Mid-Term Review
10 December 2018, Brussels

Alice MOROS

ESR12, WP2

PhD Student at TU WIEN - USTEM

EASITrain – European Advanced Superconductivity Innovation and Training. This Marie Sklodowska-Curie Action (MSCA) Innovative Training Networks (ITN) has received funding from the European Union's H2020 Framework Programme under Grant Agreement no. 764879

ESR12, WP2 - Background

- **Background:**

➢ BSc. in Material Science (Dec. 2014) & MSc. in Material Science and Engineering (Jan. 2017) at University of Genoa, Italy (Faculty of mathematical, physical and natural sciences)

➢ Fundamentals of Superconductivity at University of Genoa & CNR-SPIN (June-Sept. 2014)

➢ Fundamentals of particle accelerator physics at ELETTRA Synchrotron-Trieste, Italy (Sept.-Dec. 2016)

Elettra Sincrotrone Trieste

- **Contract start date:** 15th November 2017

- **Host institute:** Vienna University of Technology (TU-Wien) - USTEM

- **Supervisor(s):** Johannes Bernardi, Michael Stoeger-Pollach

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ESR12, WP2 - Background

- **PhD Title:** Microstructural Characterization of Superconducting materials for the CERN FCC design study
- **PhD University:** Vienna University of Technology (Vienna) – USTEM
- **Planned secondments:**

➢ COLUMBUS SUPERCONDUCTORS & ASG: Manufacturing of superconducting MgB_2 wires, PIT technique, Industrial application of MgB_2 wires, Large scale superconducting magnet manufacturing (June 2019, 2 weeks)
➢ BRUKER: Performance impact analysis of microstructure on superconducting wires at low temperatures (January 2020, 4 weeks)

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Role in the Project & Objectives

Microstructural Characterization of Superconducting materials for the CERN FCC design study

J. Bernardi – EASITrain Supervisor

A. Moros – Core Researcher

OBJECTIVES

- Analyse the microstructure & microchemistry of superconducting samples ((Tl,Bi,Pb)(Sr, Ba)$_2$Ca$_2$Cu$_3$O$_x$, MgB$_2$, YBa$_2$Cu$_3$O$_7$, Nb$_3$Sn…), coming from different manufacturing processes

- Clarify the connections between microstructural and superconducting properties of each sample

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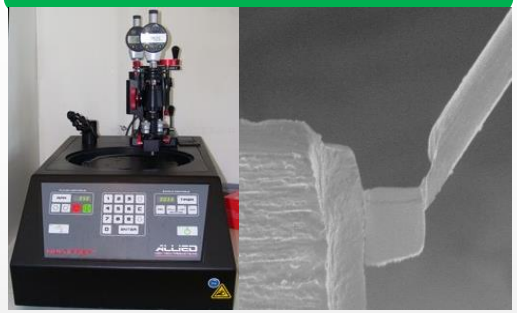
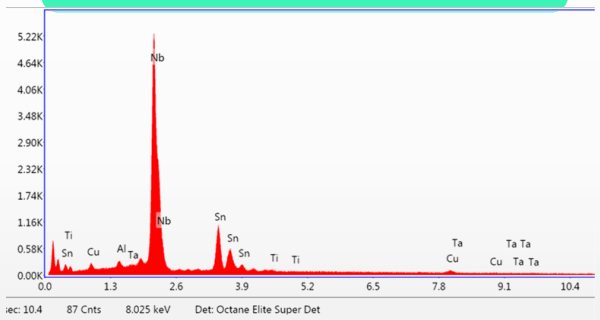
Research, Methodology, Results & Next Steps

Sample preparation

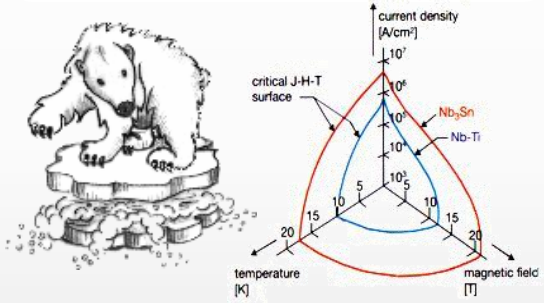


Microstructural characterization

Data analysis



Relation between microstructural and physical properties



- $(Tl,Bi,Pb)(Sr, Ba)_2Ca_2Cu_3O_x$ thin films & pellets & Nb_3Sn wires → **WORK IN PROGRESS**
- MgB_2 wires & $YBa_2Cu_3O_7$ tapes → **COMING SOON**

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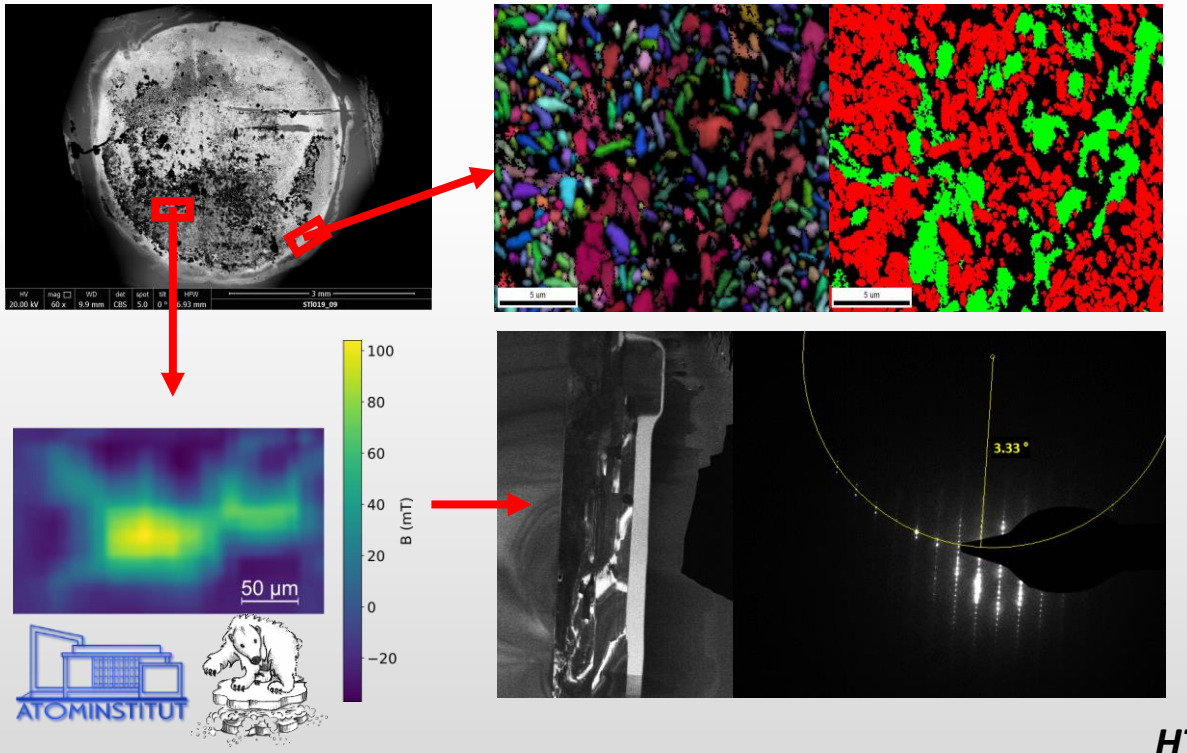
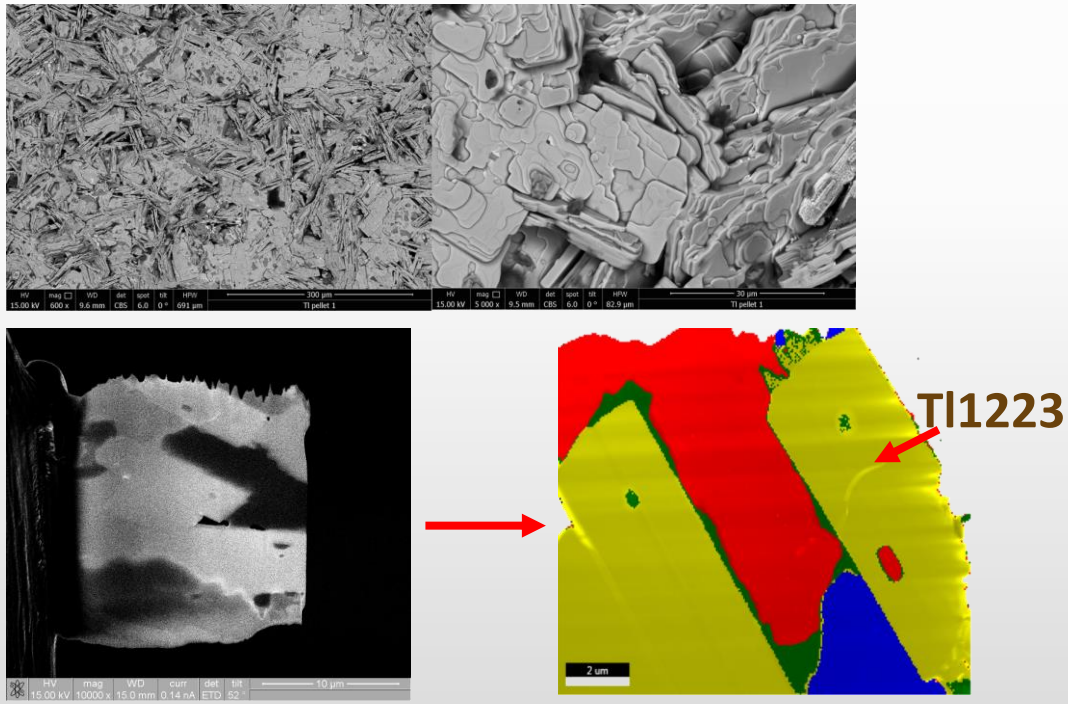
$(Tl,Bi,Pb)(Sr, Ba)_2Ca_2Cu_3O_x$ HTS Cuprates (Tl1223) → ESR 6

Tl1223 on $SrTiO_3$ *single-crystal*



Tl1223 pellets



HTS Beamscreen Meeting at ALBA (Barcelona), 30th Nov. 2018

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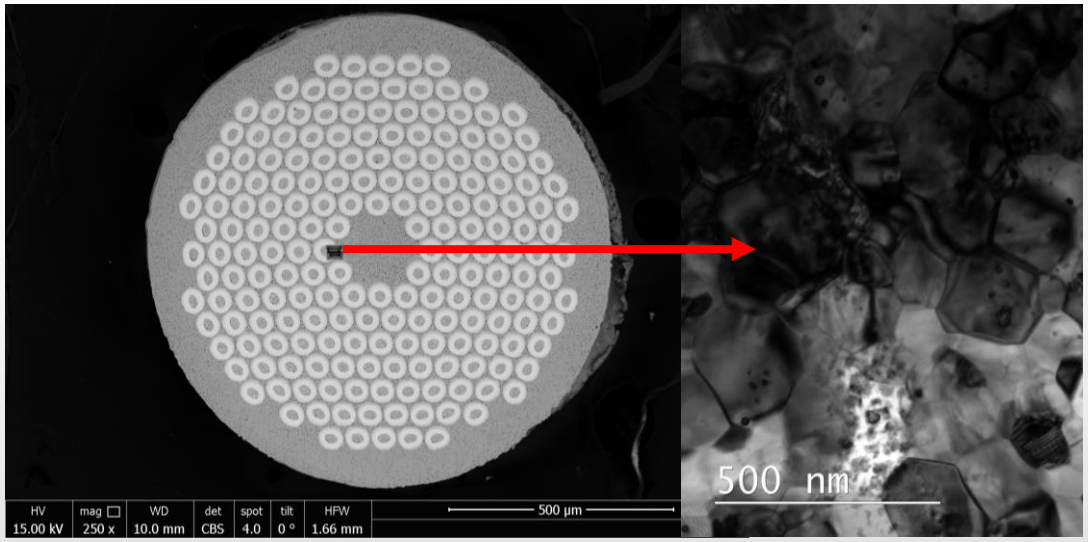
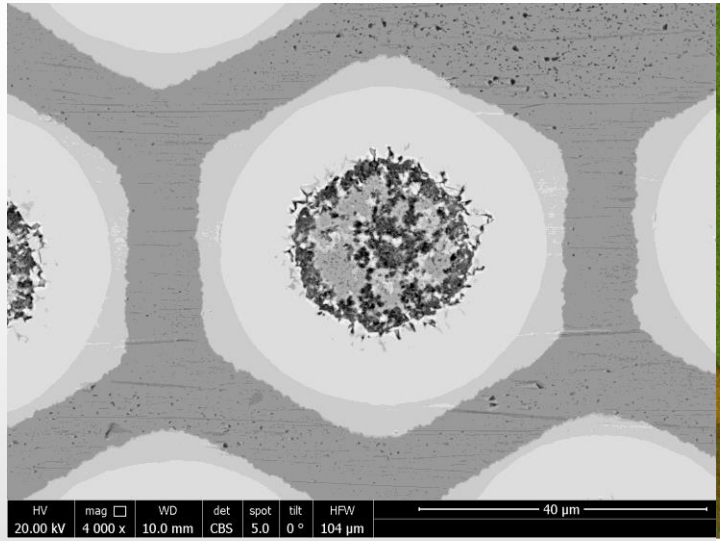
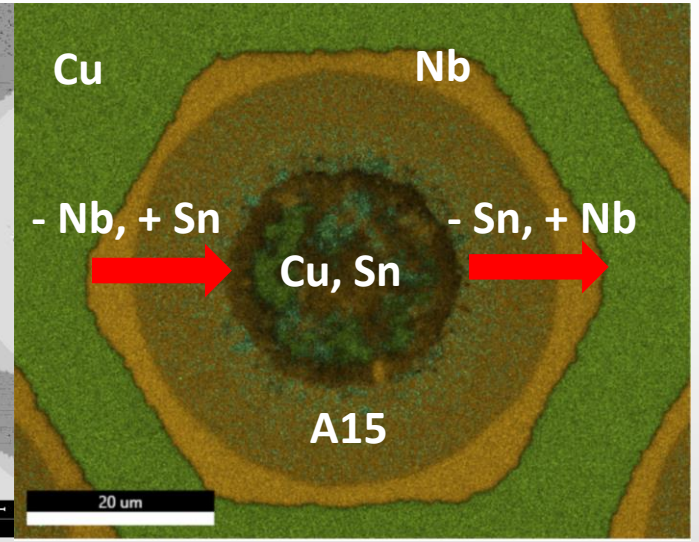
Nb_3Sn wires → **ESR 13** ATOMINSTITUT







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Research, Methodology, Results & Next Steps

- **Tl1223:** EDX & EBSD (traditional & transmission mode) of new Tl1223 thin films → comparison between "good" and "bad" areas (magnetic point of view); EDX analysis of new Tl pellets → connection with magnetic signal

- **Nb_3Sn wires:** finalize SEM EDX analysis + preparation of FIB lamellas for TEM analysis & EBSD in transmission mode → constant collaboration with ESR 13 for the magnetic characterization

- **MgB2 wires and $YBa_2Cu_3O_7$ tapes:** coming soon → collaboration with ESR 7 (COLUMBUS), ESR 2 (BRUKER)

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Training, Conferences & Workshops

- Training
  - ✓ **Trainings at USTEM:** TU general safety rules & USTEM Lab safety rules (December 2017), SEM training (January-February 2018), FIB training (March 2018), TEM training (May-June 2018)
  - ✓ **Trainings at CERN:** Sharepoint Training, INDICO Training, Computer and Cybersafety, General Saftey training, Cryogenic Saftey Fundamentals, Fire Extinguisher and Risk Analysis, Ionsing Radiation, General Electrical Risks, Radio Frequency, Magnetic Fields, Chemicals *(5th-13th March 2018)*
  - ✓ **Media Training** during EASISchool 1 (Terra Mater Factual Studios – Vienna, 12th September 2018)
  - ✓ **German courses B1.2-B2.1-B2.2** at Deutschinstitut (Vienna, January-February 2018/ May-June 2018/ November-December 2018)
  - ✓ **EDAX EBSD Training** at Ametek Germany GmbH (Weiterstadt, 14th-16th November 2018)
- Conferences
  - ✓ **FCC Week 2018** (Amsterdam, 9th-13th April 2018)
- Meetings
  - ✓ **EuroFusion Project Meeting about Tl1223 and $Bi_2Sr_2CaCu_2O_x$** (CNR SPIN – Genoa, 26th-27th March)
  - ✓ **Meeting for FCC - HTS (Tl1223, $YBa_2Cu_3O_7$) Beamscreen** (ALBA – Barcelona, 30th November)

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Training, Conferences & Workshops

- Workshops
  - ✓ Workshop on **helium II cooling** (CERN – Switzerland, 12th March 2018)
  - ✓ Workshop on **radio frequency** (CERN – Switzerland, 13th March 2018)
  - ✓ Workshop on **surface treatment, chemistry and coating with sputtering** (CERN – Switzerland, 16th March 2018)
  - ✓ **Project Management** (CERN – Switzerland, 19th – 21st March 2018, WU Wien –Vienna, 10th – 11th September 2018)
  - ✓ **8th ASEM Workshop – Advanced Electron Microscopy** (Campus Vienna Biocenter, 26th – 27th April 2018)
  - ✓ **8th International Workshop on Thin Films and New Ideas for Pushing the Limits of RF Superconductivity** (INFN – Legnaro, 8th – 10th October)
- Attended EASITRain events
  - ✓ **EASITrain Spring Lectures** (CERN – Switzerland, 5th-23rd March 2018)
  - ✓ **EASISchool 1** (TU/WU Wien – Vienna, 3rd-14th September 2018)

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Outreach, Dissemination & Networking

- ✓ MedAustron Facility visit (Wiener Neustadt, 8th September 2018)
- ✓ Active participation in the event ***Forschung, was geht mich das an?*** – Language: german (Natural History Museum, Vienna, 8th September 2018)
- ✓ ALBA Synchrotron visit (Barcelona, 30th November 2018)

http://forschung.web.cern.ch/

Frontier research: How can I be involved?

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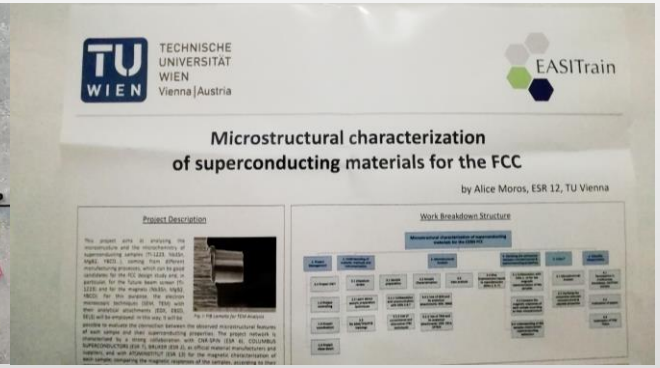
Outreach, Dissemination & Networking

- ✓ Talk at FCC Week 2018 (Amsterdam), 12th April 2018, Title: *Microstructural Characterization of Superconducting Materials for the CERN FCC*
- ✓ Talk at ATOMINSTITUT (Vienna), 18th June 2018, Title: *Microstructural analysis of advanced superconducting materials*
- ✓ Poster at Project Management Vernissage (EASISchool 1, WU Wien – Vienna), 10th September 2018, Title: *Microstructural characterization of superconducting materials for the CERN FCC*
- ✓ Talk at ALBA Synchrotron (Barcelona), 30th November 2018, Title: *Microstructural Characterization of Tl-based superconducting bulks and films*



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Outreach, Dissemination & Networking

- ✓ USTEM Meetings & Events
- ✓ First training event at CERN (5th – 23rd March 2018)
- ✓ EASISchool 1 in Vienna (3rd – 14th September 2018)
- ✓ Conferences, Workshops, Project Meetings & Social Events (April – November 2018)

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Outreach, Dissemination & Networking

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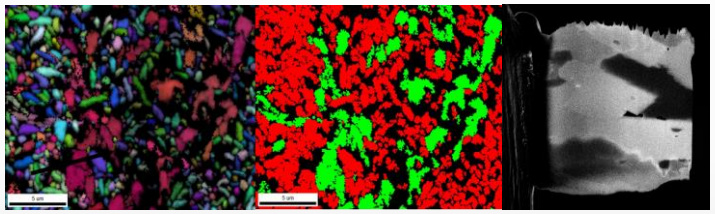
Impact

- **Physics & Industry**

- **Fusion Magnets, next generation MRI medical imaging & NMR devices**
- **Electron Microscopy skills**



- **Language skills**

→ ***ÖSD Zertifikat B2***

- **Network expansion & meeting new cultures**

- **Responsibility**

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USTEM TU WIEN

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