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| **Deliverable** | **Description** | **Completion** | **Payment** |
|  | Commencement day (CD) = Contract signature + 7 calendar days |  |  |
| D1 | Detailed schedule of project activities and all corresponding Quality and Verification Plans, and of work procedures | 1 month from CD | 10% |
| D2 | Detailed engineering design and resonance frequency analysis of OM7, OM7.5, OM8, OM9 and SPM1, detailed design of the motion control system (MCTR) | 3 months from CD | 30% |
| D3 | Manufacture, assembly and factory testing of OM7, OM8 OM9 and SPM1, assembling and factory testing of the motion control system (MCTR) | 8 months from CD | 20% |
| Detailed engineering design and resonance frequency analysis of OOM1 |
| D4 | Delivery of OM7, OM8, OM9 and SPM1 to ELI-Beamlines, delivery and installation of the motion control system (MCTR) at ELI-Beamlines | 9 months from CD | 10% |
| D5 | Manufacture, assembly and factory testing of OOM1 | 12 months from CD | 20% |
| D6 | Delivery of OOM1 to ELI-Beamlines | 14 months from CD | 10% |

Optional manufacture of OM7.5

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| **Deliverable** | **Description** | **Completion** | **Payment** |
| OptionalDA | Manufacture, assembly and factory testing of OM7.5, delivery of OM7.5 to ELI-Beamlines | 6 months from the activation of the Option 1 | Price of the Option |

1. **Contractual Deliverables description**
2. **Deliverable D1:
Detailed schedule of project activities and all corresponding quality plans and work procedures**

The supplier to whom the Public Contract will be awarded (hereinafter the “***Supplier***”) shall provide a detailed schedule of all project activities; by which is meant a schedule that defines all the activities necessary to individually define, produce or procure and deliver every component within the scope of supply. All activities shall be resourced, allocated start / finish times and linked with relevant dependencies. The amount of detail should be sufficient to identify the longest path of activities through the entire program, thus providing confidence in the overall programme for Deliverables. The scheduled activities shall not be restricted to those of the Supplier but shall include all relevant activities of sub-suppliers, the Client or relevant third parties.

Also within the first month following the Commencement Day, the Supplier shall provide a draft set of Quality and Verification Plan and associated Work Procedures detailing all the work activities and processes required for the design, procurement, fabrication, assembly and test of all products to be supplied under the contract. This shall include aspects such as design review, inspection, analysis and test procedures (Verification Plan), and configuration management, material traceability, cleanliness control, welding procedures and qualifications (Quality Plan). The provided draft set of Quality and Verification Plan shall incorporate as a minimum all required activities listed in Annex 3 (*Verification Control Document*).

Completion: 1 month after Commencement Day

1. **Deliverable D2:
Detailed engineering design and resonance frequency analysis of OM7, OM7.5, OM8, OM9 and SPM1, detailed design of the optomechanical electronic controller (MCTR)**
2. The Supplier shall develop detailed engineering 3D models of OM7, OM7.5, OM8, OM9 and SPM1, based on the preliminary design drawings and 3D models supplied by the Client. These detailed engineering models produced by the Supplier will be used in the next step (Deliverable D3) to make production drawings. The purpose of the detailed engineering design is to develop the Client’s preliminary design into a full model including all necessary mechanical details and to optimize the overall design with respect to the technologies, functionality, and fabrication methods that will be employed for manufacturing. The accepted detailed 3D model and the detailed engineering drawings developed in this Deliverable will be binding for the Supplier in the manufacturing phase (Deliverable D3).

b) A part of this Deliverable D2 will be elaboration of specific details, such as:

• Lifting mechanism / lifting points (e.g. lifting eyes) for installation of the mounts

• Relief holes in the mounts to avoid trapped air pockets

• Connection to the internal (vacuum) and external (on the outer compressor chamber surface) cable trays
*Note: The layout and location of the cable trays inside the compressor and on the compressor chamber will be specified by FZU*.

• Determination of materials, configuration of motion elements, connections of the actuators and of positioning sensors, surface finishes and other similar matters necessary to optimize for fabrication

c) The Supplier shall verify the stiffness and vibrational properties of the developed detailed design of all the optomechanical mounts, by means of FEA (Finite Element Analysis) simulations. The acceptable limits of vibrational criteria are included in the detailed specification of performance requirements in Annex 2 to this Contract. Analysis of the concept design made by the Client shows that the specified requirements are realistic. Results of the analysis shall be provided by Supplier to Client for review. Status of appropriate requirements to be verified by the analysis shall be tracked by the Verification Control Document (VCD), see Annex No. 3.

d) A brief technical report shall be provided by the Supplier that lists all the significant changes and enhancements between the FZU concept design and the agreed detail design. For each change there shall be a brief description of the reason for change and justification of the selected solution. This will provide a means of checking that no important features of the concept design have been inadvertently lost or corrupted.

f) The Supplier shall provide an updated detailed 3D model of the optomechanical mounts of OM7, OM7.5, OM8, OM9 and SPM1, showing the finally agreed configuration.

g) The Supplier shall provide final Quality and Verification Plan for all the main components and other documentation, which will be reviewed by the Client.

e) The Supplier shall develop detailed design of the compressor Motion Control System (MCTR), based on the architecture block scheme provided in Annex 2 (Requirements Specification Document). The designed system shall incorporate as minimum the control points specified in Annex 2, and may add additional control points so as to meet all other system requirements. The designed MCTR shall use the approved devices (hardware) from the list specified in Annex 2; the Supplier shall ask Client for approval if any devices not explicitly mentioned in Table 2 of Annex 2 are considered. The designed MCTR detailed scheme and associated documentation, including list of all devices to be used, shall be submitted by Supplier to Client for review. The accepted detailed scheme and list of devices developed in this Deliverable will be binding for the Supplier in the manufacturing phase (Deliverable D3).

The provided documentation shall be reviewed by Client by means of Critical Design Review (CDR) process and its results will be recorded in a CDR Report. The verification of the Design shall be considered complete when the Client and the Supplier mutually agree that, on the basis of the CDR Report and on the basis of the Verification Control Document (VCD) that all corresponding requirements related to the Design were closed out and that all associated verification objectives were fully achieved. The status of the requirements verified in the Review of Design shall be tracked by the Verification Control Document (VCD), see Annex No. 3, and shall be the basis for acceptance of the Design.

The Supplier shall further submit a timetable of individual major steps in the manufacturing process and factory testing related to D3 and D5. The Client reserves the right to witness verification and testing of the individual components and subsystems at the Supplier’s premises at any of the indicated steps in the manufacturing process, and to monitor implementation of the contract.

Completion: 3 months after Commencement Day

1. **Deliverable D3:
Manufacture, assembly and factory testing of OM7, OM8, OM9 and SPM1, assembling and factory testing of the optomechanical controller (MCTR)
Detailed engineering design and resonance frequency analysis of OOM1**

The Supplier shall develop a full set of final production drawings of the individual optomechanics OM7, OM8, OM9 and SPM1, in line with the documentation produced within the D2 Deliverable.

The Supplier shall manufacture the mounts OM7, OM8, OM9 and SPM1. The Supplier shall install the integrated optomechanical components in an ISO Class 5 or better cleanroom at his premises, where all assembly operations and testing shall be made. The Supplier shall integrate the mechanical components of the mounts with the respective electrical actuators, position encoders, and other sensors. Upon integration with vacuum-compatible cabling and connectors, the mounts shall be connected to corresponding electronic drivers.

The Supplier shall build the electronic optomechanical controller (MCTR) according to approved documentation from Deliverable D2, and shall manufacture all cables necessary to connect MCTR to the optomechanical mounts. The Supplier shall test MCTR basic functionality before connecting the mounts.

The Supplier shall provide all equipment for the required testing of the optomechanical mounts and of MCTR.

The Supplier shall validate key performance parameters of the mounts OM7, OM8, OM9 and SPM1 at their works, namely:

* + Demonstration of precision on individual movements of the mounts, achievement of required minimal step, demonstration of stability of each mount
	+ Functioning of MCTR with all electrical actuators
	+ Demonstration of individual states and transitions of MCTR machine state diagram

The verification of the optomechanical mounts OM7, OM8, OM9 and SPM1 and of the MCTR performance shall be made according to the Verification Plan. The results of this performance verification and testing will be a Protocol on Factory Testing of the OM7, OM8, OM9 and SPM1 optomechanical mounts.

The statuses of the requirements verified in this phase for OM7, OM8, OM9 and SPM1 shall be tracked by the Verification Control Document (VCD), see Annex No. 3, and shall be the basis for acceptance of D3 related to OM7, OM8, OM9 and SPM1.

As part of D3 Deliverable, the Supplier shall also develop detailed engineering 3D model of the OOM1, optomechanical mount, based on the preliminary design drawings and 3D models supplied by the Client. The detailed engineering model produced by the Supplier will be used in Deliverable D5 to make production drawings and to manufacture the OOM1 mount. The purpose of the detailed engineering design is to develop the Client’s preliminary design into a full model including all necessary mechanical details and to optimize the overall design with respect to the technologies, functionality, and fabrication methods that will be employed for manufacturing. The accepted detailed 3D model and the detailed engineering drawings developed in this Deliverable will be binding for the Supplier in the manufacturing phase (Deliverable D5).

1. Included in this detailed 3D model of OOM1 will be elaboration of specific details, such as:

• Lifting mechanism / lifting points (e.g. lifting eyes) for installation of the mounts

• Relief holes in the mounts to avoid trapped air pockets

• Connection to the internal (vacuum) and external (on the outer compressor chamber surface) cable trays
*Note: The layout and location of the cable trays inside the compressor and on the compressor chamber will be specified by FZU.*

• Determination of materials, configuration of motion elements, connections of the actuators and of positioning sensors, surface finishes and other similar matters necessary to optimize for fabrication

1. The Supplier shall verify the stiffness and vibrational properties of the developed detailed design of the optomechanical mount OOM1, by means of FEA (Finite Element Analysis) simulations. The acceptable limits of vibrational criteria are included in the detailed specification of performance requirements in Annex 2 to this Contract. Results of the analysis shall be provided by Supplier to Client for review. Status of appropriate requirements to be verified by the analysis shall be tracked by the Verification Control Document (VCD), see Annex No. 3.
2. A brief technical report shall be provided by the Supplier that lists all the significant changes and enhancements between the FZU provided concept design of OOM1 and the agreed detail design. For each change there shall be a brief description of the reason for change and justification of the selected solution. This will provide a means of checking that no important features of the concept design have been inadvertently lost or corrupted.
3. The Supplier shall provide an updated detailed 3D model of OOM1, showing the finally agreed configuration
4. Supplier shall provide final Quality and Verification Plan for all the main components of OOM1 and other documentation which will be reviewed by the Client.

The provided OOM1 documentation shall be reviewed by Client by means of Critical Design Review (CDR) process and its results will be recorded in a CDR Report. The verification of the Design shall be considered complete when the Client and the Supplier mutually agree that, on the basis of the CDR Report and on the basis of the Verification Control Document (VCD) that all corresponding requirements related to the Design were closed out and that all associated verification objectives were fully achieved. The status of the requirements verified in the Review of Design shall be tracked by the Verification Control Document (VCD), see Annex No. 3, and shall be the basis for acceptance of D3 related to OOM1.

Completion: 8 months and after Commencement Day

1. **Deliverable D4:
Delivery of OM7, OM8, OM9 and SPM1 to ELI-Beamlines, delivery and installation of the motion control system (MCTR) at ELI-Beamlines**

The Supplier shall prepare for transport the OM7, OM8, OM9 and SPM1 mounts, and the electronic motion control system (MCTR) including all related equipment (wiring etc.). Each mount shall be packed separately.

For the duration of its transport the components shall be hermetically sealed under dry air or nitrogen. The initial wrapping of all parts shall be in multiple layers of plastic film (as sheet or bags) of type specifically for use in contamination controlled areas. This clean conditions wrapping will be further enclosed in robust outer packaging and transport crates as necessary for protection and handling during shipping to the ELI-Beamlines site.

The Supplier will transport the components to the ELI-Beamlines facility and will remain responsible for them (with appropriate insurance cover) up to the start of offloading at the ELI-Beamlines Facility loading ramp. Offloading of the mounts at the ELI-Beamlines building entrance will be made by fork lift truck.

On the ELI-Beamlines site, the mounts and other delivered components will be unpacked by Supplier in ISO Class 5 cleanroom and will be inspected for absence of any damage due to transport, according to Annex 3, Verification Control Document (VCD).

The Supplier shall install the electronic motion control system (MCTR) in the L4c laser hall, into the Rittal electrical cabinets provided by the Client (see Annex 2, Requirements Specification Document). The Supplier shall then test functioning of MCTR with all electrical actuators of OM7, OM8, OM9 and SPM1 mounts.

This inspection shall be the basis for acceptance of D4 related to OM7, OM8, OM9 and SPM1 mounts.

This inspection of delivered OM7, OM8, OM9 and SPM1 mounts and results of acceptance tests of MCTR according the Verification Control Document (VCD), Annex 3, shall be the basis for acceptance of D4.

Completion: 9 months after Commencement Day

1. **Deliverable D5:
Manufacture, assembly and factory testing of OOM1**

Based on the results of Deliverable D3 the Supplier shall develop a full set of final production drawings of the optomechanical mount OOM1.

The Supplier shall manufacture the OOM1 mount. The Supplier shall install the OOM1 components in an ISO Class 5 or better cleanroom at his premises, where all assembly operations and testing shall be made. The Supplier shall integrate the mechanical components of OOM1 with the respective manual and electrical actuators, position encoders, and other sensors.

Upon integration with vacuum-compatible cabling and connectors, the OOM1 mount shall be connected to a Supplier-provided surrogate electronic driver, with the same functionality as the electronic motion control system (MCTR).

The Supplier shall validate key performance parameters of the OOM1 mounts at their works, namely:

* + Demonstration of precision on individual movements of the mount, achievement of required minimal step, demonstration of stability
	+ Functioning of all electrical actuators
	+ Functioning of the mechanical actuators

The verification of the optomechanical mount OOM1 shall be made according to the Verification Plan. The results of this performance verification and testing will be a Protocol on Factory Testing of the OOM1 optomechanical mount.

The statuses of the requirements verified in this phase shall be tracked by the Verification Control Document (VCD), see Annex No. 3, and shall be the basis for acceptance of D5.

Completion: 12 months and after Commencement Day

1. **Deliverable D6:
Delivery of OOM1 to ELI-Beamlines**

The Supplier shall prepare for transport the OOM1 optomechanical mount, including all related equipment (wiring etc.).

For the duration of its transport the OOM1 shall be hermetically sealed under dry air or nitrogen. The initial wrapping of all parts shall be in multiple layers of plastic film (as sheet or bags) of type specifically for use in contamination controlled areas. This clean conditions wrapping will be further enclosed in robust outer packaging and transport crates as necessary for protection and handling during shipping to the ELI-Beamlines site.

The Supplier will transport OOM1 and its components to the ELI-Beamlines facility and will remain responsible for them (with appropriate insurance cover) until up to the start of offloading at the ELI-Beamlines Facility loading ramp. Offloading of the mounts at the ELI-Beamlines building entrance will be made by fork lift truck.

On the ELI-Beamlines site, the OOM1 mount and other delivered components will be unpacked by Supplier in ISO Class 5 cleanroom and will be inspected for absence of any damage due to transport, according to Annex 3, Verification Control Document (VCD).

This inspection shall be the basis for acceptance of D6.

Completion: 14 months after Commencement Day

1. **Contractual options**

**Contractual Option 1: Manufacture, assembly and factory testing of OM7.5, delivery of OM7.5 to ELI-Beamlines**

As part of this Deliverable the Supplier shall develop detailed engineering drawings of the optomechanical mount OM7.5, in line with the documentation produced within the D2 Deliverable.

The Supplier shall manufacture the OM7.5 mount. The Supplier shall install the integrated optomechanical mount in an ISO Class 5 or better cleanroom at his premises, where all assembly operations and testing shall be made. The Supplier shall integrate the mechanical components of the mount with the respective actuators.

The Supplier shall provide all equipment for the required testing of this OM7.5 optomechanical mount.

The Supplier shall validate key performance parameters of the OM7.5 mount at their works, namely demonstration of range of on individual movements and demonstration of stability of the mount.

The verification of OM7.5 mount performance shall be made according to the Verification Plan. The results of this performance verification and testing will be a Protocol on Factory Testing of the optomechanical mount OM7.5.

Upon completion of the factory testing the Supplier shall pack the OM7.5 mount and all related equipment. The mount shall be hermetically sealed under dry air or nitrogen.

The Supplier shall transport the OM7.5 optomechanical mount to the ELI-Beamlines facility.

On the ELI-Beamlines site, the mount will be unpacked by Supplier in ISO Class 5 cleanroom, and will be tested according to the Protocol on Reception Testing of the optomechanical mounts.

The status of requirements verified in this phase shall be tracked by the Verification Control Document (VCD), see Annex No. 3, and shall be the basis for acceptance of the Contractual Option 1.

The Client is entitled to activate this Option 1 with a written request no later than on the date of acceptance of Deliverable D6. The Supplier is entitled to invoice the Client with the price of Option 1 after its completion (i.e. upon acceptance of Deliverable DA).

The option might be activated by the Client if the process of designing and building of the Object of Purchase and the associated technology, for technical reasons, confirms the immediate need of manufacture and delivery of the OM7.5 mount.

**Contractual Option 2: Optional design works**

The following services are agreed as contractual option herewith. The Client is entitled to require provision of optional design works. The Client is entitled (but has no duty to do so) to ask the Supplier for the services at its full discretion before or at the time of acceptance of the D6 Deliverable. The maximum extent of this contractual option is 40 man days. Detailed conditions of provision of the services (extent, subject matter of design works etc.) shall be agreed between Contractual parties. However, the Supplier will commence provision of the support no later than 10 working days after written request by the Client. The price of optional services (as man-day price) is stipulated by Annex 4 hereof and shall be paid if any optional services are provided after their due provision.

The services might be requested by the Client if there is a need of additional design works which exceeds the extent of design works that already form part of the subject matter hereof (i.e. are needed to perform and complete the subject matter of this contract as it is specified by this contract on the date of its conclusion), particularly if:

1. the Client requests any modifications of the subject matter of the public contract (the Object of Purchase) or design of any additional parts of the Object of Purchase is needed, or
2. the design works are needed to design any parts of technology needed to incorporate the Object of Purchase to the surrounding technology.

**Contractual Option 3: Optional installation technical support**

The following services are agreed as contractual option herewith. The Client is entitled to require provision of Supplier’s technical support during installation of the optomechanics being subject of this contract. The Client is entitled (but has no duty to do so) to ask the Supplier for the support at its full discretion at any time starting by D4 and up to 2 months after D6. The maximum extent of this contractual option is 20 man days. Detailed conditions of provision of the support (extent, time of provision, profession of specialists etc.) shall be agreed between Contractual parties. However, the Supplier will commence provision of the support no later than 10 working days after written request by the Client. The price of optional support (as man-day price) is stipulated by Annex 4 hereof and shall be paid if any optional support is provided after its due provision.

The services might be requested by the Client if he realizes during his own works on installation of the mounts that installation support (advice and/ or hands on work) from the Supplier is needed for efficient installation of the mounts.