FIBRES OPTICS & COMPONENTS

LASERS & AMPLIFIERS

SPECTROSCOPY & SYSTEMS

ELECTRONICS & SOFTWARE

EDUCATIONAL KITS

CUSTOM & NEW PRODUCTS

LASERS AND FIBRES OPTICS TECHNOLOGIES

Refimeve+

Metrological Fibre Network at European Vocation

May 28th, 2013

Kick-off meeting de REFIMEVE+

Réseau Fibré Métrologique à Vocation Européenne

Patrice LE BOUDEC / Tristan ALLAIN

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FIBRES OPTICS & COMPONENTS

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About the company

LASERS AND FIBRES OPTICS TECHNOLOGIES

- **1995** : creation of **IDIL Fibres Optiques**.

- An **engineering company** specialized in the **design, development**, **manufacturing** and **distribution** of **fibered systems and solutions** : fiber optics, passive and active optical components, fiber lasers, opto-electronics and software control.

- A leader company on the French optical fibers and lasers technologies market which is also involved in many international far-reaching projects.

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Business fields

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Fibers optics & Components

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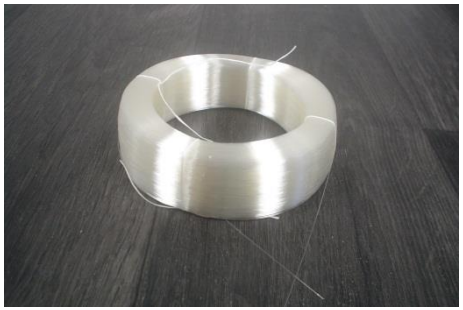
• ***Experience and high-quality engineering in the field of fiber optics and both passive and active optical components***.

► Fiber optic integration.

► Ability to work with any type of optical fiber (ordinary and special fibers: SM, MM, PM...) → splicing; polishing; micro-machining; cliving.

► Know-how as regards connectorization from all types of connectors (FC; LC; SC; SMA; MU; E2000…).

► Patchords assembly and pigtailing.



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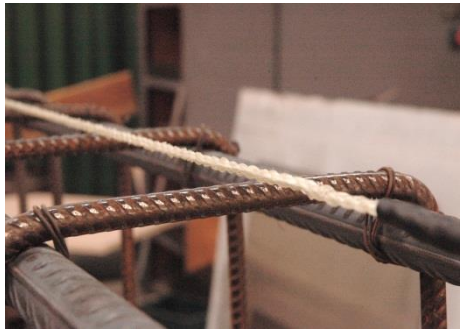
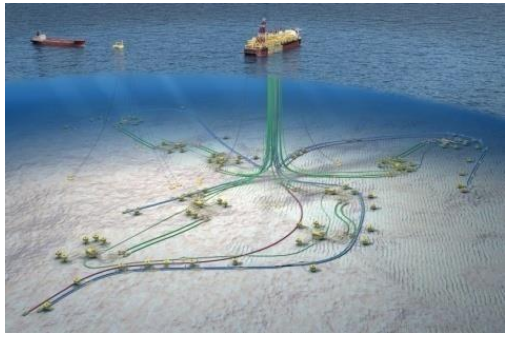
- ***Expertise concerning design and manufacturing of optical sensors***.

► **IDIL Fibres Optiques** has been involved in numerous far-reaching collaborative projects.





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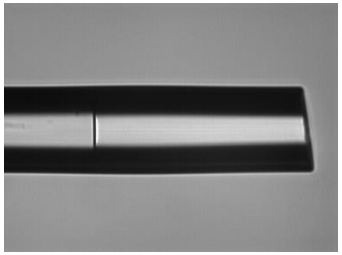
Fibers optics & Components

- ***Know-how and flexibility as regards specific customized fiber optics components***.

► Our concern : meeting exactly customers ‘requirements.
► A wide range of customized fiber optics components.

▪ Collimating or focusing lens systems

▪ Lensed fibers



▪ Optical fiber spools

FIBRES OPTICS & COMPONENTS

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Fibers optics & Components

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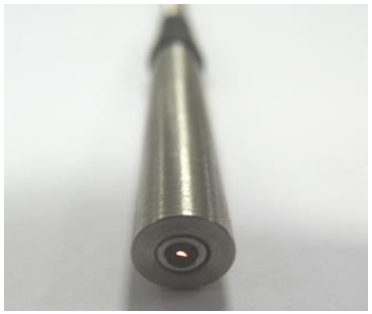
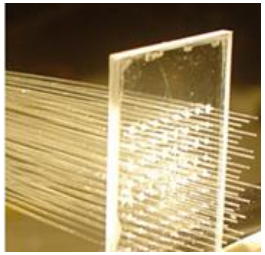
- ***Know-how and flexibility as regards specific customized fiber optics components***.

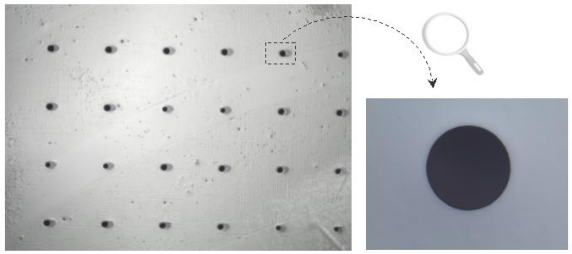
▪ Optical bundles



▪ Variable optical attenuators

▪ 2D Fiber arrays





▪ Optical delay lines

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LASERS & AMPLIFIERS

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Lasers & Amplifiers

LASERS AND FIBRES OPTICS TECHNOLOGIES

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• ***Design, development and manufacturing of fiber laser systems***.

► **Qualification** of **all parameters** of lasers.

► Realization of simple and complex **laser sources** which lead to numerous applications (science, industry, defence).

► **IDIL Fibres Optiques** has been involved in ambitious collaborative projects.

► Partnership with the CEA (the French Alternative Energies and Atomic Energy Commission).

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LASERS & AMPLIFIERS

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Lasers & Amplifiers

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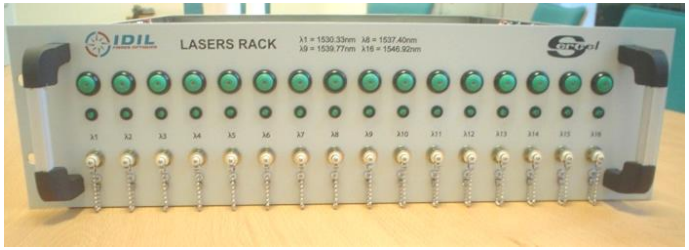
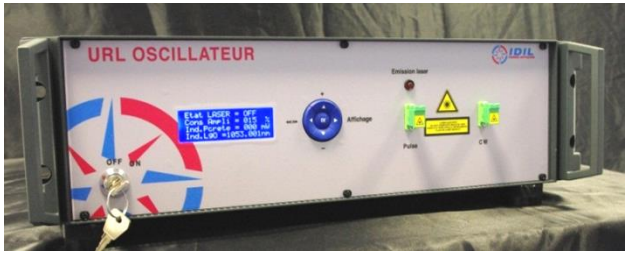
FIBRES OPTICS & COMPONENTS | LASERS & AMPLIFIERS | SPECTROSCOPY & SYSTEMS | ELECTRONICS & SOFTWARE | EDUCATIONAL KITS | CUSTOM & NEW PRODUCTS

- Fiber lasers
- Front end sources
- Fiber amplifiers
- ASE optical sources
- Customized lasers (fs; ps; ns)
- Special wavelength : 1550 and 1000 nm





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ELECTRONICS & SOFTWARE

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• ***Global solutions in the field of electronics and software***.

► **Design** of **electronics boards** combined with optical equipments.

► **Development of GUI systems** intended for **opto-electronic applications**.
→ Our software modules enable remote control, data retrieval and processing.
→ Our embedded software made from micro-controllers allows calculation of complex functions.

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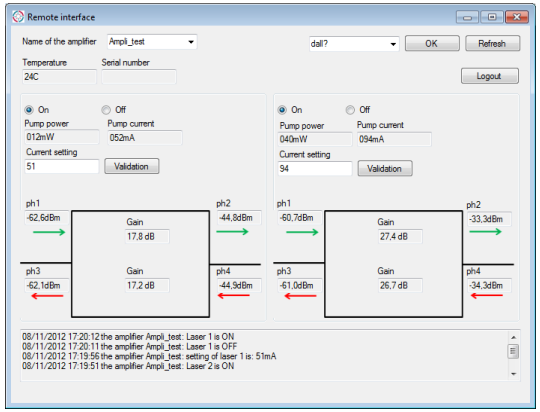
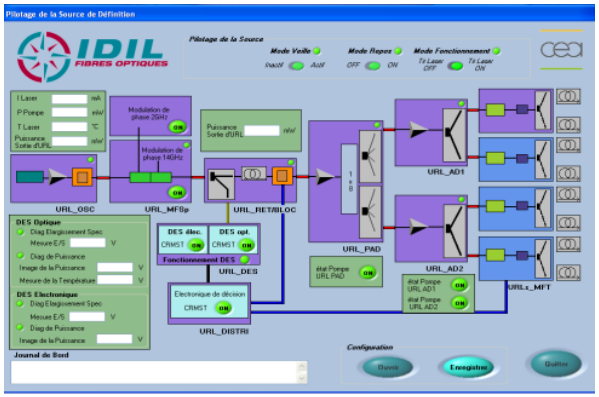
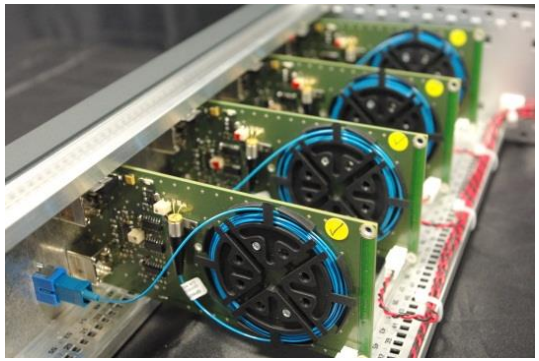
- Remote interface intended for bi-directional amplifier.



- Front end definition source monitoring software.



- Electrical-optical synchronization converter.



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EDUCATIONAL KITS

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Educational kits

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• ***Development of a series of didactic products intended for teaching in the fields of fiber optics and telecommunications technologies***.

► Fibered educational kits supplied by **IDIL Fibres Optiques** can be used by students in the context of practical works, in technical schools and colleges of engineering.

► Understanding of fundamental principles of physics, analysis of complex physical phenomena, realization of some experiments.

► **IDIL Fibres Optiques** was given the **Arnulf-Françon Prize** from the French Optical Society in 2005 thanks to its educational kits.

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Educational kits

• ***Some examples of educational kits***.

► Fiber optic Telecommunications kit, Erbium doped fiber amplifier and fiber laser kit, Optical spectrum analyzer, Fiber optic reflectometry kit, Fiber Optic interferometry kit…

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Custom & New products

- ***Some seminal projects***.

▪ **The French Megajoule Laser project.**

► Re-creating in the laboratory, thermodynamic conditions which are similar to those of fusion energy.
► Partnership between the CEA and **IDIL Fibres Optiques**.

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LASER MÉGAJOULE

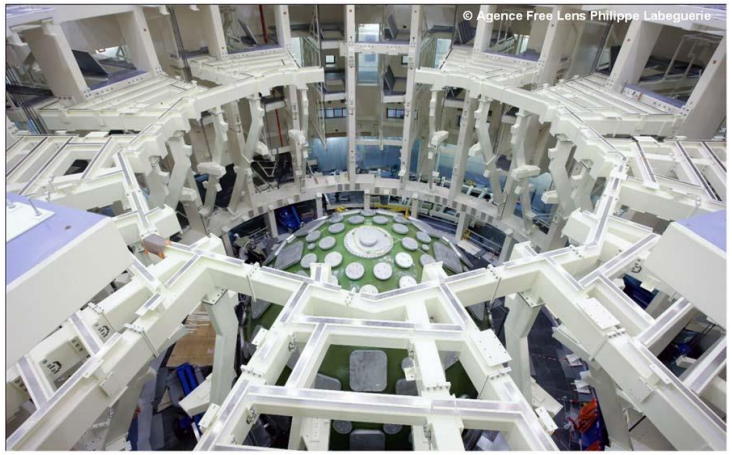

Image: CEA

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Custom & New products

▪ **The European XFEL project: high intensity fiber laser source.**

European XFEL

► Producing **high intensive and short light pulse** in the frequency field of X-rays in order to create original scientific observation ability.

► **IDIL Fibres Optiques** manufactured **fiber front end sources** which provide **sub-picoseconds duration pulse**.

Issues → varying the repetition rate while maintaining synchronization.
→ producing up to 60 micro-joules pulse.

laser Impulse

Custom & New products

▪ **The European HIPER project: High Power laser Energy Research facility**.

► Collaboration with the British Rutherford Appleton Laboratory.

► **Issue**: defining the path to the production of secure, sustainable and affordable energy with low environmental impact based on fusion driven by lasers.

► **IDIL Fibres Optiques** provided a **specific front end laser.**

HiPER
Laser energy for the future

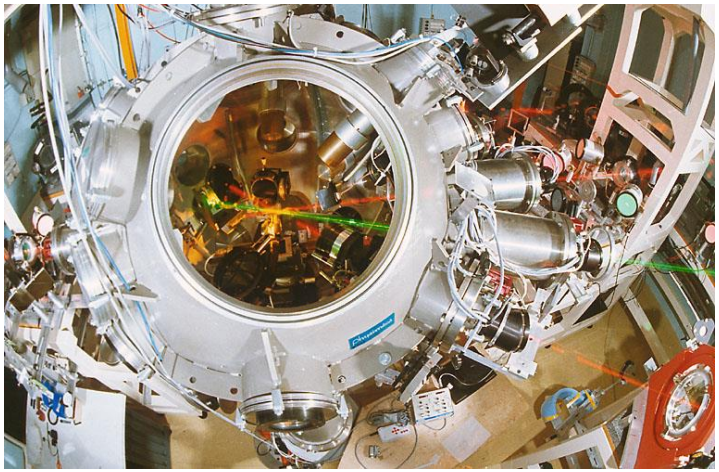

Image: CNRS

Custom & New products

- **The Photonic Doppler Velocimetry system**.

► **IDIL Fibres Optiques** developed **the first industrial photonic Doppler Velocimeter** for **shock and detonic applications**.
► **Measurement** of unique or multiple **speeds** in the range of **0 to 20 km/s** with an excellent temporal resolution.
► Dedicated processing software based on a Fourier Transform algorithm.
► This innovative system was awarded by the '**Photon d'argent** ' **Prize** of the French Optical Society in 2009.
►CEA license product.

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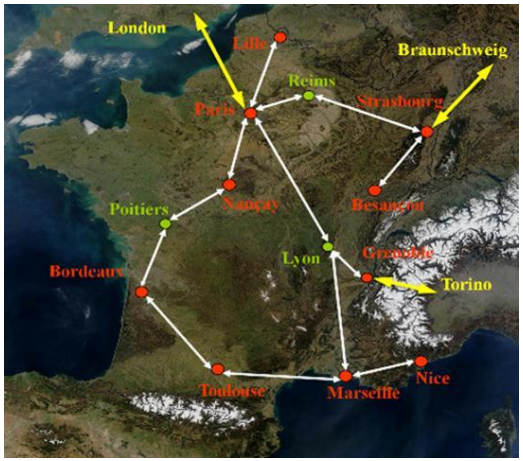
Custom & New products

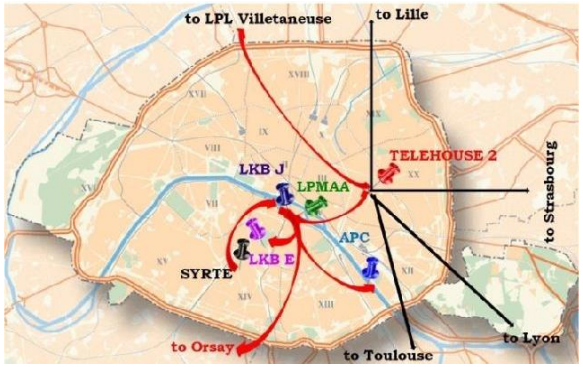
▪ **The REFIMEVE + project: Metrological fibered network with a European vocation**.

► A project selected within the framework of the second round of **Equipex** invitation to tender, in **2011**.

► **Ultra-stable optical frequency** coming from an **atomic source** situated in the SYRTE (Time-Space Reference Systems laboratory, Paris) and using the RENATER fibered internet network.

► Creation of a **unique and huge experimentation loop** in Europe.





Images: LPL

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Custom & New products

▪ **The REFIMEVE + project: Metrological fibered network with a European vocation.**

► **IDIL Fibres Optiques** is responsible for **manufacturing** the necessary **fittings** in order **to spread the network**.

► **Key role** of **IDIL Fibres Optiques** in the **technology transfer** that is following the project :

→ Realization of **system industrialization**.
→ Ensuring that **equipments** will meet **solidity and durability criteria** with their future use in mind.

Refimeve+
Metrological Fibre Network at European Vocation

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IDIL and REFIMEVE+

2001 → 2013

Refimeve+

A collaboration of more than 12 years:

2001: First collaboration between IDIL and the OBSPM: patchcords, pigtails, components….

2013: Development of the next metrological network.

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IDIL and REFIMEVE+

Refimeve+

2001 — **2005** — **2007** — 2013

2005: Development of the first bidirectionnal amplifier.

Since the network had to be compensated, the signal had to come back the same way it left, so the standard commercial amplifiers were no more usable in the link.
IDIL developped a bi-directionnal amplifier in order to allow the signal to come back in the same fiber.

2007: Introduction of the OADM filters in the system.

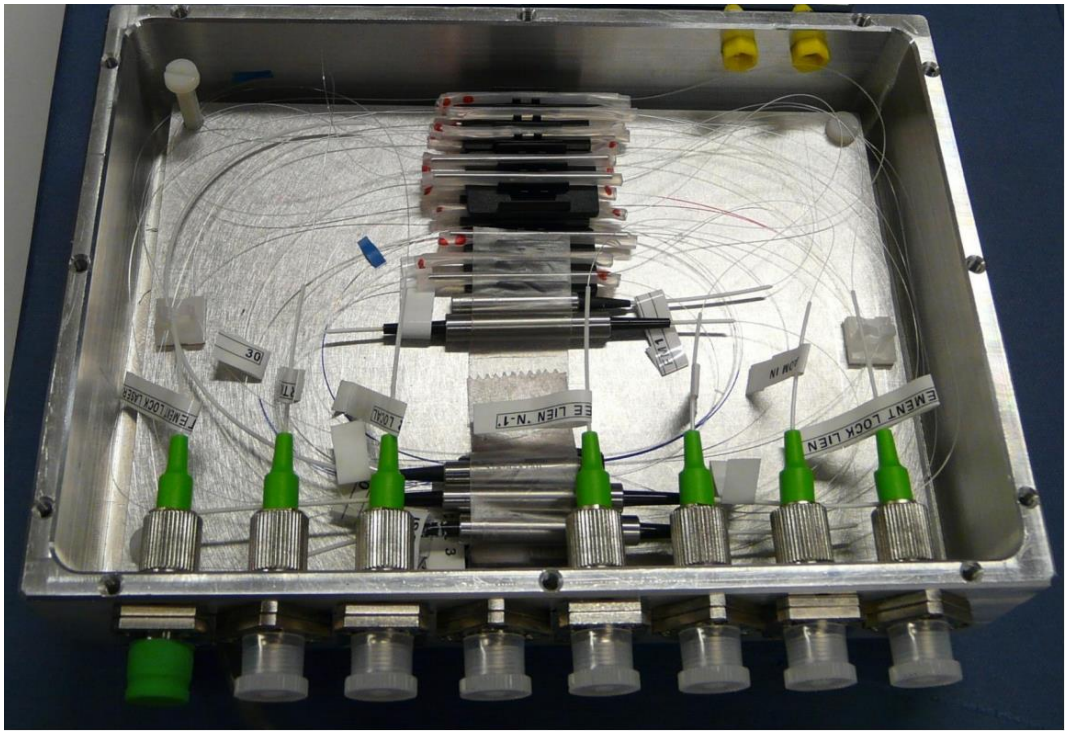
As the metrological signal will propagate through a network with trafic and adjacent frequencies, it was necessary to have good filters to add and drop the signal.

IDIL and REFIMEVE+

Refimeve+ .

2001 — 2005 — 2007 — **2009** — 2013

2009: First assembly of the interferometer
IDIL made the assembly of all the passive fibered components according to the scheme supplied by the LPL where the optical paths are critical.



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IDIL and REFIMEVE+

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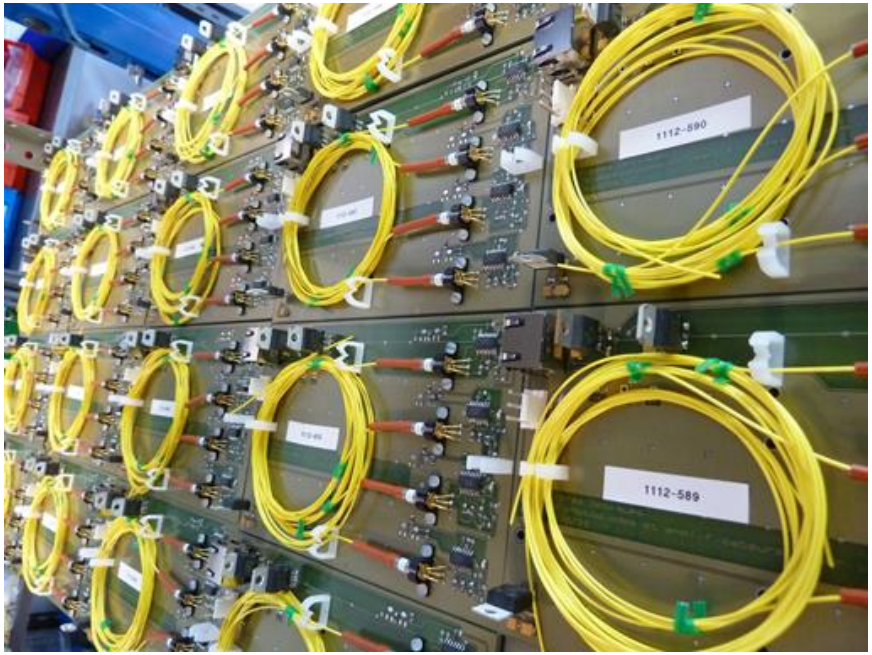
2001 2005 2007 2009 **2010** **2011** 2013

2010: First attempt to the EQUIPEX call.

In September 2010, IDIL supported the LPL in the answer of the EQUIPEX call as a partner.

2011: Second attempt:

SUCCESS



IDIL and REFIMEVE+

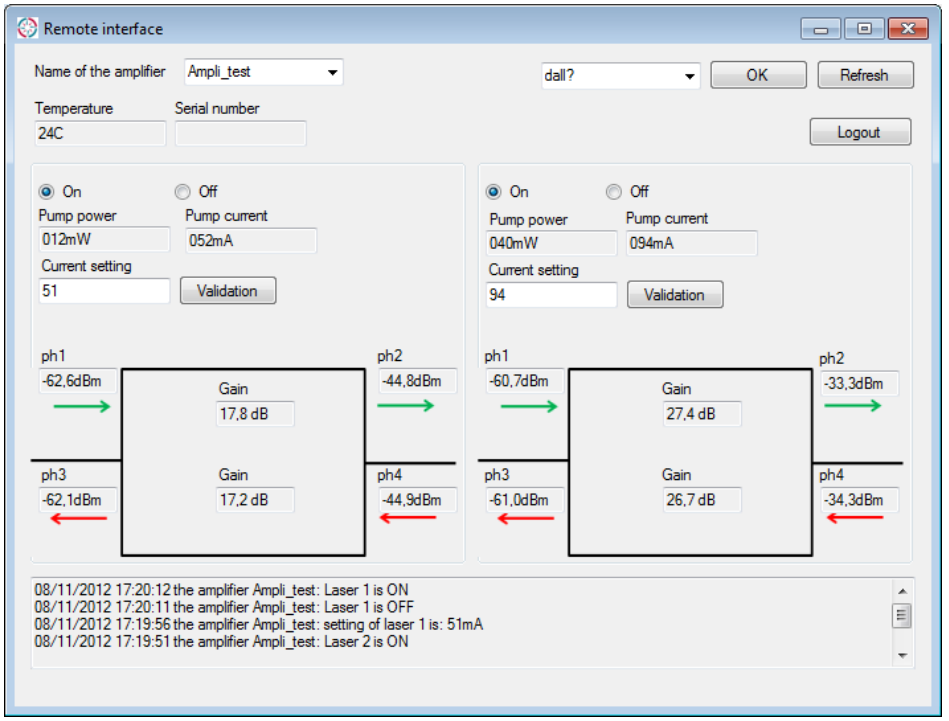
Refimeve+

2001 — 2005 — 2007 — 2009 — 2010 — 2011 — **2012** — 2013

2012: IDIL hired a R&D engineer fully dedicated to REFIMEVE+

Development of the communication via the GSM network.

As the amplifiers will be installed allong the network and since we can not use the monitoring channel of the commercial equipment, REFiMEVE had to have its own way to communicate with its equipement.



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CUSTOM & NEW PRODUCTS

IDIL and REFIMEVE+

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Refimeve+ .

2001 2005 2007 2009 2010 2011 **2012** **2013**

2012/2013: The European dimension of REFIMEVE+ already exists for us. IDIL has delivered 13 bidirectionnal amplifiers to the INRIM and the LENS in Italia.

INRiM ISTITUTO NAZIONALE DI RICERCA METROLOGICA

STUDIORUM UNIVERSITAS FLORENTINA

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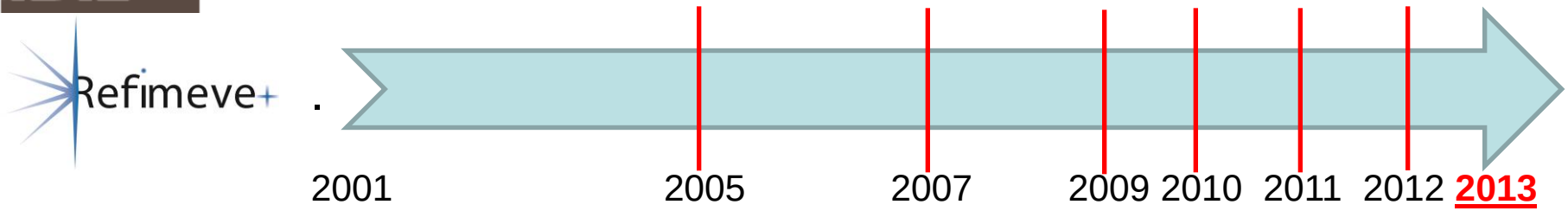
IDIL and REFIMEVE+



2013: IDIL started the development of the emission/reception stations.

May, 27-28th: Kick off meeting.

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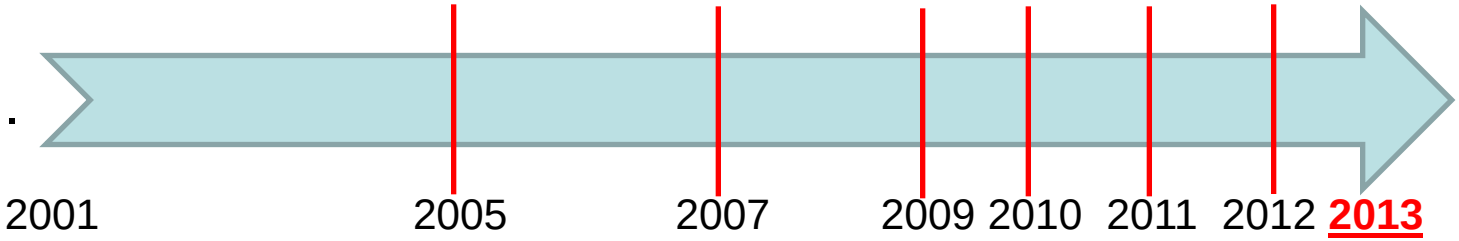
Refimeve+ .



Futur: Thanks to its know-how IDIL can provide different solutions to the final users to support them in managing the optical signals:

⇒ Final amplifier
⇒ Power spliters
⇒ Isolators
⇒ High quality connectors and patchcords….

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LASERS AND FIBRES OPTICS TECHNOLOGIES

Thank you for your attention.

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Production/Project manager

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