Innovation and industry programs: WP14 review report to EU

July 15, 2022

Marcello Losasso for WP14 – CERN

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Objectives and Tasks of WP14

Evaluate, assess and develop technology inside ARIES with the final aim to provide society with identified commercial applications of the supported research potential.

This is done via:

- implementing PoC for innovative actions
- Implementing research projects in industries
- increasing synergies in consortium between laboratories, industries, universities, applied research institutes

	Tasks
14.2	Proof-of-Concept innovation fund
14.3	Collaboration with industry
14.4	Industries for resistant materials
14.5	HTS cable development for accelerators magnets
14.6	Accelerator Timing System

– the degree to which the work plan has been carried out and whether all deliverables were completed

Deliverables

D14.1	Set-up of PoC innovation funding scheme	14.2	M12	**23/04/2018**
D14.2	Academia meets industry /1&2	14.3	M24/M36	**09/05/2019**
D14.3	Production of material samples of C-based and metal-diamond composites	14.4	M24	**30/10.2018**
D14.4	1st long length of industrial HTS	14.5	M30	**31/10/2019**
D14.5	Real-time event distribution network brought to openly accessible product grade level	14.6	M50	**20/05/2021**

Milestones

MS42	Appointing of an Industrial Advisory Board, (IAB)	14.3	M12	**09/04/2018**
MS47	Reviewed requirements document	14.6	M12	**18/04/2018**
MS45	First HTS Short Length produce via new process	14.5	M14	**13/06/2018**
MS43	1st academia-meets-industry event	14.3	M24	**30/04/2019**
MS44	2nd academia-meets-industry event	14.3	M36	**27/07/2021**

MS42: Set-up of Industry Advisory Board
MS43 & MS44: academy-meets-industry events

IAB is the body mandated for advising the ARIES PC on matters relating with industrial collaborations and to support the managing of the PoC fund;

IAB did act as Evaluation Committee of the PoC of the ARIES project.

IAB COMPOSITION

Jean-Luc Lancelot (France, SigmaPhi)
Julio Lucas (Spain, Elytt),
John Allen (UK, Elekta),
Tomas Eriksson (Sweden, GE),
Michael Peiniger (Germany, Research Instruments)

https://indico.cern.ch/event/775278/

Workshop on AD

https://indico.cern.ch/event/1048728/

Workshop on RAMI

D14.1: Set-up of Proof-of-Concept innovation-funding scheme

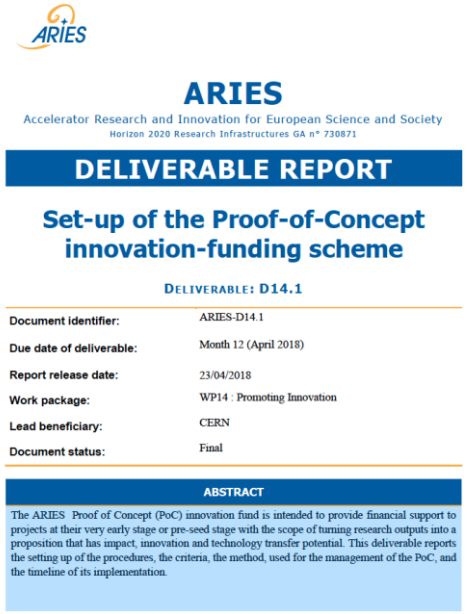
WP14 tasked to identify and support testing and validation of few key technologies with potential for market applications, at the level of 40-60 k€ each.
PoC as first-of-a-kind within a H2020 projects

PoC Fund helps to **bridge the gap between research infrastructures and innovation**, providing incentive to the beneficiaries to get actively involved in TT activities.

General aim of PoC is:

- Increase the level of innovation and TT from accelerator science, increase the impact of research, concepts & technology arising from ARIES.

- To pre-industrialise complex components of PA and demonstrating to industry the possibility to invest and engage with a target to commercialization, minimizing risks associated with innovation for SMEs.



ARIES

Accelerator Research and Innovation for European Science and Society

Horizon 2020 Research Infrastructures GA n° 730871

DELIVERABLE REPORT

Set-up of the Proof-of-Concept innovation-funding scheme

DELIVERABLE: D14.1

Document identifier:	ARIES-D14.1
Due date of deliverable:	Month 12 (April 2018)
Report release date:	23/04/2018
Work package:	WP14 : Promoting Innovation
Lead beneficiary:	CERN
Document status:	Final

ABSTRACT

The ARIES Proof of Concept (PoC) innovation fund is intended to provide financial support to projects at their very early stage or pre-seed stage with the scope of turning research outputs into a proposition that has impact, innovation and technology transfer potential. This deliverable reports the setting up of the procedures, the criteria, the method, used for the management of the PoC, and the timeline of its implementation.

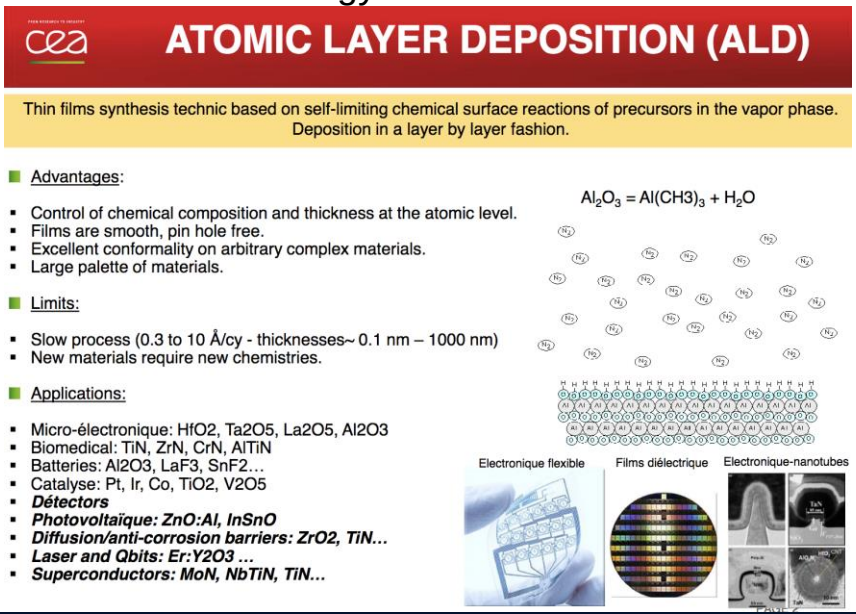
https://edms.cern.ch/document/1818311/1.0

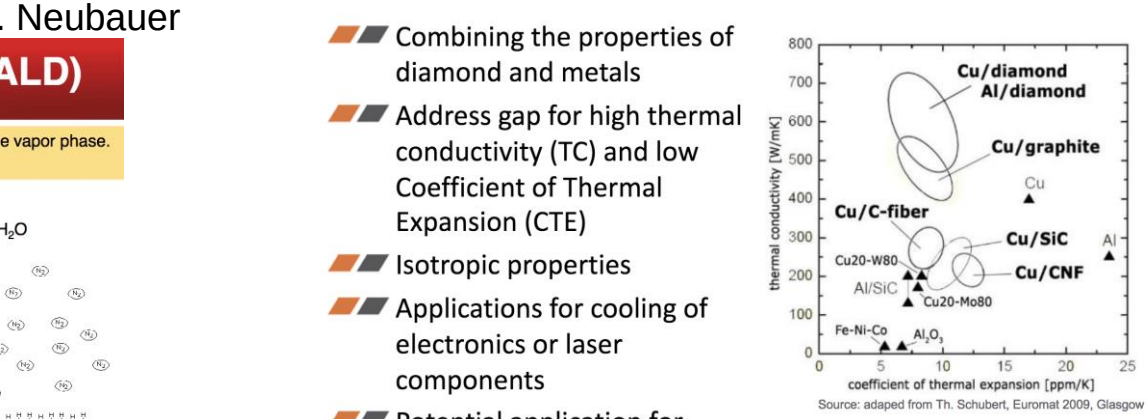
Scope, Method, Procedures, Timeline

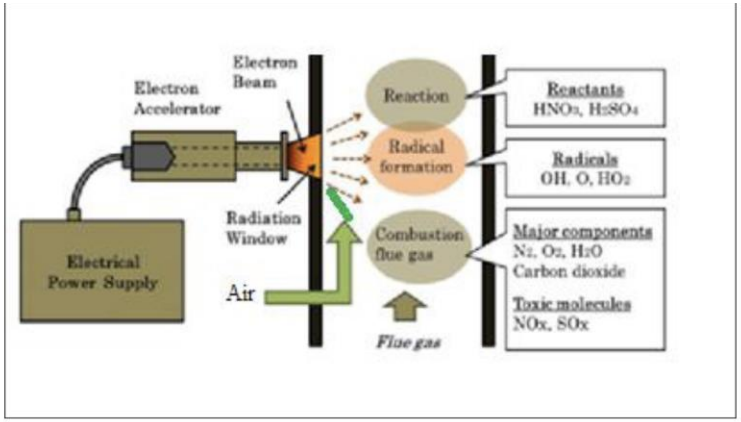
- *the management procedures and methods of the project*

PoC Projects awarded

- Atomic Layer Deposition: innovation for next generation particle accelerators – CEA -Dr. T. Proslier
- Accelerator Diagnostics using innovative Adaptive Optics (InnoAdo) – Uni.Liverpool - Prof. C. P. Welsch
- Development of hybrid e-accelerator system for treatment of marine diesel exhaust gases - RTU - Prof. T. TORIMS
- Investigation of new methods for manufacturing of Cu-C composites with tailored thermo-physical properties - RHP Technology GmbH – SME - Dr E. Neubauer







re 1. Scheme of the electron beam interaction with the molecules of the flue gas components.

Introduction: Project

ARIES PROOF OF CONCEPT FUND

- Main goal of the Innovative Adaptive Optics (*InnoAdO*) project was to **facilitate the commercialization of a novel diagnostic systems for particle accelerators and light sources.**
- Focused on the utilization of **digital micro-mirror devices (DMDs)** in several proof of concept systems.

some takeaways from PoC exercise:

- *The PoC helped* deploying and attracting resources in short amount of time. It provided money and more general support (networks, visibility, competences and know-how from cross-cutting domains) to innovative projects

- There have been identified and prospected commercialization, depending on the specific project, at prototype level. Patents submitted

- PoC has helped to develop collaborative R&D at Eu level, the creation of communities able to set roadmaps. PoC is a way to engage partners for more demanding developments.

- The general scheme considered excellent by participants. But level of effort (money) should be increased. Reporting and monitoring able to check that money is spent in proper way, to identify earlier market possibilities and to steer developments.

- *The process applied, the scheme used, the lesson learned have been a valuable experience for designing the IIF for I-FAST.*

WP14.3 Relation with industry - highlights

- ✓ W14.3 aims to increasing synergies between laboratories, universities, specialized institutes and applied research institutes: **50% of all the industries partner in ARIES are included in WP14. Industries and laboratories are well balanced in WP14.**
- ✓ Jointly with WP3, TIARA and AMICI, acted *to promote a pilot EC action* to finance a large program of accelerator relevant projects. Meeting organized on Feb 6/7 2018, in Brussels, with participation of industries and EC.
- ✓ A workshop in CERN, on Dec 1, 2017, organized in cooperation among WP3 and WP14, on *EB application for diesel motor exhaust gas purification*.
- ✓ A workshop organized with AMICI in CERN, on May 16th 2018, with participation of IPR experts from 4 EU laboratories, to *address the problematic of IPR in collaborations.*

Industrial collaboration tasks:

Task 14.4 : Materials for extreme thermal management applications (F.Carra):
Samples of materials produced by industries (**RHP and Brevetti Bizz**) in shapes required by testing devices using advanced techniques: Spark-Plasma-Sintering and Additive Manufacturing. CuCD samples were tested in the "Multimat" experiment at the CERN HiRadMat facility under high intensity proton pulses of 440 GeV/c, to acquire their dynamic response. Collected data matches well the results of simulations and will help improving constitutive models for the less known composite materials. Applications: cooling of electronics or laser components, collimators in LHC

Activity object of Deliverable D14.3
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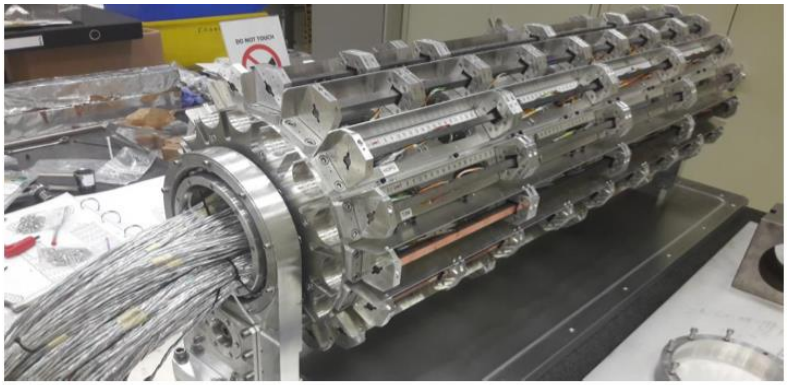


Figure 2 – Multimat rotatable sample holder, hosting rods made of 18 different materials.

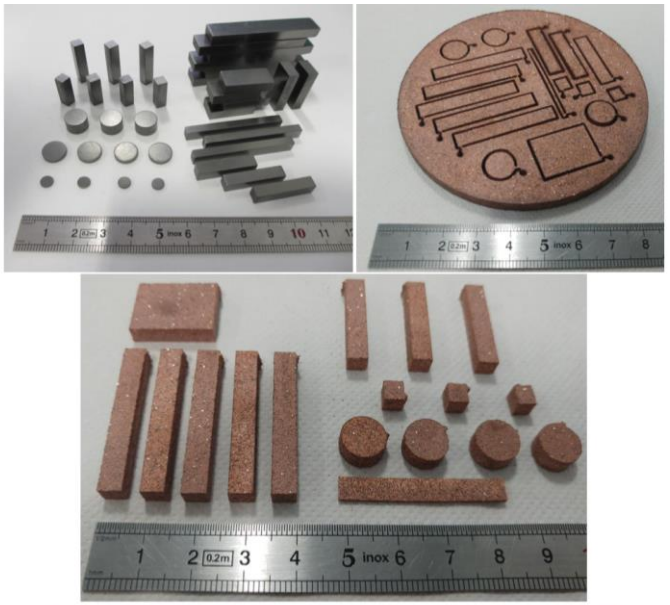
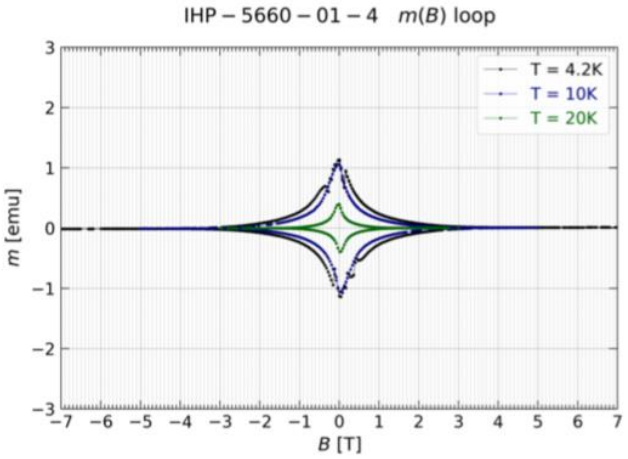


Figure 4 – Top left: 36 samples of CerGr. Top right: CuCD plate with samples cut by water-jet. Bottom: 17 samples of CuCD extracted from the plate. All specimens are for thermophysical characterization at the CERN EN-MME Mechanical Laboratory.

Industrial collaborations tasks:

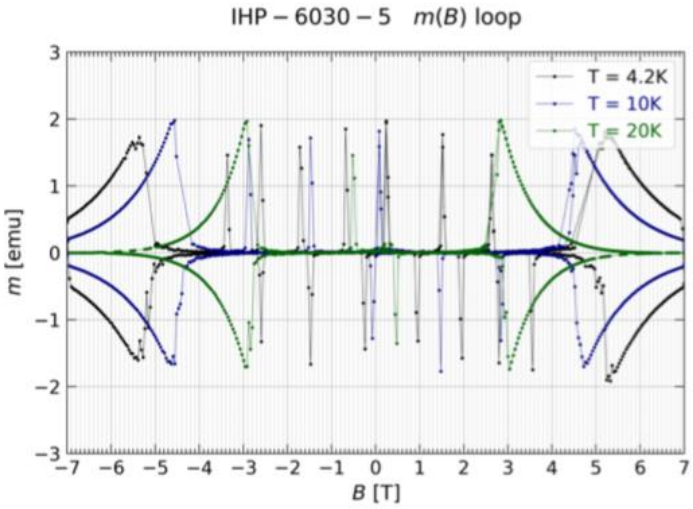
Task 14.4: samples of MgB_2 on metal substrate produced by RHP and tested by UNIGE

T_c	27 K
$T_{c\ onset}$	31 K
$B\ (J_c = 10^4 A/cm^2,\ T = 4.2\ K)$	0.20 T
$B\ (J_c = 10^4 A/cm^2,\ T = 10\ K)$	0.10 T
$B\ (J_c = 10^4 A/cm^2,\ T = 20\ K)$	0.00 T



from first batch of samples (October 2018)

T_c	38.3 K
$T_{c\ onset}$	39.2 K
$B\ (J_c = 10^4 A/cm^2,\ T = 4.2\ K)$	5.85 T
$B\ (J_c = 10^4 A/cm^2,\ T = 10\ K)$	5.05 T
$B\ (J_c = 10^4 A/cm^2,\ T = 20\ K)$	3.25 T

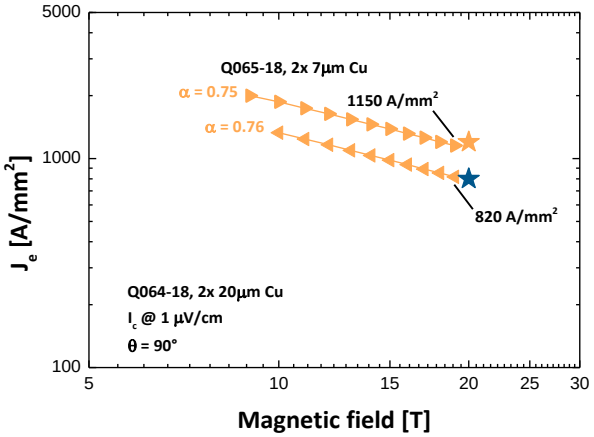


to second batch of samples (March 2019)

Industrial collaborations tasks:

Task 14.5: HTS innovative process for accelerator magnet conductor (L.Rossi)

- ***Objective: set up a NEW industrial optimized process to produce few hundreds of m of tapes with Increased J_e by a factor 2 wrt EUCARD-2***
  - ***from J_e (4.2 K, 20 T) = 400-600 A/mm²***
  - ***to J_e (4.2 K, 20 T) = 800-1000 A/mm²***



Tape Q065-18 (with 2x 7μm Cu) reached a very high performance of 1150 A/mm² at 4.2 K, 19 T, 90°

- Industrialization of a repeteable and scalable process
- Increase production yield with attempt to produce 100m lenghts with proper current
- Use of 50 μm thick substrate (SS tape) is an absolute novelty in the panorama of coated conductor.
- In total 413 m of HTS tape of 12 mm width and 50 μm substrate thickness have been produced,
- obtained tapes with record current density, beyond the ARIES goal

Activity of the task reported in ***D14.4***

https://edms.cern.ch/document/1818319/1.0

Industrial collaborations tasks:

Task 14.6: *Accelerator Timing System (J.Gutleber)*

Industrialization of Realtime Event Distribution Network - REDNet Accelerator Timing System

Central Timing System is a distributed and scalable system for synchronizing the operation of devices distributed across the accelerator (beam diagnostic, power supplies, i/o digital….)

CTS developed based on CERN know-how. Cosylab and CERN together developed a similar system called RedNET for the project MedAustron.

In the scope of ARIES, REDNet system has been upgraded, customized and supplied to a specific user (ADAM). The product developed by Cosylab is now marketed by Cosylab under the name **C-MTS**

Activity of the task reported in ***D14.5***

Conclusion

- WP14 has timely and successfully delivered
- PoC demonstrated to be a valid tool for fostering innovation and to engage industries. It attracted more resources than what deployed by the project
- Activity in WP14 has set important basis for I-FAST
- Industries leading specific actions were properly integrated in the WP14 plan of work
- Remarkable results from industrial developments, thanks to effective coordination and TT with laboratories
- Product originated in the HEP domain can be adopted by prospected customers (small / medium sized PA for medical and industrial applications): technology effectively transferred from physics research in CERN to market as a co-construction process with industry.
- R&D of industrial process developments will help deployment of new accelerators (HTS cable for magnets, and HTS materials for electronic devices, new materials for collimators, electronics…

- the expected potential scientific, technological, economic, competitive and social impact……
- the beneficiaries' contributions and their integration within the project…
- how resources were planned and used in relation to the achieved progress, and if their use respects the principles of economy, efficiency and effectiveness

Thanks to task coordinators: L.Rossi, F.Carra, J.Gutleber

Thanks to all the industries and laboratories involved in the WP14 activities

Thanks to all PoC participants and to their coordinators

Q&A