



Knowledge and Technology Transfer within EuCARD2

WP2 – Catalysing Innovation

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- **Task 1: Coordination and Communication**
 - Advertising and collaborating where appropriate with other WPs on networking events with industry
- **Task 2: Transferring Innovation to Society (in particular Industry), grouped in two categories:**
 - **Technology scouting:** interviews performed with the WPs to identify key technological areas within EuCARD-2 that may become future objects of **dissemination activities** and **3 'EuCARD² meets the industry' events**
 - **Technology promotion:** **actively marketing the technologies from EuCARD² with higher maturity rate to industry** and to other research organisations outside the consortium

- **Why Knowledge and Technology Transfer (KTT) and workshops with industry – mechanism for initial stages of commercialisation thereby creating an economic/social impact from public funded R&D**
 - **Increasing role of innovation - seen as a strategic driver of the economic development - impact**
 - **Knowledge exchange/transfer activities** help to form the links between the researchers and their institutes with industrial companies, through which the technical and scientific expertise is exchanged and ultimately transferred to industry.
 - **Tools – workshops with industry**
 - **KT can result in collaborative Research and Development (R&D), to produce novel product or process**
 - **Technology transfer**
 - **Direct marketing and active technology transfer to industry for technologies with higher TRL**
 - **Tools – licencing, start up companies, joint ventures...**



Technology Readiness Levels

Level	Definition
TRL 1 - Research	<u>Basic principles</u> observed and reported.
TRL 2 - Research	Technology concept and/or application formulated.
TRL 3 - Research - KE	Analytical and experimental critical function and/or characteristic <u>proof-of-concept</u> .
TRL 4 - R&D - In coll. with ind. - KE	Technology basic validation in a laboratory environment.
TRL 5 – R&D - KE	Technology basic validation in a relevant environment.
TRL 6 - TT - R&D - KE	Technology model or <u>prototype demonstration</u> in a relevant environment.
TRL 7 – TT – Ind. led development	Technology prototype demonstration in an operational environment .
TRL 8 - Industry led development	Actual Technology completed and qualified through test and demonstration.
TRL 9 – Industry led	Actual Technology qualified through successful mission operations.

The aim of these workshops was to:

- Review the state of the art
- Identify new applications for the technology domain in question and
- Stimulate through knowledge exchange initiation of possible future joint clinical/industrial/academic collaborative R&D projects.



WPs Overview and Analysis

Technology scouting

WP	WP Type	Market/Scope outside HEP	Time to market	Potential for KTT	Workshop wanted - ready for industry engagement	Ranking (timing)
3	R&D on energy efficiency	Energy	Near term* 3-5 years	High	Yes	1
4	Network (large), focus is on complete accelerators	Energy, medical, security	Near to medium term	Medium	Yes	3
5	HEP Network, focus is on extreme accelerators	None at present, focus is on HEP area	Long term 10+ years	Low	No	-
6	Network, focus is on ultra-low emittance accelerator rings	Light sources, medical and industrial applications	Near to medium term	High	Yes, bringing together system users and industry	2
7	Network to design fully operational accelerator facility	Photon science, medical sector, semiconductor industry	Medium term* 5-10 years	Not at present	No	-
8	Support access to ICTF	None at present	Long term*	Not at present	No	-
9	Development and testing of instrumentation under extreme environments	Medical and cryogenic industry, condition monitoring	Near to medium term	High	Yes	2
10	R&D on HTS magnets	Medical sector and applied superconductivity	Medium term	High	Potentially in additive manufacturing / 3D printing	2
11	R&D on novel materials for LHC collimators	Thermal management applications e.g. power electronics, aerospace and gas turbines	Near to Medium	High	Yes	1
12	R&D on high gradient cavities, SRF thin films	Medical, security, environment and industrial processing sectors	Medium term	High	Yes	3
13	R&D on laser plasma accelerators	Medical, security, testing of materials	Medium term	High	Potentially in the future	-



EuCARD-2 Technologies

near to medium time to market

- **The use of low-grade heat for heating buildings** and increasing energy efficiency (WP3), these methods are of general interest to industry
- **Novel applications of accelerators developed for research** (WP4), e.g. the use of e-beams for treatment of waste and flue gases
- **Novel magnet designs and coatings for complex vacuum structures** (WP6), where an early involvement industry is important to bring these developments to the market
- **The development of the first High Temperature Superconductor (HTS) ribbon based cable** in collaboration with industry for high field dipole magnets (WP10)
- **The molybdenum-carbide graphite (MoGr) material** developed at CERN (WP11)
- **Novel RF technologies for compact low energy accelerators**, which were being developed as part of WP13
- **Compact Accelerators for Isotope Production** particularly for manufacture of ^{99m}Tc from ^{100}Mo

- The initial schedules for the workshops were tentatively set for months 18, 30, and 42.
 - Although the above ranking was made as a guideline, the exact contents, time, and participants of the workshops would be determined only later, after more detailed discussions with the WPs in question.
- Also to be taken into account would be the presence of other workshops, which were already held or scheduled for some of the technologies, independently of WP2.



Organised/attended events

- **Co-organised/attended events with EuCARD² content**

Title of event	Date	Venue	Link to event or report
Workshop on Accelerators for ADS	20-21.3.2014	CERN, Geneva, CH	indico.cern.ch/event/300409/
Hannover Messe	7-11.4.2014	Hannover, DE	cds.cern.ch/record/1709754
EnEfficient RF Source Workshop	3-4.6.2014	STFC, Daresbury, UK	indico.cern.ch/event/297025/
SEMI-THERM	15-19.3.2015	San Jose, US	semi-therm.org
Compact Accelerators for Isotope Production	26-27.3.2015	STFC, Daresbury, UK	indico.cern.ch/event/366464
The Applications of Particle Accelerators in Europe	18-19/6/2015	London, UK	indico.cern.ch/event/377384/timetable/#all.detailed
Applications of Thermal Management Materials	6.11. 2015	CERN, Geneva, CH	indico.cern.ch/event/400452/
Advanced Low Emittance Ring Technology	14-16.9.2016	Trieste, Italy	indico.cern.ch/event/518497/
Low energy electron beams for industrial and environmental applications	8-9.12.2016	Warsaw, Poland	indico.cern.ch/event/563590/



Workshops with industry – Outcomes/What have we learnt

Within the EuCARD-2, a wide range of accelerator and novel materials technologies were addressed.

- **In all cases these workshops attracted a significant industrial and research institute's audience and were highly appreciated by both**
- **The workshops further highlighted the economic and societal importance of these topics and the need to continue collaboration with industry and the end users to transfer the knowledge to the market place**
- **Since major investments are required for realisation of some of these technologies, there is a need to continue collaboration through EU or government-sponsored developments**
- **Following the workshop on thermal management material, several new leads have been established in the electronics and aerospace sectors.**



Catalysing Innovation - Future

EuCARD-2~ 11 person months -dissemination

Within ARIES (268PM) :

- Understand industry challenges and markets
- Facilitate the building of partnerships
- Provide advice on IP protection and licencing
- Help to develop innovation projects with high economic potential / impact and provide funding for PoC / collaborative R&D with industry
- Increase TRL level for some of the technologies

- **Responsive:** Follow-on Funding and IPS
- **Challenge-led:** Global Challenge and CLASP
- **Delegated:** Impact Acceleration Account and Innovation Fellows

1

Technology Readiness Levels

6

Research

FoF

minIPS

Standard IPS

CLASP

IAA

Innovation Fellows

Global Challenge

One size does not fit all

Workshops
To understand

Events
To bring people together

Funding
To enable development

**Impact
Analysis**

- **Responsive:** Follow-on Funding and IPS
- **User-led:** Global Challenge and CLASP
- **Empowering:** Impact Acceleration Account and Innovation Fellows

- EuCARD² WP2 has a total of **2 deliverables** (reports) and **3 milestones** (EuCARD² meets industry events)

Code	Title	Date and status	Link to event or report
D2.1	EuCARD-2 Key Technology Areas	M12, achieved	https://edms.cern.ch/document/1325115/4
MS13	Compact Accelerators for Isotope Production	M18, achieved M23 (justified)	indico.cern.ch/event/366464
MS14	Thermal Management Materials for Industry	M30, achieved	indico.cern.ch/event/400452/
MS15	Low energy electron beams for industrial and environmental applications	M42, achieved	indico.cern.ch/event/563590/
D2.2	Final work package report	M44, achieved	https://edms.cern.ch/document/1325116/1



Thank you