



Engineering science, computer science  
and imaging laboratory

# ICube



Science and innovation at the heart of ICube

CREATED IN 2013, THE LABORATORY BRINGS TOGETHER THE RESEARCH STRENGTHS OF THE UNIVERSITY OF STRASBOURG IN THE FIELDS OF ENGINEERING SCIENCE AND COMPUTER SCIENCE, WITH IMAGING AS THE UNIFYING THEME. THE MAIN AREAS OF APPLICATION ARE BIOMEDICAL ENGINEERING, ENVIRONMENT AND SUSTAINABLE DEVELOPMENT.

WITH OVER 450 PEOPLE, ICUBE IS A MAJOR DRIVING FORCE FOR RESEARCH IN STRASBOURG.

## Scientific excellence

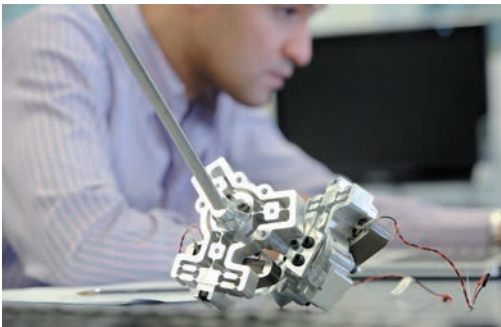
The State-funded *Investissements d'Avenir's* call for projects proved to be highly successful for the laboratory.

ICube...

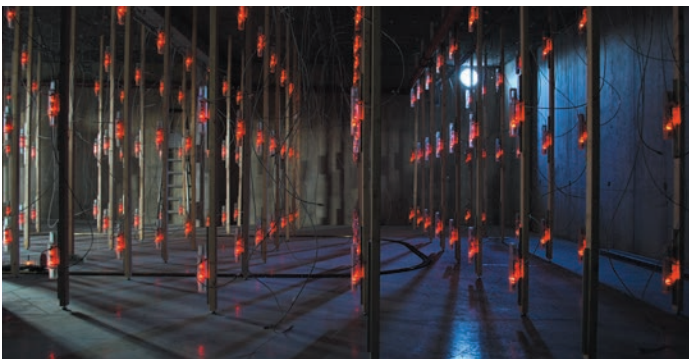
... houses Robotex and FIT, 2 platforms of excellence (part of the *Equipex* research grant program), dedicated to medical robotics and the internet of things respectively. ICube is also a partner of Equip@Meso, an *Equipex* on scientific computing.

... is member of 3 laboratories of excellence (*Labex*) - IRMIA, CAMI and G-Eau-Thermie - in theoretical computer science, medical robotics and geothermal energy respectively.

... is the main scientific partner of the *Institut Hospitalo-Universitaire* (IHU) in minimally invasive image guided surgery and also belongs to 2 Institutes of Excellence for carbon-free energies (IEED) in the field of solar energy (PVF and INES2).



Equipex Robotex: Cardiolock, an active cardiac stabilizer

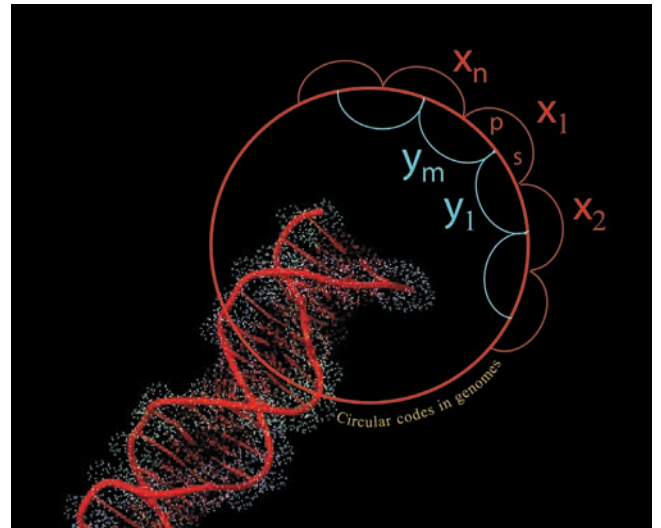


Equipex FIT: Network and Internet of Things platform

## Transversal research programs

The laboratory's scientific research program is centered around 5 transversal projects:

- Medical and surgical imaging and robotics
- The environment and sustainable development
- Scientific computing
- Imaging physics and systems
- Material engineering for energy and environmental applications



Circular code in bioinformatics

## A Laboratory at the interface between engineering and information science

ICube provides a unique environment, with 2 research communities working on cutting-edge projects interfacing the digital world and physics.



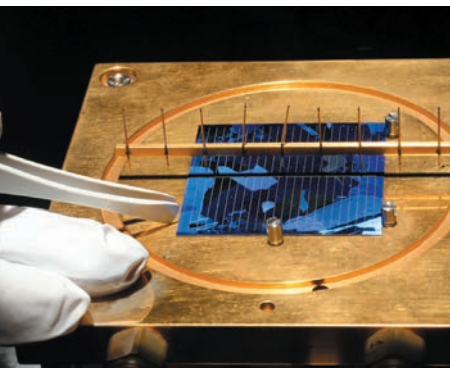
Interventional radiology- MRI

## *Biomedical Engineering and applications*

ICube is set to become a leading laboratory in biomedical engineering. The laboratory has a privileged connection with the medical world thanks to several research teams working within the Strasbourg University Hospital, the Institute of Research against Cancer of the Digestive System (IRCAD) and the Institute of Biophysics (IPB). The exceptional relationship ICube enjoys with the medical world is based on the more than 20 hospital practitioners belonging to the laboratory, working in biophysics, radiology and nuclear medicine, as well as cutting-edge medical imaging and robotics platforms, including 2 MRI machines, a high field small animal MRI scanner, several medical robot prototypes and a fast 3D prototyping system.

## *Environment and Sustainable Development*

ICube scientists are pursuing original research programs in remote sensing, water treatment, civil engineering, geothermal energy and solar energy, thanks to considerable experimental resources (a mobile laboratory for urban bioclimate monitoring, water treatment and flood simulation pilot units, a clean room for photovoltaic material engineering).



Photovoltaic material



Climate monitoring unit



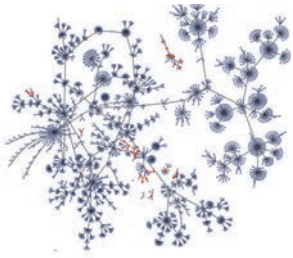
Rain water treatment unit in Ostwald

# 4

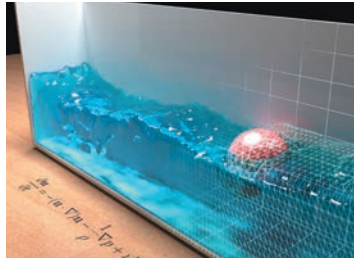
## DEPARTMENTS

### Computer science department

The Computer Science Research Department is made up of 5 teams covering a wide range of areas. It carries out fundamental and applied research in computer science, including next generation internet and networks, the internet of things, computer graphics and geometry, specifications and proofs in geometry, image processing, high-performance scientific computing, compilation, cloud computing, bioinformatics, data mining, knowledge engineering, stochastic optimization and complex systems.



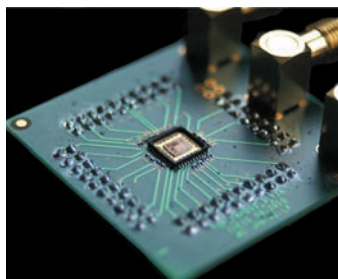
IP Network Graph



Simulation of fluid-solid interactions

### Solid-state electronics, systems and photonics department

The research performed by the 3 research teams of the department covers a wide range of areas, including the physics and technology of elementary devices, the development of photonic and electronic instrumentation systems and innovative processes. The department contributes to the development of knowledge in fields with a high societal impact, such as information technologies (nano-electronic and photonic devices), renewable energies (photovoltaic cells) and medical instruments (integrated instrumentation systems).



CMOS Ultra-fast imaging sensor



Annealing furnace in clean room environment

### Imaging, robotics, remote sensing and biomedical department

The research staff in this department carry out fundamental and applied research in the following areas of information technologies and science: signal and image acquisition and processing, computer vision, control theory, robotics, remote sensing, neurosciences and biophysics. Through its 4 research teams, the department is notably involved in developing new technologies for healthcare (clinical and preclinical medical imaging and robotics), as well as astronomy and observation of the Earth.



Robotic telemanipulation – flexible endoscopy

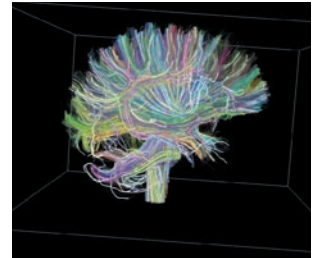


Image processing of the brain

### Department of mechanics

This department comprises 3 research teams. Its research and transfer activities include fluid mechanics (hydraulics, rheology and turbulence), reactive transfers with applications in waste water treatment, biomechanics and the relationship between medical imaging and mechanical properties, the mechanics of multiscale materials and the evolution of their microstructure, civil engineering and its applications in geothermal energy and eco-design.



Tension and compression testing machine



Shock measurement bench

# 14

## RESEARCH TEAMS

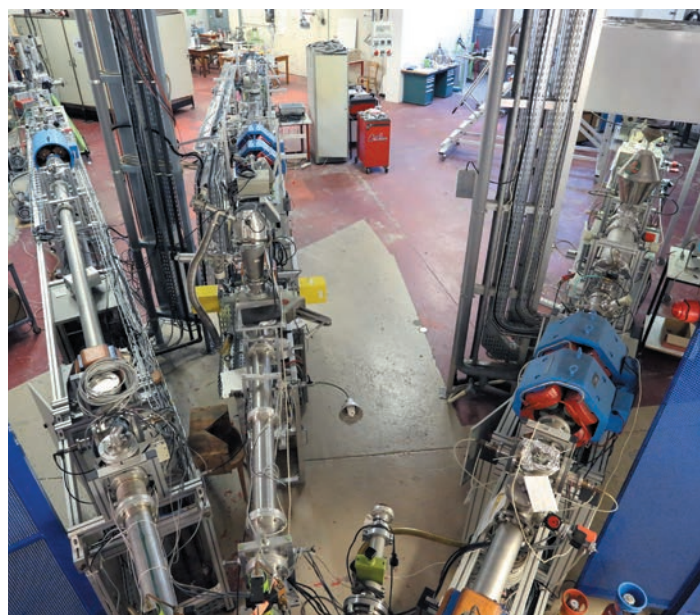
GEOMETRY AND COMPUTER GRAPHICS / NETWORKS / SCIENTIFIC AND PARALLEL COMPUTING / THEORETICAL BIO-INFORMATICS, DATA MINING AND STOCHASTIC OPTIMIZATION / MODELS, IMAGES AND VISION / CONTROL, VISION AND ROBOTICS / REMOTE SENSING, RADIOMETRY AND OPTICAL IMAGING / INTEGRATIVE MULTIMODAL IMAGING IN HEALTH-CARE / MATERIALS FOR PHOTOVOLTAIC AND ELECTRONIC DEVICES/ HETEROGENEOUS SYSTEMS AND MICROSYSTEMS / PHOTONICS INSTRUMENTATION AND PROCESSES / FLUID MECHANICS / MULTISCALE MATERIALS AND BIOMECHANICS / CIVIL ENGINEERING

### Experimental platforms

The experimental and software platforms are managed by the research teams and the departments. They are used for research purposes as well as for industrial transfer activities. They are also available for contractual work in the following areas: networks, data mining, massively parallel artificial evolution, digitization, geometric modeling, virtual reality, in-vivo imaging, medical image processing, medical robotics, interventional radiology, polarimetric imaging, urban bio-climatology, 3D urban models, optical instrumentation and microscopy, holography, technologies for organic and inorganic devices, characterization of materials and devices, microelectronic testing and design, biomechanical modeling, hydraulics, civil engineering, etc.



3T MRI scanner



Ion beam accelerator

# Partnerships

## Working closely with industry

Over the past 5 years, the laboratory researchers have developed partnerships (through research contracts and consulting activities) with over 100 SMEs, mid-cap companies and major national and international groups.

The laboratory is a member of the *Carnot Télécom & Société numérique* institute, thanks to its close relationship with *Télécom Physique Strasbourg*.



ICube is involved in a number of collaborative industrial projects in the *Alsace Biovalley*, *Energivie*, *Hydreos* and *Véhicule du futur* competitive clusters.

The laboratory also works closely with SERTIT, the Strasbourg regional image processing and remote sensing service and the IREPA LASER laser-processing centre.

## Scientific partnerships

In the field of information science, ICube enjoys a close relationship with INRIA, whose CAMUS project team works within the laboratory, and with the *Institut Mines-Télécom*, mainly through the *Futur & Ruptures* program.

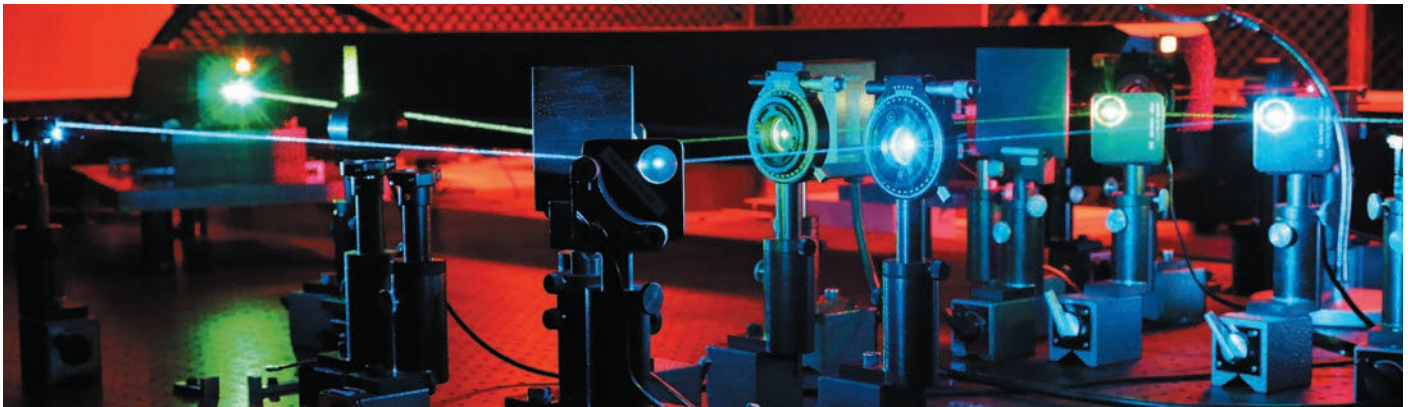


In the biomedical field, ICube works in close partnership with:

- the Strasbourg University hospital through a shared MRI platform in the interventional radiology department of the city's new hospital.
- IRCAD, the Institute of Research against Cancer of the Digestive System, which houses the laboratory's medical robotics research team and its experimental platforms.
- the Faculty of Medicine, by being an active member of Strasbourg translational research federation.



The laboratory is partner of PMNA, the regional pole of excellence about material sciences.



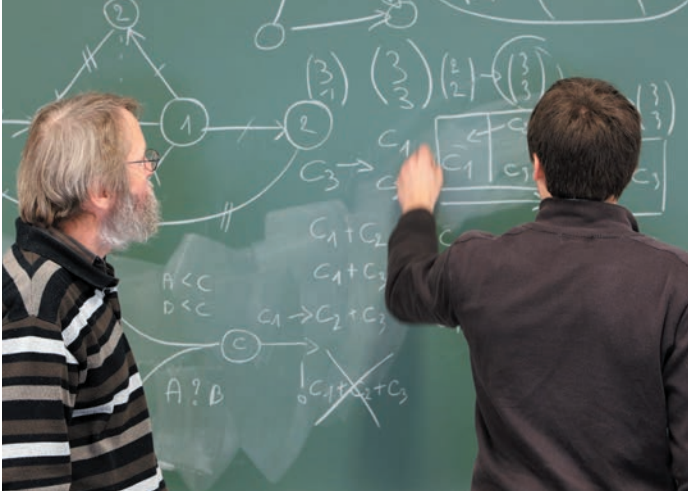
Mixed laser beams for polychromatic holography

## Researchers open to the world...

The researchers in the laboratory have developed collaborative work with close to 200 laboratories worldwide during the past 5 years.



# Researchers dedicated to teaching



ICube is the main research laboratory for Strasbourg's 4 engineering schools: *Télécom Physique Strasbourg*, INSA of Strasbourg, ENGEES, and *ECAM Strasbourg-Europe*.

ICube is the main laboratory for the teaching staff in computer science, engineering science and biophysics affiliated to the Mathematics and Computer Science Faculty (UFR), the Physics and Engineering Faculty (UFR), the Faculty of Medicine, as well as the Haguenau, the Robert Schumann and the Louis Pasteur University Institutes of Technology (IUT).

ICube is the supporting laboratory for the Computer Science Masters at the Mathematics and Computer Science Faculty, the Imaging, Robotics and Biomedical Engineering (*IRIV*) Masters at *Télécom Physique Strasbourg* and the Engineering Science (*SPI*) Masters at the Physics and Engineering Faculty. It provides training through research projects for more than 100 trainees and PhD students each year.

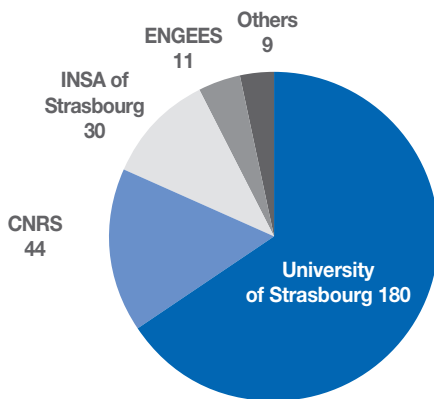
# ICube laboratory key figures

## Staff

The members of ICube numbered 454 on January 1<sup>st</sup> 2013, with:  
274 permanent members including 55 Full Professors, 143 Assistant or Associate Professors, 8 Research Directors, 12 Researchers, 45 Engineers and 11 Technicians, with 20 Hospital Practitioners among the researchers and faculty staff.

180 non-permanent members including 144 PhD students, 16 Postdocs and 20 staff members with limited-term appointments

Employers of the permanent staff



## Doctoral theses

100 researchers and faculty staff have the *Habilitation à diriger des recherches* diploma

36 PhD Diplomas were awarded in 2012

## Scientific publications

19 book chapters

164 peer reviewed international journal publications

15 peer reviewed national journal publications

183 publications in the proceedings of international conferences

## Patents

4 patent applications in 2012

12 active patents

## International collaborations

193 active scientific collaborations with foreign researchers in the past 5 years with 129 collaborations having produced joint publications

## Industrial partnerships during the past 5 years

83 national industrial partners:

Renault, AREVA, ARKEMA, SNCF, Suez Environnement, EDF, 6Wind, Telmat, Orange, Alenia Space, Framatone, Blédina, Veolia Environnement, Alcatel-Lucent, Photowatt, Total, EADS, CSG, STMicroelectronics, Hutchinson, SOCOMEC, Schiller Medical, Schlumberger... to cite but a few.

30 international industrial partners:

Novartis, Daimler, Volkswagen, General Electric, Dynamore, Holcim, Merck-Millipore, Roche, Karl Storz Medical, Cisco, Siemens, Merck-Serono, TransMedics, Montena, Novelis, Suntech, Corning, ON-Semiconductor, Lilly, KETEK, Infineon/Intel, Ela Medical, Hydac, General Motors... to cite but a few.

Startups:

Axilum Robotics, Bluejimp.

## Research grants

95 active contracts in 2012 totaling 25.5 M€:

- 14 European projects for 3 M€
- 34 grants from *Agence Nationale de la Recherche* for 12.3 M€
- 31 industrial contracts for 1.7 M€
- 16 other contracts for 8.5 M€

32 contracts started in 2012 totaling 9.5 M€:

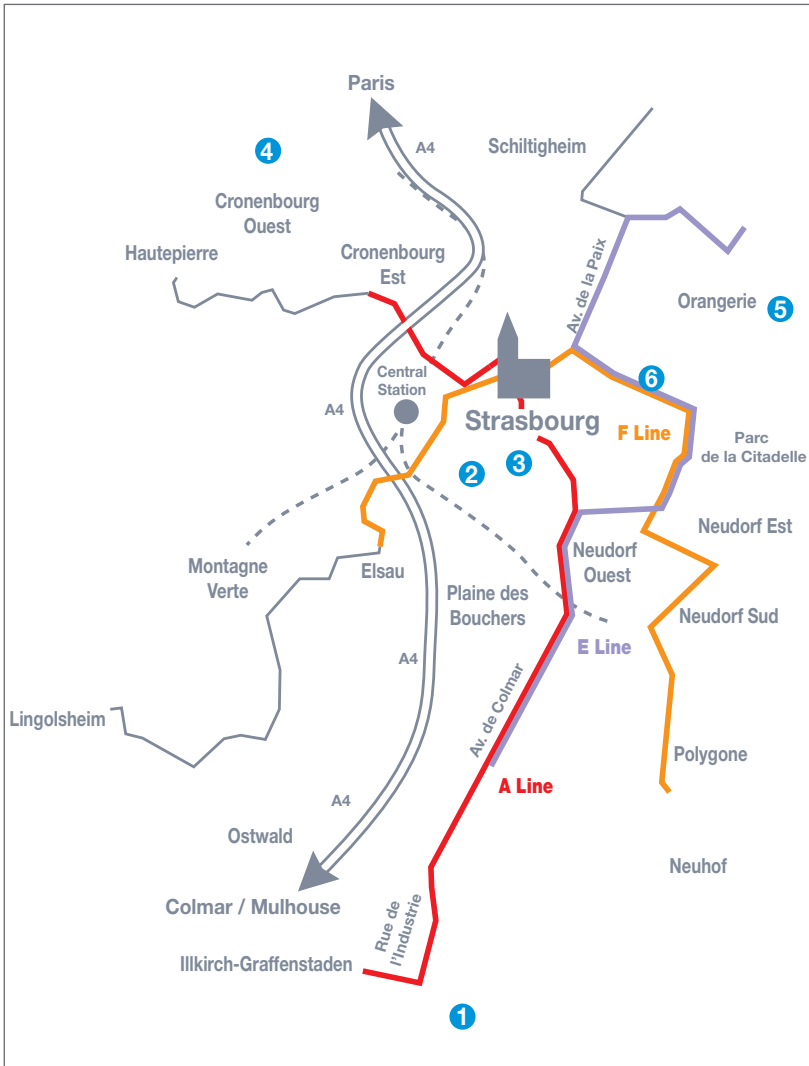
- 6 European projects for 0.75 M€
- 9 grants from *Agence Nationale de la Recherche* for 7.8 M€
- 9 industrial contracts for 0.3 M€
- 8 other contracts for 0.6 M€

2013 operating budget: 0.9 M€

2013 overall budget with research grants, permanent staff salaries and non-permanent staff scholarships: 28 M€







### Imaging, robotics, remote sensing, and biomedical department (D-IRTS)

- 1 Models, images and vision (MIV)
- 1 2 Control, vision and robotics (AVR)
- 1 6 Remote sensing, radiometry and optical imaging (TRIO)
- 1 3 Integrative multimodal imaging in healthcare (IMIS)

### Computer science department (D-IR)

- 1 Geometry and computer graphics (IGG)
- 1 Scientific and parallel computing (ICPS)
- 1 Theoretical bio-informatics, data mining and stochastic optimization (BFO)
- 1 Networks (R)
- 1 Models, images and vision (MIV)

### Solid-state electronics, systems, and photonics department (D-ESSP)

- 1 4 Materials for photovoltaic and electronic devices (MaCEPV)
- 1 4 Heterogeneous systems and micro-systems (SMH)
- 1 4 Photonics instrumentation and processes (IPP)

### Department of mechanics (D-M)

- 5 Multi-scale materials and biomechanics (MMB)
- 5 6 Fluid mechanics (Mécaflu)
- 1 6 Civil engineering (GC)

## Addresses of the different sites

1



ICube laboratory - UMR 7357  
Télécom Physique Strasbourg  
300 bd Sébastien Brant  
BP 10413  
67412 Illkirch Cedex  
France

2



ICube laboratory - UMR 7357  
IRCAD  
Hôpitaux Universitaires  
1 place de l'Hôpital  
67091 Strasbourg Cedex  
France

3



ICube laboratory - UMR 7357  
Institute of Biophysics (IPB)  
Faculté de Médecine  
4 rue Kirschleger  
67085 Strasbourg cedex  
France

4



ICube laboratory - UMR 7357  
23 rue du Loess  
BP 20 CR  
67037 Strasbourg Cedex 2  
France

5



ICube laboratory - UMR 7357  
2 rue Boussingault  
67000 Strasbourg  
France

6



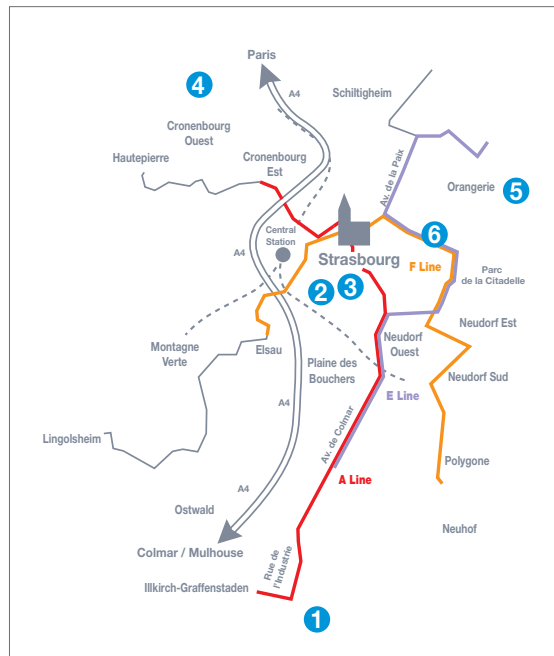
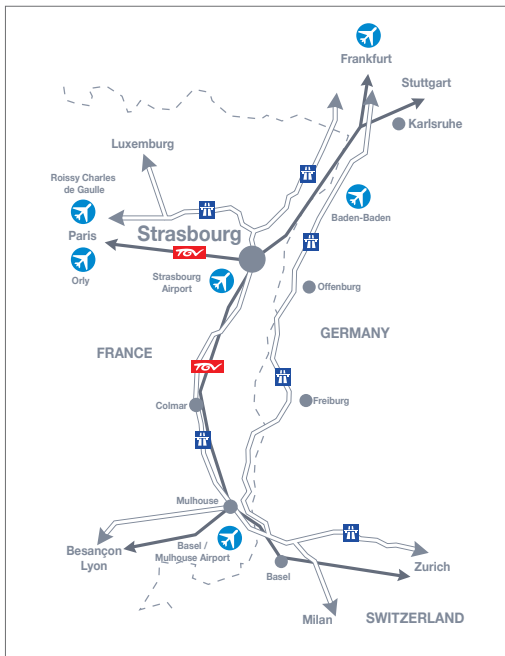
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<http://icube.unistra.fr>

ICube is a joint research laboratory, administrated by the University of Strasbourg, the CNRS, ENGEEES and INSA of Strasbourg.



ICube is a multi-site research laboratory:

- 1 Télécom Physique Strasbourg, in Illkirch
- 2 IRCAD in the *Hôpital Civil*
- 3 Institute of Biophysics (IPB), in the *Hôpital Civil*
- 4 Cronenbourg campus
- 5 Facilities, *rue Boussingault*
- 6 INSA of Strasbourg

## Getting to Télécom Physique Strasbourg (main office)



Take the A35 highway and come off at exit 5, marked Illkirch Nord, Baggersee. Go straight over the Baggersee crossroads (traffic lights) and down Alfred Kastler road. When reaching the roundabout, take the 4<sup>th</sup> exit, marked *Parc d'Innovation (bd Sébastien Brant)*. The *Télécom Physique Strasbourg* car park is on the left.



Take tram A towards Illkirch, from the main railway station and get off at the *Campus d'Illkirch* stop.



There is a train every 15 minutes from Entzheim airport to Strasbourg railway station. From there, take the tram, as indicated above.

