

2007 - 2013



SEVENTH FRAMEWORK PROGRAMME
Theme 3: Information and Communication
Technologies (ICT)



Project MIRSURG

Mid-Infrared Solid-State Laser Systems for Minimally Invasive Surgery

Grant Agreement for Specific Targeted Research or
Small or Medium-Scale Focused Research Project – STREP

Objective ICT-2-3.5: *Photonic components and subsystems*

Proposal / GA No: 224042



EU Concertation Meeting FP7 Photonics – Barcelona, Sep. 18-19th, 2008

2007 - 2013



From Application to Contract



Presented first as an idea by V. Petrov at the Photonics Infoday organized by the EC in Brussels on April 26th, 2007.

Proposal submitted electronically on Oct. 9th, 2007.

Evaluation report, Dec. 14th, 2007: 13.5/15 or 9th out of 82 IPs and STREPs above threshold.

Negotiations: 21.12.07-29.02.2008. Grant Agreement (GA): signed in Brussels on 23.04.2008.

Annex IV – Form A, Accession of Beneficiaries to the GA signed in Berlin on April 23th 2008.

The Consortium Agreement (CA) was also signed in Berlin in April 2008.

Project duration: 01.06.2008-31.05.2011.

Total EC contribution: appr. 2.8 Mio €. The total eligible costs are: 3.917.572 €.



2007 - 2013



Beneficiaries



#	Beneficiary name	Short name	Country	enter	exit
1	Forschungsverbund Berlin e.V.: Max-Born-Institute, www.mbi-berlin.de	MBI	Germany	1	36
2	Thales Research and Technology, www.research.thalesgroup.com	TRT	France	1	36
3	The Institute of Photonic Sciences, www.icfo.es	ICFO	Spain	1	36
4	LISA Laser Products OHG, www.lisalaser.com	LISA	Germany	1	36
5	Institut Franco-Allemand de Recherches de Saint-Louis, www.isl.eu	ISL	France	1	36
6	Bright Solutions srl, www.brightsolutions.it	Bright	Italy	1	36
7	Royal Institute of Technology, www.kth.se	KTH	Sweden	1	36
8	Euroscan Instruments S.A., www.euroscan.be	Euroscan	Belgium	1	36
9	University Medical Center, www.umcutrecht.nl	UMC	Netherlands	1	36



EU Concertation Meeting FP7 Photonics – Barcelona, Sep. 18-19th, 2008

Objectives



1. The main goal of the project is to develop advanced table-top solid-state photonic sources for a specific wavelength in the mid-IR spectral range, as a practical, reliable and cost-effective alternative to large-scale free-electron lasers (FELs), for an important application in biomedicine (health): minimally invasive surgery.
2. Previous experiments have verified that the use of mid-IR FEL at wavelengths near $6.45 \mu\text{m}$, with a focused beam penetration depth comparable to the cell size and coupled both into the spectral wing of the water bending mode and the amide-II vibrational mode, results in tissue ablation with minimal collateral damage and very effective ablation rate. However, the clinical use of FEL is ultimately not viable due to large size, high cost, operational complexity and restricted access at a few multi-million-dollar accelerator-based facilities worldwide. Several attempts to develop non-FEL alternatives have largely failed to meet the necessary requirements in terms of pulse energy and repetition rate.
3. The main strategy in this project will be to exploit nonlinear optical techniques (OPO) in combination with novel near-IR laser pump sources (near 1 and $2 \mu\text{m}$) and new materials (e.g. orientation patterned GaAs) to obtain an unprecedented energy level (10 mJ) near $6.45 \mu\text{m}$ at a repetition rate of 100 Hz (an average power of 1 W).



2007 - 2013



Relevance



Application-specific photonic components and systems because the specifications defined as a primary objective were derived from a thorough analysis of the requirements for MIS, an application in the health area.

Core photonic components and subsystems because this Project will deal mainly with development of dedicated photonic sources.

The development of complete systems for wide clinical use is beyond the work plan and can only be a topic of a future, larger activity based on the results achieved within MIRSURG. As such, the complex photonic systems planned for development within the present project can be regarded as

- (1) High performance lasers and
- (2) High brightness, power efficient solid-state light sources in the mid-IR spectral range, suitable for use as components or subsystems in multiple applications, e.g.
 - (a) Directed counter-measures in the area of security and safety and
 - (b) Resonant-IR Pulsed Laser Deposition (RIR-PLD) of polymers.



Approach

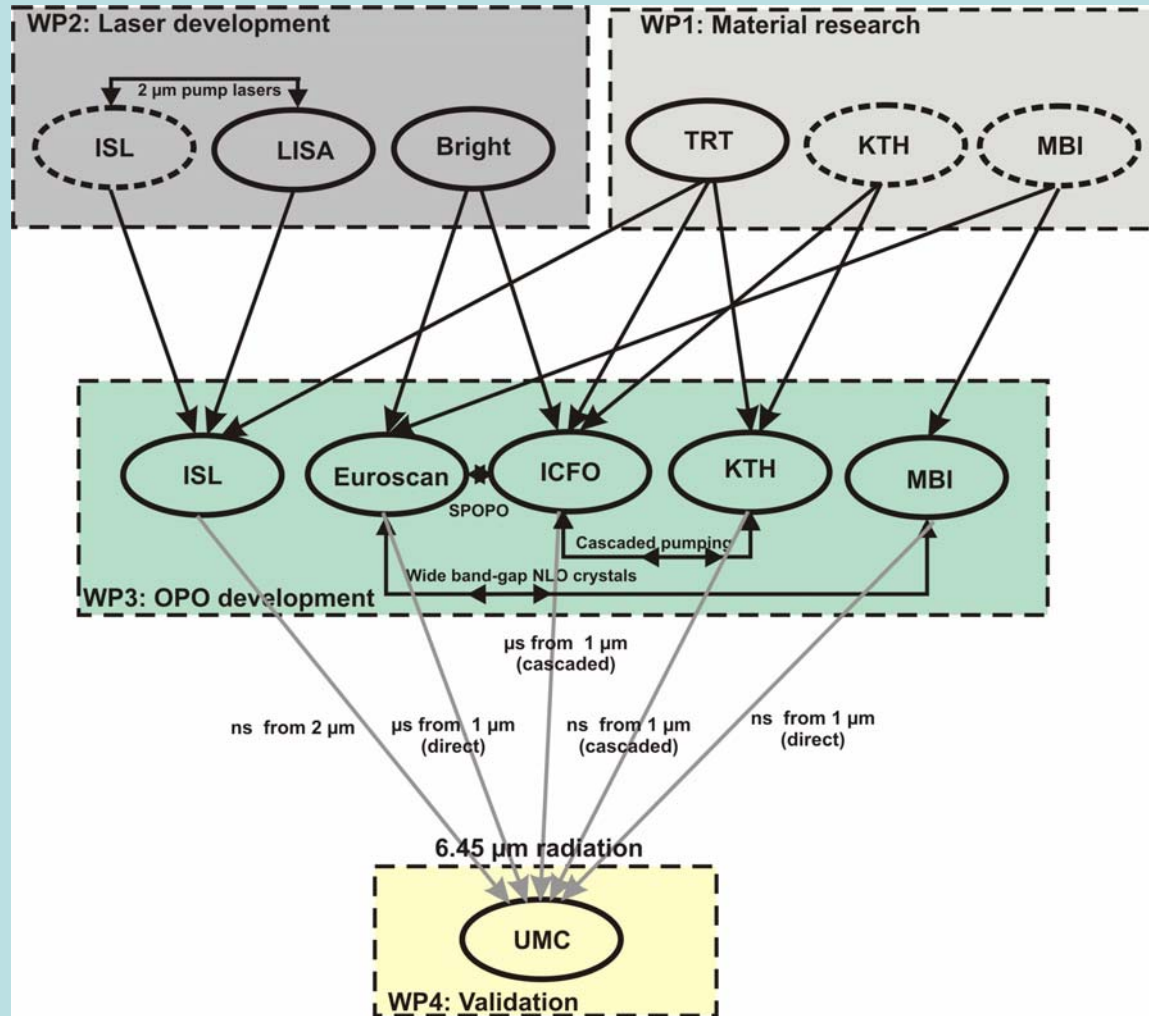


Two basic approaches, differing in the time structure, will provide less than few μs (macro) pulse duration:

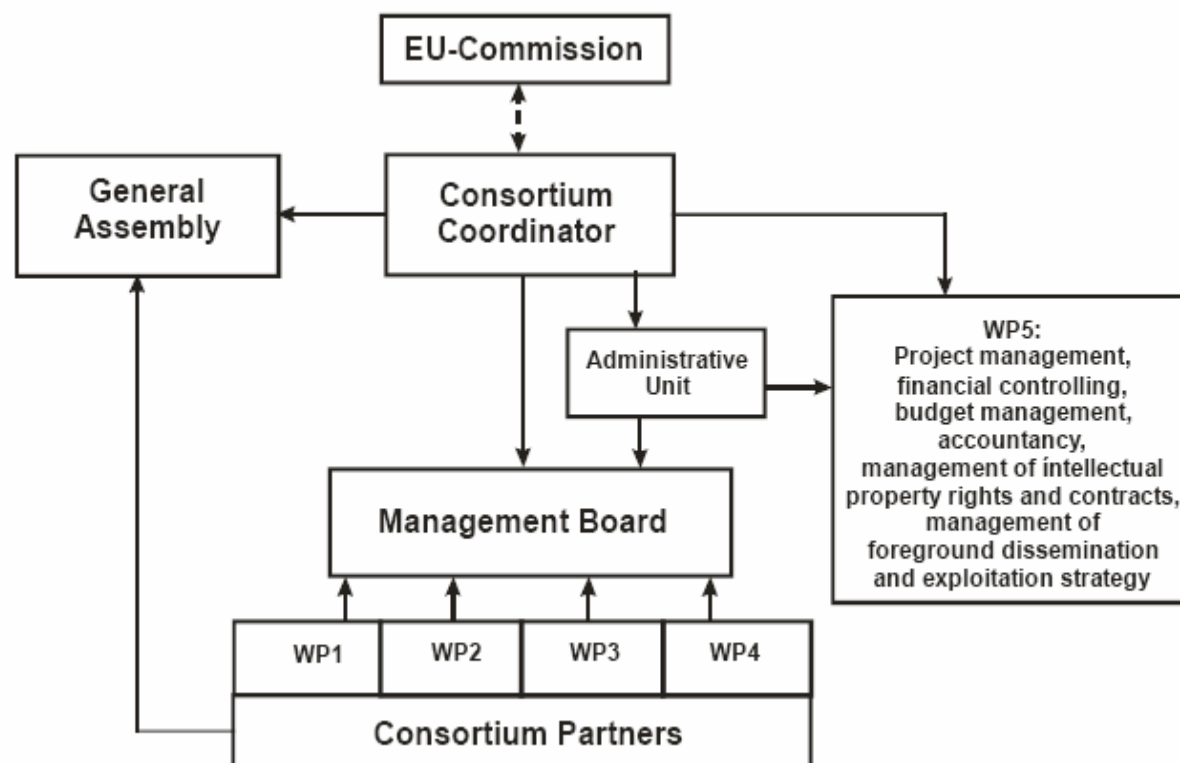
- Nanosecond pulse frequency conversion using cascaded OPOs pumped near $1 \mu\text{m}$, single stage OPOs pumped near $2 \mu\text{m}$ by Tm/Ho-lasers or single stage OPOs with wide band-gap nonlinear crystals that can be still pumped near $1 \mu\text{m}$ without TPA.
- SPOPOs providing macropulses of μs duration at 100 Hz consisting of ~ 10 ps pulses at 0.1-1 GHz repetition rate. Either directly pumped near $1 \mu\text{m}$ or cascaded with one of the stages operating at degeneracy.
- The above approaches will require the development of specialized Tm/Ho lasers, pulsed amplified mode-locked lasers near $1 \mu\text{m}$ as well as mid-IR materials with improved properties for the nonlinear conversion.
- Validation: Delivery system for $6.45 \mu\text{m}$ and visualization of the interaction to study the effect on tissue models and biological tissue. No human surgery planned.



Interaction



Management structure



Timing of the work packages (tasks)



	Year 1				Year 2				Year 3			
	3	6	9	12	15	18	21	24	27	30	33	36
WP1: Material Research												
1. OP-GaAs growth		D1.1				D1.3				D1.5		
2. Sample preparation						D1.2						D1.6
3. Sample characterization						M1			D1.4			
4. Structuring KTP type crystals						D1.7						
5. Wide band-gap mid-IR crystals						M2				D1.8		
										M3		
WP2: Laser Development												
6. Solid state ps laser system				D2.1					M4			D2.2
7. Q-switched Tm-laser									D2.3			
8. Q-switched Ho-laser									M5			D2.4
WP3: OPO Development												
9. Scaling of direct SPOPO output									M4	M3		D3.1
10. Cascaded SPOPO				D3.2		M1			M4	M9		D3.3
11. Single stage 1 μ m pumped OPO				M6		M2				M9		M10
12. Cascaded 1 μ m pumped OPO						M7				M3		D3.4
13. 2- μ m pumped ns OPO						M1			D3.5	M9		D3.6
						M2						M10
						M1			M5	M9		D3.7
						M7						M10
WP4: Validation												
14. Delivery system for 6.45 μ m				D4.1						M8	D4.2	
15. Visualization of interaction				M6						M9		D4.3
												M11
WP5: Management	D5.1	D5.2				D5.3,4,5a				D5.3,4,5b		D5.6
	M12											

Gantt chart showing the timing of the work packages, the tasks, the deliverables and the milestones



2007 - 2013



Milestones and Deliverables



1. We have 12 Milestones, with more partners and WPs involved in each of them. One of them belongs to WP5.
2. For each milestone there is a lead beneficiary who will be responsible for it and will submit the necessary information for the reports directly to the coordinator.
3. There is individual responsibility also for the Deliverables: although more partners can be involved, one of them is responsible for each Deliverable and should submit it to the Coordinator.
4. Deliverables are mostly Reports but in some cases they are Prototype or „Others“ – this will be documented by some data sheet or list in the Webpage. Some Deliverables are Public.
5. Deliverable Reports are very important for the Periodic Evaluation (Review Meetings), that is why their timing is such that we have mostly one deliverable from each WP to be submitted in the end of each reporting period.



2007 - 2013



Periodic Technical (Activity) Reports



1. These are D5.3a,b,c due in months 14, 26, 38. To be submitted by the coordinator to the Project Officer by the end of July.
2. While Deliverable Reports can include technical details, recipes, tables, etc., the Periodic Reports should be kept concise. They are Confidential and only a Summary (4 pages) will be publishable.
3. All partners will submit by the end of May concise Reports (approach and main achievements) to the 4 sub-coordinators, who combine them and submit a WP report to the Coordinator by the end of June.
4. The sub-coordinators provide also „a plan for the dissemination and exploitation of foreground“ and the coordinator summarizes it as a part of the Reports.
5. Information on any dissemination activity (publications, conferences, presentations etc.) is steadily provided by each partner to be included in the Webpage. This information is used by the Coordinator to prepare deliverables D5.4 and D5.6: Reports on Dissemination and Promotion of the results and Dissemination-Kit.



2007 - 2013



Project Webpage www.mirsurg.eu



Home

Very important Deliverable itself. Will contain information on the other Deliverables and cover completely all Dissemination Results.

The Project

Partners

Public sector: will contain published results, press releases, and recent highlights as well as information about the project and the consortium with links.

Press Releases

Internal Sector: will contain important documents, guides, financial information, deliverables, reports, minutes and copies of the talks from the meetings.

Results

Events

Will be regularly updated, with PDF files of:

Internal

Contact

- Journal papers in press if a galley proof exists (no manuscripts),
- Published journal papers,
- Conference contributions, Summary/Abstract from the Digest,
- Any press releases or similar,
- Information only (authors, title, etc.) on unpublished seminars, etc.,
- Information only (authors, title, etc.) on related patents (submitted and accepted),
- Suitable Highlights for the Public (e.g. Poster presentations from conferences).



EU Concertation Meeting FP7 Photonics – Barcelona, Sep. 18-19th, 2008

12

2007 - 2013



WEBSITE: www.mirsurg.eu



MIRSURG Mid-Infrared Solid-State Laser Systems for Minimally Invasive Surgery

[Imprint](#)

WELCOME TO THE MIRSURG WEBSITE

PRESS RELEASES

Home	The Parliament Magazine	The Max-Born-Institute for Nonlinear Optics and Ultrafast Spectroscopy in Berlin coordinates an European consortium working on novel lasers for neurosurgery	Issue 272 21 July 2008
The Project			
Partners			
Press Releases			
Results	Verbundjournal	Präzisere Gehirn Operationen per Laserstrahl	September 2008
Events			
Internal			



EU Concertation Meeting FP7 Photonics – Barcelona, Sep. 18-19th, 2008 ¹³