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Particle Accelerator R&D at ATI & USTEM (TU Wien)

Austrian Roadmap Roundtable Meeting 2024 | 10/06/2024

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Low Temperature
Physics and
Superconductivity



Outline

- **Accelerator physics activities at ATI, TU Wien**
- **TU Wien contributions to superconductor R&D for FCC**

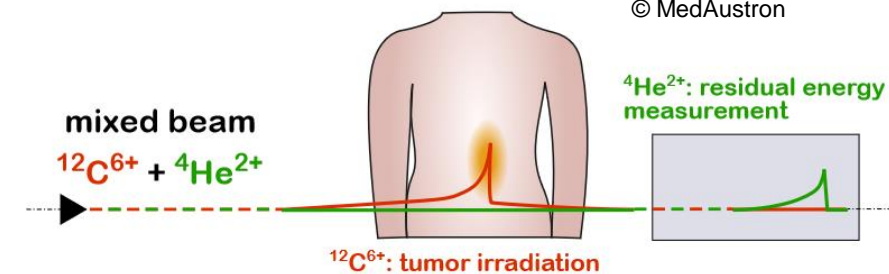
Beam dynamics in low energy hadron synchrotrons (focus on hadron therapy)

- Profit from *research beam time available* to TU Wien at *MedAustron* (Wiener Neustadt).
- *Collaborators* include Albert Hirtl (Medical Radiation Physics, ATI/TU Wien), MedAustron, HEPHY (ÖAW), MUW
- *Mid-term plans* include:

- Advancement of **slow extraction techniques**
- **Novel irradiation and beam delivery schemes**, e.g. mixed ion beam delivery for online range verification
- Facility upgrade and design studies



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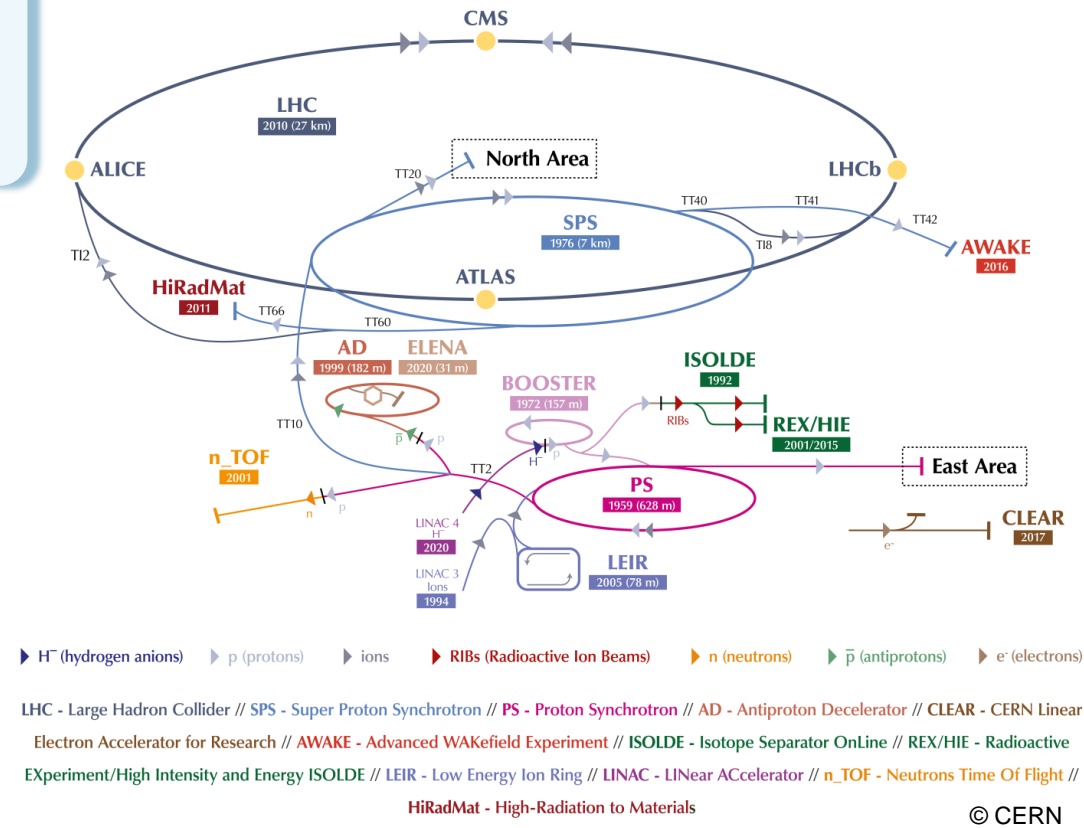


Potential collaborations with CERN on beam transfer projects, e.g.
(talks in progress)

- Collaboration on **slow extraction R&D**
→ Interesting for both medical applications as well as currently operating + future fixed target experiments (e.g. within Physics Beyond Collider study).

- Design studies (e.g. collaborate on beam transfer options for the **CERN hadron injector complex during the FCC-ee era**, already considering injector requirements for FCC-hh)

The CERN accelerator complex
Complexe des accélérateurs du CERN



In Addition: Student Projects Located at CERN and MedAustron

Example: Completed MSc and PhD projects affiliated to **Accelerator Physics** at the Atominstitut (ATI, TU Wien) in the **last 10 years:**

- **LHC & injectors:** 1 MSc, 6 PhD
- **FCC feasibility study:** 8 MSc, 4 PhD
- **Medical accelerators / MedAustron:** 6 MSc, 1 PhD
- **Novel acceleration technologies:** 1 MSc

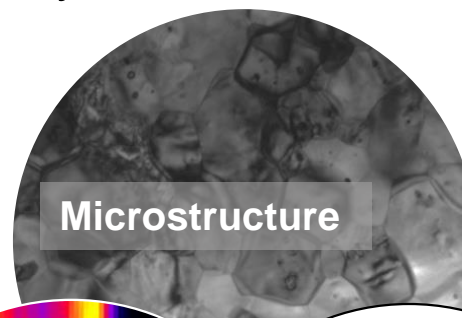
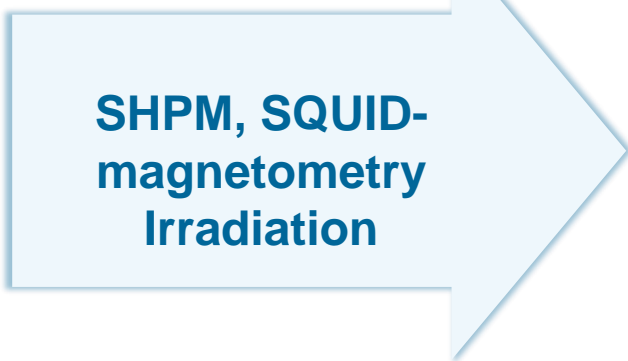
Several PhD projects enabled by Austrian Doctoral Student Program!

** Not including related academic theses that are affiliated to other universities and supervisors.*

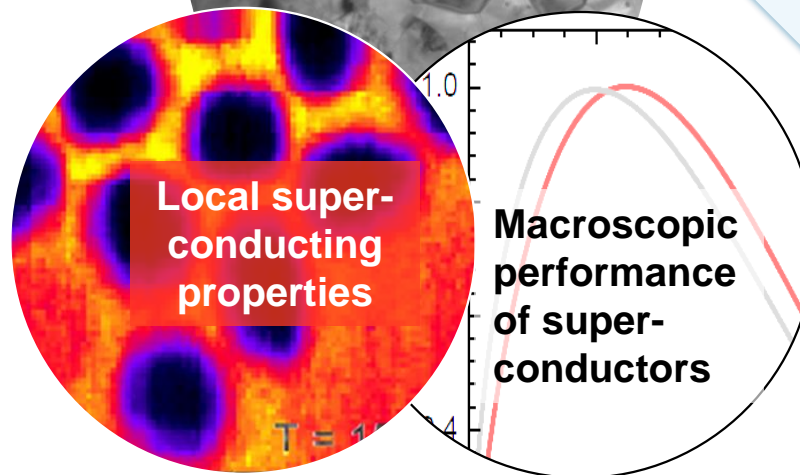
- TU Wien-CERN collaboration on superconductivity (SC) R&D already for LHC magnets
- Continued as part of the FCC feasibility study
- Characterization of SC properties and material characteristics

Low Temperature Physics and Superconductivity

M. Eisterer

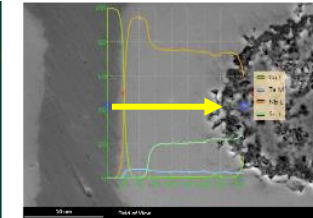
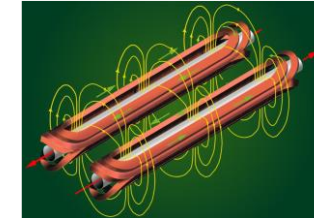


J. Bernardi

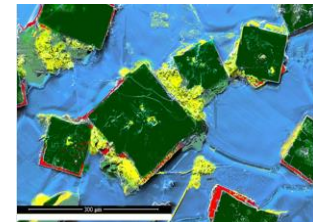


TU Wien Contributions to Superconductor R&D for FCC*

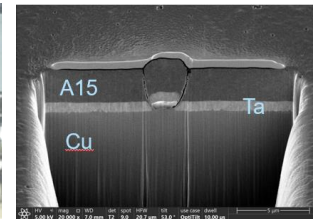
SC R&D for high-field magnets (Nb_3Sn , HTS)



HTS coatings for beam screen development



SC coatings for RF cavities



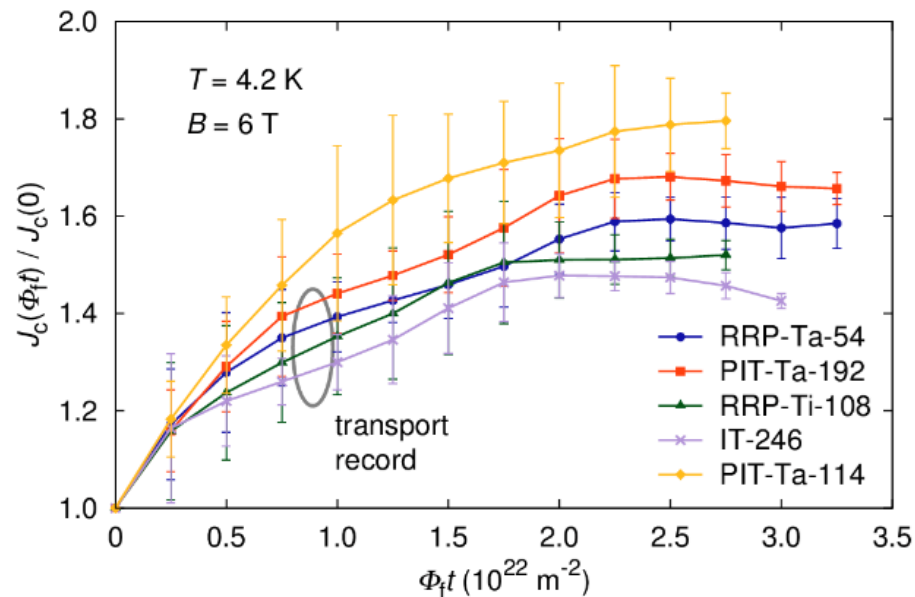
Marie Skodowska-Curie ITN EASITrain (2017-2021)



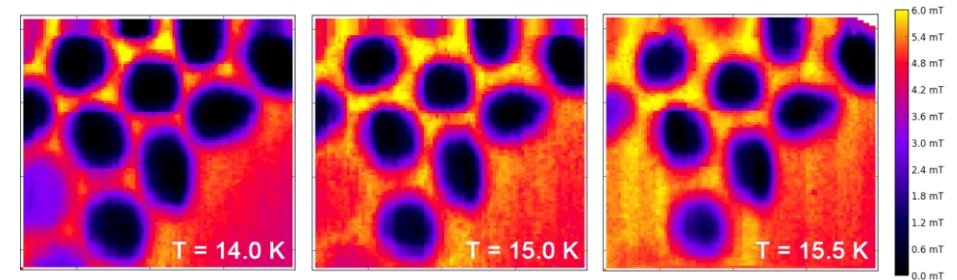
(*completed and ongoing projects)

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- Measurements of the critical currents
- Irradiation experiments of superconducting materials (TRIGA Center)

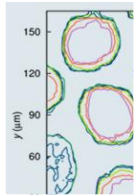


- Magnetic field mapping

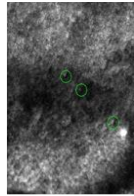


- Search for material inhomogeneities
- Finding the relationship between microstructure and superconducting properties

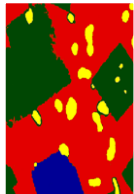
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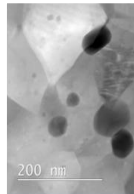
Composition gradients in Nb₃Sn wires



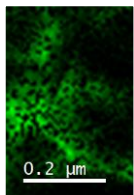
Irradiation Effects



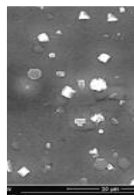
TI1223 for beam screens



Artificial pinning centers (APC)



Carbon-Cluster in MgB₂



Coated conductors YBCO



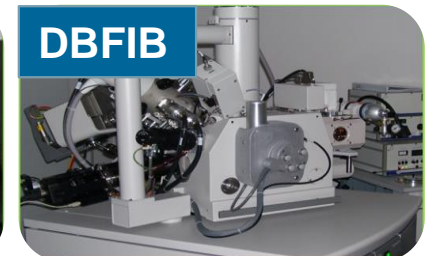
FEGTEM



TEM



FEGSEM



DBFIB



DBFIB

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Thank you for your time!