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

# Task 9.3 Progress @ INFN

2nd iFAST WP9 meeting - 24th September 2021

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iFAST

# Goal

## Realize a $Nb_3Sn$ on Cu 6 GHz elliptical cavity

Results and experience accumulated in this task will be used to realize a 1.3 GHz cavity

# What do we need?

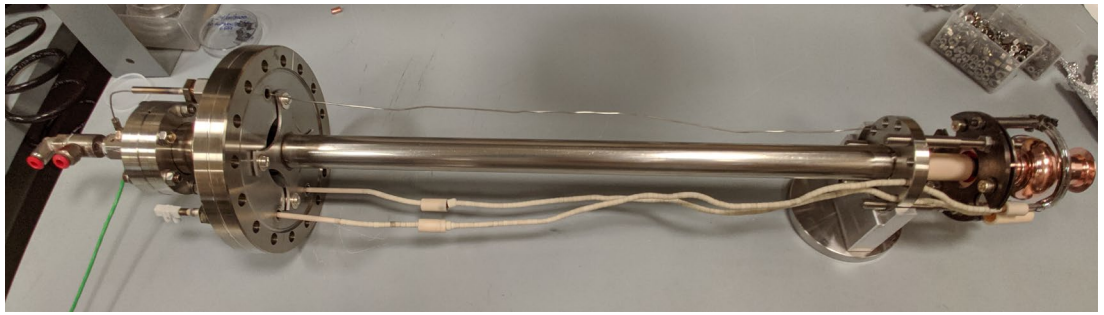
- **6 GHz Cu cavities** ✓

- **8 cavities spun** *(June 2021)*

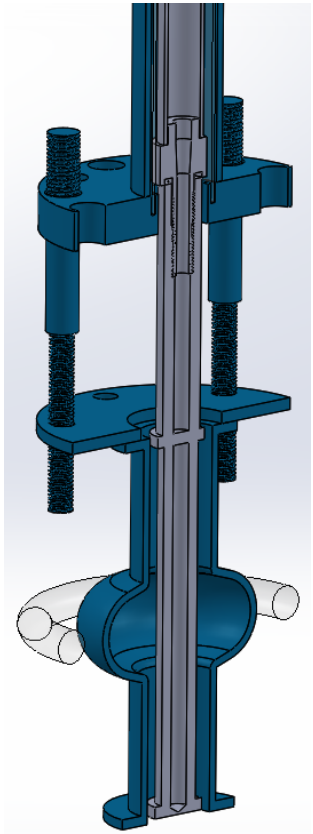
**2 cavities ready for coating** *(August 2021)*

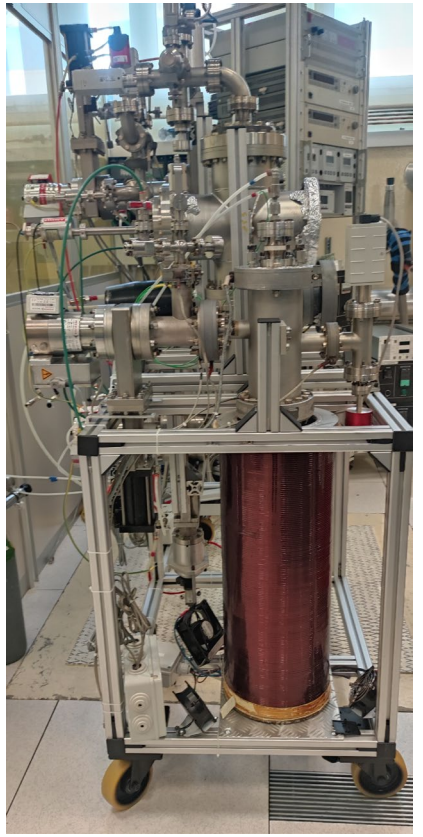
# What do we need?

- 6 GHz Cu cavities ✓
- **Coating System**



- **6 GHz cavities: It will be used Nb thick film coating system**
  *(ready, no modification required)*



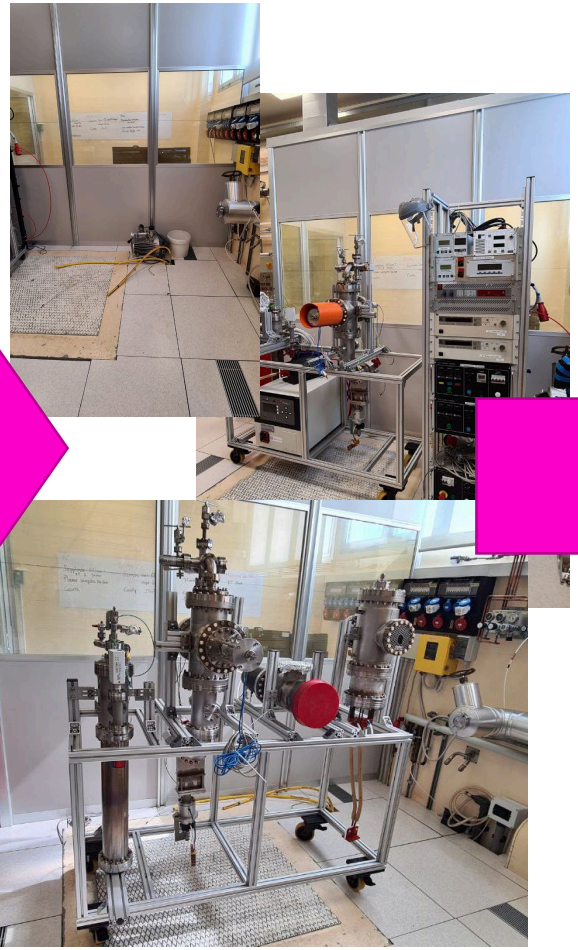


# What do we need?

- 6 GHz Cu cavities 
- **Coating System**

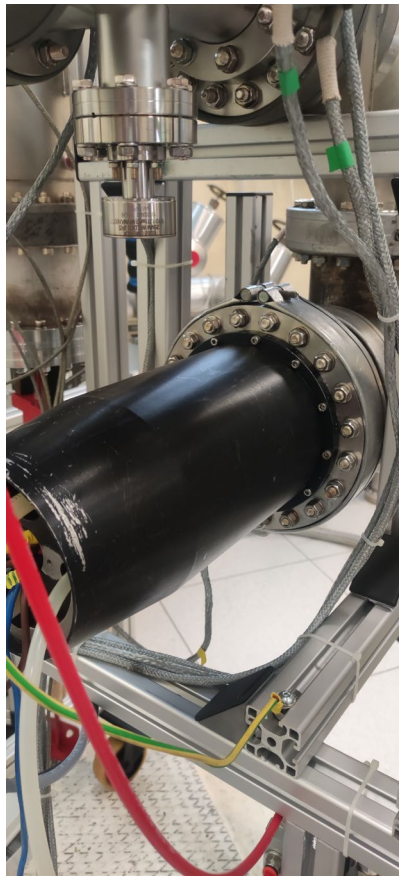
- **6 GHz cavities: It will be used Nb thick film coating system**
  *(ready, no modification required)*
- **Planar samples:**

# From old to new coating system

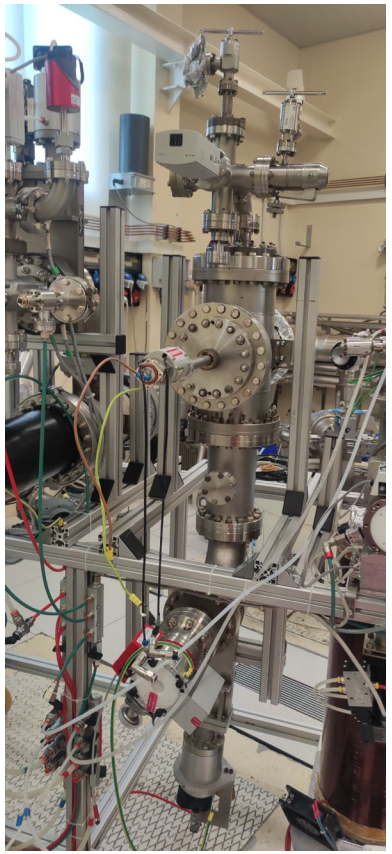


# From old to new coating system

Commercial 4 “ *magnetron source*

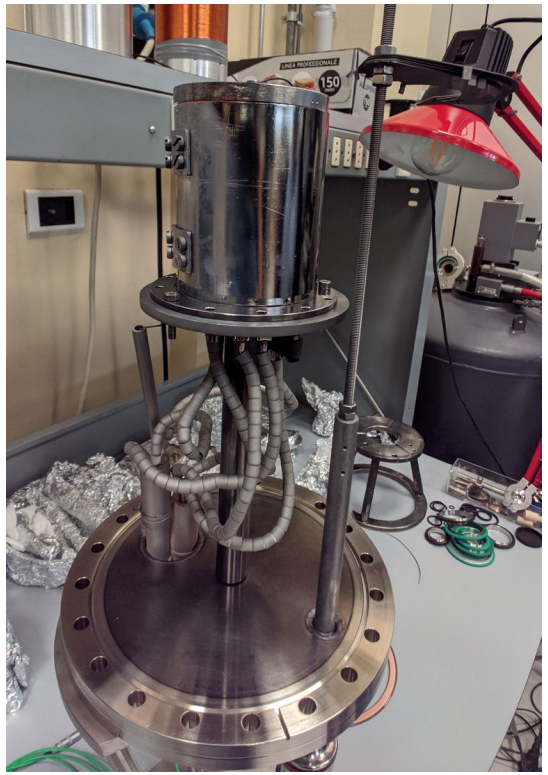


In house 4 “ *magnetron source*



1“ *MS sputtering system*

4“ *MS sputtering system*



600 °C Sample holder

# What do we need?

- 6 GHz Cu cavities 
- **Coating System** 

- **6 GHz cavities: It will be used Nb thick film coating system**
  *(ready, no modification required)*

- **Planar samples:**

  **4” magnetron source**
  - New magnetron source bought
  - $Nb_3Sn$ commercial target bought
  - Vacuum system re-designed and assembled *(September 2021)*
  - To be tested *(October 2021)*

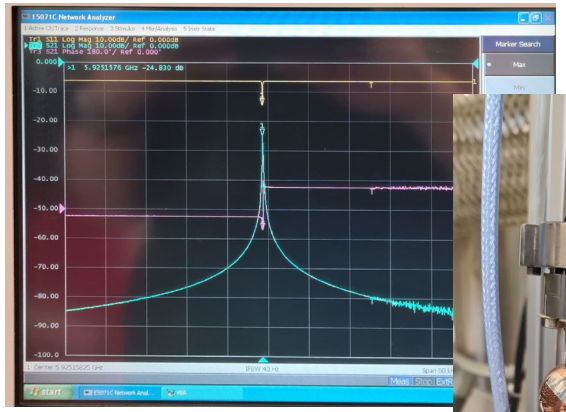
  **1” magnetron source**
  - Used to test “in house” target realized by dipping

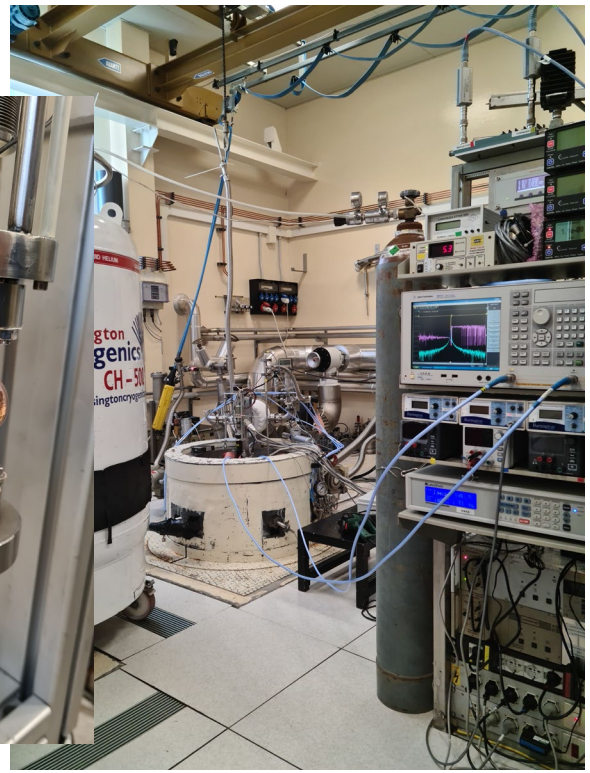
# What do we need?

- 6 GHz Cu cavities
- Coating System
- **RF Test facility**

**Ready**

*(No modification required)*





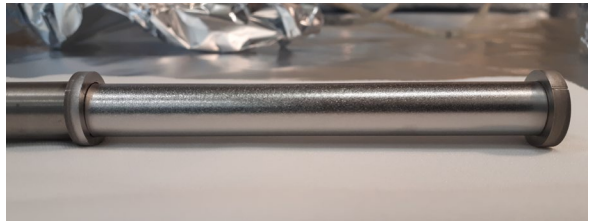
# What do we need?

- 6 GHz Cu cavities ✓
- Coating System ✓
- RF Test facility ✓
- **$Nb_3Sn$ cathode**


**Planar:** commercial one ✓


**Cylindrical:** by dipping

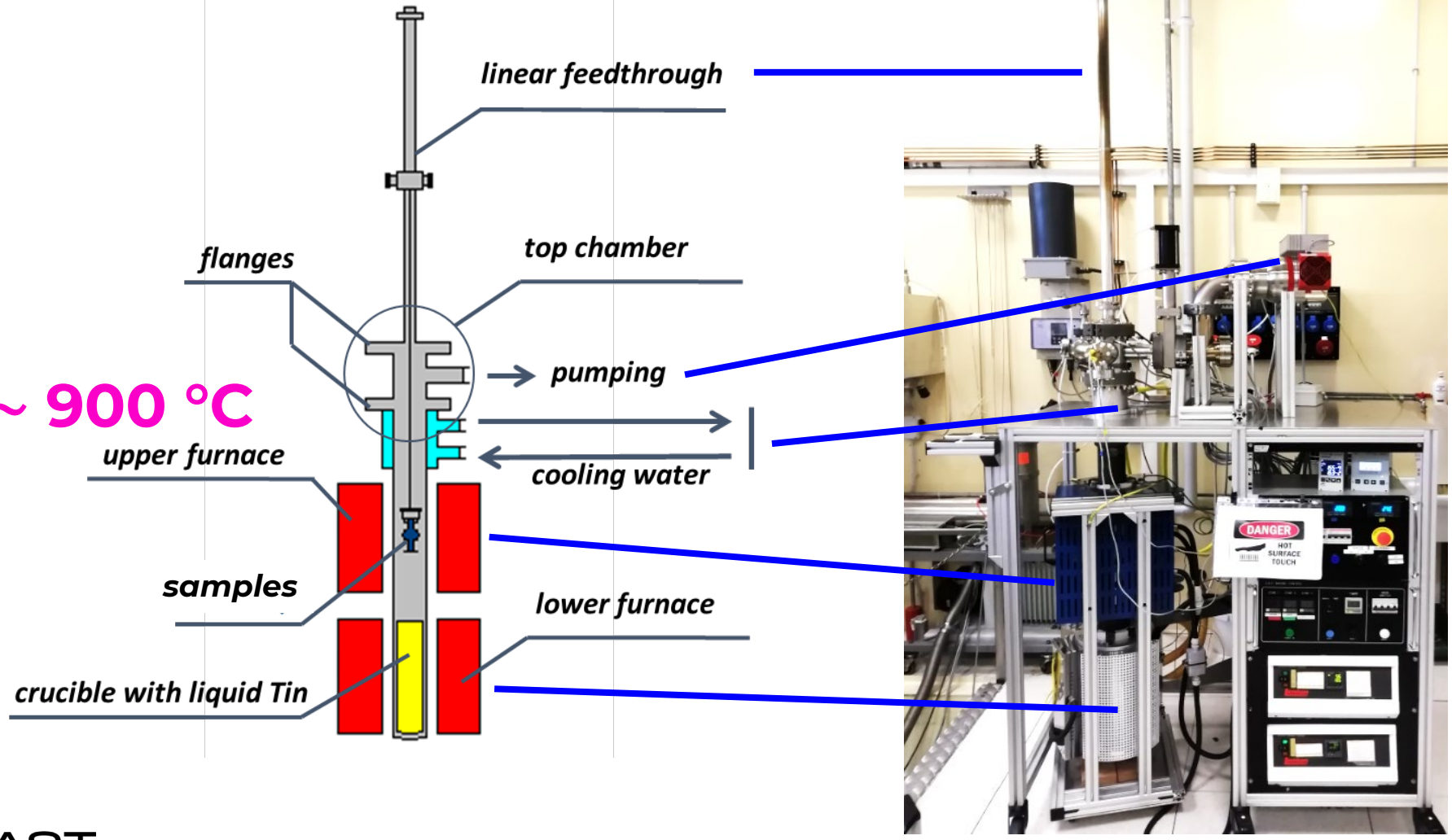
**Still a work to do**



# Single use target by dipping

- Presented at last Thin films Workshop
- Poster and proceeding at SRF21
- **No further steps since March 2021 (focus on system upgrade)**

# Liquid Tin Diffusion process set-up

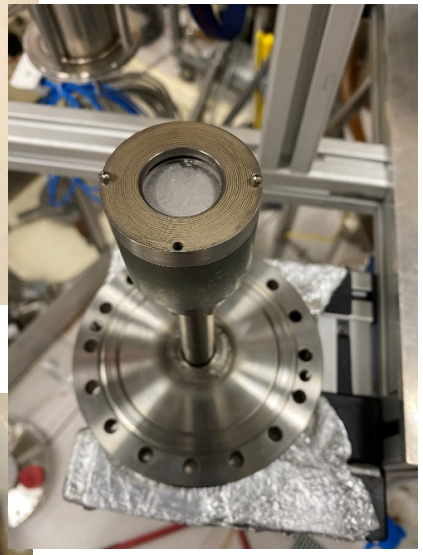


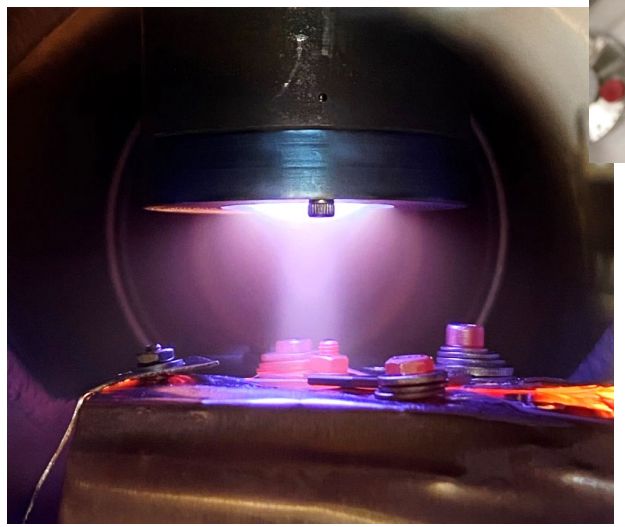
# Proof of concept

- Preparation of a 1" target (30 microns thick)
- Coating on quartz samples

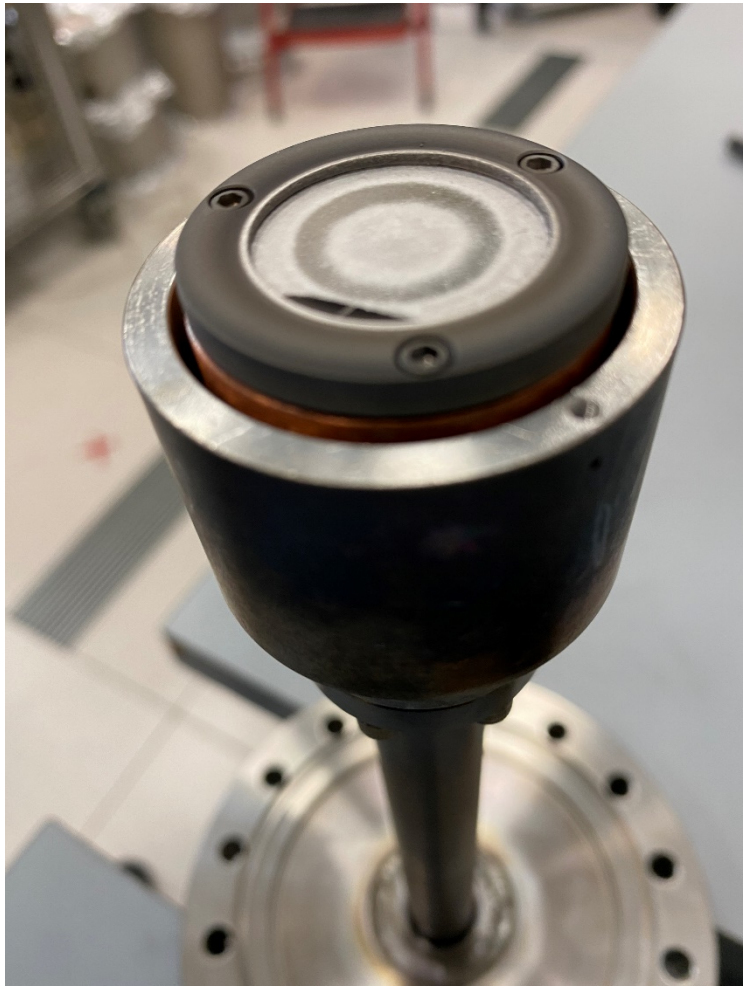
  I = 0.1 A (5 mA/cm$^2$)
  t = 30 min
  T = 750 °C

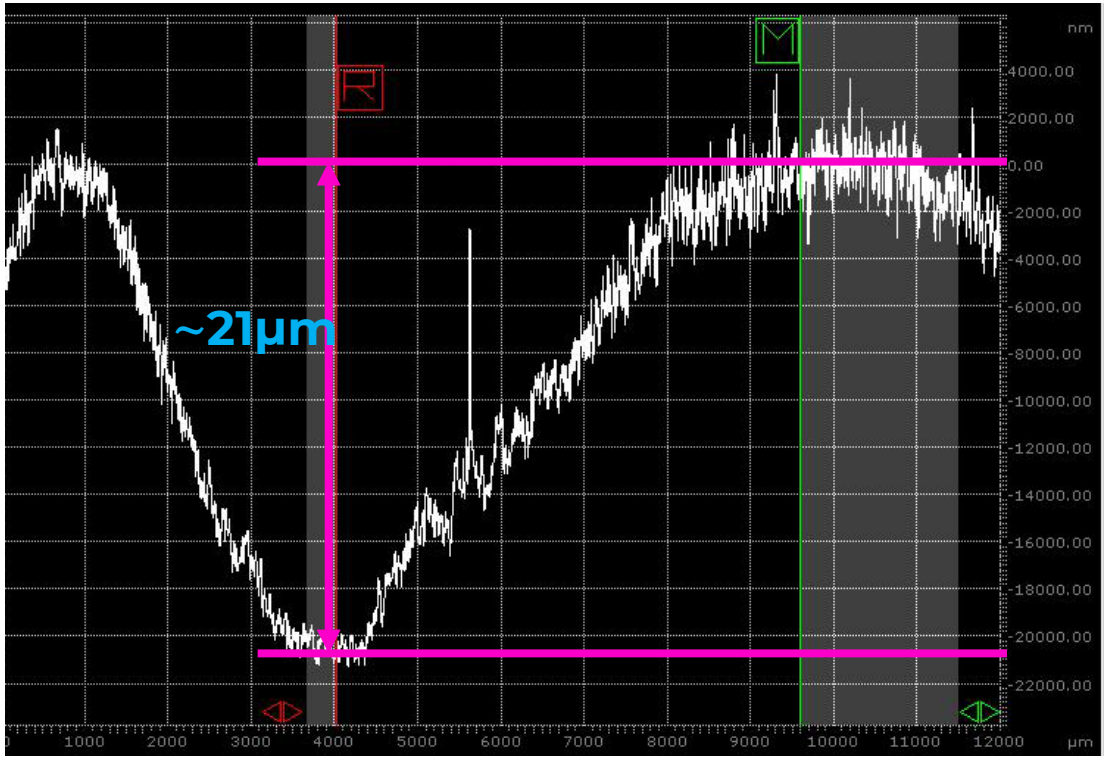
- Process stopped when V decreased





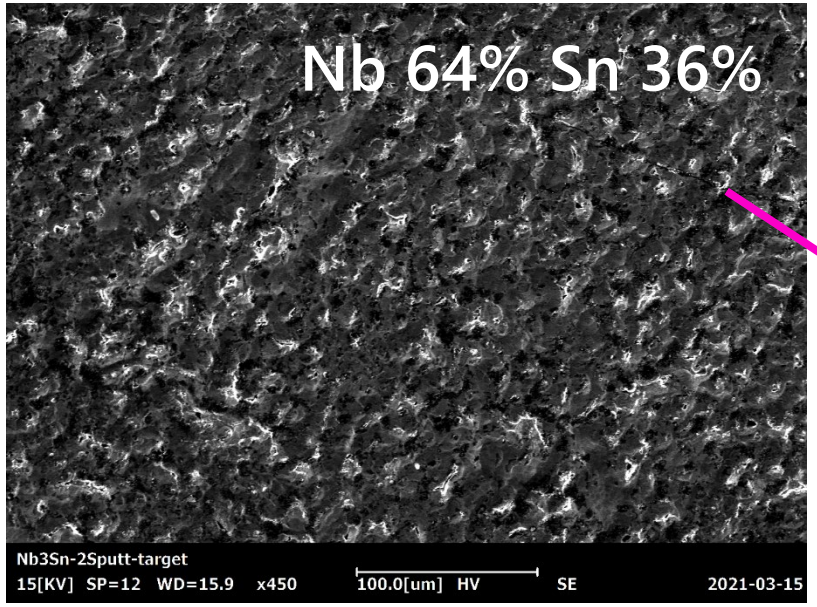
# Target erosion

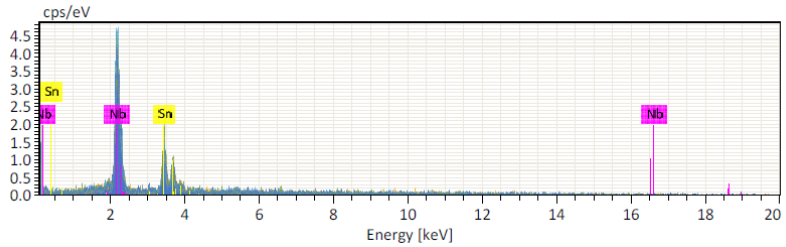


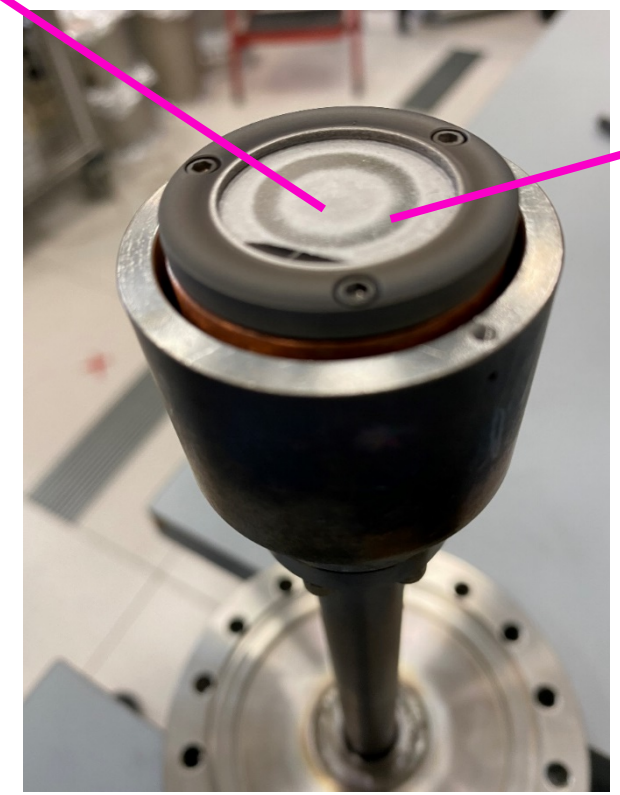


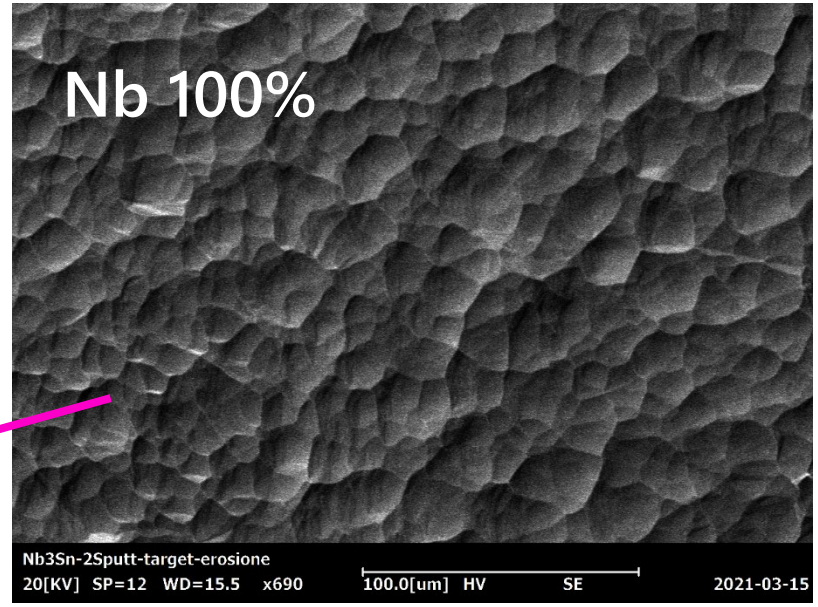

*Target erosion profile by profilometer*

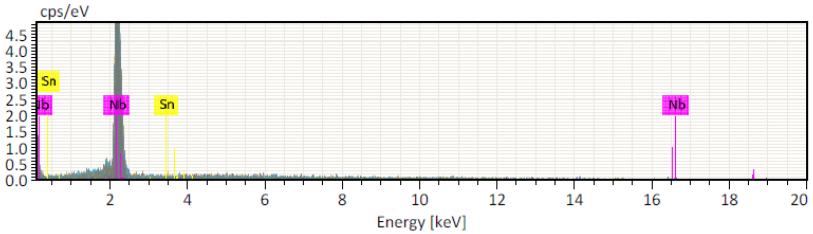
# Target characterization



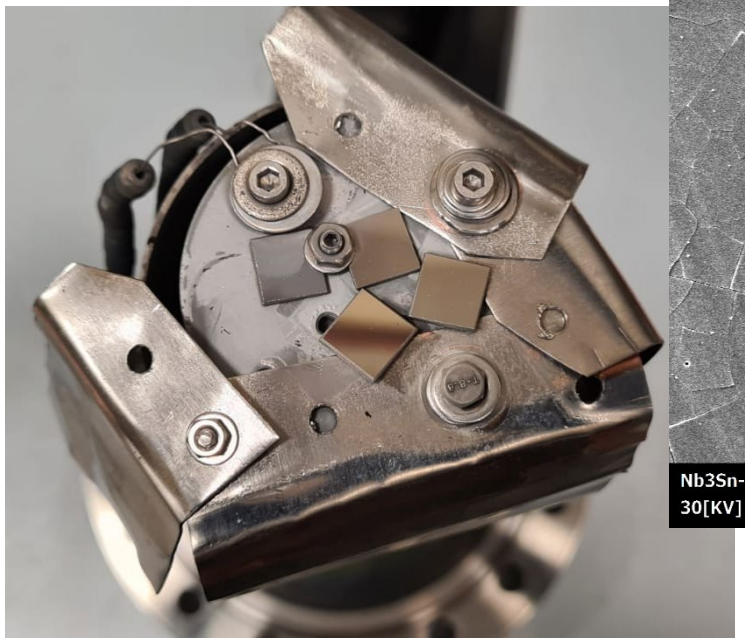



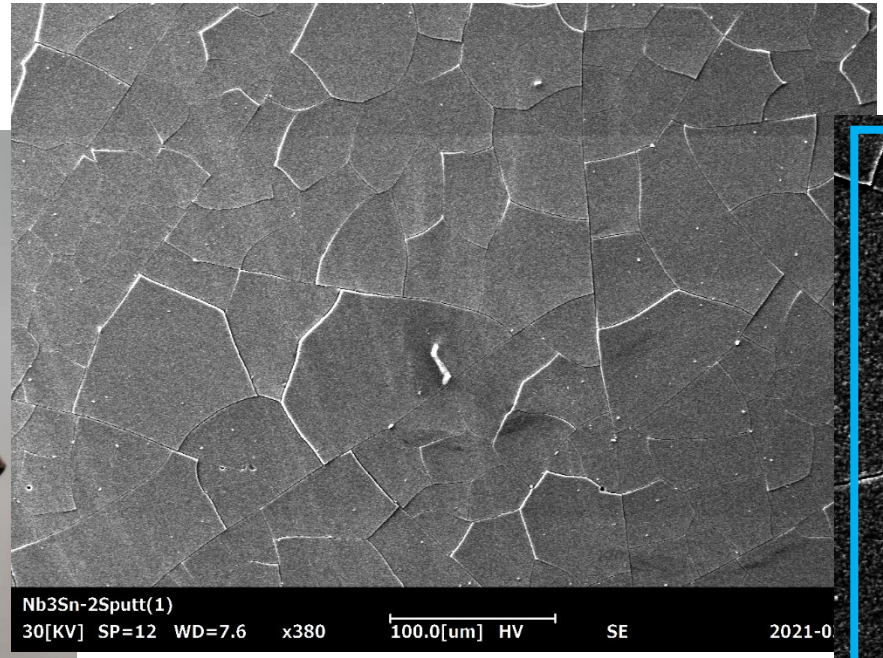





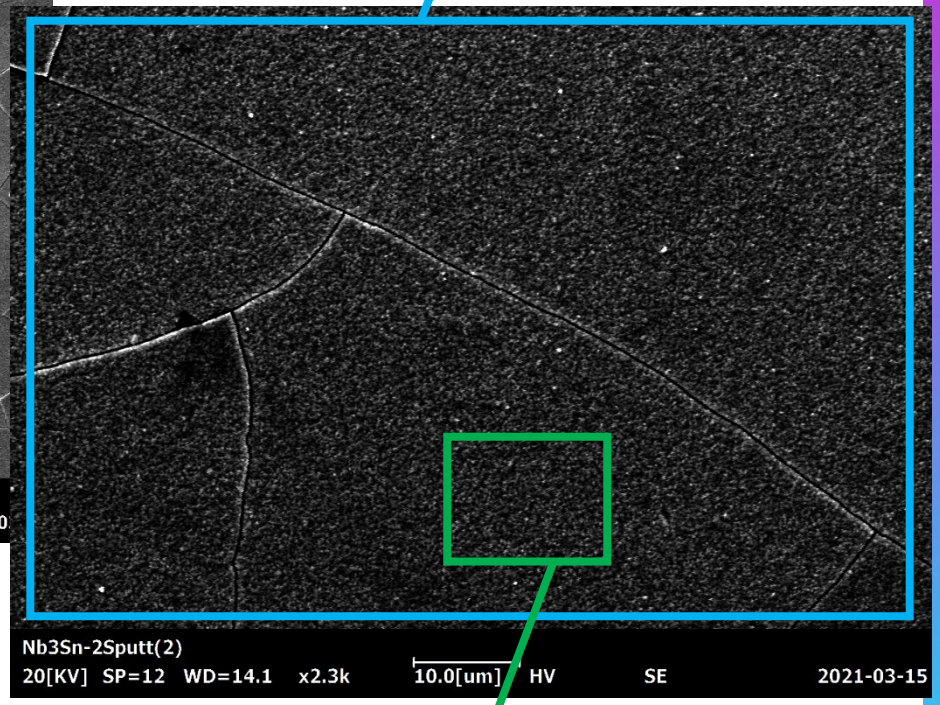



# Sample characterization






Nb 80% Sn 20%




Nb 74% Sn 26%

Strange behaviour R vs T → not possible measure Tc

# Next steps

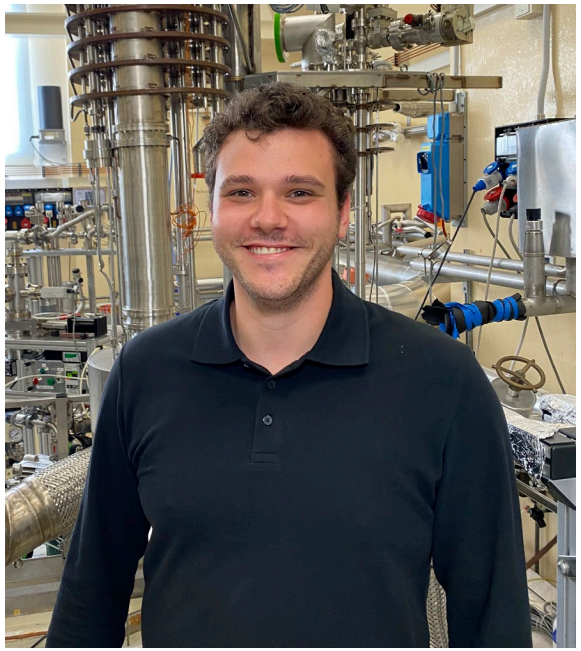
- Planar samples to study sputtering process parameters
- Continuing the development of a target by dipping

# Good news

INFN sustains a 3 year project called **SAMARA** where one of the goal is developing $Nb_3Sn$ coatings in 6 GHz cavities

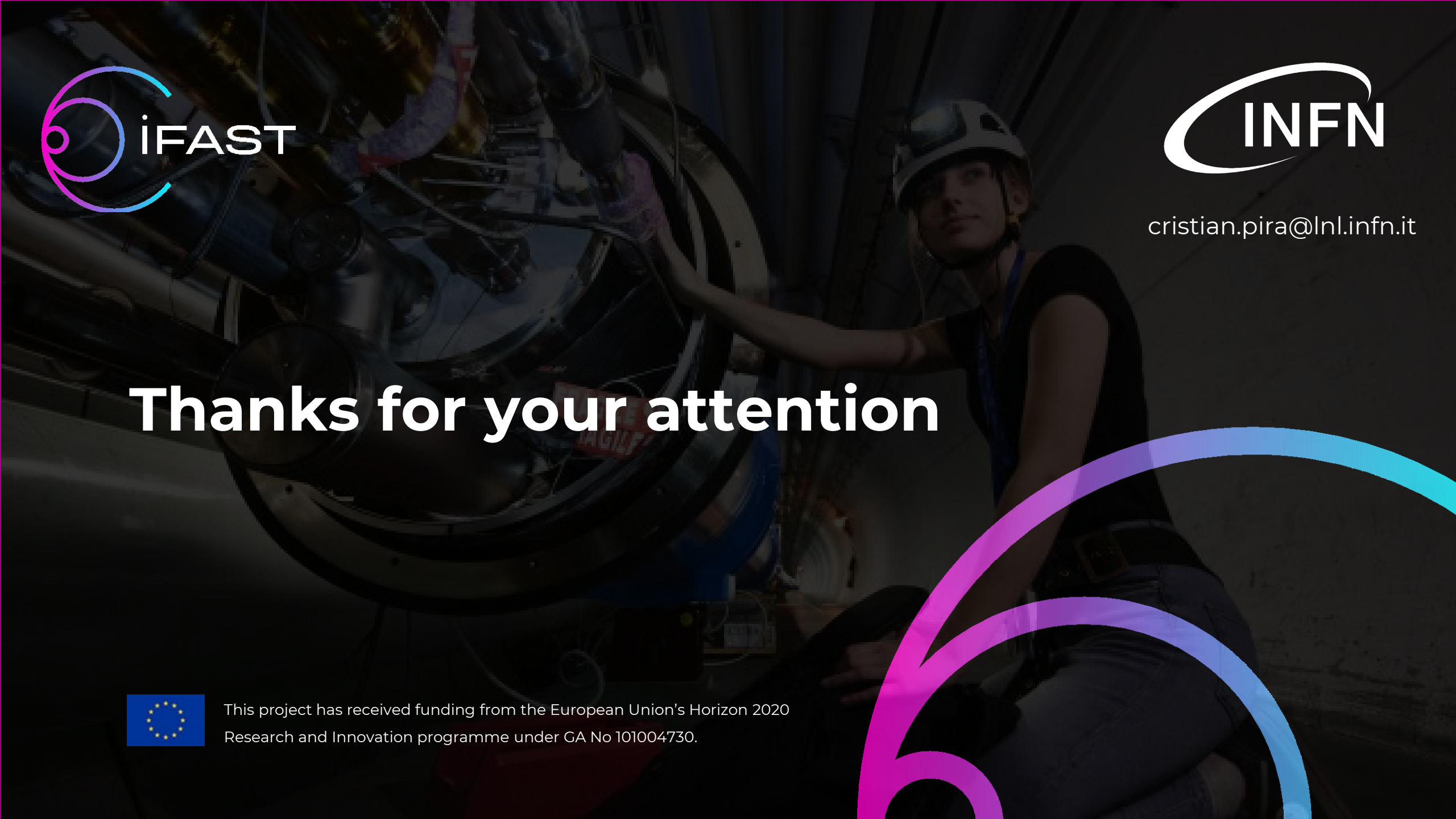
# Bad news

Matteo Zanierato will leave INFN next week



## We are looking for new talents!

Please contact me



# Thanks for your attention

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