

From Open Science to Open Innovation

the ATTRACT Initiative

CERN, 29 April 2015

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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 of 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 its 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. Densest electronic memories for portable devices. Build costs alone contributed £992 million to the economy of North West England.

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.

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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.



IP

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

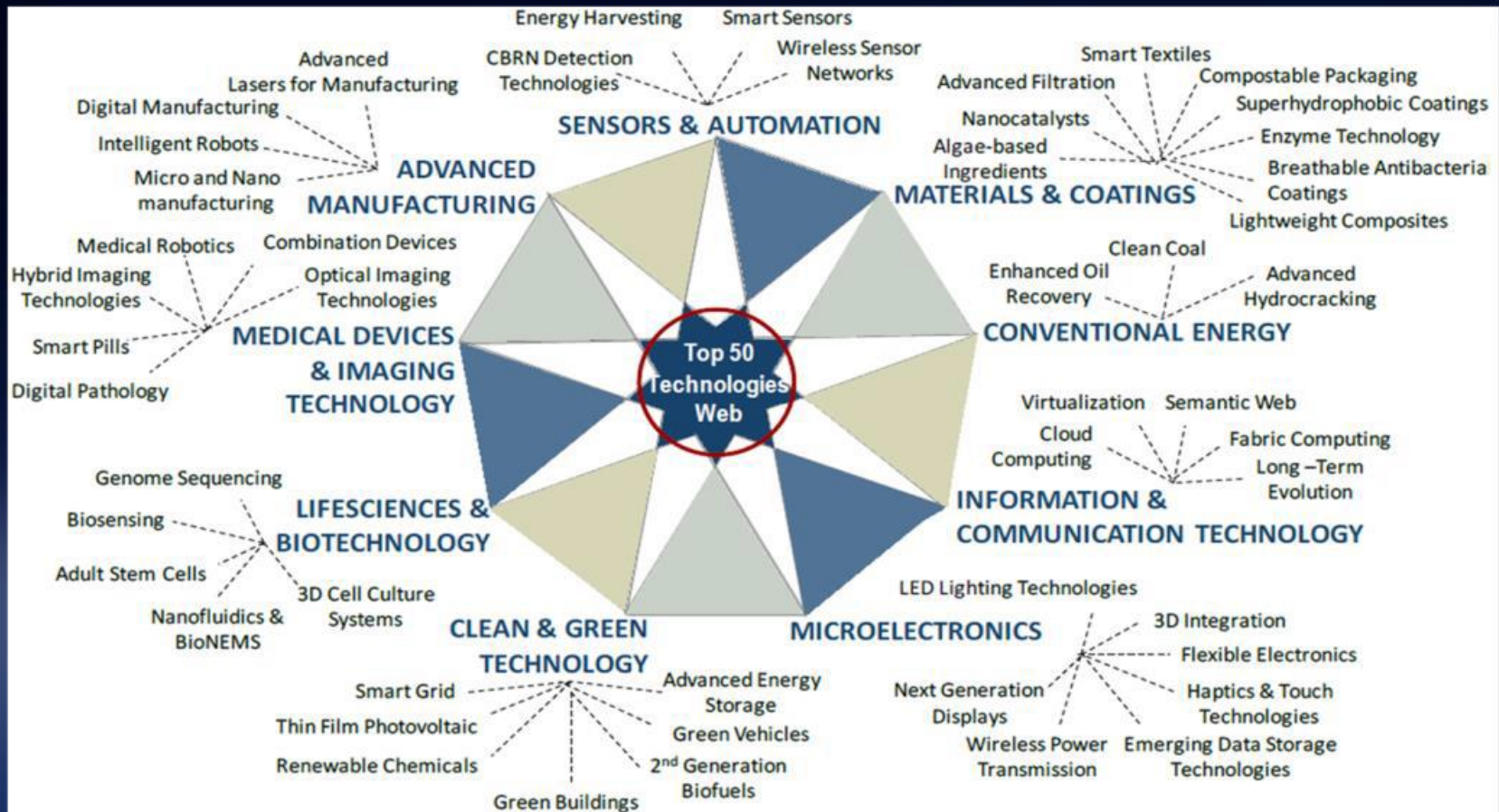
- Frontier science needs to be open because it needs to engage the best minds in a transparent manner, wherever and whoever they are
- Open Science is not interested in “Incremental” advancement
- Open Science is not challenged by the seemingly “Impossible”, either
- Instead, Open Science is driven by 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 losing 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?

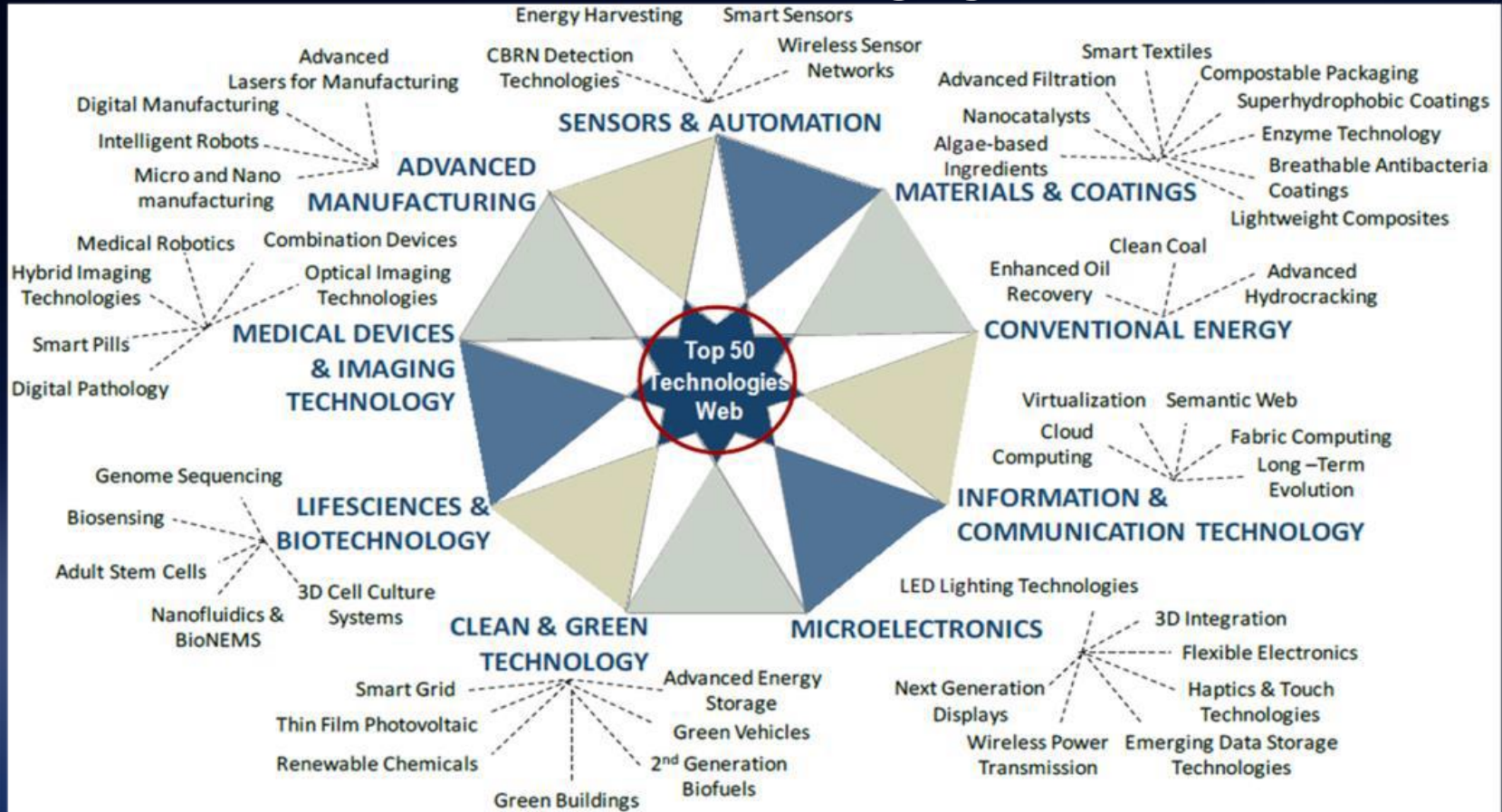
Sensors and imaging

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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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

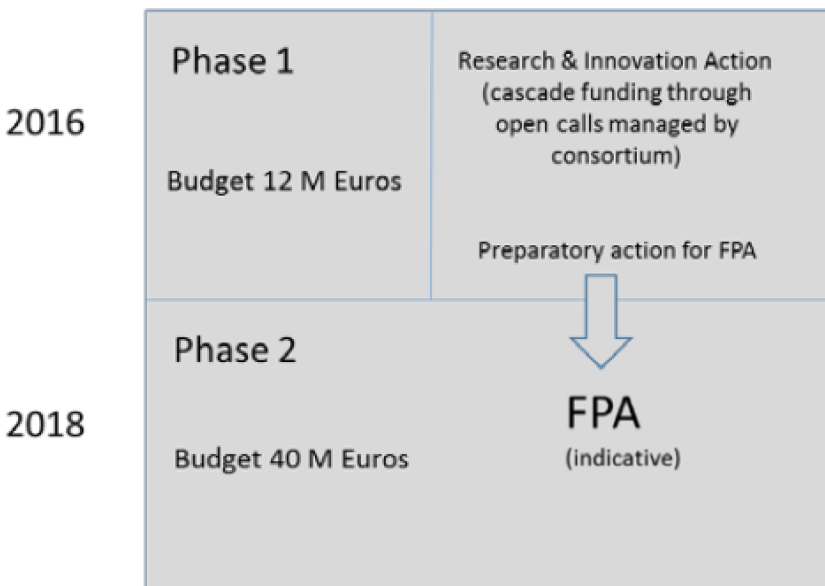
- *co-developing technologies together with industry, with special attention to Small and Medium sized Enterprises (SME)*
- creating an Ecosystem by connecting Open Science to Open Innovation
- *proceeding in steps to build up a sustainable innovation system by 2020+ (www.attract-eu.org)*

ATTRACT main idea

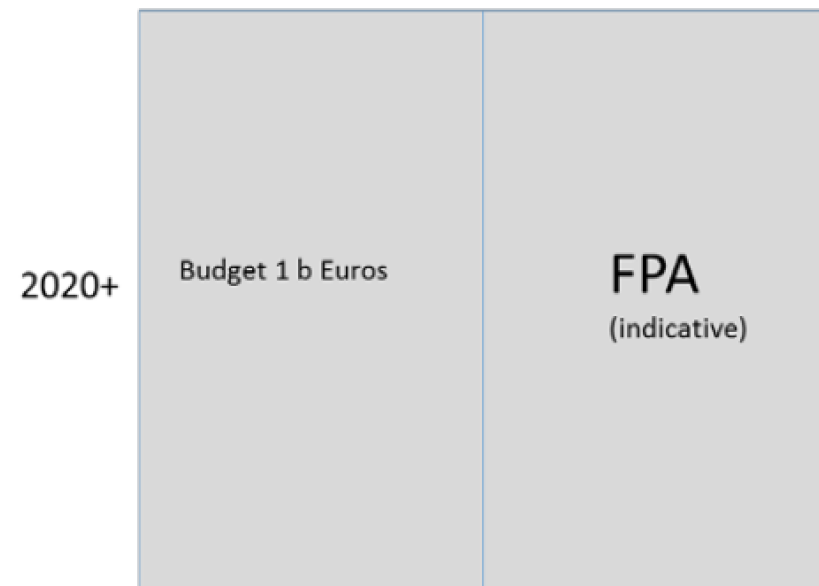
- Build up a consortium of ERIs & industrial partners interested and specialized in sensor and imaging technology
- The consortium proposes to be mandated by EU in the framework of H2020 (initially) to:
 - *Define funding programs*
 - *Organize open calls*
 - *Monitor and peer review their execution*
 - *Manage and administrate their execution*

ATTRACT : 2 phases approach

“Mini” ATTRACT



“Maxi” ATTRACT



FPA : EU Framework Partnership Agreements

“Mini” ATTRACT : 2 phases approach

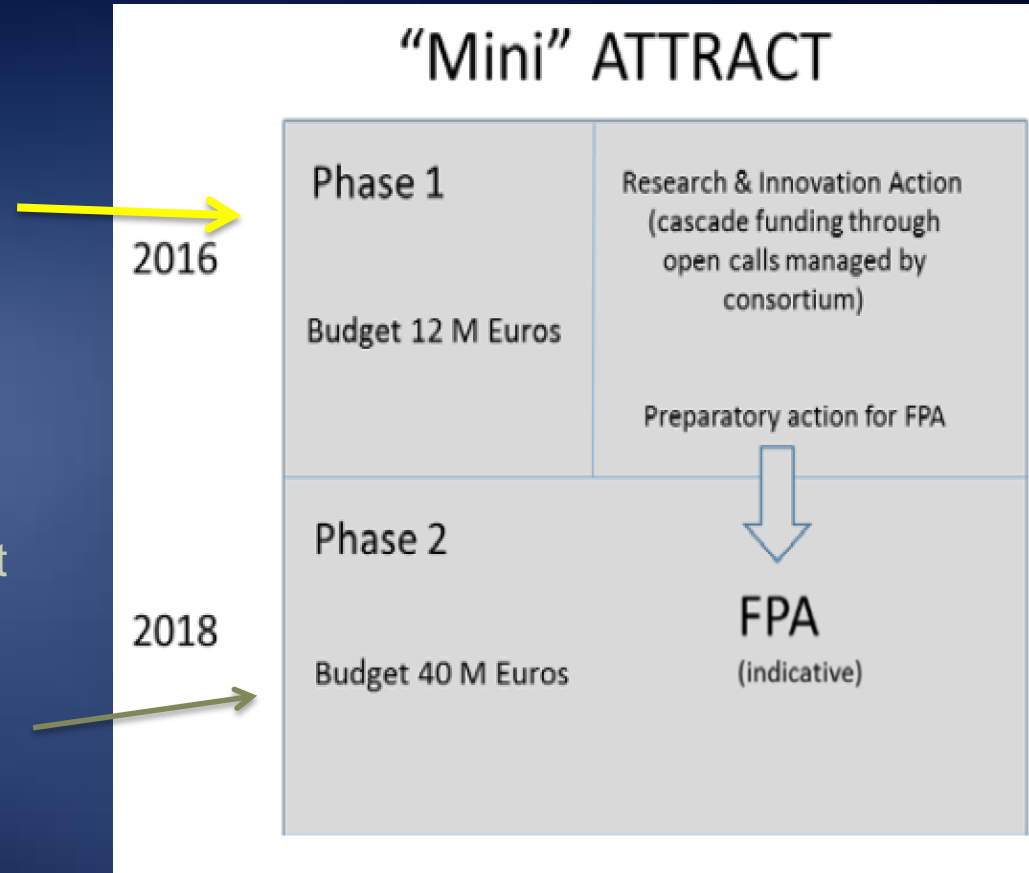
Select and finance ~100 promising breaking through proposals for a quick potential evaluation via an open call:

- 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



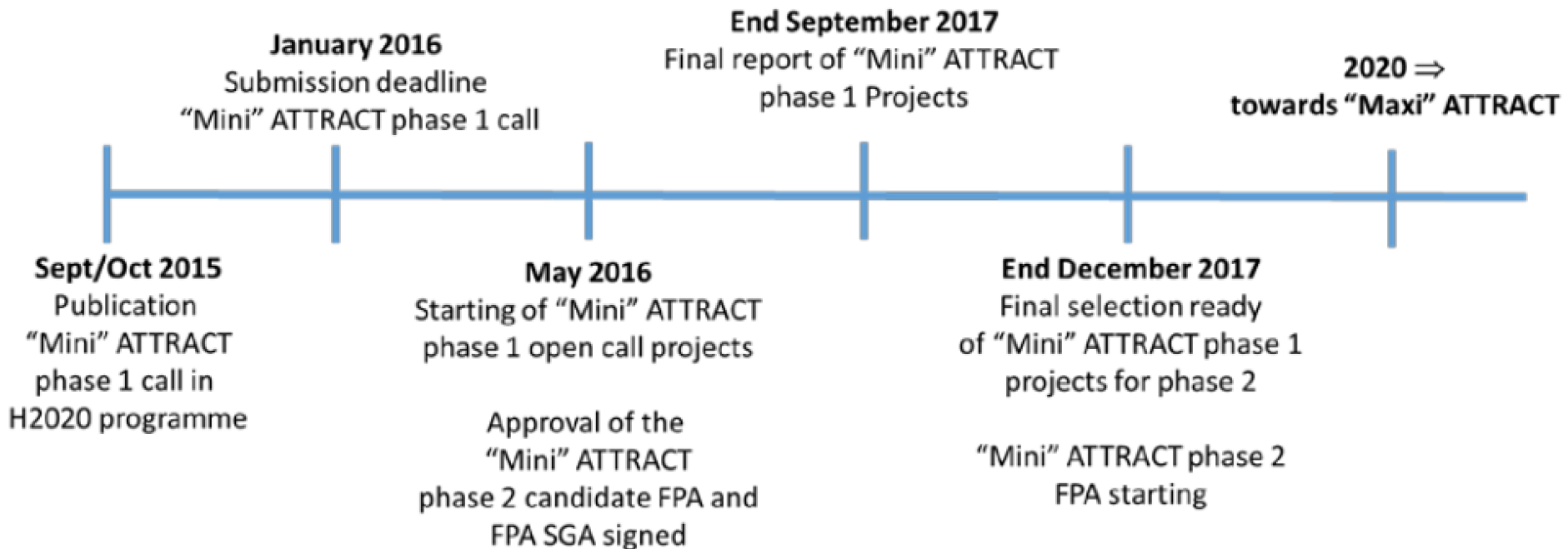
“Mini” ATTRACT phases 1 and 2 represent a new funding instrument that will help Horizon 2020 to deliver innovation.

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



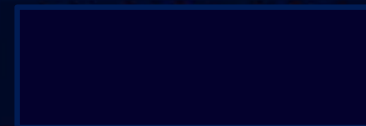
Summary

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

From Open Science to (Open) Innovation

IdeaSquare

Markus Nordberg, Marzio Nessi (CERN)



<http://ideasquare.web.cern.ch/>

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IdeaSquare

- Dedicated location at CERN that hosts detector upgrade/R&D projects and facilitates MSc-level student projects driven by Society Challenges
- Currently, IdSq has two EU-funded projects (TALENT, EDUSAFE) and a few suitable. More will follow shortly
 - Testing the concept for ATTRACT-initiative (www.attract-eu.org)
- At present, IdeaSquare hosts and facilitates the 2nd Challenge Based Innovation course (CBI) for MSc-level, cross-disciplinary student teams interacting with researchers at CERN, with a human-centric approach
- When IdeaSquare is not in full use, it can also host short innovation events such as Hackathons (e.g. Tribeca, Port, HEAD), or contribute to special schools (e.g. OpenLab summer school)
- Activities are self-financed, CERN offers the basic infrastructure
- IdeaSquare is an innovation experiment by itself; first experiences to be reported to CERN management in late 2015/early 2016



What Are the Programs?

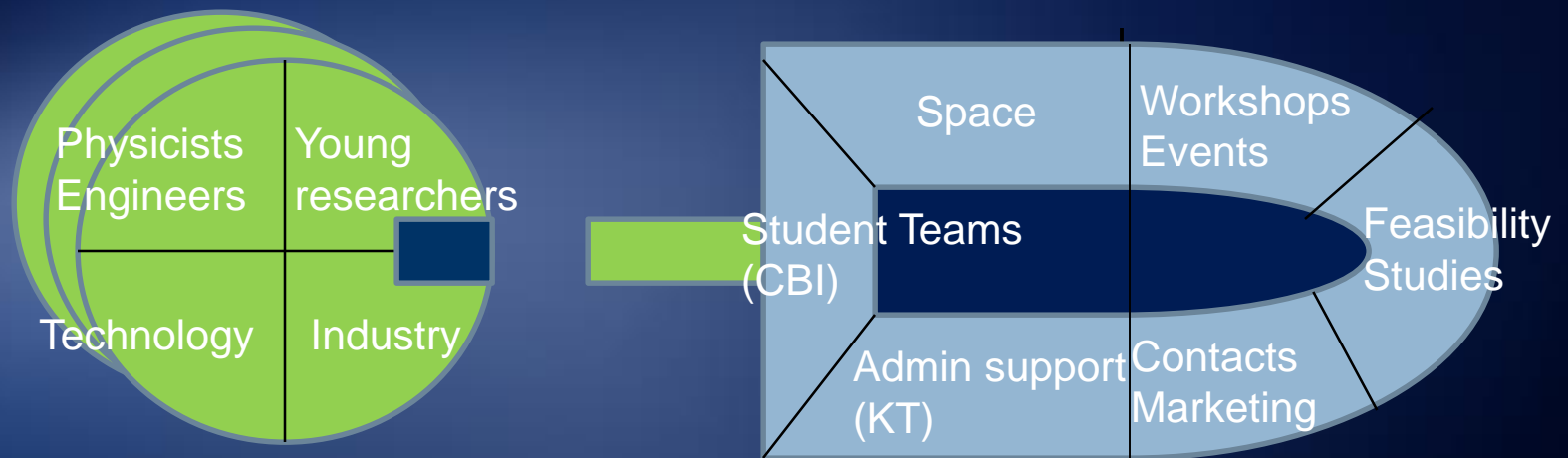
Time period spent (physically) at IdeaSquare

Hi	Summer Schools?	R&D Projects (EC)
Lo	Challenge Events	CBI
	Lo	Hi

Level of complexity/required integration

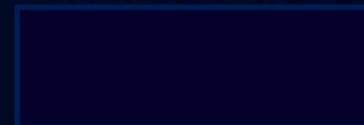


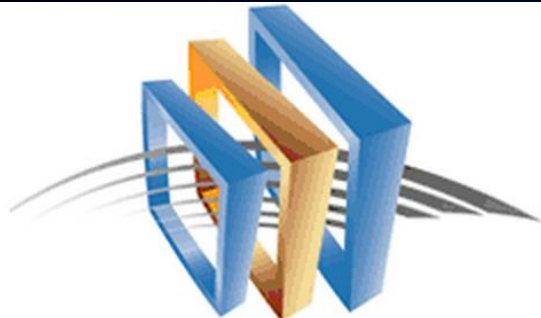
What is the Basic Principle of IdeaSquare?



EU-funded projects (e.g. in ATLAS, CMS,...) ...

... get support from CERN and elsewhere, to create new ideas





TALENT



Welcome to TALENT!

Event Calendar

TALENT 2nd Joint training event, May 26-28, 2014

The TALENT 2nd Joint training event will take place at CERN on May 26-28, 2014.

[More...](#)

TALENT Midterm Review and 2nd Annual Meeting, November 18-20, 2013

The TALENT Midterm Review and 2nd Annual Meeting will take place at CERN on November 18-20, 2013.

[More...](#)

TALENT Summer School, June 3-14, 2013

The TALENT Summer School at CERN will take place on June 3-14, 2013.

[More...](#)

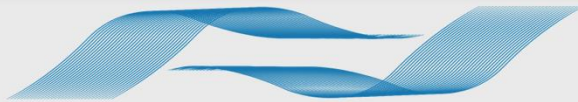
ATLAS Annual Assembly: EDUSAFE ITN and TALENT ITN joint technology workshop, February 18, 2013

TALENT aims at career development of young researchers in the field of instrumentation for radiation detection. The project focuses on piloting new state-of-the-art technologies on the new precision pixel detector ATLAS Insertable B-Layer detector (IBL) and for future precision tracking detectors. The project will strengthen the co-operation between research and multidisciplinary industry in the fields of advanced radiation sensors, fast and low power consumption read-out and data acquisition electronics, new cooling technologies and ultra light mechanical support structures.

During the next years, completely new technical solutions are required to enable the construction of new, or upgrading existing high energy particle physics research infrastructures and detectors at CERN Large Hadron Collider (LHC). Aims for running the research facilities on increased intensity levels, pose a need to significantly improve the detector technologies mainly due to the 10 fold increased radiation level and data volume. Answering the hostile environment challenges and increased data acquisition needs will require vigorous industry collaboration and research on .

- **Radiation-hard precision pixel sensors**
- **Radiation-hard high-density electronics and interconnection technologies**
- **New mechanical integration methods for light-weight support and cooling systems**
- **Detector performance and system integration**
- **Dissemination, knowledge transfer and external research funding**

The aim of this project is to enhance interaction between European stakeholders to significantly increase the RTD efficiency by finding new technical solutions for future scientific infrastructures. The outcome will be to create the means to produce affordable high performance detector modules in European industry and thus answer to the forthcoming needs of research infrastructures and industry application demand.



EDUSAFE

Education in advanced VR/AR Safety Systems for
Maintenance in Extreme Environments



Testing campaign 2015

The 1st testing campaign will take place at CERN
16 - 27 February 2015.

[More Information](#)

Technical meeting: development and integration for testing campaign

Technical meeting to prepare for the 2015 testing
campaign will take place at CERN 5 - 6 November
2014.

[More Information](#)

Midterm Review and Technical meeting

EDUSAFE Midterm Review and Technical Meeting
will take place at CERN 16 - 20 June 2014

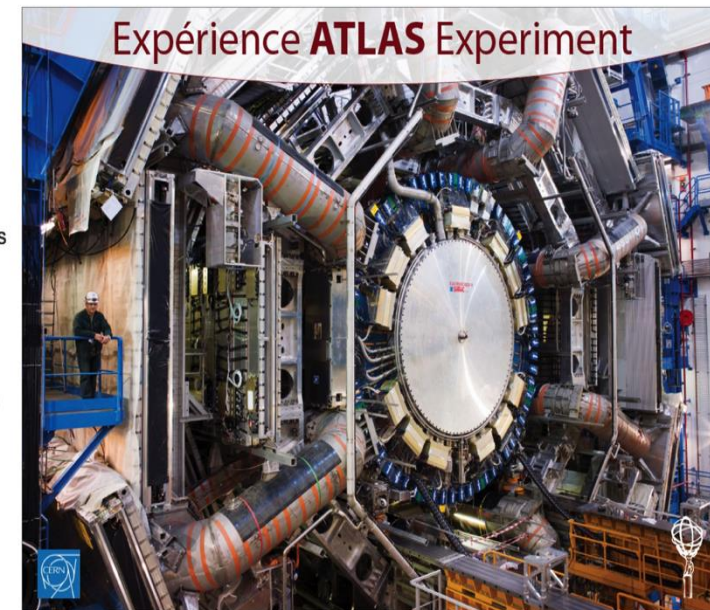
EDUSAFE is a 4-year Marie Curie ITN project that provides training for 10 Early Stage Researchers and 2 Experienced Researchers. The project focuses on research into the use of Virtual Reality (VR) and Augmented Reality (AR) during planned and emergency maintenance in extreme environments (nuclear installations, space, deep sea etc).

The scientific objective of EDUSAFE is research into advanced VR and AR technologies for a personnel safety system platform, including features, methods and tools. Current technology is not acceptable because of significant time-lag in communication and data transmission, missing multi-input interfaces, and simultaneous supervision of multiple workers who are working in the extreme environment. The aim is to technically advance and combine several technologies and integrate them as integral part of a personnel safety system to improve safety, maintain availability, reduce errors and decrease the time needed for scheduled or sudden interventions.

The research challenges lie in the development of real-time (time-lags less than human interaction speed) data-transmission, instantaneous analysis of data coming from different inputs (vision, sound, touch, buttons), interaction with multiple on-site users, complex interfaces, portability and wearability, wear/tear. The result will be an integrated wearable VR/AR system (+control system) which can be implemented and tested as a prototype.

The LHC at CERN and its existing Personnel Safety System, requirements and protocols will be used as a test and demonstration platform. The project will deliver a comprehensive local and network-wide training programme including several secondments for each fellow, combined with dissemination and outreach activities. The Fellows will gain valuable scientific skills and highly valued soft skills from expert and experienced organizations, which will be extremely beneficial for their career development both in academia and in industry.

EDUSAFE brings together expertise from 9 partners and 4 associated partners from around Europe.



CBI Course (Challenge Based Innovation)



Recent comments

No comments available.

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MSc-Student Projects in Innovation

Benefiting from the technical knowledge of the researchers and engineers working in experiments and in other parts of CERN, a dedicated MSc-level program has been started in IdeaSquare targeted to multidisciplinary student teams, complementary to the domain of physics. This program is called Challenge Based Innovation (CBI), and it is organized and coordinated in collaboration with universities and business schools. It is open to participation and has currently participants from six countries (Australia, Finland, Greece, Italy, Norway and Spain). Currently, some 50 students are working together in IdeaSquare - and remotely from their home institutions - on concrete prototypes addressing challenges faced by society.

The student teams comprise product design, business management and engineering and the students are coached by scientists and engineers at CERN. Drawing inspiration from the R&D carried out at CERN, the student teams learn for six months human-centric product development skills and will produce a tangible proof-of-concept prototype which they will publish at CERN in late February, 2015. Driven by real end-user needs obtained with Design Thinking methods and tools^[1], these prototypes aim to help, for example, the elderly in their daily lives, offer complementary information about the environment to the visually impaired, or help autistic children in their learning process. The CBI program is funded by the participating institutions, CERN providing the facilities in IdeaSquare^[2] while they are on-site. The CBI-2 student protopresentation webcast can be found [here](#).

Guidelines for external universities wishing to participate in the CBI Program can be found [here](#).



CBI Process, Inspired by Design Thinking

(Re)defining the problem

Understanding project goals
What are we solving?

Technology review

Technology specifications, need assessment
What (CERN) technologies can we use to fulfill the needs?

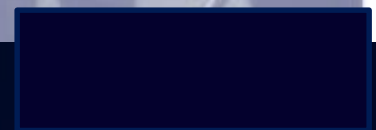
problem space
solution space

Prototyping and testing

Building solutions, testing them in reality
How does our solution work?

Ideating and selection

Brainstorming, evaluation
How could we solve the problem?





Links for More Info

- IdeaSquare web pages (under construction): cern.ch/ideasquare
- TALENT: <http://talent.web.cern.ch/talent/>
- Edusafe: <http://edusafe.web.cern.ch/edusafe/site.php>
- Indico pages: <http://indico.cern.ch/category/5134/>
- Our event calendar:
<https://mmm.cern.ch/owa/calendar/idea.s@cern.ch/Calendar/calendar.html>
- CBI: <http://www.cbi-course.com/>
- Examples of Hackathons hosted:
 - Tribeca: https://tribecafilminstitute.org/events/detail/tribeca_hacks_story_matter
 - Port: <http://theport.ch/>
 - HEAD: <http://www.hesge.ch/head/>