ATTRACT (breAkThrough innovaTion pRogrAmme for deteCtor / inrAstructure eCosysTem)

- ATTRACT is a proposal for an EU-funded R&D programme for sensor, imaging and related computing devlopment
- Its purpose is to demonstrate the value of European Research Infrastructures to industry and society, while maintaining the scientific missions of the ERIs

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Motivation

- The detector R&D community - or communities – through Research Infrastructures are currently planning large upgrades for the scientific instruments
- Examples: CERN's LHC accelerator and detectors; new ESO telescopes, ESRF beamline facilities, ESS …
- While waiting for the upgrade/construction budget decisions, the instrumentation communities proceed with their (limited) R&D means to solve remaining, related technical challenges
- Challenge: How to keep this R&D engine running (in Europe)?

Requirements amongst fields using radiation detectors

ERDIT

	HEP	SYNC	Neutron ESS	Beam monitoring	Astronomy	Hadron Therapy	Medical Imaging Pre-clinical Imaging	Electron Microscopy	Environmental radiation monitoring IAEA
Radiation type	p, n, γ	X-rays	n	p, n, γ, e⁻	λ=300nm to 28μm	N, p, γ, light ions (protons to oxygen)	X-rays	e	γ
Max Intensity	12x10 ^{15} ncm^{-2}	2700 pulses	10 ^{8} ncm^{-2}	10 ^{12} ncm^{-2} (p, n) 10MGy (e⁻)	from 1 photon/hour/pixel to 1E9 photons/s/pixel	conventional accelerator up to 10^10 ions /s Laser > 10^7/cm2 (ps pulses, low repetition rate ~ 1/s)	CT: 10^{8} g/mm^{2}/s, General X-ray: 10^{8} g/mm^{2}/s Angiography: 10^{8} g/mm^{2}/s Mammography: 10^{7} g/mm^{2}/s	20 Mrads	100 μSv/h (~100,000 cts/s)
timing	25ns	4.5 MHz	1us	Sub ns	from 2000 frames/s to 1 frame/hour	Up to MHz (singles rate)	CT: 5000 frames/s General X-ray: - Angiography: 1-60 frames/s Mammography: -	1000 frames/s	
Pixel size (Min)	50x50 um^{2}	10x10um^{2}	50x50 um^{2}	50x50 um^{2}	10μmx10μm	50 um	CT: 1000 mm General X-ray: 150-200 mm Angiography: 150-200 mm Mammography: 85 mm	10x10um^{2}	
Spectral resolution	yes	yes	no	yes	no , moderate possible with APD	yes	Today: not used, Future: yes	yes	< 1.5% @ 662 keV
Detector size (max)	2500m^{2} (ILC cal)		80m^{2}	100 cm^{2}	Optical 9Kx9K NIR 4Kx4K	40x40 cm2	CT: 10 x 100 cm^{2} (segmented), General X-ray : 43x43 cm^{2} Angiography: 30x40 cm^{2} Mammography: 24x30 cm^{2}	8k x 8k pixels	6 cm^{3}

European Radiation Detectors and Imaging Technologies

http://erdit.eu/

ATTRACT Programme

- A proposal has been made to the European Commission (EC) for a dedicated EC-funded program as part of H2020 to develop new radiation sensor, imaging and related computing technologies for scientific purposes, while addressing also societal challenges in the domains of health, sustainable materials and information and communication technologies (ICT)
- Currently, detectors (sensors) do not appear in H2020 and the effort/benefit factor has been questioned by the scientific communities
- Bringing together the detector R&D communities including physics, research, astronomy, space exploration, nuclear engineering, and medical imaging, and (mostly) Small and Medium sized Enterprises (SME)
- Basic idea: Additional tool for ERIs to further engage industry and society in their innovation cycles, while giving a boost to R&D efforts in the instrumentation communities
- Initiators: Aalto University, ESADE and CERN – other ERIs welcome to join! Next meeting in November 10 in Grenoble; DGs meet 17.11

What drives ATTRACT?

- ATTRACT is driven by needs of the detector R&D community to develop next-generation scientific instrumentation related to radiation sensors and imaging
- Examples
  - Astrophysics, astronomy
  - Electron microscopy
  - Fusion physics
  - Nuclear physics, including neutrons
  - Nuclear safety
  - Medical physics, imaging
  - Particle physics (HEP)
  - Synchrotron radiation physics
- Example of sources of R&D topics for ATTRACT
  - ERDIT Technology Platform (“Roadmap” for radiation sensor & imaging technologies)

How ATTRACT?

- ATTRACT builds upon the collaborative spirit of open science and innovation
- The detector R&D community/ies and industry (SME) are expected by EC to get themselves organized for common governance structures and guidelines, to run the Program and launch open, competitive calls
- The right governance structure needs to be established (FPA? PPP?)
- The socio-economic research community is expected be asked to help in following and studying ATTRACT to establish guidelines for EC beyond H2020 how to build up and run Innovation Ecosystems, inspired by the open environment and basic research goals of the detector R&D community/ies
- The size of detector R&D related ATTRACT calls could reach ~ 200 funded projects by 2021, or ca. 1% of H2020

When ATTRACT?

- H2020 Program is defined and (basically) approved. ATTRACT does not easily “fit” in it, not at least in the planned calls in 2014-2015
- Therefore, ATTRACT will need proceed in two ways
  - Top-down: negotiations with the EC to launch special calls for 2016
  - Bottom-up: responding to targeted calls (e.g. ICT34, FET), with help in preparing, submitting and eventually, administrating successful bids
- First dedicated discussions with the EC have started. Two documents are being prepared
  - Socio-economic study on the benefits of Open Science/Open Innovation
  - Examples of detector R&D that scientific experiments and ERIs would carry out, if adequate EC resources were to be made available. Moreover, examples of their potential use in society would be provided
  - More information: www.attract-eu.org

Summary

- ATTRACT is proposal for a dedicated EC-funded program to enhance new radiation sensor and imaging technologies and related computing R&D for scientific purposes, also addressing societal challenges together with SMEs
- The motivation is to improve the current effectiveness of EC funding for detector R&D
- The role of ERIs in the implementation is crucial
- Discussions with the Commission have started, aiming at dedicated calls for 2016
- Top-down and bottom-up approaches being pursued in parallel