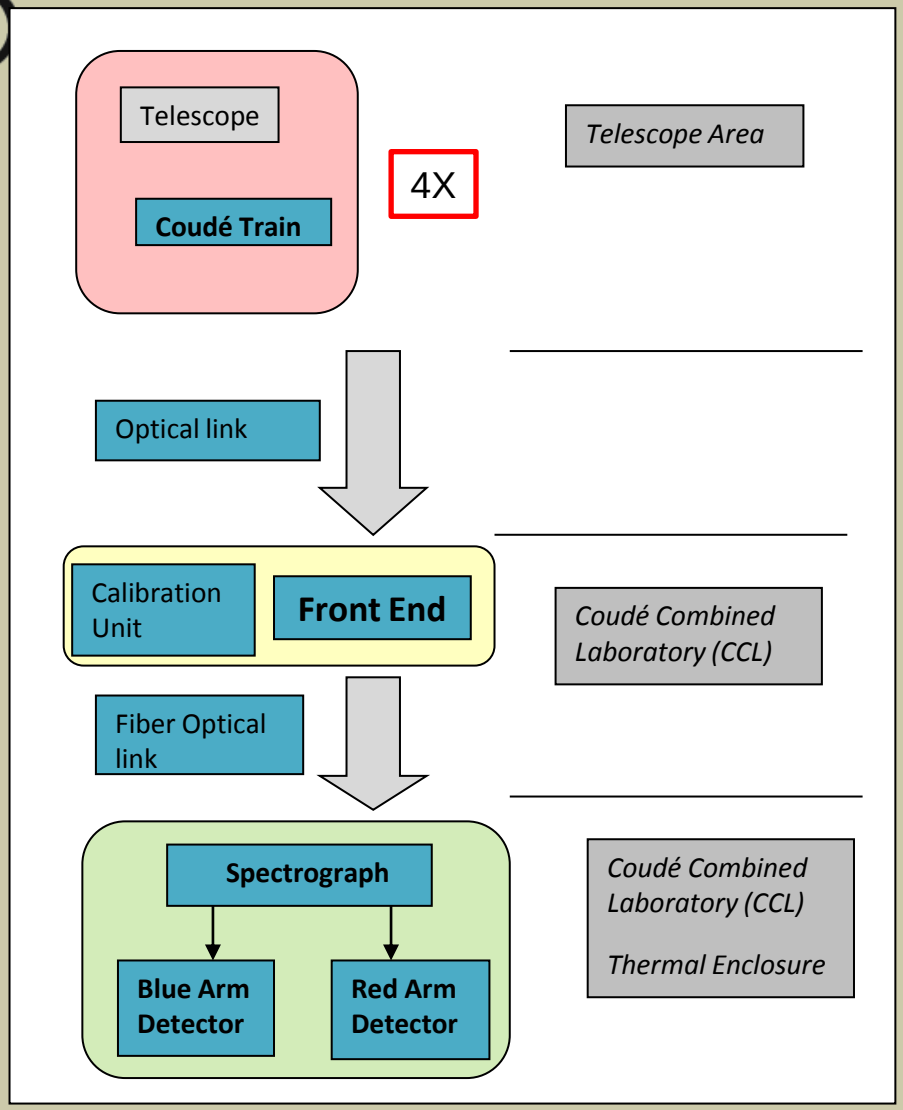
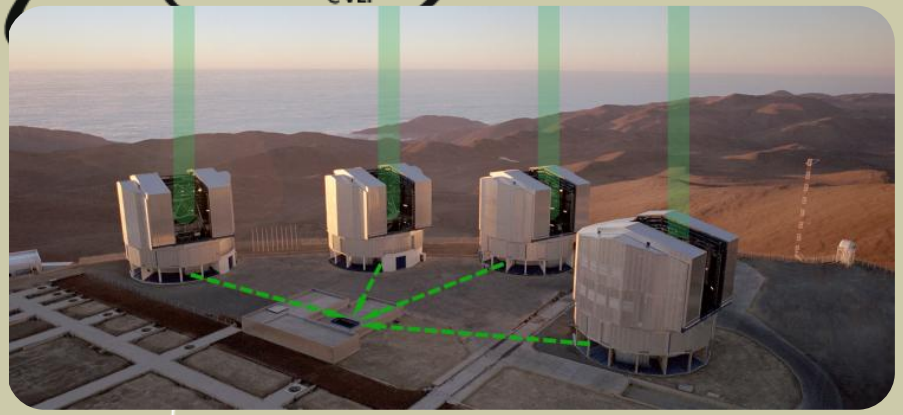
ESPRESSO - no limits

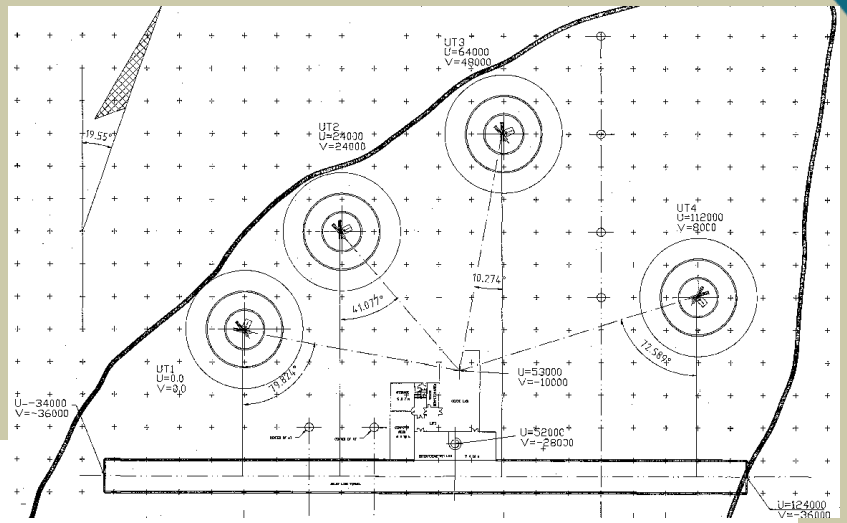
Technical Part

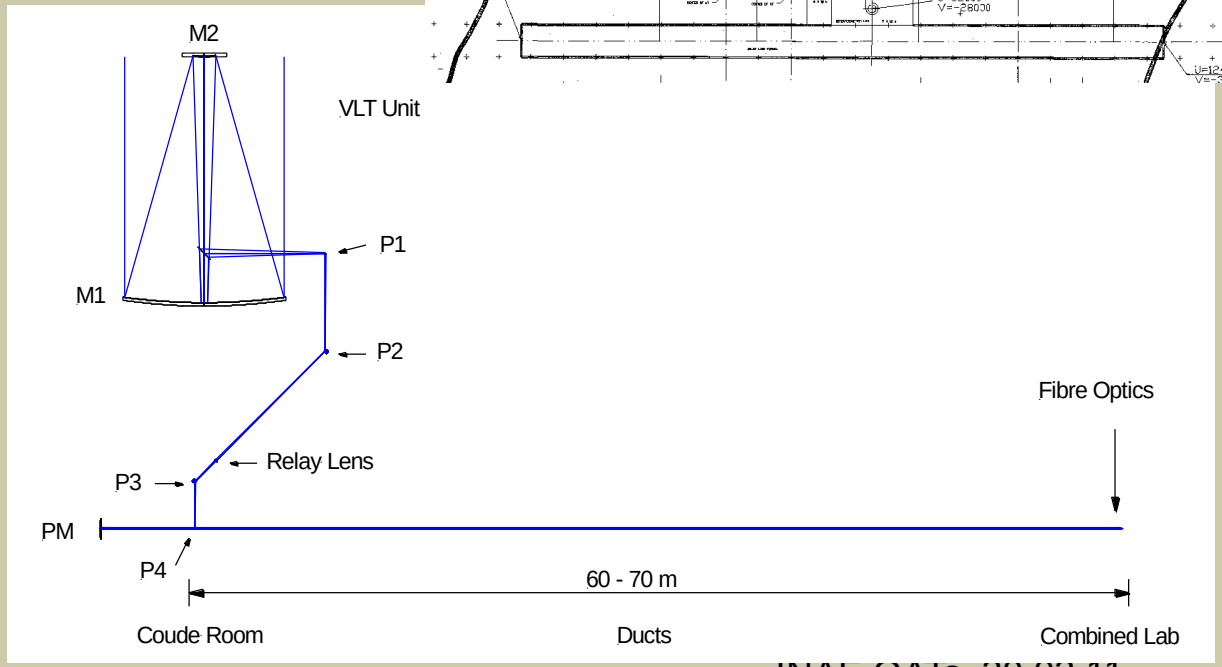
ESPRESSO light path



The 4 VLT Telescopes and the CCL







Distances to Combined Lab

UT 1 – 69 m

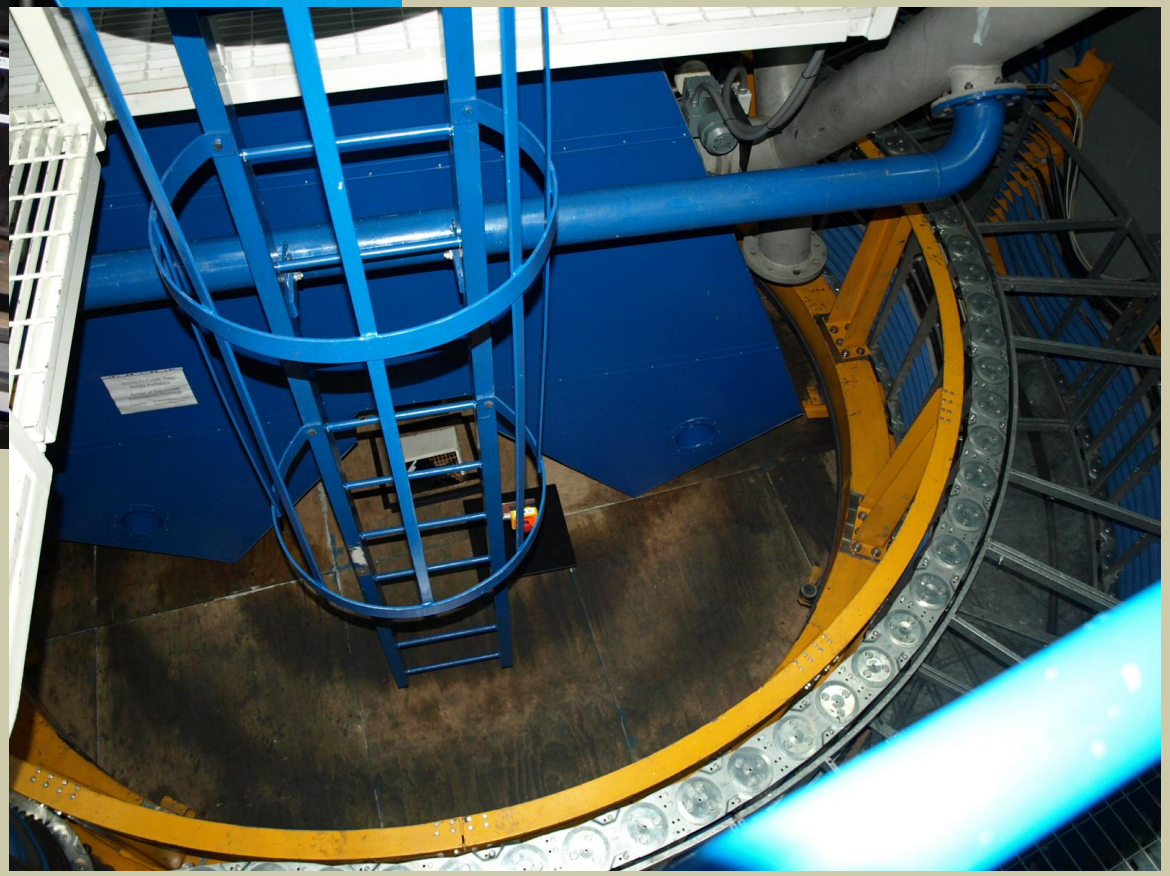
UT 2 – 48 m

UT 3 – 63 m

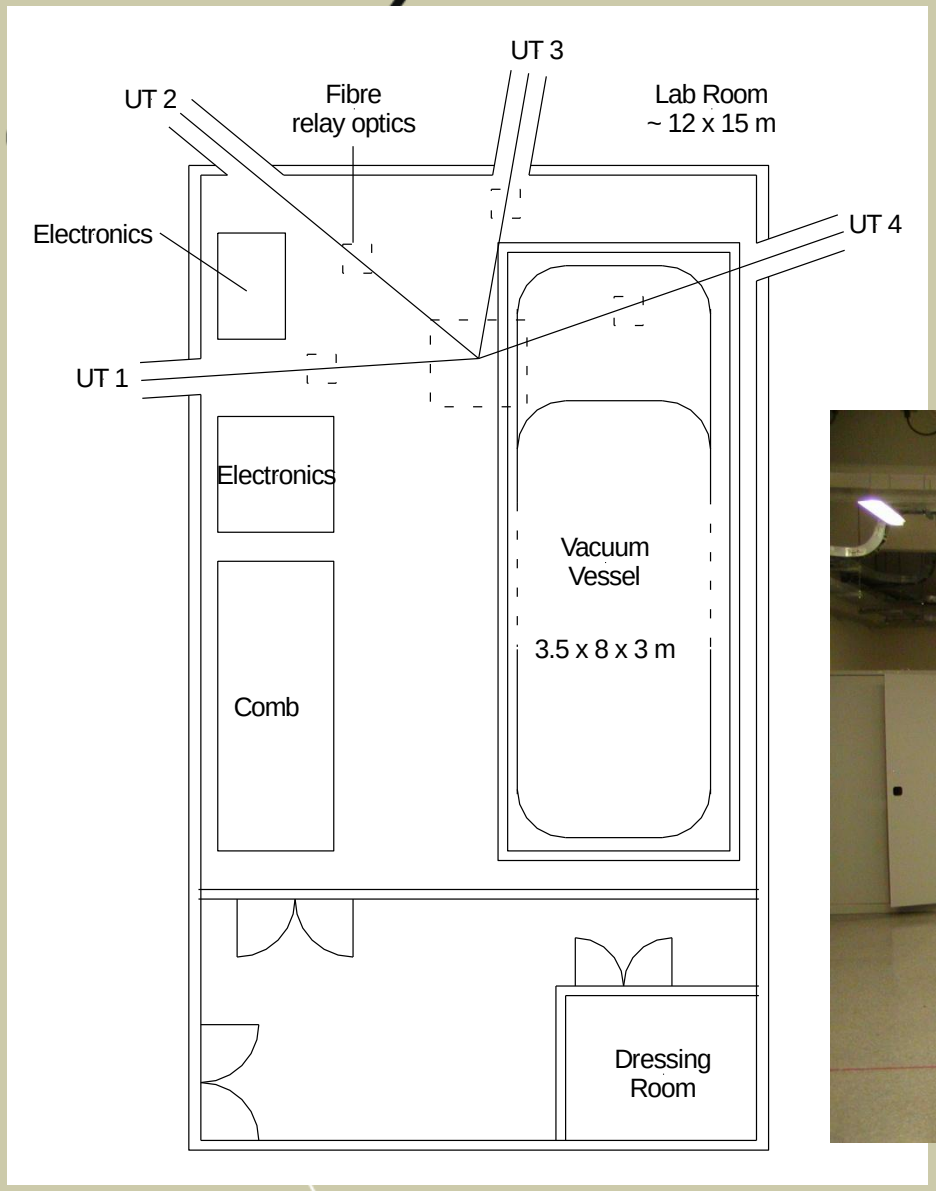
UT 4 – 63 m

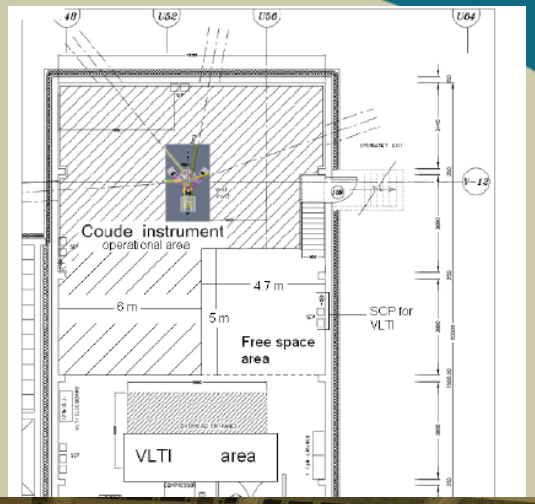
Coudé train


Access To Coudé Train
Strictly Forbidden
Acceso al Tren Coudé
Estrictamente Prohibido

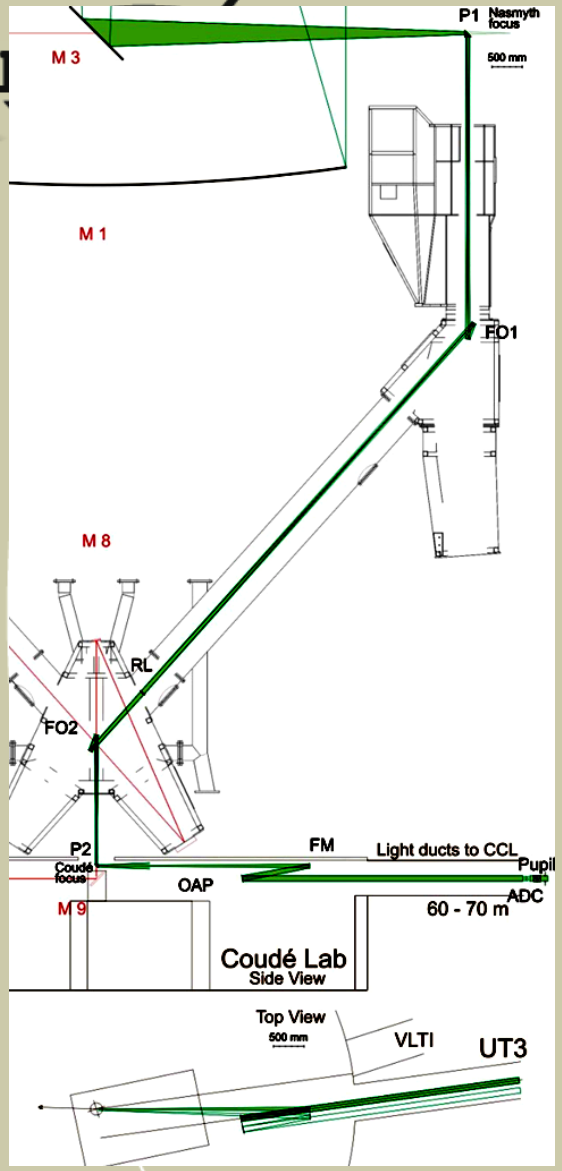


CCL

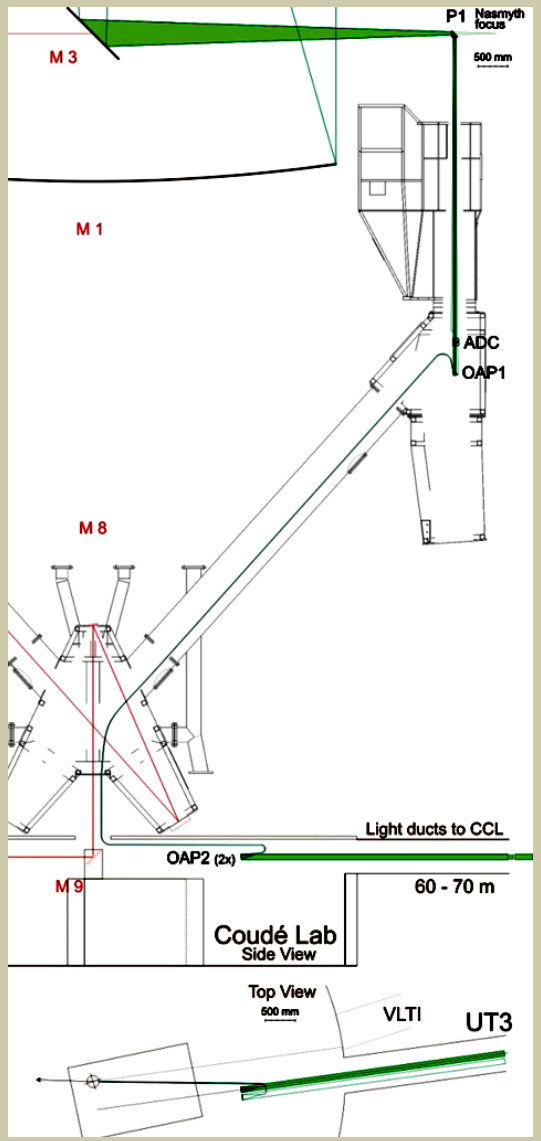

UT 3
UT 2
Fibre
relay optics
Lab Room
~ 12 x 15 m
Electronics
UT 4
UT 1
Electronics
Vacuum
Vessel
3.5 x 8 x 3 m
Comb
Dressing
Room


Coude instrument
operational area
4.7 m
6 m
5 m
SCP for
VLTI
Free space
area
VLTI
area

Coudé train preliminary concepts



Full Optics (FO)

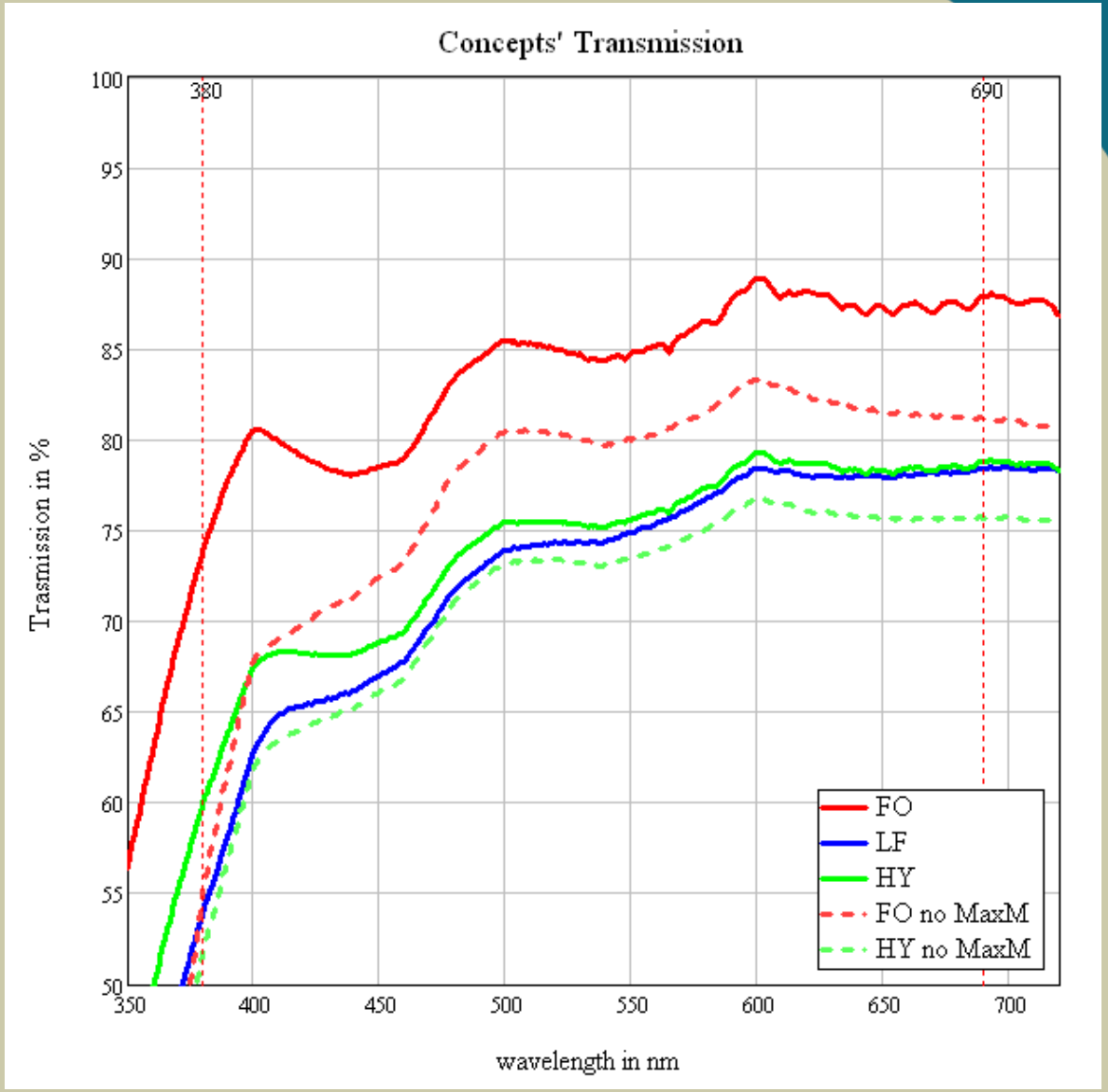


Long Fibre (LF)

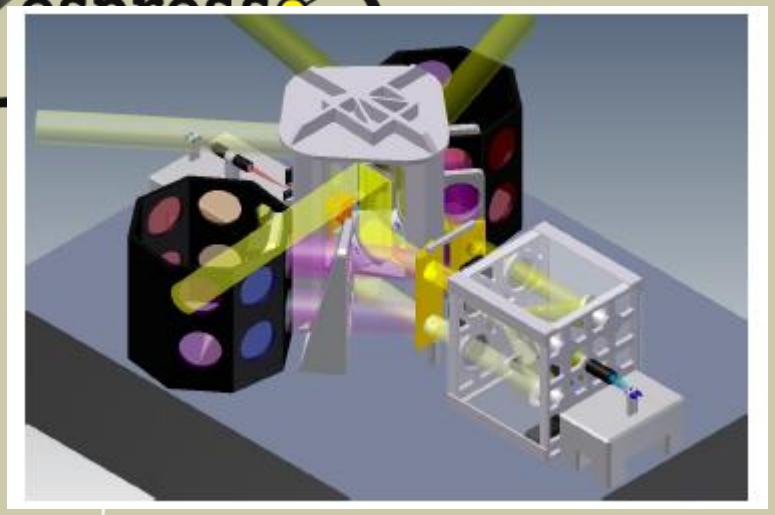
Concepts' throughput analysis

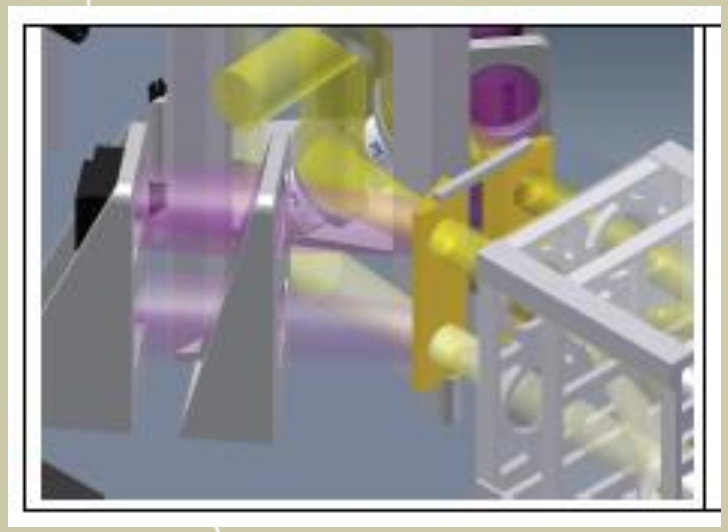
Full Optics (FO)

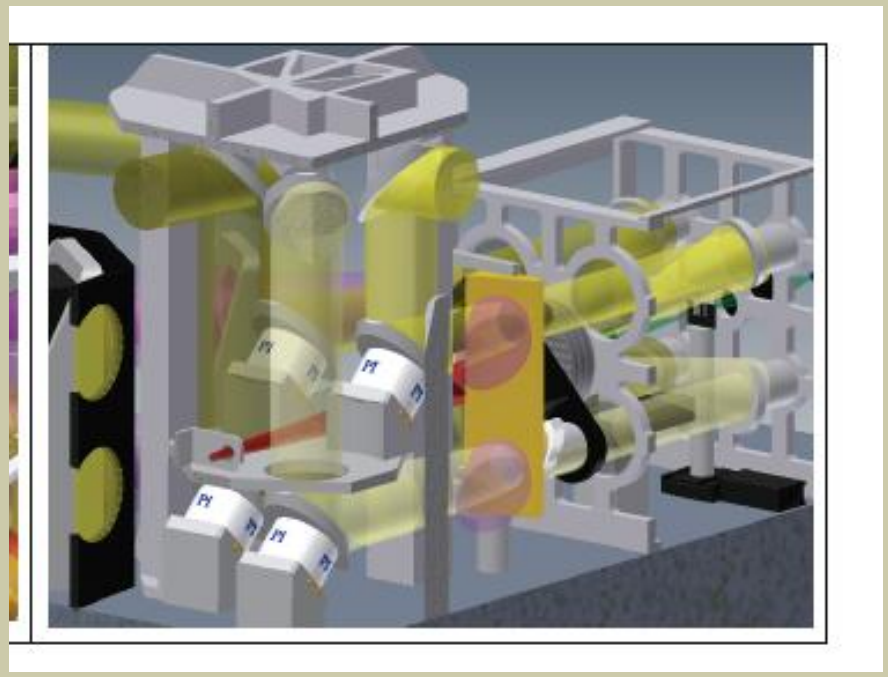
Long Fibre (LF)



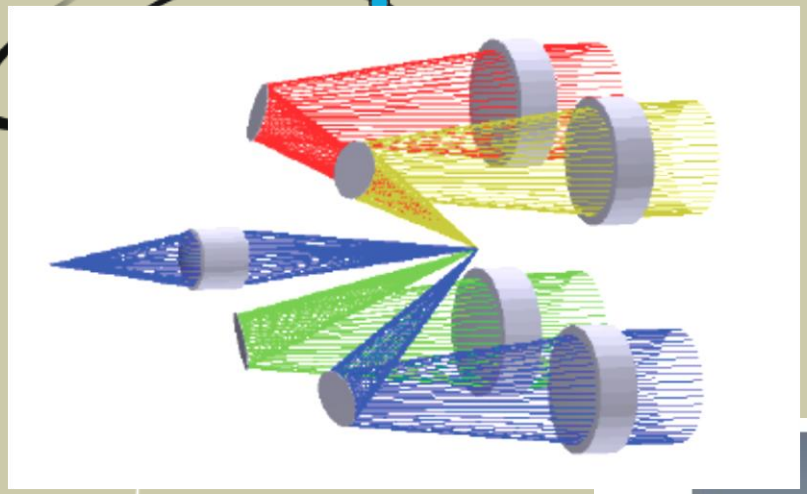
The Phase A' Front-end







The Phase A' Front-end - 4UT



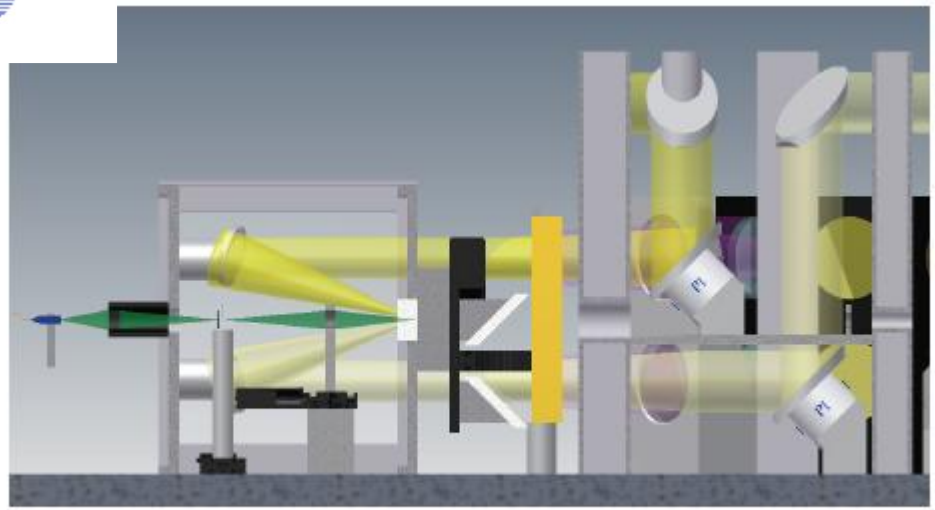


Figure 49. Location of the calibration in jection mechanicsm in the 4-UT mode.

The Phase A' Front-End – 1 UT

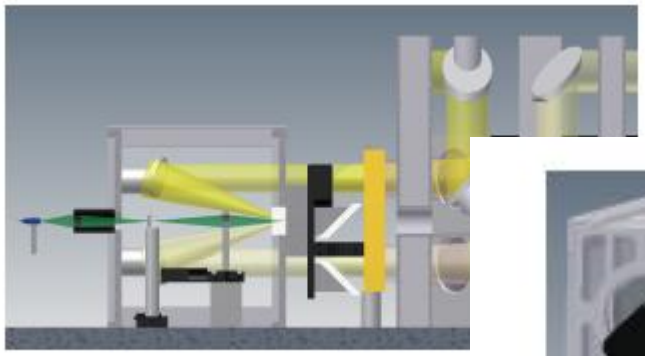
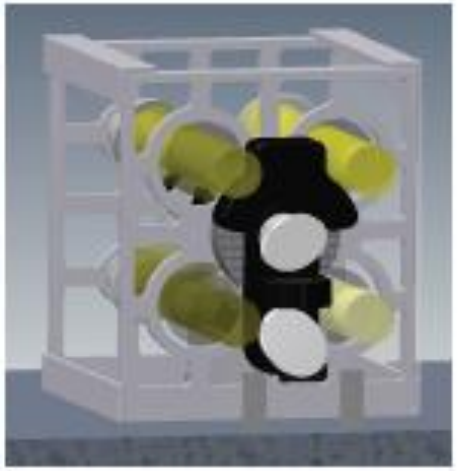
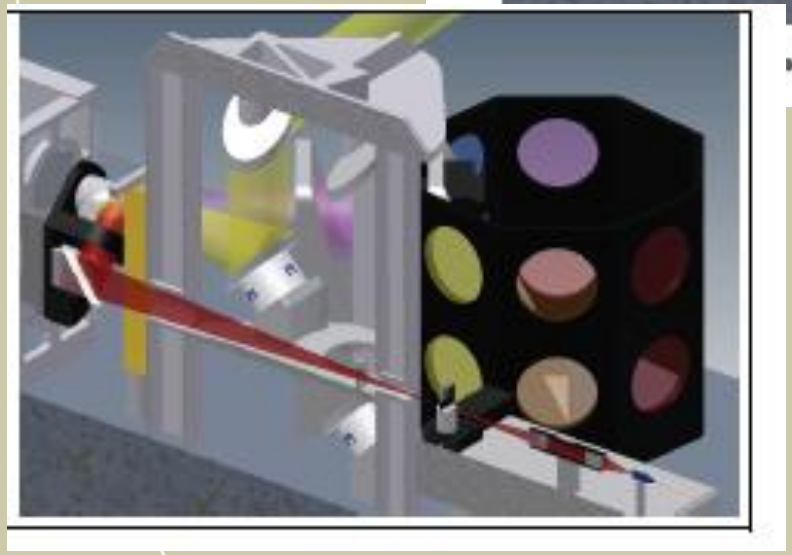


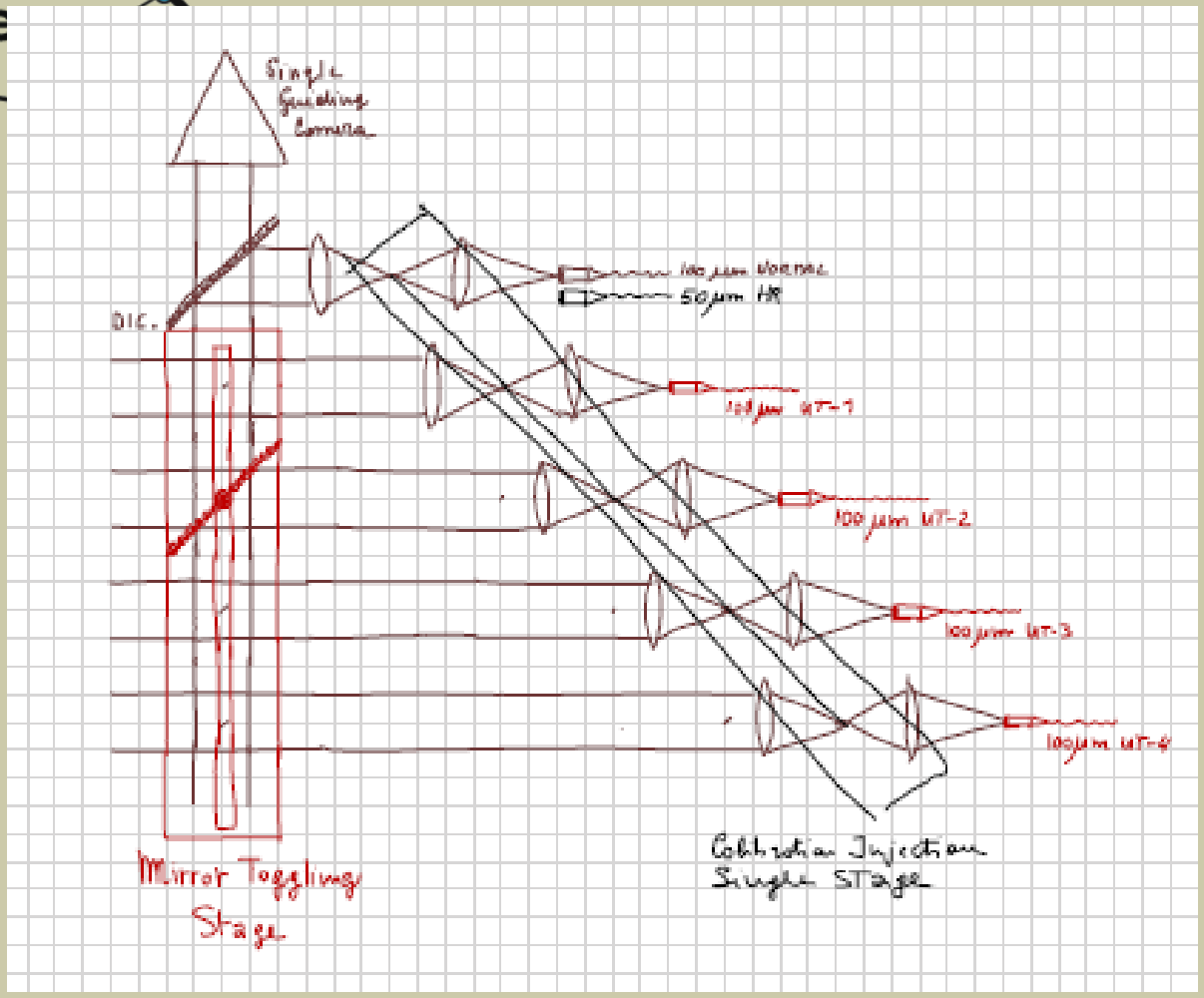
Figure 49. Location of the calibration injection mechanism in



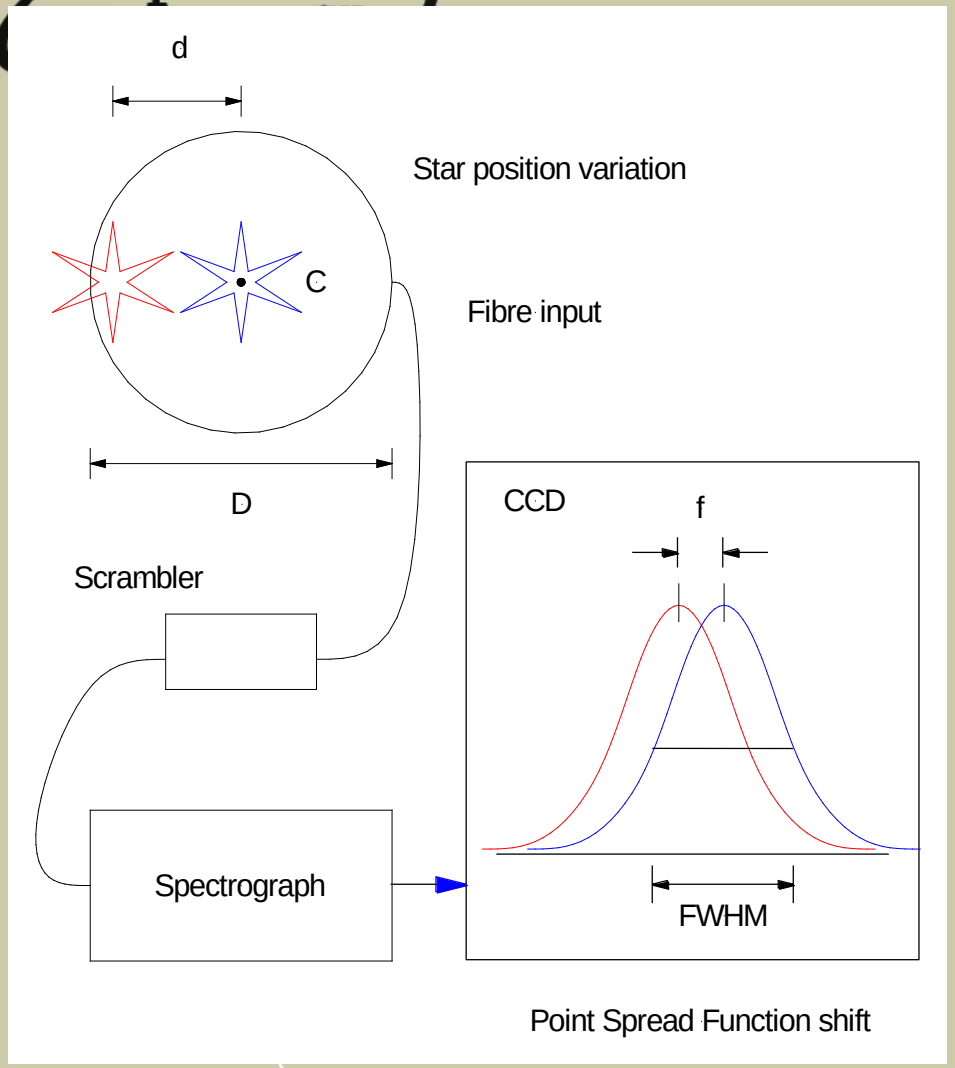
tary Mechanism to select the beam in 1 UT-mode



New design ☺


Single Guiding Lenses
DIC
100 µm Normal
50 µm HR
100 µm MT-1
100 µm MT-2
100 µm MT-3
100 µm MT-4
Mirror Toggling Stage
Calibration Injection Single STage

Scrambler



Scrambling Gain:

$$G = \frac{d / D}{f / FWHM}$$

HARPS resolves 1 m/s R=10E5 and
d/D=1/5 => G = 100

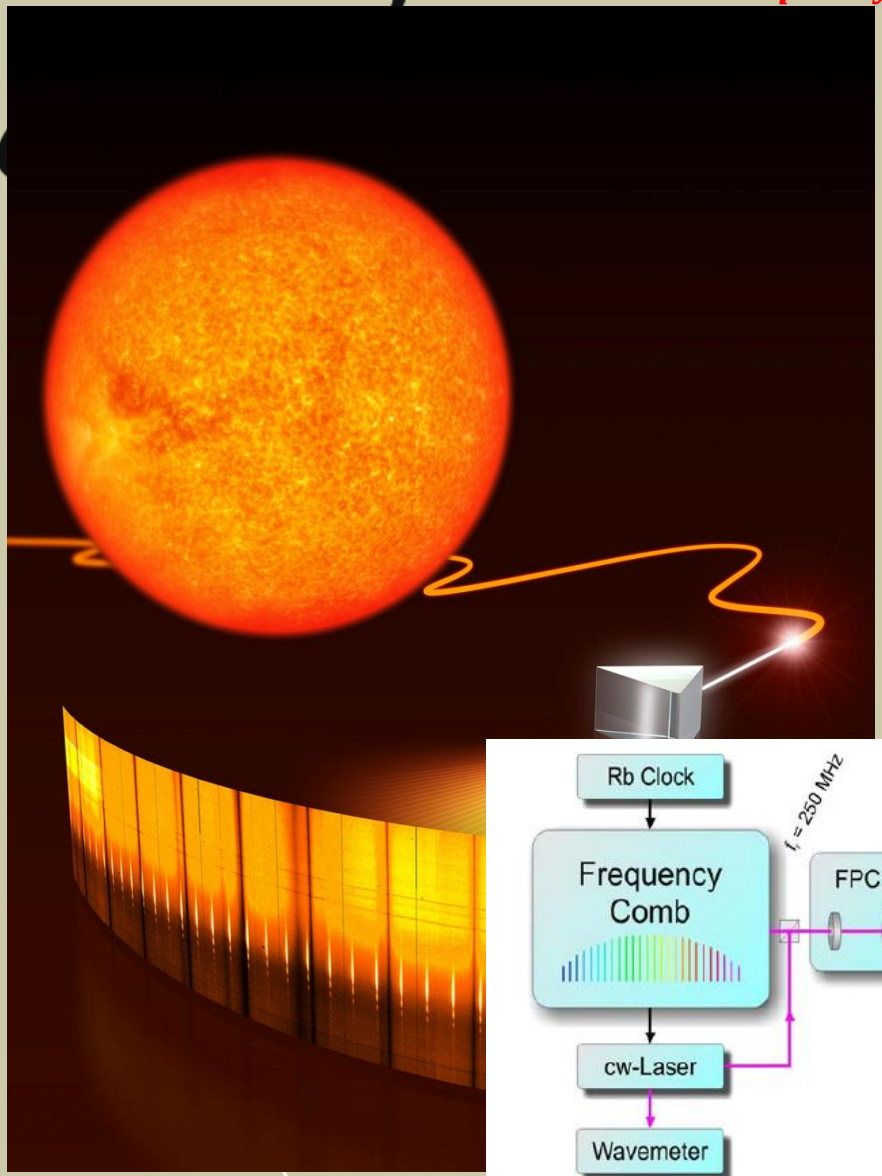
Requirement for CODEX:

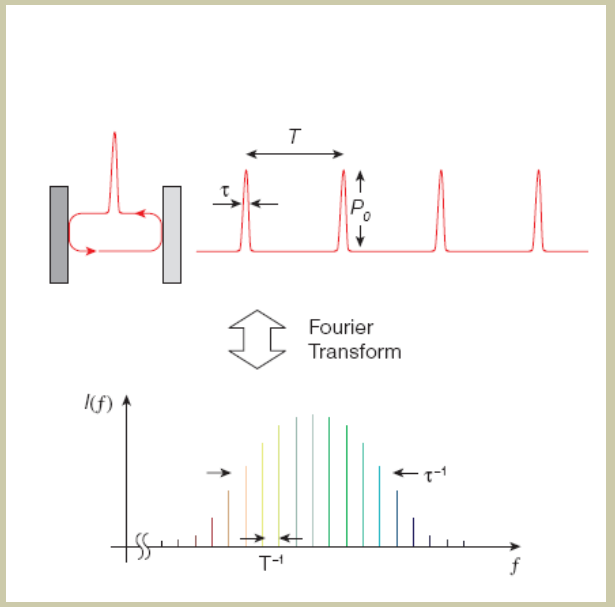
G > 5 000

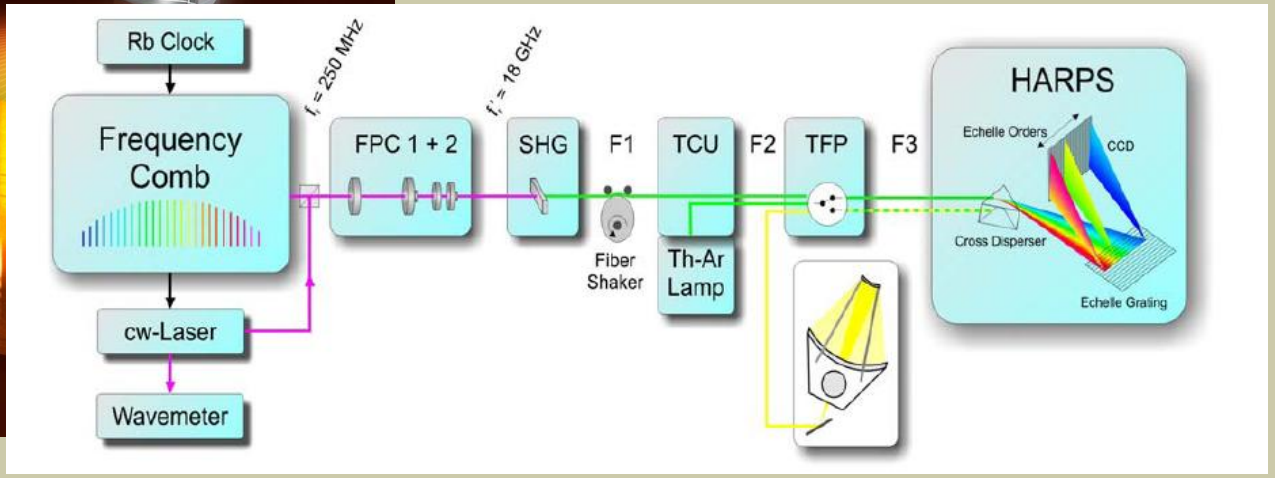
1cm/s , d/D=1/20, R 150 E3

Mechanical scrambler

Laser Frequency comb @ HARPS





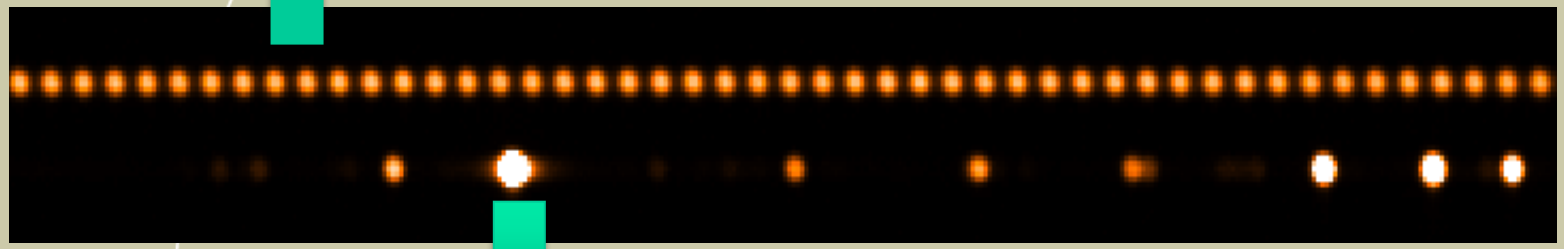


Laser Frequency Comb

Astro-comb

Astro-comb: ~450 lines per order

Th-Ar: ~ 150 lines per order



Th-Ar

Measure RV of 61 Vir using 30 wavelength calibration files on **one** stellar spectrum

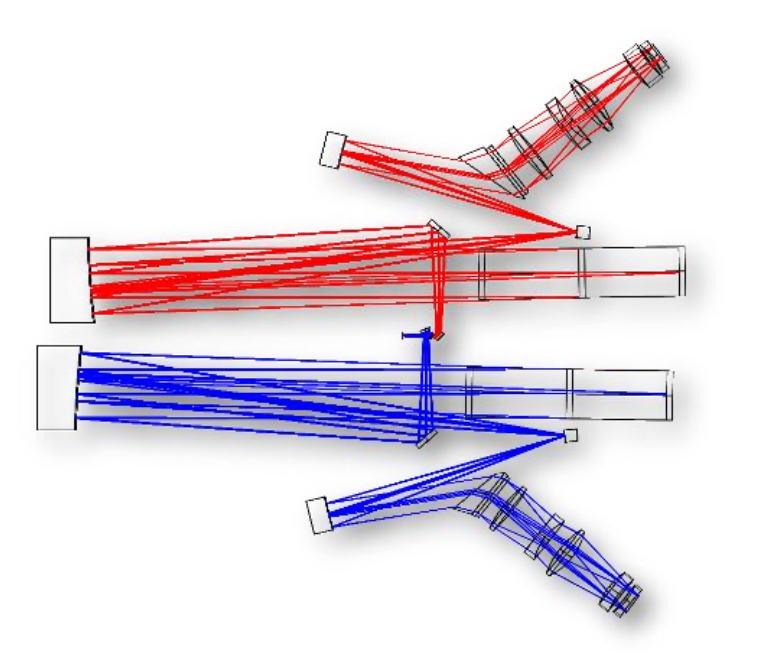
	Comb RV mean	Th RV mean	Comb RV RMS	Th RV RMS
1 order	-7.73132km/s	-7.66583km/s	7.7cm/s	220cm/s
72 orders	-	-7.69770km/s	0.9/0.8cm/s *	24cm/s

* Extrapolation to 72 orders

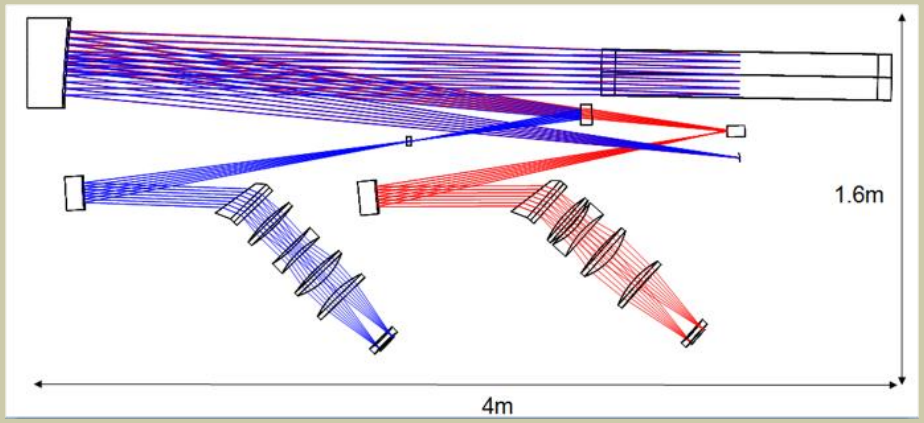
Optics

Two solutions are now being explored, compared and optimized.
Solution B: 3x slices, 2x 2x1 echelle mosaic gratings, 2 full arms, 2 medium collimators
Solution C: 2x slices, 1x 3x1 echelle mosaic grating, 2 arms, 1 common path large collimator

Solution B



Solution C



Anamorphic pupil slicer

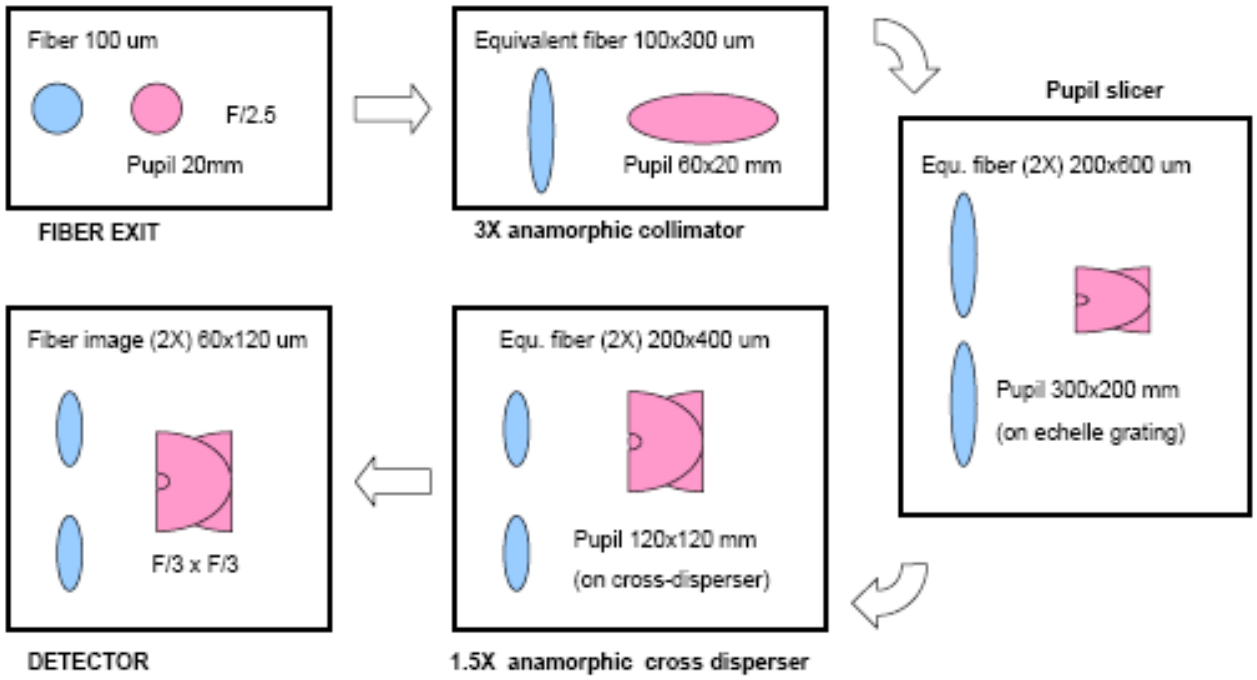


Figure 78. Paraxial image and pupil sizes along the spectrograph optics

Detector spectral format

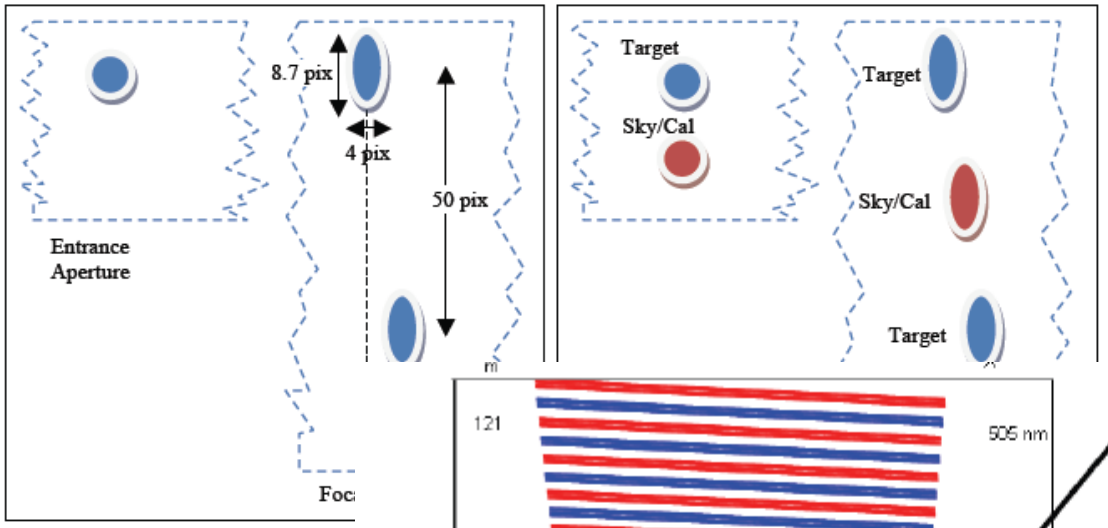


Figure 105. Projected images ont

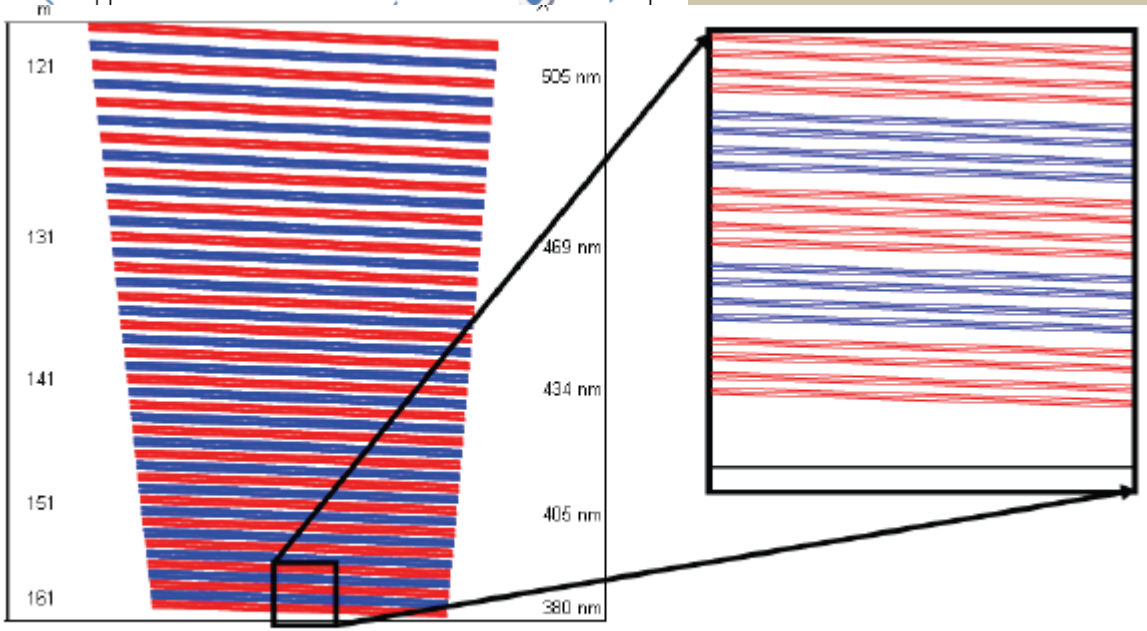
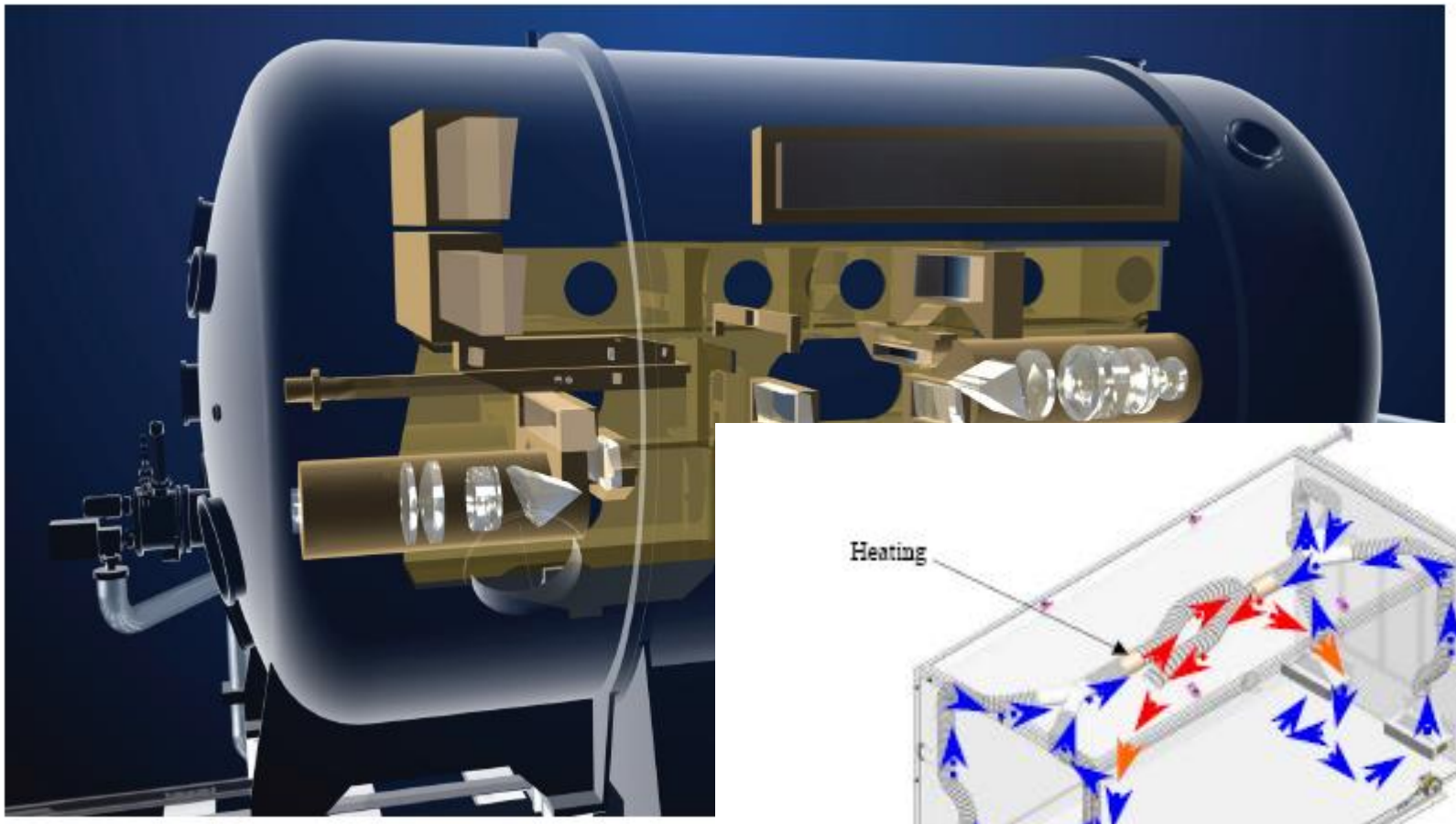


Figure 107. Blue spectral format. The box on the left represents the CCD area.

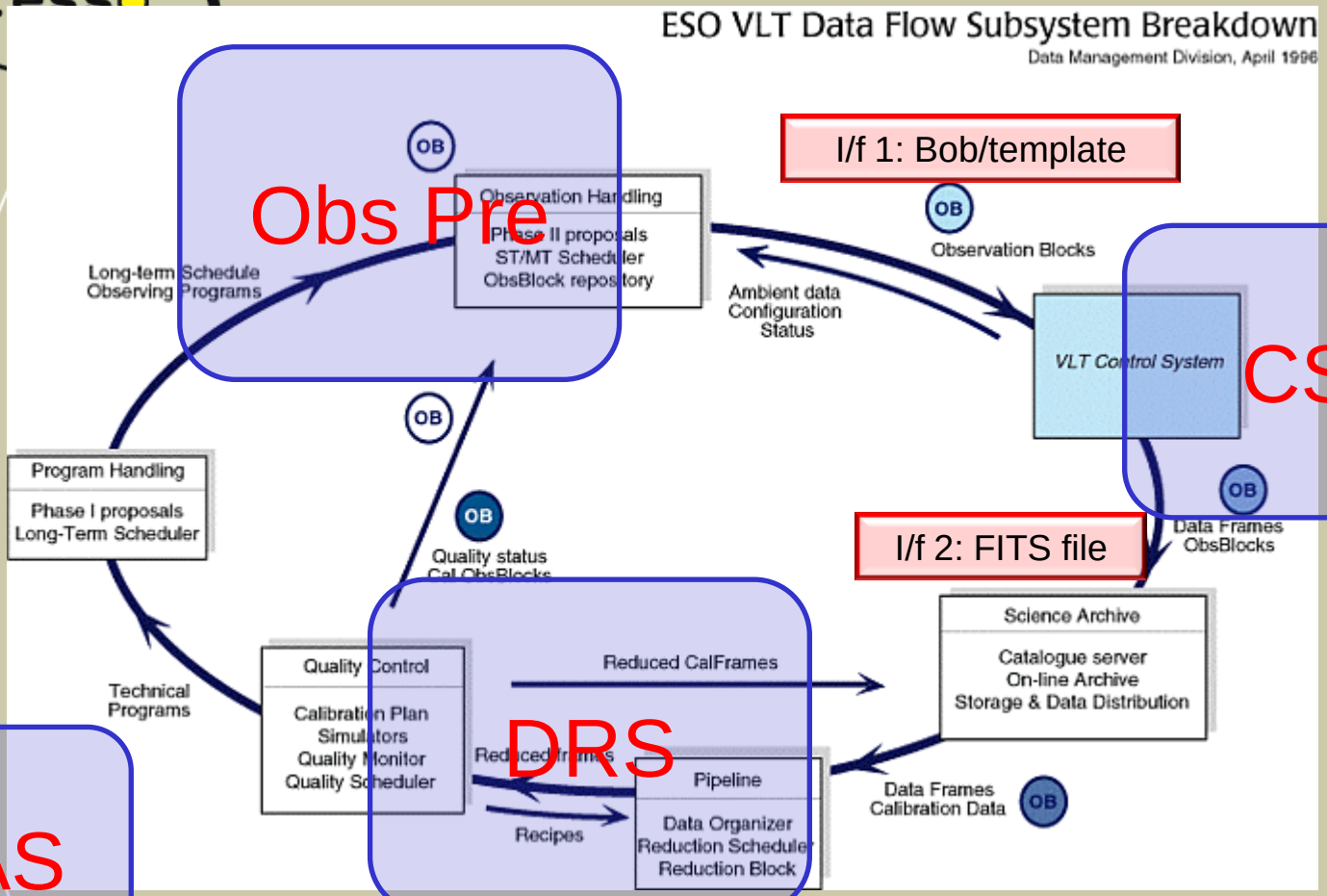
ESPRESSO characteristics

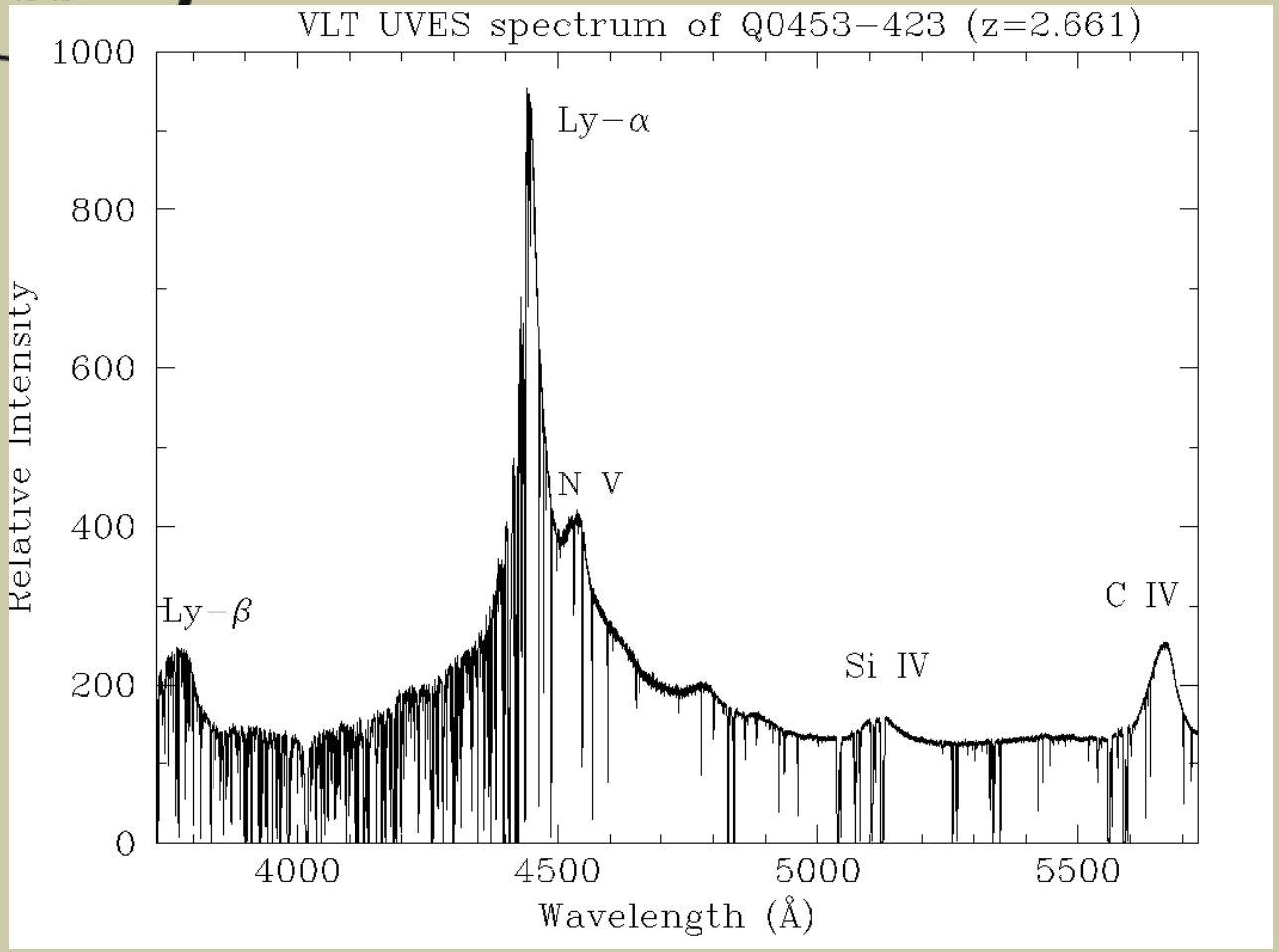
Spectral Resolution		120000	120000	120000
Spectral scale factor	pixels	4	4	4
Spatial scale factor	pixels	8	6	8
Wavelength Coverage	nm	380-790	370-750	370-710
			380-790	380-???
Average efficiency		>35%	>42%	>42%
Cumulated spectrum height (*)	pixels	16	18	16
Arrangement on Detector (???)		2 slices	3 slices	2 slices
Minimum interorder/interspectra spacing	pixels	12	TBD	TBD
Separation between fibers into the slit	um			
Gaps between adjacent orders	nm	>760	>760	>760 (TBC)
Tilt of the fiber image (+)	deg	4.7	TBD	TBD
Image Quality EE80 diam. (across the field ???)	pixels	<1.5	<1.5	<1.5
Axial Symmetry of spots diagrams		?	?	?
Thermal drift	pix/degC	<0.03	?	?
Thermal differential magnification	pix/degC	<0.2	?	?
Sensitivity of spectrum to flexures		?	?	?
PSF Stability in general	pix/??	??	??	??
Image and Pupil ghosts		no	TBC	TBC
Optical Manufacturing Complexity		high	medium-high	medium-low
Optical Alignment Complexity		high	medium-high	low
Mechanical Design Complexity		high	medium-low	medium-high
Dichroic		very complex	small, simple	mid-size, feasible
Vacuum vessel				
Long lead items, max. duration	months	24-30	18-24	15-24
Cost	M€	2-3	2.5-3	2-2.5
Detector binning (???)				
Camera F/num		F/3 x F/3	F/2.25 x F/4.5	F/3 x F/3

Mechanics

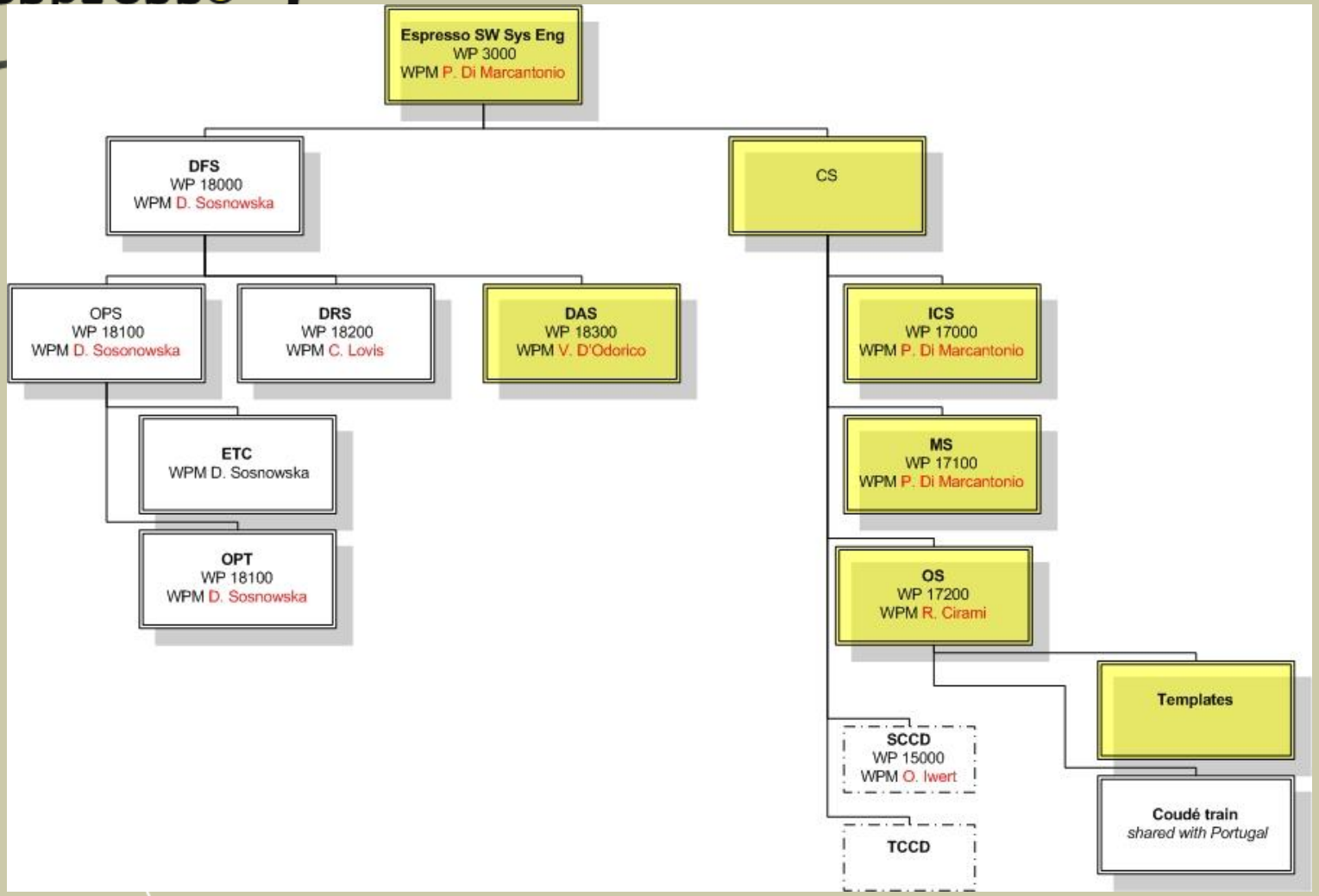


Software & Electronics

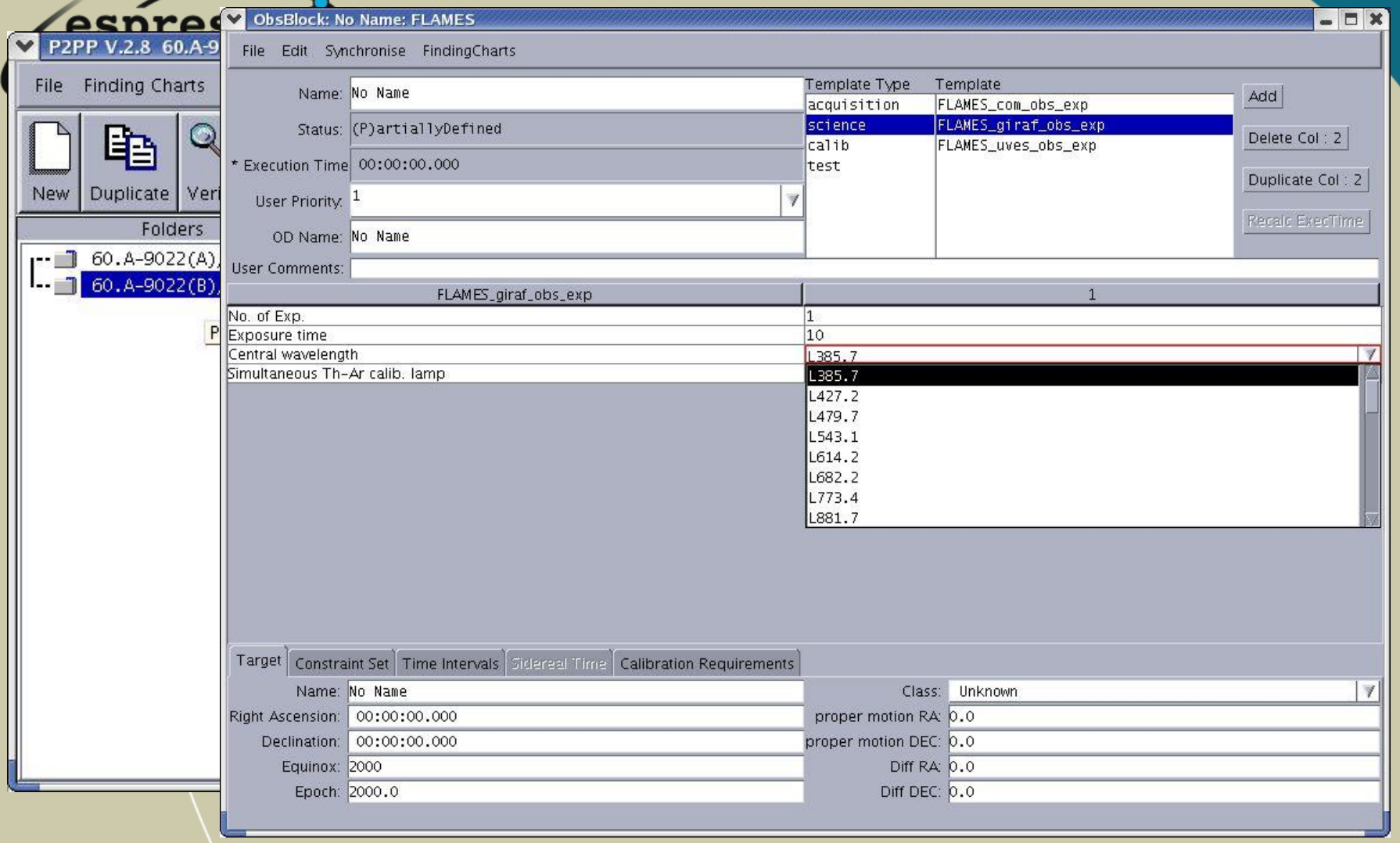

ESO VLT Data Flow Subsystem Breakdown
Data Management Division, April 1996
Obs Pre
I/f 1: Bob/template
OB
Observation Handling
Phase II proposals
ST/MT Scheduler
ObsBlock repository
Observation Blocks
Long-term Schedule
Observing Programs
Ambient data
Configuration
Status
VLT Control System
CS
Program Handling
Phase I proposals
Long-Term Scheduler
Quality status
Cal ObsBlocks
I/f 2: FITS file
Data Frames
ObsBlocks
Science Archive
Catalogue server
On-line Archive
Storage & Data Distribution
Technical
Programs
Quality Control
Calibration Plan
Simulators
Quality Monitor
Quality Scheduler
Reduced CalFrames
DRS
Pipeline
Data Organizer
Reduction Schedule
Reduction Block
Recipes
Data Frames
Calibration Data
DAS


VLT UVES spectrum of Q0453−423 (z=2.661)
Relative Intensity
Wavelength (Å)
1000
800
600
400
200
0
4000
4500
5000
5500
Ly−α
N V
Ly−β
Si IV
C IV

Software WBS

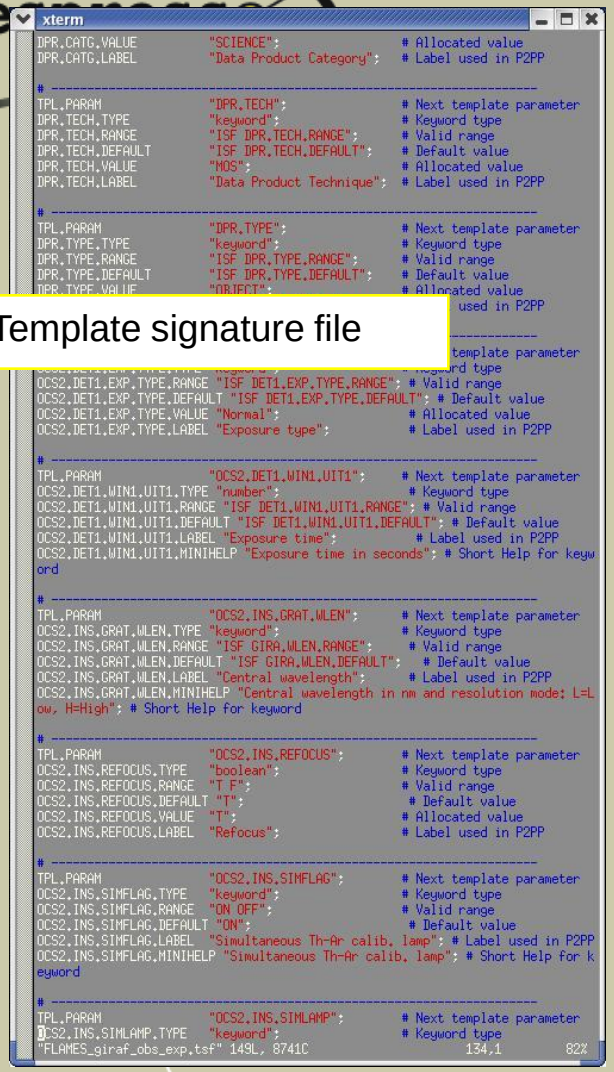


P2PP

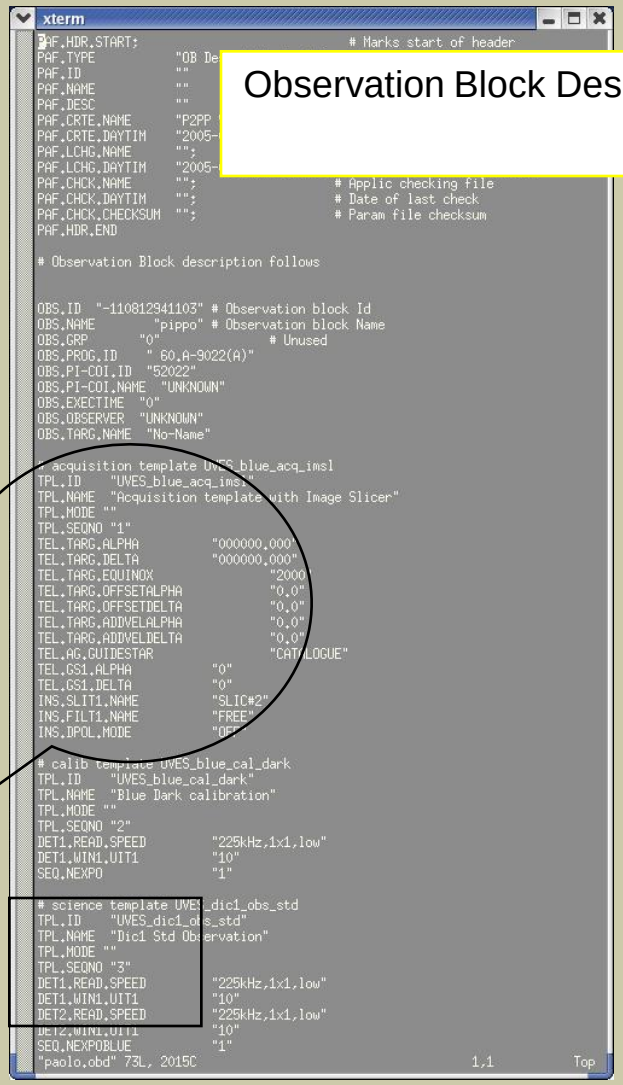

P2PP V.2.8 60.A-9
File Finding Charts
New
Duplicate
Folders
60.A-9022(A)
60.A-9022(B)
ObsBlock: No Name: FLAMES
File Edit Synchronise FindingCharts
Name: No Name
Status: (P)artiallyDefined
* Execution Time 00:00:00.000
User Priority: 1
OD Name: No Name
User Comments:
Template Type
Template
acquisition
science
calib
test
FLAMES_com_obs_exp
FLAMES_giraf_obs_exp
FLAMES_uves_obs_exp
Add
Delete Col : 2
Duplicate Col : 2
Recalc ExecTime
FLAMES_giraf_obs_exp
1
No. of Exp.
Exposure time
Central wavelength
Simultaneous Th-Ar calib. lamp
1
10
L385.7
L385.7
L427.2
L479.7
L543.1
L614.2
L682.2
L773.4
L881.7
Target
Constraint Set
Time Intervals
Sidereal Time
Calibration Requirements
Name: No Name
Right Ascension: 00:00:00.000
Declination: 00:00:00.000
Equinox: 2000
Epoch: 2000.0
Class: Unknown
proper motion RA: 0.0
proper motion DEC: 0.0
Diff RA: 0.0
Diff DEC: 0.0

Observation Blocks

Template signature file



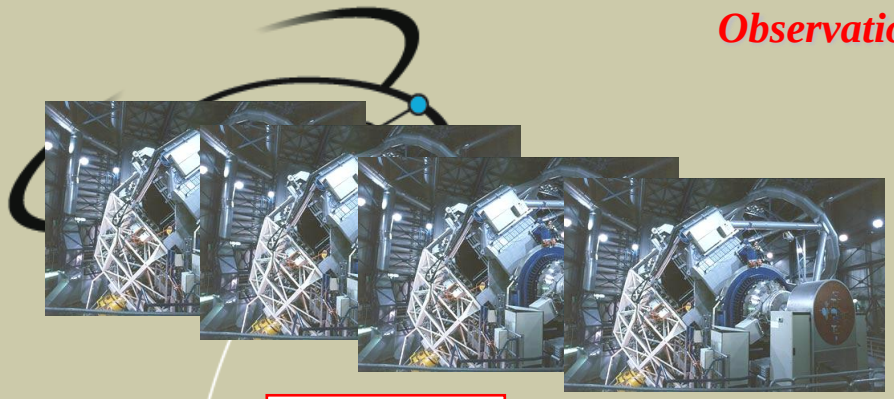
Observation Block Description



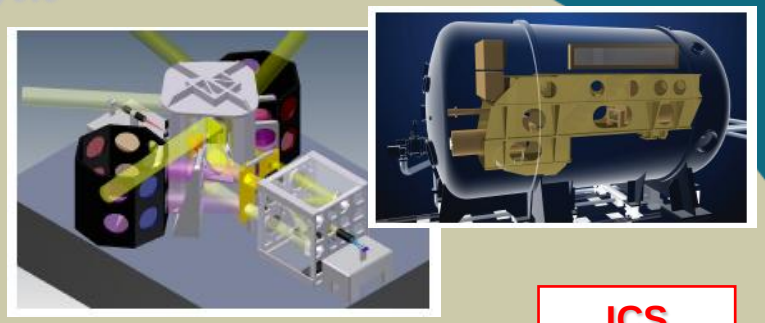
Acquisition

Setup

Observation life-cycle



TCS1/2/3/4



ICS

Observation Software (OS)

DCS (NGC)

ARCHIVE

ESPRESSO Phase A' Control Software Architecture

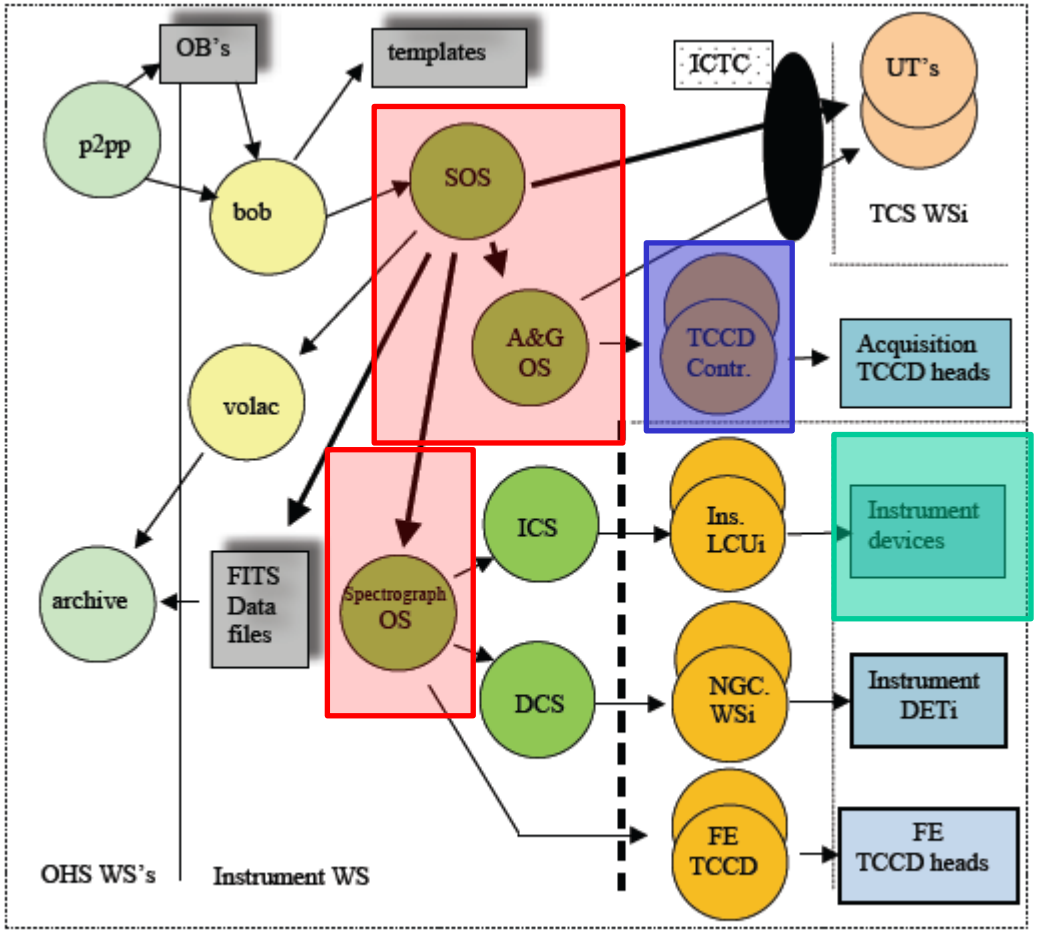
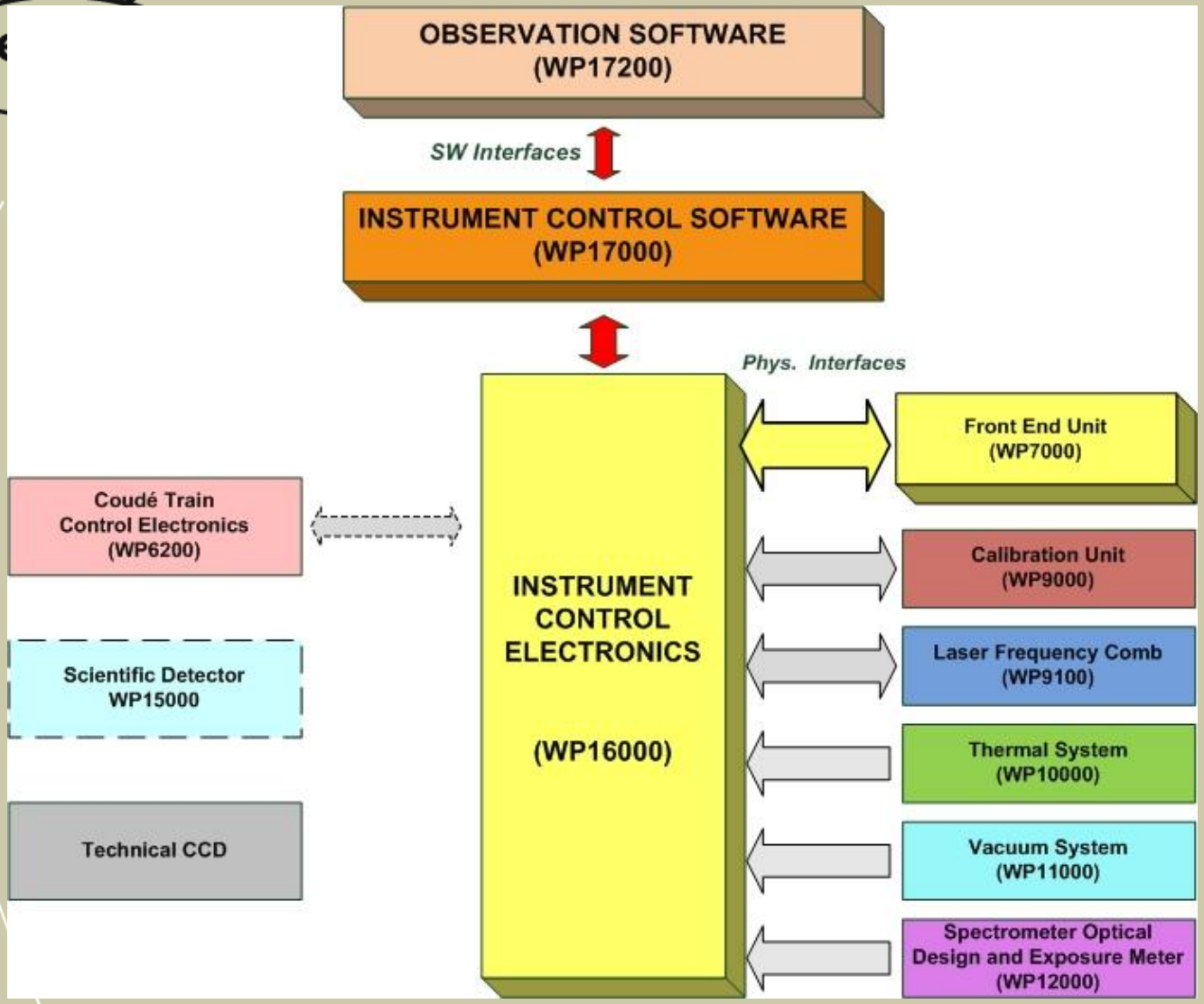


Figure 168. ESPRESSO software architecture

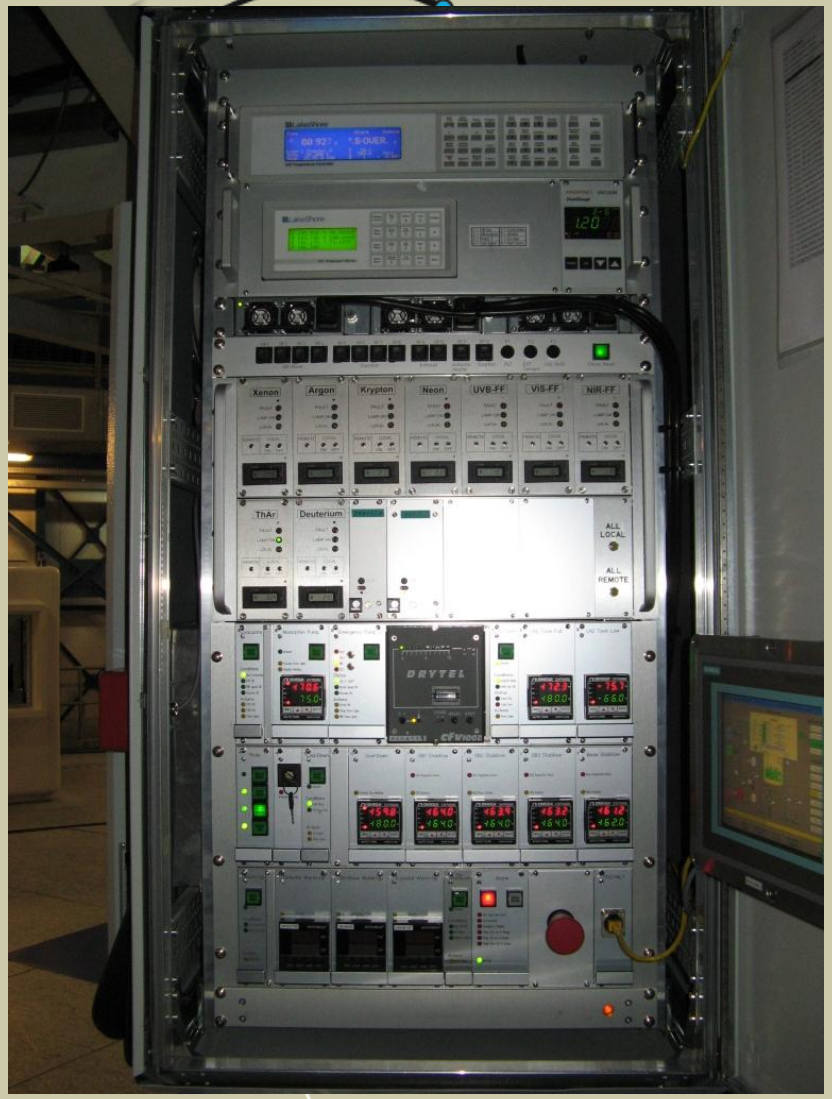
Some issues:

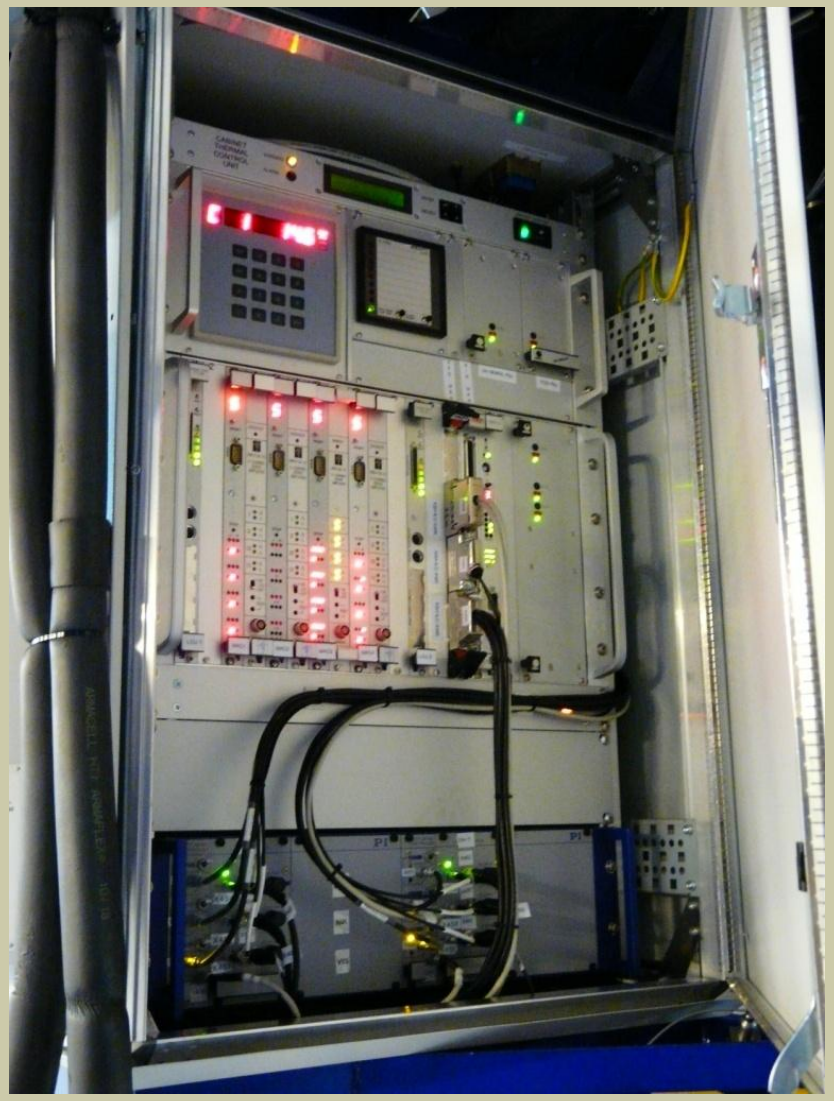
- handling of the 4 UT's;
- TCCDs;
- which electronics?

ESPRESSO ICE I/f

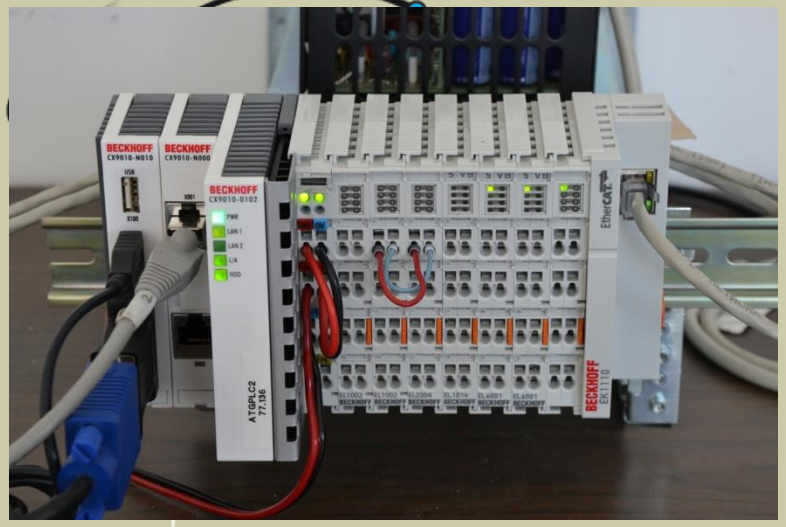


LCUs


Xenon
Argon
Krypton
Neon
UVB-FF
VIS-FF
NIR-FF
ThAr
Deuterium
ALL LOCAL
ALL REMOTE
DRYTEL



PLCs

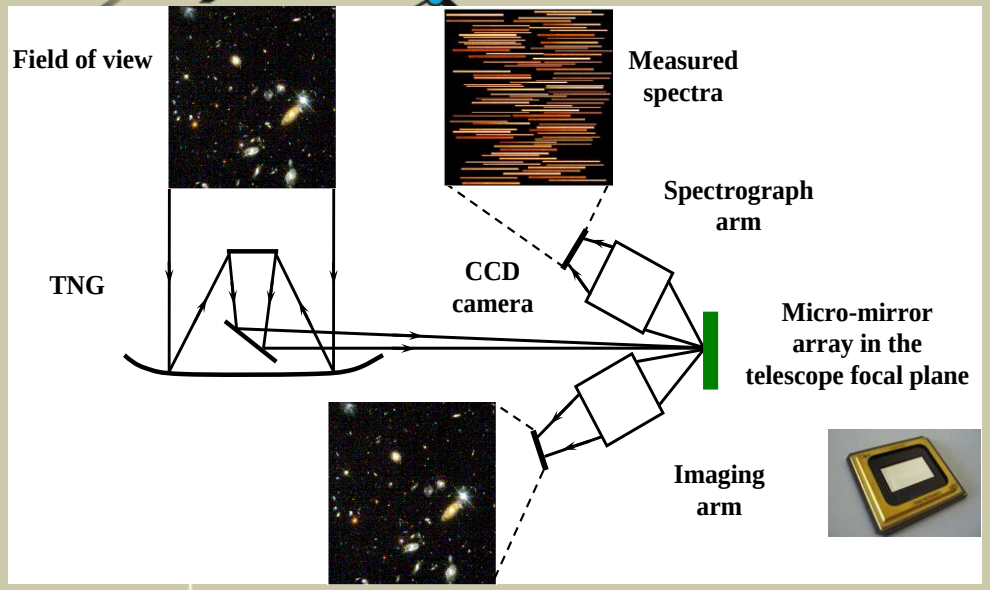

BECKHOFF
CX9010-N010
BECKHOFF
CX9010-N000
BECKHOFF
CX9010-0102
ATGPLC2
77.136
EtherCAT
BECKHOFF

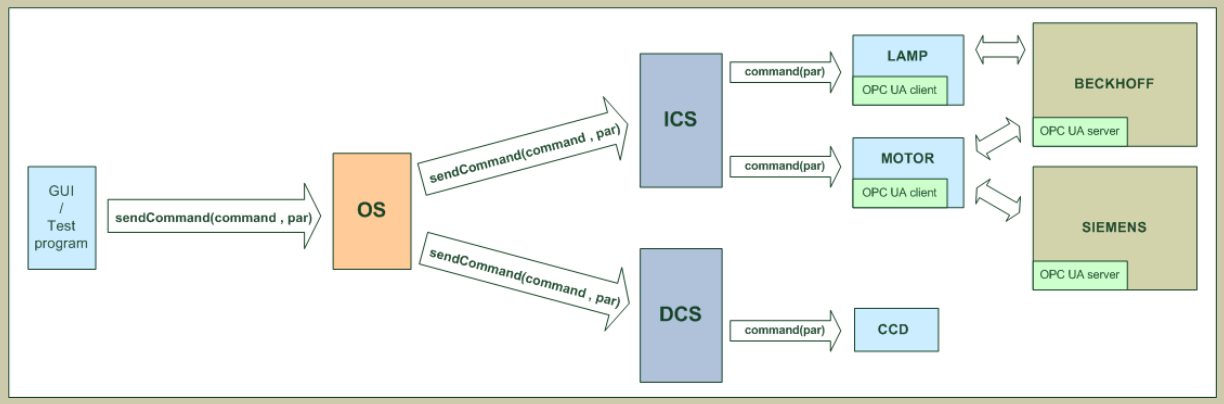

BECKHOFF


BECKHOFF

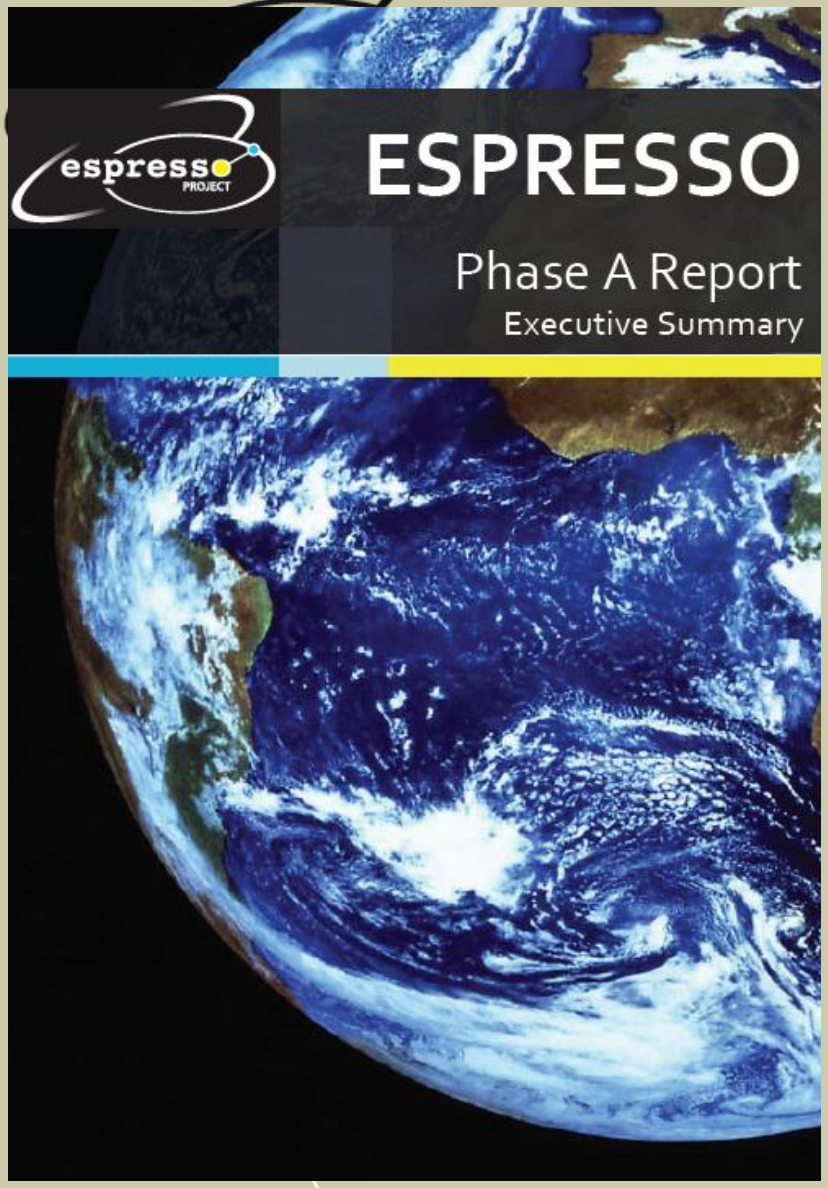

SIEMENS
SIMATIC
S7-300
SIMATIC NET

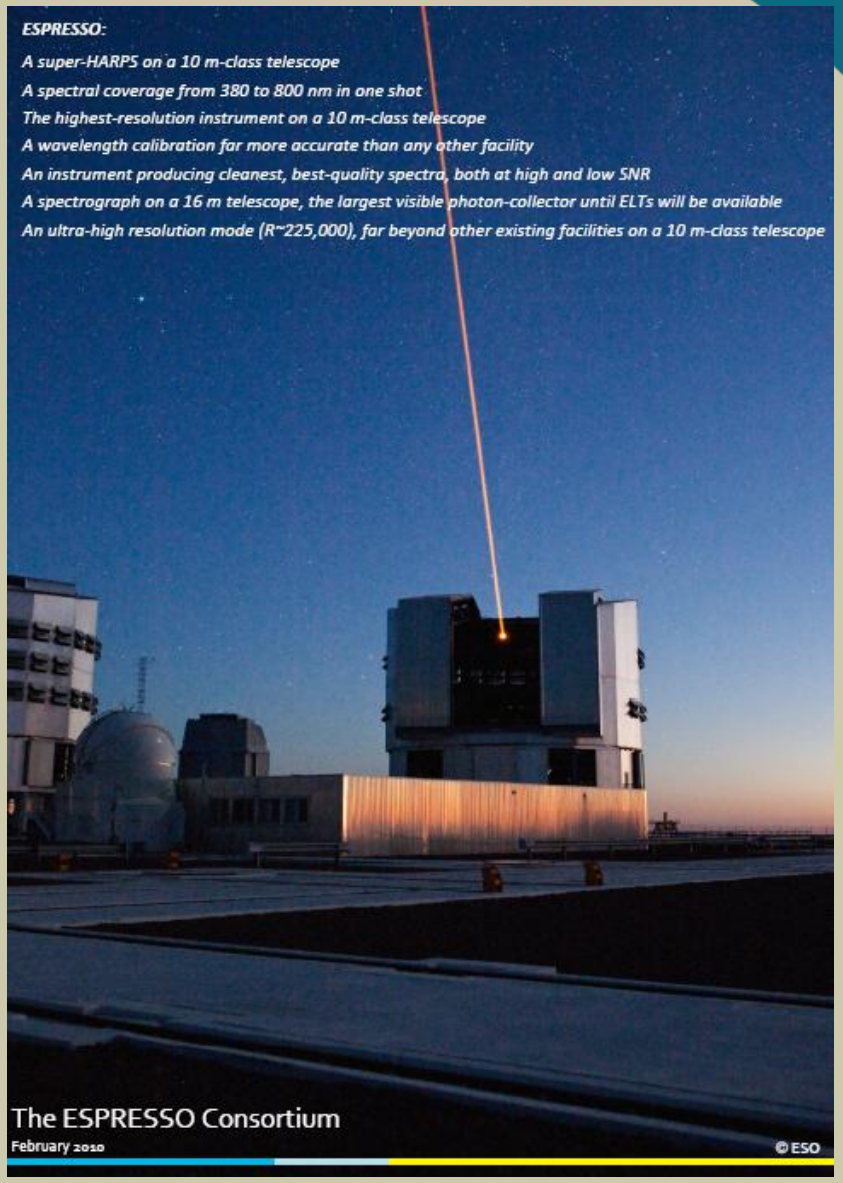
Demo: E-ELT prototype





Summary


espresso
PROJECT
ESPRESSO
Phase A Report
Executive Summary


ESPRESSO:
A super-HARPS on a 10 m-class telescope
A spectral coverage from 380 to 800 nm in one shot
The highest-resolution instrument on a 10 m-class telescope
A wavelength calibration far more accurate than any other facility
An instrument producing cleanest, best-quality spectra, both at high and low SNR
A spectrograph on a 16 m telescope, the largest visible photon-collector until ELTs will be available
An ultra-high resolution mode (R~225,000), far beyond other existing facilities on a 10 m-class telescope
The ESPRESSO Consortium
February 2010
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