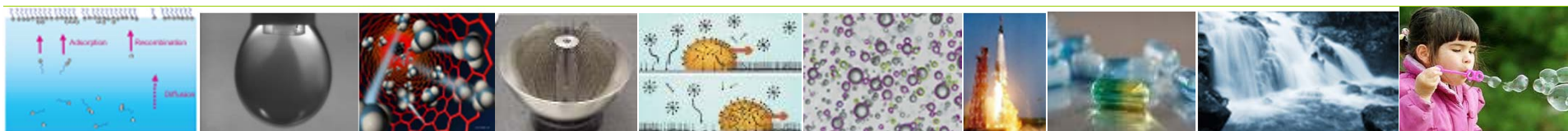


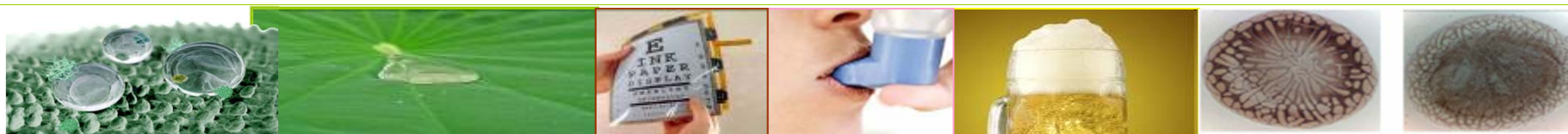


## Kick- Off of COST Action MP1106



### Smart & Green Interfaces:

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



Prof. **Thodoris Karapantsios**  
Aristotle University of Thessaloniki  
Department of Chemistry  
Greece

Brussels  
11<sup>th</sup> May - 2012



## Scientific Context

### Bubble & drop interfaces are fundamental to:

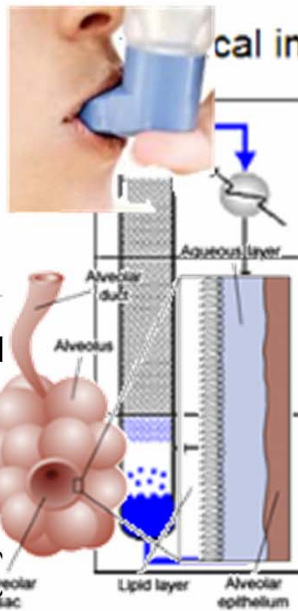
- industrial applications
- environmental applications
- biomedical applications



### Innovation

- **Smart** interfaces can accommodate adaptability and selectivity
- **Green** interfaces are eco-friendly and less energy consuming to produce

#### Biomedical



#### Biotechnology

#### Pharmaceutical Industry

### Nature understanding and protection



ry



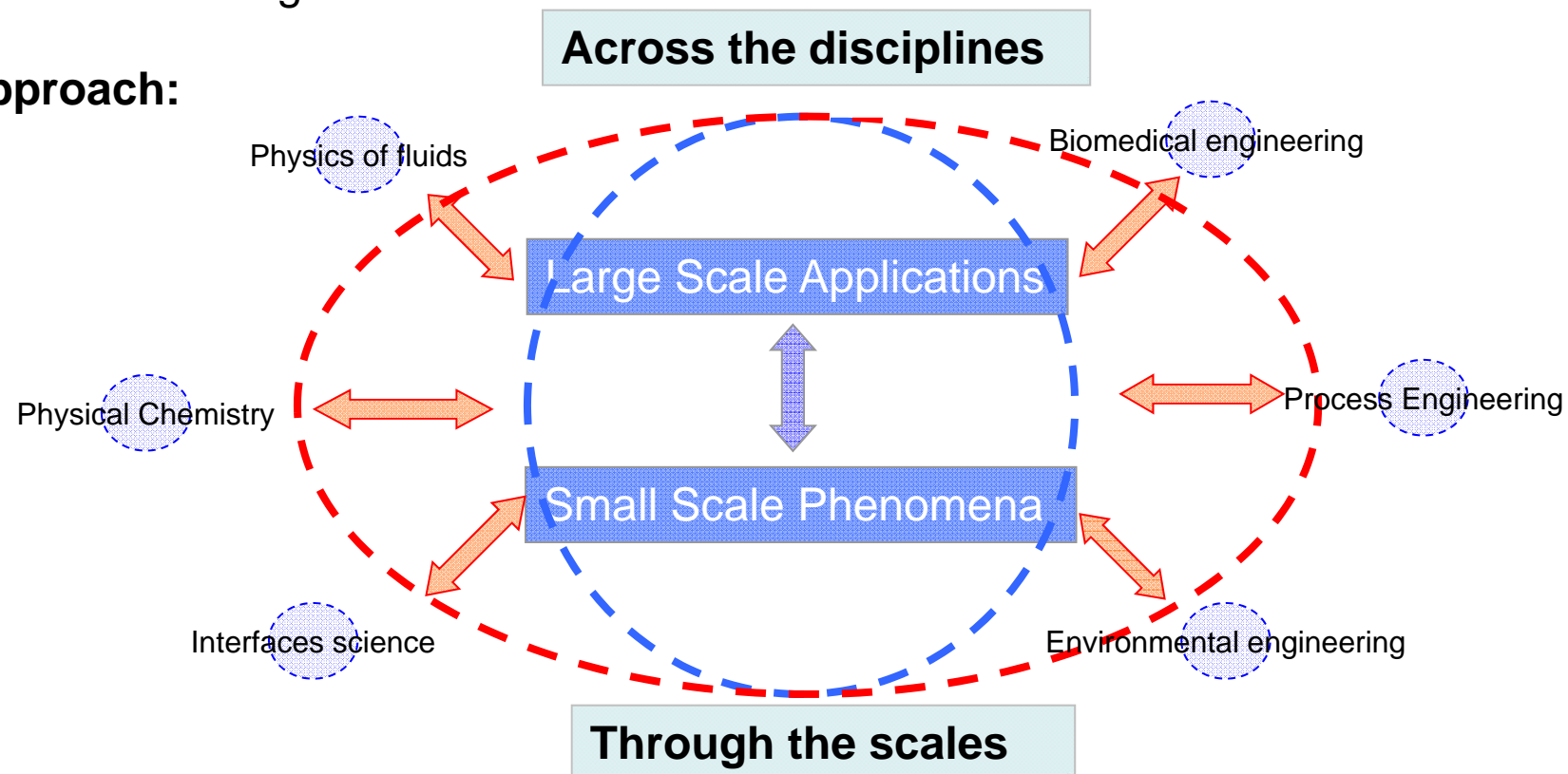


## Innovation Aspects & Approach

### 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

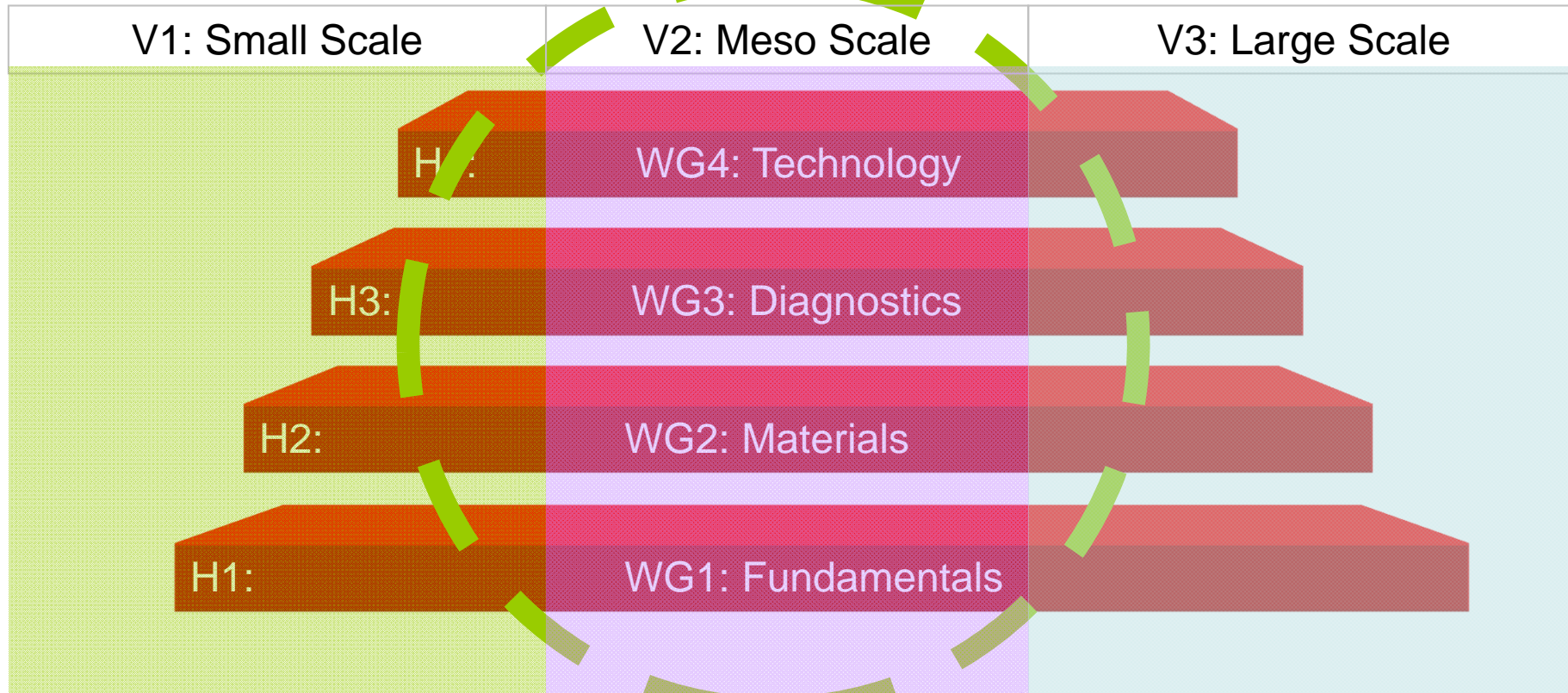
To organize a Europe-wide interdisciplinary cooperation platform directed towards scientific added value and improvement of industrial/environmental/medical applications concerning interfaces, bubbles and drops.

## 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




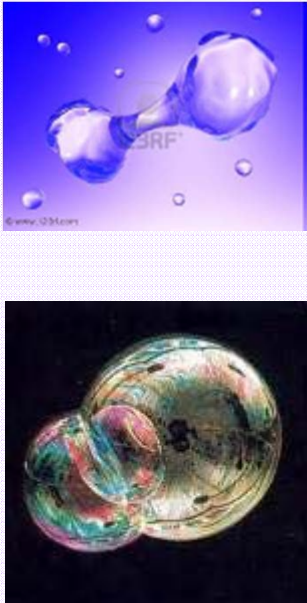

### Industrial, Environmental, Medical Applications

- 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

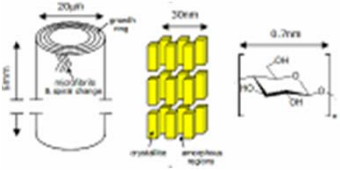
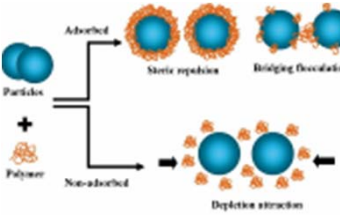
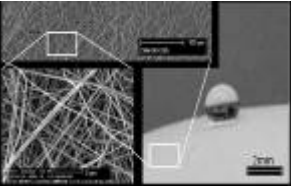
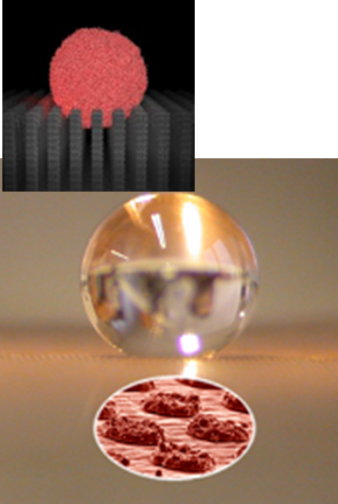
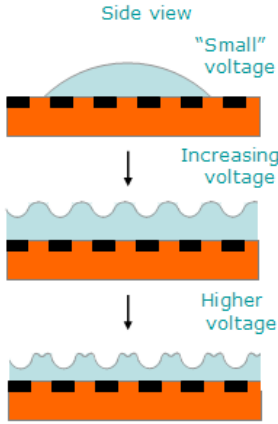
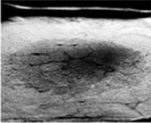
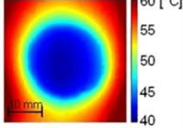

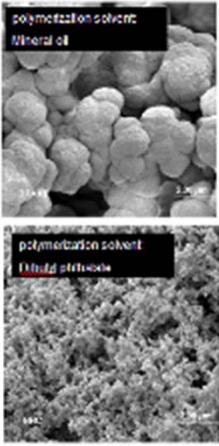
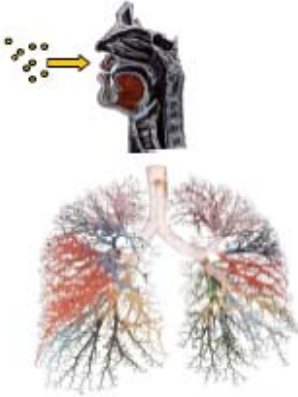
V1: Single Interfaces	V2: Multiple Interfaces	V3: Industrial Scale
 <p>Isolated bubbles or droplets</p>	 <p>Multi-bubble/droplet systems like clusters, aggregates or clouds</p>	 <p>Multiple interfaces at industrial scale</p>





## Work Group 2: Materials

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

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



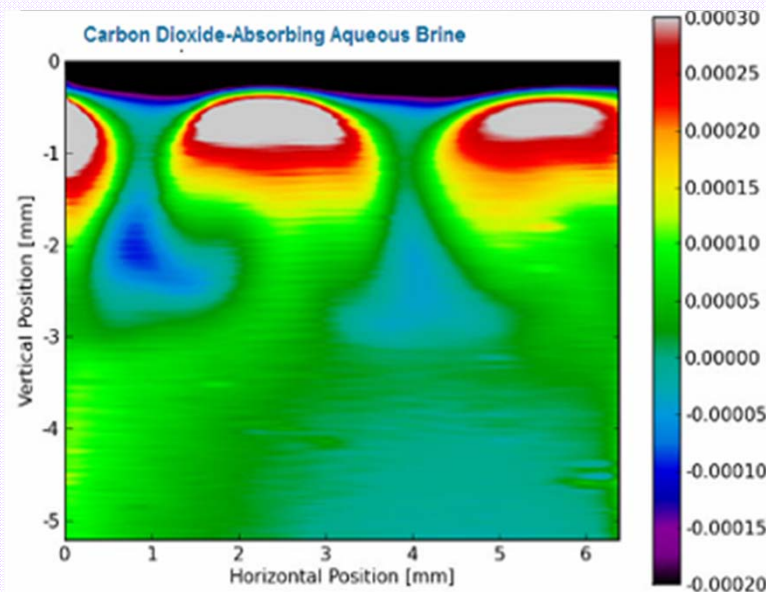
## Work Group 3: Diagnostics

**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

- Holographic tomography
- Particle image velocimetry
- Infrared thermography



### V3: Industrial , Environmental. & Medical Applications

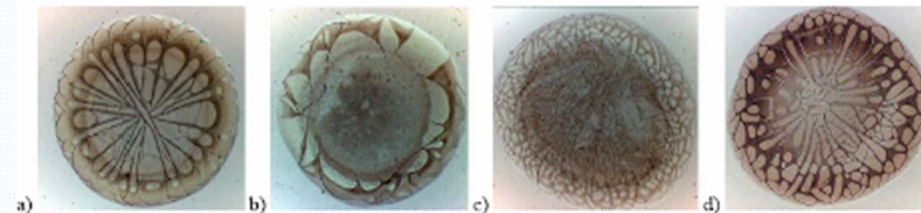
- Monitoring of void distribution & bubble characteristics in gas stripping processes
- Fast estimation of pollutants in drinking waters by measuring rising bubble velocity
- Diagnosis of diseases using patterns from blood droplet evaporation

Normal

Lung Cancer

Breast Cancer

Premature Delivery

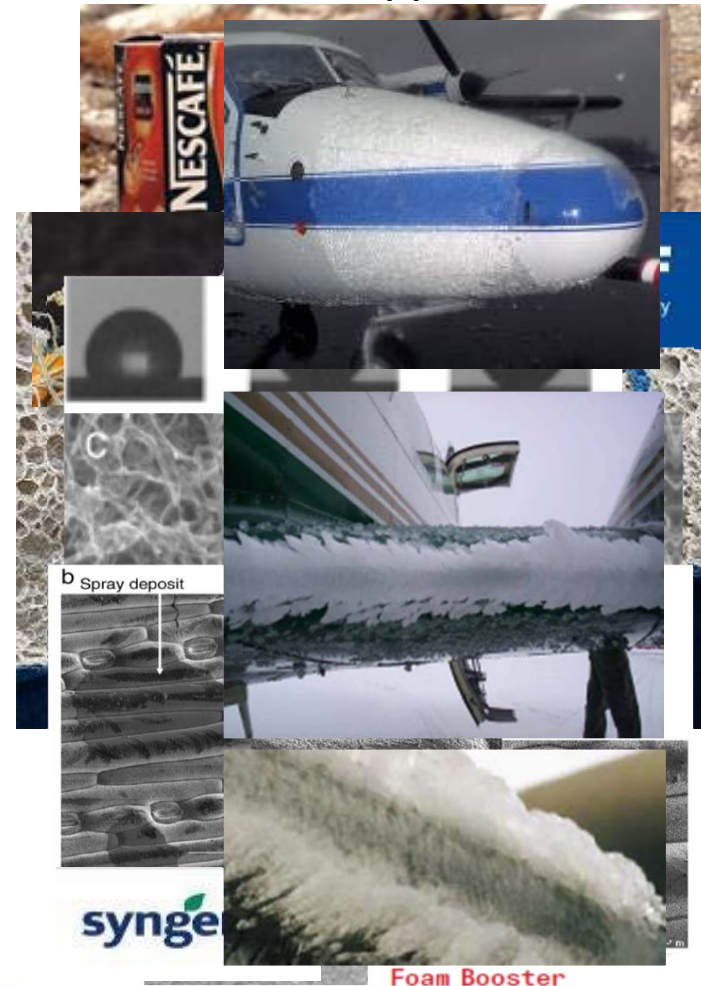




## Work Group 4: Technology

**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) vesicles 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



syngé

Foam Booster





## 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:

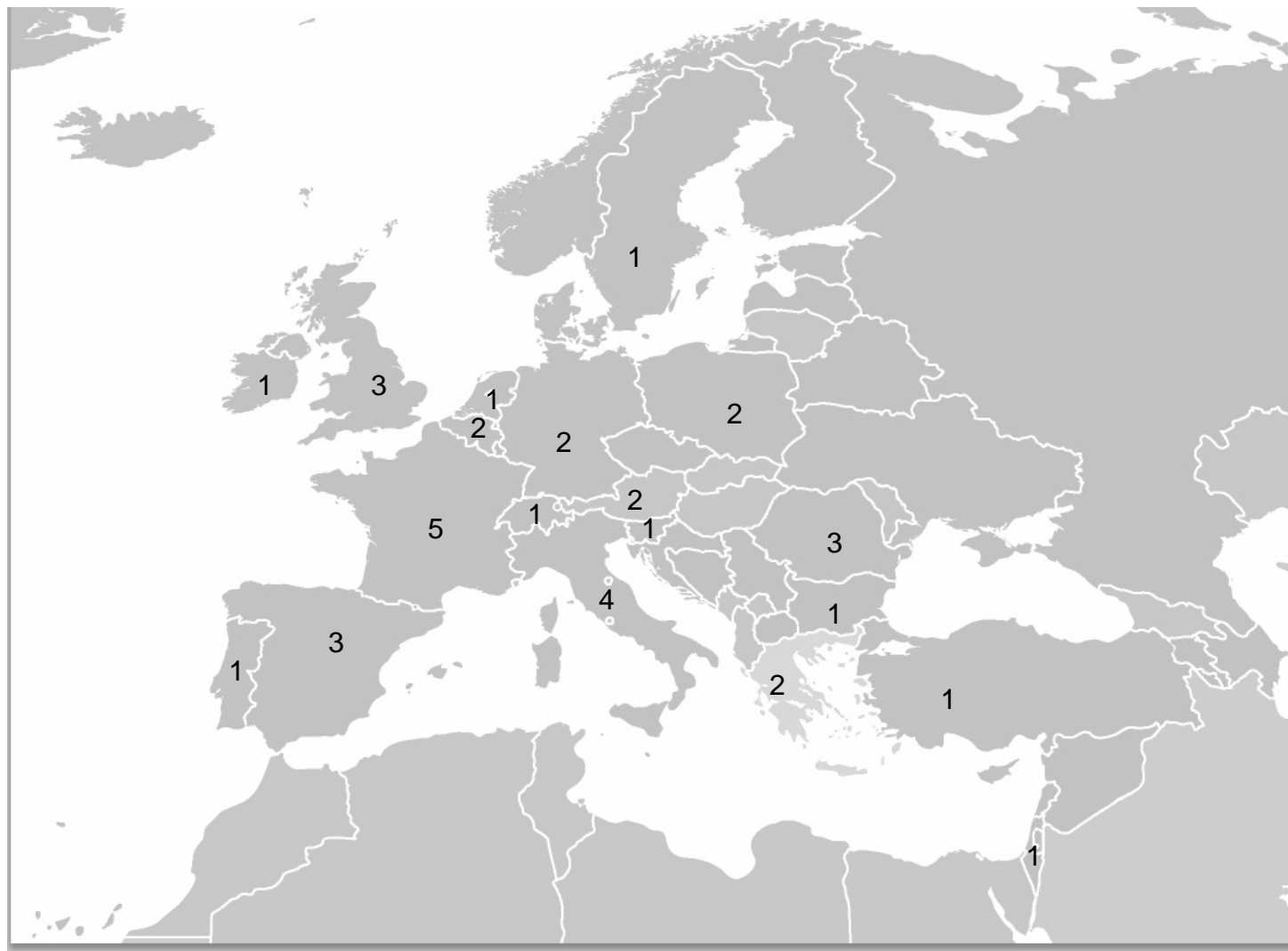
- (i) the transfer of knowledge from experienced researchers to ESRs (teaching, training and joint supervising scientific activities) and
- (ii) the active involvement of ESRs in overall Action activities (scientific, organizational, leadership, networking, reporting, dissemination and publicity).





## Participants (proposal)

Research Labs: 42





## Participants



UNIVERSITÉ  
PARIS-SUD 11



U.PORTO

FACULDADE DE CIÊNCIAS  
UNIVERSIDADE DO PORTO



IMFT

INSTITUT DE MECANIQUE  
DES FLUIDES DE TOULOUSE



University of Twente  
The Netherlands



CERTH



UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH

NOTTINGHAM  
TRENT UNIVERSITY



TECHNISCHE  
UNIVERSITÄT  
DARMSTADT



SELÇUK UNIVERSITY  
1975



Ben-Gurion University  
of the Negev



TU  
Graz



University of Thessaly



EPFL

ÉCOLE POLYTECHNIQUE  
FÉDÉRALE DE LAUSANNE



TU  
WIEN



THE UNIVERSITY  
OF EDINBURGH



IENI



Université  
de Liège



UNIVERSITÉ  
PAUL CÉZANNE  
Aix-Marseille III



TRINITY COLLEGE DUBLIN  
COLÁISTE NA TRÍONÓIDE



THE UNIVERSITY  
OF DUBLIN



THE UNIVERSITY  
OF EDINBURGH



PAN



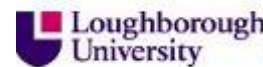
UMF



UNIVERSITATEA DE  
MEDICINĂ ȘI FARMACIE  
IULIU HAȚIEGANU  
CLUJ-NAPOCA



ENEA



Loughborough  
University

University of Ljubljana



ULB



CHALMERS



UTC  
Université de Technologie  
Compiègne



IFP  
Energies  
nouvelles



Max Planck Institute  
of Colloids and Interfaces

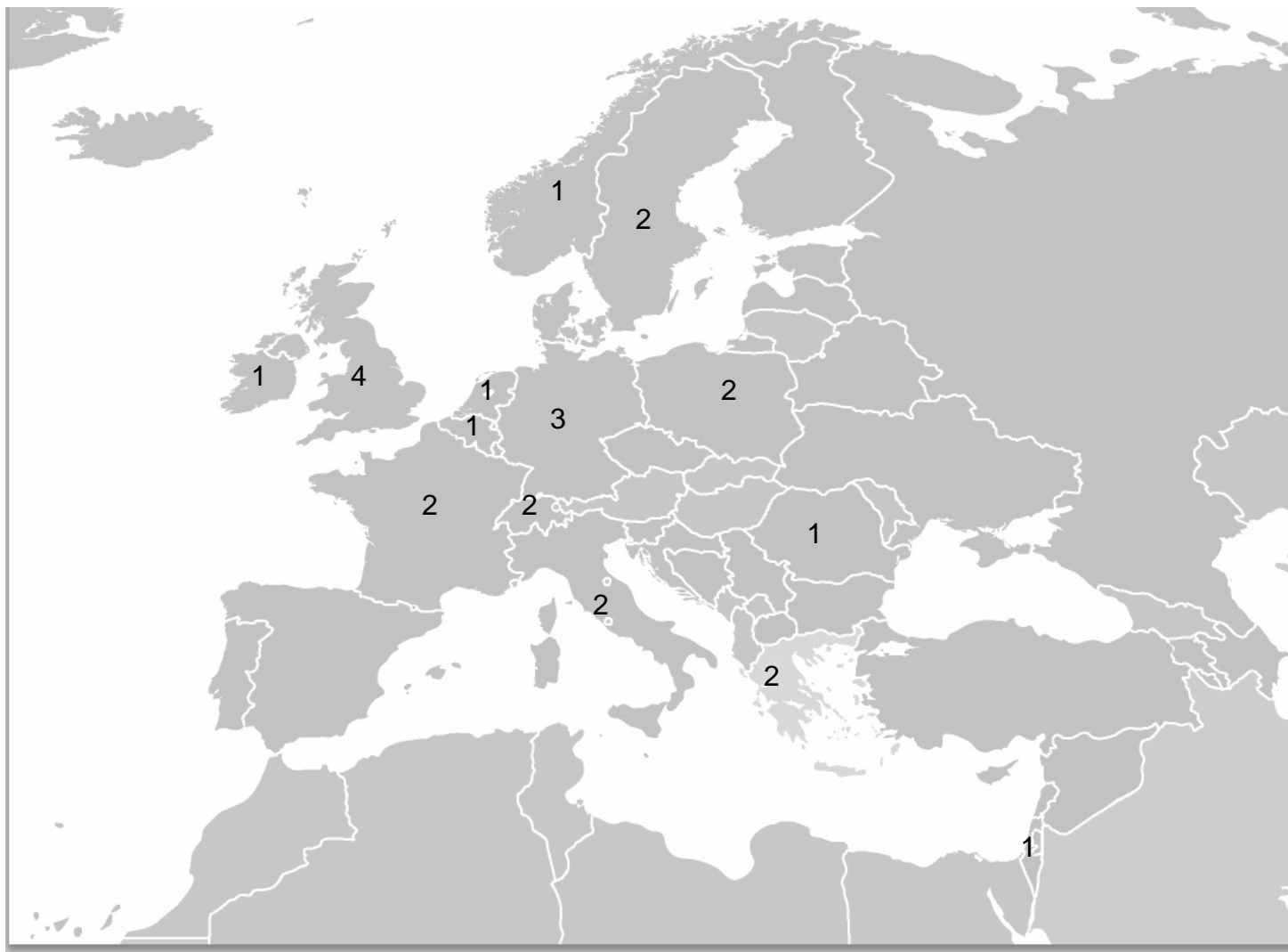


क. नारायण कृष्ण  
व्यास



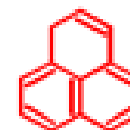
## Participants (proposal)

**Companies: 25**





## Participants

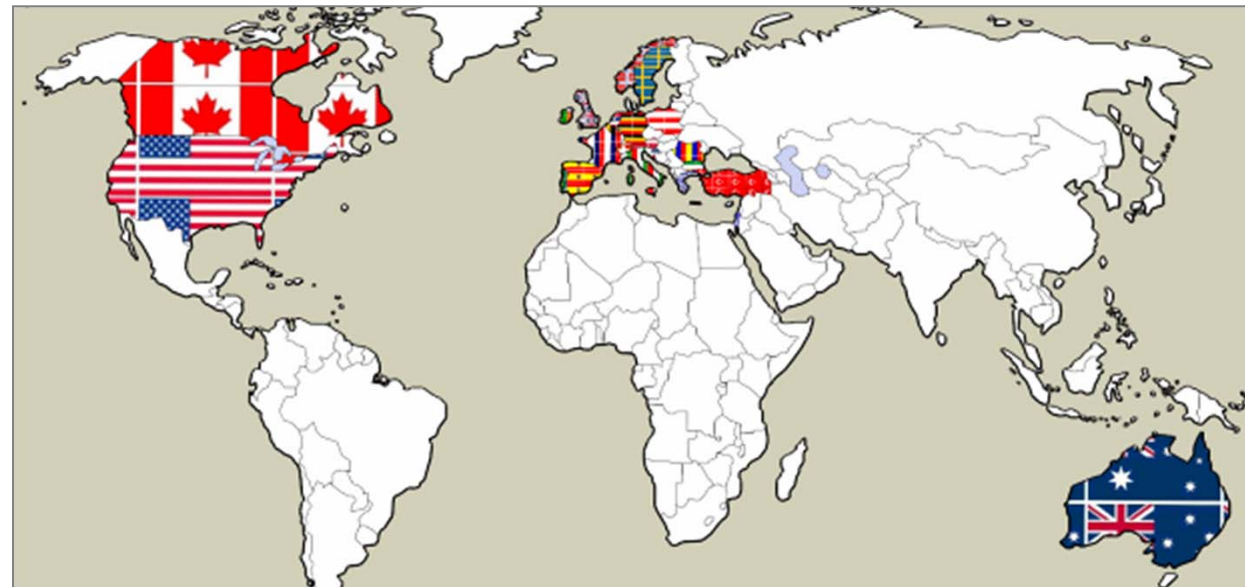






## Participants (proposal)

**Non-COST Participants: 3**



**European/International  
Bodies Participants: 2**





## 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.





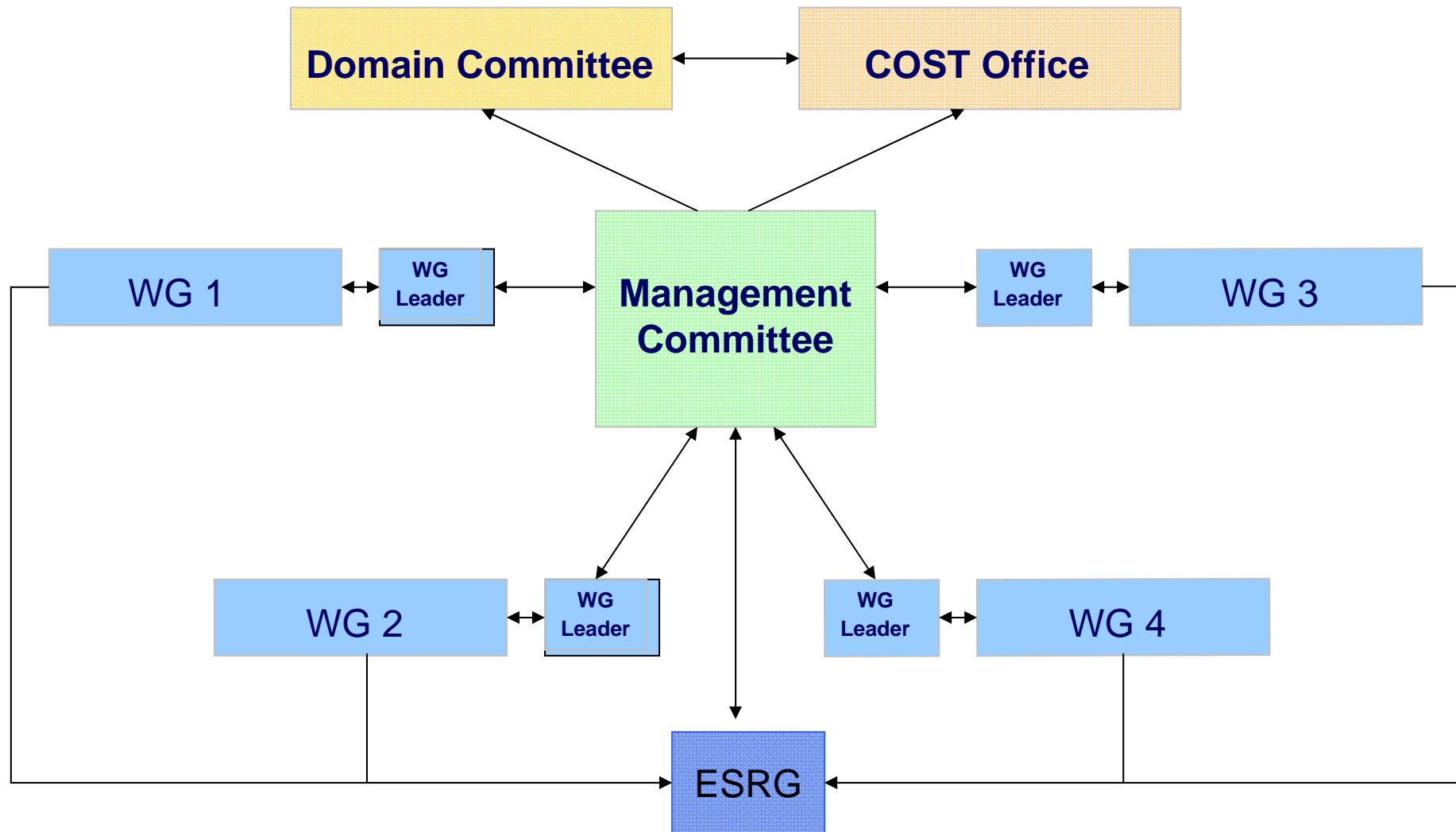
## Networking & Management Instruments



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



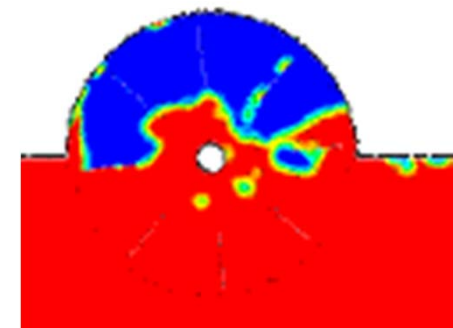
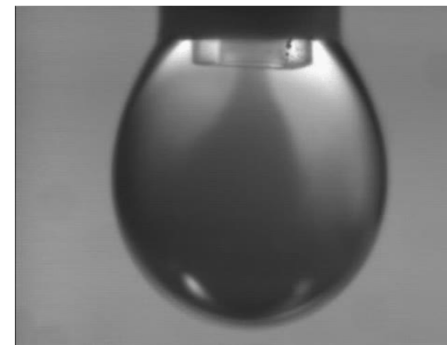
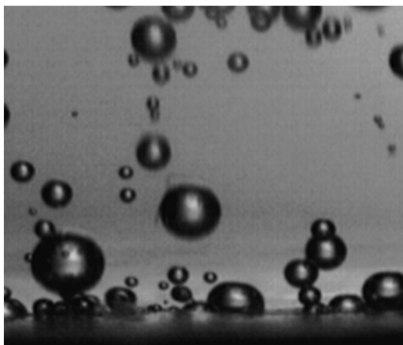
**Thank you for your attention**



## 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 Politècnica de Catalunya.
- Diamagnetic levitation for studies of fluids and granules in weightless conditions and for interdisciplinary science, (EPSRC). Collaboration with University of Nottingham.

