

DIVA+ Data Model

1. Introduction

This document describes the data model of DIVA+. The following diagram summarises the various components of this model:

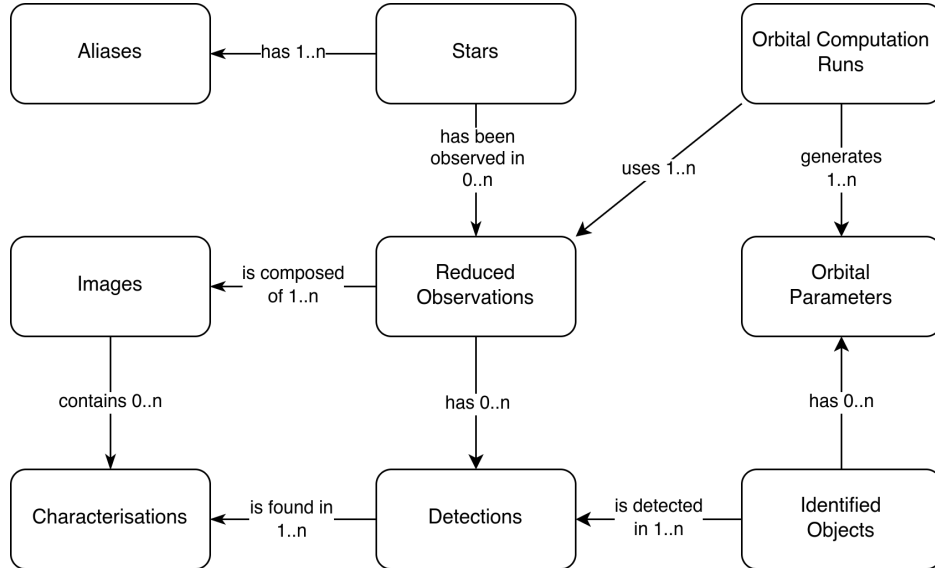


Figure 1. Simplified data model

- We have a list of stars with associated stellar parameters. Each star is associated to one or several aliases to facilitate searches.
- A star is observed in several reduced observations, with different instruments or with the same instrument but at different epochs or reduced with different algorithms or parameters. *Note that for SHINE a single reduction processed with different characterisation algorithms will appear as several reduced observations.*
- A reduced observation is composed of one or several images; for instance a cube observation is composed of as many images as there are slices in the cube.
- In each image, detection characterisations are identified.
- The image characterisations are cross-identified to define detections at the reduced observation level.
- The detections of various reduced observations are cross-identified as identified objects. They may be fully characterised (with a type) or not.
- Using the information about the identified objects at various epochs, we may process one or several orbital computations, using given reduced observations, to generate orbital parameters.

The full data model is described in [figure 2](#) and the next sections describe each table.

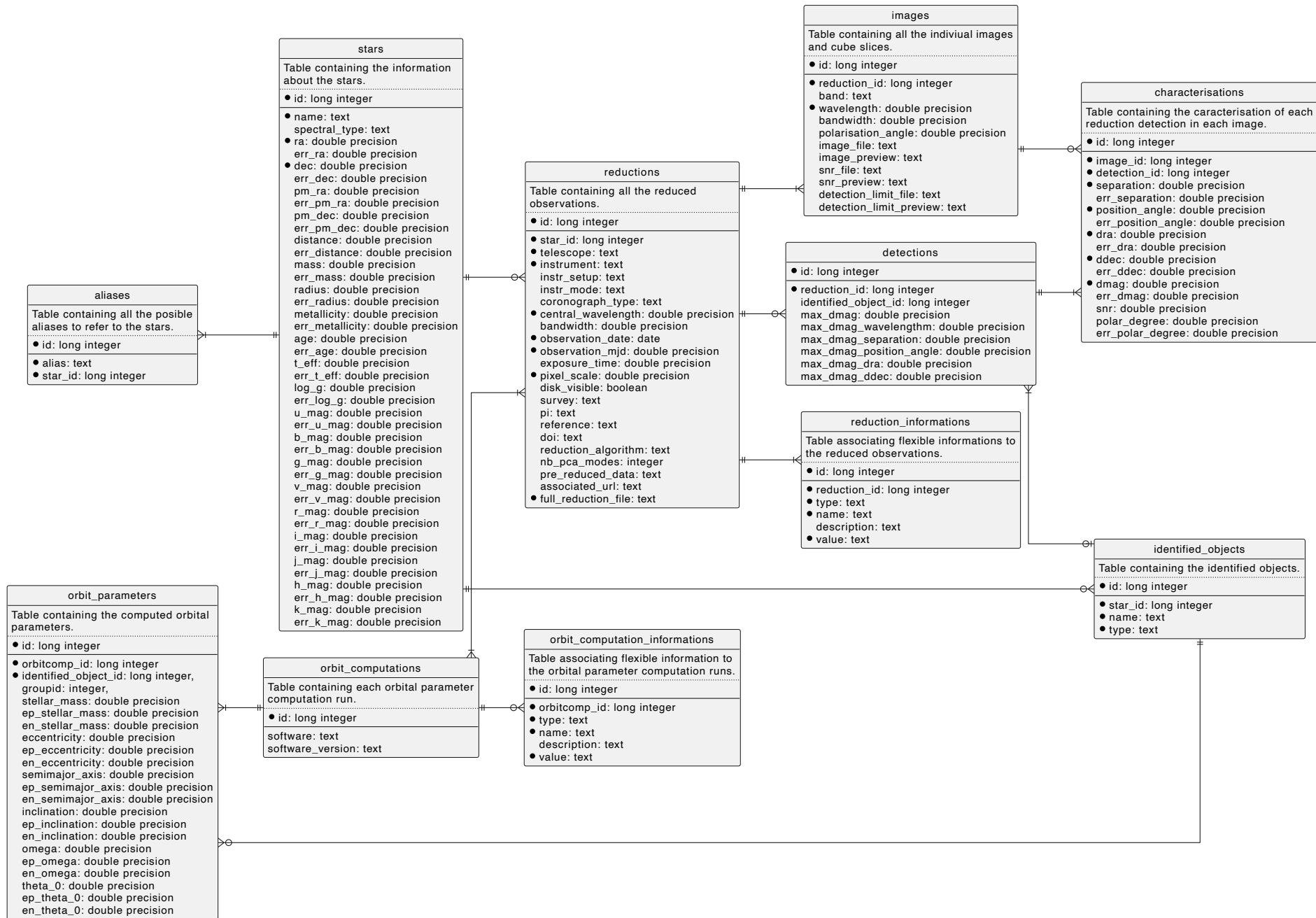


Figure 2. Full data model



In the following tables, some column names are followed by a ; that means that the column is part of a composite primary key and that there can be only one row with a given combination of values for the keys.

A following a column name means that this column is mandatory. A means the column is a foreign key.

2. Star information (table stars)

The table `stars` contains the information about each observed star.

Name	Description	Type	Unit
id	Unique identifier of the star	long integer	
name	Main name of the star	text	
spectral_type	Spectral type of the star	text	
ra	Right Ascension (J2000)	double	degree
err_ra	Uncertainty on the Right Ascension	double	degree
dec	Declination (J2000)	double	degree
err_dec	Uncertainty on the Declination	double	degree
pm_ra	Proper motion in RA	double	marcsec/yr
err_pm_ra	Uncertainty on the proper motion in RA	double	marcsec/yr
pm_dec	Proper motion in Dec	double	marcsec/yr
err_pm_dec	Uncertainty on the proper motion in Dec	double	marcsec/yr
distance	Distance from Earth	double	parsec
err_distance	Uncertainty on the distance from Earth	double	parsec
mass	Mass	double	Solar mass
err_mass	Uncertainty on the mass	double	Solar mass
radius	Radius	double	Solar radius
err_radius	Uncertainty on the radius	double	Solar radius
metallicity	Metallicity of the star	double	dex
err_metallicity	Uncertainty on the metallicity	double	dex
age	Age of the star	double	Myr
err_age	Uncertainty on the age	double	Myr
t_eff	Effective temperature	double	K
err_t_eff	Uncertainty on the effective temperature	double	K
log_g	Logarithm of surface gravity	double	log(m/s ⁻²)
err_log_g	Uncertainty on log_g	double	log(m/s ⁻²)
u_mag	U band magnitude	double	mag

Name	Description	Type	Unit
err_u_mag	Uncertainty on U band magnitude	double	mag
b_mag	B band magnitude	double	mag
err_b_mag	Uncertainty on B band magnitude	double	mag
g_mag	g band magnitude	double	mag
err_g_mag	Uncertainty on g band magnitude	double	mag
v_mag	V band magnitude	double	mag
err_v_mag	Uncertainty on V band magnitude	double	mag
R_mag	R band magnitude	double	mag
err_r_mag	Uncertainty on R band magnitude	double	mag
j_mag	J band magnitude	double	mag
err_j_mag	Uncertainty on J band magnitude	double	mag
h_mag	H band magnitude	double	mag
err_h_mag	Uncertainty on H band magnitude	double	mag
k_mag	K band magnitude	double	mag
err_k_mag	Uncertainty on K band magnitude	double	mag

3. Name aliases (table aliases)

To facilitate the search of stars in the database, we maintain an `alias` table with all the know aliases for each star (note: the main name of the star must also be in the alias table as the search is performed there).

Name	Description	Type	Unit
id 🔑	Unique identifier of the alias	long integer	
alias ☆	Alias name of the star	text	
star_id ☆ 🔗	Identifier of the star in the <code>stars</code> table	long integer	

4. Information about the reduced products (table reductions)

Name	Description	Type	Unit
id 🔑	Unique identifier of the reduction	long integer	
star_id ☆ 🔗	Identifier of the star in the <code>stars</code> table	long integer	
telescope ☆	Name of the telescope (ex: VLT)	text	
instrument ☆	Name of the instrument (ex: SPHERE)	text	
instr_setup	Name of the instrument setup (ex: IRDIFS)	text	
instr_mode	Name of the instrument mode (ex: SHINE-IRDIFS_EXT)	text	
coronograph_type	Type of the coronagraph	text	

Name	Description	Type	Unit
central_wavelength ☆	Central wavelength of the set of images composing the reduction	double	Ångström
bandwidth	Bandwidth of the set of images composing the reduction	double	Ångström
observation_date ☆	Date of the observation	date	
observation_mjd ☆	Date and time of the observation	double	Julian date
exposure_time	Exposure time	double	s
pixel_scale ☆	Size of a pixel	double	marcsec
disk_visible	Is a disk visible in the images?	Boolean	
survey	Name of the survey	text	
pi	Name of the Principal Investigator	text	
reference	Bibliographic reference of the survey	text	
doi	DOI associated to the reduced observation. It may be the reduced observation itself or a set of observations.	text	
reduction_algorithm	Name of the reduction algorithm	text	
nb_pca_modes	Number of modes if PCA algorithm	integer	
pre_reduced_data	Link to the pre-reduced data (e.g. script to download the data from SPHERE-DC)	text	
associated_url	Associated URL for more information	text	
full_reduction_file ☆	File containing the whole reduction (HCI-FITS or tar.gz)	text	







5. Information about the images (table images)

Name	Description	Type	Unit
id 🔑	Unique identifier of the image	long integer	
star_id ☆ 🔗	Identifier of the star in the stars table	long integer	
reduction_id ☆ 🔗	Identifier of the reduction in the reductions table	long integer	
band	Name of the band (ex: K)	text	
wavelength ☆	Central wavelength of the image	double	Ångström
bandwidth	FWHM of the photometric band or delta lambda of the cube slice	double	Ångström
polarisation_angle	Angle of the image polarisation (TBD is it here?)	double	degree
image_file	Path to the FITS file of the image	text	
image_preview	Path to a preview of the image	text	
snr_file	Path to the FITS file of the SNR map	text	

Name	Description	Type	Unit
snr_preview	Path to a preview of the SNR map	text	
detection_limit_file	Path to the FITS file containing the detection limit curve	text	
detection_limit_preview	Path to a preview of the detection limit curve	text	

6. Reduced observations additional information (table reduction_infos)

This table contains additional information associated to a reduced observation. Such information can be of different natures depending of the content of the type column.

Name	Description	Type	Unit
id 	Unique identifier	long integer	
reduction_id  	Identifier of the reduction in the <code>reductions</code> table	long integer	
type 	Type of the information (link, HCI-FITS, Raw data...)	text	
name 	Name of the information	text	
description	Description of the information	text	
value 	Value of the information. Depends of the type. For instance the URL of the link, the path to the file, the identifier...	text	








The following table lists the various possible types for additional information and describes the value associated.



As we've put the HCI-FITS and the link to the pre-reduced data in the reduction table we may not need this.

Type	Content of the value columns
TBD	TBD

7. Characterisations in the images (table characterisations)

Name	Description	Type	Unit
id 	Unique identifier of the characterisation	long integer	
image_id  	Identifier of the image in the <code>images</code> table	long integer	
detection_id 	Identifier of the detection in the <code>detections</code> table	long integer	
separation 	Separation from the star	double	marcsec
err_separation	Uncertainty on the separation from the star	double	marcsec
position_angle 	Position angle	double	degree
err_position_angle	Uncertainty on the position angle	double	degree
dra 	Delta in the Right Ascension	double	marcsec

Name	Description	Type	Unit
err_dra	Uncertainty on the delta in the Right Ascension	double	marcsec
ddec ☆	Delta in the Declination	double	marcsec
err_ddec	Uncertainty on the delta in the Declination	double	marcsec
dmag ☆	Delta of the characterisation magnitude	double	mag
err_dmag	Uncertainty on the delta of the characterisation magnitude	double	mag
snr	Signal to Noise ratio of the detection	double	
polar_degree	Degree of linear polarisation (TBD : is it here?)	double	
err_polar_degree	Uncertainty on the degree of linear polarisation (TBD : is it here?)	double	

8. Detections in the reductions (table detections)

This table contains the reduction detections gathering the characterisations in each image. We add the values of the maximal δmag and of the wavelength and position in the characterisation with this maximal δmag (they are not mandatory because we have some detections with no characterisation in SHINE).

Name	Description	Type	Unit
id 🔑	Unique identifier of the detection	long integer	
reduction_id ☆ 🔗	Identifier of the reduction in the reductions table	long integer	
identified_object_id 🔗	Identifier of the object in the objects table	long integer	
max_dmag	Maximal value of dmag in all the reduction characterisations	double	
max_dmag_wavelength	Wavelength at which the dmag is maximal in all the reduction characterisations	double	Ångström
max_dmag_separation	Value of the separation at the maximal dmag	double	marcsec
max_dmag_position_angle	Value of the position angle at the maximal dmag	double	degree
max_dmag_dra	Value of the dRA at the maximal dmag	double	marcsec
max_dmag_ddec	Value of the dDec at the maximal dmag	double	marcsec

9. Cross-matched identified objects (table identified_objects)

This table contains the objects cross-matched in multiple reductions.

Name	Description	Type	Unit
id 🔑	Unique identifier of the object	long integer	
star_id ☆ 🔗	Identifier of the star in the stars table	long integer	
name ☆	Name of the object (b, c...?)	text	

Name	Description	Type	Unit
type ☆	Type of object (planet, bound dwarf, background star...)	text	

10. Object orbital parameters (table orbit_parameters)


This table gathers the orbital parameters computed for the identified objects.

Name	Description	Type	Unit
id 🔑	Unique identifier of the orbital parameters	long integer	
orbitcomp_id ☆ 🔗	Identifier of the orbital parameter run in the <code>orbit_computation</code> table	long integer	
identified_object_id ☆ 🔗	Identifier of the object in the <code>objects</code> table	long integer	
groupid	Identifier for linked parameters, this is used for instance when the orbital computation run generates several possible solutions that are linked together.	integer	
stellar_mass	Stellar mass fitted while computing the stellar parameters	number	Solar mass
ep_stellar_mass	Positive uncertainty on the stellar mass	number	Solar mass
en_stellar_mass	Negative uncertainty on the stellar mass	number	Solar mass
eccentricity	Eccentricity of the orbit	double	
ep_eccentricity	Positive uncertainty on the eccentricity of the orbit	double	
en_eccentricity	Negative uncertainty on the eccentricity of the orbit	double	
semimajor_axis	Semi-major axis of the orbit	double	au
ep_semimajor_axis	Positive uncertainty on the semi-major axis of the orbit	double	au
en_semimajor_axis	Negative uncertainty on the semi-major axis of the orbit	double	au
inclination	Inclination of the orbit	double	degree
ep_inclination	Positive uncertainty on the inclination of the orbit	double	degree
en_inclination	Negative uncertainty on the inclination of the orbit	double	degree
omega	Longitude of the ascending node of the orbit	double	TBD
ep_omega	Positive uncertainty on the longitude of the ascending node of the orbit	double	TBD
en_omega	Negative uncertainty on the longitude of the ascending node of the orbit	double	TBD
theta_0	Argument of periapsis of the orbit	double	TBD
ep_theta_0	Positive uncertainty on the argument of periapsis of the orbit	double	TBD

Name	Description	Type	Unit
en_theta_0	Negative uncertainty on the argument of periapsis of the orbit	double	TBD







11. Orbital parameter runs (table orbit_computations)

This table contains the information about the orbital parameter computation runs that led to the orbital parameters. There's a many to many relationship to the reduced observation table so that we can know which ones are used in a given run. This allows for instance to query all the orbital parameters computed with data from a given instrument.

Name	Description	Type	Unit
id 	Unique identifier of the orbital parameter run	long integer	
software	Software used to compute the orbital parameters	text	
software_version	Version of the software.	text	

12. Orbital parameters additional information (table orbit_computation_informations)

This table contains additional information associated to an orbital parameter run, like the link to a table containing all the possible values for the parameters.

Name	Description	Type	Unit
id 	Unique identifier	long integer	
orbitcomp_id  	Identifier of the orbital computation run	long integer	
type 	Type of the information (link, table,...)	text	
name 	Name of the information	text	
description	Description of the information	text	
value 	Value of the information. Depends of the type.	text	

The following table lists the various possible types for additional information and describes the value associated.

Type	Content of the value columns
Analysis description	Path to a text file describing the analysis.
Corner plot	Path to an image containing a corner plot of parameter joint distributions.