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# ARIES Industrial and Societal Applications Network

Rob Edgecock / University of Huddersfield & STFC

# Outline

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- Welcome
- Agenda
- WP3 talks in the plenary
- WP3 tasks
- Deliverables
- Milestones
- Proof of Concept fund proposals
- H2020

# Agenda

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- Task 3.1/Introduction - R. Edgecock
- Task 3.2
  - General review of activities - A.G.Chmielewski
  - Current applications of electron beam accelerators up to 10 MeV - Z.Zimek
  - Electron beam technology for preservation of cultural heritage artefacts - D. Smietanko
- Task 3.3
  - General review of activities - F-H.Roegner
  - Low energy electron beam to treat biological cell-substrates - F-H.Roegner
- Task 3.4
  - General review of activities - A.Faus-Golfe
  - Consulting company in environmental applications - E.Marin
- Task 3.5
  - General review of activities - D.Campos

# WP3 in the Plenary

Thursday 24th

## Plenary Meeting - Session 2: Applications and technologies (14:00-15:30)

-Conveners: Toms Torims

time	[id] title	presenter
14:00	[24] Innovation at ARIES, report from WP14	LOSASSO, Marcello
14:30	[25] Development of metallic and ceramic composites for accelerators	CARRA, Federico
14:50	[26] The Sushi test at SM18	BARNA, Daniel
15:10	[27] Industrial and societal applications, report from WP3	EDGECOCK, Rob

## Coffee Break (15:30-16:00)

## Plenary Meeting - Session 2: Future technologies (16:00-18:00)

-Conveners: Angeles Faus-Golfe

time	[id] title	presenter
16:00	[28] Studies of marine diesel engine exhaust gas treatment	ZWOLINSKA, Ewa
16:20	[29] Molybdenum 99 production using an electron beam	NAGEL, Candice

# WP3

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- ISA: Industrial and Societal Applications of accelerators
- Three science areas:
  - Industrial and environmental applications of electrons up to 10MeV
  - Accelerator radioisotope production
  - Applications of electron beams up to ~140 MeV
- Will do real work (i.e. not organise workshops)
- Focus is on improving or developing new applications

# WP3

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## Task 3.1. Coordination and Communication (Rob Edgecock)

- Coordinate the WP activities
- Monitor the progress of WP tasks and ensure the obligations are met
- Manage the WP budget and use of resources and prepare internal and deliverable reports

## Task 3.2. Low energy electron beam applications: new technology development (Andrzej Chmielewski)

- Study and document the requirements for current e-beam applications
- Study the introduction of new technology from the research area to bring improvements to these applications
- Develop a standard electron beam unit to make the transition to electron beam applications easier for newcomers

## Task 3.3. Low energy electron beam applications: new applications (Frank-Holm Roegner)

- Study the use of electron beams in the environmental area
- Study the expansion of the use of electron beams in the industrial area
- Document the new applications and the requirements on the accelerator technology

## Task 3.4. Medium energy electron beams (Angeles Faus-Golfe)

- Study of the applications of electron beams up to 140 MeV in the medical and other areas
- Study of the construction of high performance electron linear accelerator up to 140 MeV

## Task 3.5. Radioisotope production (Diego Campos/Conchi Oliver)

- Document the requirements for compact accelerators for radioisotope production
- Optimise the design of a new compact cyclotron for PET isotope production, with the aim of maximising the production
- Analyse different solutions for a compact source for PET, with the aim of improving the performance and cost
- Study which existing and possibly new therapeutic isotopes are of interest clinically and how they can be produced using particle beams
- Study and compare novel acceleration techniques for  $^{99m}\text{Tc}$  and therapeutic isotope production

# WP3 - Partners

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- Full partners:
  - CERN (Switzerland)
  - Ciemat (Spain)
  - CNRS (France)
  - Fraunhofer FEP (Germany)
  - University of Huddersfield (UK)
  - IBA (Belgium)
  - INCT (Poland)
- Associates:
  - EBtech
  - IAEA
  - iiA
  - Slovak Medical University



Deliverable Number <sup>14</sup>	Deliverable Title	Lead beneficiary	Type <sup>15</sup>	Dissemination level <sup>16</sup>	Due Date (in months) <sup>17</sup>
D3.1	Applications of electron beams in the environmental area	27 - INCT	Report	Public	24
D3.2	Evaluation of new technology for electron beam applications	27 - INCT	Report	Public	30
D3.3	Comparison of different accelerator options for <sup>99m</sup> Tc and therapeutic isotope production	39 - HUD	Report	Public	36
D3.4	Design of a compact 140 MeV electron linear accelerator	6 - CNRS	Report	Public	42

### Description of deliverables

D3.1 : Applications of electron beams in the environmental area [24]

Report to describe the possible applications of electron beam accelerators in the environmental area including the technological requirements (Task 3.3)

D3.2 : Evaluation of new technology for electron beam applications [30]

Report to assess the potential for new accelerator technology to bring improvements in terms of cost and performance for electron beam applications (Task 3.2)

D3.3 : Comparison of different accelerator options for <sup>99m</sup>Tc and therapeutic isotope production [36]

Report to compare the different new accelerator options in this project for the production of these isotopes with those already in use and with each other (Task 3.5)

D3.4 : Design of a compact 140 MeV electron linear accelerator [42]

Report to describe the design of a compact linear accelerator for producing electron beams in the range 30 to 140 MeV for a variety of applications (Task 3.4)



# Deliverables

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- Go to the EU, so important
- Must be on time
- Approval procedure:
  - well in advance, start writing using template on website
  - >1 month in advance, send to me for comments, etc
  - 1 month in advance, send to Maurizio
  - Will allow the deliverable to be uploaded by the deadline
- “Reasonable” length: 12-20 pages?
- Scientific documents

# Milestones

Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS13	Current applications of e-beam accelerators up to 10 MeV (Task 3.2)	<b>Done!</b>		Report approved by StCom
MS14	New industrial applications of electron beams (Task 3.3)	11 - FEP	18	Report approved by StCom
MS15	Medical applications of high energy electron beams (Task 3.4)	6 - CNRS	24	Report approved by StCom
Milestone number <sup>18</sup>	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS16	Study of different options for PET isotope production (Task 3.5)	34 - CIEMAT	30	Report approved by StCom

# Milestones

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- Don't go to the EU, so not quite as important
- Should still be on time
- Approval procedure:
  - well in advance, start writing using template on website
  - >1 month in advance, send to me for comments, etc
  - 1 month in advance, send to Maurizio
- Can be short length: >4 pages?
- Scientific documents

# Papers

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- Worth considering whether deliverables & milestones could be converted to refereed papers
- Papers are encouraged
- Three rules:
  - Must ensure open access (free of charge, online access for any user) to all peer-reviewed scientific publications relating to its results. In particular, it must as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications.
  - Must have an acknowledgement to EU funding
  - Must be uploaded onto the ARIES website

# Papers

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## Acknowledgement

All ARIES publications (including Transnational Access) must include the following acknowledgement:



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# Proof of Concept Fund

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- WP3 part of/submitted 4 proposals:
  - “Eliminating the spread of AMR through wastewater” (HUD)
  - “Development of hybrid electron accelerator system for the treatment of marine diesel exhaust gases” (RIGA)
  - Production of  $^{99}\text{Mo}$  using an electron beam (IBA)
  - Novel ion source for AMIT (CIEMAT)
- Still waiting for any form of feedback!

# H2020

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- Societal Challenges area
- Two calls perhaps still of interest
- SC2: CE-SFS-30-2019: High-quality organic fertilisers from biogas digestate:
  - up to 5 MEUR
  - in collaboration with at least 3 Chinese partners
  - companies required
  - opens: 16<sup>th</sup> Oct 2018; closes: 23<sup>rd</sup> January 2019
- SC4: LC-MG-1-8-2019: Retrofit solutions and next generation propulsion for waterborne transport
  - 4 – 6 MEUR
  - company required
  - two stage proposals
  - opens: 5<sup>th</sup> Sep 2018; closes: 16<sup>th</sup> Jan 2019



## **CE-SFS-39-2019: High-Quality Organic Fertilisers from Biogas Digestate**

- Part of FAB: agreement between EU and Chinese Academy of Agricultural Sciences
- Scope: Projects shall develop treatment technologies to convert digestate into a suitable fertiliser or soil amender. They could focus on a specific digestate type or develop a flexible process covering a variety of digestates. These treatments shall:
  - reduce risks linked to biological and chemical hazards (including AMR) to acceptable levels
  - improve fertilising properties
  - address issues related to format, formulation and handling. Proper solutions must be sought for the liquid phase to avoid pollution
- Our proposal: use electron beams
- Requirements:
  - The fertiliser developed must be suitable for direct use, or for mixed formulation with other fertilisers
  - Field tests must be implemented over an appropriate period of time to assess its agronomic properties, as well as its effect on the environment (including greenhouse gas emissions), and on food safety
  - Projects shall focus on technologies that could be deployed in a decentralised manner, at a relatively small scale
  - Such technologies shall achieve a technology readiness level (TRL) 6-7 by the end of your project
  - A comprehensive impact assessment (economic, environmental and social) of the business model shall be carried out, and policy recommendations shall be provided to boost its deployment

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- Requirements (cont):
  - Proposals shall ensure solid collaboration between agro-food actors, technology providers, research centres, end-users (farmers and farmers associations), and public administration
  - Projects shall perform a thorough analysis of the state of the art, and demonstrate that your proposed activities go beyond this state and do not overlap with past or ongoing research
  - Proposals shall include a task to cluster with other projects financed under topic RUR CE-08-2018/2019/2020 and — if possible — with other relevant projects in the field funded by Horizon 2020
  - Proposals shall promote balanced research and innovation cooperation between the EU and China. China-based entities that will participate in joint projects with European partners under Horizon 2020 have also the possibility to apply for funding under the Chinese co-funding mechanism.
- Impact: Projects are expected to provide the technologies needed to develop commercial fertilisers based on biogas digestate. This will help to:
  - replace conventional, non-renewable mineral fertilisers, hence reducing external dependence and risks related to depletion
  - reduce the environmental impacts linked to the inadequate management of biogas digestate, and to the production of fossil-based fertilisers
  - develop new business models in rural areas, that are synergised with existing ones, creating value from digestate.

In the long term, this shall contribute to a more circular, resource-efficient and sustainable agro-food sector, and create wealth and quality jobs in rural areas.

Projects shall also contribute to increasing the innovation capacities of participating organisations, and to strengthening scientific and industrial collaboration between the EU and China.

- Funding available: up to 5 MEUR
  - Rate: 70% for companies
  - 100% for non-profit legal entities
- Duration: ?
- Opening date: 16<sup>th</sup> October 2018
- Closing date: 23<sup>rd</sup> January 2019
- Innovation action:
  - Action primarily consisting of activities directly aiming at producing plans and arrangements or designs for new, altered or improved products, processes or services. For this purpose they may include prototyping, testing, demonstrating, piloting, large-scale product validation and market replication.
  - Projects may include limited research and development activities
- TRLs:
  - 6: technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
  - 7: system prototype demonstration in operational environment

**PHOEBé:** Production of High-Quality Organic Fertiliser using Electron Beams