DIMM Software Configuration
SAI MASS/DIMM & tau-tec software modules

Description of configuration files and system setup

Version 1.2

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Contents

1 Preface

This document describes the configuration files of the Kornilov DIMM software, that is `ameba` and `dimm`, and the tau-tec software, that is `tt-meteo`, `tt-dome-astrohaven`, `tt-scope` and `tt-master`.

2 The `ameba` configuration

The configuration file is `ameba.cfg` and is divided in sections and sub-sections with configuration items.

2.1 Section General

2.1.1 Subsection Site

Variable	Used	Format	Function
`DeviceNumber`	✗		Descriptive name of the used device.
`SiteName`	✗		Descriptive name of the used site.
`Longitude`	✓	string (hh mm ss)	Longitude of the site [h] (not degrees!).
`Latitude`	✓	string (dd mm ss)	Latitude of the site [°].

2.1.2 Subsection Common

Variable	Used	Format	Function
`CivilNight`	✓	double	Sun altitude to calculate the start/end of the civil twilight [°].
`AstroNight`	✓	double	Sun altitude to calculate the start/end of the astronomic twilight [°].
`MinimalTime`	✓	double	Minimal night length from end of dusk to start of dawn to start observation at all [h].
`MeasurementSet`	✓	uint	Number of measurements for the normal program.
`ExperimentSet`	✓	uint	Number of measurements for the experiment program.
`PollingTime`	✓	uint	Time for polling weather conditions and start of observation [s]. default: 30
`ErrPause`	✓	uint	Time to wait after environmental conditions were reported as being bad to continue with observation [s]. default: 1200
`Stability`	✓	double	Threshold to decide for photo stability in normal program. Note: Only relevant for a MASS.

2.1.3 Subsection Objects

Variable	Used	Format	Function
Catalogue	✓	string	The file name that is used to check for observable targets. *Note:* For usage with tt-master, the entry must point to the generated file system link (see section 7).
MinAltitude	✓	double	The minimal altitude a target must have to be observed [°].
MaxAltitude	✗		
MoonZone	✓	double	The avoidance zone around the moon that will not be used for making measurements [°].
HoldTime	✓	double	The length for how long a target is used for measurements [s].
Selection	✓	double	The minimal star quality level, judged based on the distance to the moon, object altitude and possible length of observation.

2.1.4 Subsection Background

The settings of this section are not used, as only DIMM measurements are taken (see section 2.3.2).

Variable	Used	Format	Function
Displacement	✓	double	Moving distance for mount from object to estimate background [arcseconds].
Period	✓	double	Intended interval between background measurements [s].
MaxValue	✗	double	
MinimalTime	✓	double	Minimal time between measurements [s].

2.2 Section Camera

2.2.1 Subsection Geometry

Configuration of values to recenter the camera image by applying offsets to tt-scope. Therefore the scale and orientation of the camera must be known.

Note: This section was added by tau-tec to the Kornilov software.

Variable	Used	Format	Function
CenTolerance	✓	double	Tolerated deviation from center position, otherwise recentering is triggered.
Rotation	✓	double	Rotation of the camera to the mount [°].
MirrorFirst	✓	double	Mirrored influence of the first main axis to the rotated x-axis $[-1, +1]$.
MirrorSecond	✓	double	Mirrored influence of the second main axis to the rotated y-axis $[-1, +1]$.

2.3 Section Components

2.3.1 Subsection Druid

The only purpose for this is to check the availability of a server — a reasonable IP address/name should be the telescope mount. Be sure that this server can be pinged.

Variable	Used	Format	Function
`TheHost`	✓	string	Host name of a computer that is pinged to check its accessibility.
`ThePort`	✗		

2.3.2 Subsection DIMM

The section contains configuration parameters to connect to and set up values to `dimm-tool`.

Variable	Used	Format	Function
`TheHost`	✓	string	Host name of the DIMM program.
`ThePort`	✓	uint	Port of the DIMM program.
`Separation`	✓	double	Targeted horizontal separation of the two projections, used for focusing [pixel].
`SepTolerance`	✓	double	Deviation to targeted separation, used as abort criteria for focusing [pixel].
`FocusFactor`	✓	double	Factor to convert separation change in pixels to focus units.
`FocusStepLimit`	✓	double	Maximal focus units moved at one iteration. This should be in the region of a visible focus change.
`FocusThreshold`	✓	double	Minimal focus units a move must have to be executed.

2.3.3 Subsection MASS

The settings of this section are not used, as only DIMM measurements are taken (see section 2.3.2).

Variable	Used	Format	Function
`TheHost`	✓	string	Host name of the MASS program.
`ThePort`	✓	uint	Port of the MASS program.
`MaxExtinct`	✓	double	The maximal tolerated extinction.
`MinStarFluxes`	✓	double-array[4]	Minimal flux for each MASS channel.

2.3.4 Subsection TLSP

The section contains configuration parameters to connect to and set up values to `tt-scope`.

Variable	Used	Format	Function
`TheHost`	✓	string	Host name of the Tlsp program.
`ThePort`	✓	uint	Port of the Tlsp program.

Variable	Used	Format	Function
GuideSettleTime	✓	uint	Settle time to wait after a slew before measurements are started [s].
BackgroundShift	✗		
WorkZone	(✓)	double	Threshold to check for working guiding. This just generates a "DIMM guiding works" message when being lower than 20%.

2.3.5 Subsection Dome

The section contains configuration parameters to connect to and set up values to `tt-dome-astrohaven`.

Variable	Used	Format	Function
TheHost	✓	string	Host name of the Dome program.
ThePort	✓	uint	Port of the Dome program.
OpenFraction	✓	double	Target position of the dome sides for normal operations
WideOpen	✓	double	Target position of the dome sides for photometry operations.
PositionError	✓	double	The tolerated error in positioning the dome. The default value is 0.2 because of the limited number of steps the Astro Haven dome takes from opened to closed. *Note:* This property was added by tau-tec to the Kornilov software.

2.3.6 Subsection IRSky

The settings of this section are not used, as the sky-sensor program is delivering the necessary data (see section 2.3.8).

Variable	Used	Format	Function
TheHost	✗		
ThePort	✗		

2.3.7 Subsection Meteo

The section contains configuration parameters to connect to and judge the values delivered from `tt-meteo`.

Variable	Used	Format	Function
TheHost	✓	string	Host name of the Meteo program.
ThePort	✓	uint	Port of the Meteo program.
HumHigh	✓	double	Maximum tolerated humidity, above this, wet condition is detected [%rh].
HumLow	✓	double	Humidity has to fall below this level for a while, to detect dry condition [%rh].

Variable	Used	Format	Function
HeatingLevel	✓	double	Switch on telescope heater if humidity is above this level [%rh]. *Note:* This is not supported for tt-scope.
WindHigh	✓	double	Maximum tolerated wind level, above this, windy condition is detected [m/s].
WindLow	✓	double	Wind speed has to fall below this level for a while, to detect light wind condition [m/s].
HoldTime	✓	double	Time the values must be below HumLow/WindLow to detect dry/light wind conditions again [s].
PowerOff	✗	double	
PowerOn	✗	double	
HoldPower	✗	double	

2.3.8 Subsection Skysensor

The section contains configuration parameters to connect to and judge the values delivered from tt-meteo.

Variable	Used	Format	Function
TheHost	✓	string	Host name of the sky sensor program.
ThePort	✓	uint	Port of the sky sensor program.
TempClose	✓	double	corrected sky sensor temperature to close dome (default threshold between cloudy/very cloudy is -10°C for Boltwood sensor) [°C].
TempWait	✓	double	corrected sky sensor temperature to stop operation [°C].
TempStart	✓	double	corrected sky sensor temperature to start operation (default threshold between clear/cloudy is -25°C for Boltwood sensor) [°C].
HoldTime	✓	double	Time the values must be below TempStart to start again with measurements [s].

3 The dimm configuration

The configuration file is turdimm.cfg and is divided in sections and sub-sections with configuration items.

3.1 Section General

3.1.1 Subsection Site

Variable	Used	Format	Function
DeviceNumber	✗		Descriptive name of the used device.

Variable	Used	Format	Function
SiteName	✗		Descriptive name of the used site.
Longitude	✓	string (hh mm ss)	Longitude of the site [h] (not degrees!).
Latitude	✓	string (dd mm ss)	Latitude of the site [°].

3.1.2 Subsection DIMM

Variable	Used	Format	Function
ApertureBase	✓	double	Distance of the sub-aperture centers [cm].
ApertureSize	✓	double	Diameter of the sub-apertures [cm].

3.2 Section Operation

3.2.1 Subsection Normal

The estimation mode uses the configured BaseTime to get the overall run time — this is five times the configured time in seconds.

Variable	Used	Format	Function
Exposure	✓	double	The frame exposure time [ms].
FrameRate	✓	double	The captured frame rate [Hz].
BaseTime	✓	int	The base-time to get a raw measurement [s].
AccumTime	✓	int	The accumulated time that is used to capture base-time measurements and calculate a calibrated value [s].
MeasBoxSide	✓	int	The subframe width that is used for capturing [pixel].
StarRadius	✓	double	The star radius for center-of-gravity calculation [pixel].
ThresholdFactor	✓	double	The threshold used for center-of-gravity calculation in the threshold mode, to be set in the CGMethod property.
CGMethod	✓	string	The method used for the center-of-gravity calculation. Possible entries are window and others (threshold).
MaxDropped	✓	int	Maximum number of dropped frames that are tolerated in a base-time measurement.

3.2.2 Subsection Centering

Variable	Used	Format	Function
Exposure	✓	double	The frame exposure time [ms].
FrameRate	✓	double	The captured frame rate [Hz].
AccumTime	✓	double	The accumulated time that is used to capture frames [s].

Variable	Used	Format	Function
ThresholdFactor	✓	double	The threshold used to determine bright spots, based on mean brightness and ThresholdFactor multiplied with variance of brightness.
MinObjectFlux	✓	double	Minimal total flux for target images in ADU.

3.2.3 Subsection RawData

Variable	Used	Format	Function
Exposure	✓	double	The frame exposure time [ms].
FrameRate	✓	double	The captured frame rate [Hz].
AccumTime	✓	int	The accumulated time that is used to capture frames [s].
BoxFactor	✓	int	The working window factor to capture more of the frame surrounding the target. It is multiplied with the value from MeasBoxSide from section Operation, sub-section "Normal" (see section 3.2.1).

3.2.4 Subsection Pictures

Variable	Used	Format	Function
Exposure	✓	double	The frame exposure time [ms].
FrameRate	✓	double	The captured frame rate [Hz].
AccumTime	✓	int	The accumulated time that is used to capture frames [s].

3.2.5 Subsection FieldTest

Variable	Used	Format	Function
Exposure	✓	double	The frame exposure time [ms].
FrameRate	✓	double	The captured frame rate [Hz].
AccumTime	✓	int	The accumulated time that is used to capture frames [s].
ThresholdFactor	✓	double	The threshold used to calculate a segmentation threshold in brightness steps, between dark and bright spots [%].

3.3 Subsection Camera

3.3.1 Subsection Geometry

Variable	Used	Format	Function
FieldAperture	✓	double	The radius of the field diaphragm [pixel].

Variable	Used	Format	Function
Scale	✓	double	The image scale [arcsec/pixel].
FocalCoeff	✓	double	The focal changing factor [focus steps/pixel].
Separation	✓	double	The preferable image separation to get an focused image[pixel].
OpticalCenter	✓	int-array[2]	The optical center position on the frame [pixel].

3.3.2 Subsection Type

Variable	Used	Format	Function
Model	✗		
Identification	✓	string	The camera serial number (Vimba-UID) to identify the connected camera.
Digitization	✓	int	The camera digitization. Possible values are camera dependent, most common values are 8, 12 and 16 bits [bit/pixel].

3.3.3 Subsection Parameters

Variable	Used	Format	Function
Format	✓	int-array[2]	The maximum camera frame size [pixel].
Gain	✓	double	The used working gain factor (1.0 means no gain, 2.0 are 10dB - doubled values).
ReadOutNoise	✗		
BiasControl	✗		

4 The tt-meteo configuration

tt-meteo does not have a custom configuration, but is listening on standard ports after startup.

5 The tt-dome-astrohaven configuration

Configuration of tt-dome-astrohaven in the file ./log/tt-dome-astrohaven.properties located in the directory of the program.

Variable	Format	Description
LogSize	int	The size of each log file [MB]. default: 10
LogCount	int	The maximum number of log files. default: 100
SerialPort	string	The name of the serial port the dome is connected to, e.g. “ttyusb0”.
StepsOpenA	int	The number of single steps until side-A is fully opened. *Note:* This will be measured at first opening, or it can be preconfigured.

Variable	Format	Description
StepsOpenB	int	The number of single steps until side-B is fully opened. *Note:* This will be measured at first opening, or it can be preconfigured.

6 The tt-scope configuration

Variable	Format	Description
LogSize	int	The size of each log file in [MB]. default: 10
LogCount	int	The maximum number of log files. default: 100
TPLHost	string	The name or IP of the telescope OpenTPL server. default: localhost
TPLPort	int	The port of the telescope OpenTPL server. default: 65432
TPLUserName	string	The user name used for authentication at the telescope server. default: admin
TPLPassword	string	The password used for authentication at the telescope server. default: admin
TelescopePort	string	The port used for tracking objects, should be "CASSEGRAIN".
TelescopeParkPosMain0	double	The park position of the telescope first main (HA) axis [°].
TelescopeParkPosMain1	double	The park position of the telescope second main (Dec) axis [°].
TPLFocusPosition	double	The park position of the TCF-Si focuser in instrumental steps.
FocusMode	string	The focus mode, should be "TCFS", might be "TELESCOPE" and "NONE".
TCFSPort	string	The name of the serial port the focuser is connected to, e.g. "ttyusb0".

7 The tt-master configuration

Variable	Format	Description
LogSize	int	The size of each log file in [MB]. default: 10
LogCount	int	The maximum number of log files. default: 100
file and directory location created by the Kornilov software		
SpectraDir	string	Directory of the spectra data used by dimm-tool. default: /opt/dimm/dimm_tool/data/spectra/

Variable	Format	Description
`ManualCatalog`	string	The file created for manual targets for `ameba`. default: /opt/dimm/ameba/data/data/manual_star.lst
`AutoCatalog`	string	The file with the target list used for automatic selection by `ameba`. default: /opt/dimm/ameba/data/data/auto_star.lst
`LinkCatalog`	string	The file that is configured in `ameba` and links to the appropriate star-list for the current mode. default: /opt/dimm/ameba/data/data/star.lst
systemctl service names for managing program run state		
`AmebaService`	string	Systemd service handling `ameba` default: ameba
`DIMMService`	string	Systemd service handling `dimm-tool` and `preat` default: dimm-preat
`ScopeService`	string	Systemd service handling `tt-scope` default: tt-scope
`DomeService`	string	Systemd service handling `tt-dome-astrohaven` default: tt-dome
`MeteoService`	string	Systemd service handling `tt-meteo` default: tt-meteo
IP connection to other programs		
`DimmServer`	string	The name or IP of the `dimm-tool` Kornilov server. default: 127.0.0.1
`DimmPort`	int	The port of the `dimm-tool` Kornilov server. default: 16200
`ScopeServer`	string	The name or IP of the `tt-scope` Kornilov server. default: 127.0.0.1
`ScopePort`	int	The port of the `tt-scope` Kornilov server. default: 16400
`DomeServer`	string	The name or IP of the `tt-dome-astrohaven` Kornilov server. default: 127.0.0.1
`DomePort`	int	The port of the `tt-dome-astrohaven` Kornilov server. default: 16302

8 Adaption for new systems

8.1 Camera

When changing the camera, it must be positioned, that the first instrumental axis (HA) is parallel to the x-axis of the camera — moving an object horizontally when applying offsets. Therefore the second instrumental axis (Dec) will move the object vertically in the y-axis. The factor and direction of movement can be adapted in the `ameba` configuration.

These settings of the `ameba` configuration might be adapted:

- All settings in the section 2.2.1.
- `SepTolerance` and `FocusFactor` in section 2.3.2

and in the `dimm` configuration file these sections might be adapted, too:

- `Exposure` and `FrameRate` in all sub-sections of section 2.3.2
- All settings in the section 3.3.2.
- All settings in the section 3.3.3.

8.2 Optic

When changing the optics, be sure to match the requirements for the camera (see section 8.1). The prism must be rotated so that changing the focus only changes the separation of the two subapertures (and does not change their orientation!). The dimm mask as a whole needs to be rotated so that the focused images of the object are located horizontally (in the direction of the first instrumental axis (HA).

These settings of the `ameba` configuration might be adapted:

- All settings in the section 2.2.1.
- `SepTolerance` and `FocusFactor` in section 3.2

and in the `dimm` configuration file these sections might be adapted, too:

- All settings in the section 3.3.1.

8.3 Telescope

When moving the telescope, these settings of the `ameba` configuration might be adapted:

- All settings in the section 2.1.1.

and in the `dimm` configuration file these sections might be adapted, too:

- All settings in the section 3.1.1.

Of course, leveling of the mount, polar alignment and a new pointing model must be done, too.