Euclid Mission Database

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2016 Euclid Photometric Calibration Workshop

Euclid Mission Database (MDB)

Based on the Gaia Parameter Database design

Centralized, project-wide repository containing complete, consistent, clearly referenced, up-to-date values for "parameters" relevant for Euclid, aimed at scientists, engineers, software developers, industrial teams…
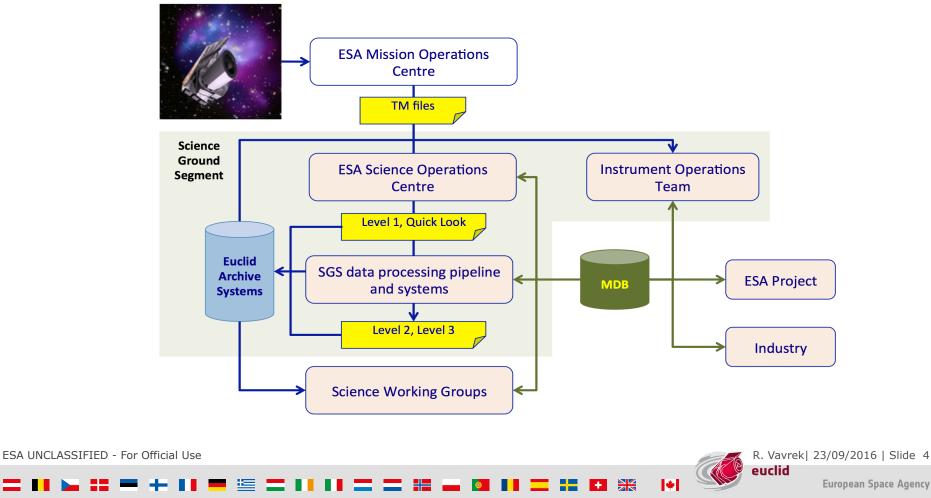
Euclid Mission Database (MDB)

➢ Hardcoding constants, tables, and inventing numbers from the widespread Euclid documentation is error prone and avoidable. The MDB is a response to this problem:

➢ Configuration control of **consistent assumptions** for all analysis, studies and software development: *Mission Database (MDB)*:

- Ensure that there is a **single repository of the reference representation of the Euclid Mission System**

- Contains **performance and environment parameters** for all mission elements and inputs.

- **Allow SGS to access system information** through API for PFs, and allow any Euclid member to access system parameter information through a web-based database viewer/browser/download tool

- Database admin tool maintained by Euclid Consortium. Viewers implemented by ESAC

- Change controlled by CCB with Mission System Engineering Working Group

MDB interfaces

- The Euclid Mission Database provides **parameter management and distribution system**
- System is being modeled and disseminated for the **SGS processing functions**.

MDB access

➢ The released Mission Database is stored on the ESAC SVN repository:

http://euclid.esac.esa.int/svn/ESA/System/Euclid_Mission_DB/

➢ The API (Python package) to access the database image and read individual parameters (or files, tables, etc.). Database in XML format compatible with the reference XML schema.

http://euclid.roe.ac.uk/projects/codeen-users/wiki/MDBTools

➢ MDB web-interface for browsing and direct parameter access purposes (accessible with rssd.esa.int LDAP credentials):

http://euclid.esac.esa.int/epdb/

MDB access – parameter browser

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MDB architecture – top level mission elements

> The MDB structure shall match the Euclid Mission Architecture of the Mission Model

> Mission elements are at the top-level of the MDB hierarchy:
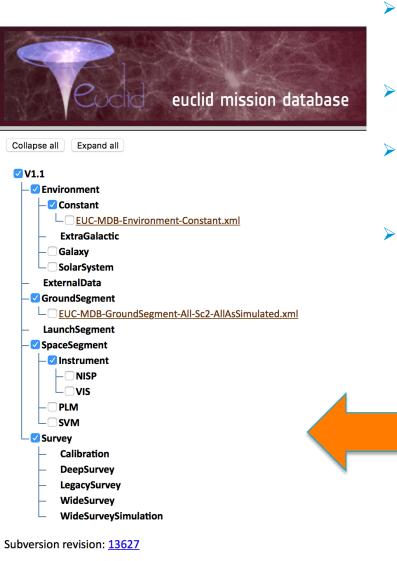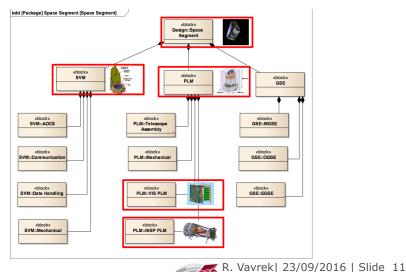
MDB architecture – decomposition down to module level

euclid mission database

Collapse all   Expand all

- ☑ **V1.1**
  - ☑ **Environment**
    - ☑ **Constant**
      - ☐ EUC-MDB-Environment-Constant.xml
    - **ExtraGalactic**
    - ☐ **Galaxy**
    - ☐ **SolarSystem**
  - **ExternalData**
  - ☑ **GroundSegment**
    - ☐ EUC-MDB-GroundSegment-All-Sc2-AllAsSimulated.xml
  - **LaunchSegment**
  - ☑ **SpaceSegment**
    - ☑ **Instrument**
      - ☐ **NISP**
      - ☐ **VIS**
    - ☐ **PLM**
    - ☐ **SVM**
  - ☑ **Survey**
    - **Calibration**
    - **DeepSurvey**
    - **LegacySurvey**
    - **WideSurvey**
    - **WideSurveySimulation**

Subversion revision: 13627
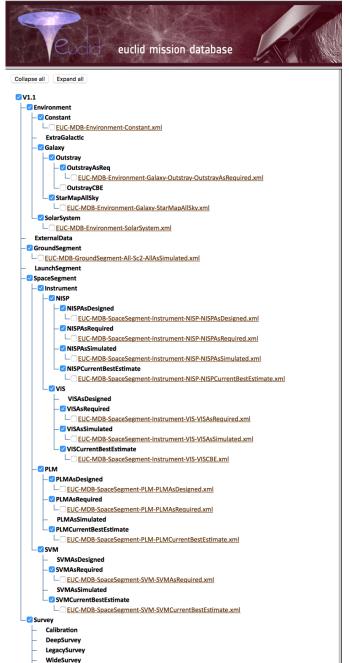
- ➤ At lower levels, the MDB follows the hierarchical top-down decomposition of the satellite, its payloads and other mission elements into logical units.

- ➤ These units correspond to sub-levels on which the system is designed and being verified.

- ➤ The decomposition stops at module level (PLM/SVM/ Instruments) and not go to lower to assembly level (Telescope Assembly/ Focal Plane Assembly / AOCS …)

- ➤ Parameters always placed at the lowest level of the hierarchy
  - • No multiplication of parameters
  - • Advantage for easy mapping and location

MDB architecture – module representations

- For each module level, add a level of what representation of the module is discussed: As Required / As Designed / CBE / As Simulated (/ As Built)

- These Mission Configurations can be isolated by the user but MCs are not equally complete

- Parameters is an abstraction of a configurable item in the MDB what consist meta data (origin, description, reference…) and dataset (scalar, table, text, fits, binary file…)

- Derived parameters can be created by transfer functions (parametric model which applies a set of MDB input parameters)

  - TFs are under MDB configuration control

Parameter formatting rules and conventions

- Meta data obligatory tags is compliant with the Common Data Model.

- MDB uses SI units as default for datasets (some flexibility to be accepted where ir is convenient)

- Standards and conventions are TBW (applicable to the SGS)

Meta data		Parameter
Description	Context, applicability, caveats and reference to parent requirement if applicable	Single parameter with unit or parameter file
Source	Originator of data	Parameter file can contain columns starting with column names. Comments started with '#' can be inserted on the top of simple parameter files.
Release	Last update (MDB version number)	
Validation	Reserved to CCB comments	

- A parameter shall be referenced by its name preceeded by hierarchical levels of prefixes **AA.BB.CC.DD.NAME**, where:

AA	Mission level component	Space segment, Ground segment, Launch segment, Environment, Survey, External data
BB	Modules	Instrument, PLM, SVM
CC	Instruments	VIS, NISP
DD	Mission configuration	As required, as designed, as simulated or current best estimate
NAME	Parameter name	Any alphabetical (English) character, mix of upper- and lower cases, no spaces, dots or underscores. Designated names can contain acronyms.

How to use the MDB?

- There should be **no ambiguity by users how mission configurations in the MDB are translated to a single representation of the system**. The main configurations provided in the MDB are "as required", "as designed" and "CBE (current best estimate)" (and later "as built" branch will be added). There is no strict rule that all parameters need to be provided at CBE level during the development phase, to the contrary, this may not be possible until dedicated (sub-)system level test campaigns are carried out.

- It is of paramount importance that **all users have exactly the same perception of the MDB**, by following a bottom-up logic to create a snapshot of parameters applicable to all PFs**: [CBE] -> [as designed] -> [as required]**

- If a parameter is not available at the CBE level then take the "as designed" value of the same parameter, if the "as designed" value is not available then take the "as required" value.

- **If a validated parameter is not available, then OUs shall request an unvalidated parameter dummy** (instead of hardcoding such values in the PFs)

- It is up to the CCB to accept or assign a parameter for the proper branch of the mission configuration.

- Users Manual is TBW

MDB user profiles

➢ ***Actors in administrative role*** take part of the database management process, can propose and approve changes to the database. Actors in administrative role are members of the CCB (Configuration Control Board).

- The MDB CCB consists of members of the MSEWG (Mission System Engineering Working Group and the MDB Manager)

➢ ***Actors in subscriber role*** are SGS Software Engineers, Scientists, Engineers with standard access rights. This group can access the content of the database and propose changes but they are not directly involved in the CCB approval cycle. Subscribers connected to the database can read only the operational database and can have write privileges to a staging database.
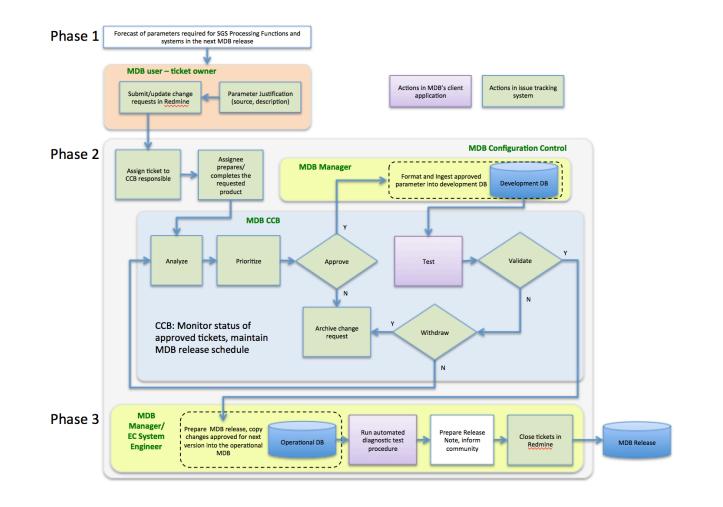
MDB content management (CCB)

MDB configuration control process flow diagram

MDB content management (CCB)

- **Evaluating and approving proposed changes** submitted by users to the issue tracking system; resolve conflicting requests if necessary

- **Prioritizing** approved changes

- The CCB **assigns the set of updates to be included in the upcoming versions** of the operational database; scheduling the changes for forthcoming releases

- If necessary, **provide content to parameters** requested

- **Format parameters** following the formatting rules

- **Collect and review Parameter Justification Files (PJFs)**, ensure a model description is comprehensible. PJFs could be considered existing documents generated by IDTs or Industry or generated for the purpose of MDB process. Single parameters may not require a PJF if applicable external reference does exists (in case of physical constants, for instance). The CCB may refrain from insisting on a PJF if the parameter update can be short explained in the parameter description field. Justification shall be traced in Redmine issue tracking system, and Redmine shall be considered the only reference repository of justification information.

- **Monitoring the status of approved changes** identified for the upcoming release; check whether they are implemented as requested in the Development Database.

- **Deploy new version of the Operational Database**, provide Release Note to the users community

MDB release plan and

- **The official representation of the Euclid Mission System provided in subsequent MDB releases shall be synchronized to SGS development and verification/validation milestones**

- The baseline release plan **shall adjust to the SGS Scientific Challenges the release of the applicable mission configuration in the MDB**. The timely update (1 month before the SCx kickoff - TBC) requires that parameters required by Processing Functions (PFs) for the upcoming Scientific Challenge are properly forecasted and entered into Redmine not later than 2 month before the MDB release.

- It remains the CCB responsibility to provide parameters on time under the configuration control process

- **In case a requested parameter is not available**, or not mature enough to include in the upcoming release then the CCB shall either reject the parameter or assign for a later release. In case a parameter dummy value is necessary for the proper execution of a PF, then the OU responsible for the PF shall indicate this fact in the request of the parameter.
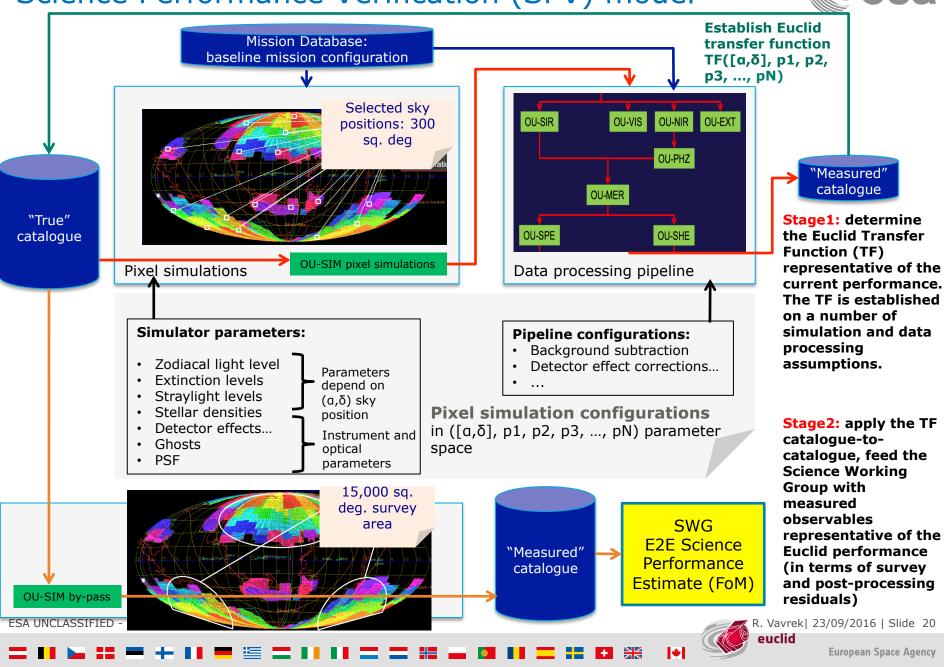
MDB status

- **MDB has been poplulated for SC2**
- **To be prepared for SC3 and beyond for the SPV2**
- MDB CCB #3 on 4 November
- Pre-MDB meeting to prepare the availability of information for the CCB meeting
- Some examples of the kind of parameters tp be tracked for SC3 and SPV2:

  - **PLM :** transmission of the telescope for each channel of VIS/NISP, PSF WFE, plateScale, FOV geometry, straylight model with NDI, ghost ratio, temperature,...

  - **SVM :** angles constraints, dithering, overlap,...

  - **NISP :** grism characteristics, transmission, bands cut on/off, QE, full well capacity, detector dimensions, plate scale , gain, persistence model, readout characteristics (macc), dark current, noise maps,...

  - **VIS :** Calibration Unit characteristics, detector FWHM parameter, non-linearity model, CTI model, ghost model, QE, CCD / FPA characteristics, exposure time, gain, dark current, noise maps,...

European Space Agency

Science Performance Verification (SPV) model

Mission Database: baseline mission configuration

Establish Euclid transfer function TF([α,δ], p1, p2, p3, …, pN)

Selected sky positions: 300 sq. deg

"True" catalogue

Pixel simulations

OU-SIM pixel simulations

OU-SIR   OU-VIS   OU-NIR   OU-EXT

OU-PHZ

OU-MER

OU-SPE   OU-SHE

Data processing pipeline

"Measured" catalogue

Stage1: determine the Euclid Transfer Function (TF) representative of the current performance. The TF is established on a number of simulation and data processing assumptions.

Simulator parameters:

- Zodiacal light level
- Extinction levels
- Straylight levels
- Stellar densities
- Detector effects…
- Ghosts
- PSF

Parameters depend on (α,δ) sky position

Instrument and optical parameters

Pipeline configurations:
- Background subtraction
- Detector effect corrections…
- …

Pixel simulation configurations in ([α,δ], p1, p2, p3, …, pN) parameter space

Stage2: apply the TF catalogue-to-catalogue, feed the Science Working Group with measured observables representative of the Euclid performance (in terms of survey and post-processing residuals)

15,000 sq. deg. survey area

OU-SIM by-pass

"Measured" catalogue

SWG E2E Science Performance Estimate (FoM)

euclid

European Space Agency

Mission Database open issues

- **The Euclid Mission Database provides parameter management and distribution system in which the actual system is being modeled and disseminated for the SGS processing functions.** The For SC3 we have to make the system access and management process fully polished out.

- Due to different schedules of hardware development and testing from SGS software development, **it remains very difficult** (practically impossible) **to validate all necessary system parameters for any given MDB release** before the knowledge of the fully assembled and characterized system becomes available. It is up to the CCB to decide if a parameter need to be validated for an MDB release, or a non-validated parameter can be safely applied for the purpose of SGS development.

- **Alternative mission configurations** needed? (For instance, try degraded system performance for simulations)

- **Calibration derived data and MDB parameters have common nature**. Where cal tables shall be stored?

- Shall we store uplink parameters in the MDB?

- **Users Manual** TBW

- Transfer Functions might be complex, who should write properly engineered code? Should it come from OUs?