

Electrical discharges with liquids for future applications

TD1208

11. 4. 2013 – 10. 4. 2017

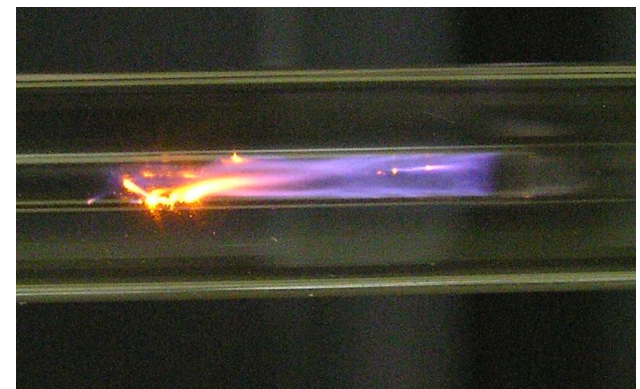
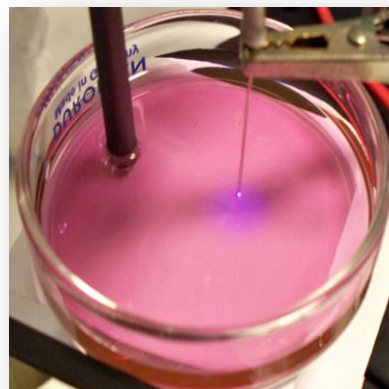
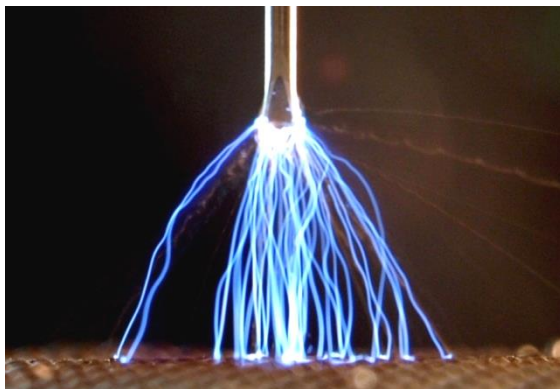
František Krčma

Brno University of Technology
Faculty of Chemistry, Czech Republic

Chair

Grant holder

Secretary



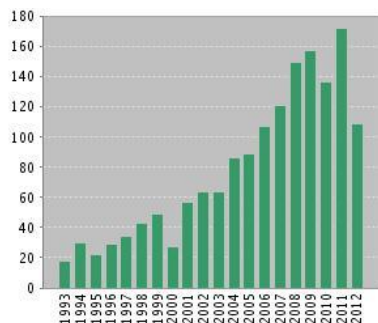
Reasons for the Action

Very hot topic opening new dimensions in non-equilibrium wet chemistry with consequent applications in

- organic synthesis
- water treatment
- nanoparticle formation
- surface treatment
- biomedicine

It was necessary to establish a broad interdisciplinary research network based around existing European infrastructures.

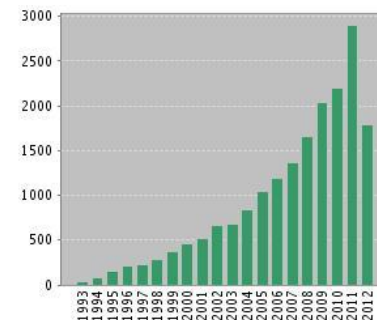
Applied research projects with industrial partners can be developed based on this platform.



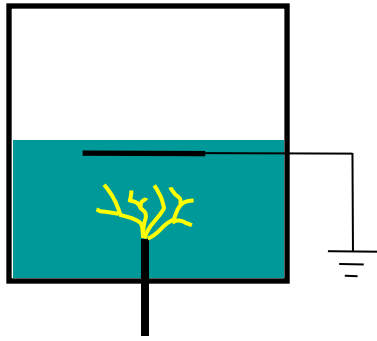
publications

discharge AND plasma AND liquid – Web of Science 27.9.2012

citations



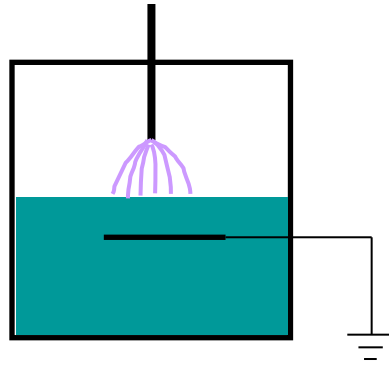
Applicable plasma-liquid systems



Under liquid discharge

Corona, spark, arc, pin-hole discharges, laser induced discharges

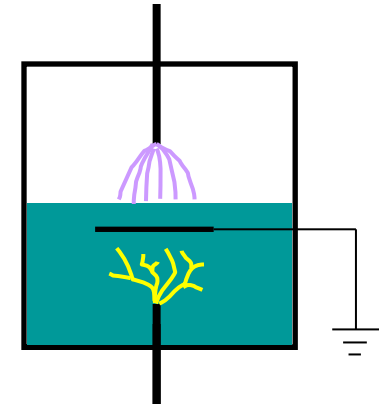
needed $E > 1 \text{ MV/cm}$



Gas phase discharge

Corona, glidarc, glow discharge, plasma jets

needed $E > 30 \text{ kV/cm}$



Hybrid systems

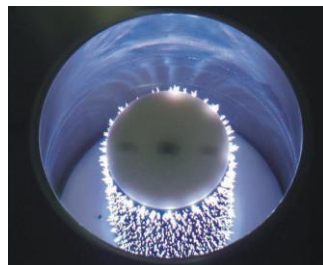
needed $E > 1 \text{ MV/cm}$

Possible power supplies

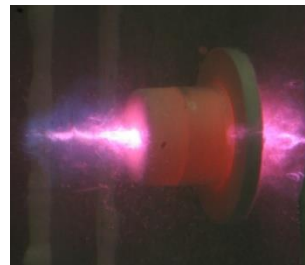
DC, AC, HF, RF
(nanopulsed), pulsed, continuous



point to plate



coaxial composite



pin-hole

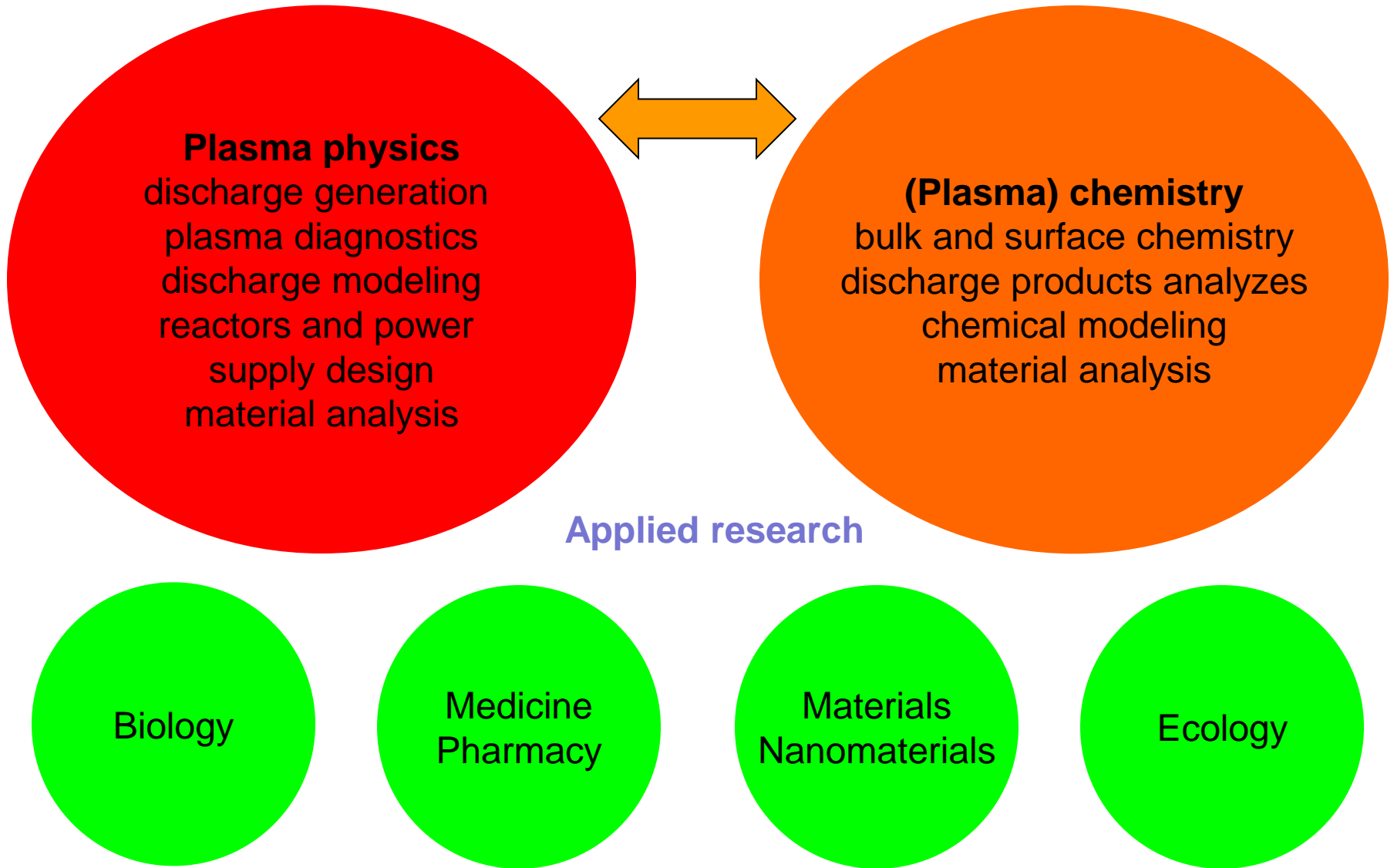


above water



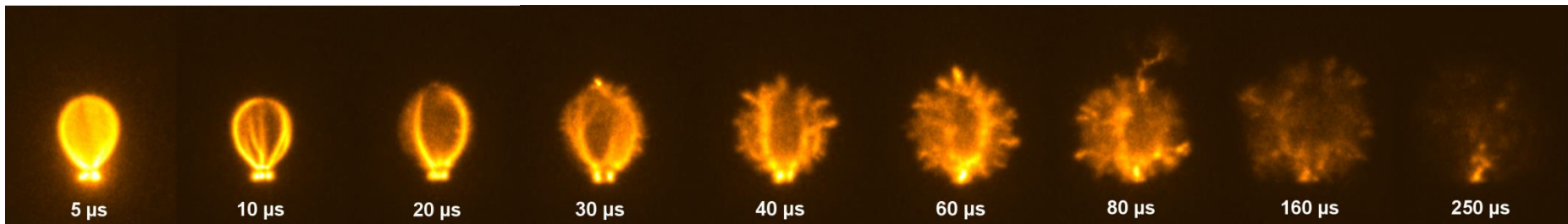
hybrid

Structure of experts



Action objectives

1. To understand discharge ignition mechanisms directly in the liquid phase.
2. Identify and understand fundamental physical phenomena in plasma-liquid interactions.
3. Identify the dominating chemical processes in liquids initiated by plasmas.
4. Develop physical-chemical models linked to the topic.
5. Control and utilize the strong non-equilibrium chemistry initiated by plasma-liquid interaction.
6. Develop strategies for specific interdisciplinary applications of the plasma-liquid systems for technological practice.



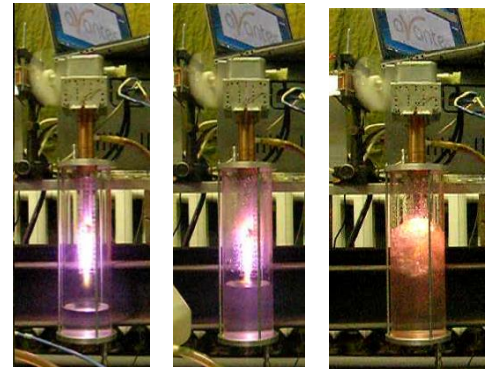
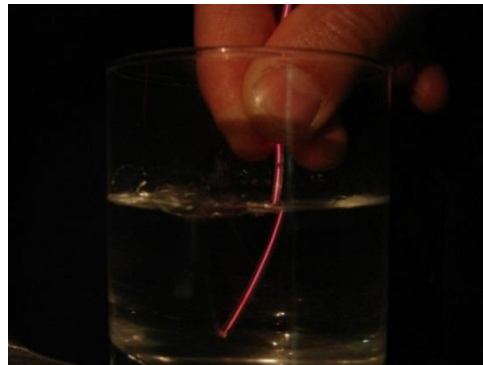
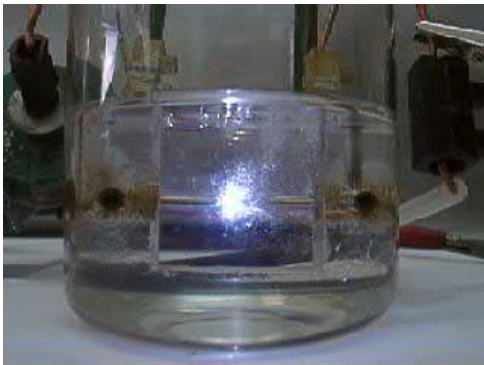
pulsed corona in air bubbles

Target groups

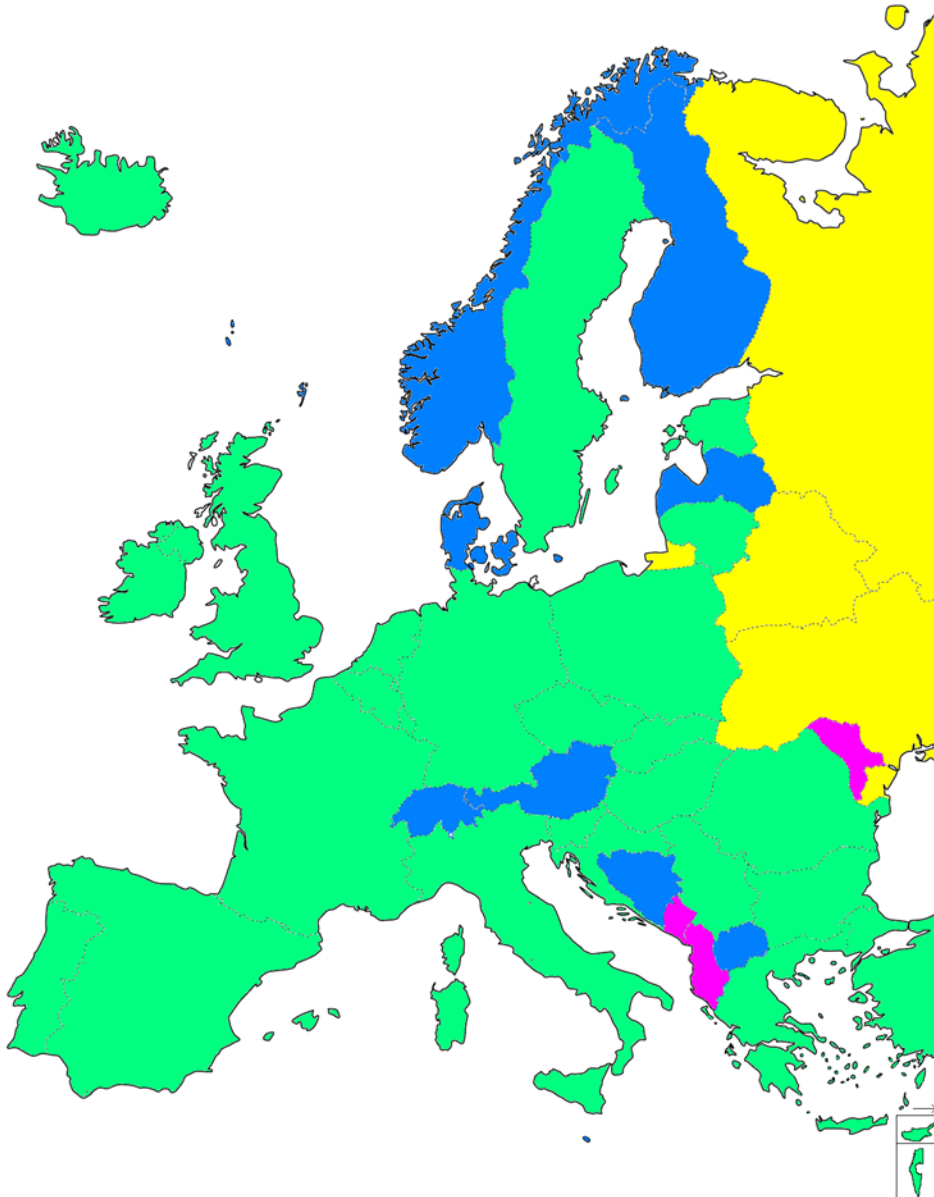
1. Academic members with expertise in physics, chemistry, biology, medicine and engineering, who study basic phenomena as well as applications of low-temperature plasma-liquid interactions.
2. Organizations focused on water treatment (both drinking and waste).
3. The chemical industry with interest in special compounds such as drugs, bioactive materials, etc.
4. Biomedical research centers and clinics.
5. Companies developing plasma reactors, power supplies and devices.
6. Industries using surface treatment technologies for specific applications (space research, automotive industry, medical instruments, etc.).
7. Industries and the research community using nanomaterials for different applications (drug delivery, cosmetic, composites, energy storage/generation etc.).

COST polices

- Inclusiveness – participation of west x east COST countries.
- Early stage researchers (ESR) – PhD students and post-docs up to 8 year after PhD.
- Gender balance.
- International cooperation – mainly international publications and projects.
- SMEs/industry participation.



Participating countries



28 COST countries

Around 80 research groups

Other countries

Australia

Belarus

Japan

Russia

Ukraine

USA

Working groups

WG1 Plasmas generated directly in the liquid phase

WG2 Atmospheric plasmas interacting with liquids

WG3 Elementary physical and chemical processes initiated by discharges

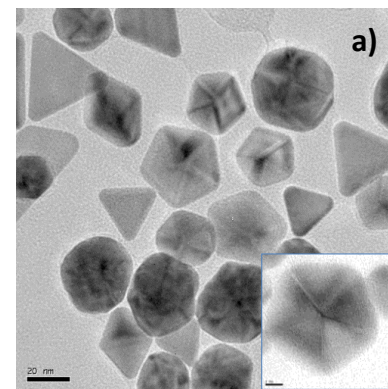
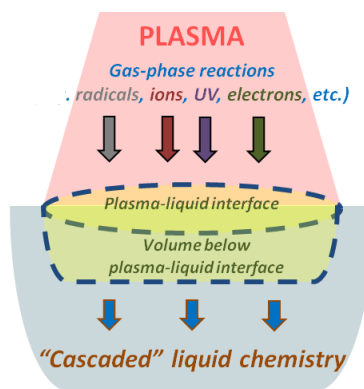
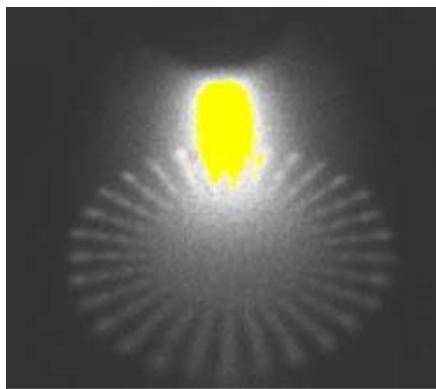
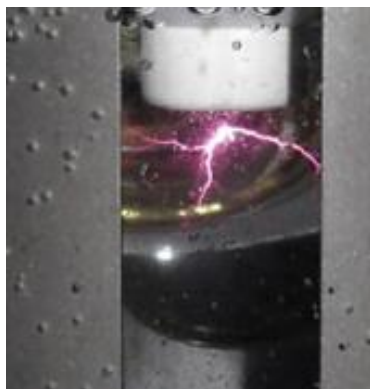
WG4 Interaction of plasma reactive species with materials and surfaces

4.1 Applications in water treatment

4.2. Biomedical applications

4.3 Applications in nanoparticles formation and surface treatment

4.4. Organic chemistry applications



Action activities during 4 years

Meetings

4 annual meetings – 3 days

(total attendance 360, reimbursed 260)

6 WG meetings – 1 - 5 days, shorter connected to existing conferences

(total attendance 490, reimbursed 160)

4 MC meetings – ½ day

Training schools

Ljubljana

Greifswald

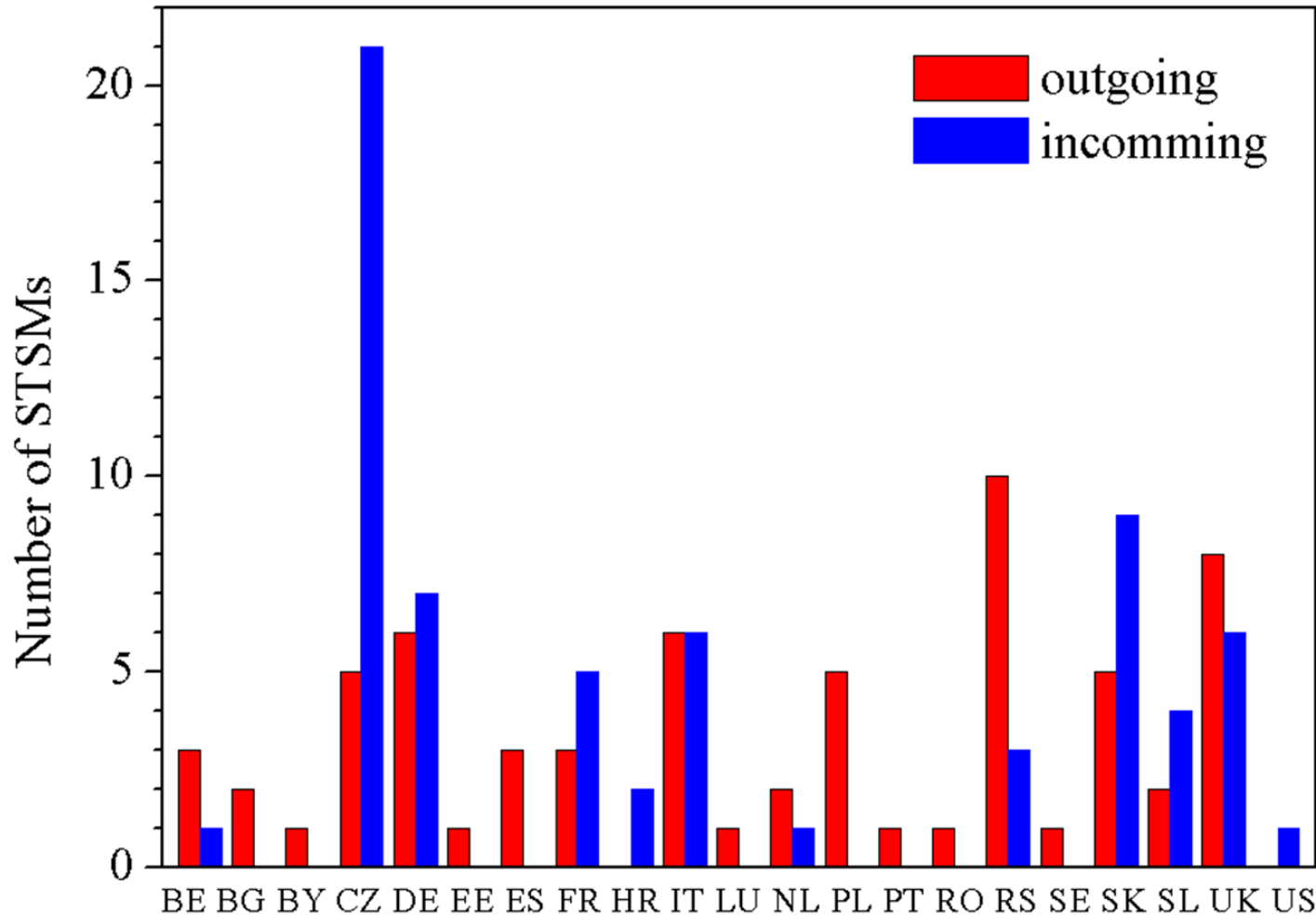
Belgrade

(total attendance 160, reimbursed 110 trainees, 25 trainers)

Action activities during 4 years

Short term scientific missions

54 scientists, 48 ECI, 17 females, 21 countries (19 out, 12 in)



Action activities during 4 years

Dissemination

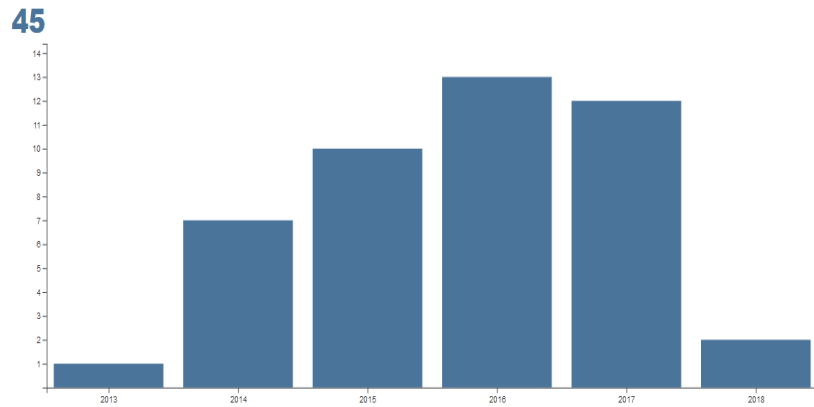
Action website – www.cost-plasma-liquids.eu

presentations at existing conferences

public presentations

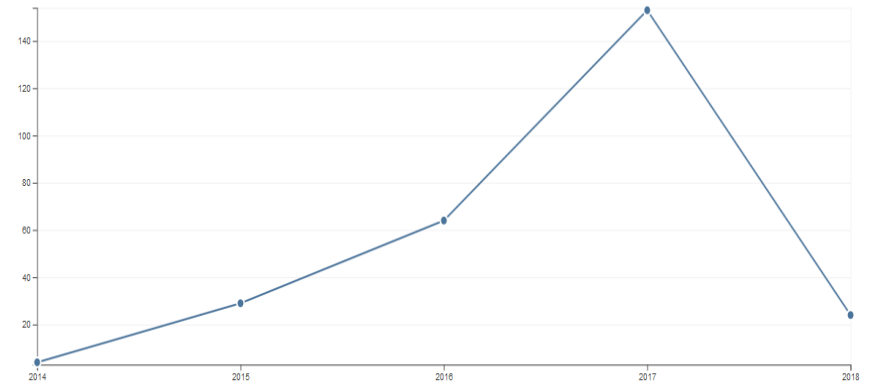
publications

Total Publications



publications

Sum of Times Cited per Year



citations

General Action's highlights

- Interdisciplinary network was successfully established
- Interdisciplinary workshop at Lorentz center
- Collaborative workshop with Bioplasma COST Action
- Plasma-liquid interactions: Review and roadmap
- Collection of presentations at Action's website
- Special issue of Plasma Medicine Journal
- Special issue of Plasma Processes and Polymers
- New plasma-liquid systems
- Novel interdisciplinary diagnostic methods
- New topics – Plasma agriculture, Plasma activated media, Plasma therapy
- Huge number of STSM – new scientists generation
- Training schools and joint study programs
- Publications (currently 45 dedicated to Action at WoS)

General Action's impacts

Description	Type	Timing
New diagnostic methods for active species in liquids phase, a critical review of the existing methods	Scientific	2 years
New procedures for the preparation of various nanoparticles	Scientific Technological	5 years
Application of discharges directly generated in liquids in medicine	Scientific Technological	Foreseen ~ 10 years
Complex numeric models of plasma-liquid systems	Scientific	5 years
Electrical breakdown in liquids	Scientific	2 years
New technologies for water treatment	Technological	5 years
Applications in agriculture	Scientific Technological	5 years

General Action's impacts

- New COST Action *Plasma Agriculture* – submitted 2017
- New COST Action *Non-Thermal treatment of biomaterials* – submitted 2018
- New COST Action *Plasma Therapy* – will be submitted 2018
- Maintain and extending valued network structure and collaborations
- Keeping all collected materials for new users
- International projects
- Collaborative publications

Many thanks to

Vice-chair

WG leaders

STSM coordinator

Organizers of events

Action's web supervisor

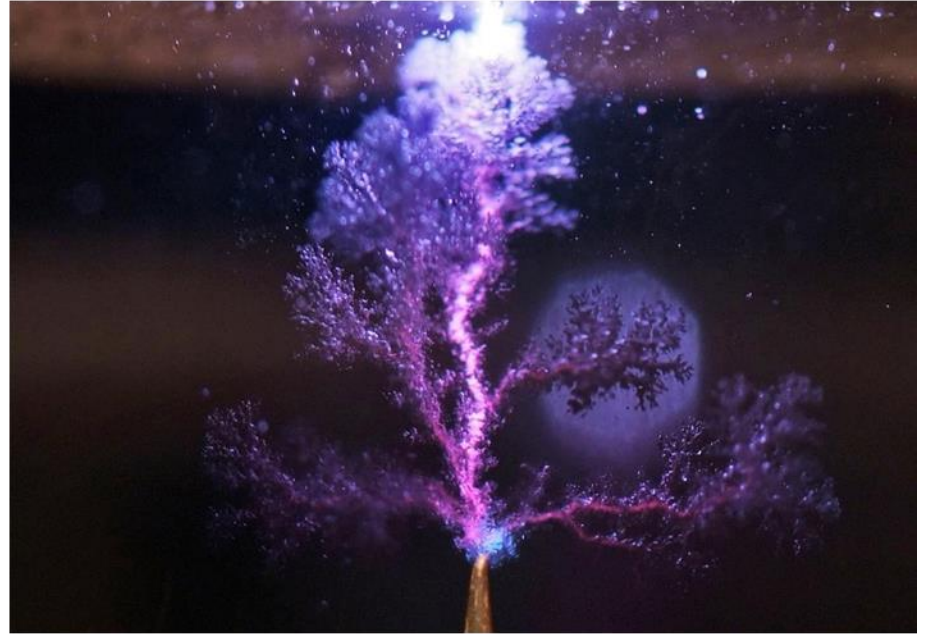
Meeting's web supervisor

MC members

All participants

Brussels administration

COST Association



Action proposal preparation

Define subject targeting as many as possible countries, ideally interdisciplinary

Look for preferred EU topics

Look for the WG fields (4-5 WG is ideal)

Search good WG leaders (communicative, according to COST policies)

Look for future chair (good organizer, reflect again COST policies)

Look for the grant holder (remember also national rules, international payments, account in EUR, etc.)

Look for the STSM coordinator (communicative, according to COST policies)

COST Association supports networking, no direct scientific support. Local projects connected to Action in CZ, only (program INTER-EXCELLENCE).

Don't forget that proposal is about science but it is not science!

Evaluator/referee will be out of topic!

Action Chair

Preparation of Memorandum of Understanding

Coordination of all activities

Final selection of speaker for meetings and training schools

Confirmation of STSMs

Preparation of Work and Budget plan – linked to MoU objectives

problem with budget changes and fixed grant periods

Reporting is rather complicated – not linked to budget periods and goals set there.

Organization of voting for new Action members

All tasks are much easier if WG leaders are very communicative and good in organization

Also, it is a great benefit if all Action participants can collaborate

Action Grant holder

Before application as grant holder study in detail COST rules and national rules. They are very different!!

Legal and financial representatives of your organization must agree with their roles and they must accept rules.

You need account in EUR, don't forget for bank charges.

Financial reporting in eCOST system is simple but not all is eligible.

Budget is sometimes delayed – prepare your organization for this.

Grant holder overheads are up to 15%, be careful about overheads of your institution.

Action grant secretary

No support is given in advance – you need existing person

Secretary is not for the full time job but sometimes her/his job is over 1.0

Good knowledge of at least English is necessary, better as many languages as possible – revision of documents in more than all EU languages is necessary

Response of eCOST system is very slow (huge database)

Not all is under your control (was mail delivered?, was grant letter downloaded, etc.)

Account data given in eCOST are not sufficient for international payments from CZ

Participants usually don't read rules – many corrections are necessary

Action – how to join

Look for the existing Actions

Look for the time schedule of new Actions approvals

Ask your foreign friends if any new Action is planned

Contact your National COST coordinator for nomination as MC member or MC substitute

Prepare proposal according rules and get confirmation of Action chair or coordinator – Czech specific point

No problems during the first 12 months of Action life;
later online voting of MC members is necessary

Action – participate or not?

Participate – YES!

Action chair – revise your ability – time, organization skills, contacts

Action vice-chair – should be

WG leader – should be

Action MC member/substitute – YES

STSM coordinator – should be

Grant holder – be very careful, study all legal details, look for specific rules at your institution

Grant secretary – good experience but NEVER MORE

Thank you for attention

