| SCIAMACHY | Operation Change Request | OCR No: 048<br>Issue: 3 |
|---|---|---|

Title:
Configuring SCIAMACHY for modified orbit in mission extension

Description of Request:
The measurement final flight configuration of SCIAMACHY has to be modified in response to the orbit change required for extending ENVISAT operations until the end 2013/2014. It affects measurement state parameters and timelines. Details of the required changes are described – together with a thorough mission extension orbit analysis – in the document [R1] *SCIAMACHY Mission Extension Orbit Analysis, PO-TN-DLR-SH-0021*. Together with the modifications of several engineering parameters – see *The Impact of the ENVISAT Mission Extension on the SCIAMACHY Scanner Control System, TN-SCIA-0000DO/31* [R2] – it is ensured that the performance of SCIAMACHY measurement operations can be maintained throughout the mission.

The corresponding modifications reflect how the azimuth and elevation of the Line-of-Sight (LoS) differ when the ENVISAT orbit is lowered by about 17 km. In order not to jeopardize the limb/nadir matching, SCIAMACHY's unique capability supporting the separation of tropospheric and stratospheric contributions, the duration of the limb states has to be adjusted by omitting the final horizontal scan. In addition the start altitude of the limb scans is raised by one vertical step of about 3 km for maintaining the maximum limb altitude.

According to [R1] the following measurement parameter tables need changing:

- Basic profile: adjust 5 basic scan positions in elevation and 1 basic scan elevation rate
- Relative profile: adjust wide swath width in limb to match reduced across-track extent of nadir states
- Scanner state: adjust number of horizontal scans and phase duration in limb states
- State duration: adjust duration of limb states (SDPU duration, Wait Measurement Execution, State duration)

Because all limb states are shortened, the timeline definitions change as well. This necessitates the generation and upload of a new timeline set (t/l set 36).

Note that none of the mission scenarios require modifications. The goal is to continue routine operations after the orbit manoeuvre without introducing new scientific, calibration or monitoring measurements.

Because in addition to the inclination, both the semi-major axis and orbital period also drift slightly in the mission extension phase (see [R1]), the corresponding engineering parameters are updated on a regular basis (see [R2]). For the semi-major axis related parameters this will occur 3×, for the inclination 20× as specified in the SCIAMACHY Operations Request (SOR) for the engineering parameter update. In order to comply with the definitions of the engineering parameters, the basic profile and relative profile modifications will be updated with the rate of the semi-major axis parameter. This requires issuing corresponding OCRs at the appropriate dates.

| Originator: M. Gottwald, E. Krieg, DLR-IMF | Date of Issue: 22/09/2010 | Signature: M. Gottwald via email 22/09/2010 |
|---|---|---|

Assessment of SSAG/SQWG (necessary for requests by scientists):
The proposed implementation of the modification of the limb states in order to have good limb-nadir matching in the new orbit, is in-line with the recommendation made by SSAG in February 2010, to start each limb state at an altitude of 0 km (instead of -3 km) thus maintaining the final limb altitude at about 93 km.

| SSAG: H. Bovensmann, IUP | Date: 27/09/2010 | Signature: H. Bovensmann vie e-mail, 27/09/2010 |
|---|---|---|

Classification of OCR:

| | | |
|---|---|---|
| OCR Analysis (incl. Implementation Option):<br>The analysis can be found in [R1]. The appendix attached to this OCR lists all of the four modified measurement parameter tables and provides a summary of the new t/l set 36. | | |
| SOST: M. Gottwald, E. Krieg, DLR-IMF<br>(ESA, Industry if necessary) | Date: 22/09/2010 | Signature: M. Gottwald via email 22/09/2010 |
| Approval of Proposed Implementation: | | |
| Originator Approval:<br>M. Gottwald, E. Krieg, DLR-IMF | Date: 22/09/2010 | Signature: M. Gottwald via email 22/09/2010 |
| SSAG Approval:<br>H. Bovensmann, IUP | Date: 27/09/2010 | Signature: H. Bovensmann via e-mail 27/09/2010 |
| Decision / Approval:<br>Approved as proposed. | | |
| DLR Approval: A. Friker<br>(if necessary NIVR, SPEC) | Date: 27/09/2010 | Signature: A. Friker via e-mail 27/09/2010 |
| Implementation by SOST:<br>According to current planning it is expected that the new final flight configuration becomes operational on October 27th, 2010. The parameter CTI tables will be uploaded in orbit 45261 (October 27th, 2010, 00:14:33 UTC) and the new timeline set in orbit 45262 (October 27th, 2010, 01:54:47 UTC). Both uploads are driven by the Mission Planning System (MPS). With the start of t/l 1 in orbit 45262 the modified configuration of SCIAMACHY in ENVISAT's mission extension orbit becomes operational. | | |
| SOST M. Gottwald/E. Krieg, DLR-IMF | Date: 22/09/2010 | Signature: M. Gottwald via email 22/09/2010 |

# Annex: CTI parameter tables to be modified and summary of new timeline set

For a detailed analysis see document [R1]. Entries marked in red are modified values.

## Basic Profile table

| Scan Profile ID | Azimuth | | Elevation | | Note: All positions are effective scanner positions. Conversion algorithms of H/W- constellation are not considered. All angular positions/rates are given in ASM/ESM scanner notation. Intended use |
|---|---|---|---|---|---|
| | Basic Scan Position 10-6 rad | Basic Scan Rate 10-6 rad/sec | Basic Scan Position 10-6 rad | Basic Scan Rate 10-6 rad/sec | |
| 0 | 0000000000 | 000000 | -0000261799 | 000000 | ASM position IDLE<br>ESM position IDLE |
| 1 | 0000000000 | 000000 | -0000794125 | 000000 | ASM new unused position pointing into telescope, mirror not used<br>ESM pointing in nadir direction (-z) - start position for nadir_pointing_left |
| 2 | -0000785398 | 000000 | -0000235814 | 000000 | ASM pointing in direction of velocity vector (-y)<br>ESM pointing at the horizon (limb start altitude = 0 km) |
| 3 | -0000471239 | 000131 | -0000174405 | 000000 | ASM following trajectory of sun from position of sunrise<br>ESM pointing at 350 km above horizon |
| 4 | 0003298672 | -008145 | 0000986111 | 000000 | ASM_Diffuser_1 - starting position +9 deg diffuser normal<br>ESM pointing to mean sun elevation within sub-solar window |
| 5 | -0001003564 | -000174 | -0000211563 | 000000 | ASM following moon trajectory from mean position of the full moon (245 deg) - currently unused<br>ESM pointing at 150 km above horizon |
| 6 | -0000468621 | 000131 | 0002879793 | 000000 | ASM following sun trajectory<br>ESM diffusor in fixed ESM pos. of 180-15 deg - timing required for normal incidence of sun on ESM |
| 7 | -0006283185 | 000000 | -0006283185 | 000000 | ASM position for 360 deg revolution of scanner bearings<br>ESM position for 360 deg revolution of scanner bearings |
| 8 | -0000468621 | 000131 | 0000570714 | 000222 | ASM following sun trajectory<br>ESM following sun via extra_mirror with half angular velocity from start at 150 km above horizon |
| 9 | -0000785398 | 000000 | -0000193833 | 000000 | ASM pointing in direction of velocity vector (-y)<br>ESM pointing at 250 km above horizon |
| 10 | 0003263766 | -008145 | 0000170480 | 000000 | ASM_Diffuser_2 - starting position +7 deg diffuser normal; ASM_diffuser_atmosphere<br>ESM pointing to SLS (9.768 deg) |
| 11 | 0003228859 | -008145 | 0003319617 | 000000 | ASM_Diffuser_3 - starting position +5 deg diffuser normal<br>ESM pointing diffusor to internal calibration sources (10.2 + 180 deg) |
| 12 | 0003193953 | -008145 | 0000183658 | 000000 | ASM_Diffuser_4 - starting position +3 deg diffuser normal<br>ESM pointing to WLS (10.523 deg) |
| 13 | 0003159046 | -008145 | 0000186279 | 000000 | ASM_Diffuser_5 - starting position +1 deg diffuser normal*<br>ESM pointing to WLS under non-optimal angle (10.673 deg) |
| 14 | -0000471239 | 000227 | -0000233153 | 000000 | ASM following trajectory of sun from position of sunrise<br>ESM pointing at 17.2 km above horizon |

* ASM position might change by -4 deg when solar azimuth exceeds 338.5 deg around orbits 48000 and 54000

## Relative Profile table

| Scanner Relative Profile 3 | Common Parameter | Segment 1 | Segment 2 | Segment 3 | Segment 4 | Segment 5 | Segment 6 | Segment 7 | Segment 8 |
|---|---|---|---|---|---|---|---|---|---|
| Number of used Segments | 4 | | | | | | | | |
| Profile ID | 3 | | | | | | | | |
| Duration of Segment [msec] | | 50 | 51 | 50 | 1536 | 0 | 0 | 0 | 0 |
| Angular Variation [mrad] | | -589 | -589 | 0 | 36671 | 0 | 0 | 0 | 0 |
| Acceleration at Start of Segment [mrad/sec2] | | 471 | 0 | 471 | 0 | 0 | 0 | 0 | 0 |
| Acceleration at End of Segment [mrad/sec2] | | 471 | 0 | 471 | 0 | 0 | 0 | 0 | 0 |
| Number of Support Points | | 5 | 1 | 5 | 1 | 0 | 0 | 0 | 0 |
| BCPS Synchronisation | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Common Parameter | Segment 9 | Segment 10 | Segment 11 | Segment 12 | Segment 13 | Segment 14 | Segment 15 | Segment 16 |
| Duration of Segment [msec] | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Angular Variation [mrad] | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Acceleration at Start of Segment [mrad/sec2] | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Acceleration at End of Segment [mrad/sec2] | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Number of Support Points | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BCPS Synchronisation | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Scanner State table (representative examples for wide and small swath limb state)

| Scanner State Parameter #28 | 28 | Limb_short | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Common Parameter | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 | Phase 7 | Phase 8 |
| STATE ID | 28 | | | | | | | | |
| spare | | | | | | | | | |
| Relative Scan Profile 1 Factor | 006 | | | | | | | | |
| Relative Scan Profile 2 Factor | 000 | | | | | | | | |
| Relative Scan Profile 3 Factor | 004 | | | | | | | | |
| Relative Scan Profile 4 Factor | 000 | | | | | | | | |
| Relative Scan Profile 5 Factor | 000 | | | | | | | | |
| Relative Scan Profile 6 Factor | 000 | | | | | | | | |
| Number of Scan Phases | 5 | | | | | | | | |
| Duration of Phase [msec] | | 00001300 | 00048937 | 00000250 | 00001438 | 00000840 | 00000000 | 00000000 | 00000000 |
| Phase Type | | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Azimuth Centering of Relative Scan Profile | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Azimuth Filtering | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Az. Inverse Rel. Scan Profile for Even Scan | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Azimuth Correction of nominal Scan Profile | | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 |
| Azimuth Relative Scan Profile Identifier | | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| H/W constellation | | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 |
| Azimuth Basic Scan Profile Identifier | | 2 | 2 | 9 | 9 | 0 | 0 | 0 | 0 |
| Azimuth Number of Repetition of Rel. Scan | | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |
| spare | | | | | | | | | |
| Elevation Centering of Relative Scan Profile | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Elevation Filtering | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| El. Inverse Rel. Scan Profile for Even Scan | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Elevation Correction of nominal Scan Profile | | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 |
| Elevation Relative Scan Profile Identifier | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| spare | | | | | | | | | |
| Elevation Basic Scan Profile Identifier | | 2 | 2 | 9 | 9 | 0 | 0 | 0 | 0 |
| Elevation Number of Repetition of Rel. Scan | | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |

| Scanner State Parameter #34 | 34 | Limb_short | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Common Parameter | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Phase 6 | Phase 7 | Phase 8 |
| STATE ID | 34 | | | | | | | | |
| spare | | | | | | | | | |
| Relative Scan Profile 1 Factor | 006 | | | | | | | | |
| Relative Scan Profile 2 Factor | 000 | | | | | | | | |
| Relative Scan Profile 3 Factor | 000 | | | | | | | | |
| Relative Scan Profile 4 Factor | 000 | | | | | | | | |
| Relative Scan Profile 5 Factor | 000 | | | | | | | | |
| Relative Scan Profile 6 Factor | 000 | | | | | | | | |
| Number of Scan Phases | 5 | | | | | | | | |
| Duration of Phase [msec] | | 00001300 | 00048937 | 00000250 | 00001438 | 00000840 | 00000000 | 00000000 | 00000000 |
| Phase Type | | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Azimuth Centering of Relative Scan Profile | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Azimuth Filtering | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Az. Inverse Rel. Scan Profile for Even Scan | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Azimuth Correction of nominal Scan Profile | | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 |
| Azimuth Relative Scan Profile Identifier | | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| H/W constellation | | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 |
| Azimuth Basic Scan Profile Identifier | | 2 | 2 | 9 | 9 | 0 | 0 | 0 | 0 |
| Azimuth Number of Repetition of Rel. Scan | | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |
| spare | | | | | | | | | |
| Elevation Centering of Relative Scan Profile | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Elevation Filtering | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| El. Inverse Rel. Scan Profile for Even Scan | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Elevation Correction of nominal Scan Profile | | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 |
| Elevation Relative Scan Profile Identifier | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| spare | | | | | | | | | |
| Elevation Basic Scan Profile Identifier | | 2 | 2 | 9 | 9 | 0 | 0 | 0 | 0 |
| Elevation Number of Repetition of Rel. Scan | | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 |

State Duration table

| State ID | Restart Time | (SDPU) Mode | SDPU Duration (Number of BCPS) | Wait Measurement Execution | State Duration | Scanner Reset Wait |
|---|---|---|---|---|---|---|
| 1 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 2 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 3 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 4 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 5 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 6 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 7 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 8 | 255 | STANDARD | 640 | 10217 | 11151 | 172 |
| 9 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 10 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 11 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 12 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 13 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 14 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 15 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 16 | 255 | STANDARD | 192 | 3049 | 5713 | 873 |
| 17 | 255 | STANDARD | 480 | 7657 | 10050 | 940 |
| 18 | 255 | STANDARD | 480 | 7657 | 10050 | 940 |
| 19 | 255 | STANDARD | 480 | 7657 | 10050 | 940 |
| 20 | 255 | STANDARD | 480 | 7657 | 10050 | 940 |
| 21 | 255 | STANDARD | 480 | 7657 | 10050 | 940 |
| 22 | 255 | STANDARD | 512 | 8169 | 10562 | 940 |
| 23 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 24 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 25 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 26 | 255 | STANDARD | 480 | 7657 | 8591 | 172 |
| 27 | 27 | LIMB | 648 | 10345 | 11279 | 172 |
| 28 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 29 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 30 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 31 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 32 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 33 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 34 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 35 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 36 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 37 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 38 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 39 | 255 | STANDARD | 192 | 3049 | 5442 | 940 |
| 40 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 41 | 27 | LIMB | 810 | 12937 | 13871 | 172 |
| 42 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 43 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 44 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 45 | 255 | STANDARD | 1040 | 16617 | 17551 | 172 |
| 46 | 255 | STANDARD | 160 | 2537 | 3471 | 172 |
| 47 | 255 | STANDARD | 1056 | 16873 | 18171 | 8 |
| 48 | 255 | STANDARD | 192 | 3049 | 5977 | 873 |
| 49 | 255 | STANDARD | 2080 | 33256 | 34554 | 8 |
| 50 | 255 | STANDARD | 48 | 745 | 2043 | 8 |
| 51 | 255 | STANDARD | 1024 | 16361 | 17659 | 8 |
| 52 | 255 | STANDARD | 480 | 7657 | 9911 | 801 |
| 53 | 255 | STANDARD | 352 | 5609 | 7286 | 8 |
| 54 | 255 | STANDARD | 192 | 3049 | 3988 | 177 |
| 55 | 27 | LIMB | 837 | 13369 | 14303 | 172 |
| 56 | 255 | STANDARD | 640 | 10217 | 11156 | 177 |
| 57 | 255 | STANDARD | 2048 | 32744 | 33685 | 179 |
| 58 | 255 | STANDARD | 352 | 5609 | 7286 | 8 |
| 59 | 255 | STANDARD | 192 | 3049 | 5523 | 875 |
| 60 | 255 | STANDARD | 352 | 5609 | 7286 | 8 |
| 61 | 255 | STANDARD | 192 | 3049 | 5977 | 873 |
| 62 | 255 | STANDARD | 480 | 7657 | 10175 | 801 |
| 63 | 255 | STANDARD | 480 | 7657 | 8591 | 172 |
| 64 | 255 | STANDARD | 64 | 1001 | 2299 | 8 |
| 65 | 255 | STANDARD | 320 | 5097 | 10803 | 172 |
| 66 | 255 | STANDARD | 176 | 2793 | 4091 | 8 |
| 67 | 255 | STANDARD | 1280 | 20456 | 21392 | 174 |
| 68 | 255 | STANDARD | 48 | 745 | 2043 | 8 |
| 69 | 255 | STANDARD | 1280 | 20456 | 22932 | 877 |
| 70 | 255 | STANDARD | 1280 | 20456 | 23122 | 875 |

## Timeline summary (set 36)

| Set 36 | | | Set 36 | | |
|---|---|---|---|---|---|
| **TL ID** | **TL** | **Duration (sec)** | **TL ID** | **TL** | **Duration (sec)** |
| 36_01_01 | SOC_beg_SOC_end_limb_sun_ns | 355,57421875 | 36_01_02 | SOC_beg_SOC_end_lmt_sun_ns | 362,32421875 |
| 36_02_01 | SOC_beg_SOC_150_limb_sun_ns_pt | 291,57812500 | 36_02_02 | SOC_beg_SOC_150_lmt_sun_ns_pt | 298,32812500 |
| 36_03_01 | SOC_150_SOC_end_sun_fs | 11,84375000 | 36_09_02 | SOC__22_SOC_end_asmd_ndfo | 43,12109375 |
| 36_04_01 | SOC_150_SOC_end_sun_exm_fs | 11,84375000 | 36_16_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 2866,74218750 |
| 36_05_01 | SOC_150_SOC_end_sun_exm_pt | 12,84375000 | 36_17_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 2920,92578125 |
| 36_06_01 | SOC_150_SOC_end_sun_exm_ns | 19,84375000 | 36_18_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 2989,48437500 |
| 36_07_01 | SOC__22_SOC_end_sun_esmd_ndfo | 42,57812500 | 36_19_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 3043,66796875 |
| 36_08_01 | SOC__22_SOC_end_sun_esmd_ndfi | 43,60937500 | 36_20_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 3112,22656250 |
| 36_09_01 | SOC__22_SOC_end_asmd_ndfo | 43,12109375 | 36_21_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 3180,78515625 |
| 36_10_01 | SOC__17_SOC_end_asmd_atm | 45,12109375 | 36_22_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 3249,34375000 |
| 36_11_01 | MOC_beg_MOC_200_moon_pt | 47,44140625 | 36_23_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 3317,90234375 |
| 36_12_01 | MOC_beg_MOC_end_moon_pt | 135,44531250 | 36_24_02 | SOC_end_MOC_beg_limb_nadir_sq1 | 3386,46093750 |
| 36_13_01 | MOC_200_MOC_end_moon_ns | 19,44140625 | 36_25_02 | sub_beg_MOC_beg_limb_nadir_sq1 | 1014,26171875 |
| 36_14_01 | SOC_end_ecl_beg_lmt_nadir_sq1 | 3843,37500000 | 36_26_02 | sub_beg_MOC_beg_limb_nadir_sq1 | 1068,44531250 |
| 36_15_01 | SOC_end_ecl_beg_lmt_nadir_sq2 | 3856,06250000 | 36_27_02 | sub_beg_MOC_beg_limb_nadir_sq1 | 1137,00390625 |
| 36_16_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2307,21484375 | 36_28_02 | sub_beg_MOC_beg_limb_nadir_sq1 | 1191,18750000 |
| 36_17_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2375,77343750 | 36_29_02 | sub_beg_MOC_beg_limb_nadir_sq1 | 1259,74609375 |
| 36_18_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2429,95703125 | 36_30_02 | sub_beg_MOC_beg_limb_nadir_sq1 | 1328,30468750 |
| 36_19_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2498,51562500 | 36_31_02 | sub_beg_MOC_beg_limb_nadir_sq1 | 1396,86328125 |
| 36_20_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2552,69921875 | 36_32_02 | sub_beg_MOC_beg_limb_nadir_sq1 | 1465,42187500 |
| 36_21_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2621,25781250 | 36_33_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 758,00781250 |
| 36_22_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2675,44140625 | 36_34_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 689,44921875 |
| 36_23_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2744,00000000 | 36_35_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 620,89062500 |
| 36_24_01 | SOC_end_MOC_beg_limb_nadir_sq1 | 2798,18359375 | 36_36_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 552,33203125 |
| 36_25_01 | sub_beg_MOC_beg_limb_nadir_sq1 | 523,29296875 | 36_37_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 483,77343750 |
| 36_26_01 | sub_beg_MOC_beg_limb_nadir_sq1 | 577,47656250 | 36_38_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 415,21484375 |
| 36_27_01 | sub_beg_MOC_beg_limb_nadir_sq1 | 646,03515625 | 36_39_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 346,65625000 |
| 36_28_01 | sub_beg_MOC_beg_limb_nadir_sq1 | 700,21875000 | 36_40_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 278,09765625 |
| 36_29_01 | sub_beg_MOC_beg_limb_nadir_sq1 | 768,77734375 | 36_41_02 | MOC_end_ecl_beg_limb_nadir_sq1 | 209,53906250 |
| 36_30_01 | sub_beg_MOC_beg_limb_nadir_sq1 | 822,96093750 | 36_56_02 | sub_beg_MOC_beg_cal_monthly_orb1 | 866,10937500 |
| 36_31_01 | sub_beg_MOC_beg_limb_nadir_sq1 | 891,51953125 | 36_57_02 | MOC_end_ecl_beg_cal_monthly_spec_orb1 | 801,15625000 |
| 36_32_01 | sub_beg_MOC_beg_limb_nadir_sq1 | 945,70312500 | 36_09_03 | SOC__22_SOC_end_asmd_ndfo | 43,12109375 |
| 36_33_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 1317,53515625 | 36_16_03 | SOC_end_MOC_beg_limb_nadir_sq1 | 3455,01953125 |
| 36_34_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 1263,35156250 | 36_17_03 | SOC_end_MOC_beg_limb_nadir_sq1 | 3523,57812500 |
| 36_35_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 1194,79296875 | 36_25_03 | sub_beg_MOC_beg_limb_nadir_sq1 | 1533,98046875 |
| 36_36_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 1140,60937500 | 36_26_03 | sub_beg_MOC_beg_limb_nadir_sq1 | 1602,53906250 |
| 36_37_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 1072,05078125 | 36_27_03 | sub_beg_MOC_beg_limb_nadir_sq1 | 1671,09765625 |
| 36_38_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 1017,86718750 | 36_28_03 | sub_beg_MOC_beg_limb_nadir_sq1 | 1739,65625000 |
| 36_39_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 949,30859375 | 36_33_03 | MOC_end_ecl_beg_limb_nadir_sq1 | 140,98046875 |
| 36_40_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 895,12500000 | 36_34_03 | MOC_end_ecl_beg_limb_nadir_sq1 | 72,42187500 |
| 36_41_01 | MOC_end_ecl_beg_limb_nadir_sq1 | 826,56640625 | 36_56_03 | sub_beg_MOC_beg_cal_monthly_orb1 | 988,85156250 |
| 36_42_01 | MOC_200_MOC_end_nadir | 72,42187500 | 36_57_03 | MOC_end_ecl_beg_cal_monthly_spec_orb1 | 642,46484375 |
| 36_43_01 | MOC_beg_MOC_end_nadir | 140,98046875 | 36_09_04 | SOC__22_SOC_end_asmd_ndfo | 43,12109375 |
| 36_44_01 | ecl_beg_ecl_end_cal_orbit_daily_2 | 1288,13281250 | 36_56_04 | sub_beg_MOC_beg_cal_monthly_orb1 | 1057,41015625 |
| 36_45_01 | SOC_end_ecl_beg_nadir_pt_left | 3843,14453125 | 36_57_04 | MOC_end_ecl_beg_cal_monthly_spec_orb1 | 505,34765625 |
| 36_46_01 | SOC_end_ecl_beg_nadir_pt | 3843,14453125 | 36_09_05 | SOC__22_SOC_end_asmd_ndfo | 43,12109375 |
| 36_47_01 | SOC_end_ecl_beg_limb_nadir_sq1 | 3866,37109375 | | | |
| 36_48_01 | SOC_end_sub_beg_limb_nadir_sq1 | 1762,06250000 | | | |
| 36_49_01 | sub_beg_ecl_beg_limb_nadir_sq1 | 2013,89062500 | | | |
| 36_50_01 | SOC_end_ecl_beg_limb_nadir_sq2 | 3880,74609375 | | | |
| 36_51_01 | SOC_end_sub_beg_limb_nadir_sq2 | 1762,06250000 | | | |
| 36_52_01 | sub_beg_ecl_beg_limb_nadir_sq2 | 1959,70703125 | | | |
| 36_53_01 | ecl_beg_ecl_end_cal_orbit_daily_1 | 1288,13281250 | | | |
| 36_54_01 | ecl_beg_ecl_end_cal_w eekly_monthly | 1233,26171875 | | | |
| 36_55_01 | SOC_end_sub_beg_cal_monthly_spec_orb1 | 1711,24218750 | | | |
| 36_56_01 | sub_beg_MOC_beg_cal_monthly_orb1 | 811,92578125 | | | |
| 36_57_01 | MOC_end_ecl_beg_cal_monthly_spec_orb1 | 869,71484375 | | | |
| 36_58_01 | SOC_end_sub_beg_cal_monthly_spec_orb2_orb3 | 1666,23828125 | | | |
| 36_59_01 | sub_beg_ecl_beg_cal_monthly_spec_orb2 | 1993,17187500 | | | |
| 36_60_01 | sub_beg_ecl_beg_cal_monthly_spec_orb3 | 1902,49609375 | | | |
| 36_61_01 | ecl_beg_ecl_end_cal_monthly_spec_orb2 | 1300,55078125 | | | |
| 36_62_01 | ecl_beg_ecl_end_cal_monthly_spec_orb3 | 1297,72265625 | | | |
| 36_63_01 | ecl_beg_ecl_end_ADC_cal | 46,06250000 | | | |