European Space Agency

Research and Scientific Support Department

Planetary Missions Division

Venus Express

Science Activity Plan for
Extended Mission
SAP-E-2

VEX-SCIOPS-PL-029_3_0

Issue 3, Rev 0

October 29, 2009

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CHANGE RECORD SHEET

Date	Iss.	Rev.	pages	Description/Authority	CR No.
20 Aug 2004	1	0	All	first go	
February 20, 2008	1	1	All	SAP till the end of Extended mission	
March 15, 2008	1	2	All	SAP till the end of Extended Mission (May 2009, MTP#40) approved at the La Thuile'08 Workshop	
March 30, 2009	2	0	All	SAP for the period June 2009-August 2010, MTPs#41-56	
April 15, 2009	2	1	All	1). Plots with orbital tracks projected on the surface added. 2). Minor corrections to the text	
October 29, 2009	3	0	Front page and headers	The document filename and version is changed, to differentiate from version RSSD-PL-025 v1.2 (the latest doc from SAP-E period). This document SAP-E-2 was renamed into SCIOPS-PL-029 v3.0. The version was increased to 3.0 (note there are no lower versions) to keep the change record sheet and Livelink versioning.	

Revisions are indicated by a vertical bar at the outside border.

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TABLE OF CONTENT

1. INTRODUCTION

1.1 Introduction

Venus Express (VEX) is ESA's first mission to Venus. It has a payload consisting of seven scientific instruments, ASPERA, PFS, SPICAV/SOIR, VeRa and VIRTIS, with heritage from Mars Express (MEX) and Rosetta, and MAG and VMC, which are new instruments. The spacecraft was inserted in orbit on April 11, 2006 and since June 2006 performs routine science observations. The Nominal Mission ended on October 2, 2007. However the mission extension till the end of 2009 was approved. The VEX Science Operations Centre (VSOC) has the task to coordinate the scientific operations of the VEX mission.

1.2 Scope of the document

The Science Activity Plan for Venus Express Extended Mission (SAP-E-2) describes in a structured way the scientific activities to be carried out throughout the second extended mission (June 2009 till August 2010, or MTPs#41-56). It follows the objectives set out in the Science Requirements Document (AD6), and is enhanced with specific information applicable to each phase of the mission, as provided by VSOC and the Science Working Team during meetings and in written correspondence. It also includes the requests, per MTPs (Medium Term Planning cycle of 28 days), from each individual instrument team for the observations required to fulfil the different objectives for the respective phases. SAP-E-2 contains preliminary MTP timelines (sequences of science cases) agreed by the VEX Science Team. The timelines will be later used as starting point for detailed discussion of each MTP planning. This document will for quite a period be a living document due to its iterative nature. In this respect the document can be considered as a combination of the long term plan and the medium term plan as outlined in the VSOC development plan. Once this document has been established and agreed, it will be used as an input for the detailed short-term plan.

1.3 General observation strategy for Extended Mission

The Venus Express Extended Mission has the following strategic objectives:

- Improve and complete spatial and temporal observational coverage;
- Study in detail the phenomena discovered in the Nominal Mission;
- Take advantage of the new operation modes (case#2 “pendulum”, spot pointing etc)
- Perform pericentre lowering down to the altitude that still allows usual operations without entering aerobraking mode (~170-270 km);
- Perform necessary studies and tests preparing the spacecraft for future aerobraking campaign.

1.4 Applicable Documents

1.4.1 Higher-level documents

AD2: Venus Express Mission Definition Report, ESA-SCI(2001)6, SCI(2001) October 2001

AD3: VEX-RSSD-PL-005_D_2_SAP_implementation_plan

AD4: VEX-RSSD-TN-001_1_b_VEX_Science_Cases

AD5: VEX-RSSD-SP-001_2_0_VSOC_Design_Specification_and_Requirements

AD6: VEX-RSSD-SP-002_1_1_VEX_Science_Requirements_Document

AD7: VEX-RSSD-LI-004_2_0_VEX_science_themes

AD8: VEX-T.ASTR.-TCN-00665_3/0_Science_Cases_Definition_and_Study_Assumptions

AD9: VEX-T.ASTR-TCN-00932_3/0_Synthesis_of_Science_Cases_Analysis, May 29, 2006.

AD10: VEX-T.ASTR-UM-01098_1/1_ Flight User Manual

AD11: VEX-RSSD-TN-0003_1/0_Thermal constraints and science planning

AD12:VEX-RSSD-TN-0006_1/1_Proposal for the post-FAR thermal analysis of the science cases

AD13: Venus Express science cases thermal analyses report, Draft, December 2005.

1.4.2 Documents on the same level

TBD

1.4.3 Lower-level documents

TBD

1.5 Reference Documents

TBD

1.6 Abbreviations

Note: A complete list of all experiment abbreviations and mission phases is given in RD1.

S/C	Spacecraft
CVP	Commissioning and Verification Phase
FoV	Field of View

1.7 Definitions

2. SCIENCE OPERATIONS PLANNING

2.1 Overview

Ten types of orbital science operations (called "science cases") were designed and studied early in the mission planning. They are now used as building blocks to design the Science Activity Plan. In order to check the experiment inputs and to merge them into a consolidated timeline, the VSOC uses a planning concept and two computer based planning tools: MAPPS and EPS. The concept and the tools are described below.

2.2 Science Cases

Science Cases are typical scientific orbital operations to be used as building blocks in the SAP development. The following ten science cases were designed in the early phase of mission planning (AD4, AD8).

Case #1: Pericentre observations (spacecraft sizing case)

Case #2: Off-pericentre observations

Case #3: Apocentre VIRTIS mosaic

Case #4: VeRa bistatic sounding

Case #5: SPICAV stellar occultation

Case #6: SPICAV solar occultation

Case #7: Limb observations

Case #8: VeRa radio occultation

Case #9: VeRa solar corona studies

Case #10: VeRa gravity anomaly studies

The Astrium study of the science cases (AD9) proved their feasibility with some constraints related to the thermal aspects and having seasonal implications.

2.3 SAP planning concept

In order to develop the Science Activity Plan a step-wise approach will be used. A detailed description of the steps are given in the SAP implementation plan (AD3). Current SAP (section

2.3.4) does not impose any limitations on number of cases as soon as the operational constraints (thermal, power, pointing etc) are not violated.

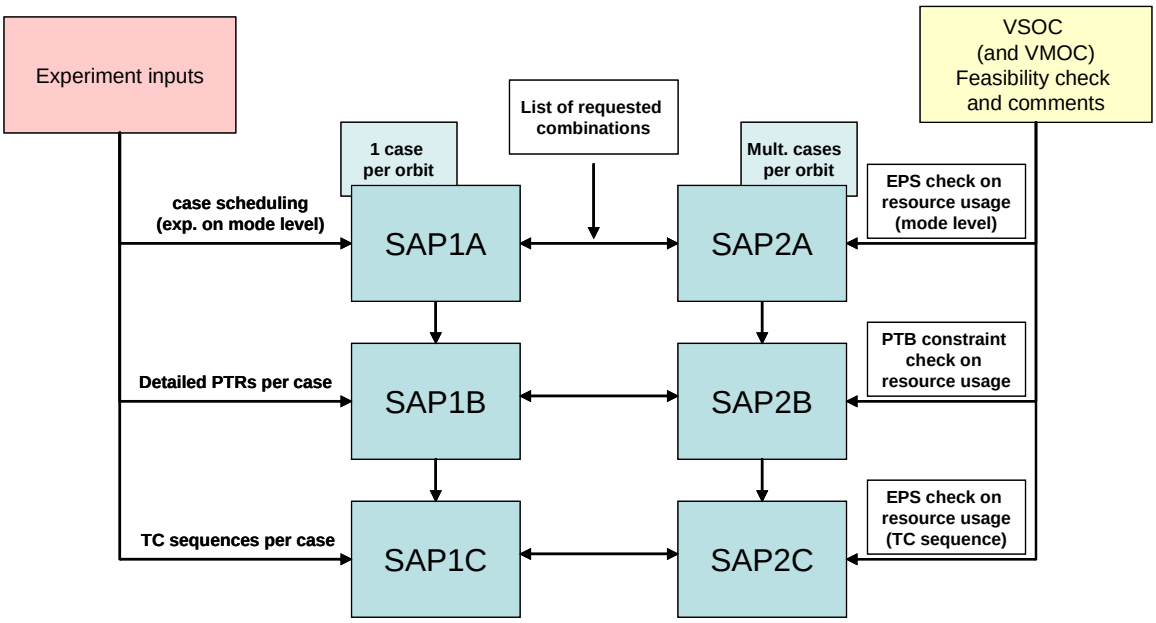


Figure 2.1 *SAP overview diagram*

2.4 MAPPS

MAPPS is a software package that will be used to analyze and plan the mapping of Venus. For Venus Express the EPS (see below) will be integrated within MAPPS. As a result MAPPS will also be able to make the necessary resource validation and conflict checking.

2.5 EPS

The Experiment Planning Software (EPS) is being used in the production of the Science Activity Plan. The particular functions of EPS used for this task are:

- Model and operate experiments on mode level (Experiment Description File, EDF)
- Consistency checks between the instrument timelines (ITL) on mode level
- Consistency check between the sequences and commands contained within the VMIB.
- Consistency checks between the instrument timelines (ITL) and the VMIB.

- ITL verification on mode level, EPS execution is prevented if ITL actions/transitions not consistent with mode.
- Modelling the resource allocation over the operational timeline.
- Output POR files for ingestion into VMOC MCS.

The use of EPS in planning is discussed in more detail in throughout this document. For more information on the capabilities of EPS refer to the user manual [AD xx].

2.6 Venus Express orbit and visibility of the ground stations

The Venus Express was inserted in a polar orbit with a period of 24 hours. The pericentre altitude was maintained between 250 km and 350 km during the first 8 months of the Extended Mission. In July-August, 2008 the pericenter was lowered to the corridor 170-270 km to allow plasma observations in this altitude range. This pericentre lowering does not require any changes in observations strategy or special spacecraft operations. The apocenter altitude is kept at about 66,000 km. In September 2009 the pericentre latitude will reach the Northern pole.

The Venus Express orbit is divided in three parts (figure 2.2): two of them allocated for observations and the third one for telecommunications with the ground station.

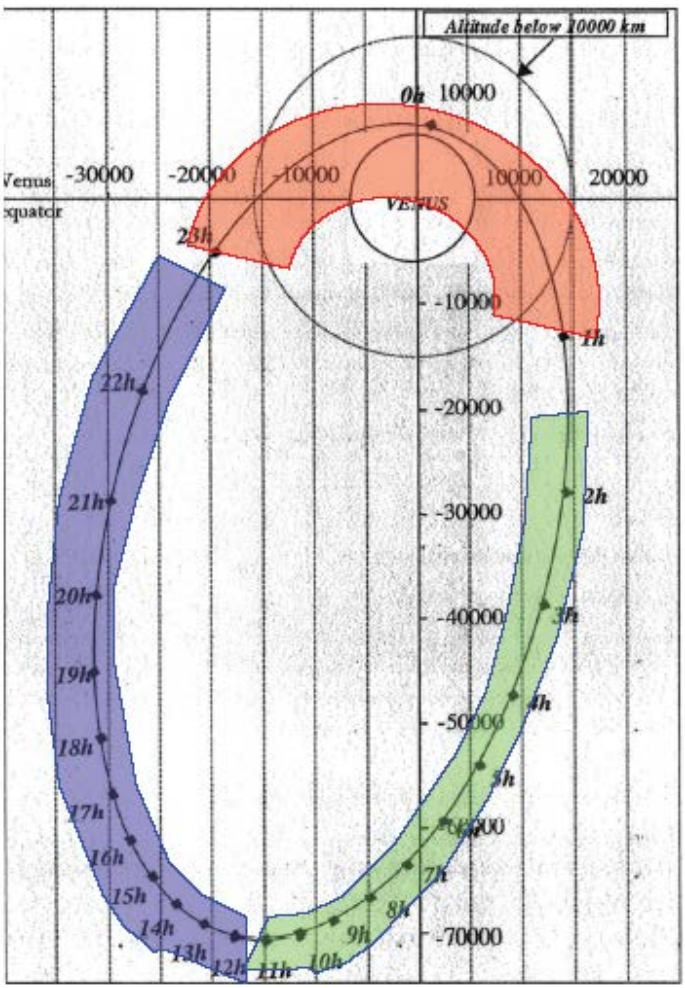


Figure 2.2 *The Venus Express orbit and orbital phases: red- pericentre observations, blue off-pericentre observations in ascending branch, green – telecommunications with Cebreros.*

Communication with Earth takes place in each orbit after the pericentre passage, i.e. in the descending part of

the orbit. The orbit period is tuned such that the communication window always falls in daytime at the primary ground station Cebreros. Figure 2.3 shows visibility of the Cebreros station from the satellite. The lower of the upper two lines shows the end of telecommunication slot. Its duration does not exceed 10 hours even in case visibility of the planet is longer. The periods when the telecommunication phase ends early enough provide favorable conditions for the Case#3 apocentric mosaic since the observations can be carried out around pericentre. These periods are marked in figure 2.3.

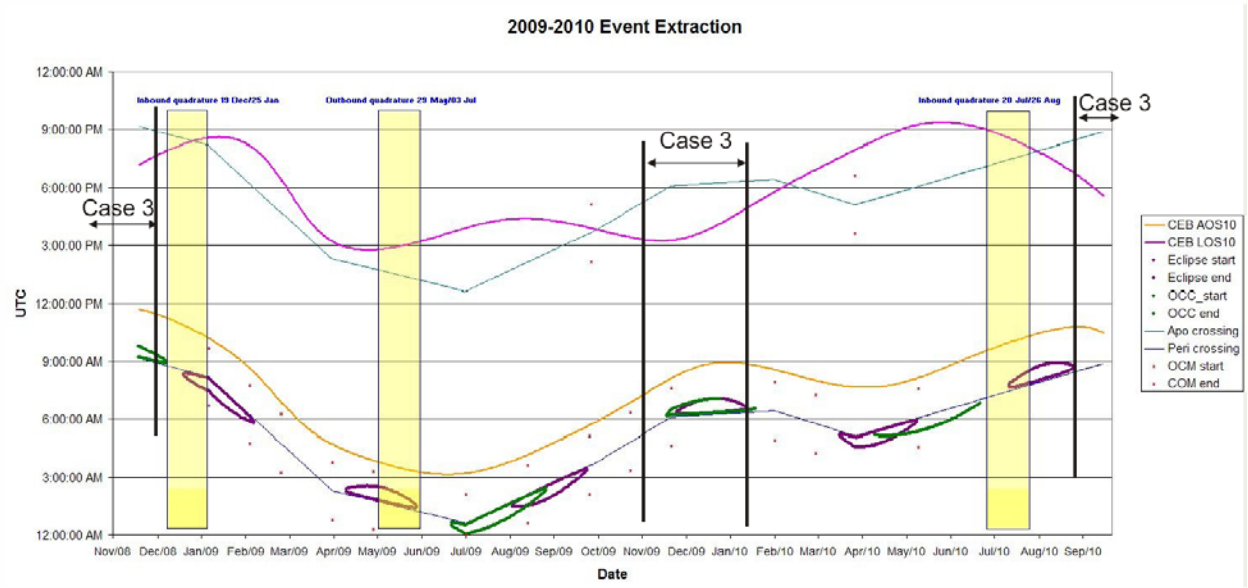


Figure 2.3 *Visibility of the Cebreros ground station from the satellite.*

The ground station at New Norcia, Australia, will be visible around pericentre and will be used for the radio science experiments. The DSN support to the VeRa bi-static radar, solar corona, and some radio occultations as well as the support for the data downlink in the periods of low data rate is agreed between ESA and NASA.

3. THE SAP-E-2 PROPER

This section gives an overview of the Science Activity Plan for Extended Mission as a whole (chapter 3.1). It is followed by descriptions of payload activity during the period covering MTP#41-56 (June 2009-August 2010). Depending on environmental conditions (occultation, illumination conditions etc.), the science will focus on different mission objectives.

3.1 Science Activity Plan overview

3.1.1 Coverage

The SAP-E-2 (SAP for 2-d extension) will cover in detail the period from June 2009 till August 2010, or MTP range from #41 till #56.

3.1.2 Mission Objectives

The Venus Express mission aim is a global investigation of the Venus atmosphere, plasma environment and some important aspects of the surface. The detailed Science Objectives of the Venus Express mission are described in AD6.

3.1.3 Main principles of the SAP development

The SAP development was based on the following principles:

1. Complete and uniform coverage of the science themes;
2. Balance between distant and close-up views of the planet;
3. Balance between the observations of the Northern and Southern hemisphere;
4. Synergy between experiments in covering science objectives;
5. Use of multiple science cases in each orbit taking into account mission constraints (thermal, pointing, data volume etc);
6. Even distribution of pericentic science cases with priority given to the solar and Earth radio occultation experiments in specific seasons of the mission;
7. Maximum compliance with the current flight rules.

3.1.4 Extended Mission overview

Extended mission overview is given in the Annexe 1.

3.1.5 Instruments objectives and Request Summary

3.1.5.1 Introduction

In this section the individual objectives for each instrument are summarised and their over all operational requests are listed.

3.1.5.2 ASPERA

ASPERA shall be ON during the entire mission thus permanently collecting data. Strategically the ASPERA activity will consist of two parts: survey observations in the beginning of the mission and more specific, more detailed observations performed on selected part of orbit later in the mission. Data is collected at different rates depending on the selected mode.

3.1.5.3 MAG

MAG shall be ON during the entire mission and would permanently collect data. Data is collected at different rates depending on the selected mode.

3.1.5.4 PFS

PFS experiment was not operational during the nominal mission despite of several attempts to unblock the scanning mechanism.

3.1.5.5 SPICAV

Environment dependent. The main goal of the SPICAV experiment is to sound the Venus atmosphere in solar and stellar occultation geometry with sufficient latitude and local time coverage. In these cases SPICAV will define the spacecraft pointing profile. SPICAV stellar occultation that require +Z axis pointing to a star at the limb will be combined with the

observations of other +Z looking instruments. In case of stellar occultation observations of dark limb are preferable.

Environment independent. (1). Nadir observations by SPICAV will be performed together with other +Z looking experiments. (2). SPICAV will observe the Venus hydrogen corona. For this purpose in apocentre the s/c will perform a 90 degrees slew from nadir pointing and back.

3.1.5.6 VeRA

The VeRa experiment will perform 4 kinds of *"environment dependent"* observations.

(1) Earth occultation with as good as possible latitude and local time coverage of Venus. Attitude profile in this experiment is the most demanding for the spacecraft AOCS system. It will be provided by the VeRa PI for each radio-occultation individually and will define the pointing for the other experiments. It would be highly desirable to select the orientation of the spacecraft +Z axis during radio occultation so that the +Z looking instruments could simultaneously see the planet.

(2). Bi-static sounding of surface targets. These observations are abandoned since autumn 2007 due to power loss in the S-band.

(3). Solar Corona observations. These observations are abandoned since autumn 2007 due to power loss in the S-band.

(4). Gravity anomaly. This investigation consists of precise tracking of the spacecraft while it passes over global geological formations on Venus solid body. It will be carried out twice during the nominal mission.

The VeRa experiment is mainly performed using the ESA New Norcia station. Support from the DSN antennae for the VeRa experiments as well as for the data downlink is agreed between ESA and NASA.

3.1.5.7 VIRTIS

Environment independent. VIRTIS goal is to provide spectral mapping of Venus with moderate spectral resolution and high spectral resolution observations preferably imbedded in the spectral

maps. The off-pericentre and apocentre observations will be organized in special VIRTIS campaigns. They will consist of similar sessions performed on several (about 5) consecutive orbits and would allow continuous temporal coverage of atmospheric dynamical phenomena. In these periods VIRTIS will define VEX operations (e.g. pointing). VIRTIS specific pointing request concerns the apocentric observations in which the experiment will take twelve images organised in a raster of 3x3 images of the whole Venus disc. That would require 12 spacecraft re-pointings by an angle of < 5 deg. These mosaics campaign will be performed in specific seasons of the mission when the telecoms with Cebreros station end relatively early (figure 2.4)

Environment dependent. VIRTIS will provide spectral mapping of specific surface targets in order to search for traces of volcanic activity, provide thermal mapping of geologically interesting regions. This type of activity is possible on the night side only.

3.1.5.8 VMC

Environment independent. The task of VMC is to perform wide-angle imaging of Venus in 4 narrow spectral channels. VMC has no specific pointing requirements.

Environment dependent. VMC will provide imaging of specific surface targets in order to provide thermal maps of geologically interesting regions. This type of activity is possible when the spacecraft is in eclipse.

3.2 MTP #41

3.2.1 Scientific focus

MTP#41 is in quadrature period, meaning that communications with Cebreros are hot due to VMC sun avoidance requirement. For this reason all observations should be cold. However in this particular MTP, which also coincides with eclipse season, hot solar occultations were allowed. This was achieved by skipping one Cebreros pass and shortening the second one in order to comply with thermal recovery time. In the orbit #1144 the HGA2→ HGA1 flip was performed that brought the downlink from very low to very high level.

3.2.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 12- 15h
- Quadrature and Hot season
- Night side surface targets: Atla Regio.
- Data rate: changes from very low (~200 Mbits/orbit) to very high (~6000 Mbit/orbit)

3.2.3 Timeleine

Dates: 31.05 – 27.06.2009

Orbits #1136-1163

Figures 3.1 and 3.2 show observations timeline and planet coverage by orbital tracks.

The meaning of the symbols in the planet coverage plots is as follows: yellow triangle – s/c enters and exits solar eclipse, blue triangle – s/c enters and exits Earth occultation. Note that the night and day on the planet in the planet coverage plots is valid for the LAST orbit of the considered MTP.

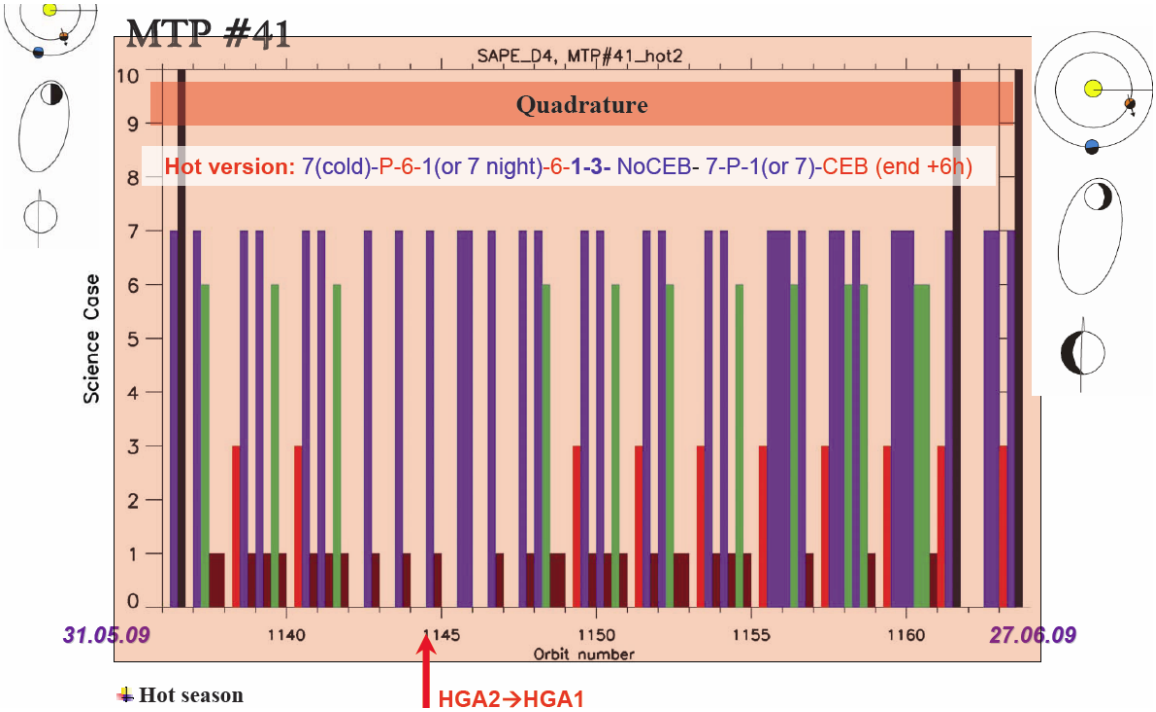


Figure 3.1 *MTP#41 timeline.*

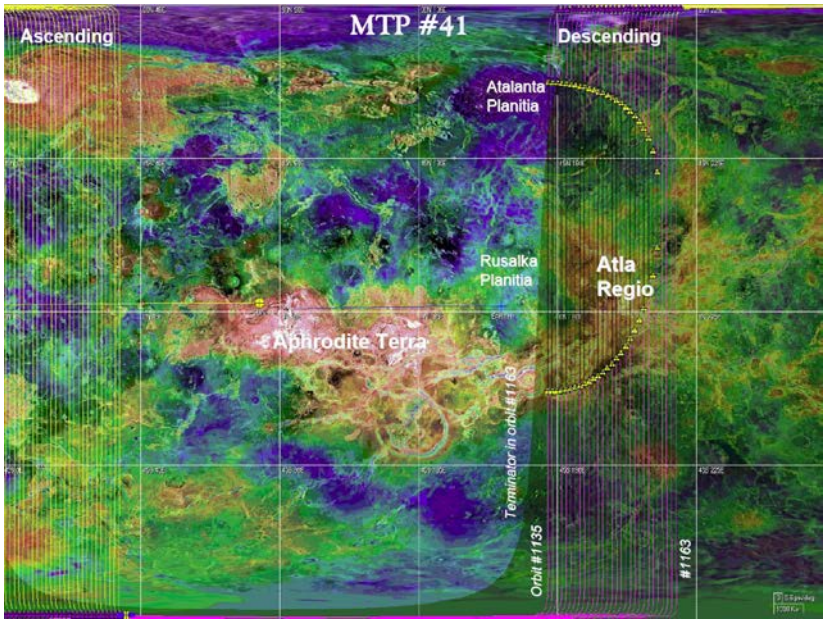


Figure 3.2. *Planet coverage by orbital tracks (see the note in 3.2.3)*

3.3 MTP #42

3.3.1 Scientific focus

First seven orbits of this MTP are in quadrature season so no hot observations are allowed. After the quadrature period the timeline will include observations of the day side (evening sector) on ascending arc and night limbs after pericentre. The last third of the MTP is in the radio-occultation season, so VeRa observations will be given priority and will take almost all pericentre passes.

3.3.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 15-18 h
- Quadrature period (#1164-1169)
- Radio-occultation season (#1182-1191)
- The data rate is high

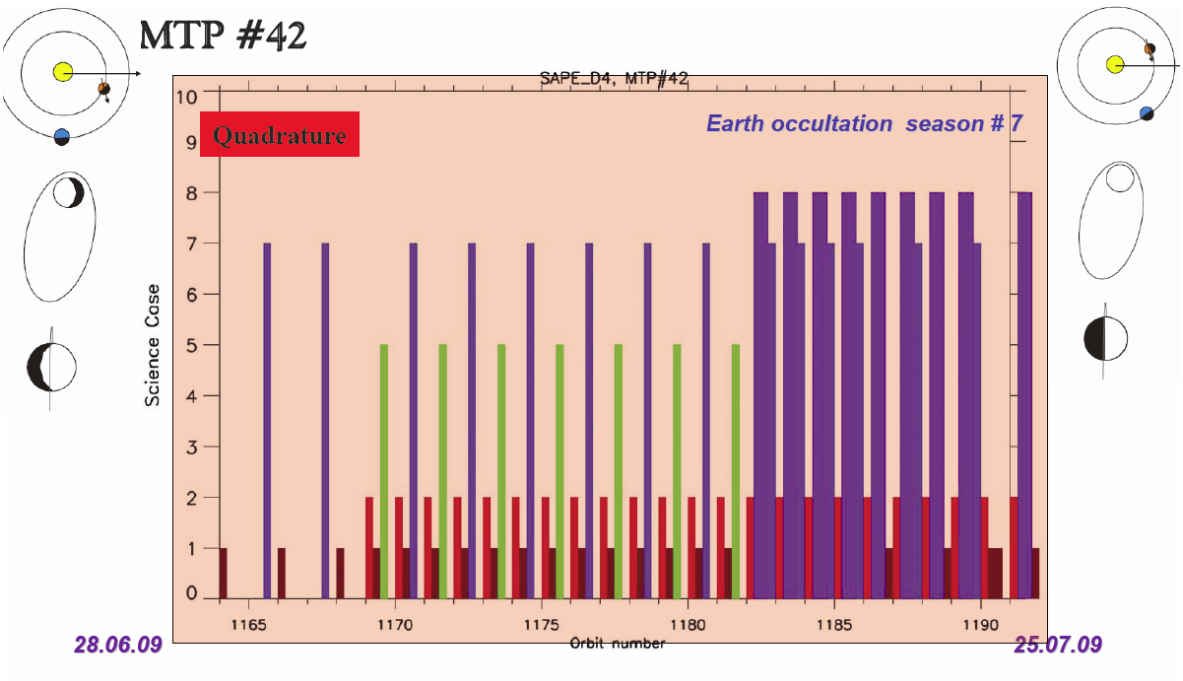


Figure 3.3 *MTP#42 timeline.*

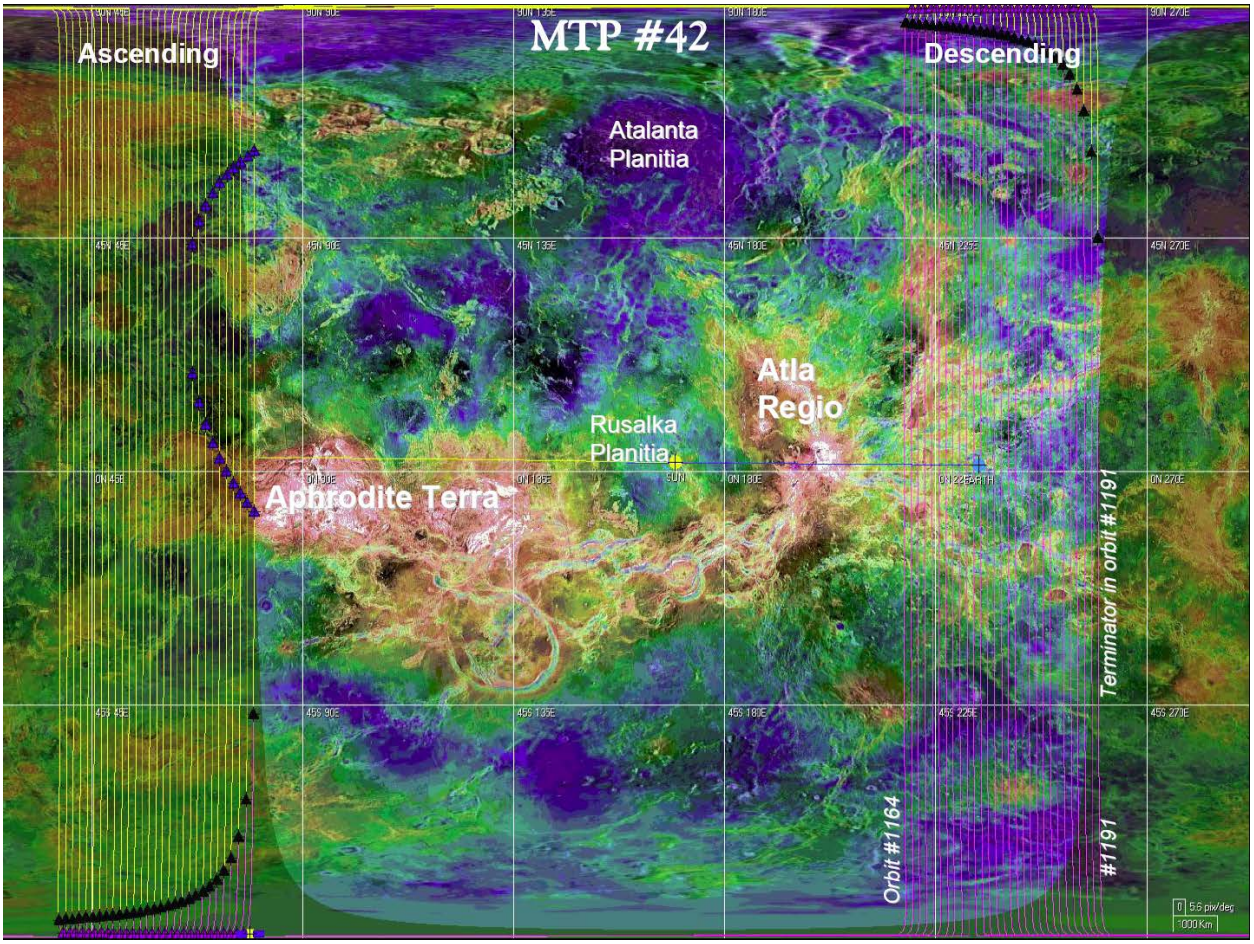


Figure 3.4 *Planet coverage by orbital tracks in MTP #42(see the note in 3.2.3)*

3.3.3 Timeline

Dates: 28.06 – 25.07.2009

Orbits # 1164- 1191

Figures 3.3 and 3.4 show observations timeline and planet coverage by orbital tracks.

3.4 MTP #43

3.4.1 Scientific focus

MTP #43 covers the period from 26.07 till 22.08.2009 and orbits # 1192 – 1219. The MTP contains Earth occultation season #7, so VeRa observations have priority. The details of the VeRa radio-occultations are in the Synoptic table in Annexe 3. The first orbit of the MTP (#1192) have OCM in pericentre so no observations are planned. The MTP is cold and has high data rate. Local time at ascending note changes from 18h to 21h, so in the beginning observations at ascending arc will study evening sector of the planet. Figures 3.5 and 3.6 show observations timeline and planet coverage by orbital tracks.

3.4.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 18h – 21h
- Cold period
- Radio Occultations (see Annexe 3)

3.4.3 Specific observations by the instruments

- SPICAV
    - Cases #5 and #7 (night-side, before pericenter) are not favorable in first 10 orbits of MTP because of proximity of bright limb. However they are very interesting in second half of MTP but pointing is likely hot.
    - Nadir observations around terminator (SO_2) in the beginning of MTP
- VMC
    - Night limb before pericentre (O_2 emission and surface)
    - Day side nadir (with off-set) after pericenter
    - Spot pointing after pericenter on the day side for phase function studies in each 3-4 orbits

- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentre in every 5-th (tbd) orbit
- Radio Occultations (see Annexe 3)

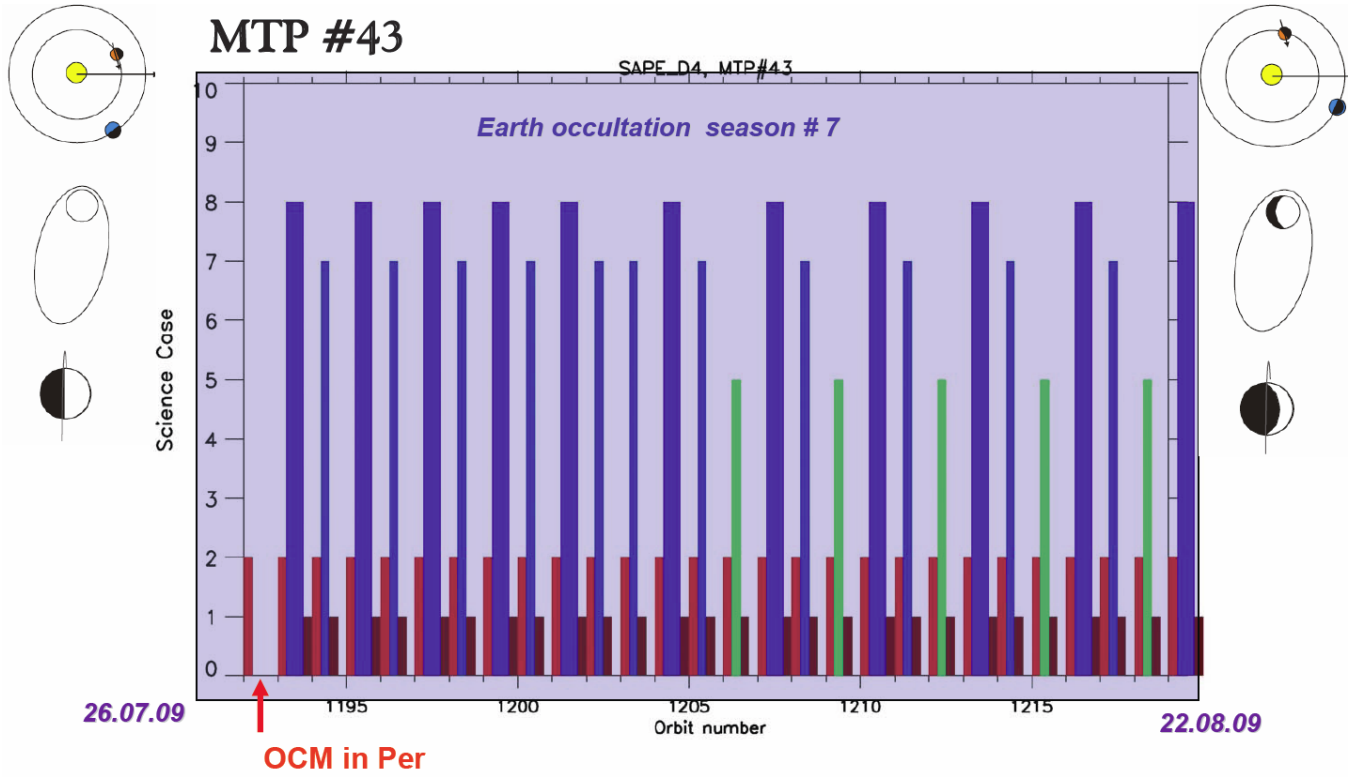


Figure 3.5 MTP #43 timeline

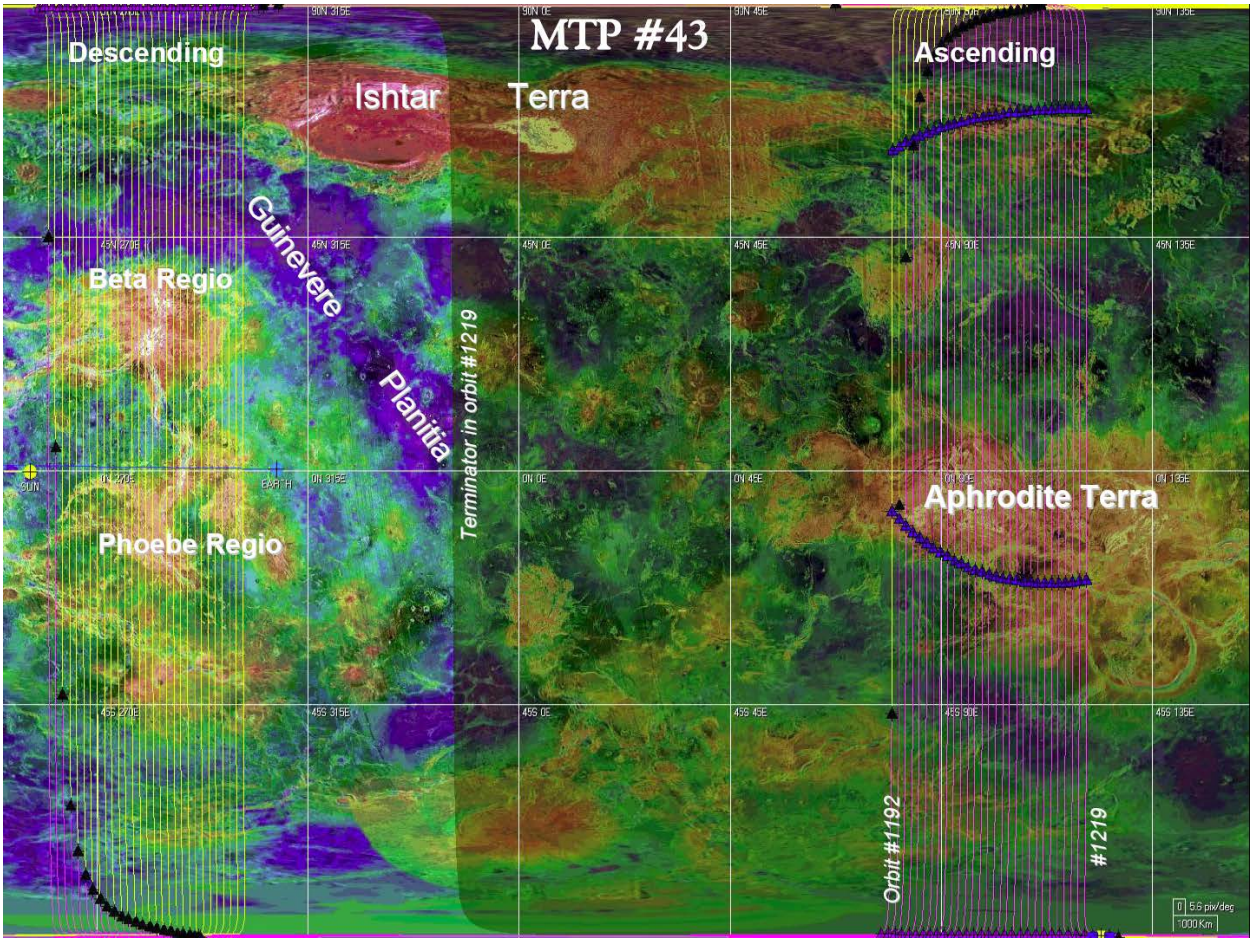


Figure 3.6 *Planet coverage by orbital tracks in MTP #43 (see the note in 3.2.3)*

3.5 MTP #44

3.5.1 Scientific focus

MTP #44 covers the period from 23.08 till 19.09.2009 and orbits # 1220 – 1247. The MTP contains both Earth occultation season #7 and eclipse season #12 starting from orbit #1224. Both occur before pericentre. Earth and solar occultations alternate but VeRa is given slightly higher priority. SPICAV "losses" will be compensated in the next MTP #44. The details of the VeRa radio-occultations are in the Synoptic table in Annexe 3. The MTP is cold and has moderate data

rate. Local time at ascending note changes from 21h to 24h, so on the descending arc illumination conditions will be ideal to study the day side. So it is requested to allow observations until at least +2:30 delaying the beginning of Cebreros communication pass. Figures 3.7 and 3.8 show observations timeline and surface coverage. Proposed timeline includes alternation of two types of orbits:

- Type #1: cases 2-6-6-P-1 or 2-6-1-6-P-1
- Type #2: cases 2-8-8-P-1

3.5.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 21 - 24 h
- Earth occultations season #7
- Eclipse season #12
- OCM in pericentre in orbit #1234
- Night side surface targets: Llorona Planitia, Aphrodite Terra
- Moderate downlink

3.5.3 Specific observations by the instruments

- SPICAV
    - Solar occultation before pericentre
    - Case 5 (stellar occultation) during entire MTP, alternating with case 6 after orbit 1235, when the latitude at egress does not vary rapidly anymore.
    - Case 5 on the ascending branch, every 2-d orbit, combined with case 2.
    - In-plane exospheric limb observations after pericenter, combined with ingress case 6 every 4-5 orbits..
- VMC
    - Request to delay Cebreros pass to allow extended observations after pericentre on descending arc at least till +2:30
    - After pericentre alternating day side nadir, VMC mosaic, and spot pointing for phase function studies

- VIRTIS
  - VIRTIS-H meridional cross-sections of the night side from ~-2h till pericentre when occultations allow
  - VIRTIS-H meridional cross-sections of the night side from ~-2h till pericentre in every 3-d (tbd) orbit
- VeRa
  - Radio Occultation season #7 (see Annexe 3)

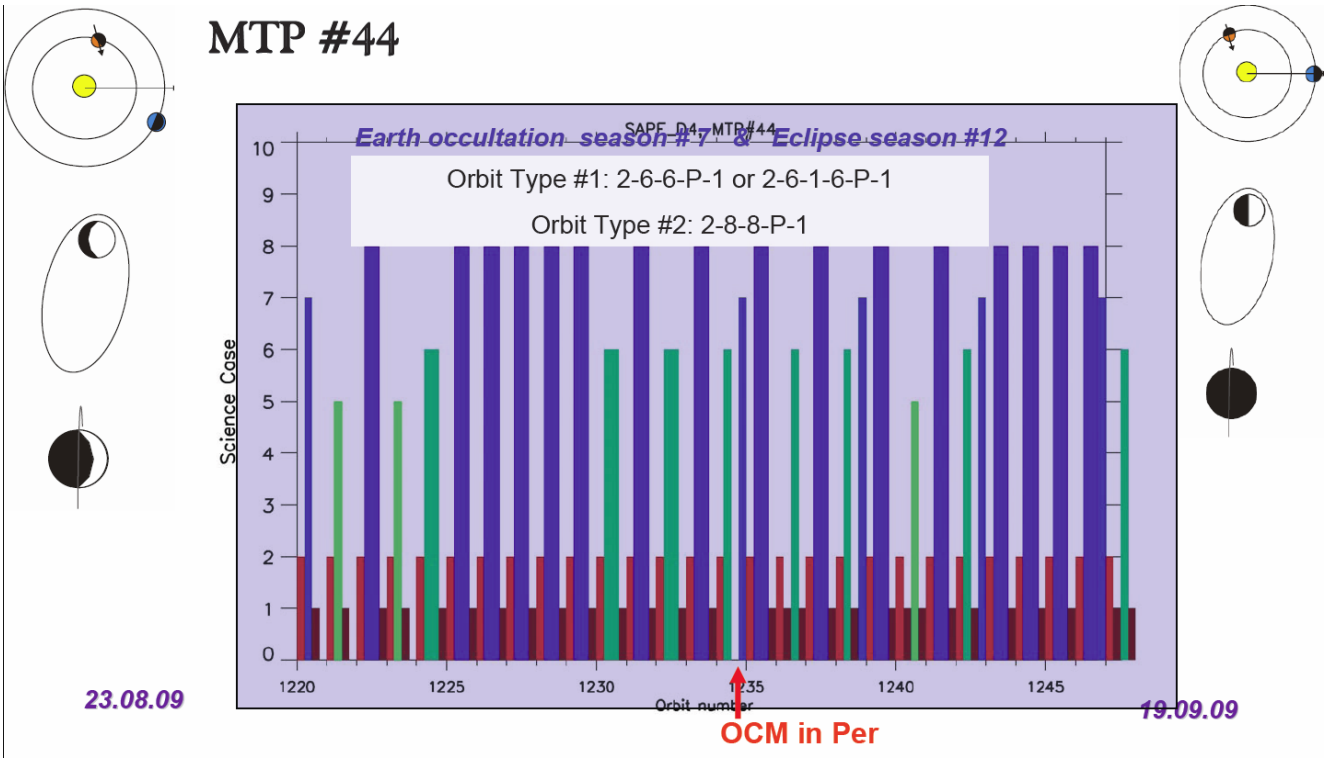


Figure 3.7 MTP#44 timeline

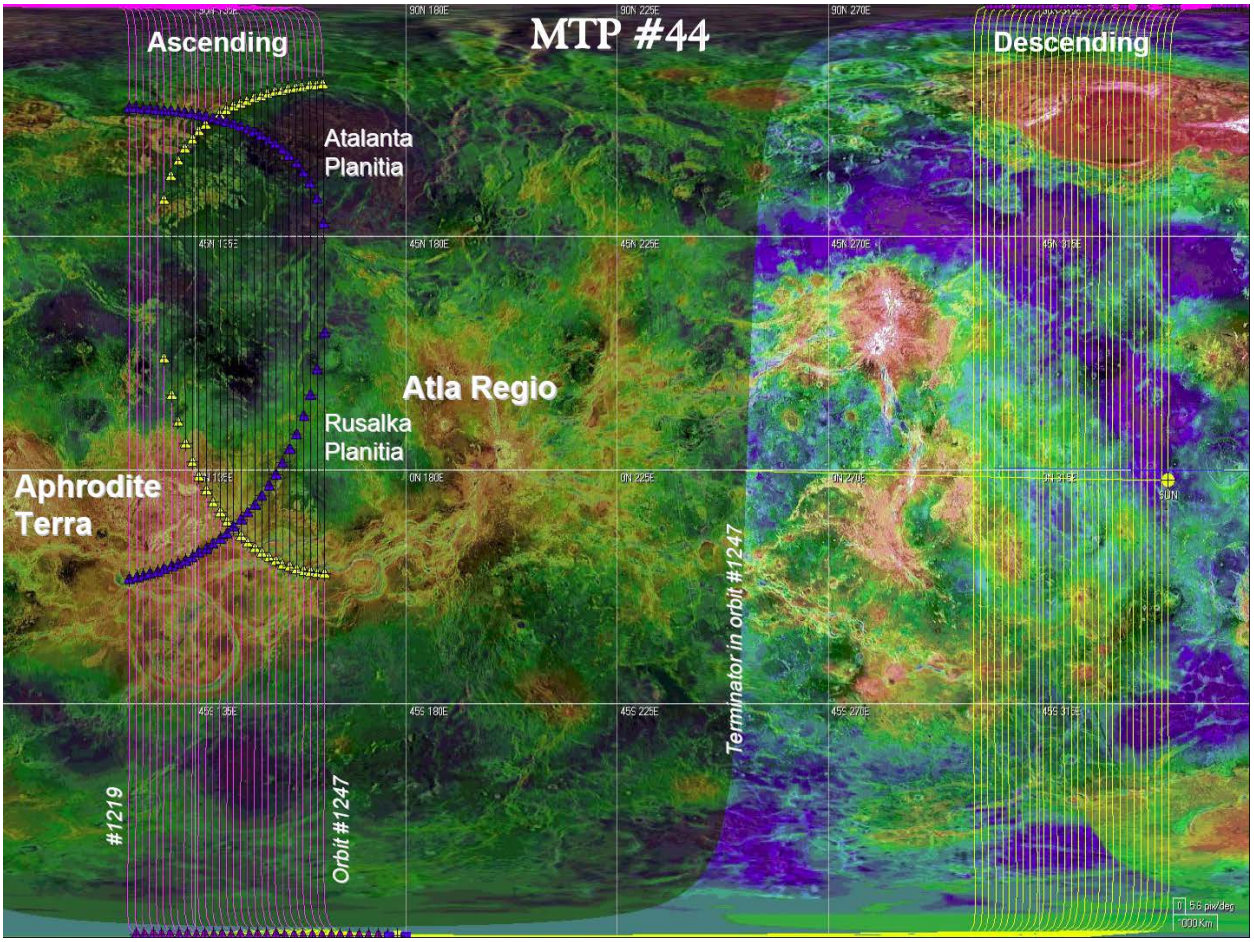


Figure 3.8 *Planet coverage by orbital tracks in MTP#44 (see the note in 3.2.3).*

3.6 MTP #45

3.6.1 Scientific focus

MTP #45 covers the period from 20.09 till 17.10.2009 and orbits #1248 – 1275. The MTP contains eclipse season #12, so SPICAV/SOIR is given priority in pericentre observations. There are 4 gravity passes scheduled in the middle of the MTP (see Annexe 3). In the end of the MTP (orbits 1271-1275) there is Drag Campaign #2, meaning that the pericentre pass will be devoted to the spacecraft tracking by NNO and no observations within +/- 2 hours from the pericentre are foreseen. The MTP is cold and has low data rate. Local time at ascending note changes from 24h

to 3h, so on the descending arc illumination conditions will be ideal to study the day side. So it is requested to allow observations until at least +2:30 delaying the beginning of Cebreros communication pass. Figure 3.9 and 3.10 show observations timeline and surface coverage. Proposed timeline includes alternation of two types of orbits:

- Type #1: cases 2-5-6-P-1(or 7)
- Type #2: cases 2-1-6-P-1

3.6.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 0-3 h.
- Eclipse season #12 (contd)
- Gravity #10 campaign
- Drag campaign #2 (orbits 1271-1275)
- Low data rate

3.6.3 Specific observations by the instruments

- SPICAV
    - Solar occultation before pericentre
    - Campaign of nadir night side observations to characterize spatially the NO emission (centered on the equator and around 2AM), with nadir offset before LTAN=1AM and after LTAN=3AM → every 2-nd orbit in alternation with case 6.
    - Case 5 on the ascending branch, every 2-d orbit, combined with case 2.
    - In-plane exospheric limb observations after pericenter, combined with ingress case 6 every 4-5 orbits..
- VMC
    - Request to delay Cebreros pass to allow extended observations after pericentre on descending arc at least till +2:30

- After pericentre alternating day side nadir, VMC mosaic, and spot pointing for phase function studies

- VIRTIS
  - VIRTIS-H meridional cross-sections of the night side from ~-2h till pericentre when occultations allow
  - VIRTIS-H meridional cross-sections of the night side from ~-2h till pericentre in every 3-d (tbd) orbit
- VeRa
  - Gravity #10 (see Annexe 3)
  - Atmospheric drag campaign #2

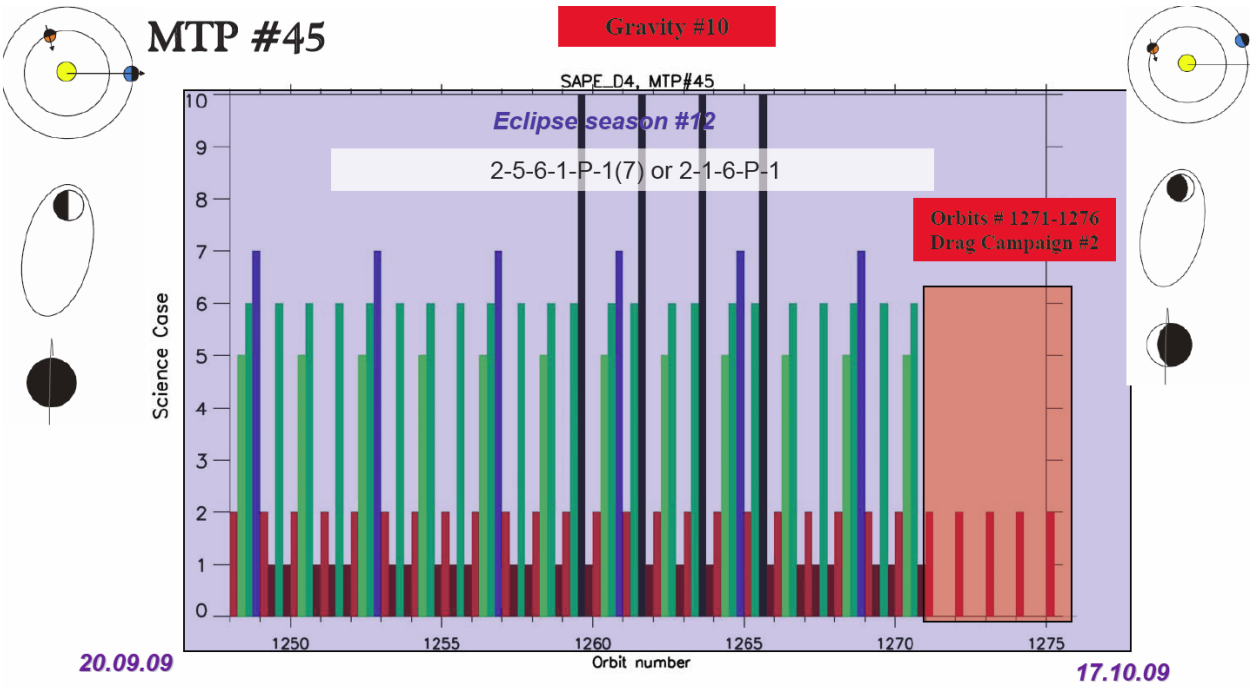


Figure 3.9 MTP#45 timeline

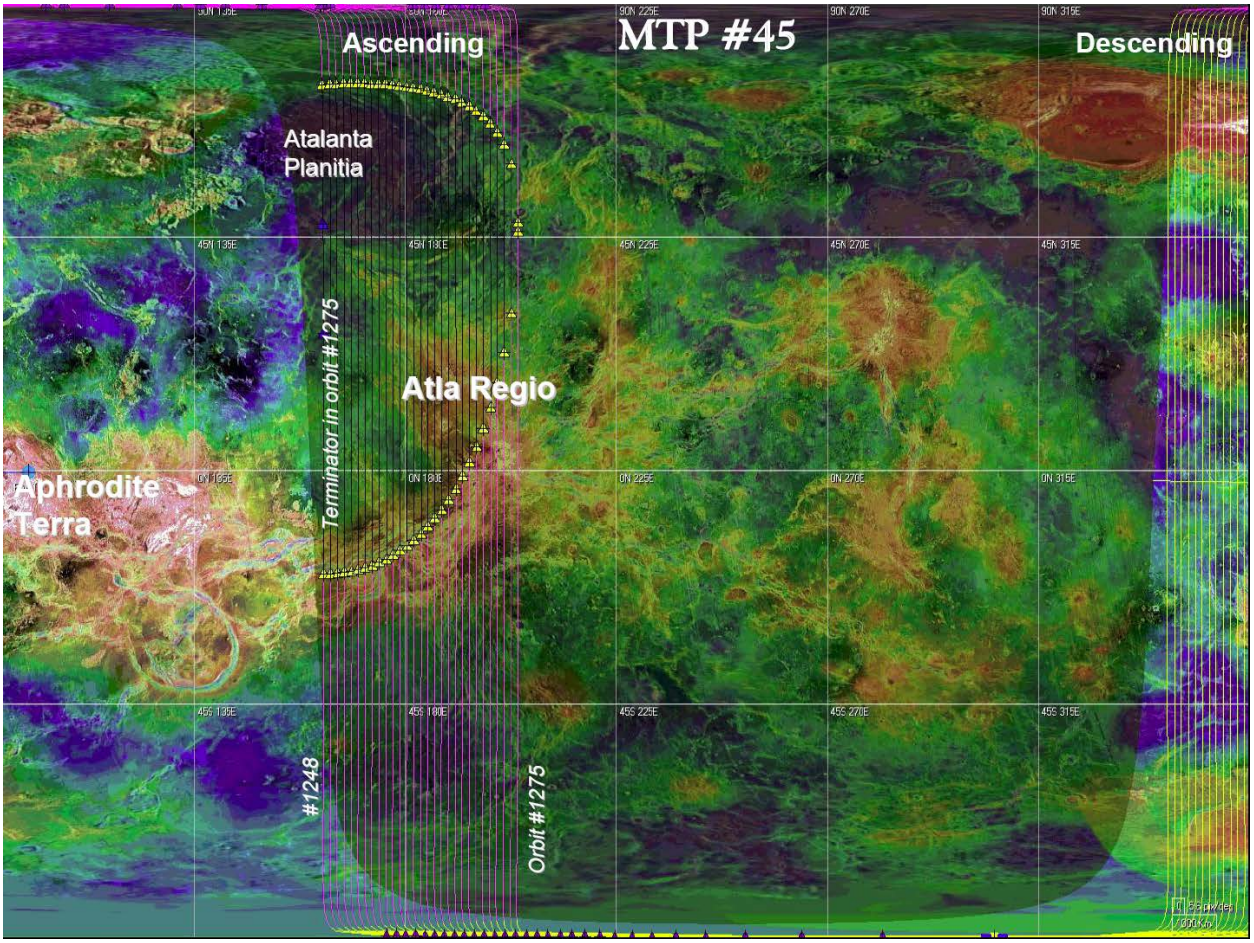


Figure 3.10 *Planet coverage by orbital tracks in MTP#45 (see the note in 3.2.3).*

3.7 MTP #46

3.7.1 Scientific focus

MTP #46 covers the period from 18.10 till 14.11.2009 and orbits #1276 – 1303. The MTP contains no peculiar seasons. The MTP is cold and has low data rate. Local time at ascending note changes from 3h to 6h. In the beginning of the MTP there are two OCMs: in pericentre in orbit #1276, and in apocentre in #1278. In the beginning of MTP pericentre crosses North pole. Figures 3.11 and 3.12 show observations timeline and planet coverage by orbital tracks.

The proposed timeline includes alternation of two types of orbits:

- Type #1: cases 2-5-P-7-1
- Type #2: cases 2-1-P-1

3.7.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 3h-6h.
- Cold season
- Specific periods: none.
- Low data rate

3.7.3 Specific observations by the instruments

- SPICAV
    - Follow-up on previous campaign of mapping NO emission on the night side - nadir offset pointing, between LTAN=3AM (~beginning of MTP) and LTAN=4AM (orbit ~1286) in every orbit.
    - Nadir observations of SO2 around terminator at the end of MTP.
- VMC
    - In the beginning of MTP day side with off-track after pericentre.
    - Night limb before pericentre
    - In the second half of MTP day side with off-track on ascending arc.
- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentret

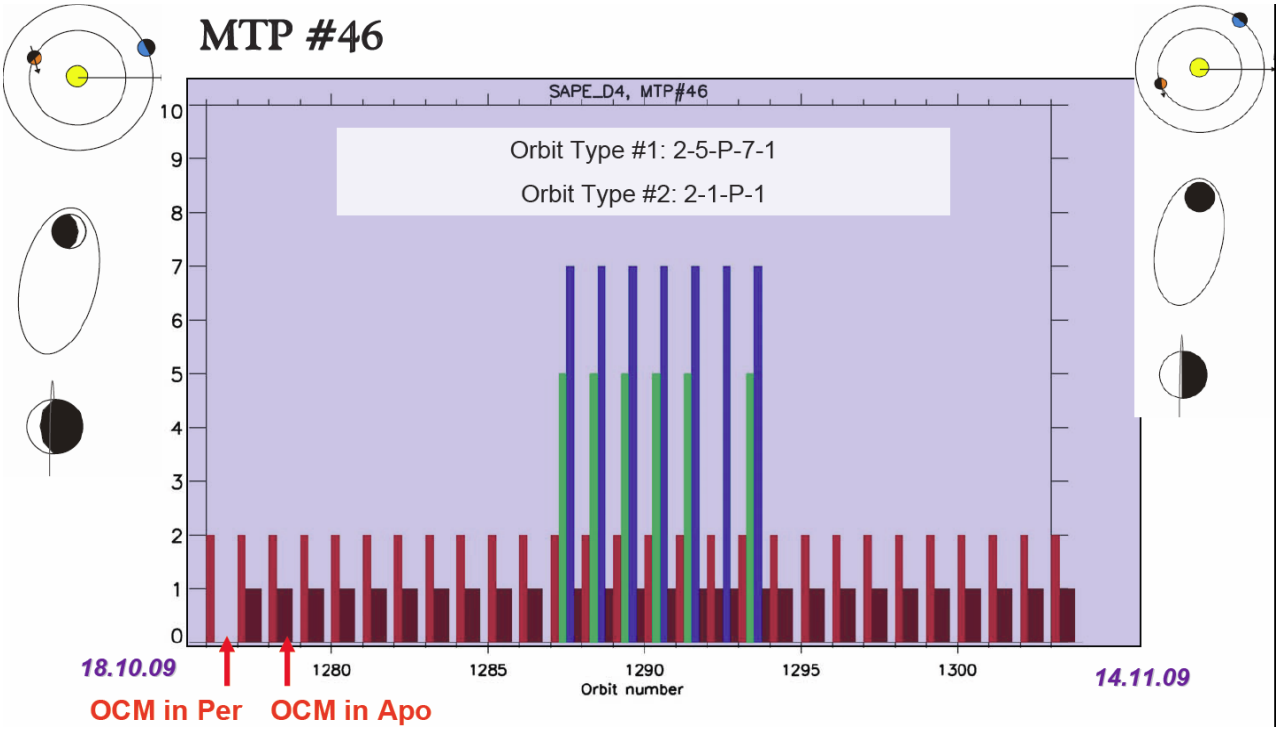


Figure 3.11 *MTP#46 timeline*

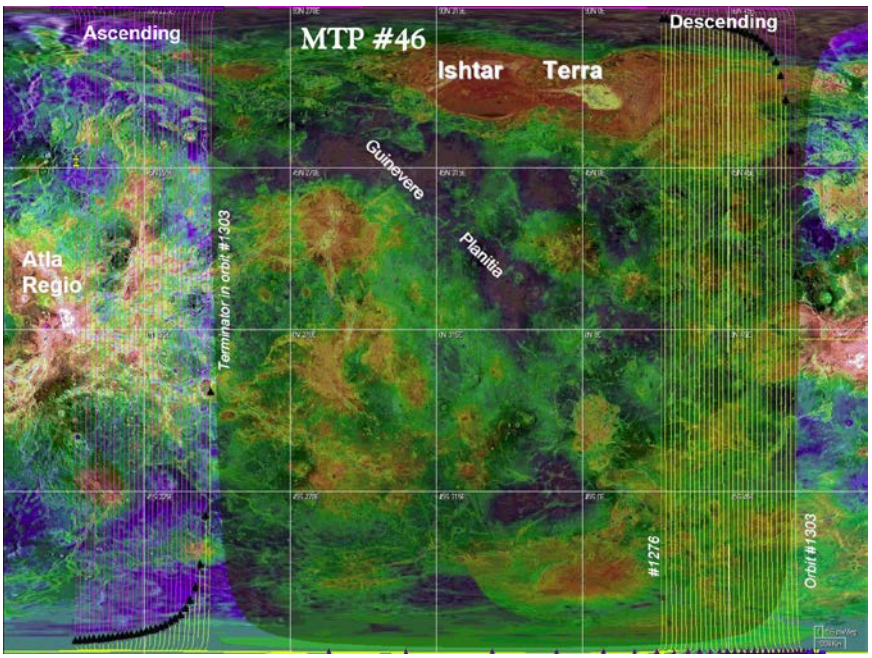


Figure 3.12 *Planet coverage by orbital tracks in MTP#46 (see the note in 3.2.3).*

3.8 MTP #47

3.8.1 Scientific focus

MTP #47 covers the period from 15.11 till 12.12.2009 and orbits #1304-1331. Earth occultation season starts in orbit 1329, but no VeRa observations are planned due proximity to conjunction. The MTP is hot and has low data rate. Local time at ascending note changes from 6h to 9h. In the beginning of the MTP there is one OCM in pericentre (orbit #1304). Figures 3.13 and 3.14 show observations timeline and planet coverage by orbital tracks. Proposed timeline includes alternation of two types of orbits:

- Type #1: cases 2-1-P-7-5
- Type #2: cases 2-1-P-7-1

3.8.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 6 - 9 h
- Hot MTP.
- Earth occultation season starts in orbit 1329, but no VeRa observations are planned due proximity to conjunction.
- Downlink is very low

3.8.3 Specific observations by the instruments

- SPICAV
    - Cases 5 and 7 in the second half of MTP(likely hot). They can be combined with between shifted pendulum.
    - Nadir observations of SO2 around terminator at the end of MTP.
- VMC
    - Day side with off-track before pericentre.
    - In the end of MTP night limb after pericentre.
- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentret

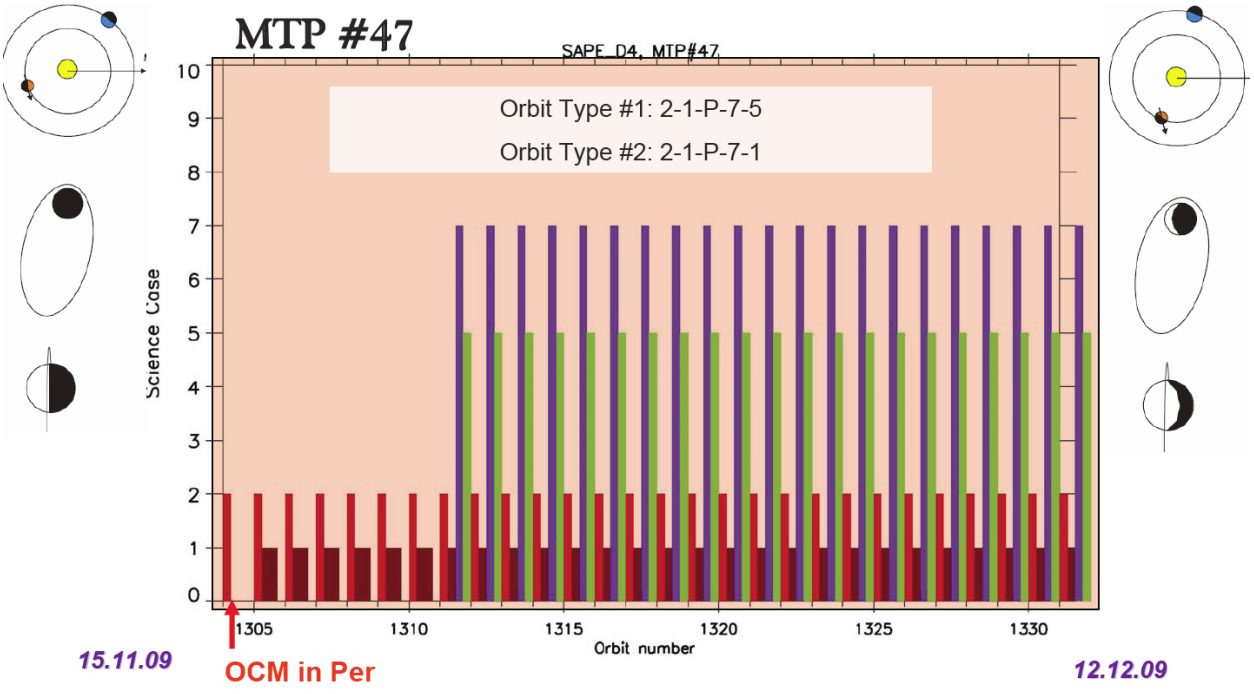


Figure 3.13 ***MTP#47*** *timeline.*

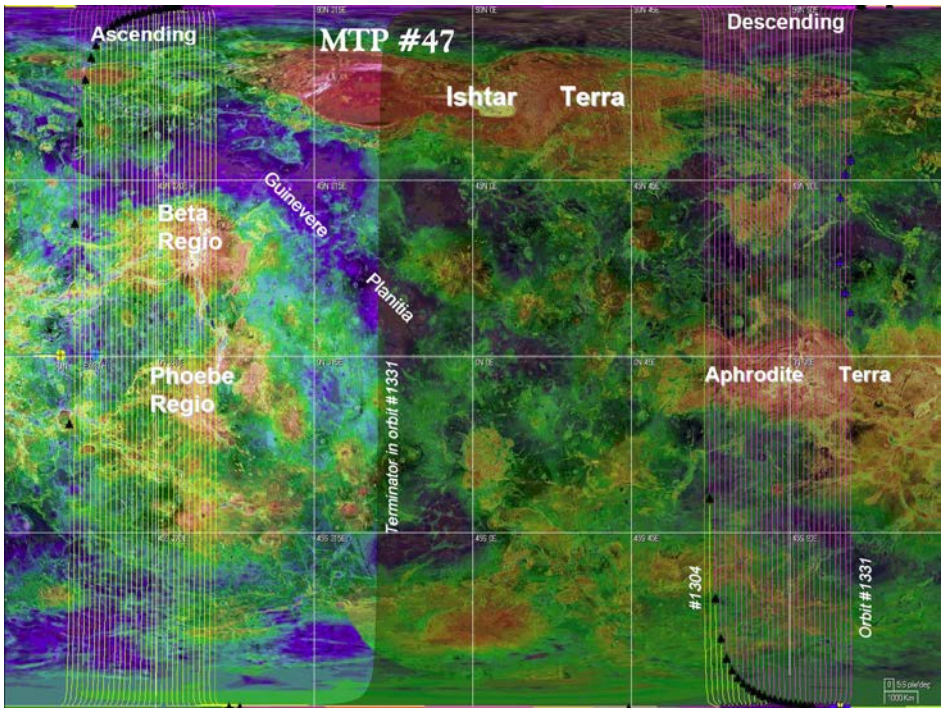


Figure 3.14 *Planet coverage by orbital tracks in MTP#47 (see the note in 3.2.3).*

3.9 MTP #48

3.9.1 Scientific focus

MTP #48 covers the period from 13.12.2009 till 9.01.2010 and orbits #1332-1358. This MTP has both earth and solar occultations, but Earth occultation cannot be made due to conjunction. Solar occultations are performed after pericentre. The MTP is hot and has very low data rate. Local time at ascending note changes from 9h to 12h. In the beginning of the MTP there is one OCM in pericentre (orbit #1332). Figures 3.15 and 3.16 show observations timeline and planet coverage by orbital tracks. Proposed timeline includes alternation of two types of orbits:

- Type #1: cases 2-1-P-6-6
- Type #2: cases 2-5-P-6-6

3.9.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 9-12 h
- Earth occultations season but VeRa will not observe due to proximity of the conjunction
- Solar occultation season #13
- Hot period
- Downlink very low
- Outage period starts in orbit 1345

3.9.3 Specific observations by the instruments

- SPICAV
    - Solar occultations after pericentre
    - Case 5 in each orbit in the beginning of MTP
    - Case 5 in ascending arc in each 2-d orbit
    - In plane exospheric limb before pericentre combined with ingress case 6 every 4-5 orbits

- VMC
    - Pendulum on ascending arc
    - Day side with off-track before pericentre.
- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentret

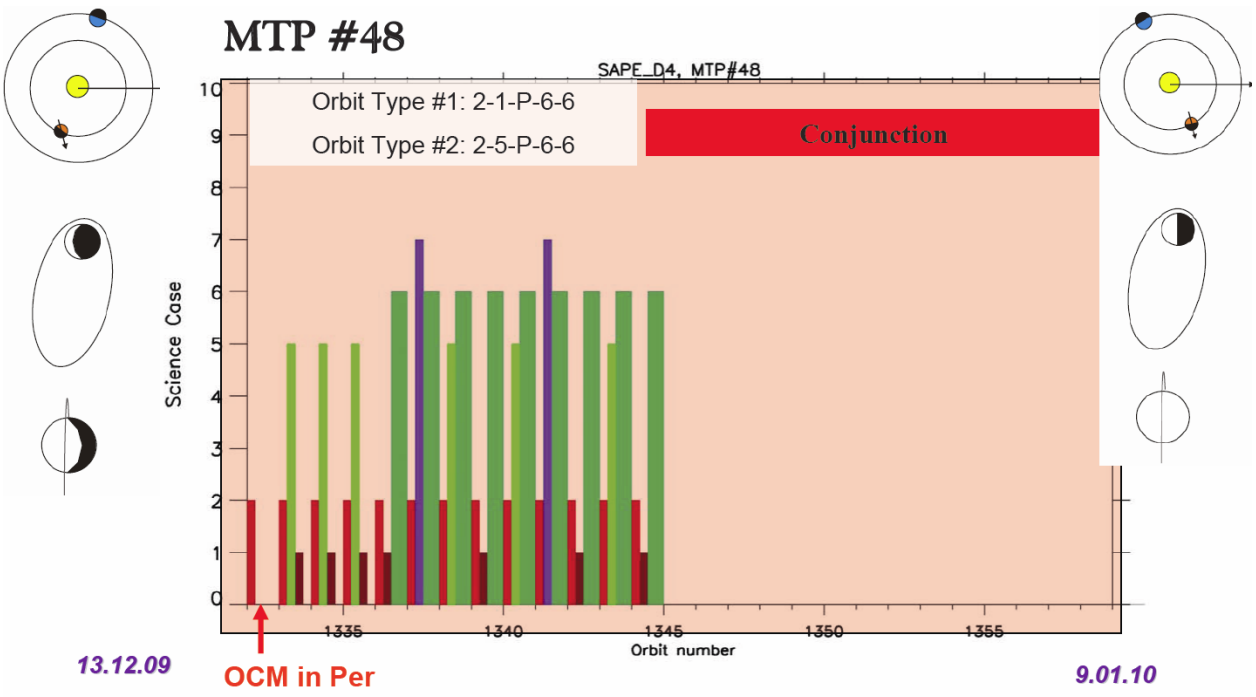


Figure 3.15 ***MTP#48*** *timeline.*

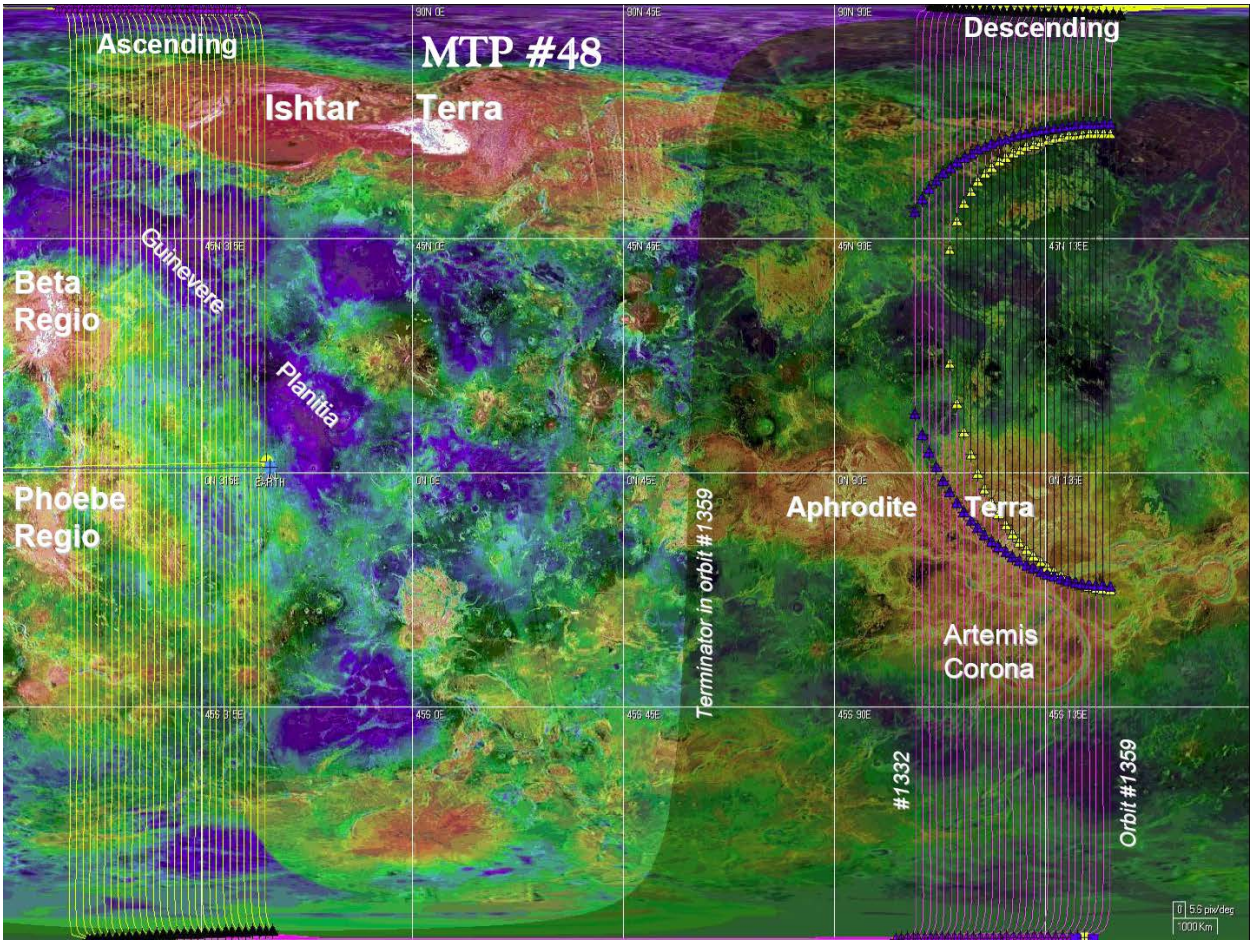


Figure 3.16 *Planet coverage by orbital tracks in MTP#48 (see the note in 3.2.3).*

3.10 MTP #49

3.10.1 Scientific focus

MTP #49 covers the period from 10.01 till 6.02.2010 and orbits #1359-1387. First 60% of the MTP are occupied by the outage when no science operations are planned. The first orbit with science operations is 1378. This MTP has both Earth and solar occultations, but VeRa does not plan any radio-occultations due to conjunction. Solar occultations are performed after pericentre. The MTP is hot and has very low data rate. Local time at ascending note changes

from 12h to 15h. Figures 3.17 and 3.18 show observations timeline and planet coverage by orbital tracks. Proposed timeline includes alternation of two types of orbits:

- Type #1: cases 2-1-P-7-5
- Type #2: cases 2-1-P-6-6

3.10.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 12-15 h
- Earth occultations season but VeRa will not observe due to proximity of the conjunction
- Solar occultation season #13
- Hot period
- Downlink is very low
- Outage period ends in orbit 1378

3.10.3 Specific observations by the instruments

- SPICAV
    - Solar occultations after pericentre until orbit 1382
    - Case 5 in ascending arc in each 2-d orbit
    - In plane exospheric limb before pericentre combined with ingress case 6 every 4-5 orbits
- VMC
    - Pendulum on ascending arc
    - Day side with off-track before pericentre.
- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentret

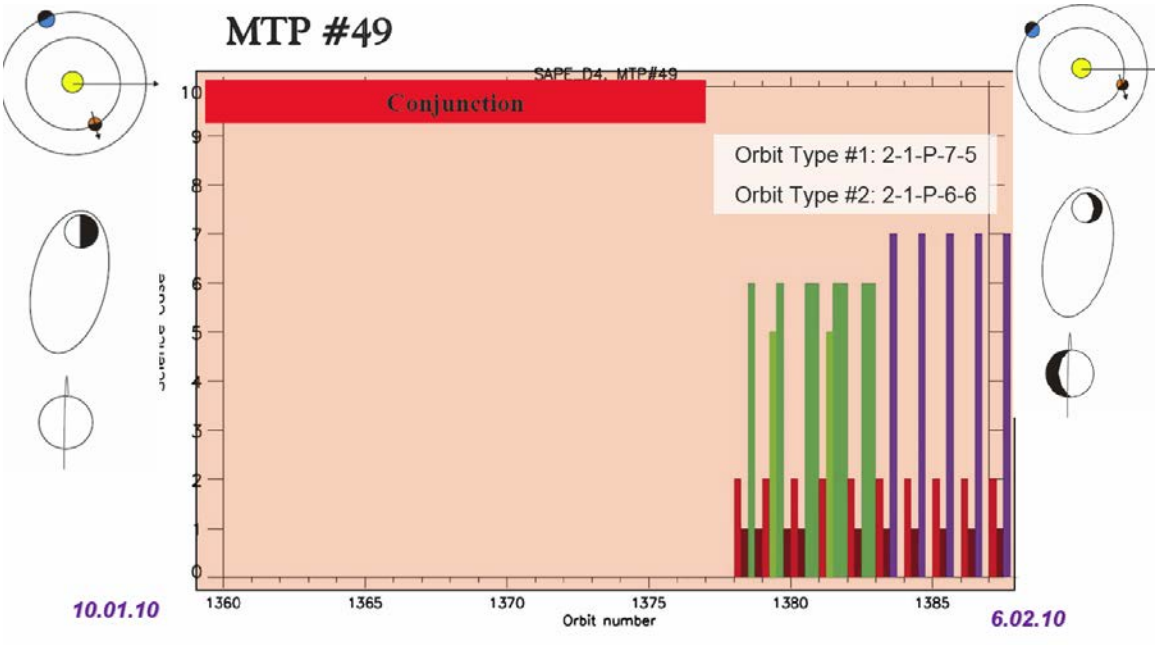


Figure 3.17 ***MTP#49*** *timeline*

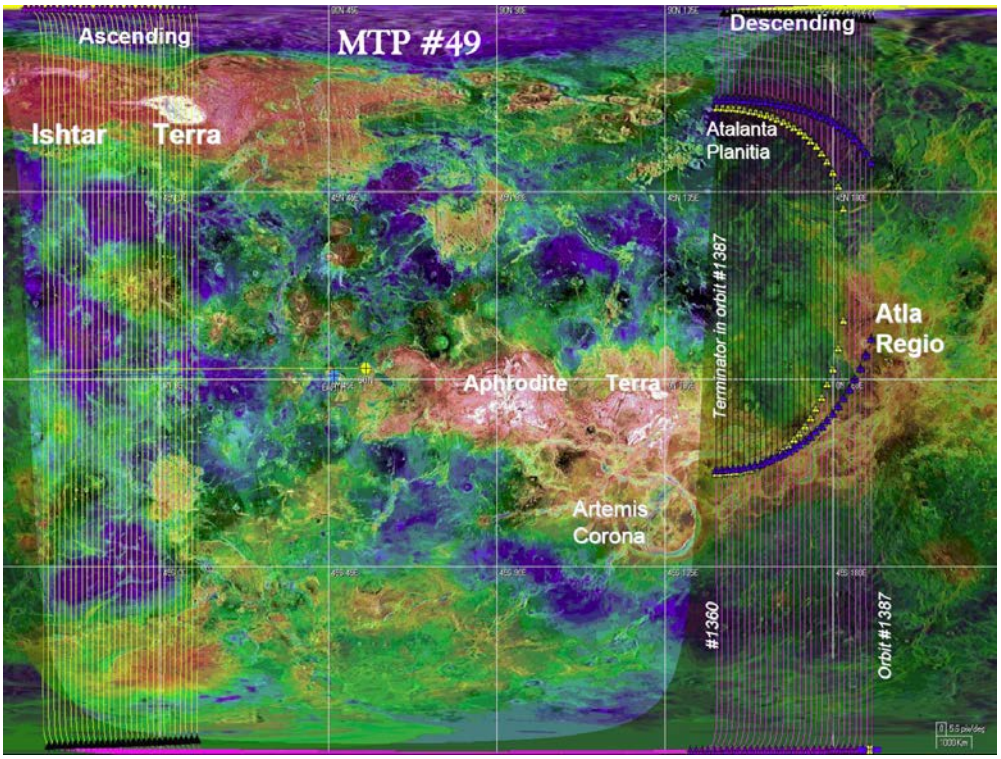


Figure 3.18 *Planet coverage by orbital tracks in MTP#49 (see the note in 3.2.3).*

3.11 MTP #50

3.11.1 Scientific focus

MTP #50 covers the period from 7.02 till 6.03.2010 and orbits #1388 -1415. This MTP has neither Earth nor solar occultations. The MTP is hot and has very low data rate. Local time at ascending note changes from 15h to 18h. Drag Campaign #3 is scheduled for the orbits #1395-1457. Exact scheduling of the orbits devoted to spacecraft tracking will be done later. A pericentre OCM is scheduled in the orbit 1402. Figures 3.19 and 3.20 show observations timeline and planet coverage by orbital tracks. In the first part of the MTP the proposed timeline consists of alternation of two types of orbits:

- Type #1: cases 2-1-P-7
- Type #2: cases 2-1-P-5

In the second part of the MTP the following orbits are alternated:

- Type #1: cases 2-1-P-7
- Type#2: cases 2-1-P-1

3.11.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 15-18 h
- Hot season
- Downlink is very low
- Drag Campaign #3 in orbits 1395-1457 (orbits for s/c tracking tbd)

3.11.3 Specific observations by the instruments

- SPICAV
    - Cases 5 and 7 after pericentre. Since they are hot combine with short pendulum on every 2-d orbit. However cases 5 and 7 are not favorable in the last 10 orbits due to proximity of bright limb
    - Case 5 close to the North pole (if possible) in support of drag campaign.
- VMC

- Pendulum on ascending arc
- Day side with off-track before pericentre
- Night limb after pericentre

- VeRa
  - Drag Campaign #3 in orbits #1395-1457. Orbits for spacecraft tracking tbd.
- VIRTIS
  - VIRTIS-H meridional cross-sections from ~-2h till pericentret

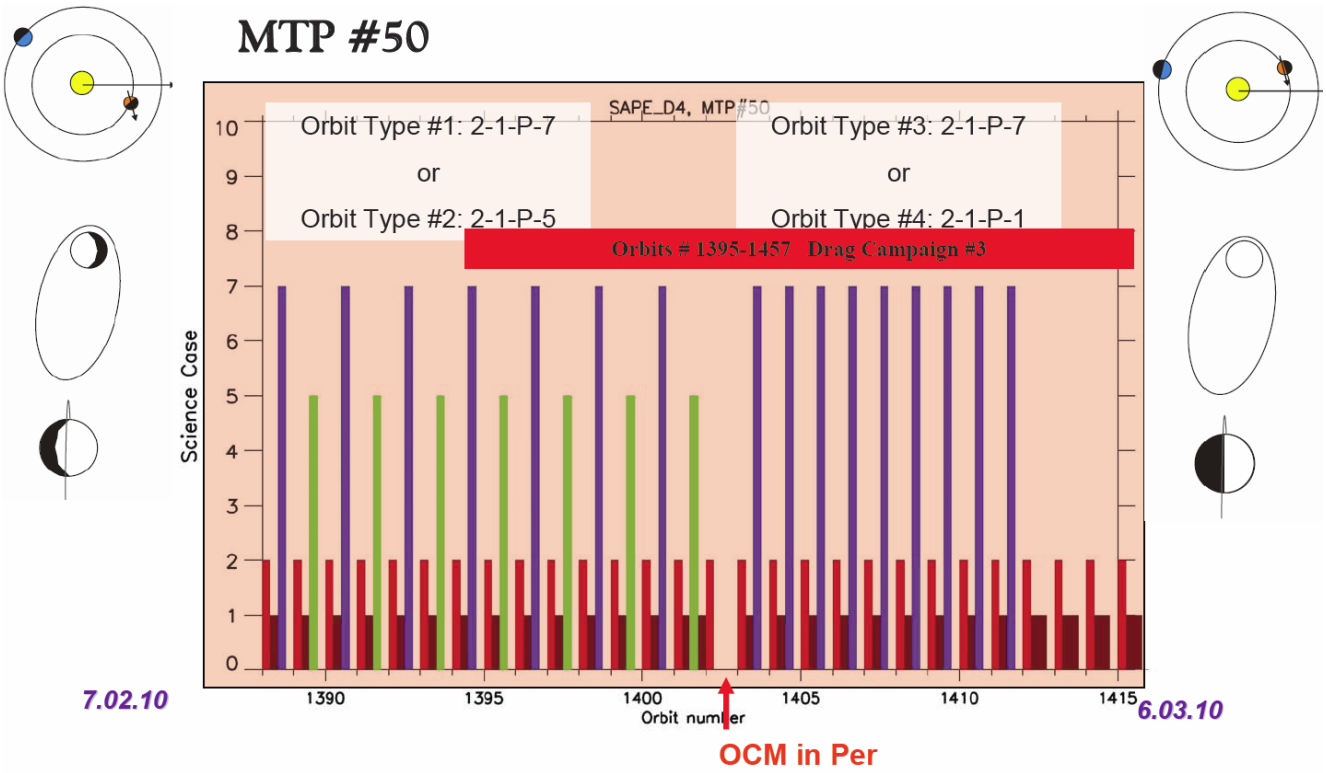


Figure 3.19 *MTP#50 timeline.*

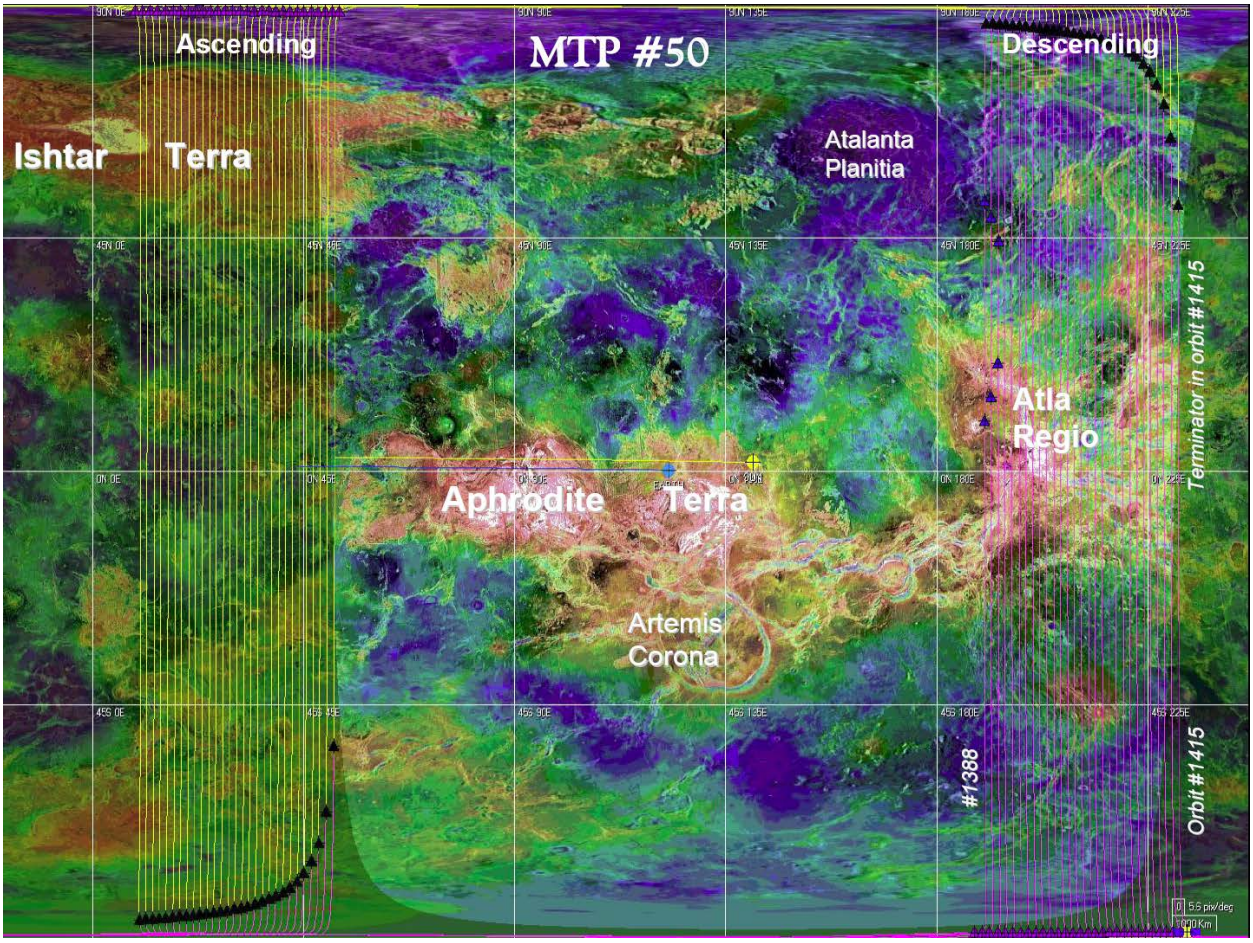


Figure 3.20 *Planet coverage by orbital tracks in MTP#50 (see the note in 3.2.3).*

3.12 MTP #51

3.12.1 Scientific focus

MTP #51 covers the period from 7.03 till 3.04.2010 and orbits #1416-1443. This MTP has neither Earth nor solar occultations. The MTP is cold and has very low data rate. Local time at ascending note changes from 18h to 21h. Drag Campaign #3 is scheduled for the orbits #1416-1457. Exact scheduling of the orbits devoted to spacecraft tracking will be done later. A pericentre OCM is scheduled in the orbit 1430. Figures 3.21 and 3.22 show observations timeline and planet coverage by orbital tracks. In the first part of the MTP the proposed timeline consists of alternation of two types of orbits:

- Type #1: cases 2-1-P-1
- Type #2: cases 2-7-P-5

In the second part of the MTP the following orbits are alternated:

- Type #1: cases 2-7-P-1
- Type#2: cases 2-5-P-1

3.12.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 18-21 h
- Cold season
- Downlink is very low
- Drag Campaign #3 in orbits 1416-1457 (orbits for s/c tracking tbd)

3.12.3 Specific observations by the instruments

- SPICAV
    - Limb tracking in the second half of MTP is not favorable because of OCM
    - Cases 5 and 7 in the 2-d half of MTP (pointing is likely hot)
- VMC
    - Day side with off-track after pericentre (latitude tracking, VMC mosaic, phase function)
    - Request to allow observations till at least +2h 30 min and delay Cebreros pass
- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentre

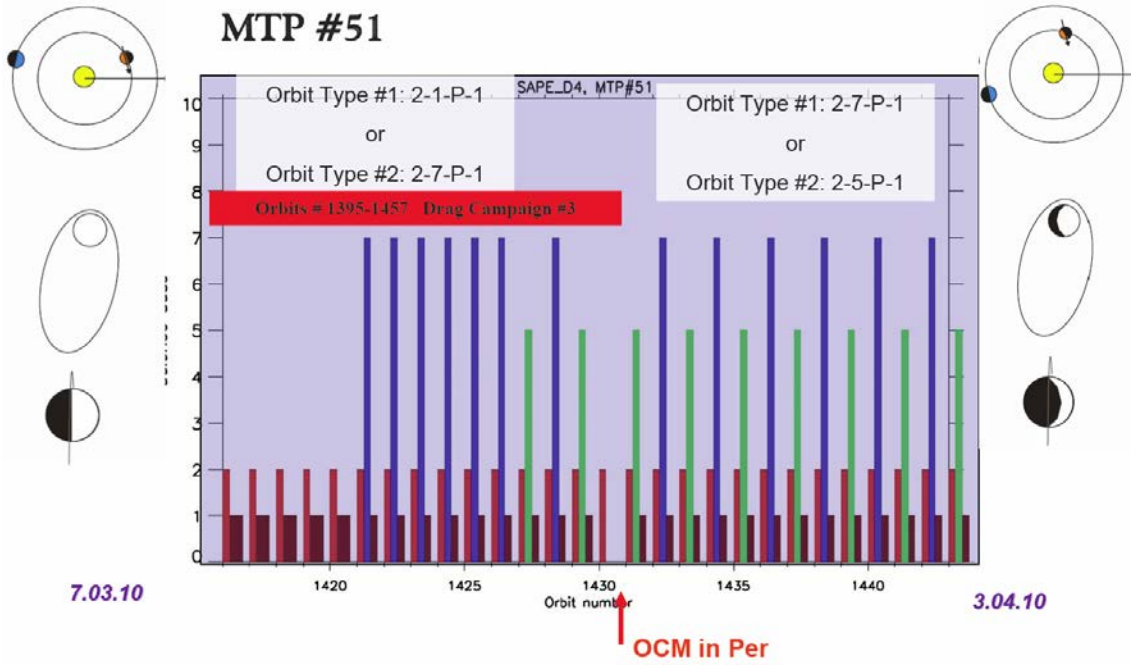


Figure 3.21 *MTP#51 timeline.*

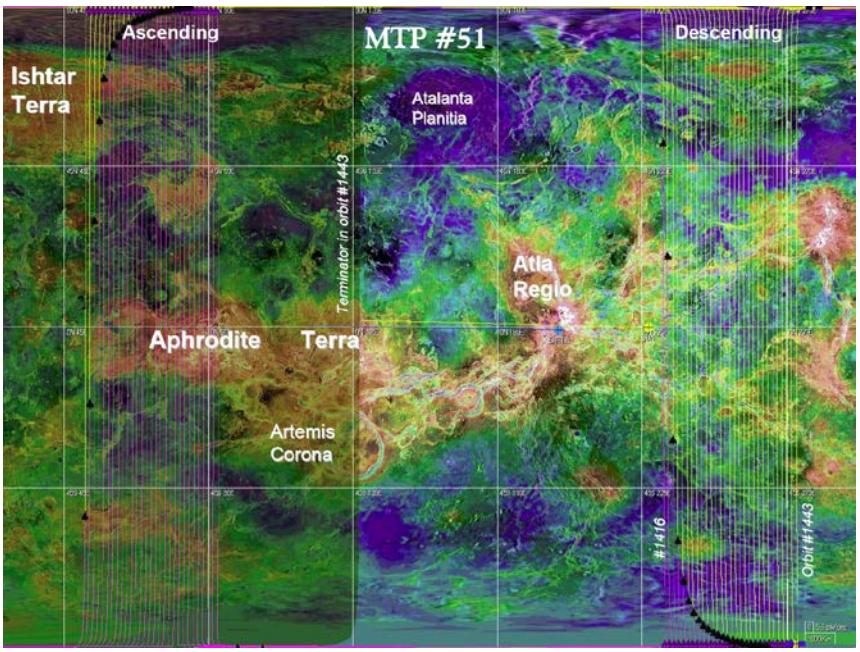


Figure 3.22 *Planet coverage by orbital tracks in MTP#51 (see the note in 3.2.3).*

3.13 MTP #52

3.13.1 Scientific focus

MTP #51 covers the period from 4.04 till 1.05.2010 and orbits #1444-1471. The MTP includes eclipse season #14 that starts in orbit 1447. Earth occultation season #9 begins in the last orbits of MTP (#1470). Gravity campaign #11 is scheduled for the orbits 1461, 1463, 1465. The MTP has very low data rate. Local time at ascending note changes from 21h to 24 h. An apocentre OCM is scheduled in the orbit 1458. Figures 3.23 and 3.24 show observations timeline and planet coverage by orbital tracks. Due to overlap of several peculiar seasons in the MTP the timeline has rather "irregular" structure.

3.13.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 21-24 h
- Eclipse season #14 starts in orbit 1447
- Earth occultation season #9 starts in orbit #1470
- Gravity campaign (1461, 1463, 1465)
- Cold period
- Downlink is low

3.13.3 Specific observations by the instruments

- SPICAV
    - Limb tracking in the second half of MTP is not favorable because of OCM
    - Cases 5 in ascending arc in every 2-d orbit (to be combined with case#2)
    - Case 5 during entire MTP in alternation with case 6 after orbit 1457, when the latitude at egress does not vary rapidly anymore
    - In-plane exospheric limb observations after pericenter, to be combined with ingress case 6 in every 4-5 orbits
- VMC

- Day side after pericentre (latitude tracking, VMC mosaic, spot pointing for cloud phase function)
- Request to allow observations till at least +2h 30 min and delay Cebreros pass

- VIRTIS
  - VIRTIS-H meridional cross-sections from ~-2h till pericentret

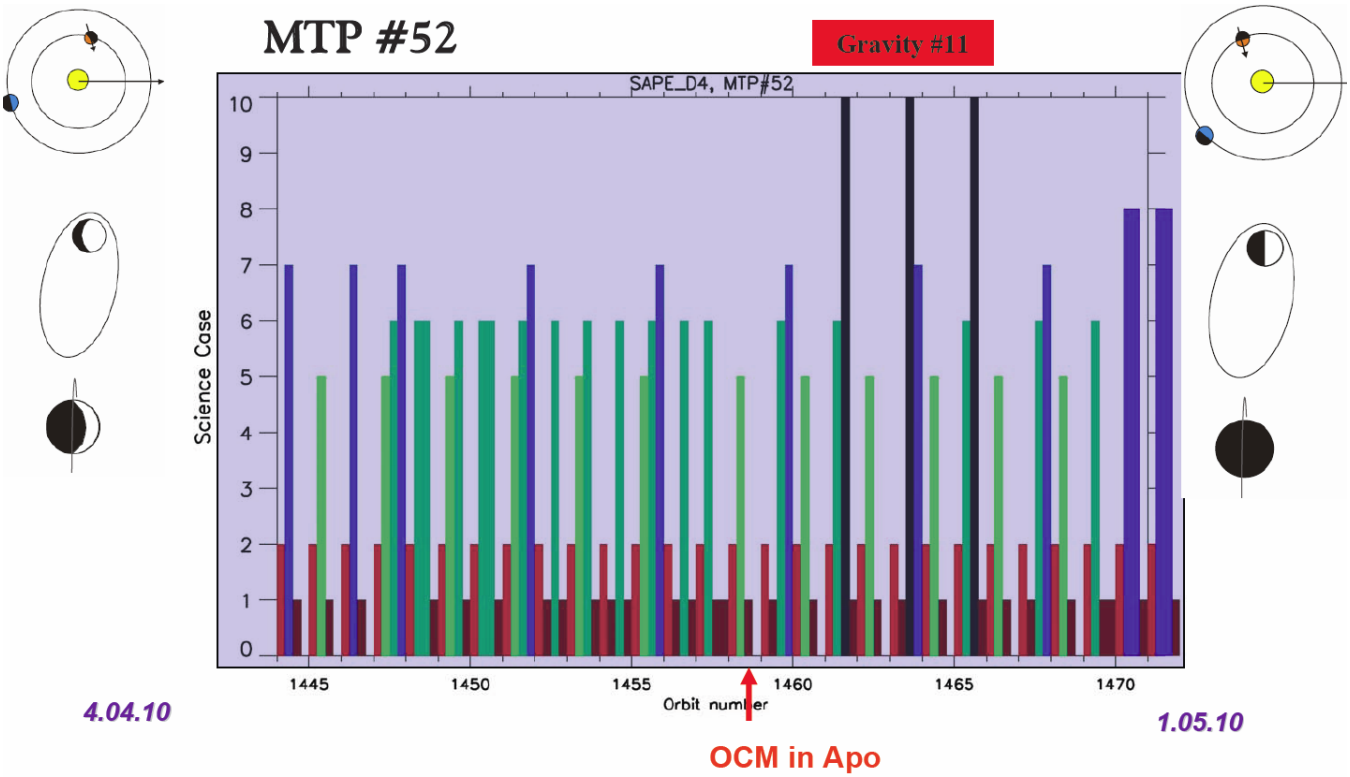


Figure 3.23 ***MTP#52 timeline***

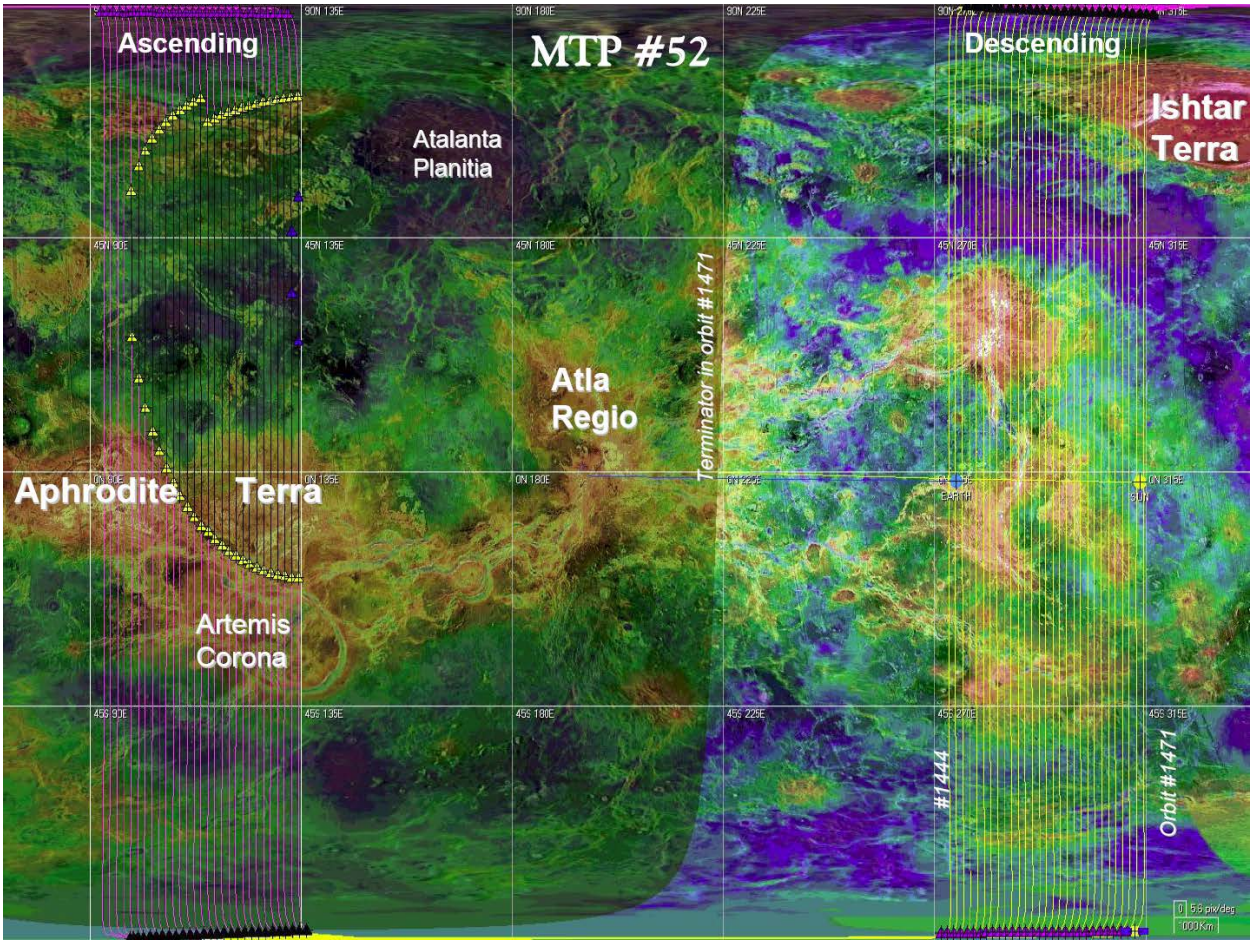


Figure 3.24 *Planet coverage by orbital tracks in MTP#52 (see the note in 3.2.3).*

3.14 MTP #53

3.14.1 Scientific focus

MTP #53 covers the period from 2.05 till 29.05.2010 and orbits #1472-1499. The MTP includes eclipse season #14 that ends in orbit 1499, and Earth occultation season #9. Both occultations occur before pericentre. The MTP has moderate data rate. Local time at ascending note changes from 0h to 3 h. Figures 3.25 and 3.26 show observations timeline and surface coverage by orbital tracks. Four types of science cases combinations are proposed for this MTP:

- Type #1: cases 2-5-6-P-1

- Type #2: cases 2-6-1-P-7
- Type #3: cases 2-6-6-P-7
- Type#4: cases 2-8-8-P-1

3.14.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 0-3 h
- Eclipse season #14 ends in orbit 1499
- Earth occultation season #9
- Cold MTP
- Downlink is moderate

3.14.3 Specific observations by the instruments

- SPICAV
    - Case #6 (solar occultation)
    - Cases 5 in ascending arc in every 2-d orbit (to be combined with case#2)
    - In-plane exospheric limb observations after pericenter, to be combined with ingress case 6 in every 4-5 orbits
- VMC
    - Day side after pericentre (latitude tracking, VMC mosaic, spot pointing for cloud phase function)
    - Request to allow observations till at least +2h 30 min and delay Cebreros pass
- VeRa
    - Radio occultations
- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentret

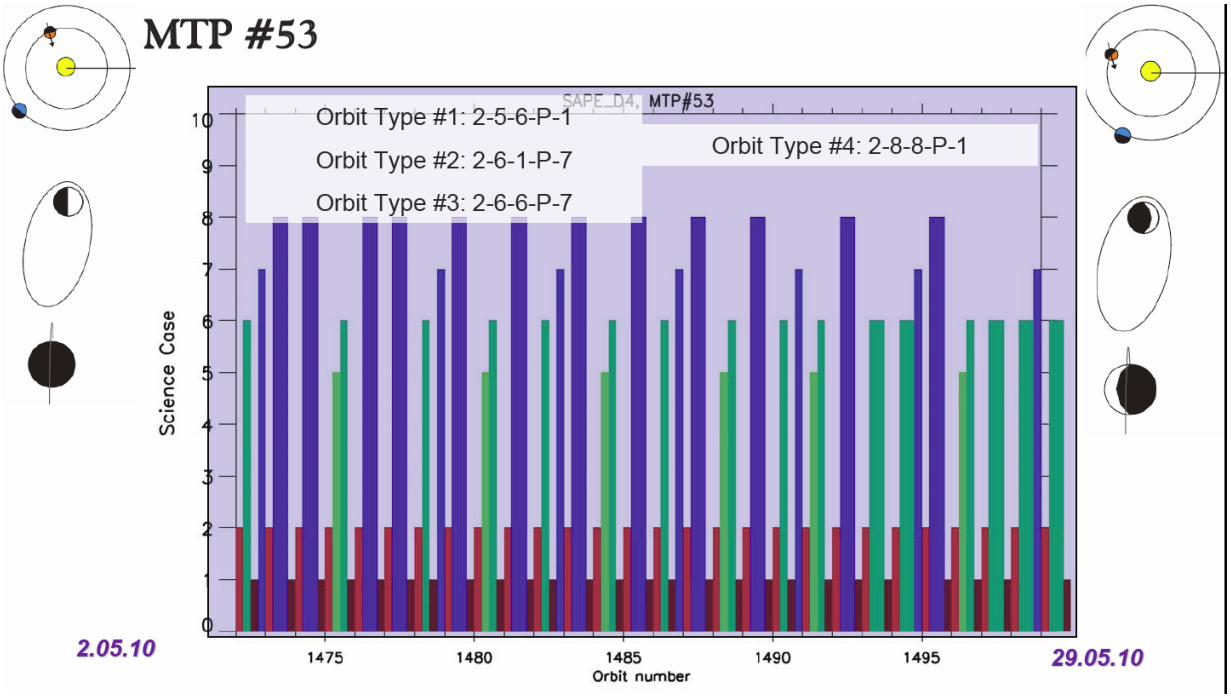


Figure 3.25 ***MTP#53 timeline.***

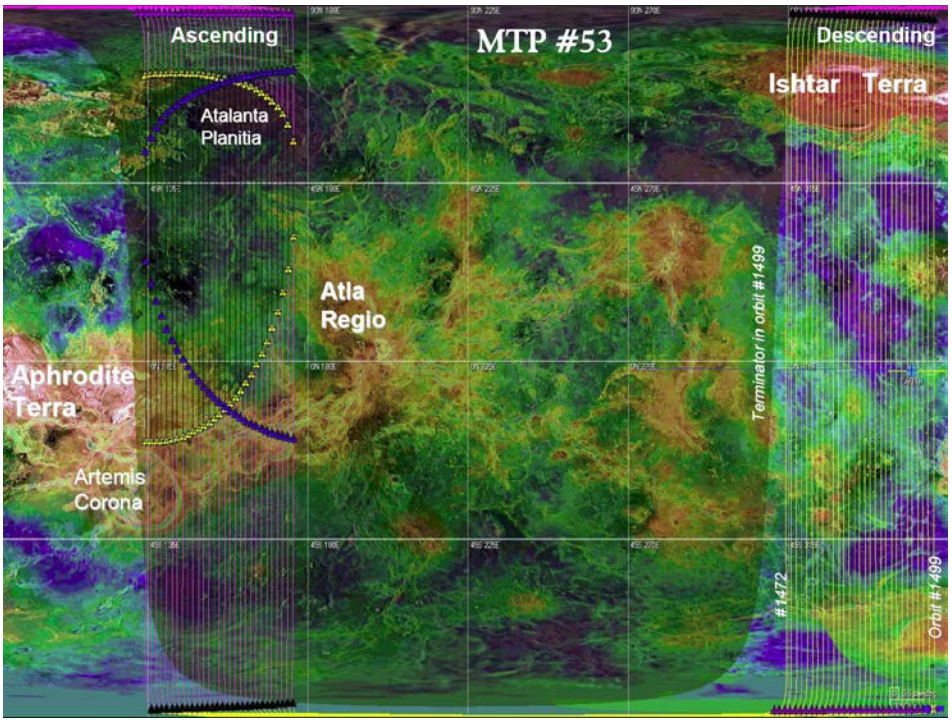


Figure 3.26 *Planet coverage by orbital tracks in MTP#53 (see the note in 3.2.3).*

3.15 MTP #54

3.15.1 Scientific focus

MTP #54 covers the period from 30.05 till 26.06.2010 and orbits #1500-1527. The MTP includes Earth occultation season #9. The occultations occur before pericentre. The MTP has moderate data rate. Local time at ascending note changes from 3h to 6 h. A pericentre OCM is scheduled in orbit 1500. Figures 3.27 and 3.28 show observations timeline and planet coverage by orbital tracks. Three types of science cases combinations are proposed for this MTP:

- Type #1: cases 2-1-5-P-1
- Type #2: cases 2-1-7-P-1
- Type#3: cases 2-8-8-P-1

3.15.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 3-6 h
- Earth occultation season #9
- Cold MTP
- Downlink is moderate

3.15.3 Specific observations by the instruments

- SPICAV
    - Cases 5 and 7 in ascending arc (to be combined with case#2)
    - Nadir observations around terminator (SO2 chemistry) near the end of MTP
    - Earth observation near end of MTP (distance to Earth still reasonable and pointing cold)
- VMC
    - Day side after pericentre (latitude tracking, VMC mosaic, spot pointing for cloud phase function)
    - Request to allow observations till at least +2h 30 min and delay Cebreros pass in the beginning of MTP

- VeRa
    - Radio occultations
- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentret

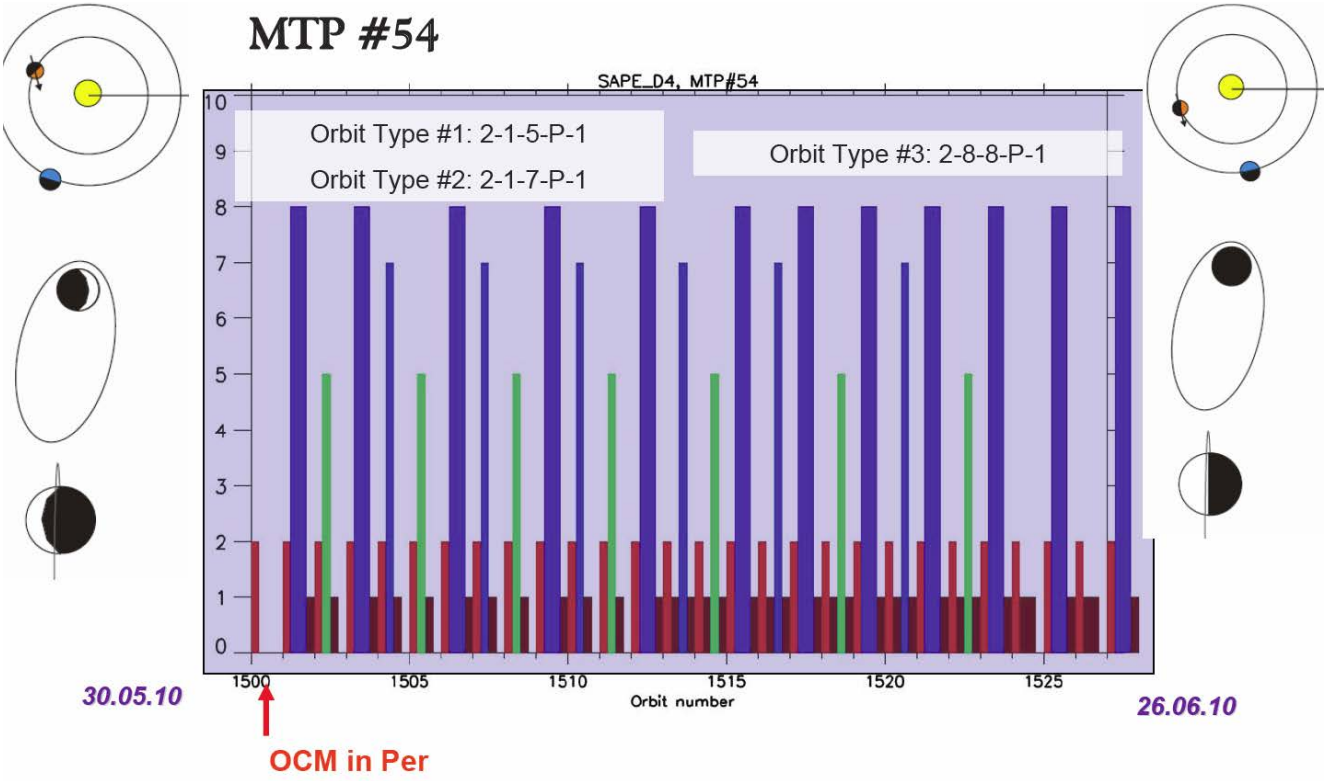


Figure 3.27 ***MTP#54 timeline.***

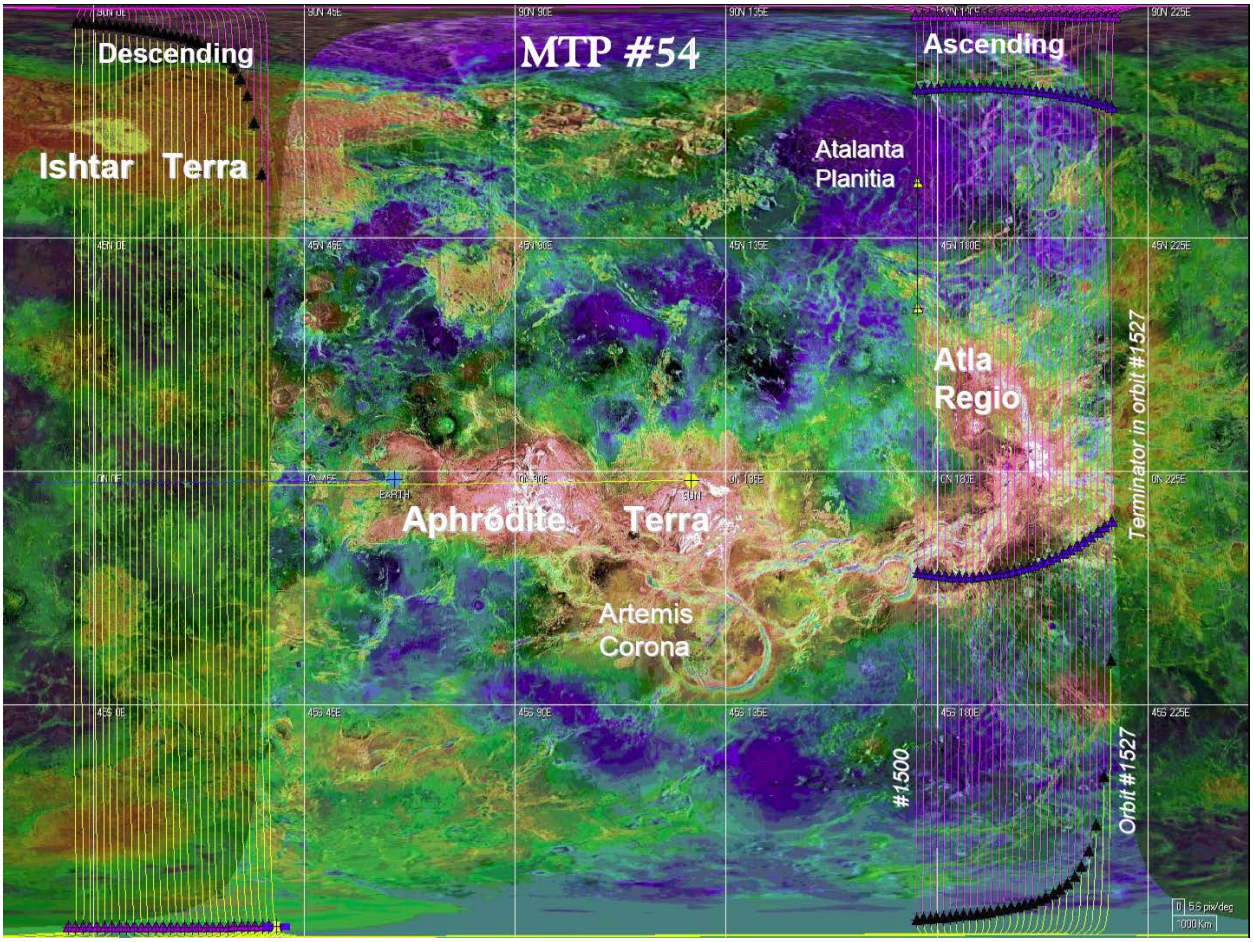


Figure 3.28 *Planet coverage by orbital tracks in MTP#54 (see the note in 3.2.3).*

3.16 MTP #55

3.16.1 Scientific focus

MTP #55 covers the period from 27.07 till 24.07.2010 and orbits #1528-1555. The MTP includes Earth occultation season #9 that ends in orbit 1542 and Gravity campaign #12 (orbits 1545, 1547, 1549, 1551 (tbd)). The occultations occur before pericentre. The MTP is hot and has high data rate. Local time at ascending note changes from 6h to 9 h. Figures 3.29 and 3.30 show observations timeline and planet coverage by orbital tracks. Three types of science cases combinations are proposed for this MTP:

- Type#1: cases 2-8-8-P-1
- Type #2: cases 2-1-5-P-1
- Type #2: cases 2-1-7-P-1

3.16.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 6-9 h
- Earth occultation season #9 until orbit 1542
- Gravity campaign #12 in orbits 1545, 1547, 1549, 1551 (tbd)
- Hot MTP
- Downlink is high

3.16.3 Specific observations by the instruments

- SPICAV
    - Cases 5 and 7 in the 2-d half of MTP (to be combined with case#2)
    - Nadir observations around terminator (SO2 chemistry) near the end of MTP
- VMC
    - Day side before pericentre with off-track to the day side (latitude tracking, VMC mosaic, spot pointing for cloud phase function)
- VeRa
    - Radio occultations
    - Gravity campaign #12
- VIRTIS
    - VIRTIS-H meridional cross-sections from ~-2h till pericentret

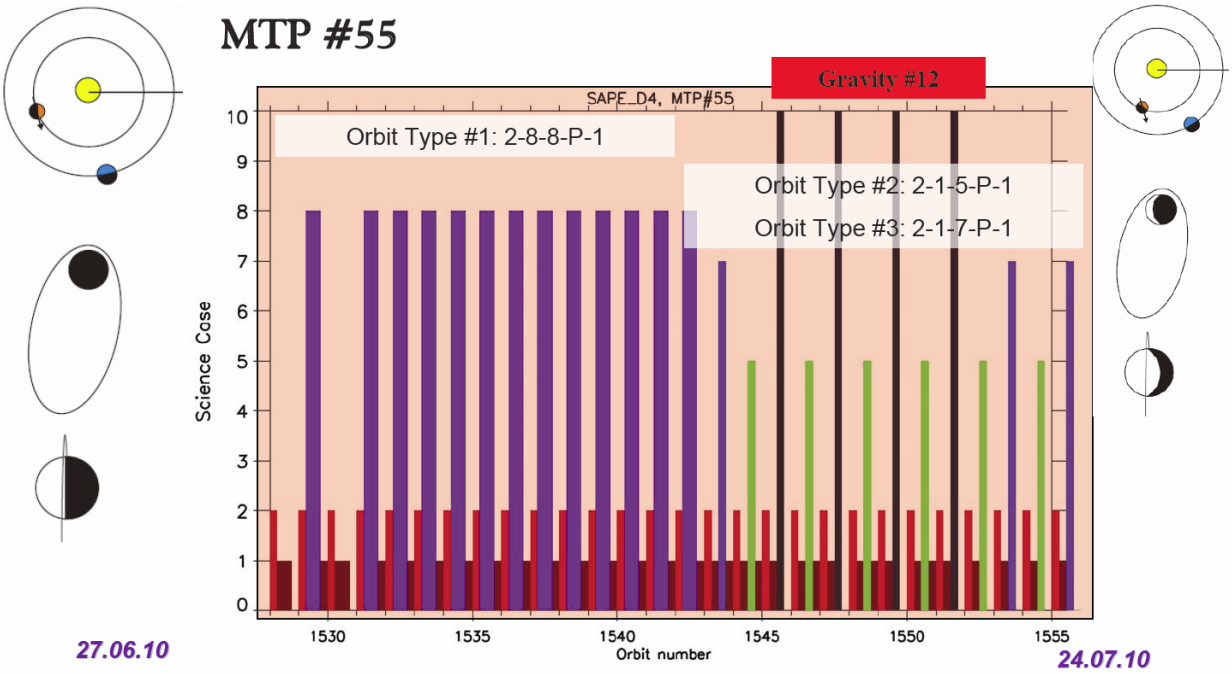


Figure 3.29 ***MTP#55 timeline.***

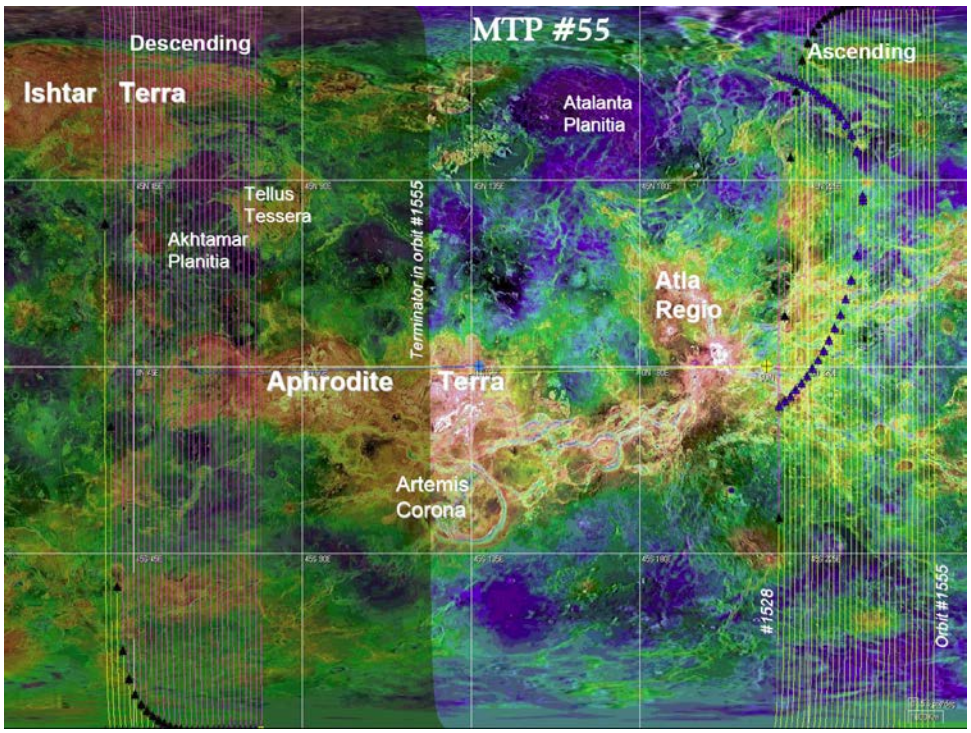


Figure 3.30 *Planet coverage by orbital tracks in MTP#55 (see the note in 3.2.3).*

3.17 MTP #56

3.17.1 Scientific focus

MTP #56 covers the period from 25.07 till 21.08.2010 and orbits #1556-1583. The MTP includes eclipse season #15 that starts in orbit 1561. This MTP is in quadrarture, so that telecommunications are hot. Usually this precludes hot observations, but in order to take advantage of the eclipse season it is proposed to skip and shorten Cebreros passes like in MTP #41. The occultations occur after pericentre. The MTP is hot and has high data rate. Local time at ascending note changes from 9h to 12h. Figures 3.31 and 3.32 show observations timeline planet coverage by orbital tracks. The following science cases combinations are proposed for this MTP.

Before start of the eclipse season (orbit 1562) group of two orbits:

- Cases 2(hot)-1(hot)-P-7-skipped CEB-7(cold)-shortened CEB (hot)

During eclipse season (after orbit 1562) a group of two orbits:

- Cases 2(hot)-6(hot)-P-7-skipped CEB-1or5or7(cold)-shortened CEB (hot)

More simple version of operation will be to abandon hot science observations before the start of eclipse season, but perform case#6 after orbit 1562 as proposed above.

3.17.2 Environmental conditions

- Local Time at Ascending Node (LTAN): 9-12 h
- Quadrature period
- Eclipse season #15 after orbit 1562
- Hot MTP
- Downlink is very high

3.17.3 Specific observations by the instruments

- SPICAV

- Case 5 during entire MTP (cold pointing), alternation with case 6 after orbit 1571, when the latitude at egress does not vary rapidly anymore: OK
- Request to use skipped CEB passes to allow hot cases #6 (see MTP 41)
- In-plane exospheric limb observations after pericenter, to be combined with ingress case 6 in every 4-5 orbits

- VMC
  - Day side before pericentre (latitude tracking, VMC mosaic, spot pointing for cloud phase function)
- VeRa
  - None
- VIRTIS
  - VIRTIS-H meridional cross-sections from ~-2h till pericentret

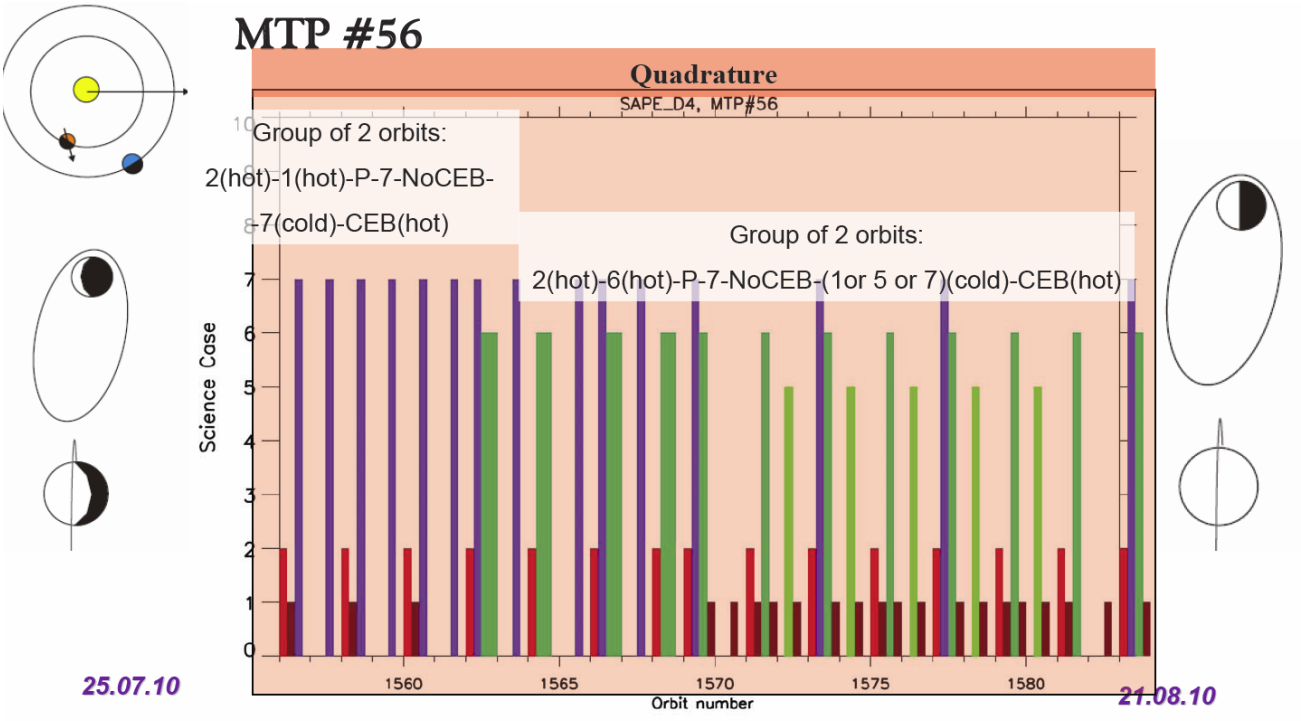


Figure 3.31 ***MTP56 timeline.***

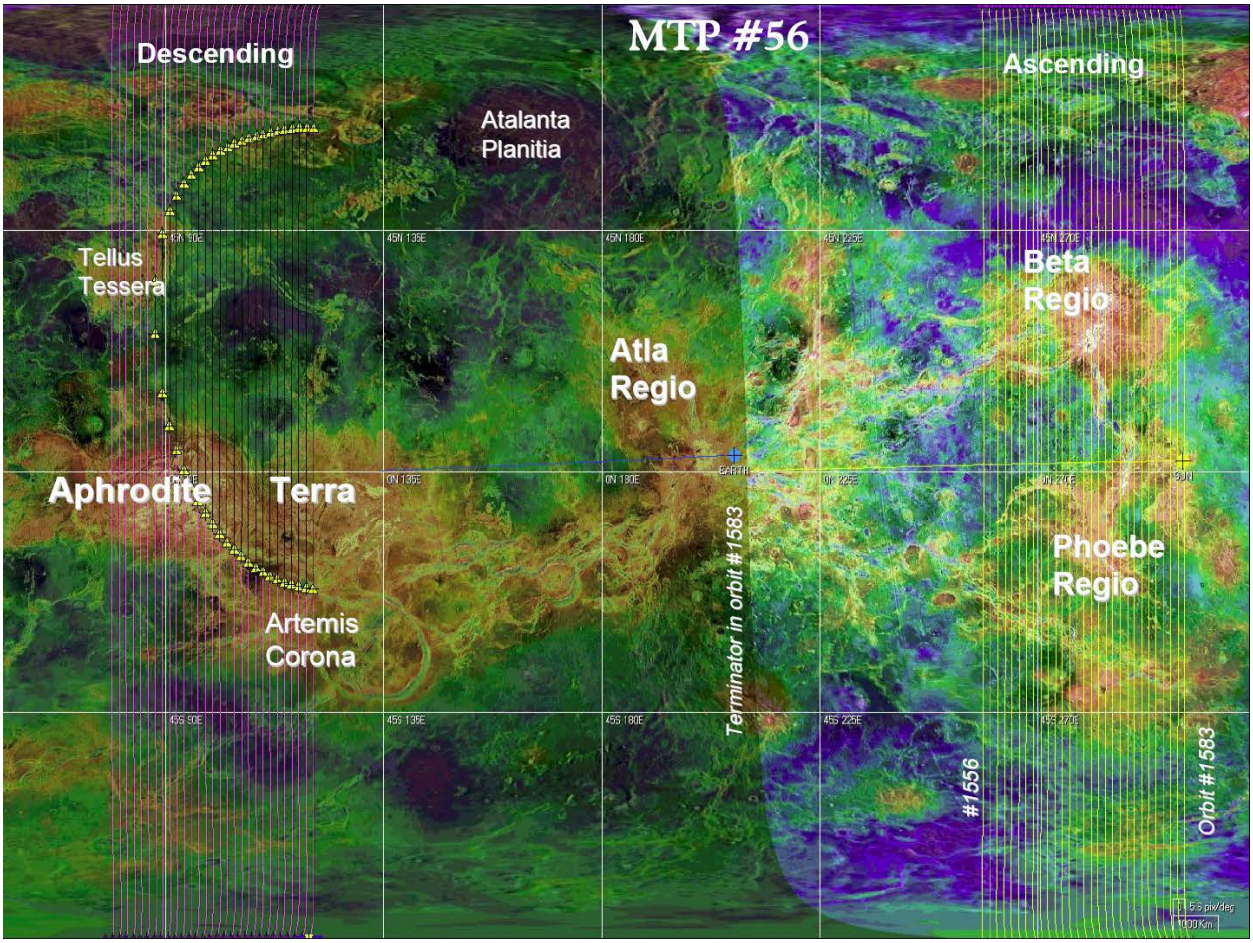
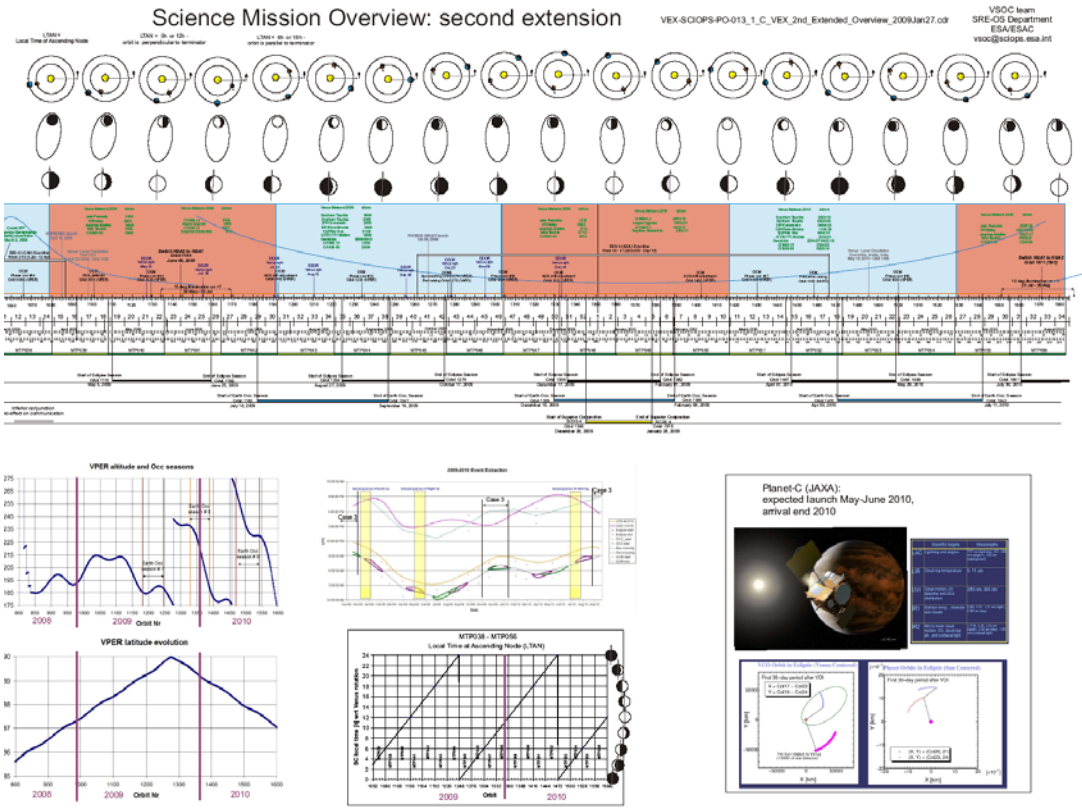


Figure 3.32 *Planet coverage by orbital tracks in MTP#56 (see the note in 3.2.3).*

4. ANNEX 1 – EXTENDED-2 MISSION OVERVIEW



5. ANNEX 2. LIST OF STARS FOR STELLAR OCCULTATION OBSERVATIONS

PTB	Star	RA	DEC	RelTimeSt	RelTimeEn	Lat.in	Long.in	LSunIn	day/night	Lat.out	Long.out	LSunOut	day/night	OccDurIn	Dist.In	OTAngle	OccDurOu	Dist.Out	OTAngle	TotOccDu
0	Star02	14,18	60,72																	
1	Star05	24,43	-57,24	-00:15:24	0:06:39	-1,52615	76,51323	2,626595	day	22,72781	-62,6585	134,4168	night	20	6031,593	137,4298	20	2926,255	25,39706	1330
2	Star08	58,53	31,88																	
3	Star09	59,46	40,01																	
4	Star12	78,63	-8,2	-00:04:14	0:19:49	59,20332	84,87461	58,52108	day	-32,9264	-38,4585	112,0243	night	20	2281,488	14,9577	20	7500,586	50,42033	1450
5	Star14	81,28	6,35	-00:02:14	0:24:39	73,92013	79,05021	72,94643	day	-38,9943	-25,3373	100,4806	night	30	1671,059	4,914946	20	9115,084	55,89387	1620
6	Star16	83	-0,3	-00:03:14	0:22:59	67,03779	85,61797	66,31215	day	-41,4765	-32,4052	105,3624	night	30	1905,423	9,954681	10	8578,777	54,2923	1580
7	Star17	83,78	9,93	-00:01:44	0:26:49	77,29326	77,23876	76,31203	day	-44,0114	-21,5792	97,12293	night	40	1559,126	12,96677	20	9793,102	57,68868	1720
8	Star18	83,86	-5,91	-00:04:04	0:21:29	61,22688	88,54272	60,85109	day	-41,3905	-38,6019	109,8713	night	30	2113,063	14,1317	10	8095,281	52,76362	1540
9	Star19	84,05	-1,2	-00:03:24	0:22:59	66,05069	87,02989	65,4361	day	-43,0943	-33,8472	106,0254	night	30	1924,192	10,79526	10	8573,839	54,2463	1590
10	Star20	85,19	-1,94	-00:03:24	0:22:59	65,26197	87,71637	64,71658	day	-44,7144	-35,236	106,5763	night	20	2005,366	10,79526	10	8583,436	54,33569	1590
11	Star21	86,94	-9,67	-00:04:34	0:21:09	57,29751	91,5157	57,44477	day	-44,3804	-45,1392	113,335	night	20	2277,305	16,59827	20	7937,852	51,94641	1550
12	Star25	95,68	-17,96	-00:05:34	0:19:49	49,09939	98,23362	51,35743	day	-46,941	-63,5439	122,8486	night	20	2651,067	21,41675	10	7512,451	50,53084	1530
13	Star28	101,29	-16,72	-00:05:24	0:20:29	50,69713	101,6513	53,8204	day	-50,5652	-72,5089	124,2366	night	20	2547,36	20,62522	10	7748,924	51,4704	1560
14	Star29	104,66	-28,97	-00:07:04	0:17:19	38,80049	104,4555	45,23914	day	-38,7178	-79,7036	136,8199	night	20	3095,736	143,3061	10	6649,52	47,01372	1470
15	Star36	120,9	-40	-00:08:24	0:14:19	29,63647	113,6572	44,89034	day	-22,8603	-92,125	155,8545	night	10	3655,507	143,7496	10	5613,058	42,21509	1370
16	Star41	140,53	-55,01	-00:11:04	0:10:29	15,64025	121,4636	45,94201	day	-0,98847	-93,032	170,3865	night	10	4572,081	142,5674	20	4226,653	34,27959	1300
17	Star44	160,74	-64,39	-00:13:34	0:08:09	4,658614	125,9419	48,70821	day	13,13918	-91,2806	161,9285	night	10	5424,197	139,87	20	3401,374	28,78338	1310
18	Star46	182,09	-50,72	-00:11:54	0:06:29	20,99942	138,0424	62,45686	day	27,94993	-98,2228	150,7571	night	20	4807,523	141,7882	20	2865,369	24,92755	1110
19	Star48	186,65	-63,1	-00:14:54	0:06:19	2,881351	133,6256	56,32148	day	25,90673	-92,5787	151,4038	night	10	5897,068	138,1165	20	2814,149	24,54457	1280
20	Star49	186,65	-63,1	-00:14:54	0:06:19	2,881351	133,6256	56,32148	day	25,90673	-92,5787	151,4038	night	10	5897,068	138,1165	20	2814,149	24,54457	1280
21	Star53	191,93	-59,69	-00:14:44	0:05:49	6,217824	136,7763	59,55759	day	29,98369	-93,8861	147,9248	night	20	5827,177	138,3426	20	2654,043	23,31475	1240
22	Star55	201,3	-11,16																	
23	Star56	204,97	-53,47	-00:14:54	0:04:29	11,59861	143,4431	66,4495	day	40,67981	-94,6861	137,7106	night	20	5903,796	138,1165	30	2147,901	19,15139	1170
24	Star57	206,88	49,31																	
25	Star59	208,88	-47,29	-00:13:54	0:03:29	20,78805	147,4832	71,15649	day	48,10999	-96,6269	130,6286	night	20	5544,446	139,4451	30	1891,641	17,05003	1050
26	Star60	210,96	-60,37	-00:17:14	0:04:29	-1,55653	140,1299	62,88125	day	38,58507	-92,0297	139,2418	night	20	6686,812	134,8496	20	2237,505	19,98597	1310
27	Star62	218,88	-42,16	-00:14:14	0:01:49	25,96898	153,5111	74,414	day	58,79292	-96,78	120,1165	night	30	5651,26	138,9936	40	1543,116	14,07431	970
28	Star65	220,48	-47,39	-00:16:24	0:02:29	13,74902	151,1879	71,13378	day	54,01476	-93,7994	124,7265	night	20	6406,017	136,0191	40	1652,793	15,01162	1140
29	Star70	239,71	-26,11																	
30	Star71	240,08	-22,62																	
31	Star73	241,36	-19,81																	
32	Star74	245,3	-25,59																	
33	Star76	248,97	-28,22	-00:23:54	-00:06:44	17,83872	162,7077	82,40637	day	73,85444	-174,197	93,22955	term	60	8889,839	125,8604	110	2971,777	25,76973	1030
34	Star77	249,29	-10,57																	
35	Star84	263,4	-37,1	-00:36:04	-00:02:04	-33,6313	163,8089	85,16366	day	75,47152	-97,1408	103,4659	night	20	12628,92	113,5194	60	1601,644	14,59286	2040
36	Star86	265,62	-39,03	-00:36:24	-00:01:24	-39,3528	161,7472	84,04897	day	73,61713	-90,8344	105,1381	night	20	12718,15	113,2478	60	1434,464	13,10046	2100
37	Star89	283,82	-26,3	-00:53:44	-00:06:14	-79,3618	170,6336	91,09294	term	85,94663	-96,5174	92,99871	term	20	17419,86	102,3025	50	2807,568	24,52729	2850
38	Star91	306,41	-56,74	-00:29:14	0:02:09	-50,076	83,67022	51,35008	day	53,44445	-73,3506	120,3645	night	20	10586,77	119,8081	30	1562,408	14,22119	1890
	LSun	=	Local	(Zenith)																
		angle	>	90	->	dark	conditions													
		angle	=	90	->	terminator	conditions													
		angle	<	90	->	light	conditions													
		RA	of	Express	orbit	is	102	degrees												
		Stars	in	102	and	282	(102	+		180)	will	get		occulted	easily					
		Stars	in	192	(102	+	90)	and		12	(102	-		90)	will	not	get	occulted	easily	

6. ANNEX 3. TABLE OF THE VERA EXPERIMENTS

Scheduling of the VeRa experiments in the Extended-2 Mission (June 2009 – August 2010).

The VeRa Synoptic Table is taken from the document: VEX-SCIOPS-LI-500_23_VeRa_Synoptic_Table_2009Mar05.xls.

Time Period Nominal Mission	Orbit No.	DoY	VeRa Experiment	Distance Earth-Venus [AU]	Surface Target	Station	Number of requested Passes	Status (executed, requested, confirmed, cancelled)	Orbits coordinated not yet finally granted or canceled	Comments
23/05/2006	32		Bistatic Radar Commissioning	1.1	Venera 13	DSN	1	executed	32	
28/05/2006	37		Gravity Commissioning	1.1		NNO	1	executed	37	
09/06/2006	49		Occultation Commissioning-Osc. Tuning	1.1		NNO	1	executed	49	
14.06.2006-19.06.2006	54-59		Bistatic Radar 1	1.3	Maxwell Montes Slant Range:850km	DSN	3	executed	55,57,59	
11.07.2006-30.08.2006	81-131		Earth Occultation 1	1.5		NNO	21	executed	81, 84,85,87,89, 91,93,99,101,105,107,109,112,115, 117,120,122,123, 126,128,131	
01.08.2006-08.08.2006	102-109		Bistatic Radar 2 **cancelled**	1.6	Ovda Regio	DSN	2	executed	cancelled due to VIRTIS interference	
20.08.2006-25.08.2006	121-126		Bistatic Radar 3 **cancelled**	1.6	Thetis Regio	DSN	2	executed	cancelled due to VIRTIS interference	
01.09.2006-10.09.2006			Gravity 1	1.7	Atalanta Planitia, Coronae	NNO	4	executed	134,135,140,142	
28/10/2006	190		Superior Solar Conjunction	1.7				executed		
20.09.2006-06.12.2006	152-229		Solar Corona	1.7		DSN	30	executed	171,173,175,177,179,180,181,182,183,184,185,186,187, 188*,193,194,195,196,197,198,199,200,201,203,205,207 ,209,211,213,215,217,229*	Blue: DSS43 (CAN 70m); Red: Pass canceled; Brown: DSS45 (CAN 34m); Green: DSS15 (GDS 34m); Lilac : G/S not yet known; * : Back-Up slot
22.11.2006-31.01.2007	215-285		Earth Occultation 2	1.6		NNO	21	executed	230,233,236 240,241, 248 250,254,257, 260,263,266 268,270,272 274,276,278, 280,282,285	
15.03.2007-21.03.2007	297-303		Bistatic Radar 4	1.3	Theia, Rhea Mons	DSN	2	executed	331.333	
23.04.2007-29.06.2007			Gravity 2 **cancelled**	0.8	Atalanta Planitia, Coronae	NNO	10	executed	Cancelled due to OCC#3	
26.04.2007-01.07.2007	370-436		Earth Occultation 3	0.8		NNO DSN	29+(5)	executed	370,372,374, 376,378,380, 381*,382,384, 386,388,390, 392,394,396, 398,399*,400, 401*,402,404, 405*,406,408, 411,412,414*, 418,420,422, 424,427,430	Black: finalised * : DSN passes; Red: Not yet finally granted/canceled; from Or #408 with HGA2 (MTP015)
03.06.2007-15.06.2007	408-420		Bistatic Radar 5	0.7	Sapas, Ozza, Maat Mons	DSN	2	executed	410, 417	
30.07.2007-08.08.2007	465-474		Bistatic Radar 6	0.3	Theia, Rhea Mons	DSN	2	executed	468.469	
17/08/2007	484		Inferior Solar Conjunction	0.3				executed		
04.09.2007-18.09.2007	501-515		Earth Occultation 3a	0.5		NNO	0	executed	-	

Extended Mission									
Time Period Extended Mission	Orbit No.		VeRa Experiment	Distance Earth-Venus [AU]	Surface Target	Station	Number of Passes		Orbits coordinated not yet finally granted
25.09.07-01.10.07	**522-528**		**Bistatic Radar 6a**	**0.5**	**Maxwell Montes**	**DSN**	**3**	**executed**	Cancelled
26/09/2007	523		#1	0.5	Maxwell Montes	DSN	1	executed	DOY 269 target hit at 01:30 UTC cancelled due to sun illumination constraints
28/09/2007	525		#2	0.5	Maxwell Montes	DSN	1	executed	DOY 271, target hit at 01:30 UTC cancelled due to sun illumination constraints
30/09/2007	527		#3	0.5	Maxwell Montes	DSN	1	executed	DOY 273, target hit at 01:30 UTC cancelled due to sun illumination constraints
02.11.07-14.11.07	**560-572**		**Bistatic Radar 7**	**0.8**	**Sapas, Ozza Montes**	**DSN**	**2**	**executed**	Cancelled
08/11/2007	566		#1			DSN		executed	DOY 312 target hit at 01:09 UTC cancelled due to weak S-Band signal
10/11/2007	568		#2					executed	DOY 314 target hit at 01:09 UTC cancelled due to weak S-Band signal
12.11.07-20.11.07	**570-578**		**Bistatic Radar 8**	**0.8**	**Sapas, Ozza Montes**	**DSN**	**2**	executed	Cancelled
12/11/2007	570		#1					executed	DOY 316 target hit at 01:09 UTC cancelled due to weak S-Band signal
14/11/2007	572		#2					executed	DOY 318 target hit at 01:09 UTC cancelled due to weak S-Band signal
19.12.07-25.12.07	**607-613**		**Bistatic Radar 9**	**1.1**	**Theia, Rhea Mons**	**DSN**	**2**	executed	Cancelled
21/12/2007	609		#1	1.1	Theia, Rhea Mons	DSN	1	executed	DOY 355 target hit at 03:00 UTC cancelled due to weak S-Band signa
23/12/2007	611		#2	1.1	Theia, Rhea Mons	DSN	1	executed	DOY 357, target hit at 03:06 UTC cancelled due to weak S-Band signa
27.12.07-02.01.08			**Gravity 3**	**1.3**	**Atalanta Planitia, Coronae**	**NNO**	**4**		
27/12/2007	615		#1	1.3	Atalanta Planitia, Coronae	NNO	1	executed	DOY 361 target hit at 03:35 UTC BOT: 2:41 EOT: 3:55
29/12/2007	617		#2	1.3	Atalanta Planitia, Coronae	NNO	1	executed	DOY 363 target hit at 03:39 UTC BOT: 2:45 EOT: 3:59
31/12/2008	619		#3	1.3	Atalanta Planitia, Coronae	NNO	1	executed	DOY 365 target hit at 03:43 UTC BOT: 2:49 EOT: 4:03
02/01/2008	621		#4	1.3	Atalanta Planitia, Coronae	NNO	1	executed	DOY 2 target hit at 03:47 UTC BOT: 2:52 EOT: 4:07
04.01.08-13.03.08	**623-692**		**Earth Occultation 4**	**1.3**		**NNO**	**35+4**		Each second orbit
05/01/2008	624		#1	1.3		NNO	1	executed	DOY 5 BOT: 3:28 EOT: 4:37
07/01/2008	626		#2	1.3		NNO	1	executed	DOY 7 BOT: 3:31 EOT: 4:44
08/01/2008	627		#3	1.3		NNO	1	executed	DOY 8 BOT: 3:33 EOT: 4:47
11/01/2008	630		#4	1.3		NNO	1	executed	DOY 11 BOT: 3:38 EOT: 4:57
13/01/2008	632		#5	1.3		NNO	1	executed	DOY 13 BOT: 3:42 EOT: 5:03

15/01/2008	634		#6	1.3		NNO	1	executed	DOY 15 BOT: 3:46 EOT: 5:10
17/01/2008	636		#7	1.3		NNO	1	executed	DOY 17 BOT: 3:50 EOT: 5:16
19/01/2008	638		#8	1.3		NNO	1	executed	DOY 19 BOT: 3:54 EOT: 5:22
20/01/2008	639		#9	1.3		NNO	1	executed	DOY 20 BOT: 3:55 EOT: 5:25
21/01/2008	640		#10	1.3		NNO	1	executed	DOY 21 BOT: 3:57 EOT: 5:28
22/01/2008	641		#11	1.3		NNO	1	executed	DOY 22 BOT: 3:59 EOT: 5:30
23/01/2008	642		#12	1.3		NNO	1	executed	DOY 23 BOT: 4:01 EOT: 5:33
24/01/2008	643		#13	1.3		NNO	1	executed	DOY 24 BOT: 4:03 EOT: 5:36
25/01/2008	644		#14	1.3		NNO	1	executed	DOY 25 BOT: 4:05 EOT: 5:39
31/01/2008	650		DSN #6	1.3		DSN	1	executed	**DOY 31** **BOT: 4:20 EOT: 5:50** **Confirmed DSN path**
02/02/2008	652		DSN #8	1.3		DSN	1	executed	**DOY 33** **BOT: 4:24 EOT: 5:55** **Confirmed DSN path**
04/02/2008	654		DSN #10	1.3		DSN	1	executed	**DOY 35** **BOT: 4:28 EOT: 6:00** **Confirmed DSN path**
06/02/2008	656		DSN #12	1.3		DSN	1	cancelled	DOY 37 BOT: 4:32 EOT: 6:04 Confirmed DSN path cancelled
09/02/2008	659		#15	1.3		NNO	1	executed	DOY 40 BOT: 4:32 EOT: 6:11
10/02/2008	660		#16	1.3		NNO	1	executed	DOY 41 BOT: 4:31 EOT: 6:11
11/02/2008	661		#17	1.3		NNO	1	executed	DOY 42 BOT: 4:31 EOT: 6:10
12/02/2008	662		#18	1.3		NNO	1	executed	DOY 43 BOT: 4:30 EOT: 6:09
13/02/2008	663		#19	1.3		NNO	1	executed	DOY 44 BOT: 4:29 EOT: 6:08
14/02/2008	664		#20	1.3		NNO	1	executed	DOY 45 BOT: 4:28 EOT: 6:07
15/02/2008	665		#21	1.3		NNO	1	executed	DOY 46 BOT: 4:27 EOT: 6:06
16/02/2008	666		#22	1.3		NNO	1	executed	DOY 47 BOT: 4:26 EOT: 6:04
18/02/2008	668		#23	1.3		NNO	1	executed	DOY 49 BOT: 4:25 EOT: 6:02
20/02/2008	670		#24	1.3		NNO	1	executed	DOY 51 BOT: 4:23 EOT: 5:59
22/02/2008	672		#25	1.3		NNO	1	executed	DOY 53 BOT: 4:22 EOT: 5:56
23/02/2008	673		#26	1.3		NNO	1	executed	DOY 54 BOT: 4:21 EOT: 5:55
26/02/2008	676		#27	1.3		NNO	1	executed	DOY 57 BOT: 4:19 EOT: 5:50
28/02/2008	678		#28	1.3		NNO	1	executed	DOY 59 BOT: 4:17 EOT: 5:47
01/03/2008	680		#29	1.3		NNO	1	executed	DOY 61 BOT: 4:15 EOT: 5:43

03/03/2008	682		#30	1.3		NNO	1	executed	DOY 63 BOT: 4:14 EOT: 5:39
05/03/2008	683		#31	1.3		NNO	1	executed	DOY 64 BOT: 4:13 EOT: 5:37
07/03/2008	686		#32	1.3		NNO	1	cancelled	DOY 67 BOT: 4:11 EOT: 5:31 cancelled
09/03/2008	688		#33	1.3		NNO	1	cancelled	DOY 69 BOT: 4:10 EOT: 5:26 cancelled
11/03/2008	690		#34	1.3		NNO	1	cancelled	DOY 71 BOT: 4:09 EOT: 5:21 cancelled
13/03/2008	692		#35	1.3		NNO	1	executed	DOY 73 BOT: 4:09 EOT: 5:16
09/06/2008			**Superior Solar Conjunction**	**1.7**					
02.05.2008-15.07.2008			**Solar Corona**	**1.7**		**DSN**	**30**		**Cancelled because of S-Band problem**
16.07.08-01.08.08	**818-833**		**Earth Occultation 5**	**1.7**		**NNO**	**11-3+2**		**During First Part of Occ. Season 5 no measurements possible (SCO influence)**
16/07/2008	817	198	#1	1.7		NNO	1	executed	
17/07/2008	818	199	#2	1.7		NNO	1	executed	
19/07/2008	820	201	#3	1.7		NNO	1	executed	
20/07/2008	821	202	#4	1.7		NNO	1	cancelled	Deleted: conflict with pericenter lowering pericenter OCM
22/07/2008	823	204	#5	1.7		NNO	1	cancelled	Deleted: conflict with pericenter lowering FD tracking
23/07/2008	824	205	#6	1.7		NNO	1	executed	
24/07/2008	825	206	#7	1.7		NNO	1	executed	Added because of conflicts with orbit lowering
25/07/2008	826	207	#8	1.7		NNO	1	executed	
26/07/2008	827	208	#9	1.7		NNO	1	executed	
28/07/2008	829	210	#10	1.7		NNO	1	executed	
29/07/2008	830	211	#11	1.7		NNO	1	cancelled	Deleted: conflict with pericenter lowering FD tracking
30/07/2008	831	212	#12	1.7		NNO	1	executed	IFMS setting problems Drag & Occ executed Added because of conflicts with orbit lowering Drag&RSI executed RSI Baseline reduced to 5 minutes
31/07/2008	832	213	#13	1.7		NNO	1	executed	Drag&RSI executed RSI baseline reduced to 5 minutes
01.08.08 - 09-08-08	**833-854**		**Drag Campaign #1**	**1.7-1.6**		**DSN**	**11**		
01/08/2008	833	214	#1	1.7		DSN	1	executed	
02/08/2008	834	215	#2	1.7		DSN	1	executed	
06/08/2008	838	219	#3	1.6		DSN	1	executed	Pericenter passage not tracked due to early end of pass
07/08/2008	839	220	#4	1.6		DSN	1	cancelled	
08/08/2008	840	221	#5	1.6		DSN	1	executed	Pericenter passage not tracked due to early end of pass
09/08/2008	841	222	#6	1.6		DSN	1	executed	Pericenter passage not tracked due to early end of pass
18/08/2008	850	231	#7	1.6		DSN	1	executed	(added by Hakan)

The start time to send the one way signal at spacecraft is shifted to 25 min. before V01S instead of 20 min because. (Due to groundstation configuration procedure changes)

The open loop recording time is adapted to the new orbit after pericenter lowering :
Additional 5 minutes Open Loop recording time at the start and end of the V01 events are allocated for the occultations.

only drag, no RSI, with occultation
only drag, no RSI, with occultation
only drag, no RSI, no occ
only drag, no RSI, no occ
only drag, no RSI, no occ
only drag, no RSI, no occ
only drag, no RSI, no occ

19/08/2008	851	232	#8	1.6		DSN	1	executed	(added by Hakan)	only drag, no RSI, no occ
20/08/2008	852	233	#9	1.6		DSN	1	executed	(added by Hakan)	only drag, no RSI, no occ
21/08/2008	853	234	#10	1.6		DSN	1	executed	(added by Hakan)	only drag, no RSI, no occ
22/08/2008	854	235	#11	1.6		DSN	1	executed	(added by Hakan)	only drag, no RSI, no occ
18.11.08 - 30-11-08	**942-954**	**323-335**	**Data-taking during CEB downtime**	**1.1-1.0**		**DSN**	**4**		**Status: requested**	
						DSN (MAD 34m))		requested (in ULP)	Description: Pass duration: 8 hours Total: 40 hours	
18/11/2008	942	323	#1	1.0		DSN (MAD 34m))	1	cancelled		Flexibility is the full window requested in the ULP (18/11/08 - 30/11/08)
22/11/2008	946	327	#2	1.0		DSN (MAD 34m))	1	cancelled		Flexibility is the full window requested in the ULP (18/11/08 - 30/11/08)
27/11/2008	951	332	#3	1.0		DSN (MAD 34m))	1	executed (first 1h DDOR)	first 1h DDOR and Comms period BOT 1147, EOT 1827	Flexibility is the full window requested in the ULP (18/11/08 - 30/11/08)
28/11/2008	952	333	#4	1.0		DSN (MAD 34m))	1	executed (specific)	Duration 2h 40min BOT 1615, EOT 1855	Flexibility is the full window requested in the ULP (18/11/08 - 30/11/08)
28.10.2008-01.01.09	**921-986**	**302-001**	**Earth Occultation 6**	**1.1-0.8**		**NNO**	**39**		**Each second orbit**	
30/10/2008	923	304	#1			NNO	1	executed		
01/11/2008	925	306	#2			NNO	1	executed		
03/11/2008	927	308	#3			NNO	1	executed		
04/11/2008	928	309	#4			DSN	1	executed	--> Now DSN requested (before there was an NNO scheduled here that was cancelled because of maintenance) DSN confirmation received at 09.Sep.08	
05/11/2008	929	310	#5			NNO	1	executed		
07/11/2008	931	312	#6			NNO	1	executed		
09/11/2008	933	314	#7			NNO	1	executed		
11/11/2008	935	316	#8			NNO	1	executed		
13/11/2008	937	318	#9			NNO	1	executed		
15/11/2008	939	320	#10			NNO	1	executed		
16/11/2008	940	321	#10+ (DSN)			DSN	1	executed	--> Now DSN requested DSN confirmation received at 09.Sep.08	
17/11/2008	941	322	#11			NNO	1	executed		
19/11/2008	943	324	#12			NNO	1	executed		

21/11/2008	945	326	#13			NNO	1	executed	
23/11/2008	947	328	#14			NNO	1	cancelled	cancelled because of conflict with OCM shifted to the 30. Dec. or alternatively to the 28. Dec.
25/11/2008	949	330	#15			NNO	1	executed	
27/11/2008	951	332	#16			NNO	1	executed	
29/11/2008	953	334	#17			NNO	1	executed	
01/12/2008	955	336	#18			NNO	1	executed	
03/12/2008	957	338	#19			NNO	1	executed	
05/12/2008	959	340	#20			NNO	1	executed	
07/12/2008	961	342	#21			NNO	1	executed	
08/12/2008	962	343	#22			DSN	1	executed	(was moved because of conflicts with orbit lowering in Occ#5)
09/12/2008	963	344	#23			NNO	1	executed	
11/12/2008	965	346	#24			NNO	1	executed	
13/12/2008	967	348	#25			NNO	1	executed	
15/12/2008	969	350	#26			NNO	1	executed	
17/12/2008	971	352	#27			NNO	1	executed	
19/12/2008	973	354	#28			NNO	1	executed	
21/12/2008	975	356	#29			NNO	1	executed	
23/12/2008	977	358	#30			NNO	1	executed	
25/12/2008	979	360	#31			NNO	1	executed	
26/12/2008	980	361	#32			DSN	1	executed	(was moved because of conflicts with orbit lowering in Occ#5)
27/12/2008	981	362	#33			NNO	1	executed	
28/12/2008	982	363	Recovery #14			NNO	1	cancelled	NNO recovery (either Dec. 28 or Dec. 30). Moved to 1 Jan.
29/12/2008	983	364	#34			NNO	1	executed	
30/12/2008	984	365	Recovery #14			NNO	1	cancelled	NNO recovery (either Dec. 28 or Dec. 30). Moved to 1 Jan
31/12/2008	985	366	#35			NNO	1	executed	
01/01/2009	986	1	Recovery #14			NNO	1	executed	NNO recovery #14
Nov.08 - Jan-09	925-1015		Gravity measurements			DSN	5		Status: SHIFTED TO GRAV#4-7
			Vera does not plan this observations, but they are in DSN UL table. They should be removed.					cancelled	Description: Pass duration: 2 hours Total: 10 hours
15 Feb-09 - 28 Feb	1031-1044	46-59	High Data-rate taking	0.6-0.4		DSN	5		Status: requested

Planning:
Each second orbit

Orbits with lower latitudes are of higher interest.

								cancelled	Description: use DSN 70 m instead of CEB in order to dump more date during low-date rate period (using HGA2) Pass duration: 8 hours Total: 40 hours
09.03.09-15.03.09			**Gravity 4**	**0.3**		**DSN**	**4**		**70m needed**
09/03/2009	1053	68	#1	0.32	North Pole Region	DSN	1	cancelled	Cancelled because of Cebreros Maintenance. Target Gravity, HGA2
11/03/2009	1055	70	#2		North Pole Region	DSN	1	cancelled	Cancelled because of Cebreros Maintenance. Target Gravity, HGA2
13/03/2009	1057	72	#3		North Pole Region	DSN	1	cancelled	Cancelled because of Cebreros Maintenance. Target Gravity, HGA2
15/03/2009	1059	74	#4	0.3	North Pole Region	DSN	1	cancelled	Cancelled because of Cebreros Maintenance. Target Gravity, HGA2
21.03.09-27.03.09			**Gravity 5**	**0.3**		**DSN**	**4**		**70m needed**
21/03/2009	1065	80	#5	0.29	North Pole Region	DSN	1	cancelled	Cancelled because of Cebreros Maintenance. Target Gravity, HGA2
23/03/2009	1067	82	#6		North Pole Region	DSN	1	cancelled	Cancelled because of Cebreros Maintenance. Target Gravity, HGA2
25/03/2009	1069	84	#7		North Pole Region	DSN	1	cancelled	Cancelled because of Cebreros Maintenance. Target Gravity, HGA2
27/03/2009	1071	86	#8	0.28	North Pole Region	DSN	1	cancelled	Cancelled because of Cebreros Maintenance. Target Gravity, HGA2
15.04.09-19.04.09			**Gravity 6**	**0.3**		**DSN**	**3**		**70m needed**
15/04/2009	1090	105	#9	0.33	North Pole Region	DSN	1	cancelled	Target Gravity, HGA2,
17/04/2009	1092	107	#10		North Pole Region	DSN	1	cancelled	Target Gravity, HGA2
20/04/2009	1095	110	#11	0.35	North Pole Region	DSN	1	requested	Target Gravity, HGA2 orbit changed to #110 instead of #109
27.04.09-01.05.09			**Gravity 7**	**0.4**		**DSN**	**3**		**70m needed**
27/04/2009	1102	117	#12		North Pole Region	DSN	1	requested	Target Gravity, HGA2
29/04/2009	1104	119	#13		North Pole Region	DSN	1	requested	Target Gravity, HGA2
01/05/2009	1106	121	#14	0.43	North Pole Region	DSN	1	requested	Target Gravity, HGA2
XX.05.09-XX.05.09			**Gravity 8**	**0.6**		**DSN**	**3**		**70m needed**
	1130		#15			DSN		requested	Target Gravity, HGA2
	1132		#16			DSN		requested	Target Gravity, HGA2
	1134		#17			DSN		requested	Target Gravity, HGA2
	1136		#18			DSN		requested	Target Gravity, HGA2
XX.06.09-XX.06.09			**Gravity 9**	**0.8**		**DSN**	**3**		**70m needed**
	1161		#19			DSN		requested	Target Gravity, HGA1

Planning strategy for the polar gravity observation:

Primary goal is an observation in equal spaced times at dates as requested.

If a station request has a conflict please shift that observation by one day.

	1163		#20			DSN		requested	Target Gravity, HGA1
	1165		#21			DSN		requested	Target Gravity, HGA1
	1167		#22			DSN		requested	Target Gravity, HGA1
XX. July 2009-XX. Sep. 2009	**1182-1246**		**Earth Occultation 7**	**1.0-1.4**		**NNO**	**36**		**Planning Strategy Adapted to Lower Latitude Coverage**
16/07/2009	1182	197	#1			NNO	1	requested	
17/07/2009	1183	198	#2			NNO	1	requested	
18/07/2009	1184	199	#3			NNO	1	requested	
19/07/2009	1185	200	#4			NNO	1	requested	
20/07/2009	1186	201	#5			NNO	1	requested	
21/07/2009	1187	202	#6			NNO	1	requested	
22/07/2009	1188	203	#7			NNO	1	requested	
23/07/2009	1189	204	#8			NNO	1	requested	
25/07/2009	1191	206	#9			NNO	1	requested	
	1193		#10			NNO	1	requested	
	1195		#11			NNO	1	requested	
	1197		#12			NNO	1	requested	
	1199		#13			NNO	1	requested	
	1201		#14			NNO	1	requested	
	1204		#15			NNO	1	requested	
	1207		#16			NNO	1	requested	
	1210		#17			NNO	1	requested	
	1213		#18			NNO	1	requested	
	1216		#19			NNO	1	requested	
	1219		#20			NNO	1	requested	
	1222		#21			NNO	1	requested	
	1225		#22			NNO	1	requested	
	1226		#23			NNO	1	requested	Additional request (Meteor Shower coverage)
	1227		#24			NNO	1	requested	
	1228		#25			NNO	1	requested	Additional request (Meteor Shower coverage)
	1229		#26			NNO	1	requested	
	1231		#27			NNO	1	requested	
	1233		#28			NNO	1	requested	
	1235		#29			NNO	1	requested	
	1237		#30			NNO	1	requested	
	1239		#31			NNO	1	requested	

Planning strategy:

Orbits with lower latitudes are of higher interest.

	1241		#32			NNO	1	requested	
	1243		#33			NNO	1	requested	
	1244		#34			NNO	1	requested	
	1245		#35			NNO	1	requested	
	1246		#36			NNO	1	requested	
01.10.09-07.10.09			**Gravity 10**	**1.5**		**DSN**	**4**		**70m needed**
01/10/2009	1259	274	#1			DSN		requested	Target Gravity, HGA1
03/10/2009	1261	276	#2			DSN		requested	Target Gravity, HGA1
05/10/2009	1263	278	#3			DSN		requested	Target Gravity, HGA1
07/10/2009	1265	280	#4			DSN		requested	Target Gravity, HGA1
13.10.09 - 18-10-09			**Drag Campaign #2**	**1.5-1.6**		**NNO**	**6**		Execution Requirements: - 4hours centered on pericenter - minimum of 8 hours on the descending branch (realization is possible with a combination of NNO (at pericenter) and CEB during the normal telecom phase)
13/10/2009	1271	286	#1	1.5		NNO	1	requested	
14/10/2009	1272	287	#2	1.5		NNO	1	requested	
15/10/2009	1273	288	#3	1.5		NNO	1	requested	
16/10/2009	1274	289	#4	1.5		NNO	1	requested	
17/10/2009	1275	290	#5	1.6		NNO	1	requested	
18/10/2009	1276	291	#6	1.6		NNO	1	requested	
27.11.2009-25.02.2010			**Solar Corona**	**1.7**		**-**	**-**		**No observations planned because of weak S-Band**
XX. Dec. 2009-XX. Feb. 2010			**Earth Occultation 8**	**1.7**		**NNO**	**4**		**No observations planned Solar Conjunction**
14.02.10 - 17-04-10	**1395-1457**	**45-107**	**Drag Campaign #3**	**1.7-1.5**					Planning parameter for orbit selection: - altitude at pericenter shall be low, - angle between pericenter velocity vector direction and LOS direction shall be small, - distance SC - GS shall be small => best execution time is at the end of the campaign
01.10.09-07.10.09			**Gravity 11**	**1.5**		**DSN**	**3**		**70m needed**
21/04/2010	1461	111	#1			DSN		requested	Target Gravity, HGA1
23/04/2010	1463	113	#2			DSN		requested	Target Gravity, HGA1
25/10/2010	1465	115	#3			DSN		requested	Target Gravity, HGA1
30. Apr. 2010-11. J04ul. 2010	**1470-1542**	**120-192**	**Earth Occultation 9**	**1.5-1.0**		**NNO**	**39**		**Planning Strategy Adapted to Lower Latitude Coverage** (OCC is before pericenter)

30/04/2010	1470	120	#1	1.46		NNO	1	requested	
01/05/2010	1471	121	#2			NNO	1	requested	
03/05/2010	1473	123	#3			NNO	1	requested	
04/05/2010	1474	124	#4			NNO	1	requested	
06/05/2010	1476	126	#5			NNO	1	requested	
07/05/2010	1477	127	#6			NNO	1	requested	
09/05/2010	1479	129	#7			NNO	1	requested	
11/05/2010	1481	131	#8			NNO	1	requested	
13/05/2010	1483	133	#9			NNO	1	requested	
15/05/2010	1485	135	#10			NNO	1	requested	
17/05/2010	1487	137	#11			NNO	1	requested	
19/05/2010	1489	139	#12			NNO	1	requested	
22/05/2010	1492	142	#13			NNO	1	requested	
25/05/2010	1495	145	#14			NNO	1	requested	
30/05/2010	1500	150	#15			NNO	1	requested	
02/06/2010	1503	153	#16			NNO	1	requested	
05/06/2010	1506	156	#17			NNO	1	requested	
08/06/2010	1509	159	#18			NNO	1	requested	
11/06/2010	1512	162	#19			NNO	1	requested	
14/06/2010	1515	165	#20			NNO	1	requested	
16/06/2010	1517	167	#21			NNO	1	requested	
18/06/2010	1519	169	#22			NNO	1	requested	
20/06/2010	1521	171	#23			NNO	1	requested	
22/06/2010	1523	173	#24			NNO	1	requested	
24/06/2010	1525	175	#25			NNO	1	requested	
26/06/2010	1527	177	#26			NNO	1	requested	
28/06/2010	1529	179	#27			NNO	1	requested	
30/06/2010	1531	181	#28			NNO	1	requested	
01/07/2010	1532	182	#29			NNO	1	requested	
02/07/2010	1533	183	#30			NNO	1	requested	
03/07/2010	1534	184	#31			NNO	1	requested	
04/07/2010	1535	185	#32			NNO	1	requested	
05/07/2010	1536	186	#33			NNO	1	requested	
06/07/2010	1537	187	#34			NNO	1	requested	
07/07/2010	1538	188	#35			NNO	1	requested	
08/07/2010	1539	189	#36			NNO	1	requested	

09/07/2010	1540	190	#37			NNO	1	requested	
10/07/2010	1541	191	#38			NNO	1	requested	
11/07/2010	1542	192	#39	0.99		NNO	1	requested	
14.07.2010-20.07.2010			**Gravity 12**	**1.0**		**DSN**	**4**		**70m needed**
14/07/2010	1545	195	#1			DSN		requested	Target Gravity, HGA1
16/07/2010	1547	197	#2			DSN		requested	Target Gravity, HGA1
18/07/2010	1549	199	#3			DSN		requested	Target Gravity, HGA1
20/07/2010	1551	201	#4			DSN		requested	Target Gravity, HGA1