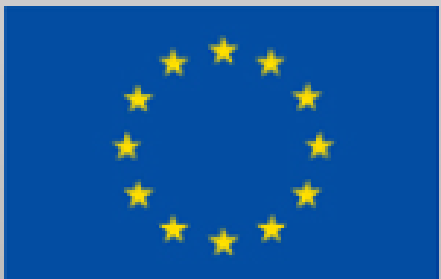




FCC Week 2018
Amsterdam, Netherlands
Alice Moros, ESR12
TU Wien - USTEM



Microstructural characterization of superconducting materials for the **CERN Future Circular Collider**



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

Outline

- Main objective and tasks
- Work place description: TU Wien - USTEM
- Sample preparation: focus on FIB
- Microstructural analysis: TEM and SEM
- Project status
- Conclusions



Main objectives

- To measure the impact of manufacturing processes on superconducting materials (TI-1223, Nb₃Sn, MgB₂, ...) by analysing the microstructure and the microchemistry of each sample

- To comprehend the connection between the microstructural features of the superconducting samples and their physical properties



How to proceed?

Sample Preparation

Microstructural characterization

Data analysis

Relation between microstructural and physical properties



WHERE?

TU WIEN – USTEM (Universitäre Service-Einrichtung für Transmissionselektronenmikroskopie)

FEGSEM



USTEM:

Service center at the Technische Universität in Vienna for research and development, quality control or failure analysis

TEM



Conventional methods

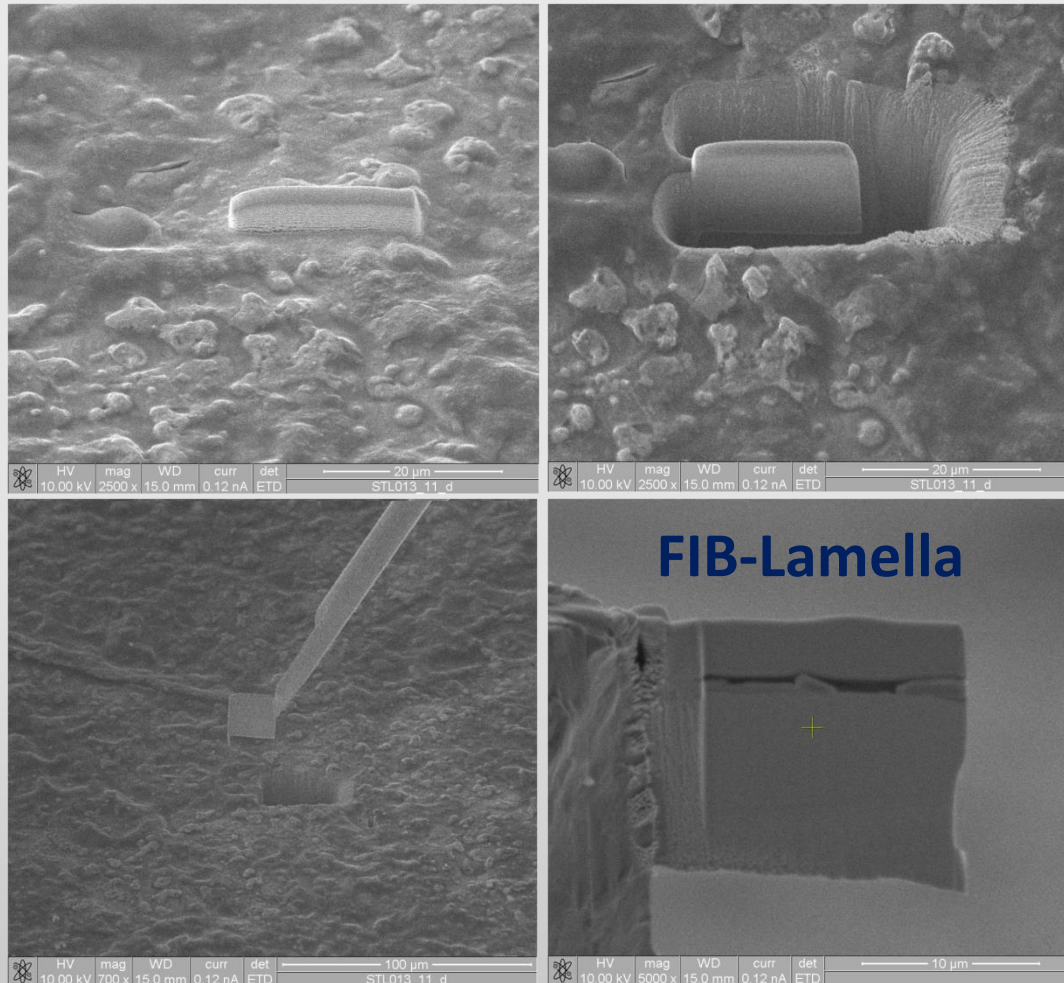
- Grinding, polishing
- Ion thinning

Alternative method

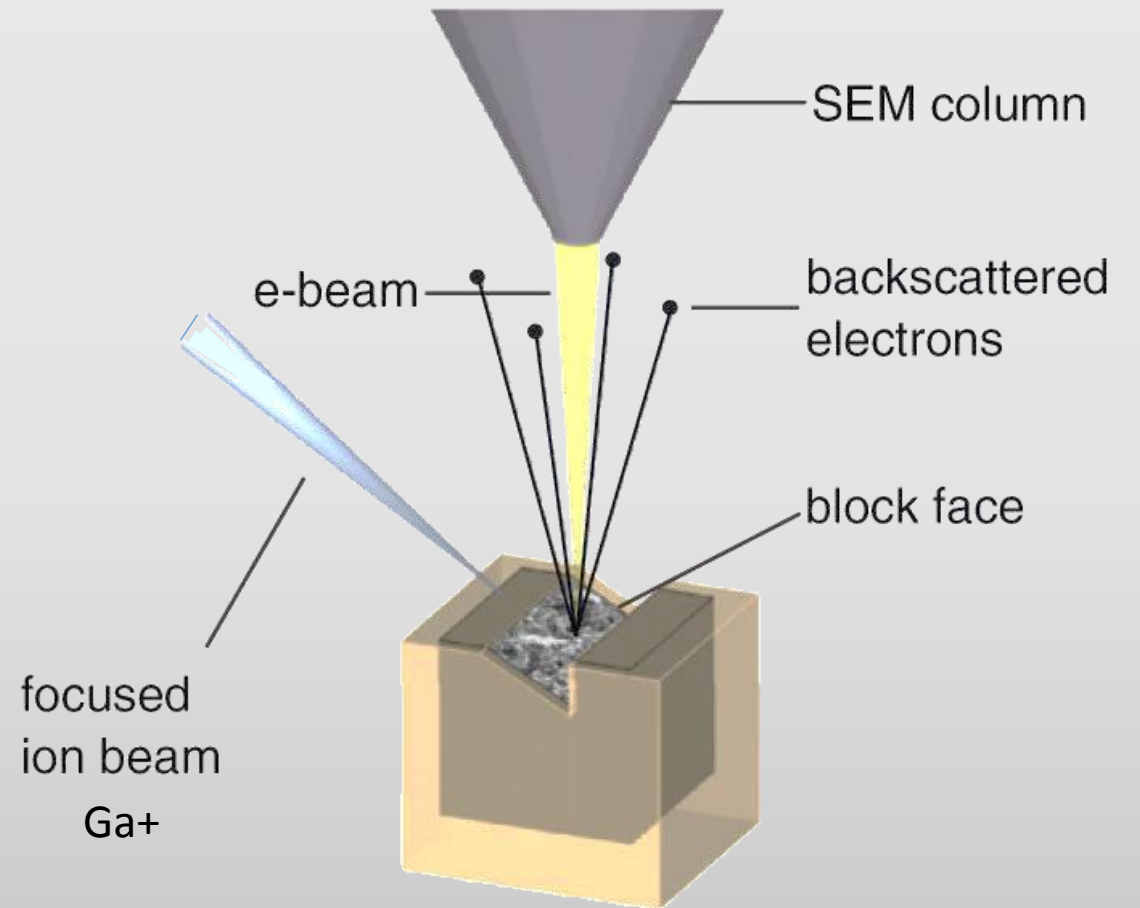
- Focused Ion Beam - FIB



Focused Ion Beam - FIB



FIB-Lamella

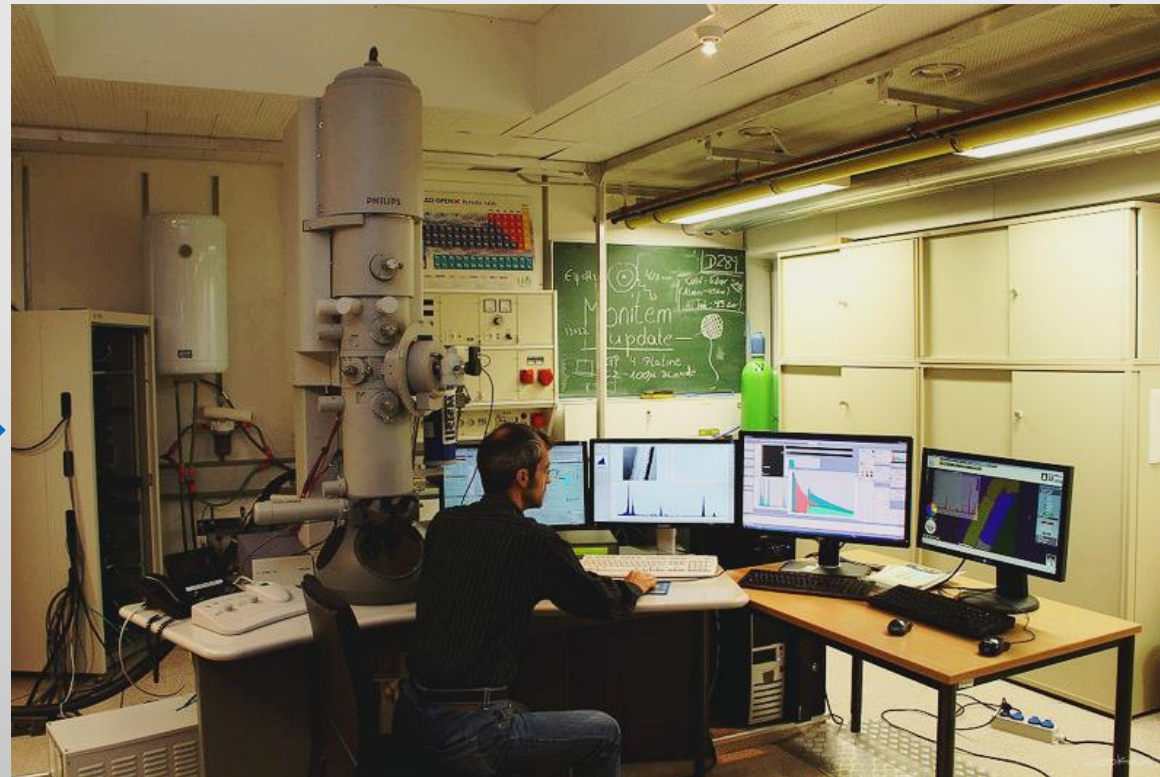
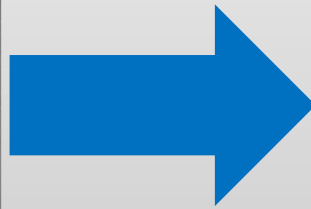
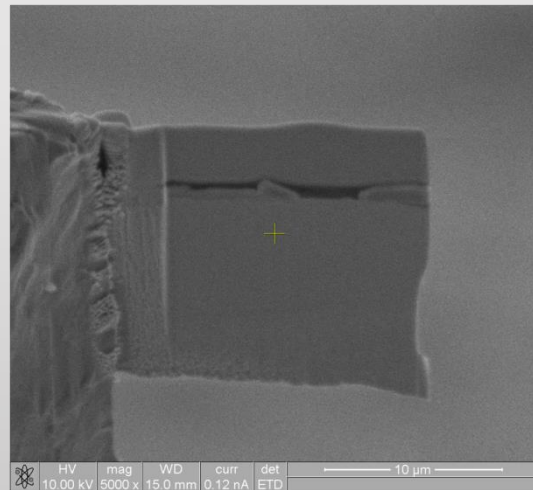


Credits: Sigrid Holleis, PhD student at ATOMINSTITUT (Vienna)

Transmission Electron Microscope - TEM

FEI TECNAI F20

FIB-LAMELLA



**2 TEMs
available at
USTEM**

Scanning Electron Microscope - SEM

FEI Quanta 250 FEGSEM



- IMAGING
- CHEMICAL ANALYSIS - Energy Dispersive X-ray analysis
- STRUCTURAL ANALYSIS - Electron Back Scatter Diffraction

**2 SEMs
available at
USTEM**

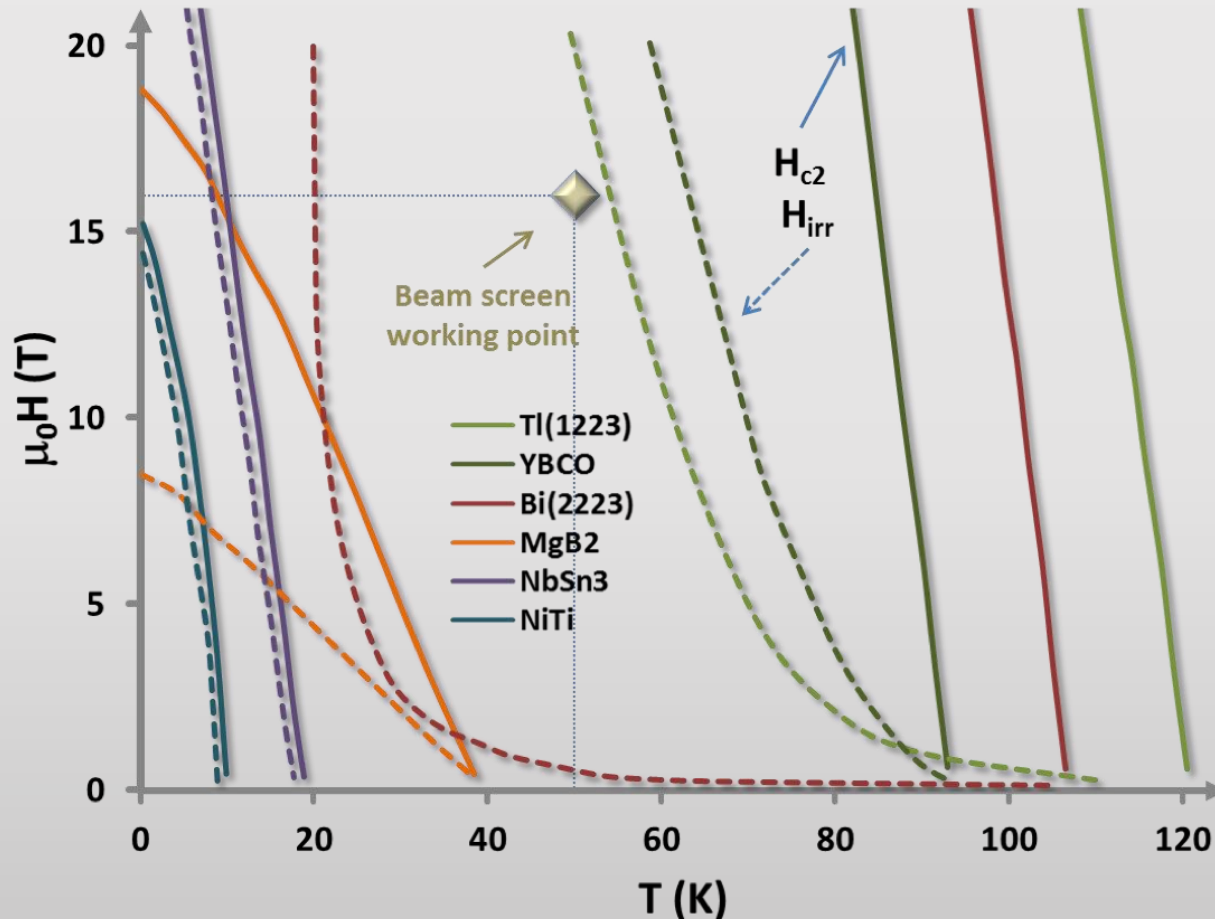


MAGNETIC CHARACTERIZATION

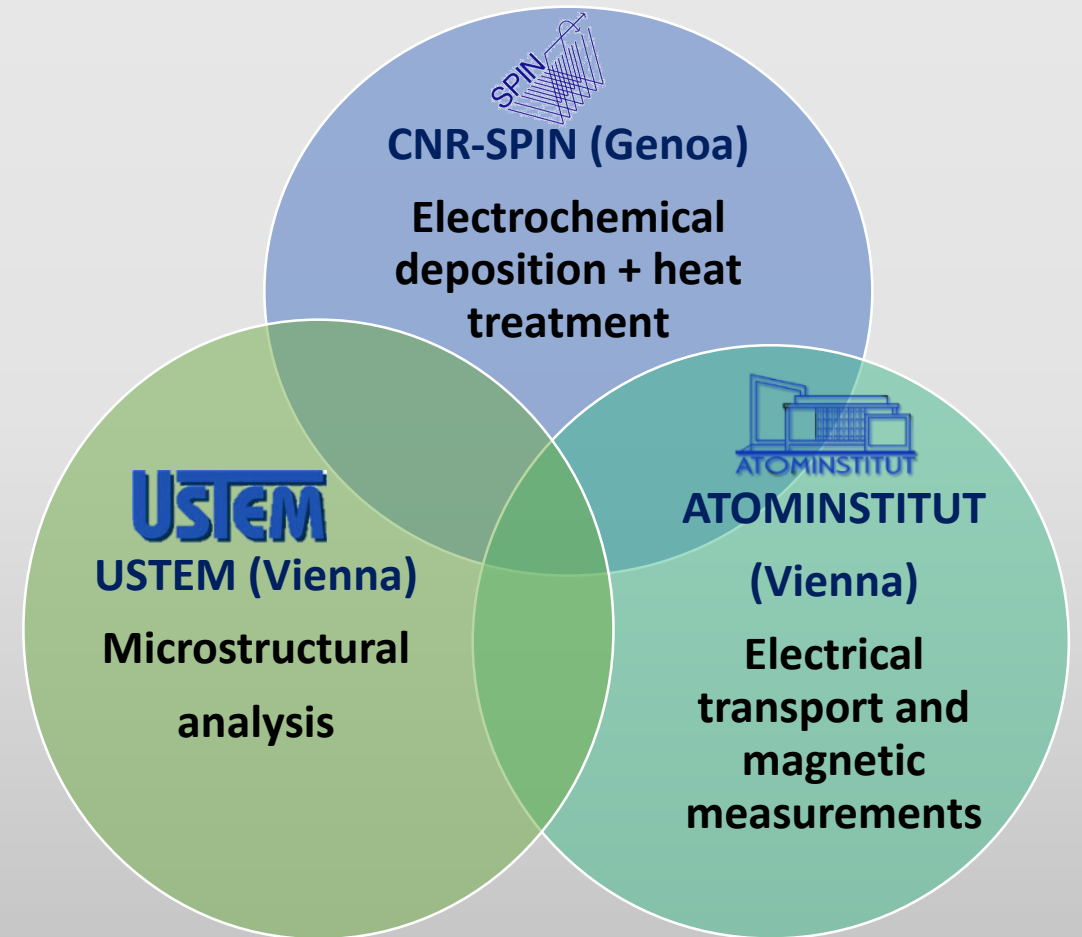


Project started: work in progress...

TI-1223 for the FCC beam screen



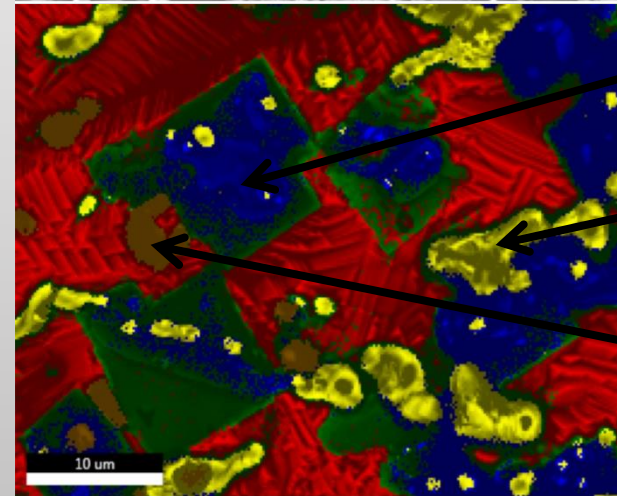
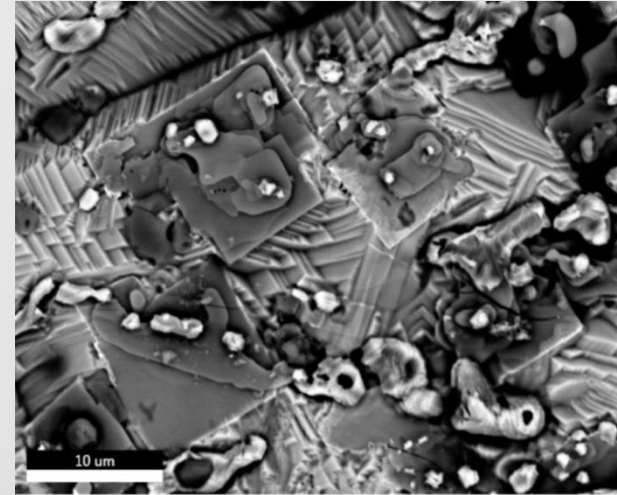
Credits: Emilio Bellingeri, Alessandro Leveratto, CNR-SPIN (Genoa)



Project started in 11/2017



- SEM analysis on samples with different deposition time
- EDX analysis
- Grains orientation: EBSD analysis
- FIB-lamella ready for TEM/SEM EBSD analysis
- New samples



Tl1223

Ca, Tl rich

Ba rich

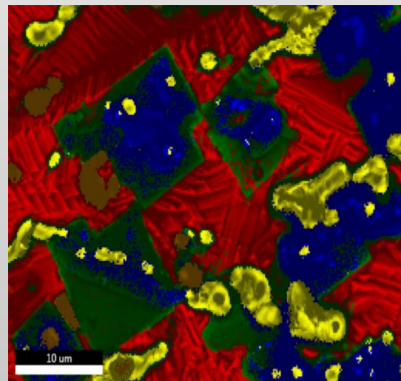
Credits: Sigrid Holleis, PhD student at ATOMINSTITUT (Vienna)

Conclusions

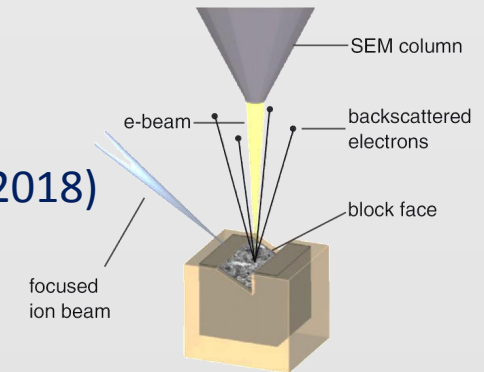


- Employed instrumentation: SEM (training: January 2018), FIB (training: February 2018)

- Still to learn: TEM → Scheduled training: April 2018



- First analysis through SEM on TI-1223 samples → EDX elemental mapping



- **Eager to get new samples!**

Thanks for your kind attention

Risks managment

- ✓ No healthy risks in my work
- ✓ Availability of infrastructure: 2 TEMs and 2 SEMs available, if one is out of order, there is a second one → No delay
- ✓ Preparation laboratory equipped with all the proper materials and instrumentations → Accurate work in a safe place

