

**ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH**

Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics

Market Survey

MS-2690/EP/CME

Supply of Semiconductor Lasers for the CMS Tracker

Contains:

General Description

Qualification Criteria

Questionnaire

Abstract

The purpose of this Market Survey is to establish a list of firms able to supply approximately 50000, 1310nm uncooled Fabry-Perot semiconductor lasers coupled to optical fibre.

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General Description

1. Introduction

CERN (Conseil Européen pour la Recherche Nucléaire) is one of the world's largest scientific laboratories and a unique example of international collaboration among its member states.

The LHC project, a large proton-proton collider, was approved in 1994 by the 19 member states of CERN. The LHC will be the next major research tool for world particle physics and it is expected to be commissioned in 2005. CMS is one of the two main experiments which will be installed at this accelerator to measure hadron-hadron collisions. The CMS-tracker detector is situated closest to the interaction point and is equipped with approximately 12 million micro-strip channels distributed in a volume of 37 cubic meters. Analogue and digital optical links will transmit data between the detector and processing electronics situated approximately 100m away. 256 detector channels will be multiplexed into each optical fibre, resulting in a total of about 50000 analogue and digital optical links required to readout and control the detector. Inside the tracker, all components will have to withstand very harsh environmental constraints during an expected experiment-lifetime of 10 years.

2. Scope of the Market Survey

The purpose of this market survey is to identify companies specialised in the manufacturing of semiconductor lasers coupled to optical fibre. These devices will be used on the transmitter side of the CMS-tracker optical links.

CERN intends to issue an Invitation to Tender for the production of these semiconductor lasers. This Invitation to Tender shall only be sent to companies which have thoroughly answered the Questionnaire and have fulfilled the Qualification Criteria of this Market Survey.

CERN reserves the right to split the contract between different suppliers.

3. Technical requirements

Recent evaluations by CERN of several uncooled Fabry-Perot semiconductor lasers have suggested that standard commercial components can satisfy the CERN requirements for analogue and digital transmitters operating in the CMS-Tracker environment (high radiation levels, high magnetic field).

As CERN is targeting the use of commercial off-the-shelf components, no special requirements are imposed upon the manufacturer apart from the set of features specified in this section (section 3, technical requirements). However, all candidate semiconductor lasers shall be evaluated by CERN in order to assess their suitability for operation in the CMS-Tracker environment (see section 4, operating environment). They will be accepted or rejected on the basis of these evaluations. The CERN evaluation procedure is expected to last about 6 months, including irradiation-tests scheduled in the autumn of 1999. Laser samples will have to be delivered on time to be included into the evaluation lot (see qualification criteria).

3.1. Description

The laser-transmitters convert into optical signals the electrical signals generated by analogue or digital laser-drivers (not part of this market survey). They emit 1310nm light into optical fibres, which exit the package in pigtail form (see interface options, section 3.5). No monitor photodiode is required.

To minimise the amount of material traversed by particles in the tracker, transmitters housed in a light-weight package (ceramic or plastic) are preferred (see section 3.4).

In addition to single-channel devices, arrays or hybrid assemblies of up to 12 channels are also considered in this survey.

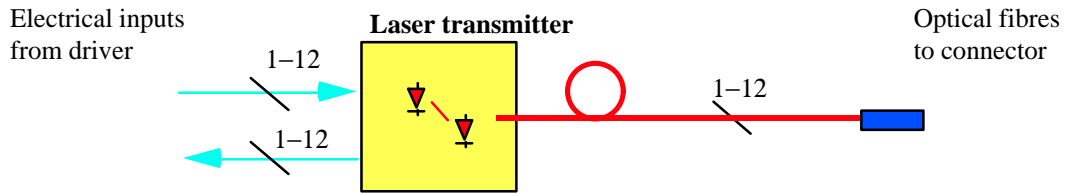


Fig. 1. Laser transmitter block diagram

3.2. Target laser transmitter specifications

Specifications have to be met by all channels at 25°C unless otherwise noted

#	operational specifications	min	typ	max	unit	note
1.1	Number of channels	1		12		
1.2	Rise / fall time			2	ns	
1.3	Crosstalk		min			Multi-channel transmitters only

#	electrical specifications	min	typ	max	unit	note
2.1	Max. input current	60	100		mA	
2.2	Threshold current		10	15	mA	As delivered
2.3	Forward voltage			1.5	V	at 60 mA
2.4	Reverse voltage	2			V	

#	optical specifications	min	typ	max	unit	note
3.1	Wavelength	1260	1310	1360	nm	
3.2	Max output power	500	1000		µW	coupled into fibre
3.3	Slope efficiency		.06		mW/mA	As delivered
3.4	Relative linearity deviation		1		%	in any 100µW window in 20µW < P _{opt} < 500µW output range
3.5	RIN		-130		dB/Hz	200µW output power, 10MHz

3.3. Operating conditions

#		min	typ	max	unit	note
4.1	Input current	0	I _{th} +2	60	mA	
4.2	Modulation current	0	1	5	mA	
4.3	Output power	0	100	500	μW	

3.4. Package

Material	low mass, non magnetic, low smoke, halogen-free
Footprint	minimal, target 5mm x 5mm per channel
Height	minimal, target 5mm
Housing ²	ceramic or plastic
Hermeticity	not mandatory

² To comply with the minimal material requirement of the CMS tracker, a laser assembled on its submount, pigtailed and only protected by a cover can also be considered

3.5. Interfaces

- Electrical

Leadframe ³ DIL or SMD (non magnetic)

³ To comply with the minimal material requirement of the CMS tracker, bonding to pads directly on the submount can also be considered

- Optical

option 1 (single channel):

Fibre count	1 fibre
Fibre type	Single mode, 9/125/250/900μm
Fibre length	2m typical, or 0m (connector integrated with package)
Connector type	1.25mm-ferrule single-way connector (to be specified) or MT-type, angle polished

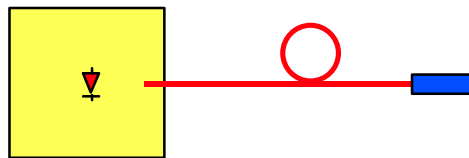


Fig. 2. Laser transmitter, option 1

option 2 (multi-channel hybrid assembly):

Fibre count	1-4 fibres in bundle, protection sleeve to be specified
Fibre type	Single mode, 9/125/250μm
Fibre length	2m typical, or 0m (connector integrated with package)
Connector type	1.25mm-ferrule single-way connectors (to be specified), or MT-type, angle polished

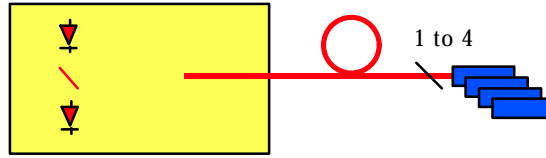


Fig. 3. Laser transmitter, option 2

option 3 (multi-channel array):

- Fibre count 4, 8 or 12 fibres in ribbon
- Fibre type Single mode 9/125, 250µm pitch ribbon
- Fibre length 2m typical, or 0m (connector integrated with package)
- Connector type MT-type, angle polished multi-way

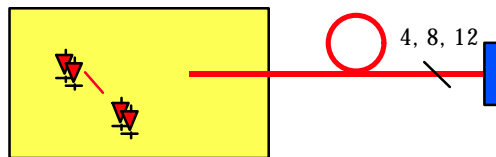


Fig. 4 Laser transmitter, option 3

4. Operating environment

#	environmental specifications	min	typ	max	unit	note
5.1	Magnetic field ¹			4	T	parallel to any axis
5.2	Neutron fluence ¹			2e14	n/cm ² (1MeV)	Integrated over lifetime
5.3	Charged hadrons fluence ¹			4e14	p/cm ² (0.3GeV)	“
5.4	Gamma radiation dose ¹			3e5	Gy(Si)	“
5.5	Temperature	-20	-10 +20	70	°C	
5.6	Operating humidity	dry Nitrogen flow				

¹The component resistance to magnetic field and radiation will be evaluated under the sole responsibility of CERN. No testing, validation or qualification is pre-required from the suppliers.

5. Quantity and Delivery

A total volume of approximately 50'000 optical channels is required for the CMS tracker.

It is foreseen to place a contract between 2000 and 2001.

The semiconductor lasers should be available in pre-production quantities (100-1000 optical channels/year) in 2000 and 2001, and in volume quantities (greater than 10000 optical channels/year) from 2001 to 2003.

6. Persons in Charge

Commercial Contact Dante Gregorio
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CH1211 Geneva 23
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Fax: + 41 22 767 2800
E-mail: Francois.Vasey@cern.ch

In case of absence Karl Gill
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CH1211 Geneva 23
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Fax: + 41 22 767 2800
E-mail: Karl.Gill@cern.ch

Qualification criteria

Acceptance of a candidate semiconductor laser is subject to testing by CERN. To this end, the manufacturer is requested to free issue at least 5 evaluation samples to CERN by July 31st, 1999, with a set of measured characteristics, a detailed product data sheet and a list of materials used in the supplied components. Test-procedure details and test-reports will be made available upon request.

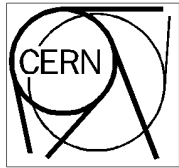
In order to be considered for the forthcoming call for tenders, the following criteria must be met:

1. Technical criteria

1. The proposed components must fulfil all technical requirements specified in section 3 of the general description;
2. The supplied samples must pass all CERN validation tests;
3. The company must guarantee a direct technical contact with the CERN engineers;
4. The company must be in a position to communicate promptly to CERN any change(s) in the manufacturing process;

2. Other criteria

5. The company must have proven experience in the manufacture and/or packaging of semiconductor lasers. In case the company intends to subcontract part of the work, experience of all major subcontractors must also be demonstrated;
6. The company must demonstrate its ability to produce over 10000 optical channels/year;
7. The company must have a registered Quality Assurance Plan satisfying the requests of ISO9000 or equivalent national standards;
8. The company shall accept a contract for either the full or part of the overall supply.



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Market Survey

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Supply of Semiconductor Lasers for the CMS Tracker

Questionnaire

(To be returned in duplicate, by the companies interested in tendering)

Company

Company:

Name:

Address:

.....

Commercial Contact Person

Telephone Number

Fax Number

Electronic Mail

In case of absence:

Commercial Contact Person

Telephone Number

Fax Number

Electronic Mail

Technical Contact Person

Telephone Number

Fax Number

Electronic Mail

In case of absence:

Technical Contact Person

Telephone Number

Fax Number

Electronic Mail

1. General Information

1. Are you interested in receiving the Invitation to Tender ?

Yes No

2. Financial information

When established:

Registered capital:

Turnover in 1997:

Number of employees in 1998:

Turnover in 1998:

3. Did you already reply to a CERN call for tender or market survey?

Yes No

If yes, specify for which product(s):

.....
.....
.....

2. Qualification criteria

4. Does your company comply with the qualification criteria stipulated in this market survey?

Yes No

If not, indicate which criterion(a) is (are) not satisfied and why:

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5. Does your product comply with the technical requirements stipulated in this market survey?

Yes No

If not, indicate which requirement(s) is (are) not satisfied and why:

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6. Is your company in a position to communicate promptly any change(s) in the manufacturing process of the component and its sub-components?

Yes No

7. Can your company assure that identical manufacturing process steps can be applied in a product validation lot and in a volume production lot?

Yes No

If yes, validation and production lots should be manufactured within a period of:

.....

8. Has your company supplied semiconductor lasers to CERN before?

Yes No

If yes, indicate reference:

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If no, indicate alternative references:

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9. How many pigtailed Fabry-Perot laser modules do you produce yearly?

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10. Would you sub-contract part of the work?

Yes No

If yes, please specify which part of the work would be sub-contracted, and give the name, address, person in charge and the telephone number of the potential sub-contractors. CERN reserves the right to contact the subcontractors directly.

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11. Do you have a registered Quality Assurance Plan?

Yes No

If yes, indicate which one:

.....
.....

3. Further Technical Information

12. Are the proposed components commercial off-the-shelf products?

Yes No

13. Does your company intend to modify the standard commercial product manufacturing process to meet the specifications?

Yes No

If yes, indicate which specification(s) is (are) causing a modification and describe the changes:

.....
.....

14. Has your product (or major parts of it) been internally qualified?

Yes No

If yes, indicate to which standard and supply a qualification report. If no, indicate plans:

.....
.....
.....

15. Does the product feature a magnetic package or leadframe?

Yes No

If yes, indicate the part and the magnetic material:

.....
.....

16. Is there any material in the light path between laser die and input-fibre endface?

Yes No

If yes, indicate the material type:

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.....

17. What optical interface option is your company able to supply (see technical requirements section 3.5)?

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18. Is your company able to supply components in pigtailed submount form without housing and without leadframe?

Yes No

19. What kind of technical support can the manufacturer provide during the pre-production and production phase?

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4. Questions from the company

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Date

Company seal and signature