



Deliverable 6.1: Definition of Interfaces

Dissemination Level: Confidential (CO)

Owner

Name: Jose Ramos De Campos David Bruneel
Lead Beneficiary: LASEA
Phone:
E-mail: jaramos@lasea.eu DBruneel@laser-ea.com

Context

Author(s): David Bruneel
Work Package: WP6
Task: 6.1 – Definition of the interfaces

Document Status

Version: 1.0
Last modified: 31/01/2017
Status: Final
Approved by: Marwan Abdou-Ahmed
Date Approved: 06/02/2017

Declaration: Any work or result described therein is genuinely a result of the Hiperdias project. Any other source will be properly referenced where and when relevant

Table of Contents

1	Version History.....	3
2	Scope	4
3	Introduction:	5
4	Demonstrator 1 – 500W - 1kW Laser	6
4.1	Interface 1	8
4.2	Interface 2:.....	10
4.3	Interface 3	12
4.4	Interface 4	14
4.5	Interface 5	16
4.6	Interface 6	18
4.7	Interface 7	20
4.8	Interface 8	22
4.9	Interface 9	24
4.10	Interface 10	26
4.11	Interface 11	28
4.12	Interface 12	30
4.13	Interface 13	32
5	Demonstrator 2 – 200W Laser	34
5.1	Interface 1	35
5.2	Interface 2	37
5.3	Interface 3	38
5.4	Interface 4	40
5.5	Interface 5	41
5.6	Interface 6	42
5.7	Interface 7	43
5.8	Interface 8	44
6	Conclusion and further work :	45

1 Version History

Version	Summary of Change	Written By	Approver	Date
0.1	LASEA - First draft	David Bruneel		22/12/2016
0.2	C4L – inputs v1	Noémie Dury		30/01/2017
0.3	LASEA – final draft	David Bruneel		31/01/2017
1.0	First issue		Marwan Abdou-Ahmed	06/02/2017

2 **Scope**

Description of the task: In this task, the information of interfaces requirements defined in T1.4 by D1.4 will be analyzed and eventually modified by the partners. Both LASEA and C4L will check all the requirements for the respective setup at their facilities. The interfaces concerned are the laser-machine communication, the man-machine communication, the mechanical interfaces for the laser and optics. Communication and user interface is necessary between the machine control, CNC axis, the laser source and the optical deflection unit. The physical connections have to be defined as well as the interface protocols needed. A combination of scanner and trepanning unit will also be considered. This task will be a continuous process that will take place during a large part of the WP to ensure that the solutions provided fit the specs for the final integration.

3 Introduction:

In project task T1.4, an exchange document was created in order to collect all the information regarding the interfaces. This deliverable takes all the information from the D1.4 as illustrated by the Table 1. In this document we review the details of all the interfaces identified in the T1.4, with the goal to gather all the requirements necessary to make the different component fit with each other. Below is the list of the interface illustrated one by one. A sketch of the 1kW setup is illustrated by the Figure 1.

In Chapter 4, all the interfaces for the Demonstrator 1 (500W – 1kW Laser) are detailed. In Chapter 5 the same work is done for demonstrator 2 (200W laser)

4 Demonstrator 1 – 500W - 1kW Laser

Interface number	Partners involved	Type of interface
1	USTUTT <-> AMP	MECHANICAL/ELECTRICAL/WATER
2	USTUTT <-> AMP	MECHANICAL/OPTICAL
3	USTUTT <-> USTUTT	MECHANICAL/ELECTRICAL/WATER
4	USTUTT <-> LASEA	SOFTWARE/ELECTRICAL
5	AMP <-> LASEA	SOFTWARE/ELECTRICAL
6	AMP <-> [AMO-USTUTT]	OPTICAL
7	USTUTT <-> [AMO-USTUTT]	MECHANICAL/OPTICAL
8	USTUTT <-> [AMO-USTUTT]	MECHANICAL/ELECTRICAL
9	[AMO-USTUTT] <-> [GLO-XLIM]	MECHANICAL/OPTICAL
10	LASEA <-> USTUTT	MECHANICAL/ELECTRICAL/WATER
11	[AMO-USTUTT] <-> LASEA	MECHANICAL/OPTICAL
12	[GLO-XLIM] <-> LASEA	MECHANICAL/OPTICAL
13	LASEA (Software) <-> LASEA (Auto-alignment)	MECHANICAL/OPTICAL/ELECTRICAL/SOFT WARE
14	LASEA (Software) <-> LASEA (Scanner)	MECHANICAL/OPTICAL/ELECTRICAL/SOFT WARE

Table 1: List of interfaces defined in the T1.4.

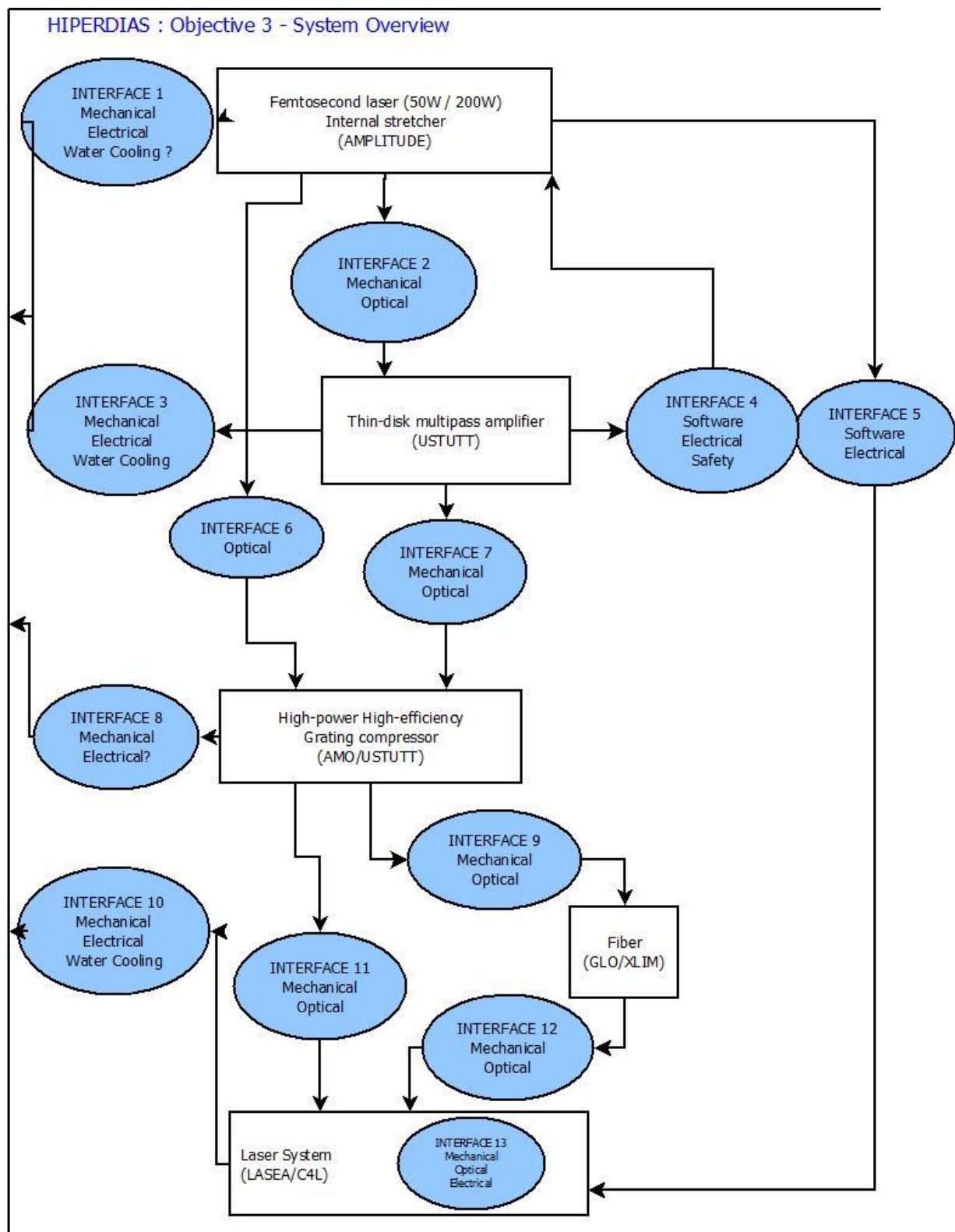


Fig.1 : Sketch of the different components and their interfaces highlighted in blue.

4.1 Interface 1

Interface number	Partners involved	Type of interface
1	USTUTT <--> AMP	MECHANICAL/ELECTRICAL/WATER

Type of interface	Description	USTUTT: room	AMP: Laser 50W
Mechanical	Dimensions	LEO lab, table 3x1.2x0.2m	0.5x0.33x0.12 m
	Weight	1000kg	80 kg
	Material	Table: steel	Aluminum
	Cautions	VERY heavy	Heavy, To not shock
	Fixings	Breadboard on Feet	Clamped feet or screwed baseplate
	Mechanical drawing file	Yes	Yes, is provided with the manual
Electrical	Voltage	430 V	220 V
	Max current	16 A	6A
	Power	6.88 kW	1.32 kW
	PSU : external/to integrate ?	N/A	External
	Electrical drawings files	N/A	Yes, provided with the manual
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	N/A	N/A
	Output pulse duration	N/A	N/A
	Output beam size (1/e2)	N/A	N/A
	Output max average power	N/A	N/A
	Output max peak power	N/A	N/A
	Output beam height (mm)	N/A	N/A
	Appropriate safety googles	N/A	N/A

	Input wavelength	N/A	N/A
	Input Pulse duration	N/A	N/A
	Input Beam size (1/e ²)	N/A	N/A
	Input max average power	N/A	N/A
	Input max peak power	N/A	N/A
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	N/A	N/A
Water	Diameter of pipes	N/A	Will be provided in the manual of the laser
	Flow rate / temperature	N/A	Will be provided in the manual of the laser
	Ratio additive / water	N/A	Will be provided in the manual of the laser
	Chiller ?	N/A	YES

4.2 Interface 2:

Interface number	Partners involved	Type of interface
2	AMP <--> USTUTT	MECHANICAL/OPTICAL

Type of interface	Description	AMP: Laser 50W	USTUTT: Booster
Mechanical	Dimensions	0.5x0.33x0.12 m	2x1x0.7m
	Weight	80 kg	400 kg
	Material	Aluminum	Alu/Cu/Steel
	Cautions	Heavy, To not shock	Very heavy
	Fixings	Clamped feet or screwed baseplate	3 points mounting feet
	Mechanical drawing file (YES/NO)	Yes, is provided with the manual	NO
Electrical	Voltage	N/A	N/A
	Max current	N/A	N/A
	Power	N/A	N/A
	PSU: external/to integrate ?	N/A	N/A
	Electrical drawings files	N/A	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	1030 nm	N/A
	Output pulse duration	350 fs	N/A
	Output beam size (1/e2)	2.5mm	N/A
	Output max average power	75W	N/A
	Output max peak power	200 MW	N/A
	Output beam height (mm)	73mm	N/A
	Appropriate safety goggles	References will be provided	N/A

	Input wavelength	N/A	1030 nm
	Input Pulse duration	N/A	350fs
	Input Beam size (1/e2)	N/A	4 mm
	Input max average power	N/A	75 W
	Input max peak power	N/A	200 MW
	Input beam Height (mm)	N/A	Flexible height (Lift)
	Appropriate Safety goggles	N/A	N/A
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

4.3 Interface 3

Interface number	Partners involved	Type of interface
3	USTUTT <--> USTUTT	MECHANICAL/ELECTRICAL/WATER

Type of interface	Description	USTUTT: booster	USTUTT: room
Mechanical	Dimensions	2x1x0.7m	LEO lab, table 3x1.2x0.2m
	Weight	400 kg	1000kg
	Material	Alu/Cu/Steel	Table: steel
	Cautions	Very heavy	VERY heavy
	Fixings	3 points mounting feet	Breadboard on Feet
	Mechanical drawing file	N/A	Yes
Electrical	Voltage	430	430 V
	Max current	16 A	16 A
	Power	6.88 kW	6.88 kW
	PSU : external/to integrate ?	External to the machine	N/A
	Electrical drawings files	To be provided	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	1030 nm	N/A
	Output pulse duration	500-1000fs	N/A
	Output beam size (1/e2)	4-5 mm	N/A
	Output max average power	500 W (1000W at the end of project)	N/A
	Output max peak power	2 GW	N/A
	Output beam height (mm)	To be defined in relation to the ground	N/A
	Appropriate safety googles	References will be	N/A

		provided	
	Input wavelength	1030 nm	N/A
	Input Pulse duration	400fs	N/A
	Input Beam size (1/e2)	4 mm	N/A
	Input max average power	50 W	N/A
	Input max peak power	110 MW	N/A
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	References will be provided	N/A
Water	Diameter of pipes	<i>To be defined</i>	No water cooling provided
	Flow rate	<i>To be defined</i>	No water cooling provided
	additive	<i>To be defined</i>	No water cooling provided
	Chiller ?	<i>To be defined</i>	No water cooling provided

4.4 Interface 4

Interface number	Partners involved	Type of interface
4	USTUTT <--> AMP	ELECTRICAL/SAFETY

Type of interface	Description	USTUTT: Booster	AMPA: Laser 50W
Mechanical	Dimensions	N/A	N/A
	Weight	N/A	N/A
	Material	N/A	N/A
	Cautions	N/A	N/A
	Fixings	N/A	N/A
	Mechanical drawing file	N/A	N/A
Electrical	Voltage	430 V	430V
	Max current	16 A	16 A
	Power	6.88 kW	6.88 kW, 5,8kW used by the machine
	PSU: external/to integrate ?	External to the machine	External to the machine
	Interlock	Linked to the laser and the machine	Linked to the laser and the machine
	Electrical drawings files	N/A	External
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	N/A	N/A
	Output pulse duration	N/A	N/A
	Output beam size (1/e ²)	N/A	N/A
	Output max average power	N/A	N/A
	Output max peak power	N/A	N/A
	Output beam height (mm)	N/A	N/A

	Appropriate safety goggles	N/A	N/A
	Input wavelength	N/A	N/A
	Input Pulse duration	N/A	N/A
	Input Beam size (1/e2)	N/A	N/A
	Input max average power	N/A	N/A
	Input max peak power	N/A	N/A
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	N/A	N/A
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

4.5 Interface 5

Interface number	Partners involved	Type of interface
5	AMP <--> LASEA/C4L	SOFTWARE/ELECTRICAL

Type of interface	Description	AMP: Laser 50W	LASEA: Laser machine
Mechanical	Dimensions	N/A	N/A
	Weight	N/A	N/A
	Material	N/A	N/A
	Cautions	N/A	N/A
	Fixings	N/A	N/A
	Mechanical drawing file	N/A	N/A
Electrical	Voltage	220 V	220 V ou 430 V
	Max current	16 A	16 A
	Max Power	35 kW	6.8 kW
	PSU: external/to integrate ?	N/A	External
	Electrical drawings files	N/A	External
Software	Protocol of communication	RS232	RS232
	Table of commands file	Will be provided	N/A
Optical	Output wavelength	N/A	N/A
	Output pulse duration	N/A	N/A
	Output beam size (1/e2)	N/A	N/A
	Output max average power	N/A	N/A
	Output max peak power	N/A	N/A
	Output beam height (mm)	N/A	N/A
	Appropriate safety googles	N/A	N/A
	Input wavelength	N/A	N/A
	Input Pulse duration	N/A	N/A

	Input Beam size (1/e2)	N/A	N/A
	Input max average power	N/A	N/A
	Input max peak power	N/A	N/A
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	N/A	N/A
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

4.6 Interface 6

Interface number	Partners involved	Type of interface
6	AMP <--> (AMO-USTUTT)	OPTICAL

Type of interface	Description	AMP: Laser 50W	(AMO-USTUTT): Booster
Mechanical	Dimensions	N/A	N/A
	Weight	N/A	N/A
	Material	N/A	N/A
	Cautions	N/A	N/A
	Fixings	N/A	N/A
	Mechanical drawing file	N/A	N/A
Electrical	Voltage	N/A	N/A
	Max current	N/A	N/A
	Power	N/A	N/A
	PSU: external/to integrate ?	N/A	N/A
	Electrical drawings files	N/A	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	1030 nm	N/A
	Output pulse duration	350 fs	N/A
	Output beam size (1/e ²)	2-2.5 mm	N/A
	Output max average power	75W	N/A
	Output max peak power	200 MW	N/A
	Output beam height (mm)	73mm	N/A
	Appropriate safety goggles	References will be provided	N/A
	Input wavelength	N/A	1030 nm
	Input Pulse duration	N/A	400 fs

	Input Beam size (1/e ²)	N/A	4 mm
	Input max average power	N/A	50 W
	Input max peak power	N/A	110 MW
	Input beam Height (mm)	N/A	To be defined
	Appropriate Safety goggles	N/A	To be defined
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

4.7 Interface 7

Interface number	Partners involved	Type of interface
7	USTUTT <--> (AMO-USTUTT)	MECHANICAL/OPTICAL

Type of interface	Description	USTUTT: Booster	(AMO-USTUTT)
Mechanical	Dimensions	N/A	N/A
	Weight	N/A	N/A
	Material	N/A	N/A
	Cautions	N/A	N/A
	Fixings	N/A	N/A
	Mechanical drawing file	N/A	N/A
Electrical	Voltage	N/A	N/A
	Max current	N/A	N/A
	Power	N/A	N/A
	PSU : external/to integrate ?	N/A	N/A
	Electrical drawings files	N/A	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	N/A	N/A
	Output pulse duration	N/A	N/A
	Output beam size (1/e2)	N/A	N/A
	Output max average power	N/A	N/A
	Output max peak power	N/A	N/A
	Output beam height (mm)	N/A	N/A
	Appropriate safety goggles	N/A	N/A
	Input wavelength	N/A	N/A
	Input Pulse duration	N/A	N/A

	Input Beam size (1/e ²)	N/A	N/A
	Input max average power	N/A	N/A
	Input max peak power	N/A	N/A
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	N/A	N/A
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

Comments:

This interface actually consists of adding the compressor developed by AMO right after the amplifier of the laser. This component is then a part of the laser itself and so is not an interface between two different components as it will be included in the building of the booster in the WP5.

4.8 Interface 8

Interface number	Partners involved	Type of interface
8	USTUTT(ROOM) <--> (AMO-USTUTT)	MECHANICAL/ELECTRICAL

Type of interface	Description	USTUTT: Room	AMO
Mechanical	Dimensions	N/A	N/A
	Weight	N/A	N/A
	Material	N/A	N/A
	Cautions	N/A	N/A
	Fixings	N/A	N/A
	Mechanical drawing file	N/A	N/A
Electrical	Voltage	N/A	N/A
	Max current	N/A	N/A
	Power	N/A	N/A
	PSU : external/to integrate ?	N/A	N/A
	Electrical drawings files	N/A	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	N/A	N/A
	Output pulse duration	N/A	N/A
	Output beam size (1/e2)	N/A	N/A
	Output max average power	N/A	N/A
	Output max peak power	N/A	N/A
	Output beam height (mm)	N/A	N/A
	Appropriate safety googles	N/A	N/A
	Input wavelength	N/A	N/A
	Input Pulse duration	N/A	N/A

	Input Beam size (1/e2)	N/A	N/A
	Input max average power	N/A	N/A
	Input max peak power	N/A	N/A
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	N/A	N/A
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

Comments:

Same comment as for the interface 7, this interface actually consists of adding the compressor developed by AMO right after the amplifier of the laser. This component is then a part of the laser itself and so is not an interface between two different components as it will be included in the laser building.

4.9 Interface 9

Interface number	Partners involved	Type of interface
9	(AMO-USTUTT) <--> (GLO-XLIM)	MECHANICAL/OPTICAL

Type of interface	Description	GLO-XLIM: Fiber	AMO-USTUTT: Booster
Mechanical	Dimensions	N/A	To be determined
	Weight	negligible	To be determined
	Material	Pure silica and air	To be determined
	Cautions	Fiber ends to be prepared	To be determined
	Fixings	3 axes translation stage	To be determined
	Mechanical drawing file	N/A	To be determined
Electrical	Voltage	N/A	N/A
	Max current	N/A	N/A
	Power	N/A	N/A
	PSU: external/to integrate ?	N/A	N/A
	Electrical drawings files	N/A	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	N/A	1030nm
	Output pulse duration	N/A	500-1000fs
	Output beam size (1/e2)	N/A	4-5 mm
	Output max average power	N/A	500 – 1000 W
	Output max peak power	N/A	2GW
	Output beam height (mm)	N/A	To be defined
	Appropriate safety goggles	N/A	yes
	Input wavelength	1030 nm	N/A

	Input Pulse duration	500-1000fs	N/A
	Input Beam size (1/e2)	Depends on the laser 1 to 3 mm	N/A
	Input max average power	To be determined (ultimate goal: 1kW)	N/A
	Input max peak power	To be determined	N/A
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	References will be provided	N/A
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

Comments:

In this interface, there is some information that is unknown at this state of the project, and will be determined in the future WPs.

4.10 Interface 10

Interface number	Partners involved	Type of interface
10	LASEA <--> USTUTT	MECHANICAL/ELECTRICAL/WATER

Type of interface	Description	LASEA: Laser machine	USTUTT: Room
Mechanical	Dimensions	External dimensions of the system LS5-1 : 2110mm(L) x 2550mm (l) x >=2400mm (H) ; height available between the granit and the (removable) roof of the system : 1000 mm ; size of the granit only : 1200mm x 1200 mm ; LS5-2 : 3050mm(L) x 2550mm (l) x >=2400mm (H) ; height available between the granit and the (removable) roof of system : 1000 mm ; size of the granit only : 1200mm x 1800mm	LEO lab, table 3x1.2x0.2m
	Weight	LS5-1 : 1700 kg with enclosure, 1250 kg without enclosure ;	N/A
	Material	Alu/Steel	N/A
	Cautions	N/A	N/A
	Fixings	On feet. The machine and the laser table are mounted independently to each other.	N/A
	Mechanical drawing file	Example of LS3	N/A

Electrical	Voltage	430 V	430 V
	Max current	16 A	16 A
	Power	6.88 kW	6.88 kW
	PSU: external/to integrate ?	Will be integrated using standards	N/A
	Electrical drawings files	Already known	N/A
Software	Protocol of communication	TCP/IP	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	N/A	N/A
	Output pulse duration	N/A	N/A
	Output beam size (1/e2)	N/A	N/A
	Output max average power	N/A	N/A
	Output max peak power	N/A	N/A
	Output beam height (mm)	N/A	N/A
	Appropriate safety googles	N/A	N/A
	Input wavelength	N/A	N/A
	Input Pulse duration	N/A	N/A
	Input Beam size (1/e2)	N/A	N/A
	Input max average power	N/A	N/A
	Input max peak power	N/A	N/A
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety googles	N/A	N/A
Water	Diameter of pipes	N/A	No water cooling
	Flow rate	N/A	No water cooling
	additive	N/A	No water cooling
	Chiller ?	N/A	Yes

4.11 Interface 11

Interface number	Partners involved	Type of interface
11	(AMO-USTUTT) <--> LASEA	MECHANICAL/OPTICAL

Type of interface	Description	USTUTT: Booster	LASEA: Laser system
Mechanical	Dimensions	N/A	Beam Stabilization (compensate for the pointing stability, air fluctuations, different thermal expansion between the 2 tables, etc.)
	Weight	N/A	
	Material	N/A	
	Cautions	N/A	
	Fixings	N/A	
	Mechanical drawing file	N/A	
Electrical	Voltage	N/A	N/A
	Max current	N/A	N/A
	Power	N/A	N/A
	PSU : external/to integrate ?	N/A	N/A
	Electrical drawings files	N/A	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	1030 nm	N/A
	Output pulse duration	500-1000 fs	N/A
	Output beam size (1/e ²)	4-5 mm	N/A
	Output max average power	500 – 1000 W	N/A
	Output max peak power	2 GW	N/A
	Output beam height (mm)	To be defined, In relation to the ground	N/A
	Appropriate safety goggles	yes	N/A
	Input wavelength	N/A	1030 nm
	Input Pulse duration	N/A	500-1000fs

	Input Beam size (1/e ²)	N/A	4-5 mm
	Input max average power	N/A	To be determined
	Input max peak power	N/A	To be determined
	Input beam Height (mm)	N/A	To be determined
	Appropriate Safety goggles	N/A	yes
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

Comments:

In this interface, there will be a special focus on the beam stabilization. Indeed, as the machine and the laser booster will be placed on different tables, there is a high probability of a decrease of the pointing stability due to low frequency vibrations, air fluctuations, thermal shifts, etc. In order to correct this, a special component will be added in the system consisting on several mirrors and sensors that will compensate any beam shift with an angle and position corrections. The choice of the component is under discussion, and so the specifications will be known later on.

4.12 Interface 12

Interface number	Partners involved	Type of interface
12	(GLO-XLIM) <--> LASEA	MECHANICAL/OPTICAL

Type of interface	Description	GLO-XLIM: Fiber	LASEA: Laser system
Mechanical	Dimensions	To be determined	To be determined
	Weight	To be determined	N/A
	Material	To be determined	Alu
	Cautions	To be determined	N/A
	Fixings	To be determined	To be determined
	Mechanical drawing file	To be determined	To be determined
Electrical	Voltage	N/A	N/A
	Max current	N/A	N/A
	Power	N/A	N/A
	PSU : external/to integrate ?	N/A	N/A
	Electrical drawings files	N/A	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical	Output wavelength	1030 nm	N/A
	Output pulse duration	500-1000fs	N/A
	Output beam size (1/e2)	To be defined	N/A
	Output max average power	To be determined	N/A
	Output max peak power	To be determined	N/A
	Output beam height (mm)	N/A	N/A
	Appropriate safety goggles	yes	Yes
	Input wavelength	N/A	1030nm
	Input Pulse duration	N/A	500-1000fs

	Input Beam size (1/e2)	N/A	To be determined
	Input max average power	N/A	To be determined
	Input max peak power	N/A	To be determined
	Input beam Height (mm)	N/A	To be determined
	Appropriate Safety goggles	N/A	yes
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

4.13 Interface 13

Interface number	Partners involved	Type of interface
13	LASEA<--> Scanner	MECHANICAL/OPTICAL/ELECTRICAL/SOFTWARE/WATER

Type of interface	Description	LASEA: Laser system	Scanner component : Scanlab/LS-Scan
Mechanical	Dimensions	Will be adapted to the scanner	Lens thread: M85 or M120
	Weight	N/A	To be determined
	Material	Aluminum	Aluminum
	Cautions	Wear safety goggles	Do not touch
	Fixings	to be designed	To be determined
	Mechanical drawing file	Will be designed	Provided by Scanlab
Electrical	Voltage	To be determined	To be determined
	Max current	To be determined	To be determined
	Power	To be determined	To be determined
	PSU : external/to integrate ?	To integrate	To be determined
	Electrical drawings files	Will be done	To be determined
Software	Protocol of communication	TCP/IP	TCP/IP : Kyla or LaserDesk
	Table of commands file	Same than the scanner	To be determined
Optical	Output wavelength	1030nm	1030nm
	Output pulse duration	500-1000fs	500-1000fs
	Output beam size (1/e2)	To be determined (5-25mm)	To be determined (5-25mm)
	Output max average power	500 – 1000 W	500 – 1000 W
	Output max peak power	2GW	2GW
	Output beam height (mm)	N/A	N/A

	Appropriate safety goggles	yes	yes
	Input wavelength	N/A	1030nm
	Input Pulse duration	N/A	500-1000fs
	Input Beam size (1/e2)	N/A	To be determined (5-25mm)
	Input max average power	N/A	500 – 1000 W
	Input max peak power	N/A	2GW
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	N/A	N/A
Water	Diameter of pipes	To be determined	To be determined
	Flow rate	To be determined	To be determined
	additive	To be determined	To be determined
	Chiller ?	To be determined	To be determined

Comments:

In this interface, the choice of the galvo is under discussion. The scanner will be integrated. Some criteria to choose the scanner is the diameter of the aperture of the scanner. Indeed, as described in the D1.1, in order to avoid any losses in the beam propagation, we must have a clear aperture of at least twice the size of the beam. The interface will be defined once the choice done.

5 Demonstrator 2 – 200W Laser

Interface number	Partners involved	Type of interface
1	AMP ↔ C4L (Motion)	SOFTWARE/ ELECTRICAL/ WATER?
2	AMP ↔ C4L (Vision)	MECHANICAL/ OPTICAL
3	AMP ↔ GLO-XLIM (Fiber)	MECHANICAL/ OPTICAL/ WATER?
4	GLO-XLIM (Fiber) ↔ C4L (Vision/Scanner)	MECHANICAL/ OPTICAL/ WATER?
5	(Software) C4L ↔ C4L (Scanner/Motion/Vision)	SOFTWARE/OPTICAL
6	(Scanner/ Vision) C4L ↔ C4L (Motion)	MECHANICAL/ ELECTRICAL / SOFTWARE/ OPTICAL
7	(Machine) C4L ↔ C4L (Part to Proceed)	MECANICAL / OPTICAL (Vision) / ATMOSPHERE (Exhaust)
8	(Machine) C4L ↔ E6 (Part to Proceed)	MECANICAL / OPTICAL (Vision) / ATMOSPHERE (Exhaust)

Table 1: List of interfaces defined in the T1.4.for Demonstrator 2

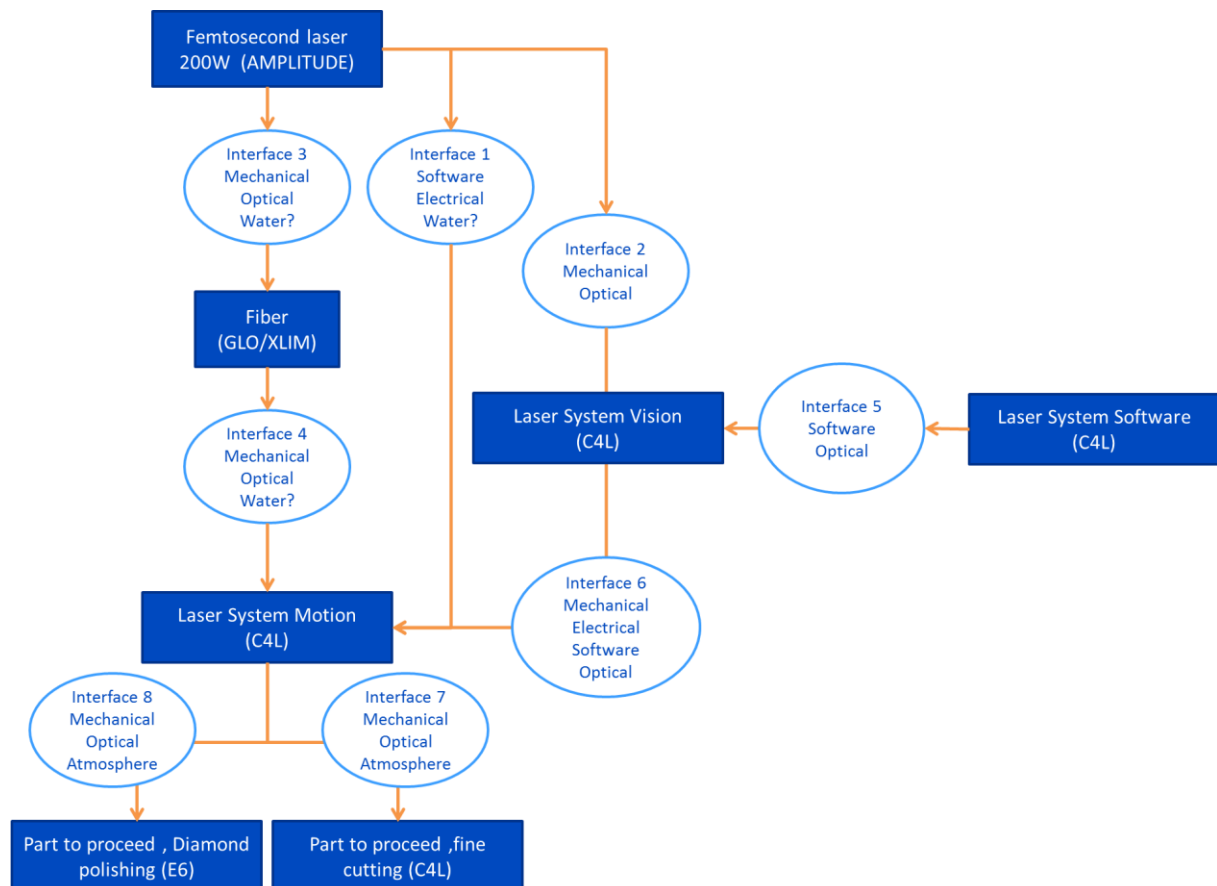


Figure 1: Sketch of the different components and their interfaces highlighted in blue.for demonstrator 1

5.1 Interface 1

Interface number	Partners involved	Type of interface
1	AMP <--> C4L	SOFTWARE/ELECTRICAL

Type of interface	Description	AMP: Laser 200W	C4L: Laser machine (Motion)
Mechanical	Dimensions	(475mm) x(677mm + 180mm) x (181mm)	(500mm) X (900mm) (foreseen place on granite for the laser)
	Weight	Will be provided	N/A
	Material	N/A	Granit, aluminum breadboard
	Cautions	N/A	N/A
	Fixings	Will be provided	Drilled granite and aluminum breadboard
	Atmosphere condition	Will be provided	Industrial (no flow box or white room)
	Mechanical drawing file	N/A	On demand
Electrical	Voltage	220 V	3 phases 400 V
	Max current	16 A	16 A
	Max Power	35 kW	6.8 kW
	PSU: external/to integrate?	To be defined	N/A
	Electrical drawings files	To be provided	N/A
Software	Protocol of communication	RS232	RS232
	Table of commands file	Will be provided	N/A
Water / Cooling	Diameter of pipes	To be defined	N/A
	Flow rate	To be defined	N/A
	Additive	To be defined	N/A
	Chiller?	To be defined	N/A

Comments:

In this interface the need of water cooling has to be defined for the laser 200W. If needed, it will be necessary to define the specifications of the water cooling:

- dimensions of the chiller,
- location of the chiller,
- need to integrate it into an rack
(yes/no ? where ?)
- diameter of pipes,
- type of water,
- ratio of additive to mix with water,
- temperature to set,
- flow rate,
- Other ? ...

5.2 Interface 2

Interface number	Partners involved	Type of interface
2	AMP <--> C4L	MECHANICAL/OPTICAL

Type of interface	Description	AMP: Laser 200W	C4L: Laser machine (Vision)
Mechanical	Dimensions	(475mm) x(677mm + 180mm) x (181mm)	(500mm) X(900mm) (foreseen place on granite for the laser)
	Fixings	N/A	Drilled granite and aluminum breadboard
	Mechanical drawing file	N/A	NC
Optical	Output wavelength	1030nm	860nm
	Output pulse duration	≤500fs – to be defined	N/A
	Output beam size (1/e ²)	To be defined	N/A
	Beam Quality M ²	To be defined	N/A
	Output beam divergence	To be defined	N/A
	Output max average power	200W	N/A
	Output max peak power	N/A	N/A
	Output max pulse energy		
	Repetition Rate	Single pulse to ...	N/A
	Output beam height (mm)	Will be provided	N/A
	Appropriate safety goggles	yes	N/A
	Input wavelength	N/A	1030nm
	Input Pulse duration	N/A	N/A
	Input Beam size (1/e ²)	N/A	14mm
	Input max average power	N/A	N/A
	Input max peak power	N/A	N/A
	Input max peak power		
	Input beam Height (mm)	N/A	To be defined
	Appropriate Safety goggles	N/A	Yes

5.3 Interface 3

Interface number	Partners involved	Type of interface
3	AMP <--> GLO-XLIM	MECHANICAL/OPTICAL (fiber)/ WATER?

Type of interface	Description	AMP: Laser 200W	GLO-XLIM: Fiber
Mechanical	Dimensions	To be determined	N/A
	Weight	To be determined	negligible
	Material	To be determined	Pure silica and air
	Cautions	To be determined	Fiber ends to be prepared
	Fixings	To be determined	3 axes translation stage
	Mechanical drawing file	To be determined	N/A
Electrical	Voltage	N/A	N/A
	Max current	N/A	N/A
	Power	N/A	N/A
	PSU: external/to integrate?	N/A	N/A
	Electrical drawings files	N/A	N/A
Software	Protocol of communication	N/A	N/A
	Table of commands file	N/A	N/A
Optical...	Output wavelength	1030nm	N/A
	Output pulse duration	≤500fs – to be defined	N/A
	Output beam size (1/e ²)	4-5 mm	N/A
	Output max average power	200W	N/A
	Output max peak power	2GW	N/A
	Output beam height (mm)	To be defined	N/A
	Appropriate safety goggles	yes	N/A
	Input wavelength	N/A	1030 nm
	Input Pulse duration	N/A	500-1000fs
	Input Beam size (1/e ²)	N/A	To be defined
	Input max average power	N/A	To be determined (1kW?)

...Optical	Input max peak power	N/A	To be determined
	Input beam Height (mm)	N/A	N/A
	Appropriate Safety goggles	yes	yes
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

Comments:

In this interface too, the need of water cooling has to be defined for the fiber. Does the fiber need to be cooled down? Starting from which power level? If needed, it will be necessary to define the specifications of the water cooling:

- dimensions of the chiller,
- location of the chiller,
- need to integrate it into an rack (yes/no ? where ?)
- diameter of pipes,
- type of water,
- ratio of additive to mix with water,
- temperature to set,
- flow rate,
- Other ? ...

5.4 Interface 4

Interface number	Partners involved	Type of interface
4	GLO-XLIM <--> C4L	MECHANICAL/OPTICAL (fiber)/ WATER?

Type of interface	Description	GLO-XLIM: Fiber	C4L: Laser system (Vision/Scanner)
Mechanical	Dimensions	To be determined	To be determined
	Weight	To be determined	N/A
	Material	To be determined	Alu
	Cautions	To be determined	N/A
	Fixings	To be determined	To be determined
	Mechanical drawing file	To be determined	NC
Optical	Output wavelength	1030 nm	N/A
	Output pulse duration	500-1000fs	N/A
	Output beam size (1/e2)	?	N/A
	Output beam divergence	To be determined	
	Output max average power	To be determined	N/A
	Output max peak power	To be determined	N/A
	Output max pulse energy	To be determined	N/A
	Output beam height (mm)	N/A	N/A
	Appropriate safety goggles	yes	Yes
	Input wavelength	N/A	1030nm
	Input Pulse duration	N/A	200-1000fs
	Input Beam size (1/e2)	N/A	14mm
	Input max average power	N/A	To be determined
	Input max peak power	N/A	To be determined
	Input beam Height (mm)	N/A	To be determined
	Appropriate Safety goggles	N/A	yes
Water	Diameter of pipes	N/A	N/A
	Flow rate	N/A	N/A
	additive	N/A	N/A
	Chiller ?	N/A	N/A

5.5 Interface 5

Interface number	Partners involved	Type of interface
5	(Software) C4L <--> C4L (Scanner/Motion/Vision)	SOFTWARE/ OPTICAL

Type of interface	Description	C4L: Software	Scanner/Vision: C4L Starfighter OCT
Software	Protocol of communication	TCP/IP	TCP/IP: C4L-3D or LaserDesk
	Table of commands file	Same than the scanner	To be determined
Optical	Output wavelength	N/A	860nm
	Output pulse duration	N/A	200-1000fs
	Output beam size (1/e2)	N/A	To be determined
	Output max average power	N/A	500 – 1000 W
	Output max peak power	N/A	2GW
	Output beam height (mm)	N/A	N/A
	Appropriate safety goggles	N/A	yes
	Input wavelength	N/A	1030nm
	Input Pulse duration	N/A	200-1000fs
	Input Beam size (1/e2)	N/A	14mm
	Input max average power	N/A	To be determined
	Input max peak power	N/A	To be determined
	Input beam Height (mm)	N/A	To be determined
	Appropriate Safety goggles	N/A	yes

5.6 Interface 6

Interface number	Partners involved	Type of interface
6	(Scanner/Vision) C4L <--> C4L (Motion)	MECHANICAL/ ELECTRICAL/ SOFTWARE/ OPTICAL

Type of interface	Description	Scanner/Vision: C4L Starfighter OCT	C4L : Laser System
Mechanical	Dimensions	Will be adapted to the scanner	Will be adapted to the scanner
	Weight	N/A	N/A
	Material	N/A	N/A
	Cautions	N/A	N/A
	Fixings	To be determined	To be determined
	Mechanical drawing file	NC	On Demand
Electrical	Voltage	To be determined	To be determined
	Max current	To be determined	To be determined
	Power	To be determined	To be determined
	PSU : external/to integrate ?	To integrate	To be determined
	Electrical drawings files	To be done	To be done
Software	Protocol of communication	TCP/IP	TCP/IP: C4L 3D or LaserDesk
	Table of commands file	Same than the scanner	To be determined
Optical	Output wavelength	1030nm, 860nm	N/A
	Output pulse duration	N/A	N/A
	Output beam size (1/e2)	To be determined (5-25mm)	N/A
	Output max average power	500 – 1000 W	N/A
	Output max peak power	2GW	N/A
	Output beam height (mm)	N/A	N/A
	Appropriate safety googles	yes	N/A
	Input wavelength	N/A	N/A
	Input Pulse duration	N/A	N/A
	Input Beam size (1/e2)	N/A	N/A
	Input max average power	N/A	N/A
	Input max peak power	N/A	N/A
	Input beam Height (mm)	N/A	N/A

5.7 Interface 7

Interface number	Partners involved	Type of interface
7	(System) C4L <--> C4L (Part to Proceed)	MECHANICAL/ OPTICAL (vision)

Type of interface	Description	C4L : Laser System	C4L : fine cutting parts
Mechanical	Dimensions	N/A	To be determined
	Weight	N/A	To be determined
	Material	N/A	Metals, ceramics, other
	Cautions	N/A	Fragile and tiny parts
	Fixings	Erowa + handling tbd	To be determined
	Mechanical drawing file	On Demand	On Demand
Atmosphere	Environment	Industrial (no flow box or clean room)	N/A
	Emanations	N/A	Micro and nanoparticles
	Exhaust	With filter – Required	N/A
Optical (Vision)	Output wavelength	1030nm, 860nm	N/A
	Output pulse duration	To be determined	N/A
	Output beam size (in focus)	To be determined (15-30µm)	N/A
	Appropriate safety goggles	yes	N/A

5.8 Interface 8

Interface number	Partners involved	Type of interface
8	(System) C4L <--> E6 (Part to Proceed)	MECHANICAL/ OPTICAL (vision)

Type of interface	Description	C4L : Laser System	E6 : polishing parts
Mechanical	Dimensions	N/A	To be determined
	Weight	N/A	To be determined
	Material	N/A	Metals, ceramics, other
	Cautions	N/A	Fragile and tiny parts
	Fixings	Erowa + handling tbd	To be determined
	Mechanical drawing file	On Demand	On Demand
Atmosphere	Environment	Industrial (no flow box or clean room)	N/A
	Emanations	N/A	Micro and nanoparticles
	Exhaust	With filter – Required	N/A
Optical (Vision)	Output wavelength	1030nm, 860nm	N/A
	Output pulse duration	To be determined	N/A
	Output beam size (in focus)	To be determined (15-30µm)	N/A
	Appropriate safety goggles	yes	N/A

6 Conclusion and further work:

The purpose of this deliverable was to have a clear idea of the technical aspects between the different components. No big mismatch has been highlighted so far, but there still some work to do especially regarding the integration in the coming WPs. Some discussions are on the way in order to define and choose some external components that take place in the demonstrator.

Even if no mismatch has been highlighted so far, we can already see that the building of the design of the demonstrator still has to be finalized, which will occur in the WP6 started few months ago.

This report should be considered a 'living document', as such it will be adapted, as required, during the course of the project. The content should not be seen as fixed and final but may be subject to change, depending on the progress of the project.