European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

MS-4086/EP

Market Survey

Technical Questionnaire
Planar Silicon Sensors for the ATLAS and CMS Outer Tracker Upgrades

Firms interested in tendering shall return a completed questionnaire in duplicate.

Firm compiling the questionnaire

Name: .....

Should you be qualified, are you interested in receiving the Invitations to Tender following this Market Survey?

ATLAS Strip Sensors	**CMS Strip Sensors**	**CMS Macro-Pixel Sensors**
☐	☐	☐

Are you interested in being kept in the CERN supplier database?

Yes	**No**
☐	☐

If yes, please state your main activities which could be of interest to CERN with the name of the person to be contacted.

Main activities	**Person to be contacted**
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.....	.....
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1. GENERAL INFORMATION ABOUT THE FIRM COMPILING THE QUESTIONNAIRE

1.1 Contact Persons for Technical Matters:

Name	Tel-Fax	Email
Mr. Mrs.	Tel: ..... Fax:	.....
In case of absence:		
Mr. Mrs.	Tel: ..... Fax:	.....

1.2 Contact Persons for Commercial Matters:

Name	Tel-Fax	Email
Mr. Mrs.	Tel: ..... Fax:	.....
In case of absence:		
Mr. Mrs.	Tel: ..... Fax:	.....

2. TYPE OF FIRMS

2.1 Country of Origin of Supplies Proposed by the Firm Compiling the Questionnaire

The term "country of origin" shall mean the country where the supplies, including their components and sub-assemblies, are manufactured or undergo the last major transformation by the contractor. This should be within a CERN Member State and, under certain conditions, from Associate Member States or Candidates for Accession or an ATLAS or CMS Member State.

The firm compiling this questionnaire shall indicate the distribution of the country (ies) of origin in percentage terms in the table below.

Name / address of the firm compiling the questionnaire	Country of origin
....	.....

2.2 Subcontracting

Would the firm subcontract any part of the contract?

Yes	No
☐	☐

If yes, please specify which part of the contract would be subcontracted, and indicate the name and address of the potential subcontractors if known at this time. Please provide the information requested below, including the distribution of the country (ies) of origin in percentage terms for each proposed subcontractor in the table below.

Name and address	Supplies	Country of origin
....	....	.....
....	....	.....

3. ADMINISTRATIVE SITUATION

Is the firm involved in bankruptcy proceedings, prosecution for debt, sequestration or any analogous situation arising from a similar procedure provided for in law?

Yes ☐ **No** ☐

Has the firm made arrangements of any kind with creditors for their benefit?

Yes ☐ **No** ☐

Has the firm been subject of a judgement for fraud, corruption or any other illegal activity?

Yes ☐ **No** ☐

4. COMPETENCE AND EXPERIENCE

4.1 Experience

Do you have the proven experience in the manufacturing of silicon sensors for ionizing radiation?

Yes ☐ **No** ☐

If not, do you have proven experience in the manufacturing of silicon devices with similar properties to sensors for ionizing radiation: high voltage operation, fully depleted and high resistive bulk, on at least 150 mm diameter wafers?

Yes ☐ **No** ☐

Please explain in which way your experiences are similar to sensors for ionizing radiation:

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Please state which aspects of your experience would be most relevant to a future contract:

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4.2 References

Please provide at least three references of similar supply. References should be related to recent contracts comparable in scope, complexity and volume to the supply required at CERN, during the last 15 years.

CERN reserves the right to verify the references provided. In addition, the firm may be required to arrange a visit by CERN to any of their references.

Please complete the three “Reference forms” provided in the Annex of this document.

5. SIZE

5.1 Number of Employees

	2016
Technical employees in semiconductor device fabrication	.....
Technical employees in production of sensors for ionizing radiation sensors	.....

If the number of employees is below the required number specified in section 5.1 of the document "Qualification Criteria": Do you plan to increase the number of technical employees and those specialised in the production of sensors for ionizing radiation in the near future and what numbers are you aiming at?

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5.2 Annual Turnover

Turnover	2013	2014	2015
In the field of semiconductor device fabrication	.....	.....	.....

6. PRODUCTION AND TESTING CAPACITY

6.1 Overall production throughput

What was your typical throughput in 2015 in wafer starts per month?

for 6” wafers: .....

for 8” wafers: .....

If your throughput was below the required number specified in section 6.1 of the document “Qualification Criteria”: Do you plan to increase your production capacity in the near future and what capacities are you aiming at?

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6.2 Production throughput

For which of the three sensor types:

A ... ATLAS strip sensors

B ... CMS strip sensors

C ... CMS macro-pixel sensors

are you able to deliver the full amount of required sensors as defined in section 3.4 of the “Technical Description” within two or three years from the start of the series production. Please indicate all possibilities.

sensor type	within 2 years	within 3 years
A		
B		
C		

Comments

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For which of the three sensor types are you able to deliver the full amount of required sensors as defined in section 3.4 of the "Technical Description" within 2 or 3 years from the start of the series production **and within the same frame**. Please indicate all possibilities.

sensor type	within 2 years	within 3 years
A + B		
A + C		
B + C		
A + B + C		

Comments

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6.3 Production throughput available to CERN in case of contract splitting

In the case of contract splitting, do you agree to increase the production up to the full quantity of the supply of ATLAS strip sensors or CMS strip sensors or CMS macro-pixel sensors if any of the other contractors fail to fulfil their contractual obligations?

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6.4 Production process stability

Can you guarantee that the pre-series and series production of sensors shall be made on the same equipment and use the same production processes as the samples delivered for qualification in step three of the qualification process describe in section 4.3 of the document "Technical Description"?

Yes ☐ **No** ☐

If not, please elaborate:

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Can you guarantee that any changes before or during the pre-series and the series production shall be documented and agreed with the experiments before implementation?

Yes ☐ **No** ☐

If not, please elaborate:

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7. QUALITY ASSURANCE

7.1 Sensor acceptance tests

Do you have the necessary on-site test facilities and agree to perform all measurements described in section 3.6 of the document “Technical Description”.

Yes	**No**
☐	☐

If not, please explain the exceptions:

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8. SCHEDULE

Will you be able to respect the provisional delivery schedule as defined in section 5.1 of the document "Technical Description"?

Yes	**No**
☐	☐

If not, please explain the exceptions:

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9. COMMUNICATION

9.1 Contact Persons

Will you make at least one commercial contact person and one technical contact person available for the entire duration of the contract?

Yes ☐ **No** ☐

If not, please explain the exceptions:

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9.2 Communication language

Are the contact persons concerned able to communicate in English?

Yes ☐ **No** ☐

10. COMPLIANCE WITH THE QUALIFICATION PROCEDURE

Do you agree to follow all three steps of the qualification procedure described in section 4 of the document "Technical Description" to qualify for receiving the Invitations to Tender for the respective sensor types (ATLAS strip sensors, CMS strip sensors and CMS macro-pixel sensors)?

Yes ☐ **No** ☐

If no, please explain to which part of the qualification procedure you cannot agree.

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11. COMPLIANCE WITH THE QUALIFICATION CRITERIA

Do you comply with all the qualification criteria as stipulated in this market survey?

Yes	**No**
☐	☐

If no, please explain which criteria are not fulfilled.

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12. GENERAL COMMENTS

Indicate any other information that may be relevant to this market survey.

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13. ADDITIONAL INFORMATION

A response to the following questions is not required for qualification within this Market Survey. Nevertheless, CERN appreciates any additional information provided in this section to facilitate the compilation of the final specifications for the Invitations to Tender.

13.1 Wafer Sizes

Which wafer sizes are available to process planar silicon sensors (6" 150 mm, 8" – 200 mm, etc.)?

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13.2 Wafer Materials

What materials with which properties are available (like FZ, MCz, deep defused materials, etc.)? Please specify available resistivities, oxygen content, crystal orientation, etc, Please indicate the estimated relative costs between such materials?

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13.3 Wafer Thickness

What wafer thicknesses (active and physical) are you able to manufacture? Please indicate the initial wafer thickness as well. Please indicate the relative estimated costs between such materials?

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13.4 Inter-strip Isolation Methods

What kind of inter-strip isolations methods for n-on-p sensors are available (e.g. p-stop or p-spray)? Which kind of inter-strip isolation do you prefer?

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13.5 Dicing Methods

Which kind of dicing methods do you offer? Do you have capabilities to do circular dicing cuts?

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13.6 Dicing Precision

What precision can you guarantee for the cutting lines or what is the maximum displacement of the actual cut from a predefined line?

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13.7 Dicing Quality

What is the limit on the size of chipping and cracking that you can guarantee?

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13.8 Testing Throughput

Which of the electrical tests proposed in section 3.6 of the document “Technical Description” could be a potential bottleneck and how would you propose to facilitate that?

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13.9 Costs: Different Sensor Variants

How does the number of different sensor variants – each requiring an individual and full set of photomasks – affect costs?

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13.10 **Production Planning**

Starting from the date of award of contract, how much time do you need to setup the production and deliver the first sensors?

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13.11 **Wafer Starts for Ionizing Radiation, Planar Sensors Only**

What is your typical throughput of silicon wafers/month, of ionizing radiation sensors only?

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13.12 **Minimum wafer starts**

Is there a minimum throughput in wafers/month?

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13.13 **Budgetary estimates**

Can you provide a budgetary estimate for each ATLAS or CMS strip sensor, under the assumption of being awarded a contract for 50% of the full production, based on the technical description of this market survey, but with no implied commitment to this figure?

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13.14 **Impact on cost**

Which sensor parameters have the largest impact on cost?

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13.15 **Impact on manufacturing**

Which sensor parameters carry the largest risk for maintaining consistency in quality?

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Date **Signature and stamp of firm**

REFERENCE 1	
Name of the customer	
Full address	
Name of the person to be contacted in customer organisation Telephone E-mail	
Scope of the contract	
Duration (start and end dates) and approximate contract value	
Number and qualifications of personnel performing the contract (in case of service contract)	
Organisational structure (e.g. single contractor, role in the case of a combination of firms, organisational flow chart).	
Quality and safety management	
Other relevant details	

Continue on separate sheet of paper if necessary.

REFERENCE 2	
Name of the customer	
Full address	
Name of the person to be contacted in customer organisation Telephone E-mail	
Scope of the contract	
Duration (start and end dates) and approximate contract value	
Number and qualifications of personnel performing the contract (in case of service contract)	
Organisational structure (e.g. single contractor, role in the case of a combination of firms, organisational flow chart)	
Quality and safety management	
Other relevant details	

Continue on separate sheet of paper if necessary.

REFERENCE 3	
Name of the customer	
Full address	
Name of the person to be contacted in customer organisation Telephone E-mail	
Scope of the contract	
Duration (start and end dates) and approximate contract value	
Number and qualifications of personnel performing the contract (in case of service contract)	
Organisational structure (e.g. single contractor, role in the case of a combination of firms, organisational flow chart)	
Quality and safety management	
Other relevant details	

Continue on separate sheet of paper if necessary.