The ESA SPICE Server
An Introduction

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SPICE data for ESA Planetary Missions

➢ One of the tasks of the **ESA SPICE Service (ESS)** is the generation and archiving of **most** of the *operational* and *archive* SPICE products for the ESA planetary missions, with the support of NAIF and the SGS of the different projects.

➢ In general the SPICE products for ESA planetary missions:

- **Operational and pre-Operational** SPICE datasets produced by the ESS are available in the ESA SPICE server:
  - ftp://spiftp.esac.esa.int/data/SPICE/
  - ftp://ssols01.esac.esa.int/pub/data/SPICE (to be deprecated)

- **PDS3 datasets and PDS4 bundles/collections for the archive** produced by the ESS are available from the PSA web and the PSA server.

- Some kernels produced outside of ESA are also available :
  - Generic Kernels produced by NAIF
  - Mission specific kernels produced by Scientific Institutes in Europe (e.g. Belgium Royal Observatory, DLR)

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SPICE Operational Kernels - current

➤ Operational kernels as opposed to Archived kernels are kernels which are used by the Project SGS and Instrument Teams in their operational pipelines and routine work.

Kernel Dataset	spiftp server	ssols01 server	NAIF server	Mission status	Kernel status for ESS
ExoMars 2016	🟩	🟨	🟩	Operational	Almost stable
Rosetta	🟨	🟩		Operational	Consolidated*
Mars Express	🟨	🟩	🟩	Operational	Consolidated**
Venus Express	🟨	🟩	🟩	Post Operations	Final Review
BepiColombo	🟨	🟨	🟥	Studies	In development
JUICE	🟩	🟥	🟥	Studies	Almost stable
Solar Orbiter	🟨	🟥	🟥	Studies	Early development
SMART-1	🟨	🟩	🟩	Legacy	Not reviewed
Chandrayaan-1	🟨	🟩	🟩	Legacy	Not reviewed
AIM	🟥	🟥	🟥	Early studies	Aware of existence

🟩 Present   🟨 Changing soon   🟥 Not present

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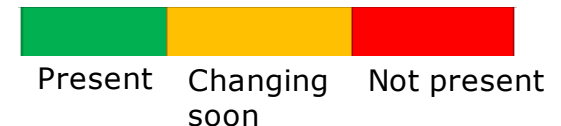
SPICE Operational Kernels – 2020?

➢ Operational kernels as opposed to Archived kernels are kernels which are used by the Project SGS and Instrument Teams in their operational pipelines and routine work.

Kernel Dataset	spiftp server	ssols01 server	NAIF mirror	Mission status	Kernel status for ESS
ExoMars 2016	🟩	🟥	🟩	Operational	Consolidated
ExoMars 2020	🟩	🟥	🟩	Operational	Consolidated
Rosetta	🟩	🟩	🟩	Legacy	Final
Mars Express	🟩	🟩	🟩	Operational	Consolidated
Venus Express	🟩	🟩	🟩	Legacy	Final
BepiColombo	🟩	🟥	🟩	Operational	Consolidated
JUICE	🟩	🟥	🟥	Study	Consolidated
Solar Orbiter	🟩	🟥	🟩	Operational	Consolidated
SMART-1	🟩	🟩	🟥	Legacy	Final
Chandrayaan-1	🟩	🟩	🟥	Legacy	Final
AIM	🟩	🟥	🟥	Operational	Consolidated

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ESA SPICE collections updated

- ➢ Two sets of SPICE collections can be distinguished for ESA Planetary Missions:
    - Classic-flavored: ROSETTA, MEX, VEX, CH-1 and SMART-1
    - Revised: EM16, BEPICOLOMBO and JUICE (and all future missions)
- ➢ Revised collections feature -as opposed to Classic-flavored:
    - Cross-mission filename convention agreed with the SPICE User Group (SUG - more information on it tomorrow).
    - Kernel filenames all lowercase as opposed to uppercase
    - Meta-kernels added to the kernel collection (life of users made easier, my life made harder ☺)
    - SPK and CK filenames non Flight Dynamics dependant:
        - em16_tgo_fcp_023_01_20160314_20161021_v01.bsp
        - ORMC_FD___131_37_WE_0001.BSP
    - SCLK time string separator changed from "." to ":"
    - Filenames might be too large: do not follow NAIF recommendations.
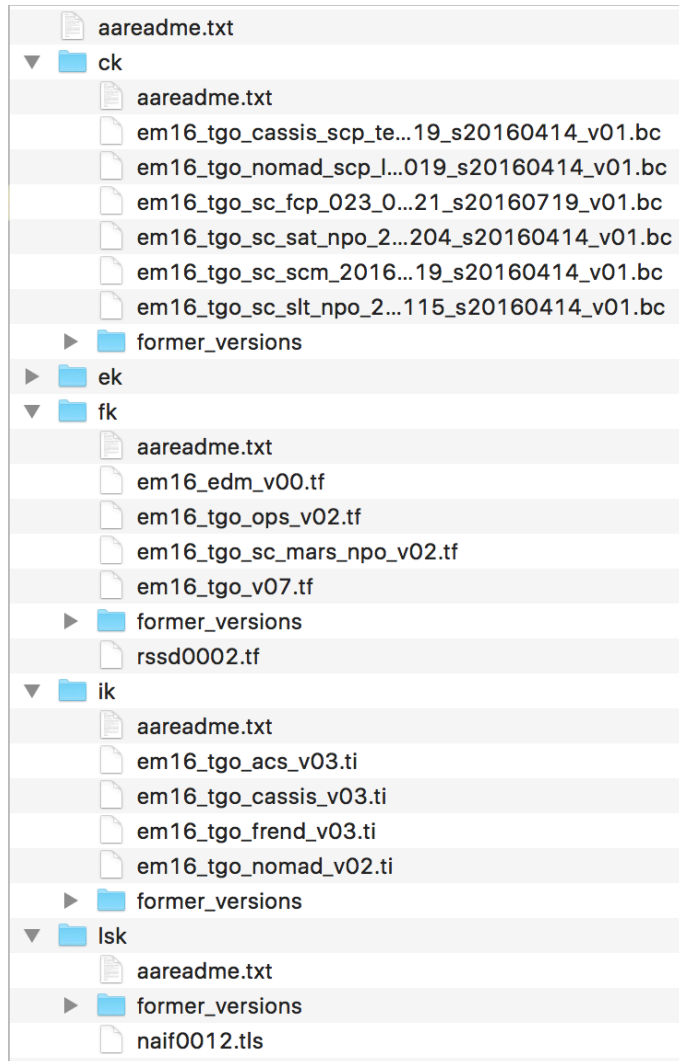   - Kernel collection version control and release strategy

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The ExoMars 2016 Kernel collection

- ➢ Access it via ftp directly or navigate your way through:
  - • spice.esac.esa.int or http://www.cosmos.esa.int/spice
- ➢ The ESA Home for SPICE contains some information on the ESA SPICE Service and the available SPICE kernel collections.

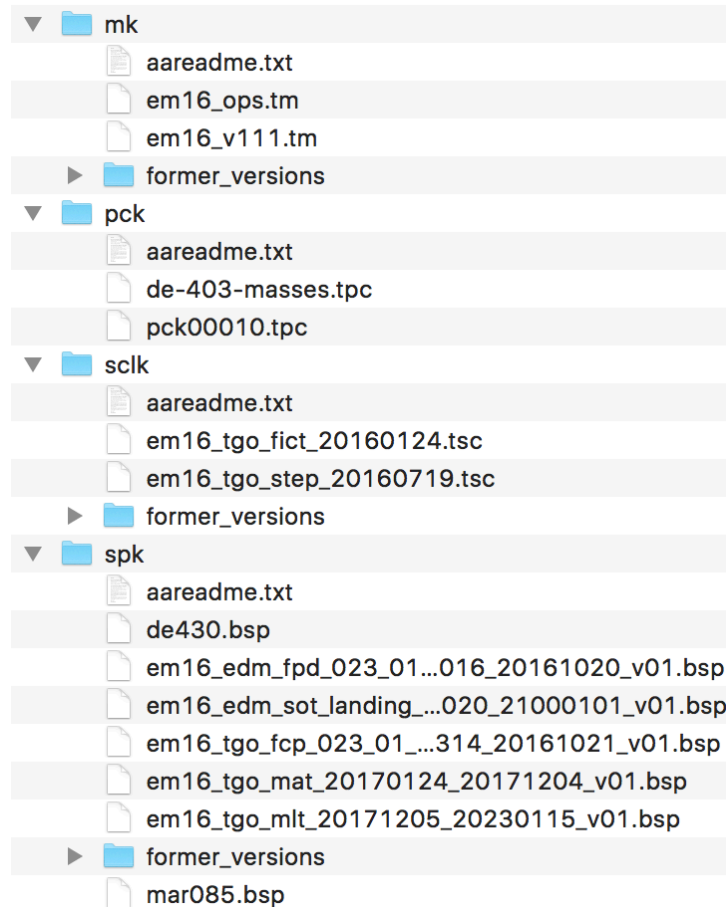- ➢ Some might remember a web based interface to the FTP... Coming one day

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The ExoMars 2016 Kernel collection

- aareadme.txt
- ▼ 📁 ck
  - aareadme.txt
  - em16_tgo_cassis_scp_te...19_s20160414_v01.bc
  - em16_tgo_nomad_scp_l...019_s20160414_v01.bc
  - em16_tgo_sc_fcp_023_0...21_s20160719_v01.bc
  - em16_tgo_sc_sat_npo_2...204_s20160414_v01.bc
  - em16_tgo_sc_scm_2016...19_s20160414_v01.bc
  - em16_tgo_sc_slt_npo_2...115_s20160414_v01.bc
  - ▶ 📁 former_versions
- ▶ 📁 ek
- ▼ 📁 fk
  - aareadme.txt
  - em16_edm_v00.tf
  - em16_tgo_ops_v02.tf
  - em16_tgo_sc_mars_npo_v02.tf
  - em16_tgo_v07.tf
  - ▶ 📁 former_versions
  - rssd0002.tf
- ▼ 📁 ik
  - aareadme.txt
  - em16_tgo_acs_v03.ti
  - em16_tgo_cassis_v03.ti
  - em16_tgo_frend_v03.ti
  - em16_tgo_nomad_v02.ti
  - ▶ 📁 former_versions
- ▼ 📁 lsk
  - aareadme.txt
  - ▶ 📁 former_versions
  - naif0012.tls

➢ "State of the art" ESA Planetary Missions operational kernels

- ▼ 📁 mk
  - aareadme.txt
  - em16_ops.tm
  - em16_v111.tm
  - ▶ 📁 former_versions
- ▼ 📁 pck
  - aareadme.txt
  - de-403-masses.tpc
  - pck00010.tpc
- ▼ 📁 sclk
  - aareadme.txt
  - em16_tgo_fict_20160124.tsc
  - em16_tgo_step_20160719.tsc
  - ▶ 📁 former_versions
- ▼ 📁 spk
  - aareadme.txt
  - de430.bsp
  - em16_edm_fpd_023_01...016_20161020_v01.bsp
  - em16_edm_sot_landing_...020_21000101_v01.bsp
  - em16_tgo_fcp_023_01_...314_20161021_v01.bsp
  - em16_tgo_mat_20170124_20171204_v01.bsp
  - em16_tgo_mlt_20171205_20230115_v01.bsp
  - ▶ 📁 former_versions
  - mar085.bsp

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Kernel collections versions & releases

- As mentioned several times during this workshop it is quite challenging to make sure one obtains the latest available kernels.

- Kernel collections releases, release notes and up-to-date mk can help users to obtain the data they desire that was produced in the date they desire.

- Kernel collections versions releases are linked to major, minor, or bug-driven updates/additions of text kernels (FK, IK, PCK, DSK, LSK), filenames, directory structure, etc. recorded in Release Notes available in the FTP: ftp://spiftp.esac.esa.int/data/SPICE/EM16/misc/release_notes/em16_ftp_111.txt

- The status of the kernel collection is "frozen" in the mk that maps the release. Note that it will be updated and overwritten when one of the kernels that it includes is moved to the *former_versions* directory. When this happens, a previously downloaded meta-kernel will not be working with a given kernel collection that a user has just downloaded or vice-versa.

- The MK usually contains a lot of useful data for the given kernel collection.

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Kernel collections versions & releases

➢ But what happens with periodically updated SPK, CK and SCLK files?

➢ Since the periodicity of the updates can be from some weeks to a ground station pass based periodicity, it is not reasonable to put this files under a version regime.

➢ We use the "operational" meta-kernel to identify the last and latest version of the kernels available. Since this meta-kernel will be overwritten every time a new SPK, CK, SCLK file is made available, the mk is always stamped with a date and version and put in the *former_versions* directory. Note that these mks in *former_versions* will also be overwritten when a non SPK, CK, SCLK file is updated –and thus a collection release has happened- to update the path of the kernels.

- em16_ops.tm
- em16_v111.tm
  - former_versions
    - em16_ops_20160915_v02.tm
    - em16_ops_20160912_v01.tm
    - em16_v110.tm

➢ **E-mail notifications are available to everyone: SGS and PI Teams are usually receivers.**

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A brief introduction to the PSA

- Repository of ESA missions for exploration of the Solar System

- It contains science datasets, as well as engineering datasets of spacecrafts and instruments

- It uses a common format with other international planetary missions, the Planetary Data System format (PDS)

- PSA has the commitment to provide access to ESA missions scientific and engineering datasets for decades to the public

- ESDC (ESAC Science Data Center) and PSA aim at providing science ready datasets to the scientific community so that they can be analysed to produce scientific results.

Presenting and Preserving reliable scientific datasets

http://www.cosmos.esa.int/web/psa

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A brief introduction to the PSA
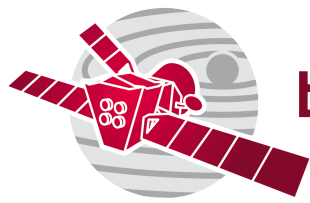
bepicolombo

venus express

rosetta

giotto

cassini-huygens

smart-1

mars express

exomars

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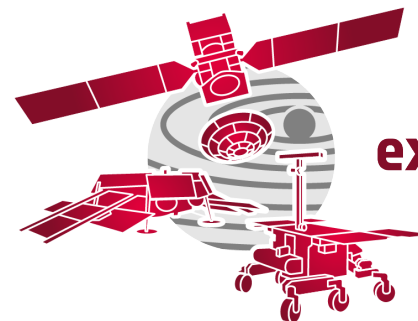
Archived Kernels
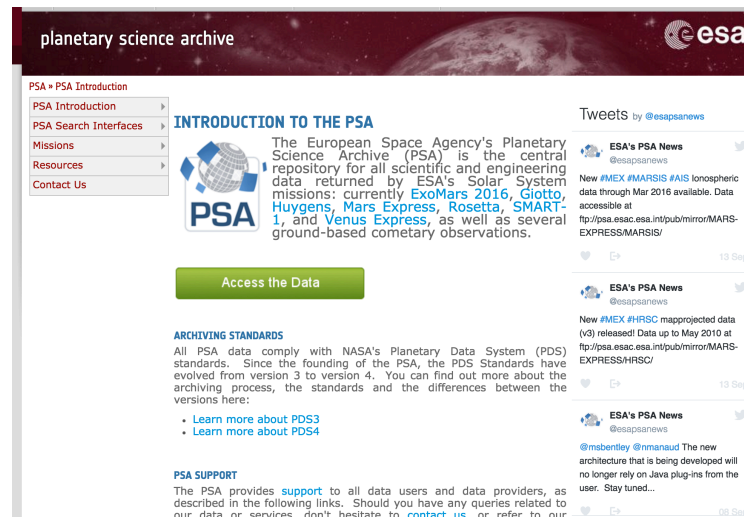
➢ **PDS3 datasets and PDS4 bundles/collections for the archive** produced by the ESS are available from the PSA web and the PSA server.

➢ Archived kernels are consolidated and "validated" kernel datasets/collections useable for Science Data Analysis

➢ PSA has the commitment to provide access to ESA missions scientific and engineering datasets for decades to the public

➢ **ftp://psa.esac.esa.int/pub/mirror/**

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Archived Kernels

➤ PDS3 Archived SPICE datasets available:

- Mars Express.   Last updated 2013-05-29 Next increment ~ Nov 2016
- Rosetta.   Last updated 2016-03-31 Next increment ~ Oct 2016
- Venus Express. Last updated 2013-02-13 Next increment ~ Nov 2016

➤ PDS4 Archived future SPICE collections:

- ExoMars 2016   Coming soon…
- BepiColombo

Index of ftp://psa.esac.esa.int/pub/mirror/

⬆ Up to higher level directory

Name	Size	Last Modified	
📁 CASSINI-HUYGENS		16/10/07	00:00:00
📁 EARTH		11/09/09	00:00:00
📁 ExoMars2016		25/05/16	15:58:00
📁 GIOTTO		17/10/06	00:00:00
📁 HST		17/10/06	00:00:00
📁 INTERNATIONAL-ROSETTA-MISSION		03/07/15	00:00:00
📁 MARS-EXPRESS		19/05/09	00:00:00
📁 PSA		13/05/16	12:36:00
📁 SMALL-MISSIONS-FOR-ADVANCED-RESEARCH-AND-TECHNOLOGY		20/08/10	00:00:00
📁 VENUS-EXPRESS		15/09/10	00:00:00

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