STREAMS

Smart Technologies for eneRgy Efficient Active cooling in Advanced Microelectronic Systems

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Smart **T**echnologies for ene**R**gy **E**fficient **A**ctive cooling in advanced **M**icroelectronic **S**ystems

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Deliverable D7.5

Preliminary Plan for Use and Dissemination of Foreground

WP	7	Exploitation & Dissemination
Task	7.1	Innovation management and exploitation roadmap

Dissemination Level[1]	PU
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Lead beneficiary	LN2
Contributing beneficiaries	ALL
Author	Louis-Michel Collin

[1] Dissemination level: **PU** = Public, **PP** = Restricted to other programme participants (including the Commission services), **RE** = Restricted to a group specified by the consortium (including the JU), **CO** = Confidential, only for members of the consortium (including the Commission services).

[2] Nature of the deliverable: **R** = Report, **D** = Demonstrator, **O** = Other.

Document version	Date	Author	Comments[3]
v1	28/07/2017	Louis-Michel Collin (LN2)	Final version for evaluation

[3] Creation, modification, final version for evaluation, revised version following evaluation, final.

Deliverable abstract

This document presents both the dissemination and the exploitation plans in their preliminary form. The objectives to be met through dissemination are identified, as well as its potential content. The targeted audience is a subject of particular interest in order to maximize the impact of such project. The dissemination plan also highlights the action taken so far in the 18 first months of the STREAMS project, while a timeline presents the expected dissemination actions. The plan emphasizes on the relevance of the publications. Finally, the plan describes how the consortium expects to deal with the networking activities related to the project. The baseline of the plan is to let to the partners a large latitude in their action, while the dissemination management establishes a suggested strategy to achieve at best the objectives.

The second part of the document presents the exploitation plan. It proposes a mean to manage such aspect through a person in charge of its management. It first clarifies the goals to be reached by such plan and presents the background, current and anticipated exploitable results. The policies and rules, originating from the Grand Agreement 688564 and agreed between the partners, are stricter that the dissemination plan. A special focus is brought to the intellectual property rights that are anterior to the project, developed inside it or that could ensue from it are covered. The document concludes with the upcoming dissemination tasks, which are mainly the periodic updates of those plans.

With the proposed approach for both the dissemination and the exploitation plans, it is expected to maximize the impact of the project in order to increase the EU competiveness in microelectronics. This will be done through offering the relevant tools and knowledge in thermal management for the next generation chips.

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1. INTRODUCTION

The STREAMS consortium aims at developing disruptive thermal management technologies in order to keep the EU leadership in microelectronic technologies. This project has the potential to generate technological innovations in a wide range of domains, such as cooling design, microfabrication processes, energy harvesting at microscale and automation. In order to maximize the reach and benefits of such work, dissemination and exploitation plans are proposed. The former first specifies the objectives to reach and the content to be disseminated. It then focuses on the target audience and the potential publishers in order to reach them. The dissemination timeline issued from the consortium management is then presented before presenting the management organization for dissemination. The plan ends with its expected networking activities.

The later, which is the exploitation plan, first specifies the goals to be reached with it. It then present the exploitable content already ready or foreseen. Its policies and rules are detailed and followed by the management of the result exploitation. The present document is a preliminary version, which is expected to be in its definitive at the end of the project (M36) with the D7.9, which is the “Final Plan for Use and Dissemination of Foreground”.

2. DISSEMINATION PLAN

The high amount of partners working together in diversified technological domains on a 3 years project makes a considerable potential quantity of innovation that can be relevant for the industry. The dissemination plan includes the goals, means, approaches and logistics related in order to share the project innovation to reach the relevant audience.

2.1 – Objectives and content

The objective of the dissemination plan contains the expectations of the STREAMS consortium in regard of its capability of producing both valuable and original technological and scientific works. The objectives highlights to which ends such works should be disseminated, while the content presents the current and anticipated works that could be disseminated.

Objectives

The STREAMS objectives in dissemination are:

- To contribute to the scientific community global knowledge;
- To offer disruptive and relevant technologies to the microelectronic EU industry;
- To establish partnership with entities relevant to enhance the project;
- To develop expertise for highly qualified professionals in the microelectronic sector.

Therefore, the project objectives cover two global aspects, which are to increase the EU capability in microelectronics, and to increase its international reach.

Potential content for dissemination

The project generates several elements potentially valuable for dissemination. In order to evaluate the potential dissemination, they are presented and grouped into three categories. First, the project brings potential innovations through its expected proofs-of-concept:

- Themoelement sensors;
- Themoelement generators;
- Array of cooling cells;
- Microfins;
- Microvalves;
- Global prototype.

Second, those demonstrations are technologies that could find relevance in other microelectronic or MEMS devise, whether it is in a heat management context or not. In addition, the project can generate innovation through its developed tools and methods, such as:

- Microelectronic interposer assembly;
- Microelectronic packaging;
- Transient thermal simulation approaches;
- Process flows and unitary processes;
- Microelectronic thermomechanical insight.

Third, those tools and methods could be relevant for subsequent projects. Finally, the knowhow developed by the partners will position them as a reference for the heat management in microelectronics and it might provide valuable asset in future project involving this aspect. It affects the following dimensions:

- Highly qualified professional formation;
- Networking activities;

2.2 – Target audience and communication channels

The potential audience for the beneficial impacts of the project is wide. It is relevant to identify in a first time the potential audience for each work to disseminate and to associate it with the proper communication channel. The potential audiences are:

Internal

Within the project itself, the partners can beneficiate from each other's work, as it can be complementary to theirs. To this end, the project documents produced by each member are shared in the online project portal. This includes reports, data, presentations, and other relevant documents. In addition, general assemblies and other work meetings allow the partners to be informed of each other's works. Regrouping EU industrials, academic and institutional entities, the dissemination through the STREAMS consortium covers a wide range of sectors. In addition to be beneficial to the project progress, internal dissemination can bring valuable knowledge to the partners. Furthermore, the collaboration between the partners involves an important networking between the institutions, making a synergy at the EU level.

External

As the external potential audience is diversified, so are the means. The scientific communities can be reached through peer reviewed publications in Journals specific to the related communities. All the publications will be Open Access (Gold or Green open access). On their side, industries can be reached by issuing patents and presentations at different conferences. The industrial and scientific reach can be further increased through other networking activities. The open access STREAMS website completes the strategy by offering to the specialized and non-specialized public an overview of the project. Such website is already online. More specifically, the targeted audiences are:

- Microelectronic industries (R&D)
    - MEMS
    - Logic chips
    - Power microelectronics
- Research communities on microelectronics
    - Universities: professors and students in microelectronics or related domains
    - Research centers
- Society in general

Up to now, there is no plan to reach the general population by more generic medias (e.g. radio, magazines, etc.). However, if such occasion should happen, it would be a good opportunity to unveil the issues and potential solutions in relation to the heat management in microelectronics.

A summer school will be held in partnership with the 24thTHERMINIC workshop (Thermal Investigations of ICs and Systems) in order to sensitize the microelectronic professional community to the issues of the heat management in microelectronic management and offer tools for it. A newsletter is also be produced periodically to inform the stakeholders and a generic audience with interest in microelectronics of our progress in the project.

2.3 – Management

The execution of the dissemination plan requires a proper management in order to be efficient. This section explains such aspect.

Responsibilities
The partner(s) producing a publishable result are in charge of its publication. The dissemination manager is in charge of selecting with the related partners the material worth disseminating and to establish how this material should be disseminated. The dissemination manager assures the follow up of the dissemination plan. This role is currently held by:

Dissemination manager
Jérôme Barrau (UdL)

The dissemination manager holds the following responsibilities:
- Establish and update dissemination strategy, plan and dissemination;
- Open access to publications;
- Support to exploitation communication activities;
- Networking and community building;
- Raise target groups awareness about project results.

The publications are to be published immediately once the results are available. Therefore, the timeline remains flexible about the moment of their publication.

2.4 – Timeline and potential publishers

The expected scientific publications for the project are summarized in Table 1, where both the content and the past or expected delivery time are shown. The table also shows the journals that has been identified has potential ways to reach relevant scientific and technical communities.

Table 1 – Publication content and delivery time timeline.

Lead	Co-authors	Type	Title	Time	Content
CEA		Journal OA	Journal of Superlattices & Microstructures	M24	Influence of annealing on QDSL structure
		Journal	Journal of Applied Physics or Thin Solid Films	M28	Comparison of QDSL thermal conductivity in cross-plane and in-plane directions by the 3ω method
	IMTEK	Journal	Sensors and Actuator A	M28	Results of µTES
	IMTEK, LN2	Journal	Nanotechnology	M36	Results of µTEG
		Conference	EMN Summer Conference - Invited oral	M6	Nanostructured thin films for thermoelectric applications
		Conference	European Conference on Thermoelectrics - Oral	M9	Presentation of CEA projects on Thermoelectrics
		Workshop	French Research Group on Thermoelectrics - Oral	M11	Presentation of CEA projects on Thermoelectrics
		Conference	International Conference on Thermoelectrics - Poster	M19	QDSL for integrated thermoelectric devices
		Conference	COMSOL Conference 2017	M22	Thermal modelling for on-interposer thermoelectric sensors
	All	Conference	International Conference on Thermoelectrics - Oral planned	M31	Presentation of thermoelectric devices integrated in STREAMS project
	All	Workshop	THERMINIC Conference 2018	M34	Presentation of STREAMS project
UdL	LN2	Journal	Applied Thermal Ingineering	M22	D2.1 cooling solution
	LN2	Journal	Int. Journ. of Heat and Mass Transfer	M25	D2.2 cooling solution
	LN2	Journal	Applied Thermal Ingineering	M30	Simulation tools
	LN2	Journal	Journal of Micromechanics and Microengineering	M30	Self adaptive fins
	All	Journal	Applied Thermal Ingineering	M30	WP2 PoC results
	LN2	Conference	Global Conference on Applied Computing in Science and Engineering	M7	Impact of inclined fins inside microchannels on the thermohidraulic performance
	LN2	Conference	Global Conference on Applied Computing in Science and Engineering	M7	Parametric study of a bimetal actuator submitted to convection
	LN2	Conference	13th International Conference on Concentrator Photovoltaic Systems (CPV-13)	M17	Distributed and Self-Adaptive Microfluidic Cell Cooling for CPV Dense Array Receivers
	LN2-ST-CEA	Workshop	THERMINIC 2017	M21	Microfluidic cell cooling system for electronics
	LN2	Conference	JITH 2017	M22	Thermohydraulic performance of an array of microfluidic cells in unsteady non uniform heat loads distributions
	All	Workshop	THERMINIC 2018	M33	WP2 results + others (Host of STREAMS Summer school)
LN2	UdL	Conference	ITherm 2017	M18	Microfluidic cell array cooling system for electronics
	UdL	Journal	Microfluidics and Nanofluidics	M24	Microfluidic cell array cooling system for electronics with adaptive fins and valves
	UdL	Conférence	ITherm 2018	M30	Microfins and impact of heat transfert
	UdL	Journal	J. MEMS	M36	Microfins and impact of heat transfert with experimental results
		Journal	Int. Journ. of Heat and Mass Transfer	M30	Microvalve arrays
		Journal	CPMT	M30	Packaging of microfluidic devices
	All	Conference	InterPACK 2018	M36 ?	WP5 demo results
	All	Journal	Microfluidics and Nanofluidics	M36	System integration and WP5 demo results
IMTEK		Conference	IEEE International Conference on Circuits & Systems	M29	Concept of energy harvesting using a single power management unit by means of multiplexing the generators
	CEA	Conference	European Solid-State Circuits Conference	M33	integrated power management unit (depends on outcome of measurements)
	CEA	Conference	IEEE International Solid-State Circuits Conference	M38	integrated power management unit (depends on outcome of measurements)
	??	Journal(s)	IEEE Journal of Solid-State Circuits, IEEE Transactions on Circuits & Systems	??	power managment unit or joint publication on final demonstrator (both depend on outcome of measurements)
HSG		Events	COMPAMED 2016	M11	Thermal flow sensor exhibition
		Events	Sensor & Test 2017	M17/M18	Thermal flow sensor exhibition
		Events	COMPAMED 2017	M23	Demonstrator variable flow pump module and electronic drive & presentation
	Udl, UFR	Journal	Sens. Act. A	M30	High dynamic thermal flow sensor and its integration in microfluidic cooling system
		Events	Eurosensors 2018	M33	Demonstrator integrated system & presentation
STM	All	Conference	To be defined, depending on the time line of the results		Assessement of STREAMS solution on realistic use cases and future applications

2.5 – Networking activities

Networking activities related to the project are expected to be initiated by the different partners. They are free to do this activity independently of the dissemination management, as long as they respect the non-disclosure agreements and that they report such activity to the later if a new partnership is required.

3. EXPLOITATION PLAN

The STREAMS project is expected to achieve several deliverables and other results that could be used outside of the project. This section presents the plan about how to deal with such elements. It starts with its objectives and the identification of the potentially exploitable and expected results. It is followed by the policies and rules related to their use. It then ends with intellectual property rights (IPR) managements, including ownership of the IPRs anterior, within or ensuing from this project.

3.1 – Objectives and content

The objectives followed with the exploitation plan are:

- To enhance the commercialization of the project content in order to support EU microelectronic industry (or related);
- To manage the project IPR issues with partners

The foreseen exploitable content and IPRs, from the Grand Agreement 688564, is updated and presented in table 2 and are associated to their proprietary.

Table 2 - Foreseen exploitable results.

Partners	Co-authors	Exploitable results	Means of exploitation
CEA		Thermoelectric sensors arrays	IP and know-hows
		Embedded µTEG on interposer	Licensing
UdL		Self-adaptive cooling device	IP and know-hows
		Stepwise varying width microchannel cooling device for uniform wall temperature: (product) and design optimization process / service for a given heat flux distribution	Licensing
LN2		Surface TEG (STEG)	IP and know-hows
		Thermally controlled cooling distribution array (with fins and or valves)	IP and know-hows
IMTEK		Read-out interface & power management unit	IP, know-how, teaching, patent (depends on outcome of measurements)
		Overall outcome of the project	follow-up proposal
HSG		Thermal flow sensor for fluid flow measurement in high dynamic range	Know-hows
		Smart and energy saving pump module	Know-hows
STM		Performance improvements of future generations of chips	IP and know-how

3.2 – Exploitation management

The management of the exploitable results from the project is essential to prevent conflicts between partners and to maximize the use of the project results. For this, two elements has been put in place, which are the nomination of an exploitation manager and the establishment of policies and rules to regulate such use.

Exploitation manager

To manage the results exploitation, the STREAMS consortium named a general exploitation manager. This person is responsible to make sure that the procedures are properly respected, that the selected results to be developed are so, and to make sure that the exploitation plan is followed or modified according to the situation. The general exploitation manager is:

Exploitation manager

Perceval Coudrain (STMicroelectronics)

He has the following responsibilities:

- Assessment and protection of IP (Pre-publication reviews, Access and usage rights);To manage the project IPR issues with partners;
- Project results identification to support the exploitation strategy;
- Scientific / Industrial & Commercial exploitation strategy (plan and implementation);
- Business plan.

Policies and rules

The STREAMS consortium has agreed on some policies and rules in order set the result exploitation baselines. The policies and rules concerning the IPR are applicable to the elements to be disseminated. It is based on the Grand Agreement 688564, section 2.2.4 IPR rules. The baselines can be summarized as follows:

- Background IPRs: those are the ones held by the partners before the project. They are shared for the purpose of the project, but remains the property of its owner.
- IPRs from the project results
    - If originating from a single institution: They remain the only owner of the patent, although all the partners must be informed of the intention to patent;
    - If originating from multiple institutions: The patent pending must be done in all the institutions of the inventors.

The partners are held by confidentiality agreement. Therefore, patent content can and should be disseminated inside the consortium. Partners are asked to keep the patent content inside the boundaries of the agreement. The partners must inform the rest of the consortium, including the disseminating manager, 3 weeks of pre-advice prior to start patent pending.

Another element is the coordination between the institutions in order to generate joint patents. To establish such coordination, when necessary, the partner(s) is/are responsible for providing their patent department contact persons.

In the case of publications, the following elements are considered:

- Prior to publication, a draft must be sent to all the partners having works related this publication. If a disagreement cannot be solved between the partners, the dissemination manager must be informed and can propose a solution. If the disagreement persists, the publication is holded until a solution is agreed.
- Authorship is naturally relative to the scientific contribution and not systematic for the whole consortium in all STREAMS publications.
- Additional publications within a partner’s task can be published without other partner’s advice if it has no element is in the publication plan and that all the work is from this partner.

4. UPCOMING TASKS

This document forms a basis for the dissemination and exploitation plans. It will discussed in the subsequent general assemblies and will be modified accordingly to the received comments.