This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under GA No 101004730.

WP10: Advanced Accelerator Technologies - Additive Manufacturing

Strategic goals

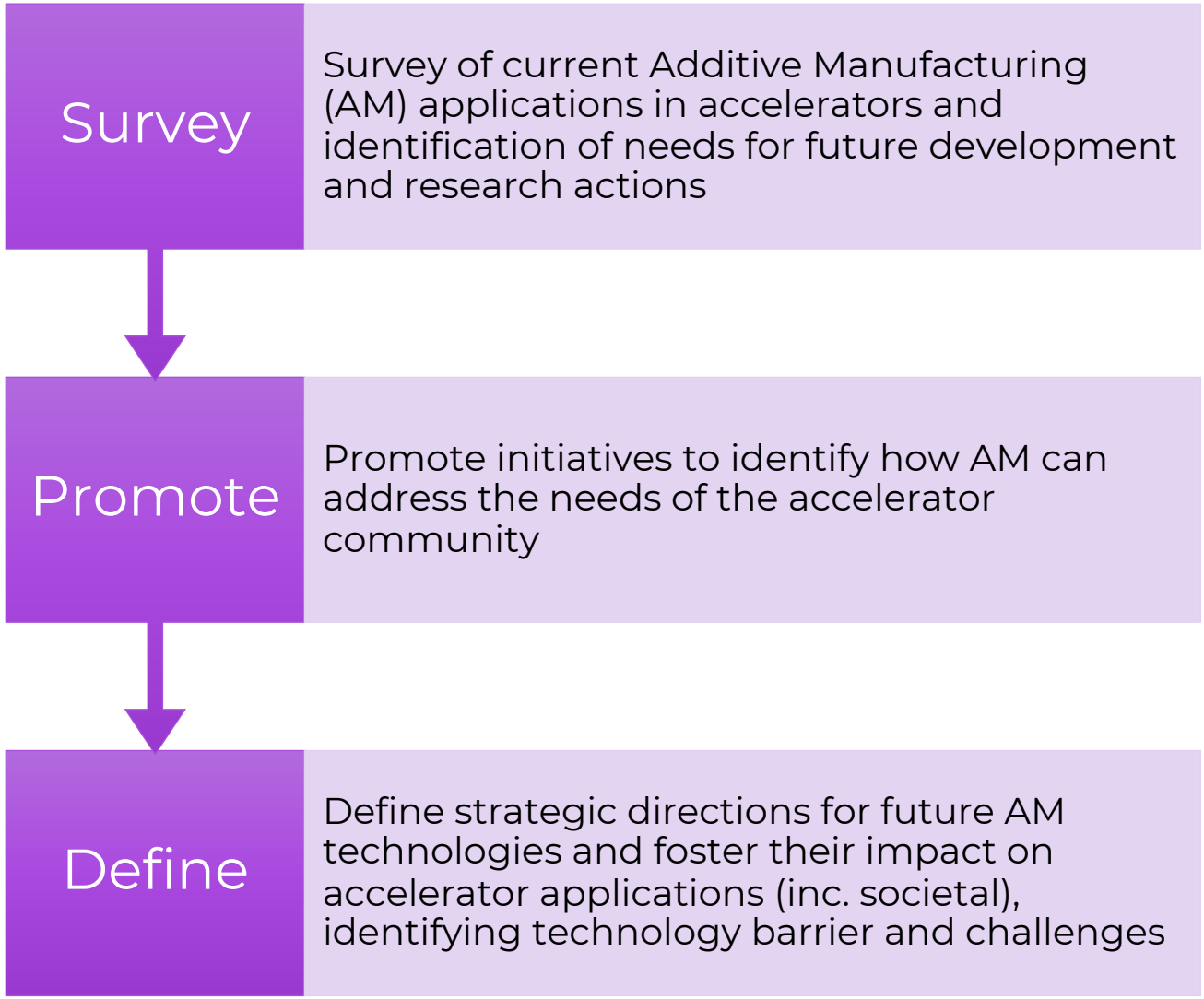
Prof. Toms TORIMS / RTU & CERN

iFAST

Task 10.2: AM – Survey of applications and potential developments / M1 – M36

Task Leader:

Prof. Maurizio VEDANI - PoliMi



Task 10.3: Refurbishment of accelerator components by AM technologies / M1 – M24

Task Leader:

Dr. Andris RATKUS – RTU

Definition of applications and components for the **repair** activities in the accelerator components **by AM**

Identification of **AM strategies** that can be adopted **to repair** parts

Study **post-processing methods** to control surface roughness and surface cleanliness of AM parts

Identification of a sample **demonstration prototype** of AM repaired unit for an accelerator

Task 10.4: Development of AM-manufactured superconductive RF cavities / M1 – M24

Task Leader:

Ing. Adriano PEPATO - INFN PD

Develop the **design approach and test** relevant properties of **AM-manufactured Niobium RF cavities**

Develop the **design approach and test** relevant properties of **AM-manufactured Ultra-Pure Cu-made RF** body cavities - coated by a Niobium thin layer at the inner surface

Both to be tested at room and at cryogenic temperature

Big challenges require joint response: Task 10.2; Task 10.3 and Task 10.4

Vacuum, cryo, RF: leak tightness, outgassing rate, porosity, electrical conductivity

Size limitations of machines and available simulation tools

Materials: ultra-clean, chemical purity – still limited avaliability, flow properties

Accuracy: surface roughness, tolerances, geometry precision

Radiation impact and activation

AM technological specificities an optimisation to end requirments (RF, cryo, etc.)

Microstructure uniformity, residual stresses, inclusions, voltage holding

Potential post-processing and eventual hybrid-machining

Yet most importantly: **traditionalism, lack of knowledge, and scepticism on AM compliance with the stringent accelerator requirements**

Expected outcomes: Task 10.2; Task 10.3 and Task 10.4

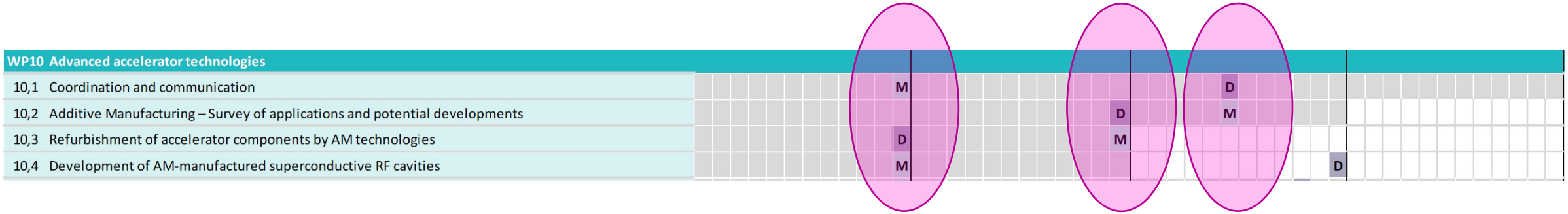
Hard Deliverables

- **D10.3:** AM Superconductive RF cavities. *Production and tests of superconductive RF cavities, made by Nb and/or Cu coated by an Nb thin film* – M12
- **D10.2**: **Survey** of AM applications and strategies for repairing accelerator components by AM. ***Report*** *listing possible* ***strategies and technologies*** *for repairing of parts* – M24
- **D10.1**: Potential AM applications in accelerators. ***Report*** *on output of the* ***survey on AM applications****, further needs for the accelerator community, and perspective developments* – M30

Soft results

- **WP 10 Strategy group** will work on the emerging applications of AM technologies in the accelerator field
- Will define further potential applications - in particular, for industrial and medical accelerators
- Will explore **possibilities of digitalisation in accelerators, evaluating market and economical as**pects concerned with AM in the accelerator sector
- PhD engagement and scientific mobility/exchange (especially NE Europe)
- This all shall result in a "**Roadmap of future AM applications for accelerators**"

Milestones



MS43	Dissemination and communication plan	10.1	12	Report
MS44	Survey on current AM applications in accelerators and expected new developments	10.2	30	Report
MS45	Survey on current AM repair technologies for accelerator and list of possible applications	10.3	24	Report
MS46	Performance of Superconductive Cavities made by AM technology by Nb or Cu with Nb thin spattered film on the internal surface	10.4	12	Report

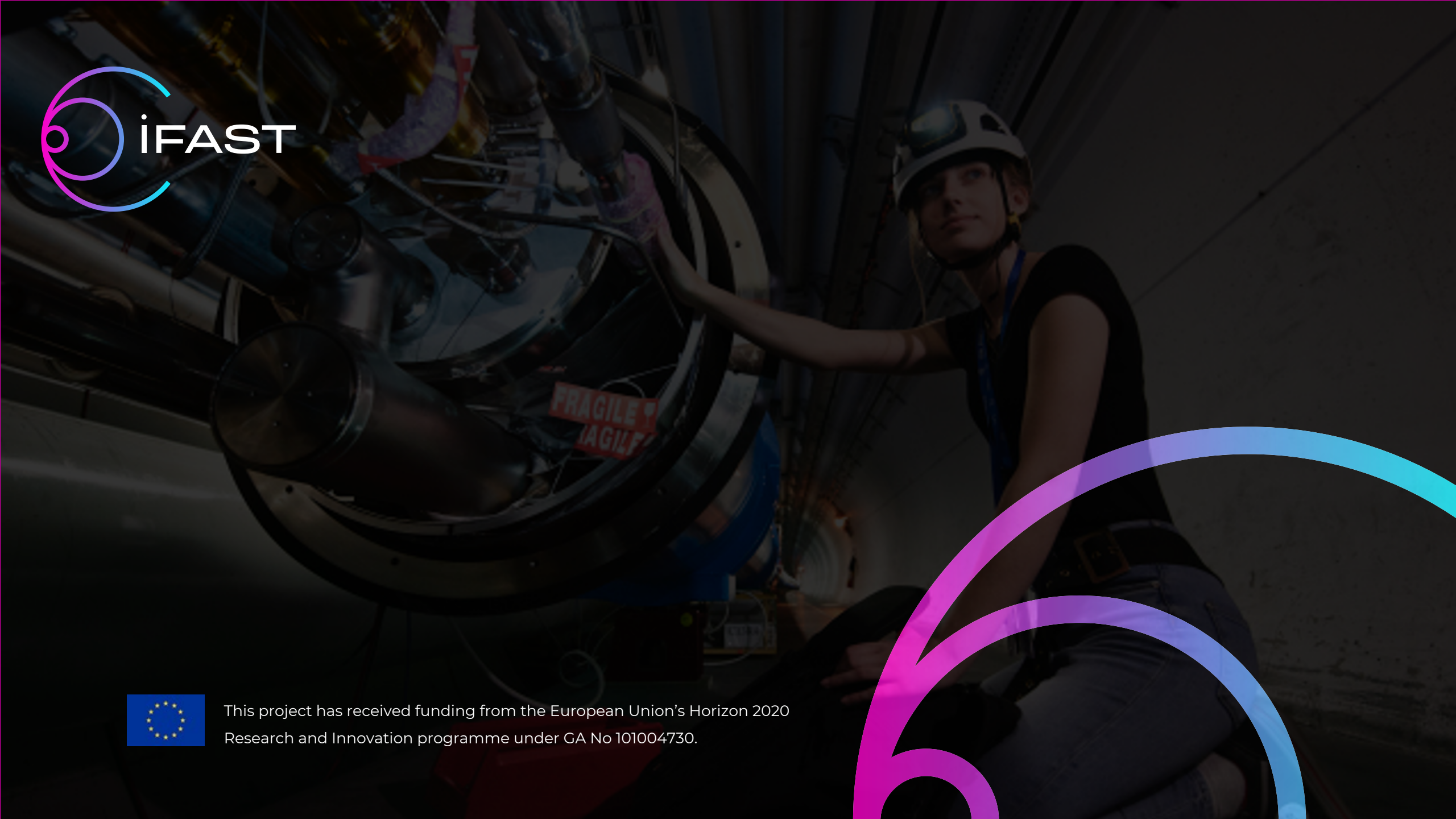
Strategic goals of AM Group within WP10

Fully in line with High-priority future initiatives of **2020 Update of the European Strategy for Particle Physics:**

A. *The particle physics community should ramp up its **R&D effort focused on advanced accelerator technologies** …*

B. *The European particle physics community must **intensify accelerator R&D** and sustain it with adequate resources. A roadmap should prioritise the technology, taking into account **synergies with international partners and other communities** …*

- **To proliferate** AM R&D in the Accelerator Community at large
- **To give a visibility** to already remarkable achievements
- **To rise the trust** to AM by showing real and tangible R&D case studies
- **To contribute** to Accelerator Community Projects and Collaborations – especially related to societal applications – e.g.NIMMS, SEEIIST, HITRIplus - hadron therapy
- **To lower overall costs** by using AM (e.g. reduced material consumption and repairs) – sustainability
- **To promote** range of new **AM projects** and grants within Accelerator Community and beyond
- **To pull resources and knowledge together** + **to engage** new partners
- **To take a leadership** at European level and coordinate efforts with US and China partners – to become **AM Strategy Group for the Accelerator Community**



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