DU438 Software Design Description

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Abstract

This is the Gaia DPAC Software Design Description (SDD) for DU 438, which aims at providing the simulated test data for all the other Non-Single Stars (NSS) Development Units (DU).

Document History

Issue	Revision	Date	Author	Comment
1	0	2009-05-25	F.A.	First version
D	2	2009-05-05	F.A.	Update for cycle 6
D	1	2008-05-10	F.A.	Creation

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Contents

1 Introduction

1.1 Objectives

The DU438 intends to provide (realistic) simulated data to the other NSS DUs. For that purpose, it relies on the work performed within the CU2 GaiaSimu toolbox (Babusiaux et al., FC-001) on one hand, to generate source data, and on the GOG (Isasi et al., YI-003) or GIBIS (Babusiaux et al., CB-003) generators in a second step for the generation of the transit data.

The software developed in DU438 thus relies on the GaiaSimu library to provide an adaptation to the NSS needs. Besides, DU438 also collects the requirements from the NSS DUs for an implementation within GaiaSimu.

1.2 Scope

This document is applicable to this software product and provides a minimum information only about the product. More information about the scientific content can be found in Arenou (DMS-FA-003) and more recently in Arenou (2009a). How to install the product is described in (Arenou, 2009b) and how to run it is shown in (Arenou, 2008b). The rest of the information is indicated through references in the text, pointing to URL links.

1.3 Applicable Documents

Levoir et al. (TL-001)	DPAC Product Assurance Plan
Pourbaix et al. (DP-005)	Software Development Plan for CU4
CU4 (DP-006)	Software Requirements Specification for CU4
Arenou (2008a)	Software Requirements Specification for product: Simulated Test Data for Non Single Stars processing

1.4 Reference Documents

Arenou, F., 2003, *Java simulation of binaries*, DMS-FA-003, URL http://www.rssd.esa.int/llink/livelink/open/357542

Arenou, F., 2008a, *DU438 Software Requirements Specification*, Tech. Rep. GAIA-C4-SP-OPM-FA-051, Observatoire de Paris / CNRS, URL http://wwwhip.obspm.fr/~arenou/PS-papers/gaia/GAIA-C4-SP-OPM-FA-051.pdf

Arenou, F., 2008b, *DU438 Software User Manual*, Tech. Rep. GAIA-C4-UG-OPM-FA-055, Observatoire de Paris / CNRS,
URL http://wwwhip.obspm.fr/~arenou/PS-papers/gaia/GAIA-C4-UG-OPM-FA-055.pdf

Arenou, F., 2009a, *Simulation of multiple stars*, Tech. Rep. GAIA-C2-SP-OPM-FA-054, Observatoire de Paris / CNRS (forthcoming)

Arenou, F., 2009b, *DU438 Software Release Note*, Tech. Rep. GAIA-C4-SP-OPM-FA-057, Observatoire de Paris / CNRS,
URL http://wwwhip.obspm.fr/~arenou/PS-papers/gaia/GAIA-C4-SP-OPM-FA-057.pdf

Arenou, F., Bernstein, H.H., Halbwachs, J., Sozzetti, A., 2006, *Simulation requirements for CU4 non-single stars processing - Cycle 2*, Tech. Rep. GAIA-C4-SP-OPM-FA-045-1, Observatoire de Paris / CNRS,
URL http://wwwhip.obspm.fr/PS-papers/gaia/GAIA-C4-SP-OPM-FA-045.pdf

Arenou, F., Halbwachs, J., Pourbaix, D., Siopis, C., Sozzetti, A., 2007a, *Simulation requirements for CU4 non-single stars processing - Cycle 3*, Tech. Rep. GAIA-C4-SP-OPM-FA-047-2, Observatoire de Paris / CNRS,
URL http://wwwhip.obspm.fr/PS-papers/gaia/GAIA-C4-SP-OPM-FA-047.pdf

Arenou, F., Tanga, P., Halbwachs, J., et al., 2007b, *Simulation requirements for CU4 NSS+SSO - Cycle 4*, Tech. Rep. GAIA-C4-SP-OPM-FA-052, Observatoire de Paris / CNRS,
URL http://wwwhip.obspm.fr/~arenou/PS-papers/gaia/GAIA-C4-SP-OPM-FA-052.pdf

Arenou, F., Tanga, P., Halbwachs, J., et al., 2008, *Simulation requirements for CU4 NSS+SSO - Cycle 5*, Tech. Rep. GAIA-C4-SP-OPM-FA-053, Observatoire de Paris / CNRS,
URL http://wwwhip.obspm.fr/~arenou/PS-papers/gaia/GAIA-C4-SP-OPM-FA-053.pdf

Babusiaux, C., Grux, E., Russo, F., et al., 2008, *GaiaSimu User Guide*,
GAIA-C2-TN-OPM-FC-001,
URL http://www.rssd.esa.int/llink/livelink/open/2711174

Babusiaux, C., Sartoretti, P., Leclerc, N., et al., 2009, *The Gaia instrument and basic image simulator (GIBIS) - User Guide*,
GAIA-C2-SP-OPM-CB-003,
URL http://www.rssd.esa.int/llink/livelink/open/491265

CU4, 2008, *CU4 Software Requirements Specification*,
GAIA-C4-SP-ULB-DP-006,
URL http://www.rssd.esa.int/llink/livelink/open/2786306

Isasi, Y., Zaldua, I., Sartoretti, P., et al., 2008, *GOG v5.0 User Guide*, GAIA-C2-UG-UB-YI-003, URL http://www.rssd.esa.int/llink/livelink/open/2775659

Levoir, T., Damery, J., Hoar, J., et al., 2007, *DPAC Software Product Assurance Plan*, GAIA-C1-PL-CNES-TL-001, URL http://www.rssd.esa.int/llink/livelink/open/2439085

Pourbaix, D., Tanga, P., Frezouls, B., 2008, *CU4 Software Development Plan*, GAIA-C4-PL-ULB-DP-005, URL http://www.rssd.esa.int/llink/livelink/open/2786666

Reyle, C., Robin, A., Arenou, F., et al., 2008, *Universe model ICD*, GAIA-C2-SP-LAOB-CR-001, URL http://www.rssd.esa.int/llink/livelink/open/2732832

Robin, A., Reyle, C., Wallut, J., et al., 2009, *Universe Model library Software Design Description*, GAIA-C2-SP-LAOB-AR-006, URL http://www.rssd.esa.int/llink/livelink/open/2892987

1.5 Definitions, acronyms, and abbreviations

The following is a complete list of acronyms used in this document:

Acronym	Description
CU	Coordination Unit (in DPAC)
DPAC	Data Processing and Analysis Consortium
DU	Development Unit
ICD	Interface Control Document
NSS	Non Single Stars

2 Methods and conventions

In the following, Unified Modeling Language (UML) diagrams may be used.

3 Design Overview

3.1 Identification

Identifier: DU438
Type: Java Archive, standalone program
Purpose: Simulated test data
Description: This software product aims at producing lists of simulated sources specifically adapted to each DU NSS needs.
Dependencies: This software product needs the GaiaSimu archive to work. It is made of a jar and of external data files; for details about the full dependencies, and how to implement them, please refer to the DU438 Software Release Note (Arenou, 2009b)

3.2 Architecture

The general organisation is the described at section 4.1.2. Besides, as most of the methods have been implemented as much as possible by default in the Universe part of GaiaSimu, the general organisation of the GaiaSimu software also needs to be described. This is done in the Universe Model SDD (Robin et al., AR-006), Sect. 4.1, to which the reader is referred.

3.3 Dynamic description

The DU438 is run as described in its Software User Manual (Arenou, 2008b). In summary, the description is the following: the user chooses to which NSS DU the data will be simulated (choice is DU432, DU433, DU434, DU436, DU437, DU439, and DMS for the general Universe Model default), and possibly:

- how many sources should be simulated,
- and in this case, possibly up to which limiting magnitude,
- and in this case, possibly up to which distance.

From this, a list of random sources pertaining to multiple systems is output. This list should then be submitted to GOG/GIBIS for the generation of the transit data.

4 Software Modules

4.1 DU438

4.1.1 Identification

Identifier: DU438
Type: Java Package
Purpose: CU4-DU438-S-FUNC-020, CU4-DU438-S-FUNC-030, CU4-DU438-S-FUNC-040
Description: This software module implements the generation of simulated sources
Dependencies: see 3.1

4.1.2 Static Description

The DU438 is organised in two parts:

- the DU438 launch environment (DU438, DU438Main, DU438Exception classes)
- the DmsSimuDU43n ($n = 2, 3, 4, 6, 7, 9$) classes inside the `current_cycle` folder.

The classes are shown Fig. 1. The various DmsSimuDU43n only contain the same public methods, and, as much as possible, all what can be deported to the DmsCommon GaiaSimu class is done, trying to leave only what is special in the DmsSimuDU43n.

4.1.3 Dynamic description

When DU438Main is launched, and after the environment is settled (output files, etc), the sources are generated. For DU433, which uses GIBIS, this is done in one (l, b) direction. For the other, this is done in several galactic areas to allow mixed statistical properties.

In each direction, the GaiaSimu getSources() method is called, which generates a list of stellar sources. These sources can be chosen at random as single or multiple systems, and of course they are systematically binary (and sometimes multiple) in our DU43n cases. This is through the getSources() that the DmsSimuDU43n are called, substituting the GaiaSimu standard DmsGenerator class. They contain the basic recipe to generate the style of binary system, choosing the period range, etc.

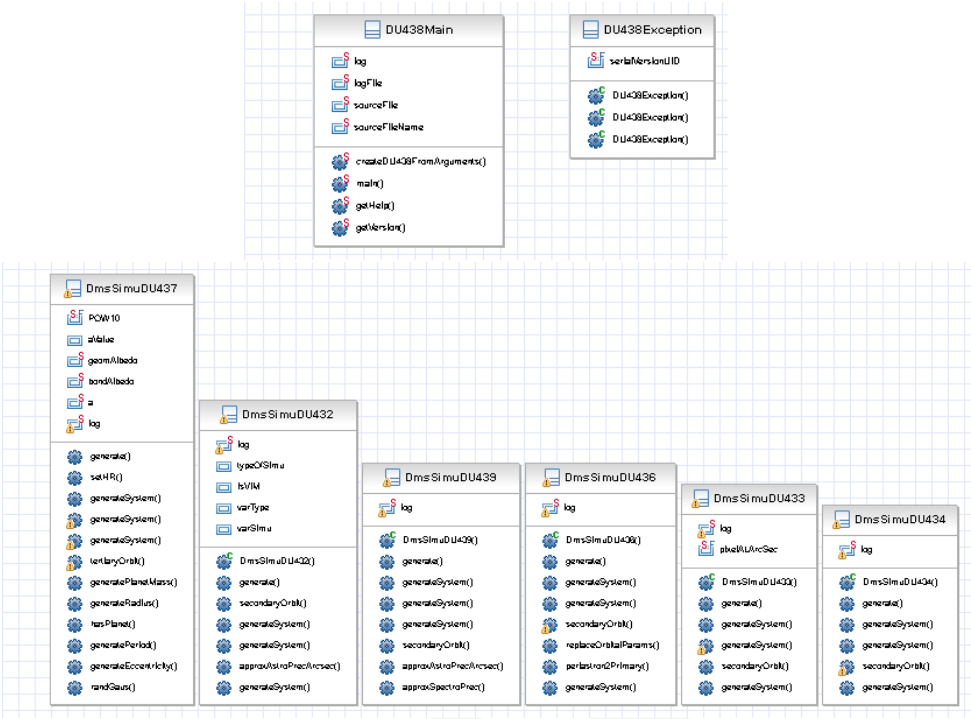

FIGURE 1: DU438 class description

4.1.4 Interfaces

The generated data strictly follows the Universe Model Interface Control Document (Reyle et al., CR-001). Please refer to this UM ICD document for all details: the output format is not repeated here to avoid any mistake.

5 Traceability

Requirement	Version	Design element implementing requirement	Completion
CU4-DU438-S-FUNC-010	1.1	N/A, see Arenou et al. (2006, 2007a,b, 2008)	C
CU4-DU438-S-FUNC-020	1.1	DU438	C
CU4-DU438-S-FUNC-030	1.1	DU438	C
CU4-DU438-S-FUNC-040	1.1	DU438 (DU438Main)	C
CU4-DU438-S-FUNC-050	1.1	DU438/test/cycle*n*/	PC
CU4-DU438-S-FUNC-060	1.1	N/A, see Mantis issues 816, 889, 1090, 1131, 1162, 1170, 1269, 1283, 1350, 1404, 1487, 1542, 1778, 1815, 1816, 1857, 2815, 2881, 2882, 2911, 2964, 3069, 3234, 3292, 4055, 4075	C

The field completion reveals whether the SRS requirement is fully covered. It can have the following values:

- C: the SRS requirement is fully covered
- PC: the SRS requirement is partially covered
- NC: the SRS requirement is not covered at all

The values PC and NC could happen when the CU/DU decide for example to delay the design of all or part of a functionality to the next cycle.