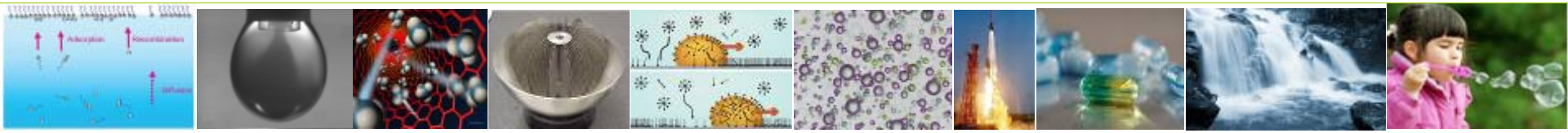
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

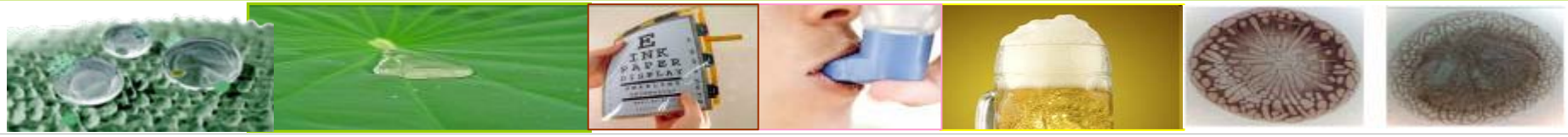
Materials Physics NanoSciences

Kick- Off of COST Action MP1106



Smart & Green Interfaces:

From Single Bubbles/Drops to Industrial/Environmental/Biomedical Applications



Prof. **Thodoris Karapantsios**

Aristotle University of Thessaloniki

Department of Chemistry

Greece

Brussels

11th May - 2012

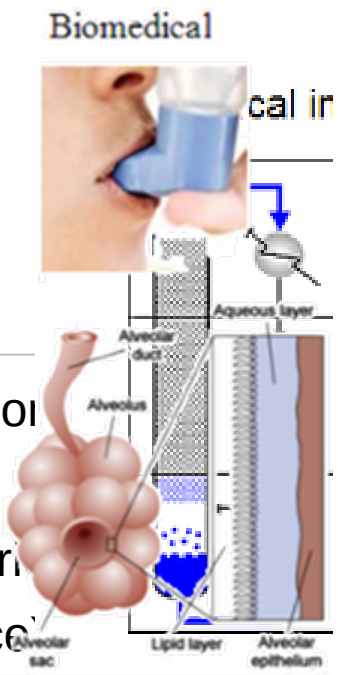
Scientific Context

Bubble & drop interfaces are fundamental to:

- industrial applications
- environmental applications
- biomedical applications

Innovation

- **Smart** interfaces can accor
  adaptability and selectivity
- **Green** interfaces are eco-fr
  energy consuming to produc

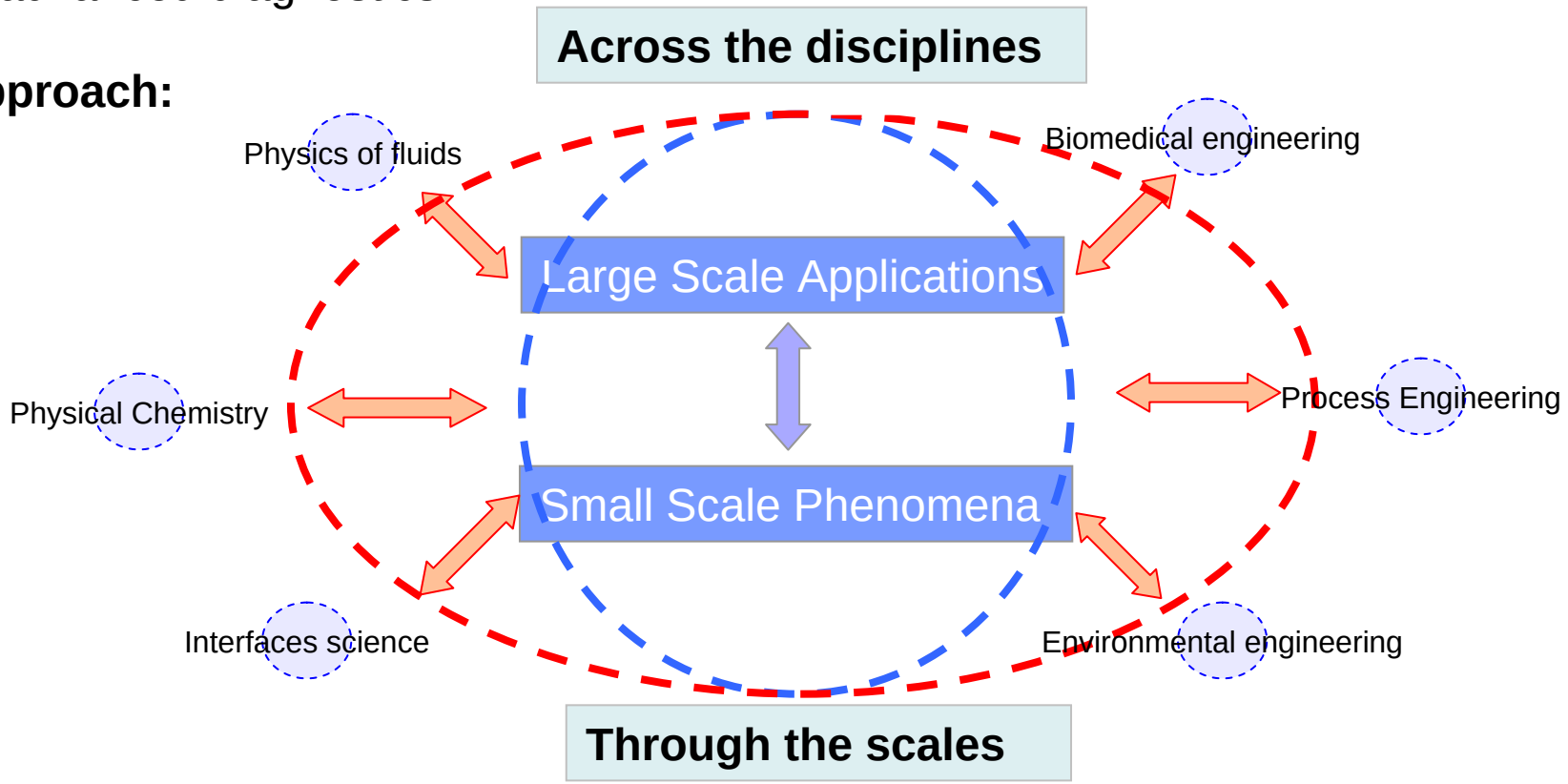


Innovation Aspects & Approach

Aspects:

- ✓ novel materials
- ✓ sophisticated production processes
- ✓ advanced diagnostics

Approach:



Challenge

1. Identify and implement best strategies and means to tailor **Smart** & **Green** interfaces
2. Accurately control their performance

. . . by **concerted action** of the most active European research institutes and companies in the field

Role of the new COST Action

1. **Bring** cross-infusion of knowledge and expertise among disciplines
2. **Overcome** research fragmentation and lack of resources in Europe
3. **Build** up bonds among research groups and industry
4. **Enhance** mobility and training of Early Stage Researchers
5. **Strengthen** the international competitiveness of European industry

Comparison with CM1101 "Colloidal Aspects of Nano-science for Innovative Processes and Materials"

- ✓ **CM1101:** From colloids science towards development of innovative materials and processes
- ✓ **New Action:** From innovative materials and processes towards breakthrough technologies and end-user applications.
- ✓ **Six** (6) common participants (proposal)
- ✓ **Synergies** especially on synthesis of innovative materials

Why COST?

1. COST Framework provides the **ideal instrument** for setting up an **interdisciplinary network** of various scientific institutions, including universities, academic research institutes and industrial R&D centres
2. The successful P21 Action “Physics of Droplets” indicated the **strong need of European collaboration** between a broad **scientific community** and **industrial stakeholders**
3. Allows important **IMPACTS** in several aspects to the benefit of Europe:

- **Science and Technology:** physics, chemistry, materials, diagnostics, engineering.

- **Economic needs:**
  - less energy + faster/easier production → cheaper products
  - new end-user products

- **Societal needs:** Strong involvement of young researchers in high level scientific and technological activities

- **Environmental Protection:** Green materials, processes, technologies

- **Health:** Smart materials and processes that can deliver drugs or do diagnosis at target tissues

Ambitious OUTPUTS of the new Action:

1. **New eco-friendly materials & processes** that will increase the efficiency, selectivity and adaptability of interfaces
2. **Innovative industrial methods** for producing and dispersing Bubble & Drops of well-controlled size, population and stability
3. **Pioneering instrumentation and diagnostics**
4. **Training of ESRs** in important science and management matters
5. **Advancement of female involvement** in high level science and technology
6. **Large scale cooperation** between **research labs** and **industrial R&D centers**
7. **Consortiums of partners** for submitting joint research proposals

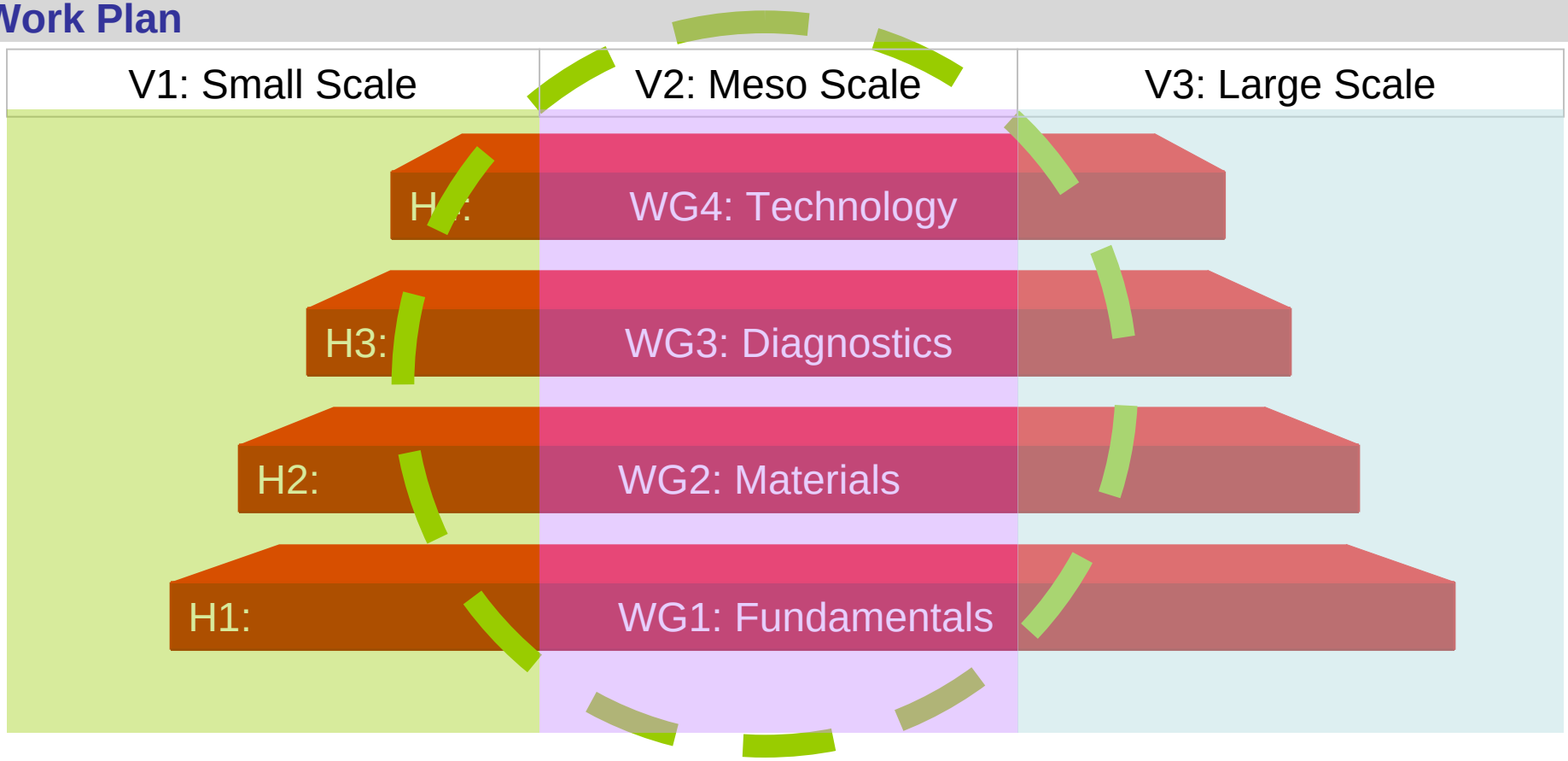
Main Objective

To organize a Europe-wide interdisciplinary cooperation platform directed towards scientific added value and improvement of industrial/environmental/medical applications concerning interfaces, bubbles and drops.

Secondary Objectives

1. **Improvement** of the fundamental understanding of interface structure and its evolution by combining theoretical development, novel numerical techniques and novel experimental techniques.
2. **Development** of new materials relevant to creation of Smart and Green interfaces e.g. surfactants, macromolecules, structured solid surfaces, solid foams or aerosol particles.
3. **Development** of novel and improvement of existing diagnostic techniques. They refer to properties of single or multiple interfaces and to general real/life applications (e.g. medical diagnosis)
4. **Development** or improvement of marketed industrial technologies. These span from consumer end-products to classical industrial processes and to computational tools for design and optimization.

Work Plan



Industrial, Environmental, Medical Applications

- A **flexible and open framework** enabling new groups to join and integrate into the project in the future
- **Updates and adjustments of initial work program** based on information and priorities of new partners

Work Group 1: Fundamentals

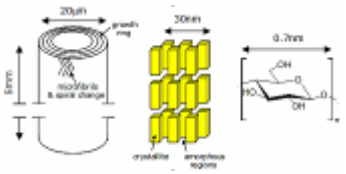
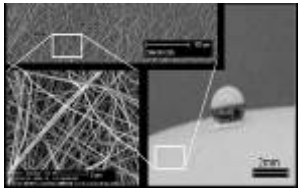
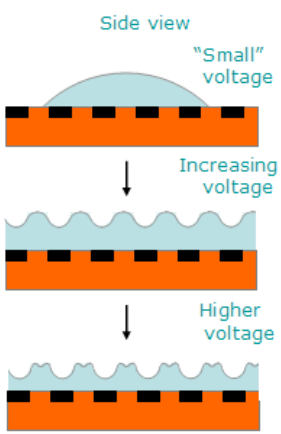
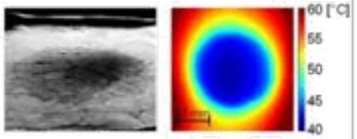
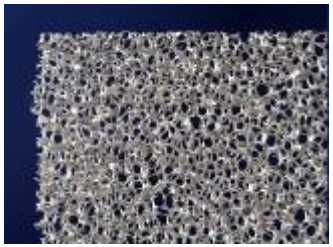
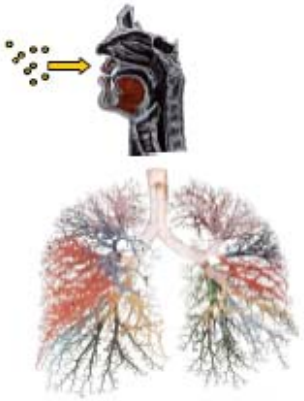
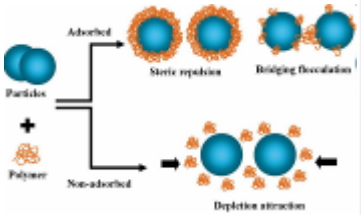
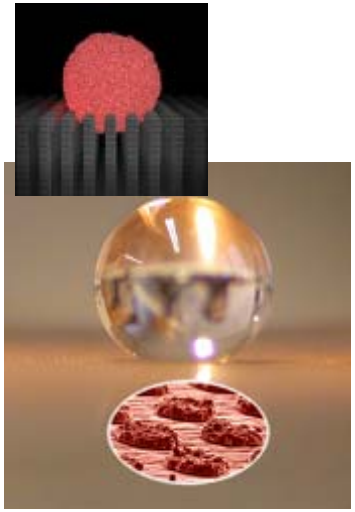
Scope:

- Extend the current fundamental understanding of interface-related phenomena
- Integrate/unify approaches across disciplines (from physics of fluids to physical chemistry and beyond)
- Improve the quantitative description of complex processes

V1: Single Interfaces	V2: Multiple Interfaces	V3: Industrial Scale
  Isolated bubbles or droplets	  Multi-bubble/droplet systems like clusters, aggregates or clouds	  Multiple interfaces at industrial scale

Work Group 2: Materials

Scope: Development and tailoring new materials → **Smart** & **Green** interfaces

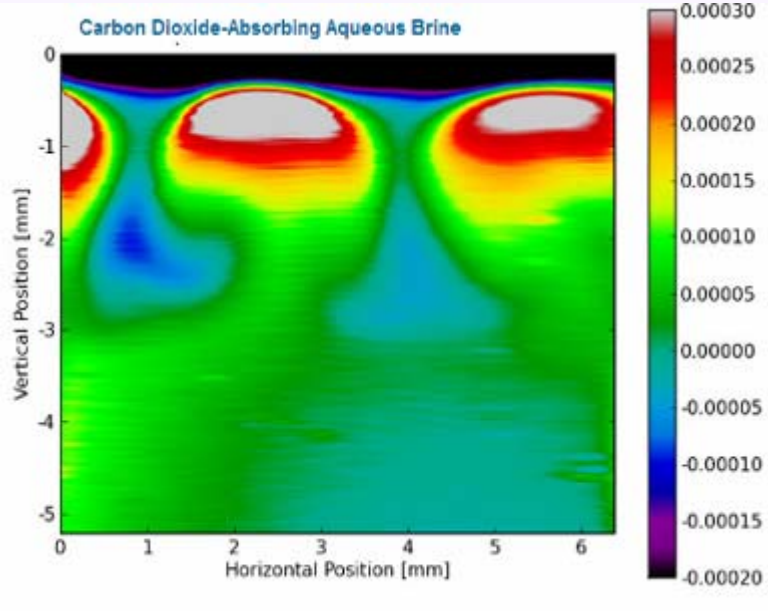
Surfactants Macromolecules Nanoparticles	Superhydrophobic Superhydrophilic Solid Surfaces	Modified surfaces for external force applications	New Foam Structured Solid Materials	Aerosol Particles with Specific surface properties
 Synthesis of Detergent cellulases (amorphous vs. crystalline cellulose)	 Nanofiber materials	  Nanofiber mat coating leads to T-reduction during drop impact cooling	 Titanium Foam imitates natural bone structure  Polymeric Foam	 Medical Aerosol
 Stabilization and destabilization of colloidal system against van der Waals attraction by polymers	 Superhydrophobic Surfaces			

Work Group 3: Diagnostics

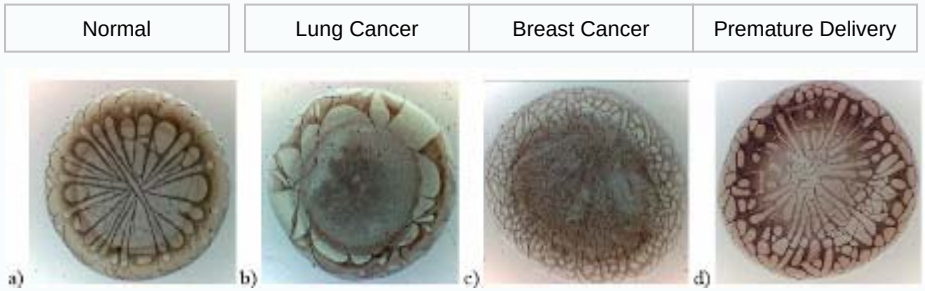
Scope: Development of diagnostic techniques
(identification of systems representative parameters, measuring principles, accuracy/sensitivity, conditions and range of applicability, data analysis and interpretation)

V1& V2: Single Interfaces & Clusters of B & D	V3: Industrial , Environmental. & Medical Applications

- Holographic tomography
- Particle image velocimetry
- Infrared thermography



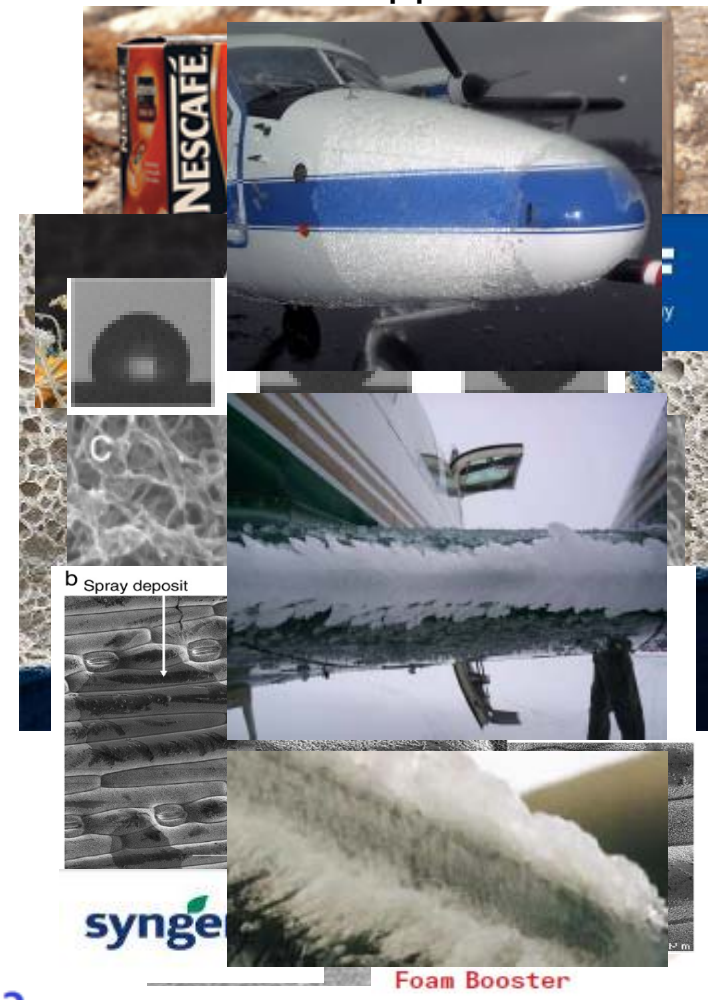
- Monitoring of void distribution & bubble characteristics in gas stripping processes
- Fast estimation of pollutants in drinking waters by measuring rising bubble velocity
- Diagnosis of diseases using patterns from blood droplet evaporation



Work Group 4: Technology

Scope: Development of marketed industrial technologies and end-user applications

- Synergistic action of proteins and food-grade articles for better stabilization of foams and emulsions
- Highly-ordered anionic surfactant (LAS) vescicles to fabricate Nano - Materials
- Nestlé's Nescafé Cappuccino instant coffee with foam booster
- Metal foams: stable as massive metal but considerably lighter
- Controlling the toner microparticles adhesion to the substrate by covering them with silica nanoparticles
- Studying leaf surfaces for pesticide wetting
- Icing: Aeronautics and Structures



AIRBUS

Early Stage Researchers Group (ESRG)

- Will contain young participants horizontally from all WGs
- In collaboration with WGs, will organize workshops and training schools/seminars and promote interaction with the other WGs

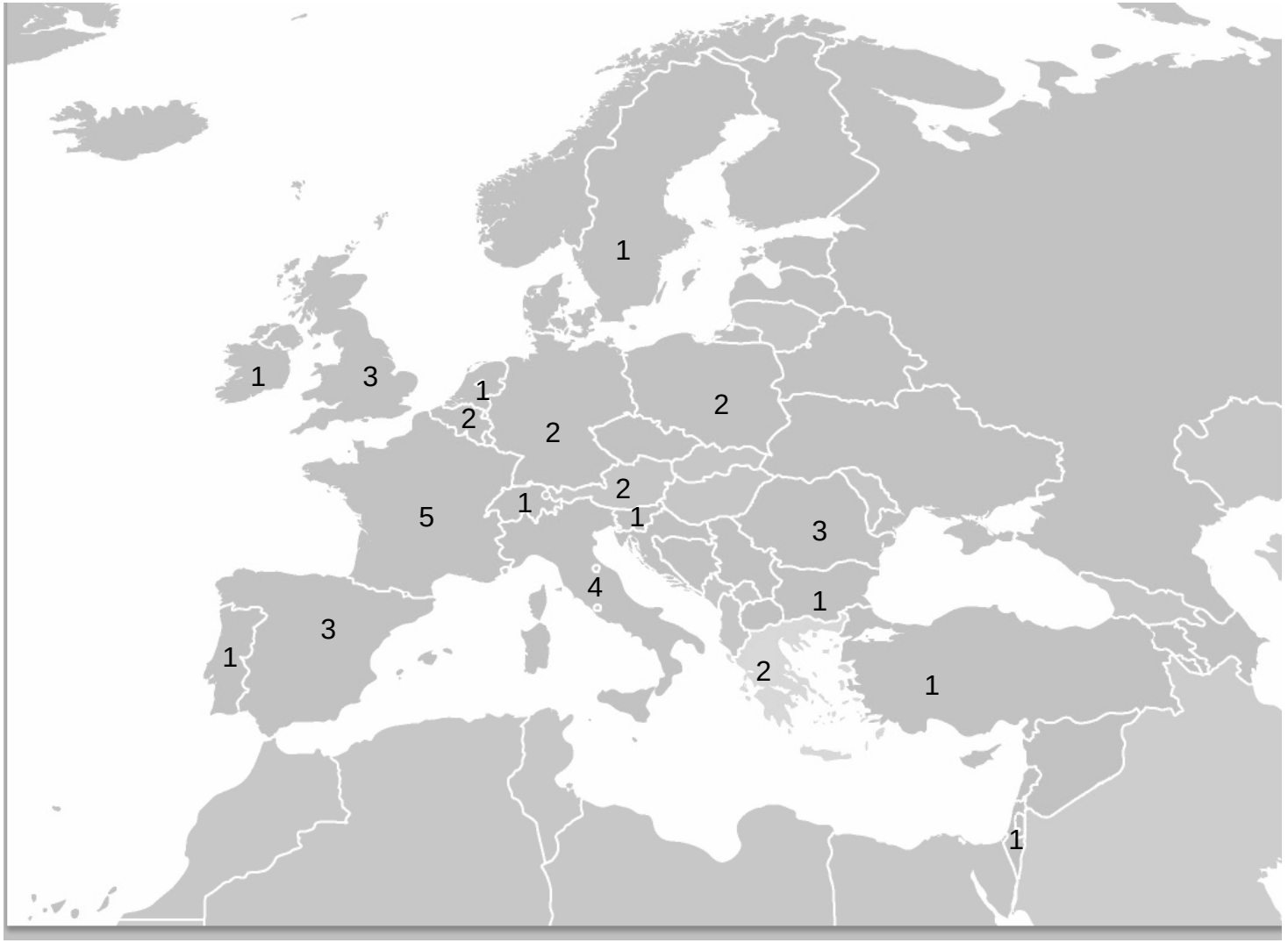
The ESRG group will be formed as a distinct overarching structure in order to maximize:

(i) the transfer of knowledge from experienced researchers to ESRs (teaching, training and joint supervising scientific activities) and

(ii) the active involvement of ESRs in overall Action activities (scientific, organizational, leadership, networking, reporting, dissemination and publicity).

Participants (proposal)

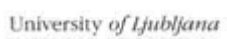
Research Labs: 42



Participants



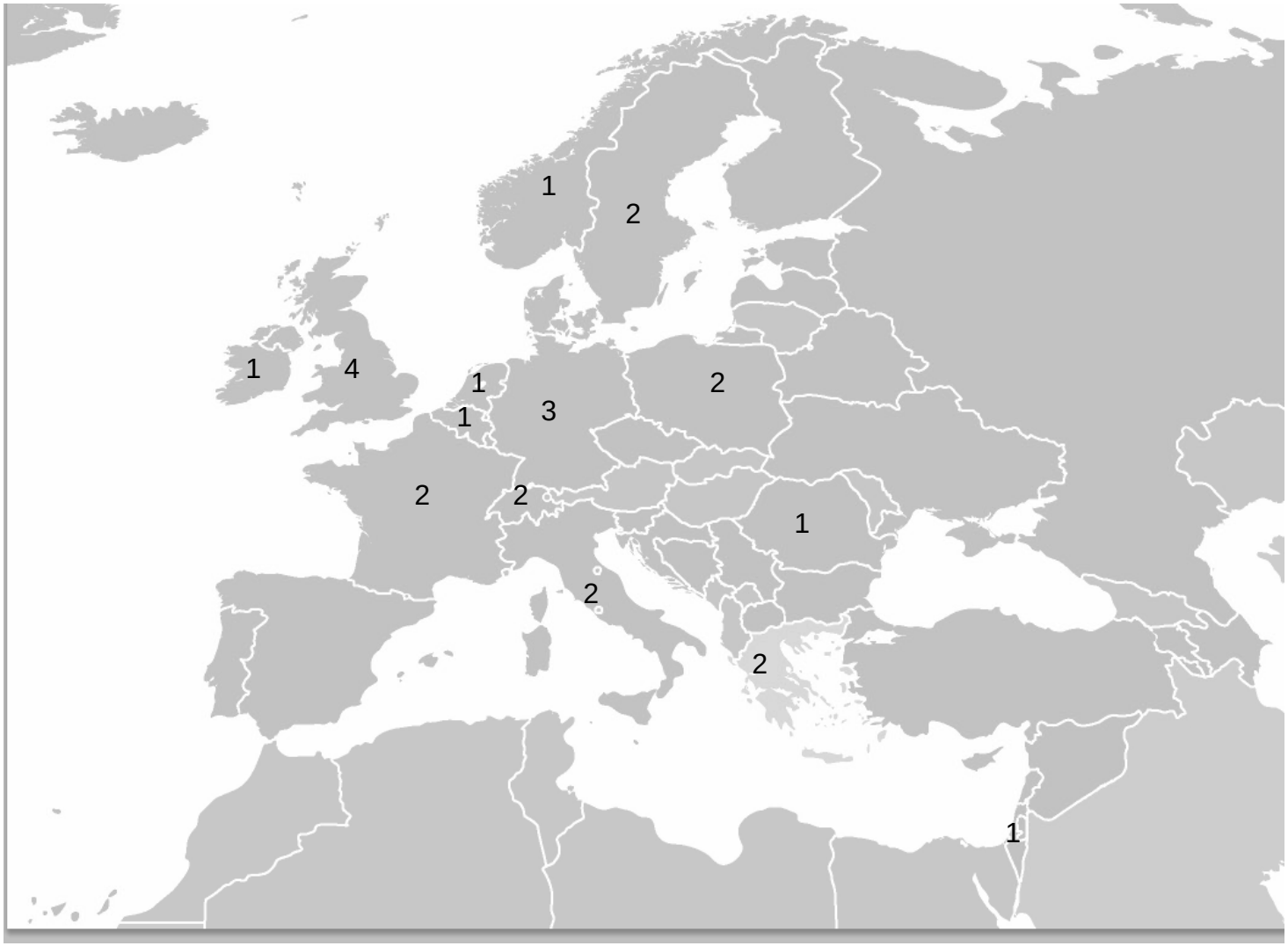




Participants (proposal)

Companies: 25



Participants

XEROX®

DOW CORNING

KRÜSS
A.KRÜSS OPTRONIC
GERMANY

foamix

Heineken
HEINEKEN LAGER BEER
PREMIUM QUALITY

Unilever

Nestlé

gsk
GlaxoSmithKline

AkzoNobel

P&G

medbryt®

LOUFAKIS
CHEMICALS

syngenta

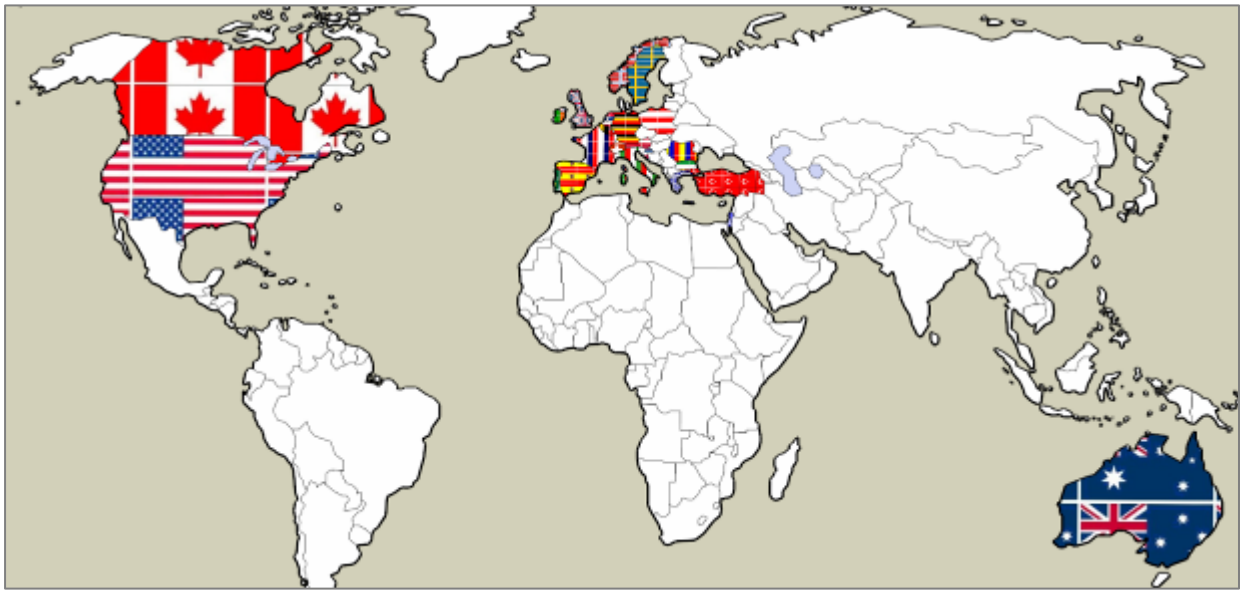
BASF
The Chemical Company

STATOIL

illy®

Participants (proposal)

Non-COST Participants: 3



European/International Bodies Participants: 2

NASA

esa

Participants (Kick Off)

Final approval of the MP1106 Action by the CSO – 1 December 2011

Participations

Country	Date	Status
Austria	30/01/2012	Confirmed
Belgium	09/02/2012	Confirmed
Bulgaria	20/01/2012	Confirmed
Croatia	11/01/2012	Confirmed
Czech Republic	10/02/2012	Confirmed
Denmark	29/03/2012	Confirmed
Estonia	11/04/2012	Confirmed
Finland	03/05/2012	Confirmed
France	23/03/2012	Confirmed
Germany	18/01/2012	Confirmed
Greece	23/01/2012	Confirmed
Hungary	05/03/2012	Confirmed
Ireland	16/01/2012	Confirmed
Israel	27/12/2011	Confirmed

Participations

Country	Date	Status
Italy	13/01/2012	Confirmed
Luxembourg	27/04/2012	Confirmed
Netherlands	17/01/2012	Confirmed
Norway	02/02/2012	Confirmed
Poland	18/01/2012	Confirmed
Portugal	06/01/2012	Confirmed
Romania	15/03/2012	Confirmed
Serbia	24/02/2012	Confirmed
Slovakia	23/03/2012	Confirmed
Slovenia	05/01/2012	Confirmed
Spain	04/01/2012	Confirmed
Turkey	15/03/2012	Confirmed
United Kingdom	09/12/2011	Confirmed

Total: 27

Networking & Management Instruments

1. MC meeting at least once a year to steer the Action; WGs meetings also at least once a year to review their specific activities and results.
2. A separate ESR Group will operate horizontally across the four WGs overseeing the active involvement of ERS in all activities and particularly for training and career development matters.
3. STSMs with emphasis to STSMs between research labs and industries (at least 70% of them to ESRs).
4. Annual workshop gathering representatives of all participating teams and renowned external experts – linked to Bubble & Drop Conference.
5. Annual Action's training school or seminars for ESR with advanced lectures.

Networking & Management Instruments

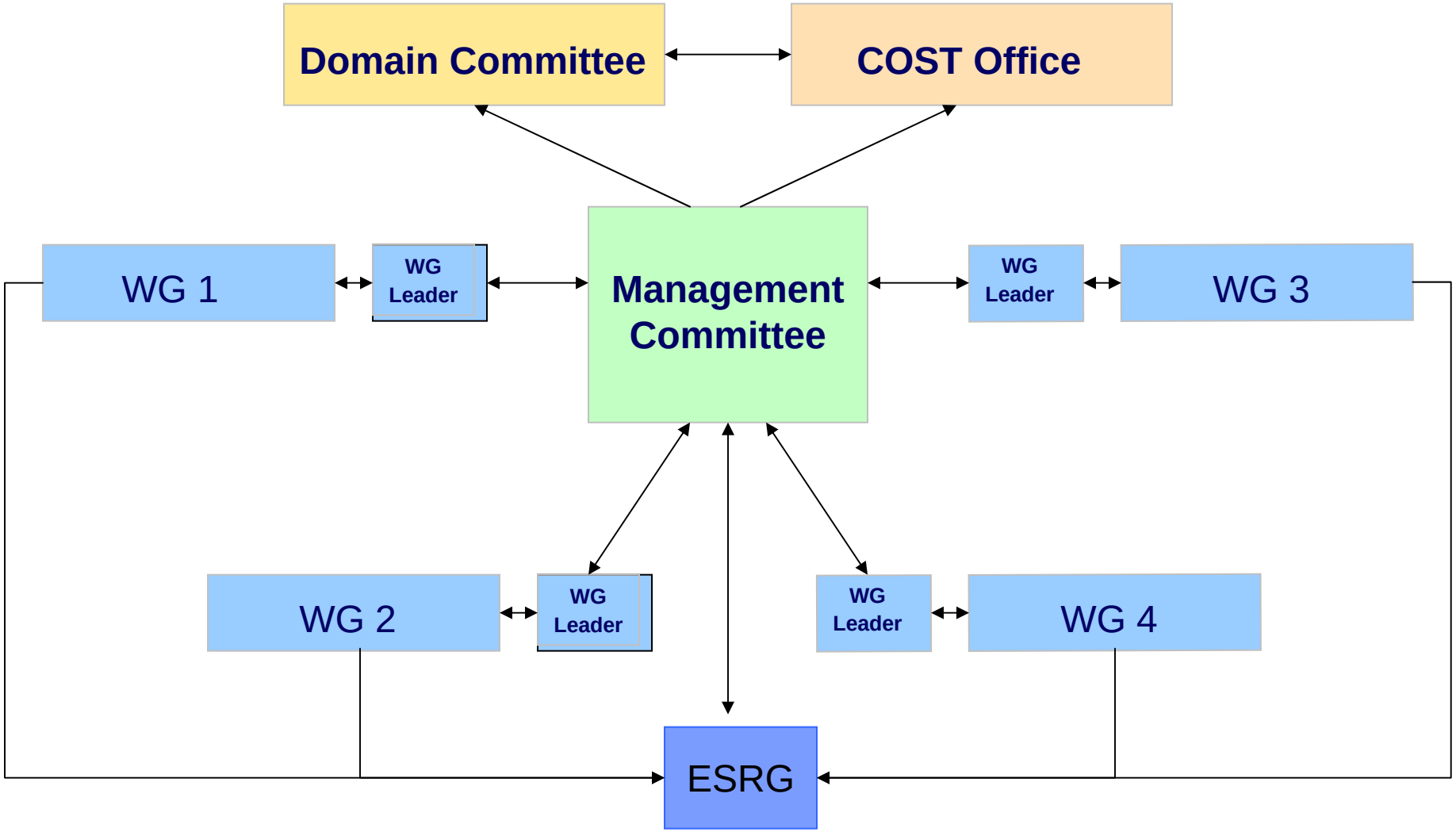
6. Monitoring and self-evaluation: A Core Group will be designated. CG meetings once per year. Self-evaluation reports (at mid-term and at the end of the project) are Milestones of the Action.

7. An appropriate gender balance in all activities. Female participants will be encouraged to take part to the MC and lead the WGs. A female member of the MC will act as a gender balance coordinator.

8. Communication between the Action members by e-mail, dedicated web page (password protected). Also, open information section for external public.

9. Dissemination activities (open web section, publications, conferences, industrial forums, training events, social e-networks, etc).

Organization



Timetable

Time	Working Groups activities
Year 1	Kick-off meeting & set up of Working Groups
	WG1 | WG2 | WG3 | WG4
	WGs/ESRG Progress meetings
	Training School, STSMs
	Annual Workshop (including MC/WGs/ESRG meetings)
	Progress Report (milestone 1)
Year 2	WGs/ESRG Progress meetings
	Training School, STSMs
	Mid-term conference + MC/WGs/ESRG meetings + Self-evaluation meeting
	Progress Report + Self-evaluation Report (milestone 2)
Year 3	WGs/ESRG Progress meetings
	Training School, STSMs
	Annual Workshop (including MC/WGs/ESRG meetings)
	Progress Report (milestone 3)
Year 4	WGs/ESRG Progress meetings
	Training School, STSMs
	Last year conference + MC/WGs/ESRG meetings + Self-evaluation meeting
	Final Report + Self-evaluation Report (milestone 4)

Initial Activities

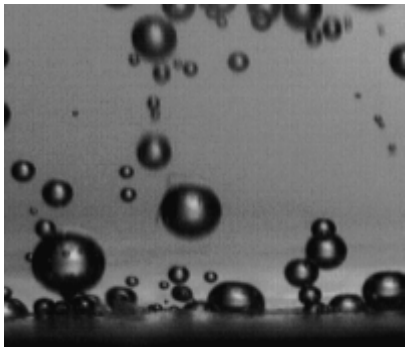
1. Kick-off meeting:
   - Establish Management Committee and Chair and Vice-Chair of the Action
   - Establish Working Groups and WG Leaders
   - Select two Financial Rapporteurs
   - Select the STSM Coordinator
   - Select the Gender Balance Coordinator (female)
   - Select the Dissemination Coordinator (webmaster)
   - Select the ESRG Leader (Smart & Green manager, Training & Career manager)
   - Setup a preliminary WG work program
   - Define a dissemination plan (communication approach, target groups, means)
   - Regulate IPR issues (IPR manager)
2. First three months:
   - Collection of information about the national programs on interfaces (WG leaders)
   - Preparation of WG programs (list of projects)
   - Approval of the WG programs by MC

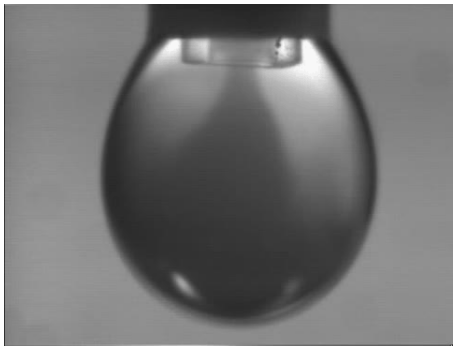
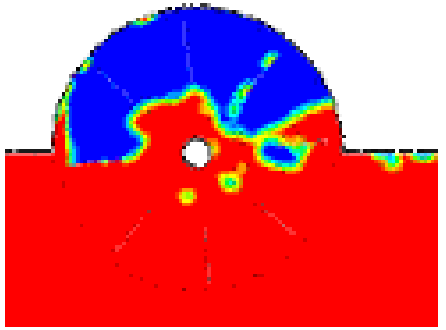
Thank you for your attention

Proposer: Multiphase Dynamics Group

Research Interests:

- Multiphase flows: Hydrodynamics, heat and mass transfer
- Foams and Emulsions: Dynamics & Stability
- Physicochemical & Rheological properties of single interfaces
- Electrical, optical and acoustic measuring techniques
- Computational fluid dynamics



Proposer: Multiphase Dynamics Group

Projects in progress:

- Development of an electrical technique for the characterization of two phase bubbly flows (PENED/GSRT).
- Influence of gravity conditions on mass and heat transfer in porous media (TRP/ ESA).
- In-Vivo Embolic Detector-Phase (GSTP/ESA)
- Interfacial characterization and stability of emulsions and foams (ELIPS-2/ESA)
- Multiphase fluids management in low gravity environment (Convocatoria de ayudas de Proyectos de Investigación Fundamental no orientada). Collaboration with Universitat Politécnica de Catalunya.
- Diamagnetic levitation for studies of fluids and granules in weightless conditions and for interdisciplinary science, (EPSRC). Collaboration with University of Nottingham.