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## **Interface Control Document between VLTI and its Instruments (Part I)**

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# 1. Introduction

## 1.1 Scope

This document describes the interfaces offered by the VLTI infrastructure in the VLTI complex and to the VLTI instruments. In some cases, the instruments may be interfaced to the VLTI in other locations than in the VLTI complex. In those cases, dedicated documents exist.

The SW interface between the VLTI and its instruments is also described in a specific document, AD7.

## 1.2 Definitions, Acronyms and Abbreviations

This document employs several abbreviations and acronyms to refer concisely to an item, after it has been introduced. The following list is aimed to help the reader in recalling the extended meaning of each short expression:

ACP	Alarm Connection Point
AT	Auxiliary Telescope
BC	Beam Compressor
CAS	Central Alarm System
CCL	Combined Coudé Laboratory
DL	Delay Lines
DDL	Differential Delay Lines
EMC	ElectroMagnetic Compatibility
IC	Interferometric Complex
IT	Information Technology
LAN	Local Area Network
OBE	Operating Basis Earthquake
OPD	Optical Path Difference
MLE	Maximum Likely Earthquake
NTP	Network Time Protocol
PSD	Power Spectral Density
RMN	Reflective Memory Network
SCP	Service Connection Point
TBC	To Be Clarified
TBD	To Be Defined
TIM	Time Interface Module
TMP	Turbo Molecular Pump
UPS	Uninterruptible Power Supply
UT	Unit Telescope
UTC	Coordinated Universal Time
VIBMET	VIBration METrology
VLTI	Very Large Telescope Interferometer



## 2. Related Documents

### 2.1 Applicable Documents

The following documents, of the exact version shown, form part of this document to the extent specified herein. In the event of conflict between the documents referenced herein and the content of this document, the content of this document shall be considered as superseding.

AD references shall be specific about which part of the target document is the subject of the reference.

- AD1 VLTI Combined Coude Lab Layout;  
CAD-117412 Version 4
- AD2 VLT Environmental specification;  
ESO-222125 Version 6
- AD3 Service Connection Point Technical Specification;  
ESO-221131 Version 4
- AD4 Technical Specification Electrical and electronics design;  
ESO-044295 Version 3
- AD5 Paranal Instrument Interface Document;  
ESO-043721 Version 3
- AD6 VLT Paranal Network / Computers / Consoles – Design Description;  
ESO-043663 Version 11
- AD7 ICD between the VLTI Supervisor Software and VLTI Instrumentation Software;  
ESO-045837 Version 5
- AD8 Time Interface Module Hardware Manual;  
ESO-041682 Version 3
- AD9 Change Control Board;  
ESO-216822 Version 2

### 2.2 Reference Documents

The following documents, of the exact version shown herein, are listed as background references only. They are not to be construed as a binding complement to the present document.

- RD1 Astronomical Site Monitor Data User Manual;  
ESO-281474 Version ?



- RD2 VLT Time Reference System Specification;  
ESO-222615 Version 1
- RD3 VLT Central Time Standard, Manual;  
ESO-041621 Version 3
- RD4 Implementation of an Alarm System for the Paranal Observatory;  
ESO-044519 Version 1
- RD5 VLTI Laser Interlock System;  
ESO-276858 Version 1
- RD6 VLTI Supervisor Software – User and Maintenance Manual;  
ESO-285966 Version 1
- RD7 STS-AT #1 STS Commissioning Test Report;  
ESO-262932 Version 1
- RD8 Image Scale and Pupil Size AT1;  
[VLTI-105](#)



## 3. Interface definition and overview

### 3.1 Interface definition

The interface specified in this document is located between the VLTI infrastructure and the VLTI instruments inside the VLTI complex (Section 3.4). Some instruments might be interfaced to the VLTI infrastructure in some other locations like the Auxiliary Telescopes or the Unit Telescope coudé room. In those cases, other dedicated documents specify the interfaces.

This document considers the following types of interfaces:

- Environmental interfaces describing:
  - The atmospheric conditions one can expect when observing with the VLTI
  - The seismic conditions the instrument is exposed to in Paranal
  - The conditions such as temperature, humidity and pressure that the instrument will be exposed to inside the VLTI complex.
- Mechanical interfaces defining:
  - The different existing locations in the VLTI complex and the volumes allocated for each subsystems and instruments.
- Thermal interfaces defining:
  - The type and location of the connections to the cooling liquid distribution system and the characteristics of the coolant.
  - The type and location of the connections to the compressed air distribution system and the characteristics of the air.
- Electrical interfaces defining:
  - The type and location of the connections to the power distribution system.
  - The characteristics of the distributed power.
- Communication interfaces defining:
  - The type of the connections to the Local Area Network (LAN)
  - The type of the connections to and the characteristics of the two distributed time network
  - The type of the connections and the characteristics of the Reflective Memory Network (RMN)
  - The type, location and usage of the connections to the VLTI complex optical fibre network infrastructure.
- Interfaces to the cable routing infrastructure defining:
  - The location and usage of the feedthroughs between different rooms.
  - The location and usage of the cable tray network existing in each room.
- Optical interfaces defining:



- The position and characteristics of the beams delivered by the VLTI inside the VLTI laboratory.
- Interfaces to the safety systems defining:
  - The type, location and usage of the connections to the Central Alarm System (CAS).
  - The type, location and usage of the connections to the VLTI Laser Interlock System.
- Software interfaces defining:
  - The communication to the Interferometer Supervisor Software (detailed in a dedicated document, AD7).
  - The usage of the Reflective Memory Network.

## 3.2 Interface management

All the interfaces defined in this document are under the responsibility of the VLTI Paranal System Engineer. Any change must be first discussed and approved by the VLTI Paranal System Engineer and VLTI Paranal System Scientist prior to be submitted to the Paranal Change Control Board, AD9.

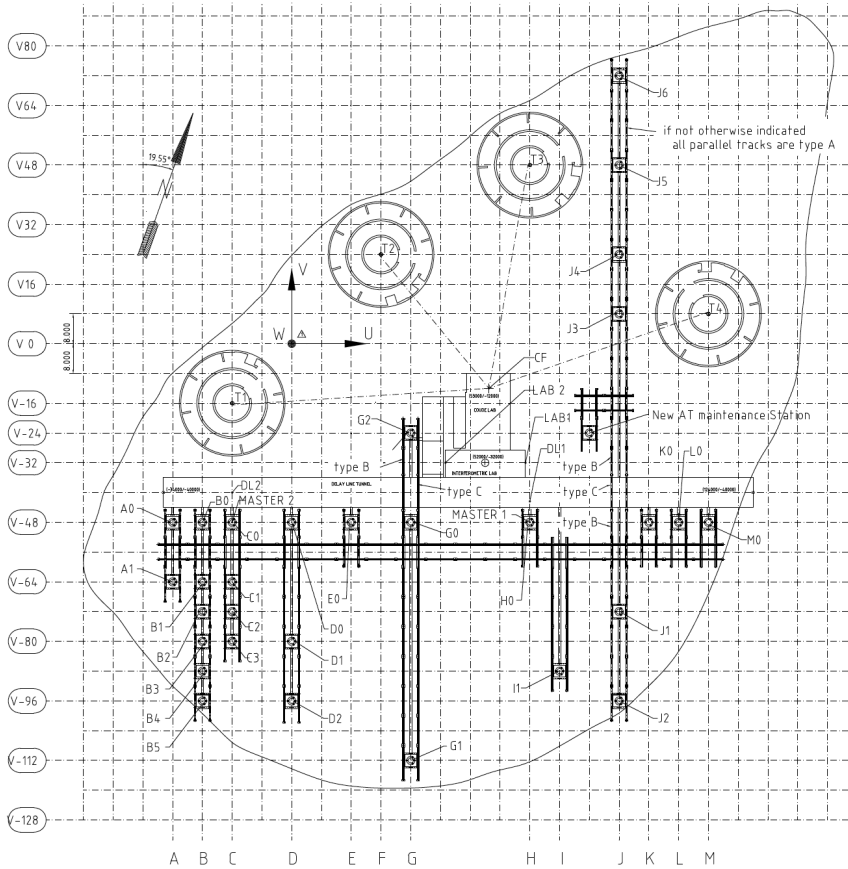
## 3.3 u, v, w coordinate system

A Cartesian coordinate system with the UV plane defined by the telescope platform on Paranal, the U-axis parallel to the rails of the delay lines and the zero-point (located between UT1 and UT2) measured in WGS84 coordinates:

- Latitude: 24.62743941° S
- Longitude: 70.40498689° E
- Height above geoid: 2669 m

This coordinate system is used to position all the VLTI elements such as mirrors, optical tables, telescope stations, ...





**Figure 1: Paranal site layout in the uvw reference coordinate system. The origin of the coordinate system is indicated between UT1 and UT2.**

### 3.4 VLTI complex

The VLTI complex is located at the centre of the Paranal platform. The rooms with a scientific purposes are all located underground. In this document we will consider:

- the VLTI Laboratory (IC108).
- the VLTI Tunnel (IC109).
- the Combined Coude Laboratory (IC107).
- the VLTI Storage room (IC104).
- the VLTI Computer room (IC102).



**Figure 2: Paranal platform - the VLTI complex is shown in red, it includes the tunnel in red dashed line.**

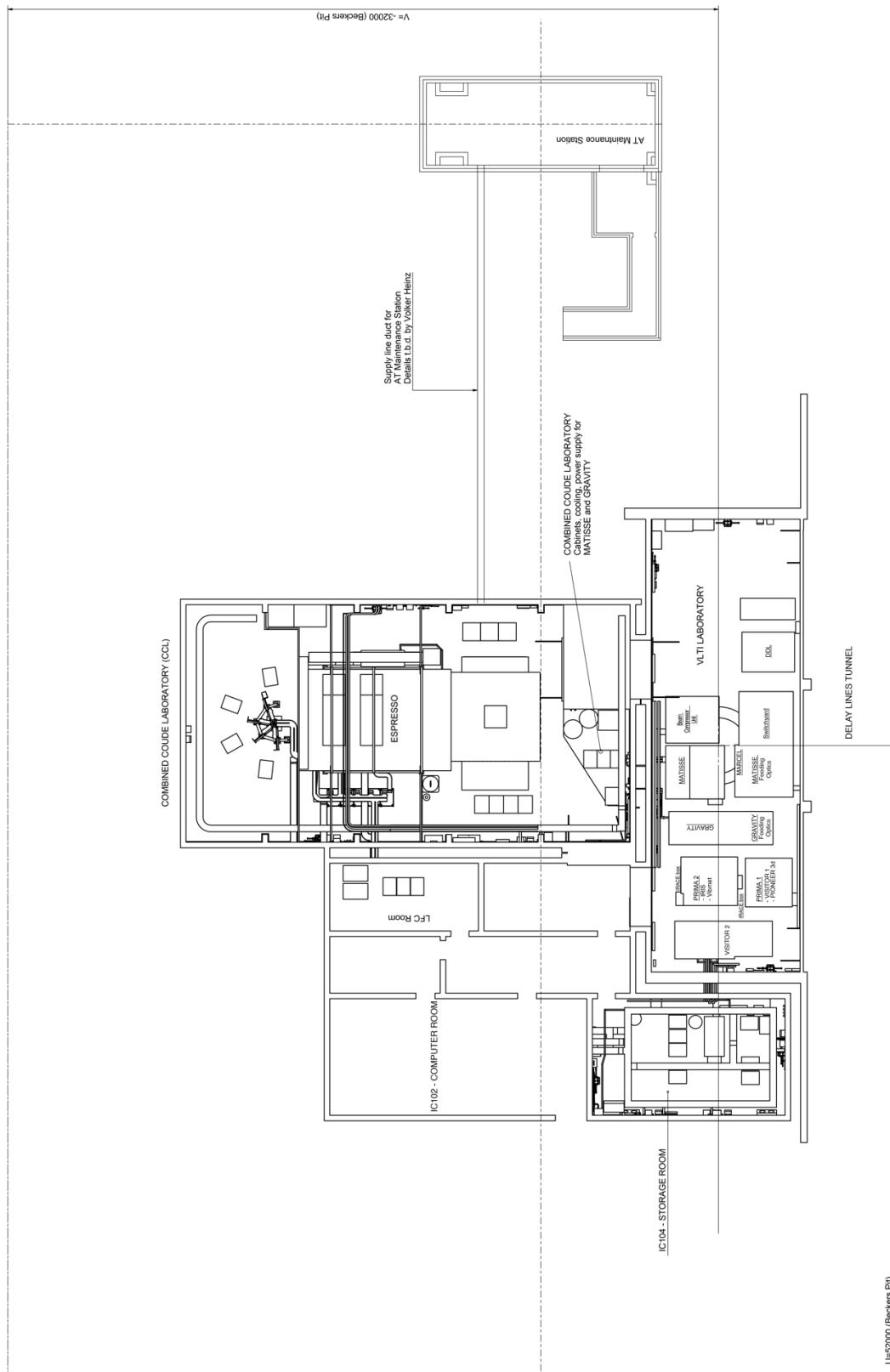


Figure 3: layout of the VLTI Complex basement level.



## 4. Interface between the VLTI complex environment and the instruments

### 4.1 Site seismic conditions

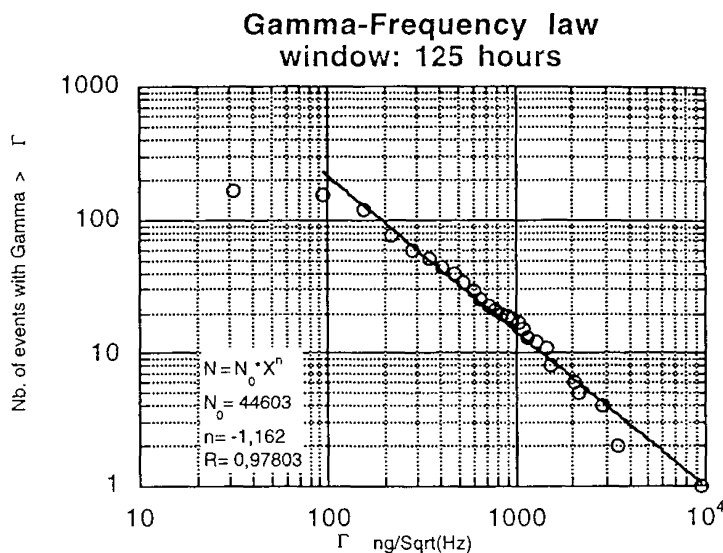
There are two main aspects of seismicity to be considered by the VLTI instruments:

1. The micro seismicity in terms of intensity and frequency of occurrence, related to:
  - a. Design requirements which have to be defined for all instruments in order to assure a low sensitivity to the frequent micro-seismic events.
  - b. Disturbances during observation (e.g. OPD jitter) produced mainly by the responses of the telescope structures to the micro seismic noise.
2. The frequent earthquakes which instruments are required to withstand without damage.

#### 4.1.1 Micro seismicity

The seismicity of the Paranal site is best characterized by the Gamma-Frequency law, as shown in the following .

This plot shows the frequency of occurrence of seismic events at Paranal as characterized by the level of ground acceleration they generate. The parameter  $\Gamma$  is the average level of the PSD of the ground acceleration in the frequency range [10-50 Hz]. The Y-axis is the number of events, recorded during the 125 hours of the test period, which exceeded the value  $\Gamma$ . Note that the departure from the straight line at  $\Gamma < 100$  nano-g/(Hz)<sup>1/2</sup> is due to the non-completeness of the sample.



**Table 1: gamma-frequency law.**

#### 4.1.2 Earthquakes

Two earthquake types are defined:



1. Operating Basis Earthquake (OBE): moderate earthquakes of a magnitude up to Mg 7.75 (Richter scale) with a high probability of occurrence in the lifetime of the observatory.
2. Maximum Likely Earthquake (MLE): an earthquake of large amplitude but with lower probability of occurrence during the lifetime of the observatory.

The characteristics of these earthquakes are summarized in the following table.

	OBE	MLE
Peak horizontal acceleration [g]	0.24	0.34
Probability of exceeding [%]	50	10
Repetition period [years]	25	100
Magnitude [Richter scale]	7.75	8.5
Hypocentral distance [km]	100	150
Duration [s]	65	200

**Table 2: characteristics of the Operating Basis Earthquake and of the Maximum Likely Earthquake.**

The type and frequency of Earthquakes are given in more detail in AD2.

## 4.2 Paranal atmosphere

The Paranal observatory is equipped with a set of tools to characterize the environmental conditions and atmosphere at the observatory, RD1. We summarize in this section statistics of the most important parameters.

### 4.2.1 Ambient temperature

Statistics of the ambient temperature measured at 2 m above the platform level are given in ???. The distribution is plotted in ???. The statistics have been obtained over 5 years.

	Ambient temperature (° C)
Mean	
Standard deviation	
Minimum	
25 <sup>th</sup> percentile	
50 <sup>th</sup> percentile	
75 <sup>th</sup> percentile	
Maximum	

**Table 3: statistics of the temperature of the air 2 m above the platform level.**

### 4.2.2 Pressure

Statistics of the atmospheric pressure measured at ??? m above the platform level are given in ???. The distribution is plotted in ???. The statistics have been obtained over 5 years.





	Atmospheric pressure (bar)
Mean	
Standard deviation	
Minimum	
25 <sup>th</sup> percentile	
50 <sup>th</sup> percentile	
75 <sup>th</sup> percentile	
Maximum	

**Table 4: statistics of the atmospheric pressure ??? m above the platform level.**

#### 4.2.3 Relative humidity

Statistics of the atmospheric relative humidity measured at ??? m above the platform level are given in ???. The distribution is plotted in ???. The statistics have been obtained over 5 years.

	Relative humidity (%)
Mean	
Standard deviation	
Minimum	
25 <sup>th</sup> percentile	
50 <sup>th</sup> percentile	
75 <sup>th</sup> percentile	
Maximum	

**Table 5: statistics of the relative humidity ??? m above the platform level.**

#### 4.2.4 Particle count

#### 4.2.5 Wind speed and wind direction

Statistics of the wind speed measured at ??? m above the platform level are given in ???. The distribution is plotted in ???. The statistics have been obtained over 5 years. Statistics of the wind direction were taken over the same duration and are displayed in ??? and ???.

	Wind speed (m/s)
Mean	
Standard deviation	
Minimum	
25 <sup>th</sup> percentile	



50 <sup>th</sup> percentile	
75 <sup>th</sup> percentile	
Maximum	

**Table 6: statistics of the wind speed measured ??? m above the platform level.**

	Wind direction (°) with North = 0 ° and East = 90 °
Mean	
Standard deviation	
Minimum	
25 <sup>th</sup> percentile	
50 <sup>th</sup> percentile	
75 <sup>th</sup> percentile	
Maximum	

**Table 7: statistics of the relative humidity ??? m above the platform level.**

#### 4.2.6 Seeing

Statistics of the of the seeing of the atmosphere over Paranal as measured by the DIMM (see ???) at 500 nm at zenith are given in ???. The distribution is plotted in ???.

	Seeing (arcsec)
Mean	
Standard deviation	
Minimum	
25 <sup>th</sup> percentile	
50 <sup>th</sup> percentile	
75 <sup>th</sup> percentile	
Maximum	

**Table 8: statistics of the seeing as measured by the DIMM at 500 nm at zenith.**

#### 4.2.7 Coherence time

Statistics of the of the coherence time of the atmosphere over Paranal as measured by the MASS and the DIMM and (see ???) at 500 nm at zenith are given in ???. The distribution is plotted in ???.

	Coherence time (ms)
Mean	
Standard deviation	
Minimum	
25 <sup>th</sup> percentile	



50 <sup>th</sup> percentile	
75 <sup>th</sup> percentile	
Maximum	

**Table 9: statistics of the coherence time as measured by the MASS and the DIMM at 500 nm at zenith.**

### 4.3 VLTI Laboratory (IC108)

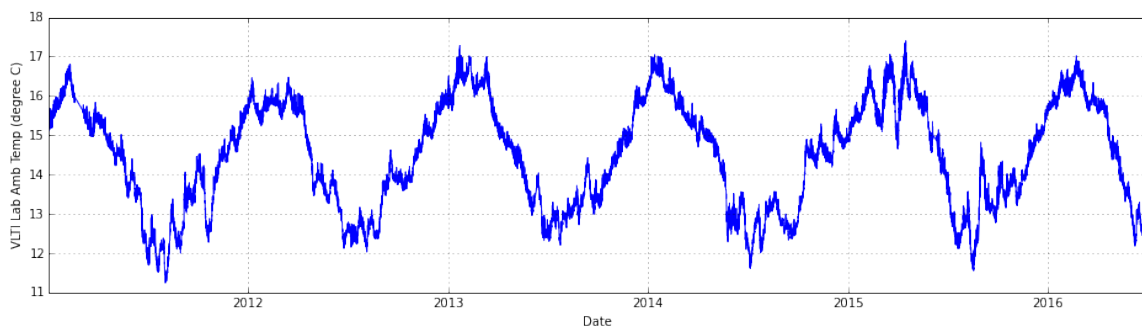
The VLTI Tunnel is not equipped with any air conditioning or air handling unit.

#### 4.3.1 Laboratory ambient temperature

Statistics of the VLTI laboratory ambient temperature measured on the eastern wall are given in Table 3. The distribution is plotted in Figure 5. The statistics have been obtained over 5 years. Some examples of weekly variations are given in Figure 6.

	Ambient temperature (° C)
Mean	14.4
Standard deviation	1.35
Minimum	11.2
25 <sup>th</sup> percentile	13.3
50 <sup>th</sup> percentile	14.5
75 <sup>th</sup> percentile	15.6
Maximum	17.4

**Table 10: statistics of the ambient temperature of the VLTI laboratory.**



**Figure 4: VLTI laboratory temperature over 5 years.**



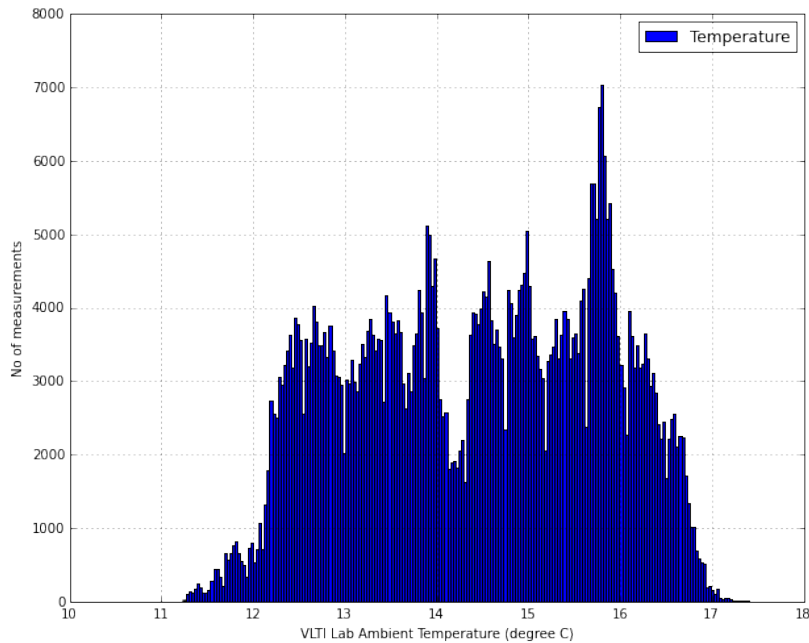


Figure 5: VLTI laboratory temperature distribution over 5 years.

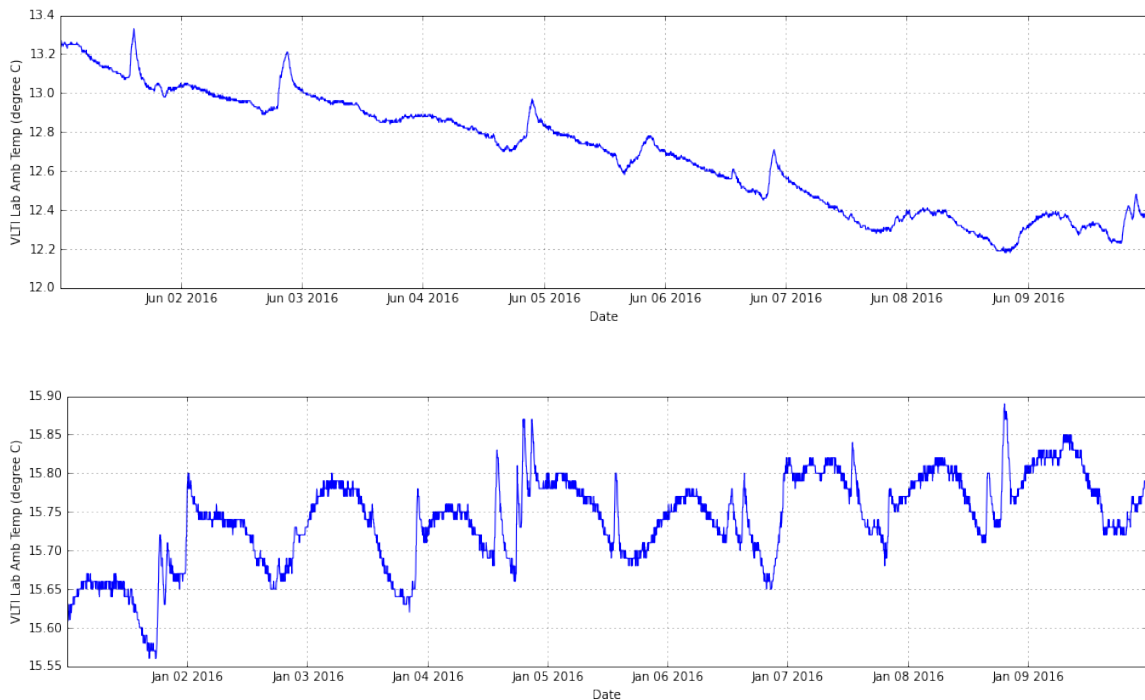


Figure 6: examples of typical temperature evolution in the VLTI laboratory over a week (upper graph represents winter, lower graph summer).

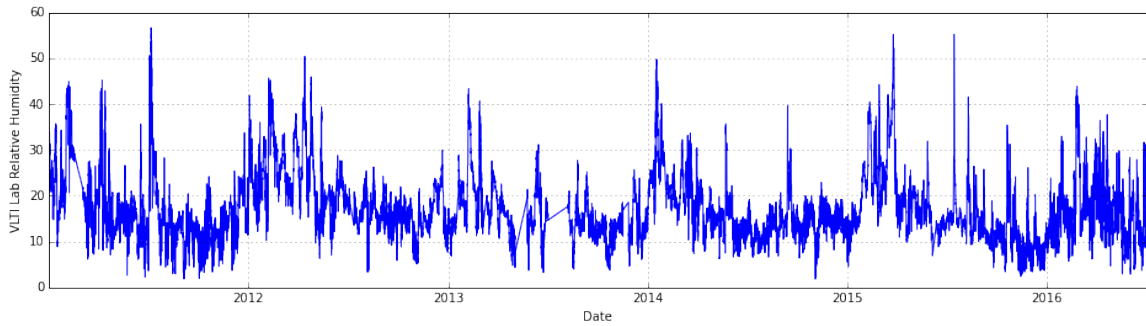
#### 4.3.2 Relative humidity

Statistics of the VLTI laboratory ambient air relative humidity are given in . The distribution is plotted in Figure 5. The statistics have been obtained over 5 years. Some examples of weekly variations are given in Figure 6.

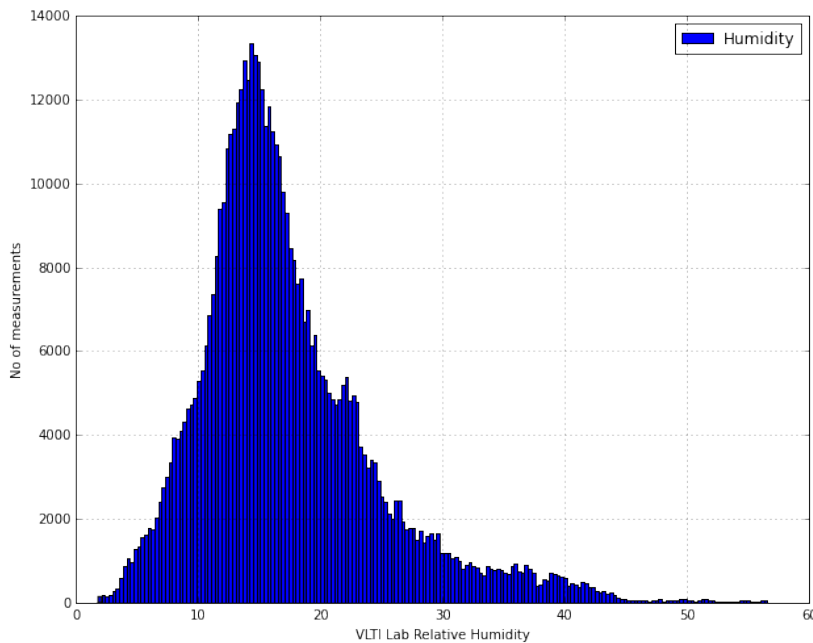


	Relative humidity (%)
Mean	17.3
Standard deviation	7.35
Minimum	1.8
25 <sup>th</sup> percentile	12.6
50 <sup>th</sup> percentile	15.75
75 <sup>th</sup> percentile	20.5
Maximum	56.6

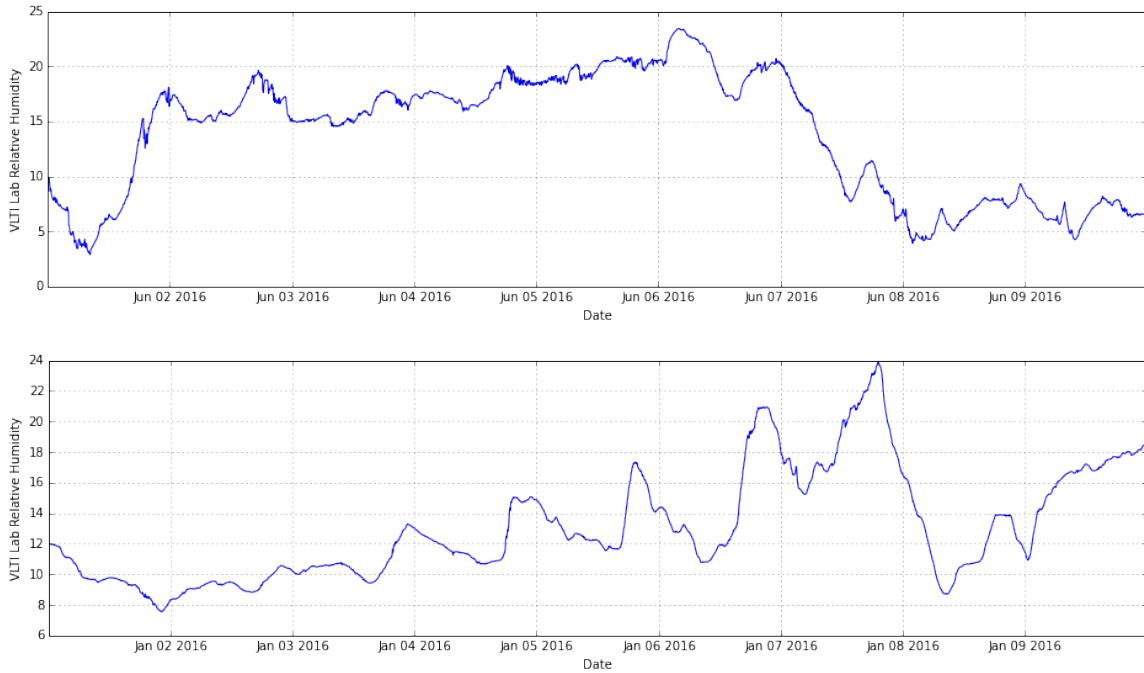
**Table 11: statistics of the ambient air relative humidity of the VLTI laboratory.**



**Figure 7: VLTI laboratory relative humidity over 5 years.**



**Figure 8: VLTI laboratory relative humidity distribution over 5 years.**



**Figure 9: examples of typical evolution of the relative humidity in the VLTI laboratory over a week (upper graph represents winter, lower graph summer).**

#### 4.3.3 Acoustic noise

#### 4.3.4 Air cleanliness

A particle counter was installed in the VLTI laboratory on the Differential Delay Lines table from September 10<sup>th</sup> to October 8<sup>th</sup> 2018. The results are plotted in the next three figures, Figure 10, Figure 11 and Figure 12. The VLTI laboratory can be considered a clean room of class 100,000 (ISO8).

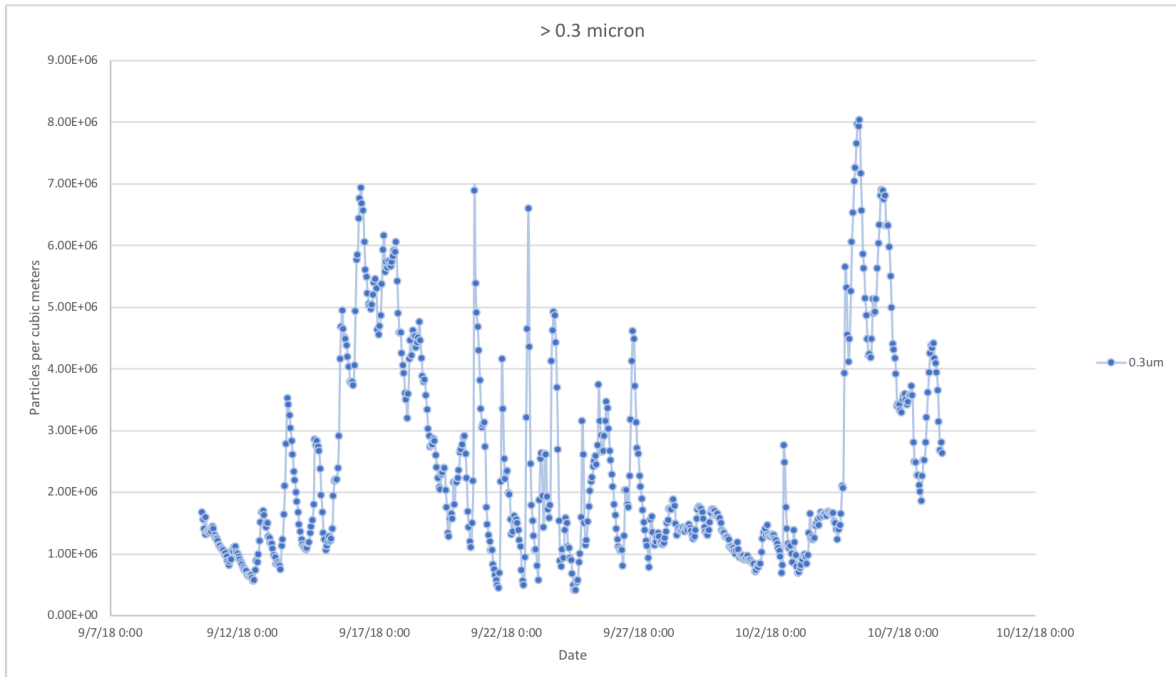


Figure 10: concentration of particles with diameter > 0.3  $\mu\text{m}$  in the VLTI laboratory.

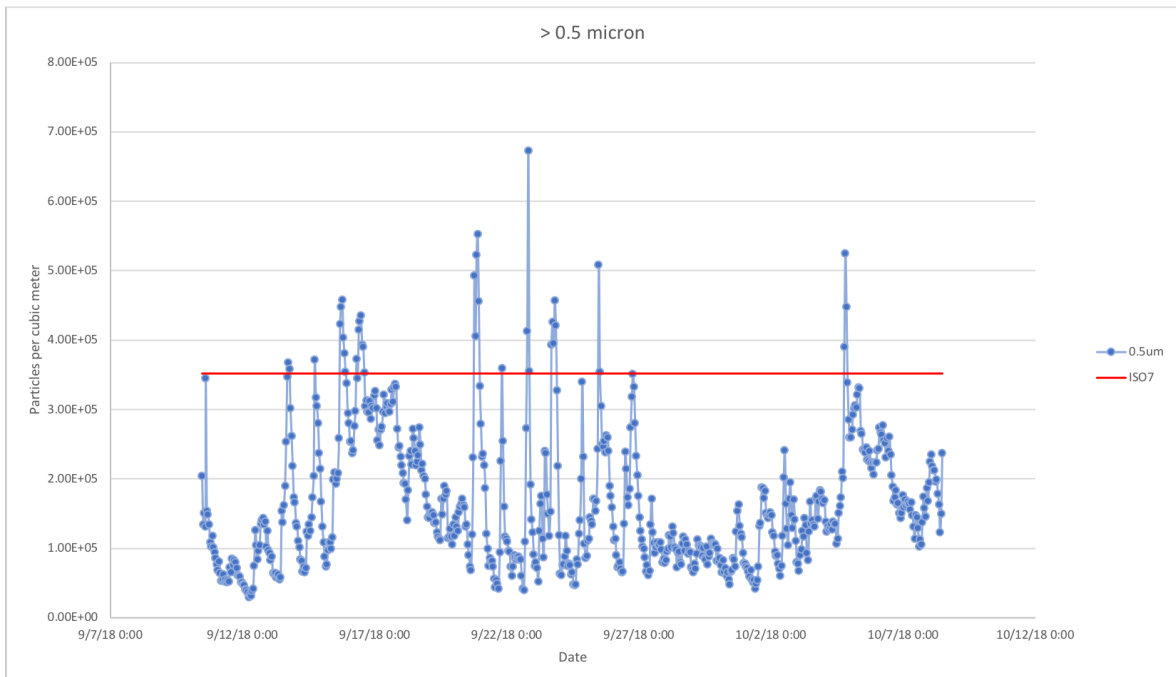


Figure 11: concentration of particles with diameter > 0.5  $\mu\text{m}$  in the VLTI laboratory.

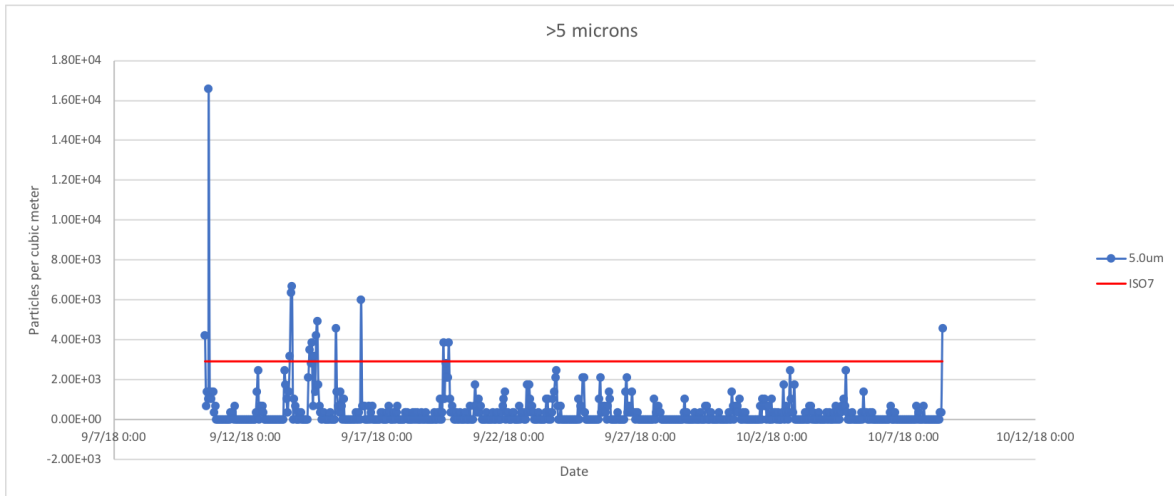


Figure 12: concentration of particles with diameter > 5  $\mu\text{m}$  in the VLTI laboratory.

## 4.4 VLTI Tunnel (IC109)

The VLTI Tunnel is not equipped with any air conditioning or air handling unit.

### 4.4.1 Ambient temperature

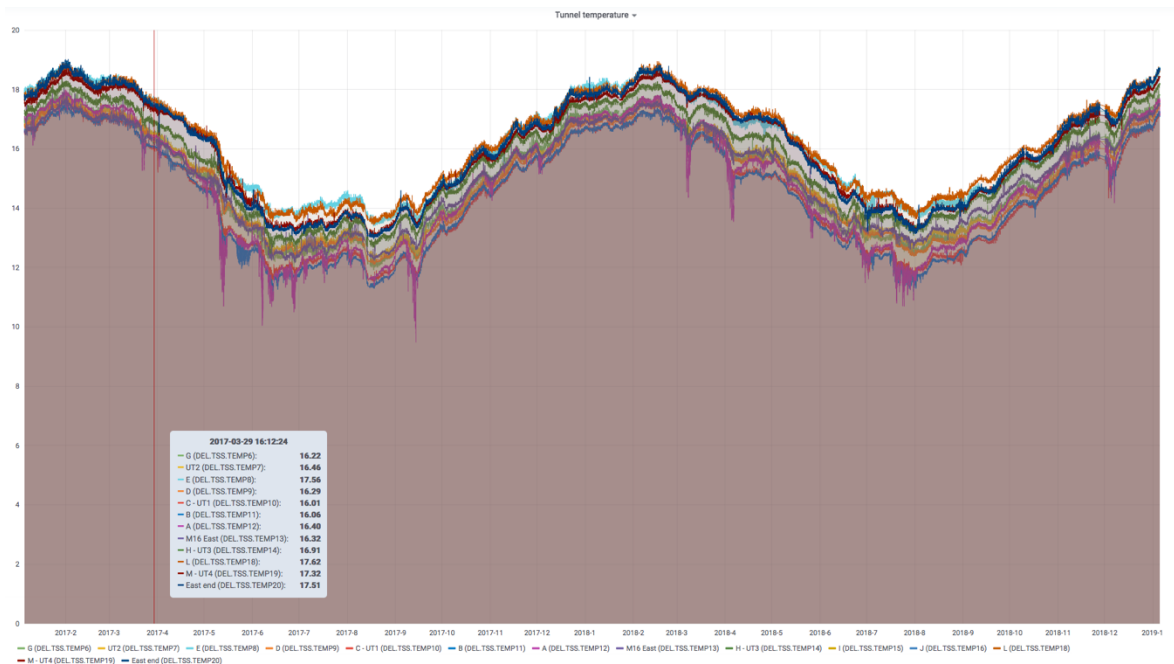


Figure 13: temperature ( $^{\circ}\text{C}$ ) at different locations of the VLTI delay lines tunnel over two years.

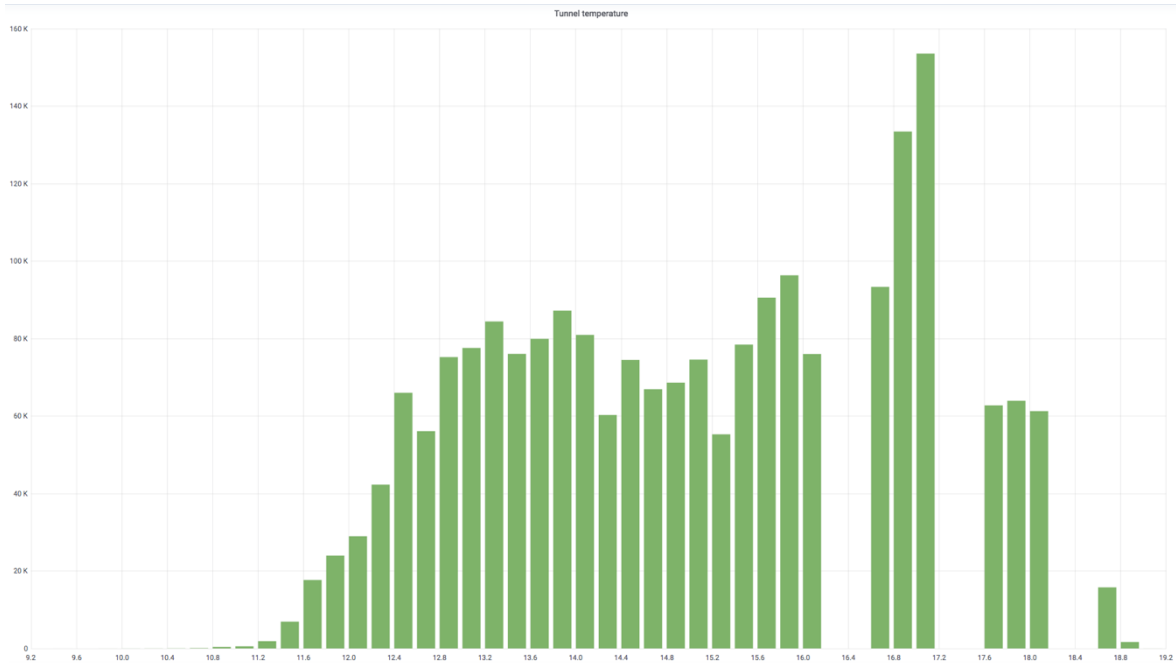


Figure 14: distribution of temperature ( $^{\circ}$  C) in the VLTI delay lines tunnel over two years.

#### 4.4.2 Relative humidity

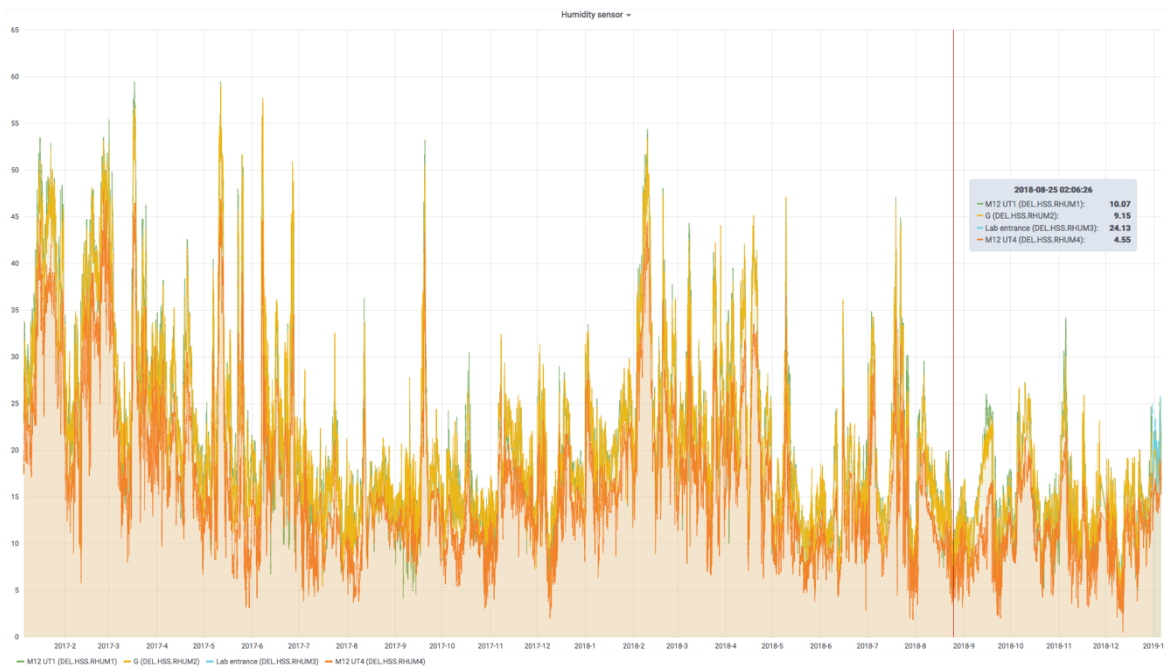


Figure 15: relative humidity (%) at four different locations of the VLTI delay lines tunnel over two years.

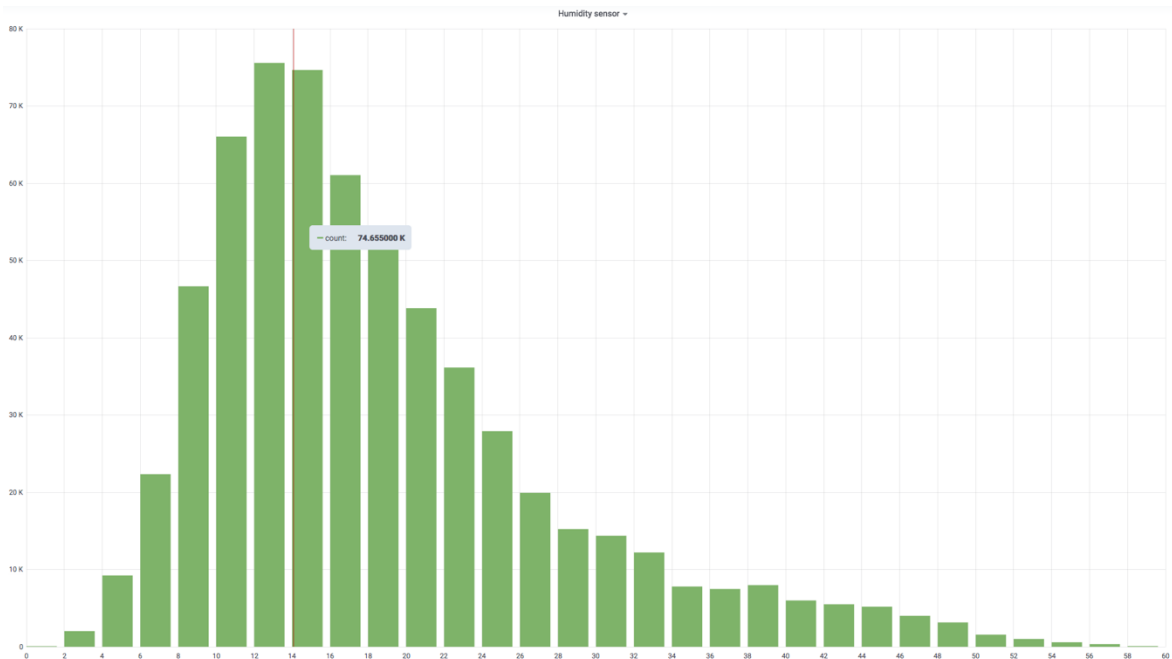


Figure 16: distribution (number of occurrences) of the relative humidity (%) at four different locations of the VLTI delay lines tunnel over two years.

#### 4.4.3 Air draft

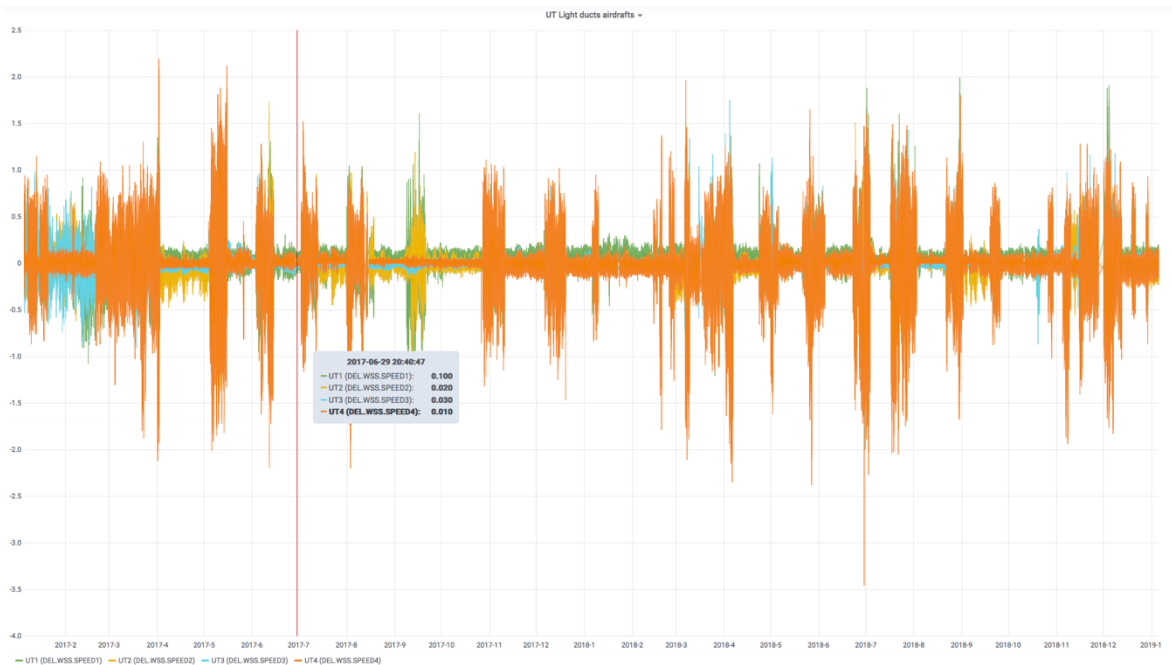


Figure 17: air draft (m/s) at the exit of the UT light ducts over two years. VLTI Ut runs can clearly be distinguished from VLTI AT runs.

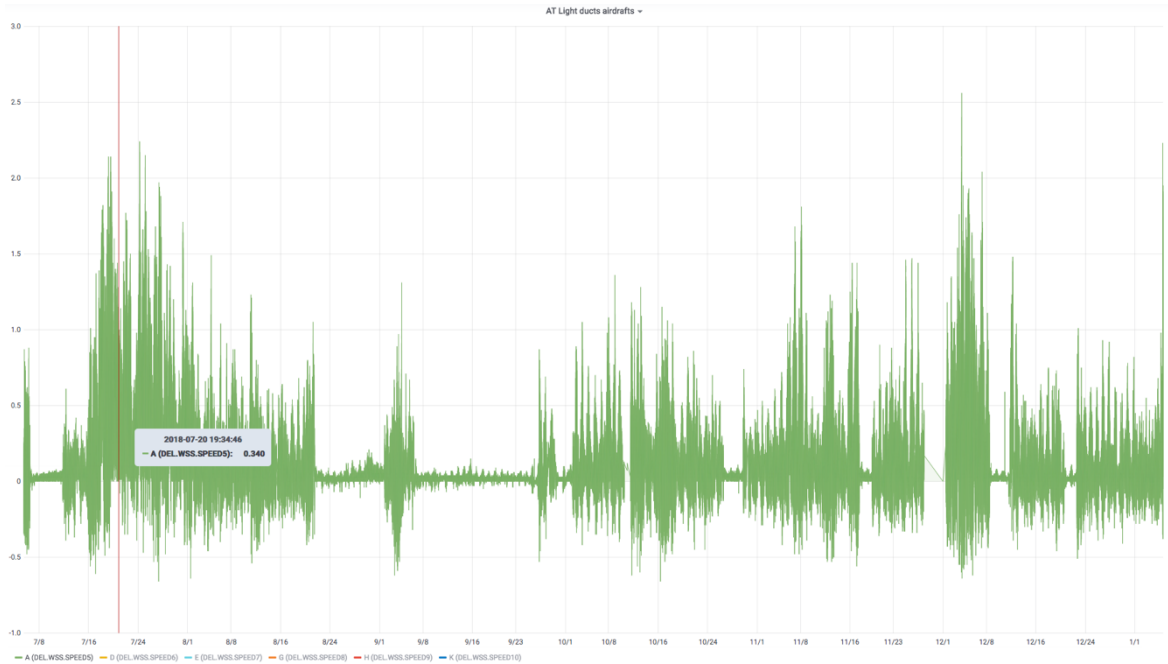


Figure 18: air draft (m/s) at the exit of the AT A stations light duct over two years. VLTI AT runs using the A0 station can clearly be identified.

## 4.5 Combined Coude Laboratory (IC107)

The Combined Coude Laboratory is not equipped with any air conditioning or air handling unit.

### 4.5.1 Ambient temperature

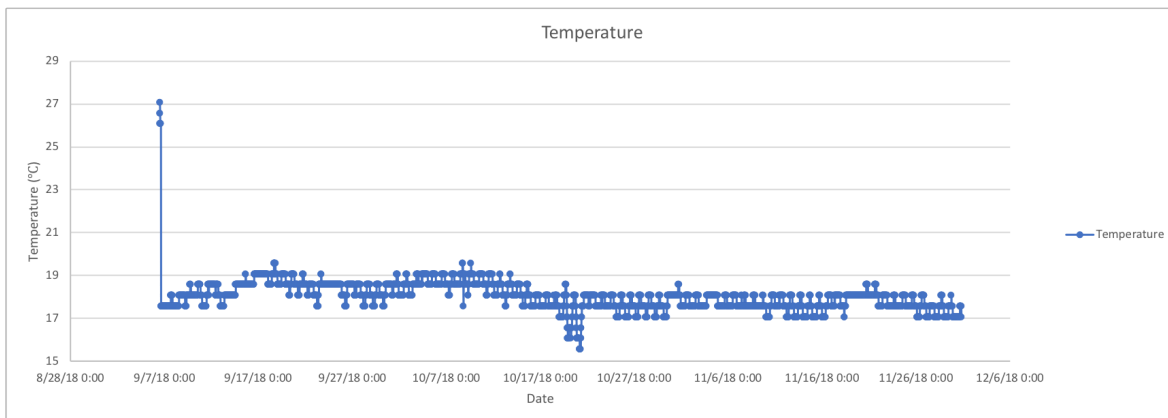


Figure 19: temperature in the CCL measured from September to November 2018.





### 4.5.2 Relative humidity

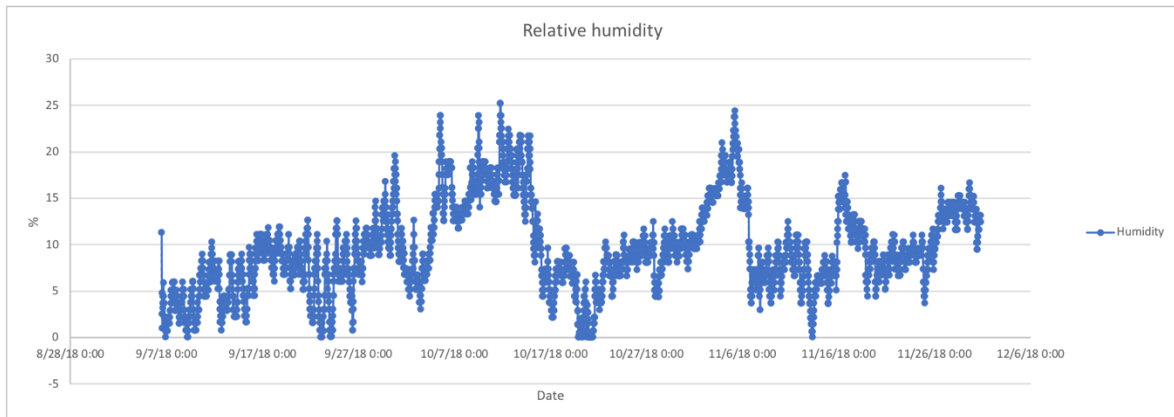


Figure 20: relative humidity in the CCL measured from September to November 2018.

## 4.6 VLTI Storage room (IC104)

The VLTI Storage room is equipped with two air handling units.

### 4.6.1 Ambient temperature

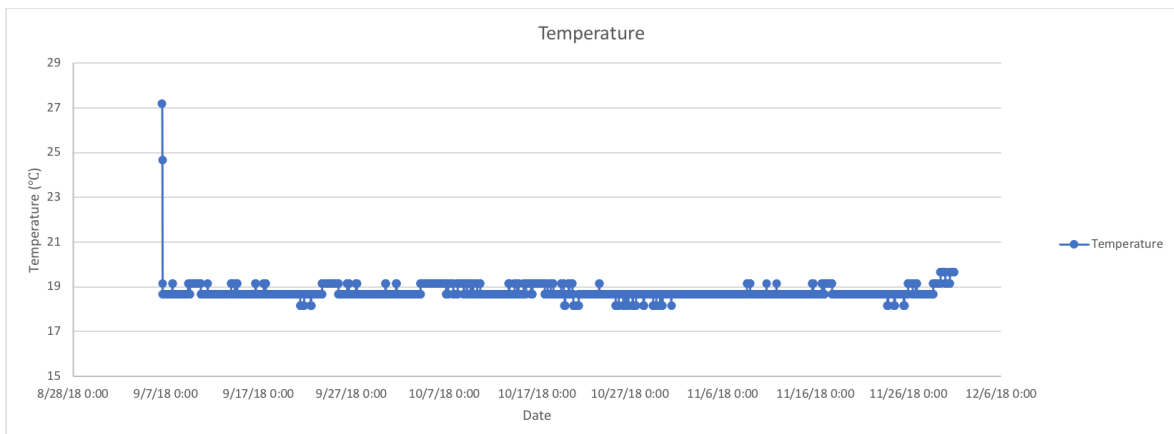


Figure 21: temperature in the IC-104 measured from September to November 2018.



#### 4.6.2 Relative humidity

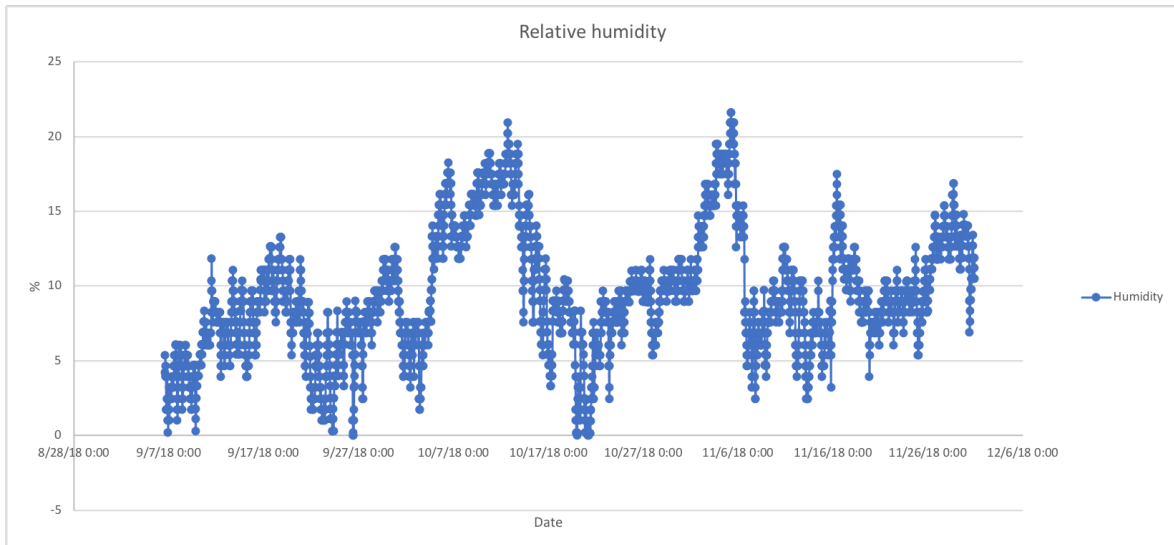


Figure 22: relative humidity in the IC-104 measured from September to November 2018.

### 4.7 VLTI Computer room (IC102)

The VLTI Computer room is equipped with an air conditioning system. Temperature and humidity have been measured over 3 months. Data are available in Figure 23 and Figure 24.

#### 4.7.1 Ambient temperature

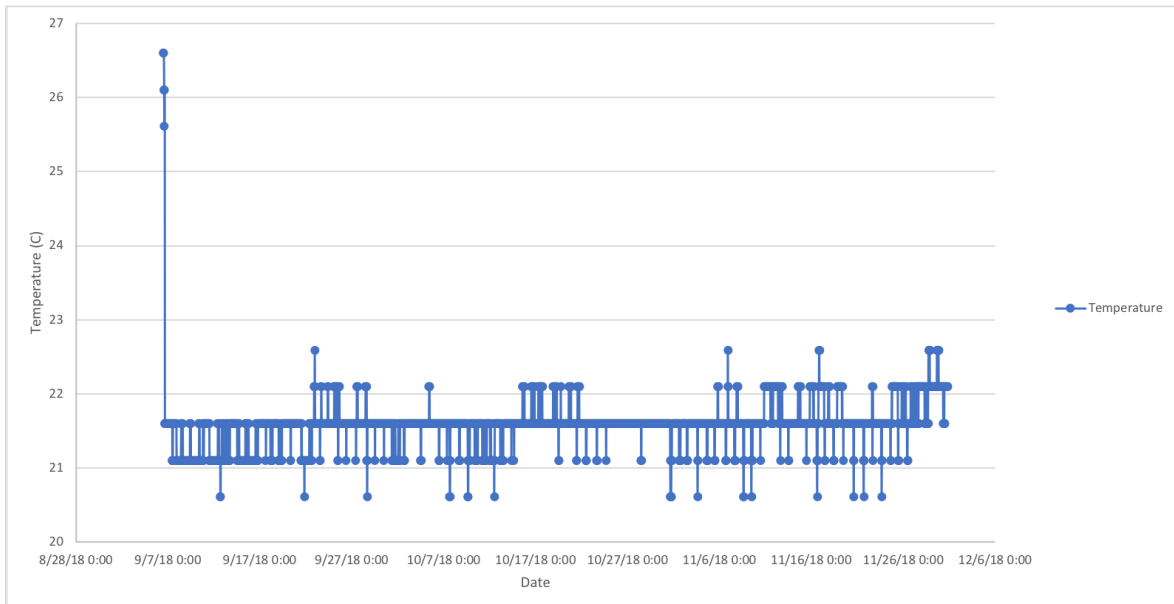
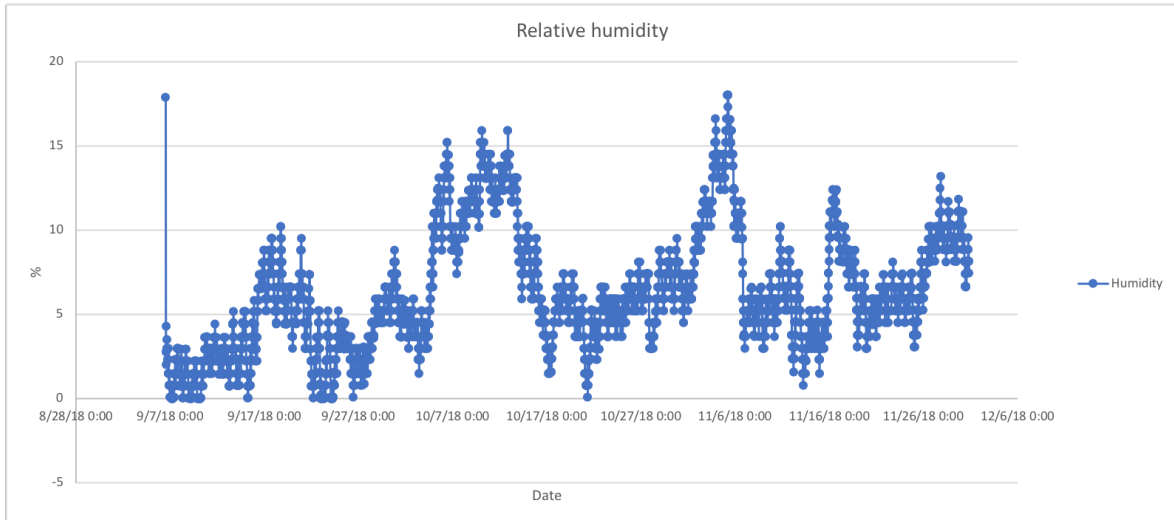


Figure 23: temperature in the IC-102 measured from September to November 2018.



#### 4.7.2 Relative humidity



**Figure 24: relative humidity in the IC-102 measured from September to November 2018.**

## 5. Mechanical interfaces between the VLTI infrastructure and the instruments

### 5.1 VLTI Laboratory (IC108)

#### 5.1.1 Room characteristics

	Values
Size U x V (m x m)	20.4 x 6.7
Access width x height (m x m)	2.7 x 2.08
Maximum usable height (m)	2.201

**Table 12: VLTI Laboratory room characteristics.**

#### 5.1.2 Volumes

Different volumes are allocated to the systems installed inside the VLTI laboratory. They are defined in the drawing AD1. We recall here below their main characteristics.

##### 5.1.2.1 PIONIER

PIO1: 150 x 420 x 81 (U x V x W, cm<sup>3</sup>) over the VISITOR1 table and as defined in ???.

##### 5.1.2.2 VIBMET

VIB1: ??? x 170 x 120 (U x V x W, cm<sup>3</sup>) over the top surface of the IRIS table.

##### 5.1.2.3 Gravity

GRA1: 150 x 410 x 255 (U x V x W, cm<sup>3</sup>) over the floor of the laboratory.

##### 5.1.2.4 MATISSE

MAT1: 180 x 90 x 76 (U x V x W, cm<sup>3</sup>) over the floor of the laboratory.

#### 5.1.2.5 Beam Compressors

BC: 210 x 240 x 66 (U x V x W, cm<sup>3</sup>) over the top surface of the Beam Compressors table.

#### 5.1.2.6 DDL

DDL: 215 x 210 x ??? (U x V x W, cm<sup>3</sup>) over the floor of the laboratory.

#### 5.1.2.7 ARAL

IRIS1: ??? x 230 x 90 (U x V x W, cm<sup>3</sup>) over the top surface of the IRIS table. It contained the IRIS warm optics and cryostat.

IRIS2: ??? x ??? x ??? (U x V x W, cm<sup>3</sup>) over the false floor. It contains the IRIS detector IRACE.

I FOA: ??? x ??? x ??? (U x V x W, cm<sup>3</sup>) over the top surface of the PRIMA2 table.

I FOB: ??? x 60 x 120 (U x V x W, cm<sup>3</sup>) over the top surface of the PRIMA2 table.

PFO: ??? x ??? x ??? (U x V x W, cm<sup>3</sup>) over the top surface of the PRIMA1 table.

GFO: 150 x 120 x 45 (U x V x W, cm<sup>3</sup>) over the top surface of the Gravity FO table.

MFO: 120 x 240 x 50 (U x V x W, cm<sup>3</sup>) over the top surface of the MATISSE FO table.

MARCEL: ??? x ??? x ??? (U x V x W, cm<sup>3</sup>) over the top surface of the MARCEL FO table.

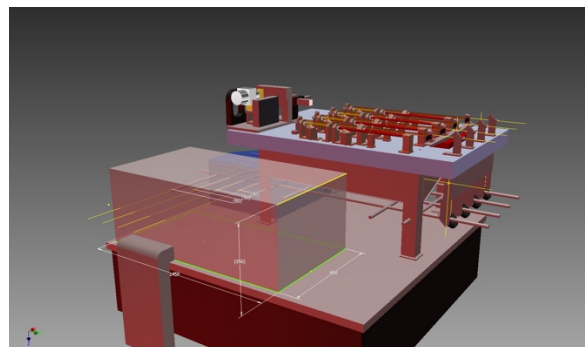
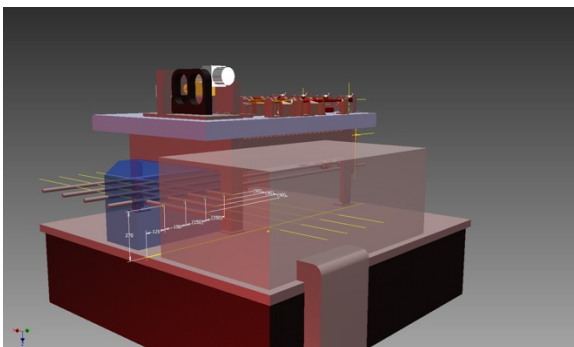
SWY: 210 x 210 x 50 (U x V x W, cm<sup>3</sup>) over the top surface of the Switchyard table.

V1FO: ??? x ??? x ??? (U x V x W, cm<sup>3</sup>) over the top surface of the PRIMA1 table.

#### 5.1.2.8 VISITOR 1:

Two volumes are allocated to the VISITOR1:

- V11A: 200 x 80 x 55 (U x V x W, cm<sup>3</sup>) over the PRIMA1 table. The footprint over the table is defined in ?.
- V11B: small volume on the side for a cable tray leading down the cables.



**Figure 25: in red - volume V1A and V1B allocated for a visitor instrument on the PRIMA1 table. In blue – volume allocated for the feeding optics for a visitor instrument. The PIONIER instrument can be seen on the mezzanine.**

#### 5.1.2.9 VISITOR 2:

Two volumes are allocated to the VISITOR2:

- V12A: 150 x 420 x 80 (U x V x W, cm<sup>3</sup>) over the VISITOR2 table top surface (defined in Table 13).



- VI2B: small volume on the side for a cable tray leading down the cables.

### 5.1.3 Table interface

Table Name	Width (m)	Length (m)	Thickness (mm)	Table Height <sup>1</sup> (mm)	Beam Height <sup>2</sup> (mm)	Table Mass (kg)	Load mass assumed for frequency (kg)	First resonance frequency <sup>3</sup> (Hz)
Switchyard	2.10	2.10		116.8	292			
Beam Compressor	2.10	2.40	457	1348	112	950	400	> 130 Hz
MATISSE FO	1.20	2.40	457?	1168	292	570	250	160
GRAVITY FO	1.20	1.50	457	1168	292 <sup>4</sup>	360		
MATISSE	2.00	1.50	610	1260		740	750	> 160
VISITOR2	1.50	4.20	610	1260	200 <sup>5</sup>	1360	500	130
VISITOR1	2.10	2.10	457	1190	270	< 1200	400	> 130
IRIS	2.10	2.30	457	1190	270	< 1315	400	> 130

**Table 13: characteristics of the optics tables installed inside the VLTI laboratory.**

### 5.1.4 False floor

The VLTI Laboratory is equipped with a false floor to allow routing of cables and hoses in cable trays at the level of the floor. The details of the false floor implementation are given in AD1. The cable trays are described in Section 9.1.

## 5.2 VLTI Tunnel (IC109)

### 5.2.1 Room characteristics

	Values
Size u x v(m x m)	161.9 x 6.675 x 2.340
Access width x height (m x m)	

### 5.2.2 Volumes

The volume PIO2 is defined for the electronics cabinet of PIONIER.

<sup>1</sup> The upper surface of the table to the nominal height will be +/-0.2 mm

<sup>2</sup> The actual beam height will be +/-0.2 mm

<sup>3</sup> From Newport specification

<sup>4</sup> Ref.: Ldv Mechanical Design – VLT-SPE-MEU-15810-2000 – Issue 1.0 – 13/7/99

<sup>5</sup> Ref.: AMBER Hardware Interface Control Document– VLT-ICD-AMB-15830-0001– Issue 1.0 – 15/11/00



PIO2: 61 x 61 x 185 (U x V x W, cm<sup>3</sup>) over the floor surface.

## 5.3 Combined Coude Laboratory (IC107)

### 5.3.1 Room characteristics

	Values
Size u x v(m x m)	10.7 x 20
Access width x height (m x m)	2.585 x 1.995 via elevator
Maximum usable height (m)	2.78

### 5.3.2 Volumes

The volumes used by the different subsystems are defined in AD1.

#### 5.3.2.1 MATISSE

MAT2: 80 x 210 x over the floor surface for the MATISSE cabinets 1, 2 and 3.

MAT3: 107 x 290 x 265 over the floor surface for the MATISSE compressor cabinet and cryogenics controller.

#### 5.3.2.2 DDL

DDL2:

#### 5.3.2.3 Gravity

GRA2: 210 x 260 x 255 over the floor surface for the Gravity cabinets 3,4,5 and 6 and their cooling distribution panel.

GRA3: 80 x 110 x 255 over the floor surface for the Gravity cabinet 2.

GRA4: 80 x 60 x 125 over the floor surface for the Gravity UPS cabinet.

## 5.4 VLTI Storage room (IC104)

### 5.4.1 Room characteristics

	Values
Size u x v(m x m)	8.675 x 5.25
Access width x height (m x m)	0.8 x 1.975
Maximum usable height (m)	2.40

**Table 14: VLTI Storage room characteristics.**

### 5.4.2 Volumes

The volumes used by the different subsystems are defined in AD1.

#### 5.4.2.1 VISITOR1

VIS1C is allocated for the installation of equipment belonging to the system installed on the VISITOR1 table.

VIS1C: 150 x 80 x 235 (U x V x W, cm<sup>3</sup>) above the floor.



### 5.4.2.2 VISITOR2

VIS2C is allocated for the installation of equipment belonging to the system installed on the VISITOR2 table.

VIS2C: 30 x 80 x 215 (U x V x W, cm<sup>3</sup>) + 245 x 80 x 235 (U x V x W, cm<sup>3</sup>) above the floor.

### 5.4.2.3 VIBMET

VIBB is allocated for the VIBMET electronic cabinet.

VIBB: 60 x 80 x 210 (U x V x W, cm<sup>3</sup>).

VIBC is allocated for the VIBMET heterodyne assembly.

VIBC: 240 x 90 x 165 (U x V x W, cm<sup>3</sup>).

### 5.4.2.4 ARAL

ARA: ??? x ??? x ??? Is allocated for the ARAL (including IRIS) electronics cabinet.

MAR Is allocated for the ARAL electronics cabinet containing MARCEL black body.

MAR: 60 x 80 x 210 (U x V x W, cm<sup>3</sup>).

### 5.4.2.5 Cryogenics

CRYO is allocated for the IRIS, VISITOR1 and VISITOR2 cryogenics controllers and LN2 cylinders.

CRYO: ??? x ???x ??? (U x V x W, cm<sup>3</sup>)

## 5.5 VLTI Computer room (IC102)

### 5.5.1 Room characteristics

	Values
Size U x V(m x m)	11.5 x 5.25
Access width x height (m x m)	0.8 x 1.98
Maximum usable height (m)	2.36

**Table 15: VLTI Computer room characteristics**

### 5.5.2 Volumes

The volumes used by the different subsystems are defined in AD1.

#### 5.5.2.1 Delay Lines

This volume contains all the Delay Lines electronics.

DLA: 80 x 242 x 200 (U x V x W, cm<sup>3</sup>)

#### 5.5.2.2 VLTI Control Electronics

This volume contains the VLTI control electronics.

CTR: 80 x 320 x 195 (U x V x W, cm<sup>3</sup>)



### 5.5.2.3 VLTI Network Infrastructure

This volume contains the patch panels for the VLTI fibre network, the TIM distribution module and other IT equipment. This volume is under the responsibility of the Paranal IT group.

NET: 80 x 480 x 195 (U x V x W, cm<sup>3</sup>)

### 5.5.2.4 VLTI Workstations

This volume contains various workstations for VLTI subsystems or instruments. This volume is under the responsibility of the Paranal IT group.

WS: 107 x 420 x 220 (U x V x W, cm<sup>3</sup>)

## 6. Thermal interfaces between the VLTI complex and the instruments

### 6.1 Interface to the liquid cooling distribution system

The VLTI is equipped with a liquid cooling distribution system derived from the UT liquid cooling distribution system. VLTI distribution has its own heat exchanger and pump. The characteristics of the distributed cooling liquid are detailed in Table 16.

Clients are either directly connected to the distribution circuit or use one of the provided Service Connection Point. The type of connectors used at the SCP are defined in ????. The position of the connections points are given per room from 6.3 to 6.7.

#### 6.1.1 Cooling characteristics

Characteristics	Values
Coolant	HVAC-50-MA, % MEG 50%, Freezing point -34°C
Supply temperature	8 ° C below laboratory ambient

**Table 16: liquid cooling general characteristics.**

#### 6.1.2 Connections

#### 6.1.3 Direct Connections

Gravity has its own cooling distribution panel which is connected directly to the liquid cooling distribution network. The connection is done in the CCL on the Western wall, see Table 26. Connectors types are defined in Table 17.

Side		Connector
Entrance	Distribution system outlet	Parker Rectus Type 75
	Equipment connector inlet	Parker Rectus Type 75
Return	Equipment connector outlet	Parker Rectus Type 75
	Distribution system inlet	Parker Rectus Type 75

**Table 17: characteristics of the connectors for the direct connection of Gravity to the liquid cooling distribution system**





MATISSE has its own cooling distribution panel which is connected directly to the liquid cooling distribution network. The connection is done in the CCL on the Southern wall, see Table 26. Connectors types are defined in Table 18.

Side		Connector
Entrance	Distribution system outlet	Parker Rectus Type 74
	Equipment connector inlet	Parker Rectus Type 74
Return	Equipment connector outlet	Parker Rectus Type 74
	Distribution system inlet	Parker Rectus Type 74

**Table 18: characteristics of the connectors for the direct connection of MATISSE to the liquid cooling distribution system**

#### 6.1.4 Service Connection Point

Characteristics	Value
Nominal supply pressure (bar)	6
Supply differential pressure (bar)	Minimum = 0.8 Maximum = 2
Maximum flow rate per SCP (15 l/min)	15

**Table 19: cooling flow characteristics at the SCP.**

Side		Connector
Entrance	Distribution system outlet	Quick coupling Parker SH6-63-BSP 3/4" male
	Equipment connector inlet	Quick coupling Parker SH6-62-BSP 3/4" female
Return	Equipment connector outlet	Quick coupling Parker SH6-63-BSP 3/4" male
	Distribution system inlet	Quick coupling Parker SH6-62-BSP 3/4" female

**Table 20: characteristics of the connectors for a connection to a Service Connection Point of the liquid cooling distribution system**

## 6.2 Interface to the compressed air distribution system

The VLTI is equipped with a compressed air distribution system. The characteristics of the distributed air are detailed in Table 21. The type of connectors provided by the distribution system are defined in Table 22. The position of the connections point are given per room from 6.3 to 6.7.

### 6.2.1 Compressed air characteristics

Characteristics	Values
Supply pressure (bars)	$7 < P < 8$
Water	30 % relative humidity at 15 ° C at local atmospheric pressure.
Oil	$> 1 \text{ mg/m}^3$



**Table 21: compressed air characteristics for the VISTA telescope as measured during an external audit. UT compressed air is assumed to have the same characteristics (since the ambient conditions and type of Kaeser compressor are the same).**

### 6.2.2 Service Connection Point

	Connector
Distribution system outlet (provider)	Rectus type 25 NW 7.8 male
Equipment connector (client)	Rectus type 25 NW 7.8 female

**Table 22: compressed air distribution system connectors**

## 6.3 VLTI Laboratory (IC108) connections points

Ref. #	Room	Approx. U coord. (m)	Approx. V coord. (m)	Port 1 (l/min)	Port 2 (l/min)	Port 3 (l/min)	Port 4 (l/min)	Port 5 (l/min)
34	Interferometric Laboratory	42.0	-32.5	DL3, > 3.5	DL4, > 3.5	-	PIONIER, > 2	-
35	Interferometric Laboratory	48.5	-29.0	Gravity Cab #1, > 4	-	-	IRIS IRACE, > 4	Gravity TMP, > 1.5
36	Interferometric Laboratory	59.5	-29.0	-	-	-	-	DDL, > 2.5

**Table 23: position of the cooling SCP in the VLTI Laboratory and usage of their outlets.**

## 6.4 VLTI Tunnel (IC109) connections points

Ref. #	Room	Approx. U coord. (m)	Approx. V coord. (m)	Port 1 (l/min)	Port 2 (l/min)	Port 3 (l/min)	Port 4 (l/min)	Port 5 (l/min)
34	VLTI Tunnel	62.5	-32.5	DL1, >3	DL2, >3	-	DL6, >3	DL5, >3

**Table 24: position of the cooling SCP in the VLTI Tunnel and usage of their outlets.**

## 6.5 Combined Coude Laboratory (IC107) connections points

Ref. #	Room	Approx. U coord. (m)	Approx. V coord. (m)	Port 1 (l/min)	Port 2 (l/min)	Port 3 (l/min)	Port 4 (l/min)	Port 5 (l/min)
43	Combined Coudé Laboratory	58.5	-17.0	DDL Cab 3, >2.0	DDL Cab 2, >2.0	-	DDL Cab 1, >2.0	ESPRESSO AC, >4.0

**Table 25: position of the cooling SCP in the Combined Coudé Laboratory and usage of their outlets.**



System	Approx U coord. (m)	Approx V coord. (m)	Flow (l/min)
MATISSE – Cooling panel #2 for electronics cabinet	53.0	-28.0	> 14.0
MATISSE – Cooling panel #1 for compressors	53.0	-28.0	> 16.0
Gravity – Cooling panel	48.0	-23.5	> 23.0

**Table 26: Direct connections to the cooling distribution system in the CCL.**

## 6.6 VLTI Storage room (IC104) connections points

Ref. #	Room	Approx. U coord. (m)	Approx. V coord. (m)	Port 1 (l/m)	Port 2 (l/m)	Port 3 (l/m)	Port 4 (l/m)	Port 5 (l/m)
31	Storage Room	39.5	-35.0	-	Metrology #1, > 3.5	-	VIBMET, > 3.5	Air Handling Unit 2, > 3.5
33	Storage room	35.5	-29.5	-	-	-	Air Handling Unit 1, > 3	-

**Table 27: position of the SCP in the Combined Coudé Laboratory and usage of their outlets.**

## 6.7 VLTI Computer room (IC102) connections points

System	Approx U coord. (m)	Approx V coord. (m)	Flow (l/min)
Air conditioning unit – Uniflair #1	40.0	-14.5	> 80.0

**Table 28: Direct connections to the cooling distribution system in the Computer Room (IC102).**

# 7. Electrical Interfaces between the VLTI complex and the instruments

The VLTI electrical distribution system is connected to the Paranal one which is itself connected to the Chilean power distribution grid. The delivered power quality is described in Section 7.1. Systems can be connected directly:

- To the SCP sockets
- To the SCP terminal blocks
- Directly to terminal blocks in the power distribution cabinet



The type of connections provided by the SCP are defined in Section 7.2.1. Connections to the distribution cabinets are defined in Section 7.2.2. The position of the SCPs and distribution cabinets along with their usage are given per room from Section 7.3 to 7.7.

## 7.1 Power quality

Paranal is connected to the Chilean power grid via a power conditioning system to clean the quality of the delivered power. Paranal also offers for critical components an Uninterruptible Power Supply.

### 7.1.1 Non-UPS

The quality of the non-ups power is given by the specifications of the Power Conditioning System installed at Paranal which aims at cleaning the quality of the power delivered by the Chilean power grid. The Power Conditioning System uses a 1250 kVA 400 V 50 Hz MTU Engine from EURO-DIESEL. The technical specifications are given in Annex A: Power Conditioning System Technical Specifications.

### 7.1.2 UPS

The UPS is using a 300 kVA (6 impulse) system from Liebert. The quality of the power distributed by this system is given in the technical specifications of the system available in Annex B: UPS Technical Specifications.

The UPS delivers power for at least 90 minutes after the failure of the main power.

## 7.2 Connections to the power distribution system

### 7.2.1 Connections to the SCP

Different sockets outlets are available for the temporary connection equipment:

- 400 VAC, 50 Hz (One connector: red-colour coded panel socket outlet; three-phases, neutral and earthing contact at the 6h position; rated current 16A, as per CENELEC document HD 196 S1 (1978)/IEC 309/CEE-el 17.
- 230 VAC, 50 Hz, (Two connectors: white or light grey coloured panel socket outlet; phase, neutral and earthing contact; rated current 10/16A, as per CEE-el 7/VII (Schuko).
- 230 VAC Uninterruptible Power Supply (UPS), 50 Hz, (Two connectors: blue-colour coded panel socket outlet, single-phase, neutral and earthing contact at the 6h position, rated current 16A, as per CENELEC document HD 196 S1 (1978)/IEC 309/CEE-el 17.

In addition to the socket outlets, power connection to normal or UPS power may also be via direct connection to terminal blocks inside the SCP. Details of the internal electrical connections are given in AD3.

Equipment connected to the SCP electrical socket-outlets shall conform to the following requirements:

- The peak electrical current drawn from one SCP must not exceed 16A per phase for the normal electrical supply, and 16A total for the UPS supply.



- The total average electrical power taken from the UPS outlets by instruments shall not exceed 2 kW per SCP. The total average non-UPS electrical power shall not exceed 6 kW per SCP without the written agreement of ESO.
- Electrical equipment connected to the SCP must respect the EMC requirements for susceptibility and emissions given in AD4.
- The requirements for the design and implementation of electronic equipment contained in AD4 shall be applicable to all equipment connected to the SCP.
- All fuses, circuit breakers and residual current detectors required for the protection of the instrument, supply cables or operator shall be incorporated in the instrument concerned.

### 7.2.2 Connections to the distribution cabinets

The distribution cabinets contain breakers and differential breakers as described in the following sections (from section 7.3 to 7.7). When not specified otherwise the brand of the breakers is ABB.

## 7.3 VLTI Laboratory (IC108) connections points

Ref. #	Room	Approx. U coord. (m)	Approx. V coord. (m)
34	Interferometric Laboratory	42.0	-32.5
35	Interferometric Laboratory	48.5	-29.0
36	Interferometric Laboratory	59.5	-29.0
37	Interferometric Laboratory	62.5	-32.5

**Table 29: position of the SCP in the VLTI Laboratory and usage.**

Distribution cabinet	Approx U coord. (m)	Approx V coord. (m)
UPS – 11B	61.3	-29.0

**Table 30: Position of the UPS cabinet of the power distribution system in the VLTI Laboratory.**

Reference	System	Breaker description
QF1	DDL Optics table	DDA 202AC AP-R 0.03A, S202M C10
QF2	FSU FE	DDA 202AC AP-R 0.03A, S202M C6
QF3	FSU IRACE	DDA 202AC AP-R 0.03A, S202M C6
QF4	Laser Interlock	DDA 202A 0.5A, S202M C6
QF5	DDL Cabinet 3	DDA 202AC AP-R 0.03A, S202M C10
QF6	DDL Cabinet 2	DDA 202AC AP-R 0.03A, S202M C10
QF7	DDL Cabinet 1	DDA 202AC AP-R 0.03A, S202M C6
QF8	-	DDA 202AC AP-R 0.03A, S202M C16



QF9	-	DDA 202AC AP-R 0.03A, S202 C10
QF10	-	DDA 202AC AP-R 0.03A, S202 C10
QF11	Gravity Cabinet 1	DDA 202AC AP-R 0.03A, S202 C10
QF12	-	DDA 202AC AP-R 0.03A, S202 C10
QF13	Plug AMBER	DDA 202AC AP-R 0.03A, S202M C16
QF14	Plug PRIMA1 FINITO	DDA 202AC AP-R 0.03A, S202M C16
QF15	Plug PRIMA2	DDA 202AC AP-R 0.03A, S202M C16
QF16	Plug VINCI	DDA 202AC AP-R 0.03A, S202M C16
QF17	Plug MIDI	DDA 202AC AP-R 0.03A, S202M C16
QF18	Plug MIDI FO	DDA 202AC AP-R 0.03A, S202M C16
QF19	Plug LEONARDO MARCEL	DDA 202AC AP-R 0.03A, S202M C16
QF20	Plug Switchyard	DDA 202AC AP-R 0.03A, S202M C16
QF21	Plug Beam Compressor	DDA 202AC AP-R 0.03A, S202M C16
QF22	Plug DDL	DDA 202AC AP-R 0.03A, S202M C16
QF23	VI1	DDA 202AC AP-R 0.03A, S202M C16
QF24	VI1	DDA 202AC AP-R 0.03A, S202M C16
QF25	VI2	DDA 202AC AP-R 0.03A, S202M C16
QF26	VI2	DDA 204AC AP-R 0.03A, S204M C16
QF27	-	DDA 204AC AP-R 0.03A, S204M C10
QF28	-	DDA 202A AP-R 0.03A, S202M C10
QF29	-	DDA 202A AP-R 0.03A, S202M C10
QF30	-	DDA 202A AP-R 0.03A, S202M C10

**Table 31: usage of the VLTI Laboratory UPS – 11B cabinet. QF23 and QF24 have been pre-allocated to the visitor focus VI1. QF25 and QF26 have been pre-allocated to the visitor focus VI2.**

### 7.4 VLTI Tunnel (IC109) connections points

Ref. #	Room	Approx. U coord. (m)	Approx. V coord. (m)
34	VLTI Tunnel		

**Table 32: position of the SCP in the VLTI Tunnel and usage.**

### 7.5 Combined Coude Laboratory (IC107) connections points

Ref. #	Room	Approx. U coord. (m)	Approx. V coord. (m)



43	Combined Coudé Laboratory	58.5	-17.0
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**Table 33: position of the SCP in the Combined Coudé Laborator.**

Distribution cabinet	Approx U coord. (m)	Approx V coord. (m)
UPS – 11E	48.0	-19.5
Non-UPS - 41	48.0	-25.0

**Table 34: Position of the cabinets of the power distribution system in the Combined Coudé Laboratory.**

Reference	System	Breaker description
QF1	-	DDA202 AC AP-R 30 mA, S202M C16
QF2	Gravity - Cabinet 2	DDA202 AC AP-R 30 mA, S202M C16
QF3	Gravity - Cabinet 3	DDA202 AC AP-R 30 mA, S202M C16
QF4	Gravity - Cabinet 4	DDA202 AC AP-R 30 mA, S202M C16
QF5	Gravity - Cabinet 5	DDA202 AC AP-R 30 mA, S202M C16
QF6	Gravity - Cabinet 6	DDA202 AC AP-R 30 mA, S202M C16
QF7	-	DDA202 AC AP-R 30 mA, S202M C16
QF8	MATISSE - WOP Cabinet	DDA202 AC AP-R 30 mA, S202M C16
QF9	MATISSE - LM Cabinet	DDA202 AC AP-R 30 mA, S202M C16
QF10	MATISSE - N Cabinet	DDA202 AC AP-R 30 mA, S202M C16
QF11	MATISSE – Cryo controller	DDA202 AC AP-R 30 mA, S202M C16
QF12	-	DDA202 AC AP-R 30 mA, S202M C16
QF13	-	DDA202 AC AP-R 30 mA, S202M C16
QF14	-	DDA202 AC AP-R 30 mA, S202M C16
QF15	-	DDA202 AC AP-R 30 mA, S202M C16
QF16	-	DDA202 AC AP-R 30 mA, S202M C16
QF17	ESPRESSO	(Merlin Gerin) S272 C63
QF18	I2	(Merlin Gerin) Multi9 vigi C60SI, Multi 9 C60N C25

**Table 35: usage of the Combined Coudé Laboratory UPS – 11E cabinet**

Reference	System	Breaker description
QF1	New I2 station	DDA 204A 0.3A, S204M C63
QF2	-	DDA 204A AP-R 0.03A, S204M C25
QF3	MATISSE compressor LM band	DDA 204A AP-R 0.03A, S204M C25



QF4	MATISSE compressor N band	DDA 204A AP-R 0.03A, S204M C25
QF5	WOP cabinet	DDA 204A AP-R 0.03A, S204M C16
QF6	LM band cabinet	DDA 204A AP-R 0.03A, S204M C16
QF7	N band cabinet	DDA 204A AP-R 0.03A, S204M C16
QF8	-	DDA 204A AP-R 0.03A, S204M C16
QF9	-	DDA 204A AP-R 0.03A, S204M C16
QF10	-	DDA 204A AP-R 0.03A, S204M C16
QF11	-	DDA 204A AP-R 0.03A, S204M C16
QF12	-	DDA 204A AP-R 0.03A, S204M C16
QF13	-	DDA 202A AP-R 0.03A, S202 C10
QF14	Gravity cabinet 2	DDA 202A AP-R 0.03A, S202 C16
QF15	Gravity cabinet 3	DDA 202A AP-R 0.03A, S202 C16
QF16	Gravity cabinet 4	DDA 202A AP-R 0.03A, S202 C16
QF17	Gravity cabinet 5	DDA 202A AP-R 0.03A, S202 C10
QF18	Gravity cabinet 6	DDA 202A AP-R 0.03A, S202 C16
QF19	Compressor cabinet	DDA 202A AP-R 0.03A, S202 C16
QF20	Enchufes auxiliares ESPRESSO	DDA 202A AP-R 0.03A, S202 C16
QF21	-	DDA 202A AP-R 0.03A, S202 C16
QF22	-	DDA 202A AP-R 0.03A, S202 C16
QF23	-	DDA 202A AP-R 0.03A, S202 C16
QF24	-	DDA 202A AP-R 0.03A, S202 C16
QF25	-	DDA 202A AP-R 0.03A, S202 C16
QF26	-	DDA 202A AP-R 0.03A, S202 C10
QF27	-	DDA 202A AP-R 0.03A, S202 C10
QF28	-	DDA 202A AP-R 0.03A, S202 C16
QF29	-	DDA 202A AP-R 0.03A, S202M C16
QF30	-	DDA 202A AP-R 0.03A, S202M C16
QF31	-	DDA 202A AP-R 0.03A, S202M C16
QF32	-	DDA 202A AP-R 0.03A, S202M C16
QF33	-	DDA 202A AP-R 0.03A, S202M C16
QF34	-	DDA 202A AP-R 0.03A, S202M C16
QF35	-	DDA 202A AP-R 0.03A, S202M C16
QF36	-	DDA 202A AP-R 0.03A, S202M C16
QF37	-	DDA 202A AP-R 0.03A, S202 C10





QF40	ESSPRESSO line 1	S804B C80
QF41	ESSPRESSO line 1	S804B C80

**Table 36: usage of the Combined Coudé Laboratory Non-UPS – 41 cabinet**

Reference	System	Breaker description
QF1	DDL Table	DDA 202A AP-R 0.03A, S202M C10
QF2	DDL Cabinet 3	DDA 202A 0.5A, S202M C10
QF3	DDL Cabinet 2	DDA 202A 0.5A, S202M C10
QF4	DDL Cabinet 1	DDA 202A 0.5A, S202M C10
QF5	-	DDA 202AC AP-R 0.03A, S202M B10
QF6	-	DDA 202AC AP-R 0.03A, S202M B10

**Table 37: normal power DDL**

## 7.6 VLTI Storage room (IC104) connections points

Ref. #	Room	Approx. U coord. (m)	Approx. V coord. (m)
31	Storage Room	39.5	-35.0
33	Storage room	35.5	-29.5

**Table 38: position of the SCP in the Combined Coudé Laboratory.**

Distribution cabinet	Approx U coord. (m)	Approx V coord. (m)
UPS – 11C	37.6	-26.0
Non-UPS – 21B	37.1	-26.0

**Table 39: position of the cabinets of the power distribution system in the Storage Room.**

Reference	System	Breaker description
QF1	Metrology1	DS672 C10
QF2	VIBMET	DS672 C10
QF3	Metrology 3	DDA202 AC AP-R 0.03 A, S202 M C 6
QF4	Laser Interlock	DS672 C10
QF5	Oxygen monitor	DDA202 AC AP-R 0.03 A, S202 M C 6
QF6	-	DS672 C10
QF7	-	DS672 C10
QF8	VI1	DDA202 AC AP-R 0.03 A, S202 M C 16
QF9	VI1	DDA202 AC AP-R 0.03 A, S202 M C 16



QF10	VI2	DDA202 AC AP-R 0.03 A, S202 M C 16
QF11	VI2	DDA202 AC AP-R 0.03 A, S202 M C 16
QF12	VI2	DDA202 AC AP-R 0.03 A, S202 M C 16
QF13	VI2	DDA202 AC AP-R 0.03 A, S202 M C 16
QF14	-	DDA202 AC AP-R 0.03 A, S202 M C 16
QF15	-	DDA202 AC AP-R 0.03 A, S202 M C 16
QF16	-	DDA 204 AC AP-R 0.03 A, S204M C16
QF17	-	DDA 204 AC AP-R 0.03 A, S204M C10
QF18	-	DS672 C10
QF19	-	DS672 C10
QF20	-	DS672 C10

**Table 40: usage of the Storage room UPS – 11C cabinet. QF8 and QF9 have been pre-allocated to the visitor focus VI1. QF10 to QF13 have been pre-allocated to the visitor focus VI2.**

Reference	System	Breaker description
QF1	AIR #1	DDA202 30 mA S202M B10
QF2	AIR #2	DDA202 30 mA S202M B10
QF3	-	S202M C3
QF4	-	S202M C3
QF5	VI1	DDA202 50 mA S202M C10
QF6	VI2	DDA202 50 mA S202M C10

**Table 41: usage of the Storage room Non-UPS – 21B cabinet. QF5 has been pre-allocated to the visitor focus VI1. QF6 has been pre-allocated to the visitor focus VI2.**

## 7.7 VLTI Computer room (IC102) connections points

Distribution cabinet	Approx U coord. (m)	Approx V coord. (m)
UPS – 11A		

**Table 42: position of the cabinets of the power distribution system in the Computer room.**

Reference	System	Breaker description
QF1	Sockets Cabinet 3	DDA 72 30 mA, S282 C16
QF2	Sockets Cabinet 4	DDA 72 30 mA, S282 C16
QF3	Sockets Cabinet 5	DDA 72 30 mA, S282 C16
QF4	Sockets Cabinet 6	DDA 72 30 mA, S282 C16
QF5	-	DS 672 C20, 30 mA



QF6	-	DDA 72 30 mA, S282 C16
QF7	Sockets Cabinet 9	DDA 72 30 mA, S282 C16
QF8	Sockets Cabinet 10	DDA 72 30 mA, S282 C16
QF9	Sockets Cabinet 11 (new APC rack)	DDA 72 30 mA, S282 C16
QF10	Sockets Cabinet 12 (new APC rack)	DDA 72 30 mA, S282 C16
QF11	Sockets Cabinet 13 (new APC rack)	DDA 72 30 mA, S282 C16
QF12	Sockets Cabinet 14 (new APC rack)	DDA 72 30 mA, S282 C16
----	No name	C3, F202 AC
QF13	Sockets Cabinet 15 (new APC rack)	DDA 72 30 mA, S282 C16
QF14	Sockets Cabinet 16 (new APC rack)	DDA 72 30 mA, S282 C16
QF15	Sockets Cabinet 17	DDA 72 30 mA, S282 C16
QF16	Sockets Cabinet 18	DDA 72 30 mA, S282 C16
QF17	Sockets Cabinet 19	DDA 72 30 mA, S282 C16
QF18	Sockets Cabinet 20	DDA 72 30 mA, S282 C16
QF19	Sockets Cabinet 1 – Main Power DL1 and DL2	DDA 72 30 mA, S282 C16
QF20	Sockets Cabinet 2 – Main Power DL3 and DL4	DDA 72 30 mA, S282 C16
QF21	Access card reader VLTI Laboratory	DDA 72 30 mA, S282 C16
QF22	Estacion enchufes	DDA 72 30 mA, S282 C16
QF23	Cooling pump and refilling controllers	DDA 72 30 mA, S282 C16
QF24	Motion stop ATs	S272 C8
QF25	Sockets Cabinet 3 – Main Power DL5 and DL6	DDA 72 30 mA, S282 C16
QF26	M16 Units – tables 1 & 2	DDA 72 30 mA, S282 C16
QF27	M16 Units – tables 3 & 4	DDA 72 30 mA, S282 C16
QF28	IRIS	DDA 72 30 mA, S282 C16
QF29	Cabinete del VLTI	DDA 72 30 mA, S282 C16
QF30	EPOD webcam	DDA 72 30 mA, S282 C16
QF31	Rack 7	DDA 72 30 mA, S282 C16
QF32	PCI FIRE	DDA202 30 mA, S202M C16

**Table 43: usage of the Computer room UPS – 11A cabinet**



## 8. Interface between the VLTI complex data communication network and the instruments

The VLTI Control System provides three data communication channels to VLTI:

- LAN
- Reflective Memory Network
- Two types of Time Bus

The LAN is used to convey commands from the Instrument Control Software to the VLTICS and to transfer back replies and status reports. It is also used to bear the data traffic due to the access to the on-line database.

The VLTI Reflective Memory Network (RMN) is a dedicated high-speed data communication channel which carries real-time control data between computers, LCU or workstations.

Two different types of Time Bus distribute the UTC can be distributed to computing nodes of the VLTI Control System and instruments in order to synchronize real-time tasks.

The data communication network makes use of a network of optical fibers of different types. Connections are done on the SCP. SCP can be linked one to another thanks to patch panels located in the VLTI Computer Room. A list of SCP available and connection type is given by room from 8.4 to 8.7.

### 8.1 LAN

The VLT Control LAN is based on the latest mature industry standards for network technology (Fast Ethernet, Gigabit Ethernet), that supports the TCP/IP communication protocol. The VLTI Instrument Control System is connected to the VLTI Backbone through the VLT core devices to communicate to the rest of the VLTI.

An accurate description of the services and connection types available for ESO and Visitor instruments arriving to Paranal is given in AD5.

The address assignment and type of network interface for each instrument host are defined in AD6.

### 8.2 Time bus

The observatory reference time can be obtained through different protocols:

- ESO time bus for synchronization of VME LCU;
- NTP time for servers, etc.
- IEEE 1588 v2 time for Beckhoff PLC, etc.

#### 8.2.1 ESO TIM

The VLTI Control System CPUs rely on the Time Reference System (TRS) to be synchronized to each other and to receive the UTC. The TRS gets the UTC from the GPS satellites and distributes it to all the LCUs using a dedicated Time Bus. The TRS is also available to the VLTI Instrument Control System through the SCPs. The Time Bus signal





	2		
3	1		
	2		
4	1		
	2		
5	1	Gravity (copper)	PLC
	2	Gravity (copper)	PLC
6	1		
	2		
7	1		
	2		
8	1		
	2		
9	1		
	2		
10	1		
	2		

**Table 45: IEEE 1588 VLTI distribution switch usage**

### 8.3 Reflective Memory Network hardware interface

The Reflective Memory Network topology is a ring.

The nodes, LCU or workstation, are equipped with a dedicated electronic board which is interfaced to the other nodes by optical fibres, Table 46.

For one subsystem, nodes are connected locally together thanks to a patch panel to allow bypassing a whole subsystem easily. The different patch panels are connected to each other using the SCP and patch panels of the optical fibre infrastructure, Figure 26.

The internal interfaces of the RMN ring are under the responsibility of the Paranal Information Technology (IT) group. The physical layout of the ring is under configuration control and described in AD6.

Node type	Model	Fibre type	Fibre connector type Rx / Tx
LCU	ABACO PMC5565PIORC	Multimode 62.5/125	LC / LC
Workstation	ABACO PCIE-5565PIORC	Multimode 62.5/125	LC / LC



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Intermediate patch panel	RMN	Custom made	Multimode 62.5/125	ST / ST
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**Table 46: hardware interface between the instrument and the RMN ring.**

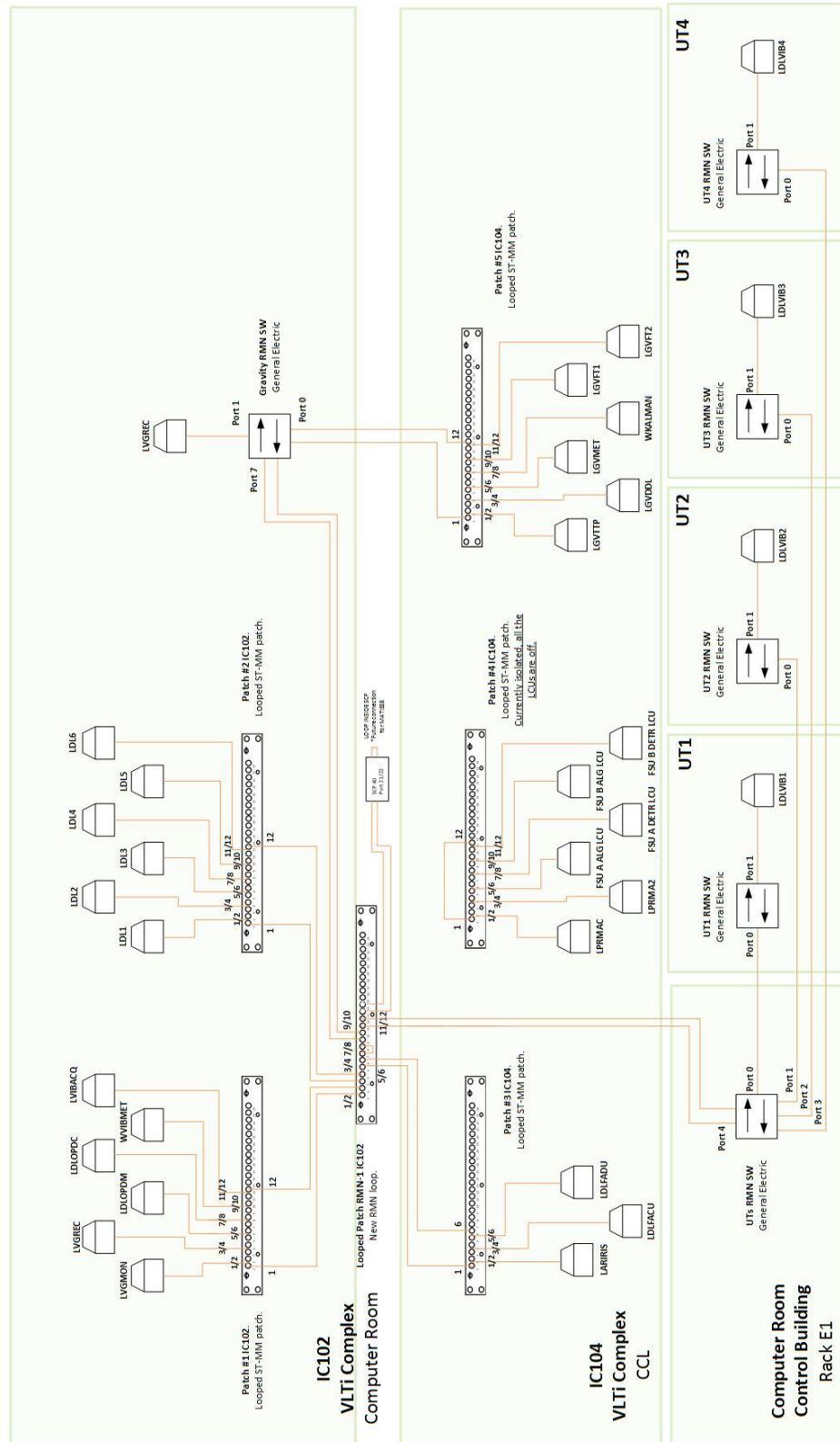


Figure 26: physical layout of the RMN ring as of July 2018. The physical layout is under configuration control by the Information Technology group and is described in AD6.





## 8.4 VLTI Laboratory (IC108) connections points

SCP #	Port #	Usage	Fibre type	Connector type	Approx. U coord. (m)	Approx. V coord. (m)
34	1 – 2	Xvg29	MM	ST – ST	42.0	-32.5
34	3 – 4	Pionier PLC Engineering	MM	ST – ST		
34	5 – 6	VI2 – VI2	MM	ST – ST		
34	7 – 8	VI2 – VI2	MM	ST – ST		
34	9 – 10	VI2 – VI2	MM	ST – ST		
34	11 – 12	VI2 – VI2	MM	ST – ST		
34	13 – 14	VI2 – VI2	MM	ST – ST		
34	15 – 16	VI1 – VI1	MM	ST – ST		
34	17 – 18	VI1 – VI1	MM	ST – ST		
34	19 – 20	VI1 – VI1	MM	ST – ST		
34	21 – 22	VI1 – VI1	MM	ST – ST		
34	23 – 24	VI1 – VI1	MM	ST – ST		
35	1 – 2	MATISSE Eth1	MM	ST – ST	48.5	-29.0
35	3 – 4	XAM1	MM	ST – ST		
35	5 – 6	Free – Free (was MATISSE ETH4)	MM	ST – ST		
35	7 – 8	Gravity Eth	MM	ST – ST		
35	9 – 10	Free – Free (was Matisse Eth2)	MM	ST – ST		
35	11 – 12	Free – Free (was Matisse Eth3)	MM	ST – ST		
35	13 – 14	Pionier	MM	ST – ST		
35	15 – 16	Pionier	MM	ST – ST		
35	17 – 18	Pionier RMN (To be removed)	MM	ST – ST		



35	19 – 20	Free - Free	SM	ST – ST		
35	21 – 22	Free - Free	SM	ST – ST		
35	23 – 24	TIM (Free) – TIM (Free)	MM	ST – ST		
36	1 – 2	Free – Free	MM	ST – ST	59.5	-29.0
36	3 – 4	Free – Free	MM	ST – ST		
36	5 – 6	Free – Free	MM	ST – ST		
36	7 – 8	Free – Free	MM	ST – ST		
36	9 – 10	Free – Free	MM	ST – ST		
36	11 – 12	Free – Free	MM	ST – ST		
36	13 – 14	Free – Free	MM	ST – ST		
36	15 – 16	Free – Free	MM	ST – ST		
36	17 – 18	Free – Free	MM	ST – ST		
36	19 – 20	Free – Free	MM	ST – ST		
36	21 – 22	Free – Free	MM	ST – ST		
36	23 – 24	Free – Free	MM	ST – ST		
37	1 – 2	Free – Free	MM	ST – ST	62.5	-32.5
37	3 – 4	Free – Free	MM	ST – ST		
37	5 – 6	Free – Free	MM	ST – ST		
37	7 – 8	Free – Free	MM	ST – ST		
37	9 – 10	Free – Free	MM	ST – ST		
37	11 – 12	Free – Free	MM	ST – ST		
37	13 – 14	Free – Free	MM	ST – ST		
37	15 – 16	Free – Free	MM	ST – ST		
37	17 – 18	Free – Free	MM	ST – ST		
37	19 – 20	Free – Free	MM	ST – ST		
37	21 – 22	Free – Free	MM	ST – ST		
37	23 – 24	Free - Free	MM	ST - ST		
MATISSE SCP	1A	MATISSE LH2RG	SM	LC – LC		
MATISSE SCP	1B	Free	SM	LC – LC		
MATISSE SCP	1C	Free	SM	LC – LC		



MATISSE SCP	2A	MATISSE AQC�2	SM	LC – LC		
MATISSE SCP	2B	Free	SM	LC – LC		
MATISSE SCP	2C	Free	SM	LC – LC		
MATISSE SCP	3A	MATISSE SPARE	SM	LC – LC		
MATISSE SCP	3B	Free	SM	LC – LC		
MATISSE SCP	3C	Free	SM	LC – LC		
MATISSE SCP	4A	MATISSE AQLN1	SM	LC – LC		
MATISSE SCP	4B	Free	SM	LC – LC		
MATISSE SCP	4C	Free	SM	LC – LC		
MATISSE SCP	5A	Free	SM	LC – LC		
MATISSE SCP	5B	Free	SM	LC – LC		
MATISSE SCP	5C	Free	SM	LC – LC		
MATISSE SCP	6A	Free	SM	LC – LC		
MATISSE SCP	6B	Free	SM	LC – LC		
MATISSE SCP	6C	Free	SM	LC – LC		
MATISSE SCP	7A	Free	SM	LC – LC		
MATISSE SCP	7B	Free	SM	LC – LC		
MATISSE SCP	7C	Free	SM	LC – LC		
MATISSE SCP	8A	Free	SM	LC – LC		
MATISSE SCP	8B	Free	SM	LC – LC		
MATISSE	8C	Free	SM	LC – LC		



SCP						
MATISSE SCP	9A	Free	SM	LC – LC		
MATISSE SCP	9B	Free	SM	LC – LC		
MATISSE SCP	9C	Free	SM	LC – LC		
MATISSE SCP	10A	Free	SM	LC – LC		
MATISSE SCP	10B	Free	SM	LC – LC		
MATISSE SCP	10C	Free	SM	LC – LC		
MATISSE SCP	11A	Free	SM	LC – LC		
MATISSE SCP	11B	Free	SM	LC – LC		
MATISSE SCP	11C	Free	SM	LC – LC		
MATISSE SCP	12A	Free	SM	LC – LC		
MATISSE SCP	12B	Free	SM	LC – LC		
MATISSE SCP	12C	Free	SM	LC – LC		

**Table 47: data distribution network SCP usage in the VLTI Laboratory. TBC indicates that a fibre is connected to the port but the exact usage has to be confirmed. Ports of SCP 34 are pre-allocated to the visitor foci VI1 and VI2.**

### 8.5 VLTI Tunnel (IC109) connections points

### 8.6 Combined Coude Laboratory (IC107) connections points

SCP #	Port #	Usage	Fibre type	Connector type	Approx. U coord. (m)	Approx. V coord. (m)
40	1 – 2	IEEE 1588	MM	ST – ST	47.5	-23.5
40	3 – 4	TBC - TBC	MM	ST – ST		
40	5 – 6	Free - T1 (TBC)	MM	ST – ST		
40	7 – 8	Free - T2 (TBC)	MM	ST – ST		



40	9 – 10	B 20 20 (TBC) - Free	MM	ST – ST		
40	11 – 12	Free – B 20-19 (TBC)	MM	ST – ST		
40	13 – 14	CAS BOX	MM	ST – ST		
40	15 – 16	Gravity CU DIODE (TBC) - Free	MM	ST – ST		
40	17 – 18	TIM MATISSE	MM	ST – ST		
40	19 – 20	Free - Free	MM	ST – ST		
40	21 – 22	RMN MATISSE	MM	ST – ST		
40	23 – 24	TIM (TBC) - TIM spare Gravity	MM	ST – ST		
41	Incoherent Combining Laboratory area				47.5	-15.0
42	Incoherent Combining Laboratory area				52.5	-8.0
43	1 – 2	Security Camera CCL	MM	ST – ST	58.5	-17.0
43	3 – 4	TBC - TBC	MM	ST – ST		
43	5 – 6	ESPRESSO ALPIQ	MM	ST – ST		
43	7 – 8	Free – Free	MM	ST – ST		
43	9 – 10	RMN DDL	MM	ST – ST		
43	11 – 12	LddI2 LAN	MM	ST – ST		
43	13 – 14	Lddopdc LAN	MM	ST – ST		
43	15 – 16	LddI4 LAN	MM	ST – ST		
43	17 – 18	DDL A (TBC)	MM	ST – ST		
43	19 – 20	DDL (TBC)	MM	ST – ST		
43	21 – 22	LddI3 LAN	MM	ST – ST		
43	23 – 24	LddI1 LAN	MM	ST – ST		
44	1 – 2	LddI4 TIM – IddI2 TIM	MM	ST – ST		



44	3 – 4	Lddlhk TIM – Iddopdc TIM	MM	ST – ST		
44	5 – 6	Lddl3 TIM – Iddl1 TIM	MM	ST – ST		
44	7 – 8	Lddl6 LAN	MM	ST – ST		
44	9 – 10	Lddl8 LAN	MM	ST – ST		
44	11 – 12	Lddl6 TIM – LDDL8 TIM	MM	ST – ST		
44	13 – 14	Free - Free	MM	ST – ST		
44	15 – 16	Free - Free	MM	ST – ST		
44	17 – 18	Free - Free	MM	ST – ST		
44	19 – 20	Free - Free	MM	ST – ST		
44	21 – 22	Free - Free	MM	ST – ST		
44	23 – 24	Free - Free	MM	ST – ST		

**Table 48: data distribution network SCP usage in the Combined Coudé Laboratory. TBC indicates that a fibre is connected to the port but the exact usage has to be confirmed.**

### 8.7 VLTI Storage room (IC104) connections points

SCP #	Port #	Usage	Fibre type	Connector type	Approx. U coord. (m)	Approx. V coord. (m)
30	1 – 2	Free – Free	MM	ST – ST	40.5	-30.0
30	3 – 4	Free – Free	MM	ST – ST		
30	5 – 6	Lariris LAN	MM	ST – ST		
30	7 – 8	larics3 LAN	MM	ST – ST		
30	9 – 10	Free – Free	MM	ST – ST		
30	11 – 12	lariris 2 <sup>nd</sup> ETH	MM	ST – ST		
30	13 – 14	Free - Free	MM	ST – ST		
30	15 – 16	Free – Free	MM	ST – ST		
30	17 – 18	Free – Free	MM	ST – ST		
30	19 – 20	Free - Free	MM	ST – ST		



30	21 – 22	Free - Free	MM	ST – ST	39.5	-35.0
30	23 – 24	Free – TIM (TBC)	MM	ST – ST		
31	1 – 2	Larics1 LAN	MM	ST – ST		
31	3 – 4	Free – Free (was lvnics1)	MM	ST – ST		
31	5 – 6	Free – Free (was lartccd)	MM	ST – ST		
31	7 – 8	Ldlfmu LAN	MM	ST – ST		
31	9 – 10	Ldlfadu LAN	MM	ST – ST		
31	11 – 12	Ldlfacu LAN	MM	ST – ST		
31	13 – 14	Larics2 LAN	MM	ST – ST		
31	15 – 16	FINITO patch	MM	ST – ST		
31	17 – 18	Ldlfadu 5576 RCV – ldlfacu 5576 xmit	MM	ST – ST		
31	19 – 20	Free (was TIM lartccd) - Free	MM	ST – ST		
31	21 – 22	Free - Free	MM	ST – ST		
31	23 – 24	FINITO patch	MM	ST – ST		
32	1 – 2	XAM2	MM	ST – ST	35.5	-32.5
32	3 – 4	VI1 – VI1	MM	ST – ST		
32	5 – 6	VI1 – VI1	MM	ST – ST		
32	7 – 8	VI1 – VI1	MM	ST – ST		
32	9 – 10	VI1 – VI1	MM	ST – ST		
32	11 – 12	VI1 – VI1	MM	ST – ST		
32	13 – 14	VI1 – VI1	MM	ST – ST		



32	15 – 16	Vibmet lvibpd VCM virtual LAN	MM	ST – ST		
32	17 – 18	Lvibpd LAN	MM	ST – ST		
32	19 – 20	Lvibacq LAN	MM	ST – ST		
32	21 – 22	Vibmet RMN	MM	ST – ST		
32	23 – 24	Free – Free	MM	ST – ST		
33	1 – 2	VI2 – VI2	MM	ST – ST	35.5	-29.5
33	3 – 4	VI2 – VI2	MM	ST – ST		
33	5 – 6	VI2 – VI2	MM	ST – ST		
33	7 – 8	VI2 – VI2	MM	ST – ST		
33	9 – 10	VI2 – VI2	MM	ST – ST		
33	11 – 12	VLTI Laser Interlock SPARE	MM	ST – ST		
33	13 – 14	VLTI Laser Interlock UT1	MM	ST – ST		
33	15 – 16	VLTI Laser Interlock UT2	MM	ST – ST		
33	17 – 18	VLTI Laser Interlock UT3	MM	ST – ST		
33	19 – 20	VLTI Laser Interlock UT4	MM	ST – ST		
33	21 – 22	Free - Free	MM	ST – ST		
33	23 – 24	Free - Free	MM	ST – ST		
45	1 – 2	Lariris TIM - Free	MM	ST – ST		
45	3 – 4	Ldlfacu TIM - Free	MM	ST – ST		
45	5 – 6	Free - Free	MM	ST – ST		
45	7 – 8	Free - Free	MM	ST – ST		
45	9 – 10	Free - Free	MM	ST – ST		





45	11 – 12	Free - Free	MM	ST – ST		
45	13 – 14	Free - Free	MM	ST – ST		
45	15 – 16	Free - Free	MM	ST – ST		
45	17 – 18	Free - Free	MM	ST – ST		
45	19 – 20	Free - Free	MM	ST – ST		
45	21 – 22	Free - Free	MM	ST – ST		
45	23 – 24	Free - Free	MM	ST – ST		

**Table 49: data distribution network SCP usage in the Storage room. TBC indicates that a fibre is connected to the port but the exact usage has to be confirmed. Ports of SCP 31 and 33 are pre-allocated to the visitor foci VI1 and VI2.**

## 9. Interface between the VLTI complex cable routing network and the instruments

The VLTI complex is equipped with a network cable trays and feedthrough to allow routing cables to and from almost any location.

### 9.1 Cable trays network

The layout of the network of cable trays is defined in AD1.

9.1.1 ARAL

9.1.2 DDL

9.1.3 DL

9.1.4 MATISSE

9.1.5 Gravity

9.1.6 PIONIER

9.1.7 Visitor 1

9.1.8 Visitor 2

### 9.2 Feedthroughs

The characteristics and usage of the feedthroughs leading to the VLTI Laboratory are defined in Table 50.

Ref. #	From:	To:	Number and Shape	Approx. height wrt floor	Size (mm x mm, Ø mm)	Detailed drawing	Usage	Wall thickness (mm)
1	VLTI Laboratory	Storage room	1 rectangular	115 mm	110*680	AD1	ARAL, VISITOR 1	1240



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2	VLTl Laboratory	Storage room	1 rectangular	2355 mm	110 x 670	AD1	Reserved for cryogenics piping (IRIS and possibly VISITOR1 and 2)	1240
3	VLTl Laboratory	Storage room	8 circular	500 mm	150	AD1	3-1: VISITOR 2 3-2: VISITOR 2 3-3: IRIS cryo controller + 4 ARAL motor cables 3-4: VIBMET 3-5: VISITOR 2 3-6: VISITOR 2 3-7: MARCEL blackbody fiber + PRIMA FE Patch cord 3-8: VISITOR 2	1240
4	VLTl Laboratory	CCL	1 rectangular	100 mm	135 x 490	AD1	MATISSE LN2 refill and exhaust lines + cables	985
5	VLTl Laboratory	CCL	1 rectangular	2300 mm	640 x 130	AD1	GRAVITY LN2 refill + cables	985
6	VLTl Laboratory	CCL	1 circular	1460 mm	65	AD1		985
7	VLTl Laboratory	CCL	1 circular	1175 mm	80	AD1		985
8	VLTl Laboratory	CCL	1 circular	190 mm	200	AD1	GRAVITY flex-line	985
9	VLTl Laboratory	CCL	1 circular	210 mm	200	AD1		985
10	VLTl Laboratory	CCL	1 circular	165 mm	200	AD1		985
11	VLTl Laboratory	CCL	1 circular	2810 mm	200	AD1	MATISSE L band: - PTC flexline	985
12	VLTl Laboratory	CCL	1 circular	2810 mm	200	AD1	MATISSE N band: - PTC flexline	985
13	VLTl Laboratory	CCL	1 rectangular			AD1	GRAVITY exhaust flex line	985
14	VLTl Laboratory	VLTl Tunnel				AD1	PIONIER	
15	VLTl Laboratory	VLTl Tunnel				AD1	PIONIER	



**Table 50: characteristics and usage of the feedthroughs leading to the VLTI Laboratory.**

## 10. Optical interface between the VLTI and the instruments

### 10.1 Pupil

#### 10.1.1 Pupil shape and diameter

In both AT and UT cases, the aperture stop is the M2.

The pupil diameter in the laboratory is the same when using ATs or UTs. Due to a non-conformity of AT1 STS optics, the pupil delivered by AT1 in the laboratory has a slightly larger diameter, RD7 and RD8.

Telescope	Pupil diameter (mm)	
	AT	UT
1	19.8 +/- 0.3	18.0 +/- 0.3
3	18.0 +/- 0.3	18.0 +/- 0.3
5	18.0 +/- 0.3	18.0 +/- 0.3
7	18.0 +/- 0.3	18.0 +/- 0.3

**Table 51: pupil diameter in the laboratory.**

#### 10.1.2 Pupil position

##### 10.1.2.1 Nominal position

The pupil is reimaged several times along the VLTI optical train. Their nominal position in the laboratory are defined in Table 52 and are identical when using ATs or UTs.

IP	U (m)	V(m)	W(m)
1	45.560	-34.215	-1.490
3	45.560	-33.975	-1.490
5	45.560	-33.735	-1.490
7	45.560	-33.495	-1.490

**Table 52: nominal position of the pupil in the VLTI laboratory for IP1, 3, 5 and 7.**

##### 10.1.2.1.1 Case of Gravity

In the case of Gravity the pupil is positioned about 20 cm downstream of the nominal position due to the current location of the Beam Combiner Instrument.

IP	U (m)	V(m)	W(m)
1	45.360	-34.215	-1.490
3	45.360	-33.975	-1.490



5	45.360	-33.735	-1.490
7	45.360	-33.495	-1.490

**Table 53: nominal position of the pupil in the VLTI laboratory for IP1, 3, 5 and 7 when used with Gravity.**

### 10.1.2.2 Lateral position accuracy

Right after alignment on IRIS, the lateral position of the pupil is accurate within +/- % of the pupil diameter.

Then, during operation, several contributions degrade the pupil position accuracy as defined in Table 54 for the ATs and Table 55 for the UTs.

The contribution of the DLs increases with the OPL of DL due to the increasing curvature of the VCM. The data in the table below are for the worst case, i.e the DL at the end of the rails. The DL imperfect rail shape generates instability at different spatial frequencies. The wobble is due to the carriage wheels and its period is 2.46 m OPL. The hysteresis appears when the carriage changes direction. The magnitude of the hysteresis is very different from one DL to another and depends on the temperature of the tunnel, i.e the time of the year. Statistics of the effects of the hysteresis on the pupil motion are given in Annex D: statistics of the pupil motion due to hysteresis.

The effect of turbulence in the light ducts and tunnel is neglectable compared to the motion introduced by the telescope and the DL.

	AT azimuth runout	AT derotator runout	DL rail shape + wobble	DL hysteresis
Pupil lateral position error (% of diameter)	< 5 %	< 5 %	< 5 %	< 20 %

**Table 54: pupil lateral instability with the ATs**

	UT azimuth runout	DL rail shape + wobble	DL hysteresis
Pupil lateral position error (% of diameter)	< 5 %	< 5 %	< 20 %

**Table 55: pupil lateral instability with the UTs**

### 10.1.2.3 Longitudinal position accuracy

The VCM inside the delay line has the function to re-image the pupil at a desired location in the interferometric lab. In the current lab configuration, the VCM re-images the pupils at the locations defined in Table 52.

Currently, the pupil position can be blindly positioned with a precision of +/- 3 m before the Beam Compressors depending on the interferometer arm configuration. As the residual error for a given configuration (station + DL + input channel) is repeatable over time, the actual error after calibration can be reduced to +/- 250 mm before the Beam Compressor which corresponds to +/- 12.8 mm after the beam compressor.

	UT	AT
Longitudinal position error after the BC	+/- 12.8 mm	+/- 12.8 mm



**Table 56: pupil longitudinal position error after the BC.**

### 10.1.3 Pupil rotation

The pupil rotation is in general defined in a differential manner:

The pupil rotation for any telescope position is the rotation angle which allows to superimpose the pupil as it is seen in this position to the pupil as seen when the telescope is in its reference position.

As it is not practical to have a differential definition, we defined it in an “absolute” way in the pupil plane located after the switchyard as being the angle of the Y axis of the M2 in the Paranal (V,W) reference frame.

The pupil rotation  $\nu$  after the switchyard is given by:

$$\nu = \pm(a - A - 90^\circ) + \Delta\nu + \theta_{rot}$$

With:

1. a telescope altitude angle,
2. A telescope azimuth angle,
3.  $\Delta\nu$  angle in the (V,W) reference frame of the Y axis of the M2 imaged after the switchyard when the telescope is in its reference position,
4.  $\theta_{rot}$  the angle of the derotator with respect to its reference position.

The  $\Delta\nu$  sign depends on possible rotation between the telescope Coudé and the VLTI laboratory.

$\theta_{rot}$  is always 0 for the UTs since they do not use a derotator.

	Reference position	Pupil rotation
AT on a Northern station	Atitude = 90 ° Azimuth = 0 ° Derotator = 0 °	$\nu = a - A + 12.98^\circ + \theta_{rot}$
AT on a Southern station	Atitude = 90 ° Azimuth = 0 ° Derotator = 0 °	$\nu = a - A - 167.02^\circ + \theta_{rot}$
UT	Atitude = 90 ° Azimuth = 0 °	$\nu = -a + A - 12.98^\circ$

**Table 57: pupil rotation after the switchyard.**

The errors in the orientation of the pupil will be dominated by alignment errors of the mirrors in the complete optical train (e.g. M9 misalignment around the Azimuth axis). The expected pupil orientation errors is  $< \pm 60$  arcmin.



## 10.2 Wavefront

### 10.2.1 Field of view

#### 10.2.1.1 At coude focus

The Field Of View (diameter) available at the coudé focus is as follows:

	UT	AT
Unvignetted FOV	> 120 arcsec	> 120 arcsec

**Table 58: Field Of View (on the sky) at the coudé focus.**

The guide star used by the adaptive optics system, CIAO or MACAO on UTs and NAOMI on the ATs, must be selected within this FOV.

#### 10.2.1.2 In the VLTI laboratory

The Field Of View (diameter) available at the input of the instrument is as follows:

	UT	AT
Unvignetted FOV	> 2 arcsec	> 4 arcsec

**Table 59: Field Of View (on the sky) at instrument input.**

The STS allows to pick up 1 field of diameter as mentioned in Table 59 anywhere on a global Coudé field of view of 120 arcsec diameter.

### 10.2.2 Field of view orientation

### 10.2.3 Wavefront quality

### 10.2.4 Residual tip-tilt

## 10.3 Optical transmission

The transmission values given in this section are defined as the ratio of the number of photons after reflection on the switchyard over the number of photons incident on the telescope primary mirror. These transmission values are therefore specific to the VLTI configuration (telescope used, single or double feed) and to the waveband considered.

	V band	J band	H band	K band	L band	N band
AT	< 0.2 %	> 11 %	> 23 %	> 28 %	> 29 %	> 33 %
UT	< 0.2 %	> 6 %	> 12 %	> 18 %	> 19 %	> 21 %

For information only, the evolution of the infrared transmission as measured on IRIS over several years is given in Annex E: Infrared transmission monitoring.

## 10.4 Polarization



## 11. Interface between the VLTI complex safety systems and the instruments

### 11.1 Central Alarm System

The Central Alarm System is described in RD4. In the VLTI complex, one Alarm Connection Point (ACP) box is available behind the Gravity cabinets. Its usage is summarized in Table 60.

CAS box input	System
0	?
1	-
2	GRAVITY
3	-
4	Oxygen sensors
5	-
6	ESPRESSO
7	-
8	-
9	FINITO (to be removed)
10	-
11	-
12	MATISSE
13	-
14	ESPRESSO
15	-

Table 60: usage of the CAS ACP located in the CCL.

### 11.2 VLTI Laser interlock

The VLTI Laser Interlock System implementation and operation are described in RD5.

The subsystems connected to the VLTI Laser Interlock are:

1. Gravity safety shutters.
2. VIBMET laser.



## 12. Software interface between the VLTI and the instruments

The main software interface between an instrument and VLTI is the Interferometer Supervisor Software, Section 12.1. An instrument may also be interfaced via the reflective memory network, Section 12.2.

### 12.1 Interferometer Supervisor Software

Interfaces between the instrument and the Interferometer Supervisor Software are described in the dedicated document AD7.

### 12.2 Reflective Memory Network software interface

The physical interface to the RMN is described in Section 8.3. The software interface corresponds to the assignment of the memory addresses to the different subsystems writing on the RMN. This is handled by the `rmassLayout.h` file available in Annex C: `rmassLayout.h`.





# 13. Annex A: Power Conditioning System Technical Specifications



## 8 ELECTRICAL PERFORMANCES

### 8.1 ACCEPTABLE MAINS TOLERANCE IN CONDITIONING MODE

Characteristic	Value
Frequency tolerance (Permanent)	$\pm 0.4$ Hz
Voltage tolerance (Permanent)	$\pm 10$ %

### 8.2 VOLTAGE REGULATION (CONDITIONING AND INDEPENDENT MODE)

Conditions	Value
In steady state conditions	$\pm 1$ %
For load variation of 10%	$\pm 1$ %
For load variation of 50%	$\pm 3$ %
On mains failure at 100% load	$\pm 5$ %

### 8.3 FREQUENCY REGULATION IN INDEPENDENT MODE

Conditions	Value
In steady state conditions	$\pm 0.2$ %
For load variation of 10%	$\pm 0.5$ %
For load variation of 50%	$\pm 1$ Hz
On mains failure at 100% load	$\pm 1$ Hz

### 8.4 HARMONICS

Characteristic	Value
Total harmonic distortion (THD) on linear load	$\leq 3$ %

### 8.5 PHASE ANGLE

Conditions	Value
With balanced load	$120^\circ \pm 0^\circ$
With 25 % unbalanced load	$120^\circ \pm 1^\circ$

**NOTE:**

- Typical values

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Figure 27: Technical specifications of the power delivered by the Power Conditioning System.

## 14. Annex B: UPS Technical Specifications



# 15. Annex C: rmassLayout.h

```

/*****
* E.S.O. - VLT project
*
* "@(#) $Id: rmassLayout.h 305507 2018-01-19 15:24:31Z rabuter $"
*
* who      when      what
* -----  -
* rabuter  2018-01-19  added defines for FTKSENS and modified type from DOUBLE to UINT32 for the
flag
* rdembet  2018-01-11  Fixed typos for MTLPIS and MTNPIS
* rdembet  2017-12-14  Clean up and merged VIBMET, GRAVITY & MATISSE areas
* smorel   2017-03-09  Added MATISSE areas
* tphan    2016-03-17  Commented out Matisse and PRIMA. Re-organise order of nodes.
* rdembet  2015-11-10  Add new items in GR OPDC table
* tphan    2015-08-23  Commented out wvgrmn
* tphan    2015-07-27  Added wmt.
* tphan    2015-06-30  Added wvgrmn.
* rabuter  2015-06-23  change lgvft3 to wgvkalm
* sg/ekw   2015-03-20  Adopt to new Metrology Design
*
*          Date shift due to SVN confusions
* tphan    2015-03-22  Removed PRIMA LCUs from RMN ring.
* lb       2015-01-29  Corrected FDDL numbering
* rabuter  2015-01-29  Added TTP GRAVITY area
* tphan    2014-12-25  Updated GRAVITY layout.
* tphan    2014-07-10  Added RFM to DLs.
* tphan    2014-05-27  Added Matisse node ids. Moved rmassRMN_LAYOUT from rmassPublic.h.
* ekw      2014-05-12  Added lgvttp TTP_NODE
* rabuter  2013-05-02  Added Gravity node ids
* aramirez 2011-10-08  PPRS41845 Updated names in list of nodes, as per
*
*          VLT-SPE-ESO-17100-3439
* swehner  2008-10-05  Created
*/

/*****
*
* -----
*/

#ifndef RMASS_LAYOUT_H
#define RMASS_LAYOUT_H

```



```

/*****
 * Contains the public global data and data type definitions
 * to be used in accessing the Reflective Memory in a safe way
 *-----
 */

/*
 ****
 * Header Files
 ****
 */

/* System Includes */

/*
 ****
 * Data Types
 ****
 */

#define rmassRfmBUFFER_LENGTH_DMA 128

/*
 * The rmassRMN_LAYOUT data structure will contain a list of all
 * data fields in the RMN window. It contains
 * - a _description_ in clear text
 * - a _token_, a short mnemonic string of max. 8 characters (has to be unique)
 * - the value's unit
 * - the frequency with which the data is provided (in Hertz)
 * - the data _type_ of the stored value
 * - and the _offset_ in the RMN window.
 *
 */
#define rmassTOKEN_LEN 8

typedef struct {
    char        description[70];
    char        token[rmassTOKEN_LEN+1];
    char        unit[12];
    double      period;
    rmassRMN_DATA_TYPE type;
    unsigned int offset;
}

```



```
} rmassRMN_LAYOUT;

/*
*****
* List of nodes
*****
*/

/*****
* Contains the public global data and data type definitions
* to be used in accessing the Reflective Memory in a safe way
*-----
*/

#define rmassOPDC_NODE      0x20
#define rmassOPDM_NODE     0x01

#define rmassIRIS_NODE     0x03

/* FINITO : ADU 0x4 ACU 0x5 */
#define rmassFSU_NODE      0x04
#define rmassFINITO_NODE  0x04

/* Delay Lines 1 to 8 */
#define rmassDL1_NODE     0x08
#define rmassDL2_NODE     0x09
#define rmassDL3_NODE     0x0A
#define rmassDL4_NODE     0x0B
#define rmassDL5_NODE     0x0C
#define rmassDL6_NODE     0x0D
#define rmassDL7_NODE     0x0E /* reserved in VLT-SPE-ESO-17100-343 */
#define rmassDL8_NODE     0x0F /* reserved */

/* DDL : dOPDC */
#define rmassDOPDC_NODE   0x10

/* PRIMA: LCU/WS re-used in the VIBMET project */
#define rmassVIBMET_ACQ   0x13
#define rmassVIBMET_WS    0x28

/* DDL 1 to 4 */
#define rmassDDL1_NODE    0x15
#define rmassDDL2_NODE    0x16
```



```
#define rmassDDL3_NODE      0x17
#define rmassDDL4_NODE      0x18 /* 0x19-0x1A reserved */
#define rmassDDL5_NODE      0x19
#define rmassDDL6_NODE      0x1A
#define rmassDDL7_NODE      0x1B
#define rmassDDL8_NODE      0x1C

/* RMN Recorder */
#define rmassRMNREC_NODE    0x1D

/* PRIMA: FSU A/B ACU's */
#define rmassPRIFSUA_ACU_NODE 0x1E
#define rmassPRIFSUB_ACU_NODE 0x1F

/* RMN Monitor */
#define rmassRMNMON_NODE    0x21

/* RMN Analysis WS. TPH 20150630 */
#define rmassRMNANALYSIS_NODE 0x22

/* MIDI */
#define rmassMILCU_NODE     0x30

/* VINCI */
#define rmassVWVDC_NODE     0x40
#define rmassVNLCU_NODE     0x41 /* not connected */

/* MACAO */
#define rmassMACAO_UT1_NODE  0x51
#define rmassMACAO_UT2_NODE  0x52
#define rmassMACAO_UT3_NODE  0x53
#define rmassMACAO_UT4_NODE  0x54

/* Nodes 0x55-60 reserved */

/* MANHATTAN2 */
#define rmassMANHATTAN_UT1_NODE 0x61
#define rmassMANHATTAN_UT2_NODE 0x62
#define rmassMANHATTAN_UT3_NODE 0x63
#define rmassMANHATTAN_UT4_NODE 0x64

/* PIONIER */
#define rmassPIONIER_NODE    0x70
```



```
/* GRAVITY */
#define rmassGRAV_METROLOGY_NODE    0x80
#define rmassGRAV_FDDL_NODE         0x81
#define rmassGRAV_PHASESENSOR_NODE  0x82
#define rmassGRAV_OPDC_NODE         0x83
#define rmassGRAV_KALMAN_NODE       0x84
#define rmassGRAV_TTP_NODE          0x85

#define rmassGRAV_RMNREC_NODE       0x8D

/* MATISSE */
#define rmassMATISSE_WS_NODE        0x90
#define rmassMATISSE1_NODE          0x91
#define rmassMATISSE2_NODE          0x92

/* Identifier of instrument Using the delay offset for Fringe Tracking*/
#define rmassFTKSENS_NONE           0
#define rmassFTKSENS_GRAVITY        1
#define rmassFTKSENS_MATISSE        2

/*
 * Please put the LCUs in this list in the order in which they appear
 * in the new Rm ring.
 * Extracted and to be updated from VLT-SPE-ESO-17100-3439, issue 5.0.
 */

rmassNODE_TYPE rmnNodes[] = {
/* {"lvgmon", rmassRMNMON_NODE, 0, 0.0},
   {"ldlvib4", rmassMANHATTAN_UT4_NODE, 0, 0.0},
   {"ldl16", rmassDL6_NODE, 0, 0.0},
   {"ldl15", rmassDL5_NODE, 0, 0.0},
   {"ldl14", rmassDL4_NODE, 0, 0.0},
   {"ldl1fadu", rmassFINITO_NODE, 0, 0.0},
   {"ldl1facu", rmassFINITO_NODE+1, 0, 0.0},
   {"lmiiics1", rmassMILCU_NODE, 0, 0.0},
   {"ldlvib3", rmassMANHATTAN_UT3_NODE, 0, 0.0},
   {"ldlopdc", rmassOPDC_NODE, 0, 0.0},
   {"lvgrec", rmassRMNREC_NODE, 0, 0.0},
   {"ldlopdm", rmassOPDM_NODE, 0, 0.0},
```



```
    {"ld13",    rmassDL3_NODE, 0, 0.0},
    {"ld12",    rmassDL2_NODE, 0, 0.0},
    {"ld11",    rmassDL1_NODE, 0, 0.0},
    {"ldlvib2", rmassMANHATTAN_UT2_NODE, 0, 0.0},
    {"ldlvib1", rmassMANHATTAN_UT1_NODE, 0, 0.0},
*/ {"",        -1, 0, 0.0}
};

/*
* Please put the LCUs in this list in the order in which they appear
* in the new Rm ring.
* Extracted and to be updated from VLT-SPE-ESO-17100-3439, issue 5.0.
*/

rmassNODE_TYPE rfmNodes[] = {
    {"lariris", rmassIRIS_NODE, 0, 0.0},
    {"ldlfacu", rmassFINITO_NODE+1, 0, 0.0},
    {"ldlfa du", rmassFINITO_NODE, 0, 0.0},

    {"lgvrec",  rmassGRAV_RMNREC_NODE, 0, 0.0},
    {"lgvttp",  rmassGRAV_TTP_NODE, 0, 0.0},
    {"lgvdd1",  rmassGRAV_FDDL_NODE, 0, 0.0},
    {"lgvmet",  rmassGRAV_METROLOGY_NODE, 0, 0.0},
    {"wgvkalm", rmassGRAV_KALMAN_NODE, 0, 0.0},
    {"lgvft1",  rmassGRAV_PHASESENSOR_NODE, 0, 0.0},
    {"lgvft2",  rmassGRAV_OPDC_NODE, 0, 0.0},

    {"ldlvib1", rmassMANHATTAN_UT1_NODE, 0, 0.0},
    {"ldlvib2", rmassMANHATTAN_UT2_NODE, 0, 0.0},
    {"ldlvib3", rmassMANHATTAN_UT3_NODE, 0, 0.0},
    {"ldlvib4", rmassMANHATTAN_UT4_NODE, 0, 0.0},

    {"ldlopdc", rmassOPDC_NODE, 0, 0.0},
    {"ldlopdm", rmassOPDM_NODE, 0, 0.0},
    {"lvgreg",  rmassRMNREC_NODE, 0, 0.0},
    {"lvgmon",  rmassRMNMON_NODE, 0, 0.0},

    {"ld11",    rmassDL1_NODE, 0, 0.0},
    {"ld12",    rmassDL2_NODE, 0, 0.0},
    {"ld13",    rmassDL3_NODE, 0, 0.0},
    {"ld14",    rmassDL4_NODE, 0, 0.0},
    {"ld15",    rmassDL5_NODE, 0, 0.0},
    {"ld16",    rmassDL6_NODE, 0, 0.0},
```



```
    {"lvbacq", rmassVIBMET_ACQ, 0, 0.0},
    {"wvbmets", rmassVIBMET_WS, 0, 0.0},

/* {"wmt", rmassMATISSE_WS_NODE, 0, 0.0}, */
/* {"lmtics1", rmassMATISSE1_NODE, 0, 0.0}, */
/* {"lmtics2", rmassMATISSE2_NODE, 0, 0.0}, */

/* {"wvgrmn", rmassRMNANALYSIS_NODE, 0, 0.0}, */
/* {"wpndcs", rmassPIONIER_NODE, 0, 0.0}, */
    {"", -1, 0, 0.0}
};

/* IMPORTANT:
* - The token has to be unique!
* - The list has to be ordered by increasing memory offsets
* - By agreement the tokens are grouped to messages which comprise of
* contiguous fields which usually belong to a particular subsystem.
* The first fields of each message contain a timestamp
*/

const rmassRMN_LAYOUT rmassRmnTable[] = {
    { "OPD DL1 Time sec", "OPD1TS", "", 0.5e-3, rmassTIMESEC, 1 },
    { "OPD DL1 Time usec", "OPD1TUS", "", 0.5e-3, rmassTIMEUSEC, 2 },
    { "OPD DL1 Rt Offset", "OPD1OFF", "", 0.5e-3, rmassDOUBLE, 4 },
    { "OPD DL1 Fringes detected", "OPD1FDET", "", 0.5e-3, rmassINT32, 5 },
    { "OPD DL1 Offset valid", "OPD1OFFV", "", 0.5e-3, rmassINT32, 6 },

    { "OPD DL2 Time sec", "OPD2TS", "", 0.5e-3, rmassTIMESEC, 26 },
    { "OPD DL2 Time usec", "OPD2TUS", "", 0.5e-3, rmassTIMEUSEC, 27 },
    { "OPD DL2 Rt Offset", "OPD2OFF", "", 0.5e-3, rmassDOUBLE, 29 },
    { "OPD DL2 Fringes detected", "OPD2FDET", "", 0.5e-3, rmassINT32, 30 },
    { "OPD DL2 Offset valid", "OPD2OFFV", "", 0.5e-3, rmassINT32, 31 },

    { "OPD DL3 Time sec", "OPD3TS", "", 0.5e-3, rmassTIMESEC, 51 },
    { "OPD DL3 Time usec", "OPD3TUS", "", 0.5e-3, rmassTIMEUSEC, 52 },
    { "OPD DL3 Rt Offset", "OPD3OFF", "", 0.5e-3, rmassDOUBLE, 54 },
    { "OPD DL3 Fringes detected", "OPD3FDET", "", 0.5e-3, rmassINT32, 55 },
    { "OPD DL3 Offset valid", "OPD3OFFV", "", 0.5e-3, rmassINT32, 56 },

    { "OPD DL4 Time sec", "OPD4TS", "", 0.5e-3, rmassTIMESEC, 76 },
    { "OPD DL4 Time usec", "OPD4TUS", "", 0.5e-3, rmassTIMEUSEC, 77 },
    { "OPD DL4 Rt Offset", "OPD4OFF", "", 0.5e-3, rmassDOUBLE, 79 },
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{ "OPD DL4 Fringes detected",	"OPD4FDET",	"",	0.5e-3,	rmasINT32,	80 },
{ "OPD DL4 Offset valid",	"OPD4OFFV",	"",	0.5e-3,	rmasINT32,	81 },
{ "OPD DL5 Time sec",	"OPD5TS",	"",	0.5e-3,	rmasTIMESEC,	101 },
{ "OPD DL5 Time usec",	"OPD5TUS",	"",	0.5e-3,	rmasTIMEUSEC,	102 },
{ "OPD DL5 Rt Offset",	"OPD5OFF",	"",	0.5e-3,	rmasDOUBLE,	104 },
{ "OPD DL5 Fringes detected",	"OPD5FDET",	"",	0.5e-3,	rmasINT32,	105 },
{ "OPD DL5 Offset valid",	"OPD5OFFV",	"",	0.5e-3,	rmasINT32,	106 },
{ "OPD DL6 Time sec",	"OPD6TS",	"",	0.5e-3,	rmasTIMESEC,	126 },
{ "OPD DL6 Time usec",	"OPD6TUS",	"",	0.5e-3,	rmasTIMEUSEC,	127 },
{ "OPD DL6 Rt Offset",	"OPD6OFF",	"",	0.5e-3,	rmasDOUBLE,	129 },
{ "OPD DL6 Fringes detected",	"OPD6FDET",	"",	0.5e-3,	rmasINT32,	130 },
{ "OPD DL6 Offset valid",	"OPD6OFFV",	"",	0.5e-3,	rmasINT32,	131 },
{ "DL 1 timestamp sec",	"DL1TS",	"",	0.5e-3,	rmasTIMESEC,	251 },
{ "DL 1 timestamp usec",	"DL1TUS",	"",	0.5e-3,	rmasTIMEUSEC,	252 },
{ "DL 1 current position",	"DL1POS",	"",	0.5e-3,	rmasDOUBLE,	254 },
{ "DL 1 tracking OK flag",	"DL1TRK",	"",	0.5e-3,	rmasUINT32,	255 },
{ "DL 1 position error",	"DL1ERR",	"",	0.5e-3,	rmasDOUBLE,	256 },
{ "DL 1 position setpoint",	"DL1PSP",	"",	0.5e-3,	rmasDOUBLE,	257 },
{ "DL 1 ratelim position",	"DL1RLP",	"",	0.5e-3,	rmasDOUBLE,	258 },
{ "DL 1 ratelim active",	"DL1RLA",	"",	0.5e-3,	rmasINT32,	259 },
{ "DL 2 timestamp sec",	"DL2TS",	"",	0.5e-3,	rmasTIMESEC,	276 },
{ "DL 2 timestamp usec",	"DL2TUS",	"",	0.5e-3,	rmasTIMEUSEC,	277 },
{ "DL 2 current position",	"DL2POS",	"",	0.5e-3,	rmasDOUBLE,	279 },
{ "DL 2 tracking OK flag",	"DL2TRK",	"",	0.5e-3,	rmasUINT32,	280 },
{ "DL 2 position error",	"DL2ERR",	"",	0.5e-3,	rmasDOUBLE,	281 },
{ "DL 2 position setpoint",	"DL2PSP",	"",	0.5e-3,	rmasDOUBLE,	282 },
{ "DL 2 ratelim position",	"DL2RLP",	"",	0.5e-3,	rmasDOUBLE,	283 },
{ "DL 2 ratelim active",	"DL2RLA",	"",	0.5e-3,	rmasINT32,	284 },
{ "DL 3 timestamp sec",	"DL3TS",	"",	0.5e-3,	rmasTIMESEC,	301 },
{ "DL 3 timestamp usec",	"DL3TUS",	"",	0.5e-3,	rmasTIMEUSEC,	302 },
{ "DL 3 current position",	"DL3POS",	"",	0.5e-3,	rmasDOUBLE,	304 },
{ "DL 3 tracking OK flag",	"DL3TRK",	"",	0.5e-3,	rmasUINT32,	305 },
{ "DL 3 position error",	"DL3ERR",	"",	0.5e-3,	rmasDOUBLE,	306 },
{ "DL 3 position setpoint",	"DL3PSP",	"",	0.5e-3,	rmasDOUBLE,	307 },
{ "DL 3 ratelim position",	"DL3RLP",	"",	0.5e-3,	rmasDOUBLE,	308 },
{ "DL 3 ratelim active",	"DL3RLA",	"",	0.5e-3,	rmasINT32,	309 },
{ "DL 4 timestamp sec",	"DL4TS",	"",	0.5e-3,	rmasTIMESEC,	326 },



```
{ "DL 4 timestamp sec",          "DL4TUS",    "",    0.5e-3,  rmassTIMEUSEC,  327 },
{ "DL 4 current position",      "DL4POS",    "",    0.5e-3,  rmassDOUBLE,    329 },
{ "DL 4 tracking OK flag",      "DL4TRK",    "",    0.5e-3,  rmassUINT32,    330 },
{ "DL 4 position error",       "DL4ERR",    "",    0.5e-3,  rmassDOUBLE,    331 },
{ "DL 4 position setpoint",     "DL4PSP",    "",    0.5e-3,  rmassDOUBLE,    332 },
{ "DL 4 ratelim position",      "DL4RLP",    "",    0.5e-3,  rmassDOUBLE,    333 },
{ "DL 4 ratelim active",       "DL4RLA",    "",    0.5e-3,  rmassINT32,     334 },

{ "DL 5 timestamp sec",        "DL5TS",     "",    0.5e-3,  rmassTIMESEC,   351 },
{ "DL 5 timestamp usec",       "DL5TUS",    "",    0.5e-3,  rmassTIMEUSEC,  352 },
{ "DL 5 current position",     "DL5POS",    "",    0.5e-3,  rmassDOUBLE,    354 },
{ "DL 5 tracking OK flag",     "DL5TRK",    "",    0.5e-3,  rmassUINT32,    355 },
{ "DL 5 position error",      "DL5ERR",    "",    0.5e-3,  rmassDOUBLE,    356 },
{ "DL 5 position setpoint",    "DL5PSP",    "",    0.5e-3,  rmassDOUBLE,    357 },
{ "DL 5 ratelim position",     "DL5RLP",    "",    0.5e-3,  rmassDOUBLE,    358 },
{ "DL 5 ratelim active",      "DL5RLA",    "",    0.5e-3,  rmassINT32,     359 },

{ "DL 6 timestamp sec",        "DL6TS",     "",    0.5e-3,  rmassTIMESEC,   376 },
{ "DL 6 timestamp usec",       "DL6TUS",    "",    0.5e-3,  rmassTIMEUSEC,  377 },
{ "DL 6 current position",     "DL6POS",    "",    0.5e-3,  rmassDOUBLE,    379 },
{ "DL 6 tracking OK flag",     "DL6TRK",    "",    0.5e-3,  rmassUINT32,    380 },
{ "DL 6 position error",      "DL6ERR",    "",    0.5e-3,  rmassDOUBLE,    381 },
{ "DL 6 position setpoint",    "DL6PSP",    "",    0.5e-3,  rmassDOUBLE,    382 },
{ "DL 6 ratelim position",     "DL6RLP",    "",    0.5e-3,  rmassDOUBLE,    383 },
{ "DL 6 ratelim active",      "DL6RLA",    "",    0.5e-3,  rmassINT32,     384 },

{ "RMAS AVISO timestamp sec",   "RMASSTS",   "",    0.0,     rmassTIMESEC,   876 },
{ "RMAS AVISO timestamp usec",  "RMASSTUS",  "",    0.0,     rmassTIMEUSEC,  877 },
{ "RMAS AVISO version",        "RMASVER",   "",    0.0,     rmassDOUBLE,    878 },
{ "RMAS AVISO RMN node",       "RMASRMND",  "",    0.0,     rmassINT32,     879 },
{ "RMAS AVISO RFM node",       "RMASRFMD",  "",    0.0,     rmassINT32,     880 },
882 },
{ "RMAS AVISO RMN node which sees no other", "RMASRMN0", "", 0.0, rmassINT32,
883 },
{ "RMAS AVISO RFM node which sees no other", "RMASRFM0", "", 0.0, rmassINT32,

{ "RMAS VOID timestamp sec",    "VOIDTS",    "",    0.0,     rmassTIMESEC,   884 },
{ "RMAS VOID timestamp usec",   "VOIDTUS",   "",    0.0,     rmassTIMEUSEC,  885 },
{ "RMAS VOID (dummy) field ",   "VOID",      "",    0.0,     rmassDOUBLE,    886 },

/* rdembet : added new flag to know which fringe sensor is used */
{ "RMAS SOP FTK_Sensor timestamp sec", "FTKSTS", "", 0.0, rmassTIMESEC, 900 },
{ "RMAS SOP FTK_Sensor timestamp usec", "FTKSTUS", "", 0.0, rmassTIMEUSEC, 901 },
{ "RMAS SOP FTK_Sensor value", "FTKSENS", "", 0.0, rmassUINT32, 902 },
```



```
{ "MACAO UT1 time sec",          "MAC1TS",    "",    2.381e-3, rmassTIMESEC, 1251 },
{ "MACAO UT1 time usec",        "MAC1TUS",   "",    2.381e-3, rmassTIMEUSEC, 1252 },
{ "MACAO UT1 wavefront error",  "MAC1WF",    "",    2.381e-3, rmassDOUBLE, 1254 },
{ "MACAO UT1 wavefront valid",  "MAC1WVF",   "",    2.381e-3, rmassUINT32, 1255 },
{ "MACAO UT1 tip",              "MAC1TIP",   "",    2.381e-3, rmassDOUBLE, 1256 },
{ "MACAO UT1 tilt",             "MAC1TILT",  "",    2.381e-3, rmassDOUBLE, 1257 },

{ "MACAO UT2 time sec",          "MAC2TS",    "",    2.381e-3, rmassTIMESEC, 1276 },
{ "MACAO UT2 time usec",        "MAC2TUS",   "",    2.381e-3, rmassTIMEUSEC, 1277 },
{ "MACAO UT2 wavefront error",  "MAC2WF",    "",    2.381e-3, rmassDOUBLE, 1279 },
{ "MACAO UT2 wavefront valid",  "MAC2WVF",   "",    2.381e-3, rmassUINT32, 1280 },
{ "MACAO UT2 tip",              "MAC2TIP",   "",    2.381e-3, rmassDOUBLE, 1281 },
{ "MACAO UT2 tilt",             "MAC2TILT",  "",    2.381e-3, rmassDOUBLE, 1282 },

{ "MACAO UT3 time sec",          "MAC3TS",    "",    2.381e-3, rmassTIMESEC, 1301 },
{ "MACAO UT3 time usec",        "MAC3TUS",   "",    2.381e-3, rmassTIMEUSEC, 1302 },
{ "MACAO UT3 wavefront error",  "MAC3WF",    "",    2.381e-3, rmassDOUBLE, 1304 },
{ "MACAO UT3 wavefront valid",  "MAC3WVF",   "",    2.381e-3, rmassUINT32, 1305 },
{ "MACAO UT3 tip",              "MAC3TIP",   "",    2.381e-3, rmassDOUBLE, 1306 },
{ "MACAO UT3 tilt",             "MAC3TILT",  "",    2.381e-3, rmassDOUBLE, 1307 },

{ "MACAO UT4 time sec",          "MAC4TS",    "",    2.381e-3, rmassTIMESEC, 1326 },
{ "MACAO UT4 time usec",        "MAC4TUS",   "",    2.381e-3, rmassTIMEUSEC, 1327 },
{ "MACAO UT4 wavefront error",  "MAC4WF",    "",    2.381e-3, rmassDOUBLE, 1329 },
{ "MACAO UT4 wavefront valid",  "MAC4WVF",   "",    2.381e-3, rmassUINT32, 1330 },
{ "MACAO UT4 tip",              "MAC4TIP",   "",    2.381e-3, rmassDOUBLE, 1331 },
{ "MACAO UT4 tilt",             "MAC4TILT",  "",    2.381e-3, rmassDOUBLE, 1332 },

{ "VIBMET Time sec",            "VMETRTS",   "",    0.125e-3, rmassTIMESEC, 1501 },
{ "VIBMET Time usec",           "VMETRTUS",  "",    0.125e-3, rmassTIMEUSEC, 1502 },
{ "VIBMET Delta",               "VMETRD",    "",    0.125e-3, rmassDOUBLE, 1504 },
{ "VIBMET Delta val",           "VMETRDV",   "",    0.125e-3, rmassUINT32, 1505 },
{ "VIBMET Status",              "VMETRST",   "",    0.125e-3, rmassUINT32, 1506 },
{ "VIBMET DC Probe 650k",       "VMETRP6",   "",    0.125e-3, rmassDOUBLE, 1507 },
{ "VIBMET DC Probe 450k",       "VMETRP4",   "",    0.125e-3, rmassDOUBLE, 1508 },
{ "VIBMET DC Ref 650k",         "VMETRR6",   "",    0.125e-3, rmassDOUBLE, 1509 },
{ "VIBMET DC Ref 450k",         "VMETRR4",   "",    0.125e-3, rmassDOUBLE, 1510 },
```

/\* RFR: Added accelerometer data to RMN for VIBMET project, re-using unused PRIMA RMN offsets \*/

```
{ "Manhattan ACCEL1 sec",        "VMETTS1",   "",    0.25e-3, rmassTIMESEC, 1526 },
{ "Manhattan ACCEL1 usec",       "VMETTUS1",  "",    0.25e-3, rmassTIMEUSEC, 1527 },
```



```
{ "Manhattan ACCEL1 displace",      "VMETRD1",  "",  0.25e-3,  rmassDOUBLE,  1529 },
{ "Manhattan ACCEL2 sec",          "VMETTS2",  "",  0.25e-3,  rmassTIMESEC,  1551 },
{ "Manhattan ACCEL2 usec",        "VMETTUS2", "",  0.25e-3,  rmassTIMEUSEC, 1552 },
{ "Manhattan ACCEL2 displace",    "VMETRD2",  "",  0.25e-3,  rmassDOUBLE,  1554 },
{ "Manhattan ACCEL3 sec",          "VMETTS3",  "",  0.25e-3,  rmassTIMESEC,  1576 },
{ "Manhattan ACCEL3 usec",        "VMETTUS3", "",  0.25e-3,  rmassTIMEUSEC, 1577 },
{ "Manhattan ACCEL3 displace",    "VMETRD3",  "",  0.25e-3,  rmassDOUBLE,  1579 },
{ "Manhattan ACCEL4 sec",          "VMETTS4",  "",  0.25e-3,  rmassTIMESEC,  1601 },
{ "Manhattan ACCEL4 usec",        "VMETTUS4", "",  0.25e-3,  rmassTIMEUSEC, 1602 },
{ "Manhattan ACCEL4 displace",    "VMETRD4",  "",  0.25e-3,  rmassDOUBLE,  1604 },
{ "Manhattan DL1 sec",            "VIB1TS",   "",  0.25e-3,  rmassTIMESEC,  1751 },
{ "Manhattan DL1 usec",          "VIB1TUS",  "",  0.25e-3,  rmassTIMEUSEC, 1752 },
{ "Manhattan DL1 datachk",       "VIB1CHK",  "",  0.25e-3,  rmassUINT32,   1753 },
{ "Manhattan DL1 accel",         "VIB1ACC",  "",  0.25e-3,  rmassDOUBLE,   1754 },
{ "Manhattan DL1 displace",      "VIB1DPL",  "",  0.25e-3,  rmassDOUBLE,   1755 },
{ "Manhattan DL1 test",          "VIB1TST",  "",  0.25e-3,  rmassDOUBLE,   1756 },
{ "Manhattan DL2 sec",            "VIB2TS",   "",  0.25e-3,  rmassTIMESEC,  1776 },
{ "Manhattan DL2 usec",          "VIB2TUS",  "",  0.25e-3,  rmassTIMEUSEC, 1777 },
{ "Manhattan DL2 datachk",       "VIB2CHK",  "",  0.25e-3,  rmassUINT32,   1778 },
{ "Manhattan DL2 accel",         "VIB2ACC",  "",  0.25e-3,  rmassDOUBLE,   1779 },
{ "Manhattan DL2 displace",      "VIB2DPL",  "",  0.25e-3,  rmassDOUBLE,   1780 },
{ "Manhattan DL2 test",          "VIB2TST",  "",  0.25e-3,  rmassDOUBLE,   1781 },
{ "Manhattan DL3 sec",            "VIB3TS",   "",  0.25e-3,  rmassTIMESEC,  1801 },
{ "Manhattan DL3 usec",          "VIB3TUS",  "",  0.25e-3,  rmassTIMEUSEC, 1802 },
{ "Manhattan DL3 datachk",       "VIB3CHK",  "",  0.25e-3,  rmassUINT32,   1803 },
{ "Manhattan DL3 accel",         "VIB3ACC",  "",  0.25e-3,  rmassDOUBLE,   1804 },
{ "Manhattan DL3 displace",      "VIB3DPL",  "",  0.25e-3,  rmassDOUBLE,   1805 },
{ "Manhattan DL3 test",          "VIB3TST",  "",  0.25e-3,  rmassDOUBLE,   1806 },
{ "Manhattan DL4 sec",            "VIB4TS",   "",  0.25e-3,  rmassTIMESEC,  1826 },
{ "Manhattan DL4 usec",          "VIB4TUS",  "",  0.25e-3,  rmassTIMEUSEC, 1827 },
{ "Manhattan DL4 datachk",       "VIB4CHK",  "",  0.25e-3,  rmassUINT32,   1828 },
{ "Manhattan DL4 accel",         "VIB4ACC",  "",  0.25e-3,  rmassDOUBLE,   1829 },
{ "Manhattan DL4 displace",      "VIB4DPL",  "",  0.25e-3,  rmassDOUBLE,   1830 },
{ "Manhattan DL4 test",          "VIB4TST",  "",  0.25e-3,  rmassDOUBLE,   1831 },
{ "Manhattan DL5 sec",            "VIB5TS",   "",  0.25e-3,  rmassTIMESEC,  1851 },
```



{ "Manhattan DL5 usec",	"VIB5TUS",	"",	0.25e-3,	rmasstimeusec,	1852 },
{ "Manhattan DL5 datachk",	"VIB5CHK",	"",	0.25e-3,	rmasuint32,	1853 },
{ "Manhattan DL5 accel",	"VIB5ACC",	"",	0.25e-3,	rmasdouble,	1854 },
{ "Manhattan DL5 displace",	"VIB5DPL",	"",	0.25e-3,	rmasdouble,	1855 },
{ "Manhattan DL5 test",	"VIB5TST",	"",	0.25e-3,	rmasdouble,	1856 },
{ "Manhattan DL6 sec",	"VIB6TS",	"",	0.25e-3,	rmasstimeusec,	1876 },
{ "Manhattan DL6 usec",	"VIB6TUS",	"",	0.25e-3,	rmasstimeusec,	1877 },
{ "Manhattan DL6 datachk",	"VIB6CHK",	"",	0.25e-3,	rmasuint32,	1878 },
{ "Manhattan DL6 accel",	"VIB6ACC",	"",	0.25e-3,	rmasdouble,	1879 },
{ "Manhattan DL6 displace",	"VIB6DPL",	"",	0.25e-3,	rmasdouble,	1880 },
{ "Manhattan DL6 test",	"VIB6TST",	"",	0.25e-3,	rmasdouble,	1881 },
{ "FINITO Ch1 Times sec",	"FNT1TS",	"",	0.5e-3,	rmasstimeusec,	2001 },
{ "FINITO Ch1 Times usec",	"FNT1TUS",	"",	0.5e-3,	rmasstimeusec,	2002 },
{ "FINITO Ch1 Data check",	"FNT1CHK",	"",	0.5e-3,	rmasuint32,	2003 },
{ "FINITO Ch1 Coherence",	"FNT1CO",	"",	0.5e-3,	rmasdouble,	2004 },
{ "FINITO Ch1 Coherence valid",	"FNT1COV",	"",	0.5e-3,	rmasuint32,	2005 },
{ "FINITO Ch1 Phase",	"FNT1PH",	"",	0.5e-3,	rmasdouble,	2006 },
{ "FINITO Ch1 Phase valid",	"FNT1PHV",	"",	0.5e-3,	rmasuint32,	2007 },
{ "FINITO Ch1 SNR",	"FNT1SNR",	"",	0.5e-3,	rmasdouble,	2008 },
{ "FINITO Ch1 Comb. Coherence",	"FNT1CMB",	"",	0.5e-3,	rmasdouble,	2012 },
{ "FINITO Modulator scan",	"FNTMOD",	"",	0.5e-3,	rmasdouble,	2013 },
{ "FINITO Detector Phot0",	"FNTFX0",	"",	0.5e-3,	rmasdouble,	2014 },
{ "FINITO Detector Phot1",	"FNTFX1",	"",	0.5e-3,	rmasdouble,	2015 },
{ "FINITO Detector ITF1A",	"FNTFX1A",	"",	0.5e-3,	rmasdouble,	2016 },
{ "FINITO Detector ITF1B",	"FNTFX1B",	"",	0.5e-3,	rmasdouble,	2017 },
{ "FINITO Ch2 Times sec",	"FNT2TS",	"",	0.5e-3,	rmasstimeusec,	2026 },
{ "FINITO Ch2 Times usec",	"FNT2TUS",	"",	0.5e-3,	rmasstimeusec,	2027 },
{ "FINITO Ch2 Data check",	"FNT2CHK",	"",	0.5e-3,	rmasuint32,	2028 },
{ "FINITO Ch2 Coherence",	"FNT2CO",	"",	0.5e-3,	rmasdouble,	2029 },
{ "FINITO Ch2 Coherence valid",	"FNT2COV",	"",	0.5e-3,	rmasuint32,	2030 },
{ "FINITO Ch2 Phase",	"FNT2PH",	"",	0.5e-3,	rmasdouble,	2031 },
{ "FINITO Ch2 Phase valid",	"FNT2PHV",	"",	0.5e-3,	rmasuint32,	2032 },
{ "FINITO Ch2 SNR",	"FNT2SNR",	"",	0.5e-3,	rmasdouble,	2033 },
{ "FINITO Ch2 Comb. Coherence",	"FNT2CMB",	"",	0.5e-3,	rmasdouble,	2037 },
{ "FINITO Modulator scan Duplicate",	"FNTMODDU",	"",	0.5e-3,	rmasdouble,	2038 },
{ "FINITO Detector Phot0 Duplicate",	"FNTFX0DU",	"",	0.5e-3,	rmasdouble,	2039 },
{ "FINITO Detector Phot2",	"FNTFX2",	"",	0.5e-3,	rmasdouble,	2040 },
{ "FINITO Detector ITF2A",	"FNTFX2A",	"",	0.5e-3,	rmasdouble,	2041 },
{ "FINITO Detector ITF2B",	"FNTFX2B",	"",	0.5e-3,	rmasdouble,	2042 },



/\* TPH 20091126: new IRIS fields for PRIMA FSU test \*/

```
{ "IRIS Q1 Times sec",          "IRI1TS",    "",    1.0e-3,  rmasstimeSec,  2251 },
{ "IRIS Q1 Times sec",          "IRI1TUS",   "",    1.0e-3,  rmasstimeusec, 2252 },
{ "IRIS Q1 Data Check",         "IRI1CHK",   "",    1.0e-3,  rmassuint32,   2253 },
{ "IRIS Q1 Offset X",           "IRI1X",     "",    1.0e-3,  rmassdouble,   2254 },
{ "IRIS Q1 Offset Y",           "IRI1Y",     "",    1.0e-3,  rmassdouble,   2255 },

{ "IRIS Q1 Flux",               "IRI1FLUX",  "",    1.0e-3,  rmassdouble,   2256 },
{ "IRIS Q1 Pixel 1",            "IRI1PI1",   "",    1.0e-3,  rmassdouble,   2257 },
{ "IRIS Q1 Pixel 1 X",          "IRI1PI1X",  "",    1.0e-3,  rmassdouble,   2258 },
{ "IRIS Q1 Pixel 1 Y",          "IRI1PI1Y",  "",    1.0e-3,  rmassdouble,   2259 },
{ "IRIS Q1 Pixel 2",            "IRI1PI2",   "",    1.0e-3,  rmassdouble,   2260 },
{ "IRIS Q1 Pixel 2 X",          "IRI1PI2X",  "",    1.0e-3,  rmassdouble,   2261 },
{ "IRIS Q1 Pixel 2 Y",          "IRI1PI2Y",  "",    1.0e-3,  rmassdouble,   2262 },
{ "IRIS Q1 Pixel 3",            "IRI1PI3",   "",    1.0e-3,  rmassdouble,   2263 },
{ "IRIS Q1 Pixel 3 X",          "IRI1PI3X",  "",    1.0e-3,  rmassdouble,   2264 },
{ "IRIS Q1 Pixel 3 Y",          "IRI1PI3Y",  "",    1.0e-3,  rmassdouble,   2265 },
{ "IRIS Q1 Pixel 4",            "IRI1PI4",   "",    1.0e-3,  rmassdouble,   2266 },
{ "IRIS Q1 Pixel 4 X",          "IRI1PI4X",  "",    1.0e-3,  rmassdouble,   2267 },
{ "IRIS Q1 Pixel 4 Y",          "IRI1PI4Y",  "",    1.0e-3,  rmassdouble,   2268 },

{ "IRIS Q2 Times sec",          "IRI2TS",    "",    1.0e-3,  rmasstimeSec,  2276 },
{ "IRIS Q2 Times sec",          "IRI2TUS",   "",    1.0e-3,  rmasstimeusec, 2277 },
{ "IRIS Q2 Data Check",         "IRI2CHK",   "",    1.0e-3,  rmassuint32,   2278 },
{ "IRIS Q2 Offset X",           "IRI2X",     "",    1.0e-3,  rmassdouble,   2279 },
{ "IRIS Q2 Offset Y",           "IRI2Y",     "",    1.0e-3,  rmassdouble,   2280 },

{ "IRIS Q2 Flux",               "IRI2FLUX",  "",    1.0e-3,  rmassdouble,   2281 },
{ "IRIS Q2 Pixel 1",            "IRI2PI1",   "",    1.0e-3,  rmassdouble,   2282 },
{ "IRIS Q2 Pixel 1 X",          "IRI2PI1X",  "",    1.0e-3,  rmassdouble,   2283 },
{ "IRIS Q2 Pixel 1 Y",          "IRI2PI1Y",  "",    1.0e-3,  rmassdouble,   2284 },
{ "IRIS Q2 Pixel 2",            "IRI2PI2",   "",    1.0e-3,  rmassdouble,   2285 },
{ "IRIS Q2 Pixel 2 X",          "IRI2PI2X",  "",    1.0e-3,  rmassdouble,   2286 },
{ "IRIS Q2 Pixel 2 Y",          "IRI2PI2Y",  "",    1.0e-3,  rmassdouble,   2287 },
{ "IRIS Q2 Pixel 3",            "IRI2PI3",   "",    1.0e-3,  rmassdouble,   2288 },
{ "IRIS Q2 Pixel 3 X",          "IRI2PI3X",  "",    1.0e-3,  rmassdouble,   2289 },
{ "IRIS Q2 Pixel 3 Y",          "IRI2PI3Y",  "",    1.0e-3,  rmassdouble,   2290 },
{ "IRIS Q2 Pixel 4",            "IRI2PI4",   "",    1.0e-3,  rmassdouble,   2291 },
{ "IRIS Q2 Pixel 4 X",          "IRI2PI4X",  "",    1.0e-3,  rmassdouble,   2292 },
{ "IRIS Q2 Pixel 4 Y",          "IRI2PI4Y",  "",    1.0e-3,  rmassdouble,   2293 },

{ "IRIS Q3 Times sec",          "IRI3TS",    "",    1.0e-3,  rmasstimeSec,  2301 },
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{ "IRIS Q3 Times sec",	"IRI3TUS",	"",	1.0e-3,	rmasstimeusec,	2302 },
{ "IRIS Q3 Data Check",	"IRI3CHK",	"",	1.0e-3,	rmasuint32,	2303 },
{ "IRIS Q3 Offset X",	"IRI3X",	"",	1.0e-3,	rmasdouble,	2304 },
{ "IRIS Q3 Offset Y",	"IRI3Y",	"",	1.0e-3,	rmasdouble,	2305 },
{ "IRIS Q3 Flux",	"IRI3FLUX",	"",	1.0e-3,	rmasdouble,	2306 },
{ "IRIS Q3 Pixel 1",	"IRI3PI1",	"",	1.0e-3,	rmasdouble,	2307 },
{ "IRIS Q3 Pixel 1 X",	"IRI3PI1X",	"",	1.0e-3,	rmasdouble,	2308 },
{ "IRIS Q3 Pixel 1 Y",	"IRI3PI1Y",	"",	1.0e-3,	rmasdouble,	2309 },
{ "IRIS Q3 Pixel 2",	"IRI3PI2",	"",	1.0e-3,	rmasdouble,	2310 },
{ "IRIS Q3 Pixel 2 X",	"IRI3PI2X",	"",	1.0e-3,	rmasdouble,	2311 },
{ "IRIS Q3 Pixel 2 Y",	"IRI3PI2Y",	"",	1.0e-3,	rmasdouble,	2312 },
{ "IRIS Q3 Pixel 3",	"IRI3PI3",	"",	1.0e-3,	rmasdouble,	2313 },
{ "IRIS Q3 Pixel 3 X",	"IRI3PI3X",	"",	1.0e-3,	rmasdouble,	2314 },
{ "IRIS Q3 Pixel 3 Y",	"IRI3PI3Y",	"",	1.0e-3,	rmasdouble,	2315 },
{ "IRIS Q3 Pixel 4",	"IRI3PI4",	"",	1.0e-3,	rmasdouble,	2316 },
{ "IRIS Q3 Pixel 4 X",	"IRI3PI4X",	"",	1.0e-3,	rmasdouble,	2317 },
{ "IRIS Q3 Pixel 4 Y",	"IRI3PI4Y",	"",	1.0e-3,	rmasdouble,	2318 },
{ "IRIS Q4 Times sec",	"IRI4TS",	"",	1.0e-3,	rmasstimeusec,	2326 },
{ "IRIS Q4 Times sec",	"IRI4TUS",	"",	1.0e-3,	rmasstimeusec,	2327 },
{ "IRIS Q4 Data Check",	"IRI4CHK",	"",	1.0e-3,	rmasuint32,	2328 },
{ "IRIS Q4 Offset X",	"IRI4X",	"",	1.0e-3,	rmasdouble,	2329 },
{ "IRIS Q4 Offset Y",	"IRI4Y",	"",	1.0e-3,	rmasdouble,	2330 },
{ "IRIS Q4 Flux",	"IRI4FLUX",	"",	1.0e-3,	rmasdouble,	2331 },
{ "IRIS Q4 Pixel 1",	"IRI4PI1",	"",	1.0e-3,	rmasdouble,	2332 },
{ "IRIS Q4 Pixel 1 X",	"IRI4PI1X",	"",	1.0e-3,	rmasdouble,	2333 },
{ "IRIS Q4 Pixel 1 Y",	"IRI4PI1Y",	"",	1.0e-3,	rmasdouble,	2334 },
{ "IRIS Q4 Pixel 2",	"IRI4PI2",	"",	1.0e-3,	rmasdouble,	2335 },
{ "IRIS Q4 Pixel 2 X",	"IRI4PI2X",	"",	1.0e-3,	rmasdouble,	2336 },
{ "IRIS Q4 Pixel 2 Y",	"IRI4PI2Y",	"",	1.0e-3,	rmasdouble,	2337 },
{ "IRIS Q4 Pixel 3",	"IRI4PI3",	"",	1.0e-3,	rmasdouble,	2338 },
{ "IRIS Q4 Pixel 3 X",	"IRI4PI3X",	"",	1.0e-3,	rmasdouble,	2339 },
{ "IRIS Q4 Pixel 3 Y",	"IRI4PI3Y",	"",	1.0e-3,	rmasdouble,	2340 },
{ "IRIS Q4 Pixel 4",	"IRI4PI4",	"",	1.0e-3,	rmasdouble,	2341 },
{ "IRIS Q4 Pixel 4 X",	"IRI4PI4X",	"",	1.0e-3,	rmasdouble,	2342 },
{ "IRIS Q4 Pixel 4 Y",	"IRI4PI4Y",	"",	1.0e-3,	rmasdouble,	2343 },
{ "BTK Beam 0 Times sec",	"BTK0TS",	"",	0.5e-3,	rmasstimeusec,	2501 },
{ "BTK Beam 0 Times sec",	"BTK0TUS",	"",	0.5e-3,	rmasstimeusec,	2502 },
{ "BTK Beam 0 Data check",	"BTK0CHK",	"",	0.5e-3,	rmasuint32,	2503 },



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{ "BTK Beam 0 Flux",          "BTK0FX",    "",    0.5e-3,  rmassDOUBLE,  2504 },
{ "BTK Beam 1 Times sec",    "BTK1TS",    "",    0.5e-3,  rmassTIMESEC,  2526 },
{ "BTK Beam 1 Times sec",    "BTK1TUS",   "",    0.5e-3,  rmassTIMEUSEC, 2527 },
{ "BTK Beam 1 Data check",   "BTK1CHK",   "",    0.5e-3,  rmassUINT32,   2528 },
{ "BTK Beam 1 Flux",         "BTK1FX",    "",    0.5e-3,  rmassDOUBLE,   2529 },

{ "BTK Beam 2 Times sec",    "BTK2TS",    "",    0.5e-3,  rmassTIMESEC,  2551 },
{ "BTK Beam 2 Times sec",    "BTK2TUS",   "",    0.5e-3,  rmassTIMEUSEC, 2552 },
{ "BTK Beam 2 Data check",   "BTK2CHK",   "",    0.5e-3,  rmassUINT32,   2553 },
{ "BTK Beam 2 Flux",         "BTK2FX",    "",    0.5e-3,  rmassDOUBLE,   2554 },

{ "Monitor Ch1 Index 1",     "MON1.1",    "",    0.0,     rmassDOUBLE,  2750 },
{ "Monitor Ch1 Index 2",     "MON1.2",    "",    0.0,     rmassDOUBLE,  2751 },
{ "Monitor Ch1 Index 3",     "MON1.3",    "",    0.0,     rmassDOUBLE,  2752 },
{ "Monitor Ch1 Index 4",     "MON1.4",    "",    0.0,     rmassDOUBLE,  2753 },
{ "Monitor Ch1 Index 5",     "MON1.5",    "",    0.0,     rmassDOUBLE,  2754 },
{ "Monitor Ch1 Index 6",     "MON1.6",    "",    0.0,     rmassDOUBLE,  2755 },
{ "Monitor Ch1 Index 7",     "MON1.7",    "",    0.0,     rmassDOUBLE,  2756 },
{ "Monitor Ch1 Index 8",     "MON1.8",    "",    0.0,     rmassDOUBLE,  2757 },
{ "Monitor Ch1 Index 9",     "MON1.9",    "",    0.0,     rmassDOUBLE,  2758 },
{ "Monitor Ch1 Index 10",    "MON1.10",   "",    0.0,     rmassDOUBLE,  2759 },

{ "Monitor Ch2 Index 1",     "MON2.1",    "",    0.0,     rmassDOUBLE,  2775 },
{ "Monitor Ch2 Index 2",     "MON2.2",    "",    0.0,     rmassDOUBLE,  2776 },
{ "Monitor Ch2 Index 3",     "MON2.3",    "",    0.0,     rmassDOUBLE,  2777 },
{ "Monitor Ch2 Index 4",     "MON2.4",    "",    0.0,     rmassDOUBLE,  2778 },
{ "Monitor Ch2 Index 5",     "MON2.5",    "",    0.0,     rmassDOUBLE,  2779 },
{ "Monitor Ch2 Index 6",     "MON2.6",    "",    0.0,     rmassDOUBLE,  2780 },
{ "Monitor Ch2 Index 7",     "MON2.7",    "",    0.0,     rmassDOUBLE,  2781 },
{ "Monitor Ch2 Index 8",     "MON2.8",    "",    0.0,     rmassDOUBLE,  2782 },
{ "Monitor Ch2 Index 9",     "MON2.9",    "",    0.0,     rmassDOUBLE,  2783 },
{ "Monitor Ch2 Index 10",    "MON2.10",   "",    0.0,     rmassDOUBLE,  2784 },

{ "Monitor Ch3 Index 1",     "MON3.1",    "",    0.0,     rmassDOUBLE,  2800 },
{ "Monitor Ch3 Index 2",     "MON3.2",    "",    0.0,     rmassDOUBLE,  2801 },
{ "Monitor Ch3 Index 3",     "MON3.3",    "",    0.0,     rmassDOUBLE,  2802 },
{ "Monitor Ch3 Index 4",     "MON3.4",    "",    0.0,     rmassDOUBLE,  2803 },
{ "Monitor Ch3 Index 5",     "MON3.5",    "",    0.0,     rmassDOUBLE,  2804 },
{ "Monitor Ch3 Index 6",     "MON3.6",    "",    0.0,     rmassDOUBLE,  2805 },
{ "Monitor Ch3 Index 7",     "MON3.7",    "",    0.0,     rmassDOUBLE,  2806 },
{ "Monitor Ch3 Index 8",     "MON3.8",    "",    0.0,     rmassDOUBLE,  2807 },
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{ "Monitor Ch3 Index 9",	"MON3.9",	"",	0.0,	rmassDOUBLE,	2808 }
{ "Monitor Ch3 Index 10",	"MON3.10",	"",	0.0,	rmassDOUBLE,	2809 }
{ "Monitor Ch4 Index 1",	"MON4.1",	"",	0.0,	rmassDOUBLE,	2825 }
{ "Monitor Ch4 Index 2",	"MON4.2",	"",	0.0,	rmassDOUBLE,	2826 }
{ "Monitor Ch4 Index 3",	"MON4.3",	"",	0.0,	rmassDOUBLE,	2827 }
{ "Monitor Ch4 Index 4",	"MON4.4",	"",	0.0,	rmassDOUBLE,	2828 }
{ "Monitor Ch4 Index 5",	"MON4.5",	"",	0.0,	rmassDOUBLE,	2829 }
{ "Monitor Ch4 Index 6",	"MON4.6",	"",	0.0,	rmassDOUBLE,	2830 }
{ "Monitor Ch4 Index 7",	"MON4.7",	"",	0.0,	rmassDOUBLE,	2831 }
{ "Monitor Ch4 Index 8",	"MON4.8",	"",	0.0,	rmassDOUBLE,	2832 }
{ "Monitor Ch4 Index 9",	"MON4.9",	"",	0.0,	rmassDOUBLE,	2833 }
{ "Monitor Ch4 Index 10",	"MON4.10",	"",	0.0,	rmassDOUBLE,	2834 }
{ "Monitor Ch5 Index 1",	"MON5.1",	"",	0.0,	rmassDOUBLE,	2850 }
{ "Monitor Ch5 Index 2",	"MON5.2",	"",	0.0,	rmassDOUBLE,	2851 }
{ "Monitor Ch5 Index 3",	"MON5.3",	"",	0.0,	rmassDOUBLE,	2852 }
{ "Monitor Ch5 Index 4",	"MON5.4",	"",	0.0,	rmassDOUBLE,	2853 }
{ "Monitor Ch5 Index 5",	"MON5.5",	"",	0.0,	rmassDOUBLE,	2854 }
{ "Monitor Ch5 Index 6",	"MON5.6",	"",	0.0,	rmassDOUBLE,	2855 }
{ "Monitor Ch5 Index 7",	"MON5.7",	"",	0.0,	rmassDOUBLE,	2856 }
{ "Monitor Ch5 Index 8",	"MON5.8",	"",	0.0,	rmassDOUBLE,	2857 }
{ "Monitor Ch5 Index 9",	"MON5.9",	"",	0.0,	rmassDOUBLE,	2858 }
{ "Monitor Ch5 Index 10",	"MON5.10",	"",	0.0,	rmassDOUBLE,	2859 }
{ "OPDC Finito1 Time sec",	"OD1TS",	"",	0.5e-3,	rmassTIMESEC,	3251 }
{ "OPDC Finito1 Time usec",	"OD1TUS",	"",	0.5e-3,	rmassTIMEUSEC,	3252 }
{ "OPDC Finito1 Rt Offset",	"OD1OFF",	"",	0.5e-3,	rmassDOUBLE,	3254 }
{ "OPDC Finito1 Fringe det",	"OD1FDET",	"",	0.5e-3,	rmassUINT32,	3255 }
{ "OPDC Finito1 Rt Off val",	"OD1OFFV",	"",	0.5e-3,	rmassUINT32,	3256 }
{ "OPDC Finito1 State",	"OD1ST",	"",	0.5e-3,	rmassUINT32,	3257 }
{ "OPDC Finito1 unwr Phase",	"OD1UPH",	"",	0.5e-3,	rmassDOUBLE,	3258 }
{ "OPDC Finito1 full Off.",	"OD1FOFF",	"",	0.5e-3,	rmassDOUBLE,	3259 }
{ "OPDC Finito1 DL feedback",	"OD1DLFB",	"",	0.5e-3,	rmassDOUBLE,	3260 }
{ "OPDC Finito1 Stp Phase",	"OD1STPH",	"",	0.5e-3,	rmassUINT32,	3261 }
{ "OPDC Finito2 Time sec",	"OD2TS",	"",	0.5e-3,	rmassTIMESEC,	3276 }
{ "OPDC Finito2 Time usec",	"OD2TUS",	"",	0.5e-3,	rmassTIMEUSEC,	3277 }
{ "OPDC Finito2 Rt Offset",	"OD2OFF",	"",	0.5e-3,	rmassDOUBLE,	3279 }
{ "OPDC Finito2 Fringe det",	"OD2FDET",	"",	0.5e-3,	rmassUINT32,	3280 }
{ "OPDC Finito2 Rt Off val",	"OD2OFFV",	"",	0.5e-3,	rmassUINT32,	3281 }
{ "OPDC Finito2 State",	"OD2ST",	"",	0.5e-3,	rmassUINT32,	3282 }
{ "OPDC Finito2 unwr Phase",	"OD2UPH",	"",	0.5e-3,	rmassDOUBLE,	3283 }



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{ "OPDC Finito2 full Off.",          "OD2FOFF",  "",  0.5e-3,  rmassDOUBLE,  3284 },
{ "OPDC Finito2 DL feedback",      "OD2DLFB",  "",  0.5e-3,  rmassDOUBLE,  3285 },
{ "OPDC Finito2 Stp Phase",        "OD2STPH",  "",  0.5e-3,  rmassUINT32,  3286 },

{ "OPDC Prima Time sec",           "ODPTS",    "",  0.5e-3,  rmassTIMESEC,  3301 },
{ "OPDC Prima Time usec",          "ODPTUS",   "",  0.5e-3,  rmassTIMEUSEC, 3302 },
{ "OPDC Prima Rt Offset",          "ODPOFF",   "",  0.5e-3,  rmassDOUBLE,  3304 },
{ "OPDC Prima Fringe det",         "ODPFDET",  "",  0.5e-3,  rmassUINT32,  3305 },
{ "OPDC Prima Rt Off val",         "ODPOFFV",  "",  0.5e-3,  rmassUINT32,  3306 },
{ "OPDC Prima State",              "ODPST",    "",  0.5e-3,  rmassUINT32,  3307 },
{ "OPDC Prima unwr Phase",         "ODPUPH",   "",  0.5e-3,  rmassDOUBLE,  3308 },
{ "OPDC Prima full Off.",          "ODPFOFF",  "",  0.5e-3,  rmassDOUBLE,  3309 },
{ "OPDC Prima DL1 feedback",       "ODPDL1FB", "",  0.5e-3,  rmassDOUBLE,  3310 },
{ "OPDC Prima DL2 feedback",       "ODPDL2FB", "",  0.5e-3,  rmassDOUBLE,  3311 },
{ "OPDC Prima DL3 feedback",       "ODPDL3FB", "",  0.5e-3,  rmassDOUBLE,  3312 },
{ "OPDC Prima DL4 feedback",       "ODPDL4FB", "",  0.5e-3,  rmassDOUBLE,  3313 },
{ "OPDC Prima DL5 feedback",       "ODPDL5FB", "",  0.5e-3,  rmassDOUBLE,  3314 },
{ "OPDC Prima DL6 feedback",       "ODPDL6FB", "",  0.5e-3,  rmassDOUBLE,  3315 },
{ "Track DL position setpoint",     "ODPPSP",   "",  0.5e-3,  rmassDOUBLE,  3316 },
{ "Track DL ratelim position",      "ODPRLP",   "",  0.5e-3,  rmassDOUBLE,  3317 },
{ "OPDC Prima Stp Phase",          "ODPSTPH",  "",  0.5e-3,  rmassUINT32,  3318 },

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/\* GRAVITY RMN AREA \*/

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\* Gravity Fringe Sensor -> IMAGING\_DATA\_FT

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```

{ "GR Fringe Sensor Time sec",      "GRFSTS",   "",  0.125e-3, rmassTIMESEC,  3701 },
{ "GR Fringe Sensor Time usec",     "GRFSTUS",  "",  0.125e-3, rmassTIMEUSEC, 3702 },

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/\* 576 pixels all sectors between GRPIX1 and GRPIX576 are used (group rmass write) \*/

```

{ "GR Fringe Sensor raw pix 1",     "GRPIX1",   "",  0.125e-3, rmassINT32,   3704 },
{ "GR Fringe Sensor raw pix 576",   "GRPIX576", "",  0.125e-3, rmassINT32,   4279 },

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{ "GR Fringe Sensor pd base 1",     "GRFSPD1",  "",  0.125e-3, rmassFLOAT,   4280 },
{ "GR Fringe Sensor pd base 2",     "GRFSPD2",  "",  0.125e-3, rmassFLOAT,   4281 },
{ "GR Fringe Sensor pd base 3",     "GRFSPD3",  "",  0.125e-3, rmassFLOAT,   4282 },
{ "GR Fringe Sensor pd base 4",     "GRFSPD4",  "",  0.125e-3, rmassFLOAT,   4283 },
{ "GR Fringe Sensor pd base 5",     "GRFSPD5",  "",  0.125e-3, rmassFLOAT,   4284 },

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{ "GR Fringe Sensor pd base 6",	"GRFSPD6",	"",	0.125e-3,	rmassFLOAT,	4285 },
{ "GR Fringe Sensor gd base 1",	"GRFSGD1",	"",	0.125e-3,	rmassFLOAT,	4286 },
{ "GR Fringe Sensor gd base 2",	"GRFSGD2",	"",	0.125e-3,	rmassFLOAT,	4287 },
{ "GR Fringe Sensor gd base 3",	"GRFSGD3",	"",	0.125e-3,	rmassFLOAT,	4288 },
{ "GR Fringe Sensor gd base 4",	"GRFSGD4",	"",	0.125e-3,	rmassFLOAT,	4289 },
{ "GR Fringe Sensor gd base 5",	"GRFSGD5",	"",	0.125e-3,	rmassFLOAT,	4290 },
{ "GR Fringe Sensor gd base 6",	"GRFSGD6",	"",	0.125e-3,	rmassFLOAT,	4291 },
{ "GR Fringe Sensor noise base 1",	"GRFSNS1",	"",	0.125e-3,	rmassFLOAT,	4292 },
{ "GR Fringe Sensor noise base 2",	"GRFSNS2",	"",	0.125e-3,	rmassFLOAT,	4293 },
{ "GR Fringe Sensor noise base 3",	"GRFSNS3",	"",	0.125e-3,	rmassFLOAT,	4294 },
{ "GR Fringe Sensor noise base 4",	"GRFSNS4",	"",	0.125e-3,	rmassFLOAT,	4295 },
{ "GR Fringe Sensor noise base 5",	"GRFSNS5",	"",	0.125e-3,	rmassFLOAT,	4296 },
{ "GR Fringe Sensor noise base 6",	"GRFSNS6",	"",	0.125e-3,	rmassFLOAT,	4297 },
{ "GR Fringe Sensor SNR base 1",	"GRFSSNR1",	"",	0.125e-3,	rmassFLOAT,	4298 },
{ "GR Fringe Sensor SNR base 2",	"GRFSSNR2",	"",	0.125e-3,	rmassFLOAT,	4299 },
{ "GR Fringe Sensor SNR base 3",	"GRFSSNR3",	"",	0.125e-3,	rmassFLOAT,	4300 },
{ "GR Fringe Sensor SNR base 4",	"GRFSSNR4",	"",	0.125e-3,	rmassFLOAT,	4301 },
{ "GR Fringe Sensor SNR base 5",	"GRFSSNR5",	"",	0.125e-3,	rmassFLOAT,	4302 },
{ "GR Fringe Sensor SNR base 6",	"GRFSSNR6",	"",	0.125e-3,	rmassFLOAT,	4303 },
{ "GR Fringe Sensor Vis base 1",	"GRFSVIS1",	"",	0.125e-3,	rmassFLOAT,	4304 },
{ "GR Fringe Sensor Vis base 2",	"GRFSVIS2",	"",	0.125e-3,	rmassFLOAT,	4305 },
{ "GR Fringe Sensor Vis base 3",	"GRFSVIS3",	"",	0.125e-3,	rmassFLOAT,	4306 },
{ "GR Fringe Sensor Vis base 4",	"GRFSVIS4",	"",	0.125e-3,	rmassFLOAT,	4307 },
{ "GR Fringe Sensor Vis base 5",	"GRFSVIS5",	"",	0.125e-3,	rmassFLOAT,	4308 },
{ "GR Fringe Sensor Vis base 6",	"GRFSVIS6",	"",	0.125e-3,	rmassFLOAT,	4309 },
{ "GR Fringe Sensor flux T1",	"GRFSFLX1",	"",	0.125e-3,	rmassFLOAT,	4310 },
{ "GR Fringe Sensor flux T2",	"GRFSFLX2",	"",	0.125e-3,	rmassFLOAT,	4311 },
{ "GR Fringe Sensor flux T3",	"GRFSFLX3",	"",	0.125e-3,	rmassFLOAT,	4312 },
{ "GR Fringe Sensor flux T4",	"GRFSFLX4",	"",	0.125e-3,	rmassFLOAT,	4313 },
{ "GR Fringe Sensor clo phase PD 1",	"GRFSCLP1",	"",	0.125e-3,	rmassFLOAT,	4314 },
{ "GR Fringe Sensor clo phase PD 2",	"GRFSCLP2",	"",	0.125e-3,	rmassFLOAT,	4315 },
{ "GR Fringe Sensor clo phase PD 3",	"GRFSCLP3",	"",	0.125e-3,	rmassFLOAT,	4316 },
{ "GR Fringe Sensor clo phase PD 4",	"GRFSCLP4",	"",	0.125e-3,	rmassFLOAT,	4317 },
{ "GR Fringe Sensor clo phase GD 1",	"GRFSCLG1",	"",	0.125e-3,	rmassFLOAT,	4318 },
{ "GR Fringe Sensor clo phase GD 2",	"GRFSCLG2",	"",	0.125e-3,	rmassFLOAT,	4319 },
{ "GR Fringe Sensor clo phase GD 3",	"GRFSCLG3",	"",	0.125e-3,	rmassFLOAT,	4320 },



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{ "GR Fringe Sensor clo phase GD 4", "GRFSCLG4", "", 0.125e-3, rmassFLOAT, 4321 },

/*
 * Gravity FDDL controller
 */
{ "GR FDDL Time sec", "GRDLTS", "", 0.125e-3, rmassTIMESEC, 4401 },
{ "GR FDDL Time usec", "GRDLTUS", "", 0.125e-3, rmassTIMEUSEC, 4402 },

{ "GR FDDL FT position sensor 1", "GRFTPOS1", "", 0.125e-3, rmassFLOAT, 4404 },
{ "GR FDDL FT position sensor 2", "GRFTPOS2", "", 0.125e-3, rmassFLOAT, 4405 },
{ "GR FDDL FT position sensor 3", "GRFTPOS3", "", 0.125e-3, rmassFLOAT, 4406 },
{ "GR FDDL FT position sensor 4", "GRFTPOS4", "", 0.125e-3, rmassFLOAT, 4407 },

{ "GR FDDL SC position sensor 1", "GRSCPOS1", "", 0.125e-3, rmassFLOAT, 4408 },
{ "GR FDDL SC position sensor 2", "GRSCPOS2", "", 0.125e-3, rmassFLOAT, 4409 },
{ "GR FDDL SC position sensor 3", "GRSCPOS3", "", 0.125e-3, rmassFLOAT, 4410 },
{ "GR FDDL SC position sensor 4", "GRSCPOS4", "", 0.125e-3, rmassFLOAT, 4411 },

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{ "GR Air OPL prediction 2", "GRDISP2", "", 0.125e-3, rmassFLOAT, 4413 },
{ "GR Air OPL prediction 3", "GRDISP3", "", 0.125e-3, rmassFLOAT, 4414 },
{ "GR Air OPL prediction 4", "GRDISP4", "", 0.125e-3, rmassFLOAT, 4415 },

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{ "GR FDDL FT FDDL command 4", "GRFTDDL4", "", 0.125e-3, rmassFLOAT, 4419 },

{ "GR FDDL SC FDDL command 1", "GRSCDDL1", "", 0.125e-3, rmassFLOAT, 4420 },
{ "GR FDDL SC FDDL command 2", "GRSCDDL2", "", 0.125e-3, rmassFLOAT, 4421 },
{ "GR FDDL SC FDDL command 3", "GRSCDDL3", "", 0.125e-3, rmassFLOAT, 4422 },
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 * Gravity OPD Controller
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{ "GR OPDC Time usec", "GROPTUS", "", 0.125e-3, rmassTIMEUSEC, 4502 },

{ "GR OPDC Main State", "GROPSTAT", "", 0.125e-3, rmassUINT32, 4504 },
{ "GR OPDC Modulation", "GROPMOD", "", 0.125e-3, rmassUINT32, 4505 },
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{ "GR OPDC Piezo Offset 2",        "GROPPZ2",  "",  0.125e-3,  rmassFLOAT,   4508 },
{ "GR OPDC Piezo Offset 3",        "GROPPZ3",  "",  0.125e-3,  rmassFLOAT,   4509 },
{ "GR OPDC Piezo Offset 4",        "GROPPZ4",  "",  0.125e-3,  rmassFLOAT,   4510 },

{ "GR OPDC VLTI DL Offset 1",      "GROPVLT1", "",  0.125e-3,  rmassFLOAT,   4511 },
{ "GR OPDC VLTI DL Offset 2",      "GROPVLT2", "",  0.125e-3,  rmassFLOAT,   4512 },
{ "GR OPDC VLTI DL Offset 3",      "GROPVLT3", "",  0.125e-3,  rmassFLOAT,   4513 },
{ "GR OPDC VLTI DL Offset 4",      "GROPVLT4", "",  0.125e-3,  rmassFLOAT,   4514 },

{ "GR OPDC Piezo prediction 1",     "GROPKZ1",  "",  0.125e-3,  rmassFLOAT,   4515 },
{ "GR OPDC Piezo prediction 2",     "GROPKZ2",  "",  0.125e-3,  rmassFLOAT,   4516 },
{ "GR OPDC Piezo prediction 3",     "GROPKZ3",  "",  0.125e-3,  rmassFLOAT,   4517 },
{ "GR OPDC Piezo prediction 4",     "GROPKZ4",  "",  0.125e-3,  rmassFLOAT,   4518 },

{ "GR OPDC OPD phase 1",           "GROPPD1",  "",  0.125e-3,  rmassFLOAT,   4519 },
{ "GR OPDC OPD phase 2",           "GROPPD2",  "",  0.125e-3,  rmassFLOAT,   4520 },
{ "GR OPDC OPD phase 3",           "GROPPD3",  "",  0.125e-3,  rmassFLOAT,   4521 },
{ "GR OPDC OPD phase 4",           "GROPPD4",  "",  0.125e-3,  rmassFLOAT,   4522 },
{ "GR OPDC OPD phase 5",           "GROPPD5",  "",  0.125e-3,  rmassFLOAT,   4523 },
{ "GR OPDC OPD phase 6",           "GROPPD6",  "",  0.125e-3,  rmassFLOAT,   4524 },

{ "GR OPDC Kalman prediction 1",    "GROPPR1",  "",  0.125e-3,  rmassFLOAT,   4525 },
{ "GR OPDC Kalman prediction 2",    "GROPPR2",  "",  0.125e-3,  rmassFLOAT,   4526 },
{ "GR OPDC Kalman prediction 3",    "GROPPR3",  "",  0.125e-3,  rmassFLOAT,   4527 },
{ "GR OPDC Kalman prediction 4",    "GROPPR4",  "",  0.125e-3,  rmassFLOAT,   4528 },
{ "GR OPDC Kalman prediction 5",    "GROPPR5",  "",  0.125e-3,  rmassFLOAT,   4529 },
{ "GR OPDC Kalman prediction 6",    "GROPPR6",  "",  0.125e-3,  rmassFLOAT,   4530 },

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{ "GR OPDC FDDL Offset 2",         "GROPDL2",  "",  0.125e-3,  rmassFLOAT,   4532 },
{ "GR OPDC FDDL Offset 3",         "GROPDL3",  "",  0.125e-3,  rmassFLOAT,   4533 },
{ "GR OPDC FDDL Offset 4",         "GROPDL4",  "",  0.125e-3,  rmassFLOAT,   4534 },

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{ "GR OPDC OGD phase 2",           "GROPGD2",  "",  0.125e-3,  rmassFLOAT,   4536 },
{ "GR OPDC OGD phase 3",           "GROPGD3",  "",  0.125e-3,  rmassFLOAT,   4537 },
{ "GR OPDC OGD phase 4",           "GROPGD4",  "",  0.125e-3,  rmassFLOAT,   4538 },
{ "GR OPDC OGD phase 5",           "GROPGD5",  "",  0.125e-3,  rmassFLOAT,   4539 },
{ "GR OPDC OGD phase 6",           "GROPGD6",  "",  0.125e-3,  rmassFLOAT,   4540 },
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{ "GR OPDC OGD closure 6",	"GROPGDC6",	"",	0.125e-3,	rmassFLOAT,	4546 },
{ "GR OPDC Reference PD 1",	"GROPRPD1",	"",	0.125e-3,	rmassFLOAT,	4547 },
{ "GR OPDC Reference PD 2",	"GROPRPD2",	"",	0.125e-3,	rmassFLOAT,	4548 },
{ "GR OPDC Reference PD 3",	"GROPRPD3",	"",	0.125e-3,	rmassFLOAT,	4549 },
{ "GR OPDC Reference PD 4",	"GROPRPD4",	"",	0.125e-3,	rmassFLOAT,	4550 },
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{ "GR OPDC Flux Instant 2",	"GROPFLX2",	"",	0.125e-3,	rmassFLOAT,	4552 },
{ "GR OPDC Flux Instant 3",	"GROPFLX3",	"",	0.125e-3,	rmassFLOAT,	4553 },
{ "GR OPDC Flux Instant 4",	"GROPFLX4",	"",	0.125e-3,	rmassFLOAT,	4554 },
{ "GR OPDC SNR Instant 1",	"GROPSNR1",	"",	0.125e-3,	rmassFLOAT,	4555 },
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{ "GR OPDC SNR Instant 3",	"GROPSNR3",	"",	0.125e-3,	rmassFLOAT,	4557 },
{ "GR OPDC SNR Instant 4",	"GROPSNR4",	"",	0.125e-3,	rmassFLOAT,	4558 },
{ "GR OPDC SNR Instant 5",	"GROPSNR5",	"",	0.125e-3,	rmassFLOAT,	4559 },
{ "GR OPDC SNR Instant 6",	"GROPSNR6",	"",	0.125e-3,	rmassFLOAT,	4560 },
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{ "GR OPDC Kalman weights 2",	"GROPWE2",	"",	0.125e-3,	rmassFLOAT,	4562 },
{ "GR OPDC Kalman weights 3",	"GROPWE3",	"",	0.125e-3,	rmassFLOAT,	4563 },
{ "GR OPDC Kalman weights 4",	"GROPWE4",	"",	0.125e-3,	rmassFLOAT,	4564 },
{ "GR OPDC Kalman weights 5",	"GROPWE5",	"",	0.125e-3,	rmassFLOAT,	4565 },
{ "GR OPDC Kalman weights 6",	"GROPWE6",	"",	0.125e-3,	rmassFLOAT,	4566 },
{ "GR OPDC Flux Smoothed 1",	"GROPFLS1",	"",	0.125e-3,	rmassFLOAT,	4567 },
{ "GR OPDC Flux Smoothed 2",	"GROPFLS2",	"",	0.125e-3,	rmassFLOAT,	4568 },
{ "GR OPDC Flux Smoothed 3",	"GROPFLS3",	"",	0.125e-3,	rmassFLOAT,	4569 },
{ "GR OPDC Flux Smoothed 4",	"GROPFLS4",	"",	0.125e-3,	rmassFLOAT,	4570 },
{ "GR OPDC DL position 1",	"GROPDLP1",	"",	0.125e-3,	rmassFLOAT,	4571 },
{ "GR OPDC DL position 2",	"GROPDLP2",	"",	0.125e-3,	rmassFLOAT,	4572 },
{ "GR OPDC DL position 3",	"GROPDLP3",	"",	0.125e-3,	rmassFLOAT,	4573 },
{ "GR OPDC DL position 4",	"GROPDLP4",	"",	0.125e-3,	rmassFLOAT,	4574 },
{ "GR OPDC Flux Threshold 1",	"GROPFLT1",	"",	0.125e-3,	rmassFLOAT,	4575 },
{ "GR OPDC Flux Threshold 2",	"GROPFLT2",	"",	0.125e-3,	rmassFLOAT,	4576 },



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{ "GR OPDC Flux Threshold 4",      "GROPFLT4",  "",  0.125e-3, rmassFLOAT,  4578 },

{ "GR OPDC SNR Smoothed 1",        "GROPSNS1",  "",  0.125e-3, rmassFLOAT,  4579 },
{ "GR OPDC SNR Smoothed 2",        "GROPSNS2",  "",  0.125e-3, rmassFLOAT,  4580 },
{ "GR OPDC SNR Smoothed 3",        "GROPSNS3",  "",  0.125e-3, rmassFLOAT,  4581 },
{ "GR OPDC SNR Smoothed 4",        "GROPSNS4",  "",  0.125e-3, rmassFLOAT,  4582 },
{ "GR OPDC SNR Smoothed 5",        "GROPSNS5",  "",  0.125e-3, rmassFLOAT,  4583 },
{ "GR OPDC SNR Smoothed 6",        "GROPSNS6",  "",  0.125e-3, rmassFLOAT,  4584 },

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{ "GR OPDC SNR Threshold 2",        "GROPSNT2",  "",  0.125e-3, rmassFLOAT,  4586 },
{ "GR OPDC SNR Threshold 3",        "GROPSNT3",  "",  0.125e-3, rmassFLOAT,  4587 },
{ "GR OPDC SNR Threshold 4",        "GROPSNT4",  "",  0.125e-3, rmassFLOAT,  4588 },
{ "GR OPDC SNR Threshold 5",        "GROPSNT5",  "",  0.125e-3, rmassFLOAT,  4589 },
{ "GR OPDC SNR Threshold 6",        "GROPSNT6",  "",  0.125e-3, rmassFLOAT,  4590 },

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{ "GR OPDC SNR Background 3",       "GROPSNB3",  "",  0.125e-3, rmassFLOAT,  4593 },
{ "GR OPDC SNR Background 4",       "GROPSNB4",  "",  0.125e-3, rmassFLOAT,  4594 },
{ "GR OPDC SNR Background 5",       "GROPSNB5",  "",  0.125e-3, rmassFLOAT,  4595 },
{ "GR OPDC SNR Background 6",       "GROPSNB6",  "",  0.125e-3, rmassFLOAT,  4596 },

{ "GR OPDC Scan Amplitude",         "GROPSCAN",  "",  0.125e-3, rmassFLOAT,  4597 },

/*
 * Gravity Metrology
 */
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{ "GR MET Volt T1 D1 cos FT",        "GRMV11CF",  "",  0.125e-3, rmassFLOAT,    4606 },
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{ "GR MET Volt T1 D2 cos FT",        "GRMV12CF",  "",  0.125e-3, rmassFLOAT,    4608 },
{ "GR MET Volt T1 D3 sin FT",        "GRMV13SF",  "",  0.125e-3, rmassFLOAT,    4609 },
{ "GR MET Volt T1 D3 cos FT",        "GRMV13CF",  "",  0.125e-3, rmassFLOAT,    4610 },
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{ "GR MET Volt T2 D3 sin FT", "GRMV23SF", "", 0.125e-3, rmassFLOAT, 4617 },
{ "GR MET Volt T2 D3 cos FT", "GRMV23CF", "", 0.125e-3, rmassFLOAT, 4618 },
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{ "GR MET Volt T3 D2 cos FT", "GRMV32CF", "", 0.125e-3, rmassFLOAT, 4624 },
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{ "GR MET Volt T3 D3 cos FT", "GRMV33CF", "", 0.125e-3, rmassFLOAT, 4626 },
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{ "GR MET Volt T4 D2 sin FT", "GRMV42SF", "", 0.125e-3, rmassFLOAT, 4631 },
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{ "GR MET Volt T4 D3 cos FT", "GRMV43CF", "", 0.125e-3, rmassFLOAT, 4634 },
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{ "GR MET Volt T4 D4 cos FT", "GRMV44CF", "", 0.125e-3, rmassFLOAT, 4636 },

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{ "GR MET Volt T1 D1 cos SC", "GRMV11CS", "", 0.125e-3, rmassFLOAT, 4638 },
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{ "GR MET Volt T3 D1 cos SC",	"GRMV31CS", "",	0.125e-3,	rmassFLOAT,	4654 },
{ "GR MET Volt T3 D2 sin SC",	"GRMV32SS", "",	0.125e-3,	rmassFLOAT,	4655 },
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{ "GR MET Volt T3 D4 cos SC",	"GRMV34CS", "",	0.125e-3,	rmassFLOAT,	4660 },
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{ "GR MET Volt T4 D1 cos SC",	"GRMV41CS", "",	0.125e-3,	rmassFLOAT,	4662 },
{ "GR MET Volt T4 D2 sin SC",	"GRMV42SS", "",	0.125e-3,	rmassFLOAT,	4663 },
{ "GR MET Volt T4 D2 cos SC",	"GRMV42CS", "",	0.125e-3,	rmassFLOAT,	4664 },
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{ "GR MET Volt FC4 cos FT",	"GRMV54CF", "",	0.125e-3,	rmassFLOAT,	4676 },
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{ "GR MET Volt FC1 cos SC",	"GRMV51CS", "",	0.125e-3,	rmassFLOAT,	4678 },
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{ "GR MET Flag T1 D3 FT",	"GRMF13F", "",	0.125e-3,	rmassUINT32,	4687 },
{ "GR MET Flag T1 D4 FT",	"GRMF14F", "",	0.125e-3,	rmassUINT32,	4688 },



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{ "GR MET Flag T2 D3 FT",	"GRMF23F",	"",	0.125e-3,	rmassUINT32,	4691 }
{ "GR MET Flag T2 D4 FT",	"GRMF24F",	"",	0.125e-3,	rmassUINT32,	4692 }
{ "GR MET Flag T3 D1 FT",	"GRMF31F",	"",	0.125e-3,	rmassUINT32,	4693 }
{ "GR MET Flag T3 D2 FT",	"GRMF32F",	"",	0.125e-3,	rmassUINT32,	4694 }
{ "GR MET Flag T3 D3 FT",	"GRMF33F",	"",	0.125e-3,	rmassUINT32,	4695 }
{ "GR MET Flag T3 D4 FT",	"GRMF34F",	"",	0.125e-3,	rmassUINT32,	4696 }
{ "GR MET Flag T4 D1 FT",	"GRMF41F",	"",	0.125e-3,	rmassUINT32,	4697 }
{ "GR MET Flag T4 D2 FT",	"GRMF42F",	"",	0.125e-3,	rmassUINT32,	4698 }
{ "GR MET Flag T4 D3 FT",	"GRMF43F",	"",	0.125e-3,	rmassUINT32,	4699 }
{ "GR MET Flag T4 D4 FT",	"GRMF44F",	"",	0.125e-3,	rmassUINT32,	4700 }
{ "GR MET Flag T1 D1 SC",	"GRMF11S",	"",	0.125e-3,	rmassUINT32,	4701 }
{ "GR MET Flag T1 D2 SC",	"GRMF12S",	"",	0.125e-3,	rmassUINT32,	4702 }
{ "GR MET Flag T1 D3 SC",	"GRMF13S",	"",	0.125e-3,	rmassUINT32,	4703 }
{ "GR MET Flag T1 D4 SC",	"GRMF14S",	"",	0.125e-3,	rmassUINT32,	4704 }
{ "GR MET Flag T2 D1 SC",	"GRMF21S",	"",	0.125e-3,	rmassUINT32,	4705 }
{ "GR MET Flag T2 D2 SC",	"GRMF22S",	"",	0.125e-3,	rmassUINT32,	4706 }
{ "GR MET Flag T2 D3 SC",	"GRMF23S",	"",	0.125e-3,	rmassUINT32,	4707 }
{ "GR MET Flag T2 D4 SC",	"GRMF24S",	"",	0.125e-3,	rmassUINT32,	4708 }
{ "GR MET Flag T3 D1 SC",	"GRMF31S",	"",	0.125e-3,	rmassUINT32,	4709 }
{ "GR MET Flag T3 D2 SC",	"GRMF32S",	"",	0.125e-3,	rmassUINT32,	4710 }
{ "GR MET Flag T3 D3 SC",	"GRMF33S",	"",	0.125e-3,	rmassUINT32,	4711 }
{ "GR MET Flag T3 D4 SC",	"GRMF34S",	"",	0.125e-3,	rmassUINT32,	4712 }
{ "GR MET Flag T4 D1 SC",	"GRMF41S",	"",	0.125e-3,	rmassUINT32,	4713 }
{ "GR MET Flag T4 D2 SC",	"GRMF42S",	"",	0.125e-3,	rmassUINT32,	4714 }
{ "GR MET Flag T4 D3 SC",	"GRMF43S",	"",	0.125e-3,	rmassUINT32,	4715 }
{ "GR MET Flag T4 D4 SC",	"GRMF44S",	"",	0.125e-3,	rmassUINT32,	4716 }
{ "GR MET Flag FC1 FT",	"GRMF51F",	"",	0.125e-3,	rmassUINT32,	4717 }
{ "GR MET Flag FC2 FT",	"GRMF52F",	"",	0.125e-3,	rmassUINT32,	4718 }
{ "GR MET Flag FC3 FT",	"GRMF53F",	"",	0.125e-3,	rmassUINT32,	4719 }
{ "GR MET Flag FC4 FT",	"GRMF54F",	"",	0.125e-3,	rmassUINT32,	4720 }
{ "GR MET Flag FC1 SC",	"GRMF51S",	"",	0.125e-3,	rmassUINT32,	4721 }
{ "GR MET Flag FC2 SC",	"GRMF52S",	"",	0.125e-3,	rmassUINT32,	4722 }
{ "GR MET Flag FC3 SC",	"GRMF53S",	"",	0.125e-3,	rmassUINT32,	4723 }
{ "GR MET Flag FC4 SC",	"GRMF54S",	"",	0.125e-3,	rmassUINT32,	4724 }
{ "GR MET Unwrapped Phase T1 D1 FT",	"GRMP11F",	"",	0.125e-3,	rmassFLOAT,	4725 }
{ "GR MET Unwrapped Phase T1 D2 FT",	"GRMP12F",	"",	0.125e-3,	rmassFLOAT,	4726 }
{ "GR MET Unwrapped Phase T1 D3 FT",	"GRMP13F",	"",	0.125e-3,	rmassFLOAT,	4727 }



{ "GR MET Unwrapped Phase T1 D4 FT",	"GRMP14F",	"",	0.125e-3,	rmassFLOAT,	4728 },
{ "GR MET Unwrapped Phase T2 D1 FT",	"GRMP21F",	"",	0.125e-3,	rmassFLOAT,	4729 },
{ "GR MET Unwrapped Phase T2 D2 FT",	"GRMP22F",	"",	0.125e-3,	rmassFLOAT,	4730 },
{ "GR MET Unwrapped Phase T2 D3 FT",	"GRMP23F",	"",	0.125e-3,	rmassFLOAT,	4731 },
{ "GR MET Unwrapped Phase T2 D4 FT",	"GRMP24F",	"",	0.125e-3,	rmassFLOAT,	4732 },
{ "GR MET Unwrapped Phase T3 D1 FT",	"GRMP31F",	"",	0.125e-3,	rmassFLOAT,	4733 },
{ "GR MET Unwrapped Phase T3 D2 FT",	"GRMP32F",	"",	0.125e-3,	rmassFLOAT,	4734 },
{ "GR MET Unwrapped Phase T3 D3 FT",	"GRMP33F",	"",	0.125e-3,	rmassFLOAT,	4735 },
{ "GR MET Unwrapped Phase T3 D4 FT",	"GRMP34F",	"",	0.125e-3,	rmassFLOAT,	4736 },
{ "GR MET Unwrapped Phase T4 D1 FT",	"GRMP41F",	"",	0.125e-3,	rmassFLOAT,	4737 },
{ "GR MET Unwrapped Phase T4 D2 FT",	"GRMP42F",	"",	0.125e-3,	rmassFLOAT,	4738 },
{ "GR MET Unwrapped Phase T4 D3 FT",	"GRMP43F",	"",	0.125e-3,	rmassFLOAT,	4739 },
{ "GR MET Unwrapped Phase T4 D4 FT",	"GRMP44F",	"",	0.125e-3,	rmassFLOAT,	4740 },
{ "GR MET Unwrapped Phase T1 D1 SC",	"GRMP11S",	"",	0.125e-3,	rmassFLOAT,	4741 },
{ "GR MET Unwrapped Phase T1 D2 SC",	"GRMP12S",	"",	0.125e-3,	rmassFLOAT,	4742 },
{ "GR MET Unwrapped Phase T1 D3 SC",	"GRMP13S",	"",	0.125e-3,	rmassFLOAT,	4743 },
{ "GR MET Unwrapped Phase T1 D4 SC",	"GRMP14S",	"",	0.125e-3,	rmassFLOAT,	4744 },
{ "GR MET Unwrapped Phase T2 D1 SC",	"GRMP21S",	"",	0.125e-3,	rmassFLOAT,	4745 },
{ "GR MET Unwrapped Phase T2 D2 SC",	"GRMP22S",	"",	0.125e-3,	rmassFLOAT,	4746 },
{ "GR MET Unwrapped Phase T2 D3 SC",	"GRMP23S",	"",	0.125e-3,	rmassFLOAT,	4747 },
{ "GR MET Unwrapped Phase T2 D4 SC",	"GRMP24S",	"",	0.125e-3,	rmassFLOAT,	4748 },
{ "GR MET Unwrapped Phase T3 D1 SC",	"GRMP31S",	"",	0.125e-3,	rmassFLOAT,	4749 },
{ "GR MET Unwrapped Phase T3 D2 SC",	"GRMP32S",	"",	0.125e-3,	rmassFLOAT,	4750 },
{ "GR MET Unwrapped Phase T3 D3 SC",	"GRMP33S",	"",	0.125e-3,	rmassFLOAT,	4751 },
{ "GR MET Unwrapped Phase T3 D4 SC",	"GRMP34S",	"",	0.125e-3,	rmassFLOAT,	4752 },
{ "GR MET Unwrapped Phase T4 D1 SC",	"GRMP41S",	"",	0.125e-3,	rmassFLOAT,	4753 },
{ "GR MET Unwrapped Phase T4 D2 SC",	"GRMP42S",	"",	0.125e-3,	rmassFLOAT,	4754 },
{ "GR MET Unwrapped Phase T4 D3 SC",	"GRMP43S",	"",	0.125e-3,	rmassFLOAT,	4755 },
{ "GR MET Unwrapped Phase T4 D4 SC",	"GRMP44S",	"",	0.125e-3,	rmassFLOAT,	4756 },
{ "GR MET Unwrapped Phase FC1 FT",	"GRMP51F",	"",	0.125e-3,	rmassFLOAT,	4757 },
{ "GR MET Unwrapped Phase FC2 FT",	"GRMP52F",	"",	0.125e-3,	rmassFLOAT,	4758 },
{ "GR MET Unwrapped Phase FC3 FT",	"GRMP53F",	"",	0.125e-3,	rmassFLOAT,	4759 },
{ "GR MET Unwrapped Phase FC4 FT",	"GRMP54F",	"",	0.125e-3,	rmassFLOAT,	4760 },
{ "GR MET Unwrapped Phase FC1 SC",	"GRMP51S",	"",	0.125e-3,	rmassFLOAT,	4761 },
{ "GR MET Unwrapped Phase FC2 SC",	"GRMP52S",	"",	0.125e-3,	rmassFLOAT,	4762 },
{ "GR MET Unwrapped Phase FC3 SC",	"GRMP53S",	"",	0.125e-3,	rmassFLOAT,	4763 },
{ "GR MET Unwrapped Phase FC4 SC",	"GRMP54S",	"",	0.125e-3,	rmassFLOAT,	4764 },
{ "GR MET Laser Power in mV",	"GRMLP0",	"",	0.125e-3,	rmassFLOAT,	4765 },
{ "GR MET Laser Wavelength",	"GRMLWAVE",	"",	0.125e-3,	rmassFLOAT,	4766 },



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{ "GR MET OPL T1",          "GRMOPT1",  "",  0.125e-3, rmassDOUBLE, 4767 },
{ "GR MET OPL T2",          "GRMOPT2",  "",  0.125e-3, rmassDOUBLE, 4768 },
{ "GR MET OPL T3",          "GRMOPT3",  "",  0.125e-3, rmassDOUBLE, 4769 },
{ "GR MET OPL T4",          "GRMOPT4",  "",  0.125e-3, rmassDOUBLE, 4770 },
{ "GR MET OPL FC1",         "GRMOPF1",  "",  0.125e-3, rmassDOUBLE, 4771 },
{ "GR MET OPL FC2",         "GRMOPF2",  "",  0.125e-3, rmassDOUBLE, 4772 },
{ "GR MET OPL FC3",         "GRMOPF3",  "",  0.125e-3, rmassDOUBLE, 4773 },
{ "GR MET OPL FC4",         "GRMOPF4",  "",  0.125e-3, rmassDOUBLE, 4774 },
```

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/*
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 * Gravity Kalman workstation
```

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*/
```

```
{ "GR Kalman Time sec" ,    "GRKALTS" , "",  0.125e-3, rmassTIMESEC, 4801 },
{ "GR Kalman Time usec",   "GRKALTUS", "",  0.125e-3, rmassTIMEUSEC, 4802 },
```

```
{ "GR Kalman State",      "GRKAST",   "",  0.125e-3, rmassUINT32, 4804 },
```

```
{ "GR Kalman turbulence TF 1",    "GRKAA1",   "",  0.125e-3, rmassFLOAT, 4805 },
{ "GR Kalman turbulence TF 31",   "GRKAA31",  "",  0.125e-3, rmassFLOAT, 4835 },
{ "GR Kalman turbulence TF 61",   "GRKAA61",  "",  0.125e-3, rmassFLOAT, 4865 },
{ "GR Kalman turbulence TF 91",   "GRKAA91",  "",  0.125e-3, rmassFLOAT, 4895 },
{ "GR Kalman turbulence TF 121",  "GRKAA121", "",  0.125e-3, rmassFLOAT, 4925 },
{ "GR Kalman turbulence TF 151",  "GRKAA151", "",  0.125e-3, rmassFLOAT, 4955 },
{ "GR Kalman turbulence TF 180",  "GRKAA180", "",  0.125e-3, rmassFLOAT, 4984 },
```

```
{ "GR Kalman turb feedback 1",    "GRKAF1",   "",  0.125e-3, rmassFLOAT, 4985 },
{ "GR Kalman turb feedback 31",   "GRKAF31",  "",  0.125e-3, rmassFLOAT, 5015 },
{ "GR Kalman turb feedback 61",   "GRKAF61",  "",  0.125e-3, rmassFLOAT, 5045 },
{ "GR Kalman turb feedback 91",   "GRKAF91",  "",  0.125e-3, rmassFLOAT, 5075 },
{ "GR Kalman turb feedback 121",  "GRKAF121", "",  0.125e-3, rmassFLOAT, 5105 },
{ "GR Kalman turb feedback 151",  "GRKAF151", "",  0.125e-3, rmassFLOAT, 5135 },
{ "GR Kalman turb feedback 180",  "GRKAF180", "",  0.125e-3, rmassFLOAT, 5164 },
```

```
{ "GR Kalman turb gain 1",        "GRKAG1",   "",  0.125e-3, rmassFLOAT, 5165 },
{ "GR Kalman turb gain 31",       "GRKAG31",  "",  0.125e-3, rmassFLOAT, 5195 },
{ "GR Kalman turb gain 61",       "GRKAG61",  "",  0.125e-3, rmassFLOAT, 5225 },
{ "GR Kalman turb gain 91",       "GRKAG91",  "",  0.125e-3, rmassFLOAT, 5255 },
{ "GR Kalman turb gain 121",      "GRKAG121", "",  0.125e-3, rmassFLOAT, 5285 },
{ "GR Kalman turb gain 151",      "GRKAG151", "",  0.125e-3, rmassFLOAT, 5315 },
{ "GR Kalman turb gain 180",      "GRKAG180", "",  0.125e-3, rmassFLOAT, 5344 },
```



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{ "GR Kalman piezo TF 1",          "GRKAC1",    "",    0.125e-3, rmassFLOAT, 5345 },
{ "GR Kalman piezo TF 20",       "GRKAC20",   "",    0.125e-3, rmassFLOAT, 5364 },

/*
 * Gravity Tip Tilt Piston LCU
 */
/* rabuter added for Timing Tests*/
{ "GR TTP Time sec" ,           "GRTPPTS" ,  "",    0.125e-3, rmassTIMESEC, 5601 },
{ "GR TTP Time usec",          "GRTPPUS" ,  "",    0.125e-3, rmassTIMEUSEC, 5602 },

{ "GR TTP T1 Tip",             "GRTPPX1" ,  "",    0.125e-3, rmassFLOAT, 5604 },
{ "GR TTP T1 Tilt",           "GRTPPY1" ,  "",    0.125e-3, rmassFLOAT, 5605 },
{ "GR TTP T1 Piston",         "GRTPPZ1" ,  "",    0.125e-3, rmassFLOAT, 5606 },

{ "GR TTP T2 Tip",             "GRTPPX2" ,  "",    0.125e-3, rmassFLOAT, 5607 },
{ "GR TTP T2 Tilt",           "GRTPPY2" ,  "",    0.125e-3, rmassFLOAT, 5608 },
{ "GR TTP T2 Piston",         "GRTPPZ2" ,  "",    0.125e-3, rmassFLOAT, 5609 },

{ "GR TTP T3 Tip",             "GRTPPX3" ,  "",    0.125e-3, rmassFLOAT, 5610 },
{ "GR TTP T3 Tilt",           "GRTPPY3" ,  "",    0.125e-3, rmassFLOAT, 5611 },
{ "GR TTP T3 Piston",         "GRTPPZ3" ,  "",    0.125e-3, rmassFLOAT, 5612 },

{ "GR TTP T4 Tip",             "GRTPPX4" ,  "",    0.125e-3, rmassFLOAT, 5613 },
{ "GR TTP T4 Tilt",           "GRTPPY4" ,  "",    0.125e-3, rmassFLOAT, 5614 },
{ "GR TTP T4 Piston",         "GRTPPZ4" ,  "",    0.125e-3, rmassFLOAT, 5615 },
/* rabuter added for Timing Tests*/

/* tott added for Laser Guiding Tests */
{ "GR TTP T1 PSD X",           "GRPSDX1" ,  "",    0.125e-3, rmassFLOAT, 5616 },
{ "GR TTP T1 PSD Y",           "GRPSDY1" ,  "",    0.125e-3, rmassFLOAT, 5617 },
{ "GR TTP T1 PSD sum",        "GRPSDS1" ,  "",    0.125e-3, rmassFLOAT, 5618 },

{ "GR TTP T2 PSD X",           "GRPSDX2" ,  "",    0.125e-3, rmassFLOAT, 5619 },
{ "GR TTP T2 PSD Y",           "GRPSDY2" ,  "",    0.125e-3, rmassFLOAT, 5620 },
{ "GR TTP T2 PSD sum",        "GRPSDS2" ,  "",    0.125e-3, rmassFLOAT, 5621 },

{ "GR TTP T3 PSD X",           "GRPSDX3" ,  "",    0.125e-3, rmassFLOAT, 5622 },
{ "GR TTP T3 PSD Y",           "GRPSDY3" ,  "",    0.125e-3, rmassFLOAT, 5623 },
{ "GR TTP T3 PSD sum",        "GRPSDS3" ,  "",    0.125e-3, rmassFLOAT, 5624 },

{ "GR TTP T4 PSD X",           "GRPSDX4" ,  "",    0.125e-3, rmassFLOAT, 5625 },
{ "GR TTP T4 PSD Y",           "GRPSDY4" ,  "",    0.125e-3, rmassFLOAT, 5626 },
```



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{ "GR TTP T4 PSD sum",          "GRPSDS4" , "", 0.125e-3, rmassFLOAT, 5627 },
/* tott added for Laser Guiding Tests */

/*****/
/* MATISSE RMN AREA */
/*****/

/*
 * MATISSE L-band
 */
{ "MATISSE L-band Times sec",      "MTLTS",      "", 1e-2,      rmassTIMESEC, 8001 },
{ "MATISSE L-band Times microsec", "MTLTUS",     "", 1e-2,      rmassTIMEUSEC, 8002
},
{ "MATISSE L-band Frame index",    "MTLFRX",    "", 1e-2,      rmassINT32,    8003 },
{ "MATISSE L-band Trk-OK-flag DL bm 1", "MTLTRK1",   "", 1e-2,      rmassUINT32,   8004 },
{ "MATISSE L-band Trk-OK-flag DL bm 2", "MTLTRK2",   "", 1e-2,      rmassUINT32,   8005 },
{ "MATISSE L-band Trk-OK-flag DL bm 3", "MTLTRK3",   "", 1e-2,      rmassUINT32,   8006 },
{ "MATISSE L-band Trk-OK-flag DL bm 4", "MTLTRK4",   "", 1e-2,      rmassUINT32,   8007 },
{ "MATISSE L-band State-machine",   "MTLFSM",    "", 1e-2,      rmassUINT32,   8008 },
{ "MATISSE L-band Offset to DL bm 1", "MTLOFFS1",  "", 1e-2,      rmassDOUBLE,   8009 },
{ "MATISSE L-band Offset to DL bm 2", "MTLOFFS2",  "", 1e-2,      rmassDOUBLE,   8010 },
{ "MATISSE L-band Offset to DL bm 3", "MTLOFFS3",  "", 1e-2,      rmassDOUBLE,   8011 },
{ "MATISSE L-band Offset to DL bm 4", "MTLOFFS4",  "", 1e-2,      rmassDOUBLE,   8012 },
{ "MATISSE L-band DL pos beam 1",   "MTLDLPS1",  "", 1e-2,      rmassDOUBLE,   8013 },
{ "MATISSE L-band DL pos beam 2",   "MTLDLPS2",  "", 1e-2,      rmassDOUBLE,   8014 },
{ "MATISSE L-band DL pos beam 3",   "MTLDLPS3",  "", 1e-2,      rmassDOUBLE,   8015 },
{ "MATISSE L-band DL pos beam 4",   "MTLDLPS4",  "", 1e-2,      rmassDOUBLE,   8016 },
{ "MATISSE L-band Piston baseline 1", "MTLPIS1",   "", 1e-2,      rmassDOUBLE,   8017 },
{ "MATISSE L-band Piston baseline 2", "MTLPIS2",   "", 1e-2,      rmassDOUBLE,   8018 },
{ "MATISSE L-band Piston baseline 3", "MTLPIS3",   "", 1e-2,      rmassDOUBLE,   8019 },
{ "MATISSE L-band Piston baseline 4", "MTLPIS4",   "", 1e-2,      rmassDOUBLE,   8020 },
{ "MATISSE L-band Piston baseline 5", "MTLPIS5",   "", 1e-2,      rmassDOUBLE,   8021 },
{ "MATISSE L-band Piston baseline 6", "MTLPIS6",   "", 1e-2,      rmassDOUBLE,   8022 },
{ "MATISSE L-band SNR baseline 1",   "MTLSNR1",   "", 1e-2,      rmassDOUBLE,   8023 },
{ "MATISSE L-band SNR baseline 2",   "MTLSNR2",   "", 1e-2,      rmassDOUBLE,   8024 },
{ "MATISSE L-band SNR baseline 3",   "MTLSNR3",   "", 1e-2,      rmassDOUBLE,   8025 },
{ "MATISSE L-band SNR baseline 4",   "MTLSNR4",   "", 1e-2,      rmassDOUBLE,   8026 },
{ "MATISSE L-band SNR baseline 5",   "MTLSNR5",   "", 1e-2,      rmassDOUBLE,   8027 },
{ "MATISSE L-band SNR baseline 6",   "MTLSNR6",   "", 1e-2,      rmassDOUBLE,   8028 },
{ "MATISSE L-band IRIS bm 1 offset X", "MTLIR1X",   "", 1e-2,      rmassDOUBLE,   8029 },
{ "MATISSE L-band IRIS bm 1 offset Y", "MTLIR1Y",   "", 1e-2,      rmassDOUBLE,   8030 },
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{ "MATISSE L-band IRIS bm 2 offset X", "MTLIR2X", "", 1e-2, rmassDOUBLE, 8031 },
{ "MATISSE L-band IRIS bm 2 offset Y", "MTLIR2Y", "", 1e-2, rmassDOUBLE, 8032 },
{ "MATISSE L-band IRIS bm 3 offset X", "MTLIR3X", "", 1e-2, rmassDOUBLE, 8033 },
{ "MATISSE L-band IRIS bm 3 offset Y", "MTLIR3Y", "", 1e-2, rmassDOUBLE, 8034 },
{ "MATISSE L-band IRIS bm 4 offset X", "MTLIR4X", "", 1e-2, rmassDOUBLE, 8035 },
{ "MATISSE L-band IRIS bm 4 offset Y", "MTLIR4Y", "", 1e-2, rmassDOUBLE, 8036 },
{ "MATISSE L-band MACAO WF error UT1", "MTLMCW1", "", 1e-2, rmassDOUBLE, 8037 },
{ "MATISSE L-band MACAO WF valid UT1", "MTLMCW1", "", 1e-2, rmassUINT32, 8038 },
{ "MATISSE L-band MACAO WF error UT2", "MTLMCW2", "", 1e-2, rmassDOUBLE, 8039 },
{ "MATISSE L-band MACAO WF valid UT2", "MTLMCW2", "", 1e-2, rmassUINT32, 8040 },
{ "MATISSE L-band MACAO WF error UT3", "MTLMCW3", "", 1e-2, rmassDOUBLE, 8041 },
{ "MATISSE L-band MACAO WF valid UT3", "MTLMCW3", "", 1e-2, rmassUINT32, 8042 },
{ "MATISSE L-band MACAO WF error UT4", "MTLMCW4", "", 1e-2, rmassDOUBLE, 8043 },
{ "MATISSE L-band MACAO WF valid UT4", "MTLMCW4", "", 1e-2, rmassUINT32, 8044 },

/*
 * MATISSE N-band
 */
{ "MATISSE N-band Times sec", "MTNTS", "", 1e-2, rmassTIMESEC, 8101 },
},
{ "MATISSE N-band Times microsec", "MTNTUS", "", 1e-2, rmassTIMEUSEC, 8102 },

{ "MATISSE N-band Frame index", "MTNFRX", "", 1e-2, rmassINT32, 8103 },
{ "MATISSE N-band Trk-OK-flag DL bm 1", "MTNTRK1", "", 1e-2, rmassUINT32, 8104 },
{ "MATISSE N-band Trk-OK-flag DL bm 2", "MTNTRK2", "", 1e-2, rmassUINT32, 8105 },
{ "MATISSE N-band Trk-OK-flag DL bm 3", "MTNTRK3", "", 1e-2, rmassUINT32, 8106 },
{ "MATISSE N-band Trk-OK-flag DL bm 4", "MTNTRK4", "", 1e-2, rmassUINT32, 8107 },
{ "MATISSE N-band State-machine", "MTNFSM", "", 1e-2, rmassUINT32, 8108 },
{ "MATISSE N-band Offset to DL bm 1", "MTNOFFS1", "", 1e-2, rmassDOUBLE, 8109 },
{ "MATISSE N-band Offset to DL bm 2", "MTNOFFS2", "", 1e-2, rmassDOUBLE, 8110 },
{ "MATISSE N-band Offset to DL bm 3", "MTNOFFS3", "", 1e-2, rmassDOUBLE, 8111 },
{ "MATISSE N-band Offset to DL bm 4", "MTNOFFS4", "", 1e-2, rmassDOUBLE, 8112 },
{ "MATISSE N-band DL pos beam 1", "MTNDLPS1", "", 1e-2, rmassDOUBLE, 8113 },
{ "MATISSE N-band DL pos beam 2", "MTNDLPS2", "", 1e-2, rmassDOUBLE, 8114 },
{ "MATISSE N-band DL pos beam 3", "MTNDLPS3", "", 1e-2, rmassDOUBLE, 8115 },
{ "MATISSE N-band DL pos beam 4", "MTNDLPS4", "", 1e-2, rmassDOUBLE, 8116 },
{ "MATISSE N-band Piston baseline 1", "MTNPIS1", "", 1e-2, rmassDOUBLE, 8117 },
{ "MATISSE N-band Piston baseline 2", "MTNPIS2", "", 1e-2, rmassDOUBLE, 8118 },
{ "MATISSE N-band Piston baseline 3", "MTNPIS3", "", 1e-2, rmassDOUBLE, 8119 },
{ "MATISSE N-band Piston baseline 4", "MTNPIS4", "", 1e-2, rmassDOUBLE, 8120 },
{ "MATISSE N-band Piston baseline 5", "MTNPIS5", "", 1e-2, rmassDOUBLE, 8121 },
{ "MATISSE N-band Piston baseline 6", "MTNPIS6", "", 1e-2, rmassDOUBLE, 8122 },
{ "MATISSE N-band SNR baseline 1", "MTNSNR1", "", 1e-2, rmassDOUBLE, 8123 },
{ "MATISSE N-band SNR baseline 2", "MTNSNR2", "", 1e-2, rmassDOUBLE, 8124 },
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{ "MATISSE N-band SNR baseline 3",      "MTNSNR3",      "",      1e-2,      rmassDOUBLE,      8125 },
{ "MATISSE N-band SNR baseline 4",      "MTNSNR4",      "",      1e-2,      rmassDOUBLE,      8126 },
{ "MATISSE N-band SNR baseline 5",      "MTNSNR5",      "",      1e-2,      rmassDOUBLE,      8127 },
{ "MATISSE N-band SNR baseline 6",      "MTNSNR6",      "",      1e-2,      rmassDOUBLE,      8128 },
{ "MATISSE N-band IRIS bm 1 offset X",   "MTNIR1X",     "",      1e-2,      rmassDOUBLE,      8129 },
{ "MATISSE N-band IRIS bm 1 offset Y",   "MTNIR1Y",     "",      1e-2,      rmassDOUBLE,      8130 },
{ "MATISSE N-band IRIS bm 2 offset X",   "MTNIR2X",     "",      1e-2,      rmassDOUBLE,      8131 },
{ "MATISSE N-band IRIS bm 2 offset Y",   "MTNIR2Y",     "",      1e-2,      rmassDOUBLE,      8132 },
{ "MATISSE N-band IRIS bm 3 offset X",   "MTNIR3X",     "",      1e-2,      rmassDOUBLE,      8133 },
{ "MATISSE N-band IRIS bm 3 offset Y",   "MTNIR3Y",     "",      1e-2,      rmassDOUBLE,      8134 },
{ "MATISSE N-band IRIS bm 4 offset X",   "MTNIR4X",     "",      1e-2,      rmassDOUBLE,      8135 },
{ "MATISSE N-band IRIS bm 4 offset Y",   "MTNIR4Y",     "",      1e-2,      rmassDOUBLE,      8136 },
{ "MATISSE N-band MACAO WF error UT1",   "MTNMCW1",     "",      1e-2,      rmassDOUBLE,      8137 },
{ "MATISSE N-band MACAO WF valid UT1",   "MTNMCWV1",    "",      1e-2,      rmassUINT32,      8138 },
{ "MATISSE N-band MACAO WF error UT2",   "MTNMCW2",     "",      1e-2,      rmassDOUBLE,      8139 },
{ "MATISSE N-band MACAO WF valid UT2",   "MTNMCWV2",    "",      1e-2,      rmassUINT32,      8140 },
{ "MATISSE N-band MACAO WF error UT3",   "MTNMCW3",     "",      1e-2,      rmassDOUBLE,      8141 },
{ "MATISSE N-band MACAO WF valid UT3",   "MTNMCWV3",    "",      1e-2,      rmassUINT32,      8142 },
{ "MATISSE N-band MACAO WF error UT4",   "MTNMCW4",     "",      1e-2,      rmassDOUBLE,      8143 },
{ "MATISSE N-band MACAO WF valid UT4",   "MTNMCWV4",    "",      1e-2,      rmassUINT32,      8144 },

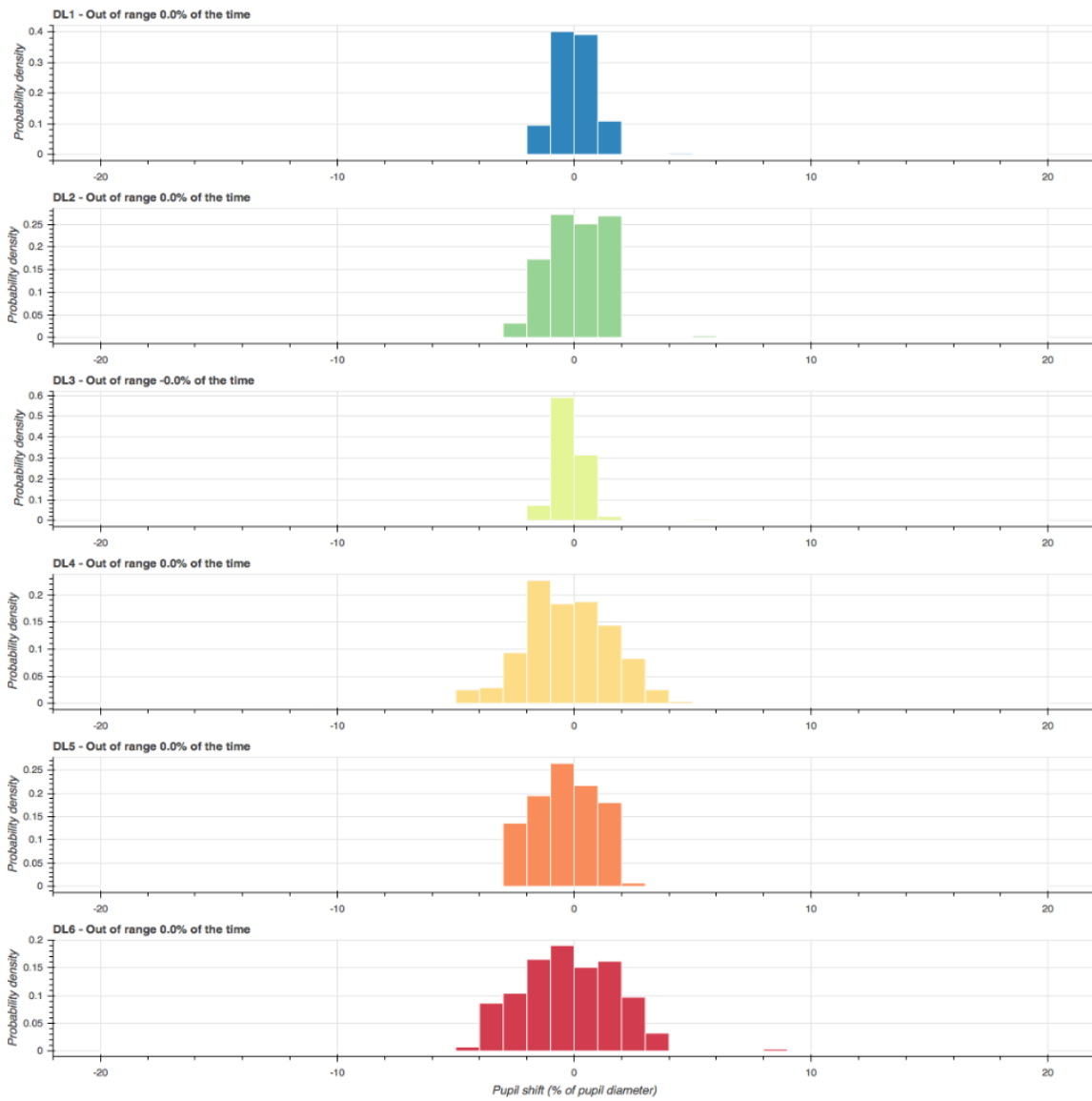
/* last Entry */
{ "", "", "", 0.0, rmassEND_OF_TABLE, 0 }
};

#endif /* RMASS_LAYOUT_H */
```

## 16. Annex D: statistics of the pupil motion due to hysteresis

Hysteresis is estimated once per week for each DL from Delirium data taken with the carriage moving in both directions. For 6 years of data we calculated the motion of the pupil due to hysteresis when the carriage is at 10 m (VCM with small curvature) in Figure 28 and 110 m (VCM with large curvature) in Figure 29.





**Figure 28: probability density of the pupil shift created by the hysteresis of the carriage for the carriage at 10 m OPL.**

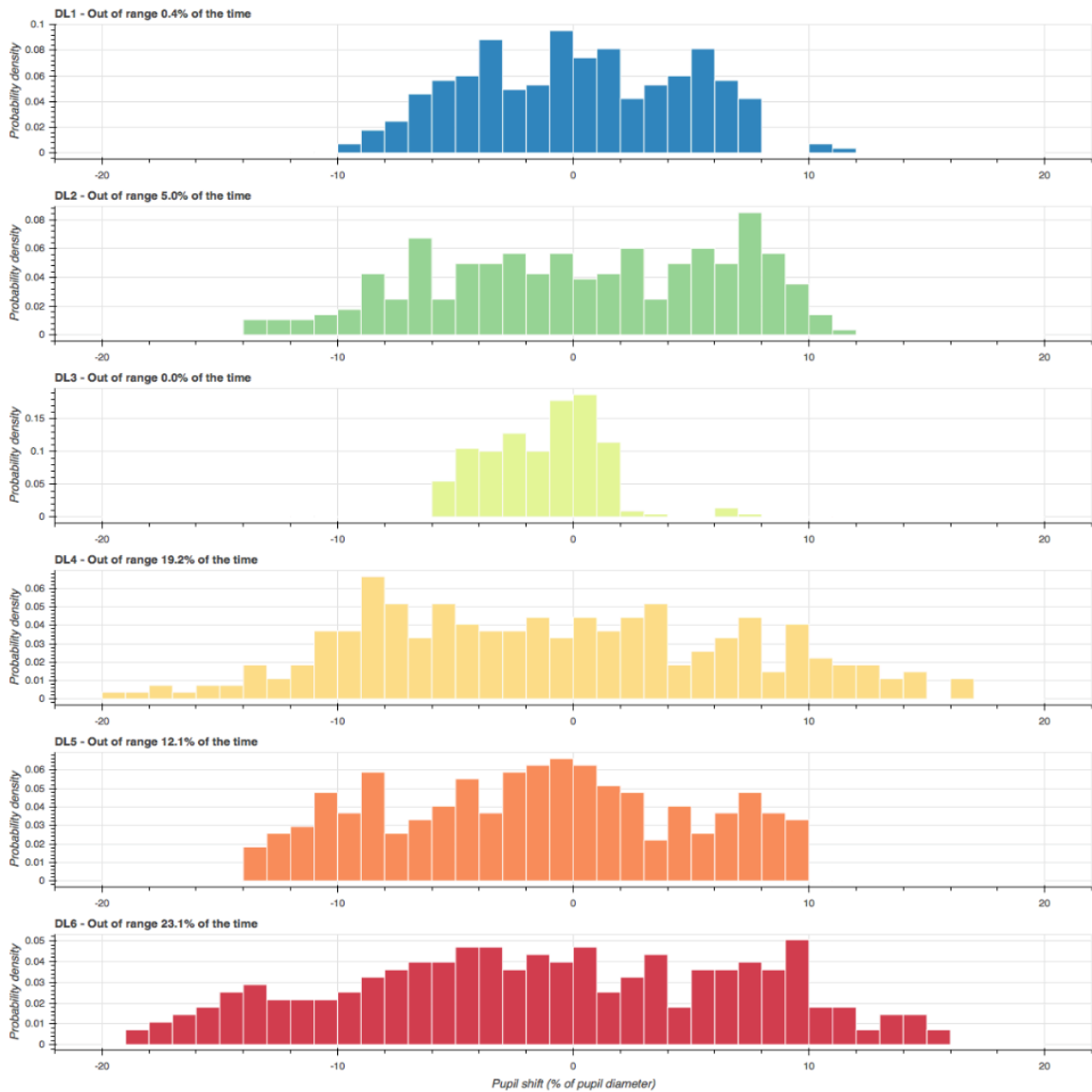
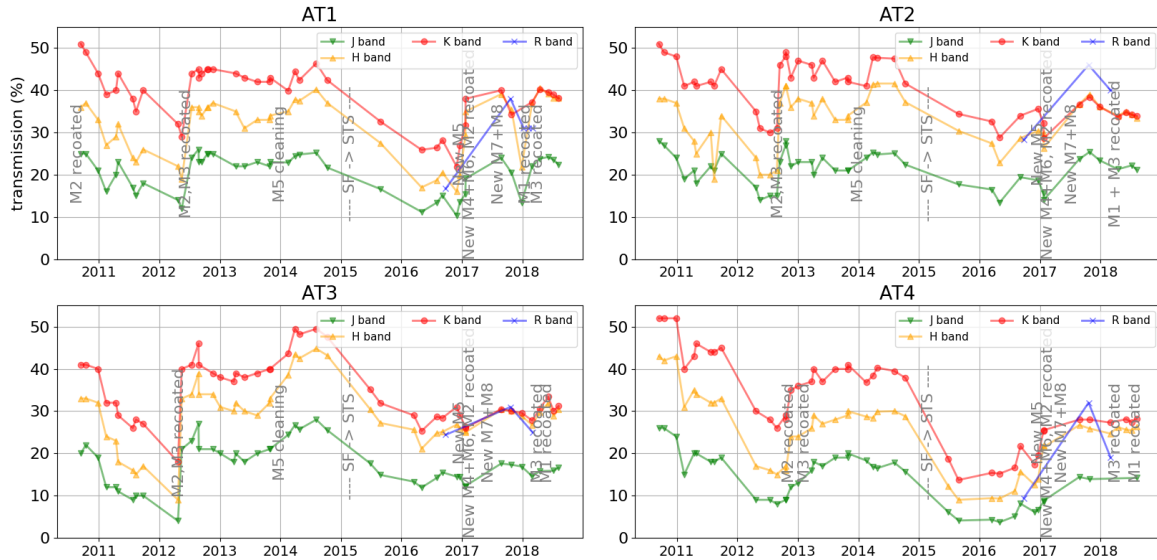


Figure 29: probability density of the pupil shift created by the hysteresis of the carriage for the carriage at 110 m OPL.

## 17. Annex E: Infrared transmission monitoring



**Table 61: infrared transmission of the VLTI with the ATs (ratio of photons after reflection on the switchyard to the number of photons reaching the AT M1).**

VLTI arm configuration	J band	H band	K band
UT1-DL5-Q2	$0.173 \pm 0.023$	$0.314 \pm 0.042$	$0.371 \pm 0.041$
UT2-DL2-Q1	$0.165 \pm 0.030$	$0.319 \pm 0.048$	$0.365 \pm 0.049$
UT3-DL3-Q3	$0.134 \pm 0.014$	$0.259 \pm 0.024$	$0.307 \pm 0.017$
UT4-DL4-Q4	$0.193 \pm 0.043$	$0.359 \pm 0.051$	$0.390 \pm 0.041$

**Table 62: last measurement of the UT infrared transmission (ratio of photons after reflection on the switchyard to the number of photons reaching the UT M1).**

### 17.1 Example for Table



**Table 63: ESO Standard Table**



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