



• **ADVANCES IN OPTOFLUIDICS:
INTEGRATION OF OPTICAL CONTROL AND
PHOTONICS WITH MICROFLUIDICS
(ADOPTIOM)**

MP1205

Start date: 22/10/2012

End date: 21/10/2016

Year: 2

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Scientific context and objectives

- **Background / Problem statement:**
- **Scientific context:** micro-optofluidics, nanosciences and photonics, bio and soft matter have a crossing area of interest that can be addressed to develop future generations of lab-on-chip platforms for life, material science and low resources settings.
- **Challenges:** Identify and implement innovative methods and strategies to develop tunable microdevices and multifunction lab-on-chip systems for detections, identifications, sorting, diagnostics, manipulation and imaging, exploiting anisotropic fluids and soft matter, optics of complex and vector light beams, nonlinear optics.
- **Innovation:** Advanced concepts in optofluidics coming from complex fluids, soft matter, complex light beams optics, nonlinear optics, interfaces interactions.
- **Brief reminder of MoU objectives:**
To organize an interdisciplinary cooperation platform (involving COST and NON COST countries) to establish active interlinks between laboratories (academic and companies) working in the fields of micro and optofluidics, optical tweezers, nanosciences and photonics, bio and soft materials.

Scientific context and objectives

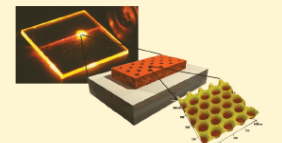
New approaches

New materials

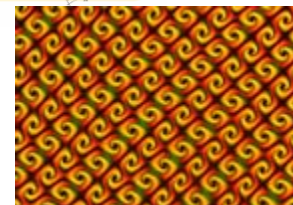


Optics

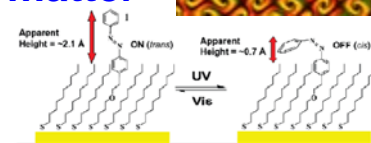
Nano-photonics (Polymer)



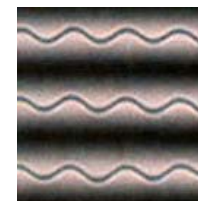
Photofluidics



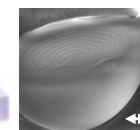
Soft matter



Interface interactions

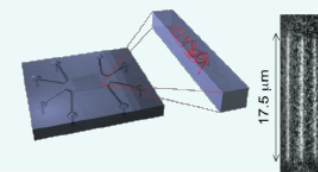


Anisotropy and chirality



Microfluidics

Nano-fluidics (DNA)



Fluidics

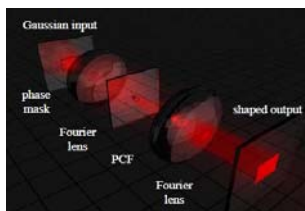
Multifunctional
Lab on chip platforms

AgNP Photonics

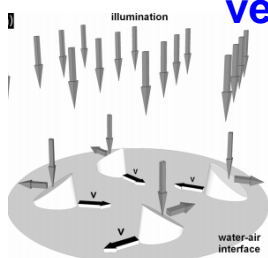


AuNP Plasmonics

Nonlinear optics



Complex and vector light beams



Optical control



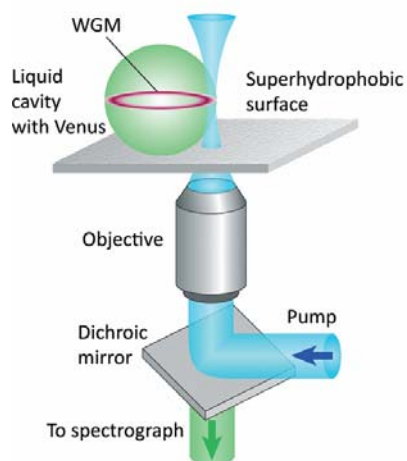
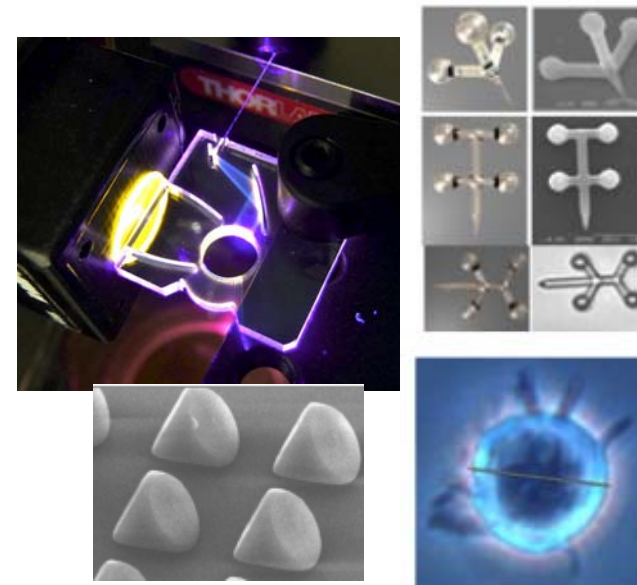
EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

Working groups

Working group 1: Integrated microfluidic photonics

Coordinator: Prof. Pal Ormos, HU

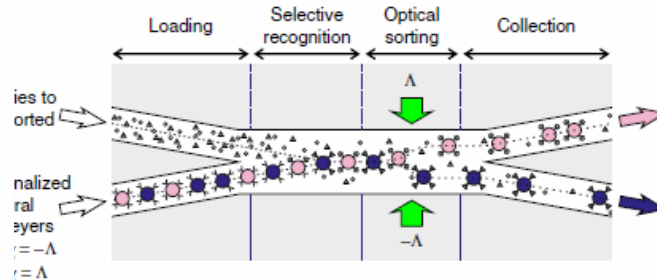
69 participants (including 26 ESR)



Working group 2: Optical control in microfluidics

Coordinator: Prof. Jean Pierre Delville, FR

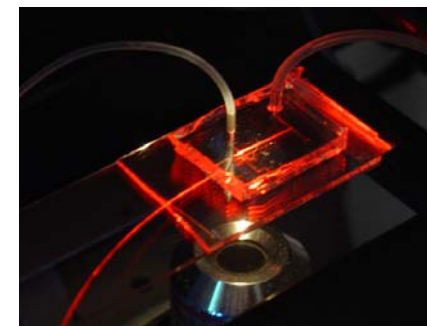
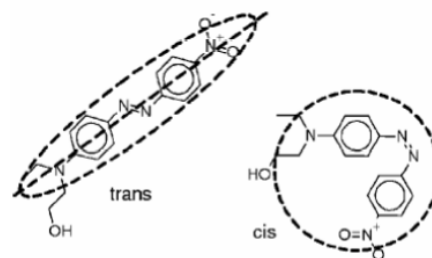
62 participants (including 23 ESR)



Working group 3: Materials (soft , bio and nano) and technologies for optofluidic devices

Coordinator: Dr. Sooraj Nandyala, PT

56 participants (including 24 ESR)





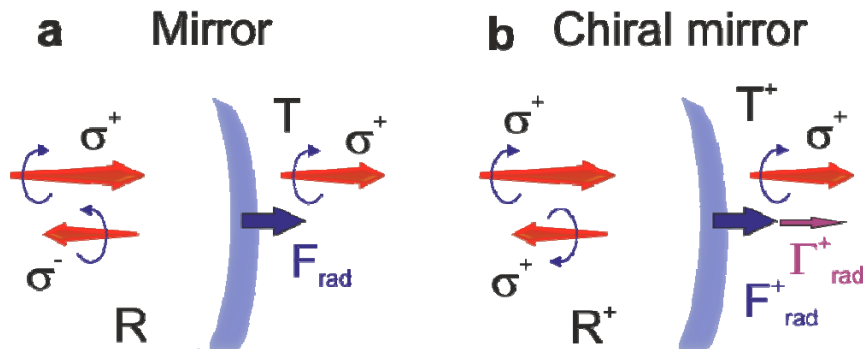
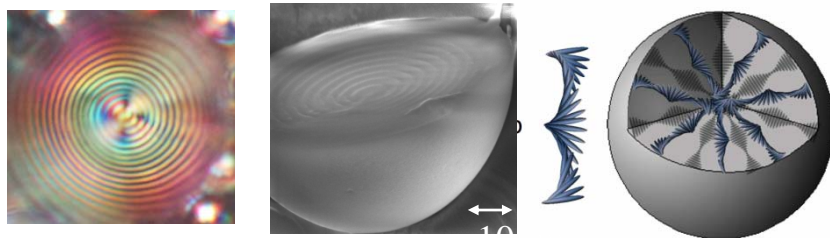
Results vs. Objectives

- Improved cooperation between WGs yields high level scientific results addressing new optofluidic strategies.
- Transfer of scientific knowledge: increase in STSM of high inter-disciplinarity level (inter- and intra-WGs).
- Companies involvement: active participation of industrial partners to Action meetings and organization of a WGs meeting at Buerkert.
- Dissemination: free of charges publication of the Action outcomes on open access journal “Optofluidics, Microfluidics and Nanofluidics” and website <http://costmp1205.eu/>.
- Added value of networking: collaborative proposals submitted to Horizon 2020 calls; collaborative publications in high IF journals; numerous and active participation to Action meetings.

Significant Highlights in Science and Networking (1/4)

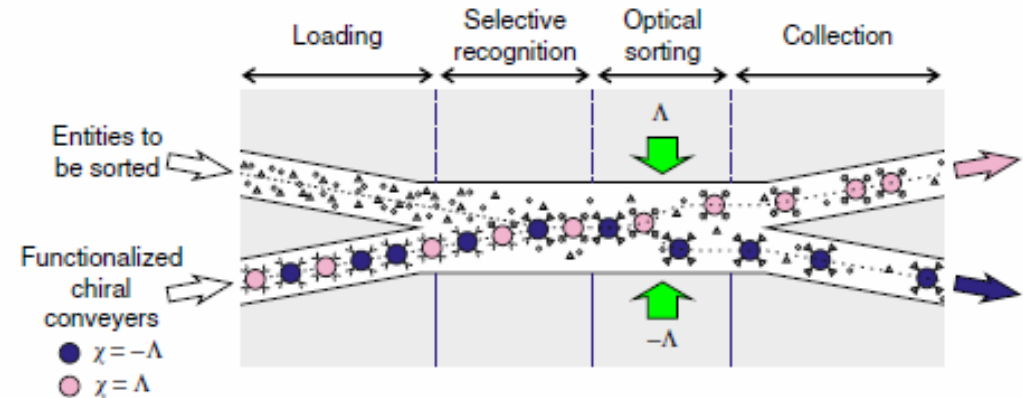
Chirality

Chiral Optomechanics
Chiral microresonators



Optofluidic sorting of material chirality by chiral light

Chiral droplets

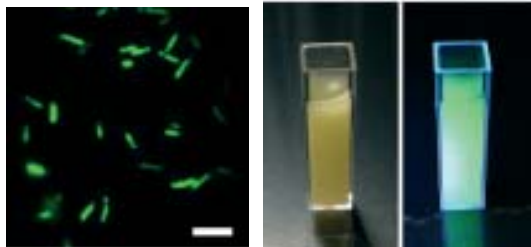


Nature communications 2014, DOI: [10.1038/ncomms4656](https://doi.org/10.1038/ncomms4656)

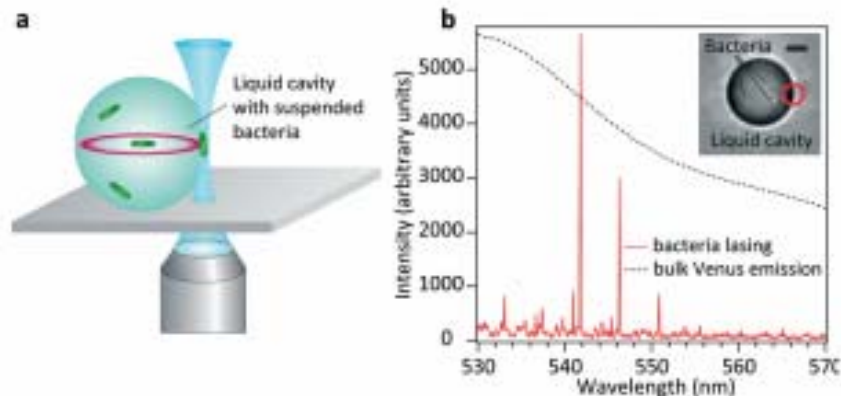
Nature communications 2014, DOI: [10.1038/ncomms4577](https://doi.org/10.1038/ncomms4577)

Significant Highlights in Science and Networking (2/4)

Fluid Microphotonic

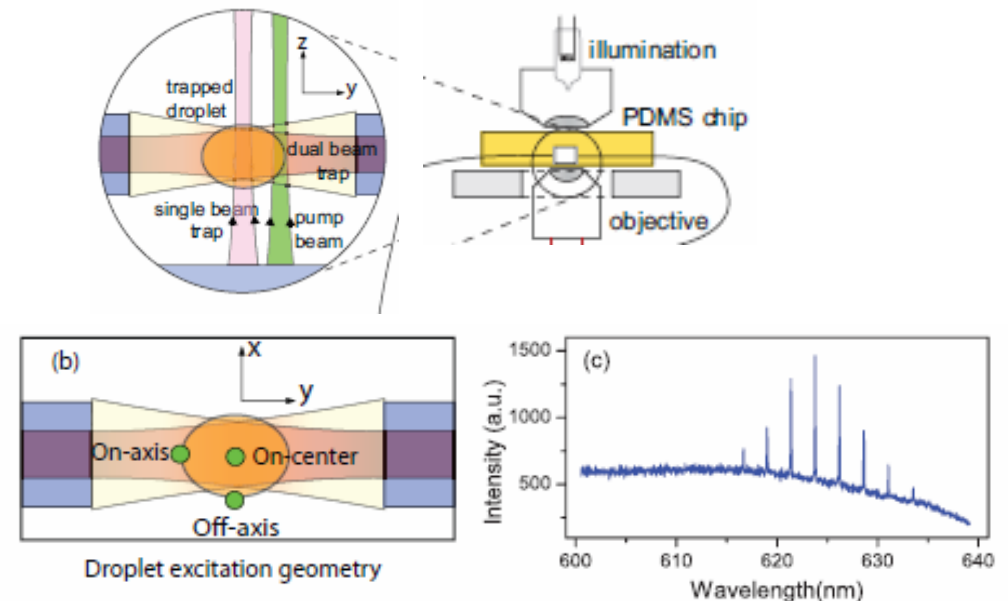


In vitro and in vivo biolasing of fluorescent proteins in liquid microdroplet cavities



Lab on a Chip (2014). DOI: [10.1039/C4LC00485J](https://doi.org/10.1039/C4LC00485J)

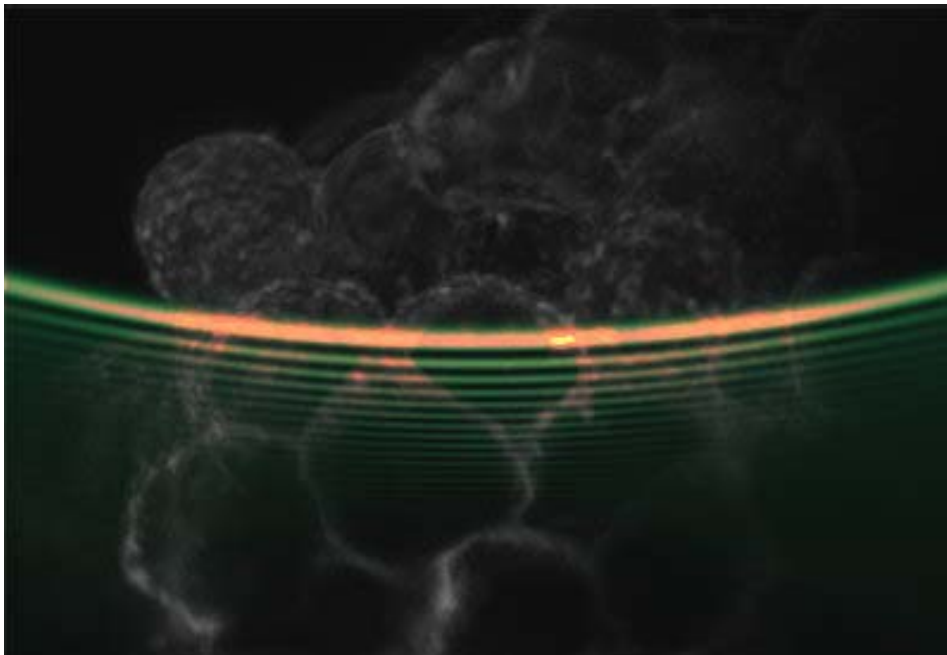
Spectral tuning of emission from optofluidic droplet microlasers using optical stretchers



Optics Express (2013). DOI: [10.1364/OE.21.021380](https://doi.org/10.1364/OE.21.021380)

Significant Highlights in Science and Networking (3/4)

Light-sheet microscopy using an Airy beam



Imaging turns a corner

A light sheet microscope creates 3D images of cells by seeing how a sample lights up slice-by-slice when moved through a sheet of light.

[Nature Methods 11, 541–544 \(2014\) doi:10.1038/nmeth.2922](https://doi.org/10.1038/nmeth.2922)



Significant Highlights in Science and Networking (4/4)

- **WGs Meetings**, 28 - 29.10.2013, Munster, Germany.
- **Annual General Meeting**, 24 - 25.04.2014, Dublin, Ireland (with exhibition)
- **10-29.08.2014 Training school** joint to PolyNano summer school– **Bringing lab-on-chip systems closer to the market** - at DTU Nanotech, Denmark.
- **16 STSMs** (II year)
- **25 joint publications**
- **2 joint research proposals** have been submitted to EU programmes (Horizon 2020 Research) and 1 is in preparation.
- **Dissemination: website** for exchange of information and for making public the action activities; **publication** on the on-line journal “Optofluidics, Microfluidics, and Nanofluidics” Ed. DeGruypter



Future Plans

Science

- Understanding on fundamentals addressing novel operation principle devices involving interdisciplinary fields within the 3 WGs.
- Identification of transversal thematics across the Working Groups for EU/Horizon 2020 Research proposals.
- Refinement of objectives and scientific strategies with respect to the ones foreseen in the MoU re-addressed by the real time achievements.
- Implementation of technological transfer strategies.

Networking

- Transfer of knowledge (mainly involving ESRs), exchange of researchers, sharing knowledge, facilities, samples, data, etc.
- Improvement of the involvement of companies.
- Collection of information for collaborative projects involving most Cost partners.
- Establishment of interdisciplinary links between physicists, material scientists, engineers, chemists for addressing problems identified within the WGs;
- Development of specific activities for ESRs.
- Definition and development of instruments to improve Gender balance.

Future Plans

COST Activities

WG/MC Meetings, October 2014, Buerkert Fluid Control Systems, Ingelfingen, Germany



Future Plans 2015 (proposals)

General Meeting, May 2015, Porto, Portugal

WGs meeting joint to International Conference Photonica 2015, August 2015, Belgrade, Serbia

Training school 2015 at Buerkert, Ingelfingen, Germany.

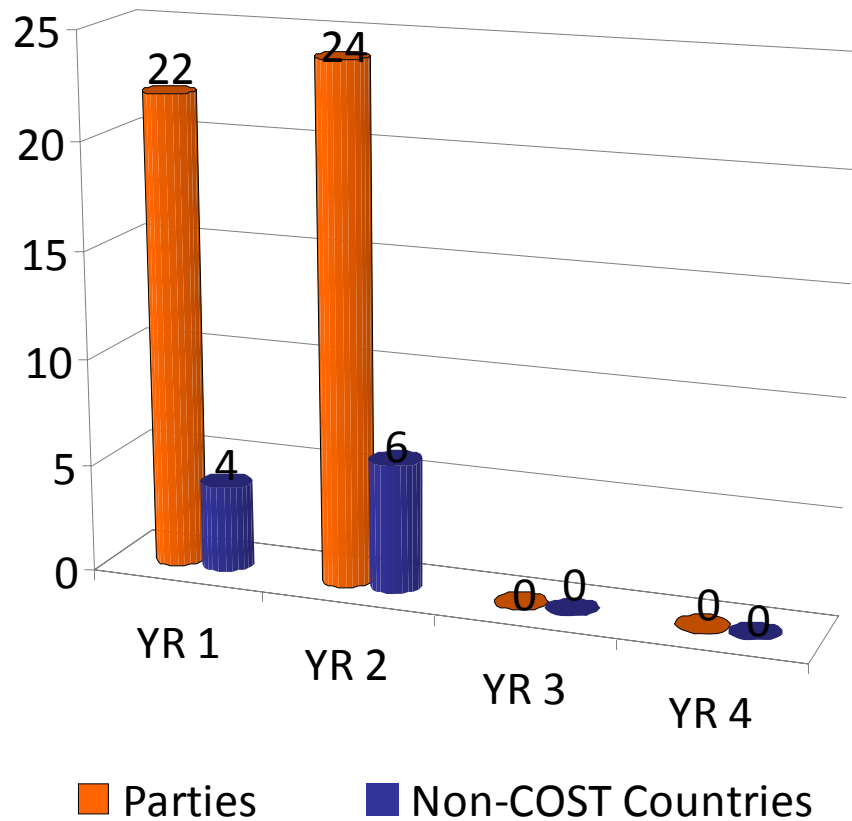


Appendix

- The following three slides should be prepared for information only in case of questions from the DC but should NOT be presented

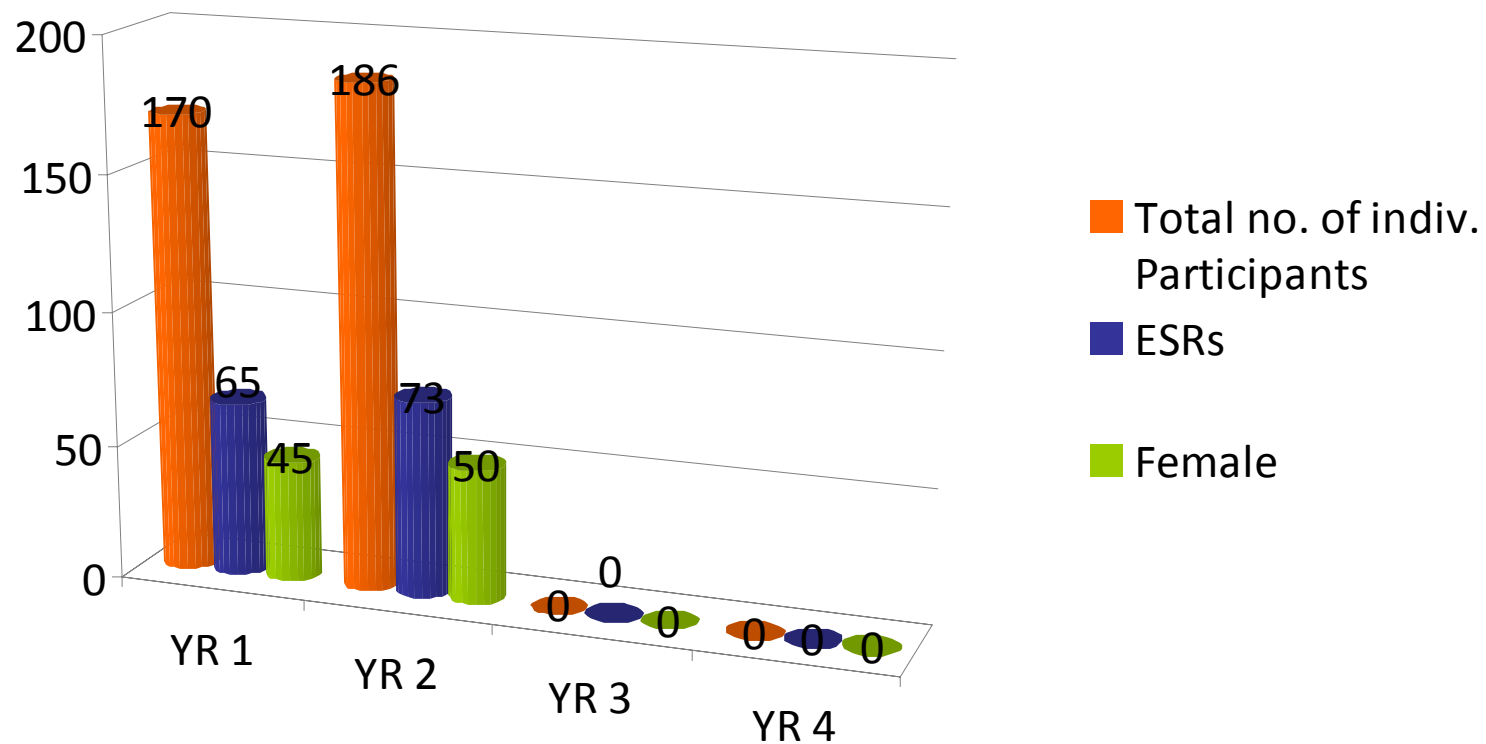


Action Parties



Grant Holder :
University of Munster
Prof. Cornelia Denz
Germany

Action participants





Use of COST Instruments

Activity (No.)	Year 1	Year 2	Year 3	Year 4
MC/WG Meetings	2	2		
STSMs	7	14		
Training Schools	0	1		
Workshops or Conferences	1	1		
Joint Publications	11/59	25/87		