

## **CERION-2**

***IST – 2001 – 39059***

***Canadian European Research Initiative On Nanostructures***

### **Final Report – Deliverable D6.2**

**Covering period 01.10.2003 – 31.03.2004**

Report Version: 1

Report Preparation Date: 27 May 2004

Classification: Int.

Contract Start Date: 1 October 2002

Duration: 18 months

Project Co-ordinator: IMEC

Partners: IMEC Leuven (B), Universiteit Antwerpen (B), Institute of Molecular Biotechnology, Jena (D), Universität Dortmund (D), Universität Erlangen / Nürnberg (D), Universität Regensburg (D), Bergische Universität – Gesamthochschule Wuppertal (D), Universität Würzburg (D), Universidad de Barcelona (E), Universidad Autonoma de Madrid (E), Universidad de la Laguna (E), Universidad del País Vasco (E), CNRS Grenoble (F), Wrocław University of Technology (PL), University of Linköping (S), Cardiff University (UK), University of Glasgow (UK), NRC-IMS Ottawa (CA), Concordia University, Montreal (CA), McGill University, Montreal (CA), McMaster University, Hamilton (CA), Queens University, Kingston (CA), University of Alberta, Edmonton (CA), University of British Columbia, Vancouver (CA), Simon-Fraser University, Burnaby B. C. (CA)



**Project funded by the European Community  
under the “Information Society Technologies”  
Programme (1998–2002)**

## Contents

|   |           |
|---|-----------|
| <b>Table of Contents</b>  | <b>2</b>  |
| <b>1. Introduction</b>  | <b>3</b>  |
| <b>2. Project objectives and executive summary</b>                                | <b>3</b>  |
| <b>3. Project results and achievements</b>  | <b>3</b>  |
| <b>4. Methodologies</b>   | <b>4</b>  |
| <b>5. Deliverables</b>  | <b>4</b>  |
| <b>6. References</b>  | <b>4</b>  |
| <b>7. Potential Impact of project results</b>                                     | <b>8</b>  |
| 7.1 Questionnaire . . . . .   | 8         |
| 7.2 Results of the questionnaire . . . . .  | 10        |
| 7.2.1 Response . . . . .  | 10        |
| 7.2.2 Impact of CERION-2 on the research carried out in the member institutes . . | 11        |
| 7.2.3 Impact of the CERION 2002 and CERION 2003 workshops . . . . .               | 11        |
| 7.2.4 Budgetary issues . . . . .  | 11        |
| 7.2.5 Future perspectives . . . . .   | 11        |
| <b>8. Conclusion and Future Outlook</b>   | <b>13</b> |

## 1. Introduction

This document contains the final report of the CERION-2 project. As such it does not contain the details of the project activities and achievements for which we refer to the project deliverables such as the topical reports and the two progress reports.

## 2. Project objectives and executive summary

The rapid increase in the cost of doing forefront research in nanotechnology and its growing multidisciplinary dimension necessitates that international resources, facilities and expertise are pooled. The CERION-2 Working Group aims to develop and strengthen collaborations between Europe and Canada in the area of nanotechnology, building on both new programs and the experience of the former CERION program. The collaborations are designed to benefit from the complementary facilities, techniques and expertise of the participating groups.

Being a thematic network (Fifth Framework Programme), CERION-2 consists of a European-Canadian consortium of institutes conducting research in various fields of nanoelectronics, including the topical areas *quantum transport in nanodevices*, *quantum information*, *nano-photonics*, *spintronics*, *molecular electronics*, *bioelectronics* as well as the underlying nano and self assembly technology. The CERION-2 Working Group is an IST project launched under the 5th Framework Programme and, as such, it has grown out of an earlier CERION project, called CERION-1 in this document.

The following long-term goals are envisaged :

- The creation of new collaboration links.
- To intensify existing collaboration links from CERION-1 that are consistent with the objectives of CERION-2.
- To exchange all scientific and strategic information of common interest between all CERION-2 members.
- To disseminate information on the CERION-2 research progress to a wider group of universities, institutes and companies.

## 3. Project results and achievements

In summary, the scientific results of the CERION-2 related research has led to numerous publications in refereed journals (see also section 6.), invited talks and contributed conference presentations. Also the 2003 Herzberg Memorial Prize and Fellowship, awarded by the The National Research Council of Canada to Dr. Marek Potemski (CRNS-High Magnetic Field Laboratory, Grenoble) should not go unnoticed in this respect.

Strategically, the existing collaborations from the CERION-1 project that are also part of CERION-2 have either been kept on the same intensity level or have been intensified. Moreover, four new collaborations have been reported that were not originally planned in the CERION-2 project proposal.

During the CERION-2 project eight CERION-2 members have applied for participation in the PHANTOMS Network of Excellence on nanotechnology. Recently, an application has also been sent by the NRC-IMS Ottawa. Moreover, non-confidential scientific and project related information has been

published (and will be published) in the PHANTOMS Newsletter issues as regular research papers and dedicated articles.

Finally, the unique transatlantic collaboration scheme established by the CERION-2 consortium has considerably strengthened the bilateral cooperation between Europe and Canada in the wide area of nanophysics, chemistry and nanotechnology.

## 4. Methodologies

The main goal of the project is the setup and enhancement of complementary collaboration between European and Canadian universities and research institutes. Therefore, the short exchange visits paid by the European scientists to their Canadian colleagues (and vice versa) play a central role in the joint research activities.

Secondly, the dissemination of scientific results is accomplished by the organization of annual workshops (alternatingly on both sides of the atlantic) and the publication of non-confidential information on the CERION-2 web site or through the communication channels of related projects.

## 5. Deliverables

The two reporting periods of the CERION-2 project are covering the first year (01.10.2002 – 30.09.2003) and the last six months (01.10.2003 – 31.03.2004).

The deliverables of the CERION-2 project are listed below :

- Eight topical reports describing the strategic and scientific progress in the four topical areas for each of the two reporting periods :
  - quantum information and decoherence in coupled nanosystems (deliverables D1.1 and D1.2),
  - nano-photonics (deliverables D2.1 and D2.2),
  - magnetoelectronics and spintronics (deliverables D3.1 and D3.2),
  - bio- and molecular electronics (deliverables D4.1 and D4.2).
- The organization of the annual CERION-2 Workshops, CERION2002 (Montreal, Canada, 2-4 October 2002) and CERION2003 (Bilbao, Spain, 2-4 September 2003), i.e. deliverable D5.
- Two periodic reports for each of the two reporting periods as well as the final report (deliverables D6.1 and D6.2).
- Setup and maintenance of the CERION-2 web-site [http://www.imec.be/cerion\\_2](http://www.imec.be/cerion_2) denoted as deliverable D7.

## 6. References

The following list of refereed publications (2002 – 2004) illustrates emerging directly and indirectly from the transatlantic CERION-2 collaboration links illustrates the scientific output of the CERION-2 project. *Bearing in mind that CERION-2 is an 18 months project, one should view the total number*

of publications in the light of the – relatively short – project duration, while a major part of the publications that are under preparation or have been submitted in the second reporting period, will be published later on in 2004.

- [1] *Optimal band-pass filter for electrons in semiconductor superlattices*, G. Morozov, D. W. L. Sprung and J. Martorell, *J. Phys.* **D35**, 2091 (2002).
- [2] *Design of electron band-pass filters for semiconductor superlattices*, G. Morozov, D. W. L. Sprung and J. Martorell, *J. Phys.* **D35**, 3052 (2002).
- [3] F. Delgado, H. Cruz and J. G. J. Muga, *Phys. A* **35**, 10377, (2002).
- [4] G. Cuniberti, G. Fagas and K. Richter, *Chem. Phys.*, **281**, 465 (2002); A. Latgé, D. C. Marcucci and M. V. Tovar Costa, *Physica E***13**, 1264 (2002).
- [5] R. Kudrawiec, G. Sęk, W. Rudno-Rudziński, J. Misiewicz, J. Wojcik, B. J. Robinson, D. A. Thompson and P. Mascher, *Acta Physica Polonica A* **102**, 649, (2002).
- [6] R. Kudrawiec, D. G. Sęk, W. Rudno-Rudziński, J. Misiewicz, J. Wojcik, B. J. Robinson, D. A. Thompson, P. Mascher, *Investigation of the non-square InGaAsP/InP quantum wells in the electric field by photoreflectance*, *Acta Physica Polonica A***102**, 649, (2002).
- [7] C. N. Allen, P. J. Poole, P. Marshall, J. Fraser, S. Raymond, S. Fafard, *InAs self-assembled quantum-dot lasers grown on (100) InP*, *Appl. Phys. Lett.* **80** (19), 3629-31 (2002).
- [8] J. Wojcik, B. J. Robinson, D. A. Thompson, P. Mascher, *Control of dielectric cap induced band-gap shift in 1.55  $\mu\text{m}$  laser structures*, *Journal of Vacuum Science & Technology A - Vacuum Surfaces & Films* **20**, 1076, (2002).
- [9] S. Behrens, K. Rahn, W. Habicht, K. J. Böhm, H. Rösner, E. Dinjus and E. Unger, *Nanoscale particle arrays induced by highly ordered protein assemblies*, *Adv. Mater.* **14**, 1621-1625 (2002).
- [10] C. Clavijo Cedeño, J. Seekamp, A. P. Kam, T. Hoffmann, S. Zankovych, C. M. Sotomayor Torres, C. Menozzi, M. Cavallini, M. Murgia, G. Ruani, F. Biscarini, M. Behl, R. Zentel, J. Ahopelto, *Microelectronic Engineering* **61-2**, 25 (2002).
- [11] B. Sorée, W. Magnus and W. Schoenmaker, *Energy and Momentum Balance Equations, An Approach to Quantum Transport in Closed Circuits*, *Phys. Rev.* **B66**(3) (2002).
- [12] G. Ortner, M. Bayer, A. Larionov, V. B. Timofeev, A. Forchel, Y. B. Lyanda-Geller, T.L. Reinecke, P. Hawrylak, S. Fafard and Z. Wasilewski, *Fine structure of excitons in coupled quantum dots: A sensitive test of electronic coupling*, *Phys. Rev. Lett.* **90**, 086404 (2003).
- [13] M. Bayer, M. Korkusinski, P. Hawrylak, T. Gutbrod, M. Michel and A. Forchel, *Optical Detection of the Aharonov-Bohm Effect on a Charged Particle in a Nanoscale Quantum Ring*, *Phys. Rev. Lett.* **90**, 186801 (2003).
- [14] A. Slobodskyy, C. Gould, T. Slobodskyy, C. R. Becker, G. Schmidt and L. W. Molenkamp, *Voltage-Controlled Spin Selection in a Magnetic Resonant Tunneling Diode*, *Phys. Rev. Lett.* **90**, 246601 (2003).

- [15] P. Borri, W. Langbein, U. Woggon, M. Schwab, M. Bayer, Z. Wasilewski, S. Fafard and P. Hawrylak, *Exciton dephasing in quantum dot molecules*, Phys. Rev. Lett. **91**, 267401 (2003).
- [16] M. L. Sadowski, M. Byszewski, M. Potemski, A. Sachrajda and G. Karczewski, Appl. Phys. Lett. **82**, 3719 (2003).
- [17] F. J. Teran, M. Potemski, D. K. Maude, D. Plantier, A. K. Hassan, A. Sachrajda, Z. Wilamowski, J. Jaroszynski, T. Wojtowicz and G. Karczewski, *Collective Character of Spin Excitations in a System of  $Mn^{2+}$  Spins Coupled to a Two-Dimensional Electron Gas*, Phys. Rev. Lett. **91**, 077201 (2003).
- [18] D. W. L. Sprung *et al.*, J. App. Phys. **93**, 4395-4406 (2003).
- [19] D. W. L. Sprung, G. Morozov and J. Martorell, *Antireflection coatings from the analogy between electron scattering and spin precession*, J. of Appl. Phys **93**, 4395 (2003).
- [20] D. W. L. Sprung, P. Jagiello, J. D. Sigeitch and J. Martorell, *Continuum bound states as surface states of a finite periodic system*, Phys. Rev. **B67**, 085318 (2003).
- [21] D. Alonso, R. S. Mayato and R. Leavens, Phys. Rev. A **67**, 032105 (2003).
- [22] C. H. Lei, A. Das, M. Elliott and J. E. Macdonald, *Conductivity of macromolecular networks measured by electrostatic force microscopy*, Appl Phys Lett **83**, 482 (2003).
- [23] R. Gutierrez, G. Fagas, K. Richter, F. Grossmann, and R. Schmidt, Europhys. Lett. **62**, 90 (2003).
- [24] R. Kudrawiec, G. Sęk, K. Ryczko, W. Rudno-Rudziński, J. Misiewicz, J. Wojcik, B. J. Robinson, D. A. Thompson and P. Mascher, Physica E **17**, 602, (2003).
- [25] R. Kudrawiec, G. Sęk, W. Rudno-Rudziński, J. Misiewicz, J. Wojcik, B. J. Robinson, D. A. Thompson and P. Mascher, Materials Science and Engineering **B101**, 232, (2003).
- [26] R. Kudrawiec, D. G. Sęk, W. Rudno-Rudziński, J. Misiewicz, J. Wojcik, B. J. Robinson, D. A. Thompson, P. Mascher, *Photoreflectance study of changes in the QW profile of 1.55-micrometer laser structure induced by  $SiO_2$  cap layers*, Materials Science & Engineering **B101**, 232, (2003).
- [27] R. Kudrawiec, D. G. Sęk, W. Rudno-Rudziński, J. Misiewicz, J. Wojcik, B. J. Robinson, D. A. Thompson, P. Mascher, *Investigation of dielectric cap induced intermixing of  $In_xGa_{1-x}As_yP_{1-y}InP$  quantum well laser structures by photoreflectance and photoluminescence*, Materials Science & Engineering **B101**, 137, (2003).
- [28] B. Sorée, *Solving dissipative quantum transport problems with balance equations*, PhD Thesis / KULeuven, December 2003.
- [29] B. Molnar, F. M. Peeters and P. Vasilopoulos, Phys. Rev. B, in press.
- [30] B. Molnar, P. Vasilopoulos and F. M. Peeters, submitted to Appl. Phys. Lett.
- [31] S. Raymond, S. Studenikin, A. Sachrajda, Z. Wasilewski, S. J. Cheng, W. Sheng, P. Hawrylak, A. Babinski, M. Potemski, G. Ortner and M. Bayer, *Excitonic Energy Shell Structure of Self-Assembled InGaAs/GaAs Quantum Dots*, Phys. Rev. Lett. **92**, 187402 (2004).

- [32] G. Ortner, I. Yugova, G. Baldassarri Höger von Högersthal, A. Larionov, D. R. Yakovlev, M. Bayer, S. Fafard, Z. Wasilewski, P. Hawrylak, Y. B. Lyanda-Geller T. L. Reinecke, and A. Forchel, *Fine structure of the excitonic emission from InAs/GaAs quantum dot molecules*, submitted for publication.
- [33] G. Ortner, M. Bayer, S. Rudin, T. L. Reinecke, Z. Wasilewski, S. Fafard, P. Hawrylak, A. Forchel, *Temperature dependence of the width of the zero phonon line in InAs/GaAs quantum dots*, submitted for publication.
- [34] S. A. Studenikin, M. Potemski, P. T. Coleridge, A. S. Sachrajda and Z. Wasilewski, *Microwave radiation induced magneto-oscillations in the longitudinal and transverse resistance of a two-dimensional electron gas*, Solid State Commun. **129**, 341 (2004).
- [35] M. Evaldsson, I. V. Zozoulenko, M. Ciorga, P. Zawadzki and A. S. Sachrajda, submitted for publication to Europhysics Letters
- [36] *Semiclassical coupled wave theory for TM waves in 1-D photonic crystals*, G. Morozov, D. W. L. Sprung and J. Martorell, Phys. Rev. **E69** (2004), accepted May 5.
- [37] *Design of electron band pass filters for electrically biased finite superlattices*, J. Martorell, D. W. L. Sprung and G. Morozov, Phys. Rev. **B69**, 115309 (2004).
- [38] *Semiclassical coupled wave theory and its application to TE waves in one dimensional crystals*, G. Morozov, D. W. L. Sprung and J. Martorell, Phys. Rev. **E69** (2004) 016612.  
Selected for *Virtual Journal of Nanoscale Science and Technology*, Vol. 9, Issue 5, February 9, 2004.
- [39] *Geometrical approach to scattering in one dimension*, D. W. L. Sprung, G. Morozov and J. Martorell, J. Phys. **A37**: Math. Gen., 1861-80 (2004).
- [40] C. H. Lei, A. Das, M. Elliott and J. E. Macdonald, *Quantitative electrostatic force microscopy-phase measurements*, Nanotechnology, **15**, 627-643 (2004).
- [41] C. H. Lei, A. Das, M. Elliott, J. E. Macdonald and M. L. Turner, *Au-poly(3-hexylthiophene) contact behaviour at high resolution*, Synthetic Metals, (2004). Accepted for publication.
- [42] A. Wensauer, M. Korkusinski and P. Hawrylak, Sol. St. Commun. **130**, 115 (2004).
- [43] B. Sorée, N. Sergueev, W. Magnus and H. Guo, *Electron-phonon interaction in contacted carbon nanotubes*, in preparation.
- [44] U. Schlierf, D. J. Lockwood, M. J. Graham and P. Schmuki, *Structural and Optical Properties of P-InP(100)anodized in halogenic acids*, Electrochemica Acta **49**, 1743 (2004).
- [45] B. Sorée, W. Magnus, S. Compernelle, A. Ceulemans and L. Chibotaru, *Electronic structure and electron-phonon interaction in carbon nanotubes*, in preparation.

## 7. Potential Impact of project results

### 7.1 Questionnaire

During the second and last reporting period a questionnaire has been circulated among the CERION-2 members in order to estimate the impact of the project on the research conducted in the member institutes – and particularly the beneficial project activities – as well as the opinion of the participants regarding a possible extension of the CERION project.

For the sake of reference, one of the question mentions the two European-Canadian projects preceding CERION-2 :

- *ECAMI*

Full name : European-Canadian Mesosopic Initiative  
 Programme : International Cooperation (INCO)  
 Period : 01.01.1994 – 31.12.1996  
 Consortium : 7 European partners, 1 Canadian partner (NRC)  
 Coordinator : IMEC

- *CERION(-1)*

Full name : Canadian-European Research Initiative On Nanostructures  
 Programme : Fourth Framework Programme (ESPRIT-IV)  
 Period : 01.05.1998 – 30.04.2001  
 Consortium : 17 European partners, 8 Canadian partners  
 Coordinator : IMEC

.....*BEGIN QUESTIONNAIRE (verbatim)* .....

### The CERION project : a questionnaire

The purpose of this questionnaire is to gather opinions about CERION, both about the CERION-II project as well as any possible extension of CERION-II in the Sixth Framework Programme. Your responses to this questionnaire will be used in the final report which is to be delivered by the end of the project. We also however, will use your input in deciding the future of this series of Canadian-European initiatives.

Therefore please note that all opinions - both Canadian and European - are important matter for us and we respectively ask you to send back the completed questionnaire **before February 29, 2004**.

Short-hand notation : Y = yes, N = no, ? = I don't know or I'm not sure, A, B = option to be chosen.

## 1. The present CERION project (CERION-II)

### 1.1 Scientific issues

- What difference did your participation in CERION-II make to your scientific work in your institute / group?
  - E.g. Have you decided to start new research on the occasion of CERION-II [**A**] or have you used CERION primarily to enhance previous research [**B**] ? [A / B]

- As a result of CERION contacts, workshops etc.. have you started new collaborations with Canadian institutes, the content of which is not mentioned in the official CERION-II technical description? [Y / N]
- Are the names of the 4 thematic areas of the project still appropriately covering (part of) the research you are doing together with your European / Canadian colleagues ? [Y / N / ? ]
- What is your opinion of the content and the format of the CERION-II workshops (Montreal, October 2–4, 2002 – Bilbao, September 3–5, 2003)?
  - The workshops have been a suitable forum to present our CERION-II related and other research results. [Y / N]
  - There have been enough opportunities during the workshops to get acquainted with the work of other colleagues with whom we have not directly collaborated. [Y / N]
  - Contacts with invited speakers and/or other external attendees have been beneficial for the progress in our work. [Y / N]

If possible please give below an example where CERION has been a positive influence. Of course constructive negative comments are equally important.

...

## 1.2 Budgetary issues

- Has the budget allocated to your institute enabled you to efficiently cover the travel and living expenses incurred during the transatlantic research visits of you or your coworkers ? [Y / N]
- Did you have to rely on other financial resources to cover the labour expenses of one or more scientists who have actively participated in CERION-II ? [Y / N]

## Comments and remarks

...

## 2. Toward a future extension of the CERION project ?

### 2.1 The Canadian–European collaboration

Would you personally be interested in being part of a new, Canadian-European consortium in the area of nanotechnology ? [Y / N]

What changes need to be made to make CERION more effective?

...

Please provide any ideas you may have on the format of a new program?

...

### 2.2 Industrial participation

Do you think it is possible or even desirable to extend the active involvement of European and Canadian industry in a new CERION consortium ? Please, explain.

...

## 2.3 Format of a possible, new CERION consortium

Within the Sixth Framework Programme various project forms and types could in principle be proposed for an extended CERION project.

Two important questions should be answered in advance of any further initiative :

- Shall we apply for another large consortium which takes the form of a network (a so-called “Network of Excellence” in terms of FP6) **[A]** or should we submit a regular research proposal which is also covering personnel expenses (thus allowing one to hire additional scientists, postdocs . . . ) **[B]** ? [A / B]

If the regular project format is chosen, a consortium as big as CERION-II would probably be oversized. So, what would be the most appropriate size and how should we split up? For instance, should we go for 4 different projects roughly following the present 4 thematic areas ?

...

- IMEC has been the prime contractor to the European Union for both CERION-I and CERION-II (and also the former ECAMI project). It is therefore the right time to appoint another institute to set up and to coordinate the new project. [Y / N]
  - I am a candidate to initiate and coordinate a new Canadian-European research initiative. [Y / N]
  - We can also attempt to initiate at a higher level some sort of specific bilateral agreement (aimed at reducing the administrative load?) between Canada and Europe in the area of Nanotechnology (this is how ECAMI started). [Y / N]  
If yes do you have any comments on what such an agreement should include?  
...
  - I would propose the following institute for the set-up and the coordination of a new Canadian-European research initiative :  
...

## 2.4 Other comments and remarks

...

.....*END QUESTIONNAIRE* .....

## 7.2 Results of the questionnaire

The responses to the questionnaire that are gathered in practice until mid-May 2004, are summarized below.

### 7.2.1 Response

In total, 16 CERION-2 member institutes (approximately 60 %) have responded to the questionnaire, 13 responses coming from Europe, 3 from Canadian partners. The figures mentioned next to the statements represent the number of CERION-2 members to which the statements apply. A question mark indicates either “no opinion” or “I don’t know”.

**7.2.2 Impact of CERION-2 on the research carried out in the member institutes**

- New research or research topics have been initiated between participating institutes due to CERION-2 ..... 8
- Existing research has been enhanced and broadened due to CERION-2 ..... 13
- New research has started in new collaboration links that were not originally planned due to other transatlantic interactions within CERION-2 ..... 5

**7.2.3 Impact of the CERION 2002 and CERION 2003 workshops**

|  | Yes | No | ? |
|--|-----|----|---|
| The two CERION workshops have offered an appropriate forum to discuss and review CERION-2 related research | 15  | 0  | 1 |
| The workshops have led to beneficial contacts with <i>other</i> colleagues                                 | 15  | 1  | 0 |
| The workshops have led to beneficial contacts with invited speakers who are not involved in CERION-2       | 14  | 1  | 1 |

**7.2.4 Budgetary issues**

|  | Yes | No | ? |
|--|-----|----|---|
| The travel budget provided by CERION-2 has been sufficient to cover the real travel expenses | 12  | 3  | 1 |
| External funding resources were needed to cover research expenses (incl. personnel)          | 13  | 3  | 0 |

**7.2.5 Future perspectives**

All 16 respondents unanimously state to be willing to participate in a new CERION or CERION-like project. The main changes to be made are listed in the following table.

|  |   |
|--|---|
| The administrative load should be reduced compared to CERION-2   | 5 |
| The overall budget should be increased and research expenses (labour) should – at least partially – be funded          | 7 |
| Not only short-term but also mid-term visits (1 to 2 months should be allowed)   | 3 |
| The “national Institute for nanotechnology” (NINT), Univ, of Alberta, Edmonton, should be included in a new consortium | 1 |

The opinions regarding industrial participation in a new project are listed separately below.

**Statement :** *Industry should participate in a new CERION project.*

- *I agree* ..... 1
- *I agree IF industry provides (partial) financial support* ..... 4
- *I agree IF industrial participation provides a strategic advantage to increase the success rate of the application* ..... 2
- *I disagree / I believe that industrial participation is rather unlikely* ..... 8
  - because of the discrepancy between the exploratory character of the CERION related research and the short-term goals envisaged by industry
  - since it is rather inconvenient to have to be involved in market related issues.

Finally, the responses regarding the possible formats of a newly launched CERION project are tabulated hereafter.

|   | Yes | No | ? |
|---|-----|----|---|
| A new CERION project should again take the form of a thematic network                                 | 7   | 6  | 3 |
| If one were to go for a regular project (such as a STREP), should the present consortium be split up? | 3   | 6  | 7 |
| Should we address alternative programmes in order to initiate an ECAMI-like project                   | 9   | 3  | 4 |
| Should IMEC again act as a prime coordinator for a new CERION project?                                | 8   | 3  | 5 |

Furthermore, one respondent suggests the possibilities to combine both alternatives, i.e. launching a new network and – at the same time – trying to define smaller research projects based on the (present) thematic areas.

## 8. Conclusion and Future Outlook

- CERION-2 has had and still has a considerable impact on the research performed at the member institutes and therefore it has accomplished one of its main tasks.
- Apart from the research itself, the two workshops have been greatly appreciated for beneficial contacts as well as for the formation of a real “consortium clan”. In order to keep the contacts and the collaboration links alive after the end of CERION-2 and before any possible launch of a new initiative, H. Guo (McGill Univ., Montreal is considering the possibility of organizing a “CERION-after” Workshop in the autumn of 2004, whenever sufficient funding should be available.
- The former ECAMI and CERION-1 projects as well as CERION-2 are considered a unique EU-CA partnership - both scientifically and strategically - in Europe as well as in Canada. Since it is very difficult to restore such a consortium once its coherence is diluted after the project end, there is an overall agreement to launch a new CERION project.
- The bureaucratic load at the European end of CERION-2 turns out to be the main criticism of Canadian participants.
- Although no clear picture about the final format of a new CERION project has emerged from the questionnaire responses, there seems to be a major agreement on the following issues:
  - The overall budget should be increased and the administrative burden should be reduced.
  - If a new network is envisaged, it should have a budget for mid-term scientific exchange visits and additional scientific meetings.
  - On the other hand, if a research oriented project is to be launched, the size of the present consortium should be preserved whenever possible. Since it is impossible to manage a genuine research project of the size of CERION-1, this option practically implies the scenario of setting up an overall network with a few number of subgroups applying for separate research projects.
  - Industrial participation can be considered only if industry provides partial funding without steering the global research activities.
- In the light of the above mentioned format options and the Sixth Framework Programme, at least two possibilities may be considered : applying for a Coordination Action (under FET Open) or incorporating the EU-Canada collaboration into an integrated project to be submitted to the next call of the “Emerging Nanoelectronics” or “Quantum Information Processing & Communications” (QIPC) sub-programmes.

Further discussions on both sides of the atlantic will be held during the coming months to identify the most appropriate format for a new CERION project. The present CERION-2 participants as well as other interested parties will be informed about any further initiatives by email and through publications on the CERION-2 website [http://www.imec.be/cerion\\_2/](http://www.imec.be/cerion_2/) which will be up at least until January 2005.