



Released .....  
Name Date Signature

This page was intentionally left blank

**Change Record**

Issue	Date	Section/Parag. affected	Reason/Initiation/Documents/Remarks
1.0	28 September, 2004	.....	.....
0.9	28 September 2004	all	First concept

This page was intentionally left blank

# Contents

0.1	Abbreviations and Acronyms . . . . .	3
0.2	Glossary . . . . .	3
<b>1</b>	<b>Observation Preparation Software User Requirements</b>	<b>5</b>
1.1	Overview . . . . .	7
1.2	Astrometric P2PP Concept . . . . .	7
1.2.1	Astrometric P2PP step : 1 . . . . .	9
1.2.2	Astrometric P2PP : step 2 . . . . .	10
1.2.3	Astrometric P2PP : step 3 . . . . .	12
1.2.4	Astrometric P2PP : step 4 . . . . .	14
1.2.5	Astrometric P2PP availability . . . . .	15
1.3	Modules . . . . .	16
1.3.1	Projected Delay & Ephemerid Calculator (PDEC) . . . . .	16
1.3.2	The Exposure Time Calculator (ETC) . . . . .	16
1.3.3	Astrometric P2PP . . . . .	17
1.3.4	Short Time Scheduler (STS) . . . . .	18

# List of Figures

1.1	This figure illustrates the different steps required to search and characterise extrasolar planets. The astrometric measurement allow to compute the astrometric motion of the star that host the planet. The top-left graph shows the parallactic motion of HD114388 only (no reference star) over a 3-year-period while the bottom-left graph show the astrometric orbits of Gl876 which can be derived only when the parallactic motion is derived with sufficient accuracy. Red crosses correspond to two orthogonal astrometric measurements with 10 microarcseconds accuracy. Combined to radial velocities, astrometric measurements allow to derive all orbital parameters and thus the mass of the planet and the star. In order to efficiently retrieve the orbital parameters of the planet, it is important to carry out the observations at different orbital phases (earth period and planet period). For example, if no measurements are scheduled at the oscillation extrema of the parallactic motion (top-left figure), the derived proper motion and parallax will be false and no planetary signal could be retrieved out of the observations. . . . .	6
1.2	Observation Preparation Software. The graphic show how the Astrometric P2PP interact with databases and modules. PDEC stands for Projected DifferentialDelay & Ephemerid Calculator, ETC stands for Exposure Time Calculator while STS stands for Short Time Scheduler. . . . .	8
1.3	This figure represents the status of the Astrometric P2PP after uploading the observer target & reference star catalog, selecting an observing date, a baseline and the maximum airmass. OPS displays all targets and reference stars that can be observed with the VLTI/PRIMA considering the previous constraints. . . . .	9
1.4	This figure show the relative parallactic motion of the selected science target and reference star, the orbital motion of the parent star as well as the UV-coverage. This set of three graphs should help the observe to decide wether a target and a reference star must be observed or not at a given date. . . . .	11
1.5	Once the observer is satisfied with its choice of science target and reference star, he should be able to select them and decide when they must be observed. A simple drag and drop function will allow to move the science-refence star from the catalog to the graph representing the full night. This action will automatically compute the integration time and the projection of the baseline onto the astrometric motion. The size of the yellow dot onto the night summary will be proportional to the integration time while the projection of the baseline on the sky will be represented by a line onto the relative parallactic motion and orbital motion. The projection information should allow to decide wether the selected reference star is good or not and wether an additonal measurements should be carried out to allow the baseline to rotate. . . . .	13

1.6 At this step, the whole observing night has been prepared. Astrometric P2PP should be able to export the observing night into a file that can be loaded by BOB. OPS should also be able to upload observing night already created in order to modify them and then reexport them. . . . . 14



# List of Tables

This page was intentionally left blank

# Introduction

The VLTI/PRIMA-DDL project is dedicated to search for extrasolar planets using the astrometric mode of the Very Large Telescope Interferometer. It will be based on the principle of narrow angle astrometry which is fully explained in [29] and has been demonstrated at the 100 microarcsec level the Palomar Testbed Interferometer (PTI) [30]. The 10 microarcsec level has recently been reached at PTI with a different instrument setup [31].

The VLTI/PRIMA-DDL instrument is described in [ref]. PRIMA-DDLs is developed by a consortium headed by 3 institutes, ie. Heidelberg Max-Planck Institute, Geneva Observatory and Leiden Observatory.

The VLTI/PRIMA-DDL Observation Preparation Software is developed at Geneva Observatory in collaboration with ESO-Garching and Leiden Observatory.

The Project Scientists have the responsibility to define the user requirement for the Observation Preparation Software as well as to define observing strategies and observing sequences necessary to reach the 10 microarcsec accuracy.

Damien Segransan (OG) manages the OPS workpackage.

For ESO Garching, Pascal Ballester is the software contact person. At Leiden Observatory, people involved in the error budget will contribute to the OPS

## Scope

This document defines the user software requirements and outlines the functional specifications of the software modules related to the OPS and scientific aspects of the VLTI/PRIMA DDLs project. The requirements coming from the hardware of the instrument, from the scientific goals to achieve and from the scientific operation by which it will be operated are described in [ref].

The general requirements for the VLT software are given in [8].

The general specifications for the software which apply to all VLT instruments are given in [15] and [16] and quoted here when relevant.

Therefore the reader is supposed to be familiar with [6], [8], [15], [16] and [36].

## Applicable Documents

The following documents, of the exact issue shown, form a part of this document to the extent specified herein.

- [1] VLT-SOW-ESO-15720-2304 2.0 12/02/2004 VLTI/PRIMA-DDLs Statement of Work

[2]		1.0	21/06/2000	VLT/PRIMA-DDLs Project Plan and Schedule
[3]		1.0	21/06/2000	VLT/PRIMA-DDLs Tech. Requirements Spec.
[4]	VLT-SPE-ESO-10000-0011	2.0	30/09/1992	VLT SW Requirements Specs.
[5]	VLT-PRO-ESO-10000-0228	1.0	10/03/1993	VLT SW Programming Standards
[6]	VLT-PLA-ESO-00000-0004	1.0	20/12/1991	VLT SW Configuration Control Plan
[7]	VLT-PLA-ESO-00000-0006	2.0	21/05/1992	VLT SW Management Plan
[8]	VLT-MAN-ESO-17210-0667	1.0	03/12/1996	Guidelines for VLT Applications
[9]	VLT-SPE-ESO-19000-1618	1.0	21/04/1999	Dataflow System Requirements Spec.
[10]	GEN-SPE-ESO-00000-0266	1.0	10/05/1993	ESO GUI Common Conventions
[11]	VLT-SPE-ESO-17212-0001	2.0	12/04/1995	VLT INS SW Spec.
[12]	VLT-SPE-ESO-17240-0385	2.1	15/07/1996	VLT INS Common SW Spec.
[13]	GEN-SPE-ESO-19400-0794	1.1	25/11/1997	Data Interface Control Document

## Reference Documents

The following documents either are referenced in this document or describe concepts relevant to this document.

[14]	PLANETS-PRI-SCI-0001	1.0	200	VLT/PRIMA-DDL Scientific Proposal
[15]	PLANETS-PRI-TEC-0002	1.0	200	VLT/PRIMA-DDL Technical Proposal
[16]	PLANETS-PRI-MAG-0004	1.0	200	VLT/PRIMA-DDL Management Plan Proposal
[17]	PLANETS-PRI-PRO-0005	1.0	200	VLT/PRIMA-DDL Project Plan Proposal
[21]	VLT-MAN-ESO-17200-0888	1.0	17/08/1995	VLT Common SW Overview
[22]	VLT-MAN-ESO-17200-0642	1.11	22/11/1999	VLT Common SW Installation Man.
[23]	VLT-MAN-ESO-17240-1913	1.0	11/10/1999	Installation Tool User Manual
[24]	VLT-MAN-ESO-19200-1644	1.3	20/06/1999	P2PP User Manual
[25]	VLT-MAN-ESO-17240-0934	2.0	28/11/1999	Base ICS User Manual
[26]	VLT-MAN-ESO-17240-1973	1.0	28/11/1999	Template Instrument ICS User Man.
[27]	VLT-MAN-SBI-17210-0001	3.5	20/10/1999	LCU Common SW User Manual
[28]	VLT-MAN-ESO-13640-1388	1.2	22/11/1999	FIERA CCD Controller User Manual
[29]	VLT-MAN-ESO-17230-0942	1.6	10/12/1999	Telescope Control SW User Manual
[20]	<i>Potential of long-baseline infrared interferometry for narrow-angle astrometry</i>			
	A&A, 262, 353 .		1992	Shao, M. & Colavita, M. M.
[29]	<i>Phase-referenced Stellar Interferometry at the Palomar Testbed Interferometer</i>			
	AJ, 125, 1623L.		2003	Lane, B.F. & Colavita, M. M.
[30]	<i>Differential Astrometry of Subarcsecond Scale Binaries at the Palomar Testbed Interferometer</i>			
	ApJ, 601, 1129L.		2004	Lane, B.F. & Muterspaugh, M. W.

## 0.1 Abbreviations and Acronyms

AD	Applicable Document
AOS	Astrometry Operations and Software
API	Application Programmer Interface
AT	Auxiliary Telescope
CASE	Computer Aided Software Engineering
CDR	Conceptual Design Review
COM	Commissioning
DAF	Data Analysis Facility
DDL	Differential Delay Line
DRS	Data Reduction Software
FAC	Final Acceptance Chili
FAE	Final Acceptance Europe
FAR	Final Acceptance Review
FDR	Final Design Review
FSU	Fringe Sensor Unit
FTE	Full-Time Equivalent
GTO	Guaranteed Science Observations
HW	Hardware
ICD	Interface Control Document
IDE	Integrated Development Environment
IDL	Interface Definition Language
KO	Kick-off
MACAO	Multi Application Curvature Adaptive Optics
MAIV	Manufacture, Assembly, Integration, and Verification
MET	Metrology
OO	Object Oriented
OPD	Optical Path Difference
PAC	Provisional Acceptance Chili
PAE	Provisional Acceptance Europe
PDR	Preliminary Design Review
PRIMA	Phase Referenced Imaging and Microarcsecond Astrometry
RD	Reference Document
STS	Star Separator
SQL	Standard Query Language
SW	Software
TBD	To Be Determined
TRR	Test Readiness Review
UML	Unified Modeling Language
VLT	Very Large Telescope
VLTI	Very Large Telescope Interferometer

## 0.2 Glossary

The following are defined in [8]:

(VLT software) Package

(VLT software) Module

(VLT software) Unit

The following are defined in [15]:

Integration

Exposure

Observation

Observation sequence

Single Observation

The following are defined in [16]:

Template

Observation Block (OB)

## Chapter 1

# Observation Preparation Software User Requirements

The scientific potential of the state of the art VLTI/PRIMA astrometry machine, in the field of extrasolar planet search and characterisation has been demonstrated provided that 10 microarcseconds accuracy is achieved. Reaching such an accuracy is both a technical and a signal processing challenge which is now being addressed by the consortium. Nevertheless, one should keep in mind that the scientific outputs of the VLTI/PRIMA astrometric mode could be dramatically increased if a careful observation scheduling is implemented. Indeed, like all interferometric measurements, individual astrometric measurements are time consuming (at least 30min/measurement). For instance, the basic determination of the parallactic motion will take at least 15 measurements spread at optimal phases over 1.5 years. 15 extra measurements should be added to derive the astrometric orbit making a total of 30 measurements per star. These numbers translate into 15 hours observation per star spread over 3 years provided that they are carried out at optimal phases.

Another difficulty comes from the survey nature of astrometric observations. We need to optimise the observation of a large sample of star, which cannot be done manually. For example, if the star sample is composed of 100 stars, it translates into 1500 measurements that should be correctly scheduled over several years. Inefficient scheduling (bad set of VLTI configuration and observing date) would prevent accurate parallax determination in a 2-year-period and thus it would prevent planet search or characterisation over a time-span of 3 years (Figure 1.1).

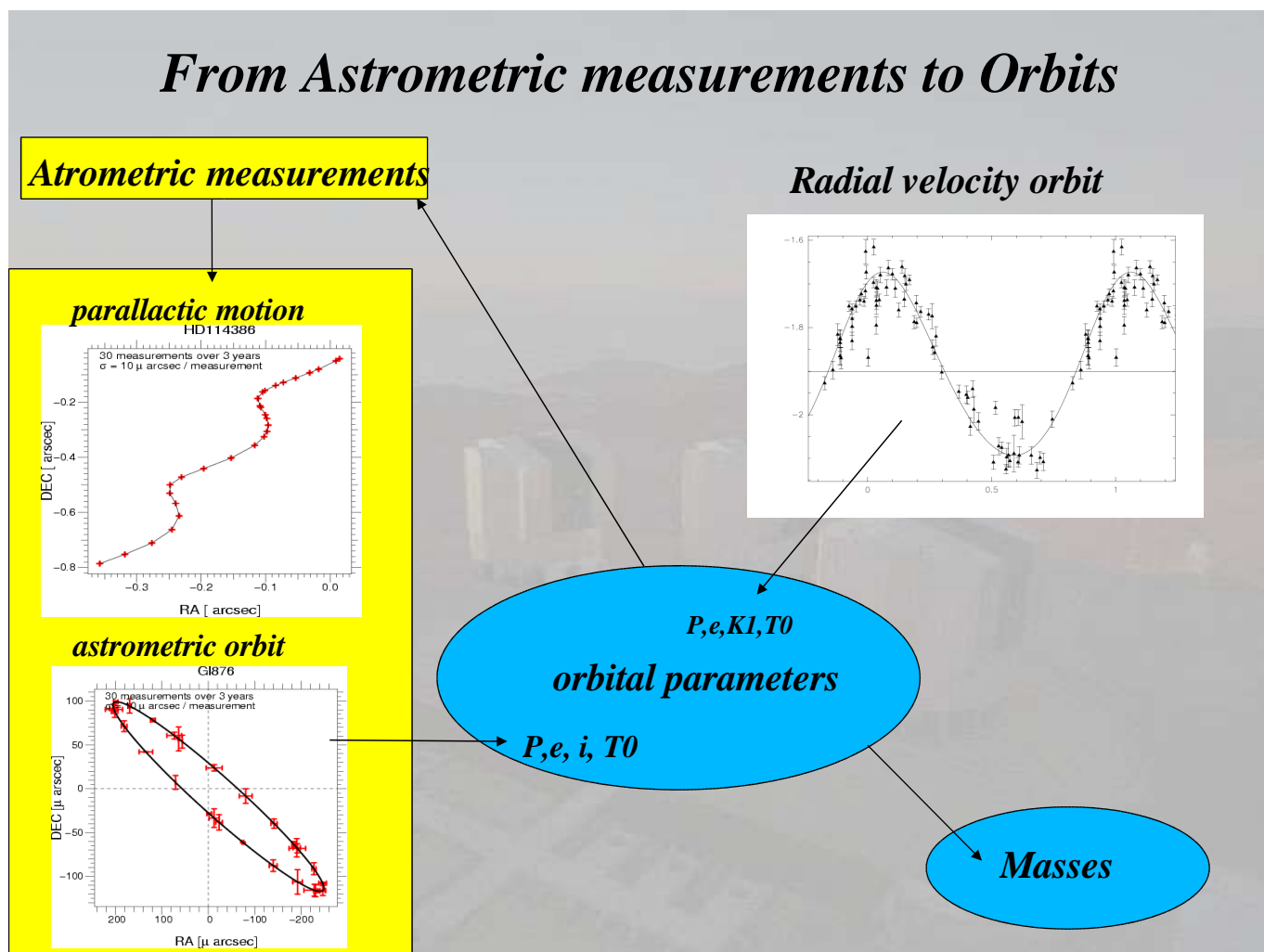


Figure 1.1: This figure illustrates the different steps required to search and characterise extrasolar planets. The astrometric measurement allow to compute the astrometric motion of the star that host the planet. The top-left graph shows the parallax motion of HD114388 only (no reference star) over a 3-year-period while the bottom-left graph show the astrometric orbits of Gl876 which can be derived only when the parallax motion is derived with sufficient accuracy. Red crosses correspond to two orthogonal astrometric measurements with 10 microarcseconds accuracy. Combined to radial velocities, astrometric measurements allow to derive all orbital parameters and thus the mass of the planet and the star. In order to efficiently retrieve the orbital parameters of the planet, it is important to carry out the observations at different orbital phases (earth period and planet period). For example, if no measurements are scheduled at the oscillation extrema of the parallax motion (top-left figure), the derived proper motion and parallax will be false and no planetary signal could be retrieved out of the observations.



## 1.1 Overview

The observation preparation software is a set of modules that will help the observer to schedule observation of a given (or several) target(s) over several years.

Based on the Statement of Work, the Observation Preparation Software is divided in two specific modules and has access to two main databases.

- Observation Preparation Software databases
  - Target-Reference star database
  - VLTI configuration database (baseline, delay-lines limitation and dome vignetting)
- Observation Preparation Software modules
  - Projected Differential Delay & Ephemerid Calculator (PDEC)
  - Exposure Time Calculator (ETC)

Considering that interferometric observations are much more difficult to schedule than observations with a single dish telescope and that the narrow angle astrometric mode of PRIMA will mainly deal with survey type observations we foresee that the ETC and PDEC should be integrated into a single entity that could be called **Astrometric P2PP**. A Short Time Scheduler (hereafter STS) based on HARPS design could also be very helpful to re-schedule the observation during the observing night. In the following section we will describe the concept of the **Astrometric P2PP**.

## 1.2 Astrometric P2PP Concept

Figure 1.2 shows how the different modules of the Observation Preparation Software interact with each other. The **Astrometric P2PP** is designed to help the observer prepare an observing night. It should be able to access both the observer science target and reference star database as well as the VLTI/PRIMA configuration database. For a given date and maximum airmass, the astrometric P2PP should be able to select which star of the catalog can be observed. Once a subset of star is selected, the astronomer should be able to select a target and its reference and obtain both expected relative parallactic motion and orbital motion. This will be done by accessing the **PDEC** module. If the astronomer is satisfied with the configuration, the **ETC** module will compute the integration time required to obtain a given SNR or a given astrometric accuracy. The **astrometric P2PP** will be able to export **IMPEX files** that can be loaded by **BOB**.

The following subsections describe the different step the astronomer should take to schedule a full observing night.

# Observation Preparation Software

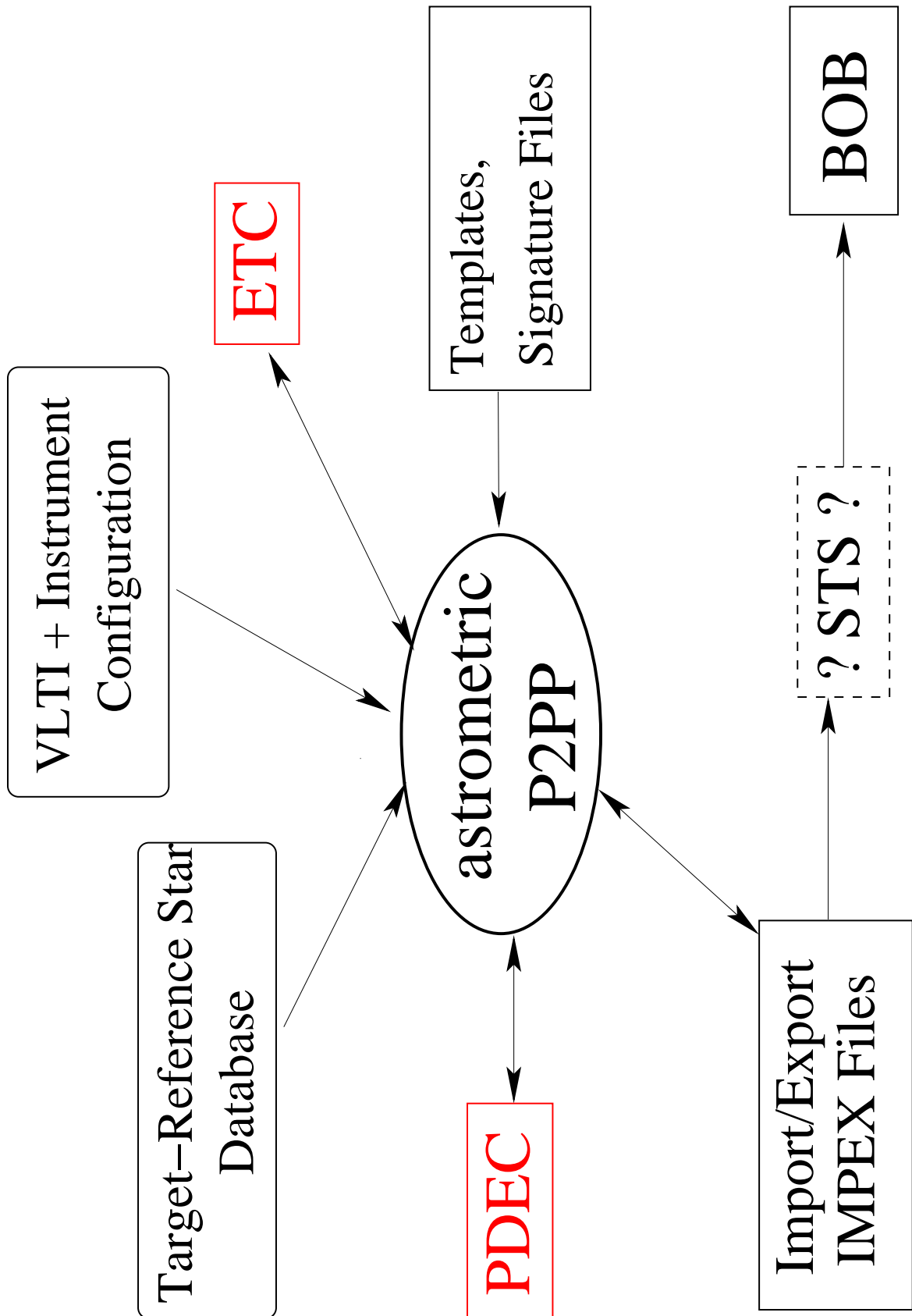


Figure 1.2: Observation Preparation Software. The graphic show how the Astrometric P2PP interact with databases and modules. PDEC stands for Projected DifferentialDelay & Ephemerid Calculator, ETC stands for Exposure Time Calculator while STS stands for Short Time Scheduler.

### 1.2.1 Astrometric P2PP step : 1

The first step of the astrometric P2PP is to be able to : **Load the full science targets and reference star catalog**

**Select the date of the observations**

**Select a baseline, default J6-G1**

**Select a maximum airmass, default = 2**

From the catalog and the 3 constraints, the astrometric P2PP will select and display which science targets and reference stars could be observed. This step is illustrated on figure 1.3.

The screenshot shows the Astrometric P2PP interface. At the top, there are four blue buttons: "Load catalog", "Date", "Baseline", and "Max airmass". Below each button is a yellow input field containing the selected value: "~/catalog/cat1.ascii", "15-APR-2005", "J6-G1", and "secz<=1.5". To the right of these fields is a red dashed box containing the text "Created from", "Observational constraints", and "Observer catalog", with a red arrow pointing to the table below. On the left side, a red circle with the number "1" is positioned next to the table. The table itself has a header row: "HD10780 RA DEC Mualpha Mubeta Vmag Kmag par P e". Below the header, there are three rows of reference star data: "Ref1 DX DY MAG", "Ref2 DX DY MAG", and "Ref3 DX DY MAG". The first row of data is highlighted in yellow: "HD162020 RA DEC Mualpha Mubeta Vmag Kmag par P e". Below this row, there are three more rows of reference star data: "Ref1 DX DY MAG", "Ref2 DX DY MAG", and "Ref3 DX DY MAG", with the last row also highlighted in yellow.

Figure 1.3: This figure represents the status of the Astrometric P2PP after uploading the observer target & reference star catalog, selecting an observing date, a baseline and the maximum airmass. OPS displays all targets and reference stars that can be observed with the VLTI/PRIMA considering the previous constraints.

### **1.2.2 Astrometric P2PP : step 2**

Once the sorted catalog is displayed, the user should be able to select (with the mouse) a given target and a reference star. Once the selection is done, the Astrometric P2PP will display 3 graphs.

The first graph is the relative parallactic motion between the target and the reference star for one year. On this curve, markers should be added for every month while a different marker should specify the location of the current observation on the curve. Baseline orientations should be overplotted for a given night.

The second plot is the visual orbit of the parent star with the same kind of markers as for the second plot.

The third graph is the UV-coverage for the target with the orientation of the target-reference star plotted on the UV-plane. A warning must be issued if the orientation of the projected baseline with respect to the target-reference star is close to 90degree. (No astrometric measurement possible).

These 3 plots will help the observer decide whether or not the observation at the current date will constrain the relative parallactic motion and/or the orbital motion of the parent star. If the constraints are not satisfactory, the observer could either change reference star or select a new science target and reference star. This second step is illustrated by figure 1.4.

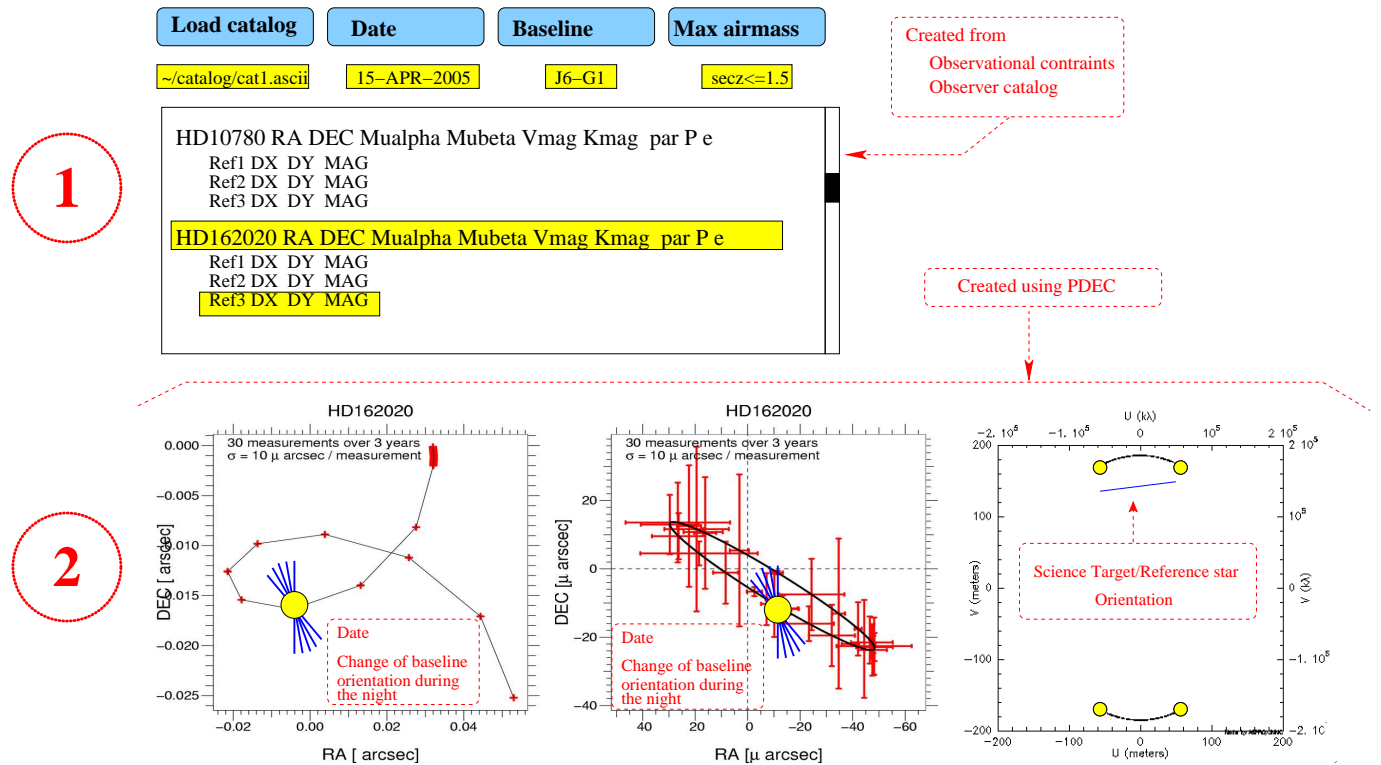


Figure 1.4: This figure show the relative parallactic motion of the selected science target and reference star, the orbital motion of the parent star as well as the UV-coverage. This set of three graphs should help the observe to decide wether a target and a reference star must be observed or not at a given date.

### **1.2.3 Astrometric P2PP : step 3**

Once the observer is satisfied with the selection of target and reference star, he will proceed with the 3rd step of the Astrometric P2PP, that is the planification of the night.

The observer should be able to select with the mouse the science target and the reference star and drag them to a new panel that represent the full night and drop it at a given hour. This step will select the precise baseline orientation, the integration time by accessing the ETC (based on default seeing values, parameters from the input catalog such as SNR, magV, target-reference separation) Figure 1.5 describes this step.

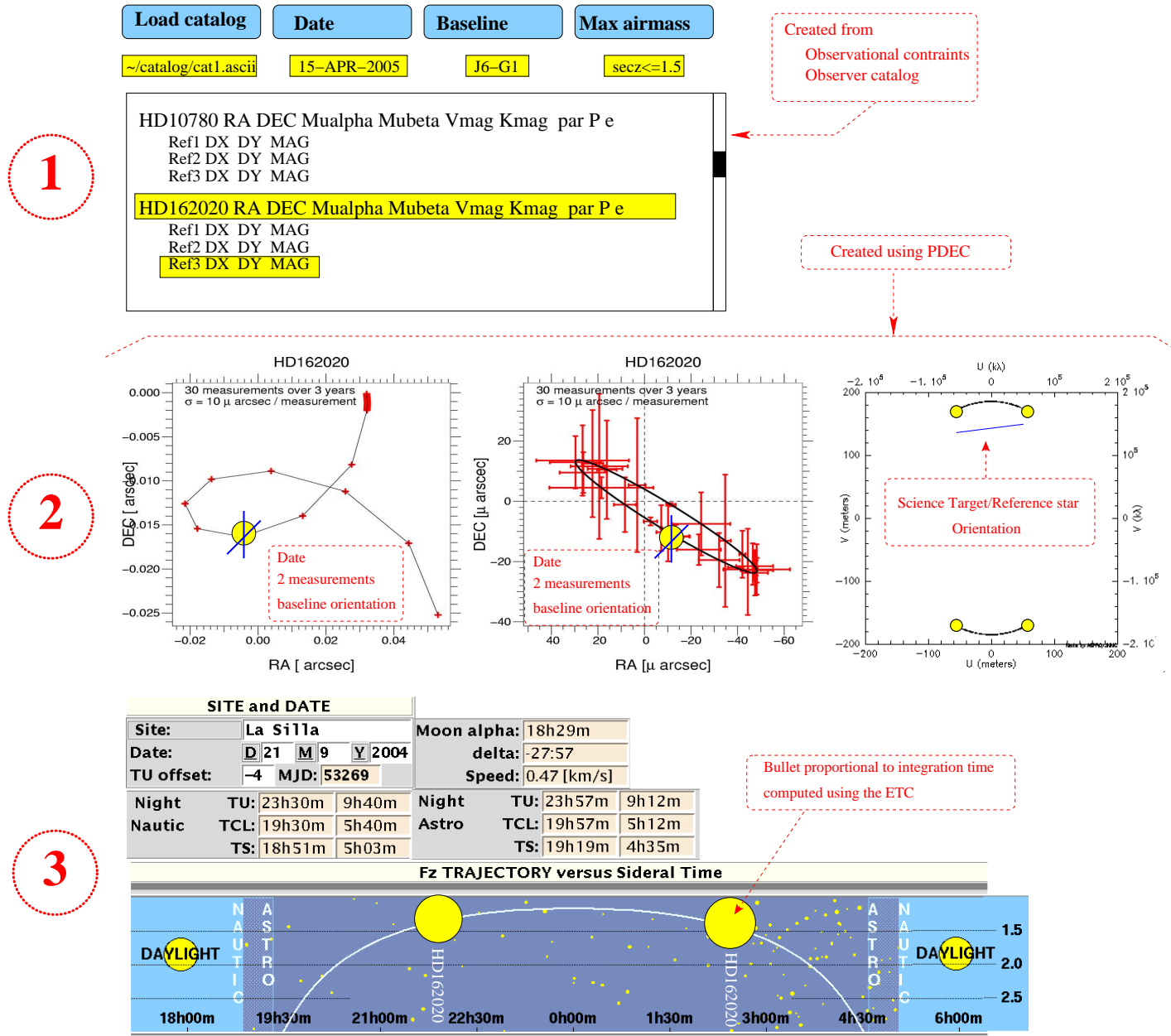


Figure 1.5: Once the observer is satisfied with its choice of science target and reference star, he should be able to select them and decide when they must be observed. A simple drag and drop function will allow to move the science-reference star from the catalog to the graph representing the full night. This action will automatically compute the integration time and the projection of the baseline onto the astrometric motion. The size of the yellow dot onto the night summary will be proportional to the integration time while the projection of the baseline on the sky will be represented by a line onto the relative parallactic motion and orbital motion. The projection information should allow to decide whether the selected reference star is good or not and whether additional measurements should be carried out to allow the baseline to rotate.

### 1.2.4 Astrometric P2PP : step 4

Load catalog

Date

Baseline

Max airmass

~/catalog/cat1.ascii

15-APR-2005

J6-G1

secz<=1.5

HD10780 RA DEC Mualpha Mubeta Vmag Kmag par P e  
 Ref1 DX DY MAG  
 Ref2 DX DY MAG  
 Ref3 DX DY MAG

HD16200 RA DEC Mualpha Mubeta Vmag Kmag par P e  
 Ref1 DX DY MAG  
 Ref2 DX DY MAG  
 Ref3 DX DY MAG

Created from  
 Observational constraints  
 Observer catalog

Created using PDEC

**1**

**2**

HD16200  
30 measurements over 3 years  
 $\sigma = 10 \mu\text{arcsec / measurement}$

HD16200  
30 measurements over 3 years  
 $\sigma = 10 \mu\text{arcsec / measurement}$

U (k), V (k)  
Science Target/Reference star  
Orientation

SITE and DATE			
Site:	La Silla		Moon alpha: 18h29m
Date:	D 21 M 9 Y 2004	delta: -27:57	
TU offset:	-4 MJD: 53269	Speed: 0.47 [km/s]	
Night	TU: 23h30m 9h40m	Night	TU: 23h57m 9h12m
Nautic	TCL: 19h30m 5h40m	Astro	TCL: 19h57m 5h12m
	TS: 18h51m 5h03m		TS: 19h19m 4h35m

**Fz TRAJECTORY versus Sideral Time**

Bullet proportional to integration time  
computed using the ETC

**4**

HD16200-ref3 : integration time + other instrument keywords  
 HD16200 RA DEC Mualpha Mubeta Vmag Kmag par P e  
 Ref3 DX DY MAG

⋮

HD16200-ref1 : integration time + other instrument keywords  
 HD16200 RA DEC Mualpha Mubeta Vmag Kmag par P e  
 Ref1 DX DY MAG

Edit templates/  
signature files

Save night

Upload night

Edit VLTI/PRIMA-DDL setup  
allow to modify default values

Export IMPEX file

Import IMPEX file

Figure 1.6: At this step, the whole observing night has been prepared. Astrometric P2PP should be able to export the observing night into a file that can be loaded by BOB. OPS should also be able to upload observing night already created in order to modify them and then reexport them.



Once the full observing night is scheduled, the Astrometric P2PP will be able to export/import IMPEX files that can be loaded by the BOB.

### **1.2.5 Astrometric P2PP availability**

The astrometric P2PP will allow off-line and interactive preparation of an observing run, providing some tools for the optimization by the observer of the instrument setting, including exposure time calculations, baseline selection, for the observing sequence preparation and edition, etc.

## 1.3 Modules

### 1.3.1 Projected Delay & Ephemerid Calculator (PDEC)

The goal of the ephemerids calculator is deliver accurate ephemerids given a projected baseline, parallactic motion and orbital elements with hour hangle constraints in order to efficiently schedule the observations. No fitting procedures will be delivered.

Formula, algorithm and ansi-C/Java libraries will be delivered to ESO that will the GUI integration. We request to ESO that the library are accessible to the astrometric P2PP.

- The input parameter for both target and reference star will be :
  - VLTI configuration (Baseline, dome vignetting, delay line stroke limitation)
  - Date, time
  - RA,DEC parallaxes, proper motionof the target and reference star
- The main output results will be:
  - Astrometric delay observed for a given projected baseline

This tool may work in 2 ways.

- Given a baseline, a date what are the targets that can be observed for a whole night? some constraints can be added such as hour angle.
- Given a target, what are the optimal dates and baseline to constrain either the parallettic motion of the orbit.

### 1.3.2 The Exposure Time Calculator (ETC)

The ETC is a module to evaluate the exposure time which is required to obtain a given differential astrometric delay accuracy(such as 10 or 30 microarcsec) for a given target-reference star and baseline. We should consider that all integration times will be longer than 15 minutes in order to efficiencely average delays. Over such a time span, the projected baseline will of course change, which will affect the observing configuration and thus the formula to compute the exposure time! For sake of simplicity, we will assume an average value for the baseline over time span of 30 minutes. For longer integration time, the software will make a second estimate based on the next avecrage value of the projected baseline

It will depend on the VLTI configuration and the angular separation between the scientific target and the reference star, their respective brightness, spectral type and instrument setup. According to [15] the exposure time will be evaluated by taking into account the atmosphere, seeing, telescope, FSU and detector effects.

As for the VLT instruments, the VLTI/PRIMA-DDL ETC will be available through the web. The formula and algoritmh will be delivered to ESO that will do the coding and the GUI integration. We request to ESO that the library are accessible to the astrometric P2PP.

- The input parameter for both target and reference star will be :

- \* Precise coordinates
  - \* VLT/PRIMA Baseline
  - \* date, time
  - \* energy distribution or object type,
  - \* visual magnitude,
  - \* seeing,
  - \* average airmass,
  - \* sky brightness in mag/arcsec<sup>2</sup>,
  - \* required differential delay precision
  - \* spectral type of the object
- The main output results will be:
- \* exposure time needed to obtain a given differential delay precision
  - \* files and graphical display of differential delay precision as a function of exposure time,
  - \* logfiles (to be printed).

A dedicated section of the on-line database containing the laboratory measurements of the telescope and the VLT/PRIMA-DDL instrument is required in order to compute the overall efficiency of the VLT/PRIMA-DDL facility.

The following data will be required:

- energy distribution of "typical" xx-type star
- mean extinction curve at a given airmass
- mean continuum of the sky; the calibration reference database in the archive will include a sky spectrum for the standard setup (see data reduction software)
- FWHM of the star in function of the seeing
- detector characteristics (Read-Out Noise (RON))
- transmission curve of the telescope (wavelength vs throughput) predicted on the bases of the laboratory measurements, to be verify during commissioning phase of the telescope
- transmission of VLT/PRIMA-DDL throughput
- TBD

### 1.3.3 Astrometric P2PP

The astrometric P2PP goal is to create OBs for the astrometric mode of PRIMA. It will have access to the target-reference star database, to PDEC and the ETC in order to increase the efficiency to create OBs.

- The input parameter for the astrometric P2PP :
  - \* Target-Reference star database
  - \* all PDEC inputs
  - \* all ETC inputs
- The main output results will be:
  - \* OB's

### **1.3.4 Short Time Scheduler (STS)**

This is an optional module based on the HARPS STS. The STS allow the user to control the exact sequence of observation to be executed, the STS tool will be developed. Its functionalities will be:

- editing a sequence of observations
- simultaneous edition of a single parameter in several OBs
- automatic launch of a sequence of observations (insured together with BOB)
- automatic warning of the user if constraints are not satisfied (distance to the moon, air mass)
- sort of OBs according to various criteria
- edition of the OB's parameters at observing time

The STS will communicate with BOB via the CCS message system, by sending the observation description files (\*.obd) and receiving the status sent by BOB.