Documentation of MSAP3-32 for PLATO
Selection

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Table 1: Author information

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Table 2: Version history

Issue	Date	№ change description	Page(s)	Paragraph(s)
1.0	March 4, 2023	Initial release	All	All
1.1	January 12, 2024	Updated version	All	All
1.2	March 4, 2024	Added full seismic inputs	All	All

Contents

1 Introduction

1.1 Scope of the document

This document aims to provide a description of the selection algorithm for the selection and validation module of the MSAP5. It provides technical details (inputs, outputs, data types) as well as the functional description (implementation). Moreover, the exact position of this algorithm within the data processing pipeline is described in [RD1].

1.2 Nomenclature

See 3 and 4.

Table 3: Nomenclature

Term	Description
M	mass of the star in units of the solar mass $M_\odot$
R	radius of the star in units of the solar radius $R_\odot$
A	age of the star in units of Gyr

Table 4: Standard data types

Type	Size	Values
array	arbitrary	floats

1.3 Referenced documents

The following documents are referenced:

RD1 PLATO-LESIA-PSPM-DD-0021, Work and data flows of the stellar L1/L2 processing pipeline

MSAP3-31 PLATO-MSAP3-31, Consistency checks

1.4 Abbreviations

IDP Intermediate Data Product

2 General overview

2.1 Name of the algorithm and status

The algorithm is MSAP5-32, *Selection*. The baseline algorithm has been implemented, but revisions are expected.

2.2 Synopsis

The objective of MSAP5-32 is to select the final values of mass (M), radius (R), and age (A). We implement a priority list, presenting the measurement type of highest priority when it is available, and otherwise moving on to the measurement with the next highest priority. The algorithm outputs which IDP was selected. In the case of no measurements, or an inconsistency flag from MSAP5-31, the algorithm returns 'None'.

In the next iteration, we will revise the above procedure. In particular, this module will not return 'None' when there are inconsistent measurements. Instead, it will proceed as if there are no inconsistencies.

The current priority list is tentative. Our consensus is to prioritize seismic data, but the remaining order is yet to be determined. It will be solidified in future iterations based on simulation data and benchmark stars.

2.3 Model

The priority list is as follows:

Mass

1. IDP_SAS_MASS_GRID_MIXED
2. IDP_SAS_MASS_GRID_SURF_IND
3. IDP_SAS_MASS_FREQS
4. IDP_SAS_MASS_SCALING_GRIDS
5. IDP_SAS_MASS_SCALING_ONLY
6. IDP_SAS_MASS_GRANULATION
7. IDP_SAS_MASS_GRANULATION_CGBM

Radius

1. IDP_SAS_RADIUS_GRID_MIXED
2. IDP_SAS_RADIUS_GRID_SURF_IND

3. IDP_SAS_RADIUS_FREQS
4. IDP_SAS_RADIUS_SCALING_GRIDS
5. IDP_SAS_RADIUS_SCALING_ONLY
6. IDP_SAS_RADIUS_GRANULATION_CGBM

Age

1. IDP_SAS_AGE_GRID_MIXED
2. IDP_SAS_AGE_GRID_SURF_IND
3. IDP_SAS_AGE_FREQS
4. IDP_SAS_AGE_SCALING_GRIDS
5. IDP_SAS_AGE_GYRO
6. IDP_SAS_AGE_ACTIVITY
7. IDP_SAS_AGE_GRANULATION_CGBM

3 Lists of inputs and outputs

3.1 Complete list of inputs

See documentation for MSAP5-31.

3.2 Complete list of outputs

Table 5: Output parameters

Name	Status	Data type	Dimension	Unit
IDP_SAS_MASS_PRIORITY	mandatory	string	1	N/A
IDP_SAS_RADIUS_PRIORITY	mandatory	string	1	N/A
IDP_SAS_AGE_PRIORITY	mandatory	string	1	N/A

4 Processing description

4.1 Type of delivery

Prototype

4.2 Algorithm maturity

Algorithm concept defined, but interfaces (inputs/outputs) unstable. Has been tested with randomly-generated pseudo inputs, but needs to be tested with actual inputs from all of the PLATO modules.

4.3 Algorithm source

The implemented algorithm and test cases are shipped directly to WP12 office alongside this document as a compressed archive.

4.4 Pseudo-code

N/A

4.5 Flow diagram

N/A

5 Test case(s)

5.1 Implementation test case(s)

The test cases are the same as MSAP5_31. These tests are run in `MSAP5-32-selection.ipynb`.

Case 1

- All consistent measurements.
- Inputs: Defaults
- Outputs: ['IDP_SAS_MASS_GRID_MIXED', 'IDP_SAS_RADIUS_GRID_MIXED', 'IDP_SAS_AGE_GRID_MIXED']

Case 2

- One inconsistent mass measurement. Additionally, in this case, the seismic radius measurement is missing.
- Inputs: Defaults, except 1 is added to all the samples from the first mass method
- Outputs: [None, 'IDP_SAS_RADIUS_GRID_SURF_IND', 'IDP_SAS_AGE_GRID_MIXED']

Case 3

- Two inconsistent radius measurements. Additionally, in this case, the seismic and granulation mass measurements are missing.
- Inputs: Defaults, except 0.5 is added to all the samples from the first radius method, and 1 is added to all the samples from the second radius method
- Outputs: ['IDP_SAS_MASS_FREQS', None, 'IDP_SAS_AGE_GRID_MIXED']

Case 4

- Three inconsistent age measurements.
- Inputs: Defaults, except $2, 4, 6$ are added to the first, second, third age methods
- Outputs: ['IDP_SAS_MASS_GRID_MIXED', 'IDP_SAS_RADIUS_GRID_MIXED', None]

Case 5

- Consistent but invalid measurements.
- Inputs: Defaults, except the radii are 10 solar radii larger
- Outputs: ['IDP_SAS_MASS_GRID_MIXED', 'IDP_SAS_RADIUS_GRID_MIXED', 'IDP_SAS_AGE_GRID_MIXED']

5.2 Scientific test case(s)

Simulated data would be highly valuable in testing the algorithm.