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**[RSD product category A]**

## **DUHA Booster Pockels Cell & Driver TP20\_115**



### **Keywords**

Booster, Pockels, Cell, Driver

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## 1. Introduction

### 1.1. Purpose

This Requirements Specification Document (RSD) lists the technical requirements and constraints on product applying in L2 Laser Beamline of the ELI project. This can lead to the identification of product interfaces with the ELI science based technology and ELI building facility. This RSD also acts as the parent document for the technical requirements that need to be addressed in lower level design description documents.

### 1.2. Scope

This RSD contains all of the technical requirements: functional, performance, operational & design, transportation & installation, safety & quality requirements for the following product: **DUHA Booster Pockels Cell & Driver** (Tender number TP20\_115), further addressed as "PC".

The product is an integral part of the following standalone - **Booster preamplifier for the OPCPA pump laser**. This product is registered in the PBS software under the following PBS code: RA1.L2.L2\_1.PL.FE.PA3.PC.1.

This product is a **product Category A**. The category A is an off-the-shelf product without necessity of modifications and necessity to be subjected to a verification program according to the ELI Beamlines project. All verification activities shall be executed by Supplier in accordance to the supplier's outgoing inspection plan. The internal acceptance procedure of the product category A shall be established and applied before the product implementation (operation phase).

### 1.3. Terms, Definitions and Abbreviations

For the purpose of this document, the following abbreviated terms are applied:

Abbreviation	Meaning
CA	Contracting Authority (Institute of Physics AV CR, v. v. i.)
E1-E6	Experimental halls 1-6
ELI	Extreme Light Infrastructure
FD	Functional Demonstration
L1-L4	Laser Halls 1, 2,3,4
RA1-RA6	Research activity 1-6
RSD	Requirements Specification Document
VCD	Verification Control Document
Clear Aperture	The clear aperture is the area of the optical component that must meet specification

## 1.4. References to standards

If this document includes references to standards or standardized/standardizing technical documents the CA allows/permits also another equal solution to be offered. If a supplier offers another equal solution the CA shall not reject its bid, once the supplier by appropriate means in the bid proves that the offered supplies, services or works meet in an equivalent manner the requirements including references to standards or technical documents.

## 2. General Functional, Performance and Design requirements

The requirements of this chapter shall be defined by the stakeholder. The chapter shall involve:

- Mechanical, optical, thermal, vacuum and etc. technical requirements,
- Required internal and external interfaces.

REQ-030362/A

The **PC** shall meet the general requirements defined in Table 1.

REQ-030363/A

The Pockels cell shall have an adjustable mount for fine adjustment of pitch and yaw (using a ball driver) of the Pockels cell crystal with respect to the input beam.

REQ-030364/A

The PC shall be designed in such a way that the Pockels cell is mounted in a grounded metal enclosure physically attached to the driver with only 2 holes for the input and output of the laser beam and 4 holes for adjustment of the positioning stage holding the Pockels cell.

REQ-030365/A

The PC shall be designed to allow water cooling of the Pockels cell and driving electronics. The cooling fluid will be Distilled Water with OptiShield Original Formula.

REQ-030366/A

The PC shall be driven with a  $\pm \lambda/4$  ON/OFF voltage. The driver should be able to switch between +6.5 kV and -6.5 kV according to the repetition rates and durations specified in Table 1. PC ON time is defined as the time interval between the transition from  $-\lambda/4$  to  $+\lambda/4$  voltage and the return transition from  $+\lambda/4$  to  $-\lambda/4$ .

REQ-030367/A

The PC shall be externally triggered (triggers provided by CA). Triggering shall be compatible with TTL logic level signals with 50 Ohm BNC connector. The trigger input shall be optically coupled for galvanic isolation. The supplier must specify the number of triggers

required (up to 4) and a clear and complete description of proper triggering of the PC.

REQ-030368/A

The driver + crystal enclosure system should not exceed the following dimensions (not including cables/connectors): 150 mm x 130 mm x 300 mm. The height of the center of the crystal shall be 50 mm above the base of the driver enclosure.

Table 1 Technical Parameters of PC

#	Parameter (description)	Required value
1.1	PC crystal material	<b>BBO, double crystal</b>
1.2	Clear aperture diameter of the PC (mm)	<b>9.7</b>
1.3	Achievable voltages across PC crystal in ON/OFF state (kV)	<b>-6.5 / +6.5</b>
1.4	Window and crystal reflectivity @ 1030 nm (single surface)	<b>&lt; 0.3%</b>
1.5	LIDT intensity for 10ns, 1030nm pulses at 50 Hz (J/cm <sup>2</sup> )	<b>10</b>
1.6	Repetition Rate (Hz)	<b>50</b>
1.7	PC ON time window minimum tuning range (ns)	<b>150 – 400</b>
1.8	Rise/Fall Time (10:90) for PC ON durations of >300 ns (ns)	<b>&lt; 5.5</b>

### 3. Transportation and Installation requirements

#### 3.1. General requirements

REQ-030369/A

The transportation to the final destination shall be conducted by the Supplier.

*NOTE 1: The bid price will be considered by the CA as the final price, including transportation cost.*

REQ-030373/A

The technologies and instruments shall be delivered in protective package preventing damage and contamination and a minimum of two plies separate clean packaging.

## 4. Safety Requirements

REQ-030374/A

The Supplier shall supply a Declaration of Conformity or any other equivalent document legally recognized and accepted in the Czech Republic for each product type if the appropriate legislation determines the Supplier's obligation to have a Declaration of Conformity (or the equivalent document) for the purposes of a Device sale in the Czech Republic to fulfil the requirements of 2001/95/EC directive or applicable Czech law.

## 5. Quality Requirements

### 5.1. General Quality Requirements

REQ-030375/A

The Supplier shall provide the Product Manual as part of the delivered Device. Completeness of the Manual shall be approved by the CA. The Manual shall include the instructions and descriptions regarding the following procedures:

- transport;
- handling;
- storage;
- installation;
- safe operation and maintenance procedures.

REQ-030376/A

The Supplier shall provide information of outgoing check control of the Product. At least this information shall comprise declaration about execution of outgoing check and declaration of conformity with technical requirements defined by the product RSD and completeness of the Product.

*NOTE: Alternatively the Supplier might provide the CA the information detailed enough to prove meeting all requirements stipulated herein (e.g.: catalogue/technical data sheets, product manuals or other similar documentation).*

REQ-030377/A

The Supplier shall establish and maintain a nonconformity control system compatible with ČSN EN ISO 9001 (or equivalent, e.g. EN ISO 9001).

## 6. Acceptance

Acceptance will be carried out by the CA on the delivered and complete product. The basis for acceptance will be a declaration of conformity with the technical requirements defined by the product RSD together with relevant documentation supporting the verification.

In case of successful acceptance phase the CA shall provide to the Supplier signed acceptance protocol. In case of unsuccessful acceptance stage the CA shall provide to the Supplier Nonconformity Report (NCR) and ELI nonconformity control process shall be applied (see REQ-030377/A).

REQ-030378/A

The Acceptance phase (as defined in the Contract) shall demonstrate the following:

1. Final product has been successfully verified by the Supplier and this process has been documented in an appropriate way (through checklist);
2. The final product is free of fabrication errors and is ready for the intended operational use.