration (e.g. L1D processor), must remove this factor on the SAR image and set the attribute to one.	Root	Double	m		a	x	x	m	x	x				x	a	a		
Calibration	Reference Slant Range Exponent	Exponent of the reference slant range R used on the image amplitude at processing time for the normalization of the range spreading loss compensation.	Root	Double			a	x	x	x							a	a		
Doppler	Azimuth Polynomial Reference Time	Reference azimuth time (in seconds since the annotated reference UTC) used to represent the azimuth polynomial of Doppler variation and Range spectrum central frequency For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	Double	s	a	m	x	x	x	x				x	x	m	x	m	

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Doppler	Centroid vs Azimuth Time Polynomial	Coefficients of the doppler centroid azimuth polynomial coefficients (from the lower to the higher degree) For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	Double(6)	Hz/s^{i}	a	m	x	x	x	x				x	x	m	m	m	
Doppler	Centroid vs Range Time Polynomial	Coefficients of the doppler centroid range polynomial coefficients (from the lower to the higher degree) For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	Double(6)	Hz/s^{i}	a	m	x	x	x	x				x	x	m	m	m	
Doppler	Doppler Ambiguity Estimation Method	Identifier of the algorithm adopted for estimation of the doppler ambiguity .	Root	String		a	m	x	x	x	x	x				x	x	x		
Doppler	Doppler Centroid Estimation Method	Identifier of the algorithm adopted for estimation of the fractional part of the doppler centroid .	Root	String		a	m	x	x	x	x	x				x	m	m	m	
Doppler	Doppler Rate Estimation Method	Identifier of the algorithm adopted for estimation of the doppler rate .	Root	String		a	x	x	x	x	x	x				x	x	x		
Doppler	Doppler Rate vs Azimuth Time Polynomial	Coefficients of the doppler rate azimuth polynomial coefficients (from the lower to the higher degree) For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	Double(6)	$Hz/s^{(i+1)}$	a	m	x	x	x	x				x	x	m	x	m	
Doppler	Doppler Rate vs Range Time Polynomial	Coefficients of the doppler rate range polynomial coefficients (from the lower to the higher degree) For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	Double(6)	$Hz/s^{(i+1)}$	a	m	x	x	x	x				x	x	m	x	m	

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Doppler	Range Polynomial Reference Time	Reference range time used to represent the range doppler polynomial For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	Double	s	a	m	x	x	x	x				x	x	m	x	m	
Formatting	Analog Cal Reconstruction Levels	Look Up Table to be used for reconstruction of the analogue signal level from the quantized levels included into the CAL lines of the RAW product. Equal to QNaN for unused levels	Root	Double(256)	mV	a														
Formatting	Analog Noise Reconstruction Levels	Look Up Table to be used for reconstruction of the analogue signal level from the quantized levels included into the NOISE lines of the RAW product. Equal to QNaN for unused levels	Root	Double(256)	mV	a														
Formatting	Analog Signal Reconstruction Levels	Look Up Table to be used for reconstruction of the analogue signal level from the quantized levels included into the ECHO lines of the RAW product. Equal to QNaN for unused levels	Root	Double(256)	mV	a														
Formatting	Bits per Sample	Number of bit per image sample	Root	UByte		a	a	a	a	a	a	a	a	a	a	a	a	a	a	
Formatting	Columns Order	Order of columns in the formatted product. The "FAR-NEAR" order is allowed only in the case of the Quick Look product.	Root	String		a	a	a	a	a	a	a	a	a	a	a	a	a		
Formatting	DOP Column Time Interval	Time spacing in the range direction between columns	DOP	Double	s														a	
Formatting	DOP First Column Time	Time of the first column	DOP	Double	s														a	
Formatting	DOP First Line Time	Time of the first line of the image in seconds since the annotated reference UTC	DOP	Double	s														a	
Formatting	DOP Line Time Interval	Time spacing in the azimuth direction between lines	DOP	Double	s														a	

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Formatting	Equivalent Column Time Interval	Equivalent time spacing in the range direction between columns	S<mm>	Double	s	a											m	m		
Formatting	Equivalent First Column Time	Equivalent time of the first column of the data in seconds. If set to QNaN it indicates that the compensation of SWST change has not been performed and the attribute "Range First Times" must be considered. In the case of burst mode data, it is set to the minimum of the equivalent times of the bursts included into the subswath	S<mm>	Double	s	a											m	m		
Formatting	Equivalent First Line Time	Equivalent time of the first line of the data in seconds since the annotated reference UTC. In the case of burst mode data, it is set to the equivalent time of the first burst included into the subswath	S<mm>	Double	s	a											m	m		
Formatting	Equivalent Line Time Interval	Equivalent time spacing in the azimuth direction between lines	S<mm>	Double	s	a											m	m		
Formatting	Image Layers	Number of Image Layers	Root	UByte		a	x	x	x	x	x	x	x	x	x	x	x	x		
Formatting	Image Scale	Scale used for image representation	Root	String		a	a	a	a	a	a	a	a	a	a	a	a	a		
Formatting	Layover Pixel Value	Value used for representation of pixels in layover geometry	GIM	Short						a										
Formatting	Lines Order	Order of lines in the formatted product. The "LATE-EARLY" order is allowed only in the case of the Quick Look product.	Root	String		a	a	a	a	a	a	a	a	a	a	a	a	a		
Formatting	Master Zero Doppler Azimuth First Time	Time of the first line of the ot the input master image to interferometry	SBI MBI	Double	s								a	x						
Formatting	Master Zero Doppler Azimuth Last Time	Time of the last line of the ot the input master image to interferometry	SBI MBI	Double	s								a	x						

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Formatting	Master Zero Doppler Range First Time	Time of the first column of the ot the input master image to interferometry	SBI MBI	Double	s								a	x						
Formatting	Master Zero Doppler Range Last Time	Time of the last column of the ot the input master image to interferometry	SBI MBI	Double	s								a	x						
Formatting	Original Zero Doppler Azimuth First Time	Time of the first line of the input image (master/slave), before coregistration	SBI MBI	Double	s							a								
Formatting	Original Zero Doppler Azimuth Last Time	Time of the last line of the input image (master/slave), before coregistration	SBI MBI	Double	s							a								
Formatting	Original Zero Doppler Range First Time	Time of the first column of the input image (master/slave), before coregistration	SBI MBI	Double	s							a								
Formatting	Original Zero Doppler Range Last Time	Time of the last column of the input image (master/slave), before coregistration	SBI MBI	Double	s							a								
Formatting	Quick Look Columns Order	Order of columns in the quick look layer. For quick look annexed to Level 0 product, it is conditioned by the consideration about geometric representation of the Quick Look product (see "Higher Level Products for Civilian Application: Products Specification" for details) aiming to simplify the image intepretation. For other products, it inherits the order of the full resolution layer.	QLK	String		a	a	a	a	a	a	a	a	a	a	a				x

Area	**Attribute name**	**Description**	**HDF5 Struc.**	**Data Type**	**Unit / ASCII repr.**	**RAW**	**SCS**	**DGM DSM**	**GEC**	**GTC**	**SPF**	**CRG**	**IPH COH**	**DEM**	**MOS**	**PBR**	**RGC**	**AZP**	**DOP**	**QLK**
Formatting	Quick Look Lines Order	Order of lines in the quick look layer. For quick look annexed to Level 0 product, it is conditioned by the consideration about geometric representation of the Quick Look product (see "Higher Level Products for Civilian Application: Products Specification" for details) aiming to simplify the image intepretation. For other products, it inherits the order of the full resolution layer.	QLK	String		a	a	a	a	a	a	a	a	a	a	a				x
Formatting	Sample Format	Sample data type	Root	String		a	a	a	a	a	a	a	a	a	a	a	a	a	a	
Formatting	Samples per Pixel	Number of samples per pixels	Root	UByte		a	a	a	a	a	a	a	a	a	a	a	a	a	a	
Formatting	Shadowing Pixel Value	Value used for representation of pixels in shadowing geometry	GIM	Short						a										
Formatting	SIM Column Time Interval	Time spacing in the range direction between columns	Root	Double	s															
Formatting	SIM First Column Time	Time of the first column	Root	Double	s															
Formatting	SIM First Line Time	Time of the first line of the image in seconds since the annotated reference UTC	Root	Double	s															
Formatting	SIM Line Time Interval	Time spacing in the azimuth direction between lines	Root	Double	s															
Formatting	Slave Zero Doppler Azimuth First Time	Time of the first line of the ot the input slave image to interferometry	SBI MBI	Double	s								a	x						
Formatting	Slave Zero Doppler Azimuth Last Time	Time of the last line of the ot the input slave image to interferometry	SBI MBI	Double	s								a	x						
Formatting	Slave Zero Doppler Range First Time	Time of the first column of the ot the input slave image to interferometry	SBI MBI	Double	s								a	x						

Area	**Attribute name**	**Description**	**HDF5 Struc.**	**Data Type**	**Unit / ASCII repr.**	**RAW**	**SCS**	**DGM DSM**	**GEC**	**GTC**	**SPF**	**CRG**	**IPH COH**	**DEM**	**MOS**	**PBR**	**RGC**	**AZP**	**DOP**	**QLK**
Formatting	Slave Zero Doppler Range Last Time	Time of the last column of the ot the input slave image to interferometry	SBI MBI	Double	s								a	x						
Formatting	Zero Doppler Azimuth First Time	Time of the first line of the zero doppler focused block in seconds since the annotated reference UTC Set to invalid value in the case of mosaicked DEM	SBI MBI	Double	s		a	m	x	x	x	m			x	x				
Formatting	Zero Doppler Azimuth Last Time	Time of the last line of the zero doppler focused block in seconds since the annotated reference UTC Set to invalid value in the case of mosaicked DEM	SBI MBI	Double	s		a	m	x	x	x	m			x	x				
Formatting	Zero Doppler Range First Time	Time of the first image column of the segment, including near and far zero padding effects due to SWST readjustment, multilooking, zero-doppler processing, … Set to invalid value in the case of mosaicked DEM	SBI MBI	Double	s		a	m	x	x	x	m			x	x				
Formatting	Zero Doppler Range Last Time	Time of the last image column of the segment, including near and far zero padding effects due to SWST readjustment, transients removal, multilooking, zero-doppler processing, … Set to invalid value in the case of mosaicked DEM	SBI MBI	Double	s		a	m	x	x	x	m			x	x				
Identification	Acquisition Station ID	Acquisition Station identifier	Root	String		a	x	x	x	x	x	x				x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Identification	AcquisitionStation	Acquisition Station code where product has been acquired from. Allowed values: *1100* *1101* *1200* *1201* *1300* *1301* *…* See GS ICD [R3] Section 6.3.3	Root	UInt 9 digits																x
Identification	BandReductionFlag	If True indicates that this ISF is acquired in SPOT300 Mode using the band reduction Allowed values: TRUE | FALSE Default FALSE	Root	String																x
Identification	CRG Image Flag	Flag indicating if the image has been used such as Master rather than Slave in co-registration process (both in master and slave images)	Root	String								a								
Identification	Delivery Mode	Identification of the processing mode used to meet the delivery time constraints. It is strictly related to the accuracy level of the support data (in partiular of the orbital data) used to originate the product	Root	String		a	x	x	x	x	x	x				x	x	x		
Identification	Downlink Start UTC	Downlink time of the first echo line of the Level 0 file used as input to generate the product	Root	String	Epoch	a	x	x	x	x	x	x				x	x	x		
Identification	Downlink Stop UTC	Downlink time of the last echo line of the Level 0 file used as input to generate the product	Root	String	Epoch	a	x	x	x	x	x	x				x	x	x		
Identification	Master Product Filename	Filename of the master product used as reference scene for coregistration. Equal to Product Filename in master one	Root	String								a								

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Identification	Master Satellite ID	Satellite identifier used for the acquisition of the master image	Root	String									a	a						
Identification	Mission ID	Mission identifier	Root	String		a	x	x	x	x	x	x	x	x	x	x	x	x		
Identification	Processing Centre	Identifier of the processing centre which generated the core preocessing step of the current product	Root	String		a	a	a	a	a	a	a	a	a	a	a	x	x		
Identification	Product Filename	Product file name according to the standard convention fixed in the Product Specification Document	Root	String		a	a	a	a	a	a	a	a	a	a	a	a	a		
Identification	Product Specificatio n Document	Code of the Specification Document (including Version and Issue) where the product content and format are detailed	Root	String		a	a	a	a	a	a	a	a	a	a	a	a	a		
Identification	Product Type	Indication of the product type. Enumerated value without suffix are for internal use only.	Root	String		a	a	a	a	a	a	a	a	a	a	a	a	a	a	
Identification	Satellite ID	Satellite Identifier For mosaicked products it is annexed only to tiles. Equal to Master Satellite ID in the case of mosaicked DEM	Root T<jjj>	String		a	x	x	x	x	x	x			x	x	x	x		
Identification	SatelliteId	Satellite Identifier Allowed values: SAR1 SAR2 SAR3 SAR4 SAR5 SAR6 SAR7 SAR8	Root	String *10char*																x
Identification	SensorId	Sensor Identifier Allowed value: SAR	Root	String *10char*																x
Identification	Slave Satellite ID	Satellite identifier used for the acquisition of the slave image	Root	String									a	a						

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Instrument	Acquisition Mode	Instrument mode enabled during acquisition For mosaicked products it is annexed only to tiles. Equal to Master Acquisition Mode in the case of mosaicked DEM	Root T<jjj>	String		a	x	x	x	x	x	x			x	x	x	x		
Instrument	Antenna Beam Code	Code of the antenna beam as it is reported in the Level 0 data.	S<mm>	Ubyte		a	x	x	x	x	x	x				x	x	x		
Instrument	Antenna Beam Elevation	Nominal elevation angle associated to the antenna beam. It represent the signed (positive sign means the beam moving to the left) offset of the nominal main lobe w.r.t. the mechanical perpendicular to the antenna, measured in the elevation plane. It is derived from a configuration table. Such angle, in conjuction with the additional elevation and azimuth steering, is used to derive the antenna electrical pointing	S<mm>	Double	deg	a	x	x	x	x	x	x				x	x	x		
Instrument	Antenna Length	Antenna length in the azimuth direction	Root	Double	m	a	x	x	x	x	x	x	x	x	x	x	x	x		
Instrument	Azimuth Beamwidth	Antenna azimuth beam width	Root	Double	deg	a	x	x	x	x	x	x				x	x	x		
Instrument	Azimuth First Time	Initial acquisition time of the burst in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	B<nnn>	Double	s	a	m	m	x	x	x	x				x	m	m		
Instrument	Azimuth Instrument Geometric Resolution	Theoretical azimuth geometric resolution of the data as derived from the radar parameters (that is not considering weighting and multilooking effects)	S<mm>	Double	m		a	x	x	x	x	x				x				
Instrument	Azimuth Last Time	Final acquisition time of the portion of the burst in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	B<nnn>	Double	s	a	m	m	x	x	x	x				x	m	m		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Instrument	Azimuth Ramp Code	Code of the azimuth scanning ramp as it is reported in the Level 0 data. The array dimension corresponds to the number of occurrences of code's changes.	B<nnn>	UByte(N13)		a	x	x	x	x	x	x				x	x	x		
Instrument	Azimuth Ramp Code Change Lines	Image Rows indexes at which the azimuth scanning ramp has been changed (within data segment) w.r.t. the corresponding values of the previous line. Line 0 is always considered as a changing line. The array dimension corresponds to the number of occurrences of code's changes.	B<nnn>	UInt(N13)		a	x	x	x	x	x	x				x	x	x		
Instrument	Azimuth Steering	Array of the Azimuth angles of the antenna beam set at the Azimuth Ramp Code Change Lines. While for the ScanSAR and StripMap case such value should be constant within the strip/burst, in the Spotlight case the array including the azimuth direction of the antenna beam due to the repointing implied by the instrument mode should be given. The array dimension corresponds to the number of occurrences of angle's changes.	B<nnn>	Double(N13)	deg	a	x	x	x	x	x	x				x	x	x		
Instrument	Beam ID	Identifier of the beam which contributes to the full swath	S<mm>	String		a	x	x	x	x	x	x				x	x	x		
Instrument	Beam Off-Nadir Angle	Angle between the main lobe of the antenna beam and the geodetic nadir, measured in acquisition geometry. It can be used for a coarse approach to the antenna pattern compensation.	S<mm>	Double	deg	a	x	x	x	x	x	x				x	x	x		
Instrument	Bursts per Subswath	Bursts per Subswath/Polarisation. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	S<mm>	UShort		a	m	m	x	x	x	x				x	m	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Instrument	Calibration Pulse Azimuth Times	Array of the slow times of the Calibration Pulses in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product. In the case of StartCal and StopCal pulses, compensated invalid lines are associated to an azimuth times equal to QNaN	CAL	Double(193) Double(N8)	s	a														
Instrument	Calibration Sampling Window Length	Sampling Window Lengths of the Periodic Calibration Data (in number of range samples) during the acquisition of the subswath.	S<mm>	UShort		a														
Instrument	Echo Sampling Window Length	Sampling Window Lengths (in number of range samples) during the acquisition of the subswath.	S<mm>	UShort		a	x	x	x	x	x	x				x	x	x		
Instrument	Elevation Ramp Code	Code of the elevation scanning ramp as it is reported in the Level 0 data. The array dimension corresponds to the number of occurrences of code's changes.	B<nnn>	UByte(N17)		a	x	x	x	x	x	x				x	x	x		
Instrument	Elevation Ramp Code Change Lines	Image Rows indexes at which the elevation scanning ramp has been changed (within data segment) w.r.t. the corresponding values of the previous line. Line 0 is always considered as a changing line. The array dimension corresponds to the number of occurrences of code's changes.	B<nnn>	UInt(N1 7)		a	x	x	x	x	x	x				x	x	x		
Instrument	Elevation Steering	Array of the signed (positive sign means the main lobe moves to the left) additional Elevation angles of the antenna beam, as it is set at the Elevation Ramp Code Change Lines. Such angle, in conjuction with the nominal antenna beam elevation, gives the total elevation angle The array dimension corresponds to the number of occurrences of angle's changes.	B<nnn>	Double(N17)	deg	a	x	x	x	x	x	x				x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Instrument	Ground Range Instrument Geometric Resolution	Theoretical ground range geometric resolution in the worst case (that is at near range), as derived from the radar parameters (that is not considering weighting and multilooking effects)	S<mm>	Double	m		a	x	x	x	x	x				x				
Instrument	Lines per Burst	Lines per burst	S<mm>	UInt		a	x	x	x	x	x	x				x	x	x		
Instrument	Look Side	Antenna direction For mosaicked products it is annexed only to tiles. Set to invalid value in the case of mosaicked DEM	Root T<jjj>	String		a	x	x	x	x	x	x	x		x	x	x	x		
Instrument	LookSide	Look side. Allowed values: LEFT RIGHT N/A	Root	String																x
Instrument	Master Acquisition Mode	Instrument mode enabled during acquisition of master image	Root	String									a	x						
Instrument	Master Multi-Beam ID	Identifier of the beam which contributes to the full swath (Slave image)	Root	String									a	x						
Instrument	Master PRF	Pulse Repetition Frequency of the instrument during the scene acquisition (Master image)	S<mm>	Double	Hz								a	x						
Instrument	Master Sampling Rate	Range Sampling rate of the instrument during the scene acquisition (Master image)	S<mm>	Double	Hz								a	x						
Instrument	MOS Polarisation	Common Transmit/Receive polarisation of the mosaicked tiles Set to invalid value in the case of mosaicked DEM	MBI	String											x					

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Instrument	Multi-Beam ID	Identifier of the beams combinated to form the full swath For mosaicked products it is annexed only to tiles. Equal to Master Multi-Beam ID in the case of mosaicked DEM	Root T<jjj>	String		a	x	x	x	x	x	x			x	x	x	x		
Instrument	Noise Data Azimuth Times	Slow times of the Noise data in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product	NOISE	Double(N11)	s	a														
Instrument	Noise Sampling Window Length	Sampling Window Lengths of the Noise Data (in number of range samples) during the acquisition of the subswath.	S<mm>	UShort		a														
Instrument	Original Bit Quantisation	Number of quantization bits of each channel of the RAW signal at origin (i.e. before the adaptive quantisation removal)	Root	UByte		a	x	x	x	x	x	x				x	x	x		
Instrument	Polarisation	Transmit/Receive polarisation enabled during data sensing. H = Horizontal V = Vertical	S<mm>	String		a	x	x	x	x	x	x	x	x		x	x	x		
Instrument	PRF	Pulse Repetition Frequency of the instrument during the scene acquisition	S<mm>	Double	Hz	a	m	x	x	x	x	x				x	m	m		
Instrument	Radar Frequency	Radar frequency For mosaicked products it is annexed only to tiles.	Root T<jjj>	Double	Hz	a	x	x	x	x	x	x	x	x	x	x	x	x		
Instrument	Radar Wavelength	Radar wavelength For mosaicked products it is annexed only to tiles.	Root T<jjj>	Double	m	a	x	x	x	x	x	x	x	x	x	x	x	x		
Instrument	Range Chirp Length	Range chirp length	S<mm>	Double	s	a	m	x	x	x	x	x				x	m	m		
Instrument	Range Chirp Rate	Rate of the transmitted pulse. In the case of Spotlight mode, for the acquisitions where an up-chirp and a down-chirp are alternated every PRI, it represents the rate of the first echo line of the L0 data segment used to generate the product and included into it.	S<mm>	Double	Hz/s	a	m	x	x	x	x	x				x	m	m		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Instrument	Range Chirp Rate Alternation	Flag indicating if up-down chirp policy was applied during the acquisition	Root	Ubyte		a														
Instrument	Range Chirp Samples	Number of chirp samples, as derived from Range Chirp Length and Sampling Frequency	S<mm>	UShort		a	x	x	x	x	x	x				x	x	x		
Instrument	Range First Time Change Lines	Image Rows indexes (starting from 0) at which the Sampling Window Start Time has been changed (within burst) w.r.t. the corresponding values of the previous line. Line 0 of the burst is always considered as a changing line.	B<nnn>	UInt(N7)		a	x	x	x	x	x	x				x	x	x		
Instrument	Range First Times	List of times between the rising edge of the transmit pulse and the rising edge of the receiving window opened to sample the echo of the same pulse, relevant to lines included in "Range First Time Change Lines". It differs from the value of the Sampling Window Start Time annotated into the downlinked data, as it take into account the time between the rising edge of the transmit pulse and the rising edge of the sampling window within the same PRI.	B<nnn>	Double(N7)	s	a	x	x	x	x	x	x				x	x	x		
Instrument	Rank	In flight pulses	S<mm>	UByte		a	x	x	x	x	x	x				x	x	x		
Instrument	Receiver Gain	The receiver attenuation settings used during the acquisition (see also Receiver Gain Change Lines)	B<nnn>	UByte(N15)	dB	a	x	x	x	x	x	x				x	x	x		
Instrument	Receiver Gain Change Lines	Image Rows indexes at which the Receiver Gain has been changed (within burst) w.r.t. the corresponding values of the previous line. Line 0 is always considered as a changing line. The array dimension corresponds to the number of occurrences of changes.	B<nnn>	UInt(N15)		a	x	x	x	x	x	x				x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Instrument	Reference Dechirping Time	Offset w.r.t. the range first time, of the reference time (null frequency time) of dechirping signal (used only for the Spotlight case, set to QNaN otherwise). As default, it corresponds to the range central time.	S<mm>	Double	s	a	x	x	x	x	x	x				x	x	x		
Instrument	Replica Azimuth Times	Slow times of the reconstructed replica in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product	REPLICA	Double(N8)	s	a														
Instrument	Sampling Rate	Range Sampling rate of the instrument during the scene acquisition	S<mm>	Double	Hz	a	m	x	x	x	x	x				x	m	m		
Instrument	Slave Acquisition Mode	Instrument mode enabled during acquisition of slave image	Root	String									a	x						
Instrument	Slave Multi-Beam ID	Identifier of the beam which contributes to the full swath (Slave image)	Root	String									a	x						
Instrument	Slave PRF	Pulse Repetition Frequency of the instrument during the scene acquisition (Slave Image)	S<mm>	Double	Hz								a	x						
Instrument	Slave Sampling Rate	Range Sampling rate of the instrument during the scene acquisition (Slave image)	S<mm>	Double	Hz								a	x						
Instrument	Subswaths Number	Number of subswaths included in scene	Root	UByte		a	x	x	x	x	x	x				x	x	x		
Instrument	Synthetic Aperture Duration	Duration of the synthetic aperture at the central slant range	S<mm>	Double	s	a	x	x	x	x	x	x				x	x	x		
PCD	ASLR Null Pixel	Percentage of null intensity pixel of the output image in the adaptively weighted image (estimated only on valid pixels)	Root	Double												a				
PCD	ASLR Null Pixel Original	Percentage of null intensity pixel in the original Image (estimated only on valid pixels)	Root	Double												a				
PCD	ASLR Signal Shift	The average signal space shifts	Root	Double												a				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	ASLR Signal to Clutter Ratio Mean	The average ratio of the weighted over the original Signal to Clutter Ratio	Root	Double												a				
PCD	ASLR Signal to Clutter Ratio Standard Deviation	The standard deviation of the ratio of the weighted over the original Signal to Clutter Ratio	Root	Double												a				
PCD	Attitude Product Category	Type of Attitude product used for processing. DOWNLINKED indicates the attitude data annexed to the Level 0 data as they are downlinked from the spacecraft RESTITUTED indicates the attitude data obtained by on-ground postprocessing. For mosaicked products it is annexed only to tiles.	Root T<jjj>	String		a	x	x	m	m	x	x			x	x	x	x		
PCD	Central Range Frequency vs Azimuth Time Polynomial	Coefficients of the polynomial representing the variation (w.r.t. the relative azimuth times) of the central frequency of the range spectrum in the azimuth direction (from the lower to the higher degree). Annotated only in complex products. Not estimated (hence set to QNaN) in the case of intermediate products.	S<mm>	Double(3)	Hz/s^i		a					x				x				
PCD	CRG Baseline	For each slave: Baseline orthogonal and parallel components w.r.t. the line of sight estimated at the image center Set to invalid value in Master Set to invalid valut in mosaiked products not representing a DEM	SBI MBI T<jjj>	Double[2]	m							a	x	x	x					

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	CRG GCP Cross-correlation SNR	For each slave: for each GCP the ration between the intensity of the peak of the cross-correlation matrix and the mean value of the intensity of the matrix itself: $q_i=I_i(max)/<I_i>$. Set to invalid value for GCPs outside the overlapping area. Set to invalid value in Master	SBI MBI	Double(N19, N18)								a								
PCD	CRG GCPs Coherence	For each slave: for each GCP the maximum value of the coherence on the matrix Set to invalid value for GCPs outside the overlapping area. Set to invalid value in Master	SBI MBI	Double(N19, N18)								a								
PCD	CRG GCPs Flag	For each slave: Flag array of valid GCPs Set to -1 for GCPs outside the overlapping area. Set to invalid value in Master	SBI MBI	Short(N19, N18)								a								
PCD	CRG GCPs in Master	Matrix of GCP Row/Col coordinates in master image (only in master image) before possible cut Set to invalid value in Slave	SBI MBI	Double[N19, N18, 2]								a								
PCD	CRG GCPs in Slave	For each slave: Matrix of GCP Row/Col coordinates in slave image before coregistration and possible cut Set to invalid value for GCPs outside the overlapping area. Set to invalid value in Master	SBI MBI	Double[N19, N18, 2]								a								
PCD	CRG GCPs Residuals	For each slave: Differences between the evaluated row,col coordinates for each GCP of the slave and the ones obtained by applying the warping function to the valid master GCP Set to invalid value for GCPs outside the overlapping area. Set to invalid value in Master	SBI MBI	Double(N19, N18,2)								a								
PCD	CRG GCPs Residuals Mean	For each slave: Mean of geometric residuals of GCPs coregistration Set to invalid value in Master	SBI MBI	Double(2)								a	x	x						

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	CRG GCPs Residuals Standard Deviation	For each slave: Standard deviation of geometric residuals of GCPs coregistration Set to invalid value in Master	SBI MBI	Double(2)								a	x	x						
PCD	CRG Master to Slave Warp Matrix	For each slave: Warp matrix converting master Row/Col indexes to the slave's ones in Coregistration process. Array is always dimensioned to represent a 3rd degree warp transformation; some field could be set to zero as function of the degree actually used. If R and C (resp. R' and C') represent Row-Col indexes in the master (resp. slave) reference, the first row of the matrix includes coefficients ai (i=0, ..., 9) such that R' = a0 + a1*R + a2*C + a3*R^2 + a4*R*C + a5*C^2 + a6*R^3 + a7*R^2*C + a8*R*C^2 + a9*C^3 The second row of the matrix includes coefficients bi (i=0, ..., 9) such that C' = b0 + b1*R + b2*C + b3*R^2 + b4*R*C + b5*C^2 + b6*R^3 + b7*R^2*C + b8*R*C^2 + b9*C^3	SBI MBI	Double[2, 10]								a								
PCD	CRG Overlapping Percentage	For each slave: extension (as percentage of the master coverage) of the overlapping zone between the slave and the master Set to invalid value in Master	SBI MBI	Double								a								

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	CRG Slave to Master Warp Matrix	For each slave: Warp matrix converting slave Row/Col indexes to the master's ones in Coregistration process. Array is always dimensioned to represent a 3rd degree warp transformation; some field could be set to zero as function of the degree actually used. If R and C (resp. R' and C') represent Row-Col indexes in the master (resp. slave) reference, the first row of the matrix includes coefficients ai (i=0, ..., 9) such that R = a0 + a1*R' + a2*C' + a3*R'^2 + a4*R'*C' + a5*C'^2 + a6*R'^3 + a7*R'^2*C' + a8*R'*C'^2 + a9*C'^3 The second row of the matrix includes coefficients bi (i=0, ..., 9) such that C = b0 + b1*R' + b2*C' + b3*R'^2 + b4*R'*C' + b5*C'^2 + b6*R'^3 + b7*R'^2*C' + b8*R'*C'^2 + b9*C'^3 Set to invalid value in Master	SBI MBI	Double[2, 10]								a	x	x						
PCD	CRG Top Left Corner in Master Reference	For each slave: Row/Col indexes of the top left corner of the slave image in the reference of the master image Set to invalid value in master.	SBI MBI	Int(2)								a	x	x						
PCD	Doppler Ambiguity	Ambiguity number of doppler centroid on the scene. Expected value equal to zero, if Yaw Steering enabled.	S<mm>	Short		a	m	x	x	x	x	x				x	m	x		
PCD	Doppler Ambiguity Confidence Measure	Normalized confidence measure of doppler centroid ambiguity. A value of zero means poor confidence.	Root	Double		a	m	x	x	x	x	x				x	m	x		
PCD	Doppler Centroid Confidence Measure	Normalized confidence measure of doppler centroid. A value of zero means poor confidence.	Root	Double		a	m	x	x	x	x	x				x	m	m	m	
PCD	Doppler Centroid Estimation Accuracy	Standard deviation in the estimation of doppler centroid.	Root	Double	Hz	a	m	x	x	x	x	x				x	m	m	m	

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	Doppler Rate Confidence Measure	Normalized confidence measure of doppler rate A value of zero means poor confidence.	Root	Double		a	x	x	x	x	x	x				x	x	x		
PCD	Doppler Rate Estimation Accuracy	Standard deviation in the estimation of doppler rate.	Root	Double	Hz/s	a	x	x	x	x	x	x				x	x	x		
PCD	Image Max	Image maximum value estimated separately on each channel of data excluding saturated pixels; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)			a	a	a	a	a	a	a	a	a	a				
PCD	Image Mean	Image mean value estimated separately on each channel of data; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)			a	a	a	a	a	a	a	a	a	a				
PCD	Image Min	Image minimum value estimated separately on each channel of data excluding pixel with values lying on the lower (underflow) quantisation bins; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)			a	a	a	a	a	a	a	a	a	a				
PCD	Image OverSaturated Percentage	Percentage of Oversaturated pixels in the image estimated separately on each channel of data; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)			a	a	a	a	a	a				a				
PCD	Image Standard Deviation	Image sigma value estimated separately on each channel of data; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)			a	a	a	a	a	a	a	a	a	a				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	Image to Simulation Warp Matrix	In geocoding process, it represents the warp matrix converting Row/Col indexes of the original SAR image to the ones of the simulated SAR scene. Array is always dimensioned to represent a 1st degree warp transformation; some field could be set to zero as function of the degree actually used. If R and C (resp. R' and C') represent Row-Col indexes in the original image (resp. simulated image) reference, the first row of the matrix includes coefficients ai (i=0, ..., 2) such that R' = a0 + a1*R + a2*C The second row of the matrix includes coefficients bi (i=0, ..., 2) such that C' = b0 + b1*R + b2*C	Root	Double[2, 3]						a											
PCD	Image UnderSaturated Percentage	Percentage of Undersaturated pixels in the image estimated separately on each channel of data; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)			a	a	a	a	a	a				a				
PCD	Layover Pixel Percentage	Percentage of pixels in layover geometry with respect to the pixel of the scene (hence not considering invalid zones at the image borders deriving from image reprojection)	GIM	Double						a										
PCD	MissingLinesPercentage	Missing Lines percentage	Root	UInt 3digit																x
PCD	NumberOfGaps	Number of Gaps	Root	UInt 9digit																x
PCD	POD Initial Position Accuracy	Quality index of the Precise Orbit Determination. It indicates the accuracy on the initial position of the propagation model. Further details in "POD Data Specification" document. Set to QNaN in the case POD Product Category is equal to "DOWNLINKED"	Root	Double	m	a	x	x	m	m	x	x				x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	POD Overlap Position Accuracy	Quality index of the Precise Orbit Determination. It indicates the accuracy of the platform position in the overlapping arcs. Further details in "POD Data Specification" document. Set to QNaN in the case POD Product Category is equal to "DOWNLINKED"	Root	Double	m	a	x	x	m	m	x	x				x	x	x		
PCD	POD Product Category	Quality index of the Precise Orbit Determination process. It indicates the level of accuracy of the orbital data annexed to the product. DOWNLINKED indicates the orbital data annexed to the Level 0 data as they are downlinked from the spacecraft PROPAGATED indicates the orbital data obtained by propagating restituted orbits after the end of the analyzed data arc FILTERED indicates the orbital data obtained by filtering the on board navigation solution RESTITUTED indicates the orbital data based on the GPS data acquired by on board GPS and the GPS ground network (CSK fiducial network and/or IGS network). Such attribute is strictly related to the product delivery mode (Fast Delivery rather than Standard Delivery). Fast Delivery mode implies usage of DOWNLINKED or PROPAGATED orbit Standard Delivery mode implies usage of FILTERED or RESTITUTED orbit For mosaicked products it is annexed only to tiles.	Root T<jjj>	String		a	x	x	x	x	x	x			x	x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	POD Quality Flag	Quality index of the Precise Orbit Determination process performed on ground, extracted from the orbital product Set to "N/A" in the case of downlinked orbit are used For mosaicked products it is annexed only to tiles.	Root T<jjj>	String		a	x	x	m	m	x	x			x	x	x	x		
PCD	RAW Bias	Bias of RAW data; two samples for the In-Phase and Quadrature signal (I-Q) estimated on valid lines of the block	B<nnn>	Double(N9, N10, 2)		a	x	x	x	x	x	x				x	x	x		
PCD	RAW Gain Imbalance	Gain imbalance of the I and Q channel of the RAW data estimated on valid lines of the block	B<nnn>	Double(N9, N10)		a	x	x	x	x	x	x				x	x	x		
PCD	RAW I/Q Normality	Measure of the Gaussian properties of I and Q channels distribution	B<nnn>	Double(N9, N10, 2)	deg	a	x	x	x	x	x	x				x	x	x		
PCD	RAW I/Q Ortogonalit y	Phase difference (orthogonality) between I and Q channels of RAW data estimated on valid lines	B<nnn>	Double(N9, N10)	deg	a	x	x	x	x	x	x				x	x	x		
PCD	RAW Missing Blocks Start Lines	Image Lines' indexes at which a readjusted (e.g. by zero filling) missing block starts. If no missing blocks occurr in data, a zeroed one-element array is used for this tag and for "RAW Missing Lines per Block" one.	B<nnn>	UInt(N1 6)		a	x	x	x	x	x	x				x	x	x		
PCD	RAW Missing Lines per Block	Number of missing lines within each readjusted missing block If no missing blocks occurr in data, a zeroed one-element array is used for this tag and for "RAW Missing Blocks Start Lines" one.	B<nnn>	UShort(N16)		a	x	x	x	x	x	x				x	x	x		
PCD	RAW Missing Lines Percentage	Percentage of missing lines to total lines of the burst	B<nnn>	Double		a	x	x	x	x	x	x				x	x	x		
PCD	RAW OverSatura ted Percentage	Percentage of RAW Oversaturated; two samples for the In-Phase and Quadrature signal (I-Q)	B<nnn>	Double(2)		a	x	x	x	x	x	x				x	x	x		
PCD	RAW Phase Uniformity	Measure of the uniform properties of phase distribution of the RAW data	B<nnn>	Double(N9, N10)	deg	a	x	x	x	x	x	x				x	x	x		

Area	**Attribute name**	**Description**	**HDF5 Struc.**	**Data Type**	**Unit / ASCII repr.**	**RAW**	**SCS**	**DGM DSM**	**GEC**	**GTC**	**SPF**	**CRG**	**IPH COH**	**DEM**	**MOS**	**PBR**	**RGC**	**AZP**	**DOP**	**QLK**
PCD	RAW Standard Deviation	Standard dev of RAW data; two samples for the In-Phase and Quadrature signal (I-Q)	B<nnn>	Double(N9, N10, 2)		a	x	x	x	x	x	x				x	x	x		
PCD	RAW UnderSaturated Percentage	Percentage of RAW Undersaturated; two samples for the In-Phase and Quadrature signal (I-Q)	B<nnn>	Double(2)		a	x	x	x	x	x	x				x	x	x		
PCD	Replica Geometric Resolution	Array including geometric resolution of each reconstructed replica	REPLICA	Double(N8)		a														
PCD	Replica ISLR	Array including ISLR of each reconstructed replica	REPLICA	Double(N8)		a														
PCD	Replica PSLR	Array including left and right PSLR of each reconstructed replica	REPLICA	Double(N8, 2)		a														
PCD	Replica Shape -10dB/-3dB	Aperture ratio of main lobe of reconstructed replica measured at -10 dB and -3dB	REPLICA	Double(N8)		a														
PCD	Replica Shape -6dB/-3dB	Aperture ratio of main lobe of reconstructed replica measured at -10 dB and -3dB	REPLICA	Double(N8)		a														
PCD	Replica SSLR	Array including left and right SSLR of each reconstructed replica	REPLICA	Double(N8, 2)		a														
PCD	Shadowing Pixel Percentage	Percentage of pixels in shadowing geometry with respect to the pixel of the scene (hence not considering invalid zones at the image borders deriving from image reprojection)	GIM	Double						a										
PCD	SPF Mean Intensity Ratio	Average of the Intensity Ratio between input and speckle filtered image Set to QNaN in the case speckle filtering is not applied.	Root	Double				a	x	x	a									
PCD	SPF Standard Deviation Intensity Ratio	Standard Deviation of the intensity ratio between input and speckle filtered image Set to QNaN in the case speckle filtering is not applied.	Root	Double				a	x	x	a									

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
PCD	SPF Target Contrast	The 1-st column represents the Target Contrast values detected for each threshold defined (in terms of in unit of standard deviation from the mean value) in the 2-nd column. Set to [QNaN, QNaN] in the case speckle filtering is not applied.	Root	Double[N14, 2]				a	x	x	a									
PCD	SPF Targets	Number of pixels above the target contrast threshold Set to 0 in the case speckle filtering is not applied.	Root	ULong(N14)				a	x	x	a									
Platform	Attitude Quaternions	Array of quaternions representing the satellite attituded associated to the annotated times. They are stored in notation (q1, q2, q3, q4) where q1 represents the so-called "real" part and (q2, q3, q4), is the so-called "imaginary" part of the quaternion For mosaicked products it is annexed only to tiles.	Root T<jjj>	Double(N12, 4)		a	x	x	x	x	x	x			x	x	x	x		
Platform	Attitude Times	Array of times (in seconds since the annotated reference UTC) at which the satellite attitude is supplied For mosaicked products it is annexed only to tiles.	Root T<jjj>	Double(N12)	s	a	x	x	x	x	x	x			x	x	x	x		
Platform	ECEF Satellite Acceleration	Satellite Acceleration in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times	Root	Double(N6, 3)	m/s^2	a	x	x	x	x	x	x				x	x	x		
Platform	ECEF Satellite Position	Satellite Position in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times Equal to Master ECEF Satellite Position in the case of mosaicked DEM For mosaicked products it is annexed only to tiles.	Root T<jjj>	Double(N6, 3)	m	a	x	x	x	x	x	x			x	x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Platform	ECEF Satellite Velocity	Satellite Velocity in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times Equal to Master ECEF Satellite Velocity in the case of mosaicked DEM For mosaicked products it is annexed only to tiles.	Root T<jjj>	Double(N6, 3)	m/s	a	x	x	x	x	x	x			x	x	x	x		
Platform	Inertial Reference Frame ID	Identifier of the inertial reference frame	Root	String		a	x	x	x	x	x	x				x	x	x		
Platform	Inertial Satellite Acceleratio n	Satellite Acceleration in Inertial Reference Frame, corresponding to the annotated times	Root	Double(N6, 3)	m/s	a	x	x	x	x	x	x				x	x	x		
Platform	Inertial Satellite Position	Satellite Position in Inertial Reference Frame, corresponding to the annotated times	Root	Double(N6, 3)	m	a	x	x	x	x	x	x				x	x	x		
Platform	Inertial Satellite Velocity	Satellite Velocity in Inertial Reference Frame, corresponding to the annotated times	Root	Double(N6, 3)	m/s	a	x	x	x	x	x	x				x	x	x		
Platform	Master ECEF Satellite Position	Satellite Position relevant to the Master image acquisition, in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times	Root	Double(N6, 3)	m								a	x						
Platform	Master ECEF Satellite Velocity	Satellite Velocity relevant to the Master image acquisition, in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times	Root	Double(N6, 3)	m/s								a	x						
Platform	Master State Vectors Times	Array of times (in seconds since the annotated reference UTC) at which the satellite state vectors relevant to the Master image (Position, Velocity, Attitude and Angular Rate) are supplied	Root	Double(N6)	s								a	x						

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Platform	Number of State Vectors	Number of annotated state vectors (N6). Products originated from orbital data derived from POD, will include fifteen state vectors extracted from the orbital product (not having recourse to interpolation), equally distributed around the centre time of the SAR product. Products originated from downlinked orbital data will include all state vectors extracted from RAW data	Root	UShort		a	x	x	x	x	x	x				x	x	x		
Platform	Orbit Direction	Ascending or descending orbit designator, as it is derived from the third component of the ECEF satellite velocity at scene centre time	Root	String		a	x	x	x	x	x	x	x			x	x	x		
Platform	PassDirection	Flight direction of the Satellite (ascending /descending / both). <u>Allowed values</u>: A Ascending D Descending B Both	Root	String 1char																x
Platform	Pitch Rate	Satellite Pitch angular rate corresponding to the annotated times.	Root	Double(N12)	deg/s	a	x	x	x	x	x	x				x	x	x		
Platform	Roll Rate	Satellite Roll angular rate corresponding to the annotated times.	Root	Double(N12)	deg/s	a	x	x	x	x	x	x				x	x	x		
Platform	Satellite Height	Satellite ellipsoidal height measured at the image central azimuth time	Root	Double	m	a	x	x	x	x	x	x				x	x	x		
Platform	Slave ECEF Satellite Position	Satellite Position relevant to the Slave image acquisition, in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times	Root	Double(N6, 3)	m								a	x						
Platform	Slave ECEF Satellite Velocity	Satellite Velocity relevant to the Slave image acquisition, in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times	Root	Double(N6, 3)	m/s								a	x						

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Platform	Slave State Vectors Times	Array of times (in seconds since the annotated reference UTC) at which the satellite state vectors relevant to the Slave image (Position, Velocity, Attitude and Angular Rate) are supplied	Root	Double(N6)	s								a	x						
Platform	State Vectors Times	Array of times (in seconds since the annotated reference UTC) at which the satellite state vectors (Position, Velocity) are supplied Equal to Master State Vectors Times in the case of mosaicked DEM For mosaicked products it is annexed only to tiles.	Root T<jjj>	Double(N6)	s	a	x	x	x	x	x	x			x	x	x	x		
Platform	Yaw Rate	Satellite Yaw angular rate corresponding to the annotated times.	Root	Double(N12)	deg/s	a	x	x	x	x	x	x				x	x	x		
Processing	ASLR Algorithm ID	The Adaptive Side Lobe Reduction Method used, either Non Integer Nyquest or Integer Nyquist	Root	String												a				
Processing	ASLR Azimuth Kernel Size	The size of the kernel used in the Adaptive Side Lobe Reduction, in the azimth direction is given by two times the ASR Az Kernel Size plus 1 pixels	Root	UShort												a				
Processing	ASLR Complex Approach	Adaptive Side Lobe Reduction approach adopted for the complex value: either jointly (the complex components are processed as a unit) or separate (each component is processed inependently)	Root	String												a				
Processing	ASLR Direction	Direction (range, azimuth or both) where is applied the Adaptive Side Lobe Reduction; in the 2 dimensional case, three options are available: apply the 1 dimensional to the Range direction the to the Azimuth one (2DRgAz); vice-versa (2DAzRg); or combined (2D) , either coupled or un-coupled	Root	String												a				
Processing	ASLR Number of Signals	The number of signals considered in the signal to clutter average and the signal shifts quality indices	Root	UShort												a				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	ASLR Oversampling Azimuth Factor	The upsampling factor (ratio of the output to the original image size) in the azimuth direction for, before the Adaptive Side Lobe Reduction; 1 means no upsampling	Root	Double												a				
Processing	ASLR Oversampling Range Factor	The upsampling factor (ratio of the output to the original image size) in the range direction for, before the Adaptive Side Lobe Reduction; 1 means no upsampling	Root	Double												a				
Processing	ASLR Range Kernel Size	The size of the kernel used in the Adaptive Side Lobe Reduction, in the range direction is given by two times the ASR Rg Kernel Size plus 1 pixels	Root	UShort												a				
Processing	ASLR Software Version	Version of the Adaptive Side Lobe Reduction software	Root	String	n.m											a				
Processing	Azimuth Bandwidth per Look	Bandwidth per look in azimuth used for the multilooked image formation	S<mm>	Double	Hz			a	x	x	x	x								
Processing	Azimuth Focusing Bandwidth	The Doppler bandwidth used at the single-look generation time	S<mm>	Double	Hz		a	x	x	x	x	x				x		a		
Processing	Azimuth Focusing Transition Bandwidth	The transition bandwidth in azimuth used at the single-look generation time	S<mm>	Double	Hz		a	x	x	x	x	x				x		a		
Processing	Azimuth Focusing Weighting Coefficient	Azimuth coefficients used for the weighting function applied at the focusing time to the processed portion of the full band	Root	Double			a	x	x	x	x	x				x		a		
Processing	Azimuth Focusing Weighting Function	Type of matched filter windowing in the azimuth direction at the focusing time	Root	String			a	x	x	x	x	x				x		a		
Processing	Azimuth Multilooking Transition Bandwidth	The transition bandwidth in azimuth used at the multilooked image formation	S<mm>	Double	Hz			a	x	x	x	x								

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	Azimuth Multilooking Weighting Coefficient	Azimuth coefficients used for the weighting function applied at the multilooking time to each look	Root	Double				a	x	x	x	x								
Processing	Azimuth Multilooking Weighting Function	Type of matched filter windowing in the azimuth direction at the multilooking time	Root	String				a	x	x	x	x								
Processing	Azimuth Processing Number of Looks	Number of processing azimuth looks	Root	UByte			a	m	x	x	m	x	m			x				
Processing	Baseline Calibration Flag	Flag indicating if the unwrapping has been applied (interferometric DEM)	Root	UByte										a						
Processing	Beam Mosaicking Policy	Algorithm used for merging of overlapped beams (used only for ScanSAR mode, set to "N/A" otherwise)	Root	String				a	x	x	x	x			x					
Processing	Column Spacing	Spacing among columns of the products. It is expressed in degrees in the case of GEODETIC projection, in meters otherwise.	SBI MBI	Double	m deg		a	m	m	m	x	m	m	m	m	m				
Processing	Column Time Interval	Time spacing in the range direction between columns Set to invalid value in the case of ground projected products	SBI MBI	Double	s		a					x	m			m				
Processing	CRG Coarse GCP Tolerance	Threshold for setting valid GCP after the coarse co-registration (both in master and slave images)	Root	Double								a								
Processing	CRG Coarse Interpolation Factor	Coarse Registration Interpolation Factor in range and azimuth direction (both in master and slave images)	Root	Double(2)								a								
Processing	CRG Coarse Window Size	Coarse Registration Window size in range and azimuth direction (both in master and slave images)	Root	UShort(2)								a								
Processing	CRG Coherence Tolerance	Threshold for setting valid GCP after the fine co-registration (both in master and slave images)	Root	Double								a								

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	CRG Coherence Window Size	Coherence Window size (both in master and slave images)	Root	Ushort(2)								a								
Processing	CRG Cubic Convolution Coefficient	Convolution Coefficient used in cubic interpolation performed on slave in the co-registration (both in master and slave images)	Root	Double								a								
Processing	CRG Fine Window Size	Fine Registration Window size in range and azimuth direction (both in master and slave images)	Root	UShort(2)								a								
Processing	CRG GCPs Selection Mode	Designator of the selection mode of GCPs for co-registration (both in master and slave images)	Root	String								a								
Processing	CRG Interpolation Inverse Tolerance	The length of lookup tables used to speed up the sinc interpolation (both in master and slave images). High values give a good accuracy at the expense of an increased memory requirement. The accuracy that can be achieved is given by the reciprocal of this parameter, i.e. the default value (1000) gives an accuracy of 1/1000 of a pixel.	Root	Double								a								
Processing	CRG Interpolator ID	Designator of the type interpolation method performed on slave in the co-registration (both in master and slave images)	Root	String								a								
Processing	CRG Level ID	Designator of the type of performed co-registration (both in master and slave images)	Root	String								a								
Processing	CRG Number of GCPs	Number of GCPs in column (in the following N18) and row (in the following N19) directions	Root	UInt(2)								a								
Processing	CRG Overlap Type	Designator of the type of rectangular zone on which the co-registration is performed (both in master and slave images)	Root	String								a								
Processing	CRG Sinc Interpolator Length	Filter length used in sinc interpolation performed on slave in the co-registration: it is the filter size in row, col (both in master and slave images)	Root	UShort(2)								a								

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	CRG Software Version	Version of the co-registration software (both in master and slave images)	Root	String	n.m							a								
Processing	CRG Warp degree	Degree of warp in Coregistration (both in master and slave images)	Root	Double								a								
Processing	DEM Software Version	Version of the DEM generation software	Root	String	n.m									a						
Processing	ECEF Beam Centre Direction for Processing	Unitary vector corresponding to the direction of the beam central plane in Earth Centred - Earth Fixed reference frame. It models the average behavior of the antenna beam central plane within each subswath acquired, hence in the case of Spotlight mode, the jumping steering scheme adopted at the scene acquisition time, is ignored.	Root	Double(N6, 3)		a	x	x	x	x	x	x				x	x	x		
Processing	ECEF Beam Pointing for Processing	Unitary vector corresponding to the pointing of the antenna main lobe in Earth Centred - Earth Fixed reference frame. It models the average behavior of the antenna pointing within each subswath acquired. In the case of ScanSAR mode, a different model per each subswath is used.	S<mm>	Double(N6, 3)		a	x	x	x	x	x	x				x	x	x		
Processing	Equivalent Number of Looks	Theorical value of the equivalent number of looks	SBI MBI	Double			a	m	x	x	m	x				x				
Processing	Focusing Algorithm ID	Identifier of the processing algorithm adopted	Root	String			a	x	x	x	x	x				x				
Processing	Incidence Angle Rescaling Factor	Scaling factor used for representation of Incidence Angle in the GIM layer	GIM	Double						a										

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	Invalid Value	Value used to fill invalid pixels/lines. Are catalogued as invalid, the following categories of data: - compensated missing lines; - area of geocoded products outside the SAR sensed data limits. As far as portion of lines added by SWST readjustment, they are in any case filled by zero. In the case of complex dataset (hence represented by two samples per pixel), invalid pixels will be characterized by Invalid Value loaded in both of its channels For L0 product, invalid pixels are associated only to missing lines. Allowed values depend on the Product Type.	Root	Float		a	a	a	a	a	a	a	a	a	a	a	a	a	a	
Processing	ITF Coherence Window	Coherence window estimation dimension (range, azimuth)	Root	UByte(2)									a							
Processing	ITF Common Band Azimuth Filter Flag	Flag indicating if the azimuth filter has been applied	Root	UByte									a							
Processing	ITF Common Band Range Filter Flag	Flag indicating if the range filter has been applied	Root	UByte									a							
Processing	ITF Demodulation Phase Reference Surface	Designator of the surface used for the evaluation of the demodulation phase	Root	String									a							
Processing	ITF Layover Filter Flag	Flag indicating if the layover filter has been applied	Root	UByte									a							
Processing	ITF Software Version	Version of the interferometric software	Root	String	n.m								a							

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	L0 Software Version	Version of the L0 processor used for the core processing step	Root	String	n.m	a	x	x	x	x	x	x				x	x	x		
Processing	L1A Software Version	Version of the L1A processor used for the core processing step	Root	String	n.m		a	x	x	x	x	x				x				
Processing	L1B Software Version	Version of the L1B processor used for the core processing step	Root	String	n.m			a	x	x	x	x								
Processing	L1C Software Version	Version of the L1C processor used for the core processing step	Root	String	n.m				a											
Processing	L1D Software Version	Version of the L1D processor used for the core processing step	Root	String	n.m					a										
Processing	Light Speed	Light Speed	Root	Double	m/s	a	x	x	x	x	x	x	x	x		x	x	x		
Processing	Line Spacing	Spacing among lines of the products. It is expressed in degrees in the case of GEODETIC projection, in meters otherwise.	SBI MBI	Double	m deg		a	m	m	m	x	m	m	m	m	m				
Processing	Line Time Interval	Time spacing in the azimuth direction between lines	SBI MBI	Double	s		a	m			x	m	m			m				
Processing	Master Reference UTC	UTC with respect the annotated slow times of the Master image are referred to. It is set to the 00:00:00.000000000 of the day at which the acquisition started.	Root	String	Epoch								a	x						
Processing	MOS Master Tile	Identifier of the tile used as master in the mosaicking process	Root	String											a					
Processing	MOS Software Version	Version of the mosaicking software	Root	String	n.m										a					
Processing	Multilook filter flag	Flag indicating if the multilook filter has been applied	Root	UByte			a	m	x	x	x	x	m			x				
Processing	Processing History Bit Mask	Bit Mask used to identify the processing steps, the SAR data has been submitted to. The coding rule is given in the next table.	Root	ULong		a	m	m	m	m	m	m	m	m	m	m	m	m		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	Product Error Flag	Flag indicating if errors have been reported during the product generation process. If set, it means that some quality measure is not compliant to the product specification. User should then refer to the product confidence data for details about the error condition.	Root	UByte		a	a	a	a	a	a	a	a	a	a	a	a	a		
Processing	Product Generation UTC	Product generation time in UTC time format	Root	String	Epoch	a	a	a	a	a	a	a	a	a	a	a	a	a		
Processing	Quick Look Column Spacing	Spacing among columns of the quick look layer. It is expressed in degrees in the case of GEODETIC projection, in meters otherwise.	QLK	Double	m	a	a	a	a	a	a	a	a	a	a	a				x
Processing	Quick Look Line Spacing	Spacing among columns of the quick look layer. It is expressed in degrees in the case of GEODETIC projection, in meters otherwise.	QLK	Double	m	a	a	a	a	a	a	a	a	a	a	a				x
Processing	Range Bandwidth per Look	Bandwidth per look in range used for the multilooked image formation	S<mm>	Double	Hz			a	x	x	x	x								
Processing	Range Focusing Bandwidth	The bandwidth in range used at the single-look generation time	S<mm>	Double	Hz		a	x	x	x	x	x				x	a	a		
Processing	Range Focusing Transition Bandwidth	The transition bandwidth in range used at the single-look generation time	S<mm>	Double	Hz		a	x	x	x	x	x				x	a	a		
Processing	Range Focusing Weighting Coefficient	Range coefficients used for the weighting function applied at the focusing time to the processed portion of the full band	Root	Double			a	x	x	x	x	x				x	a	a		
Processing	Range Focusing Weighting Function	Type of matched filter windowing in the range direction at the focusing time	Root	String			a	x	x	x	x	x				x	a	a		
Processing	Range Multilooking Transition Bandwidth	The transition bandwidth in range used at the multilooked image formation	S<mm>	Double	Hz			a	x	x	x	x								

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	Range Multilooking Weighting Coefficient	Range coefficients used for the weighting function applied at the multilooking time to each look	Root	Double				a	x	x	x	x								
Processing	Range Multilooking Weighting Function	Type of matched filter windowing in the range direction at the multilooking time	Root	String				a	x	x	x	x								
Processing	Range Processing Number of Looks	Number of nominal looks in the range direction	Root	UByte			a	m	x	x	m	x	m			x				
Processing	RAW Statistics Block Size	Size (in number of rows and number of columns) of the block where statistics on the RAW data are evaluated. In the following, N9 (resp. N10) will indicate the number of azimuth (resp. range) blocks (derived from the block size for statistics evaluation) in the burst over which statistics are evaluated. It is always assumed that: - first block for statistics evaluation is anchored to the first row/col of the burst - moving steps for other block determination is equal to the block size - block size is defined so that N9 <= 300 and N10 <= 3	S<mm>	UInt(2)		a	x	x	x	x	x	x				x	x	x		
Processing	Reference UTC	UTC with respect the annotated slow times are referred to. It is set to the 00:00:00.000000000 of the day at which the acquisition started. For mosaicked products it is annexed only to tiles.	Root T<jjj>	String	Epoch	a	x	x	x	x	x	x			x	x	x	x	x	
Processing	Replica Reconstruction Method	Designator of method for reconstruction of chirp used for image processing. Set to invalid value in the Spotlight case.	Root	String			a	x	x	x	x	x				x				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Processing	Rescaling Factor	Rescaling Factor F, used at processing time as a multiplier term applied to the signal amplitude to appropriately use the dynamic range allowed by the data type (avoiding the image saturation and minimizing quantization error).	Root	Double			a	m	m	m	m	x				m	a	a		
Processing	Slave Reference UTC	UTC with respect the annotated slow times of the Slave image are referred to. It is set to the 00:00:00.000000000 of the day at which the acquisition started.	Root	String	Epoch								a	x						
Processing	SPF Azimuth Moving Window	Speckle Filter Moving Window Length in Azimuth direction Set to 0 in the case speckle filtering is not applied.	Root	UShort				a	x	x	a									
Processing	SPF Filter Type	Applied Speckle Filter	Root	String				a	x	x	a									
Processing	SPF Iteration	Number of iterations of the applied Speckle Filter Set to 0 in the case speckle filtering is not applied.	Root	UShort				a	x	x	a									
Processing	SPF Range Moving Window	Speckle Filter Moving Window Length in Range direction Set to 0 in the case speckle filtering is not applied.	Root	UShort				a	x	x	a									
Processing	SPF Software Version	Version of the Speckle Filtering processor. Set to "0.0" in the case speckle filtering is not applied.	Root	String	n.m			a	x	x	a									
Processing	Subswath Change Column	Column index at which the subswath changes (used only for L1B ScanSAR products, set to invalid value otherwise). Its dimension, is equal to the number of subswath minus one in ScanSAR mode, and to one if unused.	SBI MBI	UInt(N3)				a												
Processing	Unwrapping Flag	Flag indicating if the unwrapping has been applied (interferometric DEM)	Root	UByte										a						
Projection	Datum Rotation	XYZ Datum rotations with respect to WGS84 Ellipsoid to be used for Helmert transformation	Root	Double(3)	deg	a	x	x	x	x	x	x	x	x	x	x	x	x	x	

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Projection	Datum Scale	XYZ Datum scale with respect to WGS84 Ellipsoid to be used for Helmert transformation	Root	Double		a	x	x	x	x	x	x	x	x	x	x	x	x	x	
Projection	Datum Shift	XYZ Datum shifts with respect to WGS84 Ellipsoid to be used for Helmert transformation	Root	Double(3)	m	a	x	x	x	x	x	x	x	x	x	x	x	x	x	
Projection	Ellipsoid Designator	Ellipsoid designator name	Root	String		a	x	x	x	x	x	x	x	x	x	x	x	x	x	
Projection	Ellipsoid Semimajor Axis	Semi-major axis length	Root	Double	m	a	x	x	x	x	x	x	x	x	x	x	x	x	x	
Projection	Ellipsoid Semiminor Axis	Semi-minor axis length	Root	Double	m	a	x	x	x	x	x	x	x	x	x	x	x	x	x	
Projection	Ground Projection Polynomial Reference Range	Reference slant range used as zero to represent the ground to slant (and viceversa) polynomials. Set to invalid value in the case of products not represented in ground range/azimuth projection	Root	Double	m			a			x	x			m					
Projection	Ground Projection Reference Surface	Designator of the surface used for the ground projection	Root	String				a	a	a	x	x			x					
Projection	Ground to Slant Polynomial	Ground range (pixels) to relative (w.r.t. the Ground Projection Polynomial Reference Range) slant range (meters) polynomial coefficient (from lower to higher degree). Set to invalid value in the case of products not represented in ground range/azimuth projection	Root	Double(6)	m/pix[i]			a			x	x			m					

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Projection	Map Projection Centre	Geodetic coordinates (lat/lon) of the map projection centre (for UTM/UPS) In the case of UTM projection, latitude is set to 0 and longitude is set equal to that one of the central meridian of the UTM zone of the product. In the case of UPS projection, a projection centre equal to [90, 0] is used in the Northern emisphere, [-90, 0] is used in the Southern one Set to [0, 0] in the case of GEODETIC projection	Root	Double(2)					a	a				x	x					
Projection	Map Projection False East-North	Map Projection False East/North (for UTM/UPS) In the case of UTM projection, false east equal to 500000 is used, while false north equal to 0 in the Northern emisphere and 10000000 in the Southern one are used. In the case of UPS zone, a value of 2000000 is used both for false east and false north Set to QNaN otherwise	Root	Double(2)	m				a	a				a	x					
Projection	Map Projection Scale Factor	Map Projection Scale factor (for UTM/UPS). In the case of UTM projection, a value of 0.9996 is used. In the case of UPS projection, a value of 0.994 is used. Set to QNaN otherwise	Root	Double					a	a				a	x					
Projection	Map Projection Zone	Map Projection Zone	Root	UByte					a	a				a	x					
Projection	Projection ID	Projection descriptor For geocoded product UPS projection is used if the scene centre latitude is greater than 84° or lower than -80°, otherwise UTM is used	Root	String		a	m	m	m	m	x	x	m	m	x	x	m	m	m	

Area	**Attribute name**	**Description**	**HDF5 Struc.**	**Data Type**	**Unit / ASCII repr.**	**RAW**	**SCS**	**DGM DSM**	**GEC**	**GTC**	**SPF**	**CRG**	**IPH COH**	**DEM**	**MOS**	**PBR**	**RGC**	**AZP**	**DOP**	**QLK**
Projection	Quick Look Projection ID	Projection descriptor for Quick Look Layer For geocoded product UPS projection is used if the scene centre latitude is greater than 84° or lower than -80°, otherwise UTM is used	QLK	String		a	a	a	a	a	a	a	a	a	a	a				x
Projection	Slant to Ground Polynomial	Relative (w.r.t. the Ground Projection Polynomial Reference Range) slant range (meters) to ground range (pixels) polynomial coefficients (from the lower to the higher degree). Set to invalid value in the case of products not represented in ground range/azimuth projection	Root	Double(6)	pix/m[i]			a			x	m			m					
Scene	Azimuth Coverage	Coverage in the azimuth direction of the full scene estimated on the ellipsoid. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	Root	Double	m	a	m	m	x	x	x	m	x	x		x	m	m		
Scene	Bottom Left East-North	Coordinates of the first pixel of the last image line for metric projections. Set to QNaN otherwise. In the case of mosaicked products it is annexed both to the mosaic and to the tile	SBI MBI T<jjj>	Double(2)	m				a	a				a	m					
Scene	Bottom Left Geodetic Coordinates	Geodetic coordinates (Lat-Lon-Ellipsoidal Height) of the first pixel of the last image line (estimated on DEM for terrain projected products, on the ellipsoid otherwise) Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data. In the case of mosaicked products it is annexed both to the mosaic and to the tile	SBI MBI T<jjj>	Double(3)	(deg, deg, m)		a	m	m	m	x	m	x	m	m	x				
Scene	Bottom Right East-North	Coordinates of the last pixel of the last image line for metric projections. Set to QNaN otherwise. In the case of mosaicked products it is annexed both to the mosaic and to the tile	SBI MBI T<jjj>	Double(2)	m				a	a				a	m					

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Scene	Bottom Right Geodetic Coordinates	Geodetic coordinates (Lat-Lon-Ellipsoidal Height) of the last pixel of the last image line (estimated on DEM for terrain projected products, on the ellipsoid otherwise) Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data. In the case of mosaicked products it is annexed both to the mosaic and to the tile	SBI MBI T<jjj>	Double(3)	(deg, deg, m)		a	m	m	m	x	m	x	m	m	x				
Scene	Centre Earth Radius	Earth radius at image centre Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	Root	Double	m	a	m	m	x	x	x	x	x	x	m	x	m	m		
Scene	Centre Geodetic Coordinates	Geodetic coordinates (lat-lon-height) of the central image point (estimated on DEM for terrain projected products, on the ellipsoid otherwise) of the swath. For RAW data it is estimated in acquisition geometry on the basis of the acquisition time of the central line discarding transients to be removed by range compression. Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data.	S<mm>	Double(3)	(deg, deg, m)	a	m	m	m	m	x	m	x	x		x	m	m		
Scene	DeltaSideWardLooking Angle	Nominal look angle of the full observed swath (unsigned angle between nominal reference direction of the multi-beam and satellite nadir) expressed in millidegree	Root	Uint 9digit																x
Scene	Estimated Bottom Left Geodetic Coordinates	Estimated geodetic coordinates (Lat-Lon-0) of the first pixel/last line of the correspendent focussed image	Root	Double(3)	(deg, deg, m)	a														
Scene	Estimated Bottom Right Geodetic Coordinates	Estimated geodetic coordinates (Lat-Lon-0) of the last pixel/last line of the correspendent focussed image	Root	Double(3)	(deg, deg, m)	a														

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Scene	Estimated Top Left Geodetic Coordinates	Estimated geodetic coordinates (Lat-Lon-0) of the first pixel/first line of the correspendent focussed image	Root	Double(3)	(deg, deg, m)	a														
Scene	Estimated Top Right Geodetic Coordinates	Estimated geodetic coordinates (Lat-Lon-0) of the last pixel/first line of the correspendent focussed image	Root	Double(3)	(deg, deg, m)	a														
Scene	Far Early Geodetic Coordinates	Geodetic coordinates of the pixel of the scene acquired at the far range at the azimuth first time (estimated on DEM for terrain projected products, on the ellipsoid otherwise) It is useful for geocoded products that are not represented in range azimuth projection, hence the image geometry doesn't correspond to the acquisition geometry	SBI MBI	Double(3)	(deg, deg, m)				a	a				a						
Scene	Far Incidence Angle	Absolute value of the incidence angle measured at the far range on the ellipsoid in zero-doppler geometry as derived by the sampling window times represented in data	SBI MBI	Double	deg		a	x	x	x	x	x				x				
Scene	Far Late Geodetic Coordinates	Geodetic coordinates of the pixel of the scene acquired at the far range at the azimuth last time (estimated on DEM for terrain projected products, on the ellipsoid otherwise) It is useful for geocoded products that are not represented in range azimuth projection, hence the image geometry doesn't correspond to the acquisition geometry	SBI MBI	Double(3)	(deg, deg, m)				a	a				a						
Scene	Far Look Angle	Look angle measured at the far range on the ellipsoid in zero-doppler geometry as derived by the sampling window times represented in data	SBI MBI	Double	deg		a	x	x	x	x	x				x				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Scene	FarRangeIncidenceAngle	Far incidence angle expressed in millidegree	Root	UInt 9digit																x
Scene	Ground Range Coverage	Coverage in ground range of the specific portion of data projected on the ellipsoid. For RAW data it is computed on the basis of the acquisition times and geometry, with right transient removed (i.e. only considering scatterers which returns a complete chirp's echo to the SAR receiver). Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	Root	Double	m	a	m	m	x	x	x	m	x	x		x	m	m		
Scene	Master Scene Look Angle	Angle between the centre of the full scene as it is derived from the sampling window times (estimated on the reference ellipsoid in zero-doppler geometry) and the geodetic nadir	Root	Double	deg								a	x						
Scene	Near Early Geodetic Coordinates	Geodetic coordinates of the pixel of the scene acquired at the near range at the azimuth first time (estimated on DEM for terrain projected products, on the ellipsoid otherwise) It is useful for geocoded products that are not represented in range azimuth projection, hence the image geometry doesn't correspond to the acquisition geometry	SBI MBI	Double(3)	(deg, deg, m)				a	a				a						
Scene	Near Incidence Angle	Absolute value of the incidence angle measured at the near range on the ellipsoid in zero-doppler geometry as derived by the sampling window times represented in data	SBI MBI	Double	deg		a	x	x	x	x	x				x				
Scene	Near Late Geodetic Coordinates	Geodetic coordinates of the pixel of the scene acquired at the near range at the azimuth last time (estimated on DEM for terrain projected products, on the ellipsoid otherwise) It is useful for geocoded products that are not represented in range azimuth projection, hence the image geometry doesn't correspond to the acquisition geometry	SBI MBI	Double(3)	(deg, deg, m)				a	a				a						

Area	**Attribute name**	**Description**	**HDF5 Struc.**	**Data Type**	**Unit / ASCII repr.**	**RAW**	**SCS**	**DGM DSM**	**GEC**	**GTC**	**SPF**	**CRG**	**IPH COH**	**DEM**	**MOS**	**PBR**	**RGC**	**AZP**	**DOP**	**QLK**
Scene	Near Look Angle	Look angle measured at the near range on the ellipsoid in zero-doppler geometry as derived by the sampling window times represented in data	SBI MBI	Double	deg		a	x	x	x	x	x				x				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Scene	NearRangeIncidenceAngle	Near incidence angle expressed in millidegree	Root	UInt 9digit																x
Scene	Polygon	List of vertex of the polygonal shape in term of Longitude and Latitude coordinates according to the following string format: [Point_1;Point_2;……. ;Point_x] where « *Point_x* » is defined as a couple Longitude:Latitude in the string format: FLOAT(010,5):FLOAT(010,6) with ranges, LONGITUDE: [-179.99999, 180.00000] ; LATITUDE: [-90.000000, 90.000000] . Vertex must be specified in a counter-clockwise direction. Closing point must not be included in the vertexes list Example: [-034.46557:067.684536;0156.37529:-63.760346;0156.16023:-63.741403;-034.21402:067.668000]	Root	String																x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Scene	Scene Centre Geodetic Coordinates	Geodetic coordinates (lat-lon-height) of the central image point (estimated on DEM for terrain projected products, on the ellipsoid otherwise) of the full scene For RAW data it is estimated in acquisition geometry on the basis of the acquisition time of the central line discarding transients (at the farthest subswath in the case of ScanSAR data) to be removed by range compression. Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data.	Root	Double(3)	(deg, deg, m)	a	m	m	x	m	x	m	x	x	m	x	m	m		
Scene	Scene Orientation	Counter-clockwise measured angle between the local north at scene centre and the opposite of the azimuth oriented direction	Root	Double	deg	a	m	m	x	x	x	m	x	x		x	m	m		
Scene	SceneCentre	Scene Centre Point Coordinates in the « *Point_x* » string format : FLOAT(6,2):FLOAT(6,2) as already detailed for *Polygon* attribute. Example: 60.96:1.96	Root	String																x
Scene	Slave Scene Look Angle	Angle between the centre of the full scene as it is derived from the sampling window times (estimated on the reference ellipsoid in zero-doppler geometry) and the geodetic nadir	Root	Double	deg								a	x						
Scene	Terrain Elevation Standard Deviation	Standard deviation of the elevation of the observed scene	Root	Double	m					a										
Scene	Terrain Maximum Elevation	Maximum elevation of the observed scene	Root	Double	m					a										

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Scene	Terrain Mean Elevation	Mean elevation of the observed scene	Root	Double	m					a										
Scene	Terrain Minimum Elevation	Minimum elevation of the observed scene	Root	Double	m					a										
Scene	Top Left East-North	Coordinates of the first pixel of the first image line for metric projections. Set to QNaN otherwise. In the case of mosaicked products it is annexed both to the mosaic and to the tile	SBI MBI T<jjj>	Double(2)	m				a	a				a	m					
Scene	Top Left Geodetic Coordinates	Geodetic coordinates (Lat-Lon-Ellipsoidal Height) of the first pixel of the first image line (estimated on DEM for terrain projected products, on the ellipsoid otherwise) Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data. In the case of mosaicked products it is annexed both to the mosaic and to the tile	SBI MBI T<jjj>	Double(3)	(deg, deg, m)		a	m	m	m	x	m	x	m	m	x				
Scene	Top Right East-North	Coordinates of the last pixel of the first image line for metric projections. Set to QNaN otherwise. In the case of mosaicked products it is annexed both to the mosaic and to the tile	SBI MBI T<jjj>	Double(2)	m				a	a				a	m					
Scene	Top Right Geodetic Coordinates	Geodetic coordinates (Lat-Lon-Ellipsoidal Height) of the last pixel of the first image line (estimated on DEM for terrain projected products, on the ellipsoid otherwise) Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data. In the case of mosaicked products it is annexed both to the mosaic and to the tile	SBI MBI T<jjj>	Double(3)	(deg, deg, m)		a	m	m	m	x	m	x	m	m	x				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Sensor	SensingMethodActivePassiveType	Short Code for the active/passive type. Allowed values: A active sensor P passive sensor Set values: A active sensor	Root	String 1char																x
Sensor	SensingMethodSensingType	Short Code for the sensing type. Allowed values: S earth surface sensing A atmospheric sounder L limb sounder atmospheric sensing V vertical altitude sensing Set values: S earth surface sensing	Root	String 1char																x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Sensor	SensingMethodSpectrumType	Short Code for the spectrum type. Allowed values: h HF (λ>10m, v<50MHz) v VHF (λ>1m, v<300MHz) m microvawe (λ=1cm..100cm, v ~ 0.3GHz to 30GHz) M millimetrevawe (λ=1mm..1cm, v in 100GHz range) S sub-millimetrevawe (λ=0.1mm..1mm, v < THZ range) I infra-red (λ ~ 0.8µm..0.1mm, v > THZ range) V visible (λ ~ 0.39µm..0.8µm, v < PetaHZ range) U ultra-violet (λ<0.39µm, v in PetaHZ range) Set values: m microvawe (λ=1cm..100cm, v ~ 0.3GHz to 30GHz)	Root	String 1char																x
Specification	Azimuth Geometric Resolution	Performance guaranteed for Azimuth geometric resolution (including weighting and multilooking effects) in order to be compliant with the product specifications. Set to NaN for mosaicked DEM.	Root	Double	m		a	a	a	a	m	x			m	m				
Specification	DEM Absolute Horizontal Accuracy	Accuracy of the horizontal position of the DEM points caused by random and uncorrected systematic errors, expressed as the maximum absolute difference between the true and measured values with a 90% confidence level, i.e. excluding the 10% worst points. Set to invalid value if product is not a DEM	Root	Double	m									a	m					

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Specification	DEM Absolute Vertical Accuracy	Accuracy of the height of the DEM points caused by random and uncorrected systematic errors, expressed as the maximum absolute difference between the true and measured values with a 90% confidence level, i.e. excluding the 10% worst points. Set to invalid value if product is not a DEM	Root	Double	m									a	m					
Specification	DEM Relative Horizontal Accuracy	Accuracy of the horizontal relative position of each two points in a small area of the DEM caused by random errors, expressed as the maximum absolute value of the unbiased difference between the true and measured values with a 90% confidence level, i.e. excluding the 10% worst points. Set to invalid value if product is not a DEM	Root	Double	m									a	m					
Specification	DEM Relative Vertical Accuracy	Accuracy of the relative height of each two points in a small area of the DEM caused by random errors, expressed as the maximum absolute value of the unbiased difference between the true and measured values with a 90% confidence level, i.e. excluding the 10% worst points. Set to invalid value if product is not a DEM	Root	Double	m									a	m					
Specification	Geolocation Accuracy	Performance guaranteed for Geolocation (3σ) Accuracy in order to be compliant with the product specifications	Root	Double	m			a	a	a	x									
Specification	Geometric Conformity	Performance guaranteed for Geometric Conformity in order to be compliant with the product specifications	Root	Double				a	a	a	x									
Specification	Ground Range Geometric Resolution	Performance guaranteed for Ground Range geometric resolution (including weighting and multilooking effects) in the worst case (that is at near range) in order to be compliant with the product specifications	Root	Double	m		a	a	a	a	m	x			m	m				
Specification	Inter-channel Co-registration	Performance guaranteed for Co-registration between differently polarized channels of PingPong products, in order to be compliant with the product specifications. Set to QNaN for other instrument modes.	Root	Double	pix		a	a	a	a	x	m				x				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Specification	IRF Shape -10dB/-3dB	Performance guaranteed for ratio of IRF Shape measured at -10 dB and -3dB in order to be compliant with the product specifications	Root	Double			a	a	a	a	x					m				
Specification	IRF Shape -6dB/-3dB	Performance guaranteed for ratio of IRF Shape measured at -6 dB and -3dB in order to be compliant with the product specifications	Root	Double			a	a	a	a	x					m				
Specification	ISLR	Performance (range/azimuth) guaranteed for ISLR in order to be compliant with the product specifications	Root	Double(2)	dB		a	a	a	a	x					a				
Specification	Local Radiometric Stability	Performance guaranteed for Local Radiometric Stability in order to be compliant with the product specifications	Root	Double	dB		a	a	a	a	x					x				
Specification	Phase Continuity	Performance (mean and standard deviation) guaranteed for Phase Continuity in order to be compliant with the product specifications	Root	Double(2)	deg		a									x				
Specification	Point Target Ambiguity	Performance guaranteed for Point Target Ambiguity in order to be compliant with the product specifications	Root	Double	dB		a	a	a	a	x					x				
Specification	PSLR	Performance (range/azimuth) guaranteed for PSLR in order to be compliant with the product specifications	Root	Double(2)	dB		a	a	a	a	x					a				
Specification	Radiometric Accuracy	Performance guaranteed for Radiometric Accuracy in order to be compliant with the product specifications	Root	Double	dB					a										
Specification	Radiometric Linearity	Performance guaranteed for Radiometric Linearity in order to be compliant with the product specifications	Root	Double	dB					a										
Specification	Radiometric Stability	Performance guaranteed for Radiometric Stability in order to be compliant with the product specifications	Root	Double	dB					a										
Specification	SSLR	Performance (range/azimuth) guaranteed for SSLR in order to be compliant with the product specifications	Root	Double(2)	dB		a	a	a	a	x					a				
Thresholds	CRG Overlapping Percentage Threshold	Threshold for AOI Overlapping (both in master and slave images) percentage w.r.t. the master image	Root	Double								a								

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Thresholds	Doppler Ambiguity Confidence Measure Threshold	Normalized confidence measure of doppler centroid ambiguity. A value of zero means poor confidence.	Root	Double		a	x	x	x	x	x	x				x	x	x		
Thresholds	Doppler Ambiguity Threshold	Threshold for setting the Doppler Centroid ambiguity quality flag	Root	UShort		a	x	x	x	x	x					x	x	x		
Thresholds	Doppler Centroid Confidence Measure Threshold	Threshold for setting the Doppler Centroid confidence quality flag	Root	Double		a	x	x	x	x	x	x				x	x	x	x	
Thresholds	Doppler Centroid Estimation Accuracy Threshold	Threshold for setting the Doppler Centroid Accuracy quality flag	Root	Double	Hz	a	x	x	x	x	x	x				x	x	x	x	
Thresholds	Doppler Rate Confidence Measure Threshold	Threshold for setting the Doppler Rate confidence quality flag	Root	Double		a	x	x	x	x	x	x				x	x	x		
Thresholds	Doppler Rate Estimation Accuracy Threshold	Threshold for setting the Doppler Rate accuracy quality flag	Root	Double	Hz/s	a	x	x	x	x	x	x				x	x	x		
Thresholds	Image OverSaturated Percentage Threshold	Threshold for setting the OverSaturated Percentage quality flag	Root	Double			a	x	x	x	x	m				x				
Thresholds	Image UnderSaturated Percentage Threshold	Threshold for setting the UnderSaturated Percentage quality flag	Root	Double			a	x	x	x	x	m				x				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Thresholds	RAW Bias Threshold	Bias of RAW data used as threshold to set the product quality flag; two samples for the In-Phase and Quadrature signal (I-Q)	Root	Double		a	x	x	x	x	x	x				x	x	x		
Thresholds	RAW Gain Imbalance Threshold	Gain imbalance of the I and Q channel of the RAW data used as threshold to set the product quality flag. It is the maximum allowed absolute deviation of the measured value from the ideal unitary one.	Root	Double		a	x	x	x	x	x	x				x	x	x		
Thresholds	RAW I/Q Normality Threshold	Measure of the Gaussian properties of I and Q channels distribution used as threshold to set the product quality flag	Root	Double	deg	a	x	x	x	x	x	x				x	x	x		
Thresholds	RAW I/Q Ortogonality Threshold	Phase difference (orthogonality) between I and Q channels of RAW data used as threshold to set the product quality flag It is the maximum allowed absolute deviation of the measured value from the ideal one eqaul to 90 degrees.	Root	Double	deg	a	x	x	x	x	x	x				x	x	x		
Thresholds	RAW Missing Lines per Block Threshold	Number of allowed missing lines which constitute a gap	Root	UShort		a	x	x	x	x	x	x				x	x	x		
Thresholds	RAW Missing Lines Percentage Threshold	Maximum percentage of missing lines to total lines.	Root	Double		a	x	x	x	x	x	x				x	x	x		
Thresholds	RAW OverSaturated Percentage Threshold	Percentage of RAW oversaturated pixels used as threshold to set the product quality flag	Root	Double		a	x	x	x	x	x	x				x	x	x		
Thresholds	RAW Phase Uniformity Threshold	Measure of the uniform properties of phase distribution of the RAW data used as threshold to set the product quality flag	Root	Double	deg	a	x	x	x	x	x	x				x	x	x		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Unit / ASCII repr.	RAW	SCS	DGM DSM	GEC	GTC	SPF	CRG	IPH COH	DEM	MOS	PBR	RGC	AZP	DOP	QLK
Thresholds	RAW UnderSaturated Percentage Threshold	Percentage of RAW undersaturated pixels used as threshold to set the product quality flag	Root	Double		a	x	x	x	x	x	x				x	x	x		
Thresholds	Replica Geometric Resolution Threshold	Geometric resolution (meters in slant range) of the replica cross correlation function; it represents a threshold for setting the replica quality flag.	Root	Double	m	a														
Thresholds	Replica ISLR Threshold	ISLR of the chirp cross correlation function; it represents a threshold for setting the chirp quality flag.	Root	Double	dB	a														
Thresholds	Replica PSLR Threshold	PSLR of the chirp cross correlation function; it represents a threshold for setting the replica quality flag.	Root	Double	dB	a														
Thresholds	Replica Shape - 10dB/-3dB Threshold	Aperture ratio of main lobe of reconstructed replica measured at -10 dB and -3dB; it represents a threshold for setting the replica quality flag.	Root	Double	dB	a														
Thresholds	Replica Shape - 6dB/-3dB Threshold	Aperture ratio of main lobe of reconstructed replica measured at -10 dB and -3dB; it represents a threshold for setting the replica quality flag.	Root	Double	dB	a														
Thresholds	Replica SSLR Threshold	SSLR of the chirp cross correlation function; it represents a threshold for setting the replica quality flag.	Root	Double	dB	a														

7 Acronyms and Glossary

7.1 Acronyms

ASI	Italian Space Agency
DEM	Digital Elevation Model
DESS	Digital Electronics SubSystem
ENL	Equivalent Numbero of Looks
EO	Earth Observation
GEC	Geocoded Ellipsoid Corrected
GTC	Geocoded Terrain Corrected
HDF	Hierarchical Data Format
HK	House Keeping
HW	Hardware
I/F	Interface
NE	Noise Equivalent
PRI	Precision Raw Image
SAR	Synthetic Aperture Radar
SCS	Single look, Complex, Slant Range products
SW	Software

7.2 Glossary

Acquisition Mode

One of the basic acquisition modes allowed by the SAR instrument

- Spotlight (Enhanced Spotlight, SMART)
- ScanSAR (WideRegion, HugeRegion)
- Stripmap (Himage, PingPong)

DEM

Digital Elevation Model. Terrain height data given on a regular map grid.

DGM Product
Synonymous with Level 1B Product

GEC Product
Synonymous with Level 1C Product

GTC Product
Synonymous with Level 1D Product

Incidence angle

It is the angle measured between the slant range direction and the normal to the tangent plane to the Earth surface in the specified point on ground

Level 0 data
L0 data (i.e. raw SAR telemetry) consists of time ordered echo data, obtained after decryption and before unpacking, and includes all UTC-dated auxiliary and ancillary data (e.g. orbit data, satellite's position and velocity, geometric sensor model, payload status, calibration data) required to produce the other basic and intermediate products.

Level 0 Data File

One Image Segment File (ISF) formatted as a sequence of Source Packets or VCDU's Data Zones (decrypted or not depending on decryption key availability).

The following standard processing levels are conceived for COSMO:

Level 0 Product
Level 0 product consists of time ordered echo data, obtained after decryption and decompression (i.e. conversion from BAQ encoded data to 8-bit uniformly quantised data) and after applying internal calibration and error compensation; this product shall include all the auxiliary data (e.g.: trajectography, accurately dated satellite's co-ordinates and speed vector, geometric sensor model, payload status, calibration data,..) required to produce the other basic and intermediate products.

Level 1A Product
Level 1A products (also indicated as Single-look Complex Slant (SCS)), consist of SAR focused data internally radiometric calibrated, in zero-doppler slant range-azimuth geometric projection, left at natural geometric spacing with associated ancillary data

Level 1B Product
Level 1B products (also indicated as Detected Ground Multi-look (MDG)), consist of SAR focused data internally radiometric calibrated, de-speckled, amplitude detected, projected in zero-doppler ground

range-azimuth onto a reference ellipsoid or on a DEM, resampled at a regular spacing on ground with associated ancillary data.

Level 1C Product

Level 1C class of products (also indicated as Geocoded Ellipsoid Corrected (GEC)) is constituted by input data projected onto a reference ellipsoid chosen among a predefined set, in a regular grid obtained from a cartographic reference system chosen among a predefined set with associated ancillary data

Level 1D Products

Level 1D class of products (also indicated as Geocoded Terrain Corrected (GTC)) is constituted by input data projected onto a reference elevation surface in a regular grid obtained from a cartographic reference system chosen among a predefined set with associated ancillary data

Local incidence angle

The angle between the radar beam center and the normal to the local topography. The difference between the global incidence angle and the terrain slope.

Look angle

Of a SAR, the angle from the nadir at which the radar beam is pointed. Of a target, the angle between the SAR-nadir and SAR-target lines.

Raw Product

Synonymous of Level 0 Product

SAR Product

Generic term referring to the SAR data acquired in the different SAR modes and handled in the GS, at different level of processing (see also Level xxx Products).

The SAR products are catalogued in two classes:

- Standard products
- Non-standard products

SCS Product

Synonymous of Level 1A Product