



# 1<sup>st</sup> Annual I.FAST meeting, 04/05/2022

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# WP10 description

Task 10.1: Coordination and communication

Task 10.2: Additive Manufacturing – Survey of applications and potential developments

Task 10.3: Refurbishment of accelerator components by AM technologies

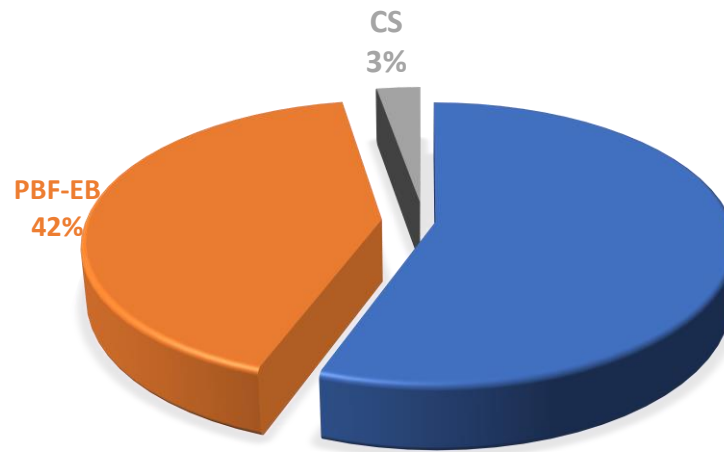
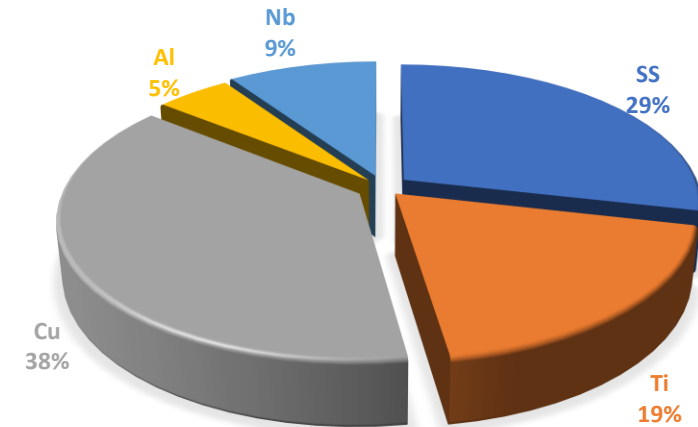
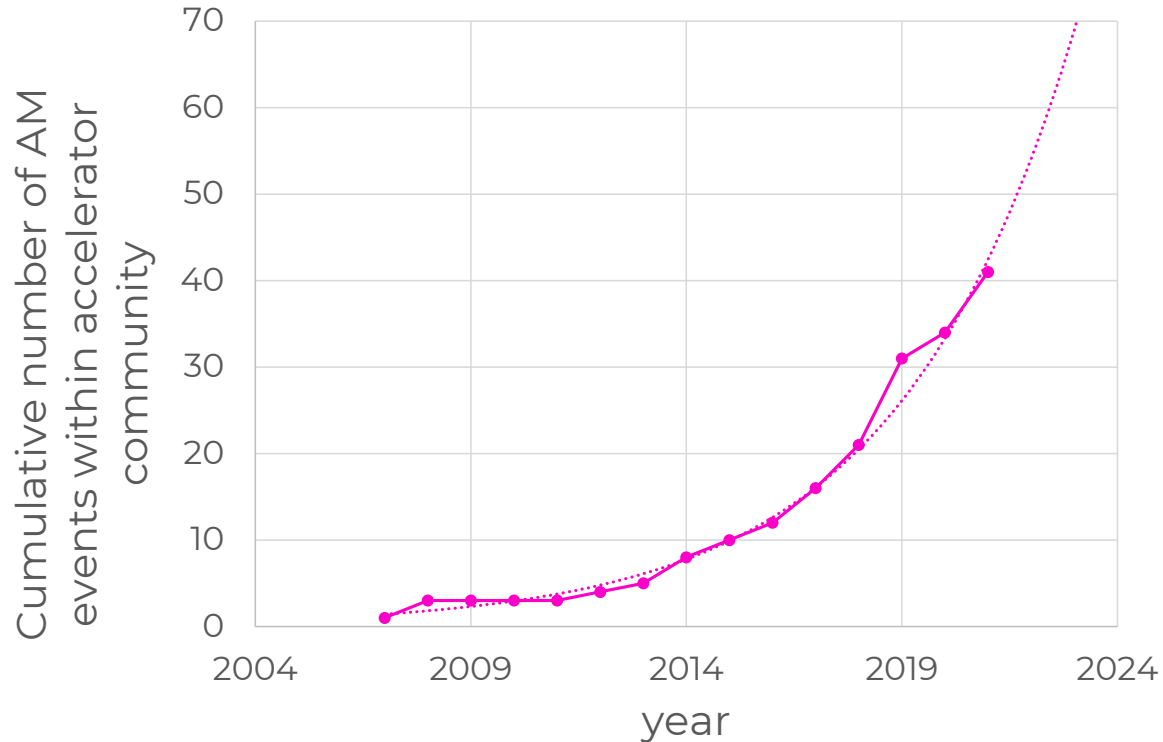
Task 10.4: Development of AM-manufactured superconductive RF cavities

Task 10.5: Photon Stimulated Desorption from NEG coatings for accelerator vacuum chambers

Task 10.6: Machine learning techniques for accelerator and target instrumentation

Task 10.7: Development of electro-optical waveguide sensors as beam electric field sensors

# Task 10.2: Additive Manufacturing – Survey of applications



## Applied metal AM technologies:

- PBF-LB
- PBF-EB
- Cold spray

## Most often used AM machines:

- GE Arcam
- EOS
- SLM
- Renishaw
- Trumpf
- GE Concept Laser

# Task 10.2: Additive Manufacturing – Survey of applications





# Task 10.2: Additive Manufacturing – future development



## ¼ Section of an RFQ

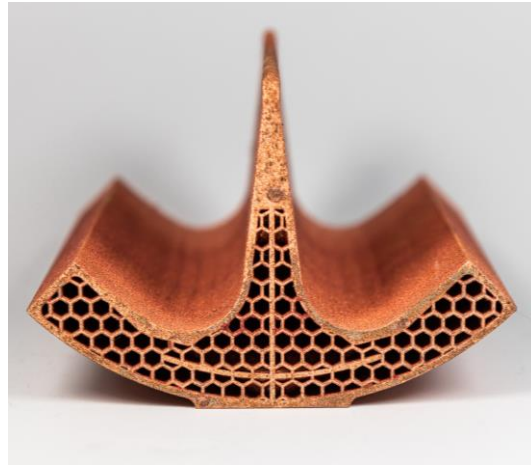
**Material:** m4p™ Pure Cu gas-atomised powder

**Process:** PBF-LB by TRUMPF TruPrint1000 Green Edition (500W disc laser@515nm wavelength)

**Process parameters:** Layer thickness 30µm; print time: 16h 29min

# Task 10.2: Additive Manufacturing – future development

Post processing to reduce surface roughness is under development



1 Traditional mass finishing process

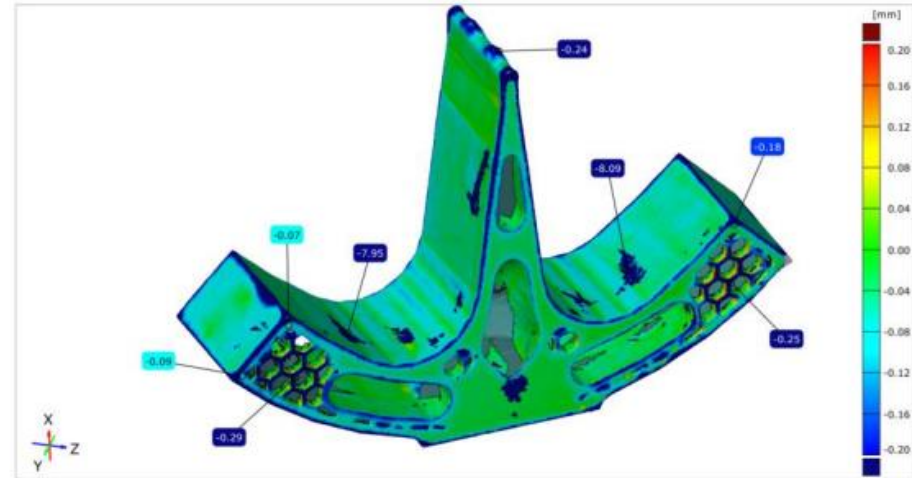


2 Chemically-assisted mass finishing process

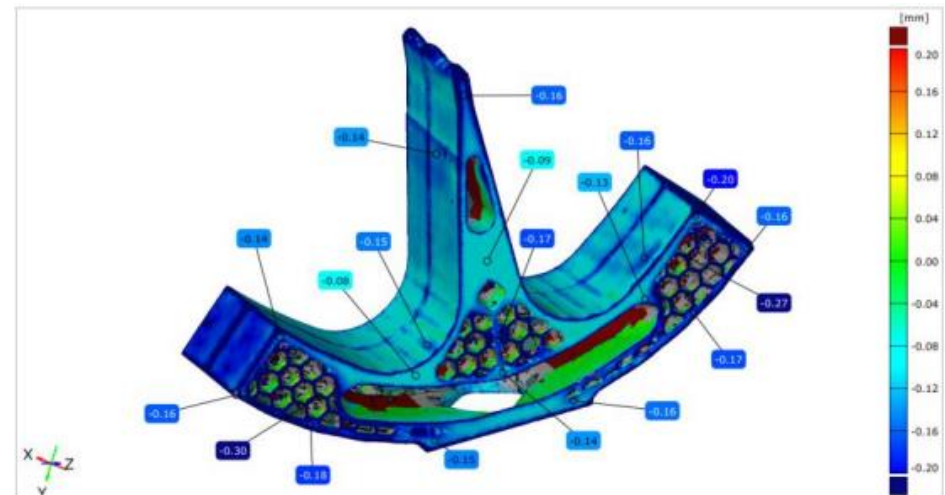


# Task 10.2: Additive Manufacturing

¼ RFQ TOP	Ra (µm)	Rz (µm)	Rq (µm)
Rough sample	10,7 ± 3,1	68,7 ± 6,7	13,6 ± 1,5
Previous treatments	4,3 ± 1,0	16,0 ± 3,8	5,8 ± 1,5
#1: mechanical treatment	1,58	4,98	1,89
#2: chemically assisted process	2,31	7,34	2,78



3D scan after mechanical treatment



3D scan after chemically assisted treatment



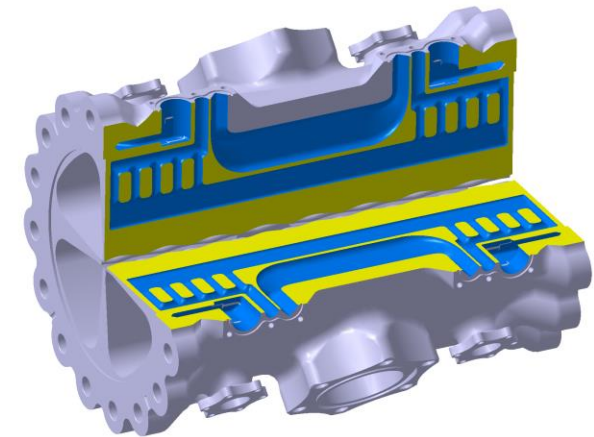
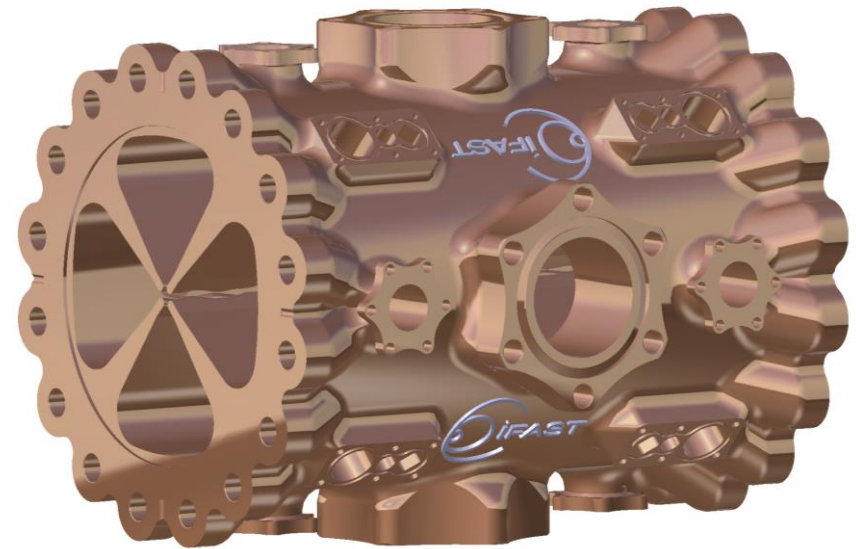
# Task 10.2: Additive Manufacturing - Toward the full-section quadrupole

The full size RFQ design is currently in advanced stage, it will be printed with pure Cu using an L-PBF system with larger build-platform

- Integration of cooling channels
- More challenging post processing

Tests are also running to evaluate other properties of materials produced by AM

- Dimensional tolerances
- Vacuum thightness
- HV holding tests





## Task 10.2: Additive Manufacturing – dissemination & communication actions

Our mission is to increase awareness and confidence on Additive technologies for accelerators, also attracting the AM industry into this sector

- Type 1: I.FAST meetings - project partners:
- Type 2: “in situ” meetings with industry and other research institutions – relevant non-project partners and interested parties
- Type 3: “Horizontal Workshops” open to everyone - transverse multidisciplinary Workshops and events involving two or more I.FAST WPs.
- Type 4: oral contribution to the international conferences and seminars, journal papers

# Task 10.2: Additive Manufacturing – dissemination & communication actions

Join us at tomorrow at the workshop on AM applications !

## Workshop on Additive Manufacturing (AM) applications

📅 Thursday 5 May 2022, 15:40 → 18:00 Europe/Zurich

📍 80/1-001 - Globe of Science and Innovation - 1st Floor (CERN)

👤 Andris Ratkus (Riga Technical University (LV)), Maurizio Vedani (Politecnico di Milano, Department of Mechanical Engineering), Toms Torims (Riga Technical University (LV))



### 15:45 → 15:50 Opening of the Workshop

Objectives of the workshop:

- to raise awareness about advantages of AM in the accelerator community, covering both research infrastructures and societal applications;
- to improve knowledge about the potential of AM applications to particle accelerators;
- to discuss the AM technological aspects, innovative materials as well as new design approaches for complex parts and assemblies.

Speaker: Toms Torims (Riga Technical University (LV))

### 15:50 → 16:10 Overview of AM applications within the industry at large

- Generally about AM
- State-of-Art
- Latest trends

Speakers: Frank Brueckner (Fraunhofer IWS), Lukas Stepien (Fraunhofer IWS)

### 16:10 → 16:30 Comprehensive review of the AM applications in the accelerator community

- Introduction
- Applications
- Advantages/ challenges

Speakers: Guntis Pīkurs (Riga Technical University (LV)), Nicolas Delerue (CNRS & Université Paris-Saclay)

### 16:30 → 16:40 First survey results: "Accelerator community response to the use of AM in the production and repairs of accelerator components"

Speakers: Andris Ratkus (Riga Technical University (LV)), Dagnija Krogere (Riga Technical University (LV))

### 16:40 → 17:25 Experience of Industry

- Rösler
- TRUMPF
- Taniobis

Speakers: Markus Weinmann (Taniobis), Matteo Pozzi (Rösler), Philipp Wagenblast (TRUMPF)

### 17:25 → 17:55 Discussion: AM applications and challenges within the accelerator community

AM is evolving rapidly forming an integral part of advanced industries technological portfolio, while uptake of this beneficial and money-saving technology by accelerator community is progressing slowly because of traditionalism, lack of knowledge, and scepticism on compliance with the stringent accelerator requirements.

- Vacuum
- High Voltage
- Surface roughness
- Geometrical Tolerances
- Radio Frequency
- Electrical conductivity

### 17:55 → 18:00 Summary and closing remarks

Speaker: Toms Torims (Riga Technical University (LV))

# Thanks for the collaboration

Frank Bruckner  
Nicolas Delerue  
Maurizio Foppa Pedretti  
Samira Gruber  
Elena Lopez  
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Adriano Pepato  
Guntis Pikurs  
Matteo Pozzi  
Tobia Romano  
Andris Ratkus  
Toms Torims  
Philipp Wagenblast



iFAST

*Thanks for your attention*

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