APEX 2005 SKY Telemetry Format

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6.0	March 1, 2005	All	New Release based on APEX 2002 Version.

CONFIDENTIALITY NOTICE

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References

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2. Radarsat Data Products Manual, RZ-MA-50-5309, Rev 2/1, Sept. 21, 1995.

3. Radarsat Product Specification, RZ-SP-50-5313, Rev 5/1, August 28, 1995.

4. Radarsat CDPF Product Specification Technical Supplement: Detail Processing Parameters Record Description, RZ-TN-50-7097, Rev 1/0, November 10, 1995.

5. User's Guide for JERS-1 SAR Data Format, March 22, 1993

6. JERS-1 Operational Interface Specification, NASDA HE-89033, Rev 4, April 15, 1993.

7. ESRIN ERS Central Facility to National and Foreign Stations Interface Specification, ER-IS-EPO-GU-0107-1.5 Issue 1, Rev. 5, March 6, 1995

8. LZP – Vexcel Level 0 Processor – Architecture and Design, VX-LZP-001, Vexcel Corporation

9. The SPOT Scene Standard Digital Product Format, S4-ST-73-01-SI, Edition 1, Revision 2, November 17, 1997, SPOT IMAGE

10. LANDSAT 7 SYSTEM: Data Format Control Book (DFCB) Volume IV – Wideband Data, Revision K, 23007702-IV-K, Lockheed Martin Missiles & Space, December 16, 1998

11. ENVISAT Satellite to National & Foreign Ground Stations Interface Control Document, Ref: PO-ID-ESA-SY-1003, Issue: 2.2, ENVISAT Satellite System and Payload Division, May 04, 2000

Table of Contents

1 Introduction

The Vexcel Level 0 Processor (SKY) can produce data in two output formats: Vexcel's SKY Telemetry Format (STF) and CEOS. For archiving purposes, the facility may decide to store the STF product rather than the CEOS product. This format is available after the Synchronization/Preparation step of the Level 0 Software Processor. An optional QuickLook image can be created as part of the STF data set.

1.1 File set

The telemetry output format of the LZP consists of a set of homogenous datatake sets. Homogenous in this sense is defined to be:

- the data is from one single satellite
- no changes in beam mode for stripmode Radarsat
- no changes in PRF
- no time gaps across which the frame and time counters do not stay in sync

Each of the output datatake sets contains the following files:

- one formatted data file
- one ASCII parameter file
- one ASCII framing information file (chop file)
- one ASCII index file
- one ASCII burst list index file (optional, for multi-beam SAR data only)
- one ASCII autofocus correlaton file (optional, for SAR data only)
- one ASCII range spectrum file (optional, for SAR data only)
- one ASCII Doppler measurement file (optional, for SAR data only)
- one ASCII histogram file (optional, for SAR data only)
- one QuickLook image data file (optional)
- one QuickLook image parameter file (optional)
- one QuickLook image (tiff or jpeg) file (optional)

The datafile is the input telemetry data file after some formatting has been applied to it. The parameter file contains valuable meta-data information about the data. The framing information file contains information for framing the input data into standard scenes. The index file provides random access to any line in the datafile. The optional burst list file, present for ScanSAR data only, stores access information for every “burst”. The optional autofocus correlation file stores the autofocus plot for SAR data. The optional range spectrum file contains the range energy spectrum for SAR data. The optional Doppler

measurement file contains the measured Doppler centroid information for SAR data. The optional histogram file shows the raw I/Q histogram for SAR data. The optional QuickLook file set contains low resolution imagery of the STF dataset.

The file names for the telemetry output format all share the same basename. The basename is selected by the operator using the jobserver GUI, or by the API program driving the jobserver. The output datatake sets will be enumerated starting with 000, continuing with 001, and so forth. The file naming convention for the datasets produced is:

- basename.000 (.001, .002, ...) - data file
- basename.000.par - parameter file
- basename.000.chop - framing information file
- basename.000.ind - index file
- basename.000.blist - burst list file
- basename.000.af - autofocus correlation file
- basename.000.rs - range spectrum file
- basename.000.dop - Doppler measurement file
- basename.000.his - histogram file
- basename.000.QL.gli - QuickLook image data file (floating point)
- basename.000.QL.gli.par - QuickLook image parameter file
- basename.000.QL.tif - QuickLook TIFF file
- basename.000.QL.jpg - QuickLook JPEG file

In addition to these datasets, a common log file and a summary parameter file might be created by the LZP system. These two files will be called basename.log and basename.par, respectively.

2 STF data format

Essentially, the format of the output telemetry data is the same as it was in the input, only that a byte-alignment and error correction has been performed on the input data stream. For satellites that perform PRN encoding, this encoding has been reversed (ERS1/2 and RSAT1, for example). To be more specific, for each of the following sensors the output telemetry data file (basename.000, for example) will have the following format:

- ERS1/2:
  - first byte: byte 0 of the frame sync code
  - frame length : 256 bytes
  - frames per SAR line : 29
  - "zero formats" may still present

- JERS1:
  - stripped off: a variable number of random bits at the end of each frame
  - first byte: byte 0 of the interleaved frame sync codes
  - frame length : 4660 bytes (containing one interleaved I and Q frame)
  - frames per SAR line : 1
  - variable number of random bits at the end of each frame
  - always I and Q bits in positive logic (not "I,~Q", for example)
  - I as first bit

- RSAT1:
  - first byte: byte 0 of the sync code
  - frame length : 323 bytes
  - frames per SAR line : variable number (~30)

- ALOS1-PALSAR:
  - first byte: byte 0 of the PALSAR sync code
  - frame length : variable
  - frames per SAR line : 1

- SPOT:
  - first byte: byte 0 of the SPOT sync code
  - frame length : 9282
  - 1 or 2 lines per frame, depending on mode

- AQUA/TERRA MODIS:
  - first byte: byte 0 of the MODIS sync code
  - frame length: 1024
  - frames contain variable number of CCSDS frames

- ENVISAT1/ASAR:
  - first byte: byte 0 of the ENVISAT1 sync code
  - frame length: 1024
  - frames contain variable number of ASAR CCSDS frames

- LSAT7:
  - first byte: byte 0 of the LSAT7 sync code
  - frame length: 1040
  - frames contain variable number of LSAT7 CCSDS frames
  - CCSDS frames per STF line : variable size close to 7000 frames / line

3 STF parameter file format

The following is a description of the ASCII parameter file accompanying the telemetry data file. It is a CONI file (a tagged ASCII file) containing plain tags and CONI information blocks.

3.1 The Direct Capture System (DCS) Information Block

This block is optional. It is created when the Vexcel Data Capture System (VxDCS) captures the input downlink file.

The DCS information block contains the following plain tags and information blocks:

- dcs_version - plain tag
- dcs_id - plain tag
- dcs_file_creation_date - plain tag
- dcs_requested_start - plain tag
- dcs_valid_data_offset - plain tag
- dcs_satellite - plain tag
- dcs_requested_stop - plain tag
- dcs_start - plain tag
- dcs_stop - plain tag
- dcs_stop_condition - plain tag
- dcs_bit_error_rate - plain tag
- dcs_bytes_captured - plain tag
- data_block - information block, 0, 1, or multiple instances

These plain tags and information blocks are described below.

3.1.1 The dcs_version plain tag

Name: dcs_version
Type: string
Unit: N/A
Range: N/A
Example: 5.1.0
Description: Specifies the DCS software version number.

3.1.2 The dcs_id plain tag

Name: dcs_id

Type: integer
Unit: N/A
Range: N/A
Example: 1-
Description: Specifies the ID of the VxDCS instance which performed the capture.

3.1.3 The dcs_file_creation_date plain tag

Name: dcs_file_creation_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 20031002211318725
Description: Specifies the date/time the capture file was created.

3.1.4 The dcs_requested_start plain tag

Name: dcs_requested_start
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 20031002211318725
Description: Specifies the requested start time of the DCS capture.

3.1.5 The dcs_valid_data_offset plain tag

Name: dcs_valid_data_offset
Type: integer
Unit: bytes
Range: 0-
Example: 10
Description: Specifies the byte position in the capture file of the first valid data.

3.1.6 The dcs_satellite plain tag

Name: dcs_satellite
Type: string
Unit: N/A
Range: ERS | JERS | RSAT | SPOT1 | SPOT2 | SPOT4 | TERRA1 | AQUA | LSAT7|ENVISAT1|UNKNOWN
Example: TERRA1
Description: Gives the satellite type as identified by DCS.

3.1.7 The dcs_requested_stop plain tag

Name: dcs_requested_stop
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 20031002211318725
Description: Specifies the requested stop time of the DCS capture.

3.1.8 The dcs_start plain tag

Name: dcs_start
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 20031002211318725
Description: Specifies the actual start time of the DCS capture.

3.1.9 The dcs_stop plain tag

Name: dcs_stop
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 20031002211318725
Description: Specifies the actual stop time of the DCS capture.

3.1.10 The dcs_stop_condition plain tag

Name: dcs_stop_condition
Type: string
Unit: N/A
Range: stop_request, lost_clock, no_clock, disk_full, usr_abort, dcs_error, system_reset, system_shutdown
Example: stop_request
Description: Specifies the reason for the conclusion of DCS capture.

3.1.11 The dcs_bit_error_rate plain tag

Name: dcs_bit_error_rate
Type: floating point
Unit: N/A
Range: [0.0, 1.0]
Example: 0.0
Description: Specifies the overall BER (bit error rate) of the data as determined by the DCS.

3.1.12 The dcs_bytes_captured plain tag

Name: dcs_bytes_captured
Type: integer
Unit: bytes
Range: 0-
Example: 410040790
Description: Specifies the size of the capture file.

3.1.13 The data_block information block

The data_block information block contains more detailed information about the blocks of recognized data in the capture. It is optional. Multiple data_block instances may be present if a capture contains more than one recognized data type.

Name: data_block
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Reports details about recognized data

The data_block information block contains the following plain tags:

- block_number - plain tag
- sync_name - plain tag
- start_byte - plain tag
- end_byte - plain tag
- percent_examined - plain tag
- percent_recognized - plain tag
- ber - plain tag

These plain tags are described below.

3.1.13.1 The block_number plain tag

Name: block_number
Type: integer
Unit: N/A
Range: 1-
Example: 1
Description: Specifies the sequential number of the data block

3.1.13.2 The sync_name plain tag

Name: sync_name
Type: string
Unit: N/A
Range: ERS | JERS | RSAT | SPOTM | TERRA1 | AQUA
Example: SPOTM
Description: Specifies the sync type recognized in the data block by DCS

3.1.13.3 The start_byte plain tag

Name: start_byte
Type: integer
Unit: byte
Range: 0-
Example: 10000
Description: Specifies the byte offset from the start of capture where the sync type was first recognized

3.1.13.4 The end_byte plain tag

Name: end_byte
Type: integer
Unit: byte
Range: 0-
Example: 20000
Description: Specifies the byte offset from the start of capture where the sync type was last recognized

3.1.13.5 The percent_examined plain tag

Name: percent_examined
Type: floating point
Unit: N/A
Range: [0.0, 100.0]
Example: 50.0
Description: Specifies the percentage of the data between the start and end bytes which was examined for sync

3.1.13.6 The percent_recognized plain tag

Name: percent_recognized
Type: floating point
Unit: N/A
Range: [0.0, 100.0]

Example: 50.0
Description: Specifies the percentage of the data examined where the sync type was recognized

3.1.13.7 The ber plain tag

Name: ber
Type: floating point
Unit: N/A
Range: [0.0, 1.0]
Example: 0.0
Description: Specifies the BER for the data block

3.2 The Synchronization Information Block

The Frame Synchronization part of the SyncPrep program will add one ss_block information block to the STF parameter file for each data block found.

Name: ss_block
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies sync detection information

The ss_block information block contains the following plain tags and information blocks:

- ss_version - plain tag
- ss_date - plain tag
- block_nr - plain tag
- sync_type - plain tag
- satellite - plain tag
- instrument - plain tag
- special_id - plain tag
- transmission mode - plain tag
- sync_pattern - plain tag
- frame_length - plain tag
- CCSDS_id - plain tag
- allowed_bit_errors - plain tag
- flywheel_constant - plain tag
- IQ_swap - plain tag
- invI - plain tag
- invQ - plain tag
- number_bytes - plain tag
- number_frames - plain tag
- bit_errors - plain tag
- bits_examined - plain tag
- bit_error_rate - plain tag
- valid_fraction - plain tag
- invalid_syncs - plain tag
- local_bit_error_rate - information block (deprecated)

These plain tags and information blocks are described below.

3.2.1 The ss_version plain tag

Name: ss_version
Type: string
Unit: N/A
Range: N/A
Example: 5.1.0
Description: Specifies the SyncPrep software version number

3.2.2 The ss_date plain tag

Name: ss_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 20031002211318725
Description: Specifies the date/time that SyncPrep was run.

3.2.3 The block_nr plain tag

Name: block_nr
Type: integer
Unit: N/A
Range: N/A
Example: 0-
Description: Specifies the sequential number of the ss_block.

3.2.4 The sync_type plain tag

Name: sync_type
Type: string
Unit: N/A
Range: CCSDS | ERS | JERS | LSAT7 | SPOT | SPOTM
Example: SPOTM
Description: Specifies the sync type detected by SyncPrep.

3.2.5 The satellite plain tag

Name: satellite
Type: string
Unit: N/A
Range: ERS1 | ERS2 | JERS1 | RSAT1 | SPOT1 | SPOT2 | SPOT4 | TERRA1 | AQUA | LSAT7|ENVISAT1|UNKNOWN
Example: AQUA
Description: Specifies the satellite detected by SyncPrep.

3.2.6 The instrument plain tag

Name: instrument
Type: string
Unit: N/A
Range: SAR | OPT | unknown
Example: SAR
Description: Specifies the satellite instrument detected by SyncPrep.

3.2.7 The special_id plain tag

Name: special_id
Type: string
Unit: N/A
Range: N/A
Example: None
Description: Gives additional information about the satellite or instrument detected.

3.2.8 The transmission_mode plain tag

Name: transmission_mode
Type: string
Unit: N/A
Range: REALTIME | PLAYBACK | unknown
Example: REALTIME
Description: Specifies whether the data is real time or from OBR (On-Board Recorder).

3.2.9 The sync_pattern plain tag

Name: sync_pattern
Type: string
Unit: N/A
Range: N/A
Example: 1acffc1d
Description: Specifies the telemetry sync pattern used to identify the sync type.

3.2.10 The frame_length plain tag

Name: frame_length
Type: integer
Unit: bytes
Range: 1-
Example: 1024
Description: Specifies the size in bytes of each output frame.

3.2.11 The CCSDS_id plain tag

Name: CCSDS_id
Type: integer
Unit: N/A
Range: N/A
Example: 14
Description: Specifies the CCSDS identifier for CCSDS satellites.

3.2.12 The allowed_bit_errors plain tag

Name: allowed_bit_errors
Type: integer
Unit: bits
Range: 0-
Example: 2
Description: Number of bad bits allowed in an identified sync code (same value as in the config.sync file.)

3.2.13 The flywheel_constant plain tag

Name: flywheel_constant
Type: integer
Unit: N/A
Range: 1-
Example: 29
Description: Flywheel factor used during sync detection (same value as in the config.sync file.)

3.2.14 The IQ_swap plain tag

Name: IQ_swap
Type: flag
Unit: N/A
Range: 0 | 1
Example: 0
Description: Flag indicating that the I and Q channels are swapped.

3.2.15 The inv_I plain tag

Name: inv_I
Type: flag
Unit: N/A
Range: 0 | 1
Example: 0

Description: Flag indicating that the I channel is inverted.

3.2.16 The inv_Q plain tag

Name: inv_Q
Type: flag
Unit: N/A
Range: 0 | 1
Example: 0
Description: Flag indicating that the Q channel is inverted.

3.2.17 The number_bytes plain tag

Name: number_bytes
Type: integer
Unit: bytes
Range: 0-
Example: 208335000
Description: Size of the data in this ss_block in bytes.

3.2.18 The number_frames plain tag

Name: number_frames
Type: integer
Unit: N/A
Range: 1-
Example: 645000
Description: Number of frames in this ss_block, or 1 if unknown.

3.2.19 The bit_errors plain tag

Name: bit_errors
Type: integer
Unit: N/A
Range: 0-
Example: 231
Description: Number of bit errors observed, or 0 if unknown.

3.2.20 The bits_examined plain tag

Name: bits_examined
Type: integer
Unit: N/A
Range: 0-
Example: 22113344

Description: Number of bits examined to determine the number of bit errors.

3.2.21 The bit_error_rate plain tag

Name: bit_error_rate
Type: floating point
Unit: N/A
Range: [0.0, 1.0]
Example: 0.0
Description: Specifies the BER for this block, or 1.0 if unknown.

3.2.22 The valid_fraction plain tag

Name: valid_fraction
Type: floating point
Unit: N/A
Range: [0.0, 1.0]
Example: 0.999923
Description: Specifies the valid fraction of the output data to the input data, or 0.0 if unknown.

3.2.23 The invalid_syncs plain tag

Name: invalid_syncs
Type: integer
Unit: N/A
Range: 0-
Example: 3
Description: Specifies the number of bad syncs found.

3.2.24 The local_bit_error_rate information block

The local_bit_error_rate information block is obsolete and should no longer be used.

3.3 The Preparation Information Block

The preparation part of the SyncPrep program will add one prep_block information block to the STF parameter file.

Name: prep_block
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the data and satellite characteristics

The prep_block information block contains the following plain tags and information blocks:

- processor_name - plain tag
- prep_version - plain tag
- prep_date - plain tag
- ss_block - plain tag
- block_nr - plain tag
- start_byte - plain tag
- number_bytes - plain tag
- number_frames - plain tag
- number_lines - plain tag
- satellite - plain tag
- instrument - plain tag
- beam_sequence - plain tag
- number_of_beams - plain tag
- bit_errors - plain tag
- bit_error_rate - plain tag
- missing_lines - plain tag
- missing_bytes_added - plain tag
- zero_data_suppression - plain tag
- ber_threshold - plain tag
- first_satellite_clock - plain tag
- last_satellite_clock - plain tag
- clock_increment - plain tag
- first_date - plain tag
- last_date - plain tag
- tce_UTC - plain tag

- tce_satellite - plain tag
- tce_corr - plain tag
- tce_step - plain tag
- estimated_acq_start - plain tag
- nominal_look_angle - plain tag
- number_range_samples - plain tag
- ADC_sampling_frequency - plain tag
- automatic_gain_control - plain tag
- state_vector - information block
- ephemeris_type - plain tag
- swath_velocity - plain tag
- flight_path_direction - plain tag
- GHA - information block
- OrbitNr - plain tag
- OrbitNr_Date - plain tag
- clock_angle - plain tag
- local_bit_error_rate - information block
- sensor - information block
- ellipsoid_name - plain tag
- location - information block, multiple instances
- missing_data_blocks - plain tag
- missing_data - information block, 0, 1, or multiple instances

These plain tags and information blocks are described in the following.

3.3.1 The processor_name plain tag

Name: processor_name
Type: string
Unit: N/A
Range: N/A
Example: SKY
Description: Specifies the processor name.

3.3.2 The prep_version plain tag

Name: prep_version
Type: string
Unit: N/A
Range: N/A
Example: 2.8
Description: Specifies the version number of SyncPrep that created this data set.

3.3.3 The prep_date plain tag

Name: prep_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the system date/time when SyncPrep was executed.

3.3.4 The ss_block plain tag

Name: ss_block
Type: integer
Unit: N/A
Range: [0,999]
Example: 0
Description: Specifies the ss_block number that corresponds to this prep_block.

3.3.5 The block_nr plain tag

Name: block_nr
Type: integer
Unit: N/A
Range: [0,999]
Example: 0
Description: Specifies the prep_block number of this prep_block.

3.3.6 The start_byte plain tag

Name: start_byte
Type: integer
Unit: N/A
Range: [0]
Example: 0
Description: Specifies the starting byte number of this prep_block. This number is always 0 for LZP versions 2.6 and higher.

3.3.7 The number_bytes plain tag

Name: number_bytes
Type: integer
Unit: N/A
Range: [0, 9999999999]
Example: 3837573894
Description: Specifies the file size of the data file that corresponds to this prep_block.

3.3.8 The number_frames plain tag

Name: number_frames
Type: integer
Unit: N/A
Range: [0,999999999]
Example: 457345743
Description: Specifies the number of satellite telemetry frames that are contained in this prep_block. The number of frames that make up one SAR line is satellite specific.

3.3.9 The number_lines plain tag

Name: number_lines
Type: integer
Unit: N/A
Range: [0,999999999]
Example: 32874562
Description: Specifies the number of SAR lines that are contained in this prep_block.

3.3.10 The satellite plain tag

Name: satellite
Type: string
Unit: N/A
Range: ERS1 | ERS2 | JERS1 | RSAT1 | SPOT1 | SPOT2 | SPOT4 | TERRA1 | AQUA|LSAT7|ENVISAT1
Example: ERS1
Description: Specifies the satellite that produced the data

3.3.11 The instrument plain tag

Name: instrument
Type: string
Unit: N/A
Range: [SAR | OPT | UNKNOWN]
Example: SAR
Description: Specifies the type of instrument that produced this data.

3.3.12 The beam_sequence plain tag

Name: beam_sequence
Type: integer
Unit: N/A
Range: [0,999]

Example: 7
Description: Valid only with RSAT1 or ALOS PALSAR data. For RSAT1, this specifies the beam slot allocation number. For ALOS PALSAR, this specifies the sensor mode, beam type, and polarization and, for scansar mode, the number of beams, each beam type and polarization.
For ERS1/2 and JERS1 this number is not relevant.

The beam_sequence field will have the following values for Radarsat scansar:

- 08091007 SWA
- 08111007 SWA (for OBR data)
- 08090506 SWB
- 08110506 SWB (for OBR data)
- 0809 SNA
- 0811 SNA (for OBR data)
- 090506 SNB
- 110506 SNB (for OBR data)

3.3.13 The number_of_beams plain tag

Name: number_of_beams
Type: integer
Unit: N/A
Range: [1, 5]
Example: 1
Description: Specifies the number of beams used to produce this data.

3.3.14 The bit_errors plain tag

Name: bit_errors
Type: integer
Unit: N/A
Range: [0,999999999]
Example: 17
Description: Specifies the number of bit errors found in the sync codes of the telemetry data.

3.3.15 The bit_error_rate plain tag

Name: bit_error_rate
Type: floating point
Unit: N/A
Range: [0.0, 1.0]
Example: 0.0

Description: Specifies the BER (bit error rate) of the data as calculated from the bit errors detected in the sync codes of the telemetry data.

3.3.16 The missing_lines plain tag

Name: missing_lines
Type: integer
Unit: N/A
Range: [0,999999999]
Example: 0
Description: Specifies the number of completely missing SAR lines in this prep_block.

3.3.17 The missing_bytes_added plain tag

Name: missing_bytes_added
Type: integer
Unit: N/A
Range: [0,999999999]
Example: 323
Description: Specifies the number of bytes that were added to ensure complete lines in the granule data file.

3.3.18 The zero_data_suppression plain tag

Name: zero_data_suppression
Type: string
Unit: N/A
Range: NONE | ALL
Example: ALL
Description: Specifies whether or not the zero-data suppression mode was activated in the creation of this granule.

3.3.19 The ber_threshold plain tag

Name: ber_threshold
Type: floating-point
Unit: N/A
Range: [0.0, 1.0]
Example: 0.001
Description: Specifies the BER threshold used to process this granule.

3.3.20 The first_satellite_clock plain tag

Name: first_satellite_clock
Type: floating point

Unit: N/A
Range: [0, 999999999999.9]
Example: 243212422.0
Description: Specifies the satellite clock that corresponds to the first imaging line in this prep_block.

3.3.21 The last_satellite_clock plain tag

Name: last_satellite_clock
Type: floating point
Unit: N/A
Range: [0, 999999999999.9]
Example: 243212422.0
Description: Specifies the satellite clock that corresponds to the last imaging line in this prep_block.

3.3.22 The clock_increment plain tag

Name: clock_increment
Type: floating point
Unit: sec
Range: [0.0, 1.0]
Example: 1.0
Description: Specifies the time interval for a satellite clock increment of 1.0.

3.3.23 The first_date plain tag

Name: first_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the UTC date/time of the first imaging line in this prep_block.

3.3.24 The last_date plain tag

Name: last_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the UTC date/time of the last imaging line in this prep_block.

3.3.25 The tce_UTC plain tag

Name: tce_UTC
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the reference UTC date/time of the TCE (Time Correlation Element) that was used to convert the satellite clock to UTC.

3.3.26 The tce_satellite plain tag

Name: tce_satellite
Type: floating_point
Unit: N/A
Range: [0.0, 9999999999.9]
Example: 452345235.0
Description: Specifies the reference satellite clock of the TCE (Time Correlation Element) that was used to convert the satellite clock to UTC.

3.3.27 The tce_corr plain tag

Name: tce_corr
Type: floating point
Unit: sec
Range: [0.0, 999.9]
Example: 0.0
Description: Specifies the correction value of the TCE (Time Correlation Element) that was used to convert the satellite clock to UTC. This value is used for JERS1.

3.3.28 The tce_step plain tag

Name: tce_step
Type: floating point
Unit: picosec
Range: [0.0, 9999999999.9]
Example: 0.0
Description: Specifies the clock step for TCE conversion in ENVISAT satellite.

3.3.29 The estimated_acq_start plain tag

Name: estimated_acq_start
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings

Example: 19960610145924761
Description: Specifies the estimated acquisition date as provided to the Level 0 Processor.

3.3.30 The nominal_look_angle plain tag

Name: nominal_look_angle
Type: floating point
Unit: degrees
Range: [0.0, 90.0]
Example: 23.5
Description: Specifies the nominal look angle of the satellite. This value is provided for backwards compatibility. All new applications should use the value as provided in the sensor information block. This is SAR sensors only.

3.3.31 The number_range_samples plain tag

Name: number_range_samples
Type: integer
Unit: N/A
Range: [0,20000]
Example: 6144
Description: Specifies the number of pixels for the first SAR line. The actual value might vary along track.
This value is provided for backwards compatibility. All new applications should use the value as provided in the sensor information block. This is SAR sensors only.

3.3.32 The ADC_sampling_frequency plain tag

Name: ADC_sampling_frequency
Type: floating_point
Unit: Hz
Range: [10.0E6, 40.0E6]
Example: 32317075.00000000
Description: Specifies the sampling frequency of the SAR in “fast time”. This is the sampling frequency of the ADC used to convert the received radar signal.
This value is provided for backwards compatibility. All new applications should use the value as provided in the sensor information block. This is SAR sensors only.

3.3.33 The automatic_gain_control plain tag

Name: automatic_gain_control
Type: string
Unit: N/A

Range: ON | OFF
Example: ON
Description: Specifies whether or not the AGC was turned on or off. For satellites that do not have AGC the value is always OFF.

3.3.34 The state_vector information block

Name: state_vector
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies a single state vector for this acquisition in the ECR (Earth Centered Rotating) coordinate frame. The state vector is given at the ascending node, i.e. the z position component is approximately 0, and the zv velocity component is positive. See the ephemeris information block for a detailed description of the state_vector information block.

3.3.35 The ephemeris_type plain tag

Name: ephemeris_type
Type: string
Unit: N/A
Range: UNKNOWN | NORAD | PREDICTED | RESTITUTED | PRECISION
Example: RESTITUTED
Description: Specifies the quality of the ephemeris data contained in this prep_block.

3.3.36 The swath_velocity plain tag

Name: swath_velocity
Type: floating point
Unit: m/sec
Range: [5000.0, 8000.0]
Example: 6123.45323
Description: Specifies the swath velocity of the satellite nadir point as estimated from the state vector information.

3.3.37 The flight_path_direction plain tag

Name: flight_path_direction
Type: string
Unit: N/A
Range: ASCENDING, DESCENDING
Example: DESCENDING
Description: Specifies the spacecraft flight direction.

3.3.38 The GHA information block

The GHA information block is repeated inside the sensor information block. See the sensor information block chapter for a description of the GHA block.

3.3.39 The OrbitNr plain tag

Name: OrbitNr
Type: integer
Unit: N/A
Range: [0, 99999]
Example: 2315
Description: Specifies the orbit number at the first valid imaging line of this data.

3.3.40 The OrbitNr_Date plain tag

Name: OrbitNr_Date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the date and time that corresponds to the orbit number tag (OrbitNr).

3.3.41 The clock_angle plain tag

Name: clock_angle
Type: floating-point
Unit: degrees
Range: +90.0 | -90.0
Example: 90.0
Description: Specifies the look direction of the satellite

3.3.42 The local_bit_error_rate information block

The local_bit_error_rate information block in the prep_block contains information about the local bit error rate, estimated from the bit errors in the sync codes. The interval between BER measurements can be specified in the global processing parameter file.

Name: local_bit_error_rate
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Reports the local bit error rate

The local_bit_error_rate information block contains multiple instances of the following plain tag:

- ss_bit_error_rate - plain tag

This plain tag is described below.

3.3.42.1 The ss_bit_error_rate plain tag

Name:	ss_bit_error_rate
Type:	(integer integer floating-point)
Unit:	N/A
Range:	([0, 999999] [0, 999999999] [0.0, 1.0])
Example:	10000 43224323 0.0023221
Description:	Specifies the local bit error rate as a triplet of numbers. The first number is the output line number, the second number is the output byte offset, the third number is the actual BER. The local BER measurement sums up all bit errors in the data block starting from the last measurement. The measurement is reported at the end of the measured block.

3.3.43 The sensor information block

Name: sensor
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the satellite and sensor characteristics

The sensor information block contains the following plain tags and information blocks:

- sensor_name - plain tag
- instrument_name - plain tag
- format_name - plain tag
- mirror_step - plain tag
- look_angle - plain tag
- incidence_angle - plain tag
- clock_angle - plain tag
- nr_temperatures - plain tag
- temperature_0 .. _3 - plain tag
- nr_bands - plain tag
- band - information block, 0 or more instances
- nr_beams - plain tag
- beam - information block, 1-5 instances
- ScanSARblock - information block, 0 or 1 instance
- ephemeris - information block, 1 instance

These plain tags and information blocks are described in the following.

3.3.43.1 The sensor_name tag

Name: sensor_name
Type: string
Unit: N/A
Range: ERS1 | ERS2 | JERS1 | RSAT1 | ALOS1 | SPOT1 | SPOT2 | SPOT4 | TERRA1 | AQUA | LSAT7|ENVISAT1
Example: ERS1
Description: Specifies the satellite that produced the data.

3.3.43.2 The instrument_name tag

Name: instrument_name
Type: string
Unit: N/A
Range: ERS1 | ERS2 | JERS1 | RSAT1 | ALOS1 | SPOT_HRV1 | SPOT_HRV2 | SPOT_HRVIR1 | SPOT_HRVIR2 | MODIS | LSAT7_ETM+
Example: ERS1
Description: Specifies the instrument that produced the data.

3.3.43.3 The format_name tag

Name: format_name
Type: string
Unit: N/A
Range: SPOT_PM | SPOT_PM+X | SPOT_XS | SPOT_XS+P | SPOT_XI | SPOT_XI+M | LSAT7_FMT1 | LSAT7_FMT2 | DAY | NIGHT
Example: SPOT_XI
Description: Specifies the instrument-specific format of the data.

3.3.43.4 The mirror_step tag

Name: mirror_step
Type: integer
Unit: N/A
Range: 0 - 20
Example: 0
Description: Specifies the position of the instrument mirror.

3.3.43.5 The look_angle tag

Name: look_angle
Type: floating-point
Unit: degrees
Range: [0, 90.0]
Example: 38.63463200
Description: Specifies the nominal look-angle of the beam.

3.3.43.6 The incidence_angle tag

Name: incidence_angle
Type: floating-point
Unit: degrees
Range: [0, 90.0]
Example: 44.50000000

Description: Specifies the nominal incidence-angle of the beam, assuming flat terrain.

3.3.43.7 The Orbit Bulletin Information Block

Name: orbit_bulletin
Type: Information block
Unit: N/A
Range: N/A
Example: N/A
Description: Describes spot4 orbit information. This block is only appearing for spot4 parameter file.

The orbit bulletin information block describes ephemeris and orbit information for spot4 satellite .

The orbit bulletin information block contains the following plain tags and information blocks:

- julian_days - plain tag
- semi_major_axis - plain tag
- eccentricity_x - plain tag
- eccentricity_y - plain tag
- inclination - plain tag
- right_ascension - plain tag
- latitude_argument - plain tag
- mean_anomaly - plain tag
- argument_perigree - plain tag
- p7 - plain tag
- p8 - plain tag
- p9 - plain tag
- p10 - plain tag

These plain tags and information blocks are described in the following.

3.3.43.7.1 The julian_days plain tag

Name: julian_days
Type: floating point
Unit: days
Range: 0.0-
Example: 19093.948437
Description: Specifies the orbit time as Julian days in the floating point

3.3.43.7.2 The semi_major_axis plain tag

Name: semi_major_axis
Type: floating point
Unit: m
Range: 0.0-
Example: 7200597.510000
Description: The semi major axis describes the size of the ellipse. Semi-major axis is one half the longest distance across the ellipse (or one half the distance between apogee and perigee) .

3.3.43.7.3 The eccentricity_x plain tag

Name: eccentricity_x
Type: floating point
Unit: ratio with the original value
Range: 0.0-
Example: 5.26666667E-06
Description: Specifies eccentricity in x axis. Eccentricity is shape of the ellipse. Eccentricity is computed as the linear eccentricity (the distance from the center of the ellipse to the center of the Earth) divided by the semi major axis. A zero eccentricity describes a circular orbit; an eccentricity approaching one describes a highly elliptical orbit.

3.3.43.7.4 The eccentricity_y plain tag

Name: eccentricity_y
Type: floating point
Unit: ratio with the original value
Range: 0.0-
Example: 1.14696667E-03
Description: Specifies eccentricity in y axis. Eccentricity is described in the above section.

3.3.43.7.5 The inclination plain tag

Name: inclination
Type: floating point
Unit: degrees
Range: [0.0, 90.0]
Example: 1.72317916E+00
Description: Inclination describes the orbital plane's tilt angle with respect to the equator. Inclination also specifies the highest latitudes (North and South) over which the satellite directly overflies. A zero inclination describes an equatorial orbit; a 90 degree inclination describes a polar orbit. Inclinations greater than 90 degrees describe orbits that move against Earth rotation (called retrograde).

3.3.43.7.6 The right_ascension plain tag

Name: right_ascension
Type: floating point
Unit: degrees
Range: [0.0, 90.0]
Example: 3.07878905E+00
Description: The right ascension of the ascending node is the angle measured eastward from the Vernal Equinox to the ascending node. The Vernal Equinox is the Sun's apparent ascending node (marking the beginning of the Northern hemisphere's spring.

3.3.43.7.7 The latitude_argument plain tag

Name: latitude_argument
Type: floating point
Unit: N/A
Range: 0.0-
Example: 1.30836978E+00
Description: Latitude argument is the parameter to calculate argument of perigee.

3.3.43.7.8 The mean_anomaly plain tag

Name: mean_anomaly
Type: floating point
Unit: N/A
Range: [-1.0E300, 1.0E300]
Example: -2.57834757E-01
Description: Mean anomaly describes what the satellite's true anomaly would be if it were in a circular orbit.

3.3.43.7.9 The argument perigree plain tag

Name: latitude_argument
Type: floating point
Unit: degree
Range: [-90.0, 90.0]
Example: 1.30836978E+00
Description: Argument of perigee is the angle measured in the direction of satellite motion from the ascending node to perigee.

3.3.43.7.10 The p7 to p10 plain tag

Name: p7, p8, p9, p10
Type: floating point
Unit: N/A
Range: [-1.0E300, 1.0E300]
Example: 0.0
Description: p7, p8, p9, and p10 parameters take into account the atmospheric drag force.

3.3.43.8 The clock_angle tag

Name: clock_angle
Type: floating-point
Unit: degrees
Range: +90.0 | -90.0
Example: 90.0
Description: Specifies the look direction of the satellite.

3.3.43.9 The nr_temperatures tag

Name: nr_temperatures
Type: integer
Unit: N/A
Range: [0,4]
Example: 0
Description: Specifies the number of temperature values extracted from the telemetry.
For RSAT1, four temperature values may be extracted.
For other satellites, no temperature value is extracted.

3.3.43.10 The temperature_0 .. temperature_3 tags

Name: temperature_0 .. temperature_3
Type: float
Unit: Kelvin
Range: [0.0, 500.0]
Example: 164.0
Description: Specifies the extracted temperature value. Up to four occurrences for Radarsat 1.

3.3.43.11 The nr_bands tag

Name: nr_bands
Type: integer
Unit: N/A
Range: 0-36
Example: 1
Description: Specifies the number of band blocks following.

3.3.43.12 The band Information Block

Name: band
Type: Information block
Unit: N/A
Range: N/A
Example: N/A

Description: Describes one band involved in the data production.

The band block describes all bands used for production of the data. Optical sensors may have from 1 to many bands of data.

The beam information block contains the following plain tags and information blocks:

- band_name - plain tag
- amp_setting - plain tag

These plain tags and information blocks are described in the following.

3.3.43.12.1 The band_name tag

Name: band_name
Type: string
Unit: N/A
Range: MODIS_B1..MODIS_B36, LSAT7, SPOT_SWIR, SPOT_B1..SPOT_B3, SPOT_PAN
Example: MODIS_B1
Description: Specifies the name of this band.

3.3.43.12.2 The amp_setting tag

Name: amp_setting
Type: integer
Unit: N/A
Range: 0-
Example: 1
Description: Specifies the amplifier setting for this band.

3.3.43.13 The nr_beams tag

Name: nr_beams
Type: integer
Unit: N/A
Range: [1,5]
Example: 1
Description: Specifies the number of beam blocks following.

3.3.43.14 The beam Information Block

Name: beam
Type: Information block
Unit: N/A

Range: N/A
Example: N/A
Description: Describes one beam involved in the data production.

The beam block describes all beams used for production of the data. For RSAT1/ScanSAR mode, there are up to four beams involved in the data production. For ALOS1/ScanSAR mode, there are up to five beams involved. For all strip mode cases, exactly one beam is engaged.

The beam information block contains the following plain tags and information blocks:

- beam_name - plain tag
- nr_of_samples - plain tag
- echo_delay - plain tag
- carrier_freq - plain tag
- sampling_freq - plain tag
- PRF - plain tag
- chirp_rate - plain tag
- pulse_length - plain tag
- look_angle - plain tag
- incidence_angle - plain tag
- range_spectrum_snr - plain tag
- replica_energy_ref_level - plain tag
- cal1_cal2_diff_ref_level - plain tag
- thermal_noise_ref_level - plain tag
- gain_corctn_factor - plain tag
- gain_scale - plain tag
- PolarizationBlock - information block, 1 instance
- DopplerCentroidParameters - information block, 1 instance
- DopplerRateParameters - information block, 1 instance

These plain tags and information blocks are described in the following.

3.3.43.14.1 The beam_name tag

Name: beam_name
Type: string
Unit: N/A
Range: ERS1 | ERS2 | JERS1 | S1..S7 | W1..W3 | F1..F5 | EL1 | EH1..EH7
Example: W2
Description: Specifies the name of this beam.
For RSAT1, this is the beam name as converted using the telemetry auxiliary

information, and the appropriate payload parameter file.
For ERS1/2 and JERS1, the sensor_name is used for the beam name.

3.3.43.14.2 The nr_of_samples tag

Name: nr_of_samples
Type: integer
Unit: N/A
Range: [4000,10000]
Example: 6144
Description: Specifies the number of range samples detected at the beginning of this dataset. This number might vary in the along track direction.

3.3.43.14.3 The echo_delay tag

Name: echo_delay
Type: floating-point
Unit: sec
Range: [0.001, 0.01]
Example: 0.00703825512000
Description: Specifies the one-way time of the radar pulse from the transmission to the start of the analog-to-digital conversion. This time includes the sampling window start time (SWST) as derived from the satellite telemetry data, and the "number of pulses in the air".

3.3.43.14.4 The carrier_freq tag

Name: carrier_freq
Type: floating-point
Unit: Hz
Range: [1.0E9, 6.0E9]
Example: 5300432000.00000000
Description: Specifies the carrier frequency of the SAR.

3.3.43.14.5 The sampling_freq tag

Name: sampling_freq
Type: floating_point
Unit: Hz
Range: [10.0E6, 40.0E6]
Example: 32317075.00000000
Description: Specifies the sampling frequency of the SAR in "fast time". This is the sampling frequency of the ADC used to convert the received radar signal.

3.3.43.14.6 The PRF tag

Name: PRF

Type: floating-point
Unit: Hz
Range: [1000.0, 2000.0]
Example: 1318.52871709
Description: Specifies the sampling frequency of the SAR in "slow time". This is the frequency of the emitted SAR pulses. PRF stands for Pulse Repetition Frequency.

3.3.43.14.7 The chirp_rate tag

Name: chirp_rate
Type: floating-point
Unit: Hs/sec
Range: [-1.0E12, 1.0E12]
Example: -721404761904.76196000
Description: Specifies the rate of the frequency change of the SAR FM signal (chirp).

3.3.43.14.8 The pulse_length tag

Name: pulse_length
Type: floating-point
Unit: sec
Range: [0, 100E-6]
Example: 0.00004200000000
Description: Specifies the length of the SAR FM signal (chirp).

3.3.43.14.9 The look_angle tag

Name: look_angle
Type: floating-point
Unit: degrees
Range: [0, 90.0]
Example: 38.63463200
Description: Specifies the nominal look-angle of the beam.

3.3.43.14.10 The incidence_angle tag

Name: incidence_angle
Type: floating-point
Unit: degrees
Range: [0, 90.0]
Example: 44.50000000
Description: Specifies the nominal incidence-angle of the beam, assuming flat terrain.

3.3.43.14.11 The range_spectrum_snr tag

Name: range_spectrum_snr

Type: floating-point
Unit: dB
Range: [0.0, 20.0]
Example: 0.000000
Description: Specifies the Signal-to-Noise ratio (SNR) determined from the range spectrum of the radar signal.
This is not evaluated inside the Level 0 Processor, unless the Clutterlock option is activated. The value will normally be 0.0 therefore.

3.3.43.14.12 The replica_energy_ref_level tag

Name: replica_energy_ref_level
Type: floating-point
Unit: N/A
Range: [0, 100.0]
Example: 65.000000
Description: Specifies the replica energy reference level of the beam. This value has been extracted from the appropriate payload parameter file. For ERS1/2 and JERS1, this value is normally 1.0.

3.3.43.14.13 The cal1_cal2_diff_ref_level tag

Name: cal1_cal2_diff_ref_level
Type: floating-point
Unit: N/A
Range: [0,100.0]
Example: 0.00000
Description: Specifies a RSAT1 specific calibration level. This value has been extracted from the appropriate payload parameter file.

3.3.43.14.14 The thermal_noise_ref_level tag

Name: thermal_noise_ref_level
Type: floating-point
Unit: dB
Range: [-30.0, 0.0]
Example: -21.370001
Description: Specifies the thermal noise reference level. This value has been extracted from the appropriate payload parameter file.

3.3.43.14.15 The gain_corctn_factor tag

Name: gain_corctn_factor
Type: floating-point
Unit: N/A
Range: [0, 1]
Example: 0.095148

Description: Specifies the gain correction factor used for radiometric calibration of the SAR image. This value has been extracted from the appropriate payload parameter file.

3.3.43.14.16 The gain_scale tag

Name: gain_scale
Type: floating-point
Unit: dB
Range: [-40.0, 40.0]
Example: -11.800000
Description: Specifies the overall gain factor necessary for radiometric calibration of Vexcels SAR Processor (FOCUS).

3.3.43.14.17 The PolarizationBlock information block

Name: PolarizationBlock
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the polarization of the SAR.

The PolarizationBlock information block contains the following plain tags and information blocks:

- NrPolarizations - plain tag
- Polarization - information block, multiple instances

These plain tags and information blocks are described in the following.

3.3.43.14.17.1 The NrPolarizations plain tag

Name: NrPolarizations
Type: integer
Unit: N/A
Range: 1 | 2 | 4
Example: 1
Description: Specifies how many different polarizations are present for this beam. For single polarization, this number is 1. For dual polarization, the number is 2. For quad polarization, the number is 4.

3.3.43.14.17.2 The Polarization information block

Name: Polarization
Type: information block
Unit: N/A
Range: N/A

Example: N/A
Description: Specifies one of the polarizations of the SAR.

The Polarization information block contains the following plain tags and information blocks:

- polarization - plain tag
- polarization_amplitude - plain tag
- polarization_phase - plain tag
- IQStatistics - information block, multiple instances

These plain tags and information blocks are described in the following.

3.3.43.14.17.2.1 The polarization plain tag

Name: polarization
Type: string
Unit: N/A
Range: HH | HV | VH | VV
Example: HH
Description: Specifies the polarization type of this polarization mode.

3.3.43.14.17.2.2 The polarization_amplitude plain tag

Name: polarization_amplitude
Type: floating point
Unit: linear units
Range: [0.0, 99.9]
Example: 1.0
Description: The respective gain setting from the payload parameter file.

3.3.43.14.17.2.3 The polarization_phase plain tag

Name: polarization_phase
Type: floating point
Unit: degrees
Range: [-360.0, 360.0]
Example: 0.0
Description: The respective phase setting from the payload parameter file.

3.3.43.14.17.2.4 The IQStatistics information block

Name: IQStatistics
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Describes the I/Q statistics of the data with this polarization.

The IQStatistics information block contains the following plain tags and information blocks:

- I_mean - plain tag
- Q_mean - plain tag
- I_std - plain tag
- Q_std - plain tag
- IQ_corr - plain tag

These plain tags and information blocks are described in the following.

3.3.43.14.17.2.4.1 The I_mean plain tag

Name: I_mean
Type: floating point
Unit: Volt
Range: [-10.0, 10.0]
Example: 0.0342
Description: The mean value of the I channel for this polarization.

3.3.43.14.17.2.4.2 The Q_mean plain tag

Name: Q_mean
Type: floating point
Unit: Volt
Range: [-10.0, 10.0]
Example: 0.0342
Description: The mean value of the Q channel for this polarization.

3.3.43.14.17.2.4.3 The I_std plain tag

Name: I_std
Type: floating point
Unit: Volt
Range: [0.0, 10.0]
Example: 3.004
Description: The standard deviation of the I channel for this polarization.

3.3.43.14.17.2.4.4 The Q_std plain tag

Name: Q_std
Type: floating point
Unit: Volt
Range: [0.0, 10.0]
Example: 3.004
Description: The standard deviation of the Q channel for this polarization.

3.3.43.14.17.2.4.5 The IQ_corr plain tag

Name: IQ_corr
Type: floating point
Unit: none
Range: [0.0, 1.0]
Example: 0.023
Description: The statistical correlation between the I and Q channel of this polarization. For exact 90 degree phase difference between the I and Q channel, this number would be 0.

3.3.43.14.18 The DopplerCentroidParameters information block

Name: DopplerCentroidParameters
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the Doppler centroid characteristic of the data. The information contained is only valid if clutterlock was performed successfully.

The DopplerCentroidParameters information block contains the following plain tags and information blocks:

- doppler_centroid_coefficients - information block, 1 instance
- reference_range - plain tag
- reference_date - plain tag
- ambiguity_number - plain tag
- MLCC_ambiguity_number_occurence - plain tag
- MLBF_ambiguity_number_occurence - plain tag
- DAR_doppler - plain tag
- Predict_doppler - plain tag
- DAR_confidence - plain tag
- doppler_fit_correlation - plain tag
- doppler_status - plain tag

These plain tags and information blocks are described in the following.

3.3.43.14.18.1 The doppler_centroid_coefficients information block

Name: doppler_centroid_coefficients
Type: information block
Unit: N/A
Range: N/A
Example: N/A

Description: Specifies the 2-dimensional polynomial that characterizes the along track/cross track Doppler centroid characteristic of the data.

The doppler_centroid_coefficients information block contains the following plain tags:

- reference_first_dimension - plain tag
- reference_second_dimension - plain tag
- number_of_coefficients_first_dimension - plain tag
- number_of_coefficients_second_dimension - plain tag
- a00..a23 - plain tags

These plain tags and information blocks are described in the following.

3.3.43.14.18.1.1 The reference_first_dimension tag

Name: reference_first_dimension
Type: floating-point
Unit: m
Range: [600.0E3, 1200.0E3]
Example: 714531.770058
Description: Specifies the reference value of the 2-dimensional Doppler centroid polynomial in cross track direction. The reference value is the slant range at the center of the swath in cross track direction.

3.3.43.14.18.1.2 The reference_second_dimension tag

Name: reference_second_dimension
Type: floating-point
Unit: sec
Range: [1.0E9, 3.0E9]
Example: 1465570764.760753
Description: Specifies the reference value of the 2-dimensional Doppler centroid polynomial in along track direction. The reference value is the Modified Julian Day (MJD, ESA variety) at the center of the swath in along track direction, in seconds, i.e. the MJD multiplied by 86400. Note that the MJD is not an integer, i.e. it also takes into account fractions of the day. The ESA MJD starts at 0:0 on 1 January 1950.

3.3.43.14.18.1.3 The number_of_coefficients_first_dimension tag

Name: number_of_coefficients_first_dimension
Type: integer
Unit: N/A
Range: [1, 4]
Example: 4
Description: Specifies the number of coefficients of the 2-d polynomial in the first dimension, which is the cross track direction.

3.3.43.14.18.1.4 The number_of_coefficients_second_dimension tag

Name: number_of_coefficients_second_dimension
Type: integer
Unit: N/A
Range: [1, 3]
Example: 3
Description: Specifies the number of coefficients of the 2-d polynomial in the second dimension, which is the along track direction.

3.3.43.14.18.1.5 The a00 to a23 tags

Name: a00 .. a23
Type: floating-point
Unit: N/A
Range: [-1.0E300, 1.0E300]
Example: -1.97384e-19
Description: aij (e.g. a21), specifies the (i,j)-th coefficient of the A matrix, which is the 2-d polynomial characterizing the Doppler centroid characteristics of the data.

The 2-d polynomial can be considered a (n,m) matrix:

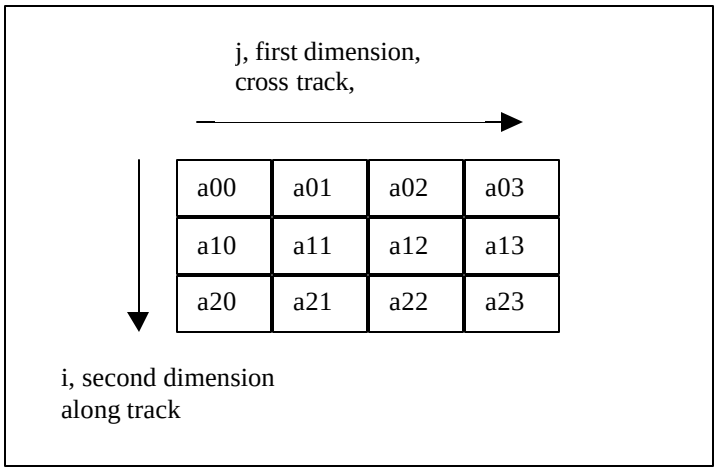

Figure 3-1: A Matrix, 2-d Doppler Centroid Polynomial

The following equation (1.0) can be used to calculate the Doppler centroid frequency f_d at any point along track (t) and cross track (R) in the data:

$$f_d = \sum_{i=0}^{2} \sum_{j=0}^{3} aij \cdot (t - t_0)^i \cdot (R - R_0)^j \qquad (1.0)$$

where

- f_d.....Doppler centroid frequency in Hz
- t.....along track variable in Modified Julian Seconds

- R.....across track variable (slant range) in meters
- t_0 .....the second dimension reference value
- R_0.....the first dimension reference value
- a_{ij} .....the (i,j)-th coefficient of the A matrix

3.3.43.14.18.2 The reference_range tag

Name: reference_range
Type: floating-point
Unit: m
Range: [600.0E3, 1200.0E3]
Example: 714531.770058
Description: Specifies the reference value of the 2-dimensional polynomial in cross track direction. This information is repeated inside of the doppler_centroid_coefficients block.

3.3.43.14.18.3 The reference_date tag

Name: reference_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the reference value of the 2-dimensional polynomial in along track direction. This information is repeated inside of the doppler_centroid_coefficients block in a different representation.

3.3.43.14.18.4 The ambiguity_number tag

Name: ambiguity_number
Type: integer
Unit: N/A
Range: [-20.0, 20.0]
Example: 1
Description: Specifies the Doppler ambiguity number at the center of the swath in both along track and cross track direction. Note that the ambiguity number might change along track. To determine the ambiguity number at any point along track, the 2-d polynomial should be evaluated.

3.3.43.14.18.5 The MLCC_ambiguity_number_occurence tag

Name: MLCC_ambiguity_number_occurence
Type: integer
Unit: N/A
Range: [0, 1000]
Example: 6
Description: Specifies the number of occurences where the MLCC technique calculated the ambiguity number that was assumed to be correct by the overall Doppler ambiguity resolver (AR).

3.3.43.14.18.6 The MLBF_ambiguity_number_occurence tag

Name: MLBF_ambiguity_number_occurence
Type: integer
Unit: N/A
Range: [0, 1000]
Example: 4
Description: Specifies the number of occurences where the MLBF technique calculated the ambiguity number that was assumed to be correct by the overall Doppler ambiguity resolver (AR).

3.3.43.14.18.7 The DAR_doppler tag

Name: DAR_doppler
Type: floating-point
Unit: Hz
Range: [-20000.0, 20000.0]
Example: 2230.801232
Description: Specifies the Doppler centroid frequency at the center of the swath in along track and cross track direction.

3.3.43.14.18.8 The Predict_doppler tag

Name: Predict_doppler
Type: floating-point
Unit: Hz
Range: [-20000.0, 20000.0]
Example: 2230.801232
Description: Doppler predicted from ephemeris and viewing geometry information.

3.3.43.14.18.9 The DAR_confidence tag

Name: DAR_confidence
Type: floating-point
Unit: N/A
Range: [0.0, 1.0]
Example: 0.833333
Description: Specifies the confidence level of the Doppler Ambiguity Resolver (DAR) algorithm. The higher the value, the higher is the confidence in the correctness of the estimated Doppler ambiguity number and thus in the value of the 2-d polynomial as far as the ambiguity number is concerned.

3.3.43.14.18.10 The doppler_fit_correlation tag

Name: doppler_fit_correlation
Type: floating-point
Unit: N/A
Range: [0.0,1.0]
Example: 0.984627

Description: Specifies the goodness of the fit of the 2-dimensional polynomial to the measured values. Higher number means closer fit.

3.3.43.14.18.11 The doppler_status tag

Name: doppler_status
Type: string
Unit: N/A
Range: SUCCESS | FAILURE | NOT PERFORMED
Example: SUCCESS
Description: Specifies the status of the Clutterlock processing.
SUCCESS means that clutterlock was performed and that a 2-d polynomial could be calculated.
FAILURE means that clutterlock was performed, but problems with the available data or meta-data caused a failure in the calculation process.
NOT PERFORMED means that clutterlock was not activated.

3.3.43.14.19 The DopplerRateParameters information block

Name: DopplerRateParameters
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the Doppler rate characteristic of the data. The information contained is only valid if autofocus was performed successfully. Inside of Vexcels Level 0 Processor, autofocus is performed automatically whenever clutterlock is performed.

The DopplerRateParameters information block contains the following plain tags and information blocks:

- effective_velocity_coefficients - information block
- veff - plain tag
- reference_range - plain tag
- reference_date - plain tag
- autofocus_scale_factor - plain tag
- autofocus_snr - plain tag
- autofocus_suggested_ambiguity_number - plain tag
- autofocus_status - plain tag

These plain tags and information blocks are described in the following.

3.3.43.14.19.1 The effective_velocity_coefficients information block

Name: effective_velocity_coefficients

Type: information block
Unit: N/A
Range: N/A
Example: N?A
Description: Specifies the result of the autofocus process.

The effective_velocity_coefficients information block contains the following plain tags:

- reference_first_dimension - information block
- reference_second_dimension - plain tag
- number_of_coefficients_first_dimension - plain tag
- number_of_coefficients_second_dimension - plain tag
- a00 .. a11 - plain tags

These plain tags are described in the following.

3.3.43.14.19.1.1 The reference_first_dimension tag

Name: reference_first_dimension
Type: floating-point
Unit: m
Range: [600.0E3, 1200.0E3]
Example: 714531.770058
Description: Specifies the reference value of the 2-dimensional effective velocity polynomial in cross track direction. The reference value is the slant range at the center of the swath in cross track direction.

3.3.43.14.19.1.2 The reference_second_dimension tag

Name: reference_second_dimension
Type: floating-point
Unit: sec
Range: [1.0E9, 3.0E9]
Example: 1465570764.760753
Description: Specifies the reference value of the 2-dimensional effective velocity polynomial in along track direction. The reference value is the Modified Julian Day (MJD, ESA variety) at the center of the swath in along track direction, in seconds, i.e. the MJD multiplied by 86400. Note that the MJD is not an integer, i.e. it also takes into account fractions of the day. The ESA MJD starts at 0:0 on 1 January 1950.

3.3.43.14.19.1.3 The number_of_coefficients_first_dimension tag

Name: number_of_coefficients_first_dimension
Type: integer
Unit: N/A
Range: [1, 2]

Example: 2
Description: Specifies the number of coefficients of the 2-d effective velocity polynomial in the first dimension, which is the cross track direction.

3.3.43.14.19.1.4 The number_of_coefficients_second_dimension tag

Name: number_of_coefficients_second_dimension
Type: integer
Unit: N/A
Range: [1, 2]
Example: 2
Description: Specifies the number of coefficients of the 2-d effective velocity polynomial in the second dimension, which is the along track direction.

3.3.43.14.19.1.5 The a00 to a11 tags

Name: a11 .. a11
Type: floating-point
Unit: N/A
Range: [-1.0E300, 1.0E300]
Example: -1.97384e-19
Description: aij (e.g. a01), specifies the (i,j)-th coefficient of the A matrix, which is the 2-d polynomial characterizing the effective velocity characteristics of the data.

The 2-d polynomial can be considered a (n,m) matrix:

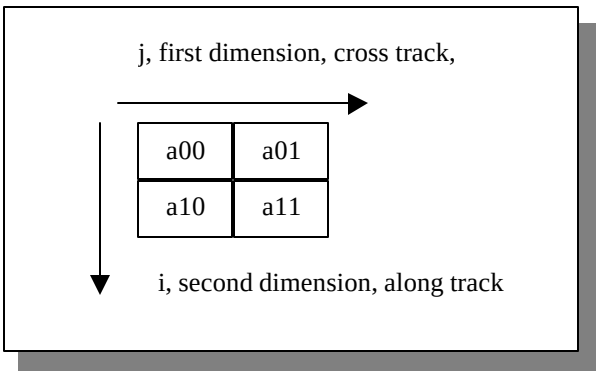

Figure 3-2: A Matrix, 2-d Effective Velocity Polynomial

The following equation (2.0) can be used to calculate the effective velocity v_{eff} at any point along track (t) and cross track (R) in the data:

$$v_{eff} = \sum_{i=0}^{1}\sum_{j=0}^{1} aij \cdot (t - t_0)^i \cdot (R - R_0)^j \qquad (2.0)$$

where

- v_{eff}.....effective velocity in m/sec
- t.....along track variable in Modified Julian Seconds

- R.....across track variable (slant range) in meters
- t_0 .....the second dimension reference value
- R_0.....the first dimension reference value
- a_{ij} .....the (i,j)-th coefficient of the A matrix

3.3.43.14.19.2 The veff tag

Name: veff
Type: floating-point
Unit: m/sec
Range: [6000.0, 8000.0]
Example: 7326.589083
Description: Specifies the Doppler rate parameter, represented as the so-called *effective velocity*.

3.3.43.14.19.3 The reference_range tag

Name: reference_range
Type: floating-point
Unit: m
Range: [600.0E3, 1200.0E3]
Example: 717156.446356
Description: Specifies the reference value for the autofocus 2-d polynomial in the first dimension, that is the cross track direction. The reference value is the slant range at the center of the swath. This information is repeated in the effective_velocity_coefficients information block.

3.3.43.14.19.4 The reference_date tag

Name: reference_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145917512
Description: Specifies the reference value for the autofocus 2-d polynomial in the second dimension, that is the along track direction. This information is also contained in the effective_velocity_coefficients information block in a different representation.

3.3.43.14.19.5 The autofocus_scale_factor tag

Name: autofocus_scale_factor
Type: floating-point
Unit: none
Range: [0.9, 1.1]
Example: 1.000163
Description: Specifies the result of the autofocus calculation as a scaling factor for scaling the effective velocity as calculated by the state vector information. This value is 1.0 if autofocus did not succeed.

3.3.43.14.19.6 The autofocus_snr tag

Name: autofocus_snr
Type: floating-point
Unit: none
Range: [0.0, 1000.0]
Example: 21.710197
Description: Specifies the signal-to-noise ratio (SNR) of the autofocus correlation algorithm. Higher values mean more radar signal energy compared to noise energy, which is generally better for the autofocus calculation. Note that this value is NOT in dB.

3.3.43.14.19.7 The autofocus_suggested_ambiguity_number tag

Name: autofocus_suggested_ambiguity_number
Type: integer
Unit: N/A
Range: [-20, 20]
Example: 1
Description: Specifies the Doppler ambiguity number as suggested by the autofocus algorithm. For the Vexcel Level 0 Processor, the ambiguity number suggestion of autofocus is automatically taken into account if the autofocus SNR was above a certain threshold.

3.3.43.14.19.8 The autofocus_status tag

Name: autofocus_status
Type: string
Unit: N/A
Range: [SUCCESS | NOT PERFORMED | FAILURE: <failure_indication>]
Example: SUCCESS
Description: Specifies the outcome of the autofocus process.
SUCCESS means that autofocus was performed and succeeded.
NOT PERFORMED means autofocus was not performed.
FAILURE: <failure_indication> means that autofocus was performed, but failed due to problems with the data. The failure_indication can be one of the following strings:
Incorrect Doppler Ambiguity
Low contrast/high snr threshold
Incorrect doppler ambiguity / Low contrast in data

3.3.43.15 The ScanSARBlock block

Name: ScanSARBlock
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies ScanSAR information, if applicable.

The ScanSARBlock information block contains the following plain tags:

- number_of_bursts - plain tag
- scan_mode - plain tag

These plain tags are described below.

3.3.43.15.1 The number_of_bursts plain tag

Name: number_of_bursts
Type: integer
Unit: N/A
Range: [0, 99999]
Example: 2315
Description: Specifies the number of burst sequences in the data set.

3.3.43.15.2 The scan_mode plain tag

Name: scan_mode
Type: string
Unit: N/A
Range: All valid scansar mode names
Example: SWB
Description: Specifies the scansar beam mode.

3.3.43.16 The ephemeris information block

Name: ephemeris
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the ephemeris used for processing the data.

The ephemeris information block contains the following plain tags and information blocks:

- sv_block - information block
- Attitude - information block
- OrbitNr - plain tag
- OrbitNr_Date - plain tag
- GHA - information block
- Type - plain tag

These plain tags and information blocks are described in the following.

3.3.43.16.1 The sv_block information block

Name: sv_block
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the state vectors used for processing the data.

The sv_block information block contains the following plain tags and information blocks:

- NrSV - plain tag
- state_vector - information block (multiple instances)

These plain tags and information blocks are described in the following.

3.3.43.16.1.1 The NrSV tag

Name: NrSV
Type: integer
Unit: N/A
Range: [1, 28]
Example: 15
Description: Specifies the number of following state_vector information blocks.

3.3.43.16.1.2 The state_vector information block

Name: state_vector
Type: information block
Unit: N/A
Range: N/A
Example: N/A

Description: Specifies one state vector in the Earth Centered Rotating (ECR) coordinate frame. This frame is also called the "Earth fixed" coordinate system. This coordinate system rotates with the Earth. The x axis points to the 0 degree meridian (Greenwich). The z axis points to the north pole. The y axis completes the right-handed coordinate system.

The state_vector information block contains the following plain tags:

- x - plain tag
- y - plain tag
- z - plain tag
- xv - plain tag
- yv - plain tag
- zv - plain tag
- Date - plain tag

These plain tags are described in the following.

3.3.43.16.1.2.1 The x, y, z plain tags

Name: x, y, or z
Type: floating point
Unit: m
Range: [-10.0E6, 10.0E6]
Example: 7000193.365648
Description: Specifies the x, y, or z position of this state vector.

3.3.43.16.1.2.2 The xv, yv, zv plain tags

Name: xv, yv, or zv
Type: floating point
Unit: m/sec
Range: [-10.0E3, 10.0E3]
Example: 7372.813980
Description: Specifies the x, y, or z velocity of this state vector.

3.3.43.16.1.2.3 The Date plain tag

Name: Date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the date and time of this state vector.

3.3.43.16.2 The Attitude information block

Name: Attitude
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the Attitude of the satellite.

The Attitude information block contains the following plain tags:

- yaw - plain tag
- roll - plain tag
- pitch - plain tag
- Date - plain tag
- yawpoly - information block
- rollpoly - information block
- pitchpoly - information block
- att - information block

These plain tags are described in the following.

3.3.43.16.2.1 The yaw plain tag

Name: yaw
Type: floating point
Unit: degrees
Range: [-1.0, 1.0]
Example: -0.003978
Description: Specifies one yaw angle instance of the spacecraft.

3.3.43.16.2.2 The roll plain tag

Name: roll
Type: floating point
Unit: degrees
Range: [-1.0, 1.0]
Example: -0.012546
Description: Specifies one roll angle instance of the spacecraft.

3.3.43.16.2.3 The pitch plain tag

Name: pitch
Type: floating point
Unit: degrees
Range: [-1.0, 1.0]
Example: 0.019890
Description: Specifies one pitch angle instance of the spacecraft.

3.3.43.16.2.4 The Date plain tag

Name: Date
Type: string
Unit: UTC date/time
Range: all valid UTC strings
Example: 20011211123456789
Description: Specifies the date of the above yaw/roll/pitch values.

3.3.43.16.2.5 The att information block

Name: att
Type: information blocks
Unit: N/A
Range: N/A
Example: N/A
Description: Gives a block representation for yaw, roll and pitch. This block is used alternatively with yawpoly, rollpoly, and pitchpoly representation. If one representation is used, the other is not being appearing in the STF parameter block.

The att information blocks contains the following plain tags:

- date - plain tag
- pitch - plain tag
- roll - plain tag
- yaw - plain tag

3.3.43.16.2.5.1 The date plain tag

Name: Date
Type: string
Unit: UTC date/time
Range: all valid UTC strings
Example: 20011211123456789
Description: Specifies the date of the above yaw/roll/pitch values.

3.3.43.16.2.5.2 The pitch plain tag

Name: pitch
Type: floating point
Unit: degrees
Range: [-1.0, 1.0]
Example: 0.019890
Description: Specifies one pitch angle instance of the spacecraft.

3.3.43.16.2.5.3 The roll plain tag

Name: roll

Type: floating point
Unit: degrees
Range: [-1.0, 1.0]
Example: -0.012546
Description: Specifies one roll angle instance of the spacecraft.

3.3.43.16.2.5.4 The yaw plain tag

Name: yaw
Type: floating point
Unit: degrees
Range: [-1.0, 1.0]
Example: -0.003978
Description: Specifies one yaw angle instance of the spacecraft.

3.3.43.16.2.6 The yawpoly, rollpoly, pitchpoly information blocks

Name: yawpoly, rollpoly, pitchpoly
Type: information blocks
Unit: N/A
Range: N/A
Example: N/A
Description: Gives a polynomial representation for yaw, roll and pitch. All three information blocks have the same internal representation.

The yawpoly, rollpoly and pitchpoly information blocks contains the following plain tags:

- reference - plain tag
- number_of_coefficients - plain tag
- a0, a1, a2, a3 - plain tags

These plain tags are described in the following.

3.3.43.16.2.6.1 The reference plain tag

Name: reference
Type: floating-point
Unit: sec
Range: [1.0E9, 3.0E9]
Example: 1465570764.760753
Description: Specifies the reference value of the yaw/roll/pitch polynomial in along track direction. The reference value is the Modified Julian Day (MJD, ESA variety) at the center of the swath in along track direction, in seconds, i.e. the MJD multiplied by 86400. Note that the MJD is not an integer, i.e. it also takes into account fractions of the day. The ESA MJD starts at 0:0 on 1 January 1950.

3.3.43.16.2.6.2 The number_of_coefficients plain tag

Name: number_of_coefficients
Type: integer
Unit: N/A
Range: [1, 4]
Example: 4
Description: Specifies the number of coefficients of the yaw/roll/pitch polynomial.

3.3.43.16.2.6.3 The a0, a1, a2, a4 plain tags

Name: a0, a1, a2, a3
Type: floating-point
Unit: deg, deg/sec, deg/sec^2, deg/sec^3
Range: [-1.0, 1.0]
Example:
Description: Specifies the yaw/roll/pitch angle polynomial coefficients.

3.3.43.16.3 The OrbitNr plain tag

Name: OrbitNr
Type: integer
Unit: N/A
Range: [0, 99999]
Example: 2315
Description: Specifies the orbit number as extracted from the ephemeris file.

3.3.43.16.4 The OrbitNr_Date plain tag

Name: OrbitNr_Date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the date and time that corresponds with the orbit number tag (OrbitNr).

3.3.43.16.5 The GHA information block

Name: GHA
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the Greenwich Hour Angle as extracted from the ephemeris file, or as calculated inside of the Level 0 Processor (approximation). It is normally given at the date of the first state vector. The information is provided as a (angle, date/time) pair.

The GHA information block contains the following plain tags:

- angle - plain tag
- date - plain tag

These plain tags are described in the following

3.3.43.16.5.1 The angle plain tag

Name: angle
Type: floating point
Unit: degrees
Range: [0.0, 360.0]
Example: 353.260051
Description: Specifies the Greenwich Hour Angle at the given date/time.

3.3.43.16.5.2 The date plain tag

Name: date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19981201185121213
Description: Specifies the date that corresponds with the GHA angle tag.

3.3.43.16.6 The Type plain tag

Name: Type
Type: string
Unit: N/A
Range: UNKNOWN | NORAD | PREDICTED | RESTITUTED | PRECISION
Example: RESTITUTED
Description: Specifies the quality of the ephemeris data contained in the ephemeris block.

3.3.44 The ellipsoid_name plain tag

Name: ellipsoid_name
Type: string
Unit: N/A
Range: N/A
Example: GEM6
Description: The name of the ellipsoid in the earth model (Datum) used to process this data.

3.3.45 The location information block

For each 25000 number of SAR lines (a configurable number) and whenever the SWST changes, SyncPrep will add an information block called "location" at the end of the prep_block. The location will be the estimated lat/lon of the first and last pixel in this

line. The estimation is based on the state vector, nominal look angle, SWST, GHA, and Doppler centroid reported in the prep_block. In addition, the UTC time, calculated from the satellite time code and the TCE, will be written into the location block. There will be at least 2 location blocks for each prep_block, one for the first SAR line and one for the last.

Name: location
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies location information at certain along track positions.

The location information block contains the following plain tags and information blocks:

- block_nr - plain tag
- frame_nr - plain tag
- line_nr - plain tag
- start_byte - plain tag
- satellite_clock - plain tag
- line_date - plain tag
- first_pixel_ll - plain tag
- last_pixel_ll - plain tag
- SWST_code - plain tag
- SWST - plain tag
- range_gate - plain tag
- near_range - plain tag
- far_range - plain tag
- platform_altitude - plain tag
- grs_path_row - plain tag
- sun_azimuth - plain tag
- sun_elev - plain tag
- is_att_out_of_range - plain tag
- num_unstable_mjfs - plain tag
- cloud_cover - plain tag
- snow_cover - plain tag
- Doppler_centroid - plain tag
- DopplerPolynomial - information block

These plain tags and information blocks are described in the following.

3.3.45.1 The block_nr plain tag

Name: block_nr
Type: integer
Unit: N/A
Range: [0, 999]
Example: 0
Description: Specifies the number of this location block.

3.3.45.2 The frame_nr plain tag

Name: frame_nr
Type: integer
Unit: N/A
Range: [0, 999999999]
Example: 206134
Description: Specifies the satellite frame number that corresponds to this location block. This is an estimate based on the average number of frames per line. This tag is obsolete, instead the line_nr tag should be used.

3.3.45.3 The line_nr plain tag

Name: line_nr
Type: integer
Unit: N/A
Range: [0, 999999999]
Example: 2134
Description: Specifies the line number that corresponds to this location block.

3.3.45.4 The start_byte plain tag

Name: start_byte
Type: integer
Unit: N/A
Range: [0, 999999999]
Example: 66581282
Description: Specifies the first byte of the satellite frame that corresponds to this location block.

3.3.45.5 The satellite_clock plain tag

Name: satellite_clock
Type: floating point
Unit: N/A
Range: [0, 999999999999.9]

Example: 63907766.692273
Description: Specifies the satellite that produced the data

3.3.45.6 The line_date plain tag

Name: line_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19970928160926692
Description: Specifies the UTC date of this location block.

3.3.45.7 The first_pixel_ll plain tag

Name: first_pixel_ll
Type: floating point (3 values)
Unit: degrees, degrees, m
Range: [-90.0, 90.0] , [-180.0, 180.0], [-1000.0, 10000.0]
Example: 76.278845 -89.039152 0.000000
Description: Specifies the geodetic latitude, longitude and altitude of the first pixel in this SAR line.

3.3.45.8 The last_pixel_ll plain tag

Name: last_pixel_ll
Type: floating point (3 values)
Unit: degrees, degrees, m
Range: [-90.0, 90.0] , [-180.0, 180.0], [-1000.0, 10000.0]
Example: 75.292080 -87.110738 0.000000
Description: Specifies the geodetic latitude, longitude and altitude of the last pixel in this SAR line.

3.3.45.9 The SWST_code plain tag

Name: SWST_code
Type: integer
Unit: N/A
Range: [0, 99999]
Example: 389
Description: Specifies the satellite specfic SWST code reported in the auxiliary part of the telemetry data.

3.3.45.10 The SWST plain tag

Name: SWST
Type: floating point
Unit: sec
Range: [0.0, 0.001]
Example: 0.00018287510000
Description: Specifies the Sampling Window Start Time (SWST) for this line.

3.3.45.11 The range_gate plain tag

Name: range_gate
Type: floating point
Unit: sec
Range: [0.0, 01]
Example: 0.00611979510000
Description: Specifies the time between the emission of the SAR pulse and the start of the analog-to-digital conversion.

3.3.45.12 The near_range plain tag

Name: near_range
Type: floating point
Unit: m
Range: [500.0E3, 1500.0E3]
Example: 917334.20774268
Description: Specifies the distance between the sensor and the ground viewed by the first pixel in the line.

3.3.45.13 The far_range plain tag

Name: far_range
Type: floating point
Unit: m
Range: [500.0E3, 1500.0E3]
Example: 986212.93518475
Description: Specifies the distance between the sensor and the ground viewed by the first pixel in the line.

3.3.45.14 The platform_altitude plain tag

Name: platform_altitude
Type: floating point
Unit: m
Range: [600.0E3, 1000.0E3]

Example: 804185.58316156
Description: Specifies the flying altitude of the satellite for this line.

3.3.45.15 The grs_path_row plain tag

Name: grs_path_row
Type: integer & integer
Unit: N/A
Range: 0-
Example: 628 266
Description: Specifies the path number and row number in the worldwide reference system(WRS). GRS stands for grid reference system which includes WRS. This tag is only for SPOT and Landsat 7 satellite.

3.3.45.16 The sun_azimuth plain tag

Name: sun_azimuth
Type: floating point
Unit: degrees
Range: [-180.0, 180.0]
Example: 155.311616
Description: Specifies the Sun azimuth angle.

3.3.45.17 The sun_elev plain tag

Name: sun_elev
Type: floating point
Unit: degrees
Range: [-90.0, 90.0]
Example: 55.002291
Description: Specifies the Sun elevation angle.

3.3.45.18 The is_att_out_of_range plain tag

Name: att_out_of_range
Type: integer
Unit: N/A
Range: [0,1]
Example: 0
Description: Specifies if the attitude is out of range. If 0, it is in range, if not, it is out of range.

3.3.45.19 The num_unstable_mjfs plain tag

Name: num_unstable_mjfs
Type: integer
Unit: N/A
Range: 0-
Example: 0
Description: Specifies # of total major frames in the location block The stability is specified in each frame's header data.

3.3.45.20 The cloud_cover plain tag

Name: cloud_cover
Type: integer
Unit: %
Range: [-1, 100]
Example: 84 100 61 100 84 100 100 100
Description: Specifies % of cloud coverings for array of areas inside the location block. If –1, cloud covering has not been calculated.

3.3.45.21 The snow cover plain tag

Name: snow_cover
Type: integer
Unit: %
Range: [-1, 100]
Example: 84 100 61 100 84 100 100 100
Description: Specifies % of snow coverings for array of areas inside the location block. If –1, snow covering has not been calculated.

3.3.45.22 The Doppler_centroid plain tag

Name: Doppler_centroid
Type: floating point
Unit: Hz
Range: [-20.0E3, 20.0E3]
Example: -323.31231148
Description: Specifies the Doppler centroid frequency at the center of this line.

3.3.45.23 The DopplerPolynomial information block

Name: DopplerPolynomial
Type: information block
Unit: N/A

Range: N/A
Example: N/A
Description: Specifies the cross track Doppler centroid profile for this line in a polynomial representation.

The DopplerPolynomial information block contains the following plain tags and information blocks:

- reference - plain tag
- number_of_coefficients - plain tag
- a0 .. a3 - plain tag

These plain tags and information blocks are described in the following.

3.3.45.23.1 The reference plain tag

Name: reference
Type: floating point
Unit: m
Range: [600.0E3, 1500.0E3]
Example: 951773.571464
Description: Specifies the reference value for the cross track Doppler centroid polynomial. The reference value is the slant range to the center of the swath.

3.3.45.23.2 The number_of_coefficients plain tag

Name: number_of_coefficients
Type: integer
Unit: N/A
Range: [1, 4]
Example: 4
Description: Specifies the number of coefficients of the cross track Doppler polynomial.

3.3.45.23.3 The a0 to a3 plain tags

Name: a0 to a3
Type: floating point
Unit: N/A
Range: [-1.0E300, 1.0E300]
Example: -2.14634e-14
Description: Specifies the one coefficient of the cross track Doppler centroid polynomial.

The following equation (3.0) can be used to calculate the Doppler centroid frequency f_d for a given slant range R for this line:

$$f_d = \sum_{j=0}^{3} a_j \cdot (R - R_0)^j \qquad (3.0)$$

where

- f_d.....Doppler centroid frequency in Hz
- R.....across track variable (slant range) in meters
- R_0.....the reference value
- a_j.....the j-th coefficient of the A polynomial

3.3.46 The missing_data_blocks plain tag

Name: missing_data_blocks
Type: integer
Unit: N/A
Range: [0,999]
Example: 3
Description: Specifies the number of missing_data information blocks following.

3.3.47 The missing_data information block

SyncPrep reports occasions of missing data in so-called missing_data information blocks. The number of missing data blocks will be indicated by the tag missing_data_blocks. All missing_data blocks will only contain completely missing lines.

Name: missing_data
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies one missing data block in the data granule.

The missing_data information block contains the following plain tags:

- start_frame - plain tag
- start_line - plain tag
- start_byte - plain tag
- missing_bytes - plain tag
- missing_frames - plain tag
- missing_lines - plain tag
- missing_data_indicator - plain tag

These plain tags are described in the following.

3.3.47.1 The start_frame plain tag

Name: start_frame
Type: integer
Unit: N/A
Range: [1, 999999999]
Example: 23443
Description: Specifies the frame number of the first missing frame of this missing_data block. Note that this frame number is an estimate based on the approximate number of frames per line.

3.3.47.2 The start_line plain tag

Name: start_line
Type: integer
Unit: N/A
Range: [1, 999999999]
Example: 324
Description: Specifies the line number of the first missing line of this missing_data block. Logical line numbers start at 0.

3.3.47.3 The start_byte plain tag

Name: start_byte
Type: integer
Unit: N/A
Range: [0, 999999999999]
Example: 23443765
Description: Specifies the byte number of the first missing byte of this missing_data block.

3.3.47.4 The missing_bytes plain tag

Name: missing_bytes
Type: integer
Unit: N/A
Range: [1, 999999999]
Example: 6340
Description: Specifies the number of missing bytes in this missing_data block. Note that this is an estimate based on the estimated number of bytes per line.

3.3.47.5 The missing_frames plain tag

Name: missing_frames
Type: integer
Unit: N/A

Range: [1, 999999999]
Example: 29
Description: Specifies the number of missing frames in this missing_data block. Note that this is an estimate based on the estimated number of frames per line.

3.3.47.6 The missing_lines plain tag

Name: missing_lines
Type: integer
Unit: N/A
Range: [1, 999999999]
Example: 1
Description: Specifies the number of missing lines in this missing_data block.

3.3.47.7 The missing_data_indicator plain tag

Name: missing_data_indicator
Type: string
Unit: N/A
Range: EXCEEDED_BER_THRESHOLD | OTHER
Example: 23443
Description: Indicates the reason for a missing_data block. The tag takes on the value EXCEEDED_BER_THRESHOLD if the actual BER exceeds the BER threshold. For all other cases, the tag will be set to OTHER.

3.4 Telemetry Parameter File Example

The following is an example of a telemetry parameter file:

```
dcs_version: 5.1.0
dcs_id: 1
dcs_file_creation_date: 20011228211032933
dcs_requested_start: 20011228211105879
dcs_start: 20011228211106108
dcs_stop: 20011228211129973
dcs_bytes_captured: 222298112
dcs_stop_condition: lost_clock
dcs_satellite: RSAT
dcs_bit_error_rate: 0.0000000
dcs_requested_stop: 20011228211401066

data_block {
    block_number: 1
    sync_name: RSAT1
    start_byte: 0
    end_byte: 222298112
    percent_examined: 45.0
    percent_recognized: 100.0
    ber: 0.0E-00
}

datatake {
    satellite: RSAT1
    instrument: SAR
    tce_UTC: 0
    tce_satellite: 0
    tce_corr: 0.0
    estimated_acq_start: 20011201195151000
    estimated_acq_time: 20.0
    OrbitNr: 0
    clock_angle: 90.0
    ellipsoid_name: INTERNATIONAL
    GHA {
        angle: 0.0
        date: 0.0
    }
}
ss_block {
    ss_version: 4.0.0
    ss_date: 20011121215228014
    block_nr: 0
    sync_type: CCSDS
    satellite: RSAT1
    instrument: SAR
    special_id: None
```

```
    transmission_mode: RECORDED
    sync_pattern: 1acffc1d
    frame_length: 323
    number_bytes: 944012720
    number_frames: 2922640
    bit_errors: 5
    bits_examined: 3237312
    bit_error_rate: 0.000002
    valid_fraction: 1.000000
    invalid_syncs: 0
    allowed_bit_errors: 1
    flywheel_constant: 29
    CCSDS_id: 201
    IQswap: 0
    invI: 0
    invQ: 0

    local_bit_error_rate {
        ss_bit_error_rate: 00116865 0000000037747395 0.000000E+00
        ss_bit_error_rate: 00220745 0000000071300635 0.000000E+00
        ss_bit_error_rate: 00324625 0000000104853875 0.000000E+00
        ss_bit_error_rate: 00428505 0000000138407115 0.000000E+00
        ss_bit_error_rate: 00532385 0000000171960355 0.000000E+00
        ss_bit_error_rate: 00636265 0000000205513595 0.000000E+00
    }
}

prep_block {
    processor_name: SKY
    prep_version: 4.0.0
    prep_date: 20011121220043165
    ss_block: 0
    block_nr: 0
    start_byte: 0
    number_bytes: 911773121
    number_frames: 2822827
    number_lines: 107241
    satellite: RSAT1
    instrument: SAR
    beam_sequence: 07
    number_of_beams: 1
    bit_errors: 5
    bit_error_rate: 0.000002
    missing_lines: 0
    missing_bytes_added: 323
    zero_data_suppression: ALL
    ber_threshold: 0.010000
    first_satellite_clock: 65083534.652248
    last_satellite_clock:  65083620.465320
    clock_increment: 1.000000
    first_date: 19971012064534652
    last_date:  19971012064700465
```

```
    tce_UTC: 19950920000000000
    tce_satellite: 0.000000
    tce_corr: 0.000000
    estimated_acq_start: 19971012000000000
    nominal_look_angle: 40.679953
    number_range_samples: 7644
    ADC_sampling_frequency: 12926830.000000
    automatic_gain_control: ON

    state_vector {
        x: -7106380.859291
        y: -975485.912005
        z: 0.246062
        xv: -213.689682
        yv: 1621.001745
        zv: 7372.664511
        Date: 19971012052938097
    }
    ephemeris_type: RESTITUTED
    swath_velocity: 6659.141865

    GHA {
        angle: 122.275720
        date: 19971012064534652
    }
    OrbitNr: 10114
    OrbitNr_Date: 19971012064534652
    clock_angle: -90.000000

    local_bit_error_rate {
        ss_bit_error_rate: 00010000 0000000085020706 3.605769E-07
        ss_bit_error_rate: 00020000 0000000170041735 0.000000E+00
        ss_bit_error_rate: 00030000 0000000255062764 0.000000E+00
        ss_bit_error_rate: 00040000 0000000340083793 0.000000E+00
        ss_bit_error_rate: 00050000 0000000425104822 2.403846E-07
        ss_bit_error_rate: 00060000 0000000510125528 2.884615E-06
        ss_bit_error_rate: 00070000 0000000595146557 1.682692E-06
        ss_bit_error_rate: 00080000 0000000680167586 3.004808E-06
        ss_bit_error_rate: 00090000 0000000765188615 2.163462E-06
        ss_bit_error_rate: 00100000 0000000850209644 3.846154E-06
        ss_bit_error_rate: 00107241 0000000911773121 2.157851E-06
    }

    sensor {
        sensor_name: RSAT1
        clock_angle:     -90.00000000
        nr_temperatures: 0
        nr_beams: 1

        beam {
            beam_name: S7
            nr_of_samples: 7644
```

```
            echo_delay: 0.00731360335937
            carrier_freq:    5300432000.00000000
            sampling_freq:      12926830.00000000
            PRF:          1249.69354215
            chirp_rate: -279309523809.52380000
            pulse_length: 0.00004200000000
            look_angle:      40.43882400
            incidence_angle:      47.00000000
            range_spectrum_snr: 0.000000
            replica_energy_ref_level: 65.000000
            cal1_cal2_diff_ref_level: 0.000000
            thermal_noise_ref_level: -24.510000
            gain_corctn_factor: 0.095148
            gain_scale: -16.300000

            PolarizationBlock {
                NrPolarizations: 1

                Polarization {
                    polarization: HH
                    polarization_amplitude:             1.00000000
                    polarization_phase:             0.00000000
                    stc_pattern_id: -1

                    IQStatistics {
                        I_mean: -0.009760
                        Q_mean: 0.034655
                        I_std: 2.567837
                        Q_std: 2.551473
                        IQ_corr: 0.022267
                    }
                }
            }

            DopplerCentroidParameters {

                doppler_centroid_coefficients {
                    reference_first_dimension:   1137446.460001
                    reference_second_dimension: 1507790777.559167
                    number_of_coefficients_first_dimension: 4
                    number_of_coefficients_second_dimension: 3
                    a00: 701.027
                    a01: -0.00286592
                    a02: -8.8722e-09
                    a03: -7.15027e-15
                    a10: 13.6937
                    a11: 1.18007e-05
                    a12: -8.43124e-11
                    a13: 1.25966e-17
                    a20: 0.00140193
                    a21: 7.33743e-08
                    a22: 6.17657e-13
```

```
                a23: 9.58173e-19
            }
            reference_range: 1137446.460001
            reference_date: 19971012064617559
            ambiguity_number: 1
            MLCC_ambiguity_number_occurence: 4
            MLBF_ambiguity_number_occurence: 4
            DAR_doppler: 701.026867
            Predict_doppler: 833.881187
            DAR_confidence: 1.000000
            doppler_fit_correlation: 0.951469
            doppler_status: SUCCESS
        }

        DopplerRateParameters {

            effective_velocity_coefficients {
                reference_first_dimension:   1140600.502740
                reference_second_dimension: 1507790777.558767
                number_of_coefficients_first_dimension: 2
                number_of_coefficients_second_dimension: 2
                a00: 6995.04
                a01: -0.000193202
                a10: 0.00869305
                a11: 7.76135e-09
            }
            veff: 6995.044073
            reference_range: 1140600.502740
            reference_date: 19971012064617558
            autofocus_scale_factor: 1.000000
            autofocus_snr: 19.476862
            autofocus_suggested_ambiguity_number: 1
            autofocus_status: SUCCESS
        }
    }

    ephemeris {

        sv_block {
            NrSV: 1

            state_vector {
                x: 5583387.232527
                y: -4503061.807812
                z: -1028.790000
                xv: -1032.409304
                yv: -1267.845403
                zv: 7372.697380
                Date: 19971012203627035
            }
        }
```

```
            Attitude {
                yaw: 0.001530
                roll: -0.000918
                pitch: 0.000918
                Date: 19971012064617358703

                yawpoly {
                    reference: 1507790777.358718
                    number_of_coefficients: 4
                    a0: 0.00152999
                    a1: 0
                    a2: 0
                    a3: 0
                }

                rollpoly {
                    reference: 1507790777.358718
                    number_of_coefficients: 4
                    a0: -0.000918021
                    a1: 0
                    a2: 0
                    a3: 0
                }

                pitchpoly {
                    reference: 1507790777.358718
                    number_of_coefficients: 4
                    a0: 0.00091799
                    a1: 0
                    a2: 0
                    a3: 0
                }
            }
            OrbitNr: 10123
            OrbitNr_Date: 19971012203627176

            GHA {
                angle: 330.566854
                date: 19971012203627035
            }
            Type: RESTITUTED
        }
    }
    ellipsoid_name: INTERNATIONAL

    location {
        block_nr: 0
        frame_nr: 0
        line_nr: 0
        start_byte: 0
        satellite_clock: 65083534.652248
        line_date: 19971012064534652
```

```
        first_pixel_ll: -87.188235 -132.259706 0.000000
        last_pixel_ll: -88.044356 -148.401784 0.000000
        platform_altitude:        820992.72847882
        SWST_code: 245
        SWST: 0.00011603772928
        range_gate: 0.00000000000000
        near_range:       1096281.56397124
        far_range:       1184919.44150780
        Doppler_centroid:           105.80218457

        DopplerPolynomial {
            reference:   1140600.502740
            number_of_coefficients: 4
            a0: 105.802
            a1: -0.00326332
            a2: -4.17359e-09
            a3: -5.92675e-15
        }
    }
    missing_data_blocks: 0
}
```

4 Framing Information File Format

The framing information file, also called chop-file, is a by-product of the Preparation step and used for later CEOS conversion. Essentially, the CEOS conversion will produce output scenes that are determined by the information contained in this chop file. The chop file is an ASCII file in the CONI format.

The chop file contains the following plain tags and information blocks:

- num_scene_lines - plain tag
- num_overlap_lines - plain tag
- scene - information blocks

These plain tags and information blocks are described in the following.

4.1 The num_scene_lines plain tag

Name: num_scene_lines
Type: integer
Unit: N/A
Range: [1, 999999]
Example: 27000
Description: Specifies the number of lines for each scene in the scene blocks.

4.2 The num_overlap_lines plain tag

Name: num_overlap_lines
Type: integer
Unit: N/A
Range: [1, 999999]
Example: 4096
Description: Specifies the number of overlap lines between two scenes in the scene blocks.

4.3 The scene information block

The chop file will contain one “scene” information block for each image frame (scene) contained in the telemetry data.

Name: scene
Type: information block
Unit: N/A
Range: N/A

Example: N/A
Description: Specifies framing information for one scene.

The scene information block contains the following plain tags:

- start_index - plain tag
- start_line - plain tag
- end_index - plain tag
- end_line - plain tag
- number_lines - plain tag

These plain tags are described in the following.

4.3.1 The start_index plain tag

Name: start_index
Type: integer
Unit: N/A
Range: [1, 9999999]
Example: 20323
Description: Specifies the first frame for this scene. This tag is obsolete and should not be used any more.

4.3.2 The start_line plain tag

Name: start_line
Type: integer
Unit: N/A
Range: [1, 9999999]
Example: 20323
Description: Specifies the first line for this scene.

4.3.3 The end_index plain tag

Name: end_index
Type: integer
Unit: N/A
Range: [1, 9999999]
Example: 47323
Description: Specifies the last frame for this scene. This tag is obsolete and should not be used any more.

4.3.4 The end_line plain tag

Name: end_line
Type: integer
Unit: N/A
Range: [1, 9999999]
Example: 47323
Description: Specifies the last line for this scene.

4.4 Sample Framing File

The following is an example of a JERS1 framing information file. For JERS1, frames and lines are identical.

```
num_scene_lines: 20480
num_overlap_lines: 4096
scene {
  start_index: 13644
  start_line: 13644
  end_index: 34123
  end_line: 34123
  number_lines: 20480
}
scene {
  start_index: 30029
  start_line: 30029
  end_index: 50508
  end_line: 50508
  number_lines: 20480
}
```

5 The STF Index File

For RSAT1, a SAR line exhibits a variable length in bytes due to the variable number of transmission frames per SAR line and the presence of replica data every eighth line. As a general and efficient solution to allow random access to any SAR line inside the STF data set, a new metadata file was created that contains an offset value (sixteen bytes in length) for each echo line of SAR data.

The index file has the extension .ind, for example <path>/<basename>.000.ind

The index file is an ASCII file, containing 15 valid characters plus one new line character for every SAR line, resulting in 16 bytes total per index entry. Every index entry represents the byte offset to the first byte of the respective line inside the STF data file. A SAR line that is missing will be represented by the value -1. The following is a short example of an RSAT1 index file:

```
              0
           8398
          16150
          23902
          31654
          39406
          47158
          54910
          62662
          72352
          81396
          90440
          99484
         108528
         117572
         126616
         135660
```

This means that SAR line number 0 (the first SAR line) starts at byte 0 in the STF data set, and SAR line number 1 (the second SAR line) starts at byte offset 8398. The first line therefore consists of 26 frames with 323 bytes each.

The Zero-formats of an ERS1 or ERS2 STF data set will not be represented in the index file.

For ENVISAT1/ASAR, the index file format also shows the line type as well as file offsets of each STF lines.

From the right column, ' N ' stands for 'noisy line, ' C ' stands for calibration line, ' P ' stands for 'periodic calibration line' and finally ' I ' is for 'imaging line'.

```
             0              N
          6818              N
         13636              N
         20454              N
         27272              N
         34090              N
         40908              N
         47726              N
         54544              C
         55584              C
         56624              C
         57664              C
         58704              C
         59744              C
         60784              C
         61824              C
```

6 The STF Burst List File

The optional STF burst list file is a by-product of the Preparation step. It is only available for ScanSAR data. It can be used for fast access to every burst of ScanSAR data

The burst list file contains the following information block:

- BAP_Block - information block

This information block is described in the following.

6.1 The BAP_Block information block

Name: BAP_Block
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Describes the burst structure of ScanSAR data.

The BAP_Block information block contains the following plain tag and information block:

- NrBAP - plain tag
- BurstAuxParameters - information block

These plain tags and information blocks are described in the following.

6.1.1 The NrBAP plain tag

Name: NrBAP
Type: integer
Unit: N/A
Range: [1, 99999]
Example: 1000
Description: Specifies how many BurstAuxParameters blocks are following.

6.1.2 The BurstAuxParameters information block

Name: BurstAuxParameters
Type: information block
Unit: N/A

Range: N/A
Example: N/A
Description: Describes the burst auxiliary parameters of one burst.

The BurstAuxParameters information block contains the following plain tag and information block:

- beam_sequence_id - plain tag
- number_of_samples - plain tag
- echo_delay - plain tag
- prf - plain tag
- first_record_number - plain tag
- number_of_records - plain tag
- first_record_date - plain tag

These plain tags are described in the following.

6.1.2.1 The beam_sequence_id plain tag

Name: beam_sequence_id
Type: integer
Unit: N/A
Range: [1, 5]
Example: 1
Description: Specifies the position inside the beam sequence for this burst, starting with 0. For example, a burst containing W2 data in the [W2, S5, S6] ScanSAR mode will have beam_sequence_id number 0.

6.1.2.2 The number_of_samples plain tag

Name: number_of_samples
Type: integer
Unit: N/A
Range: [1000, 20000]
Example: 8520
Description: Specifies the number of range samples for this burst.

6.1.2.3 The echo_delay plain tag

Name: echo_delay
Type: floating point
Unit: sec
Range: [0.003, 0.01]
Example: 0.0062344

Description: Specifies the time between sending a pulse of SAR data to it's reception for this burst.

6.1.2.4 The prf plain tag

Name: prf
Type: floating point
Unit: Hz
Range: [1000.0, 5000.0]
Example: 1331.21233
Description: Specifies the Pulse Repetition Frequency for this burst.

6.1.2.5 The first_record_number plain tag

Name: first_record_number
Type: integer
Unit: N/A
Range: [0, 9999999999]
Example: 105
Description: Specifies the STF line number of the first SAR line of this burst.

6.1.2.6 The number_of_records plain tag

Name: number_of_records
Type: integer
Unit: N/A
Range: [0, 999]
Example: 85
Description: Specifies the number of useable STF lines contained in this burst.

6.1.2.7 The first_record_date plain tag

Name: first_record_date
Type: string
Unit: UTC date/time
Range: all valid UTC strings
Example: 20011205123456789
Description: Specifies the UTC date/time of the first SAR line of this burst.

6.2 Sample Burst List File

The following is a sample of a burst list file, showing the start and end of the file.

```
BAP_Block {
    NrBAP: 1358

    BurstAuxParameters {
        beam_sequence_id: 0
        number_of_samples: 8520
        echo_delay: 0.00606410909047
        prf:          1331.56468892
        first_record_number: 105
        number_of_records: 84
        first_record_date: 19960414131228986
    }
…
    BurstAuxParameters {
        beam_sequence_id: 1
        number_of_samples: 7446
        echo_delay: 0.00635606001734
        prf:          1291.64968026
        first_record_number: 129010
        number_of_records: 1
        first_record_date: 19960414131406750
    }
}
```

7 The STF Autofocus Correlation File

For single beam SAR data, the SyncPrep STF processor can optionally perform a Doppler rate analysis, often called “autofocus”. As a by-product, the Autofocus Correlation File can be produced and then is part of the STF data set.

The autofocus correlation file is organized in columns. The first column is an azimuth pixel index, the second column contains the corresponding correlation value. The third and fourth columns contain the seldom used range correlation plot.

7.1 Sample Autofocus Correlation File

The following is a sample of an autofocus correlation file, showing the beginning and end of the file, and a graphical representation of the correlation plot.

```
-640      0.00000 -128      0.07163
-639      0.00000 -127      0.07201
-638      0.00000 -126      0.07613
…
 253      0.00673  765      0.00000
 254      0.00731  766      0.00000
 255      0.00546  767      0.00000
```

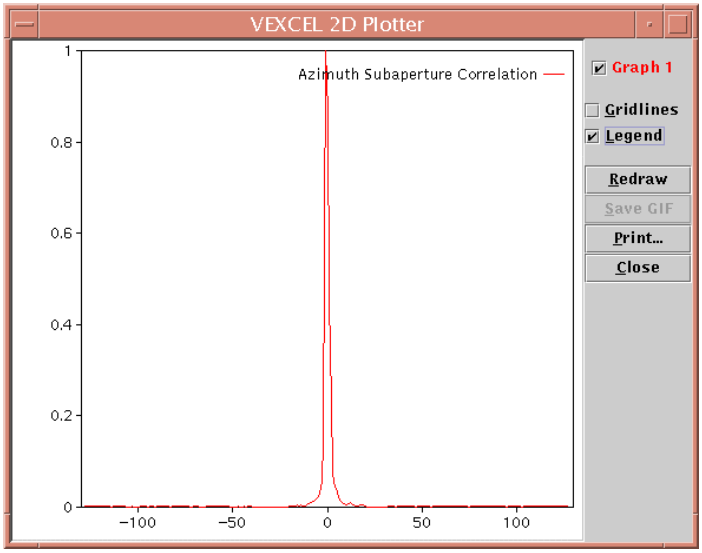

Figure 7-1 Autofocus Correlation Plot

8 The STF Range Spectrum File

The SyncPrep STF Processor can optionally perform an estimate of the Range Energy spectrum for SAR data. In this case, the STF dataset will also continue a range spectrum file.

The optional range spectrum file is organized in columns. The first column contains the range frequency in Hz, the second column contains the range spectrum value in linear units, the third column is range spectrum value in dB, and the fourth column is an indicator whether the notch filter was applied (0 when the notch filter is used).

8.1 Sample STF Range Spectrum File

The following is a sample of a range spectrum file, showing the beginning and end of the file, and a graphical representation of the range spectrum plot.

```
-8.00000e+00    0.00550  -22.59658 1
-7.99219e+00    0.00560  -22.51887 1
-7.98438e+00    0.00542  -22.66019 1
-7.97656e+00    0.00590  -22.28784 1
…
 7.97656e+00    0.00574  -22.41045 1
 7.98438e+00    0.00549  -22.60689 1
 7.99219e+00    0.00534  -22.72173 1
```

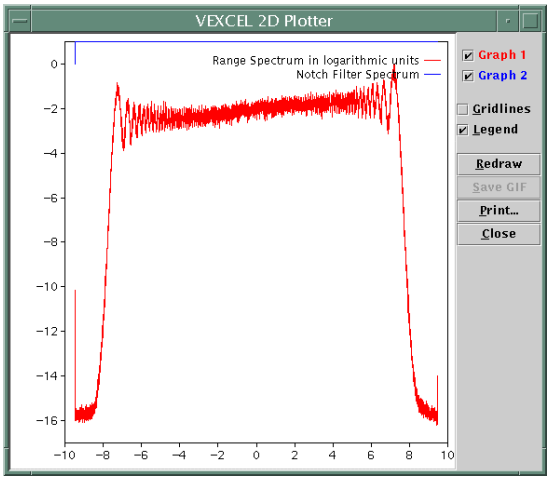

Figure 8-1 Range Spectrum Plot

9 The STF Histogram File

The STF histogram file is a by-product of the Preparation step and can be used for data Quality Assurance purposes. It is only available for SAR data.

The histogram file contains the following information block:

- RawHistogramBlock - information block

This information block is described in the following.

9.1 The RawHistogramBlock information block

Name: RawHistogramBlock
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Describes the raw I/Q histogram of SAR data.

The RawHistogramBlock information block contains the following plain tag and information block:

- NrHistograms - plain tag
- RawHistogram - information block

These plain tags and information blocks are described in the following.

9.1.1 The NrHistograms plain tag

Name: NrHistograms
Type: integer
Unit: N/A
Range: [1, 4]
Example: 1
Description: Specifies how many RawHistogram blocks are following.

9.1.2 The RawHistogram information block

Name: RawHistogram
Type: information block
Unit: N/A

Range: N/A
Example: N/A
Description: Describes one raw I/Q histogram of SAR data.

The RawHistogram information block contains the following plain tags and information block:

- Polarization - plain tag
- NrValues - plain tag
- HistogramValues - information block

These plain tags and information blocks are described in the following.

9.1.2.1 The Polarization plain tag

Name: Polarization
Type: string
Unit: N/A
Range: HH | HV | VH | VV
Example: HH
Description: Specifies the polarization of data for this histogram.

9.1.2.2 The NrValues plain tag

Name: NrValues
Type: integer
Unit: N/A
Range: [1, 1024]
Example: 1024
Description: Specifies how many histogram values are following.

9.1.2.3 The HistogramValues information block

Name: HistogramValues
Type: information block
Unit: N/A
Range: N/A
Example: N/A
Description: Contains the actual raw I/Q histogram values for SAR data.

The HistogramValues information block contains the following plain tags:

- value - plain tag

This plain tag is described in the following.

9.1.2.3.1 The value plain tag

Name:	value
Type:	integer integer integer
Unit:	N/A
Range:	[0, 64] [0, 64] [0, 9999999999]
Example:	2 4 2763543
Description:	Specifies how many occurrences of the specified (I,Q) pair were found in the observed data.

9.2 Sample Raw Histogram File

The following is a sample raw histogram file, showing the start and end of the file.

```
RawHistogramBlock {
    NrHistograms: 1

    RawHistogram {
        Polarization: HH
        NrValues: 1024

        HistogramValues {
            value:  0  0      0
            value:  0  1      0
            value:  0  2      0
            value:  0  3      0
…
            value: 31 29      0
            value: 31 30      0
            value: 31 31      0
        }
    }
}
```

10 The STF Doppler Centroid File

For SAR data, the STF data set may optionally contain a Doppler Centroid file. The SyncPrep STF processor can optionally perform Doppler Centroid estimation of the input data. This is done at different along track locations of the data, normally approximately six times in along track direction. The benefit of performing Doppler estimation at the STF processing step is increased robustness for problem data (low SNR, low contrast) and higher processing efficiency, since the later SAR processing image formation step does not have to perform this again.

The contents of the Doppler Centroid file are different for single beam and ScanSAR data. In either case, the contents of the file are ordered in columns.

For single beam SAR data, the Doppler centroid file content is grouped into columns of three. The first three columns are slant range, the Doppler centroid value resulting from the evaluation of the polynomial fit, and the Doppler centroid as estimated from the data. These three columns describe one along track observation as a function of range. The next group of three columns describes the next along track observation. Since the SyncPrep program normally performs six estimates, the file will typically have 18 columns.

For ScanSAR data, the first column represents slant range, and the remaining columns are the Doppler centroid value as evaluated from the resulting Doppler polynomial. For six ScanSAR observations, there will be 7 columns in this file.

10.1 Sample STF Doppler Centroid File

The following is a sample of a Doppler Centroid file for a single beam data case, showing the start and end of the file. Only the first three columns are shown here for space reasons.

```
 977660.687500 -2445.897698 -1990.796341  …
 978555.375000 -2448.482962 -2254.952927  …
…
1033131.625000 -2584.893343 -2550.429794  …
1034026.375000 -2586.748251 -2579.269028  …
```

The following is a graphical representation of a Doppler Centroid plot for a single beam data case.

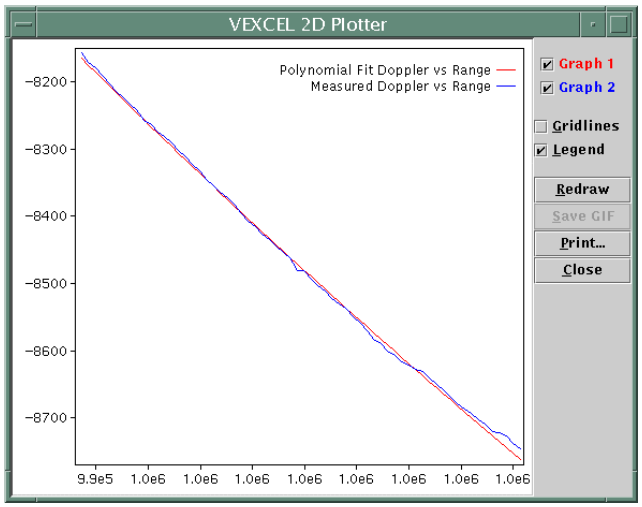

Figure 10-1

The following is a graphical representation of a Doppler Centroid plot for a ScanSAR data case.

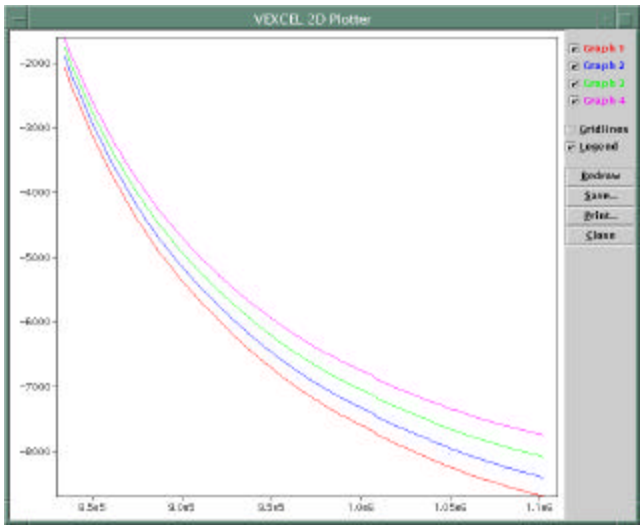

Figure 10-2

11 QuickLook Image File Set

An STF dataset can optionally contain a quick-look image of the whole granule, produced by the QuickLook processor.

Each quick-look image set consists of the following files:

- basename.000.QL.gli - QuickLook image data file
- basename.000.QL.gli.par - QuickLook image parameter file
- basename.000.QL.tif - QuickLook (tif) file (if TIFF selected)
- basename.000.QL.jpeg - QuickLook (jpeg) file (if JPEG selected)

11.1 The QuickLook image data file

The QuickLook image data file is a flat, rectangular floating-point file (32 bit per pixel) containing image intensity values. The image pixels are by default written as sigma nought values (configurable). The image extent (number of pixels, number of lines) and all other image characteristics are contained in the ASCII image parameter file.

11.2 The QuickLook image parameter file

The ASCII QuickLook image parameter file completely describes the floating-point QuickLook image data file.

The QuickLook image parameter file contains the following plain tags and information blocks:

- sensor - information block
- flight_path_direction - plain tag
- RawSARImage - information block
- ScanSARProduct - information block

See chapter 3.3.43 for a description of the sensor information block. The other plain tags and information blocks are described in the following.

11.2.1 The flight_path_direction plain tag

Name: flight_path_direction
Type: string
Unit: N/A
Range: ASCENDING | DESCENDING
Example: ASCENDING
Description: Specifies whether the acquisition was in the ascending or descending phase of the satellite orbit.

11.3 The RawSARImage information block

Name: RawSARImage
Type: Information Block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the input STF data set from the view of the QuickLook processor.

The RawSARImage information block contains the following plain tags:

- image_desc - information block
- processor_name - plain tag
- processor_version - plain tag
- first_line - plain tag
- first_line_txpol - plain tag

- time_per_line - plain tag

This information block and these plain tags are described in the following.

11.3.1 The image_desc information block

Name: image_desc
Type: Information Block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies basic image characteristics of the input STF data set from the view of the QuickLook processor.

The image_desc information block contains the following plain tags:

- Facility - plain tag
- Format - plain tag
- Type - plain tag
- BytesPerPixel - plain tag
- Title - plain tag
- PixelSpacing - plain tag
- PixelResolution - plain tag
- LineSpacing - plain tag
- LineResolution - plain tag
- NrPixels - plain tag
- NrLines - plain tag
- MinValue - plain tag
- MaxValue - plain tag
- MeanValue - plain tag
- SigmaValue - plain tag
- coord - information block

These information blocks and plain tags are described in the following.

11.3.1.1 The Facility plain tag

Name: Facility
Type: string
Unit: N/A
Range: N/A
Example: ASF

Description: Specifies the facility name that processed the QuickLook image.

11.3.1.2 The Format plain tag

Name: Format
Type: string
Unit: N/A
Range: STF_Telemetry
Example: STF_Telemetry
Description: Specifies the type of input data. Always STF_Telemetry for STF input data.

11.3.1.3 The Type plain tag

Name: Type
Type: string
Unit: N/A
Range: RAW
Example: RAW
Description: Specifies the type of input data. Always RAW for STF input data.

11.3.1.4 The BytesPerPixel plain tag

Name: BytesPerPixel
Type: integer
Unit: N/A
Range: [1, 4]
Example: 2
Description: Not applicable for STF data. Default set to 2.

11.3.1.5 The Title plain tag

Name: Title
Type: string
Unit: N/A
Range: N/A
Example: ERS2 orbit: 23862
Description: Informal title of the input STF data set.

11.3.1.6 The PixelSpacing plain tag

Name: PixelSpacing
Type: float
Unit: meters
Range: [1.0, 100.0]

Example: 7.9
Description: Natural pixel spacing of input data (for SAR: slant range pixel spacing).

11.3.1.7 The PixelResolution plain tag

Name: PixelResolution
Type: float
Unit: meters
Range: [1.0, 100.0]
Example: 9.6
Description: Natural pixel resolution of input data (for SAR: slant range pixel resolution).

11.3.1.8 The LineSpacing plain tag

Name: LineSpacing
Type: float
Unit: meters
Range: [1.0, 100.0]
Example: 4.0
Description: Natural line spacing of input data (for SAR: azimuth line spacing).

11.3.1.9 The LineResolution plain tag

Name: LineResolution
Type: float
Unit: meters
Range: [1.0, 100.0]
Example: 5.6
Description: Natural line resolution of input data (for SAR: azimuth line resolution).

11.3.1.10 The NrPixels plain tag

Name: NrPixels
Type: integer
Unit: N/A
Range: [4000, 20000]
Example: 5615
Description: Number of pixels contained in input data. This is taken from the input STF parameter file.

11.3.1.11 The NrLines plain tag

Name: NrLines
Type: integer

Unit: N/A
Range: [4000, 9999999]
Example: 495085
Description: Number of lines contained in input data. This is taken from the input STF parameter file.

11.3.1.12 The MinValue plain tag

Name: MinValue
Type: float
Unit: N/A
Range: [0.0, 100.0]
Example: 0.0
Description: Minimum input data value.

11.3.1.13 The MaxValue plain tag

Name: MaxValue
Type: float
Unit: N/A
Range: [0.0, 100.0]
Example: 15.0
Description: Maximum possible input data value. This is normally the maximum input value after the I/Q integer value has been converted to a float value (voltage).

11.3.1.14 The MeanValue plain tag

Name: MeanValue
Type: float
Unit: N/A
Range: [0.0, 100.0]
Example: 0.0
Description: The output image sample mean value. Not supported for input data.

11.3.1.15 The SigmaValue plain tag

Name: SigmaValue
Type: float
Unit: N/A
Range: [0.0, 100.0]
Example: 0.0
Description: The output image standard deviation. Not supported for input data.

11.3.1.16 The coord information block

Name: coord
Type: Information Block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies corner and center coordinates of the input STF data set.

The coord information block contains the following plain tags:

- earth_model - information block
- first_line_first_pixel - plain tag
- first_line_last_pixel - plain tag
- last_line_first_pixel - plain tag
- last_line_last_pixel - plain tag
- center_line_center_pixel - plain tag

These information blocks and plain tags are described in the following.

11.3.1.17 The earth_model information block

Name: earth_model
Type: Information Block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the characteristics of the Earth model (i.e. Datum) contained in the input STF data set.

The earth_model information block contains the following plain tags:

- name - information block
- ellipsoid_name - plain tag
- major - plain tag
- minor - plain tag
- terrain_height - plain tag
- mass - plain tag
- delta_x - plain tag
- delta_y - plain tag
- delta_z - plain tag
- g - plain tag

- j2 - plain tag
- j3 - plain tag
- j4 - plain tag

These information blocks and plain tags are described in the following.

11.3.1.17.1 The name plain tag

Name: name
Type: string
Unit: N/A
Range: N/A
Example: WGS84
Description: The name of the earth model (Datum).

11.3.1.17.2 The ellipsoid_name plain tag

Name: ellipsoid_name
Type: string
Unit: N/A
Range: N/A
Example: GEM6
Description: The name of the ellipsoid that is used in this earth model (Datum).

11.3.1.17.3 The major plain tag

Name: major
Type: float
Unit: meters
Range: [6300000.0, 6500000.0]
Example: 6378144.0
Description: The major axis of the ellipsoid used in this earth model.

11.3.1.17.4 The minor plain tag

Name: minor
Type: float
Unit: meters
Range: [6300000.0, 6500000.0]
Example: 6356759.0
Description: The minor axis of the ellipsoid used in this earth model.

11.3.1.17.5 The terrain_height plain tag

Name: terrain_height
Type: float
Unit: meters

Range: [-2000.0, 10000.0]
Example: 0.0
Description: The terrain height specified in the earth model.

11.3.1.17.6 The mass plain tag

Name: mass
Type: float
Unit: kilograms
Range: [5.0E24, 6.0E24]
Example: 5.974e+24
Description: The mass of the earth as specified in the earth model.

11.3.1.17.7 The delta_x plain tag

Name: delta_x
Type: float
Unit: meters
Range: [-10000.0, 10000]
Example: 0.0
Description: The x offset between the center of the earth and the origin of the ellipsoid used in this earth model.

11.3.1.17.8 The delta_y plain tag

Name: delta_y
Type: float
Unit: meters
Range: [-10000.0, 10000]
Example: 0.0
Description: The y offset between the center of the earth and the origin of the ellipsoid used in this earth model.

11.3.1.17.9 The delta_z plain tag

Name: delta_z
Type: float
Unit: meters
Range: [-10000.0, 10000]
Example: 0.0
Description: The z offset between the center of the earth and the origin of the ellipsoid used in this earth model.

11.3.1.17.10 The g plain tag

Name: g
Type: float

Unit: ???
Range: [6.0E-11, 7.0E-11]
Example: 6.6622e-11
Description: The g factor used in this earth model.

11.3.1.17.11 The j2 plain tag

Name: j2
Type: float
Unit: ???
Range: [0.0, 1.0]
Example: 0.00108262
Description: The j2 factor used in this earth model.

11.3.1.17.12 The j3 plain tag

Name: j3
Type: float
Unit: ???
Range: [0.0, 1.0]
Example: 2.53881e-06
Description: The j3 factor used in this earth model.

11.3.1.17.13 The j4 plain tag

Name: j4
Type: float
Unit: ???
Range: [-1.0, 0.0]
Example: -1.65597e-06
Description: The j4 factor used in this earth model.

11.3.1.18 The first_line_first_pixel plain tag

Name: first_line_first_pixel
Type: float, float, float
Unit: degrees, degrees, meters
Range: [-90.0, 90.0], [-180.0, 180.0], [-10000.0, 10000.0],
Example: 35.196008 124.468864 0.000000
Description: A triplet describing the geodetic coordinates of the first pixel in the first line of the STF dataset. The first value is the geodetic latitude, the second value is the geodetic longitude, the third value is the terrain height. Note that these coordinates are based on the input (raw data) characteristics.

11.3.1.19 The first_line_last_pixel plain tag

Name: first_line_last_pixel
Type: float, float, float
Unit: degrees, degrees, meters
Range: [-90.0, 90.0], [-180.0, 180.0], [-10000.0, 10000.0],
Example: 35.196008 124.468864 0.000000
Description: A triplet describing the geodetic coordinates of the last pixel in the first line of the STF dataset. The first value is the geodetic latitude, the second value is the geodetic longitude, the third value is the terrain height. Note that these coordinates are based on the input (raw data) characteristics.

11.3.1.20 The last_line_first_pixel plain tag

Name: last_line_first_pixel
Type: float, float, float
Unit: degrees, degrees, meters
Range: [-90.0, 90.0], [-180.0, 180.0], [-10000.0, 10000.0],
Example: 35.196008 124.468864 0.000000
Description: A triplet describing the geodetic coordinates of the first pixel in the last line of the STF dataset. The first value is the geodetic latitude, the second value is the geodetic longitude, the third value is the terrain height. Note that these coordinates are based on the input (raw data) characteristics.

11.3.1.21 The last_line_last_pixel plain tag

Name: last_line_last_pixel
Type: float, float, float
Unit: degrees, degrees, meters
Range: [-90.0, 90.0], [-180.0, 180.0], [-10000.0, 10000.0],
Example: 35.196008 124.468864 0.000000
Description: A triplet describing the geodetic coordinates of the last pixel in the last line of the STF dataset. The first value is the geodetic latitude, the second value is the geodetic longitude, the third value is the terrain height. Note that these coordinates are based on the input (raw data) characteristics.

11.3.1.22 The center_line_center_pixel plain tag

Name: center_line_center_pixel
Type: float, float, float
Unit: degrees, degrees, meters
Range: [-90.0, 90.0], [-180.0, 180.0], [-10000.0, 10000.0],
Example: 35.196008 124.468864 0.000000
Description: A triplet describing the geodetic coordinates of the center pixel in the center line of the STF dataset. The first value is the geodetic latitude, the second value is the

geodetic longitude, the third value is the terrain height. Note that these coordinates are based on the input (raw data) characteristics.

11.3.2 The processor_name plain tag

Name: processor_name
Type: string
Unit: N/A
Range: N/A
Example: SKY
Description: The name of the processor that created the raw input data set.

11.3.3 The processor_version plain tag

Name: processor_version
Type: string
Unit: N/A
Range: N/A
Example: 2.15
Description: The version of the processor that created the raw input data set.

11.3.4 The first_line plain tag

Name: first_line
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the UTC date/time of the first imaging line in the input raw data set.

11.3.5 The first_line_txpol plain tag

Name: first_line_txpol
Type: string
Unit: N/A
Range: H | V
Example: H
Description: Specifies the transmit polarization of the first SAR line.

11.3.6 The time_per_line plain tag

Name: time_per_line
Type: float
Unit: seconds
Range: [0.0, 1.0]

Example: 0.001232
Description: Specifies the time distance between input raw lines.

11.4 The ScanSARProduct information block

Name: ScanSARProduct
Type: Information Block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies the image characteristics of the floating-point QuickLook image.

The ScanSARProduct information block contains the following plain tags:

- image_desc - information block
- processor_name - plain tag
- processor_version - plain tag
- image_type - plain tag
- first_line - plain tag
- time_per_line - plain tag
- OrbitNr - plain tag
- OrbitNr_Date - plain tag
- near_range - plain tag
- center_range - plain tag
- far_range - plain tag
- skew_flag - plain tag
- Kaiser_range - plain tag
- Kaiser_azimuth - plain tag
- range_looks - plain tag
- azimuth_looks - plain tag
- range_block_average_factor - plain tag
- azimuth_block_average_factor - plain tag
- Gr2Sr_Block - information block
- dwell_time - plain tag
- integration_time - plain tag
- range_decimation_factor - plain tag
- raw_start_burst - plain tag
- nr_raw_bursts - plain tag

These information blocks and plain tags are described in the following.

11.4.1 The image_desc information block

Name: image_desc
Type: Information Block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies basic image characteristics of the floating-point QuickLook image. See chapter 11.3.1 for a detailed description of an image_desc block.

11.4.2 The processor_name plain tag

Name: processor_name
Type: string
Unit: N/A
Range: N/A
Example: SKY
Description: The name of the QuickLook processor that created the quick-look image.

11.4.3 The processor_version plain tag

Name: processor_version
Type: string
Unit: N/A
Range: N/A
Example: 2.15
Description: The version of the QuickLook processor that created the quick-look image.

11.4.4 The image_type plain tag

Name: image_type
Type: string
Unit: N/A
Range: SigmaNought | BetaNought
Example: SigmaNought
Description: Specifies the radiometric units of the quick-look image.

11.4.5 The first_line plain tag

Name: first_line
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761

Description: Specifies the UTC date/time of the first image line of the floating-point quick-look image.

11.4.6 The time_per_line plain tag

Name: time_per_line
Type: float
Unit: seconds
Range: [0.0, 1.0]
Example: 0.001232
Description: Specifies the time distance between floating-point quick-look image lines.

11.4.7 The OrbitNr plain tag

Name: OrbitNr
Type: integer
Unit: N/A
Range: [0, 99999]
Example: 2315
Description: Specifies the orbit number at the center of the ScanSAR image.

11.4.8 The OrbitNr_Date plain tag

Name: OrbitNr_Date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings
Example: 19960610145924761
Description: Specifies the date and time that corresponds to the scene center.

11.4.9 The near_range plain tag

Name: near_range
Type: float
Unit: meters
Range: [500000.0, 1500000.0]
Example: 829924.375000
Description: Specifies the distance between the sensor and the near edge of the quick-look image.

11.4.10 The center_range plain tag

Name: center_range
Type: float
Unit: meters

Range: [500000.0, 1500000.0]
Example: 849336.218750
Description: Specifies the distance between the sensor and the center line of the quick-look image.

11.4.11 The far_range plain tag

Name: far_range
Type: float
Unit: meters
Range: [500000.0, 1500000.0]
Example: 868748.062500
Description: Specifies the distance between the sensor and the far edge of the quick-look image.

11.4.12 The skew_flag plain tag

Name: skew_flag
Type: integer
Unit: N/A
Range: 0 | 1
Example: 0
Description: Specifies if the quick-look image is skewed (1) or de-skewed to Zero-Doppler (0).

11.4.13 The Kaiser_range plain tag

Name: Kaiser_range
Type: float
Unit: N/A
Range: [0.0, 10.0]
Example: 2.4
Description: Specifies the Kaiser parameter used during range compression.

11.4.14 The Kaiser_azimuth plain tag

Name: Kaiser_azimuth
Type: float
Unit: N/A
Range: [0.0, 10.0]
Example: 2.4
Description: Specifies the Kaiser parameter used during azimuth compression

11.4.15 The range_looks plain tag

Name: range_looks
Type: integer
Unit: N/A
Range: [0, 10]
Example: 1
Description: Specifies the number of looks applied during range multi-looking.

11.4.16 The azimuth_looks plain tag

Name: azimuth_looks
Type: integer
Unit: N/A
Range: [0, 10]
Example: 1
Description: Specifies the number of looks applied during azimuth multi-looking.

11.4.17 The range_block_average_factor plain tag

Name: range_block_average_factor
Type: integer
Unit: N/A
Range: [0, 20]
Example: 1
Description: Specifies the block averaging factor applied in range direction while creating the floating-point quick-look image. Note: this is not the block averaging factor applied while creating the standard format image (TIFF).

11.4.18 The azimuth_block_average_factor plain tag

Name: azimuth_block_average_factor
Type: integer
Unit: N/A
Range: [0, 20]
Example: 1
Description: Specifies the block averaging factor applied in azimuth direction while creating the floating-point quick-look image. Note: this is not the block averaging factor applied while creating the standard format image (TIFF).

11.4.19 The Gr2Sr_Block information block

Name: Gr2Sr_Block
Type: Information Block
Unit: N/A

Range: N/A
Example: N/A
Description: Specifies a set of ground-range to slant-range conversion polynomials.

The Gr2Sr_Block information block contains the following plain tags:

- NrGr2Sr - plain tag
- gr2sr - information blocks, multiple instances

These information blocks and plain tags are described in the following.

11.4.19.1 The NrGr2Sr plain tag

Name: NrGr2Sr
Type: integer
Unit: N/A
Range: [1, 40]
Example: 1
Description: Specifies the number of gr2sr information blocks following.

11.4.19.2 The gr2sr information block

Name: gr2sr
Type: Information Block
Unit: N/A
Range: N/A
Example: N/A
Description: Specifies one ground-range to slant-range conversion polynomial.

The gr2sr information block contains the following plain tags:

- reference_date - plain tag
- reference_range - plain tag
- number_of_coefficients - plain tag
- a0..a3 - plain tags

These plain tags are described in the following.

11.4.19.2.1 The reference_date plain tag

Name: reference_date
Type: date/time string
Unit: YYYYMMDDhhmmssttt
Range: all valid date/time strings

Example: 19960610145924761
Description: Specifies the reference UTC date/time of this polynomial.

11.4.19.2.2 The reference_range plain tag

Name: reference_range
Type: float
Unit: meters
Range: [0.0, 1500000.0]
Example: 0.0
Description: Specifies the reference range of this polynomial.

11.4.19.2.3 The number_of_coefficients plain tag

Name: number_of_coefficients
Type: integer
Unit: N/A
Range: [1, 6]
Example: 4
Description: Specifies the number of coefficients of this polynomial.

11.4.19.2.4 The a0-a5 plain tag

Name: a0, a1, a2, a3, a4, a5
Type: float
Unit: meters
Range: [-1.0, 1500000.0]
Example: 829924.467835
Description: Specifies the coefficients of this polynomial.

The following equation (3.0) can be used to calculate the slant range r_s at any point cross track (R) at the specified reference date:

$$r_s = \sum_{j=0}^{n} a_j \cdot (R - R_0)^j \qquad (4.0)$$

where

- r_s .....slant range in meters
- R.....across track variable (ground range) in meters
- R_0.....the range reference value
- a_j .....the j-th coefficient of the ground-to-slant range polynomial

To calculate the ground range R from the pixel number:

$$R = i * R_g \qquad (4.1)$$

where

- R.....across track variable (ground range) in meters

- i.....pixel number (0 for nearest pixel to sensor)
- R_g.....the ground range pixel spacing in meters

The ground range pixel spacing can be obtained from the image_desc information block.

11.4.20 The dwell_time plain tag

Name: dwell_time
Type: float
Unit: seconds
Range: [0.0, 1.0]
Example: 0.031163281521
Description: Specifies the dwell time of the burst sequence. The dwell time is the time extent of one burst cycle. A burst cycle is one sequence of all different beams involved in a ScanSAR mode.

11.4.21 The integration_time plain tag

Name: integration_time
Type: float
Unit: seconds
Range: [0.0, 1.0]
Example: 0.653025625576
Description: Specifies the time extent of a processed burst.

11.4.22 The range_decimation_factor plain tag

Name: range_decimation_factor
Type: integer
Unit: N/A
Range: [0, 32]
Example: 8
Description: Specifies the decimation factor applied to reduce the number of range samples after range compression has been applied.

11.4.23 The raw_start_burst plain tag

Name: raw_start_burst
Type: integer
Unit: N/A
Range: [0, 99999]
Example: 0
Description: Specifies the first raw burst number that was used to create this quick-look image.

11.4.24 The nr_raw_bursts plain tag

Name: nr_raw_bursts
Type: integer
Unit: N/A
Range: [0, 99999]
Example: 1799
Description: Specifies the number of raw bursts used to create this quick-look image.

11.4.25 QuickLook Image Parameter File Example

```
sensor {
    sensor_name: JERS1
    clock_angle:      90.00000000
    nr_temperatures: 0
    nr_beams: 1
    beam {
        beam_name: JERS1
        nr_of_samples: 6144
        echo_delay: 0.00471774000658
        carrier_freq:    1274086000.00000000
        sampling_freq:      17076000.00000000
        PRF:          1555.20000000
        chirp_rate: -427570000000.00006000
        pulse_length: 0.00003500000000
        look_angle:      35.21000000
        incidence_angle:      38.97000000
        range_spectrum_snr: 0.000000
        replica_energy_ref_level: 1.000000
        cal1_cal2_diff_ref_level: 0.000000
        thermal_noise_ref_level: -24.000000
        gain_corctn_factor: 1.000000
        gain_scale: -13.400000
        PolarizationBlock {
            NrPolarizations: 1
            Polarization {
                polarization: HH
                polarization_amplitude:            1.00000000
                polarization_phase:            0.00000000
                stc_pattern_id: -1
                IQStatistics {
                    I_mean: -0.141744
                    Q_mean: -0.445589
                    I_std: 1.558211
                    Q_std: 1.547448
                    IQ_corr: 0.087245
                }
            }
        }
        DopplerCentroidParameters {
            doppler_centroid_coefficients {
                reference_first_dimension:    731513.333966
                reference_second_dimension: 1499201244.480709
                number_of_coefficients_first_dimension: 2
                number_of_coefficients_second_dimension: 3
                a00: 713.492
                a01: -0.000295374
                a10: 2.25695
                a11: 5.14378e-06
```

```
                a20: -0.000488737
                a21: 3.31817e-09
            }
            reference_range: 731513.333966
            reference_date: 19970704204724480
            ambiguity_number: 0
            MLCC_ambiguity_number_occurence: 0
            MLBF_ambiguity_number_occurence: 0
            DAR_doppler: 713.491652
            Predict_doppler: 912.338184
            DAR_confidence: 0.000000
            doppler_fit_correlation: 1.000000
            doppler_status: SUCCESS
        }
        DopplerRateParameters {
            effective_velocity_coefficients {
                reference_first_dimension:    734138.010264
                reference_second_dimension: 1499201244.480387
                number_of_coefficients_first_dimension: 2
                number_of_coefficients_second_dimension: 2
                a00: 7283.54
                a01: -0.000169806
                a10: 0.0287741
                a11: 4.85411e-08
            }
            veff: 7283.538656
            reference_range: 734138.010264
            reference_date: 19970704204724480
            autofocus_scale_factor: 1.000670
            autofocus_snr: 25.066750
            autofocus_suggested_ambiguity_number: 0
            autofocus_status: SUCCESS
        }
    }
    ephemeris {
        sv_block {
            NrSV: 1
            state_vector {
                x: 4631167.068366
                y: 2265960.647816
                z: 4653204.900000
                xv: -3721.171358
                yv: -3771.711763
                zv: 5523.830000
                Date: 19970704202859998
            }
        }
        Attitude {
            yaw: 0.000000
            roll: 0.000000
            pitch: 0.000000
            Date: 19970704204724319689
```

```
            yawpoly {
                reference: 1499201244.319704
                number_of_coefficients: 4
                a0: 0
                a1: 0
                a2: 0
                a3: 0
            }
            rollpoly {
                reference: 1499201244.319704
                number_of_coefficients: 4
                a0: 0
                a1: 0
                a2: 0
                a3: 0
            }
            pitchpoly {
                reference: 1499201244.319704
                number_of_coefficients: 4
                a0: 0
                a1: 0
                a2: 0
                a3: 0
            }
        }
        OrbitNr: 29517
        OrbitNr_Date: 19970704204314592
        GHA {
            angle: 233.704512
            date: 19970704204314592
        }
        Type: RESTITUTED
    }
}
flight_path_direction: DESCENDING
RawSARImage {
    image_desc {
        Facility: Vexcel
        Format: STF_Telemetry
        Type: RAW
        BytesPerPixel: 2
        Title: JERS1 orbit: 29517
        PixelSpacing: 8.778182
        PixelResolution: 10.016487
        LineSpacing: 4.505601
        LineResolution: 6.371882
        NrPixels: 6144
        NrLines: 777250
        MinValue:      0.000000000
        MaxValue:      3.000000000
        MeanValue:      0.000000000
        SigmaValue:      0.000000000
```

```
        coord {
            earth_model {
                name: TOKYO
                ellipsoid_name: Bessel_1841
                major: 6377397.155000
                minor: 6356078.963000
                terrain_height: 0.000000
                mass: 5.974e+24
                delta_x:    -147.5400000000
                delta_y:     507.2600000000
                delta_z:     680.4700000000
                g: 6.6622e-11
                j2: 0.00108262
                j3: 2.53881e-06
                j4: -1.65597e-06
            }
            first_line_first_pixel: 82.708760 -114.794908 -0.036111
            first_line_last_pixel: 83.136721 -119.929043 -0.035224
            last_line_first_pixel: 53.011219 -148.052982 -0.051974
            last_line_last_pixel: 53.142569 -149.289291 -0.051318
            center_line_center_pixel: 68.360064 -142.384251 -0.042994
        }
    }
    processor_name: SKY
    processor_version: 2.21
    first_line: 19970704204314592981
    first_line_txpol: H
    time_per_line:  0.000643004115
}
ScanSARProduct {
    image_desc {
        Facility: VEXCEL
        Format: Vexcel Plain
        Type: GLI
        BytesPerPixel: 4
        Title: JERS1 orbit: 29517
        PixelSpacing: 75.000000
        PixelResolution: 147.519813
        LineSpacing: 75.000000
        LineResolution: 90.286233
        NrPixels: 1029
        NrLines: 46946
        MinValue:      0.000000027
        MaxValue:    295.588012695
        MeanValue:      0.487601314
        SigmaValue:      0.071618736
        coord {
            earth_model {
                name: TOKYO
                ellipsoid_name: Bessel_1841
                major: 6377397.155000
                minor: 6356078.963000
```

```
                terrain_height: 0.000000
                mass: 5.974e+24
                delta_x:    -147.5400000000
                delta_y:     507.2600000000
                delta_z:     680.4700000000
                g: 6.6622e-11
                j2: 0.00108262
                j3: 2.53881e-06
                j4: -1.65597e-06
            }
            first_line_first_pixel: 82.736864 -114.629405 -0.036098
            first_line_last_pixel: 83.127784 -119.254406 -0.035296
            last_line_first_pixel: 52.882368 -148.093037 -0.052042
            last_line_last_pixel: 53.001546 -149.206775 -0.051451
            center_line_center_pixel: 68.304788 -142.311402 -0.043061
        }
    }
    processor_name: QuickLook
    processor_version: 2.21
    image_type: BetaNought
    polarization: HH
    first_line: 19970704204314028590
    time_per_line:  0.010702638894
    OrbitNr: 29517
    OrbitNr_Date: 19970704204725251
    near_range: 707171.437500
    center_range: 731407.562500
    far_range: 755643.687500
    skew_flag: 0
    Kaiser_range: 2.400000
    Kaiser_azimuth: 2.400000
    range_looks: 1
    azimuth_looks: 4
    range_block_average_factor: 1
    azimuth_block_average_factor: 1
    Gr2Sr_Block {
        NrGr2Sr: 1
        gr2sr {
            reference_date: 19970704204314075
            reference_range: 0.000000
            number_of_coefficients: 4
            a0: 707171.342905
            a1: 5.908754e-01
            a2: 5.221931e-07
            a3: -4.109836e-13
        }
    }
    dwell_time:  0.391060547402
    integration_time:  1.564242189606
    range_decimation_factor: 8
    raw_start_burst: 0
    nr_raw_bursts: 1275
```

```
}
```

11.5 The QuickLook standard format image (TIFF, JPEG)

The QuickLook standard format image is created from the floating-point quick-look image. The floating-point image can be down-averaged further to reduce the size of the image. An exponential factor can be applied in the conversion from floating-point pixels (32 bit) to integer pixels (8 bit). The image is written in a standard format. Right now, the TIFF and JPEG formats are supported.

Note that the quick-look image parameter file describes the image characteristic of the floating-point image file. The standard format file will inherit most of the image characteristics. Obviously, the number of lines and pixels will change if the image was further down-averaged, in addition to image mean, max and standard deviation values. The corner coordinates will still be valid also for the standard format image.