Mattia Ortino
ESR # 13 @ ATOMINSTITUT – TU Wien

“Characterization of superconducting properties of the next-generation Nb₃Sn and MgB₂ wires”
Where, who

Wien

Atominstitut (Tu Wien)

M. Eisterer

Extra: contact person @

= Dr. Simon Hopkins

Mattia Ortino
Outline

1) research description
   - Main goals
   - Tasks and milestones

2) working plan
   - 1st year
   - 2nd year
   - 3rd year

3) challenges

4) risks

5) state of the art

Mattia Ortino
ESR #13 research description

“Characterization of superconducting properties of the next-generation Nb$_3$Sn and MgB$_2$ wires”

1. Main goals

- In-depth characterization of new Nb$_3$Sn wires pointing to the standards requested by the next 16 T CERN-FCC dipole magnet

- Identification of new MgB$_2$ wires performances for next generation 10 T magnets and high current links provided by Columbus Superconductors SpA (collaboration with ESR #7)
ESR #13 research description

“Characterization of superconducting properties of the next-generation Nb$_3$Sn and MgB$_2$ wires”

1. Tasks and milestones

- Deep understanding of the state-of-the-art Nb$_3$Sn wires (with and without APC) & MgB$_2$ wires;

- Assessment of local properties pre/post high-energy neutron irradiation;

- Examination of micro-nanostructure by SEM/TEM to facilitate correlation between material features and superconducting properties. To be done @ USTEM (TU Wien)

- Development of self-built devices for further characterization (VCM, laser calorimeter)
ESR #13 working plan

“Characterization of superconducting properties of the next-generation Nb$_3$Sn and MgB$_2$ wires”

1$^\text{st}$ year

- Acquisition of experimental techniques knowledge
- Focus on artificial pinning centers rich (APC)-Nb$_3$Sn wires characterization
- Development of a reliable self-built Vibrating Coil Magnetometer (VCM) (to be used as valuable device for magnetization measurements)

Squid magnetometry

Transport current measurements

Scanning Hall Probe Microscopy (SHPM);

SEM/TEM
ESR #13 working plan

“Characterization of superconducting properties of the next-generation Nb$_3$Sn and MgB$_2$ wires”

2nd year

- Nano-included Nb$_3$Sn wires characterization of different samples
- No APC Nb$_3$Sn wires characterization of different samples
- MgB$_2$ wires characterization
  - RRR measurements
  - Heat treatments on unreacted wires
- Production process training/hands on

Work to be done @ (TU Wien)

Further collaborating partners

Possible secondments

Mattia Ortino
"Characterization of superconducting properties of the next-generation Nb$_3$Sn and MgB$_2$ wires"

3$^{\text{rd}}$ year

Nano-included Nb$_3$Sn wires characterization of different samples
No APC Nb$_3$Sn wires characterization of different samples
MgB$_2$ wires characterization

Collection and evaluation of results (comparison, improvements, validation)

Possible secondments

Same or further partners

And finally....
ESR #13 working plan

“Characterization of superconducting properties of the next-generation Nb₃Sn and MgB₂ wires”

3rd year

...Ph.D. THESIS WRITING!!
ESR #13 working plan

“Characterization of superconducting properties of the next-generation Nb₃Sn and MgB₂ wires”

Meanwhile, through the 3 years...

- Scientific dissemination (conferences, public events, high schools)
- Possible publication of the works
- Grants and/or patents hunting (if and when possible)
- Training (EASITrain, schools, ecc)

Mattia Ortino
ESR #13 challenges

“Characterization of superconducting properties of the next-generation Nb$_3$Sn and MgB$_2$ wires”

1. Managing of two different topics together with devices development

2. Out-of-box (market potential) constant outlook

3. Efficient communication (companies, colleagues, administration)

Do not focus just on our own work, do not lose curiosity for other SCs and/or related physics projects (events such as SC-Hackathon extremely important)

e.g. “German is better than English @ work!”

Mattia Ortino
ESR #13 risks

“Characterization of superconducting properties of the next-generation Nb$_3$Sn and MgB$_2$ wires”

1. Samples delivering delays

2. Dissemination obstacles

3. Ph.D thesis delays

Overall the highest risk

Industry/Academic partners possible disagreements (possible collaborations outside the network need to be evaluated)

The amount of work needs to fit with the times of standard Ph.D career path (6-months delay acceptable)
ESR #13 work state-of-art

“Characterization of superconducting properties of the next-generation Nb$_3$Sn and MgB$_2$ wires”

- Literature review
- VCM further development
  Implementation of a reliable feedback-signal via piezo-back voltage

Mattia Ortino
ESR #13 work state-of-art

“Characterization of superconducting properties of the next-generation Nb₃Sn and MgB₂ wires”

- Preliminary characterization of the APC wires already done (mono, multi-filamentary)

Magnetization measurements

TEM

Pinning analysis

Courtesy of T. Baumgartner, TU Wien

Mattia Ortino
ESR #13 work state-of-art

“Characterization of superconducting properties of the next-generation \( \text{Nb}_3\text{Sn} \) and \( \text{MgB}_2 \) wires”

- Preliminary characterization of the APC wires already done (mono, multi-filamentary)

SEM

Scanning Hall Probe Microscopy (SHPM)

Courtesy of S. Pfeiffer, TU Wien

Mattia Ortino
…..Thanks for your attention!

..Any question?