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## Data product description document of the stellar L1/L2 processing pipeline

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## Document Change Record

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2.3	12/20/2023	Fix reference documents list		



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## Introduction

### 1.1 Purpose of the document

The *WP120 Data Product Definition Document (WP120DPDD)* provides full details on the several types of products. This document details the content of the **data outputs (DP3-DP5)**, defines and describes the **additional data outputs (ADP)** and **Intermediate Data Products (IDP)** involved in the SAS pipeline in charge of delivering the DP3-DP5 data products. The data are for the target stars of the core program, that is, stars belonging to the P1, P2, P4 and P5 samples. These stars are main-sequence and subgiant stars of spectral type F5 to K7, and M dwarfs.

### 1.2 Scope of the document

This document shall be used as a reference document by WP12. It is part of the *internal* WP120 data package among which the architecture document [PLATO-LESIA-PSPM-DD-0021] and interface request document [PLATO-LESIA-PSM-IRD-0004]. It might become part of the WP120 data package to be delivered for forthcoming PMC internal reviews and later to the PDC. The document is based on the IDP documents provided by each WP12X leaders.

### 1.3 Reference documents/applicable documents

[RD01] PLATO-LESIA-PSPM-DD-0021, Work and data flows of the stellar L1/L2 processing pipeline

[RD02] PLATO-LESIA-PSM-IRD-0004, Interface request document for the SAS pipeline

[AD01] ESA/SPC(2017)33, PLATO Science Management Plan (SMP)

[AD02] PTO-EST-SOC-RS-0247, PLATO Science Implementation Requirements Document (SciRD) issue 2, revision 0

[AD03] PLATO-UWA-PSM-RS-0001, L2 Ground Data Processing User Requirements Document

### 1.4 Terminology

In this section, we define the terminology used throughout this document.

Term	Description
Asteroseismic parameters	Parameters derived from asteroseismic data that are related to pulsation properties (e.g. oscillation frequencies)
Classical stellar parameters	Stellar parameters that are not derived from asteroseismic data. Specifically, the stellar effective temperature, luminosity, surface chemical abundance, projected rotational velocity, and surface gravity derived from spectroscopy.
Global asteroseismic parameters	Parameters derived from asteroseismic data that are related to global pulsation properties. Specifically, the large frequency separation, and the frequency of the maximum height in the power spectrum.
Data Products	The Data Products (hereafter DP) are the final outputs of the mission. They are submitted to requirements as stated in [AD02].





Term	Description
Preparatory Data Products	Preparatory Data Products are any product used as input by the SAS stellar pipeline. These data are computed in advance, stored in the PDC-DB and described in [RD02].
Intermediate Data Products	Intermediate Data Products (hereafter IDP) are mainly internal data products for the SAS pipeline, which are generated by one of the SAS module/sub-module and used as input by another SAS module/sub-module.
Additional Data Products	Additional Data Products (hereafter ADP) are additional output data products delivered by the SAS pipeline, which are not designated as DPs, nor are they used as inputs by another SAS module. They are to be stored in the PDC-DB because of their scientific interest.
Stellar properties	Global stellar intrinsic characteristics such as mass, radius, age, etc.
Level 0 module	high level processes as MSAP1 to MSAP5
Level 1 module	sub-module of a level 0 module
Quarters	Each observational run will be composed of quarters of 3 months. The quarter numbering is denoted $Q=0,1,\dots$

## 1.5 List of abbreviations

ATBD Algorithm Theoretical Baseline Document  
DO-SAPP During Operation Stellar Abundances and atmospheric Parameters Pipeline  
DP Data Product  
EAS Exoplanet Analysis System  
ESA European Space Agency  
FU follow-up  
GO Guest Observer  
GOP Ground-based Observation Program  
LC light curve  
PLATO PLANetary Transits and Oscillations of Stars  
PDC PLATO Data Centre  
PDC-DB PDC-Database  
PIC PLATO Input Catalogue  
PMC PLATO Mission Consortium  
ppm parts per million  
PSM PLATO Science Management  
SAS Stellar Analysis System  
SNR Signal-to-Noise Ratio



TBC To Be Confirmed

TBD To Be Defined

TBS To Be Specified

TBW To Be Written

URD User Requirements Document

URJD User Requirements Justification Document

## 2 Definition of the data product types

### 2.1 The product types

Several types of data products are defined in this document. They are classified using the following nomenclature:

- *Data Products* (hereafter DP) are the final outputs of the mission. The SAS pipeline is expected to deliver DP3, DP4 and DP5. They are submitted to requirements as stated in the Science Requirements Document [AD02].
- *Preparatory Data Products* are any product used as input by the SAS pipeline and are defined in [RD02]. These data are computed in advance, stored in the PDC-DB. The preparatory products can evolve whenever new observational data (apart from the follow-up program) is available. These data are submitted to requirements internal to WP120 which are set in order to achieve the requirements for DP3-DP5.
- *Intermediate Data Products* (hereafter IDP) are mainly internal data products for the SAS pipeline, which are generated by one of the SAS modules and used as input by another SAS module. These data are submitted to requirements internal to WP120 which are set in order to achieve the requirements for DP3-DP5. These IDP are to be stored in the PDC-DB in order to ensure the reproducibility of the delivered results.
- *Additional Data Products* (here after ADP) are additional output data products delivered by the SAS pipeline, which are not designated as PLATO DPs (listed in Table 1), nor are they used as inputs by another SAS module. These ADPs are not submitted to any requirements. They are to be stored in the PDC-DB because of their scientific interest.

The ADPs and a sub-sample of IDPs, which are judged of scientific interest, will be made available to the community according to the PLATO Science management plan [AD01].

The term product, if not specified otherwise, designates DP, ADP and IDP altogether.

Product	Designation	Level
Validated imagerettes, light curves, and centroid curves	DP0	L0
Calibrated light curves and centroid curves	DP1	L1
Planet transits and parameters	DP2	L2
Asteroseismic mode parameters	DP3	L2
Stellar rotation and activity	DP4	L2
Stellar radii, masses, and ages	DP5	L2
Living catalog of confirmed planetary systems and their characteristics using light curves and transit time variations	DP6	L2
Follow-up ground-based observations		Lg



Product	Designation	Level
Living catalog of confirmed planetary systems and their characteristics using new ground-based follow-up observations (Lg)	DP6+Lg	L3

## 2.2 Multiple Values products

Several stellar properties, such as stellar mass, radius, and age, are expected to be derived using several methods. They are therefore considered as IDPs until the final values are selected. The selected values then define the set of values considered as DP. The other values which have been determined by the SAS pipeline but not selected as the final DP should be stored as ADP. Disagreements between the different values are flagged.

## 2.3 Uncertainties and statistical properties of products

Most of the products are determined together with uncertainties, statistical properties, biases, etc... These characteristics can appear either under the form of a separate data product, or included in the corresponding data product. In the case of the official data products (DP3, DP4, and DP5), the choice has been to create an additional DP, with the naming convention:

DP<DP number>\_SAS\_<DP name>\_METADATA.

For example, DP3\_SAS\_DELTA\_NU\_AV has its uncertainty, etc... contained in DP3\_SAS\_DELTA\_NU\_AV\_METADATA.

# 3 Definition of the data products nomenclature

## 3.1 Product definition and codes

Each product is designated using the following rules:

- a standard name is assigned, which corresponds to the common name as found in the literature.
- a short description is associated to clarify the definition.
- a code is assigned. This code is constructed as follows:  
<class of product>\_SAS\_<usual name> e.g: DP4\_SAS\_PROT is the rotation period produced by the module MSAP4. This is a final output of the mission DP4.
- external references, if any, are provided.

## 3.2 Source/Destination and SAS modules

The SAS pipeline is designed as specified in the architecture document [RD01]. We recall that it is composed of five main modules defined as follows:

- MSAP1: *Preparation of analysis-ready light-curves*
- MSAP2: *Classical stellar parameters determination* (includes DO-SAPP)
- MSAP3: *Stellar oscillation modes detection and measurement* (this module provides DP3)
- MSAP4: *Stellar rotation and activity measurement* (this module provides DP4)
- MSAP5: *Stellar properties determination* (this module provides DP5)

During the pre-operation phases, the WP120 will deliver some specific preparatory data to the PDC-DB, through two internal WP120 modules, distinct from the SAS pipeline:

- MStSci1: *Classical stellar parameters determination from preparatory data*
- MStSci2: *Stellar properties determination from preparatory data*



## 4 Stellar core data

Parameters	
Level	L2
Name	L2: Core Stellar
Description	Various flags regarding oscillations detection, and log g from variability. Generated every times SAS runs, for each star identifier.
Producer	SAS
Consumer	EAS, DAST, SAS

### 4.1 Stellar\_core

Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_CONSISTENCY_FLAGS</b>
Description	Consistency flags (TBD): For control purposes, when anomalous values are detected when combining the parameters values into the final ones
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
mass_consistency_flag		boolean,0	
radius_consistency_flag		boolean,0	
age_consistency_flag		boolean,0	

Parameters	
Name	<b>IDP_SAS_LOGG_FLIPER_FLAG</b>
Description	Flag indicating whether a log g value from variability can be computed.
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
logg_flag	Boolean on the logg_fliper value	Boolean,0	

Parameters	
Name	<b>IDP_SAS_SEISMIC_DETECTION_FLAG</b>
Description	Detection flag: Results and metadata from detection stage of pipeline: Detection Flag (4 entries: power excess, large separation, a combination of the two, and peak bagging detection flag)
Reference	PLATO-UBI-PSM-DN-0019
Related to	



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Columns			
Name	Description	Type, dim	Unit
MSAP3_01_flag	Power excess detection flag. True, if a threshold crossing event is detected using the single-module threshold for MSAP3 01.	bool,0	
MSAP3_02_flag	Large separation detection flag. True, if a threshold crossing event is detected using the single-module threshold for MSAP3 02.	bool,0	
osc_detection_flag	MSAP3 01 flag, MSAP3 02 flag combination. True, if a threshold crossing event is detected using the double-module thresholds for MSAP3 01 and MSAP3 02.	bool,0	
peakbagging_flag	Peak-bagging flag	bool,0	

## 5 Light curves for seismic and variability analysis data

Parameters	
Level	L2
Name	L2: Light curves for analysis-ready
Description	Results of LC preparation for seismic and variability analysis Generated every times SAS runs, for each star identifier.
Producer	SAS
Consumer	EAS, DAST, SAS

### 5.1 Lightcurves\_preparation

Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_LC_DETRENDED</b>
Description	LC detrended total length: place holder in case L1 detrending is not adapted.
Reference	out of baseline
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

Parameters	
Name	<b>ADP_SAS_FLARES</b>
Description	Flares parameters : Flares parameters from preparation of the LC
Reference	
Related to	

Columns			
---------	--	--	--



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Name	Description	Type, dim	Unit
TBD	TBD		

Parameters	
Name	<b>ADP_SAS_FLARES_FLAG</b>
Description	Metadata on flares detection
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
flare_flag	How many and which algorithms have flagged the point	S4,1	
quarter	quarter number of the point	float64,1	
time		float64,1	BJD

Parameters	
Name	<b>IDP_SAS_FLARES_FLAG</b>
Description	Flare flag: Indications allowing to identify the points of the timeseries involved in a flare. Total length containing all the quarters.
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
merged_flag	1 if point involved in flare, 0 otherwise	int64,1	
time	Time points of the timeseries	float64,1	BJD

Parameters	
Name	<b>ADP_SAS_LC_NT</b>
Description	Lightcurve corrected for the transit: LC after the transit have been removed and the gaps filled
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
flux	Flux of the timeseries	float64,1	normalized
time	Time points of the timeseries	float64,1	BJD

Parameters	
Name	<b>IDP_SAS_VARLC_FILT_BINNED</b>



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Description	Filtered and binned VARLC, long term filtering for removing variabilities larger than 55 days (TBC)
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
flux	Flux of the timeseries	float64,1	normalized
time	Time points of the timeseries	float64,1	BJD

Parameters	
Name	<b>IDP_SAS_VARPSD_BINNED</b>
Description	Variability analysis ready Power spectrum from binned lightcurve
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
frequency		float64,1	
powerdensity		float64,1	

Parameters	
Name	<b>IDP_SAS_VARLC_BINNED</b>
Description	Binned VARLC: Binned variability analysis ready light curve
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
bins	Time points of the binned LC	float64,1	BJD
err_flux		float64,1	
med_flux	Flux points of the binned LC	float64,1	normalized

Parameters	
Name	<b>IDP_SAS_VARPSD</b>
Description	Variability analysis ready Power spectrum
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
frequency	Frequency points of the varlc psd	>f8,1	μHz
power	Power points of the varlc psd	>f8,1	ppm <sup>2</sup> /μHz



Parameters	
Name	<b>IDP_SAS_VARLC</b>
Description	VARLC: (Non-seismic) Variability Analysis-ready LC, stitched, gaps filled, detrended
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
flux	Flux of the timeseries	float64,1	normalized
time	Time points of the timeseries	float64,1	BJD

Parameters	
Name	<b>IDP_SAS_AARPSD</b>
Description	AARPSD[WP12PDP_I32]: Asteroseismic Analysis-ready power spectrum.Frequency-power spectra of the AARLC (AARPS), including information on the spectral window function
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
frequency	Frequency points of the aarlc psd	float64,1	$\mu\text{Hz}$
power	Power points of the aarlc psd	float64,1	$\text{ppm}^2/\mu\text{Hz}$

Parameters	
Name	<b>IDP_SAS_AARLC</b>
Description	AARLC[WP12PDP_I32]: Asteroseismic Analysis-ready LC
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
flux	Flux of the timeseries	float64,1	normalized
time	Time points of the timeseries	float64,1	BJD

## Meta-Data-Structure(s):

Parameters	
Name	<b>ADP_SAS_FLARES_METADATA</b>
Description	Flares parameters metadata: Metadata for flares parameters from preparation of the LC
Reference	





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Related to

Columns

Name	Description	Type, dim	Unit
TBD	TBD		

Parameters

Name	<b>ADP_SAS_LC_NT_METADATA</b>		
Description	Metadata of the lightcurve corrected for the transit: Metadata of the LC without transit		
Reference			
Related to			

Columns

Name	Description	Type, dim	Unit
adjustable_parameters/Plist used	the list of periods used	float64,1	
adjustable_parameters/it	number of iterations used	int64,0	
adjustable_parameters/it2	number of iterations used	int64,0	
adjustable_parameters/timescale_long	timescale used	float64,0	
xlong	the long-term low-passed filtered version of the LC	float64,1	
xshort	the short-term filtered version of the LC	float64,1	
xtransit	the transit light curve used in the correction	float64,1	

Parameters

Name	<b>IDP_SAS_VARPSD_BINNED_METADATA</b>		
Description	Metadata for the VARPSD binned		
Reference			
Related to			

Columns

Name	Description	Type, dim	Unit
NT		int64,0	
Nyquist		float64,0	
amplitude		float64,1	
dT		float64,0	
df		float64,0	
dt		float64,0	
dutyCycle		float64,0	
fit_mean		bool,0	
freqHz		float64,1	
indx		S3,1	
ls		S87,0	
normfactor		float64,0	
power		float64,1	
power_standard_norm		float64,1	
timeConversion		int64,0	



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Parameters	
Name	<b>IDP_SAS_VARLC_BINNED_METADATA</b>
Description	Metadata for the binned VARLC: Metadata of the production of the (Non-seismic) Binned Variability Analysis-ready LC metadata
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
cadence		float64,0	
step		int64,0	

Parameters	
Name	<b>IDP_SAS_VARPSD_METADATA</b>
Description	Metadata of the variability analysis ready Power spectrum: Including the duty cycle
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_VARPSD_METADATA			

Parameters	
Name	<b>IDP_SAS_VARLC_METADATA</b>
Description	Metadata for VARLC: Metadata of the production of the (Non-seismic) Variability Analysis-ready LC
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
Kadaes flags	Matrix containing the flags of the regularized vector	float64,2	

Parameters	
Name	<b>IDP_SAS_AARPSD_METADATA</b>
Description	Metadata for AARPSD[WP12PDP_I32]: Metadata for the frequency-power spectra of the AARLC (AARPS), including information on the spectral window function, and the duty cycle
Reference	
Related to	



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Columns			
Name	Description	Type, dim	Unit
NT		int64,0	
Nyquist		float64,0	
amplitude		float64,1	
dT		float64,0	
df		float64,0	
dt		float64,0	
dutyCycle		float64,0	
fit_mean		bool,0	
freqHz		float64,1	
indx		bool,1	
ls		S87,0	
normfactor		float64,0	
power		float64,1	
timeConversion		int64,0	

Parameters	
Name	<b>IDP_SAS_AARLC_METADATA</b>
Description	Metadata for AARLC[WP12PDP_I32]: Metadata for AARLC: processing flag (was DP2 model for transit removal applied or not)
Reference	PLATO-AU-PSM-TN-0003
Related to	

Columns			
Name	Description	Type, dim	Unit
adjustable_t_long		float64,0	
quality_flags	vector with a bit for every timestamp indicating the source of a potential removal of the point	int64,1	
unc	time-series providing the scatter of the LC	float64,1	
weights		float64,1	
xfinal	combined filter if xlong and xshort	float64,1	
xlong	time-series giving the long-term low-passed version of LC	float64,1	
xshort	time-series giving the short-term high-passed version of LC	float64,1	

## 6 Classical parameters from photometric log g

Parameters	
Level	L2
Name	L2: Classical parameters derived from log g
Description	The data products contained in this section is generated only if IDP_SAS_SEISMIC_DETECTION_FLAG/osc_detection_flag is true OR IDP_SAS_LOGG_FLIPER_FLAG/logg_flag is true}.
Producer	SAS
Consumer	DAST, SAS



## 6.1 Classical\_parameters\_from\_spectroscopy

### Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_RADIAL_VELOCITY_SPECTROSCOPY</b>
Description	Radial velocity
Reference	PLATO-MPIA-PSM-DN-0012
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,0	kms-1
error		float64,0	kms-1

Parameters	
Name	<b>IDP_SAS_MOD_BESTFIT_SPECTROSCOPY</b>
Description	BestModel_Spec: Best-fitting theoretical model from spectral synthesis
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

Parameters	
Name	<b>IDP_SAS_FLAGS_SPECTROSCOPY</b>
Description	Flags from spectroscopy
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

Parameters	
Name	<b>IDP_SAS_MACROTURBULENCE_SPECTROSCOPY</b>
Description	$\zeta_{\text{spec}}$ : Macroturbulence from spectroscopy (only for spectral synthesis)
Reference	PLATO-MPIA-PSM-DN-0012
Related to	



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Columns			
Name	Description	Type, dim	Unit
TBD	TBD		kms-1

Parameters	
Name	<b>IDP_SAS_MICROTURBULENCE_SPECTROSCOPY</b>
Description	$\xi_{\text{spec}}$ : Microturbulence from spectroscopy
Reference	PLATO-MPIA-PSM-DN-0012
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		kms-1

Parameters	
Name	<b>IDP_SAS_[ALPHA_FE]_SPECTROSCOPY</b>
Description	Alpha elements: Abundances in alpha elements relative to iron
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		dex

Parameters	
Name	<b>IDP_SAS_[ELEM1_ELEM2]_SPECTROSCOPY</b>
Description	[element1/element2]spec: Chemical abundance of element 1 (TBD) relative to element 2 (TBD) from spectroscopy fixing log g to the seismic value, or to the granulation value
Reference	PLATO-MPIA-PSM-DN-0012
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,0	dex
error		float64,0	dex

Parameters	
Name	<b>IDP_SAS_VSINI_SPECTROSCOPY</b>



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Description	vsinispec: Projected rotational velocity from spectroscopy (only for spectral synthesis) fixing log g to the seismic value, or to the granulation value
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		kms-1

Parameters	
Name	<b>IDP_SAS_LOGG_SPECTROSCOPY</b>
Description	Log g from spectroscopy: Log g from spectroscopy after iteration
Reference	PLATO-MPIA-PSM-DN-0012
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,0	dex
error		float64,0	dex

Parameters	
Name	<b>IDP_SAS_TEFF_SPECTROSCOPY</b>
Description	Teffspec: Effective temperature from spectroscopy fixing log g to the best value yielded from the lightcurve
Reference	PLATO-MPIA-PSM-DN-0012
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,0	K
error		float64,0	K

Parameters	
Name	<b>IDP_SAS_LOGG_SAPP_TMP</b>
Description	Log g for spectroscopy: Log g from variability or seismic analysis for spectroscopy
Reference	PLATO-MPIA-PSM-DN-0012
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,0	dex
lower_err		float64,0	dex
upper_err		float64,0	dex



Logg_fix_mode		object,0	
Logg_select_flag		object,0	

## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_METADATA_STAT_SPECTROSCOPY</b>
Description	Stat_Spec: metadata from spectral synthesis: statistics of fit
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

## 6.2 Final\_classical\_parameters

### Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_COVMAT_SAPP</b>
Description	COVARIANCE matrix classical parameters: Covariance matrix for classical parameters from the SAPP pipeline
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD		float64,2	

Parameters	
Name	<b>IDP_SAS_RADIUS_SAPP</b>
Description	Stellar radius combined by MSAP2 from various methods
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_D_SAS_RADIUS_SAPP			

Parameters	
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Name	<b>IDP_SAS_[ALPHA_FE]_SAPP</b>
Description	Mean abundance ratio by number of the $\alpha$ elements over iron relative to the solar value
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_D_SAS_[ALPHA_FE]_SAPP			

Parameters	
Name	<b>IDP_SAS_[FE_H]_SAPP</b>
Description	Combined value for [Fe/H]: Value of Fe/H selected after statistical analysis: combination of values yielded from the SAPP pipeline, after validation by WP125200.
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,0	
error		float64,0	

Parameters	
Name	<b>IDP_SAS_LOGG_SAPP</b>
Description	Combined value for log g: Value of log g selected after statistical analysis: combination of values yielded from the SAPP pipeline, after validation by WP125200.
Reference	PLATO-MPIA-PSM-DN-0012
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,0	dex
error		float64,0	dex

Parameters	
Name	<b>IDP_SAS_TEFF_SAPP</b>
Description	Combined value for Teff: Value of Teff selected after statistical analysis: combination of values yielded from the SAPP pipeline, after validation by WP125200.
Reference	PLATO-MPIA-PSM-DN-0012
Related to	

Columns			
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Name	Description	Type, dim	Unit
value		float64,0	K
error		float64,0	K

Metadata-Structure(s):

## 7 Seismic variability data

Parameters	
Level	L2
Name	L2: Seismic variability
Description	Results of the seismic analysis
Producer	SAS
Consumer	DAST, SAS

### 7.1 SeismicVariabilityMetrics

Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_ACF_METRICS</b>
Description	Autocorrelation function metrics: Metrics used when determining the detection probability using ACF of the timeseries
Reference	PLATO-UBI-PSM-DN-0018
Related to	

Columns			
Name	Description	Type, dim	Unit
ACF dnu	Bins of inverse ACF lag used to test for a large separation.	float64,1	μHz
ACF lag	Bins of ACF lag used to test for a large separation.	float64,1	s
Effective Hanning bins	Effective number of bins of the Hanning filter in terms of bins of the binned AARPS frequencies, accounting for the lower and upper limits of the AARPS.	int64,1	
Hanning bins	Number of bins of the Hanning filter in terms of bins of the binned AARPS frequencies.	int64,1	
Nnu	Number of bins inside the dnu-numax filter in the frequency (ν) direction at each test lag.	int64,1	
Ntau	Number of bins inside the dnu-numax filter in the lag (τ) direction at each test frequency.	int64,1	
PSD background	Estimate of the PSD background level.	float64,1	ppm <sup>2</sup> /μHz
PSD bin factor	Binning factor used to bin the PSD.	float64,0	
PSD bin width	Width of the PSD frequency bins.	float64,0	μHz
Scaling dnu limits	Lower and upper bounds on ACF lag as a function of test frequency.	float64,2	s
Test frequency	Frequencies in the AARPS test for the presence of pmode oscillations.	float64,1	μHz



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calibration	Calibration values as a function of ACF lag to estimate the noise level.	float64,1	
calibration points	Points used to estimate the calibration values for the collapsed ACF noise level.	bool,2	
collapsed ACF/dnu	Values of the 2D ACF collapsed along frequency axis.	float64,1	
collapsed ACF/numax	Values of the 2D ACF collapsed along the lag axis.	float64,1	
collapsed ACF weights	Weights applied along the frequency axis, based on either the power excess metric or the prior on numax.	float64,1	
logL dnu	Prior on $\Delta\nu$ constructed from scaling relations.	float64,1	$\mu\text{Hz}$
logL numax	Prior on $v_{\text{max}}$ constructed from scaling relations.	float64,1	$\mu\text{Hz}$
numax limits	Lower and upper limits on the frequencies to test for p-modes.	float64,1	$\mu\text{Hz}$

Parameters	
Name	<b>IDP_SAS_ACF_PROBABILITY</b>
Description	Autocorrelation function probability: Detection probability using ACF of the timeseries
Reference	PLATO-UBI-PSM-DN-0018
Related to	

Columns			
Name	Description	Type, dim	Unit
ACF dnu	Bins of inverse ACF lag used to test for a large separation.	float64,1	$\mu\text{Hz}$
MSAP3_02 dnupdf	PDF of $\Delta\nu$ as measured from the collapsed. ACF.	float64,1	
MSAP3_02 merit	p-mode detection metric as measured from the collapsed ACF.	float64,1	
MSAP3_02 numaxpdf	PDF of $v_{\text{max}}$ as measured from the collapsed ACF.	float64,1	
Test frequency	Frequencies in the AARPS test for the presence of pmode oscillations.	float64,1	$\mu\text{Hz}$

Parameters	
Name	<b>IDP_SAS_POWER_EXCESS_METRICS</b>
Description	POWER EXCESS PROBABILITY: The metrics and criteria used to compute the probability density of $Nu_{\text{max}}$
Reference	PLATO-UBI-PSM-DN-0017
Related to	

Columns			
Name	Description	Type, dim	Unit
Amax	Values of predicted maximum envelope amplitude as a function of test frequency with varying degrees of uncertainty.	float64,2	$\text{ppm}^2/\mu\text{Hz}$
Binned background	Binned values of the PSD background level.	float64,1	$\text{ppm}^2/\mu\text{Hz}$
Binned power	Binned values of the PSD.	float64,1	$\text{ppm}^2/\mu\text{Hz}$



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H0 likelihood	The likelihood that power in a frequency bin is consistent with the background.	float64,2	
H1 likelihood	The likelihood that the power in a frequency bin is consistent with the expectation from scaling relations.	float64,2	
H1 posterior	pseudo-posterior calculation of the probability that an envelope is observed at a test frequency.	float64,2	
Observed SNR	The binned PSD divided by the binned background level.	float64,2	
Predicted SNR	The predicted signal-to-noise ratio based on scaling relations.	float64,2	
Test frequency	Frequencies in the AARPS test for the presence of pmode oscillations.	float64,1	$\mu\text{Hz}$
Threshold prior	The probability that the envelope power will exceed a given false-alarm-probability.	float64,2	
numax prior	The calculated prior on numax based on classical observables.	float64,2	

Parameters	
Name	<b>IDP_SAS_POWER_EXCESS_PROBABILITY</b>
Description	POWER EXCESS PROBABILITY: The probability density of Nu max using MSAP3-03 to assess detection flag
Reference	PLATO-UBI-PSM-DN-0017
Related to	

Columns			
Name	Description	Type, dim	Unit
MSAP3_01 merit	Power excess test merit values for different frequency bins across the spectrum.	float64,1	
MSAP3_01 numaxpdf	probability density function (PDF) of numax given the posterior probability of the envelope power density matching the expected scaling relations.	float64,1	
Test frequency	Frequencies in the AARPS test for the presence of pmode oscillations.	float64,1	$\mu\text{Hz}$

Parameters	
Name	<b>IDP_SAS_MULTIDETECTION_METRICS</b>
Description	Multiple Detection Flag: Results and metadata from detection stage of pipeline: Multiple Detection Flag (single or multiple spectra, number)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		



Parameters	
Name	<b>IDP_SAS_DETECTION_METRICS</b>
Description	Detection metrics: Results and metadata from detection stage of pipeline: Detection metrics (SNR, integrated power) (metadata)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
MSAP3_01 merit	Power excess test merit values for different frequency bins across the spectrum.	float64,1	
MSAP3_01 thresholds/double	Required threshold for the power excess merit to yield a detection if used in combination with MSAP3 02.	float64,0	
MSAP3_01 thresholds/single	Required threshold for the power excess merit to yield a detection if used without MSAP3 02.	float64,0	
MSAP3_02 merit	Large separation test merit values for different frequency bins across the spectrum.	float64,1	
MSAP3_02 thresholds/double	Required threshold for the large separation merit to yield a detection if used in combination with MSAP3 01.	float64,0	
MSAP3_02 thresholds/single	Required threshold for the large separation merit to yield a detection if used without MSAP3 01.	float64,0	

## 7.2 Global\_seismology

This section contains data products which are generated only if IDP\_SAS\_SEISMIC\_DETECTION\_FLAG/osc\_detection\_flag is true.

Data-Structure(s):

Parameters	
Name	<b>DP3_SAS_NU_MAX</b>
Description	Frequency of maximum oscillations power: Frequency of maximum oscillations power from global analysis of AARPS, or from peak bagging if available (optional)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
value	Median of the PDF of numax from either the marginalized posterior from MSAP3 03 or, if no peakbagging is done from MSAP3 02, and if no frequency separation is observed from MSAP3 01	float64,0	μHz
error	Mean of the mutual difference of the 16th, 50th and 84th percentiles of the PDF of numax	float64,0	μHz



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Parameters	
Name	<b>DP3_SAS_DELTA_NU_AV</b>
Description	Average large frequency separation: Average large frequency separation from global analysis of Asteroseismic Analysis Ready Power spectrum (AARPS), or from peak bagging when available (optional)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
value	Median of the PDF of delta nu from either the marginalized posterior from MSAP3 03 or, if no peakbagging is done from MSAP3 02.	float64,0	$\mu\text{Hz}$
error	Mean of the mutual difference of the 16th, 50th and 84th percentiles of the PDF of delta nu	float64,0	$\mu\text{Hz}$

## Metadata-Structure(s):

Parameters	
Name	<b>DP3_SAS_NU_MAX_METADATA</b>
Description	Metadata on the frequency of maximum oscillations power: Metadata on frequency of maximum oscillations power, including model for estimate (optional)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
MSAP3_01 numax	Estimate of numax and corresponding uncertainty from MSAP3 1. This is adopted for DP3 SAS NU MAX if no peakbagging is performed and no frequency separation is observed.	float64,1	$\mu\text{Hz}$
MSAP3_01 samples	Samples drawn from the PDF of numax from MSAP3 1 if a power excess is observed.	float64,1	$\mu\text{Hz}$
MSAP3_02 numax	Estimate of numax and corresponding uncertainty from MSAP3 2. This is adopted for DP3 SAS NU MAX if no peakbagging is performed but a frequency separation is observed.	float64,1	$\mu\text{Hz}$
MSAP3_02 samples	Samples drawn from the PDF of numax from MSAP3 2 if a large frequency separation is observed.	float64,1	$\mu\text{Hz}$
MSAP3_03 samples	Samples drawn from the PDF of numax from MSAP3 3 if peakbagging is performed.	float64,1	$\mu\text{Hz}$

Parameters	
Name	<b>DP3_SAS_DELTA_NU_AV_METADATA</b>



Description	Metadata on the average large frequency separation: Metadata on the average large frequency separation, including model and range for estimate (optional)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
MSAP3_02 dnu	Estimate of delta nu and corresponding uncertainty from MSAP3 2. This is adopted for DP3 SAS NU MAX if no peakbagging is performed but a frequency separation is observed.	float64,1	$\mu\text{Hz}$
MSAP3_02 samples	Samples drawn from the PDF of delta nu from MSAP3 2 if a large frequency separation is observed.	float64,1	$\mu\text{Hz}$
MSAP3_03 samples	Samples drawn from the PDF of delta nu from MSAP3 3 if peakbagging is performed.	float64,1	$\mu\text{Hz}$

### 7.3 Peakbagging\_seismo

This section contains data products which are generated only if IDP\_SAS\_SEISMIC\_DETECTION\_FLAG/peakbagging\_flag is true.

Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_OSC_MODE_WIDTHS_FIRST_GUESS</b>
Description	First-guess oscillation modes widths: First-guess oscillation modes widths from peak-bagging preparation (optional)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
mode width	Median of the marginalized width posterior distribution of modes observed in the AARPS, ordered according to the frequencies in IDP SAS FREQUENCIES FIRST GUESS	float64,1	$\mu\text{Hz}$
mode width samples	Samples of the width posterior distribution, from which mode width and uncertainty columns are derived	float64,2	$\mu\text{Hz}$
mode width uncertainty	Median absolute deviation of the marginalized width posterior distribution, scaled to be 1 sigma for a normal distribution	float64,1	$\mu\text{Hz}$

Parameters	
Name	<b>IDP_SAS_OSC_MODE_HEIGHTS_FIRST_GUESS</b>
Description	First-guess oscillation modes heights: First-guess oscillation modes heights from peak-bagging preparation (optional)



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Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
mode height	Median of the marginalized height posterior distribution of modes observed in the AARPS, ordered according to the frequencies in IDP SAS FREQUENCIES FIRST GUESS	float64,1	ppm <sup>2</sup> /μHz
mode height samples	Samples of the height posterior distribution, from which mode height and uncertainty columns are derived	float64,2	ppm <sup>2</sup> /μHz
mode height uncertainty	Median absolute deviation of the marginalized height posterior distribution, scaled to be 1 sigma for a normal distribution	float64,1	ppm <sup>2</sup> /μHz

Parameters	
Name	<b>IDP_SAS_FREQUENCIES_FIRST_GUESS</b>
Description	First-guess frequency list: First-guess frequency list from peak-bagging preparation (optional)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
mode frequency	Median of the marginalized frequency posterior distribution of modes observed in the AARPS, ordered according to the frequencies in IDP SAS FREQUENCIES FIRST GUESS	float64,1	μHz
mode frequency samples	Samples of the frequency posterior distribution, from which mode frequency and uncertainty columns are derived	float64,2	μHz
mode frequency uncertainty	Median absolute deviation of the marginalized frequency posterior distribution, scaled to be 1 sigma for a normal distribution	float64,1	μHz

Parameters	
Name	<b>IDP_SAS_BACKGROUND_FIT</b>
Description	Back-ground fit : Background fit (model and parameter)
Reference	PLATO-UBI-PSM-DN-0019
Related to	

Columns			
Name	Description	Type, dim	Unit
Harvey amplitude/median	Posterior median of the granulation amplitude.	float64,0	ppm <sup>2</sup> /μHz
Harvey amplitude/samples	Posterior samples of the granulation amplitude.	float64,1	ppm <sup>2</sup> /μHz





Harvey amplitude/uncertainty	16th, 50th and 84th percentile differences of the granulation amplitude posterior.	float64,1	ppm <sup>2</sup> /μHz
Harvey exponent 1/median	Posterior median of the high-frequency granulation term exponent.	float64,0	
Harvey exponent 1/samples	Posterior samples of the high-frequency granulation term exponent.	float64,1	
Harvey exponent 1/uncertainty	16th, 50th and 84th percentile differences of the highfrequency granulation term exponent posterior.	float64,1	
Harvey exponent 2/median	Posterior median of the low-frequency granulation term exponent.	float64,0	
Harvey exponent 2/samples	Posterior samples of the low-frequency granulation term exponent.	float64,1	
Harvey exponent 2/uncertainty	16th, 50th and 84th percentile differences of the lowfrequency granulation term exponent posterior.	float64,1	
Harvey frequency 1/median	Posterior median of the high-frequency granulation term frequency.	float64,0	μHz
Harvey frequency 1/samples	Posterior samples of the high-frequency granulation term frequency.	float64,1	μHz
Harvey frequency 1/uncertainty	16th, 50th and 84th percentile differences of the highfrequency granulation term frequency posterior.	float64,1	μHz
Harvey frequency 2/median	Posterior median of the low-frequency granulation term frequency.	float64,0	μHz
Harvey frequency 2/samples	Posterior samples of the low-frequency granulation term frequency.	float64,1	μHz
Harvey frequency 2/uncertainty	16th, 50th and 84th percentile differences of the lowfrequency granulation term frequency posterior.	float64,1	μHz
Instrumental amplitude/median	Posterior median of the frequency dependent instrumental term amplitude.	float64,0	ppm <sup>2</sup> /μHz
Instrumental amplitude/samples	Posterior samples of the frequency dependent instrumental term amplitude.	float64,1	ppm <sup>2</sup> /μHz
Instrumental amplitude/uncertainty	16th, 50th and 84th percentile differences of the frequency dependent instrumental term amplitude posterior.	float64,1	ppm <sup>2</sup> /μHz
Instrumental frequency/median	Posterior median of the frequency dependent instrumental term frequency.	float64,0	μHz
Instrumental frequency/samples	Posterior samples of the frequency dependent instrumental term frequency.	float64,1	μHz
Instrumental frequency/uncertainty	16th, 50th and 84th percentile differences of the frequency dependent instrumental term frequency posterior.	float64,1	μHz
White noise level/median	Posterior median of the frequency independent instrumental offset.	float64,0	ppm <sup>2</sup> /μHz
White noise level/samples	Posterior samples of the frequency independent instrumental offset.	float64,1	ppm <sup>2</sup> /μHz
White noise level/uncertainty	16th, 50th and 84th percentile differences of the frequency independent instrumental offset posterior.	float64,1	ppm <sup>2</sup> /μHz

## Parameters





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Name	<b>ADP_SAS_PEAK_ASYMMETRIES</b>
Description	Final mode assymetry estimates
Reference	Empty in HDF5
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

Parameters	
Name	<b>ADP_SAS_MODE_POWERES</b>
Description	Mode powers: From peak-bagging
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
median	Posterior median of the mode power	float64,1	ppm <sup>2</sup>
samples	Posterior samples of the mode power	float64,2	ppm <sup>2</sup>
uncertainty	16th, 50th and 84th percentile differences of the mode power posteriors	float64,2	ppm <sup>2</sup>

Parameters	
Name	<b>ADP_SAS_MODE_WIDTHS</b>
Description	Mode widths: From peak-bagging
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
median	Posterior median of the mode widths	float64,1	μHz
samples	Posterior samples of the mode widths	float64,2	μHz
uncertainty	16th, 50th and 84th percentile differences of the mode width posteriors	float64,2	μHz

Parameters	
Name	<b>ADP_SAS_MODE_HEIGHTS</b>
Description	Mode heights: From peak-bagging
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
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Name	Description	Type, dim	Unit
median	Posterior median of the mode heights	float64,1	ppm <sup>2</sup> /μHz
samples	Posterior samples of the mode heights	float64,2	ppm <sup>2</sup> /μHz
uncertainty	16th, 50th and 84th percentile differences of the mode height posteriors	float64,2	ppm <sup>2</sup> /μHz

Parameters	
Name	<b>ADP_SAS_BACKGROUND_BESTFIT</b>
Description	Background best fitting parameters: From peak bagging: Background parameters (various, various units)
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
Harvey amplitude/median	Posterior median of the granulation amplitude.	float64,0	ppm <sup>2</sup> /μHz
Harvey amplitude/samples	Posterior samples of the granulation amplitude.	float64,1	ppm <sup>2</sup> /μHz
Harvey amplitude/uncertainty	16th, 50th and 84th percentile differences of the granulation amplitude posterior.	float64,1	ppm <sup>2</sup> /μHz
Harvey exponent 1/median	Posterior median of the high-frequency granulation term exponent.	float64,0	
Harvey exponent 1/samples	Posterior samples of the high-frequency granulation term exponent.	float64,1	
Harvey exponent 1/uncertainty	16th, 50th and 84th percentile differences of the highfrequency granulation term exponent posterior.	float64,1	
Harvey exponent 2/median	Posterior median of the low-frequency granulation term exponent.	float64,0	
Harvey exponent 2/samples	Posterior samples of the low-frequency granulation term exponent.	float64,1	
Harvey exponent 2/uncertainty	16th, 50th and 84th percentile differences of the lowfrequency granulation term exponent posterior.	float64,1	
Harvey frequency 1/median	Posterior median of the high-frequency granulation term frequency.	float64,0	μHz
Harvey frequency 1/samples	Posterior samples of the high-frequency granulation term frequency.	float64,1	μHz
Harvey frequency 1/uncertainty	16th, 50th and 84th percentile differences of the highfrequency granulation term frequency posterior.	float64,1	μHz
Harvey frequency 2/median	Posterior median of the low-frequency granulation term frequency.	float64,0	μHz
Harvey frequency 2/samples	Posterior samples of the low-frequency granulation term frequency.	float64,1	μHz
Harvey frequency 2/uncertainty	16th, 50th and 84th percentile differences of the lowfrequency granulation term frequency posterior.	float64,1	μHz
Instrumental amplitude/median	Posterior median of the frequency dependent instrumental term amplitude.	float64,0	ppm <sup>2</sup> /μHz
Instrumental amplitude/samples	Posterior samples of the frequency dependent instrumental term amplitude.	float64,1	ppm <sup>2</sup> /μHz



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Instrumental amplitude/uncertainty	16th, 50th and 84th percentile differences of the frequency dependent instrumental term amplitude posterior.	float64,1	ppm <sup>2</sup> /μHz
Instrumental frequency/median	Posterior median of the frequency dependent instrumental term frequency.	float64,0	μHz
Instrumental frequency/samples	Posterior samples of the frequency dependent instrumental term frequency.	float64,1	μHz
Instrumental frequency/uncertainty	16th, 50th and 84th percentile differences of the frequency dependent instrumental term frequency posterior.	float64,1	μHz
White noise level/median	Posterior median of the frequency independent instrumental offset.	float64,0	ppm <sup>2</sup> /μHz
White noise level/samples	Posterior samples of the frequency independent instrumental offset.	float64,1	ppm <sup>2</sup> /μHz
White noise level/uncertainty	16th, 50th and 84th percentile differences of the frequency independent instrumental offset posterior.	float64,1	ppm <sup>2</sup> /μHz

Parameters	
Name	<b>IDP_SAS_INCLINATION_ANGLE_PEAKBAGGING</b>
Description	Inclination angle: From peak-bagging
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
median	Posterior median of the inclination angle.	float64,0	radians
samples	Posterior samples of the inclination angle.	float64,1	radians
uncertainty	16th, 50th and 84th percentile differences of inclination angle posterior.	float64,1	radians

Parameters	
Name	<b>IDP_SAS_SPLITTINGS</b>
Description	Oscillation modes splittings: Oscillation frequency splittings from peak-bagging
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
median	Posterior median of the frequency splittings	float64,0	μHz
samples	Posterior samples of the frequency splittings	float64,1	μHz
uncertainty	16th, 50th and 84th percentile differences of the frequency splitting posteriors	float64,1	μHz

Parameters
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Name	<b>IDP_SAS_COVMAT_ALL_PARAMETERS</b>
Description	Covariances for all parameters: Covariance matrix for all parameters
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_COVMAT_ALL_PARAMETERS	Covariance matrix for all parameters from peakbagging	float64,2	

Parameters	
Name	<b>DP3_SAS_OSC_FREQ_COVMAT</b>
Description	Covariance matrix: Covariance matrix for the fitted frequencies
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
DP3_SAS_OSC_FREQ_COVMAT	Covariance matrix for the fitted frequencies	float64,2	$\mu\text{Hz}^2$

Parameters	
Name	<b>DP3_SAS_OSC_FREQ</b>
Description	Oscillation mode frequencies: Inferred from the power spectra. Individual frequencies from peak-bagging
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
median	Posterior median of the mode frequencies	float64,1	$\text{ppm}^2/\mu\text{Hz}$
samples	Posterior samples of the mode frequencies	float64,2	$\text{ppm}^2/\mu\text{Hz}$
uncertainty	16th, 50th and 84th percentile differences of the mode frequencies posteriors	float64,2	$\text{ppm}^2/\mu\text{Hz}$

## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_FREQUENCIES_FIRST_GUESS_METADATA</b>
Description	First-guess frequency list metadata: Metadata on the first-guess frequency list from peak-bagging preparation (optional)
Reference	PLATO-UBI-PSM-DN-0019
Related to	



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Columns			
Name	Description	Type, dim	Unit
angular degree	Angular degree of the modes observed in the AARPS, ordered according to the frequencies in IDP SAS FREQUENCIES FIRST GUESS.	int64,1	
p mode radial order	p-mode radial order of the modes observed in the AARPS, ordered according to the frequencies in IDP SAS FREQUENCIES FIRST GUESS.	float64,1	

Parameters	
Name	<b>IDP_SAS_SEISMIC_QUALITY_METADATA</b>
Description	Quality control metadata produced by the seismic analysis: Quality control metadata (numbers and flags for every parameters)
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
Quality control chains	Position in parameter space of each walker at each step in the MCMC chain.	float64,3	
Total steps	Total number of steps taken by the MCMC sampler	int64,0	
fit PSD range	PSD for the frequency bins in the range considered in the fit	float64,1	
fit frequency range	Frequency bins in the range considered in the fit.	float64,1	
nmodes	Total number of modes in the fit	int64,0	

Parameters	
Name	<b>DP3_SAS_OSC_FREQ_METADATA</b>
Description	Metadata on frequencies: Metadata on individual frequencies, including radial p-mode order and angular degree (latter to include separate explicit entry for mixed modes)
Reference	PLATO-UBI-PSM-DN-0020
Related to	

Columns			
Name	Description	Type, dim	Unit
angular degrees	Angular degrees of the modes included in the peakbagging	int64,1	

Quality-Control-Structure(s):

## 8 Other variability data

Parameters	
Level	L2



Parameters	
Name	L2: Other variability
Description	Results of the variability analysis. Generated every times SAS runs, for each star identifier.
Producer	SAS
Consumer	DAST, SAS, EAS (TBC)

## 8.1 Nonseismic\_variability

### Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_LOGG_FLIPER</b>
Description	Log g from variability[WP12PDP_I33]: Log g determined from the variability of the light curve
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,0	dex
error		float64,0	dex
bin_logg	bins of logg for posterior probability	float64,0	dex
nb_star_bin_logg	number of artificial stars in each bin of logg for posterior probability	float64,0	dex

Parameters	
Name	<b>DP4_SAS_SPH</b>
Description	Activity index
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
value	Mean value of the Sph timeseries, computed using the stellar rotation period, standard deviation of th Sph	float64,0	ppm
standard_deviation	Standard deviation of the Sph time series	float64,0	ppm

Parameters	
Name	<b>DP4_SAS_DELTAPROT</b>
Description	Differential rotation: Selected final value of the surface differential rotation's amplitude (inferred from Fourier analysis, time series analysis, or spot modelling).
Reference	PLATO-INAF-PSPM-TN-0007
Related to	



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Columns			
Name	Description	Type, dim	Unit
value	Amplitude of Surface Differential Rotation	float64	
uncertainty		float64	

Parameters	
Name	<b>DP4_SAS_PROT</b>
Description	Rotation Period: Rotation period determined either from the Fourier analysis, from the timeseries analysis, or else from spot modelling
Reference	PLATO-INAF-PSPM-TN-0007
Related to	

Columns			
Name	Description	Type, dim	Unit
value	Value of the stellar rotation period	float64	sec
uncertainty		float64	sec

Parameters	
Name	<b>DP4_SAS_LONGTERM_MODULATION</b>
Description	Final periods identified relatively to the long-term cyclical variation
Reference	PLATO-INAF-PSPM-TN-0006
Related to	

Columns			
Name	Description	Type, dim	Unit
values	Long term modulation periods identified in the Fourier spectrum, or -1	float64,1	sec
lower_uncertainty		float64,1	sec
upper_uncertainty		float64,1	sec
acf_period	compatible period measured in the ACF	float64,1	sec
acf_period_lower_uncertainty		float64,1	sec
acf_period_upper_uncertainty		float64,1	sec
gls_sph_period	compatible period measured in the GLS of the Sph , or -1	float64,1	sec
gls_sph_period_lower_uncertainty		float64,1	sec
gls_sph_period_upper_uncertainty		float64,1	sec
acf_sph_period	compatible period measured in the ACF of the Sph , or -1	float64,1	sec
acf_sph_period_lower_uncertainty		float64,1	sec
acf_sph_period_upper_uncertainty		float64,1	sec

Parameters	
Name	<b>IDP_SAS_LONGTERM_MODULATION_PHOTO_INDEX_TIMESERIES</b>



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Description	Period corresponding to the local maxima of ACF computed with the Sph time series
Reference	PLATO-INAF-PSPM-TN-0006
Related to	

Columns			
Name	Description	Type, dim	Unit
value	Period corresponding to the local maxima of ACF	float64	sec
lower_uncertainty		float64	sec
upper_uncertainty		float64	sec
H_ACF	Corresponding height of the peak in the smoothed ACF	float64	
G_ACF	Corresponding global maximum of the smoothed ACF	float64	
peak_sequential_number	Peak sequential number by which to divide column 1 to get the cycle length	float64	

Parameters	
Name	<b>IDP_SAS_LONGTERM_MODULATION_PHOTO_INDEX_FOURIER</b>
Description	Periods extracted from GLS periodogram of the Sph timeseries
Reference	PLATO-INAF-PSPM-TN-0006
Related to	

Columns			
Name	Description	Type, dim	Unit
periods		float64,1	sec
errs_lower		float64,1	sec
errs_upper		float64,1	sec
peak_power	Corresponding power of the selected peak	float64,1	
fap	Corresponding false alarm probability	float64,1	

Parameters	
Name	<b>IDP_SAS_DELTA_PROT_NOSPOT</b>
Description	Combined differential rotation: Combined differential rotation from all the methods except spot modelling (power spectrum, Fourier analysis, time-series)
Reference	PLATO-INAF-PSPM-TN-0005
Related to	

Columns			
Name	Description	Type, dim	Unit
periods	Candidate periods	float64,1	sec
errs_lower		float64,1	sec
errs_upper		float64,1	sec
shear_value	absolute shear value $ P\_SDR - P\_rot /P\_rot$	float64,1	

Parameters	
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Name	<b>IDP_SAS_PROT_NOSPOT</b>
Description	Combined rotation period: Combined rotation period from all the methods except spot modelling (power spectrum, Fourier analysis, time-series)
Reference	PLATO-INAF-PSPM-TN-0005
Related to	

Columns			
Name	Description	Type, dim	Unit
value	Value of the stellar rotation period	float64	sec
err_lower		float64,1	sec
err_upper		float64,1	sec
rotation_score		float64	
rossby_number	the Rossby number computed from the rotation period	float64	
mean_sph	The mean value of the Sph timeseries	float64	ppm
std_sph	The standard deviation of the Sph time series	float64	

<b>Parameters</b>	
Name	<b>IDP_SAS_S_PHOTO_INDEX</b>
Description	Measurement of a temporal photometric activity index Sph
Reference	PLATO-INAF-PSPM-TN-0005
Related to	

Columns			
Name	Description	Type, dim	Unit
time	time	float64,1	sec
sph_series	Temporal Sph	float64,1	ppm

<b>Parameters</b>	
Name	<b>IDP_SAS_LONGTERM_MODULATION_TIMESERIES</b>
Description	Periods corresponding to the local maxima above a period of 45 days of the ACF of binned LC, likely arising from either activity cycles or beating of close rotation frequencies
Reference	PLATO-INAF-PSPM-TN-0004
Related to	

Columns			
Name	Description	Type, dim	Unit
values	Periods corresponding to the local maxima below a period of 45 days of the ACF	float64,1	sec
lower_uncertainty		float64,1	sec
upper_uncertainty		float64,1	sec
H_ACF	Corresponding height of the peak in the smoothed ACF	float64,1	
G_ACF	Corresponding global maximum of the smoothed ACF	float64,1	



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peak_sequential_number	Peak sequential number by which to divide column 1 to get the rotation period	float64,1	
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Parameters	
Name	<b>IDP_SAS_ACF_FILT_TIMESERIES</b>
Description	Autocorrelation Function of the filtered binned LC
Reference	PLATO-INAF-PSPM-TN-0004
Related to	

Columns			
Name	Description	Type, dim	Unit
time_lag	Time lag	float64,1	sec
acf	AutoCorrelation Function	float64,1	

Parameters	
Name	<b>IDP_SAS_ACF_TIMESERIES</b>
Description	Autocorrelation Function of the binned LC
Reference	PLATO-INAF-PSPM-TN-0004
Related to	

Columns			
Name	Description	Type, dim	Unit
time_lag	Time lag	float64,1	sec
acf	AutoCorrelation Function	float64,1	

Parameters	
Name	<b>IDP_SAS_PROT_TIMESERIES</b>
Description	Rotation period: from time-series analysis ( below a period of 45 days)
Reference	PLATO-INAF-PSPM-TN-0004
Related to	

Columns			
Name	Description	Type, dim	Unit
values	Periods corresponding to the local maxima below a period of 45 days of the ACF	float64,1	sec
lower_uncertainty		float64,1	sec
upper_uncertainty		float64,1	sec
H_ACF	Corresponding height of the peak in the smoothed ACF	float64,1	
G_ACF	Corresponding global maximum of the smoothed ACF	float64,1	
peak_sequential_number	Peak sequential number by which to divide column 1 to get the cycle length	float64,1	



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#### Parameters

Name	<b>IDP_SAS_PROT_FOURIER</b>
Description	Rotation period: from Fourier analysis.
Reference	PLATO-INAF-PSPM-TN-0003
Related to	

#### Columns

Name	Description	Type, dim	Unit
values	Periods likely arising from rotation	float64,1	sec
lower_uncertainty		float64,1	sec
upper_uncertainty		float64,1	sec
power	Corresponding power	float64,1	
pFA	Corresponding False Alarm Probability	float64,1	

#### Parameters

Name	<b>IDP_SAS_LONGTERM_MODULATION_FOURIER</b>
Description	Periods of long-term flux modulations extracted from binned PSD that may arise either from activity cycles or from beating of close rotation frequencies, that are longer than a fixed threshold value
Reference	PLATO-INAF-PSPM-TN-0003
Related to	

#### Columns

Name	Description	Type, dim	Unit
values	Periods of long-term flux modulations	float64,1	sec
lower_uncertainty		float64,1	sec
upper_uncertainty		float64,1	sec
power	Corresponding power	float64,1	
pFA	Corresponding False Alarm Probability	float64,1	

#### Parameters

Name	<b>DP4_SAS_WHITE_NOISE_FOURIER</b>
Description	White noise of the Fourier spectrum: White noise yielded from the Harvey fit
Reference	
Related to	

#### Columns

Name	Description	Type, dim	Unit
median_value	median value	float64,0	ppm <sup>2</sup> /μHz
uncertainty	1-sigma uncertainty	float64,0	ppm <sup>2</sup> /μHz

#### Parameters



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Name	<b>DP4_SAS_HARVEY3_EXPONENT</b>
Description	Harvey profile 3 (granulation) : exponent: Exponent of the Harvey profile 3
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
median_value	median value	float64,0	
uncertainty	1-sigma uncertainty	float64,0	

Parameters	
Name	<b>DP4_SAS_HARVEY3_TIME</b>
Description	Harvey profile 3 (granulation) : characteristic time: Characteristic time of the Harvey profile 3
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
median_value	median value	float64,0	sec
uncertainty	1-sigma uncertainty	float64,0	sec

Parameters	
Name	<b>DP4_SAS_HARVEY3_AMPLITUDE</b>
Description	Harvey profile 3 (granulation) : amplitude: Amplitude of the Harvey profile modelling the granulation in the Fourier background
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
median_value	median value	float64,0	ppm
uncertainty	1-sigma uncertainty	float64,0	ppm

Parameters	
Name	<b>DP4_SAS_HARVEY2_EXPONENT</b>
Description	Harvey profile 2 (mesogranulation) : exponent: Exponent of the Harvey profile 2
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit



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median_value	median value	float64,0	
uncertainty	1-sigma uncertainty	float64,0	

Parameters	
Name	<b>DP4_SAS_HARVEY2_TIME</b>
Description	Harvey profile 2 (mesogranulation) : characteristic time: Characteristic time of the Harvey profile 2
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
median_value	median value	float64,0	sec
uncertainty	1-sigma uncertainty	float64,0	sec

Parameters	
Name	<b>DP4_SAS_HARVEY2_AMPLITUDE</b>
Description	Harvey profile 2 (mesogranulation) : amplitude: Amplitude of the Harvey profile modelling the mesogranulation in the Fourier background
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
median_value	median value	float64,0	ppm
uncertainty	1-sigma uncertainty	float64,0	ppm

Parameters	
Name	<b>DP4_SAS_HARVEY1_EXPONENT</b>
Description	Harvey profile 1 (activity) : exponent: Exponent of the Harvey profile 1
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
median_value	median value	float64,0	
uncertainty	1-sigma uncertainty	float64,0	

Parameters	
Name	<b>DP4_SAS_HARVEY1_TIME</b>
Description	Harvey profile 1 (activity): characteristic time: Characteristic time of the Harvey profile 1



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Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
median_value	median value	float64,0	sec
uncertainty	1-sigma uncertainty	float64,0	sec

Parameters	
Name	<b>DP4_SAS_HARVEY1_AMPLITUDE</b>
Description	Harvey profile1 (activity): amplitude: Amplitude of the Harvey profile modelling the activity in the Fourier background
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
median_value	median value	float64,0	ppm
uncertainty	1-sigma uncertainty	float64,0	ppm

## Metadata-Structure(s):

Parameters	
Name	<b>DP4_SAS_DELTAPROT_METADATA</b>
Description	Differential rotation determination metadata: Containing the process by which the differential rotation is generated
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
DP4_SAS_DELTAPROT_METADATA			

Parameters	
Name	<b>DP4_SAS_PROT_METADATA</b>
Description	Rotation period determination metadata: Containing the process by which the rotation is generated
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit



DP4\_SAS\_PROT\_METADATA

Parameters	
Name	<b>DP4_SAS_LONGTERM_MODULATION_METADATA</b>
Description	Additional information on the process by which the long-term cyclical variation is identified
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
DP4_SAS_LONGTERM_MODULATION_METADATA	TBD		

Parameters	
Name	<b>DP4_SAS_HARVEY_METADATA</b>
Description	Harvey profiles metadata: Containing the process by which the Harvey profiles are fitted
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
DP4_SAS_HARVEY_METADATA			

## 8.2 Spotmodelling

This section contains data products which are generated only if spot modelling is performed.

### Data-Structure(s):

Parameters	
Name	<b>ADP_SAS_SPOT_MODEL</b>
Description	Spot model: Spot model parameters and residuals
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
ADP_SAS_SPOT_MODEL			

Parameters	
Name	<b>IDP_SAS_SPOT_DELTAPROT</b>
Description	Spot differential rotation: For each spot, from spot modelling(out of baseline)



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Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_SPOT_PROT			

Parameters	
Name	<b>IDP_SAS_SPOT_AREA</b>
Description	Spot areas: For each spot, from spot modelling(out of baseline)
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_SPOT_AREA			

Parameters	
Name	<b>IDP_SAS_SPOT_PROT</b>
Description	Spot rotation period: For each spot, from spot modelling(out of baseline)
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_SPOT_PROT			

Metadata-Structure(s):

## 9 Stellar properties data

Parameters	
Level	L2
Name	L2: Stellar properties
Description	Results of the computation of the stellar properties from various methods. Generated every times SAS runs, for each star identifier.
Producer	SAS
Consumer	DAST, SAS, EAS (TBC)

### 9.1 Nonseismic\_stellar\_properties\_from\_gyrochronology

This section contains data products only generated if there is a proper value of DP4\_SAS\_PROT.





## Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_AGE_GYRO</b>
Description	Age from gyrochronology: Age determined from gyrochronology
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,2	Myr
uncertainty		float64,2	Myr

## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_METADATA_GYRO</b>
Description	Metadata from gyrochronology
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
catalog_id			
star_id			
quality_flag		boolean,0	

### 9.2 Nonseismic\_stellar\_properties\_from\_activity

This section contains data products only generated if there is a proper value of DP4\_SAS\_PROT and DP4\_SAS\_SPH.

## Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_AGE_ACTIVITY</b>
Description	Age from age-activity relations: Age determined from activity-age relations
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
value		float64,1	Gyr
uncertainty		float64,1	Gyr



## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_AGE_ACTIVITY_METADATA</b>
Description	Metadata age-activity relations
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
catalog_id			
star_id			
quality_flag		boolean,0	

### 9.3 Nonseismic\_stellar\_properties\_from\_granulation

This section contains data products only generated if IDP\_SAS\_LOGG\_FLIPER/log\_flag is true.

## Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_AGE_GRANULATION_CGBM</b>
Description	Age from non-seismic grid based methods and granulation: Age determined from grid-based modelling with classical methods using granulation log g as a constraint
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		S11,0	
info/plotname		S9,0	
info/unit		S3,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	Myr
summary/err_plus		float64,0	Myr
summary/mean		float64,0	Myr
summary/median		float64,0	Myr
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_RADIUS_GRANULATION_CGBM</b>



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Description	Radius from non-seismic grid based methods and granulation: Radius determined from grid-based modelling with classical methods using granulation log g as a constraint
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		S19,0	
info/plotname		S29,0	
info/unit		S5,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	R $\odot$
summary/err_plus		float64,0	R $\odot$
summary/mean		float64,0	R $\odot$
summary/median		float64,0	R $\odot$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	IDP_SAS_MASS_GRANULATION_CGBM
Description	Mass from non-seismic grid based methods and granulation: Mass determined from grid-based modelling with classical methods using granulation log g as a constraint
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		S12,0	
info/plotname		S15,0	
info/unit		S5,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	M $\odot$
summary/err_plus		float64,0	M $\odot$
summary/mean		float64,0	M $\odot$
summary/median		float64,0	M $\odot$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	IDP_SAS_MASS_GRANULATION
Description	Mass from granulation: Mass determined using the granulation log g and the photometric radius



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Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
Mass		float64,0	g
Mass_pdf/entropy		float64,0	
Mass_pdf/int_err		float64,0	
Mass_pdf/iqr(0.025)		float64,0	
Mass_pdf/kurtosis		float64,0	
Mass_pdf/mean		float64,0	
Mass_pdf/median		float64,0	
Mass_pdf/mode		float64,0	
Mass_pdf/range		float64,1	
Mass_pdf/skewness		float64,0	
Mass_pdf/std		float64,0	
Mass_pdf/var		float64,0	
Mass_std		float64,0	g

## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_METADATA_GRANULATION_CGBM</b>
Description	Metadata for non-seismic grid based methods and granulation
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
fit-quality/max-likelihood		float64,0	
fit-quality/min-chi2		float64,0	

Parameters	
Name	<b>IDP_SAS_METADATA_GRANULATION</b>
Description	Metadata mass from granulation method
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

### 9.4 Nonseismic\_stellar\_properties\_from\_transit\_mean\_density

This section is not included in the baseline version of the pipeline



## Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_AGE_RHO_TRANSIT_CGBM</b>
Description	Age from non-seismic grid-based methods and mean density from transit: Age determined from grid-based modelling with classical methods using mean density from transit as a constraint
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_AGE_RHO_TRANSIT_CGBM		float64,1	

Parameters	
Name	<b>IDP_SAS_RADIUS_RHO_TRANSIT_CGBM</b>
Description	Radius from non-seismic grid-based methods and mean density from transit: Radius determined from grid-based modelling with classical methods using mean density from transit as a constraint
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_RADIUS_RHO_TRANSIT_CGBM		float64,1	

Parameters	
Name	<b>IDP_SAS_MASS_RHO_TRANSIT_CGBM</b>
Description	Mass from non-seismic grid-based methods and mean density from transit: Mass determined from grid-based modelling with classical methods using mean density from transit as a constraint
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_MASS_RHO_TRANSIT_CGBM		float64,1	

Parameters	
Name	<b>IDP_SAS_MASS_RHO_TRANSIT</b>
Description	Mass from transit mean density: Mass determined using the mean density inferred from the transit, and the photometric radius
Reference	
Related to	



Columns			
Name	Description	Type, dim	Unit
IDP_SAS_MASS_RHO_TRANSIT			

## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_METADATA_RHO_TRANSIT_CGBM</b>
Description	Metadata from non-seismic grid-based methods and mean density from transit
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_METADATA_RHO_TRANSIT_CGBM			

Parameters	
Name	<b>IDP_SAS_METADATA_RHO_TRANSIT</b>
Description	Metadata mass from transit mean density
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_METADATA_RHO_TRANSIT			

## 9.5 Global\_seismic\_stellar\_properties

This section contains data products which are generated only if seismic inferences are performed, i.e. if IDP\_SAS\_SEISMIC\_DETECTION\_FLAG/osc\_detection\_flag is true.

## Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_DENSITY_SCALING_GRIDS</b>
Description	Density scaling on grids: Density inferred from scaling relations constrained on stellar evolution tracks
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit



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info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	g cm <sup>-3</sup>
summary/err_plus		float64,0	g cm <sup>-3</sup>
summary/mean		float64,0	g cm <sup>-3</sup>
summary/median		float64,0	g cm <sup>-3</sup>
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_LOGG_SCALING_GRIDS</b>
Description	Log g scaling on grids: Log g inferred from scaling relations constrained on stellar evolution tracks
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	dex(cgs)
summary/err_plus		float64,0	dex(cgs)
summary/mean		float64,0	dex(cgs)
summary/median		float64,0	dex(cgs)
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_AGE_SCALING_GRIDS</b>
Description	Age scaling on grids: Age inferred from scaling relations constrained on stellar evolution tracks
Reference	
Related to	

Columns
---------



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Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	Myr
summary/err_plus		float64,0	Myr
summary/mean		float64,0	Myr
summary/median		float64,0	Myr
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_RADIUS_SCALING_GRIDS</b>
Description	Radius scaling on grids: Radius inferred from scaling relations constrained on stellar evolution tracks
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	R $\odot$
summary/err_plus		float64,0	R $\odot$
summary/mean		float64,0	R $\odot$
summary/median		float64,0	R $\odot$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_MASS_SCALING_GRIDS</b>
Description	Mass scaling on grids: Mass inferred from scaling relations constrained on stellar evolution tracks
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit





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info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	$M_{\odot}$
summary/err_plus		float64,0	$M_{\odot}$
summary/mean		float64,0	$M_{\odot}$
summary/median		float64,0	$M_{\odot}$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stddev		float64,0	

Parameters	
Name	<b>IDP_SAS_RADIUS_SCALING_ONLY</b>
Description	Radius scaling only: Radius inferred from scaling relations
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
data/err_minus		float64,0	$R_{\odot}$
data/err_plus		float64,0	$R_{\odot}$
data/mean		float64,0	$R_{\odot}$
data/median		float64,0	$R_{\odot}$
data/quant_16		float64,0	
data/quant_84		float64,0	
data/samples		float64,1	
data/std		float64,0	
info/description		object,0	
info/latex_name		object,0	
info/latex_unit		object,0	

Parameters	
Name	<b>IDP_SAS_MASS_SCALING_ONLY</b>
Description	Mass scaling only: Mass inferred from scaling relations
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
data/err_minus		float64,0	$M_{\odot}$
data/err_plus		float64,0	$M_{\odot}$
data/mean		float64,0	$M_{\odot}$
data/median		float64,0	$M_{\odot}$
data/quant_16		float64,0	



data/quant_84		float64,0	
data/samples		float64,1	
data/std		float64,0	
info/description		object,0	
info/latex_name		object,0	
info/latex_unit		object,0	

## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_METADATA_SCALING_GRIDS</b>
Description	Metadata for the scaling grids method: We store in the metadata information to retrieve the optimal model, together with information on the quality of the fit
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
fit-quality/max-likelihood		float64,0	
fit-quality/min-chi2		float64,0	

Parameters	
Name	<b>IDP_SAS_METADATA_SCALING_ONLY</b>
Description	
Reference	Empty in HDF5
Related to	

Columns			
Name	Description	Type, dim	Unit
errors/missing_input	Errors encountered during code execution	bool,0	
warnings/has_nans_or_inf	Warnings encountered during code execution: has_nans_or_inf,low_sample_count, sample_count	bool,2	

## 9.6 Individual seismic stellar properties

The following section contains data products that are generated only if seismic inference based on individual frequencies is possible. Criteria based on IDP\_SAS\_QUALITY\_METADATA

## Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_L_GRID_FREQS</b>
Description	Luminosity from grid-based method using frequencies: Luminosity of the inferred from grid-based methods using the individual frequencies fit
Reference	



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Related to

Columns

Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	L $\odot$
summary/err_plus		float64,0	L $\odot$
summary/mean		float64,0	L $\odot$
summary/median		float64,0	L $\odot$
summary/quant_16		float64,0	L $\odot$
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters

Name

IDP\_SAS\_DENSITY\_GRID\_FREQS

Description

Density from grid-based method using frequencies: The value for the mean density will be inferred from the pdf distribution of the mean density. The pdf, in turn, is derived through forward modelling, from mean density values provided for each model in the grid.

Reference

Related to

Columns

Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	g cm <sup>-3</sup>
summary/err_plus		float64,0	g cm <sup>-3</sup>
summary/mean		float64,0	g cm <sup>-3</sup>
summary/median		float64,0	g cm <sup>-3</sup>
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters



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Name	<b>IDP_SAS_TEFF_GRID_FREQS</b>
Description	Teff from grid-based method using frequencies: Teff of the inferred from grid-based methods using the individual frequencies fit
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	K
summary/err_plus		float64,0	K
summary/mean		float64,0	K
summary/median		float64,0	K
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_LOGG_GRID_FREQS</b>
Description	Log g from grid-based method using frequencies: Log g inferred from grid based methods using individual frequencies
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	dex (cgs)
summary/err_plus		float64,0	dex (cgs)
summary/mean		float64,0	dex (cgs)
summary/median		float64,0	dex (cgs)
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	



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Parameters	
Name	<b>IDP_SAS_AGE_GRID_FREQS</b>
Description	Age from grid-based method using frequencies: Age inferred from grid based methods using individual frequencies
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	Myr
summary/err_plus		float64,0	Myr
summary/mean		float64,0	Myr
summary/median		float64,0	Myr
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_RADIUS_GRID_FREQS</b>
Description	Radius from grid-based method using frequencies: Radius inferred from grid based methods using individual frequencies
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	R $\odot$
summary/err_plus		float64,0	R $\odot$
summary/mean		float64,0	R $\odot$
summary/median		float64,0	R $\odot$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	



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Parameters	
Name	<b>IDP_SAS_MASS_GRID_FREQS</b>
Description	Mass from grid-based method using frequencies: Mass inferred from grid based methods using individual frequencies
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	$M_{\odot}$
summary/err_plus		float64,0	$M_{\odot}$
summary/mean		float64,0	$M_{\odot}$
summary/median		float64,0	$M_{\odot}$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_L_GRID_SURFACE_INDEPENDENT</b>
Description	Luminosity from grid-based method using surface independent methods: Luminosity of the inferred from grid based method using surface-independent methods
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	$L_{\odot}$
summary/err_plus		float64,0	$L_{\odot}$
summary/mean		float64,0	$L_{\odot}$
summary/median		float64,0	$L_{\odot}$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	



Parameters	
Name	<b>IDP_SAS_DENSITY_GRID_SURFACE_INDEPENDENT</b>
Description	Density from grid-based method using surface independent methods : The value for the mean density will be inferred from the pdf distribution of the mean density. The pdf, in turn, is derived through forward modelling, from mean density values provided for each model in the grid.
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	g cm <sup>-3</sup>
summary/err_plus		float64,0	g cm <sup>-3</sup>
summary/mean		float64,0	g cm <sup>-3</sup>
summary/median		float64,0	g cm <sup>-3</sup>
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stddev		float64,0	

Parameters	
Name	<b>IDP_SAS_TEFF_GRID_SURFACE_INDEPENDENT</b>
Description	Teff from grid-based method using surface independent methods: Teff inferred from grid-based methods using surface independent methods
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	K
summary/err_plus		float64,0	K
summary/mean		float64,0	K



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summary/median		float64,0	K
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stddev		float64,0	

Parameters			
Name	<b>IDP_SAS_LOGG_GRID_SURFACE_INDEPENDENT</b>		
Description	Log g from grid-based method using surface independent methods: Log g inferred from grid based methods using surface independent methods		
Reference			
Related to			

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	dex (cgs)
summary/err_plus		float64,0	dex (cgs)
summary/mean		float64,0	dex (cgs)
summary/median		float64,0	dex (cgs)
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stddev		float64,0	

Parameters			
Name	<b>IDP_SAS_AGE_GRID_SURFACE_INDEPENDENT</b>		
Description	Age from grid-based method using surface independent methods: Age inferred from grid based methods using surface independent methods		
Reference			
Related to			

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	





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summary/err_minus		float64,0	Myr
summary/err_plus		float64,0	Myr
summary/mean		float64,0	Myr
summary/median		float64,0	Myr
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stddev		float64,0	

Parameters	
Name	<b>IDP_SAS_RADIUS_GRID_SURFACE_INDEPENDENT</b>
Description	Radius from grid-based method using surface independent methods: Radius inferred from grid based methods using surface independent methods
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	R $\odot$
summary/err_plus		float64,0	R $\odot$
summary/mean		float64,0	R $\odot$
summary/median		float64,0	R $\odot$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stddev		float64,0	

Parameters	
Name	<b>IDP_SAS_MASS_GRID_SURFACE_INDEPENDENT</b>
Description	Mass from grid-based method using surface independent methods: Mass inferred from grid based methods using surface independent methods
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	M $\odot$



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summary/err_plus		float64,0	M☉
summary/mean		float64,0	M☉
summary/median		float64,0	M☉
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stddev		float64,0	

## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_METADATA_GRID_FREQS</b>
Description	Metadata of the optimal model with grid based methods using frequencies: We store in the metadata information to retrieve the optimal model to be used as reference model for the sophisticated methods (inversion, glitch), together with information on the quality of the fit
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
fit-quality/max-likelihood		float64,0	
fit-quality/min-chi2		float64,0	

Parameters	
Name	<b>IDP_SAS_METADATA_GRID_SURFACE_INDEPENDENT</b>
Description	Metadata of the optimal model with grid based methods using surface independent methods: We store in the metadata information to retrieve the optimal model to be used as reference model for the sophisticated methods (inversion, glitch), together with information on the quality of the fit
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

## 9.7 Individual seismic stellar properties from mixed modes

The following section contains data products that are generated only if seismic inference based on individual frequencies including mixed modes is possible. Criteria based on IDP\_SAS\_QUALITY\_METADATA

## Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_DENSITY_GRID_MIXED</b>
Description	Density from grid-based method using mixed modes: Mean density inferred from grid based methods using mixed modes



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Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	g cm <sup>-3</sup>
summary/err_plus		float64,0	g cm <sup>-3</sup>
summary/mean		float64,0	g cm <sup>-3</sup>
summary/median		float64,0	g cm <sup>-3</sup>
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_L_GRID_MIXED</b>
Description	Luminosity from grid-based method using mixed modes: L inferred from grid based methods using mixed modes
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	L $\odot$
summary/err_plus		float64,0	L $\odot$
summary/mean		float64,0	L $\odot$
summary/median		float64,0	L $\odot$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters
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Name	<b>IDP_SAS_TEFF_GRID_MIXED</b>
Description	Teff from grid-based method using mixed modes: Teff inferred from grid based methods using mixed modes
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	K
summary/err_plus		float64,0	K
summary/mean		float64,0	K
summary/median		float64,0	K
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_LOGG_GRID_MIXED</b>
Description	Log g from grid-based method using mixed modes: Log g inferred from grid based methods using mixed modes
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	dex (cgs)
summary/err_plus		float64,0	dex (cgs)
summary/mean		float64,0	dex (cgs)
summary/median		float64,0	dex (cgs)
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	



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Parameters	
Name	<b>IDP_SAS_AGE_GRID_MIXED</b>
Description	Age from grid-based method using mixed modes: Age inferred from grid based methods using mixed modes
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	Myr
summary/err_plus		float64,0	Myr
summary/mean		float64,0	Myr
summary/median		float64,0	Myr
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

Parameters	
Name	<b>IDP_SAS_RADIUS_GRID_MIXED</b>
Description	Radius from grid-based method using mixed modes: Radius inferred from grid based methods using mixed modes
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	R $\odot$
summary/err_plus		float64,0	R $\odot$
summary/mean		float64,0	R $\odot$
summary/median		float64,0	R $\odot$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	



Parameters	
Name	<b>IDP_SAS_MASS_GRID_MIXED</b>
Description	Mass from grid-based method using mixed modes: Mass inferred from grid based methods using mixed modes
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
info/description		object,0	
info/plotname		object,0	
info/unit		object,0	
posterior/pdf/kde		float64,1	
posterior/pdf/values		float64,1	
posterior/samples		float64,1	
summary/err_minus		float64,0	$M_{\odot}$
summary/err_plus		float64,0	$M_{\odot}$
summary/mean		float64,0	$M_{\odot}$
summary/median		float64,0	$M_{\odot}$
summary/quant_16		float64,0	
summary/quant_84		float64,0	
summary/stdev		float64,0	

## Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_METADATA_GRID_MIXED</b>
Description	Metadata of the optimal model with grid based methods using mixed modes: We store in the metadata information to retrieve the optimal model to be used as reference model for inversions with mixed modes, together with information on the quality of the fit we store the metadata to retrieve the optimal model
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
fit-quality/max-likelihood		float64,0	
fit-quality/min-chi2		float64,0	

## 9.8 Sophisticated\_individual\_stellar\_properties

The following section contains data products that are generated only if seismic inference based on individual frequencies is possible, and only if the quality of seismic spectra allows it. Criteria based on IDP\_SAS\_QUALITY\_METADATA, and if observation duration exceeds 1 year.

These data products are out of the SAS baseline version.



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## Data-Structure(s):

Parameters	
Name	<b>IDP_SAS_R_BCE_INV_GRID</b>
Description	Radius at the base of the convective zone from inversion method: Radius at the base of the convective zone inferred from grid based methods using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_R_BCE_INV_GRID			

Parameters	
Name	<b>IDP_SAS_Y_S_INV_GRID</b>
Description	Surface helium from inversion method: Surface helium inferred from grid based methods using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_Y_S_INV_GRID			

Parameters	
Name	<b>IDP_SAS_DENSITY_INV_GRID</b>
Description	Density from inversion method: Density inferred from grid based methods using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_DENSITY_INV_GRID			

Parameters	
Name	<b>IDP_SAS_L_INV_GRID</b>
Description	Luminosity from inversion method: Luminosity inferred from grid based methods using inversion constraints
Reference	
Related to	



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Columns			
Name	Description	Type, dim	Unit
IDP_SAS_L_INV_GRID			

Parameters	
Name	<b>IDP_SAS_TEFF_INV_GRID</b>
Description	Teff from inversion method: Teff inferred from grid based methods using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_TEFF_INV_GRID			

Parameters	
Name	<b>IDP_SAS_LOGG_INV_GRID</b>
Description	Log g from inversion method: Log g inferred from grid based methods using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_LOGG_INV_GRID			

Parameters	
Name	<b>IDP_SAS_AGE_INV_GRID</b>
Description	Age from inversion method: Age inferred from grid based methods using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_AGE_INV_GRID			

Parameters	
Name	<b>IDP_SAS_RADIUS_INV_GRID</b>
Description	Radius from inversion method: Radius inferred from grid based methods using inversion constraints
Reference	





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Related to

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_RADIUS_INV_GRID			

Parameters	
Name	<b>IDP_SAS_MASS_INV_GRID</b>
Description	Mass from inversion method: Mass inferred from grid based methods using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_MASS_INV_GRID			

Parameters	
Name	<b>IDP_SAS_ENV_IND_INV</b>
Description	Envelope indicators (TBD): Envelope indicators from inversion process
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_ENV_IND_INV			

Parameters	
Name	<b>IDP_SAS_CORE_IND_INV</b>
Description	Core indicators (TBD): Core indicators from inversion process
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_CORE_IND_INV			

Parameters	
Name	<b>IDP_SAS_ACOUSTIC_RADIUS_INV</b>
Description	Acoustic radius : Acoustic radius from inversion process
Reference	



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Related to

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_ACOUSTIC_RADIUS_INV			

Parameters	
Name	<b>IDP_SAS_DENSITY_INV</b>
Description	Mean density from inversion process: Mean density yielded from the inversion
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_DENSITY_INV			

Parameters	
Name	<b>IDP_SAS_STRUCT_MOD</b>
Description	Structural model from interpolation before inversion: we store the metadata to retrieve the models interpolated to be used for inversions
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_STRUCT_MOD			

Parameters	
Name	<b>IDP_SAS_Y_S_GRID_GLITCHES</b>
Description	Surface helium from grid-based methods and glitches : Surface Helium inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_Y_S_GRID_GLITCHES			

Parameters	
Name	<b>IDP_SAS_R_BCE_GRID_GLITCHES</b>



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Description	Radius at the base of the convective envelope from grid-based methods and glitches : Radius at the base of the convective envelope inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_R_BCE_GRID_GLITCHES			

Parameters	
Name	<b>IDP_SAS_DENSITY_GRID_GLITCHES</b>
Description	Density from grid-based methods and glitches: Density inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_DENSITY_GRID_GLITCHES			

Parameters	
Name	<b>IDP_SAS_L_GRID_GLITCHES</b>
Description	Luminosity from grid-based methods and glitches: L inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_L_GRID_GLITCHES			

Parameters	
Name	<b>IDP_SAS_TEFF_GRID_GLITCHES</b>
Description	Teff from grid-based methods and glitches: Teff inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_TEFF_GRID_GLITCHES			

Parameters	
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Name	<b>IDP_SAS_LOGG_GRID_GLITCHES</b>
Description	Log g from grid-based methods and glitches: Log g inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_LOGG_GRID_GLITCHES			

<b>Parameters</b>	
Name	<b>IDP_SAS_AGE_GRID_GLITCHES</b>
Description	Age from grid-based methods and glitches: Age inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_AGE_GRID_GLITCHES			

<b>Parameters</b>	
Name	<b>IDP_SAS_RADIUS_GRID_GLITCHES</b>
Description	Radius from grid-based methods and glitches: Radius inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_RADIUS_GRID_GLITCHES			

<b>Parameters</b>	
Name	<b>IDP_SAS_MASS_GRID_GLITCHES</b>
Description	Mass from grid-based methods and glitches: Mass inferred from grid based methods using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_MASS_GRID_GLITCHES			



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#### Parameters

Name	<b>IDP_SAS_CC_GLITCHES</b>
Description	Convective core glitch: Coefficients of a polynomial regression of the r01 ratios
Reference	
Related to	

#### Columns

Name	Description	Type, dim	Unit
IDP_SAS_CC_GLITCHES			

#### Parameters

Name	<b>IDP_SAS_BCE_AMPLITUDE_GLITCHES</b>
Description	Amplitude BCE glitch: Amplitude of the glitch due to the base of the convection envelope
Reference	
Related to	

#### Columns

Name	Description	Type, dim	Unit
IDP_SAS_BCE_AMPLITUDE_GLITCHES			

#### Parameters

Name	<b>IDP_SAS_BCE_DEPTH_GLITCHES</b>
Description	Depth BCE glitch: Depth of the glitch due to the base of the convection envelope
Reference	
Related to	

#### Columns

Name	Description	Type, dim	Unit
IDP_SAS_BCE_DEPTH_GLITCHES			

#### Parameters

Name	<b>IDP_SAS_Y_AMPLITUDE_GLITCHES</b>
Description	Amplitude helium glitch: Amplitude of the helium glitch
Reference	
Related to	

#### Columns

Name	Description	Type, dim	Unit
IDP_SAS_Y_AMPLITUDE_GLITCHES			



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#### Parameters

Name **IDP\_SAS\_Y\_DEPTH\_GLITCHES**

Description Depth helium glitch: Depth of the helium glitch

Reference

Related to

#### Columns

Name	Description	Type, dim	Unit
IDP_SAS_Y_DEPTH_GLITCHES			

#### Parameters

Name **IDP\_SAS\_DENSITY\_INV\_GRID\_MIXED**

Description Density from grid and inversion using mixed modes: Density inferred from mixed modes fitting using inversion constraints

Reference

Related to

#### Columns

Name	Description	Type, dim	Unit
IDP_SAS_DENSITY_INV_GRID_MIXED			

#### Parameters

Name **IDP\_SAS\_L\_INV\_GRID\_MIXED**

Description Luminosity from grid and inversion using mixed modes: Luminosity inferred from mixed modes fitting using inversion constraints

Reference

Related to

#### Columns

Name	Description	Type, dim	Unit
IDP_SAS_L_INV_GRID_MIXED			

#### Parameters

Name **IDP\_SAS\_TEFF\_INV\_GRID\_MIXED**

Description Teff from grid and inversion using mixed modes: Teff inferred from mixed modes fitting using inversion constraints

Reference

Related to

#### Columns



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Name	Description	Type, dim	Unit
IDP_SAS_TEFF_INV_GRID_MIXED			

Parameters	
Name	<b>IDP_SAS_LOGG_INV_GRID_MIXED</b>
Description	Log g from grid and inversion using mixed modes: Log g inferred from mixed modes fitting using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_LOGG_INV_GRID_MIXED			

Parameters	
Name	<b>IDP_SAS_AGE_INV_GRID_MIXED</b>
Description	Age from grid and inversion using mixed modes: Age inferred from mixed modes fitting using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_AGE_INV_GRID_MIXED			

Parameters	
Name	<b>IDP_SAS_RADIUS_INV_GRID_MIXED</b>
Description	Radius from grid and inversion using mixed modes: Radius inferred from mixed modes fitting using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_RADIUS_INV_GRID_MIXED			

Parameters	
Name	<b>IDP_SAS_MASS_INV_GRID_MIXED</b>
Description	Mass from grid and inversion using mixed modes: Mass inferred from mixed modes fitting using inversion constraints



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Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_MASS_INV_GRID_MIXED			

Parameters	
Name	<b>IDP_SAS_DENSITY_INV_MIXED</b>
Description	Mean density from inversion process with mixed modes: Mean density yielded from the inversion with mixed modes
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_DENSITY_INV_MIXED			

Parameters	
Name	<b>IDP_SAS_STRUCT_MOD_MIXED</b>
Description	Structural model from interpolation before mixed modes inversion: we store the metadata to retrieve the models interpolated to be used for inversions with mixed modes
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_STRUCT_MOD_MIXED			

Metadata-Structure(s):

Parameters	
Name	<b>IDP_SAS_METADATA_INV_GRID</b>
Description	Metadata of the inversion method: Metadata of the grid based methods using inversion constraints
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_METADATA_INV_GRID			





Parameters	
Name	<b>IDP_SAS_METADATA_GRID_GLITCHES</b>
Description	Metadata for grid based inference using glitches
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_METADATA_GRID_GLITCHES			

Parameters	
Name	<b>IDP_SAS_METADATA_INV_GRID_MIXED</b>
Description	Metadata from grid and inversion using mixed modes: We store in the metadata information to retrieve the properties from inversions with mixed modes, together with information on the quality of the fit
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
IDP_SAS_METADATA_INV_GRID_MIXED			

## 9.9 Final\_stellar\_properties

Data-Structure(s):

Parameters	
Name	<b>DP5_SAS_AGE</b>
Description	Stellar age: Value of the stellar age. If relevant, selected after comparison of the different masses determined by the pipeline
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
mean, std			Gyr

Parameters	
Name	<b>DP5_SAS_RADIUS</b>
Description	Stellar radius: Value of the stellar radius. If relevant, selected after comparison of the different masses determined by the pipeline
Reference	



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Related to

Columns			
Name	Description	Type, dim	Unit
mean, std			R $\odot$

Parameters	
Name	DP5_SAS_MASS
Description	Stellar mass: Value of the stellar mass. If relevant, selected after comparison of the different masses determined by the pipeline
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
mean, std			M $\odot$

## Metadata-Structure(s):

Parameters	
Name	DP5_SAS_AGE_METADATA
Description	Stellar age metadata: Contains the whole history of generation of the stellar age
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
DP5_SAS_AGE_METADATA			

Parameters	
Name	DP5_SAS_RADIUS_METADATA
Description	Stellar radius metadata: Contains the whole history of generation of the stellar radius
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
DP5_SAS_RADIUS_METADATA			

Parameters	
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Name	<b>DP5_SAS_MASS_METADATA</b>
Description	Stellar mass metadata: Contains the whole history of generation of the stellar mass
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
DP5_SAS_MASS_METADATA			

### Quality-Control-Structure(s):

Parameters	
Name	<b>IDP_SAS_AGE_PRIORITY</b>
Description	Age value selection: combining all age determinations
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

Parameters	
Name	<b>IDP_SAS_RADIUS_PRIORITY</b>
Description	Radius value selection: combining all radius determinations
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		

Parameters	
Name	<b>IDP_SAS_MASS_PRIORITY</b>
Description	Mass value selection: combining all mass determinations
Reference	
Related to	

Columns			
Name	Description	Type, dim	Unit
TBD	TBD		



## 10 Pending issues

This document is meant to be updated regularly. As the present state some issues have been pointed out which need to be resolved.

[WP12PDP\_I02]: Some data products are associated with covariance matrices and some are not. We should define a way to store the statistical characterization of the DPs, and use it as a standard for all the DPs, and the IDPs which are used to propagate the errors.

[WP12PDP\_I04]: Do the stellar properties determined by MSAP5 at quarter q replace the preparatory values at quarter q+1?

[WP12PDP\_I07]: If nothing is modified by SAS, and the final DP5 are the default values given by the PDPs, should we still generate an official DP5?

[WP12PDP\_I09]: Do the IDP produced by MSAP2 at quarter q replace the PDP produced by MSteSci1 when quarter q+1 is running? If so, care should be put in handling the correlations.

[WP12PDP\_I24]: Which criterium will determine if spot modelling is activated?

[WP12PDP\_I25]: TBC that by-products of the SAPP pipeline are kept and stored (mass, radius, age)

[WP12PDP\_I26]: TBD which IDP output of MSAP5-1 are really going as inputs of MSAP5-3, and which are not.

[WP12PDP\_I30]: Bolometric flux from IRFM: does not go anywhere.

The following issues are solved :

[WP12PDP\_I01]: Some data products (DPx) are associated with metadata which constitute a product itself (as an example DP3\_SAS\_OSC\_FREQ and DP3\_SAS\_OSC\_FREQ\_METADATA), whereas others are not paired with a metadata product (DP4\_SAS\_PROT).

The metadata DP have been generated and synched with [PLATO-LESIA-PSPM-DD-0021]. We'd like to preconize separated metadata DP for the DP3-5, and metadata by techniques for the others.

[WP12PDP\_I03]: The exact DP4 to take as input of MSAP2 need to be defined from the list of DP4.

[WP12PDP\_I05]: MSAP5-1 needs the stellar internal structure models (PDP\_B\_SAS\_MOD\_STRUCTURE) for modules 131 and 162, but they do not appear in the architecture [PLATO-LESIA-PSPM-DD-0021]. What does it contain exactly?

[WP12PDP\_I08]: In [PLATO-LESIA-PSPM-DD-0021], whenever there is a decision box, the decision relies on a flag that seldom appears as input of the module. This is the case for :

IDP\_SAS\_detection\_flag in MSAP5-Overview

Quarter number in MSAP1

Spots detection in MSAP4

IDP\_SAS\_QUALITY\_METADATA in MSAP5-1

[WP12PDP\_I11]: PDP\_B\_SAS\_MOD\_EVOL do not appear as input of MSAP5-2 despite modules MSAP5-24 and MSAP5-26 which are supposed to perform grid-based modelling.

[WP12PDP\_I14]: PDP\_C\_SAS\_TEFF\_SPECTROSCOPY and PDP\_C\_SAS\_LOGG\_SPECTROSCOPY are internal to MSteSci1, in the pipeline, the “\_SAPP” values are used, therefore these former (SPECTROSCOPY) should not appear here.

[WP12PDP\_I15]: PDP\_C\_SAS\_TEFF\_VAL does not appear anywhere in the pipeline architecture.

[WP12PDP\_I06]: There is a lack of unification concerning the stellar parameters that are used by different parts of the pipeline. For example MSAP3 takes the PDP\_C\_SAS\_[M/H]\_SPECTROSCOPY, whereas MSAP5-1 takes PDP\_C\_SAS\_[M/H]\_SAPP or IDP\_SAS\_[M/H]\_SAPP, and whereas MSAP4 takes

PDP\_C\_SAS\_[ELEM1/ELEM2]\_SPECTROSCOPY.

[WP12PDP\_I13]: PDP\_C\_SAS\_SPECTROSCOPY\_METADATA does not appear in the architecture but is important for traceability of the spectroscopic determinations

[WP12PDP\_I21]: Is SED needed for MSAP3? No

[WP12PDP\_I10]: Is IDP\_SAS\_BACKGROUND\_FIT needed for the module MSAP3-04 peak-bagging? Yes

[WP12PDP\_I12]: PDP\_B\_SAS\_MOD\_PHOTOMETRY does not appear anywhere in the architecture, specifically it does not appear in MSAP5-2 where it is expected. It's removed now.

[Synthetic Photometry / PDP\_B\_SAS\_MOD\_PHOTOMETRY / S: Not applicable D: MSAP5-part2 (TBC) / Synthetic photometry in different common passbands, in addition to those from PLATO. Grids of stellar models will include these quantities because they are useful for stellar parameters determinations, particularly for non-seismic targets. ]

[WP12PDP\_I16]: PDP\_B\_SAS\_MOD\_LIMBDARKENING is it needed for modes visibility assessment? TBC

[WP12PDP\_I17]: PDP\_C\_SAS\_LD\_INTERFEROMETRY is it needed as input of MSAP4, or do they use only theoretical values?



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[WP12PDP\_I19]: DP2 and DP1 appear in the workflow of the architecture document, but not in this document.

[WP12PDP\_I20]: Aperture flux dilution appears in the MSAP3 workflow but neither in this DP document, nor in the PIC-WP2 interface document. Is it actually necessary? How will we retrieve it?

This data does not make sense for PLATO lightcurve as:

Mask-based photometry will be performed on-board only for the P5 sample. But MSAP1 will only use merged LC from the L1 pipeline.

For all the other samples, the lightcurves will be extracted using a PSF fitting method.

[WP12PDP\_I22]: M/H has to be calculated from elem1/elem2 in the Bayesian inference module. To be checked in accordance with WP124 and WP128 heads to make sure they have the same definition for [M/H] => FE/H and ALPHA/FE provided

[WP12PDP\_I23] Some outputs of the spectroscopy module (MSAP2-02) seem to be ADP rather than IDP. TBC.

Solved: they're IDP because they're ingested by MSAP2-03.

[WP12PDP\_I27]: MSAP3 was the only user of [M/H]\_spec, should it still be considered here? Solved. M/H removed

[WP12PDP\_I28]: These SED DPs are not directly used by the pipeline. Solved. SED removed.

[WP12PDP\_I29]: what is behind prep\_obs\_data? For MSAP1? For MSAP2: is it the spectroscopic data only?

[WP12PDP\_I31]: PDP\_D\_SAS\_TEFF\_VAL: does not appear anywhere else. Is it still expected to validate Teff within a MStSci2 pre-op module? [Validated value for Teff/ PDP\_D\_SAS\_TEFF\_VAL / S: MStSci2D:TBD / Value of Teff selected after validation by WP125200. ]

[WP12PDP\_I32]: AARLC no longer as input of MSAP4 in MSAP4 architecture version of May the 3rd 2022

[WP12PDP\_I33]: IDP\_SAS\_LOGG\_VARLC is IDP\_SAS\_LOGG\_FLIPER? Name change?

[WP12PDP\_I34]: Synchronise with PIC interface document => SAS interfaces document