From Open Science to Open Innovation

the ATTRACT Initiative

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Two simple observations

European Research Infrastructure

European Industry

two different and somehow independent planets ?

Two simple observations

European Research Infrastructure

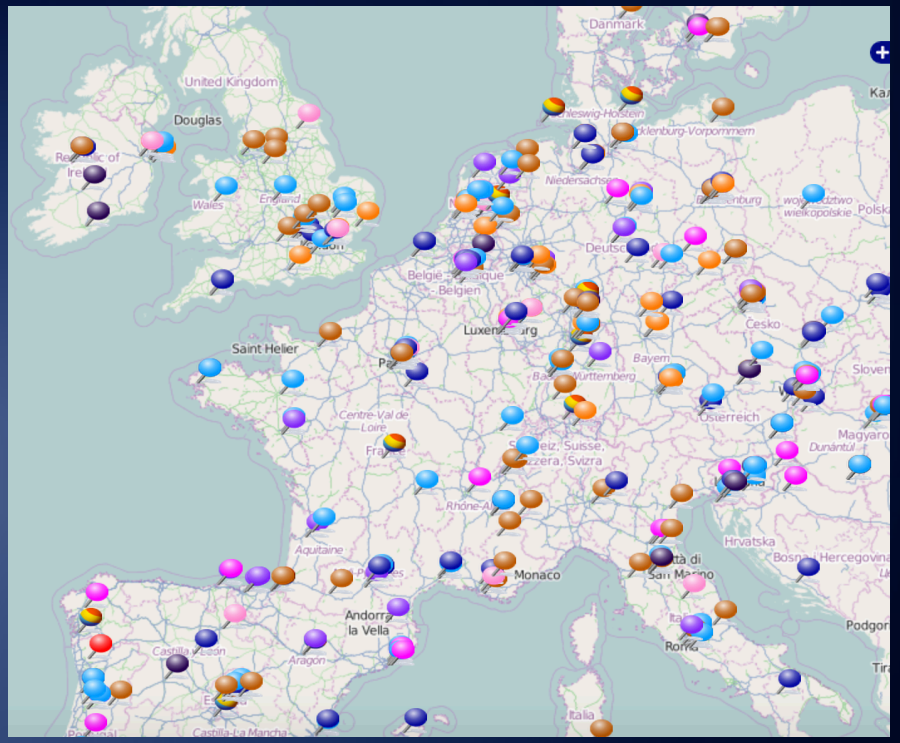
European Research Infrastructures (ERIs) and contributing national scientific labs play a crucial, facilitating role in scientific research

They also have extensive experience in working together on new technologies with industry, in particular Small and Medium sized Enterprises (SME)

ERIs face continuous pressure from their funding authorities to improve this bridge, without compromising their primary research missions

Two simple observations

European Research Infrastructure



Large network with a substantial scientific and societal impact

Knowledge is not cheap. The world spends more than $1 trillion a year on research and development, including basic research. The biggest projects —“research infrastructures” like particle accelerators and DNA databases — carry correspondingly big price tags.

ITER, the experimental, international fusion reactor in the south of France, is taking years and more than €13 billion to build. The Square Kilometer Array, the world’s biggest radio telescope now under development in South Africa and other southern countries, will cost well more than €1.5 billion.

It’s all great science, no doubt. But is it a great investment for society?

RESEARCH INFRASTRUCTURE	WHAT IS IT?	SCIENTIFIC IMPACT	TECHNOLOGY IMPACT	SOCIETAL IMPACT
CERN, Geneva	Particle accelerator and other high energy physics infrastructure—using some of the world's most advanced equipment to study the tiniest particles in the universe.	Discovery of subatomic particles including the W and Z bosons in 1983 and the Higgs in 2012, confirming the Standard Model of what the universe is made of. Contributed to at least two Nobel Prizes.	Hypertext Markup Language that enabled the WWW. Capacitative touch screen. Grid computing. Advancement of detectors, accelerators, and magnets used in many fields including medical imaging and treatments. And much more.	WWW alone produces $4 trillion annual economic activity—if it were a country it would be the world's fifth largest. Leader in design and coordination of physicists, engineers, biologists and physicians for revolutionary hadron-based cancer therapy. Pioneer of big data.
Diamond, Harwell	Third generation synchrotron producing beams of light 10,000 times brighter than the sun allowing scientists to deduce the structure of complex molecules and study the makeup of materials.	Over 1,000 papers published a year in the field of life, physical and environmental sciences. Over 500 protein structures solved and deposited in the Protein Data Bank.	Method for discovery of hidden content in ancient documents. Decoding of complex structure of histamine receptors.	New drugs and therapies from side-effect free allergy treatments to training T- cells to attack cancer. Safer flying thanks to better insights into materials. Training platform for researchers. About a fifth of all operating time devoted to industry.
EMBL, multi-site	European Molecular Biology Laboratory—Europe's flagship laboratory for the life sciences seeking fundamental understanding of basic biological processes in model organisms.	Some 200 scholarly papers produced a year. Contributed to at least one Nobel Prize including one for the first systematic genetic analysis of embryonic development in the fruit fly.	Instrumentation for DNA sequencing, cell fractionation, light and electron microscopy methods, mass spectrometry of proteins, X-ray imaging plates, synchrotron beam-lines and automated cell micro injectors. An area of prolific current activity is in the development of software and databases for the life sciences.	New medicines for a range of ailments including cystic fibrosis, insights into conditions and diseases such as autism and cancer, information management techniques that can be applied to many areas within and beyond science.
ESO, multisite	The European Southern Observatory, a 15-nation intergovernmental research organisation which lays claim to be the world's most productive astronomical observatory. One of its projects is the Very Large Telescope or VLT in Antofagasta, Chile.	The VLT alone produces at least one peer reviewed paper a day. Firsts include observation of stars orbiting the black hole in the Milky Way, the accelerating universe, imaging the first planet outside of our solar system and measuring the age of the oldest known star in the Milky Way.	Pioneer of active and adaptive optics as well as interferometry, all of which have found applications beyond astronomy including medical imaging and military.	ESO offers numerous possibilities for technology spin-offs and transfer, together with high technology contract opportunities and is a dramatic showcase for European industry.
ESRF, Grenoble	European Synchrotron Radiation Facility. A collaboration between 20 countries, it is the most powerful synchrotron radiation source in Europe.	Every year at least 6,000 scientists use the facility. Among synchrotrons worldwide, ESRF has the most external users and refereed publications. Contributed to at least two Nobel Prizes.	X-ray optics, sample handling and sample environment, detectors and electronics and data analysis and other software developments at ESRF are now in use beyond the organisation, including in other synchrotrons around the globe.	Applications across the oil industry including exploration, reservoir engineering, drilling, pipelines, refining and CO2 sequestration are allowing us to make significant advances in making the most of dwindling reserves. Magneto-electronics may enable the next generation of computer memory and even computer processing.
Human Genome Project	World's largest collaborative biological project seeking to identify and map all of the genes of the human genome.	The project was declared completed in 2003, some 20,500 genes and 3.3 billion DNA base-pairs having been identified and sequenced, opening new avenues for advances in medicine and biotechnology.	Tests to show dispositions for diseases. More specific treatments.	As well as providing the basis for advances in human medicine, agriculture, energy, and environment, it is suggested that the $3.8 billion investment in the project drove $796 billion in economic impact, personal income exceeding $244 billion and 3.8 million job-years of employment.
Lawrence Berkeley National Lab	Centre for physics research addressing the world's most urgent scientific challenges by advancing sustainable energy, protecting human health, creating new materials and revealing the origin and fate of the universe Observation of the antiproton, discovery of several transuranic	elements, and of the accelerating universe and dark energy. The Lab has been associated with 13 Nobel Prizes.	Antimalaria and anti-AIDS drugs; a cooking stove which uses one-quarter of the firewood of traditional stoves; electronic ballasts for more efficient lighting; a do-it-yourself home energy audit tool; a pocket-sized DNA sample; smart windows with embedded electrodes that enable window glass to respond to changes in sunlight; and much more.	Economic impact on the US per year assessed at $3.2 billion if the effect of the 30 or so startups it has spawned is taken into account. $1.6 billion without.
Square Kilometre Array, multi-site	Radio telescope 50 times larger than any in existence.	Goal is to discover the nature of the first stars in the Universe, the cosmic history of the Universe, the nature of dark matter and dark energy, theories of gravity and black holes and the origin of cosmic magnetism.	SKA will be powered entirely by regenerative energy and apply data processing approaches of the next generation, all of which has to be developed for the project but will have benefits far beyond.	The benefits in terms of innovation, capacity and capability enhancement, and indirect societal impacts, particularly but not only in the countries where the array is sited, are expected to be significant and important.
SRS, Daresbury	World's first second generation synchrotron—ceased operations in 2008 after 28 years of operation and two million hours of science but it impact will be felt for years to come.	5,000 papers published and 1,200 protein structures deposited in the worldwide Protein Data Bank. Two Nobel Prizes.	Pioneered protein crystallography unmasking multitude of processes that take place within living organisms at a molecular level.	Medicines in areas such as host-graft rejection and HIV/AIDS. Key to developing a Foot & Mouth vaccine potentially saving hundreds of millions of euros and understanding species-hopping Avian Flu. Denser electronic memories for portable devices. Build costs alone contributed £992 million to the economy of North West England.

RESEARCH INFRASTRUCTURE	WHAT IS IT?	SCIENTIFIC IMPACT	TECHNOLOGY IMPACT	SOCIETAL IMPACT
CERN				ic activity—if it st. Leader in biologists and f therapy.
Diam				lergy treatments hanks to better earchers. About a
EMBL				cystic fibrosis, ism and cancer, e applied to
ESO,				spin-offs tfact opean industry.
ESRF,				olofation, and CO2 t advances in o-electronics mory and even
Huma Proje				man medicine, sted that the billion in 44 billion and
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Capacitive touch screen—A key invention in 1973, introduced into CERN control systems in 1976, but now used on billions of smart phones and tablets world-wide.

Pharmaceuticals—Five of the top 20 drugs in use in the world today were developed using synchrotrons.

Scratch-resistant eyeglasses—Developed by NASA to provide scratch-proof coatings for astronauts' visors, most eyeglasses now feature it.

WiFi—The Fast Fourier Transformations technology at the core of most WiFi-equipped devices—whether computers, tablets, mobile phones or others—was based on technology developed by Australian astronomers to study radiation from black holes.

Hypertext Markup Language—The key idea that transformed the academic Internet into the commercial World Wide Web came from CERN computing scientists trying to make it easier for physicists to interlink their documents.

Two simple observations

Application area	EU companies turnover 2012 (Billion Euros)	Turnover growth/year	R&D % overall	R&D in EU (2012) billion Euros
Total	1390	4.7	4.9	69
Aerospace & defense	150	4.7	5.9	8.8
Alternative Energy	13	3.9	5.9	0.8
Automotive	698	6.5	5.1	35
Electronic & electrical equipment	156	1	5	7.7
Healthcare equipment and services	65	6	4.1	2.7
Industrial engineering	236	1.8	3.1	7.4
Software and computer	69	5	8.1	5.6

European Industry

two different and somehow independent planets ?

Two simple observations

- European Industry should be one of the key players on innovation ! It was true a few decades ago. Is it still the case?
- Innovation and high-end technology is slowly drifting towards small and medium-sized firms.
- Applied research is more natural in this environment. The market pressure is increasingly demanding! IP issues are still very important and present.
- Basic research is still confined to the public sector. Just a few industries can afford it.

European Industry

two different and somehow independent planets ?

From Open Science to Open Innovation

Our observations:

- ✓ Basic science is still a seed for major ideas in the field of innovation
- ✓ The important public research network could be better integrated in the overall innovation picture, establishing a closer relation to the industrial R&D needs
- ✓ Science works if it is open. Knowledge transfer could become more effective if it was open → Co-innovation
- ✓ Co-innovating partners will identify common synergies and subsequently co-develop and co-implement projects leading to mutual benefits.

From Open Science to Open Innovation

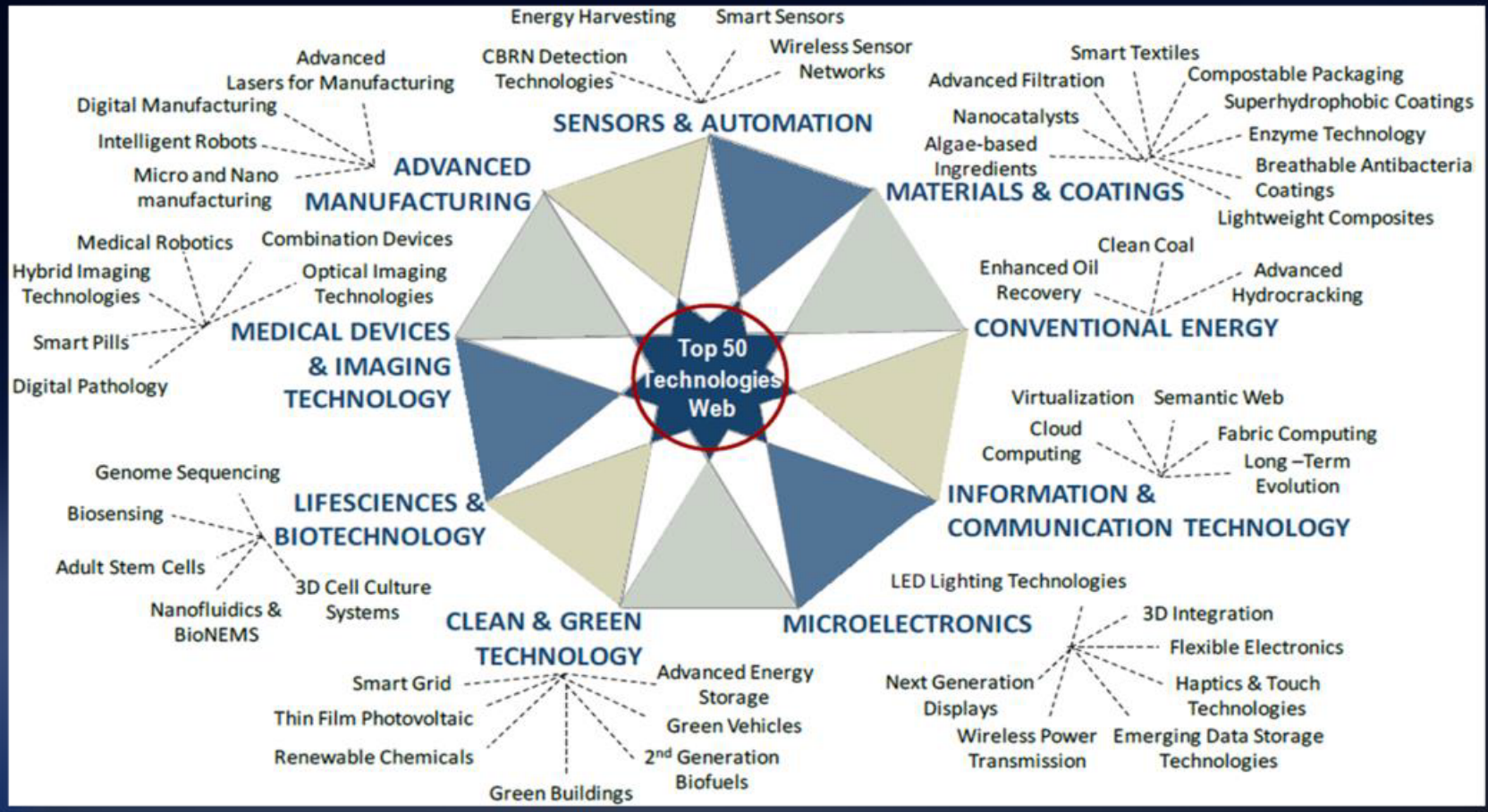
- Frontier science needs to be open because it needs to engage the best minds in a transparent manner, wherever and whoever they are
- Open Science is not interested in “Incremental” advancement
- Open Science is not challenged by the seemingly “Impossible”, either
- Instead, Open Science is driven by the “Unthinkable”
- The challenge thus is to capture and exploit the innovation opportunities generated by the push for the Unthinkable

Some innocent considerations

- Europe is loosing the race on new technologies. Most of the new technologies have been exploited in the US or Asia (WWW, ICT,….)
- New European ways need to be found to facilitate this co-innovation mode between the scientific R&D communities and industry to restore the European leading position
- Which fields to target first?

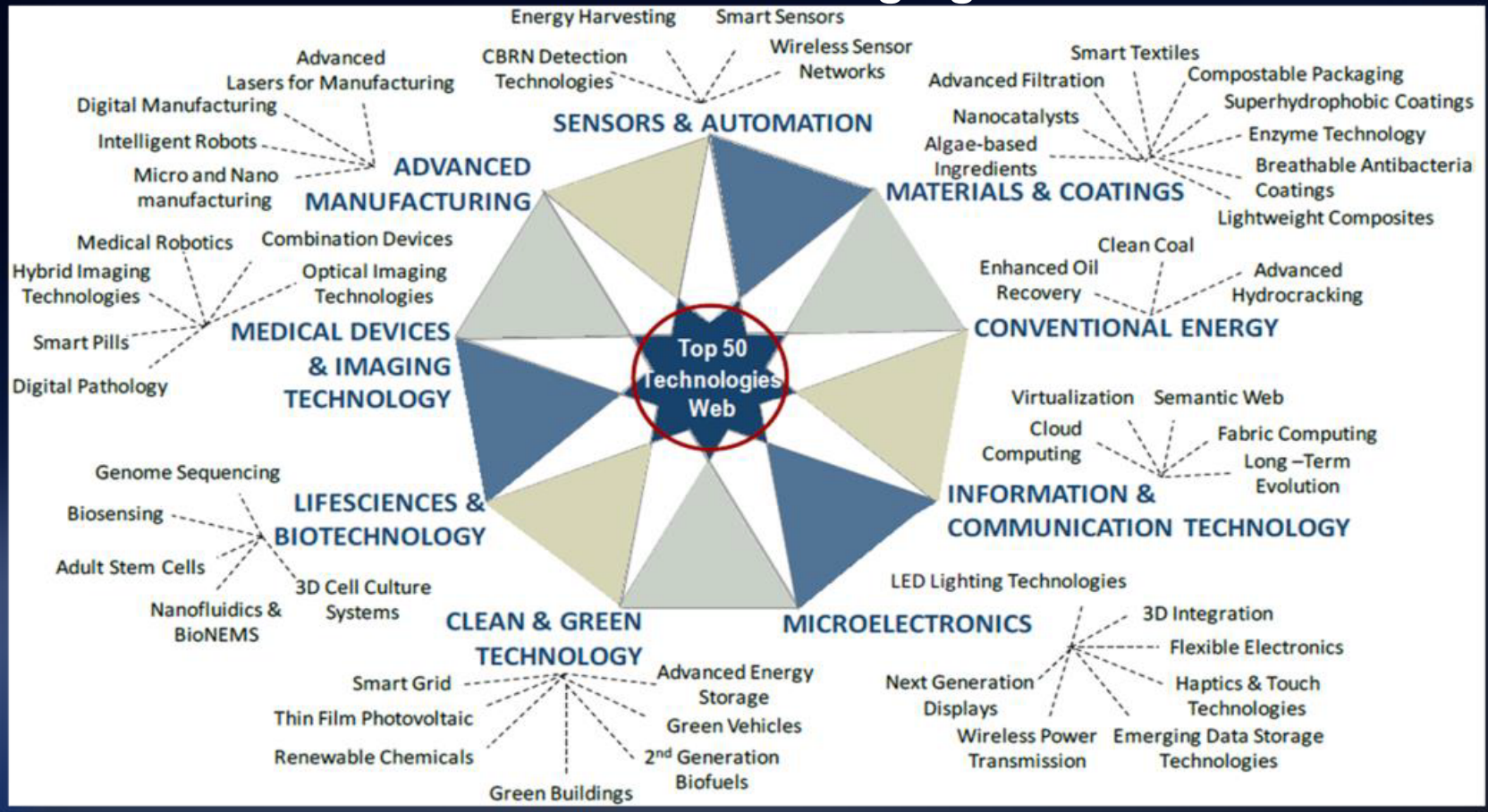
Sensors and imaging

Why Sensors and Imaging ?



Detection and Imaging Technologies are crucial enablers for all the converging technological families illustrated above. More importantly, they create bridges between them. In other words it will be difficult to think or foresee a future application, product or business targeting any upcoming Societal Challenge that is not enabled by cutting edge Detection and Imaging Technologies.

Difficult to think on a technology not in connection with Sensors and Imaging



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Megatrend: Connectivity & Data Traffic

By 2020

80 billion connected devices.

9 billion mobile phones.

5 billion internet users.

5 connected devices per individual.

10 connected devices per household.

500 devices with digital IDs per square kilometer.

Challenge

How to take advantage of the Data Deluge?

How to deal with data traffic?

Detection and Imaging Technologies

Today

Hardware & Software technologies developed at the LHC Experiment today are capable of analyzing 10’000 terabytes of data each year.

They are the equivalent of the content in:

- 25 km of CD-ROMs stacked on top of each other.
- 2000 years of listening to songs.
- 500 US Library of Congress (10 billion books).

Tomorrow?

Megatrend: Personalized Medicine

By 2020

The number of people who develop cancers in Europe is expected to grow to 3.4 million each year by 2020, a 20% increase from 2002.

…by 2050, healthcare spending will double, claiming 20-30% of GDP for some economies.

Challenge

How to accurately Predict, Prevent, Personalize?

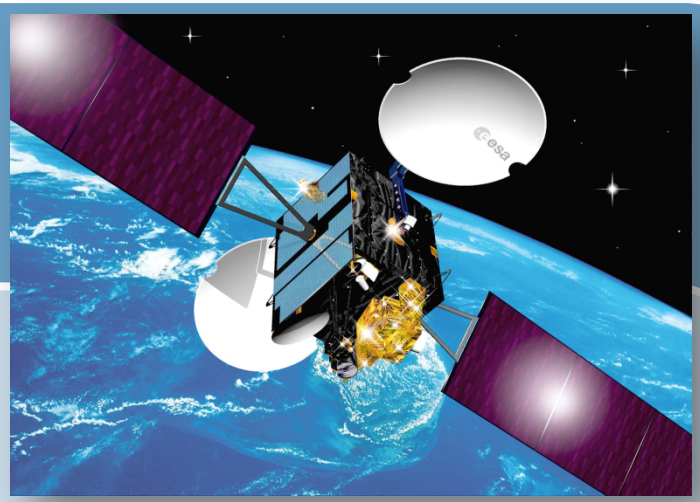
Detection and Imaging Technologies

Today

MEDIPIX Chip technology has been applied in X-ray CT, in prototype systems for digital mammography, in CT imagers for mammography and for beta and gamma autoradiography of biological samples.

Tomorrow?

Megatrend: Space Use



By 2020

By 2020, there will be approximately 927 newly launched Satellites (Communication – 405; Earth Observation – 151; Navigation – 85; Reconnaissance – 212 and R&D 75).

Challenge

How to increase life time (Space Jam), reliability and performance?

Detection and Imaging Technologies

Today

Radiation hard ASICS and FPGA technology developed at CERN & Detectors, ESA, DESY, etc, can be one of the keys.

Tomorrow?

Megatrend: Air Mobility

By 2020

Over the 2009-2028 period, world passenger traffic is expected to increase by 4.7% per annum,

(Airbus 2009-2028 Global Market Forecast).

Traffic demand will nearly triple, and

airlines will more than double their fleets.

Challenge

How to keep technology leadership of Europe's Aeronautical Industry?

Detection and Imaging Technologies

Today

Optoelectronics sensing technology developed for fundamental research allows for innovative real time in flight aircraft health structure monitoring.

Tomorrow?

Megatrend: Zero Emissions

By 2020

In 2002, the global data center Footprint was 76 MtCO2e and this is expected to more than triple by 2020 making it the fastest-growing contributor to the ICT sector's carbon footprint.

Challenge

How to achieve a zero emission ICT industry and contribute to reduce CO_2 footprint in other industrial sectors?

Detection and Imaging Technologies

Today

Hardware (i.e. micro-cooled ASICS) and software (i.e. cloud computing) technologies developed for large RI instruments can be put to work for reducing global CO_2 footprint.

Tomorrow?

ATTRACT

(breAkThrough innovaTion pRogrAmme for deteCtor / infrAstructure eCosysTem)

ATTRACT

- A proposal for a dedicated, interdisciplinary program within H2020 to co-develop with scientists and industry breakthrough sensor & imaging technologies
- *The purpose is to address demanding challenges in **both** science and societal needs in the domains of health, sustainable materials and information and communication technologies*
- It involves the detector R&D community from many fields including eg. physics, astronomy, space exploration, nuclear engineering, medical imaging, related computing (ICT) and others

ATTRACT

European Research Infrastructures (ERIs) and contributing national labs are to play a crucial facilitating role

- *co-developing technologies together with industry, with special attention to Small and Medium sized Enterprises (SME)*
- creating an Ecosystem by connecting Open Science to Open Innovation
- *proceeding in steps to build up a sustainable innovation system by 2020+ (*www.attract-eu.org)

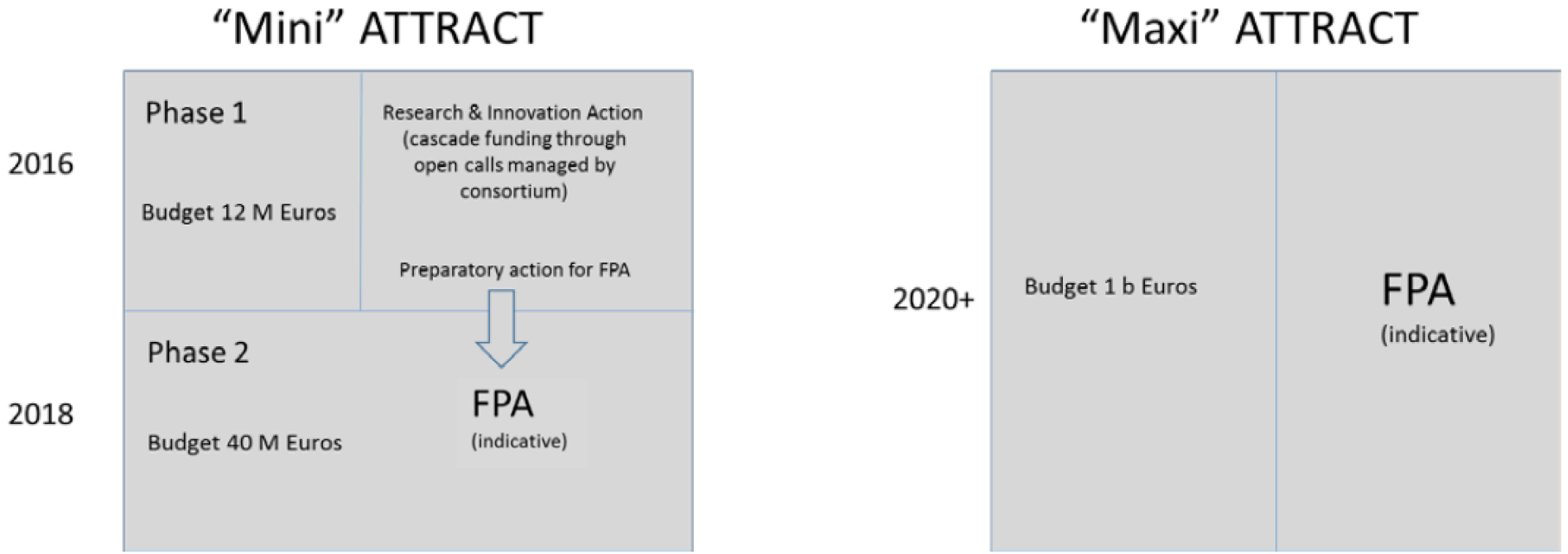
ATTRACT main idea

- Build up a consortium of ERIs & industrial partners interested and specialized in sensor and imaging technology

- The consortium proposes to be mandated by EU in the framework of H2020 (initially) to:

    - *Define funding programs*
    - *Organize open calls*
    - *Monitor and peer review their execution*
    - *Manage and administrate their execution*

ATTRACT : 2 phases approach



FPA : EU Framework Partnership Agreements

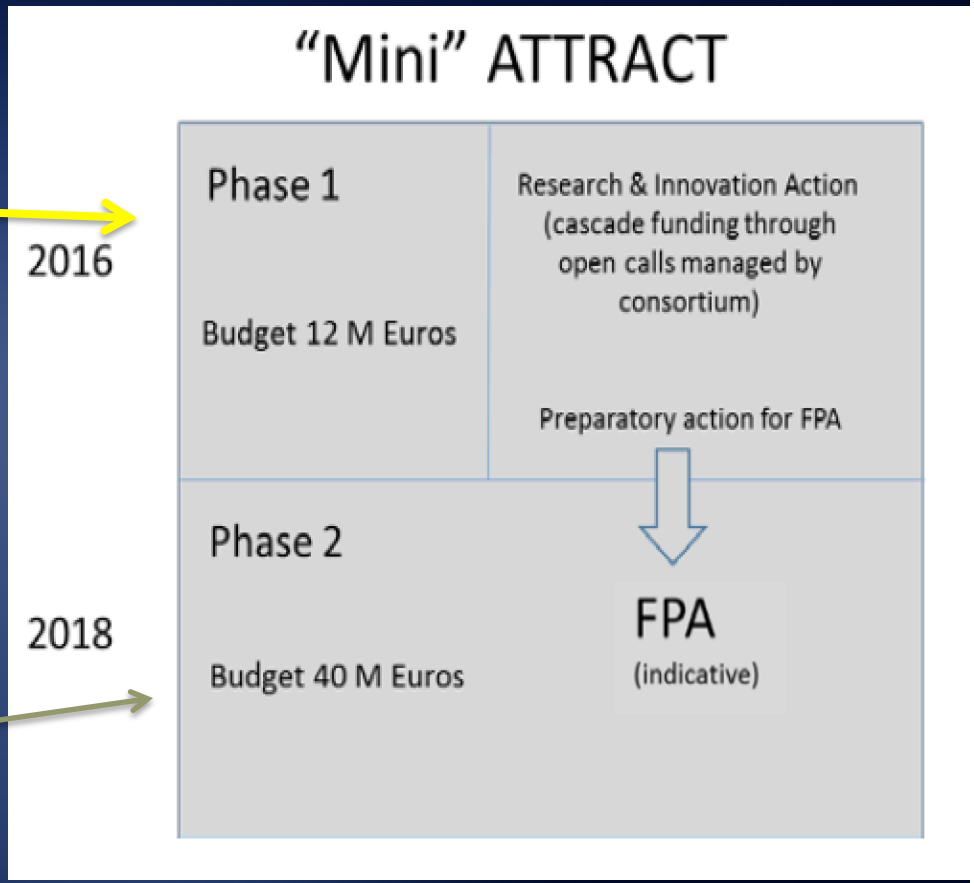
“Mini” ATTRACT : 2 phases approach

Select and finance ~100 promising breaking through proposals for a quick potential evaluation via an open call:

- feasibility demonstrators
- at least one SME and 1 ERI involved

Select and finance ~10 of the best Phase 1 selected projects:

- 3-4 years of execution
- performance monitoring
- define an optimal model for “maxi” ATTRACT



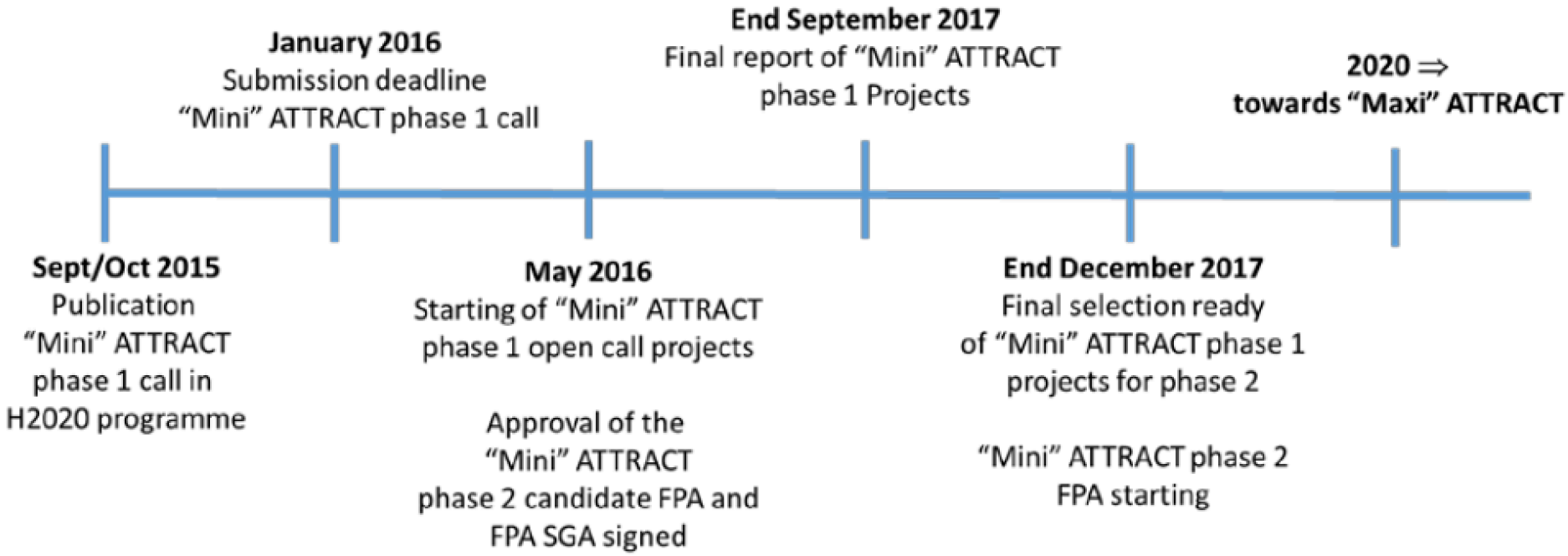
"Mini" ATTRACT phases 1 and 2 represent a new funding instrument that will help Horizon 2020 to deliver innovation.

They are designed to streamline the value chain from the development of technologies towards their market application.

Furthermore, ATTRACT incorporates the fundamental value of co-innovation through collaboration and competition which is essential for exploiting the untapped potential of ERI-SME-Large corporations.

Public funding is used for ramping-up the ATTRACT initiative, thereby generating trust between ERIs-SMEs and large firms.

Time scale proposed to EC



Summary

- ATTRACT is proposed as a pioneering initiative aiming to provide solid evidence on ERIs-Industry-Business impact in a co-innovation working framework.
- Sensors and Imaging technologies are target as primary candidates for such an enterprise
- ATTRACT, in its initial phase, is proposed as a new funding mechanism that will help Horizon 2020 to deliver innovation. Detailed implementation discussions are happening right now with the EU commission.
- ATTRACT is proposed as a new attempt to establish an effective, large-scale collaboration between fundamental and applied research