Opportunities and Challenges of a Swiss SME in European Research Projects

Dr. Carolina Medrano
Rainbow Photonics AG

Outline:

- Rainbow Photonics AG: Company and Mission
- SME and EU Research Opportunities
- Recent Projects:
  - **MUTIVIS**: *Multispectral terahertz, infrared, visible imaging and spectroscopy*
  - **COSIT:** *Compact high brilliance single frequency THz source*
- Outlook

Rainbow Photonics AG

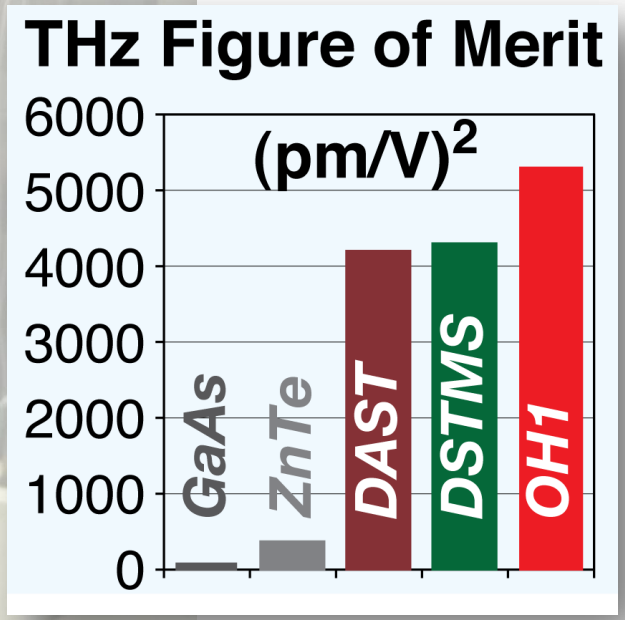
- Founded as a spin-off NLO Laboratory of the Institute of Quantum Electronics* ETH-Zürich (1997)
- *IQE founded in 1986 following an initiative of ETHZ to strengthen research in the area of (optical) information technology (more than 12 spin-offs).
- SME (6 employees, majority scientists and engineers)
- Mission: production of photonics materials for THz technology and THz sources and instruments.
- Participated in 6 European research projects in the area of optical information technology, one as project coordinator.

Core product: THz Generation Materials

- **Organic materials:**
  DAST, DSTMS, OH1
  Worldwide only producer

- **Core product from**
  Rainbow Photonics AG
  protected with patents

- **Production line at the premises of**
  Rainbow Photonics AG
  since 2007



EU- Projects

Opportunities

- Develop new technologies
- Extension of technology to new areas
- Collaboration with Universities
  - Extension of technology
  - New fundamental results relevant for technology
- Collaboration with other companies
  - Joint development of technology in pre-competitive area
  - Extension of product portfolio

Challenges

Financing for a high tech SME at an early stage

Transition: Technology
Business Portfolio

EU-Projects:

Solutions for these problems for SME's

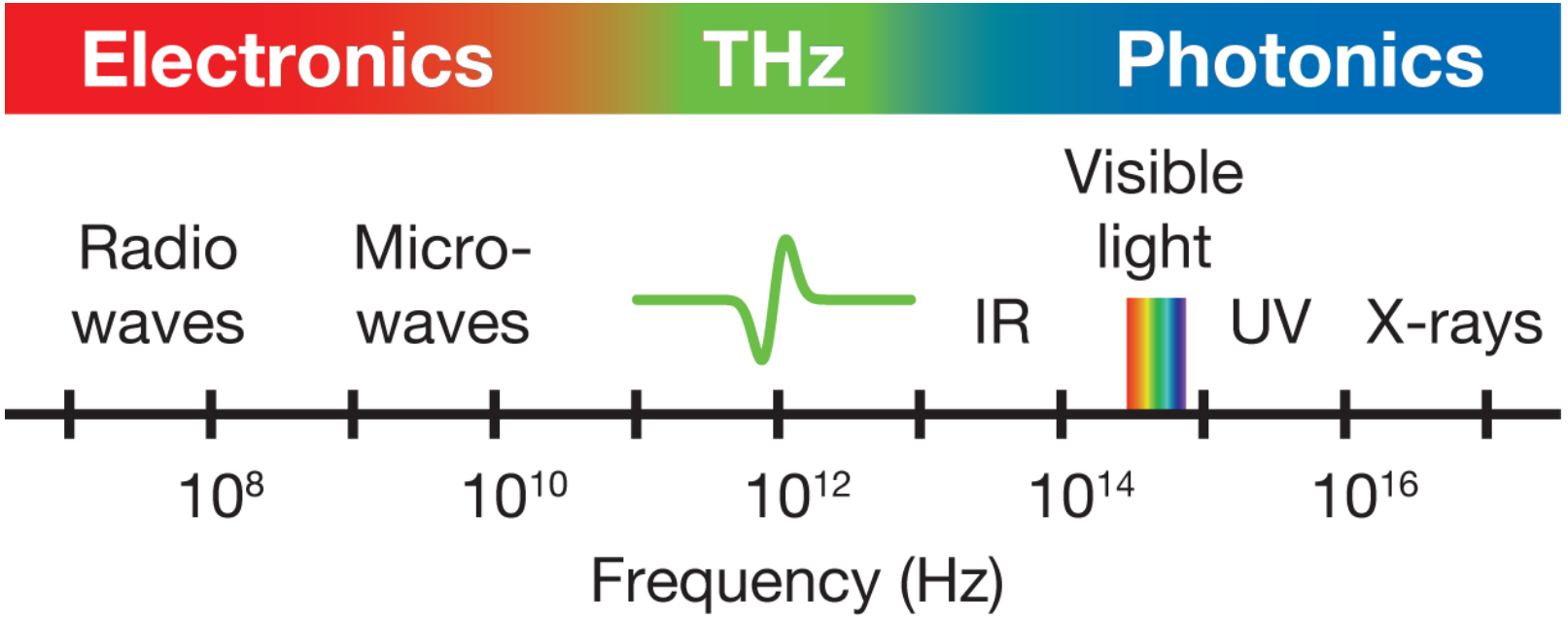
Drawbacks

- Project acceptance: very competitive, high risk
- Acceptance rate in Information Technology and Photonics: 5 -10%
- Project preparation: time consuming much more than for SNF

Improvement of Success Rate

- Contact with Universities and research centers
- Networking with potential European partners
- Participation in EU-project evaluations
- Advice from National Contact Points (Euresearch)

Terahertz (THz) Radiation



- Specific transmission characteristics in the THz range (**fingerprints**)
- **Non-ionizing** (no harm to people)
- Ideal for **materials testing, security**
- **Radiation goes through most packing materials and cloth**

Applications of THz Radiation

- Basic Research
- Materials Spectroscopy
- Materials Defect Inspection
- Explosives Detection
- Chemical and Biological Agents
- Bio-medical
- Inspection (cargo, postal)

MUTIVIS-EU (2008-2012)

Multispectral terahertz, infrared, visible imaging and spectroscopy

Objective: Photonic components for imaging applications in Security, safety, medical, and production areas

Optical Image

THz Image

MUTIVIS-EU (2008-2012)

Multispectral terahertz, infrared, visible imaging and spectroscopy

Objective: THz system for security screening at airports

BOSCH	D	Integration and coordination
CEA-Leti	F	Integrated camera for visible, infrared and terahertz radiation
FBK	I	Electronic circuits and chip design
ETH zürich, Rainbow Photonics		Tunable THz source design and manufacture
FLUGHAFEN ZÜRICH		Validation and demonstration: security tests at Zurich airport

MUTIVIS-EU: Results

- High power THz system
- Tunable narrow band source (1 – 20 THz)
- Technology for tunable pump source (all-solid-state)
- Software for automatic tuning of THz frequency
- Determination of optical power limit and other fundamental parameters of our THz generators

MUTIVIS-EU (2008-2012)

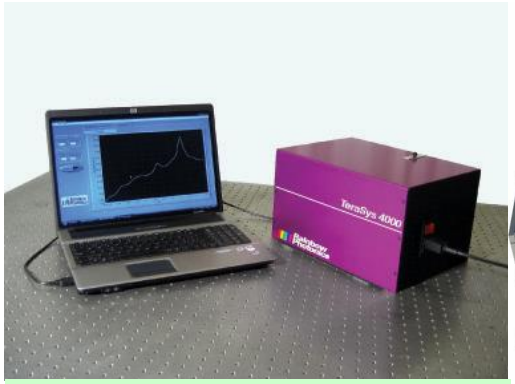
TeraTune®: Tunable THz source (1 – 20 THz)design and production

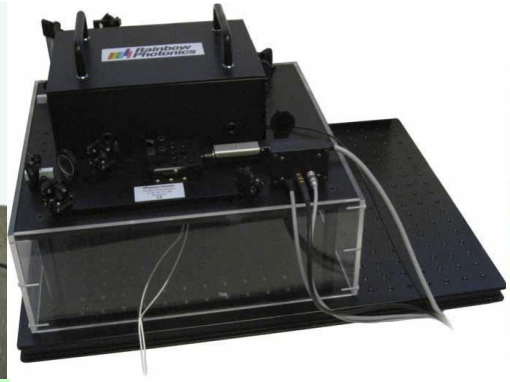
ETH zürich
Rainbow Photonics
SEVENTH FRAMEWORK PROGRAMME

Terahertz Instruments

- THz technology start-up at Rainbow Photonics in 2010
- Existing instruments: (laboratory use)

TeraSys® (Spectrometer 0-4 THz)
TeraKit® (1-12 THz)
TeraIMAGE® (1-12 THz)
TeraTune® (THz source 1-20 THz)





Sales worldwide

Ultra-High Density Polymers

- Biomedical industry (knee/shoulder/hip implants)
- Automotive industry/ aerospace

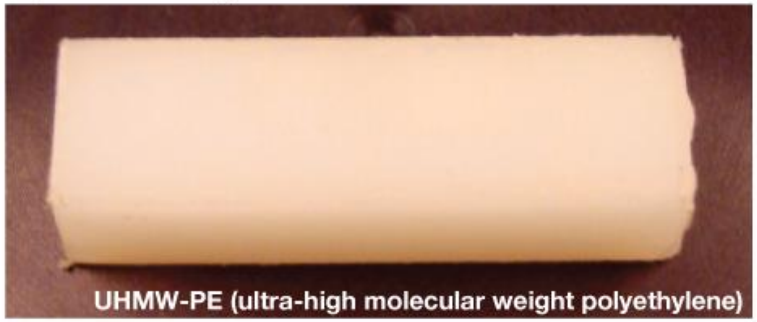
The problem: Quality testing

Not satisfactory results with present technologies:

- visual inspection
- ultrasound
- UV light
- X-ray

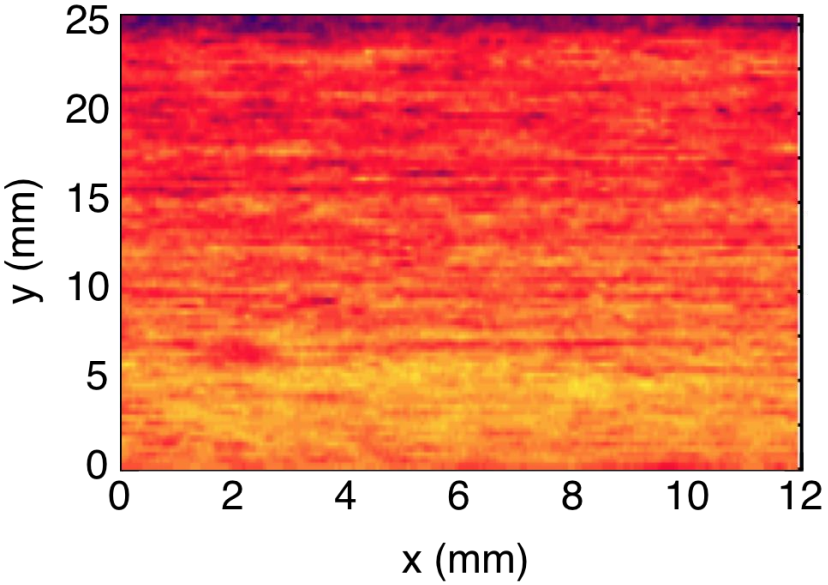
THz Imaging in Biomedical Materials

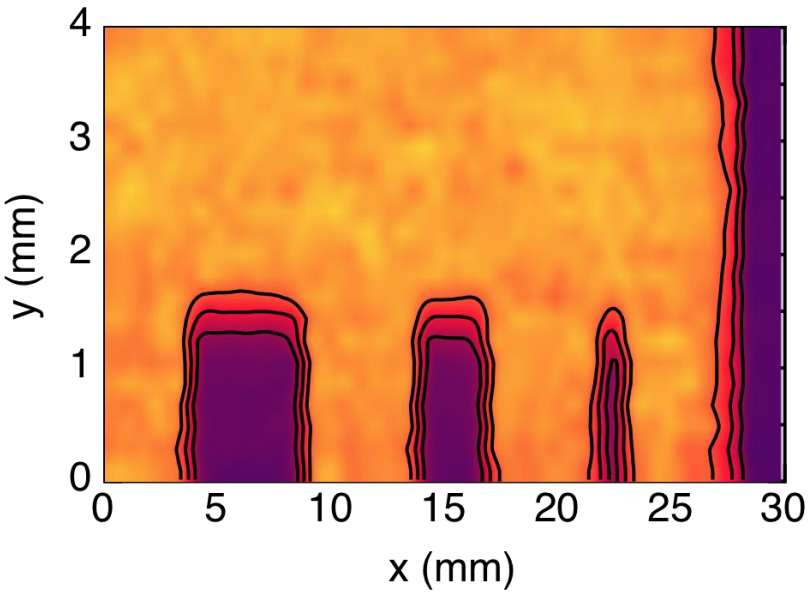
Optical image:



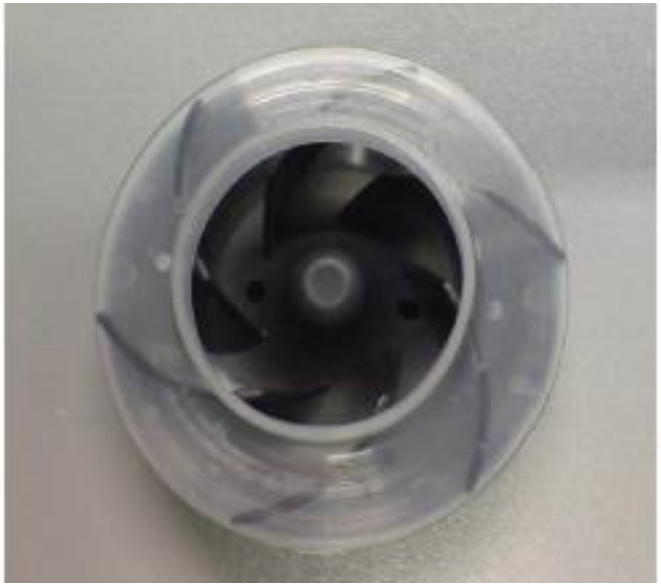
Biomedical material with hidden defects

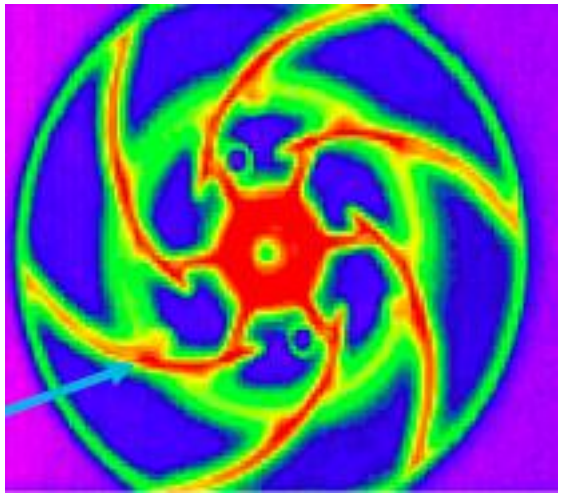
THz images

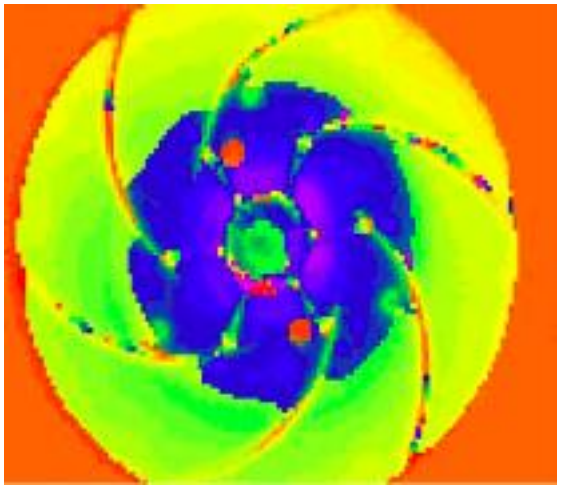




THz Imaging in Plastic Welding







Applications: THz Imaging

- Small changes in the density of dielectrics, polymers, ceramics can be detected (credit card imprint)

COSIT-EU (2012-2013)

Compact High Brilliance Single Frequency Terahertz Source

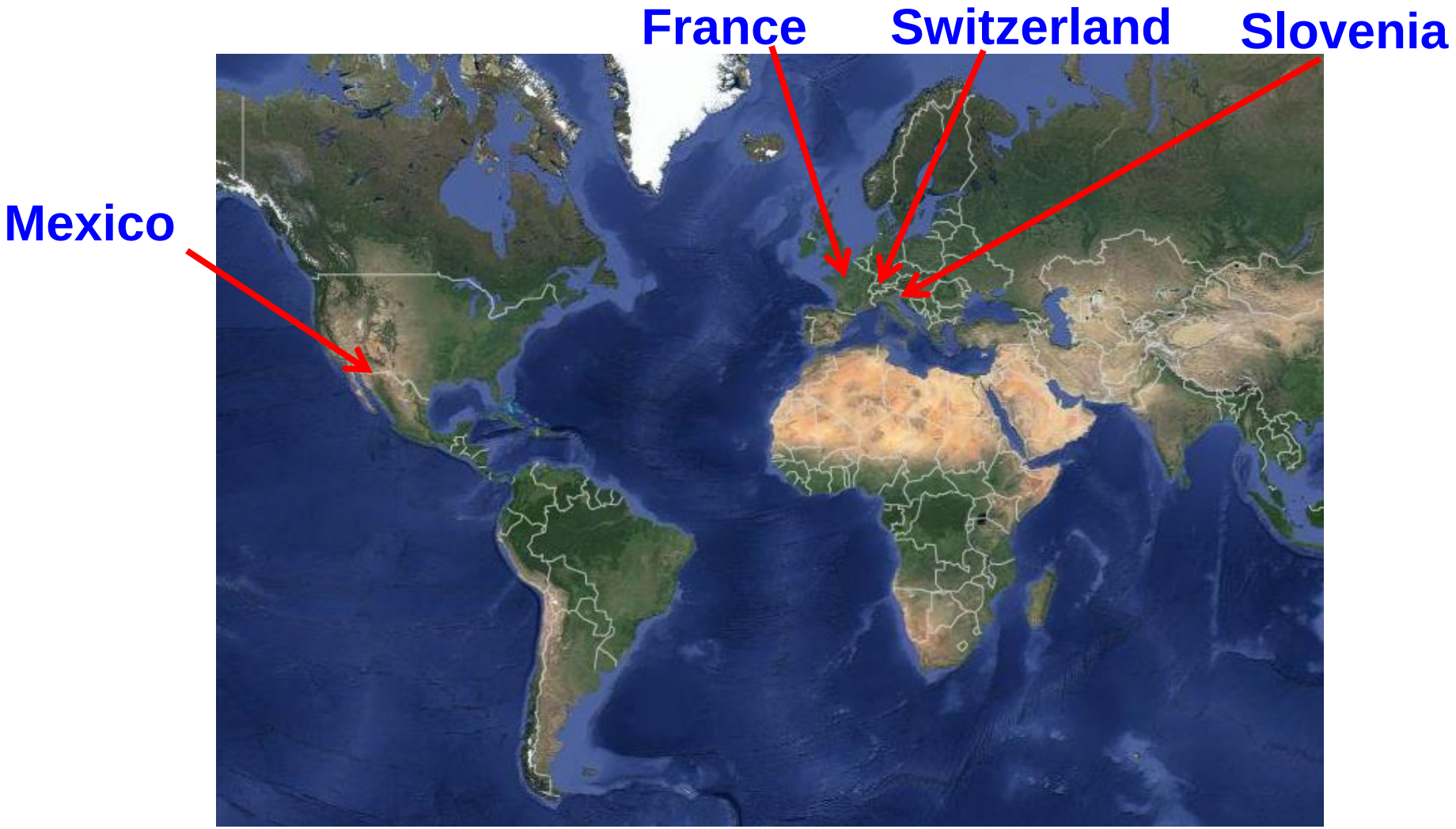
Main objectives:

- New all solid state TWIN wavelength laser
- Lower cost, high reliability in industrial environment
- Compact
- Turn-key operation
- Higher THz power leading to faster evaluation/ determination of defects, dangerous goods, etc..

COSIT-EU (2012-2013) - Partners

Rainbow Photonics	**CH**	THz generators, THz sources and coordination
UNIVERSITÉ DE LORRAINE	**F**	New detection approach
Institut "Jožef Stefan" Ljubljana, Slovenija	**SI**	Laser development and THz generation
CICESE	**MX**	Laser development

Worldwide Collaboration

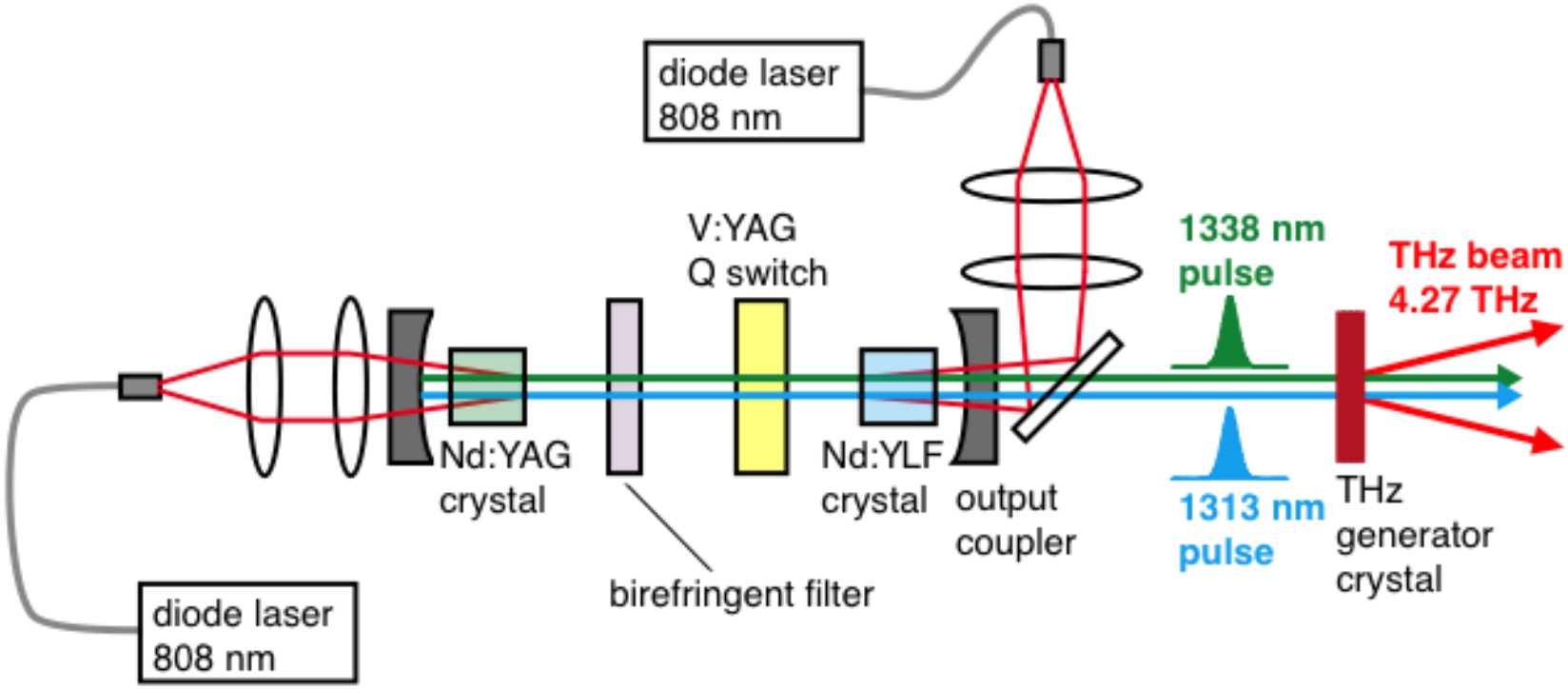


Proposal set-up

Timeline

1. November 15th, 2010: contact to potential partners, discussion of the idea, preparation of first draft
2. November 30th, 2010: submission of short proposal
3. February 23, 2011: invitation to write the full proposal
4. May 3, 2011 submission to Euresearch inputs received on May 12, 2011
5. May 17, 2011. Proposal submitted to EU
6. Notice of eligibility on September 1, 2011
7. Negotiation started September 2, 2011
8. January 1, 2012 COSIT starts, kick-off meeting January 12, 2012

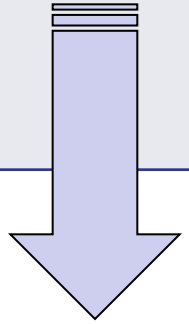
COSIT: Single Frequency THz Source



Major Achievements - COSIT

Component design	Technology development	Benchmark validation
Improved THz generators	Dual-wavelength laser	Component for new THz sources
New THz structures	New unique THz sources	Non destructive testing of polymers and plastics
New filters for THz technology		Thickness control

New product



New product, further development

Outlook

THz technology is ideally suited for :

- Detection of special chemicals, drugs,
- Industrial materials testing of defects in polymers, ceramics, etc..
- Gas sensing

Future:

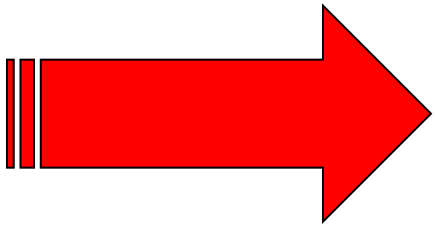
- Industrial systems for non destructive testing (biomedical, automotive, ceramics)
- Thickness monitoring of industrial plastic foils, paper production etc…

EU- projects funding is a useful tool for the technological development of SME's

Acknowledgments

Thanks to:

- Nonlinear Optics Lab. ETHZ: Prof. P. Günter
- European Commission:
  (Future Emerging Technologies Program)
- Euresearch



for valuable support and advice

Past Collaborations-EU Projects

- ETH-Nonlinear optics laboratory: Prof. P. Günter

- NAIS-EU: "Information Society Technologies-**N**ext Generation **A**ctive **I**ntegrated Optic **S**ubsystems" (2001 – 2004).
- BRIGHT-EU: "Wide Wavelength Light for Public Welfare_ High-**Brig**htness Laser Diode Systems for **H**ealth, **T**elecom and **E**nvironment **U**se" (2004 – 2006).
- BRIGHTER-EU: "World Wide Welfare: High-**BRIGHT**ness Semiconductor las**ER**s for g**E**neric **U**se". (2006 – 2009).

Past Collaborations-EU Projects

- MUTIVIS-EU : "**MU**ltiS**s**pectral terahertz, **I**nfrared, visible imaging and **S**pectroscopy". (2008 – 2011)
- SOFI-EU: **"S**ilicon-Organic hybrid **F**abrication platform for **I**ntegrated circuits". (2010-2012)
- COSIT-EU: "**CO**mpact High Brilliance **SI**ngle Frequency **T**Hz Source". (2012-2013).

  Rainbow Photonics as coordinator.